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Benchmark Calculation for the Hatch Unit 1 Cycles 1–3 Using the SCALE 6.3/Polaris–PARCS v3.4.2 Code Package

Kang Seog Kim
William A. Wieselquist

December 2024

OAK RIDGE National Laboratory

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Nuclear Energy and Fuel Cycle Division

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ABBREVIATIONS

BOC	beginning of cycle
BWR	boiling water reactor
CR	control rod
ENDF	Evaluated Nuclear Data File
EOC	end of cycle
EPRI	Electric Power Research Institute
Hatch1	Hatch Unit 1
HFP	hot full power
HZP	hot zero power
Inc-718	Inconel-718
ORNL	Oak Ridge National Laboratory
RMS	root mean square
SS-304	stainless steel 304
TIP	traverse in-core probe
TIPS	traverse in-core probe system
Zr-2	Zircaloy-2
Zr-4	Zircaloy-4

ACKNOWLEDGMENTS

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ABSTRACT

This study was the performance of the benchmark calculation for the Hatch Unit 1 cycles 1–3, to validate the SCALE 6.3/Polaris–PARCS v3.4.2 with the ENDF/B-VII.1 AMPX 56-group library by comparing the simulated results with the measured data. The benchmark results will be used in evaluating uncertainties of the SCALE/Polaris–PARCS code package for boiling water reactor (BWR) physics analysis for key nuclear parameters such as reactivity and assembly power peaking factors. This report details plant and fuel design specifications and input data for SCALE/Polaris, GenPMAXS and PARCS, and additionally, detailed information is provided for all the input and output files produced for the benchmark calculations. The benchmark results were summarized such that they can be used in evaluating uncertainties for key nuclear parameters with other BWR benchmark results.

1. INTRODUCTION

Hatch Unit 1 (Hatch1) [1, 2] is a General Electric boiling water reactor (BWR) operated by the Constellation Energy Generation that began operation at 2,436 MW_{th} power using the BWR 7×7 and 8×8 assemblies. Hatch1 has 31 traverse in-core probe (TIP) instrument assemblies. Detailed design data and measured data are provided in Electric Power Research Institute (EPRI) reports NP-562 [1] and NP-2106 [2] for Hatch1.

This study performed the benchmark calculations for the Hatch1 benchmark problems to validate the SCALE 6.3/Polaris [3, 4]–GenPMAXS v6.3.1 [5]–PARCS v3.4.2 [6] code package for BWR analysis with the ENDF/B-VII.1 AMPX 56-group library [7]. The simulated benchmark results were compared with the measured data and will be used in the validation of the SCALE 6.3/PARCS–GenPMAXS–PARCS v3.4.2 code package by evaluating uncertainties for key nuclear parameters such as reactivity and assembly power peaking factors. Previous investigations using HELIOS–PARCS/PATHS [8] were performed by Yarsky et al. [9, 10].

The Polaris–GenPMAXS–PARCS code package is briefly overviewed, and detailed information is provided for the plant design data and measured data in Section 2. Since the measured data were obtained for hot full power (HFP), the design data would ideally be thermally expanded to prepare input data for Polaris, GenPMAXS, and PARCS. Because the Polaris-PARCS code package does not support an automatic thermal expansion, the data were not thermally expanded for this study for simplicity. If it would not result in a meaningful difference, then the reactor dimensions do not need to be thermally expanded. In Section 3, the simulated benchmark results are summarized and compared with the measured data. In addition, detailed information is provided for the input and output files generated from the benchmark calculations. The summary and concluding remarks are presented in Section 4.

2. CODE PACKAGE AND DESIGN SPECIFICATION

2.1 PROCEDURE AND CODE PACKAGE

Benchmark calculations for the Hatch1 cycles 1–3 were performed using the SCALE 6.3/Polaris–GenPMAXS v6.3.1–PARCS v3.4.2 code package with the ENDF/B-VII.1 AMPX 56-group library. SCALE 6.3 provides the ENDF/B-VII.1 AMPX 56- and 252-group libraries and ENDF/B-VIII.0 252-group library for LWR analysis. Because the Polaris calculation with the AMPX 252-group library is not practical due to significant computing time, the ENDF/B-VII.1 AMPX 56-group was used in this analysis. Figure 2.1 illustrates the flowchart of the Polaris–GenPMAXS–PARCS code package to simulate BWRs. The SCALE/Polaris code developed by Oak Ridge National Laboratory is a 2D lattice physics code to generate 2-group homogenized cross sections and pin power form factors for fuel assemblies and reflectors. The Polaris depletion calculations were performed at the reference states with various branch calculations to cover all the probable states in the reactor. The GenPMAXS code, developed by the University of Michigan, prepares cross-section table-set for each type of fuel assembly and reflector in which 2-group macroscopic cross sections are tabulated as a function of burnup, moderator and fuel temperatures, moderator/coolant density, and control rod insertion. Once cross-section table-sets are prepared for all types of fuel assemblies and radial and axial reflectors, whole-core nodal diffusion calculations are performed using the PARCS code. Typically the PATHS [8] thermal-hydraulics module is used for the BWR physics analysis because it can treat two-phase flow.

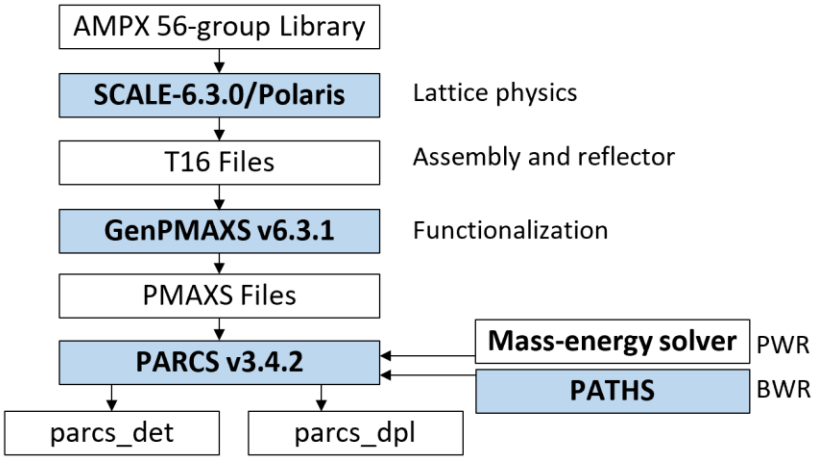


Figure 2.1. Flowchart of the Polaris–GenPMAXS–PARCS procedure.

Table 2.1 provides detailed information on the programs and data used in the calculations. The PATHS module is integrated with PARCS.

Table 2.1. Programs used in the benchmark calculations.

Program	File name	Version	md5sum	Reference
SCALE/Polaris	scalerte	6.3.0	c30aa9d4841d51636ea08f2aa71cf1e5	[3, 4]
ENDF/B-VII.1 56-group library	scale.rev00.xn56g19v7.1	6.3.0	2a1ab889c81354758bd85b3c0593db7a	[7]
GenPMAXS	genpmaxs-v6.3.1-linux2-intel-x64-release.x	6.3.1	5a0428587c6ba65e2028e6dc98d29488	[5]
PARCS	parcs-v342-linux2-intel-x64-release.x	3.4.2	fd005b709d0b597dd6910129d03fe8f5	[6]

2.2 SPECIFICATION OF THE HATCH1 CORE

2.2.1 Design Data

Hatch1 [1, 2] is a General Electric Type 4 BWR operated by the Southern Nuclear Operating Company that began operation at 2,436 MW_{th} power using the BWR 7×7 and 8×8 assemblies. Hatch1 has 31 TIP instrument assemblies. Detailed design data and measured data for Hatch1 are provided in EPRI reports NP-562 [1] and NP-2106 [2].

Table 2.2 provides the key design specifications of the Hatch1 core for cycles 1−3. Specifications of the TIP instrument system, control blade, and radial and axial reflectors are described in Table 2.3. Hatch1 used fission chamber TIP for cycles 1−3 and gamma TIP for cycle 3 from cycle burnup 9,294 MWd/t (data set 41). The Hatch1 cycles 1–3 used five types of fuel assemblies, which include axial variation in ^{235}U enrichment and burnable poisons. Therefore, cross-section table-sets should be generated to consider the axial variation. Table 2.4 provides the fuel assembly types, and each assembly type includes axial variation to have different subassembly types. Figures 2.2–2.6 show the UO_2, gadolinia, and water rod configurations. More detailed information for each type of fuel assembly is provided in Table 2.5, which was used in preparing the Polaris inputs. Figure 2.7 illustrates the axial variations of fuel rods in fuel assembly Types 1, 2, and 3. The fuel rods with the axial variations are indicated in Figures 2.2−2.4. Figure 2.8 shows the axial variations of fuel rods in assembly Type 5 in which all fuel rods include the axial variations. Figures 2.9 and 2.10 provide fuel assembly and control rod configurations for the 7×7 and 8×8 fuel assemblies, respectively.

This investigation employed some modeling simplifications. Fuel assembly types 1, 2 and 3 includes one short length fuel rod (1s) per assembly that was neglected in modeling for simplification, which was verified to negligibly impact the results by performing some sensitivity calculations. As illustrated in Figure 2.8, the active height of type 5 fuel rod is longer than other fuel rods by 6 inch (15.24 cm), which could not be modeled due to the capability limitation of PARCS. Since top 6 inch was neglected for all the type 5 assemblies, total amount of the neglected natural uranium would be significant which would result in less core reactivity and larger uncertainty for TIP comparison. Therefore, the modeling limitation for long fuel rods should increase uncertainties for reactivity and TIP.

Figures 2.11 and 2.12 illustrate the configurations of control rods, orifices, and TIP instruments. The layouts of fuel assemblies for the Hatch1 cycles 1–3 are provided in Figures 2.13–2.15, indicating fresh, once-burnt, and twice-burnt fuel assemblies. Fresh assembly loading and shuffling patterns are illustrated in Figures 2.16–2.18, with which the PARCS input files were prepared. Table 2.6 provides the PARCS axial mesh configuration and subassembly type assignment for each type of fuel assembly.

Table 2.2. Specification of the Hatch1 core [1, 2].

Parameter	Design data		
	Cycle 1	**Cycle 2**	**Cycle 3**
Core thermal power (MW_{th})	2436	2436	2436
Core total flow rate (Mlb/hr)	78.5	78.5	78.5
(kg/s)	9890.8	9890.8	9890.8
Core pressure (psia)	1035	1035	1035
Reactor dome pressure (psia)	1020	1020	1020
Core inlet enthalpy (Btu/lb)	523.7	523.7	523.7
(kJ/kg)	1218.1	1218.1	1218.1
Total number of fuel assemblies	560	560	560
Total number of control elements	136	136	136
Total number of In-core flux monitors	31	31	31
Heat transfer surface area (m^2)	4509.0	4602.2	4778.9
Total U mass (ton)	104.69	104.69	103.969
Lattice pitch (cm)	30.48	30.48	30.48
Active height (cm)	365.76	365.76	365.76[a]
Fresh fuel assembly types	7×7 UO_2 Type 1 7×7 UO_2 Type 2 7×7 UO_2 Type 3	8×8 UO_2 Type 4	8×8 UO_2 Type 5

[a]Actual fuel height is 381 cm.

Table 2.3. Specification of the Hatch1 in-core detector, control blade, and reflectors [1. 2].

Item	Material	Density (g/cm^3)	Subitem	Dimension
In-core detector	^{235}U		Virtual in gas	
	Argon gas	8.31E-03	Outer radius(cm)	0.3226
	H_2O	-	Outer radius(cm)	0.3556
	SS-304	8.0300	Outer radius(cm)	0.4763
	H_2O (47.87 wt%) A_2O_3 (15.7 wt%) SS-304 (36.43 wt%)	1.3611	Outer radius(cm)	0.8128
	SS-304	8.0300	Outer radius(cm)	0.8890
Control blade			Half thickness (cm)	0.3962
			Sheath thickness (cm)	0.1422
			Dead length (cm)	1.9850
			Wing tip curvature (cm)	0.3962
			Width of control section (cm)	10.0279
			# of tubes	21
Control tubes	B4C	1.7642	Outer radius (cm)	0.1753
	SS-304	8.0300	Outer radius (cm)	0.2388
Radial reflector	H_2O		Coolant (cm)	20.1950
	SS-3161		Shroud (cm)	5.0800
	H_2O		Moderator (cm)	4.7250
Top reflector	H_2O (24.33023 wt%) He (0.000809 wt%) Zr-2 (32.83966 wt%) Zr-4 (16.67851 wt%) SS-304 (26.15079 wt%)	1.9258	Zone-1 (cm) lower	30.4800
	H_2O (41.76238 wt%) Zr-2 (26.66206 wt%) SS-304 (31.57556 wt%)	1.5460	Zone-2 (cm) upper	9.5200
Bottom reflector	H_2O (21.25524 wt%) Zr-2 (10.76185 wt%) SS-304 (66.47959 wt%) INC-718 (0.64007 wt%) B_4C (0.86324 wt%)	2.5470	Zone-1 (cm) upper	12.7000
	H_2O (4.50458 wt%) SS-304 (95.09426 wt%) B_4C (0.40116 wt%)	5.4808	Zone-2 (cm) lower	10.0076

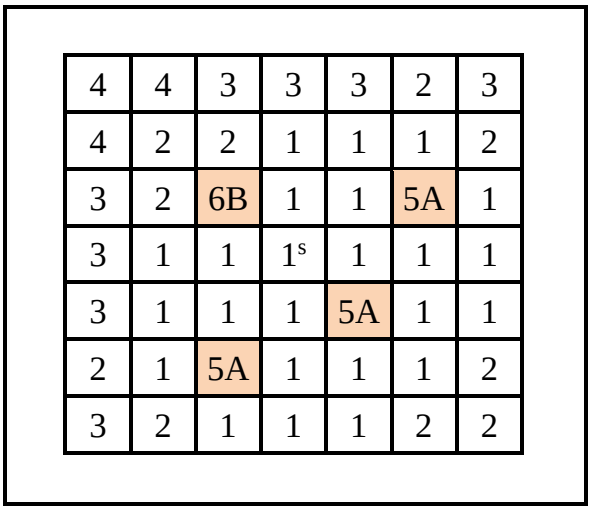
Table 2.4. Assembly types for Hatch1 cycles 1−3 [1. 2].

Cycle	Assembly type	Axial type	Power density (W/g)	Fuel rods		^{235}U wt%	Gd_2O_3 wt%	# of rods	Density (g/cm^3)	Figure
				Type	material					
1	1	1A	23.5	1	UO_2	2.79	−	24	10.32	2.2 2.7
				1s	UO_2	2.79	−	1	9.32	
				2	UO_2	1.94	−	10	10.32	
				3	UO_2	1.69	−	8	10.32	
				4	UO_2	1.27	−	3	10.32	
				5A	UO_2+ Gd_2O_3	2.79	4.0	3	10.16	
		1B	23.5	1	UO_2	2.79	−	23	10.32	2.2 2.7
				1s	UO_2	2.79	−	1	9.32	
				2	UO_2	1.94	−	10	10.32	
				3	UO_2	1.69	−	8	10.32	
				4	UO_2	1.27	−	3	10.32	
				5A, 5B	UO_2+ Gd_2O_3	2.79	4.0	4	10.16	
	2	2A	23.5	1	UO_2	2.79	−	25	10.32	2.3 2.7
				1s	UO_2	2.79	−	1	9.32	
				2	UO_2	1.94	−	10	10.32	
				3	UO_2	1.69	−	8	10.32	
				4	UO_2	1.27	−	3	10.32	
				5A	UO_2+ Gd_2O_3	2.79	4.0	2	10.16	
		2C	23.5	1	UO_2	2.79	−	24	10.32	2.3 2.7
				1s	UO_2	2.79	−	1	9.32	
				2	UO_2	1.94	−	10	10.32	
				3	UO_2	1.69	−	8	10.32	
				4	UO_2	1.27	−	3	10.32	
				5A, 5C	UO_2+ Gd_2O_3	2.79	4.0	3	10.16	
		3D	23.5	1	UO_2	2.79	−	23	10.32	2.3 2.7
				1s	UO_2	2.79	−	1	9.32	
				2	UO_2	1.94	−	10	10.32	
				3	UO_2	1.69	−	8	10.32	
				4	UO_2	1.27	−	3	10.32	
				5A, 5C, 5D	UO_2+ Gd_2O_3	2.79	4.0	4	10.16	
	3	3	23.5	1	UO_2	2.79	−	25	10.32	2.4 2.7
				1s	UO_2	2.79	−	1	9.32	
				2	UO_2	1.94	−	10	10.32	
				3	UO_2	1.69	−	8	10.32	
				4	UO_2	1.27	−	3	10.32	
				5E	UO_2+ Gd_2O_3	2.79	2.5	2	10.22	
2	4	4	23.5	1	UO_2	2.73	−	40	10.32	2.5
				2	UO_2	2.06	−	14	10.32	
				3	UO_2	1.80	−	4	10.32	
				4	UO_2	1.40	−	1	10.32	
				5	UO_2+ Gd_2O_3	2.73	1.5	4	10.25	
				WR	H_2O	−	−	1	−	
3	5	5A	23.5	1	UO_2	0.71	−	62	10.32	2.6 2.8
				WR	H_2O	−	−	2	−	
		5B	23.5	1	UO_2	3.00	−	27	10.32	2.6 2.8
				2	UO_2	2.80	−	14	10.32	
				3	UO_2	2.00	−	14	10.32	
				4	UO_2	1.70	−	4	10.32	
				5	UO_2	2.40	−	2	10.32	
				6	UO_2	1.30	−	1	10.32	
				WR	H_2O	−	−	2	−	

Table 2.5. Assembly geometry specification for Hatch1 cycles 1−3 [1.2].

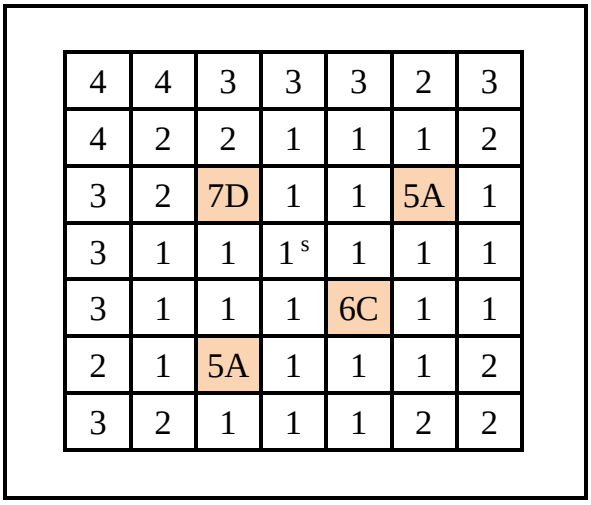
Assembly type			Type 1	Type 2	Type 3	Type 4	Type 5
Array			7×7	7×7	7×7	8×8	8×8
Narrow gap (cm)			0.475	0.475	0.475	0.475	0.475
Wide gap (cm)			0.9525	0.9525	0.9525	0.9525	0.9525
Channel	Material		Zr-4	Zr-4	Zr-4	Zr-4	Zr-4
	Box thickness (cm)		0.2032	0.2032	0.2032	0.2032	0.2032
	Corner inner radius (cm)		0.9652	0.9652	0.9652	0.9652	0.9652
	Inner half width (cm)		6.7	6.7	6.7	6.7	6.7
Pins	Fuel rods		45	45	47	59	62
	Gadolinia rods		4	4	2	4	0
	Water rods		0	0	0	1	2
	Total		49	49	49	64	64
	Pitch (cm)		1.875	1.875	1.875	1.6256	1.6256
Fuel	Outer radius (cm)		0.607	0.607	0.607	0.528	0.521
Clad	Material		Zr-2	Zr-2	Zr-2	Zr-2	Zr-2
	Density (g/cm^3)		6.84699	6.84699	6.84699	6.87213	6.90749
	Mixture with spacer grids (wt%)	Zr-2	95.8085	95.8085	95.8085	95.458	94.9694
		Inc718	0.6691	0.6691	0.6691	0.6489	0.7748
		Zr-4	3.5224	3.5224	3.5224	3.8931	4.2558
	Inner radius (cm)		0.622	0.622	0.622	0.540	0.532
	Outer radius(cm)		0.716	0.716	0.716	0.626	0.613
Water rod	Inner radius(cm)		–	–	–	0.540	0.674
	Outer radius (cm)		–	–	–	0.626	0.751
PD[a]	Ratio		1.31083	1.31083	1.31083	1.29817	1.32505
Area	Fuel (cm^2)		56.49242	56.49242	56.49242	55.24392	52.81007
	Gas (cm^2)		2.87814	2.87814	2.87814	2.41622	2.34394
	Cladding (cm^2)		19.32862	19.32862	19.32862	20.24365	18.81798
	Water rod (cm^2)		–	–	–	0.91524	2.85743
Clad	Perimeter (cm)		220.13448	220.13448	220.13448	251.77377	248.39040

[a]PD: pitch-to-diameter ratio = pin pitch/diameter



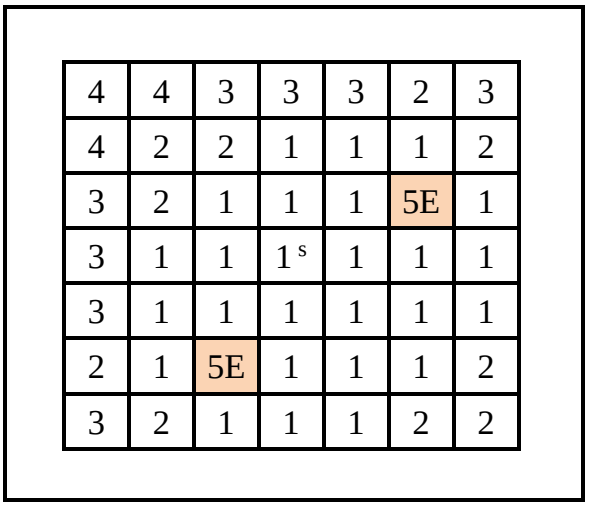
Rod type	^{235}U (wt%)	Gd_2O_3 (wt%)	# of rods
1	2.79	0	23
1s	2.79	0	1
2	1.94	0	10
3	1.69	0	8
4	1.27	0	3
5A	2.79	4.0	3
6B	2.79	4.0	1

Figure 2.2. Fuel assembly Type 1.



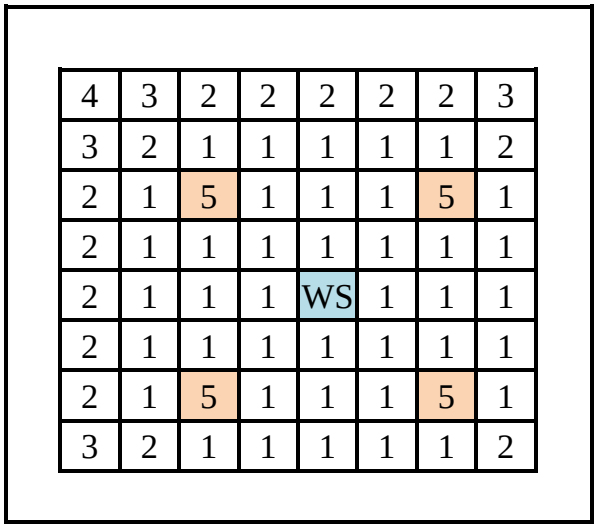
Rod type	^{235}U (wt%)	Gd_2O_3 (wt%)	# of rods
1	2.79	0	23
1s	2.79	0	1
2	1.94	0	10
3	1.69	0	8
4	1.27	0	3
5A	2.79	4.0	2
6C	2.79	4.0	1
7D	2.79	4.0	1

Figure 2.3. Fuel assembly Type 2.



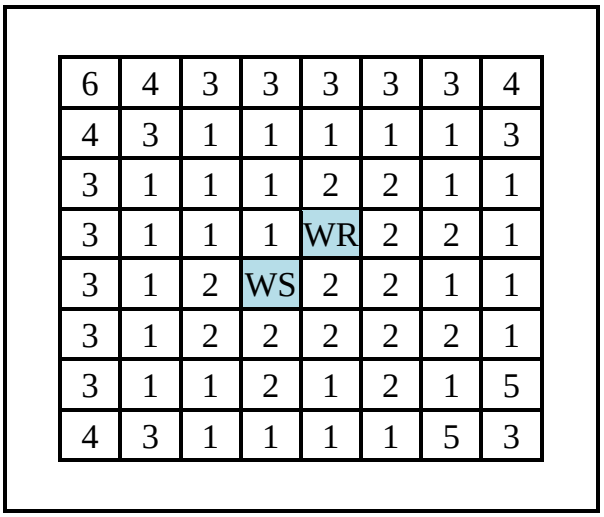
Rod type	^{235}U (wt%)	Gd_2O_3 (wt%)	# of rods
1	2.79	0	25
1s	2.79	0	1
2	1.94	0	10
3	1.69	0	8
4	1.27	0	3
5E	2.79	2.5	2

Figure 2.4. Fuel assembly Type 3.



Rod type	^{235}U (wt%)	Gd_2O_3 (wt%)	# of rods	Remark
1	2.73	0	40	
2	2.06	0	14	
3	1.80	0	4	
4	1.40	0	1	
5	2.73	1.50	4	
WS	–	0	1	Water rod + spacer

Figure 2.5. Fuel assembly Type 4.



Rod type	^{235}U wt%	Gd_2O_3 wt%	# of rods	Remark
1	3.00	0	27	
2	3.80	0	14	
3	2.00	0	14	
4	1.70	0	4	
5	2.40	0	2	
6	1.30	0	1	
WS	–	0	1	Water rod + spacer
WR	–	0	1	Water rod

Figure 2.6. Fuel assembly Type 5.

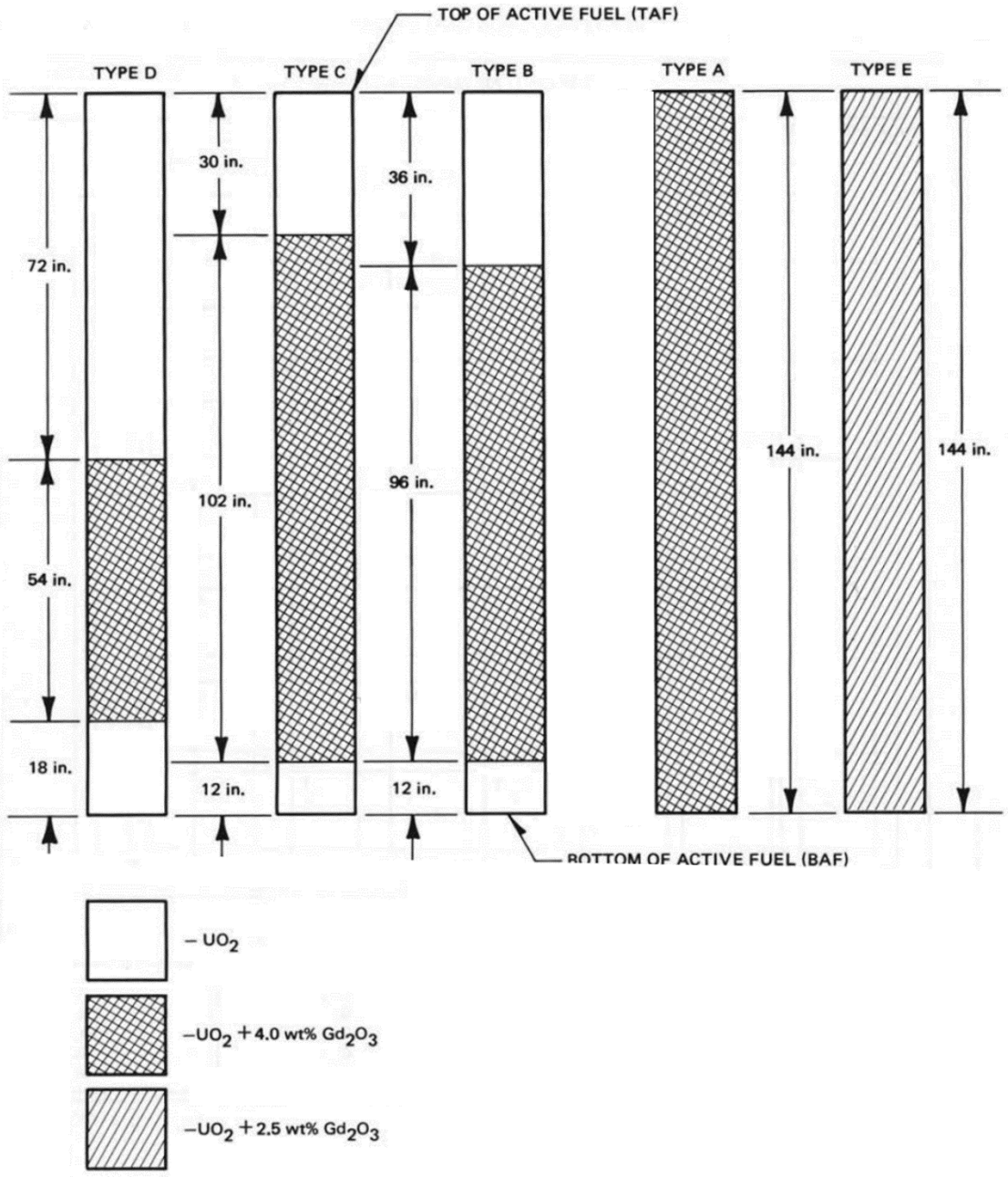


Figure 2.7. Axial variation of fuel rods in assembly Types 1, 2, and 3.

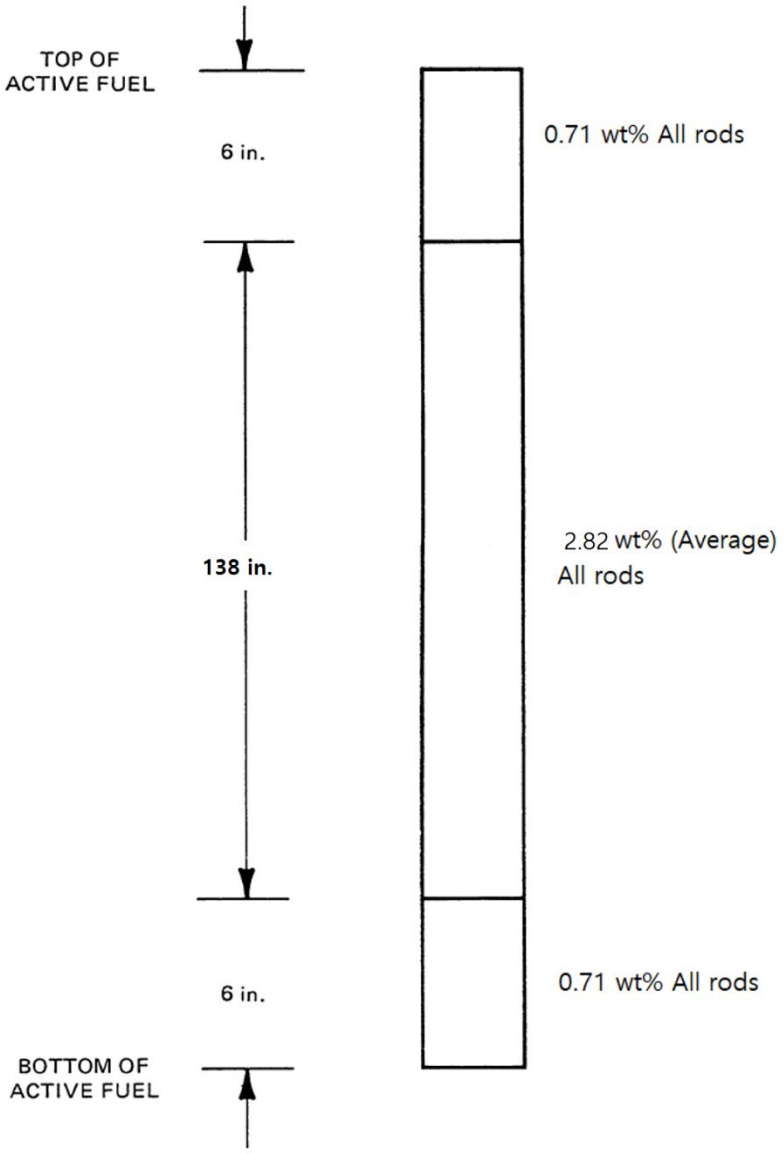
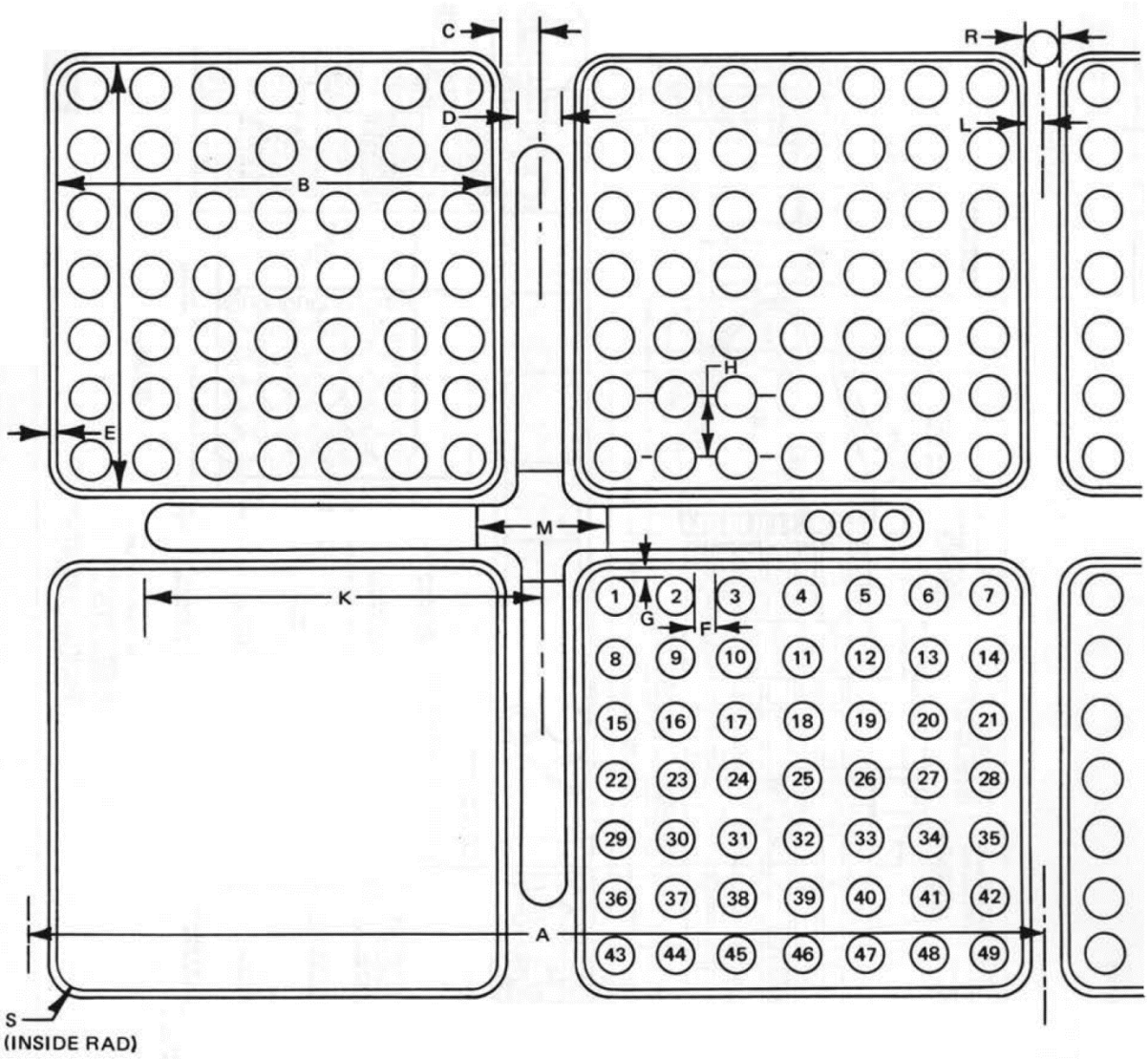


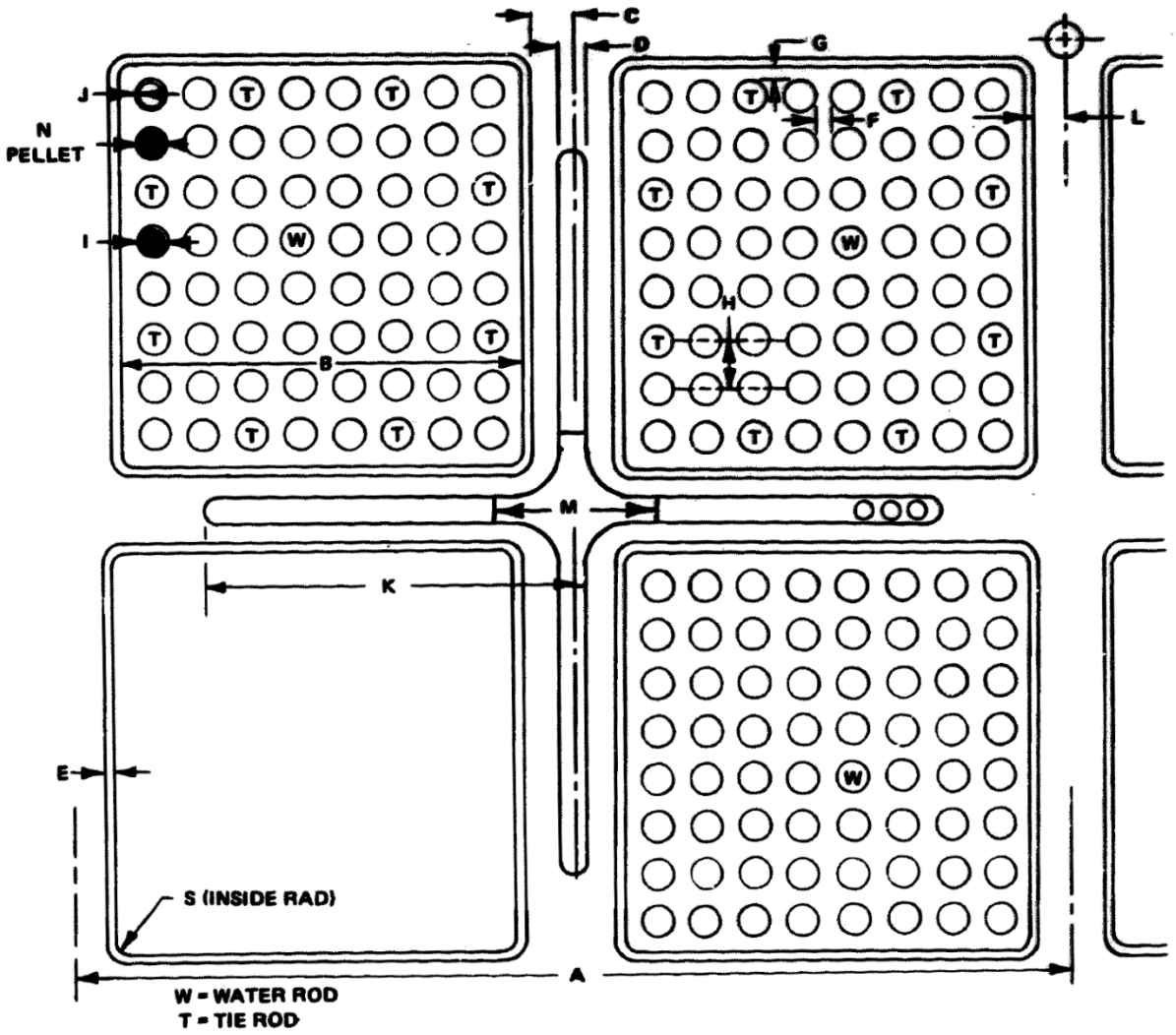
Figure 2.8. Axial variation of fuel rods in assembly Type 5.



DIM. IDENTIFICATION	A	B	C	D	E	F	G	H	I	J
DIM. INCHES	12.0	5.278	0.375		0.080	0.175	0.1435	0.738		

DIM. IDENTIFICATION	K	L	M	N	O	P	Q	R	S	
DIM. INCHES		0.188							0.380	

Figure 2.9. Assembly and control rod configuration for the 7×7 assembly.



DIM. IDENTIFICATION	A	B	C	D	E	F	G	H	I	J
DIM. INCHES	12.0	5.278	0.375	0.312	0.080	0.147	0.153	0.640	0.425	0.034

DIM. IDENTIFICATION	K	L	M	N	O	P	Q	R	S	T
DIM. INCHES	4.875	0.187	1.563	0.416					0.380	

Figure 2.10. Assembly and control rod configuration for the 8×8 assembly.

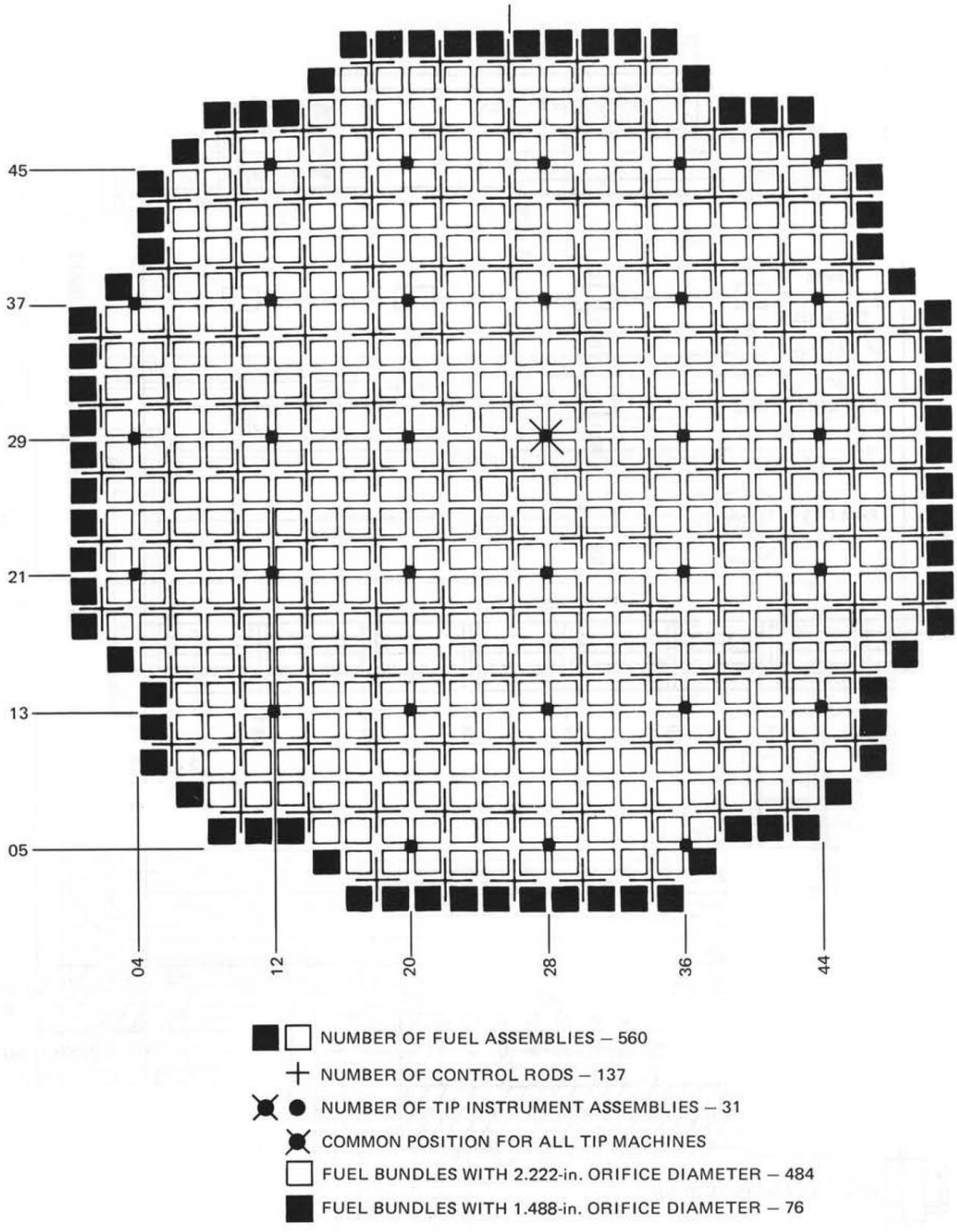


Figure 2.11. Hatch1 control rod, TIP, and orifice positions (cycle 1).

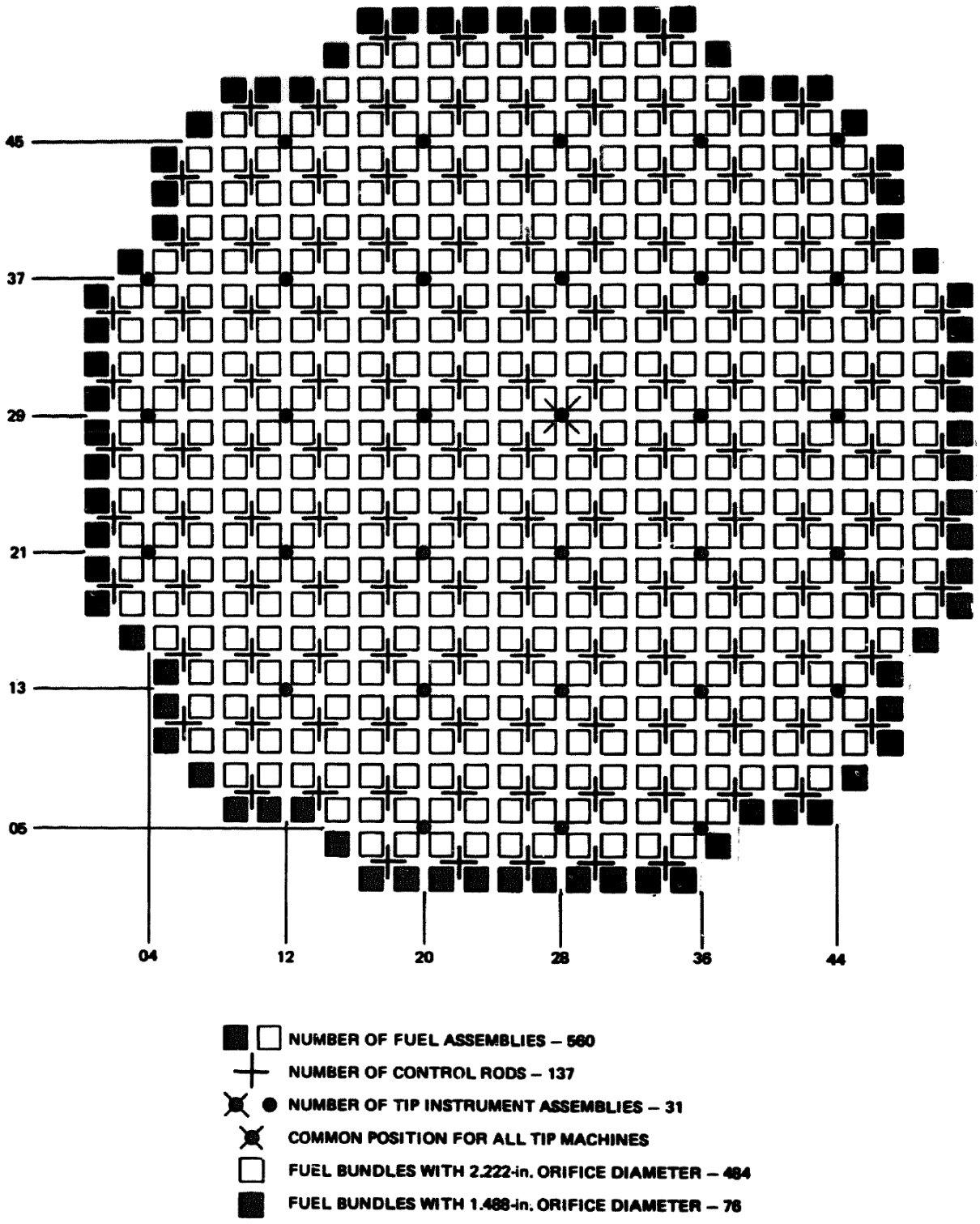
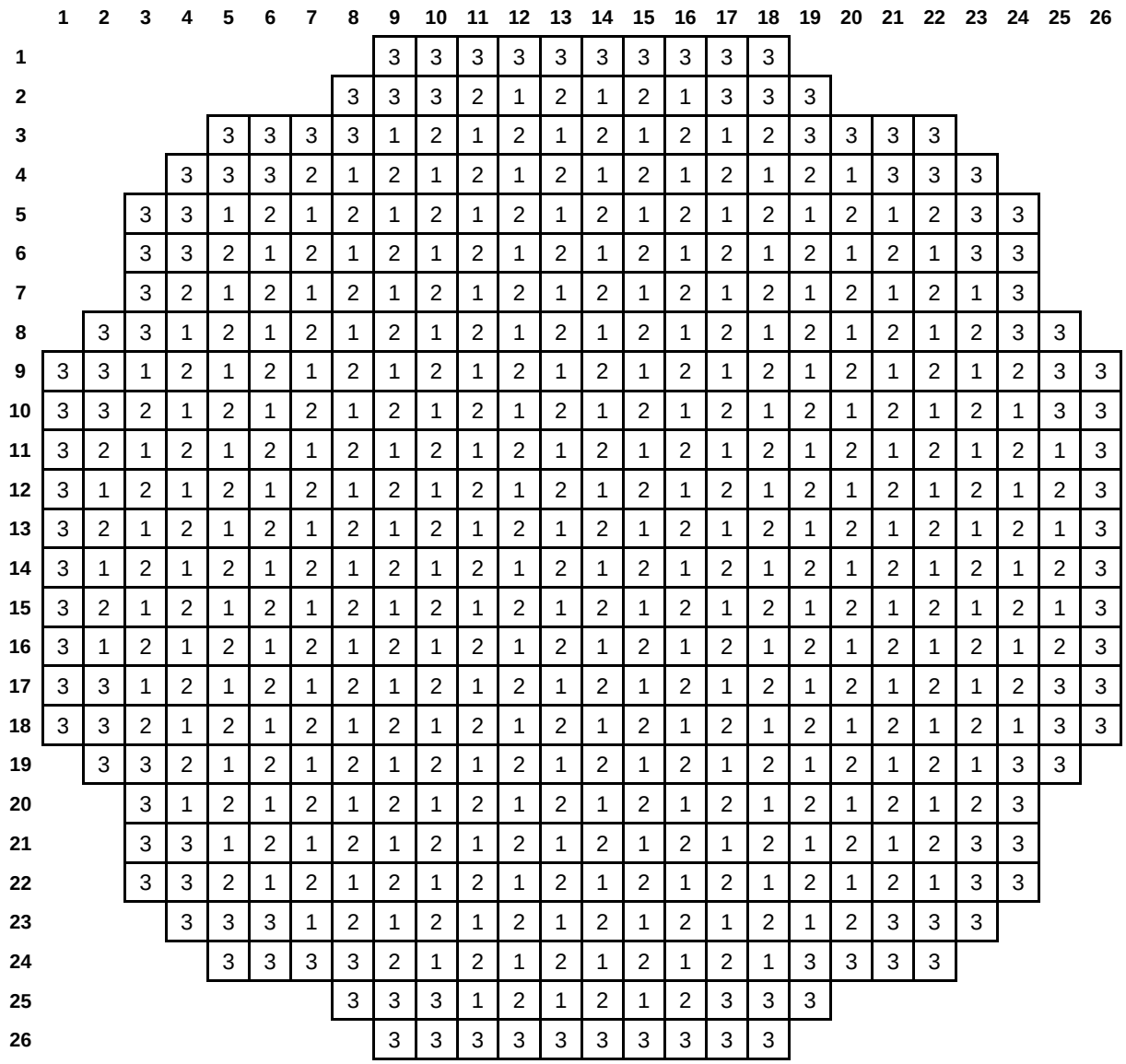
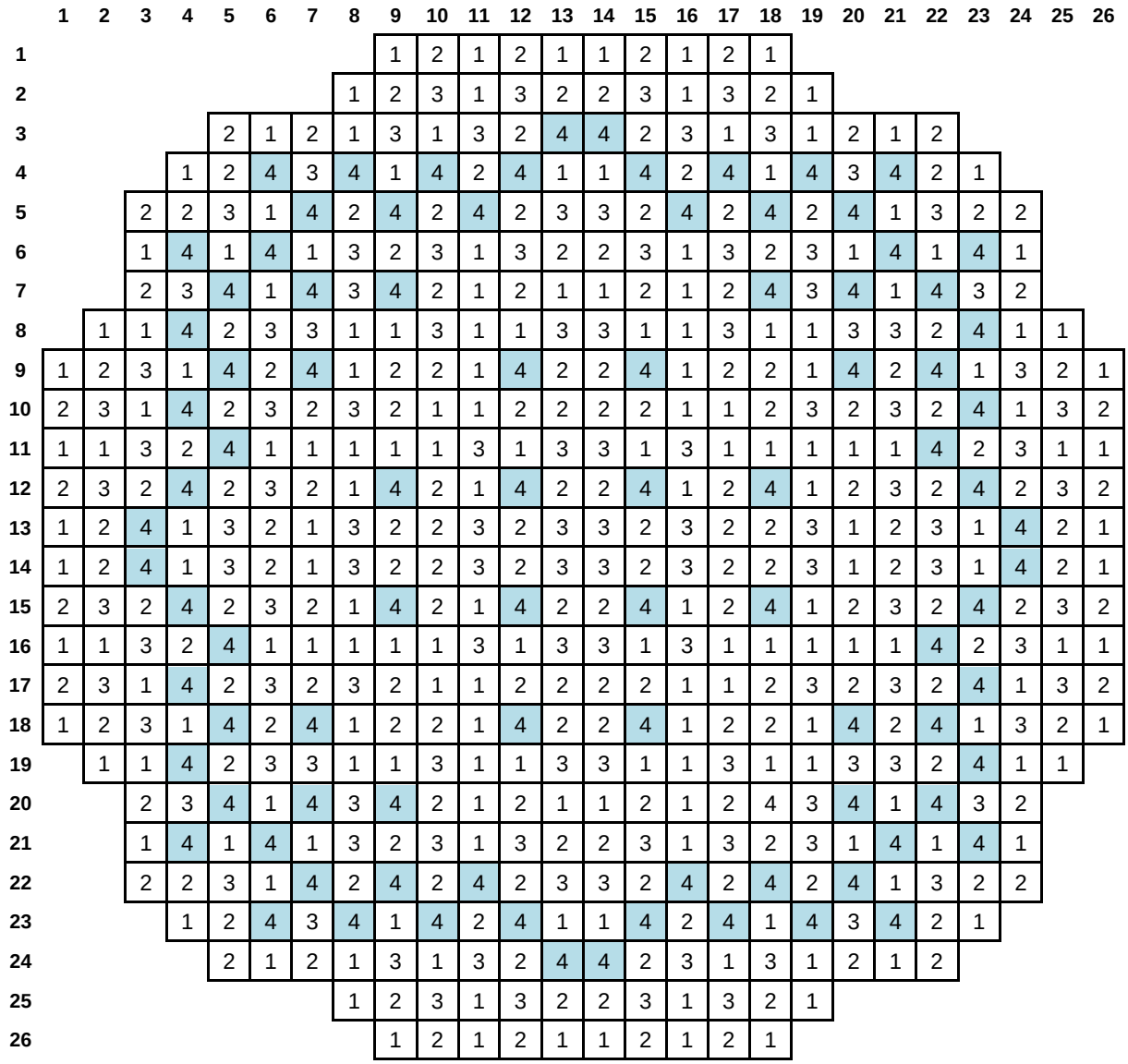


Figure 2.12. Hatch1 control rod, TIP, and orifice positions (cycles 2 and 3).



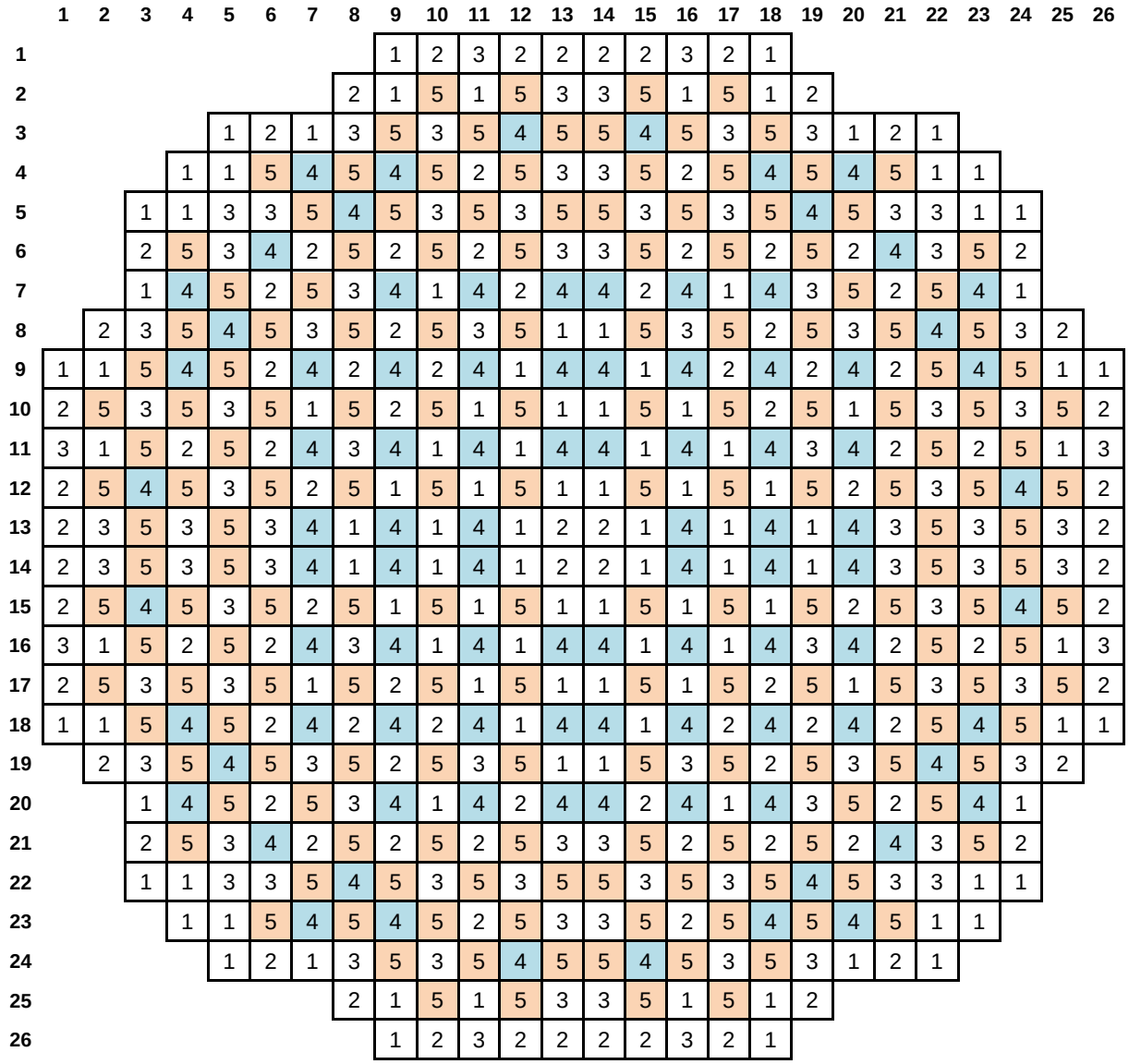
	# of assemblies	Description
Type 1	222	7×7 2.34 wt% ^{235}U + 4.0 wt% Gd_2O_3
Type 2	222	7×7 2.34 wt% ^{235}U + 4.0 wt% Gd_2O_3
Type 3	116	7×7 2.34 wt% ^{235}U + 2.5 wt% Gd_2O_3
Total	560	

Figure 2.13. Layout of fuel assemblies in the Hatch1 cycle 1.



	# of assemblies	Description	Remarks
Type 1	180	7×7 2.34 wt% ^{235}U + 4.0 wt% Gd_2O_3	once-burned
Type 2	172	7×7 2.34 wt% ^{235}U + 4.0 wt% Gd_2O_3	once-burned
Type 3	116	7×7 2.34 wt% ^{235}U + 2.5 wt% Gd_2O_3	once-burned
Type 4	92	8×8 2.50 wt% ^{235}U	fresh
Total	560		

Figure 2.14. Layout of fuel assemblies in the Hatch1 cycle 2.



	# of assemblies	Description	Remarks
Type 1	108	7×7 2.34 wt% ^{235}U + 4.0 wt% Gd_2O_3	twice-burned
Type 2	100	7×7 2.34 wt% ^{235}U + 4.0 wt% Gd_2O_3	twice-burned
Type 3	92	7×7 2.34 wt% ^{235}U + 2.5 wt% Gd_2O_3	twice-burned
Type 4	92	8×8 2.50 wt% ^{235}U	once-burned
Type 5	168	8×8 2.65 wt% ^{235}U	fresh
Total	560		

Figure 2.15. Layout of fuel assemblies in the Hatch1 cycle 3.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
1									509	463	550	495	496	486	467	482	512	476								
2								474	493	475	284	192	290	178	306	176	453	459	487							
3					554	503	504	455	202	421	19	417	84	251	222	292	74	375	545	477	460	446				
4				539	478	470	262	201	424	27	413	22	254	49	278	181	376	172	314	180	543	491	514			
5			510	516	40	377	14	415	175	378	111	326	140	321	109	277	149	274	89	298	135	341	507	524		
6			481	518	313	79	414	16	382	110	273	60	322	23	257	138	279	179	361	194	339	122	508	468		
7			547	296	219	358	92	328	119	266	3	346	54	233	213	359	218	330	66	332	30	315	177	505		
8		542	533	221	362	144	329	97	433	188	351	209	396	169	373	220	420	211	333	197	407	7	310	559	450	
9	526	457	203	232	24	355	1	239	2	429	87	431	18	393	141	388	165	438	53	250	37	256	190	291	501	462
10	497	471	297	182	353	33	370	214	434	113	436	136	389	86	391	156	422	161	319	45	260	91	311	200	544	525
11	464	240	13	288	11	225	21	344	70	401	98	383	83	405	137	402	145	337	77	441	112	327	28	430	8	556
12	466	187	228	57	231	115	268	146	395	55	394	96	336	170	404	76	271	143	323	72	363	126	425	147	224	555
13	511	307	56	281	158	275	210	267	58	444	6	338	85	397	104	398	160	387	29	334	5	304	35	238	42	500
14	490	26	249	51	255	39	263	20	443	59	368	9	385	94	400	102	390	108	365	212	305	67	229	95	223	557
15	531	302	204	410	185	325	198	356	171	442	90	419	151	403	174	384	114	440	116	428	93	265	173	309	123	502
16	479	186	408	17	320	32	343	157	381	133	411	65	399	128	369	63	432	163	244	31	227	48	243	88	312	489
17	537	522	208	286	47	412	118	357	117	439	134	372	99	236	215	380	124	248	193	437	43	352	191	426	465	469
18	553	549	293	82	409	12	354	75	435	127	371	121	235	107	379	164	423	120	364	162	246	36	427	189	536	529
19		506	456	270	41	261	195	348	150	374	217	242	216	230	103	340	196	247	142	360	78	349	131	515	540	
20			552	206	347	62	366	15	272	148	241	139	226	52	342	207	245	46	318	71	350	73	289	499		
21			548	485	61	345	101	386	155	324	25	234	129	294	183	287	68	300	10	335	168	276	560	541		
22			558	473	282	166	392	100	308	152	253	153	331	154	367	184	299	38	418	64	252	50	458	448		
23				528	454	521	132	317	199	416	106	295	167	269	105	283	125	316	205	258	534	527	492			
24					449	452	520	523	406	44	259	4	237	159	264	80	301	130	546	494	535	532				
25								513	519	451	69	303	81	280	34	285	530	472	551							
26									445	483	447	538	517	488	498	461	484	480								

The numbers indicate the assembly identifications without the first two characters.

	# of assemblies	Description
Type 1	HX001 – HX222	7×7 2.34 wt% ^{235}U + 4.0 wt% Gd_2O_3
Type 2	HX223 – HX444	7×7 2.34 wt% ^{235}U + 4.0 wt% Gd_2O_3
Type 3	HX445 – HX560	7×7 2.34 wt% ^{235}U + 2.5 wt% Gd_2O_3

Figure 2.16. Fresh assembly loading pattern in the Hatch1 cycle 1.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
1									72	351	220	390	167	93	444	15	427	22								
2								183	410	454	82	504	313	276	520	190	507	425	195							
3					366	221	360	138	449	135	553	440	5184	2115	395	462	80	558	25	235	71	332				
4				139	241	5169	468	5167	163	5177	267	2124	118	55	3947	365	5161	137	2104	548	5146	243	205			
5			273	298	528	20	2096	426	2126	394	2095	368	463	512	262	2103	384	5150	248	2116	185	492	242	286		
6			17	5153	97	2097	95	479	294	535	50	555	341	282	502	40	460	333	464	94	3946	90	5171	28		
7			343	538	5162	151	5136	546	5148	272	123	337	193	214	381	178	330	5180	518	2092	170	2101	467	441		
8		31	107	2119	304	506	543	47	4	447	154	2	516	527	127	6	551	35	14	508	450	255	5156	60	184	
9	116	268	554	23	2105	263	5176	148	249	239	156	2121	228	309	5185	130	319	397	145	2088	334	2111	218	524	244	96
10	328	457	122	5137	442	550	432	496	256	64	188	435	338	433	422	9	92	364	488	371	461	411	5166	166	549	340
11	74	157	476	437	5174	192	26	75	177	117	545	104	451	475	5	534	67	88	132	42	34	2108	370	445	59	66
12	301	547	389	5139	245	511	417	165	2113	237	128	5154	290	312	2106	83	403	5141	208	264	557	331	5178	265	505	387
13	162	326	5182	76	469	285	87	493	420	405	465	223	533	559	302	544	247	374	459	174	306	525	63	2123	320	143
14	1	367	5181	114	497	303	119	472	289	399	471	224	515	456	307	522	305	380	519	215	284	537	129	5157	327	171
15	443	499	231	2110	388	500	372	120	5160	251	147	2091	280	240	5159	204	336	5142	200	401	490	321	5164	259	552	421
16	108	77	509	236	2112	176	8	134	13	161	470	211	453	530	39	523	158	206	180	186	69	2100	292	480	160	44
17	318	536	99	5170	271	513	391	486	406	103	196	438	275	400	423	150	209	375	517	419	487	402	5143	61	501	344
18	146	428	532	65	2098	369	5173	133	238	357	202	5155	408	430	5179	53	436	385	136	2122	383	2102	210	446	232	197
19		21	18	5172	297	540	521	213	222	474	102	124	478	458	113	140	482	51	91	485	542	434	5149	173	57	
20			311	495	2120	84	5145	455	2089	266	81	281	46	164	229	187	404	2093	560	2094	159	2125	498	342		
21			182	5163	126	2117	56	489	348	452	189	466	291	293	531	203	503	322	556	85	5165	142	5186	207		
22			287	288	514	121	2118	429	2099	250	2090	258	483	484	398	2114	379	2107	439	2109	29	539	392	310		
23				105	253	5144	481	5140	70	5152	431	5138	98	45	5168	354	5158	212	5175	541	5147	359	201			
24					270	3	329	111	448	19	526	269	5151	5183	254	529	86	510	191	227	131	277				
25								112	234	473	153	494	252	377	477	109	491	257	32							
26									196	356	217	363	115	49	325	58	323	11								

The numbers indicate the assembly identifications without the first two characters.

	# of assemblies	Description
Type 1	HX001 – HX222	7×7 2.34 wt% ^{235}U + 4.0 wt% Gd_2O_3
Type 2	HX223 – HX444	7×7 2.34 wt% ^{235}U + 4.0 wt% Gd_2O_3
Type 3	HX445 – HX560	7×7 2.34 wt% ^{235}U + 2.5 wt% Gd_2O_3
Type 4	LJ2088 – LJ5186	8×8 2.50 wt% ^{235}U

Figure 2.17. Fresh assembly loading and shuffling patterns in the Hatch1 cycle 2.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
1									59	428	522	241	443	387	243	458	268	82								
2								340	62	9354	110	9414	532	526	9398	68	9416	30	318							
3					3	342	173	481	9385	474	9384	2123	9307	9308	5157	9379	482	9282	541	18	329	71				
4				187	79	9303	2125	9277	5149	9284	317	9363	445	509	9406	314	9375	5156	9310	2120	9279	168	123			
5			8	106	484	529	9295	2099	9356	473	9413	494	9344	9419	499	9404	540	9274	2107	9373	524	483	181	186		
6			257	9396	448	5151	382	9321	283	9357	386	9355	487	513	9273	361	9389	413	9391	300	5183	449	9306	244		
7			111	5141	9353	226	9437	536	2090	184	2100	246	2118	2109	299	2108	21	2114	457	9345	233	9324	5160	25		
8		444	469	9394	5179	9366	478	9315	416	9392	552	9291	58	201	9400	496	9301	376	9399	491	9327	2121	9387	497	390	
9	77	144	9288	5140	9322	414	5150	287	2089	277	5154	115	5164	5158	93	2091	366	2093	273	2098	335	9338	5175	9299	78	157
10	242	9403	557	9381	489	9286	207	9328	344	9311	101	9370	198	11	9326	194	9278	323	9427	17	9329	464	9285	511	9359	253
11	519	24	9376	352	9325	358	5170	504	5173	16	5145	32	5163	5153	195	2094	10	2122	520	5143	350	9378	353	9280	36	459
12	276	9372	2117	9330	506	9435	345	9367	57	9290	105	9426	52	54	9420	108	9340	143	9430	339	9418	531	9275	5165	9422	313
13	360	514	9320	498	9349	452	5138	220	5152	22	5144	175	412	260	38	5169	146	5178	49	5168	503	9409	538	9297	539	227
14	235	528	9412	495	9289	460	3947	167	5139	197	5146	179	393	373	155	5147	116	2110	15	2124	535	9305	467	9333	492	441
15	377	9314	3946	9336	555	9401	378	9318	171	9298	112	9346	37	12	9335	183	9339	162	9374	355	9350	502	9343	2097	9272	252
16	472	43	9319	315	9417	349	5137	488	5176	7	5136	74	5171	5186	44	2092	41	2088	505	5166	362	9337	347	9383	33	493
17	288	9429	500	9348	479	9371	182	9395	351	9281	149	9313	96	72	9331	152	9431	427	9438	28	9351	556	9287	454	9380	392
18	109	125	9436	2104	9361	274	2105	286	5148	270	5159	217	5177	5161	66	2106	332	5180	310	2111	308	9347	5167	9407	27	153
19		325	537	9421	5155	9362	507	9434	407	9415	517	9276	139	205	9368	486	9369	261	9334	527	9364	5185	9365	525	363	
20			191	5142	9433	279	9296	501	2103	1	5174	230	2116	2096	396	2112	31	2095	549	9408	324	9283	2113	138		
21			425	9292	558	5184	278	9402	418	9312	316	9423	550	461	9342	424	9300	415	9410	295	2115	510	9382	410		
22			42	89	512	553	9302	2126	9293	450	9386	477	9352	9428	547	9317	466	9432	2102	9388	462	490	100	26		
23				192	169	9294	2101	9425	2119	9390	256	9405	480	476	9358	409	9323	5172	9316	5162	9393	216	81			
24					131	343	60	548	9439	551	9341	5182	9309	9360	5181	9424	447	9332	468	107	311	221				
25								356	172	9304	141	9377	446	554	9411	219	9397	199	328							
26									160	232	516	359	301	421	298	544	234	190								

The numbers indicate the assembly identifications without the first two characters.

	# of assemblies	Description
Type 1	HX001 – HX222	7×7 2.34 wt% ^{235}U + 4.0 wt% Gd_2O_3
Type 2	HX223 – HX444	7×7 2.34 wt% ^{235}U + 4.0 wt% Gd_2O_3
Type 3	HX445 – HX560	7×7 2.34 wt% ^{235}U + 2.5 wt% Gd_2O_3
Type 4	LJ2088 – LJ5186	8×8 2.50 wt% ^{235}U
Type 5	LJ9272 – LJ9439	8×8 2.65 wt% ^{235}U

Figure 2.18. Fresh assembly loading and shuffling patterns in the Hatch1 cycle 3.

Table 2.6. Hatch1 core axial configurations.

No	Mesh size (cm)	Fuel (cm)	Cross-section assembly types				
			Type 1	Type 2	Type 3	Type 4	Type 5
26	15.24		R_{TOP}[a]	R_{TOP}	R_{TOP}	R_{TOP}	R_{TOP}
		15.24					5A[c]
25	15.24	15.24	1A	2A	3	4	5B
24	15.24	15.24	1A	2A	3	4	5B
23	15.24	15.24	1A	2A	3	4	5B
22	15.24	15.24	1A	2A	3	4	5B
21	15.24	15.24	1A	2A	3	4	5B
20	15.24	15.24	1A	2C	3	4	5B
19	15.24	15.24	1B	2C	3	4	5B
18	15.24	15.24	1B	2C	3	4	5B
17	15.24	15.24	1B	2C	3	4	5B
16	15.24	15.24	1B	2C	3	4	5B
15	15.24	15.24	1B	2C	3	4	5B
14	15.24	15.24	1B	2C	3	4	5B
13	15.24	15.24	1B	2D	3	4	5B
12	15.24	15.24	1B	2D	3	4	5B
11	15.24	15.24	1B	2D	3	4	5B
10	15.24	15.24	1B	2D	3	4	5B
9	15.24	15.24	1B	2D	3	4	5B
8	15.24	15.24	1B	2D	3	4	5B
7	15.24	15.24	1B	2D	3	4	5B
6	15.24	15.24	1B	2D	3	4	5B
5	15.24	15.24	1B	2D	3	4	5B
4	15.24	15.24	1B	2C	3	4	5B
3	15.24	15.24	1A	2A	3	4	5B
2	15.24	15.24	1A	2A	3	4	5A
1	15.24		R_{BOT}[b]	R_{BOT}	R_{BOT}	R_{BOT}	R_{BOT}

[a]Top reflector
[b]Bottom reflector
[c]Active fuel height of Type 5 assembly is longer than that of other assemblies by 15.24 cm.

2.2.2 Measured Data

The measured data used in the current study were obtained from the publicly available Hatch1 cycles 1–3 operating history [1. 2]. Figures 2.19−2.21 and Table 2.7 provide the operation histories for powers, flow rates, pressures, and inlet temperatures at burnups. The PARCS and PATHS inputs were prepared using this information. Because PARCS/PATHS includes a capability limitation to consider bypass flow, total flow rate excluding bypass flow was considered in the PARCS/PATHS calculation. So it is required to improve PARCS/PATHS to explicitly consider bypass flow. Table 2.8 provides the detailed burnup points for PARCS to consider the TIP measurements and operation history.

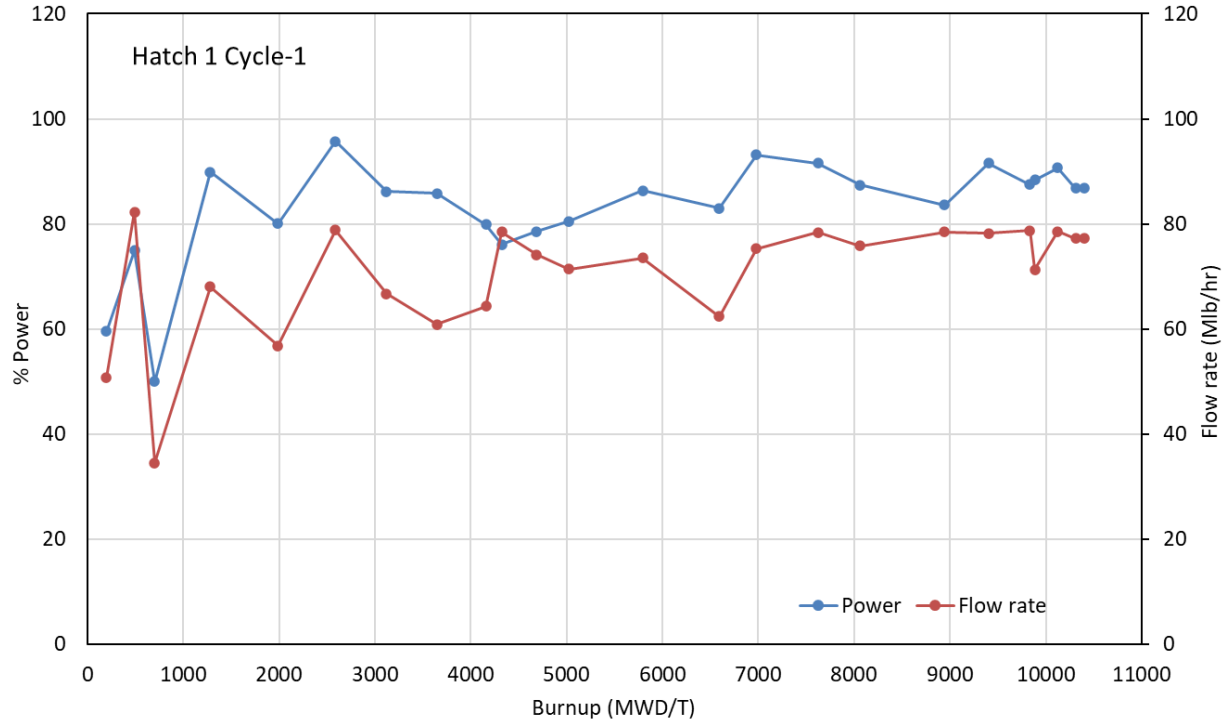


Figure 2.19. Power and flow rate history for the Hatch1 cycle 1.

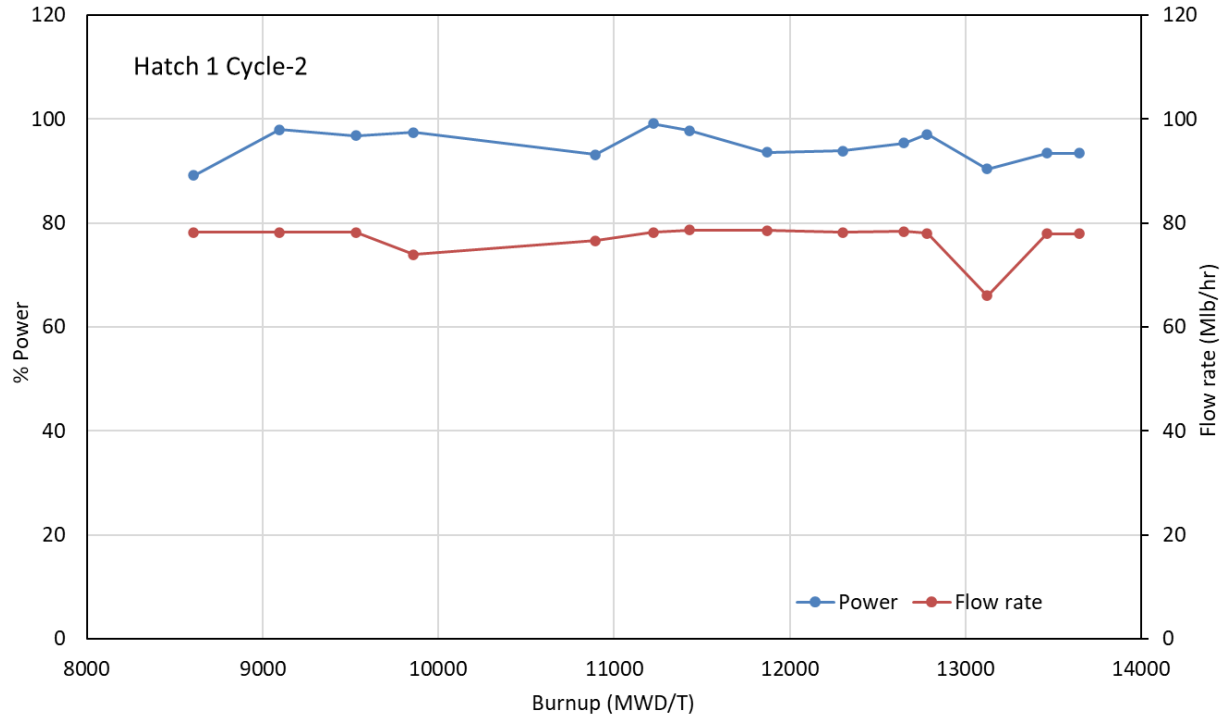


Figure 2.20. Power and flow rate history for the Hatch1 cycle 2.

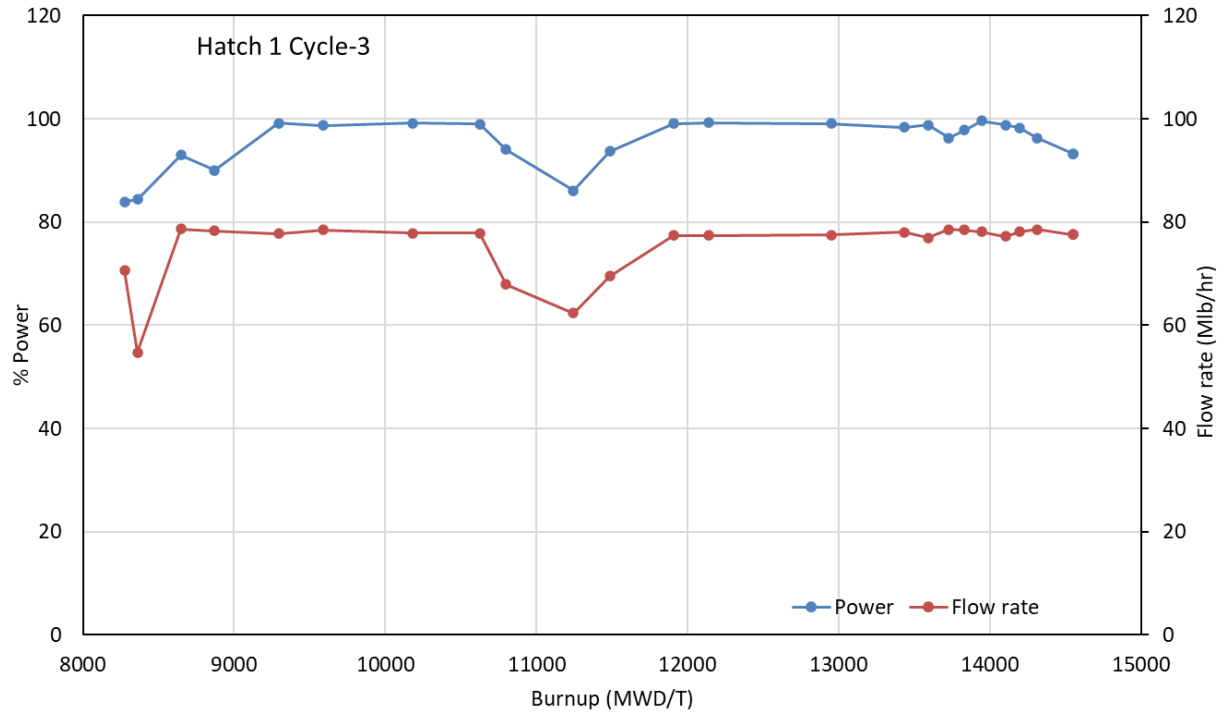


Figure 2.21. Power and flow rate history for the Hatch1 cycle 3.

Table 2.7. Hatch1 operation history.

Cycle	Dataset	Exposure (MWd/t)		Power (MW)	Dome Pressure (Psi)	Flow (Mlb/h)	Inlet Subcool		Flow (%)	Total (kg/s) [1]	Bypass (kg/s) [2]	[1−2]
		Core	Cycle				(Btu/lb)	(kJ/kg)				
1	1	198.5	198.5	1451	964	50.8	23.1	53.695	64.71	6,400.69	721.64	5,679.05
	2	493.9	493.9	1826	980	82.3	19.4	45.094	104.84	10,369.63	1,281.10	9,088.53
	3	702.3	702.3	1218	959	34.5	34.2	79.496	43.95	4,346.93	411.60	3,935.33
	4	1282.2	1282.2	2189	997	68.0	23.9	55.554	86.62	8,567.86	1,033.60	7,534.26
	5	1984.6	1984.6	1950	985	56.8	26.3	61.133	72.36	7,156.68	832.23	6,324.45
	6	2584.3	2584.3	2331	996	78.8	21.1	49.046	100.38	9,928.63	1,221.52	8,707.11
	7	3116.9	3116.9	2098	989	66.7	24.0	55.787	84.97	8,404.06	1,010.57	7,393.49
	8	3647.2	3647.2	2091	988	60.9	25.8	59.971	77.58	7,673.27	906.72	6,766.55
	9	4158.8	4158.8	1947	995	64.3	23.3	54.160	81.91	8,101.66	506.57	7,595.09
	10	4320.8	4320.8	1853	991	78.5	18.1	42.072	100.00	9,890.83	644.56	9,246.27
	11	4686.9	4686.9	1914	997	74.1	19.6	45.559	94.39	9,336.44	601.78	8,734.66
	12	5025.4	5025.4	1962	1,001	71.4	20.8	48.348	90.96	8,996.25	575.54	8,420.71
	13	5794.9	5794.9	2104	989	73.5	20.9	48.581	93.63	9,260.84	595.94	8,664.90
	14	6594.3	6594.3	2021	979	62.4	24.5	56.949	79.49	7,862.27	488.13	7,374.14
	15	6981.3	6981.3	2269	986	75.3	21.8	50.673	95.92	9,487.64	613.44	8,874.20
	16	7620.7	7620.7	2230	987	78.4	20.9	48.581	99.87	9,878.23	643.59	9,234.64
	17	8061.7	8061.7	2129	981	75.8	21.0	48.813	96.56	9,550.64	618.30	8,932.34
	18	8940.5	8940.5	2037	996	78.5	19.4	45.094	100.00	9,890.83	644.56	9,246.27
	19	9404.6	9404.6	2231	987	78.2	20.6	47.884	99.62	9,853.03	641.64	9,211.39
	20	9831.3	9831.3	2131	992	78.7	20.0	46.489	100.25	9,916.03	646.50	9,269.53
	21	9885.3	9885.3	2153	994	71.3	22.3	51.835	90.83	8,983.65	574.56	8,409.09
	22	10121.3	10121.3	2208	995	78.6	20.6	47.884	100.13	9,903.43	645.53	9,257.90
	23	10313.1	10313.1	2114	1,000	77.20	20.40	47.419	98.34	9,727.04	631.92	9,095.12
	EOC1	10401.3	10401.3	2114	1,000	77.20	20.40	47.419	98.34	9,727.04	631.92	9,095.12

Table 2.7. Hatch1 operation history. (continued)

Cycle	Dataset	Exposure (MWd/t)		Power (MW)	Dome Pressure (Psi)	Flow (Mlb/h)	Inlet Subcool		Flow (%)	Total (kg/s) [1]	Bypass (kg/s) [2]	[1−2]	TIP
		Core	Cycle				(Btu/lb)	(kJ/kg)					
	BOC2	8,486.2	0.0										fission
	24	8,608.6	122.4	2,172	969	78.2	20.1	46.721	99.62	9,853.03	988.66	8,864.37	fission
	25	9,097.0	610.8	2,387	1003	78.2	21.9	50.905	99.62	9,853.03	988.66	8,864.37	fission
	26	9,529.2	1043.0	2,357	997	78.2	21.6	50.208	99.62	9,853.03	988.66	8,864.37	fission
	27	9,857.8	1371.6	2,372	997	73.9	23.1	53.695	94.14	9,311.24	924.62	8,386.62	fission
	28	10,895.3	2409.0	2,268	989	76.6	21.2	49.278	97.58	9,651.44	964.82	8,686.62	fission
	29	11,223.8	2737.6	2,415	998	78.2	21.9	50.905	99.62	9,853.03	988.66	8,864.37	fission
2	30	11,428.9	2942.7	2,382	996	78.6	21.5	49.976	100.13	9,903.43	994.62	8,908.81	fission
	31	11,868.8	3382.6	2,280	988	78.5	20.6	47.884	100.00	9,890.83	993.13	8,897.70	fission
	32	12,302.1	3815.9	2,286	988	78.2	21.2	49.278	99.62	9,853.03	988.66	8,864.37	fission
	33	12,650.5	4164.3	2,322	986	78.4	21.2	49.278	99.87	9,878.23	991.64	8,886.59	fission
	34	12,782.8	4296.6	2,365	988	78.0	21.6	50.208	99.36	9,827.83	985.68	8,842.15	fission
	35	13,122.4	4636.2	2,201	986	66.0	24.3	56.484	84.08	8,315.86	807.15	7,508.71	fission
	36	13,462.0	4975.7	2,275	986	77.9	21.1	49.046	99.24	9,815.23	984.19	8,831.04	fission
	EOC2	13,649.4	5163.2	2,275	986	77.9	21.1	49.046	99.24	9,815.23	984.19	8,831.04	fission
	BOC3	8,138.9	0.0										fission
	37	8,275.6	136.7	2,045	978	70.6	21.6	50.208	89.94	8,895.45	875.52	8,019.93	fission
	38	8,361.6	222.7	2,056	977	54.8	28.4	66.014	69.81	6,904.68	641.02	6,263.66	fission
	39	8,648.3	509.4	2,265	986	78.7	20.6	47.884	100.25	9,916.03	996.11	8,919.92	fission
	40	8,869.9	731.0	2,193	985	78.3	20.0	46.489	99.75	9,865.63	990.15	8,875.48	fission
	41	9,294.4	1155.5	2,415	993	77.8	21.9	50.905	99.11	9,802.64	982.70	8,819.94	gamma
	42	9,587.7	1448.7	2,404	993	78.5	21.6	50.208	100.00	9,890.83	993.13	8,897.70	gamma
	43	10,178.6	2039.7	2,416	987	77.9	21.8	50.673	99.24	9,815.23	984.19	8,831.04	gamma
	44	10,624.0	2485.1	2,411	990	77.9	21.7	50.440	99.24	9,815.23	984.19	8,831.04	gamma
	45	10,799.3	2660.4	2,292	984	67.9	24.5	56.949	86.50	8,555.26	835.38	7,719.88	gamma
	46	11,244.8	3105.8	2,097	975	62.4	25.4	59.041	79.49	7,862.27	753.70	7,108.57	gamma
	47	11,486.2	3347.3	2,283	983	69.5	23.7	55.089	88.54	8,756.85	859.16	7,897.69	gamma
3	48	11,907.4	3768.5	2,414	989	77.4	22.2	51.603	98.60	9,752.24	976.74	8,775.50	gamma
	49	12,142.2	4003.3	2,419	993	77.4	22.1	51.370	98.60	9,752.24	976.74	8,775.50	gamma
	50	12,950.4	4811.5	2,413	987	77.5	21.9	50.905	98.73	9,764.84	978.23	8,786.61	gamma
	51	13,431.1	5292.2	2,397	987	78.0	21.8	50.673	99.36	9,827.83	985.68	8,842.15	gamma
	52	13,592.1	5453.1	2,407	989	77.0	22.2	51.603	98.09	9,701.84	970.78	8,731.06	gamma
	53	13,728.8	5589.9	2,345	987	78.6	21.4	49.743	100.13	9,903.43	994.62	8,908.81	gamma
	54	13,831.3	5692.4	2,383	991	78.5	21.7	50.440	100.00	9,890.83	993.13	8,897.70	gamma
	55	13,944.9	5806.0	2,426	991	78.1	22.4	52.068	99.49	9,840.43	987.17	8,853.26	gamma
	56	14,103.6	5964.7	2,408	991	77.2	22.5	52.300	98.34	9,727.04	973.76	8,753.28	gamma
	57	14,195.1	6056.2	2,393	990	78.1	22.1	51.370	99.49	9,840.43	987.17	8,853.26	gamma
	58	14,309.8	6170.9	2,346	989	78.6	21.6	50.208	100.13	9,903.43	994.62	8,908.81	gamma
	59	14,548.0	6409.0	2,272	986	77.6	21.3	49.511	98.85	9,777.44	979.72	8,797.72	gamma
	EOC3	14,552.4	6413.5	2,272	986	77.6	21.3	49.511	98.85	9,777.44	979.72	8,797.72	gamma

Table 2.8. Hatch1 burnup points for PARCS.

Cycle	Burnup (MWd/t)		Rod pattern	TIP data set		Burnup points (MWd/t)			Burnup intervals (MWd/kgU)	
	From	To		Number	Burnup (MWd/t)					
1	0.00	308.65	A	1	198.42	0	198.42	308.65	-0.1984	-0.1102
	308.65	493.84	B	2	493.84	308.65	493.84	–	-0.1852	–
	493.84	702.17	A	3	702.17	493.84	702.17	1040.58	-0.2083	-0.3384
	702.17	1040.58	A							
	1040.58	1281.99	A	4	1281.99	1040.58	1281.99	1631.42	-0.2414	-0.3494
	1281.99	1631.42	A							
	1631.42	2013.92	A	5	1984.16	1631.42	1984.16	2013.92	-0.3527	-0.0298
	2013.92	2583.82	B	6	2583.82	2013.92	2583.82	–	-0.5699	–
	2583.82	3116.23	B	7	3116.23	2583.82	3116.23	–	-0.5324	–
	3116.23	3646.44	B	8	3646.44	3116.23	3646.44	3948.48	-0.5302	-0.3020
	3646.44	3948.48	B							
	3948.48	4157.92	B	9	4157.92	3948.48	4157.92	4204.21	-0.2094	-0.0463
	4157.92	4204.21	B							
	4204.21	4319.96	A	10	4319.96	4204.21	4319.96	4685.92	-0.1157	-0.3660
	4319.96	4685.92	A							
	4685.92	5024.33	A	11	4685.92	4685.92	5024.33	–	-0.3384	–
	5024.33	5301.01	A	12	5024.33	5024.33	5301.01	–	-0.2767	–
	5301.01	5793.75	B	13	5793.75	5301.01	5793.75	6276.56	-0.4927	-0.4828
	5793.75	6276.56	B							
	6276.56	6592.92	A	14	6592.92	6276.56	6592.92	–	-0.3164	–
	6592.92	6979.83	A	15	6979.83	6592.92	6979.83	7161.71	-0.3869	-0.1819
	6979.83	7161.71	A							
	7161.71	7619.17	B	16	7619.17	7161.71	7619.17	8060.10	-0.4575	-0.4409
	7619.17	8060.10	B							
	8060.10	8432.68	B	17	8060.10	8060.10	8432.68	–	-0.3726	–
	8432.68	8938.64	B	18	8938.64	8432.68	8938.64	9025.72	-0.5060	-0.0871
	8938.64	9025.72	B							
	9025.72	9402.71	A	19	9402.71	9025.72	9402.71	–	-0.3770	–
	9402.71	9829.31	A	20	9829.31	9402.71	9829.31	–	-0.4266	–
	9829.31	9883.32	A	21	9883.32	9829.31	9883.32	10119.21	-0.0540	-0.2359
	9883.32	10119.21	A							
	10119.21	10311.02	A	22	10119.21	10119.21	10311.02	–	-0.1918	–
	10311.02	10399.20	A	23	10311.02	10311.02	10399.20	–	-0.0882	–
2	8484.49	8655.35	B1	24	8606.84	8484.49	8606.84	8655.35	-0.1224	-0.0485
	8655.35	9164.61	A1	25	9095.17	8655.35	9095.17	9164.61	-0.4398	-0.0694
	9164.61	9754.35	A1	26	9527.27	9164.61	9527.27	9754.35	-0.3627	-0.2271
	9754.35	10296.69	B1	27	9855.76	9754.35	9855.76	10296.69	-0.1014	-0.4409
	10296.69	10937.13	B1	28	10893.04	10296.69	10893.04	10937.13	-0.5964	-0.0441
	10937.13	11244.67	A2	29	11221.53	10937.13	11221.53	11244.67	-0.2844	-0.0231
	11244.67	11536.79	A2	30	11426.56	11244.67	11426.56	11536.79	-0.1819	-0.1102
	11536.79	12073.61	A2	31	11866.38	11536.79	11866.38	12073.61	-0.3296	-0.2072
	12073.61	12329.35	B2	32	12299.59	12073.61	12299.59	12329.35	-0.2260	-0.0298
	12329.35	12689.80	B2	33	12647.92	12329.35	12647.92	12689.80	-0.3186	-0.0419
	12689.80	12987.43	B2	34	12780.19	12689.80	12780.19	12987.43	-0.0904	-0.2072
	12987.43	13247.57	A2	35	13119.71	12987.43	13119.71	13247.57	-0.1323	-0.1279
	13247.57	13646.61	A2	36	13459.22	13247.57	13459.22	13646.61	-0.2116	-0.1874

Table 2.8. Hatch1 burnup points for PARCS. (continued)

Cycle	Burnup (MWd/t)		Rod pattern	TIP data set		Burnup points (MWd/t)			Burnup intervals (MWd/kgU)	
	From	To		Number	Burnup (MWd/t)					
3	8137.26	8293.79	B1	37	8273.95	8137.26	8273.95	8293.79	-0.1367	-0.0198
	8293.79	8481.18	A1	38	8359.93	8293.79	8359.93	8481.18	-0.0661	-0.1213
	8481.18	8688.42	A1	39	8646.53	8481.18	8646.53	8688.42	-0.1653	-0.0419
	8688.42	8930.92	A1	40	8868.09	8688.42	8868.09	8930.92	-0.1797	-0.0628
	8930.92	9407.12	A1	41	9292.48	8930.92	9292.48	9407.12	-0.3616	-0.1146
	9407.12	9834.82	B1	42	9585.70	9407.12	9585.70	9834.82	-0.1786	-0.2491
	9834.82	10427.86	B1	43	10176.54	9834.82	10176.54	10427.86	-0.3417	-0.2513
	10427.86	10643.91	B1	44	10621.87	10427.86	10621.87	10643.91	-0.1940	-0.0220
	10643.91	10921.70	A2	45	10797.14	10643.91	10797.14	10921.70	-0.1532	-0.1246
	10921.70	11328.45	A2	46	11242.47	10921.70	11242.47	11328.45	-0.3208	-0.0860
	11328.45	11628.28	A2	47	11483.88	11328.45	11483.88	11628.28	-0.1554	-0.1444
	11628.28	12095.66	B2	48	11904.96	11628.28	11904.96	12095.66	-0.2767	-0.1907
	12095.66	12634.69	B2	49	12139.75	12095.66	12139.75	12634.69	-0.0441	-0.4949
	12634.69	13151.67	A1	50	12947.74	12634.69	12947.74	13151.67	-0.3131	-0.2039
	13151.67	13625.67	A1	51	13428.35	13151.67	13428.35	13625.67	-0.2767	-0.1973
	13625.67	14077.61	A1	54	13828.49	13625.67	13828.49	14077.61	-0.2028	-0.2491
	14077.61	14549.40	A1	58	14306.89	14077.61	14306.89	14549.40	-0.2293	-0.2425

3. BENCHMARK CALCULATIONS AND RESULTS

3.1 BENCHMARK CALCULATION

3.1.1 Polaris Calculations

The SCALE 6.3/Polaris inputs were prepared using the data provided in Section 2 to produce assembly-homogenized 2-group cross sections for whole-core nodal diffusion calculations. To cover all the possible reactor states, the 2-group cross sections were tabulated as a function of burnup, moderator and fuel temperatures, moderator density, and control rod insertion. Table 3.1 provides state information for six history cases. There are seven Zr-4 spacer grids in Hatch1, including Inc-718 springs, which should be considered in the Polaris lattice physics calculation. The spacer grids were homogenized with fuel cladding for a model simplification to minimize the number of Polaris calculations. To explicitly consider spacer grids, independent assembly-homogenized 2-group cross sections must be generated for assemblies with and without spacer grids, respectively. This model simplification is expected to increase the differences in the TIP comparison between the measured data and calculation results. Because Hatch1 used two types of TIPs with fission and gamma, the Polaris inputs were prepared with fission and gamma TIPs.

To complete the functionalization of the cross-section table-sets, various branch calculations should be performed at each burnup point for each history case. Table 3.2 provides the information for branch states for assembly. Table 3.3 provides the branch cases for reflectors for which no depletion calculation was performed. Figure 3.1 illustrates the Polaris models for radial,top, and bottom axial reflectors.

Table 3.4 provides the Polaris input and output files for the Hatch1 cycles 1−3. A sample file name with ‘hatch-t1a_DC40CR0.inp’ indicates

- hatch: Plant name,
- t1a: assembly type,
- DC40: 40% void,
- CR0: control rod out,
- inp: Polaris input.

Appendices A.1−A.4 provide the Polaris inputs for the fuel assembly Type 1A and the reflectors (see list below).

- Appendix A.1: Polaris input for the fuel assembly Type 1A
- Appendix A.2: Polaris input for radial edge reflector
- Appendix A.3: Polaris input for axial top reflector
- Appendix A.4: Polaris input for axial bottom reflector

Table 3.1. History cases for each assembly type.

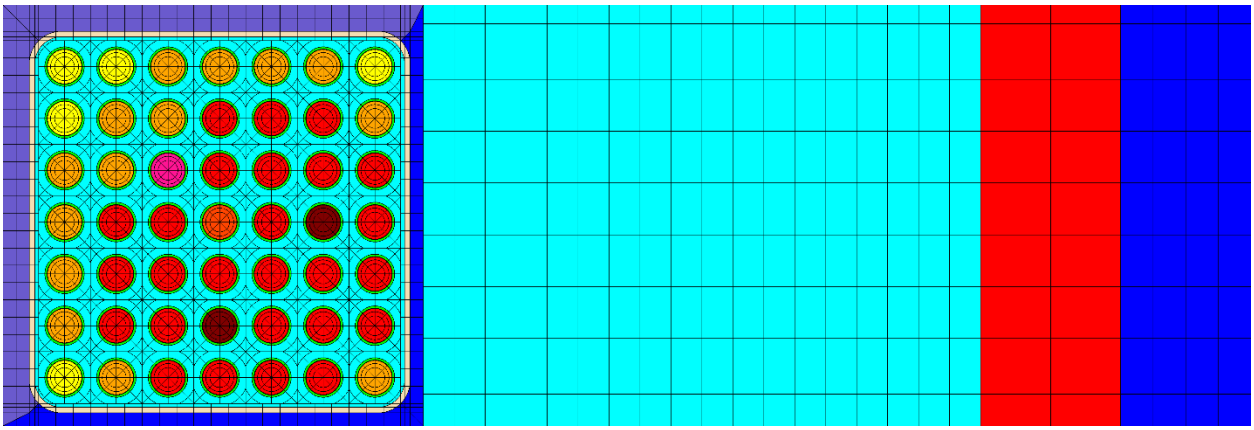
	File name	Coolant		Moderator		Temperature (K)					Rod-in
		Temp. (K)	Density (g/cm^3)	Temp. (K)	Density (g/cm^3)	Fuel	Clad	Gap	CR	Channel	
A1	cr0_v00	560.29	0.7373	560.29	0.7373	948.45	637.92	793.19	560.29	560.29	no
A2	cr0_v40	"	0.4573	"	"	"	"	"	"	"	no
A3	cr0_v70	"	0.2473	"	"	"	"	"	"	"	no
A4	cr1_v00	"	0.7373	"	"	"	"	"	"	"	yes
A5	cr1_v40	"	0.4573	"	"	"	"	"	"	"	yes
A6	cr1_v70	"	0.2473	"	"	"	"	"	"	"	yes

Table 3.2. Branch states for each assembly type.

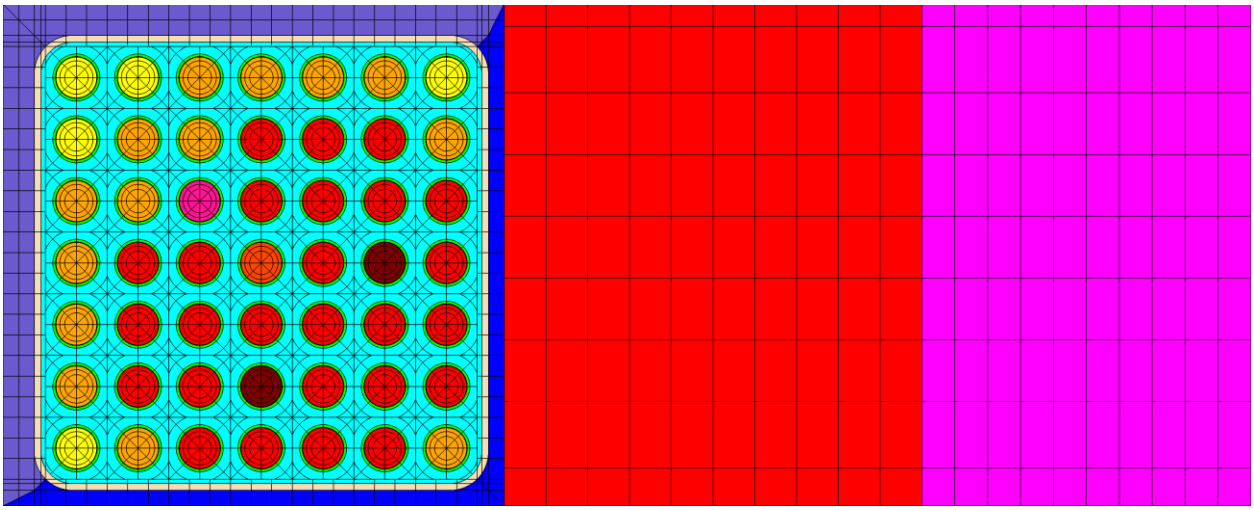
No	Coolant		Moderator		Temperature (K)					Rod-in
	Density (g/cm^3)	Temp. (K)	Density (g/cm^3)	Temp. (K)	Fuel	Clad	Gap	CR	Channel	
1	0.7373	560.29	0.7373	560.29	948.45	637.92	793.19	560.29	560.29	no
2	0.4573	"	"	"	"	"	"	"	"	no
3	0.2473	"	"	"	"	"	"	"	"	no
4	0.7373	"	"	"	"	"	"	"	"	yes
5	0.4573	"	"	"	"	"	"	"	"	yes
6	0.2473	"	"	"	"	"	"	"	"	yes
7	0.1073	"	"	"	"	"	"	"	"	no
8	0.1073	"	"	"	"	"	"	"	"	yes
9	0.7373	"	"	"	500	548.23	524.12	"	"	no
10	0.4573	"	"	"	"	"	"	"	"	no
11	0.2473	"	"	"	"	"	"	"	"	no
12	0.1073	"	"	"	"	"	"	"	"	no
13	0.7373	"	"	"	"	"	"	"	"	yes
14	0.4573	"	"	"	"	"	"	"	"	yes
15	0.2473	"	"	"	"	"	"	"	"	yes
16	0.1073	"	"	"	"	"	"	"	"	yes
17	0.7373	"	"	"	1,500	748.23	1,124.12	"	"	no
18	0.4573	"	"	"	"	"	"	"	"	no
19	0.2473	"	"	"	"	"	"	"	"	no
20	0.1073	"	"	"	"	"	"	"	"	no
21	0.7373	"	"	"	"	"	"	"	"	yes
22	0.4573	"	"	"	"	"	"	"	"	yes
23	0.2473	"	"	"	"	"	"	"	"	yes
24	0.1073	"	"	"	"	"	"	"	"	yes

Table 3.3. Branch states for reflectors.

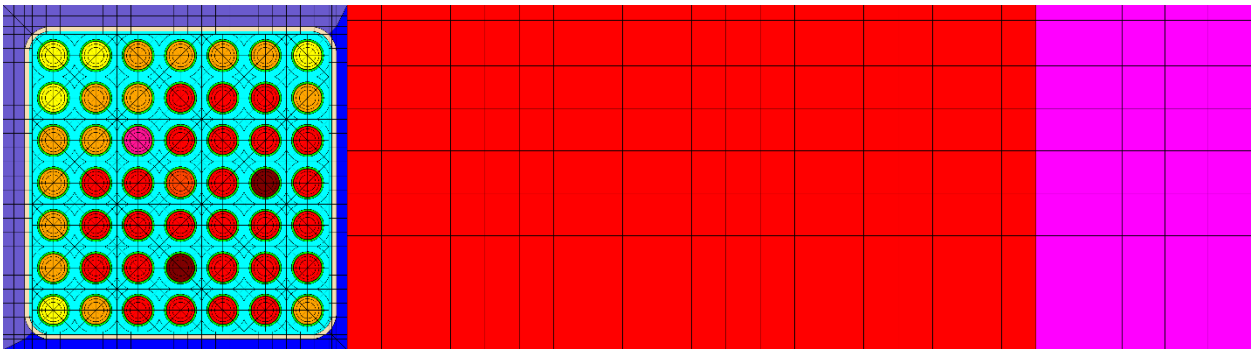
Case	Coolant		Moderator		Temperature (K)					Rod-in
	Temp. (K)	Density (g/cm^3)	Temp. (K)	Density (g/cm^3)	Fuel	Clad	Gap	CR	Channel	
Reference	560.29	0.4573	560.29	0.7373	948.45	560.29	560.29	560.29	560.29	no
1	"	0.7373	"	"	"	"	"	"	"	no
2	"	0.2473	"	"	"	"	"	"	"	no
3	"	0.1073	"	"	"	"	"	"	"	no



(A) Radial reflector



(B) Bottom axial reflector



(C) Top axial reflector

Figure 3.1. Polaris models for reflectors.

Table 3.4. Polaris input and output files for Hatch1.

Assembly type	Directory	File name	Description
Type 1A	./Polaris/type1a	hatch-t1a_DC??CR?,*	Input, output, T16 DC?? void percent DC00: 0 % void DC40: 40 % void DC70: 70 % void CR? control rod CR0: out CR1: in * File names inp: input file idc: IDC format input msg: message file out: output file png: geometry image file t16: few-group cross sections f71: ORIGEN concentration f33: ORIGEN library
Type 1B	./Polaris/type1b	hatch-t1b_DC??CR?,*	
Type 2A	./Polaris/type2a	hatch-t2a_DC??CR?,*	
Type 2C	./Polaris/type2c	hatch-t2c_DC??CR?,*	
Type 2D	./Polaris/type2d	hatch-t2d_DC??CR?,*	
Type 3	./Polaris/type3	hatch-t3_DC??CR?,*	
Type 4	./Polaris/type4	hatch-t4_DC??CR?,*	
Type 5A	./Polaris/type5a	hatch-t5a_DC??CR?,*	
Type 5B	./Polaris/type5b	hatch-t5b_DC??CR?,*	
Radial reflector	./Polaris/reflector	hatch1_refl_rad.*	
Top reflector	./Polaris/reflector	hatch1_refl_top.*	
Bottom reflector	./Polaris/reflector	hatch1_refl_bot.*	

3.1.2 Cross-Section Table-Set Generation Using GenPMAXS

Appendices B.1−B.4 provide the GenPMAXS inputs for the fuel assembly Type 1 and the radial edge, axial top, and axial bottom reflectors.

- Appendix B.1: GenPMAXS input for the fuel assembly Type 1A
- Appendix B.2: GenPMAXS input for radial edge reflector
- Appendix B.3: GenPMAXS input for axial top reflector
- Appendix B.4: GenPMAXS input for axial bottom reflector

Table 3.5 provides the GenPMAXS input and output files. Various GenPMAXS input files can exist for various radial reflectors including edge, east, south-east, and south reflectors.

Table 3.5. GenPMAXS input and output files for Hatch1.

Assembly type	Dir	Filename	Description
Type 1A	./GenPMAXS/fuel_polaris	hatch-t1a,*	* inp: input files kinf: kinf summary out: output file PMAX: cross section table-set ?? diag: diagonal edge: edge E: east NE: northeast N: north NW: northwest SE: southeast S: south SW: southwest W: west
Type 1B	./GenPMAXS/fuel_polaris	hatch-t1b,*	
Type 2A	./GenPMAXS/fuel_polaris	hatch-t2a,*	
Type 2C	./GenPMAXS/fuel_polaris	hatch-t2c,*	
Type 2D	./GenPMAXS/fuel_polaris	hatch-t2d,*	
Type 3	./GenPMAXS/fuel_polaris	hatch-t3,*	
Type 4	./GenPMAXS/fuel_polaris	hatch-t4,*	
Type 5A	./GenPMAXS/fuel_polaris	hatch-t5a,*	
Type 5B	./GenPMAXS/fuel_polaris	hatch-t5b,*	
Radial reflector	./GenPMAXS/refl_polaris	refl_rad_??.*	
Top reflector	./GenPMAXS/refl_polaris	refl_top.*	
Bottom reflector	./GenPMAXS/refl_polaris	refl_bot.*	

3.1.3 Whole-Core Nodal Diffusion Calculations Using PARCS

Appendices C.1−C.10 provide the PARCS inputs for the Hatch1 cycles 1−3 hot zero power (HZP) and HFP calculations.

- Appendix C.1: PATHS input for the HFP cycle 1
- Appendix C.2: PARCS input for the HFP cycle 1
- Appendix C.3: PATHS input for the cycle 2
- Appendix C.4: PARCS input for the HZP cycle 2 fuel shuffling
- Appendix C.5: PARCS input for the HFP cycle 2
- Appendix C.6: PATHS input for the cycle 3
- Appendix C.7: Assembly layout file for cycle 1
- Appendix C.8: Assembly layout file for cycle 2
- Appendix C.9: PARCS input for the HZP cycle 3 fuel shuffling
- Appendix C.10: PARCS input for the HFP cycle 3

Table 3.6 provides the PARCS input and output files.

Table 3.6. PARCS input and output files for Hatch1.

Cycle	File name	Description
1	paths_h1c1.inp	PATHS input
	H1C1.inp	PARCS input
	H1C1.parcs_out	output
	H1C1.parcs_det	TIP data
	H1C1.parcs_dpl	Summary
2	paths_h1c2.inp	PATHS input
	H1C1-C2.inp	PARCS input for shuffling
	H1C2.inp	PARCS input
	H1C2.parcs_out	output
	H1C1-C2.parcs_cyc-02	Restart file
	H1C2.parcs_det	Detector response
	H1C2.parcs_dpl	Summary
3	H1C1.lay	Cycle 1 layout
	H1C2.lay	Cycle 2 layout
	paths_h1c3.inp	PATHS input
	H1C2-C3.inp	PARCS input for shuffling
	H1C3.inp	PARCS input
	H1C3.parcs_out	output
	H1C2-C3.parcs_cyc-02	Restart file
	H1C3.parcs_det	Detector response
	H1C3.parcs_dpl	Summary

3.2 BENCHMARK RESULTS

Figure 3.2 and Table 3.7 illustrate the HFP multiplication factors and reactivity differences as a function of burnup at the operating critical conditions for Hatch1, which has significant reactivity biases for cycle 1 and which can be expected considering the unusual variations in operating history and tests conducted during the operation. Cycle 1 was divided into two parts: before and after plugging. The core support plate included holes to promote bypass flow in the inter-assembly region, and then the holes were plugged. The reactivities in cycles 2 and 3 for Hatch1 are close to criticality over whole burnups. A more detailed investigation is required to identify the significant reactivity bias issue of the Polaris-PARCS

procedure for cycle 1. The large reactivity bias might result from poor xenon modeling caused by frequent reactor power changes and shutdowns or a poor thermal-hydraulics model. The EPRI reports provide a very coarse operation history. Therefore, since the PARCS models with wide burnup intervals would have equilibrium xenon, the simulation might not correctly track short-term non-equilibrium xenon behavior.

Figure 3.3 and Table 3.8 compare the TIP data between the measured data and calculated results by PARCS for Hatch1. The figure and table include the TIP data comparisons for the 3D, axially-integrated 2D radial and the radially-integrated 1D axial distributions. The total 3D root mean square (RMS) errors are 9.58%, the total radial 2D RMS errors are 4.27%, and the total axial 1D RMS errors are 7.04%. Fission TIP was replaced with gamma TIP during cycle 3. The RMS errors for gamma TIP data are better than the RMS errors for fission TIP data, which indicate that gamma TIP is more stable and reliable than fission TIP. Appendix D provides the utility program to compare the calculated TIP results with the measured data.

- Appendix D.1: Program source for TIP comparison
- Appendix D.2: Cycle 1 input for TIP comparison
- Appendix D.3: Cycle 2 input for TIP comparison
- Appendix D.4: Cycle 3 input for TIP comparison
- Appendix D.5: Cycle 1 TIP measured data
- Appendix D.6: Cycle 2 TIP measured data
- Appendix D.7: Cycle 3 TIP measured data

Appendix E provides the detailed TIP comparison figures including RMS, average and maximum errors for individual TIPs at all the measured burnup points.

- Appendix E.1: Hatch1 cycle 1 TIP comparison
- Appendix E.2: Hatch1 cycle 2 TIP comparison
- Appendix E.3: Hatch1 cycle 3 TIP comparison

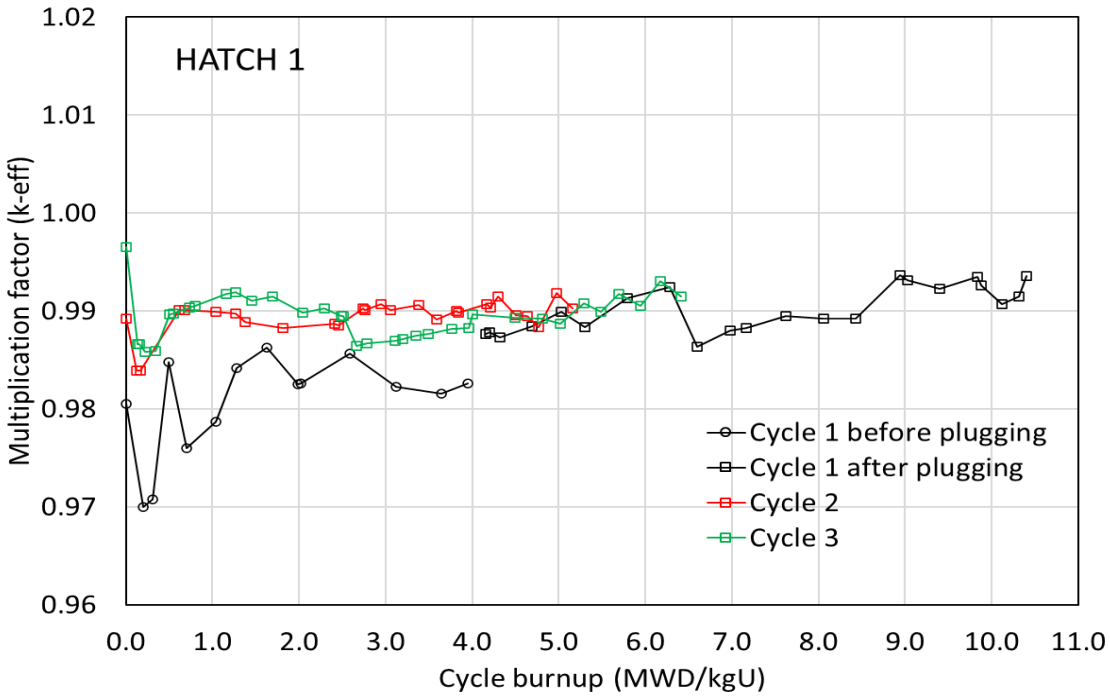


Figure 3.2. Hatch1 cycles 1–3 HFP PARCS reactivities.

Table 3.7. Comparison of HFP reactivities.

No	Cycle 1				Cycle 2				Cycle 3			
	Burnup (MWd/kgU)		$k_{eff.}$	$\Delta k_{eff.}$ (pcm)	Burnup (MWd/kgU)		$k_{eff.}$	$\Delta k_{eff.}$ (pcm)	Burnup (MWd/kgU)		$k_{eff.}$	$\Delta k_{eff.}$ (pcm)
	Core	Cycle			Core	Cycle			Core	Cycle		
1	0	0	0.980487	-1951	8.534	0.000	0.989249	-1075	8.137	0.000	0.99656	-344
2	0.198	0.198	0.970004	-3000	8.656	0.122	0.983946	-1605	8.274	0.137	0.98657	-1343
3	0.309	0.309	0.9708	-2920	8.704	0.170	0.983874	-1613	8.293	0.156	0.98657	-1343
4	0.494	0.494	0.984776	-1522	9.144	0.610	0.990084	-992	8.359	0.222	0.98585	-1415
5	0.702	0.702	0.976035	-2397	9.214	0.680	0.990072	-993	8.481	0.344	0.98593	-1407
6	1.041	1.041	0.978731	-2127	9.576	1.042	0.989903	-1010	8.646	0.509	0.98963	-1037
7	1.282	1.282	0.984141	-1586	9.803	1.269	0.989754	-1025	8.688	0.551	0.98971	-1029
8	1.631	1.631	0.986288	-1371	9.905	1.371	0.988914	-1109	8.868	0.731	0.99038	-962
9	1.984	1.984	0.982486	-1751	10.346	1.812	0.988284	-1172	8.930	0.793	0.99051	-949
10	2.014	2.014	0.982629	-1737	10.942	2.408	0.98874	-1126	9.292	1.155	0.99178	-822
11	2.584	2.584	0.985617	-1438	10.986	2.452	0.988561	-1144	9.407	1.270	0.99195	-806
12	3.116	3.116	0.982246	-1775	11.271	2.737	0.990229	-977	9.585	1.448	0.99107	-893
13	3.646	3.646	0.981544	-1846	11.294	2.760	0.990106	-989	9.834	1.697	0.99152	-848
14	3.948	3.948	0.982575	-1743	11.476	2.942	0.990718	-928	10.176	2.039	0.98981	-1019
15	4.158	4.158	0.987689	-1231	11.586	3.052	0.990057	-994	10.427	2.290	0.99029	-971
16	4.204	4.204	0.987825	-1218	11.915	3.381	0.990638	-936	10.621	2.484	0.98947	-1053
17	4.32	4.32	0.987328	-1267	12.123	3.589	0.989128	-1087	10.643	2.506	0.98952	-1048
18	4.686	4.686	0.988396	-1160	12.349	3.815	0.990035	-997	10.797	2.660	0.98648	-1352
19	5.024	5.024	0.989897	-1010	12.378	3.844	0.989795	-1021	10.921	2.784	0.98674	-1326
20	5.301	5.301	0.988353	-1165	12.697	4.163	0.990693	-931	11.242	3.105	0.98695	-1305
21	5.794	5.794	0.99135	-865	12.739	4.205	0.990322	-968	11.328	3.191	0.98711	-1289
22	6.276	6.276	0.992439	-756	12.829	4.295	0.991454	-855	11.483	3.346	0.98746	-1255
23	6.593	6.593	0.986364	-1364	13.037	4.503	0.989578	-1042	11.628	3.491	0.98766	-1234
24	6.98	6.98	0.988024	-1198	13.169	4.635	0.98945	-1055	11.904	3.767	0.98816	-1184
25	7.162	7.162	0.988278	-1172	13.297	4.763	0.988365	-1163	12.095	3.958	0.98823	-1177
26	7.619	7.619	0.989458	-1054	13.508	4.974	0.991843	-816	12.139	4.002	0.98962	-1038
27	8.06	8.06	0.989244	-1076	13.696	5.162	0.990237	-976	12.634	4.497	0.98931	-1069
28	8.433	8.433	0.98925	-1075					12.947	4.810	0.98926	-1075
29	8.939	8.939	0.99362	-638					13.151	5.014	0.98873	-1127
30	9.026	9.026	0.993167	-683					13.428	5.291	0.99076	-924
31	9.403	9.403	0.992263	-774					13.625	5.488	0.98995	-1005
32	9.829	9.829	0.993482	-652					13.828	5.691	0.99178	-822
33	9.883	9.883	0.992618	-738					14.077	5.940	0.99056	-944
34	10.119	10.119	0.990674	-933					14.306	6.169	0.99303	-697
35	10.311	10.311	0.991465	-853					14.549	6.412	0.99153	-847
36	10.399	10.399	0.993598	-640								

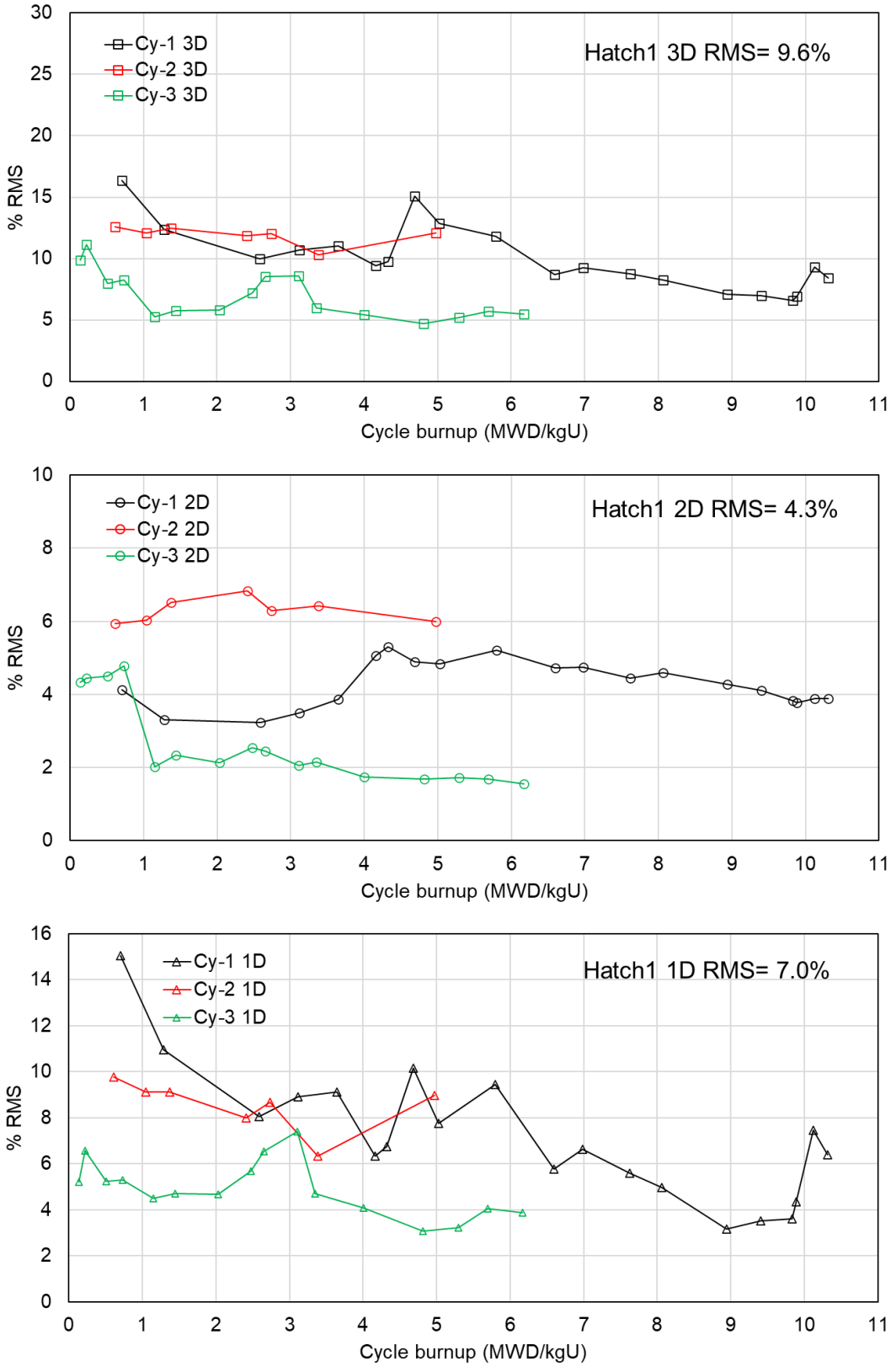


Figure 3.3. Comparison of the HFP TIP data for Hatch1.

Table 3.8. Comparison of the TIP data for Hatch1.

Cycle	Data point	Burnup (MWd/kgU)		PARCS point	3D		Radial		Axial		TIP
		Core	Cycle		RMS (%)	Cases	RMS (%)	Cases	RMS (%)	Cases	
1	3	0.702	0.702	10	16.37	744	4.12	31	15.03	24	Fission
	4	1.282	1.282	14	12.37	744	3.31	31	10.96	24	
	6	2.584	2.584	22	9.98	744	3.24	31	8.06	24	
	7	3.116	3.117	24	10.69	744	3.5	31	8.92	24	
	8	3.646	3.647	26	11.03	744	3.86	31	9.13	24	
	9	4.158	4.159	30	9.43	744	5.06	31	6.34	24	
	10	4.320	4.321	34	9.76	744	5.3	31	6.75	24	
	11	4.686	4.687	36	15.08	744	4.9	31	10.16	24	
	12	5.024	5.025	38	12.84	744	4.83	31	7.76	24	
	13	5.794	5.795	42	11.78	744	5.21	31	9.45	24	
	14	6.593	6.594	46	8.72	744	4.73	31	5.78	24	
	15	6.980	6.981	48	9.26	744	4.75	31	6.64	24	
	16	7.619	7.621	52	8.77	744	4.45	31	5.6	24	
	17	8.060	8.062	54	8.26	744	4.59	31	4.98	24	
	18	8.939	8.941	58	7.09	744	4.28	31	3.16	24	
	19	9.403	9.405	62	6.98	744	4.1	31	3.53	24	
	20	9.829	9.831	64	6.56	744	3.83	31	3.61	24	
	21	9.883	9.885	66	6.93	744	3.77	31	4.34	24	
	22	10.119	10.121	68	9.3	744	3.88	31	7.46	24	
	23	10.311	10.313	70	8.44	744	3.88	31	6.39	24	
2	25	9.144	0.610	8	12.57	744	5.93	31	9.78	24	
	26	9.576	1.042	12	12.11	744	6.04	31	9.13	24	
	27	9.905	1.371	16	12.45	744	6.51	31	9.12	24	
	28	10.942	2.408	20	11.85	744	6.84	31	7.98	24	
	29	11.271	2.737	24	12.04	744	6.29	31	8.68	24	
	31	11.915	3.381	32	10.30	744	6.43	31	6.33	24	
	36	13.508	4.974	52	12.09	744	5.99	31	8.96	24	
3	37	8.274	0.137	4	9.85	744	4.33	31	5.22	24	
	38	8.359	0.222	8	11.14	744	4.45	31	6.58	24	
	39	8.646	0.509	12	8.00	744	4.51	31	5.24	24	
	40	8.868	0.731	16	8.23	744	4.78	31	5.29	24	
	41	9.284	1.147	20	5.27	744	2.01	31	4.51	24	Gamma
	42	9.577	1.440	24	5.76	744	2.33	31	4.71	24	
	43	10.168	2.031	28	5.82	744	2.14	31	4.67	24	
	44	10.613	2.476	32	7.18	744	2.55	31	5.67	24	
	45	10.789	2.652	36	8.54	744	2.45	31	6.53	24	
	46	11.243	3.106	40	8.57	744	2.06	31	7.40	24	
	47	11.484	3.347	44	5.99	744	2.15	31	4.70	24	
	49	12.140	4.003	52	5.41	744	1.74	31	4.08	24	
	50	12.948	4.811	56	4.71	744	1.68	31	3.09	24	
	51	13.429	5.292	60	5.17	744	1.72	31	3.22	24	
	54	13.829	5.692	64	5.68	744	1.69	31	4.04	24	
	58	14.308	6.171	68	5.49	744	1.56	31	3.87	24	
All					9.58	31992	4.27	1333	7.04	1032	

Figure 3.4 compares the 1D axial TIP data for Hatch1 cycle 3 at the core average burnups 8.3 and 13.3 MWD/kgU. The overall shapes of the 1D TIP data are consistent, but differences in local shapes might

result from neglecting spacer grids in the Polaris-PARCS modeling. Detailed modeling for the seven spacer grids is expected to improve the calculated axial TIP data shapes and provide reduced RMS errors.

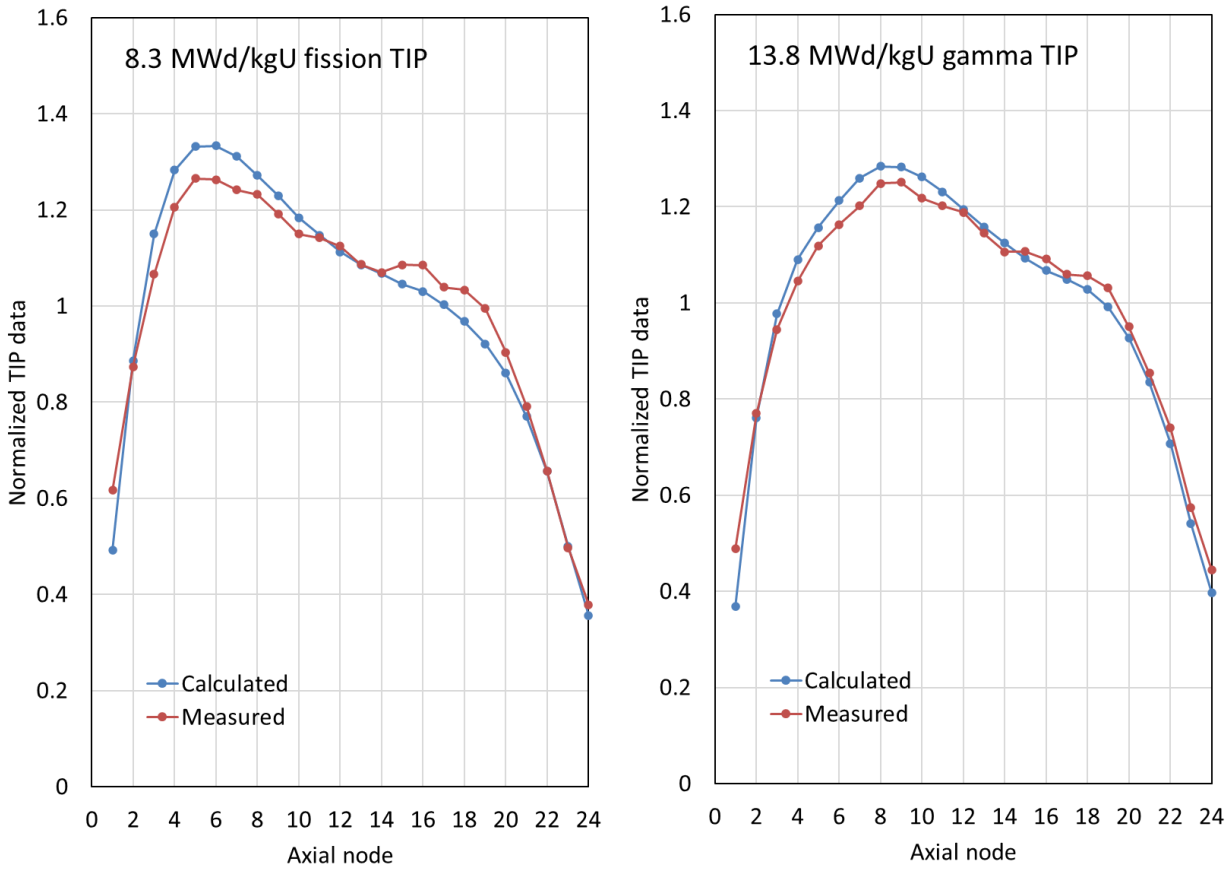


Figure 3.4. Axial 1D TIP comparison for Hatch1 cycle 3.

4. CONCLUSION

The benchmark calculations were performed for the Hatch1 cycles 1−3 using the SCALE 6.3/Polaris−PARCS v3.4.2 code package with the ENDF/B-VII.1 AMPX 56-group library. The benchmark results were compared with the measured data for the HFP reactivities and TIP data which are provided by the EPRI technical reports NP-562 and NP-2106. The EPRI reports does not provide very detailed information for operational histories and design data such as top and bottom axial reflectors. Therefore, the information for top and bottom axial reflectors was adopted from the Peach Bottom Unit 2.

The benchmark results show relatively large reactivity biases for initial and reload cycles, and large discrepancy for axial power distributions. Hatch cycle 3 includes 15.24 cm longer fuel rods in the assembly type 5, which requires mixed axial meshes for nominal and long fuel rods. However, because PARCS cannot model different active fuel heights, they were treated as a nominal fuel rod resulting in reduced fuel mass in the core. This model simplification should reduce reactivity and increase uncertainty for the TIP comparison, which introduces more conservative uncertainties. This issue in PARCS must be resolved because the mixed use of different active fuel heights is common in the BWR in-core fuel management.

More detailed investigation is required to improve the Polaris-PARCS benchmark results for axial power distributions. This issue may come from poor axial reflector models, modeling approximation for Inc-718 spacer grids and/or a poor two-phase T/H model including the neglected bypass flow. Gamma TIP was used for Hatch1 cycle 3 instead of fission TIP, of which the measured TIP data introduce better agreement with the calculated TIP data.

The final goal of these benchmark calculations is to validate the SCALE/Polaris-GenPMAXS-PARCS code package with the ENDF/B-VII.1 AMPX 56-group library by assessing uncertainties for key nuclear parameters such as reactivity and assembly power peaking factors [11]. In addition, the Polaris-PARCS benchmark models, procedures and methodologies must be continuously improved based on this investigation.

5. REFERENCES

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APPENDIX A. SAMPLE OF POLARIS INPUT FILES

A.1 Polaris Input for Fuel Assembly Type 1A

```
=polaris
%-------------------------------------------------------
%    general options
%-------------------------------------------------------
title "Hatch Type 1a"
lib   "broad_lwr"
opt PRINT XFile16=true
system BWR
%-------------------------------------------------------
%    geometry
%-------------------------------------------------------
geom BWR7x7: ASSM 7  1.875  FULL       % 7x7 assy, pin pitch, full symmetry
hgap  0.475  0.9525:  MOD.1  MOD.2     % Narrow gap, wide gap
mesh MOD.1 : nd=2  nf=3                % Additional detail in bypass added at ORNL suggestion
mesh MOD.2 : nd=3  nf=3                %   (see email from Matt Jessee, 7/20/17)
box   0.2032 0.9652 6.7      CAN.1   % box thickness, corner inner radius, inner half width
%-------------------------------------------------------
%    compositions and materials
%-------------------------------------------------------
% fuel comps
comp c_U279  UOX  enr=2.79
comp c_U194  UOX  enr=1.94
comp c_U169  UOX  enr=1.69
comp c_U127  UOX  enr=1.27
comp c_GdFu  WT   GD2O3=4.0 c_U279=-100

% fuel mats - use stack density from EPRI reports
mat FUEL.1  c_U279  dens=10.32
mat FUEL.2  c_U194  dens=10.32
mat FUEL.3  c_U169  dens=10.32
mat FUEL.4  c_U127  dens=10.32
mat FUEL.5  c_GdFu  dens=10.16

% cladding comp - smear the spacer grids into the cladding material
% this was done consistent with the TRITON models (ML13042A450)
comp c_ZIRI : WT refdens=6.84699
              ZIRC4=3.5224
              INC718=0.6691
              ZIRC2=-100

% cladding mat
mat CLAD.1  c_ZIRI

% absorber mats - B4C, 70% TD
mat CNTL.2  B4C   dens=1.7642

% channel box is Zry4
mat CAN.1   ZIRC4

% detector comps/mats
comp c_U235   : CONC 92235=1.0e-10
comp c_AL2O3  : FORM Al=2 O=3
comp c_DETMIX : WT WATER=47.87 c_AL2O3=15.7 SS304=-100
mat GAS.1 : Ar dens=8.31E-03
mat DET.1 : c_U235
mat DETMIX.1 : c_DETMIX 1.3611

%-------------------------------------------------------
%    pin definitions
%-------------------------------------------------------
% fuel pins
pin  1 :  0.607  0.622  0.716  :  FUEL.1  GAP.1  CLAD.1
pin  2 :  0.607  0.622  0.716  :  FUEL.2  GAP.1  CLAD.1
pin  3 :  0.607  0.622  0.716  :  FUEL.3  GAP.1  CLAD.1
pin  4 :  0.607  0.622  0.716  :  FUEL.4  GAP.1  CLAD.1
pin  5 :  0.607  0.622  0.716  :  FUEL.5  GAP.1  CLAD.1

% add rings according to ORNL recommendations
mesh FUEL.1 nr=3
mesh FUEL.2 nr=3
mesh FUEL.3 nr=3
mesh FUEL.4 nr=3
mesh FUEL.5 nr=10

mesh GAP ns=1 %gap is insignificant - don't need meshing there
```

```
% Self-shield fuel pin regions as single region, gad pins in multiregion
shield ALL=N FUEL.1=P FUEL.2=P FUEL.3=P FUEL.4=P FUEL.5=R

% control rod absorber pin
pin  C :  0.17526 0.23876  :  CNTL.2  STRUCT.1  MOD.2

% detector pin
pin  D :  0.32258 0.35560 0.47625 0.81280 0.88900
       :  GAS     MOD.1   STRUCT  DETMIX  STRUCT

%-------------------------------------------------------
%    pin maps
%-------------------------------------------------------
pinmap
4
4 2
3 2 1
3 1 1 1
3 1 1 1 5
2 1 5 1 1 1
3 2 1 1 1 2 2
%-------------------------------------------------------
%    control blade
%-------------------------------------------------------
control OEM  :  BLADE  0.39624  0.14224  1.98501
                       wgcrv=0.39624
             :  C
             :  10.02792
             :  21
                       % half thickness, sheath thickness, dead length
                       % wing tip curvature
                       % pin C defined above
                       % width of controlled section of wing
                       % 21 control tubes per wing
%-------------------------------------------------------
%    states
%-------------------------------------------------------

power 23.5
bu 0.00000 0.00012 0.15714 0.46920 0.77820 1.08492 1.39005 1.69420 1.99793 2.30175
   2.60614 2.91158 3.21850 3.52733 3.83852 4.15248 4.46966 4.79050 5.11548 5.44507
   5.77980 6.12019 6.46685 6.82040 7.18152 7.55097 7.92959 8.31830 8.71814 9.13029
   9.55609 9.99709 10.4551 10.9322 11.4309 11.9543 12.5061 13.0909 13.7146 14.3849
   15.1122 15.9112 16.8035 17.8231 19.0300 20.5464 22.7041 25.5054 28.5054 31.5054
   34.5054 37.5054 40.5054 43.5054 46.5054 49.5054 52.5054 55.5054 58.5054 61.5054

det d_U235 : pin.D : R(n,FIS) GAS.1 DET.1
opt FG DetectorEdit=d_U235

%Set base temperature field to core average, use
% history and branching variables to perturb to appropriate
% value for calculations

state ALL    : temp=560.29

      MOD    : temp=560.29 dens=0.7373

      COOL   : temp=560.29 dens=0.7373
      CLAD.1 : temp=637.92
      GAP.1  : temp=793.19
      FUEL   : temp=948.45

      OEM    : in=FALSE

read branch
%LABELS
add COOL   :   dens    = 0.7373  0.4573  0.2473  0.7373  0.4573  0.2473  0.1073  0.1073  0.7373  0.4573  0.2473
0.1073  0.7373  0.4573  0.2473  0.1073  0.7373  0.4573  0.2473  0.1073  0.7373  0.4573  0.2473  0.1073
    COOL   :   temp    = 560.29  560.29  560.29  560.29  560.29  560.29  560.29  560.29  560.29  560.29  560.29
560.29  560.29  560.29  560.29  560.29  560.29  560.29  560.29  560.29  560.29  560.29  560.29  560.29
    CLAD.1 :   temp    = 637.92  637.92  637.92  637.92  637.92  637.92  637.92  637.92  548.23  548.23  548.23
548.23  548.23  548.23  548.23  548.23  748.23  748.23  748.23  748.23  748.23  748.23  748.23  748.23
    GAP.1  :   temp    = 793.19  793.19  793.19  793.19  793.19  793.19  793.19  793.19  524.12  524.12  524.12
524.12  524.12  524.12  524.12  524.12 1124.12 1124.12 1124.12 1124.12 1124.12 1124.12 1124.12 1124.12
    FUEL   :   temp    = 948.45  948.45  948.45  948.45  948.45  948.45  948.45  948.45  500.00  500.00  500.00
500.00  500.00  500.00  500.00  500.00 1500.00 1500.00 1500.00 1500.00 1500.00 1500.00 1500.00 1500.00
    MOD    :   dens    = 0.7373  0.7373  0.7373  0.7373  0.7373  0.7373  0.7373  0.7373  0.7373  0.7373  0.7373
0.7373  0.7373  0.7373  0.7373  0.7373  0.7373  0.7373  0.7373  0.7373  0.7373  0.7373  0.7373  0.7373
    MOD    :   temp    = 560.29  560.29  560.29  560.29  560.29  560.29  560.29  560.29  560.29  560.29  560.29
560.29  560.29  560.29  560.29  560.29  560.29  560.29  560.29  560.29  560.29  560.29  560.29  560.29
```

```
    CNTL   :   temp    = 560.29  560.29  560.29  560.29  560.29  560.29  560.29  560.29  560.29  560.29  560.29
560.29  560.29  560.29  560.29  560.29  560.29  560.29  560.29  560.29  560.29  560.29  560.29  560.29
    CAN    :   temp    = 560.29  560.29  560.29  560.29  560.29  560.29  560.29  560.29  560.29  560.29  560.29
560.29  560.29  560.29  560.29  560.29  560.29  560.29  560.29  560.29  560.29  560.29  560.29  560.29
    OEM    :   in      = FALSE   FALSE   FALSE   TRUE    TRUE    TRUE    FALSE   TRUE    FALSE   FALSE   FALSE
FALSE   TRUE    TRUE    TRUE    TRUE    FALSE   FALSE   FALSE   FALSE   TRUE    TRUE    TRUE    TRUE
end branch

end
```

A.2 Polaris Input for Radial Reflector

```
=polaris
% ------------------------------------------------
%    general options
% ------------------------------------------------
title "WEC 7x7 lattice + radial reflector"
lib   "broad_lwr"
opt   PRINT XFile16=true
system BWR
% ------------------------------------------------
%    compositions and materials
% ------------------------------------------------
% fuel comps
comp c_U247a  UOX  enr=2.47
comp c_U170   UOX  enr=1.70
comp c_U120   UOX  enr=1.20
comp c_U247b  UOX  enr=2.47
comp c_U247c  UOX  enr=2.47
comp c_U247d  UOX  enr=2.47

% fuel mats - use stack density from EPRI reports
mat FUEL.1  c_U247a  dens=9.94
mat FUEL.2  c_U170   dens=9.94
mat FUEL.3  c_U120   dens=9.94
mat FUEL.4  c_U247b  dens=10.34
mat FUEL.5  c_U247c  dens=10.34
mat FUEL.6  c_U247d  dens=9.48

% cladding comp - smear the spacer grids into the cladding material
% this was done consistent with the TRITON models (ML13042A450)
comp c_ZIRI : WT refdens=6.84699
              ZIRC4=3.5224
              INC718=0.6691
              ZIRC2=-100

% cladding mat
mat CLAD.1  c_ZIRI

% channel box is Zry4
mat CAN.1   ZIRC4

% shroud
comp SS3161 : WT  FE=68.7 CR=19.0 NI=11.3 MO=1.0
mat SHROUD.1 : SS3161 7.93

% ------------------------------------------------
%    geometry
% ------------------------------------------------
geom BWR7x7: ASSM 7  1.875  FULL       % 7x7 assy, pin pitch, full symmetry
hgap  0.475  0.9525:  MOD.1  MOD.2     % Narrow gap, wide gap
mesh MOD.1 : nd=2  nf=3                % Additional detail in bypass added at ORNL suggestion
mesh MOD.2 : nd=3  nf=3                %   (see email from Matt Jessee, 7/20/17)
box   0.2032 0.9652 6.7      CAN.1     % box thickness, corner inner radius, inner half width

% fuel pins
pin  1 :  0.61976  0.63373  0.71501  :  FUEL.1  GAP.1  CLAD.1
pin  2 :  0.61976  0.63373  0.71501  :  FUEL.2  GAP.1  CLAD.1
pin  3 :  0.61976  0.63373  0.71501  :  FUEL.3  GAP.1  CLAD.1
pin  4 :  0.61849  0.63373  0.71501  :  FUEL.4  GAP.1  CLAD.1
pin  5 :  0.61849  0.63373  0.71501  :  FUEL.5  GAP.1  CLAD.1
pin  6 :  0.61976  0.63373  0.71501  :  FUEL.6  GAP.1  CLAD.1

% add rings according to ORNL recommendations
mesh FUEL.1 nr=3
mesh FUEL.2 nr=3
mesh FUEL.3 nr=3
mesh FUEL.4 nr=3
mesh FUEL.5 nr=3
```

```
mesh FUEL.6 nr=3

shield ALL=N FUEL=P
pinmap
 3
 3 2
 2 2 5
 2 1 1 6
 2 1 1 1 1
 2 1 1 4 1 1
 3 2 1 1 1 1 2
geom rad_ref : REFL 30.0
slab rad_ref : 20.195 5.080 4.725 : COOL.1 SHROUD.1 MOD.1 : 18  2  4  : 2  2  2
% -----------------------------------------------
%    states
% -----------------------------------------------
state ALL  : temp=560.29
      FUEL : temp=948.45
           COOL : temp=560.29 dens=0.4573
           MOD  : temp=560.29 dens=0.7373
           rad_ref : in=yes
read branch
  add ALL : temp=560.29 FUEL : temp=948.45 COOL : dens=0.7373 MOD : dens=0.7373
  add ALL : temp=560.29 FUEL : temp=948.45 COOL : dens=0.2573 MOD : dens=0.7373
  add ALL : temp=560.29 FUEL : temp=948.45 COOL : dens=0.1073 MOD : dens=0.7373
end branch

end
```

A.3 Polaris Input for Axial Top Reflector

```
=polaris
% -----------------------------------------------
%    general options
% -----------------------------------------------
title "WEC 7x7 lattice + top reflector"
lib   "broad_lwr"
opt   PRINT XFile16=true
system BWR
% -----------------------------------------------
%    compositions and materials
% -----------------------------------------------
% fuel comps
comp c_U247a  UOX  enr=2.47
comp c_U170   UOX  enr=1.70
comp c_U120   UOX  enr=1.20
comp c_U247b  UOX  enr=2.47
comp c_U247c  UOX  enr=2.47
comp c_U247d  UOX  enr=2.47

% fuel mats - use stack density from EPRI reports
mat FUEL.1  c_U247a  dens=9.94
mat FUEL.2  c_U170   dens=9.94
mat FUEL.3  c_U120   dens=9.94
mat FUEL.4  c_U247b  dens=10.34
mat FUEL.5  c_U247c  dens=10.34
mat FUEL.6  c_U247d  dens=9.48

% cladding comp - smear the spacer grids into the cladding material
% this was done consistent with the TRITON models (ML13042A450)
comp c_ZIRI : WT refdens=6.84699
              ZIRC4=3.5224
              INC718=0.6691
              ZIRC2=-100

% cladding mat
mat CLAD.1  c_ZIRI

% channel box is Zry4
mat CAN.1   ZIRC4

% top reflectors
comp TOP1 : WT  H2O=24.33023 HE=0.000809 ZIRC2=32.83966 ZIRC4=16.67851 SS304=26.15079
comp TOP2 : WT  H2O=41.76238 ZIRC2=26.66206 SS304=31.57556
mat TOPREF.1 : TOP1 1.925764
mat TOPREF.2 : TOP2 1.545993

% -----------------------------------------------
%    geometry
% -----------------------------------------------
```

```
geom BWR7x7: ASSM 7  1.875  FULL       % 7x7 assy, pin pitch, full symmetry
hgap  0.475  0.9525:  MOD.1  MOD.2     % Narrow gap, wide gap
mesh MOD.1 : nd=2  nf=3                % Additional detail in bypass added at ORNL suggestion
mesh MOD.2 : nd=3  nf=3                %   (see email from Matt Jessee, 7/20/17)
box   0.2032 0.9652 6.7      CAN.1     % box thickness, corner inner radius, inner half width

% fuel pins
pin  1 :  0.61976  0.63373  0.71501  :  FUEL.1  GAP.1  CLAD.1
pin  2 :  0.61976  0.63373  0.71501  :  FUEL.2  GAP.1  CLAD.1
pin  3 :  0.61976  0.63373  0.71501  :  FUEL.3  GAP.1  CLAD.1
pin  4 :  0.61849  0.63373  0.71501  :  FUEL.4  GAP.1  CLAD.1
pin  5 :  0.61849  0.63373  0.71501  :  FUEL.5  GAP.1  CLAD.1
pin  6 :  0.61976  0.63373  0.71501  :  FUEL.6  GAP.1  CLAD.1

% add rings according to ORNL recommendations
mesh FUEL.1 nr=3
mesh FUEL.2 nr=3
mesh FUEL.3 nr=3
mesh FUEL.4 nr=3
mesh FUEL.5 nr=3
mesh FUEL.6 nr=3

shield ALL=N FUEL=P
pinmap
 3
 3 2
 2 2 5
 2 1 1 6
 2 1 1 1 1
 2 1 1 4 1 1
 3 2 1 1 1 1 2
geom rad_ref : REFL 40.0
slab rad_ref : 30.48 9.52  : TOPREF.1 TOPREF.2 : 20  5  : 2  2
% -----------------------------------------------
%    states
% -----------------------------------------------
state ALL  : temp=560.29
      FUEL : temp=948.45
           COOL : temp=560.29 dens=0.4573
           MOD  : temp=560.29 dens=0.7373
           rad_ref : in=yes
read branch
  add ALL : temp=560.29 FUEL : temp=948.45 COOL : dens=0.7373 MOD : dens=0.7373
  add ALL : temp=560.29 FUEL : temp=948.45 COOL : dens=0.2573 MOD : dens=0.7373
  add ALL : temp=560.29 FUEL : temp=948.45 COOL : dens=0.1073 MOD : dens=0.7373
end branch

end
```

A.4 Polaris Input for Axial Bottom Reflector

```
=polaris
% -----------------------------------------------
%    general options
% -----------------------------------------------
title "WEC 7x7 lattice + bottom reflector"
lib   "broad_lwr"
opt   PRINT XFile16=true
system BWR
% -----------------------------------------------
%    compositions and materials
% -----------------------------------------------
% fuel comps
comp c_U247a  UOX  enr=2.47
comp c_U170   UOX  enr=1.70
comp c_U120   UOX  enr=1.20
comp c_U247b  UOX  enr=2.47
comp c_U247c  UOX  enr=2.47
comp c_U247d  UOX  enr=2.47

% fuel mats - use stack density from EPRI reports
mat FUEL.1  c_U247a  dens=9.94
mat FUEL.2  c_U170   dens=9.94
mat FUEL.3  c_U120   dens=9.94
mat FUEL.4  c_U247b  dens=10.34
mat FUEL.5  c_U247c  dens=10.34
mat FUEL.6  c_U247d  dens=9.48
```

```
% cladding comp - smear the spacer grids into the cladding material
% this was done consistent with the TRITON models (ML13042A450)
comp c_ZIRI : WT refdens=6.84699
              ZIRC4=3.5224
              INC718=0.6691
              ZIRC2=-100

% cladding mat
mat CLAD.1  c_ZIRI

% channel box is Zry4
mat CAN.1   ZIRC4

% top reflectors
comp BOT1 : WT  H2O=21.25524 ZIRC2=10.76185 SS304=66.47959 INC718=0.64007 B4C=0.86324
comp BOT2 : WT  H2O=4.50458 SS304=95.09426 B4C=0.40116
mat BOTREF.1 : BOT1 2.547030
mat BOTREF.2 : BOT2 5.480845

% -------------------------------------------------
%    geometry
% -------------------------------------------------
geom BWR7x7: ASSM 7  1.875  FULL       % 7x7 assy, pin pitch, full symmetry
hgap  0.475  0.9525:  MOD.1  MOD.2     % Narrow gap, wide gap
mesh MOD.1 : nd=2  nf=3                % Additional detail in bypass added at ORNL suggestion
mesh MOD.2 : nd=3  nf=3                %   (see email from Matt Jessee, 7/20/17)
box   0.2032 0.9652 6.7      CAN.1     % box thickness, corner inner radius, inner half width

% fuel pins
pin  1 :  0.61976  0.63373  0.71501  :  FUEL.1  GAP.1  CLAD.1
pin  2 :  0.61976  0.63373  0.71501  :  FUEL.2  GAP.1  CLAD.1
pin  3 :  0.61976  0.63373  0.71501  :  FUEL.3  GAP.1  CLAD.1
pin  4 :  0.61849  0.63373  0.71501  :  FUEL.4  GAP.1  CLAD.1
pin  5 :  0.61849  0.63373  0.71501  :  FUEL.5  GAP.1  CLAD.1
pin  6 :  0.61976  0.63373  0.71501  :  FUEL.6  GAP.1  CLAD.1

% add rings according to ORNL recommendations
mesh FUEL.1 nr=3
mesh FUEL.2 nr=3
mesh FUEL.3 nr=3
mesh FUEL.4 nr=3
mesh FUEL.5 nr=3
mesh FUEL.6 nr=3

shield ALL=N FUEL=P
pinmap
 3
 3 2
 2 2 5
 2 1 1 6
 2 1 1 1 1
 2 1 1 4 1 1
 3 2 1 1 1 1 2
geom rad_ref : REFL 22.7076
slab rad_ref : 12.70 10.0076  : BOTREF.1 BOTREF.2 : 10  10  : 2  2
% -------------------------------------------------
%    states
% -------------------------------------------------
state ALL  : temp=560.29
      FUEL : temp=948.45
           COOL : temp=560.29 dens=0.7373
           MOD  : temp=560.29 dens=0.7373
           rad_ref : in=yes
read branch
  add ALL : temp=560.29 FUEL : temp=948.45 COOL : dens=0.7373 MOD : dens=0.7373
  add ALL : temp=560.29 FUEL : temp=948.45 COOL : dens=0.2573 MOD : dens=0.7373
  add ALL : temp=560.29 FUEL : temp=948.45 COOL : dens=0.1073 MOD : dens=0.7373
end branch

end
```

APPENDIX B. SAMPLE OF GENPMAXS INPUT FILES

B.1 GenPMAXS Input for Fuel Assembly Type 1A

```
%JOB_TIT
 'hatch-t1a.PMAX'  T  3.0
%JOB_OPT
  T   T   F   F   T   F   F   T   T   F   T   F   F   F   F
 !adf,xes,ded,j1f,chi,chd,inv,det,yld,cdf,gff,bet,lam,dec,zdf
%DAT_SRC
    8   6   1
%STA_VAR
  3
  CR DC TF
%HISTORY
   6   2
  HIST01   0.00000    0.73730     948.45
  HIST02   0.00000    0.45730     948.45
  HIST03   0.00000    0.24730     948.45
  HIST04   1.00000    0.73730     948.45
  HIST05   1.00000    0.45730     948.45
  HIST06   1.00000    0.24730     948.45
%BRANCH
  24   2
  STAT01   0.00000    0.73730     948.45
  STAT02   0.00000    0.45730     948.45
  STAT03   0.00000    0.24730     948.45
  STAT04   1.00000    0.73730     948.45
  STAT05   1.00000    0.45730     948.45
  STAT06   1.00000    0.24730     948.45
  STAT07   0.00000    0.10730     948.45
  STAT08   1.00000    0.10730     948.45
  STAT09   0.00000    0.73730     500.00
  STAT10   0.00000    0.45730     500.00
  STAT11   0.00000    0.24730     500.00
  STAT12   0.00000    0.10730     500.00
  STAT13   1.00000    0.73730     500.00
  STAT14   1.00000    0.45730     500.00
  STAT15   1.00000    0.24730     500.00
  STAT16   1.00000    0.10730     500.00
  STAT17   0.00000    0.73730    1500.00
  STAT18   0.00000    0.45730    1500.00
  STAT19   0.00000    0.24730    1500.00
  STAT20   0.00000    0.10730    1500.00
  STAT21   1.00000    0.73730    1500.00
  STAT22   1.00000    0.45730    1500.00
  STAT23   1.00000    0.24730    1500.00
  STAT24   1.00000    0.10730    1500.00
%BURNUP
   1
   BS1  31
      0.000000E+00 1.571400E-01 7.782000E-01 1.390050E+00 1.997930E+00 2.606140E+00
      3.218500E+00 3.838520E+00 4.469660E+00 5.115480E+00 5.779800E+00 6.466850E+00
      7.181520E+00 7.929590E+00 8.718140E+00 9.556090E+00 1.045510E+01 1.143090E+01
      1.250610E+01 1.371460E+01 1.511220E+01 1.680350E+01 1.903000E+01 2.270410E+01
      2.850540E+01 3.450540E+01 4.050540E+01 4.650540E+01 5.250540E+01 5.850540E+01
      6.150540E+01
   HIST01  24*1
   HIST02  24*1
   HIST03  24*1
   HIST04  24*1
   HIST05  24*1
   HIST06  24*1
%USERINP
  1
  PIN  1.875 0.71375 0.71375  0  7  7
%FIL_CNT
  1  '../../Polaris/hatch-t1a_DC00CR0.t16' 24 1
       1  1  1  1 31  !   0.00000    0.73730     948.45
       2  1  2  1 31  !   0.00000    0.45730     948.45
       3  1  3  1 31  !   0.00000    0.24730     948.45
       4  1  4  1 31  !   1.00000    0.73730     948.45
       5  1  5  1 31  !   1.00000    0.45730     948.45
       6  1  6  1 31  !   1.00000    0.24730     948.45
       7  1  7  1 31  !   0.00000    0.10730     948.45
       8  1  8  1 31  !   1.00000    0.10730     948.45
       9  1  9  1 31  !   0.00000    0.73730     500.00
      10  1 10  1 31  !   0.00000    0.45730     500.00
      11  1 11  1 31  !   0.00000    0.24730     500.00
```

```
    12  1 12  1 31  !   0.00000    0.10730     500.00
    13  1 13  1 31  !   1.00000    0.73730     500.00
    14  1 14  1 31  !   1.00000    0.45730     500.00
    15  1 15  1 31  !   1.00000    0.24730     500.00
    16  1 16  1 31  !   1.00000    0.10730     500.00
    17  1 17  1 31  !   0.00000    0.73730    1500.00
    18  1 18  1 31  !   0.00000    0.45730    1500.00
    19  1 19  1 31  !   0.00000    0.24730    1500.00
    20  1 20  1 31  !   0.00000    0.10730    1500.00
    21  1 21  1 31  !   1.00000    0.73730    1500.00
    22  1 22  1 31  !   1.00000    0.45730    1500.00
    23  1 23  1 31  !   1.00000    0.24730    1500.00
    24  1 24  1 31  !   1.00000    0.10730    1500.00
2  '../../Polaris/hatch-t1a_DC40CR0.t16' 24 1
     1  2  2  1 31  !   0.00000    0.45730     948.45
     2  2  1  1 31  !   0.00000    0.73730     948.45
     3  2  3  1 31  !   0.00000    0.24730     948.45
     4  2  4  1 31  !   1.00000    0.73730     948.45
     5  2  5  1 31  !   1.00000    0.45730     948.45
     6  2  6  1 31  !   1.00000    0.24730     948.45
     7  2  7  1 31  !   0.00000    0.10730     948.45
     8  2  8  1 31  !   1.00000    0.10730     948.45
     9  2  9  1 31  !   0.00000    0.73730     500.00
    10  2 10  1 31  !   0.00000    0.45730     500.00
    11  2 11  1 31  !   0.00000    0.24730     500.00
    12  2 12  1 31  !   0.00000    0.10730     500.00
    13  2 13  1 31  !   1.00000    0.73730     500.00
    14  2 14  1 31  !   1.00000    0.45730     500.00
    15  2 15  1 31  !   1.00000    0.24730     500.00
    16  2 16  1 31  !   1.00000    0.10730     500.00
    17  2 17  1 31  !   0.00000    0.73730    1500.00
    18  2 18  1 31  !   0.00000    0.45730    1500.00
    19  2 19  1 31  !   0.00000    0.24730    1500.00
    20  2 20  1 31  !   0.00000    0.10730    1500.00
    21  2 21  1 31  !   1.00000    0.73730    1500.00
    22  2 22  1 31  !   1.00000    0.45730    1500.00
    23  2 23  1 31  !   1.00000    0.24730    1500.00
    24  2 24  1 31  !   1.00000    0.10730    1500.00
3  '../../Polaris/hatch-t1a_DC70CR0.t16' 24 1
     1  3  3  1 31  !   0.00000    0.24730     948.45
     2  3  1  1 31  !   0.00000    0.73730     948.45
     3  3  2  1 31  !   0.00000    0.45730     948.45
     4  3  4  1 31  !   1.00000    0.73730     948.45
     5  3  5  1 31  !   1.00000    0.45730     948.45
     6  3  6  1 31  !   1.00000    0.24730     948.45
     7  3  7  1 31  !   0.00000    0.10730     948.45
     8  3  8  1 31  !   1.00000    0.10730     948.45
     9  3  9  1 31  !   0.00000    0.73730     500.00
    10  3 10  1 31  !   0.00000    0.45730     500.00
    11  3 11  1 31  !   0.00000    0.24730     500.00
    12  3 12  1 31  !   0.00000    0.10730     500.00
    13  3 13  1 31  !   1.00000    0.73730     500.00
    14  3 14  1 31  !   1.00000    0.45730     500.00
    15  3 15  1 31  !   1.00000    0.24730     500.00
    16  3 16  1 31  !   1.00000    0.10730     500.00
    17  3 17  1 31  !   0.00000    0.73730    1500.00
    18  3 18  1 31  !   0.00000    0.45730    1500.00
    19  3 19  1 31  !   0.00000    0.24730    1500.00
    20  3 20  1 31  !   0.00000    0.10730    1500.00
    21  3 21  1 31  !   1.00000    0.73730    1500.00
    22  3 22  1 31  !   1.00000    0.45730    1500.00
    23  3 23  1 31  !   1.00000    0.24730    1500.00
    24  3 24  1 31  !   1.00000    0.10730    1500.00
4  '../../Polaris/hatch-t1a_DC00CR1.t16' 24 1
     1  4  4  1 31  !   1.00000    0.73730     948.45
     2  4  1  1 31  !   0.00000    0.73730     948.45
     3  4  2  1 31  !   0.00000    0.45730     948.45
     4  4  3  1 31  !   0.00000    0.24730     948.45
     5  4  5  1 31  !   1.00000    0.45730     948.45
     6  4  6  1 31  !   1.00000    0.24730     948.45
     7  4  7  1 31  !   0.00000    0.10730     948.45
     8  4  8  1 31  !   1.00000    0.10730     948.45
     9  4  9  1 31  !   0.00000    0.73730     500.00
    10  4 10  1 31  !   0.00000    0.45730     500.00
    11  4 11  1 31  !   0.00000    0.24730     500.00
    12  4 12  1 31  !   0.00000    0.10730     500.00
    13  4 13  1 31  !   1.00000    0.73730     500.00
    14  4 14  1 31  !   1.00000    0.45730     500.00
    15  4 15  1 31  !   1.00000    0.24730     500.00
    16  4 16  1 31  !   1.00000    0.10730     500.00
    17  4 17  1 31  !   0.00000    0.73730    1500.00
```

```
      18  4 18  1 31  !   0.00000    0.45730    1500.00
      19  4 19  1 31  !   0.00000    0.24730    1500.00
      20  4 20  1 31  !   0.00000    0.10730    1500.00
      21  4 21  1 31  !   1.00000    0.73730    1500.00
      22  4 22  1 31  !   1.00000    0.45730    1500.00
      23  4 23  1 31  !   1.00000    0.24730    1500.00
      24  4 24  1 31  !   1.00000    0.10730    1500.00
  5  '../../Polaris/hatch-t1a_DC40CR1.t16' 24 1
       1  5  5  1 31  !   1.00000    0.45730     948.45
       2  5  1  1 31  !   0.00000    0.73730     948.45
       3  5  2  1 31  !   0.00000    0.45730     948.45
       4  5  3  1 31  !   0.00000    0.24730     948.45
       5  5  4  1 31  !   1.00000    0.73730     948.45
       6  5  6  1 31  !   1.00000    0.24730     948.45
       7  5  7  1 31  !   0.00000    0.10730     948.45
       8  5  8  1 31  !   1.00000    0.10730     948.45
       9  5  9  1 31  !   0.00000    0.73730     500.00
      10  5 10  1 31  !   0.00000    0.45730     500.00
      11  5 11  1 31  !   0.00000    0.24730     500.00
      12  5 12  1 31  !   0.00000    0.10730     500.00
      13  5 13  1 31  !   1.00000    0.73730     500.00
      14  5 14  1 31  !   1.00000    0.45730     500.00
      15  5 15  1 31  !   1.00000    0.24730     500.00
      16  5 16  1 31  !   1.00000    0.10730     500.00
      17  5 17  1 31  !   0.00000    0.73730    1500.00
      18  5 18  1 31  !   0.00000    0.45730    1500.00
      19  5 19  1 31  !   0.00000    0.24730    1500.00
      20  5 20  1 31  !   0.00000    0.10730    1500.00
      21  5 21  1 31  !   1.00000    0.73730    1500.00
      22  5 22  1 31  !   1.00000    0.45730    1500.00
      23  5 23  1 31  !   1.00000    0.24730    1500.00
      24  5 24  1 31  !   1.00000    0.10730    1500.00
  6  '../../Polaris/hatch-t1a_DC70CR1.t16' 24 1
       1  6  6  1 31  !   1.00000    0.24730     948.45
       2  6  1  1 31  !   0.00000    0.73730     948.45
       3  6  2  1 31  !   0.00000    0.45730     948.45
       4  6  3  1 31  !   0.00000    0.24730     948.45
       5  6  4  1 31  !   1.00000    0.73730     948.45
       6  6  5  1 31  !   1.00000    0.45730     948.45
       7  6  7  1 31  !   0.00000    0.10730     948.45
       8  6  8  1 31  !   1.00000    0.10730     948.45
       9  6  9  1 31  !   0.00000    0.73730     500.00
      10  6 10  1 31  !   0.00000    0.45730     500.00
      11  6 11  1 31  !   0.00000    0.24730     500.00
      12  6 12  1 31  !   0.00000    0.10730     500.00
      13  6 13  1 31  !   1.00000    0.73730     500.00
      14  6 14  1 31  !   1.00000    0.45730     500.00
      15  6 15  1 31  !   1.00000    0.24730     500.00
      16  6 16  1 31  !   1.00000    0.10730     500.00
      17  6 17  1 31  !   0.00000    0.73730    1500.00
      18  6 18  1 31  !   0.00000    0.45730    1500.00
      19  6 19  1 31  !   0.00000    0.24730    1500.00
      20  6 20  1 31  !   0.00000    0.10730    1500.00
      21  6 21  1 31  !   1.00000    0.73730    1500.00
      22  6 22  1 31  !   1.00000    0.45730    1500.00
      23  6 23  1 31  !   1.00000    0.24730    1500.00
      24  6 24  1 31  !   1.00000    0.10730    1500.00
%JOB_END
```

B.2 GenPMAXS Input for Radial Edge Reflector

```
%JOB_TIT
 'refl_rad_edge.PMAX' T 3.0
%JOB_OPT
  F   F   F   F   F   F   F   F   F   F   F   F   F   F   F
 !adf,xes,ded,j1f,chi,chd,inv,det,yld,cdf,gff,bet,lam,dec,zdf
%DAT_SRC
  8  1  0
%STA_VAR
  3
  CR DC DM
%HISTORY
  1  1
  HIST1 0  0.4573  0.7373
%BRANCH
  4  1
  HIST1 0  0.4573  0.7373
  HIST2 0  0.7373  0.7373
  HIST3 0  0.2573  0.7373
  HIST4 0  0.1073  0.7373
%BURNUP
  1
  'NOBP'  1
          0
  HIST1 4*1
%FIL_CNT
  1 '../../Polaris_refl/hatch_refl_rad.t16'  4 0
   1  1  1  1  1
   2  1  2  1  1
   3  1  3  1  1
   4  1  4  1  1
%JOB_END
```

B.3 GenPMAXS Input for Axial Top Reflector

```
%JOB_TIT
 'refl_top.PMAX'  T  3.0
%JOB_OPT
  F   F   F   F   F   F   T   F   F   F   F   F   F   F   F
 !adf,xes,ded,j1f,chi,chd,inv,det,yld,cdf,gff,bet,lam,dec,zdf
%DAT_SRC
  8  1  0
%STA_VAR
  3
  CR DC DM
%HISTORY
  1  1
  HIST1 0  0.4573  0.7373
%BRANCH
  4  1
  HIST1 0  0.4573  0.7373
  HIST2 0  0.7373  0.7373
  HIST3 0  0.2573  0.7373
  HIST4 0  0.1073  0.7373
%BURNUP
  1
  'NOBP'  1
          0
  HIST1 4*1
%FIL_CNT
  1 '../../Polaris_refl/hatch_refl_top.t16'  4 0
   1  1  1  1  1
   2  1  2  1  1
   3  1  3  1  1
   4  1  4  1  1
%JOB_END
```

B.4 GenPMAXS Input for Axial Bottom Reflector

```
%JOB_TIT
 'hatch-refl_bot.PMAX'  T  3.0
%JOB_OPT
  F   F   F   F   F   F   F   F   F   F   F   F   F   F   F
 !adf,xes,ded,j1f,chi,chd,inv,det,yld,cdf,gff,bet,lam,dec,zdf
%DAT_SRC
```

```
  8  1  0
%STA_VAR
  3
  CR DC DM
%HISTORY
  1  1
  HIST1 0  0.7373  0.7373
%BRANCH
  3  1
  HIST1 0  0.7373  0.7373
  HIST2 0  0.2573  0.7373
  HIST3 0  0.1073  0.7373
%BURNUP
  1
  'NOBP'  1
          0
  HIST1 4*1
%FIL_CNT
  1 '../Polaris_fission/reflector/hatch_refl_bot.t16'  3 0
   1  1  1  1  1
   2  1  2  1  1
   3  1  3  1  1
%JOB_END
```

APPENDIX C. PARCS INPUT FILES

C.1 PATHS Input for HFP Cycle 1

```
     paths_id   h1c1_paths

     CORE_STATE 2436000 5687.93 1202.79 6.750E6
     COMM_PARM  10 0.1524
     CONV_PARM  1000  1.0E-6  100000  1.0E-8   0.25
     TH_LSOLVER 1
     TH_IPATHS  F
     TH_CORR    1 1 3 4

     NK_RADIAL      1  560  26
     TH_RADIAL      560  0  0
     TH_AXIAL       26  1  1
     AX_MESH        1*15.24 24*15.24 1*15.24

     TH_CONF
                                       1   2   3   4   5   6   7   8   9  10
                                  11  12  13  14  15  16  17  18  19  20  21  22
                      23  24  25  26  27  28  29  30  31  32  33  34  35  36  37  38  39  40
                  41  42  43  44  45  46  47  48  49  50  51  52  53  54  55  56  57  58  59  60
              61  62  63  64  65  66  67  68  69  70  71  72  73  74  75  76  77  78  79  80  81  82
              83  84  85  86  87  88  89  90  91  92  93  94  95  96  97  98  99 100 101 102 103 104
             105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126
         127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150
     151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176
     177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202
     203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228
     229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251 252 253 254
     255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280
     281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305 306
     307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332
     333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358
     359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384
     385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400 401 402 403 404 405 406 407 408 409 410
         411 412 413 414 415 416 417 418 419 420 421 422 423 424 425 426 427 428 429 430 431 432 433 434
             435 436 437 438 439 440 441 442 443 444 445 446 447 448 449 450 451 452 453 454 455 456
             457 458 459 460 461 462 463 464 465 466 467 468 469 470 471 472 473 474 475 476 477 478
             479 480 481 482 483 484 485 486 487 488 489 490 491 492 493 494 495 496 497 498 499 500
                 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515 516 517 518 519 520
                     521 522 523 524 525 526 527 528 529 530 531 532 533 534 535 536 537 538
                                 539 540 541 542 543 544 545 546 547 548 549 550
                                     551 552 553 554 555 556 557 558 559 560
!
! H1C1 Core Design
!
     CH_T_MAP
                             30 30 30 30 30 30 30 30 30 30
                          30  3  3  2  1  2  1  2  1  3  3 30
                 30 30 30  3  1  2  1  2  1  2  1  2  1  2  3 30 30 30
              30  3  3  2  1  2  1  2  1  2  1  2  1  2  1  2  1  3  3 30
           30  3  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  3 30
           30  3  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  3 30
           30  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1 30
        30  3  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  3 30
     30  3  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  3 30
     30  3  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  3 30
     30  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1 30
     30  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2 30
     30  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1 30
     30  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2 30
     30  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1 30
     30  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2 30
     30  3  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  3 30
     30  3  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  3 30
        30  3  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  3 30
           30  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2 30
           30  3  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  3 30
           30  3  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  3 30
              30  3  3  1  2  1  2  1  2  1  2  1  2  1  2  1  2  3  3 30
                 30 30 30  3  2  1  2  1  2  1  2  1  2  1  3 30 30 30
                          30  3  3  1  2  1  2  1  2  3  3 30
                             30 30 30 30 30 30 30 30 30 30
!
! Channel Description
!
!                    charea    chhd    rough ppitch   n_f or_cld  or_fuel th_clad hgap  wr r_wrod
     CHAN_GEOM    1    100.23E-4 1.73E-2 5E-6  18.75E-3 49  7.15E-3 6.06E-3 0.94E-3 3060  0  7.15E-3 !7X7 Type 1 channel geometry
     CHAN_GEOM    2    100.23E-4 1.73E-2 5E-6  18.75E-3 49  7.15E-3 6.06E-3 0.94E-3 3060  0  7.15E-3 !7X7 Type 2 channel geometry
     CHAN_GEOM    3    100.23E-4 1.73E-2 5E-6  18.75E-3 49  7.15E-3 6.06E-3 0.94E-3 3060  0  7.15E-3 !7X7 Type 3 channel geometry
!    CHAN_GEOM    4    100.11E-4 1.52E-2 5E-6  16.26E-3 63  6.26E-3 5.28E-3 0.86E-3 3920  1  6.26E-3 !8X8 Type 4 channel geometry
!    CHAN_GEOM    5    102.09E-4 1.57E-2 5E-6  16.26E-3 62  6.13E-3 5.21E-3 0.81E-3 3920  2  7.51E-3 !8X8 Type 5 channel geometry
!    CHAN_GEOM    10   100.23E-4 1.73E-2 5E-6  18.75E-3 49  7.15E-3 6.06E-3 0.94E-3 3060  0  7.15E-3 !7X7 Type 1 channel geometry
!    CHAN_GEOM    20   100.23E-4 1.73E-2 5E-6  18.75E-3 49  7.15E-3 6.06E-3 0.94E-3 3060  0  7.15E-3 !7X7 Type 2 channel geometry
     CHAN_GEOM    30   100.23E-4 1.73E-2 5E-6  18.75E-3 49  7.15E-3 6.06E-3 0.94E-3 3060  0  7.15E-3 !7X7 Type 3 channel geometry
!    CHAN_GEOM    40   100.11E-4 1.52E-2 5E-6  16.26E-3 63  6.26E-3 5.28E-3 0.86E-3 3920  1  6.26E-3 !8X8 Type 4 channel geometry
!    CHAN_GEOM    50   102.09E-4 1.57E-2 5E-6  16.26E-3 62  6.13E-3 5.21E-3 0.81E-3 3920  2  7.51E-3 !8X8 Type 5 channel geometry
     KA_CHAN      1    1*20.17000 1*0.5 2*0 1*2.00 2*0 1*2.00 3*0 1*2.00 2*0 1*2.00 3*0 1*2.00 2*0 1*2.00 2*0 1*2.00 1*1.0 ! 7X7 Fuel loss
coefficient (loose)
```

```
     KA_CHAN      2   1*20.17000 1*0.5 2*0 1*2.00 2*0 1*2.00 3*0 1*2.00 2*0 1*2.00 3*0 1*2.00 2*0 1*2.00 2*0 1*2.00 1*1.0 ! 7X7 Fuel loss
coefficient (loose)
     KA_CHAN      3   1*20.17000 1*0.5 2*0 1*2.00 2*0 1*2.00 3*0 1*2.00 2*0 1*2.00 3*0 1*2.00 2*0 1*2.00 2*0 1*2.00 1*1.0 ! 7X7 Fuel loss
coefficient (loose)
!    KA_CHAN      4   1*20.15000 1*0.5 2*0 1*2.25 2*0 1*2.25 3*0 1*2.25 2*0 1*2.25 3*0 1*2.25 2*0 1*2.25 2*0 1*2.25 1*1.0 ! 8X8 Fuel loss
coefficient (loose)
!    KA_CHAN      5   1*20.93000 1*0.5 2*0 1*2.25 2*0 1*2.25 3*0 1*2.25 2*0 1*2.25 3*0 1*2.25 2*0 1*2.25 2*0 1*2.25 1*1.0 ! 8X8 Fuel loss
coefficient (loose)
!    KA_CHAN      10  1*92.13000 1*0.5 2*0 1*2.00 2*0 1*2.00 3*0 1*2.00 2*0 1*2.00 3*0 1*2.00 2*0 1*2.00 2*0 1*2.00 1*1.0 ! 7X7 Fuel loss
coefficient (tight)
!    KA_CHAN      20  1*92.13000 1*0.5 2*0 1*2.00 2*0 1*2.00 3*0 1*2.00 2*0 1*2.00 3*0 1*2.00 2*0 1*2.00 2*0 1*2.00 1*1.0 ! 7X7 Fuel loss
coefficient (tight)
     KA_CHAN      30  1*92.13000 1*0.5 2*0 1*2.00 2*0 1*2.00 3*0 1*2.00 2*0 1*2.00 3*0 1*2.00 2*0 1*2.00 2*0 1*2.00 1*1.0 ! 7X7 Fuel loss
coefficient (tight)
!    KA_CHAN      40  1*92.01000 1*0.5 2*0 1*2.25 2*0 1*2.25 3*0 1*2.25 2*0 1*2.25 3*0 1*2.25 2*0 1*2.25 2*0 1*2.25 1*1.0 ! 8X8 Fuel loss
coefficient (tight)
!    KA_CHAN      50  1*95.60000 1*0.5 2*0 1*2.25 2*0 1*2.25 3*0 1*2.25 2*0 1*2.25 3*0 1*2.25 2*0 1*2.25 2*0 1*2.25 1*1.0 ! 8X8 Fuel loss
coefficient (tight)
.
```

C.2 PARCS Input for HFP Cycle 1

```
!************************************************
CASEID h1c1
!************************************************
CNTL
    CORE_TYPE      BWR
    CORE_POWER     59.56   ! percent of core power
    BANK_POS       -13
                        48 48 40 48 48            !5
                     48 48 48 48 48 48 48 48 48   !9
                  48 32 48 40 48  0 48 40 48 32 48   !11
                  48 48 48 48 48 48 48 48 48 48 48   !11
               48 48 40 48  0 48  8 48  0 48 40 48 48  !13
               48 48 48 48 48 48 48 48 48 48 48 48 48  !13
               40 48  0 48  8 48  0 48  8 48  0 48 40  !13
               48 48 48 48 48 48 48 48 48 48 48 48 48  !13
               48 48 40 48  0 48  8 48  0 48 40 48 48  !13
                  48 48 48 48 48 48 48 48 48 48 48   !11
                  48 32 48 40 48  0 48 40 48 32 48   !11
                     48 48 48 48 48 48 48 48 48      !9
                        48 48 40 48 48            !5
    DEPLETION      T  1.0E-5 T  F
!                 NSET   LADF LXES LJ1F LDED LCHI LCHD LINV LDET LYLD LCDF LGFF LBET LAMB LDEC
    TREE_XS      T  20    T    T    F    F    F    F    F    T    T    F    F    F    F    F
    TH_FDBK        T
    DECAY_HEAT     T
    RESTART        F
    XE_SM          1 1
    TRANSIENT      F
    EXT_TH         F
    INT_TH         T  1  'paths_h1c1.inp'
!
! Printing Options
!
! 1  Detailed input edit
! 2  Iteration history display
! 3  Planar power distributions
! 4  Detailed pin power distributions
! 5  Reactivity edit and adjoint flux
! 6  Feedback component reactivity edit
! 7  Integrated flux and precursor density edit
! 8  Planar flux distributions
! 9  Xe/Sm number densities
! 10 T/H state variables
! 11 1D collapsed group constants
! 12 Point Kinetics Data
! 13 Radial Power Shape
! 14 Radial Flux Shape
! 15 Harmonics
!            1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
!    PRINT_OPT T F F F F F F F F  T  F  F  F  F  F
     inp_opts   F  T
     plot_opts   0  0  2
    ROT_ADF   T
    DETECTOR  T 74400  2
PARAM
     nlupd_ss       3  5  1
     n_iters        15  200
     conv_ss        1.0e-5 1.0e-4 1.0e-3
     cnv_th_ss      0.001
     wielandt       0.2  0.1  1.0
     decusp         2
     NODAL_KERN     NEMMG
!     LSOLVER        1 1 20
     CMFD           2
XSEC
    group_spec      2  1
GEOM
!                   nasyx        nasyy          nz         nzbr         nztr
    GEO_DIM           28           28          26            1            1

!              Radial core configuration
```

```
    RAD_CONF
!
! H1C1 Core Design
!
      0  0  0  0  0  0  0  0  0 13 13 13 13 13 13 13 13 13 13  0  0  0  0  0  0  0  0  0
      0  0  0  0  0  0  0  0  6  3  3  3  3  3  3  3  3  3  3 12  0  0  0  0  0  0  0  0
      0  0  0  0  0 13 13  6  3  3  3  2  1  2  1  2  1  3  3  3 12 13 13  0  0  0  0  0
      0  0  0  0  6  3  3  3  3  1  2  1  2  1  2  1  2  1  2  3  3  3  3 12  0  0  0  0
      0  0  0  6  3  3  3  2  1  2  1  2  1  2  1  2  1  2  1  2  1  3  3  3 12  0  0  0
      0  0  7  3  3  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  3  3 11  0  0
      0  0  7  3  3  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  3  3 11  0  0
      0  0  6  3  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  3 12  0  0
      0  6  3  3  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  3  3 12  0
      7  3  3  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  3  3 11
      7  3  3  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  3  3 11
      7  3  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  3 11
      7  3  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  3 11
      7  3  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  3 11
      7  3  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  3 11
      7  3  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  3 11
      7  3  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  3 11
      7  3  3  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  3  3 11
      7  3  3  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  3  3 11
      0  8  3  3  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  3  3 10  0
      0  0  8  3  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  3 10  0  0
      0  0  7  3  3  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  3  3 11  0  0
      0  0  7  3  3  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  2  1  3  3 11  0  0
      0  0  0  8  3  3  3  1  2  1  2  1  2  1  2  1  2  1  2  1  2  3  3  3 10  0  0  0
      0  0  0  0  8  3  3  3  3  2  1  2  1  2  1  2  1  2  1  3  3  3  3 10  0  0  0  0
      0  0  0  0  0  9  9  8  3  3  3  1  2  1  2  1  2  3  3  3 10  9  9  0  0  0  0  0
      0  0  0  0  0  0  0  0  8  3  3  3  3  3  3  3  3  3  3 10  0  0  0  0  0  0  0  0
      0  0  0  0  0  0  0  0  0  9  9  9  9  9  9  9  9  9  9  0  0  0  0  0  0  0  0  0
!
    ASSY_TYPE    1  1*10 1*1  1*1  1*2  9*2  6*2  1*1  5*1  1*12  FUEL ! Type 1 7X7 Fuel
    ASSY_TYPE    2  1*10 1*3  1*3  1*4  9*5  6*4  1*4  5*3  1*12  FUEL ! Type 2 7X7 Fuel
    ASSY_TYPE    3  1*10 1*6  1*6  1*6  9*6  6*6  1*6  5*6  1*12  FUEL ! Type 3 7X7 Fuel
    ASSY_TYPE    4  1*10 1*7  1*7  1*7  9*7  6*7  1*7  5*7  1*12  FUEL ! Type 4 8X8 Fuel
    ASSY_TYPE    5  1*10 1*8  1*9  1*9  9*9  6*9  1*9  5*9  1*12  FUEL ! Type 5 8X8 Fuel, removed top nat U
    ASSY_TYPE    6  1*10 1*13 1*13 1*13 9*13 6*13 1*13 5*13 1*12  REFL ! NW
    ASSY_TYPE    7  1*10 1*14 1*14 1*14 9*14 6*14 1*14 5*14 1*12  REFL ! W
    ASSY_TYPE    8  1*10 1*15 1*15 1*15 9*15 6*15 1*15 5*15 1*12  REFL ! SW
    ASSY_TYPE    9  1*10 1*16 1*16 1*16 9*16 6*16 1*16 5*16 1*12  REFL ! S
    ASSY_TYPE   10  1*10 1*17 1*17 1*17 9*17 6*17 1*17 5*17 1*12  REFL ! SE
    ASSY_TYPE   11  1*10 1*18 1*18 1*18 9*18 6*18 1*18 5*18 1*12  REFL ! E
    ASSY_TYPE   12  1*10 1*19 1*19 1*19 9*19 6*19 1*19 5*19 1*12  REFL ! NE
    ASSY_TYPE   13  1*10 1*20 1*20 1*20 9*20 6*20 1*20 5*20 1*12  REFL ! N
    ASSY_TYPE   14  1*10 1*11 1*11 1*11 9*11 6*11 1*11 5*11 1*12  REFL ! No ADF
!
    GRID_X     28*15.24
    GRID_Y     28*15.24
    GRID_Z     1*15.24 24*15.24 1*15.24

    NEUTMESH_X 28*1
    NEUTMESH_Y 28*1
    BOUN_COND  2 2 2 2 2 2
    CR_AXINFO  17.78        7.62        48
!               Control rod banks defined
    BANK_CONF
                                           0   0   0   0   0   0   0   0   0   0
                                       0   1   1   2   2   3   3   4   4   5   5   0
                           0   0   0   0   1   1   2   2   3   3   4   4   5   5   0   0   0   0
                       0   6   6   7   7   8   8   9   9  10  10  11  11  12  12  13  13  14  14   0
                   0   0   6   6   7   7   8   8   9   9  10  10  11  11  12  12  13  13  14  14   0   0
               0  15  15  16  16  17  17  18  18  19  19  20  20  21  21  22  22  23  23  24  24  25  25   0
               0  15  15  16  16  17  17  18  18  19  19  20  20  21  21  22  22  23  23  24  24  25  25   0
               0  26  26  27  27  28  28  29  29  30  30  31  31  32  32  33  33  34  34  35  35  36  36   0
           0   0  26  26  27  27  28  28  29  29  30  30  31  31  32  32  33  33  34  34  35  35  36  36   0   0
       0  37  37  38  38  39  39  40  40  41  41  42  42  43  43  44  44  45  45  46  46  47  47  48  48  49  49   0
       0  37  37  38  38  39  39  40  40  41  41  42  42  43  43  44  44  45  45  46  46  47  47  48  48  49  49   0
       0  50  50  51  51  52  52  53  53  54  54  55  55  56  56  57  57  58  58  59  59  60  60  61  61  62  62   0
       0  50  50  51  51  52  52  53  53  54  54  55  55  56  56  57  57  58  58  59  59  60  60  61  61  62  62   0
       0  63  63  64  64  65  65  66  66  67  67  68  68  69  69  70  70  71  71  72  72  73  73  74  74  75  75   0
       0  63  63  64  64  65  65  66  66  67  67  68  68  69  69  70  70  71  71  72  72  73  73  74  74  75  75   0
       0  76  76  77  77  78  78  79  79  80  80  81  81  82  82  83  83  84  84  85  85  86  86  87  87  88  88   0
       0  76  76  77  77  78  78  79  79  80  80  81  81  82  82  83  83  84  84  85  85  86  86  87  87  88  88   0
       0  89  89  90  90  91  91  92  92  93  93  94  94  95  95  96  96  97  97  98  98  99  99 100 100 101 101   0
       0  89  89  90  90  91  91  92  92  93  93  94  94  95  95  96  96  97  97  98  98  99  99 100 100 101 101   0
           0   0 102 102 103 103 104 104 105 105 106 106 107 107 108 108 109 109 110 110 111 111 112 112   0   0
               0 102 102 103 103 104 104 105 105 106 106 107 107 108 108 109 109 110 110 111 111 112 112   0
               0 113 113 114 114 115 115 116 116 117 117 118 118 119 119 120 120 121 121 122 122 123 123   0
               0 113 113 114 114 115 115 116 116 117 117 118 118 119 119 120 120 121 121 122 122 123 123   0
                   0   0 124 124 125 125 126 126 127 127 128 128 129 129 130 130 131 131 132 132   0   0
                       0 124 124 125 125 126 126 127 127 128 128 129 129 130 130 131 131 132 132   0
                           0   0   0   0 133 133 134 134 135 135 136 136 137 137   0   0   0   0
                                       0 133 133 134 134 135 135 136 136 137 137   0
                                           0   0   0   0   0   0   0   0   0   0
!               Assembly rotation
    ADF_ROT
                   0 0 0 0 0 0 0 0 0 0
                 0 2 1 2 1 2 1 2 1 2 1 0
           0 0 0 0 3 0 3 0 3 0 3 0 3 0 0 0 0 0
         0 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 0
       0 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 0 0
     0 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 0
     0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 0
```

```
        0 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 0
      0 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 0 0
    0 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 0
    0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 0
    0 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 0
    0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 0
    0 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 0
    0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 0
    0 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 0
    0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 0
    0 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 0
    0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 0
      0 0 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 0 0
        0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 0
        0 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 0
        0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 0
          0 0 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 0 0
            0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 0
              0 0 0 0 2 1 2 1 2 1 2 1 2 1 0 0 0 0
                    0 3 0 3 0 3 0 3 0 3 0 0
                      0 0 0 0 0 0 0 0 0 0
!            TIP detectors
    DET_XY_LOC 31
                         0  0  0  0  0  0  0  0  0  0
                      0  0  0  0  0  0  0  0  0  0  0  0
             0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
          0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
       0  0  0 27 27  0  0 28 28  0  0 29 29  0  0 30 30  0  0 31 31  0
    0  0  0  0 27 27  0  0 28 28  0  0 29 29  0  0 30 30  0  0 31 31  0  0
    0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
    0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
 0 21 21  0  0 22 22  0  0 23 23  0  0 24 24  0  0 25 25  0  0 26 26  0  0  0
0  0 21 21  0  0 22 22  0  0 23 23  0  0 24 24  0  0 25 25  0  0 26 26  0  0  0  0
0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
0  0 15 15  0  0 16 16  0  0 17 17  0  0 18 18  0  0 19 19  0  0 20 20  0  0  0  0
0  0 15 15  0  0 16 16  0  0 17 17  0  0 18 18  0  0 19 19  0  0 20 20  0  0  0  0
0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
0  0  9  9  0  0 10 10  0  0 11 11  0  0 12 12  0  0 13 13  0  0 14 14  0  0  0  0
0  0  9  9  0  0 10 10  0  0 11 11  0  0 12 12  0  0 13 13  0  0 14 14  0  0  0  0
0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
   0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
      0  0  0  0  4  4  0  0  5  5  0  0  6  6  0  0  7  7  0  0  8  8  0  0
      0  0  0  0  4  4  0  0  5  5  0  0  6  6  0  0  7  7  0  0  8  8  0  0
      0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
         0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
            0  0  0  0  0  0  1  1  0  0  2  2  0  0  3  3  0  0  0  0
               0  0  0  0  0  1  1  0  0  2  2  0  0  3  3  0  0  0
                        0  0  0  0  0  0  0  0  0  0  0  0
                           0  0  0  0  0  0  0  0  0  0
!
    DET_Z_LOC 24 1
               2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
    DET_Z_WEI  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
    DET_NAME
    1     TIP2005
    2     TIP2805
    3     TIP3605
    4     TIP1213
    5     TIP2013
    6     TIP2813
    7     TIP3613
    8     TIP4413
    9     TIP0421
    10    TIP1221
    11    TIP2021
    12    TIP2821
    13    TIP3621
    14    TIP4421
    15    TIP0429
    16    TIP1229
    17    TIP2029
    18    TIP2829
    19    TIP3629
    20    TIP4429
    21    TIP0437
    22    TIP1237
    23    TIP2037
    24    TIP2837
    25    TIP3637
    26    TIP4437
    27    TIP1245
    28    TIP2045
    29    TIP2845
    30    TIP3645
    31    TIP4445

FDBK
    fa_powpit   4.35  15.24

DEPL
!     INP_HST 'Hatch.dep' 1 1
!     INP_OPT    F F F F            ! ppm,crp,ths,xesm
    TIME_STP   -1E-9
```

```
    HST_OPT    T T F F F
    OUT_OPT    F T F F F
    BANK_NR    137*1
!
! Cross-sections
!
    PMAXS_F    1  '../GenPMAXS_fission/hatch-t1a.PMAX'              1  ! Type 1 7X7 only rod A gad
    PMAXS_F    2  '../GenPMAXS_fission/hatch-t1b.PMAX'              2  ! Type 1 7x7 rod A and B gad
    PMAXS_F    3  '../GenPMAXS_fission/hatch-t2a.PMAX'              3  ! Type 2 7x7 no gad
    PMAXS_F    4  '../GenPMAXS_fission/hatch-t2c.PMAX'              4  ! Type 2 7x7 only rod C gad
    PMAXS_F    5  '../GenPMAXS_fission/hatch-t2d.PMAX'              5  ! Type 2 7x7 rod C and D gad
    PMAXS_F    6  '../GenPMAXS_fission/hatch-t3.PMAX'               6  ! Type 3 7x7
    PMAXS_F    7  '../GenPMAXS_fission/hatch-t4.PMAX'               7  ! Type 4 8x8
    PMAXS_F    8  '../GenPMAXS_fission/hatch-t5a.PMAX'              8  ! Type 5 8x8 natural u
    PMAXS_F    9  '../GenPMAXS_fission/hatch-t5b.PMAX'              9  ! Type 5 8x8 enriched u
    PMAXS_F   10  '../GenPMAXS_fission/hatch-refl_bot.PMAX'        10  ! Bottom Axial Reflector
    PMAXS_F   11  '../GenPMAXS_fission/hatch-refl_rad_edge.PMAX'   11  ! Radial Reflector
    PMAXS_F   12  '../GenPMAXS_fission/hatch-refl_top.PMAX'        12  ! Top Axial Reflector
    PMAXS_F   13  '../GenPMAXS_fission/hatch-refl_rad_NW.PMAX'     13  ! NW Radial Reflector
    PMAXS_F   14  '../GenPMAXS_fission/hatch-refl_rad_W.PMAX'      14  !  W Radial Reflector
    PMAXS_F   15  '../GenPMAXS_fission/hatch-refl_rad_SW.PMAX'     15  ! SW Radial Reflector
    PMAXS_F   16  '../GenPMAXS_fission/hatch-refl_rad_S.PMAX'      16  !  S Radial Reflector
    PMAXS_F   17  '../GenPMAXS_fission/hatch-refl_rad_SE.PMAX'     17  ! SE Radial Reflector
    PMAXS_F   18  '../GenPMAXS_fission/hatch-refl_rad_E.PMAX'      18  !  E Radial Reflector
    PMAXS_F   19  '../GenPMAXS_fission/hatch-refl_rad_NE.PMAX'     19  ! NE Radial Reflector
    PMAXS_F   20  '../GenPMAXS_fission/hatch-refl_rad_N.PMAX'      20  !  N Radial Reflector

/
! DATASET 1
CNTL
    CORE_POWER 59.56
    BANK_POS       -13
                        48 48 40 48 48
                     48 48 48 48 48 48 48 48 48
                  48 32 48 40 48  0 48 40 48 32 48
                  48 48 48 48 48 48 48 48 48 48 48
               48 48 40 48  0 48  8 48  0 48 40 48 48
               48 48 48 48 48 48 48 48 48 48 48 48 48
               40 48  0 48  8 48  0 48  8 48  0 48 40
               48 48 48 48 48 48 48 48 48 48 48 48 48
               48 48 40 48  0 48  8 48  0 48 40 48 48
                  48 48 48 48 48 48 48 48 48 48 48
                  48 32 48 40 48  0 48 40 48 32 48
                     48 48 48 48 48 48 48 48 48
                        48 48 40 48 48
DEPL
    TIME_STP -0.1985
TH
    STATE_CORE  5679.06 1214.75 6.7500E+06
/
! DATASET 2
CNTL
    CORE_POWER 74.9589
    BANK_POS       -13
                        48 48 48 48 48
                     48 48 48 48  6 48 48 48 48
                  48 48 48 48 48 48 48 48 48 48 48
                  48 46 48  6 48 44 48  6 48 46 48
               48 48 48 48 48 48 48 48 48 48 48 48 48
               48 48  6 48 40 48  6 48 40 48  6 48 48
               48 48 48 48 48 48 48 48 48 48 48 48 48
               48 48  6 48 40 48  6 48 40 48  6 48 48
               48 48 48 48 48 48 48 48 48 48 48 48 48
                  48 46 48  6 48 44 48  6 48 46 48
                  48 48 48 48 48 48 48 48 48 48 48
                     48 48 48 48  6 48 48 48 48
                        48 48 48 48 48
DEPL
    TIME_STP -0.2955
TH
    STATE_CORE 9088.53 1223.35 6.8603E+06
/
! DATASET 3
CNTL
    CORE_POWER 50.0000
    BANK_POS       -13
                        48 48 48 48 48
                     48 48 48 48 48 48 48 48 48
                  48 40 48 40 48  6 48 40 48 40 48
                  48 48 48 48 48 48 48 48 48 48 48
               48 48 40 48  6 48  6 48  6 48 40 48 48
               48 48 48 48 48 48 48 48 48 48 48 48 48
               48 48  6 48  6 48  6 48  6 48  6 48 48
               48 48 48 48 48 48 48 48 48 48 48 48 48
               48 48 40 48  6 48  6 48  6 48 40 48 48
                  48 48 48 48 48 48 48 48 48 48 48
                  48 40 48 40 48  6 48 40 48 40 48
                     48 48 48 48 48 48 48 48 48
                        48 48 48 48 48
DEPL
    TIME_STP -0.2084
TH
    STATE_CORE 3935.33 1188.95 6.7155E+06
/
! DATASET 4
```

```
CNTL
     CORE_POWER 89.8604
     BANK_POS       -13
                         48 48 48 48 48
                      48 48 48 48 48 48 48 48 48
                   48 44 48 42 48 12 48 42 48 44 48
                   48 48 48 48 48 48 48 48 48 48 48
               48 48 42 48  8 48 32 48  8 48 42 48 48
               48 48 48 48 48 48 44 48 48 48 48 48 48
               48 48 12 48 32 44  6 44 32 48 12 48 48
               48 48 48 48 48 48 44 48 48 48 48 48 48
               48 48 42 48  8 48 32 48  8 48 42 48 48
                  48 48 48 48 48 48 48 48 48 48 48
                  48 44 48 42 48 12 48 42 48 44 48
                     48 48 48 48 48 48 48 48 48
                         48 48 48 48 48
DEPL
     TIME_STP -0.5799
TH
     STATE_CORE 7534.25 1212.89 6.9775E+06
/
! DATASET 5
CNTL
     CORE_POWER 80.0493
     BANK_POS       -13
                         48 48 48 48 48
                      48 48 48 44 48 44 48 48 48
                   48 40 48 40 48 10 48 40 48 40 48
                   48 48 48 48 48 48 48 48 48 48 48
               48 48 40 48  6 48 20 48  6 48 40 48 48
               48 44 48 48 48 48 44 48 48 48 48 44 48
               40 48  8 48 20 44  0 44 20 48  8 48 40
               48 44 48 48 48 48 44 48 48 48 48 44 48
               48 48 40 48  6 48 20 48  6 48 40 48 48
                  48 48 48 48 48 48 48 48 48 48 48
                  48 40 48 40 48 10 48 40 48 40 48
                     48 48 48 44 48 44 48 48 48
                         48 48 48 48 48
DEPL
     TIME_STP -0.7023
TH
     STATE_CORE 6324.45 1207.32 6.8948E+06
/
! DATASET 6
CNTL
     CORE_POWER 95.6897
     BANK_POS       -13
                         48 48 48 48 48
                      48 48 48 48 32 48 48 48 48
                   48 48 48 48 48 48 48 48 48 48 48
                   48 44 48  2 48 36 48  2 48 44 48
               48 48 48 48 48 48 48 48 48 48 48 48 48
               48 48 18 48 12 48  6 48 12 48 18 48 48
               48 48 48 42 48 48 48 48 48 42 48 48 48
               48 48 18 48 12 48  6 48 12 48 18 48 48
               48 48 48 48 48 48 48 48 48 48 48 48 48
                  48 44 48  2 48 36 48  2 48 44 48
                  48 48 48 48 48 48 48 48 48 48 48
                     48 48 48 48 32 48 48 48 48
                         48 48 48 48 48
DEPL
     TIME_STP -0.5998
TH
     STATE_CORE 8707.11 1219.40 6.9706E+06
/
! DATASET 7
CNTL
     CORE_POWER 86.1248
     BANK_POS       -13
                         48 48 48 48 48
                      48 48 48 48 28 48 48 48 48
                   48 48 48 48 48 48 48 48 48 48 48
                   48 40 48  0 48 32 48  0 48 40 48
               48 48 48 48 48 48 48 48 48 48 48 48 48
               48 48 16 48  4 48  0 48  4 48 16 48 48
               48 48 48 42 48 48 48 48 48 42 48 48 48
               48 48 16 48  4 48  0 48  4 48 16 48 48
               48 48 48 48 48 48 48 48 48 48 48 48 48
                  48 40 48  0 48 32 48  0 48 40 48
                  48 48 48 48 48 48 48 48 48 48 48
                     48 48 48 48 28 48 48 48 48
                         48 48 48 48 48
DEPL
     TIME_STP -0.5325
TH
     STATE_CORE 7393.49 1212.66 6.9223E+06
/
! DATASET 8
CNTL
     CORE_POWER 85.8374
     BANK_POS       -13
                         48 48 48 48 48
                      48 48 38 48 18 48 38 48 48
                   48 48 48 48 48 48 48 48 48 48 48
                   48 38 48  2 48 32 48  2 48 38 48
```

```
            48 48 48 48 48 48 48 48 48 48 48 48 48
            48 48 14 48 10 48  6 48 10 48 14 48 48
            48 48 48 42 48 48 48 48 48 42 48 48 48
            48 48 14 48 10 48  6 48 10 48 14 48 48
            48 48 48 48 48 48 48 48 48 48 48 48 48
               48 38 48  2 48 32 48  2 48 38 48
               48 48 48 48 48 48 48 48 48 48 48
                  48 48 38 48 18 48 38 48 48
                        48 48 48 48 48
DEPL
     TIME_STP -0.5303
TH
     STATE_CORE 6766.56 1208.48 6.9154E+06
/
! DATASET 9
CNTL
     CORE_POWER 79.9261
     BANK_POS       -13
                        48 48 48 48 48
                  48 48 30 48 12 48 30 48 48
               48 48 48 48 48 48 48 48 48 48 48
               48 30 48  0 48 16 48  0 48 30 48
            48 48 48 36 48 48 48 48 48 36 48 48 48
            48 48 14 48  8 48  8 48  8 48 14 48 48
            48 48 48 42 48 36 48 36 48 42 48 48 48
            48 48 14 48  8 48  8 48  8 48 14 48 48
            48 48 48 36 48 48 48 48 48 36 48 48 48
               48 30 48  0 48 16 48  0 48 30 48
               48 48 48 48 48 48 48 48 48 48 48
                  48 48 30 48 12 48 30 48 48
                        48 48 48 48 48
DEPL
     TIME_STP -0.5116
TH
     STATE_CORE 7595.09 1214.29 6.9637E+06
/
! DATASET 10
CNTL
     CORE_POWER 76.0673
     BANK_POS       -13
                        48 48 30 48 48
                  48 48 48 48 48 48 48 48 48
               48 34 48 16 48  6 48 16 48 34 48
               48 48  0 48 48 48 48 48  0 48 48
            48 48 18 48  0 48 12 48  0 48 18 48 48
            48 48 48 48 48 44 48 44 48 48 48 48 48
            30 48  8 48 14 48  0 48 14 48  8 48 30
            48 48 48 48 48 44 48 44 48 48 48 48 48
            48 48 18 48  0 48 12 48  0 48 18 48 48
               48 48  0 48 48 48 48 48  0 48 48
               48 34 48 16 48  6 48 16 48 34 48
                  48 48 48 48 48 48 48 48 48
                        48 48 30 48 48
DEPL
     TIME_STP -0.1621
TH
     STATE_CORE 9246.28 1226.38 6.9361E+06
/
! DATASET 11
CNTL
     CORE_POWER 78.5714
     BANK_POS       -13
                        48 48 34 48 48
                  48 48 48 48 48 48 48 48 48
               48 34 48 18 48  8 48 18 48 34 48
               48 48 10 48 40 48 40 48 10 48 48
            48 48 16 48  0 48 14 48  0 48 16 48 48
            48 40 48 44 48 40 48 40 48 44 48 40 48
            34 48  8 48 14 48  0 48 14 48  8 48 34
            48 40 48 44 48 40 48 40 48 44 48 40 48
            48 48 16 48  0 48 14 48  0 48 16 48 48
               48 48 10 48 40 48 40 48 10 48 48
               48 34 48 18 48  8 48 18 48 34 48
                  48 48 48 48 48 48 48 48 48
                        48 48 34 48 48
DEPL
     TIME_STP -0.3660
TH
     STATE_CORE 8734.67 1222.89 6.9775E+06
/
! DATASET 12
CNTL
     CORE_POWER 80.5419
     BANK_POS       -13
                        48 48 34 48 48
                  48 48 48 48 48 48 48 48 48
               48 34 48 18 48 8 48 18 48 34 48
               48 48 10 48 40 48 40 48 10 48 48
            48 48 16 48  0 48 14 48  0 48 16 48 48
            48 40 48 44 48 40 48 40 48 44 48 40 48
            34 48  8 48 14 48  0 48 14 48  8 48 34
            48 40 48 44 48 40 48 40 48 44 48 40 48
            48 48 16 48  0 48 14 48  0 48 16 48 48
               48 48 10 48 40 48 40 48 10 48 48
               48 34 48 18 48 8 48 18 48 34 48
```

```
                  48 48 48 48 48 48 48 48 48
                        48 48 34 48 48
DEPL
     TIME_STP -0.3385
TH
     STATE_CORE 8420.71 1220.10 7.0051E+06
/
! DATASET 13
CNIL
     CORE_POWER 86.3711
     BANK_POS       -13
                        48 48 48 48 48
                  48 48 48 48 38 48 48 48 48
               48 48 28 48 14 48 14 48 28 48 48
               48 40 48 32 48 36 48 32 48 40 48
            48 28 48  4 48  8 48  8 48  4 48 28 48
            48 48 36 48 30 48 26 48 30 48 36 48 48
            40 18 48 10 48 12 48 12 48 10 48 18 40
            48 48 36 48 30 48 26 48 30 48 36 48 48
            48 28 48  4 48  8 48  8 48  4 48 28 48
               48 40 48 32 48 36 48 32 48 40 48
               48 48 28 48 14 48 14 48 28 48 48
                  48 48 48 48 38 48 48 48 48
                        48 48 48 48 48
DEPL
     TIME_STP -0.7696
TH
     STATE_CORE 8664.90 1219.87 6.9223E+06
/
! DATASET 14
CNIL
     CORE_POWER 82.9639
     BANK_POS       -13
                        48 48 48 48 48
                  48 48 48 34 48 34 48 48 48
               48 36 48 24 48 28 48 24 48 36 48
               48 48  8 48  8 48  8 48  8 48 48
            48 48 24 48 34 48 38 48 34 48 24 48 48
            48 32 48  8 48 10 48 10 48  8 48 32 48
            48 48 26 48 36 48 30 48 36 48 26 48 48
            48 32 48  8 48 10 48 10 48  8 48 32 48
            48 48 24 48 34 48 38 48 34 48 24 48 48
               48 48  8 48  8 48  8 48  8 48 48
               48 36 48 24 48 28 48 24 48 36 48
                  48 48 48 34 48 34 48 48 48
                        48 48 48 48 48
DEPL
     TIME_STP -0.7993
TH
     STATE_CORE 7374.14 1211.50 6.8534E+06
/
! DATASET 15
CNIL
     CORE_POWER 93.1445
     BANK_POS       -13
                        48 48 48 48 48
                  48 48 48 34 48 34 48 48 48
               48 36 48 24 48 28 48 24 48 36 48
               48 48  8 48  8 48  8 48  8 48 48
            48 48 24 48 34 48 38 48 34 48 24 48 48
            48 32 48  8 48 10 48 10 48  8 48 32 48
            48 48 26 48 36 48 30 48 36 48 26 48 48
            48 32 48  8 48 10 48 10 48  8 48 32 48
            48 48 24 48 34 48 38 48 34 48 24 48 48
               48 48  8 48 8 48  8 48  8 48 48
               48 36 48 24 48 28 48 24 48 36 48
                  48 48 48 34 48 34 48 48 48
                        48 48 48 48 48
DEPL
     TIME_STP -0.3870
TH
     STATE_CORE 8874.20 1217.78 6.9017E+06
/
! DATASET 16
CNIL
     CORE_POWER 91.5435
     BANK_POS       -13
                        48 48 48 48 48
                  48 48 48 48 32 48 48 48 48
               48 48 24 48 10 48 10 48 24 48 48
               48 32 48 28 48 28 48 28 48 32 48
            48 20 48  8 48  8 48  8 48  8 48 20 48
            48 48 26 48 30 48 30 48 30 48 26 48 48
            48 18 48 10 48  8 48  8 48 10 48 18 48
            48 48 26 48 30 48 30 48 30 48 26 48 48
            48 20 48  8 48  8 48  8 48  8 48 20 48
               48 32 48 28 48 28 48 28 48 32 48
               48 48 24 48 10 48 10 48 24 48 48
                  48 48 48 48 32 48 48 48 48
                        48 48 48 48 48
DEPL
     TIME_STP -0.6395
TH
     STATE_CORE 9234.65 1219.87 6.9085E+06
/
```

```
! DATASET 17
CNTL
     CORE_POWER 87.3974
     BANK_POS       -13
                         48 48 48 48 48
                      48 48 48 48 32 48 48 48 48
                   48 48 24 48 10 48 10 48 24 48 48
                   48 32 48 28 48 28 48 28 48 32 48
               48 20 48  8 48  8 48  8 48  8 48 20 48
               48 48 26 48 30 48 30 48 30 48 26 48 48
               48 18 48 10 48  8 48  8 48 10 48 18 48
               48 48 26 48 30 48 30 48 30 48 26 48 48
               48 20 48  8 48  8 48  8 48  8 48 20 48
                   48 32 48 28 48 28 48 28 48 32 48
                   48 48 24 48 10 48 10 48 24 48 48
                      48 48 48 48 32 48 48 48 48
                         48 48 48 48 48
DEPL
     TIME_STP -0.4410
TH
     STATE_CORE 8932.34 1219.64 6.8672E+06
/
! DATASET 18
CNTL
     CORE_POWER 83.6207
     BANK_POS       -13
                         48 48 48 48 48
                      48 48 48 48 32 48 48 48 48
                   48 48 24 48 10 48 10 48 24 48 48
                   48 32 48 28 48 28 48 28 48 32 48
               48 20 48  8 48  8 48  8 48  8 48 20 48
               48 48 26 48 30 48 30 48 30 48 26 48 48
               48 18 48 10 48  8 48  8 48 10 48 18 48
               48 48 26 48 30 48 30 48 30 48 26 48 48
               48 20 48  8 48  8 48  8 48  8 48 20 48
                   48 32 48 28 48 28 48 28 48 32 48
                   48 48 24 48 10 48 10 48 24 48 48
                      48 48 48 48 32 48 48 48 48
                         48 48 48 48 48
DEPL
     TIME_STP -0.8787
TH
     STATE_CORE 9246.28 1223.35 6.9706E+06
/
! DATASET 19
CNTL
     CORE_POWER 91.5846
     BANK_POS       -13
                         48 48 48 48 48
                      48 48 48 20 48 20 48 48 48
                   48 48 48 28 48 32 48 28 48 48 48
                   48 48 18 48 12 48 12 48 18 48 48
               48 48 28 48 48 48 34 48 48 48 28 48 48
               48 20 48 12 48 10 48 10 48 12 48 20 48
               48 48 32 48 34 48 48 48 34 48 32 48 48
               48 20 48 12 48 10 48 10 48 12 48 20 48
               48 48 28 48 48 48 34 48 48 48 28 48 48
                   48 48 18 48 12 48 12 48 18 48 48
                   48 48 48 28 48 32 48 28 48 48 48
                      48 48 48 20 48 20 48 48 48
                         48 48 48 48 48
DEPL
     TIME_STP -0.4642
TH
     STATE_CORE 9211.39 1220.57 6.9085E+06
/
! DATASET 20
CNTL
     CORE_POWER 87.4795
     BANK_POS       -13
                         48 48 48 48 48
                      48 48 48 20 48 20 48 48 48
                   48 48 48 28 48 32 48 28 48 48 48
                   48 48 18 48 12 48 12 48 18 48 48
               48 48 28 48 48 48 34 48 48 48 28 48 48
               48 20 48 12 48 10 48 10 48 12 48 20 48
               48 48 32 48 34 48 48 48 34 48 32 48 48
               48 20 48 12 48 10 48 10 48 12 48 20 48
               48 48 28 48 48 48 34 48 48 48 28 48 48
                   48 48 18 48 12 48 12 48 18 48 48
                   48 48 48 28 48 32 48 28 48 48 48
                      48 48 48 20 48 20 48 48 48
                         48 48 48 48 48
DEPL
     TIME_STP -0.4267
TH
     STATE_CORE 9269.53 1221.96 6.9430E+06
/
! DATASET 21
CNTL
     CORE_POWER 88.3826
     BANK_POS       -13
                         48 48 48 48 48
                      48 48 48 20 48 20 48 48 48
                   48 48 48 28 48 32 48 28 48 48 48
```

```
                48 48 18 48 14 48 14 48 18 48 48
             48 48 28 48 48 48 34 48 48 48 28 48 48
             48 20 48 14 48 14 48 14 48 14 48 20 48
             48 48 32 48 34 48 48 48 34 48 32 48 48
             48 20 48 14 48 14 48 14 48 14 48 20 48
             48 48 28 48 48 48 34 48 48 48 28 48 48
                48 48 18 48 14 48 14 48 18 48 48
                48 48 48 28 48 32 48 28 48 48 48
                   48 48 48 20 48 20 48 48 48
                        48 48 48 48 48
DEPL
     TIME_STP -0.0540
TH
     STATE_CORE 8409.08 1216.61 6.9568E+06
/
! DATASET 22
CNTL
     CORE_POWER 90.6404
     BANK_POS       -13
                        48 48 48 48 48
                   48 48 48 20 48 20 48 48 48
                48 48 48 28 48 32 48 28 48 48 48
                48 48 18 48 14 48 14 48 18 48 48
             48 48 28 48 48 48 34 48 48 48 28 48 48
             48 20 48 14 48 14 48 14 48 14 48 20 48
             48 48 32 48 34 48 48 48 34 48 32 48 48
             48 20 48 14 48 14 48 14 48 14 48 20 48
             48 48 28 48 48 48 34 48 48 48 28 48 48
                48 48 18 48 14 48 14 48 18 48 48
                48 48 48 28 48 32 48 28 48 48 48
                   48 48 48 20 48 20 48 48 48
                        48 48 48 48 48
DEPL
     TIME_STP -0.2359
TH
     STATE_CORE 9257.90 1220.57 6.9637E+06
/
! DATASET 23
CNTL
     CORE_POWER 86.7816
     BANK_POS       -13
                        48 48 48 48 48
                   48 48 48 20 48 20 48 48 48
                48 48 48 28 48 32 48 28 48 48 48
                48 48 18 48 14 48 14 48 18 48 48
             48 48 28 48 48 48 34 48 48 48 28 48 48
             48 20 48 14 48 14 48 14 48 14 48 20 48
             48 48 32 48 34 48 48 48 34 48 32 48 48
             48 20 48 14 48 14 48 14 48 14 48 20 48
             48 48 28 48 48 48 34 48 48 48 28 48 48
                48 48 18 48 14 48 14 48 18 48 48
                48 48 48 28 48 32 48 28 48 48 48
                   48 48 48 20 48 20 48 48 48
                        48 48 48 48 48
DEPL
     TIME_STP -0.1918
TH
     STATE_CORE 9095.12 1221.03 6.9982E+06
/
! Finish Cycle 1
CNTL
     CORE_POWER 86.7816
     BANK_POS       -13
                        48 48 48 48 48
                   48 48 48 20 48 20 48 48 48
                48 48 48 28 48 32 48 28 48 48 48
                48 48 18 48 14 48 14 48 18 48 48
             48 48 28 48 48 48 34 48 48 48 28 48 48
             48 20 48 14 48 14 48 14 48 14 48 20 48
             48 48 32 48 34 48 48 48 34 48 32 48 48
             48 20 48 14 48 14 48 14 48 14 48 20 48
             48 48 28 48 48 48 34 48 48 48 28 48 48
                48 48 18 48 14 48 14 48 18 48 48
                48 48 48 28 48 32 48 28 48 48 48
                   48 48 48 20 48 20 48 48 48
                        48 48 48 48 48
DEPL
     TIME_STP -0.0882
TH
     STATE_CORE 9095.12 1221.03 6.9982E+06
.
```

C.3 PATHS Input for Cycle 2

```
     paths_id   h1c2_paths

     CORE_STATE 2436000 8916.37 1211.3 6784680
     COMM_PARM  10 0.1524
     CONV_PARM  1000  1.0E-6  100000  1.0E-8   0.25
     TH_LSOLVER 1
     TH_IPATHS  F
     TH_CORR    1 1 3 4
```

```
    NK_RADIAL      1  560  26
    TH_RADIAL      560  0  0
    TH_AXIAL       26  1  1
    AX_MESH        1*15.24 24*15.24 1*15.24

    TH_CONF
                                    1   2   3   4   5   6   7   8   9  10
                                11  12  13  14  15  16  17  18  19  20  21  22
                            23  24  25  26  27  28  29  30  31  32  33  34  35  36  37  38  39  40
                        41  42  43  44  45  46  47  48  49  50  51  52  53  54  55  56  57  58  59  60
                    61  62  63  64  65  66  67  68  69  70  71  72  73  74  75  76  77  78  79  80  81  82
                    83  84  85  86  87  88  89  90  91  92  93  94  95  96  97  98  99 100 101 102 103 104
                105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126
            127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150
        151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176
        177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202
        203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228
        229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251 252 253 254
        255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280
        281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305 306
        307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332
        333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358
        359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384
        385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400 401 402 403 404 405 406 407 408 409 410
            411 412 413 414 415 416 417 418 419 420 421 422 423 424 425 426 427 428 429 430 431 432 433 434
                435 436 437 438 439 440 441 442 443 444 445 446 447 448 449 450 451 452 453 454 455 456
                457 458 459 460 461 462 463 464 465 466 467 468 469 470 471 472 473 474 475 476 477 478
                479 480 481 482 483 484 485 486 487 488 489 490 491 492 493 494 495 496 497 498 499 500
                    501 502 503 504 505 506 507 508 509 510 511 512 513 514 515 516 517 518 519 520
                        521 522 523 524 525 526 527 528 529 530 531 532 533 534 535 536 537 538
                                539 540 541 542 543 544 545 546 547 548 549 550
                                    551 552 553 554 555 556 557 558 559 560
!
! H1C2 Core Design
!
    CH_T_MAP
                                10 20 10 20 10 10 20 10 20 10
                            10  2  3  1  3  2  2  3  1  3  2 10
                        20 10 20  1  3  1  3  2  4  4  2  3  1  3  1 20 10 20
                    10  2  4  3  4  1  4  2  4  1  1  4  2  4  1  4  3  4  2 10
                20  2  3  1  4  2  4  2  4  2  3  3  2  4  2  4  2  4  1  3  2 20
                10  4  1  4  1  3  2  3  1  3  2  2  3  1  3  2  3  1  4  1  4 10
                20  3  4  1  4  3  4  2  1  2  1  1  2  1  2  4  3  4  1  4  3 20
            10  1  4  2  3  3  1  1  3  1  1  3  3  1  1  3  1  1  3  3  2  4  1 10
        10  2  3  1  4  2  4  1  2  2  1  4  2  2  4  1  2  2  1  4  2  4  1  3  2 10
        20  3  1  4  2  3  2  3  2  1  1  2  2  2  2  1  1  2  3  2  3  2  4  1  3 20
        10  1  3  2  4  1  1  1  1  1  3  1  3  3  1  3  1  1  1  1  1  4  2  3  1 10
        20  3  2  4  2  3  2  1  4  2  1  4  2  2  4  1  2  4  1  2  3  2  4  2  3 20
        10  2  4  1  3  2  1  3  2  2  3  2  3  3  2  3  2  2  3  1  2  3  1  4  2 10
        10  2  4  1  3  2  1  3  2  2  3  2  3  3  2  3  2  2  3  1  2  3  1  4  2 10
        20  3  2  4  2  3  2  1  4  2  1  4  2  2  4  1  2  4  1  2  3  2  4  2  3 20
        10  1  3  2  4  1  1  1  1  1  3  1  3  3  1  3  1  1  1  1  1  4  2  3  1 10
        20  3  1  4  2  3  2  3  2  1  1  2  2  2  2  1  1  2  3  2  3  2  4  1  3 20
        10  2  3  1  4  2  4  1  2  2  1  4  2  2  4  1  2  2  1  4  2  4  1  3  2 10
            10  1  4  2  3  3  1  1  3  1  1  3  3  1  1  3  1  1  3  3  2  4  1 10
                20  3  4  1  4  3  4  2  1  2  1  1  2  1  2  4  3  4  1  4  3 20
                10  4  1  4  1  3  2  3  1  3  2  2  3  1  3  2  3  1  4  1  4 10
                20  2  3  1  4  2  4  2  4  2  3  3  2  4  2  4  2  4  1  3  2 20
                    10  2  4  3  4  1  4  2  4  1  1  4  2  4  1  4  3  4  2 10
                        20 10 20  1  3  1  3  2  4  4  2  3  1  3  1 20 10 20
                                10  2  3  1  3  2  2  3  1  3  2 10
                                    10 20 10 20 10 10 20 10 20 10
!
! Channel Description
!
!                    charea    chhd     rough ppitch    n_f or_cld  or_fuel th_clad hgap  wr r_wrod
    CHAN_GEOM    1   100.23E-4 1.73E-2 5E-6  18.75E-3 49  7.15E-3 6.06E-3 0.94E-3 3060  0  7.15E-3 !7X7 Type 1 channel geometry
    CHAN_GEOM    2   100.23E-4 1.73E-2 5E-6  18.75E-3 49  7.15E-3 6.06E-3 0.94E-3 3060  0  7.15E-3 !7X7 Type 2 channel geometry
    CHAN_GEOM    3   100.23E-4 1.73E-2 5E-6  18.75E-3 49  7.15E-3 6.06E-3 0.94E-3 3060  0  7.15E-3 !7X7 Type 3 channel geometry
    CHAN_GEOM    4   100.11E-4 1.52E-2 5E-6  16.26E-3 63  6.26E-3 5.28E-3 0.86E-3 3920  1  6.26E-3 !8X8 Type 4 channel geometry
!   CHAN_GEOM    5   102.09E-4 1.57E-2 5E-6  16.26E-3 62  6.13E-3 5.21E-3 0.81E-3 3920  2  7.51E-3 !8X8 Type 5 channel geometry
    CHAN_GEOM    10  100.23E-4 1.73E-2 5E-6  18.75E-3 49  7.15E-3 6.06E-3 0.94E-3 3060  0  7.15E-3 !7X7 Type 1 channel geometry
    CHAN_GEOM    20  100.23E-4 1.73E-2 5E-6  18.75E-3 49  7.15E-3 6.06E-3 0.94E-3 3060  0  7.15E-3 !7X7 Type 2 channel geometry
!   CHAN_GEOM    30  100.23E-4 1.73E-2 5E-6  18.75E-3 49  7.15E-3 6.06E-3 0.94E-3 3060  0  7.15E-3 !7X7 Type 3 channel geometry
!   CHAN_GEOM    40  100.11E-4 1.52E-2 5E-6  16.26E-3 63  6.26E-3 5.28E-3 0.86E-3 3920  1  6.26E-3 !8X8 Type 4 channel geometry
!   CHAN_GEOM    50  102.09E-4 1.57E-2 5E-6  16.26E-3 62  6.13E-3 5.21E-3 0.81E-3 3920  2  7.51E-3 !8X8 Type 5 channel geometry
    KA_CHAN      1   1*20.17000 1*0.5 2*0 1*2.00 2*0 1*2.00 3*0 1*2.00 2*0 1*2.00 3*0 1*2.00 2*0 1*2.00 2*0 1*2.00 1*1.0 ! 7X7 Fuel loss coefficient (loose)
    KA_CHAN      2   1*20.17000 1*0.5 2*0 1*2.00 2*0 1*2.00 3*0 1*2.00 2*0 1*2.00 3*0 1*2.00 2*0 1*2.00 2*0 1*2.00 1*1.0 ! 7X7 Fuel loss coefficient (loose)
    KA_CHAN      3   1*20.17000 1*0.5 2*0 1*2.00 2*0 1*2.00 3*0 1*2.00 2*0 1*2.00 3*0 1*2.00 2*0 1*2.00 2*0 1*2.00 1*1.0 ! 7X7 Fuel loss coefficient (loose)
    KA_CHAN      4   1*20.15000 1*0.5 2*0 1*2.25 2*0 1*2.25 3*0 1*2.25 2*0 1*2.25 3*0 1*2.25 2*0 1*2.25 2*0 1*2.25 1*1.0 ! 8X8 Fuel loss coefficient (loose)
```

```
!   KA_CHAN     5  1*20.93000 1*0.5 2*0 1*2.25 2*0 1*2.25 3*0 1*2.25 2*0 1*2.25 3*0 1*2.25 2*0 1*2.25 2*0 1*2.25 1*1.0 ! 8X8 Fuel loss coefficient (loose)
    KA_CHAN     10 1*92.13000 1*0.5 2*0 1*2.00 2*0 1*2.00 3*0 1*2.00 2*0 1*2.00 3*0 1*2.00 2*0 1*2.00 2*0 1*2.00 1*1.0 ! 7X7 Fuel loss coefficient (tight)
    KA_CHAN     20 1*92.13000 1*0.5 2*0 1*2.00 2*0 1*2.00 3*0 1*2.00 2*0 1*2.00 3*0 1*2.00 2*0 1*2.00 2*0 1*2.00 1*1.0 ! 7X7 Fuel loss coefficient (tight)
!   KA_CHAN     30 1*92.13000 1*0.5 2*0 1*2.00 2*0 1*2.00 3*0 1*2.00 2*0 1*2.00 3*0 1*2.00 2*0 1*2.00 2*0 1*2.00 1*1.0 ! 7X7 Fuel loss coefficient (tight)
!   KA_CHAN     40 1*92.01000 1*0.5 2*0 1*2.25 2*0 1*2.25 3*0 1*2.25 2*0 1*2.25 3*0 1*2.25 2*0 1*2.25 2*0 1*2.25 1*1.0 ! 8X8 Fuel loss coefficient (tight)
!   KA_CHAN     50 1*95.60000 1*0.5 2*0 1*2.25 2*0 1*2.25 3*0 1*2.25 2*0 1*2.25 3*0 1*2.25 2*0 1*2.25 2*0 1*2.25 1*1.0 ! 8X8 Fuel loss coefficient (tight)
.
```

C.4 PARCS Input for HZP Cycle 2 Fuel Shuffling

```
!*********************************************
CASEID H1C1-C2
!*********************************************
CNTL
     CORE_TYPE       BWR
     CORE_POWER     100.0   ! percent of core power
     BANK_POS        -13
                        48 48 48 48 48
                     40 48 48 48 20 48 48 48 40
                  48 48 48 48 48 48 48 48 48 48 48
                  48 38 48 30 48  8 48 30 48 38 48
               48 48 48 48 48 48 48 48 48 48 48 48 48
               48 48 20 48  8 48 16 48  8 48 20 48 48
               48 48 48 48 48 48 48 48 48 48 48 48 48
               48 48 20 48  8 48 16 48  8 48 20 48 48
               48 48 48 48 48 48 48 48 48 48 48 48 48
                  48 38 48 30 48  8 48 30 48 38 48
                  48 48 48 48 48 48 48 48 48 48 48
                     40 48 48 48 20 48 48 48 40
                        48 48 48 48 48
     DEPLETION       T  1.0E-5 T
!                    NSET   LADF LXES LJ1F LDED LCHI LCHD LINV LDET LYLD LCDF LGFF LBET LAMB LDEC
     TREE_XS      T  20    T    T    F    F    F    F    F    T    T    F    F    F    F    F
     TH_FDBK         F
     DECAY_HEAT      F
     RESTART         F
     XE_SM           1 1
     TRANSIENT       F
     EXT_TH          F
     mult_cyc        T
!
! Printing Options
!
! 1  Detailed input edit
! 2  Iteration history display
! 3  Planar power distributions
! 4  Detailed pin power distributions
! 5  Reactivity edit and adjoint flux
! 6  Feedback component reactivity edit
! 7  Integrated flux and precursor density edit
! 8  Planar flux distributions
! 9  Xe/Sm number densities
! 10 T/H state variables
! 11 1D collapsed group constants
! 12 Point Kinetics Data
! 13 Radial Power Shape
! 14 Radial Flux Shape
! 15 Harmonics
!              1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
!     PRINT_OPT T T F F F F F F F  T  F  F  F  F  F
      inp_opts   F  T
      plot_opts   0  0  2
     ROT_ADF   T
PARAM
      nlupd_ss       3  5  1
      n_iters        15  5
      conv_ss        1.0e-5 1.0e-4 1.0e-3
      cnv_th_ss      0.001
      wielandt       0.2  0.1  1.0
      decusp         2
      NODAL_KERN     NEMMG
!      LSOLVER        1 1 20
      CMFD           2
XSEC
     group_spec      2  1
GEOM
!                    nasyx         nasyy           nz          nzbr          nztr
     GEO_DIM            28            28           26             1             1

!                Radial core configuration
```

```
    RAD_CONF
!
! H1C2 Core Design
!
     0  0  0  0  0  0  0  0  0 13 13 13 13 13 13 13 13 13 13  0  0  0  0  0  0  0  0  0
     0  0  0  0  0  0  0  0  6  1  2  3  2  2  2  2  3  2  1 12  0  0  0  0  0  0  0  0
     0  0  0  0  0 13 13  6  2  1  5  1  5  3  3  5  1  5  1  2 12 13 13  0  0  0  0  0
     0  0  0  0  6  1  2  1  3  5  3  5  4  5  5  4  5  3  5  3  1  2  1 12  0  0  0  0
     0  0  0  6  1  1  5  4  5  4  5  2  5  3  3  5  2  5  4  5  4  5  1  1 12  0  0  0
     0  0  7  1  1  3  3  5  4  5  3  5  3  5  5  3  5  3  5  4  5  3  3  1  1 11  0  0
     0  0  7  2  5  3  4  2  5  2  5  2  5  3  3  5  2  5  2  5  2  4  3  5  2 11  0  0
     0  0  6  1  4  5  2  5  3  4  1  4  2  4  4  2  4  1  4  3  5  2  5  4  1 12  0  0
     0  6  2  3  5  4  5  3  5  2  5  3  5  1  1  5  3  5  2  5  3  5  4  5  3  2 12  0
     7  1  1  5  4  5  2  4  2  4  2  4  1  4  4  1  4  2  4  2  4  2  5  4  5  1  1 11
     7  2  5  3  5  3  5  1  5  2  5  1  5  1  1  5  1  5  2  5  1  5  3  5  3  5  2 11
     7  3  1  5  2  5  2  4  3  4  1  4  1  4  4  1  4  1  4  3  4  2  5  2  5  1  3 11
     7  2  5  4  5  3  5  2  5  1  5  1  5  1  1  5  1  5  1  5  2  5  3  5  4  5  2 11
     7  2  3  5  3  5  3  4  1  4  1  4  1  2  2  1  4  1  4  1  4  3  5  3  5  3  2 11
     7  2  3  5  3  5  3  4  1  4  1  4  1  2  2  1  4  1  4  1  4  3  5  3  5  3  2 11
     7  2  5  4  5  3  5  2  5  1  5  1  5  1  1  5  1  5  1  5  2  5  3  5  4  5  2 11
     7  3  1  5  2  5  2  4  3  4  1  4  1  4  4  1  4  1  4  3  4  2  5  2  5  1  3 11
     7  2  5  3  5  3  5  1  5  2  5  1  5  1  1  5  1  5  2  5  1  5  3  5  3  5  2 11
     7  1  1  5  4  5  2  4  2  4  2  4  1  4  4  1  4  2  4  2  4  2  5  4  5  1  1 11
     0  8  2  3  5  4  5  3  5  2  5  3  5  1  1  5  3  5  2  5  3  5  4  5  3  2 10  0
     0  0  8  1  4  5  2  5  3  4  1  4  2  4  4  2  4  1  4  3  5  2  5  4  1 10  0  0
     0  0  7  2  5  3  4  2  5  2  5  2  5  3  3  5  2  5  2  5  2  4  3  5  2 11  0  0
     0  0  7  1  1  3  3  5  4  5  3  5  3  5  5  3  5  3  5  4  5  3  3  1  1 11  0  0
     0  0  0  8  1  1  5  4  5  4  5  2  5  3  3  5  2  5  4  5  4  5  1  1 10  0  0  0
     0  0  0  0  8  1  2  1  3  5  3  5  4  5  5  4  5  3  5  3  1  2  1 10  0  0  0  0
     0  0  0  0  0  9  9  8  2  1  5  1  5  3  3  5  1  5  1  2 10  9  9  0  0  0  0  0
     0  0  0  0  0  0  0  0  8  1  2  3  2  2  2  2  3  2  1 10  0  0  0  0  0  0  0  0
     0  0  0  0  0  0  0  0  0  9  9  9  9  9  9  9  9  9  9  0  0  0  0  0  0  0  0  0
!
     ASSY_TYPE    1  1*10 1*1  1*1  1*2  9*2  6*2  1*1  5*1  1*12  FUEL ! Type 1 7X7 Fuel
     ASSY_TYPE    2  1*10 1*3  1*3  1*4  9*5  6*4  1*4  5*3  1*12  FUEL ! Type 2 7X7 Fuel
     ASSY_TYPE    3  1*10 1*6  1*6  1*6  9*6  6*6  1*6  5*6  1*12  FUEL ! Type 3 7X7 Fuel
     ASSY_TYPE    4  1*10 1*7  1*7  1*7  9*7  6*7  1*7  5*7  1*12  FUEL ! Type 4 8X8 Fuel
     ASSY_TYPE    5  1*10 1*8  1*9  1*9  9*9  6*9  1*9  5*9  1*12  FUEL ! Type 5 8X8 Fuel, removed top nat U
     ASSY_TYPE    6  1*10 1*13 1*13 1*13 9*13 6*13 1*13 5*13 1*12  REFL ! NW
     ASSY_TYPE    7  1*10 1*14 1*14 1*14 9*14 6*14 1*14 5*14 1*12  REFL ! W
     ASSY_TYPE    8  1*10 1*15 1*15 1*15 9*15 6*15 1*15 5*15 1*12  REFL ! SW
     ASSY_TYPE    9  1*10 1*16 1*16 1*16 9*16 6*16 1*16 5*16 1*12  REFL ! S
     ASSY_TYPE   10  1*10 1*17 1*17 1*17 9*17 6*17 1*17 5*17 1*12  REFL ! SE
     ASSY_TYPE   11  1*10 1*18 1*18 1*18 9*18 6*18 1*18 5*18 1*12  REFL ! E
     ASSY_TYPE   12  1*10 1*19 1*19 1*19 9*19 6*19 1*19 5*19 1*12  REFL ! NE
     ASSY_TYPE   13  1*10 1*20 1*20 1*20 9*20 6*20 1*20 5*20 1*12  REFL ! N
     ASSY_TYPE   14  1*10 1*11 1*11 1*11 9*11 6*11 1*11 5*11 1*12  REFL ! No ADF
!
     GRID_X     28*15.24
     GRID_Y     28*15.24
     GRID_Z     1*15.24 24*15.24 1*15.24

     NEUTMESH_X 28*1
     NEUTMESH_Y 28*1
     BOUN_COND  2 2 2 2 2 2
     CR_AXINFO  17.78        7.62         48
!                 Control rod banks defined
     BANK_CONF
                                        0   0   0   0   0   0   0   0   0   0
                                    0   1   1   2   2   3   3   4   4   5   5   0
                            0   0   0   0   1   1   2   2   3   3   4   4   5   5   0   0   0   0
                        0   6   6   7   7   8   8   9   9  10  10  11  11  12  12  13  13  14  14   0
                    0   0   6   6   7   7   8   8   9   9  10  10  11  11  12  12  13  13  14  14   0   0
            0  15  15  16  16  17  17  18  18  19  19  20  20  21  21  22  22  23  23  24  24  25  25   0
            0  15  15  16  16  17  17  18  18  19  19  20  20  21  21  22  22  23  23  24  24  25  25   0
            0  26  26  27  27  28  28  29  29  30  30  31  31  32  32  33  33  34  34  35  35  36  36   0
        0   0  26  26  27  27  28  28  29  29  30  30  31  31  32  32  33  33  34  34  35  35  36  36   0   0
    0  37  37  38  38  39  39  40  40  41  41  42  42  43  43  44  44  45  45  46  46  47  47  48  48  49  49   0
    0  37  37  38  38  39  39  40  40  41  41  42  42  43  43  44  44  45  45  46  46  47  47  48  48  49  49   0
    0  50  50  51  51  52  52  53  53  54  54  55  55  56  56  57  57  58  58  59  59  60  60  61  61  62  62   0
    0  50  50  51  51  52  52  53  53  54  54  55  55  56  56  57  57  58  58  59  59  60  60  61  61  62  62   0
    0  63  63  64  64  65  65  66  66  67  67  68  68  69  69  70  70  71  71  72  72  73  73  74  74  75  75   0
    0  63  63  64  64  65  65  66  66  67  67  68  68  69  69  70  70  71  71  72  72  73  73  74  74  75  75   0
    0  76  76  77  77  78  78  79  79  80  80  81  81  82  82  83  83  84  84  85  85  86  86  87  87  88  88   0
    0  76  76  77  77  78  78  79  79  80  80  81  81  82  82  83  83  84  84  85  85  86  86  87  87  88  88   0
    0  89  89  90  90  91  91  92  92  93  93  94  94  95  95  96  96  97  97  98  98  99  99 100 100 101 101   0
    0  89  89  90  90  91  91  92  92  93  93  94  94  95  95  96  96  97  97  98  98  99  99 100 100 101 101   0
        0   0 102 102 103 103 104 104 105 105 106 106 107 107 108 108 109 109 110 110 111 111 112 112   0   0
            0 102 102 103 103 104 104 105 105 106 106 107 107 108 108 109 109 110 110 111 111 112 112   0
            0 113 113 114 114 115 115 116 116 117 117 118 118 119 119 120 120 121 121 122 122 123 123   0
            0 113 113 114 114 115 115 116 116 117 117 118 118 119 119 120 120 121 121 122 122 123 123   0
```

```
               0   0 124 124 125 125 126 126 127 127 128 128 129 129 130 130 131 131 132 132   0   0
                   0 124 124 125 125 126 126 127 127 128 128 129 129 130 130 131 131 132 132   0
                       0   0   0   0 133 133 134 134 135 135 136 136 137 137   0   0   0   0
                                   0 133 133 134 134 135 135 136 136 137 137   0
                                       0   0   0   0   0   0   0   0   0   0
!                 Assembly rotation
     ADF_ROT
                       0 0 0 0 0 0 0 0 0 0
                     0 2 1 2 1 2 1 2 1 2 1 0
               0 0 0 0 3 0 3 0 3 0 3 0 3 0 0 0 0 0
             0 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 0
           0 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 0 0
         0 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 0
         0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 0
         0 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 0
       0 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 0 0
     0 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 0
     0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 0
     0 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 0
     0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 0
     0 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 0
     0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 0
     0 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 0
     0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 0
     0 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 0
     0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 0
       0 0 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 0 0
         0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 0
         0 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 0
         0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 0
           0 0 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 0 0
             0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 0
               0 0 0 0 2 1 2 1 2 1 2 1 2 1 0 0 0 0
                     0 3 0 3 0 3 0 3 0 3 0 0
                       0 0 0 0 0 0 0 0 0 0
FDBK
    fa_powpit   4.35  15.24
TH
    unif_th     0.4   600.0   300.0
DEPL
     INP_HST    'H1C1.parcs_dep' 1 74
     HST_OPT    T T F F F
     OUT_OPT    F T F F F
     BANK_NR    137*1
!
! Cross-sections
!
     PMAXS_F    1  '../GenPMax/fuel_polaris/hatch-t1a.PMAX'                  1  ! Type 1 7X7 only rod A gad
     PMAXS_F    2  '../GenPMax/fuel_polaris/hatch-t1b.PMAX'                  2  ! Type 1 7x7 rod A and B gad
     PMAXS_F    3  '../GenPMax/fuel_polaris/hatch-t2a.PMAX'                  3  ! Type 2 7x7 no gad
     PMAXS_F    4  '../GenPMax/fuel_polaris/hatch-t2c.PMAX'                  4  ! Type 2 7x7 only rod C gad
     PMAXS_F    5  '../GenPMax/fuel_polaris/hatch-t2d.PMAX'                  5  ! Type 2 7x7 rod C and D gad
     PMAXS_F    6  '../GenPMax/fuel_polaris/hatch-t3.PMAX'                   6  ! Type 3 7x7
     PMAXS_F    7  '../GenPMax/fuel_polaris/hatch-t4.PMAX'                   7  ! Type 4 8x8
     PMAXS_F    8  '../GenPMax/fuel_polaris/hatch-t5a.PMAX'                  8  ! Type 5 8x8 natural u
     PMAXS_F    9  '../GenPMax/fuel_polaris/hatch-t5b.PMAX'                  9  ! Type 5 8x8 enriched u
     PMAXS_F   10  '../GenPMax/refl_triton/hatch-refl-bot.PMAX'     10  ! Bottom Axial Reflector
     PMAXS_F   11  '../GenPMax/refl_triton/hatch-refl-rad.PMAX'     11  ! Radial Reflector
     PMAXS_F   12  '../GenPMax/refl_triton/hatch-refl-top.PMAX'     12  ! Top Axial Reflector
     PMAXS_F   13  '../GenPMax/refl_triton/hatch-refl-rad-NW.PMAX'  13  ! NW Radial Reflector
     PMAXS_F   14  '../GenPMax/refl_triton/hatch-refl-rad-W.PMAX'   14  !  W Radial Reflector
     PMAXS_F   15  '../GenPMax/refl_triton/hatch-refl-rad-SW.PMAX'  15  ! SW Radial Reflector
     PMAXS_F   16  '../GenPMax/refl_triton/hatch-refl-rad-S.PMAX'   16  !  S Radial Reflector
     PMAXS_F   17  '../GenPMax/refl_triton/hatch-refl-rad-SE.PMAX'  17  ! SE Radial Reflector
     PMAXS_F   18  '../GenPMax/refl_triton/hatch-refl-rad-E.PMAX'   18  !  E Radial Reflector
     PMAXS_F   19  '../GenPMax/refl_triton/hatch-refl-rad-NE.PMAX'  19  ! NE Radial Reflector
     PMAXS_F   20  '../GenPMax/refl_triton/hatch-refl-rad-N.PMAX'   20  !  N Radial Reflector

MCYCLE
!                  index     locmap
      bank_def       1        137*48

      cycle_def      1
      depl_step      1*0.00001
      power_lev      2*0.01
      bank_seq       2*1

      location
                                         0   0   0   0   0   0   0   0   0   0
                                     0   1   2   3   4   5   6   7   8   9  10   0
                         0   0   0  11  12  13  14  15  16  17  18  19  20  21  22   0   0   0
```

```
                    0  23  24  25  26  27  28  29  30  31  32  33  34  35  36  37  38  39  40   0
                0  41  42  43  44  45  46  47  48  49  50  51  52  53  54  55  56  57  58  59  60   0
            0  61  62  63  64  65  66  67  68  69  70  71  72  73  74  75  76  77  78  79  80  81  82   0
            0  83  84  85  86  87  88  89  90  91  92  93  94  95  96  97  98  99 100 101 102 103 104   0
            0 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126   0
        0 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150   0
    0 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176   0
    0 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202   0
    0 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228   0
    0 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251 252 253 254   0
    0 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280   0
    0 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305 306   0
    0 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332   0
    0 333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358   0
    0 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384   0
    0 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400 401 402 403 404 405 406 407 408 409 410   0
        0 411 412 413 414 415 416 417 418 419 420 421 422 423 424 425 426 427 428 429 430 431 432 433 434   0
            0 435 436 437 438 439 440 441 442 443 444 445 446 447 448 449 450 451 452 453 454 455 456   0
            0 457 458 459 460 461 462 463 464 465 466 467 468 469 470 471 472 473 474 475 476 477 478   0
            0 479 480 481 482 483 484 485 486 487 488 489 490 491 492 493 494 495 496 497 498 499 500   0
                0 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515 516 517 518 519 520   0
                    0 521 522 523 524 525 526 527 528 529 530 531 532 533 534 535 536 537 538   0
                        0   0   0 539 540 541 542 543 544 545 546 547 548 549 550   0   0   0
                                  0 551 552 553 554 555 556 557 558 559 560   0
                                    0   0   0   0   0   0   0   0   0   0

! shuffling definition
!                   index  mode: 1-individual; 2-batch
      shuf_map        1      1
                                      0   0   0   0   0   0   0   0   0   0
                                  0 248 136 141 297 510 327 264 440 407  49   0
                        0   0   0 469 310 502 388  25  85 476 523 173  81 251 416   0   0   0
                    0 439 129 429  96 521  79 385 324  -4  -4 237 176 532 479 465 397 452 122   0
                0 444 443  -4 104  -4 350  -4 262  -4 365 238  -4 299  -4 217  -4 457  -4 355 516   0
            0  91  78 501 288  -4 382  -4 239  -4 291   2   9  44  -4 322  -4 376  -4 311 520 421 362   0
            0 336  -4 133  -4 304 333 468 537 498 254  80 481 332  63  39 144 203 294  -4 317  -4 225   0
            0 339 554  -4 319  -4 535  -4 441 331 220 377 184 341  17 120  -4  84  -4 242  -4   7 222   0
        0 352 398  -4 276 411  58 363 528 553 490 159  62 519 394 265 550 277  65 103 150 285  -4  92 492   0
    0 325 235  23  94  -4 287  -4 442 283 158 192  -4 231 330  -4 534 195 268 219  -4 274  -4 119  82 351 240   0
    0 110 152 102  -4 316   3 349   5 172 496 135 393 266 134 193 292 109 403 556 395 558 343  -4 482 386 425   0
    0  35 340  10 378  -4  15 282 392 125 367  37 269 541  13 275 518 302 356 504 279 546  -4 183 551 290 121   0
    0 533 105 189  -4 449 255  30 167  -4 529 346  -4  16 357  -4 215 320  -4 361 531 306 489  -4 328 126 272   0
    0 404  70  -4 244 384 547 161  12 142 216 383 305 128 149 308 201 427 419  21 321  18 202 348  -4 337 246   0
    0 157 491  -4 323 177 543 111 549 455 345 178 253 433 412 256 360 301 374 540 373  14 359 467  -4 224 315   0
    0 289 456 233  -4 166 280 370 402  -4  32 252  -4 545 204  -4 309 241  -4 200 212 281  72  -4 527 435  28   0
    0 298 221   1 372  -4  19 227 369 205 194  43 143  20 548 286 524 259 436  57 334 542  -4  34 560 271 526   0
    0 451 409 371  -4 245 539 191   6 525 424 426 168 260 295 401 418 137  36 555 318  22 218  -4 459 175 210   0
    0 236 326 538 344  -4 347  -4 342 278 366  27  -4 335 226  -4 169 187 293 188  -4 214  -4 261  40 154 145   0
        0 209 163  -4 179 434 503 117  33  11 296 375  42 499 186  71   8 284 198 458 127 185  -4 329 232   0
            0 199   4  -4  31  -4  26  -4 112 544 258 450 400 303 230 243  -4 477  -4 530  -4 557 447   0
            0 180  -4 250  -4 257 358 417 522 408 229 174 387 307 153  24  93 228 267  -4 428  -4 448   0
            0 470 206  60 396  -4 160  -4 170  -4 517 552 559 270  -4 399  -4 368  -4 273  41 483 148   0
                0 512 487  -4  83  -4 211  -4 162  -4 213 196  -4 391  -4 300  -4 478  -4 118  45   0
                    0 413 113 132  69 500  29 151 511  -4  -4  50 410 190  61 381 353 432  74   0
                        0   0   0 223 466 480 488 536 497  64  38  73  59  95 338   0   0   0
                                  0 426 314 420 249 234  51 312 263 247 207   0
                                    0   0   0   0   0   0   0   0   0   0

! Multi-cycle schedule
!                   itsq  itshufsq itcyclesq
      cycle_ind      1      0         1
      cycle_ind      2      1         1
!                crit.(GWD/T)   max itr
      conv_ec        0.1           2

.
```

C.5 PARCS Input for HFP Cycle 2

```
!*********************************************
CASEID H1C2
!*********************************************
CNTL
     CORE_TYPE       BWR
     CORE_POWER      89.16   ! percent of core power
     BANK_POS        -13
                         48 48 48 48 48
                    48 48 28 48 12 48 28 48 48
                48 48 48 48 40 48 40 48 48 48 48
                48 28 48  8 48  6 48  8 48 28 48
```

```
             48 48 48 32 48 40 48 40 48 32 48 48 48
             36 48 12 48  6 48 12 48  6 48 12 48 36
             48 48 48 42 48 48 48 48 48 42 48 48 48
             36 48 12 48  6 48 12 48  6 48 12 48 36
             48 48 48 32 48 40 48 40 48 32 48 48 48
                48 28 48  8 48  6 48  8 48 28 48
                48 48 48 48 40 48 40 48 48 48 48
                   48 48 28 48 12 48 28 48 48
                         48 48 48 48 48
     DEPLETION       T  1.0E-5 T  F
!                   NSET   LADF LXES LJ1F LDED LCHI LCHD LINV LDET LYLD LCDF LGFF LBET LAMB LDEC
     TREE_XS      T  20    T    T    F    F    F    F    F    T    T    F    F    F    F    F
     TH_FDBK         T
     DECAY_HEAT      T
     RESTART         F
     XE_SM           1 1
     TRANSIENT       F
     EXT_TH          F
     INT_TH          T  1  'paths_h1c2.inp'
!
! Printing Options
!
! 1  Detailed input edit
! 2  Iteration history display
! 3  Planar power distributions
! 4  Detailed pin power distributions
! 5  Reactivity edit and adjoint flux
! 6  Feedback component reactivity edit
! 7  Integrated flux and precursor density edit
! 8  Planar flux distributions
! 9  Xe/Sm number densities
! 10 T/H state variables
! 11 1D collapsed group constants
! 12 Point Kinetics Data
! 13 Radial Power Shape
! 14 Radial Flux Shape
! 15 Harmonics
!              1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
!     PRINT_OPT T F F F F F F F F  T  F  F  F  F  F
      inp_opts   F  T
      plot_opts   0  0  2
     ROT_ADF   T
     DETECTOR  T 74400  2
PARAM
      nlupd_ss       3  5  1
      n_iters        15  200
      conv_ss        1.0e-5 1.0e-4 1.0e-3
      cnv_th_ss      0.001
      wielandt       0.2  0.1  1.0
      decusp         2
      NODAL_KERN     NEMMG
!      LSOLVER        1 1 20
      CMFD           2
XSEC
     group_spec      2  1
GEOM
!                    nasyx         nasyy            nz          nzbr          nztr
     GEO_DIM           28            28            26             1             1
!                 Radial core configuration
     RAD_CONF
!
! H1C2 Core Design
!
     0  0  0  0  0  0  0  0  0 13 13 13 13 13 13 13 13 13 13  0  0  0  0  0  0  0  0  0
     0  0  0  0  0  0  0  0  6  1  2  1  2  1  1  2  1  2  1 12  0  0  0  0  0  0  0  0
     0  0  0  0  0 13 13  6  1  2  3  1  3  2  2  3  1  3  2  1 12 13 13  0  0  0  0  0
     0  0  0  0  6  2  1  2  1  3  1  3  2  4  4  2  3  1  3  1  2  1  2 12  0  0  0  0
     0  0  0  6  1  2  4  3  4  1  4  2  4  1  1  4  2  4  1  4  3  4  2  1 12  0  0  0
     0  0  7  2  2  3  1  4  2  4  2  4  2  3  3  2  4  2  4  2  4  1  3  2  2 11  0  0
     0  0  7  1  4  1  4  1  3  2  3  1  3  2  2  3  1  3  2  3  1  4  1  4  1 11  0  0
     0  0  6  2  3  4  1  4  3  4  2  1  2  1  1  2  1  2  4  3  4  1  4  3  2 12  0  0
     0  6  1  1  4  2  3  3  1  1  3  1  1  3  3  1  1  3  1  1  3  3  2  4  1  1 12  0
     7  1  2  3  1  4  2  4  1  2  2  1  4  2  2  4  1  2  2  1  4  2  4  1  3  2  1 11
     7  2  3  1  4  2  3  2  3  2  1  1  2  2  2  2  1  1  2  3  2  3  2  4  1  3  2 11
     7  1  1  3  2  4  1  1  1  1  3  1  3  3  1  3  1  1  1  1  1  4  2  3  1  1 11
     7  2  3  2  4  2  3  2  1  4  2  1  4  2  2  4  1  2  4  1  2  3  2  4  2  3  2 11
     7  1  2  4  1  3  2  1  3  2  2  3  2  3  3  2  3  2  2  3  1  2  3  1  4  2  1 11
     7  1  2  4  1  3  2  1  3  2  2  3  2  3  3  2  3  2  2  3  1  2  3  1  4  2  1 11
     7  2  3  2  4  2  3  2  1  4  2  1  4  2  2  4  1  2  4  1  2  3  2  4  2  3  2 11
     7  1  1  3  2  4  1  1  1  1  1  3  1  3  3  1  3  1  1  1  1  1  4  2  3  1  1 11
     7  2  3  1  4  2  3  2  3  2  1  1  2  2  2  2  1  1  2  3  2  3  2  4  1  3  2 11
     7  1  2  3  1  4  2  4  1  2  2  1  4  2  2  4  1  2  2  1  4  2  4  1  3  2  1 11
     0  8  1  1  4  2  3  3  1  1  3  1  1  3  3  1  1  3  1  1  3  3  2  4  1  1 10  0
     0  0  8  2  3  4  1  4  3  4  2  1  2  1  1  2  1  2  4  3  4  1  4  3  2 10  0  0
     0  0  7  1  4  1  4  1  3  2  3  1  3  2  2  3  1  3  2  3  1  4  1  4  1 11  0  0
     0  0  7  2  2  3  1  4  2  4  2  4  2  3  3  2  4  2  4  2  4  1  3  2  2 11  0  0
     0  0  0  8  1  2  4  3  4  1  4  2  4  1  1  4  2  4  1  4  3  4  2  1 10  0  0  0
     0  0  0  0  8  2  1  2  1  3  1  3  2  4  4  2  3  1  3  1  2  1  2 10  0  0  0  0
```

```
     0  0  0  0  0  9  9  8  1  2  3  1  3  2  2  3  1  3  2  1 10  9  9  0  0  0  0  0
     0  0  0  0  0  0  0  0  8  1  2  1  2  1  1  2  1  2  1 10  0  0  0  0  0  0  0  0
     0  0  0  0  0  0  0  0  0  0  9  9  9  9  9  9  9  9  9  9  0  0  0  0  0  0  0  0
!
     ASSY_TYPE    1  1*10 1*1  1*1  1*2  9*2  6*2  1*1  5*1  1*12  FUEL ! Type 1 7X7 Fuel
     ASSY_TYPE    2  1*10 1*3  1*3  1*4  9*5  6*4  1*4  5*3  1*12  FUEL ! Type 2 7X7 Fuel
     ASSY_TYPE    3  1*10 1*6  1*6  1*6  9*6  6*6  1*6  5*6  1*12  FUEL ! Type 3 7X7 Fuel
     ASSY_TYPE    4  1*10 1*7  1*7  1*7  9*7  6*7  1*7  5*7  1*12  FUEL ! Type 4 8X8 Fuel
     ASSY_TYPE    5  1*10 1*8  1*9  1*9  9*9  6*9  1*9  5*9  1*12  FUEL ! Type 5 8X8 Fuel, removed top nat U
     ASSY_TYPE    6  1*10 1*13 1*13 1*13 9*13 6*13 1*13 5*13 1*12  REFL ! NW
     ASSY_TYPE    7  1*10 1*14 1*14 1*14 9*14 6*14 1*14 5*14 1*12  REFL ! W
     ASSY_TYPE    8  1*10 1*15 1*15 1*15 9*15 6*15 1*15 5*15 1*12  REFL ! SW
     ASSY_TYPE    9  1*10 1*16 1*16 1*16 9*16 6*16 1*16 5*16 1*12  REFL ! S
     ASSY_TYPE   10  1*10 1*17 1*17 1*17 9*17 6*17 1*17 5*17 1*12  REFL ! SE
     ASSY_TYPE   11  1*10 1*18 1*18 1*18 9*18 6*18 1*18 5*18 1*12  REFL ! E
     ASSY_TYPE   12  1*10 1*19 1*19 1*19 9*19 6*19 1*19 5*19 1*12  REFL ! NE
     ASSY_TYPE   13  1*10 1*20 1*20 1*20 9*20 6*20 1*20 5*20 1*12  REFL ! N
     ASSY_TYPE   14  1*10 1*11 1*11 1*11 9*11 6*11 1*11 5*11 1*12  REFL ! No ADF
!
     GRID_X     28*15.24
     GRID_Y     28*15.24
     GRID_Z     1*15.24 24*15.24 1*15.24
     NEUTMESH_X 28*1
     NEUTMESH_Y 28*1
     BOUN_COND  2 2 2 2 2 2
     CR_AXINFO  17.78        7.62         48
!               Control rod banks defined
     BANK_CONF
                                       0   0   0   0   0   0   0   0   0   0
                                   0   1   1   2   2   3   3   4   4   5   5   0
                       0   0   0   0   1   1   2   2   3   3   4   4   5   5   0   0   0   0
                   0   6   6   7   7   8   8   9   9  10  10  11  11  12  12  13  13  14  14   0
               0   0   6   6   7   7   8   8   9   9  10  10  11  11  12  12  13  13  14  14   0   0
           0  15  15  16  16  17  17  18  18  19  19  20  20  21  21  22  22  23  23  24  24  25  25   0
           0  15  15  16  16  17  17  18  18  19  19  20  20  21  21  22  22  23  23  24  24  25  25   0
           0  26  26  27  27  28  28  29  29  30  30  31  31  32  32  33  33  34  34  35  35  36  36   0
       0   0  26  26  27  27  28  28  29  29  30  30  31  31  32  32  33  33  34  34  35  35  36  36   0   0
   0  37  37  38  38  39  39  40  40  41  41  42  42  43  43  44  44  45  45  46  46  47  47  48  48  49  49   0
   0  37  37  38  38  39  39  40  40  41  41  42  42  43  43  44  44  45  45  46  46  47  47  48  48  49  49   0
   0  50  50  51  51  52  52  53  53  54  54  55  55  56  56  57  57  58  58  59  59  60  60  61  61  62  62   0
   0  50  50  51  51  52  52  53  53  54  54  55  55  56  56  57  57  58  58  59  59  60  60  61  61  62  62   0
   0  63  63  64  64  65  65  66  66  67  67  68  68  69  69  70  70  71  71  72  72  73  73  74  74  75  75   0
   0  63  63  64  64  65  65  66  66  67  67  68  68  69  69  70  70  71  71  72  72  73  73  74  74  75  75   0
   0  76  76  77  77  78  78  79  79  80  80  81  81  82  82  83  83  84  84  85  85  86  86  87  87  88  88   0
   0  76  76  77  77  78  78  79  79  80  80  81  81  82  82  83  83  84  84  85  85  86  86  87  87  88  88   0
   0  89  89  90  90  91  91  92  92  93  93  94  94  95  95  96  96  97  97  98  98  99  99 100 100 101 101   0
   0  89  89  90  90  91  91  92  92  93  93  94  94  95  95  96  96  97  97  98  98  99  99 100 100 101 101   0
       0   0 102 102 103 103 104 104 105 105 106 106 107 107 108 108 109 109 110 110 111 111 112 112   0   0
           0 102 102 103 103 104 104 105 105 106 106 107 107 108 108 109 109 110 110 111 111 112 112   0
           0 113 113 114 114 115 115 116 116 117 117 118 118 119 119 120 120 121 121 122 122 123 123   0
           0 113 113 114 114 115 115 116 116 117 117 118 118 119 119 120 120 121 121 122 122 123 123   0
               0   0 124 124 125 125 126 126 127 127 128 128 129 129 130 130 131 131 132 132   0   0
                   0 124 124 125 125 126 126 127 127 128 128 129 129 130 130 131 131 132 132   0
                       0   0   0   0 133 133 134 134 135 135 136 136 137 137   0   0   0   0
                                   0 133 133 134 134 135 135 136 136 137 137   0
                                       0   0   0   0   0   0   0   0   0   0
!               Assembly rotation
     ADF_ROT
                       0 0 0 0 0 0 0 0 0 0
                     0 2 1 2 1 2 1 2 1 2 1 0
               0 0 0 0 3 0 3 0 3 0 3 0 3 0 0 0 0 0
             0 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 0
           0 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 0 0
         0 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 0
         0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 0
         0 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 0
       0 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 0 0
     0 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 0
     0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 0
     0 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 0
     0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 0
     0 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 0
     0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 0
     0 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 0
     0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 0
     0 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 0
     0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 0
       0 0 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 0 0
         0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 0
         0 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 0
         0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 0
           0 0 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 0 0
             0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 0
               0 0 0 0 2 1 2 1 2 1 2 1 2 1 0 0 0 0
                     0 3 0 3 0 3 0 3 0 3 0 0
                       0 0 0 0 0 0 0 0 0 0
!             TIP detectors
     DET_XY_LOC 31
```

```
                                  0  0  0  0  0  0  0  0  0  0
                              0  0  0  0  0  0  0  0  0  0  0  0
                        0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
                     0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
                  0  0  0 27 27  0  0 28 28  0  0 29 29  0  0 30 30  0  0 31 31  0
               0  0  0  0 27 27  0  0 28 28  0  0 29 29  0  0 30 30  0  0 31 31  0  0
               0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
               0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
            0 21 21  0  0 22 22  0  0 23 23  0  0 24 24  0  0 25 25  0  0 26 26  0  0  0
         0  0 21 21  0  0 22 22  0  0 23 23  0  0 24 24  0  0 25 25  0  0 26 26  0  0  0  0
         0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
         0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
         0  0 15 15  0  0 16 16  0  0 17 17  0  0 18 18  0  0 19 19  0  0 20 20  0  0  0  0
         0  0 15 15  0  0 16 16  0  0 17 17  0  0 18 18  0  0 19 19  0  0 20 20  0  0  0  0
         0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
         0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
         0  0  9  9  0  0 10 10  0  0 11 11  0  0 12 12  0  0 13 13  0  0 14 14  0  0  0  0
         0  0  9  9  0  0 10 10  0  0 11 11  0  0 12 12  0  0 13 13  0  0 14 14  0  0  0  0
         0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
            0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
               0  0  0  0  4  4  0  0  5  5  0  0  6  6  0  0  7  7  0  0  8  8  0  0
               0  0  0  0  4  4  0  0  5  5  0  0  6  6  0  0  7  7  0  0  8  8  0  0
               0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
                  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
                     0  0  0  0  0  0  1  1  0  0  2  2  0  0  3  3  0  0  0  0
                        0  0  0  0  0  1  1  0  0  2  2  0  0  3  3  0  0  0
                              0  0  0  0  0  0  0  0  0  0  0  0
                                 0  0  0  0  0  0  0  0  0  0
!
     DET_Z_LOC 24 1
                     2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
     DET_Z_WEI       1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
     DET_NAME
     1     TIP2005
     2     TIP2805
     3     TIP3605
     4     TIP1213
     5     TIP2013
     6     TIP2813
     7     TIP3613
     8     TIP4413
     9     TIP0421
     10    TIP1221
     11    TIP2021
     12    TIP2821
     13    TIP3621
     14    TIP4421
     15    TIP0429
     16    TIP1229
     17    TIP2029
     18    TIP2829
     19    TIP3629
     20    TIP4429
     21    TIP0437
     22    TIP1237
     23    TIP2037
     24    TIP2837
     25    TIP3637
     26    TIP4437
     27    TIP1245
     28    TIP2045
     29    TIP2845
     30    TIP3645
     31    TIP4445

FDBK
     fa_powpit   4.35  15.24

DEPL
     INP_HST    'H1C1-C2.parcs_cyc-02'  1  1
     TIME_STP   -1E-9
     HST_OPT    T T F F F
     OUT_OPT    F T F F F
     BANK_NR    137*1
!
! Cross-sections
!
     PMAXS_F    1  '../GenPMAXS_fission/hatch-t1a.PMAX'                 1  ! Type 1 7X7 only rod A gad
     PMAXS_F    2  '../GenPMAXS_fission/hatch-t1b.PMAX'                 2  ! Type 1 7x7 rod A and B gad
     PMAXS_F    3  '../GenPMAXS_fission/hatch-t2a.PMAX'                 3  ! Type 2 7x7 no gad
     PMAXS_F    4  '../GenPMAXS_fission/hatch-t2c.PMAX'                 4  ! Type 2 7x7 only rod C gad
     PMAXS_F    5  '../GenPMAXS_fission/hatch-t2d.PMAX'                 5  ! Type 2 7x7 rod C and D gad
     PMAXS_F    6  '../GenPMAXS_fission/hatch-t3.PMAX'                  6  ! Type 3 7x7
     PMAXS_F    7  '../GenPMAXS_fission/hatch-t4.PMAX'                  7  ! Type 4 8x8
     PMAXS_F    8  '../GenPMAXS_fission/hatch-t5a.PMAX'                 8  ! Type 5 8x8 natural u
     PMAXS_F    9  '../GenPMAXS_fission/hatch-t5b.PMAX'                 9  ! Type 5 8x8 enriched u
     PMAXS_F   10  '../GenPMAXS_fission/hatch-refl_bot.PMAX'           10  ! Bottom Axial Reflector
     PMAXS_F   11  '../GenPMAXS_fission/hatch-refl_rad_edge.PMAX'      11  ! Radial Reflector
```

```
     PMAXS_F   12  '../GenPMAXS_fission/hatch-refl_top.PMAX'          12  ! Top Axial Reflector
     PMAXS_F   13  '../GenPMAXS_fission/hatch-refl_rad_NW.PMAX'       13  ! NW Radial Reflector
     PMAXS_F   14  '../GenPMAXS_fission/hatch-refl_rad_W.PMAX'        14  !  W Radial Reflector
     PMAXS_F   15  '../GenPMAXS_fission/hatch-refl_rad_SW.PMAX'       15  ! SW Radial Reflector
     PMAXS_F   16  '../GenPMAXS_fission/hatch-refl_rad_S.PMAX'        16  !  S Radial Reflector
     PMAXS_F   17  '../GenPMAXS_fission/hatch-refl_rad_SE.PMAX'       17  ! SE Radial Reflector
     PMAXS_F   18  '../GenPMAXS_fission/hatch-refl_rad_E.PMAX'        18  !  E Radial Reflector
     PMAXS_F   19  '../GenPMAXS_fission/hatch-refl_rad_NE.PMAX'       19  ! NE Radial Reflector
     PMAXS_F   20  '../GenPMAXS_fission/hatch-refl_rad_N.PMAX'        20  !  N Radial Reflector

/
! DATASET 24
CNTL
     CORE_POWER 89.16
     BANK_POS        -13
                          48 48 48 48 48
                      48 48 28 48 12 48 28 48 48
                   48 48 48 48 40 48 40 48 48 48 48
                   48 28 48  8 48  6 48  8 48 28 48
               48 48 48 32 48 40 48 40 48 32 48 48 48
               36 48 12 48  6 48 12 48  6 48 12 48 36
               48 48 48 42 48 48 48 48 48 42 48 48 48
               36 48 12 48  6 48 12 48  6 48 12 48 36
               48 48 48 32 48 40 48 40 48 32 48 48 48
                   48 28 48  8 48  6 48  8 48 28 48
                   48 48 48 48 40 48 40 48 48 48 48
                      48 48 28 48 12 48 28 48 48
                          48 48 48 48 48
DEPL
     TIME_STP -0.1224
TH
     STATE_CORE 8857.43 1221.73 6.7844E+06
/
! DATASET 25
CNTL
     CORE_POWER 97.99
     BANK_POS        -13
                          48 48 48 48 48
                      48 34 48 28 48 28 48 34 48
                   48 48 48 48 48 48 48 48 48 48 48
                   34 48 14 48  8 48  8 48 14 48 34
               48 48 48 48 48 48 48 48 48 48 48 48 48
               48 28 48  8 48 16 48 16 48  8 48 28 48
               48 48 48 48 48 48 48 48 48 48 48 48 48
               48 28 48  8 48 16 48 16 48  8 48 28 48
               48 48 48 48 48 48 48 48 48 48 48 48 48
                   34 48 14 48  8 48  8 48 14 48 34
                   48 48 48 48 48 48 48 48 48 48 48
                      48 34 48 28 48 28 48 34 48
                          48 48 48 48 48
DEPL
     TIME_STP -0.4884
TH
     STATE_CORE 8857.43 1217.54 7.0189E+06
/
! DATASET 26
CNTL
     CORE_POWER 96.76
     BANK_POS        -13
                          48 48 48 48 48
                      48 34 48 28 48 28 48 34 48
                   48 48 48 48 48 48 48 48 48 48 48
                   34 48 14 48  8 48  8 48 14 48 34
               48 48 48 48 48 48 48 48 48 48 48 48 48
               48 28 48  8 48 16 48 16 48  8 48 28 48
               48 48 48 48 48 48 48 48 48 48 48 48 48
               48 28 48  8 48 16 48 16 48  8 48 28 48
               48 48 48 48 48 48 48 48 48 48 48 48 48
                   34 48 14 48  8 48  8 48 14 48 34
                   48 48 48 48 48 48 48 48 48 48 48
                      48 34 48 28 48 28 48 34 48
                          48 48 48 48 48
DEPL
     TIME_STP -0.4322
TH
     STATE_CORE 8857.43 1218.24 6.9775E+06
/
! DATASET 27
CNTL
     CORE_POWER 97.37
     BANK_POS        -13
                          48 48 48 48 48
                      48 48 34 48 18 48 34 48 48
                   48 48 48 48 48 48 48 48 48 48 48
                   48 30 48 12 48  6 48 12 48 30 48
               48 48 48 48 48 48 48 48 48 48 48 48 48
               48 48 20 48  8 48 20 48  8 48 20 48 48
               48 48 48 48 48 48 48 48 48 48 48 48 48
```

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             48 48 20 48  8 48 20 48  8 48 20 48 48
             48 48 48 48 48 48 48 48 48 48 48 48 48
                48 30 48 12 48  6 48 12 48 30 48
                48 48 48 48 48 48 48 48 48 48 48
                   48 48 34 48 18 48 34 48 48
                         48 48 48 48 48
DEPL
     TIME_STP -0.3286
TH
     STATE_CORE 8380.05 1214.75 6.9775E+06
/
! DATASET 28
CNTL
     CORE_POWER 93.1
     BANK_POS        -13
                         48 48 48 48 48
                      48 48 42 48 18 48 42 48 48
                   48 48 48 48 48 48 48 48 48 48 48
                   48 36 48 12 48  6 48 12 48 36 48
             48 48 48 48 48 48 48 48 48 48 48 48 48
             48 48 20 48  4 48 20 48  4 48 20 48 48
             48 48 48 48 48 48 48 48 48 48 48 48 48
             48 48 20 48  4 48 20 48  4 48 20 48 48
             48 48 48 48 48 48 48 48 48 48 48 48 48
                48 36 48 12 48  6 48 12 48 36 48
                48 48 48 48 48 48 48 48 48 48 48
                   48 48 42 48 18 48 42 48 48
                         48 48 48 48 48
DEPL
     TIME_STP -1.0375
TH
     STATE_CORE 8679.81 1219.17 6.9223E+06
/
! DATASET 29
CNTL
     CORE_POWER 99.14
     BANK_POS        -13
                         48 48 48 48 48
                      48 48 48 48 48 48 48 48 48
                   48 16 48 34 48 12 48 34 48 16 48
                   48 48 48 48 48 48 48 48 48 48 48
             48 48 34 48  6 48 40 48  6 48 34 48 48
             48 48 48 48 48 48 48 48 48 48 48 48 48
             48 48 12 48 40 48  8 48 40 48 12 48 48
             48 48 48 48 48 48 48 48 48 48 48 48 48
             48 48 34 48  6 48 40 48  6 48 34 48 48
                48 48 48 48 48 48 48 48 48 48 48
                48 16 48 34 48 12 48 34 48 16 48
                   48 48 48 48 48 48 48 48 48
                         48 48 48 48 48
DEPL
     TIME_STP -0.3286
TH
     STATE_CORE 8857.43 1217.54 6.9844E+06
/
! DATASET 30
CNTL
     CORE_POWER 97.78
     BANK_POS        -13
                         48 48 48 48 48
                      48 48 48 48 48 48 48 48 48
                   48 16 48 34 48 12 48 34 48 16 48
                   48 48 48 48 48 48 48 48 48 48 48
             48 48 34 48  6 48 40 48  6 48 34 48 48
             48 48 48 48 48 48 48 48 48 48 48 48 48
             48 48 12 48 40 48 16 48 40 48 12 48 48
             48 48 48 48 48 48 48 48 48 48 48 48 48
             48 48 34 48  6 48 40 48  6 48 34 48 48
                48 48 48 48 48 48 48 48 48 48 48
                48 16 48 34 48 12 48 34 48 16 48
                   48 48 48 48 48 48 48 48 48
                         48 48 48 48 48
DEPL
     TIME_STP -0.2051
TH
     STATE_CORE 8901.84 1218.47 6.9706E+06
/
! DATASET 31
CNTL
     CORE_POWER 93.6
     BANK_POS        -13
                         48 48 48 48 48
                      48 48 48 48 48 48 48 48 48
                   48 18 48 34 48 12 48 34 48 18 48
                   48 48 48 48 48 48 48 48 48 48 48
             48 48 34 48  8 48 40 48  8 48 34 48 48
             48 48 48 48 48 48 48 48 48 48 48 48 48
             48 48 12 48 40 48 16 48 40 48 12 48 48
```

```
             48 48 48 48 48 48 48 48 48 48 48 48 48
             48 48 34 48  8 48 40 48  8 48 34 48 48
                48 48 48 48 48 48 48 48 48 48 48
                48 18 48 34 48 12 48 34 48 18 48
                   48 48 48 48 48 48 48 48 48
                         48 48 48 48 48
DEPL
     TIME_STP -0.4399
TH
     STATE_CORE 8890.73 1220.57 6.9154E+06
/
! DATASET 32
CNTL
     CORE_POWER 93.84
     BANK_POS        -13
                         48 48 48 48 48
                   48 48 48 48 48 48 48 48 48
                40 48 42 48 16 48 16 48 42 48 40
                48 48 48 48 48 48 48 48 48 48 48
             48 48 48 10 48 42 48 42 48 10 48 48 48
             48 48 48 48 48 48 48 48 48 48 48 48 48
             48 18 48 48 48 18 48 18 48 48 48 18 48
             48 48 48 48 48 48 48 48 48 48 48 48 48
             48 48 48 10 48 42 48 42 48 10 48 48 48
                48 48 48 48 48 48 48 48 48 48 48
                40 48 42 48 16 48 16 48 42 48 40
                   48 48 48 48 48 48 48 48 48
                         48 48 48 48 48
DEPL
     TIME_STP -0.4333
TH
     STATE_CORE 8857.43 1219.17 6.9154E+06
/
! DATASET 33
CNTL
     CORE_POWER 95.32
     BANK_POS        -13
                         48 48 48 48 48
                   48 48 48 48 48 48 48 48 48
                48 48 42 48 30 48 30 48 42 48 48
                48 48 48 48 48 48 48 48 48 48 48
             48 48 48 12 48 40 48 40 48 12 48 48 48
             48 48 48 48 48 48 48 48 48 48 48 48 48
             48 32 48 48 48 16 48 16 48 48 48 32 48
             48 48 48 48 48 48 48 48 48 48 48 48 48
             48 48 48 12 48 40 48 40 48 12 48 48 48
                48 48 48 48 48 48 48 48 48 48 48
                48 48 42 48 30 48 30 48 42 48 48
                   48 48 48 48 48 48 48 48 48
                         48 48 48 48 48
DEPL
     TIME_STP -0.3484
TH
     STATE_CORE 8879.63 1219.17 6.9017E+06
/
! DATASET 34
CNTL
     CORE_POWER 97.09
     BANK_POS        -13
                         48 48 48 48 48
                   48 48 48 48 48 48 48 48 48
                48 48 42 48 30 48 30 48 42 48 48
                48 48 48 48 48 48 48 48 48 48 48
             48 48 48 16 48 42 48 42 48 16 48 48 48
             48 48 48 48 48 48 48 48 48 48 48 48 48
             48 34 48 48 48 30 48 30 48 48 48 34 48
             48 48 48 48 48 48 48 48 48 48 48 48 48
             48 48 48 16 48 42 48 42 48 16 48 48 48
                48 48 48 48 48 48 48 48 48 48 48
                48 48 42 48 30 48 30 48 42 48 48
                   48 48 48 48 48 48 48 48 48
                         48 48 48 48 48
DEPL
     TIME_STP -0.1323
TH
     STATE_CORE 8835.23 1218.24 6.9154E+06
/
! DATASET 35
CNTL
     CORE_POWER 90.35
     BANK_POS        -13
                         48 48 48 48 48
                   48 48 48 48 48 48 48 48 48
                48 44 48 48 48 26 48 48 48 44 48
                48 48 48 48 48 48 48 48 48 48 48
             48 48 48 48 48 48 48 48 48 48 48 48 48
             48 48 48 48 48 48 48 48 48 48 48 48 48
             48 48 26 48 48 48 40 48 48 48 26 48 48
```

```
              48 48 48 48 48 48 48 48 48 48 48 48 48
              48 48 48 48 48 48 48 48 48 48 48 48 48
                 48 48 48 48 48 48 48 48 48 48 48
                 48 44 48 48 48 26 48 48 48 44 48
                    48 48 48 48 48 48 48 48 48
                          48 48 48 48 48
DEPL
     TIME_STP -0.3396
TH
     STATE_CORE 7502.83 1211.97 6.9017E+06
/
! DATASET 36
CNTL
     CORE_POWER 93.39
     BANK_POS        -13
                          48 48 48 48 48
                    48 48 48 48 48 48 48 48 48
                 48 48 48 48 48 48 48 48 48 48 48
                 48 48 48 48 48 48 48 48 48 48 48
              48 48 48 48 48 48 48 48 48 48 48 48 48
              48 48 48 48 48 48 48 48 48 48 48 48 48
              48 48 48 48 48 48 48 48 48 48 48 48 48
              48 48 48 48 48 48 48 48 48 48 48 48 48
              48 48 48 48 48 48 48 48 48 48 48 48 48
                 48 48 48 48 48 48 48 48 48 48 48
                 48 48 48 48 48 48 48 48 48 48 48
                    48 48 48 48 48 48 48 48 48
                          48 48 48 48 48
DEPL
     TIME_STP -0.3396
TH
     STATE_CORE 8824.13 1219.40 6.9017E+06
/
! DATASET EOC
CNTL
     CORE_POWER 93.39
     BANK_POS        -13
                          48 48 48 48 48
                    48 48 48 48 48 48 48 48 48
                 48 48 48 48 48 48 48 48 48 48 48
                 48 48 48 48 48 48 48 48 48 48 48
              48 48 48 48 48 48 48 48 48 48 48 48 48
              48 48 48 48 48 48 48 48 48 48 48 48 48
              48 48 48 48 48 48 48 48 48 48 48 48 48
              48 48 48 48 48 48 48 48 48 48 48 48 48
              48 48 48 48 48 48 48 48 48 48 48 48 48
                 48 48 48 48 48 48 48 48 48 48 48
                 48 48 48 48 48 48 48 48 48 48 48
                    48 48 48 48 48 48 48 48 48
                          48 48 48 48 48
DEPL
     TIME_STP -0.1874
TH
     STATE_CORE 8824.13 1219.40 6.9017E+06
.
```

C.6 PATHS Input for Cycle 3

```
    paths_id   h1c3_paths

    CORE_STATE 2436000 8931.82 1211.18 6846735
    COMM_PARM  10 0.1524
    CONV_PARM  1000  1.0E-6  100000  1.0E-8   0.25
    TH_LSOLVER 1
    TH_IPATHS  F
    TH_CORR    1 1 3 4

    NK_RADIAL      1  560  26
    TH_RADIAL      560  0  0
    TH_AXIAL       26  1  1
    AX_MESH        1*15.24 24*15.24 1*15.24

    TH_CONF
                                       1   2   3   4   5   6   7   8   9  10
                                  11  12  13  14  15  16  17  18  19  20  21  22
                      23  24  25  26  27  28  29  30  31  32  33  34  35  36  37  38  39  40
                  41  42  43  44  45  46  47  48  49  50  51  52  53  54  55  56  57  58  59  60
              61  62  63  64  65  66  67  68  69  70  71  72  73  74  75  76  77  78  79  80  81  82
              83  84  85  86  87  88  89  90  91  92  93  94  95  96  97  98  99 100 101 102 103 104
             105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126
         127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150
     151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176
     177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202
     203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228
     229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251 252 253 254
     255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280
```

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     281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305 306
     307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332
     333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358
     359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384
     385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400 401 402 403 404 405 406 407 408 409 410
         411 412 413 414 415 416 417 418 419 420 421 422 423 424 425 426 427 428 429 430 431 432 433 434
             435 436 437 438 439 440 441 442 443 444 445 446 447 448 449 450 451 452 453 454 455 456
             457 458 459 460 461 462 463 464 465 466 467 468 469 470 471 472 473 474 475 476 477 478
             479 480 481 482 483 484 485 486 487 488 489 490 491 492 493 494 495 496 497 498 499 500
                 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515 516 517 518 519 520
                     521 522 523 524 525 526 527 528 529 530 531 532 533 534 535 536 537 538
                                 539 540 541 542 543 544 545 546 547 548 549 550
                                     551 552 553 554 555 556 557 558 559 560
!
! H1C2 Core Design
!
     CH_T_MAP
                                10 20 30 20 20 20 20 30 20 10
                             20  1  5  1  5  3  3  5  1  5  1 20
                          10 20 10  3  5  3  5  4  5  5  4  5  3  5  3 10 20 10
                       10  1  5  4  5  4  5  2  5  3  3  5  2  5  4  5  4  5  1 10
                    10  1  3  3  5  4  5  3  5  3  5  5  3  5  3  5  4  5  3  3  1 10
                    20  5  3  4  2  5  2  5  2  5  3  3  5  2  5  2  5  2  4  3  5 20
                    10  4  5  2  5  3  4  1  4  2  4  4  2  4  1  4  3  5  2  5  4 10
                 20  3  5  4  5  3  5  2  5  3  5  1  1  5  3  5  2  5  3  5  4  5  3 20
     10  1  5  4  5  2  4  2  4  2  4  1  4  4  1  4  2  4  2  4  2  5  4  5  1 10
     20  5  3  5  3  5  1  5  2  5  1  5  1  1  5  1  5  2  5  1  5  3  5  3  5 20
     30  1  5  2  5  2  4  3  4  1  4  1  4  4  1  4  1  4  3  4  2  5  2  5  1 30
     20  5  4  5  3  5  2  5  1  5  1  5  1  1  5  1  5  1  5  2  5  3  5  4  5 20
     20  3  5  3  5  3  4  1  4  1  4  1  2  2  1  4  1  4  1  4  3  5  3  5  3 20
     20  3  5  3  5  3  4  1  4  1  4  1  2  2  1  4  1  4  1  4  3  5  3  5  3 20
     20  5  4  5  3  5  2  5  1  5  1  5  1  1  5  1  5  1  5  2  5  3  5  4  5 20
     30  1  5  2  5  2  4  3  4  1  4  1  4  4  1  4  1  4  3  4  2  5  2  5  1 30
     20  5  3  5  3  5  1  5  2  5  1  5  1  1  5  1  5  2  5  1  5  3  5  3  5 20
     10  1  5  4  5  2  4  2  4  2  4  1  4  4  1  4  2  4  2  4  2  5  4  5  1 10
        20  3  5  4  5  3  5  2  5  3  5  1  1  5  3  5  2  5  3  5  4  5  3 20
           10  4  5  2  5  3  4  1  4  2  4  4  2  4  1  4  3  5  2  5  4 10
           20  5  3  4  2  5  2  5  2  5  3  3  5  2  5  2  5  2  4  3  5 20
           10  1  3  3  5  4  5  3  5  3  5  5  3  5  3  5  4  5  3  3  1 10
              10  1  5  4  5  4  5  2  5  3  3  5  2  5  4  5  4  5  1 10
              10 20 10  3  5  3  5  4  5  5  4  5  3  5  3 10 20 10
                        20  1  5  1  5  3  3  5  1  5  1 20
                           10 20 30 20 20 20 20 30 20 10
!
! Channel Description
!
!                    charea    chhd    rough ppitch   n_f or_cld  or_fuel th_clad hgap  wr r_wrod
     CHAN_GEOM    1   100.23E-4 1.73E-2 5E-6  18.75E-3 49  7.15E-3 6.06E-3 0.94E-3 3060  0  7.15E-3 !7X7 Type 1 channel geometry
     CHAN_GEOM    2   100.23E-4 1.73E-2 5E-6  18.75E-3 49  7.15E-3 6.06E-3 0.94E-3 3060  0  7.15E-3 !7X7 Type 2 channel geometry
     CHAN_GEOM    3   100.23E-4 1.73E-2 5E-6  18.75E-3 49  7.15E-3 6.06E-3 0.94E-3 3060  0  7.15E-3 !7X7 Type 3 channel geometry
     CHAN_GEOM    4   100.11E-4 1.52E-2 5E-6  16.26E-3 63  6.26E-3 5.28E-3 0.86E-3 3920  1  6.26E-3 !8X8 Type 4 channel geometry
     CHAN_GEOM    5   102.09E-4 1.57E-2 5E-6  16.26E-3 62  6.13E-3 5.21E-3 0.81E-3 3920  2  7.51E-3 !8X8 Type 5 channel geometry
     CHAN_GEOM    10  100.23E-4 1.73E-2 5E-6  18.75E-3 49  7.15E-3 6.06E-3 0.94E-3 3060  0  7.15E-3 !7X7 Type 1 channel geometry
     CHAN_GEOM    20  100.23E-4 1.73E-2 5E-6  18.75E-3 49  7.15E-3 6.06E-3 0.94E-3 3060  0  7.15E-3 !7X7 Type 2 channel geometry
     CHAN_GEOM    30  100.23E-4 1.73E-2 5E-6  18.75E-3 49  7.15E-3 6.06E-3 0.94E-3 3060  0  7.15E-3 !7X7 Type 3 channel geometry
!    CHAN_GEOM    40  100.11E-4 1.52E-2 5E-6  16.26E-3 63  6.26E-3 5.28E-3 0.86E-3 3920  1  6.26E-3 !8X8 Type 4 channel geometry
!    CHAN_GEOM    50  102.09E-4 1.57E-2 5E-6  16.26E-3 62  6.13E-3 5.21E-3 0.81E-3 3920  2  7.51E-3 !8X8 Type 5 channel geometry
     KA_CHAN      1   1*20.17000 1*0.5 2*0 1*2.00 2*0 1*2.00 3*0 1*2.00 2*0 1*2.00 3*0 1*2.00 2*0 1*2.00 2*0 1*2.00 1*1.0 ! 7X7 Fuel loss
coefficient (loose)
     KA_CHAN      2   1*20.17000 1*0.5 2*0 1*2.00 2*0 1*2.00 3*0 1*2.00 2*0 1*2.00 3*0 1*2.00 2*0 1*2.00 2*0 1*2.00 1*1.0 ! 7X7 Fuel loss
coefficient (loose)
     KA_CHAN      3   1*20.17000 1*0.5 2*0 1*2.00 2*0 1*2.00 3*0 1*2.00 2*0 1*2.00 3*0 1*2.00 2*0 1*2.00 2*0 1*2.00 1*1.0 ! 7X7 Fuel loss
coefficient (loose)
     KA_CHAN      4   1*20.15000 1*0.5 2*0 1*2.25 2*0 1*2.25 3*0 1*2.25 2*0 1*2.25 3*0 1*2.25 2*0 1*2.25 2*0 1*2.25 1*1.0 ! 8X8 Fuel loss
coefficient (loose)
     KA_CHAN      5   1*20.93000 1*0.5 2*0 1*2.25 2*0 1*2.25 3*0 1*2.25 2*0 1*2.25 3*0 1*2.25 2*0 1*2.25 2*0 1*2.25 1*1.0 ! 8X8 Fuel loss
coefficient (loose)
     KA_CHAN      10  1*92.13000 1*0.5 2*0 1*2.00 2*0 1*2.00 3*0 1*2.00 2*0 1*2.00 3*0 1*2.00 2*0 1*2.00 2*0 1*2.00 1*1.0 ! 7X7 Fuel loss
coefficient (tight)
     KA_CHAN      20  1*92.13000 1*0.5 2*0 1*2.00 2*0 1*2.00 3*0 1*2.00 2*0 1*2.00 3*0 1*2.00 2*0 1*2.00 2*0 1*2.00 1*1.0 ! 7X7 Fuel loss
coefficient (tight)
     KA_CHAN      30  1*92.13000 1*0.5 2*0 1*2.00 2*0 1*2.00 3*0 1*2.00 2*0 1*2.00 3*0 1*2.00 2*0 1*2.00 2*0 1*2.00 1*1.0 ! 7X7 Fuel loss
coefficient (tight)
!    KA_CHAN      40  1*92.01000 1*0.5 2*0 1*2.25 2*0 1*2.25 3*0 1*2.25 2*0 1*2.25 3*0 1*2.25 2*0 1*2.25 2*0 1*2.25 1*1.0 ! 8X8 Fuel loss
coefficient (tight)
!    KA_CHAN      50  1*95.60000 1*0.5 2*0 1*2.25 2*0 1*2.25 3*0 1*2.25 2*0 1*2.25 3*0 1*2.25 2*0 1*2.25 2*0 1*2.25 1*1.0 ! 8X8 Fuel loss
coefficient (tight)
.
```

C.7 Assembly Layout File for Cycle 1

```
                                                0     0     0     0     0     0     0     0     0     0     0
                                          0 HX0509 HX0463 HX0550 HX0495 HX0496 HX0486 HX0467 HX0482 HX0512 HX0476     0
                              0     0     0 HX0474 HX0493 HX0475 HX0284 HX0192 HX0290 HX0178 HX0306 HX0176 HX0453 HX0459 HX0487     0     0     0
                         0 HX0554 HX0503 HX0504 HX0455 HX0202 HX0421 HX0019 HX0417 HX0084 HX0251 HX0222 HX0292 HX0074 HX0375 HX0545 HX0477 HX0460 HX0446     0
                    0 HX0539 HX0478 HX0470 HX0262 HX0201 HX0424 HX0027 HX0413 HX0022 HX0254 HX0049 HX0278 HX0181 HX0376 HX0172 HX0314 HX0180 HX0543 HX0491 HX0514     0
               0 HX0510 HX0516 HX0040 HX0377 HX0014 HX0415 HX0175 HX0378 HX0111 HX0326 HX0140 HX0321 HX0109 HX0277 HX0149 HX0274 HX0089 HX0298 HX0135 HX0341 HX0507 HX0524     0
```

```
              0 HX0481 HX0518 HX0313 HX0079 HX0414 HX0016 HX0382 HX0110 HX0273 HX0060 HX0322 HX0023 HX0257 HX0138 HX0279 HX0179 HX0361 HX0194 HX0339 HX0122 HX0508 HX0468      0
              0 HX0547 HX0296 HX0219 HX0358 HX0092 HX0328 HX0119 HX0266 HX0003 HX0346 HX0054 HX0233 HX0213 HX0359 HX0218 HX0330 HX0066 HX0332 HX0030 HX0315 HX0177 HX0505      0
        0 HX0542 HX0533 HX0221 HX0362 HX0144 HX0329 HX0097 HX0433 HX0188 HX0351 HX0209 HX0396 HX0169 HX0373 HX0220 HX0420 HX0211 HX0333 HX0197 HX0407 HX0007 HX0310 HX0559 HX0450      0
 0  HX0526 HX0457 HX0203 HX0232 HX0024 HX0355 HX0001 HX0239 HX0002 HX0429 HX0087 HX0431 HX0018 HX0393 HX0141 HX0388 HX0165 HX0438 HX0053 HX0250 HX0037 HX0256 HX0190 HX0291 HX0501 HX0462      0
 0  HX0497 HX0471 HX0297 HX0182 HX0353 HX0033 HX0370 HX0214 HX0434 HX0113 HX0436 HX0136 HX0389 HX0086 HX0391 HX0156 HX0422 HX0161 HX0319 HX0045 HX0260 HX0091 HX0311 HX0200 HX0544 HX0525      0
 0  HX0464 HX0240 HX0013 HX0288 HX0011 HX0225 HX0021 HX0344 HX0070 HX0401 HX0098 HX0383 HX0083 HX0405 HX0137 HX0402 HX0145 HX0337 HX0077 HX0441 HX0112 HX0327 HX0028 HX0430 HX0008 HX0556      0
 0  HX0466 HX0187 HX0228 HX0057 HX0231 HX0115 HX0268 HX0146 HX0395 HX0055 HX0394 HX0096 HX0336 HX0170 HX0404 HX0076 HX0271 HX0143 HX0323 HX0072 HX0363 HX0126 HX0425 HX0147 HX0224 HX0555      0
 0  HX0511 HX0307 HX0056 HX0281 HX0158 HX0275 HX0210 HX0267 HX0058 HX0444 HX0006 HX0338 HX0085 HX0397 HX0104 HX0398 HX0160 HX0387 HX0029 HX0334 HX0005 HX0304 HX0035 HX0238 HX0042 HX0500      0
 0  HX0490 HX0026 HX0249 HX0051 HX0255 HX0039 HX0263 HX0020 HX0443 HX0059 HX0368 HX0009 HX0385 HX0094 HX0400 HX0102 HX0390 HX0108 HX0365 HX0212 HX0305 HX0067 HX0229 HX0095 HX0223 HX0557      0
 0  HX0531 HX0302 HX0204 HX0410 HX0185 HX0325 HX0198 HX0356 HX0171 HX0442 HX0090 HX0419 HX0151 HX0403 HX0174 HX0384 HX0114 HX0440 HX0116 HX0428 HX0093 HX0265 HX0173 HX0309 HX0123 HX0502      0
 0  HX0479 HX0186 HX0408 HX0017 HX0320 HX0032 HX0343 HX0157 HX0381 HX0133 HX0411 HX0065 HX0399 HX0128 HX0369 HX0063 HX0432 HX0163 HX0244 HX0031 HX0227 HX0048 HX0243 HX0088 HX0312 HX0489      0
 0  HX0537 HX0522 HX0208 HX0286 HX0047 HX0412 HX0118 HX0357 HX0117 HX0439 HX0134 HX0372 HX0099 HX0236 HX0215 HX0380 HX0124 HX0248 HX0193 HX0437 HX0043 HX0352 HX0191 HX0426 HX0465 HX0469      0
 0  HX0553 HX0549 HX0293 HX0082 HX0409 HX0012 HX0354 HX0075 HX0435 HX0127 HX0371 HX0121 HX0235 HX0107 HX0379 HX0164 HX0423 HX0120 HX0364 HX0162 HX0246 HX0036 HX0427 HX0189 HX0536 HX0529      0
        0 HX0506 HX0456 HX0270 HX0041 HX0261 HX0195 HX0348 HX0150 HX0374 HX0217 HX0242 HX0216 HX0230 HX0103 HX0340 HX0196 HX0247 HX0142 HX0360 HX0078 HX0349 HX0131 HX0515 HX0540      0
              0 HX0552 HX0206 HX0347 HX0062 HX0366 HX0015 HX0272 HX0148 HX0241 HX0139 HX0226 HX0052 HX0342 HX0207 HX0245 HX0046 HX0318 HX0071 HX0350 HX0073 HX0289 HX0499      0
              0 HX0548 HX0485 HX0061 HX0345 HX0101 HX0386 HX0155 HX0324 HX0025 HX0234 HX0129 HX0294 HX0183 HX0287 HX0068 HX0300 HX0010 HX0335 HX0168 HX0276 HX0560 HX0541      0
              0 HX0558 HX0473 HX0282 HX0166 HX0392 HX0100 HX0308 HX0152 HX0253 HX0153 HX0331 HX0154 HX0367 HX0184 HX0299 HX0038 HX0418 HX0064 HX0252 HX0050 HX0458 HX0448      0
                    0 HX0528 HX0454 HX0521 HX0132 HX0317 HX0199 HX0416 HX0106 HX0295 HX0167 HX0269 HX0105 HX0283 HX0125 HX0316 HX0205 HX0258 HX0534 HX0527 HX0492      0
                          0 HX0449 HX0452 HX0520 HX0523 HX0406 HX0044 HX0259 HX0004 HX0237 HX0159 HX0264 HX0080 HX0301 HX0130 HX0546 HX0494 HX0535 HX0532      0
                                0      0      0 HX0513 HX0519 HX0451 HX0069 HX0303 HX0081 HX0280 HX0034 HX0285 HX0530 HX0472 HX0551      0      0      0      0
                                                    0 HX0445 HX0483 HX0447 HX0538 HX0517 HX0488 HX0498 HX0461 HX0484 HX0480      0
                                                          0      0      0      0      0      0      0      0      0      0      0
```

C.8 Assembly Layout File for Cycle 2

```
                                                          0      0      0      0      0      0      0      0      0      0      0
                                                    0 HX0072 HX0351 HX0220 HX0390 HX0167 HX0093 HX0444 HX0015 HX0427 HX0022      0
                                      0      0      0 HX0183 HX0410 HX0454 HX0082 HX0504 HX0313 HX0276 HX0520 HX0190 HX0507 HX0425 HX0195      0      0      0
                                0 HX0366 HX0221 HX0360 HX0138 HX0449 HX0135 HX0553 HX0440 LJ5184 LJ2115 HX0395 HX0462 HX0080 HX0558 HX0025 HX0235 HX0071 HX0332      0
                          0 HX0139 HX0241 LJ5169 HX0468 LJ5167 HX0163 LJ5177 HX0267 LJ2124 HX0118 HX0055 LJ3947 HX0365 LJ5161 HX0137 LJ2104 HX0548 LJ5146 HX0243 HX0205      0
                    0 HX0273 HX0298 HX0528 HX0020 LJ2096 HX0426 LJ2126 HX0394 LJ2095 HX0368 HX0463 HX0512 HX0262 LJ2103 HX0384 LJ5150 HX0248 LJ2116 HX0185 HX0492 HX0242 HX0286      0
                    0 HX0017 LJ5153 HX0097 LJ2097 HX0095 HX0479 HX0294 HX0535 HX0050 HX0555 HX0341 HX0282 HX0502 HX0040 HX0460 HX0333 HX0464 HX0094 LJ3946 HX0090 LJ5171 HX0028      0
                    0 HX0343 HX0538 LJ5162 HX0151 LJ5136 HX0546 LJ5148 HX0272 HX0123 HX0337 HX0193 HX0214 HX0381 HX0178 HX0330 LJ5180 HX0518 LJ2092 HX0170 LJ2101 HX0467 HX0441      0
        0 HX0031 HX0107 LJ2119 HX0304 HX0506 HX0543 HX0047 HX0004 HX0447 HX0154 HX0002 HX0516 HX0527 HX0127 HX0006 HX0551 HX0035 HX0014 HX0508 HX0450 HX0255 LJ5156 HX0060 HX0184      0
 0  HX0116 HX0268 HX0554 HX0023 LJ2105 HX0263 LJ5176 HX0148 HX0249 HX0239 HX0156 LJ2121 HX0228 HX0309 LJ5185 HX0130 HX0319 HX0397 HX0145 LJ2088 HX0334 LJ2111 HX0218 HX0524 HX0244 HX0096      0
 0  HX0328 HX0457 HX0122 LJ5137 HX0442 HX0550 HX0432 HX0496 HX0296 HX0064 HX0188 HX0435 HX0338 HX0433 HX0422 HX0009 HX0092 HX0364 HX0488 HX0371 HX0461 HX0411 LJ5166 HX0166 HX0549 HX0340      0
 0  HX0074 HX0157 HX0476 HX0437 LJ5174 HX0192 HX0026 HX0075 HX0177 HX0117 HX0545 HX0104 HX0451 HX0475 HX0005 HX0534 HX0067 HX0088 HX0132 HX0042 HX0034 LJ2108 HX0370 HX0445 HX0059 HX0066      0
 0  HX0301 HX0547 HX0389 LJ5139 HX0245 HX0511 HX0417 HX0165 LJ2113 HX0237 HX0128 LJ5154 HX0290 HX0312 LJ2106 HX0083 HX0403 LJ5141 HX0208 HX0264 HX0557 HX0331 LJ5178 HX0265 HX0505 HX0387      0
 0  HX0162 HX0326 LJ5182 HX0076 HX0469 HX0285 HX0087 HX0493 HX0420 HX0405 HX0465 HX0223 HX0533 HX0559 HX0302 HX0544 HX0247 HX0374 HX0459 HX0174 HX0306 HX0525 HX0063 LJ2123 HX0320 HX0143      0
 0  HX0001 HX0367 LJ5181 HX0114 HX0497 HX0303 HX0119 HX0472 HX0289 HX0399 HX0471 HX0224 HX0515 HX0456 HX0307 HX0522 HX0305 HX0380 HX0519 HX0215 HX0284 HX0537 HX0129 LJ5157 HX0327 HX0171      0
 0  HX0443 HX0499 HX0231 LJ2110 HX0388 HX0500 HX0372 HX0120 LJ5160 HX0251 HX0147 LJ2091 HX0280 HX0240 LJ5159 HX0204 HX0336 LJ5142 HX0200 HX0401 HX0490 HX0321 LJ5164 HX0259 HX0552 HX0421      0
 0  HX0108 HX0077 HX0509 HX0236 LJ2112 HX0176 HX0008 HX0134 HX0013 HX0161 HX0470 HX0211 HX0453 HX0530 HX0039 HX0523 HX0158 HX0206 HX0180 HX0186 HX0069 LJ2100 HX0292 HX0480 HX0160 HX0044      0
 0  HX0318 HX0536 HX0099 LJ5170 HX0271 HX0513 HX0391 HX0486 HX0406 HX0103 HX0196 HX0438 HX0275 HX0400 HX0423 HX0150 HX0209 HX0375 HX0517 HX0419 HX0487 HX0402 LJ5143 HX0061 HX0501 HX0344      0
 0  HX0146 HX0428 HX0532 HX0065 LJ2098 HX0369 LJ5173 HX0133 HX0238 HX0357 HX0202 LJ5155 HX0408 HX0430 LJ5179 HX0053 HX0436 HX0385 HX0136 LJ2122 HX0383 LJ2102 HX0210 HX0446 HX0232 HX0197      0
        0 HX0021 HX0018 LJ5172 HX0297 HX0540 HX0521 HX0213 HX0222 HX0474 HX0102 HX0124 HX0478 HX0458 HX0113 HX0140 HX0482 HX0051 HX0091 HX0485 HX0542 HX0434 LJ5149 HX0173 HX0057      0
              0 HX0311 HX0495 LJ2120 HX0084 LJ5145 HX0455 LJ2089 HX0266 HX0081 HX0281 HX0046 HX0164 HX0229 HX0187 HX0404 LJ2093 HX0560 LJ2094 HX0159 LJ2125 HX0498 HX0342      0
              0 HX0182 LJ5163 HX0126 LJ2117 HX0056 HX0489 HX0348 HX0452 HX0189 HX0466 HX0291 HX0293 HX0531 HX0203 HX0503 HX0322 HX0556 HX0085 LJ5165 HX0142 LJ5186 HX0207      0
              0 HX0287 HX0288 HX0514 HX0121 LJ2118 HX0429 LJ2099 HX0250 LJ2090 HX0258 HX0483 HX0484 HX0398 LJ2114 HX0379 LJ2107 HX0439 LJ2109 HX0029 HX0539 HX0392 HX0310      0
                    0 HX0105 HX0253 LJ5144 HX0481 LJ5140 HX0070 LJ5152 HX0431 LJ5138 HX0098 HX0045 LJ5168 HX0354 LJ5158 HX0212 LJ5175 HX0541 LJ5147 HX0359 HX0201      0
                          0 HX0270 HX0003 HX0329 HX0111 HX0448 HX0019 HX0526 HX0269 LJ5151 LJ5183 HX0254 HX0529 HX0086 HX0510 HX0191 HX0227 HX0131 HX0277      0
                                0      0      0 HX0112 HX0234 HX0473 HX0153 HX0494 HX0252 HX0377 HX0477 HX0109 HX0491 HX0257 HX0032      0      0      0
                                                    0 HX0196 HX0356 HX0217 HX0363 HX0115 HX0049 HX0325 HX0058 HX0323 HX0011      0
                                                          0      0      0      0      0      0      0      0      0      0      0
```

C.9 PARCS Input for HZP Cycle 3 Fuel Shuffling

```
!*********************************************
CASEID H1C2-C3
!*********************************************
CNTL
     CORE_TYPE       BWR
     CORE_POWER     100.0   ! percent of core power
     BANK_POS        -13
                          48 48 48 48 48
                       40 48 48 48 20 48 48 48 40
                    48 48 48 48 48 48 48 48 48 48 48
                    48 38 48 30 48  8 48 30 48 38 48
                 48 48 48 48 48 48 48 48 48 48 48 48 48
                 48 48 20 48  8 48 16 48  8 48 20 48 48
                 48 48 48 48 48 48 48 48 48 48 48 48 48
                 48 48 20 48  8 48 16 48  8 48 20 48 48
                 48 48 48 48 48 48 48 48 48 48 48 48 48
                    48 38 48 30 48  8 48 30 48 38 48
                    48 48 48 48 48 48 48 48 48 48 48
                       40 48 48 48 20 48 48 48 40
                          48 48 48 48 48
     DEPLETION       T  1.0E-5 T
!                   NSET   LADF LXES LJ1F LDED LCHI LCHD LINV LDET LYLD LCDF LGFF LBET LAMB LDEC
     TREE_XS      T  20    T    T    F    F    F    F    F    T    T    F    F    F    F    F
     TH_FDBK         F
     DECAY_HEAT      F
     RESTART         F
     XE_SM           1 1
     TRANSIENT       F
     EXT_TH          F
     mult_cyc        T
!
! Printing Options
!
! 1  Detailed input edit
! 2  Iteration history display
! 3  Planar power distributions
! 4  Detailed pin power distributions
! 5  Reactivity edit and adjoint flux
! 6  Feedback component reactivity edit
! 7  Integrated flux and precursor density edit
```

```
! 8  Planar flux distributions
! 9  Xe/Sm number densities
! 10 T/H state variables
! 11 1D collapsed group constants
! 12 Point Kinetics Data
! 13 Radial Power Shape
! 14 Radial Flux Shape
! 15 Harmonics
!             1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
!     PRINT_OPT T T F F F F F F F  T  F  F  F  F  F
      inp_opts   F  T
      plot_opts   0  0  2
     ROT_ADF   T
PARAM
      nlupd_ss       3  5  1
      n_iters        15  5
      conv_ss        1.0e-5 1.0e-4 1.0e-3
      cnv_th_ss      0.001
      wielandt       0.2  0.1  1.0
      decusp         2
      NODAL_KERN     NEMMG
!      LSOLVER        1 1 20
      CMFD           2
XSEC
     group_spec      2  1
GEOM
!                    nasyx         nasyy            nz          nzbr          nztr
     GEO_DIM           28            28            26             1             1

!                Radial core configuration
     RAD_CONF
!
! H1C2 Core Design
!
     0  0  0  0  0  0  0  0  0 13 13 13 13 13 13 13 13 13  0  0  0  0  0  0  0  0
     0  0  0  0  0  0  0  0  6  1  2  3  2  2  2  2  3  2  1 12  0  0  0  0  0  0  0  0
     0  0  0  0  0 13 13  6  2  1  5  1  5  3  3  5  1  5  1  2 12 13 13  0  0  0  0  0
     0  0  0  0  6  1  2  1  3  5  3  5  4  5  5  4  5  3  5  3  1  2  1 12  0  0  0  0
     0  0  0  6  1  1  5  4  5  4  5  2  5  3  3  5  2  5  4  5  4  5  1  1 12  0  0  0
     0  0  7  1  1  3  3  5  4  5  3  5  3  5  5  3  5  3  5  4  5  3  3  1  1 11  0  0
     0  0  7  2  5  3  4  2  5  2  5  2  5  3  3  5  2  5  2  5  2  4  3  5  2 11  0  0
     0  0  6  1  4  5  2  5  3  4  1  4  2  4  4  2  4  1  4  3  5  2  5  4  1 12  0  0
     0  6  2  3  5  4  5  3  5  2  5  3  5  1  1  5  3  5  2  5  3  5  4  5  3  2 12  0
     7  1  1  5  4  5  2  4  2  4  2  4  1  4  4  1  4  2  4  2  4  2  5  4  5  1  1 11
     7  2  5  3  5  3  5  1  5  2  5  1  5  1  1  5  1  5  2  5  1  5  3  5  3  5  2 11
     7  3  1  5  2  5  2  4  3  4  1  4  1  4  4  1  4  1  4  3  4  2  5  2  5  1  3 11
     7  2  5  4  5  3  5  2  5  1  5  1  5  1  1  5  1  5  1  5  2  5  3  5  4  5  2 11
     7  2  3  5  3  5  3  4  1  4  1  4  1  2  2  1  4  1  4  1  4  3  5  3  5  3  2 11
     7  2  3  5  3  5  3  4  1  4  1  4  1  2  2  1  4  1  4  1  4  3  5  3  5  3  2 11
     7  2  5  4  5  3  5  2  5  1  5  1  5  1  1  5  1  5  1  5  2  5  3  5  4  5  2 11
     7  3  1  5  2  5  2  4  3  4  1  4  1  4  4  1  4  1  4  3  4  2  5  2  5  1  3 11
     7  2  5  3  5  3  5  1  5  2  5  1  5  1  1  5  1  5  2  5  1  5  3  5  3  5  2 11
     7  1  1  5  4  5  2  4  2  4  2  4  1  4  4  1  4  2  4  2  4  2  5  4  5  1  1 11
     0  8  2  3  5  4  5  3  5  2  5  3  5  1  1  5  3  5  2  5  3  5  4  5  3  2 10  0
     0  0  8  1  4  5  2  5  3  4  1  4  2  4  4  2  4  1  4  3  5  2  5  4  1 10  0  0
     0  0  7  2  5  3  4  2  5  2  5  2  5  3  3  5  2  5  2  5  2  4  3  5  2 11  0  0
     0  0  7  1  1  3  3  5  4  5  3  5  3  5  5  3  5  3  5  4  5  3  3  1  1 11  0  0
     0  0  0  8  1  1  5  4  5  4  5  2  5  3  3  5  2  5  4  5  4  5  1  1 10  0  0  0
     0  0  0  0  8  1  2  1  3  5  3  5  4  5  5  4  5  3  5  3  1  2  1 10  0  0  0  0
     0  0  0  0  0  9  9  8  2  1  5  1  5  3  3  5  1  5  1  2 10  9  9  0  0  0  0  0
     0  0  0  0  0  0  0  0  0  8  1  2  3  2  2  2  2  3  2  1 10  0  0  0  0  0  0  0
     0  0  0  0  0  0  0  0  0  0  9  9  9  9  9  9  9  9  9  0  0  0  0  0  0  0  0  0
!
     ASSY_TYPE    1  1*10 1*1  1*1  1*2  9*2  6*2  1*1  5*1  1*12  FUEL ! Type 1 7X7 Fuel
     ASSY_TYPE    2  1*10 1*3  1*3  1*4  9*5  6*4  1*4  5*3  1*12  FUEL ! Type 2 7X7 Fuel
     ASSY_TYPE    3  1*10 1*6  1*6  1*6  9*6  6*6  1*6  5*6  1*12  FUEL ! Type 3 7X7 Fuel
     ASSY_TYPE    4  1*10 1*7  1*7  1*7  9*7  6*7  1*7  5*7  1*12  FUEL ! Type 4 8X8 Fuel
     ASSY_TYPE    5  1*10 1*8  1*9  1*9  9*9  6*9  1*9  5*9  1*12  FUEL ! Type 5 8X8 Fuel, removed top nat U
     ASSY_TYPE    6  1*10 1*13 1*13 1*13 9*13 6*13 1*13 5*13 1*12  REFL ! NW
     ASSY_TYPE    7  1*10 1*14 1*14 1*14 9*14 6*14 1*14 5*14 1*12  REFL ! W
     ASSY_TYPE    8  1*10 1*15 1*15 1*15 9*15 6*15 1*15 5*15 1*12  REFL ! SW
     ASSY_TYPE    9  1*10 1*16 1*16 1*16 9*16 6*16 1*16 5*16 1*12  REFL ! S
     ASSY_TYPE   10  1*10 1*17 1*17 1*17 9*17 6*17 1*17 5*17 1*12  REFL ! SE
     ASSY_TYPE   11  1*10 1*18 1*18 1*18 9*18 6*18 1*18 5*18 1*12  REFL ! E
     ASSY_TYPE   12  1*10 1*19 1*19 1*19 9*19 6*19 1*19 5*19 1*12  REFL ! NE
     ASSY_TYPE   13  1*10 1*20 1*20 1*20 9*20 6*20 1*20 5*20 1*12  REFL ! N
     ASSY_TYPE   14  1*10 1*11 1*11 1*11 9*11 6*11 1*11 5*11 1*12  REFL ! No ADF
!
     GRID_X     28*15.24
     GRID_Y     28*15.24
     GRID_Z     1*15.24 24*15.24 1*15.24

     NEUTMESH_X 28*1
     NEUTMESH_Y 28*1
     BOUN_COND  2 2 2 2 2 2
     CR_AXINFO  17.78        7.62         48
!                 Control rod banks defined
     BANK_CONF
```

```
                                       0   0   0   0   0   0   0   0   0   0
                                   0   1   1   2   2   3   3   4   4   5   5   0
                       0   0   0   0   1   1   2   2   3   3   4   4   5   5   0   0   0   0
                   0   6   6   7   7   8   8   9   9  10  10  11  11  12  12  13  13  14  14   0
               0   0   6   6   7   7   8   8   9   9  10  10  11  11  12  12  13  13  14  14   0   0
           0  15  15  16  16  17  17  18  18  19  19  20  20  21  21  22  22  23  23  24  24  25  25   0
           0  15  15  16  16  17  17  18  18  19  19  20  20  21  21  22  22  23  23  24  24  25  25   0
           0  26  26  27  27  28  28  29  29  30  30  31  31  32  32  33  33  34  34  35  35  36  36   0
       0   0  26  26  27  27  28  28  29  29  30  30  31  31  32  32  33  33  34  34  35  35  36  36   0   0
   0  37  37  38  38  39  39  40  40  41  41  42  42  43  43  44  44  45  45  46  46  47  47  48  48  49  49   0
   0  37  37  38  38  39  39  40  40  41  41  42  42  43  43  44  44  45  45  46  46  47  47  48  48  49  49   0
   0  50  50  51  51  52  52  53  53  54  54  55  55  56  56  57  57  58  58  59  59  60  60  61  61  62  62   0
   0  50  50  51  51  52  52  53  53  54  54  55  55  56  56  57  57  58  58  59  59  60  60  61  61  62  62   0
   0  63  63  64  64  65  65  66  66  67  67  68  68  69  69  70  70  71  71  72  72  73  73  74  74  75  75   0
   0  63  63  64  64  65  65  66  66  67  67  68  68  69  69  70  70  71  71  72  72  73  73  74  74  75  75   0
   0  76  76  77  77  78  78  79  79  80  80  81  81  82  82  83  83  84  84  85  85  86  86  87  87  88  88   0
   0  76  76  77  77  78  78  79  79  80  80  81  81  82  82  83  83  84  84  85  85  86  86  87  87  88  88   0
   0  89  89  90  90  91  91  92  92  93  93  94  94  95  95  96  96  97  97  98  98  99  99 100 100 101 101   0
   0  89  89  90  90  91  91  92  92  93  93  94  94  95  95  96  96  97  97  98  98  99  99 100 100 101 101   0
       0   0 102 102 103 103 104 104 105 105 106 106 107 107 108 108 109 109 110 110 111 111 112 112   0   0
           0 102 102 103 103 104 104 105 105 106 106 107 107 108 108 109 109 110 110 111 111 112 112   0
           0 113 113 114 114 115 115 116 116 117 117 118 118 119 119 120 120 121 121 122 122 123 123   0
           0 113 113 114 114 115 115 116 116 117 117 118 118 119 119 120 120 121 121 122 122 123 123   0
               0   0 124 124 125 125 126 126 127 127 128 128 129 129 130 130 131 131 132 132   0   0
                   0 124 124 125 125 126 126 127 127 128 128 129 129 130 130 131 131 132 132   0
                       0   0   0   0 133 133 134 134 135 135 136 136 137 137   0   0   0   0
                                   0 133 133 134 134 135 135 136 136 137 137   0
                                       0   0   0   0   0   0   0   0   0   0
!                 Assembly rotation
     ADF_ROT
                         0 0 0 0 0 0 0 0 0 0
                       0 2 1 2 1 2 1 2 1 2 1 0
                 0 0 0 0 3 0 3 0 3 0 3 0 3 0 0 0 0 0
               0 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 0
             0 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 0 0
           0 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 0
           0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 0
           0 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 0
         0 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 0 0
       0 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 0
       0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 0
       0 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 0
       0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 0
       0 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 0
       0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 0
       0 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 0
       0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 0
       0 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 0
       0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 0
         0 0 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 0 0
           0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 0
           0 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 0
           0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 0
             0 0 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 0 0
               0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 0
                 0 0 0 0 2 1 2 1 2 1 2 1 2 1 0 0 0 0
                       0 3 0 3 0 3 0 3 0 3 0 0
                         0 0 0 0 0 0 0 0 0 0
FDBK
    fa_powpit   4.35  15.24
TH
    unif_th     0.4   600.0   300.0
DEPL
!     INP_HST    'H1C2.dep' 1 54
     HST_OPT    T T F F F
     OUT_OPT    F T F F F
     BANK_NR    137*1
!
! Cross-sections
!
     PMAXS_F    1  '../GenPMax/fuel_polaris/hatch-t1a.PMAX'          1  ! Type 1 7X7 only rod A gad
     PMAXS_F    2  '../GenPMax/fuel_polaris/hatch-t1b.PMAX'          2  ! Type 1 7x7 rod A and B gad
     PMAXS_F    3  '../GenPMax/fuel_polaris/hatch-t2a.PMAX'          3  ! Type 2 7x7 no gad
     PMAXS_F    4  '../GenPMax/fuel_polaris/hatch-t2c.PMAX'          4  ! Type 2 7x7 only rod C gad
     PMAXS_F    5  '../GenPMax/fuel_polaris/hatch-t2d.PMAX'          5  ! Type 2 7x7 rod C and D gad
     PMAXS_F    6  '../GenPMax/fuel_polaris/hatch-t3.PMAX'           6  ! Type 3 7x7
     PMAXS_F    7  '../GenPMax/fuel_polaris/hatch-t4.PMAX'           7  ! Type 4 8x8
     PMAXS_F    8  '../GenPMax/fuel_polaris/hatch-t5a.PMAX'          8  ! Type 5 8x8 natural u
     PMAXS_F    9  '../GenPMax/fuel_polaris/hatch-t5b.PMAX'          9  ! Type 5 8x8 enriched u
     PMAXS_F   10  '../GenPMax/refl_triton/hatch-refl-bot.PMAX'     10  ! Bottom Axial Reflector
     PMAXS_F   11  '../GenPMax/refl_triton/hatch-refl-rad.PMAX'     11  ! Radial Reflector
     PMAXS_F   12  '../GenPMax/refl_triton/hatch-refl-top.PMAX'     12  ! Top Axial Reflector
     PMAXS_F   13  '../GenPMax/refl_triton/hatch-refl-rad-NW.PMAX'  13  ! NW Radial Reflector
     PMAXS_F   14  '../GenPMax/refl_triton/hatch-refl-rad-W.PMAX'   14  !  W Radial Reflector
     PMAXS_F   15  '../GenPMax/refl_triton/hatch-refl-rad-SW.PMAX'  15  ! SW Radial Reflector
     PMAXS_F   16  '../GenPMax/refl_triton/hatch-refl-rad-S.PMAX'   16  !  S Radial Reflector
     PMAXS_F   17  '../GenPMax/refl_triton/hatch-refl-rad-SE.PMAX'  17  ! SE Radial Reflector
     PMAXS_F   18  '../GenPMax/refl_triton/hatch-refl-rad-E.PMAX'   18  !  E Radial Reflector
```

```
     PMAXS_F   19  '../GenPMax/refl_triton/hatch-refl-rad-NE.PMAX'  19  ! NE Radial Reflector
     PMAXS_F   20  '../GenPMax/refl_triton/hatch-refl-rad-N.PMAX'   20  !  N Radial Reflector
MCYCLE
!                 index     locmap
      bank_def      1        137*48

! cycle definition
      cycle_def     1
      depl_step     1*0.00001
      bank_seq      2*1
      power_lev     2*0.01
      prev_cyc      2
                    './layout/H1C2.lay' './H1C2.parcs_dep'  1  54
                    './layout/H1C1.lay' './H1C1.parcs_dep'  1  74
      location      1
                                                          0      0      0      0      0      0      0      0      0      0
                                                0     -1     -1     -1     -1     -1     -1     -1     -1     -1     -1      0
                                    0      0      0     -1     -1      0     -1      0     -1     -1      0     -1      0     -1     -1      0
0      0
                              0     -1     -1     -1     -1      0     -1      0     -1      0      0     -1      0     -1      0     -1     -1
-1     -1      0
                        0     -1     -1      0     -1      0     -1      0     -1      0     -1     -1      0     -1      0     -1      0     -1
0     -1     -1      0
                  0     -1     -1     -1     -1      0     -1      0     -1      0     -1      0      0     -1      0     -1      0     -1      0
-1     -1     -1     -1      0
                0     -1      0     -1     -1     -1      0     -1      0     -1      0     -1     -1      0     -1      0     -1      0     -1
-1     -1      0     -1      0
                0     -1     -1      0     -1      0     -1     -1     -1     -1     -1     -1     -1     -1     -1     -1     -1     -1      0
-1      0     -1     -1      0
          0     -1     -1      0     -1      0     -1      0     -1      0     -1      0     -1     -1      0     -1      0     -1      0     -1
0     -1      0     -1     -1      0
  0     -1     -1      0     -1      0     -1     -1     -1     -1     -1     -1     -1     -1     -1     -1     -1     -1     -1     -1     -1
-1      0     -1      0     -1     -1      0
  0     -1      0     -1      0     -1      0     -1      0     -1      0     -1      0     -1     -1      0     -1      0     -1      0     -1
0     -1      0     -1      0     -1      0
  0     -1     -1      0     -1      0     -1     -1     -1     -1     -1     -1     -1     -1     -1     -1     -1     -1     -1     -1     -1
-1      0     -1      0     -1     -1      0
  0     -1      0     -1      0     -1      0     -1      0     -1      0     -1      0     -1     -1      0     -1      0     -1      0     -1
0     -1      0     -1      0     -1      0
  0     -1     -1      0     -1      0     -1     -1     -1     -1     -1     -1     -1     -1     -1     -1     -1     -1     -1     -1     -1
-1      0     -1      0     -1     -1      0
  0     -1     -1      0     -1      0     -1     -1     -1     -1     -1     -1     -1     -1     -1     -1     -1     -1     -1     -1     -1
-1      0     -1      0     -1     -1      0
  0     -1      0     -1      0     -1      0     -1      0     -1      0     -1      0     -1     -1      0     -1      0     -1      0     -1
0     -1      0     -1      0     -1      0
  0     -1     -1      0     -1      0     -1     -1     -1     -1     -1     -1     -1     -1     -1     -1     -1     -1     -1     -1     -1
-1      0     -1      0     -1     -1      0
  0     -1      0     -1      0     -1      0     -1      0     -1      0     -1      0     -1     -1      0     -1      0     -1      0     -1
0     -1      0     -1      0     -1      0
  0     -1     -1      0     -1      0     -1     -1     -1     -1     -1     -1     -1     -1     -1     -1     -1     -1     -1     -1     -1
-1      0     -1      0     -1     -1      0
          0     -1     -1      0     -1      0     -1      0     -1      0     -1      0     -1     -1      0     -1      0     -1      0     -1
0     -1      0     -1     -1      0
            0     -1     -1      0     -1      0     -1     -1     -1     -1     -1     -1     -1     -1     -1     -1     -1     -1      0
-1      0     -1     -1      0
              0     -1      0     -1     -1     -1      0     -1      0     -1      0     -1     -1      0     -1      0     -1      0     -1
-1     -1      0     -1      0
              0     -1     -1     -1     -1      0     -1      0     -1      0     -1      0      0     -1      0     -1      0     -1      0
-1     -1     -1     -1      0
                0     -1     -1      0     -1      0     -1      0     -1      0     -1      0     -1     -1      0     -1      0     -1      0     -1
0     -1     -1      0
                          0     -1     -1     -1     -1      0     -1      0     -1      0      0     -1      0     -1      0     -1     -1
-1     -1      0
                                    0      0      0     -1     -1      0     -1      0     -1     -1      0     -1      0     -1     -1      0
0      0
                                                          0     -1     -1     -1     -1     -1     -1     -1     -1     -1     -1      0
                                                                0      0      0      0      0      0      0      0      0      0

! shuffling definition
!                 index  mode: 0-character; 1-individual; 2-batch
      shuf_map      1      1
                                                                0      0      0      0      0      0      0      0      0      0
                                                          0 HX0059 HX0428 HX0522 HX0241 HX0443 HX0387 HX0243 HX0458 HX0268 HX0082      0
                                    0      0      0 HX0340 HX0062 LJ9354 HX0110 LJ9414 HX0532 HX0526 LJ9398 HX0068 LJ9416 HX0030 HX0318      0
0      0
                              0 HX0003 HX0342 HX0173 HX0481 LJ9385 HX0474 LJ9384 LJ2123 LJ9307 LJ9308 LJ5157 LJ9379 HX0482 LJ9282 HX0541 HX0018
HX0329 HX0071      0
                        0 HX0187 HX0079 LJ9303 LJ2125 LJ9277 LJ5149 LJ9284 HX0317 LJ9363 HX0445 HX0509 LJ9406 HX0314 LJ9375 LJ5156 LJ9310 LJ2120
LJ9279 HX0168 HX0123      0
                0 HX0008 HX0106 HX0484 HX0529 LJ9295 LJ2099 LJ9356 HX0473 LJ9413 HX0494 LJ9344 LJ9419 HX0499 LJ9404 HX0540 LJ9274 LJ2107 LJ9373
HX0524 HX0483 HX0181 HX0186      0
                0 HX0257 LJ9396 HX0448 LJ5151 HX0382 LJ9321 HX0283 LJ9357 HX0386 LJ9355 HX0487 HX0513 LJ9273 HX0361 LJ9389 HX0413 LJ9391 HX0300
LJ5183 HX0449 LJ9306 HX0244      0
                0 HX0111 LJ5141 LJ9353 HX0226 LJ9437 HX0536 LJ2090 HX0184 LJ2100 HX0246 LJ2118 LJ2109 HX0299 LJ2108 HX0021 LJ2114 HX0457 LJ9345
HX0233 LJ9324 LJ5160 HX0025      0
          0 HX0444 HX0469 LJ9394 LJ5179 LJ9366 HX0478 LJ9315 HX0416 LJ9392 HX0552 LJ9291 HX0058 HX0201 LJ9400 HX0496 LJ9301 HX0376 LJ9399 HX0491
LJ9327 LJ2121 LJ9387 HX0497 HX0390      0
 0  HX0077 HX0144 LJ9288 LJ5140 LJ9322 HX0414 LJ5150 HX0287 LJ2089 HX0277 LJ5154 HX0115 LJ5164 LJ5158 HX0093 LJ2091 HX0366 LJ2093 HX0273 LJ2098
HX0335 LJ9338 LJ5175 LJ9299 HX0078 HX0157      0
```

```
 0  HX0242 LJ9403 HX0557 LJ9381 HX0489 LJ9286 HX0207 LJ9328 HX0344 LJ9311 HX0101 LJ9370 HX0198 HX0011 LJ9326 HX0194 LJ9278 HX0323 LJ9427 HX0017
LJ9329 HX0464 LJ9285 HX0511 LJ9359 HX0253      0
 0  HX0519 HX0024 LJ9376 HX0352 LJ9325 HX0358 LJ5170 HX0504 LJ5173 HX0016 LJ5145 HX0032 LJ5163 LJ5153 HX0195 LJ2094 HX0010 LJ2122 HX0520 LJ5143
HX0350 LJ9378 HX0353 LJ9280 HX0036 HX0459      0
 0  HX0276 LJ9372 LJ2117 LJ9330 HX0506 LJ9435 HX0345 LJ9367 HX0057 LJ9290 HX0105 LJ9426 HX0052 HX0054 LJ9420 HX0108 LJ9340 HX0143 LJ9430 HX0339
LJ9418 HX0531 LJ9275 LJ5165 LJ9422 HX0313      0
 0  HX0360 HX0514 LJ9320 HX0498 LJ9349 HX0452 LJ5138 HX0220 LJ5152 HX0022 LJ5144 HX0175 HX0412 HX0260 HX0038 LJ5169 HX0146 LJ5178 HX0049 LJ5168
HX0503 LJ9409 HX0538 LJ9297 HX0539 HX0227      0
 0  HX0235 HX0528 LJ9412 HX0495 LJ9289 HX0460 LJ3947 HX0167 LJ5139 HX0197 LJ5146 HX0179 HX0393 HX0373 HX0155 LJ5147 HX0116 LJ2110 HX0015 LJ2124
HX0535 LJ9305 HX0467 LJ9333 HX0492 HX0441      0
 0  HX0377 LJ9314 LJ3946 LJ9336 HX0555 LJ9401 HX0378 LJ9318 HX0171 LJ9298 HX0112 LJ9346 HX0037 HX0012 LJ9335 HX0183 LJ9339 HX0162 LJ9374 HX0355
LJ9350 HX0502 LJ9343 LJ2097 LJ9272 HX0252      0
 0  HX0472 HX0043 LJ9319 HX0315 LJ9417 HX0349 LJ5137 HX0488 LJ5176 HX0007 LJ5136 HX0074 LJ5171 LJ5186 HX0044 LJ2092 HX0041 LJ2088 HX0505 LJ5166
HX0362 LJ9337 HX0347 LJ9383 HX0033 HX0493      0
 0  HX0288 LJ9429 HX0500 LJ9348 HX0479 LJ9371 HX0182 LJ9395 HX0351 LJ9281 HX0149 LJ9313 HX0096 HX0072 LJ9331 HX0152 LJ9431 HX0427 LJ9438 HX0028
LJ9351 HX0556 LJ9287 HX0454 LJ9380 HX0392      0
 0  HX0109 HX0125 LJ9436 LJ2104 LJ9361 HX0274 LJ2105 HX0286 LJ5148 HX0270 LJ5159 HX0217 LJ5177 LJ5161 HX0066 LJ2106 HX0332 LJ5180 HX0310 LJ2111
HX0308 LJ9347 LJ5167 LJ9407 HX0027 HX0153      0
         0 HX0325 HX0537 LJ9421 LJ5155 LJ9362 HX0507 LJ9434 HX0407 LJ9415 HX0517 LJ9276 HX0139 HX0205 LJ9368 HX0486 LJ9369 HX0261 LJ9334 HX0527
LJ9364 LJ5185 LJ9365 HX0525 HX0363      0
               0 HX0191 LJ5142 LJ9433 HX0279 LJ9296 HX0501 LJ2103 HX0001 LJ5174 HX0230 LJ2116 LJ2096 HX0396 LJ2112 HX0031 LJ2095 HX0549 LJ9408
HX0324 LJ9283 LJ2113 HX0138      0
               0 HX0425 LJ9292 HX0558 LJ5184 HX0278 LJ9402 HX0418 LJ9312 HX0316 LJ9423 HX0550 HX0461 LJ9342 HX0424 LJ9300 HX0415 LJ9410 HX0295
LJ2115 HX0510 LJ9382 HX0410      0
               0 HX0042 HX0089 HX0512 HX0553 LJ9302 LJ2126 LJ9293 HX0450 LJ9386 HX0477 LJ9352 LJ9428 HX0547 LJ9317 HX0466 LJ9432 LJ2102 LJ9388
HX0462 HX0490 HX0100 HX0026      0
                     0 HX0192 HX0169 LJ9294 LJ2101 LJ9425 LJ2119 LJ9390 HX0256 LJ9405 HX0480 HX0476 LJ9358 HX0409 LJ9323 LJ5172 LJ9316 LJ5162
LJ9393 HX0216 HX0081      0
                          0 HX0131 HX0343 HX0060 HX0548 LJ9439 HX0551 LJ9341 LJ5182 LJ9309 LJ9360 LJ5181 LJ9424 HX0447 LJ9332 HX0468 HX0107
HX0311 HX0221      0
                                0      0      0 HX0356 HX0172 LJ9304 HX0141 LJ9377 HX0446 HX0554 LJ9411 HX0219 LJ9397 HX0199 HX0328      0
0      0
                                                0 HX0160 HX0232 HX0516 HX0359 HX0301 HX0421 HX0298 HX0544 HX0234 HX0190      0
                                                       0      0      0      0      0      0      0      0      0      0      0

! Multi-cycle schedule
!                  itsq  itshufsq itcyclesq
      cycle_ind      1      0         1
      cycle_ind      2      1         1
!                crit.(GWD/T)   max itr
      conv_ec        0.1           2

.
```

C.10 PARCS Input for HFP Cycle 3

```
!***********************************************
CASEID H1C3
!***********************************************
CNTL
     CORE_TYPE       BWR
     CORE_POWER      83.95   ! percent of core power
     BANK_POS        -13
                          48 48 48 48 48
                       40 48 48 48 20 48 48 48 40
                    48 48 48 48 48 48 48 48 48 48 48
                    48 38 48 30 48  8 48 30 48 38 48
                 48 48 48 48 48 48 48 48 48 48 48 48 48
                 48 48 20 48  8 48 16 48  8 48 20 48 48
                 48 48 48 48 48 48 48 48 48 48 48 48 48
                 48 48 20 48  8 48 16 48  8 48 20 48 48
                 48 48 48 48 48 48 48 48 48 48 48 48 48
                    48 38 48 30 48  8 48 30 48 38 48
                    48 48 48 48 48 48 48 48 48 48 48
                       40 48 48 48 20 48 48 48 40
                          48 48 48 48 48
     DEPLETION       T  1.0E-5 T  F
!                    NSET   LADF LXES LJ1F LDED LCHI LCHD LINV LDET LYLD LCDF LGFF LBET LAMB LDEC
     TREE_XS       T  20    T    T    F    F    F    F    F    T    T    F    F    F    F    F
     TH_FDBK         T
     DECAY_HEAT      T
     RESTART         F
     XE_SM           1 1
     TRANSIENT       F
     EXT_TH          F
     INT_TH          T  1  'paths_h1c3.inp'
!
! Printing Options
!
! 1  Detailed input edit
! 2  Iteration history display
! 3  Planar power distributions
! 4  Detailed pin power distributions
```

```
! 5  Reactivity edit and adjoint flux
! 6  Feedback component reactivity edit
! 7  Integrated flux and precursor density edit
! 8  Planar flux distributions
! 9  Xe/Sm number densities
! 10 T/H state variables
! 11 1D collapsed group constants
! 12 Point Kinetics Data
! 13 Radial Power Shape
! 14 Radial Flux Shape
! 15 Harmonics
!              1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
!     PRINT_OPT T F F F F F F F F   T  F  F  F  F  F
      inp_opts   F  T
      plot_opts   0  0  2
     ROT_ADF   T
     DETECTOR  T 74400  2
PARAM
      nlupd_ss       3  5  1
      n_iters        15  200
      conv_ss        1.0e-5 1.0e-4 1.0e-3
      cnv_th_ss      0.001
      wielandt       0.2  0.1  1.0
      decusp         2
      NODAL_KERN     NEMMG
!      LSOLVER        1 1 20
      CMFD           2
XSEC
     group_spec      2  1
GEOM
!                    nasyx         nasyy           nz          nzbr          nztr
     GEO_DIM           28            28           26             1             1

!                Radial core configuration
     RAD_CONF
!
! H1C2 Core Design
!
     0  0  0  0  0  0  0  0  0 13 13 13 13 13 13 13 13 13 13  0  0  0  0  0  0  0  0  0
     0  0  0  0  0  0  0  0  6  1  2  3  2  2  2  2  3  2  1 12  0  0  0  0  0  0  0  0
     0  0  0  0  0 13 13  6  2  1  5  1  5  3  3  5  1  5  1  2 12 13 13  0  0  0  0  0
     0  0  0  0  6  1  2  1  3  5  3  5  4  5  5  4  5  3  5  3  1  2  1 12  0  0  0  0
     0  0  0  6  1  1  5  4  5  4  5  2  5  3  3  5  2  5  4  5  4  5  1  1 12  0  0  0
     0  0  7  1  1  3  3  5  4  5  3  5  3  5  5  3  5  3  5  4  5  3  3  1  1 11  0  0
     0  0  7  2  5  3  4  2  5  2  5  2  5  3  3  5  2  5  2  5  2  4  3  5  2 11  0  0
     0  0  6  1  4  5  2  5  3  4  1  4  2  4  4  2  4  1  4  3  5  2  5  4  1 12  0  0
     0  6  2  3  5  4  5  3  5  2  5  3  5  1  1  5  3  5  2  5  3  5  4  5  3  2 12  0
     7  1  1  5  4  5  2  4  2  4  2  4  1  4  4  1  4  2  4  2  4  2  5  4  5  1  1 11
     7  2  5  3  5  3  5  1  5  2  5  1  5  1  1  5  1  5  2  5  1  5  3  5  3  5  2 11
     7  3  1  5  2  5  2  4  3  4  1  4  1  4  4  1  4  1  4  3  4  2  5  2  5  1  3 11
     7  2  5  4  5  3  5  2  5  1  5  1  5  1  1  5  1  5  1  5  2  5  3  5  4  5  2 11
     7  2  3  5  3  5  3  4  1  4  1  4  1  2  2  1  4  1  4  1  4  3  5  3  5  3  2 11
     7  2  3  5  3  5  3  4  1  4  1  4  1  2  2  1  4  1  4  1  4  3  5  3  5  3  2 11
     7  2  5  4  5  3  5  2  5  1  5  1  5  1  1  5  1  5  1  5  2  5  3  5  4  5  2 11
     7  3  1  5  2  5  2  4  3  4  1  4  1  4  4  1  4  1  4  3  4  2  5  2  5  1  3 11
     7  2  5  3  5  3  5  1  5  2  5  1  5  1  1  5  1  5  2  5  1  5  3  5  3  5  2 11
     7  1  1  5  4  5  2  4  2  4  2  4  1  4  4  1  4  2  4  2  4  2  5  4  5  1  1 11
     0  8  2  3  5  4  5  3  5  2  5  3  5  1  1  5  3  5  2  5  3  5  4  5  3  2 10  0
     0  0  8  1  4  5  2  5  3  4  1  4  2  4  4  2  4  1  4  3  5  2  5  4  1 10  0  0
     0  0  7  2  5  3  4  2  5  2  5  2  5  3  3  5  2  5  2  5  2  4  3  5  2 11  0  0
     0  0  7  1  1  3  3  5  4  5  3  5  3  5  5  3  5  3  5  4  5  3  3  1  1 11  0  0
     0  0  0  8  1  1  5  4  5  4  5  2  5  3  3  5  2  5  4  5  4  5  1  1 10  0  0  0
     0  0  0  0  8  1  2  1  3  5  3  5  4  5  5  4  5  3  5  3  1  2  1 10  0  0  0  0
     0  0  0  0  0  9  9  8  2  1  5  1  5  3  3  5  1  5  1  2 10  9  9  0  0  0  0  0
     0  0  0  0  0  0  0  0  0  8  1  2  3  2  2  2  2  3  2  1 10  0  0  0  0  0  0  0
     0  0  0  0  0  0  0  0  0  0  9  9  9  9  9  9  9  9  9  9  0  0  0  0  0  0  0  0
!
     ASSY_TYPE    1  1*10 1*1  1*1  1*2  9*2  6*2  1*1  5*1  1*12  FUEL ! Type 1 7X7 Fuel
     ASSY_TYPE    2  1*10 1*3  1*3  1*4  9*5  6*4  1*4  5*3  1*12  FUEL ! Type 2 7X7 Fuel
     ASSY_TYPE    3  1*10 1*6  1*6  1*6  9*6  6*6  1*6  5*6  1*12  FUEL ! Type 3 7X7 Fuel
     ASSY_TYPE    4  1*10 1*7  1*7  1*7  9*7  6*7  1*7  5*7  1*12  FUEL ! Type 4 8X8 Fuel
     ASSY_TYPE    5  1*10 1*8  1*9  1*9  9*9  6*9  1*9  5*9  1*12  FUEL ! Type 5 8X8 Fuel, removed top nat U
     ASSY_TYPE    6  1*10 1*13 1*13 1*13 9*13 6*13 1*13 5*13 1*12  REFL ! NW
     ASSY_TYPE    7  1*10 1*14 1*14 1*14 9*14 6*14 1*14 5*14 1*12  REFL ! W
     ASSY_TYPE    8  1*10 1*15 1*15 1*15 9*15 6*15 1*15 5*15 1*12  REFL ! SW
     ASSY_TYPE    9  1*10 1*16 1*16 1*16 9*16 6*16 1*16 5*16 1*12  REFL ! S
     ASSY_TYPE   10  1*10 1*17 1*17 1*17 9*17 6*17 1*17 5*17 1*12  REFL ! SE
     ASSY_TYPE   11  1*10 1*18 1*18 1*18 9*18 6*18 1*18 5*18 1*12  REFL ! E
     ASSY_TYPE   12  1*10 1*19 1*19 1*19 9*19 6*19 1*19 5*19 1*12  REFL ! NE
     ASSY_TYPE   13  1*10 1*20 1*20 1*20 9*20 6*20 1*20 5*20 1*12  REFL ! N
     ASSY_TYPE   14  1*10 1*11 1*11 1*11 9*11 6*11 1*11 5*11 1*12  REFL ! No ADF
!
     GRID_X     28*15.24
     GRID_Y     28*15.24
     GRID_Z     1*15.24 24*15.24 1*15.24

     NEUTMESH_X 28*1
     NEUTMESH_Y 28*1
```

```
     BOUN_COND  2 2 2 2 2 2
     CR_AXINFO  17.78        7.62         48
!                Control rod banks defined
     BANK_CONF
                                      0   0   0   0   0   0   0   0   0   0
                                  0   1   1   2   2   3   3   4   4   5   5   0
                      0   0   0   0   1   1   2   2   3   3   4   4   5   5   0   0   0   0
                  0   6   6   7   7   8   8   9   9  10  10  11  11  12  12  13  13  14  14   0
              0   0   6   6   7   7   8   8   9   9  10  10  11  11  12  12  13  13  14  14   0   0
          0  15  15  16  16  17  17  18  18  19  19  20  20  21  21  22  22  23  23  24  24  25  25   0
          0  15  15  16  16  17  17  18  18  19  19  20  20  21  21  22  22  23  23  24  24  25  25   0
          0  26  26  27  27  28  28  29  29  30  30  31  31  32  32  33  33  34  34  35  35  36  36   0
      0   0  26  26  27  27  28  28  29  29  30  30  31  31  32  32  33  33  34  34  35  35  36  36   0   0
  0  37  37  38  38  39  39  40  40  41  41  42  42  43  43  44  44  45  45  46  46  47  47  48  48  49  49   0
  0  37  37  38  38  39  39  40  40  41  41  42  42  43  43  44  44  45  45  46  46  47  47  48  48  49  49   0
  0  50  50  51  51  52  52  53  53  54  54  55  55  56  56  57  57  58  58  59  59  60  60  61  61  62  62   0
  0  50  50  51  51  52  52  53  53  54  54  55  55  56  56  57  57  58  58  59  59  60  60  61  61  62  62   0
  0  63  63  64  64  65  65  66  66  67  67  68  68  69  69  70  70  71  71  72  72  73  73  74  74  75  75   0
  0  63  63  64  64  65  65  66  66  67  67  68  68  69  69  70  70  71  71  72  72  73  73  74  74  75  75   0
  0  76  76  77  77  78  78  79  79  80  80  81  81  82  82  83  83  84  84  85  85  86  86  87  87  88  88   0
  0  76  76  77  77  78  78  79  79  80  80  81  81  82  82  83  83  84  84  85  85  86  86  87  87  88  88   0
  0  89  89  90  90  91  91  92  92  93  93  94  94  95  95  96  96  97  97  98  98  99  99 100 100 101 101   0
  0  89  89  90  90  91  91  92  92  93  93  94  94  95  95  96  96  97  97  98  98  99  99 100 100 101 101   0
      0   0 102 102 103 103 104 104 105 105 106 106 107 107 108 108 109 109 110 110 111 111 112 112   0   0
          0 102 102 103 103 104 104 105 105 106 106 107 107 108 108 109 109 110 110 111 111 112 112   0
          0 113 113 114 114 115 115 116 116 117 117 118 118 119 119 120 120 121 121 122 122 123 123   0
          0 113 113 114 114 115 115 116 116 117 117 118 118 119 119 120 120 121 121 122 122 123 123   0
              0   0 124 124 125 125 126 126 127 127 128 128 129 129 130 130 131 131 132 132   0   0
                  0 124 124 125 125 126 126 127 127 128 128 129 129 130 130 131 131 132 132   0
                      0   0   0   0 133 133 134 134 135 135 136 136 137 137   0   0   0   0
                                  0 133 133 134 134 135 135 136 136 137 137   0
                                      0   0   0   0   0   0   0   0   0   0
!                Assembly rotation
     ADF_ROT
                    0 0 0 0 0 0 0 0 0 0
                  0 2 1 2 1 2 1 2 1 2 1 0
            0 0 0 0 3 0 3 0 3 0 3 0 3 0 0 0 0 0
          0 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 0
        0 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 0 0
      0 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 0
      0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 0
      0 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 0
    0 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 0 0
  0 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 0
  0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 0
  0 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 0
  0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 0
  0 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 0
  0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 0
  0 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 0
  0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 0
  0 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 0
  0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 0
    0 0 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 0 0
      0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 0
      0 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 0
      0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 0
        0 0 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 0 0
          0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 0
            0 0 0 0 2 1 2 1 2 1 2 1 2 1 0 0 0 0
                  0 3 0 3 0 3 0 3 0 3 0 0
                    0 0 0 0 0 0 0 0 0 0
!              TIP detectors
     DET_XY_LOC 31
                               0  0  0  0  0  0  0  0  0  0
                            0  0  0  0  0  0  0  0  0  0  0  0
                   0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
                0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
             0  0  0 27 27  0  0 28 28  0  0 29 29  0  0 30 30  0  0 31 31  0
          0  0  0  0 27 27  0  0 28 28  0  0 29 29  0  0 30 30  0  0 31 31  0  0
          0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
          0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
       0 21 21  0  0 22 22  0  0 23 23  0  0 24 24  0  0 25 25  0  0 26 26  0  0  0
    0  0 21 21  0  0 22 22  0  0 23 23  0  0 24 24  0  0 25 25  0  0 26 26  0  0  0  0
    0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
    0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
    0  0 15 15  0  0 16 16  0  0 17 17  0  0 18 18  0  0 19 19  0  0 20 20  0  0  0  0
    0  0 15 15  0  0 16 16  0  0 17 17  0  0 18 18  0  0 19 19  0  0 20 20  0  0  0  0
    0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
    0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
    0  0  9  9  0  0 10 10  0  0 11 11  0  0 12 12  0  0 13 13  0  0 14 14  0  0  0  0
    0  0  9  9  0  0 10 10  0  0 11 11  0  0 12 12  0  0 13 13  0  0 14 14  0  0  0  0
    0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
       0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
          0  0  0  0  4  4  0  0  5  5  0  0  6  6  0  0  7  7  0  0  8  8  0  0
          0  0  0  0  4  4  0  0  5  5  0  0  6  6  0  0  7  7  0  0  8  8  0  0
          0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
             0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
```

```
                0  0  0  0  0  0  1  1  0  0  2  2  0  0  3  3  0  0  0  0
                   0  0  0  0  0  1  1  0  0  2  2  0  0  3  3  0  0  0
                            0  0  0  0  0  0  0  0  0  0  0  0
                               0  0  0  0  0  0  0  0  0  0
!
     DET_Z_LOC 24 1
                     2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
     DET_Z_WEI       1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
     DET_NAME
     1     TIP2005
     2     TIP2805
     3     TIP3605
     4     TIP1213
     5     TIP2013
     6     TIP2813
     7     TIP3613
     8     TIP4413
     9     TIP0421
     10    TIP1221
     11    TIP2021
     12    TIP2821
     13    TIP3621
     14    TIP4421
     15    TIP0429
     16    TIP1229
     17    TIP2029
     18    TIP2829
     19    TIP3629
     20    TIP4429
     21    TIP0437
     22    TIP1237
     23    TIP2037
     24    TIP2837
     25    TIP3637
     26    TIP4437
     27    TIP1245
     28    TIP2045
     29    TIP2845
     30    TIP3645
     31    TIP4445

FDBK
     fa_powpit   4.35  15.24

DEPL
     INP_HST    'H1C2-C3.parcs_cyc-02'  1  1
     TIME_STP   -1E-9
     HST_OPT    T T F F F
     OUT_OPT    F T F F F
     BANK_NR    137*1
!
! Cross-sections
!
     PMAXS_F    1  '../GenPMAXS_fission/hatch-t1a.PMAX'                1  ! Type 1 7X7 only rod A gad
     PMAXS_F    2  '../GenPMAXS_fission/hatch-t1b.PMAX'                2  ! Type 1 7x7 rod A and B gad
     PMAXS_F    3  '../GenPMAXS_fission/hatch-t2a.PMAX'                3  ! Type 2 7x7 no gad
     PMAXS_F    4  '../GenPMAXS_fission/hatch-t2c.PMAX'                4  ! Type 2 7x7 only rod C gad
     PMAXS_F    5  '../GenPMAXS_fission/hatch-t2d.PMAX'                5  ! Type 2 7x7 rod C and D gad
     PMAXS_F    6  '../GenPMAXS_fission/hatch-t3.PMAX'                 6  ! Type 3 7x7
     PMAXS_F    7  '../GenPMAXS_fission/hatch-t4.PMAX'                 7  ! Type 4 8x8
     PMAXS_F    8  '../GenPMAXS_fission/hatch-t5a.PMAX'                8  ! Type 5 8x8 natural u
     PMAXS_F    9  '../GenPMAXS_fission/hatch-t5b.PMAX'                9  ! Type 5 8x8 enriched u
     PMAXS_F   10  '../GenPMAXS_fission/hatch-refl_bot.PMAX'          10  ! Bottom Axial Reflector
     PMAXS_F   11  '../GenPMAXS_fission/hatch-refl_rad_edge.PMAX'     11  ! Radial Reflector
     PMAXS_F   12  '../GenPMAXS_fission/hatch-refl_top.PMAX'          12  ! Top Axial Reflector
     PMAXS_F   13  '../GenPMAXS_fission/hatch-refl_rad_NW.PMAX'       13  ! NW Radial Reflector
     PMAXS_F   14  '../GenPMAXS_fission/hatch-refl_rad_W.PMAX'        14  !  W Radial Reflector
     PMAXS_F   15  '../GenPMAXS_fission/hatch-refl_rad_SW.PMAX'       15  ! SW Radial Reflector
     PMAXS_F   16  '../GenPMAXS_fission/hatch-refl_rad_S.PMAX'        16  !  S Radial Reflector
     PMAXS_F   17  '../GenPMAXS_fission/hatch-refl_rad_SE.PMAX'       17  ! SE Radial Reflector
     PMAXS_F   18  '../GenPMAXS_fission/hatch-refl_rad_E.PMAX'        18  !  E Radial Reflector
     PMAXS_F   19  '../GenPMAXS_fission/hatch-refl_rad_NE.PMAX'       19  ! NE Radial Reflector
     PMAXS_F   20  '../GenPMAXS_fission/hatch-refl_rad_N.PMAX'        20  !  N Radial Reflector

/
! DATASET 37
CNTL
     CORE_POWER 83.95
     BANK_POS        -13
                          48 48 48 48 48
                      40 48 48 48 20 48 48 48 40
                   48 48 48 48 48 48 48 48 48 48 48
                   48 38 48 30 48  8 48 30 48 38 48
              48 48 48 48 48 48 48 48 48 48 48 48 48
              48 48 20 48  8 48 16 48  8 48 20 48 48
              48 48 48 48 48 48 48 48 48 48 48 48 48
              48 48 20 48  8 48 16 48  8 48 20 48 48
              48 48 48 48 48 48 48 48 48 48 48 48 48
```

```
                48 38 48 30 48  8 48 30 48 38 48
               48 48 48 48 48 48 48 48 48 48 48
                  40 48 48 48 20 48 48 48 40
                        48 48 48 48 48
DEPL
     TIME_STP -0.1367
TH
     STATE_CORE 8008.11  1218.24  6.8465E+06
/
! DATASET 38
CNTL
     CORE_POWER 84.4
     BANK_POS        -13
                        48 48 48 48 48
                  48 48 48 48 48 48 48 48 48
               48 48 48 48 48 48 48 48 48 48 48
               48 48 42 48 20 48 20 48 42 48 48
            48 48 48 48 48 48 48 48 48 48 48 48 48
            48 42 48 20 48 14 48 14 48 20 48 42 48
            48 48 48 48 48 48 48 48 48 48 48 48 48
            48 42 48 20 48 14 48 14 48 20 48 42 48
            48 48 48 48 48 48 48 48 48 48 48 48 48
               48 48 42 48 20 48 20 48 42 48 48
               48 48 48 48 48 48 48 48 48 48 48
                  48 48 48 48 48 48 48 48 48
                        48 48 48 48 48
DEPL
     TIME_STP -0.0860
TH
     STATE_CORE 6254.43 1202.43 6.8396E+06
/
! DATASET 39
CNTL
     CORE_POWER 92.98
     BANK_POS        -13
                        48 48 48 48 48
                  48 34 48 44 48 44 48 34 48
               48 48 48 48 48 48 48 48 48 48 48
               34 48 36 48 16 48 16 48 36 48 34
            48 48 48 48 48 48 48 48 48 48 48 48 48
            48 44 48 16 48 12 48 12 48 16 48 44 48
            48 48 48 48 48 48 48 48 48 48 48 48 48
            48 44 48 16 48 12 48 12 48 16 48 44 48
            48 48 48 48 48 48 48 48 48 48 48 48 48
               34 48 36 48 16 48 16 48 36 48 34
               48 48 48 48 48 48 48 48 48 48 48
                  48 34 48 44 48 44 48 34 48
                        48 48 48 48 48
DEPL
     TIME_STP -0.2867
TH
     STATE_CORE 8906.78 1220.57 6.9017E+06
/
! DATASET 40
CNTL
     CORE_POWER 90.02
     BANK_POS        -13
                        48 48 48 48 48
                  48 48 48 38 48 38 48 48 48
               48 48 48 48 48 48 48 48 48 48 48
               48 48 32 48 16 48 16 48 32 48 48
            48 48 48 48 48 48 48 48 48 48 48 48 48
            48 38 48 16 48 10 48 10 48 16 48 38 48
            48 48 48 48 48 48 48 48 48 48 48 48 48
            48 38 48 16 48 10 48 10 48 16 48 38 48
            48 48 48 48 48 48 48 48 48 48 48 48 48
               48 48 32 48 16 48 16 48 32 48 48
               48 48 48 48 48 48 48 48 48 48 48
                  48 48 48 38 48 38 48 48 48
                        48 48 48 48 48
DEPL
     TIME_STP -0.2216
TH
     STATE_CORE 8862.41 1221.96 6.8948E+06
/
! DATASET 41
CNTL
     CORE_POWER 99.14
     BANK_POS        -13
                        48 48 48 48 48
                  48 48 48 48 48 48 48 48 48
               48 48 48 48 48 48 48 48 48 48 48
               48 48 40 48 20 48 20 48 40 48 48
            48 48 48 48 48 48 48 48 48 48 48 48 48
            48 48 48 20 48 14 48 14 48 20 48 48 48
            48 48 48 48 48 48 48 48 48 48 48 48 48
            48 48 48 20 48 14 48 14 48 20 48 48 48
            48 48 48 48 48 48 48 48 48 48 48 48 48
```

```
                48 48 40 48 20 48 20 48 40 48 48
                48 48 48 48 48 48 48 48 48 48 48
                   48 48 48 48 48 48 48 48 48
                         48 48 48 48 48
DEPL
     TIME_STP -0.4245
TH
     STATE_CORE 8806.94 1217.54 6.9499E+06
/
! DATASET 42
CNTL
     CORE_POWER 98.69
     BANK_POS        -13
                         48 48 48 48 48
                      48 48 48 48 48 48 48 48 48
                48 48 48 48 48 48 48 48 48 48 48
                48 42 48 30 48 16 48 30 48 42 48
             48 48 48 48 48 48 48 48 48 48 48 48 48
             48 48 38 48 14 48  6 48 14 48 38 48 48
             48 48 48 48 48 48 48 48 48 48 48 48 48
             48 48 38 48 14 48  6 48 14 48 38 48 48
             48 48 48 48 48 48 48 48 48 48 48 48 48
                48 42 48 30 48 16 48 30 48 42 48
                48 48 48 48 48 48 48 48 48 48 48
                   48 48 48 48 48 48 48 48 48
                         48 48 48 48 48
DEPL
     TIME_STP -0.2933
TH
     STATE_CORE 8884.59 1218.24 6.9499E+06
/
! DATASET 43
CNTL
     CORE_POWER 99.18
     BANK_POS        -13
                         48 48 48 48 48
                      48 48 48 48 48 48 48 48 48
                48 48 48 48 48 48 48 48 48 48 48
                48 48 48 26 48 14 48 26 48 48 48
             48 48 48 48 48 48 48 48 48 48 48 48 48
             48 48 36 48 14 48  6 48 14 48 36 48 48
             48 48 48 48 48 48 48 48 48 48 48 48 48
             48 48 36 48 14 48  6 48 14 48 36 48 48
             48 48 48 48 48 48 48 48 48 48 48 48 48
                48 48 48 26 48 14 48 26 48 48 48
                48 48 48 48 48 48 48 48 48 48 48
                   48 48 48 48 48 48 48 48 48
                         48 48 48 48 48
DEPL
     TIME_STP -0.5910
TH
     STATE_CORE 8818.03 1217.78 6.9085E+06
/
! DATASET 44
CNTL
     CORE_POWER 98.97
     BANK_POS        -13
                         48 48 48 48 48
                      48 48 48 48 48 48 48 48 48
                48 48 48 48 48 48 48 48 48 48 48
                48 48 48 26 48 14 48 26 48 48 48
             48 48 48 48 48 48 48 48 48 48 48 48 48
             48 48 28 48 12 48  6 48 12 48 28 48 48
             48 48 48 48 48 48 48 48 48 48 48 48 48
             48 48 28 48 12 48  6 48 12 48 28 48 48
             48 48 48 48 48 48 48 48 48 48 48 48 48
                48 48 48 26 48 14 48 26 48 48 48
                48 48 48 48 48 48 48 48 48 48 48
                   48 48 48 48 48 48 48 48 48
                         48 48 48 48 48
DEPL
     TIME_STP -0.4454
TH
     STATE_CORE 8818.03 1218.01 6.9292E+06
/
! DATASET 45
CNTL
     CORE_POWER 94.09
     BANK_POS        -13
                         48 48 48 48 48
                      48 48 48 48 48 48 48 48 48
                48 48 48 48 48 28 48 48 48 48 48
                48 48 36 48 48 48 48 48 36 48 48
             48 48 48 48 14 48  4 48 14 48 48 48 48
             48 48 48 48 48 48 48 48 48 48 48 48 48
             48 48 28 48  4 48 26 48  4 48 28 48 48
             48 48 48 48 48 48 48 48 48 48 48 48 48
             48 48 48 48 14 48  4 48 14 48 48 48 48
```

```
               48 48 36 48 48 48 48 48 36 48 48
               48 48 48 48 48 28 48 48 48 48 48
                  48 48 48 48 48 48 48 48 48
                        48 48 48 48 48
DEPL
     TIME_STP -0.1753
TH
     STATE_CORE 7708.50 1211.50 6.8879E+06
/
! DATASET 46
CNTL
     CORE_POWER 86.08
     BANK_POS        -13
                        48 48 48 48 48
                  48 48 48 48 48 48 48 48 48
               48 48 48 48 48 24 48 48 48 48 48
               48 48 32 48 48 48 48 48 32 48 48
            48 48 48 48 14 48  2 48 14 48 48 48 48
            48 48 48 48 48 48 48 48 48 48 48 48 48
            48 48 24 48  2 48 24 48  2 48 24 48 48
            48 48 48 48 48 48 48 48 48 48 48 48 48
            48 48 48 48 14 48  2 48 14 48 48 48 48
               48 48 32 48 48 48 48 48 32 48 48
               48 48 48 48 48 24 48 48 48 48 48
                  48 48 48 48 48 48 48 48 48
                        48 48 48 48 48
DEPL
     TIME_STP -0.454
TH
     STATE_CORE 7098.09 1209.41 6.8258E+06
/
! DATASET 47
CNTL
     CORE_POWER 93.72
     BANK_POS        -13
                        48 48 48 48 48
                  48 48 48 48 48 48 48 48 48
               48 48 48 48 48 24 48 48 48 48 48
               48 48 32 48 48 48 48 48 32 48 48
            48 48 48 48 14 48  4 48 14 48 48 48 48
            48 48 48 48 48 48 48 48 48 48 48 48 48
            48 48 24 48  4 48 26 48  4 48 24 48 48
            48 48 48 48 48 48 48 48 48 48 48 48 48
            48 48 48 48 14 48  4 48 14 48 48 48 48
               48 48 32 48 48 48 48 48 32 48 48
               48 48 48 48 48 24 48 48 48 48 48
                  48 48 48 48 48 48 48 48 48
                        48 48 48 48 48
DEPL
     TIME_STP -0.2415
TH
     STATE_CORE 7886.05 1213.36 6.8810E+06
/
! DATASET 48.1
CNTL
     CORE_POWER 99.1
     BANK_POS        -13
                        48 48 48 48 48
                  48 48 48 48 48 48 48 48 48
               48 36 48 16 48 48 48 16 48 36 48
               48 48 48 48 48 48 48 48 48 48 48
            48 48 24 48 10 48 48 48 10 48 24 48 48
            48 48 48 48 48 48 48 48 48 48 48 48 48
            48 32 48 12 48 18 48 18 48 12 48 32 48
            48 48 48 48 48 48 48 48 48 48 48 48 48
            48 48 24 48 10 48 48 48 10 48 24 48 48
               48 48 48 48 48 48 48 48 48 48 48
               48 36 48 16 48 48 48 16 48 36 48
                  48 48 48 48 48 48 48 48 48
                        48 48 48 48 48
DEPL
     TIME_STP -0.4212
TH
     STATE_CORE 8762.57 1216.85 6.9223E+06
/
! DATASET 49
CNTL
     CORE_POWER 99.3
     BANK_POS        -13
                        48 48 48 48 48
                  48 48 48 48 48 48 48 48 48
               48 48 36 48 16 48 16 48 36 48 48
               48 48 48 48 48 48 48 48 48 48 48
            48 48 48 24 48 12 48 12 48 24 48 48 48
            48 48 48 48 48 48 48 48 48 48 48 48 48
            48 34 48 10 48 18 48 18 48 10 48 34 48
            48 48 48 48 48 48 48 48 48 48 48 48 48
            48 48 48 24 48 12 48 12 48 24 48 48 48
```

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                48 48 48 48 48 48 48 48 48 48 48 48
                48 48 36 48 16 48 16 48 36 48 48
                   48 48 48 48 48 48 48 48 48
                         48 48 48 48 48
DEPL
     TIME_STP -0.2348
TH
     STATE_CORE 8762.57 1217.08 6.9499E+06
/
! DATASET 50
CNTL
     CORE_POWER 99.06
     BANK_POS        -13
                         48 48 48 48 48
                      48 48 48 34 48 34 48 48 48
                   48 48 48 48 48 48 48 48 48 48 48
                   48 48 42 48 12 48 12 48 42 48 48
               48 48 48 48 48 48 48 48 48 48 48 48 48
               48 34 48 12 48 18 48 18 48 12 48 34 48
               48 48 48 48 48 48 48 48 48 48 48 48 48
               48 34 48 12 48 18 48 18 48 12 48 34 48
               48 48 48 48 48 48 48 48 48 48 48 48 48
                   48 48 42 48 12 48 12 48 42 48 48
                   48 48 48 48 48 48 48 48 48 48 48
                      48 48 48 34 48 34 48 48 48
                            48 48 48 48 48
DEPL
     TIME_STP -0.8082
TH
     STATE_CORE 8773.66 1217.54 6.9085E+06
/
! DATASET 51
CNTL
     CORE_POWER 98.4
     BANK_POS        -13
                         48 48 48 48 48
                      48 48 48 34 48 34 48 48 48
                   48 48 48 48 48 48 48 48 48 48 48
                   48 48 42 48 14 48 14 48 42 48 48
               48 48 48 48 48 48 48 48 48 48 48 48 48
               48 34 48 14 48 20 48 20 48 14 48 34 48
               48 48 48 48 48 48 48 48 48 48 48 48 48
               48 34 48 14 48 20 48 20 48 14 48 34 48
               48 48 48 48 48 48 48 48 48 48 48 48 48
                   48 48 42 48 14 48 14 48 42 48 48
                   48 48 48 48 48 48 48 48 48 48 48
                      48 48 48 34 48 34 48 48 48
                            48 48 48 48 48
DEPL
     TIME_STP -0.4807
TH
     STATE_CORE 8829.13 1217.78 6.9085E+06
/
! DATASET 52
CNTL
     CORE_POWER 98.81
     BANK_POS        -13
                         48 48 48 48 48
                      48 48 48 34 48 34 48 48 48
                   48 48 48 48 48 48 48 48 48 48 48
                   48 48 42 48 14 48 14 48 42 48 48
               48 48 48 48 48 48 48 48 48 48 48 48 48
               48 34 48 14 48 20 48 20 48 14 48 34 48
               48 48 48 48 48 48 48 48 48 48 48 48 48
               48 34 48 14 48 20 48 20 48 14 48 34 48
               48 48 48 48 48 48 48 48 48 48 48 48 48
                   48 48 42 48 14 48 14 48 42 48 48
                   48 48 48 48 48 48 48 48 48 48 48
                      48 48 48 34 48 34 48 48 48
                            48 48 48 48 48
DEPL
     TIME_STP -0.1610
TH
     STATE_CORE 8718.19 1216.85 6.9223E+06
/
! DATASET 53
CNTL
     CORE_POWER 96.26
     BANK_POS        -13
                         48 48 48 48 48
                      48 48 48 34 48 34 48 48 48
                   48 48 48 48 48 48 48 48 48 48 48
                   48 48 42 48 12 48 12 48 42 48 48
               48 48 48 48 48 48 48 48 48 48 48 48 48
               48 34 48 12 48 20 48 20 48 12 48 34 48
               48 48 48 48 48 48 48 48 48 48 48 48 48
               48 34 48 12 48 20 48 20 48 12 48 34 48
               48 48 48 48 48 48 48 48 48 48 48 48 48
```

```
               48 48 42 48 12 48 12 48 42 48 48
               48 48 48 48 48 48 48 48 48 48 48
                  48 48 48 34 48 34 48 48 48
                        48 48 48 48 48
DEPL
     TIME_STP -0.1367
TH
     STATE_CORE 8895.69 1218.71 6.9085E+06
/
! DATASET 54
CNTL
     CORE_POWER 97.82
     BANK_POS        -13
                        48 48 48 48 48
                  48 48 48 36 48 36 48 48 48
               48 48 48 48 48 48 48 48 48 48 48
               48 48 48 48 14 48 14 48 48 48 48
            48 48 48 48 48 48 48 48 48 48 48 48 48
            48 36 48 14 48 48 48 48 48 14 48 36 48
            48 48 48 48 48 48 34 48 48 48 48 48 48
            48 36 48 14 48 48 48 48 48 14 48 36 48
            48 48 48 48 48 48 48 48 48 48 48 48 48
               48 48 48 48 14 48 14 48 48 48 48
               48 48 48 48 48 48 48 48 48 48 48
                  48 48 48 36 48 36 48 48 48
                        48 48 48 48 48
DEPL
     TIME_STP -0.1025
TH
     STATE_CORE 8884.59 1218.01 6.9361E+06
/
! DATASET 55
CNTL
     CORE_POWER 99.59
     BANK_POS        -13
                        48 48 48 48 48
                  48 48 48 36 48 36 48 48 48
               48 48 48 48 48 48 48 48 48 48 48
               48 48 48 48 16 48 16 48 48 48 48
            48 48 48 48 48 48 48 48 48 48 48 48 48
            48 36 48 16 48 48 48 48 48 16 48 36 48
            48 48 48 48 48 48 34 48 48 48 48 48 48
            48 36 48 16 48 48 48 48 48 16 48 36 48
            48 48 48 48 48 48 48 48 48 48 48 48 48
               48 48 48 48 16 48 16 48 48 48 48
               48 48 48 48 48 48 48 48 48 48 48
                  48 48 48 36 48 36 48 48 48
                        48 48 48 48 48
DEPL
     TIME_STP -0.1136
TH
     STATE_CORE 8840.22 1216.38 6.9361E+06
/
! DATASET 56
CNTL
     CORE_POWER 98.85
     BANK_POS        -13
                        48 48 48 48 48
                  48 48 48 36 48 36 48 48 48
               48 48 48 48 48 48 48 48 48 48 48
               48 48 48 48 18 48 18 48 48 48 48
            48 48 48 48 48 48 48 48 48 48 48 48 48
            48 36 48 18 48 48 48 48 48 18 48 36 48
            48 48 48 48 48 48 34 48 48 48 48 48 48
            48 36 48 18 48 48 48 48 48 18 48 36 48
            48 48 48 48 48 48 48 48 48 48 48 48 48
               48 48 48 48 18 48 18 48 48 48 48
               48 48 48 48 48 48 48 48 48 48 48
                  48 48 48 36 48 36 48 48 48
                        48 48 48 48 48
DEPL
     TIME_STP -0.1588
TH
     STATE_CORE 8740.38 1216.15 6.9361E+06
/
! DATASET 57
CNTL
     CORE_POWER 98.23
     BANK_POS        -13
                        48 48 48 48 48
                  48 48 48 36 48 36 48 48 48
               48 48 48 48 48 48 48 48 48 48 48
               48 48 48 48 18 48 18 48 48 48 48
            48 48 48 48 48 48 48 48 48 48 48 48 48
            48 36 48 18 48 48 48 48 48 18 48 36 48
            48 48 48 48 48 48 34 48 48 48 48 48 48
            48 36 48 18 48 48 48 48 48 18 48 36 48
            48 48 48 48 48 48 48 48 48 48 48 48 48
```

```
                48 48 48 48 18 48 18 48 48 48 48
                48 48 48 48 48 48 48 48 48 48 48
                   48 48 48 36 48 36 48 48 48
                         48 48 48 48 48
DEPL
     TIME_STP -0.0915
TH
     STATE_CORE 8840.22 1217.08 6.9292E+06
/
! DATASET 58
CNTL
     CORE_POWER 96.31
     BANK_POS        -13
                         48 48 48 48 48
                      48 48 48 36 48 36 48 48 48
                48 48 48 48 48 48 48 48 48 48 48
                48 48 48 48 18 48 18 48 48 48 48
             48 48 48 48 48 48 48 48 48 48 48 48 48
             48 36 48 18 48 48 48 48 48 18 48 36 48
             48 48 48 48 48 48 34 48 48 48 48 48 48
             48 36 48 18 48 48 48 48 48 18 48 36 48
             48 48 48 48 48 48 48 48 48 48 48 48 48
                48 48 48 48 18 48 18 48 48 48 48
                48 48 48 48 48 48 48 48 48 48 48
                   48 48 48 36 48 36 48 48 48
                         48 48 48 48 48
DEPL
     TIME_STP -0.1147
TH
     STATE_CORE 8895.69 1218.24 6.9223E+06
/
! DATASET 59
CNTL
     CORE_POWER 93.27
     BANK_POS        -13
                         48 48 48 48 48
                      48 48 48 36 48 36 48 48 48
                48 48 48 48 48 48 48 48 48 48 48
                48 48 48 48 18 48 18 48 48 48 48
             48 48 48 48 48 48 48 48 48 48 48 48 48
             48 36 48 18 48 48 48 48 48 18 48 36 48
             48 48 48 48 48 48 34 48 48 48 48 48 48
             48 36 48 18 48 48 48 48 48 18 48 36 48
             48 48 48 48 48 48 48 48 48 48 48 48 48
                48 48 48 48 18 48 18 48 48 48 48
                48 48 48 48 48 48 48 48 48 48 48
                   48 48 48 36 48 36 48 48 48
                         48 48 48 48 48
DEPL
     TIME_STP -0.2381
TH
     STATE_CORE 8784.75 1218.94 6.9017E+06
/
! DATASET EOC
CNTL
     CORE_POWER 93.27
     BANK_POS        -13
                         48 48 48 48 48
                      48 48 48 36 48 36 48 48 48
                48 48 48 48 48 48 48 48 48 48 48
                48 48 48 48 18 48 18 48 48 48 48
             48 48 48 48 48 48 48 48 48 48 48 48 48
             48 36 48 18 48 48 48 48 48 18 48 36 48
             48 48 48 48 48 48 34 48 48 48 48 48 48
             48 36 48 18 48 48 48 48 48 18 48 36 48
             48 48 48 48 48 48 48 48 48 48 48 48 48
                48 48 48 48 18 48 18 48 48 48 48
                48 48 48 48 48 48 48 48 48 48 48
                   48 48 48 36 48 36 48 48 48
                         48 48 48 48 48
DEPL
     TIME_STP -0.0044
TH
     STATE_CORE 8784.75 1218.94 6.9017E+06
.
```

APPENDIX D. PROGRAM TO COMPARE TIPS DATA FOR BWR

D.1 Program Source for TIP Comparison

```
      program CompareTips
      !
      implicit none
      !
      character(2) :: ss2
      character(3) :: ss3
      character(4) :: ss4
      character(5) :: ss5
      character(400) :: ssw
      integer :: i,j,k,m,n,iorder,icase,ipic,idum
      logical :: kr
      real :: sum0,dum,rmsn,rmsr,rmsa,total(1000),sum1,sum2,sum3
      character(30) :: file_tips,file_parcs_dpl,file_parcs_det
      integer :: levels,tstrings,ncases,npoints,ntipdata
      integer :: ndets,naxials
      !tips data
      type tips_type
        integer :: icase,ibu_parcs
        real :: power,burnup0,burnup,burnup_parcs
        real,allocatable :: tipdata(:,:),tipradial(:),tipaxial(:),tipdiff(:)
        logical,allocatable :: loctips(:)
        character(7),allocatable :: tipname(:)
      end type
      type(tips_type),pointer :: tips(:),tips_parcs(:)
      type(tips_type),pointer :: tip1,tip2
      real,allocatable :: axialrms(:),axialave(:),axialmax(:)
!
      !read input file
      open(1,file='comparetips.in',status='old')
      read(1,*) ss3,tstrings,levels   !# of detectors, # of axials
      read(1,*) ss3,file_tips         !tips measured data
      read(1,*) ss3,file_parcs_dpl    !parcs *.dpl file
      read(1,*) ss3,file_parcs_det    !parcs *.det file
!
      !read tips measured data
      open(11,file=file_tips,status='old')
      read(11,*)
      read(11,*) ncases,ndets,naxials
      if (ndets .ne. tstrings .or. naxials .ne. levels) then
        write(6,*) "Error: ndets .ne. tstrings .or. naxials .ne. levels"
        stop
      endif
      allocate(tips(ncases))
      do i=1,ncases
        allocate(tips(i)%tipdata(ndets,naxials))
        allocate(tips(i)%tipname(ndets))
        allocate(tips(i)%tipradial(ndets))
        allocate(tips(i)%tipaxial(naxials))
        allocate(tips(i)%tipdiff(ndets))
        allocate(tips(i)%loctips(ndets))
        read(11,*) ss4,tips(i)%icase,tips(i)%power,tips(i)%burnup0, &
                   tips(i)%burnup,tips(i)%burnup_parcs,tips(i)%ibu_parcs
        read(11,*) (tips(i)%tipname(j),j=1,ndets)
        do k=1,naxials
          read(11,*) (tips(i)%tipdata(j,k),j=1,ndets)
        enddo
      enddo
      close(11)
!
      !read the PARCS output
      open(12,file=file_parcs_dpl,status='old')
      read(12,*); read(12,*); read(12,*); read(12,*);
      read(12,*) ss2
      if (ss2 .ne. 'PT') then
        write(6,*) "Error: data structure is wrong!"
        stop
      endif
      do i=1,1000
        read(12,'(a400)',end=111) ssw
        read(ssw,*,err=111) iorder
      enddo
  111 continue
      npoints=iorder
      allocate(tips_parcs(npoints))
```

```
      rewind(12)
      read(12,*); read(12,*); read(12,*); read(12,*); read(12,*)
      do i=1,npoints
        read(12,'(a400)') ssw
        read(ssw(70:80),*) tips_parcs(i)%burnup_parcs
      enddo
      close(12)
!
      !read the PARCS TIPS data axially reverse order
      open(13,file=file_parcs_det,status='old')
      read(13,*)
      do i=1,npoints
        allocate(tips_parcs(i)%tipdata(ndets,naxials))
        allocate(tips_parcs(i)%tipname(ndets))
        allocate(tips_parcs(i)%tipradial(ndets))
        allocate(tips_parcs(i)%tipaxial(naxials))
        read(13,*) ss5,ss5,ss5,ss5,(tips_parcs(i)%tipname(j),j=1,ndets)
        do k=naxials,1,-1
          read(13,*) dum,idum,idum,idum,(tips_parcs(i)%tipdata(j,k),j=1,ndets)
        enddo
      enddo
      close(13)
!
      ! normalize psrcs tip data
      do i=1,npoints
        sum0=0.0
        do j=1,tstrings
          do k=1,levels
            sum0=sum0+tips_parcs(i)%tipdata(j,k)
          enddo
        enddo
        do j=1,tstrings
          do k=1,levels
            tips_parcs(i)%tipdata(j,k)=tips_parcs(i)%tipdata(j,k)/sum0*float(tstrings*levels)
          enddo
        enddo
      enddo
!
      !calculate average power shape information
      !initialization
      do i=1,npoints
        tips_parcs(i)%tipradial(:)=0.0
        tips_parcs(i)%tipaxial(:)=0.0
        total(i)=0.0
      enddo
      !calculate radial
      do i=1,npoints
        do j=1,tstrings
          do k=1,levels
            tips_parcs(i)%tipradial(j)=tips_parcs(i)%tipradial(j)+tips_parcs(i)%tipdata(j,k)
            total(i)=total(i)+tips_parcs(i)%tipdata(j,k)
          enddo
        enddo
      enddo
      ! normalize radial
      do i=1,npoints
        do j=1,tstrings
          tips_parcs(i)%tipradial(j)=tips_parcs(i)%tipradial(j)/total(i)*float(tstrings)
        enddo
      enddo
!
      ! calculate axial
      do i=1,npoints
        do k=1,levels
          do j=1,tstrings
            tips_parcs(i)%tipaxial(k)=tips_parcs(i)%tipaxial(k)+tips_parcs(i)%tipdata(j,k)
          enddo
        enddo
      enddo
      ! normalize axial
      do i=1,npoints
        total(i)=0.0
      enddo
      do i=1,npoints
        do k=1,levels
          total(i)=total(i)+tips_parcs(i)%tipaxial(k)
        enddo
      enddo
      do i=1,npoints
        do k=1,levels
          tips_parcs(i)%tipaxial(k)=tips_parcs(i)%tipaxial(k)/total(i)*float(levels)
```

```
      enddo
    enddo

!   Loop over the measured cases ================================
    open(2,file='CompareTips.out',status='unknown')
    open(3,file='CompareTips_detail.out',status='unknown')
    open(4,file='CompareTips.sum',status='unknown')
    allocate(axialrms(tstrings),axialave(tstrings),axialmax(tstrings))
    do icase=1,ncases
      tip1=>tips(icase)
      !normalize measured tips data
      sum0=0.0
      do j=1,tstrings
        do k=1,levels
          sum0=sum0+tip1%tipdata(j,k)
        enddo
      enddo
      do j=1,tstrings
        do k=1,levels
          tip1%tipdata(j,k)=tip1%tipdata(j,k)/sum0*float(tstrings*levels)
        enddo
      enddo
      !calculate radial array with normalization
      tip1%tipradial(:)=0.0
      sum0=0.0
      do j=1,tstrings
        do k=1,levels
          tip1%tipradial(j)=tip1%tipradial(j)+tip1%tipdata(j,k)
          sum0=sum0+tip1%tipdata(j,k)
        enddo
      enddo
      do j=1,tstrings
        tip1%tipradial(j)=tip1%tipradial(j)/sum0*float(tstrings)
      enddo
      !calculate axial array with normalization
      tip1%tipaxial(:)=0.0
      sum0=0.0
      do k=1,levels
        do j=1,tstrings
          tip1%tipaxial(k)=tip1%tipaxial(k)+tip1%tipdata(j,k)
          sum0=sum0+tip1%tipdata(j,k)
        enddo
      enddo
      do k=1,levels
        tip1%tipaxial(k)=tip1%tipaxial(k)/sum0*float(levels)
      enddo
!
      !search for the corresponding parcs burnup point
      ipic=tip1%ibu_parcs
      tip2=>tips_parcs(ipic)
      !check the consistency for detector names
      kr=.false.
      do j=1,tstrings
        if (tip1%tipname(j) .ne. tip2%tipname(j)) then
          write(6,*) "Error: TIP names are different!",j, &
                     tips(icase)%tipname(j),tip2%tipname(j)
          stop
        endif
      enddo
      !compare
      rmsn=0.0
      rmsr=0.0
      rmsa=0.0
      do j=1,tstrings
        do k=1,levels
          rmsn=rmsn+(tip1%tipdata(j,k)-tip2%tipdata(j,k))**2
        enddo
        rmsr=rmsr+(tip1%tipradial(j)-tip2%tipradial(j))**2
        tip1%tipdiff(j)=(tip2%tipradial(j)-tip1%tipradial(j))*100.0
      enddo

      do k=1,levels
        rmsa=rmsa+(tip1%tipaxial(k)-tip2%tipaxial(k))**2
      enddo

      rmsn=sqrt(rmsn/float(tstrings*levels))*100.0
      rmsr=sqrt(rmsr/float(tstrings))*100.0
      rmsa=sqrt(rmsa/float(levels))*100.0
      ! print outputs

      write(2,'(a6,i4,2x,70("-"))')     '$CASE:',icase
```

```
      write(2,*)
      write(2,*)'@general information'
      write(2,'(2x,a37,f6.0)')'core exposure [mwd/short-ton]:      ',tip1%burnup0
      write(2,'(2x,a37,f6.3)')'core exposure [gwd/tonne]:          ',tip1%burnup
      write(2,'(2x,a37,f6.3)')'parcs core exposure [gwd/tonne]:    ',tip2%burnup_parcs
      write(2,'(2x,a37,i2)')  'depletion point in parcs:           ',ipic
      write(2,'(2x,a37,i2)')  'associated dataset:                 ',tip1%icase
      write(2,'(2x,a37,f5.2)')'3D nodal rms difference [%]:        ',rmsn
      write(2,'(2x,a37,f5.2)')'radial rms difference [%]:          ',rmsr
      write(2,'(2x,a37,f5.2)')'axial rms difference [%]:           ',rmsa
      write(2,*)

      if (icase == 1) write(4,*) "SUMMARY"
      write(4,'(i5,f9.3,3f8.2)') icase,tip2%burnup_parcs,rmsn,rmsr,rmsa

      write(2,*)'@axially integrated radial distribution'
      write(2,*)'  tip name'
      write(2,*)'  calculated'
      write(2,*)'  measured'
      write(2,*)'  difference(%)'
      write(2,*)' '
      write(2,fmt='(1x,6a10)') ' ',(tip1%tipname(m),m=27,31)
      write(2,fmt='(1a10,5f10.4)') ' ',(tip2%tipradial(m),m=27,31)
      write(2,fmt='(1a10,5f10.4)') ' ',(tip1%tipradial(m),m=27,31)
      write(2,fmt='(1a10,5f10.3)') ' ',(tip1%tipdiff(m),m=27,31)
      !write(2,*)
      write(2,fmt='(1x,6a10)') (tip1%tipname(m),m=21,26)
      write(2,fmt='(6f10.4)') (tip2%tipradial(m),m=21,26)
      write(2,fmt='(6f10.4)') (tip1%tipradial(m),m=21,26)
      write(2,fmt='(6f10.3)') (tip1%tipdiff(m),m=21,26)
      !write(2,*)
      write(2,fmt='(1x,6a10)') (tip1%tipname(m),m=15,20)
      write(2,fmt='(6f10.4)') (tip2%tipradial(m),m=15,20)
      write(2,fmt='(6f10.4)') (tip1%tipradial(m),m=15,20)
      write(2,fmt='(6f10.3)') (tip1%tipdiff(m),m=15,20)
      !write(2,*)
      write(2,fmt='(1x,6a10)') (tip1%tipname(m),m=9,14)
      write(2,fmt='(6f10.4)') (tip2%tipradial(m),m=9,14)
      write(2,fmt='(6f10.4)') (tip1%tipradial(m),m=9,14)
      write(2,fmt='(6f10.3)') (tip1%tipdiff(m),m=9,14)
      !write(2,*)
      write(2,fmt='(1x,6a10)') ' ',(tip1%tipname(m),m=4,8)
      write(2,fmt='(1a10,5f10.4)') ' ',(tip2%tipradial(m),m=4,8)
      write(2,fmt='(1a10,5f10.4)') ' ',(tip1%tipradial(m),m=4,8)
      write(2,fmt='(1a10,5f10.3)') ' ',(tip1%tipdiff(m),m=4,8)
      !write(2,*)
      write(2,fmt='(1x,6a10)') ' ',' ',(tip1%tipname(m),m=1,3),' '
      write(2,fmt='(2a10,3f10.4,1a10)') ' ',' ',(tip2%tipradial(m),m=1,3),' '
      write(2,fmt='(2a10,3f10.4,1a10)') ' ',' ',(tip1%tipradial(m),m=1,3),' '
      write(2,fmt='(2a10,3f10.3,1a10)') ' ',' ',(tip1%tipdiff(m),m=1,3),' '
      write(2,*)' '
      write(2,*)'@radially integrated axial distribution'
      write(2,*)
      sum0=sum(tip1%tipaxial(:))
      sum1=sum(tip1%tipaxial(1:levels/2))
      sum2=sum(tip2%tipaxial(:))
      sum3=sum(tip2%tipaxial(1:levels/2))
      write(2,*)
      write(2,'("   node    calc.     meas.     diff.(%)")')
      do k=levels,1,-1
        write(2,'(2x,i4,2f10.4,f10.2)') k,tip2%tipaxial(k),tip1%tipaxial(k), &
                                 (tip2%tipaxial(k)-tip1%tipaxial(k))*100.0
      enddo
      write(2,*)
      write(2,'(6x,2f10.4,f10.2,"  axial offset")') 1.0-2.0*sum3/sum2, &
                             1.0-2.0*sum1/sum0,-2.0*(sum3/sum2-sum1/sum0)*100.0
      write(2,*)
!
      write(3,'(a6,i4,2x,70("-"))')     '$CASE:',icase
      write(3,*)
      write(3,*)'@general information'
      write(3,'(2x,a37,f6.0)')'core exposure [mwd/short-ton]:      ',tip1%burnup0
      write(3,'(2x,a37,f6.3)')'core exposure [gwd/tonne]:          ',tip1%burnup
      write(3,'(2x,a37,f6.3)')'parcs core exposure [gwd/tonne]:    ',tip2%burnup_parcs
      write(3,'(2x,a37,i2)')  'depletion point in parcs:           ',ipic
      write(3,'(2x,a37,i2)')  'associated dataset:                 ',tip1%icase
      write(3,'(2x,a37,f5.2)')'3D nodal rms difference [%]:        ',rmsn
      write(3,'(2x,a37,f5.2)')'radial rms difference [%]:          ',rmsr
      write(3,'(2x,a37,f5.2)')'axial rms difference [%]:           ',rmsa
      write(3,*)
      write(3,'(2x,80a14)') (tip1%tipname(j),j=1,tstrings)
```

```
axialrms(:)=0.0
axialave(:)=0.0
axialmax(:)=0.0
do k=1,levels
  do j=1,tstrings
    axialrms(j)=axialrms(j)+(tip1%tipdata(j,k)-tip2%tipdata(j,k))**2
    axialave(j)=axialave(j)+(tip2%tipdata(j,k)-tip1%tipdata(j,k))
    if (abs(tip2%tipdata(j,k)-tip1%tipdata(j,k)) > abs(axialmax(j))) then
      axialmax(j)=tip2%tipdata(j,k)-tip1%tipdata(j,k)
    endif
  enddo
enddo
tips(icase)%loctips(:)=.true.
do j=1,tstrings
  axialrms(j)=sqrt(axialrms(j)/float(levels))
  axialave(j)=axialave(j)/float(levels)
  if (abs(axialmax(j)*100.0) > 30.0 .or. axialrms(j)*100.0 > 20.0) then
    tips(icase)%loctips(j)=.false.
  endif
enddo
do k=1,levels
  write(3,'(i4,80(2f6.3,2x))') k,(tip1%tipdata(j,k),tip2%tipdata(j,k),j=1,tstrings)
enddo
write(3,*)
write(3,'(a4,80(6x,f6.2,2x))') " RMS",(axialrms(j)*100.0,j=1,tstrings)
write(3,'(a4,80(6x,f6.2,2x))') " AVE",(axialave(j)*100.0,j=1,tstrings)
write(3,'(a4,80(6x,f6.2,2x))') " MAX",(axialmax(j)*100.0,j=1,tstrings)
write(3,*)
!
!compare
rmsn=0.0
rmsr=0.0
rmsa=0.0
ntipdata=0
do j=1,tstrings
  if (.not.tips(icase)%loctips(j)) cycle
  ntipdata=ntipdata+1
enddo
!Renormalization
!normalize measured tips data
sum0=0.0
do j=1,tstrings
  if (.not.tips(icase)%loctips(j)) cycle
  do k=1,levels
    sum0=sum0+tip1%tipdata(j,k)
  enddo
enddo
do j=1,tstrings
  if (.not.tips(icase)%loctips(j)) cycle
  do k=1,levels
    tip1%tipdata(j,k)=tip1%tipdata(j,k)/sum0*float(ntipdata*levels)
  enddo
enddo
!calculate radial array with normalization
sum0=0.0
tip1%tipradial(:)=0.0
do j=1,tstrings
  if (.not.tips(icase)%loctips(j)) cycle
  do k=1,levels
    tip1%tipradial(j)=tip1%tipradial(j)+tip1%tipdata(j,k)
    sum0=sum0+tip1%tipdata(j,k)
  enddo
enddo
do j=1,tstrings
  if (.not.tips(icase)%loctips(j)) cycle
  tip1%tipradial(j)=tip1%tipradial(j)/sum0*float(ntipdata)
enddo
!calculate axial array with normalization
tip1%tipaxial(:)=0.0
sum0=0.0
do k=1,levels
  do j=1,tstrings
  if (.not.tips(icase)%loctips(j)) cycle
    tip1%tipaxial(k)=tip1%tipaxial(k)+tip1%tipdata(j,k)
    sum0=sum0+tip1%tipdata(j,k)
  enddo
enddo
do k=1,levels
  tip1%tipaxial(k)=tip1%tipaxial(k)/sum0*float(levels)
enddo
!normalize calculated tips data
```

```
        sum0=0.0
        do j=1,tstrings
          if (.not.tips(icase)%loctips(j)) cycle
          do k=1,levels
            sum0=sum0+tip2%tipdata(j,k)
          enddo
        enddo
        do j=1,tstrings
          if (.not.tips(icase)%loctips(j)) cycle
          do k=1,levels
            tip2%tipdata(j,k)=tip2%tipdata(j,k)/sum0*float(ntipdata*levels)
          enddo
        enddo
        !calculate radial array with normalization
        sum0=0.0
        tip2%tipradial(:)=0.0
        do j=1,tstrings
          if (.not.tips(icase)%loctips(j)) cycle
          do k=1,levels
            tip2%tipradial(j)=tip2%tipradial(j)+tip2%tipdata(j,k)
            sum0=sum0+tip2%tipdata(j,k)
          enddo
        enddo
        do j=1,tstrings
          if (.not.tips(icase)%loctips(j)) cycle
          tip2%tipradial(j)=tip2%tipradial(j)/sum0*float(ntipdata)
        enddo
        !calculate axial array with normalization
        tip2%tipaxial(:)=0.0
        sum0=0.0
        do k=1,levels
          do j=1,tstrings
          if (.not.tips(icase)%loctips(j)) cycle
            tip2%tipaxial(k)=tip2%tipaxial(k)+tip2%tipdata(j,k)
            sum0=sum0+tip2%tipdata(j,k)
          enddo
        enddo
        do k=1,levels
          tip2%tipaxial(k)=tip2%tipaxial(k)/sum0*float(levels)
        enddo
!
        do j=1,tstrings
          if (.not.tips(icase)%loctips(j)) cycle
          do k=1,levels
            rmsn=rmsn+(tip1%tipdata(j,k)-tip2%tipdata(j,k))**2
          enddo
          rmsr=rmsr+(tip1%tipradial(j)-tip2%tipradial(j))**2
          tip1%tipdiff(j)=(tip2%tipradial(j)-tip1%tipradial(j))*100.0
        enddo
        do k=1,levels
          rmsa=rmsa+(tip1%tipaxial(k)-tip2%tipaxial(k))**2
        enddo

        rmsn=sqrt(rmsn/float(tstrings*levels))*100.0
        rmsr=sqrt(rmsr/float(tstrings))*100.0
        rmsa=sqrt(rmsa/float(levels))*100.0
!
        write(3,*) "Statistics with removing bad data"
        write(3,'(2x,a37,f5.2)')'3D nodal rms difference [%]:        ',rmsn
        write(3,'(2x,a37,f5.2)')'radial rms difference [%]:          ',rmsr
        write(3,'(2x,a37,f5.2)')'axial rms difference [%]:           ',rmsa
        write(3,'(2x,a37,2i5)') 'Number of TIPS:                     ',ntipdata,tstrings
        write(3,*)
!
      enddo
      close(2)

      write(6,*)'Completed!!!'

      end program CompareTips
```

D.2 Cycle 1 Input for TIP Comparison

```
DIM  31  24                !# of detectors, # of axials
TIP  H1C1_tips.det         !# of TIPS measure data
DPL  H1C1.parcs_dpl        !PARCS output summary
DET  H1C1.parcs_det        !PARCS TIPS calculated data
```

D.3 Cycle 2 Input for TIP Comparison

```
DIM  31  24                !# of detectors, # of axials
TIP  H1C2_tips.det         !# of TIPS measure data
DPL  H1C2.parcs_dpl        !PARCS output summary
DET  H1C2.parcs_det        !PARCS TIPS calculated data
```

D.4 Cycle 3 Input for TIP Comparison

```
DIM  31  24                !# of detectors, # of axials
TIP  H1C3_tips.det         !# of TIPS measure data
DPL  H1C3.parcs_dpl        !PARCS output summary
DET  H1C3.parcs_det        !PARCS TIPS calculated data
```

D.5 Cycle 1 TIP Measured Data

```
HATCH CYCLE-1
HATCH CYCLE-1
20  31  24  !cases, # of detectors, # of axials (opposite direction to PARCS)
@set    3   1218    637 0.702   0.702   10  !power, #, MWD/ton, MWD/kgU, PARCS, PARCS #
TIP2005 TIP2805 TIP3605 TIP1213 TIP2013 TIP2813 TIP3613 TIP4413 TIP0421 TIP1221 TIP2021 TIP2821 TIP3621 TIP4421 TIP0429 TIP1229 TIP2029 TIP2829 TIP3629 TIP4429 TIP0437 TIP1237 TIP2037 TIP2837 TIP3637 TIP4437 TIP1245 TIP2045 TIP2845 TIP3645 TIP4445
100.0   125.8   91.2    99.9    118.1   120.8   116.8   88.7    130.5   126.5   111.7   113.7   116.8   117.2   133.3   118.5   106.3   98.3    111.9   114.1   100.3   122.2   109.1   98.4    114.4   66.6    80.2    129.5   116.6   103.4   51.6
134.1   147.4   116.5   131.6   140.8   139.3   136.7   115.3   152.1   146.4   129.3   127.3   135.9   143.0   151.4   138.9   123.2   118.8   127.3   140.0   124.7   144.9   131.4   121.5   135.9   107.4   107.6   146.9   135.8   127.4   69.5
155.8   155.6   136.3   155.4   157.4   148.6   154.1   136.6   166.1   161.6   136.0   132.8   146.2   161.4   161.1   151.7   131.0   128.5   133.5   152.7   143.8   161.6   143.7   132.3   148.5   141.6   132.5   158.9   143.5   145.5   88.9
163.3   160.4   148.8   175.3   172.8   156.2   175.5   158.9   174.9   178.2   141.4   136.7   154.5   176.8   167.0   159.0   135.6   133.4   139.4   159.8   155.9   180.8   152.4   137.7   159.3   156.1   154.3   174.8   149.6   165.2   111.6
163.1   150.1   148.4   187.4   178.4   150.2   182.9   168.2   169.4   181.8   135.0   130.5   149.7   179.8   158.8   155.4   129.6   129.4   133.7   154.7   152.9   182.6   147.9   134.4   160.8   177.2   167.0   176.3   143.0   174.0   128.8
152.5   137.5   138.3   184.9   172.9   141.6   175.4   163.1   153.7   176.8   125.7   120.8   140.1   170.7   144.2   145.7   120.1   120.8   125.0   146.8   143.9   177.3   139.0   124.5   154.6   181.3   166.1   166.2   132.0   171.2   130.1
138.2   125.1   124.7   172.4   158.3   131.0   163.3   152.4   139.2   164.3   115.8   111.8   128.2   156.6   129.3   132.6   110.5   110.1   116.0   134.1   129.9   164.5   128.1   115.5   145.5   174.0   153.6   151.6   120.1   157.4   124.0
130.2   115.6   115.6   163.1   150.2   124.1   153.9   143.9   127.7   155.4   110.0   106.1   121.8   149.7   120.9   123.4   104.7   105.1   109.6   126.9   120.7   155.6   120.9   110.6   139.5   161.7   147.8   141.4   114.1   148.0   118.1
118.5   104.2   105.2   148.4   136.2   114.7   138.7   129.3   114.9   141.5   100.7   97.4    112.9   135.0   108.2   113.8   96.4    96.3    102.0   115.5   108.8   141.4   110.9   102.8   129.6   150.3   133.9   127.0   105.2   134.4   106.8
108.1   95.6    96.0    136.8   126.7   107.6   128.4   120.3   105.3   131.4   93.9    92.4    105.8   123.4   99.4    108.9   90.8    90.6    96.6    105.5   101.5   131.7   103.8   95.5    120.3   136.2   122.8   116.1   96.8    124.8   97.7
101.8   92.4    90.9    129.1   123.3   105.0   124.1   114.6   99.8    129.0   93.3    91.5    103.0   119.6   94.1    107.0   90.4    89.4    96.0    101.5   95.8    127.9   100.7   93.4    118.0   125.0   113.6   113.0   93.7    120.1   91.9
97.0    89.6    86.5    125.7   121.5   103.2   120.3   111.6   96.1    123.9   94.1    91.2    102.7   117.2   91.6    105.0   90.4    90.3    96.1    99.8    92.2    124.0   99.4    93.3    115.4   121.8   108.2   111.7   91.4    115.7   88.0
93.0    85.5    82.0    122.5   119.5   100.2   115.9   107.4   90.3    120.0   94.1    89.8    100.9   114.9   88.0    102.4   90.4    91.1    94.8    97.7    86.5    118.7   97.5    93.0    110.6   118.1   101.6   107.5   88.4    111.1   82.8
88.4    83.6    78.3    116.6   118.5   100.3   113.5   101.4   87.0    113.9   94.2    89.9    99.5    110.4   85.9    100.0   89.4    90.0    94.7    94.6    81.7    116.5   95.3    91.0    107.8   112.2   94.4    106.2   86.4    107.2   78.0
87.5    82.0    76.6    116.0   116.4   100.1   112.9   99.3    84.9    111.5   94.6    91.6    101.1   109.1   85.0    100.6   90.1    90.6    95.1    94.0    79.2    115.8   96.5    92.4    105.0   109.3   92.4    105.0   85.6    105.6   75.5
85.7    81.1    75.2    115.4   116.6   102.3   112.2   97.2    83.7    113.3   97.4    94.2    101.3   107.3   83.6    100.1   91.4    93.2    97.0    93.8    76.4    116.3   97.3    93.5    104.1   105.9   89.4    103.9   85.2    103.3   73.3
81.9    76.8    71.5    110.5   113.2   99.9    108.1   90.8    80.8    111.9   96.4    94.2    98.8    102.4   80.1    96.6    90.9    92.6    96.6    90.6    70.7    112.7   95.4    92.3    100.3   103.6   83.9    99.4    82.3    97.9    68.7
82.4    78.9    72.4    111.2   117.3   104.9   110.8   90.3    82.1    116.4   102.9   101.5   104.1   104.3   82.2    100.9   95.5    98.8    102.1   93.4    70.3    115.6   100.4   96.5    104.0   99.6    83.5    100.8   85.0    98.7    68.1
80.4    77.9    68.6    110.5   117.4   106.6   109.4   87.6    79.2    115.6   107.0   105.9   106.1   103.7   80.6    102.6   100.3   103.9   106.4   95.1    67.2    113.8   102.4   100.2   105.5   100.7   82.1    99.2    85.1    96.1    65.1
74.5    72.9    61.7    102.5   109.1   104.2   102.0   80.6    72.2    109.2   107.2   105.4   102.6   96.7    74.9    100.9   100.8   105.7   105.9   91.8    61.2    106.6   100.9   100.2   102.8   96.2    76.5    91.2    81.6    88.2    59.1
66.1    66.7    54.9    90.4    99.6    101.4   92.2    71.6    64.2    99.0    105.7   104.4   99.2    86.9    67.7    97.6    99.7    105.0   104.2   86.9    54.6    95.5    97.4    97.3    97.6    86.4    68.0    82.3    78.0    78.0    51.9
58.2    57.7    46.8    79.4    87.5    90.4    80.0    62.0    54.5    86.4    98.5    94.5    92.1    77.6    58.2    91.7    95.3    99.1    95.5    80.7    46.6    82.6    91.8    93.3    88.7    77.8    60.2    70.0    72.1    67.5    44.3
41.7    38.7    31.4    55.3    59.8    62.4    53.3    42.8    36.4    57.8    69.9    64.7    65.3    54.1    39.1    66.4    68.8    70.9    66.6    57.9    31.0    56.3    66.9    70.1    62.7    62.6    43.1    46.3    50.9    46.2    29.8
27.2    24.6    19.7    35.9    38.9    40.0    33.8    26.9    22.7    37.6    44.6    41.3    42.9    34.2    24.6    43.2    45.7    48.3    42.7    37.6    19.4    36.7    43.9    46.7    40.9    44.1    27.0    30.3    32.7    28.6    19.0
@set    4   2189    1163    1.282   1.282   14  !power, #, MWD/ton,    MWD/kgU
TIP2005 TIP2805 TIP3605 TIP1213 TIP2013 TIP2813 TIP3613 TIP4413 TIP0421 TIP1221 TIP2021 TIP2821 TIP3621 TIP4421 TIP0429 TIP1229 TIP2029 TIP2829 TIP3629 TIP4429 TIP0437 TIP1237 TIP2037 TIP2837 TIP3637 TIP4437 TIP1245 TIP2045 TIP2845 TIP3645 TIP4445
58.4    57.7    39.3    62.5    64.6    57.5    63.3    61.9    72.5    75.8    56.4    39.4    66.7    69.8    72.8    67.0    45.7    21.4    62.4    66.0    59.6    77.4    61.1    54.4    70.2    43.7    56.8    77.2    67.1    66.2    40.0
94.3    93.6    73.4    107.9   101.5   92.9    103.2   102.2   103.6   108.5   82.8    65.9    96.9    106.9   102.4   97.1    69.7    43.6    88.4    100.7   86.9    115.0   91.6    92.4    103.9   84.9    95.7    108.6   94.8    100.2   66.7
110.9   109.2   96.2    132.7   122.0   107.5   126.5   122.0   116.9   126.1   93.2    82.2    109.6   124.6   111.2   100.8   83.2    65.5    97.5    113.5   105.3   133.0   103.6   92.9    115.6   115.2   117.1   123.8   103.8   117.3   85.5
120.0   115.9   107.3   146.4   138.4   116.9   142.6   133.4   128.3   142.9   103.8   94.4    119.0   137.2   119.1   118.7   95.1    81.3    105.6   120.9   116.3   148.9   114.1   100.9   126.4   130.9   133.2   138.1   111.6   134.0   99.0
119.9   115.2   112.9   149.5   142.1   119.1   148.0   132.9   124.7   144.1   106.4   102.0   119.0   139.2   115.7   119.8   100.6   95.8    106.4   121.0   114.6   148.3   115.6   103.1   127.2   144.6   134.1   135.3   109.3   136.4   100.5
112.4   109.0   107.1   142.6   137.4   114.0   142.3   125.0   115.3   136.0   105.5   103.4   114.0   130.3   107.6   115.0   102.1   101.8   103.5   114.9   106.7   139.8   110.2   101.4   121.6   142.9   125.9   127.1   101.5   128.8   94.1
103.1   98.4    96.3    130.1   126.6   108.2   129.4   111.0   104.7   127.9   104.4   105.2   107.0   120.4   96.9    107.0   103.9   103.0   103.4   106.5   96.9    127.6   105.3   100.0   114.1   132.0   112.2   116.6   93.5    116.3   86.3
99.1    93.2    90.4    122.9   122.9   108.0   122.6   107.1   98.7    124.5   105.7   114.9   107.4   115.4   93.7    108.2   111.7   108.9   110.9   102.6   91.6    123.9   106.3   105.7   112.8   121.0   106.7   110.2   90.3    111.2   81.9
91.6    85.8    83.8    113.9   116.3   105.0   112.6   98.6    89.6    116.9   104.7   119.2   104.7   107.4   87.3    102.4   116.6   111.7   112.7   95.1    83.9    112.9   102.6   108.2   106.5   114.4   97.6    100.4   84.2    102.3   74.0
84.5    78.1    76.8    105.7   111.6   100.7   104.4   90.6    83.7    110.6   104.1   121.7   101.1   100.7   80.5    100.0   120.6   111.5   114.7   88.3    78.6    105.9   99.7    110.8   101.1   103.9   89.2    92.7    79.5    93.9    67.9
81.4    74.5    72.2    99.4    109.4   99.5    99.0    87.3    80.7    110.9   107.7   124.3   102.7   98.1    76.6    101.2   125.8   113.3   118.2   87.2    75.4    104.6   100.6   114.7   100.8   95.8    83.9    92.1    79.1    91.1    66.2
81.0    74.9    71.1    100.9   112.3   102.1   100.3   86.8    79.6    110.7   112.2   127.7   105.5   98.0    78.2    102.3   129.0   119.5   122.0   88.9    72.9    105.6   102.3   117.9   100.6   95.9    82.5    92.7    78.9    91.4    64.6
78.4    73.6    63.6    99.4    110.6   101.5   98.9    83.9    75.8    107.4   112.5   128.5   104.5   95.8    76.4    102.1   127.1   122.1   121.0   87.9    68.9    101.9   102.4   117.9   98.3    93.6    79.1    89.5    76.8    88.4    61.6
74.0    70.4    64.0    94.6    107.9   98.3    94.5    79.3    73.2    103.0   112.1   125.0   102.5   93.2    75.0    100.1   125.6   119.3   118.7   84.6    68.6    99.2    100.7   114.7   95.2    88.9    74.0    89.1    75.5    85.3    58.9
74.9    72.1    64.6    95.9    110.1   102.6   96.5    79.6    73.5    103.7   113.4   127.0   105.8   95.7    76.3    102.9   127.0   121.3   122.2   86.9    66.3    101.2   102.8   117.1   96.0    87.5    74.1    90.4    78.1    86.2    58.4
75.6    73.2    64.0    97.3    113.2   107.0   99.0    79.4    74.3    107.0   115.5   129.2   106.9   97.8    77.6    105.4   127.3   120.8   125.1   89.8    65.3    102.9   105.6   119.6   96.8    87.7    73.7    91.2    80.2    86.8    56.2
71.7    70.9    61.5    93.3    109.3   106.1   95.0    74.3    70.2    106.1   112.0   123.9   103.3   94.0    75.0    103.6   120.5   119.8   120.9   89.5    59.9    99.3    101.1   115.3   93.1    87.1    69.7    87.4    79.8    81.9    54.5
73.0    73.8    60.1    93.1    112.8   114.2   95.7    73.6    72.5    111.2   116.4   126.5   107.8   96.4    78.0    112.5   123.4   116.4   125.3   97.6    60.3    101.9   105.5   119.4   96.9    82.9    69.5    91.2    88.4    82.7    54.3
72.3    75.9    60.4    94.0    113.6   122.7   97.1    73.9    72.0    112.2   120.3   128.0   111.2   96.0    78.9    120.0   124.3   120.0   127.6   105.1   58.6    102.7   110.3   122.9   100.4   84.6    69.0    92.2    94.1    82.8    52.8
67.2    72.2    56.1    89.4    106.4   119.3   93.4    67.6    65.6    104.3   116.5   121.8   107.8   92.6    72.6    115.2   116.4   119.0   119.8   102.2   53.1    96.5    107.9   116.8   96.6    83.3    65.1    84.4    90.3    76.2    47.8
58.8    63.8    48.7    77.8    93.2    106.4   82.6    58.3    57.8    92.3    108.0   108.3   100.3   81.2    64.5    103.6   104.9   110.4   106.7   91.5    47.2    85.1    101.2   104.4   91.0    73.3    56.6    75.0    81.5    66.4    41.6
51.6    57.4    43.3    68.2    81.5    94.4    73.9    51.3    49.7    79.8    95.2    96.6    90.1    71.2    55.1    91.0    92.3    104.6   91.6    80.6    40.4    73.6    92.0    92.4    82.2    65.4    50.4    63.6    71.5    57.6    35.6
36.1    41.3    32.8    49.1    56.2    66.9    53.7    36.3    32.8    53.1    65.8    67.7    62.1    49.9    36.6    63.7    84.5    87.0    61.4    55.7    26.9    50.0    64.5    65.6    57.4    53.5    36.4    42.0    48.5    39.3    24.1
22.5    26.5    21.8    31.4    35.2    41.6    35.4    22.5    20.6    34.7    41.9    43.9    40.5    31.8    22.6    41.3    42.7    61.9    38.8    34.7    16.9    32.5    40.4    41.4    36.8    38.3    23.5    25.6    29.7    24.9    14.7
@set    6   2331    2344    2.584   2.584   22  !power, #, MWD/ton,    MWD/kgU
TIP2005 TIP2805 TIP3605 TIP1213 TIP2013 TIP2813 TIP3613 TIP4413 TIP0421 TIP1221 TIP2021 TIP2821 TIP3621 TIP4421 TIP0429 TIP1229 TIP2029 TIP2829 TIP3629 TIP4429 TIP0437 TIP1237 TIP2037 TIP2837 TIP3637 TIP4437 TIP1245 TIP2045 TIP2845 TIP3645 TIP4445
73.8    54.1    54.9    79.6    85.5    67.0    85.1    77.7    88.7    93.9    85.0    66.1    77.5    78.7    87.7    61.8    73.3    62.9    57.7    71.7    77.5    107.5   79.1    72.1    84.5    55.0    89.8    115.2   85.6    106.7   66.3
116.8   87.3    99.2    135.4   128.2   112.4   133.4   124.2   122.8   130.1   118.4   102.7   116.3   119.9   120.2   91.5    103.2   97.9    87.1    111.1   112.0   154.9   116.8   107.4   123.6   109.5   137.2   153.6   120.9   150.6   102.3
134.5   104.4   127.7   164.4   143.7   134.8   154.1   148.2   135.1   143.0   129.9   119.3   131.0   135.2   130.2   110.0   114.1   113.4   106.1   128.4   130.0   171.6   129.8   120.9   135.2   149.5   155.4   160.5   128.6   162.0   116.1
141.6   113.1   135.6   179.1   152.6   144.1   161.3   158.0   143.4   152.7   140.3   128.0   141.7   141.8   137.7   128.3   124.6   124.5   124.6   137.4   140.0   180.1   140.4   130.6   144.5   164.3   162.4   166.8   136.0   168.4   122.1
138.3   114.7   136.8   175.3   151.3   149.2   158.2   153.4   136.8   148.1   136.6   130.8   138.9   138.5   132.0   130.4   123.5   126.6   127.5   136.0   133.0   169.8   139.9   136.4   141.1   168.6   156.7   158.4   132.4   158.9   116.4
128.3   109.4   127.2   164.5   143.9   148.4   146.9   140.5   122.5   136.9   127.2   126.1   128.1   127.6   119.6   123.2   117.7   122.7   121.3   126.8   119.9   154.6   134.0   139.6   133.6   156.6   142.2   144.8   125.8   144.5   105.8
117.6   103.5   112.5   144.5   132.4   144.6   129.5   122.0   109.0   124.9   117.1   117.1   115.0   113.9   106.3   113.6   110.2   114.1   112.3   113.6   103.7   137.9   122.0   135.4   121.4   143.7   123.2   130.4   118.4   127.4   93.7
113.7   105.4   101.5   133.5   128.0   147.3   121.2   114.1   101.1   116.5   113.3   115.6   112.2   108.8   99.3    107.7   106.0   111.1   108.5   107.7   97.2    129.0   120.6   136.7   116.6   126.7   113.9   123.8   121.8   118.8   86.6
105.7   106.3   93.3    120.5   120.4   144.4   110.3   101.6   90.4    106.9   106.6   109.6   104.8   100.4   90.7    100.0   98.3    105.5   101.5   98.7    87.3    117.4   112.0   130.5   107.1   117.0   101.9   114.0   119.6   106.1   77.9
97.9    102.9   84.8    110.3   113.3   138.1   100.7   93.0    82.6    100.1   99.9    104.2   97.8    92.5    83.0    94.4    94.6    100.3   96.2    88.9    79.4    106.4   104.9   123.2   100.4   105.3   91.1    104.4   115.3   97.7    69.9
93.6    99.8    78.6    101.2   110.7   131.8   94.1    86.8    79.7    99.0    101.2   101.4   95.6    87.5    81.5    93.9    95.3    96.0    95.0    85.4    75.9    104.4   101.7   120.3   96.7    97.5    83.8    101.8   114.5   92.8    66.2
95.6    99.9    76.2    101.4   111.0   131.4   93.4    86.0    78.4    98.6    102.3   102.7   95.4    87.0    81.0    95.4    96.5    99.4    97.1    87.4    73.3    102.9   103.4   122.1   96.2    91.7    81.5    101.9   114.0   91.6    63.9
87.3    95.5    72.5    98.3    108.3   127.9   89.3    82.1    75.6    96.6    100.7   100.6   95.4    87.0    80.0    96.0    95.5    98.4    97.4    89.1    69.7    99.9    102.2   118.0   93.4    89.7    76.3    97.4    108.8   87.6    60.5
80.2    87.6    66.4    95.5    101.7   118.9   83.2    75.9    75.5    98.6    98.9    95.9    96.1    86.9    80.9    101.2   94.5    94.0    98.9    90.0    67.9    97.7    96.8    112.8   89.3    84.7    70.0    93.0    101.9   81.7    56.5
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79.2 86.5 65.3 91.2 101.1 119.6 83.4 74.9 77.0 106.8 101.4 98.4 100.8 95.9 85.1 113.6 97.8 98.2 104.3 99.4 68.4 100.0 98.9 112.7 90.4 83.7 69.7 91.8 101.7 81.1 55.3
77.7 84.7 63.3 91.4 100.5 118.9 84.6 75.8 79.6 116.4 104.2 100.9 105.4 104.8 88.5 124.3 102.4 103.1 112.6 111.2 67.5 104.1 101.0 113.6 93.2 85.7 68.9 90.4 100.2 80.6 55.3
71.2 78.4 59.9 88.2 93.8 118.2 80.2 71.8 76.8 117.9 104.4 97.4 105.2 104.4 85.6 125.6 103.4 101.1 115.4 112.9 63.0 100.4 96.7 108.2 89.2 85.8 63.8 83.6 92.2 74.4 51.4
69.1 75.7 56.8 86.3 92.2 109.3 79.2 70.9 79.4 123.1 114.0 100.2 113.3 108.2 87.9 132.4 114.6 104.1 128.2 112.9 63.4 103.2 98.9 108.1 91.6 82.5 62.5 82.6 90.8 73.2 50.4
66.4 73.9 55.3 85.7 89.6 107.7 77.9 69.0 77.1 121.9 119.4 102.5 122.5 109.4 87.0 133.3 121.5 108.4 137.0 119.8 60.7 102.9 99.3 107.2 93.0 83.4 61.3 79.7 87.3 75.9 48.6
59.2 67.2 50.6 80.2 80.4 100.3 72.3 63.0 69.1 110.2 112.7 97.6 117.8 101.7 78.3 122.7 116.1 106.3 130.2 111.9 54.3 94.0 92.4 99.6 86.5 81.7 56.6 70.9 78.1 64.1 43.4
50.1 57.4 42.9 68.6 68.9 86.7 62.4 53.7 59.3 96.1 101.4 89.5 103.0 87.2 68.0 107.2 104.2 99.3 113.9 96.6 47.9 81.6 81.6 87.3 75.4 72.4 48.9 61.3 68.2 54.5 37.3
43.4 50.3 37.3 59.6 60.2 74.9 55.1 42.9 50.1 80.3 87.3 78.1 89.8 75.4 57.0 92.9 91.2 93.9 98.2 64.0 40.5 68.8 71.4 76.3 66.6 63.7 43.3 51.4 57.3 47.0 32.3
30.1 35.3 28.1 42.8 42.5 54.0 39.3 33.6 32.5 52.7 58.5 59.4 61.6 53.4 37.1 63.5 62.4 70.4 65.3 59.0 26.5 45.4 49.6 54.4 46.6 52.9 31.0 33.7 39.1 32.2 21.8
18.8 22.6 18.4 27.4 27.4 36.3 25.9 21.2 20.0 32.8 36.5 39.1 38.5 34.3 22.3 39.6 39.0 46.1 41.0 37.9 16.2 28.6 31.6 35.3 30.6 37.4 19.9 21.1 24.6 20.1 13.3
@set 7 2098 2827 3.116 3.116 24 !power, #, MND/ton, MND/kgU
TIP2005 TIP2805 TIP3605 TIP1213 TIP2013 TIP2813 TIP3613 TIP4413 TIP0421 TIP1221 TIP2021 TIP2821 TIP3621 TIP4421 TIP0429 TIP1229 TIP2029 TIP2829 TIP3629 TIP4429 TIP0437 TIP1237 TIP2037 TIP2837 TIP3637 TIP4437 TIP1245 TIP2045 TIP2845 TIP3645 TIP4445
90.5 66.6 67.9 87.7 104.7 83.4 101.4 81.7 91.6 80.7 92.1 84.1 93.5 91.5 83.1 71.9 79.9 79.9 71.4 89.9 76.4 97.5 98.9 89.1 100.2 58.5 102.2 141.2 105.2 127.8 74.1
140.8 105.7 121.7 144.9 156.8 139.9 159.3 127.6 138.0 136.3 138.9 129.8 138.2 139.3 130.4 110.2 123.1 123.8 108.4 138.7 120.5 151.1 144.6 131.9 148.0 114.3 158.0 186.2 144.7 179.6 113.1
161.1 124.5 152.6 173.0 175.0 164.5 182.2 149.3 155.6 165.5 157.2 146.7 156.2 159.4 148.9 134.0 142.4 141.3 132.1 157.9 141.9 177.2 160.8 144.5 162.3 156.1 177.4 193.3 153.0 190.2 130.1
167.7 132.8 162.6 187.9 182.4 171.8 191.1 166.7 164.9 180.7 167.8 156.2 168.1 170.1 159.0 156.1 153.3 153.8 153.2 168.3 153.9 196.0 170.9 152.8 173.6 173.8 185.3 196.4 159.9 194.6 140.5
161.8 132.3 163.7 198.7 176.9 171.7 188.9 172.2 159.0 184.5 165.4 155.5 164.3 167.7 153.2 160.7 155.0 154.7 155.1 166.7 152.7 199.4 165.4 151.4 171.5 190.8 181.0 182.7 149.2 185.4 135.4
147.7 121.6 147.5 190.8 163.8 160.3 173.5 163.6 144.5 173.3 153.1 145.5 151.2 154.3 146.1 152.0 145.2 146.6 145.9 153.8 140.2 188.9 153.8 145.4 160.5 186.9 163.8 163.9 137.2 166.7 122.3
128.8 108.3 128.0 170.2 147.5 148.2 151.8 143.9 127.0 156.4 137.4 133.4 134.7 136.4 126.5 135.2 132.3 134.2 132.7 135.4 123.3 168.8 140.0 136.5 144.7 169.8 140.6 144.9 123.0 143.9 108.6
123.0 103.7 113.8 157.9 140.2 147.3 139.1 134.7 116.5 144.8 131.8 129.0 128.3 127.5 115.5 127.3 126.4 129.0 126.1 125.7 112.8 157.0 135.5 139.8 130.3 154.1 128.2 136.9 120.0 133.8 99.6
112.8 97.9 103.8 141.5 132.8 149.4 126.8 120.0 103.2 132.6 121.6 121.9 117.1 115.9 104.5 116.5 117.4 119.9 116.4 111.6 101.6 140.5 125.1 138.5 125.6 141.2 114.9 122.4 114.6 120.6 88.3
103.9 96.5 92.9 126.4 125.2 146.9 114.4 107.8 93.0 121.9 111.9 115.3 107.9 104.5 93.5 107.6 108.5 111.4 107.1 99.6 90.8 127.1 117.3 133.8 116.1 124.3 101.4 111.2 113.7 108.2 79.0
99.6 99.5 85.1 115.4 121.9 144.0 104.9 99.0 85.7 111.9 108.2 111.5 103.2 97.0 86.5 103.2 105.0 106.4 103.2 92.5 83.7 118.7 114.1 132.1 109.1 109.1 92.0 110.2 117.8 102.1 73.7
97.2 102.9 82.9 111.5 121.1 145.3 102.2 95.6 82.1 109.2 108.2 110.2 101.6 94.3 83.3 101.0 103.9 106.1 101.3 92.2 79.4 115.6 112.1 131.8 106.8 103.6 88.5 110.0 119.0 99.1 70.0
94.4 100.3 77.7 106.6 116.3 140.2 97.1 89.5 78.0 104.8 105.2 105.3 98.2 90.2 80.0 98.5 99.7 102.1 98.1 90.8 73.6 108.7 106.9 126.9 100.5 97.3 81.6 104.4 114.3 93.0 65.2
85.4 93.3 71.0 97.5 108.7 130.1 88.7 82.0 73.1 97.2 100.5 98.4 92.9 86.5 76.4 96.1 93.3 94.9 94.7 86.5 69.1 102.1 99.9 118.1 93.3 90.1 73.9 98.9 108.7 86.4 60.5
83.5 91.9 68.8 95.3 106.4 128.5 87.8 80.2 73.9 98.1 99.2 97.0 94.2 90.2 79.1 101.2 92.7 94.2 95.0 90.8 68.3 102.8 99.7 116.0 92.1 86.2 71.6 96.6 107.0 84.3 58.4
81.7 88.7 66.7 93.9 103.9 125.9 86.6 78.3 75.1 103.8 97.4 95.7 94.4 95.9 80.7 108.9 91.4 92.5 97.1 98.0 66.9 103.8 98.6 114.3 91.0 85.7 69.5 93.8 104.8 82.3 56.4
73.1 80.9 62.3 88.5 94.0 117.2 80.2 72.0 71.6 106.8 91.2 88.0 89.4 95.9 78.3 109.8 84.8 85.9 92.7 100.3 61.4 98.3 90.6 104.4 84.3 84.6 63.7 85.9 94.6 74.8 51.4
70.8 77.7 58.0 84.8 91.3 110.5 77.0 69.9 72.9 108.7 89.2 86.5 90.0 99.2 79.4 114.8 83.5 83.0 94.3 105.5 60.6 97.5 88.1 100.2 83.4 78.9 61.2 83.6 91.5 72.4 50.4
67.3 74.9 55.7 83.6 86.4 106.2 75.4 68.0 71.6 109.4 86.2 83.5 88.4 100.0 80.0 113.9 81.3 80.9 93.4 106.9 59.0 95.4 85.2 96.4 81.5 79.4 59.7 78.8 87.2 69.2 47.7
59.3 67.2 50.2 76.5 75.9 97.2 68.3 61.4 65.3 102.2 77.8 75.3 80.1 92.4 74.4 101.8 73.9 74.0 84.9 100.7 52.8 87.0 77.1 86.5 73.7 77.2 54.2 69.0 76.3 61.3 42.0
49.9 56.6 42.1 64.6 63.2 81.1 57.9 51.7 56.7 86.9 67.3 63.7 69.8 78.4 64.7 89.9 65.4 64.0 74.2 86.3 46.3 74.3 66.1 73.2 62.7 67.6 46.4 59.0 65.5 52.3 36.2
43.1 49.4 36.5 55.3 53.8 69.4 50.3 45.3 48.3 76.3 59.8 55.1 62.3 68.3 56.4 77.4 59.4 55.6 65.6 75.5 39.7 63.4 56.4 63.1 54.3 58.7 40.7 49.1 55.4 44.5 30.9
29.8 34.5 27.1 40.0 36.8 50.4 35.3 31.3 32.9 55.5 42.2 37.6 44.1 47.6 40.6 52.2 43.7 40.1 45.3 52.8 26.8 43.5 38.5 43.9 37.3 48.5 28.6 31.6 37.4 30.0 20.7
18.9 21.6 17.8 25.5 23.3 32.6 22.6 19.4 20.0 35.9 27.8 24.0 28.2 30.3 25.2 32.8 28.3 25.9 29.0 33.5 16.2 27.3 23.8 28.3 23.8 33.8 18.7 20.1 23.5 19.1 12.4
@set 8 2091 3308 3.646 3.646 26 !power, #, MND/ton, MND/kgU
TIP2005 TIP2805 TIP3605 TIP1213 TIP2013 TIP2813 TIP3613 TIP4413 TIP0421 TIP1221 TIP2021 TIP2821 TIP3621 TIP4421 TIP0429 TIP1229 TIP2029 TIP2829 TIP3629 TIP4429 TIP0437 TIP1237 TIP2037 TIP2837 TIP3637 TIP4437 TIP1245 TIP2045 TIP2845 TIP3645 TIP4445
48.7 48.4 35.9 76.7 87.9 72.9 84.1 72.8 91.6 90.7 87.4 82.0 90.5 88.8 101.6 62.7 76.6 82.2 70.9 86.8 70.7 76.8 93.1 83.8 93.1 55.0 82.9 92.0 83.9 82.7 65.1
80.4 79.2 67.0 126.5 134.4 124.0 135.2 113.7 137.5 139.3 134.5 126.1 133.9 134.2 140.5 104.5 119.6 125.2 107.5 133.9 113.2 129.9 137.2 124.4 137.0 106.8 129.5 127.6 117.9 121.8 99.1
99.7 98.0 90.9 151.6 153.7 149.8 159.0 132.2 154.5 159.3 154.1 143.4 149.8 151.1 153.7 131.6 140.0 141.6 129.1 153.4 134.2 158.1 154.2 137.5 152.5 143.7 151.5 141.7 130.0 138.2 114.3
115.9 111.2 107.5 164.8 165.4 158.7 169.1 145.7 162.0 172.8 163.7 151.3 161.0 160.5 161.8 152.1 150.2 152.2 149.8 162.2 149.5 172.2 163.5 145.2 162.0 157.5 160.7 157.0 139.6 152.2 125.1
128.0 115.7 122.1 173.0 164.0 160.7 170.3 149.8 155.4 170.6 161.0 149.9 156.7 156.9 152.7 158.9 149.5 150.9 149.3 158.7 145.9 180.6 156.8 143.5 160.5 171.0 159.9 158.5 136.1 157.1 122.7
131.3 111.2 126.8 170.9 154.8 151.4 159.7 145.4 140.1 159.7 147.0 139.7 143.2 142.0 134.7 149.7 139.8 141.6 138.8 146.2 133.2 176.0 144.8 136.5 150.6 169.8 149.5 153.8 128.2 152.8 114.3
124.9 102.0 120.2 157.1 140.1 139.6 141.2 133.0 121.4 141.8 131.2 126.7 126.0 125.9 115.3 131.8 124.5 128.0 123.5 128.7 116.4 160.0 131.4 128.8 135.6 158.1 131.8 141.6 116.8 140.1 101.9
121.7 97.5 112.4 146.4 133.9 139.2 132.2 125.3 110.4 131.3 123.4 120.8 118.4 118.5 107.2 122.1 116.3 121.3 115.8 116.8 107.5 150.1 126.2 128.3 129.9 143.1 121.6 132.7 112.4 133.7 94.2
110.3 88.6 103.5 131.7 124.5 138.6 118.2 112.3 97.0 118.7 113.0 112.8 107.9 107.3 94.3 109.2 106.3 111.4 105.9 103.5 96.2 135.6 116.5 126.9 118.0 131.0 109.1 118.2 103.5 118.7 83.3
99.2 81.0 93.0 118.7 115.9 133.1 105.3 100.5 85.6 107.0 103.4 105.0 98.4 96.4 82.4 100.2 98.7 101.7 96.5 89.4 85.7 122.0 108.0 121.5 107.2 115.7 96.8 106.8 94.8 105.5 75.0
91.9 75.2 83.7 107.7 111.8 127.0 97.5 91.8 78.7 101.1 98.4 100.8 93.6 88.6 78.2 94.3 94.4 97.3 93.0 83.2 78.5 110.6 103.0 118.6 101.0 103.1 87.0 101.3 92.2 98.8 70.4
87.8 73.4 79.5 104.9 109.6 126.6 93.8 88.0 74.4 97.8 98.3 98.9 91.4 86.0 74.6 91.0 92.3 96.4 90.9 82.7 73.7 107.6 101.7 117.2 97.9 95.7 82.6 93.4 89.4 94.2 66.1
82.3 69.3 73.8 97.9 104.3 121.2 88.0 82.0 69.6 91.5 95.4 94.5 87.5 80.8 69.3 86.6 88.5 92.7 87.0 79.1 67.5 101.2 96.3 113.2 91.5 89.8 76.1 93.1 85.2 87.3 60.6
76.1 67.1 66.5 89.4 98.0 112.3 80.2 74.5 64.7 85.2 90.9 89.6 83.4 75.5 68.0 83.3 84.3 87.6 83.7 74.8 62.3 93.4 90.5 105.6 85.1 81.9 68.7 89.5 83.1 80.6 55.6
75.4 70.7 64.8 87.1 96.8 112.7 79.7 73.0 64.8 85.1 91.3 89.2 84.1 77.0 68.6 86.1 84.7 87.4 85.3 76.3 61.8 93.1 90.7 104.2 83.9 78.6 66.5 88.3 86.5 79.2 54.0
74.5 74.7 62.6 86.4 95.6 112.9 79.2 71.4 65.8 89.3 92.3 89.8 85.6 80.1 70.4 90.3 85.2 88.4 88.2 80.3 59.9 93.6 90.6 103.2 83.1 76.5 64.9 86.8 89.9 76.9 52.1
69.3 72.9 58.2 81.3 89.0 107.1 73.6 64.9 63.5 92.4 88.4 84.9 82.9 80.3 68.1 92.5 82.4 85.0 87.6 82.4 55.1 90.0 86.0 96.7 78.8 75.6 59.2 81.2 85.4 70.7 47.5
67.7 73.6 55.1 79.2 87.1 103.5 71.6 63.8 65.1 99.4 91.4 86.1 87.3 85.1 70.8 101.2 86.6 86.2 95.1 89.3 54.9 89.8 86.0 95.5 79.4 71.1 57.7 80.4 86.1 69.2 46.9
65.3 72.8 53.7 77.4 83.5 102.6 70.3 61.9 64.6 101.2 95.3 86.2 92.2 88.1 70.2 106.4 92.1 88.7 101.5 94.7 52.9 90.4 85.5 94.2 79.4 72.2 56.1 76.8 83.6 66.9 44.4
58.3 65.1 48.8 71.4 74.2 94.5 64.8 56.1 58.4 94.1 93.2 82.0 89.6 82.8 63.9 101.1 91.7 86.5 99.2 90.8 47.9 85.0 79.3 86.3 73.6 70.1 51.4 67.3 74.2 59.3 39.7
49.5 56.8 41.7 61.0 62.7 80.7 55.6 47.8 51.1 82.7 84.7 74.8 80.9 72.4 55.9 90.2 84.9 80.6 89.9 80.0 42.0 73.9 69.9 75.6 64.5 61.7 44.4 58.2 64.1 50.8 34.3
43.3 50.0 36.1 52.5 54.7 70.0 43.7 42.0 43.5 70.9 74.9 69.4 71.8 63.4 46.4 80.3 77.5 75.5 79.2 70.3 36.3 64.3 61.5 66.7 56.9 54.7 39.2 49.1 55.2 44.1 29.3
30.2 35.0 27.2 37.7 38.4 51.7 35.1 29.3 28.7 48.1 52.1 50.0 49.6 44.8 29.9 57.1 55.7 55.4 53.0 49.2 24.2 46.6 43.6 47.6 40.0 45.1 28.4 32.6 37.6 30.4 20.1
19.2 22.1 18.0 24.1 24.7 34.0 23.4 18.2 17.6 30.5 33.3 33.2 32.0 28.8 18.5 36.4 35.6 36.6 34.1 31.7 14.7 30.3 28.5 31.4 26.5 31.8 19.1 21.3 24.4 20.0 12.9
@set 9 1947 3772 4.158 4.158 30 !power, #, MND/ton, MND/kgU
TIP2005 TIP2805 TIP3605 TIP1213 TIP2013 TIP2813 TIP3613 TIP4413 TIP0421 TIP1221 TIP2021 TIP2821 TIP3621 TIP4421 TIP0429 TIP1229 TIP2029 TIP2829 TIP3629 TIP4429 TIP0437 TIP1237 TIP2037 TIP2837 TIP3637 TIP4437 TIP1245 TIP2045 TIP2845 TIP3645 TIP4445
28.2 27.6 19.5 39.3 48.8 42.1 42.5 37.8 51.5 32.5 37.4 39.4 31.1 44.2 58.5 28.3 24.1 28.4 30.3 49.3 37.5 27.4 39.7 47.5 33.9 27.3 48.4 41.6 37.3 40.2 30.6
45.8 45.2 35.3 64.7 74.2 71.1 68.3 61.1 78.6 53.5 60.3 61.7 48.2 70.0 84.2 48.2 40.1 43.3 47.9 73.3 61.5 48.4 65.2 68.8 52.3 53.2 73.9 67.4 61.5 62.6 51.3
56.0 55.1 47.4 79.0 84.5 86.6 81.3 73.0 91.1 66.6 73.2 72.8 57.7 82.3 92.1 63.2 50.9 51.5 61.4 91.8 75.3 62.6 79.0 76.3 61.3 73.5 85.0 81.2 74.5 73.4 63.2
62.8 61.4 53.9 85.3 90.6 92.3 87.8 79.1 97.0 77.5 81.6 80.1 67.2 88.2 98.0 76.8 59.5 60.3 75.5 99.5 81.4 71.2 87.0 82.1 68.9 80.3 89.9 88.3 75.8 78.7 67.9
63.2 62.9 56.9 86.8 86.8 92.6 86.5 78.0 92.9 82.6 83.7 81.4 71.0 86.6 91.1 83.3 66.6 66.9 79.8 98.4 80.7 76.6 87.3 79.8 71.5 84.8 87.0 89.2 80.0 77.2 68.0
60.2 59.0 54.2 79.6 79.4 84.4 79.0 72.8 81.6 82.9 79.5 77.7 70.9 78.5 80.3 80.8 69.6 70.4 77.8 89.3 74.1 75.8 81.6 72.9 71.7 79.2 78.2 82.3 73.9 70.8 63.3
55.3 53.8 49.2 70.9 69.6 74.6 70.3 64.7 69.0 80.6 72.3 70.4 69.4 69.0 69.3 74.1 70.0 71.8 71.9 77.7 64.6 73.1 72.2 64.7 70.7 71.1 67.8 72.7 64.8 62.5 55.2
54.3 51.0 47.3 68.3 65.6 69.0 66.2 62.8 63.0 78.7 69.6 67.0 68.5 63.8 62.1 70.0 71.2 71.8 69.3 72.4 59.7 74.3 68.9 61.0 70.2 65.1 63.6 68.5 60.9 60.1 52.0
52.1 46.6 46.0 65.3 59.9 63.5 61.9 60.8 55.8 72.6 64.2 61.8 62.2 57.4 54.0 63.6 66.6 65.8 63.5 63.4 54.5 72.2 62.4 55.6 64.8 63.4 59.1 64.5 56.9 57.8 47.6
51.0 42.5 45.8 63.1 54.7 57.6 56.8 59.1 49.1 66.6 57.8 56.3 56.1 51.7 46.6 57.2 61.5 60.0 57.7 54.9 50.0 69.9 56.3 49.9 59.5 60.1 53.5 61.8 51.7 55.9 43.9
49.8 40.0 45.0 60.9 51.6 52.7 53.8 57.6 44.8 63.0 53.6 52.5 53.2 48.6 43.4 52.4 57.6 57.1 54.2 49.8 46.6 66.0 52.2 47.8 56.1 56.0 49.6 59.8 40.3 54.4 41.0

48.2	38.2	44.0	60.0	49.7	51.4	52.5	56.0	42.2	60.1	52.5	50.5	50.8	46.2	41.3	50.2	54.8	53.9	51.5	48.3	44.3	64.2	51.0	45.2	54.0	54.8	47.6	59.6	47.0	52.8	39.1
44.9	36.0	41.4	55.8	46.7	48.6	48.7	51.9	38.7	54.5	49.4	47.1	46.4	43.4	37.4	46.5	51.2	49.2	47.4	44.8	41.0	60.3	47.7	43.0	49.3	50.7	43.7	56.3	44.8	49.3	36.5
40.6	33.2	37.2	49.7	42.9	43.9	43.2	46.8	35.3	48.7	44.7	43.6	42.3	38.8	35.0	42.4	46.7	45.1	44.0	40.6	37.3	53.7	42.9	40.2	44.5	44.8	39.7	51.1	40.8	44.5	33.1
39.6	32.7	35.7	48.4	42.1	44.2	42.2	45.0	34.8	47.4	44.1	42.9	42.1	38.4	35.2	42.9	45.4	44.6	43.5	40.5	36.5	51.8	42.1	41.3	43.2	42.2	38.2	50.2	40.4	43.2	31.9
38.4	32.3	34.0	47.0	42.2	46.2	41.5	43.2	34.5	48.2	43.1	43.2	41.2	38.7	35.3	43.6	44.6	43.9	43.8	41.9	34.8	50.6	42.3	43.4	41.9	40.4	36.8	48.8	40.3	42.2	30.7
35.0	30.5	31.1	43.0	38.8	46.7	38.2	38.7	32.0	47.4	40.4	40.9	38.0	37.4	33.1	43.3	42.3	40.7	41.6	41.2	31.5	47.3	40.3	42.3	38.3	39.1	32.8	45.4	39.0	38.3	27.9
34.3	32.1	29.6	41.2	38.8	47.3	37.1	37.0	32.3	49.6	41.5	41.8	38.8	39.3	34.0	46.5	42.3	42.1	43.3	43.6	30.7	45.9	39.5	44.2	38.4	35.5	31.7	44.1	39.8	37.1	26.4
33.6	34.0	26.6	40.1	37.8	48.3	36.0	35.5	31.6	49.2	42.4	42.4	39.6	40.5	33.7	48.4	43.9	43.3	44.0	45.8	29.4	45.7	40.2	44.3	38.2	35.8	30.4	43.3	42.2	35.6	25.0
30.5	32.4	25.9	36.5	34.1	45.1	32.8	31.9	28.5	45.1	41.2	41.3	38.0	37.6	30.2	45.8	43.4	42.1	42.5	43.0	26.2	42.4	38.0	40.7	34.8	34.2	27.2	39.7	41.2	31.8	22.6
26.1	28.8	21.8	30.6	29.3	38.9	27.9	26.8	24.8	39.4	38.1	38.3	35.1	32.7	26.5	40.5	40.4	40.2	39.4	37.1	22.7	36.1	33.3	36.2	30.5	29.8	23.4	33.8	36.0	26.9	19.2
23.1	25.9	19.2	26.7	25.5	34.3	24.8	23.3	21.5	34.2	35.2	35.9	32.4	29.4	22.5	36.5	38.0	37.7	35.7	32.8	19.6	31.1	30.4	32.1	27.1	26.2	20.5	29.5	32.3	22.0	16.9
16.4	18.4	14.5	19.4	18.1	25.8	17.9	16.5	15.0	24.1	26.0	26.5	23.2	21.5	14.9	27.0	29.6	27.2	24.8	23.7	13.4	23.5	23.1	23.3	19.3	22.0	14.4	21.5	24.7	16.6	12.4
10.1	11.8	9.2	12.5	11.5	17.0	11.9	10.4	9.3	15.2	16.6	17.7	15.3	14.2	9.1	17.7	20.3	17.6	16.1	15.4	8.2	15.2	15.7	15.1	12.8	16.3	9.4	14.0	16.2	10.8	8.0
@set	10	1853	3919	4.320	4.320	34	!power,	#,	MWD/ton,	MWD/kgU																				
TIP2005	TIP2805	TIP3605	TIP1213	TIP2013	TIP2813	TIP3613	TIP4413	TIP0421	TIP1221	TIP2021	TIP2821	TIP3621	TIP4421	TIP0429	TIP1229	TIP2029	TIP2829	TIP3629	TIP4429	TIP0437	TIP1237	TIP2037	TIP2837	TIP3637	TIP4437	TIP1245	TIP2045	TIP2845	TIP3645	TIP4445
90.0	69.0	52.1	48.5	92.0	84.5	59.9	58.2	90.0	94.9	79.0	75.8	94.5	94.3	86.9	90.8	73.7	76.2	106.1	97.6	66.5	53.4	94.5	101.6	69.1	49.8	61.2	88.8	80.3	72.8	33.0
140.0	111.7	96.1	82.8	142.1	145.2	98.3	96.9	140.0	150.2	130.2	125.6	142.7	146.0	127.1	146.5	125.5	124.9	153.0	154.1	110.8	94.3	142.7	143.5	105.6	97.2	95.5	141.4	130.5	112.8	55.9
163.0	132.6	125.8	105.2	163.4	177.5	120.9	120.5	163.0	176.9	163.4	156.5	163.5	168.1	145.1	171.8	158.8	154.5	169.8	181.0	136.6	123.3	163.5	157.6	123.8	133.7	113.7	167.7	155.1	132.4	70.9
178.7	146.3	138.1	121.9	174.6	187.2	136.2	137.4	178.7	191.7	183.7	176.0	174.5	180.1	158.6	184.0	179.0	176.4	182.4	194.3	151.0	139.4	174.5	169.7	135.7	150.2	128.6	182.6	164.5	145.2	82.2
171.7	146.5	141.7	129.2	169.0	188.2	137.7	141.8	171.7	187.7	184.0	177.2	169.1	173.6	152.7	184.1	180.9	179.1	175.1	189.6	153.4	145.4	169.1	162.8	134.6	161.3	130.7	182.0	163.9	143.4	87.9
155.1	134.2	131.7	124.4	152.5	172.3	126.2	137.8	155.1	169.7	168.2	164.4	150.7	154.8	136.6	167.2	167.0	166.5	157.6	172.7	140.4	137.5	150.7	146.3	125.1	151.2	125.1	166.1	149.2	132.5	90.0
133.2	116.8	115.7	118.3	129.6	149.7	112.7	128.6	133.2	148.5	143.7	143.4	129.7	131.2	119.3	143.5	145.1	147.6	136.1	149.8	123.3	124.8	129.7	126.5	111.2	134.5	119.0	143.2	129.2	115.2	91.4
121.0	109.4	102.3	118.9	119.9	137.2	103.9	129.6	121.0	135.1	132.3	132.9	118.4	120.6	112.1	128.3	133.4	135.6	125.4	135.7	112.3	115.6	118.4	116.6	103.7	120.4	119.7	129.8	120.5	108.8	96.5
106.7	101.1	92.4	112.2	105.9	123.9	93.0	121.4	106.7	118.2	118.3	119.0	104.1	105.0	101.7	114.9	119.3	120.2	110.7	120.9	100.0	103.8	104.1	101.9	91.7	110.7	110.4	116.1	107.8	96.9	92.6
93.2	91.8	81.9	101.7	93.9	109.1	83.1	109.9	93.2	105.0	103.9	105.1	92.1	92.9	93.5	101.9	105.6	105.2	99.3	105.3	89.3	92.1	92.1	91.3	80.9	98.0	99.4	100.9	95.9	85.5	84.9
86.1	87.3	72.7	93.0	86.9	97.2	75.8	100.2	86.1	96.9	95.5	96.2	84.9	86.2	90.1	92.9	96.9	96.6	92.5	96.4	82.3	83.1	84.9	84.9	75.6	86.9	89.9	91.8	87.6	79.3	79.9
81.7	83.2	68.9	88.7	81.3	93.7	73.0	95.0	81.7	95.0	93.2	91.6	81.6	83.3	87.8	89.3	93.9	92.5	88.3	94.5	70.4	80.1	81.6	81.6	73.5	83.0	84.0	89.2	84.2	75.1	75.4
76.7	77.2	63.5	83.3	75.9	87.2	67.9	87.9	76.7	90.8	87.1	85.8	76.6	78.3	81.2	84.5	88.0	86.7	83.6	90.4	72.8	75.3	76.6	75.5	69.1	79.0	77.1	84.3	78.8	69.8	69.4
71.9	70.2	56.8	76.4	71.4	79.1	62.5	79.8	71.9	87.5	80.0	78.7	71.2	73.1	76.8	77.5	80.8	79.1	78.5	82.8	66.2	71.1	71.2	70.2	65.1	73.4	70.5	77.4	72.2	64.3	62.1
72.5	69.3	55.6	76.8	73.5	79.6	64.1	78.9	72.5	91.4	80.7	79.3	72.6	76.9	76.3	78.6	80.9	79.3	86.2	82.8	66.2	74.2	72.6	70.9	66.1	74.3	69.5	78.5	71.1	65.8	60.5
72.8	68.0	55.0	76.6	77.6	81.0	68.3	77.8	72.8	95.3	81.5	81.0	74.1	80.8	75.1	79.6	82.8	79.7	84.0	83.1	65.2	80.3	74.1	72.3	67.4	78.0	68.4	82.2	71.5	69.2	59.0
67.2	62.4	52.9	72.4	76.9	78.4	69.6	72.2	67.2	90.4	78.3	79.3	71.5	77.9	69.6	76.8	82.0	76.1	84.2	78.3	60.2	81.4	71.5	70.1	64.6	78.1	62.6	80.9	68.1	68.3	54.6
65.9	61.9	51.8	72.0	80.5	78.3	72.8	70.9	65.9	90.5	81.0	83.5	73.2	78.9	70.2	78.6	85.8	78.3	90.1	77.9	59.9	81.7	73.2	76.0	66.6	72.4	63.0	82.8	68.0	71.3	53.5
64.3	62.0	52.3	71.7	81.6	80.5	73.8	68.7	64.3	86.8	81.8	87.6	73.5	79.2	69.1	80.7	89.8	79.0	91.6	79.5	57.9	81.6	73.5	79.7	65.8	72.6	62.0	82.6	69.0	70.5	51.6
57.4	57.2	46.0	65.5	74.1	77.9	68.3	62.6	57.4	80.2	75.6	82.6	67.6	73.7	61.7	78.6	84.5	74.0	84.1	76.7	51.6	76.5	67.6	75.3	60.8	70.0	55.8	76.4	65.3	54.5	46.3
50.0	49.8	41.3	55.4	63.8	71.0	59.1	53.1	50.0	69.6	66.3	72.4	58.7	63.6	54.4	71.6	73.4	65.4	73.3	69.4	44.8	65.1	58.7	67.1	52.6	60.3	47.9	66.2	59.1	55.7	39.3
43.5	44.9	36.4	48.1	56.4	65.1	51.6	46.8	43.5	60.5	58.4	64.6	52.4	56.5	46.3	65.8	65.0	57.9	64.1	62.8	39.2	57.2	52.4	59.4	46.7	53.1	42.1	58.5	55.2	45.2	34.6
30.1	32.8	27.7	34.9	39.5	49.9	36.8	33.4	30.1	42.0	46.1	46.0	37.4	41.4	30.8	48.8	48.3	41.8	44.4	46.5	26.8	42.2	37.4	46.2	33.0	44.3	23.9	42.3	43.7	33.6	24.7
18.4	21.0	18.2	21.5	24.0	33.2	22.7	20.9	18.4	26.2	26.7	29.2	24.4	27.1	18.2	31.5	30.4	27.7	28.7	30.4	16.0	26.3	24.4	27.1	21.4	32.8	17.7	26.6	29.0	20.8	15.3
@set	11	1914	4251	4.686	4.686	36	!power,	#,	MWD/ton,	MWD/kgU																				
TIP2005	TIP2805	TIP3605	TIP1213	TIP2013	TIP2813	TIP3613	TIP4413	TIP0421	TIP1221	TIP2021	TIP2821	TIP3621	TIP4421	TIP0429	TIP1229	TIP2029	TIP2829	TIP3629	TIP4429	TIP0437	TIP1237	TIP2037	TIP2837	TIP3637	TIP4437	TIP1245	TIP2045	TIP2845	TIP3645	TIP4445
79.0	68.0	52.0	43.2	59.1	50.9	51.1	55.6	52.3	62.3	52.1	47.5	62.7	55.5	43.5	57.3	50.4	35.1	70.9	54.0	52.2	44.2	49.1	56.5	53.5	41.1	59.8	80.7	72.1	71.1	32.4
129.9	110.7	95.1	76.5	96.3	92.1	85.7	89.6	87.6	110.6	88.4	80.6	103.6	90.9	70.8	102.9	86.5	67.0	114.9	92.3	89.1	75.3	85.1	88.8	84.5	80.2	93.9	132.7	110.4	110.8	55.2
156.5	136.9	124.6	101.5	122.8	125.3	110.6	112.1	119.5	148.8	118.8	109.9	133.6	117.9	94.7	140.9	116.9	98.4	146.4	124.1	110.5	109.7	115.0	114.0	105.3	114.0	114.8	162.0	146.6	133.5	70.4
170.6	151.3	139.0	98.0	150.2	157.3	129.2	129.3	143.2	179.6	151.1	143.3	159.4	146.8	126.1	170.5	149.9	128.3	171.1	153.6	135.1	129.0	147.6	146.0	123.8	135.4	129.8	181.3	164.0	148.5	63.3
168.9	153.6	144.3	126.5	162.1	178.6	135.9	134.8	161.9	187.8	172.1	166.2	163.3	161.9	145.6	183.3	169.0	161.3	174.8	179.2	144.1	142.3	169.2	159.7	130.4	150.5	133.6	184.4	169.3	147.5	90.4
155.1	144.6	133.5	124.7	156.6	178.0	130.0	133.1	162.4	177.1	170.9	168.4	151.7	156.7	149.6	174.1	168.4	172.4	163.9	177.9	140.7	139.2	168.6	158.6	126.4	148.5	123.1	170.8	157.6	136.0	92.7
135.1	132.7	117.1	119.3	140.9	162.7	117.3	129.7	147.5	159.7	156.3	156.0	134.0	141.2	146.7	154.5	155.2	164.7	144.5	164.5	126.7	127.5	152.4	143.2	115.9	137.5	122.6	151.3	138.9	120.9	95.5
126.4	127.7	107.1	120.8	132.3	153.0	111.0	130.2	139.0	147.0	148.1	147.4	125.5	131.6	142.3	142.8	147.3	156.5	134.9	154.3	119.2	119.8	142.7	134.2	109.8	125.4	122.4	139.9	130.7	113.6	99.8
112.0	116.5	94.9	114.1	115.8	140.6	99.3	121.0	122.3	129.8	131.7	131.8	110.0	110.3	128.2	126.8	131.6	142.8	120.2	137.7	106.8	108.8	128.3	119.1	97.4	116.8	114.2	123.3	118.5	102.2	95.0
98.6	102.5	83.6	104.0	102.7	123.9	88.5	108.9	107.5	114.4	117.0	117.3	96.9	101.5	111.8	112.3	116.7	126.4	106.8	118.0	96.0	96.1	111.8	106.2	86.9	102.1	102.5	108.4	105.6	90.4	87.4
88.1	92.2	74.6	95.1	95.2	111.2	81.2	100.4	95.4	103.6	107.2	108.3	89.4	92.8	101.5	100.9	107.0	111.5	98.8	105.9	86.1	86.3	100.8	98.8	80.2	89.2	93.3	97.9	95.5	83.7	81.5
82.2	86.6	71.0	89.3	89.8	104.4	77.5	93.9	89.3	98.6	102.1	103.6	85.0	87.5	94.5	95.3	101.4	106.2	93.6	100.7	80.4	81.9	96.7	94.2	75.8	84.0	86.8	95.1	91.8	78.8	76.7
75.6	79.5	66.1	83.9	84.5	97.1	72.9	85.7	80.8	89.9	95.1	95.6	78.8	80.6	85.3	88.1	93.3	99.8	86.8	92.5	74.0	76.6	90.5	86.0	71.6	76.6	79.3	89.5	85.3	73.8	70.7
68.4	71.6	59.6	77.3	80.6	87.9	68.1	78.6	73.1	81.8	87.5	87.4	72.9	73.4	79.0	79.6	85.9	89.6	81.1	83.7	67.2	70.2	82.3	80.8	66.9	68.4	72.9	83.6	77.1	69.7	63.2
68.4	70.5	59.3	78.1	84.9	89.3	72.6	76.8	72.4	82.5	87.7	87.8	73.7	74.1	76.5	79.6	86.2	87.3	81.9	81.9	66.2	72.0	83.1	81.0	67.9	66.0	72.5	87.4	77.3	74.0	62.0
68.6	69.8	58.7	78.9	90.5	92.1	78.5	76.4	71.2	87.7	89.0	91.6	74.9	77.7	75.5	80.5	88.6	87.3	85.4	82.1	66.9	76.4	85.0	84.6	70.0	67.1	72.6	92.7	78.2	79.2	61.0
64.4	64.4	57.4	77.0	88.3	89.7	79.1	72.2	65.5	88.3	85.7	90.1	72.5	76.5	69.7	78.2	87.4	85.6	85.1	77.6	60.7	79.6	82.3	83.7	68.8	69.8	67.7	90.6	75.3	77.9	57.1
63.8	63.9	55.7	78.4	91.2	89.3	84.0	72.6	66.3	93.7	88.7	95.6	75.6	79.6	70.8	80.2	91.5	83.8	91.6	78.3	60.2	85.3	84.3	91.2	74.6	69.5	68.6	90.6	74.6	79.8	56.5
63.8	64.1	55.7	81.3	91.7	92.5	88.0	72.4	66.2	95.1	89.7	97.7	76.6	80.6	69.5	83.3	94.3	86.4	92.5	80.6	59.7	91.4	86.2	93.0	76.7	73.6	63.7	90.7	75.9	79.2	55.6
58.5	60.3	51.9	82.4	83.8	90.7	86.1	67.2	59.5	86.5	82.9	90.3	71.3	76.4	62.6	81.7	87.8	83.4	86.5	78.1	54.4	92.5	81.3	85.8	75.7	73.5	62.4	85.0	74.5	73.0	52.1
50.8	52.8	44.9	74.7	72.7	82.2	77.8	58.7	52.8	77.3	72.6	73.5	63.4	67.4	55.7	75.2	76.5	72.6	75.7	71.1	47.3	83.4	71.9	76.1	69.5	65.4	55.6	72.9	68.8	63.5	45.3
45.2	47.8	40.1	67.1	65.4	74.2	70.3	52.0	46.2	67.9	63.3	69.5	56.7	60.0	47.7	70.0	67.7	65.0	66.6	65.4	41.5	74.5	64.7	67.1	63.0	58.4	49.8	64.0	64.1	52.5	40.2
32.4	34.6	30.8	48.2	45.9	57.1	50.4	37.6	32.0	47.7	44.7	49.1	41.3	45.0	31.3	53.4	49.3	52.0	46.7	49.0	28.7	56.3	48.5	47.2	45.2	51.5	34.9	43.8	49.3	39.3	29.4
20.8	23.2	19.7	30.5	28.8	37.1	31.3	24.2	19.6	29.7	27.9	31.4	27.6	30.6	18.6	34.9	31.7	37.0	31.4	32.7	17.5	35.6	31.7	30.9	30.2	37.7	22.1	30.3	32.8	25.0	18.4
@set	12	1962	4558	5.024	5.024	38	!power,	#,	MWD/ton,	MWD/kgU																				
TIP2005	TIP2805	TIP3605	TIP1213	TIP2013	TIP2813	TIP3613	TIP4413	TIP0421	TIP1221	TIP2021	TIP2821	TIP3621	TIP4421	TIP0429	TIP1229	TIP2029	TIP2829	TIP3629	TIP4429	TIP0437	TIP1237	TIP2037	TIP2837	TIP3637	TIP4437	TIP1245	TIP2045	TIP2845	TIP3645	TIP4445
38.7	25.7	35.3	41.8	46.4	38.3	43.7	51.5	44.8	47.1	47.3	47.3	44.2	45.9	36.6	41.1	44.4	52.7	53.4	42.1	46.9	38.4	44.2	52.1	39.9	23.5	51.5	41.9	32.2	53.0	29.8
66.6	45.1	66.4	72.7	78.4	72.1	74.8	82.2	75.3	82.8	82.2	81.8	77.1	78.9	59.9	73.5	78.6	86.9	88.8	74.8	81.2	70.9	78.6	83.2	70.8	58.9	82.2	72.8	57.4	86.2	50.5
90.4	63.8	91.5	95.4	106.0	104.1	99.3	102.9	100.3	114.9	112.8	112.8	105.9	103.9	79.6	103.4	110.0	116.1	119.4	104.4	106.2	99.8	110.1	110.0	94.9	97.2	102.9	99.2	80.1	109.3	65.5
115.7	65.7	109.8	114.9	138.8	139.9	121.0	121.6	125.6	151.3	147.6	149.1	138.4	130.3	105.3	135.9	146.4	153.4	156.6	136.5	126.5	120.6	146.4	145.0	116.1	122.1	121.6	128.5	105.6	129.3	78.7
138.6	112.7	124.8	125.0	158.2	171.5	132.4	131.1	143.8	176.8	174.3	173.5	161.4	150.9	129.9	164.1	172.6	177.3	177.3	164.7	137.7	137.0	168.4	161.2	131.2	143.6	131.1	155.6	132.6	138.9	87.6
150.5	135.9	127.8	128.6	160.8	179.4	131.4	129.7	153.3	180.0	177.6	175.0	163.4	156.9	145.8	171.6	175.9	176.9	175.1	177.6	138.9	137.7	169.4	160.7	134.2	151.6	129.7	168.2	150.0	136.7	91.9
150.3	149.4	121.6	128.5	149.6	172.8	122.5	128.1	148.4	169.1	162.6	162.7	151.5	149.1	151.3	159.8	162.8	162.7	161.5	174.0	129.1	130.1	157.8	148.7	126.4	146.5	128.1	163.8	150.5	127.6	96.3
150.5	155.8	118.3	130.2	144.3	168.1	118.6	131.3	145.0	156.6	153.2	153.1	142.2	144.7	153.6	151.2	152.6	153.5	152.4	170.8	125.9	123.3	149.7	140.5	121.9	134.3	131.3	157.3	150.4	123.9	103.7

136.4 144.0 108.8 123.1 130.1 153.9 106.4 122.1 130.6 139.7 135.7 137.6 127.0 128.3 138.8 135.9 137.6 134.8 136.0 153.4 113.7 113.9 133.4 123.8 108.7 127.8 122.1 143.7 140.1 110.7 100.6
120.8 128.8 97.2 112.2 114.5 136.3 96.1 108.9 114.7 124.3 120.3 123.0 111.0 113.3 122.0 120.5 122.4 117.8 119.9 133.6 102.1 101.9 117.6 110.0 96.1 115.2 108.9 126.0 127.9 99.5 92.8
108.2 116.9 84.6 101.6 105.3 121.7 88.3 100.4 102.1 112.4 109.0 111.0 100.1 103.6 112.2 108.2 110.5 107.9 109.9 119.0 94.0 92.2 106.3 101.8 87.1 101.5 100.4 115.0 115.3 91.7 85.5
100.9 106.7 81.1 95.9 98.5 115.1 83.5 92.9 95.1 105.8 104.3 104.5 94.9 97.5 102.6 101.3 104.3 101.3 102.4 112.8 86.6 87.2 100.5 95.3 83.8 93.2 92.9 110.0 108.1 86.7 79.0
89.9 96.3 75.1 88.6 90.9 104.7 77.9 84.0 85.7 97.4 95.5 95.0 86.9 89.6 92.1 92.9 94.7 90.7 93.0 103.4 79.0 81.7 92.9 86.0 78.1 86.3 84.0 102.2 98.8 80.4 72.8
80.1 85.0 66.5 80.8 85.3 94.0 72.3 76.7 77.6 88.8 85.5 85.0 78.6 82.4 84.1 83.5 84.2 81.0 85.9 92.4 72.0 75.7 82.9 79.0 71.3 79.0 76.7 93.6 87.3 75.3 66.4
78.3 82.6 65.8 81.6 89.1 92.9 76.8 76.1 76.5 91.1 83.4 83.8 78.3 85.0 82.3 83.4 81.9 80.2 85.0 91.1 70.9 78.7 82.4 78.5 72.3 72.4 76.1 96.2 85.7 79.2 64.1
77.4 79.7 64.9 82.8 94.6 94.3 83.4 75.7 75.1 95.9 82.7 83.7 78.9 88.9 80.7 83.7 81.0 79.2 84.4 90.8 69.8 85.1 83.0 78.5 74.3 75.8 75.7 100.4 85.9 83.1 63.0
71.5 72.8 62.0 81.1 91.8 91.0 59.0 70.7 69.7 94.3 77.8 78.6 74.8 85.0 74.2 80.6 76.2 73.7 80.4 85.2 65.1 88.3 79.5 73.8 73.8 80.3 70.7 96.6 82.2 81.4 58.9
71.2 72.6 60.1 85.6 94.3 91.6 89.9 71.8 69.9 96.8 79.3 80.3 76.2 87.4 74.8 81.9 76.6 75.6 84.3 87.0 63.5 93.5 80.3 77.7 80.3 77.8 71.8 96.0 81.7 82.8 58.4
70.2 71.7 59.4 90.3 95.1 96.4 95.1 70.9 68.2 97.0 80.6 84.7 78.0 86.9 72.8 86.8 80.5 78.2 88.4 90.6 61.9 99.0 82.2 81.6 85.1 79.3 70.9 96.3 84.8 82.1 57.2
62.8 66.0 55.0 86.3 86.7 95.2 91.4 64.7 61.3 88.5 76.5 83.0 73.9 80.3 65.5 85.0 80.4 77.2 84.2 87.0 56.1 96.2 77.7 78.7 81.7 79.0 64.7 89.2 83.3 74.7 52.2
54.6 57.5 47.3 75.7 75.2 85.3 79.7 56.5 53.4 76.9 68.1 74.9 65.2 70.3 57.5 76.6 73.3 72.6 76.3 77.2 48.9 83.8 68.5 71.8 72.4 72.1 56.5 76.8 74.7 64.8 45.3
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34.4 37.4 31.9 48.8 47.1 57.7 50.7 34.3 32.5 47.9 44.4 40.7 43.4 44.3 32.5 52.9 51.4 49.1 46.0 48.9 29.3 55.7 47.0 46.5 47.5 55.6 34.3 48.3 52.1 39.3 28.7
21.8 24.1 21.0 31.0 29.0 36.1 32.6 22.3 10.9 30.9 28.6 33.1 28.1 26.6 19.3 34.4 33.6 32.9 29.4 29.7 17.8 34.8 31.5 30.4 29.3 41.1 22.3 31.6 34.4 25.6 18.4
@set 13 2104 5256 5.794 5.794 42 !power, #, MMD/ton, MMD/kgU
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83.2 66.4 73.6 47.1 56.2 58.0 54.0 58.0 42.3 43.6 37.7 37.7 39.5 43.2 49.6 36.7 33.4 36.2 44.3 43.1 31.9 38.6 39.2 46.5 43.7 19.7 67.6 81.2 54.1 79.1 50.5
138.1 106.6 113.8 84.6 93.1 91.7 88.8 96.5 71.6 75.8 64.8 64.8 66.5 72.9 79.4 64.0 58.0 58.8 70.7 74.6 55.3 72.5 68.5 73.9 74.7 48.1 106.4 136.7 93.2 125.4 86.8
171.1 133.9 134.8 115.1 116.7 115.0 111.4 126.5 93.5 102.3 86.0 86.0 87.2 95.2 100.8 86.9 76.8 75.5 91.8 100.2 73.1 105.3 91.6 93.5 98.2 81.2 131.0 172.0 122.2 150.9 112.0
190.3 159.7 147.1 146.2 137.4 140.3 132.0 156.0 113.9 129.8 105.8 105.8 107.0 119.1 123.1 110.5 95.5 93.6 114.3 127.0 89.2 137.0 112.3 115.3 120.5 108.7 151.1 195.6 147.5 169.8 129.4
193.7 174.7 146.5 170.8 148.0 157.8 139.4 177.3 128.7 153.7 122.4 122.4 123.4 138.8 136.5 133.5 110.5 106.8 128.6 150.9 103.8 165.2 129.1 134.0 135.8 142.6 154.4 204.5 169.7 171.0 138.8
183.8 176.0 136.0 175.4 150.1 170.9 139.0 180.3 134.7 171.4 129.3 129.3 132.1 152.2 140.0 153.1 117.7 112.3 135.3 167.3 112.0 176.4 135.7 146.8 141.8 161.8 148.9 198.7 177.8 163.0 134.9
166.5 164.6 124.1 168.6 148.8 178.7 136.9 172.4 133.3 180.6 131.5 131.5 135.3 159.8 136.7 164.9 122.1 115.4 140.1 177.8 113.0 173.1 137.3 153.2 142.8 165.5 137.8 184.8 172.9 148.5 125.6
159.2 156.7 118.6 170.5 158.5 184.9 143.0 172.0 134.2 185.7 138.7 138.7 143.6 164.0 135.1 172.3 130.9 119.7 147.2 183.6 115.5 174.7 147.6 157.9 155.3 160.4 133.3 177.7 169.4 143.8 121.5
146.3 140.0 109.2 164.1 158.5 173.5 145.3 162.6 129.3 176.4 141.7 141.7 143.1 154.4 124.6 163.7 136.0 116.9 151.4 172.9 114.4 166.4 152.0 149.2 157.2 159.4 126.3 165.0 157.0 139.3 113.4
129.8 121.5 99.1 159.5 152.2 158.4 147.8 150.2 127.3 164.9 145.5 145.5 142.8 149.4 115.1 153.8 140.9 116.6 150.9 155.9 115.4 155.7 149.4 139.1 154.1 151.9 122.8 150.8 140.9 133.9 104.8
116.9 109.7 95.7 156.8 146.3 149.5 153.2 142.0 129.1 156.4 147.7 147.7 143.4 150.3 110.2 144.2 145.4 124.6 151.0 146.9 119.7 146.3 144.8 135.5 150.1 143.7 121.4 139.5 127.5 131.3 98.6
110.0 101.4 90.8 157.1 139.3 140.1 151.1 138.2 127.4 149.2 148.3 148.3 140.5 147.4 106.4 136.6 145.0 132.4 145.1 141.3 119.1 143.3 140.5 130.9 145.7 142.4 119.9 135.7 120.7 129.9 95.4
99.6 90.8 82.4 146.3 128.4 126.1 137.7 127.4 118.8 138.2 138.6 138.6 129.2 134.1 100.2 128.2 135.9 128.9 133.0 132.1 111.9 133.6 129.8 119.8 133.0 137.1 111.2 127.4 110.9 121.7 89.5
87.1 80.6 75.3 127.9 115.7 117.1 123.3 113.3 106.4 119.2 125.2 125.2 114.2 120.5 96.9 113.7 122.4 120.0 122.5 121.4 101.5 117.7 116.1 108.3 117.6 124.0 99.6 113.6 98.1 108.4 79.4
84.6 78.8 72.5 121.9 112.7 115.5 118.1 107.9 104.6 113.0 121.7 121.7 110.7 117.1 100.2 111.7 119.5 118.6 118.7 123.3 97.5 112.8 112.2 106.5 113.1 110.0 94.8 109.3 95.5 104.7 77.1
82.2 76.8 69.7 116.5 111.0 116.0 113.6 102.4 99.8 108.6 116.5 116.5 106.5 112.0 102.0 108.3 116.9 116.9 115.1 124.1 90.8 107.5 108.5 104.8 108.4 105.2 91.0 108.2 95.9 101.3 72.7
75.4 70.4 62.5 105.2 104.9 112.1 102.8 89.2 89.1 98.5 107.4 107.4 96.4 98.0 94.9 99.8 108.8 110.3 105.5 114.1 80.1 98.2 99.6 96.7 96.8 100.1 79.2 103.8 93.5 91.3 65.0
73.3 70.3 61.8 98.0 107.6 116.4 98.7 84.3 85.5 94.8 106.6 106.6 94.2 94.8 94.7 97.1 110.9 116.5 108.1 111.9 74.4 91.7 97.2 97.4 92.8 86.9 75.2 104.2 95.7 88.2 60.2
72.2 68.5 57.9 93.2 107.1 114.6 95.0 79.1 80.0 90.1 107.6 107.6 92.2 90.8 89.2 98.2 115.4 120.3 108.1 107.8 69.2 88.3 97.7 96.3 90.4 83.2 71.7 104.5 99.2 84.1 57.1
65.2 62.4 50.3 84.3 96.6 101.7 83.6 68.5 70.1 80.1 102.7 102.7 84.6 80.2 77.0 93.5 110.6 112.9 100.1 95.7 60.3 80.5 93.6 89.5 81.9 78.1 64.0 96.4 93.8 75.2 51.3
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35.8 33.3 24.7 46.0 53.4 50.7 43.9 33.3 35.0 46.2 63.8 63.8 52.3 42.3 35.7 56.3 65.6 64.5 52.0 48.4 30.1 47.2 62.0 56.6 48.8 50.3 33.8 52.0 54.9 39.4 27.6
23.6 22.1 15.7 30.7 34.1 33.2 28.6 20.1 21.4 30.6 42.9 42.9 33.4 26.3 22.0 37.6 43.7 42.7 34.6 29.5 17.8 32.3 41.8 38.0 32.3 36.7 23.5 34.5 37.8 26.2 17.8
@set 14 2021 5981 6.593 6.593 46 !power, #, MMD/ton, MMD/kgU
TIP2005 TIP2805 TIP3605 TIP1213 TIP2013 TIP2813 TIP3613 TIP4413 TIP0421 TIP1221 TIP2021 TIP2821 TIP3621 TIP4421 TIP0429 TIP1229 TIP2029 TIP2829 TIP3629 TIP4429 TIP0437 TIP1237 TIP2037 TIP2837 TIP3637 TIP4437 TIP1245 TIP2045 TIP2845 TIP3645 TIP4445
40.3 43.7 46.2 36.3 39.4 46.4 41.8 41.4 41.8 40.5 38.3 41.3 37.1 41.0 44.6 33.5 35.4 41.2 39.1 45.0 39.8 33.4 25.1 42.4 40.9 14.4 45.8 40.7 35.8 49.7 21.0
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118.8 125.9 111.1 119.5 114.6 129.3 117.3 125.2 117.2 125.2 131.5 142.9 116.1 112.2 120.6 111.3 126.2 129.3 130.0 126.0 112.5 115.8 123.7 133.4 117.6 118.7 124.6 126.0 115.0 126.0 82.2
125.6 132.6 113.3 131.8 122.7 137.0 123.9 137.0 122.5 134.0 144.3 157.3 127.4 118.2 127.0 122.3 141.7 137.6 145.9 133.9 119.7 124.7 136.3 146.7 127.8 130.9 135.6 136.9 125.0 130.0 94.4
132.0 138.6 112.0 139.8 124.3 144.2 125.3 142.9 126.6 139.0 154.1 158.8 136.7 122.8 133.7 124.4 153.5 138.5 154.3 142.8 120.2 128.1 143.7 148.3 137.3 133.7 141.1 145.2 132.8 129.3 105.6
144.2 149.2 113.4 148.5 129.8 151.6 129.2 151.5 136.7 146.6 165.3 162.6 148.6 133.8 144.0 131.7 163.2 142.3 161.0 157.0 122.6 134.2 156.5 151.0 144.9 132.5 144.3 159.7 146.8 132.7 115.3
144.0 146.3 108.3 141.3 125.7 152.0 122.4 147.1 138.7 139.2 160.7 153.3 144.6 135.7 147.2 129.4 156.9 140.8 155.6 160.3 119.9 130.8 154.2 142.5 140.3 135.2 133.1 158.8 151.0 124.6 113.8
134.9 137.1 101.1 131.7 120.9 152.3 115.2 137.3 132.8 135.8 140.9 144.8 135.1 133.0 141.5 128.7 147.6 137.5 144.5 159.8 113.4 123.3 145.8 131.1 130.7 131.1 124.2 151.8 150.4 115.6 105.1
126.9 129.2 98.3 121.5 120.2 155.1 113.1 127.1 128.6 135.7 139.3 136.6 128.6 136.5 138.2 131.2 139.5 134.1 137.6 165.3 110.0 119.7 136.8 125.6 125.1 123.2 115.4 146.8 150.5 111.8 98.3
119.5 122.3 93.0 119.1 120.8 149.4 113.9 121.7 123.3 137.9 133.5 127.4 121.8 137.0 132.9 134.7 132.5 127.4 130.7 164.5 105.9 121.7 131.4 119.2 118.4 115.7 109.5 149.6 150.2 110.4 93.7
108.5 109.1 85.1 110.4 117.9 133.7 109.5 112.6 112.3 132.5 121.1 114.6 110.3 129.5 121.0 129.6 118.6 113.6 119.2 153.6 99.6 119.1 120.1 107.1 108.4 114.1 99.2 145.8 141.2 108.0 86.2
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91.9 92.0 74.8 94.9 106.2 116.9 99.7 96.0 97.0 116.1 101.1 98.6 95.3 114.1 103.8 114.0 99.7 97.1 102.4 132.7 86.9 108.9 102.9 92.1 94.6 102.3 84.6 128.1 118.9 97.9 72.5
86.9 86.2 70.5 89.9 100.4 110.5 95.2 90.9 91.3 110.0 95.4 94.6 90.5 108.2 97.2 108.0 95.7 93.6 97.7 123.1 80.7 103.7 98.1 89.5 90.6 98.6 81.1 121.7 112.0 94.2 67.7
76.4 75.1 62.2 81.2 89.7 95.3 85.4 80.3 80.0 99.2 86.8 86.9 80.5 94.0 84.6 96.6 88.6 86.1 88.4 107.2 71.2 95.4 90.3 81.2 81.8 93.9 71.4 108.2 102.0 83.5 62.6
71.4 71.4 59.7 76.9 85.5 95.9 83.4 75.0 74.4 94.5 87.2 88.5 79.9 88.9 80.8 91.9 86.5 88.0 86.9 102.2 66.2 89.7 87.4 81.2 82.1 84.5 68.2 100.4 94.1 79.3 56.6
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59.7 58.2 47.2 70.2 77.1 83.6 74.9 63.4 60.6 82.7 86.0 85.6 76.0 74.6 64.0 82.5 86.9 88.5 82.3 82.2 54.1 84.0 85.3 77.4 76.2 74.3 58.0 84.8 81.0 67.0 50.1
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43.3 42.7 34.3 57.5 62.7 64.7 61.3 46.6 43.6 66.6 71.8 70.3 66.1 55.9 45.3 68.0 71.0 73.7 68.6 59.4 39.4 67.9 72.5 67.1 63.9 57.1 44.2 62.0 60.7 46.3 37.6
31.4 29.8 22.6 42.8 45.8 44.2 43.4 33.4 30.6 48.0 52.6 49.8 48.9 39.3 30.2 51.6 55.4 53.8 49.0 39.3 27.3 52.3 56.2 42.7 45.2 51.7 31.7 45.4 46.3 35.4 30.0
20.8 19.7 14.5 29.2 29.9 30.2 28.5 20.9 19.9 32.6 35.2 33.9 32.1 25.2 19.4 35.5 38.2 36.5 31.8 25.4 17.0 34.3 39.4 33.7 29.2 43.0 21.5 30.5 32.4 25.3 20.9
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36.3 40.1 40.8 32.2 35.4 42.0 37.3 36.2 37.7 36.3 34.2 38.0 33.7 36.5 40.2 30.8 32.7 35.3 36.4 39.9 34.4 29.3 39.0 37.6 37.1 12.4 42.4 39.5 39.6 47.9 25.7
61.7 65.9 64.6 57.1 59.2 66.8 61.1 62.5 62.7 62.3 59.8 63.0 56.2 59.6 64.4 53.6 57.1 60.9 61.0 65.4 58.7 54.5 63.3 61.1 60.5 37.8 67.5 65.3 63.2 74.8 42.9
80.4 85.6 78.9 76.3 75.8 85.5 77.4 81.9 79.2 82.4 81.7 85.2 73.8 74.8 81.4 71.4 78.4 82.2 80.6 83.1 75.7 75.2 82.3 79.7 77.3 68.1 84.2 83.4 80.2 91.9 55.2
97.0 105.2 93.3 93.5 93.5 106.5 94.6 97.8 94.1 101.1 104.4 112.5 91.5 90.9 99.2 87.5 99.6 104.3 102.7 102.4 90.2 90.2 103.6 103.0 95.5 90.6 101.4 101.9 98.8 108.3 67.6
111.5 120.6 102.8 109.9 107.9 121.8 108.5 114.6 108.0 116.6 125.0 137.6 108.8 102.7 111.8 104.1 120.9 124.0 124.2 116.8 102.9 105.2 120.9 125.1 110.0 107.0 117.7 119.0 113.1 119.9 80.6

121.3	130.5	108.4	124.9	116.4	132.6	117.8	129.4	117.9	128.0	140.7	152.3	121.8	111.5	123.7	114.7	138.2	134.4	142.3	128.4	111.8	116.6	132.7	141.2	123.8	121.2	130.9	132.9	125.1	126.4	94.2
133.3	140.9	111.6	135.7	122.9	143.4	123.7	140.1	126.2	136.1	152.1	158.5	135.7	121.1	134.4	123.7	151.7	138.3	154.3	142.5	116.2	123.8	146.1	146.3	137.0	127.5	139.3	147.0	135.8	128.6	107.1
149.1	155.2	114.6	146.2	130.3	153.6	128.7	152.5	140.5	144.5	165.8	163.7	150.8	135.8	149.2	133.5	162.9	146.5	163.0	159.4	121.9	132.0	159.5	152.0	148.7	131.0	145.4	162.9	152.1	133.9	115.6
149.2	152.9	110.1	142.7	128.1	154.6	124.0	148.3	145.6	143.5	163.4	156.7	147.9	138.9	152.9	133.2	159.5	145.3	158.3	165.0	120.6	131.4	154.9	142.6	144.2	138.6	138.4	161.6	155.0	127.2	111.7
139.2	144.1	105.6	134.9	124.9	157.3	119.0	141.4	141.0	139.5	153.3	147.1	139.0	139.0	149.3	133.8	150.9	142.9	150.4	167.1	116.0	127.8	145.5	133.2	134.5	135.3	127.6	156.6	157.3	119.6	104.2
133.5	138.2	103.0	127.0	124.7	161.9	117.9	132.9	137.1	139.6	144.9	139.9	134.4	143.4	146.4	136.2	142.2	139.5	143.8	173.4	112.3	124.3	141.7	129.2	130.7	129.1	120.1	155.1	160.8	117.9	99.5
125.7	128.4	96.9	123.3	125.8	155.6	117.6	129.2	131.3	142.9	138.2	132.8	127.6	144.3	138.6	141.2	135.7	132.8	135.9	173.3	110.6	125.3	133.8	122.7	125.6	121.9	113.7	156.1	155.6	116.7	94.3
114.4	114.9	88.3	114.9	122.9	138.5	114.0	119.3	120.2	138.1	125.9	118.2	115.2	135.6	125.6	135.5	122.6	120.1	122.9	159.3	103.5	124.6	119.5	110.8	114.8	121.6	103.3	150.6	143.4	112.3	85.6
101.2	101.6	80.8	101.9	113.7	126.1	106.2	105.5	106.5	126.6	109.4	104.9	102.0	123.5	113.0	122.5	107.4	104.1	110.6	145.2	93.1	114.3	106.7	98.6	103.2	117.6	92.6	137.3	127.0	105.0	76.8
95.5	95.8	77.9	98.3	108.8	120.2	102.8	99.9	101.9	118.5	104.5	100.6	98.0	118.4	107.1	118.1	101.9	99.8	105.3	137.1	89.3	111.3	102.1	94.6	98.4	107.1	88.3	132.0	120.6	101.6	72.8
90.1	89.5	73.5	93.3	102.7	113.2	97.4	94.4	94.4	111.6	98.8	96.7	93.2	111.5	100.2	111.8	97.0	96.0	100.8	127.4	83.4	106.7	98.6	91.2	93.2	104.4	83.4	124.1	114.7	96.5	68.3
78.2	77.0	64.2	83.3	90.5	99.1	86.8	83.2	81.9	99.5	89.1	87.8	82.6	96.8	87.0	99.0	88.7	87.8	90.8	109.4	72.8	96.5	88.2	82.0	83.3	98.6	72.6	108.5	100.6	84.8	60.2
72.7	72.4	61.5	78.3	86.5	95.9	84.2	76.3	76.7	94.5	88.3	88.0	80.5	90.6	81.6	92.9	87.0	88.1	88.3	103.1	67.8	89.9	87.4	80.8	82.6	88.1	69.1	100.1	94.6	81.0	57.7
68.3	67.6	56.0	76.1	83.5	92.1	80.6	72.6	71.5	89.2	89.1	90.0	80.1	85.5	75.0	88.8	88.4	90.5	86.8	95.3	63.0	88.5	87.0	80.9	82.0	80.0	65.1	93.9	88.2	75.4	53.7
59.3	58.2	47.4	70.7	76.9	82.7	74.5	63.9	61.2	82.5	86.3	84.9	76.1	75.2	63.9	82.6	85.3	88.0	82.0	81.5	54.8	83.3	82.1	77.1	77.0	76.2	57.1	82.5	77.4	65.6	47.5
49.5	49.4	40.5	62.8	68.6	74.5	67.4	53.6	51.0	73.4	78.2	76.8	70.0	63.3	53.9	73.7	77.3	79.7	75.3	69.3	46.1	73.7	75.3	70.6	70.4	68.7	49.1	68.4	65.4	56.1	39.7
42.9	42.8	34.3	57.0	62.1	64.5	61.1	46.8	43.6	65.5	71.2	68.2	65.4	55.0	45.0	67.1	70.4	72.4	68.2	58.7	39.2	67.1	67.7	66.2	63.7	58.2	42.9	59.4	57.2	45.3	34.8
30.7	29.6	22.7	42.5	44.9	43.7	43.0	33.8	30.6	47.4	52.1	48.7	48.9	39.0	29.5	50.3	53.3	53.3	48.9	39.0	27.3	51.2	49.4	49.0	45.2	51.7	30.0	41.9	40.2	33.7	24.3
20.2	19.4	14.3	28.7	28.8	29.0	28.0	20.8	19.5	31.3	35.1	32.5	31.1	24.8	18.5	34.5	37.0	34.0	31.2	25.1	16.8	33.8	32.1	32.6	22.7	42.8	19.1	28.0	26.9	21.6	15.1

@set 16 2230 6912 7.619 7.619 52 !power, #, MWD/ton, MWD/kgU

TIP2005	TIP2805	TIP3605	TIP1213	TIP2013	TIP2813	TIP3613	TIP4413	TIP0421	TIP1221	TIP2021	TIP2821	TIP3621	TIP4421	TIP0429	TIP1229	TIP2029	TIP2829	TIP3629	TIP4429	TIP0437	TIP1237	TIP2037	TIP2837	TIP3637	TIP4437	TIP1245	TIP2045	TIP2845	TIP3645	TIP4445
46.3	41.1	35.3	23.3	32.5	35.0	30.3	25.0	22.2	25.1	25.4	26.7	24.4	22.8	26.4	21.4	24.0	27.0	26.2	27.3	15.4	20.4	32.0	28.9	28.5	6.4	38.9	52.2	41.3	49.5	29.4
79.1	67.5	58.7	41.4	53.9	55.7	49.6	42.8	37.3	42.8	44.1	44.4	40.4	37.3	42.4	37.5	41.9	45.3	43.9	44.5	26.2	37.2	51.1	46.9	46.3	18.9	60.5	84.2	64.2	75.2	48.0
99.7	85.9	71.8	55.6	68.4	69.6	62.8	55.3	48.1	56.1	58.9	58.1	52.6	47.3	53.4	50.2	56.7	59.7	57.6	57.0	34.3	51.6	65.0	59.5	58.6	34.2	73.3	103.4	79.0	89.3	59.7
114.4	100.9	84.8	66.6	81.9	84.2	74.7	66.0	58.7	69.4	72.3	71.7	64.4	58.0	65.8	61.5	70.1	75.0	71.9	71.1	41.8	61.4	80.1	72.7	71.5	46.2	86.8	120.1	94.2	103.4	70.9
125.6	111.9	92.0	78.2	93.1	96.3	85.7	77.5	69.2	82.3	86.4	84.7	76.1	68.6	76.8	73.4	83.9	89.7	85.1	82.5	50.5	73.9	91.8	83.9	83.7	55.6	96.6	131.6	103.8	111.5	79.7
130.4	118.2	96.5	88.9	101.6	107.7	94.5	89.2	79.0	95.5	98.7	96.2	87.6	79.2	85.9	84.8	95.4	102.1	96.7	94.0	58.9	85.9	102.6	92.9	95.2	66.2	103.3	139.7	111.9	115.2	84.9
132.2	122.8	99.3	98.9	110.4	120.2	104.6	103.3	88.1	110.1	111.6	108.9	101.4	90.4	94.1	95.8	107.0	114.3	110.2	106.1	67.1	100.0	113.9	102.6	107.0	77.7	109.4	144.9	120.1	118.0	90.2
138.9	135.9	104.9	118.6	121.9	135.3	117.3	126.1	99.3	126.4	128.7	125.8	118.5	104.0	103.6	109.8	125.4	132.8	128.6	119.2	78.1	123.1	128.4	114.6	121.6	90.7	116.7	152.3	134.2	125.2	99.2
136.1	140.2	103.5	133.0	128.6	143.5	123.1	140.2	103.9	137.0	142.3	140.3	132.8	112.8	106.7	119.7	140.6	144.8	143.4	123.5	86.1	139.6	136.3	122.6	130.2	112.3	116.3	150.3	140.9	125.1	100.7
131.6	136.5	102.1	141.6	140.5	154.4	132.0	148.6	108.0	147.8	154.8	154.3	143.0	120.4	108.0	128.9	153.1	151.6	154.8	130.6	92.9	149.9	147.4	131.5	138.4	126.8	116.2	147.9	143.6	122.0	101.1
126.6	132.9	101.6	148.7	150.0	167.1	148.0	152.8	112.2	163.4	163.5	163.4	154.7	135.7	112.2	141.4	161.7	157.7	163.2	146.5	100.8	156.3	161.9	142.8	153.1	134.5	120.5	147.6	144.6	126.5	103.8
122.4	126.0	100.8	158.4	153.1	166.6	159.0	152.5	113.8	170.4	165.7	161.9	154.6	144.1	112.3	151.6	160.0	157.0	163.4	157.1	101.6	160.7	163.3	146.2	155.4	137.8	124.0	148.2	138.0	129.4	102.7
112.2	113.0	95.0	159.0	147.6	152.5	159.0	146.2	112.8	165.3	155.2	150.6	144.9	142.2	110.4	149.2	148.5	144.8	152.4	155.6	102.1	154.5	151.6	135.3	145.4	136.5	122.0	141.3	125.2	126.3	98.1
97.9	99.2	87.5	146.5	132.4	137.9	146.6	134.3	113.6	150.4	87.1	134.6	129.8	138.8	113.0	138.3	131.0	125.7	137.7	151.5	103.3	140.7	135.6	120.6	131.6	132.5	116.3	126.4	111.6	118.6	91.5
94.4	93.9	84.8	142.4	125.7	131.3	140.7	130.2	119.5	142.2	129.5	126.2	123.1	144.4	120.9	137.0	123.5	118.7	131.5	155.6	110.5	137.5	128.2	115.4	123.8	123.8	113.3	119.6	105.1	114.7	88.5
89.1	88.3	81.7	135.7	119.0	123.8	134.5	124.5	121.6	135.7	121.8	118.3	116.6	142.4	124.4	131.9	116.3	112.8	125.5	154.8	111.5	132.7	121.0	109.5	117.1	126.4	107.4	114.3	100.1	110.4	84.7
79.3	77.4	72.1	120.9	106.6	110.6	118.3	110.2	110.8	122.9	108.5	105.6	103.1	126.5	115.7	119.6	103.9	100.7	112.2	141.3	100.9	120.6	106.9	97.9	103.3	125.4	94.0	101.3	89.4	97.1	75.5
74.2	74.4	68.4	111.2	102.7	109.9	111.5	103.7	107.0	117.1	104.0	102.8	100.5	122.0	113.0	115.1	99.0	96.3	111.4	137.3	94.9	111.2	104.3	94.9	101.3	114.6	88.4	97.0	89.0	92.1	71.3
71.2	71.1	64.7	106.5	100.9	109.2	105.7	96.0	99.3	111.1	102.2	100.0	98.1	113.7	105.9	114.0	96.9	95.0	110.6	127.9	87.5	107.1	101.6	93.2	97.9	105.9	82.1	95.3	88.7	86.2	66.4
64.1	64.2	54.9	94.9	93.5	99.4	93.1	84.1	85.4	100.9	97.2	94.1	92.0	99.3	89.8	106.3	91.5	90.6	103.0	109.1	76.3	99.7	94.4	89.3	89.1	101.4	71.1	88.1	82.6	74.8	57.9
54.3	55.0	47.5	78.6	81.8	88.6	79.3	69.4	71.2	89.6	88.4	85.5	83.5	83.8	76.3	92.4	83.6	83.7	91.3	92.3	64.4	86.3	86.5	81.6	80.6	90.4	59.7	76.3	73.3	63.5	48.3
47.8	48.7	41.2	68.1	73.8	76.1	69.5	59.6	60.2	78.7	80.3	77.4	77.0	73.1	62.9	82.9	77.4	77.5	81.7	77.4	54.5	77.6	78.1	75.4	72.8	74.9	51.4	66.9	65.7	51.0	41.7
35.2	34.7	28.5	50.9	54.2	51.8	49.6	42.1	41.6	56.6	59.7	55.7	67.3	51.3	40.6	61.0	59.2	58.5	58.1	51.3	37.3	59.8	56.1	56.9	51.2	66.6	35.6	47.4	46.8	38.3	29.1
23.7	23.1	17.8	34.8	35.0	34.6	33.1	25.7	25.5	37.3	39.9	37.4	37.4	32.0	24.6	41.2	40.1	38.8	37.0	32.3	22.4	39.3	37.4	38.8	33.9	55.2	22.8	31.5	31.1	24.5	18.0

@set 17 2129 7312 8.060 8.060 54 !power, #, MWD/ton, MWD/kgU

TIP2005	TIP2805	TIP3605	TIP1213	TIP2013	TIP2813	TIP3613	TIP4413	TIP0421	TIP1221	TIP2021	TIP2821	TIP3621	TIP4421	TIP0429	TIP1229	TIP2029	TIP2829	TIP3629	TIP4429	TIP0437	TIP1237	TIP2037	TIP2837	TIP3637	TIP4437	TIP1245	TIP2045	TIP2845	TIP3645	TIP4445
43.1	38.3	38.4	22.1	29.9	32.9	28.4	23.3	20.8	23.0	23.8	25.7	22.6	21.1	24.9	19.8	22.5	24.9	24.6	25.8	14.4	18.8	28.8	27.0	26.5	5.8	36.2	46.2	38.0	45.5	27.4
72.9	62.7	59.8	39.3	49.9	51.8	46.4	39.8	35.1	40.0	41.5	42.3	37.7	34.5	40.0	34.8	39.7	42.8	41.3	42.0	24.7	34.3	46.8	43.9	43.0	17.7	55.8	75.7	59.4	68.4	44.5
91.6	79.8	71.5	52.1	63.0	63.6	57.6	51.5	45.2	52.3	55.4	54.6	48.9	43.5	51.0	46.8	53.6	56.6	54.0	53.7	32.4	47.2	59.7	55.7	53.8	31.5	67.8	93.9	72.7	80.6	55.4
104.4	93.8	82.2	62.3	74.9	77.3	69.1	61.5	55.2	64.3	66.2	68.0	59.8	53.2	62.6	57.0	66.3	70.7	66.8	66.4	39.1	56.9	73.1	68.1	66.4	42.3	79.7	109.6	86.2	94.3	65.9
117.0	104.5	89.3	73.8	86.1	90.1	80.2	73.0	65.6	77.2	62.1	80.5	71.2	62.9	72.9	68.6	79.0	85.0	79.0	78.1	47.5	69.0	85.4	78.3	78.3	51.1	89.7	122.4	97.1	103.2	74.6
123.7	112.0	94.4	84.4	95.4	100.9	89.2	83.9	75.1	89.3	94.1	91.8	82.3	73.4	82.5	79.4	91.0	97.4	91.2	88.9	55.8	80.4	95.7	87.6	89.8	61.7	98.0	131.9	106.5	109.1	81.3
126.7	119.1	98.4	96.4	105.6	114.4	99.7	98.7	84.9	103.6	106.2	105.1	95.8	84.5	92.5	90.7	103.2	110.3	105.1	102.0	64.1	94.1	108.0	97.7	102.7	72.4	104.9	138.1	115.9	114.0	86.6
136.1	134.4	104.4	116.3	118.8	130.8	113.1	120.8	97.5	121.7	124.6	123.5	114.7	98.9	102.3	106.1	122.0	128.2	123.1	115.4	75.3	117.7	122.3	111.4	118.7	85.5	113.4	148.6	130.3	122.1	96.0
135.1	139.9	105.0	133.0	128.3	141.1	121.8	136.3	103.6	135.7	141.0	139.4	131.1	108.0	106.6	117.7	137.9	142.4	139.5	123.3	84.7	137.5	133.9	121.5	127.0	106.1	115.9	151.2	139.9	122.9	98.9
131.6	138.8	103.7	143.5	139.5	153.8	132.9	146.1	109.4	148.7	154.8	155.3	145.6	119.7	110.6	129.1	151.4	153.0	153.6	132.2	92.5	150.0	145.3	131.9	141.1	122.4	116.8	150.2	143.7	122.5	100.4
129.0	136.4	104.0	153.1	153.8	166.6	150.7	153.4	116.2	166.4	165.3	165.9	156.9	135.1	116.6	143.8	161.9	160.6	164.0	149.1	100.5	156.2	160.9	145.1	156.4	131.9	122.7	151.1	145.2	127.0	103.7
126.6	129.6	103.2	163.2	157.5	168.4	162.0	154.6	117.9	176.0	168.7	165.5	157.7	145.1	117.8	154.1	163.8	159.7	164.3	161.2	104.7	162.6	163.2	147.2	158.3	136.4	127.8	153.7	140.5	131.6	104.0
116.0	117.8	97.4	164.0	151.3	154.5	161.2	151.3	117.0	170.2	161.5	155.2	148.5	145.3	115.8	153.7	153.8	147.3	156.1	159.6	105.0	159.0	154.3	138.0	149.7	138.5	126.4	147.6	128.8	128.3	99.4
103.1	102.7	90.7	153.5	136.9	142.2	149.0	138.3	118.7	155.3	143.9	138.5	133.4	141.8	118.1	144.3	134.3	130.0	141.3	157.6	107.3	147.1	139.2	123.8	136.4	132.7	119.2	131.3	113.8	121.4	93.0
98.3	97.4	87.9	149.1	129.9	134.3	143.3	135.3	124.9	147.3	135.6	129.4	127.6	146.0	125.4	140.9	128.0	121.7	134.2	159.8	113.0	142.1	131.4	118.5	128.3	124.5	115.9	125.7	107.8	116.9	91.2
93.1	91.2	83.5	140.2	122.6	126.2	137.6	129.4	125.3	141.7	126.2	122.0	120.4	144.4	129.9	135.9	121.1	116.1	127.8	156.7	113.9	135.4	123.2	111.8	121.3	127.7	109.4	119.0	103.0	112.2	87.1
81.9	80.3	74.3	125.1	109.0	112.4	120.7	113.9	115.5	126.3	113.3	108.9	106.3	128.2	120.6	124.3	109.5	103.8	114.7	143.1	103.8	123.2	110.1	100.0	106.6	127.1	96.0	105.7	91.9	98.5	77.4
77.6	76.7	71.4	115.3	105.2	111.4	114.0	106.9	110.7	120.5	108.1	105.7	103.6	122.8	117.2	117.7	101.8	100.0	113.1	140.0	97.3	113.8	105.5	96.9	104.1	115.7	90.8	99.7	90.4	93.9	73.3
73.9	73.6	65.6	109.2	104.1	110.4	107.7	99.9	102.1	113.9	106.4	103.3	100.5	115.0	108.7	116.3	98.9	98.1	111.9	129.4	89.9	109.9	102.7	95.9	99.6	107.9	84.6	97.6	89.6	87.5	68.1
66.0	65.3	56.8	97.5	95.2	101.0	95.3	86.3	86.7	103.7	100.8	96.5	93.3	99.1	92.0	108.9	93.4	92.2	104.5	110.4	78.0	101.5	95.2	90.1	90.7	102.1	72.1	91.3	84.2	75.9	59.1
55.8	55.9	48.6	80.7	82.7	89.9	80.4	72.0	72.4	91.6	91.0	87.5	85.1	84.4	77.2	94.7	85.2	84.4	92.4	93.1	65.5	87.6	86.8	81.8	82.4	91.4	60.8	78.8	74.6	64.4	49.3
49.2	49.8	41.3	69.9	74.2	78.0	70.2	61.8	62.5	80.9	82.8	79.4	78.4	72.9	64.3	84.1	79.9	79.3	82.3	78.2	56.4	79.2	78.6	76.5	73.7	75.1	52.3	68.6	66.4	51.6	42.6
36.1	35.5	27.5	52.4	54.1	52.6	50.5	43.9	42.9	59.2	61.9	57.1	58.1	51.1	41.7	62.8	62.5	59.0	58.2	52.3	38.6	61.0	57.4	57.6	51.7	66.8	36.1	49.9	47.3	38.5	29.9
24.2	23.3	17.5	36.2	35.8	35.2	33.7	27.1	26.4	39.4	41.6	38.3	38.1	32.4	25.7	42.8	42.6	36.8	36.9	32.9	23.6	40.8	37.9	38.7	34.2	54.9	23.5	32.5	31.6	25.1	19.0

@set 18 2037 8109 8.939 8.939 58 !power, #, MWD/ton, MWD/kgU

TIP2005	TIP2805	TIP3605	TIP1213	TIP2013	TIP2813	TIP3613	TIP4413	TIP0421	TIP1221	TIP2021	TIP2821	TIP3621	TIP4421	TIP0429	TIP1229	TIP2029	TIP2829	TIP3629	TIP4429	TIP0437	TIP1237	TIP2037	TIP2837	TIP3637	TIP4437	TIP1245	TIP2045	TIP2845	TIP3645	TIP4445
22.9	19.7	19.2	17.1	18.5	15.6	17.2	13.1	16.5	13.6	14.0	15.6	13.1	11.6	19.9	11.2	13.3	15.1	14.6	15.5	11.4	9.8	17.7	16.8	16.3	3.6	17.7	21.5	19.7	24.9	16.6
55.1	48.9	45.3	30.5	38.9	40.4	35.9	31.2	27.7	31.8	33.2	34.1	30.0	27.3	31.8	28.3	32.1	34.3	33.0	33.5	19.7	27.3	36.7	35.1	34.3	14.1	43.1	58.4	46.6	52.8	34.8

69.8 62.4 54.5 40.5 49.1 49.8 44.9 39.8 35.9 41.4 44.7 43.8 38.4 34.6 40.2 37.9 43.3 45.3 43.0 42.1 25.8 37.5 46.9 44.3 43.3 25.5 52.7 72.1 57.1 63.4 43.8
81.2 73.9 63.8 48.2 58.7 60.8 54.2 47.9 43.6 51.1 54.6 53.8 46.8 42.3 49.7 46.0 53.0 56.4 53.3 52.2 31.2 44.0 57.4 53.8 52.3 34.0 63.0 86.4 68.4 75.1 52.2
93.3 84.9 71.9 57.7 68.9 72.0 63.3 57.1 52.2 61.7 65.5 64.4 56.2 50.3 58.1 55.1 63.6 68.0 63.6 62.1 38.1 54.3 67.8 63.4 62.9 41.0 72.0 100.3 78.5 84.3 60.2
103.7 94.4 79.8 68.3 79.1 84.1 73.1 68.0 61.3 73.3 76.6 75.6 66.7 59.3 66.9 64.6 74.2 79.8 74.3 73.1 45.7 64.8 77.6 72.8 75.1 49.6 80.9 111.9 90.4 93.2 67.1
113.5 106.7 86.5 81.4 90.4 99.4 85.1 82.2 71.0 87.7 89.9 88.9 79.2 70.4 76.5 76.2 86.3 93.9 88.6 85.4 53.4 78.9 91.7 83.7 88.5 59.5 91.6 122.9 103.8 102.8 75.7
127.0 127.2 96.0 100.9 107.8 117.5 102.0 105.0 83.7 106.2 109.0 109.6 99.6 85.6 89.5 92.6 105.4 113.7 108.5 100.9 65.1 101.4 109.0 100.0 106.4 71.4 104.1 138.3 122.3 115.6 86.5
130.2 137.6 100.5 122.4 122.4 132.6 114.0 123.7 95.0 122.3 130.5 128.9 120.4 98.8 99.4 107.0 126.5 132.6 129.6 113.4 75.4 124.5 123.7 113.7 121.1 92.3 110.6 144.8 135.4 121.9 92.7
131.8 141.3 103.7 137.2 138.2 152.0 130.0 140.1 106.0 141.9 149.6 150.3 138.3 116.0 108.5 125.7 145.3 147.6 148.1 130.2 85.9 142.8 142.1 129.7 139.9 112.2 116.5 149.2 144.2 125.5 98.4
133.7 144.2 108.2 153.1 155.3 169.4 152.3 153.7 116.7 164.4 166.4 165.3 154.7 136.3 119.7 146.5 161.8 152.7 164.2 152.1 97.6 157.6 162.6 146.7 160.6 125.1 127.4 155.6 149.7 131.6 106.4
133.3 138.7 108.4 166.2 163.2 173.3 166.4 160.0 122.3 177.7 171.6 167.8 160.2 148.3 123.5 158.2 166.0 162.7 167.2 166.2 104.3 167.3 167.9 151.6 167.1 136.3 134.3 158.0 148.7 137.5 108.2
127.3 128.3 104.4 173.3 159.3 163.7 169.7 156.6 122.9 177.0 167.0 160.0 154.4 152.3 124.1 161.4 159.8 153.4 162.7 169.4 109.1 166.0 161.7 145.4 158.7 142.1 134.3 155.5 137.9 139.1 105.9
113.8 115.4 98.5 165.0 149.4 154.4 160.9 147.9 126.7 165.1 155.3 148.0 141.8 152.4 128.1 155.4 145.2 140.8 152.6 168.5 113.6 157.0 150.7 132.9 148.9 139.7 129.0 144.0 124.9 132.7 100.0
109.3 109.8 95.5 161.3 141.2 147.3 156.9 146.6 134.2 158.7 148.2 141.8 137.5 156.4 135.3 152.3 139.0 133.1 146.8 172.5 120.7 154.2 143.3 127.7 142.4 136.2 126.2 137.2 120.2 129.0 98.3
103.7 104.0 92.6 154.8 135.9 139.6 149.7 140.1 136.3 152.7 139.4 134.9 130.9 155.2 141.1 148.0 132.5 126.9 140.0 173.6 121.7 148.3 136.2 122.5 134.9 139.3 121.1 131.2 114.4 123.8 95.5
92.9 91.7 82.6 138.1 121.3 126.3 132.9 125.6 125.3 139.0 126.0 120.9 118.2 139.1 130.7 135.5 119.6 114.5 126.6 157.1 112.6 135.5 121.8 110.1 119.8 137.1 106.8 116.4 103.0 109.6 85.5
88.2 88.1 79.9 128.3 117.6 125.2 127.3 118.4 121.2 132.1 121.7 117.2 114.6 135.0 128.3 130.5 113.2 111.4 125.8 153.3 107.5 126.6 118.4 107.0 117.8 127.7 101.5 111.7 101.4 105.2 81.5
84.1 84.0 74.5 122.0 115.9 124.1 119.6 111.5 112.1 125.8 119.6 115.0 111.6 126.2 118.9 128.9 111.2 109.5 125.2 142.0 99.4 122.4 114.4 106.0 113.3 119.2 94.5 108.9 100.7 98.4 75.8
75.1 74.0 63.7 109.2 106.3 113.0 105.1 98.3 96.6 114.9 112.9 107.4 103.3 109.4 100.9 120.1 104.4 104.1 116.6 121.3 86.4 112.5 105.7 100.2 102.0 113.2 81.3 101.5 94.3 84.8 66.4
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56.4 56.8 46.9 77.7 82.8 86.6 79.1 69.2 68.2 90.2 93.6 89.4 87.5 80.4 70.2 93.7 88.7 87.8 92.3 86.5 62.1 88.5 88.1 85.0 83.0 83.8 59.2 76.4 74.3 57.7 48.0
41.2 40.5 31.4 58.1 60.9 58.4 56.4 49.4 48.2 64.7 69.5 64.0 65.3 56.2 46.2 69.8 68.2 64.2 65.2 58.5 43.2 67.3 64.2 63.9 57.3 74.2 40.6 54.6 53.1 43.3 33.5
27.7 26.0 20.0 39.4 39.3 38.7 37.5 29.4 30.7 42.6 46.3 42.2 42.0 36.2 27.9 47.4 46.3 41.4 41.2 36.7 26.1 45.3 41.0 42.6 37.6 60.9 26.1 36.5 35.5 27.4 21.1
@set 19 2231 8530 9.403 9.403 62 !power, #, MWD/ton, MWD/kgU
TIP2005 TIP2805 TIP3605 TIP1213 TIP2013 TIP2813 TIP3613 TIP4413 TIP0421 TIP1221 TIP2021 TIP2821 TIP3621 TIP4421 TIP0429 TIP1229 TIP2029 TIP2829 TIP3629 TIP4429 TIP0437 TIP1237 TIP2037 TIP2837 TIP3637 TIP4437 TIP1245 TIP2045 TIP2845 TIP3645 TIP4445
19.2 20.6 24.4 35.7 28.4 28.8 32.6 38.7 24.4 31.9 46.5 40.9 44.1 25.6 24.6 23.8 36.9 55.7 35.1 26.6 25.1 28.0 49.6 34.1 48.9 10.1 45.5 23.9 23.8 36.0 34.6
31.9 33.8 37.4 61.5 46.5 44.4 52.1 65.0 40.3 52.8 78.6 64.9 71.0 40.7 38.8 40.9 62.4 89.0 57.0 42.3 41.7 50.0 77.6 53.2 77.0 31.2 67.6 38.6 36.8 52.8 54.3
40.1 42.5 44.1 76.9 57.1 53.4 62.4 79.3 50.1 66.2 97.8 78.8 85.4 49.3 47.9 52.6 79.3 108.7 70.5 52.0 51.5 65.9 93.2 64.4 90.8 54.0 78.4 47.4 44.7 61.0 64.3
46.4 50.4 50.3 85.9 65.8 63.6 71.1 87.4 57.7 75.6 110.9 90.4 96.1 57.8 56.8 60.4 90.3 121.1 81.4 62.7 59.0 73.5 105.5 74.0 101.4 68.8 89.2 55.6 53.3 70.1 71.1
53.6 57.7 55.9 93.7 73.4 72.6 77.1 92.6 65.7 84.4 119.0 98.2 103.5 64.6 64.3 69.3 98.9 126.7 90.7 71.5 66.2 81.4 111.6 82.1 107.2 76.7 93.7 64.2 60.7 76.2 74.7
60.5 64.5 61.3 96.0 79.6 83.3 81.3 96.4 72.4 90.5 120.9 104.5 106.5 71.2 71.8 77.6 103.0 125.3 99.5 81.2 72.2 85.5 113.9 89.0 107.9 83.7 97.4 72.4 68.9 82.2 76.5
67.5 71.5 67.0 96.5 86.3 97.9 86.3 97.8 79.5 98.4 120.3 112.3 107.0 78.1 80.1 87.4 108.0 122.8 110.2 95.1 76.2 88.9 114.4 98.7 109.3 87.9 99.6 82.3 80.6 89.3 76.2
78.5 82.1 74.4 102.6 96.1 117.6 94.1 105.4 89.0 108.5 126.0 122.1 112.3 89.2 90.6 104.9 118.7 124.6 124.7 116.2 82.4 96.1 121.2 111.5 112.9 90.2 104.4 95.7 97.8 97.3 80.6
86.6 88.8 79.3 105.4 102.9 129.4 98.1 108.1 94.0 116.7 122.7 122.7 110.9 97.8 96.8 118.0 120.6 119.4 127.3 127.2 87.9 101.1 119.6 116.4 111.3 97.6 104.9 107.2 110.8 102.5 80.9
93.3 94.3 85.0 108.7 112.4 136.4 104.5 110.6 99.2 125.8 119.9 120.4 109.3 108.6 101.7 126.6 119.7 113.5 126.7 134.0 92.2 107.8 119.2 117.0 112.6 101.8 105.1 120.0 120.0 109.4 81.7
101.6 107.8 90.7 111.3 125.1 143.7 116.8 114.3 105.2 138.6 119.8 120.5 111.4 120.7 108.0 130.3 118.4 111.0 128.4 142.4 97.2 118.9 122.7 119.0 117.4 105.8 109.0 135.0 129.8 120.5 83.6
104.6 104.7 93.3 116.3 130.9 143.9 122.6 117.5 106.5 144.4 123.8 119.5 112.6 125.1 109.7 132.7 118.9 110.2 128.0 144.2 100.2 128.9 124.3 118.3 120.6 113.3 110.8 145.5 133.0 124.3 84.4
105.2 104.7 91.4 116.8 130.6 138.5 121.4 116.1 106.2 141.0 120.8 114.9 109.7 123.7 108.9 129.7 114.5 105.8 122.3 142.1 99.0 130.2 120.2 114.4 117.8 122.4 105.7 149.2 131.6 120.8 81.9
105.8 108.2 90.2 112.1 126.8 133.8 117.4 109.8 106.8 132.2 113.3 108.7 103.9 122.4 113.3 121.5 106.5 97.5 115.6 141.6 95.5 126.8 116.6 107.1 116.1 121.1 99.2 147.6 131.5 116.3 78.4
115.1 117.4 91.0 117.8 127.2 135.7 123.9 110.9 111.8 130.7 114.2 109.5 105.7 127.0 118.9 121.9 106.8 98.5 115.8 145.4 96.8 132.7 119.1 108.2 122.9 112.8 100.2 153.0 138.4 117.8 79.2
117.6 119.4 90.4 122.8 127.2 136.9 130.9 109.5 114.2 131.0 115.8 110.8 107.7 128.3 120.4 122.1 107.0 99.1 118.3 144.6 93.9 139.0 121.6 110.3 128.6 113.0 100.4 154.5 141.4 118.3 79.2
108.5 109.3 83.0 119.2 120.8 130.5 125.1 102.8 105.7 126.6 111.2 105.5 103.9 116.6 109.6 118.0 103.4 94.5 112.9 131.9 86.4 135.1 117.6 107.4 122.3 112.7 92.2 143.5 131.1 109.0 73.2
104.1 106.0 81.4 116.8 123.1 135.2 124.0 100.5 101.8 126.7 113.3 109.5 107.8 115.6 107.3 118.3 103.7 97.9 118.2 128.8 83.4 130.3 122.5 112.8 123.7 105.6 90.4 137.8 127.6 106.2 71.6
98.1 100.0 76.2 113.3 123.0 133.1 118.8 95.8 95.7 124.3 116.4 112.8 110.5 110.0 99.7 120.0 107.8 102.7 121.3 122.3 79.2 127.4 123.4 116.8 119.9 100.0 85.9 130.7 120.6 99.7 67.7
86.7 86.1 65.6 101.5 110.1 115.5 104.8 84.9 82.2 112.6 111.8 106.7 103.6 97.4 86.0 111.8 104.3 99.3 111.9 105.5 60.5 116.7 112.8 109.1 105.8 97.5 74.7 114.9 105.4 86.2 59.5
71.7 72.2 56.0 84.0 93.0 99.6 87.9 69.9 69.4 96.3 99.2 94.9 89.9 82.5 73.1 96.1 93.0 90.0 97.9 89.4 59.6 97.4 98.0 95.2 90.6 88.7 63.1 93.7 88.1 73.0 50.3
61.9 62.3 47.7 72.7 81.2 84.4 76.3 60.8 59.3 84.1 89.3 85.1 60.8 71.8 61.2 85.1 84.0 82.6 86.1 75.5 51.2 84.1 84.9 85.3 77.6 73.2 54.7 79.9 76.3 58.0 43.9
44.8 43.7 31.8 54.0 58.7 56.9 53.9 43.8 41.6 60.4 65.5 61.1 59.0 50.7 40.7 63.5 64.9 62.4 60.6 49.8 36.1 63.7 61.6 63.4 53.2 63.6 38.4 57.7 53.2 42.8 30.9
30.2 28.5 20.3 37.4 38.9 38.0 36.0 26.6 25.9 39.9 43.3 40.3 38.0 32.1 25.2 43.0 44.0 42.1 38.5 32.2 22.1 41.6 40.7 42.5 35.1 53.2 25.0 33.7 35.4 27.8 19.6
@set 20 2131 8917 9.829 9.829 64 !power, #, MWD/ton, MWD/kgU
TIP2005 TIP2805 TIP3605 TIP1213 TIP2013 TIP2813 TIP3613 TIP4413 TIP0421 TIP1221 TIP2021 TIP2821 TIP3621 TIP4421 TIP0429 TIP1229 TIP2029 TIP2829 TIP3629 TIP4429 TIP0437 TIP1237 TIP2037 TIP2837 TIP3637 TIP4437 TIP1245 TIP2045 TIP2845 TIP3645 TIP4445
20.7 19.3 20.3 38.5 26.7 23.8 29.8 33.8 21.9 28.1 40.4 37.8 37.2 22.2 19.6 23.7 36.5 47.0 30.6 21.3 22.2 28.3 41.6 27.7 42.0 10.9 37.9 19.7 19.0 28.3 29.0
31.8 31.5 33.1 60.7 42.7 39.0 46.8 56.6 36.4 47.5 68.9 60.1 61.5 35.7 33.2 39.2 59.7 77.9 50.5 35.8 37.2 47.8 67.9 45.9 67.5 30.5 59.3 33.2 31.7 45.4 47.7
38.2 39.5 40.3 73.0 52.3 48.2 56.9 71.1 45.4 60.0 87.5 72.8 76.6 44.2 42.3 48.7 73.9 97.6 62.8 46.1 46.3 60.4 83.9 57.4 81.5 51.5 71.2 42.3 40.0 54.9 58.2
44.7 46.7 45.6 81.5 60.8 56.5 64.9 78.4 52.4 68.3 99.8 83.2 86.2 51.1 49.7 56.4 83.5 109.9 72.7 54.7 52.6 67.7 96.2 65.9 91.1 64.3 79.7 49.7 46.5 62.1 65.2
50.9 53.4 51.5 87.0 68.1 65.9 71.9 84.9 59.6 77.2 108.5 91.2 94.4 58.4 57.7 64.7 91.3 116.8 82.5 64.3 60.1 74.7 104.0 73.8 98.0 70.7 85.7 58.1 54.5 69.4 69.5
58.2 60.5 57.0 90.6 74.6 76.3 77.1 89.5 66.7 84.4 113.0 98.7 99.5 64.9 65.4 72.6 97.1 118.7 92.2 73.8 65.9 79.6 107.6 82.1 102.8 77.9 91.2 66.9 63.2 75.6 72.1
66.2 67.9 62.6 94.9 82.1 90.1 82.6 93.5 74.0 91.3 114.8 108.3 102.3 73.2 72.5 84.2 104.2 117.6 104.5 85.3 70.8 84.3 110.1 92.5 105.9 82.9 95.3 75.9 73.8 83.0 73.3
77.5 78.8 71.0 102.6 92.8 110.2 92.1 102.3 84.6 103.8 120.3 120.1 109.5 84.2 83.7 102.4 115.0 120.6 120.0 105.1 78.6 92.6 119.1 107.6 111.8 87.4 102.9 89.4 89.9 93.2 77.8
86.5 86.4 78.3 107.1 102.2 124.5 98.2 106.0 92.6 111.2 120.9 121.9 110.3 94.7 93.0 115.9 119.0 118.6 124.2 121.9 84.8 100.0 119.4 113.8 111.5 95.8 104.6 102.0 105.9 100.4 79.9
95.3 94.3 84.8 110.8 113.4 134.6 106.3 109.8 98.2 122.3 118.6 120.4 110.1 107.4 99.4 125.1 118.5 113.8 127.1 132.5 91.0 108.6 121.0 116.7 113.3 101.1 106.6 115.9 113.5 110.3 81.7
104.8 104.3 91.9 116.0 127.6 141.8 118.9 115.0 107.2 137.1 119.3 121.6 112.7 120.8 107.5 131.6 120.4 111.9 129.9 142.0 97.1 121.6 124.8 120.0 118.6 108.4 111.0 134.8 129.4 121.2 85.3
108.4 109.5 95.7 120.2 133.8 146.6 125.5 120.8 110.8 144.3 123.6 121.5 115.6 127.8 111.4 134.7 120.8 112.4 130.7 145.1 101.3 131.1 128.7 121.8 123.7 118.9 114.2 146.9 135.3 126.7 86.7
111.3 110.8 95.6 119.6 135.6 144.4 125.3 119.3 110.4 144.0 124.1 119.0 114.7 128.3 112.1 130.3 118.1 109.4 128.1 145.8 102.2 133.2 127.3 119.1 123.2 126.1 111.6 153.0 137.1 126.3 85.1
115.0 114.2 94.3 119.1 132.5 139.9 123.6 114.1 109.8 135.9 117.3 114.5 108.8 126.4 114.8 125.9 111.4 102.4 121.4 146.2 97.6 131.0 122.8 111.5 121.6 126.5 105.8 153.2 136.8 122.0 82.4
120.9 123.1 96.3 126.1 134.4 142.1 131.4 116.3 117.1 134.8 119.4 115.4 111.9 132.9 122.5 128.3 112.2 103.3 122.0 151.8 99.8 140.2 126.1 114.1 129.4 119.3 106.9 160.5 145.6 122.9 83.9
122.9 125.6 96.9 131.7 136.1 144.5 138.0 116.2 119.3 136.8 119.8 116.9 114.0 134.5 125.3 127.7 113.6 104.0 123.5 152.2 97.5 144.4 129.1 116.7 136.1 119.1 106.9 162.1 149.5 124.3 83.8
114.4 116.6 91.0 126.3 130.1 138.0 132.5 109.6 110.5 131.8 116.3 113.0 110.0 125.5 117.0 122.5 108.6 100.4 120.4 141.0 91.7 140.5 125.6 114.1 130.2 119.7 98.9 152.9 141.4 115.9 78.1
111.0 112.6 88.3 125.7 132.1 142.6 131.9 106.5 106.3 133.3 118.6 116.8 114.3 123.1 112.4 126.1 111.2 103.8 124.8 136.5 88.4 137.7 131.0 118.6 131.3 112.4 97.4 146.6 136.7 113.1 76.4
103.5 105.3 82.5 120.8 131.3 140.9 126.0 103.3 98.7 132.7 122.9 120.1 118.3 119.1 107.1 127.3 115.1 109.1 128.4 130.7 84.8 134.1 131.9 124.2 128.0 106.9 93.0 139.3 130.9 107.7 72.9
88.8 92.5 72.9 106.5 118.3 127.7 112.4 93.0 92.1 120.8 119.2 114.4 112.7 106.1 94.8 117.9 110.5 106.6 121.4 117.6 75.8 121.8 122.2 117.6 115.4 103.9 81.9 123.8 115.3 95.4 64.5
75.3 77.7 62.3 88.2 99.9 108.7 94.8 77.4 74.6 103.1 106.2 102.2 98.2 89.8 80.1 101.2 98.9 96.8 105.7 99.3 64.7 102.3 106.3 102.9 97.7 93.8 69.5 101.9 96.9 79.7 55.0
68.8 66.8 54.1 75.9 87.3 94.1 82.8 67.6 64.6 90.7 96.1 91.1 88.2 79.4 69.3 89.9 89.5 88.5 94.3 85.7 57.0 88.8 91.6 92.4 85.3 78.8 50.7 87.0 84.4 65.7 48.0
44.4 46.6 37.7 53.5 62.8 66.6 59.1 49.9 46.3 66.9 72.5 65.8 67.3 58.0 48.8 65.2 67.8 67.5 68.9 62.9 41.6 66.2 67.2 69.6 60.0 69.4 41.7 63.7 62.6 48.1 33.9
27.8 29.6 23.1 33.9 40.8 42.5 38.6 33.0 29.7 44.8 51.6 43.4 46.3 38.6 30.4 44.1 45.0 45.3 46.0 40.0 27.3 44.0 44.1 47.6 40.3 58.8 27.1 41.8 42.7 31.8 21.3
@set 21 2153 8966 9.883 9.883 66 !power, #, MWD/ton, MWD/kgU

TIP2005	TIP2805	TIP3605	TIP1213	TIP2013	TIP2813	TIP3613	TIP4413	TIP0421	TIP1221	TIP2021	TIP2821	TIP3621	TIP4421	TIP0429	TIP1229	TIP2029	TIP2829	TIP3629	TIP4429	TIP0437	TIP1237	TIP2037	TIP2837	TIP3637	TIP4437	TIP1245	TIP2045	TIP2845	TIP3645	TIP4445
12.1	11.8	12.3	23.2	13.0	14.5	17.8	19.9	13.5	16.9	24.7	22.7	22.5	13.3	12.0	14.4	22.1	29.5	18.6	12.9	13.6	17.2	25.5	17.0	25.3	6.7	23.2	12.1	11.7	17.3	18.0
18.3	19.1	19.9	36.5	25.8	23.5	28.4	34.2	22.2	28.5	42.3	36.1	37.1	21.6	20.4	23.7	36.0	48.5	30.4	21.6	22.6	29.1	41.1	27.9	40.6	18.4	36.0	20.3	19.4	27.5	29.1
22.8	24.1	24.2	43.8	31.6	29.2	34.4	42.5	27.7	36.2	53.6	43.8	46.1	26.7	25.9	29.4	44.5	59.5	37.9	28.1	28.3	37.0	50.5	34.9	48.7	30.6	43.1	25.9	24.5	33.2	35.2
26.5	28.3	27.4	48.8	36.5	34.3	39.2	46.4	31.8	41.6	60.3	50.1	51.7	30.8	30.4	34.0	50.6	66.4	43.7	33.1	32.1	41.2	57.7	40.1	54.5	38.4	48.4	30.3	28.6	37.5	39.3
30.6	32.2	30.9	52.5	41.2	39.9	42.8	50.1	36.3	46.5	65.3	54.9	56.8	35.1	35.2	38.7	54.9	70.2	49.4	38.7	36.6	45.2	62.7	45.0	58.9	42.3	52.3	35.3	33.4	42.1	41.9
34.7	36.5	34.3	55.6	45.5	45.9	46.5	53.2	40.7	50.4	68.0	59.4	59.5	38.9	39.6	43.7	58.1	71.2	54.8	44.5	39.8	48.2	65.6	49.7	61.2	46.9	54.9	40.5	38.3	45.5	43.3
39.2	41.1	37.7	57.4	49.6	54.0	49.9	56.2	45.1	55.1	69.0	64.7	61.2	43.3	44.2	50.2	62.9	70.9	62.5	51.9	42.7	51.4	66.5	55.9	62.4	49.7	57.7	46.4	44.6	50.1	44.1
46.2	47.3	43.0	62.1	56.4	66.6	55.3	61.5	51.0	62.7	72.5	71.4	66.0	50.6	50.7	60.9	69.6	72.3	71.9	63.4	47.7	56.4	71.0	64.8	66.1	52.6	61.8	54.5	54.7	56.0	47.5
51.4	52.0	46.7	64.1	61.8	74.7	58.9	63.7	55.5	68.2	73.2	73.1	66.2	56.8	56.0	69.6	71.0	70.5	74.6	73.3	51.1	60.0	71.9	68.9	67.2	57.2	63.2	62.3	64.0	60.6	48.5
56.6	57.0	50.8	66.5	68.8	80.1	64.4	65.6	60.1	74.6	72.0	73.3	66.2	64.6	60.5	74.8	70.7	68.5	76.5	79.7	54.9	65.5	72.7	70.7	68.2	60.6	64.5	71.5	71.9	65.9	49.5
62.5	62.4	55.6	70.1	76.6	85.8	71.7	69.2	63.9	83.2	72.9	74.2	68.2	72.6	65.3	76.7	72.7	68.4	78.7	85.6	58.8	73.5	75.0	73.7	71.6	65.4	66.8	81.1	78.5	72.9	51.6
65.1	65.1	57.7	72.6	80.7	88.9	76.2	72.4	65.3	87.1	75.8	74.5	70.3	76.9	67.2	80.7	74.1	69.7	79.6	88.2	61.5	78.5	77.8	74.9	75.1	71.2	67.9	88.4	81.6	76.3	52.4
66.5	67.1	57.8	72.5	82.7	88.4	76.6	72.9	66.4	87.3	76.6	74.7	70.3	77.6	66.0	79.7	73.4	68.8	79.6	89.2	61.2	81.0	77.9	74.1	75.8	75.8	66.4	92.7	83.5	76.7	51.6
68.8	69.9	56.6	72.8	82.1	86.5	75.9	69.0	65.9	83.4	75.0	74.5	68.3	77.2	69.0	77.4	71.4	67.0	77.2	89.1	59.9	80.7	77.7	71.6	75.8	76.1	63.7	94.7	84.3	74.1	49.7
72.9	74.9	58.1	76.5	84.6	89.9	81.1	70.3	71.0	85.4	78.2	77.7	72.1	80.9	74.1	79.3	74.4	70.4	79.8	93.5	60.1	86.1	81.2	74.5	81.1	72.2	64.5	98.4	90.5	75.1	50.4
74.6	77.0	58.8	80.5	86.7	93.6	86.1	71.1	71.0	86.7	80.9	82.1	74.7	82.7	76.0	81.7	78.7	75.0	83.7	93.9	59.4	89.2	85.2	78.5	85.9	71.9	64.4	99.4	92.7	76.1	50.4
69.6	70.9	55.3	77.2	85.1	92.0	82.9	67.4	67.2	86.1	81.9	83.4	75.2	77.5	71.5	80.5	79.5	76.5	84.2	88.0	55.9	87.0	85.2	80.2	83.4	72.2	59.4	94.1	87.9	71.2	47.0
67.7	68.3	53.7	76.6	87.6	94.5	82.2	65.1	65.0	87.0	86.9	88.2	78.9	76.5	69.4	82.7	83.6	82.1	87.8	85.1	54.1	85.3	88.1	84.1	84.1	68.1	58.9	90.0	85.1	69.8	45.9
62.9	64.6	50.7	73.9	85.1	90.8	78.1	62.8	61.5	84.5	88.3	88.0	79.1	73.4	65.0	82.2	83.5	83.0	87.4	82.2	51.5	83.0	87.3	84.2	81.2	64.9	56.0	85.9	80.7	65.9	44.1
54.6	56.2	44.9	65.3	75.1	80.7	69.8	56.8	54.2	76.4	81.4	79.3	72.6	65.3	57.8	74.6	76.5	75.6	79.2	72.9	46.1	75.0	78.5	76.6	72.3	63.1	49.6	76.2	70.9	58.7	38.9
45.9	47.6	38.1	54.0	62.9	67.8	58.3	47.6	45.5	64.0	69.3	67.8	61.8	55.6	48.1	63.0	65.0	64.6	67.4	61.7	39.2	62.8	66.4	64.5	61.3	57.0	41.9	62.6	59.1	48.9	33.0
39.4	40.9	33.0	46.3	54.5	58.2	50.9	41.1	39.3	55.7	60.7	58.6	54.8	48.4	41.8	55.1	57.2	57.2	58.9	52.8	34.6	54.0	57.1	57.3	53.1	47.8	36.1	53.1	51.5	40.1	28.7
27.3	29.1	23.3	33.0	39.2	41.0	36.6	30.5	28.1	41.1	45.1	42.3	41.4	35.4	30.0	40.5	42.5	41.8	42.3	38.2	25.2	39.6	40.8	43.0	37.9	42.3	25.4	38.4	37.8	30.0	20.1
17.1	18.7	14.7	21.6	26.2	27.0	28.8	20.0	17.7	28.3	31.2	26.2	28.9	23.1	19.3	27.6	29.4	27.6	20.4	24.9	16.3	25.9	27.9	29.4	25.6	35.6	16.8	25.0	26.0	20.0	12.6

@set 22 2208 9180 10.119 10.119 68 !power, #, MWD/ton, MWD/kgU

TIP2005	TIP2805	TIP3605	TIP1213	TIP2013	TIP2813	TIP3613	TIP4413	TIP0421	TIP1221	TIP2021	TIP2821	TIP3621	TIP4421	TIP0429	TIP1229	TIP2029	TIP2829	TIP3629	TIP4429	TIP0437	TIP1237	TIP2037	TIP2837	TIP3637	TIP4437	TIP1245	TIP2045	TIP2845	TIP3645	TIP4445
11.2	10.4	10.7	19.9	14.0	12.6	15.6	18.0	11.7	14.7	21.4	19.8	19.9	11.9	10.3	12.5	19.2	25.8	16.4	11.4	11.7	14.9	22.0	14.7	22.4	5.9	20.1	10.5	10.1	14.9	15.3
17.0	16.8	17.4	31.7	22.7	20.6	24.8	30.2	19.1	25.0	36.6	31.7	32.8	19.1	17.7	20.7	31.2	42.7	26.9	19.1	19.7	25.2	36.0	24.3	36.1	16.2	31.3	17.7	16.7	23.9	25.0
20.3	21.2	21.2	38.2	27.7	25.6	30.0	37.7	24.0	31.5	46.9	38.6	40.5	23.7	22.5	25.7	38.8	52.2	33.7	24.8	24.9	32.1	43.9	30.4	43.4	27.2	37.6	22.7	21.3	29.0	30.5
24.0	25.1	24.1	43.1	32.0	30.2	34.2	41.7	27.9	36.1	52.9	44.3	45.6	27.5	26.4	29.8	44.2	58.8	39.1	29.3	28.2	36.0	50.1	35.2	48.5	33.9	42.4	26.6	25.1	32.9	34.1
27.4	28.8	27.4	47.1	35.9	35.3	38.1	45.7	31.8	40.9	58.5	49.2	50.6	31.5	30.9	34.3	48.6	63.4	44.6	34.5	31.9	40.1	55.1	40.0	53.0	37.7	46.4	31.5	29.4	35.8	36.9
31.5	32.5	30.7	49.9	40.4	41.0	41.6	48.9	36.3	45.1	61.8	54.1	53.6	35.2	34.9	39.0	52.5	65.4	50.0	39.9	35.6	43.1	58.2	44.6	56.2	41.7	49.9	36.2	34.1	40.9	39.1
36.3	36.8	34.0	53.1	45.1	49.1	45.3	52.3	40.4	50.0	64.4	60.2	56.7	39.2	39.4	45.5	57.6	66.9	57.8	46.6	38.7	46.5	61.6	51.0	59.1	45.2	53.3	41.7	40.1	45.7	41.0
43.2	43.2	39.4	58.4	52.1	61.6	51.0	57.7	46.9	57.4	69.3	67.8	61.2	47.4	46.2	56.3	64.9	69.9	67.3	58.2	43.5	52.1	66.3	60.4	63.7	48.2	57.8	49.9	50.1	52.5	44.1
48.8	49.0	44.1	60.9	57.6	71.3	55.6	61.4	51.6	63.2	69.1	69.5	63.0	53.9	51.7	65.2	67.5	68.7	71.8	68.8	48.3	57.0	68.8	65.1	64.1	53.9	60.2	58.3	59.2	57.4	45.8
54.9	53.9	48.5	63.8	65.0	77.7	60.7	64.3	56.9	70.6	69.8	70.2	64.0	62.0	56.8	71.1	68.1	67.1	73.7	76.3	52.9	62.5	69.0	67.9	66.7	58.2	62.0	67.5	67.8	63.6	47.7
61.3	60.1	53.8	68.2	73.4	83.8	68.9	68.3	61.8	79.9	71.8	72.2	66.6	71.0	62.5	76.8	70.9	67.6	76.5	83.2	57.6	71.3	72.5	70.8	70.4	63.1	65.4	78.1	75.5	70.8	50.5
64.7	64.1	56.3	70.4	78.3	85.2	74.6	72.2	64.5	85.0	74.9	73.9	69.3	75.0	65.9	78.5	72.6	69.2	78.3	86.9	60.5	77.6	74.2	73.1	73.6	70.2	67.4	86.8	79.2	74.4	52.2
66.6	66.2	56.9	71.9	80.8	85.8	75.1	73.0	66.4	86.2	76.2	74.1	68.8	76.3	67.5	78.6	72.6	69.1	78.2	88.2	60.9	79.6	75.4	72.8	74.9	74.3	66.2	91.0	81.9	75.9	50.8
70.1	69.1	55.8	71.8	80.9	85.5	74.3	69.8	66.2	82.6	74.5	73.2	67.5	77.3	68.8	76.4	71.0	67.2	76.5	88.6	59.2	79.8	75.8	70.6	75.3	74.9	63.8	93.6	83.0	73.8	49.3
73.6	74.7	58.3	76.5	83.2	89.6	79.4	70.8	69.7	84.2	77.9	77.0	70.9	80.9	74.4	79.2	74.4	70.7	79.4	93.7	60.6	85.5	80.1	72.9	80.4	72.3	64.6	98.2	89.1	75.7	50.4
75.3	76.7	58.7	80.3	85.8	93.6	84.6	71.2	71.8	87.3	81.3	82.4	74.1	82.9	75.5	81.6	78.5	76.1	83.1	93.7	59.5	90.2	84.6	78.4	85.6	72.7	64.7	99.4	92.1	75.5	50.2
69.0	70.0	55.0	77.3	84.6	91.8	81.9	67.6	67.5	86.1	82.6	84.0	74.6	78.1	71.0	80.3	79.9	78.0	83.3	88.1	56.1	88.0	84.8	79.5	82.9	72.4	60.2	93.5	87.4	70.8	47.4
67.4	68.4	53.8	76.3	86.6	93.8	81.7	65.7	64.7	87.0	87.1	88.5	78.3	75.9	68.9	82.6	84.0	82.3	87.5	84.8	54.3	86.3	87.9	83.4	83.9	67.1	58.9	90.4	85.1	69.0	46.8
63.4	63.9	50.9	73.7	84.5	90.6	77.8	63.4	61.8	84.7	88.9	87.5	79.2	73.7	65.8	82.0	84.2	83.4	87.0	81.1	51.8	83.0	86.3	83.8	81.3	65.6	56.4	86.0	80.3	66.2	44.4
54.4	56.4	45.0	65.4	74.2	80.1	69.1	57.5	54.4	76.4	82.5	79.1	72.2	65.2	58.7	73.0	76.0	76.7	79.1	72.9	47.0	75.2	77.4	76.6	72.0	63.3	50.1	76.0	71.1	58.4	39.6
45.8	47.0	38.6	54.0	62.0	67.4	58.1	47.6	45.8	64.3	70.5	67.5	61.3	54.7	49.0	63.2	64.4	65.8	67.0	61.4	40.2	63.6	65.7	64.9	60.7	57.3	42.3	63.0	59.4	49.0	33.5
39.3	40.9	33.3	46.3	54.0	58.0	50.9	41.7	39.3	55.8	61.4	58.3	54.5	48.8	42.3	55.3	56.6	57.7	58.7	53.0	35.3	55.0	57.0	56.9	52.5	48.3	36.7	53.5	51.9	40.1	29.3
27.1	29.0	23.6	33.2	38.9	41.0	36.2	31.1	28.5	41.5	46.1	42.2	41.5	35.7	30.4	41.0	43.0	42.3	42.6	38.6	25.6	40.5	41.3	43.0	38.0	43.0	25.4	39.0	37.9	30.2	21.0
17.4	19.2	14.9	21.7	25.4	26.9	23.9	20.7	18.9	28.3	32.6	28.3	30.0	24.7	19.4	28.4	29.9	28.7	29.4	25.8	17.2	26.6	28.1	30.7	26.5	36.7	16.8	26.7	26.8	20.8	13.6

@set 23 2114 9354 10.311 10.311 70 !power, #, MWD/ton, MWD/kgU

TIP2005	TIP2805	TIP3605	TIP1213	TIP2013	TIP2813	TIP3613	TIP4413	TIP0421	TIP1221	TIP2021	TIP2821	TIP3621	TIP4421	TIP0429	TIP1229	TIP2029	TIP2829	TIP3629	TIP4429	TIP0437	TIP1237	TIP2037	TIP2837	TIP3637	TIP4437	TIP1245	TIP2045	TIP2845	TIP3645	TIP4445
10.2	9.9	10.1	18.9	13.2	12.0	14.6	17.3	11.2	14.0	20.4	18.5	19.0	11.3	10.0	11.9	18.4	23.6	15.7	11.0	11.1	14.1	20.9	14.1	21.3	5.6	19.1	10.1	9.8	14.3	14.8
15.9	16.1	16.5	30.1	21.6	19.5	23.2	28.8	18.6	23.7	34.5	29.9	31.3	18.3	17.0	19.6	29.8	39.6	25.7	18.4	18.7	24.0	34.1	23.1	34.4	15.5	29.6	17.0	16.2	22.9	24.3
19.3	20.2	20.2	36.8	26.4	24.3	23.3	35.7	23.0	29.8	44.0	36.5	38.7	22.6	21.4	24.4	36.9	49.4	32.3	23.6	23.5	30.6	41.8	29.1	41.4	26.0	35.7	21.8	20.5	27.7	29.5
22.4	24.0	22.9	40.9	30.4	28.5	32.5	39.8	26.5	34.4	50.1	41.7	43.2	26.2	25.3	28.1	42.1	55.6	37.1	28.1	26.7	34.1	48.0	33.3	46.6	32.1	40.5	25.5	24.0	31.4	32.8
25.7	27.5	26.1	45.1	34.6	33.3	35.9	43.2	30.7	39.0	55.7	46.5	48.2	29.9	29.5	32.4	46.5	59.7	42.3	32.7	30.7	37.8	52.7	38.0	50.9	35.7	44.7	30.1	28.2	35.5	36.2
29.6	30.9	29.5	48.5	38.8	38.9	39.5	46.8	34.8	43.1	58.9	51.4	51.5	33.7	33.4	37.0	50.2	61.8	47.9	37.9	34.3	41.1	56.3	42.7	54.5	39.9	47.8	34.8	32.4	39.7	38.1
34.0	35.1	32.6	51.6	43.0	46.6	43.5	50.2	38.7	47.6	61.4	57.3	54.9	38.1	37.5	42.9	54.7	63.6	55.4	44.8	37.4	44.6	59.4	49.2	57.2	42.9	51.1	40.1	38.6	44.1	39.5
40.7	41.9	37.4	56.6	50.0	58.5	49.0	55.9	45.1	54.7	66.5	64.9	59.5	45.3	44.5	53.5	62.7	67.5	64.8	56.2	42.1	49.6	65.0	58.0	61.5	46.4	55.8	48.4	48.0	51.1	43.0
46.2	47.2	42.1	59.6	56.0	68.3	53.0	59.7	49.5	60.9	67.7	67.6	61.5	52.2	50.4	62.0	66.0	66.6	69.1	66.4	46.4	54.8	66.9	63.0	63.1	52.6	58.3	56.6	57.7	55.8	44.5
52.3	52.6	46.9	63.0	64.0	74.3	59.3	63.3	55.0	69.1	68.4	68.9	63.3	60.7	55.5	69.2	67.4	65.6	72.1	74.0	51.3	61.0	67.6	65.7	65.1	56.9	60.8	65.8	66.2	62.5	47.0
59.1	59.4	52.3	67.7	72.9	81.3	67.8	68.0	60.7	78.4	71.0	71.6	65.4	69.3	60.8	75.2	70.4	66.2	75.5	81.3	56.0	69.6	71.7	69.9	69.5	61.4	64.0	76.8	73.5	70.0	50.1
63.3	63.0	55.6	71.0	78.1	84.8	72.2	70.5	64.3	83.3	74.5	72.9	67.9	74.0	64.9	77.2	72.2	68.6	77.4	84.8	59.1	76.0	75.1	72.4	72.7	68.0	65.9	85.1	77.8	74.0	51.6
65.7	65.6	56.4	72.1	80.3	85.7	74.0	71.8	65.2	84.3	74.9	72.8	68.7	75.2	67.4	77.5	72.1	68.4	77.6	86.5	60.3	78.7	75.4	71.9	74.1	73.4	65.2	90.4	81.1	74.7	51.0
69.0	66.9	56.0	71.3	81.0	84.3	74.0	69.8	65.9	82.4	74.1	73.4	67.4	75.8	68.7	75.6	70.8	66.5	76.3	87.5	58.5	78.9	75.3	70.7	75.5	74.4	62.6	92.9	83.6	73.4	49.4
72.9	75.2	57.7	75.9	84.0	89.3	79.7	70.9	70.0	84.8	78.2	77.5	71.4	80.3	73.7	78.5	74.4	70.3	78.7	93.0	59.7	84.9	80.5	74.1	81.8	71.3	64.3	98.8	89.0	75.1	50.3
75.0	76.4	58.2	80.5	86.7	92.6	85.0	71.3	71.8	86.5	81.6	82.6	74.2	81.9	75.0	81.1	78.8	75.6	82.6	93.8	59.4	89.7	84.4	77.6	86.5	72.0	64.3	99.4	91.7	75.4	50.8
70.3	70.4	55.2	77.4	85.6	91.5	82.5	67.2	67.2	86.5	83.0	83.7	74.6	77.1	71.0	79.8	80.6	77.4	83.4	87.8	56.0	87.5	84.6	78.9	83.7	71.3	59.8	94.3	88.3	70.5	48.1
68.2	68.7	53.9	77.5	87.8	93.5	81.9	65.4	65.5	87.3	87.2	89.0	79.0	76.2	69.1	82.6	84.3	82.1	88.3	84.9	53.9	85.7	88.2	83.7	84.5	68.3	59.4	90.7	86.0	69.2	47.2
64.0	64.8	51.0	74.8	85.6	90.6	78.2	64.1	61.7	85.3	89.6	87.9	79.4	73.4	66.2	81.7	85.0	83.3	87.5	81.2	52.3	83.9	87.5	84.1	82.3	65.8	56.8	86.8	81.4	66.2	45.2
55.7	57.2	45.5	66.2	75.6	80.7	69.8	58.0	55.3	76.9	82.8	79.7	72.3	65.3	58.7	74.4	76.8	77.1	79.3	73.3	47.0	75.3	78.5	76.3	72.6	63.8	50.5	76.8	71.7	59.2	40.2
47.2	48.1	39.0	55.4	63.1	68.2	59.1	48.3	46.3	64.9	70.3	68.2	62.1	55.6	49.7	63.6	65.5	66.1	67.8	62.3	41.0	63.2	66.5	65.0	61.6	57.7	42.8	64.1	60.1	50.0	34.5
40.3	41.7	34.0	47.8	54.9	58.8	52.2	42.0	40.1	56.6	62.1	59.5	55.6	48.9	43.1	56.1	58.0	58.6	59.8	53.7	35.6	54.9	57.9	57.7	53.8	48.8	37.2	54.7	52.5	40.7	30.1

28.6	29.7	24.2	33.9	39.4	42.2	37.6	31.3	29.1	41.6	47.2	43.0	41.6	35.8	30.5	41.1	43.3	43.3	43.4	39.0	25.8	40.2	41.8	43.5	38.5	43.8	26.2	39.3	38.6	30.3	21.3
18.2	19.5	15.0	22.0	25.7	28.4	26.1	20.7	19.0	28.5	34.0	28.7	29.0	24.1	19.1	27.7	30.0	29.2	29.1	25.2	17.0	26.6	27.4	31.2	25.9	36.7	17.4	25.0	26.7	20.8	14.0

D.6 Cycle 2 TIP Measured Data

```
HATCH CYCLE-2
7  31  24  !cases, # of detectors, # of axials (opposite direction to PARCS)
@set 25  49.7  8251   9.095   9.149   6  !power, #, MWD/ton, MWD/kgU
```

TIP2005	TIP2805	TIP3605	TIP1213	TIP2013	TIP2813	TIP3613	TIP4413	TIP0421	TIP1221	TIP2021	TIP2821	TIP3621	TIP4421	TIP0429	TIP1229	TIP2029	TIP2829	TIP3629	TIP4429	TIP0437	TIP1237	TIP2037	TIP2837	TIP3637	TIP4437	TIP1245	TIP2045	TIP2845	TIP3645	TIP4445
49.7	49.5	36.3	76.9	86.4	86.6	82.3	47.7	39.2	67.6	66.4	89.5	73.5	63.5	43.7	76.6	70.6	72.0	77.9	71.8	32.2	68.0	80.4	72.0	77.9	27.0	49.6	65.0	63.6	61.0	34.7
63.4	66.4	50.3	97.8	109.7	115.1	108.6	73.1	62.8	100.1	97.4	109.1	106.7	95.3	66.4	112.7	103.4	99.0	110.0	104.2	49.5	101.4	108.6	104.8	110.3	60.7	73.1	94.9	93.0	88.8	51.8
70.7	75.6	57.5	108.5	117.6	125.1	117.0	87.2	77.4	113.7	111.0	113.6	120.2	110.9	79.1	129.6	115.5	108.0	120.3	117.9	58.3	116.5	118.6	118.4	121.5	92.4	86.6	106.8	107.1	102.6	60.8
77.9	82.6	63.4	114.3	122.5	129.7	120.9	98.3	85.1	120.0	114.1	115.1	125.5	119.0	88.1	137.3	119.1	111.7	126.2	123.2	63.8	121.8	125.3	123.9	124.1	109.8	97.4	114.0	114.2	111.6	67.5
81.6	84.6	66.1	111.0	118.0	128.6	114.5	102.7	90.4	117.0	111.9	106.6	122.1	118.0	93.6	135.9	115.9	108.9	121.5	123.8	69.5	119.8	121.9	121.4	120.6	119.6	102.3	111.9	111.6	112.4	71.7
85.1	85.9	71.5	106.8	111.1	124.3	107.5	105.4	92.4	109.6	103.9	99.7	115.4	112.4	96.6	127.4	110.1	101.3	115.2	119.0	74.3	115.1	113.0	113.2	111.5	120.2	103.2	105.5	105.4	110.6	73.6
91.9	88.1	81.2	106.2	108.6	119.5	103.5	107.7	93.8	100.7	96.6	95.1	108.3	106.9	99.9	118.6	102.5	94.8	106.4	113.4	80.9	108.5	107.7	105.0	102.3	118.1	106.4	101.9	99.6	112.0	76.3
96.8	92.5	87.9	103.6	108.1	118.9	103.0	111.7	99.9	98.8	93.6	90.4	106.5	108.6	104.2	118.1	99.6	93.3	103.6	115.2	89.4	106.8	107.1	102.7	101.4	117.7	111.6	102.8	101.1	115.1	79.5
103.3	98.4	89.1	100.2	107.2	117.3	99.6	109.5	104.7	94.4	88.8	88.2	101.0	107.2	109.5	114.5	95.1	90.3	98.1	114.2	92.2	101.0	103.6	99.1	95.8	123.2	110.3	102.9	102.3	112.5	77.5
111.2	109.1	90.7	96.9	105.7	117.6	96.5	108.0	112.5	93.5	85.2	84.7	96.8	110.4	118.2	114.4	91.5	88.2	93.3	120.3	93.5	95.8	100.4	94.8	90.2	122.5	106.5	106.9	107.0	110.5	76.0
118.5	119.3	91.8	96.7	108.1	122.7	96.8	108.4	121.6	93.5	84.9	86.9	97.9	119.1	129.3	115.5	91.4	90.7	93.7	131.1	97.2	94.1	100.3	94.2	89.9	120.3	105.5	112.9	114.7	111.1	75.6
119.0	121.8	90.5	93.7	109.3	122.7	95.5	107.8	123.8	95.8	86.8	89.1	99.1	121.7	133.1	115.6	94.2	92.6	94.5	134.6	96.1	95.0	101.5	96.9	90.0	120.4	103.1	115.8	121.7	109.1	75.3
112.3	116.5	86.7	87.3	104.3	119.9	92.1	103.5	122.6	93.5	87.4	88.6	96.6	117.7	128.2	114.1	95.0	93.5	92.3	130.6	93.0	92.3	99.9	95.9	87.1	121.7	97.8	113.3	120.7	103.7	73.8
111.4	116.1	85.3	89.0	104.7	117.9	91.1	98.4	115.8	89.1	87.1	94.8	96.3	112.4	122.2	110.7	98.4	99.3	91.4	126.4	88.3	87.9	99.4	95.1	84.4	117.7	93.4	109.9	115.1	99.0	70.0
107.6	114.1	82.6	89.9	105.7	118.3	94.0	98.9	113.0	90.4	93.9	105.5	102.3	112.0	120.3	111.8	107.4	109.8	96.2	125.3	87.3	90.5	103.2	100.2	88.4	111.8	93.4	110.4	115.2	98.8	69.6
99.7	109.0	80.4	91.0	104.7	119.0	96.3	98.2	108.9	92.2	102.0	114.2	107.0	111.2	116.3	111.6	118.5	121.6	99.6	121.1	83.6	94.2	109.2	103.6	93.5	111.9	92.7	110.0	113.7	98.3	69.0
93.1	100.0	74.8	93.4	101.1	113.8	96.6	93.0	100.2	90.1	104.9	118.6	105.8	102.6	105.3	106.9	123.7	127.8	99.5	111.7	77.2	94.7	108.0	102.9	94.6	111.6	87.0	102.6	106.3	91.4	65.8
89.8	96.3	73.2	95.0	102.5	114.8	101.8	92.5	94.4	91.3	110.4	122.8	109.4	100.6	100.8	105.3	129.8	137.3	103.5	107.7	74.7	99.6	112.2	105.6	101.0	105.0	86.2	100.2	103.2	89.8	65.0
81.0	88.3	67.2	90.1	99.1	111.5	98.3	88.2	87.9	92.1	112.2	118.5	111.5	96.7	93.2	104.9	130.1	135.8	104.1	101.0	69.5	100.3	111.8	107.2	101.5	102.9	82.4	95.9	99.3	86.1	61.9
68.5	75.1	57.8	77.6	91.0	102.1	86.5	78.2	77.5	87.3	104.4	105.5	105.3	85.3	79.9	99.3	119.5	122.4	98.1	89.0	61.4	92.5	105.3	103.7	93.2	99.0	72.4	85.1	88.7	75.6	55.7
56.8	62.8	48.0	64.5	79.9	90.1	75.4	65.1	64.9	78.8	92.3	91.1	95.6	73.4	67.0	90.9	105.0	106.8	90.9	75.4	54.0	80.7	94.0	95.1	82.1	87.7	61.4	72.9	75.7	64.8	47.5
42.5	47.4	35.3	49.3	62.6	69.7	60.0	51.0	52.0	67.2	77.4	71.9	80.0	58.6	52.5	80.0	85.5	84.5	75.0	59.8	45.2	66.2	76.9	80.3	67.2	75.8	47.2	57.8	62.1	52.3	37.2
29.3	33.2	24.9	34.5	45.5	51.5	43.8	36.2	38.9	53.1	60.0	53.6	60.1	43.8	38.2	57.9	65.6	63.8	56.3	44.3	30.5	51.0	58.9	63.1	51.0	63.9	34.3	43.3	48.0	39.3	27.7
22.4	24.9	19.1	27.9	37.2	39.0	34.1	24.2	28.4	39.5	46.3	47.7	43.4	30.6	26.9	42.1	48.5	47.0	41.1	32.2	21.2	37.4	41.6	48.1	38.0	50.8	24.0	32.8	35.4	27.9	20.0

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@set 26  50.2  8643   9.527   9.581   8  !#, MWD/ton, MWD/kgU
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TIP2005	TIP2805	TIP3605	TIP1213	TIP2013	TIP2813	TIP3613	TIP4413	TIP0421	TIP1221	TIP2021	TIP2821	TIP3621	TIP4421	TIP0429	TIP1229	TIP2029	TIP2829	TIP3629	TIP4429	TIP0437	TIP1237	TIP2037	TIP2837	TIP3637	TIP4437	TIP1245	TIP2045	TIP2845	TIP3645	TIP4445
50.2	49.9	37.5	80.5	86.0	82.9	85.0	52.3	38.9	66.3	62.5	83.2	73.3	66.4	44.1	75.2	66.8	68.2	77.3	73.3	33.0	68.9	77.7	70.1	78.5	29.9	52.8	67.5	63.4	63.7	37.2
64.1	67.3	51.8	103.4	108.4	110.6	110.2	78.8	62.9	98.7	92.8	102.4	104.4	98.9	66.4	109.8	97.9	93.0	106.8	105.0	50.3	102.8	106.3	101.1	109.8	65.0	79.3	97.4	93.2	92.6	54.4
71.9	76.4	58.4	113.6	116.6	120.8	117.7	92.6	77.7	112.7	105.7	107.0	115.0	115.1	80.1	125.1	109.5	102.1	117.9	116.9	59.4	118.4	116.3	113.6	120.1	98.2	93.1	109.5	107.3	107.1	63.7
79.3	84.7	64.5	119.7	123.2	127.5	121.8	103.3	86.5	117.7	109.8	110.1	120.5	122.4	90.2	135.4	113.7	106.3	123.5	124.4	65.6	124.2	123.2	121.2	124.2	114.4	103.3	116.6	113.6	114.9	70.8
82.5	86.9	68.3	116.6	120.1	125.3	118.1	107.4	92.4	117.3	108.7	104.6	119.5	121.9	95.7	135.4	112.7	105.1	120.8	122.5	71.4	125.2	122.0	119.6	119.3	122.9	107.7	115.7	112.2	115.9	74.0
85.8	87.2	73.2	114.4	113.9	122.3	109.3	108.6	93.9	110.1	102.6	97.9	113.2	114.8	98.6	128.9	107.8	100.7	113.3	117.2	76.5	119.2	115.7	112.5	111.5	124.1	108.2	109.2	107.7	115.6	76.6
92.8	90.7	82.2	110.2	110.6	119.9	105.0	111.9	95.8	103.7	96.7	95.6	107.1	109.8	102.4	121.6	101.6	94.6	105.4	114.9	82.7	109.9	110.3	105.2	103.6	122.1	111.6	104.3	101.3	114.8	77.7
98.7	95.2	89.2	108.0	111.8	119.9	104.5	116.6	101.2	102.0	93.5	92.9	107.3	109.9	108.3	120.1	100.4	93.6	103.2	117.0	92.1	108.7	108.3	104.2	101.3	122.4	115.2	105.4	102.4	119.6	81.0
104.6	101.0	91.6	103.9	109.8	118.4	101.1	112.8	107.2	98.2	89.8	88.7	102.7	110.1	112.7	117.9	96.6	91.8	98.8	116.6	94.2	104.1	105.0	100.5	96.3	129.0	114.0	106.9	105.2	119.1	79.5
114.8	111.8	91.8	98.1	108.5	118.8	98.5	110.9	113.1	95.3	86.8	86.6	99.4	113.5	122.7	117.8	94.3	89.1	95.7	123.9	96.4	99.2	102.2	97.2	92.3	127.3	111.3	108.6	110.1	115.3	77.2
121.9	123.8	94.3	98.3	111.8	124.0	99.3	109.8	123.6	95.4	87.4	88.9	98.3	120.6	132.8	119.0	94.1	91.6	96.4	134.2	98.9	96.9	102.2	97.5	92.5	124.0	108.6	115.6	119.8	114.6	77.7
120.5	125.6	92.8	95.5	111.9	124.9	97.8	109.7	126.4	97.3	89.8	89.7	98.7	124.7	137.8	120.1	96.1	94.2	96.4	138.6	97.7	97.0	102.3	99.4	91.9	124.1	107.1	119.7	125.9	113.8	76.5
113.8	121.0	88.9	89.6	108.1	121.8	93.9	103.7	123.9	95.2	90.1	90.1	98.9	118.7	134.1	116.9	97.6	93.4	94.0	134.6	94.5	94.5	101.7	98.4	88.9	125.9	101.1	114.8	124.2	107.2	74.3
113.1	119.2	87.1	91.1	108.5	120.8	94.1	99.8	118.1	91.1	89.3	96.5	98.2	114.0	127.5	112.7	100.0	100.0	94.6	129.1	90.4	89.7	102.0	97.5	86.7	120.9	96.1	111.6	118.2	101.5	71.9
109.1	117.0	84.8	92.3	108.2	121.8	96.2	101.0	114.7	93.6	96.2	107.4	102.8	113.3	123.5	115.1	108.9	111.6	97.9	127.0	89.4	92.2	106.7	102.6	91.2	114.2	96.1	111.7	119.0	101.9	71.6
102.2	111.8	82.6	93.4	106.6	120.3	97.3	100.5	110.2	94.3	104.0	115.4	107.5	111.9	120.3	114.0	121.1	123.8	102.7	123.2	86.1	96.3	111.9	106.4	96.2	113.8	95.4	112.1	116.5	101.2	71.0
95.1	102.8	77.3	94.4	103.1	115.7	98.8	94.5	101.2	90.6	107.3	120.4	106.4	104.9	110.2	108.5	126.8	129.5	101.6	113.2	79.9	97.1	110.4	104.9	96.8	112.7	89.0	105.6	108.9	94.9	67.5
92.1	100.0	75.4	96.8	105.0	116.8	104.2	93.9	96.2	92.0	113.2	124.9	110.9	101.8	105.0	107.9	132.5	138.9	106.2	110.3	77.7	101.6	115.1	108.6	102.9	106.6	88.4	102.3	107.0	92.9	66.4
83.4	91.6	69.5	92.3	102.1	113.9	100.4	90.6	89.2	93.9	115.1	120.7	112.8	97.3	96.7	107.6	132.3	137.4	107.6	103.3	71.8	102.3	115.8	110.6	103.2	104.6	85.1	97.5	102.2	88.4	63.3
70.6	77.4	59.9	80.5	92.4	104.7	89.0	79.7	78.5	89.7	108.4	107.5	107.3	87.0	83.7	101.9	122.4	124.7	101.9	90.1	63.5	94.8	108.1	106.1	94.9	100.9	74.7	87.1	90.9	78.9	57.8
58.3	65.2	50.4	66.4	82.7	92.7	77.2	67.4	66.3	82.0	96.3	94.2	97.4	74.8	70.2	93.0	107.4	108.9	96.2	77.1	55.2	83.0	97.7	98.1	84.1	88.9	63.1	75.4	78.4	67.3	49.2
43.9	50.1	37.7	50.8	65.2	72.8	61.5	51.8	54.0	69.8	81.5	71.9	80.9	59.7	55.1	84.4	87.1	87.1	76.4	61.3	46.9	68.8	80.6	83.8	68.7	76.5	48.9	59.7	64.2	54.2	39.0
29.8	35.4	26.8	35.6	47.5	53.6	45.4	36.8	41.1	55.8	61.2	55.6	61.7	44.2	40.4	61.9	67.9	65.8	57.5	45.6	32.2	53.6	61.1	65.9	52.2	65.3	35.8	45.3	49.3	41.6	29.0
23.6	25.9	19.5	29.3	38.5	40.4	35.3	24.6	29.7	41.7	49.3	49.2	43.0	32.4	27.8	45.0	54.2	48.5	41.8	33.0	22.0	39.9	44.2	50.5	39.1	50.6	24.8	33.3	36.3	29.9	21.0

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@set 27   55.0  8941   9.856   9.910  10  !#, MWD/ton, MWD/kgU
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TIP2005	TIP2805	TIP3605	TIP1213	TIP2013	TIP2813	TIP3613	TIP4413	TIP0421	TIP1221	TIP2021	TIP2821	TIP3621	TIP4421	TIP0429	TIP1229	TIP2029	TIP2829	TIP3629	TIP4429	TIP0437	TIP1237	TIP2037	TIP2837	TIP3637	TIP4437	TIP1245	TIP2045	TIP2845	TIP3645	TIP4445
55.0	54.4	42.3	95.4	88.7	85.9	93.7	60.8	76.1	72.8	63.8	86.7	74.7	84.7	88.7	80.6	66.4	74.7	77.8	96.3	59.0	77.4	79.8	72.4	80.7	35.6	76.3	74.4	68.9	73.0	47.0
70.0	72.8	57.1	118.8	111.4	114.4	120.6	90.0	121.6	106.1	93.0	107.6	106.2	121.9	129.8	116.7	96.7	99.4	106.7	133.4	88.0	114.4	108.3	106.0	111.0	77.3	111.1	106.6	99.6	55.0	68.1
77.3	82.6	64.8	127.3	120.1	125.1	127.8	103.7	143.1	119.8	105.5	111.3	117.8	135.5	148.5	131.7	108.6	107.6	118.2	144.9	100.8	128.3	117.3	119.9	121.7	115.0	126.8	119.0	113.5	121.9	78.3
85.8	90.1	70.8	130.1	126.4	132.5	131.0	112.7	150.8	122.8	109.5	113.7	122.1	140.4	156.0	137.0	113.0	112.0	124.3	150.6	105.8	131.5	124.3	126.0	126.1	130.9	135.8	125.5	120.8	129.5	84.9
91.0	91.8	74.9	122.5	121.6	130.9	123.7	111.4	145.3	118.6	108.7	107.5	119.4	133.6	150.3	135.1	112.0	108.7	119.5	141.6	105.4	127.8	121.4	123.0	122.2	136.7	132.0	123.3	119.1	125.4	85.6
97.3	92.4	80.1	113.6	116.0	125.8	115.0	107.2	134.6	110.5	103.2	100.7	113.6	121.7	136.8	126.1	107.1	103.0	112.3	127.6	98.1	117.4	113.4	115.1	114.4	132.4	125.2	117.5	111.5	122.6	82.4
108.3	93.4	89.7	112.2	114.5	121.4	110.4	101.6	122.8	101.4	96.7	96.3	106.8	110.0	125.4	116.9	102.7	98.2	107.3	116.0	91.5	110.6	108.5	107.1	107.2	124.6	118.9	114.0	105.3	120.8	80.5
113.2	93.4	95.0	112.9	114.1	119.3	110.9	105.3	117.6	99.1	95.7	93.5	106.9	104.8	121.4	112.8	101.7	96.1	104.7	109.7	89.6	111.3	105.4	103.8	105.7	115.9	117.2	117.8	105.8	125.8	81.6
112.1	90.6	93.2	113.5	110.2	115.1	107.1	108.2	111.3	96.0	91.0	89.7	101.1	98.8	111.2	108.5	97.2	92.5	98.3	104.0	87.3	111.4	102.2	98.2	102.0	118.0	113.7	115.7	100.8	122.1	80.2
111.1	89.7	91.8	114.4	106.5	111.2	104.2	110.4	105.4	94.0	89.6	85.9	99.6	98.1	105.5	107.5	94.5	90.3	94.5	100.8	85.8	110.8	99.4	94.3	98.0	118.3	108.8	111.0	98.1	115.6	78.4
110.8	90.1	90.1	117.7	108.5	113.2	104.9	115.1	103.5	95.0	90.5	89.4	102.7	99.6	104.0	108.7	96.1	94.1	98.1	102.4	85.2	113.5	99.6	94.0	98.0	119.5	107.4	108.4	95.9	112.8	79.0

105.4 88.7 87.5 114.9 107.1 112.4 104.0 117.0 104.8 98.3 92.5 92.0 104.1 102.5 105.4 112.1 99.2 98.7 100.0 106.6 86.6 114.6 100.0 96.6 97.8 122.7 105.8 108.4 96.7 110.5 79.0
100.0 88.4 83.3 107.4 101.4 110.3 99.5 113.7 102.7 100.7 93.5 94.9 103.6 102.8 105.0 115.4 100.9 101.8 99.9 108.6 86.0 112.8 98.1 96.4 95.1 124.6 100.7 104.8 95.9 103.9 76.9
100.9 93.4 81.4 107.8 102.8 111.2 98.7 108.8 101.3 102.9 93.5 104.7 103.9 106.6 103.1 122.5 102.3 110.4 100.0 114.4 83.0 107.9 99.1 96.7 93.1 122.6 95.1 100.1 94.9 98.9 74.0
100.7 100.9 81.1 107.1 105.3 113.2 99.6 109.1 103.3 110.8 98.1 113.4 109.0 114.3 106.5 134.6 107.1 120.3 105.2 124.2 84.7 110.3 103.9 101.9 94.9 119.7 95.4 102.8 101.4 98.2 74.3
98.2 106.0 79.4 103.3 106.8 115.7 99.2 107.9 101.9 114.3 100.2 114.9 112.7 117.9 108.2 140.0 112.4 125.1 108.0 127.5 82.7 112.3 107.0 105.1 97.8 122.3 93.5 105.1 107.9 97.9 72.7
93.8 103.2 75.2 99.0 106.9 112.3 97.1 99.7 96.2 110.6 97.6 112.7 109.7 111.3 102.6 133.8 111.0 122.8 105.0 120.5 76.9 106.4 105.2 102.1 96.9 122.4 87.2 99.6 105.8 91.9 68.3
91.9 103.2 73.4 97.6 112.7 114.4 100.7 96.7 92.5 110.3 100.3 114.4 111.7 109.8 100.1 132.4 113.5 126.1 109.5 117.0 74.2 105.2 113.2 104.5 100.8 113.7 84.4 99.1 106.5 90.5 66.5
84.5 95.0 68.1 90.7 108.9 110.2 98.5 91.0 88.2 108.2 102.3 110.3 112.4 104.0 93.6 127.4 114.6 123.3 108.4 111.2 70.8 103.3 115.9 104.4 102.5 110.3 80.6 97.0 103.7 86.0 63.1
71.4 81.0 59.9 77.9 96.5 98.5 87.4 79.6 76.6 98.5 99.1 98.8 106.4 90.8 81.7 115.3 109.8 111.8 102.0 96.6 62.7 93.8 107.8 99.1 94.6 105.5 71.0 87.0 92.8 76.2 56.4
59.4 68.9 49.3 64.4 83.5 87.6 75.9 66.2 65.8 84.9 89.6 86.6 96.0 77.2 68.0 98.7 101.0 99.0 93.4 81.5 54.5 81.2 96.6 90.9 83.5 92.0 59.7 74.2 79.2 65.5 48.2
44.7 51.7 36.7 49.1 64.4 70.2 59.6 51.1 53.4 69.5 77.7 69.5 79.6 61.1 53.4 86.2 84.9 79.1 76.1 64.0 46.3 66.7 77.8 78.5 68.0 78.5 45.1 58.8 64.9 52.9 37.7
30.7 36.5 25.9 34.6 47.0 52.1 43.9 36.1 40.6 53.9 62.1 52.2 60.6 45.1 39.3 60.5 66.2 60.6 57.6 47.6 31.3 51.8 58.4 62.0 52.4 66.2 33.6 44.3 49.9 40.1 27.8
24.1 26.6 20.0 33.9 38.9 39.5 35.3 24.3 29.9 39.9 46.3 46.5 42.4 31.3 27.3 43.8 48.6 44.6 42.1 34.5 21.8 38.3 41.5 47.4 39.0 49.9 23.5 33.3 37.1 29.0 20.2
@set 28 74.4 9882 10.893 10.947 12 !#, MMD/ton, MMD/kgU
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74.4 69.7 60.8 119.0 100.0 92.1 111.3 78.0 78.7 72.1 59.5 82.6 73.7 96.1 94.3 76.0 60.9 71.1 74.4 105.5 64.0 85.6 81.2 74.4 86.5 43.6 103.6 98.2 86.1 103.0 61.4
99.7 94.3 87.3 145.3 124.6 120.5 139.8 114.5 123.7 106.1 86.8 101.5 103.7 137.7 137.3 110.9 88.2 94.9 102.5 142.1 94.2 125.9 108.6 107.9 119.9 94.1 147.7 141.2 123.7 149.2 87.0
119.0 106.0 104.8 150.7 134.0 130.5 148.7 131.7 144.8 119.4 98.6 106.4 115.9 154.5 156.5 123.7 99.2 103.3 113.0 154.7 108.1 142.3 117.9 121.5 130.2 138.1 162.6 159.5 139.8 171.5 98.9
133.5 113.9 118.3 154.4 142.1 137.3 152.8 143.5 150.9 123.6 102.5 110.2 122.7 144.1 163.3 131.1 103.6 110.0 119.8 159.6 115.1 148.6 125.6 128.3 136.6 156.3 171.3 172.9 146.4 183.1 106.5
134.2 112.3 117.4 150.1 137.6 135.3 143.8 146.6 149.1 123.2 103.3 106.6 123.5 149.0 159.2 132.4 106.1 109.3 120.1 152.5 116.3 149.2 124.2 125.9 132.0 163.3 164.5 166.2 140.2 180.1 106.2
125.9 105.5 112.1 144.2 127.1 129.3 132.2 146.4 141.5 116.8 101.3 102.4 119.9 139.7 149.1 127.4 104.6 105.0 117.3 141.4 111.2 146.0 118.9 119.4 125.7 166.5 151.9 153.7 130.5 164.4 102.5
120.6 101.3 107.0 140.5 120.6 127.1 123.2 143.2 131.6 110.1 98.7 100.3 116.4 126.3 136.6 121.3 103.6 101.9 113.1 129.0 105.0 140.5 115.8 111.8 119.8 162.1 137.8 135.0 117.6 147.8 97.6
113.9 97.4 100.0 135.3 117.6 123.2 119.4 141.6 125.5 108.3 98.6 98.4 115.7 122.8 130.4 119.5 104.6 101.1 109.2 123.4 102.2 140.3 112.6 110.1 118.0 156.6 131.7 128.5 112.2 137.9 96.6
106.2 89.8 91.1 125.3 111.4 116.1 112.3 131.7 116.8 103.9 94.9 94.8 109.3 115.1 119.6 116.2 100.3 98.0 105.5 114.3 98.6 130.7 107.0 105.1 111.2 156.3 121.5 118.2 105.3 125.4 90.8
99.6 84.9 84.5 116.1 106.7 110.9 104.2 123.0 110.1 98.7 93.0 92.6 106.4 108.3 111.7 113.7 98.0 97.1 102.7 109.1 93.3 120.3 102.9 99.8 104.3 146.0 110.5 108.7 98.1 114.6 85.4
98.1 84.7 83.3 114.8 106.7 111.6 102.2 119.7 107.5 96.9 93.0 94.7 108.4 107.7 109.2 114.2 100.7 100.2 102.9 110.8 90.6 115.2 102.9 99.1 103.4 136.3 107.3 104.2 95.6 108.8 82.7
96.9 84.5 79.7 109.0 104.6 110.4 99.3 117.5 107.1 99.2 95.3 96.4 109.2 108.7 109.4 115.4 102.7 103.8 104.5 112.5 89.9 114.0 103.0 99.8 101.2 131.5 103.7 102.3 95.7 105.9 81.2
92.2 83.0 77.3 100.8 99.8 106.9 93.9 110.9 104.9 100.9 95.6 98.4 108.2 107.8 106.6 119.0 103.8 106.4 102.5 113.8 85.8 110.0 100.6 99.3 96.4 129.6 97.3 98.2 94.0 100.3 78.0
94.1 88.9 76.8 100.1 100.7 107.8 92.1 106.7 101.7 102.1 94.2 106.1 107.7 109.1 105.0 124.9 104.6 113.5 102.0 119.6 83.1 105.3 101.0 98.6 93.8 125.1 91.7 95.4 93.1 94.7 74.3
94.3 97.7 74.4 100.2 102.8 111.2 94.2 107.3 102.5 108.9 98.2 112.1 110.7 116.6 108.3 134.9 108.7 122.4 104.9 128.2 83.6 106.2 104.2 103.6 95.3 119.6 91.1 98.7 100.9 95.0 74.2
92.4 102.1 74.1 96.7 104.1 112.2 93.9 105.1 103.5 112.0 100.6 114.2 114.3 119.0 110.4 138.9 111.2 124.2 107.5 131.3 86.7 105.7 107.4 106.7 97.5 122.0 90.5 101.3 107.1 94.5 72.9
88.9 102.1 71.0 93.6 104.3 109.7 90.9 98.3 97.2 108.9 97.2 111.5 109.4 113.0 104.1 134.3 108.4 119.6 104.1 123.9 77.4 102.4 105.1 103.7 95.7 122.6 94.5 97.4 105.5 88.8 68.7
88.8 102.2 70.2 92.5 111.3 111.6 95.8 96.2 92.6 108.1 97.9 111.5 110.4 112.5 102.5 126.7 108.0 122.4 105.4 122.1 76.2 102.8 113.1 106.2 99.8 115.3 93.4 98.6 107.4 88.7 67.7
83.3 92.9 65.7 88.8 108.3 107.9 94.3 91.7 87.7 105.6 97.0 106.6 107.5 107.3 96.3 125.8 104.9 118.7 101.1 114.4 72.3 100.0 115.2 106.3 100.5 111.4 79.5 95.9 104.0 84.7 64.3
71.8 82.3 58.1 74.3 96.8 97.2 84.3 79.0 78.6 96.7 90.9 95.1 99.6 94.4 83.6 112.8 96.7 106.8 90.7 99.8 64.7 91.3 106.0 99.6 92.9 106.1 70.0 86.3 94.8 76.1 57.9
60.4 70.1 49.3 62.4 85.2 87.7 73.8 67.1 67.0 83.9 80.9 83.9 88.5 80.6 70.2 98.4 86.7 94.3 81.9 85.1 56.4 80.0 94.5 91.6 82.1 91.5 59.6 74.4 82.8 65.7 50.3
45.8 54.1 37.1 48.3 65.9 72.8 58.8 50.9 54.8 70.0 70.4 67.5 74.1 64.1 52.5 85.6 75.5 75.7 67.9 66.2 48.2 65.4 77.6 79.9 67.8 80.0 46.2 58.9 67.9 53.6 39.3
31.7 37.7 26.6 34.2 48.1 52.6 43.7 37.1 41.5 54.5 57.0 50.5 57.6 47.5 40.5 62.5 60.5 58.1 52.7 49.5 32.6 51.1 58.9 63.1 51.7 68.0 33.6 46.1 52.7 40.9 29.3
24.9 27.8 20.3 29.4 39.6 40.3 34.9 24.8 30.5 41.6 44.1 45.0 40.2 32.5 28.4 44.9 45.9 42.4 38.6 35.9 23.0 38.2 41.9 48.2 38.8 52.6 23.8 33.7 38.6 29.6 21.2
@set 29 99.1 10180 11.221 11.276 14 !#, MMD/ton, MMD/kgU
TIP2005 TIP2805 TIP3605 TIP1213 TIP2013 TIP2813 TIP3613 TIP4413 TIP0421 TIP1221 TIP2021 TIP2821 TIP3621 TIP4421 TIP0429 TIP1229 TIP2029 TIP2829 TIP3629 TIP4429 TIP0437 TIP1237 TIP2037 TIP2837 TIP3637 TIP4437 TIP1245 TIP2045 TIP2845 TIP3645 TIP4445
99.1 106.9 67.6 100.8 93.4 91.0 94.6 65.1 73.9 70.6 64.5 94.0 75.7 91.8 89.9 79.9 71.6 87.8 83.7 101.5 57.3 78.1 84.5 78.9 82.5 37.5 67.1 95.6 93.9 82.9 30.6
121.3 137.5 89.5 122.8 116.2 119.3 119.2 96.2 115.2 103.6 95.4 117.1 107.4 132.6 131.3 114.9 105.4 114.5 117.2 137.2 85.6 115.5 113.7 113.3 112.1 81.5 96.6 131.7 132.8 116.9 43.6
126.4 146.2 96.8 129.0 124.6 130.0 125.2 110.1 135.4 118.7 110.8 128.5 120.1 145.5 147.2 131.6 123.1 123.5 133.2 149.4 97.5 131.1 124.5 131.1 122.2 118.5 108.9 140.6 145.5 128.7 49.8
129.9 149.7 99.6 131.1 131.7 140.1 128.9 118.2 141.1 123.3 118.9 140.8 129.0 149.7 156.7 142.8 135.9 132.0 147.9 155.9 102.8 135.9 134.1 145.2 129.3 133.1 116.3 143.5 147.3 134.0 54.8
125.5 139.9 96.9 125.2 130.5 139.4 125.3 119.0 141.9 125.1 123.5 141.3 130.4 143.4 155.1 146.4 144.6 132.2 152.1 148.6 103.8 135.0 137.0 153.1 127.6 140.2 115.7 137.0 140.3 129.7 57.2
117.3 126.0 94.1 117.9 128.5 136.5 121.8 111.6 135.0 121.2 121.4 134.9 129.0 135.6 145.4 143.7 141.6 126.5 150.5 138.8 100.4 130.1 133.5 148.9 123.6 138.5 112.0 129.6 129.4 126.5 57.3
114.9 116.3 92.5 114.9 133.0 135.5 124.5 105.9 128.5 119.5 116.4 131.4 126.2 130.4 136.6 138.4 138.4 119.1 143.4 130.0 96.2 125.9 130.6 141.3 121.9 133.2 107.2 124.3 117.3 124.5 57.4
110.9 112.0 90.6 112.2 136.5 134.3 127.7 105.1 126.3 123.5 114.4 126.3 124.6 132.7 133.0 135.4 137.3 118.5 141.5 125.9 97.1 129.3 130.5 141.2 122.4 131.3 104.7 126.5 113.4 126.5 58.8
105.5 106.1 85.4 107.5 135.0 128.9 123.8 100.1 119.8 120.3 109.9 120.6 120.6 127.8 123.1 130.5 131.5 113.0 132.3 119.0 93.7 126.6 125.4 133.0 115.8 137.5 99.0 122.2 108.0 124.3 57.9
101.3 99.8 80.7 100.6 129.9 124.0 117.3 94.8 114.1 115.6 104.8 114.9 116.5 121.1 113.1 126.4 125.8 107.0 123.0 111.1 90.1 119.0 121.1 125.4 109.8 134.3 93.1 114.7 102.7 116.7 57.5
100.1 97.7 79.8 100.1 128.7 124.5 114.9 93.2 109.0 112.9 103.6 114.4 115.0 116.4 107.3 123.1 123.1 107.7 120.2 109.5 86.8 114.3 118.6 120.8 108.5 127.6 90.9 110.8 99.3 112.3 57.7
95.5 94.6 77.5 96.7 124.8 122.7 112.7 91.9 105.6 111.5 102.7 110.5 113.6 113.1 103.6 120.0 121.9 105.7 118.3 106.6 85.3 111.1 115.3 119.8 105.2 125.1 88.2 110.3 98.4 108.3 57.3
88.9 89.0 73.2 90.8 116.5 117.1 105.6 88.1 98.7 106.2 98.1 103.6 107.9 106.4 97.7 114.5 116.2 98.6 110.8 100.1 81.6 106.8 110.1 115.1 97.2 122.8 84.0 103.5 93.5 101.9 56.5
88.5 87.4 72.6 92.4 113.0 112.9 102.5 86.5 91.9 98.5 93.0 102.2 102.6 99.1 91.8 107.5 110.7 96.2 103.4 94.5 77.2 98.8 105.6 108.7 92.4 115.3 81.5 97.8 88.4 95.9 57.0
87.9 87.6 72.2 96.5 112.9 113.3 102.6 90.4 92.1 98.6 93.2 101.5 103.9 98.6 91.0 107.2 109.6 96.7 104.4 94.5 77.5 98.7 106.7 108.6 91.8 109.3 83.9 98.3 88.5 95.9 60.2
83.8 86.1 71.2 97.3 110.3 113.5 100.1 94.7 90.5 98.6 92.1 98.4 103.3 98.6 91.5 107.6 108.5 94.6 103.5 94.6 75.8 98.1 105.2 108.3 91.4 110.0 87.7 97.8 89.1 95.1 65.9
80.1 82.0 67.7 96.1 104.3 110.4 93.9 92.8 84.3 94.0 86.8 93.9 98.7 92.9 85.8 103.6 103.4 92.7 99.0 91.2 70.3 94.3 99.3 102.2 84.9 109.2 86.8 92.1 86.2 89.1 69.2
79.8 82.8 67.0 95.9 103.5 114.4 93.1 94.4 82.2 92.7 85.2 94.5 98.0 92.7 85.2 108.4 102.9 98.7 99.4 94.9 69.4 92.6 98.4 101.3 85.0 102.7 88.8 91.3 88.7 88.1 72.8
74.3 78.1 62.8 88.6 97.7 111.1 87.0 90.6 78.5 92.7 85.5 91.6 96.7 89.9 82.2 109.9 100.8 99.2 96.8 94.7 66.2 90.4 94.5 99.1 82.8 100.9 85.3 88.2 90.3 83.2 71.3
63.9 68.3 54.8 76.5 86.0 99.8 76.3 79.8 70.9 85.7 81.2 82.1 88.8 80.6 72.8 102.0 93.6 92.6 87.4 85.8 60.1 83.5 86.0 91.1 76.6 96.8 75.2 79.9 84.3 74.2 64.8
54.1 58.7 46.4 64.3 74.5 86.1 67.1 67.9 60.9 74.8 73.7 72.2 79.7 70.0 62.6 90.2 83.2 94.1 78.3 74.6 53.0 72.6 77.7 81.0 70.0 86.0 64.0 68.7 74.3 63.5 56.0
41.1 45.6 35.1 49.1 58.3 66.8 53.5 52.4 49.8 62.8 65.8 58.4 68.7 55.8 49.6 80.0 70.0 67.9 63.7 59.4 45.5 60.8 65.2 67.6 59.0 74.6 49.2 54.9 61.0 51.1 44.0
28.8 33.1 25.3 35.3 43.3 49.7 40.6 36.9 38.7 49.4 53.9 45.2 52.5 41.4 37.0 57.4 55.1 52.6 47.7 44.4 31.0 48.4 51.0 53.3 46.4 62.6 35.8 41.7 47.0 39.8 32.2
22.8 24.3 19.2 29.2 36.0 37.3 32.2 24.4 27.9 37.4 42.5 41.3 37.7 29.7 26.2 41.0 41.7 38.7 36.4 33.3 21.3 36.5 36.8 40.9 35.2 49.1 24.0 30.6 34.4 27.3 22.5
@set 31 84.0 10765 11.866 11.921 18 !#, MMD/ton, MMD/kgU
TIP2005 TIP2805 TIP3605 TIP1213 TIP2013 TIP2813 TIP3613 TIP4413 TIP0421 TIP1221 TIP2021 TIP2821 TIP3621 TIP4421 TIP0429 TIP1229 TIP2029 TIP2829 TIP3629 TIP4429 TIP0437 TIP1237 TIP2037 TIP2837 TIP3637 TIP4437 TIP1245 TIP2045 TIP2845 TIP3645 TIP4445
84.0 92.3 58.1 86.6 76.7 75.2 80.6 56.5 60.4 57.2 53.8 75.9 60.9 75.9 75.3 63.9 58.3 67.2 67.1 82.6 47.6 64.8 68.4 64.2 67.4 32.1 57.6 81.5 79.9 70.2 26.1
102.6 120.3 77.1 105.9 96.0 98.9 102.0 83.2 94.8 84.4 79.6 95.5 86.5 107.8 109.2 92.9 86.5 92.4 94.3 113.6 70.5 95.8 92.5 93.9 92.7 68.6 82.8 113.1 113.1 98.5 37.5
108.8 128.2 84.3 113.8 105.1 109.8 109.0 96.7 111.4 96.5 93.1 107.9 98.3 121.5 125.4 108.2 102.9 103.1 109.2 126.6 80.3 109.6 103.5 110.1 101.0 100.9 95.1 122.5 125.3 110.0 43.6
113.8 132.9 89.4 119.4 113.3 119.5 115.9 106.5 119.5 103.8 101.8 121.2 108.6 129.7 135.0 117.4 117.4 112.5 125.5 136.1 85.8 116.6 114.7 125.4 108.8 115.8 104.0 128.1 130.1 118.1 48.0
113.2 128.5 89.4 116.3 118.0 123.9 115.6 108.9 124.1 109.4 108.8 126.9 113.9 129.8 137.9 124.9 129.2 116.2 134.3 134.6 90.6 120.2 118.7 135.6 111.9 123.3 106.1 124.7 126.1 118.9 50.5
110.2 119.0 89.1 111.9 120.4 126.4 115.6 106.4 124.3 111.3 110.6 126.1 115.5 127.2 135.7 127.6 133.9 117.1 138.0 130.5 91.1 120.5 121.6 138.5 112.8 125.4 104.1 121.5 120.1 117.2 51.7
112.4 113.9 91.3 113.0 128.3 129.2 121.3 104.4 123.0 111.6 110.0 126.3 118.2 124.9 132.4 127.8 133.2 115.3 136.3 125.4 91.6 121.3 123.5 134.6 114.0 125.5 102.0 120.6 113.1 119.9 53.0
109.8 111.9 90.9 112.6 134.9 130.4 127.1 103.9 123.3 120.9 113.0 123.6 121.8 131.2 131.7 130.6 135.0 116.2 135.3 125.3 92.9 127.6 126.3 135.1 117.8 127.3 102.8 124.6 111.5 125.8 55.2

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103.4  105.9  86.8  107.1  133.5  127.9  125.3  101.0  119.6  119.8  111.3  119.5  118.0  126.9  124.7  129.4  130.7  113.3  130.1  119.7  91.7  126.4  125.6  130.9  114.3  133.7  99.1  120.8  106.7  122.8  55.8
102.0  99.9  83.7  104.1  130.7  124.7  120.1  97.1  115.2  117.1  107.7  114.7  116.4  120.3  116.4  126.6  127.2  108.5  122.9  113.7  90.8  119.5  121.2  126.1  110.5  132.8  95.4  115.6  101.9  116.6  56.9
101.2  99.2  82.7  104.8  131.5  125.7  120.0  98.0  112.3  115.1  105.7  114.9  115.7  117.0  112.3  124.6  126.0  110.0  122.8  113.9  90.9  116.6  119.2  125.3  108.7  129.0  94.6  112.9  100.7  113.9  59.0
98.3  97.2  80.8  102.6  127.7  124.9  117.8  97.3  109.5  114.4  107.0  112.6  114.4  114.7  109.3  121.7  126.4  109.0  119.2  111.3  83.7  116.7  117.1  124.3  106.6  126.6  93.1  111.3  99.6  112.1  60.2
92.8  92.3  77.9  98.2  119.3  119.6  110.6  94.7  105.1  109.3  104.9  107.5  109.9  109.2  102.9  116.9  121.8  104.7  112.1  105.2  84.8  111.7  112.8  119.4  101.0  125.1  90.7  106.2  95.9  106.8  61.3
92.9  91.1  77.8  103.5  118.5  117.6  109.5  97.4  94.9  101.7  99.1  107.7  106.6  103.1  97.5  111.3  116.5  102.0  108.6  100.1  81.7  104.9  109.7  113.7  95.8  119.9  90.7  101.2  90.2  101.2  64.5
92.5  91.3  77.2  107.8  117.9  117.5  110.0  103.3  97.4  101.9  100.0  107.3  107.7  102.3  98.4  112.2  118.7  104.9  108.6  99.9  82.2  104.9  110.0  115.2  95.5  114.4  97.1  101.1  91.3  102.1  71.2
88.8  89.7  76.4  106.7  115.7  117.8  108.3  106.8  97.5  102.6  99.6  104.9  108.9  102.7  97.7  111.4  118.2  109.0  108.3  99.7  80.9  105.0  110.9  114.9  95.5  115.9  101.5  102.4  92.8  101.9  78.3
85.9  85.8  72.9  104.0  109.9  115.6  101.6  102.9  91.2  98.6  95.0  101.0  103.4  96.5  92.5  109.3  112.6  108.3  103.8  97.2  76.8  100.8  104.8  108.4  90.2  115.5  97.7  96.6  89.9  94.9  79.5
85.5  87.3  72.8  103.2  111.1  120.5  100.4  103.5  88.5  98.2  95.5  103.0  104.5  97.1  92.9  111.8  112.1  111.8  106.1  101.4  75.9  100.6  105.0  108.4  91.8  109.2  98.4  96.5  93.1  93.8  79.8
79.3  82.7  68.5  96.5  105.6  118.5  95.0  99.4  86.0  98.3  96.3  99.1  104.5  95.4  89.1  116.0  111.1  110.6  104.0  101.5  72.7  99.5  103.2  107.7  90.4  107.8  93.1  93.3  95.2  89.8  76.7
69.4  72.9  59.9  83.1  94.1  105.9  84.0  87.3  77.5  91.5  92.2  88.8  98.9  86.6  80.0  109.8  103.3  101.8  95.3  92.5  65.8  92.0  95.5  99.9  86.0  103.5  82.1  85.1  89.5  79.7  69.1
58.7  63.0  51.2  69.5  82.3  92.4  73.8  74.2  67.2  81.5  85.8  79.0  90.6  75.7  69.1  97.7  92.2  91.2  84.4  80.8  58.5  80.7  87.7  89.1  79.0  93.0  69.7  74.5  79.0  69.5  57.1
45.5  49.2  38.5  53.6  64.6  73.1  59.7  58.0  56.2  68.6  75.4  63.7  76.6  61.1  55.2  87.8  77.1  74.4  69.4  65.1  50.9  67.4  73.9  75.1  66.0  80.5  53.9  60.0  65.7  56.2  46.8
32.0  35.8  28.0  38.6  48.0  54.0  44.9  41.1  43.4  54.1  60.5  49.6  58.8  46.1  41.3  63.6  60.4  58.0  53.3  48.8  35.7  53.0  57.9  59.4  51.8  68.6  39.5  46.3  50.8  42.8  34.6
25.1  26.3  21.3  32.8  39.1  40.6  36.4  27.0  31.8  40.9  46.5  44.9  41.3  32.1  28.6  45.9  45.7  43.0  39.3  35.4  24.5  39.1  40.8  44.6  39.1  52.3  26.7  33.4  37.2  30.3  24.1
@set 36  76.3  12210  13.459  13.514  28  !#, MWD/ton, MWD/kgU
TIP2005 TIP2805 TIP3605 TIP1213 TIP2013 TIP2813 TIP3613 TIP4413 TIP0421 TIP1221 TIP2021 TIP2821 TIP3621 TIP4421 TIP0429 TIP1229 TIP2029 TIP2829 TIP3629 TIP4429 TIP0437 TIP1237 TIP2037 TIP2837 TIP3637 TIP4437 TIP1245 TIP2045 TIP2845 TIP3645 TIP4445
76.3  107.8  76.1  147.2  134.7  129.8  135.5  102.7  70.6  101.3  93.3  127.0  107.4  115.3  84.5  107.6  101.5  116.0  115.9  121.9  61.1  113.7  117.6  112.4  120.2  55.0  105.4  125.1  121.3  122.7  55.2
117.4  132.7  94.9  163.5  156.9  159.7  151.6  140.0  107.1  139.4  130.1  145.2  144.2  156.5  119.9  148.9  141.1  145.5  151.4  158.5  87.1  155.9  149.6  150.7  156.3  115.8  141.7  164.1  158.5  158.6  76.1
117.4  135.9  98.6  158.8  158.1  162.7  154.3  149.9  121.9  150.0  139.9  142.3  150.7  162.8  133.4  160.9  148.5  145.4  156.3  165.9  95.6  164.2  154.0  157.1  160.2  159.3  146.3  165.0  164.8  161.8  84.2
120.4  136.4  99.5  150.9  157.7  163.8  153.6  149.3  127.1  146.5  137.7  138.9  153.5  161.5  140.3  166.2  146.7  144.2  156.5  168.6  98.1  162.0  156.4  154.6  155.9  167.7  143.4  158.3  161.1  158.0  90.1
115.3  128.2  93.6  136.4  145.8  158.8  140.2  140.7  126.7  141.3  134.0  129.2  146.8  151.6  138.5  161.4  140.1  133.6  148.9  159.1  97.1  153.2  149.6  146.0  147.7  167.2  136.1  147.3  148.2  145.9  87.3
106.4  117.7  88.4  121.5  131.9  147.5  127.6  127.6  121.0  128.5  123.7  119.3  137.0  136.1  132.3  150.7  130.8  124.9  138.8  147.3  92.9  136.8  138.7  133.6  134.7  157.2  122.9  132.7  134.3  132.8  82.4
104.4  110.9  85.2  114.2  124.3  138.5  116.8  113.6  113.3  116.2  113.9  115.0  127.1  120.6  126.3  139.3  122.4  117.7  129.9  133.9  86.4  123.6  128.6  123.7  123.3  143.8  112.4  122.8  119.8  120.1  83.5
98.9  106.0  82.0  108.0  119.5  134.6  114.4  109.1  111.2  111.4  111.8  112.2  124.8  114.9  121.6  133.9  121.3  116.0  126.0  130.5  84.6  118.7  127.4  121.7  120.5  130.1  107.4  111.7  114.3  112.4  76.4
92.7  97.9  76.2  100.7  113.8  127.2  107.7  101.1  105.3  106.5  108.1  106.3  119.4  108.3  113.3  127.7  117.1  111.5  119.1  122.4  79.5  110.3  120.9  116.7  112.9  124.9  98.7  103.4  107.5  104.0  72.3
89.0  91.8  72.3  94.9  109.3  122.6  100.5  96.0  98.5  100.3  103.9  102.4  114.4  103.0  107.0  124.0  114.0  107.7  114.1  115.6  76.7  103.2  115.9  109.5  106.9  116.8  92.9  97.4  100.7  97.2  69.4
87.9  90.8  71.3  94.7  109.5  122.4  99.8  92.9  96.4  97.1  103.4  103.6  113.0  99.1  102.1  120.5  111.2  108.1  112.4  114.2  75.4  99.1  115.2  107.6  105.0  110.6  90.9  94.3  97.9  94.9  68.5
85.3  87.7  68.6  91.1  106.9  120.8  97.6  91.1  95.3  97.7  103.4  102.1  113.5  98.1  99.4  119.7  111.1  106.9  111.1  111.5  74.6  97.7  112.9  108.0  102.5  107.7  89.1  92.9  97.2  93.3  67.5
80.8  82.9  65.7  85.2  99.8  115.8  91.2  88.5  91.0  93.6  100.0  97.0  108.3  93.6  94.2  113.5  108.3  101.3  104.2  104.7  71.3  94.0  107.6  104.8  96.3  107.6  84.2  88.3  93.0  88.7  64.9
80.4  81.7  65.1  84.3  98.6  111.6  89.3  83.8  85.3  86.9  94.5  94.9  103.1  87.4  88.5  107.6  103.5  96.8  99.5  100.0  68.3  87.5  103.3  100.2  91.0  102.4  79.4  85.0  86.5  83.8  62.4
79.6  81.2  64.6  84.6  98.2  110.9  89.4  84.4  74.7  86.6  94.8  93.4  103.3  87.2  88.0  106.6  103.3  95.7  99.4  98.7  68.2  87.1  103.9  100.2  90.2  96.3  79.6  85.7  87.3  83.9  62.2
76.0  78.4  62.4  80.9  95.5  108.1  86.7  83.5  82.5  86.7  92.6  90.7  103.0  87.2  86.9  105.0  101.3  93.4  97.6  96.7  67.2  87.4  103.5  99.0  89.1  96.9  78.6  85.7  86.9  82.1  60.7
72.6  74.4  59.6  77.0  90.1  101.2  80.9  77.3  76.5  81.7  86.6  85.1  96.5  81.9  82.1  97.9  95.3  86.7  90.9  90.3  63.4  81.9  96.5  92.2  83.1  95.5  72.6  80.2  81.9  76.4  57.7
72.3  73.8  59.4  76.6  89.7  98.7  79.7  77.0  73.8  80.6  84.4  84.6  95.4  81.3  79.7  95.3  92.7  86.7  90.7  88.9  62.4  81.1  94.5  90.5  82.4  88.6  71.7  79.4  80.3  75.6  57.1
67.9  69.7  55.5  71.6  84.5  93.0  75.1  74.2  71.2  78.9  82.6  80.6  92.6  79.0  76.5  92.3  89.9  84.2  87.9  84.8  59.7  79.5  90.5  88.1  79.3  87.1  69.0  77.4  78.2  72.0  52.6
59.4  61.4  49.3  63.2  74.7  81.5  63.7  66.2  64.2  73.5  76.2  71.6  85.5  72.4  68.8  83.9  82.0  76.9  79.6  75.2  54.7  73.4  81.0  80.4  71.8  84.2  62.4  71.1  71.4  64.9  50.5
51.3  53.5  42.8  54.5  65.3  70.9  58.8  58.2  56.6  64.8  64.9  63.1  73.9  63.4  59.8  74.0  72.4  68.6  69.7  65.9  49.7  64.7  70.6  70.7  63.6  75.9  53.8  61.1  62.4  56.9  44.1
40.0  42.0  33.0  42.9  51.1  55.9  47.3  45.9  47.9  55.0  58.0  51.6  60.7  51.9  48.8  66.8  61.3  56.0  57.3  53.0  43.0  54.6  59.8  59.5  51.9  66.4  43.1  50.2  51.7  47.2  35.4
27.8  30.3  24.0  31.0  38.4  41.9  36.2  32.6  37.6  43.5  45.9  40.1  45.7  38.8  36.9  48.8  48.0  43.7  43.4  39.6  29.9  43.3  45.5  47.3  40.2  57.5  32.0  39.7  40.8  36.3  26.5
21.9  23.1  18.2  27.1  32.7  32.0  29.9  23.1  28.1  32.9  35.4  35.6  34.1  27.9  25.6  35.3  35.9  32.8  32.9  29.8  20.2  32.3  32.7  35.9  31.6  46.0  22.7  29.0  30.0  26.1  18.6
```

D.7 Cycle 3 TIP Measured Data

```
HATCH CYCLE-3
16  31  24  !cases, # of detectors, # of axials (opposite direction to FAPCS)
@set 37  50.4  7506  8.274  8.265  4  !power, #, MWD/ton, MWD/kgU
TIP2005 TIP2805 TIP3605 TIP1213 TIP2013 TIP2813 TIP3613 TIP4413 TIP0421 TIP1221 TIP2021 TIP2821 TIP3621 TIP4421 TIP0429 TIP1229 TIP2029 TIP2829 TIP3629 TIP4429 TIP0437 TIP1237 TIP2037 TIP2837 TIP3637 TIP4437 TIP1245 TIP2045 TIP2845 TIP3645 TIP4445
50.4  40.0  42.1  70.9  79.3  86.2  72.6  37.5  34.5  57.2  69.3  93.7  67.6  46.0  42.9  67.2  77.6  88.4  77.7  52.0  30.4  53.5  8.4 74.4  75.0  19.6  52.5  65.3  50.2  69.9  22.6
66.1  55.2  58.2  94.4  104.3  90.3  97.4  56.0  54.7  89.6  104.9  118.9  97.9  66.3  63.2  100.9  115.1  118.5  108.1  74.8  47.4  62.7  33.1  106.7  104.0  48.1  78.0  92.8  72.0  98.4  34.5
76.7  66.0  69.2  111.2  117.3  104.2  113.8  72.5  70.4  110.6  125.3  128.5  116.3  86.1  78.9  121.1  132.1  131.0  122.5  91.8  60.3  105.7  73.6  123.1  120.5  72.6  98.3  110.8  90.9  119.8  44.2
85.4  75.4  78.9  127.5  126.7  114.8  126.7  90.6  82.7  125.3  131.5  131.6  129.4  100.4  91.5  134.4  139.3  137.5  133.0  106.1  72.0  124.5  104.3  132.5  132.2  94.1  117.6  126.2  104.2  136.1  56.5
88.1  79.9  83.3  137.3  125.3  115.5  127.2  107.9  92.1  130.7  132.8  125.0  133.4  108.2  97.8  139.7  135.7  129.0  133.1  113.7  81.7  137.7  121.0  131.8  136.3  116.2  129.8  130.8  110.8  139.1  67.4
87.7  81.4  84.6  138.7  121.5  112.9  124.2  120.0  97.1  128.8  125.2  116.5  131.9  111.4  99.3  133.3  127.2  119.7  126.3  115.2  85.9  142.9  131.2  125.3  133.7  129.8  133.9  127.4  111.6  134.2  73.9
89.1  83.0  85.8  141.6  123.7  111.4  123.2  124.6  98.7  123.9  117.2  112.1  127.3  113.5  97.2  125.9  117.7  110.4  118.5  115.0  88.0  138.2  131.3  117.4  129.7  135.1  131.4  124.5  110.5  127.9  77.7
87.7  82.8  84.8  136.4  127.9  110.8  125.2  126.9  101.2  123.2  114.2  108.8  125.5  113.6  97.5  120.6  112.3  104.8  115.7  113.4  89.6  137.4  128.1  116.5  133.6  132.9  129.5  125.3  110.7  125.5  80.3
84.2  80.8  82.2  130.7  128.1  107.2  127.4  121.8  98.7  116.8  108.6  103.8  123.3  108.7  92.1  114.9  106.0  98.0  109.8  108.5  87.6  134.5  122.8  112.7  136.6  131.1  124.8  120.2  106.5  120.3  79.5
80.9  79.5  80.2  123.8  128.4  102.5  127.7  114.6  95.0  110.8  104.6  100.3  119.8  103.4  88.1  111.2  101.0  93.0  105.2  105.4  85.6  127.0  122.6  108.1  136.4  124.3  118.6  115.1  103.4  114.1  77.2
81.9  80.7  78.9  122.3  128.7  104.8  128.8  112.6  93.8  107.4  102.2  101.1  118.5  102.2  86.6  109.8  97.9  91.8  106.1  105.6  84.6  125.0  124.2  106.9  140.8  116.6  116.3  114.3  102.9  112.6  78.0
80.4  80.3  76.8  115.4  124.9  104.5  124.9  109.2  91.4  107.1  102.0  98.9  118.7  100.8  85.2  108.4  98.4  89.7  106.0  106.3  81.9  125.0  126.6  106.5  139.4  112.5  111.3  112.7  102.5  111.1  75.9
74.9  79.7  73.3  106.7  119.1  100.9  116.9  102.6  88.8  106.4  98.7  94.2  115.7  99.4  83.2  108.8  95.7  87.8  104.0  107.0  77.4  120.1  127.6  102.1  133.0  111.3  103.6  108.5  101.2  104.0  72.2
75.2  85.1  71.8  105.2  117.8  99.7  113.6  96.6  86.1  105.1  94.4  99.3  112.4  101.9  81.1  112.1  93.8  89.2  104.0  113.0  73.6  115.1  126.4  98.6  126.7  105.9  97.7  104.9  101.7  100.2  68.6
75.2  89.1  70.2  103.1  117.0  101.5  111.8  95.7  85.6  110.5  96.7  106.7  115.2  108.5  82.8  120.1  97.2  95.5  106.8  120.1  72.6  115.1  121.1  101.0  127.9  100.6  96.3  102.9  108.2  99.7  66.7
72.1  90.5  68.2  98.8  112.9  99.2  111.3  92.9  83.9  115.0  97.4  111.0  116.8  110.6  82.8  124.1  99.6  103.8  109.6  122.7  71.3  114.0  115.6  103.1  124.6  100.7  92.8  102.3  110.5  97.4  64.8
69.7  86.7  64.2  93.2  107.1  94.6  104.5  86.3  79.1  110.5  93.8  114.3  111.7  103.7  78.7  119.6  98.9  107.9  104.7  117.6  66.3  107.8  116.8  100.6  115.6  98.9  85.2  95.1  105.7  90.0  59.9
68.3  84.4  62.2  92.3  106.1  95.8  102.1  84.5  77.5  108.7  94.9  117.9  113.9  103.5  78.1  118.8  102.7  115.5  107.0  116.3  64.9  104.5  117.2  103.2  115.2  91.3  82.7  93.3  105.5  87.8  56.2
62.6  78.1  57.1  83.4  98.8  94.3  95.9  80.0  74.2  105.7  96.1  113.5  114.2  98.5  74.2  116.1  104.1  114.4  107.4  109.7  61.2  100.6  111.9  104.5  110.9  88.5  77.9  88.7  101.4  83.3  54.6
54.4  67.7  49.5  71.6  87.1  87.1  82.7  70.2  66.0  97.9  92.2  101.5  107.1  87.0  66.1  107.3  100.9  106.1  101.4  96.3  53.7  90.9  112.9  100.5  98.1  83.6  68.5  79.2  91.3  72.3  49.2
46.2  58.7  42.4  59.9  76.1  80.2  70.7  60.1  57.2  84.8  84.8  67.8  96.5  74.4  57.0  94.3  93.9  93.9  92.7  83.7  47.3  77.2  110.8  93.0  88.8  74.4  58.6  67.6  79.6  62.5  42.4
35.5  45.5  32.1  46.5  59.3  65.2  54.8  45.7  46.5  70.2  74.5  69.2  86.7  59.1  46.3  84.1  79.0  75.3  75.8  66.6  40.2  62.9  102.5  78.6  74.7  63.8  45.7  54.3  65.4  48.8  33.8
25.3  32.1  23.1  34.0  43.5  48.9  41.0  33.4  35.6  54.6  61.0  49.7  59.0  44.6  34.9  61.7  61.0  56.0  57.8  49.8  28.0  49.6  91.8  61.9  50.6  51.0  33.9  41.9  51.2  36.7  25.4
```

19.3 23.2 17.8 28.6 35.3 36.4 32.8 22.7 26.9 40.9 46.9 40.6 41.6 31.5 24.6 45.0 46.3 42.9 40.6 34.5 19.9 37.4 87.4 46.5 39.3 44.5 23.8 30.4 37.5 25.5 18.5
@set 38 68.8 7584 8.360 8.351 6 !power, #, MMD/ton, MMD/kgU
TIP2005 TIP2805 TIP3605 TIP1213 TIP2013 TIP2813 TIP3613 TIP4413 TIP0421 TIP1221 TIP2021 TIP2821 TIP3621 TIP4421 TIP0429 TIP1229 TIP2029 TIP2829 TIP3629 TIP4429 TIP0437 TIP1237 TIP2037 TIP2837 TIP3637 TIP4437 TIP1245 TIP2045 TIP2845 TIP3645 TIP4445
68.8 73.0 54.2 102.5 95.3 86.6 95.3 71.5 34.4 64.9 74.5 103.1 60.2 63.7 18.6 71.4 79.3 93.5 87.3 62.9 41.6 73.1 9.1 83.8 87.7 33.4 79.6 84.4 79.9 91.4 41.2
88.8 98.5 73.2 133.7 123.9 114.8 127.1 101.8 56.6 102.3 111.8 127.5 113.9 94.6 60.4 107.6 116.7 124.6 119.3 94.7 64.3 113.8 36.3 116.7 121.3 80.7 112.3 117.4 113.1 126.7 60.1
99.4 112.5 84.0 150.9 136.3 126.3 147.6 119.9 77.8 126.0 131.5 135.9 131.4 120.4 83.1 131.0 132.9 134.5 132.4 122.3 80.2 142.9 80.3 131.1 141.4 118.6 132.3 135.6 134.7 144.5 70.8
105.5 121.2 92.2 158.9 143.0 133.6 159.8 133.3 97.5 140.2 137.8 136.7 141.2 141.5 103.8 145.3 138.7 138.0 141.4 145.8 93.3 160.5 114.7 137.6 152.4 144.0 145.5 147.9 146.5 155.9 78.7
103.3 119.0 92.5 152.0 135.1 128.2 154.3 132.8 110.4 143.5 135.2 124.8 140.0 145.2 115.4 148.8 136.3 128.3 137.0 154.6 99.1 163.7 131.6 133.1 148.6 156.5 144.2 146.6 145.0 150.1 80.6
97.6 110.5 89.3 139.3 124.4 120.4 142.1 125.6 113.4 137.3 124.6 113.5 134.0 139.4 116.5 141.0 125.0 114.7 127.8 150.9 97.6 154.0 140.9 123.2 138.2 152.5 137.1 136.4 136.6 137.9 79.2
95.1 104.5 85.9 129.3 116.6 112.7 130.9 116.8 111.7 125.7 112.0 106.6 125.7 130.5 112.4 129.4 112.3 103.2 116.2 142.9 94.3 139.5 139.1 112.2 126.3 141.5 126.8 126.0 124.9 124.2 76.7
89.2 100.3 81.8 121.3 111.6 107.7 124.6 112.9 110.2 119.4 106.4 101.3 120.0 126.4 109.6 121.9 106.6 97.6 112.6 137.7 90.9 131.0 130.3 108.3 119.6 128.0 120.9 121.3 122.1 118.4 74.2
81.6 93.5 76.2 111.0 104.3 101.3 115.1 103.0 103.3 109.6 97.9 94.6 112.4 116.6 100.6 114.3 99.5 90.6 106.1 128.8 84.8 121.8 120.2 102.1 110.8 121.6 110.8 112.4 113.8 107.7 70.5
76.8 88.5 73.1 102.5 98.5 95.9 107.5 95.5 97.3 101.1 90.8 91.3 105.4 108.4 93.8 109.1 93.5 85.6 100.6 120.7 80.1 112.0 114.5 96.4 104.8 111.3 101.5 105.6 105.6 99.5 66.9
76.5 86.6 71.7 101.1 98.9 97.5 107.3 92.2 92.0 98.1 89.1 93.3 104.8 104.5 89.2 106.5 93.3 85.8 102.2 119.3 77.6 107.1 105.2 95.2 104.5 102.4 97.7 101.8 102.8 97.0 65.5
72.8 83.6 69.4 97.7 93.5 99.4 104.2 89.6 89.0 98.0 90.6 93.9 106.6 102.1 85.3 107.6 95.5 85.6 104.7 117.0 74.5 108.8 99.4 97.5 104.3 98.7 94.8 99.6 103.4 94.3 63.8
67.4 79.6 65.9 91.3 98.1 102.7 98.7 85.6 85.3 97.4 90.3 94.2 108.7 98.0 81.1 107.0 96.3 85.4 107.2 112.2 69.8 106.4 97.2 100.1 101.3 97.8 88.7 96.5 101.3 89.9 60.8
68.2 78.8 65.1 90.7 105.6 109.9 98.4 81.5 79.6 98.8 90.9 101.0 113.8 96.2 76.9 110.3 97.2 87.9 115.5 110.0 66.8 102.3 99.2 105.4 100.9 92.7 84.2 93.8 98.9 87.8 58.1
67.4 78.4 63.1 91.4 111.7 117.3 102.6 81.7 78.1 106.7 97.1 109.3 125.1 98.2 76.4 120.7 104.4 94.6 126.4 112.1 65.2 103.7 101.1 116.3 104.4 88.1 83.5 95.4 101.6 88.6 57.8
64.9 76.7 61.4 89.0 113.2 121.0 103.8 79.8 75.6 112.0 103.2 116.7 133.2 96.7 75.0 126.6 113.2 103.5 133.9 111.1 63.0 105.3 104.3 124.5 107.4 88.4 82.4 94.8 102.5 87.5 56.4
62.3 72.8 58.4 85.3 109.0 116.9 99.0 74.8 70.7 108.8 105.3 122.3 132.2 93.4 70.3 121.8 117.4 110.0 130.4 104.7 58.8 100.0 114.3 123.1 102.0 87.8 76.6 89.8 98.0 81.7 52.8
61.7 71.2 56.9 84.1 108.4 117.3 98.1 74.2 68.8 107.6 111.0 128.8 133.3 93.0 69.8 119.5 124.9 120.4 132.4 104.5 57.2 97.7 121.7 124.5 101.9 80.8 74.8 87.3 97.4 80.7 51.4
56.8 66.5 52.9 77.5 101.8 110.2 91.9 70.9 65.6 106.0 113.2 123.9 130.4 88.4 66.2 117.4 125.6 123.1 126.6 99.1 54.7 94.1 120.1 122.2 97.5 76.7 70.4 83.9 93.2 77.0 48.9
49.3 57.8 45.9 66.6 88.7 96.1 80.1 62.4 58.8 95.2 105.7 110.2 117.9 78.2 58.4 105.3 116.7 113.0 112.8 86.6 49.0 84.5 121.5 111.5 87.5 74.7 62.2 74.1 84.0 66.2 43.6
42.4 49.8 39.2 56.0 75.8 81.7 68.6 53.1 50.7 82.2 93.1 94.0 103.2 67.1 50.6 92.1 102.5 99.4 96.8 74.6 42.9 72.3 118.2 97.2 77.1 66.5 53.1 63.8 72.1 58.8 38.3
32.7 38.8 29.7 43.7 58.7 63.5 53.0 40.8 41.9 67.7 78.0 73.0 86.1 52.1 41.1 81.2 84.0 78.2 76.4 59.1 37.3 58.8 108.2 80.3 65.1 57.0 41.3 50.9 59.0 46.2 30.6
23.4 27.6 21.5 32.1 42.9 46.9 39.6 29.5 32.4 52.7 61.6 52.8 56.6 39.2 31.4 59.7 64.2 57.7 57.1 43.9 26.9 45.4 95.7 61.9 43.7 45.9 31.0 39.1 46.0 34.7 23.2
17.8 20.4 16.4 27.4 35.3 36.2 31.7 20.8 24.7 44.1 48.7 42.1 41.3 28.0 22.1 44.3 47.6 45.2 40.8 32.1 20.7 34.7 91.1 47.1 33.1 40.3 21.8 26.7 34.5 25.8 16.8
@set 39 37.6 7844 8.646 8.638 8 !power, #, MMD/ton, MMD/kgU
TIP2005 TIP2805 TIP3605 TIP1213 TIP2013 TIP2813 TIP3613 TIP4413 TIP0421 TIP1221 TIP2021 TIP2821 TIP3621 TIP4421 TIP0429 TIP1229 TIP2029 TIP2829 TIP3629 TIP4429 TIP0437 TIP1237 TIP2037 TIP2837 TIP3637 TIP4437 TIP1245 TIP2045 TIP2845 TIP3645 TIP4445
37.6 46.8 25.3 56.1 71.3 74.7 62.6 35.3 35.7 62.6 52.2 88.8 71.1 50.9 42.9 74.9 80.7 74.2 76.0 61.6 24.7 58.9 74.0 81.3 83.1 52.6 40.8 80.2 83.2 53.5 23.1
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74.4 93.6 46.8 96.3 114.3 116.6 103.8 69.0 78.4 116.2 117.7 128.5 116.4 107.3 90.9 127.8 127.8 126.2 123.7 123.3 50.9 107.9 117.0 124.1 106.7 100.1 76.0 111.9 118.3 98.4 42.8
88.8 112.3 56.8 113.1 128.0 128.8 119.4 83.2 95.8 131.3 127.2 134.4 129.6 127.9 109.8 145.1 135.3 132.4 134.6 145.4 60.9 125.3 128.6 133.3 120.2 119.1 91.9 130.8 138.4 115.3 51.1
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99.5 119.3 71.7 132.8 128.9 126.8 132.5 106.3 111.4 133.9 125.7 119.7 133.3 137.4 118.8 142.9 125.1 120.0 130.0 154.5 78.1 140.8 129.4 125.7 130.1 131.3 114.9 136.4 142.4 128.7 64.7
102.0 119.6 81.0 142.0 129.8 122.2 139.5 115.3 113.8 130.7 117.4 113.2 129.9 134.5 116.7 135.1 115.1 109.3 121.4 147.0 87.6 144.3 123.2 118.2 129.9 133.8 126.1 135.6 138.3 132.6 71.7
103.2 116.2 88.5 146.0 128.3 118.4 141.8 124.3 115.7 130.4 113.2 109.1 130.1 135.5 114.5 130.0 113.2 103.4 119.4 145.7 95.4 145.8 122.3 116.9 131.0 136.0 135.0 135.9 135.5 135.1 77.7
98.2 109.6 89.8 139.5 122.4 111.3 136.6 122.8 111.2 121.6 108.5 102.7 122.7 128.0 107.5 124.8 106.3 96.7 112.9 136.1 94.9 141.3 117.2 110.4 126.5 131.1 134.4 128.7 128.2 129.9 80.0
93.8 104.1 89.6 131.3 115.1 106.7 129.7 119.2 105.2 113.8 100.7 96.3 115.9 119.6 100.2 117.9 100.3 91.4 107.0 129.2 94.2 134.3 110.0 103.8 119.6 124.8 127.6 121.3 121.2 123.0 80.6
92.1 102.4 89.4 129.4 113.2 106.9 126.8 117.3 103.6 110.3 95.9 97.5 113.8 115.5 95.8 114.2 98.3 89.1 105.9 127.6 94.1 131.0 108.8 102.4 117.5 123.2 125.3 118.8 118.2 121.2 80.9
87.9 98.2 85.0 124.8 110.9 105.4 121.9 114.9 99.7 107.9 95.4 97.2 113.4 112.4 92.4 111.6 98.8 88.1 104.5 124.1 89.5 127.2 106.8 100.7 115.4 118.2 119.8 116.0 115.7 116.9 79.6
81.8 91.9 80.1 115.0 105.8 101.8 113.3 106.3 92.9 103.1 93.7 93.9 110.5 106.8 88.3 107.2 96.7 85.8 102.9 117.5 83.3 121.0 102.5 98.3 109.9 109.8 112.2 108.8 110.1 109.3 76.4
79.3 88.9 78.1 109.8 106.1 104.8 109.3 99.4 87.3 100.1 90.4 96.4 111.1 101.8 82.4 106.9 96.6 84.7 104.0 113.5 78.4 116.4 103.4 99.8 105.9 103.3 104.9 105.1 107.0 104.7 72.2
78.7 88.2 76.0 108.4 110.6 112.1 112.5 98.8 86.0 104.8 95.5 103.3 117.4 104.8 82.8 113.4 102.4 90.0 112.6 113.5 76.5 116.9 109.4 108.3 109.8 102.3 101.7 106.6 108.0 104.6 70.2
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59.3 67.2 55.1 82.3 101.7 105.8 91.1 75.2 64.0 103.9 111.6 118.5 125.1 87.1 65.0 113.7 120.5 119.3 122.1 94.5 56.7 92.8 114.7 119.0 95.5 75.2 74.5 82.9 90.4 79.1 52.2
51.7 57.9 47.2 69.6 88.2 91.5 78.3 63.8 55.4 90.8 100.4 105.7 111.5 74.6 55.9 99.9 107.9 107.6 106.4 81.4 50.1 80.0 101.0 105.1 64.9 65.3 63.1 72.2 78.3 67.6 45.5
40.4 45.8 36.2 54.8 68.1 71.4 61.5 49.9 44.7 73.1 86.1 83.4 93.5 60.0 46.2 87.2 86.5 89.8 86.0 66.4 43.0 63.5 82.4 85.3 73.0 51.3 49.7 57.2 63.3 53.3 36.3
30.3 33.2 26.4 40.2 49.9 52.5 45.8 36.8 34.4 55.8 68.2 61.7 61.1 46.2 36.1 60.4 65.8 68.9 65.8 51.8 30.7 48.1 63.8 65.4 49.7 38.4 36.6 43.7 48.0 40.2 27.1
21.9 24.0 19.0 30.8 38.7 40.0 35.6 26.5 25.5 41.5 56.2 46.8 44.6 33.5 26.3 44.5 47.2 53.7 45.5 35.0 22.5 35.1 47.7 46.9 37.1 26.3 27.3 32.9 33.5 28.7 19.4
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TIP2005 TIP2805 TIP3605 TIP1213 TIP2013 TIP2813 TIP3613 TIP4413 TIP0421 TIP1221 TIP2021 TIP2821 TIP3621 TIP4421 TIP0429 TIP1229 TIP2029 TIP2829 TIP3629 TIP4429 TIP0437 TIP1237 TIP2037 TIP2837 TIP3637 TIP4437 TIP1245 TIP2045 TIP2845 TIP3645 TIP4445
32.5 32.1 37.6 71.3 89.6 68.1 69.4 62.8 30.6 61.6 59.2 87.9 76.5 53.3 29.2 67.6 78.0 89.8 79.3 53.5 35.9 65.6 73.9 77.7 72.3 77.2 65.2 57.6 50.1 72.1 35.0
46.5 47.4 54.0 98.8 95.9 92.4 96.6 89.2 47.1 91.6 95.1 114.9 104.2 78.7 44.6 99.4 109.4 116.9 108.4 77.8 55.1 96.4 101.5 106.0 98.6 110.6 93.6 81.7 72.6 103.9 52.0
59.1 62.6 66.7 115.7 113.0 108.2 113.8 107.6 61.7 111.6 117.0 126.9 119.1 98.9 59.8 119.6 124.2 127.5 123.0 98.9 69.8 115.7 117.0 120.5 112.5 132.4 113.1 100.8 92.5 125.2 61.6
74.3 81.4 79.0 127.6 128.1 122.7 126.5 123.3 77.0 127.2 127.9 133.7 131.0 118.9 77.0 136.0 132.8 133.5 135.0 123.0 82.8 130.8 129.4 130.3 124.2 149.0 129.9 120.3 113.9 142.8 69.7
88.8 101.0 86.3 129.0 132.5 127.8 129.5 129.0 94.8 134.7 132.9 128.2 134.3 134.2 96.7 145.7 133.6 127.9 136.7 143.1 91.9 135.7 132.7 131.7 125.6 152.4 136.6 134.7 131.6 147.2 74.5
100.2 116.3 91.2 128.2 130.9 128.4 128.5 127.4 109.6 134.3 128.4 122.1 133.7 143.1 113.8 146.9 127.0 120.6 131.3 156.8 98.1 136.4 129.6 127.8 123.7 146.2 136.1 142.2 143.3 144.4 77.0
108.9 127.3 94.5 129.5 131.0 127.5 127.7 122.5 117.8 130.9 119.9 116.7 131.5 146.4 123.9 141.8 121.3 111.5 125.5 161.8 101.0 137.3 127.0 121.6 124.2 140.6 132.8 144.2 149.2 139.7 77.9
111.3 131.6 95.9 133.6 130.3 125.6 133.4 121.7 124.8 131.3 117.6 114.1 130.1 146.2 128.3 137.4 117.4 106.0 124.3 160.7 101.5 142.3 125.2 119.7 130.1 136.6 133.2 144.2 150.7 138.2 80.4
107.1 125.6 93.1 133.0 126.4 118.8 133.7 119.3 122.0 125.8 111.9 106.3 126.2 138.2 121.9 131.0 109.9 99.8 118.2 152.8 98.9 140.8 119.5 114.6 128.8 130.3 125.8 138.5 143.8 129.5 79.8
101.9 118.3 91.0 127.7 120.1 114.6 129.4 115.0 114.5 118.4 106.1 101.1 120.8 130.6 115.0 126.1 104.1 94.7 112.7 146.1 94.6 136.7 115.5 108.6 125.9 123.2 120.8 130.6 136.6 120.9 78.5
100.3 116.8 89.3 126.8 119.7 114.6 130.0 112.9 112.8 115.4 101.6 101.8 119.9 126.4 111.2 123.8 103.9 94.7 113.1 143.4 93.7 134.1 114.2 106.9 126.1 120.7 118.6 128.4 131.9 119.7 78.6
95.7 110.8 84.8 123.7 117.3 112.6 126.1 110.1 108.2 111.6 102.1 101.2 119.1 122.1 106.1 119.7 102.6 92.8 111.8 137.9 90.0 132.3 112.3 105.6 123.9 117.3 115.7 123.7 128.3 116.2 77.4
88.5 103.3 81.0 114.8 112.4 108.7 117.4 102.9 101.5 107.6 100.3 97.2 115.8 115.6 98.7 113.9 100.0 89.0 108.7 129.8 83.8 127.7 109.2 102.9 118.6 109.2 108.4 116.8 122.2 110.5 73.7
85.6 98.5 79.3 110.2 111.5 110.8 114.4 98.7 94.0 103.9 96.3 99.3 117.0 110.7 92.3 113.0 98.4 89.9 110.9 126.1 78.3 120.4 107.4 103.5 114.0 104.4 101.2 112.3 117.6 105.3 70.6
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82.1 95.8 76.2 108.1 121.7 124.4 119.8 95.9 88.4 115.5 102.9 108.8 132.3 111.9 89.5 127.5 106.9 96.2 128.5 126.0 75.4 122.4 122.7 122.0 119.1 100.9 98.6 112.0 119.5 104.5 68.3
76.4 89.0 70.7 101.0 121.6 125.2 113.2 89.2 81.9 117.0 102.9 110.6 136.6 106.6 84.2 128.1 108.8 98.8 130.1 120.3 70.3 114.7 124.9 125.2 113.6 93.1 90.8 105.3 114.2 97.3 63.0
75.7 87.8 69.4 100.0 124.3 128.2 112.6 88.1 80.1 122.1 106.4 119.6 142.7 106.5 82.9 132.0 117.1 109.6 136.4 119.4 68.7 113.7 131.1 132.7 114.4 91.0 88.6 104.2 114.6 95.6 61.7
71.7 82.9 65.3 94.7 119.1 122.9 107.4 84.2 76.3 118.9 112.2 124.2 140.0 102.0 78.9 129.4 121.8 114.5 135.0 113.4 64.7 108.9 129.6 131.0 110.9 85.9 83.9 99.2 109.3 91.3 58.8
63.4 72.7 56.7 83.5 105.7 108.8 94.1 74.4 67.2 107.8 111.1 115.8 126.2 90.8 70.9 117.5 117.4 111.9 123.2 100.3 58.1 97.7 118.4 120.0 99.5 75.1 74.1 87.2 96.3 81.0 53.0

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55.3  62.7  48.5  71.6  91.7  94.1  81.5  63.8  57.8  93.5  102.1 105.0 113.5 77.8  61.1  103.8 107.7 104.1 107.5 87.2  51.1  83.3  103.8 107.3 88.6  64.7  63.2  75.4  83.5  69.5  46.3
43.6  49.5  37.0  56.5  71.8  73.9  64.2  48.7  47.1  75.1  90.6  83.7  91.8  61.7  50.5  90.1  88.5  85.1  85.8  69.3  43.8  66.6  86.1  87.6  74.3  50.7  49.9  59.2  68.1  55.2  37.1
32.5  36.2  27.0  42.0  52.1  54.3  48.3  35.5  36.8  57.7  73.2  61.5  61.6  46.7  39.3  64.2  68.3  65.8  65.6  52.2  30.8  50.1  66.5  66.8  51.1  37.5  36.9  44.6  51.5  41.8  27.8
23.9  26.5  19.8  31.9  40.5  41.8  36.6  25.3  27.0  41.6  59.2  47.8  48.4  32.9  30.3  46.4  48.9  47.1  46.9  39.1  21.4  36.7  50.0  48.8  40.3  26.9  26.9  31.5  39.1  32.7  21.0
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40.8  45.6  36.3  54.9  56.8  56.0  53.0  47.9  44.7  53.7  57.3  51.3  62.3  56.4  49.4  56.3  55.9  52.5  52.2  55.9  35.4  55.3  56.0  57.0  57.2  59.3  50.9  56.9  57.0  60.2  31.3
68.1  77.5  56.8  90.1  90.1  86.9  86.1  80.3  72.6  87.0  87.2  83.2  89.8  95.9  79.5  88.9  85.9  83.4  84.1  96.2  56.4  90.8  87.4  86.3  89.2  101.8 83.9  95.1  95.3  100.6 47.9
86.0  97.9  70.2  113.9 110.7 105.3 112.5 101.9 90.0  108.0 104.2 100.9 105.6 122.5 98.3  109.1 101.8 100.4 103.1 122.7 70.9  116.1 105.4 102.8 110.7 129.8 106.5 120.5 119.3 128.0 57.7
96.9  109.7 78.4  131.6 123.2 115.3 130.6 115.6 102.2 120.4 112.6 108.5 115.3 136.1 109.8 119.5 109.9 106.3 111.3 137.2 80.2  134.4 114.9 110.7 127.4 145.0 119.6 134.7 132.1 142.5 64.1
102.5 115.5 83.0  144.6 128.8 119.2 143.5 122.2 106.7 126.5 114.6 110.6 118.6 140.6 113.9 124.3 113.0 107.6 115.4 142.9 85.5  145.3 119.8 113.2 136.2 150.5 127.0 139.7 136.7 146.7 67.9
102.1 113.6 82.7  145.1 126.6 116.4 144.6 119.6 106.1 125.0 112.1 107.5 116.5 138.5 111.5 122.6 110.4 104.1 113.0 139.1 84.6  145.7 118.7 110.3 135.6 144.9 125.3 136.2 133.4 142.4 69.3
98.7  109.1 81.0  138.3 121.3 113.2 139.6 114.6 103.3 120.3 107.8 103.0 113.2 130.4 107.5 118.1 106.2 99.1  108.7 132.5 82.9  140.8 114.2 105.8 131.2 134.4 119.8 130.1 127.7 133.8 69.1
97.4  107.1 80.5  134.5 120.2 111.8 137.0 113.0 100.7 118.5 106.2 101.9 112.1 126.6 105.6 116.4 105.1 96.4  107.8 128.7 82.3  139.0 112.8 104.7 129.5 129.6 116.5 127.5 125.2 129.7 69.1
93.2  101.6 77.1  129.9 115.8 107.5 131.2 107.6 96.4  113.8 102.6 99.0  108.6 121.6 100.3 112.3 101.5 93.2  104.9 122.2 79.0  132.9 109.7 101.9 123.9 123.3 110.6 121.5 116.9 122.7 66.9
87.9  95.2  72.9  120.5 109.7 102.5 123.0 100.5 91.0  107.9 98.5  94.5  104.0 112.5 94.0  106.3 98.1  89.1  99.6  115.4 75.1  125.6 104.6 97.6  115.9 114.4 103.6 113.6 112.9 112.9 64.6
85.5  92.2  71.5  116.0 108.0 102.7 119.3 96.1  89.2  105.1 99.4  93.7  104.8 109.7 91.6  106.4 97.7  88.2  98.6  112.1 73.5  121.6 104.2 98.1  114.3 109.0 99.0  111.2 110.0 108.8 63.4
84.1  91.5  69.8  113.3 108.0 105.9 118.3 94.6  87.1  105.8 101.8 96.9  107.3 109.1 90.1  108.2 100.2 90.0  102.9 111.5 71.7  121.2 106.7 100.2 115.4 107.8 96.9  111.0 109.5 107.4 62.1
80.3  87.9  66.7  109.3 109.1 108.9 115.8 90.4  83.9  107.0 102.6 99.0  110.4 106.5 86.9  110.8 101.6 90.9  106.3 109.5 68.6  118.9 109.3 105.1 114.5 102.6 92.2  107.9 106.8 103.6 60.2
78.0  85.3  65.4  104.8 114.3 116.1 114.1 86.3  81.3  112.2 107.0 102.4 119.2 104.5 85.1  116.9 105.8 94.0  112.7 108.3 67.1  117.3 116.0 113.8 115.8 98.5  88.1  106.0 105.8 99.4  59.0
79.2  86.0  65.3  106.2 123.5 126.8 116.8 86.4  81.3  122.1 115.1 111.5 130.5 106.6 85.3  128.0 114.7 103.2 126.2 112.1 66.9  119.9 126.9 127.2 120.0 99.5  87.8  107.8 109.2 100.1 58.9
76.9  84.4  63.8  103.4 125.9 130.5 116.9 84.3  79.7  125.8 121.4 120.1 134.5 106.7 83.6  131.6 123.2 112.3 135.5 112.2 64.7  119.7 131.9 134.0 122.2 97.2  85.9  107.5 109.0 98.2  56.6
72.2  80.4  60.9  98.1  123.6 127.4 111.9 79.9  75.9  123.4 127.0 126.7 134.6 101.9 80.1  130.2 130.4 120.5 136.1 108.2 62.1  115.2 130.8 135.3 118.1 93.0  80.5  102.5 104.6 93.6  54.2
71.1  78.9  59.5  95.6  122.7 126.6 110.0 78.0  74.5  123.5 135.0 136.0 135.5 100.1 79.4  130.2 139.8 132.6 137.9 107.0 60.8  113.5 130.8 137.0 116.6 90.5  78.5  100.2 103.8 91.4  52.8
67.3  75.9  56.3  91.4  117.5 122.1 105.9 74.6  71.2  119.9 134.9 139.5 130.2 96.4  76.0  125.8 141.7 138.1 136.0 102.4 57.9  110.1 128.3 134.3 112.7 86.6  75.1  95.7  99.7  87.3  50.8
60.1  68.3  50.4  82.7  106.2 111.1 96.1  67.4  64.7  110.6 126.0 131.3 118.5 87.4  68.9  115.9 133.7 131.8 126.5 93.0  52.7  100.7 116.5 124.4 102.4 77.8  67.5  86.6  91.2  78.8  46.1
53.7  60.2  44.1  73.2  94.1  98.7  85.2  59.6  58.5  100.1 115.1 118.3 105.9 77.3  62.9  104.4 121.7 119.7 112.9 82.6  47.8  91.0  105.1 111.6 92.0  69.0  59.0  76.2  81.1  69.3  40.9
45.4  51.2  36.6  62.2  79.4  83.7  72.4  50.8  50.9  86.8  99.5  102.6 87.9  66.1  54.7  91.0  106.2 105.2 98.4  72.1  41.5  79.4  90.5  96.5  78.4  58.9  50.4  65.4  69.5  59.4  34.7
34.4  38.2  26.7  47.7  59.4  62.9  55.1  38.2  40.2  68.9  76.9  79.9  63.8  50.4  43.5  72.6  83.5  81.2  76.6  55.5  32.8  63.6  69.2  74.1  59.3  44.9  38.2  50.1  53.9  45.8  26.3
25.4  28.8  19.7  36.2  45.2  48.6  42.4  27.5  32.2  55.6  60.1  61.6  46.2  37.7  34.9  57.9  65.2  60.5  57.2  42.0  26.3  52.1  52.3  55.8  43.8  33.1  27.9  38.0  41.0  34.8  19.3
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TIP2005 TIP2805 TIP3605 TIP1213 TIP2013 TIP2813 TIP3613 TIP4413 TIP0421 TIP1221 TIP2021 TIP2821 TIP3621 TIP4421 TIP0429 TIP1229 TIP2029 TIP2829 TIP3629 TIP4429 TIP0437 TIP1237 TIP2037 TIP2837 TIP3637 TIP4437 TIP1245 TIP2045 TIP2845 TIP3645 TIP4445
44.5  55.2  39.2  61.8  67.9  65.3  67.5  50.8  43.9  64.8  62.3  56.0  67.8  53.6  54.7  68.2  66.0  53.6  62.3  52.9  34.6  73.7  60.4  65.9  66.7  57.4  69.1  73.9  73.9  75.9  32.2
78.2  92.1  63.1  101.5 103.8 99.7  104.6 81.6  74.3  100.7 95.0  89.1  99.7  90.5  86.7  103.4 96.8  86.7  96.8  89.4  57.7  112.4 93.5  96.8  99.4  100.1 103.3 116.3 116.4 122.0 50.1
100.4 115.9 79.5  132.4 125.6 120.6 127.7 108.3 98.0  127.1 113.8 108.4 119.8 118.6 108.5 128.1 113.6 106.4 117.7 117.4 74.5  142.3 113.4 113.3 119.6 136.8 125.6 142.4 142.2 149.2 61.8
113.7 129.2 89.5  154.7 138.2 132.5 141.8 131.5 115.1 148.9 124.6 117.9 133.7 142.8 125.5 150.0 123.0 115.8 131.4 141.2 88.7  165.2 124.6 123.4 133.2 164.6 140.4 157.9 157.7 163.9 70.6
120.7 135.0 94.8  166.6 142.7 137.1 148.0 141.8 127.2 166.7 128.3 122.4 141.5 161.9 135.8 166.9 127.1 120.8 140.1 162.5 99.0  175.2 130.0 126.3 139.4 177.0 143.6 161.9 160.9 166.3 77.0
120.3 131.9 95.4  166.8 141.4 134.8 145.7 140.9 132.0 172.8 128.0 121.9 142.1 171.3 138.6 175.7 125.0 119.1 142.5 174.3 102.5 174.5 129.2 124.5 139.4 176.3 140.7 157.6 155.8 159.7 79.9
116.2 126.3 93.6  160.9 138.9 130.3 141.4 137.3 131.8 172.4 125.7 118.5 142.5 169.6 139.3 176.4 121.1 115.0 139.9 178.0 102.4 169.5 127.9 122.5 138.8 168.5 135.2 151.7 148.4 151.4 80.9
115.0 123.7 92.9  158.5 143.2 130.2 144.4 135.9 131.5 171.8 126.1 119.4 143.2 171.6 137.2 176.4 120.6 113.7 140.2 178.0 103.1 166.9 131.7 123.3 141.2 165.8 132.1 148.7 145.0 149.2 81.2
109.8 117.9 89.7  152.3 145.6 127.0 145.4 126.9 127.2 165.5 123.9 116.8 141.3 163.6 130.1 169.5 117.9 110.6 137.1 171.1 99.7  159.5 135.6 121.1 145.3 156.4 126.1 143.9 141.0 142.0 79.6
103.2 109.9 85.1  142.6 144.4 122.2 144.2 119.6 119.2 154.5 119.0 111.6 135.0 151.1 120.4 157.9 111.7 105.1 129.2 158.5 93.2  152.5 138.3 117.1 144.6 145.0 118.4 136.3 131.6 133.1 77.1
99.6  107.3 83.5  138.6 145.6 122.0 145.6 116.4 113.6 149.9 118.1 110.8 133.7 144.8 116.0 152.6 110.4 102.0 125.4 152.8 89.4  149.3 140.3 116.4 146.8 137.9 114.6 133.4 128.6 130.3 75.3
97.2  103.8 80.9  134.8 144.2 120.6 143.5 112.4 108.5 145.5 117.2 110.4 131.4 140.2 112.2 148.6 109.3 101.8 123.9 146.8 86.8  144.8 140.2 115.9 145.1 133.3 110.5 131.1 125.3 127.6 73.0
92.4  98.3  77.0  127.2 138.6 116.9 136.5 105.0 101.1 137.7 114.5 108.0 125.5 131.3 104.5 140.9 106.5 100.4 119.1 137.6 81.7  137.1 137.2 113.4 139.7 124.4 103.8 124.4 119.5 120.3 70.0
87.7  94.5  73.6  121.2 133.6 115.2 131.5 100.1 95.2  131.7 113.4 106.7 122.3 124.6 99.9  135.6 106.6 96.2  115.7 130.5 77.9  132.4 133.5 113.7 134.2 116.9 99.8  120.0 115.9 114.8 67.2
86.8  93.8  72.5  119.1 133.9 119.6 130.1 98.1  93.3  131.4 116.5 110.3 124.9 122.4 97.0  135.8 111.2 101.1 118.6 127.8 75.3  131.8 133.7 119.6 134.1 115.5 98.5  119.6 116.7 113.6 66.2
84.2  90.8  69.8  113.4 130.7 123.5 126.0 92.9  88.6  128.0 118.2 112.1 125.3 118.1 92.0  132.4 115.4 103.3 121.0 123.4 72.3  126.4 131.9 124.6 130.3 110.2 92.5  115.9 113.8 108.5 63.9
78.6  84.7  66.2  106.1 125.2 124.7 119.3 86.3  82.8  122.6 120.1 110.6 127.0 109.5 86.6  127.4 120.5 103.3 123.1 115.2 67.3  119.3 129.0 126.0 124.2 101.8 87.0  109.3 108.6 101.3 60.2
76.6  82.5  64.2  103.3 124.2 127.7 116.4 83.9  79.6  120.7 125.7 113.6 131.7 105.9 83.8  125.9 128.4 105.6 129.2 111.8 65.0  116.4 128.7 129.7 122.2 96.9  83.5  106.1 107.4 97.9  57.9
72.7  78.8  60.6  97.5  117.8 123.9 109.1 78.6  75.1  116.6 125.8 113.4 128.9 100.0 78.4  121.4 129.6 107.1 128.1 105.7 61.0  109.6 125.2 127.1 116.9 92.1  78.1  99.6  103.1 92.1  54.7
65.2  70.4  54.0  86.7  105.9 112.5 98.0  69.5  67.4  106.8 118.2 107.1 117.2 90.2  70.4  110.5 121.8 104.0 120.4 95.6  55.1  98.2  115.5 116.8 106.2 82.5  68.5  89.8  92.3  82.2  49.4
57.4  62.7  47.7  76.4  94.3  99.8  86.5  61.1  60.0  96.3  108.3 101.2 106.2 79.4  62.7  99.3  112.8 99.8  109.8 84.4  49.4  87.6  103.7 106.4 95.0  72.6  60.1  79.0  82.1  71.8  43.8
48.9  53.0  40.0  64.3  79.3  85.2  72.1  50.6  51.4  82.2  94.9  93.0  89.5  67.5  53.3  85.0  97.9  93.0  95.3  72.5  42.3  73.6  90.2  92.1  80.2  61.6  49.8  67.0  69.8  60.1  37.4
37.3  39.7  29.5  48.0  59.3  64.6  52.9  36.3  39.9  64.7  74.6  73.2  65.7  50.2  40.1  65.7  75.4  74.4  73.1  55.0  32.8  56.2  70.8  70.2  59.9  45.9  35.5  50.6  52.9  44.7  28.3
28.1  30.2  21.9  36.2  44.8  49.3  41.0  25.6  30.7  50.8  57.3  56.3  46.8  37.4  31.2  51.7  58.0  59.3  53.9  40.3  25.4  44.1  54.3  52.2  44.1  33.2  25.8  37.7  39.6  32.8  20.9
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TIP2005 TIP2805 TIP3605 TIP1213 TIP2013 TIP2813 TIP3613 TIP4413 TIP0421 TIP1221 TIP2021 TIP2821 TIP3621 TIP4421 TIP0429 TIP1229 TIP2029 TIP2829 TIP3629 TIP4429 TIP0437 TIP1237 TIP2037 TIP2837 TIP3637 TIP4437 TIP1245 TIP2045 TIP2845 TIP3645 TIP4445
47.8  59.3  42.6  86.4  70.6  67.5  76.3  78.6  50.8  72.3  63.1  52.6  71.2  63.7  60.3  68.6  64.0  52.5  60.3  56.5  44.0  100.3 63.7  67.5  75.3  84.2  84.8  83.8  84.1  89.6  40.6
85.7  101.1 70.5  137.2 111.3 106.0 118.4 117.7 85.1  110.6 96.7  86.0  104.0 104.7 95.7  102.8 93.0  84.3  94.4  94.3  71.6  144.1 98.4  99.1  109.6 136.9 124.1 132.2 132.2 141.2 61.3
111.8 129.0 88.4  163.9 136.3 129.5 143.0 139.0 109.9 135.0 115.0 105.7 122.6 131.7 119.4 124.9 108.6 103.8 113.2 122.1 90.4  167.3 118.0 115.8 128.6 167.2 144.7 161.8 159.2 168.2 73.3
126.8 144.0 99.1  176.4 149.1 140.7 155.7 150.0 125.9 152.1 125.0 116.7 134.6 150.1 137.1 142.3 118.8 112.6 126.5 142.6 102.6 180.8 129.1 124.5 139.7 183.3 155.6 174.9 174.1 181.6 79.2
133.4 149.6 104.0 178.4 153.0 145.1 158.3 150.0 136.2 162.1 129.0 121.7 140.8 162.2 146.0 158.6 123.0 117.0 134.2 158.8 109.9 181.5 133.2 128.4 142.3 185.5 154.6 176.1 175.1 179.1 82.5
130.9 143.2 102.4 169.8 147.5 141.4 153.1 144.7 138.9 168.2 127.2 121.3 140.5 168.4 146.9 170.4 121.6 116.6 136.6 170.9 110.4 174.6 131.1 125.6 138.3 178.2 146.6 167.2 166.5 168.9 82.6
123.9 134.4 98.1  159.5 140.0 133.4 143.5 137.2 136.9 170.6 123.6 117.7 139.4 170.3 146.4 177.2 120.6 113.0 137.4 176.6 107.9 167.1 127.4 121.6 133.9 167.1 137.8 156.6 156.2 155.5 81.8
119.6 129.8 95.6  155.6 136.7 131.8 139.8 132.5 136.2 172.0 123.6 117.6 139.9 173.1 144.3 181.5 119.9 112.8 137.7 180.2 106.5 163.9 126.0 121.3 133.5 160.0 133.2 150.2 151.9 150.1 81.1
113.9 122.0 91.4  146.7 133.5 126.5 134.1 125.1 130.5 166.3 121.0 114.5 136.1 165.1 137.4 174.9 116.2 109.8 135.4 174.6 101.6 157.4 122.9 118.0 130.4 153.4 125.6 141.8 142.0 140.6 78.3
105.6 112.6 85.5  138.5 130.2 119.8 128.4 115.1 121.4 157.0 116.7 110.7 130.0 153.5 126.7 163.3 111.1 104.5 128.1 164.1 94.9  147.7 121.0 112.6 127.1 140.9 116.6 132.5 131.9 131.2 74.7
100.0 107.8 82.5  134.1 134.5 118.6 132.2 111.4 116.7 151.9 115.7 108.5 129.7 147.0 123.5 159.0 110.5 102.2 125.3 157.1 91.4  144.8 126.1 113.6 132.4 135.3 113.4 130.4 128.1 127.7 73.2
97.5  104.5 80.7  131.3 138.8 118.7 136.3 108.8 112.8 147.8 116.1 109.6 128.6 142.8 118.2 153.6 109.0 101.6 124.5 150.3 88.6  142.9 134.4 113.9 137.2 130.9 109.7 128.2 124.9 124.7 72.0
92.7  99.3  76.8  125.4 138.5 116.1 135.1 102.2 104.9 140.1 113.7 107.2 124.3 133.6 109.3 146.1 106.9 99.7  119.9 142.3 83.1  136.4 135.0 111.9 135.0 121.8 102.9 124.2 119.2 119.4 69.4
88.3  95.0  73.9  120.4 135.1 113.4 133.3 98.6  97.9  134.9 113.3 106.3 124.0 126.1 104.1 141.3 108.3 98.6  117.3 133.8 79.1  132.9 133.6 112.3 134.9 116.3 100.7 119.5 115.7 115.1 66.7
87.8  94.8  73.6  119.3 136.5 116.6 132.9 96.1  95.5  134.1 117.2 110.9 127.3 124.1 101.7 139.9 112.4 102.6 119.3 131.9 77.3  131.6 136.8 115.9 135.9 113.9 98.4  119.7 116.8 114.2 65.9
85.7  91.5  71.0  115.3 133.3 117.9 129.1 92.6  91.0  130.4 119.6 112.2 127.0 119.4 96.4  136.9 117.1 105.1 122.3 126.3 74.0  127.0 136.3 119.4 132.9 108.7 93.7  116.3 113.9 110.5 63.2
80.5  86.3  67.6  107.7 127.9 119.0 122.4 86.3  84.8  125.7 122.2 111.8 128.2 111.4 89.5  130.7 122.5 104.8 123.8 118.6 69.0  120.8 131.0 122.8 126.6 101.2 88.3  109.2 109.3 103.6 60.0
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78.2  84.4  65.8  104.6 126.0 124.6 119.7 83.7  81.6  123.6 128.4 114.4 133.2 107.5 87.4  129.5 131.2 108.1 129.8 114.0 66.7  117.2 131.9 128.5 125.1 97.3  85.4  106.9 108.3 100.7 58.3
74.9  80.6  62.2  99.3  122.3 124.6 113.5 78.8  76.8  118.3 128.9 115.0 130.7 101.9 82.1  123.9 132.4 110.3 130.4 107.5 62.8  110.5 129.1 128.1 119.5 91.9  79.5  100.8 103.1 95.1  55.7
67.3  72.5  55.9  88.4  110.8 115.3 101.7 69.0  68.6  108.7 121.2 110.5 119.9 90.9  72.6  113.0 124.6 106.9 122.6 95.9  56.5  99.7  119.5 120.2 108.5 81.7  70.4  91.0  93.4  85.0  50.5
59.6  64.3  49.3  78.5  99.0  103.4 90.5  61.2  60.9  97.6  111.2 104.7 107.7 79.8  65.0  101.9 115.2 102.7 111.0 85.1  50.4  89.0  107.9 109.4 96.5  72.2  61.8  80.8  83.3  74.2  44.6
51.5  55.2  41.7  66.6  83.7  89.0  76.2  50.6  52.3  83.5  96.8  96.7  90.4  67.1  55.3  87.6  99.6  95.5  97.3  72.7  42.3  74.8  93.9  94.8  80.9  60.8  50.8  68.1  70.0  62.1  38.1
40.3  41.8  31.3  50.7  63.2  67.7  57.1  36.2  40.8  64.7  75.2  78.6  66.2  50.3  42.5  67.3  76.7  77.5  75.3  55.5  32.9  57.3  73.3  72.9  60.1  45.3  36.5  51.1  52.7  46.3  29.0
30.9  31.7  23.5  38.6  48.1  51.6  43.6  25.4  31.1  51.2  58.6  61.5  47.6  36.6  32.2  53.0  59.1  58.0  54.6  40.2  27.0  44.9  54.9  53.5  43.8  32.4  26.1  37.6  38.9  33.8  21.6
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TIP2005 TIP2805 TIP3605 TIP1213 TIP2013 TIP2813 TIP3613 TIP4413 TIP0421 TIP1221 TIP2021 TIP2821 TIP3621 TIP4421 TIP0429 TIP1229 TIP2029 TIP2829 TIP3629 TIP4429 TIP0437 TIP1237 TIP2037 TIP2837 TIP3637 TIP4437 TIP1245 TIP2045 TIP2845 TIP3645 TIP4445
52.5  65.7  45.6  89.3  75.5  70.5  80.6  96.0  52.9  73.6  63.9  51.9  83.4  82.7  61.3  66.4  62.7  60.8  70.5  70.4  45.8  105.2 66.3  69.7  91.1  108.8 90.0  93.5  94.8  101.1 43.4
95.6  113.3 76.2  143.0 120.4 113.0 126.3 132.9 88.0  111.2 98.0  86.9  111.3 122.9 96.2  99.6  90.9  89.1  98.6  105.9 74.3  150.7 102.5 102.3 122.7 156.8 132.5 147.7 149.6 158.7 65.4
126.2 145.8 98.4  171.9 148.0 139.2 152.7 151.5 112.3 134.8 116.4 107.7 126.4 146.9 119.0 119.9 106.0 104.1 115.0 128.1 93.0  174.5 121.5 119.4 138.0 181.4 152.8 177.0 179.3 188.6 77.5
141.6 160.7 109.9 183.9 160.1 152.0 164.5 158.4 126.2 148.3 126.4 118.7 136.6 162.1 134.3 132.7 115.8 113.2 124.3 143.8 104.9 185.4 133.0 128.7 146.0 191.1 163.8 191.4 193.2 202.3 84.1
147.8 165.5 114.0 185.5 162.5 155.7 167.1 154.9 134.2 152.7 130.1 124.5 138.0 163.5 139.5 137.9 120.6 116.4 128.0 147.9 110.4 182.9 136.7 131.1 144.6 184.3 161.7 190.9 191.6 197.7 87.4
142.3 156.7 111.8 176.3 155.8 149.3 159.0 145.2 133.6 149.4 127.9 123.8 135.4 156.7 137.7 138.3 119.8 115.7 127.6 145.1 107.8 171.6 133.4 128.9 138.4 170.2 151.7 179.9 180.7 183.7 86.7
131.9 145.2 105.6 163.4 147.1 140.0 147.9 137.7 128.4 143.5 124.5 120.3 133.6 152.1 133.7 137.8 118.6 113.1 126.8 143.5 104.3 161.7 128.3 123.9 132.3 161.8 141.0 165.3 166.8 167.8 84.3
125.8 137.7 102.1 157.9 143.3 136.4 143.4 131.7 127.8 145.2 123.6 119.6 133.0 150.7 133.0 140.0 118.2 112.2 128.1 144.1 102.5 158.5 128.2 123.1 131.7 156.7 134.8 158.4 159.7 160.2 83.7
119.0 127.8 96.7  149.7 137.4 130.7 136.8 123.5 125.0 143.9 121.0 116.7 130.1 149.7 129.1 143.3 115.6 109.2 126.1 144.9 98.5  152.5 124.9 116.9 129.7 146.9 126.2 147.8 146.3 148.2 79.8
110.5 117.3 89.6  140.3 132.8 123.6 131.1 116.8 118.8 144.9 117.5 112.4 128.5 150.1 123.2 147.2 111.4 104.0 123.5 148.4 94.0  146.5 122.2 113.7 128.2 137.7 117.2 136.7 136.0 136.8 75.8
103.6 110.8 85.6  135.9 136.6 120.9 134.2 113.8 117.6 149.5 117.6 110.5 131.9 155.3 122.6 155.8 111.1 103.5 126.2 156.9 91.3  147.2 128.1 114.7 136.1 136.3 114.5 133.5 131.2 134.7 74.3
100.5 107.5 83.7  134.8 141.4 120.2 139.0 109.8 115.9 151.6 117.8 111.3 132.0 155.0 121.1 158.3 110.8 102.4 126.8 157.2 89.3  145.9 136.0 115.6 140.4 133.3 111.4 131.4 128.4 131.8 73.1
95.3  101.4 79.7  129.5 139.4 117.6 137.1 104.1 110.7 147.3 115.2 108.7 127.6 148.6 116.0 154.9 107.8 99.8  124.0 149.8 85.7  140.5 135.1 113.3 137.5 124.2 104.8 125.1 121.5 125.7 70.5
89.6  95.6  75.9  124.0 135.8 115.0 134.7 102.6 105.4 143.3 114.0 106.6 129.0 144.7 111.7 151.4 107.3 99.1  123.5 147.3 82.0  137.1 133.0 112.8 137.5 120.8 101.1 119.9 116.8 121.1 68.3
88.8  94.8  74.7  122.6 136.1 117.2 135.1 100.1 103.5 143.0 116.2 109.2 128.7 142.7 110.1 150.6 110.2 101.9 124.2 144.6 80.7  137.2 135.4 116.9 137.3 119.4 100.3 120.3 116.2 121.0 67.8
85.9  91.9  72.3  118.0 132.7 118.3 130.8 94.0  98.2  138.7 116.0 109.8 126.6 135.3 104.6 145.9 111.9 102.7 123.7 137.3 77.3  131.7 134.3 119.4 131.0 112.5 95.2  117.0 113.5 116.6 65.3
80.6  86.4  68.4  111.1 126.6 118.6 122.9 89.2  91.5  132.2 115.7 107.8 126.7 126.5 97.6  139.0 115.1 102.6 123.9 128.3 72.5  124.0 129.3 122.0 126.4 105.4 89.0  110.1 108.2 108.7 61.9
78.0  83.9  66.4  107.1 123.0 123.3 119.8 86.1  88.0  129.5 122.0 110.9 131.4 123.0 93.8  137.1 124.1 106.3 128.8 123.8 70.1  121.0 129.7 127.8 124.1 101.5 86.1  106.4 106.6 106.0 60.2
75.0  80.4  63.3  101.7 120.1 124.2 113.8 79.2  82.4  125.2 124.9 112.6 129.7 113.6 88.3  131.7 129.4 107.9 130.7 115.3 66.2  114.2 127.5 127.6 117.2 94.3  80.6  101.5 102.7 99.1  56.8
67.6  72.7  57.4  92.1  110.2 116.2 102.8 69.2  74.4  114.2 120.3 108.8 119.2 100.6 78.6  120.3 124.3 105.4 121.9 101.9 58.8  102.8 118.7 119.4 106.5 82.8  71.0  90.9  93.7  88.1  51.9
59.6  64.3  50.7  81.6  98.7  104.9 91.3  60.5  65.6  103.1 112.7 104.9 107.3 88.2  69.6  108.4 116.6 102.1 112.3 89.7  52.9  92.2  107.7 109.6 95.4  72.2  62.6  80.7  83.5  77.6  46.0
52.1  55.3  43.4  69.5  84.8  91.2  77.4  48.5  56.1  88.1  100.0 98.1  86.0  72.8  59.3  93.1  102.3 94.4  95.7  74.8  45.2  77.6  94.4  95.5  77.6  59.2  51.6  68.7  70.3  65.3  39.6
40.7  42.2  32.9  53.0  64.9  70.4  58.0  33.6  43.4  68.6  79.6  80.9  61.9  51.9  45.5  72.8  78.2  74.9  70.5  54.0  35.2  59.0  73.8  73.2  55.8  42.4  37.1  52.4  53.1  48.8  30.0
31.7  32.8  25.8  41.0  49.9  56.3  45.1  25.0  33.1  52.9  62.8  64.3  46.6  40.5  34.6  55.1  59.9  59.3  51.3  38.1  26.9  46.1  55.7  53.6  42.5  30.0  26.6  41.6  39.4  35.4  22.6
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TIP2005 TIP2805 TIP3605 TIP1213 TIP2013 TIP2813 TIP3613 TIP4413 TIP0421 TIP1221 TIP2021 TIP2821 TIP3621 TIP4421 TIP0429 TIP1229 TIP2029 TIP2829 TIP3629 TIP4429 TIP0437 TIP1237 TIP2037 TIP2837 TIP3637 TIP4437 TIP1245 TIP2045 TIP2845 TIP3645 TIP4445
48.6  57.5  43.5  68.4  84.5  71.2  73.9  101.7 63.0  91.6  66.3  53.7  97.5  121.9 74.4  79.4  67.5  78.2  89.1  101.0 50.5  88.4  67.6  72.5  85.1  126.9 83.0  91.0  76.2  95.1  40.4
88.9  100.8 73.3  111.9 133.8 111.3 116.4 131.2 103.8 139.2 100.6 89.1  122.4 164.4 115.8 118.3 98.2  105.6 115.3 138.7 82.0  129.0 104.6 106.1 108.5 170.6 122.5 142.7 119.9 149.3 60.4
117.1 129.6 93.5  139.3 161.3 134.6 141.3 145.0 129.9 164.6 119.3 110.3 134.7 183.6 139.1 140.6 114.0 117.4 128.2 157.4 101.4 151.8 125.3 123.3 121.5 188.5 143.4 171.6 145.3 178.3 72.5
131.6 143.8 104.1 153.0 173.2 145.3 154.7 152.4 144.4 175.2 128.1 119.8 142.4 189.2 151.4 152.7 123.0 122.8 135.5 165.9 112.4 164.6 136.0 132.2 132.7 193.7 154.9 184.8 159.2 189.2 78.3
137.3 147.3 108.5 159.7 175.4 148.3 161.7 148.5 146.7 175.8 129.7 123.5 141.8 181.6 151.2 155.1 125.2 122.1 134.8 163.6 116.9 169.4 139.7 134.3 138.1 187.0 155.0 183.8 160.0 187.2 81.6
133.0 142.1 107.2 161.1 169.1 143.5 162.8 139.5 141.1 170.5 125.8 121.4 137.6 169.5 143.2 150.0 121.5 116.6 129.7 154.5 113.8 168.7 138.1 130.7 140.2 173.1 148.3 174.0 153.1 176.1 82.5
124.1 133.1 101.3 159.1 160.5 137.0 161.1 135.7 133.7 161.9 120.8 115.6 137.6 162.5 134.5 145.5 117.7 113.1 127.3 149.9 106.5 165.1 133.0 125.5 141.8 162.1 140.7 162.0 144.0 163.1 81.3
119.6 128.1 98.4  158.6 156.6 138.6 159.9 128.4 128.0 158.8 119.3 115.0 132.1 155.7 129.5 147.0 117.1 110.1 125.6 149.4 102.9 162.7 132.6 123.8 139.0 153.2 134.9 156.9 142.2 156.2 80.8
113.9 122.1 93.4  151.3 151.7 139.2 153.4 118.1 120.3 152.3 114.6 112.4 125.5 144.2 122.4 147.0 113.6 106.6 120.6 148.4 95.8  153.7 127.6 120.9 130.7 140.8 125.9 148.1 140.9 145.3 77.7
105.2 113.9 86.7  139.6 141.5 138.0 141.8 109.2 110.8 141.3 108.0 107.7 120.5 135.5 114.9 144.4 107.6 105.4 115.1 143.8 89.0  142.5 119.7 114.5 123.2 129.6 114.8 137.8 138.5 131.7 72.9
99.1  109.0 82.0  130.9 136.1 136.3 135.1 104.5 106.4 136.2 105.8 105.2 118.4 131.4 111.4 142.7 106.9 110.8 114.8 142.3 84.4  136.8 114.9 113.0 119.8 125.2 109.7 132.0 136.7 125.6 70.8
95.1  105.3 78.3  125.7 132.5 134.6 129.5 98.7  101.3 131.8 103.8 105.9 112.6 125.7 106.7 139.4 105.8 113.4 111.4 135.1 80.9  131.1 112.2 110.1 113.0 116.9 104.3 127.6 132.2 120.6 68.1
89.5  98.8  73.7  117.0 125.3 128.3 121.3 92.1  94.1  124.0 99.9  103.1 107.0 116.7 98.7  132.5 102.0 111.3 105.1 125.5 75.5  122.3 107.1 104.8 107.3 108.3 96.1  120.1 124.0 112.1 63.9
83.3  92.6  69.3  109.2 118.2 121.5 114.9 90.1  88.3  117.9 97.1  99.3  106.9 113.6 93.0  126.4 100.9 111.5 104.2 123.1 70.9  116.1 101.7 101.1 106.0 104.3 91.1  112.9 117.6 105.4 60.8
81.1  91.0  67.7  106.3 116.2 120.4 113.2 86.3  85.4  116.8 98.6  99.9  106.3 109.3 90.7  124.0 101.2 112.2 103.3 118.7 68.6  113.9 101.2 101.0 105.0 100.8 88.2  110.5 114.9 103.2 59.8
78.6  86.3  64.5  101.9 112.0 115.8 109.4 80.1  80.7  112.6 99.0  99.0  105.1 102.3 84.9  118.1 99.2  108.5 98.9  110.6 64.7  109.2 100.8 98.4  102.4 93.9  83.3  104.9 109.5 98.0  56.9
72.1  79.9  60.2  94.6  106.3 108.5 102.3 75.7  74.6  106.5 99.8  95.8  107.2 96.6  78.9  111.1 96.3  105.3 95.8  104.0 60.1  103.4 99.7  94.8  104.5 88.1  77.1  97.8  101.4 90.3  53.5
68.5  76.7  57.9  90.7  102.8 104.9 99.7  72.3  71.8  104.4 103.7 94.6  108.5 92.1  76.0  107.9 96.8  104.2 94.3  98.9  57.9  101.0 104.1 94.2  103.8 84.3  74.2  93.6  98.2  87.1  51.9
65.2  72.3  54.7  86.4  98.2  100.1 95.9  65.9  67.4  100.3 103.3 93.9  102.1 84.1  70.8  102.2 93.6  99.3  89.3  90.8  54.4  95.6  103.8 90.8  97.2  77.1  68.7  87.5  91.1  81.6  48.7
58.6  64.9  49.3  77.6  89.1  90.5  86.7  57.8  60.1  91.7  95.8  88.3  92.1  73.4  62.5  92.2  87.1  89.9  81.8  78.9  49.2  86.2  96.4  83.0  87.5  67.3  60.5  78.3  80.7  73.0  43.8
51.3  56.5  43.2  68.4  80.0  80.5  76.8  49.8  53.1  81.9  88.2  80.8  81.8  63.9  55.5  82.8  81.1  81.9  75.7  69.3  43.4  77.2  87.5  76.6  76.9  58.4  52.9  68.9  71.4  63.6  38.9
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34.4  36.9  27.9  44.5  51.6  53.9  49.5  25.8  35.8  56.0  59.9  60.8  44.5  35.2  35.3  55.2  56.9  49.1  47.1  39.0  28.9  50.5  60.4  54.5  42.2  32.1  31.3  44.2  44.6  41.0  24.9
27.2  29.0  22.0  34.4  40.4  42.6  39.6  21.9  26.9  43.9  46.7  49.3  37.8  28.5  27.1  43.3  45.0  36.6  37.6  30.3  22.5  39.8  48.6  44.3  35.3  25.4  22.5  36.1  32.9  32.4  18.1
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TIP2005 TIP2805 TIP3605 TIP1213 TIP2013 TIP2813 TIP3613 TIP4413 TIP0421 TIP1221 TIP2021 TIP2821 TIP3621 TIP4421 TIP0429 TIP1229 TIP2029 TIP2829 TIP3629 TIP4429 TIP0437 TIP1237 TIP2037 TIP2837 TIP3637 TIP4437 TIP1245 TIP2045 TIP2845 TIP3645 TIP4445
56.7  67.0  50.8  77.3  94.6  77.9  85.8  92.0  73.0  104.0 69.3  55.2  86.6  108.4 83.8  88.3  69.1  59.9  75.1  88.0  57.0  101.0 73.8  77.7  75.8  114.5 92.9  105.2 87.1  110.9 44.4
103.2 116.4 85.6  125.2 149.5 122.3 133.5 133.1 119.3 153.8 104.6 92.4  121.0 167.4 129.5 130.8 100.3 93.9  110.9 137.8 92.3  143.4 112.7 112.3 107.2 175.4 135.6 163.8 136.5 170.9 66.9
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139.3 149.6 112.1 149.8 167.9 144.8 152.1 140.5 145.7 167.4 123.0 121.2 135.7 177.4 144.4 148.5 120.7 117.5 132.5 160.3 115.1 153.6 133.8 128.6 124.9 178.4 144.5 174.5 156.0 174.9 82.8
125.3 134.8 103.5 139.9 152.4 134.2 142.8 131.9 132.0 153.8 117.8 114.9 130.5 160.3 131.5 139.2 115.2 111.5 124.6 146.7 106.8 147.9 127.1 121.6 123.4 160.2 134.9 156.8 141.8 158.2 79.0
118.4 125.7 98.6  141.0 148.0 129.3 144.7 127.1 125.0 148.8 115.7 112.3 128.2 152.7 124.5 133.3 113.2 109.0 121.4 138.9 101.0 148.0 124.8 118.3 128.6 152.5 129.6 149.0 133.9 149.9 77.7
111.0 116.8 92.1  142.7 141.2 124.3 143.3 119.6 116.1 141.7 110.7 109.1 122.6 142.0 116.1 126.6 108.9 104.2 116.5 129.3 94.0  145.0 119.2 113.1 128.0 143.0 121.6 140.0 124.7 138.9 75.3
101.3 107.2 84.9  137.9 133.6 117.7 139.2 110.8 106.2 133.7 105.6 105.2 117.1 131.1 106.2 120.7 104.7 100.1 110.2 121.7 87.2  138.8 113.1 107.6 123.3 131.0 112.7 129.4 115.8 127.9 72.0
95.8  103.0 80.4  133.7 129.7 117.7 136.1 108.0 101.9 130.1 104.9 103.1 117.2 127.8 103.8 122.1 104.7 101.5 108.4 121.5 82.8  136.6 111.7 106.5 121.8 125.7 108.8 124.7 114.6 122.5 70.5
93.6  101.5 78.4  130.0 129.9 123.0 132.6 103.8 99.6  128.5 104.2 104.9 115.6 125.1 101.4 127.1 104.9 106.1 109.2 124.5 79.8  131.8 110.2 105.8 119.3 120.8 104.3 122.9 117.5 120.1 68.3
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84.7  93.2  70.8  114.3 120.4 124.4 120.0 92.5  89.5  119.7 100.4 102.5 109.2 115.1 93.6  128.0 102.7 112.4 105.2 124.0 71.4  120.2 103.1 102.3 109.4 107.1 92.7  113.1 117.9 106.7 61.8
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83.8 92.6 69.1 112.5 120.1 125.9 118.3 90.6 87.6 120.1 103.0 105.1 110.8 114.3 92.7 128.8 104.5 116.4 107.4 124.6 69.7 118.0 104.7 103.8 109.7 104.9 90.2 112.0 119.4 104.9 60.2
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61.3 67.1 50.6 82.2 93.3 95.3 89.1 62.8 62.0 93.7 98.8 91.0 98.2 81.1 65.0 95.7 89.3 96.8 86.3 88.1 49.9 87.4 98.7 84.6 95.3 73.3 61.7 80.1 85.4 73.7 45.1
53.3 58.2 44.3 72.4 82.2 84.4 78.9 54.7 54.4 84.0 89.5 82.1 88.3 70.4 57.5 85.6 80.3 86.7 77.9 77.1 44.4 78.2 88.4 76.3 85.1 64.1 54.3 69.8 75.0 64.1 40.0
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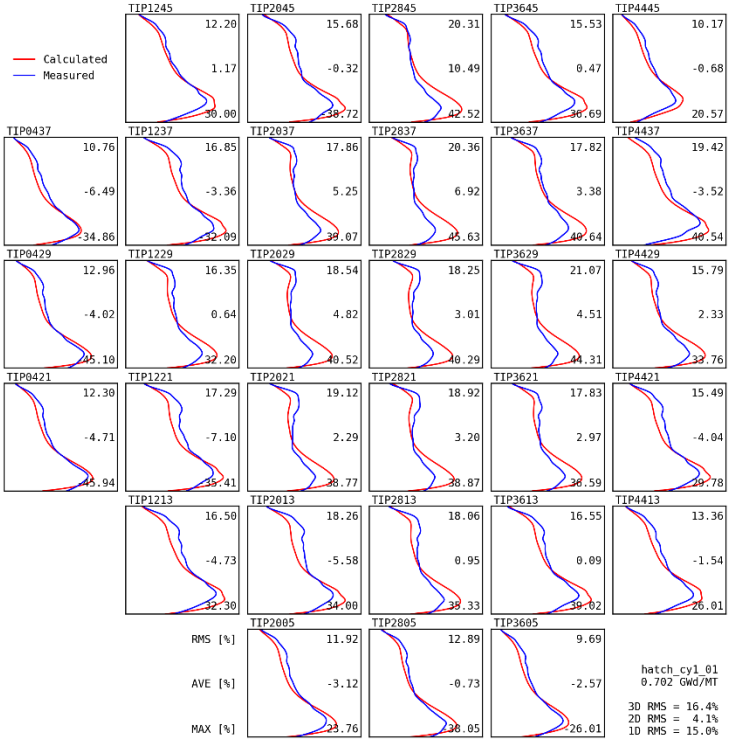
35.9 37.4 28.8 47.6 54.2 56.0 49.9 31.1 35.9 57.0 61.0 59.0 53.6 42.7 37.3 55.9 54.9 57.0 52.7 47.3 29.8 49.9 60.0 51.2 51.7 38.7 32.3 44.8 47.7 40.3 25.9
27.8 28.9 22.6 36.2 41.7 44.4 38.8 23.3 27.5 44.2 46.7 47.5 39.5 33.2 28.4 43.2 42.2 45.3 39.0 36.2 22.9 38.3 46.4 39.7 38.1 28.1 23.1 33.8 36.9 29.1 19.7
@set 47 50.6 10418 11.483 11.484 24 !power, #, MMD/ton, MMD/kgU
TIP2005 TIP2805 TIP3605 TIP1213 TIP2013 TIP2813 TIP3613 TIP4413 TIP0421 TIP1221 TIP2021 TIP2821 TIP3621 TIP4421 TIP0429 TIP1229 TIP2029 TIP2829 TIP3629 TIP4429 TIP0437 TIP1237 TIP2037 TIP2837 TIP3637 TIP4437 TIP1245 TIP2045 TIP2845 TIP3645 TIP4445
50.6 60.7 45.7 67.8 84.5 69.2 74.8 80.4 65.8 91.2 61.8 49.4 77.0 98.4 77.2 77.9 61.5 53.7 66.5 79.6 51.2 88.0 64.4 69.4 66.0 100.7 82.0 95.2 79.7 98.2 38.5
93.4 106.6 77.3 111.5 134.9 109.7 118.0 118.0 109.7 137.8 94.1 83.0 107.6 153.5 120.0 117.2 90.3 85.0 99.7 125.9 83.4 127.3 100.2 101.1 94.3 156.4 121.4 150.1 126.6 153.7 58.1
123.7 138.5 98.5 137.5 162.7 133.4 142.1 137.0 136.9 161.5 111.2 103.4 123.9 182.7 144.0 139.3 106.2 103.1 117.5 153.0 104.3 148.1 119.9 118.2 110.6 183.9 142.2 180.7 152.2 181.6 69.3
138.6 153.0 109.0 148.8 174.3 143.8 153.4 147.2 150.2 172.8 120.3 113.3 133.2 194.3 156.2 149.6 115.8 112.0 126.6 166.9 114.9 157.0 131.3 127.5 119.3 193.6 152.8 191.9 164.6 192.3 75.3
143.5 155.9 113.0 152.3 174.0 146.4 155.4 144.8 152.5 172.2 123.3 118.5 133.9 190.2 154.9 151.9 118.9 115.7 129.4 167.9 117.8 157.6 135.0 129.9 122.3 186.5 151.8 189.2 162.9 187.1 78.8
137.7 148.2 109.4 140.2 166.5 140.1 150.4 137.3 144.3 164.6 120.7 117.0 132.6 178.0 144.3 146.1 117.3 113.2 127.9 157.7 113.7 152.3 132.1 127.0 121.0 174.2 143.0 176.1 154.8 174.9 79.1
127.5 134.5 103.2 142.4 156.9 132.1 143.7 130.4 133.9 156.0 117.5 114.2 129.0 164.8 133.2 138.9 115.5 109.7 123.3 146.1 106.9 149.2 128.7 121.8 122.3 161.4 135.2 162.2 143.2 161.8 78.0
121.3 127.7 99.5 145.5 153.0 130.0 147.2 127.4 128.3 153.1 116.7 113.9 128.5 157.2 127.6 135.8 114.8 109.9 121.2 139.4 102.7 151.7 128.0 119.2 128.1 155.5 131.9 154.5 137.1 154.9 77.7
113.6 120.4 94.3 146.9 147.2 125.2 147.4 122.1 120.3 144.8 113.6 112.2 124.9 148.1 118.8 130.0 111.9 107.8 118.1 131.9 96.6 149.6 123.8 115.6 129.7 146.0 124.8 145.6 128.8 146.1 75.9
105.2 109.9 87.6 141.4 139.0 119.2 142.1 113.1 110.3 137.0 108.5 107.5 118.5 136.3 109.2 123.7 107.4 105.0 111.9 123.4 89.4 142.9 117.0 109.9 125.2 134.0 115.6 134.3 118.6 134.8 72.7
99.0 105.1 83.4 137.3 135.6 120.1 139.1 110.3 105.3 133.5 106.5 106.6 118.4 131.2 106.1 125.7 107.6 107.7 111.4 124.3 86.1 141.1 116.2 109.6 124.8 129.3 112.1 129.8 118.5 129.6 71.6
96.3 104.2 80.9 133.9 134.6 124.9 135.5 105.9 101.9 131.5 106.2 107.3 116.6 129.1 103.9 130.0 107.7 113.1 111.1 126.4 82.7 136.8 115.0 108.8 120.9 124.2 106.0 127.5 121.4 124.7 69.6
92.3 99.4 76.6 125.8 129.5 126.2 128.9 98.8 96.9 127.1 103.9 106.0 111.9 123.2 98.8 130.9 104.9 114.1 106.7 127.1 78.5 128.5 110.2 105.7 114.6 116.3 100.4 122.1 121.4 117.5 66.4
87.1 95.2 72.1 118.9 124.7 126.0 123.2 94.8 91.1 123.0 101.8 102.9 110.5 118.3 95.5 129.7 103.9 113.8 106.6 126.5 74.5 122.9 106.5 104.4 112.4 109.4 95.9 116.5 121.4 111.5 63.7
85.9 94.6 71.3 115.8 124.2 126.9 122.2 92.3 89.9 123.0 104.7 104.8 111.8 117.5 94.9 129.9 105.6 116.1 108.1 126.1 72.7 122.0 108.1 105.3 112.8 107.7 93.8 115.4 121.6 109.8 62.7
82.9 91.3 68.6 112.1 121.6 123.6 117.9 87.1 85.8 119.6 105.3 104.3 111.4 113.0 90.6 125.6 104.7 114.4 106.6 121.6 69.2 117.0 108.2 103.6 110.4 102.5 88.6 110.9 117.3 104.6 60.4
77.4 85.7 64.2 104.2 115.1 116.5 111.5 82.0 80.1 113.7 106.2 101.3 111.8 105.8 84.2 119.1 101.3 110.1 102.0 113.3 64.5 110.3 107.5 99.6 109.5 94.9 82.3 103.6 109.5 97.5 56.5
74.1 82.3 62.2 99.8 112.1 113.2 109.3 79.5 77.0 111.6 110.6 101.2 115.2 101.5 80.9 116.5 101.8 109.1 101.7 108.6 62.0 108.6 111.2 99.7 112.9 91.4 79.1 100.1 105.8 94.4 54.7
70.5 77.5 58.8 95.3 107.7 107.8 103.1 73.6 71.8 106.6 110.1 100.1 111.9 95.1 75.6 110.5 99.4 107.1 98.9 102.3 58.5 102.3 110.7 96.1 108.6 85.6 73.8 94.1 98.9 87.9 51.7
63.5 69.4 52.9 85.4 97.6 98.0 93.1 64.7 64.3 97.3 101.5 93.6 102.5 84.5 66.9 99.6 92.5 99.3 91.0 90.8 52.6 92.3 103.3 88.1 98.0 75.9 64.8 83.6 87.7 77.8 47.1
55.2 60.4 46.3 75.3 86.4 87.2 82.0 56.7 56.8 88.0 93.5 86.2 91.8 74.3 59.5 89.4 85.4 90.4 84.0 79.4 46.5 81.8 93.3 81.0 87.5 66.6 56.9 73.0 77.0 68.0 41.7
47.7 51.7 39.4 64.9 74.1 75.3 69.8 46.3 48.7 75.9 81.9 79.3 77.0 61.8 50.1 76.4 76.6 80.1 75.7 66.9 39.9 69.1 82.1 71.9 73.3 55.5 47.2 61.2 64.7 56.8 35.2
37.6 39.4 30.1 50.2 57.0 57.9 53.0 32.8 38.2 60.0 63.8 65.4 55.1 45.4 37.9 59.3 61.0 62.2 59.1 49.5 31.1 53.0 64.2 57.5 53.9 41.2 34.1 46.2 48.7 42.7 26.8
29.1 30.6 22.7 38.3 43.4 45.0 40.4 23.2 28.8 47.4 49.2 51.2 40.4 34.4 29.1 45.4 47.2 47.5 43.7 35.9 23.7 40.6 48.8 42.8 39.3 29.3 24.2 34.0 35.4 30.7 19.3
@set 49 34.5 11013 12.139 12.140 28 !power, #, MMD/ton, MMD/kgU
TIP2005 TIP2805 TIP3605 TIP1213 TIP2013 TIP2813 TIP3613 TIP4413 TIP0421 TIP1221 TIP2021 TIP2821 TIP3621 TIP4421 TIP0429 TIP1229 TIP2029 TIP2829 TIP3629 TIP4429 TIP0437 TIP1237 TIP2037 TIP2837 TIP3637 TIP4437 TIP1245 TIP2045 TIP2845 TIP3645 TIP4445
34.5 45.0 28.3 49.6 47.1 46.6 49.4 49.4 54.3 65.8 49.2 38.5 45.0 58.7 49.5 62.3 49.2 31.5 38.7 47.5 43.7 72.1 46.6 49.0 46.0 61.1 43.8 52.7 54.6 51.6 26.5
65.6 80.8 49.0 84.1 77.5 73.9 79.5 85.0 91.1 101.1 75.9 64.3 74.3 108.5 77.8 95.5 72.8 56.8 66.6 87.9 71.1 106.0 73.7 72.3 75.5 113.8 67.0 86.4 89.6 85.2 40.9
89.5 106.5 64.9 106.8 96.0 92.3 99.8 108.6 114.2 121.7 91.6 80.0 92.4 144.2 96.1 115.8 86.8 76.0 88.6 120.8 89.2 124.8 90.0 85.8 96.3 149.1 83.1 108.5 111.4 107.6 49.8
103.1 120.6 75.8 121.5 110.9 103.0 113.5 121.4 127.7 131.9 101.2 88.5 104.0 160.7 109.1 128.4 96.2 85.9 99.7 138.8 99.2 134.7 100.6 94.9 107.8 164.8 96.2 121.6 124.5 123.1 56.2
111.7 127.2 83.7 131.2 118.6 109.5 123.6 127.7 131.9 135.9 106.5 94.8 110.4 165.4 115.7 133.1 100.7 92.6 107.6 147.8 104.6 137.8 107.4 100.1 116.9 169.1 108.2 127.8 130.0 133.6 61.4
112.7 125.3 87.3 137.3 121.4 110.2 132.1 127.6 131.0 133.6 107.6 96.8 112.7 161.3 120.4 131.9 101.8 95.1 109.9 149.3 101.6 136.4 109.9 101.2 118.0 163.2 118.6 128.5 126.2 140.6 65.6
108.7 118.9 88.8 140.5 120.2 108.3 139.1 124.5 127.2 129.6 106.0 96.8 112.5 152.3 127.1 129.9 101.9 94.9 108.7 148.9 97.6 132.2 110.0 100.9 116.5 151.6 126.1 125.3 121.2 142.3 69.0
107.3 114.9 90.0 144.4 121.1 106.3 143.0 124.3 126.9 128.4 107.1 98.6 113.5 149.4 132.9 129.8 102.4 95.3 110.1 153.1 97.6 131.0 110.9 102.1 118.5 147.1 129.9 123.8 116.4 143.8 72.1
103.3 109.2 87.8 141.8 118.3 105.4 141.2 119.7 122.3 125.7 105.3 97.5 111.8 145.0 130.5 126.6 100.8 95.7 109.6 154.0 93.5 127.8 109.6 100.4 117.1 140.6 125.3 118.8 111.8 138.6 72.4
96.2 100.8 83.2 134.7 112.4 100.9 134.2 113.7 114.5 120.8 101.7 95.2 110.0 137.7 123.1 121.6 98.3 93.3 107.2 148.8 88.0 122.0 104.2 96.4 113.4 133.4 118.3 111.2 103.5 130.0 71.1
90.6 95.6 81.0 131.4 109.6 99.0 131.0 109.7 110.5 122.5 102.8 95.2 112.5 132.3 119.7 121.1 100.5 91.9 106.0 142.4 85.5 124.9 104.2 96.8 113.9 126.7 114.9 107.9 101.0 126.0 70.5
89.2 93.9 78.2 130.8 109.6 99.2 130.9 107.8 107.2 127.0 104.6 97.6 119.2 131.0 114.8 120.7 102.6 94.1 107.8 140.8 83.7 128.1 105.6 97.1 119.0 125.7 110.4 105.4 98.7 122.0 69.8
85.4 90.8 74.8 125.9 108.4 98.8 126.9 103.7 101.2 127.7 105.0 99.1 124.4 127.9 107.4 117.8 103.7 96.5 109.7 135.1 78.7 129.1 105.1 96.6 123.4 121.3 104.3 101.7 96.1 116.6 68.0
82.4 88.3 72.8 121.6 107.7 100.4 125.1 99.4 95.5 129.6 107.5 100.8 128.1 122.7 102.3 115.6 109.2 100.0 110.0 128.1 75.4 130.2 105.1 98.6 126.0 115.6 101.7 100.6 97.1 112.7 65.9
84.1 90.5 73.2 122.4 113.2 108.4 127.8 99.5 93.1 131.4 113.7 108.5 134.0 122.5 99.5 117.3 120.5 110.8 114.9 126.5 74.4 131.1 110.5 104.8 131.3 115.3 100.6 104.8 103.5 114.0 65.8
84.2 92.3 72.7 119.3 119.5 117.9 127.3 96.0 88.7 126.9 117.4 114.3 135.1 119.9 94.1 115.4 129.4 124.0 117.2 123.0 70.5 128.3 114.2 109.9 131.2 113.2 96.2 109.9 109.7 112.3 63.9
82.5 90.2 69.9 113.2 124.1 125.0 123.5 90.3 82.5 123.3 120.1 119.7 132.4 113.9 88.2 112.0 133.7 131.3 117.9 116.2 66.7 122.0 115.5 114.7 127.2 106.0 91.1 112.8 114.6 107.2 61.0
82.2 91.1 69.6 111.0 129.3 133.1 123.8 87.7 79.8 122.4 128.7 130.0 134.1 109.3 85.1 113.7 140.0 136.9 120.3 112.6 64.6 119.5 124.3 125.6 127.4 101.5 89.6 116.0 119.5 106.6 59.9
81.2 89.6 66.8 106.6 128.8 134.2 119.9 83.7 74.9 118.5 132.5 138.1 132.9 104.9 79.4 114.1 139.2 141.3 124.2 109.1 60.4 112.4 129.1 132.3 125.7 97.3 84.0 113.3 118.3 102.2 56.8
74.8 82.1 61.4 96.4 120.7 125.5 108.9 75.8 66.4 109.0 126.1 134.8 124.8 97.0 69.9 108.6 130.2 137.7 123.1 101.5 54.0 100.8 123.7 128.2 117.1 88.8 74.0 102.8 108.1 92.1 52.0
66.3 73.3 54.4 85.4 108.6 114.1 97.2 66.3 58.6 97.7 117.1 125.3 114.3 84.9 61.7 100.6 119.9 127.1 115.9 89.9 47.5 89.3 114.7 116.8 105.3 78.1 65.0 91.9 97.5 81.2 46.3
58.5 63.8 46.7 73.3 94.2 99.1 83.4 57.2 49.4 83.8 102.2 112.3 100.7 74.5 51.2 86.9 102.6 116.7 105.8 79.7 40.3 74.4 101.2 104.4 93.6 67.7 54.2 78.1 83.5 69.2 39.8
46.7 49.4 35.8 56.4 73.4 77.2 64.1 43.2 37.3 64.9 79.1 90.1 79.2 58.8 37.8 66.7 77.8 95.9 86.8 64.1 30.3 56.0 79.0 80.8 73.3 53.9 39.2 58.9 63.7 52.9 30.4
36.8 38.1 27.2 43.0 56.2 59.6 49.1 32.6 26.6 48.5 58.9 69.3 61.1 47.4 27.2 49.1 57.7 78.8 70.0 50.7 22.3 41.5 59.0 61.9 57.9 42.6 27.7 43.4 48.4 42.1 23.2
@set 50 26.5 11746 12.947 12.948 30 !power, #, MMD/ton, MMD/kgU
TIP2005 TIP2805 TIP3605 TIP1213 TIP2013 TIP2813 TIP3613 TIP4413 TIP0421 TIP1221 TIP2021 TIP2821 TIP3621 TIP4421 TIP0429 TIP1229 TIP2029 TIP2829 TIP3629 TIP4429 TIP0437 TIP1237 TIP2037 TIP2837 TIP3637 TIP4437 TIP1245 TIP2045 TIP2845 TIP3645 TIP4445
26.5 28.8 32.6 62.3 53.8 48.7 65.7 54.7 34.2 61.3 52.0 38.9 47.7 44.2 35.9 55.3 48.8 29.7 36.7 37.7 37.2 78.8 52.3 51.6 54.3 58.8 74.2 59.6 51.2 79.4 34.6
50.0 52.4 56.1 106.2 89.3 78.6 108.2 93.7 57.5 95.3 80.8 65.2 79.2 80.8 57.9 84.3 71.9 53.0 64.6 70.2 61.4 118.2 83.0 75.4 91.0 110.9 111.9 96.3 83.9 127.5 52.8
68.6 71.4 74.1 137.2 113.5 99.5 139.7 120.9 74.8 116.1 97.8 81.9 99.3 110.8 73.6 102.3 85.2 69.8 83.1 98.2 77.5 144.5 102.3 89.1 120.5 146.5 133.1 119.6 106.9 154.7 63.6
81.6 85.2 85.6 159.2 129.1 112.7 161.8 134.7 87.4 129.8 108.7 91.2 112.1 126.3 87.2 115.5 95.0 78.4 94.1 114.8 87.6 161.7 114.3 98.9 141.4 162.1 145.7 133.7 122.4 168.4 70.4
93.5 97.9 93.0 168.3 139.1 122.1 170.9 141.1 98.6 137.5 114.6 98.3 121.9 136.3 99.7 124.4 101.0 85.4 103.8 128.5 95.3 165.9 122.5 105.6 154.2 170.2 149.1 141.7 133.9 170.4 74.7
102.6 110.2 97.0 167.2 142.1 127.2 168.3 139.3 108.0 140.3 116.1 101.4 124.6 142.4 113.1 129.7 104.1 89.1 107.8 137.3 98.4 164.9 124.1 108.5 153.5 168.3 143.7 146.9 143.3 166.5 76.1
112.8 124.4 98.7 160.4 141.4 130.6 161.4 133.9 121.0 140.4 116.0 102.9 125.2 146.4 129.4 133.4 105.9 91.0 109.7 146.4 99.8 159.7 123.6 109.5 146.7 162.4 138.3 152.9 154.5 160.5 76.7
126.9 141.4 101.9 157.2 144.7 135.5 160.2 132.2 134.8 142.0 117.4 105.1 126.6 156.8 144.4 138.2 108.4 94.0 112.4 160.8 102.8 159.3 125.1 111.3 147.4 160.6 135.4 162.2 167.3 159.0 77.3
133.3 148.6 100.8 152.8 142.7 134.8 154.7 127.1 137.4 140.2 115.0 104.9 125.2 160.6 147.8 137.7 107.5 94.3 113.7 168.5 103.2 153.8 122.3 110.1 143.4 158.7 129.2 162.9 169.9 152.8 76.3
129.6 145.1 96.5 143.2 136.5 129.8 145.3 120.1 133.2 134.2 110.5 102.1 119.5 157.3 141.8 132.0 105.2 93.0 110.5 164.9 99.6 144.6 117.0 106.0 136.0 149.9 120.4 154.0 161.9 142.9 73.8
124.2 140.6 93.1 138.2 131.7 128.0 140.2 115.9 130.0 130.7 109.2 101.9 117.2 151.3 139.2 131.1 106.0 92.2 107.9 159.2 96.5 140.8 115.7 106.4 131.8 141.4 117.4 149.9 158.2 139.0 72.6

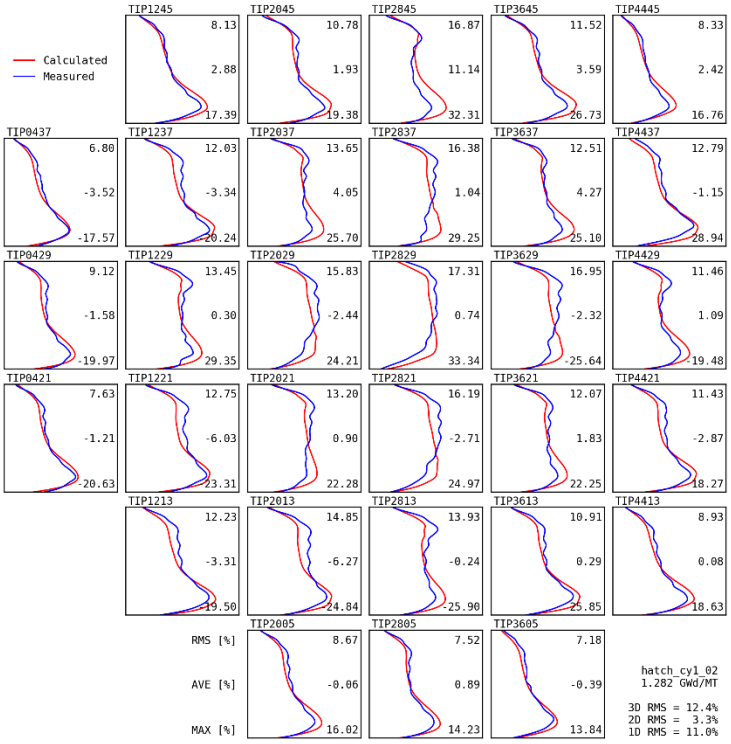
121.3	135.7	91.0	135.0	129.6	126.0	137.4	113.1	125.3	127.5	109.3	103.8	116.0	148.0	133.8	128.0	107.2	95.1	108.9	155.7	93.0	137.7	114.6	105.6	131.4	138.1	113.9	145.5	152.5	134.7	71.3
114.0	126.6	86.5	128.8	124.4	120.4	130.5	107.7	117.7	121.0	107.8	104.4	113.5	141.5	124.3	122.3	108.7	96.9	107.7	148.9	87.7	130.7	111.3	103.9	126.1	131.2	105.9	136.3	141.6	127.0	68.5
106.1	117.2	81.4	121.6	117.8	115.3	125.1	100.6	109.5	116.2	111.1	108.2	110.9	131.2	116.3	117.8	114.1	101.6	105.8	139.1	83.7	126.3	109.2	104.4	120.8	121.9	102.0	128.3	132.9	119.9	66.1
102.7	114.0	80.4	120.2	117.9	115.8	124.5	99.7	105.6	117.3	121.3	120.5	115.0	129.6	113.7	119.1	126.7	114.5	110.3	135.5	81.0	125.3	112.7	109.7	121.3	119.2	100.6	125.8	130.6	118.5	65.2
98.8	108.4	77.2	116.4	116.1	115.6	122.0	95.8	99.6	115.6	128.9	131.7	116.7	124.9	106.2	117.9	136.3	129.1	114.1	131.8	76.9	121.3	115.2	113.1	120.7	115.8	95.7	121.1	126.4	114.2	63.2
91.8	100.3	72.7	109.5	113.1	114.1	116.3	89.7	91.2	113.1	131.5	137.3	117.2	117.9	98.6	116.6	139.5	137.9	117.1	125.1	72.0	114.8	116.3	116.6	117.7	108.5	89.6	114.1	119.5	106.4	59.9
87.3	96.3	70.1	106.4	116.5	119.4	115.4	86.8	88.1	117.4	136.2	142.9	123.8	113.8	94.9	122.7	144.9	144.0	122.8	120.2	69.3	113.7	122.8	125.9	117.3	103.2	86.9	112.5	116.4	103.7	58.3
83.8	92.2	67.3	103.1	119.0	122.7	112.2	83.2	82.8	120.2	135.8	144.1	129.6	110.2	89.2	125.0	144.4	145.9	130.4	117.3	64.9	109.5	127.3	130.4	117.2	99.9	81.7	107.7	113.3	98.7	55.8
75.9	83.1	61.4	93.2	113.9	117.4	103.5	76.2	73.5	113.7	127.4	137.0	125.1	102.7	79.0	118.4	134.7	140.7	130.2	109.9	58.4	98.8	122.1	125.5	110.9	92.0	72.4	98.1	102.7	89.1	51.2
67.0	73.1	54.1	83.5	104.8	107.4	92.9	66.9	64.5	102.8	117.0	125.3	116.6	91.1	69.4	108.5	123.6	129.0	121.9	97.6	51.6	88.1	112.7	116.0	101.3	80.9	63.5	86.7	91.8	78.5	45.9
58.8	62.9	46.8	72.4	92.2	94.9	80.3	58.1	54.8	88.6	101.4	112.6	103.0	79.9	57.8	93.4	107.0	118.2	111.0	86.1	44.3	74.1	99.9	101.1	90.6	70.4	53.0	74.0	78.7	67.0	39.8
47.2	48.8	36.9	56.4	72.3	74.0	62.1	45.2	41.5	68.1	77.8	90.8	80.8	63.6	42.3	71.2	82.0	97.7	91.8	69.5	34.1	55.6	79.8	78.1	71.5	56.3	38.7	57.3	60.5	51.1	31.0
37.6	37.2	29.2	43.3	57.1	57.1	47.9	34.4	29.5	50.1	57.9	70.1	61.2	49.6	30.4	51.8	59.6	79.6	72.6	55.2	25.1	41.2	61.1	56.8	56.0	44.2	27.4	45.0	46.7	38.6	23.5
@set 51	22.3	12182	13.428	13.429	32	!power, #, MMD/ton, MMD/kgU																								
TIP2005	TIP2805	TIP3605	TIP1213	TIP2013	TIP2813	TIP3613	TIP4413	TIP0421	TIP1221	TIP2021	TIP2821	TIP3621	TIP4421	TIP0429	TIP1229	TIP2029	TIP2829	TIP3629	TIP4429	TIP0437	TIP1237	TIP2037	TIP2837	TIP3637	TIP4437	TIP1245	TIP2045	TIP2845	TIP3645	TIP4445
22.3	24.1	28.5	51.3	44.8	40.6	54.2	45.8	34.6	57.2	52.1	32.5	38.8	36.9	36.1	52.5	45.9	25.1	30.5	32.0	37.0	72.2	43.6	42.8	44.6	48.5	62.2	50.4	43.9	66.2	28.8
42.3	44.0	49.1	86.6	74.3	65.8	89.5	78.6	53.0	82.5	75.1	54.6	64.8	67.5	53.5	74.2	63.0	44.2	53.6	59.1	55.3	102.4	69.0	62.9	75.1	90.2	93.4	81.3	71.1	106.4	43.5
58.0	60.2	64.3	113.9	94.7	83.4	115.6	100.7	66.0	97.9	88.2	68.6	81.7	91.4	66.1	87.5	73.5	58.7	69.4	81.9	67.0	123.4	85.4	74.5	100.6	120.2	112.2	101.7	89.8	130.7	52.7
69.6	72.5	74.5	133.7	108.8	95.5	135.2	113.6	77.2	109.8	98.2	77.2	93.9	105.5	77.9	100.0	81.8	66.1	78.4	96.7	76.4	138.9	96.9	83.1	118.2	137.6	124.4	115.2	104.0	144.7	58.7
81.0	85.7	82.4	145.0	119.4	105.7	147.0	120.5	87.0	118.3	105.7	84.8	103.3	117.5	89.4	109.1	88.4	72.7	87.4	109.6	82.9	146.8	105.8	90.7	130.7	146.3	130.9	125.3	117.7	151.1	63.6
91.2	98.7	87.2	146.7	126.2	113.0	149.6	123.8	99.9	123.3	109.7	89.7	108.2	125.2	104.6	116.0	93.4	77.7	93.9	120.3	87.4	147.8	110.7	96.2	135.0	149.4	129.7	133.9	129.2	150.8	66.5
104.0	114.2	90.1	145.7	129.7	119.7	147.1	122.5	116.4	128.4	113.5	93.2	112.1	133.0	123.3	123.6	98.3	81.8	98.1	132.5	92.1	149.4	113.0	101.0	134.9	146.7	128.3	144.4	144.9	149.1	68.9
120.0	133.3	95.3	146.5	135.0	127.4	149.3	124.6	129.4	131.9	116.8	98.8	117.8	147.0	136.4	129.6	102.6	87.0	104.4	149.2	96.4	149.6	117.9	106.0	138.5	150.4	129.1	155.8	159.8	152.0	71.4
127.6	142.5	96.3	145.6	134.9	130.5	148.2	122.3	132.6	132.5	116.9	101.7	119.3	155.0	139.9	131.2	104.3	90.4	108.0	158.8	96.7	146.7	119.5	107.0	137.2	150.0	125.7	158.7	164.7	148.6	72.0
127.0	140.6	94.8	139.4	132.2	128.1	141.8	118.4	130.0	128.6	116.7	102.0	116.6	153.4	137.3	129.7	106.0	92.4	108.2	160.3	95.1	142.2	117.7	106.5	132.5	144.1	119.0	154.0	159.9	141.3	71.6
125.1	139.0	92.9	136.3	132.1	128.4	140.0	115.7	130.2	128.8	119.3	104.7	117.4	150.2	137.3	131.1	111.1	95.0	108.2	157.3	95.7	142.1	117.4	108.7	130.7	141.2	119.2	152.5	158.2	139.6	71.9
123.7	136.2	91.3	135.8	131.4	127.3	136.3	114.3	126.3	126.7	122.1	109.0	119.4	150.0	132.8	130.0	113.8	101.5	111.3	157.4	92.5	138.9	117.8	109.9	132.9	139.4	116.1	148.7	154.0	137.6	71.7
117.3	128.2	88.1	130.6	126.7	124.3	132.8	109.8	117.9	121.7	125.9	114.3	118.3	143.8	124.3	124.9	121.9	108.3	112.0	151.6	87.8	132.9	116.8	110.3	128.6	133.5	109.9	140.8	145.4	131.6	70.4
109.4	120.0	83.7	125.1	122.4	121.3	129.0	104.5	112.6	121.5	136.5	123.6	117.5	136.4	121.0	125.2	134.1	117.5	113.5	144.8	85.8	131.8	116.8	113.7	125.5	126.1	106.2	134.7	138.5	126.0	68.3
107.0	119.3	82.8	125.1	125.3	124.6	130.1	104.6	110.1	123.8	147.7	138.3	121.7	135.7	117.7	128.5	144.3	134.3	119.6	142.5	83.3	131.7	124.0	119.6	127.1	124.7	104.9	134.3	138.1	125.2	67.9
103.0	113.7	80.5	122.7	126.0	126.7	128.0	101.2	103.9	125.0	150.9	147.0	127.1	133.7	109.9	129.9	147.5	145.9	125.4	140.3	78.3	127.3	127.7	125.3	128.4	121.8	99.9	130.2	133.9	119.7	66.4
96.5	105.7	75.8	116.2	125.7	127.8	123.4	95.2	97.4	127.3	150.2	148.4	129.6	127.5	103.9	133.9	147.3	148.2	130.4	134.8	73.8	123.2	129.8	130.8	125.5	114.9	94.6	122.9	127.1	113.7	62.8
92.3	101.7	73.9	113.3	130.5	133.3	122.6	92.6	93.4	132.2	151.5	150.0	135.8	123.6	100.8	138.1	148.6	147.6	136.7	130.7	72.0	122.0	136.3	140.0	125.0	110.3	93.0	120.5	125.4	111.3	61.7
86.6	97.5	70.3	109.3	130.8	133.9	119.3	88.9	86.5	128.8	146.4	148.8	139.0	120.0	92.0	133.6	141.6	148.0	142.4	128.0	67.0	114.2	137.1	140.1	125.2	107.3	87.1	115.3	120.1	106.1	58.9
80.4	88.7	64.0	100.3	121.4	123.9	109.9	80.7	76.1	117.3	135.4	139.0	132.6	111.5	81.1	122.5	129.9	140.6	137.3	119.0	59.8	102.1	128.6	129.9	117.3	98.1	77.3	103.4	108.4	95.2	53.9
70.6	77.5	56.5	89.0	109.5	112.6	98.2	70.9	66.9	104.8	122.7	125.5	121.2	97.6	71.4	109.3	113.0	127.9	125.9	104.4	52.7	90.6	117.4	118.8	106.3	86.4	68.1	92.0	95.9	83.7	48.2
61.3	67.2	48.5	76.8	95.7	97.9	85.2	61.2	55.1	87.5	103.6	112.2	105.7	85.7	57.2	90.5	98.2	115.7	113.1	91.9	43.6	73.7	102.7	103.3	94.4	75.2	56.5	77.3	81.4	71.0	41.5
48.6	52.4	37.6	60.0	73.9	76.2	65.4	47.4	39.9	64.0	77.7	89.9	84.1	67.2	40.4	66.0	70.9	96.1	92.4	74.0	31.7	52.5	81.5	79.6	74.2	59.7	41.3	58.4	61.7	54.2	31.9
38.2	43.7	28.7	45.7	56.4	50.4	50.6	35.0	29.0	49.2	58.7	69.7	71.8	53.0	30.3	50.6	54.6	77.4	77.8	58.3	23.5	41.4	61.6	57.8	57.6	46.3	29.1	42.9	44.6	39.6	22.8
@set 54	18.7	12545	13.828	13.829	38	!power, #, MMD/ton, MMD/kgU																								
TIP2005	TIP2805	TIP3605	TIP1213	TIP2013	TIP2813	TIP3613	TIP4413	TIP0421	TIP1221	TIP2021	TIP2821	TIP3621	TIP4421	TIP0429	TIP1229	TIP2029	TIP2829	TIP3629	TIP4429	TIP0437	TIP1237	TIP2037	TIP2837	TIP3637	TIP4437	TIP1245	TIP2045	TIP2845	TIP3645	TIP4445
18.7	20.2	23.8	53.2	42.0	36.4	57.6	43.7	31.2	57.1	73.8	47.7	47.1	34.3	32.6	51.5	75.1	40.3	37.3	29.9	32.6	81.7	51.6	51.5	56.1	46.0	58.0	46.9	40.7	62.9	26.8
36.6	38.4	42.6	90.8	70.8	60.7	94.1	73.7	48.2	79.6	102.9	82.3	75.6	62.3	49.0	72.3	101.3	71.2	64.1	54.9	48.9	108.7	79.3	74.1	89.6	84.4	86.5	74.8	65.8	99.0	40.1
51.6	54.1	56.4	113.7	90.0	77.4	115.9	91.4	60.1	92.9	116.0	103.1	90.9	83.9	60.8	84.7	112.9	93.6	81.0	75.8	59.1	120.4	94.0	85.8	109.2	109.7	101.3	92.6	82.1	117.7	47.2
61.9	66.0	64.9	122.8	100.0	87.9	124.3	101.0	70.5	101.4	122.9	111.8	99.2	95.9	73.1	94.0	120.7	102.7	89.8	89.1	67.0	126.7	101.5	93.0	116.9	121.4	109.3	105.3	95.2	127.8	51.2
72.8	79.6	71.7	127.5	108.2	96.9	129.7	106.0	82.6	106.5	124.4	118.6	104.0	105.8	86.9	101.3	122.6	108.5	96.0	102.5	72.9	127.9	106.1	98.1	120.6	128.7	112.2	115.4	108.8	131.2	54.6
85.0	94.0	76.4	125.9	110.8	103.0	128.3	106.2	95.9	109.6	122.3	119.6	105.9	113.8	101.2	106.5	122.0	109.7	98.9	114.4	76.9	126.3	107.1	99.8	120.1	130.1	111.5	124.5	122.9	130.8	56.5
97.4	109.6	79.0	122.7	113.4	108.2	125.7	104.7	108.5	113.1	121.6	117.8	106.9	121.8	114.5	111.2	122.7	111.7	100.7	125.9	80.8	127.8	107.9	101.0	117.9	128.2	110.3	133.0	135.0	130.6	57.8
108.6	123.3	83.1	123.1	118.4	114.0	126.9	105.6	115.2	116.3	122.7	119.7	109.7	130.9	122.4	115.9	124.3	118.1	103.6	137.0	83.6	128.7	110.3	104.0	120.1	130.5	109.4	140.2	143.5	132.0	60.0
113.0	126.9	83.9	123.1	119.3	115.6	125.2	104.8	115.6	115.3	121.4	121.4	109.2	133.7	121.3	116.8	122.6	122.8	104.7	139.8	84.0	125.3	110.5	103.4	118.9	130.4	107.0	140.0	143.9	129.2	60.8
111.7	123.5	81.5	119.4	115.1	113.1	121.0	101.1	113.3	112.2	116.4	119.0	107.0	130.5	117.9	114.7	119.6	123.1	102.8	138.1	83.4	121.2	107.4	100.1	115.1	125.4	103.3	134.6	137.8	123.4	61.1
108.3	120.0	79.6	116.3	113.8	111.4	117.8	98.8	112.2	112.1	116.7	116.0	106.0	127.9	118.5	115.0	120.1	119.8	101.5	134.9	83.4	122.5	106.7	100.4	112.7	121.4	102.6	132.8	135.9	121.0	62.2
106.8	118.6	76.9	116.0	113.8	111.4	117.7	98.5	108.5	110.5	115.1	116.6	105.9	126.6	114.3	113.5	117.9	119.8	102.4	134.2	80.8	120.2	105.6	99.1	113.3	120.4	101.0	129.4	132.6	119.9	62.0
102.1	112.2	76.4	112.5	109.3	108.2	114.3	96.0	103.6	106.2	110.2	114.6	102.8	122.4	107.5	108.8	112.6	116.2	100.3	129.6	78.3	116.1	102.1	96.2	109.9	116.7	95.5	122.6	125.1	114.6	60.7
95.2	105.2	73.1	107.6	106.1	103.9	110.1	90.8	100.3	105.4	108.3	110.4	99.7	116.9	105.1	108.5	112.0	111.9	97.8	122.9	76.0	113.8	100.5	95.3	106.2	109.2	93.0	117.3	119.5	109.7	59.4
94.0	103.1	72.3	107.8	106.6	105.6	110.9	90.8	98.0	105.9	109.2	110.6	102.3	115.8	102.6	110.5	113.2	110.9	99.4	123.1	74.1	113.4	102.4	98.2	107.0	109.2	92.4	116.9	119.2	109.1	59.6
91.0	99.6	70.4	106.8	106.7	107.0	110.1	89.0	92.2	107.2	108.3	110.4	103.4	113.5	96.9	111.6	110.5	110.2	101.5	121.7	70.5	111.0	104.3	100.0	106.9	107.1	88.5	113.5	115.8	105.5	58.0
85.4	93.2	67.0	101.4	105.6	107.9	106.1	83.7	86.8	109.0	105.8	107.3	104.7	109.2	91.6	113.8	107.7	106.8	103.3	116.9	66.9	106.6	105.1	103.0	104.3	100.9	83.6	107.9	110.1	99.1	55.3
81.2	89.4	64.7	99.0	109.1	111.6	104.5	81.3	84.4	112.6	106.7	105.9	109.7	106.4	89.5	117.9	108.1	103.1	108.4	113.2	64.9	106.4	109.9	110.0	103.8	97.3	81.9	105.5	108.4	97.9	54.4
79.1	86.7	62.5	96.5	110.0	112.1	102.2	78.0	78.4	110.8	103.9	105.5	111.5	104.3	82.8	115.0	104.8	103.1	111.9	110.9	60.7	99.9	110.3	110.1	102.3	94.2	77.0	100.5	103.9	93.2	52.0
72.3	79.3	57.4	89.0	103.9	106.3	95.1	71.4	69.2	100.9	95.8	100.9	105.6	96.9	72.8	105.3	96.5	98.4	108.0	103.8	53.8	88.9	103.4	102.4	97.0	86.9	66.2	90.1	93.8	83.1	47.8
63.5	69.4	50.6	79.5	94.2	95.8	85.5	62.9	60.7	91.1	87.3	92.2	97.0	85.4	63.8	95.0	87.6	89.8	99.2	91.6	47.6	78.7	94.2	94.4	88.1	76.6	60.5	80.5	83.5	73.5	42.9
55.9	60.7	44.2	69.9	83.3	85.3	75.1	54.6	50.4	75.5	74.2	83.1	85.3	75.1	51.6	78.9	74.3	82.2	90.2	81.0	39.7	64.7	83.1	82.1	77.9	66.7	50.7	68.3	71.2	62.0	36.9
45.5	48.2	34.8	56.0	66.6	68.8	59.6	42.2	37.1	55.2	55.7	69.6	66.6	58.8	36.8	57.7	55.2	69.2	74.3	64.7	29.1	47.0	65.2	63.2	61.3	52.9	36.6	51.7	53.9	46.7	28.4
36.9	39.4	27.6	44.8	52.3	55.0	49.4	31.4	26.2	42.4	43.3	56.7	51.3	46.4	27.2	43.9	41.9	57.2	59.9	51.0	21.7	36.1	48.9	46.5	47.9	41.5	26.0	38.2	39.0	33.9	20.5
@set 58	16.3	12979	14.306	14.308	46	!power, #, MMD/ton, MMD/kgU																								
TIP2005	TIP2805	TIP3605	TIP1213	TIP2013	TIP2813	TIP3613	TIP4413	TIP0421	TIP1221	TIP2021	TIP2821	TIP3621	TIP4421	TIP0429	TIP1229	TIP2029	TIP2829	TIP3629	TIP4429	TIP0437	TIP1237	TIP2037	TIP2837	TIP3637	TIP4437	TIP1245	TIP2045	TIP2845	TIP3645	TIP4445
16.3	17.7	20.6	45.0	35.9	31.4	50.1	37.7	26.6	47.8	61.6	40.9	40.3	30.2	27.9	42.9	62.6	33.7	32.2	25.7	27.9	67.8	43.1	43.6	48.1	39.4	48.8	39.0	35.1	52.8	22.9
31.7	33.9	36.7	77.3	60.3	52.8	81.5	63.8	41.4	67.3	86.6	70.8	65.0	54.7	41.7	60.7	84.7	59.8	55.0	47.2	41.9	90.7	67.1	62.7	77.3	72.5	73.0	62.9	56.6	84.1	34.4
44.9	47.5	49.1	97.8	76.4	68.2	100.5	80.1	51.5	78.9	98.8	89.6	79.3	73.3	52.0	71.4	95.8	79.2	69.3	65.5	50.7	102.1	80.4	73.2	95.0	94.4	86.7	79.1	70.8	101.8	40.8
54.4	58.3	57.2	107.2	85.7	77.3	110.4	88.7	61.1	87.6	106.8	99.2	87.5	84.0	63.3	80.6	103.3	87.9	77.1	77.2	58.0	110.7	88.9	81.0	102.9	106.6	94.9	90.8	83.1	112.5	44.8
64.9	71.6	63.8	113.4	95.7	86.5	116.1	95.1	73.0	94.7	110.9	106.5	94.0	94.8	76.4	88.8	108.7	94.7	84.5	89.9	64.1	115.9	94.9	87.2	108.8	115.9	99.9	101.9	97.0	118.7	48.2
76.9	86.2	69.0	115.5	101.7	94.2	118.8	97.9	85.9	99.3	112.5	109.5	98.1	106.0	90.8	95.7	111.4	99.7	89.9	103.8	69.0	117.2	99.2	90.5	111.6	119.5	102.1	114.1	111.7	121.4	50.9
89.2	102.3	73.6	116.2	106.9	100.9	118.7	99.6	98.1	105.4	115.5	112.0	101.6	117.0	105.0	103.4	115.2	104.9	93.7	116.9	75.2	120.4	102.4	95.3	112.6	121.3	104.7	124.2	126.9	123.2	53.1
102.3	117.2	78.9	118.8	113.9	108.5	121.4	103.9	108.3	110.8	119.0	117.0	106.9	128.7	113.4	109.0	120.2	113.5	99.8	130.0	80.2	125.3	106.8	100.1	116.5	126.6	107.1	132.9	138.8	128.1	56.6

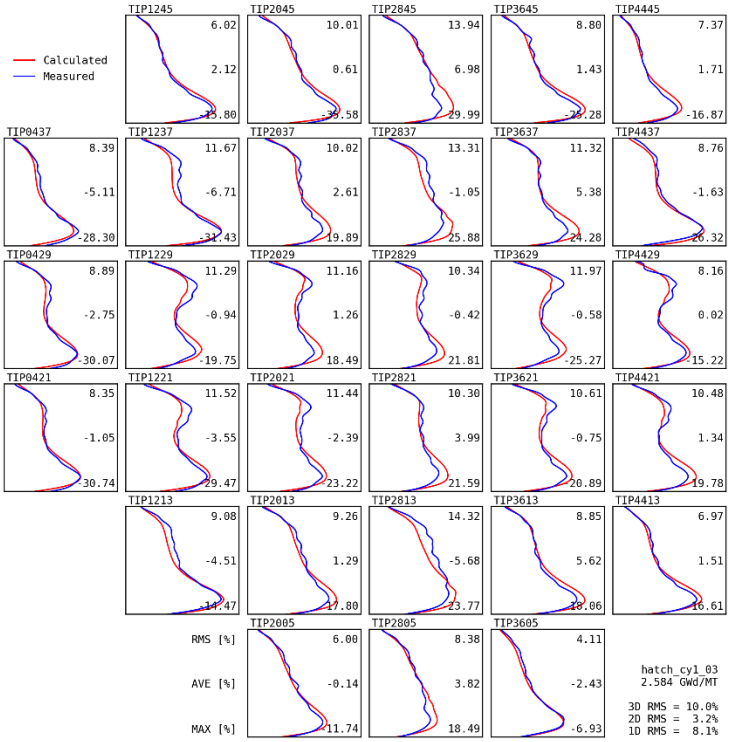
108.7	122.5	81.2	120.0	115.9	113.1	123.0	103.8	112.2	112.5	119.4	120.5	109.4	133.2	116.5	112.2	121.9	120.3	102.9	135.8	81.9	123.9	108.1	101.9	117.7	128.7	105.5	136.2	139.1	127.0	59.1
109.8	122.1	80.7	118.9	115.7	113.8	120.6	101.6	112.9	111.2	117.7	120.5	109.3	131.3	118.8	113.7	120.5	122.4	103.6	136.6	82.8	123.6	106.9	101.2	118.5	126.7	103.7	135.0	136.4	123.7	60.6
108.7	122.5	81.5	117.8	116.7	114.3	120.0	102.5	115.4	113.6	120.4	119.8	111.1	130.8	119.7	117.2	123.1	121.4	104.7	136.2	84.3	125.3	108.8	103.4	116.6	124.7	105.0	134.1	138.0	124.6	62.8
110.4	121.8	81.5	120.5	118.5	116.4	122.0	103.2	113.7	114.3	121.3	122.6	112.9	131.9	118.8	118.2	123.5	123.6	106.9	138.6	84.0	124.9	111.4	105.0	120.0	126.3	103.8	133.0	138.4	124.6	64.1
106.5	117.3	79.7	118.7	117.5	118.9	121.3	101.0	108.0	113.4	119.4	123.0	111.3	130.7	113.2	117.5	120.4	122.9	108.7	137.2	82.0	122.7	110.7	105.5	118.7	123.5	100.0	129.9	131.3	119.7	63.8
100.8	111.6	77.7	115.8	116.6	117.1	118.3	97.7	105.8	117.8	118.8	120.0	113.2	130.9	110.2	123.2	120.9	118.5	109.5	132.7	80.3	123.2	114.2	109.4	117.5	117.3	98.5	126.0	128.9	116.7	63.1
99.7	111.8	78.0	118.4	122.9	125.5	121.3	98.4	104.7	124.4	122.4	123.2	121.6	128.8	109.4	131.4	122.6	119.5	117.7	135.4	79.7	123.7	121.6	119.0	121.1	117.7	98.4	128.9	129.9	117.0	63.5
97.5	108.9	76.0	115.7	127.7	129.7	121.3	98.2	100.8	126.7	121.3	124.5	128.7	128.9	103.9	134.3	119.9	119.7	125.0	134.4	76.6	120.6	128.4	123.9	121.2	116.7	95.2	124.1	126.9	114.7	62.2
91.8	102.3	72.5	110.4	126.2	127.9	115.9	91.5	93.7	124.9	117.8	120.4	127.3	123.8	98.5	131.5	116.4	115.5	126.4	129.2	72.0	116.4	124.4	122.6	118.2	110.7	89.7	117.3	120.3	107.8	59.5
88.2	97.8	70.2	107.7	124.7	126.6	114.6	88.9	90.7	125.8	116.5	117.5	126.7	120.3	95.9	131.5	115.3	111.0	125.5	125.8	70.2	114.3	123.6	122.5	116.6	106.6	88.1	114.7	118.2	105.5	58.8
85.6	94.0	67.9	104.3	121.9	123.6	111.3	84.8	84.3	118.5	111.6	115.6	124.5	116.5	89.1	123.9	110.6	110.3	123.4	122.1	65.6	106.6	119.4	118.7	113.9	103.0	82.8	108.8	112.1	100.5	55.9
78.0	85.7	62.5	96.6	112.5	115.0	102.4	77.5	74.0	106.1	102.3	108.2	115.0	107.5	77.7	111.6	100.0	104.6	116.4	113.1	56.2	95.9	110.2	108.5	106.2	95.7	73.3	98.2	99.9	90.0	51.6
68.8	75.0	55.0	86.2	100.7	102.1	91.1	68.2	65.5	94.7	92.1	97.7	103.9	94.3	68.4	99.7	90.9	95.3	105.1	100.4	51.8	84.6	99.8	98.4	95.3	83.6	64.9	88.0	89.5	79.0	46.5
60.3	64.4	47.7	75.7	88.2	90.0	79.4	59.3	53.9	78.9	79.4	88.4	91.2	82.6	54.9	82.0	76.6	86.8	94.0	87.6	42.9	66.6	87.1	85.4	84.2	72.3	54.3	73.2	75.5	66.6	40.0
49.3	51.0	37.4	60.5	70.5	71.4	62.5	45.3	39.1	58.0	61.3	73.2	72.7	64.8	39.1	60.1	56.7	72.1	77.0	69.9	31.1	49.7	68.9	65.9	65.9	57.3	39.3	55.7	57.0	50.5	30.4
39.8	43.4	29.8	47.8	56.2	57.9	49.9	33.8	28.0	44.7	50.0	60.2	56.4	51.1	28.9	48.1	44.0	63.0	62.0	54.8	23.1	26.3	51.7	48.0	51.1	44.9	27.9	40.3	41.9	38.7	22.0

APPENDIX E. TIP COMPARISON

E.1 Hatch1 Cycle 1 TIP Comparison






Calculated
Measured
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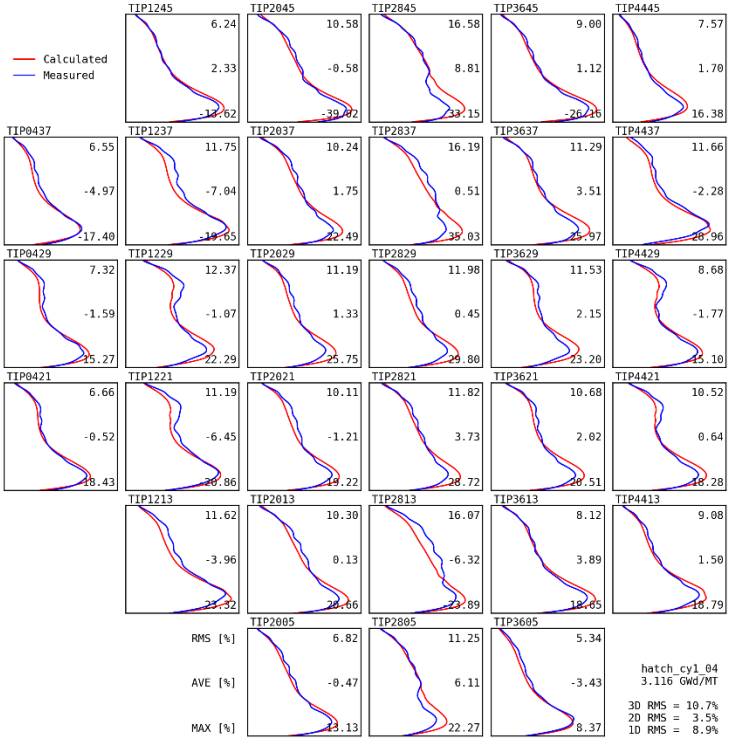
2.12
-15.80
TIP2045
10.01
0.61
-39.58
TIP2845
13.94
6.98
29.99
TIP3645
8.80
1.43
-26.28
TIP4445
7.37
1.71
-16.87
TIP0437
8.39
-5.11
-28.30
TIP1237
11.67
-6.71
-31.43
TIP2037
10.02
2.61
19.89
TIP2837
13.31
-1.05
25.88
TIP3637
11.32
5.38
-24.28
TIP4437
8.76
-1.63
26.32
TIP0429
8.89
-2.75
-30.07
TIP1229
11.29
-0.94
-19.75
TIP2029
11.16
1.26
18.49
TIP2829
10.34
-0.42
21.81
TIP3629
11.97
-0.58
-25.27
TIP4429
8.16
0.02
-15.22
TIP0421
8.35
-1.05
30.74
TIP1221
11.52
-3.55
29.47
TIP2021
11.44
-2.39
23.22
TIP2821
10.30
3.99
21.59
TIP3621
10.61
-0.75
-20.89
TIP4421
10.48
1.34
19.78
TIP1213
9.08
-4.51
-14.47
TIP2013
9.26
1.29
17.80
TIP2813
14.32
-5.68
23.77
TIP3613
8.85
5.62
18.06
TIP4413
6.97
1.51
16.61
RMS [%]
AVE [%]
MAX [%]
TIP2005
6.00
-0.14
11.74
TIP2805
8.38
3.82
18.49
TIP3605
4.11
-2.43
6.93
hatch_cy1_03
2.584 GWd/MT
3D RMS = 10.0%
2D RMS = 3.2%
1D RMS = 8.1%


Calculated
Measured
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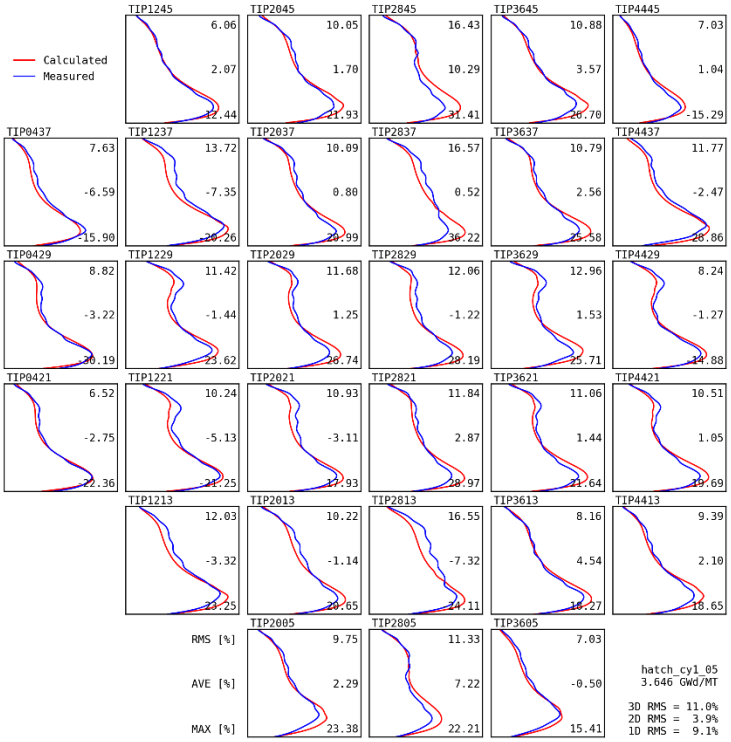
-13.62
TIP2045
10.58
-0.58
-39.02
TIP2845
16.58
8.81
33.15
TIP3645
9.00
1.12
-26.16
TIP4445
7.57
1.70
16.38
TIP0437
6.55
-4.97
-17.40
TIP1237
11.75
-7.04
-19.65
TIP2037
10.24
1.75
22.49
TIP2837
16.19
0.51
35.03
TIP3637
11.29
3.51
25.97
TIP4437
11.66
-2.28
28.96
TIP0429
7.32
-1.59
15.27
TIP1229
12.37
-1.07
22.29
TIP2029
11.19
1.33
25.75
TIP2829
11.98
0.45
29.80
TIP3629
11.53
2.15
23.20
TIP4429
8.68
-1.77
15.10
TIP0421
6.66
-0.52
18.43
TIP1221
11.19
-6.45
20.86
TIP2021
10.11
-1.21
19.22
TIP2821
11.82
3.73
28.72
TIP3621
10.68
2.02
20.51
TIP4421
10.52
0.64
18.28
TIP1213
11.62
-3.96
23.32
TIP2013
10.30
0.13
20.66
TIP2813
16.07
-6.32
23.89
TIP3613
8.12
3.89
18.65
TIP4413
9.08
1.50
16.79
RMS [%]
AVE [%]
MAX [%]
TIP2005
6.82
-0.47
13.13
TIP2805
11.25
6.11
22.27
TIP3605
5.34
-3.43
8.37
hatch_cy1_04
3.116 GWd/MT
3D RMS = 10.7%
2D RMS = 3.5%
1D RMS = 8.9%


Calculated
Measured
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2.07
-12.44
TIP2045
10.05
1.70
-21.93
TIP2845
16.43
10.29
-31.41
TIP3645
10.88
3.57
-20.70
TIP4445
7.03
1.04
-15.29
TIP0437
7.63
-6.59
-15.90
TIP1237
13.72
-7.35
-20.26
TIP2037
10.09
0.80
-20.99
TIP2837
16.57
0.52
-36.22
TIP3637
10.79
2.56
-25.58
TIP4437
11.77
-2.47
-28.86
TIP0429
8.82
-3.22
-30.19
TIP1229
11.42
-1.44
-23.62
TIP2029
11.68
1.25
-26.74
TIP2829
12.06
-1.22
-28.19
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1.53
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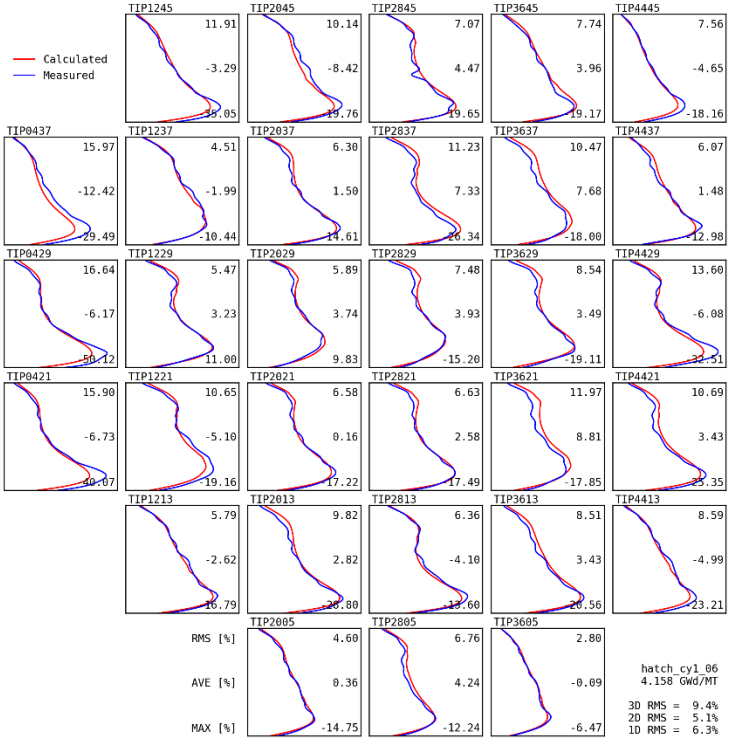
8.24
-1.27
-14.88
TIP0421
6.52
-2.75
-22.36
TIP1221
10.24
-5.13
-21.25
TIP2021
10.93
-3.11
-17.93
TIP2821
11.84
2.87
-28.97
TIP3621
11.06
1.44
-21.64
TIP4421
10.51
1.05
-19.69
TIP1213
12.03
-3.32
-23.25
TIP2013
10.22
-1.14
-20.65
TIP2813
16.55
-7.32
-34.11
TIP3613
8.16
4.54
-18.27
TIP4413
9.39
2.10
-18.65
RMS [%]
AVE [%]
MAX [%]
TIP2005
9.75
2.29
-23.38
TIP2805
11.33
7.22
-22.21
TIP3605
7.03
-0.50
-15.41
hatch_cy1_05
3.646 GWd/MT
3D RMS = 11.0%
2D RMS = 3.9%
1D RMS = 9.1%


Calculated
Measured
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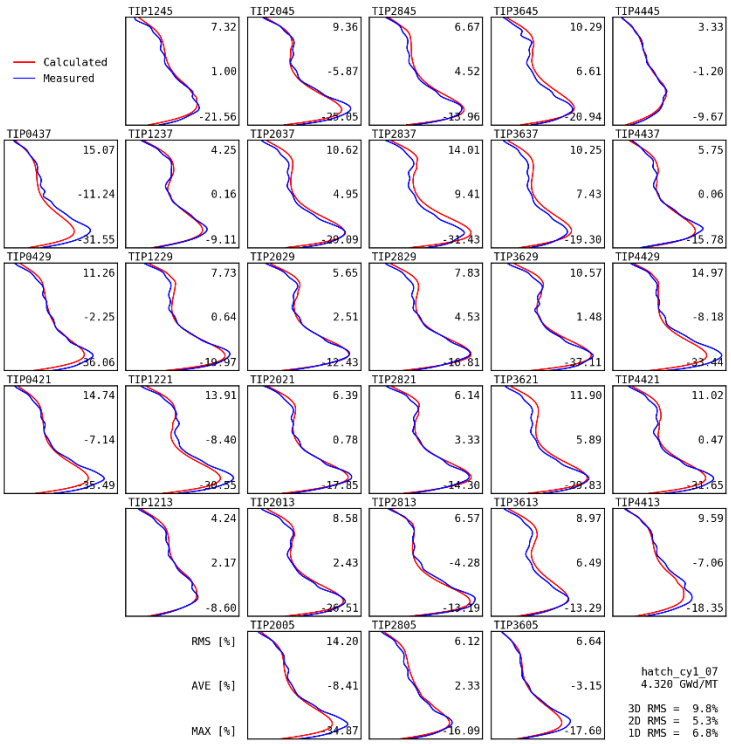
11.91
-3.29
-15.05
TIP2045
10.14
-8.42
-19.76
TIP2845
7.07
4.47
-19.65
TIP3645
7.74
3.96
-19.17
TIP4445
7.56
-4.65
-18.16
TIP0437
15.97
-12.42
-29.49
TIP1237
4.51
-1.99
-10.44
TIP2037
6.30
1.50
-14.61
TIP2837
11.23
7.33
-26.34
TIP3637
10.47
7.68
-18.00
TIP4437
6.07
1.48
-12.98
TIP0429
16.64
-6.17
-50.12
TIP1229
5.47
3.23
-11.00
TIP2029
5.89
3.74
-9.83
TIP2829
7.48
3.93
-15.20
TIP3629
8.54
3.49
-19.11
TIP4429
13.60
-6.08
-32.51
TIP0421
15.90
-6.73
-40.07
TIP1221
10.65
-5.10
-19.16
TIP2021
6.58
0.16
-17.22
TIP2821
6.63
2.58
-17.49
TIP3621
11.97
8.81
-17.85
TIP4421
10.69
3.43
-25.35
TIP1213
5.79
-2.62
-16.79
TIP2013
9.82
2.82
-20.80
TIP2813
6.36
-4.10
-13.60
TIP3613
8.51
3.43
-20.56
TIP4413
8.59
-4.99
-23.21
RMS [%]
AVE [%]
MAX [%]
TIP2005
4.60
0.36
-14.75
TIP2805
6.76
4.24
-12.24
TIP3605
2.80
-0.09
-6.47
hatch_cy1_06
4.158 GWd/MT
3D RMS = 9.4%
2D RMS = 5.1%
1D RMS = 6.3%


Calculated
Measured
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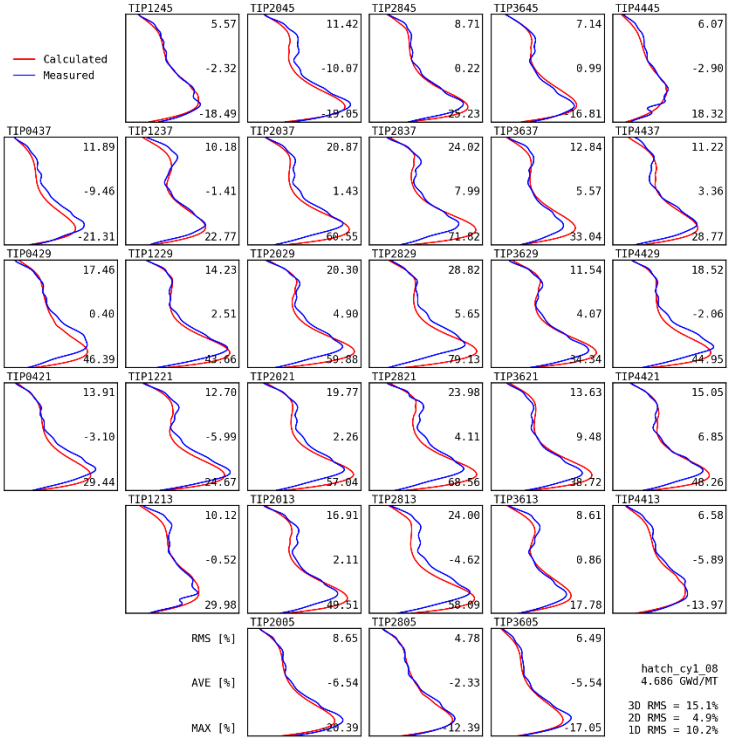
7.32
1.00
-21.56
TIP2045
9.36
-5.87
-28.05
TIP2845
6.67
4.52
-13.96
TIP3645
10.29
6.61
-20.94
TIP4445
3.33
-1.20
-9.67
TIP0437
15.07
-11.24
-31.55
TIP1237
4.25
0.16
-9.11
TIP2037
10.62
4.95
-20.09
TIP2837
14.01
9.41
-31.43
TIP3637
10.25
7.43
-19.30
TIP4437
5.75
0.06
-15.78
TIP0429
11.26
-2.25
-36.06
TIP1229
7.73
0.64
-19.97
TIP2029
5.65
2.51
-12.43
TIP2829
7.83
4.53
-10.81
TIP3629
10.57
1.48
-37.11
TIP4429
14.97
-8.18
-33.44
TIP0421
14.74
-7.14
-35.49
TIP1221
13.91
-8.40
-30.55
TIP2021
6.39
0.78
-17.05
TIP2821
6.14
3.33
-14.30
TIP3621
11.90
5.89
-20.03
TIP4421
11.02
0.47
-31.65
TIP1213
4.24
2.17
-8.60
TIP2013
8.58
2.43
-26.51
TIP2813
6.57
-4.28
-13.19
TIP3613
8.97
6.49
-13.29
TIP4413
9.59
-7.06
-18.35
RMS [%]
AVE [%]
MAX [%]
TIP2005
14.20
-8.41
-34.87
TIP2805
6.12
2.33
-16.09
TIP3605
6.64
-3.15
-17.60
hatch_cy1_07
4.320 GWd/MT
3D RMS = 9.8%
2D RMS = 5.3%
1D RMS = 6.8%


Calculated
Measured
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-18.49
TIP2045
11.42
-10.07
-19.05
TIP2845
8.71
0.22
-25.23
TIP3645
7.14
0.99
-16.81
TIP4445
6.07
-2.90
18.32
TIP0437
11.89
-9.46
-21.31
TIP1237
10.18
-1.41
22.77
TIP2037
20.87
1.43
60.55
TIP2837
24.02
7.99
71.82
TIP3637
12.84
5.57
33.04
TIP4437
11.22
3.36
28.77
TIP0429
17.46
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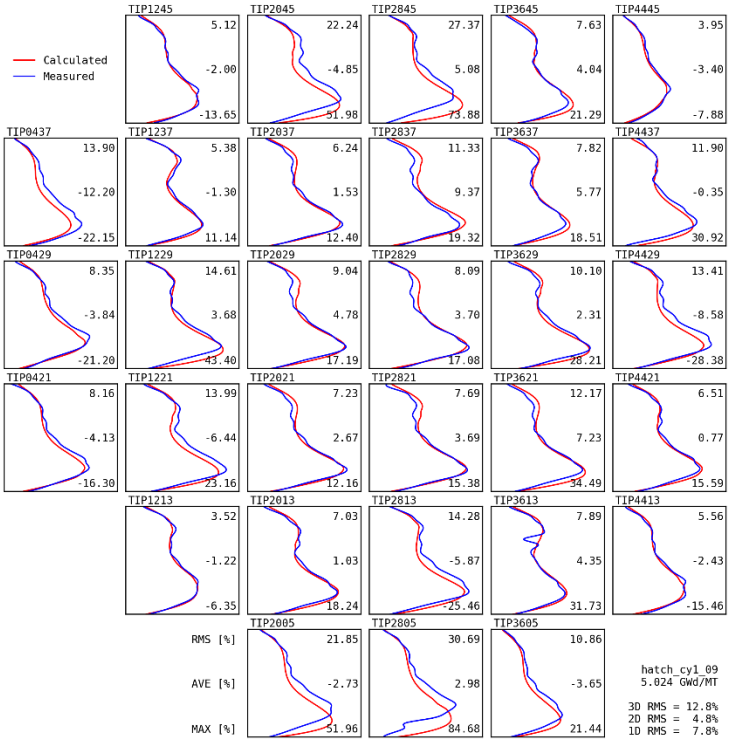
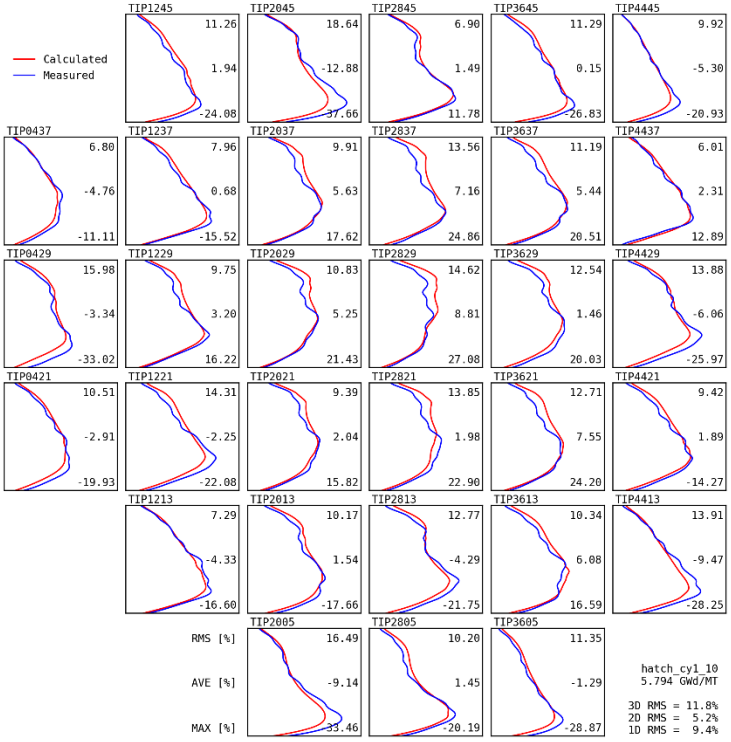
46.39
TIP1229
14.23
2.51
43.66
TIP2029
20.30
4.90
59.88
TIP2829
28.82
5.65
79.13
TIP3629
11.54
4.07
34.34
TIP4429
18.52
-2.06
44.95
TIP0421
13.91
-3.10
29.44
TIP1221
12.70
-5.99
24.67
TIP2021
19.77
2.26
57.04
TIP2821
23.98
4.11
68.56
TIP3621
13.63
9.48
38.72
TIP4421
15.05
6.85
48.26
TIP1213
10.12
-0.52
29.98
TIP2013
16.91
2.11
49.51
TIP2813
24.00
-4.62
58.09
TIP3613
8.61
0.86
17.78
TIP4413
6.58
-5.89
-13.97
RMS [%]
AVE [%]
MAX [%]
TIP2005
8.65
-6.54
-20.39
TIP2805
4.78
-2.33
-12.39
TIP3605
6.49
-5.54
-17.05
hatch_cy1_08
4.686 GWd/MT
3D RMS = 15.1%
2D RMS = 4.9%
1D RMS = 10.2%


Calculated
Measured
TIP1245
5.12
-2.00
-13.65
TIP2045
22.24
-4.85
51.98
TIP2845
27.37
5.08
73.88
TIP3645
7.63
4.04
21.29
TIP4445
3.95
-3.40
-7.88
TIP0437
13.90
-12.20
-22.15
TIP1237
5.38
-1.30
11.14
TIP2037
6.24
1.53
12.40
TIP2837
11.33
9.37
19.32
TIP3637
7.82
5.77
18.51
TIP4437
11.90
-0.35
30.92
TIP0429
8.35
-3.84
-21.20
TIP1229
14.61
3.68
43.40
TIP2029
9.04
4.78
17.19
TIP2829
8.09
3.70
17.08
TIP3629
10.10
2.31
28.21
TIP4429
13.41
-8.58
-28.38
TIP0421
8.16
-4.13
-16.30
TIP1221
13.99
-6.44
23.16
TIP2021
7.23
2.67
12.16
TIP2821
7.69
3.69
15.38
TIP3621
12.17
7.23
34.49
TIP4421
6.51
0.77
15.59
TIP1213
3.52
-1.22
-6.35
TIP2013
7.03
1.03
18.24
TIP2813
14.28
-5.87
-25.46
TIP3613
7.89
4.35
31.73
TIP4413
5.56
-2.43
-15.46
RMS [%]
AVE [%]
MAX [%]
TIP2005
21.85
-2.73
51.96
TIP2805
30.69
2.98
84.68
TIP3605
10.86
-3.65
21.44
hatch_cy1_09
5.024 GWd/MT
3D RMS = 12.8%
2D RMS = 4.8%
1D RMS = 7.8%


Calculated
Measured
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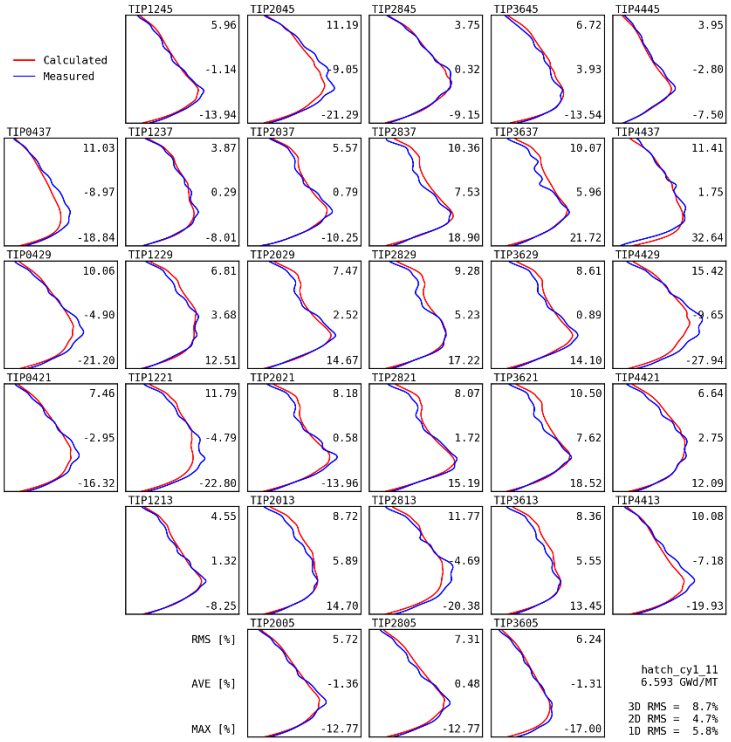
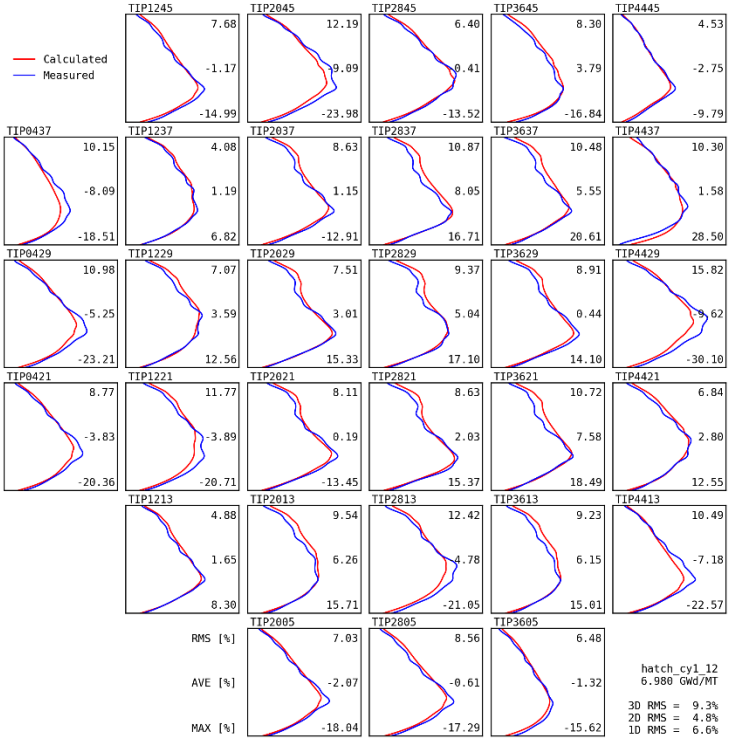
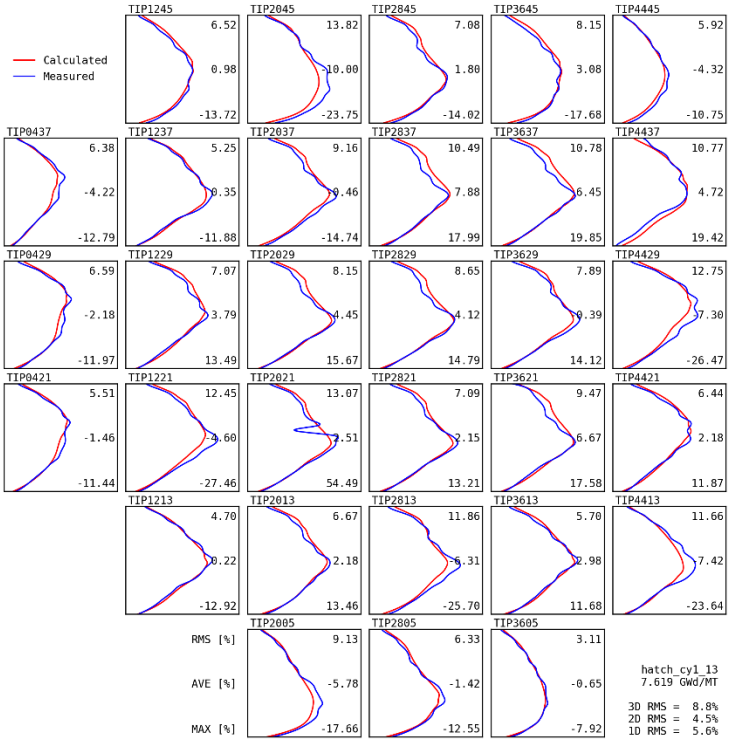
11.26
1.94
-24.08
TIP2045
18.64
-12.88
37.66
TIP2845
6.90
1.49
11.78
TIP3645
11.29
0.15
-26.83
TIP4445
9.92
-5.30
-20.93
TIP0437
6.80
-4.76
-11.11
TIP1237
7.96
0.68
-15.52
TIP2037
9.91
5.63
17.62
TIP2837
13.56
7.16
24.86
TIP3637
11.19
5.44
20.51
TIP4437
6.01
2.31
12.89
TIP0429
15.98
-3.34
-33.02
TIP1229
9.75
3.20
16.22
TIP2029
10.83
5.25
21.43
TIP2829
14.62
8.81
27.08
TIP3629
12.54
1.46
20.03
TIP4429
13.88
-6.06
-25.97
TIP0421
10.51
-2.91
-19.93
TIP1221
14.31
-2.25
-22.08
TIP2021
9.39
2.04
15.82
TIP2821
13.85
1.98
22.90
TIP3621
12.71
7.55
24.20
TIP4421
9.42
1.89
-14.27
TIP1213
7.29
-4.33
-16.60
TIP2013
10.17
1.54
-17.66
TIP2813
12.77
-4.29
-21.75
TIP3613
10.34
6.08
16.59
TIP4413
13.91
-9.47
-28.25
RMS [%]
AVE [%]
MAX [%]
TIP2005
16.49
-9.14
33.46
TIP2805
10.20
1.45
-20.19
TIP3605
11.35
-1.29
-28.87
hatch_cy1_10
5.794 GWd/MT
3D RMS = 11.8%
2D RMS = 5.2%
1D RMS = 9.4%


Calculated
Measured
TIP1245 5.96 -1.14 -13.94
TIP2045 11.19 9.05 -21.29
TIP2845 3.75 0.32 -9.15
TIP3645 6.72 3.93 -13.54
TIP4445 3.95 -2.80 -7.50
TIP0437 11.03 -8.97 -18.84
TIP1237 3.87 0.29 -8.01
TIP2037 5.57 0.79 -10.25
TIP2837 10.36 7.53 18.90
TIP3637 10.07 5.96 21.72
TIP4437 11.41 1.75 32.64
TIP0429 10.06 -4.90 -21.20
TIP1229 6.81 3.68 12.51
TIP2029 7.47 2.52 14.67
TIP2829 9.28 5.23 17.22
TIP3629 8.61 0.89 14.10
TIP4429 15.42 -9.65 -27.94
TIP0421 7.46 -2.95 -16.32
TIP1221 11.79 -4.79 -22.80
TIP2021 8.18 0.58 -13.96
TIP2821 8.07 1.72 15.19
TIP3621 10.50 7.62 18.52
TIP4421 6.64 2.75 12.09
TIP1213 4.55 1.32 -8.25
TIP2013 8.72 5.89 14.70
TIP2813 11.77 -4.69 -20.38
TIP3613 8.36 5.55 13.45
TIP4413 10.08 -7.18 -19.93
RMS [%]
AVE [%]
MAX [%]
TIP2005 5.72 -1.36 -12.77
TIP2805 7.31 0.48 -12.77
TIP3605 6.24 -1.31 -17.00
hatch_cy1_11
6.593 GWd/MT
3D RMS = 8.7%
2D RMS = 4.7%
1D RMS = 5.8%


Calculated
Measured
TIP1245 7.68 -1.17 -14.99
TIP2045 12.19 9.09 -23.98
TIP2845 6.40 0.41 -13.52
TIP3645 8.30 3.79 -16.84
TIP4445 4.53 -2.75 -9.79
TIP0437 10.15 -8.09 -18.51
TIP1237 4.08 1.19 6.82
TIP2037 8.63 1.15 -12.91
TIP2837 10.87 8.05 16.71
TIP3637 10.48 5.55 20.61
TIP4437 10.30 1.58 28.50
TIP0429 10.98 -5.25 -23.21
TIP1229 7.07 3.59 12.56
TIP2029 7.51 3.01 15.33
TIP2829 9.37 5.04 17.10
TIP3629 8.91 0.44 14.10
TIP4429 15.82 -9.62 -30.10
TIP0421 8.77 -3.83 -20.36
TIP1221 11.77 -3.89 -20.71
TIP2021 8.11 0.19 -13.45
TIP2821 8.63 2.03 15.37
TIP3621 10.72 7.58 18.49
TIP4421 6.84 2.80 12.55
TIP1213 4.88 1.65 8.30
TIP2013 9.54 6.26 15.71
TIP2813 12.42 -4.78 -21.05
TIP3613 9.23 6.15 15.01
TIP4413 10.49 -7.18 -22.57
RMS [%]
AVE [%]
MAX [%]
TIP2005 7.03 -2.07 -18.04
TIP2805 8.56 -0.61 -17.29
TIP3605 6.48 -1.32 -15.62
hatch_cy1_12
6.980 GWd/MT
3D RMS = 9.3%
2D RMS = 4.8%
1D RMS = 6.6%


Calculated
Measured
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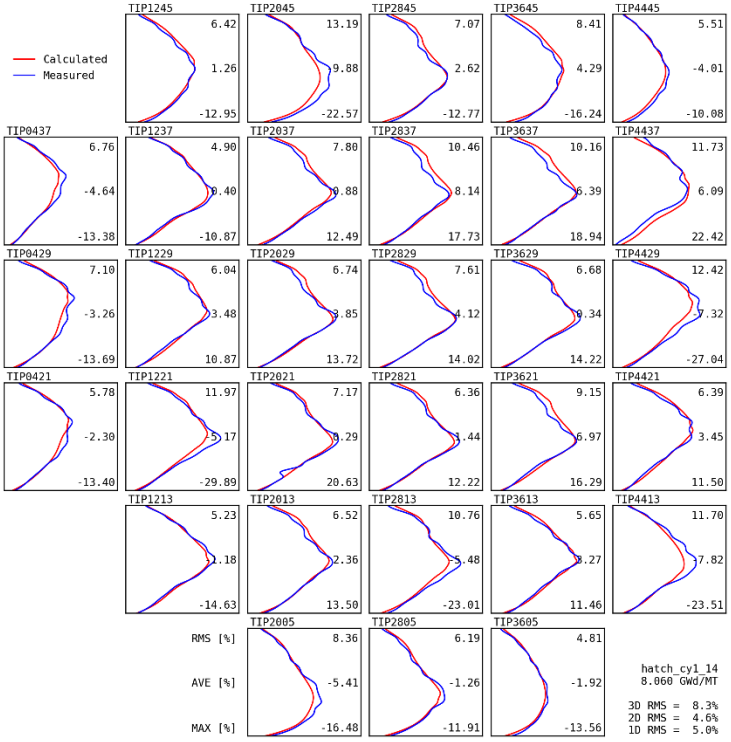
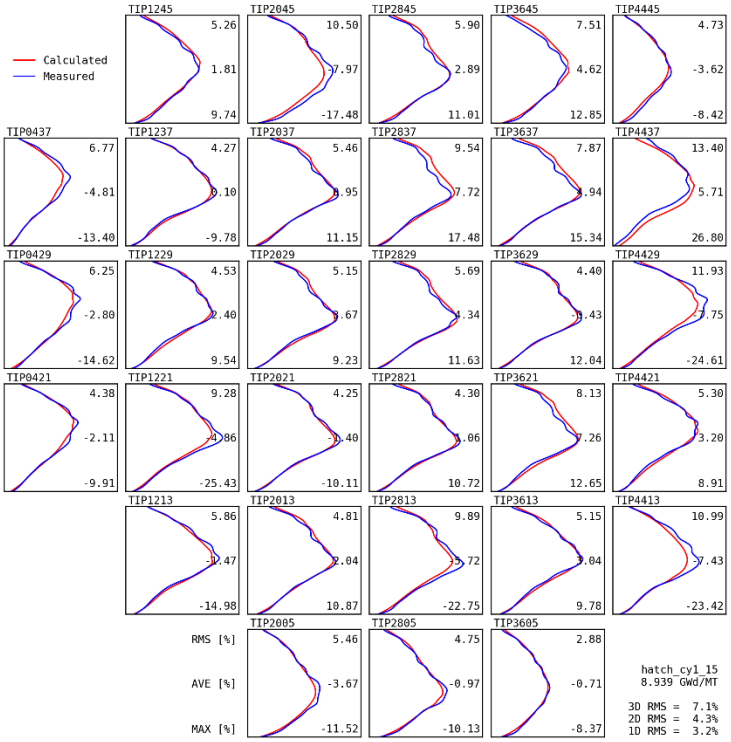
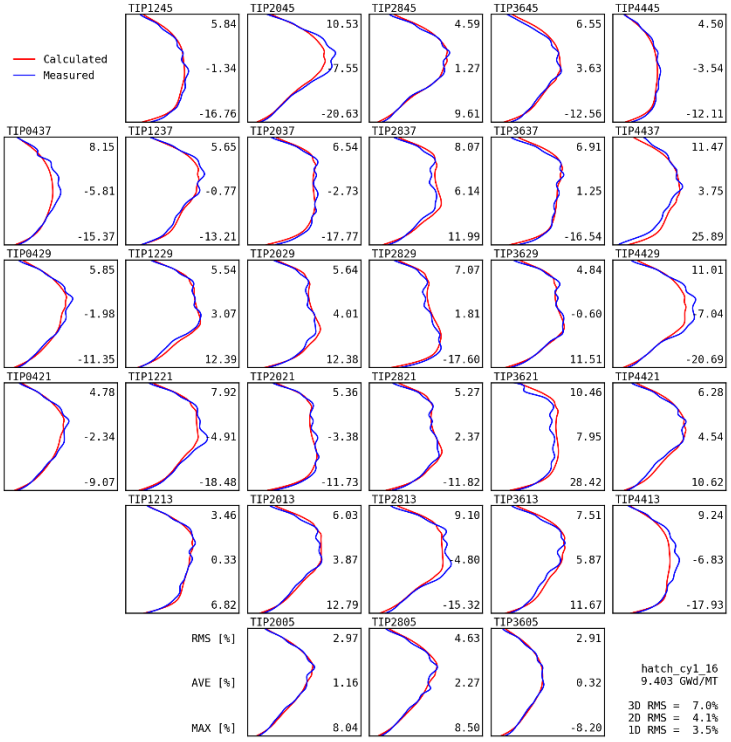
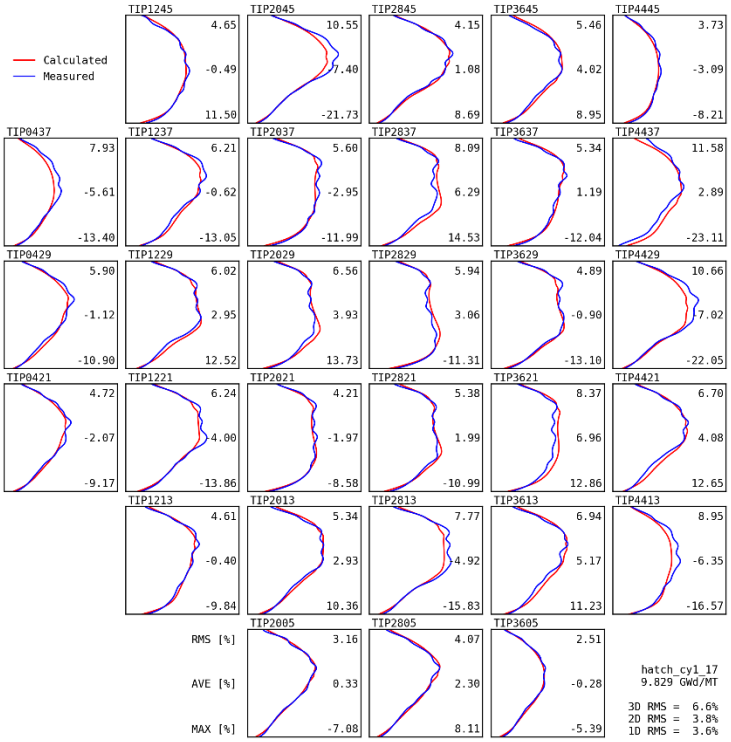
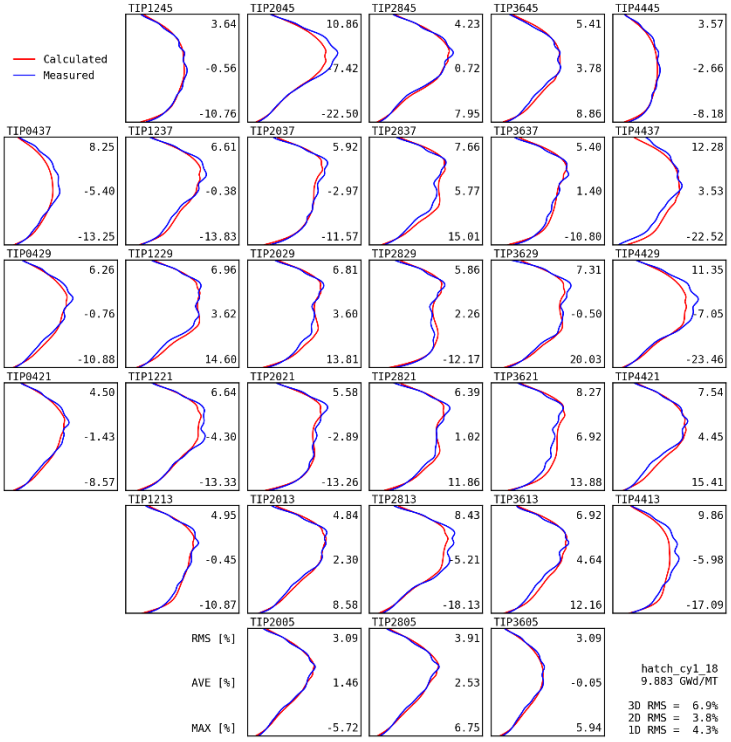
6.52
0.98
-13.72
TIP2045
13.82
-10.00
-23.75
TIP2845
7.08
1.80
-14.02
TIP3645
8.15
3.08
-17.68
TIP4445
5.92
-4.32
-10.75
TIP0437
6.38
-4.22
-12.79
TIP1237
5.25
0.35
-11.88
TIP2037
9.16
-0.46
-14.74
TIP2837
10.49
7.88
17.99
TIP3637
10.78
6.45
19.85
TIP4437
10.77
4.72
19.42
TIP0429
6.59
-2.18
-11.97
TIP1229
7.07
3.79
13.49
TIP2029
8.15
4.45
15.67
TIP2829
8.65
4.12
14.79
TIP3629
7.89
0.39
14.12
TIP4429
12.75
7.30
-26.47
TIP0421
5.51
-1.46
-11.44
TIP1221
12.45
4.60
-27.46
TIP2021
13.07
2.51
54.49
TIP2821
7.09
2.15
13.21
TIP3621
9.47
6.67
17.58
TIP4421
6.44
2.18
11.87
TIP1213
4.70
0.22
-12.92
TIP2013
6.67
2.18
13.46
TIP2813
11.86
-5.31
-25.70
TIP3613
5.70
2.98
11.68
TIP4413
11.66
7.42
-23.64
RMS [%]
AVE [%]
MAX [%]
TIP2005
9.13
-5.78
-17.66
TIP2805
6.33
-1.42
-12.55
TIP3605
3.11
-0.65
-7.92
hatch_cy1_13
7.619 GWd/MT
3D RMS = 8.8%
2D RMS = 4.5%
1D RMS = 5.6%

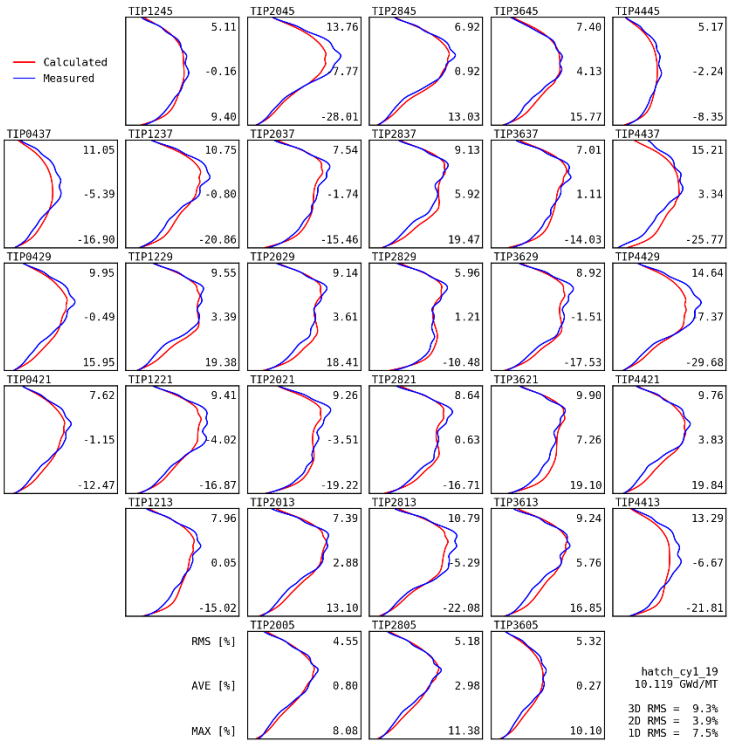

Calculated
Measured
TIP1245
6.42
1.26
-12.95
TIP2045
13.19
-9.88
-22.57
TIP2845
7.07
2.62
-12.77
TIP3645
8.41
4.29
-16.24
TIP4445
5.51
-4.01
-10.08
TIP0437
6.76
-4.64
-13.38
TIP1237
4.90
0.40
-10.87
TIP2037
7.80
-0.88
12.49
TIP2837
10.46
8.14
17.73
TIP3637
10.16
6.39
18.94
TIP4437
11.73
6.09
22.42
TIP0429
7.10
-3.26
-13.69
TIP1229
6.04
3.48
10.87
TIP2029
6.74
3.85
13.72
TIP2829
7.61
4.12
14.02
TIP3629
6.68
0.34
14.22
TIP4429
12.42
7.32
-27.04
TIP0421
5.78
-2.30
-13.40
TIP1221
11.97
5.17
-29.89
TIP2021
7.17
3.29
20.63
TIP2821
6.36
1.44
12.22
TIP3621
9.15
6.97
16.29
TIP4421
6.39
3.45
11.50
TIP1213
5.23
1.18
-14.63
TIP2013
6.52
2.36
13.50
TIP2813
10.76
-5.48
-23.01
TIP3613
5.65
3.27
11.46
TIP4413
11.70
7.82
-23.51
RMS [%]
AVE [%]
MAX [%]
TIP2005
8.36
-5.41
-16.48
TIP2805
6.19
-1.26
-11.91
TIP3605
4.81
-1.92
-13.56
hatch_cy1_14
8.060 GWd/MT
3D RMS = 8.3%
2D RMS = 4.6%
1D RMS = 5.0%

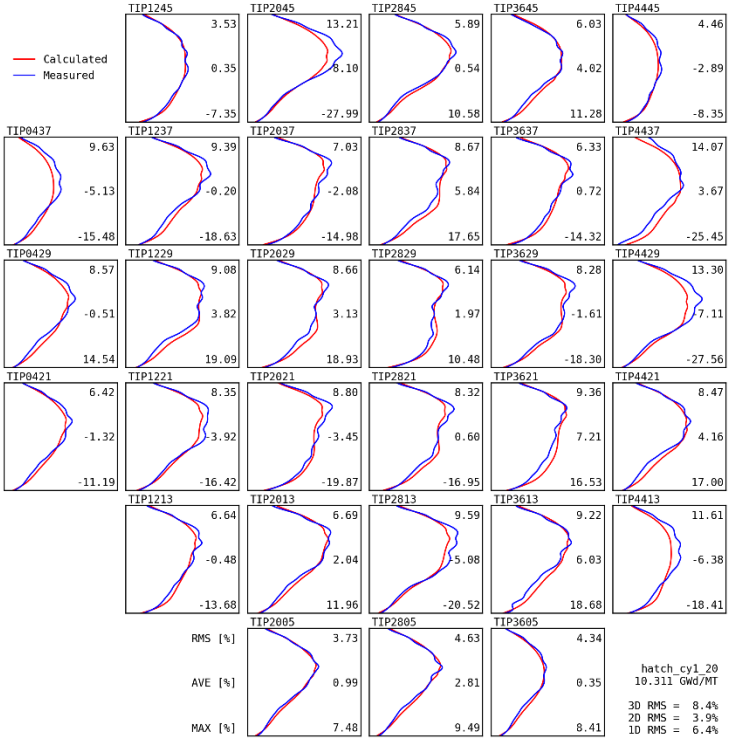

Calculated
Measured
TIP1245
5.26
1.81
9.74
TIP2045
10.50
-7.97
-17.48
TIP2845
5.90
2.89
11.01
TIP3645
7.51
4.62
12.85
TIP4445
4.73
-3.62
-8.42
TIP0437
6.77
-4.81
-13.40
TIP1237
4.27
0.10
-9.78
TIP2037
5.46
0.95
11.15
TIP2837
9.54
7.72
17.48
TIP3637
7.87
4.94
15.34
TIP4437
13.40
5.71
26.80
TIP0429
6.25
-2.80
-14.62
TIP1229
4.53
2.40
9.54
TIP2029
5.15
3.67
9.23
TIP2829
5.69
4.34
11.63
TIP3629
4.40
0.43
12.04
TIP4429
11.93
7.75
-24.61
TIP0421
4.38
-2.11
-9.91
TIP1221
9.28
4.86
-25.43
TIP2021
4.25
-1.40
-10.11
TIP2821
4.30
1.06
10.72
TIP3621
8.13
7.26
12.65
TIP4421
5.30
3.20
8.91
TIP1213
5.86
0.47
-14.98
TIP2013
4.81
2.04
10.87
TIP2813
9.89
5.72
-22.75
TIP3613
5.15
3.04
9.78
TIP4413
10.99
7.43
-23.42
RMS [%]
AVE [%]
MAX [%]
TIP2005
5.46
-3.67
-11.52
TIP2805
4.75
-0.97
-10.13
TIP3605
2.88
-0.71
-8.37
hatch_cy1_15
8.939 GWd/MT
3D RMS = 7.1%
2D RMS = 4.3%
1D RMS = 3.2%


Calculated
Measured
TIP1245
5.84
-1.34
-16.76
TIP2045
10.53
7.55
-20.63
TIP2845
4.59
1.27
9.61
TIP3645
6.55
3.63
-12.56
TIP4445
4.50
-3.54
-12.11
TIP0437
8.15
-5.81
-15.37
TIP1237
5.65
-0.77
-13.21
TIP2037
6.54
-2.73
-17.77
TIP2837
8.07
6.14
11.99
TIP3637
6.91
1.25
-16.54
TIP4437
11.47
3.75
25.89
TIP0429
5.85
-1.98
-11.35
TIP1229
5.54
3.07
12.39
TIP2029
5.64
4.01
12.38
TIP2829
7.07
1.81
-17.60
TIP3629
4.84
-0.60
11.51
TIP4429
11.01
7.04
-20.69
TIP0421
4.78
-2.34
-9.07
TIP1221
7.92
4.91
-18.48
TIP2021
5.36
-3.38
-11.73
TIP2821
5.27
2.37
-11.82
TIP3621
10.46
7.95
28.42
TIP4421
6.28
4.54
10.62
TIP1213
3.46
0.33
6.82
TIP2013
6.03
3.87
12.79
TIP2813
9.10
4.80
-15.32
TIP3613
7.51
5.87
11.67
TIP4413
9.24
6.83
-17.93
RMS [%]
AVE [%]
MAX [%]
TIP2005
2.97
1.16
8.04
TIP2805
4.63
2.27
8.50
TIP3605
2.91
0.32
-8.20
hatch_cy1_16
9.403 GWd/MT
3D RMS = 7.0%
2D RMS = 4.1%
1D RMS = 3.5%

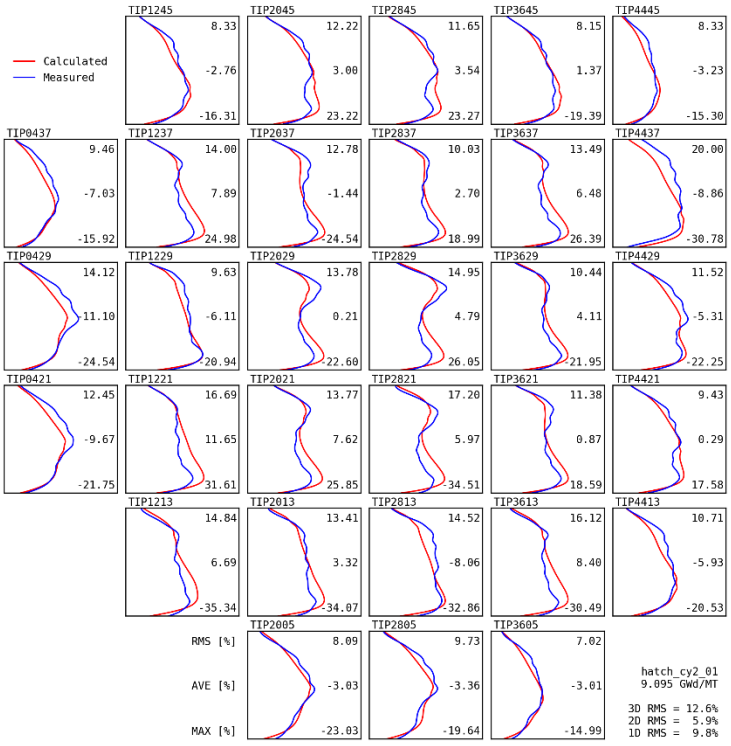

Calculated
Measured
TIP1245
4.65
-0.49
11.50
TIP2045
10.55
7.40
-21.73
TIP2845
4.15
1.08
8.69
TIP3645
5.46
4.02
8.95
TIP4445
3.73
-3.09
-8.21
TIP0437
7.93
-5.61
-13.40
TIP1237
6.21
-0.62
-13.05
TIP2037
5.60
-2.95
-11.99
TIP2837
8.09
6.29
14.53
TIP3637
5.34
1.19
-12.04
TIP4437
11.58
2.89
-23.11
TIP0429
5.90
-1.12
-10.90
TIP1229
6.02
2.95
12.52
TIP2029
6.56
3.93
13.73
TIP2829
5.94
3.06
-11.31
TIP3629
4.89
-0.90
-13.10
TIP4429
10.66
7.02
-22.05
TIP0421
4.72
-2.07
-9.17
TIP1221
6.24
4.00
-13.86
TIP2021
4.21
-1.97
-8.58
TIP2821
5.38
1.99
-10.99
TIP3621
8.37
6.96
12.86
TIP4421
6.70
4.08
12.65
TIP1213
4.61
-0.40
-9.84
TIP2013
5.34
2.93
10.36
TIP2813
7.77
4.92
-15.83
TIP3613
6.94
5.17
11.23
TIP4413
8.95
-6.35
-16.57
RMS [%]
AVE [%]
MAX [%]
TIP2005
3.16
0.33
-7.08
TIP2805
4.07
2.30
8.11
TIP3605
2.51
-0.28
-5.39
hatch_cy1_17
9.829 GWd/MT
3D RMS = 6.6%
2D RMS = 3.8%
1D RMS = 3.6%

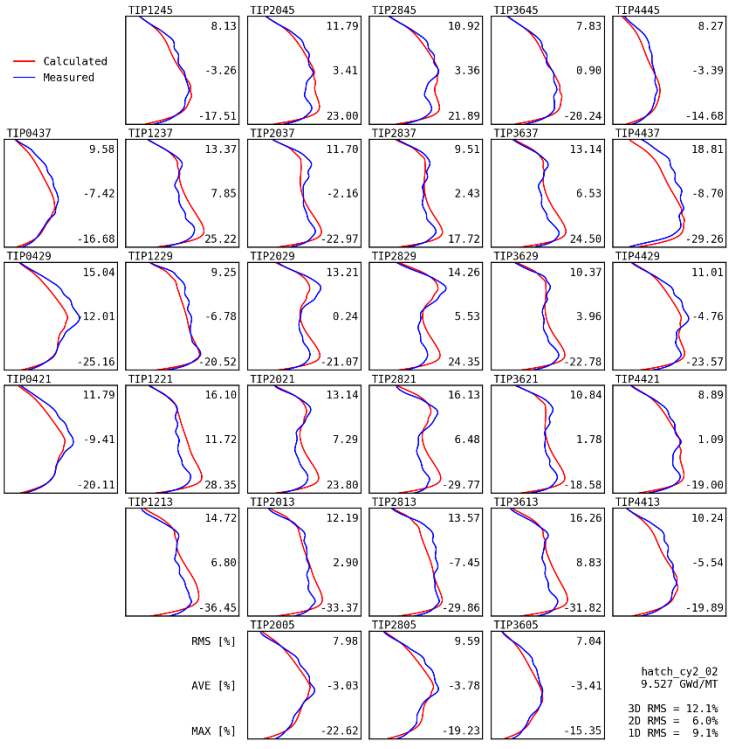

Calculated
Measured
TIP1245
3.64
-0.56
-10.76
TIP2045
10.86
7.42
-22.50
TIP2845
4.23
0.72
7.95
TIP3645
5.41
3.78
8.86
TIP4445
3.57
-2.66
-8.18
TIP0437
8.25
-5.40
-13.25
TIP1237
6.61
-0.38
-13.83
TIP2037
5.92
-2.97
-11.57
TIP2837
7.66
5.77
15.01
TIP3637
5.40
1.40
-10.80
TIP4437
12.28
3.53
-22.52
TIP0429
6.26
-0.76
-10.88
TIP1229
6.96
3.62
14.60
TIP2029
6.81
3.60
13.81
TIP2829
5.86
2.26
-12.17
TIP3629
7.31
-0.50
20.03
TIP4429
11.35
7.05
-23.46
TIP0421
4.50
-1.43
-8.57
TIP1221
6.64
4.30
-13.33
TIP2021
5.58
-2.89
-13.26
TIP2821
6.39
1.02
11.86
TIP3621
8.27
6.92
13.88
TIP4421
7.54
4.45
15.41
TIP1213
4.95
-0.45
-10.87
TIP2013
4.84
2.30
8.58
TIP2813
8.43
5.21
-18.13
TIP3613
6.92
4.64
12.16
TIP4413
9.86
-5.98
-17.09
RMS [%]
AVE [%]
MAX [%]
TIP2005
3.09
1.46
-5.72
TIP2805
3.91
2.53
6.75
TIP3605
3.09
-0.05
5.94
hatch_cy1_18
9.883 GWd/MT
3D RMS = 6.9%
2D RMS = 3.8%
1D RMS = 4.3%

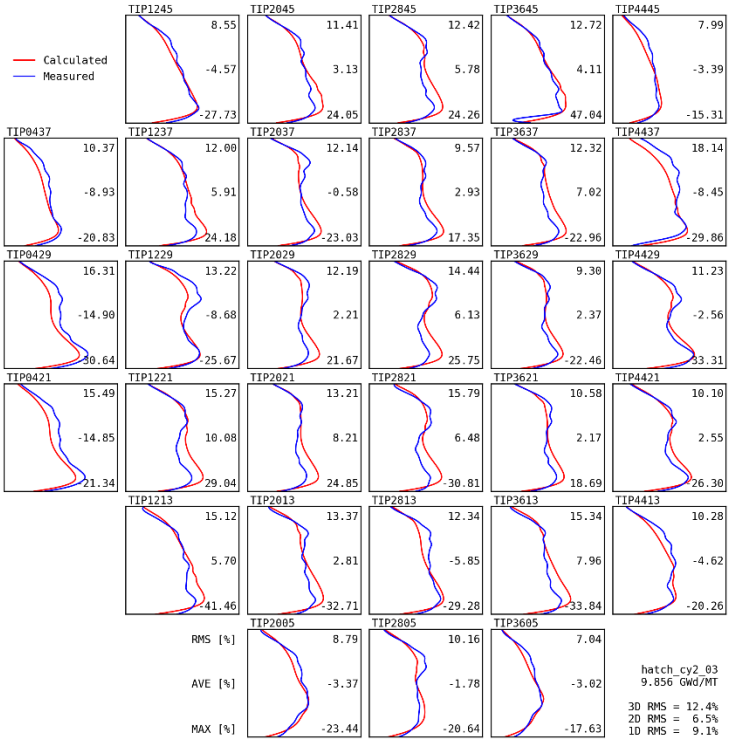

Calculated
Measured
TIP1245
5.11
-0.16
9.40
TIP2045
13.76
7.77
-28.01
TIP2845
6.92
0.92
13.03
TIP3645
7.40
4.13
15.77
TIP4445
5.17
-2.24
-8.35
TIP0437
11.05
-5.39
-16.90
TIP1237
10.75
-0.80
-20.86
TIP2037
7.54
-1.74
-15.46
TIP2837
9.13
5.92
19.47
TIP3637
7.01
1.11
-14.03
TIP4437
15.21
3.34
-25.77
TIP0429
9.95
-0.49
15.95
TIP1229
9.55
3.39
19.38
TIP2029
9.14
3.61
18.41
TIP2829
5.96
1.21
-10.48
TIP3629
8.92
-1.51
-17.53
TIP4429
14.64
7.37
-29.68
TIP0421
7.62
-1.15
-12.47
TIP1221
9.41
-4.02
-16.87
TIP2021
9.26
-3.51
-19.22
TIP2821
8.64
0.63
-16.71
TIP3621
9.90
7.26
19.10
TIP4421
9.76
3.83
19.84
TIP1213
7.96
0.05
-15.02
TIP2013
7.39
2.88
13.10
TIP2813
10.79
-5.29
-22.08
TIP3613
9.24
5.76
16.85
TIP4413
13.29
-6.67
-21.81
RMS [%]
AVE [%]
MAX [%]
TIP2005
4.55
0.80
8.08
TIP2805
5.18
2.98
11.38
TIP3605
5.32
0.27
10.10
hatch_cy1_19
10.119 GWd/MT
3D RMS = 9.3%
2D RMS = 3.9%
1D RMS = 7.5%

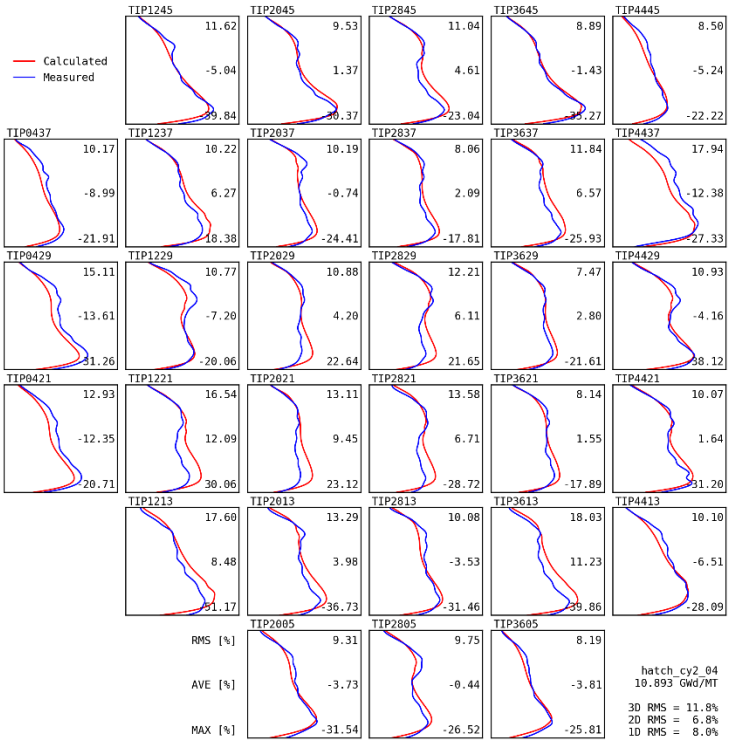

Calculated
Measured
TIP1245
3.53
0.35
-7.35
TIP2045
13.21
8.10
-27.99
TIP2845
5.89
0.54
10.58
TIP3645
6.03
4.02
11.28
TIP4445
4.46
-2.89
-8.35
TIP0437
9.63
-5.13
-15.48
TIP1237
9.39
-0.20
-18.63
TIP2037
7.03
-2.08
-14.98
TIP2837
8.67
5.84
17.65
TIP3637
6.33
0.72
-14.32
TIP4437
14.07
3.67
-25.45
TIP0429
8.57
-0.51
14.54
TIP1229
9.08
3.82
19.09
TIP2029
8.66
3.13
18.93
TIP2829
6.14
1.97
10.48
TIP3629
8.28
-1.61
-18.30
TIP4429
13.30
7.11
-27.56
TIP0421
6.42
-1.32
-11.19
TIP1221
8.35
-3.92
-16.42
TIP2021
8.80
-3.45
-19.87
TIP2821
8.32
0.60
-16.95
TIP3621
9.36
7.21
16.53
TIP4421
8.47
4.16
17.00
TIP1213
6.64
-0.48
-13.68
TIP2013
6.69
2.04
11.96
TIP2813
9.59
-5.08
-20.52
TIP3613
9.22
6.03
18.68
TIP4413
11.61
-6.38
-18.41
RMS [%]
AVE [%]
MAX [%]
TIP2005
3.73
0.99
7.48
TIP2805
4.63
2.81
9.49
TIP3605
4.34
0.35
8.41
hatch_cy1_20
10.311 GWd/MT
3D RMS = 8.4%
2D RMS = 3.9%
1D RMS = 6.4%

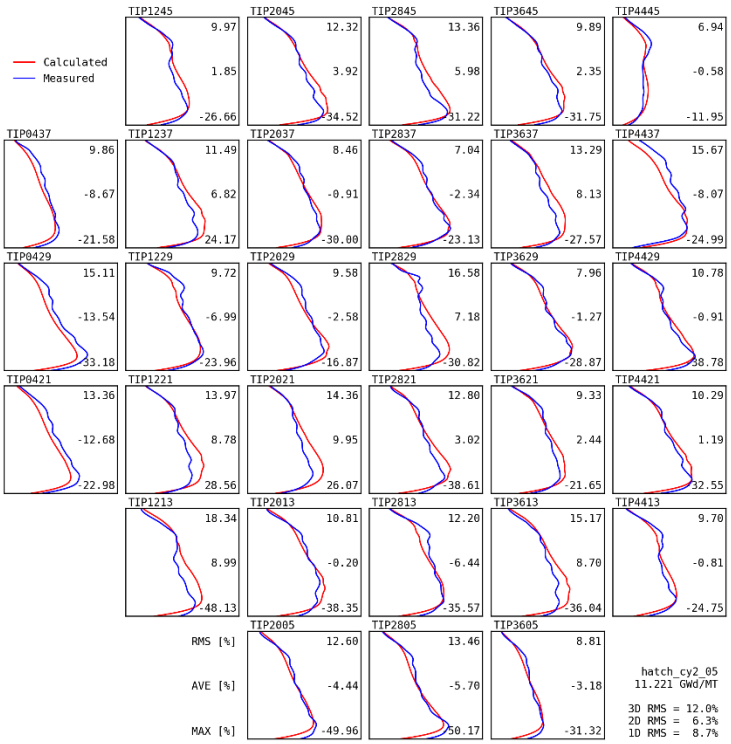
E.2 Hatch1 Cycle 2 TIP Comparison

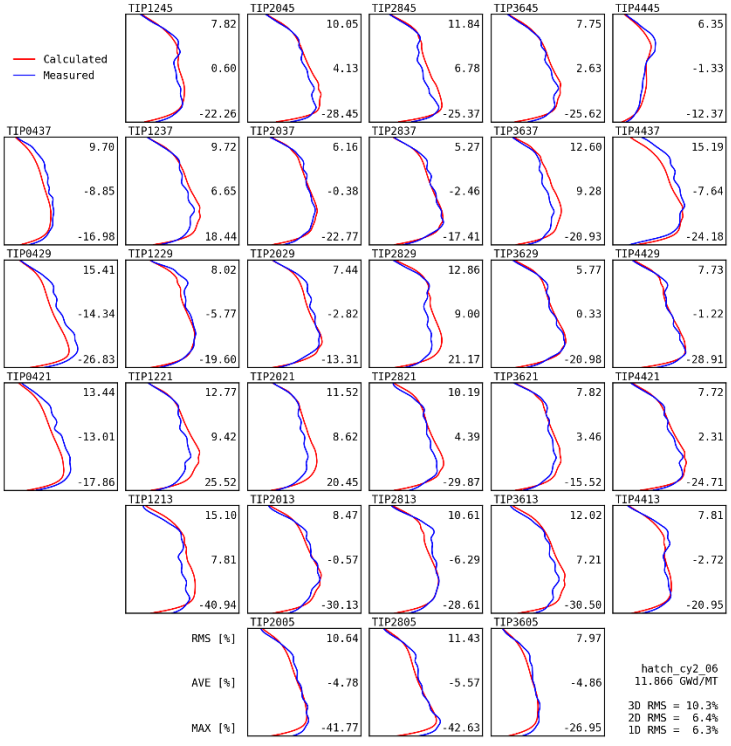


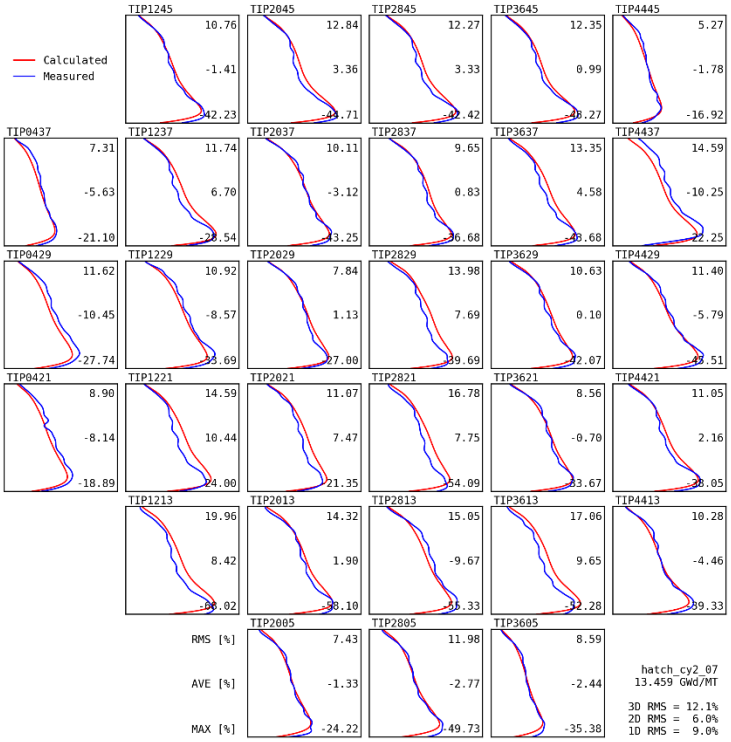



Calculated
Measured
TIP1245 8.55 -4.57 -27.73
TIP2045 11.41 3.13 24.05
TIP2845 12.42 5.78 24.26
TIP3645 12.72 4.11 47.04
TIP4445 7.99 -3.39 -15.31
TIP0437 10.37 -8.93 -20.83
TIP1237 12.00 5.91 24.18
TIP2037 12.14 -0.58 -23.03
TIP2837 9.57 2.93 17.35
TIP3637 12.32 7.02 -22.96
TIP4437 18.14 -8.45 -29.86
TIP0429 16.31 -14.90 -30.64
TIP1229 13.22 -8.68 -25.67
TIP2029 12.19 2.21 21.67
TIP2829 14.44 6.13 25.75
TIP3629 9.30 2.37 -22.46
TIP4429 11.23 -2.56 -33.31
TIP0421 15.49 -14.85 -21.34
TIP1221 15.27 10.08 29.04
TIP2021 13.21 8.21 24.85
TIP2821 15.79 6.48 -30.81
TIP3621 10.58 2.17 18.69
TIP4421 10.10 2.55 -26.30
TIP1213 15.12 5.70 -41.46
TIP2013 13.37 2.81 -32.71
TIP2813 12.34 -5.85 -29.28
TIP3613 15.34 7.96 -33.84
TIP4413 10.28 -4.62 -20.26
RMS [%] TIP2005 8.79
AVE [%] -3.37
MAX [%] -23.44
TIP2805 10.16 -1.78 -20.64
TIP3605 7.04 -3.02 -17.63
hatch_cy2_03
9.856 GWd/MT
3D RMS = 12.4%
2D RMS = 6.5%
1D RMS = 9.1%

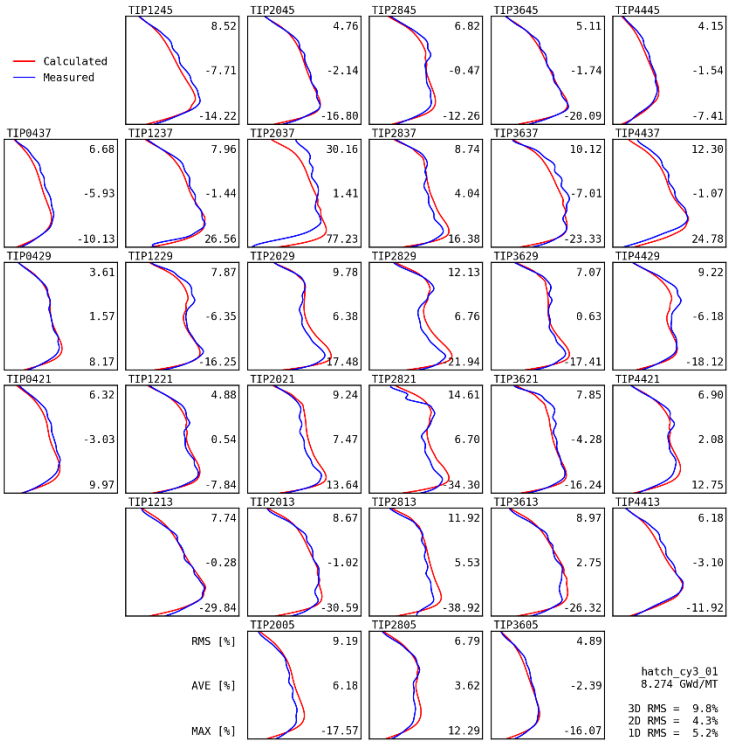

Calculated
Measured
TIP1245 11.62 -5.04 -39.84
TIP2045 9.53 1.37 30.37
TIP2845 11.04 4.61 -23.04
TIP3645 8.89 -1.43 -25.27
TIP4445 8.50 -5.24 -22.22
TIP0437 10.17 -8.99 -21.91
TIP1237 10.22 6.27 18.38
TIP2037 10.19 -0.74 -24.41
TIP2837 8.06 2.09 -17.81
TIP3637 11.84 6.57 -25.93
TIP4437 17.94 -12.38 -27.33
TIP0429 15.11 -13.61 -31.26
TIP1229 10.77 -7.20 -20.06
TIP2029 10.88 4.20 22.64
TIP2829 12.21 6.11 21.65
TIP3629 7.47 2.80 -21.61
TIP4429 10.93 -4.16 -38.12
TIP0421 12.93 -12.35 -20.71
TIP1221 16.54 12.09 30.06
TIP2021 13.11 9.45 23.12
TIP2821 13.58 6.71 -28.72
TIP3621 8.14 1.55 -17.89
TIP4421 10.07 1.64 -31.20
TIP1213 17.60 8.48 -31.17
TIP2013 13.29 3.98 -36.73
TIP2813 10.08 -3.53 -31.46
TIP3613 18.03 11.23 -39.86
TIP4413 10.10 -6.51 -28.09
RMS [%] TIP2005 9.31
AVE [%] -3.73
MAX [%] -31.54
TIP2805 9.75 -0.44 -26.52
TIP3605 8.19 -3.81 -25.81
hatch_cy2_04
10.893 GWd/MT
3D RMS = 11.8%
2D RMS = 6.8%
1D RMS = 8.0%

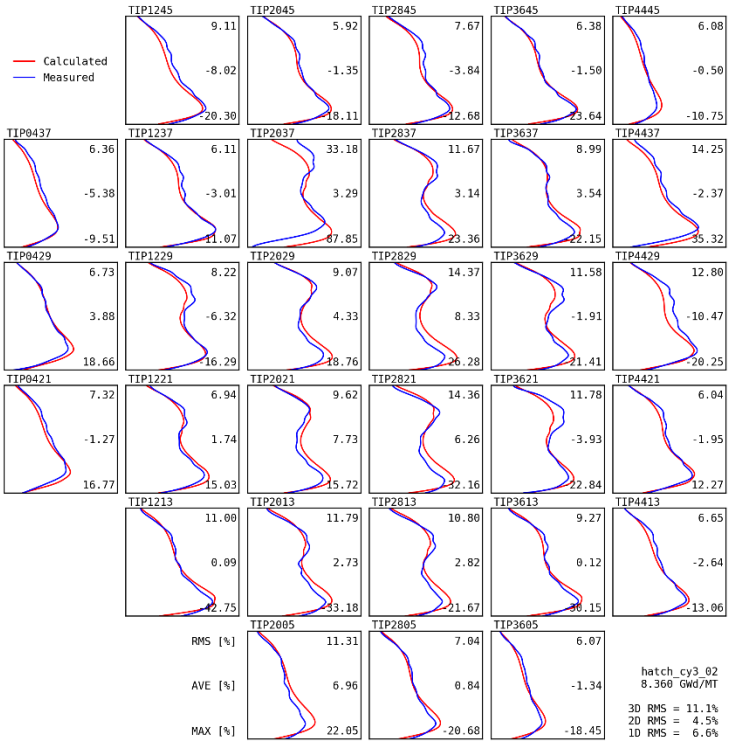

Calculated
Measured
TIP1245
9.97
1.85
-26.66
TIP2045
12.32
3.92
-34.52
TIP2845
13.36
5.98
-31.22
TIP3645
9.89
2.35
-31.75
TIP4445
6.94
-0.58
-11.95
TIP0437
9.86
-8.67
-21.58
TIP1237
11.49
6.82
-24.17
TIP2037
8.46
-0.91
-30.00
TIP2837
7.04
-2.34
-23.13
TIP3637
13.29
8.13
-27.57
TIP4437
15.67
-8.07
-24.99
TIP0429
15.11
-13.54
-33.18
TIP1229
9.72
-6.99
-23.96
TIP2029
9.58
-2.58
-16.87
TIP2829
16.58
7.18
-30.82
TIP3629
7.96
-1.27
-28.87
TIP4429
10.78
-0.91
-38.78
TIP0421
13.36
-12.68
-22.98
TIP1221
13.97
8.78
-28.56
TIP2021
14.36
9.95
-26.07
TIP2821
12.80
3.02
-38.61
TIP3621
9.33
2.44
-21.65
TIP4421
10.29
1.19
-32.55
TIP1213
18.34
8.99
-48.13
TIP2013
10.81
-0.20
-38.35
TIP2813
12.20
-6.44
-35.57
TIP3613
15.17
8.70
-36.04
TIP4413
9.70
-0.81
-24.75
RMS [%]
AVE [%]
MAX [%]
TIP2005
12.60
-4.44
-49.96
TIP2805
13.46
-5.70
-50.17
TIP3605
8.81
-3.18
-31.32
hatch_cy2_05
11.221 GWd/MT
3D RMS = 12.0%
2D RMS = 6.3%
1D RMS = 8.7%

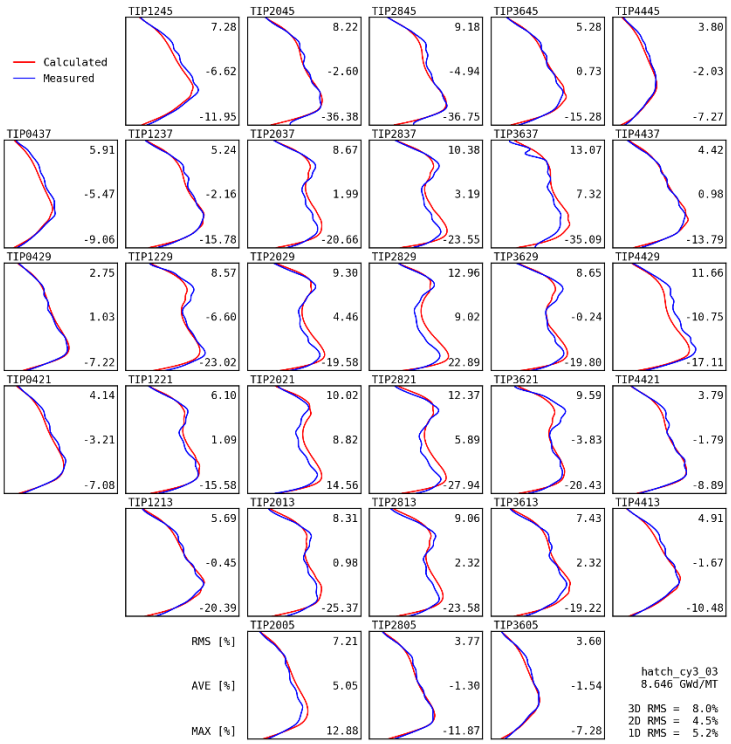

Calculated
Measured
TIP1245
7.82
0.60
-22.26
TIP2045
10.05
4.13
-28.45
TIP2845
11.84
6.78
-25.37
TIP3645
7.75
2.63
-25.62
TIP4445
6.35
-1.33
-12.37
TIP0437
9.70
-8.85
-16.98
TIP1237
9.72
6.65
-18.44
TIP2037
6.16
-0.38
-22.77
TIP2837
5.27
-2.46
-17.41
TIP3637
12.60
9.28
-20.93
TIP4437
15.19
-7.64
-24.18
TIP0429
15.41
-14.34
-26.83
TIP1229
8.02
-5.77
-19.60
TIP2029
7.44
-2.82
-13.31
TIP2829
12.86
9.00
-21.17
TIP3629
5.77
0.33
-20.98
TIP4429
7.73
-1.22
-28.91
TIP0421
13.44
-13.01
-17.86
TIP1221
12.77
9.42
-25.52
TIP2021
11.52
8.62
-20.45
TIP2821
10.19
4.39
-29.87
TIP3621
7.82
3.46
-15.52
TIP4421
7.72
2.31
-24.71
TIP1213
15.10
7.81
-40.94
TIP2013
8.47
-0.57
-30.13
TIP2813
10.61
-6.29
-28.61
TIP3613
12.02
7.21
-30.50
TIP4413
7.81
-2.72
-20.95
RMS [%]
AVE [%]
MAX [%]
TIP2005
10.64
-4.78
-41.77
TIP2805
11.43
-5.57
-42.63
TIP3605
7.97
-4.86
-26.95
hatch_cy2_06
11.866 GWd/MT
3D RMS = 10.3%
2D RMS = 6.4%
1D RMS = 6.3%

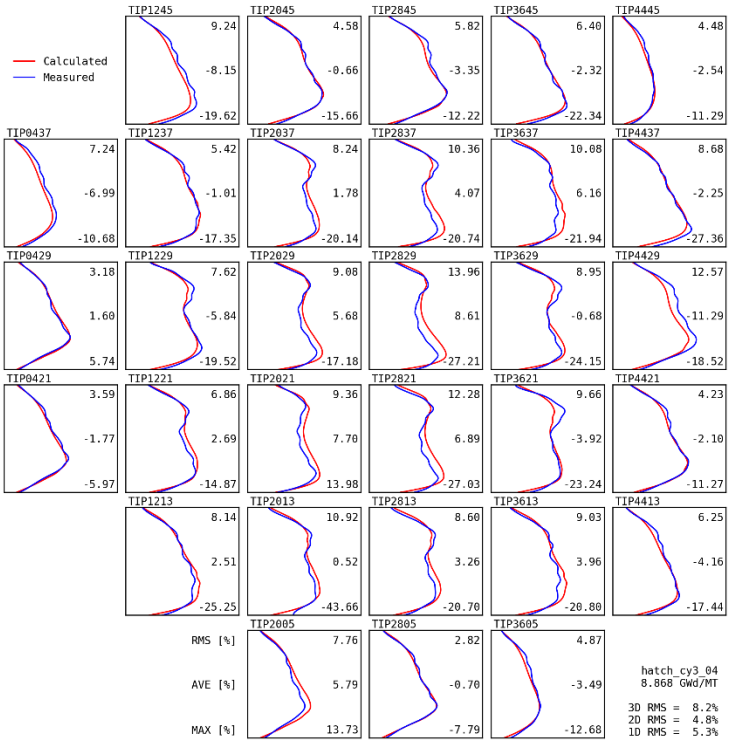

Calculated
Measured
TIP1245
10.76
-1.41
-42.23
TIP2045
12.84
3.36
-44.71
TIP2845
12.27
3.33
-42.42
TIP3645
12.35
0.99
-38.27
TIP4445
5.27
-1.78
-16.92
TIP0437
7.31
-5.63
-21.10
TIP1237
11.74
6.70
-28.54
TIP2037
10.11
-3.12
-43.25
TIP2837
9.65
0.83
-36.68
TIP3637
13.35
4.58
-38.68
TIP4437
14.59
-10.25
-22.25
TIP0429
11.62
-10.45
-27.74
TIP1229
10.92
-8.57
-33.69
TIP2029
7.84
1.13
-27.00
TIP2829
13.98
7.69
-39.69
TIP3629
10.63
0.10
-42.07
TIP4429
11.40
-5.79
-43.51
TIP0421
8.90
-8.14
-18.89
TIP1221
14.59
10.44
-24.00
TIP2021
11.07
7.47
-21.35
TIP2821
16.78
7.75
-54.09
TIP3621
8.56
-0.70
-33.67
TIP4421
11.05
2.16
-38.05
TIP1213
19.96
8.42
-46.02
TIP2013
14.32
1.90
-58.10
TIP2813
15.05
-9.67
-51.33
TIP3613
17.06
9.65
-32.28
TIP4413
10.28
-4.46
-39.33
RMS [%]
AVE [%]
MAX [%]
TIP2005
7.43
-1.33
-24.22
TIP2805
11.98
-2.77
-49.73
TIP3605
8.59
-2.44
-35.38
hatch_cy2_07
13.459 GWd/MT
3D RMS = 12.1%
2D RMS = 6.0%
1D RMS = 9.0%

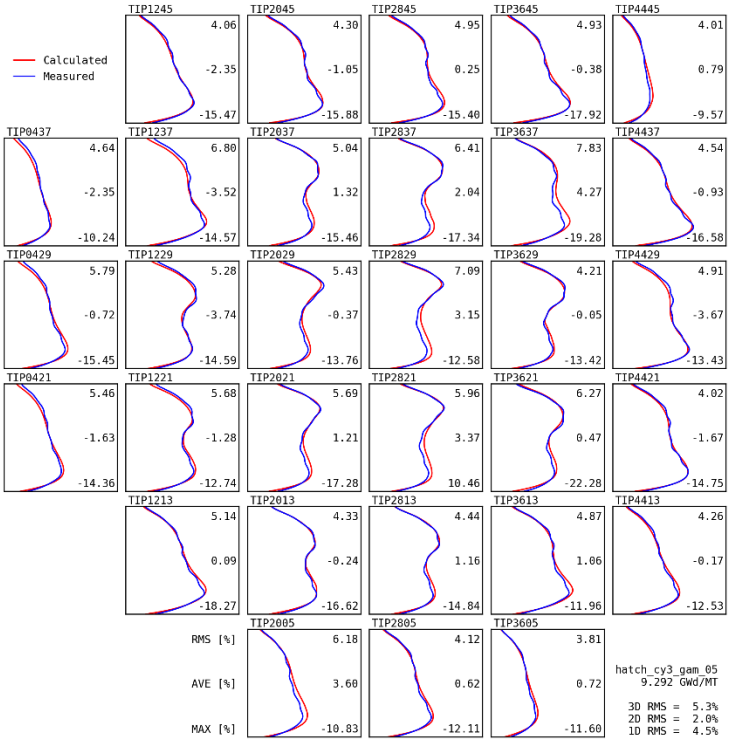
E.3 Hatch1 Cycle 3 TIP Comparison

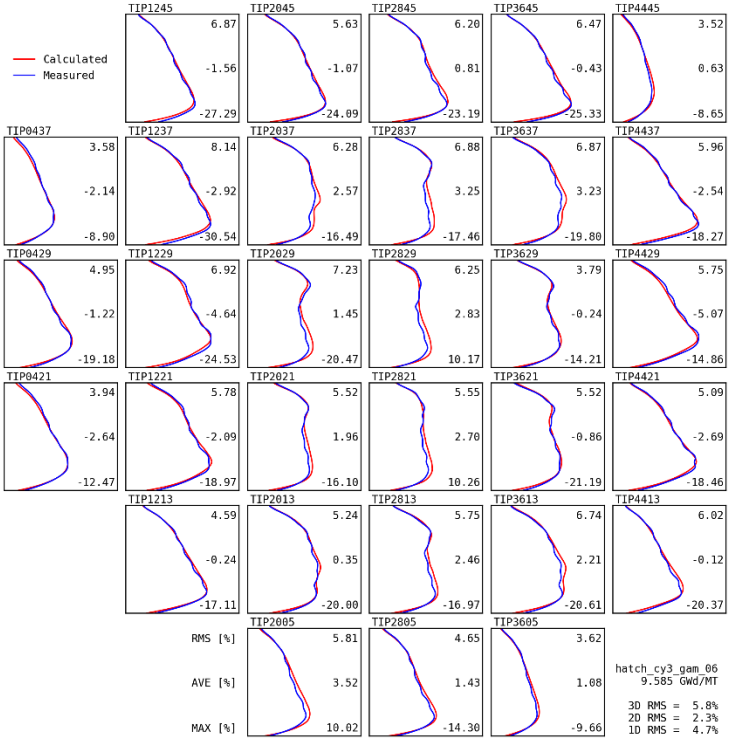


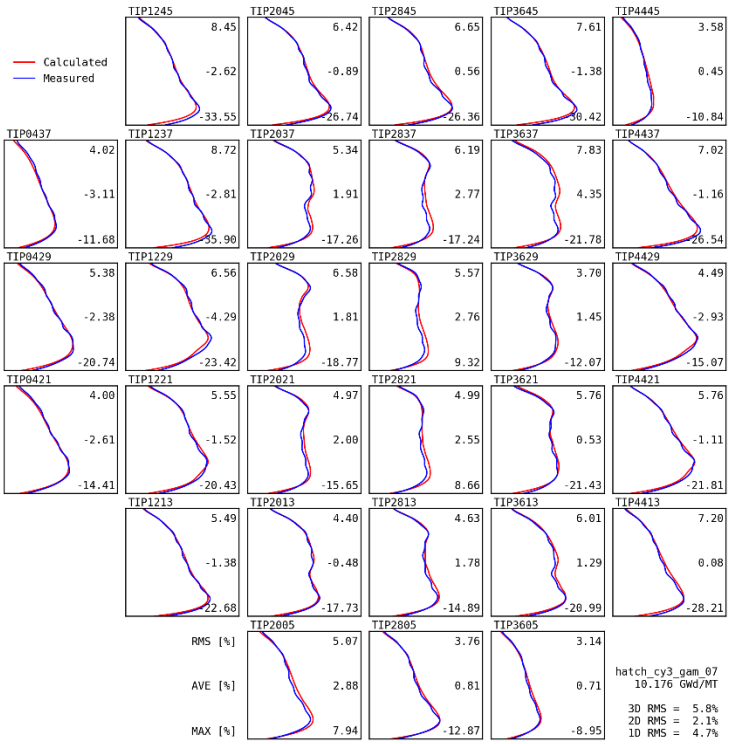


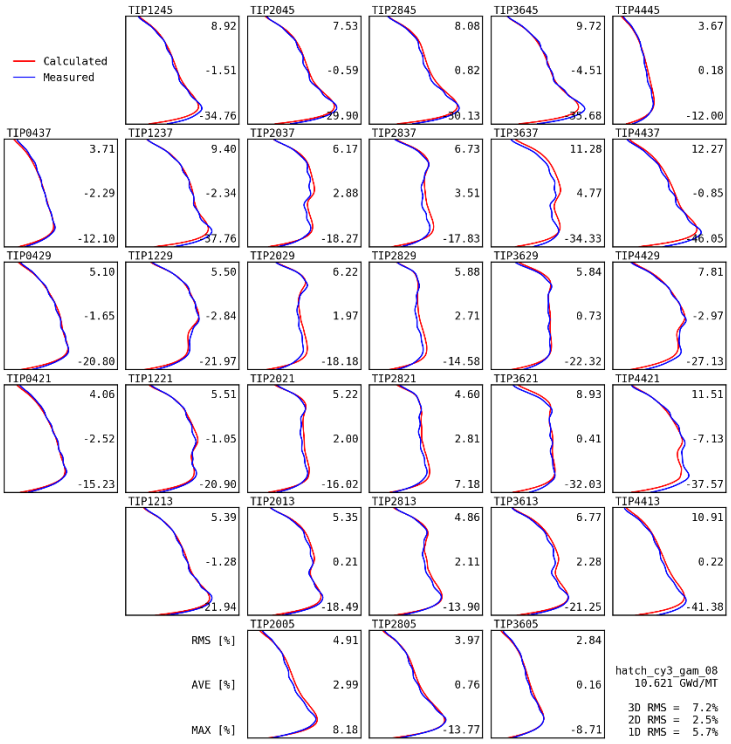

Calculated
Measured
TIP1245 7.28 -6.62 -11.95
TIP2045 8.22 -2.60 -36.38
TIP2845 9.18 -4.94 -36.75
TIP3645 5.28 0.73 -15.28
TIP4445 3.80 -2.03 -7.27
TIP0437 5.91 -5.47 -9.06
TIP1237 5.24 -2.16 -15.78
TIP2037 8.67 1.99 -20.66
TIP2837 10.38 3.19 -23.55
TIP3637 13.07 7.32 -35.09
TIP4437 4.42 0.98 -13.79
TIP0429 2.75 1.03 -7.22
TIP1229 8.57 -6.60 -23.02
TIP2029 9.30 4.46 -19.58
TIP2829 12.96 9.02 -22.89
TIP3629 8.65 -0.24 -19.80
TIP4429 11.66 -10.75 -17.11
TIP0421 4.14 -3.21 -7.08
TIP1221 6.10 1.09 -15.58
TIP2021 10.02 8.82 14.56
TIP2821 12.37 5.89 27.94
TIP3621 9.59 -3.83 -20.43
TIP4421 3.79 -1.79 -8.89
TIP1213 5.69 -0.45 -20.39
TIP2013 8.31 0.98 -25.37
TIP2813 9.06 2.32 -23.58
TIP3613 7.43 2.32 -19.22
TIP4413 4.91 -1.67 -10.48
RMS [%]
AVE [%]
MAX [%]
TIP2005 7.21 5.05 12.88
TIP2805 3.77 -1.30 -11.87
TIP3605 3.60 -1.54 -7.28
hatch_cy3_03
8.646 GWd/MT
3D RMS = 8.0%
2D RMS = 4.5%
1D RMS = 5.2%

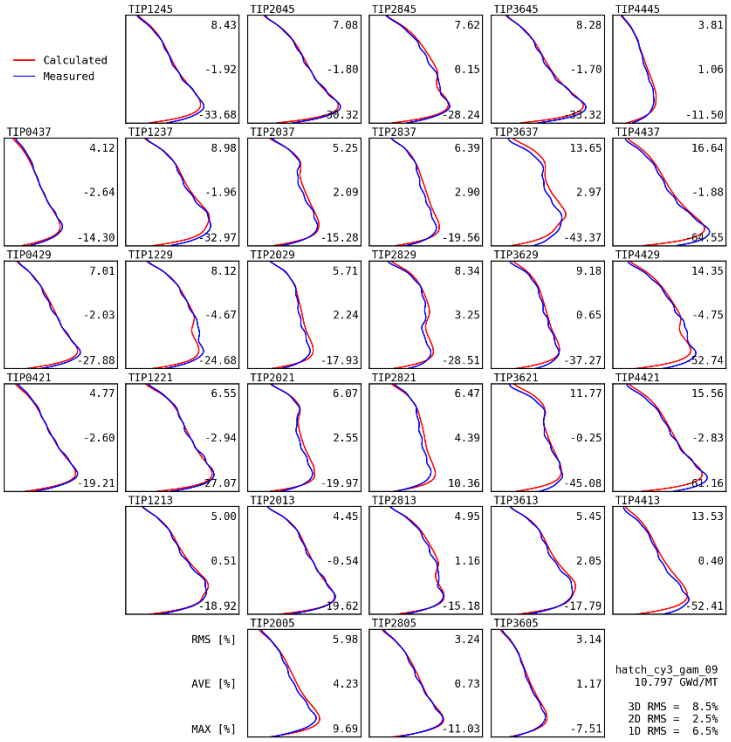

Calculated
Measured
TIP1245 9.24 -8.15 -19.62
TIP2045 4.58 -0.66 -15.66
TIP2845 5.82 -3.35 -12.22
TIP3645 6.40 -2.32 -22.34
TIP4445 4.48 -2.54 -11.29
TIP0437 7.24 -6.99 -10.68
TIP1237 5.42 -1.01 -17.35
TIP2037 8.24 1.78 -20.14
TIP2837 10.36 4.07 -20.74
TIP3637 10.08 6.16 -21.94
TIP4437 8.68 -2.25 -27.36
TIP0429 3.18 1.60 5.74
TIP1229 7.62 -5.84 -19.52
TIP2029 9.08 5.68 -17.18
TIP2829 13.96 8.61 -27.21
TIP3629 8.95 -0.68 -24.15
TIP4429 12.57 -11.29 -18.52
TIP0421 3.59 -1.77 -5.97
TIP1221 6.86 2.69 -14.87
TIP2021 9.36 7.70 13.98
TIP2821 12.28 6.89 -27.03
TIP3621 9.66 -3.92 -23.24
TIP4421 4.23 -2.10 -11.27
TIP1213 8.14 2.51 -25.25
TIP2013 10.92 0.52 -43.66
TIP2813 8.60 3.26 -20.70
TIP3613 9.03 3.96 -20.80
TIP4413 6.25 -4.16 -17.44
RMS [%]
AVE [%]
MAX [%]
TIP2005 7.76 5.79 13.73
TIP2805 2.82 -0.70 -7.79
TIP3605 4.87 -3.49 -12.68
hatch_cy3_04
8.868 GWd/MT
3D RMS = 8.2%
2D RMS = 4.8%
1D RMS = 5.3%

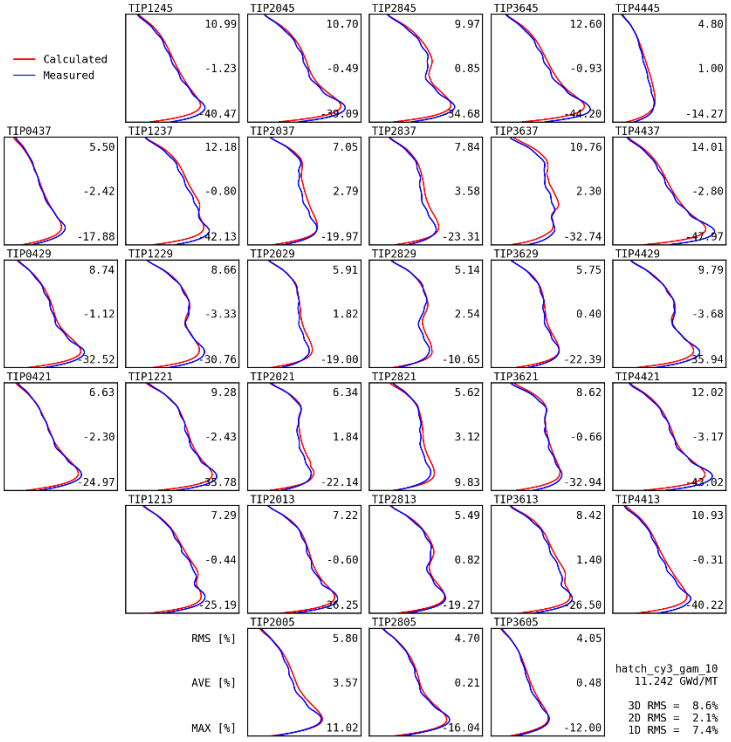

Calculated
Measured
TIP1245
4.06
-2.35
-15.47
TIP2045
4.30
-1.05
-15.88
TIP2845
4.95
0.25
-15.40
TIP3645
4.93
-0.38
-17.92
TIP4445
4.01
0.79
-9.57
TIP0437
4.64
-2.35
-10.24
TIP1237
6.80
-3.52
-14.57
TIP2037
5.04
1.32
-15.46
TIP2837
6.41
2.04
-17.34
TIP3637
7.83
4.27
-19.28
TIP4437
4.54
-0.93
-16.58
TIP0429
5.79
-0.72
-15.45
TIP1229
5.28
-3.74
-14.59
TIP2029
5.43
-0.37
-13.76
TIP2829
7.09
3.15
-12.58
TIP3629
4.21
-0.05
-13.42
TIP4429
4.91
-3.67
-13.43
TIP0421
5.46
-1.63
-14.36
TIP1221
5.68
-1.28
-12.74
TIP2021
5.69
1.21
-17.28
TIP2821
5.96
3.37
10.46
TIP3621
6.27
0.47
-22.28
TIP4421
4.02
-1.67
-14.75
TIP1213
5.14
0.09
-18.27
TIP2013
4.33
-0.24
-16.62
TIP2813
4.44
1.16
-14.84
TIP3613
4.87
1.06
-11.96
TIP4413
4.26
-0.17
-12.53
RMS [%]
AVE [%]
MAX [%]
TIP2005
6.18
3.60
-10.83
TIP2805
4.12
0.62
-12.11
TIP3605
3.81
0.72
-11.60
hatch_cy3_gam_05
9.292 GWd/MT
3D RMS = 5.3%
2D RMS = 2.0%
1D RMS = 4.5%

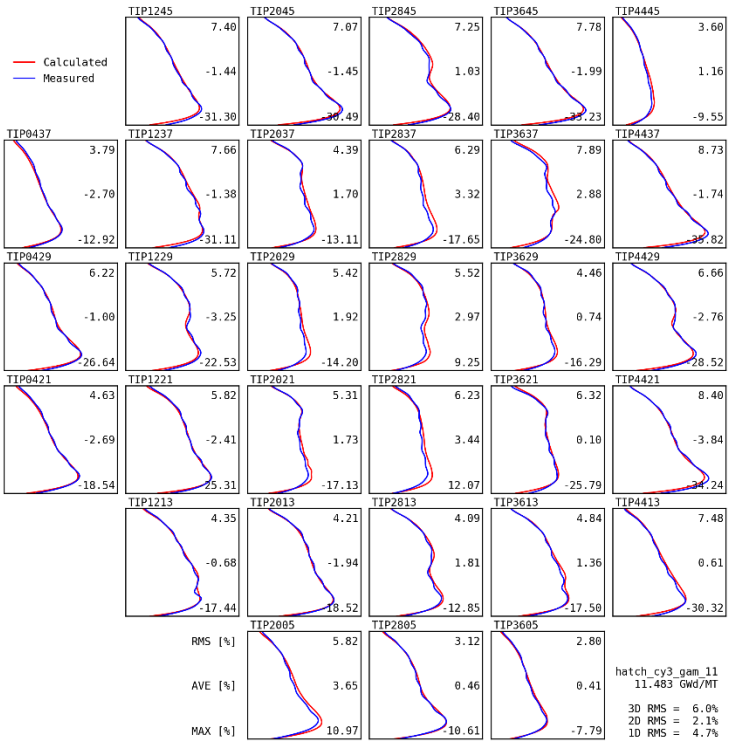

Calculated
Measured
TIP1245
6.87
-1.56
-27.29
TIP2045
5.63
-1.07
-24.09
TIP2845
6.20
0.81
-23.19
TIP3645
6.47
-0.43
-25.33
TIP4445
3.52
0.63
-8.65
TIP0437
3.58
-2.14
-8.90
TIP1237
8.14
-2.92
-30.54
TIP2037
6.28
2.57
-16.49
TIP2837
6.88
3.25
-17.46
TIP3637
6.87
3.23
-19.80
TIP4437
5.96
-2.54
-18.27
TIP0429
4.95
-1.22
-19.18
TIP1229
6.92
-4.64
-24.53
TIP2029
7.23
1.45
-20.47
TIP2829
6.25
2.83
10.17
TIP3629
3.79
-0.24
-14.21
TIP4429
5.75
-5.07
-14.86
TIP0421
3.94
-2.64
-12.47
TIP1221
5.78
-2.09
-18.97
TIP2021
5.52
1.96
-16.10
TIP2821
5.55
2.70
10.26
TIP3621
5.52
-0.86
-21.19
TIP4421
5.09
-2.69
-18.46
TIP1213
4.59
-0.24
-17.11
TIP2013
5.24
0.35
-20.00
TIP2813
5.75
2.46
-16.97
TIP3613
6.74
2.21
-20.61
TIP4413
6.02
-0.12
-20.37
RMS [%]
AVE [%]
MAX [%]
TIP2005
5.81
3.52
10.02
TIP2805
4.65
1.43
-14.30
TIP3605
3.62
1.08
-9.66
hatch_cy3_gam_06
9.585 GWd/MT
3D RMS = 5.8%
2D RMS = 2.3%
1D RMS = 4.7%

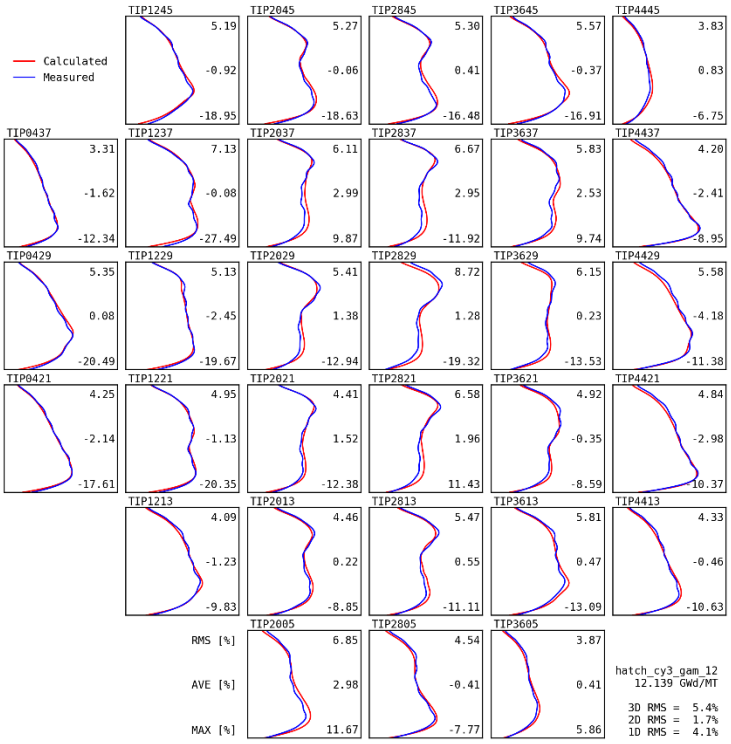

Calculated
Measured
TIP1245 8.45 -2.62 -33.55
TIP2045 6.42 -0.89 -26.74
TIP2845 6.65 0.56 -26.36
TIP3645 7.61 -1.38 -30.42
TIP4445 3.58 0.45 -10.84
TIP0437 4.02 -3.11 -11.68
TIP1237 8.72 -2.81 -35.90
TIP2037 5.34 1.91 -17.26
TIP2837 6.19 2.77 -17.24
TIP3637 7.83 4.35 -21.78
TIP4437 7.02 -1.16 -26.54
TIP0429 5.38 -2.38 -20.74
TIP1229 6.56 -4.29 -23.42
TIP2029 6.58 1.81 -18.77
TIP2829 5.57 2.76 9.32
TIP3629 3.70 1.45 -12.07
TIP4429 4.49 -2.93 -15.07
TIP0421 4.00 -2.61 -14.41
TIP1221 5.55 -1.52 -20.43
TIP2021 4.97 2.00 -15.65
TIP2821 4.99 2.55 8.66
TIP3621 5.76 0.53 -21.43
TIP4421 5.76 -1.11 -21.81
TIP1213 5.49 -1.38 -22.68
TIP2013 4.40 -0.48 -17.73
TIP2813 4.63 1.78 -14.89
TIP3613 6.01 1.29 -20.99
TIP4413 7.20 0.08 -28.21
RMS [%]
AVE [%]
MAX [%]
TIP2005 5.07 2.88 7.94
TIP2805 3.76 0.81 -12.87
TIP3605 3.14 0.71 -8.95
hatch_cy3_gam_07
10.176 GWd/MT
3D RMS = 5.8%
2D RMS = 2.1%
1D RMS = 4.7%

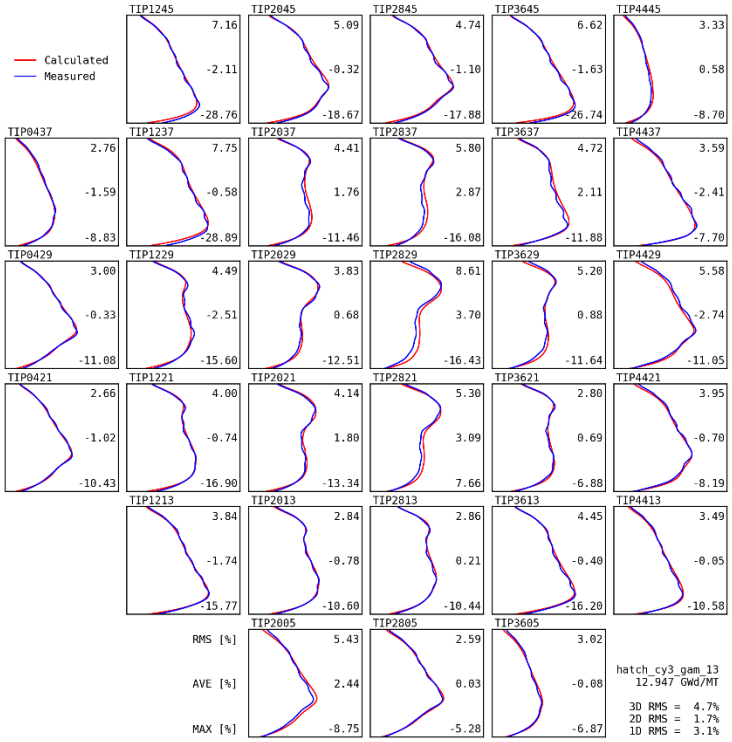

Calculated
Measured
TIP1245 8.92 -1.51 -34.76
TIP2045 7.53 -0.59 29.90
TIP2845 8.08 0.82 30.13
TIP3645 9.72 -4.51 35.68
TIP4445 3.67 0.18 -12.00
TIP0437 3.71 -2.29 -12.10
TIP1237 9.40 -2.34 37.76
TIP2037 6.17 2.88 -18.27
TIP2837 6.73 3.51 -17.83
TIP3637 11.28 4.77 -34.33
TIP4437 12.27 -0.85 -46.05
TIP0429 5.10 -1.65 -20.80
TIP1229 5.50 -2.84 -21.97
TIP2029 6.22 1.97 -18.18
TIP2829 5.88 2.71 -14.58
TIP3629 5.84 0.73 -22.32
TIP4429 7.81 -2.97 -27.13
TIP0421 4.06 -2.52 -15.23
TIP1221 5.51 -1.05 -20.90
TIP2021 5.22 2.00 -16.02
TIP2821 4.60 2.81 7.18
TIP3621 8.93 0.41 -32.03
TIP4421 11.51 -7.13 -37.57
TIP1213 5.39 -1.28 21.94
TIP2013 5.35 0.21 -18.49
TIP2813 4.86 2.11 -13.90
TIP3613 6.77 2.28 -21.25
TIP4413 10.91 0.22 -41.38
RMS [%]
AVE [%]
MAX [%]
TIP2005 4.91 2.99 8.18
TIP2805 3.97 0.76 -13.77
TIP3605 2.84 0.16 -8.71
hatch_cy3_gam_08
10.621 GWd/MT
3D RMS = 7.2%
2D RMS = 2.5%
1D RMS = 5.7%

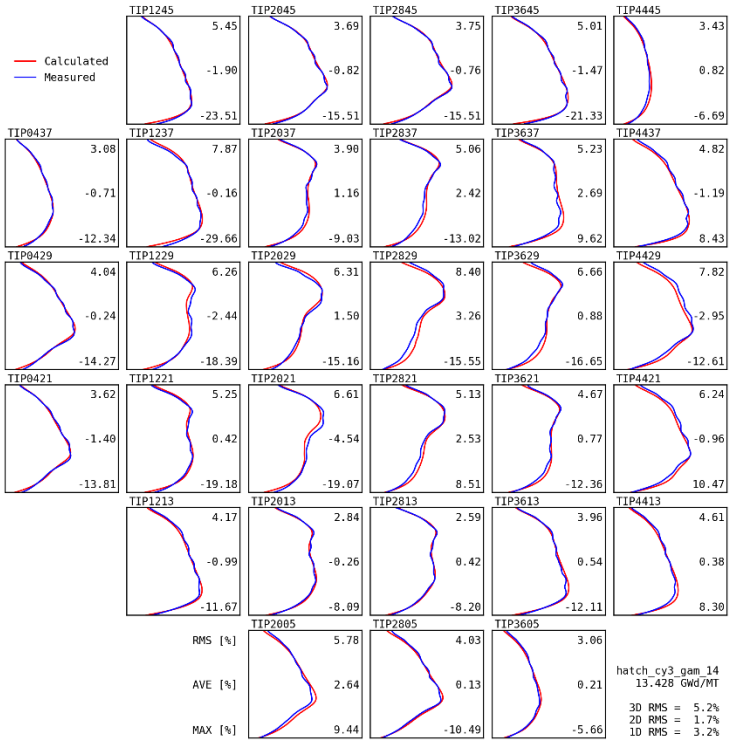

Calculated
Measured
TIP1245
8.43
-1.92
-33.68
TIP2045
7.08
-1.80
-30.32
TIP2845
7.62
0.15
-28.24
TIP3645
8.28
-1.70
-33.32
TIP4445
3.81
1.06
-11.50
TIP0437
4.12
-2.64
-14.30
TIP1237
8.98
-1.96
-32.97
TIP2037
5.25
2.09
-15.28
TIP2837
6.39
2.90
-19.56
TIP3637
13.65
2.97
-43.37
TIP4437
16.64
-1.88
-60.55
TIP0429
7.01
-2.03
-27.88
TIP1229
8.12
-4.67
-24.68
TIP2029
5.71
2.24
-17.93
TIP2829
8.34
3.25
-28.51
TIP3629
9.18
0.65
-37.27
TIP4429
14.35
-4.75
-52.74
TIP0421
4.77
-2.60
-19.21
TIP1221
6.55
-2.94
-27.07
TIP2021
6.07
2.55
-19.97
TIP2821
6.47
4.39
-10.36
TIP3621
11.77
-0.25
-45.08
TIP4421
15.56
-2.83
-61.16
TIP1213
5.00
0.51
-18.92
TIP2013
4.45
-0.54
-19.62
TIP2813
4.95
1.16
-15.18
TIP3613
5.45
2.05
-17.79
TIP4413
13.53
0.40
-52.41
RMS [%]
AVE [%]
MAX [%]
TIP2005
5.98
4.23
9.69
TIP2805
3.24
0.73
-11.03
TIP3605
3.14
1.17
-7.51
hatch_cy3_gam_09
10.797 GWd/MT
3D RMS = 8.5%
2D RMS = 2.5%
1D RMS = 6.5%

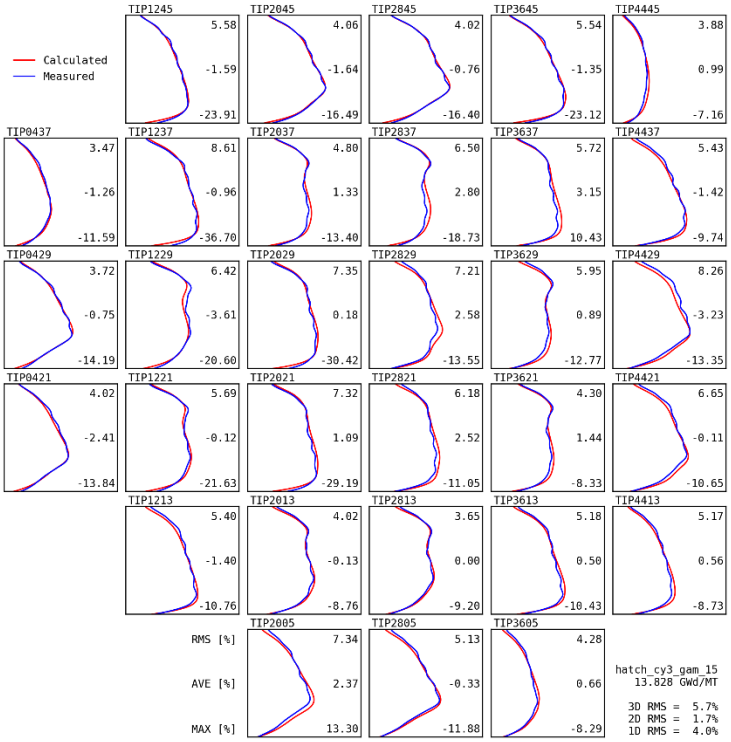

Calculated
Measured
TIP1245
10.99
-1.23
-40.47
TIP2045
10.70
-0.49
-39.09
TIP2845
9.97
0.85
-34.68
TIP3645
12.60
-0.93
-44.20
TIP4445
4.80
1.00
-14.27
TIP0437
5.50
-2.42
-17.88
TIP1237
12.18
-0.80
-42.13
TIP2037
7.05
2.79
-19.97
TIP2837
7.84
3.58
-23.31
TIP3637
10.76
2.30
-32.74
TIP4437
14.01
-2.80
-47.97
TIP0429
8.74
-1.12
-32.52
TIP1229
8.66
-3.33
-30.76
TIP2029
5.91
1.82
-19.00
TIP2829
5.14
2.54
-10.65
TIP3629
5.75
0.40
-22.39
TIP4429
9.79
-3.68
-35.94
TIP0421
6.63
-2.30
-24.97
TIP1221
9.28
-2.43
-33.78
TIP2021
6.34
1.84
-22.14
TIP2821
5.62
3.12
-9.83
TIP3621
8.62
-0.66
-32.94
TIP4421
12.02
-3.17
-43.02
TIP1213
7.29
-0.44
-25.19
TIP2013
7.22
-0.60
-26.25
TIP2813
5.49
0.82
-19.27
TIP3613
8.42
1.40
-26.50
TIP4413
10.93
-0.31
-40.22
RMS [%]
AVE [%]
MAX [%]
TIP2005
5.80
3.57
11.02
TIP2805
4.70
0.21
-16.04
TIP3605
4.05
0.48
-12.00
hatch_cy3_gam_10
11.242 GWd/MT
3D RMS = 8.6%
2D RMS = 2.1%
1D RMS = 7.4%

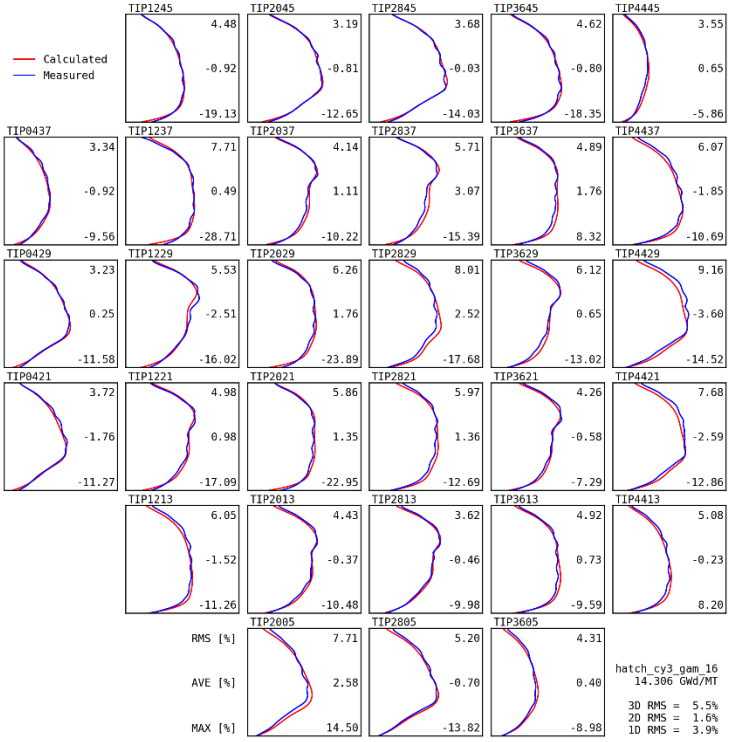

Calculated
Measured
TIP1245
7.40
-1.44
-31.30
TIP2045
7.07
-1.45
-30.49
TIP2845
7.25
1.03
-28.40
TIP3645
7.78
-1.99
-33.23
TIP4445
3.60
1.16
-9.55
TIP0437
3.79
-2.70
-12.92
TIP1237
7.66
-1.38
-31.11
TIP2037
4.39
1.70
-13.11
TIP2837
6.29
3.32
-17.65
TIP3637
7.89
2.88
-24.80
TIP4437
8.73
-1.74
-35.82
TIP0429
6.22
-1.00
-26.64
TIP1229
5.72
-3.25
-22.53
TIP2029
5.42
1.92
-14.20
TIP2829
5.52
2.97
9.25
TIP3629
4.46
0.74
-16.29
TIP4429
6.66
-2.76
28.52
TIP0421
4.63
-2.69
-18.54
TIP1221
5.82
-2.41
25.31
TIP2021
5.31
1.73
-17.13
TIP2821
6.23
3.44
12.07
TIP3621
6.32
0.10
-25.79
TIP4421
8.40
-3.84
-34.24
TIP1213
4.35
-0.68
-17.44
TIP2013
4.21
-1.94
18.52
TIP2813
4.09
1.81
-12.85
TIP3613
4.84
1.36
-17.50
TIP4413
7.48
0.61
-30.32
RMS [%]
AVE [%]
MAX [%]
TIP2005
5.82
3.65
10.97
TIP2805
3.12
0.46
10.61
TIP3605
2.80
0.41
-7.79
hatch_cy3_gam_11
11.483 GWd/MT
3D RMS = 6.0%
2D RMS = 2.1%
1D RMS = 4.7%


Calculated
Measured
TIP1245
5.19
-0.92
-18.95
TIP2045
5.27
-0.06
-18.63
TIP2845
5.30
0.41
-16.48
TIP3645
5.57
-0.37
-16.91
TIP4445
3.83
0.83
-6.75
TIP0437
3.31
-1.62
-12.34
TIP1237
7.13
-0.08
-27.49
TIP2037
6.11
2.99
9.87
TIP2837
6.67
2.95
-11.92
TIP3637
5.83
2.53
9.74
TIP4437
4.20
-2.41
-8.95
TIP0429
5.35
0.08
-20.49
TIP1229
5.13
-2.45
-19.67
TIP2029
5.41
1.38
-12.94
TIP2829
8.72
1.28
-19.32
TIP3629
6.15
0.23
-13.53
TIP4429
5.58
-4.18
-11.38
TIP0421
4.25
-2.14
-17.61
TIP1221
4.95
-1.13
-20.35
TIP2021
4.41
1.52
-12.38
TIP2821
6.58
1.96
11.43
TIP3621
4.92
-0.35
-8.59
TIP4421
4.84
-2.98
10.37
TIP1213
4.09
-1.23
-9.83
TIP2013
4.46
0.22
-8.85
TIP2813
5.47
0.55
-11.11
TIP3613
5.81
0.47
-13.09
TIP4413
4.33
-0.46
-10.63
RMS [%]
AVE [%]
MAX [%]
TIP2005
6.85
2.98
11.67
TIP2805
4.54
-0.41
-7.77
TIP3605
3.87
0.41
5.86
hatch_cy3_gam_12
12.139 GWd/MT
3D RMS = 5.4%
2D RMS = 1.7%
1D RMS = 4.1%


Calculated
Measured
TIP1245
7.16
-2.11
-28.76
TIP2045
5.09
-0.32
-18.67
TIP2845
4.74
-1.10
-17.88
TIP3645
6.62
-1.63
-26.74
TIP4445
3.33
0.58
-8.70
TIP0437
2.76
-1.59
-8.83
TIP1237
7.75
-0.58
-28.89
TIP2037
4.41
1.76
-11.46
TIP2837
5.80
2.87
-16.08
TIP3637
4.72
2.11
-11.88
TIP4437
3.59
-2.41
-7.70
TIP0429
3.00
-0.33
-11.08
TIP1229
4.49
-2.51
-15.60
TIP2029
3.83
0.68
-12.51
TIP2829
8.61
3.70
-16.43
TIP3629
5.20
0.88
-11.64
TIP4429
5.58
-2.74
-11.05
TIP0421
2.66
-1.02
-10.43
TIP1221
4.00
-0.74
-16.90
TIP2021
4.14
1.80
-13.34
TIP2821
5.30
3.09
7.66
TIP3621
2.80
0.69
-6.88
TIP4421
3.95
-0.70
-8.19
TIP1213
3.84
-1.74
-15.77
TIP2013
2.84
-0.78
-10.60
TIP2813
2.86
0.21
-10.44
TIP3613
4.45
-0.40
-16.20
TIP4413
3.49
-0.05
-10.58
RMS [%]
AVE [%]
MAX [%]
TIP2005
5.43
2.44
-8.75
TIP2805
2.59
0.03
-5.28
TIP3605
3.02
-0.08
-6.87
hatch_cy3_gam_13
12.947 GWd/MT
3D RMS = 4.7%
2D RMS = 1.7%
1D RMS = 3.1%


Calculated
Measured
TIP1245
5.45
-1.90
-23.51
TIP2045
3.69
-0.82
-15.51
TIP2845
3.75
-0.76
-15.51
TIP3645
5.01
-1.47
-21.33
TIP4445
3.43
0.82
-6.69
TIP0437
3.08
-0.71
-12.34
TIP1237
7.87
-0.16
-29.66
TIP2037
3.90
1.16
-9.03
TIP2837
5.06
2.42
-13.02
TIP3637
5.23
2.69
9.62
TIP4437
4.82
-1.19
8.43
TIP0429
4.04
-0.24
-14.27
TIP1229
6.26
-2.44
-18.39
TIP2029
6.31
1.50
-15.16
TIP2829
8.40
3.26
-15.55
TIP3629
6.66
0.88
-16.65
TIP4429
7.82
-2.95
-12.61
TIP0421
3.62
-1.40
-13.81
TIP1221
5.25
0.42
-19.18
TIP2021
6.61
-4.54
-19.07
TIP2821
5.13
2.53
8.51
TIP3621
4.67
0.77
-12.36
TIP4421
6.24
-0.96
10.47
TIP1213
4.17
-0.99
-11.67
TIP2013
2.84
-0.26
-8.09
TIP2813
2.59
0.42
-8.20
TIP3613
3.96
0.54
-12.11
TIP4413
4.61
0.38
8.30
RMS [%]
AVE [%]
MAX [%]
TIP2005
5.78
2.64
9.44
TIP2805
4.03
0.13
-10.49
TIP3605
3.06
0.21
-5.66
hatch_cy3_gam_14
13.428 GWd/MT
3D RMS = 5.2%
2D RMS = 1.7%
1D RMS = 3.2%


Calculated
Measured
TIP1245
5.58
-1.59
-23.91
TIP2045
4.06
-1.64
-16.49
TIP2845
4.02
-0.76
-16.40
TIP3645
5.54
-1.35
-23.12
TIP4445
3.88
0.99
-7.16
TIP0437
3.47
-1.26
-11.59
TIP1237
8.61
-0.96
-36.70
TIP2037
4.80
1.33
-13.40
TIP2837
6.50
2.80
-18.73
TIP3637
5.72
3.15
10.43
TIP4437
5.43
-1.42
-9.74
TIP0429
3.72
-0.75
-14.19
TIP1229
6.42
-3.61
-20.60
TIP2029
7.35
0.18
-30.42
TIP2829
7.21
2.58
-13.55
TIP3629
5.95
0.89
-12.77
TIP4429
8.26
-3.23
-13.35
TIP0421
4.02
-2.41
-13.84
TIP1221
5.69
-0.12
-21.63
TIP2021
7.32
1.09
-29.19
TIP2821
6.18
2.52
-11.05
TIP3621
4.30
1.44
-8.33
TIP4421
6.65
-0.11
-10.65
TIP1213
5.40
-1.40
-10.76
TIP2013
4.02
-0.13
-8.76
TIP2813
3.65
0.00
-9.20
TIP3613
5.18
0.50
-10.43
TIP4413
5.17
0.56
-8.73
RMS [%]
AVE [%]
MAX [%]
TIP2005
7.34
2.37
13.30
TIP2805
5.13
-0.33
-11.88
TIP3605
4.28
0.66
-8.29
hatch_cy3_gam_15
13.828 GWd/MT
3D RMS = 5.7%
2D RMS = 1.7%
1D RMS = 4.0%


Calculated
Measured
TIP1245
4.48
-0.92
-19.13
TIP2045
3.19
-0.81
-12.65
TIP2845
3.68
-0.03
-14.03
TIP3645
4.62
-0.80
-18.35
TIP4445
3.55
0.65
-5.86
TIP0437
3.34
-0.92
-9.56
TIP1237
7.71
0.49
-28.71
TIP2037
4.14
1.11
-10.22
TIP2837
5.71
3.07
-15.39
TIP3637
4.89
1.76
8.32
TIP4437
6.07
-1.85
-10.69
TIP0429
3.23
0.25
-11.58
TIP1229
5.53
-2.51
-16.02
TIP2029
6.26
1.76
-23.89
TIP2829
8.01
2.52
-17.68
TIP3629
6.12
0.65
-13.02
TIP4429
9.16
-3.60
-14.52
TIP0421
3.72
-1.76
-11.27
TIP1221
4.98
0.98
-17.09
TIP2021
5.86
1.35
-22.95
TIP2821
5.97
1.36
-12.69
TIP3621
4.26
-0.58
-7.29
TIP4421
7.68
-2.59
-12.86
TIP1213
6.05
-1.52
-11.26
TIP2013
4.43
-0.37
-10.48
TIP2813
3.62
-0.46
-9.98
TIP3613
4.92
0.73
-9.59
TIP4413
5.08
-0.23
8.20
RMS [%]
AVE [%]
MAX [%]
TIP2005
7.71
2.58
14.50
TIP2805
5.20
-0.70
-13.82
TIP3605
4.31
0.40
-8.98
hatch_cy3_gam_16
14.306 GWd/MT
3D RMS = 5.5%
2D RMS = 1.6%
1D RMS = 3.9%