

Radiation Protection Computer Code  
Analysis and Maintenance Program (RAMP)  
User's Meeting  
October 5-9, 2015

Rockville, Maryland

SNAP Overview

Ken Jones

Applied Programming Technology, Inc.  
Bloomsburg, PA



# What is SNAP?

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- Symbolic Nuclear Analysis Package
  - Suite of Applications
- Standard Graphical User Interface designed to simplify the use of analytical codes.
  - Construct, Maintain and Document Models
  - Run Cases
  - Analyze Results
- Platform Independent, Pure-Java, Plug-in Arch.
  - Can Be Adapted to Any Engineering Code
  - Highly Extensible and Flexible

# SNAP is a Suite of Applications

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- Primary SNAP Apps:
  - Configuration Tool
  - Model Editor
  - Job Status
  - Calculation Server
- Associated Software
  - AptPlot & Demuxers – Plotting Tools
  - ACAP - Automated Code Assessment Program
  - TSA – Test Suite Analyzer
  - Matlab / Mathcad
  - DAKOTA – Optimization & Uncertainty Quantification

# Consistent and Intuitive User Interface

- Common Functionality Across Several Codes
- Minimize Learning Curve for Analysis Codes
- Logical Organization of Model Components and Interconnections
- 2D and 3D Visualization
- Input Checking and Model Validation Tests
- Advanced Model Editing Tools
- Manage Model Documentation
- Easily Submit, and Monitor Calculations
- Automate Analysis of Results

# Why Use SNAP?

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- Greatly reduces time to develop and/or modify analytic code models.
- Permits model developers to graphically annotate and document their input models.
- Simplifies the process of running analytical codes using job automation.
- Provides for quick and easy visualization of code results and/or data.
- Improves Efficiency and Quality!

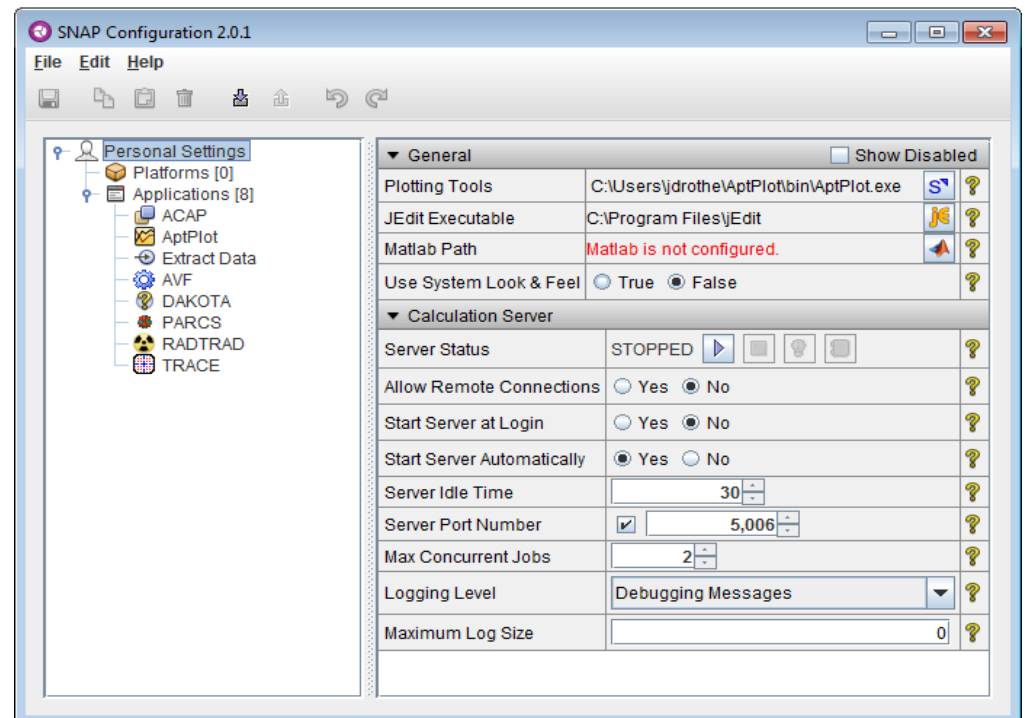
# Advanced SNAP Functionality

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- Numerics - Use variables & functions to define input and control execution
- Model Notes - Attach HTML notes to components & individual attributes
- Track Input Ownership & Reviewer
- Model Notebook Generation
- Master Integrator - Split complex models into sub-models.
- Engineering Templates - Provides support for multiple diverse models.
- Kiosk - Create Input templates to constrain execution of predefined engineering templates.
- Uncertainty Quantification Analysis (Dakota)
- Restart Cases
- Component & Group Renodalization
- I/C Import & Management
- Component-to-Component and Model-to-Model Comparisons
- Advanced Job Stream (Under Design)

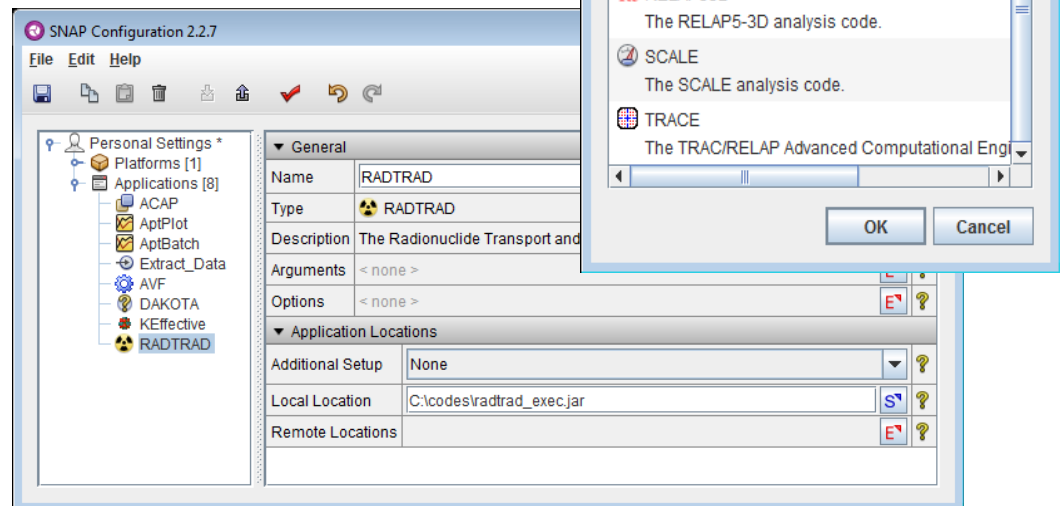
# Configuration Tool

- SNAP can be installed under a User's directory or in a System Directory where it can be available to multiple Users.
- Personal Settings are stored in the User's home directory.
- Application paths for jEdit, AptPlot, and Matlab.
- Local Calculation Server Settings
  - Status, Server Port, Logging Level, etc.
- Manages the available set of Platforms & Applications.



# Configuration Tool – Applications

- Applications can be included as steps in a Job Stream.
  - Local and remote executable locations.
  - Command line arguments.
  - Application version (TRACE, MELCOR).
- Built-in support for:
  - ACAP
  - AptPlot
  - DAKOTA Uncertainty
- Supported applications (partial list):
  - COBRA-IE
  - CONTAIN
  - MELCOR
  - PARCS
  - RELAP5 / RELAP5-3D
  - TRACE
  - RADTRAD
  - FRAPCON/FRAPTRAN
  - SCALE





# Model Editor

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- Primary User Interface
  - Navigator, 2D/3D Views, Property View, Message Window, ASCII Views
- Model Editing and Animation
- Platform Independent Binary save format.
- Allows Editing Multiple Models Simultaneously
- Data Driven Hierarchy
  - Component Data model
  - Displayed in multiple Places
- Built in Engineering Unit Support

# Model Editor User Interface

The screenshot displays the Model Editor 2.2.7 software interface. The window title is "Model Editor 2.2.7". The menu bar includes File, Edit, Tools, Window, and Help. The toolbar contains various icons for file operations and editing.

**Navigator:** A tree view on the left side of the interface. It shows the project structure for "unsaved - (Test23)". The tree includes Model Options, Nuclide Data, Sources [1], Source 1 (1465), Compartments [5], Pathways [10], Dose Locations [3], Natural Deposition [1], Filters [4], Sprays [1], X/Q Tables [3], Connections [26], Job Streams [1], Numerics [0], Views [1], and Test23. A yellow box labeled "Navigator" points to this tree.

**Main Property View:** A panel below the Navigator showing the properties of the selected compartment, "Compartment 1 (Sprayed Region)". It includes a "General" tab with fields for Name (Sprayed Region), Component Number (1), Description (<none>), Type (Normal), Output Detail Level (Full Edit at Time Steps), Volume (2.74E6 m³), Deposition (<none>), Filter (<none>), and Spray (Spray 1 (Sprayed Region Spray)). A yellow box labeled "Main Property View" points to this panel.

**2D Views:** A large central area displaying a flow diagram titled "ALION / ITSC Acceptance Test 23". The diagram shows a source (1465 [1]) connected to a "Sprayed Region 1" compartment. From this compartment, three pathways lead to "Unsprayed Region 2": "Sprayed to Environment 3", "Sprayed to Annulus 2" (which connects to an "Annulus" compartment), and "Sprayed to Unsprayed 1". From "Unsprayed Region 2", three pathways lead to "Environment 6": "Unsprayed to Environment 6", "Unsprayed to Annulus 5" (which connects to a "Sprayed to Annulus" compartment), and "Unsprayed to Sprayed 4". A yellow box labeled "2D Views" points to this diagram.

**Message Window:** A panel at the bottom right displaying a list of messages. It includes error messages about missing plugins (CRM-External Application Module, CRMProject, CRMStructure, PDMAccess) and informational notes about verification, imports, and model options. A yellow box labeled "Message Window" points to this panel.

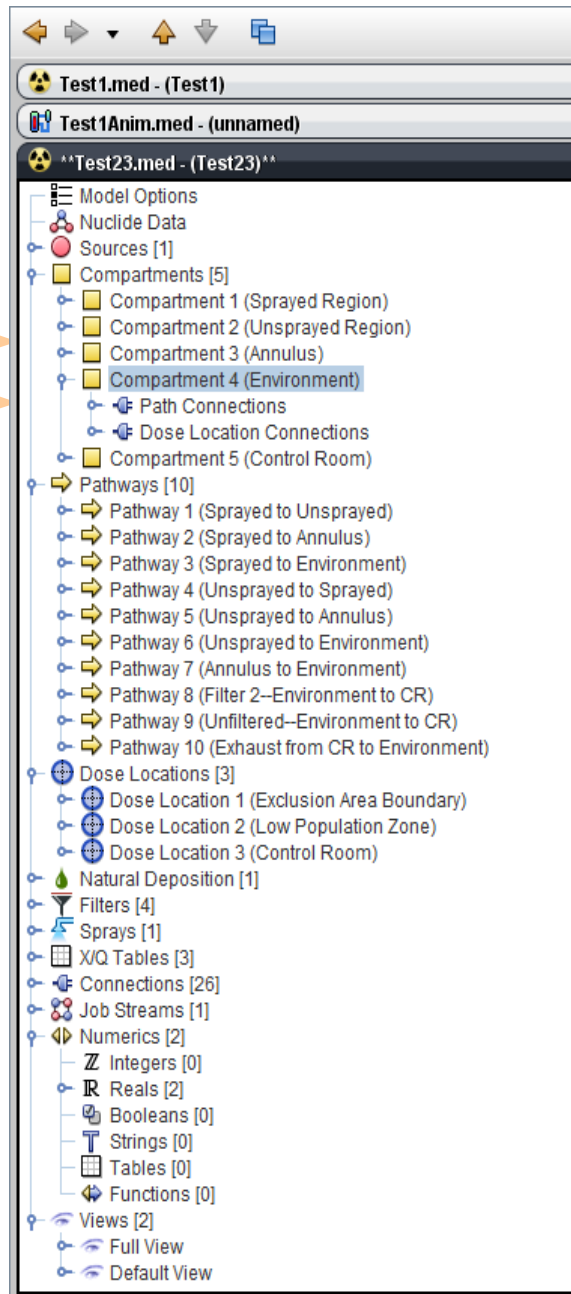
# Component Navigator

Toolbar →  
Open Models →  
Current Model →

Categories →  
Components →  
Connections →

Job Streams →  
User Defined Numerics →

2D Views →



Multiple Open Models  
– Accordion Layout

Organizes all Model  
Components

Categories and Root  
Components

Interconnections

Copy/Paste

Add/Remove

Drag onto 2D View

# Property Views

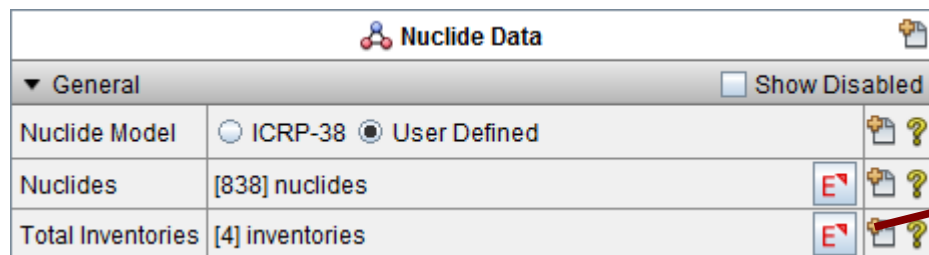
- Main Property View
  - Data Follows Selection in 2D Views or the Navigator
  - Multi-Select Editing
- Component Property View
  - Separate Window
  - Single Component Only
- Custom Editors
- Attribute Documentation
- Pop-up Help

Compartment 1 (Sprayed Region)	
▼ General <input type="checkbox"/> Show Disabled	
Name	Sprayed Region
Component Number	1
Description	<none>
Type	Normal
Output Detail Level	Full Edit at Time Steps
Volume	2.74E6 (ft <sup>3</sup> )
Deposition	<none>
Filter	<none>
Spray	Spray 1 (Sprayed Region Spray)

Pathway 1 (Sprayed to Unsprayed)	
▼ General <input type="checkbox"/> Show Disabled	
Name	Sprayed to Unsprayed
Component Number	1
Description	<none>
From Compartment	Compartment 1 (Sprayed Region)
To Compartment	Compartment 2 (Unsprayed Region)
Pathway Type	Air Leakage
Printout detail level	Nuclide & Transport Each Time Step
Leakage Rate	Rows: 5 [0.0,1053.0],[0.1667,4056.0],[0.5,4425.0]...

# Property Editors and Selectors

- Property Editors – **E**
  - Detailed custom dialogs
  - Display/edit sets of values



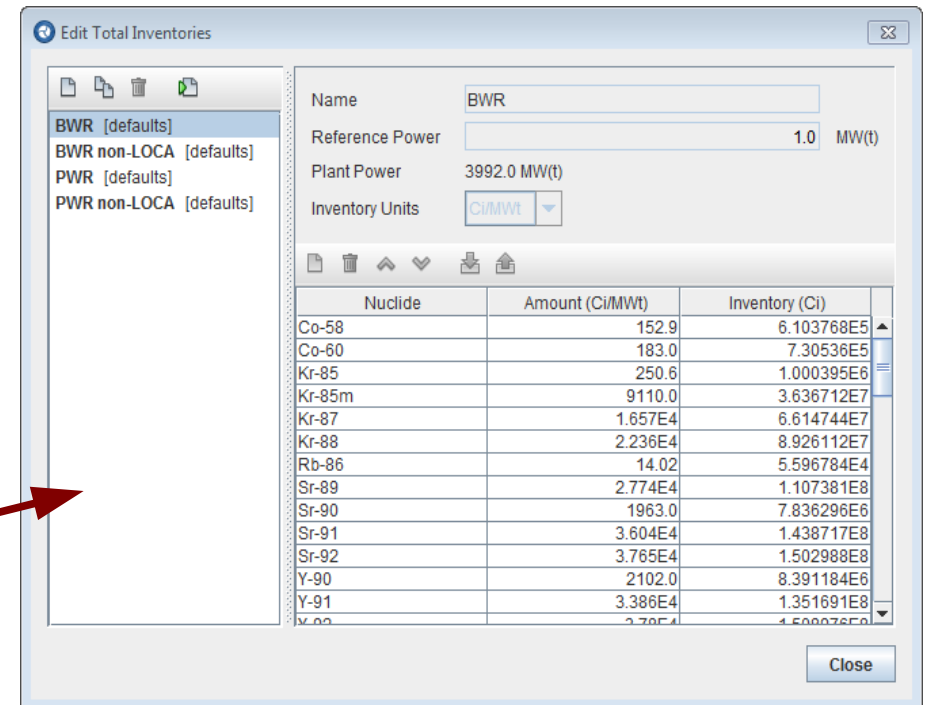
**Nuclide Data**

▼ General ☐ Show Disabled

Nuclide Model ☐ ICRP-38 ☒ User Defined

Nuclides [838] nuclides

Total Inventories [4] inventories



**Edit Total Inventories**

Name BWR

Reference Power 1.0 MW(t)

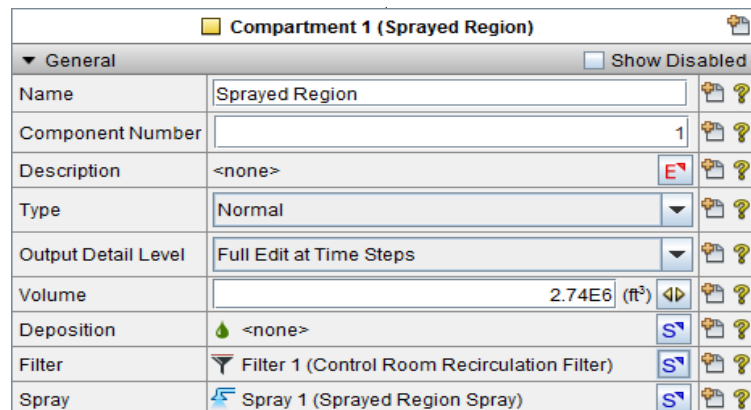
Plant Power 3992.0 MW(t)

Inventory Units Ci/MWT

Nuclide	Amount (Ci/MWT)	Inventory (Ci)
Co-58	152.9	6.103768E5
Co-60	183.0	7.30536E5
Kr-85	250.6	1.000395E6
Kr-85m	9110.0	3.636712E7
Kr-87	1.657E4	6.614744E7
Kr-88	2.236E4	8.926112E7
Rb-86	14.02	5.596784E4
Sr-89	2.774E4	1.107381E8
Sr-90	1963.0	7.836296E6
Sr-91	3.604E4	1.438717E8
Sr-92	3.765E4	1.502988E8
Y-90	2102.0	8.391184E6
Y-91	3.386E4	1.351691E8

Close

- Component Selectors – **S**
  - Select from the available components
  - Sort by category, number,



**Compartment 1 (Sprayed Region)**

▼ General ☐ Show Disabled

Name Sprayed Region

Component Number 1

Description <none>

Type Normal

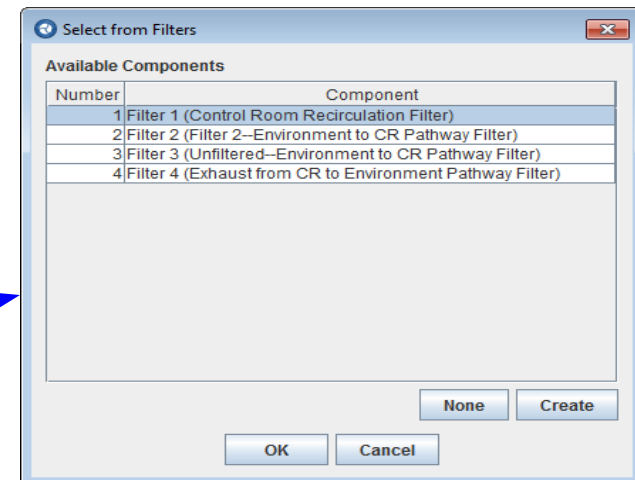
Output Detail Level Full Edit at Time Steps

Volume 2.74E6 (ft³)

Deposition <none>

Filter Filter 1 (Control Room Recirculation Filter)

Spray Spray 1 (Sprayed Region Spray)



**Select from Filters**

Available Components

Number	Component
1	Filter 1 (Control Room Recirculation Filter)
2	Filter 2 (Filter 2–Environment to CR Pathway Filter)
3	Filter 3 (Unfiltered–Environment to CR Pathway Filter)
4	Filter 4 (Exhaust from CR to Environment Pathway Filter)

None Create

OK Cancel

# Component Differencing

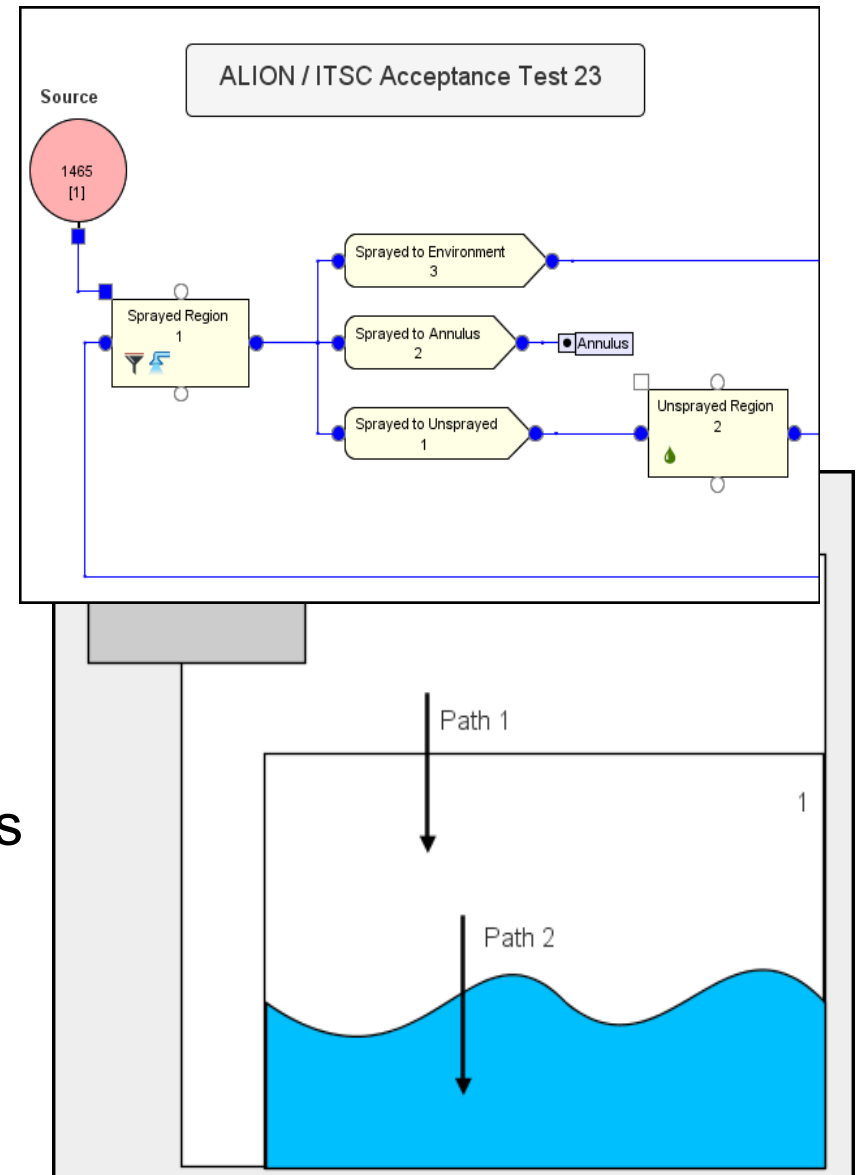
- Compare the ASCII input of two component selections
- Selection can include anything from a Single Component to Entire Models
- Left Side Implements Component Listener Interface
  - Monitor Changes to a component
- Results can be Exported to a File.

Tee 17 (\$17\$ bkn-loop sec-side downcomer)					Tee 27 (\$27\$ brk-loop sec boiler/stdome)				
* alp1	*	1.0	0.0	0.0	* pa1	*	0.0	0.0	0.0e
* v11	*	0.0	0.0	0.0	* dx2	*	2.175e		
* vv1	*	0.0	0.0	0.0	* vo12	*	6.525e		
* vv1	*	0.0e			* fa2	*	5.0	1.5e	
* t11	*	535.14	535.14	535.14	* kf2	*	1.0E-10	3.0E-3e	
* tv1	*	535.14	535.14	535.14	* grav2	*	-0.55758	-1.0e	
* p1	*	4.85E6	4.85E6	4.85E6					
* pa1	*	0.0	0.0	0.0					
* dx2	*	1.0e							
* vo12	*	0.5e							
* fa2	*	0.5	0.5e						
* kf2	*	1.0E-10	0.0e						
* grav2	*	0.0	0.0e						
* hd2	*	0.1	0.1e		* hd2	*	0.1	0.1e	
* nff2	*	1	1e		* nff2	*	1	1e	
* alp2	*	0.0e			* alp2	*	1.0e		
* v12	*	0.0	0.0e		* v12	*	0.0	0.0e	
* vv2	*	0.0	0.0e		* vv2	*	0.0	0.0e	
* t12	*	440.0e			* t12	*	535.14e		
* tv2	*	440.0e			* tv2	*	535.14e		
* p2	*	4.85E6e			* p2	*	4.85E6e		
* pa2	*	0.0e			* pa2	*	0.0e		

Left [46] \* alp2 \* 0.0e  
Right [39] \* alp2 \* 1.0e

# 2D Views

- 2D Representation of Components and Interconnections
- Each Component may appear once in each view.
- Add & Remove Components
  - Delete – Remove from model
  - Cut – Remove from the view
- Annotations
  - Labels, Lines, Boxes, etc.
  - Can be associated with model components
- Group/Ungroup to treat a set of items as one.
- Use Layers to control selection and prevent modification.
- Use Embedded Views to hyperlink between views.



# RADTRAD Editors

- RCS Activity Editor

- Calculates RCS Activity for BWR and PWR scenarios
- Displays Equilibrium, Spike and Total RCS Inventories

**RCS Activity Calculator**

**Defaults Type:**

☒ BWR ☐ PWR

**Plant Power** 3992.0 MW(t)

**Activity Parameters**

RCS Mass  gm

T/S Eq. Act.  uCi/gm DE I-131

T/S Eq. Act.  uCi/gm DE Xe-133

☒ Use RCS equilibrium activity

☒ Use pre-incident spike

T/S spike act.  uCi/gm DEI-131

☐ Use co-incident spike

Spike duration  hr

**Iodine Appearance Rate**

Nuclide	Ci/hr
I-131	0.0
I-132	0.0
I-133	0.0
I-134	0.0
I-135	0.0

**RCS Activity**

Nuclide Symbol	Activity (uCi/gm)	Equilibrium RCS Inventory (Ci)	Spike RCS Inventory (Ci)	Total RCS Inventory (Ci)
Kr-83m	5.9E-4	1.73804E-7	0.0	1.73804E-7
Kr-85	4.0E-6	1.178332E-9	0.0	1.178332E-9
Kr-85m	1.0E-3	2.94583E-7	0.0	2.94583E-7
Kr-87	3.3E-3	9.72124E-7	0.0	9.72124E-7
Kr-88	3.3E-3	9.72124E-7	0.0	9.72124E-7
Xe-131m	3.3E-6	9.72124E-10	0.0	9.72124E-10
Xe-133	1.4E-3	4.124163E-7	0.0	4.124163E-7
Xe-133m	4.9E-5	1.443457E-8	0.0	1.443457E-8
Xe-135	3.8E-3	1.119416E-6	0.0	1.119416E-6
Xe-135m	4.4E-3	1.296165E-6	0.0	1.296165E-6
Xe-138	0.015	4.418746E-6	0.0	4.418746E-6
I-131	4.594311E-4	3.84895E-7	2.30937E-5	2.34786E-5
I-132	5.944034E-3	4.9797E-6	2.98782E-4	3.037617E-4
I-133	3.224372E-3	2.701264E-6	1.620758E-4	1.647771E-4
I-134	0.015952785	1.336467E-5	8.018805E-4	8.152452E-4
I-135	5.053347E-3	4.233514E-6	2.540108E-4	2.582444E-4
Cs-134	3.453661E-8	2.893354E-11	0.0	2.893354E-11
Cs-136	2.328687E-8	1.950891E-11	0.0	1.950891E-11
Cs-137	9.208031E-8	7.71416E-11	0.0	7.71416E-11
Rb-86	0.0	0.0	0.0	0.0

**Buttons:** Calculate Appearance, Calculate Activity, Reset, OK, Cancel



# RADTRAD Editors

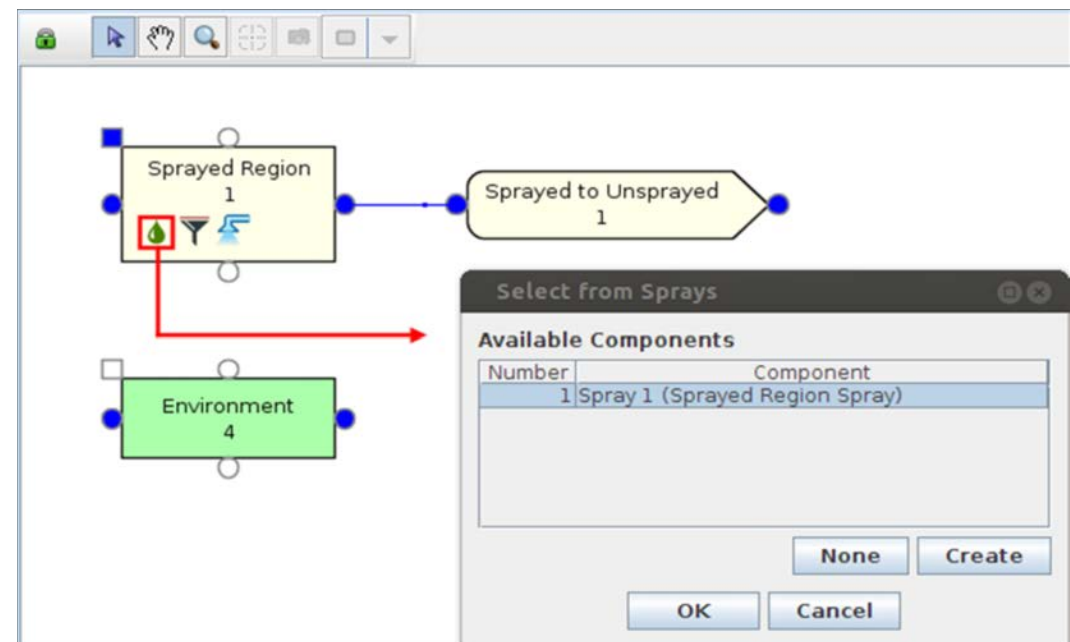
Onsite X/Q Table Map

	From Environment		
↓ Pathways →	[8] Filter 2--Environment to CR	[9] Unfiltered--Environment to CR	
[3] Sprayed to Environment	X/Q Table 3 (Multi Point Odd)	X/Q Table 3 (Multi Point Odd)	<no
[6] Unsprayed to Environment	X/Q Table 3 (Multi Point Odd)	X/Q Table 3 (Multi Point Odd)	<no
[7] Annulus to Environment	X/Q Table 3 (Multi Point Odd)	X/Q Table 3 (Multi Point Odd)	<no
[10] Exhaust from CR to Environment			
[11] test path 1	X/Q Table 1 (Single Point)	<none>	<no
[12] test path 2	X/Q Table 2 (Multi Point Even)	<none>	<no
[13] test path 3	X/Q Table 3 (Multi Point Odd)	<none>	<no
[14] test path 4	X/Q Table 4 (Unknown Indep)	<none>	<no
[15] test path 5	X/Q Table 6 (Unknown End Time)	<none>	<no
[16] test path 6	X/Q Table 5 (Unknown Dep)	<none>	<no

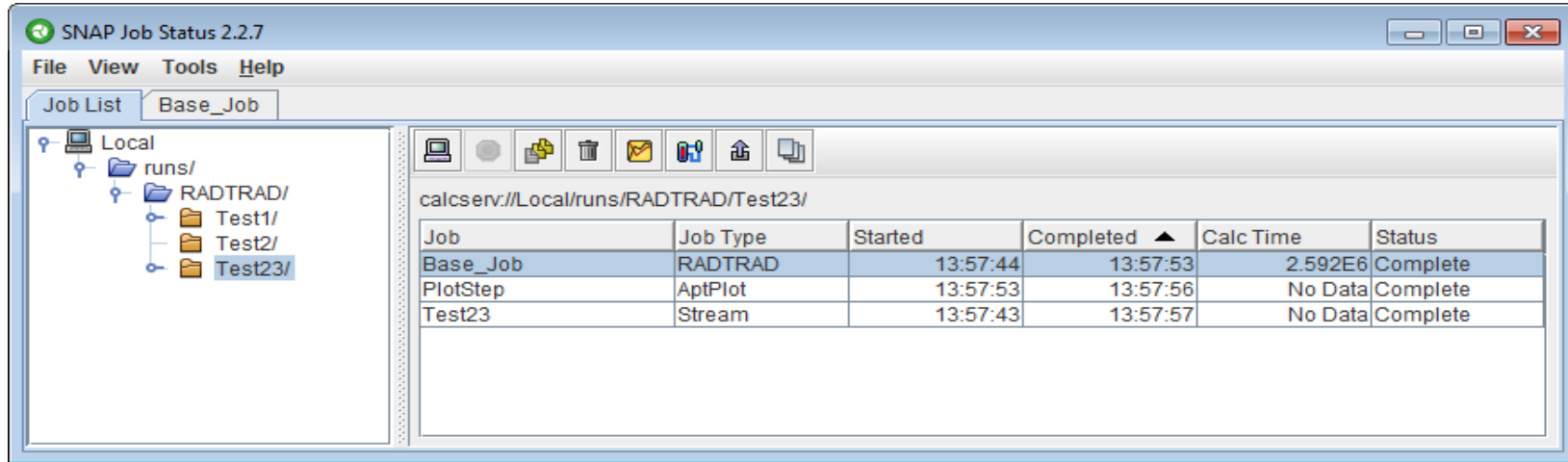
Help OK Cancel

- Onsite X/Q table map
  - Display and Edit X/Q for Pathways To/From the Environment

- Quick Edit Feature on Drawn Compartments & Pathways
  - Create and select filters, depositions and sprays.



# Job Status



- Display the Status of Submitted Jobs
- Connect to Local or Remote Machines
  - Calculation Server or HPC Clusters
- View ASCII Input and Output Files
- Delete, Plot, and Terminate jobs
- Import Completed Jobs

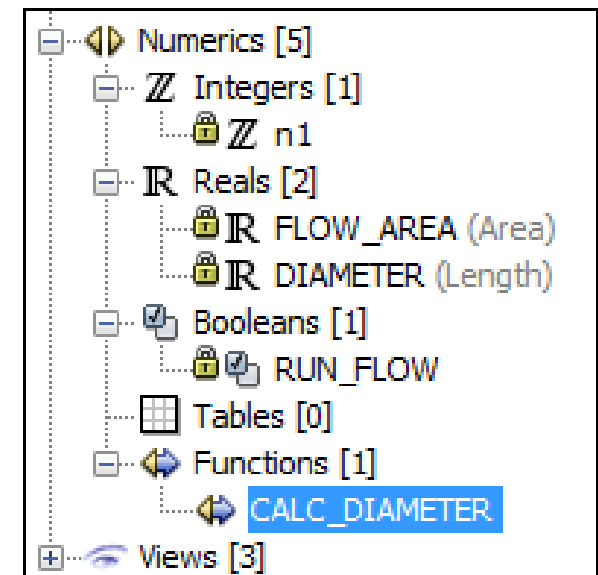
# Calculation Server

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- Manages job stream execution.
- Required to Animate results. Interactively or in Replay mode.
- Provides access to files output by a calculation.
- Local server starts & stops automatically as needed.
- Configuration Tool is used to Start/Stop remote servers.

# User Defined Numerics

- Variables may be used in place of entering an explicit value for component data.
- Supported Types: Integer, Boolean, Real & Table.
- Python, MATLAB or MathCAD functions can be used to calculate variable values.
- Variables are either Interactive or Calculated.
  - Interactive variable values are entered directly.
  - Calculated variables are assigned values by functions.
- Real variables have engineering units
- (Area, Length, etc.).
- Automatically converts to selected units (SI or British)
- Variables can only be used by a property that has the same units.

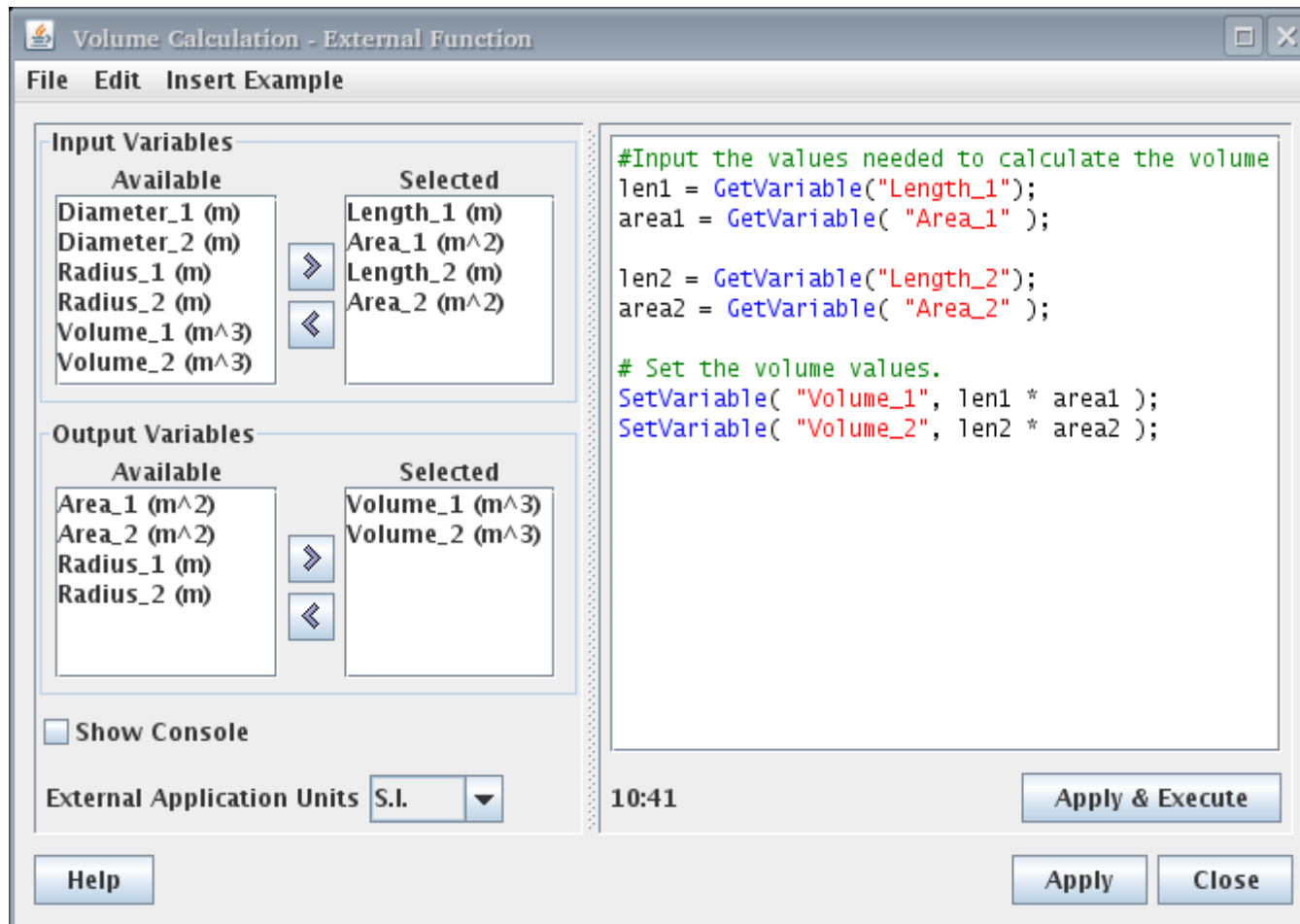


# User-Defined Functions

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- Matlab, Mathcad, Python
- Operate on SNAP Variables
  - Input: Interactive and Calculated Variables
  - Output: Calculated Variables
- Customizable execution order
- Enabling Booleans can be used to control execution
- Python- function source embedded in the model.
- Matlab/Mathcad- references external .m/.xmcd files

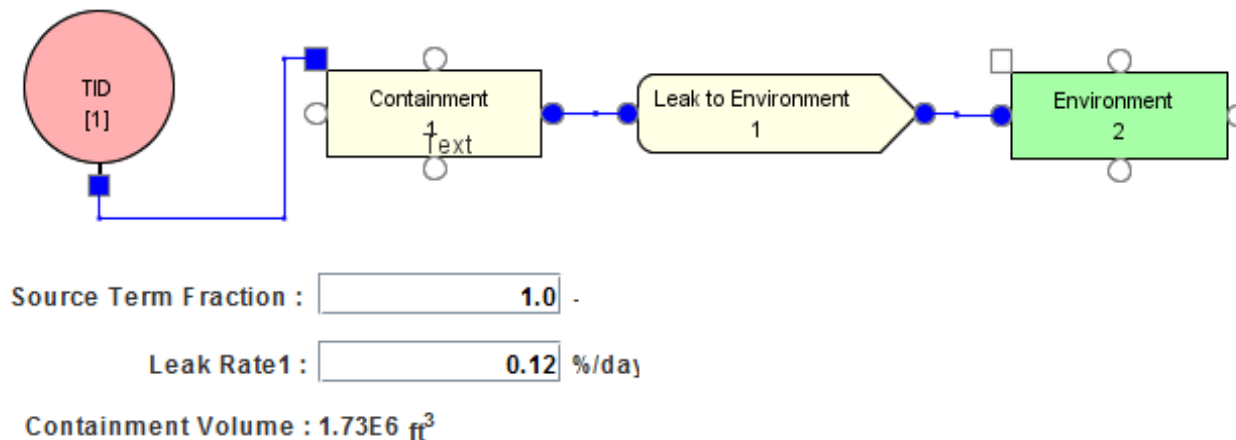
# Sample Python Function



# Variables in Views

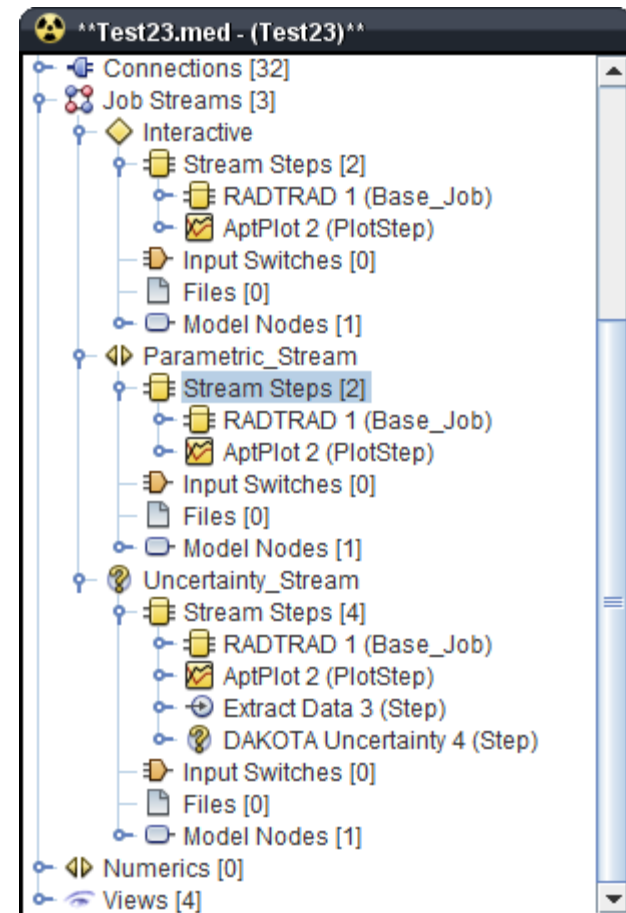
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- Booleans, Integers, Reals
- Drag and drop into a 2D View
- Interactive variables can be set to editable
- Changing a value executes the Functions
- Values updated after function execution
- Can be used to create custom input forms



# Job Streams

- Job Streams define how a series of interrelated applications should be executed.
- Graphically construct sequences of Job steps.
- A Model can contain any number of Job Streams.
- Parametric Support through Numerics and File connections.
- Parametric Fan-Out and Fan-In.

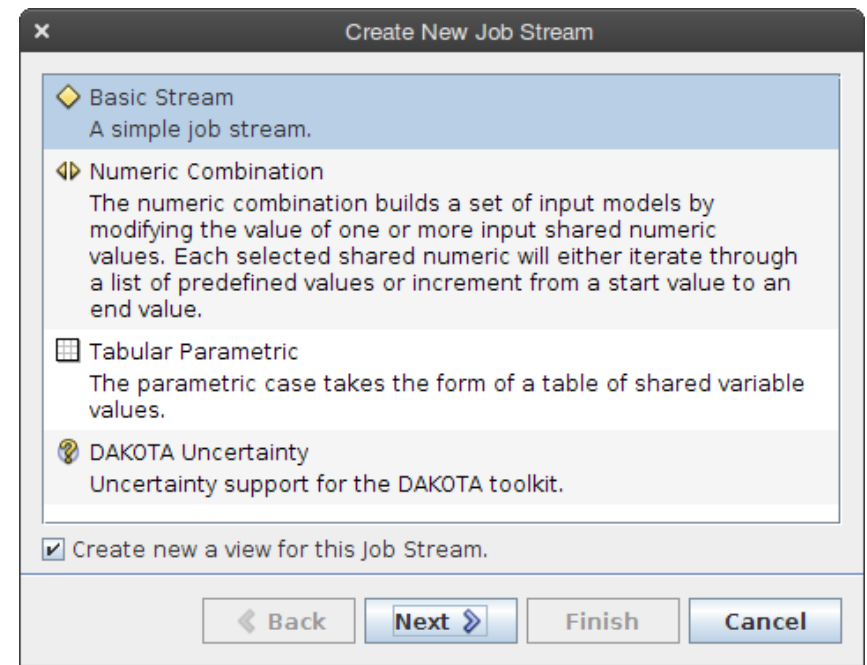




# Job Stream Types

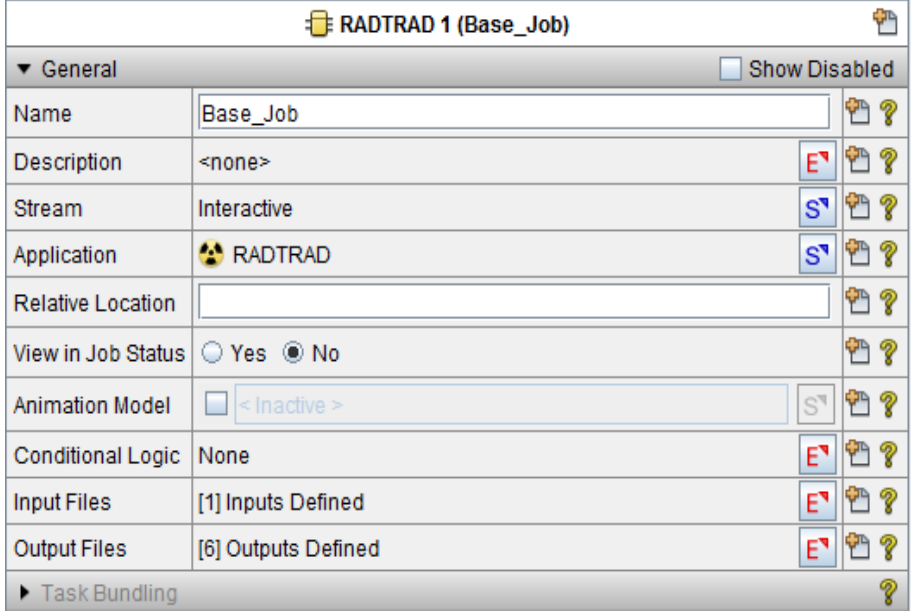
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- Basic Job Stream
  - Non-Parametric cases
- Numeric Combination
  - Generate a set of parametric cases by specifying one or more interactive variables.
  - A set of values is specified for each variable.
  - Each combination of values corresponds to a parametric case.
- Tabular Parametric
  - Create a table of variables
  - Each row corresponds to a parametric case.
- Dakota Uncertainty



# Job Streams – Job Steps

- Job Steps can include:
  - Input Pre-processing (IC retrieval, Renodalize, etc.)
  - Analysis Code Execution (RADTRAD, PARCS, etc...)
  - Post-Processing (Plot generation, Data Extraction, etc...)
  - Notifications (E-mail)
- Application Outputs can be archived after execution.
- Conditional Logic can be used to determine if a step should be included in the stream submission.



The screenshot shows the configuration window for 'RADTRAD 1 (Base\_Job)'. The 'General' tab is selected, and the 'Show Disabled' checkbox is unchecked. The configuration table includes the following fields:

RADTRAD 1 (Base_Job)	
▼ General <input type="checkbox"/> Show Disabled	
Name	Base_Job
Description	<none>
Stream	Interactive
Application	RADTRAD
Relative Location	
View in Job Status	<input type="radio"/> Yes <input checked="" type="radio"/> No
Animation Model	<input type="checkbox"/> <Inactive>
Conditional Logic	None
Input Files	[1] Inputs Defined
Output Files	[6] Outputs Defined
► Task Bundling	

# Job Streams – External Files

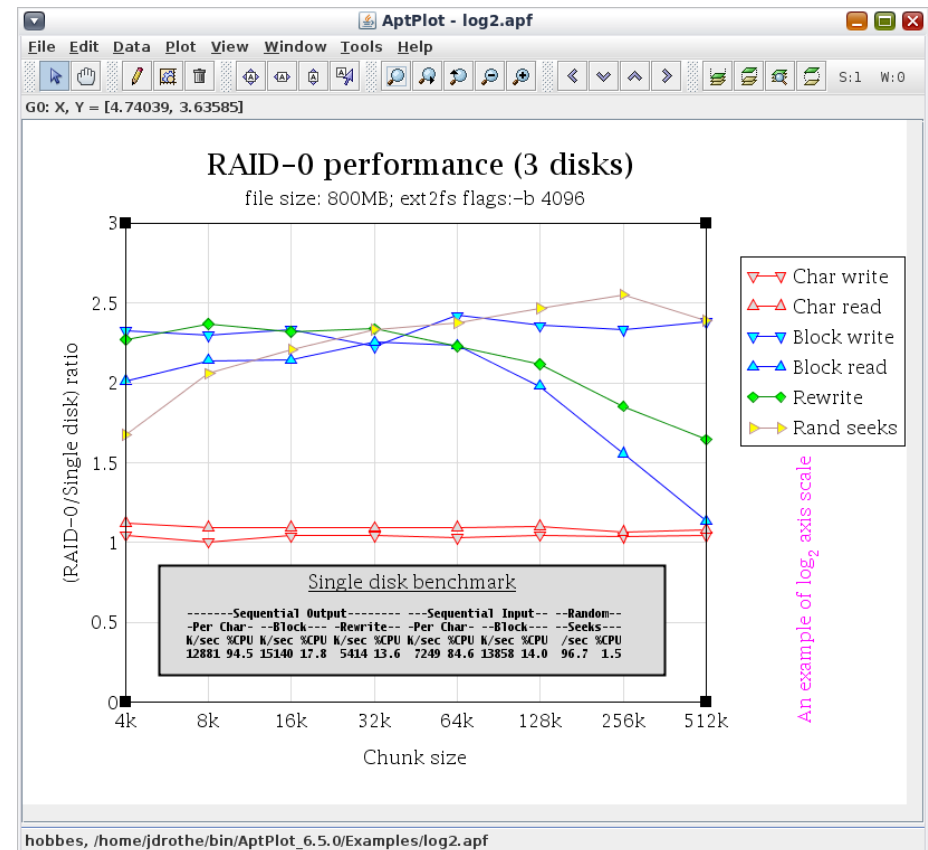
- Represent one or more files that will be included in the Stream.
- Each file has an explicit file type that determines where it can be used in a Job Stream. e.g. EXTDATA:Plot, RADTRAD:Input
- Files can be bundled with the stream, retrieved as they are needed during execution, or directly referenced.

External File 1 (Test13b.psf)	
▼ General <input type="checkbox"/> Show Disabled	
Name	Test13b.psf
Description	<none>
Stream	Interactive
File Mode	Bundle With Stream
File Type	RADTRAD:Input
File	file:/C:/batch_tests/3_10_Tests/Test13b.psf

File Set 3 (Plot_Files)	
▼ General <input type="checkbox"/> Show Disabled	
Name	Plot_Files
Description	<none>
Stream	Interactive
File Type	EXTDATA:Plot
Files	[5] Selected Files
File Mode	Reference From Tasks

# AptPlot

- Pure- Java WYSIWYG Plotting Application
- Creates Publishing-Quality plots
- Supports Several output formats:
  - PDF, JPG, PNG, EMF, TIFF, PostScript
- Analysis Code Support Plug-in (ACS)



# AptPlot: Scripting

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- Batch commands can control all aspects of a plot: formatting and data
- Simple command syntax
  - case insensitive “declaration” style commands
  - examples:
    - TITLE “title” - set the current graph's title
    - COPY G0.S1 TO G0.S2 – copy the data in set1 to set2
- Print plots directly to several supported formats
  - HARDCOPY DEVICE “PDF” -set the output image type to PDF
  - PRINT TO “filepath” - print the PDF to the given location
- Equation Interpreter provides advanced mathematical and statistical data analysis.
  - Automatic vector interpolation across all operations
- Supports headless mode for batch execution on a server.

# Analysis Code Support (ACS) plug-in

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- Allows reading analysis-code plot-file data directly
  - Select code type, file type, and file.
  - Supports demultiplexed (demux) plot files
  - Demux files are optimized for plotting
- Ties directly into scripting
  - Open command makes the plot-file available
    - TRAC DEMUX “filepath”
  - Read command to mark which channels to read and retrieve them
    - TREAD “pn-12A01”
    - TREAD DONE
  - Ties directly into Equation Interpreter:
    - CALC “G0.S0 = t0\_pn-12A01”
- Currently supports the following plot files:
  - TRAC/TRACE: XTV, TRAC-B: TRCGRF, RELAP5: RSTPLT, PIB, & Strip, MELCOR, PARCS, COBRA, CONTAIN, GOTHIC, EXTDATA, NRC Databank
- RADTRAD uses a EXTDATA data file for its' plot data.