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



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William A. Wieselquist

December 2024

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Nuclear Energy and Fuel Cycle Division

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the SCALE 6.3/POLARIS–PARCS V3.4.2 Code Package**

Kang Seog Kim
William A. Wieselquist

December 2024

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ABBREVIATIONS

BOC	beginning of cycle
BWR	boiling water reactor
CR	control rods
EFPD	effective full power day
ENDF	Evaluated Nuclear Data File
EOC	end of cycle
EPRI	Electric Power Research Institute
HFP	hot full power
HZP	hot zero power
Inc-718	Inconel-718
LWR	light-water reactor
NRC	Nuclear Regulatory Commission
ORNL	Oak Ridge National Laboratory
QC1	Quad Cities Unit 1
RMSE	root mean square error
SS-304	Stainless steel 304
TIP	traverse in-core probe
TIPS	traverse in-core probe system
Zr-2	Zircaloy-2
Zr-4	Zircaloy-4

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ABSTRACT

In this study, benchmark calculations were performed for the Quad Cities Unit 1 cycles 1–3 to validate the SCALE 6.3/Polaris–PARCS v3.4.2 code package 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 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; additionally, detailed information is provided for all the input and output files produced for the benchmark calculations. The benchmark results are summarized herein so that they can be used to evaluate uncertainties with other benchmark results for key nuclear parameters.

1. INTRODUCTION

The Quad Cities Unit 1 (QC1) is a General Electric (GE) Type 3 boiling water reactor (BWR) operated by the Exelon Generation Company that began operation at 2,511 MW_{th} power using GE 7×7 and 8×8 assemblies [1, 2]. There are 41 traverse in-core probe (TIP) instrument assemblies for QC1. Detailed design data and measured data are provided in Electric Power Research Institute (EPRI) reports NP-240 [1] and NP-552 [2] for QC1.

In this study, the benchmark calculations were performed for the QC1 cycles 1–3 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 Evaluated Nuclear Data File (ENDF)/B-VII.1 AMPX 56-group library [7]. The simulated benchmark results were compared to the measured data; they 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.

Section 2 provides a brief overview of the Polaris–GenPMAXS–PARCS code package and provides the plant design data and measured data. Because 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 design data were not thermally expanded for this study for simplicity. However, no thermal expansion would not result in a meaningful difference. In Section 3, the simulated benchmark results are summarized and compared with the measured data. In addition, Section 3 provides detailed information about 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 QC1 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 requiring significant computing time, the ENDF/B-VII.1 AMPX 56-group was used in this analysis. The flowchart in **Error! Reference source not found.** illustrates how the Polaris–GenPMAXS–PARCS code package was used to simulate BWRs. The SCALE/Polaris code, developed by Oak Ridge National Laboratory, is a 2D lattice physics code used to generate two-group homogenized cross sections and pin power form factors for fuel assemblies and reflectors. Polaris depletion calculations were performed at the reference states with various branch calculations to cover all the probable states in a reactor. The GenPMAXS code developed by the University of Michigan prepares a cross section table set for each type of fuel assembly and reflector, in which two-group macroscopic cross sections are tabulated as functions of burnup, moderator and fuel temperature, moderator density, and control rod insertion. After cross section table sets were prepared for all types of fuel assemblies and radial and axial reflectors, whole-core nodal diffusion calculations were performed using the PARCS code. The PATHS thermal hydraulics model was used for BWR physics analysis because it can treat two-phase flow [8].

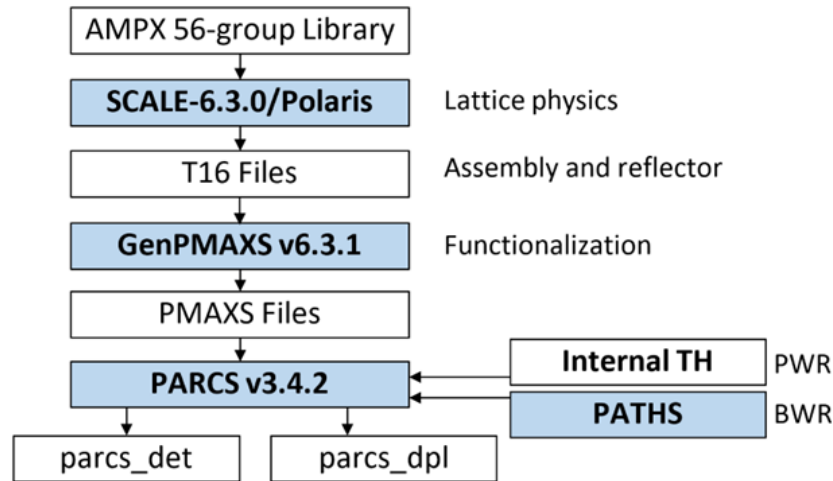


Figure 2.1. Flowchart of the Polaris–GenPMAXS–PARCS procedure.

Error! Reference source not found. provides detailed information on the programs and data used in the benchmark 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	genpmxs-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 QC1 CORE

2.2.1 Design Data

QC1 is a General Electric Type 3 BWR operated by the Constellation Energy Generation that began operation at 2,511 MW_{th} power using GE 7×7 assemblies [1, 2]. QC1 has 41 TIP instrument assemblies. Detailed design data and measured data are provided in EPRI reports NP-240 [1] and NP-552 [2] for QC1.

Table 2.2 provides the key design specifications of the QC1 core for cycles 1–3. Specifications of the QC1 active height, TIP instrument system, control blade, and radial and axial reflectors are described in Table 2.3. The QC1 cycles 1–3 used seven types of fuel assemblies which include axial variation with different ²³⁵U enrichments or 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 sub-assembly types. Some fuel assemblies include short length fuel rods which were axially homogenized to have same active fuel height by changing fuel densities. Figures 2.2–2.8 show the UO₂, PuO₂, gadolinia and water rod configurations. Figure 2.9 illustrates the axial variations for the fuel assembly types 1 and 2, respectively. More detailed information for each type of fuel assembly is provided in Table 2.5, which was used in preparing the Polaris inputs. Figures 2.10–2.12 provide fuel assembly and control rod configurations for the 7 × 7 and 8 × 8 fuel assemblies.

Figure 2.13 illustrates the configurations of control rods, orifices, and TIP instruments. The layouts of fuel assemblies for the QC1 cycles 1–3 are provided in Figures 2.14–2.16 indicating fresh, once-burnt and twice-burnt fuel assemblies. The fresh assembly loading and shuffling patterns with which the PARCS input files were prepared are illustrated in Figures 2.17–2.19. Table 2.6 provides the PARCS axial mesh configuration and sub-assembly type assignment for each type of fuel assembly.

Table 2.2. Specification of the QC1 core.

Parameter	Design data		
	Cycle 1	Cycle 2	Cycle 3
Operating core thermal power (MW _{th})	2511	2511	2511
Core pressure (psia)	1035	1035	1035
Reactor dome pressure (psia)	1020	1020	1020
Core inlet enthalpy (Btu/lb)	521.3	521.3	521.3
(kJ/kg)	1211.7	1211.7	1211.7
Average enthalpy rise across core (Btu/lb)	109.6	109.6	109.6
(kJ/kg)	254.8	254.8	254.8
Total number of fuel assemblies	724	724	724
Total number of control elements	177	177	177
Total number of in-core flux monitors	41	41	41
Heat transfer surface area (m ²)	5829.39	5866.73	6023.92
Total U mass (ton)	140.34	139.71	138.16
Lattice pitch (cm)	30.48	30.48	30.48
Active height (cm)	365.76	365.76	365.76
Fresh fuel assembly types	7×7 UO ₂ type 1a 7×7 UO ₂ type 1b 7×7 UO ₂ type 2a 7×7 UO ₂ type 2b	7×7 UO ₂ type 3 8×8 UO ₂ type 4 7×7 MO ₂ type 5 7×7 MO ₂ type 6	8×8 UO ₂ type 7

Table 2.3. Specification of the QC1 in-core detector, control blade and reflectors.

Item	Material	Density (g/cm ³)	Subitem	Dimension
In-core detector	²³⁵ U		Virtual in gas	
	Argon gas	8.31E-03	Outer radius(cm)	0.32258
	H ₂ O	—	Outer radius(cm)	0.35560
	SS-304	8.03	Outer radius(cm)	0.47625
	H ₂ O (47.87 wt%) A ₂ O ₃ (15.7 wt%) SS-304 (36.43 wt%)	1.3611	Outer radius(cm)	0.81280
	SS-304	8.03	Outer radius(cm)	0.88900
Control blade			Half thickness (cm)	0.39624
			Sheath thickness (cm)	0.14224
			Dead length (cm)	1.98501
			Wing tip curvature (cm)	0.39624
			Width of control section (cm)	10.02792
			# of tubes	21
Control tubes	B4C	1.7642	Outer radius (cm)	0.17526
	SS-304	8.03	Outer radius (cm)	0.23876
Radial reflector	H ₂ O		Coolant (cm)	20.195
	SS-3161		Shroud (cm)	5.08
	H ₂ O		Moderator (cm)	4.725
Top reflector	H ₂ O (24.33023 wt%) He (0.000809 wt%) Zr-2 (32.83966 wt%) Zr-4 (16.67851 wt%) SS-304 (26.15079 wt%)	1.925764	Zone-1 (cm) lower	30.48
	H ₂ O (41.76238 wt%) Zr-2 (26.66206 wt%) SS-304 (31.57556 wt%)	1.545993	Zone-2 (cm) upper	9.52
Bottom reflector	H ₂ O (21.25524 wt%) Zr-2 (10.76185 wt%) SS-304 (66.47959 wt%) INC-718 (0.64007 wt%) B ₄ C (0.86324 wt%)	2.547030	Zone-1 (cm) upper	12.70
	H ₂ O (4.50458 wt%) SS-304 (95.09426 wt%) B ₄ C (0.40116 wt%)	5.480845	Zone-2 (cm) lower	10.0076

Table 2.4. Assembly types for the QC1 cycles 1–3.

Cycle	Assembly type	Power density ^a (W/g)	Axial type	Fuel rods		²³⁵ U wt%	Gd ₂ O ₃ wt%	# of rods	Density (g/cm ³)	Figure
				Type	Material					
1	1A	2511MW/724/ 192.2kg= 18.045	1dx	1	UO ₂	2.47	–	19	10.34	2.2 2.9
				2	UO ₂	1.70	–	3	10.34	
				1s ^a	UO ₂	2.47	–	1	9.48	
				1d	UO ₂	2.47	–	10	9.94	
				2d	UO ₂	1.70	–	11	9.94	
				3d	UO ₂	1.20	–	5	9.94	
			1dy	1	UO ₂	2.47	–	17	10.34	
				2	UO ₂	1.70	–	3	10.34	
				1s ^a	UO ₂	2.47	–	1	9.48	
				1d	UO ₂	2.47	–	10	9.94	
				2d	UO ₂	1.70	–	11	9.94	
				3d	UO ₂	1.20	–	5	9.94	
				4Y	UO ₂ + Gd ₂ O ₃	2.47	3.0	2	10.26	
			1dz	1	UO ₂	2.47	–	16	10.34	
				2	UO ₂	1.70	–	3	10.34	
				1s ^a	UO ₂	2.47	–	1	9.48	
				1d	UO ₂	2.47	–	10	9.94	
				2d	UO ₂	1.70	–	11	9.94	
				3d	UO ₂	1.20	–	5	9.94	
				4Y	UO ₂ + Gd ₂ O ₃	2.47	3.0	2	10.26	
				5Z	UO ₂ + Gd ₂ O ₃	2.47	0.5	1	10.34	
	1B	2511MW/724/ 196.6kg= 17.641	1ux	1	UO ₂	2.47	–	29	10.34	2.2 2.9
				2	UO ₂	1.70	–	14	10.34	
				3	UO ₂	1.20	–	5	10.34	
				1s ^a	UO ₂	2.47	–	1	9.48	
			1uy	1	UO ₂	2.47	–	26	10.34	
				2	UO ₂	1.70	–	14	10.34	
				3	UO ₂	1.20	–	5	10.34	
				1s ^a	UO ₂	2.47	–	1	9.48	
				4Y	UO ₂ + Gd ₂ O ₃	2.47	3.0	2	10.26	
			1uz	1	UO ₂	2.47	–	26	10.34	
				2	UO ₂	1.70	–	14	10.34	
				3	UO ₂	1.20	–	5	10.34	
				1s ^a	UO ₂	2.47	–	1	9.48	
				4Y	UO ₂ + Gd ₂ O ₃	2.47	3.0	2	10.26	
				5Z	UO ₂ + Gd ₂ O ₃	2.47	0.5	1	10.34	
	2A	2511MW/724/ 192.3kg= 18.036	2dx	1	UO ₂	2.47	–	19	10.34	2.3 2.9
				2	UO ₂	1.70	–	3	10.34	
				1s ^a	UO ₂	2.47	–	1	9.48	
				1d	UO ₂	2.47	–	10	9.94	
				2d	UO ₂	1.70	–	11	9.94	
				3d	UO ₂	1.20	–	5	9.94	
			2dy	1	UO ₂	2.47	–	17	10.34	
				2	UO ₂	1.70	–	3	10.34	
				1s ^a	UO ₂	2.47	–	1	9.48	
				1d	UO ₂	2.47	–	10	9.94	
				2d	UO ₂	1.70	–	11	9.94	
				3d	UO ₂	1.20	–	5	9.94	
				4	UO ₂ + Gd ₂ O ₃	2.47	3.0	2	10.26	

^a Power density (W/g) = Thermal power (MW) / number of assemblies / heavy metal mass (kg)

Table 2.4. Assembly types for the QC1 cycles 1–3. (continued)

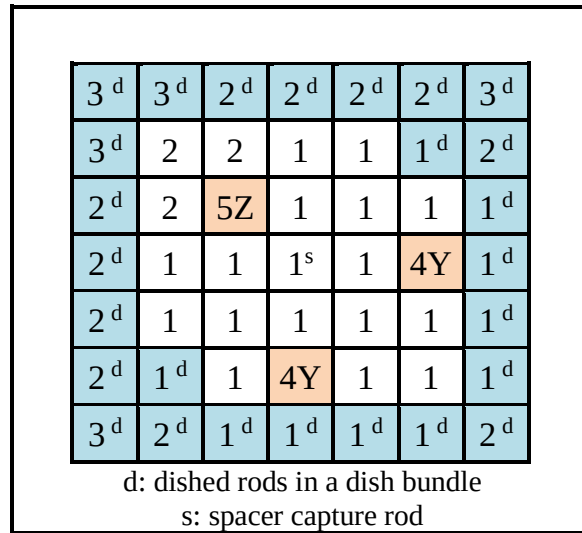
Cycle	Assembly type	Power density (W/g)	Axial type	Fuel rods		²³⁵ U wt%	Gd ₂ O ₃ wt%	# of rods	Density (g/cm ³)	Figure
				Type	Material					
1	2B	2511MW/724/ 196.6kg= 17.641	2ux	1	UO ₂	2.47	–	29	10.34	2.3 2.9
				2	UO ₂	1.70	–	14	10.34	
				3	UO ₂	1.20	–	5	10.34	
				1s ^a	UO ₂	2.47	–	1	9.48	
			2uy	1	UO ₂	2.47	–	27	10.34	
				1s ^a	UO ₂	2.47	–	1	9.48	
				2	UO ₂	1.70	–	14	10.34	
				3	UO ₂	1.20	–	5	10.34	
				4	UO ₂ + Gd ₂ O ₃	2.47	3.0	2	10.26	
2	3	2511MW/724/ 187.2kg= 18.527	3uy	1	UO ₂	2.56	–	28	10.32	2.4
				1s ^a	UO ₂	2.56	–	1	9.32	
				2	UO ₂	1.94	–	10	10.32	
				3	UO ₂	1.59	–	6	10.32	
				4	UO ₂	1.33	–	1	10.32	
	4	2511MW/724/ 183.5kg= 18.900	4uy	5	UO ₂ + Gd ₂ O ₃	2.56	2.50	3	10.22	2.5
				1	UO ₂	2.73	–	40	10.32	
				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 ₂ O ₃	2.73	1.50	4	10.25	
				WS	H ₂ O	–	–	1	–	
	5	2511MW/724/ 185.225kg= 18.724	5uy	1	UO ₂	2.56	–	8	10.32	2.6
				2	UO ₂	1.94	–	9	10.32	
				3	UO ₂	1.69	–	6	10.32	
				4	UO ₂	1.33	–	1	10.32	
				5	UO ₂	3.30	–	10	10.32	
				6	UO ₂ + Gd ₂ O ₃	2.56	3.0	5	10.19	solid
				P ₁	PuO ₂	2.14 Pu wt%	–	2	9.99	
				P ₂	PuO ₂	3.52 Pu wt%	–	3	9.99	
				P ₃	PuO ₂	2.34 Pu wt%	–	2	9.04	
				P ₄	PuO ₂	3.62 Pu wt%	–	3	9.04	
									hollow	
	6	2511MW/724/ 185.921kg= 18.654	6uy	1	UO ₂	2.56	–	21	10.32	2.7
				1s ^a	UO ₂	2.56	–	1	9.32	
				2	UO ₂	1.94	–	9	10.32	
				3	UO ₂	1.69	–	6	10.32	
				4	UO ₂	1.33	–	1	10.32	
				5	UO ₂ + Gd ₂ O ₃	2.56	2.5	3	10.21	solid
				P ₁	PuO ₂	2.14 Pu wt%	–	2	9.99	
				P ₂	PuO ₂	3.52 Pu wt%	–	2	9.99	
				P ₃	PuO ₂	2.34 Pu wt%	–	2	9.04	
				P ₄	PuO ₂	3.62 Pu wt%	–	2	9.04	
									hollow	
3	7	2511MW/724/ 183.5kg= 18.900	7uy	1	UO ₂	2.87	–	40	10.32	2.8
				2	UO ₂	2.14	–	14	10.32	
				3	UO ₂	1.87	–	4	10.32	
				4	UO ₂	1.45	–	1	10.32	
				5	UO ₂ + Gd ₂ O ₃	2.87	1.5	4	10.25	
				WS	H ₂ O	–	–	1	–	

^a Density of short length fuel rod was axially homogenized.

Table 2.5. Assembly geometry specification for the QC1 cycles 1–3.

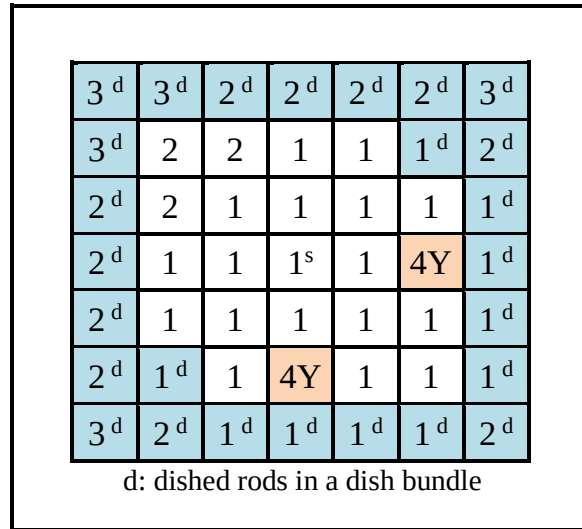
Assembly types			1A	1B	2A	2B	3	4	5	6	7
Array		Unit	7x7	7x7	7x7	7x7	7x7	8x8	7x7	7x7	8x8
Narrow gap		cm	0.475	0.475	0.475	0.475	0.475	0.475	0.475	0.475	0.475
Wide gap		cm	0.9525	0.9525	0.9525	0.9525	0.9525	0.9525	0.9525	0.9525	0.9525
Channel	Material		Zr-4	Zr-4	Zr-4	Zr-4	Zr-4	Zr-4	Zr-4	Zr-4	Zr-4
	Box thickness	cm	0.2032	0.2032	0.2032	0.2032	0.2032	0.2032	0.2032	0.2032	0.2032
	Corner inner radius	cm	0.9652	0.9652	0.9652	0.9652	0.9652	0.9652	0.9652	0.9652	0.9652
	Inner half width	cm	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7
Pins	UO ₂ fuel rods		46	46	47	47	46	59	34	38	59
	Gadolinia rods		3	3	2	2	3	4	5	3	4
	Water rods		0	0	0	0	0	1	0	0	1
	PuO ₂ fuel rods		0	0	0	0	0	0	10	8	0
	Total		49	49	49	49	49	64	49	49	64
	Pitch	cm	1.87452	1.87452	1.87452	1.87452	1.87452	1.62560	1.87452	1.87452	1.62560
Fuel UO ₂	Outer radius	cm	0.61976	0.61976	0.61976	0.61976	0.60579	0.52832	0.60579	0.60579	0.52832
Fuel PuO ₂	Inner radius	cm	–	–	–	–	–	–	0.19050	0.19050	–
	Outer radius	cm	–	–	–	–	–	–	0.61849	0.61849	–
Gadolinia	Outer radius	cm	0.61849	0.61849	0.61849	0.61849	0.60579	0.52832	0.60579	0.60579	0.52832
Clad	Material		Zr-2	Zr-2	Zr-2	Zr-2	Zr-2	Zr-2	Zr-2	Zr-2	Zr-2
	Density	g/cm ³	6.84699	6.84699	6.84699	6.84699	6.84699	6.87213	6.84699	6.84699	6.87213
	Mixture	Zr-2	wt%	95.8085	95.8085	95.8085	95.8085	95.8085	95.458	95.8085	95.458
		Inc718		0.6691	0.6691	0.6691	0.6691	0.6691	0.6489	0.6691	0.6489
		Zr-4		95.8085	95.8085	95.8085	95.8085	95.8085	3.8931	95.8085	3.8931
	Inner radius	cm	0.63373	0.63373	0.63373	0.63373	0.62103	0.53975	0.62103	0.62103	0.53975
	Outer radius	cm	0.71501	0.71501	0.71501	0.71501	0.71501	0.62611	0.71501	0.71501	0.62611
Water rod	Inner radius	cm	–	–	–	–	–	0.53975	–	–	0.53975
	Outer radius	cm	–	–	–	–	–	0.62611	–	–	0.62611
PD ^a	Ratio		1.5123	1.5123	1.5123	1.5123	1.5472	1.5385	1.5472	1.5472	1.5385
Volume	Fuel	cm ²	59.1132	59.1132	59.1181	59.1181	56.4924	55.2439	55.8408	55.9711	55.2439
	Gas	cm ²	18.5528	18.5528	18.8923	18.8923	21.0234	21.0783	15.8014	17.4769	21.0783
	Clad	cm ²	153.9380	153.9380	153.9380	153.9380	153.9380	201.0619	153.9380	153.9380	201.0619
	Water rods	cm ²	0	0	0	0	0	0.9152	0	0	0.9152
Clad	Perimeter	cm	220.1345	220.1345	220.1345	220.1345	220.1345	251.7738	175.2091	184.1942	251.7738

^a PD: ratio of pin pitch to pin diameter



Rod type	²³⁵ U wt%	Gd ₂ O ₃ wt%	# of rods
1	2.47	0	27
2	1.70	0	14
3	1.20	0	5
4Y	2.47	3.0	2
5Z	2.47	0.5	1

Figure 2.2. Fuel assembly type 1.



Rod type	²³⁵ U wt%	Gd ₂ O ₃ wt%	# of rods
1	2.47	0	28
2	1.70	0	14
3	1.20	0	5
4Y	2.47	3.0	2

Figure 2.3. Fuel assembly type 2.

4	3	3	2	2	2	3
3	2	1	1	1	1	2
3	1	5	1	1	1	1
2	1	1	1	1	5	1
2	1	1	1	1	1	1
2	1	1	5	1	1	1
3	2	1	1	1	1	2

Rod type	²³⁵ U wt%	Gd ₂ O ₃ wt%	# of rods
1	2.56	0	29
2	1.94	0	10
3	1.59	0	6
4	1.33	0	1
5	2.56	2.50	3

Figure 2.4. Fuel assembly type 3.

4	3	2	2	2	2	2	3
3	2	1	1	1	1	1	2
2	1	5	1	1	1	5	1
2	1	1	1	1	1	1	1
2	1	1	1	WS	1	1	1
2	1	1	1	1	1	1	1
2	1	5	1	1	1	5	1
3	2	1	1	1	1	1	2

Rod type	²³⁵ U wt%	Gd ₂ O 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	1.5	4	
WS	—	0	1	Water rod

Figure 2.5. Fuel assembly type 4.

4	3	3	2	2	2	3
3	2	1	5	5	1	2
3	1	6	P ₃	P ₁	6	1
2	5	P ₃	1	P ₄	P ₄	5
2	5	P ₁	P ₂	6	P ₂	5
2	1	6	P ₄	P ₂	6	5
3	2	1	5	5	5	1

Rod type	²³⁵ U wt%	Gd ₂ O ₃ wt%	# of rods	Remark
1	2.56	0	8	
2	1.94	0	9	
3	1.69	0	6	
4	1.33	0	1	
5	3.30	0	10	
6	2.56	3.0	5	
P ₁	2.14 Pu wt%	0	2	solid
P ₂	3.52 Pu wt%	0	3	solid
P ₃	2.34 Pu wt%	0	2	hollow
P ₄	3.62 Pu wt%	0	3	hollow

Figure 2.6. Fuel assembly type 5.

4	3	3	2	2	2	3
3	2	1	1	1	1	2
3	1	5	1	1	1	1
2	1	1	1	1	5	P ₁
2	1	1	P ₄	P ₂	1	1
2	1	1	5	P ₄	P ₂	1
3	2	1	P ₁	1	P ₃	P ₃

Rod type	²³⁵ U wt%	Gd ₂ O ₃ wt%	# of rods	Remark
1	2.56	0	22	
2	1.94	0	9	
3	1.69	0	6	
4	1.33	0	1	
5	2.56	2.5	3	
P ₁	2.14 Pu wt%	0	2	solid
P ₂	3.52 Pu wt%	0	2	solid
P ₃	2.34 Pu wt%	0	2	hollow
P ₄	3.62 Pu wt%	0	2	hollow

Figure 2.7. Fuel assembly type 6.

4	3	2	2	2	2	2	3
3	2	1	1	1	1	1	2
2	1	5	1	1	1	5	1
2	1	1	1	1	1	1	1
2	1	1	1	WS	1	1	1
2	1	1	1	1	1	1	1
2	1	5	1	1	1	5	1
3	2	1	1	1	1	1	2

Rod type	²³⁵ U wt%	Gd ₂ O ₃ wt%	# of rods	Remark
1	2.87	0	40	
2	2.14	0	14	
3	1.87	0	4	
4	1.45	0	1	
5	2.87	1.5	4	
WS	—	0	1	Water rod

Figure 2.8. Fuel assembly type 7.

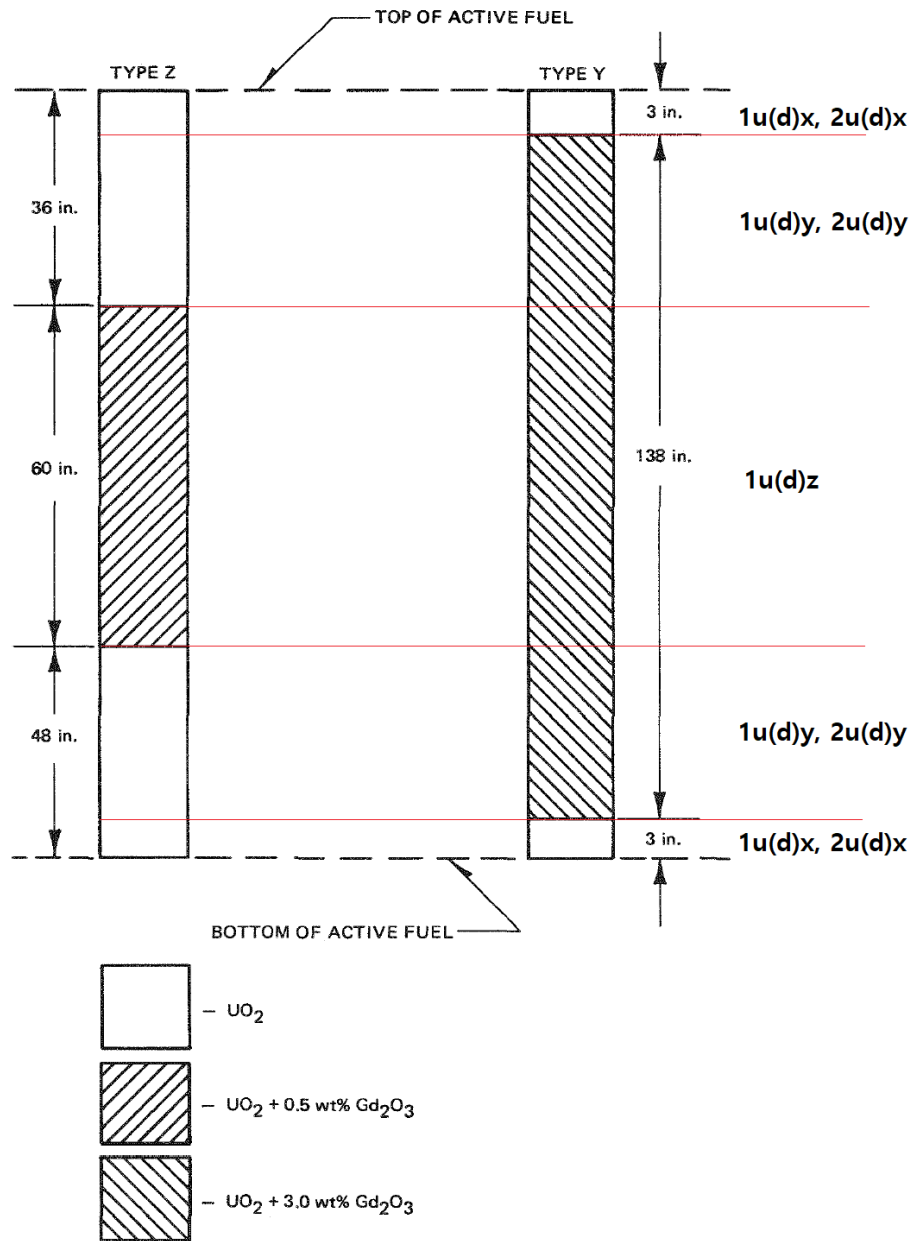


Figure 2.9. Axial variation of Types 1 and 2 fuel rods [1].

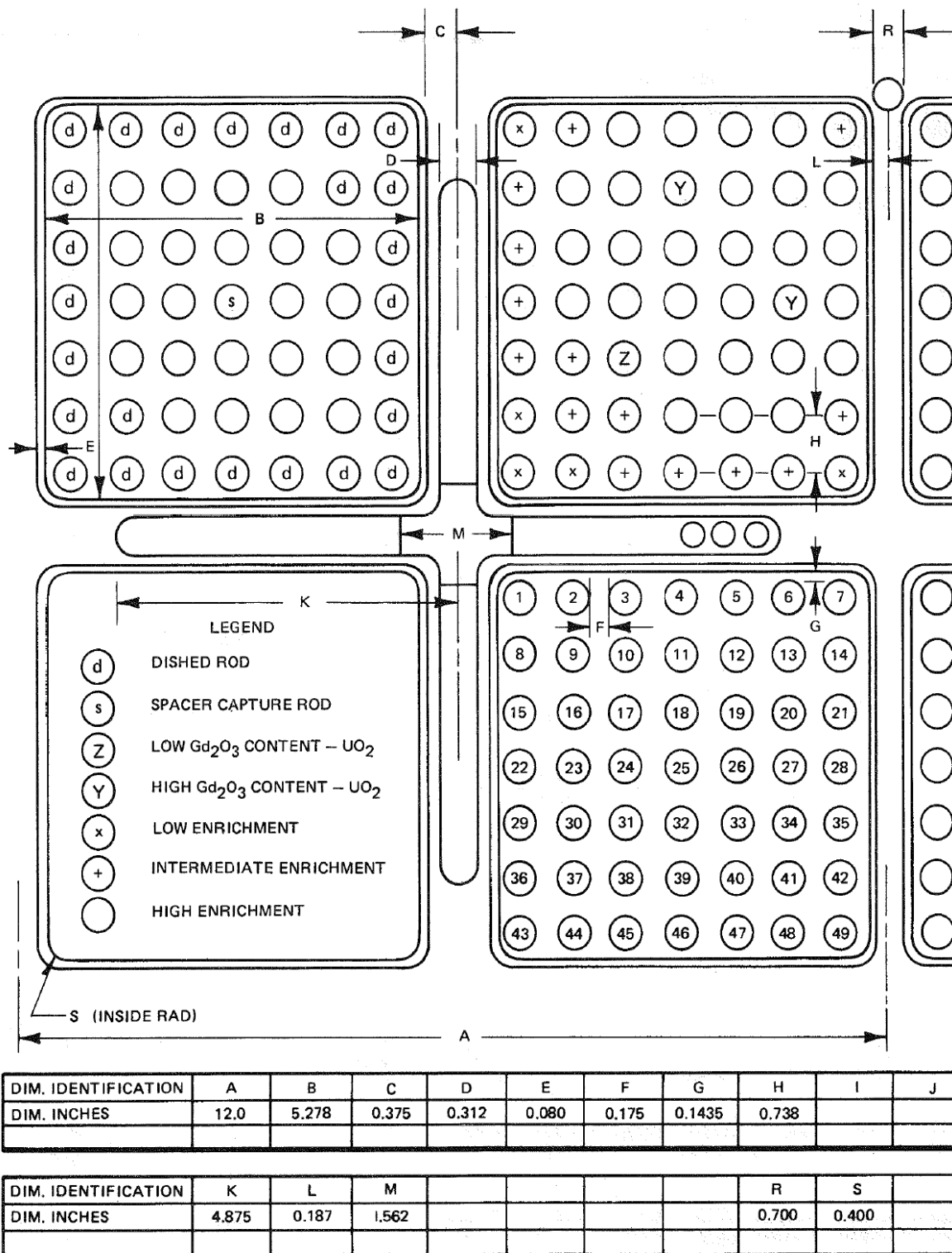


Figure 2.10. Assembly and control rod configuration for the type 1 7x7 assembly [1].

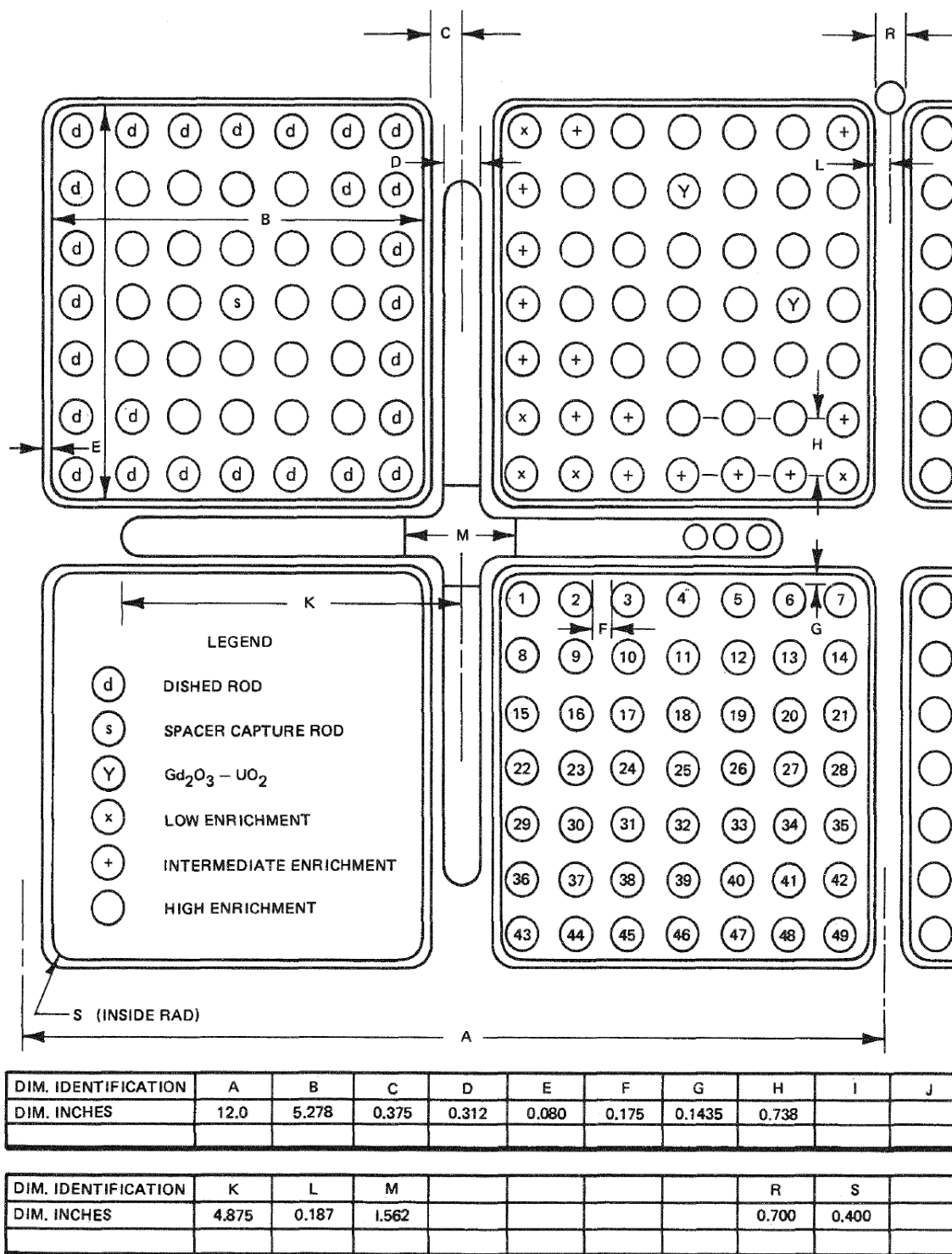
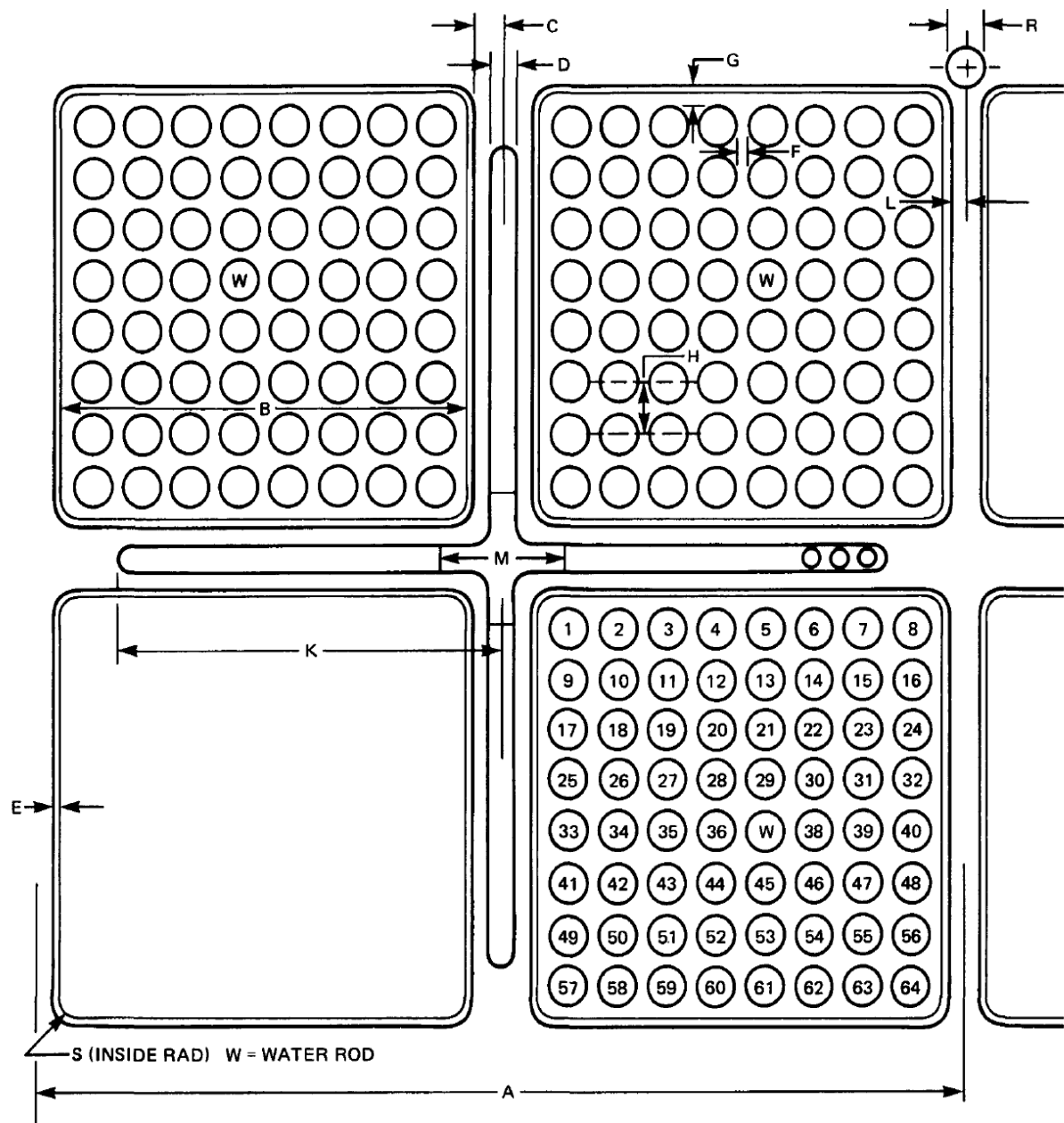


Figure 2.11. Assembly and control rod configuration for the type 2 7×7 assembly [1].



DIM IDENTIFICATION	A	B	C	D	E	F	G	H	I	J
DIM INCHES	12.0	5.278	0.375		0.080	0.147	0.1525	0.640		

DIM IDENTIFICATION	K	L	M					R	S	
DIM INCHES		0.187							0.400	

Figure 2.12. Assembly and control rod configuration for the 8×8 assembly [1].

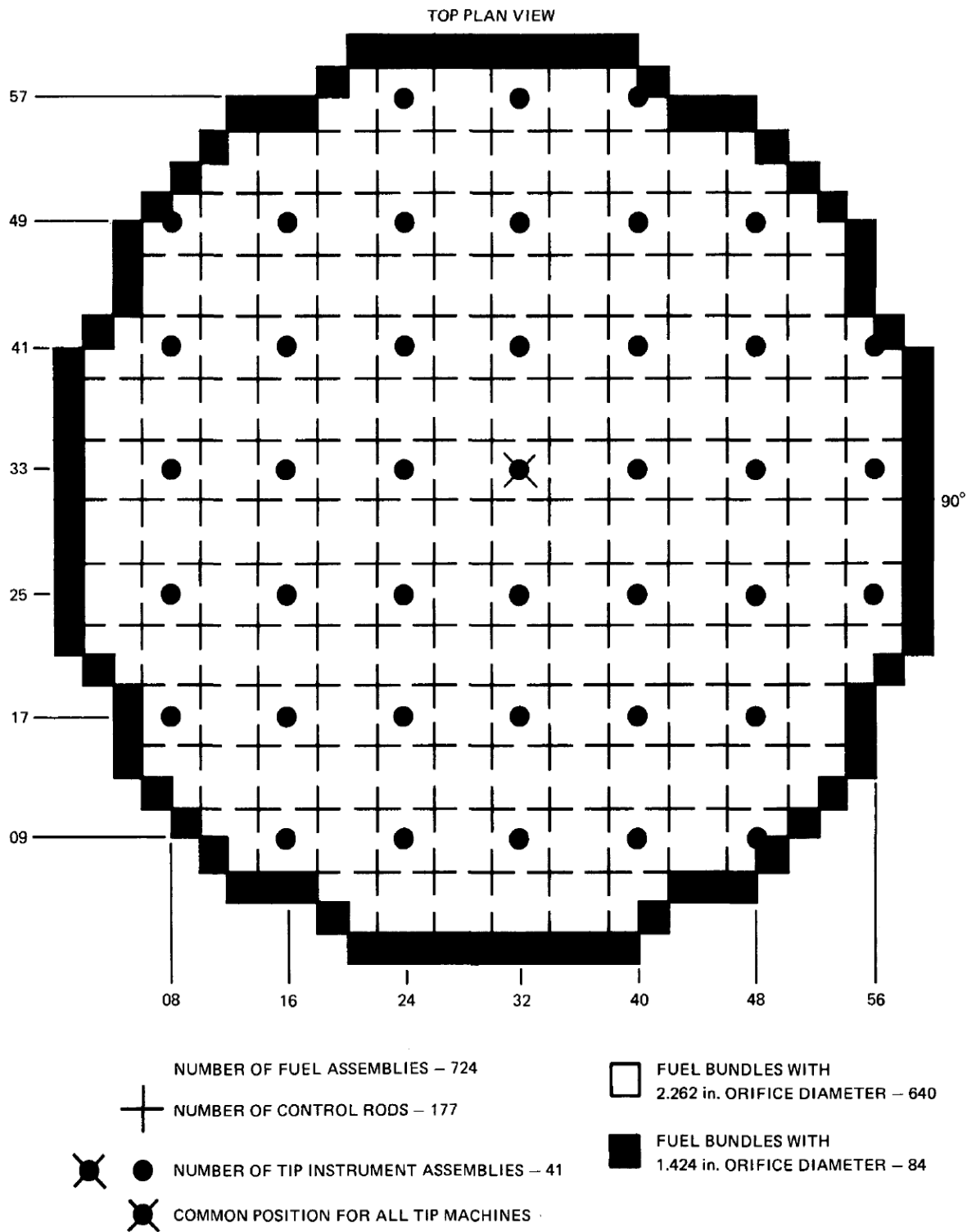
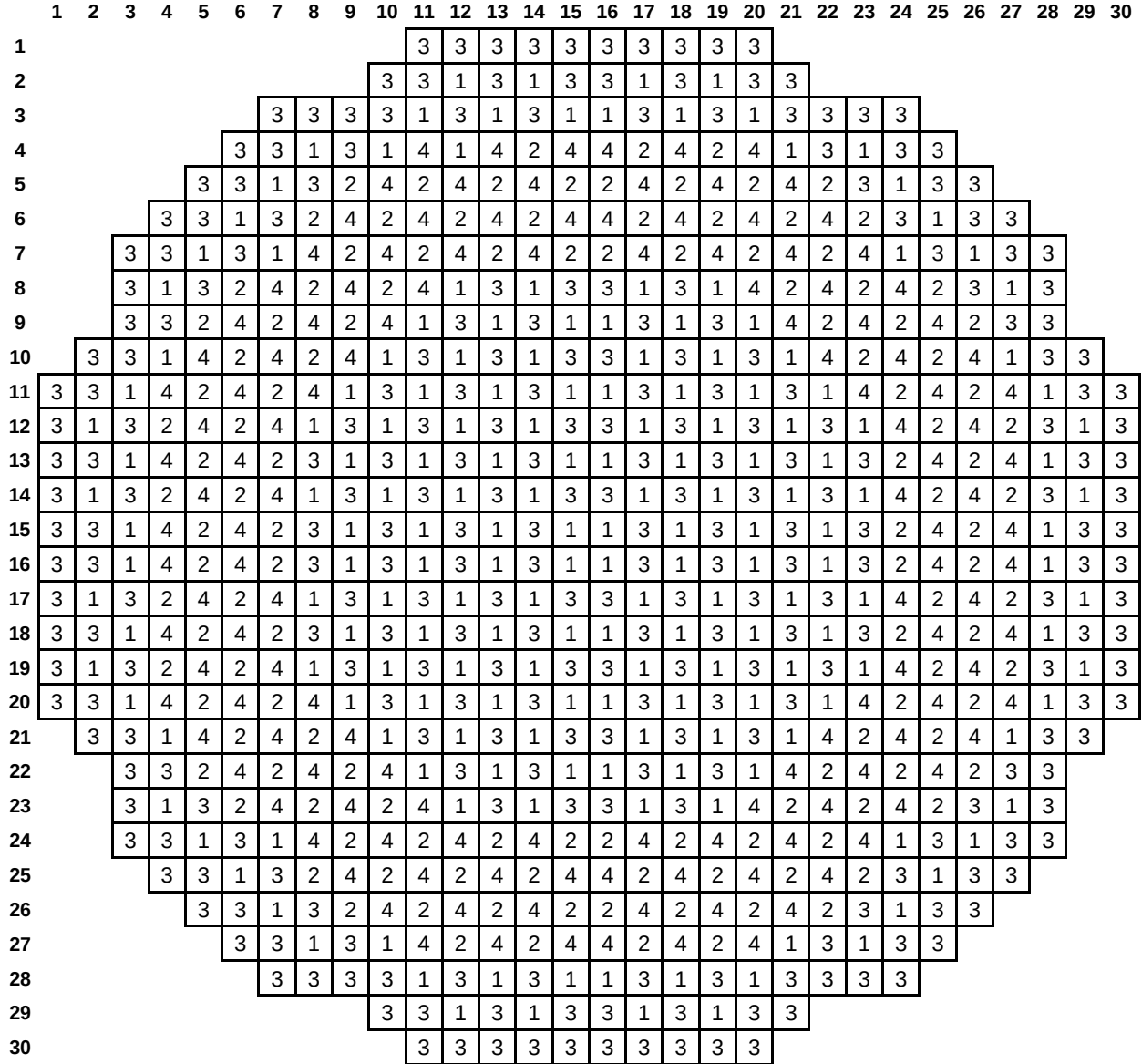


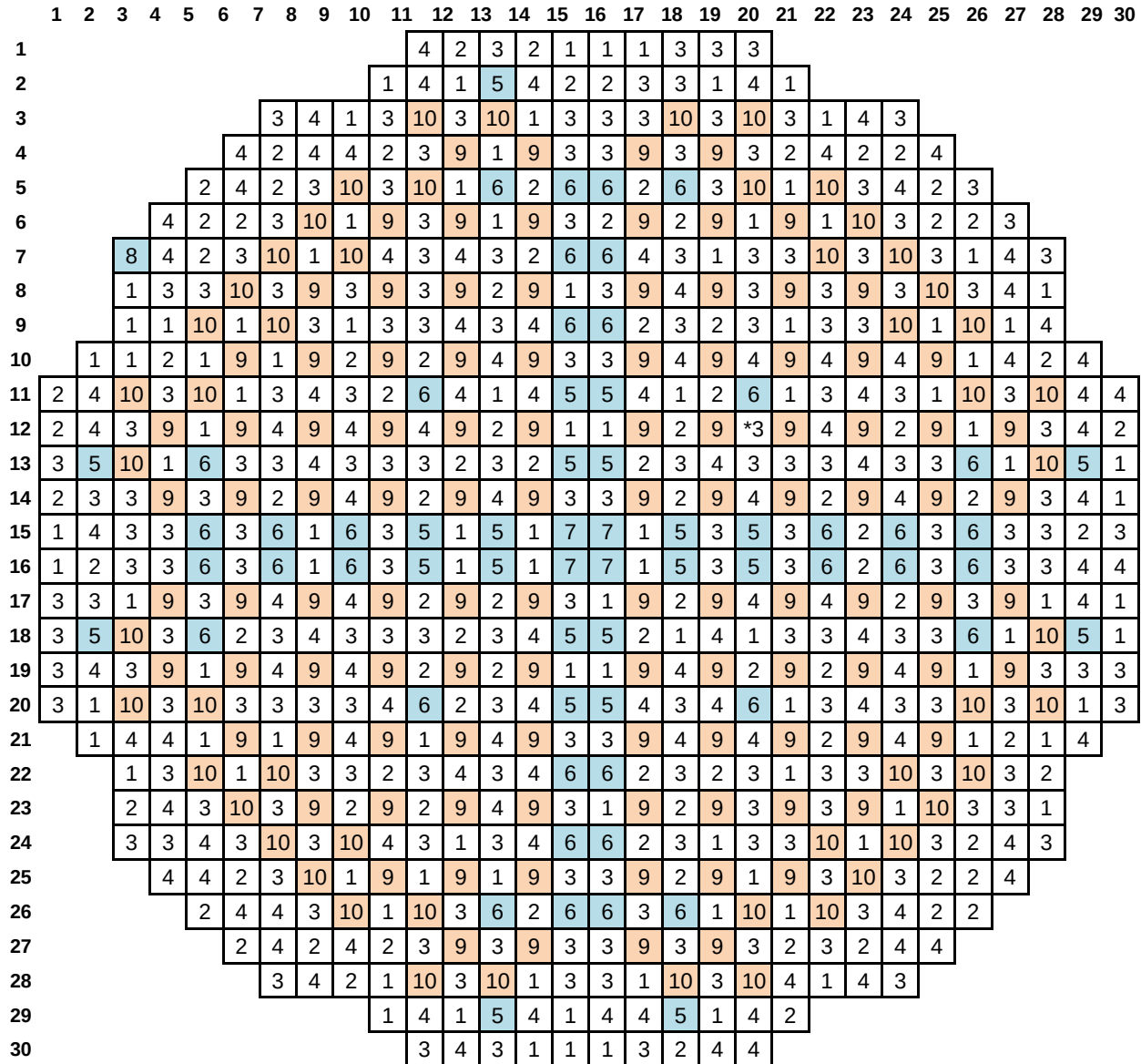
Figure 2.13. QC1 control rod, TIP, and orifice positions [1] (Cycles 1, 2 and 3).



No	Type	# of assemblies	Description
1	1A	185	7×7 2.12 wt% ²³⁵ U + 3 Gd ₂ O ₃ undished ^a
2	1B	127	7×7 2.12 wt% ²³⁵ U + 3 Gd ₂ O ₃ dished ^a
3	2A	276	7×7 2.12 wt% ²³⁵ U + 2 Gd ₂ O ₃ undished
4	2B	136	7×7 2.12 wt% ²³⁵ U + 2 Gd ₂ O ₃ dished
	Total	724	

^a ‘dished’ refers to fuel rod with concave end plugs designed to better handle thermal expansion.
‘undished’ refers to those with flat end plugs.

Figure 2.14. Layout of fuel assemblies in the QC1 cycle 1.



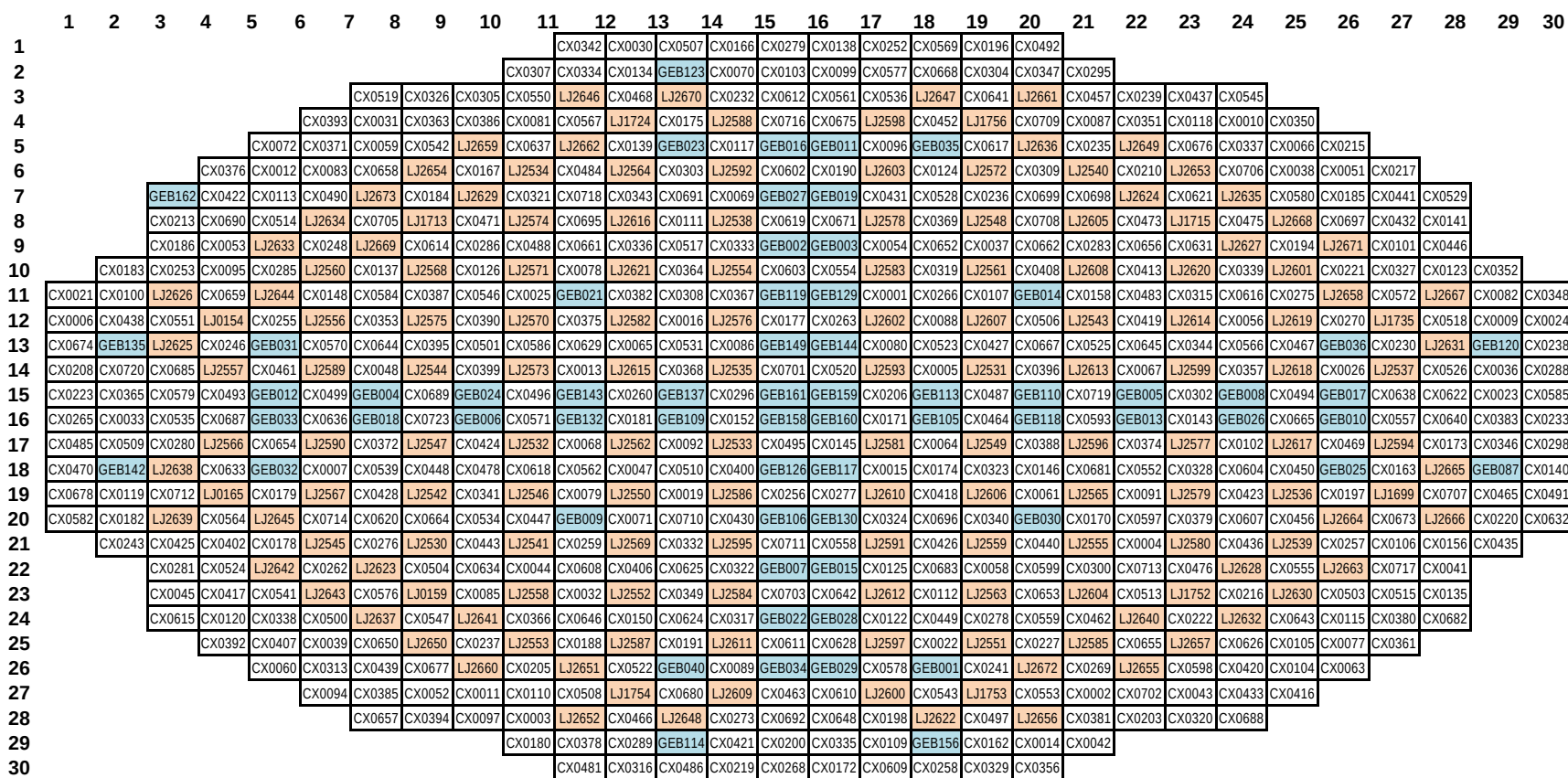
No	Type	# of assemblies	Description
1	1A	109	7×7 2.12 wt% ²³⁵ U + 3 Gd ₂ O ₃ undished
2	1B	98	7×7 2.12 wt% ²³⁵ U + 3 Gd ₂ O ₃ dished
3	2A	196	7×7 2.12 wt% ²³⁵ U + 2 Gd ₂ O ₃ undished
4	2B	101	7×7 2.12 wt% ²³⁵ U + 2 Gd ₂ O ₃ dished
5	3	23	7×7 2.30 wt% ²³⁵ U + 3 Gd ₂ O ₃ undished
6	4	36	8×8 2.50 wt% ²³⁵ U + 4 Gd ₂ O ₃ undished
7	5	4	7×7 2.71 wt% MO ₂ + 5 Gd ₂ O ₃ undished
8	6	1	7×7 2.51 wt% MO ₂ + 3 Gd ₂ O ₃ undished
9	4	92	8×8 2.50 wt% ²³⁵ U + 4 Gd ₂ O ₃ undished
10	7	52	8×8 2.62 wt% ²³⁵ U + 4 Gd ₂ O ₃ undished
	Total	724	

Figure 2.16. Layout of fuel assemblies in the QC1 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	27	28	29	30
1												CX0657	CX0691	CX0650	CX0551	CX0466	CX0518	CX0706	CX0542	CX0646	CX0615									
2																														
3																														
4																														
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29																														
30																														

	# of assemblies	Description
Type 1A	CX0128 – CX0312	7×7 2.12 wt% ²³⁵ U + 3 Gd ₂ O ₃ undished
Type 1B	CX0001 – CX0127	7×7 2.12 wt% ²³⁵ U + 3 Gd ₂ O ₃ dished
Type 2A	CX0449 – CX0724	7×7 2.12 wt% ²³⁵ U + 2 Gd ₂ O ₃ undished
Type 2B	CX0313 – CX0448	7×7 2.12 wt% ²³⁵ U + 2 Gd ₂ O ₃ dished

Figure 2.17. Fresh assembly loading pattern in the QC1 cycle 1.



	# of assemblies	Description
Type 1A	CX0128 – CX0312	7×7 2.12 wt% ²³⁵ U + 3 Gd ₂ O ₃ undished
Type 1B	CX0001 – CX0127	7×7 2.12 wt% ²³⁵ U + 3 Gd ₂ O ₃ dished
Type 2A	CX0449 – CX0724	7×7 2.12 wt% ²³⁵ U + 2 Gd ₂ O ₃ undished
Type 2B	CX0313 – CX0448	7×7 2.12 wt% ²³⁵ U + 2 Gd ₂ O ₃ dished
3	GEB087 – GEB157	7×7 2.30 wt% ²³⁵ U + 3 Gd ₂ O ₃ undished
4	GEB001 – GEB040	8×8 2.50 wt% ²³⁵ U + 4 Gd ₂ O ₃ undished
5,6	GEB158 – GEB161, GEB162	7×7 2.71/2.51 wt% MO ₂ + 5/3 Gd ₂ O ₃ undished
7	LJ2622 – LJ2673	8×8 2.62 wt% ²³⁵ U + 4 Gd ₂ O ₃ undished
4	LJ2530 – LJ2621	8×8 2.50 wt% ²³⁵ U + 4 Gd ₂ O ₃ undished

Figure 2.19. Fresh assembly loading and shuffling patterns in the QC1 cycle 3.

Table 2.6. QC1 core axial configurations.

No	PARCS mesh Height (cm)	Fuel (cm)	Cross section assembly types								
			1A	1B	2A	2B	3	4	5	6	7
28	15.24		R _{TOP} ^a	R _{TOP}	R _{TOP}	R _{TOP}	R _{TOP}	R _{TOP}	R _{TOP}	R _{TOP}	R _{TOP}
27	7.62	7.62	1dx	1ux	2dx	2ux	3uy	4uy	5uy	6uy	7uy
26	7.62	7.62	1dy	1uy	2dy	2uy	3uy	4uy	5uy	6uy	7uy
25	15.24	15.24	1dy	1uy	2dy	2uy	3uy	4uy	5uy	6uy	7uy
24	15.24	15.24	1dy	1uy	2dy	2uy	3uy	4uy	5uy	6uy	7uy
23	15.24	15.24	1dy	1uy	2dy	2uy	3uy	4uy	5uy	6uy	7uy
22	15.24	15.24	1dy	1uy	2dy	2uy	3uy	4uy	5uy	6uy	7uy
21	15.24	15.24	1dy	1uy	2dy	2uy	3uy	4uy	5uy	6uy	7uy
20	15.24	15.24	1dz	1uz	2dy	2uy	3uy	4uy	5uy	6uy	7uy
19	15.24	15.24	1dz	1uz	2dy	2uy	3uy	4uy	5uy	6uy	7uy
18	15.24	15.24	1dz	1uz	2dy	2uy	3uy	4uy	5uy	6uy	7uy
17	15.24	15.24	1dz	1uz	2dy	2uy	3uy	4uy	5uy	6uy	7uy
16	15.24	15.24	1dz	1uz	2dy	2uy	3uy	4uy	5uy	6uy	7uy
15	15.24	15.24	1dz	1uz	2dy	2uy	3uy	4uy	5uy	6uy	7uy
14	15.24	15.24	1dz	1uz	2dy	2uy	3uy	4uy	5uy	6uy	7uy
13	15.24	15.24	1dz	1uz	2dy	2uy	3uy	4uy	5uy	6uy	7uy
12	15.24	15.24	1dz	1uz	2dy	2uy	3uy	4uy	5uy	6uy	7uy
11	15.24	15.24	1dz	1uz	2dy	2uy	3uy	4uy	5uy	6uy	7uy
10	15.24	15.24	1dy	1uy	2dy	2uy	3uy	4uy	5uy	6uy	7uy
9	15.24	15.24	1dy	1uy	2dy	2uy	3uy	4uy	5uy	6uy	7uy
8	15.24	15.24	1dy	1uy	2dy	2uy	3uy	4uy	5uy	6uy	7uy
7	15.24	15.24	1dy	1uy	2dy	2uy	3uy	4uy	5uy	6uy	7uy
6	15.24	15.24	1dy	1uy	2dy	2uy	3uy	4uy	5uy	6uy	7uy
5	15.24	15.24	1dy	1uy	2dy	2uy	3uy	4uy	5uy	6uy	7uy
4	15.24	15.24	1dy	1uy	2dy	2uy	3uy	4uy	5uy	6uy	7uy
3	7.62	7.62	1dy	1uy	2dy	2uy	3uy	4uy	5uy	6uy	7uy
2	7.62	7.62	1dx	1ux	2dx	2ux	3uy	4uy	5uy	6uy	7uy
1	15.24		R _{BOT} ^b	R _{BOT}	R _{BOT}	R _{BOT}	R _{BOT}	R _{BOT}	R _{BOT}	R _{BOT}	R _{BOT}

^a Top reflector

^b Bottom reflector

2.2.2 Measured Data

The measured data used in the current study were obtained from the publicly available QC1 cycles 1–3 operating history. Figures 2.21–2.23 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.

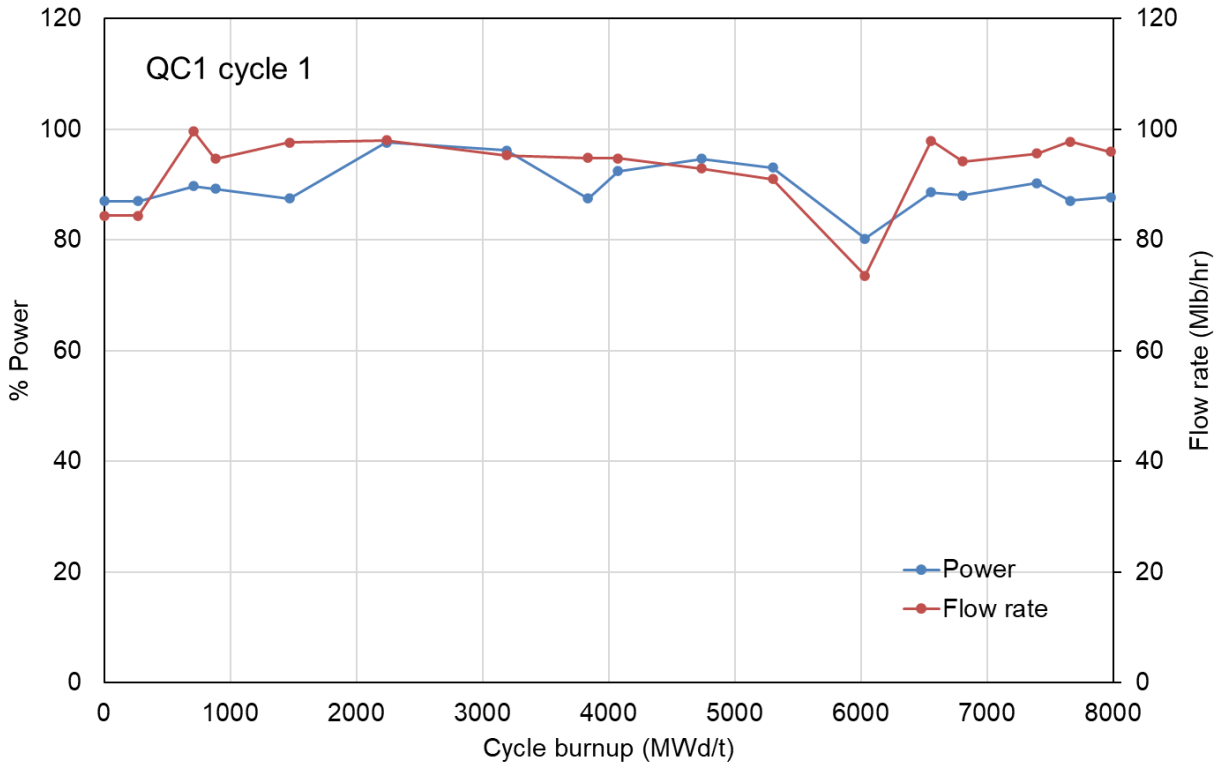


Figure 2.20. Power and flow rate history for the QC1 cycle 1.

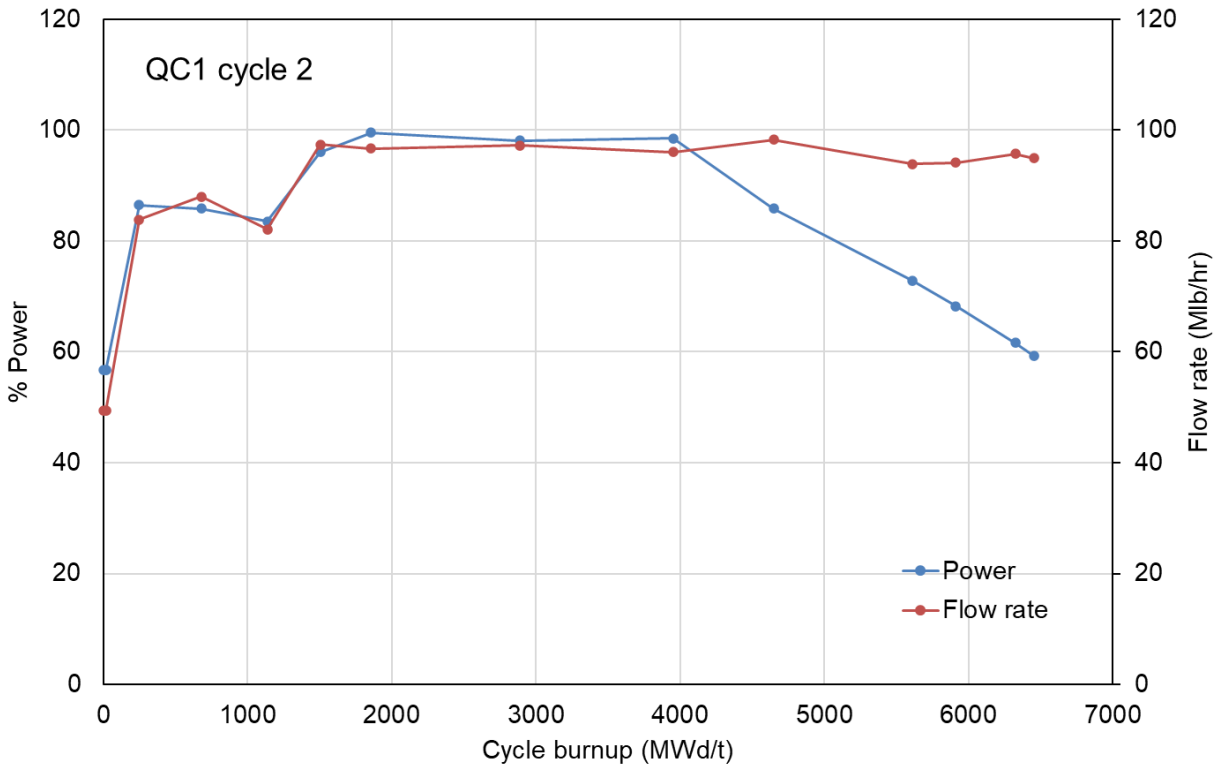


Figure 2.21. Power and flow rate history for the QC1 cycle 2.

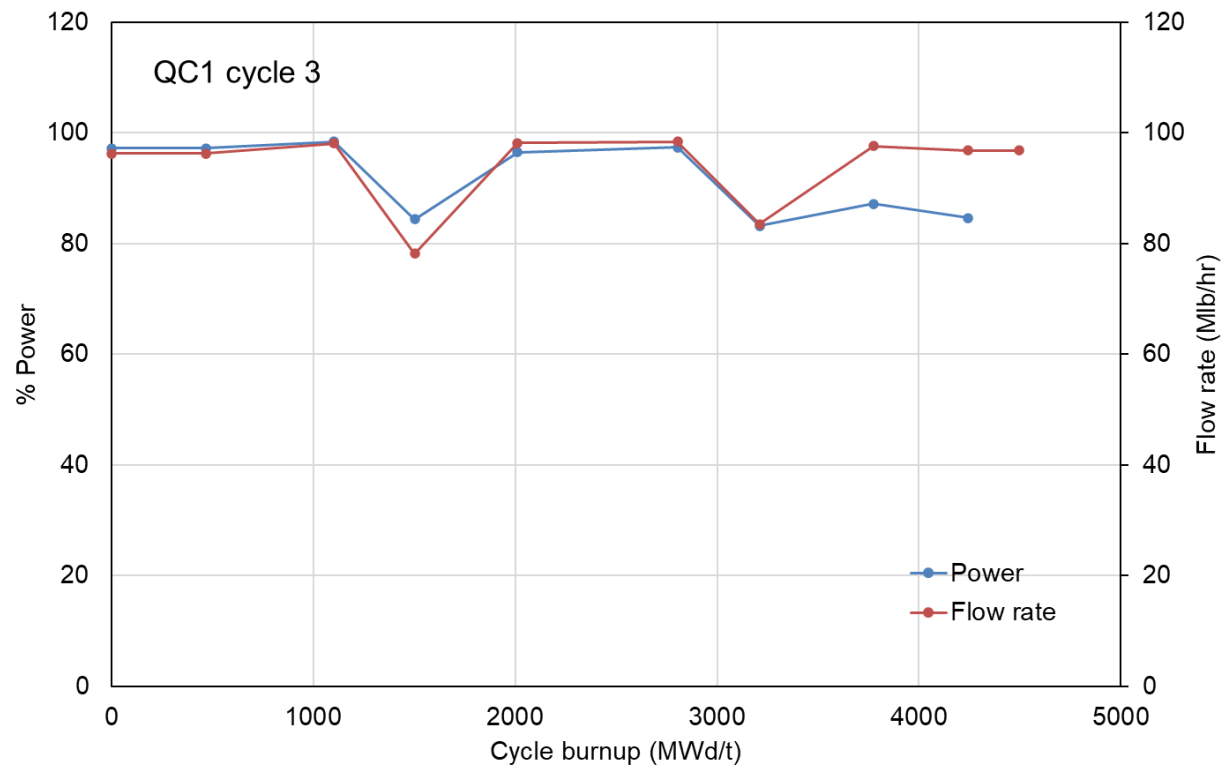


Figure 2.22. Power and flow rate history for the QC1 cycle 3.

Table 2.7. QC1 operating history.

Cycle	Dataset	Exposure (MWd/t)		Power (MW)	Dome Press (MPa)	Flow (Mlb/hr)	Inlet Subcool		Flow (%)	Total (kg/s) [1]	Bypass (kg/s) [2]	[1-2]
		Core	Cycle				(Btu/lb)	(kJ/kg)				
1	BOC ^a 1	0.0	0.0	2185	7.150	84.4	18.9	43.886	89.662	10632.96	956.32	9676.64
	1	272.3	272.3	2185	7.150	84.4	18.9	43.886	89.662	10632.96	956.32	9676.64
	2	712.1	712.1	2253	7.088	99.6	21.2	49.232	105.833	12550.65	1213.53	11337.12
	3	881.8	881.8	2240	7.067	94.7	22.0	51.091	100.563	11925.70	1129.17	10796.53
	4	1470.5	1470.5	2197	7.164	97.6	21.2	49.255	103.676	12294.87	1178.94	11115.93
	5	2238.8	2238.8	2450	7.205	98.0	23.3	54.253	104.091	12344.01	1185.58	11158.43
	6	3190.1	3190.1	2414	7.164	95.3	23.5	54.671	101.254	12007.60	1140.20	10867.40
	7	3836.0	3836.0	2197	7.040	94.8	21.8	50.626	100.765	11949.64	1132.39	10817.25
	8	4074.1	4074.1	2320	7.115	94.7	22.7	52.649	100.637	11934.52	1130.36	10804.16
	9	4736.6	4736.6	2377	7.108	92.9	23.6	54.810	98.736	11708.98	1100.04	10608.94
	10	5301.0	5301.0	2337	7.033	91.0	23.4	54.438	96.632	11459.51	1066.58	10392.93
	11	6030.7	6030.7	2014	6.964	73.5	25.1	58.437	78.092	9260.84	775.27	8485.57
	12	6557.6	6557.6	2226	7.102	97.9	21.2	49.325	104.006	12333.93	1184.22	11149.71
	13	6806.8	6806.8	2210	7.067	94.1	21.8	50.696	100.021	11861.44	1120.53	10740.91
	14	7396.5	7396.5	2267	7.088	95.6	22.2	51.626	101.594	12047.92	1145.63	10902.29
	15	7658.9	7658.9	2187	7.005	97.7	21.1	48.999	103.836	12313.77	1181.49	11132.28
	16	7979.6	7979.6	2203	7.074	95.9	21.5	50.069	101.934	12088.24	1151.06	10937.18
2	BOC 2	7286.3	0.0	1423	6.764	49.3	27.7	64.364	52.412	6215.48	460.17	5755.31
	17	7302.8	16.5	1423	6.764	49.3	27.7	64.364	52.412	6215.48	460.17	5755.31
	18	7532.1	245.8	2171	7.060	83.8	24.0	55.833	89.067	10562.40	1071.51	9490.89
	19	7964.2	677.9	2156	7.129	88.0	24.0	55.740	93.508	11089.07	1148.02	9941.05
	20	8422.8	1136.5	2097	6.957	82.1	23.7	55.182	87.197	10340.65	1039.45	9301.20
	21	8788.7	1502.4	2412	7.060	97.4	23.0	53.509	103.506	12274.71	1322.20	10952.51
	22	9141.5	1855.2	2500	7.233	96.7	24.2	56.252	102.720	12181.48	1308.40	10873.08
	23	10173.2	2887.0	2463	7.260	97.2	23.7	55.182	103.304	12250.77	1318.65	10932.12
	24	11238.1	3951.8	2474	6.998	96.0	23.0	53.439	102.019	12098.32	1296.11	10802.21
	25	11934.7	4648.4	2156	6.943	98.2	20.6	47.930	104.377	12378.03	1337.50	11040.53
	26	12895.9	5609.7	1829	6.633	93.9	18.3	42.491	99.734	11827.42	1256.17	10571.25
	27	13198.0	5911.7	1713	6.619	94.1	17.1	39.794	99.979	11856.40	1260.44	10595.96
	28	13611.3	6325.1	1547	6.564	95.7	15.6	36.261	101.679	12058.00	1290.16	10767.84
	29	13741.4	6455.1	1487	6.571	94.9	15.2	35.332	100.829	11957.20	1275.29	10681.91
3	BOC 3	10306.6	0.0	2441	6.881	96.3	21.0	48.813	102.316	12133.60	1502.23	10631.37
	30	10774.0	467.4	2441	6.881	96.3	21.0	48.813	102.316	12133.60	1502.23	10631.37
	31	11408.9	1102.3	2472	6.853	98.1	20.7	48.116	104.229	12360.39	1538.39	10822.00
	32	11809.1	1502.4	2119	6.964	78.2	23.7	55.089	83.085	9853.03	1142.13	8710.90
	33	12318.3	2011.7	2423	6.998	98.2	20.7	48.116	104.335	12372.99	1540.40	10832.59
	34	13112.0	2805.4	2445	7.005	98.4	20.9	48.581	104.547	12398.19	1544.43	10853.76
	35	13517.6	3211.0	2090	6.881	83.5	21.7	50.440	88.717	10520.82	1246.91	9273.91
	36	14082.0	3775.4	2190	6.909	97.6	19.1	44.397	103.697	12297.39	1528.34	10769.05
	37	14550.5	4243.9	2126	6.909	96.8	18.8	43.700	102.847	12196.59	1512.27	10684.32
	EOC ^b 3	14805.1	4498.5	2126	6.909	96.8	18.8	43.700	102.847	12196.59	1512.27	10684.32

^a Beginning of cycle

^b End of cycle

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 process assembly-homogenized two-group cross sections for whole-core nodal diffusion calculations. To cover all the possible reactor states, the two-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 QC1, including Inc-718 springs, which should be considered in the Polaris lattice physics calculation. They 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.

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. Figure 3.1 illustrates the Polaris models for radial and top and bottom axial reflectors.

Table 3.4 provides the Polaris input and output files for the QC1 cycles 1–3. A sample file name with ‘quad-1dx_DC40CR0.inp’ indicates

- quad: plant name,
- 1dx: assembly type,
- DC40: 40% void,
- CR0: control rod out,
- inp: Polaris input.

Appendices A.1–A.4 provides the Polaris inputs for the fuel assembly type 1dx (A.1) and radial (A.2), axial top (A.3) and bottom (A.4) reflectors. Table 3.4 provides the Polaris input and output files for QC1 cycles 1–3. The organization of the appendices are as follow:

- Appendix A.1: Polaris input for the fuel assembly type 1A 1dx
- 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.

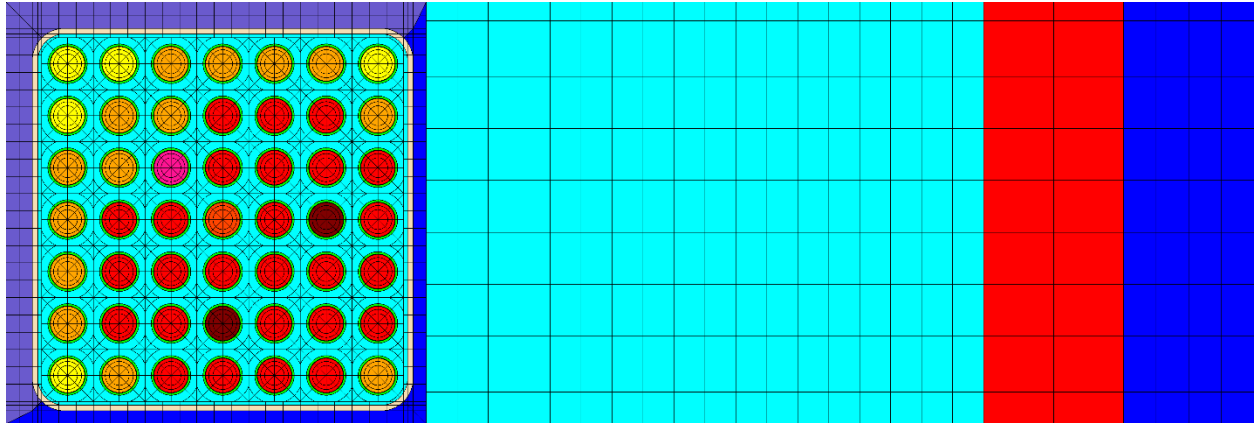
	File name	Coolant		Moderator		Temperature (K)					Rod-in
		Temp. (K)	Density (g/cm ³)	Temp. (K)	Density (g/cm ³)	Fuel	Clad	Gap	CR	Channel	
A1	cr0_v00	560.29	0.7373	560.29	0.7373	948.45	637.92	793.19	560.29	560.29	no
A2	cr0_v40	560.29	0.4573	560.29	0.7373	948.45	637.92	793.19	560.29	560.29	no
A3	cr0_v70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

Table 3.2. Branch states for each assembly type.

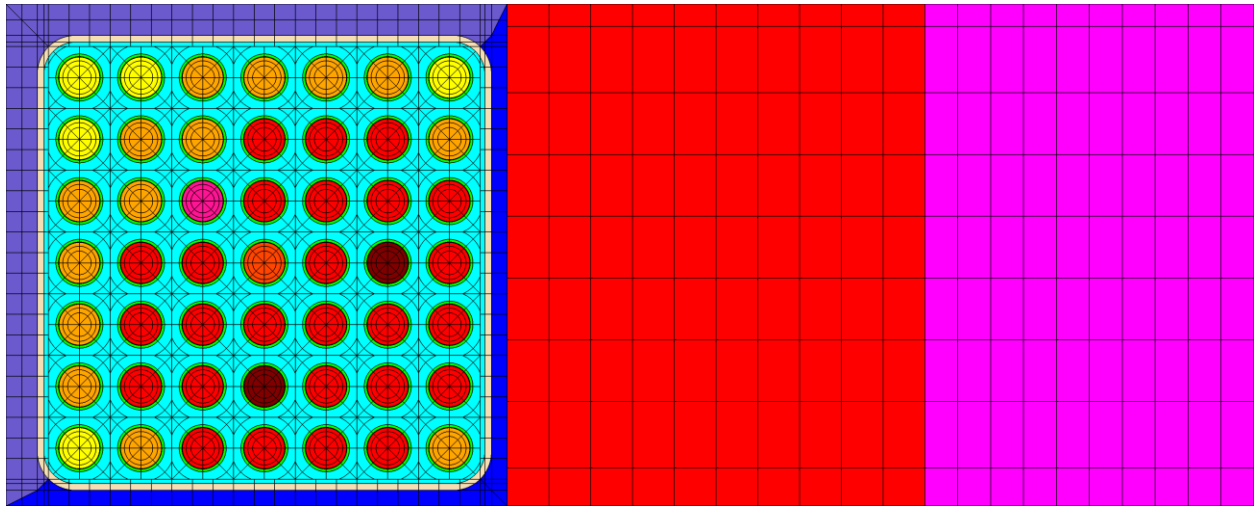
No	Coolant		Moderator		Temperature (K)					Rod-in
	Density (g/cm ³)	Temp. (K)	Density (g/cm ³)	Temp. (K)	Fuel	Clad	Gap	CR	Channel	
1	0.7373	560.29	0.7373	560.29	948.45	637.92	793.19	560.29	560.29	no
2	0.4573	560.29	0.7373	560.29	948.45	637.92	793.19	560.29	560.29	no
3	0.2473	560.29	0.7373	560.29	948.45	637.92	793.19	560.29	560.29	no
4	0.7373	560.29	0.7373	560.29	948.45	637.92	793.19	560.29	560.29	yes
5	0.4573	560.29	0.7373	560.29	948.45	637.92	793.19	560.29	560.29	yes
6	0.2473	560.29	0.7373	560.29	948.45	637.92	793.19	560.29	560.29	yes
7	0.1073	560.29	0.7373	560.29	948.45	637.92	793.19	560.29	560.29	no
8	0.1073	560.29	0.7373	560.29	948.45	637.92	793.19	560.29	560.29	yes
9	0.7373	560.29	0.7373	560.29	500	548.23	524.12	560.29	560.29	no
10	0.4573	560.29	0.7373	560.29	500	548.23	524.12	560.29	560.29	no
11	0.2473	560.29	0.7373	560.29	500	548.23	524.12	560.29	560.29	no
12	0.1073	560.29	0.7373	560.29	500	548.23	524.12	560.29	560.29	no
13	0.7373	560.29	0.7373	560.29	500	548.23	524.12	560.29	560.29	yes
14	0.4573	560.29	0.7373	560.29	500	548.23	524.12	560.29	560.29	yes
15	0.2473	560.29	0.7373	560.29	500	548.23	524.12	560.29	560.29	yes
16	0.1073	560.29	0.7373	560.29	500	548.23	524.12	560.29	560.29	yes
17	0.7373	560.29	0.7373	560.29	1500	748.23	1124.12	560.29	560.29	no
18	0.4573	560.29	0.7373	560.29	1500	748.23	1124.12	560.29	560.29	no
19	0.2473	560.29	0.7373	560.29	1500	748.23	1124.12	560.29	560.29	no
20	0.1073	560.29	0.7373	560.29	1500	748.23	1124.12	560.29	560.29	no
21	0.7373	560.29	0.7373	560.29	1500	748.23	1124.12	560.29	560.29	yes
22	0.4573	560.29	0.7373	560.29	1500	748.23	1124.12	560.29	560.29	yes
23	0.2473	560.29	0.7373	560.29	1500	748.23	1124.12	560.29	560.29	yes
24	0.1073	560.29	0.7373	560.29	1500	748.23	1124.12	560.29	560.29	yes

Table 3.3. Branch states for reflectors.

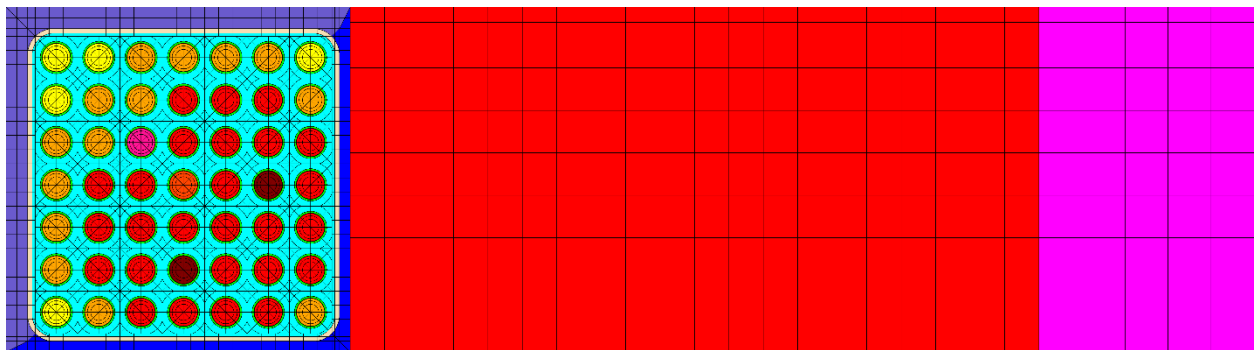
Case	Coolant		Moderator		Temperature (K)					Rod-in
	Temp. (K)	Density (g/cm ³)	Temp. (K)	Density (g/cm ³)	Fuel	Clad	Gap	CR	Channel	
Reference	560.29	0.4573	560.29	0.7373	948.45	560.29	560.29	560.29	560.29	no
1	560.29	0.7373	560.29	0.7373	948.45	560.29	560.29	560.29	560.29	no
2	560.29	0.2473	560.29	0.7373	948.45	560.29	560.29	560.29	560.29	no
3	560.29	0.1073	560.29	0.7373	948.45	560.29	560.29	560.29	560.29	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 QC1.

Assembly type	Directory	File name	Description
Type 1A 1dx	./Polaris/type1dx	quad-1dx_DC??CR?,*	Input, output, T16 CR? control rod CR0: out CR1: in DC?? void percent DC00: 0 % void DC40: 40 % void DC70: 70 % void * 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: ORIGIN concentration f33: ORIGIN library
Type 1A 1dy	./Polaris/type1dy	quad-1dy_DC??CR?,*	
Type 1A 1dz	./Polaris/type1dz	quad-1dz_DC??CR?,*	
Type 1B 1ux	./Polaris/type1ux	quad-1ux_DC??CR?,*	
Type 1B 1uy	./Polaris/type1uy	quad-1uy_DC??CR?,*	
Type 1B 1uz	./Polaris/type1uz	quad-1uz_DC??CR?,*	
Type 2A 2dx	./Polaris/type2dx	quad-2dx_DC??CR?,*	
Type 2A 2dy	./Polaris/type2dy	quad-2dy_DC??CR?,*	
Type 2B 2ux	./Polaris/type2ux	quad-2ux_DC??CR?,*	
Type 2B 2uy	./Polaris/type2uy	quad-2uy_DC??CR?,*	
Type 3 3uy	./Polaris/type3uy	quad-3uy_DC??CR?,*	
Type 4 4uy	./Polaris/type4uy	quad-4uy_DC??CR?,*	
Type 5 5uy	./Polaris/type5uy	quad-5uy_DC??CR?,*	
Type 6 6uy	./Polaris/type6uy	quad-6uy_DC??CR?,*	
Type 7 7uy	./Polaris/type7uy	quad-7uy_DC??CR?,*	
Radial reflector	./Polaris/reflector	qc1_refl_rad.*	
Top reflector	./Polaris/reflector	qc1_refl_top.*	
Bottom reflector	./Polaris/reflector	qc1_refl_bot.*	

3.1.2 Cross Section Table Set Generation Using GenPMAXS

Table 3.5 provides the GenPMAXS input and output files. Appendices B.1–B.4 provide the GenPMAXS inputs for the fuel assembly type 1dx and radial edge as well as axial top and bottom reflectors.

- Appendix B.1: GenPMAXS input for the fuel assembly type 1A 1dx
- 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. GenPMAXS input and output files for QC1.

Assembly type	Directory	Filename	Description
Type 1A 1dx	./GenPMAXS/fuel	quad-1dx,*	* Inp_pmx: 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 S: south SE: southeast W: west SW:southwest
Type 1A 1dy	./GenPMAXS/fuel	quad-1dy,*	
Type 1A 1dz	./GenPMAXS/fuel	quad-1dz,*	
Type 1B 1ux	./GenPMAXS/fuel	quad-1ux,*	
Type 1B 1uy	./GenPMAXS/fuel	quad-1uy,*	
Type 1B 1uz	./GenPMAXS/fuel	quad-1uz,*	
Type 2A 2dx	./GenPMAXS/fuel	quad-2dx,*	
Type 2A 2dy	./GenPMAXS/fuel	quad-2dy,*	
Type 2B 2ux	./GenPMAXS/fuel	quad-2ux,*	
Type 2B 2uy	./GenPMAXS/fuel	quad-2uy,*	
Type 3 3uy	./GenPMAXS/fuel	quad-3uy,*	
Type 4 4uy	./GenPMAXS/fuel	quad-4uy,*	
Type 5 5uy	./GenPMAXS/fuel	quad-5uy,*	
Type 6 6uy	./GenPMAXS/fuel	quad-6uy,*	
Radial reflector	./GenPMAXS/reflector	refl_rad_????.*	
Top reflector	./GenPMAXS/reflector	refl_top.*	
Bottom reflector	./GenPMAXS/reflector	refl_bot.*	

3.1.3 Whole-Core Nodal Diffusion Calculations Using PARCS

Appendices C.1–C.12 provide the PARCS inputs for the QC1 cycles 1–3 HZP and HFP calculations.

- Appendix C.1: PARCS input for the cycle 1 assembly geometry ‘qc-cyc1.geom’ file
- Appendix C.2: PATHS input for the cycle 1 ‘qc-cyc1.paths’ file
- Appendix C.3: PARCS input for the HFP cycle 1 ‘quad-cyc1.inp’ file
- Appendix C.4: Cycle 1 assembly configuration ‘qc-c1_lay.mcyc’ file
- Appendix C.5: PARCS input for the cycle 2 assembly geometry ‘qc-cyc2.geom’ file
- Appendix C.6: PATHS input for the cycle 2 ‘qc-cyc2.paths’ file
- Appendix C.7: PARCS input for the cycle 1–2 shuffling ‘quad-cyc12.inp’ file
- Appendix C.8: PARCS input for the HFP cycle 2 ‘quad-cyc2.inp’ file
- Appendix C.9: Cycle 2 assembly configuration ‘qc-c2_lay.mcyc’ file
- Appendix C.10: PARCS input for the cycle 3 assembly geometry ‘qc-cyc3.geom’ file
- Appendix C.11: PATHS input for the cycle 3 ‘qc-cyc3.paths’ file
- Appendix C.12: PARCS input for the cycle 2–3 shuffling ‘quad-cyc23.inp’ file
- Appendix C.13: PARCS input for the HFP cycle 3 ‘quad-cyc3.inp’ file

Table 3.6 provides the PARCS input and output files.

Table 3.6. PARCS input and output files for QC1.

Cycle	File name	Description
1	./support/qc-cyc1.geom	Geometry input
	./support/qc-cyc1.paths	PATHS input
	quad-cyc1.inp	PARCS input
	qc -cyc1.parc_out	output
	qc -cyc1.parc_dep	Restart file
	qc -cyc1.parc_det	Detector response
	qc -cyc1.parc_dpl	Summary
	./support/qc_c1_lay.mcyc	Assembly configuration
2	./support/qc-cyc2.geom	Geometry input
	./support/qc-cyc2.paths	PATHS input
	quad-cyc12.inp	PARCS input for shuffling
	quad-cyc2.inp	PARCS input
	qc-cyc2.parc_out	output
	qc-cyc2.parc_dep	Restart file
	qc-cyc2.parc_det	Detector response
	qc-cyc2.parc_dpl	Summary
3	./support/qc_c2_lay.mcyc	Assembly configuration
	./support/qc-cyc3.geom	Geometry input
	./support/qc-cyc3.paths	PATHS input
	quad-cyc23.inp	PARCS input for shuffling
	quad-cyc3.inp	PARCS input
	qc-cyc3.parc_out	output
	qc-cyc3.parc_dep	Restart file
	qc-cyc3.parc_det	Detector response
	qc-cyc3.parc_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 QC1. QC1 has significant reactivity biases for cycle 1, which may be typical in the BWR simulation because of its very complicated operation history and many tests. However, the reactivities in cycles 2 and 3 for QC1 are very 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, which can be a result of poor xenon modeling caused by frequent reactor power changes and shutdown or by a poor thermal hydraulics model such as neglecting bypass flow. 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 QC1. The figure and table include the TIP data comparisons for the 3D, axially integrated 2D radial, and radially integrated 1D axial distributions. The total 3D root mean square (RMS) errors are 12.59%, the total radial 2D RMS errors are 6.05%, and the total axial 1D RMS errors are 9.33%. Appendix D provides the utility program to compare the calculated flux map 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: QC1 Cycle 1 TIP comparison
- Appendix E.2: QC1 Cycle 2 TIP comparison
- Appendix E.3: QC1 Cycle 3 TIP comparison

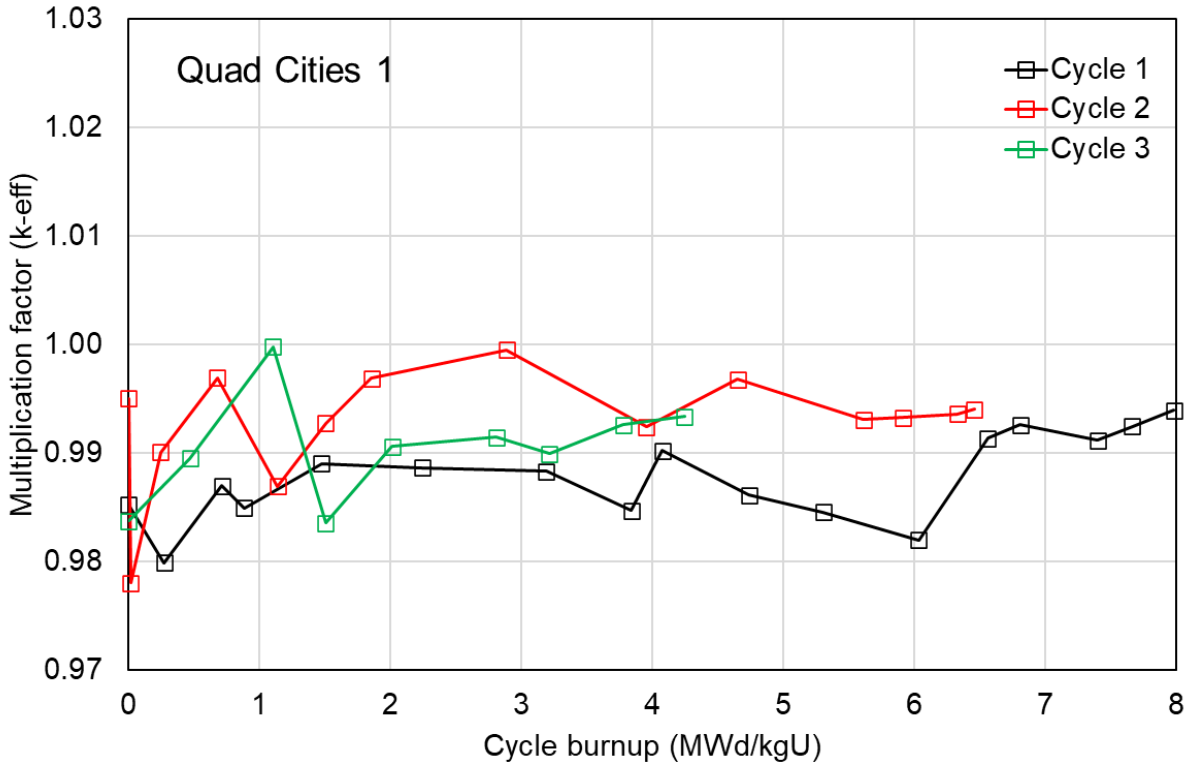


Figure 3.2. QC1 cycles 1–3 HFP reactivities.

Table 3.7. Comparison of the HFP reactivities.

No	Cycle 1				Cycle 2				Cycle 3			
	Burnup (MWd/kgU)		k _{eff}	Δk _{eff} (pcm)	Burnup (MWd/kgU)		k _{eff}	Δk _{eff} (pcm)	Burnup (MWd/kgU)		k _{eff}	Δk _{eff} (pcm)
	Core	Cycle			Core	Cycle			Core	Cycle		
1	0.000	0.000	0.98519	1482	7.189	0.000	0.99501	499	10.171	0.000	0.98374	1626
2	0.272	0.272	0.97985	2015	7.205	0.016	0.97802	2198	10.638	0.467	0.98950	1050
3	0.712	0.712	0.98699	1301	7.434	0.245	0.99005	995	11.273	1.102	0.99981	19
4	0.882	0.882	0.98491	1510	7.867	0.678	0.99694	306	11.673	1.502	0.98355	1645
5	1.471	1.471	0.98903	1097	8.325	1.136	0.98694	1306	12.183	2.012	0.99059	941
6	2.239	2.239	0.98862	1138	8.691	1.502	0.99275	725	12.976	2.805	0.99147	853
7	3.190	3.190	0.98828	1172	9.044	1.855	0.99690	311	13.382	3.211	0.98993	1007
8	3.836	3.836	0.98469	1531	10.076	2.887	0.99951	49	13.946	3.775	0.99260	740
9	4.074	4.074	0.99021	979	11.140	3.951	0.99238	762	14.415	4.244	0.99337	663
10	4.737	4.737	0.98613	1387	11.837	4.648	0.99678	322	14.669	4.498	0.99101	899
11	5.301	5.301	0.98454	1546	12.798	5.609	0.99309	691				
12	6.031	6.031	0.98198	1802	13.100	5.911	0.99327	673				
13	6.558	6.558	0.99138	862	13.514	6.325	0.99357	643				
14	6.807	6.807	0.99261	739	13.644	6.455	0.99404	596				
15	7.397	7.397	0.99118	882								
16	7.659	7.659	0.99246	754								
17	7.980	7.980	0.99391	609								

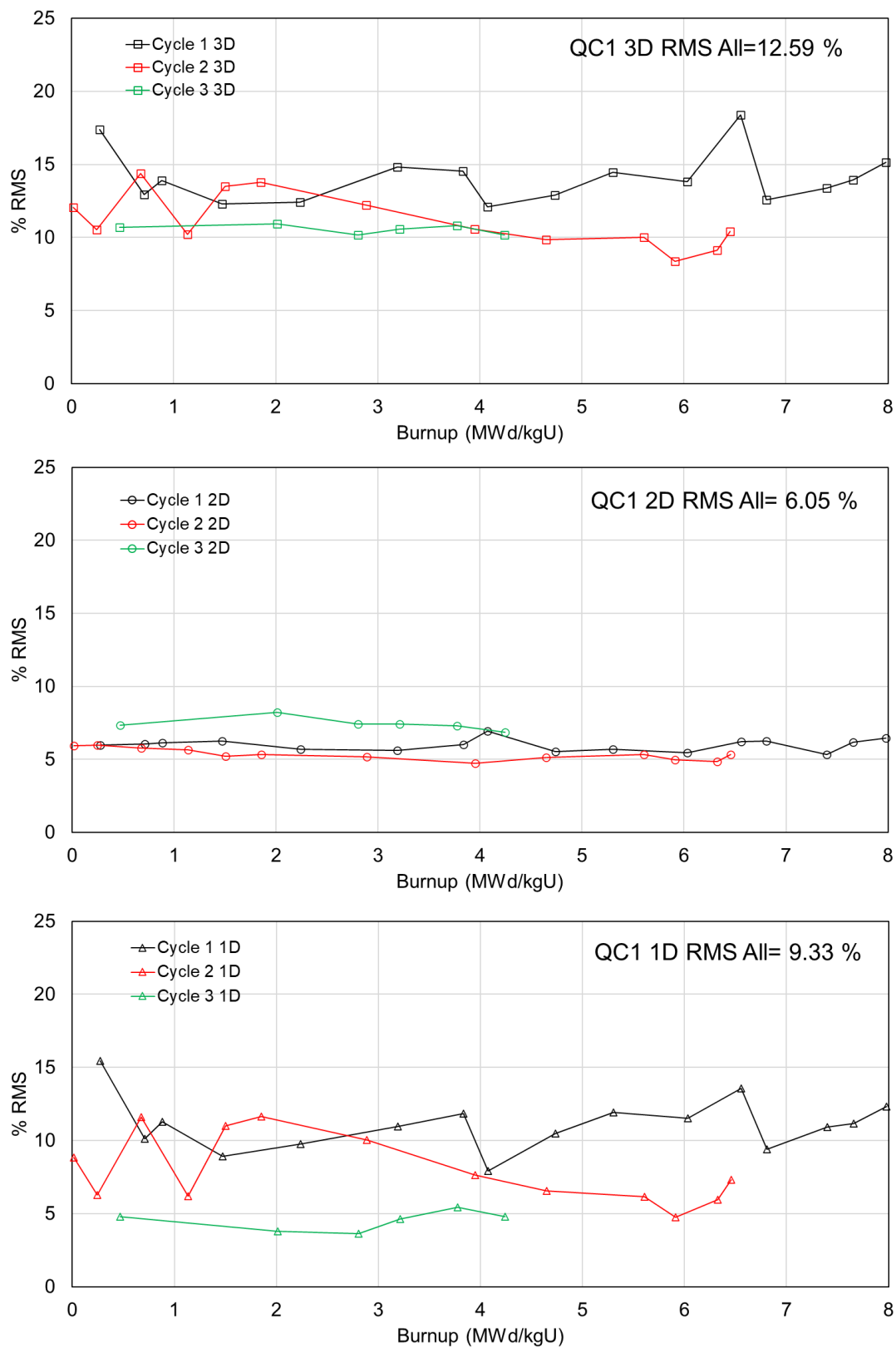


Figure 3.3. Comparison of the HFP TIP data for QC1.

Table 3.8. Comparison of the TIP data for QC1.

Cycle	Data point	Burnup (MWD/kgU)		PARCS point	3D		Radial		Axial	
		Total	Cycle		RMS (%)	Cases	RMS (%)	Cases	RMS (%)	Cases
1	1	0.272	0.272	2	17.40	984	5.97	41	15.46	24
	2	0.712	0.712	4	12.94	984	6.04	41	10.13	24
	3	0.882	0.882	6	13.92	984	6.12	41	11.30	24
	4	1.471	1.471	8	12.30	984	6.26	41	8.94	24
	5	2.239	2.239	10	12.41	984	5.70	41	9.78	24
	6	3.190	3.190	12	14.84	984	5.61	41	10.98	24
	7	3.836	3.836	14	14.54	984	6.01	41	11.85	24
	8	4.074	4.074	16	12.12	984	6.94	41	7.92	24
	9	4.737	4.737	18	12.90	984	5.54	41	10.47	24
	10	5.301	5.301	20	14.45	984	5.69	41	11.92	24
	11	6.031	6.031	22	13.81	984	5.46	41	11.52	24
	12	6.558	6.558	24	18.39	984	6.21	41	13.58	24
	13	6.807	6.807	26	12.57	984	6.24	41	9.41	24
	14	7.397	7.397	28	13.38	984	5.35	41	10.91	24
	15	7.659	7.659	30	13.93	984	6.19	41	11.15	24
	16	7.980	7.980	32	15.14	984	6.46	41	12.32	24
2	17	7.205	0.016	4	12.07	984	5.92	41	8.84	24
	18	7.434	0.245	6	10.52	984	5.97	41	6.28	24
	19	7.867	0.678	8	14.40	984	5.77	41	11.62	24
	20	8.325	1.136	10	10.22	984	5.64	41	6.18	24
	21	8.691	1.502	12	13.50	984	5.21	41	10.99	24
	22	9.044	1.855	14	13.77	984	5.34	41	11.66	24
	23	10.076	2.887	16	12.24	984	5.18	41	10.05	24
	24	11.140	3.951	18	10.56	984	4.72	41	7.65	24
	25	11.837	4.648	20	9.87	984	5.12	41	6.54	24
	26	12.798	5.609	22	10.00	984	5.32	41	6.14	24
	27	13.100	5.911	24	8.39	984	4.98	41	4.75	24
	28	13.514	6.325	26	9.14	984	4.87	41	5.96	24
	29	13.644	6.455	28	10.42	984	5.35	41	7.31	24
3	30	10.638	0.467	4	10.69	984	7.33	41	4.80	24
	33	12.183	2.012	10	10.92	984	8.21	41	3.80	24
	34	12.976	2.805	12	10.19	984	7.42	41	3.65	24
	35	13.382	3.211	14	10.59	984	7.43	41	4.64	24
	36	13.946	3.775	16	10.83	984	7.28	41	5.42	24
	37	14.415	4.244	18	10.16	984	6.87	41	4.81	24
All					12.59	34440	6.05	1435	9.33	840

Figure 3.4 compares the 1D axial TIP data for QC1 cycle 2 at the burnups 7.4 and 13.5 MWd/kgU. The overall shapes of the 1D TIP data are consistent, but differences in local shapes may result from neglecting spacer grids in the Polaris–PARCS modeling. Detailed modeling for the seven spacer grids would improve the calculated axial TIP data shapes by providing improved RMS errors.

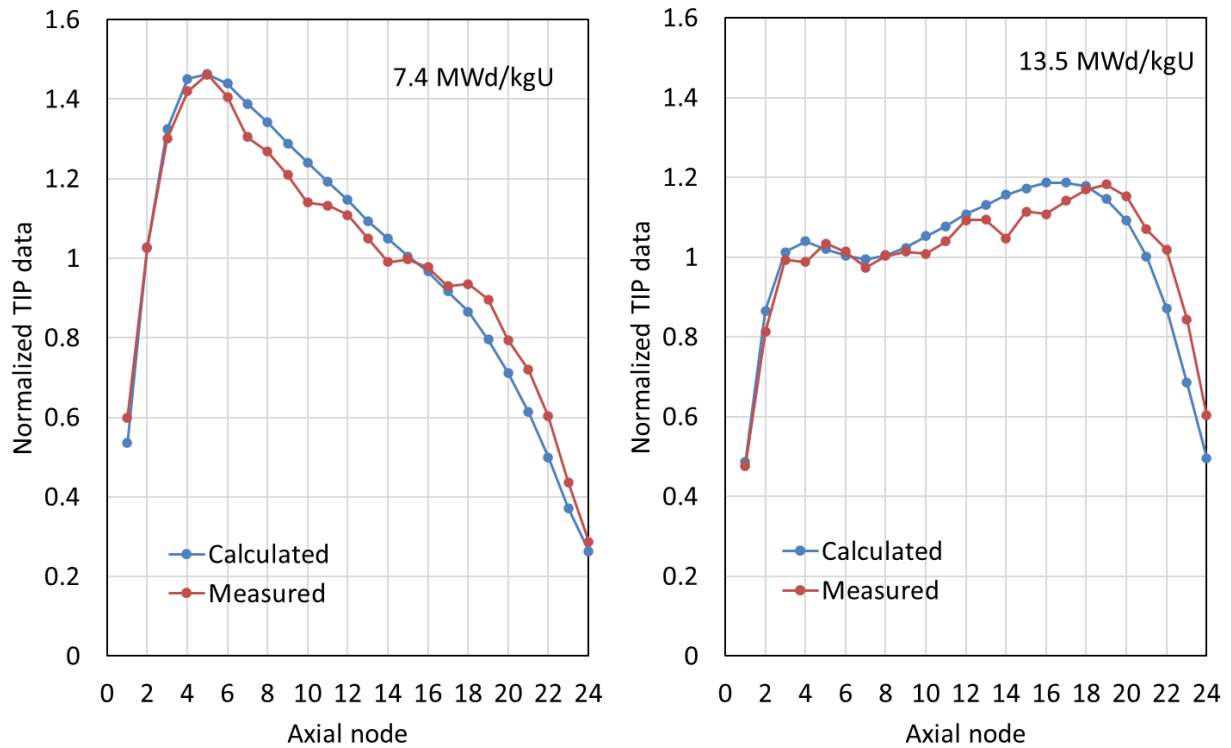


Figure 3.4. Axial 1D TIP comparison for QC1 cycle 2.

4. CONCLUSION

In this work, benchmark calculations were performed for the QC1 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, which has been used in confirmatory analysis by US Nuclear Regulatory Commission. The benchmark results were compared with the measured data for the HFP reactivities and TIP data. The final goal of this benchmark calculation is to validate the SCALE/Polaris–GenPMAXS–PARCS code package with the ENDF/B-VII.1 AMPX 56-group libraries by assessing uncertainties through statistical analysis for key nuclear parameters such as reactivity and assembly power peaking factors [9].

The results show large reactivity biases for cycle 1 and large RMS errors in TIP comparisons for all cycles. These differences are attributed to modeling limitations and nuclear data deficiencies in the Polaris–PARCS procedure. For future evaluations, it is recommended to implement a bypass flow modeling capability in PARCS and use a higher fidelity multigroup cross section library to treat slightly harder flux spectrums introduced by increasing void fractions. Considering the inefficiency in employing 252-group neutron library for modeling, a new 61 group AMPX library has been developed.

5. REFERENCES

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APPENDIX A. SAMPLE OF POLARIS INPUT FILES

A.1 Polaris input for the fuel assembly type 1dx

```
=polaris
%-----
%   general options
%-----
title "QuadCities Type 1dx"
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_U247  UOX  enr=2.47
comp c_U170  UOX  enr=1.70
comp c_U247s UOX  enr=2.47
comp c_U247d UOX  enr=2.47
comp c_U170d UOX  enr=1.70
comp c_U120d UOX  enr=1.20

% fuel mats - use stack density from EPRI reports
mat FUEL.1 c_U247  dens=10.34
mat FUEL.2 c_U170  dens=10.34
mat FUEL.3 c_U247s dens=9.48
mat FUEL.4 c_U247d dens=9.94
mat FUEL.5 c_U170d dens=9.94
mat FUEL.6 c_U120d dens=9.94

% 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 A1=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 : 0.61976 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 : 0.61976 0.63373 0.71501 : FUEL.4 GAP.1 CLAD.1
pin 5 : 0.61976 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

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=P FUEL.6=P

% 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
6
6 2
5 2 1
5 1 1 3
5 1 1 1 1
5 4 1 1 1 1
6 5 4 4 4 4 5
%-----
% control blade
%-----
control OEM : BLADE 0.39624 0.14224 1.98501
              wgcrrv=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 18.045
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 loc=SE : E(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 0.1073
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 = 637.92 637.92 637.92 637.92 637.92 637.92 637.92 637.92 637.92 637.92 637.92 637.92
548.23 548.23 548.23 548.23 548.23 748.23 748.23 748.23 748.23 748.23 748.23 748.23
GAP.1 : temp = 793.19 793.19 793.19 793.19 793.19 793.19 793.19 793.19 793.19 793.19 793.19 793.19
524.12 524.12 524.12 524.12 524.12 1124.12 1124.12 1124.12 1124.12 1124.12 1124.12 1124.12
FUEL : temp = 948.45 948.45 948.45 948.45 948.45 948.45 948.45 948.45 948.45 948.45 500.00 500.00
500.00 500.00 500.00 500.00 500.00 1500.00 1500.00 1500.00 1500.00 1500.00 1500.00 1500.00

```

```

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  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  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  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  560.29  560.29  560.29  560.29
OEM      : in        = FALSE  FALSE  FALSE  TRUE  TRUE  TRUE  FALSE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  FALSE
FALSE  TRUE  TRUE  TRUE  TRUE  FALSE  FALSE  FALSE  FALSE  TRUE  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 the fuel assembly type 1dx

```
%JOB_TIT
'quad-1dx.PMAX' T 3.0
%JOB_OPT
T T F F T F F T T F T F F F F
!adf,xes,ded,jlf,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/typeldx/quad-1dx_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/typeldx/quad-ldx_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/typeldx/quad-ldx_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/typeldx/quad-ldx_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/typeldx/quad-ldx_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/typeldx/quad-ldx_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,jlf,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/reflector/qcl_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,jlf,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/reflector/qcl_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
'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,jlf,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/reflector/qcl_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 PARCS input for the cycle 1 assembly geometry 'qc-cyc1.geom' file

```
geo_dim      32 32 28 1 1      !nasyx,nasy,y,nz
rad_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
0 0 0 0 0 0 0 0 0 0 0 9 4 4 4 4 4 4 4 4 9 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 9 9 9 5 22 22 22 22 22 22 22 22 22 8 9 9 9 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 9 4 4 5 22 22 12 22 12 22 22 12 22 12 22 8 4 4 9 0 0 0 0 0 0 0
0 0 0 0 0 0 9 5 22 22 12 22 11 21 11 21 11 21 11 21 11 21 11 21 12 22 22 8 9 0 0 0 0
0 0 0 9 5 22 22 12 22 11 21 11 21 11 21 11 21 11 21 11 21 11 21 12 22 22 8 9 0 0 0
0 0 9 5 22 22 12 22 11 21 11 21 11 21 11 21 11 21 11 21 11 21 11 21 12 22 22 8 9 0 0
0 9 1 22 22 12 22 11 21 11 21 11 21 11 21 11 21 11 21 11 21 11 21 12 22 22 3 9 0 0
0 9 1 22 12 22 11 21 11 21 11 21 12 22 12 22 12 22 12 21 11 21 11 21 12 22 22 3 9 0
0 9 5 22 22 11 21 11 21 11 21 12 22 12 22 12 12 22 12 22 12 11 21 11 21 22 22 8 9 0
9 5 22 22 12 21 11 21 11 21 12 22 12 22 12 22 12 22 12 22 12 21 11 21 11 21 12 22 8 9
1 22 22 12 21 11 21 11 21 12 22 12 22 12 12 12 12 22 12 22 12 21 11 21 11 21 12 22 3
1 22 12 22 11 21 11 21 12 22 12 22 12 22 12 22 12 22 12 22 12 21 11 21 11 21 12 22 3
1 22 12 22 11 21 11 21 22 12 22 12 22 12 12 12 22 12 22 12 22 11 21 11 21 12 22 3
1 22 12 22 11 21 11 21 12 22 12 22 12 22 12 22 12 22 12 22 12 21 11 21 11 21 12 22 3
1 22 22 12 21 11 21 11 22 12 22 12 22 12 12 12 22 12 22 12 22 11 21 11 21 12 22 3
1 22 22 12 21 11 21 11 22 12 22 12 22 12 12 12 22 12 22 12 22 11 21 11 21 12 22 3
1 22 12 22 11 21 11 21 12 22 12 22 12 22 12 22 12 22 12 22 12 21 11 21 11 21 12 22 3
1 22 12 22 11 21 11 21 12 22 12 22 12 22 12 22 12 22 12 22 12 21 11 21 11 21 12 22 3
1 22 22 12 21 11 21 11 21 22 12 22 12 22 12 12 12 22 12 22 12 21 11 21 11 21 12 22 3
9 6 22 22 12 21 11 21 11 21 12 22 12 22 12 22 12 22 12 22 12 21 11 21 11 21 12 22 7 9
0 9 6 22 22 11 21 11 21 11 21 12 22 12 22 12 12 22 12 22 12 21 11 21 11 21 12 22 7 9 0
0 9 1 22 12 22 11 21 11 21 11 21 12 22 12 22 12 22 12 21 11 21 11 21 11 21 12 22 3 9 0
0 9 1 22 22 12 22 12 21 11 21 11 21 11 21 11 21 11 21 11 21 11 21 12 22 22 3 9 0
0 0 9 6 22 22 12 22 11 21 11 21 11 21 11 21 11 21 11 21 11 21 11 22 12 22 7 9 0 0
0 0 0 9 6 22 22 12 22 11 21 11 21 11 21 11 21 11 21 11 21 11 22 12 22 7 9 0 0
0 0 0 0 9 6 22 22 12 22 12 21 11 21 11 21 11 21 11 21 11 21 12 22 22 7 9 0 0
0 0 0 0 0 9 6 22 22 22 12 22 12 22 12 22 12 22 12 22 22 7 9 0 0 0 0
0 0 0 0 0 0 9 2 2 6 22 22 12 22 12 22 12 22 12 22 7 2 2 9 0 0 0 0 0
0 0 0 0 0 0 0 9 9 9 6 22 22 22 22 22 22 22 22 7 9 9 9 0 0 0 0 0
0 0 0 0 0 0 0 0 9 2 2 2 2 2 2 2 2 2 2 2 2 2 9 0 0 0 0 0
!!
!!

grid_x      32*15.240
neutmesh_x  32*1
grid_y      32*15.240
neutmesh_y  32*1
grid_z      1*15.24 2*7.62 22*15.24 2*7.62 1*15.24
boun_cond   2 2 2 2 2 2

assy_type   1 1*1 2*3 22*3 2*3 1*2 REFL ! West
assy_type   2 1*1 2*4 22*4 2*4 1*2 REFL ! South
assy_type   3 1*1 2*5 22*5 2*5 1*2 REFL ! East
assy_type   4 1*1 2*6 22*6 2*6 1*2 REFL ! North
assy_type   5 1*1 2*7 22*7 2*7 1*2 REFL ! NorthWest
assy_type   6 1*1 2*8 22*8 2*8 1*2 REFL ! SouthWest
assy_type   7 1*1 2*9 22*9 2*9 1*2 REFL ! SouthEast
assy_type   8 1*1 2*10 22*10 2*10 1*2 REFL ! NorthEast
assy_type   9 1*1 2*11 22*11 2*11 1*2 REFL ! No ADFs

! Elevation (in) 0 3 6 48 108 138 141 144
assy_type   11 1*1 1*12 1*13 7*13 10*14 5*13 1*13 1*12 1*2 FUEL ! Type 1b Not Dished
assy_type   12 1*1 1*15 1*16 7*16 10*17 5*16 1*16 1*15 1*2 FUEL ! Type 1a Dished
assy_type   21 1*1 1*18 1*19 7*19 10*19 5*19 1*19 1*18 1*2 FUEL ! Type 2b Not Dished
assy_type   22 1*1 1*20 1*21 7*21 10*21 5*21 1*21 1*20 1*2 FUEL ! Type 2a Dished
assy_type   23 1*1 1*22 1*22 7*22 10*22 5*22 1*22 1*22 1*2 FUEL ! Type 3a Dished for cy-2
assy_type   24 1*1 1*23 1*23 7*23 10*23 5*23 1*23 1*23 1*2 FUEL ! Type 4a Dished for cy-2
assy_type   25 1*1 1*24 1*24 7*24 10*24 5*24 1*24 1*24 1*2 FUEL ! Type 5a Dished for cy-2
assy_type   26 1*1 1*25 1*25 7*25 10*25 5*25 1*25 1*25 1*2 FUEL ! Type 6a Dished for cy-2
assy_type   27 1*1 1*23 1*23 7*23 10*23 5*23 1*23 1*23 1*2 FUEL ! Type 4a Dished for cy-3
assy_type   28 1*1 1*26 1*26 7*26 10*26 5*26 1*26 1*26 1*2 FUEL ! Type 7a Dished for cy-3

! assume stroke = absorber length = 143[in], 48 steps, 365.76[cm]/48 = 7.62[cm]
cr_axinfo   17.78 7.62 48 !fully inserted position and step size
bank_conf
0 0 0 0 0 0 0 0 0 0 0 0 0 0 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 2 2 3 3 4 4 5 5 0 0 0 0 0 0 0 0 0 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 0 0 0 0 0 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 0 0 0 0 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 0 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 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 37 37 38 38 0 0
0 0 26 27 27 28 28 29 29 30 30 31 31 32 32 33 33 34 34 35 35 36 36 37 37 38 38 0 0
0 0 39 39 40 40 41 41 42 42 43 43 44 44 45 45 46 46 47 47 48 48 49 49 50 50 51 51 0 0
0 0 39 39 40 40 41 41 42 42 43 43 44 44 45 45 46 46 47 47 48 48 49 49 50 50 51 51 0 0
0 52 52 53 53 54 54 55 55 56 56 57 57 58 58 59 59 60 60 61 61 62 62 63 63 64 64 65 65 66 66 0
0 52 52 53 53 54 54 55 55 56 56 57 57 58 58 59 59 60 60 61 61 62 62 63 63 64 64 65 65 66 66 0
0 67 67 68 68 69 69 70 70 71 71 72 72 73 73 74 74 75 75 76 76 77 77 78 78 79 79 80 80 81 81 0
0 67 67 68 68 69 69 70 70 71 71 72 72 73 73 74 74 75 75 76 76 77 77 78 78 79 79 80 80 81 81 0
0 82 82 83 83 84 84 85 85 86 86 87 87 88 88 89 89 90 90 91 91 92 92 93 93 94 94 95 95 96 96 0
0 82 82 83 83 84 84 85 85 86 86 87 87 88 88 89 89 90 90 91 91 92 92 93 93 94 94 95 95 96 96 0
0 97 97 98 98 99 99 100 100 101 101 102 102 103 103 104 104 105 105 106 106 107 107 108 108 109 109 110 110 111 111 0
0 97 97 98 98 99 99 100 100 101 101 102 102 103 103 104 104 105 105 106 106 107 107 108 108 109 109 110 110 111 111 0
```



```

      48 8 48 8 48 0 48 0 48 8 48 8 48
      48 48 36 48 26 48 40 48 26 48 36 48 48
      48 48 8 48 12 48 12 48 8 48 48
      48 48 36 48 30 48 36 48 48
      48 48 48 48 48

!-----
th_fdbk      T
int_th       T 1 './support/qc-cycl.paths'
!-----
xe_sm        1 1
rot_adf      T
mult_cyc     T
detector     T 100.0
!-----
depletion    T 1.0e-3 F
!          TREE,nset,adf,xes,ene,jlf,chi,cbd,vel,det,yld,odf,gff,bet,lam,dht
tree_xs      T 26 T T F F F F F T T F F F F
!-----
run_opts     T
!*****
PARAM
  nlupd_ss   3 5 1
  n_iters    15 200
  conv_ss    1.0e-5 1.0e-4 1.0e-3 0.001
  wielandt   0.1 0.1 1.0
!
  decusp     2
  nodal_kern nemmg
  cmfd       2
!*****
XSEC
  group_spec 2 1
!*****
GEOM
  file './support/qc-cycl.geom'
!*****
FDBK
  fa_powpit  3.468 15.24
TH
  state_core 9676.6 1225.5 7251147.3
!*****
DEPL
  bank_nr    177*1
  time_stp   -0.2723
!   inp_hst   'parcs.dep' 1 1
!   inp_opt   F F F F      ! pgn,crp,ths,xesm

  hst_opt    T T F F F      ! hcr, hdc, hpc, htf, htc
  out_opt    T T F F F      ! ppow,phst,pths,pxesm,pss

! Reflector XS
  pmaxs_f 1 './GenPMXS_fission/refl_bot.FMAX' 1 ! Bottom Axial Reflector
  pmaxs_f 2 './GenPMXS_fission/refl_top.FMAX' 2 ! Top Axial Reflector
  pmaxs_f 3 './GenPMXS_fission/refl_rad.W.FMAX' 3 ! W Radial Reflector
  pmaxs_f 4 './GenPMXS_fission/refl_rad.S.FMAX' 4 ! S Radial Reflector
  pmaxs_f 5 './GenPMXS_fission/refl_rad.E.FMAX' 5 ! E Radial Reflector
  pmaxs_f 6 './GenPMXS_fission/refl_rad.N.FMAX' 6 ! N Radial Reflector
  pmaxs_f 7 './GenPMXS_fission/refl_rad.NW.FMAX' 7 ! NW Radial Reflector
  pmaxs_f 8 './GenPMXS_fission/refl_rad.SW.FMAX' 8 ! SW Radial Reflector
  pmaxs_f 9 './GenPMXS_fission/refl_rad.SE.FMAX' 9 ! SE Radial Reflector
  pmaxs_f 10 './GenPMXS_fission/refl_rad.NE.FMAX' 10 ! NE Radial Reflector
  pmaxs_f 11 './GenPMXS_fission/refl_rad_edge.FMAX' 11 ! Radial Reflector

! Fuel XS
  pmaxs_f 12 './GenPMXS_fission/quad-ldx.FMAX' 12 ! Cycle 1, T1 Not Dished -
  pmaxs_f 13 './GenPMXS_fission/quad-ldy.FMAX' 13 ! Cycle 1, T1 Not Dished Y
  pmaxs_f 14 './GenPMXS_fission/quad-ldz.FMAX' 14 ! Cycle 1, T1 Not Dished YZ
  pmaxs_f 15 './GenPMXS_fission/quad-lux.FMAX' 15 ! Cycle 1, T1 Dished -
  pmaxs_f 16 './GenPMXS_fission/quad-luy.FMAX' 16 ! Cycle 1, T1 Dished Y
  pmaxs_f 17 './GenPMXS_fission/quad-luz.FMAX' 17 ! Cycle 1, T1 Dished YZ
  pmaxs_f 18 './GenPMXS_fission/quad-2dx.FMAX' 18 ! Cycle 1, T2 Not Dished -
  pmaxs_f 19 './GenPMXS_fission/quad-2dy.FMAX' 19 ! Cycle 1, T2 Not Dished Y
  pmaxs_f 20 './GenPMXS_fission/quad-2ux.FMAX' 20 ! Cycle 1, T2 Dished -
  pmaxs_f 21 './GenPMXS_fission/quad-2uy.FMAX' 21 ! Cycle 1, T2 Dished Y
  pmaxs_f 22 './GenPMXS_fission/quad-3uy.FMAX' 22 ! Cycle 2, T3 Dished Y
  pmaxs_f 23 './GenPMXS_fission/quad-4uy.FMAX' 23 ! Cycle 2, T4 Dished Y
  pmaxs_f 24 './GenPMXS_fission/quad-5uy.FMAX' 24 ! Cycle 2, T5 Dished Y
  pmaxs_f 25 './GenPMXS_fission/quad-6uy.FMAX' 25 ! Cycle 2, T6 Dished Y
  pmaxs_f 26 './GenPMXS_fission/quad-7uy.FMAX' 26 ! Cycle 3, T7 Dished Y

```

/

!*****

! DATASET 2

CNTL

```
core_power      89.74
bank_pos        -15

      48 48 48 48 48
      48 48 36 48 28 48 36 48 48
      48 48 2 48 8 48 8 48 2 48 48
      48 48 36 48 26 48 40 48 26 48 36 48 48
      48 0 48 8 48 0 48 0 48 8 48 0 48
      48 36 48 26 48 32 48 26 48 32 48 26 48 36 48
      48 48 8 48 0 48 0 48 0 48 0 48 8 48 48
      48 28 48 40 48 26 48 32 48 26 48 40 48 28 48
      48 48 8 48 0 48 0 48 0 48 8 48 48
      48 36 48 26 48 32 48 26 48 32 48 26 48 36 48
      48 0 48 8 48 0 48 0 48 8 48 0 48
      48 48 36 48 26 48 40 48 26 48 36 48 48
      48 48 2 48 8 48 8 48 2 48 48
      48 48 36 48 28 48 36 48 48
      48 48 48 48 48
```

TH

state_core 11337.1 1220.1 7193714.0

DEPL

time_stp -0.4398

/

! DATASET 3

CNTL

```
core_power      89.21
bank_pos        -15

      48 48 48 48 48
      48 48 36 48 28 48 36 48 48
      48 48 0 48 4 48 4 48 0 48 48
      48 48 36 48 26 48 44 48 26 48 36 48 48
      48 0 48 8 48 0 48 0 48 8 48 0 48
      48 36 48 26 48 32 48 26 48 32 48 26 48 36 48
      48 48 4 48 0 48 0 48 0 48 4 48 48
      48 28 48 44 48 26 48 32 48 26 48 44 48 28 48
      48 48 4 48 0 48 0 48 0 48 4 48 48
      48 36 48 26 48 32 48 26 48 32 48 26 48 36 48
      48 0 48 8 48 0 48 0 48 8 48 0 48
      48 48 36 48 26 48 44 48 26 48 36 48 48
      48 48 0 48 4 48 4 48 0 48 48
      48 48 36 48 28 48 36 48 48
      48 48 48 48 48
```

TH

state_core 10796.5 1218.3 7170616.5

DEPL

time_stp -0.1698

/

! DATASET 4

CNTL

```
core_power      87.50
bank_pos        -15

      48 48 48 48 48
      48 48 36 48 36 48 48 48
      48 30 48 0 48 0 48 0 48 30 48
      48 36 48 8 48 26 48 26 48 8 48 36 48
      48 48 0 48 0 48 0 48 0 48 0 48 48
      48 48 22 48 34 48 30 48 30 48 34 48 22 48 48
      48 0 48 0 48 0 48 0 48 0 48 0 48
      48 48 36 48 34 48 22 48 22 48 34 48 36 48 48
      48 0 48 0 48 0 48 0 48 0 48 0 48
      48 48 22 48 34 48 30 48 30 48 34 48 22 48 48
      48 48 0 48 0 48 0 48 0 48 0 48 48
      48 36 48 8 48 26 48 26 48 8 48 36 48
      48 30 48 0 48 0 48 0 48 30 48
      48 48 36 48 36 48 48 48
      48 48 48 48 48
```

TH

state_core 11115.9 1220.1 7269211.6

DEPL

time_stp -0.5886

```

/
! DATASET 5
CNTL
    core_power    97.57
    bank_pos     -15
           48 48 48 48 48
           48 48 48 24 48 24 48 48 48
           48 32 48 0 48 0 48 0 48 32 48
           48 36 48 14 48 36 48 36 48 14 48 36 48
           48 48 0 48 0 48 0 48 0 48 48
           48 48 22 48 48 48 24 48 24 48 48 22 48 48
           48 0 48 8 48 8 48 0 48 8 48 8 48 0 48
           48 48 24 48 28 48 48 48 48 28 48 24 48 48
           48 0 48 8 48 8 48 0 48 8 48 8 48 0 48
           48 48 22 48 48 48 24 48 24 48 48 22 48 48
           48 48 0 48 0 48 0 48 0 48 48
           48 36 48 14 48 36 48 36 48 14 48 36 48
           48 32 48 0 48 0 48 0 48 32 48
           48 48 48 24 48 24 48 48 48
           48 48 48 48 48

```

```

TH
    state_core    11158.4 1215.1 7306719.0
DEPL
    time_stp     -0.7683

```

```

/
! DATASET 6
CNTL
    core_power    96.13
    bank_pos     -15
           48 48 48 48 48
           48 48 8 48 4 48 8 48 48
           48 48 24 48 34 48 34 48 24 48 48
           48 48 4 48 0 48 8 48 0 48 4 48 48
           48 24 48 40 48 24 48 24 48 40 48 24 48
           48 8 48 0 48 8 48 4 48 8 48 0 48 8 48
           48 48 34 48 24 48 38 48 38 48 24 48 34 48 48
           48 4 48 10 48 4 48 8 48 4 48 10 48 4 48
           48 48 34 48 24 48 38 48 38 48 24 48 34 48 48
           48 8 48 0 48 8 38 4 38 8 48 0 48 8 48
           48 24 48 40 48 34 48 34 48 40 48 24 48
           48 48 4 48 0 48 8 48 0 48 4 48 48
           48 48 24 48 34 48 34 48 24 48 48
           48 48 8 48 4 48 8 48 48
           48 48 48 48 48

```

```

TH
    state_core    10867.4 1214.7 7267350.0
DEPL
    time_stp     -0.9513

```

```

/
! DATASET 7
CNTL
    core_power    87.50
    bank_pos     -15
           48 48 48 48 48
           48 10 48 6 48 6 48 10 48
           48 34 48 20 48 28 48 20 48 34 48
           48 6 48 4 48 6 48 6 48 4 48 6 48
           48 48 20 48 34 48 20 48 34 48 20 48 48
           48 48 8 48 6 48 4 48 4 48 6 48 8 48 48
           48 20 48 34 48 20 48 34 48 20 48 34 48 20 48
           4 48 4 48 4 48 0 48 0 48 4 48 4 48 4
           48 20 48 34 48 20 48 34 48 20 48 34 48 20 48
           48 48 8 48 6 48 4 48 4 48 6 48 8 48 48
           48 48 20 48 34 48 20 48 34 48 20 48 48
           48 6 48 4 48 6 48 6 48 4 48 6 48
           48 34 48 20 48 28 48 20 48 34 48
           48 10 48 6 48 6 48 10 48
           48 48 48 48 48

```

```

TH

```

```

state_core      10817.2 1218.8 7145243.8
DEFL
time_stp        -0.6460

/

! DATASET 8
CNTL
core_power      92.40
bank_pos        -15
               48 48 48 48 48
               48 10 48 6 48 6 48 10 48
               48 36 48 20 48 32 48 20 48 36 48
               48 8 48 4 48 8 48 8 48 4 48 8 48
               48 48 20 48 36 48 20 48 36 48 20 48 48
               48 48 8 48 8 48 4 48 4 48 8 48 8 48 48
               48 28 48 36 48 24 48 36 48 24 48 36 48 28 48
               48 48 8 48 8 48 6 48 6 48 8 48 8 48 48
               48 28 48 36 48 24 48 36 48 24 48 36 48 28 48
               48 48 8 48 8 48 4 48 4 48 8 48 8 48 48
               48 48 20 48 36 48 20 48 36 48 20 48 48
               48 8 48 4 48 8 48 8 48 4 48 8 48
               48 36 48 20 48 32 48 20 48 36 48
               48 10 48 6 48 6 48 10 48
               48 48 48 48 48

```

```

TH
state_core      10804.2 1216.7 7220465.6
DEFL
time_stp        -0.2381

/

! DATASET 9
CNTL
core_power      94.66
bank_pos        -15
               48 48 48 48 48
               48 10 48 6 48 6 48 10 48
               48 36 48 20 48 32 48 20 48 36 48
               48 8 48 6 48 8 48 8 48 6 48 8 48
               48 48 20 48 36 48 20 48 36 48 20 48 48
               48 48 8 48 8 48 6 48 6 48 8 48 8 48 48
               48 28 48 36 48 24 48 36 48 24 48 36 48 28 48
               10 48 8 48 6 48 0 48 0 48 6 48 8 48 10
               48 28 48 36 48 24 48 36 48 24 48 36 48 28 48
               48 48 8 48 8 48 6 48 6 48 8 48 8 48 48
               48 48 20 48 36 48 20 48 36 48 20 48 48
               48 8 48 6 48 8 48 8 48 6 48 8 48
               48 36 48 20 48 32 48 20 48 36 48
               48 10 48 6 48 6 48 10 48
               48 48 48 48 48

```

```

TH
state_core      10608.9 1214.6 7208606.6
DEFL
time_stp        -0.6625

/

! DATASET 10
CNTL
core_power      93.07
bank_pos        -15
               48 48 48 48 48
               48 10 48 6 48 6 48 10 48
               48 36 48 24 48 32 48 24 48 36 48
               48 8 48 6 48 8 48 8 48 6 48 8 48
               48 48 24 48 36 48 20 48 36 48 24 48 48
               48 48 8 48 6 48 6 48 6 48 6 48 8 48 48
               48 30 48 36 48 24 48 36 48 24 48 36 48 30 48
               10 48 8 48 6 48 0 48 0 48 6 48 8 48 10
               48 30 48 36 48 24 48 36 48 24 48 36 48 30 48
               48 48 8 48 8 48 6 48 6 48 8 48 8 48 48
               48 48 24 48 36 48 20 48 36 48 24 48 48
               48 8 48 6 48 6 48 8 48 6 48 8 48
               48 36 48 24 48 32 48 24 48 36 48
               48 10 48 6 48 6 48 10 48
               48 48 48 48 48

```

```

TH
state_core      10392.9 1214.9 7136211.7
DEPL
time_stp        -0.5644

/

! DATASET 11
CNVL
core_power      80.21
bank_pos        -15
               48 48 48 48 48
               48 10 48 6 48 8 48 10 48
               48 44 48 26 48 36 48 26 48 44 48
               48 6 48 6 48 6 48 6 48 6 48 6 48
               48 48 28 48 40 48 24 48 40 48 28 48 48
               48 48 8 48 6 48 6 48 6 48 6 48 8 48 48
               48 24 48 38 48 26 48 40 48 26 48 38 48 24 48
               48 48 8 48 6 48 0 48 0 48 6 48 8 48 48
               48 24 48 38 48 26 48 40 48 26 48 38 48 24 48
               48 48 8 48 6 48 6 48 6 48 6 48 8 48 48
               48 48 28 48 40 48 24 48 40 48 28 48 48
               48 6 48 6 48 6 48 6 48 6 48 6 48
               48 44 48 26 48 36 48 26 48 44 48
               48 10 48 8 48 6 48 10 48
               48 48 48 48 48

```

```

TH
state_core      8485.6 1210.9 7068298.3
DEPL
time_stp        -0.7297

/

! DATASET 12
CNVL
core_power      88.63
bank_pos        -15
               48 48 48 48 48
               48 48 30 48 20 48 30 48 48
               48 48 10 48 6 48 6 48 10 48 48
               48 48 36 48 20 48 38 48 20 48 36 48 48
               48 10 48 4 48 4 48 4 48 4 48 10 48
               48 48 48 20 48 38 48 20 48 38 48 20 48 48 48
               48 48 6 48 4 48 6 48 6 48 4 48 6 48 48
               48 20 48 38 48 20 48 40 48 20 48 38 48 20 48
               48 48 6 48 4 48 6 48 6 48 4 48 6 48 48
               48 48 48 20 48 38 48 20 48 38 48 20 48 48 48
               48 10 48 4 48 4 48 4 48 4 48 10 48
               48 48 36 48 20 48 38 48 20 48 36 48 48
               48 48 10 48 6 48 6 48 10 48 48
               48 48 30 48 20 48 30 48 48
               48 48 48 48 48

```

```

TH
state_core      11149.7 1220.1 7203780.3
DEPL
time_stp        -0.5269

/

! DATASET 13
CNVL
core_power      88.01
bank_pos        -15
               48 48 48 48 48
               48 48 38 48 28 48 38 48 48
               48 48 14 48 0 48 0 48 14 48 48
               48 48 38 48 26 48 42 48 26 48 38 48 48
               48 14 48 6 48 4 48 4 48 6 48 14 48
               48 38 48 26 48 40 48 26 48 40 48 26 48 38 48
               48 48 0 48 4 48 0 48 0 48 4 48 0 48 48
               48 28 48 42 48 26 48 44 48 26 48 42 48 28 48
               48 48 0 48 4 48 0 48 0 48 4 48 0 48 48
               48 38 48 26 48 40 48 26 48 40 48 26 48 38 48
               48 14 48 6 48 4 48 4 48 6 48 14 48
               48 48 38 48 26 48 42 48 26 48 38 48 48

```

```

48 48 14 48 0 48 0 48 14 48 48
48 48 38 48 28 48 38 48 48
48 48 48 48 48

TH
state_core    10740.9 1218.7 7171581.8
DEPL
time_stp      -0.2491

/

! DATASET 14
CNVL
core_power    90.28
bank_pos      -15
48 48 48 48 48 48
48 48 48 32 48 32 48 48 48
48 16 48 6 48 6 48 6 48 16 48
48 44 48 30 48 40 48 40 48 30 48 44 48
10 48 6 48 8 48 4 48 8 48 6 48 10
48 48 32 48 40 48 28 48 28 48 40 48 32 48 48
48 12 48 8 48 6 48 10 48 6 48 8 48 12 48
48 48 40 48 26 48 44 48 44 48 26 48 40 48 48
48 12 48 8 48 6 48 10 48 6 48 8 48 12 48
48 48 32 48 40 48 28 48 28 48 40 48 32 48 48
10 48 6 48 8 48 4 48 8 48 6 48 10
48 44 48 30 48 40 48 40 48 30 48 44 48
48 16 48 6 48 6 48 6 48 16 48
48 48 48 32 48 32 48 48 48
48 48 48 48 48

TH
state_core    10902.3 1217.8 7188542.9
DEPL
time_stp      -0.5897

/

! DATASET 15
CNVL
core_power    87.11
bank_pos      -15
48 48 48 48 48 48
48 48 36 48 28 48 36 48 48
48 48 14 48 6 48 6 48 14 48 48
48 48 38 48 26 48 40 48 26 48 38 48 48
48 14 48 6 48 6 48 6 48 6 48 14 48
48 36 48 26 48 40 48 26 48 40 48 26 48 36 48
48 48 6 48 6 48 4 48 4 48 4 48 6 48 48
48 28 48 40 48 26 48 44 48 26 48 40 48 28 48
48 48 6 48 6 48 4 48 4 48 6 48 6 48 48
48 36 48 26 48 40 48 26 48 40 48 26 48 36 48
48 14 48 6 48 6 48 6 48 6 48 14 48
48 48 38 48 26 48 40 48 26 48 38 48 48
48 48 14 48 6 48 6 48 14 48 48
48 48 36 48 28 48 36 48 48
48 48 48 48 48

TH
state_core    11132.3 1220.4 7109597.9
DEPL
time_stp      -0.2624

/

! DATASET 16
CNVL
core_power    87.74
bank_pos      -15
48 48 48 48 48 48
48 48 38 48 28 48 38 48 48
48 48 14 48 8 48 8 48 14 48 48
48 48 38 48 32 48 46 48 32 48 38 48 48
48 14 48 6 48 6 48 6 48 6 48 14 48
48 38 48 32 48 42 48 30 48 42 48 32 48 38 48
48 48 8 48 6 48 8 48 8 48 6 48 8 48 48
48 28 48 46 48 30 48 48 48 30 48 46 48 28 48
48 48 8 48 6 48 8 48 8 48 6 48 8 48 48

```

C.4 Cycle 1 assembly configuration ‘qc-c1_lay.mcyf’ file

C.5 PARCS input for the cycle 2 assembly geometry ‘qc-cyc2.geom’ file

	geo_dim	32	32	28	1	1	!nasyx,nasyy,nz																															
!	rad_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					
	0	0	0	0	0	0	0	0	0	0	0	9	4	4	4	4	4	4	4	4	4	4	9	0	0	0	0	0	0	0	0	0	0					
	0	0	0	0	0	0	0	0	9	9	5	22	22	22	22	22	22	22	22	22	22	22	8	9	9	9	0	0	0	0	0	0	0					
	0	0	0	0	0	0	0	9	4	4	5	22	22	12	23	12	22	22	12	22	12	22	22	8	4	4	9	0	0	0	0	0	0	0				
	0	0	0	0	0	0	9	5	22	22	22	22	12	22	12	22	12	12	22	12	22	12	22	22	22	22	8	9	0	0	0	0	0	0				
	0	0	0	0	9	5	22	22	12	22	22	12	21	12	21	11	21	21	11	21	11	21	11	12	22	12	22	22	8	9	0	0	0	0	0			
	0	0	0	9	5	22	22	12	22	11	21	21	24	21	24	21	11	11	21	24	21	24	21	11	22	12	22	22	8	9	0	0	0	0	0			
	0	0	9	5	22	22	12	22	11	21	11	21	11	21	11	21	11	11	21	11	21	11	21	11	21	11	22	12	22	22	8	9	0	0	0			
	0	9	1	26	22	12	22	24	21	11	24	21	11	21	24	21	11	11	21	24	21	11	21	24	21	24	22	12	22	11	3	9	0	0	0			
	0	9	1	22	12	22	11	21	11	21	11	21	12	22	12	22	22	12	22	12	22	12	21	11	21	11	21	11	22	12	22	3	9	0	0	0		
	0	9	5	22	22	11	21	24	21	23	21	12	22	23	11	12	12	11	23	22	12	21	23	21	24	21	11	22	22	8	9	0	0	0	0			
	9	5	22	22	12	21	11	21	11	21	12	22	12	22	12	22	22	21	22	12	22	12	22	11	21	11	21	12	22	22	8	9	0	0	0			
	1	22	22	12	21	24	21	11	21	12	22	23	12	12	22	12	22	12	22	12	12	23	22	12	11	21	24	21	12	22	22	3	9	0	0	0		
	1	22	22	12	21	21	11	21	12	22	12	21	12	22	12	22	22	12	22	12	22	12	12	12	22	12	11	21	11	12	22	22	3	9	0	0		
	1	22	22	12	21	24	21	24	22	23	22	12	22	23	22	12	12	22	23	22	12	22	22	23	22	24	21	24	21	12	22	22	3	9	0	0		
	1	22	22	12	21	21	11	21	22	22	22	12	22	12	22	12	22	22	12	22	12	22	12	22	12	11	21	21	11	12	22	22	3	9	0	0		
	1	22	22	12	21	11	21	11	11	12	22	12	22	12	12	22	25	25	22	12	12	12	22	12	11	11	2											


```
det z loc      24  2
```



```

!-----
depletion      T 1.0e-3 F
!
TREE,nset,adf,xes,ene,jlf,chi,chn,vel,det,yld,cdf,gff,bet,lam,dht
tree_xs        T 26  T  F  F  F  F  F  F  F  F  F  F  F  F  F  F  F  F
!-----
!
input iteration planar adj
! edit table power pin reac
! print_opt T F F F F
!
fdbk flux planar
! rho precurs flux xe/sm T/H
! print_opt F F F F F
!
ld pk rad pwr rad flux assy
! const data shape shape const
! print_opt F F F F F
!*****
PARAM
nlupd_ss      3 5 1
n_iters_ss    5 6
conv_ss       1.0e-5 1.0e-4 1.0e-3 0.001
wielandt      0.2 0.1 1.0
decusp        2
nodal kern    nemmg
cmfd          2
!*****
XSEC
group_spec    2 1
!*****
GEOM
file          './support/qc-cycl.geom'
!*****
FDBK
fa_powpit     3.468 15.24
!*****
TH
unif_th       0.4 600.0 300.0
!*****
DEPL
satu_den      0.737 0.03753
bank_nr       177*1
!
time_stp      0.00
inp_hst       'qc-cycl.parcs_dep' 1 32
inp_opt       F F F F ! ppm,crp,ths,xesm
!
hst_opt       T T F F F ! hcr, hdc, hpc, htf, htc
out_opt       T T F F F ! ppow,phst,pths,pxesm,pxss
!
! Reflector XS
pmaxs_f 1 './GenPMAXS_fission/refl_bot.PMAX' 1 ! Bottom Axial Reflector
pmaxs_f 2 './GenPMAXS_fission/refl_top.PMAX' 2 ! Top Axial Reflector
pmaxs_f 3 './GenPMAXS_fission/refl_rad_W.PMAX' 3 ! W Radial Reflector
pmaxs_f 4 './GenPMAXS_fission/refl_rad_S.PMAX' 4 ! S Radial Reflector
pmaxs_f 5 './GenPMAXS_fission/refl_rad_E.PMAX' 5 ! E Radial Reflector
pmaxs_f 6 './GenPMAXS_fission/refl_rad_N.PMAX' 6 ! N Radial Reflector
pmaxs_f 7 './GenPMAXS_fission/refl_rad_NW.PMAX' 7 ! NW Radial Reflector
pmaxs_f 8 './GenPMAXS_fission/refl_rad_SW.PMAX' 8 ! SW Radial Reflector
pmaxs_f 9 './GenPMAXS_fission/refl_rad_SE.PMAX' 9 ! SE Radial Reflector
pmaxs_f 10 './GenPMAXS_fission/refl_rad_NE.PMAX' 10 ! NE Radial Reflector
pmaxs_f 11 './GenPMAXS_fission/refl_rad_edge.PMAX' 11 ! Radial Reflector
! Fuel XS
pmaxs_f 12 './GenPMAXS_fission/quad-1dx.PMAX' 12 ! Cycle 1, T1 Not Dished -
pmaxs_f 13 './GenPMAXS_fission/quad-1dy.PMAX' 13 ! Cycle 1, T1 Not Dished Y
pmaxs_f 14 './GenPMAXS_fission/quad-1dz.PMAX' 14 ! Cycle 1, T1 Not Dished YZ
pmaxs_f 15 './GenPMAXS_fission/quad-1ux.PMAX' 15 ! Cycle 1, T1 Dished -
pmaxs_f 16 './GenPMAXS_fission/quad-1uy.PMAX' 16 ! Cycle 1, T1 Dished Y
pmaxs_f 17 './GenPMAXS_fission/quad-1uz.PMAX' 17 ! Cycle 1, T1 Dished YZ
pmaxs_f 18 './GenPMAXS_fission/quad-2dx.PMAX' 18 ! Cycle 1, T2 Not Dished -
pmaxs_f 19 './GenPMAXS_fission/quad-2dy.PMAX' 19 ! Cycle 1, T2 Not Dished Y
pmaxs_f 20 './GenPMAXS_fission/quad-2ux.PMAX' 20 ! Cycle 1, T2 Dished -
pmaxs_f 21 './GenPMAXS_fission/quad-2uy.PMAX' 21 ! Cycle 1, T2 Dished Y
pmaxs_f 22 './GenPMAXS_fission/quad-3uy.PMAX' 22 ! Cycle 2, T3 Dished Y
pmaxs_f 23 './GenPMAXS_fission/quad-4uy.PMAX' 23 ! Cycle 2, T4 Dished Y
pmaxs_f 24 './GenPMAXS_fission/quad-5uy.PMAX' 24 ! Cycle 2, T5 Dished Y
pmaxs_f 25 './GenPMAXS_fission/quad-6uy.PMAX' 25 ! Cycle 2, T6 Dished Y
pmaxs_f 26 './GenPMAXS_fission/quad-7uy.PMAX' 26 ! Cycle 3, T7 Dished Y
!*****
MCYCLE
!
index locmap
bank_def 1 177*48
! cycle definition
cycle_def 1
depl_step 1*0.00001
power_lev 2*0.01
bank_seq 2*1
!
location

```



```

BANK_POS      -15
               48 48 48 48 48
               48 48 42 48 36 48 42 48 48
               48 48 14 48 0 48 0 48 14 48 48
               48 48 38 48 32 48 42 48 32 48 38 48 48
               48 14 48 0 48 0 48 0 48 0 48 14 48
               48 42 48 32 48 44 48 34 48 44 48 32 48 42 48
               48 48 0 48 0 48 0 48 0 48 0 48 48
               48 36 48 42 48 34 48 44 48 34 48 42 48 36 48
               48 48 0 48 0 48 0 48 0 48 0 48 48
               48 42 48 32 48 44 48 34 48 44 48 32 48 42 48
               48 14 48 0 48 0 48 0 48 0 48 14 48
               48 48 38 48 32 48 42 48 32 48 38 48 48
               48 48 14 48 0 48 0 48 14 48 48
               48 48 42 48 36 48 42 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 26 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 './support/qc-cyc2.paths'
!
! 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 T F F F F F
inp_opts       F T
plot_opts      0 0 2
ROT_ADF        T
DETECTOR       T 100 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
  file './support/qc-cyc2.geom'
FDBK
  fa_powpit     3.468 15.24
DEPL
  INP_HST       'qc-shuff-clc2.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       177*1
!
! Cross-sections
!
! Reflector XS
  pmaxs_f 1 './GenPMAXS_fission/refl_bot.PMAX' 1 ! Bottom Axial Reflector
  pmaxs_f 2 './GenPMAXS_fission/refl_top.PMAX' 2 ! Top Axial Reflector
  pmaxs_f 3 './GenPMAXS_fission/refl_rad_W.PMAX' 3 ! W Radial Reflector
  pmaxs_f 4 './GenPMAXS_fission/refl_rad_S.PMAX' 4 ! S Radial Reflector
  pmaxs_f 5 './GenPMAXS_fission/refl_rad_E.PMAX' 5 ! E Radial Reflector
  pmaxs_f 6 './GenPMAXS_fission/refl_rad_N.PMAX' 6 ! N Radial Reflector
  pmaxs_f 7 './GenPMAXS_fission/refl_rad_NW.PMAX' 7 ! NW Radial Reflector
  pmaxs_f 8 './GenPMAXS_fission/refl_rad_SW.PMAX' 8 ! SW Radial Reflector
  pmaxs_f 9 './GenPMAXS_fission/refl_rad_SE.PMAX' 9 ! SE Radial Reflector
  pmaxs_f 10 './GenPMAXS_fission/refl_rad_NE.PMAX' 10 ! NE Radial Reflector

```

```

pmaxs_f 11      './GenPMAXS_fission/refl_rad_edge.PMAX' 11 ! Radial Reflector
! Fuel XS
pmaxs_f 12      './GenPMAXS_fission/quad-1dx.PMAX'      12 ! Cycle 1, T1 Not Dished -
pmaxs_f 13      './GenPMAXS_fission/quad-1dy.PMAX'      13 ! Cycle 1, T1 Not Dished Y
pmaxs_f 14      './GenPMAXS_fission/quad-1dz.PMAX'      14 ! Cycle 1, T1 Not Dished YZ
pmaxs_f 15      './GenPMAXS_fission/quad-1ux.PMAX'      15 ! Cycle 1, T1 Dished -
pmaxs_f 16      './GenPMAXS_fission/quad-1uy.PMAX'      16 ! Cycle 1, T1 Dished Y
pmaxs_f 17      './GenPMAXS_fission/quad-1uz.PMAX'      17 ! Cycle 1, T1 Dished YZ
pmaxs_f 18      './GenPMAXS_fission/quad-2dx.PMAX'      18 ! Cycle 1, T2 Not Dished -
pmaxs_f 19      './GenPMAXS_fission/quad-2dy.PMAX'      19 ! Cycle 1, T2 Not Dished Y
pmaxs_f 20      './GenPMAXS_fission/quad-2ux.PMAX'      20 ! Cycle 1, T2 Dished -
pmaxs_f 21      './GenPMAXS_fission/quad-2uy.PMAX'      21 ! Cycle 1, T2 Dished Y
pmaxs_f 22      './GenPMAXS_fission/quad-3uy.PMAX'      22 ! Cycle 2, T3 Dished Y
pmaxs_f 23      './GenPMAXS_fission/quad-4uy.PMAX'      23 ! Cycle 2, T4 Dished Y
pmaxs_f 24      './GenPMAXS_fission/quad-5uy.PMAX'      24 ! Cycle 2, T5 Dished Y
pmaxs_f 25      './GenPMAXS_fission/quad-6uy.PMAX'      25 ! Cycle 2, T6 Dished Y
pmaxs_f 26      './GenPMAXS_fission/quad-7uy.PMAX'      26 ! Cycle 3, T7 Dished Y

```

/

! DATASET 17

CNTL

CORE_POWER 56.66

BANK_POS -15

```

      48 48 48 48 48
      48 48 42 48 36 48 42 48 48
      48 48 14 48 0 48 0 48 14 48 48
      48 48 38 48 32 48 42 48 32 48 38 48 48
      48 14 48 0 48 0 48 0 48 0 48 14 48
      48 42 48 32 48 44 48 34 48 44 48 32 48 42 48
      48 48 0 48 0 48 0 48 0 48 0 48 48
      48 36 48 42 48 34 48 44 48 34 48 42 48 36 48
      48 48 0 48 0 48 0 48 0 48 0 48 48
      48 42 48 32 48 44 48 34 48 44 48 32 48 42 48
      48 14 48 0 48 0 48 0 48 0 48 14 48
      48 48 38 48 32 48 42 48 32 48 38 48 48
      48 48 14 48 0 48 0 48 14 48 48
      48 48 42 48 36 48 42 48 48
      48 48 48 48 48

```

DEPL

TIME_STP -0.0165

TH

STATE_CORE 5750.8 1205.0 6865482.2

/

! DATASET 18

CNTL

CORE_POWER 86.48

BANK_POS -15

```

      48 48 48 48 48
      48 48 48 48 36 48 48 48 48
      48 48 30 48 0 48 0 48 30 48 48
      48 48 44 48 38 48 48 48 38 48 44 48 48
      48 30 48 0 48 0 48 0 48 30 48
      48 48 48 38 48 48 48 40 48 48 48 38 48 48 48
      48 48 0 48 0 48 16 48 16 48 0 48 0 48 48
      48 36 48 48 48 40 48 48 48 40 48 48 48 36 48
      48 48 0 48 0 48 16 48 16 48 0 48 0 48 48
      48 48 48 38 48 48 48 40 48 48 48 38 48 48 48
      48 30 48 0 48 0 48 0 48 0 48 30 48
      48 48 44 48 38 48 48 48 38 48 44 48 48
      48 48 30 48 0 48 0 48 30 48 48
      48 48 48 48 36 48 48 48 48
      48 48 48 48 48

```

DEPL

TIME_STP -0.2293

TH

STATE_CORE 9483.5 1213.5 7165031.8

/

! DATASET 19

CNTL

CORE_POWER 85.86

BANK_POS -15

```

      48 48 48 48 48
      48 48 48 48 40 48 48 48 48
      48 48 30 48 6 48 6 48 30 48 48
      48 48 48 48 40 48 48 48 40 48 48 48 48
      48 30 48 0 48 6 48 6 48 0 48 30 48
      48 48 48 40 48 48 48 44 48 48 48 40 48 48 48
      48 48 6 48 6 48 28 48 28 48 6 48 6 48 48
      48 40 48 48 48 44 48 48 44 48 00 48 40 48
      48 48 6 48 6 48 28 48 28 48 6 48 6 48 48
      48 48 48 40 48 48 48 44 48 48 48 40 48 48 48
      48 30 48 0 48 6 48 6 48 0 48 30 48
      48 48 48 48 40 48 48 48 40 48 48 48 48
      48 48 30 48 6 48 6 48 30 48 48
      48 48 48 48 48 40 48 48 48 48
      48 48 48 48 48

```

DEPL

TIME_STP -0.4321

```

TH
STATE_CORE 9933.3 1213.6 7231910.9
/
! DATASET 20
CNTL
CORE_POWER 83.50
BANK_POS -15
      48 48 48 48 48
      48 48 48 44 48 44 48 48 48
      48 36 48 6 48 0 48 6 48 36 48
      48 48 48 42 48 48 48 48 48 42 48 48 48
      38 48 0 48 10 48 0 48 10 48 0 48 38
      48 48 42 48 48 48 42 48 42 48 48 48 42 48 48
      48 28 48 10 48 6 48 28 48 6 48 10 48 28 48
      48 48 48 48 42 48 48 48 48 48 42 48 48 48 48
      48 28 48 10 48 6 48 28 48 6 48 10 48 28 48
      48 48 42 48 48 48 42 48 42 48 48 48 42 48 48
      38 48 0 48 10 48 0 48 10 48 0 48 38
      48 48 48 42 48 48 48 48 48 42 48 48 48
      48 36 48 6 48 0 48 6 48 36 48
      48 48 48 44 48 44 48 48 48
      48 48 48 48 48

DEPL
TIME_STP -0.4586
TH
STATE_CORE 9293.9 1214.2 7058094.1
/
! DATASET 21
CNTL
CORE_POWER 96.05
BANK_POS -15
      48 48 48 48 48 48 48
      48 34 48 6 48 16 48 4 48 34 48
      48 48 48 48 48 48 48 48 48 48 48 48
      38 48 0 48 28 48 0 48 28 48 0 48 38
      48 48 44 48 48 48 48 48 48 48 48 44 48 48
      48 12 48 28 48 0 48 32 48 0 48 28 48 12 48
      48 48 48 48 48 48 48 48 48 48 48 48 48 48
      48 12 48 28 48 0 48 32 48 0 48 28 48 12 48
      48 48 44 48 48 48 48 48 48 48 48 44 48 48
      38 48 0 48 28 48 0 48 28 48 0 48 38
      48 48 48 48 48 48 48 48 48 48 48 48 48
      48 34 48 6 48 16 48 4 48 34 48
      48 48 48 48 48 48 48 48 48
      48 48 48 48 48

DEPL
TIME_STP -0.3660
TH
STATE_CORE 10957.7 1215.9 7161515.4
/
! DATASET 22
CNTL
CORE_POWER 99.57
BANK_POS -15
      48 48 48 48 48 48 48
      48 36 48 10 48 34 48 10 48 36 48
      48 48 48 48 48 48 48 48 48 48 48 48
      42 48 5 48 42 48 6 48 42 48 4 48 42
      48 48 48 48 48 48 48 48 48 48 48 48 48
      48 0 48 34 48 12 48 32 48 12 48 34 48 0 48
      48 48 48 48 48 48 48 48 48 48 48 48 48 48
      48 0 48 34 48 12 48 32 48 12 48 34 48 0 48
      48 48 48 48 48 48 48 48 48 48 48 48 48 48
      42 48 5 48 42 48 6 48 42 48 4 48 42
      48 48 48 48 48 48 48 48 48 48 48 48 48
      48 36 48 10 48 34 48 10 48 36 48
      48 48 48 48 48 48 48 48 48
      48 48 48 48 48

DEPL
TIME_STP -0.3527
TH
STATE_CORE 10854.3 1213.1 7338710.7
/
! DATASET 23
CNTL
CORE_POWER 98.09
BANK_POS -15
      48 48 48 48 48 48 48
      48 48 8 48 40 48 40 48 8 48 48
      48 48 48 48 48 48 48 48 48 48 48 48
      48 8 48 8 48 28 48 28 48 6 48 8 48
      48 48 48 48 48 48 48 48 48 48 48 48 48
      48 48 40 48 28 48 38 48 38 48 28 48 40 48 48
      48 48 48 48 48 48 48 48 48 48 48 48 48 48
      48 48 40 48 28 48 38 48 38 48 28 48 40 48 48

```


C-23


```

2 1 1 1 1 1 4 1 4 1 1 4 1 4 1 1 1 1 2
2 2 2 1 4 1 4 1 1 1 4 1 4 1 2 2 2
2 1 1 3 1 1 1 3 1 1 2
2 2 2 2 2 2 2 2 2

```

! data taken from PB inputs, not exactly right

	chan_geom	1	charea	chhd	rough	ppitch	n_fpin	or_cld	or_pin	th_clad	hgap	wr	r_wrod
7x7	chan_geom	1	0.0100225	0.0147335	4.57e-05	0.0187452	49	0.0071501	0.0061976	0.0008128	4600.00	0	0.0071501
	chan_geom	2	0.0100225	0.0147335	4.57e-05	0.0187452	49	0.0071501	0.0061976	0.0008128	4600.00	0	0.0071501
7x7 with periph orifice	chan_geom	3	0.0100225	0.0147335	4.57e-05	0.0187452	49	0.0071501	0.0060579	0.0009398	4600.00	0	0.0071501
7x7 (type 3)	chan_geom	4	100.11E-4	1.52E-2	5E-6	16.26E-3	63	6.26E-3	5.28E-3	0.86E-3	3920.0	1	6.26E-3
8x8 (type 4 & 7)	chan_geom	5	0.0100225	0.0147335	4.57e-05	0.0187452	49	0.0071501	0.0061976	0.0008128	4600.00	0	0.0071501
7x7 with MOX (type 5 & 6)													

! loss coefficients (taken from PB, not exactly right)

	ka_chan	1	33.16946	8.82098	0 0 0 0	1.15335	0 0 0 0	1.15335	0 0 0 0	1.15335	0 0 0 0	1.15335	0 0 0 0	1.15335	0 0 0 0
1.15335	0 0 0 0	1.15335	0 0 2.0												
	ka_chan	2	203.1175	8.82098	0 0 0 0	1.15335	0 0 0 0	1.15335	0 0 0 0	1.15335	0 0 0 0	1.15335	0 0 0 0	1.15335	0 0 0 0
1.15335	0 0 0 0	1.15335	0 0 2.0												
	ka_chan	3	33.16946	8.82098	0 0 0 0	1.15335	0 0 0 0	1.15335	0 0 0 0	1.15335	0 0 0 0	1.15335	0 0 0 0	1.15335	0 0 0 0
1.15335	0 0 0 0	1.15335	0 0 2.0												
	ka_chan	4	92.01000	8.82098	0 0 0 0	2.25	0 0 0 0	2.25	0 0 0 0	2.25	0 0 0 0	2.25	0 0 0 0	2.25	0 0 0 0
2.25	0 0 0 0	2.25	0 0 2.0												
	ka_chan	5	33.16946	8.82098	0 0 0 0	1.15335	0 0 0 0	1.15335	0 0 0 0	1.15335	0 0 0 0	1.15335	0 0 0 0	1.15335	0 0 0 0
1.15335	0 0 0 0	1.15335	0 0 2.0												

C.12 PARCS input for the cycle 2–3 shuffling ‘quad-cyc23.inp’ file

```

*****
CASEID qp-shuff-c2c3
*****
CNIL
  core_type  BHR
  core_power 100.0
!-----
  th_fidbk   F
!-----
!
  rot_adf    T
  restart    F
  xe_sm      1 1
  transient  F
  decay_heat F
!-----
  depletion  T 1.0e-3 T
!
  tree_xs    T 26 T T F F F F F T T F F F F F F
  mult_cyc   T
!-----
!
  input      iteration  planar  adj
! edit      table      power   pin   reac
! print_opt  T          F        F        F
!
  fidbk      flux      planar
! rho        precurs   flux      xe/sm  T/H
! print_opt  F          F        F        F
!
  ld         pk        rad pwr  rad flux assy
! const      data      shape   shape  const
! print_opt  F          F        F        F
! inp_opts   F T
*****
PARAM
  nlupd_ss   3 5 1
  n_iters    15 5
  conv_ss    1.0e-5 1.0e-4 1.0e-3 0.001
  wielandt   0.2 0.1 1.0
  decusp     2
  nodal_kern naming
  cmfd       2
*****
XSEC
  group_spec 2 1
*****
GECM
  file        './support/qp-cyc2.geom'
*****
FCHK
  fa_pospit   4.3102 15.24
*****
TH

```

C-28

C.13 PARCS input for the HFP cycle 3 ‘quad-cyc3.inp’ file

C-29

```

! 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
      file        './support/qc-cyc3.geom'
FDBK
      fa_powpit   3.468 15.24
DEPL
      INP_HST     'qc-shuff-c2c3.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     177*1
!
! Cross-sections
!
! Reflector XS
      pmaxs_f 1 './GenPMAXS_fission/refl_bot.PMAX' 1 ! Bottom Axial Reflector
      pmaxs_f 2 './GenPMAXS_fission/refl_top.PMAX' 2 ! Top Axial Reflector
      pmaxs_f 3 './GenPMAXS_fission/refl_rad_W.PMAX' 3 ! W Radial Reflector
      pmaxs_f 4 './GenPMAXS_fission/refl_rad_S.PMAX' 4 ! S Radial Reflector
      pmaxs_f 5 './GenPMAXS_fission/refl_rad_E.PMAX' 5 ! E Radial Reflector
      pmaxs_f 6 './GenPMAXS_fission/refl_rad_N.PMAX' 6 ! N Radial Reflector
      pmaxs_f 7 './GenPMAXS_fission/refl_rad_NW.PMAX' 7 ! NW Radial Reflector
      pmaxs_f 8 './GenPMAXS_fission/refl_rad_SW.PMAX' 8 ! SW Radial Reflector
      pmaxs_f 9 './GenPMAXS_fission/refl_rad_SE.PMAX' 9 ! SE Radial Reflector
      pmaxs_f 10 './GenPMAXS_fission/refl_rad_NE.PMAX' 10 ! NE Radial Reflector
      pmaxs_f 11 './GenPMAXS_fission/refl_rad_edge.PMAX' 11 ! Radial Reflector
! Fuel XS
      pmaxs_f 12 './GenPMAXS_fission/quad-1dx.PMAX' 12 ! Cycle 1, T1 Not Dished -
      pmaxs_f 13 './GenPMAXS_fission/quad-1dy.PMAX' 13 ! Cycle 1, T1 Not Dished Y
      pmaxs_f 14 './GenPMAXS_fission/quad-1dz.PMAX' 14 ! Cycle 1, T1 Not Dished YZ
      pmaxs_f 15 './GenPMAXS_fission/quad-1ux.PMAX' 15 ! Cycle 1, T1 Dished -
      pmaxs_f 16 './GenPMAXS_fission/quad-1uy.PMAX' 16 ! Cycle 1, T1 Dished Y
      pmaxs_f 17 './GenPMAXS_fission/quad-1uz.PMAX' 17 ! Cycle 1, T1 Dished YZ
      pmaxs_f 18 './GenPMAXS_fission/quad-2dx.PMAX' 18 ! Cycle 1, T2 Not Dished -
      pmaxs_f 19 './GenPMAXS_fission/quad-2dy.PMAX' 19 ! Cycle 1, T2 Not Dished Y
      pmaxs_f 20 './GenPMAXS_fission/quad-2ux.PMAX' 20 ! Cycle 1, T2 Dished -
      pmaxs_f 21 './GenPMAXS_fission/quad-2uy.PMAX' 21 ! Cycle 1, T2 Dished Y
      pmaxs_f 22 './GenPMAXS_fission/quad-3uy.PMAX' 22 ! Cycle 2, T3 Dished Y
      pmaxs_f 23 './GenPMAXS_fission/quad-4uy.PMAX' 23 ! Cycle 2, T4 Dished Y
      pmaxs_f 24 './GenPMAXS_fission/quad-5uy.PMAX' 24 ! Cycle 2, T5 Dished Y
      pmaxs_f 25 './GenPMAXS_fission/quad-6uy.PMAX' 25 ! Cycle 2, T6 Dished Y
      pmaxs_f 26 './GenPMAXS_fission/quad-7uy.PMAX' 26 ! Cycle 3, T7 Dished Y
/
! DATASET 30
CNTL
      CORE_POWER 97.21
      BANK_POS   -15
              48 48 48 48 48 48
              48 48 48 48 48 48 48 48 48
              48 48 48 48 48 48 48 48 48 48
              48 48 12 48 38 48 24 48 38 48 12 48 48
              48 48 48 48 48 48 48 48 48 48 48 48
              48 48 48 38 48 12 48 44 48 12 48 38 48 48 48

```



```

CORE_POWER 97.37
BANK_POS      -15
               48  48  48  48  48  48
               48  48  48  48  48  48  48  48
               48  48  44  48  10  48  10  48  44  48  48
               48  48  48  48  48  48  48  48  48  48  48  48
               48  44  48  28  48  36  48  36  48  28  48  44  48
               48  48  48  48  48  48  48  48  48  48  48  48  48
               48  48  10  48  36  48  44  48  44  48  36  48  10  48  48
               48  48  48  48  48  48  48  48  48  48  48  48  48  48
               48  48  10  48  36  48  44  48  44  48  36  48  10  48  48
               48  48  48  48  48  48  48  48  48  48  48  48  48  48
               48  44  48  28  48  36  48  36  48  28  48  44  48
               48  48  48  48  48  48  48  48  48  48  48  48  48
               48  48  44  48  10  48  10  48  44  48  48
               48  48  48  48  48  48  48  48  48  48
DEPL
TIME_STP -0.7937
TH
STATE_CORE 10837.8  1220.8  7108494.8
/
! DATASET 35
CNTL
CORE_POWER 83.23
BANK_POS      -15
               48  48  48  48  48  48
               48  48  48  48  48  48  48  48
               48  48  44  48  10  48  10  48  44  48  48
               48  48  48  48  48  48  48  48  48  48  48  48
               48  44  48  26  48  36  48  36  48  26  48  44  48
               48  48  48  48  48  48  48  48  48  48  48  48  48
               48  48  10  48  36  48  44  48  44  48  36  48  10  48  48
               48  48  48  48  48  48  48  48  48  48  48  48  48
               48  48  10  48  36  48  44  48  44  48  36  48  10  48  48
               48  48  48  48  48  48  48  48  48  48  48  48  48
               48  44  48  26  48  36  48  36  48  26  48  44  48
               48  48  48  48  48  48  48  48  48  48  48  48
               48  48  44  48  10  48  10  48  44  48  48
               48  48  48  48  48  48  48  48  48  48
DEPL
TIME_STP -0.4057
TH
STATE_CORE 9260.2  1218.9  6984389.1
/
! DATASET 36
CNTL
CORE_POWER 87.22
BANK_POS      -15
               48  48  48  48  48  48
               48  48  48  48  20  48  20  48  48  48  48
               48  48  48  48  48  48  48  48  48  48  48  48
               48  48  48  16  48  48  48  48  48  16  48  48  48
               48  48  48  48  48  48  48  48  48  48  48  48  48
               48  48  20  48  48  48  48  48  48  48  20  48  48
               48  48  48  48  48  48  48  32  48  48  48  48  48  48
               48  48  20  48  48  48  48  48  48  48  20  48  48
               48  48  48  48  48  48  48  48  48  48  48  48  48
               48  48  48  16  48  48  48  48  16  48  48  48
               48  48  48  48  48  48  48  48  48  48  48
               48  48  48  48  20  48  20  48  48  48  48
               48  48  48  48  48  48  48  48  48  48
DEPL
TIME_STP -0.5644
TH
STATE_CORE 10753.2  1225.0  7011968.2
/
! DATASET 37
CNTL
CORE_POWER 84.67
BANK_POS      -15
               48  48  48  48  48  48
               48  48  48  48  48  48  48  48
               48  48  48  48  40  48  40  48  48  48  48
               48  48  48  48  48  48  48  48  48  48  48  48
               48  48  48  22  48  48  48  48  22  48  48  48
               48  48  48  48  48  48  48  48  48  48  48  48
               48  48  40  48  48  48  48  48  48  48  40  48  48
               48  48  48  48  48  48  48  32  48  48  48  48  48
               48  48  40  48  48  48  48  48  48  48  40  48  48
               48  48  48  48  48  48  48  48  48  48  48  48
               48  48  48  22  48  48  48  48  22  48  48  48
               48  48  48  48  48  48  48  48  48  48  48
               48  48  48  48  40  48  40  48  48  48  48
               48  48  48  48  48  48  48  48  48  48

```

```

                                48  48  48  48  48
DEPL
    TIME_STP -0.4685
TH
    STATE_CORE 10668.6  1225.7  7011968.2
/
! DATASET EOC
CNTL
    CORE_POWER 84.67
    BANK_POS   -15
                                48  48  48  48  48
                                48  48  48  48  40  48  40  48  48  48  48
                                48  48  48  48  48  48  48  48  48  48  48  48
                                48  48  48  22  48  48  48  48  48  22  48  48  48
                                48  48  48  48  48  48  48  48  48  48  48  48  48
                                48  48  40  48  48  48  48  48  48  48  48  40  48  48
                                48  48  48  48  48  48  48  32  48  48  48  48  48  48
                                48  48  40  48  48  48  48  48  48  48  48  40  48  48
                                48  48  48  48  48  48  48  48  48  48  48  48  48  48
                                48  48  48  22  48  48  48  48  48  22  48  48  48
                                48  48  48  48  48  48  48  48  48  48  48  48  48
                                48  48  48  48  40  48  40  48  48  48  48  48
                                48  48  48  48  48  48  48  48  48  48
DEPL
    TIME_STP -0.2546
TH
    STATE_CORE 10668.6  1225.7  7011968.2
.

```

APPENDIX D. PROGRAM TO COMPARE TIPS DATA FOR BWRS

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
do j=1,ndets
read(11,*) tips(i)%tipname(j), (tips(i)%tipdata(j,k),k=1,naxials)
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 psracs 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

```

```

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 ica=1,ncases
  tip1=>tips(ica)
  !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(ica)%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:',ica
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(icasel)%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(icasel)%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(icasel)%loctips(j)) cycle
  ntipdata=ntipdata+1
enddo
!Renormalization
!normalize measured tips data
sum0=0.0
do j=1,tstrings
  if (.not.tips(icasel)%loctips(j)) cycle
  do k=1,levels
    sum0=sum0+tip1%tipdata(j,k)
  enddo
enddo
do j=1,tstrings
  if (.not.tips(icasel)%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(icasel)%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(icasel)%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(icasel)%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(icas)%loctips(j)) cycle
  do k=1,levels
    sum0=sum0+tip2%tipdata(j,k)
  enddo
enddo
do j=1,tstrings
  if (.not.tips(icas)%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(icas)%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(icas)%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(icas)%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(icas)%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,i5)') '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 41 24                !# of detectors, # of axials
TIP Cyl_TIPS.det          !# of TIPS measure data
DPL qc-cycl.parc_dpl      !PARCS output summary
DET qc-cycl.parc_det      !PARCS TIPS calculated data

```

D.3 Cycle 2 input for TIP comparison

DIM	41 24	!# of detectors, # of axials
TIP	Cy2_TIPS.det	!# of TIPS measure data
DPL	qc-cyc2.parcs_dpl	!PARCS output summary
DET	qc-cyc2.parcs_det	!PARCS TIPS calculated data

D.4 Cycle 3 input for TIP comparison

DIM	41 24	!# of detectors, # of axials
TIP	Cy3_TIPS.det	!# of TIPS measure data
DPL	qc-cyc3.parcs_dpl	!PARCS output summary
DET	qc-cyc3.parcs_det	!PARCS TIPS calculated data

CYCLE-1					
16	41	24	#cases,	# of detectors,	# of axials (opposite direction to PARCS)
@set	1	87.0	0.247	0.247	2 !sets, power, MWD/kgU, MWD/kgU, MWD/kgU, Parcs #
D1609	36.6	57.7	76.0	96.8	114.3 122.8 133.2 131.6 128.5 117.5 119.8 112.9 102.9 101.5 97.0 89.6 88.0 90.8 90.0 87.8 89.2 73.6 52.1 35.3
D2409	34.0	56.5	77.1	101.6	122.9 145.1 169.4 182.7 178.0 168.8 172.4 169.7 158.2 149.2 143.9 141.6 141.1 152.9 157.4 145.6 141.3 114.3 76.2 31.9
D3209	30.6	53.2	72.2	95.3	113.7 127.1 138.7 146.5 144.5 145.5 153.3 148.2 142.5 136.9 131.1 136.7 122.7 135.8 136.6 127.2 124.5 106.0 70.8 38.2
D4009	26.7	46.7	63.0	79.7	97.6 111.3 125.4 140.5 134.1 130.2 128.5 125.1 118.4 112.9 112.2 110.9 106.0 110.1 114.7 106.2 106.6 93.1 65.1 42.0
D4809	34.5	56.1	72.4	90.0	102.1 112.0 115.9 114.8 108.1 104.1 99.7 93.9 88.6 80.1 76.6 74.3 69.5 69.7 68.9 62.3 58.5 51.0 39.0 28.3
D0817	35.0	57.4	75.3	96.4	110.0 118.7 117.0 114.8 113.3 108.9 107.3 102.8 93.9 90.3 88.2 83.0 80.9 81.4 81.8 76.5 78.9 66.4 49.0 27.7
D1617	34.9	54.9	71.5	92.5	109.7 131.7 149.2 155.0 145.6 144.2 147.7 146.0 140.7 133.3 136.5 129.4 122.9 124.6 123.3 127.2 115.9 112.2 92.2 62.6 27.2
D2417	27.6	46.6	64.4	83.7	105.5 114.8 125.1 131.9 138.2 133.8 148.5 162.8 159.3 161.1 162.7 159.7 152.1 151.7 148.8 134.2 123.7 105.7 72.9 43.1
D3217	27.8	50.7	72.4	101.1	134.8 156.3 164.9 174.4 170.4 156.1 157.2 155.4 153.1 148.7 148.4 140.0 144.7 134.2 138.4 134.5 119.4 113.2 94.4 68.3 46.1
D4017	30.7	49.7	67.2	85.0	97.8 111.1 121.8 128.3 128.8 127.7 138.9 153.2 158.0 153.4 152.2 154.0 144.7 135.9 139.2 133.3 128.7 112.6 113.0 79.2 45.5
D4817	37.5	61.1	80.6	102.9	124.4 140.4 164.9 175.4 170.3 154.8 148.5 150.2 133.0 130.2 130.4 124.4 114.0 121.3 123.1 113.2 114.1 99.7 71.7 46.3
D0825	29.1	49.1	67.0	86.4	102.0 117.4 131.7 138.2 139.7 131.7 137.8 130.3 126.5 122.8 120.5 115.9 118.7 126.3 129.8 123.4 117.3 99.7 66.7 31.9
D1625	30.1	49.1	65.4	84.8	96.9 106.7 114.6 119.7 117.3 121.0 129.6 140.0 141.2 141.1 146.6 135.6 135.0 131.4 129.6 120.8 111.5 85.0 59.5 31.0
D2425	23.6	39.9	52.2	66.1	78.6 88.8 101.4 119.1 132.6 138.4 142.8 155.4 150.6 151.2 144.4 140.0 134.0 131.3 124.5 108.7 98.0 78.8 54.4 34.4
D3225	23.6	40.9	55.7	69.1	82.4 94.7 105.6 116.2 121.1 128.4 140.9 157.8 157.1 150.2 149.3 137.7 130.2 121.7 115.5 98.7 90.0 75.4 50.6 29.6
D4025	32.4	49.4	64.3	79.4	94.1 104.3 120.6 140.8 142.9 159.8 171.1 168.7 162.7 160.5 154.3 150.7 138.6 133.9 129.3 111.7 99.0 83.6 57.8 28.8
D4825	36.9	56.6	72.4	95.9	111.1 123.6 132.2 133.7 128.3 129.7 140.1 145.3 143.5 146.0 139.2 138.9 139.4 144.1 148.9 133.9 127.6 104.6 72.8 36.6
S5625	43.4	62.6	80.1	98.6	115.0 138.1 160.9 158.9 155.4 149.5 154.3 142.1 131.9 127.6 124.1 119.9 113.7 114.5 109.8 101.4 88.9 70.4 47.0 24.3
D0833	31.5	52.6	72.5	91.1	108.7 122.5 132.3 141.7 136.7 139.0 146.8 146.8 141.1 133.4 134.8 125.7 122.4 135.5 139.0 131.5 124.4 106.1 72.6 40.3
D1633	28.4	49.0	67.2	94.0	126.8 146.6 153.6 155.3 152.2 145.2 146.5 152.5 140.3 139.3 136.9 139.9 128.0 129.3 125.3 111.4 105.7 86.2 62.7 48.2
D2433	22.9	39.3	54.1	67.4	81.2 90.6 100.2 110.8 118.3 127.2 145.5 153.0 162.5 159.9 156.2 147.7 138.0 135.2 122.5 106.8 94.2 77.8 52.0 31.8
D3233	23.0	39.0	52.1	66.7	80.2 88.9 102.7 118.6 135.2 141.7 158.3 158.3 152.3 144.8 142.5 134.2 123.1 119.2 109.1 93.8 82.4 66.1 45.3 25.9
D4033	25.8	42.4	59.7	77.1	93.0 102.4 113.5 119.8 123.3 121.7 137.3 151.9 160.3 152.0 152.1 145.8 134.6 136.7 129.7 112.4 100.9 84.5 63.9 45.7
D4833	41.4	61.9	85.3	116.4	136.7 144.5

D4825	42.8	65.9	85.7	108.4	122.4	127.5	139.5	140.8	138.2	133.3	139.6	146.0	141.1	136.1	128.5	115.1	105.7	103.2	90.0	72.3	65.3	52.7	38.2	25.1	
D5625	39.1	59.3	75.3	98.5	127.2	143.8	150.4	154.2	155.7	143.3	151.2	147.7	120.8	114.4	110.4	101.1	87.7	82.0	73.9	58.1	50.7	39.4	27.7	16.0	
D0833	38.4	66.4	82.2	105.5	118.0	126.2	129.5	132.4	124.7	126.5	140.2	141.6	134.4	128.1	116.7	104.8	96.1	85.5	78.6	63.1	57.7	47.1	33.7	19.5	
D1633	46.1	76.8	105.8	133.2	145.4	151.6	155.4	155.2	146.8	130.2	146.5	143.1	126.5	129.4	122.0	106.0	100.3	96.8	81.5	68.9	60.0	45.1	30.5	15.1	
D2433	28.0	44.6	61.0	78.2	89.5	97.8	111.2	120.4	128.8	141.9	146.9	162.1	159.4	159.3	146.3	143.1	122.6	114.0	98.9	85.0	68.7	53.9	36.4	22.4	
D3233	27.9	45.6	61.3	76.2	89.8	100.5	114.5	132.1	146.0	152.5	167.8	163.6	151.0	149.3	138.0	127.3	109.3	104.2	91.2	74.8	66.9	50.6	34.6	20.8	
D4033	39.8	61.4	74.4	94.4	106.5	115.3	127.9	131.0	129.8	132.2	147.5	157.6	154.1	147.9	143.2	130.7	116.5	115.1	97.9	80.4	70.7	55.7	39.1	23.7	
D4833	57.1	92.7	114.7	144.1	152.3	152.2	143.7	151.8	147.4	145.8	141.2	137.5	128.1	124.5	119.3	108.5	96.1	94.3	86.6	70.0	61.0	50.6	35.8	20.9	
D5633	34.4	57.0	76.0	96.9	109.8	120.3	123.9	133.3	125.8	132.3	145.7	149.1	135.9	124.7	123.5	107.3	93.1	95.1	77.2	65.0	58.8	48.3	32.4	19.6	
D0849	29.1	50.9	67.7	87.6	105.1	124.1	150.9	157.6	157.3	134.3	146.5	146.3	125.8	119.8	110.3	102.1	87.7	81.5	72.5	60.0	53.1	42.6	28.9	16.7	
D1641	33.9	54.6	72.4	91.7	107.8	115.2	130.2	132.6	135.7	129.7	139.8	150.3	142.1	133.3	126.5	115.5	103.4	94.5	86.9	77.1	72.3	58.1	39.6	24.0	
D2441	32.2	51.9	69.3	89.8	104.0	112.3	124.5	141.5	163.6	164.6	178.3	170.8	158.0	155.9	150.1	136.0	119.4	113.4	100.5	81.5	73.1	54.3	36.9	16.9	
D3241	32.9	55.6	76.5	97.5	112.5	122.2	129.0	131.5	140.7	134.6	154.1	166.4	161.2	159.2	150.5	138.5	120.6	114.1	100.7	80.9	70.6	55.8	36.6	18.3	
D4041	29.6	48.7	64.8	81.6	93.0	105.0	110.7	127.4	137.3	140.5	153.8	158.1	145.6	135.6	132.4	124.6	107.4	104.5	95.8	85.0	80.2	66.4	45.0	25.0	
D4841	34.6	53.3	70.0	86.9	97.7	108.4	111.6	116.9	114.2	114.5	128.2	130.0	122.1	119.4	111.7	104.0	92.1	86.8	76.7	63.2	58.0	44.0	30.0	15.6	
D5641	22.0	34.1	43.2	58.2	71.4	83.4	96.9	102.5	98.8	94.0	92.6	90.1	81.8	79.1	71.1	66.3	59.3	57.1	50.6	42.0	36.5	27.5	18.2	8.8	
D0849	35.3	58.1	80.0	100.6	108.6	113.9	123.0	121.6	117.1	108.8	107.3	100.4	90.1	82.4	75.8	68.5	59.1	55.6	48.0	40.6	36.2	26.4	17.6	6.6	
D1649	40.5	62.9	77.4	100.4	119.4	136.1	156.2	157.9	144.2	131.9	135.3	125.5	109.6	106.9	98.0	91.8	82.4	78.2	66.0	60.4	50.9	39.9	26.7	14.2	
D2449	43.1	68.8	86.4	109.8	120.4	128.6	140.3	135.2	130.6	123.6	140.6	148.0	134.6	132.8	123.7	114.5	105.4	95.3	84.1	69.4	61.1	47.0	33.3	20.6	
D3249	43.7	79.3	114.7	147.8	170.8	172.9	172.8	171.8	162.1	154.3	153.2	156.5	150.9	142.1	135.8	125.1	109.7	104.8	92.5	76.9	67.4	56.8	41.2	28.2	
D4049	32.7	53.7	71.1	88.9	102.0	115.8	127.2	131.9	125.2	126.2	131.4	133.9	133.5	121.7	116.6	108.5	95.8	89.6	81.7	68.8	62.1	53.3	33.2	18.1	
D4849	45.0	71.0	90.2	111.5	122.7	139.4	149.1	165.6	146.2	134.0	133.4	126.4	109.2	105.9	95.4	94.4	83.2	74.0	69.2	55.2	49.3	38.1	24.8	12.9	
D2457	32.4	53.7	71.0	88.7	110.1	127.6	149.2	165.5	154.4	145.0	146.4	140.0	124.7	114.2	108.4	97.6	88.3	81.6	73.1	57.8	50.8	38.3	25.0	9.6	
D3257	37.7	64.2	80.3	101.6	114.5	126.4	136.5	136.2	136.9	137.5	148.9	149.1	133.1	129.5	114.4	108.7	90.4	85.2	75.4	63.5	55.3	41.9	27.8	12.9	
D4057	23.7	38.4	49.6	66.3	82.8	102.1	119.1	127.2	124.3	114.2	107.9	103.7	90.3	90.3	80.9	74.9	65.2	60.7	53.3	43.3	38.3	30.0	18.2	6.2	
!set 4 87.5 1.334 1.334 1.334 8 !set#, power, MWD/kgU, MWD/kgU, MWD/kgU, Parcs #																									
D1609	43.1	69.5	91.8	115.7	126.2	135.3	141.9	149.5	155.8	157.0	156.2	146.4	134.2	123.0	117.2	103.9	90.7	82.1	73.2	63.4	56.1	42.3	29.1	15.0	
D2409	41.6	71.4	101.7	128.1	154.4	181.1	192.0	210.2	211.9	198.1	190.1	185.8	164.1	147.4	139.9	129.6	108.1	104.7	92.0	75.2	65.0	52.2	34.6	19.3	
D3209	41.6	69.6	93.7	119.1	144.4	164.1	192.1	203.2	181.1	167.9	163.8	161.8	139.8	129.6	114.6	108.4	98.6	87.8	75.1	61.2	52.1	42.4	28.2	15.8	
D4009	54.8	88.7	111.1	135.7	154.3	156.0	160.6	166.6	158.3	141.4	147.9	135.4	119.8	117.7	103.9	98.5	86.5	79.2	72.4	57.9	51.3	41.1	26.0	12.5	
D4809	24.0	37.7	47.4	62.1	73.6	82.3	92.9	101.8	111.2	123.7	128.9	128.9	110.8	103.1	94.2	91.7	76.5	70.0	63.8	52.5	47.4	36.2	25.3	16.6	
D0817	46.6	70.6	87.4	113.2	122.3	139.0	163.1	160.2	152.3	142.0	141.2	140.7	122.1	115.2	110.2	97.6	88.7	84.3	73.9	59.1	51.5	38.3	25.5	12.7	
D1617	39.6	61.3	79.1	102.7	120.2	133.5	142.5	151.2	144.4	140.4	147.0	138.3	127.6	124.8	110.3	99.2	91.7	85.7	78.2	68.5	60.6	47.9	31.7	14.5	
D2417	34.0	56.3	74.9	94.2	112.5	123.3	132.0	143.7	146.6	148.7	166.7	175.2	163.6	162.5	154.8	140.1	125.9	120.6	103.7	84.8	74.0	58.8	39.7	20.8	
D3217	29.3	51.7	71.8	90.0	109.5	123.0	131.2	145.4	155.2	152.2	167.5	177.9	178.5	165.1	163.0	151.3	127.3	124.5	110.3	86.8	76.6	61.4	41.9	27.0	
D4017	40.4	64.8	81.5	104.3	121.0	133.4	141.3	149.9	146.5	151.1	154.5	140.3	134.5	133.0	121.5	110.1	97.5	92.3	83.1	72.6	67.4	55.2	37.7	18.0	
D4817	47.1	67.9	88.8	121.7	139.9	168.1	190.1	193.2	187.0	176.5	181.8	160.1	149.1	139.6	135.1	118.4	105.4	101.5	88.1	73.4	64.0	48.1	33.2	21.9	
D0825	43.0	67.4	87.8	106.2	121.4	127.1	140.4	133.2	125.9	112.6	119.0	114.7	111.1	117.8	113.6	111.8	98.0	91.0	80.7	66.2	56.7	42.4	27.3	15.7	
D1625	39.8	60.0	79.7	104.1	127.1	139.3	162.6	171.1	172.9	168.1	167.8	164.0	148.2	139.1	129.4	123.3	110.3	101.5	91.9	73.6	61.7	44.7	30.1	14.7	
D2425	31.9	51.5	67.2	87.3	102.9	113.5	129.7	140.8	148.9	157.7	167.2	175.3	167.2	159.4	154.1	139.3	124.8	117.5	104.8	82.5	72.7	54.7	37.4	21.0	
D3225	31.2	50.2	65.6	86.0	103.2	114.6	129.8	138.0	157.3	169.7	167.8	176.9	159.9	153.0	143.5	136.3	119.7	109.7	100.3	79.3	71.1	55.2	37.4	21.6	
D4025	43.2	63.9	79.3	106.3	117.5	155.3	184.2	202.9	201.3	198.3	195.1	179.7	164.5	155.7	144.2	133.4	119.9	107.0	96.1	76.8	68.6	50.3	35.1	20.2	
D4825	44.7	72.5	90.3	116.8	137.0	150.8	153.5	164.6	156.4	153.5	140.9	146.3	137.2	148.5	132.9	127.6	117.3	106.9	94.4	77.1	64.3	49.7	34.7	18.4	
D5625	52.1	78.7	97.6	125.1	133.4	139.3	137.9	134.2	118.8	119.6	112.6	112.6	91.9	101.0	94.5	85.8	75.6	71.4	67.0	51.5	46.2	32.9	22.7	14.9	
D0833	39.6	67.1	86.8	111.8	129.5	150.3	153.9	170.7	161.3	148.2	144.5	132.1	120.3	113.7	104.3	100.8	84.2	83.8	70.1	61.7	51.0	39.3	27.6	16.3	
D1638	38.8	63.1	79.1	105.1	127.2	144.4	166.2	197.7	192.0	188.6	165.5	168.1	149.8	144.8	122.5	120.3	104.0	100.5	85.6	68.4	58.3	44.2	28.8	13.6	
D2433	32.3	51.2	70.4	88.3	108.0	128.1	134.4	153.6	149.1	143.0	156.3	154.0	157.6	159.4	155.6	148.6	129.9	124.8	107.7	87.9	76.4	59.2	38.4	18.6	
D3233	30.8	48.8	64.4	85.4	98.8	109.4	122.4	133.2	131.2	131.7	138.2	129.7	140.7	142.7	137.0	124.5	122.0	106.2	85.4	73.4	56.6	38.9	20.0	20.0	
D4033	39.1	58.2	75.2	101.7	121.6	134.1	161.8	184.3	206.4	188.5	193.1	178.4	158.9	153.0	149.5	132.0	118.7	111.1	99.8	83.1	74.2	55.2	38.0	23.9	
D4833	47.7	69.9	85.8	107.7	139.1	159.0	177.7	175.4	183.1	168.9	172.3	156.9	139.9	138.4	122.8	116.7	107.4	101.5	91.6	72.3	58.0	44.2	31.9	17.2	
D5633	39.9	66.5	86.2	101.3	122.1	138.4	129.0	136.4	133.5	118.5	114.9	107.3	100.5	89.3	89.0	81.1	72.3	66.8	65.2	47.8	42.8	34.1	22.9	14.6	

D3257	35.2	56.4	70.4	87.3	98.4	103.0	103.2	105.6	96.3	92.5	99.0	101.5	105.1	108.7	103.5	95.9	85.0	80.4	70.6	58.6	51.3	39.4	26.7	13.3
D4057	38.1	59.7	74.1	89.2	96.2	101.7	102.0	102.8	93.6	88.6	88.2	83.0	75.6	73.8	71.5	67.1	58.9	55.0	50.0	41.8	36.2	26.8	17.5	7.1
!set#, power, MWD/kgU, MWD/kgU, MWD/kgU, Parcs #																								
D1609	33.6	54.3	69.5	86.5	93.9	97.9	101.3	95.5	90.8	86.2	87.7	88.4	88.3	87.9	90.2	79.8	75.7	70.6	67.3	56.0	50.7	39.2	27.1	15.7
D2409	29.5	51.6	70.4	90.0	108.3	122.3	138.0	155.0	151.5	141.5	142.3	133.6	119.3	109.1	106.2	95.9	86.7	83.6	77.0	69.2	64.5	54.9	39.3	26.0
D3209	33.1	52.8	71.7	86.5	103.0	115.2	125.8	142.6	136.7	123.9	124.5	114.2	101.4	96.9	85.9	80.0	72.0	68.1	64.3	56.0	52.3	43.6	31.7	22.6
D4009	31.0	50.2	64.7	81.4	91.7	97.0	99.9	104.8	99.6	94.3	94.6	97.9	95.0	97.2	91.8	87.3	80.1	74.8	69.5	60.3	56.7	45.6	32.5	18.9
D4809	27.9	48.5	63.9	80.9	89.9	92.0	87.0	89.4	84.3	78.4	76.8	69.5	67.5	65.1	62.0	55.5	52.9	46.8	39.8	36.1	30.1	21.1	13.2	
D0817	27.5	48.3	63.4	76.1	87.2	93.4	87.1	87.8	83.0	78.7	79.0	83.4	84.1	84.0	81.2	77.1	69.2	66.3	63.9	53.7	47.7	40.9	30.0	18.2
D1617	31.2	53.6	75.9	106.0	131.7	142.3	138.6	140.0	129.7	116.3	119.3	111.8	108.3	106.4	102.4	93.5	86.8	80.5	71.8	62.5	53.4	40.3	30.8	
D2417	33.5	54.7	73.1	96.2	112.1	118.0	118.2	120.7	119.9	112.7	115.3	116.4	115.6	119.4	112.1	108.7	100.2	98.6	89.7	79.1	71.2	58.7	41.3	25.7
D3217	30.0	51.8	72.2	90.9	107.8	117.9	123.6	127.7	121.5	116.1	115.8	117.4	115.2	115.5	116.4	107.1	100.7	97.1	92.6	84.2	77.2	69.3	52.2	36.5
D4017	31.5	56.2	79.1	111.2	138.5	154.7	150.2	157.4	146.1	132.4	131.7	128.7	118.6	112.8	111.1	103.9	95.3	93.0	85.3	72.7	64.1	53.0	37.2	20.9
D4817	32.9	58.0	82.4	102.8	120.9	132.5	128.6	127.5	122.9	109.6	110.9	111.1	112.4	108.3	108.7	104.2	94.3	86.5	82.1	66.3	61.2	50.0	34.8	21.1
D0825	23.7	41.0	57.2	72.6	85.2	96.0	98.6	111.7	118.0	112.8	109.0	108.0	102.0	92.1	88.1	81.5	74.0	73.8	71.8	63.1	59.2	52.6	41.1	28.7
D1625	29.8	50.9	70.0	88.8	104.6	108.9	112.8	116.6	111.5	103.4	103.5	111.0	110.9	108.6	112.6	107.3	98.2	95.2	92.1	79.5	70.6	61.3	44.9	33.9
D2425	36.2	60.5	81.0	104.4	124.0	135.3	140.1	139.3	132.0	119.3	118.5	118.3	109.4	106.4	102.9	100.6	92.3	91.2	84.5	78.2	74.9	61.9	45.3	28.2
D3225	37.2	61.4	83.1	109.4	132.5	147.2	151.9	153.0	144.8	125.6	127.7	116.1	103.1	99.6	94.9	90.7	83.1	80.5	76.5	67.2	64.3	54.1	42.2	28.7
D4025	34.1	59.6	82.0	105.0	121.9	131.7	137.8	137.4	127.2	116.4	117.2	118.7	118.2	116.2	110.9	108.1	99.8	95.8	89.3	78.8	78.8	68.4	48.7	31.8
D4825	27.7	50.1	69.8	89.6	107.2	119.0	131.8	143.8	147.8	138.7	134.0	129.1	116.7	108.5	105.3	100.9	91.3	87.6	81.9	71.0	62.4	54.6	39.6	23.6
D5625	24.7	42.9	62.7	75.7	90.9	100.0	104.2	107.8	103.6	99.2	100.0	90.6	83.7	74.6	70.7	65.0	57.3	53.6	48.1	48.3	43.0	30.8	21.8	
D0833	24.6	45.0	61.2	76.4	94.8	108.5	116.0	134.1	134.2	130.4	124.2	111.6	107.7	95.8	91.6	81.8	75.3	70.5	70.0	61.7	57.9	51.8	41.5	29.2
D1633	30.5	50.0	67.4	86.2	98.7	107.8	114.0	112.1	111.3	104.5	109.5	114.2	115.6	110.3	106.4	105.6	95.5	96.2	92.3	84.4	81.3	71.2	51.8	33.8
D2433	28.6	52.1	75.4	96.5	127.6	151.1	152.9	159.6	156.7	134.7	132.1	129.9	120.0	109.6	109.2	103.3	95.3	94.1	86.7	80.4	71.6	64.6	51.9	41.7
D3233	39.8	65.3	88.3	120.5	149.4	165.4	166.8	167.6	150.7	135.1	137.1	119.8	108.6	100.6	96.4	89.6	83.6	80.1	76.9	69.4	68.4	57.8	45.3	27.4
D4033	29.1	52.6	74.0	95.6	112.1	123.1	124.3	132.8	123.8	117.6	115.7	115.5	115.5	112.5	118.9	113.6	102.3	99.8	94.2	83.9	77.0	66.0	51.9	38.7
D4833	29.0	49.6	67.9	85.8	103.0	113.3	123.6	134.4	146.8	132.3	130.3	130.5	119.7	110.2	110.2	103.9	94.0	91.3	88.8	82.6	77.0	66.2	47.5	33.5
D5633	30.7	50.9	68.1	80.3	93.6	98.2	105.9	110.7	102.2	94.5	95.5	90.2	79.2	77.5	71.9	66.4	59.7	57.3	52.9	45.7	43.0	37.0	27.0	19.2
D0841	21.3	40.0	56.2	72.0	87.4	97.2	103.0	107.6	105.5	100.2	100.1	99.7	100.9	100.2	98.7	92.0	83.3	78.6	72.1	65.3	59.6	55.0	42.0	27.0
D1641	40.2	66.2	90.5	121.8	146.9	157.3	154.9	147.0	133.5	122.2	115.1	111.1	104.1	97.7	93.1	87.6	79.7	73.8	69.7	60.0	53.3	43.8	31.4	17.6
D2441	37.8	63.1	85.9	111.2	131.6	137.3	142.3	140.4	133.4	123.2	122.1	123.5	120.4	118.7	119.3	111.6	103.1	97.8	91.8	83.1	78.5	65.7	45.8	24.1
D3241	34.1	59.3	79.9	102.8	119.3	129.8	133.0	134.2	129.0	123.6	122.1	124.8	125.5	124.9	123.2	118.0	107.4	100.3	93.4	81.6	74.3	62.9	46.8	30.6
D4041	35.9	60.2	83.5	113.1	134.6	141.6	137.8	136.5	127.3	117.6	119.0	117.1	109.0	102.9	103.5	98.0	89.6	89.6	83.8	75.4	71.0	61.2	45.4	29.6
D4841	35.2	54.0	69.4	88.6	97.1	97.7	100.5	101.7	95.2	91.9	96.6	96.3	91.9	96.2	92.1	86.0	79.4	75.8	68.9	59.3	52.7	41.7	28.7	13.6
D5641	19.1	30.1	37.4	46.4	52.0	53.4	56.1	57.7	54.2	52.8	52.7	49.7	48.4	47.0	44.7	42.8	41.5	38.3	36.1	35.9	30.4	22.0	14.6	
D0849	33.5	54.5	69.7	85.7	94.4	97.8	94.7	91.9	84.7	77.4	77.5	77.1	73.0	69.0	67.8	63.8	57.1	54.8	48.9	40.6	35.8	29.1	19.3	8.5
D1649	41.0	63.0	78.3	97.5	108.0	108.9	110.0	101.2	94.2	88.7	88.4	90.0	88.2	90.1	88.5	79.9	73.3	69.6	63.0	54.4	49.1	39.1	27.1	15.7
D2449	38.7	58.7	75.1	95.2	108.2	116.3	127.0	139.8	132.4	126.6	125.5	118.9	107.2	105.2	98.8	91.9	84.7	81.1	74.0	63.8	58.2	45.6	32.7	21.2
D3249	31.3	53.3	71.0	91.9	109.7	124.0	138.7	153.4	156.9	144.5	145.3	138.9	133.1	120.3	113.8	108.0	96.7	92.3	86.3	76.0	74.1	63.7	46.4	33.3
D4049	34.7	57.1	74.9	95.4	109.1	117.2	117.9	117.0	109.1	100.8	103.1	104.5	100.8	99.7	98.2	92.3	83.5	79.5	72.7	63.2	56.2	45.3	30.3	13.6
D4849	41.6	65.1	84.4	102.4	103.4	107.1	102.6	97.1	86.9	82.9	82.6	82.3	78.5	78.5	75.5	73.2	66.1	62.6	57.2	47.1	42.3	34.0	25.0	15.6
D2457	29.5	48.1	63.4	79.4	90.9	96.7	105.2	107.2	101.0	94.6	91.3	85.5	75.6	71.8	66.1	62.0	56.1	54.2	50.4	46.2	45.0	37.2	26.1	14.4
D3257	33.8	54.3	70.1	87.4	101.1	106.0	113.2	112.8	106.3	99.4	95.9	88.7	76.8	73.5	67.3	61.1	55.1	53.4	48.9	42.3	39.7	32.9	25.3	16.4
D4057	22.3	34.2	43.9	55.4	63.1	67.2	70.4	70.4	67.6	67.7	63.4	59.0	57.9	53.5	50.3	45.5	44.3	42.3	39.1	38.0	31.2	22.0	12.0	
!set#, power, MWD/kgU, MWD/kgU, MWD/kgU, Parcs #																								
D1609	18.9	30.5	41.3	53.5	66.4	77.3	89.6	102.2	109.4	106.9	105.5	106.8	89.9	89.7	85.3	81.0	77.8	79.4	78.5	70.4	69.8	55.3	38.7	21.4
D2409	27.9	49.1	69.1	90.4	107.4	113.3	118.3	122.7	121.5	112.9	118.4	114.2	108.8	113.0	113.0	118.5	112.3	113.6	104.1	91.6	86.7	75.1	54.9	33.2
D3209	31.7	52.4	67.1	83.6	95.4	99.0	102.7	109.4	104.5	100.3	116.3	116.8	108.6	105.7	100.3	96.8	89.3	88.2	81.9	73.1	69.6	60.9	43.1	24.4
D4009	27.6	45.1	58.6	77.2	86.5	96.5	104.5	104.2	101.0	95.4	91.7	93.8	87.1	92.9	96.9	99.7	96.9	96.2	92.6	83.5	78.7	63.3	44.3	26.3
D4809	11.1	20.6	28.6	37.4	47.2	58.2	70.4	87.5	95.2	92.6	95.3	89.7	81.8	76.5	73.0	69.0	62.7	61.8	60.1	50.2	48.9	41.0	29.9	19.3
D0817	30.2	50.7	69.9	83.7	96.0	97.5	96.0	96.2	91.1	86.4	81.6	80.8	76.1	70.8	72.8	69.8	65.4	63.9	63.4	59.3	53.6	49.3	40.0	30.8
D1617	27.8	48.7	69.5	87.2	104.3	111.5	116.7	128.0	125.0	116.8	116.5	115.2	115.6	107.0	119.2	121.0	113.2	114.7	110.6	95.2	85.7	75.7	56.5	38.6
D2417	33.5	56.0	75.1	96.3	111.9	123.6	140.0	159.2	151.															

D2433	28.9	52.9	74.8	96.4	115.6	125.5	125.3	129.8	128.6	120.9	124.2	128.8	125.5	127.7	122.3	113.5	110.2	102.2	88.7	78.8	68.1	52.4	37.3	
D3233	35.7	60.0	81.6	108.1	127.8	141.0	152.8	159.9	153.4	140.9	129.3	122.3	114.9	110.9	105.8	94.3	92.7	85.5	70.9	64.6	51.4	37.0	22.4	
D4033	32.0	57.3	79.6	102.9	121.7	131.8	130.1	140.3	132.3	125.9	126.2	128.1	128.3	132.6	130.3	125.3	112.2	109.9	102.5	91.3	81.5	72.8	54.4	38.2
D4833	32.6	59.3	80.0	105.3	126.9	142.1	146.4	160.0	159.0	149.2	148.6	143.6	136.5	123.4	116.1	115.5	103.9	98.8	97.2	86.7	80.9	73.4	54.4	36.1
D5633	23.1	37.7	49.8	59.7	70.7	76.8	82.2	86.2	90.9	98.1	107.4	111.5	105.9	99.8	94.5	85.5	80.3	77.3	71.4	65.1	61.8	54.1	39.5	28.6
D0841	34.7	65.5	91.8	112.1	133.6	137.6	133.4	131.1	128.7	117.1	114.1	109.5	105.8	96.0	95.1	89.6	81.6	80.2	75.9	72.5	68.9	65.7	52.7	36.9
D1641	39.9	64.1	85.5	105.5	122.6	132.9	137.5	134.4	121.7	111.7	106.4	103.0	95.2	97.6	100.4	97.7	93.7	93.8	89.8	81.2	80.6	68.4	48.8	24.0
D2441	38.5	63.2	86.0	111.1	134.3	153.2	166.6	169.8	158.5	145.6	142.0	135.9	125.2	121.0	118.1	117.4	108.4	106.3	101.0	87.3	82.5	69.1	49.3	27.0
D3241	34.7	60.1	81.6	106.2	130.1	142.0	143.9	149.3	138.9	131.8	127.6	123.7	119.1	119.0	126.6	123.8	116.3	115.3	106.8	93.3	86.4	74.0	55.1	34.2
D4041	39.9	65.6	87.0	110.5	127.0	139.4	148.8	151.4	145.3	133.2	134.0	127.0	116.6	113.5	112.5	108.3	100.5	100.0	98.1	86.8	80.4	73.7	54.0	36.9
D4841	40.0	63.2	79.1	96.0	103.0	108.9	111.2	105.8	101.5	97.8	96.7	91.7	85.2	90.1	92.7	91.4	89.3	87.6	86.2	79.3	77.8	65.9	48.0	28.6
D5641	35.2	54.7	65.5	77.5	83.2	81.5	80.1	79.2	75.6	72.8	75.5	72.0	69.2	68.0	65.9	61.0	58.4	56.7	53.0	47.6	44.5	36.7	26.9	18.2
D0849	19.4	31.8	42.6	53.9	64.3	71.0	76.3	76.2	73.1	70.3	69.7	65.8	60.3	59.4	53.7	51.0	50.4	48.9	47.4	45.1	47.2	39.9	29.1	17.2
D1649	33.5	53.5	68.0	86.6	101.2	113.6	126.6	125.1	114.7	104.9	104.1	95.3	86.6	87.1	86.8	82.6	80.1	80.3	77.0	67.6	65.0	52.8	39.0	22.9
D2449	39.2	60.9	77.8	98.5	109.8	116.9	119.4	118.6	114.6	111.1	107.3	102.9	93.4	99.3	103.2	105.9	99.5	101.8	94.6	86.7	84.5	70.5	51.0	30.7
D3249	33.7	56.9	76.6	96.3	113.3	123.4	132.9	145.8	147.2	143.4	141.8	137.7	132.8	124.6	123.6	120.2	113.2	112.6	106.6	100.7	95.3	87.7	64.0	46.7
D4049	31.9	51.0	69.6	90.1	107.1	113.4	121.6	121.6	111.6	104.8	105.6	99.9	92.3	92.5	98.5	98.7	94.1	96.3	92.4	82.2	76.0	65.9	49.2	33.0
D4849	24.9	39.4	53.1	68.7	84.3	97.1	109.9	113.1	106.3	99.0	94.4	91.9	83.9	81.3	78.9	76.7	72.4	74.0	70.8	64.9	64.7	52.9	39.0	22.7
D2457	29.1	47.2	61.7	76.8	88.2	94.2	99.8	101.9	93.0	86.7	86.8	80.5	73.2	74.1	70.8	68.7	65.4	64.1	63.2	57.4	55.2	47.8	35.1	21.1
D3257	34.4	56.1	71.9	87.2	101.0	105.5	107.9	110.3	104.5	96.8	96.1	87.9	79.5	75.3	72.6	69.8	65.0	62.8	59.8	53.6	54.1	47.6	35.4	20.2
D4057	21.9	35.0	44.6	56.8	64.0	69.4	73.0	73.6	69.6	68.9	67.8	61.4	56.2	56.1	55.1	55.8	54.2	55.6	53.6	54.4	51.3	41.1	28.2	12.3
@set 9 94.7 4.297 4.297 4.297 18 !set#, power, MWD/kgU, MWD/kgU, MWD/kgU, Parcs #																								
D1609	20.3	33.8	44.5	59.2	74.7	85.7	102.1	107.3	107.5	100.1	104.9	95.5	90.5	87.9	84.2	81.6	78.2	79.6	80.8	77.6	75.9	59.3	42.8	28.7
D2409	29.9	52.3	72.6	91.4	109.1	116.6	124.8	126.7	119.1	114.4	115.7	109.3	107.3	106.8	113.4	115.1	111.7	111.4	107.8	98.0	92.8	81.2	63.9	49.0
D3209	34.7	54.6	74.3	89.8	103.7	108.8	117.5	123.8	123.2	119.9	120.0	101.7	99.6	93.2	91.2	90.0	87.6	78.7	75.6	66.4	48.8	29.1		
D4009	28.6	46.7	61.8	78.3	92.3	98.3	101.9	105.0	99.0	94.5	89.6	89.1	84.3	90.9	98.1	98.2	98.3	99.3	96.4	90.7	86.7	70.3	49.6	29.0
D4809	12.8	23.4	32.0	42.1	55.4	70.3	86.3	95.7	94.6	89.7	90.6	85.4	76.8	75.6	71.8	68.4	65.6	67.4	62.8	57.0	54.6	44.5	33.5	24.7
D0817	31.4	54.5	73.2	90.3	103.1	103.3	97.9	101.8	97.1	87.9	83.9	83.0	77.6	71.6	72.8	73.0	66.3	68.6	65.9	64.3	61.8	58.1	44.2	30.6
D1617	29.2	52.3	72.9	95.5	110.3	118.5	121.3	129.8	119.6	115.9	113.9	111.3	109.1	108.2	114.7	120.3	117.5	115.5	114.8	105.5	99.5	90.2	71.0	54.8
D2417	36.0	58.0	79.4	102.4	119.7	137.6	153.3	154.2	147.6	129.8	131.6	129.0	122.9	117.8	120.3	121.4	116.8	119.1	115.0	105.9	104.1	89.5	68.0	50.9
D3217	30.6	54.6	76.8	97.3	115.2	123.4	130.7	131.3	127.2	118.9	125.1	114.0	108.7	110.2	119.0	122.1	118.1	122.9	120.3	110.5	113.6	94.8	79.4	69.0
D4017	34.2	57.5	77.6	101.2	124.4	135.8	147.1	157.5	153.0	137.2	137.2	131.3	129.5	125.2	124.0	125.2	120.2	120.7	113.8	105.1	102.8	89.1	67.1	44.0
D4817	33.7	57.0	79.4	102.4	118.9	124.6	127.9	126.6	123.5	113.9	111.1	111.6	106.5	106.0	112.9	118.4	113.6	115.8	110.6	100.6	106.0	83.0	60.3	41.3
D0825	31.2	55.1	75.8	94.1	110.6	108.4	103.7	112.0	115.2	111.7	114.1	120.1	112.7	107.7	108.3	104.9	92.0	91.9	90.8	84.5	82.9	76.2	60.6	50.1
D1625	31.7	55.5	77.9	101.2	117.3	131.1	133.9	143.7	137.3	128.2	130.9	127.2	122.0	112.4	118.1	115.6	108.5	110.7	106.5	102.8	98.3	88.3	70.8	53.8
D2425	37.7	61.1	80.1	101.3	113.8	117.3	117.0	122.8	115.7	105.7	111.9	115.1	115.4	123.4	119.6	118.3	115.2	113.7	105.5	91.6	87.4	71.6	54.5	34.3
D3225	37.4	62.4	84.1	104.9	122.2	133.6	141.8	142.0	136.6	128.6	123.7	122.6	113.3	108.6	107.1	102.0	98.9	100.8	95.2	82.5	80.4	70.7	53.6	32.5
D4025	37.6	63.4	84.1	107.2	124.2	129.4	134.4	133.1	124.5	119.0	120.2	128.5	128.8	128.0	128.4	125.1	116.4	118.0	113.4	104.4	101.4	85.4	67.3	46.2
D4825	34.4	61.7	83.4	105.8	122.0	138.2	146.3	159.7	152.4	137.8	139.2	134.4	127.7	116.8	118.5	116.2	104.9	105.7	102.9	91.8	91.3	83.1	64.1	44.2
D5625	32.5	56.9	76.3	95.0	106.2	112.6	112.5	115.6	114.5	115.4	128.8	122.1	123.0	102.2	93.4	92.4	84.8	77.2	71.8	59.8	42.1	24.4		
D0833	27.4	47.4	68.3	86.4	102.8	111.5	115.8	117.8	119.5	121.6	126.1	129.7	122.8	110.2	110.1	105.0	94.8	93.0	94.8	87.9	86.2	79.0	64.7	55.0
D1633	33.7	57.4	76.2	95.8	116.7	134.6	144.4	154.6	144.7	135.8	134.6	126.9	124.0	117.2	113.9	111.5	103.6	105.9	99.0	92.4	88.6	81.9	67.3	56.6
D2433	28.7	52.4	73.5	93.9	113.0	118.3	123.2	123.2	115.9	112.1	115.5	113.6	125.7	123.2	131.5	128.0	116.8	117.1	114.1	102.1	90.0	78.3	62.0	51.1
D3233	28.7	51.7	74.6	92.9	114.0	128.2	134.5	149.3	145.5	131.2	130.5	127.4	122.2	115.0	117.4	111.1	103.9	101.5	97.9	86.3	78.7	68.1	52.9	38.3
D4033	30.9	54.7	78.4	98.9	119.0	127.4	125.9	129.6	123.5	117.6	116.5	117.4	125.4	128.1	128.3	130.5	118.3	121.3	116.5	101.7	97.7	88.7	66.1	43.7
D4833	34.2	59.9	81.2	102.4	122.6	137.0	146.7	150.3	153.2	147.4	147.7	143.1	131.8	125.4	125.8	118.5	108.5	110.2	108.3	101.3	100.4	83.9	63.9	44.2
D5633	26.7	42.6	57.1	68.4	77.2	83.0	88.8	96.3	100.4	99.9	111.9	119.2	116.1	114.2	106.7	102.1	88.7	93.2	90.2	82.2	79.2	69.7	48.3	30.4
D0841	34.3	66.8	93.8	116.3	131.2	136.1	132.8	136.1	130.1	118.6	115.6	112.2	107.3	98.8	101.4	98.8	90.2	87.4	86.0	81.1	79.1	74.3	61.4	43.2
D1641	40.3	65.6	85.4	108.2	121.4	126.1	130.2	128.1	121.3	112.6	108.4	105.5	101.5	99.8	105.8	107.4	104.7	101.6	100.6	93.8	95.5	80.1	60.2	36.9
D2441	39.4	65.4	85.4	108.9	127.4	144.7	157.5	157.0	152.5	140.6	135.3	128.5	126.0	127.1	121.0	118.8	119.6	113.4	102.1	101.2	86.4	63.7	34.3	
D3241	35.5	61.0	82.2	105.9	125.8	137.8	143.4	142.0	136.9	124.3	123.9	125.6	118.0	120.3	126.8	129.2	125.7	125.3	118.5	106.1	103.5	90.0	67.5	45.3
D4041	38.9	61.2	81.5	100.4	120.4	132.4	144.2	145.6	136.4	126.2	130.2	126.8	119.6											

D2409	26.7	51.9	78.7	94.3	111.7	121.0	119.0	125.2	117.3	113.2	123.8	132.1	132.9	125.7	124.8	121.4	111.9	109.3	105.5	98.9	92.0	84.1	66.7	51.0
D3209	29.4	53.9	76.4	93.0	109.6	118.7	122.8	126.8	127.0	116.5	116.6	111.9	109.3	99.6	99.9	96.3	92.4	91.5	90.7	84.8	82.1	78.0	56.3	36.2
D4009	29.3	53.8	75.7	92.9	101.9	104.7	102.1	102.5	97.7	94.7	100.1	107.0	112.6	108.9	108.4	106.7	96.9	98.2	96.5	89.6	88.3	80.1	59.0	43.7
D4809	23.4	43.3	66.6	87.1	101.6	100.4	94.3	89.3	85.3	79.1	82.0	81.7	76.5	71.7	71.7	66.3	63.2	64.0	59.5	52.9	50.0	43.5	21.1	
D0817	38.0	64.9	85.4	99.9	106.3	104.7	97.1	93.7	89.6	86.1	88.1	89.4	84.2	80.1	78.7	73.5	67.8	70.0	65.1	58.9	55.5	51.4	45.7	45.4
D1617	41.0	70.6	95.8	118.6	126.6	129.8	119.4	120.6	120.4	119.5	125.6	136.8	135.0	129.1	129.9	124.1	115.1	113.5	108.7	97.0	93.3	87.3	64.2	47.0
D2417	33.5	62.5	91.3	113.7	140.6	156.6	140.1	138.7	135.9	124.1	123.3	124.9	122.5	115.0	125.1	119.7	114.1	118.2	111.9	106.5	100.4	90.1	75.1	62.5
D3217	27.4	53.7	80.3	100.6	120.8	126.0	124.6	121.8	119.6	110.4	111.0	113.0	122.1	118.6	125.6	123.6	118.1	118.1	116.3	109.5	103.8	90.0	81.2	61.7
D4017	40.7	71.3	94.8	126.9	146.1	147.0	135.9	140.6	138.6	127.1	134.9	133.3	128.6	126.9	128.0	125.3	118.1	116.7	113.1	103.8	99.2	88.5	65.1	37.8
D4817	39.7	70.2	95.0	112.9	122.1	123.0	116.7	118.5	116.0	117.7	132.4	141.1	134.7	127.4	128.8	122.6	112.9	113.9	107.2	95.3	92.1	79.4	57.4	34.8
D0825	36.0	64.4	85.4	106.0	117.7	118.7	110.4	106.2	101.8	99.4	94.5	99.2	102.0	106.2	111.1	106.9	99.2	101.2	100.9	93.8	87.4	81.1	60.4	36.3
D1625	39.1	67.2	90.5	108.3	128.1	135.5	131.8	132.4	125.7	118.8	118.1	119.9	121.2	114.1	114.3	113.1	106.4	111.5	106.6	98.7	93.5	86.6	69.9	58.6
D2425	34.2	63.5	88.3	106.8	122.3	123.9	116.0	110.5	106.7	98.7	107.8	117.1	121.7	117.6	120.6	117.6	114.0	111.9	110.5	99.8	96.8	89.4	71.5	56.9
D3225	33.7	62.9	89.3	109.6	135.6	138.2	133.8	131.4	121.0	113.3	112.3	110.7	110.7	102.6	104.6	102.0	99.3	99.4	98.9	91.7	86.5	81.8	68.0	53.4
D4025	41.3	70.1	92.2	109.4	122.1	122.6	116.5	116.8	114.4	111.4	117.5	126.5	124.8	123.1	126.6	121.3	112.8	117.4	111.7	100.3	97.8	87.8	66.8	42.5
D4825	36.3	64.7	90.0	110.2	128.0	138.4	138.2	141.1	134.5	126.6	126.4	133.2	123.0	118.9	118.5	119.8	110.8	110.3	103.9	99.2	94.1	90.2	67.9	44.1
D5625	39.0	66.7	90.6	106.5	117.7	115.3	112.1	116.1	108.2	105.1	101.5	107.5	117.3	119.3	118.2	116.7	111.1	105.5	103.0	88.8	78.3	66.4	48.7	34.2
D0833	35.0	61.0	83.1	101.4	114.7	114.2	115.1	109.7	103.5	96.5	97.2	102.2	107.0	111.1	112.0	114.2	105.5	106.4	104.6	97.6	95.4	85.4	67.7	50.0
D1633	39.2	65.2	89.8	108.9	125.9	134.1	127.9	126.7	124.9	114.4	119.7	114.3	113.9	113.9	113.5	109.8	102.7	105.6	103.7	94.7	91.4	87.2	67.0	52.5
D2433	32.5	59.9	84.9	99.6	114.7	116.5	111.0	112.3	108.0	105.9	108.6	118.6	124.6	121.4	122.4	116.9	115.3	112.5	112.2	101.7	91.3	82.6	63.9	45.2
D3233	32.9	62.8	89.2	116.5	141.7	146.5	137.1	131.9	121.3	113.1	114.6	114.8	114.4	109.9	111.3	106.2	98.9	101.8	100.2	89.0	82.5	72.0	54.6	39.1
D4033	33.7	61.4	84.4	105.0	113.9	113.5	112.2	114.0	111.6	109.0	115.5	121.2	122.3	122.9	126.5	125.6	120.5	117.7	113.0	103.2	97.2	89.7	72.7	55.0
D4833	38.7	69.1	91.6	111.1	132.8	142.6	137.7	141.7	131.4	126.8	129.6	132.0	123.8	120.4	123.3	124.1	116.7	119.6	111.5	106.3	106.2	94.6	72.1	51.5
D5633	29.5	56.7	83.5	101.1	117.0	121.0	113.1	112.8	113.3	104.6	106.6	116.8	122.9	126.3	128.8	127.9	122.6	116.5	112.5	99.0	88.4	77.3	59.2	40.5
D0841	38.7	74.5	102.7	116.7	130.8	128.8	123.8	123.1	118.8	111.0	118.7	114.7	112.4	107.1	108.5	101.9	96.3	94.3	90.6	84.3	79.2	73.2	61.0	41.0
D1641	45.9	74.6	94.3	113.1	120.1	119.3	115.1	114.0	108.8	111.8	122.2	122.3	134.3	112.4	108.4	104.8	96.7	97.8	91.1	81.9	83.3	73.5	53.3	29.2
D2441	44.7	74.5	102.0	131.1	148.0	149.3	144.7	138.7	128.5	122.3	122.0	124.3	125.2	119.2	120.9	116.1	113.7	114.8	108.3	99.7	96.2	82.9	59.9	35.0
D3241	42.6	72.5	96.4	119.2	130.5	130.0	126.7	124.4	116.3	111.7	118.8	121.7	127.9	126.5	128.3	124.7	117.1	119.2	112.5	100.3	99.1	86.5	64.0	39.1
D4041	30.4	59.2	87.2	111.8	137.7	147.1	144.8	134.2	129.1	124.7	123.5	125.7	123.1	116.6	114.7	115.5	108.8	111.7	110.3	100.6	96.5	90.9	73.9	58.0
D4841	34.3	62.7	87.6	101.5	113.3	111.9	90.7	110.6	105.5	105.9	112.6	118.2	116.3	107.9	107.5	103.2	96.8	95.5	93.3	88.1	86.2	81.7	64.3	50.7
D5641	29.3	53.6	74.4	83.8	93.4	98.0	90.4	87.1	84.7	75.2	77.8	80.0	78.5	73.3	76.3	72.1	70.2	70.2	67.2	59.1	55.8	47.7	38.7	31.1
D0849	25.3	43.1	55.2	66.5	74.2	76.1	75.1	73.2	71.5	68.1	70.8	70.2	65.6	64.8	62.4	59.1	53.7	53.6	48.8	44.3	44.5	40.1	30.4	21.6
D1649	37.7	69.9	101.1	125.8	137.1	130.3	114.6	112.1	106.3	99.1	101.1	102.6	100.0	97.9	95.9	92.9	86.0	87.3	84.0	76.3	75.7	69.7	52.3	37.4
D2449	33.7	61.5	85.7	104.5	120.0	123.9	116.9	119.4	113.1	108.7	112.4	121.3	121.4	116.9	120.5	113.7	105.9	109.8	105.3	96.6	93.0	86.9	65.4	47.0
D3249	25.0	51.0	77.6	96.6	117.8	131.8	141.2	148.0	146.3	136.5	134.7	136.1	134.1	129.5	132.5	129.4	120.6	119.6	116.4	109.7	100.2	93.2	77.9	52.0
D4049	44.5	75.2	97.0	115.4	123.9	119.0	116.7	112.4	105.8	100.0	111.5	115.1	115.1	115.0	109.1	100.8	93.8	97.9	93.1	84.1	82.8	74.5	54.3	30.9
D4849	27.9	55.6	83.8	107.3	126.4	127.9	119.5	115.3	102.4	95.9	94.1	94.7	92.9	91.1	85.9	83.6	79.3	77.1	76.1	70.9	64.6	59.3	48.7	37.0
D2457	34.1	55.1	71.0	86.4	95.1	95.7	98.3	99.3	94.0	90.9	91.9	83.0	81.8	81.9	77.5	73.1	72.8	73.4	69.4	68.9	56.4	41.2	24.3	
D3257	40.5	64.7	80.6	97.5	104.0	104.1	106.5	103.6	96.8	90.7	91.8	87.1	81.3	80.2	78.4	74.3	70.1	69.6	65.7	59.7	58.9	52.1	39.4	25.5
D4057	27.2	42.6	54.5	66.7	72.3	74.1	75.4	71.9	71.6	70.7	73.1	71.5	67.7	65.9	62.5	61.2	58.3	58.4	57.1	55.9	54.3	44.5	30.6	14.9
#set 12 88.6 5.949 5.949 5.949 24 !set#, power, MWD/kgU, MWD/kgU, MWD/kgU, Parcs #																								
D1609	31.6	56.2	77.0	94.5	108.2	113.8	104.7	108.9	110.3	104.9	110.5	106.7	103.7	99.1	99.6	98.4	97.8	98.1	97.4	93.8	83.2	64.0	48.2	
D2409	26.4	49.9	75.1	91.9	108.1	115.1	114.9	124.0	125.8	130.8	141.8	147.2	143.5	138.5	139.0	144.3	137.7	137.9	133.6	125.3	116.9	104.5	80.6	60.0
D3209	27.9	51.9	75.1	88.3	99.3	102.2	100.5	107.5	101.1	95.6	96.4	99.7	102.5	105.9	117.9	122.2	121.2	122.8	118.6	107.3	103.3	90.4	71.2	54.1
D4009	26.0	47.7	63.5	77.8	88.5	92.4	95.5	99.6	102.4	107.1	117.7	121.6	120.8	120.6	118.7	118.3	111.2	115.5	118.0	111.8	106.4	94.5	72.4	60.2
D4809	31.3	53.7	73.4	87.4	95.1	98.9	94.2	95.4	93.5	94.8	92.9	93.4	86.8	88.3	88.1	86.6	82.4	80.5	79.7	69.4	64.9	57.6	39.8	21.9
D0817	33.8	58.3	77.0	90.1	100.6	99.5	97.8	106.1	97.9	93.6	98.8	99.2	96.0	88.9	90.6	88.2	83.7	87.3	88.3	82.9	83.1	72.9	56.0	48.8
D1617	34.8	60.7	81.0	101.2	113.2	125.5	127.0	134.0	135.1	130.5	137.4	132.9	126.4	130.1	135.8	130.2	133.8	133.5	120.1	113.3	96.5	77.7	60.2	
D2417	27.7	52.4	74.0	91.9	103.5	108.9	103.5	111.0	106.7	101.6	104.3	103.1	104.1	103.6	124.1	130.3	134.1	141.8	134.7	128.6	114.3	106.5	85.1	69.6
D3217	24.7	49.1	72.8	91.5	113.4	127.0	135.7	140.6	136.0	123.8	122.1	118.7	117.9	108.2	120.9	124.4	124.3	130.5	127.3	123.0	112.5	104.1	82.1	58.0
D4017	34.5	59.6	77.9	94.3	108.0	105.8	104.0	107.1	108.6	104.1	109.8	116.4	112.3	117.6	137.0	143.5	140.1	143.8	136.5	129.9	119.3	100.6	76.3	53.0
D4817	35.0	62.7	81.6	99.8	113.0	126.6																		

D5633	27.8	56.1	85.6	104.9	120.8	125.9	122.8	127.8	127.8	125.9	130.0	140.4	141.3	128.8	129.8	124.4	116.1	108.8	102.2	94.8	79.8	66.4	50.1	37.9
D0841	28.4	53.9	76.6	89.7	110.2	122.2	130.2	140.5	138.1	125.9	129.7	131.2	124.6	118.2	123.7	116.3	120.6	124.0	126.9	119.0	104.9	90.9	65.6	35.0
D1641	46.8	76.3	93.9	111.1	113.7	112.3	117.2	115.1	111.7	105.9	116.7	119.9	119.6	122.9	120.3	119.0	111.2	116.5	109.6	96.0	94.0	79.6	57.2	25.1
D2441	48.5	79.1	102.6	125.3	142.6	141.6	143.6	139.6	130.6	121.6	122.8	130.1	127.1	124.9	124.5	127.2	123.5	117.2	113.2	100.7	93.2	76.3	53.0	25.7
D3241	47.0	79.3	104.0	122.0	129.3	129.2	125.0	125.6	121.4	115.4	125.7	130.6	134.0	128.6	127.8	126.4	118.6	118.6	112.7	97.9	92.5	78.7	55.3	31.9
D4041	29.8	60.5	88.5	108.0	131.4	138.5	129.7	126.8	121.5	112.2	113.9	124.6	125.2	115.2	117.2	118.3	115.8	113.6	111.9	107.5	98.5	91.1	75.2	56.6
D4841	31.9	59.3	83.3	98.8	112.8	114.6	109.5	109.0	107.5	104.8	110.3	113.2	118.3	113.5	115.3	116.2	115.2	119.7	122.8	112.6	100.7	89.6	65.5	44.8
D5641	18.6	35.5	50.7	62.4	76.1	87.9	93.5	94.2	97.3	90.2	92.2	90.2	87.0	79.4	81.0	77.7	76.4	78.3	74.5	68.6	60.4	51.8	31.1	26.9
D0849	41.6	67.0	87.0	99.8	111.4	111.5	109.3	107.5	105.0	93.3	99.3	95.6	96.8	94.3	92.4	88.5	88.5	90.2	85.3	75.9	66.6	55.6	37.4	18.8
D1649	37.7	83.9	112.2	123.0	127.0	126.7	127.3	117.4	115.4	116.1	113.7	110.0	106.1	116.2	114.6	112.5	124.0	124.0	111.3	106.8	89.0	65.4	40.7	
D2449	38.5	68.6	95.2	114.5	124.4	124.1	118.9	119.9	116.0	109.3	117.0	124.2	125.1	120.4	124.1	121.4	116.8	120.9	115.0	101.1	92.7	77.7	55.8	38.5
D3249	31.0	64.8	104.3	132.3	163.2	169.5	159.3	154.7	145.3	135.7	134.2	142.6	139.9	132.0	135.7	132.6	126.5	121.8	118.7	107.3	94.0	82.9	62.0	36.7
D4049	45.4	74.2	92.6	111.3	120.5	120.0	117.9	117.3	110.8	107.1	115.6	119.4	124.0	121.6	120.9	119.1	118.8	129.1	123.8	115.3	104.7	87.2	60.1	34.3
D4849	37.0	71.9	104.1	124.3	142.1	150.2	143.5	141.0	130.1	122.6	123.3	120.9	118.4	111.8	114.5	112.3	110.7	112.3	113.9	105.1	92.3	79.3	60.3	38.3
D2457	40.2	65.8	87.5	109.1	128.4	136.7	143.4	141.6	138.4	131.4	127.7	129.8	123.6	117.1	117.3	108.6	103.9	103.4	95.1	81.1	71.6	55.3	37.7	22.2
D3257	47.3	76.0	94.5	111.6	121.5	120.2	121.7	116.3	115.8	114.4	127.3	133.1	126.5	122.0	119.3	111.7	101.5	99.6	91.3	79.8	71.3	56.4	39.1	20.5
D4057	32.3	50.6	65.9	83.4	99.2	110.8	116.4	118.6	110.8	109.3	110.2	103.5	94.9	96.7	88.1	88.0	83.6	84.5	78.9	67.9	60.9	46.3	32.2	17.5
#set 14 90.3 6.710 6.710 6.710 28 !set#, power, MWD/kgU, MWD/kgU, MWD/kgU, Parcs #																								
D1609	28.0	53.6	72.3	84.4	93.3	93.4	87.0	90.7	93.7	95.0	94.3	93.7	90.3	89.4	98.4	97.8	104.3	109.0	99.5	89.9	79.0	53.3	31.7	
D2409	27.1	53.6	78.3	91.6	107.9	112.3	114.4	122.6	134.2	135.1	145.3	145.1	134.0	126.9	125.9	121.4	114.8	111.4	114.0	105.6	97.5	90.0	71.0	50.0
D3209	27.1	51.2	71.5	83.9	94.9	100.1	101.6	110.9	119.3	117.3	114.9	118.7	116.4	110.8	106.7	102.2	97.2	97.8	97.2	89.6	82.7	79.6	61.0	46.1
D4009	35.2	65.3	88.0	100.0	108.5	111.1	102.7	105.4	106.7	104.1	110.5	108.7	107.4	102.8	105.3	102.5	99.0	105.3	100.8	91.9	84.1	79.6	61.0	45.0
D4809	17.2	30.2	40.5	48.0	55.5	57.6	55.9	57.3	57.5	57.7	60.9	65.0	63.1	68.2	70.6	78.0	81.7	92.3	90.8	79.7	73.0	60.3	42.0	24.4
D0817	24.2	43.6	65.9	79.6	88.3	89.9	84.0	84.8	88.3	83.8	88.6	83.5	85.6	80.4	82.4	84.1	80.5	83.9	88.3	82.5	79.0	72.8	55.7	43.3
D1617	33.4	58.2	79.8	94.7	100.4	103.2	99.2	106.2	110.6	120.7	132.6	131.3	131.4	129.6	127.7	126.7	132.2	129.7	119.6	114.9	105.0	81.1	50.6	
D2417	27.6	52.4	75.1	90.9	112.1	121.0	122.8	124.7	121.3	114.5	118.1	125.9	121.8	112.3	116.5	113.5	109.2	119.4	117.3	114.3	111.3	107.0	86.2	67.4
D3217	22.1	45.4	70.3	88.4	111.8	125.5	130.7	128.2	127.8	122.6	118.6	118.2	117.4	107.9	110.5	111.1	112.3	108.7	112.8	111.1	105.8	99.5	84.5	61.2
D4017	31.5	55.3	72.6	85.4	92.0	97.9	97.6	103.6	108.7	117.6	130.7	137.1	130.5	129.5	130.4	125.2	120.4	127.7	132.4	118.1	122.4	110.4	77.7	48.9
D4817	29.6	56.0	79.3	96.3	104.4	107.0	105.1	115.3	113.5	116.7	123.4	123.1	119.3	117.8	122.1	119.4	120.5	124.4	128.4	116.7	108.4	100.3	70.0	42.2
D0825	26.5	46.8	63.9	78.2	85.6	90.4	89.7	96.9	103.0	103.1	102.8	104.7	103.0	93.6	102.3	101.0	98.1	103.9	116.5	112.5	105.6	100.7	77.2	54.8
D1625	32.8	55.6	74.4	91.8	107.7	112.3	108.7	108.3	107.6	105.4	105.6	110.4	104.8	113.2	107.6	109.0	108.9	115.4	117.0	112.0	106.1	109.7	81.9	56.3
D2425	28.7	51.6	71.7	82.4	91.7	93.2	88.0	89.7	91.4	91.8	100.0	109.7	108.1	102.9	109.8	112.8	111.7	118.5	121.3	121.6	116.8	112.7	91.2	74.4
D3225	28.1	52.2	71.2	78.7	86.9	86.1	83.5	85.5	86.7	82.4	95.6	105.4	112.0	102.0	101.8	105.8	105.5	111.2	118.5	121.5	123.5	115.2	91.6	71.5
D4025	33.4	55.8	72.8	89.3	98.3	104.7	107.3	108.1	108.3	106.3	114.7	113.2	111.4	114.5	109.2	114.8	110.6	118.1	118.1	113.8	112.8	106.7	80.9	58.2
D4825	27.0	49.4	66.5	78.9	86.1	92.0	92.6	104.5	112.2	120.3	118.8	122.2	116.9	114.4	113.8	112.2	110.3	117.6	120.8	115.7	114.7	109.6	82.4	52.4
D5625	23.6	41.0	54.8	64.9	73.4	76.5	77.0	84.0	88.5	87.5	94.6	92.2	85.7	85.6	85.2	88.6	90.5	99.8	106.2	106.7	100.9	85.0	61.8	39.2
D0833	27.7	49.5	70.2	90.1	107.3	112.4	114.5	117.6	117.6	116.6	108.6	107.6	105.4	96.8	95.6	102.4	97.5	101.3	110.7	119.1	121.5	113.1	105.3	
D1633	31.6	53.1	71.0	81.3	88.7	87.9	87.3	90.8	92.4	89.5	99.1	105.2	106.2	109.3	113.7	115.0	113.6	121.1	118.9	117.6	124.4	118.3	91.5	77.7
D2433	34.6	64.3	90.2	107.0	111.8	114.0	105.1	101.6	100.5	101.8	101.7	105.4	110.0	99.1	107.5	105.9	111.6	116.4	120.0	118.5	115.6	113.7	97.8	80.4
D3233	32.2	63.8	93.7	107.6	115.6	111.1	104.8	102.0	100.4	94.8	99.5	103.8	104.0	101.4	103.7	106.1	104.6	114.8	121.9	123.8	127.1	116.7	90.1	70.9
D4033	30.1	55.0	75.3	87.0	94.0	93.5	92.4	93.7	91.5	92.2	96.1	102.8	108.6	112.5	112.2	114.5	116.5	119.7	125.7	118.8	119.9	115.5	94.2	80.1
D4833	29.9	53.6	72.5	92.3	107.6	114.1	112.1	115.1	115.1	113.3	112.2	116.8	115.4	113.4	118.0	115.2	116.4	122.6	130.6	124.0	126.8	114.1	86.2	62.9
D5633	22.2	44.3	66.0	77.5	92.0	97.2	97.3	100.1	97.9	95.6	95.9	93.0	90.0	82.9	85.8	90.7	91.8	97.3	110.3	112.0	104.1	97.9	73.3	47.1
D0841	21.5	40.1	56.0	64.6	72.2	76.9	81.3	91.4	104.3	111.0	119.7	119.4	122.6	116.8	112.6	111.8	106.3	109.9	114.6	112.0	111.5	104.2	80.4	53.2
D1641	33.1	56.1	71.5	86.8	100.9	108.0	110.2	113.6	114.1	110.8	117.0	112.2	106.4	109.4	106.2	105.6	100.2	104.1	107.1	97.9	100.2	89.7	69.8	46.6
D2441	32.7	55.6	73.0	85.3	93.5	96.4	95.8	98.6	100.8	105.2	110.5	126.6	122.7	124.2	125.6	125.2	121.4	126.4	125.8	122.8	125.1	113.3	78.9	40.2
D3241	31.0	54.6	72.7	88.1	95.1	98.7	98.0	103.6	103.2	107.8	120.5	127.1	126.4	123.6	124.6	123.4	121.5	129.0	123.4	118.1	117.0	104.7	80.6	54.8
D4041	24.9	46.9	69.7	85.2	102.9	109.9	109.8	106.7	107.0	106.0	107.2	113.3	113.9	106.6	107.7	106.8	106.7	113.3	115.9	114.3	115.3	109.3	88.3	61.5
D4841	25.7	47.0	66.7	78.5	90.8	92.0	90.8	96.5	106.8	106.9	110.4	113.0	107.1	102.1	103.1	106.1	98.4	105.0	104.6	100.7	97.3	88.2	73.1	54.4
D5641	14.1	26.1	36.3	41.9	52.0	55.1	53.1	57.2	59.0	58.0	58.1	59.9	58.0	59.1	60.0	57.6	57.0	62.7	68.1	70.3	69.6	64.0	49.8	37.8
D0849	18.5	34.6	52.9	66.1	73.9	79.0	76.5	78.5	77.5	79.7	84.2	85.1	82.7	84.4	84.8	84.9	85.1	87.0	86.9	76.4	70.1	61.2	42.3	24.2
D1649	29																							

D0817	10.0	20.0	30.0	35.0	41.0	45.0	44.0	44.0	42.0	44.0	42.0	41.0	41.0	42.0	43.0	42.0	46.0	49.0	49.0	43.0	39.0	28.0	18.0
D1617	11.0	21.0	33.0	39.0	46.0	53.0	55.0	59.0	60.0	56.0	60.0	63.0	59.0	57.0	62.0	58.0	60.0	66.0	64.0	59.0	53.0	42.0	26.0
D2417	14.0	24.0	35.0	38.0	44.0	44.0	42.0	48.0	50.0	50.0	54.0	59.0	54.0	51.0	55.0	52.0	54.0	56.0	59.0	60.0	55.0	56.0	46.0
D3217	15.0	32.0	46.0	52.0	57.0	55.0	53.0	52.0	54.0	51.0	50.0	51.0	52.0	49.0	50.0	46.0	46.0	52.0	51.0	56.0	53.0	56.0	43.0
D4017	12.0	22.0	32.0	35.0	40.0	42.0	43.7	47.8	54.0	56.0	60.0	57.0	61.0	58.0	58.0	56.0	56.0	58.0	62.0	60.0	56.5	56.0	46.0
D4817	10.0	20.0	30.0	34.0	41.0	47.0	52.0	56.0	59.0	56.0	60.0	61.0	59.9	58.0	57.0	58.0	64.0	70.0	74.0	71.0	75.0	66.0	44.0
D0825	10.0	20.0	30.0	35.0	40.0	47.0	50.0	54.0	51.0	51.0	50.0	53.0	51.0	47.0	47.0	48.0	48.0	52.0	51.0	50.0	51.0	44.0	35.0
D1625	13.0	24.0	34.0	39.0	45.0	45.0	42.0	42.0	46.0	48.0	50.0	52.0	50.0	48.0	50.0	49.0	50.0	52.7	53.7	54.0	54.0	50.0	40.0
D2425	13.0	25.0	38.0	43.0	51.7	52.0	49.0	50.0	49.0	46.0	47.0	48.0	48.0	42.0	46.0	46.0	46.0	50.0	52.0	53.0	56.0	54.0	29.0
D3225	13.0	24.0	34.0	38.0	42.0	42.0	38.0	39.0	42.0	42.0	44.0	49.0	36.0	42.0	45.0	45.0	45.0	48.0	52.0	52.0	56.0	55.0	46.0
D4025	13.0	24.0	34.0	41.0	50.0	50.0	48.0	49.7	50.0	50.0	52.0	51.0	50.0	48.0	52.0	50.0	50.0	51.0	54.0	54.0	54.0	52.0	44.0
D4825	12.0	24.0	32.0	36.0	41.0	42.0	40.0	45.0	51.6	54.0	58.0	56.0	54.0	52.0	55.0	52.0	55.0	56.0	57.0	57.0	57.0	52.0	28.0
D5625	10.0	20.0	28.0	32.0	40.0	46.0	48.0	54.0	52.0	56.0	58.0	60.0	55.0	52.0	54.0	55.0	52.0	56.0	56.0	50.0	42.0	39.0	19.6
D0833	11.0	22.0	33.0	34.0	40.8	44.0	42.0	42.0	44.0	46.0	46.0	52.0	52.0	48.0	52.0	49.0	50.0	51.6	50.0	54.0	49.0	46.0	38.0
D1633	15.0	30.0	44.0	48.0	51.0	49.0	46.7	49.3	46.4	46.0	45.0	49.0	46.0	44.0	48.0	44.0	45.0	51.0	49.0	50.0	49.0	50.0	42.0
D2433	14.0	25.0	32.6	37.0	42.0	40.0	40.0	39.0	43.0	47.0	52.0	50.0	49.0	50.0	49.0	50.0	51.6	57.0	58.0	58.0	56.0	54.0	30.0
D3233	16.0	30.0	44.0	46.0	48.0	46.0	45.0	44.0	44.0	42.0	44.0	45.0	46.0	43.0	47.0	46.3	46.0	48.0	52.0	53.0	54.0	56.0	43.0
D4033	14.0	26.0	36.0	40.0	44.0	45.0	42.0	44.0	47.0	49.0	52.0	50.0	54.0	51.0	52.0	50.0	53.7	56.0	56.3	56.0	54.0	44.0	30.0
D4833	16.0	32.0	48.0	48.7	53.7	52.0	49.0	54.0	46.0	48.0	50.0	55.0	52.0	50.0	50.7	51.0	52.0	53.7	56.0	57.0	56.0	54.0	28.0
D5633	11.0	21.0	31.0	36.0	42.0	46.0	48.0	48.0	51.0	52.0	53.0	57.0	58.0	53.0	62.0	55.0	51.0	54.0	55.0	52.0	43.0	41.0	32.0
D0841	8.0	17.0	25.0	28.0	35.0	40.0	44.0	48.0	51.8	51.8	55.0	54.0	57.0	52.0	54.0	54.0	53.0	56.0	62.0	59.0	55.0	50.0	36.0
D1641	11.0	21.0	30.0	33.0	38.0	41.0	41.0	45.0	50.0	52.0	56.0	55.0	53.0	49.0	52.0	51.0	47.0	55.0	55.0	50.0	48.0	40.0	26.5
D2441	12.0	23.0	35.0	41.0	53.0	54.0	53.0	52.0	50.0	52.0	54.0	51.0	53.0	52.0	54.0	56.0	56.0	60.0	57.0	54.0	54.0	45.0	30.0
D3241	17.0	26.0	37.0	42.0	47.0	47.0	50.0	51.0	52.0	58.5	54.0	56.0	56.0	53.0	56.0	54.0	52.0	55.0	55.0	55.0	54.0	56.0	43.0
D4041	12.0	25.0	31.0	41.0	50.0	50.0	46.0	48.0	47.0	46.5	49.0	49.5	49.5	57.5	49.0	49.8	50.0	52.0	55.0	53.0	52.0	50.0	27.0
D4841	10.0	20.0	29.4	33.5	39.0	40.0	41.0	45.0	49.0	48.0	52.0	50.0	48.0	49.0	49.0	51.0	54.0	61.0	56.0	53.0	48.0	39.0	25.0
D5641	7.0	12.0	17.0	20.0	27.0	32.0	35.0	39.0	37.0	36.7	34.5	38.0	37.5	34.0	37.0	36.0	35.0	36.0	37.0	36.0	32.0	29.0	14.0
D0849	9.0	17.0	25.0	31.0	35.0	38.0	38.0	41.0	41.0	40.0	41.0	41.0	43.0	40.0	41.0	42.0	41.0	44.0	44.0	43.0	36.0	32.0	15.0
D1649	10.5	20.0	29.0	32.5	40.0	42.0	46.0	47.0	48.0	47.0	46.0	47.0	44.0	50.0	49.0	47.0	48.0	53.0	57.0	57.0	54.0	47.0	39.0
D2449	13.0	25.0	35.0	37.5	42.5	42.0	42.5	46.5	51.0	51.0	52.5	51.5	53.5	50.0	53.0	50.0	50.0	53.0	55.0	54.0	55.0	52.0	42.5
D3249	17.0	34.0	49.0	55.0	58.0	58.0	55.0	55.0	53.0	52.0	55.0	56.0	59.0	53.0	55.0	55.0	54.0	57.0	60.0	61.0	59.0	56.5	45.0
D4049	11.5	22.0	31.0	34.0	41.0	42.3	42.5	48.0	54.0	52.5	51.0	55.0	54.0	47.5	51.0	47.5	51.0	55.0	61.0	62.0	57.0	53.0	40.0
D4849	13.0	27.0	36.0	40.0	48.0	53.0	50.0	52.5	53.5	49.0	48.5	50.0	52.0	46.0	49.0	48.0	52.5	54.0	51.0	46.5	42.0	30.0	20.0
D2457	9.0	17.0	26.0	32.0	40.0	44.0	48.0	53.0	53.0	53.0	53.0	55.0	54.0	51.0	53.0	52.0	50.0	53.0	52.0	50.0	48.0	40.0	30.0
D3257	11.0	22.0	31.0	33.5	40.0	40.0	40.0	45.0	44.0	45.0	50.0	55.0	55.0	52.0	54.0	54.0	50.0	51.5	50.0	48.0	44.0	41.5	31.0
D4057	7.0	14.0	20.0	24.0	30.0	35.0	39.0	43.0	41.0	41.0	43.5	42.5	42.0	40.0	42.0	41.5	39.5	42.3	43.0	38.0	35.3	31.0	27.0

D.6 Cycle 2 TIP measured data

```
QC1 CYCLE-2
13 41 24 !cases, # of detectors, # of axials (opposite direction to PARCS)
@set 17 56.7 6.625 6.625 6.530 4 !set#, power, MWD/kgU, MWD/kgU, MWD/kgU, Parcs #
D1609 41.1 77.3 109.8 127.3 139.1 130.4 123.1 114.6 111.3 103.5 103.9 97.6 96.9 89.2 89.9 89.0 89.9 98.2 97.3 91.0 84.8 72.2 54.1 40.7
D2409 41.0 81.4 124.3 155.8 181.3 178.6 171.5 162.7 156.3 139.2 134.8 130.8 119.5 113.2 111.2 105.1 104.7 104.7 99.6 91.6 81.7 68.3 50.6 34.3
D3209 47.2 88.7 121.4 138.8 157.3 155.4 152.1 153.3 141.4 120.3 116.8 112.6 103.4 97.1 94.8 91.5 85.3 86.7 82.6 74.8 67.0 56.6 40.8 29.5
D4009 36.3 70.0 103.4 126.0 144.0 141.6 125.2 122.5 119.1 112.3 109.1 108.4 103.3 96.5 97.7 96.9 97.2 104.0 103.4 96.0 89.3 75.0 55.9 40.4
D4809 42.5 72.2 94.6 109.6 114.6 111.8 104.3 102.1 95.6 90.2 92.9 88.1 84.6 84.9 86.7 85.2 82.3 83.0 80.3 71.1 64.5 52.2 37.7 23.6
D0817 58.7 96.0 117.8 134.2 139.1 129.6 123.1 119.9 113.5 104.0 102.7 97.7 93.8 89.1 87.3 88.0 87.6 95.3 90.6 82.1 75.8 62.8 45.0 31.4
D1617 61.0 94.2 116.1 134.6 143.9 147.5 155.3 156.1 145.0 139.0 139.5 135.3 127.5 124.1 121.9 119.0 112.5 116.5 110.4 95.9 88.9 68.8 48.4 29.7
D2417 42.9 82.3 115.3 129.1 139.1 134.4 126.1 132.2 132.6 126.3 127.1 121.6 113.7 104.3 107.7 102.9 98.9 95.6 94.4 88.5 79.4 66.0 49.5 36.8
D3217 38.2 79.9 120.3 145.6 172.7 173.6 159.7 150.3 143.6 132.3 123.2 120.9 111.0 101.7 98.7 93.5 92.5 91.8 90.1 83.6 73.9 65.4 51.2 34.3
D4017 54.5 92.9 116.4 129.8 132.6 130.8 124.6 130.9 136.0 136.0 134.6 130.4 127.1 119.7 120.2 120.8 117.7 120.8 112.4 102.0 93.2 72.2 52.3 38.2
D4817 48.0 80.0 98.8 116.2 138.9 144.0 146.9 147.4 141.2 133.2 134.1 130.6 126.0 126.5 121.9 120.4 121.0 128.2 124.9 113.4 99.3 78.8 53.9 33.1
D0825 61.3 105.7 137.1 171.8 173.2 162.8 148.7 151.7 137.5 122.8 120.4 111.4 105.3 98.6 94.6 91.4 88.8 89.2 84.4 74.1 67.0 55.5 38.9 24.8
D1625 66.7 105.4 129.5 149.4 141.3 139.3 134.8 133.7 133.9 131.6 130.5 122.6 115.0 109.2 105.7 102.5 97.8 96.8 92.4 82.8 75.8 59.7 44.6 31.8
D2425 51.0 99.1 141.5 158.1 169.0 160.5 145.3 142.7 135.7 126.5 119.5 113.6 104.1 94.3 95.0 90.3 86.2 85.1 82.9 73.8 68.5 57.7 43.1 29.6
D3225 48.5 90.0 123.0 134.1 143.4 139.7 131.7 136.9 132.7 122.6 116.8 113.3 104.6 96.7 94.5 90.5 85.3 85.8 81.6 74.7 69.3 58.6 45.5 33.5
D4025 68.2 112.5 145.5 163.5 162.5 156.7 147.4 141.6 134.6 125.1 122.7 114.9 106.6 100.8 95.5 92.2 89.8 88.3 83.9 73.9 68.2 53.3 36.4 18.9
D4825 49.8 89.8 116.3 135.1 140.4 138.7 132.3 137.5 138.4 130.7 130.8 126.4 119.7 115.0 107.8 108.1 102.8 101.1 96.0 85.7 80.1 61.6 44.4 25.0
D5625 50.7 89.9 123.9 153.4 163.1 156.1 155.0 155.7 150.9 138.4 130.1 110.3 103.6 103.4 102.6 96.6 86.7 85.9 78.2 72.8 66.0 53.4 37.7 23.6
D0833 63.7 103.2 124.9 141.9 147.7 149.0 147.6 144.3 134.9 119.2 115.7 105.3 93.9 88.9 85.2 83.3 76.4 77.6 73.1 63.7 58.5 47.2 35.2 23.7
D1633 70.9 113.0 138.2 165.4 166.5 156.5 148.1 144.9 134.3 126.7 120.4 109.9 106.6 101.3 94.0 93.4 90.3 88.5 81.3 73.4 67.0 49.9 34.5 19.0
D2433 60.0 95.4 116.6 129.4 131.8 127.8 132.7 138.0 130.4 119.6 116.9 108.1 100.3 93.8 89.2 86.1 79.2 79.9 74.8 66.7 62.7 50.4 37.0 26.2
D3233 55.1 97.9 134.7 158.9 163.1 157.8 144.5 143.6 134.8 122.9 117.1 110.9 102.1 95.7 91.2 86.8 83.0 79.6 75.7 66.9 62.2 50.0 36.5 26.8
D4033 53.9 94.2 121.5 137.3 142.4 141.9 136.5 143.9 137.9 127.8 122.6 112.8 103.2 98.1 94.4 93.4 88.5 88.7 83.5 74.8 69.7 55.4 39.8 27.0
D4833 60.4 102.7 135.5 162.9 174.3 165.3 158.0 153.0 142.1 132.7 128.8 124.0 115.8 110.6 107.6 105.3 98.3 96.1 88.5 75.7 69.3 53.4 37.6 23.6
D5633 50.0 92.7 130.9 150.6 162.7 170.6 171.6 176.8 162.2 154.8 140.8 133.9 120.0 109.2 107.3 96.8 92.3 91.0 85.5 75.0 66.7 54.1 39.1 26.6
D0841 46.7 85.8 111.9 135.5 150.0 148.2 143.3 143.5 134.7 124.4 121.7 114.3 108.5 107.6 105.3 100.8 102.6 104.3 105.2 95.8 88.8 71.4 52.7 39.9
D1641 49.2 85.7 112.4 127.7 136.2 136.6 131.8 135.1 137.0 135.6 135.1 128.9 119.1 114.3 110.4 105.3 100.8 102.7 97.7 86.8 81.4 66.3 46.5 32.0
D2441 58.9 105.5 139.6 161.8 163.8 150.8 135.9 131.2 127.5 117.0 115.9 111.0 104.6 98.1 92.3 88.8 86.2 85.6 83.4 73.1 67.2 54.0 38.6 24.8
D3241 51.8 93.9 126.7 143.0 148.7 149.6 146.8 156.9 154.5 144.8 135.7 126.4 116.2 110.2 103.7 98.1 92.4 92.7 86.2 78.6 69.6 56.6 41.1 27.2
D4041 51.0 99.9 138.6 160.4 163.2 159.9 144.4 138.2 133.2 122.3 122.1 117.8 111.4 103.2 104.4 98.3 93.2 93.6 88.9 77.9 72.4 60.1 42.7 26.6
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D2433 57.9 89.4 107.9 125.5 133.2 129.1 113.3 106.7 97.1 84.7 86.5 82.0 75.2 77.6 82.3 90.7 94.5 109.1 108.0 102.4 93.8 79.9 60.4 43.7
D3233 60.1 100.5 128.5 140.0 137.3 129.4 115.8 108.5 96.5 89.0 87.3 83.4 81.4 84.4 89.1 97.8 108.1 123.1 121.6 112.0 106.7 89.4 64.2 43.3
D4033 52.9 89.4 114.0 128.5 140.4 137.5 118.4 118.5 102.8 93.3 88.6 86.2 82.0 77.8 81.5 82.4 81.6 86.9 87.0 78.7 74.0 62.1 45.8 33.3
D4833 73.6 116.0 131.0 140.0 137.5 129.3 113.1 109.3 103.3 97.3 93.5 92.6 90.1 86.7 82.3 82.1 77.5 76.5 74.7 61.9 56.8 46.0 31.9 19.4
D5633 43.5 78.9 104.1 115.1 119.3 129.2 123.4 127.7 127.8 120.3 111.6 105.8 95.8 85.5 91.2 85.4 77.6 73.2 69.5 61.4 53.0 46.2 32.0 19.5
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D1641 51.3 88.5 114.6 123.7 137.0 139.6 134.3 133.2 127.6 119.0 114.0 115.7 113.1 114.0 106.2 99.1 95.6 95.4 88.4 84.6 81.0 69.0 64.4 39.4 23.7
D2441 64.4 109.6 136.8 144.7 143.4 133.9 114.3 108.1 101.7 95.7 90.8 87.2 85.2 85.2 76.6 80.1 83.0 79.3 84.5 81.9 75.2 70.9 59.1 44.1 26.7
D3241 51.0 91.3 117.8 132.9 142.4 141.8 132.2 127.9 117.4 107.7 102.2 93.9 90.0 87.6 89.6 88.3 92.2 90.5 82.1 77.8 67.0 49.6 33.1
D4041 57.1 102.5 134.1 141.5 142.5 129.8 113.7 109.0 103.5 95.4 93.5 90.3 89.8 82.2 84.0 85.1 79.1 79.3 77.1 68.8 63.7 54.9 38.5 24.2
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D5641 42.9 73.2 88.6 94.2 96.0 88.3 80.7 78.0 74.1 72.9 74.2 74.2 70.7 65.4 67.8 63.4 59.4 58.0 52.8 45.9 41.9 34.6 24.3 16.3
D0849 39.0 70.7 92.4 101.6 107.6 101.0 94.6 92.4 92.6 86.7 87.1 87.4 87.5 85.8 83.8 80.3 71.9 71.4 65.1 56.3 49.7 42.0 29.8 20.5
D1649 56.5 95.3 121.9 140.3 137.7 126.7 112.5 113.6 108.1 110.9 114.0 115.7 109.5 106.3 104.7 100.8 95.8 93.3 84.4 73.6 65.4 51.7 35.0 17.3
D2449 58.7 94.2 115.8 122.8 126.5 127.0 121.7 118.4 107.9 99.0 101.2 95.7 86.1 86.7 83.5 80.7 77.7 76.4 72.8 61.3 58.0 45.7 32.2 17.3
D3249 58.1 108.1 141.2 155.8 159.3 152.9 136.8 126.7 118.1 107.3 103.9 99.7 95.8 89.1 86.9 82.5 79.8 76.4 76.9 67.2 51.5 53.5 39.0 23.7
D4049 44.2 78.2 103.7 118.8 127.3 128.6 129.5 129.4 123.1 122.6 129.1 123.7 117.6 108.1 108.2 105.1 96.3 93.9 88.9 78.2 68.9 57.2 40.8 26.5
D4849 44.5 84.5 122.0 134.9 140.1 132.6 124.8 115.5 109.4 103.2 112.4 110.8 104.6 98.5 101.9 94.9 87.7 88.1 82.5 72.1 64.5 53.3 38.3 28.2
D5457 55.4 99.3 125.9 135.6 137.7 126.4 114.5 110.5 103.0 96.6 93.0 94.6 87.7 82.1 81.3 79.4 73.2 71.8 67.7 59.9 53.2 44.8 30.2 16.5
D3257 46.2 83.4 105.2 113.5 118.2 118.5 114.3 116.7 108.6 100.8 98.1 95.1 89.1 80.3 83.9 79.1 75.2 73.7 69.4 61.7 55.7 47.2 34.0 22.6
D4057 46.9 82.8 102.0 115.3 114.8 108.1 94.5 93.6 91.5 86.4 83.8 84.8 80.7 76.0 76.0 73.7 65.3 64.9 60.0 54.0 46.8 39.4 27.0 16.6
@set 19 85.9 7.225 7.225 7.130 8 !set#, power, MWD/kgU, MWD/kgU, MWD/kgU, Parcs #
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D2409 45.0 87.3 123.2 136.2 142.4 136.1 119.8 114.8 107.8 97.0 93.0 92.3 90.8 82.9 81.5 80.3 75.8 74.2 74.0 67.1 61.3 53.2 44.0 31.9
D3209 42.7 80.2 105.3 114.6 127.3 128.2 109.7 105.2 92.5 85.4 77.0 74.2 72.3 66.3 67.7 66.7 66.1 64.5 64.6 60.3 57.6 53.2 43.6 35.6
D4009 40.9 77.0 105.4 115.0 117.1 107.7 100.8 97.8 93.0 93.5 95.7 94.8 91.1 88.4 90.2 88.0 80.7 82.7 79.0 73.8 65.3 57.2 43.7 31.5
D4809 42.2 68.0 84.9 91.3 90.7 83.0 77.0 74.9 71.5 67.6 73.6 72.4 69.2 68.2 69.6 68.1 64.7 63.8 59.3 50.5 46.5 37.5 26.5 16.4
D0817 59.7 92.5 100.9 108.0 104.2 92.0 84.7 82.7 85.3 87.1 90.4 91.5 89.2 85.2 83.0 78.9 70.3 72.6 67.9 57.4 51.9 42.9 31.2 20.7
D1617 79.4 119.9 132.1 137.3 133.4 121.5 111.9 113.0 104.8 98.9 103.9 106.1 99.5 96.3 93.3 91.4 85.4 83.3 78.7 68.9 61.8 49.0 35.1 20.1
D2417 40.4 75.1 101.9 111.9 123.5 120.5 111.8 102.4 99.6 88.2 86.3 84.5 80.6 76.3 75.6 75.7 74.1 74.5 74.0 68.4 64.9 62.8 51.0 37.6
D3217 44.4 91.8 131.6 140.3 140.8 129.9 119.2 108.2 100.7 87.4 85.0 80.6 78.3 72.0 74.3 72.5 71.2 71.9 73.1 71.6 67.8 66.4 59.2 46.6
D4017 54.9 89.7 110.9 120.3 127.5 122.9 111.2 108.2 102.3 97.0 97.7 98.0 93.1 89.0 91.1 91.9 87.0 89.5 85.7 75.5 71.9 60.8 44.2 29.3
D4817 62.7 105.6 124.7 134.5 129.9 120.8 108.4 106.3 106.6 111.4 113.3 110.0 111.7 105.5 106.0 103.3 97.2 95.1 87.2 77.2 69.4 55.4 40.4 27.9
D0825 66.6 107.1 118.1 127.6 129.0 116.9 105.2 99.9 88.3 84.2 81.1 83.6 76.5 73.0 71.4 71.1 67.3 66.5 63.3 56.8 55.1 49.5 37.9 27.8
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D2425 55.3 102.3 131.6 137.6 129.5 115.6 103.3 93.4 92.5 88.1 95.0 97.5 96.7 90.2 94.4 95.6 91.8 93.6 90.3 86.2 79.8 72.6 57.1 41.8
D3225 46.6 89.7 123.8 137.4 137.5 123.2 103.8 99.5 96.7 89.3 94.4 102.0 106.5 99.7 104.9 98.2 97.5 102.1 100.3 94.0 86.4 78.9 65.4 49.0
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D4825 50.4 84.4 106.8 120.4 127.4 123.6 109.9 109.1 101.0 94.8 94.1 87.9 87.6 81.1 80.5 79.1 76.6 76.1 73.7 66.4 65.5 58.8 44.8 33.9
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D0833 59.0 92.6 109.4 123.8 122.4 117.9 104.4 95.3 92.7 79.2 74.4 72.2 68.2 65.1 61.4 61.4 59.1 61.1 59.0 54.0 54.4 48.9 40.5 34.2
D1633 86.3 124.9 131.5 142.3 130.7 115.1 100.7 93.0 85.7 82.4 83.0 79.7 73.9 72.2 73.6 74.9 71.1 73.2 71.1 64.1 63.6 57.6 44.5 30.3
D2433 62.9 109.9 122.6 134.2 128.1 115.0 100.5 96.2 94.3 93.7 101.5 102.5 97.7 99.2 100.7 98.5 93.4 93.8 94.1 86.5 82.2 72.2 52.7 35.8
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D4033 57.3 99.3 122.2 132.5 133.5 122.6 103.2 97.9 89.5 87.6 86.5 81.8 80.8 80.2 82.8 80.8 77.1 80.1 78.4 72.9 74.2 68.3 53.7 42.0
D4833 67.8 106.4 121.5 126.5 122.3 118.4 108.7 96.4 90.7 84.4 83.9 82.4 75.2 74.1 73.8 74.0 69.9 70.5 68.7 62.5 63.3 56.0 45.0 38.9
D5633 41.4 74.2 96.7 111.1 128.5 129.8 117.6 117.2 106.1 94.4 86.8 84.7 81.9 73.3 76.7 70.6 66.3 67.2 65.9 59.5 54.5 46.9 35.2 26.8
D0841 55.0 96.0 117.4 124.3 118.7 116.6 108.3 105.1 103.6 104.3 108.9 108.7 102.3 97.2 99.2 93.6 87.8 84.2 81.0 70.9 63.0 56.7 42.4 33.9
D1641 52.4 90.0 112.5 126.3 132.9 127.9 119.5 117.6 105.3 99.8 98.4 96.3 90.9 86.6 85.6 83.1 76.9 75.7 73.0 66.7 62.1 54.1 41.7 28.5
D2441 65.4 110.0 130.7 136.6 132.8 119.1 100.4 95.8 90.4 84.3 87.0 86.4 82.2 80.8 79.3 78.9 76.5 78.3 78.0 72.6 71.6 64.9 48.8 33.2
D3241 52.1 96.1 132.5 141.2 140.4 132.0 117.3 109.0 107.0 92.8 93.9 95.0 94.6 88.4 88.6 84.6 82.8 84.5 83.0 76.2 75.1 69.8 55.3 38.5
D4041 57.6 99.0 123.6 126.5 127.1 114.0 99.8 97.6 92.6 85.6 84.0 86.7 79.3 75.7 77.5 75.0 72.1 72.9 71.3 66.1 62.7 55.3 41.7 30.7
D4841 48.6 81.6 103.8 112.5 118.5 114.6 101.7 104.3 105.8 100.0 107.1 104.5 98.6 92.4 90.4 86.4 81.4 82.0 77.0 67.9 63.7 55.1 39.9 27.2
D5641 38.3 66.1 78.3 84.9 85.9 79.8 71.3 68.6 68.5 66.0 64.9 63.3 58.9 58.1 58.4 57.2 52.4 54.2 49.9 44.8 41.2 34.1 25.5 18.6
D0849 38.8 68.8 88.8 95.3 96.5 88.3 78.9 73.7 70.6 69.9 72.9 75.3 74.0 71.8 72.7 69.3 63.7 62.6 60.1 51.8 46.6 38.7 27.6 17.1
D1649 71.3 109.0 126.1 128.2 120.6 107.2 96.5 97.5 89.5 91.4 96.7 96.8 91.6 90.9 89.6 87.1 83.0 81.9 76.1 69.0 60.6 48.5 34.7 20.0
D2449 56.0 90.4 110.9 121.8 127.3 123.1 109.5 99.6 90.4 82.8 84.8 80.7 74.6 74.8 73.5 72.7 68.5 69.6 67.8 63.2 61.3 53.8 39.9 25.1
D3249 55.1 102.0 133.2 140.7 145.2 138.1 119.6 111.1 100.2 92.9 88.2 85.8 80.4 76.2 76.6 73.4 70.5 72.0 70.1 67.9 65.8 62.4 50.1 41.3
D4049 45.9 82.7 107.5 117.2 124.0 119.3 105.3 106.9 107.7 105.3 106.2 102.3 99.9 95.5 97.3 92.2 84.3 85.0 81.3 74.5 68.6 59.8 44.0 30.3
D4849 56.5 103.2 127.0 129.0 125.1 116.8 100.0 99.3 95.3 89.6 90.1 91.2 92.8 82.2 87.2 83.8 75.1 74.9 74.7 64.4 58.8 50.0 35.7 23.4
D5457 52.0 91.3 117.3 128.2 126.0 114.2 103.0 97.1 88.1 80.1 80.2 78.1 74.0 71.2 70.7 68.0 63.8 65.1 63.3 56.9 52.8 45.1 32.9 21.5
D3257 43.7 79.5 101.2 110.6 121.2 118.0 104.3 104.2 92.2 83.9 82.6 76.5 72.9 69.4 70.2 67.1 64.2 65.9 63.4 58.5 56.7 48.4 36.7 23.9
D4057 44.2 75.5 95.0 102.3 101.3 94.7 86.3 83.5 74.6 71.5 70.6 71.9 69.2 66.7 65.8 63.1 60.5 60.0 56.1 50.1 45.4 38.5 27.6 18.6
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D2409 67.3 117.8 147.0 162.2 161.7 142.4 123.9 111.6 103.4 92.8 88.4 84.8 80.6 75.7 76.0 74.8 72.2 73.3 71.3 65.5 63.9 55.3 41.5 31.3
D3209 81.0 129.3 148.8 158.2 144.8 127.4 112.9 99.9 86.3 77.0 73.8 71.9 63.7 63.3 64.9 62.6 63.0 63.6 63.7 55.9 53.5 43.5 30.4 16.1
D4009 67.0 100.5 116.9 128.2 122.0 112.9 102.6 95.5 88.3 79.0 78.3 76.6 72.4 71.1 70.1 70.3 67.9 69.9 66.5 62.6 59.7 48.9 33.9 17.7
D4809 25.0 42.6 53.6 61.8 67.6 76.7 79.0 88.4 84.3 79.8 82.4 81.2 77.6 76.3 75.9 75.0 69.6 68.0 65.1 57.8 52.6 42.4 29.6 17.8
D0817 54.4 87.5 102.6 114.4 121.8 116.0 113.4 113.6 107.2 95.8 96.3 92.6 89.6 86.7 83.7 83.2 76.1 76.7 72.3 64.0 58.3 49.1 35.7 24.0
D1617 64.5 104.6 126.9 140.2 139.7 133.7 127.6 118.7 113.5 102.9 102.0 98.0 92.5 88.6 91.2 89.4 85.7 86.7 84.5 76.0 69.6 58.7 42.3 25.7
D2417 88.4 131.3 147.8 148.5 136.4 121.7 110.8 100.0 89.7 81.5 80.1 78.7 72.9 73.4 73.1 72.9 78.1 80.2 77.5 79.4 65.9 45.5 40.5 20.1
D3217 79.5 130.4 152.8 155.7 147.4 130.3 114.3 106.4 95.2 86.4 81.0 78.2 74.1 72.5 71.2 73.2 72.4 74.9 77.0 71.4 70.1 60.1 48.4 40.5
D4017 63.1 104.3 136.9 150.1 149.4 137.9 121.7 116.6 110.4 101.3 102.2 96.8 90.0 87.4 81.9 80.7 79.3 74.3 73.1 69.5 95.3 94.7 83.3 60.7 40.3
D4817 59.0 98.7 122.8 136.6 144.0 138.3 128.5 128.8 120.7 109.3 106.9 108.5 98.4 98.5 96.4 94.3 91.0 91.9 87.5 77.4 70.6 57.1 40.7 24.5
D0825 54.2 88.5 108.9 127.2 132.1 125.4 111.0 111.9 109.2 103.7 113.8 114.6 111.4 105.6 107.2 107.2 101.6 104.4 102.1 89.3 83.7 71.1 53.4 41.5
D1625 83.4 122.9 138.7 149.9 141.4 125.0 111.9 107.7 100.2 89.5 88.0 83.8 79.2 79.4 81.8 84.1 82.5 88.6 91.3 90.9 90.0 79.6 62.0 45.4
D2425 65.3 96.7 112.0 126.1 124.3 115.7 107.7 98.5 90.5 83.7 85.3 82.7 76.4 78.2 78.7 80.4 83.7 84.8 82.8 81.4 82.5 69.7 49.7 29.0
D3225 60.9 95.4 115.8 130.3 132.5 122.7 106.9 103.6 95.1 92.4 100.5 101.6 96.8 100.6 99.7 100.6 96.8 97.2 99.8 92.5 89.4 76.3 56.2 40.0
D4025 79.4 123.1 137.6 145.6 145.6 126.8 117.4 109.3 101.7 90.7 90.9 88.0 82.1 81.7 83.3 84.6 83.9 88.3 88.9 87.0 87.7 76.0 58.4 38.3
D4825 56.7 96.7 121.4 143.8 145.2 140.0 123.1 116.7 110.5 103.8 102.3 101.9 96.6 94.9 94.6 92.4 93.2 95.9 99.0 95.2 94.8 77.7 60.4 44.7
D5625 35.2 61.8 76.5 85.6 86.7 81.1 84.2 89.8 95.5 102.3 112.3 112.2 107.3 113.6 115.2 112.6 105.6 101.1 91.2 85.4 78.5 66.1 48.0 32.0
D0833 71.5 109.6 127.5 131.8 128.1 119.9 102.9 95.0 93.4 91.8 102.6 110.3 100.5 97.2 99.3 97.6 94.6 97.1 97.0 89.1 82.5 69.4 54.1 32.9
D1633 73.0 101.0 124.7 140.8 138.1 127.7 108.4 99.7 95.6 90.0 90.5 85.6 80.5 81.7 84.6 86.1 84.5 89.9 97.2 96.9 95.9 82.5 63.7 41.5
D2433 72.2 107.7 127.4 136.8 134.6 121.2 106.9 98.1 92.0 87.8 89.1 85.3 85.1 82.7 85.6 85.4 83.3 85.5 85.2 82.4 81.8 76.3 59.0 42.6
D3233 60.6 103.1 125.1 134.5 133.1 120.0 108.3 101.9 99.2 94.8 102.7 108.9 105.3 107.3 106.9 102.1 105.7 102.8 94.0 89.4 80.7 65.5 44.3
D4033 52.9 90.6 117.8 131.2 131.9 123.0 109.0 109.3 101.9 84.7 81.8 80.0 75.6 76.8 82.3 80.9 80.8 84.3 87.6 85.1 87.6 81.9 67.7 51.1
D4833 73.7 117.9 130.7 138.9 136.5 127.5 111.3 110.8 103.2 100.2 101.3 100.8 101.2 96.4 98.8 99.9 99.4 102.7 105.2 101.0 98.6 84.4 62.7 42.2
D5633 37.0 69.2 92.2 97.4 102.0 99.5 88.7 92.2 95.6 98.1 106.0 119.5 117.9 115.1 118.8 117.1 105.9 108.0 103.2 93.4 82.4 74.6 52.1 34.5
D0841 42.7 75.9 102.8 124.5 137.9 141.1 140.5 140.3 131.4 120.7 121.4 120.1 117.3 109.1 111.9 106.6 100.6 101.5 98.2 84.3 77.5 66.6 52.1 44.3
D1641 66.7 117.4 144.1 155.6 157.9 142.6 129.9 118.4 108.9 101.2 96.2 93.4 90.9 83.4 85.0 84.2 81.2 83.2 83.3 79.8 77.9 68.4 51.8 36.6
D2441 54.0 92.5 116.2 130.5 134.9 124.6 109.6 103.7 96.4 90.2 87.3 84.9 79.9 76.5 77.1 79.0 75.9 82.8 85.0 84.7 86.

D1609	60.3	90.4	103.0	105.5	98.7	96.4	89.8	95.8	93.8	91.6	98.9	90.4	87.2	85.2	87.1	83.8	80.6	84.1	80.2	68.4	64.5	53.9	36.7	21.7	
D2409	85.9	137.7	156.6	166.0	142.9	134.5	118.8	106.0	98.6	89.5	88.2	86.3	81.4	84.3	85.3	86.3	86.0	89.1	88.8	80.9	80.0	69.0	49.8	32.3	
D3209	103.4	147.2	158.2	155.4	137.0	122.2	97.3	91.0	79.9	72.8	74.3	71.8	69.3	70.7	75.2	78.7	85.2	90.8	90.6	81.5	76.4	61.9	44.5	22.1	
D4009	74.0	110.1	116.7	122.1	113.0	100.9	95.5	88.3	84.8	77.4	81.7	78.3	76.3	77.0	77.6	78.9	74.7	77.0	73.0	64.4	59.9	49.7	34.2	16.5	
D4809	26.1	41.9	53.0	59.6	60.0	61.0	63.3	70.8	78.3	77.4	79.9	79.5	75.4	77.8	78.4	74.8	70.2	70.8	67.3	59.0	53.6	49.6	30.7	19.7	
D0817	54.5	83.5	96.9	104.8	111.8	109.2	102.4	100.8	95.2	90.9	90.3	87.6	85.2	82.3	83.1	82.8	77.1	78.1	72.5	65.7	57.7	49.8	37.4	28.8	
D1617	89.8	126.8	143.3	145.8	129.7	120.3	110.5	110.6	106.7	100.1	104.2	107.6	102.9	99.1	100.9	101.4	92.5	93.1	89.9	77.7	71.8	58.8	41.7	23.1	
D2417	98.9	142.5	155.1	148.7	129.5	115.4	105.9	99.4	95.4	90.4	102.4	103.5	99.3	96.1	100.3	101.3	101.8	104.4	102.4	89.8	84.7	69.3	48.8	27.4	
D3217	87.6	139.0	154.1	154.5	138.3	125.6	107.7	105.2	94.6	89.9	91.3	89.1	87.7	85.3	88.2	90.0	88.4	93.6	93.3	85.2	77.8	68.8	50.6	34.7	
D4017	85.8	136.1	152.9	156.5	146.4	125.4	110.6	106.2	104.4	103.8	113.7	117.6	113.9	113.9	121.4	118.4	114.6	116.9	111.7	101.7	94.0	77.1	54.9	28.6	
D4817	63.8	105.0	123.7	132.2	129.6	123.5	119.4	118.1	107.7	107.4	103.9	104.8	100.0	99.4	101.7	98.9	95.3	93.1	88.5	80.4	71.5	57.2	39.8	24.8	
D0825	56.6	94.2	116.9	127.9	121.5	113.3	101.1	102.3	94.0	90.5	92.1	94.5	93.7	87.4	90.1	89.1	86.1	92.9	96.6	89.9	88.8	76.8	54.8	31.8	
D1625	86.3	123.9	138.5	140.5	132.5	117.3	101.4	99.6	98.7	98.2	111.8	112.7	110.8	110.5	116.1	113.0	110.5	111.6	109.7	95.2	86.2	71.6	53.5	41.2	
D2425	91.5	131.6	135.1	133.1	119.3	110.0	98.6	102.9	93.9	89.5	89.9	91.7	88.4	88.6	90.9	89.8	87.1	87.8	83.5	74.2	70.8	56.2	38.4	21.2	
D3225	91.9	133.6	142.0	138.7	123.4	111.8	103.5	103.9	103.2	101.8	106.8	104.3	103.3	101.8	99.7	99.0	92.9	96.2	96.9	82.6	78.6	65.8	48.9	33.8	
D4025	87.6	129.3	145.6	147.5	137.5	122.0	110.9	105.5	100.7	99.3	104.2	103.9	101.0	100.7	98.0	96.9	95.3	96.4	95.0	81.8	75.1	62.0	45.4	31.0	
D4825	58.4	101.7	129.9	144.5	137.3	128.3	111.8	103.6	107.4	105.0	119.0	116.2	115.4	117.3	116.4	120.3	108.5	110.7	111.2	99.8	94.2	75.2	53.9	31.2	
D5625	33.0	56.3	71.3	78.1	77.6	72.4	72.8	79.1	81.9	88.5	77.9	75.5	70.9	78.0	80.7	80.5	81.3	83.0	87.0	86.3	86.6	73.1	55.1	41.1	
D0833	70.0	105.8	118.9	123.5	114.5	103.7	96.7	91.9	89.1	84.3	82.7	87.4	85.1	83.2	85.7	87.0	88.1	94.0	94.5	90.4	90.9	70.7	64.2	52.4	
D1633	95.2	137.2	144.9	137.7	123.4	113.9	105.0	110.1	99.8	101.8	114.7	123.3	116.3	112.7	119.8	113.4	114.9	117.0	107.4	93.9	90.5	68.9	53.6	35.4	
D2433	81.3	120.7	129.0	132.8	127.4	111.8	104.7	97.7	94.9	85.2	89.7	90.0	84.8	85.5	87.9	83.3	80.8	81.6	82.0	72.1	67.8	58.2	41.6	21.9	
D3233	67.0	112.4	132.6	138.4	132.0	121.0	106.5	110.5	112.2	111.8	111.5	112.8	108.8	104.8	105.5	104.5	98.5	97.6	94.5	84.2	77.7	68.0	50.1	35.1	
D4033	73.8	119.7	136.7	133.4	131.8	122.7	104.5	99.8	93.3	92.6	95.5	97.5	92.0	89.9	93.9	93.8	88.5	91.7	87.8	78.6	76.7	63.7	47.1	36.2	
D4833	74.6	116.8	127.8	130.0	122.4	112.8	99.4	98.1	97.3	102.4	112.8	118.1	116.2	119.7	124.4	125.1	118.4	118.1	113.8	104.0	92.7	78.3	57.7	38.7	
D5633	34.5	63.0	80.5	86.5	88.4	83.4	81.7	79.6	75.7	76.5	69.2	71.7	70.1	74.6	77.4	75.4	82.1	91.5	90.3	90.2	75.1	56.0	39.5		
D0841	45.4	80.2	106.2	126.3	135.1	134.9	125.8	125.0	119.9	114.6	110.0	108.3	104.6	105.0	105.0	103.4	98.4	98.8	97.6	86.5	78.6	67.3	53.8	48.0	
D1641	72.6	126.1	150.4	155.0	146.2	138.6	117.6	116.7	109.1	104.5	106.9	108.1	103.8	100.0	102.7	104.5	96.7	94.9	95.0	83.5	76.0	66.8	47.8	29.6	
D2441	74.5	120.0	140.8	140.4	132.7	117.9	102.0	99.1	95.6	96.5	103.5	107.0	105.9	102.2	103.1	103.4	97.1	100.0	99.5	89.3	81.1	71.7	51.7	38.6	
D3241	72.5	123.2	148.3	147.3	144.5	132.0	116.3	115.8	108.8	103.4	103.7	103.4	97.0	100.4	98.7	92.2	96.6	92.6	84.3	76.7	65.7	50.3	36.2		
D4041	68.0	117.8	139.0	139.9	131.4	115.8	107.0	100.9	97.5	93.6	101.0	106.5	108.1	104.1	107.4	107.7	101.7	99.4	96.6	86.1	80.3	68.8	50.2	34.0	
D4841	57.3	99.0	123.0	129.3	132.0	125.3	107.0	102.2	100.8	93.5	95.6	96.8	94.2	91.6	93.5	89.1	84.6	87.7	83.5	76.1	70.0	60.1	42.4	29.4	
D5641	23.4	41.0	50.8	57.5	63.9	68.0	66.0	70.7	70.3	65.8	66.6	64.8	62.9	60.7	60.9	60.8	61.2	63.5	64.5	57.7	53.4	47.7	35.3	26.0	
D0849	31.6	56.2	73.3	81.1	87.3	84.8	79.8	80.1	75.1	79.1	78.2	76.9	75.7	73.3	71.0	72.1	69.2	60.0	54.4	45.7	33.7	23.6			
D1649	76.6	120.3	136.5	140.0	126.5	117.7	106.8	106.3	102.1	97.0	99.7	98.2	95.6	93.1	96.9	95.5	89.7	89.0	86.4	74.9	70.0	58.6	41.6	23.3	
D2449	91.3	141.2	155.5	158.9	145.1	124.3	102.4	95.1	89.2	80.7	82.9	81.9	78.2	81.2	81.5	83.1	79.9	83.8	84.4	77.2	74.9	65.6	49.2	32.8	
D3249	70.9	128.7	162.3	161.3	157.7	139.9	119.0	110.7	102.1	92.3	92.2	91.7	89.0	86.7	90.0	91.8	94.5	104.3	103.7	98.3	91.8	78.7	61.4	46.2	
D4049	71.9	119.6	140.8	145.2	136.5	125.4	110.4	107.3	98.9	92.9	93.7	93.5	91.4	89.3	85.2	88.7	87.0	83.6	83.8	81.3	73.6	68.7	60.6	46.3	30.2
D4849	46.2	80.3	104.3	109.5	110.3	104.8	95.5	97.1	99.1	96.8	95.0	93.3	94.5	88.1	90.3	91.3	83.7	83.4	80.9	69.9	68.5	55.4	41.2	28.5	
D2457	62.4	110.6	132.7	136.2	131.2	116.4	102.4	94.7	86.7	78.0	77.9	75.5	71.8	69.3	72.8	73.1	71.4	74.8	76.0	68.7	64.4	56.9	41.0	28.5	
D3257	74.0	126.8	151.1	146.6	139.7	120.3	104.7	95.1	85.2	77.2	74.8	72.5	72.0	67.3	73.7	74.6	73.6	78.8	80.2	73.2	68.0	60.9	45.3	32.7	
D4057	48.4	79.2	98.5	102.1	99.1	91.7	80.6	77.0	73.4	67.0	64.5	66.8	63.7	61.0	63.4	63.5	60.1	61.5	58.8	52.8	48.8	42.0	30.6	20.7	
Eset 22		99.6	8.293	8.293	8.193	14	1set#,	power,	MWD/kgU,	MWD/kgU,	MWD/kgU,	Parcs #													
D1609	60.9	85.5	93.6	98.4	98.1	98.3	97.0	99.2	92.1	84.1	87.4	85.6	82.7	78.5	80.0	79.3	76.4	80.6	77.5	72.9	70.4	57.7	44.5	34.7	
D2409	81.3	121.6	142.8	153.4	142.8	130.3	115.8	111.3	101.7	95.3	96.7	93.3	89.7	87.4	89.1	88.8	87.6	92.9	94.3	88.9	88.1	76.0	55.8	38.0	
D3209	92.9	130.6	139.3	139.4	131.7	120.1	112.3	109.3	104.4	94.9	95.9	90.3	87.0	88.3	86.1	85.4	85.6	90.3	88.3	80.2	75.9	63.9	48.0	27.9	
D4009	73.3	103.0	113.5	117.9	111.9	103.1	95.1	86.9	82.3	78.2	81.3	80.2	75.9	76.9	76.0	76.4	76.3	80.9	83.5	78.4	77.1	63.5	44.5	23.2	
D4809	26.0	43.5	52.4	59.2	63.8	65.3	70.5	74.4	77.1	73.9	75.4	72.0	71.2	72.0	71.0	69.3	66.1	67.0	65.1	58.2	54.8	45.3	31.6	16.5	
D0817	59.6	90.0	107.8	119.1	116.2	113.5	102.5	97.3	90.7	81.1	79.6	79.0	77.1	75.3	70.7	72.6	67.9	69.0	64.9	58.0	55.6	47.0	34.7	25.1	
D1617	94.1	132.1	146.0	156.8	149.1	132.7	116.2	114.4	105.1	97.5	101.0	98.1	92.3	90.7	92.9	93.6	86.7	88.7	89.0	80.6	76.9	68.3	50.3	31.8	
D2417	96.8	139.8	155.1	162.1	158.3	137.4	127.7	117.4	106.9	98.3	98.1	97.1	92.1	88.1	92.4	92.7	92.3	96.2	95.5	85.8	84.1	71.7	54.5	34.5	
D3217	82.3	130.6	145.6	151.8	142.6	130.0	115.5	111.5	104.2	94.7	94.5	92.2	87.6	84.3	86.9	87.9	84.7	90.6	92.0	87.0	85.8	80.3	63.5	46.1	
D4017	88.6	144.0	169.7	177.1	175.5	153.4	133.4	125.4	124.4	109.9	110.7	108.7	102.1	100.4	105.9	107.9	103.4	110.6	108.5	99.7	93.9	81.2	59.0	36.5	
D4817	69.0	111.9	126.0	136.3	136.8																				

D4833	60.9	84.8	110.9	119.6	129.3	123.8	122.8	116.4	114.6	110.1	110.1	110.3	110.6	105.4	106.8	108.9	100.7	101.9	98.0	87.6	79.4	67.3	50.7	34.0	
D5633	48.6	85.9	110.8	120.8	116.8	117.3	107.7	107.6	100.6	92.6	91.6	90.1	84.4	82.2	84.5	81.1	76.1	79.2	76.8	69.6	64.5	57.4	42.5	32.1	
D0841	48.3	81.8	96.4	103.8	104.6	111.4	93.8	96.3	90.3	86.6	87.2	84.8	79.6	78.5	80.4	77.2	75.3	76.4	76.4	73.7	72.9	68.1	54.6	41.0	
D1641	53.8	86.8	104.0	107.8	111.7	106.2	100.1	98.6	95.0	92.4	94.8	93.8	92.4	88.1	87.8	89.8	85.6	88.0	89.9	84.6	78.5	79.9	62.4	46.5	
D2441	48.8	80.7	92.7	96.3	98.3	98.0	93.8	94.4	96.5	98.7	110.0	117.4	112.9	110.2	112.6	108.1	101.6	106.8	104.8	95.4	88.8	80.2	61.3	43.9	
D3241	45.2	78.5	95.1	97.9	106.3	109.2	107.4	111.9	111.2	115.0	124.2	133.5	128.9	126.1	123.9	121.9	115.1	115.9	112.9	103.3	95.1	82.8	64.8	42.6	
D4041	53.4	85.7	100.5	102.7	99.2	95.3	89.0	88.7	88.9	86.0	91.4	94.1	95.3	92.2	92.0	90.0	86.5	86.4	84.4	79.5	75.2	69.4	55.9	40.0	
D4841	58.0	94.5	110.0	111.4	107.2	100.0	95.0	92.5	91.0	87.0	85.0	82.0	79.6	76.6	77.8	77.8	72.0	76.6	76.6	72.9	72.3	66.3	49.1	36.0	
D5641	33.3	54.8	67.1	68.7	70.5	66.2	62.2	59.9	59.3	53.7	55.9	54.6	52.5	51.1	51.6	50.9	50.2	51.5	51.2	46.5	44.6	40.0	30.4	22.6	
D0849	26.8	47.8	60.4	62.5	64.6	61.8	57.4	55.8	54.6	51.1	56.6	57.7	57.7	57.5	59.2	58.1	55.9	58.5	58.2	55.9	53.4	46.8	34.1	21.6	
D1649	57.4	87.3	95.7	99.1	97.8	88.0	82.8	79.9	75.5	68.5	73.5	75.3	69.2	69.1	71.4	69.6	69.2	72.7	73.6	72.8	73.9	63.9	46.6	26.4	
D2449	62.3	80.8	115.3	130.0	134.3	128.8	119.3	114.8	110.4	104.6	104.6	102.0	100.3	96.3	96.5	95.8	89.8	92.5	91.3	84.0	80.0	66.8	49.1	27.9	
D3249	46.5	85.1	110.4	124.1	137.6	141.7	138.1	136.5	133.2	127.4	127.4	129.8	123.2	114.9	115.4	112.5	107.4	109.0	107.6	98.6	89.9	80.3	63.2	50.5	
D4049	50.4	83.9	104.8	109.5	111.0	105.6	98.7	96.4	93.0	87.5	86.9	89.4	87.6	83.3	83.7	81.8	78.7	81.7	81.2	76.0	75.1	70.4	56.4	45.7	
D4849	45.7	80.5	99.2	103.7	106.8	95.4	84.1	80.5	73.4	66.8	69.3	68.4	68.5	63.5	68.3	66.4	63.4	67.4	67.4	64.3	64.1	56.4	44.7	34.8	
D2457	45.1	78.9	95.7	103.2	105.5	101.6	96.4	95.2	90.8	86.2	81.7	84.7	80.2	77.5	77.7	79.0	74.7	76.0	75.5	68.3	63.9	55.6	42.2	27.6	
D3257	46.8	82.5	102.3	104.8	107.9	106.4	98.8	97.6	93.1	87.4	87.5	87.5	86.8	80.0	82.3	81.5	78.1	79.0	79.9	72.5	68.7	60.7	46.3	34.4	
D4057	31.6	55.9	69.9	72.3	75.6	73.2	69.3	70.4	66.4	65.9	65.5	62.5	63.3	62.0	60.8	60.6	57.9	58.3	58.5	53.3	50.7	46.4	34.0	23.9	
#set 24 98.5 10.195 10.195 10.195 10.100 18 !set#, power, MWD/kgU, MWD/kgU, MWD/kgU, MWD/kgU, Parcels #																									
D1609	64.0	91.6	103.6	107.4	102.2	98.3	86.9	84.3	77.0	75.9	80.4	79.3	75.7	75.4	74.0	70.8	72.5	71.6	69.8	61.4	59.5	49.5	36.1	23.4	
D2409	67.3	104.4	124.5	138.6	143.8	138.9	129.8	130.9	122.9	113.9	114.0	111.9	103.5	100.9	100.0	97.8	94.8	95.9	93.1	82.0	76.5	66.2	48.8	31.6	
D3209	71.2	104.4	117.3	129.5	134.5	128.1	116.9	114.4	105.6	99.8	96.2	93.4	87.7	85.0	84.9	85.4	82.8	82.0	84.6	74.5	70.9	58.4	43.8	29.7	
D4009	78.6	113.0	125.7	130.3	125.2	112.8	102.9	101.8	93.4	86.5	88.7	85.6	81.0	80.1	80.4	79.1	77.5	78.7	77.3	69.1	63.0	53.3	39.3	25.8	
D4809	36.8	61.1	73.2	74.1	74.9	71.0	66.3	64.0	60.0	58.4	58.8	57.9	56.1	55.9	57.3	60.3	57.6	56.9	54.8	49.2	48.1	40.7	30.6	20.8	
D0817	55.5	87.8	100.7	103.4	108.7	102.5	90.5	92.8	90.3	84.5	82.2	83.0	78.8	75.0	75.0	77.9	71.0	72.3	68.5	63.6	58.4	51.0	37.9	26.9	
D1617	71.4	109.4	123.6	128.3	131.7	124.3	108.4	111.0	108.8	99.6	96.4	98.0	93.8	88.0	90.1	86.6	84.6	83.8	81.3	75.4	68.2	61.2	47.6	37.7	
D2417	87.2	132.6	147.1	150.0	138.4	126.3	116.2	115.0	109.6	100.0	99.2	97.3	93.5	89.5	90.3	91.7	86.6	91.3	87.6	79.5	75.5	62.0	45.8	31.7	
D3217	76.7	129.1	149.2	156.7	156.9	140.4	128.1	126.0	113.3	108.1	102.7	98.9	93.7	90.0	89.8	91.8	86.3	88.9	90.6	83.1	77.5	70.3	55.7	45.3	
D4017	68.5	109.9	126.2	131.1	130.4	119.6	106.7	108.5	101.3	97.4	101.3	96.1	92.5	90.9	91.1	94.8	89.6	93.2	91.1	82.0	77.8	68.3	53.9	40.1	
D4817	75.0	115.0	132.7	140.3	136.1	131.0	124.4	124.9	113.6	105.3	109.3	102.2	99.3	95.7	97.8	94.1	90.8	91.3	86.8	77.6	73.9	60.8	45.6	31.1	
D0825	63.5	102.6	114.6	123.9	125.9	122.5	114.5	116.7	114.9	101.8	101.7	98.7	97.1	90.4	91.1	92.1	86.1	86.2	87.0	80.2	73.2	64.4	51.1	43.8	
D1625	76.7	120.3	142.5	150.8	144.5	138.8	124.9	121.2	111.4	102.8	102.6	102.9	97.9	93.7	98.3	99.8	93.9	97.7	97.3	89.7	83.7	73.4	55.2	37.4	
D2425	77.7	113.1	121.2	126.8	128.2	122.8	117.1	116.9	106.4	96.9	97.7	94.2	87.7	89.1	91.9	89.0	88.6	89.3	80.5	75.1	63.5	47.0	29.0		
D3225	77.3	112.5	126.0	127.1	128.3	123.8	117.2	115.7	105.7	100.1	98.7	98.0	91.6	89.1	88.7	89.6	85.7	88.8	87.3	79.3	75.8	68.0	53.9	41.4	
D4025	73.4	115.2	136.5	148.0	143.7	137.1	127.1	118.7	112.2	103.5	105.7	102.2	96.6	95.7	97.5	96.8	92.2	98.5	97.2	87.1	82.9	68.7	53.9	38.8	
D4825	68.2	114.5	132.0	139.7	138.3	139.1	127.7	120.4	116.2	108.4	112.4	104.2	101.5	97.7	102.5	100.6	94.7	98.0	96.9	87.6	82.6	70.0	56.5	44.6	
D5625	51.2	83.3	100.0	103.9	101.0	88.9	88.8	95.8	92.3	94.2	87.9	82.2	79.9	81.6	83.5	84.5	79.6	75.5	70.5	66.9	66.0	56.2	41.0	30.3	
D0833	76.5	118.5	135.2	136.4	128.5	119.8	107.9	106.8	102.9	92.9	89.2	90.0	84.4	80.6	83.2	84.2	80.9	82.7	80.3	75.4	68.9	63.3	53.6	50.8	
D1633	77.4	114.2	119.4	121.6	124.0	116.3	107.3	102.7	98.5	88.6	93.9	88.1	88.1	89.3	95.8	104.7	96.7	103.2	98.2	87.0	83.3	73.6	57.7	41.7	
D2433	78.4	120.6	137.4	141.0	133.1	127.5	111.9	106.5	102.7	93.1	89.1	90.2	88.3	82.2	83.8	85.4	86.3	88.0	86.8	80.5	74.4	69.2	55.8	45.8	
D3233	82.1	135.1	157.3	161.5	151.5	141.1	119.9	117.3	107.3	99.2	94.9	96.8	91.1	88.0	91.2	92.1	84.3	87.1	87.1	79.5	76.0	65.9	50.4	39.8	
D4033	62.5	98.2	117.5	119.6	119.5	116.1	100.0	99.3	100.3	96.6	88.1	86.4	79.9	81.0	84.0	89.2	94.1	93.7	96.5	97.4	90.2	81.9	72.1	55.0	42.6
D4833	84.4	131.2	143.5	147.9	139.4	129.5	122.0	116.8	108.7	102.4	107.2	101.0	101.9	99.4	103.3	102.5	102.5	101.6	98.8	87.3	79.5	69.4	53.8	40.8	
D5633	53.2	90.3	110.8	115.9	113.2	110.7	100.8	102.0	100.5	93.0	93.3	90.6	87.9	83.9	84.9	83.1	80.6	80.2	78.8	74.0	68.4	58.3	43.5	29.1	
D0841	47.6	81.1	97.6	103.4	112.2	116.8	119.7	122.6	118.1	112.7	107.0	107.4	103.7	96.7	100.0	94.8	90.6	90.4	88.8	85.2	73.6	67.6	51.8	34.0	
D1641	65.7	110.9	137.4	148.3	151.9	143.5	130.5	125.9	117.1	109.5	107.3	108.4	102.8	94.6	90.9	96.6	91.0	90.9	90.4	82.6	75.5	66.8	55.8	48.5	
D2441	62.2	101.7	118.6	124.7	129.9	127.1	124.5	123.1	115.1	108.6	107.0	103.9	94.8	91.7	95.7	92.9	86.4	90.9	90.1	83.2	78.4	69.7	54.7	45.8	
D3241	58.3	101.6	119.8	125.2	135.4	138.1	132.5	135.7	131.8	118.0	113.8	112.1	106.2	100.2	101.9	96.5	96.1	95.7	94.6	87.2	81.2	73.2	57.5	41.8	
D4041	62.2	108.2	140.3	142.9	142.6	135.2	120.9	116.1	111.4	101.3	100.8	98.9	95.4	89.7	92.5	89.5	84.8	86.5	85.1	79.1	73.6	64.6	50.3	39.2	
D4841	66.8	106.5	123.2	128.1	129.9	132.4	126.5	125.1	115.4	111.4	105.1	103.3	98.6	97.3	94.1	93.7	85.8	87.8	87.4	77.3	72.2	62.4	47.5	36.2	
D5641	33.0	55.0	65.8	69.4	70.7	67.7	68.1	68.9	65.2	60.5	63.6	63.8	61.1	60.6	59.0	59.1	57.1	58.8	57.2	51.1	48.2	41.4	30.2	19.6	
D0849	33.2	56.3	69.8	73.3	74.0	73.4	68.2	68.4	65.9	63.5	66.1	66.8	64.0	64.9	62.8	66.9	64.2	63.4	62.8	58.3	51.7	44.8	32.7	20.5	
D1649	65.8	9																							

D4809	29.4	48.6	57.1	60.4	62.8	61.1	59.8	59.9	59.5	60.8	66.2	65.6	64.4	63.5	69.7	67.2	66.6	69.0	67.7	59.8	57.7	50.3	37.2	25.1
D0817	60.8	86.0	91.1	98.5	96.6	90.6	86.3	86.9	88.3	84.2	85.2	83.3	81.5	83.4	84.7	85.0	79.7	80.6	78.9	69.7	65.3	55.5	42.9	28.8
D1617	75.3	102.4	109.6	119.2	124.9	124.4	125.2	133.0	131.5	124.9	129.4	129.9	124.7	121.8	123.1	120.1	116.8	119.5	116.6	100.7	94.1	73.9	54.9	32.7
D2417	80.9	112.7	126.1	125.6	117.8	111.2	103.9	108.0	110.4	103.9	105.4	103.5	99.4	98.0	97.6	100.1	96.2	100.0	100.2	90.7	83.6	70.6	55.6	41.6
D3217	73.9	112.3	126.4	127.2	123.3	119.2	110.3	106.2	104.5	101.8	100.2	99.4	95.5	93.7	93.2	97.6	92.9	98.2	99.7	91.0	87.1	81.0	62.9	47.1
D4017	60.5	94.8	107.2	109.9	109.4	110.8	112.2	120.2	120.8	118.8	127.0	126.6	123.4	118.1	122.2	126.9	120.1	126.0	120.6	111.9	104.8	91.4	67.6	50.6
D4817	67.4	104.3	116.6	120.3	118.2	119.1	111.0	118.1	112.4	109.7	110.5	111.3	111.1	109.0	109.7	109.8	104.3	107.5	103.7	94.5	85.3	71.8	56.5	43.2
D0825	89.3	119.1	121.1	125.9	119.3	117.3	110.3	106.2	100.4	91.0	96.1	96.3	91.9	91.0	89.5	91.7	86.6	90.4	88.7	80.1	77.0	70.7	50.3	34.6
D1625	99.8	131.6	134.3	135.0	125.6	118.5	111.3	112.8	106.0	100.2	108.5	106.2	103.0	103.0	106.7	103.5	101.5	102.6	101.3	91.4	88.6	72.6	54.3	38.3
D2425	89.1	124.1	125.9	125.1	119.3	111.4	106.2	104.0	97.4	89.9	93.5	94.2	88.7	87.6	88.5	91.5	86.6	92.1	91.5	81.4	81.1	67.9	51.0	30.6
D3225	89.7	128.1	137.4	135.8	122.6	114.0	104.0	96.4	96.4	90.1	93.0	91.2	89.3	90.0	93.2	91.5	89.3	95.3	96.3	86.2	82.7	73.8	58.4	40.5
D4025	79.2	115.3	126.9	126.5	122.9	118.3	111.4	111.7	112.2	106.1	109.7	112.4	104.7	103.0	102.9	102.2	99.8	105.2	100.3	92.4	88.9	75.1	57.1	39.5
D4825	79.9	123.1	141.0	141.8	136.5	126.6	112.3	114.5	112.0	109.6	105.5	106.1	108.3	103.2	107.6	105.9	100.7	101.7	105.5	95.1	91.0	79.8	59.2	42.3
D5625	48.5	79.3	93.8	94.2	90.9	78.3	78.3	87.2	85.1	83.3	84.6	77.8	79.1	85.7	88.3	88.5	82.6	85.8	79.4	76.1	77.4	67.8	50.4	40.4
D0833	80.2	109.2	111.1	115.4	107.8	101.7	95.2	95.4	91.2	86.8	89.0	86.8	84.4	86.1	86.4	86.0	78.5	84.8	84.8	77.7	76.5	68.4	54.7	41.4
D1633	83.8	111.7	118.9	124.6	125.7	118.9	107.4	110.4	109.0	104.8	105.0	101.6	96.1	98.8	101.8	99.9	96.4	100.3	95.2	88.0	85.1	70.7	52.7	27.6
D2433	84.6	113.1	119.6	123.4	117.6	106.8	103.3	100.0	100.5	92.9	95.5	93.8	90.0	89.5	90.3	90.6	88.9	90.4	88.7	81.7	79.9	71.0	54.0	35.0
D3233	66.9	118.1	143.8	143.5	141.9	129.9	118.2	114.2	108.9	100.5	100.8	97.3	95.3	92.2	93.8	93.2	93.6	95.7	94.6	89.7	85.5	75.3	60.6	44.4
D4033	53.9	87.3	99.9	101.8	100.7	100.0	88.7	96.3	99.4	98.2	101.0	100.2	96.2	90.1	95.9	98.7	92.0	98.9	94.4	90.7	86.3	77.6	58.9	38.0
D4833	74.4	112.1	126.6	124.4	124.4	119.8	109.6	106.5	106.1	104.0	109.8	107.0	101.6	102.7	106.4	111.3	100.9	107.3	104.1	91.8	89.4	76.5	57.8	46.6
D5633	46.3	80.7	94.6	95.7	99.2	93.7	91.9	92.2	92.9	86.3	91.1	92.5	91.1	85.7	87.0	90.2	86.5	88.4	87.3	81.8	77.4	68.1	51.4	32.6
D0841	75.0	112.7	120.0	120.3	117.5	110.9	102.8	106.4	102.6	99.0	99.4	103.3	99.3	96.6	98.7	102.1	94.9	96.0	95.8	85.9	81.3	70.9	56.2	43.3
D1641	70.7	113.1	128.9	134.6	132.0	127.5	121.0	122.5	120.1	118.2	118.7	118.3	115.3	110.2	115.2	113.0	106.4	107.2	104.2	93.7	90.6	81.6	66.2	55.6
D2441	70.4	114.1	130.4	129.9	127.4	119.7	109.4	111.8	105.6	102.4	101.2	105.6	104.8	98.6	103.1	101.8	99.9	102.3	101.0	93.0	90.3	80.2	64.0	51.0
D3241	66.0	114.4	132.6	130.7	129.8	125.5	116.6	116.4	113.5	105.8	106.3	109.4	106.6	100.3	103.7	102.6	99.9	101.6	103.9	95.5	88.8	80.0	64.6	48.5
D4041	69.1	112.9	133.9	133.3	129.1	121.0	113.0	111.8	107.8	106.8	108.0	110.3	107.3	100.6	104.8	103.9	97.9	102.8	98.2	91.0	85.8	77.4	58.7	41.9
D4841	79.6	124.6	143.1	140.1	133.3	127.6	116.6	117.1	112.7	108.9	110.6	110.1	107.3	100.7	104.4	105.0	97.1	99.1	99.4	86.8	81.7	75.3	55.5	42.7
D5641	36.6	57.9	66.4	68.1	68.2	63.9	59.3	59.9	58.0	56.0	59.4	61.5	61.2	59.7	61.5	61.5	60.9	62.4	60.2	55.5	54.5	48.0	36.3	26.5
D0849	27.0	47.5	57.7	60.3	64.8	63.0	61.5	62.6	64.5	64.0	68.9	71.7	74.3	74.8	74.2	73.0	71.5	75.0	74.3	68.5	64.4	57.3	41.8	28.7
D1649	53.9	77.8	86.2	93.0	97.0	97.6	101.9	107.8	106.6	101.8	112.3	105.9	105.3	103.6	105.1	105.3	97.2	104.7	95.8	87.7	84.5	67.8	50.1	28.1
D2449	81.0	118.1	131.0	132.6	127.6	119.3	111.9	111.3	108.9	109.8	107.5	106.8	103.6	101.4	99.0	100.1	94.7	98.8	98.4	88.4	84.8	74.3	52.8	28.1
D3249	62.0	108.1	129.9	129.2	133.3	129.2	122.8	123.1	118.7	115.8	115.9	116.5	114.3	108.3	110.8	108.2	106.9	109.5	109.0	102.8	95.9	84.6	67.5	56.5
D4049	48.1	79.2	95.9	99.2	103.0	106.9	109.8	119.3	120.4	115.7	114.0	116.9	114.3	112.9	110.9	108.1	104.5	105.2	103.9	96.9	90.1	81.7	61.9	48.4
D4849	45.4	76.7	93.0	95.4	100.0	98.9	94.7	96.8	94.4	91.6	96.4	97.2	95.9	90.9	94.1	92.1	86.5	88.8	89.4	80.3	78.2	67.3	52.6	42.9
D2457	43.3	73.1	90.2	90.3	91.3	86.9	84.1	84.0	82.4	83.7	83.7	84.6	81.2	85.7	83.9	82.5	86.6	84.5	77.1	71.9	65.0	48.0	31.9	
D3257	43.6	74.4	87.5	86.6	86.3	82.5	76.9	77.0	75.8	74.9	78.0	79.7	80.4	77.9	81.6	82.5	82.1	86.3	87.9	83.0	77.8	70.1	55.1	42.6
D4057	31.4	52.1	62.6	65.4	67.0	63.9	63.8	64.2	63.3	65.3	66.7	69.6	69.4	69.4	73.1	71.4	69.9	70.4	70.8	65.7	60.9	54.1	42.3	32.5
@set 27 68.1 11.973 11.973 11.878 24 !set#, power, MWD/kgU, MWD/kgU, MWD/kgU, Parcs #																								
D1609	55.1	81.2	86.8	87.9	87.1	84.4	80.2	80.0	81.4	81.8	87.6	89.5	84.3	88.2	90.6	89.8	89.0	93.9	92.4	81.2	77.6	67.7	48.1	30.1
D2409	64.7	101.6	114.6	118.2	118.6	113.4	109.2	110.0	108.8	108.7	115.4	115.2	111.5	116.3	112.9	117.0	113.2	119.7	114.3	102.9	100.6	91.3	65.9	45.8
D3209	69.1	99.3	108.4	110.0	103.8	101.1	98.2	93.2	96.1	87.5	93.4	95.6	93.3	95.2	97.2	99.1	96.0	102.7	99.3	91.6	89.9	76.4	60.3	44.7
D4009	67.4	97.5	105.8	108.0	104.1	96.7	92.1	92.0	88.3	87.2	91.0	94.6	92.2	92.0	94.0	96.6	93.4	97.7	93.4	84.3	83.9	69.2	51.2	32.2
D4809	32.9	54.0	63.3	62.3	62.6	60.9	57.0	59.5	56.5	55.1	59.9	59.9	61.4	63.9	66.8	67.5	67.0	69.3	68.6	62.8	62.3	52.0	40.4	28.9
D0817	58.9	82.9	90.3	91.1	88.9	85.9	84.5	85.0	88.0	84.1	88.1	84.6	86.2	90.2	86.6	85.1	90.0	83.5	77.6	74.7	66.3	49.8	36.9	
D1617	95.9	131.4	140.6	144.5	134.7	129.4	120.8	124.3	121.0	115.7	122.1	126.0	118.3	121.3	122.5	121.8	117.9	118.9	112.5	103.0	99.8	80.2	62.4	43.9
D2417	77.6	110.4	121.4	122.8	119.0	113.0	108.8	103.7	104.4	97.1	101.6	107.2	101.1	102.2	106.8	107.8	105.6	110.7	109.0	95.2	94.5	79.1	63.4	51.4
D3217	64.8	102.4	113.9	113.3	112.6	110.3	103.8	103.6	103.1	97.8	100.6	102.9	100.1	97.7	100.3	107.1	100.8	105.1	110.7	104.4	98.5	90.9	74.9	59.5
D4017	76.7	116.5	129.6	132.0	128.7	122.8	113.8	116.2	111.4	108.5	115.7	118.1	120.6	114.4	128.7	123.2	122.3	126.2	128.0	118.4	109.9	99.1	74.7	57.3
D4817	68.0	103.2	116.3	121.4	119.7	115.5	110.0	109.0	109.2	107.1	110.7	116.4	110.1	105.0	114.3	122.0	109.7	112.0	111.8	104.3	95.5	84.9	61.8	45.4
D0825	77.5	106.8	116.4	121.1	115.1	107.4	102.2	102.6	98.0	95.0	101.4	101.6	99.0	100.1	101.1	98.5	95.2	99.0	98.1	92.8	87.4	80.3	60.5	45.5
D1625	94.3	130.3	133.0	137.8	130.9	121.0	113.9	114.0	111.7	106.2	110.4	111.0	105.9	106.6	108.9	108.2	105.3	113.2	114.5	101.5	95.6	81.6	63.4	47.5
D2425	81.7	114.5	120.8	121.3	112.8	109.1	103.0	102.8	97.8	91.9	95.4	94.8	92.5	90.9										

D2441	48.1	79.5	98.4	94.6	100.3		92.3	100.9	98.9	93.6	104.7	106.1	113.7	100.9	114.6	111.2	111.5	115.0	114.8	121.5	108.9	106.1	91.1	68.4
D3241	49.9	76.9	98.4	96.2	106.1	104.8	104.8	105.2	107.9	113.9	108.6	111.0	113.0	108.4	120.5	108.8	111.9	117.2	121.1	115.1	107.6	107.6	85.9	56.8
D4041	46.5	83.0	108.2	105.6	109.6	107.9	104.6	106.2	104.6	103.6	107.9	112.5	115.5	106.2	112.9	109.6	114.5	114.2	111.9	109.6	100.3	94.6	76.4	51.8
D4841	51.1	93.1	112.9	107.6	116.6	116.2	106.9	110.2	112.9	109.9	108.9	116.2	119.5	109.9	115.5	113.2	111.9	115.5	113.5	109.2	102.3	96.6	73.0	45.5
D5641	25.2	43.2	53.8	52.1	54.8	55.4	53.5	56.4	57.4	56.8	59.8	66.1	65.7	66.4	66.7	69.7	67.1	73.0	73.0	67.1	66.7	62.1	49.8	36.5
D0849	20.8	36.4	49.2	49.9	53.1	53.4	53.6	51.5	55.8	58.2	62.5	72.8	74.7	73.6	76.7	83.3	82.1	77.1	82.2	86.9	72.6	72.1	62.9	45.3
D1649	51.5	83.5	99.3	102.3	99.6	99.3	92.3	92.0	92.3	89.6	102.9	103.9	99.3	101.9	110.9	111.9	101.6	114.5	111.6	102.6	96.3	91.0	69.7	39.8
D2449	49.8	84.7	101.3	102.3	102.6	99.9	99.9	102.3	102.6	99.9	102.3	106.2	104.6	99.9	111.2	105.2	101.3	117.9	112.2	107.9	102.9	96.3	79.7	46.5
D3249	33.2	68.1	89.6	96.3	102.9	102.3	99.6	105.2	106.2	109.6	109.6	118.5	118.5	117.9	122.8	120.2	123.8	125.5	129.5	122.8	112.9	112.9	92.0	69.7
D4049	45.0	86.8	112.9	104.4	116.2	116.2	113.3	112.2	115.5	108.8	107.8	116.2	120.7	117.3	122.1	116.6	114.1	122.4	120.3	117.9	107.4	104.3	81.0	53.1
D4849	30.5	61.4	81.0	86.0	93.0	90.0	85.7	83.3	86.3	84.7	83.3	93.1	92.3	89.6	96.3	97.9	96.9	91.6	96.3	97.9	87.0	83.0	71.4	47.1
D2457	26.6	50.0	66.9	69.6	75.8	72.1	66.7	65.3	68.1	72.8	71.7	80.4	81.6	75.9	88.5	89.5	93.7	94.6	93.1	91.2	85.0	82.5	76.4	54.2
D3257	29.3	54.2	67.6	67.6	71.1	67.1	64.9	68.6	68.1	70.0	73.7	82.2	84.9	86.1	87.4	86.1	96.3	96.9	97.9	99.9	95.6	93.3	71.5	52.3
D4057	24.7	45.6	56.0	55.8	56.4	59.3	57.8	60.4	62.0	61.3	64.0	69.4	69.6	75.7	73.4	74.6	74.5	82.5	81.8	77.8	75.4	74.5	58.3	38.3
!set, 29, 59.2, 12.466, 12.466, 12.371, 28, !set#, power, MWD/kgU, MWD/kgU, MWD/kgU, Parcs #																								
D1609	32.4	56.2	70.1	70.1	72.1	75.0	72.1	73.4	74.4	76.0	82.6	81.0	89.3	89.3	97.2	91.2	98.8	98.5	97.5	96.2	86.6	87.6	72.7	52.9
D2409	30.8	67.8	89.3	89.3	98.8	95.9	94.2	98.8	101.8	102.5	109.1	113.7	116.7	115.7	124.0	125.6	122.3	123.0	125.6	125.0	109.8	109.1	97.5	76.0
D3209																								

D.7 Cycle 3 TIP measured data

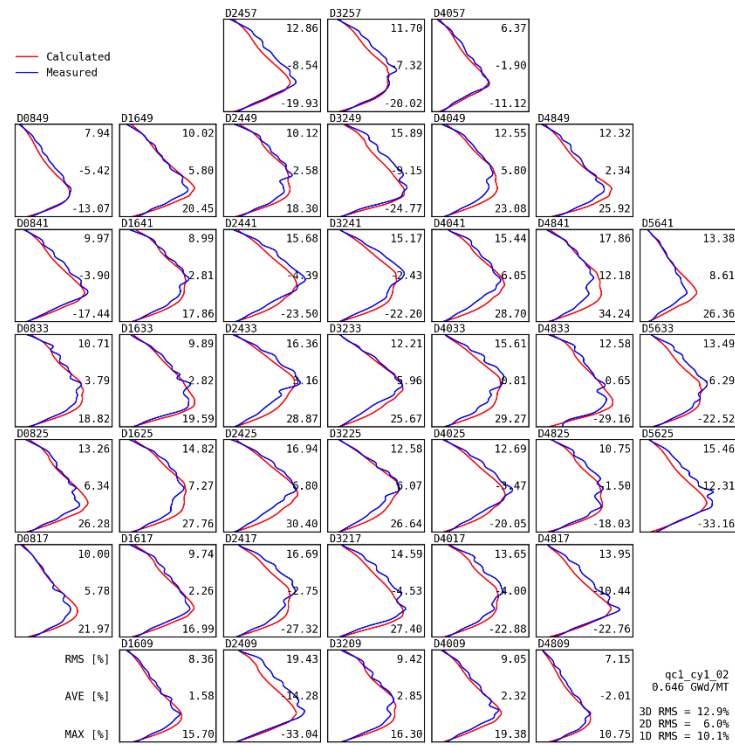
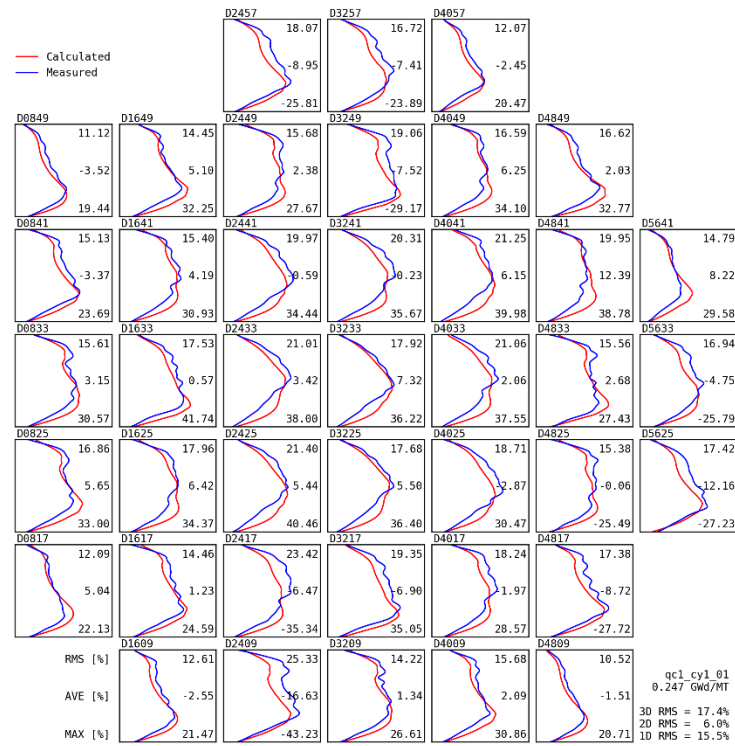
C61	CYCLE-3																							
6	41	24	#cases, # of detectors, # of axials (opposite direction to PARCS)																					
#set	30	97.2	9.774	9.774	9.622	4	#!set#, power, MWD/kgU, MWD/kgU, MWD/kgU, Parcs %																	
D1609	39.4	63.2	75.2	83.0	88.6	89.1	92.5	94.7	94.5	91.2	93.3	92.4	88.2	84.5	87.1	84.4	84.8	83.6	83.8	76.8	71.7	61.5	42.6	24.0
D2409	76.6	116.7	140.3	159.0	162.9	160.8	155.4	156.9	147.8	134.8	137.9	136.5	128.7	127.5	127.3	123.2	120.5	119.8	114.3	102.1	93.3	74.0	53.1	36.6
D3209	66.3	104.3	125.7	147.6	151.9	147.8	144.7	143.9	134.2	125.2	123.5	122.2	118.9	115.3	116.6	116.3	111.1	109.8	106.6	96.7	91.5	75.4	55.1	38.6
D4009	57.9	91.2	106.3	119.2	126.6	124.6	123.5	125.2	120.0	114.5	114.7	112.9	105.7	103.8	104.1	101.2	97.5	98.4	94.7	84.4	79.1	63.5	45.5	26.8
D4809	18.3	30.0	35.7	37.5	39.7	41.0	39.0	41.0	42.2	41.7	44.4	44.3	45.1	46.5	47.5	47.7	48.0	51.8	53.8	51.0	50.8	45.0	33.8	23.2
D0817	63.3	75.0	82.6	86.5	85.9	84.5	86.6	83.9	82.0	83.8	82.6	77.8	78.3	78.2	75.4	75.0	77.5	76.0	69.1	64.8	57.0	41.5	28.6	23.2
D1617	52.7	75.6	86.2	95.2	102.0	103.0	103.6	104.7	102.6	98.9	98.3	95.8	89.5	89.1	92.0	91.5	91.9	96.4	98.9	92.6	89.8	74.2	52.9	28.8
D2417	58.3	87.8	102.3	113.8	126.6	131.1	134.3	131.7	120.8	114.9	120.7	114.9	111.0	111.6	113.5	110.4	108.4	112.1	108.8	98.3	93.1	75.8	57.2	37.4
D3217	66.6	99.6	115.8	127.2	131.9	132.1	125.7	124.8	117.1	111.0	119.0	124.5	126.3	130.3	134.8	135.7	130.5	134.2	129.2	116.3	107.7	87.6	63.2	39.6
D4017	47.9	77.9	93.9	107.5	120.2	129.4	134.0	133.9	134.8	126.2	131.5	124.6	120.8	115.6	119.0	116.8	115.5	119.6	117.9	109.2	103.5	87.5	67.5	49.7
D4817	39.4	67.6	86.1	97.7	108.0	111.4	113.0	121.4	114.3	109.4	110.2	105.2	100.5	98.1	98.0	99.3	96.3	100.6	105.5	99.9	92.8	79.9	59.8	42.2
D0825	111.4	124.4	133.0	137.1	137.9	129.5	125.5	120.5	111.9	111.8	114.0	107.7	106.8	105.4	103.7	98.6	97.7	93.9	83.9	75.9	67.2	47.8	34.3	28.8
D1625	66.5	96.5	109.6	127.1	135.9	138.9	139.0	141.0	137.1	126.4	131.5	129.4	124.6	123.3	125.5	128.9	126.0	129.0	121.2	112.8	104.0	86.5	64.4	45.0
D2425	59.1	89.7	104.4	115.4	118.5	115.4	111.4	112.9	105.1	102.2	102.7	101.5	97.5	98.7	98.1	100.6	100.0	106.0	110.6	103.4	98.9	82.3	59.4	36.1
D3225	97.4	122.3	137.2	141.2	133.2	125.2	125.1	126.7	109.8	112.2	111.4	106.8	100.9	103.3	103.4	97.6	100.5	99.5	90.5	80.7	78.4	59.5	42.7	34.8
D4025	53.5	84.7	102.0	111.6	119.5	121.3	118.0	116.5	115.1	106.7	108.7	108.2	104.3	103.8	103.0	104.5	101.8	107.6	114.3	107.6	106.5	90.9	67.9	48.6
D4825	58.3	94.																						

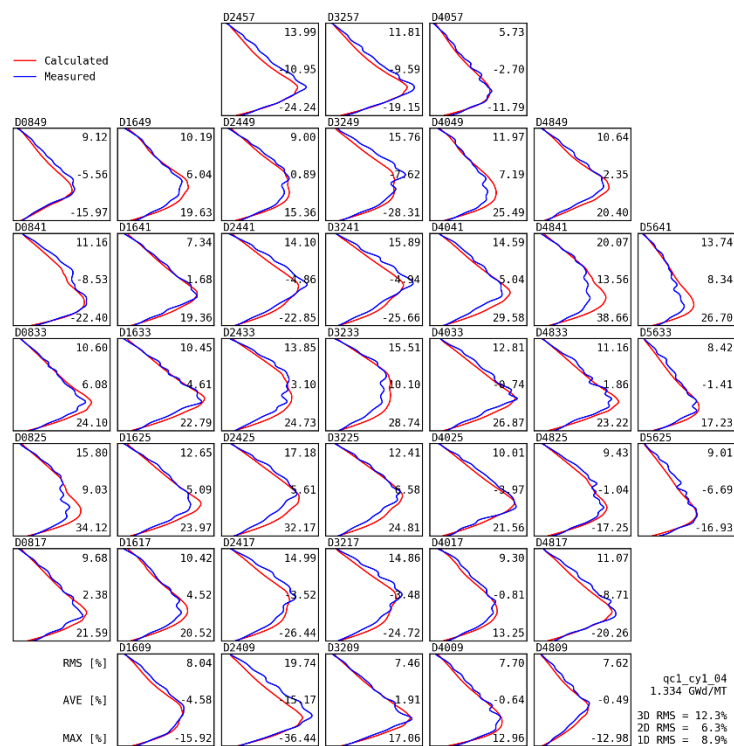
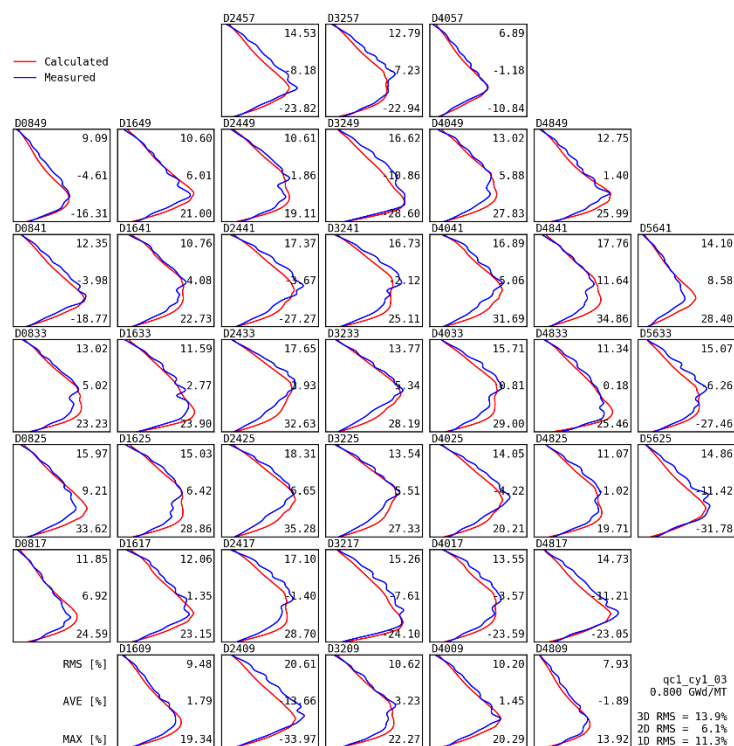
D-13

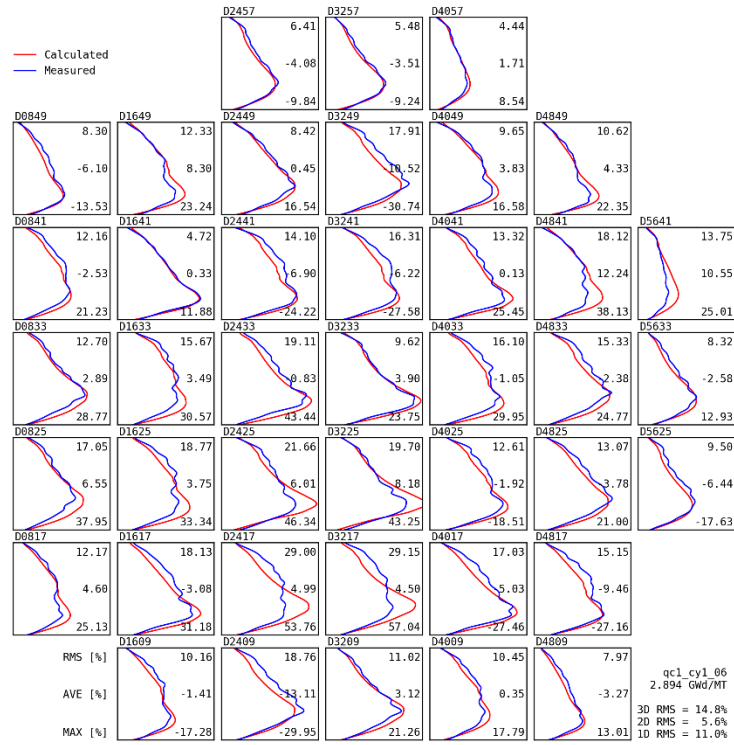
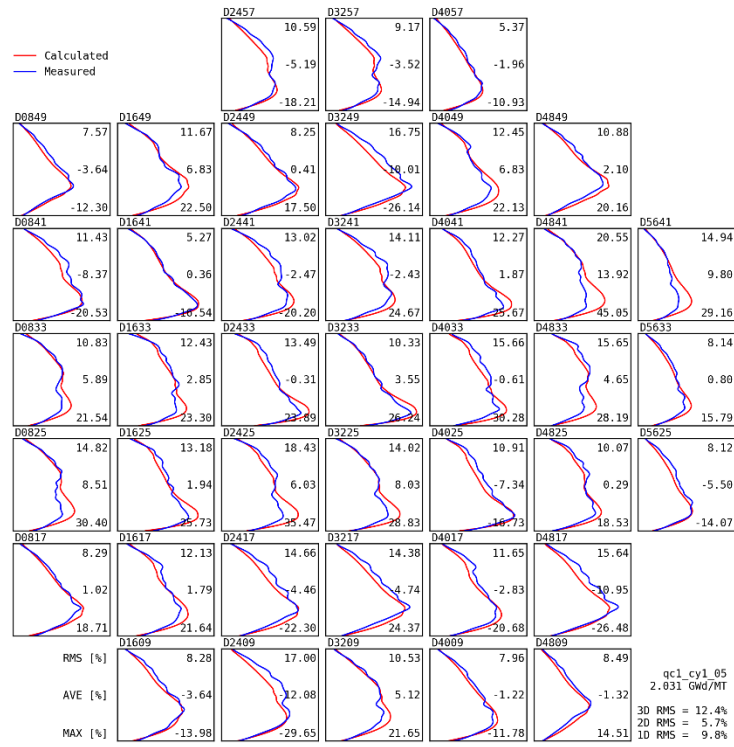
D4833	37.3	59.0	70.3	79.2	84.8	88.4	93.1	97.1	101.7	97.0	99.5	97.4	93.1	93.3	90.2	96.2	91.3	96.5	98.7	94.7	96.6	84.6	62.1	46.6	
D5633	28.3	46.3	55.2	57.1	61.2	62.6	62.5	67.0	69.3	69.3	70.7	71.6	71.2	71.4	73.1	70.9	70.1	74.4	75.5	71.4	68.9	62.5	44.1	28.3	
D0841	76.4	95.3	107.6	112.2	112.8	111.9	112.9	108.9	107.4	107.5	108.4	101.0	99.3	98.5	96.4	91.7	93.0	89.6	79.7	79.7	64.6	46.6	33.3	27.7	
D1641	48.8	79.6	96.8	105.5	112.7	113.3	113.9	116.0	117.8	119.4	125.5	134.6	131.2	136.3	138.4	131.7	125.3	126.4	121.3	108.4	102.3	64.6	46.6	49.5	
D2441	39.1	61.2	72.3	79.8	87.4	93.6	101.6	109.3	110.3	107.9	112.8	114.2	108.7	103.0	105.3	103.3	97.5	101.0	97.2	87.3	84.5	72.6	56.2	35.9	
D3241	43.4	66.9	78.9	88.9	100.1	110.2	122.0	133.7	132.4	132.7	133.3	132.7	130.7	127.9	126.9	123.3	117.0	118.9	113.0	101.0	94.5	78.7	58.1	33.9	
D4041	35.5	61.3	77.8	85.4	91.8	94.4	93.3	100.6	100.1	100.5	108.1	116.6	122.0	116.8	120.0	118.6	112.0	115.1	110.2	101.1	96.7	82.6	62.7	45.5	
D4841	49.1	84.9	107.0	119.4	124.9	119.6	111.1	114.0	109.9	106.5	107.9	107.4	104.3	103.4	104.0	103.7	98.3	101.7	98.9	91.0	85.8	75.6	53.8	35.3	
D5641	22.8	38.0	47.7	52.2	53.9	53.9	51.2	52.3	52.1	50.5	52.7	53.8	53.5	54.1	54.2	54.4	51.8	53.7	53.6	48.9	46.9	41.9	31.4	22.8	
D0849	34.7	43.0	46.5	49.6	49.3	48.6	49.7	50.2	50.0	52.6	51.5	51.3	51.9	51.8	51.6	50.6	50.3	48.7	45.0	45.4	29.2	29.7	20.6	14.4	
D1649	46.5	84.8	113.8	131.0	140.6	135.4	125.2	122.3	118.3	114.0	114.1	114.2	110.8	102.4	107.2	107.2	100.2	106.0	101.2	90.1	83.2	69.3	51.1	37.3	
D2449	35.8	62.5	81.1	86.0	93.2	95.2	94.7	100.0	98.6	94.9	95.2	100.5	98.9	93.8	99.1	97.9	91.8	93.6	97.4	92.9	93.2	81.9	63.4	47.8	
D3249	32.0	56.7	71.1	77.6	86.3	91.2	93.0	98.4	100.2	97.6	100.4	99.5	99.1	93.3	97.0	92.9	90.6	92.5	98.9	97.0	97.6	87.3	69.7	55.9	
D4049	51.9	85.5	104.5	118.3	121.1	117.1	111.3	109.8	103.3	98.8	103.5	100.3	97.4	98.2	98.8	99.5	94.6	99.9	96.8	86.2	83.9	70.4	51.7	30.2	
D4849	45.6	80.9	99.8	113.2	117.8	115.5	107.9	108.3	107.9	102.8	101.2	103.6	102.6	98.4	102.1	99.1	92.7	94.8	90.2	77.7	71.8	62.3	44.4	27.2	
D2457	48.4	60.5	66.6	70.4	71.3	71.0	71.6	70.1	68.3	71.8	70.1	68.0	66.7	68.2	69.0	66.1	69.2	67.6	61.2	60.6	53.5	39.9	26.9	17.6	
D3257	30.2	46.3	53.8	55.6	56.8	56.7	55.2	57.1	57.8	56.9	60.5	59.8	58.7	62.0	61.5	61.7	62.4	65.1	65.0	61.3	61.9	55.3	42.9	32.1	
D4057	34.4	45.1	49.1	53.7	56.0	56.4	56.8	59.6	59.2	61.6	61.8	61.8	59.9	60.2	59.1	57.1	59.7	58.6	55.0	52.0	46.2	34.6	21.5	7.4	
#set 36 87.2 12.775 12.775 12.623 16 !set#, power, MWD/kgU, MWD/kgU, MWD/kgU, Parcels #																									
D1609	51.2	76.1	86.0	91.1	91.1	88.0	87.9	86.5	86.9	86.5	87.9	90.3	87.6	88.5	90.5	92.4	90.5	93.6	91.6	82.8	77.2	64.9	47.1	29.2	
D2409	53.3	78.2	87.3	95.0	95.5	95.1	96.1	96.2	95.2	93.8	101.2	103.0	106.6	116.4	128.4	134.6	131.9	134.7	130.2	116.7	109.9	90.9	60.7	33.4	
D3209	41.0	61.8	70.3	73.9	75.3	74.9	74.9	78.3	77.9	76.2	83.2	85.1	90.7	100.9	111.1	119.4	122.1	121.7	120.5	109.1	103.5	86.4	62.4	40.1	
D4009	57.3	85.7	96.3	102.1	102.7	100.3	98.1	98.6	96.3	94.7	101.3	101.8	101.6	104.6	108.3	109.8	109.3	112.6	108.8	98.8	90.0	73.0	52.4	29.2	
D4809	24.3	37.6	41.7	42.7	42.1	41.1	39.5	39.9	40.9	40.8	43.5	45.5	46.6	47.9	49.1	52.0	52.9	54.8	55.3	51.4	49.7	44.3	34.7	25.8	
D0817	75.7	82.8	89.2	87.1	84.2	84.7	83.5	80.2	78.4	81.3	83.3	80.5	80.4	85.0	83.5	79.9	82.3	81.6	72.0	70.2	61.9	45.0	31.2	23.6	
D1617	74.6	100.7	106.9	113.3	108.5	101.2	99.5	96.6	92.1	88.7	91.4	91.6	87.0	89.0	92.7	98.7	102.8	107.6	108.5	95.6	91.3	75.9	56.3	32.7	
D2417	73.5	104.9	112.9	115.9	113.6	108.3	102.4	99.3	94.1	90.5	91.8	96.5	93.4	97.8	105.2	106.1	104.3	109.7	110.4	98.9	94.5	79.8	57.9	31.8	
D3217	75.1	104.8	116.1	120.4	117.0	111.7	103.9	102.2	100.5	93.9	101.5	104.8	105.4	109.9	117.0	123.3	119.5	124.9	125.5	114.8	106.9	89.6	65.6	40.0	
D4017	57.6	88.1	100.8	104.3	104.9	99.6	95.4	95.1	94.4	99.6	94.6	95.1	96.5	99.8	106.7	114.7	116.5	126.0	128.5	117.7	110.7	95.6	69.6	45.1	
D4817	66.1	106.6	124.7	131.3	131.0	124.9	118.2	118.1	115.3	107.7	109.9	109.0	108.4	106.5	110.1	112.3	108.4	113.9	111.8	101.4	96.4	83.9	61.2	42.4	
D0825	73.3	81.9	90.2	92.0	87.0	85.8	86.5	82.4	84.6	89.4	90.3	91.9	101.5	110.3	111.8	111.9	114.5	111.7	98.5	94.0	79.0	58.3	41.5	35.1	
D1625	82.9	114.8	124.3	130.8	126.2	118.0	112.4	110.6	106.0	101.8	107.3	107.0	108.6	113.1	117.9	121.6	119.8	127.8	126.0	114.4	107.1	93.6	68.1	46.7	
D2425	73.3	105.0	111.5	114.4	112.5	107.6	104.6	103.4	101.1	99.5	101.9	101.7	99.4	102.4	104.8	105.2	104.3	107.8	107.0	96.4	92.8	77.6	58.3	36.1	
D3225	94.7	107.4	110.2	108.2	105.4	99.9	101.4	103.1	100.8	103.4	104.8	102.6	102.4	105.8	106.1	100.0	103.1	103.8	93.6	90.5	80.8	63.1	46.2	40.6	
D4025	66.1	102.8	116.2	118.4	117.1	110.6	102.3	105.2	100.7	97.4	100.5	102.5	102.6	104.1	109.0	109.5	108.5	116.3	115.6	105.9	102.2	80.9	65.7	44.7	
D4825	53.4	80.4	91.3	95.7	92.9	89.6	87.2	88.0	85.7	85.8	86.6	87.8	90.3	98.9	108.2	111.2	108.6	111.2	113.0	102.3	103.4	84.6	63.4	42.2	
D5625	38.6	59.2	67.3	72.1	72.8	67.3	70.4	78.9	80.5	81.3	83.0	82.1	84.8	94.6	100.0	100.6	101.2	98.7	97.8	87.6	82.8	67.5	47.2	27.3	
D0833	46.7	63.8	68.3	72.6	74.5	74.1	74.8	75.6	74.5	78.7	83.1	86.9	91.0	102.1	107.5	118.2	119.8	116.9	115.0	103.0	98.8	80.9	60.6	38.5	
D1633	83.2	112.9	121.2	129.9	130.3	124.5	119.2	121.0	116.7	117.7	120.8	125.5	123.2	129.0	134.7	137.2	135.0	137.9	137.4	121.3	114.7	94.1	73.7	54.8	
D2433	81.9	106.7	111.5	115.7	111.6	104.5	108.8	102.0	102.2	108.4	111.1	117.7	113.3	113.0	113.9	115.8	113.4	117.4	111.2	100.4	96.9	79.4	60.1	37.9	
D3233	49.3	77.7	90.5	93.9	95.2	93.8	94.1	102.2	110.4	111.1	118.9	122.8	123.8	119.2	119.0	121.1	113.3	119.6	117.2	104.9	95.5	88.5	67.3	50.4	
D4033	74.2	108.7	116.5	121.0	118.1	104.3	99.9	106.7	103.6	98.7	104.5	102.1	101.4	103.5	106.2	108.8	104.5	108.2	108.6	97.4	95.7	80.7	59.4	34.2	
D4833	47.1	74.3	86.8	91.2	94.6	91.7	90.2	93.5	90.5	90.0	92.9	99.1	99.6	109.0	127.7	134.2	132.8	135.9	133.5	117.9	113.4	95.4	74.4	57.3	
D5633	29.3	47.5	54.6	57.2	59.9	59.3	59.9	64.1	67.8	71.0	77.4	78.8	83.6	87.7	95.0	101.1	98.5	101.3	102.0	89.8	86.5	73.7	55.6	43.0	
D0841	93.2	105.7	111.8	109.1	107.0	104.1	109.1	106.7	107.1	110.2	111.5	113.5	112.0	116.6	118.5	117.1	121.4	116.7	101.5	95.2	79.5	58.6	40.9	34.9	
D1641	60.9	95.1	111.7	113.9	114.7	112.8	108.8	109.0	109.1	104.7	108.8	110.6	114.0	114.8	122.2	128.0	132.0	142.5	141.6	126.7	121.1	103.9	77.9	55.3	
D2441	65.3	96.7	109.0	111.8	109.1	105.0	99.5	100.0	97.3	92.9	96.1	97.6	93.7	94.7	99.0	99.9	100.5	104.0	103.8	95.9	95.5	79.7	62.0	43.9	
D3241	76.8	112.2	126.5	130.4	127.6	120.7	117.1	121.0	119.6	110.4	117.1	123.0	117.1	123.0	124.4	122.8	125.0	123.7	123.4	120.6	109.2	102.7	86.6	65.4	38.8
D4041	49.9	83.5	99.3	102.8	104.2	99.5	92.7	94.3	91.7	89.3	90.2	92.4	93.8	93.6	99.4	107.1	111.5	123.0	123.4	112.2	111.6	96.8	77.6	63.2	
D4841	66.5	108.1	123.2	126.1	122.0	117.1	107.3	107.8	105.6	99.5	104.2	106.6	103.3	101.8	111.2	112.4	110.2	117.2	117.4	105.6	100.9	88.4	66.3	45.3	
D5641	25.8	41.6	50.0	53.2	52.9	51.6	49.9	52.0	52.1	51.6	54.0	55.4	56.6	61.1	63.9	67.2	65.7	68.5	67.4	59.5	58.1	51.6	38.2	25.5	
D0849	38.1	45.6	46.4	48.1	47.3	45.6	45.7	46.8	46.0	47.6	49.8	51.1	53.6	53.											

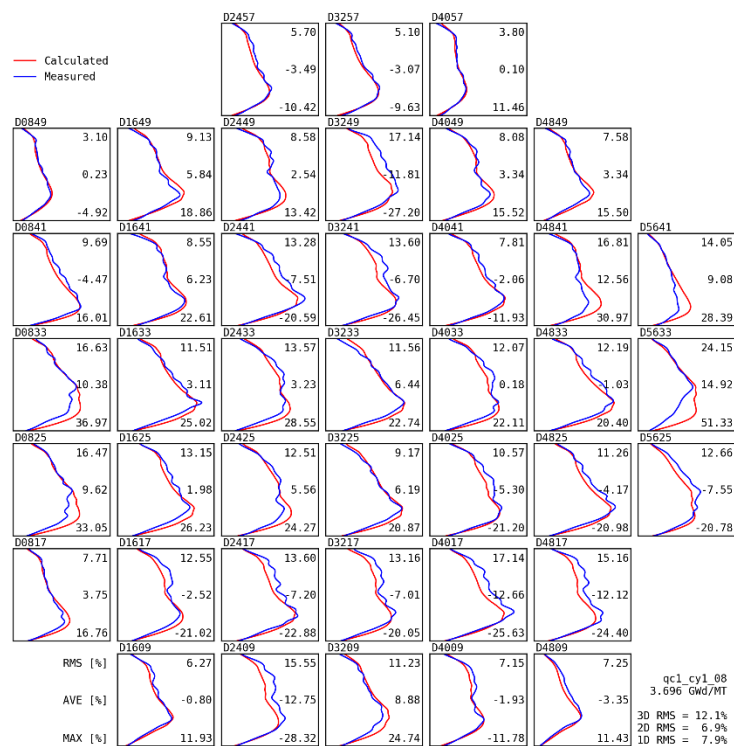
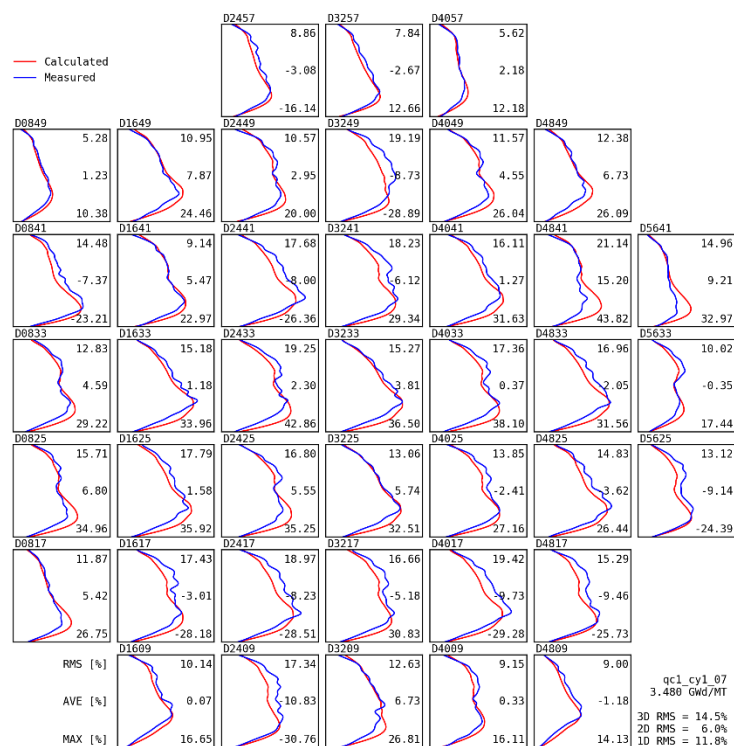
APPENDIX E. TIP COMPARISON

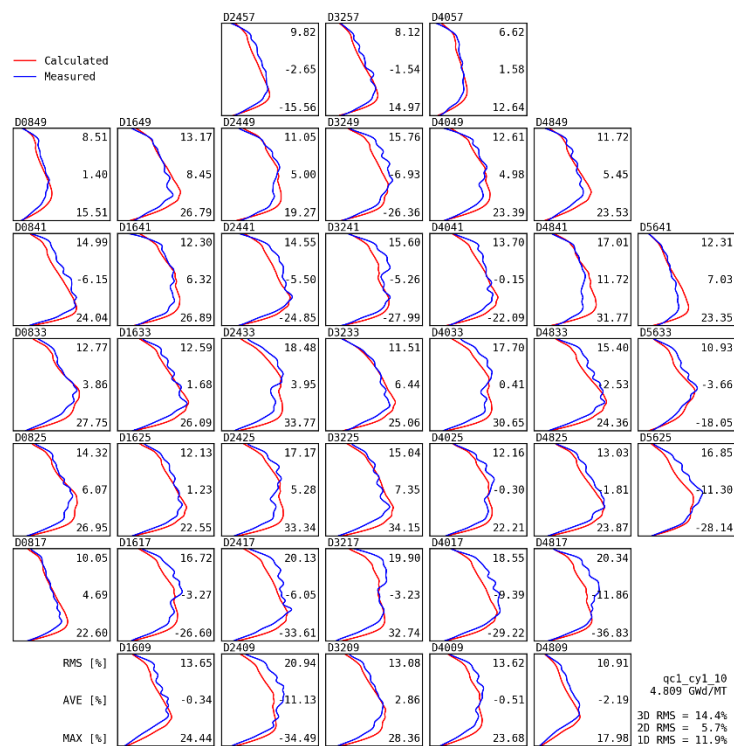
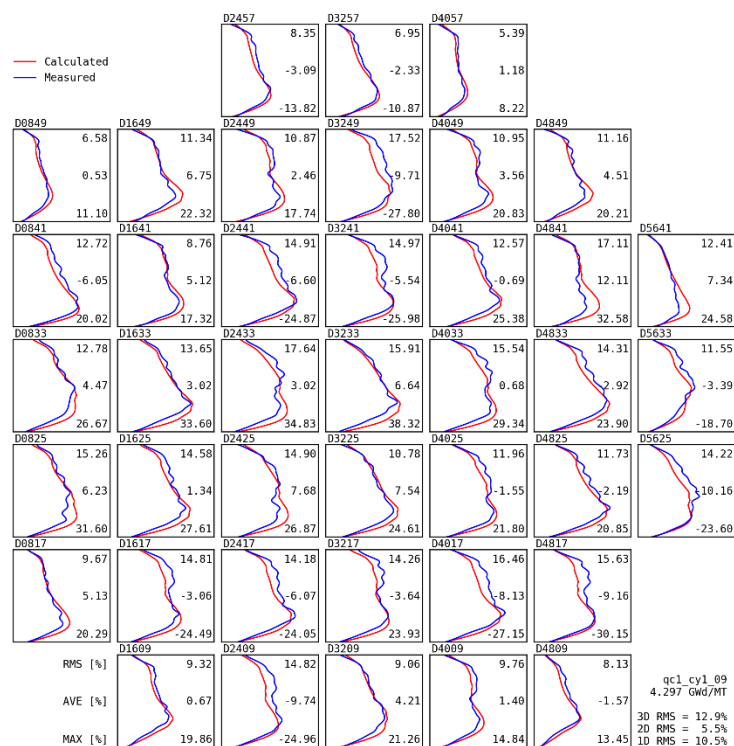
E.1 QC1 Cycle 1 TIP comparison

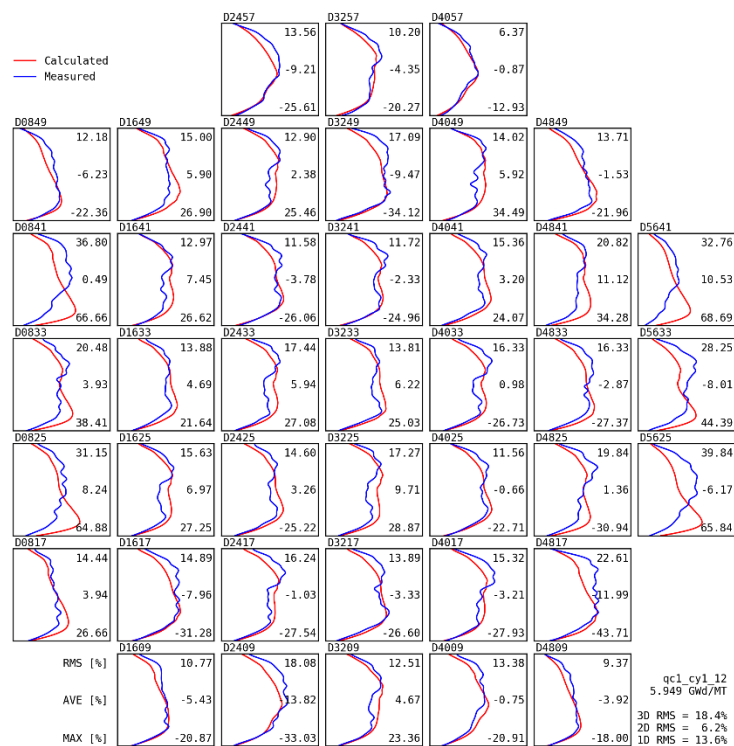
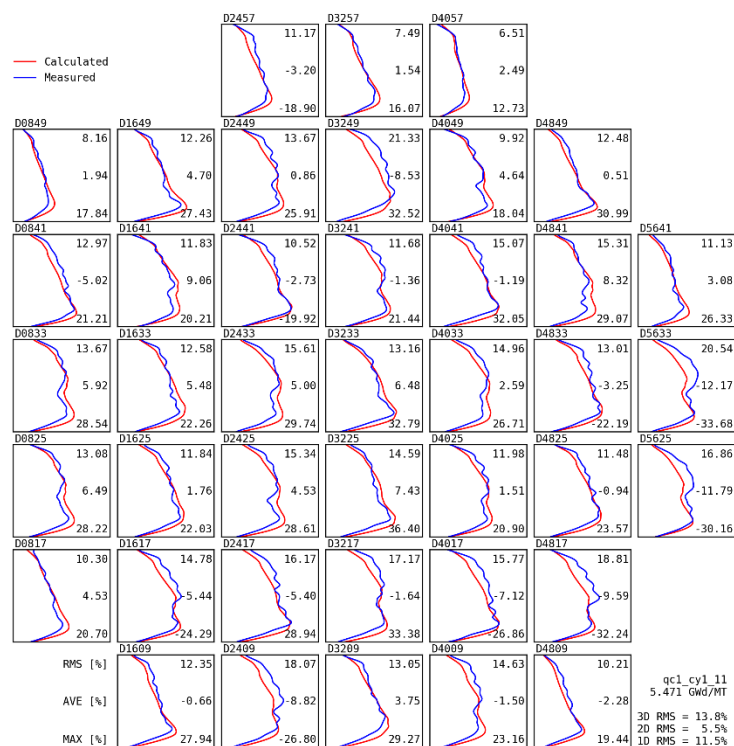


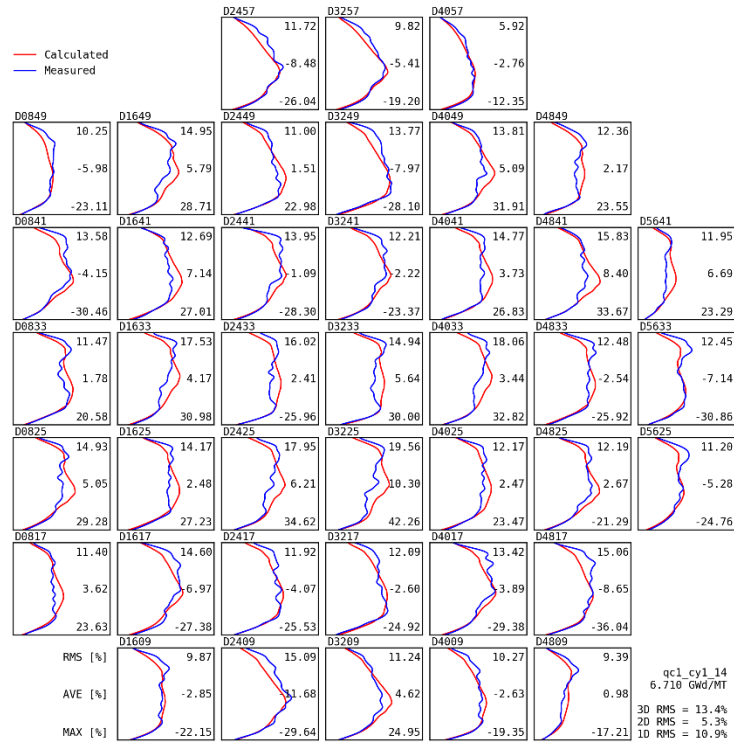
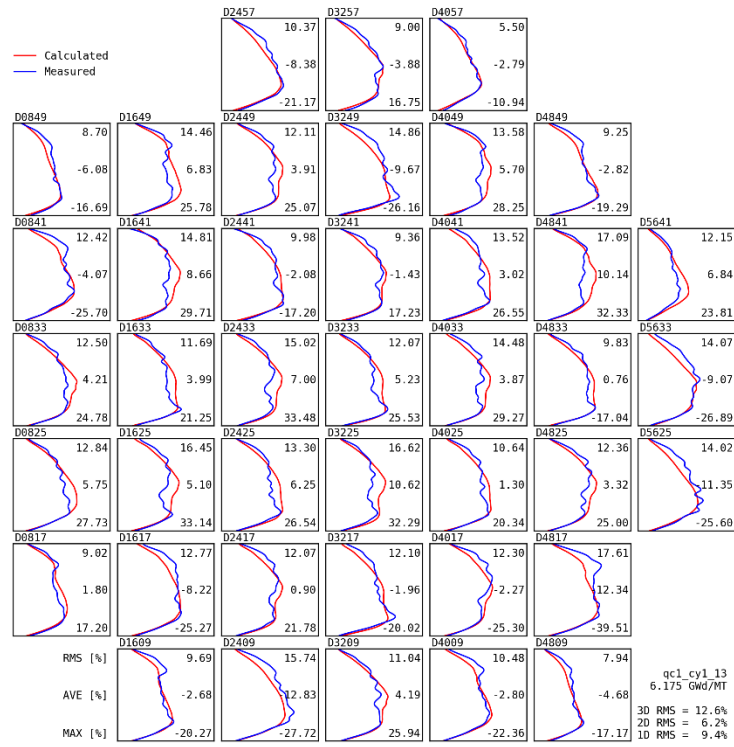


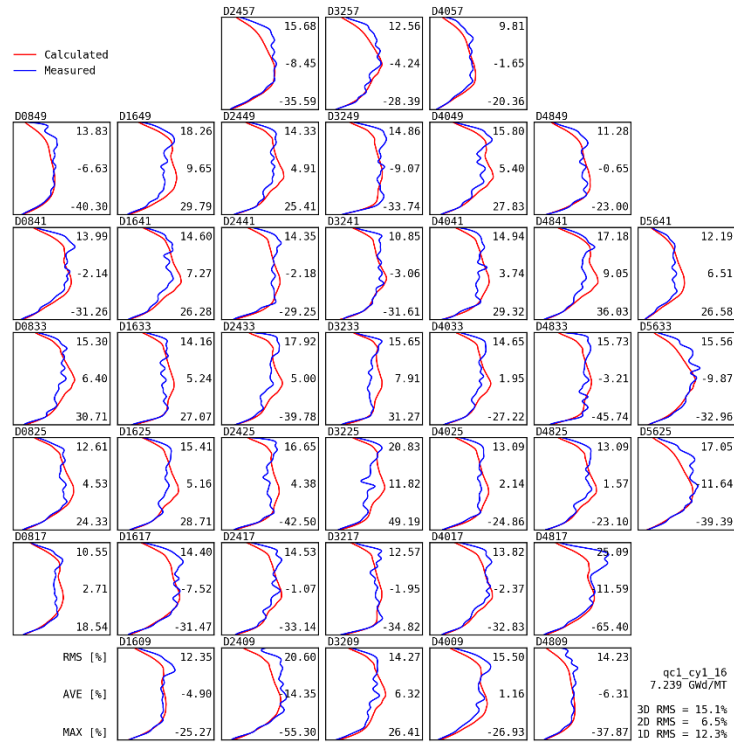
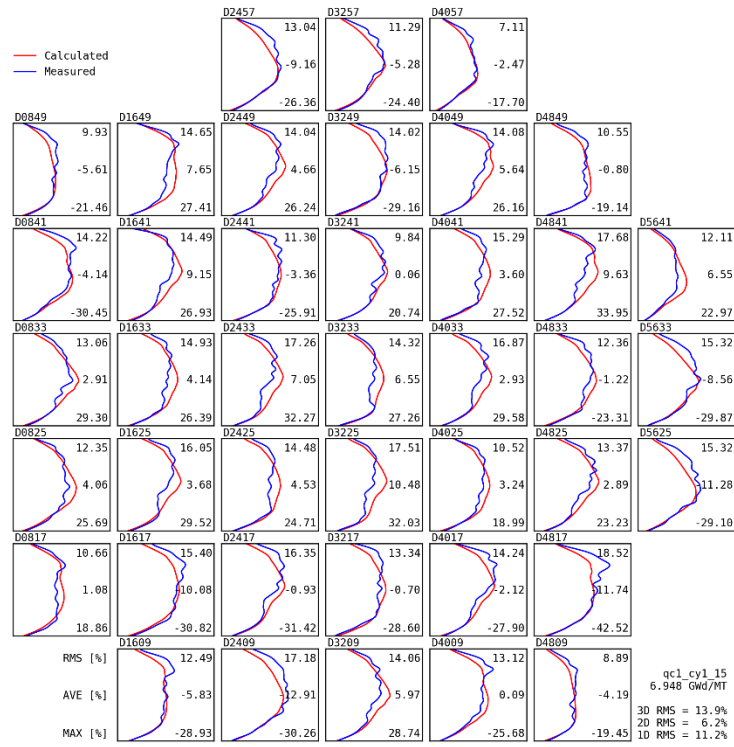




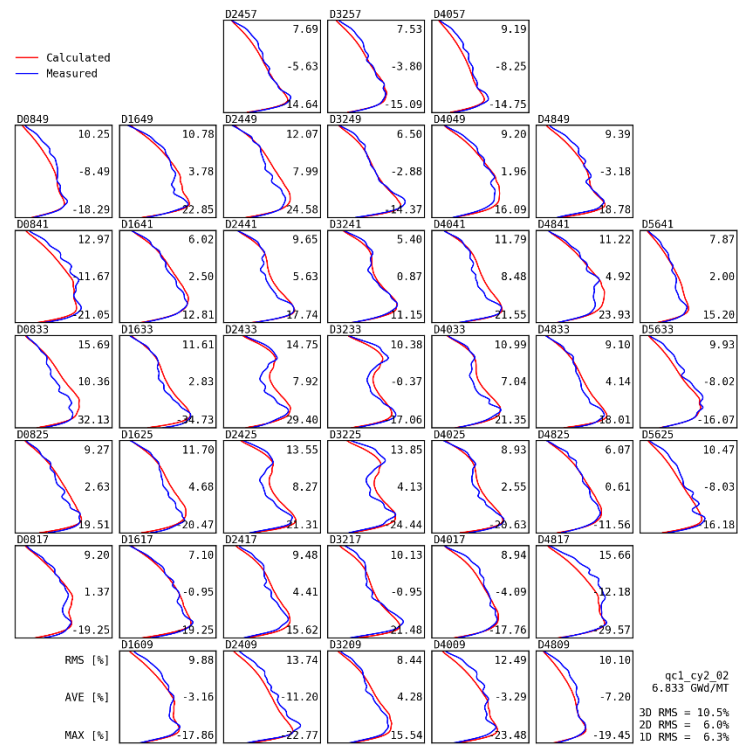
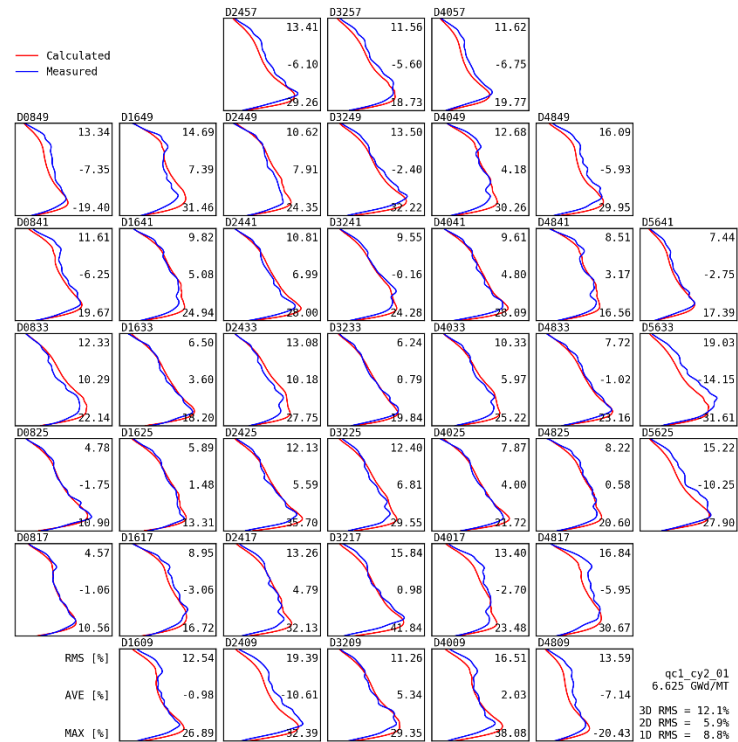


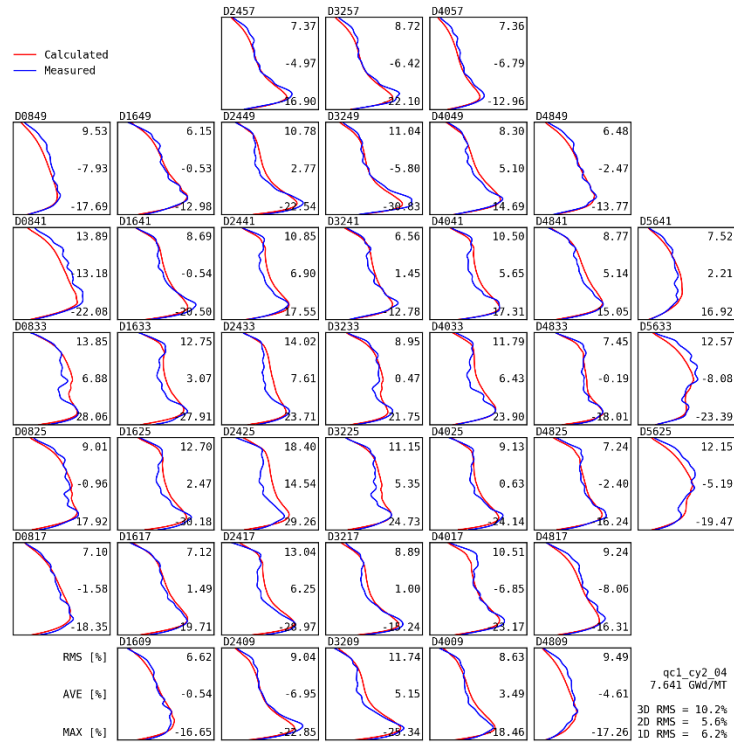
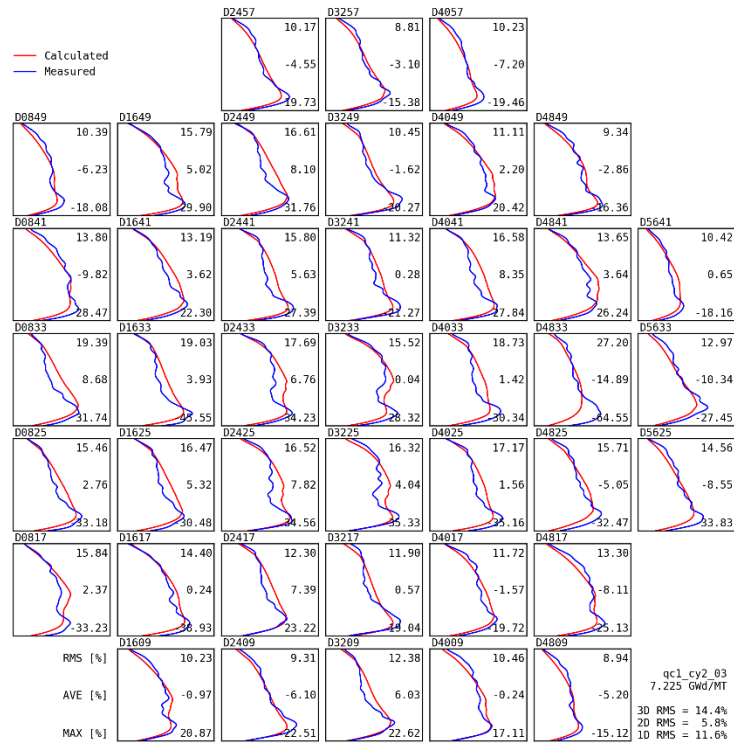


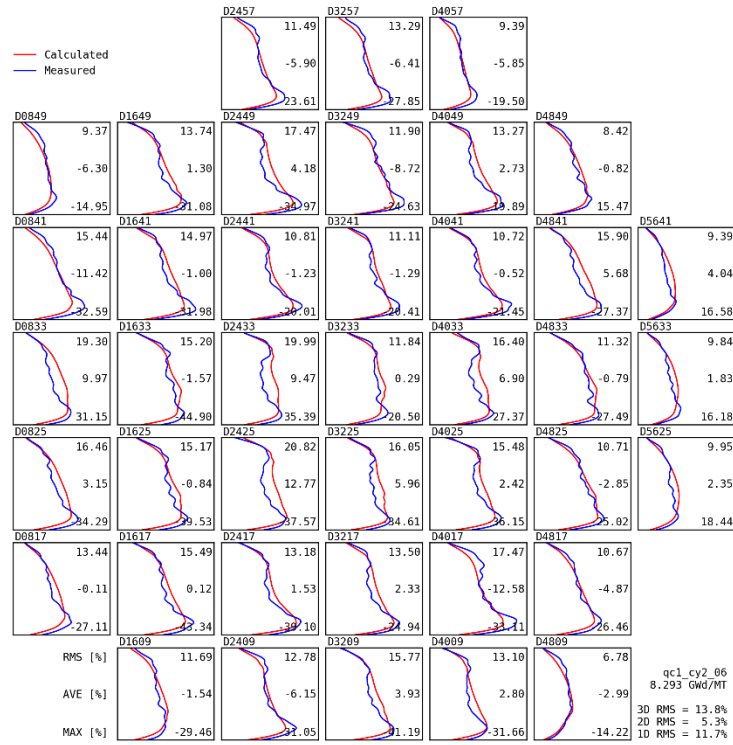
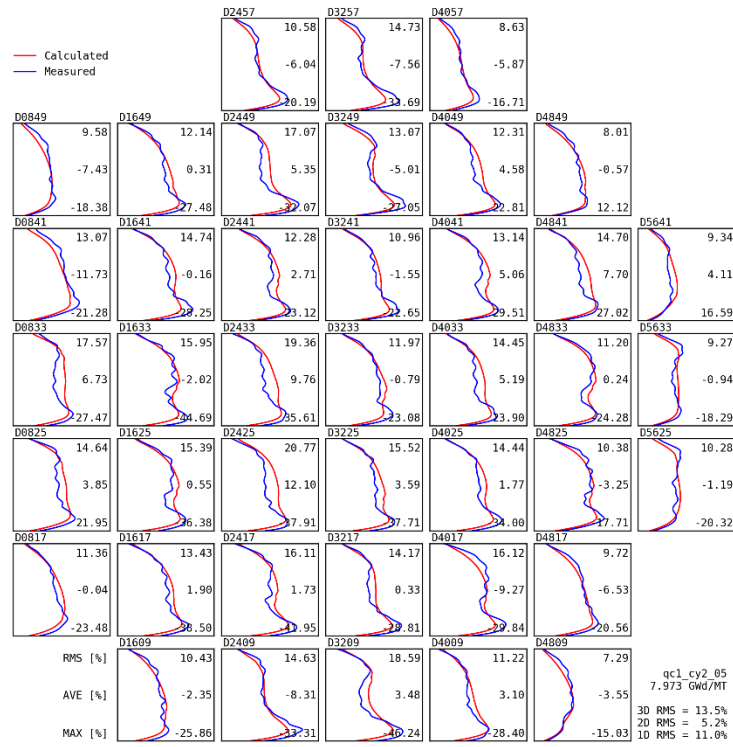


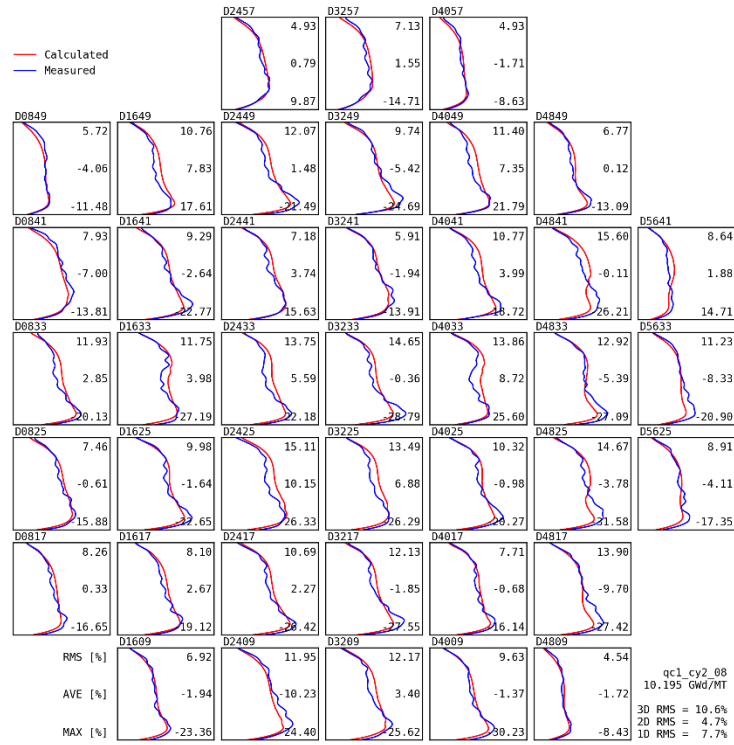
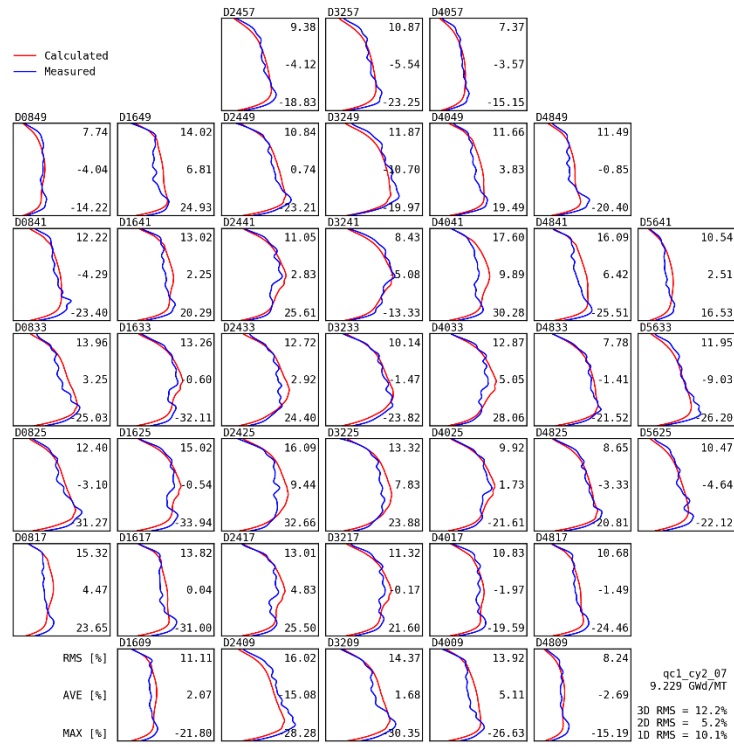


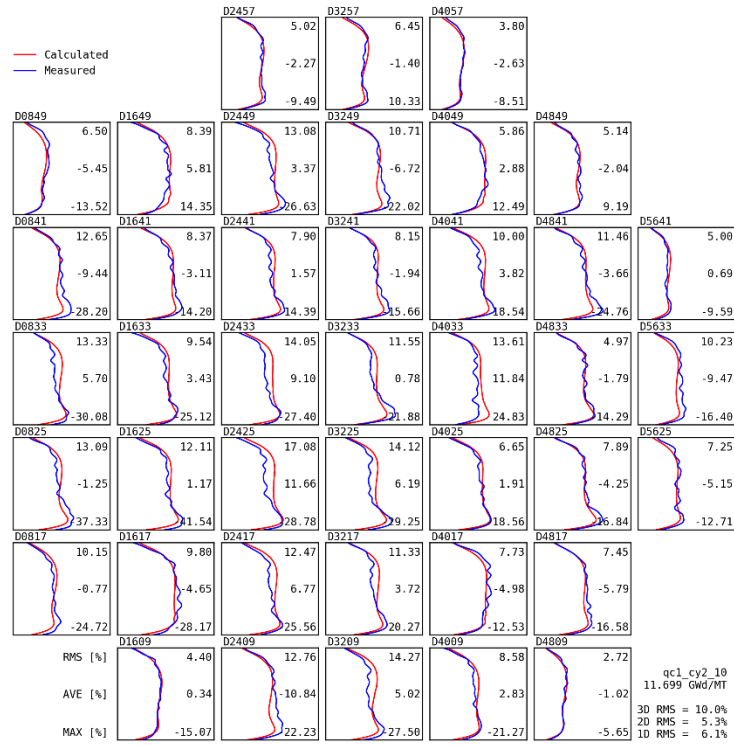
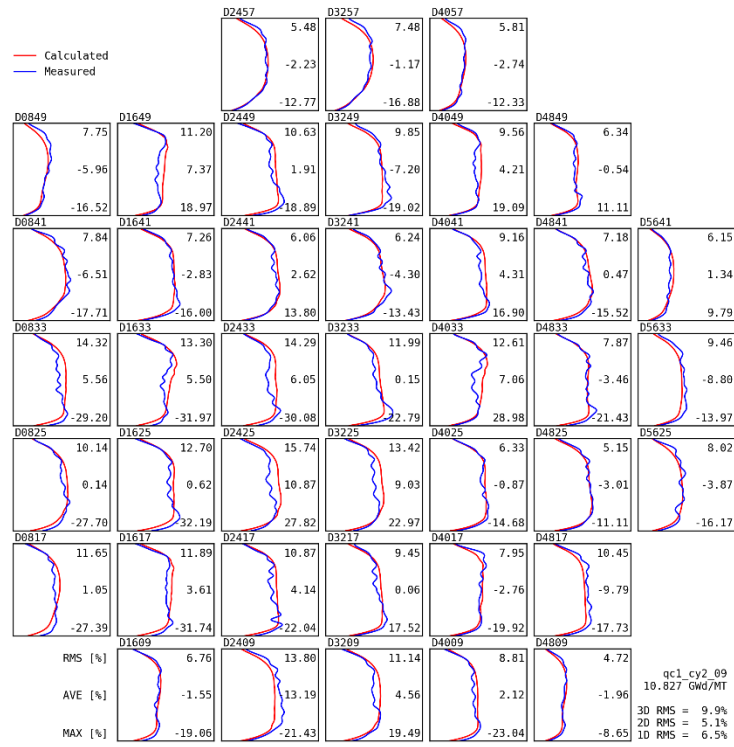
E.2 QC1 Cycle 2 TIP comparison

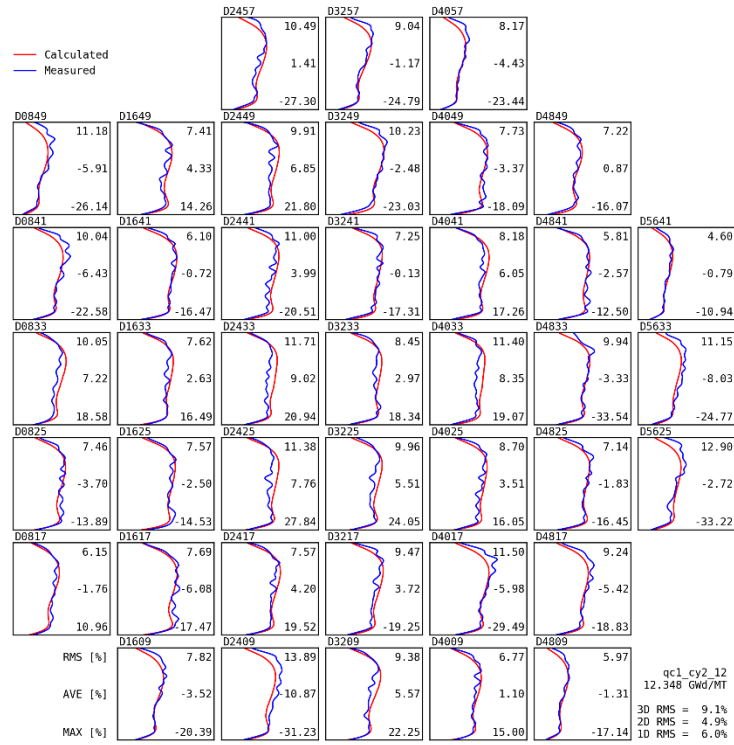
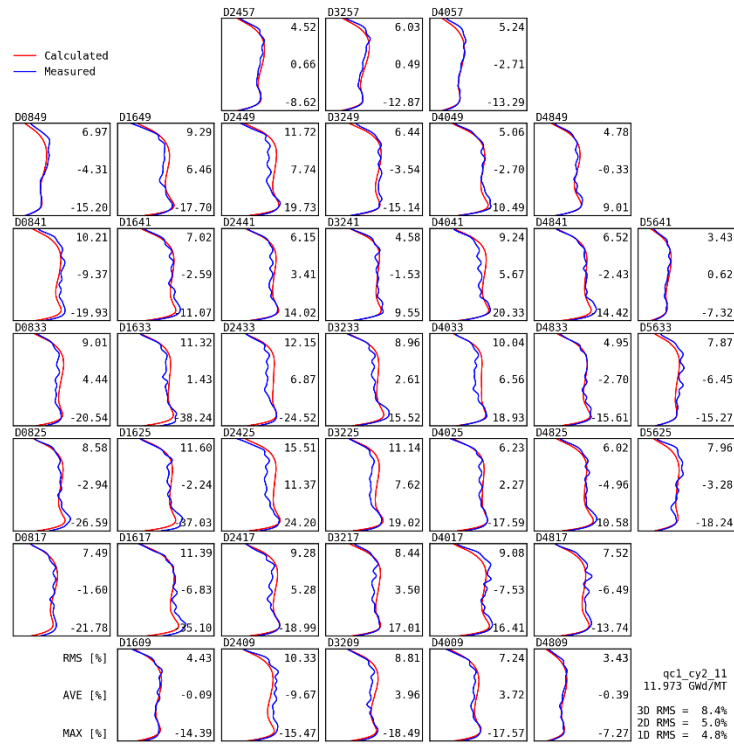


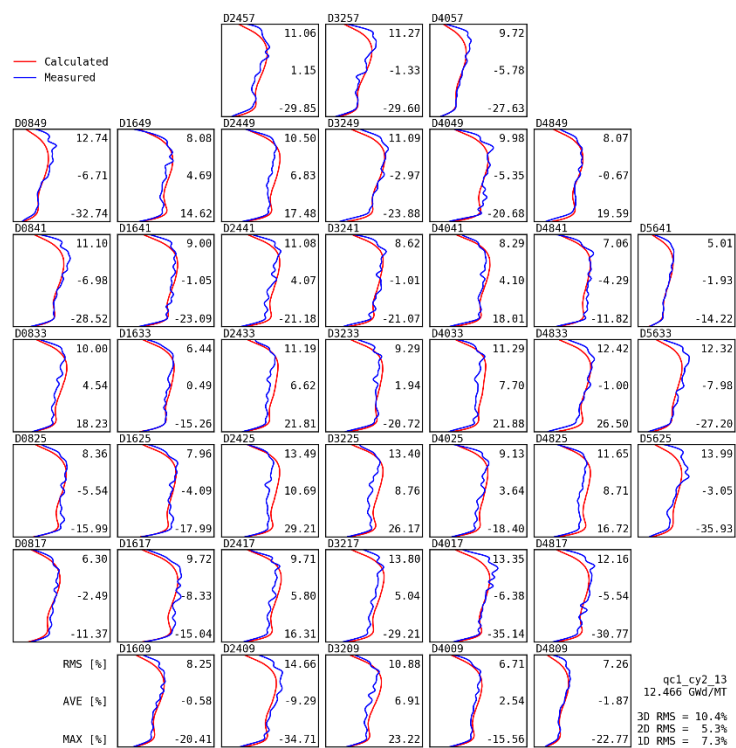












E.3 QC1 Cycle 3 TIP comparison

