



Italian National Agency for New Technologies,
Energy and Sustainable Economic Development

MELCOR/DAKOTA COUPLING IN THE SNAP ENVIRONMENT/ARCHITECTURE

*12th Meeting of the European MELCOR and MACCS User Group,
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F. Mascari¹, A. Bersano², G. Agnello³, M. Angelucci⁴

1 ENEA, Bologna, Italy.

2 Politecnico di Torino, Torino, Italy

3 UNIPA, Palermo, Italy

4 UNIPI, Pisa, Italy



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INTRODUCTION

- ❑ Nowadays, for the evaluation of the safety margins, the use of BEPU approach is of great interest for the International Scientific Nuclear Community.
- ❑ Considering the key role of Severe Accident (SA) codes for deterministic safety analyses and source term evaluations, several research activities in national and international frameworks are in progress and are planned to reduce and/or estimate the uncertainty in SA phenomena prediction.
- ❑ In this framework, from an operative point of view, one of the key needs is to have an automatic coupling between the UTs and the SA code.
 - For example, by using the probabilistic method to propagate input uncertainty, the Uncertainty Tool (Uts) will perform several steps and several parameters should be selected by the user when performing an Uncertainty Analyses (UA).
 - The use of a user-friendly environment/architecture, that permits a direct coupling between the SA code and the UTs, for characterizing the UA and to perform all the uncertainty steps, is one of key operative needs.

INTRODUCTION

- USNRC codes (e.g. MELCOR, TRACE, etc.) can be used together with a user-friendly front end, **Symbolic Nuclear Analysis Package (SNAP)**, able to:
 - Support the code user in the development and visualization of the nodalization,
 - Show a direct visualization of selected calculated data, and
 - Accept existing code inputs.
- One of the features of SNAP of current interest for the International Technical Nuclear Community, **is the possibility of coupling USNRC codes with the DAKOTA toolkit**. Through SNAP it is possible to set up the DAKOTA uncertainty analysis and to perform automatically all the necessary steps.
- The target of this presentations is to briefly show:
 - **Main details of the MELCOR/DAKOTA coupling in a SNAP environment/architecture;**
 - **Different steps necessary to set it up;**
 - **Some exemplificative applications to show the potentiality of the coupling.**

INTRODUCTION

- ❑ Several methodologies have been developed in the past to perform UA. In particular these uncertainty methodologies can be grouped in:
 - **Methods to propagate input uncertainty**, divided in
 - Probabilistic (e.g. CSAU, GRS, IPSN, etc.);
 - **Deterministic methods (e.g. AEAU, EDF-Framatome, etc.);**
 - **Method to extrapolate output uncertainty (e.g. UMAE).**
- ❑ The probabilistic method to propagate input uncertainty can be applied through the **DAKOTA toolkit** developed by SANDIA.
- ❑ DAKOTA can be also coupled with the USNRC codes in the SNAP environment/architecture to **automate the uncertainty analysis execution.**

PROBABILISTIC METHOD TO PROPAGATE INPUT UNCERTAINTIES IN A CODE

- ❑ The **probabilistic method to propagate input uncertainty** is based on the creation of a set code runs.
- ❑ Each individual run is obtained by **randomly selecting a value from each uncertain parameter Probability Density Function (PDF)**.
- ❑ The model input is adjusted, implementing these values, to create a singular instance of the model input of which an analysis is to be performed.
- ❑ **A set of N models and corresponding code analyses are created** and solved with a given analysis code.
- ❑ Then, **through correlation analysis**, the relationship between the selected uncertain input parameters and the results is characterized for selected FOMs.
- ❑ Each uncertain input parameter is defined by its range of variation and its PDF.

MELCOR/DAKOTA COUPLING IN A SNAP ENVIRONMENT/ARCHITECTURE-DAKOTA TOOLKIT

- ❑ **DAKOTA** is an open source software written in C++ and developed by Sandia National Laboratories to perform parametric and uncertainty analysis in a fast and automatic way.
- ❑ The aim of this toolkit is to bridge simulation codes and analysis methods for **parametric evaluation, uncertainty quantification and system optimization**.
- ❑ The DAKOTA toolkit is **also provided as a plug-in for SNAP**, which is a graphical user interface designed to support the use of USNRC nuclear codes (e.g. MELCOR, TRACE, etc.).
- ❑ Using SNAP, it is possible to build the input model in a graphical environment and to have a direct visualization of the computed data by using animation capability within SNAP.

Through SNAP it is possible to set up a DAKOTA UA and to perform all analytical steps automatically.

MELCOR/DAKOTA COUPLING IN A SNAP ENVIRONMENT/ARCHITECTURE - SNAP

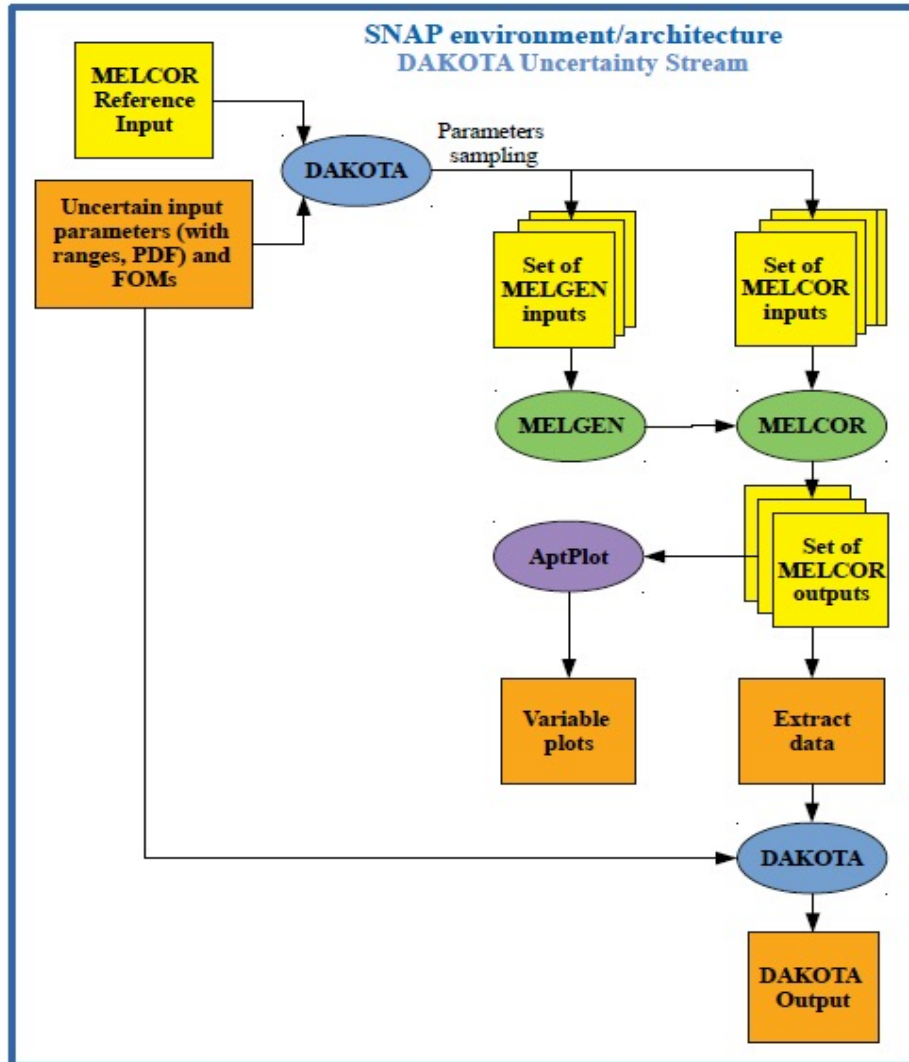
- ❑ USNRC codes (e.g. MELCOR, TRACE) can be used together with a **user-friendly front end, SNAP**, able to:
 - Support the user in the development and visualization of the nodalization,
 - Show a direct visualization of selected calculated data,
 - Accept existing code input.

- ❑ **SNAP is a suite of integrated applications including:**
 - “Model Editor”,
 - “Job Status”,
 - “Configuration Tool”, and
 - “Calculation Server”.

- ❑ In particular, the “Model Editor” is used for the **nodalization development** and visualization and for the visualization of the selected calculated data by using its **graphical and animation model capability**.

- ❑ SNAP allows the:
 - Development of input-decks from scratch,
 - Import of existing input-decks developed in native ASCII format,
 - Development of the post processing of the simulations by using:
 - SNAP animation modelling capabilities and
 - AptPlot plot capabilities,
 - Execution of uncertainty analyses that automatically:
 - Run different random sampling tasks,
 - Develop requested dispersion plots, and
 - Generate statistical and response correlation analyses.
 - Etc.

DAKOTA UNCERTAINTY ANALYSIS WORKFLOW FOR MELCOR CODE IN A SNAP ENVIRONMENT/ARCHITECTURE



- In particular, the **DAKOTA plugin** allows the following:
 - Enter the uncertain input parameters with their range and PDF,
 - Select the sampling method (Monte Carlo or Latin Hypercube),
 - Enter the desired FOMs for the analysis, and
 - Set the final report that contains the results of the UA application; this report is automatically generated at the end of the uncertainty quantification analysis.
- **DAKOTA is run first to sample** the uncertain input parameter values and to generate the set of code inputs.
- After the solution of the set of code inputs and the extraction of the desired data, **DAKOTA is run a second time to perform the uncertainty analysis** and applies correlation techniques to evaluate the correlation between input and output parameters selected as FOMs.

MELCOR/DAKOTA COUPLING IN A SNAP ENVIRONMENT/ARCHITECTURE

- ❑ The minimum number of code runs, N , depends on the requested probability content α , the confidence level β and the number of FOMs.
- ❑ **In case only one FOM is investigated**, for the one-sided tolerance interval, the required number of code runs can be found, based on Wilks, by solving the following equation with respect to N :

$$1 - \alpha^N = \beta$$

- ❑ **If more than one FOM is investigated**, for the one-sided tolerance interval, the required number of code runs can be found by solving the following equation with respect to N

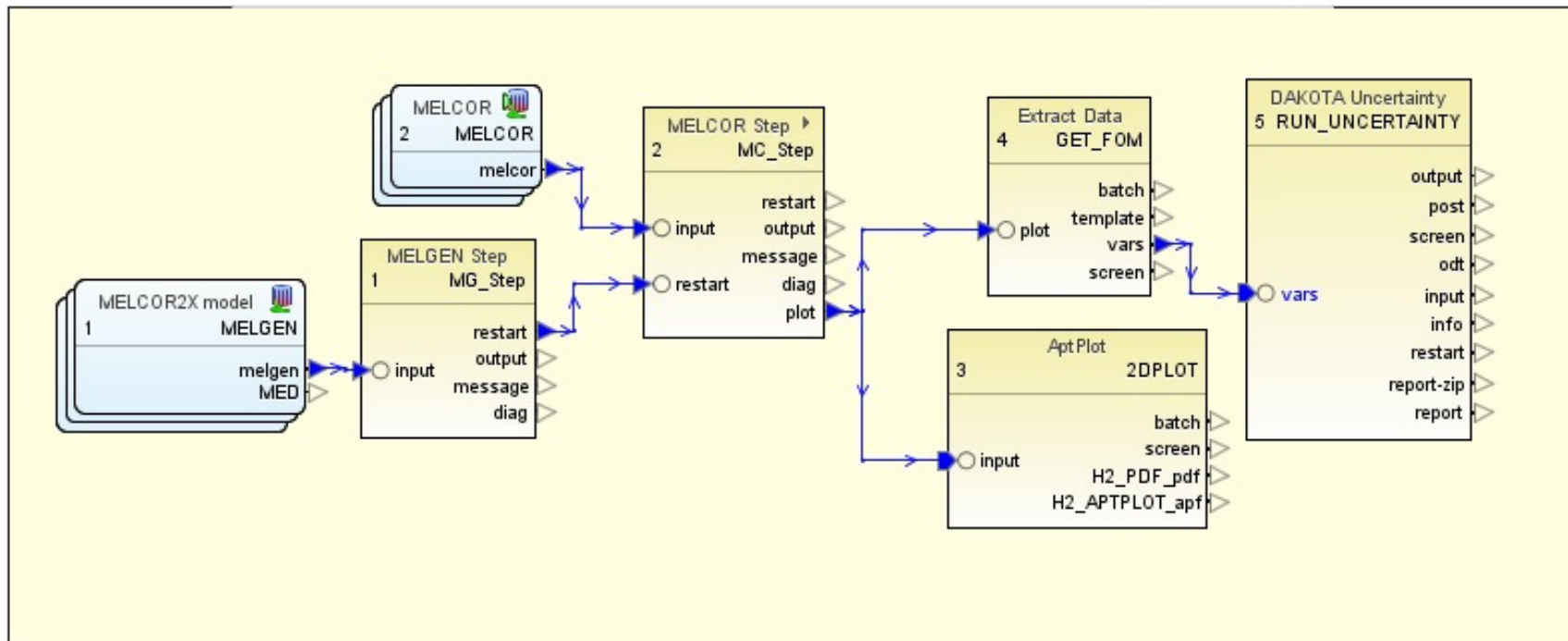
$$\beta = \sum_{j=0}^{N-p} \frac{N!}{(N-j)!j!} \alpha^j (1 - \alpha)^{N-j}$$

where p is the number of FOMs.

STEPS NECESSARY TO SETUP A MELCOR/DAKOTA COUPLING IN A SNAP NVIRONMENT/ARCHITECTURE

1. Creation of the DAKOTA Uncertainty Job Stream for a Two-Step MELGEN/MELCOR Stream and selection of the MELGEN and MELCOR executables,
2. Definition of the DAKOTA application properties, characterization of the PDF, set-up of the automatically generated report,
3. Definition of the Plotting Step properties,
4. Creation and set-up of the Data Extraction and DAKOTA Uncertainty Steps,
5. Creation and set-up of DAKOTA Uncertainty Steps,
6. Execution of the Uncertainty Analysis.

ALL the STEPS are described in detail in the NUREG-IA



DEFINITION OF THE DAKOTA APPLICATION PROPERTIES, CHARACTERIZATION OF THE PDF, SET-UP OF THE AUTOMATICALLY GENERATED REPORT

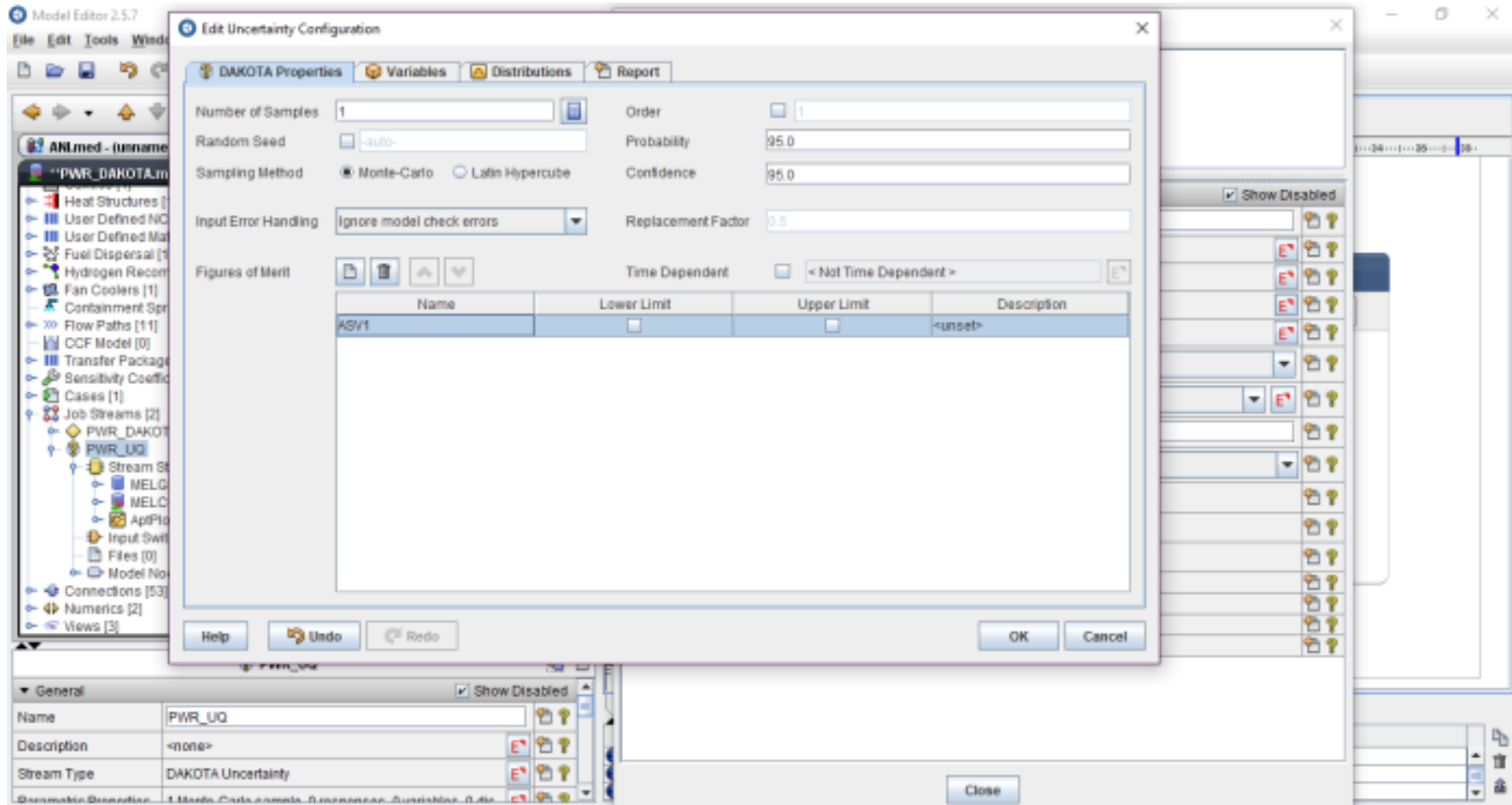
- ❑ After setting up the MELGEN and MELCOR steps, the characterization of the different uncertain parameters may be defined.

- ❑ From the EDIT UNCERTAINTY CONFIGURATION, various **Tabs** allow users to:
 - Characterize the sampling process:
 - **“Number of Samples”**: In order to select the number of samples a “Calculated Samples Button” is available to the user to evaluate the required number of tasks considering the Order, Probability, and Confidence selected by the user. The calculation is based on Wilks formula.
 - **“Random Seed”**;
 - **“Sampling Method”** (Monte-Carlo or Latin Hypercube method);
 - **“Input Error Handling”** (ignore model check errors; filter out inputs that fail model check; replace input that fail model check),
 - **FOMs**,
 - **Order, probability and confidence level**;
 - **Replacement factor**.
 - Identify uncertain input parameters and their related distribution characteristics;

 - Identify the FOMs;

 - Specifying the aspects of the automatically generated report.

EDIT UNCERTAINTY CONFIGURATION/DAKOTA PROPERTIES” SNAP TAB



“VARIABLE/ SELECT THE VARIABLE CATEGORY/SELECT THE VARIABLE” TAB

The screenshot displays the Model Editor 2.5.7 interface. A dialog box titled "Select New Variable Reference" is open, showing two panes. The left pane, "Select the variable category:", has "Sensitivity Coefficients" selected. The right pane, "Select the variable:", lists several variables, with "COR 1141-2 0.2 (Nounit)" highlighted. The background shows the Model Editor's tree view on the left and the Properties View on the right.

Variable Category	Variable Name	Value	Unit
User-Defined Reals	RN1 7000-1	1.0E-15	(Nounit)
Sensitivity Coefficients	COR 1131-2	2400.0	(Nounit)
Sensitivity Coefficients	COR 1141-2	0.2	(Nounit)
Sensitivity Coefficients	COR 1132-1	2700.0	(Nounit)
Sensitivity Coefficients	COR 1502-2	5.0	(Nounit)
Sensitivity Coefficients	COR 1250-1	2800.0	(Nounit)

EXAMPLE OF INPUT UNCERTAIN PDF REPRESENTATION IN THE “EDIT UNCERTAINTY CONFIGURATION/DISTRIBUTION” TAB

The screenshot displays the 'Edit Uncertainty Configuration' dialog box in Model Editor 2.5.7. The dialog is titled 'Edit Uncertainty Configuration' and has tabs for 'DAKOTA Properties', 'Variables', 'Distributions', and 'Report'. The 'Distributions' tab is active, showing the configuration for a variable named 'd1' (Scalar, No Unit).

The configuration details are as follows:

- Name: d1
- Distribution: Triangular
- Rule: Scalar
- Distribution Parameters:
 - a (min): 2098.0 (-)
 - m (mode): 2400.0 (-)
 - b (max): 2550.0 (-)
 - Min: 0.5 (-)
 - Max: 1.5 (-)

Two graphs are displayed on the right side of the dialog:

- Probability density:** A triangular distribution plot with a peak at 2400.0. The x-axis ranges from 2.10e+03 to 2.55e+03, and the y-axis ranges from 0.00 to 0.00442.
- Cumulative distribution:** A cumulative distribution function plot showing a smooth curve from 0.00 to 1.00. The x-axis ranges from 2.10e+03 to 2.55e+03.

The dialog includes 'Help', 'Undo', and 'Redo' buttons at the bottom left, and 'OK' and 'Cancel' buttons at the bottom right. A 'Close' button is also visible at the bottom of the main window.

“EDIT UNCERTAINTY CONFIGURATION/REPORT” SNAP TAB

Model Editor 2.5.7

File Edit Tools Window

DAKOTA Properties Variables Distributions Report

Title Page PWR_UQ

Front Matter <unset>

Header

Footer

Misc.

- Include Section Titles
- Include Random Variables
- Include FOM Values
- Include Extract Script
- Include Input File
- Include Page Numbers
- Include Table of Contents

Sort by Task No.

Plotted Values

Dependent	Use Independent	Independent
d1		Iteration Index
d2		Iteration Index
d3		Iteration Index
d4		Iteration Index
d5		Iteration Index
d6		Iteration Index
d7		Iteration Index
H2_GEN	<input checked="" type="checkbox"/>	d1
H2_GEN	<input checked="" type="checkbox"/>	d2
H2_GEN	<input checked="" type="checkbox"/>	d3
H2_GEN	<input checked="" type="checkbox"/>	d4
H2_GEN	<input checked="" type="checkbox"/>	d5
H2_GEN	<input checked="" type="checkbox"/>	d6
H2_GEN	<input checked="" type="checkbox"/>	d7

Help Undo Redo OK Cancel

General Show Disabled

Name PWR_UQ

Description <none>

Stream Type DAKOTA Uncertainty

Close

DAKOTA UA REPORT

- ❑ The report is automatically generated by DAKOTA at the end of the UA as characterized in the “Edit Uncertainty Configuration View/Report” Tab along with the input specifications.

- ❑ The report includes the following sections:
 - Introduction section,
 - Uncertainty quantification input options section,
 - Variate and response data section,
 - DAKOTA Results:

In this section after a summary of the second DAKOTA run, the following information are reported for each FOM:

 - Cumulative distribution function and probability density function,
 - Statistical results, and
 - Response correlation.
 - DAKOTA Input File: The input file used in a -pre_run DAKOTA invocation to generate the random variates.

DAKOTA UA REPORT

□ REPORT: Variate and Response data:

- The Uncertainty quantification input options section includes:
 - A tabulated summary of the main information characterizing the UA application,
 - A tabulated summary of distributions, their characteristic parameters, and the selected model variables,
 - A table listing the application used in the job stream is reported, and
 - User identified FOMs in the analysis.

□ REPORT: Variate and Response data:

- In the Variate and response data section, after a summary of the first DAKOTA run, the following information are present:
 - Plot requested in the “Edit Uncertainty Configuration/Report”
 - Variate data (input uncertain parameters value for each task) and response data table (FOM value for each task).
- The plots present in the DAKOTA automatically generated report are:
 - Input uncertain parameter against iteration index,
 - FOM VS input uncertain parameter, and
 - Input uncertain parameter VS another input uncertain parameter.
- For each FOM the follow is reported:
 - A table presenting response data for each task and
 - A table presenting the value of each uncertain parameter for each task.

□ REPORT: DAKOTA results

- In relation to the DAKOTA statistical results of the FOM, the following information can be found in the automatically generated report:
 - Plots: Cumulative distribution function and Probability density function,
 - Tabulated Data: Statistical results -Min value, Max value, Mean value, Median value and the related task, Standard deviation, and Coefficient of variance.

MELCOR/DAKOTA COUPLING, IN A SNAP ENVIRONMENT/ARCHITECTURE - ENEA SAMPLES

- ❑ ENEA MELCOR/DAKOTA uncertainty studies are reported here:
 - SAMPLE 1: MELCOR/DAKOTA COUPLING AGAINST CSTF-AB1 test
 - SAMPLE 2: MELCOR/DAKOTA COUPLING FOR A PWR

- ❑ These represent only the first ENEA exercises showing complete application of the coupling procedure of MELCOR and DAKOTA within the SNAP environment/architecture.

- ❑ The purpose of these exercises is not to be a complete and representative analysis of the MELCOR code nor the most relevant input parameters or their associated PDFs but instead is only intended to demonstrate the methodology.

- ❑ Therefore, the main purpose of these applications is to:
 - Show the feasibility of the MELCOR/DAKOTA coupling,
 - Provide detailed on the capabilities provided by this methodology, and
 - Show the great advantage of using SNAP:

SAMPLE 1 - MELCOR/DAKOTA COUPLING AGAINST CSTF-AB1 TEST: FOMS

Edit Uncertainty Configuration

DAKOTA Properties Variables Distributions Report

Number of Samples: 452
Random Seed: -auto-
Sampling Method: Monte-Carlo Latin Hypercube
Input Error Handling: Ignore model check errors
Figures of Merit: [Add] [Delete] [Up] [Down]

Order: 1
Probability: 98.0
Confidence: 98.0
Replacement Factor: 0.5
Time Dependent: ndent > E

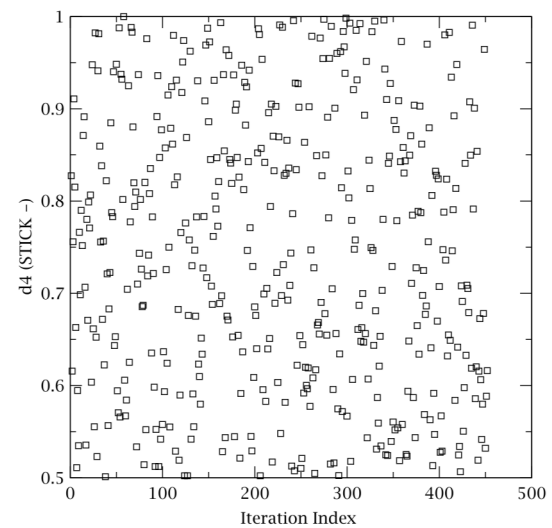
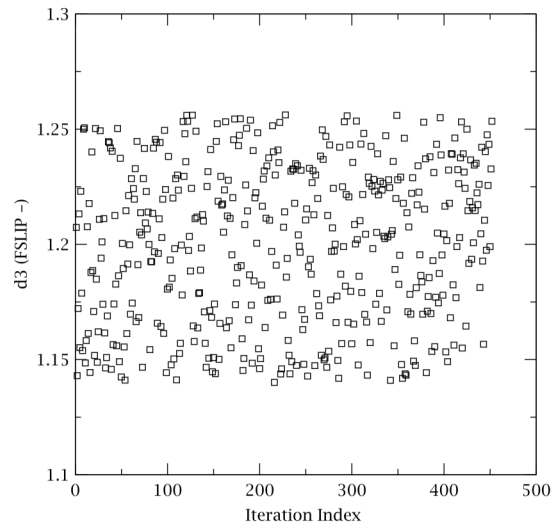
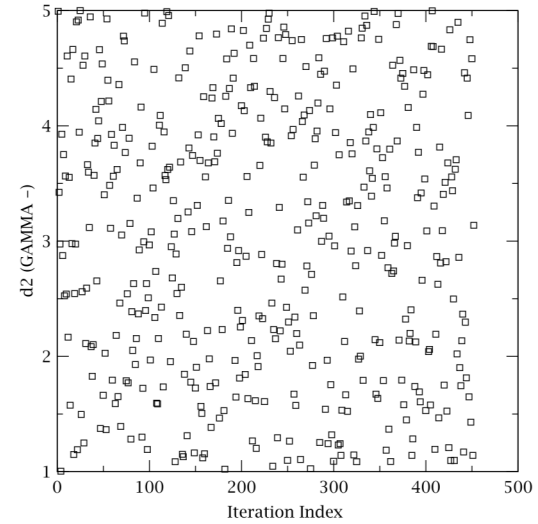
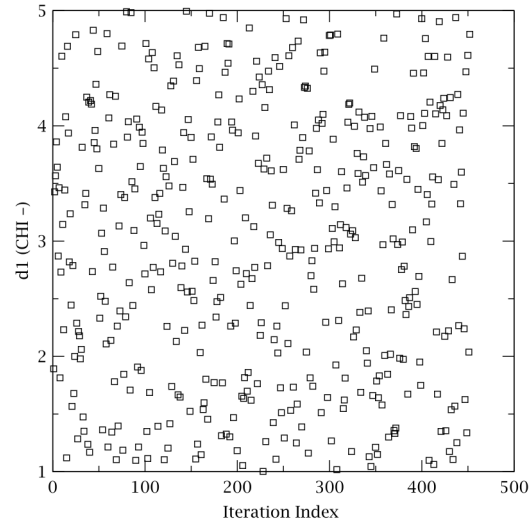
Name	Lower Limit	Upper Limit	Description
SUSP	<input type="checkbox"/>	<input type="checkbox"/>	<unset>
MMD	<input type="checkbox"/>	<input type="checkbox"/>	<unset>
SSD	<input type="checkbox"/>	<input type="checkbox"/>	<unset>
TOT_DEP	<input type="checkbox"/>	<input type="checkbox"/>	<unset>

Help Undo Redo OK Cancel

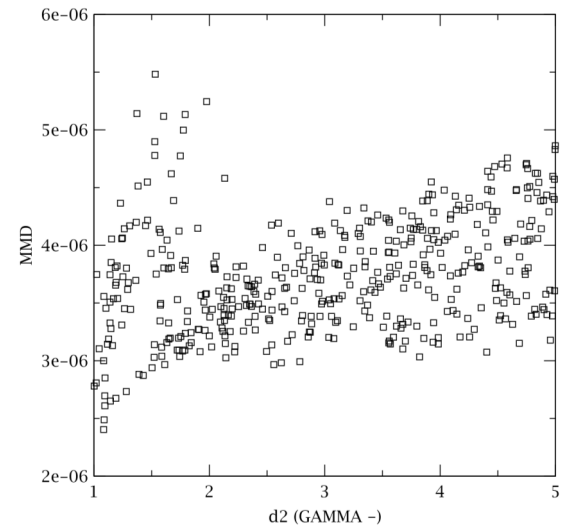
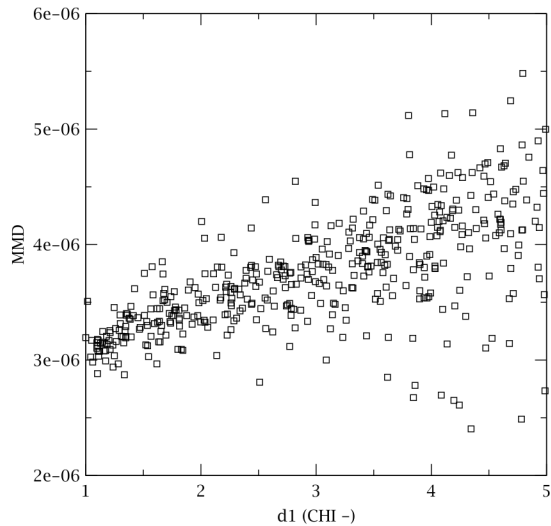
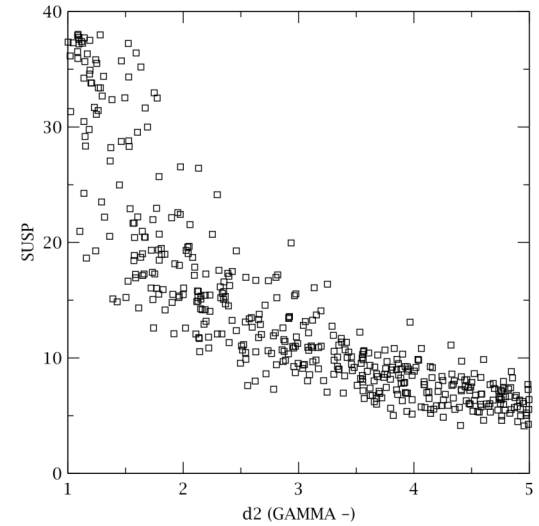
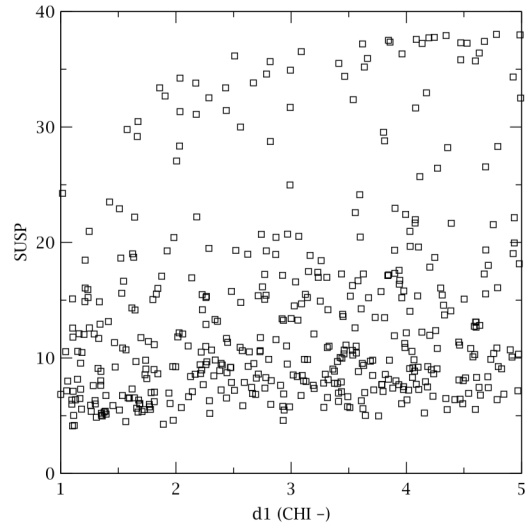
The following four figures of merit are defined for this uncertainty analysis:

- SUSP: Suspended airborne concentration
- MMD: Aerosol mass median diameter
- SSD: Geometric standard deviation of the aerosol distribution
- TOT_DEP: Tot mass deposited

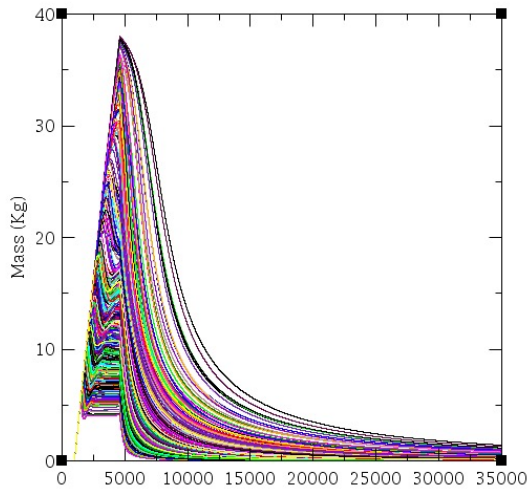
SAMPLE 1 - VARIATE AND RESPONSE DATA: INPUT UNCERTAIN PARAMETER VS ITERATION INDEX FOR THE CASE1



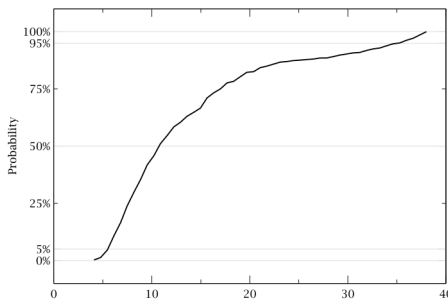
SAMPLE 1: VARIATE AND RESPONSE DATA: FOM VS INPUT UNCERTAIN PARAMETERS



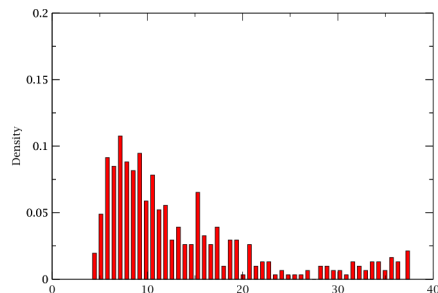
SAMPLE 1 - MELCOR/DAKOTA COUPLING AGAINST CSTF-AB1 TEST : SUSPENDED MASS AT THE END OF THE POOL FIRE



Cumulative Distribution Function



Probability Density Function



Statistical results

Summary	Value	Task #
Min Value	4.10529	121
Max Value	38.00867	300
Mean	13.88923	-
Median	10.69479	average of 419 and 436
Standard Deviation	8.68916	-
Coefficient of Variance	1.38387	-

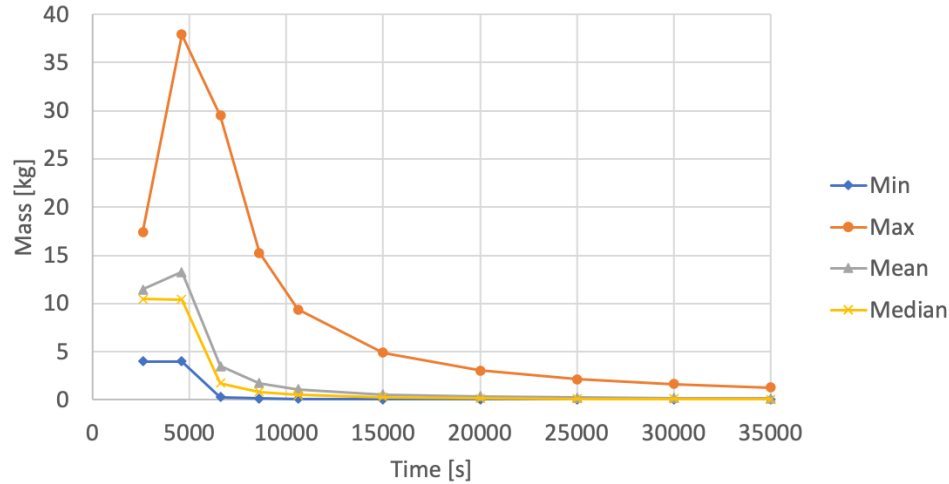
Response correlation reported in the automatically generated DAKOTA report based on the 59 samples

	Simple	Partial	Simple Rank	Partial Rank
d1	0.212682	0.45182	0.22458	0.809953
d2	-0.839444	-0.891894	-0.920448	-0.984271
d3	-0.00536477	-0.052228	0.00593418	-0.0868283
d4	-0.166987	-0.376395	-0.151035	-0.685502
d5	-0.160288	-0.37879	-0.201699	-0.793493
d6	0.0381186	0.0479846	0.0215019	-0.00823322
d7	0.00950152	-0.0383844	0.0139928	-0.0606922
d8	0.019709	0.0737938	-0.0320248	-0.134612
MMD	-0.107979	-	-0.138996	-
SSD	-0.797382	-	-0.716527	-
TOT_DEP	-1.0	-	-1.0	-

Note: NaN values typically indicate an insufficient number of tasks were supplied to perform the analysis.

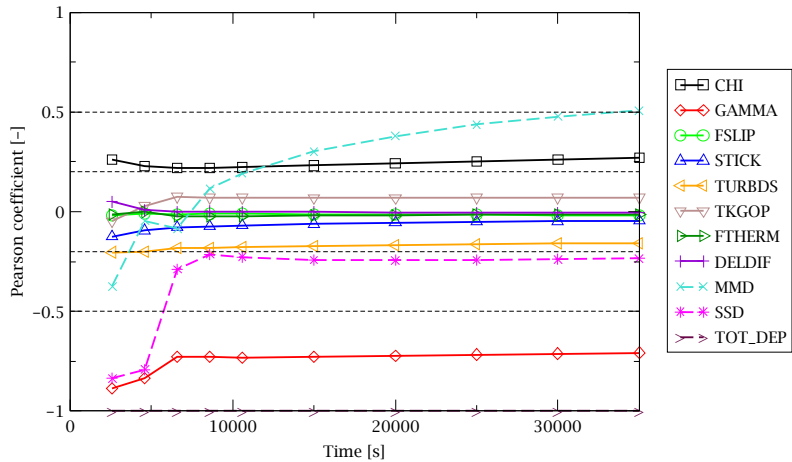
SAMPLE 1 - MELCOR/DAKOTA COUPLING AGAINST CSTF-AB1 TEST: SUSPENDED MASS - TIME DEPENDENT ANALYSES

SUSP STATISTICAL ANALYSIS

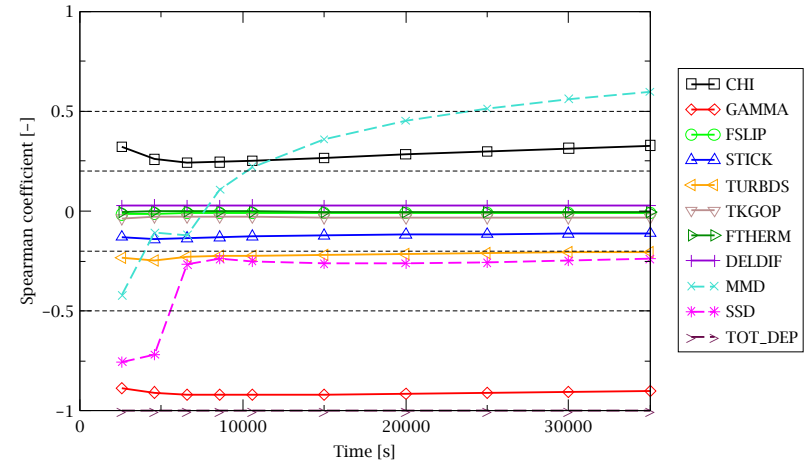


Time Dependent Analysis

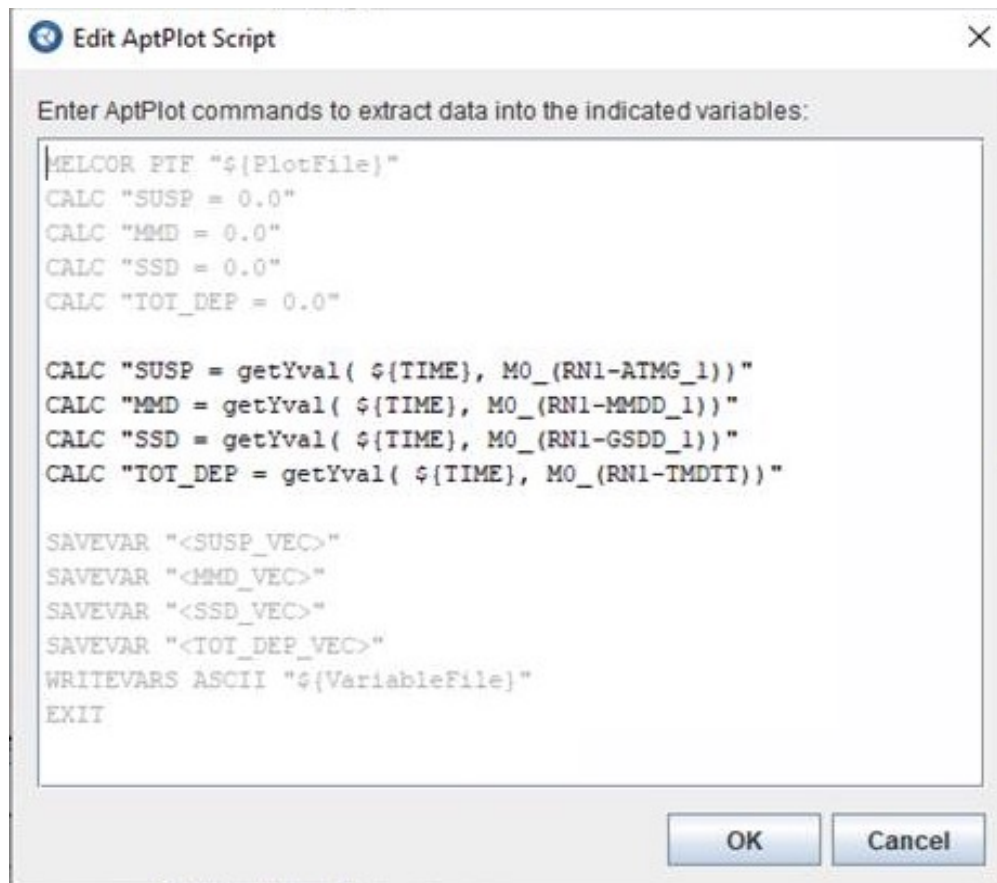
SUSP Pearson Coefficient



SUSP Spearman Coefficient



SAMPLE 1 - TIME DEPENDENT ANALYSIS, APTPLOT SCRIPT FOR THE DATA EXTRACTION



```
MELCOR PTF "${PlotFile}"
CALC "SUSP = 0.0"
CALC "MMD = 0.0"
CALC "SSD = 0.0"
CALC "TOI_DEP = 0.0"

CALC "SUSP = getYval( ${TIME}, MO_(RN1-ATMG_1))"
CALC "MMD = getYval( ${TIME}, MO_(RN1-MMDD_1))"
CALC "SSD = getYval( ${TIME}, MO_(RN1-GSDD_1))"
CALC "TOI_DEP = getYval( ${TIME}, MO_(RN1-TMDIT))"

SAVEVAR "<SUSP_VEC>"
SAVEVAR "<MMD_VEC>"
SAVEVAR "<SSD_VEC>"
SAVEVAR "<TOI_DEP_VEC>"
WRITEVARS ASCII "${VariableFile}"
EXIT
```

OK Cancel

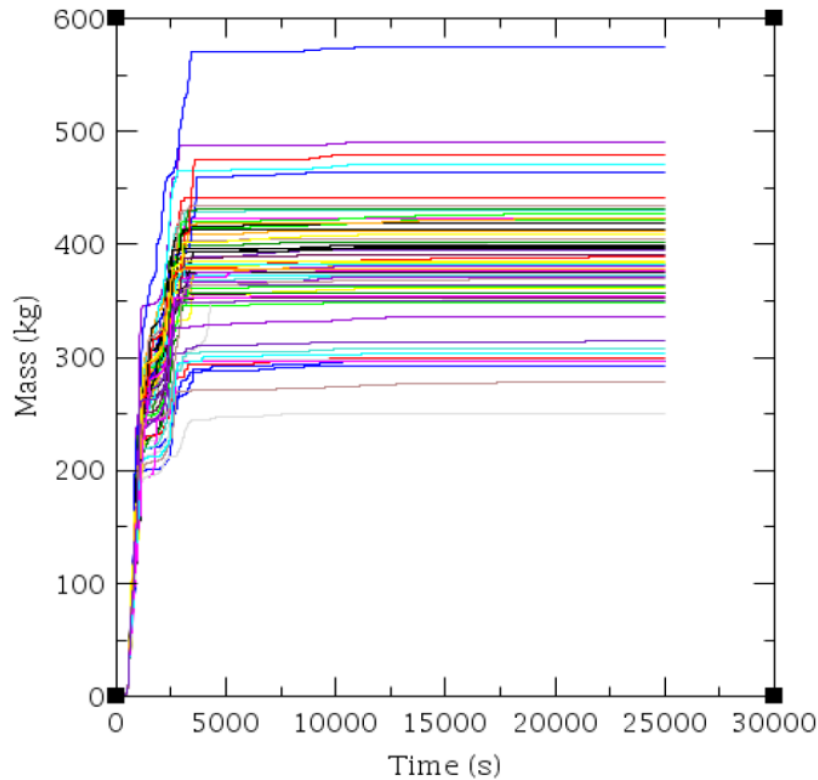
SAMPLE 2: MELCOR/DAKOTA COUPLING FOR A PWR

- ❑ In the CSARP framework, a MELCOR/DAKOTA sample input model has been developed by ENEA using the `_PWR_v2-0.inp` input available for MELCOR users.
- ❑ Since the file was available in ASCII format, the steps that have been performed with SNAP are:
 - Import the `_PWR_v2-0.inp` into SNAP and create a `.med` file,
 - Create the Job Stream for the MELCOR and DAKOTA analysis,
 - Identify uncertain input parameters and their related distribution characteristics;
 - Run the analyses with SNAP.
- ❑ The total cumulative hydrogen production in the core from all the oxidation processes (COR-DMH2-TOT) at the end the transient has been selected as the only FOM for this analysis.

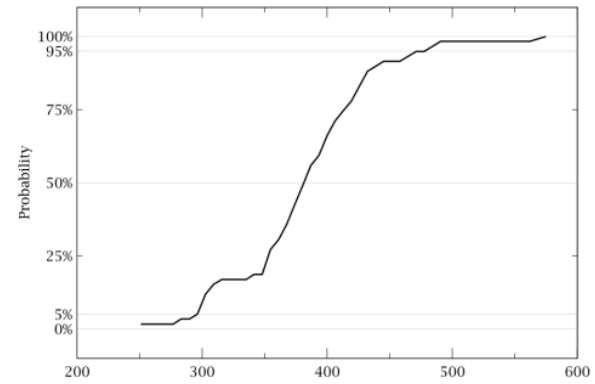
An model input set of 59 runs is computed such that the 1 specified FOM with a 95.0% probability and a 95.0% confidence level are satisfied.

SAMPLE-2: TOT HYDROGEN MASS GENERATED DISPERSION, CUMULATIVE DISTRIBUTION FUNCTION, AND PROBABILITY DENSITY FUNCTION

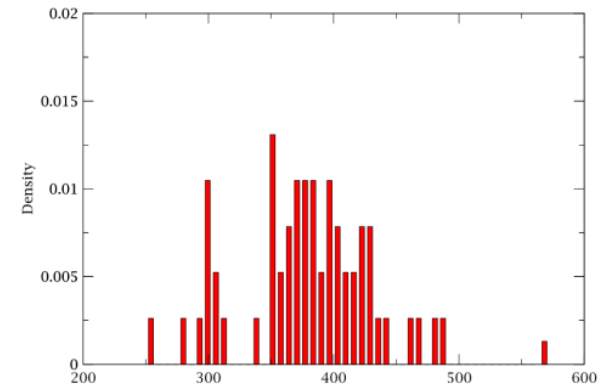
H2 GENERATION



Cumulative Distribution Function



Probability Density Function



SAMPLE 2 - STATISTICAL AND RESPONSE CORRELATION RESULTS

Statistical results based on the 59 samples

Summary	Value	Task #
Min Value	250.87505	54
Max Value	574.76666	51
Mean	381.43805	-
Median	382.44507	40
Standard Deviation	56.8461	-
Coefficient of Variance	0.38578	-

Response correlation reported in the automatically generated DAKOTA report based on the 59 samples

	Simple	Partial	Simple Rank	Partial Rank
d5	0.0979063	0.102384	0.135067	0.268539
d6	0.110172	0.146704	0.0338983	0.0599765
d7	0.098521	0.123725	0.126768	0.209831
d1	0.737284	0.791904	0.765926	0.855157
d2	-0.495872	-0.627241	-0.379486	-0.653184
d3	0.03035	0.00594472	0.0189947	0.0516358
d4	-0.0188159	0.0125986	-0.0151373	0.0108442

SAMPLE 2- DAKOTA INPUT REPORTED IN THE AUTOMATICALLY GENERATED REPORT

REPORT

Update for Chapter Headers

3.2 DAKOTA Input File

The input file used in a `-pre_run` DAKOTA invocation to generate the random variates.

```
method,
  nond_sampling,
  samples = 59
  # stub response levels
  response_levels = 0.0 1.0
  sample_type random
  distribution cumulative

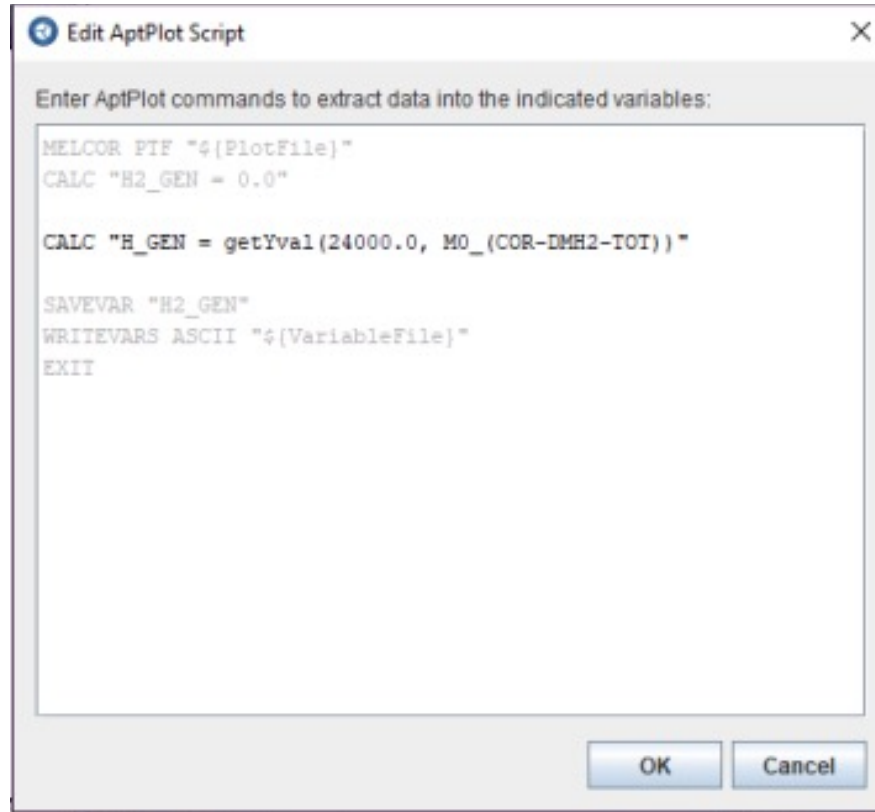
variables,
  normal_uncertain = 3
  descriptors = 'd5' 'd6' 'd7'
  means = 2700.0 5.0 2800.0
  std_deviations = 120.0 1.0 150.0
  lower_bounds = -1.7976931348623157E308 -1.7976931348623157E308 -
1.7976931348623157E308
  upper_bounds = 1.7976931348623157E308 1.7976931348623157E308
1.7976931348623157E308

  triangular_uncertain = 4
  descriptors = 'd1' 'd2' 'd3' 'd4'
  lower_bounds = 2098.0 0.01 0.05 50.0
  upper_bounds = 2550.0 1.0 1.2 1100.0
  modes = 2400.0 0.083 0.1 1000.0

interface,
  system
  analysis_driver = '<not used>'

responses,
  num_response_functions = 1
  no_gradients
  no_hessians
```

SAMPLE 2- NOT TIME DEPENDENT ANALYSIS, APTPLOT SCRIPT FOR THE DATA EXTRACTION



The screenshot shows a dialog box titled "Edit AptPlot Script" with a close button (X) in the top right corner. Below the title bar, there is a label "Enter AptPlot commands to extract data into the indicated variables:". The main area of the dialog contains a text box with the following script:

```
MELCOR PTF "%{PlotFile}"  
CALC "H2_GEN = 0.0"  
  
CALC "H_GEN = getYval(24000.0, MO_(COR-DMH2-TOI))"  
  
SAVEVAR "H2_GEN"  
WRITEVARS ASCII "%{VariableFile}"  
EXIT
```

At the bottom right of the dialog, there are two buttons: "OK" and "Cancel".

SAMPLE 2- SNAP JOB-STATUS DURING THE DAKOTA UNCERTAINTY APPLICATION

calcserv://Local/UNCERTAINTY/MELCOR/PWR_UQ/

Job	Priority	Job Type	Status ▼	Submitted	Started	Completed	Calc Time	Loaded	Evaluation
PWR_UQ	4	Stream	Complete	Aug 05 12:21	Aug 05 12:21	Aug 05 12:33	No Data	No	
2DPLOT	5	AptPlot	Complete	Aug 05 12:30	Aug 05 12:32	Aug 05 12:32	No Data	No	
GET_FOM_T01	5	AptPlotExtract	Complete	Aug 05 12:24	Aug 05 12:30	Aug 05 12:30	No Data	No	
GET_FOM_T02	5	AptPlotExtract	Complete	Aug 05 12:24	Aug 05 12:30	Aug 05 12:30	No Data	No	
GET_FOM_T03	5	AptPlotExtract	Complete	Aug 05 12:24	Aug 05 12:30	Aug 05 12:30	No Data	No	
GET_FOM_T04	5	AptPlotExtract	Complete	Aug 05 12:24	Aug 05 12:30	Aug 05 12:30	No Data	No	
GET_FOM_T05	5	AptPlotExtract	Complete	Aug 05 12:25	Aug 05 12:30	Aug 05 12:31	No Data	No	
GET_FOM_T06	5	AptPlotExtract	Complete	Aug 05 12:25	Aug 05 12:30	Aug 05 12:31	No Data	No	
GET_FOM_T07	5	AptPlotExtract	Complete	Aug 05 12:24	Aug 05 12:30	Aug 05 12:31	No Data	No	
GET_FOM_T08	5	AptPlotExtract	Complete	Aug 05 12:25	Aug 05 12:31	Aug 05 12:31	No Data	No	
GET_FOM_T09	5	AptPlotExtract	Complete	Aug 05 12:25	Aug 05 12:30	Aug 05 12:31	No Data	No	
GET_FOM_T10	5	AptPlotExtract	Complete	Aug 05 12:25	Aug 05 12:30	Aug 05 12:31	No Data	No	
GET_FOM_T11	5	AptPlotExtract	Complete	Aug 05 12:25	Aug 05 12:31	Aug 05 12:31	No Data	No	
GET_FOM_T12	5	AptPlotExtract	Complete	Aug 05 12:25	Aug 05 12:31	Aug 05 12:31	No Data	No	
GET_FOM_T13	5	AptPlotExtract	Complete	Aug 05 12:25	Aug 05 12:31	Aug 05 12:31	No Data	No	
GET_FOM_T14	5	AptPlotExtract	Complete	Aug 05 12:25	Aug 05 12:31	Aug 05 12:31	No Data	No	
GET_FOM_T15	5	AptPlotExtract	Complete	Aug 05 12:26	Aug 05 12:31	Aug 05 12:31	No Data	No	
GET_FOM_T16	5	AptPlotExtract	Complete	Aug 05 12:26	Aug 05 12:31	Aug 05 12:31	No Data	No	
GET_FOM_T17	5	AptPlotExtract	Complete	Aug 05 12:26	Aug 05 12:31	Aug 05 12:31	No Data	No	
GET_FOM_T18	5	AptPlotExtract	Complete	Aug 05 12:26	Aug 05 12:31	Aug 05 12:31	No Data	No	
GET_FOM_T19	5	AptPlotExtract	Complete	Aug 05 12:26	Aug 05 12:31	Aug 05 12:31	No Data	No	
GET_FOM_T20	5	AptPlotExtract	Complete	Aug 05 12:26	Aug 05 12:31	Aug 05 12:31	No Data	No	
GET_FOM_T21	5	AptPlotExtract	Complete	Aug 05 12:26	Aug 05 12:31	Aug 05 12:31	No Data	No	
GET_FOM_T22	5	AptPlotExtract	Complete	Aug 05 12:26	Aug 05 12:31	Aug 05 12:31	No Data	No	
GET_FOM_T23	5	AptPlotExtract	Complete	Aug 05 12:27	Aug 05 12:31	Aug 05 12:31	No Data	No	
GET_FOM_T24	5	AptPlotExtract	Complete	Aug 05 12:27	Aug 05 12:31	Aug 05 12:31	No Data	No	
GET_FOM_T25	5	AptPlotExtract	Complete	Aug 05 12:27	Aug 05 12:31	Aug 05 12:31	No Data	No	
GET_FOM_T26	5	AptPlotExtract	Complete	Aug 05 12:27	Aug 05 12:31	Aug 05 12:31	No Data	No	
GET_FOM_T27	5	AptPlotExtract	Complete	Aug 05 12:27	Aug 05 12:31	Aug 05 12:31	No Data	No	
GET_FOM_T28	5	AptPlotExtract	Complete	Aug 05 12:27	Aug 05 12:31	Aug 05 12:31	No Data	No	
GET_FOM_T29	5	AptPlotExtract	Complete	Aug 05 12:27	Aug 05 12:31	Aug 05 12:31	No Data	No	
GET_FOM_T30	5	AptPlotExtract	Complete	Aug 05 12:27	Aug 05 12:31	Aug 05 12:31	No Data	No	
GET_FOM_T31	5	AptPlotExtract	Complete	Aug 05 12:28	Aug 05 12:31	Aug 05 12:32	No Data	No	
GET_FOM_T32	5	AptPlotExtract	Complete	Aug 05 12:27	Aug 05 12:31	Aug 05 12:31	No Data	No	
GET_FOM_T33	5	AptPlotExtract	Complete	Aug 05 12:27	Aug 05 12:31	Aug 05 12:31	No Data	No	
GET_FOM_T34	5	AptPlotExtract	Complete	Aug 05 12:28	Aug 05 12:31	Aug 05 12:31	No Data	No	

IN PROGRESS NUREG-IA

- ❑ Considering the interest of the International Community (e.g. EU-MUSA, IAEA-CRP(I31033), etc.) on the MELCOR/DAKOTA coupling a **NUREG-IA**, developed together with SANDIA and POLITO, **is in review phase** and has the main target of:
 - Showing the main details of the MELCOR/DAKOTA coupling in a SNAP environment/architecture;
 - Showing the different steps necessary to set it up;
 - Describing two sample applications to show the feasibility and to analyze the capabilities of this coupling (*these first exercises aim to show only the complete application of the coupling procedure of MELCOR and DAKOTA in a SNAP environment/architecture; they do not want to represent a complete and representative analyses of the MELCOR code uncertainty*).
 - Supporting MECOR users.

A NUREG-IA, in SANDIA REVIEW process, has been prepared to investigate the MELCOR/DAKOTA coupling in a SNAP environment/architecture and to be an endorsed user-guide

NUREG/IA-



International Agreement Report

MELCOR – DAKOTA Coupling for Uncertainty Analyses, in a SNAP Environment/Architecture

Prepared by:

Fulvio Mascari*, Andrea Bersano**, Jesse Phillips***

*ENEA, Nuclear Safety, Security and Sustainability Division (FSN-SICNUC), Via Martiri di Monte Sole 4, Bologna, 40129, Italy

**Politecnico di Torino, Energy Department (DENERG), Corso Duca degli Abruzzi 24, Turin, 10129, Italy

***Sandia National Laboratories, 1515 Eubank SE Albuquerque, New Mexico 87123

H. Hossein, NRC Project Manager

Division full name spelled out
Office of Nuclear Regulatory Research
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UNDER SANDIA
REVIEW

A NUREG-IA, in SANDIA REVIEW process, has been prepared to investigate the MELCOR/DAKOTA coupling in a SNAP environment/architecture and to be an endorsed user-guide

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The activity is done in collaboration with
POLITO, SANDIA.

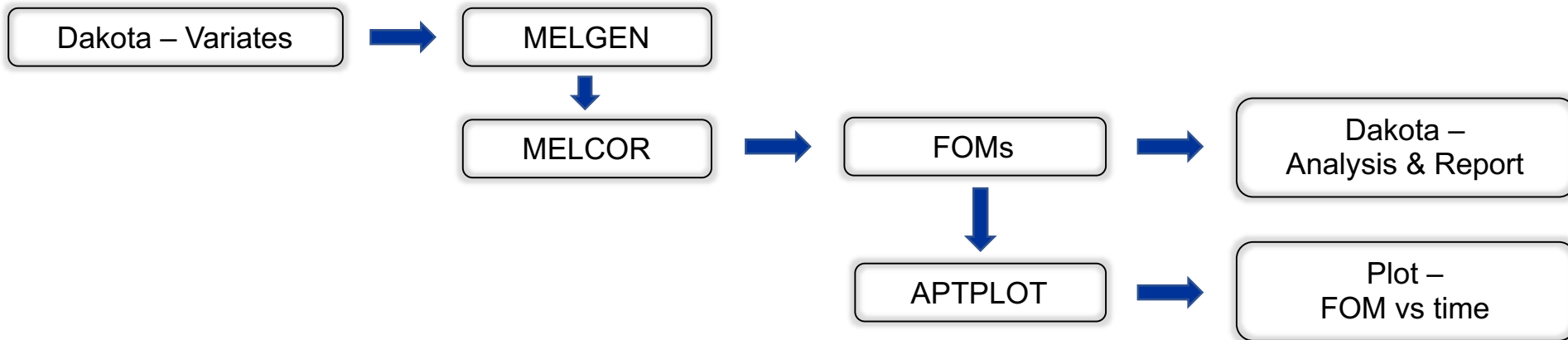
CONCLUSIONS- ON MELCOR/DAKOTA COUPLING THROUGH SNAP GUI

- ❑ MELCOR can be coupled with DAKOTA to perform Uncertainty Analysis.
- ❑ The coupling can be done in SNAP or “stand alone” with scripts.
- ❑ Using SNAP, it is possible to build the input model in a graphical environment and to have a direct visualization of the computed data by using animation capability within SNAP.
- ❑ Two sample applications about the MELCOR/DAKOTA coupling in a SNAP environment/architecture have been carried out by ENEA.
- ❑ A NUREG-IA is in progress to support the MELCOR users in the development of the MELCOR/DAKOTA coupling in SNAP.
- ❑ Currently if one calculation fails it prevents finalizing the UA application in SNAP:
 - New Python directed job-stream capability in SNAP have been added;
 - In the version 1.7 of the SNAP uncertainty plugin “the uncertainty quantification support in Python Directed streams was updated to support a specified number of "Replacement Samples" that are used to run additional tasks to replace those that fail to execute”
(<https://www.aptpplot.com/snap/plugins/uncertainty/changes.jsp>).

DEVELOPMENT OF MELCOR AND DAKOTA THROUGH THE NEW PYTHON DIRECTED JOB-STREAM CAPABILITY IN SNAP

- ❑ Currently the “replacement samples” option is not available when using the SNAP/GUI. Therefore, if one calculation fails, it prevents Uncertainty Analysis finalization:
- ❑ **New Python Directed job-stream feature has been added in SNAP.**

MELCOR and DAKOTA coupling through SNAP: PYTHON DIRECTED STREAM



DEVELOPMENT OF MELCOR AND DAKOTA THROUGH THE NEW PYTHON DIRECTED JOB-STREAM CAPABILITY IN SNAP

The screenshot displays the Model Editor 3.1.5 interface. On the left, a tree view shows the project structure for 'Phebus_FPT1_v5_4.med'. The 'Py' (Python) job stream is selected, and its properties are shown in the 'General' tab below. The Python script is open in the main editor, showing the following code:

```
import parametric

from snap import streams
import snap.model_editor as model_editor
from snap.codes.melcor import *
from pypost.codes.melcor import *
from pypost.codes.aptpilot import *

stream = streams.get_stream()

phebus = model_editor.open_model("C:\Users\miche_m24ypcm\Desktop\Phebus_FPT1_PythonStream.med")

actors=[]
for row in parametric.get_table():
    row.apply_values(phebus)

    actor_name = row.new_task_name("Melgen_Job")

    melgen_run = MelgenActor(actor_name, input=phebus)

    actors.append(melgen_run)

    actor_name2 = row.new_task_name("Melcor_Job")

    melcor_run = MelcorActor(actor_name2, input=phebus.case('MELCOR'), restart_in=melgen_run.restart_out)

    actors.append(melcor_run)
    #stream.add([melgen_run, melcor_run])

stream.add(actors)
stream.wait()

actors_list=stream.get_actors
for actor in actors_list():
```

The 'General' tab for the 'Py' job stream shows the following configuration:

Property	Value
Name	Py
Description	<none>
Stream Type	Python Dire...
Platform	Local
Root Folder	Py_Dir_T...
Relative Location	
Log Level	Debug
View in Job Status	Yes
ECl Support	D
Python Application	Python
Python Script Location	F
Python Script	107 Lines
Bundled Files	1 Selected File
Uncertainty Quantification	59 Mont...

The bottom of the window shows a 'Messages' pane with several status messages, including 'Note: Saving model documents. Please wait...', 'Note: Save Complete.', and 'Note: Stream submitted with batch ID 'Py_Dir_Test/Py''.

DEVELOPMENT OF MELCOR AND DAKOTA THROUGH THE NEW PYTHON DIRECTED JOB-STREAM CAPABILITY IN SNAP

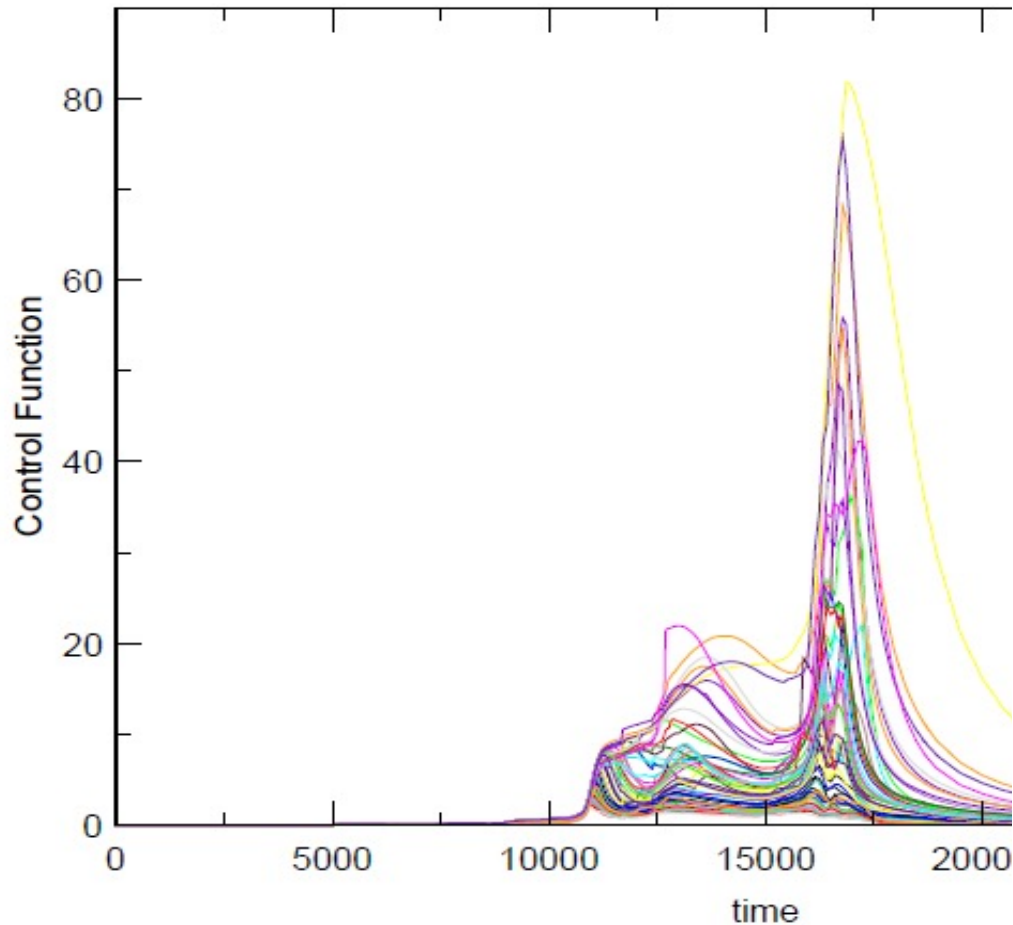


Figure:
**Aerosol amount
in the containment (g)**

First results

DEVELOPMENT OF MELCOR AND DAKOTA THROUGH THE NEW PYTHON DIRECTED JOB-STREAM CAPABILITY IN SNAP

❑ SNAP (Dakota Uncertainty Plugin - GUI):

- Problems in handling failed MELCOR calculations →
- ExtractionData & Uncertainty steps fail

❑ SNAP (Python Directed Stream):

- Script phase seems not user friendly;
- “Replacement samples” option: additional samplings created, but currently failed calculations not re-run;
- Stream manager current failures when adding jobs to the stream;
- “generate_report” currently fails.

❑ Considering the current commitments in the EU-MUSA project and IAEA CRP (I31033) and the current close deadlines for developing the planned research activity, the direct support of SNAP developers could be necessary to develop uncertainty estimation that handle the failed calculations (through GUI or Python direct stream).

MELCOR/DAKOTA COUPLING GROUP

- ❑ The quantification of the uncertainty in a SA transient calculation is a currently relevant topic in the BEPU framework.
- ❑ Among the available methodologies, the **probabilistic method to propagate input uncertainties** is widely adopted in deterministic safety analyses.
- ❑ Several **MELCOR users** are currently applying this method with the **DAKOTA Uncertainty Tool (UT)**, developed by SNL.
- ❑ The goal of this group is to create a platform for MELCOR users for sharing experience and discussing the coupling with DAKOTA, both through the Symbolic Nuclear Analysis Package (SNAP) and with other coupling methods (e.g. Python scripts).
- ❑ The activity is performed in the framework of the **USNRC Cooperative Severe Accident Research Program (CSARP)**.
- ❑ A «MELCOR/DAKOTA coupling» Project has been set in ResearchGate for sharing public material.
- ❑ **Meetings:**
 - *Two meetings have been already carried out;*
 - *A third meeting will be planned in the next months for discussing and consolidate the current approaches for coupling MELCOR and UT tools*
- ❑ The group is open to all MELCOR users and it is currently done in collaboration with:
 - *CIEMAT, ENEA, JACOBS, KIT, POLITO, PSI, SANDIA, UNIPA, UNIPI, UNIROMA1, USNRC*

NEXT MELCOR/DAKOTA COUPLING GROUP MEETING

- ❑ Considering the feedback from the previous meetings we propose to have a further dedicated meeting open to:
 - MELCOR user community,
 - MELCOR developer,
 - DAKOTA developer,
 - SNAP developerto discuss in detail the MELCOR/DAKOTA coupling aspects.

- ❑ At the end of this meeting will be useful to prepare a document that could be a consolidate and endorsed reference to perform uncertainty analyses with MELCOR.

- ❑ Eventually this document could be a NUREG-IA that could be an endorsed reference that summarize the use of MELCOR with uncertainty tools as DAKOTA or RAVEN.

- ❑ The possible date could be in May but the date is open to discussion to optimize the interaction and effectiveness with EU-MUSA and IAEA-CRP(I31033) activities where a lot of use of MELCOR/DAKOTA activity is in progress.

ACKNOWLEDGEMENTS

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Part of the activity has been done through the MUSA project:



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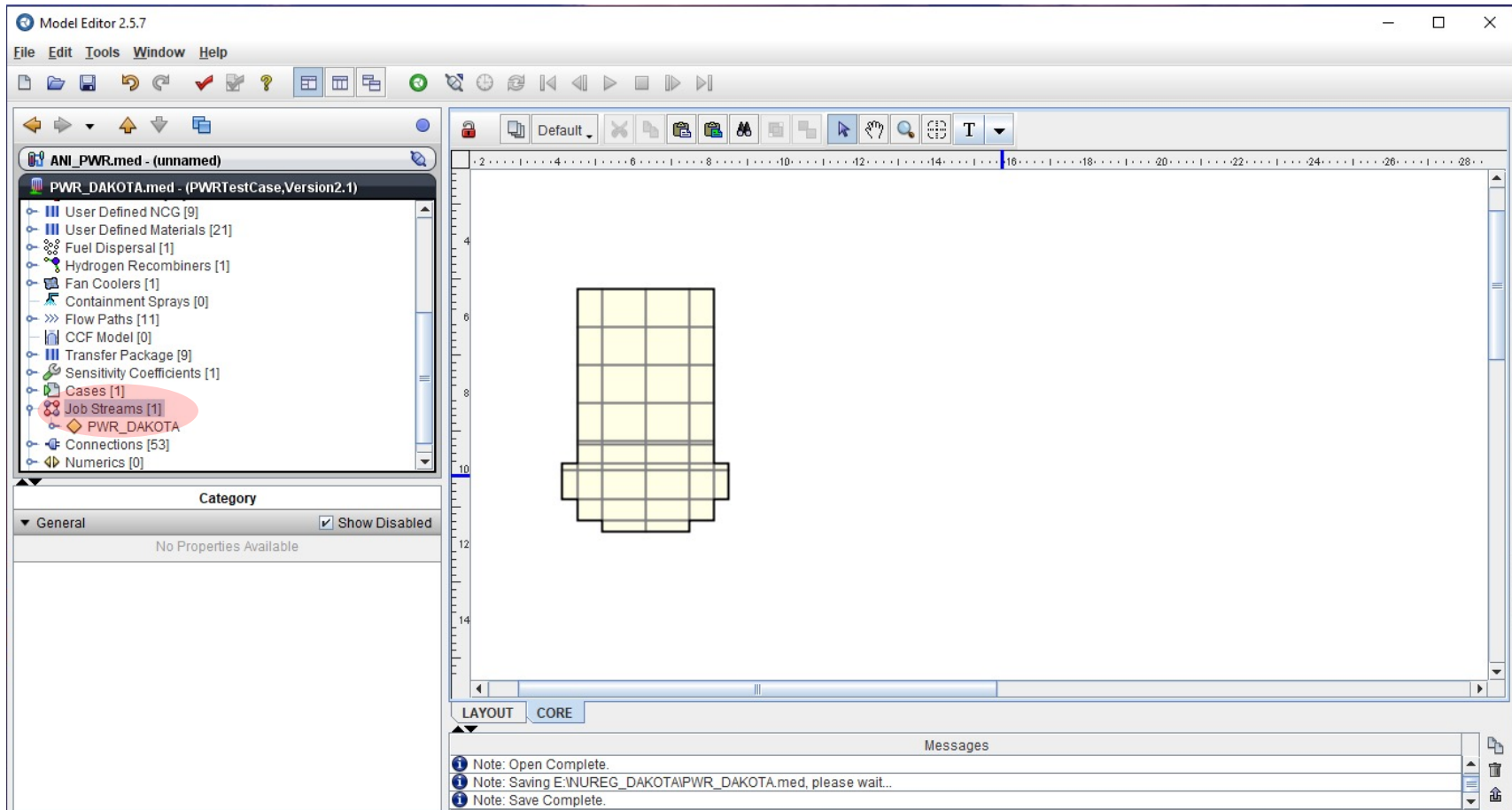
*GRAZIE PER LA VOSTRA
ATTENZIONE*

Fulvio Mascari:
fulvio.mascari@enea.it

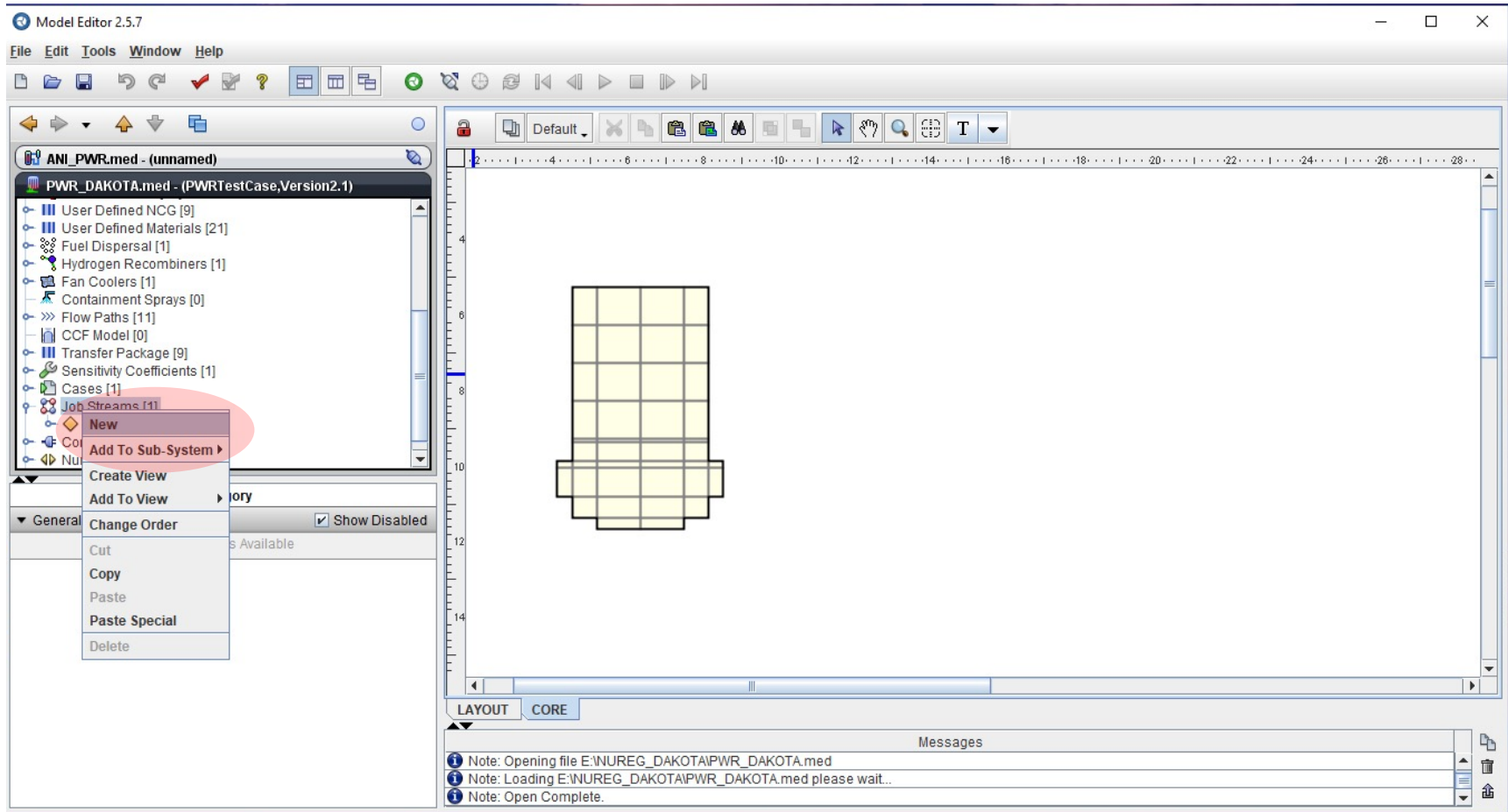


STEPS NECESSARY TO SET-UP A MELCOR/DAKOTA COUPLING IN A SNAP ENVIRONMENT/ARCHITECTURE THROUGH THE GUI

STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM



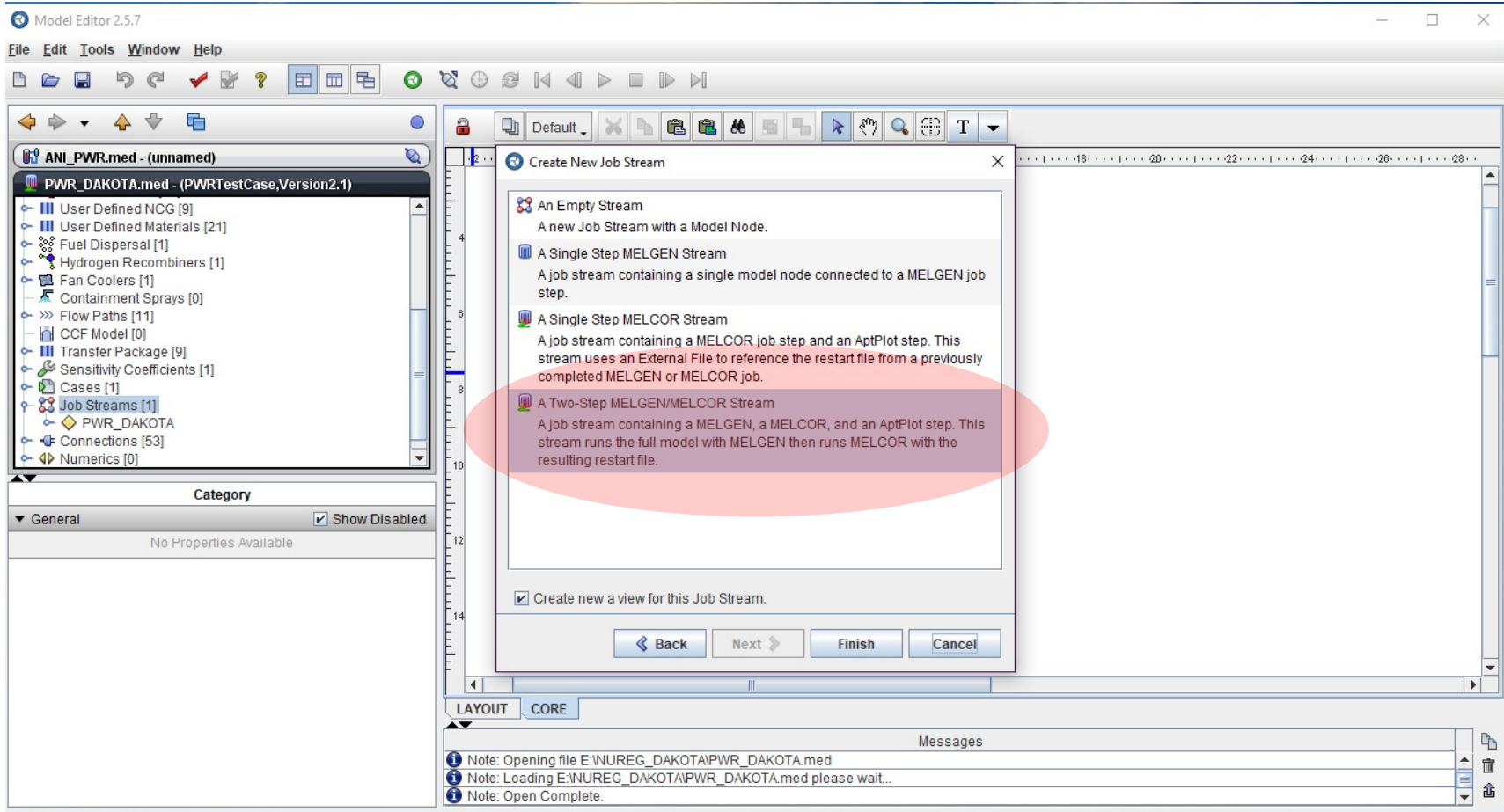
STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM



STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM

The screenshot displays the Model Editor 2.5.7 interface. On the left, a tree view shows the project structure for 'PWR_DAKOTA.med - (PWRTestCase,Version2.1)', including categories like 'User Defined NCG', 'User Defined Materials', 'Fuel Dispersal', 'Hydrogen Recombiners', 'Fan Coolers', 'Containment Sprays', 'Flow Paths', 'CCF Model', 'Transfer Package', 'Sensitivity Coefficients', 'Cases', 'Job Streams', 'Connections', and 'Numerics'. The 'Job Streams' category is expanded, showing 'PWR_DAKOTA'. Below the tree is a 'Category' panel with a 'General' tab and a 'Show Disabled' checkbox. The main workspace is currently empty. A 'Create New Job Stream' dialog box is open in the center, listing four options: 'Basic Stream', 'Template', 'Numeric Combination', and 'DAKOTA Uncertainty'. The 'DAKOTA Uncertainty' option is highlighted with a red oval. At the bottom of the dialog, there is a checkbox for 'Create new a view for this Job Stream.' and buttons for 'Back', 'Next', 'Finish', and 'Cancel'. The bottom status bar shows a 'Messages' panel with three notes: 'Note: Opening file E:\NUREG_DAKOTA\PWR_DAKOTA.med', 'Note: Loading E:\NUREG_DAKOTA\PWR_DAKOTA.med please wait...', and 'Note: Open Complete.'

STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM



In a more recent version of SNAP (e.g. Model Editor 3.1.3) a Two-Step MELGEN/MELCOR stream, and a Three-Step MELGEN/MELCOR/APTPLOT Stream are available. In the case of the Three-Step MELGEN/MELCOR/APTPLOT Stream, the AptPlot stream step is automatically generated. In a more recent Model Editor version (e.g. 3.1.3) in the Two-Step MELGEN/MELCOR job stream, the AptPlot stream step should be added by the code user. To be consistent with the description of this report, based on the Model Editor 2.5.7. the reader should select the Three-Step MELGEN/MELCOR/APTPLOT Stream, if available in the version that he is using.

STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM

The screenshot displays the Model Editor 2.5.7 interface. The main workspace shows a flow diagram titled "Two-Step MELGEN/MELCOR Stream". The diagram consists of the following components and connections:

- MELCOR2X model MELGEN (1):** A blue box on the left with an "input" port.
- MELGEN Step MG_Step (1):** A yellow box in the middle with an "input" port connected to the MELGEN model. It has "restart", "output", "message", and "diag" ports.
- MELCOR Step MC_Step (2):** A yellow box on the right with an "input" port connected to the MG_Step. It has "restart", "output", "message", "diag", and "plot" ports.
- MELCOR2 (2):** A blue box at the top with an "input" port connected to the MC_Step.

The "TwoStep_Stream" properties panel on the left shows the following details:

TwoStep_Stream	
Name	TwoStep_Stream
Description	<none>
Stream Type	DAKOTA Uncertainty
Parametric Properties	1 Monte-Carlo sample, 0 re...
File Groups	0 Groups
Platform	Local
Root Folder	UNCERTAINTY
Relative Location	MELCOR/
Log Level	Information

The Messages panel at the bottom shows the following log entries:

- Note: Opening file E:\NUREG_DAKOTA\PWR_DAKOTA.med
- Note: Loading E:\NUREG_DAKOTA\PWR_DAKOTA.med please wait...
- Note: Open Complete.

STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM

The screenshot displays the Model Editor 2.5.7 interface. On the left, a tree view shows the project structure for "PWR_DAKOTA.med". The "TwoStep_Stream" folder is highlighted with a red oval. Below the tree, the properties for "TwoStep_Stream" are shown in a table:

TwoStep_Stream	
Name	TwoStep_Stream
Description	<none>
Stream Type	DAKOTA Uncertainty
Parametric Properties	1 Monte-Carlo sample, 0 re...
File Groups	0 Groups
Platform	Local
Root Folder	UNCERTAINTY
Relative Location	MELCOR/
Log Level	Information

The main workspace shows a diagram titled "Two-Step MELCOR MELCOR Stream". The diagram consists of three main components:

- MELCOR2X model 1 MELCOR**: A blue box on the left with an "input" port.
- MELCOR Step 1 MG_Step**: A yellow box in the middle with "restart", "output", "message", and "diag" ports.
- MELCOR Step 2 MC_Step**: A yellow box on the right with "restart", "output", "message", and "diag" ports.

Connections are shown as blue arrows: from MELCOR2X model 1 to MELCOR Step 1, and from MELCOR Step 1 to MELCOR Step 2. A "Submit" button is located in the top right corner of the diagram area. At the bottom, a "Messages" pane shows the following log entries:

- Note: Opening file E:\NUREG_DAKOTA\PWR_DAKOTA.med
- Note: Loading E:\NUREG_DAKOTA\PWR_DAKOTA.med please wait.
- Note: Open Complete.

STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM

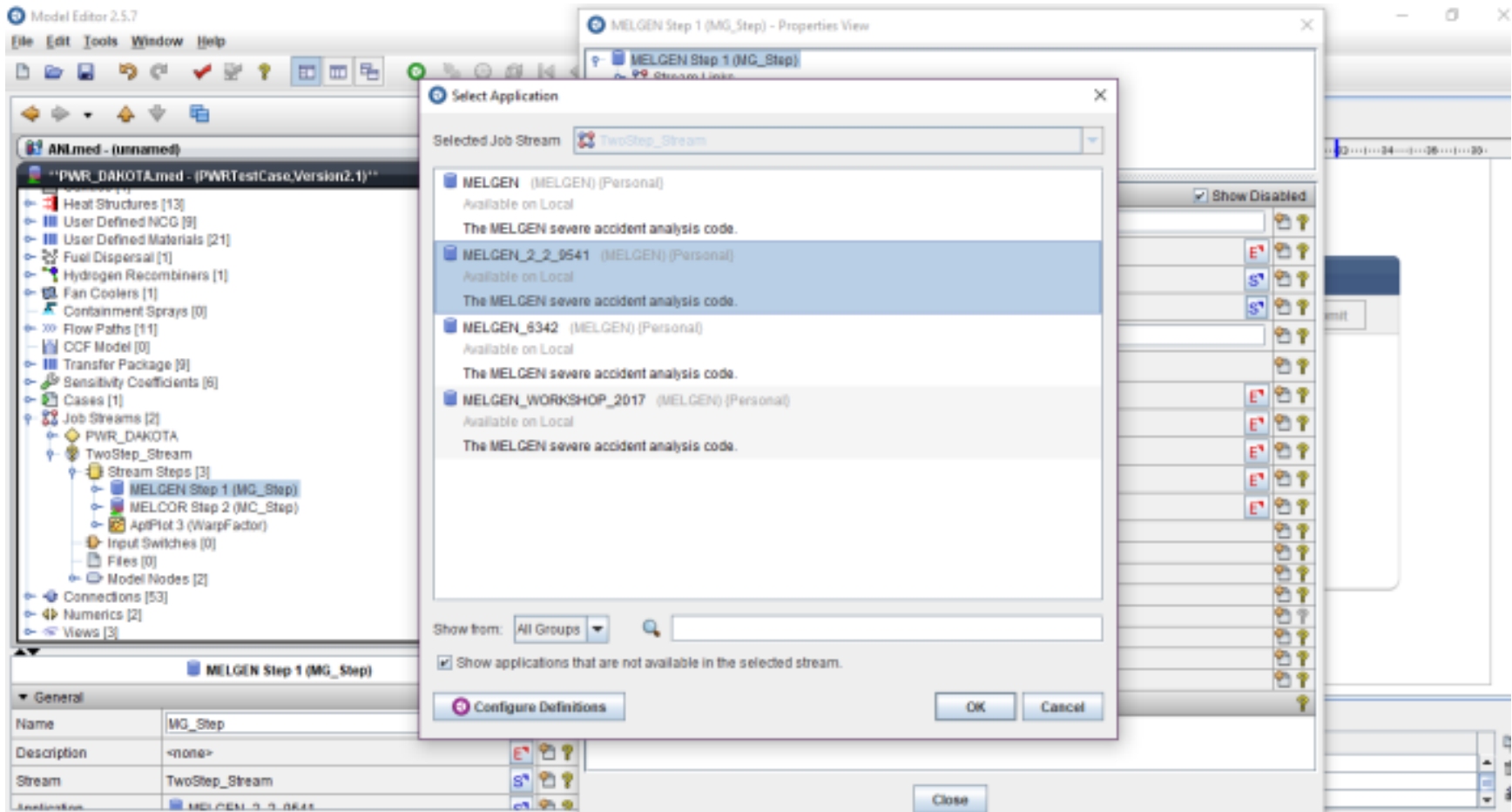
The screenshot displays the Model Editor 2.5.7 interface. On the left, the project tree for 'ANI.med - (unnamed)' is visible, with 'PWR_DAKOTA' and 'TwoStep_Stream' expanded. Under 'TwoStep_Stream', 'Stream Steps [3]' is highlighted, containing 'MELGEN Step 1 (MG_Step)', 'MELCOR Step 2 (MC_Step)', and 'AptPlot 3 (WarpFactor)'. The main workspace shows a 'Two-Step MELGEN/MELCOR Stream' diagram. This diagram consists of three main components: 'MELCOR2X model MELGEN' (labeled '1'), 'MELGEN Step 1 (MG_Step)' (labeled '1'), and 'MELCOR Step 2 (MC_Step)' (labeled '2'). Arrows indicate the data flow: from 'MELCOR2X model MELGEN' to 'MELGEN Step 1 (MG_Step)', and from 'MELGEN Step 1 (MG_Step)' to 'MELCOR Step 2 (MC_Step)'. The 'MELCOR Step 2 (MC_Step)' component has several output ports labeled 'restart', 'output', 'message', 'diag', and 'plot'. A 'Submit' button is located in the top right corner of the diagram area. At the bottom of the interface, a 'Messages' pane shows three status messages: 'Note: Opening file E:\NUREG_DAKOTA\IPWR_DAKOTA.med', 'Note: Loading E:\NUREG_DAKOTA\IPWR_DAKOTA.med please wait...', and 'Note: Open Complete.'

STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM

The screenshot displays the Model Editor 2.5.7 interface. The left pane shows a tree view of the model structure, with 'MELGEN Step 1 (MG_Step)' selected under 'Stream Steps'. The right pane shows the 'Properties View' for 'MELGEN Step 1 (MG_Step)'. The 'Application' field is highlighted in red, and a tooltip indicates 'Select an application for this step.' The 'Stream' field is set to 'TwoStep_Stream'.

General		Show Disabled
Name	MG_Step	
Description	<none>	E
Stream	TwoStep_Stream	S
Application	MELGEN	S
Relative Location		
View in Job Status	<input type="radio"/> Yes <input checked="" type="radio"/> No	
Keywords	No Keywords	E
Conditional Logic	None	E
Input Files	[1] Inputs Defined	E
Output Files	[10] Outputs Defined	E
Custom Processing	None	E
Parametric Tasks	Disabled	
Submission Properties	Disabled	
Animation Model	Disabled	
Open Animation	Disabled	
Data Sources	Disabled	
Interactive Step	Disabled	
Start Paused	Disabled	
ECL Task Set	Disabled	
Task Bundling		

STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM



STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM

The screenshot shows the ANSYS Model Editor 2.5.7 interface. The main window displays a project tree for 'ANL.med - (unnamed)' with a sub-project 'PWR_DAKOTA.mad - (PWRTCase,Version2.1)'. The tree shows a hierarchy of components including Heat Structures, User Defined NCG, User Defined Materials, Fuel Dispersal, Hydrogen Recombiners, Fan Coolers, Containment Sprays, Flow Paths, CCF Model, Transfer Package, Sensibility Coefficients, Cases, Job Streams, and Stream Steps. The 'MELGEN Step 1 (MG_Step)' is selected in the Stream Steps folder.

The 'Properties View' window for 'MELGEN Step 1 (MG_Step)' is open, showing the following configuration:

MELGEN Step 1 (MG_Step) - Properties View	
MELGEN Step 1 (MG_Step)	
Stream Links	
▼ General <input checked="" type="checkbox"/> Show Disabled	
Name	MG_Step
Description	<none>
Stream	TwoStep_Stream
Application	MELGEN_2_2_9541
Relative Location	
View in Job Status	<input type="radio"/> Yes <input checked="" type="radio"/> No
Keywords	No Keywords
Conditional Logic	None
Input Files	[1] Inputs Defined
Output Files	[10] Outputs Defined
Custom Processing	None
Parametric Tasks	Disabled
Submission Properties	Disabled
Animation Model	Disabled
Open Animation	Disabled
Data Sources	Disabled
Interactive Step	Disabled
Start Paused	Disabled
ECI Task Set	Disabled
▶ Task Bundling	
Close	

STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM

The screenshot displays the Model Editor 2.5.7 interface. On the left, a tree view shows the project structure for 'AN.med - (unnamed)', with 'PWR_DAKOTA.med - (PWRTestCase_Version2.1)' expanded to show 'Job Streams [2]' and 'TwoStep_Stream'. The 'TwoStep_Stream' contains 'Stream Steps [3]', including 'MELGEN Step 1 (MC_Step)' and 'MELCOR Step 2 (MC_Step)'. The main workspace shows a 'Two-Step MELGEN/MELCOR Stream' diagram. This diagram consists of several interconnected components: 'MELCOR2X model 1 MELGEN' (input: 'melgen', output: 'MEO'), 'MELCOR 2 MELCOR' (input: 'melcor', output: 'MELCOR'), 'MELCOR Step 1 MC_Step' (inputs: 'restart', 'output', 'message', 'diag'; outputs: 'input', 'restart'), and 'MELCOR Step 2 MC_Step' (inputs: 'restart', 'output', 'message', 'diag'; outputs: 'input', 'output', 'message', 'diag', 'plot'). A 'Submit' button is located in the top right of the diagram area. At the bottom, a 'Messages' panel displays the following log entries:

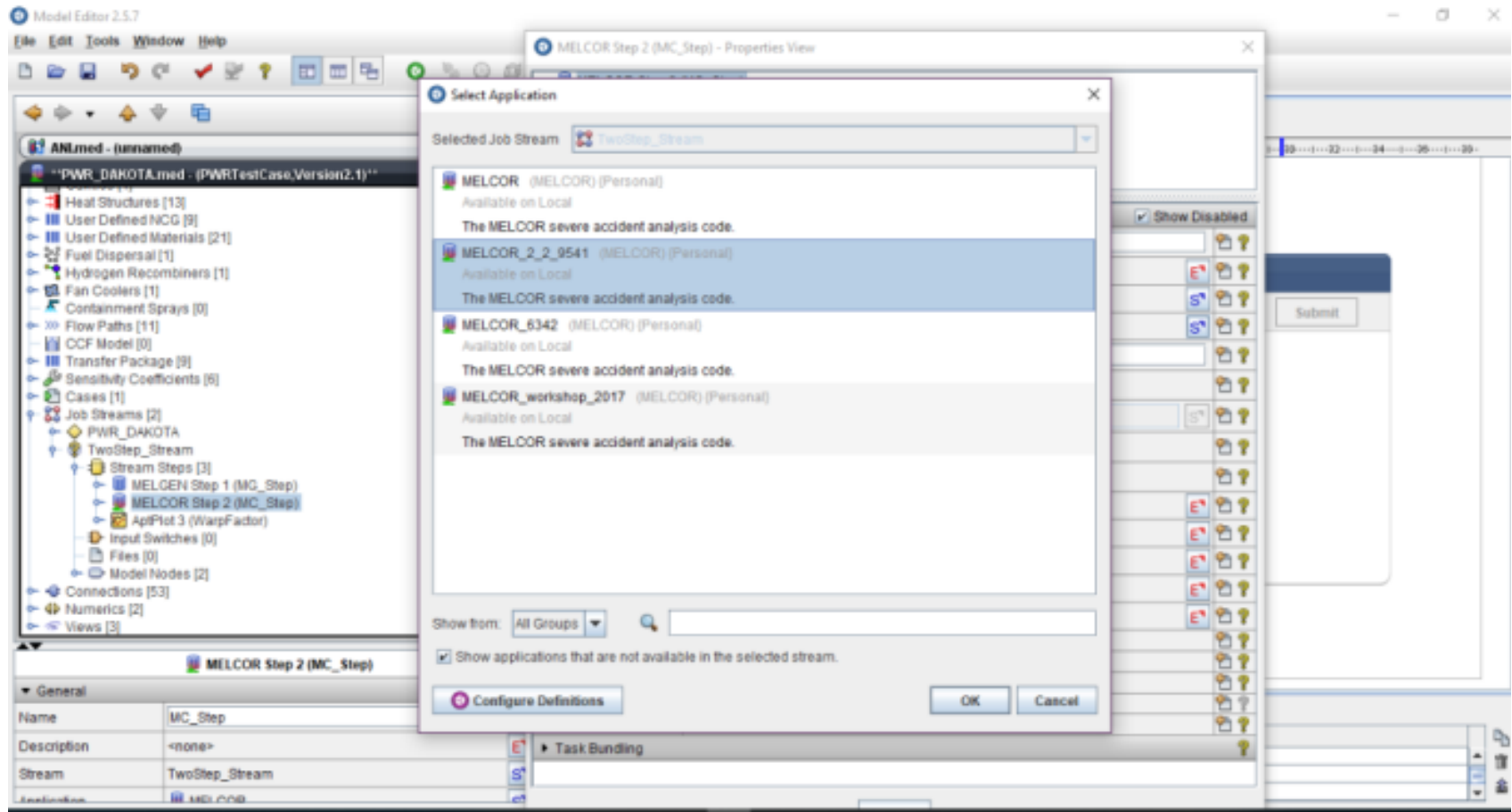
- Note: Opening file E:\NUREG_DAKOTA\PWR_DAKOTA_REV1.med
- Note: Loading E:\NUREG_DAKOTA\PWR_DAKOTA_REV1.med please wait...
- Note: Open Complete

STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM

The screenshot displays the Model Editor 2.5.7 interface. The left pane shows a tree view of the model structure, with 'MELCOR Step 2 (MC_Step)' selected. The main area shows the 'Properties View' for this step. The 'General' tab is active, showing various configuration options. A red oval highlights the 'Stream' field, which is set to 'TwoStep_Stream'. The 'Application' field is set to 'MELCOR'. The 'Stream Links' section is also visible at the top of the Properties View.

MELCOR Step 2 (MC_Step) - Properties View	
MELCOR Step 2 (MC_Step)	
Stream Links	
▼ General <input checked="" type="checkbox"/> Show Disabled	
Name	MC_Step
Description	<none>
Stream	TwoStep_Stream
Application	MELCOR
Relative Location	
View in Job Status	<input type="radio"/> Yes <input checked="" type="radio"/> No
Animation Model	<Inactive>
Interactive Step	<input checked="" type="radio"/> On <input type="radio"/> Off
Start Paused	<input type="radio"/> On <input checked="" type="radio"/> Off
Keywords	No Keywords
Conditional Logic	None
Input Files	[2] Inputs Defined
Output Files	[11] Outputs Defined
Custom Processing	None
Parametric Tasks	Disabled
Submission Properties	Disabled
Open Animation	Disabled
Data Sources	Disabled
ECI Task Set	Disabled
▶ Task Bundling	

STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM



STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM

The screenshot displays the Model Editor 2.5.7 interface. The left pane shows a tree view of the model structure, with 'MELCOR Step 2 (MC_Step)' selected under 'TwoStep_Stream'. The main window shows the 'MELCOR Step 2 (MC_Step) - Properties View' with the following details:

MELCOR Step 2 (MC_Step) - Properties View	
MELCOR Step 2 (MC_Step)	
Stream Links	
General <input checked="" type="checkbox"/> Show Disabled	
Name	MC_Step
Description	<none>
Stream	TwoStep_Stream
Application	MELCOR_2_2_9541
Relative Location	
View in Job Status	<input type="radio"/> Yes <input checked="" type="radio"/> No
Animation Model	<input type="checkbox"/> Inactive
Interactive Step	<input checked="" type="radio"/> On <input type="radio"/> Off
Start Paused	<input type="radio"/> On <input checked="" type="radio"/> Off
Keywords	No Keywords
Conditional Logic	None
Input Files	[2] Inputs Defined
Output Files	[11] Outputs Defined
Custom Processing	None
Parametric Tasks	Disabled
Submission Properties	Disabled
Open Animation	Disabled
Data Sources	Disabled
ECl Task Set	Disabled
Task Bundling	

The right pane shows a simulation control panel with a 'Submit' button and a progress indicator.

STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM

The screenshot displays the Model Editor 2.5.7 interface. On the left, a project tree for 'ANI_PWR.med - (unnamed)' shows a hierarchy including 'PWR_DAKOTA.med - (PWRTestCase.Version2.1)', 'Sensitivity Coefficients [3]', 'Cases [1]', 'MELCOR', 'Job Streams [2]', 'PWR_DAKOTA', 'PWR_UQ', and 'Stream Steps [3]'. The 'Stream Steps' folder is expanded, showing 'MELGEN Step 1 (MG_Step)', 'MELCOR Step 2 (MC_Step)', and 'AptPlot3 (WarpFactor)'. The 'AptPlot3 (WarpFactor)' component is selected, and its properties are shown in the 'General' pane below the tree. The properties include Name: 'WarpFactor', Description: '<none>', Stream: 'PWR_UQ', Application: 'AptPlot', and View in Job Status: 'No'. The central workspace shows a diagram titled 'Two-Step MELGEN-MELCOR Stream' with a 'Submit' button. The diagram consists of three main components: 'MELCOR2X model MELGEN' (left), 'MELCOR Step 1 MG_Step' (middle), and 'MELCOR Step 2 MC_Step' (right). Arrows indicate data flow from the MELGEN model to the MG_Step, and from the MG_Step to the MC_Step. The MG_Step has inputs for 'input', 'restart', 'message', and 'diag', and outputs for 'output', 'message', and 'diag'. The MC_Step has inputs for 'input', 'restart', 'message', and 'diag', and outputs for 'output', 'message', and 'diag'. The bottom pane shows a 'Messages' section with three entries: 'Note: Save Complete.', 'Note: Saving E:\NJREG_DAKOTA\PWR_DAKOTA.med, please wait...', and 'Note: Save Complete.'

STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM

The image displays two windows from the ANSYS Workbench software. The left window is the 'Properties View' for 'AptPlot 3 (WarpFactor)'. The right window shows a simulation diagram for 'MELCOR/MELCOR Stream'.

Properties View: AptPlot 3 (WarpFactor)

Property	Value
Name	WarpFactor
Description	<none>
Stream	PWR_UQ
Application	AptPlot
Relative Location	
View in Job Status	<input type="radio"/> Yes <input checked="" type="radio"/> No
Keywords	No Keywords
Conditional Logic	None
Custom Processing	None
Plot Inputs	[1] input definition
Plots	[1] plot
Plot Outputs	[1] output definition
Parameter File	<input checked="" type="checkbox"/> <unset>

MELCOR/MELCOR Stream Diagram

The diagram shows a 'MELCOR Step 2 MC_Step' block with various input and output ports. Inputs include 'COR', 'Step 0_Step', 'restart', 'output', 'message', and 'diag'. Outputs include 'restart', 'output', 'message', 'diag', and 'plot'. A 'Submit' button is visible in the top right of the diagram area.

STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM

The screenshot displays the ANSYS Model Editor 2.5.7 interface. The left pane shows a tree view of the model structure, including 'Job Streams' and 'Stream Steps'. The main workspace shows the 'AptPlot 3 (2DPLOT)' stream. Two property view windows are open on the right. The top window, titled 'AptPlot 3 (2DPLOT) - Properties View', shows the following configuration:

Property	Value
Name	2DPLOT
Description	<none>
Stream	TwoStep_Stream
Application	AptPlot
Relative Location	
View in Job Status	<input type="radio"/> Yes <input checked="" type="radio"/> No
Keywords	No Keywords
Conditional Logic	None
Custom Processing	None
Plot Inputs	[1] input definition
Plots	[1] plot
Plot Outputs	[1] output definition
Parameter File	<input checked="" type="checkbox"/> <unset>
Parametric Tasks	Disabled
Submission Properties	Disabled
Animation Model	Disabled
Open Animation	Disabled
Data Sources	Disabled
Interactive Step	Disabled
Start Paused	Disabled
ECL Task Set	Disabled

The bottom-left window shows a smaller version of the same properties view. Red circles highlight the 'Name' field in the top window and the 'Plot Inputs' field in the bottom window.

STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM

The screenshot displays the ANSYS Model Editor 2.5.7 interface. The main window shows a model tree for 'PWR_DAKOTA.med'. The 'Stream Steps' folder is expanded, showing 'MELCOR Step 2 (MC_Step)' and 'AptPlot 3 (2D PLOT)'. The 'AptPlot 3 (2D PLOT)' stream is selected, and its properties are shown in the 'Properties View' window. The 'Edit Plot Inputs - AptPlot 3 (2D PLOT)' dialog is open, showing the 'input' stream with the following properties:

Property	Value
Name	input
Type	MELCOR
Demux	<input type="radio"/> True <input checked="" type="radio"/> False
File Set	<input checked="" type="radio"/> True <input type="radio"/> False
Input Files	[2] inputs available
ASCII Input Type	Disabled

The 'File Set' property is highlighted with a red circle. The 'Close' button is visible at the bottom right of the dialog. The background shows the 'Properties View' window for 'AptPlot 3 (2D PLOT)' with 'Stream Links' listed. The bottom status bar indicates 'The ECI task set number is used to determine which steps/tasks will be executed...'.

STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM

The screenshot shows the ANSYS Model Editor 2.5.7 interface. The main window displays a project tree for 'ANLmed - (unnamed)' with a sub-project 'PWR_DAKOTA_med - (PWRTestCase.Version2.1)'. The tree shows various components like Heat Structures, User Defined NCG, and Job Streams. The 'TwoStep_Stream' job stream is selected, showing its sub-components: Stream Steps (3), MELCOR Step 1 (MG_Step), MELCOR Step 2 (MC_Step), AptPlot 3 (2DPLOT), Input Switches (0), Files (0), and Model Nodes (2).

The 'Properties View' window for 'TwoStep_Stream' is open, showing the following configuration:

General	
Name	TwoStep_Stream
Description	<none>
Stream Type	DAKOTA Uncertainty
Parametric Properties	1 Monte-Carlo sample, 0 responses, 0 variables, 0 distributions
File Groups	0 Groups
Platform	Local
Root Folder	UNCERTAINTY
Relative Location	MELCOR/
Log Level	Information
View in Job Status	<input checked="" type="radio"/> Yes <input type="radio"/> No
Linear Execution	<input type="radio"/> Yes <input checked="" type="radio"/> No
ECI Support	<input type="radio"/> Enabled <input checked="" type="radio"/> Disabled
Platform Properties	Disabled
SNAP Version	Disabled
Staging Location	Disabled
Submission Properties	Disabled

STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM

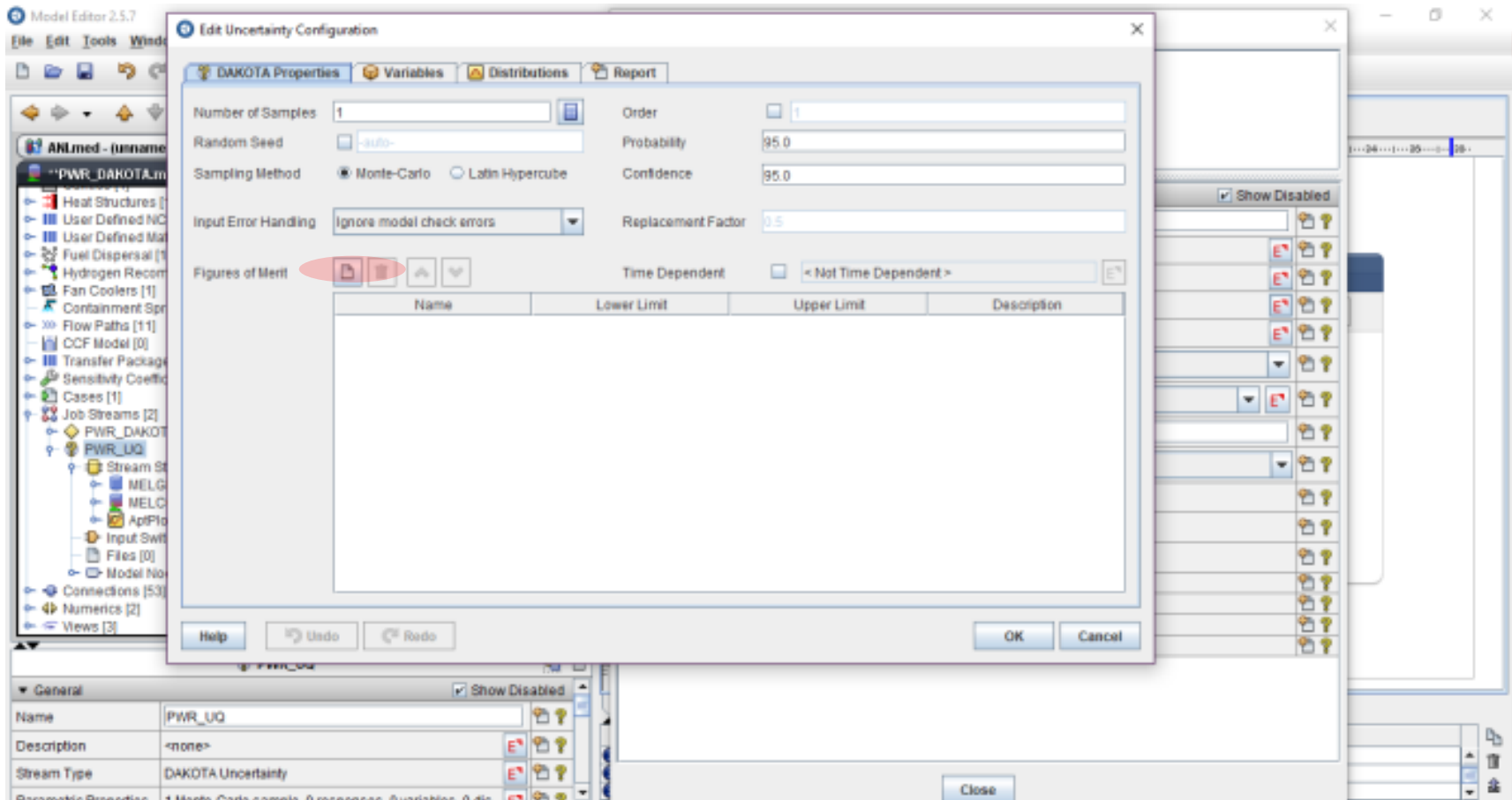
The screenshot displays the Model Editor 2.5.7 interface. The main window shows a project tree for 'ANL.med - (unnamed)' with a sub-project 'PWR_DAKOTA.med - (PWRTestCase.Version2.1)'. The tree includes various components like Heat Structures, User Defined NCG, Materials, Fuel Dispersal, Hydrogen Recombiners, Fan Coolers, Containment Sprays, Flow Paths, CCF Model, Transfer Package, Sensitivity Coefficients, Cases, Job Streams, and PWR_UQ. The PWR_UQ node is expanded, showing Stream Steps (MELGEN Step 1, MELCOR Step 2, AptPlot 3), Input Switches, Files, and Model Nodes.

The 'PWR_UQ - Properties View' dialog is open, showing the following details:

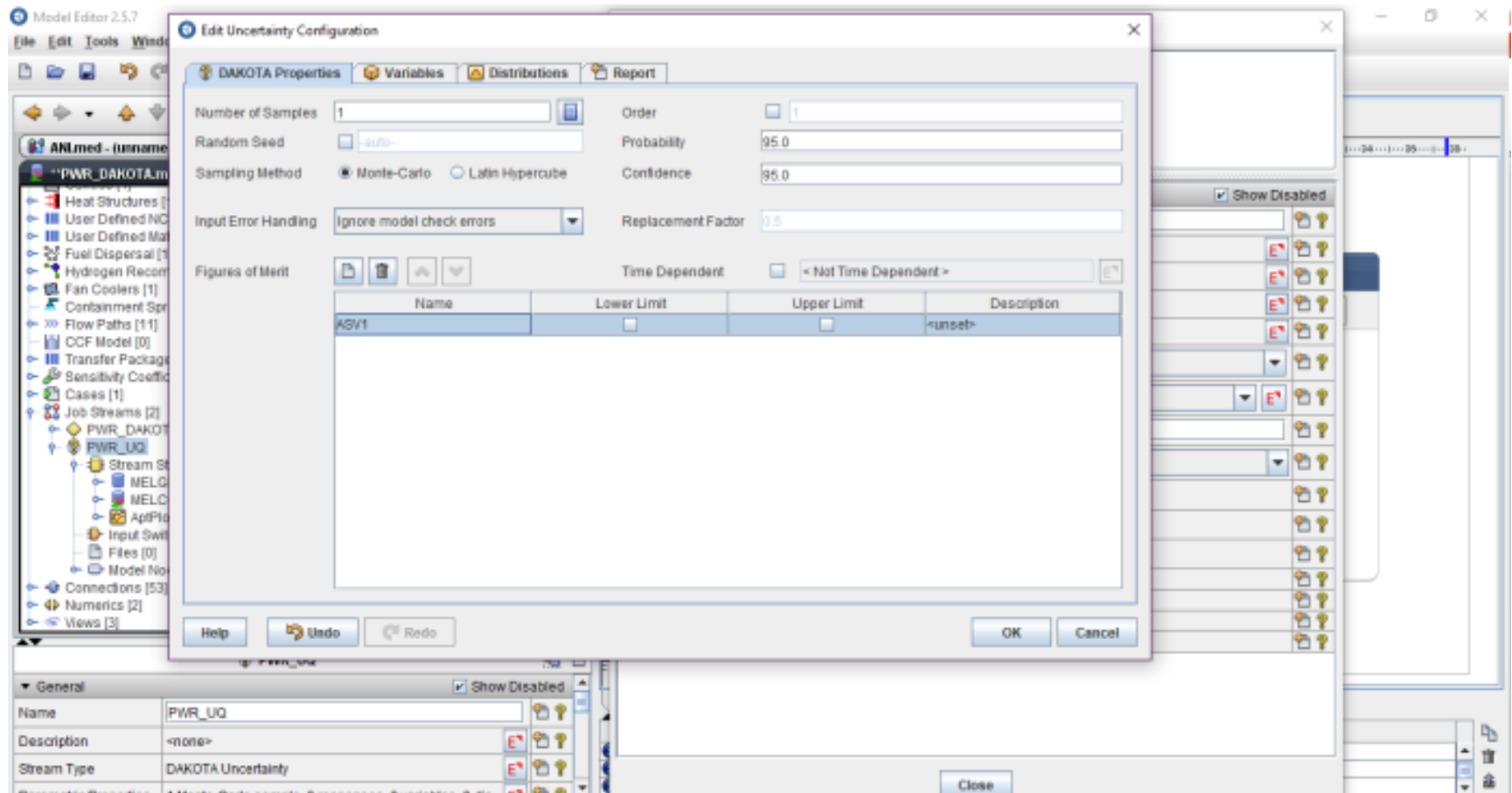
- Name:** PWR_UQ
- Description:** <none>
- Stream Type:** DAKOTA Uncertainty
- Parametric Properties:** 1 Monte-Carlo sample, 0 responses, 0 variables, 0 distributions
- File Groups:** 0 Groups
- Platform:** Local
- Root Folder:** UNCERTAINTY
- Relative Location:** MELCOR\
- Log Level:** Information
- View in Job Status:** Yes (selected)
- Linear Execution:** No (selected)
- ECI Support:** Disabled (selected)
- Platform Properties:** Disabled
- SNAP Version:** Disabled
- Staging Location:** Disabled
- Submission Properties:** Disabled

The 'Close' button is visible at the bottom of the dialog.

STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM



STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM

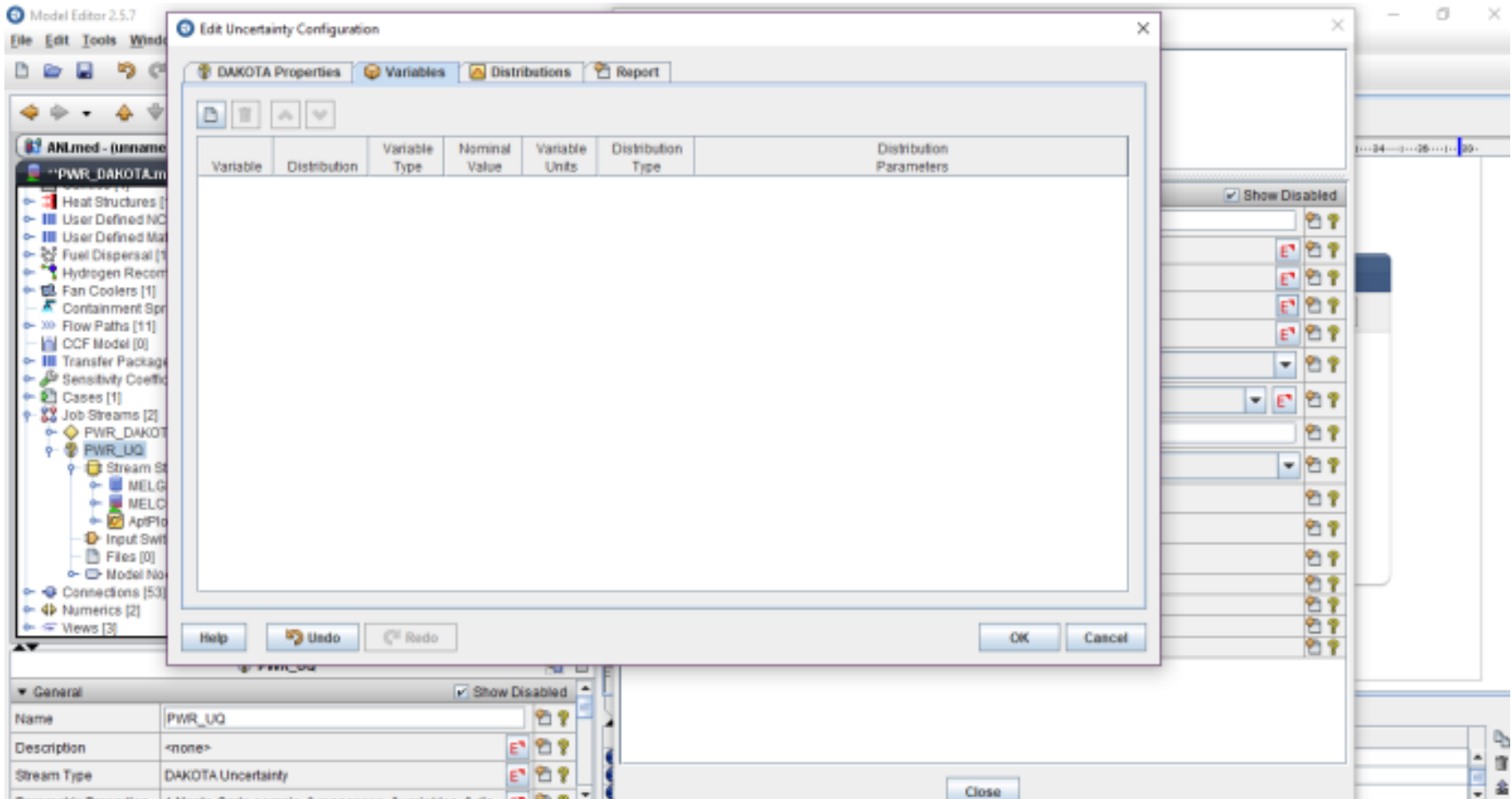


STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM

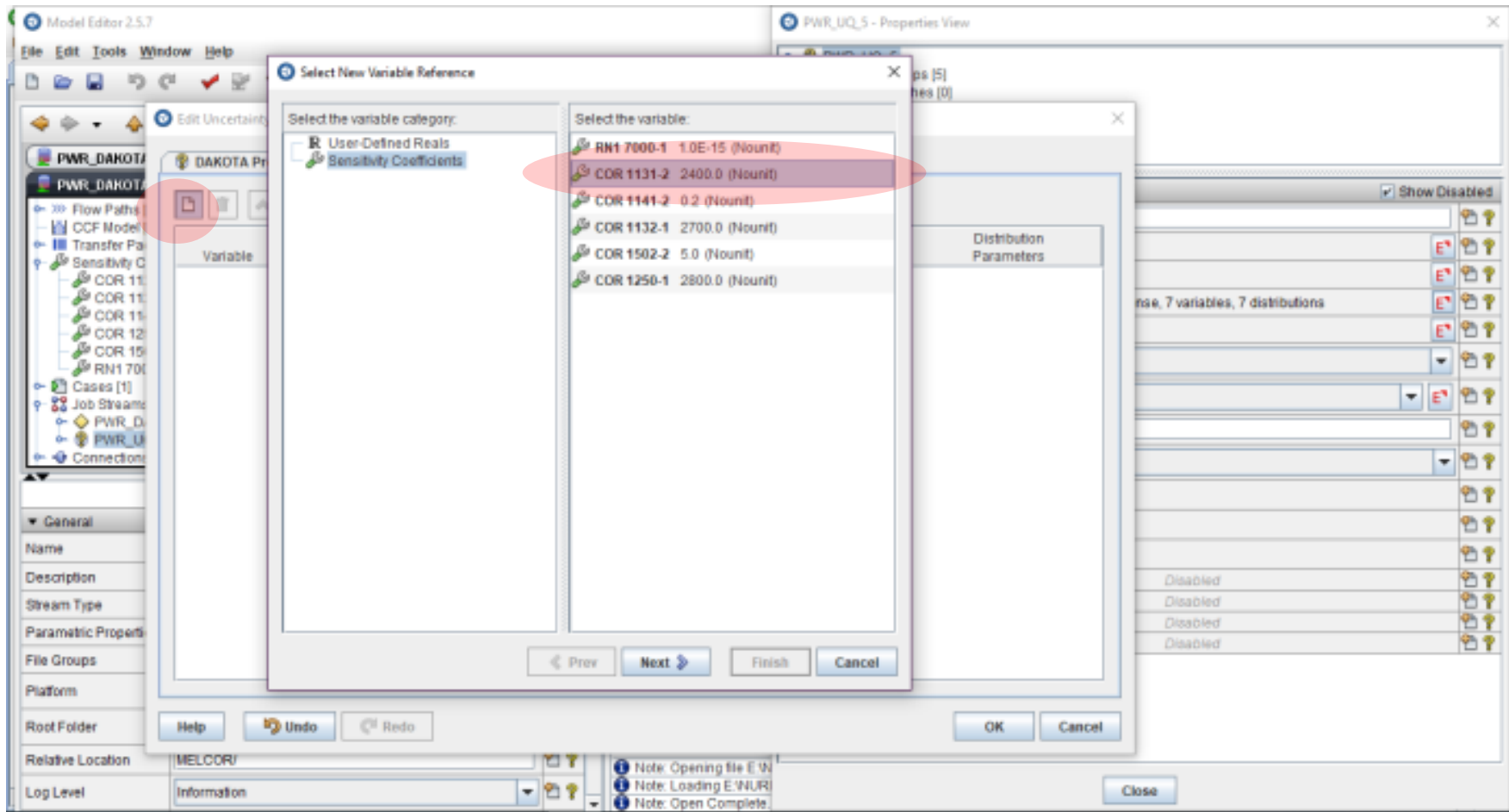
The screenshot displays the 'Edit Uncertainty Configuration' dialog box in the ANL Model Editor 2.5.7. The dialog is configured for a DAKOTA Uncertainty stream. The 'Number of Samples' is set to 1, and the 'Sampling Method' is Monte-Carlo. The 'Input Error Handling' is set to 'Ignore model check errors'. The 'Replacement Factor' is 0.5. The 'Time Dependent' checkbox is unchecked, and the value is '< Not Time Dependent >'. A table at the bottom of the dialog lists the uncertainty stream with columns for Name, Lower Limit, Upper Limit, and Description.

Name	Lower Limit	Upper Limit	Description
H2_GEN	<input type="checkbox"/>	<input type="checkbox"/>	<unset>

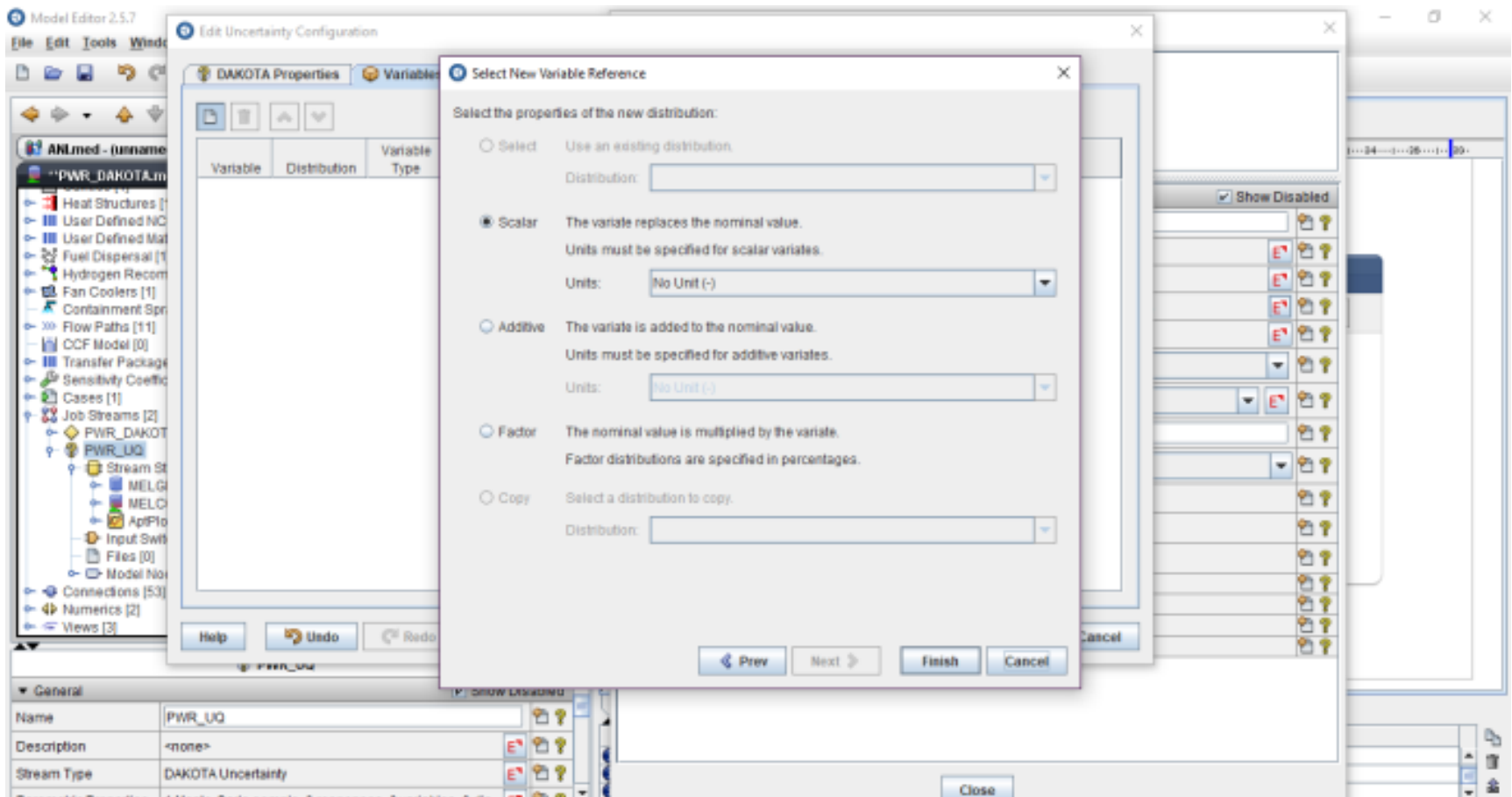
STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM



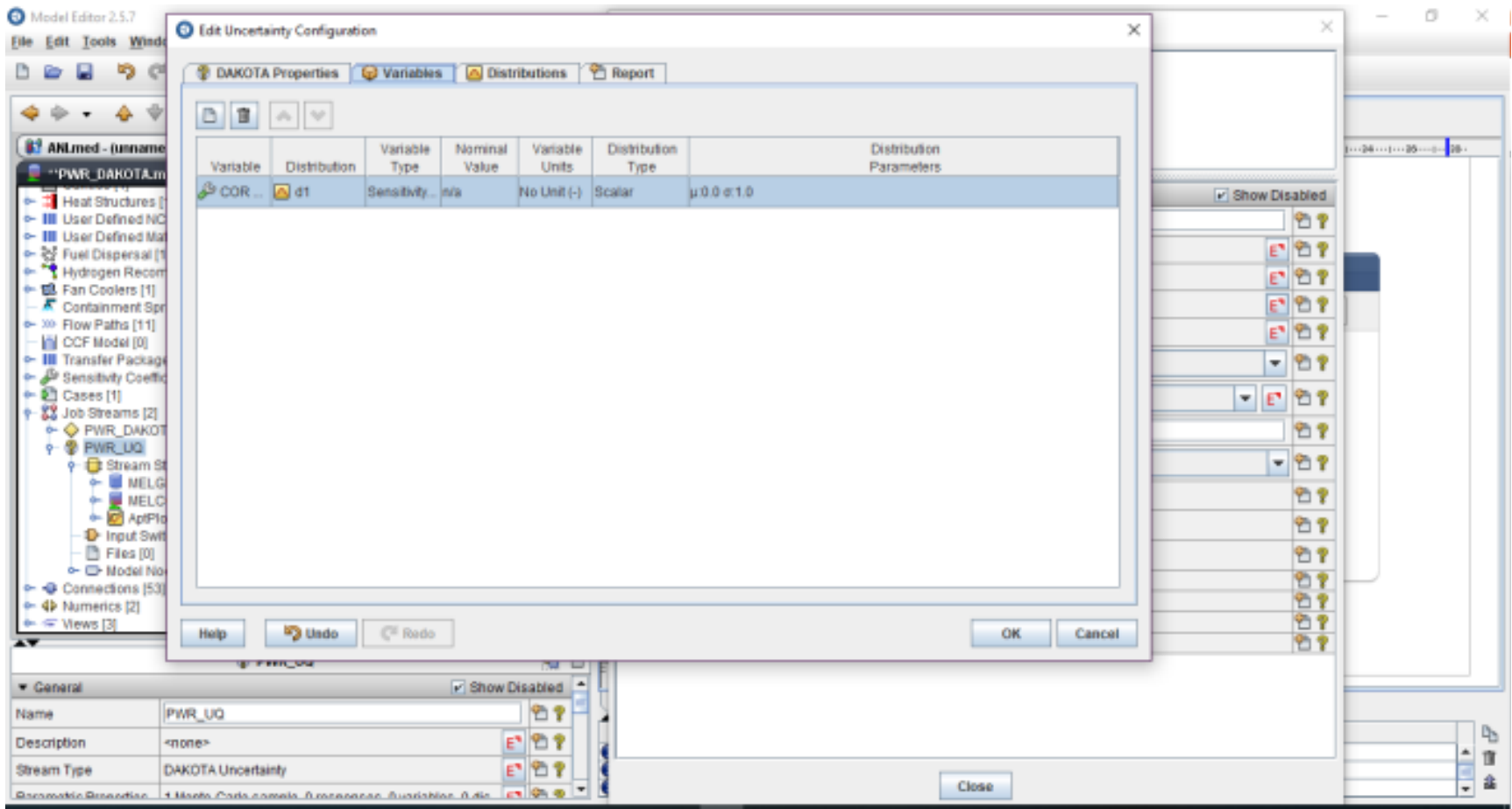
STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM



STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM



STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM



STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM

The screenshot displays the 'Edit Uncertainty Configuration' dialog box in Model Editor 2.5.7. The dialog is titled 'Edit Uncertainty Configuration' and has tabs for 'DAKOTA Properties', 'Variables', 'Distributions', and 'Report'. The 'Distributions' tab is active, showing the configuration for a distribution named 'd1 (Scalar: No Unit)'. The distribution is set to 'Triangular' and has a 'Scalar' rule. The distribution parameters are:

- a (min): 2088.0 (-)
- m (mode): 2400.0 (-)
- b (max): 2550.0 (-)
- Min: 0.5 (-)
- Max: 1.5 (-)

Two graphs are shown on the right side of the dialog:

- Probability density:** A triangular distribution curve with a peak at 2400.0. The x-axis ranges from 2.10e+03 to 2.55e+03, and the y-axis ranges from 0.00 to 0.00442.
- Cumulative distribution:** A cumulative distribution function curve. The x-axis ranges from 2.10e+03 to 2.55e+03, and the y-axis ranges from 0.00 to 1.00.

The dialog also includes 'Help', 'Undo', and 'Redo' buttons at the bottom left, and 'OK' and 'Cancel' buttons at the bottom right. In the background, the 'Model Editor 2.5.7' interface is visible, showing a tree view of the model structure with 'PWR_UQ' selected under 'Stream St'.

STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM

The screenshot displays the 'Model Editor 2.5.7' interface. The 'Edit Uncertainty Configuration' dialog box is open, showing a table of variables and their distributions. The table has the following columns: Variable, Distribution, Variable Type, Nominal Value, Variable Units, Distribution Type, and Distribution Parameters.

Variable	Distribution	Variable Type	Nominal Value	Variable Units	Distribution Type	Distribution Parameters
COR 1131-2	d1	Sensitivity Coefficients	n/a	No Unit (-)	Scalar	μ 2098.0 m...
COR 1141-2	d2	Sensitivity Coefficients	n/a	No Unit (-)	Scalar	μ 0.01 m.0...
VFALL	d3	User-Defined Reals	n/a	Velocity (m/s)	Scalar	μ 0.05 m.0...
HDBLH	d4	User-Defined Reals	n/a	Heat Transfer C. (...)	Scalar	μ 50.0 m.1...
COR 1132-1	d5	Sensitivity Coefficients	n/a	No Unit (-)	Scalar	μ 2700.0 σ ...
COR 1502-2	d6	Sensitivity Coefficients	n/a	No Unit (-)	Scalar	μ 5.0 σ :1.0
COR 1250-1	d7	Sensitivity Coefficients	n/a	No Unit (-)	Scalar	μ 2800.0 σ ...

The background window, 'PWR_UQ_5 - Properties View', shows a 'Show Disabled' checkbox and a list of variables. The list includes 'Use, 7 variables, 7 distributions' and several 'Disabled' entries. The bottom status bar shows a log of events: 'Note: Opening file E:\V...', 'Note: Loading E:\NUR', and 'Note: Open Complete'.

STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM

The screenshot displays the 'Model Editor 2.5.7' interface. The 'Edit Uncertainty Configuration' dialog box is the central focus, showing the configuration for a variable named 'd1'. The dialog is divided into several sections:

- DAKOTA Properties:** A list of variables including d1 through d7.
- Name:** d1
- Distribution:** Triangular
- Rule:** Scalar
- Distribution Parameters:**
 - a (min): 2098.0
 - m (mode): 2400.0
 - b (max): 2550.0
 - Min: 0.5
 - Max: 1.5
- Probability density:** A graph showing a triangular distribution with a peak at 2400.0 and a maximum density of 0.00442.
- Cumulative distribution:** A graph showing the cumulative distribution function, which is an S-shaped curve starting at 0.00 and ending at 1.00.

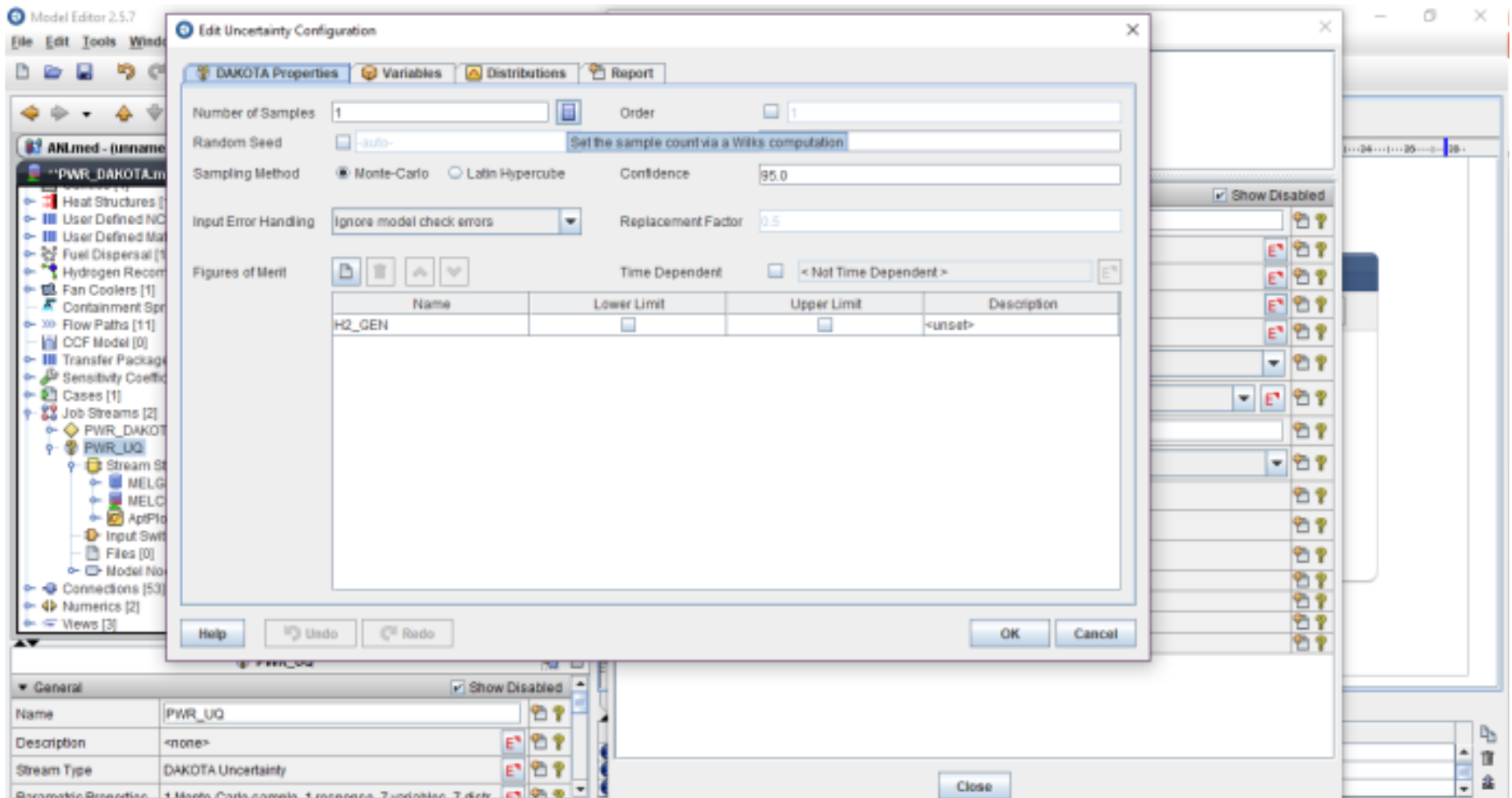
At the bottom of the dialog are 'Help', 'Undo', 'Redo', 'OK', and 'Cancel' buttons. In the background, the 'Model Editor' interface shows a tree view of the model structure, including 'ANLmed - (unname)', 'PWR_DAKOTA.m', and 'PWR_UQ'. A 'General' tab is visible at the bottom, showing details for the 'PWR_UQ' stream, such as its name, description, and stream type.

STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM

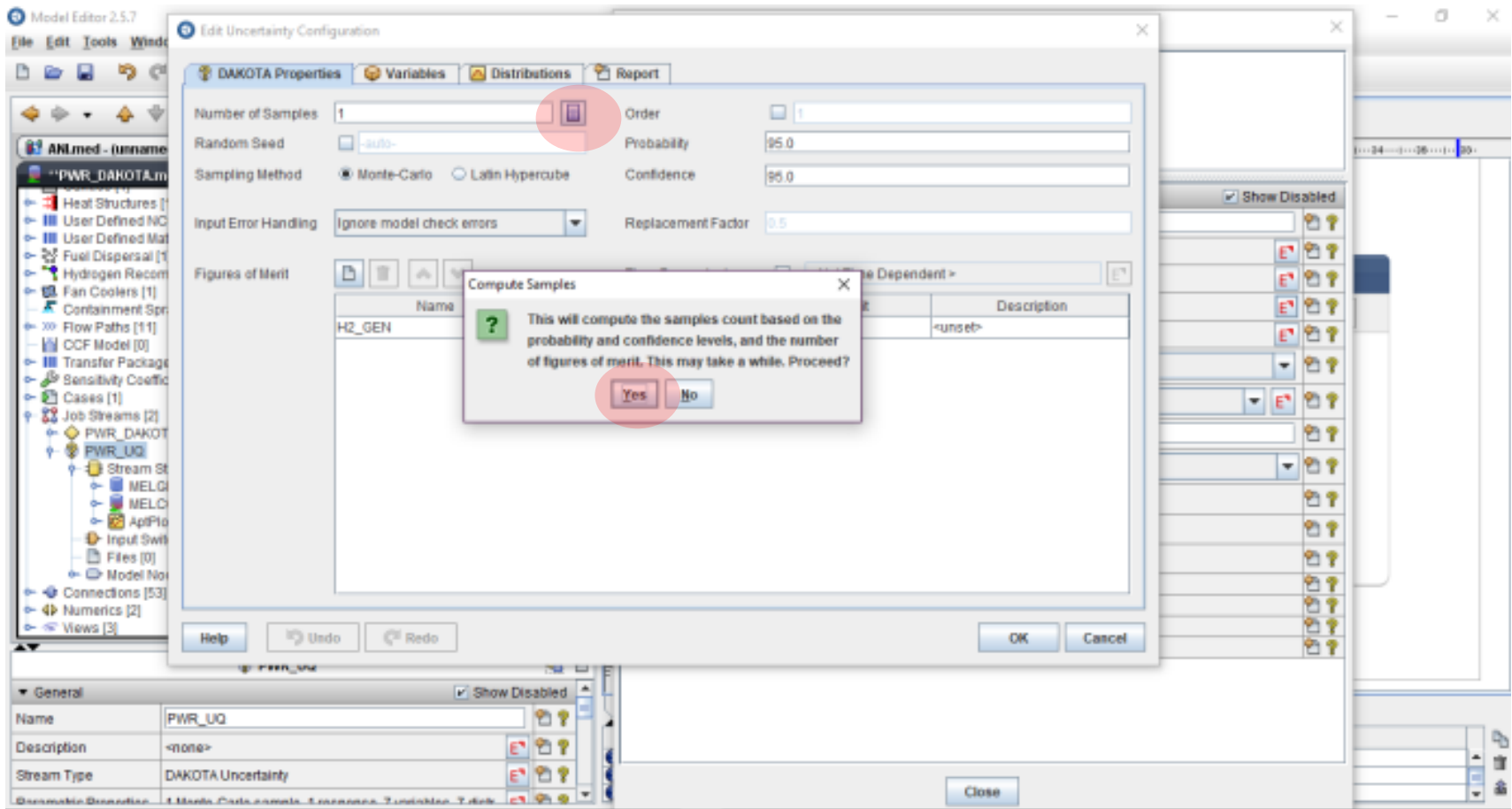
The screenshot displays the 'Edit Uncertainty Configuration' window in Model Editor 2.5.7. The window is titled 'Edit Uncertainty Configuration' and has tabs for 'DAKOTA Properties', 'Variables', 'Distributions', and 'Report'. The 'Distributions' tab is active, showing a list of variables on the left and configuration options for 'd1' on the right. The configuration for 'd1' includes a 'Triangular' distribution with 'Scalar' rule. The 'Probability density' plot shows a triangular distribution with a peak at 2.40×10^3 and a base extending from 2.10×10^3 to 2.55×10^3 . An 'Insufficient Samples' error dialog is overlaid on the plot, with the 'Yes' button circled in red. The error message reads: 'The number of samples (1) does not meet the number required for the probability, confidence, and figure of merit count (50). Reports generated for this stream will not list the probability and confidence levels. Continue?' with 'Yes' and 'No' buttons. The 'Yes' button is circled in red.

Name	Description	Stream Type
PWR_UQ	<none>	DAKOTA Uncertainty

STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM



STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM



STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM

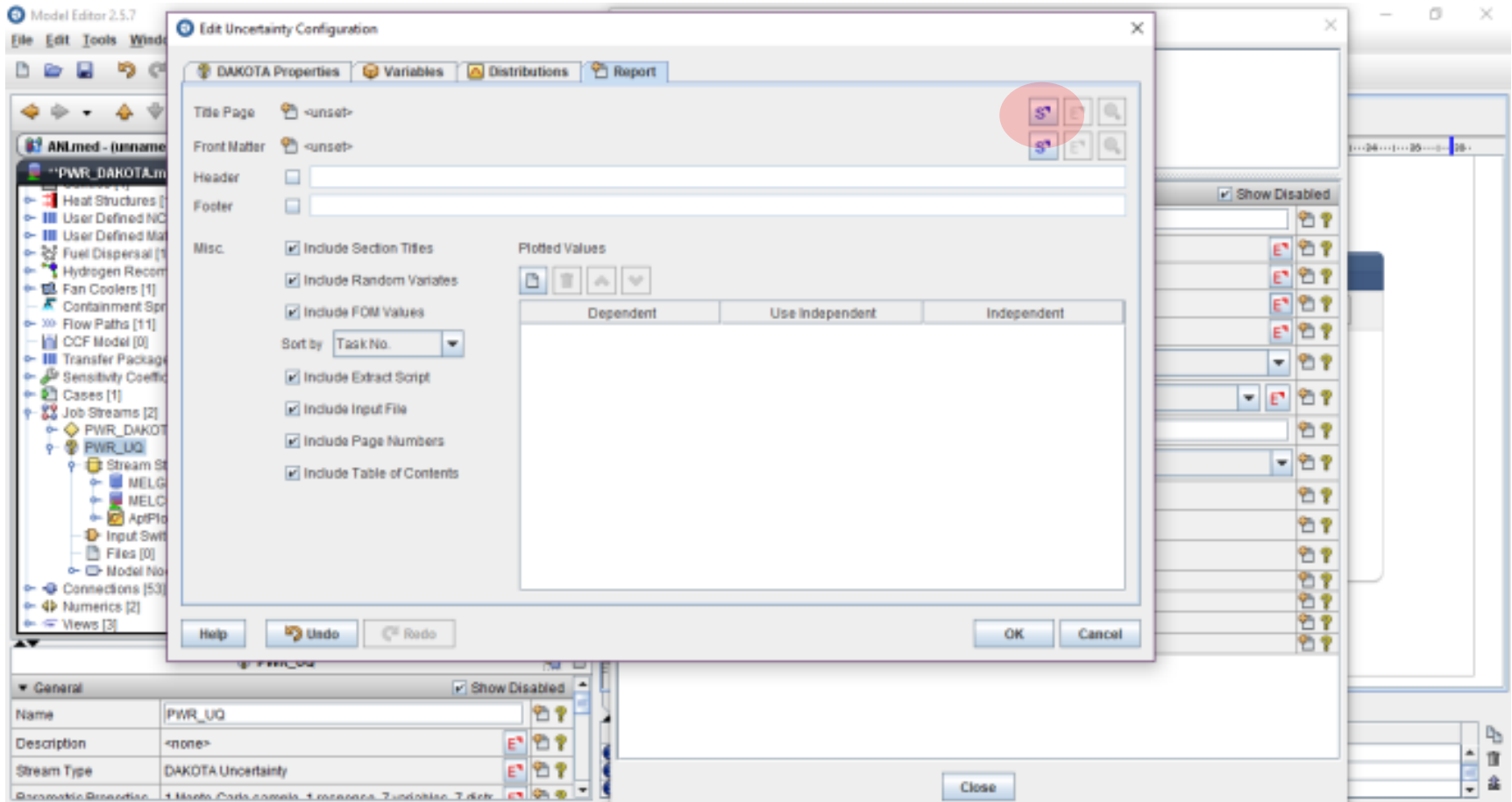
The screenshot displays the 'Edit Uncertainty Configuration' dialog box in the Model Editor 2.5.7 software. The 'Number of Samples' field is highlighted with a red circle and contains the value '59'. The dialog is divided into several sections:

- DAKOTA Properties:** Includes fields for 'Number of Samples' (59), 'Random Seed' (auto), 'Order' (1), 'Probability' (95.0), 'Confidence' (95.0), 'Replacement Factor' (0.5), and 'Time Dependent' (Not Time Dependent).
- Variables:** Includes 'Input Error Handling' (ignore modal check errors).
- Distributions:** Includes 'Sampling Method' (Monte-Carlo selected).
- Report:** Includes 'Figures of Merit' table.

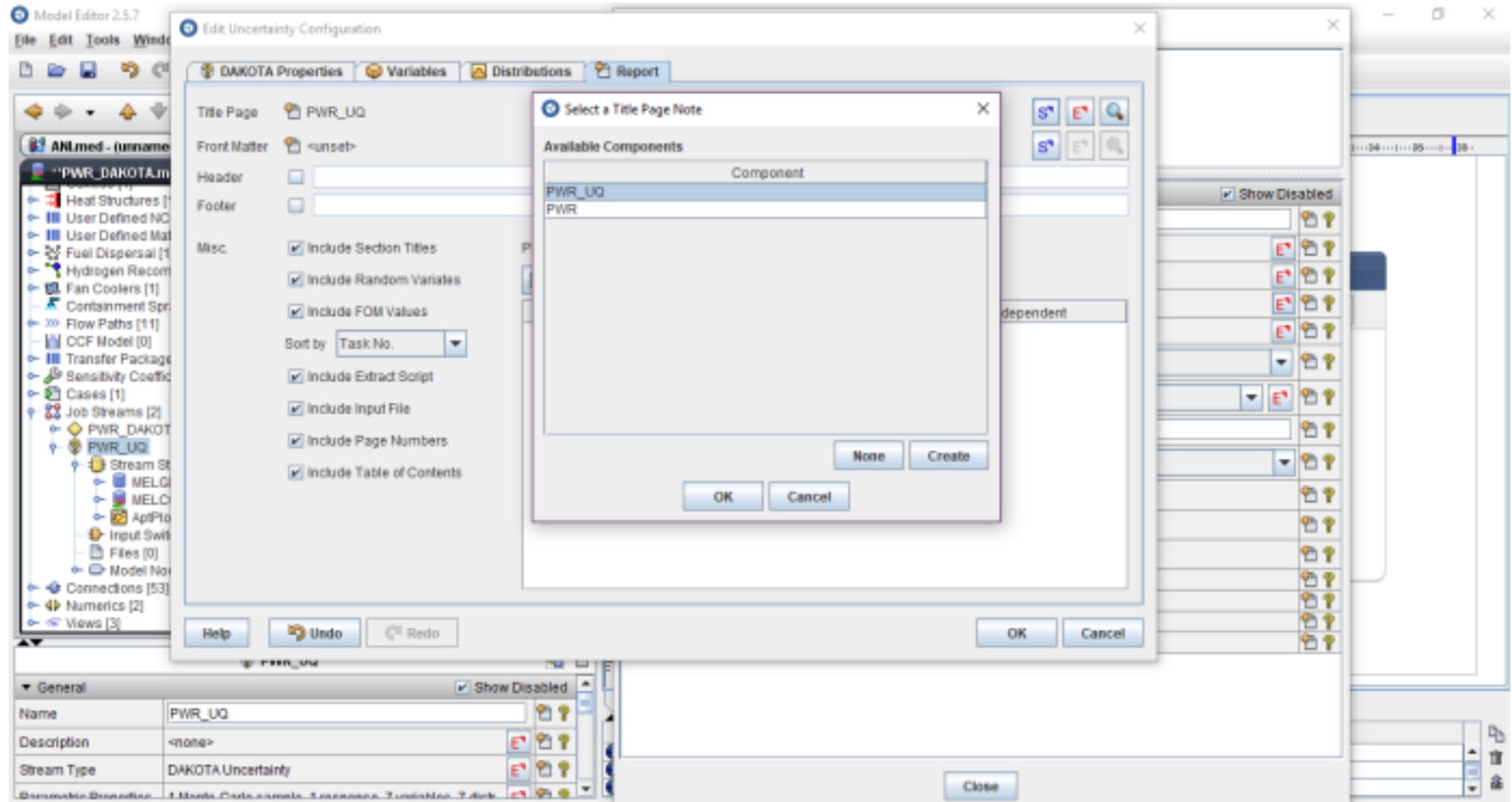
Name	Lower Limit	Upper Limit	Description
H2_GEN	<input type="checkbox"/>	<input type="checkbox"/>	<unset>

The background shows the Model Editor interface with a tree view on the left containing various model components like 'Heat Structures', 'User Defined NC', 'Fuel Dispersal', 'Hydrogen Recombination', 'Fan Coolers', 'Containment Spray', 'Flow Paths', 'CCF Model', 'Transfer Package', 'Sensitivity Coefficient', 'Cases', 'Job Streams', 'PWR_DAKOTA', 'PWR_UQ', 'Stream Structure', 'MELG', 'MELC', 'ApFlo', 'Input Switch', 'Files', 'Model Nodes', 'Connections', 'Numerics', and 'Views'. A 'General' tab is visible at the bottom left, showing 'Name: PWR_UQ', 'Description: <none>', and 'Stream Type: DAKOTA Uncertainty'.

STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM



STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM



STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM

Edit Uncertainty Configuration

DAKOTA Properties Variables Distributions Report

Title Page PWR_UQ

Front Matter <unset>

Header

Footer

Misc. Include Section Titles Include Random Variables Include FOM Values Include Extract Script Include Input File Include Page Numbers Include Table of Contents

Sort by Task No.

Plotted Values

Dependent

Select Plotted Values

Select a figure of merit or probability distribution

- H2_GEN [no limits]
- d1 (Scalar/No Unit) a:2098.0 m:2400.0 b:2550.0
- d2 (Scalar/No Unit) a:0.1 m:0.2 b:1.0
- d3 (Scalar/Velocity) a:0.05 m:0.1 b:1.2
- d4 (Scalar/Heat Transfer C.) a:50.0 m:1000.0 b:1100.0

OK Cancel

Name	Description	Stream Type
PWR_UQ	<none>	DAKOTA Uncertainty

STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM

Edit Uncertainty Configuration

DAKOTA Properties Variables Distributions Report

Title Page PWR_UQ

Front Matter <unset>

Header

Footer

Misc. Include Section Titles Include Random Variables Include FOM Values

Sort by Task No.

Include Extract Script Include Input File Include Page Numbers Include Table of Contents

Plotted Values

Dependent	Use Independent	Independent
d1	<input type="checkbox"/>	Iteration Index
d2	<input type="checkbox"/>	Iteration Index
d3	<input type="checkbox"/>	Iteration Index
d4	<input type="checkbox"/>	Iteration Index
d5	<input type="checkbox"/>	Iteration Index
d6	<input type="checkbox"/>	Iteration Index
d7	<input type="checkbox"/>	Iteration Index

Help Undo Redo OK Cancel

Model Editor 2.5.7

File Edit Tools Window

ANLmed - (username)

PWR_DAKOTA.m

- Heat Structures [1]
- User Defined NC
- User Defined Ma
- Fuel Dispersal [1]
- Hydrogen Recomb
- Fan Coolers [1]
- Containment Spr
- Flow Paths [11]
- CCF Model [0]
- Transfer Package
- Sensitivity Coeffi
- Cases [1]
- Job Streams [2]
- PWR_DAKOT
- PWR_UQ
- Stream St
- MELG
- MELC
- ApFlo
- Input Swit
- Files [0]
- Model No
- Connections [53]
- Numerics [2]
- Views [3]

General

Show Disabled

Name	Description	Stream Type
PWR_UQ	<none>	DAKOTA Uncertainty

Close

STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM

Edit Uncertainty Configuration

DAKOTA Properties Variables Distributions Report

Title Page PWR_UQ

Front Matter <unset>

Header

Footer

Misc. Include Section Titles Include Random Variables Include FOM Values

Sort by Task No.

Include Extract Script Include Input File Include Page Numbers Include Table of Contents

Plotted Values

Dependent	Use Independent	Independent
d1		Iteration Index
d2		Iteration Index
d3		Iteration Index
d4		Iteration Index
d5		Iteration Index
d6		Iteration Index
d7		Iteration Index
H2_GEN	<input checked="" type="checkbox"/>	d1
H2_GEN	<input checked="" type="checkbox"/>	d2
H2_GEN	<input checked="" type="checkbox"/>	d3
H2_GEN	<input checked="" type="checkbox"/>	d4
H2_GEN	<input checked="" type="checkbox"/>	d5
H2_GEN	<input checked="" type="checkbox"/>	d6
H2_GEN	<input checked="" type="checkbox"/>	d7

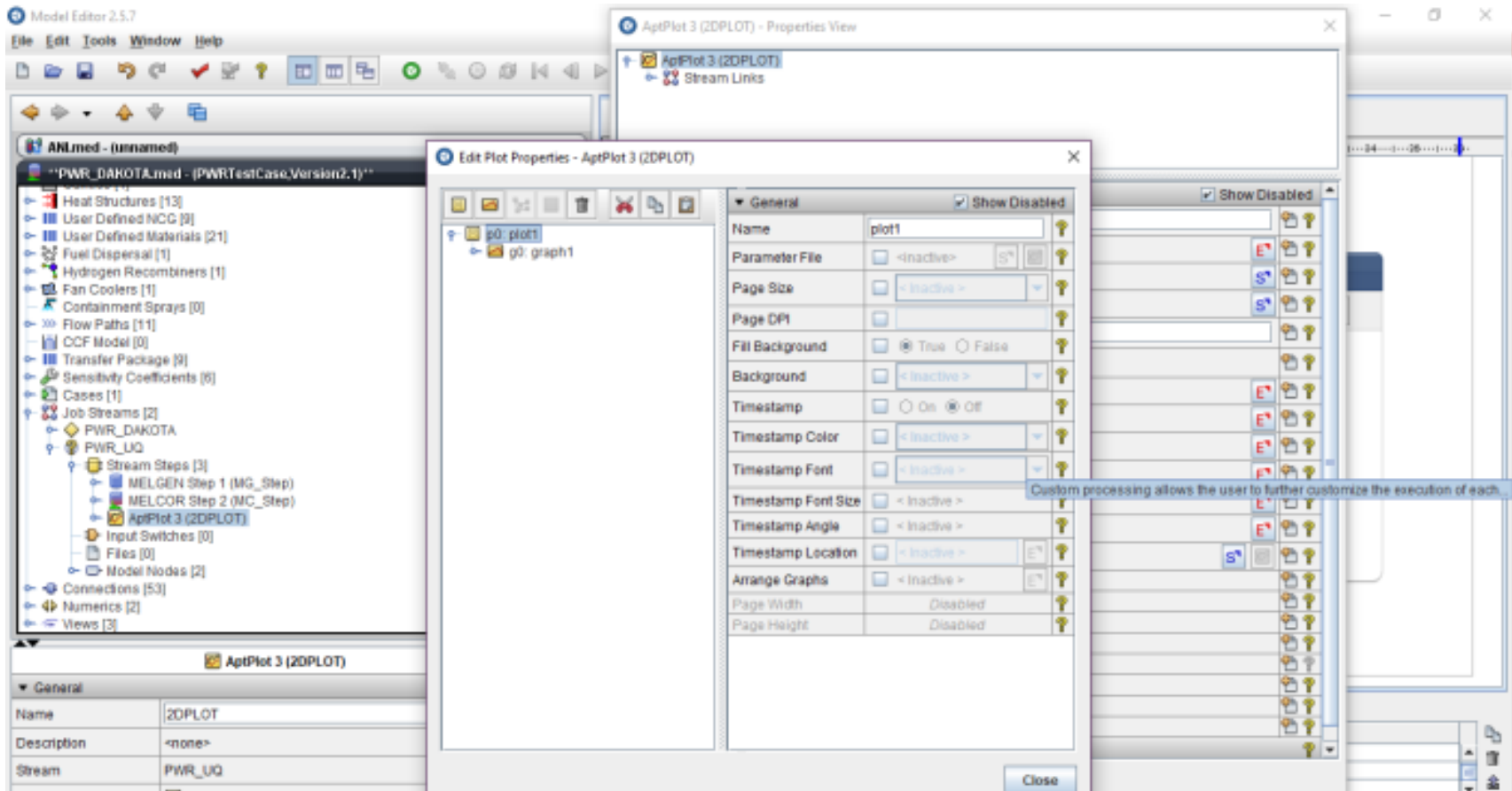
Help Undo Redo OK Cancel

STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM

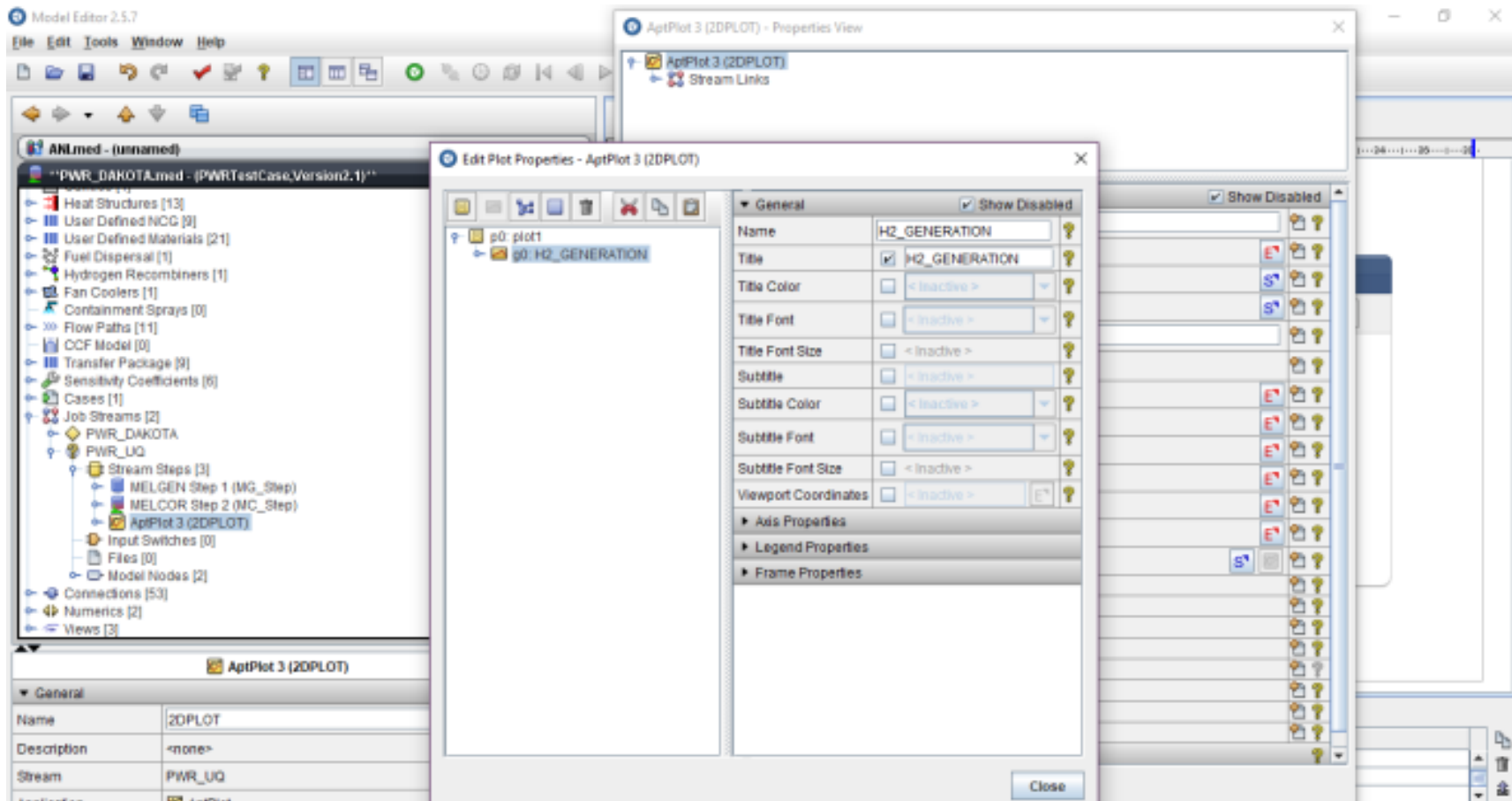
The screenshot displays the Model Editor 2.5.7 interface. On the left, the tree view shows the project structure under 'ANLmed - (unnamed)' and 'PWR_DAKOTA_med - (PWRTestCase_Version2.1)'. The 'AptPlot 3 (2DPLOT)' node is highlighted. The right pane shows the 'Properties View' for 'AptPlot 3 (2DPLOT)' with the following configuration:

AptPlot 3 (2DPLOT) - Properties View	
Stream Links	
▼ General <input checked="" type="checkbox"/> Show Disabled	
Name	2DPLOT
Description	<none>
Stream	PWR_UQ
Application	AptPlot
Relative Location	
View in Job Status	<input type="radio"/> Yes <input checked="" type="radio"/> No
Keywords	No Keywords
Conditional Logic	None
Custom Processing	None
Plot Inputs	[1] input definition
Plots	[1] plot
Plot Outputs	[1] output definition
Parameter File	<input checked="" type="checkbox"/> <unset>
Parametric Tasks	Disabled
Submission Properties	Disabled
Animation Model	Disabled
Open Animation	Disabled
Data Sources	Disabled
Interactive Step	Disabled
Start Paused	Disabled
ECI Task Set	Disabled
▶ Task Bundling	

STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM



STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM



STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM

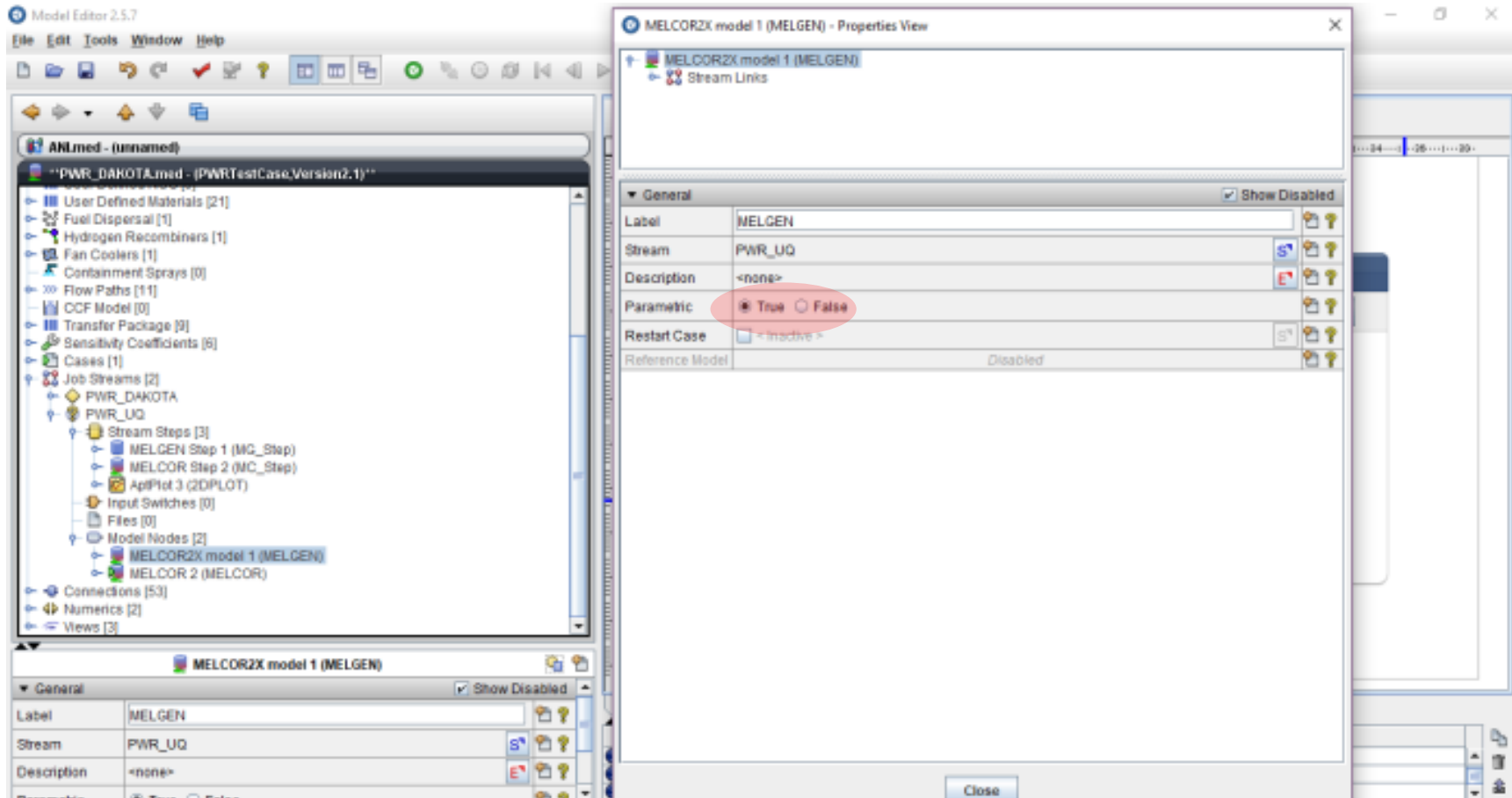
The screenshot displays the ANSYS Model Editor 2.5.7 interface. The main window shows a tree view of the model components, including Heat Structures, User Defined NCC, User Defined Materials, Fuel Dispersal, Hydrogen Recombiners, Fan Coolers, Containment Sprays, Flow Paths, CCF Model, Transfer Package, Sensitivity Coefficients, Cases, Job Streams, and Stream Steps. The Stream Steps section is expanded, showing MELGEN Step 1 (MG_Step), MELCOR Step 2 (MC_Step), and AptPlot 3 (2D PLOT). The AptPlot 3 (2D PLOT) properties are shown in the bottom left pane.

The AptPlot 3 (2D PLOT) Properties View is open, showing the following configuration:

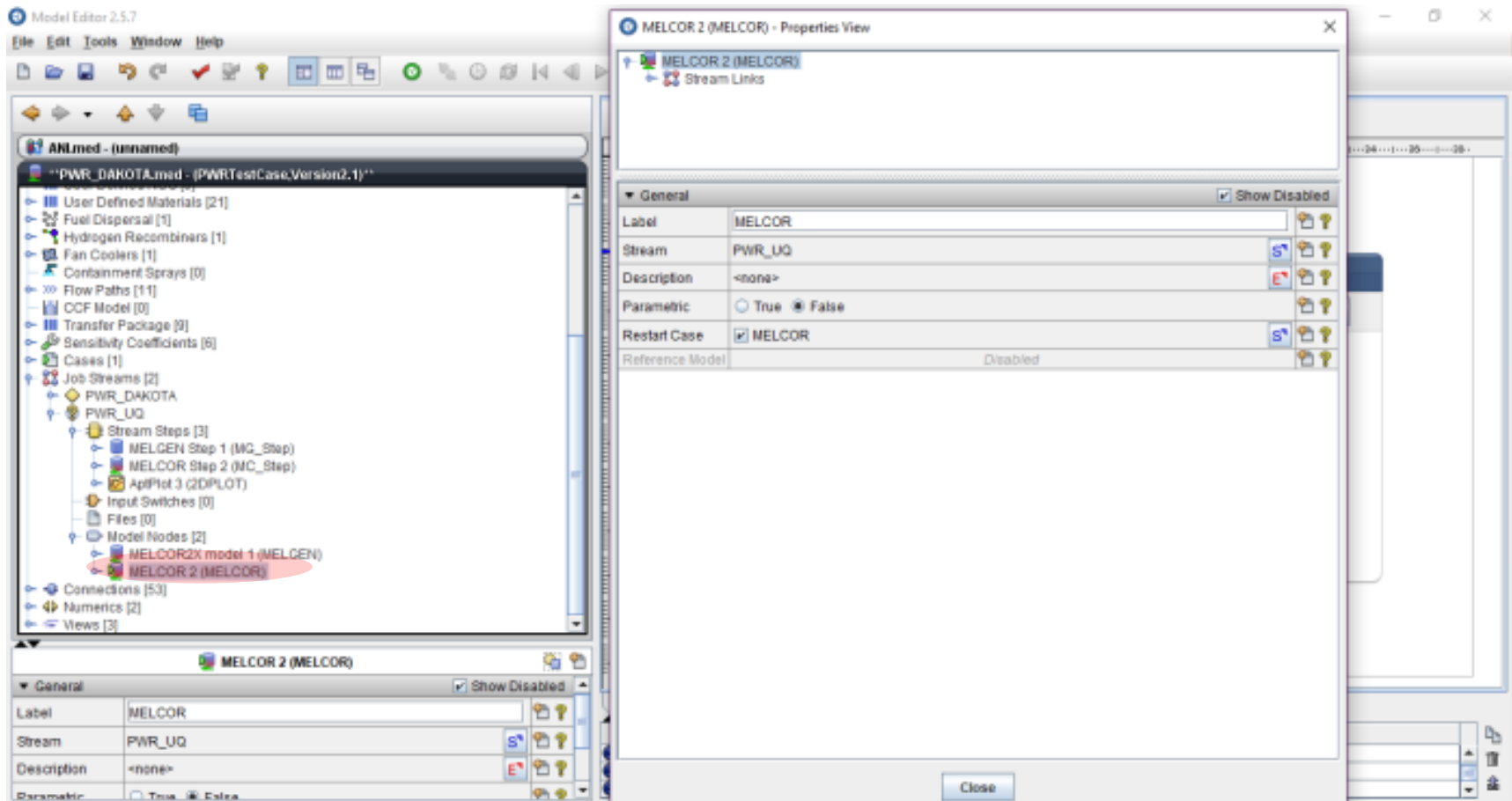
- Name: H2
- Input: Input
- Input Filter: [0]
- Plot Type: Time
- Dependent Data: COR-DMH2-TOT
- Dependent Type: C
- Units: SI
- X Slope Factor: 1.0 (-)
- X Shift: 0.0 (-)
- Y Slope Factor: 1.0 (-)
- Y Shift: 0.0 (-)
- Legend Entry: < Inactive >
- Independent Data: Disabled
- Independent Type: Disabled
- Independent Column: Disabled
- Dependent Column: Disabled
- Point Type: Disabled
- Independent Scalar: Disabled
- Dependent Scalar: Disabled
- Vector: Disabled
- Time: Disabled
- Plot Method: Disabled

The Edit Plot Properties - AptPlot 3 (2D PLOT) dialog is also open, showing the plot configuration. The plot is named p0: plot1 and is associated with the H2 GENERATION stream. The plot is currently set to Time.

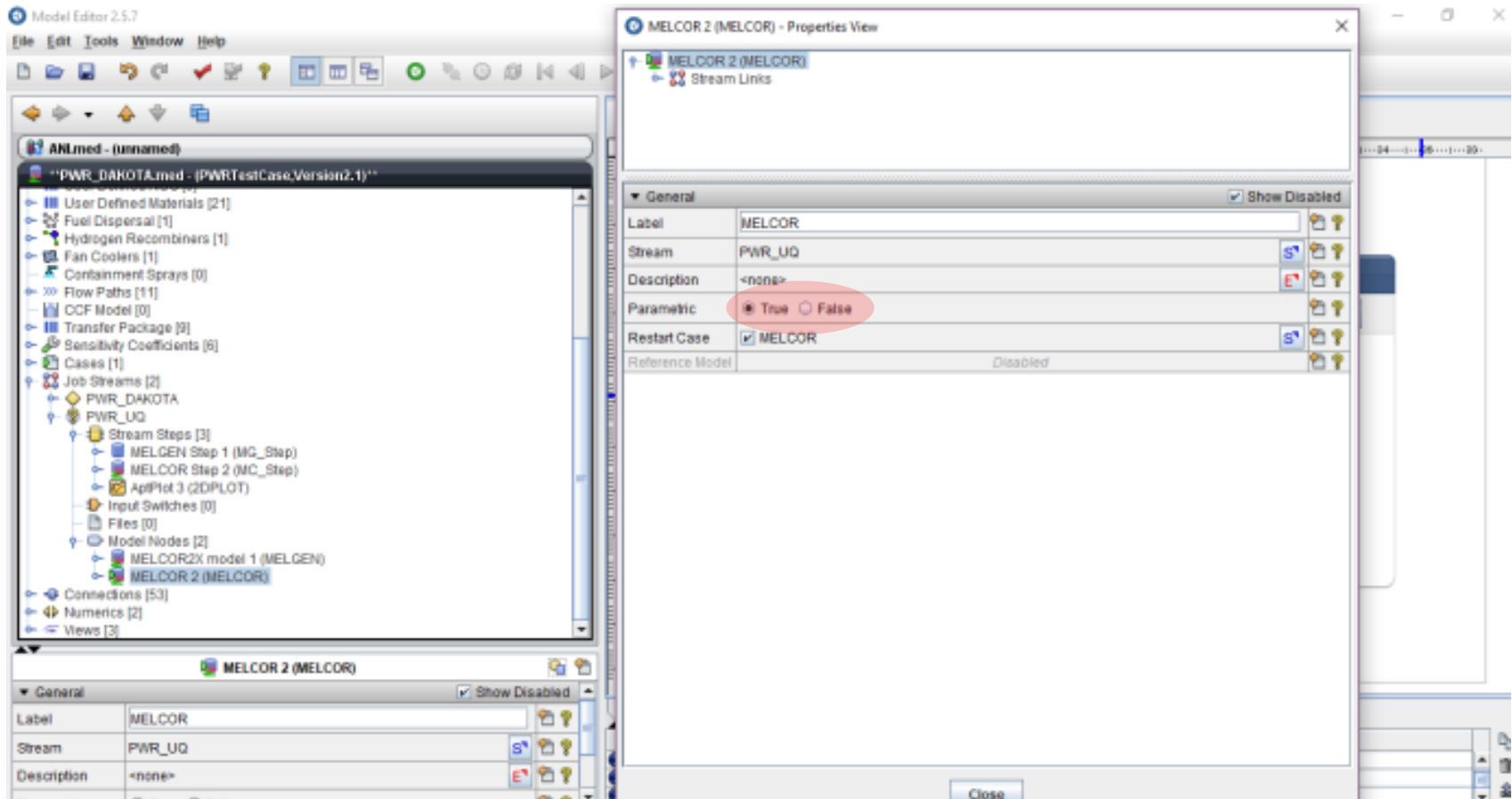
STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM



STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM



STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM



STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM

The screenshot displays the ANSYS Model Editor 2.5.7 interface. On the left, the tree view shows a project named 'PWR_DAKOTA.med - (PWRTestCas)'. Under 'Job Streams [2]', 'PWR_UQ' is expanded to show 'Stream Steps [3]'. 'AptPlot 3 (2DPLOT)' is selected. The central plot area shows a tree structure with 'p0: plot1' containing 'g0: H2_GENERATION' and 'sets 0-58: H2'. A red oval highlights a list of sets from s0 to s34. The right panel shows the 'Edit Plot Properties - AptPlot 3 (2DPLOT)' dialog. The 'General' tab is active, showing the following properties:

Property	Value
Name	H2_GENERATION
Title	<input checked="" type="checkbox"/> H2_GENERATION
Title Color	<input type="checkbox"/> < Inactive >
Title Font	<input type="checkbox"/> < Inactive >
Title Font Size	<input type="checkbox"/> < Inactive >
Subtitle	<input type="checkbox"/> < Inactive >
Subtitle Color	<input type="checkbox"/> < Inactive >
Subtitle Font	<input type="checkbox"/> < Inactive >
Subtitle Font Size	<input type="checkbox"/> < Inactive >
Viewport Coordinates	<input type="checkbox"/> < Inactive >
Axis Properties	
Legend Properties	
Frame Properties	

Below the properties panel, a list of 'Disabled' items is visible. A tooltip at the bottom right reads: 'This property instructs this step's tasks to pause immediately after startin...'. The 'Close' button is visible at the bottom left of the dialog.

STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM

The screenshot displays the Model Editor 2.5.7 interface. The 'Edit Plot Properties - AptPlot 3 (2DPLOT)' dialog is open, showing a list of keywords (d5-d29) and their corresponding values. A red circle highlights keyword 'd5' in the list. A tooltip window shows the details for 'd5'.

Keyword	Value
d5	2588.1506282651949
d6	4.3690401096574627
d7	2743.1536503647303
d1	2417.0135434980111
d2	5.76403429870274047

The dialog also shows the 'General' tab with the following properties:

- Keywords: d5=2588.1506282651949, d6...
- X Slope Factor: 1
- X Shift: 0
- Y Slope Factor: 1
- Y Shift: 0
- Legend Entry: < Inactive >

The 'AptPlot 3' properties are also visible:

- Name: 2DPLOT
- Description: <none>
- Stream: PWR_UQ

STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM

The screenshot displays the Model Editor 2.5.7 interface. On the left, a tree view shows the project structure for 'ANLmed - (unnamed)', including 'PWR_DAKOTA_med - (PWRTestCase_Version2.1)' and its sub-components like 'User Defined Materials', 'Fuel Dispersal', and 'Stream Steps'. A context menu is open over the 'MELCOR' component, with 'Add To View' selected, showing sub-options for 'LAYOUT', 'CORE', and 'TwoStep_Stream'. The main workspace shows a flow diagram titled 'Two-Step MELGEN/MELCOR Stream'. The diagram includes a 'MELCOR model' block, a 'MELGEN Step 1 MG_Step' block, and a 'MELCOR Step 2 MC_Step' block. Arrows indicate data flow from the MELCOR model to the MELGEN step, and from the MELGEN step to the MELCOR step. A 'Submit' button is visible in the top right of the workspace. The bottom status bar shows a 'Messages' pane with three notes: 'Note: Saving E:\WUREG_DAKOTA\PWR_DAKOTA_REV1.med, please wait.', 'Note: Saving model documents. Please wait.', and 'Note: Save Complete.'

STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM

The screenshot displays the ANSYS Model Editor 2.5.7 interface. The left sidebar shows a project tree for 'ANL.med - (unnamed)' with a sub-project 'PWR_DAKOTA'. Under 'PWR_DAKOTA', there are 'Stream Steps' including 'MELGEN Step 1 (MG_Step)', 'MELCOR Step 2 (MC_Step)', and 'AptPlot3 (2DPLOT)'. The main workspace shows a 'Two-Step MELGEN-MELCOR Stream' diagram. This diagram consists of three main components connected in a sequence:

- MELCOR2X model 1 (MELGEN)**: A blue box with 'melgen MED' and '1'.
- MELGEN Step 1 (MG_Step)**: A yellow box with '1' and 'MELGEN Step 1 (MG_Step)'. It has 'input', 'output', 'message', and 'diag' ports.
- MELCOR Step 2 (MC_Step)**: A yellow box with '2' and 'MELCOR Step 2 (MC_Step)'. It has 'input', 'output', 'message', and 'diag' ports.
- AptPlot 2DPLOT**: A yellow box with '3' and 'AptPlot 2DPLOT'. It has 'input', 'batch', 'screen', 'IC_M_PDF_pdf', and 'HQ_M_APTPLOT_apr' ports.

Connections are shown as blue arrows: from MELCOR2X model 1 to MELGEN Step 1, from MELGEN Step 1 to MELCOR Step 2, and from MELCOR Step 2 to AptPlot. A 'Submit' button is located in the top right corner of the diagram area. The bottom status bar shows a 'Messages' window with the following text:

- Note: Saving E:\NUREG_DAKOTA\PWR_DAKOTA_REV1.med, please wait...
- Note: Saving model documents. Please wait...
- Note: Save Complete.

STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM

The screenshot displays the Model Editor 2.5.7 interface. On the left, a tree view shows the project structure for 'ANLmed - (unnamed)', with 'PWR_DAKOTA.med' selected. A context menu is open over the 'MELGEN Step' component, listing options such as 'New', 'Add To Sub-System', 'Create View', 'Change Order', 'Cut', 'Copy', 'Paste', and 'Delete'. The main workspace shows a 'Two-Step MELGEN-MELCOR Stream' diagram with three main components: 'MELCOR model' (1), 'MELGEN Step' (1), and 'MELCOR Step' (2). The 'MELCOR model' component has an 'input' port connected to the 'MELGEN Step' component. The 'MELGEN Step' component has 'restart', 'output', 'message', and 'diag' ports. The 'MELCOR Step' component has 'input', 'output', 'message', 'diag', and 'plot' ports. The 'MELCOR Step' component is connected to an 'AppPlot' component (3) which has 'batch', 'screen', 'H2_M_PDF_pnf', and 'H2_M_APTPLOT_pnf' ports. A 'Submit' button is visible in the top right of the diagram area. The bottom status bar shows messages: 'Note: Save Complete.', 'Warning: Stream check complete. Found 0 errors, 1 warning, 0 alerts, 0 notes.', and 'Warning: Stream check complete. Found 0 errors, 1 warning, 0 alerts, 0 notes.'

STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM

The screenshot displays the Model Editor 2.5.7 interface. A 'Select Application' dialog box is open, showing a list of applications available for the selected job stream 'PWR_UQ'. The 'Extrad_Data' application is highlighted. The background shows a project tree on the left and a process flow diagram on the right.

Model Editor 2.5.7

File Edit Tools Window Help

ANLmed - (unnamed)

"PWR_DAKOTA.med - (PWRTestCase.Version2.1)"

- User Defined Materials [21]
- Fuel Dispersal [1]
- Hydrogen Recombiners [1]
- Fan Coolers [1]
- Containment Sprays [0]
- Flow Paths [11]
- CCF Model [0]
- Transfer Package [3]
- Sensitivity Coefficients [6]
- Cases [1]
- Job Streams [2]
- PWR_DAKOTA
 - PWR_UQ
 - Stream Steps [3]
 - MELGEN Step 1 (MC_Step)
 - MELCOR Step 2 (MC_Step)
 - AptPlot 3 (2DPLOT)
 - Input Switches [0]
 - Files [0]
 - Model Nodes [2]
 - MELCOR2X model 1 (MELGEN)
 - MELCOR 2 (MELCOR)
- Connections [53]
- Numerics [2]
- Views [3]

Category

General

No Properties Available

Select Application

Selected Job Stream: PWR_UQ

- AptBatch (AptPlot-Batch) (Personal)
Available on Local
A WYSIWYG 2D plotting tool designed for creating production quality plots of numerical data and performing data analysis.
- Extrad_Data (Extrad Data) (Personal)**
Available on Local
AptPlot Data Extraction
- DAKOTA (DAKOTA Uncertainty) (Personal)
Available on Local
DAKOTA Uncertainty Quantification
- MELCOR (MELCOR) (Personal)
Available on Local
The MELCOR severe accident analysis code.
- MELCOR_2_2_9541 (MELCOR) (Personal)
Available on Local
The MELCOR severe accident analysis code.

Show from: All Groups

Show applications that are not available in the selected stream.

Configure Definitions OK Cancel

Messages

- Note: Save Complete.
- Warning: Stream check complete. Found 0 errors, 1 warning, 0 alerts, 0 notes.
- Warning: Stream check complete. Found 0 errors, 1 warning, 0 alerts, 0 notes.

Process Flow Diagram:

- MELCOR Step 2 (MC_Step)
- input
- output
- message
- start
- diag
- plot
- AptPlot 3 (2DPLOT)
- batch
- screen
- input
- H2_M_PDF_pdf
- H2_M_APTPLOT_apf

STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM

The screenshot displays the ANSYS Model Editor 2.5.7 interface. On the left, a project tree shows a hierarchy of components including 'User Defined Materials', 'Fuel Dispersal', 'Hydrogen Recombiners', 'Fan Coolers', 'Containment Sprays', 'Flow Paths', 'CCF Model', 'Transfer Package', 'Sensitivity Coefficients', 'Cases', 'Job Streams', 'PWR_DAKOTA', 'PWR_UQ', 'Stream Steps', 'MELGEN Step 1 (MG_Step)', 'MELCOR Step 2 (MC_Step)', 'AptPlot 3 (2DPLOT)', and 'Extract Data 4 (Step)'. The 'Extract Data 4 (Step) - Properties View' dialog box is open, showing the following properties:

General	
Name	Step
Description	<none>
Stream	PWR_UQ
Application	Extract_Data
Relative Location	
View in Job Status	<input type="radio"/> Yes <input checked="" type="radio"/> No
Keywords	No Keywords
Conditional Logic	None
Input Files	[1] Required Files Missing
Output Files	[4] Outputs Defined
Custom Processing	None
Plot File Type	COBRA
Plot File Data	COBRA
AptPlot Script	CONTAIN EXTDATA
Parametric Tasks	MELCOR
Submission Properties	NRC DATABANK
Animation Model	PARCS
Open Animation	RELAP
Data Sources	TRACE
Interactive Step	Disabled
Start Paused	Disabled

The 'Input Files' field is highlighted with a red circle. To the right, a 'Submit' button is visible, and below it, a diagram shows 'AptPlot 2DPLOT' with 'batch' and 'screen' outputs, and 'Input' with 'HQ_M_PDF_apf' and 'HQ_M_APTPLOT_apf'.

STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM

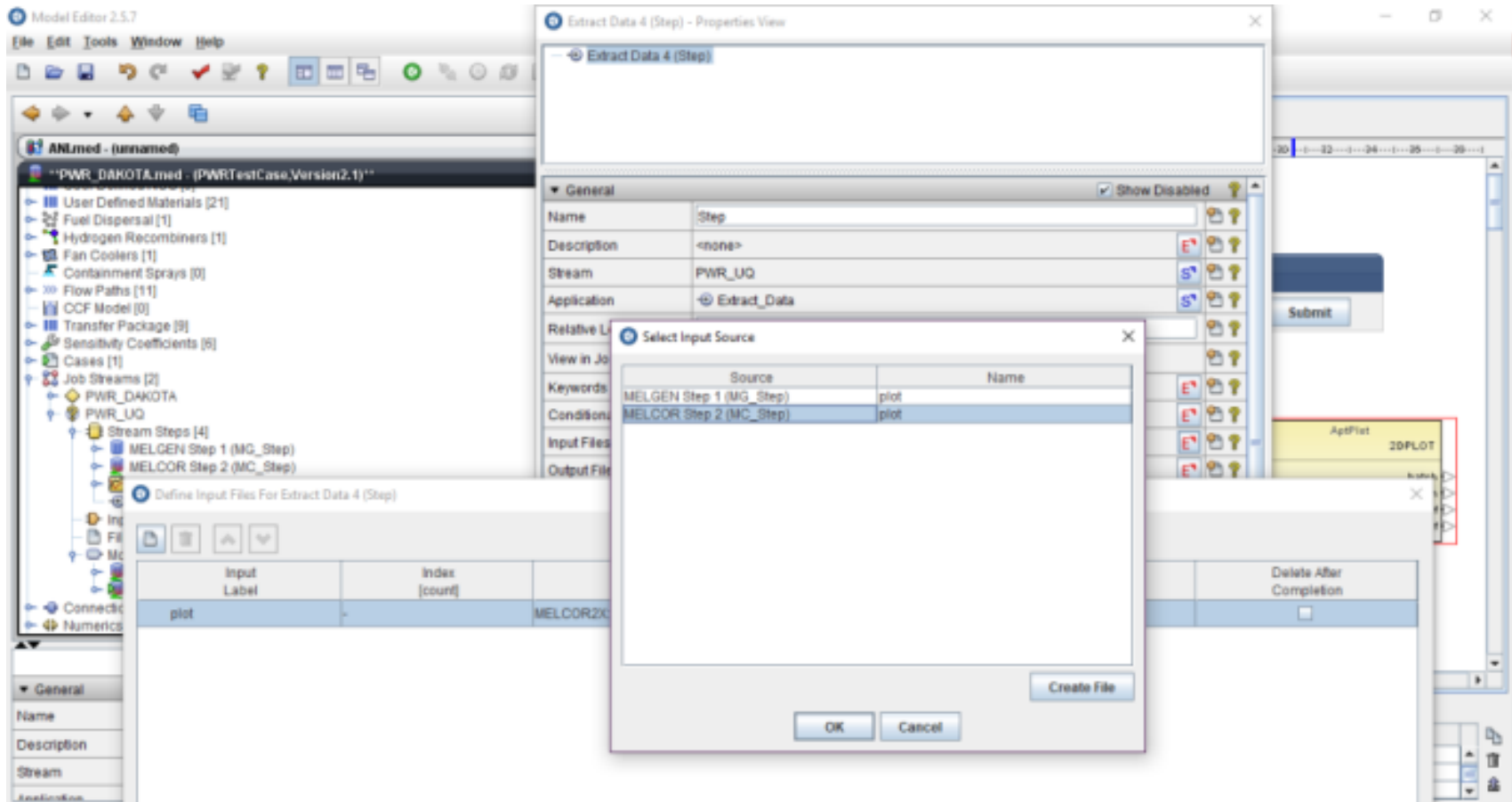
The screenshot displays the Model Editor 2.5.7 interface. The main window shows a project tree for 'ANLmed - (unnamed)' with a sub-project 'PWR_DAKOTA_med - (PWRTestcase.Version2.1)'. The 'Extract Data 4 (Step)' properties view is open, showing the following details:

- Name: Step
- Description: <none>
- Stream: PWR_UQ
- Application: Extract_Data
- Relative Location:
- View in Job Status: Yes No
- Keywords: No Keywords
- Conditional Logic: None
- Input Files: [1] Required Files Missing
- Output Files: [4] Outputs Defined

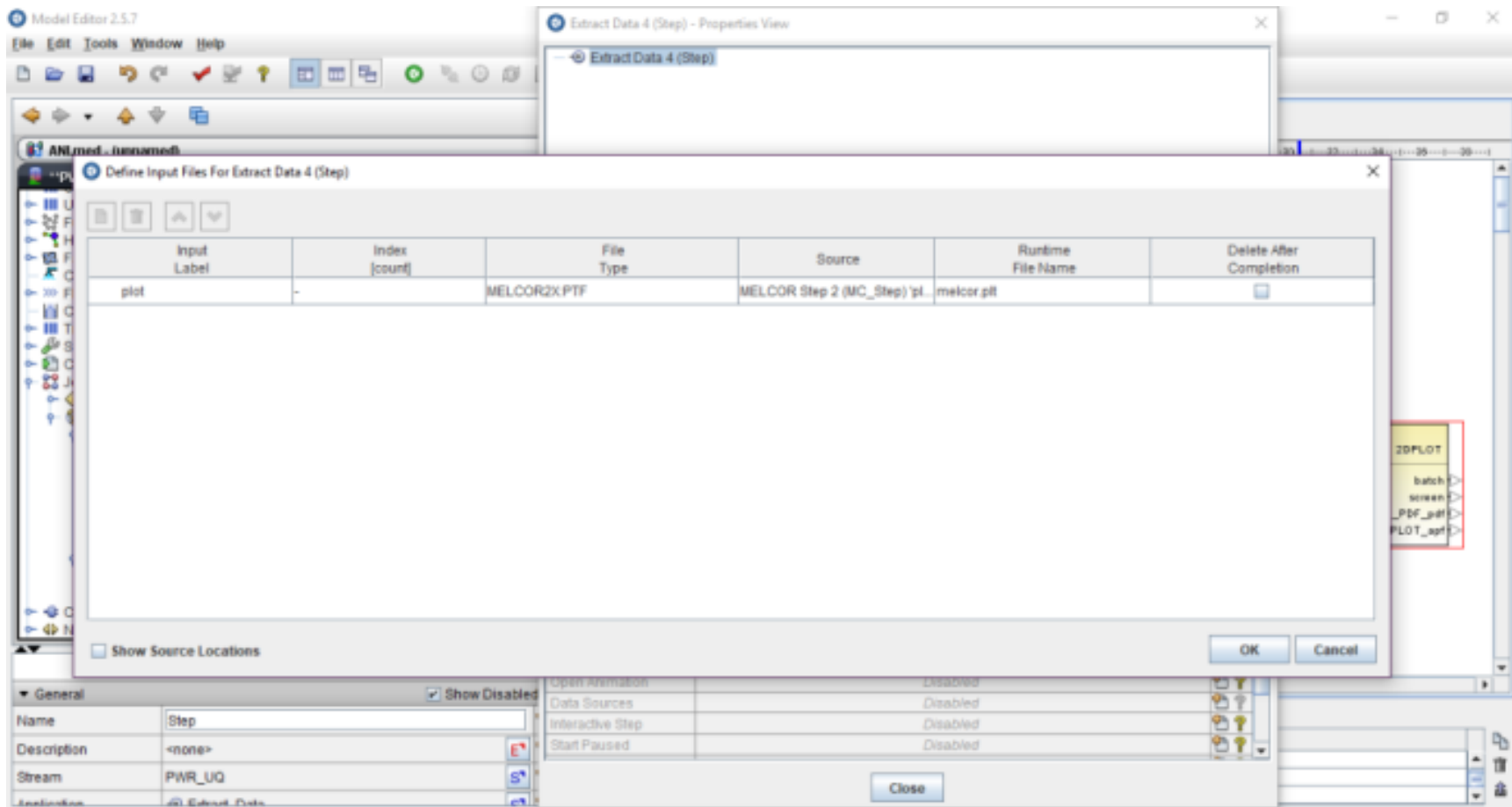
The 'Define Input Files For Extract Data 4 (Step)' dialog box is also open, showing a table with the following data:

Input Label	Index [count]	File Type	Source	Runtime File Name	Delete After Completion
plot	-	MELCOR2X.PTF	Disconnected	melcor.plt	<input type="checkbox"/>

STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM



STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM



STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM

Model Editor 2.5.7

Extract Data 4 (Step) - Properties View

General Show Disabled

Name	Step	
Description	<none>	
Stream	PWR_UQ	
Parametric Tasks	Including 59 of 59	
Application	Extract_Data	
Relative Location		
Keywords	No Keywords	
Conditional Logic	None	
Input Files	[1] Inputs Defined	
Output Files	[4] Outputs Defined	
Custom Processing	None	
Plot File Type	MELCOR	
Plot File Data	<input type="radio"/> Demux <input checked="" type="radio"/> Standard Plot	
ApPlot Script	MELCOR PTF "[PlotFile]", CALC "H2_GEN = 0.0" ...	
Submission Properties	Disabled	
View in Job Status	Disabled	
Animation Model	Disabled	
Open Animation	Disabled	
Data Sources	Disabled	
Interactive Step	Disabled	
Start Paused	Disabled	

When the Immediately option is selected the the Animation Model will be open.

STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM

Model Editor 2.5.7

File Edit Tools Window Help

ANL.med - (unnamed)

"PWR_DAKOTA.med - (PWRTCase,Version2.1)"

- User Defined Materials [21]
- Fuel Dispersal [1]
- Hydrogen Recombiners [1]
- Fan Coolers [1]
- Containment Sprays [0]
- Flow Paths [11]
- CCF Model [0]
- Transfer Package [9]
- Sensitivity Coefficients [6]
- Cases [1]
- Job Streams [2]
- PWR_DAKOTA
 - PWR_UQ
 - Stream Steps [4]
- Files [0]
- Model Nodes [2]
- Connections [53]
- Numerics [2]

Stream Steps [4]

- MELGEN Step 1 (MG_Step)
- MELCOR Step 2 (MC_Step)
- ApPlot 3 (2DPLOT)
- Extract Data 4 (Step)

Model Nodes [2]

- MELCOR2X model 1 (MELGEN)
- MELCOR 2 (MELCOR)

Extract Data 4 (Step) - Properties View

Extract Data 4 (Step)

General Show Disabled

Name	Step
Description	<none>
Stream	PWR_UQ

Enter ApPlot commands to extract data into the indicated variables:

```
MELCOR PTF "%(PlotFile)"  
CALC "R2_GEN = 0.0"  
  
< Enter ApPlot commands here >  
  
SAVEVAR "R2_GEN"  
WRITEVAR ASCII "%(VariableFile)"  
EXIT
```

OK Cancel

Submit

ApPlot 2DPLOT

batch screen

input H2_M_PDF.pdf H2_M_APTPLOT.apf

GEN = 0.0 ...

View in Job Status Disabled

Animation Model Disabled

Open Animation Disabled

Data Sources Disabled

Interactive Step Disabled

Start Paused Disabled

Close

STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM

CALC "H2_GEN = 0.0"
CALC "H_GEN = getYval(24000.0, M0_(COR-DMH2-TOT))"
SAVEVAR "H2_GEN"
WRITEVARS ASCII "\${VariableFile}"
EXIT. The 'CALC' line is highlighted with a red oval. The background shows the 'Extract Data 4 (Step)' properties view and a 'Submit' button."/>

Model Editor 2.5.7

File Edit Tools Window Help

ANL.med - (unnamed)

PWR_DAKOTA.med - (PWRTestCase,Version2.1)

Stream Steps [4]

- MELGEN Step 1 (MG_Step)
- MELCOR Step 2 (MC_Step)
- AptPlot 3 (2DPLOT)
- Extract Data 4 (Step)

Input Switches [0]

Files [0]

Model Nodes [2]

- MELCOR2X model 1 (MELGEN)
- MELCOR 2 (MELCOR)

Connections [53]

Numerics [2]

Extract Data 4 (Step) - Properties View

Extract Data 4 (Step)

Show Disabled

Submit

AptPlot

2DPLOT

batch

screen

param

H2_M_PDF_pdf

input

H2_M_APTPLOT_apf

Enter AptPlot commands to extract data into the indicated variables:

```
MELCOR PTF "${PlotFile}"
CALC "H2_GEN = 0.0"
CALC "H_GEN = getYval(24000.0, M0_(COR-DMH2-TOT))"
SAVEVAR "H2_GEN"
WRITEVARS ASCII "${VariableFile}"
EXIT
```

OK Cancel

Animation Model Disabled

Open Animation Disabled

Data Sources Disabled

Interactive Step Disabled

Start Paused Disabled

Close

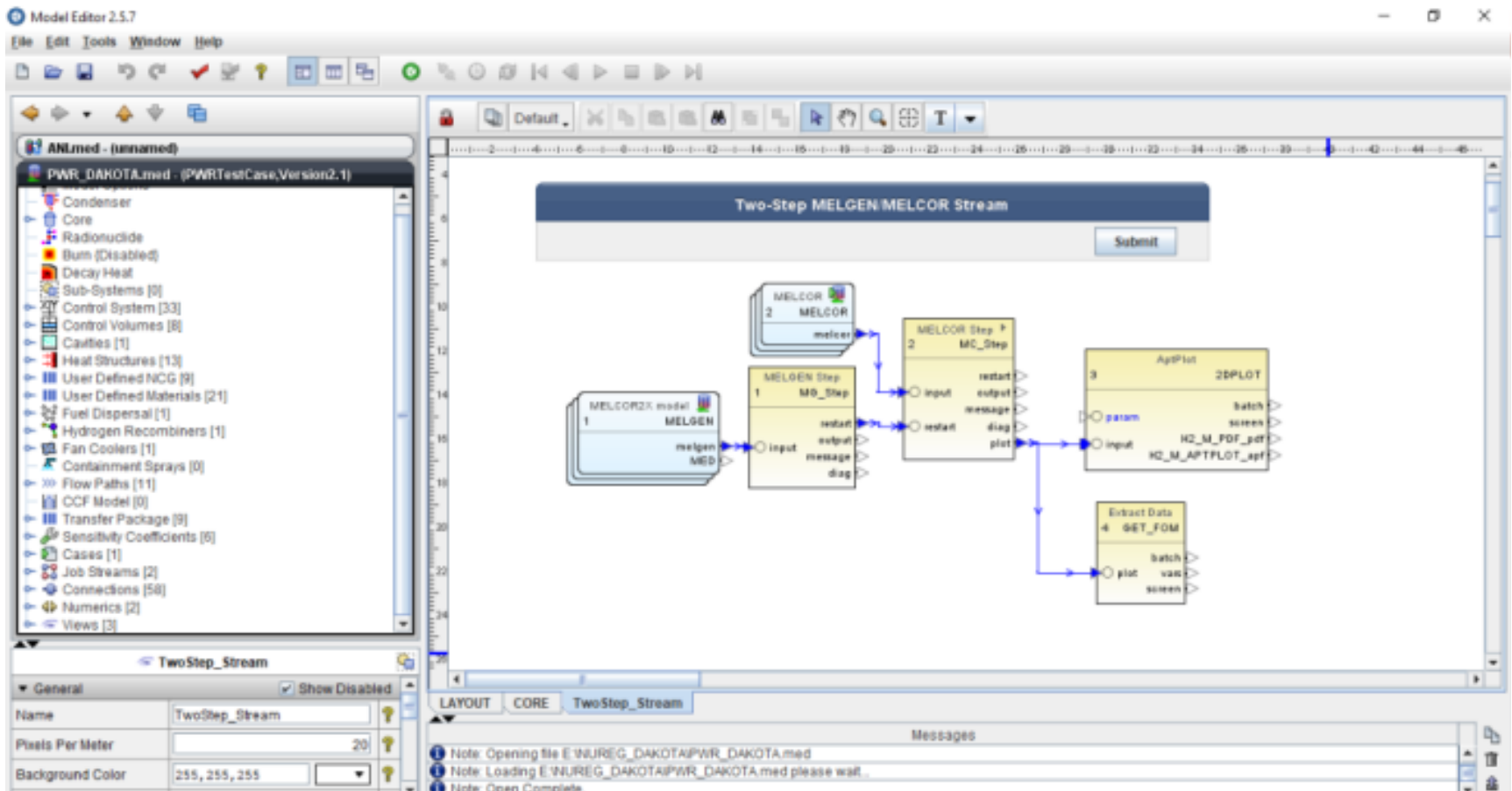
STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM

The screenshot displays the ANSYS Model Editor 2.5.7 interface. The left-hand tree view shows a project named 'ANLmed - (unnamed)' with a sub-project 'PWR_DAKOTA.mod'. Underneath, there are various components like 'Control System', 'Control Volumes', and 'Stream Steps'. The 'Stream Steps' folder is expanded, showing 'MELCOR Step 1 (MG_Step)', 'MELCOR Step 2 (MC_Step)', 'ApiPlot 3 (2DPLOT)', and 'Extract Data 4 (GET_FOM)'. A context menu is open over 'Extract Data 4 (GET_FOM)', listing actions such as 'Properties', 'Select Left Side to Compare', 'Move Up', 'Move Down', 'Cut', 'Copy', 'Paste', 'Paste Special', 'Delete', 'Add To Sub-System', and 'Add To View'. The 'Properties View' window for 'Extract Data 4 (GET_FOM)' is open, showing the following details:

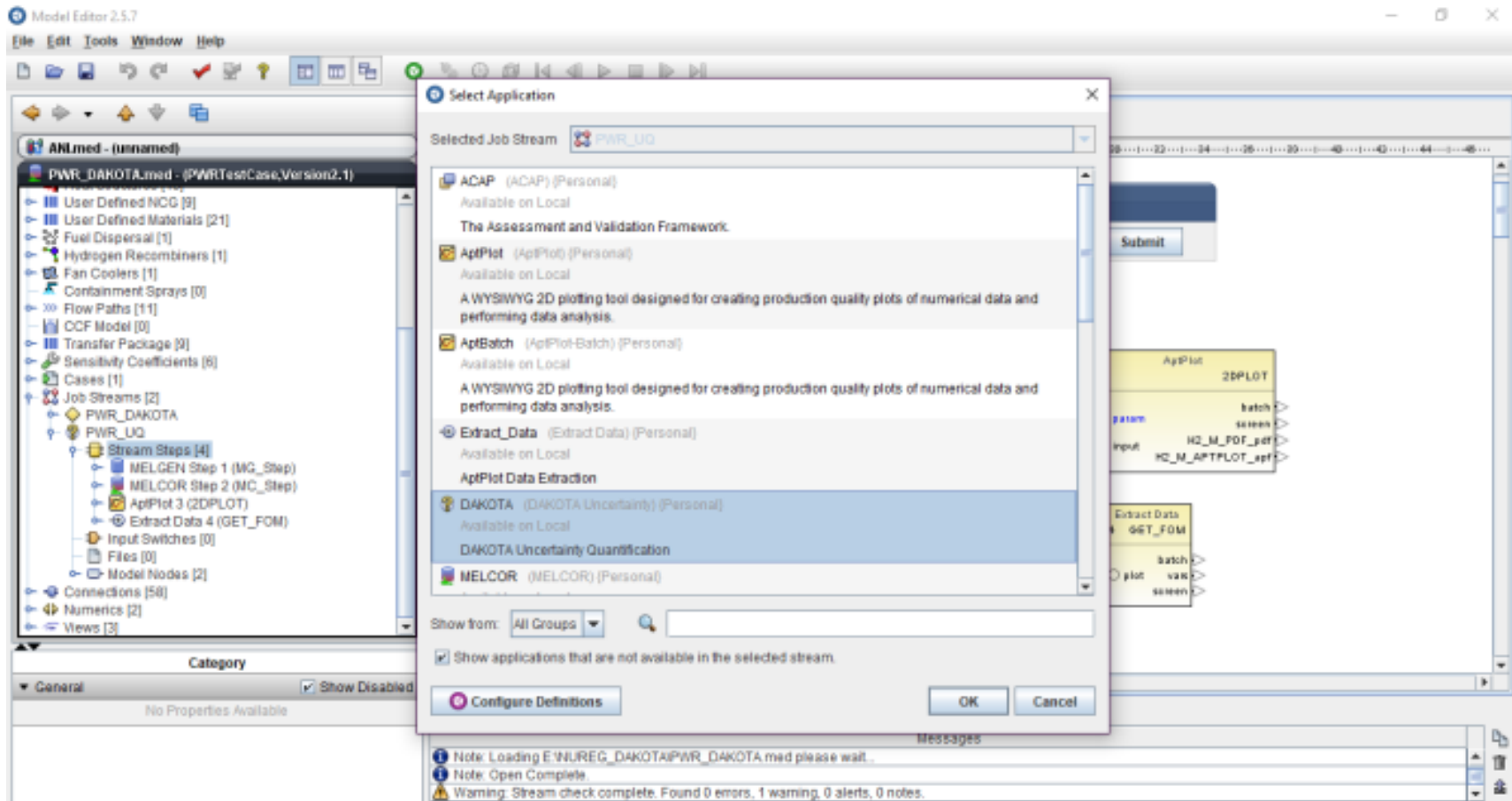
General	
Name	GET_FOM
Description	<none>
Stream	PWR_UQ
Parametric Tasks	Including 59 of 59
Application	Extract_Data
Relative Location	
Keywords	No Keywords
Conditional Logic	None
Input Files	[1] Inputs Defined
Output Files	[4] Outputs Defined
Custom Processing	None
Plot File Type	MELCOR
Plot File Data	<input type="radio"/> Demux <input checked="" type="radio"/> Standard Plot
ApiPlot Script	MELCOR PTF "\$PlotFile", CALC "H2_GEN = 0.0" ...
Submission Properties	Disabled
View in Job Status	Disabled
Animation Model	Disabled
Open Animation	Disabled
Data Sources	Disabled
Interactive Step	Disabled
Start Paused	Disabled

The bottom of the screen shows the Windows taskbar with the system clock at 12:06 on 05/08/2018.

STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM



STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM



STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM

The screenshot displays the Model Editor 2.5.7 interface. On the left, a tree view shows the project structure for 'PWR_DAKOTA.med'. The 'Stream Steps' folder is expanded, highlighting 'DAKOTA Uncertainty 5 (Step)'. The main window shows a grid with a vertical axis from 0 to 35. A 'Properties View' dialog box is open for the selected step, showing the following details:

General	
Name	Step
Description	<none>
Stream	PWR_UQ
Application	DAKOTA
Relative Location	
View in Job Status	<input type="radio"/> Yes <input checked="" type="radio"/> No
Keywords	No Keywords
Conditional Logic	None
Input Files	[0] Inputs Defined
Output Files	[8] Outputs Defined
Custom Processing	None
Parametric Tasks	Disabled
Submission Properties	Disabled
Animation Model	Disabled
Open Animation	Disabled
Data Sources	Disabled
Interactive Step	Disabled
Start Paused	Disabled
ECI Task Set	Disabled
Task Bundling	

At the bottom of the dialog, there are status messages: 'Note: Loading E:\N\UREG...', 'Note: Open Complete...', and 'Warning: Stream check...'. A 'Close' button is located at the bottom right of the dialog.

STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM

The screenshot displays the Model Editor 2.5.7 interface. On the left, a tree view shows the project structure under "PWR_DAKOTA", including "Stream Steps [5]" with sub-items like "MELCOR Step 2 (MC_Step)" and "DAKOTA Uncertainty 5 (Step)". A context menu is open over "DAKOTA Uncertainty 5 (Step)", listing actions such as "Properties", "Move Up", and "Delete".

The "DAKOTA Uncertainty 5 (Step) - Properties View" window is open, showing the following properties:

DAKOTA Uncertainty 5 (Step)	
General <input checked="" type="checkbox"/> Show Disabled	
Name	Step
Description	<none>
Stream	PWR_UQ
Application	DAKOTA
Relative Location	
View in Job Status	<input type="radio"/> Yes <input checked="" type="radio"/> No
Keywords	No Keywords
Conditional Logic	None
Input Files	[0] Inputs Defined
Output Files	[8] Outputs Defined
Custom Processing	None
Parametric Tasks	Disabled
Submission Properties	Disabled
Animation Model	Disabled
Open Animation	Disabled
Data Sources	Disabled
Interactive Step	Disabled
Start Paused	Disabled
ECI Task Set	Disabled
Task Bundling	

STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM

The screenshot displays the Model Editor 2.5.7 interface. On the left, a tree view shows the project structure for 'PWR_DAKOTA.med - (PWRTCase,Version2.1)', including various model components and a 'Stream Steps' folder containing 'MELGEN Step 1 (MG_Step)', 'MELCOR Step 2 (MC_Step)', 'AptPlot 3 (2DPLOT)', 'Extract Data 4 (GET_FOM)', and 'DAKOTA Uncertainty 5 (Step)'. The main workspace shows a flow diagram titled 'Two-Step MELGEN/MELCOR Stream'. The workflow starts with 'MELCOR2X model MELGEN' (Step 1) and 'MELCOR MELCOR' (Step 2). Step 1 outputs 'restart', 'output', 'message', and 'diag' to Step 2. Step 2 outputs 'restart', 'output', 'message', and 'diag' to 'AptPlot 3 (2DPLOT)'. 'AptPlot 3' outputs 'batch' and 'screen' to 'Extract Data 4 (GET_FOM)'. 'Extract Data 4' outputs 'batch', 'vars', and 'screen' to 'DAKOTA Uncertainty 5 (Step)'. A 'Submit' button is visible in the top right of the diagram area. The bottom status bar shows messages: 'Note: Loading E:\NUREG_DAKOTA\PWR_DAKOTA.med please wait...', 'Note: Open Complete.', and 'Warning: Stream check complete. Found 0 errors, 1 warning, 0 alerts, 0 notes.'

STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM

Model Editor 2.5.7

File Edit Tools Window Help

ANI.med - (unnamed)

PWR_DAKOTA.med - (PWRTestCase,Version2.1)

- User Defined NCG [9]
- User Defined Materials [21]
- Fuel Dispersal [1]
- Hydrogen Recombiners [1]
- Fan Coolers [1]
- Containment Sprays [0]
- Flow Paths [11]
- CCF Model [0]
- Transfer Package [9]
- Sensitivity Coefficients [6]
- Cases [1]
- Job Streams [2]
- PWR_DAKOTA
 - PWR_UQ
 - Stream Steps [5]
- Input Switches [0]
- Files [0]
- Model Nodes [2]
- Connections [58]
- Numerics [2]

MELCOR2X model 1 MELGEN melgen MED

MELCOR Step 1 MG_Step

MELCOR Step 2 MC_Step

AptPlot 3 2DPLOT

Extract Data 4 GET_FOM

DAKOTA Uncertainty 5 Step

TwoStep_Stream

General Show Disabled

Name	TwoStep_Stream
Pixels Per Meter	20
Background Color	255, 255, 255

Messages

- Note: Loading E:\NUREG_DAKOTA\PWR_DAKOTA.med please wait...
- Note: Open Complete.
- Warning: Stream check complete. Found 0 errors, 1 warning, 0 alerts, 0 notes.

STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM

Model Editor 2.5.7

File Edit Tools Window Help

ANLmed - (unnamed)

PWR_DAKOTA.mad - (PWRTestCase,Version2.1)

- Fuel Dispersal [1]
- Hydrogen Recombiners [1]
- Fan Coolers [1]
- Containment Sprays [0]
- Flow Paths [11]
- CCF Model [0]
- Transfer Package [3]
- Sensitivity Coefficients [6]
- Cases [1]
- MELCOR
 - Job Streams [2]
 - PWR_DAKOTA
 - PWR_UQ
 - Stream Steps [5]
 - MELGEN Step 1 (MC_Step)
 - MELCOR Step 2 (MC_Step)
 - AptPlot 3 (2DPLOT)
 - Extract Data 4 (GET_FOM)
 - DAKOTA Uncertainty 5 (Step)
 - Input Switches [0]
 - Files [0]
 - Model Nodes [2]
- Connections [59]
- Numerics [2]
- Views [3]

AptPlot 3 (2DPLOT)

General Show Disabled

Name	2DPLOT	
Description	<none>	E
Stream	PWR_UQ	S
Application	AptPlot	S
Relative Location		
View in Job Status	<input type="radio"/> Yes <input checked="" type="radio"/> No	
Keywords	No Keywords	E
Conditional Logic	None	E
Custom Processing	None	E
Plot Inputs	[1] input definition	E
Plots	[1] plot	E
Plot Outputs	[2] output definitions	E
Parameter File	<input type="checkbox"/> <inactive>	S
Parametric Tasks	Disabled	
Submission Properties	Disabled	
Animation Model	Disabled	
Open Animation	Disabled	
Data Sources	Disabled	
Interactive Step	Disabled	
Start Paused	Disabled	
ECI Task Set	Disabled	

Task Bundling

Close

DTA Uncertainty Step

output

post

screen

edt

Note: Saving E:\NUREG...

Note: Saving model docu...

Note: Save Complete.

STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM

The screenshot displays the Model Editor 2.5.7 interface. The main workspace shows a workflow diagram titled "Two-Step MELGEN/MELCOR Stream". The workflow consists of the following steps:

- MELCOR2X model (MELGEN):** A blue box representing the initial model.
- MELGEN Step 1 (MG_Step):** A yellow box that receives input from the MELGEN model and outputs restart, output, message, and diag files.
- MELCOR (MELCOR):** A blue box representing the second model, which receives input from the MG_Step.
- MELCOR Step 2 (MC_Step):** A yellow box that receives input from the MELCOR model and outputs restart, output, message, and diag files.
- AptPlot (2DPLOT):** A yellow box that receives input from the MC_Step and outputs batch, screen, H2_M_PDF_pdf, and H2_M_APTPLOT_apf files.
- Extract Data (GET_FOM):** A yellow box that receives input from the AptPlot and outputs plot, vars, and screen files.
- DAKOTA Uncertainty (Step):** A yellow box that receives input from the GET_FOM and outputs output, post, screen, and odt files.

The workflow is connected by arrows indicating the flow of data and control. A "Submit" button is visible in the top right of the diagram area. The left sidebar shows a tree view of the model structure, including "PWR_DAKOTA" and "PWR_UQ". The bottom status bar shows messages: "Note: Saving E:\NUREG_DAKOTA\PWR_DAKOTA.med, please wait...", "Note: Saving model documents. Please wait...", and "Note: Save Complete."

STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM

The screenshot displays the Model Editor 2.5.7 interface. On the left, a tree view shows the model structure for 'PWR_DAKOTA.med - (PWRTestCase_Version2.1)'. The main workspace shows a workflow diagram titled 'Two-Step MELGEN MELCOR Stream'. The workflow consists of several interconnected components: 'MELCOR 2 MELCOR', 'MELCOR Step 2 MC_Step', 'MELGEN Step 2 MG_Step', 'AppPlot 3 ZDPLOT', and 'Extract Data 4 GET_FOM'. A 'Submit Job Stream' dialog box is open in the center, showing a list of job streams: 'PWR_UQ', 'PWR_DAKOTA', and 'PWR_UQ'. The 'PWR_DAKOTA' job stream is highlighted with a red oval. The dialog also shows 'Local' as the selected location. The bottom of the interface features a 'Messages' panel with several status notes.

Model Editor 2.5.7

File Edit Tools Window Help

PWR_DAKOTA.med - (PWRTestCase_Version2.1)

Model Options

- Condenser
- Core
- Radionuclide
- Bum (Disabled)
- Decay Heat
- Sub-Systems [0]
- Control System [33]
- Control Volumes [8]
- Cavities [1]
- Heat Structures [13]
- User Defined NCG [9]
- User Defined Materials [21]
- Fuel Dispersal [1]
- Hydrogen Recombiners [1]
- Fan Coolers [1]
- Containment Storage [0]

Two-Step MELGEN MELCOR Stream

Submit

Submit Job Stream

Submit Job Stream

- PWR_UQ
- PWR_DAKOTA
- PWR_UQ

Local

OK Cancel

MELCOR 2 MELCOR

MELCOR Step 2 MC_Step

MELGEN Step 2 MG_Step

AppPlot 3 ZDPLOT

Extract Data 4 GET_FOM

LAYOUT CORE TwoStep_Stream

Messages

- Note: Opening file E:\NUREG_DAKOTA\PWR_DAKOTA.med
- Note: Loading E:\NUREG_DAKOTA\PWR_DAKOTA.med please wait...
- Note: Open Complete.

STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM

The screenshot displays the Model Editor 2.5.7 interface. On the left, a tree view shows the model structure for 'PWR_DAKOTA.med - (PWRTestCase,Version2.1)', including components like Condenser, Core, Radionuclide, Burn (Disabled), Decay Heat, Sub-Systems [0], Control System [33], Control Volumes [8], Cavities [1], Heat Structures [13], User Defined NCG [9], User Defined Materials [21], Fuel Dispersal [1], Hydrogen Recombiners [1], Fan Coolers [1], and Containment System [0].

The main workspace shows a workflow diagram titled 'Two-Step MELGEN/MELCOR Stream'. The workflow consists of the following steps:

- MELCOR 2 MELCOR**: A block with an 'restart' input and 'output', 'message', and 'diag' outputs.
- MELGEN Step 2 MO_Step**: A block with 'restart' and 'average' inputs, and 'output' and 'diag' outputs.
- MELCOR Step 2 MC_Step**: A block with 'restart' and 'diag' inputs, and 'output' and 'plot' outputs.
- AppPlot 2D PLOT 3**: A block with 'batch', 'screen', 'H2_M_PDF_plot', and 'H2_M_APTPLOT_app' outputs.
- Extract Data 4 GET_FOM**: A block with 'batch', 'var', and 'screen' outputs.

Arrows indicate the flow of data between these steps. A 'Submit Job Stream' dialog box is overlaid on the workflow, with the 'OK' button highlighted in red. The dialog box contains the following fields:

- Submit Job Stream: PWR_UQ
- Submit To Platform: Local
- Buttons: OK, Cancel

The bottom of the window shows a 'Messages' pane with the following text:

- Note: Opening file E:\NUREG_DAKOTA\PWR_DAKOTA.med
- Note: Loading E:\NUREG_DAKOTA\PWR_DAKOTA.med please wait...
- Note: Open Complete.

STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM

SNAP Job Status 2.5.7

File View Tools Help

Job List

Local

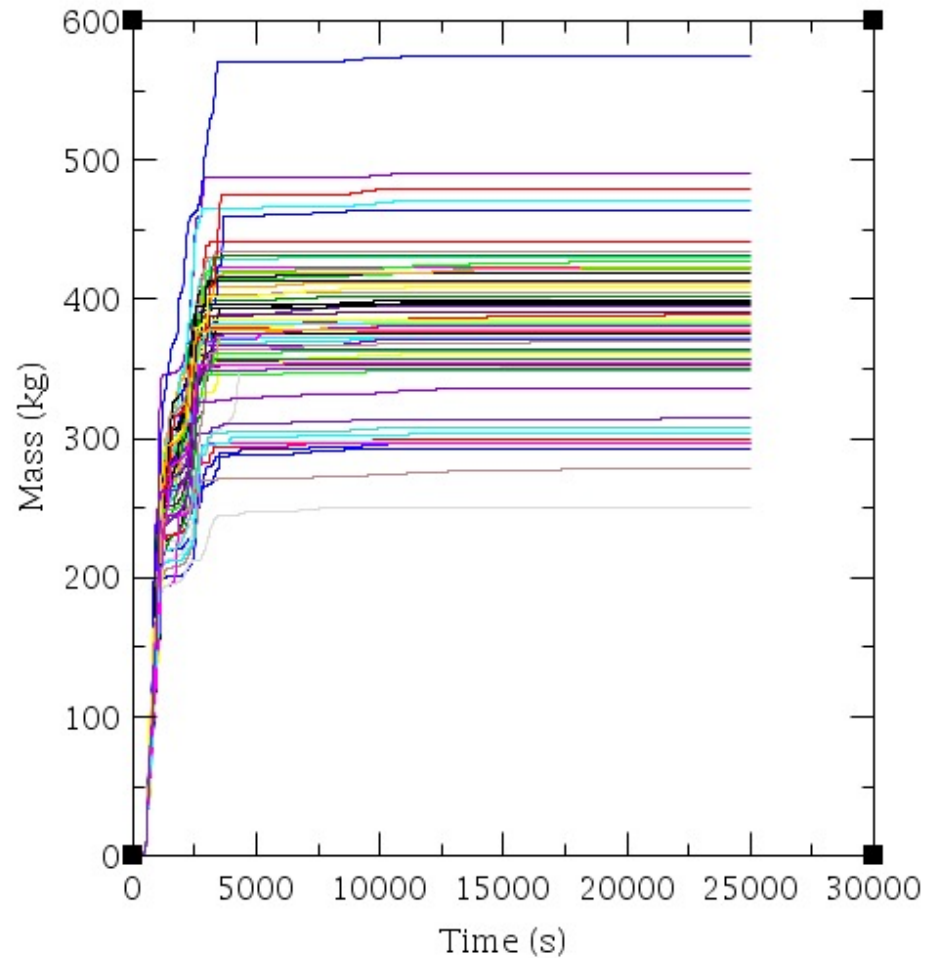
- MELCOR_E/
- RUN/
- RUN_2/
- TRACE/
- UNCERTAINTY/
- MELCOR/
- ARTICOLO_E
- ARTICOLO_E
- ARTICOLO_E
- ARTICOLO_E
- PWR_DAKO7
- PWR_UQ/
- PWR_UQ_1/
- PWR_UQ_2/
- PWR_UQ_4/
- PWR_UQ_5/
- SFR_UNCEP
- TwoStep_Str
- UNCERTAINTY
- uncertainty_1

calcsew/LocalUNCERTAINTYMELCOR/PWR_UQ/

Job	Priority	Job Type	Status	Submitted	Started	Completed	Calc Time	Loaded	Evaluation
PWR_UQ	4	Stream	Complete	Aug 05 12:21	Aug 05 12:21	Aug 05 12:33	No Data	No	
2DPLOT	5	AptPlot	Complete	Aug 05 12:30	Aug 05 12:32	Aug 05 12:32	No Data	No	
GET_FOM_T01	5	AptPlotExtract	Complete	Aug 05 12:24	Aug 05 12:30	Aug 05 12:30	No Data	No	
GET_FOM_T02	5	AptPlotExtract	Complete	Aug 05 12:24	Aug 05 12:30	Aug 05 12:30	No Data	No	
GET_FOM_T03	5	AptPlotExtract	Complete	Aug 05 12:24	Aug 05 12:30	Aug 05 12:30	No Data	No	
GET_FOM_T04	5	AptPlotExtract	Complete	Aug 05 12:24	Aug 05 12:30	Aug 05 12:30	No Data	No	
GET_FOM_T05	5	AptPlotExtract	Complete	Aug 05 12:25	Aug 05 12:30	Aug 05 12:31	No Data	No	
GET_FOM_T06	5	AptPlotExtract	Complete	Aug 05 12:25	Aug 05 12:30	Aug 05 12:31	No Data	No	
GET_FOM_T07	5	AptPlotExtract	Complete	Aug 05 12:24	Aug 05 12:30	Aug 05 12:31	No Data	No	
GET_FOM_T08	5	AptPlotExtract	Complete	Aug 05 12:25	Aug 05 12:31	Aug 05 12:31	No Data	No	
GET_FOM_T09	5	AptPlotExtract	Complete	Aug 05 12:25	Aug 05 12:30	Aug 05 12:31	No Data	No	
GET_FOM_T10	5	AptPlotExtract	Complete	Aug 05 12:25	Aug 05 12:30	Aug 05 12:31	No Data	No	
GET_FOM_T11	5	AptPlotExtract	Complete	Aug 05 12:25	Aug 05 12:31	Aug 05 12:31	No Data	No	
GET_FOM_T12	5	AptPlotExtract	Complete	Aug 05 12:25	Aug 05 12:31	Aug 05 12:31	No Data	No	
GET_FOM_T13	5	AptPlotExtract	Complete	Aug 05 12:25	Aug 05 12:31	Aug 05 12:31	No Data	No	
GET_FOM_T14	5	AptPlotExtract	Complete	Aug 05 12:25	Aug 05 12:31	Aug 05 12:31	No Data	No	
GET_FOM_T15	5	AptPlotExtract	Complete	Aug 05 12:26	Aug 05 12:31	Aug 05 12:31	No Data	No	
GET_FOM_T16	5	AptPlotExtract	Complete	Aug 05 12:26	Aug 05 12:31	Aug 05 12:31	No Data	No	
GET_FOM_T17	5	AptPlotExtract	Complete	Aug 05 12:26	Aug 05 12:31	Aug 05 12:31	No Data	No	
GET_FOM_T18	5	AptPlotExtract	Complete	Aug 05 12:26	Aug 05 12:31	Aug 05 12:31	No Data	No	
GET_FOM_T19	5	AptPlotExtract	Complete	Aug 05 12:26	Aug 05 12:31	Aug 05 12:31	No Data	No	
GET_FOM_T20	5	AptPlotExtract	Complete	Aug 05 12:26	Aug 05 12:31	Aug 05 12:31	No Data	No	
GET_FOM_T21	5	AptPlotExtract	Complete	Aug 05 12:26	Aug 05 12:31	Aug 05 12:31	No Data	No	
GET_FOM_T22	5	AptPlotExtract	Complete	Aug 05 12:26	Aug 05 12:31	Aug 05 12:31	No Data	No	
GET_FOM_T23	5	AptPlotExtract	Complete	Aug 05 12:27	Aug 05 12:31	Aug 05 12:31	No Data	No	
GET_FOM_T24	5	AptPlotExtract	Complete	Aug 05 12:27	Aug 05 12:31	Aug 05 12:31	No Data	No	
GET_FOM_T25	5	AptPlotExtract	Complete	Aug 05 12:27	Aug 05 12:31	Aug 05 12:31	No Data	No	
GET_FOM_T26	5	AptPlotExtract	Complete	Aug 05 12:27	Aug 05 12:31	Aug 05 12:31	No Data	No	
GET_FOM_T27	5	AptPlotExtract	Complete	Aug 05 12:27	Aug 05 12:31	Aug 05 12:31	No Data	No	
GET_FOM_T28	5	AptPlotExtract	Complete	Aug 05 12:27	Aug 05 12:31	Aug 05 12:31	No Data	No	
GET_FOM_T29	5	AptPlotExtract	Complete	Aug 05 12:27	Aug 05 12:31	Aug 05 12:31	No Data	No	
GET_FOM_T30	5	AptPlotExtract	Complete	Aug 05 12:27	Aug 05 12:31	Aug 05 12:31	No Data	No	
GET_FOM_T31	5	AptPlotExtract	Complete	Aug 05 12:28	Aug 05 12:31	Aug 05 12:32	No Data	No	
GET_FOM_T32	5	AptPlotExtract	Complete	Aug 05 12:27	Aug 05 12:31	Aug 05 12:31	No Data	No	
GET_FOM_T33	5	AptPlotExtract	Complete	Aug 05 12:27	Aug 05 12:31	Aug 05 12:31	No Data	No	

STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM

H2 GENERATION



STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM

Statistical Analyses:

Statistical results based on 59 samples:

Summary	Value	Task #
Min Value	250.87505	54
Max Value	574.76666	51
Mean	381.43805	-
Median	382.44507	40
Standard Deviation	56.8461	-
Coefficient of Variance	0.38578	-

Response Correlations

	Simple	Partial	Simple Rank	Partial Rank
d5	0.0979063	0.102384	0.135067	0.268539
d6	0.110172	0.146704	0.0338983	0.0599765
d7	0.098521	0.123725	0.126768	0.209831
d1	0.737284	0.791904	0.765926	0.855157
d2	-0.495872	-0.627241	-0.379486	-0.653184
d3	0.03035	0.00594472	0.0189947	0.0516358
d4	-0.0188159	0.0125986	-0.0151373	0.0108442

STEP BY STEP GUIDE TO DEVELOP AN UNCERTAINTY STREAM

Probability Density Function

