

Fulcrum: Integrated Graphical User Interface in SCALE

Capability Overview

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SCALE Users Group Meeting
Sept 26-28 2017, ORNL



Presentation Outline

- Mission Statement
- Component Overview
- Input Editor
- Data Plotting
- Geometry Visualization

Fulcrum Mission Statement

Provide a cross-platform graphical user interface (GUI) designed to facilitate problem creation, modification, navigation, validation, and visualization, as well as output and data file interaction as needed by new and experienced users.



Fulcrum Component Overview

The screenshot displays the SCALE software interface with three main components highlighted:

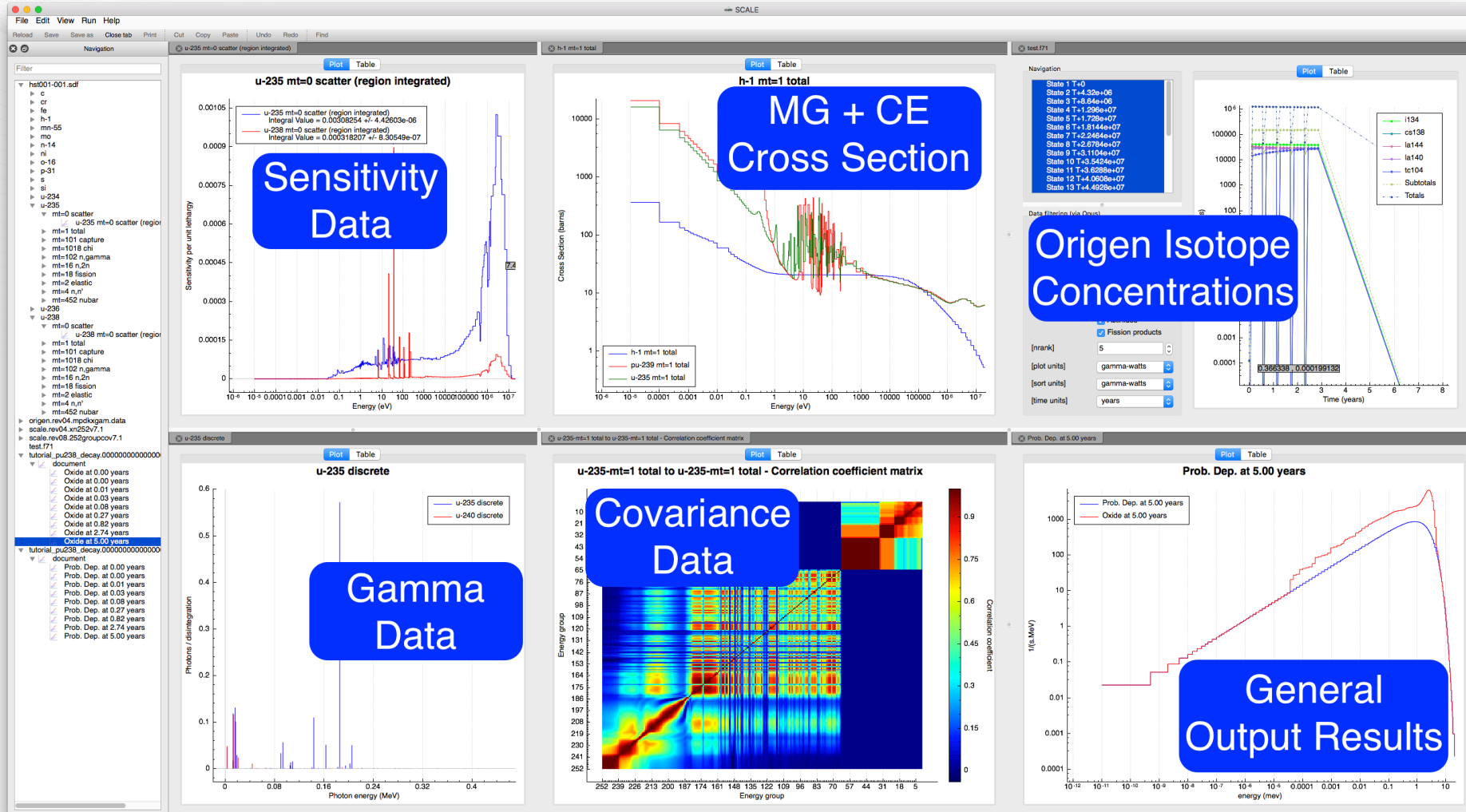
- Input Editor:** Shows the text-based input for the model, including geometry definitions like cylinders, cuboids, and media, along with their parameters and coordinates.
- Document Navigation:** A tree view on the left side of the interface, allowing users to navigate through the project's hierarchical structure, including documents, shells, and various material and meshing options.
- Geometry Viewer:** A 3D visualization of the model's geometry, overlaid with a color-coded response map. The response values range from approximately 1.30×10^{-3} to 3.28×10^3 .

Below the Input Editor, a **Data Plot** is shown, titled "radial axis plot at a=6.1098, b=-1.9435 generated on Thu Jul 28 17:01:33 2016". The plot shows a series of data points for "Response 1" on a semi-logarithmic scale, with the radial axis ranging from 0 to 320 and the response axis from 0.1 to 10^6 .

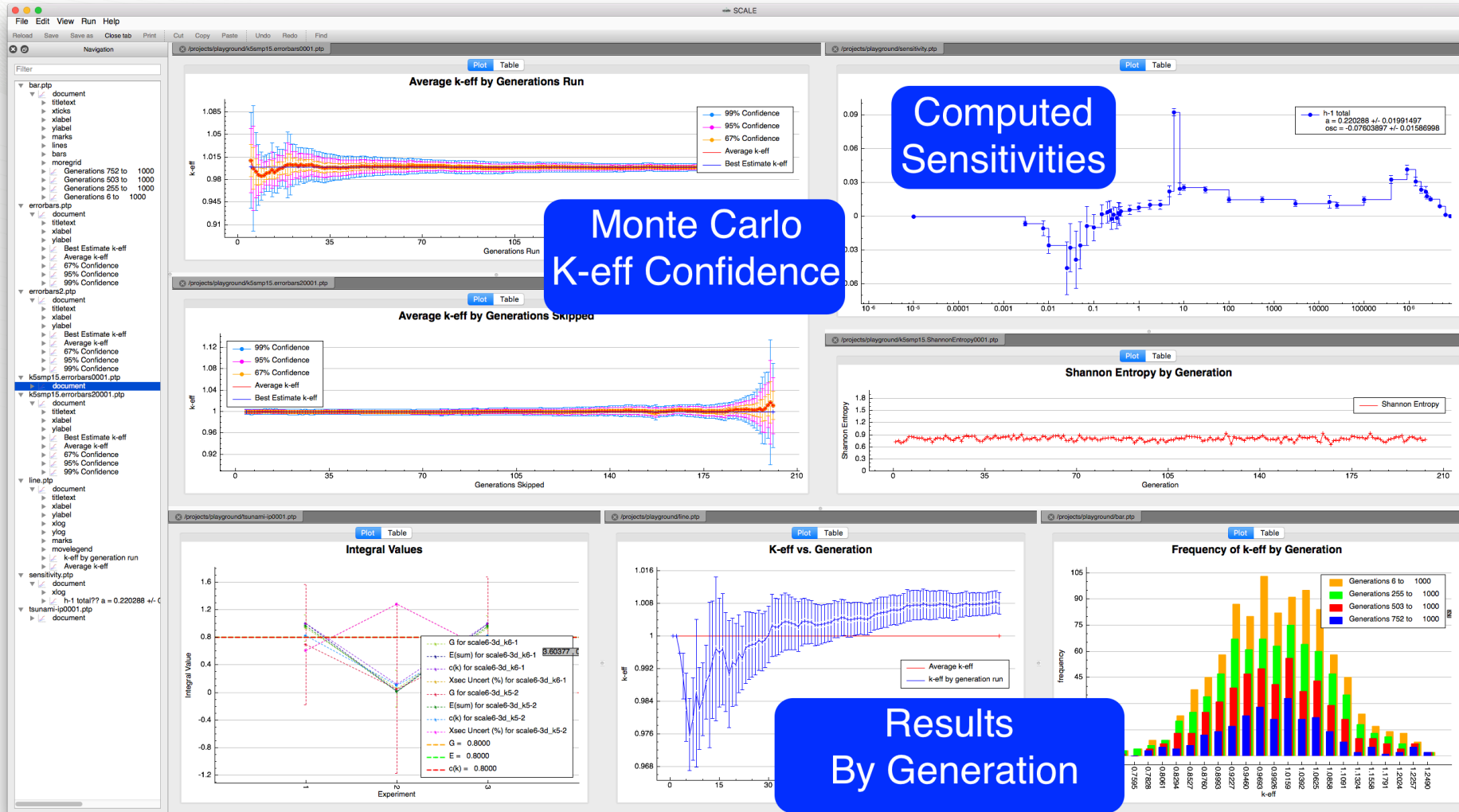
Fulcrum Plot Data

- Supports Most Major SCALE Data Formats

- Export to Image (supports scalar vector graphics)



Fulcrum General Output Result Plots

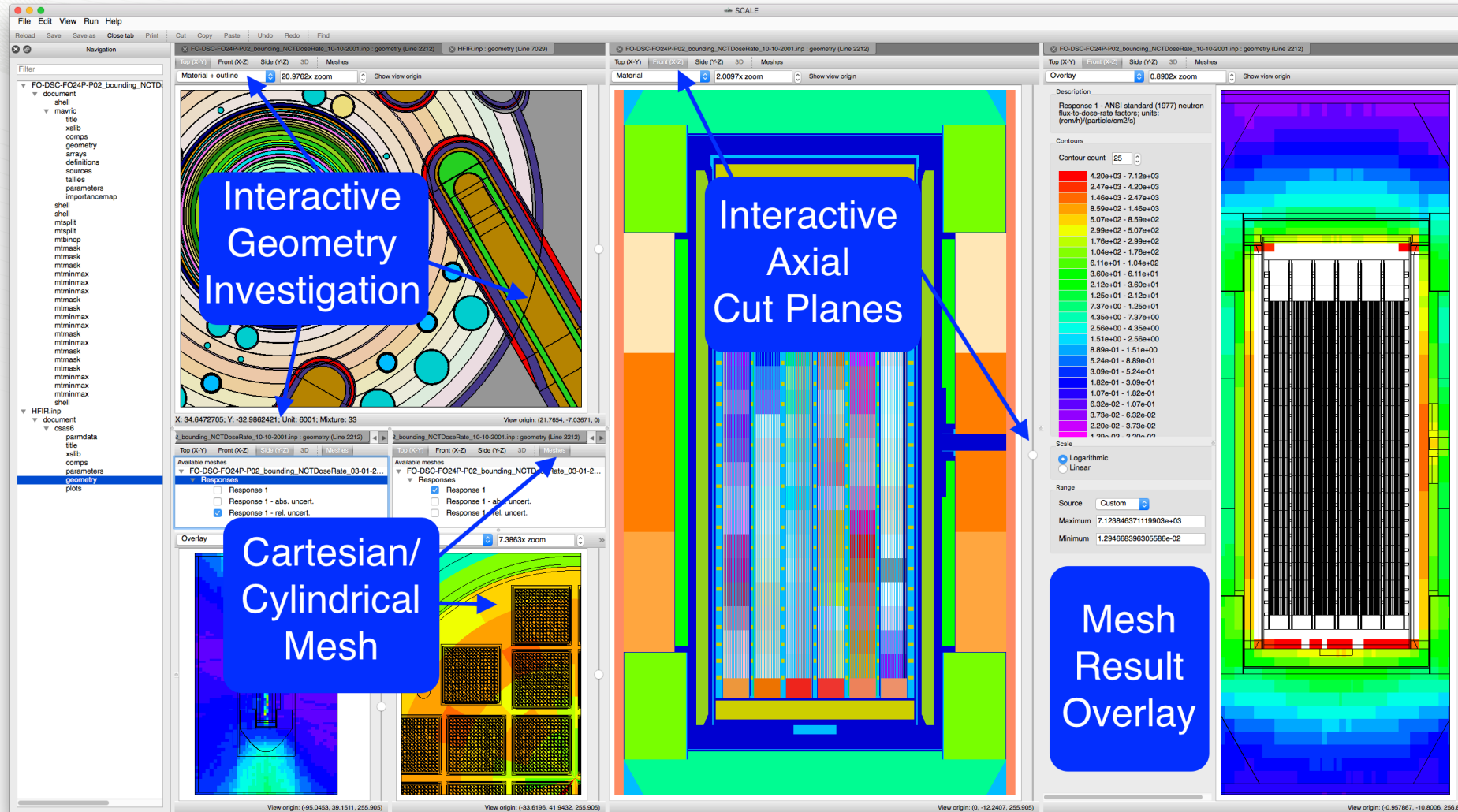


Results By Generation

Fulcrum Geometry Visualization

- Interactive Geometry Visualization

- Support for Most Mesh Data*



*Currently Support: 3dmap, Mesh Importance Map, Mesh Source Map, and Denovo Flux File

Component Summary

- Input editor facilitates problem creation, modification, navigation, validation, execution and output file viewing in a consistent, platform independent manner.
- Data plotting facilitates a fast, interactive means of interrogating input and output data.
 - Supports most SCALE data formats.
- Geometry viewer facilitates a fast, interactive means of interrogating SCALE Geometry.
- Fulcrum provides a modular workspace with splitting and drag-and-drop configurable layout.

Fulcrum Input Editor Components

The image displays the Fulcrum Input Editor interface, which is a text-based editor for scientific input files. The interface is divided into several panes and features several key components highlighted with blue callouts:

- Customizable Execution:** Located at the top of the editor, it includes a menu bar (File, Edit, View, Run, Help) and a toolbar with buttons for Reload, Save, Save as, Close tab, Print, Cut, Copy, Paste, Undo, Redo, and Find.
- Document Quick Navigation:** A dropdown menu at the top left of the editor area, currently showing "SCALE 6.2".
- Context Aware Input Autocompletion:** A list of suggestions that appears below the text as the user types, such as "cone", "cylinder", "dodecahedron", etc.
- Synchronized Input Text Editor:** The main text area where the user's input is displayed, with a cursor and various text elements.
- Execution Messages:** A pane on the right side of the interface that displays the output of the execution, including status messages and numerical results.
- Syntax Highlights:** The text in the editor is color-coded to indicate different parts of the input, such as keywords, numbers, and strings.
- Input Block Highlights:** Specific blocks of text within the editor are highlighted in yellow, indicating they are selected or active.
- Input Validation:** A pane at the bottom left of the interface that displays error messages, such as "line:49 column:22 - Validation Error: region value '30' does not exist in set: [...]".

```
34 global unit 1
35   cylinder 1 8.255 25.40 -25.40
36   cylinder 2 10.795 27.94 -27.94
37   cylinder 3 20.955 27.94 -27.94
38   cylinder 4 13.335 40.64 30.48
39   cylinder 5 13.335 -30.48 -40.64
40   cylinder 6 35.56 45.72 -45.72
41
42 cone - kenovi (configurable) 2.4 -152.4
43 cone
44 cone
45 cone
46 cone
47 cone
48 cone
49 cylinder
50 zcylinder
51 ecylinder
52 ecylinder
53 end geom
54 dodecahedron
55 dodecahedron
56 ellipsoid - kenovi (configurable)
57 ellipsoid
58 hexprism - kenovi (configurable)
59 hexprism
60 resp
61 hopper - kenovi (configurable)
62 hopper
63 parallelepiped - kenovi (configurable)
64 parallelepiped
65 pentagon - kenovi (configurable)
66 pentagon
67 dist
68 plane - kenovi (configurable)
69 plane
70 xpplane - kenovi (configurable)
71 xpplane
72 zpplane - kenovi (configurable)
73 zpplane
74 grid
75 quadratic - kenovi (configurable)
76 quadratic
77 rhexprism - kenovi (configurable)
78 rhexprism
79 rhomboid - kenovi (configurable)
80 rhomboid
81 ring - kenovi (configurable)
82 ring
83 sphere - kenovi (configurable)
84 sphere
85 end geometry
```

```
114 meshTally 1
115   photon
116   gridGeometryID=8
117   responseID=5
118   unit=1 region=7
119   energyBoundsID=1
120 end meshTally
121
122 multiplier=1000.0
123 end tallies
124
```

```
43
44
45
46 MAVRIC, part 2, writing the forward discrete ordinates input
47 *****
48
49 constructMacroMaterialRAYS (46 x-bins, 46 y-bins)
50
51 Total numMacros: 23
```

```
89 linear 30 0.00e6 1.50e6
90 bounds 0.510e+6 0.512e+6 1.172e6 1.174e6 1.331e6 1.333e6 end
91 end energyBounds
92 end definitions
93
94
95 Sources Block
96
97 read sources
98   src 1
99     title="one of 65 cobalt-60"
100     useNormConst
101     multiplier=37e9
102     cylinder 8.255 25.40 -25.40
103     photons
104     eDistributionID=1
105 end src
106 end sources
107
108
109 Tallies Block
110 only collect mesh tally information outside the package (in air region)
111 multiplier converts responses from rem/hr to mrem/hr
112
113 read tallies
114 meshTally 1
115   photon
116   gridGeometryID=8
117   responseID=5
118   unit=1 region=7
119   energyBoundsID=1
```

Input Autocompletion : Static Text

- Static text autocompletion also facilitates abbreviated input to include the component's description allowing users to discover and/or more quickly recall the necessary input components for their analysis.
- Cursor context allows the autocompletion popup to show what is legal and has not already been specified.

Access Autocomplete via
* CTRL+SPACE Keys, or,
* Edit...>Autocomplete

```
File Edit View Run Help
Reload Save Save as Close tab Print Cut Copy Paste Undo Redo Find
csas6_7.inp*
document SCALE 6.2 Run View... Edit...
24 uranium 10 den=18.76 1 293 92235 93.2 92238 5.6 92234 1.0 92236 0.2 end
25 uranium 11 den=18.76 1 293 92235 93.2 92238 5.6 92234 1.0 92236 0.2 end
26 uranium 12 den=18.76 1 293 92235 93.2 92238 5.6 92234 1.0 92236 0.2 end
27 uranium 13 den=18.76 1 293 92235 93.2 92238 5.6 92234 1.0 92236 0.2 end
28 uranium 14 den=18.76 1 293 92235 93.2 92238 5.6 92234 1.0 92236 0.2 end
29 end comp
30 read param
31 pgm=yes plt=yes
32 end param
33 read geom
34 global unit 1
35 *** one through t wta
36 'one top piece wth
37 cuboid 10 2p6.3 wtl
38 'two middle pie sig
39 cuboid 20 2p6.3 msh
40 'three bottom pie ttl
41 cuboid 30 4p6.3 dbh
42 *** four is item dbl
43 cylinder 40 4.55 gen
44 *** five is item npg
45 cylinder 50 5.76 nsk
46 *** six is item 4 res
47 cylinder 60 4.55 nbk
48 *** seven and eig xnb
49 'seven nfb
50 cuboid 70 2p3. xfb
51 'eight xld
52 cylinder 80 4.57 beg
53 *** nine is item nb8
54 cylinder 90 4.55 nl8
55 *** ten is item 7 nqd
56 cylinder 100 5.7 ngp
57 *** eleven is ite pnm
58 cylinder 110 4.5 cxm
59 *12 through 14 is cep
60 'twelve fno
61 cylinder 120 5.7 fni
62 'thirteen dbr
63 cuboid 130 4p6.3 dbx
64 'fourteen app
65 sphere 140 6. flx
66 *** fifteen is th fdn
67 'fifteen adj
68 cuboid 150 4p2 ptb
69 media 1 1 +10
70 media 2 1 +20 -10
71 media 3
72 media 4
73 media 5
74 media 6
75 media 7
76 media 8
77 media 9
78 media 10
79 media 11
80 media 12
81 media 13
82 media 14
83 media 0
84 -110 -120 -130 -140 vol=31432.726088316

rnd - random number
tme - execution time (min)
tba - batch time (min)
wta - average weight
wth - wt. for splitting
wtl - russian roulette wt.
sig - deviation limit
msh - size of flux mesh
ttl - ce temperature tol.
dbh - upper dbrc energy cutoff
dbl - lower dbrc energy cutoff
gen - no. of generations
npg - no. per generation
nsk - generations skipped
res - gens. between restart
nbk - neutron bank positions
xnb - extra bank entries
nfb - fission bank positions
xfb - extra bank entries
xld - no. of extra l-das
beg - restart at this gen.
nb8 - blocks for d.a. unit
nl8 - length of d.a. block
nqd - quadrature order for angular fluxes moments
npg - number of energy groups for tallying
pnm - order of flux moments
cxm - reaction rate tallying mode
cep - continuous energy directory file
fno - output restart file identifier
fni - input restart file identifier
dbr - use dbrc for scattering
dbx - doppler broadening method
app - append restart data
flx - collect and print
fdn - fission densities
adj - adjoint calculation
ptb - use probability tables
vol=20.58546356
vol=245.678420867
```

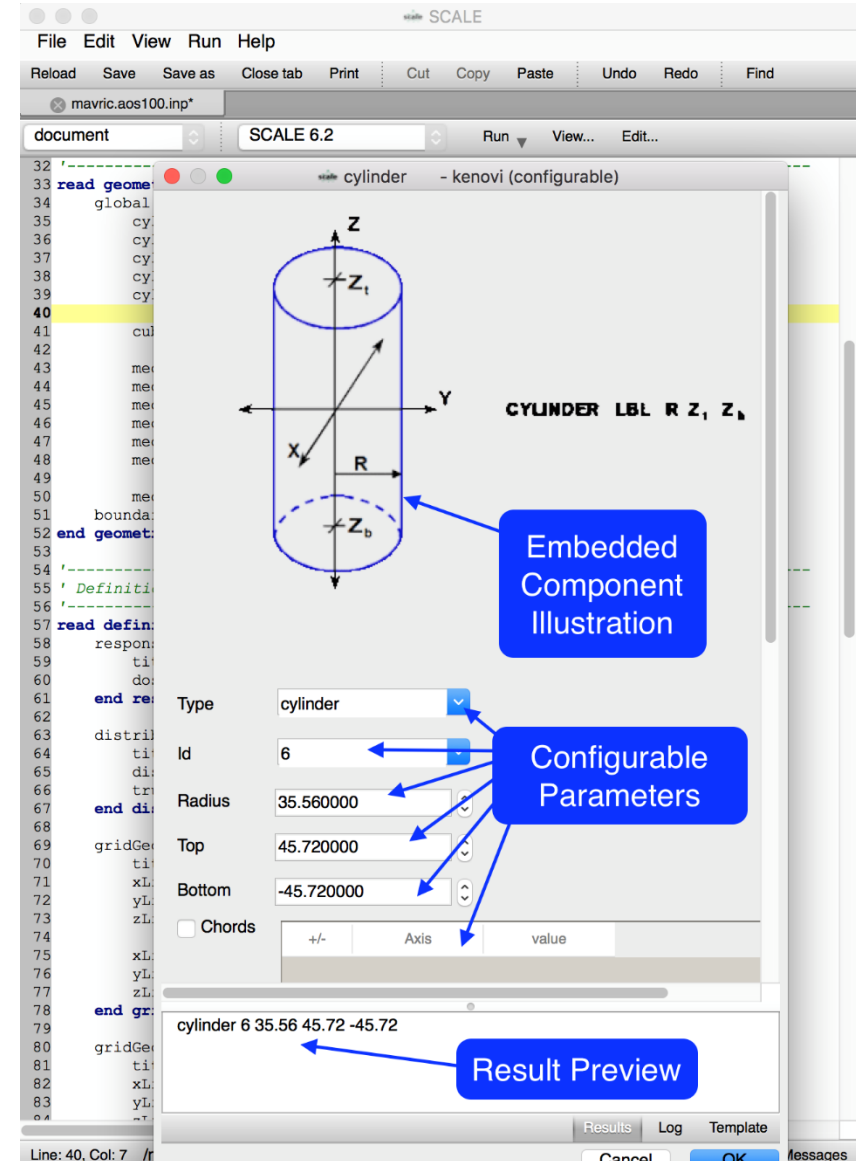
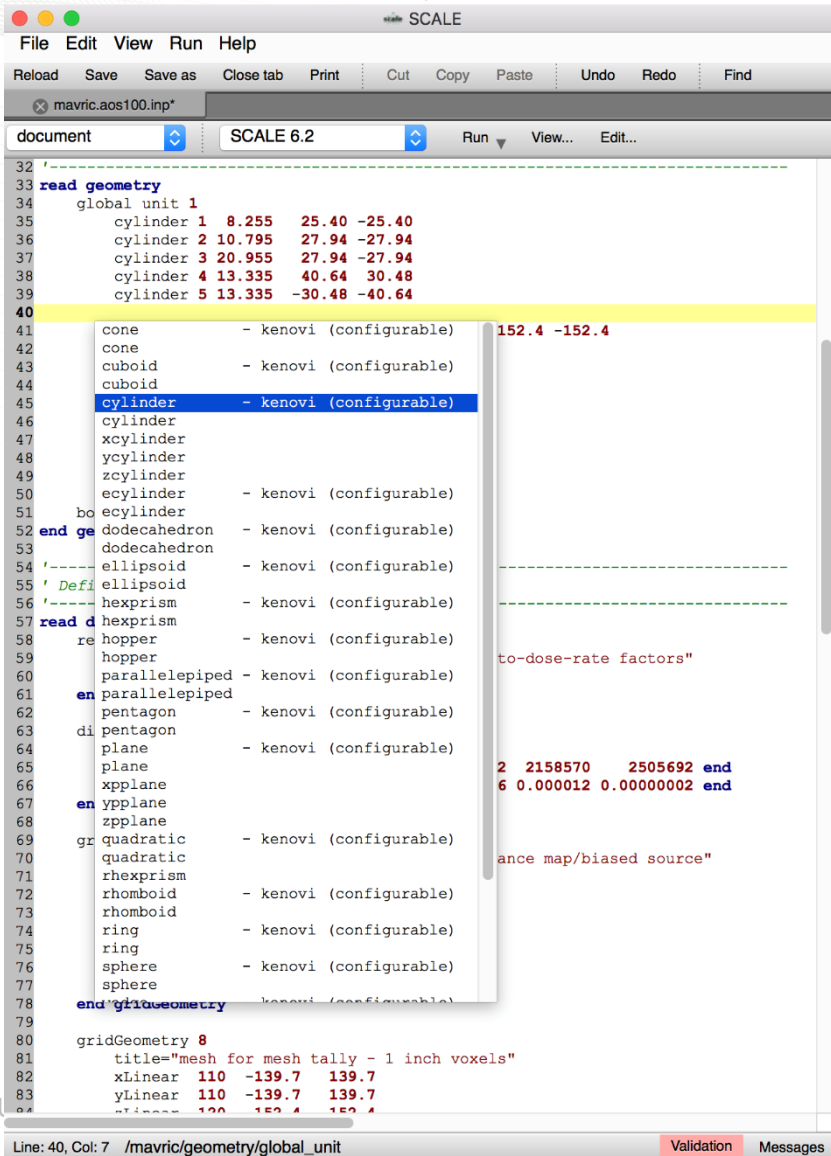
Parameters with descriptions

Line: 31, Col: 19 /csas6/parameters Validation Messages

Input Autocompletion : Configurable Text

- Allows user to configure values prior to inserting into input.

Access Autocomplete via
* CTRL+SPACE Keys, or,
* Edit...>Autocomplete



Input Autocompletion : Configurable Text

- Configurable autocompletion allows entire input creation.
- Results preview facilitates learning input syntax.
- Attributes can be labeled even when the actual input attribute may not have a label.
- Attributes can have a drop-down listing the available or common values to specify.

Access Autocomplete via
* CTRL+SPACE Keys, or,
* Edit...>Autocomplete

The screenshot shows the SCALE software interface. At the top, there is a menu bar with 'File', 'Edit', 'View', 'Run', and 'Help'. Below the menu bar, there are buttons for 'Reload', 'Save', 'Save as', 'Close tab', 'Print', 'Cut', 'Copy', 'Paste', and 'Undo'. The main window is titled 'SCALE 6.2' and contains a configuration window for 'origami' with the subtitle '- UO2 express form (configurable)'. The configuration window has several input fields with drop-down menus:

- Title: this-is-my-title
- Fuel Type: w17x17
- Uranium (MTU): 1.0
- Enrichment (Wt%U235): 4.5
- Burnup (MWd/MTU): 40000
- Cycles: 3
- Number of Burnup Interpolations per Cycle: 4
- Cooling Time (days): 1825
- Power History - Percent Up: 95
- Power History - Average Power (MW/MTU): 40
- Moderator Density (g/cc): 0.7332

A blue button labeled 'Results Preview' is positioned above a text area that displays the generated input syntax for 'origami':

```
=origami
title="this-is-my-title"
options{ mtu=1.0 ft71=all}
libs=[ "w17x17" ]
fuelcomp{
  uox(fuel){ enrich=4.5 }
  mix(1){ comps=[ fuel=100 ] }
}
modz=[ 0.7332 ]
pz=[ 1.0 ]
hist[
  cycle{ power=40 burn=333.33 nlib=4 down=16.67 }
  cycle{ power=40 burn=333.33 nlib=4 down=16.67 }
  cycle{ power=40 burn=333.33 nlib=4 down=0 }
  cycle{ down=1825 }
]
end
```

At the bottom of the configuration window, there are buttons for 'Results', 'Log', and 'Template', along with 'Cancel' and 'OK' buttons. The status bar at the bottom of the window shows 'Line: 1, Col: 1', 'Validation', and 'Messages'.

Input Validation : Value Errors

Value constraint errors can be hard to find. Input validation provides immediate feedback on the following.

- Simple value ranges
 - E.g., $0.0 < x \leq 100$
- More complex
 - Expected value sums
 - Expected value function (increasing, decreasing, etc.)
 - Component relationship
 - E.g., $X > Y$

The screenshot shows the SCALE software interface with three instances of the text editor displaying input files. The first instance shows a validation error for a weight sum: "Incorrect weight-percent sum". The second instance shows a validation error for zone radii: "Zone radii overlap - validation message indicates the input block and offending component". The third instance shows a validation error for a relationship between two components: "Relationship between 2 components (zt and zb) violated".

Incorrect weight-percent sum

```
24 read composition
25   ss304           1 end
26 wtptTungsten     2 17.8 4 74182 26 74183 14 74184 31.5 74186 29 end
27   dry-air         3 end
28 end composition
29 read celldata
```

line:26 column:5 - Validation Error: wtptcomp children "wtpt" sum to 100.5 - instead of the required sum of 100
line:30 column:1 - Validation Error: multiregion children "radius" are not strictly increasing at line:31 column:30
line:40 column:35 - Validation Error: zb value "27.94" is greater than or equal to the allowed maximum exclusive value of "27.94" from "../zt"

Zone radii overlap - validation message indicates the input block and offending component

```
28 end composition
29 read celldata
30 multiregion cylindrical right_bdy vacuum end
31   1 8.255 2 20.955 3 13.335 end zone
32 end celldata
33
```

line:26 column:5 - Validation Error: wtptcomp children "wtpt" sum to 100.5 - instead of the required sum of 100
line:30 column:1 - Validation Error: multiregion children "radius" are not strictly increasing at line:31 column:30
line:40 column:35 - Validation Error: zb value "27.94" is greater than or equal to the allowed maximum exclusive value of "27.94" from "../zt"

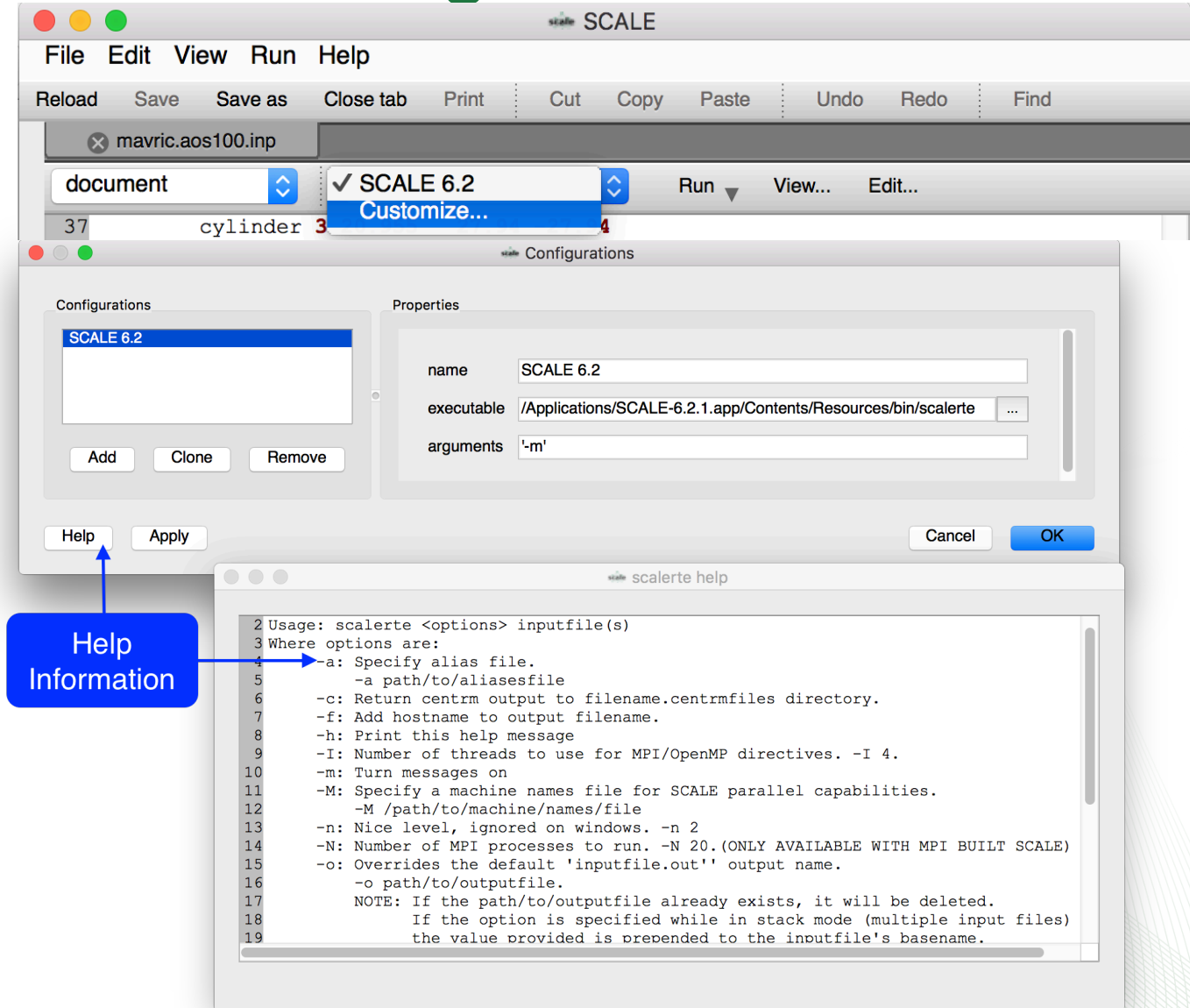
Relationship between 2 components (zt and zb) violated

```
38 global unit 1
39   cylinder 1 8.255 25.40 25.40
40   cylinder 2 10.795 27.94 27.94
41   cylinder 3 20.955 27.94 -27.94
42   cylinder 4 13.335 40.64 30.48
43   cylinder 5 13.335 30.48 40.64
```

line:26 column:5 - Validation Error: wtptcomp children "wtpt" sum to 100.5 - instead of the required sum of 100
line:30 column:1 - Validation Error: multiregion children "radius" are not strictly increasing at line:31 column:30
line:40 column:35 - Validation Error: zb value "27.94" is greater than or equal to the allowed maximum exclusive value of "27.94" from "../zt"

Input Execution : Customized Configurations

- Add new
- Clone existing
- Remove existing
- Modify existing
- Show executable help
- Provide additional arguments



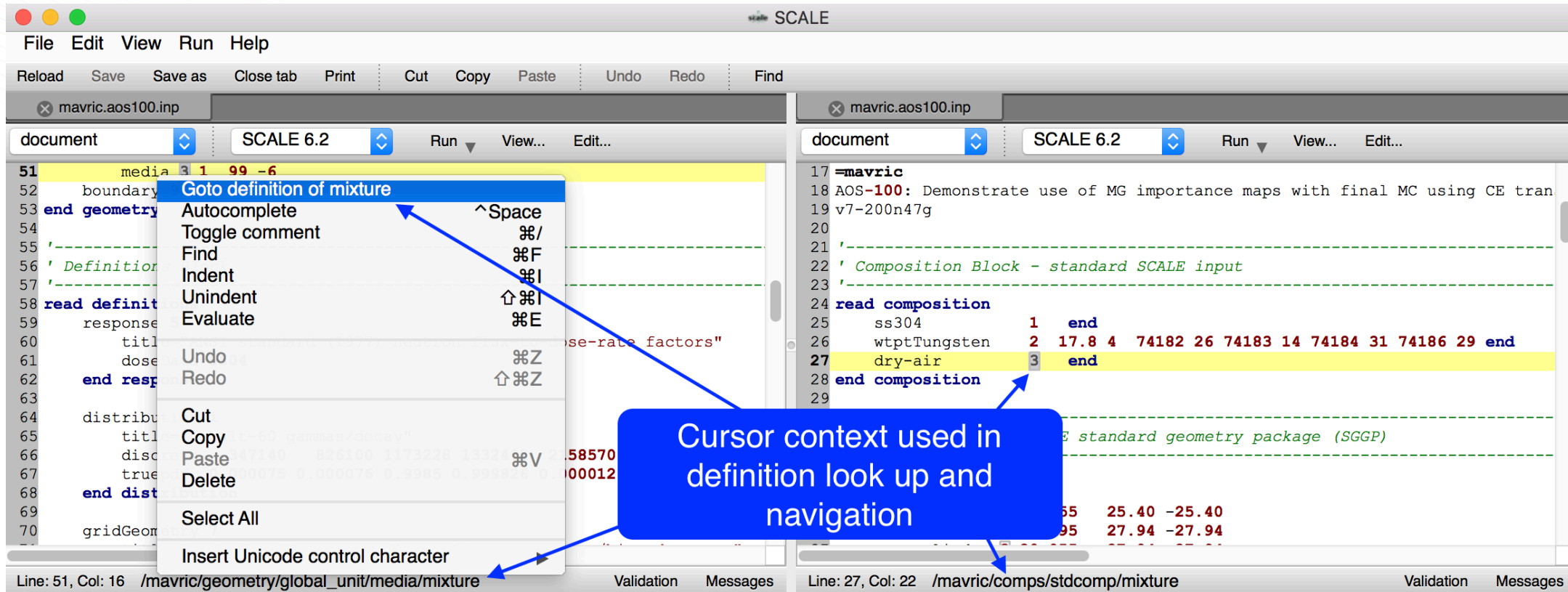
Miscellaneous Features

- Column select/edit
 - via ALT+left click+mouse drag key and mouse combo
- Go to definition – allows quick navigation to input components definition via a right click popup context menu.
 - E.g., anywhere an identifier is used to reference another input component.
- Math evaluator
 - Ability to evaluate selected text as a math expression – replaces selection with expression's result.
- Comment toggle
 - Ability to comment/uncomment selected lines
- Indent/unindent
 - Ability to indent/unindent selected lines
- Auto saves – automatic backup to *inputname.fulcrum.autosave*.
 - File exists only while there are unsaved document changes

Miscellaneous : Go To Definition

The 'Go To Definition' feature (available via right clicking an input component) is intended to facilitate the user in quickly navigating to the component being referenced. New users can discover input component relationships. Experienced users can have their navigation accelerated, especially in larger inputs.

- Referenced mixture identifier – goes to the mixture's definition.
- Referenced Geometry unit identifiers (holes) – goes to the unit definition.



General Plot Overview

- Interactive and configurable plot rendering
- Plot data table displays graph data.
 - allows row and table copy to clipboard.

The screenshot displays the Fulcrum User Interface with the following components:

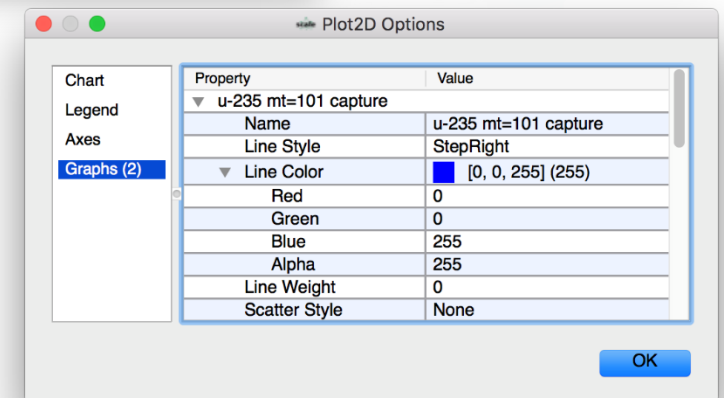
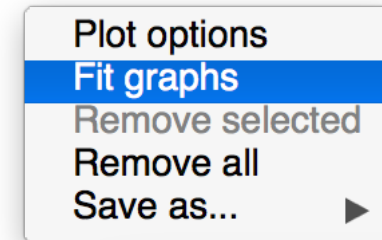
- Navigation Pane (Left):** A tree view of "Plottable Items" including various reaction types for u-235 and u-238. The item "u-238 mt=101 capti" is highlighted.
- Plot Area (Center):** A log-log plot titled "u-235 mt=101 capture" showing Cross Section (barns) vs Energy (eV). Two series are plotted: "u-235 mt=101 capture" (blue line) and "u-238 mt=101 capture" (red line). A cursor is positioned at approximately 142.492 eV, with a value of 0.0889841 barns displayed.
- Data Table (Right):** A "Plot Data Table" with columns for energy and cross-section values for both isotopes. The table contains 20 rows of data.
- Buttons:** "Plot" and "Table" buttons are visible above the plot and table respectively.

	u-235 mt=101 capture	u-238 mt=101 capture
1.000000e-05	2549.51	57.5376
1.000000e-04	2549.51	57.5376
5.000000e-04	1019.96	23.0493
7.500000e-04	749.208	16.9494
1.000000e-03	633.714	14.3542
1.200000e-03	565.393	12.8189
1.500000e-03	509.626	11.568
2.000000e-03	446.367	10.1574
2.500000e-03	392.842	8.96325
3.000000e-03	354.603	8.11052
4.000000e-03	312.641	7.18681
5.000000e-03	273.998	6.34148
7.500000e-03	229.257	5.37751
1.000000e-02	190	4.61111
2.500000e-02	124	3.00000
3.000000e-02	93	2.29046
4.000000e-02	80.2046	2.0223
5.000000e-02	68.1773	1.83251
6.000000e-02	59.9927	1.68718
7.000000e-02	54.0181	1.57261
8.000000e-02	49.4856	1.47887
9.000000e-02	45.9571	1.40101
1.000000e-01	43.1479	1.29587
1.250000e-01	39.7232	1.17473
1.500000e-01	36.6038	1.08349
1.750000e-01	35.493	1.01205
2.000000e-01	36.2203	0.95478
2.250000e-01	38.7622	

Plot Controls

Fulcrum plots consist of graph, bars, or color maps, which can be manipulated as follows.

- Select graph via left click in plot or legend.
 - Remove selection via context menu 'Remove selected'
- Zooming is performed via the mouse scroll action.
 - Zoom in by scrolling up.
 - Zoom out by scrolling down.
- Reset to original via context menu Fit graphs.
- Panning is performed via a click and drag.
 - Pan right by left clicking and dragging left.
 - Pan up by left clicking and dragging down.
- Save Plot as
 - **PDF (includes scalable vector graphics - SVG),**
 - PNG and JPG image format
 - **Interactive Scale Plot Format (SPF)**
- Plot attributes (color, style, etc.) can be changed via context menu Plot options.
- Plot Legend can be drug to 9 cardinal positions via left-click and drag.



Covariance Data

Covariance Data is available at SCALE/data. Because the files do not have a unique extension, the user must load them specifically by type.

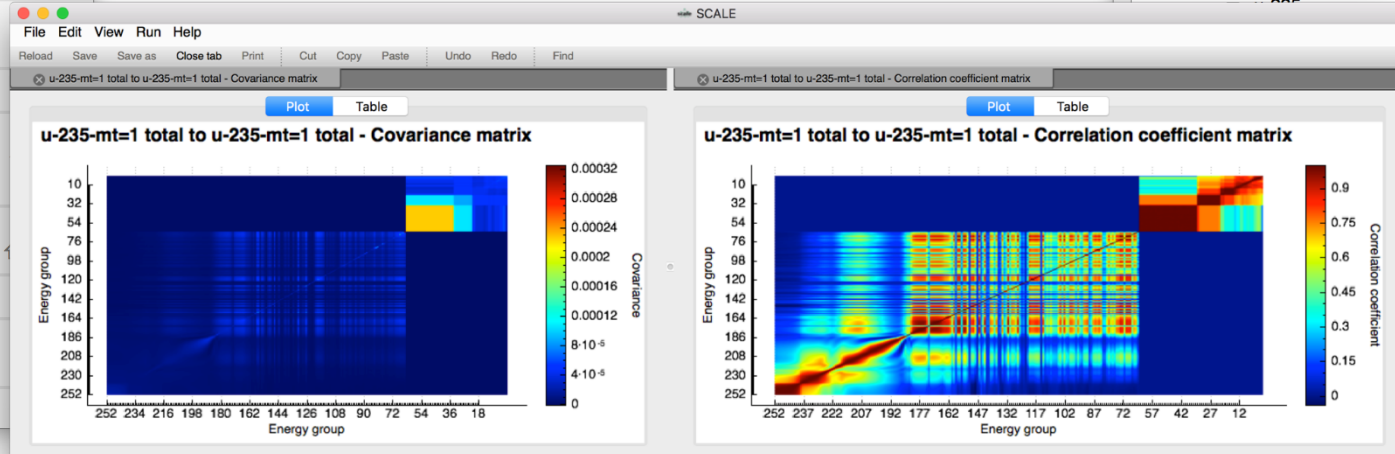
- Correlation coefficient matrix color map plots
- Covariance matrix color map plots
- Isotope Reaction Standard Deviation by energy or group graph plots

File menu options:

- New file... ⌘N
- New ORIGAMI Automator project... ⇧⌘N
- Open file... ⌘O
- Open ORIGAMI Automator project... ⇧⌘O
- Open ORIGEN concentration file...
- Open UNF-ST&DARDS time series...
- Open multigroup library...
- Open continuous-energy library...
- Open covariance library...**
- Open ORIGEN gamma data...

Recent files and actions:

- Recent files
- Recent ORIGAMI Automator projects
- Reload
- Save
- Save as...
- Save all
- Close
- Close all
- Print
- Settings...
- Reset settings
- Exit



Navigation window showing a tree view of data files:

- u-235
 - mt=1 total
 - u-235
 - u-235-mt=1 total to u-235-mt=1 total
 - u-235-mt=1 total to u-235-mt=1 total - Correlation coefficient matrix
 - u-235-mt=1 total to u-235-mt=1 total - Covariance matrix
 - u-235-mt=1 total to u-235-mt=102 n,gamma
 - u-235-mt=1 total to u-235-mt=102 n,gamma - Correlation coefficient matrix
 - u-235-mt=1 total to u-235-mt=102 n,gamma - Covariance matrix
 - u-235-mt=1 total to u-235-mt=18 fission
 - u-235-mt=1 total to u-235-mt=18 fission - Correlation coefficient matrix
 - u-235-mt=1 total to u-235-mt=18 fission - Covariance matrix
 - u-235-mt=1 total to u-235-mt=2 elastic
 - u-235-mt=1 total to u-235-mt=2 elastic - Correlation coefficient matrix
 - u-235-mt=1 total to u-235-mt=2 elastic - Covariance matrix
 - u-235 mt=1 total - Std dev by energy**
 - u-235 mt=1 total - Std dev by group
 - mt=1018 chi
 - mt=102 n,gamma
 - mt=16 n,2n
 - mt=18 fission
 - mt=2 elastic
 - mt=4 n,n'
 - u-235
 - u-235-mt=4 n,n' to u-235-mt=2 elastic
 - u-235-mt=4 n,n' to u-235-mt=2 elastic - Correlation coefficient matrix
 - u-235-mt=4 n,n' to u-235-mt=2 elastic - Covariance matrix
 - u-235-mt=4 n,n' to u-235-mt=4 n,n'
 - u-235-mt=4 n,n' to u-235-mt=4 n,n' - Correlation coefficient matrix
 - u-235-mt=4 n,n' to u-235-mt=4 n,n' - Covariance matrix
 - u-235 mt=4 n,n' - Std dev by energy
 - u-235 mt=4 n,n' - Std dev by group
 - mt=452 nubar
 - u-235
 - u-235-mt=452 nubar to u-235-mt=452 nubar
 - u-235-mt=452 nubar to u-235-mt=452 nubar - Correlation coefficient matrix
 - u-235-mt=452 nubar to u-235-mt=452 nubar - Covariance matrix

Correlation Coefficient and Covariance Matrix Color Map Plots

Standard Deviation Graph Plots

u-235-mt=1 total to u-235-mt=452 nubar - Correlation coefficient matrix

u-235-mt=1 total to u-235-mt=452 nubar - Covariance matrix

u-235-mt=1 total to u-235-mt=452 nubar - Std dev by energy

u-235-mt=1 total to u-235-mt=452 nubar - Std dev by group

u-235-mt=1 total to u-235-mt=452 nubar - Correlation coefficient matrix

u-235-mt=1 total to u-235-mt=452 nubar - Covariance matrix

u-235-mt=1 total to u-235-mt=452 nubar - Std dev by energy

u-235-mt=1 total to u-235-mt=452 nubar - Std dev by group

u-235-mt=1 total to u-235-mt=452 nubar - Correlation coefficient matrix

u-235-mt=1 total to u-235-mt=452 nubar - Covariance matrix

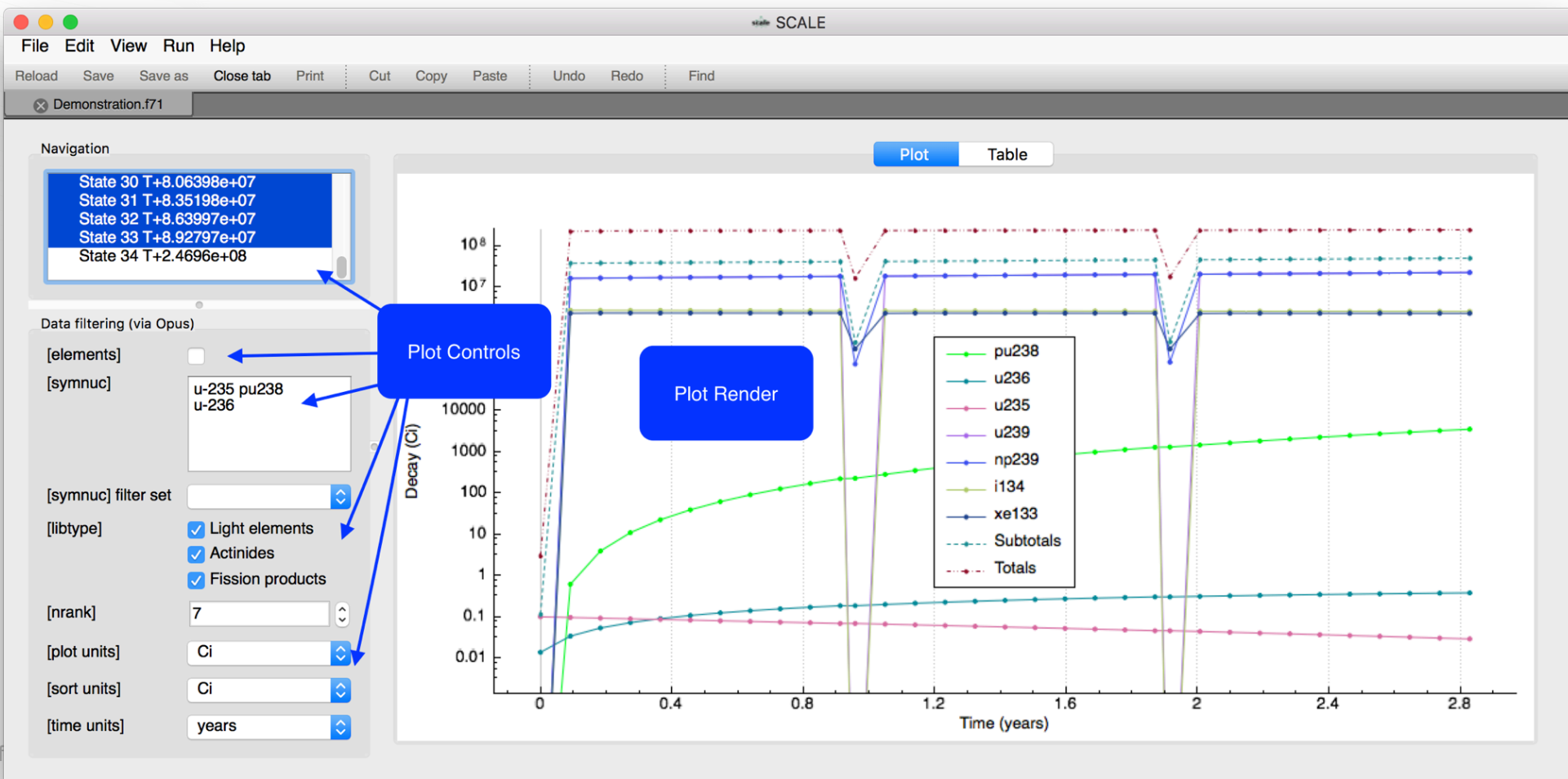
u-235-mt=1 total to u-235-mt=452 nubar - Std dev by energy

u-235-mt=1 total to u-235-mt=452 nubar - Std dev by group

ORIGEN Isotope Concentration Data (F71)

Origen concentration data contains results from depletion, decay, and activation calculations. The plot capabilities are centered about the expected Fulcrum interactive plot with the addition of a more familiar PlotOPUS style set of controls.

- Easy selection of state information to display.
- Easy display of nuclides or elements by id or category.
- Easily display different units (Decay, Mass, Number).



ORIGEN Gamma Data

The master photon data library, located at SCALE/data/origen_data/origen.rev##.mpdkxgam.data, provides both discrete and continuous energy gamma lines.

- Opened via File>Open ORIGEN gamma data...

The screenshot displays the SCALE software interface. The 'File' menu is open, showing the option 'Open ORIGEN gamma data...' highlighted. The main window shows a list of gamma data entries in the 'Navigation' pane, with 'ag-123 continuous' selected. Two plots are visible: 'bk-251 discrete' showing a bar chart of photons per disintegration versus photon energy (MeV), and 'ag-123 continuous' showing a continuous spectrum of photons per (MeV * disintegration) versus photon energy (MeV).

File Menu:

- New file... ⌘N
- New ORIGAMI Automator project... ⌘N
- Open file... ⌘O
- Open ORIGAMI Automator project... ⌘O
- Open ORIGEN concentration file...
- Open UNF-ST&DARDS time series...
- Open multigroup library...
- Open continuous-energy library...
- Open covariance library...
- Open ORIGEN gamma data...**
- Recent files
- Recent ORIGAMI Automator projects
- Reload ⌘R
- Save ⌘S
- Save as... ⌘S
- Save all
- Close ⌘W
- Close all ⌘W
- Print ⌘P
- Settings... ⌘,
- Reset settings
- Exit ⌘Q

Navigation Pane:

- Filter
- ▶ ag-115
- ▶ ag-115m
- ▶ ag-116
- ▶ ag-116m
- ▶ ag-117
- ▶ ag-117m
- ▶ ag-118
- ▶ ag-118m
- ▶ ag-119
- ▶ ag-120
- ▼ ag-120m
- ▶ ag-120m discrete
- ▶ ag-121
- ▶ ag-122
- ▶ ag-122m
- ▼ ag-123
- ▶ ag-123 continuous**
- ▶ ag-124
- ▶ ag-125
- ▶ ag-126
- ▶ ag-127
- ▶ ag-128
- ▶ ag-129
- ▶ ag-130
- ▶ al-26
- ▶ al-28
- ▶ al-29
- ▶ al-30
- ▶ am-239

bk-251 discrete Plot:

Photons / disintegration

Photon energy (MeV)

Legend: bk-251 discrete

ag-123 continuous Plot:

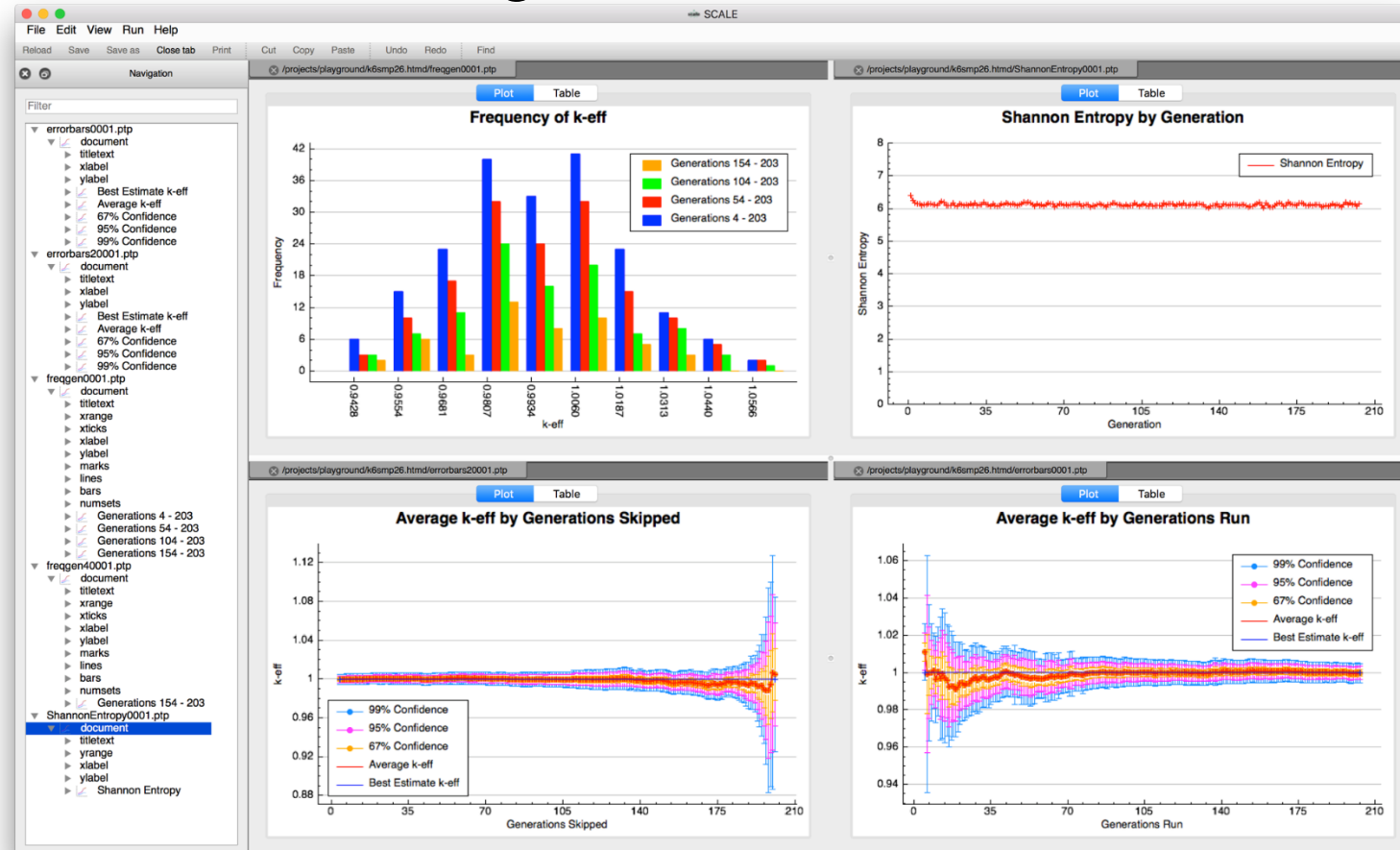
Photons / (MeV * disintegration)

Photon energy (MeV)

Legend: ag-123 continuous

Keno Result Plots

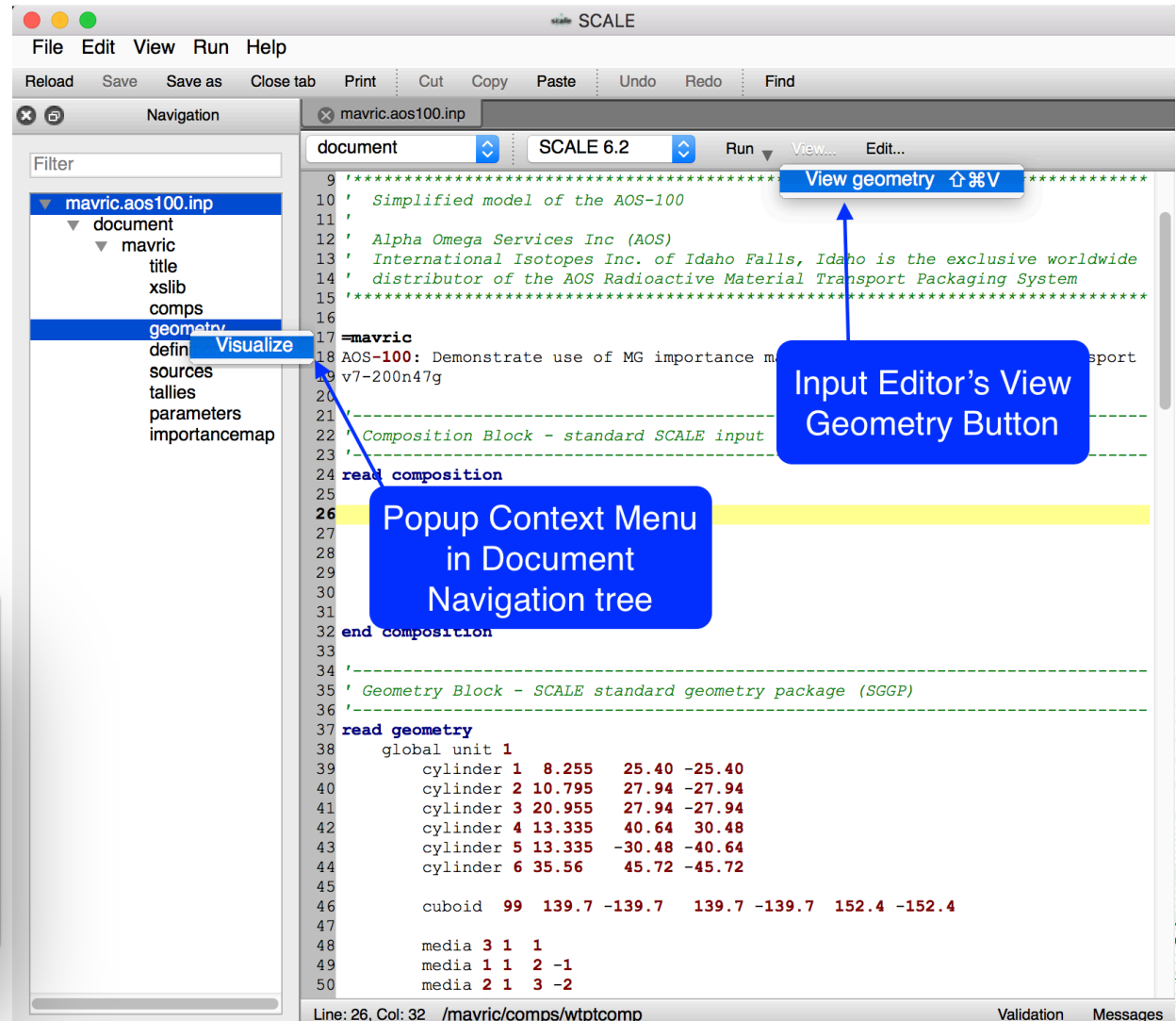
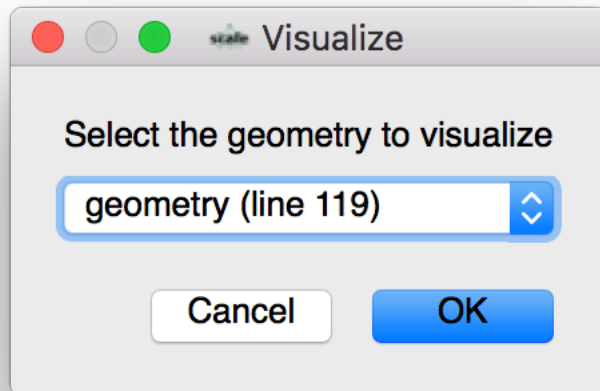
- Plot of average k-effective by generation run
- Plot of average k-effective by generations skipped
- Final edit of fissions, absorptions, and leakage
- Frequency distributions
- Shannon Entropy
- Flux plotting



Activating the Geometry Viewer

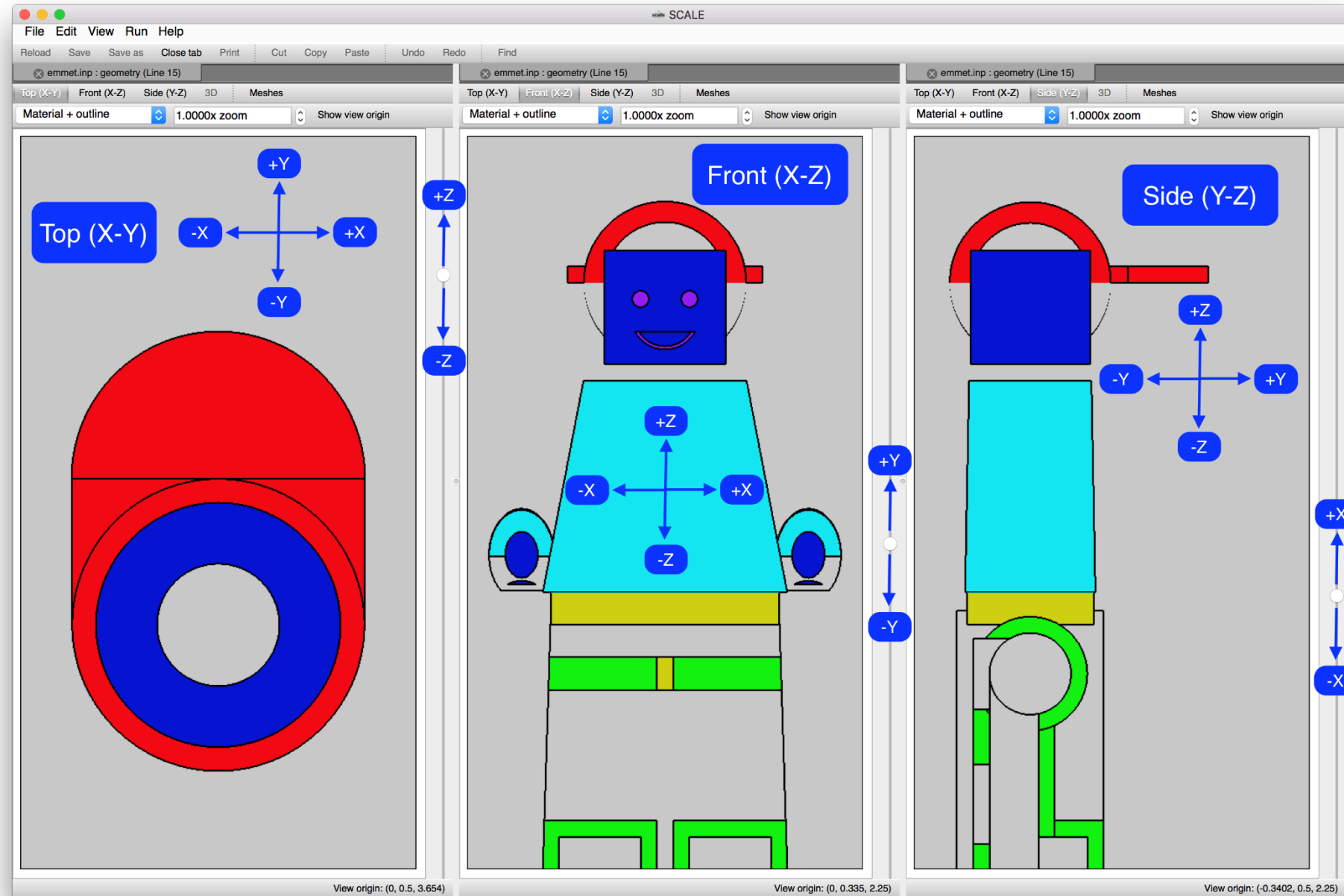
Activating the geometry viewer can be accomplished via the Input Editor's View...>View geometry button or the Document Navigation geometry item's popup context menu.

- If multiple geometry input blocks exist in the document, a selection will be provided.



Axis Views

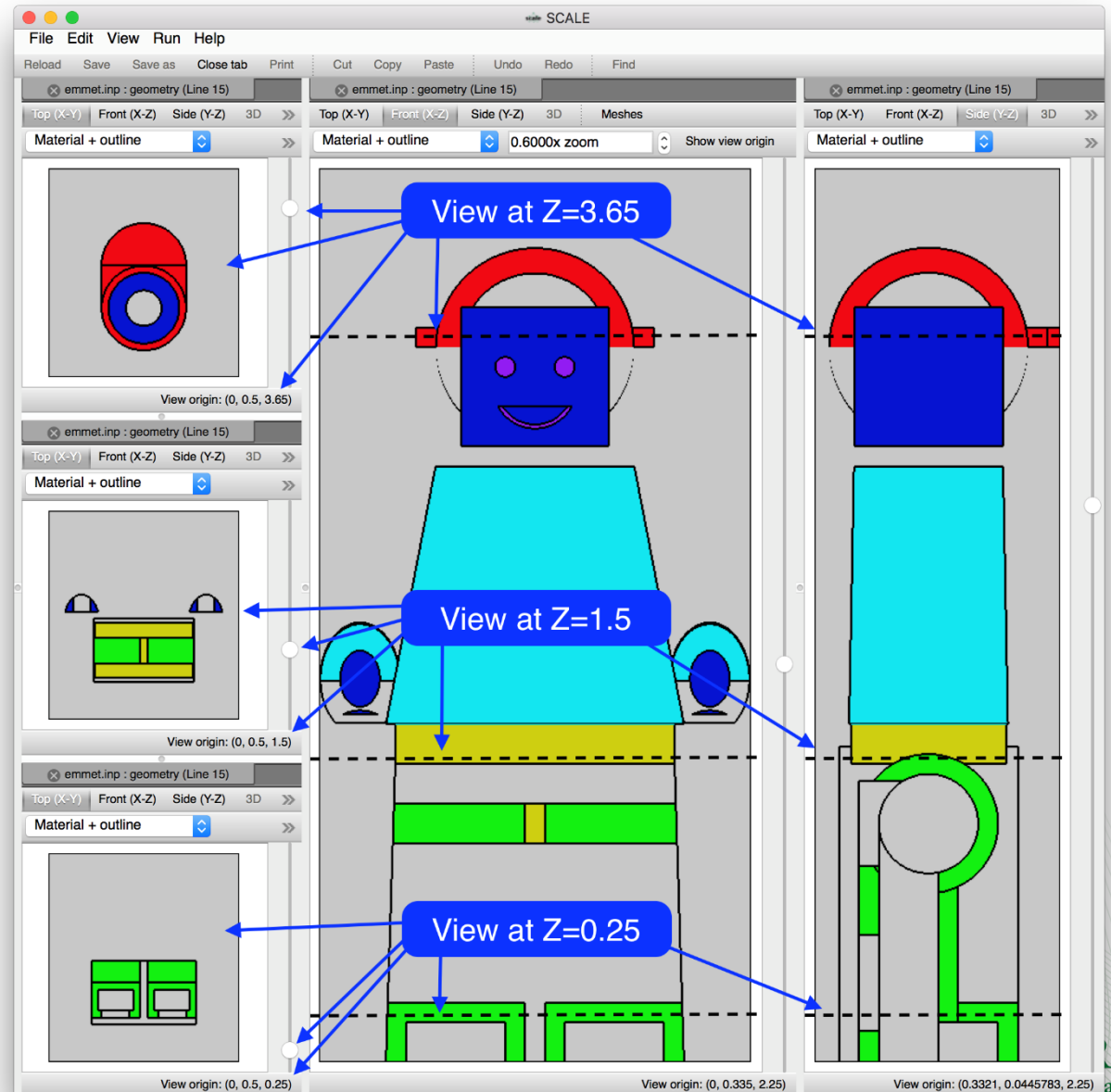
- Axis views provide standard orthographic model projections of the top, front, and side of the geometry.



Axis Views : Elevation Control

View plane elevation is controlled via a slide control on the right side of each geometry view.

- View plane elevation corresponds to view plane control – the higher the slider control, the higher the view plane.
 - Top (X-Y) - raising the slider increases the Z intersect.
 - Front (X-Z) – raising the slider increases the Y intersect.
 - Side (Y-Z) – raising the slider increases the Z intersect.

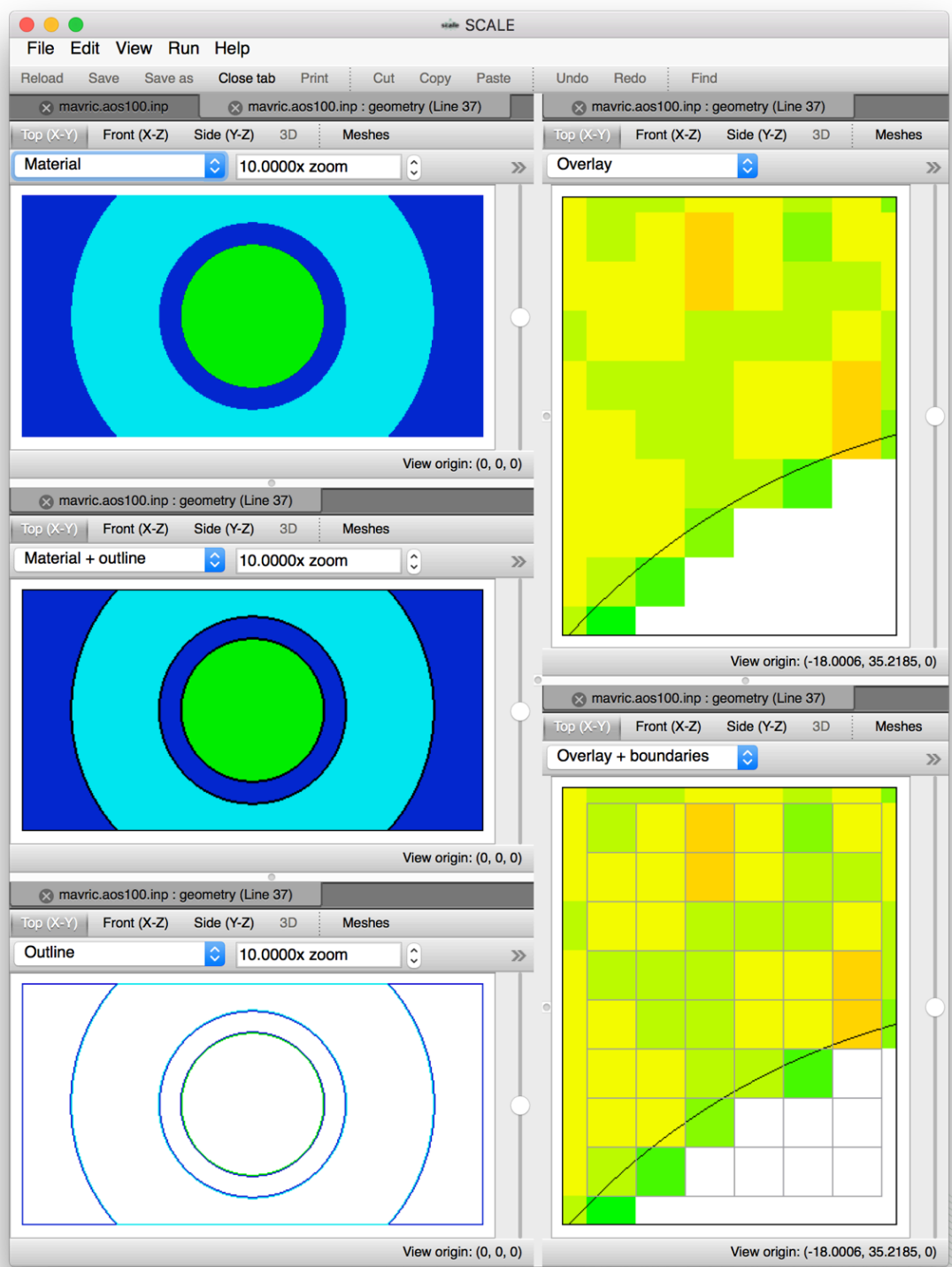


- ✓ Material
- Material + outline
- Outline
- Overlay
- Overlay + boundaries

Render Modes

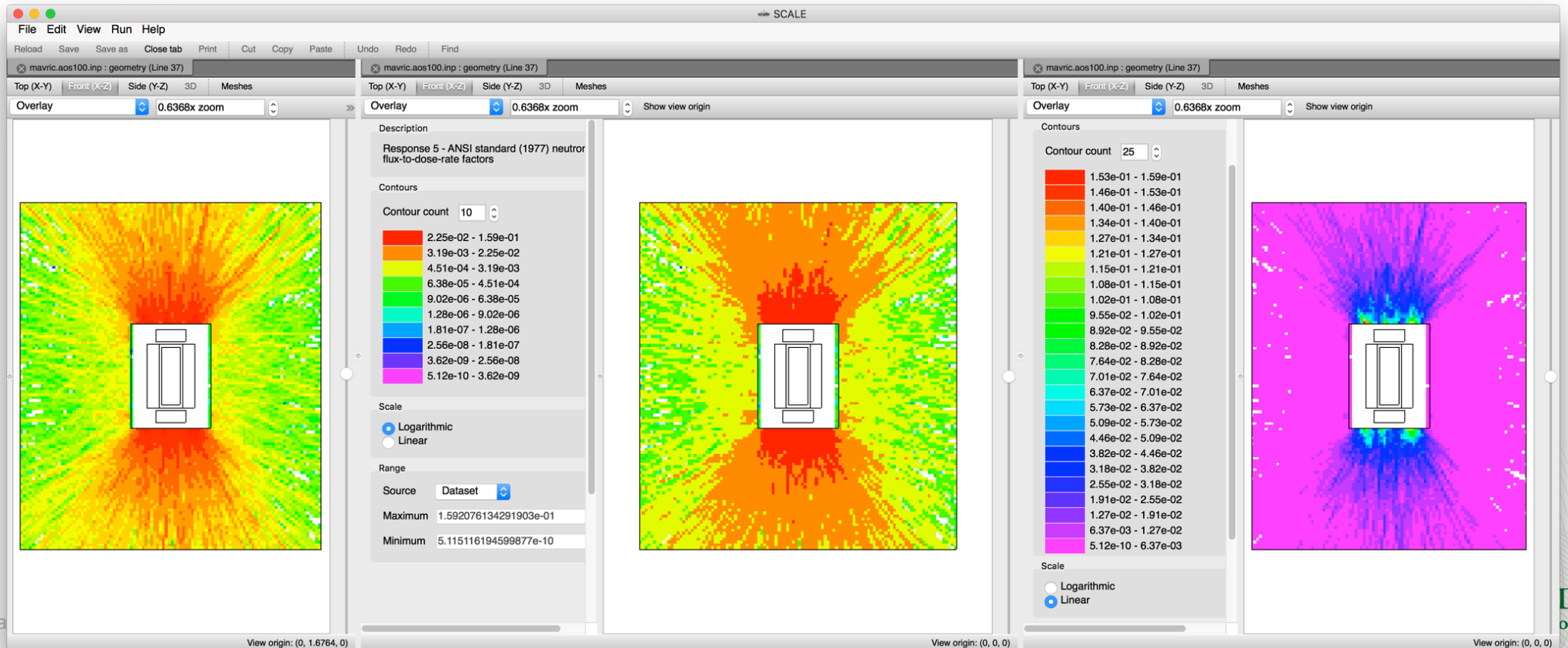
Render modes control the information displayed.

- Material displays only the materials/mixtures.
 - Can hide geometry region outlines that are the same material.
- Material + outline displays the material and the region outlines.
 - Displays region outline in black.
 - Useful for contrasting geometry regions.
- Outline displays only geometry region outlines.
 - Displays region outline in material color.
- Overlay displays geometry region outline and mesh data results.
- Overlay + boundaries displays geometry region outline, mesh boundaries*, and mesh data results



Mesh Contours, Color Legend, and Scale

- Controls influenced by MAVRIC's MeshView plot program.
- Allows changing contour count from 25 to 2 enhancing data contrast.
- Can improve print quality for black and white printouts.
- Linear and logarithmic scale data display.



Mesh Overlay : Data Ranges

The overlaid dataset's data range can be selected as the file, family, dataset or as custom user-specified.

- The file indicates the entire mesh file context.
- The family range provides context to a selected dataset.
- Custom allows down-selection.

Available meshes

- ▼ mavric.aos100.mt1.3dmap
 - ▼ Photon Flux
 - group 1
 - group 1 - abs. uncert.
 - group 1 - rel. uncert.
 - group 2
 - group 2 - abs. uncert.
 - group 2 - rel. uncert.
 - group 3
 - group 3 - abs. uncert.
 - group 3 - rel. uncert.
 - group 4
 - group 4 - abs. uncert.
 - group 4 - rel. uncert.
 - group 5
 - group 5 - abs. uncert.
 - group 5 - rel. uncert.

Range

Source **Dataset**

Maximum 1.519504113329853e+02

Minimum 3.324160066332479e-07

SCALE

File Edit View Run Help

Reload Save Save as Close tab Print Cut Copy Paste Undo Redo Find

mavric.aos100.inp : geometry (Line 37)

Top (X-Y) Front (X-Z) Side (Y-Z) 3D Meshes

Overlay 1.1399x zoom Show view origin

8.86e-01 - 1.13e+00

6.93e-01 - 8.86e-01

5.43e-01 - 6.93e-01

4.25e-01 - 5.43e-01

3.32e-01 - 4.25e-01

Scale

Logarithmic

Linear

Range

Source Custom

Maximum 1.519504113329853e+02

Minimum 3.324160066332479e-01

View origin: (0, 0, 0)

mavric.aos100.inp : geometry (Line 37)

Top (X-Y) Front (X-Z) Side (Y-Z) 3D Meshes

Overlay 4.0032x zoom Show view origin

8.86e-01 - 1.13e+00

6.93e-01 - 8.86e-01

5.43e-01 - 6.93e-01

4.25e-01 - 5.43e-01

3.32e-01 - 4.25e-01

Scale

Logarithmic

Linear

Range

Source Custom

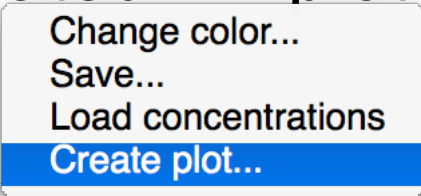
Maximum 1.519504113329853e+02

Minimum 3.324160066332479e-01

View origin: (0, 0, 49.3776)

Mesh Overlay : Integrated 2D Plot Creation

Mesh data can be further investigated via the integrated 2D plot creation capability. 2D Plot creation is available via the Create plot popup context menu.



- Plot options include
 - Independent axis
 - Cartesian X,Y, and Z.
 - Cylindrical Radial, Theta, and Z.
 - Group when group-wise data is available.
 - Plot using values or indices.
 - When data is group-wise axis interval widths can optionally be divided linearly or logarithmically.

The screenshot shows the MAVRIC software interface with several annotations:

- 1. Locate point of interest. Right click and select Create plot...**: A red box points to a specific mesh cell in a 3D visualization.
- 2. Configure plot options and click OK. The MAVRIC Chart file will be generated.**: A red box points to the 'ChartOptions' configuration window.
- 3. Selection of Chart document will display 2D plot values with uncertainties.**: A red box points to the 'document' list in the 'ChartOptions' window.

The 'ChartOptions' window shows the following configuration:

```
document
1 ChartOptions
2 titletext x axis plot at a=0, b=47.7493
  xtitletext x axis
  ytitletext Photon Flux
  xlogscale false
  ylogscale true
  xgridlines true
  ygridlines true
  xlabel true
  ylabel true
  legend true
  topborder true
  rightborder true
  leftborder true
```

The 'document' list shows:

```
document
  chartoptions
  series
    series 1
```

The 'Instructions' window states: "You have selected the mesh cell 56, 56, 79. For the 2D plot, please select the independent axis and how to space the data." The 'Options' window shows 'Independent axis' set to 'x axis', 'Plot using' set to 'values', and 'Divide by axis interval widths' set to 'none'.

The final 2D plot is titled "x axis plot at a=0, b=47.7493 generated on Mon Oct 17 14:45:03 2016". The y-axis is labeled "Photon Flux" on a logarithmic scale from 0.001 to 100. The x-axis is labeled "x axis" from -120 to 120. The plot shows a series of data points with error bars, labeled "series 1".

Presentation Summary

- Fulcrum Mission Statement
- Fulcrum Component Overview
- Fulcrum Input Editor
- Fulcrum Data Plotting
- Fulcrum Geometry Visualization
- Questions?