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Modification of the SAS4A Safety Analysis Code for Integration with the ADAPT Discrete Dynamic Event Tree Framework

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Abstract

It is difficult to assess the consequences of a transient in a sodium-cooled fast reactor (SFR) using traditional probabilistic risk assessment (PRA) methods, as numerous safety-related systems have passive characteristics. Often there is significant dependence on the value of continuous stochastic parameters rather than binary success/failure determinations. One form of dynamic PRA uses a system simulator to represent the progression of a transient, tracking events through time in a discrete dynamic event tree (DDET). In order to function in a DDET environment, a simulator must have characteristics that make it amenable to changing physical parameters midway through the analysis. The SAS4A SFR system analysis code did not have these characteristics as received. This report describes the code modifications made to allow dynamic operation as well as the linking to a Sandia DDET driver code. A test case is briefly described to demonstrate the utility of the changes.

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Nomenclature

ADAPT Analysis of Dynamic Accident Progression Trees

ANL Argonne National Laboratory

DDET Discrete Dynamic Event Tree

DPRA Dynamic Probabilistic Risk Assessment

DRACS Direct Reactor Auxiliary Cooling System

PRA Probabilistic Risk Assessment

PSID Preliminary Safety Information Document

RPS Reactor Protection System

SFR Sodium Fast Reactor

SNL Sandia National Laboratories

TOP Transient Overpower

1 Introduction

This report focuses on the technical details involved in linking the SAS4A safety analysis code [1] with the Analysis of Dynamic Accident Progression Trees (ADAPT) discrete dynamic event tree (DDET) driver code [2]. The significance of such an effort in the safety analysis of a sodium-cooled fast reactor (SFR) is explained in References [3, 4, 5].

In general, traditional probabilistic risk assessment (PRA) for an SFR follows the progression in Figure 1. In this case the *Core Response Event Trees* portion is represented by a DDET created by ADAPT using the SAS4A system analysis code to represent the evolution of a transient in the plant.

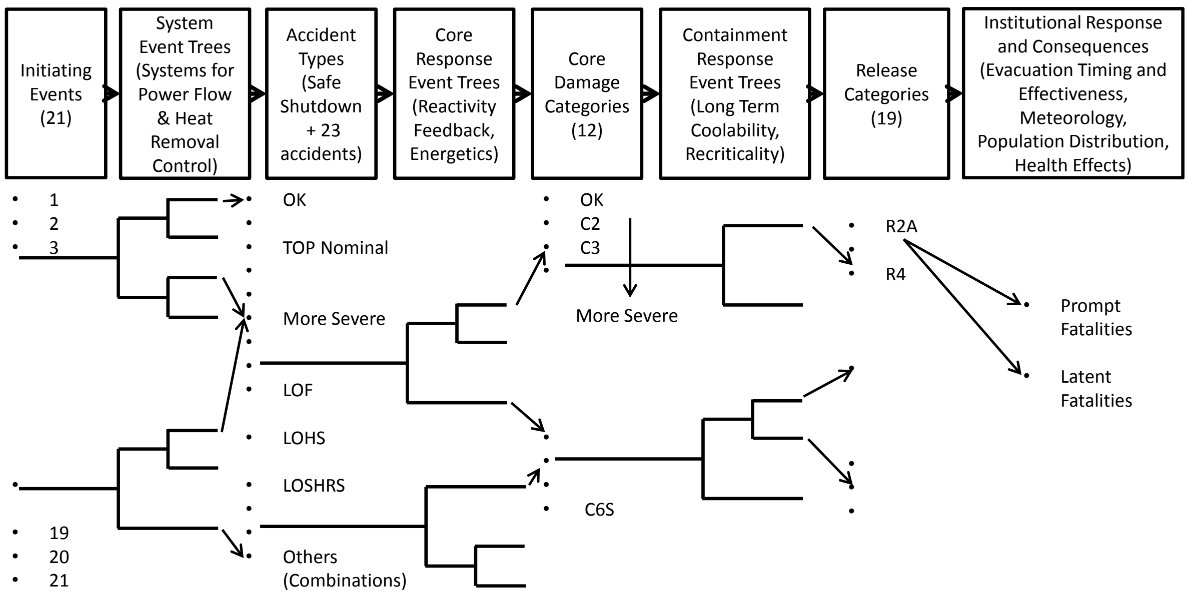

Figure 1: Risk Model Structure for PRISM, recreated from Reference [6]

As received, SAS4A 5.0.3 did not have the characteristics required to work under ADAPT [7]. Linking the two codes required first modifying a branch of the SAS4A source code to do the following, as described in Chapter 2:

- Accept modified input parameters for its control system upon restart of analysis
- Stop on control system values crossing a pre-defined threshold
- Output the reason for any code stoppage
- Stop when commanded by ADAPT

The codes were then linked as described in Chapter 3. The process of linking a code to ADAPT and generating input has been previously described for the MELCOR light water severe accident analysis code [8] in References [9, 10].

The initial code base was uploaded as received to a Subversion repository, which allowed modifications to be tracked. The repository is accessible only from the internal Sandia network, and only to authorized users. The location is: `https://farmall.sandia.gov/svn/developers/zkjanko/2015-SAS4ADAPT-project-files/`

2 Preparation of SAS4A for Dynamic Operation

SAS4A as received by SNL (version 5.0.3) was not compatible with ADAPT for a number of reasons, primarily owing to the fact that its development significantly predates the practical use of DDETs. The general process followed by SAS4A is shown as Figure 2. The Data Management Initialization module reserves sufficient memory for all possible variables and functions of SAS4A. *INPDRV*, or the *Read Card Input* module, populates memory spaces with values from the input file. This includes all information about plant parameters as well as the time-dependent transient behavior. *INPDRV* also reads the plant state file if an analysis is being restarted. To begin a scenario, the Steady State module *SSTHRM* is run to establish pre-transient plant conditions. Finally, the Transient Analysis module *TSTHRM* simulates the transient portion of the scenario until the specified end time or simulator failure.

SAS4A is currently undergoing a transition from predominantly Fortran 77 to a more modern version of Fortran, as well as the addition of C++ functions. It is possible that some of the changes contained herein will become redundant as features are added by SAS4A developers according to their development plan. SAS4A 5.0.3 is built with a standard Fortran compiler and is commonly built on Linux and Mac systems. The modified branch of SAS4A was marked as such and was compiled with the Intel Fortran compiler version 11.1 under CentOS 5.10.

2.1 Sharing Control Signal Values

The simulator feature used to communicate with ADAPT is typically one that allows arbitrarily mathematical and plant state functions to be read and written. In MELCOR, the first code linked with ADAPT, this functionality is referred to as the ”Control Function” package [8]; the corresponding module in SAS4A is the ”Control System”. The particular method used to trigger the simulator to stop upon a branching condition being reached is dependent on the architecture of the simulator. In MELCOR a function was added such that the code will stop when a designated logical control function toggles from false to true. SAS4A does not support control signals with logical values; rather, all signal output values are floating point numbers. Therefore using an exact value of a signal output would be unreliable. It was decided to acknowledge stopping conditions when the simulation time exceeds the value of a designated control signal.

The first change was to make control system signal values visible to the Transient Analysis routine (see Figure 2). Each control system ”signal” is assigned a type upon definition such as ”summer” which sums values of two input signals, or ”OR” which returns 1.0 if at least one of two input signals is greater than 0.0. In addition to type, signal definition also includes the control signal numbers of other signals to use as input values, as well as initial values and convergence criteria where applicable. The control system input values are read by Read Card Input and are not directly available to Transient Analysis in the main branch of SAS4A. These input values are interpreted for their specific physical effects on the plant, such as pump power control or reactivity insertion, which are in turn made available to Transient Analysis. In order to stop on a control system signal value, the values must be directly visible to Transient Analysis, and so a new common variable

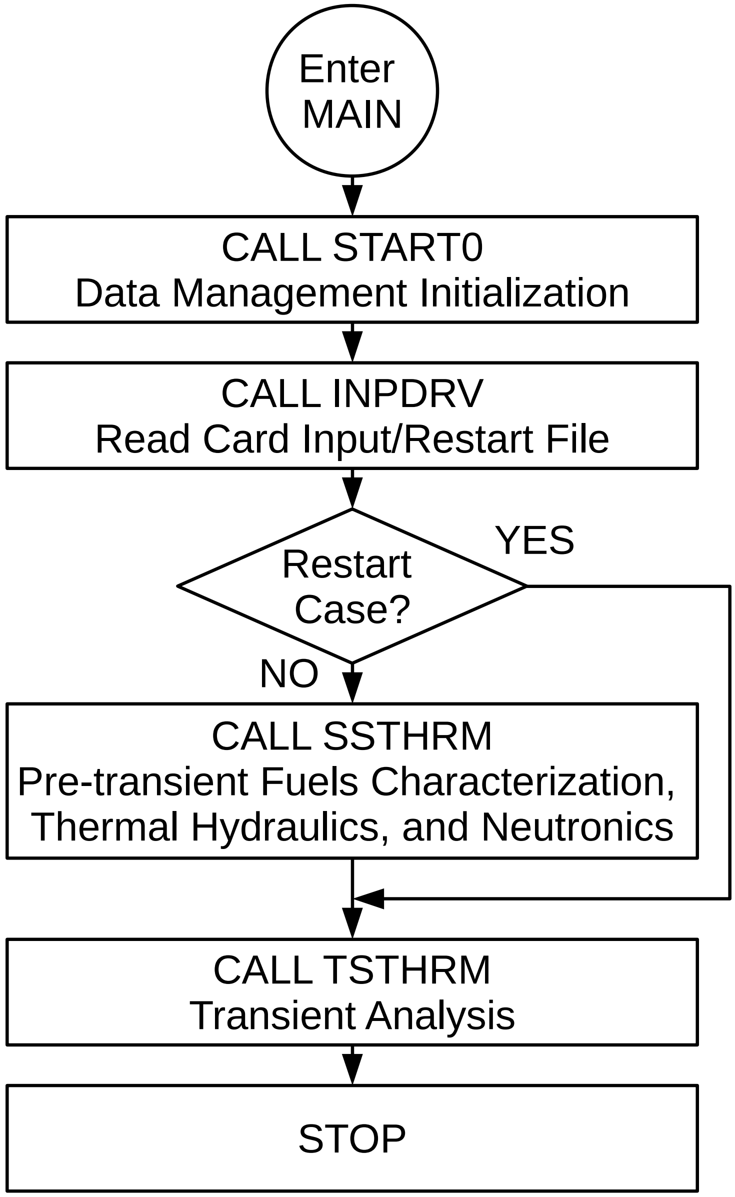

Figure 2: SAS4A Main Program Flow Diagram [1]

was created that mirrors the values determined in Read Card Input and updated at every time step. This new variable (*ZJSIG6*) is invisible to the end user, and tracks the values of all 998 control signals that may be created in SAS4A. An early revision of SAS4A version 5.1 adds a function (GetSignal) to pass values to Transient Analysis which will make this change redundant in future releases of SAS4A.

2.2 Defining Stopping Signals

Two input file variables were added to the *INPCOM* block in the input file, which contains channel independent options and integer input and is also handled by Read Card Input. As of version 5.0.3, INPCOM reserved space for 250 input locations. The following locations were assigned for dynamic operation and their values are made available to Transient Analysis:

- INPCOM 120: How many control signal values are considered for stopping (integer range 0 to 50), 0 de-activates
- INPCOM 121-171: The control signal numbers that may cause SAS4A to stop (integers from 1 to 998)

A sample set of INPCOM input is given as Listing 1[1]. The first value under *120* indicates the number of locations to be used, *1*. The second value, *4*, indicates the number of signal stopping conditions. The first value of *121* also indicates that there are *4* stopping conditions. The values *113*, *566*, *114*, and *501* are the signals that will be tested for stopping SAS4A. A stop will be ordered if the value of a tested signal is greater than 0 and is less than or equal to the current time. Therefore it is important to form these trigger control signals such that when a stop is not desired their values are either less than 0 or very large.

Listing 1: Sample SAS4A INPCOM Input for Dynamic Operation

```
INPCOM    1    1      1
     120    1    4
     121    4    113   398   114   501
```

2.3 Format of Control Signals for Stopping

A sample set of input to determine the need for plant action on a plant condition is shown in Listing 2. This set of signals will compare the current normalized reactor flux (signal type *-72*) to the given trigger value of *1.19*. If current flux exceeds the trigger value in a time step, the time at that step (signal type *-55*) will be held in signal *223*. This will be held until flux exceeds the trigger again, if ever. Signal *291* will return the last time the trigger was exceeded plus a small margin (*0.075* seconds) to ensure that a subroutine time step passes before action is taken.

[1]Spacing has been altered in sample inputs for page formatting. Due to its Fortran 77 roots, SAS4A is sensitive to spacing in input. See Appendix C for an exact representation of the spacing used in this section of SAS4A input.

Listing 2: Sample SAS4A Control Signal Input for Dynamic Stopping

```
INCONT  5    1    0
   12   21             1.19
  202   21             0.075
  211   -55
  212   -72
  220   21             0.0
  221   18   212    12
  222   20   220   221
  223   19   222   211
  224   2    223   222  1.
  225   17   222
  226   21             1.0D10
  227   2    225   226  1.
  228   1    224   227  1.  1.  1.
  291   1    228   202  1.  1.  1.
```

The output of signal *291* is not used directly to trigger the reactor protection system (RPS) or to stop the code; it is combined with other triggers for the RPS which account for off-normal core inlet temperature, core outlet temperature, and power-to-flow ratio. If the combined signal (*398* in Listing 1) has a value greater than zero and less than the current time, SAS4A is directed to stop. In the branch where scram is successful, when SAS4A restarts additional signals direct the control system to use a lookup table for reactivity insertion that corresponds to control rod insertion. In the branch where scram fails, a signal value is set which prevents this action.

2.4 Detecting Stopping Conditions

The portion of Transient Analysis relevant to this work is partially reconstructed in Figure 3, where *Ka* begins after a check for whether maximum computation time has been exceeded and *Kb* continues into a check of whether reactivity is below a user-set value for termination. The decision for *Maximum Problem Time?* is used as the model for stopping on the presence of a token file. This is because maximum problem time is one of few ”successful” conditions that would lead SAS4A to stop, and therefore the plant state is dumped into a binary ”restart” file. SAS4A now also checks to see if the file *SAS.stp* exists. If it does, SAS4A stops at the next main time step and writes a restart file.

The final stopping condition is for control signal values, and is subject to a series of nested ”if-then-else” statements which are shown as a flowchart in Figure 4. This process is inserted at *Kb* from Figure 3, and pushes the check for user-defined reactivity termination to *Kc*. A variable that determines whether to stop (*SASTOP*) is initialized with a value of 0, which will change to 1 if a stop is required. The first test is whether dynamic operation is enabled, which is determined by the

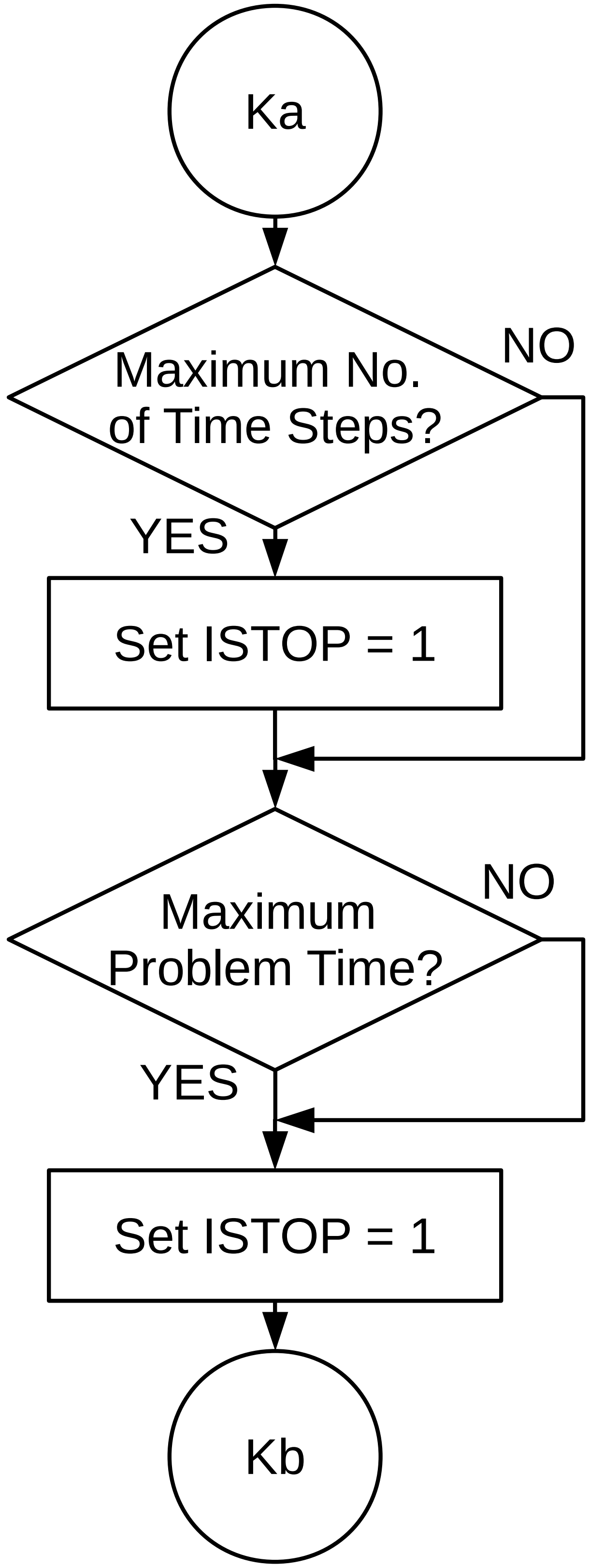

Figure 3: SAS4A Transient Analysis Subroutine Flow Diagram (partial) [1]

value of INPCOM location 120 (*SASTPI*). Stopping may only occur if it has been at least one time step since the simulation last restarted. Next a loop is performed over all signals given in INPCOM locations 121-171. The number of signals to be considered (*SASTPN*) equals 4 using the input in Listing 1, and the signals are *[113, 566, 114, 501]*.

Within the loop, the value of signal *SASTPV(i)* is retrieved by calling the equivalent common variable *ZJSIG6*. The first test is that the value (*ZJSIG6(SASTPV(i))*) is greater than 0. If this test is passed, the value is compared to the current simulation time. If the current time is greater than the signal value, a stop is required and the loop is broken. Outside of the loop, the value of the stopping command variable is checked. If it is 1 or greater SAS4A is ordered to stop, write a restart file, and write the reason for stopping. If stopping on a signal is not enabled or the loop ends without a stopping command, SAS4A continues to run.

If multiple stopping signals become true in the same time step, the first one listed in INPCOM 121-171 will be listed as the reason for stopping. This is because the loop in Figure 4 is broken the first time a stopping signal is found to be true. A message to this effect is presented to the user if the size of INPCOM 121 is greater than 1. This is similar to behavior in other simulator codes used with DDET drivers and may result in one stopping code being ignored if it is no longer true in the following time steps. Therefore it is important when building DDET input to consider the effects of multiple stopping signals becoming true in the same time step.

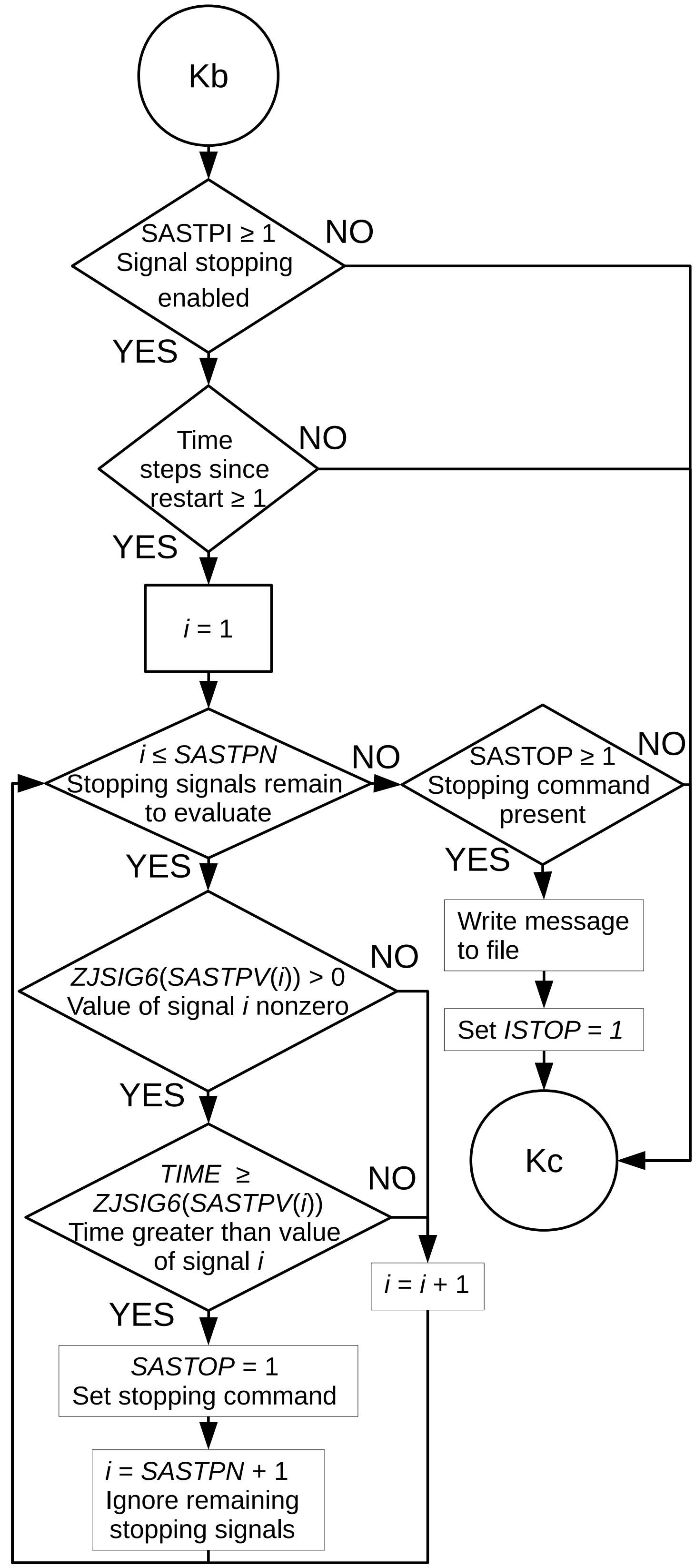

Figure 4: SAS4A Control Signal Value Stopping Logic

2.5 Writing a Message File

An additional output file ”SAS.mes” was added which includes the specific reason why SAS4A closed. The possible values for SAS.mes are given for each stopping case in Table 1. The simulation time at the stop is given as *[time]*, and in the case of a Branching Condition the control signal that became true is given as *[signal]*. If SAS4A stops on the presence of a stopping file or upon reaching maximum problem time, these are also relayed to the message file. SAS.mes is not created if a simulator error occurs, and so such conditions must be detected with other methods.

Table 1: SAS4A Message File Content Format

Condition	Text
Stop File Present	STOPPED ON STOP FILE AT: *[time]*
Maximum Problem Time	STOPPED ON MAX PROBLEM TIME AT: *[time]*
Branching Condition	ADAPTSTOP: *[signal]* AT: *[time]*

2.6 Redefining Control System Signals

Perhaps the most critical limitation to dynamic operation is that SAS4A 5.0.3 requires identical control system input values from start to finish. The restriction on redefinition of control system elements is at least partially to ensure convergence in the control system [1], which calculates values of signals at iteratively smaller time steps until user-specified convergence criteria are met. A change in a control system signal value that takes place upon restart acts as a step change, and could in some cases result in instability or excessively small time steps being used. With this caveat in mind, the prohibition on redefinition of signal values on restart was removed. Signal types are still not allowed to be redefined due to the difference in memory allocation at the time of initialization for different types of signals. A message is displayed to the user if a control signal value is changed to remind of the potential for instability.

This modification brings the flexibility of redefinition in the SAS4A control signal system to equivalency with MELCOR version 1.8.5 when ADAPT was initially created and linked with the simulator:

Some of the data associated with an existing control function may be changed when running MELCOR. Note that new control functions may not be added, not may the type of an existing control function be changed. [11]

SAS4A is currently undergoing an effort to modernize its codebase, which as of version 5.0.3 was a mix of Fortran 77 and modern Fortran [12]. MELCOR underwent a similar modernization effort, and now allows full redefinition of control functions upon restart of the code:

The introducing of new control function means that in MELCOR input new CF_ID record appears with new name (not input in MELGEN). Also user may change the type of an existing control function (with name identical to one in MELGEN) but it means that all records for the control function must be input from the beginning (in other words, the changing of CF type is equivalent to the introducing of new CF). [8]

3 Linking SAS4A with ADAPT

The minimal number of files for an ADAPT case submitted via the point-and-click web interface is 7:

- Web Wrapper: submits the case to the ADAPT database through the web interface
- Wrapper: defines the link between ADAPT and the simulator(s)
- Checkpoint File: defines how ADAPT can pause the simulator
- Branching Rules File: defines the actions to be taken when a branching condition is reached
- Simulator Restart File: contains the state of the plant at the start of the case
- Template Simulator Input File: contains information necessary to run the simulator with new values after branching
- Simulator Executable: runs the plant model from the previously saved state with new input values

The Web Wrapper, Wrapper, Checkpoint File, and Simulator Executable(s) are submitted ahead of time as a Simulator package, while the Branching Rules File, Simulator Restart File(s), and Template Simulator Input File(s) are specific to each case. The Web Wrapper and Checkpoint files do not change significantly between simulator packages. For SAS4A the Checkpoint file makes use of the added feature of stopping on presence of the file *SAS.stp*. This modification as well as others that contributed to the creation of an ADAPT-ready executable for SAS4A were described in Section 2.

ADAPT comprises two long-running processes (adapt-server and adapt-webmin) as well as a collection of modularized helper scripts. The adapt-webmin process is optional, and is used to visually interrogate existing experiments and launch new ones in a user-friendly environment. Queued jobs are detected by adapt-server, which prepares the required inputs and environment variables and spawns a job to the next available computation node. At its core adapt-server is a job scheduler, with the helper scripts interacting with a central database to build the DDET.

3.1 ADAPT-SAS4A Wrapper File

This wrapper file links a simulator or set of simulators [13] to ADAPT, and must be created once for each unique set of simulators and post-processing activities. It may be reused for different DDETs as long as the simulator input requirements, simulator output formats, and desired pre- and post-processing actions do not change. The basic requirements of the wrapper file are given as Figure 5.

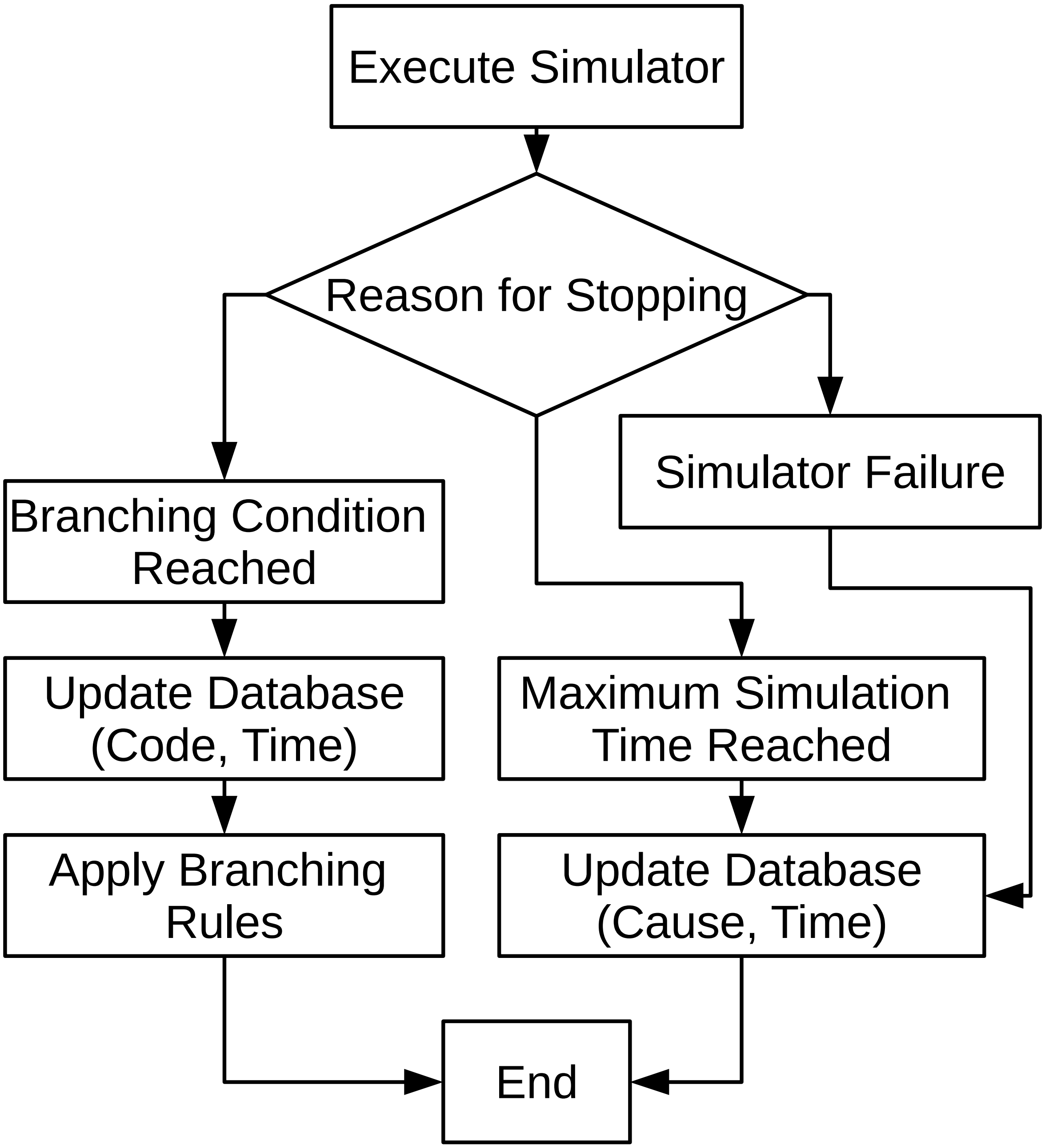

Figure 5: Required ADAPT Wrapper Actions

First, the appropriate input files are gathered and the simulator is started. There are three possible outcomes: the simulation may have reached its maximum time, which will be detected by the wrapper and will result in no new branches; the simulator may fail, which also results in no new branches; finally, a branching condition may be reflected in the simulator output. Failure of the branch is detected by the exit status of the simulator, or by a watchdog tool that detects when a simulator has failed but has remained open. The status of the simulator is read through specially-created message files (see Table 1) and the main simulator output files.

If a branching condition is reached, the branching rules file is read to determine what variables to change for the next branches. The variable values and probabilities of the new branches are submitted to the database to join the queue. In addition, simulator restart and other output files are marked to be copied to the run directory of each new branch. The primary changes to the wrapper for a new simulator are the execution syntax and the exact location in the message file of the reason and time for stoppage. This is by design, as ADAPT is intended to be highly code-neutral [2]. The wrapper for MELCOR (which appears in its entirety in Reference [9]) was used as a template for SAS4A.

The first major operation in the wrapper script is to prepare the root branch. The portion of script that performs this is seen as Listing 3. This piece of code is executed only if adapt-server has passed the *ROOT* environment variable with value *1* and the branch is not being restarted from a checkpoint. The restart file, template input file, and branching rules files are copied from a central location to the directory of the first branch. The branching rules are processed, using the *INIT* values for all variables.

Listing 3: ADAPT Root Branch Handling

```
if [ $ROOT -eq 1 ] && [ $RESUME_CHECKPOINT -eq 0 ]; then
cp $SAS_ROOT/$RST $SAS_ROOT/$TEMPLATE $SAS_ROOT/$EDITRULES .
adapt-editrule-apply --init $EDITRULES \
$BRANCHESF 0 sas $OTHERSIMF
cat $BRANCHESF | while read CONFIG IGNORE0 \
IGNORE1 IGNORE2 IGNORE3 IGNORE4; do
cp $CONFIG sas.cor
rm -f $CONFIG
done
rm -f $BRANCHESF
fi
```

If the *TERMINATE_EARLY* variable is passed by adapt-server with a value greater than 0, the job is marked to run for that many seconds and then terminate. The simulator is then run, with the syntax for SAS4A being:

nice $SAS_ROOT/$EXE < sas.cor > sas.out

The *nice* prefix runs the simulator at a relatively low priority to avoid delaying the system processes of the computation node. The exit status of the simulator is read by the wrapper script. If an error is indicated, the job is marked as a simulator failure and no new branches are created. If the simulator closed successfully, the branching code (if any) is read from the message file and the simulation time is determined from the main output file. Retrieving the simulation time is the most simulator-dependent part of the wrapper (see Listing 4), as output formatting patterns differ by programming language and developer.

Listing 4: SAS4A-ADAPT Determination of Simulation Time

```
word_check=`grep ++ sas.out | tail -1 | awk '{print $1}'`
word_size=${#word_check}
if [ $word_size -lt 3 ];
then sim_elapsed=`grep ++ sas.out | \
tail -1 | awk '{print $3}'`
else sim_elapsed=`grep ++ sas.out | \
tail -1 | awk '{print $2}'`
fi
```

In the output file *sas.out*, the token ++ only appears on lines containing simulation time records (see Listing 4), and is always the beginning of the first word on that line. However, the cycle (main time step) number comes between the token and the simulation time. At low cycle numbers, the simulation time is the third word on the line, for example: ++ *44 4.4000*. If more than 10,000 cycles have elapsed, it is the 2nd word: ++*67698 16349.0*. This is common in codes where a fixed number of characters are given to each output parameter. In MELCOR, for example, negative simulation times (typically used to establish a steady state before the transient) affect the number of words on the line that contains the simulation time.

One difference appears in the handling of the restart file. In MELCOR, a sequence of commands in the wrapper are typically used to truncate the restart file to retain only the most recent plant state dump. This is to save disk space and to reduce the burden on the network, as the restart files may become large ($\sim$2GB each) and are copied to potentially tens of thousands of branches. No plottable data is lost, as MELCOR also outputs a distinct plot file. SAS4A outputs a file named *RESTART.dat*, but requires a file named *fort.18* to restart a case. After SAS4A has finished running in the wrapper, the incoming *fort.18* is renamed *old.fort.18* and the new *RESTART.dat* is named *fort.18*. This preserves the input used by the branch as well as its output to be used for the next branches. SAS4A has an option that, by default, only saves the most recent restart dump. This option was used for the same reasons as the truncation of the MELCOR restart file.

SAS4A outputs the bulk of its plottable data in three files: *CHANNEL.dat*, *PRIMAR4.dat*, and *sas.out*. Utilities are provided with SAS4A that extract data from *CHANNEL.dat* and *PRIMAR4.dat*, which are binary files. If a branching code is indicated, the branching rules file is interpreted as shown in Listing 5. While most outputs of *adapt-editrule-apply* are ignored in preparing the root branch (see Listing 3), all are used in determining child branches. The information is provided as a list of new branches, each with:

- SAS4A input file location
- ADAPT variable states
- Branch number
- Branching code of parent
- Probability
- Early termination status
- Simulator to run

The early termination status, executable to be run, probability, and branch number are submitted to the database as pieces of data for each new branch. The database is updated with every file the new branches will require to run. Small files are uploaded in their entirety to the database, while for large files the location is submitted. After finishing this operation, the wrapper signals *adapt-server* that the branch is complete and a slot on its computation node may be marked as available for queued jobs.

Listing 5: SAS4A-ADAPT Determination of New Branches

```
adapt-editrule-apply $EDITRULES $BRANCHESF \
$simtime sas $OTHERSIMF
cat $BRANCHESF | while read CONFIG newstate branchnum \
stopcode probability terminate_early newsim; do
    adapt-submit
    --terminate_early $terminate_early
    --executable $newsim
    --handoff     $EDITRULES $EDITRULES
    --handoff     $newstate $EDITRULES.state
    --handoffref $RST $RST
    --handoff     $TEMPLATE $TEMPLATE
    --handoff     $config sas.cor
    --probability $probability
    sas
    ”sb $branchnum”
    $THISSCRIPT
    rm -f $CONFIG $newstate
done
rm -f $BRANCHESF
```

In Listings 3 and 5, *$OTHERSIMF* refers to a temporary file used for simulations with multiple simulators. The changes in ADAPT variables required for branching are performed against the immediate parent branch and not the initial input file. Therefore all simulator input files must be updated for each branch, even for simulators that are not currently being run. SAS4A is run as a single simulator in the example DDET, and so *$OTHERSIMF* contains no important information.

3.2 ADAPT-SAS4A Branching Rules File

A truncated branching rules file for SAS4A is given as Listing 6. This file contains information on how ADAPT should proceed when a branching condition is detected by the wrapper. A template simulator input file is given at the start of the DDET, and it is progressively modified for each branch. The input file is given in the field *InputFile*. Within the template input file, ADAPT variables are set off using separators as defined in *VarSeparator*. The message file associated with the simulator is found in the *StoppingWord* field, as well as where to search within that file. In this case ADAPT will search the file *SAS.mes*, using the 2nd word on the line that contains the word *ADAPTSTOP* as the branching condition. For this set of branching rules, ADAPT only performs an action if the branching condition is *501*.

Listing 6: Sample ADAPT Branching Rule File

```
InputFile 1 sas.cor.tpl
StoppingWord 1 SAS.mes ADAPTSTOP 2
VarSeparator 1 "{" "}"
BranchingSimulator 501 1
SimulatorExecutable 1 sas
InitialSimulator 1
BranchProbability 501 1 0.5
BranchProbability 501 2 0.5
INIT BC_RPS_10S  501
INIT OP_TRIP     1.0D20
INIT OP_REC      1.0D20
501 1 OP_TRIP    0.0D20
501 1 OP_REC     1.0D20
501 1 BC_RPS_10S 566
501 2 OP_TRIP    1.0D20
501 2 OP_REC     0.0D20
501 2 BC_RPS_10S 566
```

In the case of Listing 6, a branch that ends in condition *501* will lead to two child branches. The branches differ in the value of *OP_TRIP* and *OP_REC*, which represent uncertain mitigating operator actions. In both cases the variable *BC_RPS_10S* is changed to a value of *566*. For this specific input file, that change has the effect of disabling the branching condition in the future, ensuring it occurs at most once in any final state in the DDET. Branching conditions that are allowed to occur multiple times in a DDET commonly must be crafted with a refractory period in the simulator input file to avoid their occurring inadvertently in quick succession. This input is consistent with ADAPT input format changes introduced in Reference [13] and other efforts in early 2016.

3.3 SAS4A-ADAPT Template Input File

The template simulator input file used with ADAPT typically does not contain all of the input used in the plant model. It is only required to contain the input that is necessary to restart the simulation and that which may change with branching. Reducing the size of the template input file may contribute to saving time and disk space over the course of a DDET, particularly if the full input is very large and many branches are created.

A portion of the template input is given as Listing 7. The input file used to generate the initial restart file is not included, as it is approximately 5,000 lines long. The text set off by "{" and "}" are ADAPT variables to be defined by the branching rules file (see Listing 6). When the branching condition represented by *BC_RPS_10S* is enabled, its value is "501". This corresponds to the possible operator override of primary pump trip status 10s after the RPS is triggered. When it is disabled its value is "566", which is a stopping signal that has a constant value of 0. When branching condition *501* from Listing 6 occurs, in the first branch {*OP_TRIP*} is replaced with *0.0D20*, {*OP_REC*} is replaced with *1.0D20*, and {*BC_RPS_10S*} is replaced with *566* to create a valid SAS4A input file for that branch.

Listing 7: Portion of SAS4A-ADAPT Template Input File

```
INPCOM 1 1 1
120 1 8
121 8 {BC_RC} {BC_RPS4} {BC_RPS2} {BC_CENTS} {BC_RPS_10S}
INCONT 5 1 0
41 21 {RPS_SCRAM}
42 21 {RPS_TRIP}
43 21 {OP_TRIP}
44 21 {OP_REC}
```

4 Conclusion

This work described the process of modifying SAS4A source code to perform dynamic analyses with the ADAPT DDET driver code. The modifications were incorporated with minimal impact to the source code and were regression-tested on cases that do not utilize the new features; this was to minimize coding effort required if the changes were to be incorporated into the main branch of SAS4A. Next, SAS4A was linked to the DDET driver code ADAPT. ADAPT uses a wrapper to run simulators and collect their outputs to determine the course of the DDET. For each new set of simulators, the wrapper is modified according to the syntax and output formats of the simulators. See Appendix A for the wrapper file generated in this work.

The branching rules and template SAS4A input for a sample DDET are given in Appendices B and C, respectively. This DDET explores uncertainties in the following parameters, which were developed in detail in Reference [3]:

- Reactivity insertion leading to transient overpower (TOP)
- Reactivity coefficients of reactor materials and coolant
- Reactor protection system (RPS) reliability (reactor scram and primary pump trip)
- Operator override of primary pump trip
- Operator attempt to enhance heat transfer to secondary loop
- Operator attempt to enhance heat transfer to direct reactor auxiliary cooling system (DRACS)
- Operator trip of primary pumps at high temperature
- Thermal damage to primary pumps at high temperature

The DDET was run for 24 hours of simulation time and used 113 processor-days on Intel Xeon E5-2620 processors. The sample DDET resulted in 2,919 total branches, and 2,052 unique sequences. The physical results and safety insights of this DDET will be fully described in a follow-on paper.

References

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A Appendix A: SAS4A ADAPT Wrapper File

The SAS4A ADAPT wrapper is listed below. Note that line numbers are given on the left.

```
#!/bin/sh
# BEGIN adapt attributes
# checkpoint: sas-checkpoint
# arg1: sas_root (directory which contains sas, fort.18, etc.)
# END adapt attributes
set -e
set -x
echo "Hello, sas on `hostname` on `date`"

# Declare files used for this simulator.
SAS_ROOT=$sas_root
RST=fort.18
TEMPLATE=sas.cor.tpl
EDITRULES=sas_editrules.cor
EXE=sas
BRANCHESF=branches.tmp
OTHERFILELIST=otherfilelist.tmp
if [ $NCENGINE_ROOT -eq 1 ] && \
[ $NCENGINE_RESUMING_CHECKPOINT -eq 0 ]; then
    echo "initializing edit rules for root job at `date`"
    cp $SAS_ROOT/$RST $SAS_ROOT/$TEMPLATE $SAS_ROOT/$EDITRULES .
    test -f $SAS_ROOT/$PLOTF && cp $SAS_ROOT/$PLOTF .
    adapt-editrule-apply --init $EDITRULES \
    $BRANCHESF 0 sas $OTHERFILELIST
    cat $BRANCHESF | while read config ignore0 ignore1 \
    ignore2 ignore3 ignore4 ignore5; do
        cp $config sas.cor
        rm -f $config
    done
    rm -f $BRANCHESF
fi

# Kill branches marked for early termination.
rm -f term-early
if [ $NCENGINE_TERMINATE_EARLY -gt 0 ]; then
    (sleep $NCENGINE_TERMINATE_EARLY; \
    echo "Terminating early!"; \
    touch term-early; touch sas.stp) &
fi

```

```
# Execute the simulator.
set +e
echo ”Started executing sas at ‘date‘”
nice $SAS_ROOT/$EXE <sas.cor> sas.out
echo ”stopped executing sas at ‘date‘”
rc=$?
echo ”sas process returned $rc”
if [ $rc −ne 0 ]; then
    exit $rc
fi

# If we were checkpointed, stop here.
if [ −f adapt.cp ]; then
    echo ”We were checkpointed at ‘date‘ on ‘hostname‘, \
    removing sas.stp.”
    rm −f adapt.cp
    adapt−checkpoint−note−taken
    exit 0
fi

# Stop here if this branch was terminated early.
if [ −f term−early ]; then
    adapt−job−record logical_fail 1
    exit 0
fi

# Record stopping control signal from message file.
mystopping_code=‘grep ’ADAPTSTOP’ SAS.mes | awk ’{print $2}’‘

word_check=‘grep ++ sas.out | tail −1 | awk ’{print $1}’‘
word_size=${#word_check}

if [ $word_size −lt 3 ];
then sim_elapsed=‘grep ++ sas.out | tail −1 | awk ’{print $3}’‘
else sim_elapsed=‘grep ++ sas.out | tail −1 | awk ’{print $2}’‘
fi

if [ $word_size −eq 0 ];
then sim_elapsed=0.0
fi

# Normal termination time is recorded from SAS.mes file.
normal_term=‘tail −1 SAS.mes | \
grep ”^ STOPPED ON MAX PROBLEM TIME AT:” | awk ’{print $7}’‘

```

```
# Prepare new restart file for next branch.
mv fort.18 old.fort.18
rm old.fort.18
mv RESTART.dat fort.18

# Gather some text data from binary files
SAS11toCSV-Linux-x86_64.x <CHANNEL.dat> channel.out
SAS15toCSV-Linux-x86_64.x <PRIMAR4.dat> p4out.csv
sas4a-extract-clad-intact-fraction &
sas4a-extract-sas-out &
sas4a-separate-Channel-outputs &
sas4a-separate-p4out-outputs &
sas4a-separate-WholeCore-outputs &

# Record the outcome of this branch.
if [ "$mystopping_code" = "" ]; then
    if [ "$normal_term" != "" ]; then
    adapt-job-record simtime `printf %.2f $normal_term`
    else
        adapt-job-record logical_fail 1 simtime $sim_elapsed
    fi
    exit 0
else
    adapt-job-record code $mystopping_code simtime $sim_elapsed
fi
set -e

# Run the edit rules module to determine
# which child branches to submit.
adapt-editrule-apply $EDITRULES $BRANCHESF \
$sim_elapsed sas $OTHERFILELIST
cat $BRANCHESF | while read config newstate branchnum \
stopcode branchhit probability terminate_early newsim; do
    adapt-submit \
    --terminate_early $terminate_early \
    --executable $newsim \
    --handoff    $EDITRULES $EDITRULES \
    --handoff    $newstate $EDITRULES.state \
    --handoffref $RST $RST \
    --handoff    $TEMPLATE $TEMPLATE \
    --handoff    $config sas.cor \
    --probability $probability \
    sas \
    "sb $branchnum" \
    $THISSCRIPT
```

```
    rm -f $config $newstate
done
rm -f $BRANCHESF

echo "Goodbye, sas on `hostname` on `date`"
```

B Appendix B: SAS4A ADAPT Branching Rules File

A sample set of SAS4A ADAPT branching rules are listed below. Note that line numbers are given on the left.

```
// The "base" SAS4A input file
InputFile 1 sas.cor.tpl

// <filename> <magicword> <word_on_that_line>
StoppingWord 1 SAS.mes ADAPTSTOP 2

// Separators for ADAPT variables.
VarSeparator 1 "{" "}"

// Simulator to be run when each branching code is reached.
BranchingSimulator 113 1
BranchingSimulator 398 1
BranchingSimulator 498 1
BranchingSimulator 114 1
BranchingSimulator 501 1
BranchingSimulator 440 1
BranchingSimulator 448 1
BranchingSimulator 467 1

// Names of the simulators being used.
SimulatorExecutable 1 sas

// Simulator to be run initially.
InitialSimulator 1

// Probability for each main branch of each branching condition.
BranchProbability 113 1 0.1
BranchProbability 113 2 0.1
BranchProbability 113 3 0.1
BranchProbability 113 4 0.1
BranchProbability 113 5 0.1
BranchProbability 113 6 0.1
BranchProbability 113 7 0.1
BranchProbability 113 8 0.1
BranchProbability 113 9 0.1
BranchProbability 113 10 0.1
BranchProbability 398 1 1-((1.4E-9)+(1.4E-9)+(2.9E-7))
BranchProbability 398 2 1.4E-9
BranchProbability 398 3 1.4E-9
```

```
BranchProbability 398 4 2.9E-7
BranchProbability 498 1 1.4E-9
BranchProbability 498 2 2.9E-7
BranchProbability 114 1 1-((2.74E-6)+(2.74E-7)+(2.74E-8))
BranchProbability 114 2 2.740E-6
BranchProbability 114 3 2.740E-7
BranchProbability 114 4 2.740E-8
BranchProbability 501 1 0.5
BranchProbability 501 2 0.5
BranchProbability 440 1 0.3333
BranchProbability 440 2 0.3333
BranchProbability 440 3 0.3333
BranchProbability 448 1 0.3333
BranchProbability 448 2 0.3333
BranchProbability 448 3 0.3333
BranchProbability 467 1 0.16667
BranchProbability 467 2 0.16667
BranchProbability 467 3 0.16667
BranchProbability 467 4 0.16667
BranchProbability 467 5 0.16667
BranchProbability 467 6 0.16667

// initial values

// reactivity coefficients, BC1
INIT      ADOP__chan1      -2.745E-03
INIT      BDOP__chan1      -1.999E-03
INIT      VOIDRA_1_01      1.4933E-05
INIT      VOIDRA_1_02      1.4966E-05
INIT      VOIDRA_1_03      1.4999E-05
INIT      VOIDRA_1_04      1.5033E-05
INIT      VOIDRA_1_05      5.6271E-05
INIT      VOIDRA_1_06      5.6381E-05
INIT      VOIDRA_1_07      5.6490E-05
INIT      VOIDRA_1_08      5.6601E-05
INIT      VOIDRA_1_09      6.7437E-05
INIT      VOIDRA_1_10      6.7577E-05
INIT      VOIDRA_1_11      6.7717E-05
INIT      VOIDRA_1_12      6.7858E-05
INIT      VOIDRA_1_13      5.4904E-05
INIT      VOIDRA_1_14      5.5008E-05
INIT      VOIDRA_1_15      5.5114E-05
INIT      VOIDRA_1_16      5.5220E-05
INIT      VOIDRA_1_17      2.7867E-05
INIT      VOIDRA_1_18      2.7908E-05
```

85	INIT	VOIDRA_1_19	2.7950E−05
86	INIT	VOIDRA_1_20	2.7992E−05
87	INIT	VOIDRA_1_21	−4.0960E−06
88	INIT	VOIDRA_1_22	−4.1016E−06
89	INIT	VOIDRA_1_23	−4.1071E−06
90	INIT	VOIDRA_1_24	−4.1127E−06
91	INIT	VOIDRA_1_25	−1.0200E−05
92	INIT	VOIDRA_1_26	−1.1769E−06
93	INIT	VOIDRA_1_27	−4.3287E−07
94	INIT	VOIDRA_1_28	−1.5609E−08
95	INIT	ADOP__chan2	−8.617E−04
96	INIT	BDOP__chan2	−8.906E−04
97	INIT	VOIDRA_2_01	5.5374E−06
98	INIT	VOIDRA_2_02	5.5487E−06
99	INIT	VOIDRA_2_03	5.5600E−06
100	INIT	VOIDRA_2_04	5.5714E−06
101	INIT	VOIDRA_2_05	3.1639E−05
102	INIT	VOIDRA_2_06	3.1701E−05
103	INIT	VOIDRA_2_07	3.1762E−05
104	INIT	VOIDRA_2_08	3.1824E−05
105	INIT	VOIDRA_2_09	3.9900E−05
106	INIT	VOIDRA_2_10	3.9982E−05
107	INIT	VOIDRA_2_11	4.0066E−05
108	INIT	VOIDRA_2_12	4.0150E−05
109	INIT	VOIDRA_2_13	3.2115E−05
110	INIT	VOIDRA_2_14	3.2177E−05
111	INIT	VOIDRA_2_15	3.2239E−05
112	INIT	VOIDRA_2_16	3.2302E−05
113	INIT	VOIDRA_2_17	1.4153E−05
114	INIT	VOIDRA_2_18	1.4174E−05
115	INIT	VOIDRA_2_19	1.4196E−05
116	INIT	VOIDRA_2_20	1.4217E−05
117	INIT	VOIDRA_2_21	−5.0731E−06
118	INIT	VOIDRA_2_22	−5.0793E−06
119	INIT	VOIDRA_2_23	−5.0855E−06
120	INIT	VOIDRA_2_24	−5.0918E−06
121	INIT	VOIDRA_2_25	−7.0936E−06
122	INIT	VOIDRA_2_26	−7.7950E−07
123	INIT	VOIDRA_2_27	−2.9573E−07
124	INIT	VOIDRA_2_28	−1.1013E−08
125	INIT	ADOP__chan3	−6.930E−04
126	INIT	BDOP__chan3	−7.223E−04
127	INIT	VOIDRA_3_01	−3.0344E−06
128	INIT	VOIDRA_3_02	−3.0392E−06
129	INIT	VOIDRA_3_03	−3.0441E−06

130	INIT	VOIDRA_3_04	−3.0489E−06
131	INIT	VOIDRA_3_05	2.5021E−06
132	INIT	VOIDRA_3_06	2.5070E−06
133	INIT	VOIDRA_3_07	2.5120E−06
134	INIT	VOIDRA_3_08	2.5171E−06
135	INIT	VOIDRA_3_09	4.8878E−06
136	INIT	VOIDRA_3_10	4.8983E−06
137	INIT	VOIDRA_3_11	4.9089E−06
138	INIT	VOIDRA_3_12	4.9195E−06
139	INIT	VOIDRA_3_13	3.4466E−06
140	INIT	VOIDRA_3_14	3.4535E−06
141	INIT	VOIDRA_3_15	3.4605E−06
142	INIT	VOIDRA_3_16	3.4675E−06
143	INIT	VOIDRA_3_17	−4.5131E−07
144	INIT	VOIDRA_3_18	−4.5203E−07
145	INIT	VOIDRA_3_19	−4.5275E−07
146	INIT	VOIDRA_3_20	−4.5347E−07
147	INIT	VOIDRA_3_21	−3.5737E−06
148	INIT	VOIDRA_3_22	−3.5772E−06
149	INIT	VOIDRA_3_23	−3.5808E−06
150	INIT	VOIDRA_3_24	−3.5844E−06
151	INIT	VOIDRA_3_25	−3.1977E−06
152	INIT	VOIDRA_3_26	−4.9953E−07
153	INIT	VOIDRA_3_27	−1.8427E−07
154	INIT	VOIDRA_3_28	−7.7668E−09
155	INIT	ADOP__chan5	−4.865E−05
156	INIT	BDOP__chan5	−5.011E−05
157	INIT	VOIDRA_5_01	2.6061E−06
158	INIT	VOIDRA_5_02	2.6116E−06
159	INIT	VOIDRA_5_03	2.6171E−06
160	INIT	VOIDRA_5_04	2.6226E−06
161	INIT	VOIDRA_5_05	2.5572E−05
162	INIT	VOIDRA_5_06	2.5624E−05
163	INIT	VOIDRA_5_07	2.5676E−05
164	INIT	VOIDRA_5_08	2.5728E−05
165	INIT	VOIDRA_5_09	3.3329E−05
166	INIT	VOIDRA_5_10	3.3402E−05
167	INIT	VOIDRA_5_11	3.3475E−05
168	INIT	VOIDRA_5_12	3.3548E−05
169	INIT	VOIDRA_5_13	2.7244E−05
170	INIT	VOIDRA_5_14	2.7299E−05
171	INIT	VOIDRA_5_15	2.7355E−05
172	INIT	VOIDRA_5_16	2.7412E−05
173	INIT	VOIDRA_5_17	1.2361E−05
174	INIT	VOIDRA_5_18	1.2381E−05

```
INIT VOIDRA_5_19 1.2401E-05
INIT VOIDRA_5_20 1.2422E-05
INIT VOIDRA_5_21 -4.8165E-06
INIT VOIDRA_5_22 -4.8233E-06
INIT VOIDRA_5_23 -4.8302E-06
INIT VOIDRA_5_24 -4.8371E-06
INIT VOIDRA_5_25 -7.0698E-06
INIT VOIDRA_5_26 -7.4344E-07
INIT VOIDRA_5_27 -2.6509E-07
INIT VOIDRA_5_28 -1.1868E-08
INIT EXPCFFmult 1.238800
INIT _RDEXPCvar -4.011E-04
INIT _CRDLEL_ -1.466E+01
INIT _CRDLEQ_ -1.935E+01
INIT BC_RC 113

// rps, BC2 and BC3
INIT RPS_SCRAM 1.0D20
INIT RPS_TRIP 1.0D20
INIT BC_RPS4 566
INIT BC_RPS2 566
INIT BOP_STATUS 1.0

// top insertion, BC4
INIT TOP_CENT 0.00000E-00
INIT CENT_TIME 3.00000e+00
INIT BC_CENTS 114

// rps + 10s, BC5
INIT BC_RPS_10S 501
INIT OP_TRIP 1.0D20
INIT OP_REC 1.0D20

// cold pool 480C, BC6
INIT BC_CP_480 440
INIT DRACS_HT 1.762E+01

// cold pool 480C and BOP 1.0, BC7
INIT BC_CP_480_BOP 448
INIT SECONDARY 1.0

// cold pool 515C, BC8
INIT BC_CP_515C 467
INIT OP_THERM 1.0D20
INIT FAIL_FRAC 0.5
```

```

// BC1 branches

113 1 ADOP__chan1 -3.354E-03
113 1 BDOP__chan1 -2.443E-03
113 1 VOIDRA_1_01 1.3975E-05
113 1 VOIDRA_1_02 1.4006E-05
113 1 VOIDRA_1_03 1.4037E-05
113 1 VOIDRA_1_04 1.4069E-05
113 1 VOIDRA_1_05 5.2661E-05
113 1 VOIDRA_1_06 5.2764E-05
113 1 VOIDRA_1_07 5.2866E-05
113 1 VOIDRA_1_08 5.2970E-05
113 1 VOIDRA_1_09 6.3111E-05
113 1 VOIDRA_1_10 6.3242E-05
113 1 VOIDRA_1_11 6.3373E-05
113 1 VOIDRA_1_12 6.3505E-05
113 1 VOIDRA_1_13 5.1382E-05
113 1 VOIDRA_1_14 5.1479E-05
113 1 VOIDRA_1_15 5.1578E-05
113 1 VOIDRA_1_16 5.1678E-05
113 1 VOIDRA_1_17 2.6079E-05
113 1 VOIDRA_1_18 2.6118E-05
113 1 VOIDRA_1_19 2.6157E-05
113 1 VOIDRA_1_20 2.6196E-05
113 1 VOIDRA_1_21 -3.8332E-06
113 1 VOIDRA_1_22 -3.8385E-06
113 1 VOIDRA_1_23 -3.8436E-06
113 1 VOIDRA_1_24 -3.8489E-06
113 1 VOIDRA_1_25 -9.5457E-06
113 1 VOIDRA_1_26 -1.1014E-06
113 1 VOIDRA_1_27 -4.0510E-07
113 1 VOIDRA_1_28 -1.4608E-08
113 1 ADOP__chan2 -1.053E-03
113 1 BDOP__chan2 -1.088E-03
113 1 VOIDRA_2_01 5.1822E-06
113 1 VOIDRA_2_02 5.1928E-06
113 1 VOIDRA_2_03 5.2033E-06
113 1 VOIDRA_2_04 5.2140E-06
113 1 VOIDRA_2_05 2.9609E-05
113 1 VOIDRA_2_06 2.9667E-05
113 1 VOIDRA_2_07 2.9724E-05
113 1 VOIDRA_2_08 2.9782E-05
113 1 VOIDRA_2_09 3.7340E-05
113 1 VOIDRA_2_10 3.7417E-05
```

265	113	1	VOIDRA_2_11	3.7496E-05
266	113	1	VOIDRA_2_12	3.7574E-05
267	113	1	VOIDRA_2_13	3.0055E-05
268	113	1	VOIDRA_2_14	3.0113E-05
269	113	1	VOIDRA_2_15	3.0171E-05
270	113	1	VOIDRA_2_16	3.0230E-05
271	113	1	VOIDRA_2_17	1.3245E-05
272	113	1	VOIDRA_2_18	1.3265E-05
273	113	1	VOIDRA_2_19	1.3285E-05
274	113	1	VOIDRA_2_20	1.3305E-05
275	113	1	VOIDRA_2_21	-4.7477E-06
276	113	1	VOIDRA_2_22	-4.7535E-06
277	113	1	VOIDRA_2_23	-4.7593E-06
278	113	1	VOIDRA_2_24	-4.7652E-06
279	113	1	VOIDRA_2_25	-6.6385E-06
280	113	1	VOIDRA_2_26	-7.2950E-07
281	113	1	VOIDRA_2_27	-2.7676E-07
282	113	1	VOIDRA_2_28	-1.0307E-08
283	113	1	ADOP__chan3	-8.468E-04
284	113	1	BDOP__chan3	-8.826E-04
285	113	1	VOIDRA_3_01	-2.8397E-06
286	113	1	VOIDRA_3_02	-2.8442E-06
287	113	1	VOIDRA_3_03	-2.8488E-06
288	113	1	VOIDRA_3_04	-2.8533E-06
289	113	1	VOIDRA_3_05	2.3416E-06
290	113	1	VOIDRA_3_06	2.3462E-06
291	113	1	VOIDRA_3_07	2.3509E-06
292	113	1	VOIDRA_3_08	2.3556E-06
293	113	1	VOIDRA_3_09	4.5742E-06
294	113	1	VOIDRA_3_10	4.5841E-06
295	113	1	VOIDRA_3_11	4.5940E-06
296	113	1	VOIDRA_3_12	4.6039E-06
297	113	1	VOIDRA_3_13	3.2255E-06
298	113	1	VOIDRA_3_14	3.2320E-06
299	113	1	VOIDRA_3_15	3.2385E-06
300	113	1	VOIDRA_3_16	3.2451E-06
301	113	1	VOIDRA_3_17	-4.2236E-07
302	113	1	VOIDRA_3_18	-4.2303E-07
303	113	1	VOIDRA_3_19	-4.2371E-07
304	113	1	VOIDRA_3_20	-4.2438E-07
305	113	1	VOIDRA_3_21	-3.3444E-06
306	113	1	VOIDRA_3_22	-3.3477E-06
307	113	1	VOIDRA_3_23	-3.3511E-06
308	113	1	VOIDRA_3_24	-3.3545E-06
309	113	1	VOIDRA_3_25	-2.9926E-06

310	113	1	VOIDRA_3_26	−4.6749E−07
311	113	1	VOIDRA_3_27	−1.7245E−07
312	113	1	VOIDRA_3_28	−7.2686E−09
313	113	1	ADOP__chan5	−5.945E−05
314	113	1	BDOP__chan5	−6.123E−05
315	113	1	VOIDRA_5_01	2.4389E−06
316	113	1	VOIDRA_5_02	2.4441E−06
317	113	1	VOIDRA_5_03	2.4492E−06
318	113	1	VOIDRA_5_04	2.4544E−06
319	113	1	VOIDRA_5_05	2.3932E−05
320	113	1	VOIDRA_5_06	2.3980E−05
321	113	1	VOIDRA_5_07	2.4029E−05
322	113	1	VOIDRA_5_08	2.4078E−05
323	113	1	VOIDRA_5_09	3.1191E−05
324	113	1	VOIDRA_5_10	3.1259E−05
325	113	1	VOIDRA_5_11	3.1328E−05
326	113	1	VOIDRA_5_12	3.1396E−05
327	113	1	VOIDRA_5_13	2.5496E−05
328	113	1	VOIDRA_5_14	2.5548E−05
329	113	1	VOIDRA_5_15	2.5600E−05
330	113	1	VOIDRA_5_16	2.5654E−05
331	113	1	VOIDRA_5_17	1.1568E−05
332	113	1	VOIDRA_5_18	1.1587E−05
333	113	1	VOIDRA_5_19	1.1605E−05
334	113	1	VOIDRA_5_20	1.1625E−05
335	113	1	VOIDRA_5_21	−4.5075E−06
336	113	1	VOIDRA_5_22	−4.5139E−06
337	113	1	VOIDRA_5_23	−4.5203E−06
338	113	1	VOIDRA_5_24	−4.5268E−06
339	113	1	VOIDRA_5_25	−6.6163E−06
340	113	1	VOIDRA_5_26	−6.9575E−07
341	113	1	VOIDRA_5_27	−2.4808E−07
342	113	1	VOIDRA_5_28	−1.1107E−08
343	113	1	EXPCFFmult	1.330843
344	113	1	_RDEXPCvar	−6.658E−04
345	113	1	_CRDLEL_	−1.622E+01
346	113	1	_CRDLEQ_	−2.141E+01
347	113	2	ADOP__chan1	−2.271E−03
348	113	2	BDOP__chan1	−1.654E−03
349	113	2	VOIDRA_1_01	1.7357E−05
350	113	2	VOIDRA_1_02	1.7395E−05
351	113	2	VOIDRA_1_03	1.7433E−05
352	113	2	VOIDRA_1_04	1.7473E−05
353	113	2	VOIDRA_1_05	6.5404E−05
354	113	2	VOIDRA_1_06	6.5532E−05

355	113	2	VOIDRA_1_07	6.5658E−05
356	113	2	VOIDRA_1_08	6.5787E−05
357	113	2	VOIDRA_1_09	7.8382E−05
358	113	2	VOIDRA_1_10	7.8545E−05
359	113	2	VOIDRA_1_11	7.8707E−05
360	113	2	VOIDRA_1_12	7.8871E−05
361	113	2	VOIDRA_1_13	6.3815E−05
362	113	2	VOIDRA_1_14	6.3936E−05
363	113	2	VOIDRA_1_15	6.4059E−05
364	113	2	VOIDRA_1_16	6.4182E−05
365	113	2	VOIDRA_1_17	3.2390E−05
366	113	2	VOIDRA_1_18	3.2437E−05
367	113	2	VOIDRA_1_19	3.2486E−05
368	113	2	VOIDRA_1_20	3.2535E−05
369	113	2	VOIDRA_1_21	−4.7608E−06
370	113	2	VOIDRA_1_22	−4.7673E−06
371	113	2	VOIDRA_1_23	−4.7737E−06
372	113	2	VOIDRA_1_24	−4.7802E−06
373	113	2	VOIDRA_1_25	−1.1855E−05
374	113	2	VOIDRA_1_26	−1.3679E−06
375	113	2	VOIDRA_1_27	−5.0312E−07
376	113	2	VOIDRA_1_28	−1.8142E−08
377	113	2	ADOP__chan2	−7.129E−04
378	113	2	BDOP__chan2	−7.368E−04
379	113	2	VOIDRA_2_01	6.4361E−06
380	113	2	VOIDRA_2_02	6.4493E−06
381	113	2	VOIDRA_2_03	6.4624E−06
382	113	2	VOIDRA_2_04	6.4756E−06
383	113	2	VOIDRA_2_05	3.6774E−05
384	113	2	VOIDRA_2_06	3.6846E−05
385	113	2	VOIDRA_2_07	3.6917E−05
386	113	2	VOIDRA_2_08	3.6989E−05
387	113	2	VOIDRA_2_09	4.6376E−05
388	113	2	VOIDRA_2_10	4.6471E−05
389	113	2	VOIDRA_2_11	4.6569E−05
390	113	2	VOIDRA_2_12	4.6666E−05
391	113	2	VOIDRA_2_13	3.7327E−05
392	113	2	VOIDRA_2_14	3.7399E−05
393	113	2	VOIDRA_2_15	3.7471E−05
394	113	2	VOIDRA_2_16	3.7545E−05
395	113	2	VOIDRA_2_17	1.6450E−05
396	113	2	VOIDRA_2_18	1.6474E−05
397	113	2	VOIDRA_2_19	1.6500E−05
398	113	2	VOIDRA_2_20	1.6524E−05
399	113	2	VOIDRA_2_21	−5.8965E−06

400	113	2	VOIDRA_2_22	−5.9037E−06
401	113	2	VOIDRA_2_23	−5.9109E−06
402	113	2	VOIDRA_2_24	−5.9182E−06
403	113	2	VOIDRA_2_25	−8.2449E−06
404	113	2	VOIDRA_2_26	−9.0601E−07
405	113	2	VOIDRA_2_27	−3.4373E−07
406	113	2	VOIDRA_2_28	−1.2800E−08
407	113	2	ADOP__chan3	−5.733E−04
408	113	2	BDOP__chan3	−5.976E−04
409	113	2	VOIDRA_3_01	−3.5269E−06
410	113	2	VOIDRA_3_02	−3.5325E−06
411	113	2	VOIDRA_3_03	−3.5382E−06
412	113	2	VOIDRA_3_04	−3.5437E−06
413	113	2	VOIDRA_3_05	2.9082E−06
414	113	2	VOIDRA_3_06	2.9139E−06
415	113	2	VOIDRA_3_07	2.9197E−06
416	113	2	VOIDRA_3_08	2.9256E−06
417	113	2	VOIDRA_3_09	5.6811E−06
418	113	2	VOIDRA_3_10	5.6933E−06
419	113	2	VOIDRA_3_11	5.7056E−06
420	113	2	VOIDRA_3_12	5.7179E−06
421	113	2	VOIDRA_3_13	4.0060E−06
422	113	2	VOIDRA_3_14	4.0140E−06
423	113	2	VOIDRA_3_15	4.0221E−06
424	113	2	VOIDRA_3_16	4.0303E−06
425	113	2	VOIDRA_3_17	−5.2456E−07
426	113	2	VOIDRA_3_18	−5.2539E−07
427	113	2	VOIDRA_3_19	−5.2623E−07
428	113	2	VOIDRA_3_20	−5.2707E−07
429	113	2	VOIDRA_3_21	−4.1537E−06
430	113	2	VOIDRA_3_22	−4.1578E−06
431	113	2	VOIDRA_3_23	−4.1620E−06
432	113	2	VOIDRA_3_24	−4.1661E−06
433	113	2	VOIDRA_3_25	−3.7167E−06
434	113	2	VOIDRA_3_26	−5.8060E−07
435	113	2	VOIDRA_3_27	−2.1418E−07
436	113	2	VOIDRA_3_28	−9.0274E−09
437	113	2	ADOP__chan5	−4.025E−05
438	113	2	BDOP__chan5	−4.146E−05
439	113	2	VOIDRA_5_01	3.0291E−06
440	113	2	VOIDRA_5_02	3.0355E−06
441	113	2	VOIDRA_5_03	3.0419E−06
442	113	2	VOIDRA_5_04	3.0482E−06
443	113	2	VOIDRA_5_05	2.9722E−05
444	113	2	VOIDRA_5_06	2.9783E−05

445	113	2	VOIDRA_5_07	2.9843E−05
446	113	2	VOIDRA_5_08	2.9904E−05
447	113	2	VOIDRA_5_09	3.8738E−05
448	113	2	VOIDRA_5_10	3.8823E−05
449	113	2	VOIDRA_5_11	3.8908E−05
450	113	2	VOIDRA_5_12	3.8993E−05
451	113	2	VOIDRA_5_13	3.1666E−05
452	113	2	VOIDRA_5_14	3.1730E−05
453	113	2	VOIDRA_5_15	3.1795E−05
454	113	2	VOIDRA_5_16	3.1861E−05
455	113	2	VOIDRA_5_17	1.4367E−05
456	113	2	VOIDRA_5_18	1.4390E−05
457	113	2	VOIDRA_5_19	1.4414E−05
458	113	2	VOIDRA_5_20	1.4438E−05
459	113	2	VOIDRA_5_21	−5.5982E−06
460	113	2	VOIDRA_5_22	−5.6061E−06
461	113	2	VOIDRA_5_23	−5.6141E−06
462	113	2	VOIDRA_5_24	−5.6222E−06
463	113	2	VOIDRA_5_25	−8.2172E−06
464	113	2	VOIDRA_5_26	−8.6410E−07
465	113	2	VOIDRA_5_27	−3.0811E−07
466	113	2	VOIDRA_5_28	−1.3794E−08
467	113	2	EXPCFFmult	1.385226
468	113	2	_RDEXPCvar	−4.046E−04
469	113	2	_CRDLEL_	−1.931E+01
470	113	2	_CRDLEQ_	−2.549E+01
471	113	3	ADOP__chan1	−2.788E−03
472	113	3	BDOP__chan1	−2.030E−03
473	113	3	VOIDRA_1_01	1.5874E−05
474	113	3	VOIDRA_1_02	1.5909E−05
475	113	3	VOIDRA_1_03	1.5944E−05
476	113	3	VOIDRA_1_04	1.5980E−05
477	113	3	VOIDRA_1_05	5.9816E−05
478	113	3	VOIDRA_1_06	5.9933E−05
479	113	3	VOIDRA_1_07	6.0049E−05
480	113	3	VOIDRA_1_08	6.0167E−05
481	113	3	VOIDRA_1_09	7.1686E−05
482	113	3	VOIDRA_1_10	7.1834E−05
483	113	3	VOIDRA_1_11	7.1983E−05
484	113	3	VOIDRA_1_12	7.2133E−05
485	113	3	VOIDRA_1_13	5.8363E−05
486	113	3	VOIDRA_1_14	5.8474E−05
487	113	3	VOIDRA_1_15	5.8586E−05
488	113	3	VOIDRA_1_16	5.8699E−05
489	113	3	VOIDRA_1_17	2.9623E−05

490	113	3	VOIDRA_1_18	2.9666E−05
491	113	3	VOIDRA_1_19	2.9711E−05
492	113	3	VOIDRA_1_20	2.9755E−05
493	113	3	VOIDRA_1_21	−4.3540E−06
494	113	3	VOIDRA_1_22	−4.3600E−06
495	113	3	VOIDRA_1_23	−4.3658E−06
496	113	3	VOIDRA_1_24	−4.3718E−06
497	113	3	VOIDRA_1_25	−1.0843E−05
498	113	3	VOIDRA_1_26	−1.2510E−06
499	113	3	VOIDRA_1_27	−4.6014E−07
500	113	3	VOIDRA_1_28	−1.6592E−08
501	113	3	ADOP__chan2	−8.751E−04
502	113	3	BDOP__chan2	−9.044E−04
503	113	3	VOIDRA_2_01	5.8863E−06
504	113	3	VOIDRA_2_02	5.8983E−06
505	113	3	VOIDRA_2_03	5.9103E−06
506	113	3	VOIDRA_2_04	5.9224E−06
507	113	3	VOIDRA_2_05	3.3632E−05
508	113	3	VOIDRA_2_06	3.3698E−05
509	113	3	VOIDRA_2_07	3.3763E−05
510	113	3	VOIDRA_2_08	3.3829E−05
511	113	3	VOIDRA_2_09	4.2414E−05
512	113	3	VOIDRA_2_10	4.2501E−05
513	113	3	VOIDRA_2_11	4.2590E−05
514	113	3	VOIDRA_2_12	4.2679E−05
515	113	3	VOIDRA_2_13	3.4138E−05
516	113	3	VOIDRA_2_14	3.4204E−05
517	113	3	VOIDRA_2_15	3.4270E−05
518	113	3	VOIDRA_2_16	3.4337E−05
519	113	3	VOIDRA_2_17	1.5045E−05
520	113	3	VOIDRA_2_18	1.5067E−05
521	113	3	VOIDRA_2_19	1.5090E−05
522	113	3	VOIDRA_2_20	1.5113E−05
523	113	3	VOIDRA_2_21	−5.3927E−06
524	113	3	VOIDRA_2_22	−5.3993E−06
525	113	3	VOIDRA_2_23	−5.4059E−06
526	113	3	VOIDRA_2_24	−5.4126E−06
527	113	3	VOIDRA_2_25	−7.5405E−06
528	113	3	VOIDRA_2_26	−8.2861E−07
529	113	3	VOIDRA_2_27	−3.1436E−07
530	113	3	VOIDRA_2_28	−1.1707E−08
531	113	3	ADOP__chan3	−7.038E−04
532	113	3	BDOP__chan3	−7.335E−04
533	113	3	VOIDRA_3_01	−3.2256E−06
534	113	3	VOIDRA_3_02	−3.2307E−06

535	113	3	VOIDRA_3_03	−3.2359E−06
536	113	3	VOIDRA_3_04	−3.2410E−06
537	113	3	VOIDRA_3_05	2.6597E−06
538	113	3	VOIDRA_3_06	2.6649E−06
539	113	3	VOIDRA_3_07	2.6703E−06
540	113	3	VOIDRA_3_08	2.6757E−06
541	113	3	VOIDRA_3_09	5.1957E−06
542	113	3	VOIDRA_3_10	5.2069E−06
543	113	3	VOIDRA_3_11	5.2182E−06
544	113	3	VOIDRA_3_12	5.2294E−06
545	113	3	VOIDRA_3_13	3.6637E−06
546	113	3	VOIDRA_3_14	3.6711E−06
547	113	3	VOIDRA_3_15	3.6785E−06
548	113	3	VOIDRA_3_16	3.6860E−06
549	113	3	VOIDRA_3_17	−4.7974E−07
550	113	3	VOIDRA_3_18	−4.8051E−07
551	113	3	VOIDRA_3_19	−4.8127E−07
552	113	3	VOIDRA_3_20	−4.8204E−07
553	113	3	VOIDRA_3_21	−3.7988E−06
554	113	3	VOIDRA_3_22	−3.8026E−06
555	113	3	VOIDRA_3_23	−3.8064E−06
556	113	3	VOIDRA_3_24	−3.8102E−06
557	113	3	VOIDRA_3_25	−3.3992E−06
558	113	3	VOIDRA_3_26	−5.3100E−07
559	113	3	VOIDRA_3_27	−1.9588E−07
560	113	3	VOIDRA_3_28	−8.2561E−09
561	113	3	ADOP__chan5	−4.941E−05
562	113	3	BDOP__chan5	−5.089E−05
563	113	3	VOIDRA_5_01	2.7703E−06
564	113	3	VOIDRA_5_02	2.7761E−06
565	113	3	VOIDRA_5_03	2.7820E−06
566	113	3	VOIDRA_5_04	2.7878E−06
567	113	3	VOIDRA_5_05	2.7183E−05
568	113	3	VOIDRA_5_06	2.7238E−05
569	113	3	VOIDRA_5_07	2.7294E−05
570	113	3	VOIDRA_5_08	2.7349E−05
571	113	3	VOIDRA_5_09	3.5429E−05
572	113	3	VOIDRA_5_10	3.5506E−05
573	113	3	VOIDRA_5_11	3.5584E−05
574	113	3	VOIDRA_5_12	3.5662E−05
575	113	3	VOIDRA_5_13	2.8960E−05
576	113	3	VOIDRA_5_14	2.9019E−05
577	113	3	VOIDRA_5_15	2.9078E−05
578	113	3	VOIDRA_5_16	2.9139E−05
579	113	3	VOIDRA_5_17	1.3140E−05

580	113	3	VOIDRA_5_18	1.3161E−05
581	113	3	VOIDRA_5_19	1.3182E−05
582	113	3	VOIDRA_5_20	1.3205E−05
583	113	3	VOIDRA_5_21	−5.1199E−06
584	113	3	VOIDRA_5_22	−5.1272E−06
585	113	3	VOIDRA_5_23	−5.1345E−06
586	113	3	VOIDRA_5_24	−5.1418E−06
587	113	3	VOIDRA_5_25	−7.5152E−06
588	113	3	VOIDRA_5_26	−7.9028E−07
589	113	3	VOIDRA_5_27	−2.8179E−07
590	113	3	VOIDRA_5_28	−1.2616E−08
591	113	3	EXPCFFmult	1.577364
592	113	3	_RDEXPCvar	−4.636E−04
593	113	3	_CRDLEL_	−1.416E+01
594	113	3	_CRDLEQ_	−1.869E+01
595	113	4	ADOP__chan1	−2.078E−03
596	113	4	BDOP__chan1	−1.514E−03
597	113	4	VOIDRA_1_01	1.4202E−05
598	113	4	VOIDRA_1_02	1.4234E−05
599	113	4	VOIDRA_1_03	1.4265E−05
600	113	4	VOIDRA_1_04	1.4297E−05
601	113	4	VOIDRA_1_05	5.3517E−05
602	113	4	VOIDRA_1_06	5.3622E−05
603	113	4	VOIDRA_1_07	5.3725E−05
604	113	4	VOIDRA_1_08	5.3831E−05
605	113	4	VOIDRA_1_09	6.4137E−05
606	113	4	VOIDRA_1_10	6.4270E−05
607	113	4	VOIDRA_1_11	6.4403E−05
608	113	4	VOIDRA_1_12	6.4537E−05
609	113	4	VOIDRA_1_13	5.2217E−05
610	113	4	VOIDRA_1_14	5.2316E−05
611	113	4	VOIDRA_1_15	5.2417E−05
612	113	4	VOIDRA_1_16	5.2518E−05
613	113	4	VOIDRA_1_17	2.6503E−05
614	113	4	VOIDRA_1_18	2.6542E−05
615	113	4	VOIDRA_1_19	2.6582E−05
616	113	4	VOIDRA_1_20	2.6622E−05
617	113	4	VOIDRA_1_21	−3.8955E−06
618	113	4	VOIDRA_1_22	−3.9009E−06
619	113	4	VOIDRA_1_23	−3.9061E−06
620	113	4	VOIDRA_1_24	−3.9114E−06
621	113	4	VOIDRA_1_25	−9.7008E−06
622	113	4	VOIDRA_1_26	−1.1193E−06
623	113	4	VOIDRA_1_27	−4.1169E−07
624	113	4	VOIDRA_1_28	−1.4845E−08

625	113	4	ADOP__chan2	−6.525E−04
626	113	4	BDOP__chan2	−6.743E−04
627	113	4	VOIDRA_2_01	5.2664E−06
628	113	4	VOIDRA_2_02	5.2771E−06
629	113	4	VOIDRA_2_03	5.2879E−06
630	113	4	VOIDRA_2_04	5.2987E−06
631	113	4	VOIDRA_2_05	3.0091E−05
632	113	4	VOIDRA_2_06	3.0150E−05
633	113	4	VOIDRA_2_07	3.0208E−05
634	113	4	VOIDRA_2_08	3.0267E−05
635	113	4	VOIDRA_2_09	3.7947E−05
636	113	4	VOIDRA_2_10	3.8025E−05
637	113	4	VOIDRA_2_11	3.8105E−05
638	113	4	VOIDRA_2_12	3.8185E−05
639	113	4	VOIDRA_2_13	3.0543E−05
640	113	4	VOIDRA_2_14	3.0602E−05
641	113	4	VOIDRA_2_15	3.0661E−05
642	113	4	VOIDRA_2_16	3.0721E−05
643	113	4	VOIDRA_2_17	1.3460E−05
644	113	4	VOIDRA_2_18	1.3480E−05
645	113	4	VOIDRA_2_19	1.3501E−05
646	113	4	VOIDRA_2_20	1.3521E−05
647	113	4	VOIDRA_2_21	−4.8248E−06
648	113	4	VOIDRA_2_22	−4.8307E−06
649	113	4	VOIDRA_2_23	−4.8366E−06
650	113	4	VOIDRA_2_24	−4.8426E−06
651	113	4	VOIDRA_2_25	−6.7464E−06
652	113	4	VOIDRA_2_26	−7.4135E−07
653	113	4	VOIDRA_2_27	−2.8126E−07
654	113	4	VOIDRA_2_28	−1.0474E−08
655	113	4	ADOP__chan3	−5.247E−04
656	113	4	BDOP__chan3	−5.469E−04
657	113	4	VOIDRA_3_01	−2.8859E−06
658	113	4	VOIDRA_3_02	−2.8905E−06
659	113	4	VOIDRA_3_03	−2.8951E−06
660	113	4	VOIDRA_3_04	−2.8997E−06
661	113	4	VOIDRA_3_05	2.3796E−06
662	113	4	VOIDRA_3_06	2.3843E−06
663	113	4	VOIDRA_3_07	2.3891E−06
664	113	4	VOIDRA_3_08	2.3939E−06
665	113	4	VOIDRA_3_09	4.6486E−06
666	113	4	VOIDRA_3_10	4.6586E−06
667	113	4	VOIDRA_3_11	4.6687E−06
668	113	4	VOIDRA_3_12	4.6787E−06
669	113	4	VOIDRA_3_13	3.2779E−06

670	113	4	VOIDRA_3_14	3.2845E−06
671	113	4	VOIDRA_3_15	3.2911E−06
672	113	4	VOIDRA_3_16	3.2978E−06
673	113	4	VOIDRA_3_17	−4.2922E−07
674	113	4	VOIDRA_3_18	−4.2991E−07
675	113	4	VOIDRA_3_19	−4.3059E−07
676	113	4	VOIDRA_3_20	−4.3128E−07
677	113	4	VOIDRA_3_21	−3.3988E−06
678	113	4	VOIDRA_3_22	−3.4021E−06
679	113	4	VOIDRA_3_23	−3.4056E−06
680	113	4	VOIDRA_3_24	−3.4090E−06
681	113	4	VOIDRA_3_25	−3.0412E−06
682	113	4	VOIDRA_3_26	−4.7508E−07
683	113	4	VOIDRA_3_27	−1.7525E−07
684	113	4	VOIDRA_3_28	−7.3867E−09
685	113	4	ADOP__chan5	−3.684E−05
686	113	4	BDOP__chan5	−3.794E−05
687	113	4	VOIDRA_5_01	2.4786E−06
688	113	4	VOIDRA_5_02	2.4838E−06
689	113	4	VOIDRA_5_03	2.4890E−06
690	113	4	VOIDRA_5_04	2.4942E−06
691	113	4	VOIDRA_5_05	2.4321E−05
692	113	4	VOIDRA_5_06	2.4370E−05
693	113	4	VOIDRA_5_07	2.4419E−05
694	113	4	VOIDRA_5_08	2.4469E−05
695	113	4	VOIDRA_5_09	3.1698E−05
696	113	4	VOIDRA_5_10	3.1767E−05
697	113	4	VOIDRA_5_11	3.1837E−05
698	113	4	VOIDRA_5_12	3.1906E−05
699	113	4	VOIDRA_5_13	2.5911E−05
700	113	4	VOIDRA_5_14	2.5963E−05
701	113	4	VOIDRA_5_15	2.6016E−05
702	113	4	VOIDRA_5_16	2.6070E−05
703	113	4	VOIDRA_5_17	1.1756E−05
704	113	4	VOIDRA_5_18	1.1775E−05
705	113	4	VOIDRA_5_19	1.1794E−05
706	113	4	VOIDRA_5_20	1.1814E−05
707	113	4	VOIDRA_5_21	−4.5808E−06
708	113	4	VOIDRA_5_22	−4.5872E−06
709	113	4	VOIDRA_5_23	−4.5938E−06
710	113	4	VOIDRA_5_24	−4.6004E−06
711	113	4	VOIDRA_5_25	−6.7238E−06
712	113	4	VOIDRA_5_26	−7.0706E−07
713	113	4	VOIDRA_5_27	−2.5212E−07
714	113	4	VOIDRA_5_28	−1.1287E−08

715	113	4	EXPCFFmult	1.266054
716	113	4	_RDEXPCvar	−4.604E−04
717	113	4	_CRDLEL_	−1.646E+01
718	113	4	_CRDLEQ_	−2.172E+01
719	113	5	ADOP__chan1	−2.134E−03
720	113	5	BDOP__chan1	−1.554E−03
721	113	5	VOIDRA_1_01	1.7366E−05
722	113	5	VOIDRA_1_02	1.7404E−05
723	113	5	VOIDRA_1_03	1.7442E−05
724	113	5	VOIDRA_1_04	1.7482E−05
725	113	5	VOIDRA_1_05	6.5438E−05
726	113	5	VOIDRA_1_06	6.5565E−05
727	113	5	VOIDRA_1_07	6.5692E−05
728	113	5	VOIDRA_1_08	6.5821E−05
729	113	5	VOIDRA_1_09	7.8422E−05
730	113	5	VOIDRA_1_10	7.8585E−05
731	113	5	VOIDRA_1_11	7.8748E−05
732	113	5	VOIDRA_1_12	7.8912E−05
733	113	5	VOIDRA_1_13	6.3848E−05
734	113	5	VOIDRA_1_14	6.3969E−05
735	113	5	VOIDRA_1_15	6.4092E−05
736	113	5	VOIDRA_1_16	6.4215E−05
737	113	5	VOIDRA_1_17	3.2407E−05
738	113	5	VOIDRA_1_18	3.2454E−05
739	113	5	VOIDRA_1_19	3.2503E−05
740	113	5	VOIDRA_1_20	3.2552E−05
741	113	5	VOIDRA_1_21	−4.7632E−06
742	113	5	VOIDRA_1_22	−4.7698E−06
743	113	5	VOIDRA_1_23	−4.7761E−06
744	113	5	VOIDRA_1_24	−4.7827E−06
745	113	5	VOIDRA_1_25	−1.1862E−05
746	113	5	VOIDRA_1_26	−1.3686E−06
747	113	5	VOIDRA_1_27	−5.0338E−07
748	113	5	VOIDRA_1_28	−1.8152E−08
749	113	5	ADOP__chan2	−6.698E−04
750	113	5	BDOP__chan2	−6.923E−04
751	113	5	VOIDRA_2_01	6.4394E−06
752	113	5	VOIDRA_2_02	6.4526E−06
753	113	5	VOIDRA_2_03	6.4657E−06
754	113	5	VOIDRA_2_04	6.4790E−06
755	113	5	VOIDRA_2_05	3.6793E−05
756	113	5	VOIDRA_2_06	3.6865E−05
757	113	5	VOIDRA_2_07	3.6936E−05
758	113	5	VOIDRA_2_08	3.7008E−05
759	113	5	VOIDRA_2_09	4.6400E−05

760	113	5	VOIDRA_2_10	4.6495E−05
761	113	5	VOIDRA_2_11	4.6593E−05
762	113	5	VOIDRA_2_12	4.6690E−05
763	113	5	VOIDRA_2_13	3.7347E−05
764	113	5	VOIDRA_2_14	3.7419E−05
765	113	5	VOIDRA_2_15	3.7491E−05
766	113	5	VOIDRA_2_16	3.7564E−05
767	113	5	VOIDRA_2_17	1.6459E−05
768	113	5	VOIDRA_2_18	1.6483E−05
769	113	5	VOIDRA_2_19	1.6509E−05
770	113	5	VOIDRA_2_20	1.6533E−05
771	113	5	VOIDRA_2_21	−5.8995E−06
772	113	5	VOIDRA_2_22	−5.9067E−06
773	113	5	VOIDRA_2_23	−5.9139E−06
774	113	5	VOIDRA_2_24	−5.9213E−06
775	113	5	VOIDRA_2_25	−8.2491E−06
776	113	5	VOIDRA_2_26	−9.0648E−07
777	113	5	VOIDRA_2_27	−3.4390E−07
778	113	5	VOIDRA_2_28	−1.2807E−08
779	113	5	ADOP__chan3	−5.387E−04
780	113	5	BDOP__chan3	−5.615E−04
781	113	5	VOIDRA_3_01	−3.5287E−06
782	113	5	VOIDRA_3_02	−3.5343E−06
783	113	5	VOIDRA_3_03	−3.5400E−06
784	113	5	VOIDRA_3_04	−3.5456E−06
785	113	5	VOIDRA_3_05	2.9097E−06
786	113	5	VOIDRA_3_06	2.9154E−06
787	113	5	VOIDRA_3_07	2.9212E−06
788	113	5	VOIDRA_3_08	2.9271E−06
789	113	5	VOIDRA_3_09	5.6840E−06
790	113	5	VOIDRA_3_10	5.6962E−06
791	113	5	VOIDRA_3_11	5.7086E−06
792	113	5	VOIDRA_3_12	5.7209E−06
793	113	5	VOIDRA_3_13	4.0081E−06
794	113	5	VOIDRA_3_14	4.0161E−06
795	113	5	VOIDRA_3_15	4.0242E−06
796	113	5	VOIDRA_3_16	4.0324E−06
797	113	5	VOIDRA_3_17	−5.2483E−07
798	113	5	VOIDRA_3_18	−5.2567E−07
799	113	5	VOIDRA_3_19	−5.2650E−07
800	113	5	VOIDRA_3_20	−5.2734E−07
801	113	5	VOIDRA_3_21	−4.1559E−06
802	113	5	VOIDRA_3_22	−4.1599E−06
803	113	5	VOIDRA_3_23	−4.1641E−06
804	113	5	VOIDRA_3_24	−4.1683E−06

805	113	5	VOIDRA_3_25	−3.7186E−06
806	113	5	VOIDRA_3_26	−5.8090E−07
807	113	5	VOIDRA_3_27	−2.1429E−07
808	113	5	VOIDRA_3_28	−9.0320E−09
809	113	5	ADOP__chan5	−3.782E−05
810	113	5	BDOP__chan5	−3.895E−05
811	113	5	VOIDRA_5_01	3.0306E−06
812	113	5	VOIDRA_5_02	3.0370E−06
813	113	5	VOIDRA_5_03	3.0434E−06
814	113	5	VOIDRA_5_04	3.0498E−06
815	113	5	VOIDRA_5_05	2.9738E−05
816	113	5	VOIDRA_5_06	2.9798E−05
817	113	5	VOIDRA_5_07	2.9859E−05
818	113	5	VOIDRA_5_08	2.9919E−05
819	113	5	VOIDRA_5_09	3.8758E−05
820	113	5	VOIDRA_5_10	3.8843E−05
821	113	5	VOIDRA_5_11	3.8928E−05
822	113	5	VOIDRA_5_12	3.9013E−05
823	113	5	VOIDRA_5_13	3.1682E−05
824	113	5	VOIDRA_5_14	3.1746E−05
825	113	5	VOIDRA_5_15	3.1811E−05
826	113	5	VOIDRA_5_16	3.1877E−05
827	113	5	VOIDRA_5_17	1.4375E−05
828	113	5	VOIDRA_5_18	1.4398E−05
829	113	5	VOIDRA_5_19	1.4421E−05
830	113	5	VOIDRA_5_20	1.4446E−05
831	113	5	VOIDRA_5_21	−5.6011E−06
832	113	5	VOIDRA_5_22	−5.6090E−06
833	113	5	VOIDRA_5_23	−5.6170E−06
834	113	5	VOIDRA_5_24	−5.6251E−06
835	113	5	VOIDRA_5_25	−8.2215E−06
836	113	5	VOIDRA_5_26	−8.6455E−07
837	113	5	VOIDRA_5_27	−3.0827E−07
838	113	5	VOIDRA_5_28	−1.3801E−08
839	113	5	EXPCFFmult	1.311270
840	113	5	_RDEXPCvar	−4.068E−04
841	113	5	_CRDLEL_	−1.552E+01
842	113	5	_CRDLEQ_	−2.048E+01
843	113	6	ADOP__chan1	−2.741E−03
844	113	6	BDOP__chan1	−1.996E−03
845	113	6	VOIDRA_1_01	1.1985E−05
846	113	6	VOIDRA_1_02	1.2012E−05
847	113	6	VOIDRA_1_03	1.2038E−05
848	113	6	VOIDRA_1_04	1.2065E−05
849	113	6	VOIDRA_1_05	4.5163E−05

850	113	6	VOIDRA_1_06	4.5251E−05
851	113	6	VOIDRA_1_07	4.5338E−05
852	113	6	VOIDRA_1_08	4.5427E−05
853	113	6	VOIDRA_1_09	5.4124E−05
854	113	6	VOIDRA_1_10	5.4237E−05
855	113	6	VOIDRA_1_11	5.4349E−05
856	113	6	VOIDRA_1_12	5.4462E−05
857	113	6	VOIDRA_1_13	4.4065E−05
858	113	6	VOIDRA_1_14	4.4149E−05
859	113	6	VOIDRA_1_15	4.4234E−05
860	113	6	VOIDRA_1_16	4.4319E−05
861	113	6	VOIDRA_1_17	2.2366E−05
862	113	6	VOIDRA_1_18	2.2399E−05
863	113	6	VOIDRA_1_19	2.2432E−05
864	113	6	VOIDRA_1_20	2.2466E−05
865	113	6	VOIDRA_1_21	−3.2874E−06
866	113	6	VOIDRA_1_22	−3.2919E−06
867	113	6	VOIDRA_1_23	−3.2963E−06
868	113	6	VOIDRA_1_24	−3.3008E−06
869	113	6	VOIDRA_1_25	−8.1864E−06
870	113	6	VOIDRA_1_26	−9.4457E−07
871	113	6	VOIDRA_1_27	−3.4742E−07
872	113	6	VOIDRA_1_28	−1.2528E−08
873	113	6	ADOP__chan2	−8.605E−04
874	113	6	BDOP__chan2	−8.894E−04
875	113	6	VOIDRA_2_01	4.4443E−06
876	113	6	VOIDRA_2_02	4.4533E−06
877	113	6	VOIDRA_2_03	4.4624E−06
878	113	6	VOIDRA_2_04	4.4715E−06
879	113	6	VOIDRA_2_05	2.5393E−05
880	113	6	VOIDRA_2_06	2.5443E−05
881	113	6	VOIDRA_2_07	2.5492E−05
882	113	6	VOIDRA_2_08	2.5542E−05
883	113	6	VOIDRA_2_09	3.2023E−05
884	113	6	VOIDRA_2_10	3.2089E−05
885	113	6	VOIDRA_2_11	3.2157E−05
886	113	6	VOIDRA_2_12	3.2224E−05
887	113	6	VOIDRA_2_13	2.5775E−05
888	113	6	VOIDRA_2_14	2.5825E−05
889	113	6	VOIDRA_2_15	2.5875E−05
890	113	6	VOIDRA_2_16	2.5925E−05
891	113	6	VOIDRA_2_17	1.1359E−05
892	113	6	VOIDRA_2_18	1.1376E−05
893	113	6	VOIDRA_2_19	1.1394E−05
894	113	6	VOIDRA_2_20	1.1410E−05

895	113	6	VOIDRA_2_21	−4.0716E−06
896	113	6	VOIDRA_2_22	−4.0766E−06
897	113	6	VOIDRA_2_23	−4.0816E−06
898	113	6	VOIDRA_2_24	−4.0866E−06
899	113	6	VOIDRA_2_25	−5.6933E−06
900	113	6	VOIDRA_2_26	−6.2562E−07
901	113	6	VOIDRA_2_27	−2.3735E−07
902	113	6	VOIDRA_2_28	−8.8389E−09
903	113	6	ADOP__chan3	−6.921E−04
904	113	6	BDOP__chan3	−7.213E−04
905	113	6	VOIDRA_3_01	−2.4354E−06
906	113	6	VOIDRA_3_02	−2.4392E−06
907	113	6	VOIDRA_3_03	−2.4432E−06
908	113	6	VOIDRA_3_04	−2.4470E−06
909	113	6	VOIDRA_3_05	2.0082E−06
910	113	6	VOIDRA_3_06	2.0121E−06
911	113	6	VOIDRA_3_07	2.0161E−06
912	113	6	VOIDRA_3_08	2.0202E−06
913	113	6	VOIDRA_3_09	3.9229E−06
914	113	6	VOIDRA_3_10	3.9313E−06
915	113	6	VOIDRA_3_11	3.9398E−06
916	113	6	VOIDRA_3_12	3.9483E−06
917	113	6	VOIDRA_3_13	2.7662E−06
918	113	6	VOIDRA_3_14	2.7717E−06
919	113	6	VOIDRA_3_15	2.7774E−06
920	113	6	VOIDRA_3_16	2.7830E−06
921	113	6	VOIDRA_3_17	−3.6222E−07
922	113	6	VOIDRA_3_18	−3.6279E−07
923	113	6	VOIDRA_3_19	−3.6337E−07
924	113	6	VOIDRA_3_20	−3.6395E−07
925	113	6	VOIDRA_3_21	−2.8682E−06
926	113	6	VOIDRA_3_22	−2.8710E−06
927	113	6	VOIDRA_3_23	−2.8739E−06
928	113	6	VOIDRA_3_24	−2.8768E−06
929	113	6	VOIDRA_3_25	−2.5664E−06
930	113	6	VOIDRA_3_26	−4.0092E−07
931	113	6	VOIDRA_3_27	−1.4789E−07
932	113	6	VOIDRA_3_28	−6.2336E−09
933	113	6	ADOP__chan5	−4.859E−05
934	113	6	BDOP__chan5	−5.004E−05
935	113	6	VOIDRA_5_01	2.0916E−06
936	113	6	VOIDRA_5_02	2.0960E−06
937	113	6	VOIDRA_5_03	2.1005E−06
938	113	6	VOIDRA_5_04	2.1049E−06
939	113	6	VOIDRA_5_05	2.0524E−05

940	113	6	VOIDRA_5_06	2.0566E−05
941	113	6	VOIDRA_5_07	2.0607E−05
942	113	6	VOIDRA_5_08	2.0649E−05
943	113	6	VOIDRA_5_09	2.6750E−05
944	113	6	VOIDRA_5_10	2.6808E−05
945	113	6	VOIDRA_5_11	2.6867E−05
946	113	6	VOIDRA_5_12	2.6925E−05
947	113	6	VOIDRA_5_13	2.1866E−05
948	113	6	VOIDRA_5_14	2.1910E−05
949	113	6	VOIDRA_5_15	2.1955E−05
950	113	6	VOIDRA_5_16	2.2001E−05
951	113	6	VOIDRA_5_17	9.9208E−06
952	113	6	VOIDRA_5_18	9.9369E−06
953	113	6	VOIDRA_5_19	9.9529E−06
954	113	6	VOIDRA_5_20	9.9698E−06
955	113	6	VOIDRA_5_21	−3.8657E−06
956	113	6	VOIDRA_5_22	−3.8711E−06
957	113	6	VOIDRA_5_23	−3.8767E−06
958	113	6	VOIDRA_5_24	−3.8822E−06
959	113	6	VOIDRA_5_25	−5.6742E−06
960	113	6	VOIDRA_5_26	−5.9668E−07
961	113	6	VOIDRA_5_27	−2.1276E−07
962	113	6	VOIDRA_5_28	−9.5251E−09
963	113	6	EXPCFFmult	1.624438
964	113	6	_RDEXPCvar	−2.460E−04
965	113	6	_CRDLEL_	−1.900E+01
966	113	6	_CRDLEQ_	−2.508E+01
967	113	7	ADOP__chan1	−3.586E−03
968	113	7	BDOP__chan1	−2.612E−03
969	113	7	VOIDRA_1_01	1.4019E−05
970	113	7	VOIDRA_1_02	1.4050E−05
971	113	7	VOIDRA_1_03	1.4081E−05
972	113	7	VOIDRA_1_04	1.4113E−05
973	113	7	VOIDRA_1_05	5.2828E−05
974	113	7	VOIDRA_1_06	5.2932E−05
975	113	7	VOIDRA_1_07	5.3034E−05
976	113	7	VOIDRA_1_08	5.3138E−05
977	113	7	VOIDRA_1_09	6.3311E−05
978	113	7	VOIDRA_1_10	6.3443E−05
979	113	7	VOIDRA_1_11	6.3574E−05
980	113	7	VOIDRA_1_12	6.3706E−05
981	113	7	VOIDRA_1_13	5.1545E−05
982	113	7	VOIDRA_1_14	5.1643E−05
983	113	7	VOIDRA_1_15	5.1742E−05
984	113	7	VOIDRA_1_16	5.1842E−05

985	113	7	VOIDRA_1_17	2.6162E−05
986	113	7	VOIDRA_1_18	2.6201E−05
987	113	7	VOIDRA_1_19	2.6240E−05
988	113	7	VOIDRA_1_20	2.6279E−05
989	113	7	VOIDRA_1_21	−3.8454E−06
990	113	7	VOIDRA_1_22	−3.8507E−06
991	113	7	VOIDRA_1_23	−3.8558E−06
992	113	7	VOIDRA_1_24	−3.8611E−06
993	113	7	VOIDRA_1_25	−9.5760E−06
994	113	7	VOIDRA_1_26	−1.1049E−06
995	113	7	VOIDRA_1_27	−4.0639E−07
996	113	7	VOIDRA_1_28	−1.4654E−08
997	113	7	ADOP__chan2	−1.126E−03
998	113	7	BDOP__chan2	−1.164E−03
999	113	7	VOIDRA_2_01	5.1986E−06
1000	113	7	VOIDRA_2_02	5.2092E−06
1001	113	7	VOIDRA_2_03	5.2198E−06
1002	113	7	VOIDRA_2_04	5.2305E−06
1003	113	7	VOIDRA_2_05	2.9703E−05
1004	113	7	VOIDRA_2_06	2.9762E−05
1005	113	7	VOIDRA_2_07	2.9819E−05
1006	113	7	VOIDRA_2_08	2.9877E−05
1007	113	7	VOIDRA_2_09	3.7459E−05
1008	113	7	VOIDRA_2_10	3.7536E−05
1009	113	7	VOIDRA_2_11	3.7615E−05
1010	113	7	VOIDRA_2_12	3.7694E−05
1011	113	7	VOIDRA_2_13	3.0150E−05
1012	113	7	VOIDRA_2_14	3.0208E−05
1013	113	7	VOIDRA_2_15	3.0267E−05
1014	113	7	VOIDRA_2_16	3.0326E−05
1015	113	7	VOIDRA_2_17	1.3287E−05
1016	113	7	VOIDRA_2_18	1.3307E−05
1017	113	7	VOIDRA_2_19	1.3327E−05
1018	113	7	VOIDRA_2_20	1.3347E−05
1019	113	7	VOIDRA_2_21	−4.7627E−06
1020	113	7	VOIDRA_2_22	−4.7685E−06
1021	113	7	VOIDRA_2_23	−4.7744E−06
1022	113	7	VOIDRA_2_24	−4.7803E−06
1023	113	7	VOIDRA_2_25	−6.6596E−06
1024	113	7	VOIDRA_2_26	−7.3181E−07
1025	113	7	VOIDRA_2_27	−2.7764E−07
1026	113	7	VOIDRA_2_28	−1.0339E−08
1027	113	7	ADOP__chan3	−9.054E−04
1028	113	7	BDOP__chan3	−9.437E−04
1029	113	7	VOIDRA_3_01	−2.8488E−06

1030	113	7	VOIDRA_3_02	−2.8533E−06
1031	113	7	VOIDRA_3_03	−2.8579E−06
1032	113	7	VOIDRA_3_04	−2.8624E−06
1033	113	7	VOIDRA_3_05	2.3490E−06
1034	113	7	VOIDRA_3_06	2.3536E−06
1035	113	7	VOIDRA_3_07	2.3583E−06
1036	113	7	VOIDRA_3_08	2.3631E−06
1037	113	7	VOIDRA_3_09	4.5888E−06
1038	113	7	VOIDRA_3_10	4.5986E−06
1039	113	7	VOIDRA_3_11	4.6086E−06
1040	113	7	VOIDRA_3_12	4.6185E−06
1041	113	7	VOIDRA_3_13	3.2357E−06
1042	113	7	VOIDRA_3_14	3.2422E−06
1043	113	7	VOIDRA_3_15	3.2488E−06
1044	113	7	VOIDRA_3_16	3.2554E−06
1045	113	7	VOIDRA_3_17	−4.2370E−07
1046	113	7	VOIDRA_3_18	−4.2437E−07
1047	113	7	VOIDRA_3_19	−4.2505E−07
1048	113	7	VOIDRA_3_20	−4.2573E−07
1049	113	7	VOIDRA_3_21	−3.3551E−06
1050	113	7	VOIDRA_3_22	−3.3583E−06
1051	113	7	VOIDRA_3_23	−3.3617E−06
1052	113	7	VOIDRA_3_24	−3.3651E−06
1053	113	7	VOIDRA_3_25	−3.0021E−06
1054	113	7	VOIDRA_3_26	−4.6897E−07
1055	113	7	VOIDRA_3_27	−1.7300E−07
1056	113	7	VOIDRA_3_28	−7.2916E−09
1057	113	7	ADOP__chan5	−6.357E−05
1058	113	7	BDOP__chan5	−6.547E−05
1059	113	7	VOIDRA_5_01	2.4467E−06
1060	113	7	VOIDRA_5_02	2.4518E−06
1061	113	7	VOIDRA_5_03	2.4570E−06
1062	113	7	VOIDRA_5_04	2.4621E−06
1063	113	7	VOIDRA_5_05	2.4008E−05
1064	113	7	VOIDRA_5_06	2.4056E−05
1065	113	7	VOIDRA_5_07	2.4105E−05
1066	113	7	VOIDRA_5_08	2.4154E−05
1067	113	7	VOIDRA_5_09	3.1290E−05
1068	113	7	VOIDRA_5_10	3.1358E−05
1069	113	7	VOIDRA_5_11	3.1427E−05
1070	113	7	VOIDRA_5_12	3.1496E−05
1071	113	7	VOIDRA_5_13	2.5577E−05
1072	113	7	VOIDRA_5_14	2.5629E−05
1073	113	7	VOIDRA_5_15	2.5681E−05
1074	113	7	VOIDRA_5_16	2.5735E−05

1075	113	7	VOIDRA_5_17	1.1605E−05
1076	113	7	VOIDRA_5_18	1.1624E−05
1077	113	7	VOIDRA_5_19	1.1642E−05
1078	113	7	VOIDRA_5_20	1.1662E−05
1079	113	7	VOIDRA_5_21	−4.5218E−06
1080	113	7	VOIDRA_5_22	−4.5282E−06
1081	113	7	VOIDRA_5_23	−4.5347E−06
1082	113	7	VOIDRA_5_24	−4.5412E−06
1083	113	7	VOIDRA_5_25	−6.6373E−06
1084	113	7	VOIDRA_5_26	−6.9796E−07
1085	113	7	VOIDRA_5_27	−2.4887E−07
1086	113	7	VOIDRA_5_28	−1.1142E−08
1087	113	7	EXPCFFmult	1.350664
1088	113	7	_RDEXPCvar	−5.114E−04
1089	113	7	_CRDLEL_	−1.743E+01
1090	113	7	_CRDLEQ_	−2.301E+01
1091	113	8	ADOP__chan1	−2.322E−03
1092	113	8	BDOP__chan1	−1.691E−03
1093	113	8	VOIDRA_1_01	1.3567E−05
1094	113	8	VOIDRA_1_02	1.3597E−05
1095	113	8	VOIDRA_1_03	1.3627E−05
1096	113	8	VOIDRA_1_04	1.3658E−05
1097	113	8	VOIDRA_1_05	5.1123E−05
1098	113	8	VOIDRA_1_06	5.1223E−05
1099	113	8	VOIDRA_1_07	5.1322E−05
1100	113	8	VOIDRA_1_08	5.1423E−05
1101	113	8	VOIDRA_1_09	6.1267E−05
1102	113	8	VOIDRA_1_10	6.1394E−05
1103	113	8	VOIDRA_1_11	6.1522E−05
1104	113	8	VOIDRA_1_12	6.1650E−05
1105	113	8	VOIDRA_1_13	4.9881E−05
1106	113	8	VOIDRA_1_14	4.9975E−05
1107	113	8	VOIDRA_1_15	5.0072E−05
1108	113	8	VOIDRA_1_16	5.0168E−05
1109	113	8	VOIDRA_1_17	2.5317E−05
1110	113	8	VOIDRA_1_18	2.5355E−05
1111	113	8	VOIDRA_1_19	2.5393E−05
1112	113	8	VOIDRA_1_20	2.5431E−05
1113	113	8	VOIDRA_1_21	−3.7213E−06
1114	113	8	VOIDRA_1_22	−3.7263E−06
1115	113	8	VOIDRA_1_23	−3.7313E−06
1116	113	8	VOIDRA_1_24	−3.7364E−06
1117	113	8	VOIDRA_1_25	−9.2668E−06
1118	113	8	VOIDRA_1_26	−1.0692E−06
1119	113	8	VOIDRA_1_27	−3.9327E−07

1120	113	8	VOIDRA_1_28	−1.4181E−08
1121	113	8	ADOP__chan2	−7.291E−04
1122	113	8	BDOP__chan2	−7.535E−04
1123	113	8	VOIDRA_2_01	5.0308E−06
1124	113	8	VOIDRA_2_02	5.0410E−06
1125	113	8	VOIDRA_2_03	5.0513E−06
1126	113	8	VOIDRA_2_04	5.0617E−06
1127	113	8	VOIDRA_2_05	2.8744E−05
1128	113	8	VOIDRA_2_06	2.8801E−05
1129	113	8	VOIDRA_2_07	2.8856E−05
1130	113	8	VOIDRA_2_08	2.8912E−05
1131	113	8	VOIDRA_2_09	3.6250E−05
1132	113	8	VOIDRA_2_10	3.6324E−05
1133	113	8	VOIDRA_2_11	3.6400E−05
1134	113	8	VOIDRA_2_12	3.6477E−05
1135	113	8	VOIDRA_2_13	2.9177E−05
1136	113	8	VOIDRA_2_14	2.9233E−05
1137	113	8	VOIDRA_2_15	2.9289E−05
1138	113	8	VOIDRA_2_16	2.9347E−05
1139	113	8	VOIDRA_2_17	1.2858E−05
1140	113	8	VOIDRA_2_18	1.2877E−05
1141	113	8	VOIDRA_2_19	1.2897E−05
1142	113	8	VOIDRA_2_20	1.2916E−05
1143	113	8	VOIDRA_2_21	−4.6090E−06
1144	113	8	VOIDRA_2_22	−4.6146E−06
1145	113	8	VOIDRA_2_23	−4.6202E−06
1146	113	8	VOIDRA_2_24	−4.6260E−06
1147	113	8	VOIDRA_2_25	−6.4446E−06
1148	113	8	VOIDRA_2_26	−7.0818E−07
1149	113	8	VOIDRA_2_27	−2.6867E−07
1150	113	8	VOIDRA_2_28	−1.0005E−08
1151	113	8	ADOP__chan3	−5.863E−04
1152	113	8	BDOP__chan3	−6.111E−04
1153	113	8	VOIDRA_3_01	−2.7568E−06
1154	113	8	VOIDRA_3_02	−2.7611E−06
1155	113	8	VOIDRA_3_03	−2.7656E−06
1156	113	8	VOIDRA_3_04	−2.7700E−06
1157	113	8	VOIDRA_3_05	2.2732E−06
1158	113	8	VOIDRA_3_06	2.2776E−06
1159	113	8	VOIDRA_3_07	2.2822E−06
1160	113	8	VOIDRA_3_08	2.2868E−06
1161	113	8	VOIDRA_3_09	4.4406E−06
1162	113	8	VOIDRA_3_10	4.4502E−06
1163	113	8	VOIDRA_3_11	4.4598E−06
1164	113	8	VOIDRA_3_12	4.4694E−06

1165	113	8	VOIDRA_3_13	3.1313E−06
1166	113	8	VOIDRA_3_14	3.1375E−06
1167	113	8	VOIDRA_3_15	3.1439E−06
1168	113	8	VOIDRA_3_16	3.1503E−06
1169	113	8	VOIDRA_3_17	−4.1002E−07
1170	113	8	VOIDRA_3_18	−4.1067E−07
1171	113	8	VOIDRA_3_19	−4.1133E−07
1172	113	8	VOIDRA_3_20	−4.1198E−07
1173	113	8	VOIDRA_3_21	−3.2467E−06
1174	113	8	VOIDRA_3_22	−3.2499E−06
1175	113	8	VOIDRA_3_23	−3.2532E−06
1176	113	8	VOIDRA_3_24	−3.2565E−06
1177	113	8	VOIDRA_3_25	−2.9051E−06
1178	113	8	VOIDRA_3_26	−4.5383E−07
1179	113	8	VOIDRA_3_27	−1.6741E−07
1180	113	8	VOIDRA_3_28	−7.0562E−09
1181	113	8	ADOP__chan5	−4.116E−05
1182	113	8	BDOP__chan5	−4.240E−05
1183	113	8	VOIDRA_5_01	2.3677E−06
1184	113	8	VOIDRA_5_02	2.3727E−06
1185	113	8	VOIDRA_5_03	2.3777E−06
1186	113	8	VOIDRA_5_04	2.3827E−06
1187	113	8	VOIDRA_5_05	2.3232E−05
1188	113	8	VOIDRA_5_06	2.3280E−05
1189	113	8	VOIDRA_5_07	2.3327E−05
1190	113	8	VOIDRA_5_08	2.3374E−05
1191	113	8	VOIDRA_5_09	3.0280E−05
1192	113	8	VOIDRA_5_10	3.0346E−05
1193	113	8	VOIDRA_5_11	3.0412E−05
1194	113	8	VOIDRA_5_12	3.0479E−05
1195	113	8	VOIDRA_5_13	2.4751E−05
1196	113	8	VOIDRA_5_14	2.4801E−05
1197	113	8	VOIDRA_5_15	2.4852E−05
1198	113	8	VOIDRA_5_16	2.4904E−05
1199	113	8	VOIDRA_5_17	1.1230E−05
1200	113	8	VOIDRA_5_18	1.1248E−05
1201	113	8	VOIDRA_5_19	1.1266E−05
1202	113	8	VOIDRA_5_20	1.1286E−05
1203	113	8	VOIDRA_5_21	−4.3758E−06
1204	113	8	VOIDRA_5_22	−4.3820E−06
1205	113	8	VOIDRA_5_23	−4.3883E−06
1206	113	8	VOIDRA_5_24	−4.3946E−06
1207	113	8	VOIDRA_5_25	−6.4230E−06
1208	113	8	VOIDRA_5_26	−6.7542E−07
1209	113	8	VOIDRA_5_27	−2.4084E−07

1210	113	8	VOIDRA_5_28	−1.0782E−08
1211	113	8	EXPCFFmult	1.330223
1212	113	8	_RDEXPCvar	−3.302E−04
1213	113	8	_CRDLEL_	−8.815E+00
1214	113	8	_CRDLEQ_	−1.164E+01
1215	113	9	ADOP__chan1	−2.949E−03
1216	113	9	BDOP__chan1	−2.148E−03
1217	113	9	VOIDRA_1_01	1.5729E−05
1218	113	9	VOIDRA_1_02	1.5764E−05
1219	113	9	VOIDRA_1_03	1.5798E−05
1220	113	9	VOIDRA_1_04	1.5834E−05
1221	113	9	VOIDRA_1_05	5.9270E−05
1222	113	9	VOIDRA_1_06	5.9386E−05
1223	113	9	VOIDRA_1_07	5.9501E−05
1224	113	9	VOIDRA_1_08	5.9618E−05
1225	113	9	VOIDRA_1_09	7.1031E−05
1226	113	9	VOIDRA_1_10	7.1179E−05
1227	113	9	VOIDRA_1_11	7.1326E−05
1228	113	9	VOIDRA_1_12	7.1475E−05
1229	113	9	VOIDRA_1_13	5.7830E−05
1230	113	9	VOIDRA_1_14	5.7940E−05
1231	113	9	VOIDRA_1_15	5.8052E−05
1232	113	9	VOIDRA_1_16	5.8163E−05
1233	113	9	VOIDRA_1_17	2.9352E−05
1234	113	9	VOIDRA_1_18	2.9395E−05
1235	113	9	VOIDRA_1_19	2.9440E−05
1236	113	9	VOIDRA_1_20	2.9484E−05
1237	113	9	VOIDRA_1_21	−4.3143E−06
1238	113	9	VOIDRA_1_22	−4.3202E−06
1239	113	9	VOIDRA_1_23	−4.3260E−06
1240	113	9	VOIDRA_1_24	−4.3319E−06
1241	113	9	VOIDRA_1_25	−1.0744E−05
1242	113	9	VOIDRA_1_26	−1.2396E−06
1243	113	9	VOIDRA_1_27	−4.5594E−07
1244	113	9	VOIDRA_1_28	−1.6441E−08
1245	113	9	ADOP__chan2	−9.257E−04
1246	113	9	BDOP__chan2	−9.568E−04
1247	113	9	VOIDRA_2_01	5.8325E−06
1248	113	9	VOIDRA_2_02	5.8444E−06
1249	113	9	VOIDRA_2_03	5.8563E−06
1250	113	9	VOIDRA_2_04	5.8684E−06
1251	113	9	VOIDRA_2_05	3.3325E−05
1252	113	9	VOIDRA_2_06	3.3391E−05
1253	113	9	VOIDRA_2_07	3.3455E−05
1254	113	9	VOIDRA_2_08	3.3520E−05

1255	113	9	VOIDRA_2_09	4.2027E−05
1256	113	9	VOIDRA_2_10	4.2113E−05
1257	113	9	VOIDRA_2_11	4.2202E−05
1258	113	9	VOIDRA_2_12	4.2290E−05
1259	113	9	VOIDRA_2_13	3.3827E−05
1260	113	9	VOIDRA_2_14	3.3892E−05
1261	113	9	VOIDRA_2_15	3.3957E−05
1262	113	9	VOIDRA_2_16	3.4024E−05
1263	113	9	VOIDRA_2_17	1.4907E−05
1264	113	9	VOIDRA_2_18	1.4929E−05
1265	113	9	VOIDRA_2_19	1.4953E−05
1266	113	9	VOIDRA_2_20	1.4975E−05
1267	113	9	VOIDRA_2_21	−5.3435E−06
1268	113	9	VOIDRA_2_22	−5.3500E−06
1269	113	9	VOIDRA_2_23	−5.3566E−06
1270	113	9	VOIDRA_2_24	−5.3632E−06
1271	113	9	VOIDRA_2_25	−7.4717E−06
1272	113	9	VOIDRA_2_26	−8.2105E−07
1273	113	9	VOIDRA_2_27	−3.1149E−07
1274	113	9	VOIDRA_2_28	−1.1600E−08
1275	113	9	ADOP__chan3	−7.445E−04
1276	113	9	BDOP__chan3	−7.760E−04
1277	113	9	VOIDRA_3_01	−3.1961E−06
1278	113	9	VOIDRA_3_02	−3.2012E−06
1279	113	9	VOIDRA_3_03	−3.2064E−06
1280	113	9	VOIDRA_3_04	−3.2114E−06
1281	113	9	VOIDRA_3_05	2.6355E−06
1282	113	9	VOIDRA_3_06	2.6406E−06
1283	113	9	VOIDRA_3_07	2.6459E−06
1284	113	9	VOIDRA_3_08	2.6513E−06
1285	113	9	VOIDRA_3_09	5.1483E−06
1286	113	9	VOIDRA_3_10	5.1594E−06
1287	113	9	VOIDRA_3_11	5.1705E−06
1288	113	9	VOIDRA_3_12	5.1817E−06
1289	113	9	VOIDRA_3_13	3.6303E−06
1290	113	9	VOIDRA_3_14	3.6376E−06
1291	113	9	VOIDRA_3_15	3.6449E−06
1292	113	9	VOIDRA_3_16	3.6523E−06
1293	113	9	VOIDRA_3_17	−4.7536E−07
1294	113	9	VOIDRA_3_18	−4.7612E−07
1295	113	9	VOIDRA_3_19	−4.7688E−07
1296	113	9	VOIDRA_3_20	−4.7764E−07
1297	113	9	VOIDRA_3_21	−3.7642E−06
1298	113	9	VOIDRA_3_22	−3.7679E−06
1299	113	9	VOIDRA_3_23	−3.7717E−06

1300	113	9	VOIDRA_3_24	−3.7754E−06
1301	113	9	VOIDRA_3_25	−3.3681E−06
1302	113	9	VOIDRA_3_26	−5.2615E−07
1303	113	9	VOIDRA_3_27	−1.9409E−07
1304	113	9	VOIDRA_3_28	−8.1808E−09
1305	113	9	ADOP__chan5	−5.227E−05
1306	113	9	BDOP__chan5	−5.384E−05
1307	113	9	VOIDRA_5_01	2.7450E−06
1308	113	9	VOIDRA_5_02	2.7508E−06
1309	113	9	VOIDRA_5_03	2.7566E−06
1310	113	9	VOIDRA_5_04	2.7624E−06
1311	113	9	VOIDRA_5_05	2.6935E−05
1312	113	9	VOIDRA_5_06	2.6990E−05
1313	113	9	VOIDRA_5_07	2.7045E−05
1314	113	9	VOIDRA_5_08	2.7099E−05
1315	113	9	VOIDRA_5_09	3.5105E−05
1316	113	9	VOIDRA_5_10	3.5182E−05
1317	113	9	VOIDRA_5_11	3.5259E−05
1318	113	9	VOIDRA_5_12	3.5336E−05
1319	113	9	VOIDRA_5_13	2.8696E−05
1320	113	9	VOIDRA_5_14	2.8754E−05
1321	113	9	VOIDRA_5_15	2.8813E−05
1322	113	9	VOIDRA_5_16	2.8873E−05
1323	113	9	VOIDRA_5_17	1.3020E−05
1324	113	9	VOIDRA_5_18	1.3041E−05
1325	113	9	VOIDRA_5_19	1.3062E−05
1326	113	9	VOIDRA_5_20	1.3084E−05
1327	113	9	VOIDRA_5_21	−5.0732E−06
1328	113	9	VOIDRA_5_22	−5.0804E−06
1329	113	9	VOIDRA_5_23	−5.0876E−06
1330	113	9	VOIDRA_5_24	−5.0949E−06
1331	113	9	VOIDRA_5_25	−7.4466E−06
1332	113	9	VOIDRA_5_26	−7.8307E−07
1333	113	9	VOIDRA_5_27	−2.7922E−07
1334	113	9	VOIDRA_5_28	−1.2501E−08
1335	113	9	EXPCFFmult	1.161016
1336	113	9	_RDEXPCvar	−7.337E−05
1337	113	9	_CRDLEL_	−1.170E+01
1338	113	9	_CRDLEQ_	−1.545E+01
1339	113	10	ADOP__chan1	−2.621E−03
1340	113	10	BDOP__chan1	−1.909E−03
1341	113	10	VOIDRA_1_01	1.4813E−05
1342	113	10	VOIDRA_1_02	1.4846E−05
1343	113	10	VOIDRA_1_03	1.4879E−05
1344	113	10	VOIDRA_1_04	1.4912E−05

1345	113	10	VOIDRA_1_05	5.5819E−05
1346	113	10	VOIDRA_1_06	5.5928E−05
1347	113	10	VOIDRA_1_07	5.6036E−05
1348	113	10	VOIDRA_1_08	5.6146E−05
1349	113	10	VOIDRA_1_09	6.6895E−05
1350	113	10	VOIDRA_1_10	6.7034E−05
1351	113	10	VOIDRA_1_11	6.7173E−05
1352	113	10	VOIDRA_1_12	6.7313E−05
1353	113	10	VOIDRA_1_13	5.4463E−05
1354	113	10	VOIDRA_1_14	5.4566E−05
1355	113	10	VOIDRA_1_15	5.4671E−05
1356	113	10	VOIDRA_1_16	5.4777E−05
1357	113	10	VOIDRA_1_17	2.7643E−05
1358	113	10	VOIDRA_1_18	2.7684E−05
1359	113	10	VOIDRA_1_19	2.7726E−05
1360	113	10	VOIDRA_1_20	2.7767E−05
1361	113	10	VOIDRA_1_21	−4.0631E−06
1362	113	10	VOIDRA_1_22	−4.0687E−06
1363	113	10	VOIDRA_1_23	−4.0741E−06
1364	113	10	VOIDRA_1_24	−4.0797E−06
1365	113	10	VOIDRA_1_25	−1.0118E−05
1366	113	10	VOIDRA_1_26	−1.1674E−06
1367	113	10	VOIDRA_1_27	−4.2939E−07
1368	113	10	VOIDRA_1_28	−1.5484E−08
1369	113	10	ADOP__chan2	−8.228E−04
1370	113	10	BDOP__chan2	−8.504E−04
1371	113	10	VOIDRA_2_01	5.4929E−06
1372	113	10	VOIDRA_2_02	5.5041E−06
1373	113	10	VOIDRA_2_03	5.5154E−06
1374	113	10	VOIDRA_2_04	5.5267E−06
1375	113	10	VOIDRA_2_05	3.1385E−05
1376	113	10	VOIDRA_2_06	3.1446E−05
1377	113	10	VOIDRA_2_07	3.1507E−05
1378	113	10	VOIDRA_2_08	3.1568E−05
1379	113	10	VOIDRA_2_09	3.9580E−05
1380	113	10	VOIDRA_2_10	3.9661E−05
1381	113	10	VOIDRA_2_11	3.9744E−05
1382	113	10	VOIDRA_2_12	3.9828E−05
1383	113	10	VOIDRA_2_13	3.1857E−05
1384	113	10	VOIDRA_2_14	3.1919E−05
1385	113	10	VOIDRA_2_15	3.1980E−05
1386	113	10	VOIDRA_2_16	3.2043E−05
1387	113	10	VOIDRA_2_17	1.4039E−05
1388	113	10	VOIDRA_2_18	1.4060E−05
1389	113	10	VOIDRA_2_19	1.4082E−05

1390	113	10	VOIDRA_2_20	1.4103E−05
1391	113	10	VOIDRA_2_21	−5.0324E−06
1392	113	10	VOIDRA_2_22	−5.0385E−06
1393	113	10	VOIDRA_2_23	−5.0447E−06
1394	113	10	VOIDRA_2_24	−5.0509E−06
1395	113	10	VOIDRA_2_25	−7.0366E−06
1396	113	10	VOIDRA_2_26	−7.7324E−07
1397	113	10	VOIDRA_2_27	−2.9336E−07
1398	113	10	VOIDRA_2_28	−1.0925E−08
1399	113	10	ADOP__chan3	−6.618E−04
1400	113	10	BDOP__chan3	−6.897E−04
1401	113	10	VOIDRA_3_01	−3.0100E−06
1402	113	10	VOIDRA_3_02	−3.0148E−06
1403	113	10	VOIDRA_3_03	−3.0197E−06
1404	113	10	VOIDRA_3_04	−3.0244E−06
1405	113	10	VOIDRA_3_05	2.4820E−06
1406	113	10	VOIDRA_3_06	2.4869E−06
1407	113	10	VOIDRA_3_07	2.4918E−06
1408	113	10	VOIDRA_3_08	2.4969E−06
1409	113	10	VOIDRA_3_09	4.8486E−06
1410	113	10	VOIDRA_3_10	4.8590E−06
1411	113	10	VOIDRA_3_11	4.8695E−06
1412	113	10	VOIDRA_3_12	4.8800E−06
1413	113	10	VOIDRA_3_13	3.4189E−06
1414	113	10	VOIDRA_3_14	3.4258E−06
1415	113	10	VOIDRA_3_15	3.4327E−06
1416	113	10	VOIDRA_3_16	3.4397E−06
1417	113	10	VOIDRA_3_17	−4.4769E−07
1418	113	10	VOIDRA_3_18	−4.4840E−07
1419	113	10	VOIDRA_3_19	−4.4911E−07
1420	113	10	VOIDRA_3_20	−4.4983E−07
1421	113	10	VOIDRA_3_21	−3.5450E−06
1422	113	10	VOIDRA_3_22	−3.5485E−06
1423	113	10	VOIDRA_3_23	−3.5520E−06
1424	113	10	VOIDRA_3_24	−3.5556E−06
1425	113	10	VOIDRA_3_25	−3.1720E−06
1426	113	10	VOIDRA_3_26	−4.9552E−07
1427	113	10	VOIDRA_3_27	−1.8279E−07
1428	113	10	VOIDRA_3_28	−7.7044E−09
1429	113	10	ADOP__chan5	−4.646E−05
1430	113	10	BDOP__chan5	−4.785E−05
1431	113	10	VOIDRA_5_01	2.5852E−06
1432	113	10	VOIDRA_5_02	2.5906E−06
1433	113	10	VOIDRA_5_03	2.5961E−06
1434	113	10	VOIDRA_5_04	2.6015E−06

113	10	VOIDRA_5_05	2.5367E−05
113	10	VOIDRA_5_06	2.5418E−05
113	10	VOIDRA_5_07	2.5470E−05
113	10	VOIDRA_5_08	2.5521E−05
113	10	VOIDRA_5_09	3.3061E−05
113	10	VOIDRA_5_10	3.3134E−05
113	10	VOIDRA_5_11	3.3206E−05
113	10	VOIDRA_5_12	3.3279E−05
113	10	VOIDRA_5_13	2.7025E−05
113	10	VOIDRA_5_14	2.7080E−05
113	10	VOIDRA_5_15	2.7135E−05
113	10	VOIDRA_5_16	2.7192E−05
113	10	VOIDRA_5_17	1.2262E−05
113	10	VOIDRA_5_18	1.2282E−05
113	10	VOIDRA_5_19	1.2301E−05
113	10	VOIDRA_5_20	1.2322E−05
113	10	VOIDRA_5_21	−4.7778E−06
113	10	VOIDRA_5_22	−4.7846E−06
113	10	VOIDRA_5_23	−4.7914E−06
113	10	VOIDRA_5_24	−4.7983E−06
113	10	VOIDRA_5_25	−7.0130E−06
113	10	VOIDRA_5_26	−7.3747E−07
113	10	VOIDRA_5_27	−2.6296E−07
113	10	VOIDRA_5_28	−1.1773E−08
113	10	EXPCFFmult	0.942764
113	10	_RDEXPCvar	−1.412E−04
113	10	_CRDLEL_	−1.449E+01
113	10	_CRDLEQ_	−1.912E+01

113	1	BC_RPS4	398
113	2	BC_RPS4	398
113	3	BC_RPS4	398
113	4	BC_RPS4	398
113	5	BC_RPS4	398
113	6	BC_RPS4	398
113	7	BC_RPS4	398
113	8	BC_RPS4	398
113	9	BC_RPS4	398
113	10	BC_RPS4	398
113	1	BC_RPS2	566
113	2	BC_RPS2	566
113	3	BC_RPS2	566
113	4	BC_RPS2	566
113	5	BC_RPS2	566
113	6	BC_RPS2	566

```
113        7       BC_RPS2        566
113        8       BC_RPS2        566
113        9       BC_RPS2        566
113        10      BC_RPS2       566

113        1       BC_RC        566
113        2       BC_RC        566
113        3       BC_RC        566
113        4       BC_RC        566
113        5       BC_RC        566
113        6       BC_RC        566
113        7       BC_RC        566
113        8       BC_RC        566
113        9       BC_RC        566
113        10      BC_RC        566

// BC2 branches

398        1       RPS_SCRAM        0.0D20
398        2       RPS_SCRAM        0.0D20
398        3       RPS_SCRAM        1.0D20
398        4       RPS_SCRAM        1.0D20
398        1       RPS_TRIP        0.0D20
398        2       RPS_TRIP        1.0D20
398        3       RPS_TRIP        0.0D20
398        4       RPS_TRIP        1.0D20

398        1       BOP_STATUS        0.1
398        2       BOP_STATUS        0.1
398        3       BOP_STATUS        1.0
398        4       BOP_STATUS        1.0

398        1       BC_CP_480_BOP        566
398        2       BC_CP_480_BOP        566
398        3       BC_CP_480_BOP        448
398        4       BC_CP_480_BOP        448

398        1       BC_RPS4        566
398        2       BC_RPS4        566
398        3       BC_RPS4        566
398        4       BC_RPS4        566

// BC3 branches

498        1       RPS_TRIP        0.0D20
```

```
498    2    RPS_TRIP      1.0D20

498    1    BC_RPS2     566
498    2    BC_RPS2     566

// BC4 branches

114    1    TOP_CENT      0.00000E-02
114    2    TOP_CENT      6.00000E-02
114    3    TOP_CENT      3.00000E-01
114    4    TOP_CENT      5.00000E-01

114    1    CENT_TIME      3.00000e+00
114    2    CENT_TIME      3.75000e+00
114    3    CENT_TIME      6.77000e+00
114    4    CENT_TIME      9.29000e+00

114    1    BC_CENTS      566
114    2    BC_CENTS      566
114    3    BC_CENTS      566
114    4    BC_CENTS      566

// BC5 branches

501    1    OP_TRIP      0.0D20
501    2    OP_REC     1.0D20
501    1    OP_TRIP      1.0D20
501    2    OP_REC     0.0D20

501    1    BC_RPS_10S      566
501    2    BC_RPS_10S      566

// BC6 branches

440    1    DRACS_HT      7.048E+01
440    2    DRACS_HT      1.762E+01
440    3    DRACS_HT      8.810E+00

440    1    BC_CP_480      566
440    2    BC_CP_480      566
440    3    BC_CP_480      566

// BC7 branches

448    1    SECONDARY      4.00
```

```
448        2        SECONDARY        1.00
448        3        SECONDARY        0.25

448        1        BC_CP_480_BOP         566
448        2        BC_CP_480_BOP         566
448        3        BC_CP_480_BOP         566

// BC8 branches

467        1        OP_THERM        0.0D20
467        2        OP_THERM        1.0D20
467        3        OP_THERM        0.0D20
467        4        OP_THERM        1.0D20
467        5        OP_THERM        0.0D20
467        6        OP_THERM        1.0D20
467        1        FAIL_FRAC        1.0
467        2        FAIL_FRAC        0.5
467        3        FAIL_FRAC        0.0
467        4        FAIL_FRAC        1.0
467        5        FAIL_FRAC        0.5
467        6        FAIL_FRAC        0.0

467        1        BC_CP_515C        566
467        2        BC_CP_515C        566
467        3        BC_CP_515C        566
467        4        BC_CP_515C        566
467        5        BC_CP_515C        566
467        6        BC_CP_515C        566
```

C Appendix B: SAS4A ADAPT Template Input File

A sample SAS4A ADAPT template input file is listed below. Note that line numbers are given on the left. Portions of the SAS4A version used in this work were programmed in Fortran 77, and spacing matters in the input file.

```
 SAS4ADAPT SNL Model
 SAS4A model with SNL modifications and ADAPT hooks, restart
RESTART   100     1
INPCOM      1     1     1
     120      1       8
     121      8    {BC_RC}    {BC_RPS4}    {BC_RPS2}    {BC_CENTS}    {BC_RPS_10S}    {BC_CP_480}    {BC_CP_480_BOP}    {BC_CP_515C}
    -1
OPCIN      11     1     1
       7      1       86400.0
    -1
INCONT      5     1     0
     41    21              {RPS_SCRAM}
     42    21              {RPS_TRIP}
     43    21              {OP_TRIP}
     44    21              {OP_REC}
     45    21              {OP_THERM}
     39    21              {FAIL_FRAC}
     52    21              {SECONDARY}
   999
   4101        4  0.0           0.00000e-00  {TOP_CENT}  {TOP_CENT}
   6101        4  0.0           3.00000e+00  {CENT_TIME}  100000000.0
    -1
PMR4IN     18     1     1
   2937        4          1.0          {BOP_STATUS}          {BOP_STATUS}          {BOP_STATUS}
   3273        4          0.0          10.0          50.0     1.000E+10
   3813        1    {DRACS_HT}
    -1
POWINC     62     1     1
      62       2 {ADOP__chan1} {BDOP__chan1}                ADOP,BDOP
     112       5 0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00  VOIDRA
     117       5 0.00000E+00   {VOIDRA_1_01}   {VOIDRA_1_02}   {VOIDRA_1_03}   {VOIDRA_1_04} VOIDRA
     122       5   {VOIDRA_1_05}   {VOIDRA_1_06}   {VOIDRA_1_07}   {VOIDRA_1_08}   {VOIDRA_1_09} VOIDRA
```

```
      127       5  {VOIDRA_1_10}  {VOIDRA_1_11}  {VOIDRA_1_12}  {VOIDRA_1_13}  {VOIDRA_1_14} VOIDRA
      132       5  {VOIDRA_1_15}  {VOIDRA_1_16}  {VOIDRA_1_17}  {VOIDRA_1_18}  {VOIDRA_1_19} VOIDRA
      137       5  {VOIDRA_1_20} {VOIDRA_1_21} {VOIDRA_1_22} {VOIDRA_1_23} {VOIDRA_1_24} VOIDRA
      142       4 {VOIDRA_1_25} {VOIDRA_1_26} {VOIDRA_1_27} {VOIDRA_1_28}                VOIDRA
       -1
POWINC     62       2       2
       62       2 {ADOP__chan2} {BDOP__chan2}    ADOP,BDOP
      112       5 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00 VOIDRA
      117       5 0.00000E+00  {VOIDRA_2_01}  {VOIDRA_2_02}  {VOIDRA_2_03}  {VOIDRA_2_04} VOIDRA
      122       5  {VOIDRA_2_05}  {VOIDRA_2_06}  {VOIDRA_2_07}  {VOIDRA_2_08}  {VOIDRA_2_09} VOIDRA
      127       5  {VOIDRA_2_10}  {VOIDRA_2_11}  {VOIDRA_2_12}  {VOIDRA_2_13}  {VOIDRA_2_14} VOIDRA
      132       5  {VOIDRA_2_15}  {VOIDRA_2_16}  {VOIDRA_2_17}  {VOIDRA_2_18}  {VOIDRA_2_19} VOIDRA
      137       5  {VOIDRA_2_20} {VOIDRA_2_21} {VOIDRA_2_22} {VOIDRA_2_23} {VOIDRA_2_24} VOIDRA
      142       4 {VOIDRA_2_25} {VOIDRA_2_26} {VOIDRA_2_27} {VOIDRA_2_28}                VOIDRA
       -1
POWINC     62       3       3
       62       2 {ADOP__chan3} {BDOP__chan3}    ADOP,BDOP
      112       5 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00 VOIDRA
      117       5 0.00000E+00 {VOIDRA_3_01} {VOIDRA_3_02} {VOIDRA_3_03} {VOIDRA_3_04} VOIDRA
      122       5  {VOIDRA_3_05}  {VOIDRA_3_06}  {VOIDRA_3_07}  {VOIDRA_3_08}  {VOIDRA_3_09} VOIDRA
      127       5  {VOIDRA_3_10}  {VOIDRA_3_11}  {VOIDRA_3_12}  {VOIDRA_3_13}  {VOIDRA_3_14} VOIDRA
      132       5  {VOIDRA_3_15}  {VOIDRA_3_16} {VOIDRA_3_17} {VOIDRA_3_18} {VOIDRA_3_19} VOIDRA
      137       5 {VOIDRA_3_20} {VOIDRA_3_21} {VOIDRA_3_22} {VOIDRA_3_23} {VOIDRA_3_24} VOIDRA
      142       4 {VOIDRA_3_25} {VOIDRA_3_26} {VOIDRA_3_27} {VOIDRA_3_28}                VOIDRA
       -1
```

```
58 POWINC      62     5     5
59      62      2 {ADOP__chan5} {BDOP__chan5}
60     112      5 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00
        0.00000E+00 VOIDRA
61     117      5 0.00000E+00  {VOIDRA_5_01}  {VOIDRA_5_02}  {
        VOIDRA_5_03}  {VOIDRA_5_04} VOIDRA
62     122      5  {VOIDRA_5_05}  {VOIDRA_5_06}  {VOIDRA_5_07}  {
        VOIDRA_5_08}  {VOIDRA_5_09} VOIDRA
63     127      5  {VOIDRA_5_10}  {VOIDRA_5_11}  {VOIDRA_5_12}  {
        VOIDRA_5_13}  {VOIDRA_5_14} VOIDRA
64     132      5  {VOIDRA_5_15}  {VOIDRA_5_16}  {VOIDRA_5_17}  {
        VOIDRA_5_18}  {VOIDRA_5_19} VOIDRA
65     137      5  {VOIDRA_5_20} {VOIDRA_5_21} {VOIDRA_5_22} {
        VOIDRA_5_23} {VOIDRA_5_24} VOIDRA
66     142      4 {VOIDRA_5_25} {VOIDRA_5_26} {VOIDRA_5_27} {
        VOIDRA_5_28}                 VOIDRA
67      -1
68 PMATCH      63     1     1
69      79      1  {EXPCFFmult}
70      -1
71 POWINA      12     1     1
72      73      2  {_CRDLEL_}  {_CRDLEQ_}
73      78      2  {_RDEXPCvar} 6.78579E-01
74      -1
75 ENDJOB      -1
```

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