VERA Virtual Environment for Reactor Applications

ORNL/SPR-2022/2491

VERAView Software Requirements, Test Plan, and Test Report

June 15, 2022

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Revision Log

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VERAView Software Requirements, Test Plan, and Test Report

Approvals:

Erik Walker	08/04/2022
Erik Walker, VERAIO Product Software Manager	**Date**
Aaron Graham	08/04/2022
Aaron Graham, Independent Reviewer	**Date**

EXECUTIVE SUMMARY

This document details the software requirements, test plan, and test results for VERAView. In this document, the test platform hardware and software are described. Section 2 provides a list of the tests run and their acceptability as a test report. Section 3 provides the step-by-step execution of these tests and their results.

CONTENTS

1. VERAVIEW SOFTWARE REQUIREMENTS

The VERAView Code shall meet the following software requirements:

1. Open a single file and multiple files simultaneously
2. Demonstrate an ability to display values and plot values in multiple categories
3. Calculate and display value differences between files
4. Export data related to specific areas of focus into multiple different file formats

1.1 COMPUTER PROGRAM TESTED

VERAView 2.4.3

1.2 HARDWARE AND OPERATING SYSTEM

These tests were performed on an HP laptop with an Intel® Core™ i7-8665U CPU running 64-bit Windows 10 Enterprise, version 1909, build 18363.16.79.

1.3 TEST EQUIPMENT AND CALIBRATIONS

None.

1.4 DATE OF TEST

8/5/2021

1.5 TESTER

Erik Walker

1.6 SIMULATION MODELS USED

Outputs from VERA Core Physics Benchmark Progression Problem Specifications [1] were used in this test plan: specifically, 2p, 2o, and 4-mini_dep.

1.7 TEST PROBLEMS

A list of test problems is included in Section 2 of this document.

1.8 RESULTS AND ACCEPTABILITY

The test steps and results are given in Section 3. These test results satisfy the defined software requirements.

1.9 ACTION TAKEN IN CONNECTION WITH NOTED DEVIATIONS

There were no noted deviations. Therefore, no actions were taken.

2. VERAVIEW SOFTWARE TESTS

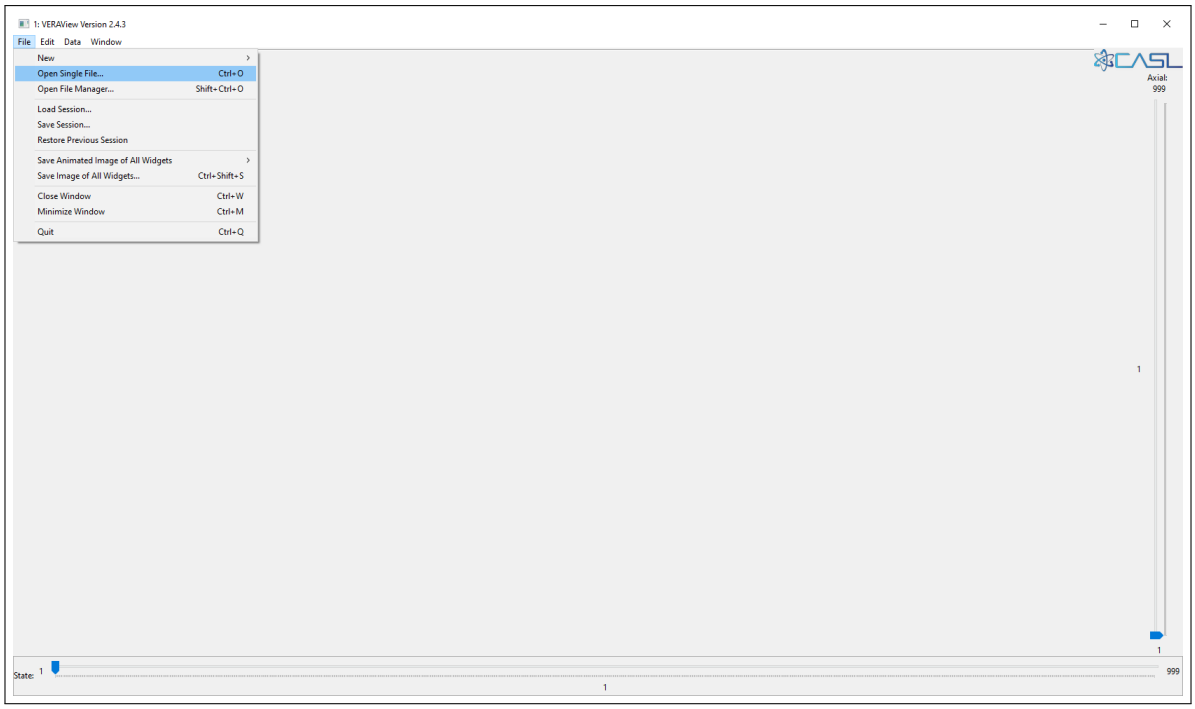
Table 1. VERAView software tests

Test No.	Test name	Details	Status
1	Open Single File with Test File “2p”	Completed	Passed
2	Find Max Value Pin with Test File “2p”	Completed	Passed
3	Find Min Value Pin with Test File “2p”	Completed	Passed
4	Save Image with Test File “2p”	Completed	Passed
5	Copy Displayed Dataset with Test File “2p”	Completed	Passed
6	Open Multiple Files with Test Files “2p” and “2o”	Completed	Passed
7	Switch Dataset Selection Between Files with Test Files “2p” and “2o”	Completed	Passed
8	Create Pin_Powers Dataset Difference with Test Files “2p” and “2o”	Completed	Passed
9	Close Files from Multi File Manager with Test Files “2p” and “2o”	Completed	Passed
10	Evaluate Radial Core Widget with Test File “4-mini_dep”	Completed	Passed
11	Evaluate Axial Core Widget with Test File “4-mini_dep”	Completed	Passed
12	Evaluate Axial Plot Widget with Test File “4-mini_dep”	Completed	Passed
13	Evaluate Time Plot Widget with Test File “4-mini_dep”	Completed	Passed
14	Evaluate Multiple Rods in Assembly Widget with Test File “4-mini_dep”	Completed	Passed
15	Find Max Over All Assemblies Over All Time – Pin Power with Test File “4-mini_dep”	Completed	Passed
16	Find Min Over All Assemblies Over All Time – Pin Power with Test File “4-mini_dep”	Completed	Passed
17	Evaluate Moving Through Axial Levels (on slider and on axial plot widget) with Test File “4-mini_dep”	Completed	Passed
18	Evaluate Moving Through Time (on slider and on axial plot widget) with Test File “4-mini_dep”	Completed	Passed
19	Save Animated (GIF) Image Over Time – Pin Power with Test File “4-mini_dep”	Completed	Passed
20	Save Animated (GIF) Image Over Axial Levels – Pin Power with Test File “4-mini_dep”	Completed	Passed

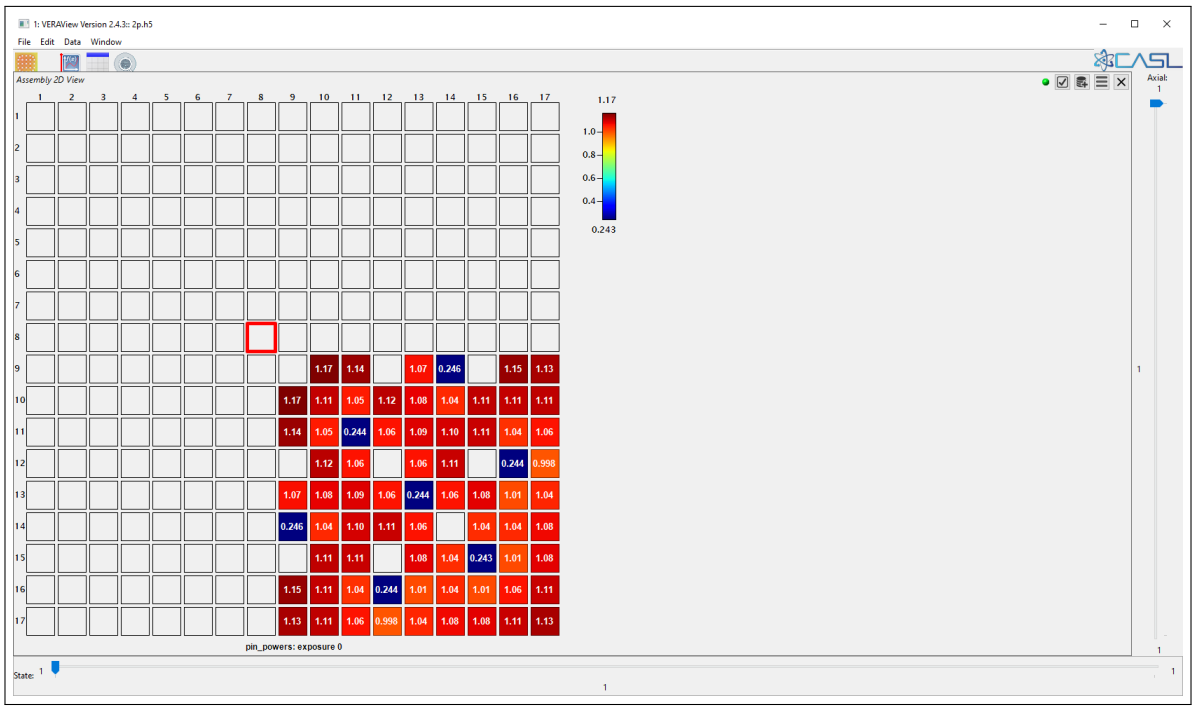
3. VERAVIEW SOFTWARE TEST RESULTS

Test 1: Open Single File with Test File "2p"

1. With VERAView application open, click on the "File" dropdown menu in the upper left corner and select "Open Single File…".

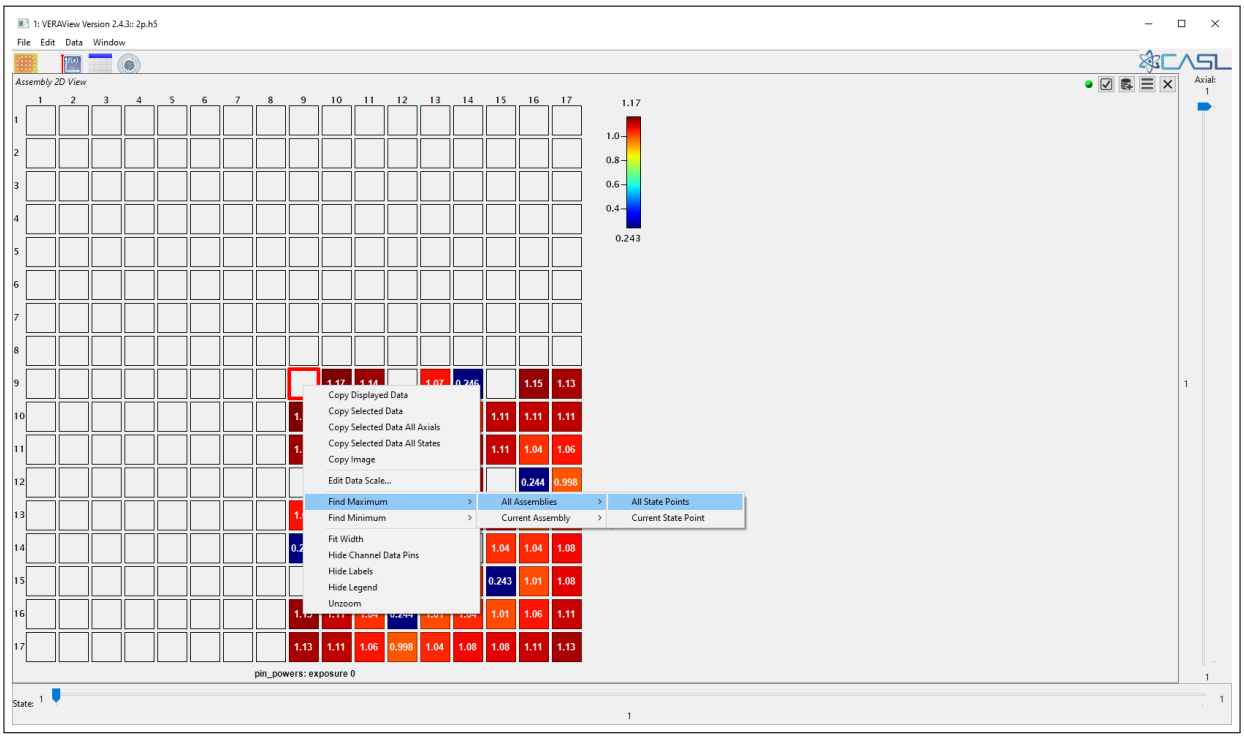


2. Select file "2p.h5".
3. Review the open file and verify that it matches below.

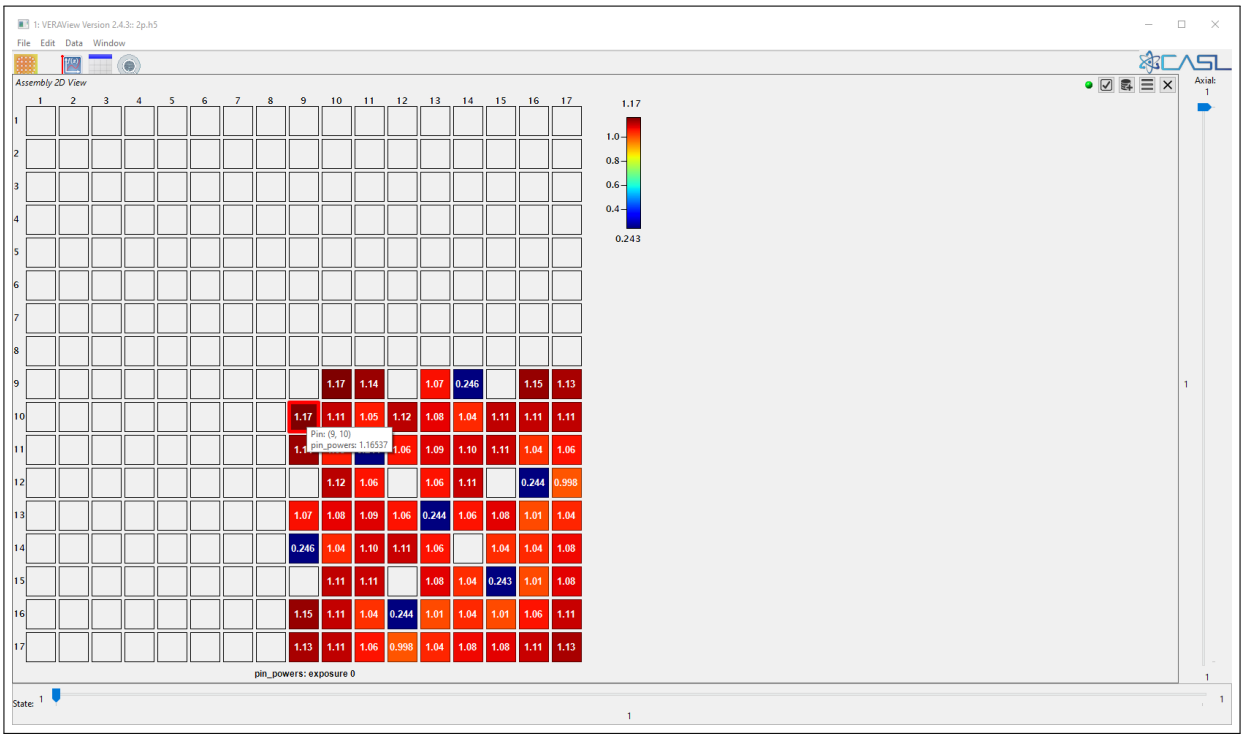


Test 2: Find Max Value Pin with Test File "2p"

1. With file 2p open, right-click and hover mouse over "Find Maximum" in the dropdown menu, and then hover over "All Assemblies" and left-click on "All State Points".

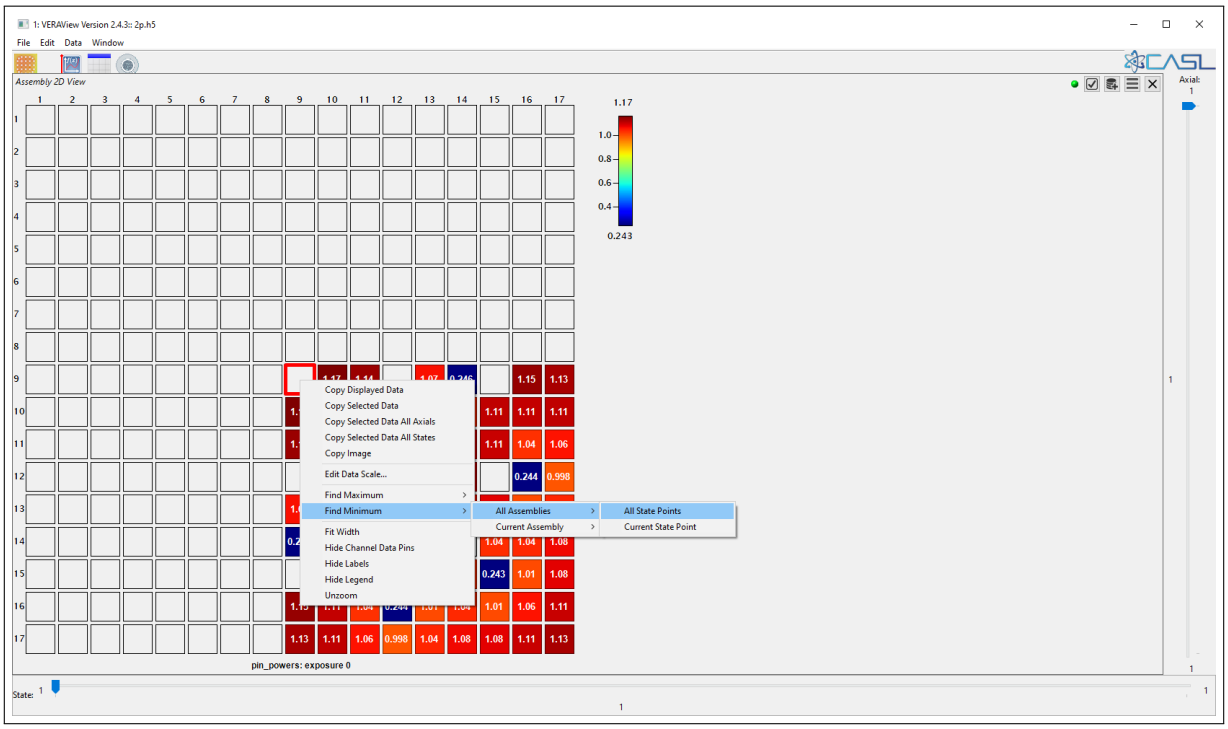


2. VERAView will automatically include a red border around the highest value state point. For file 2p, the highest value state point is Pin: (9,10) with Pin Power: 1.16537 (see below).

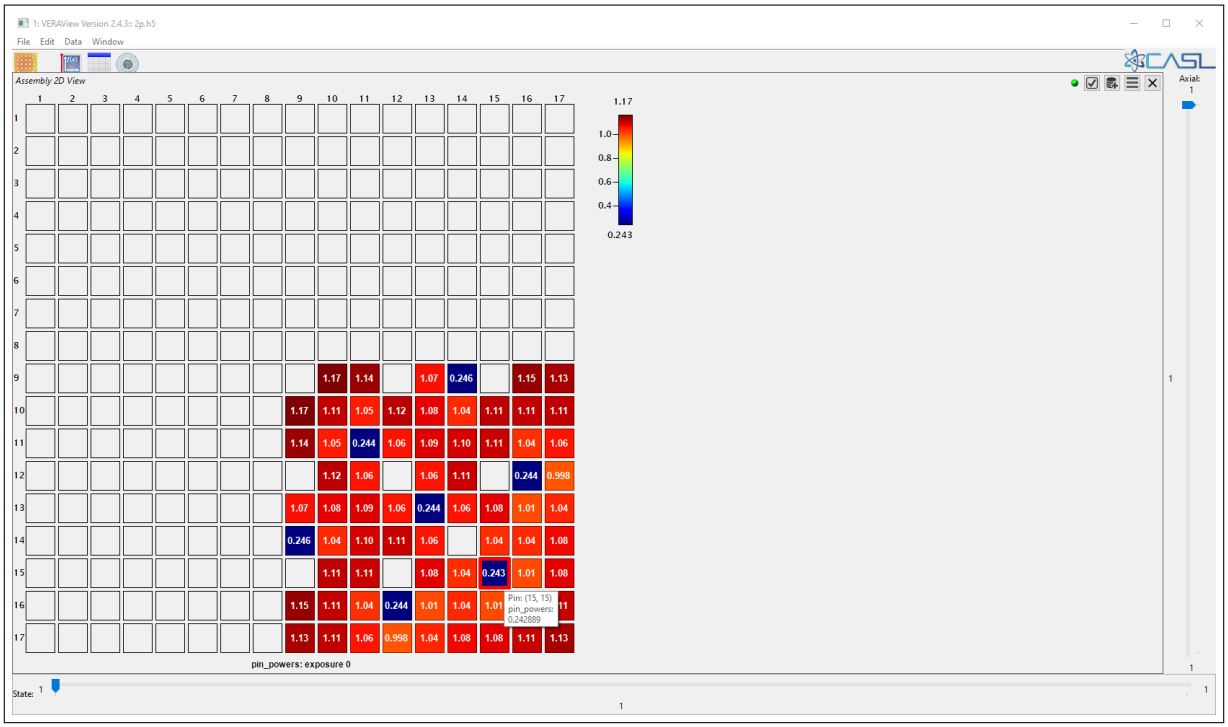


Test 3: Find Min Value Pin with Test File "2p"

1. With file 2p open, right-click and hover mouse over "Find Minimum" in the dropdown menu, and then hover over "All Assemblies" and left-click on "All State Points".

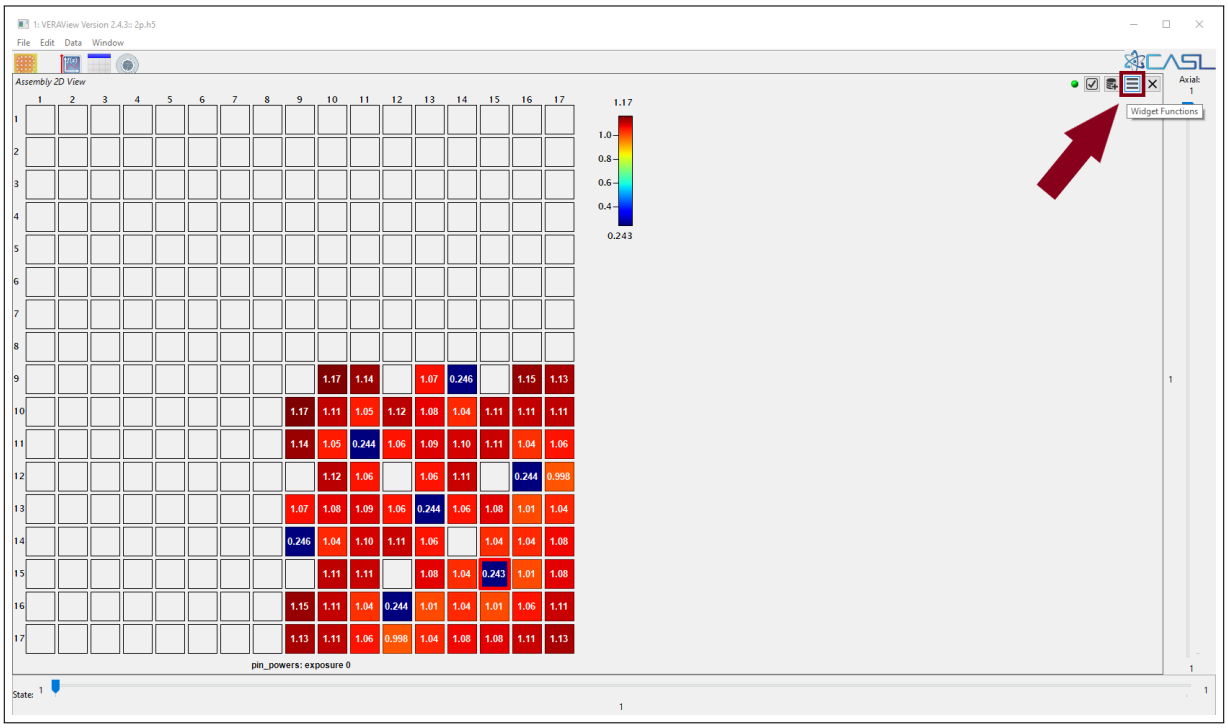


2. VERAView will automatically include a red border around the lowest value state point. For file 2p, the lowest value state point is Pin: (15,15) with Pin Power: 0.242889 (see below).

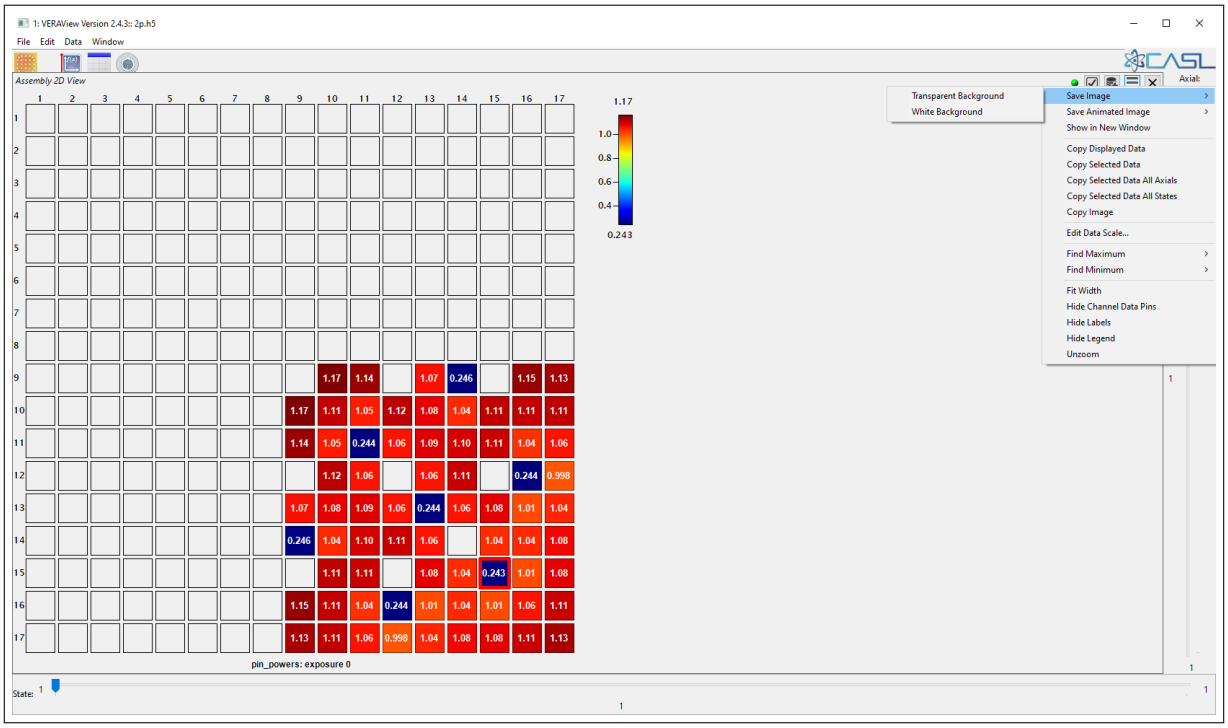


Test 4: Save Image with Test File “2p”

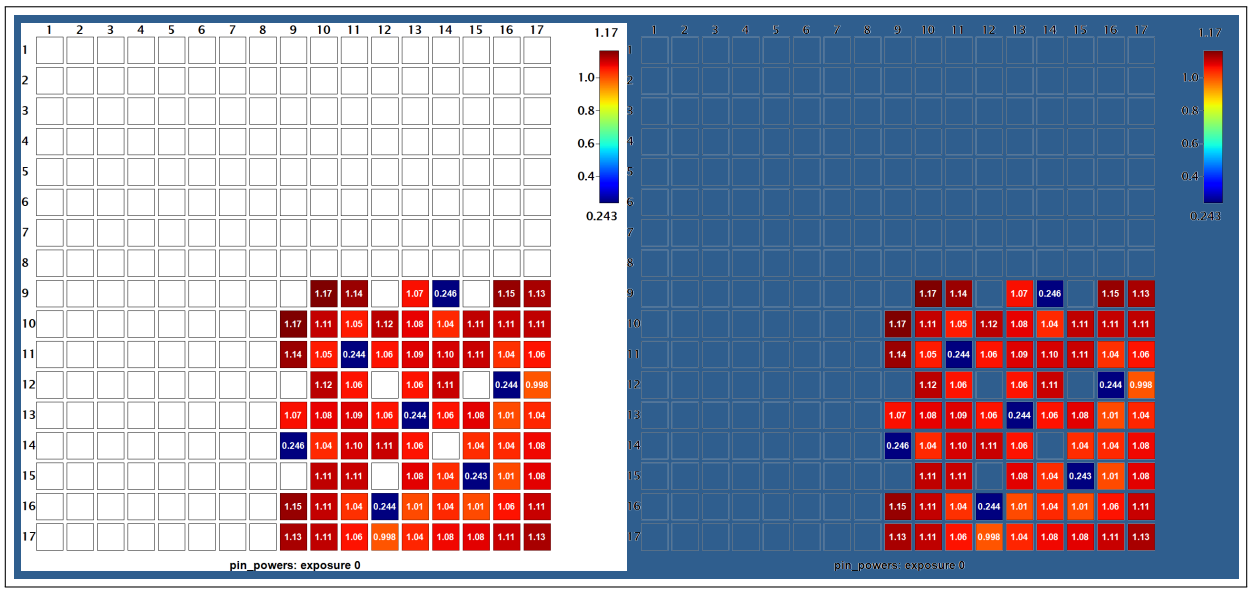
1. With file 2p open, click on the “Widget Functions” button in the upper right corner.



2. Hover over the “Save Image” button in the drop-down menu, and select either “Transparent Background” or “White Background”



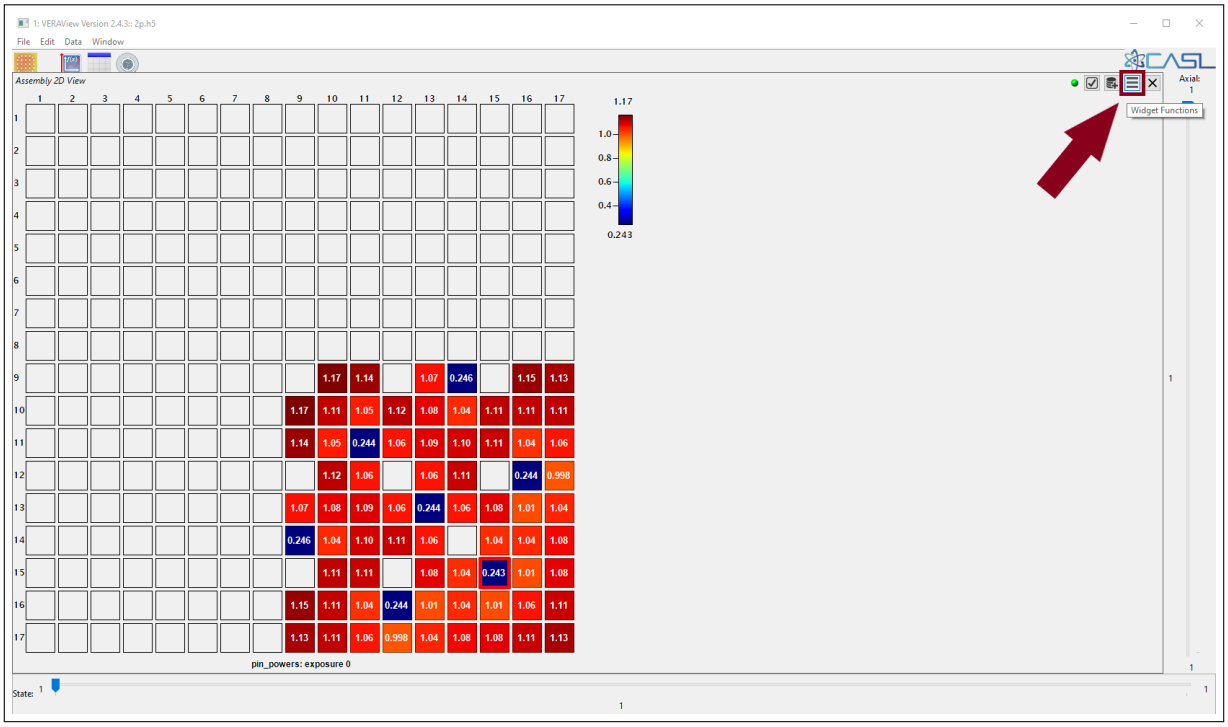
3. Your image will be saved as a '.png' file.



(White Background) (Transparent Background)

Test 5: Copy Displayed Dataset with Test File "2p"

1. With file 2p open, click on the "Widget Functions" button in the upper right corner.



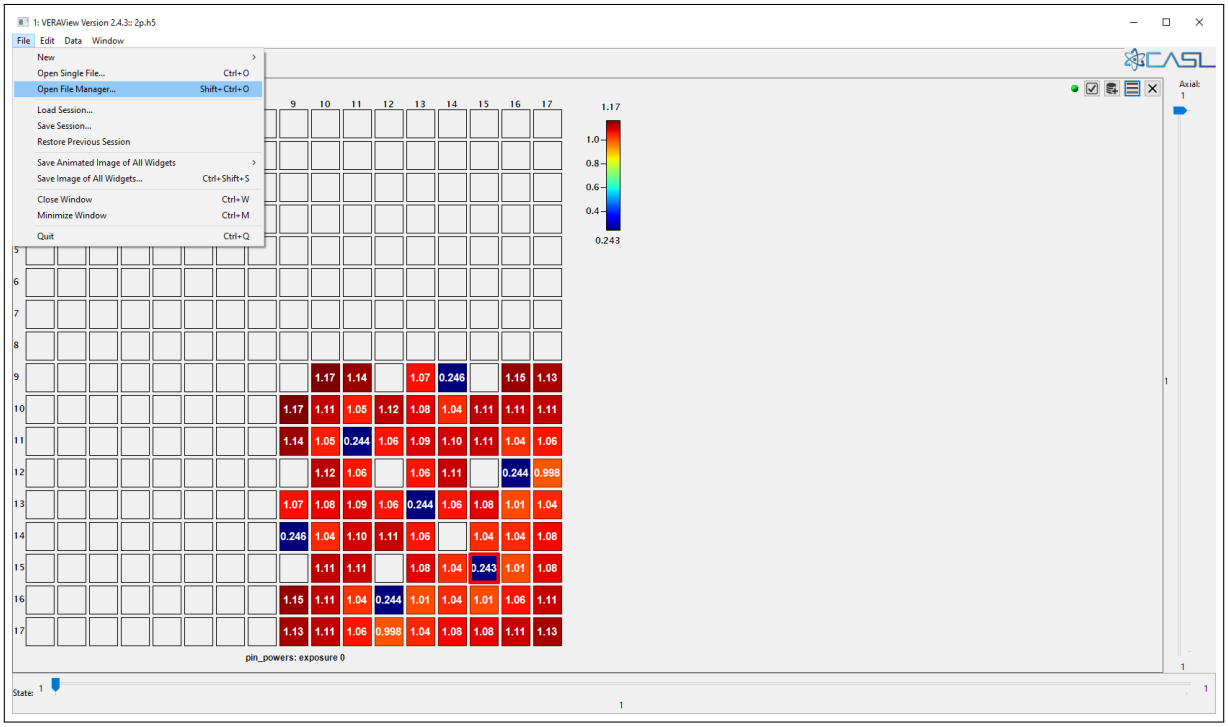
2. Click on the “Copy Displayed Data Set” button in the drop-down menu.
3. Your data set is now copied and can be pasted into any format. Your data should match the data shown below.

Table 2. File 2p.h5 pin_powers data set

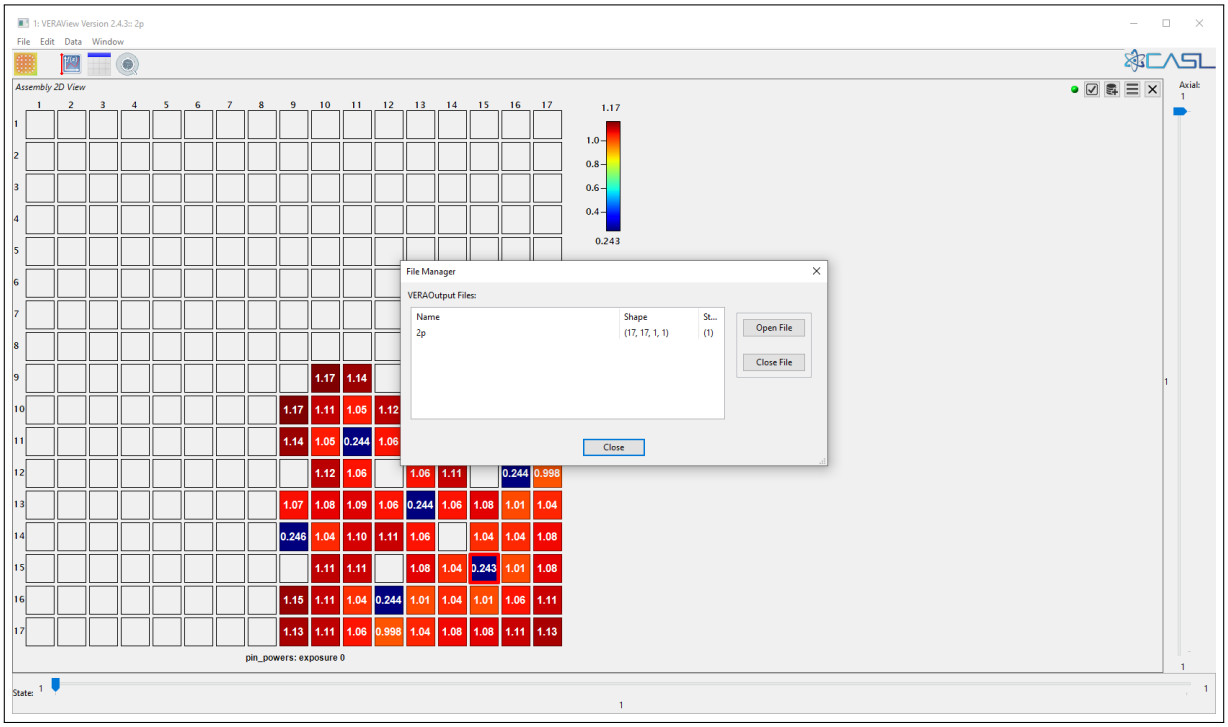
pin_powers: Assembly=(A-1); Axial=0.500; exposure=0;Col Range=[1,17]; Row Range=[1,17]																
1.1299	1.105	1.0833	1.0751	1.0436	0.9979	1.0627	1.1129	1.1311	1.1129	1.0627	0.9979	1.0436	1.0751	1.0833	1.105	1.1299
1.105	1.061	1.0072	1.0395	1.0092	0.2439	1.0355	1.1095	1.1459	1.1095	1.0355	0.2439	1.0092	1.0395	1.0072	1.061	1.105
1.0833	1.0072	0.2429	1.0387	1.0829	0	1.1052	1.1126	0	1.1126	1.1052	0	1.0829	1.0387	0.2429	1.0072	1.0833
1.0751	1.0395	1.0387	0	1.0615	1.1056	1.0965	1.0419	0.2455	1.0419	1.0965	1.1056	1.0615	0	1.0387	1.0395	1.0751
1.0436	1.0092	1.0829	1.0615	0.2442	1.0624	1.0888	1.0815	1.0664	1.0815	1.0888	1.0624	0.2442	1.0615	1.0829	1.0092	1.0436
0.9979	0.2439	0	1.1056	1.0624	0	1.0631	1.1154	0	1.1154	1.0631	0	1.0624	1.1056	0	0.2439	0.9979
1.0627	1.0355	1.1052	1.0965	1.0888	1.0631	0.244	1.0549	1.1414	1.0549	0.244	1.0631	1.0888	1.0965	1.1052	1.0355	1.0627
1.1129	1.1095	1.1126	1.0419	1.0815	1.1154	1.0549	1.1102	1.1654	1.1102	1.0549	1.1154	1.0815	1.0419	1.1126	1.1095	1.1129
1.1311	1.1459	0	0.2455	1.0664	0	1.1414	1.1654	0	1.1654	1.1414	0	1.0664	0.2455	0	1.1459	1.1311
1.1129	1.1095	1.1126	1.0419	1.0815	1.1154	1.0549	1.1102	1.1654	1.1102	1.0549	1.1154	1.0815	1.0419	1.1126	1.1095	1.1129
1.0627	1.0355	1.1052	1.0965	1.0888	1.0631	0.244	1.0549	1.1414	1.0549	0.244	1.0631	1.0888	1.0965	1.1052	1.0355	1.0627
0.9979	0.2439	0	1.1056	1.0624	0	1.0631	1.1154	0	1.1154	1.0631	0	1.0624	1.1056	0	0.2439	0.9979
1.0436	1.0092	1.0829	1.0615	0.2442	1.0624	1.0888	1.0815	1.0664	1.0815	1.0888	1.0624	0.2442	1.0615	1.0829	1.0092	1.0436
1.0751	1.0395	1.0387	0	1.0615	1.1056	1.0965	1.0419	0.2455	1.0419	1.0965	1.1056	1.0615	0	1.0387	1.0395	1.0751
1.0833	1.0072	0.2429	1.0387	1.0829	0	1.1052	1.1126	0	1.1126	1.1052	0	1.0829	1.0387	0.2429	1.0072	1.0833
1.105	1.061	1.0072	1.0395	1.0092	0.2439	1.0355	1.1095	1.1459	1.1095	1.0355	0.2439	1.0092	1.0395	1.0072	1.061	1.105
1.1299	1.105	1.0833	1.0751	1.0436	0.9979	1.0627	1.1129	1.1311	1.1129	1.0627	0.9979	1.0436	1.0751	1.0833	1.105	1.1299

Test 6: Open Multiple Files with Test Files “2p” and “2o”

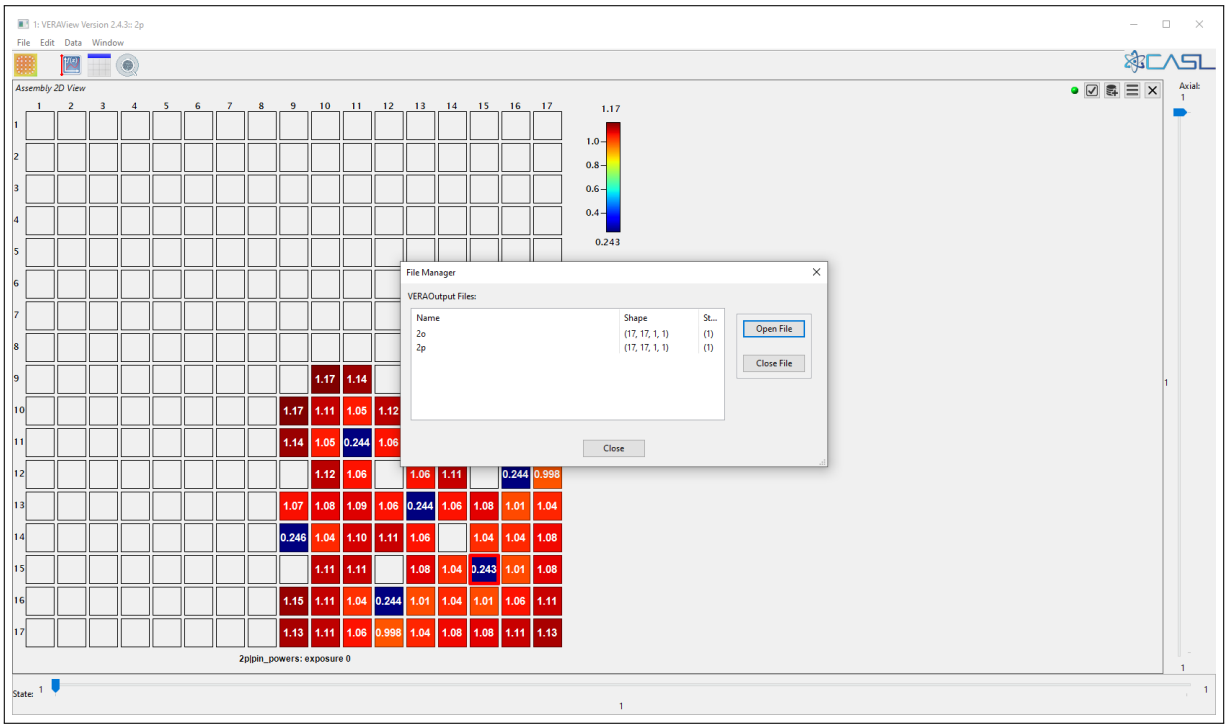
1. With file 2p open, click on the “File” dropdown menu in the upper left corner, and select “Open File Manager…”.



2. With “File Manager” open, you should see file 2p listed under “VERAOutput Files:”. Click on “Open File” on the right side of the window. Select file “2o.h5”.

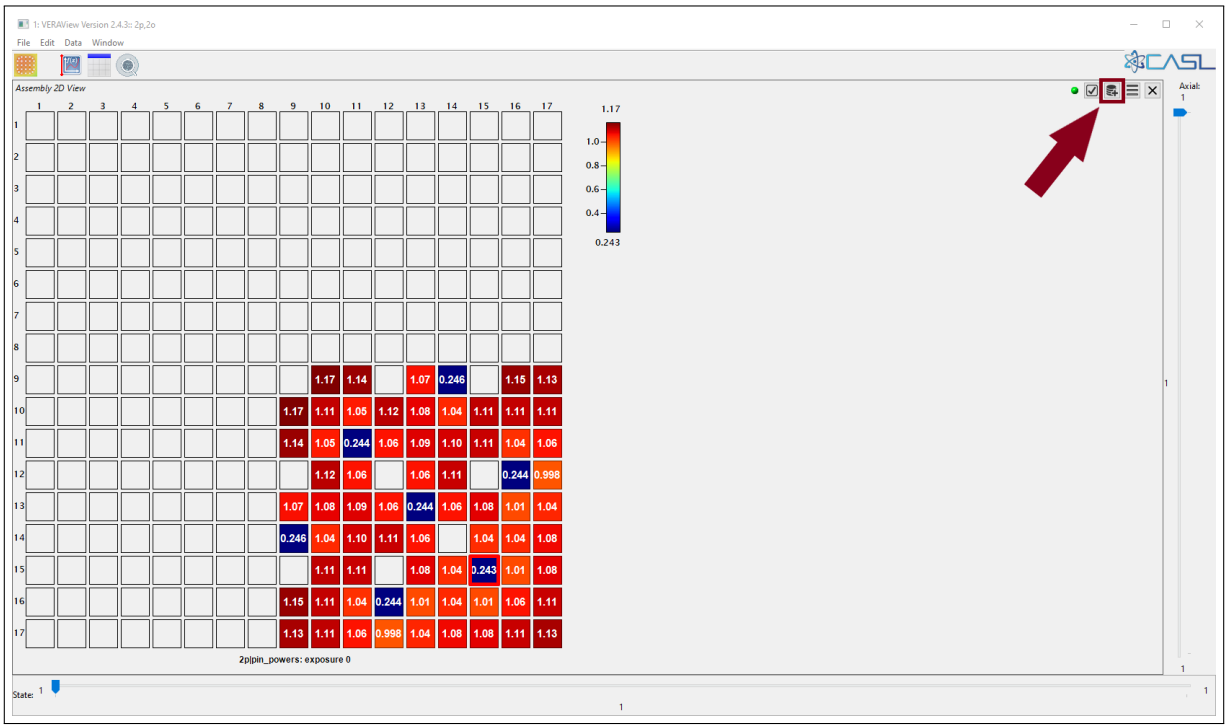


3. Your new file (2o) will now show up in the File Manager window, and the window can be closed.

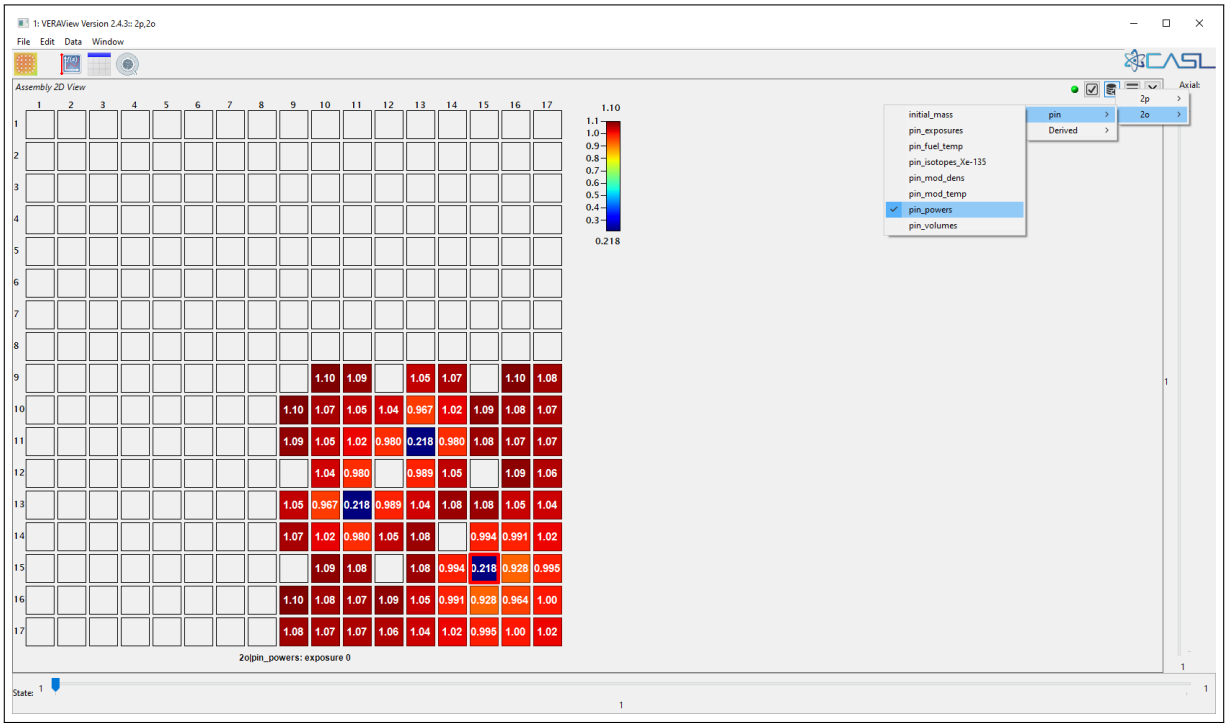


Test 7: Switch Dataset Selection Between Files with Test Files “2p” and “2o”

1. With files 2p and 2o open, click on the “Select Datasets” button in the upper right corner.

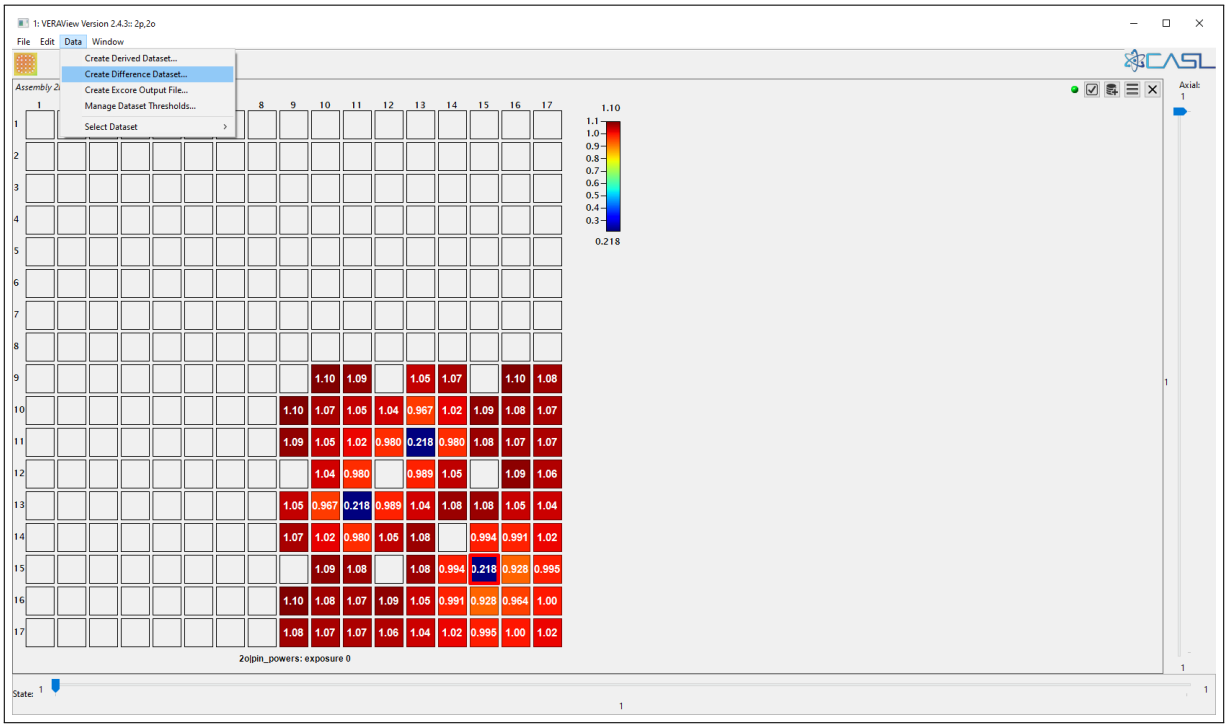


2. Hover over file “2o” in the drop-down menu. Hover over “Pin” and select “pin_powers” to show the pin power display. You are now viewing file 2o pin powers.

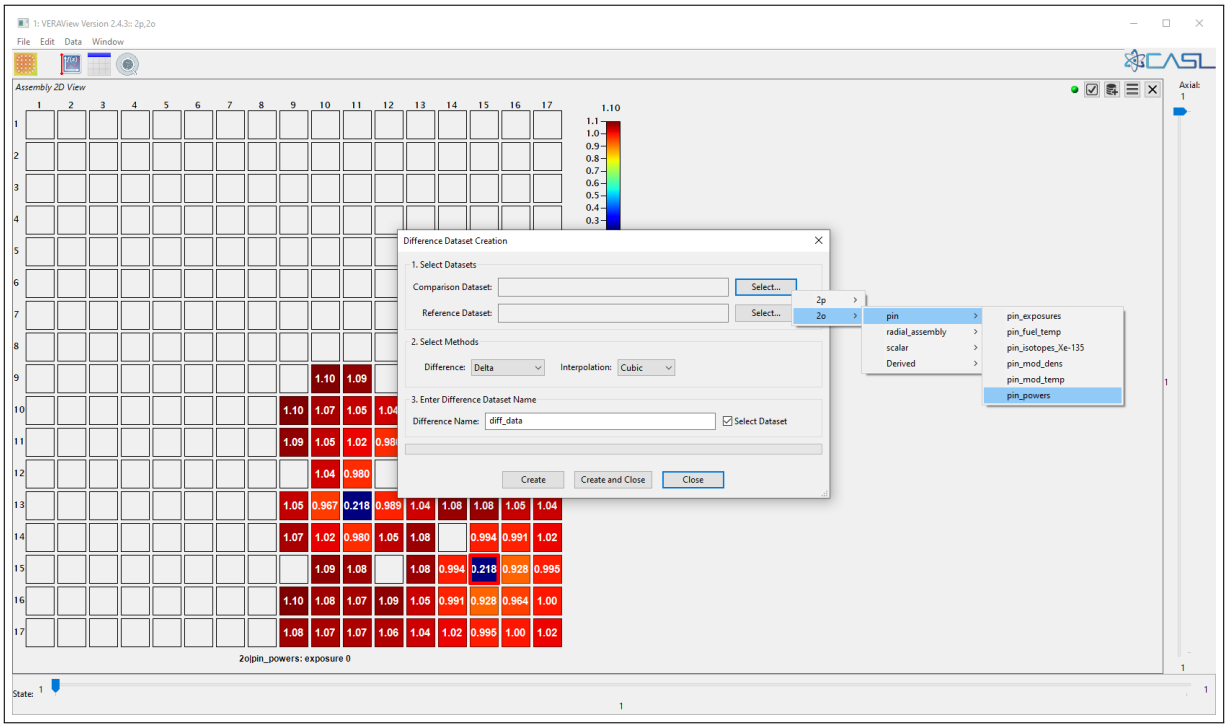


Test 8: Create Pin_Powers Difference Dataset with Test Files “2p” and “2o”

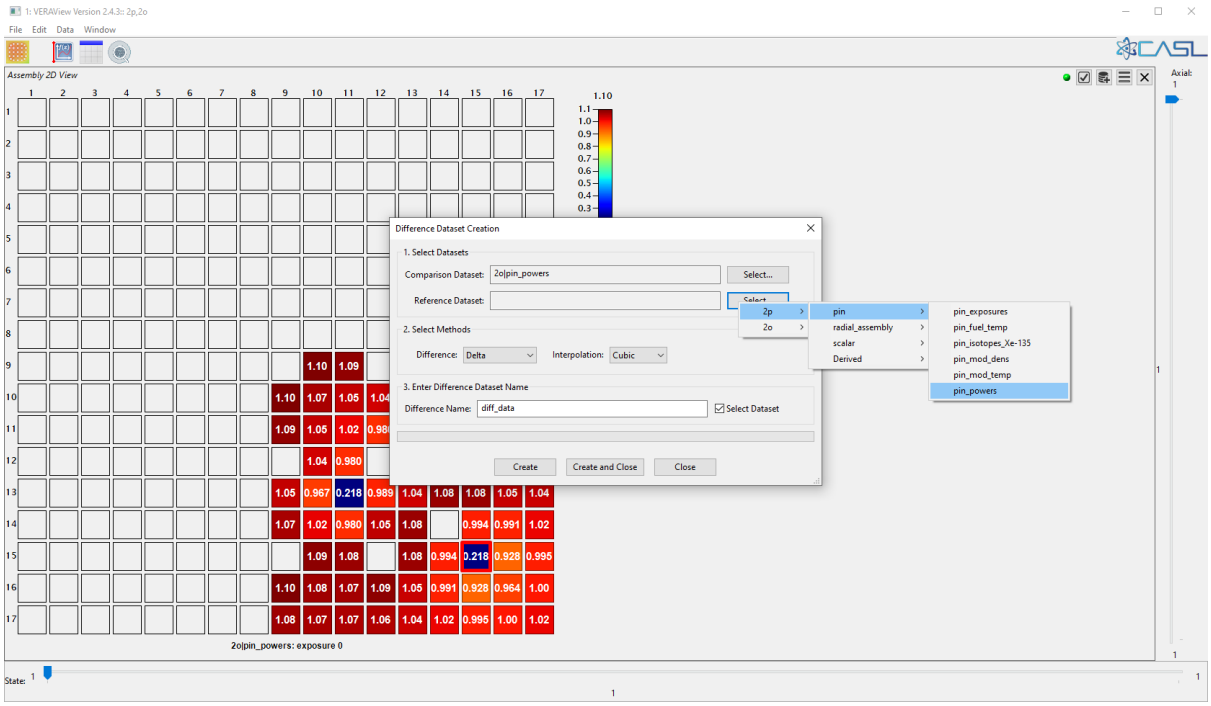
1. With files 2p and 2o open, click on “Data” dropdown menu in upper-left and select “Create Difference Dataset. . . ”.



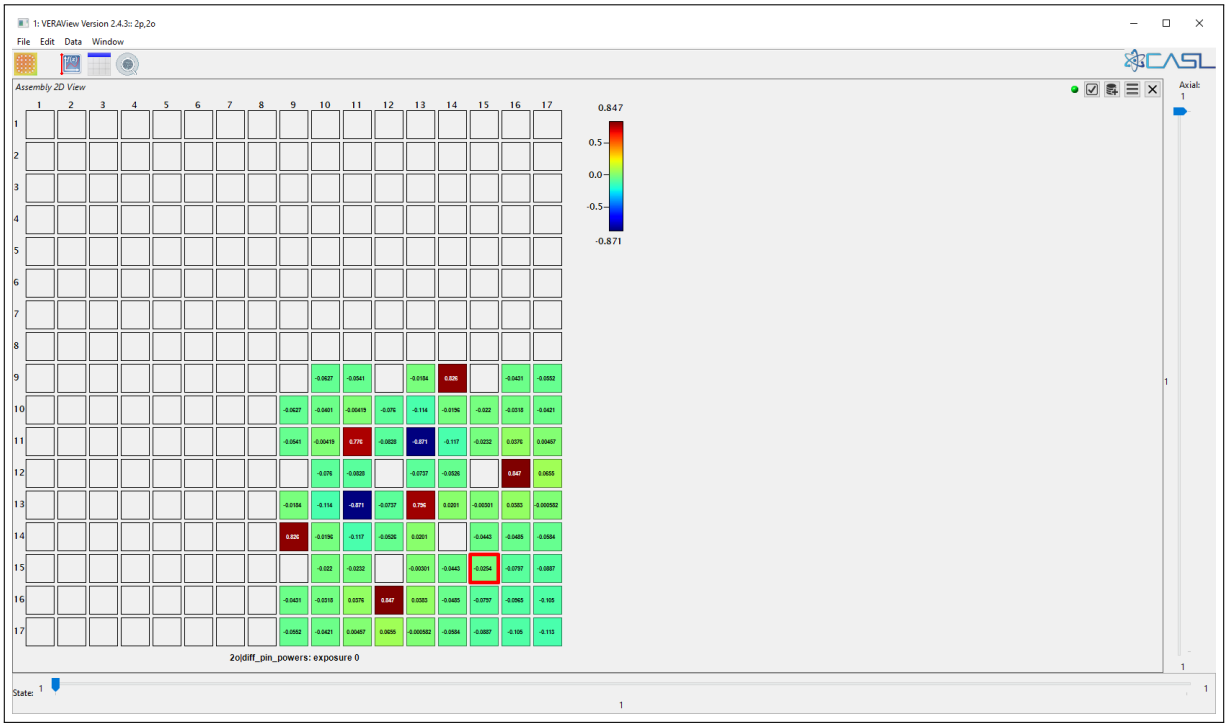
2. With the “Difference Dataset Creation” window open, click the “Select. . . ” button next to “Comparison Dataset”. A dropdown window will open. Hover over file “2o”, and then hover over “pin”, and click on “pin_powers”.



3. Perform the same action with the “Reference Dataset”: a dropdown window will open, hover over file “2p”, then hover over “pin”, and click on “pin_powers”.

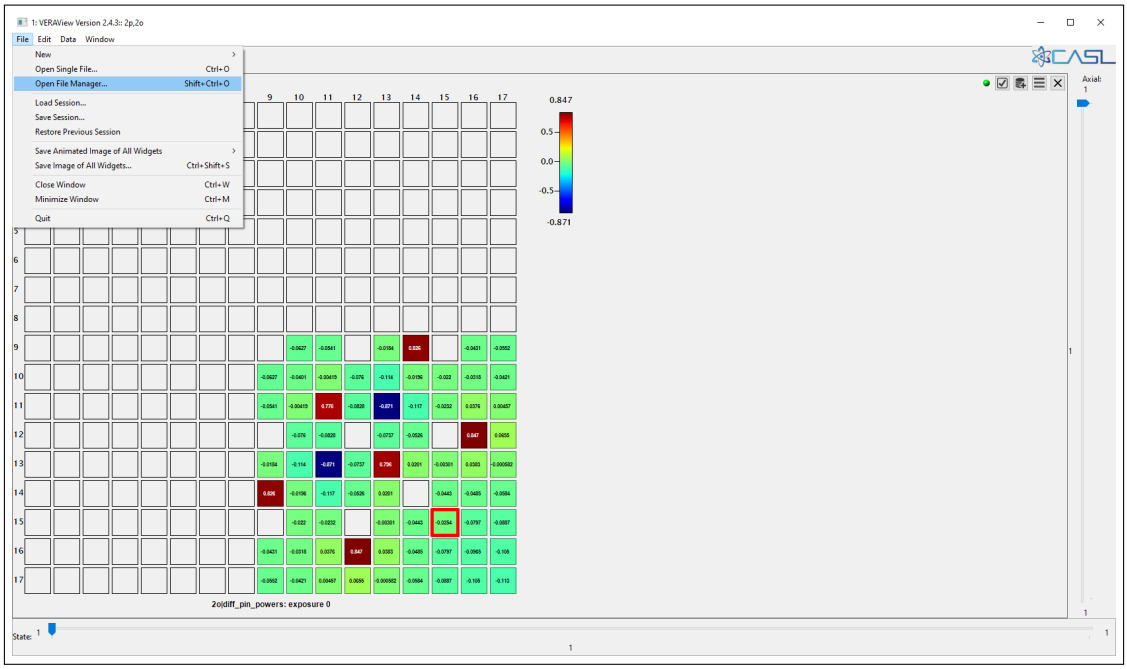


4. Click the “Create” button at the bottom of the “Difference Dataset Creation” window. The display will change to reflect the comparison of the datasets.



Test 9: Close Files from Multi File Manager with Test Files “2p” and “2o”

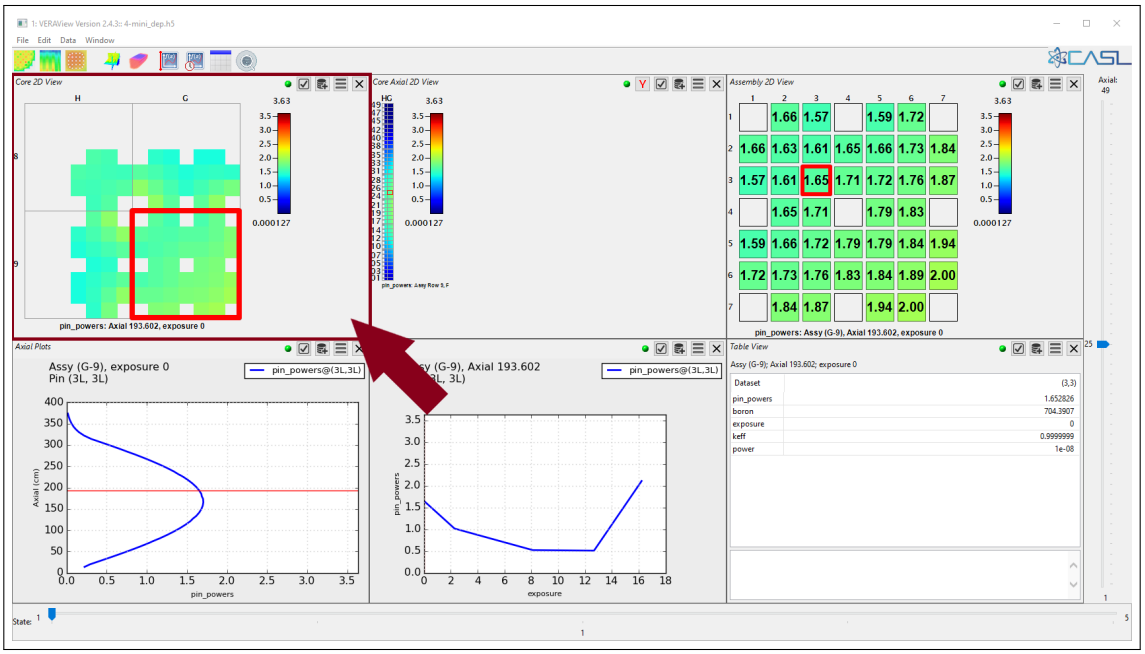
1. With files 2p and 2o open, click on the “File” dropdown menu in the upper left corner and select “Open File Manager. . . ”.



2. Select one file or multiple files, and click on the “Close File” button on the right side. Your VERAView window will be blank.

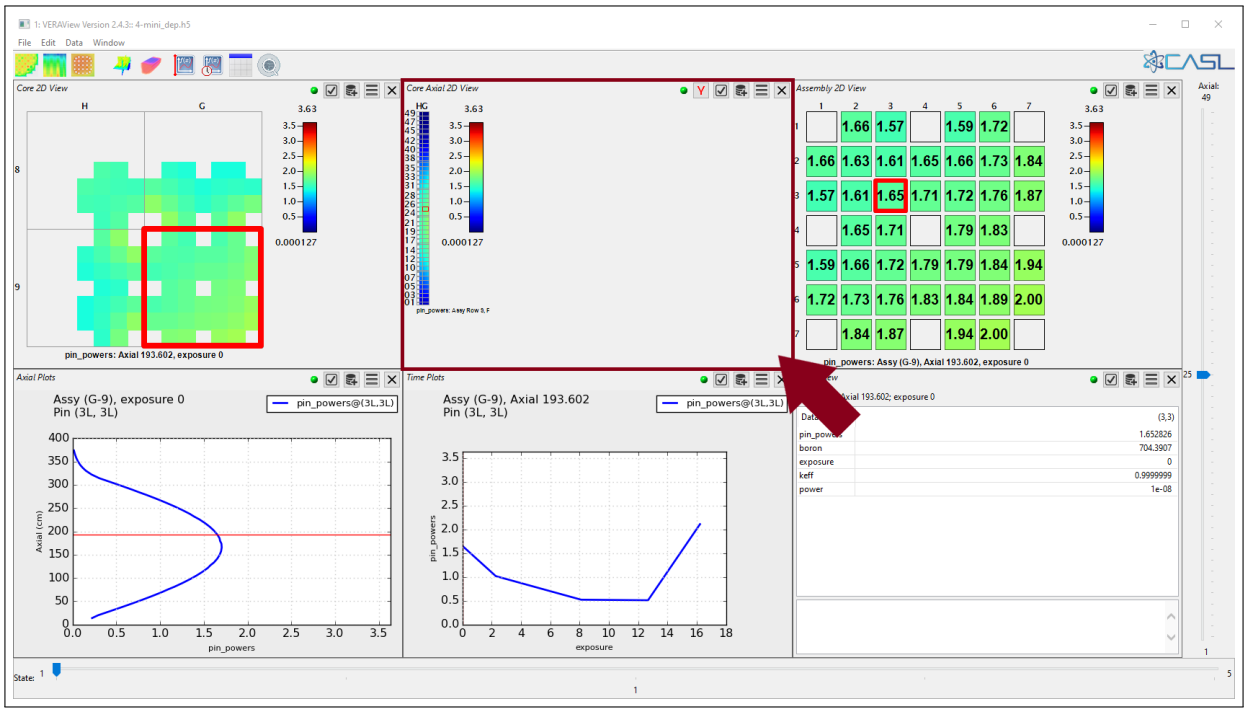
Test 10: Evaluate Radial Core Widget with Test File “4-mini_dep”

1. After working with smaller files like 2p and 2o, close VERAView entirely and reopen.
2. Open single file “4-mini_dep.h5”.
3. Verify that the Core 2D View widget shows the correct symmetry.



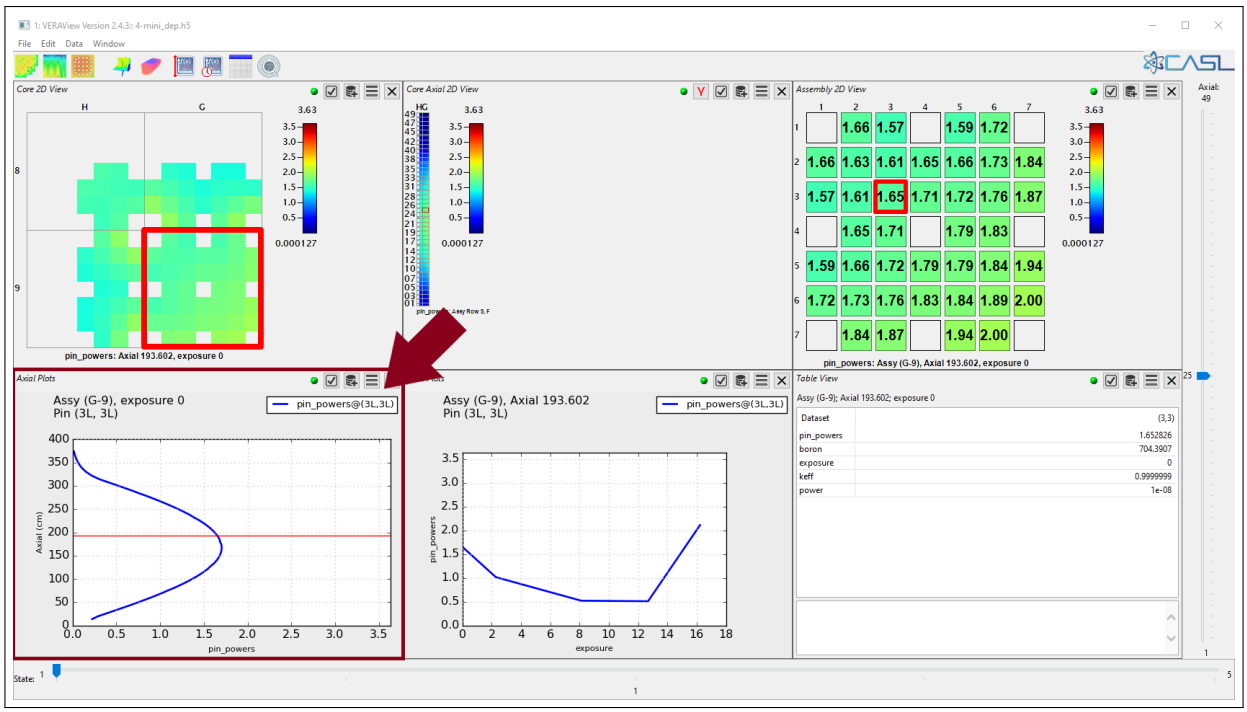
Test 11: Evaluate Axial Core Widget with Test File “4-mini_dep”

1. Verify that the Core Axial 2D View widget displays 49 axial planes.



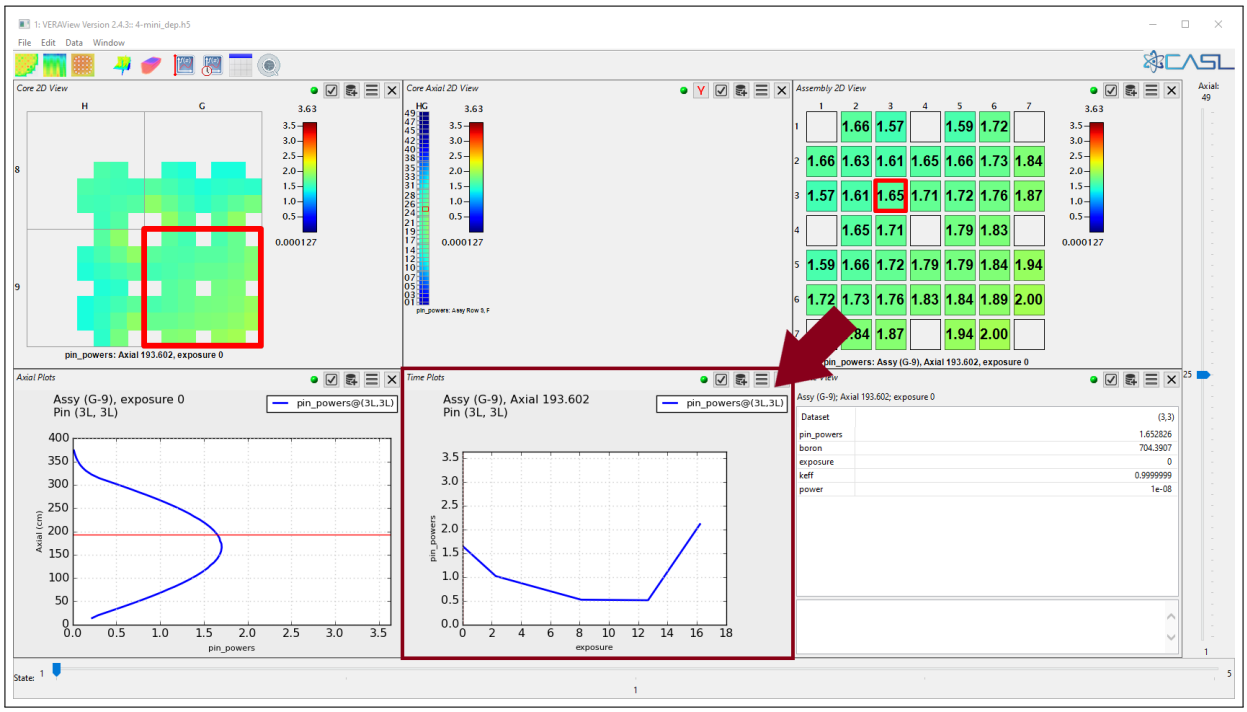
Test 12: Evaluate Axial Plot Widget with Test File “4-mini_dep”

1. Verify that the Axial Plots widget displays the y-axis as “axial” in centimeters and the x-axis as “pin_powers” and that the pin power curve is cosine shaped, as shown below.



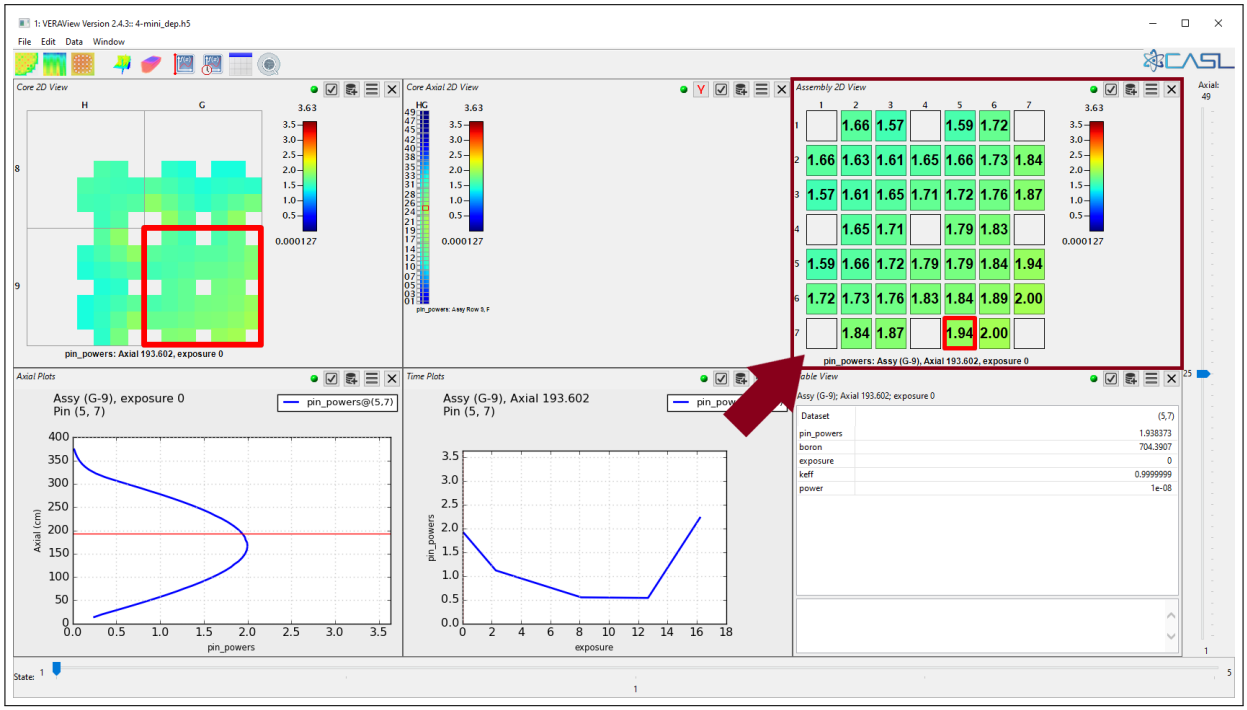
Test 13: Evaluate Time Plot Widget with Test File “4-mini_dep”

1. Verify that the Time Plots widget displays the y-axis as “pin_powers” and the x-axis as “exposure” and that the curve is shaped as shown below.



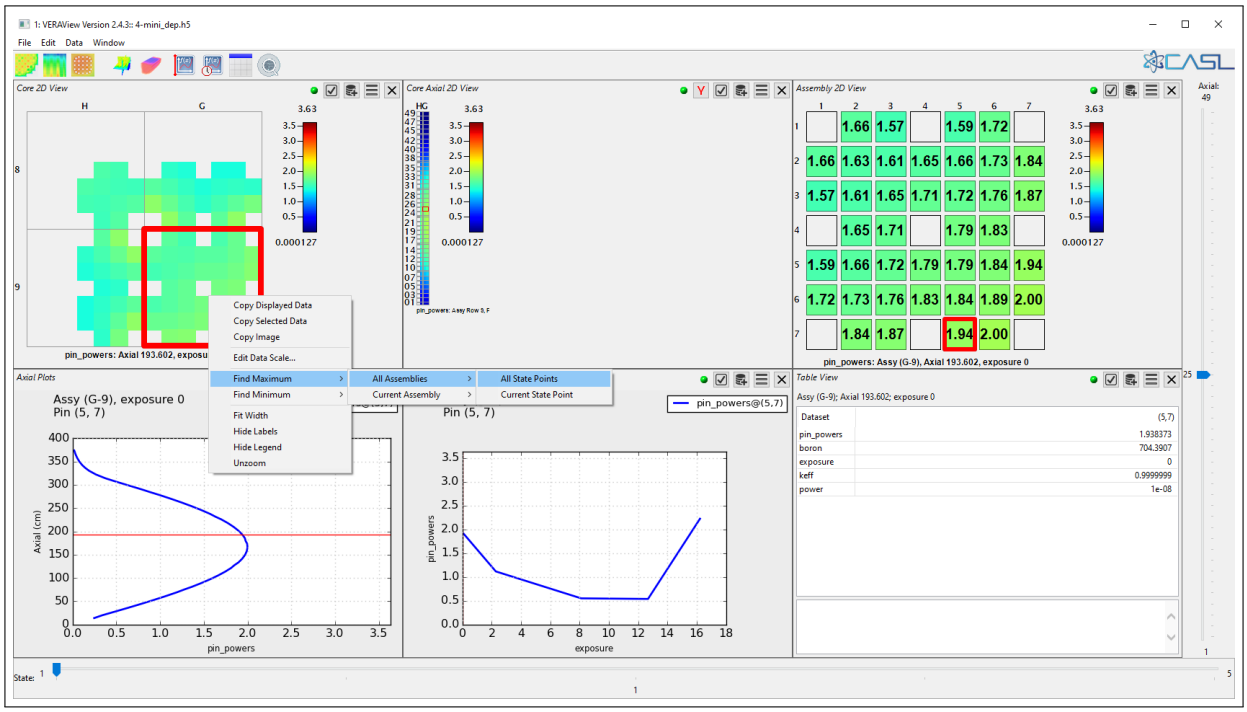
Test 14: Evaluate Multiple Rods in Assembly Widget with Test File “4-mini_dep”

1. Using the Assembly 2D View widget, verify that pin (2,5) has a pin power of approximately 1.65917 and that pin (5,7) has a pin power of approximately 1.93837.

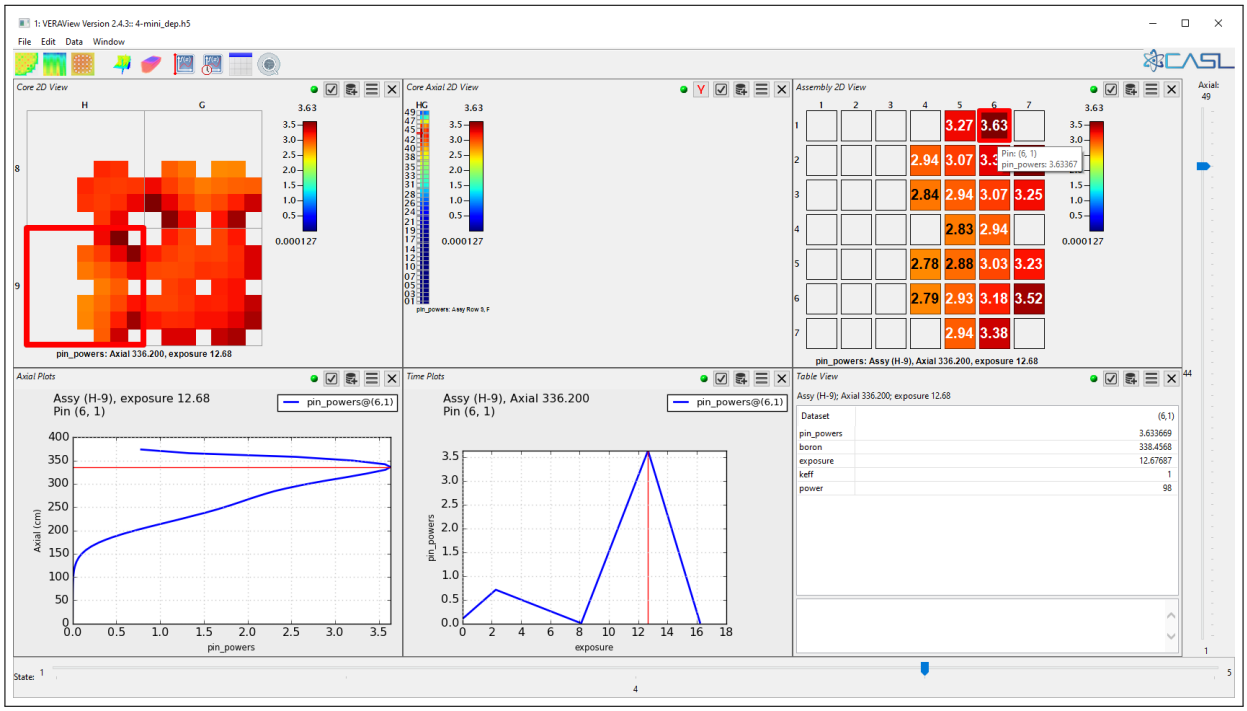


Test 15: Find Max Over All Assemblies Over All Time – Pin Power with Test File "4-mini_dep"

1. In the Core 2D View widget, right-click and hover mouse over "Find Maximum" in the dropdown menu, and then hover over "All Assemblies" and left-click on "All State Points".

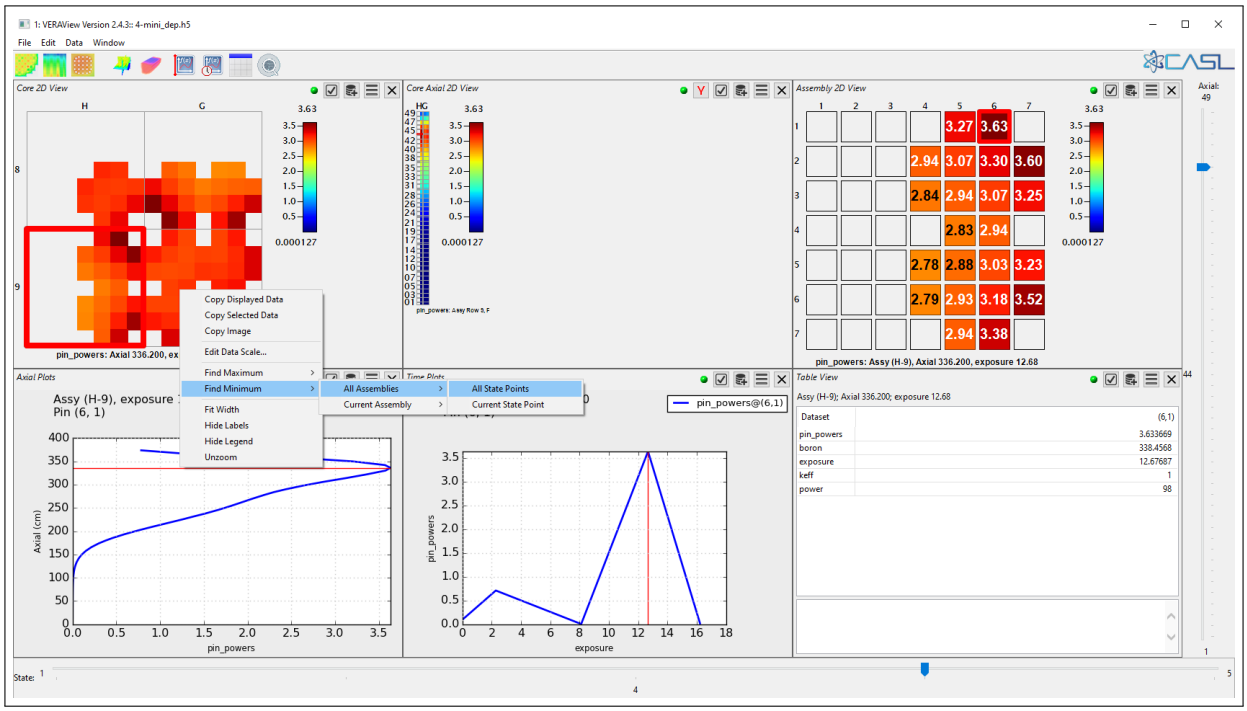


2. VERAView will automatically include a red border around the highest value. Verify that the highest value is in state 4, axial level 44, assembly H-9, pin (6,1), with a pin power of 3.63367 (see below).

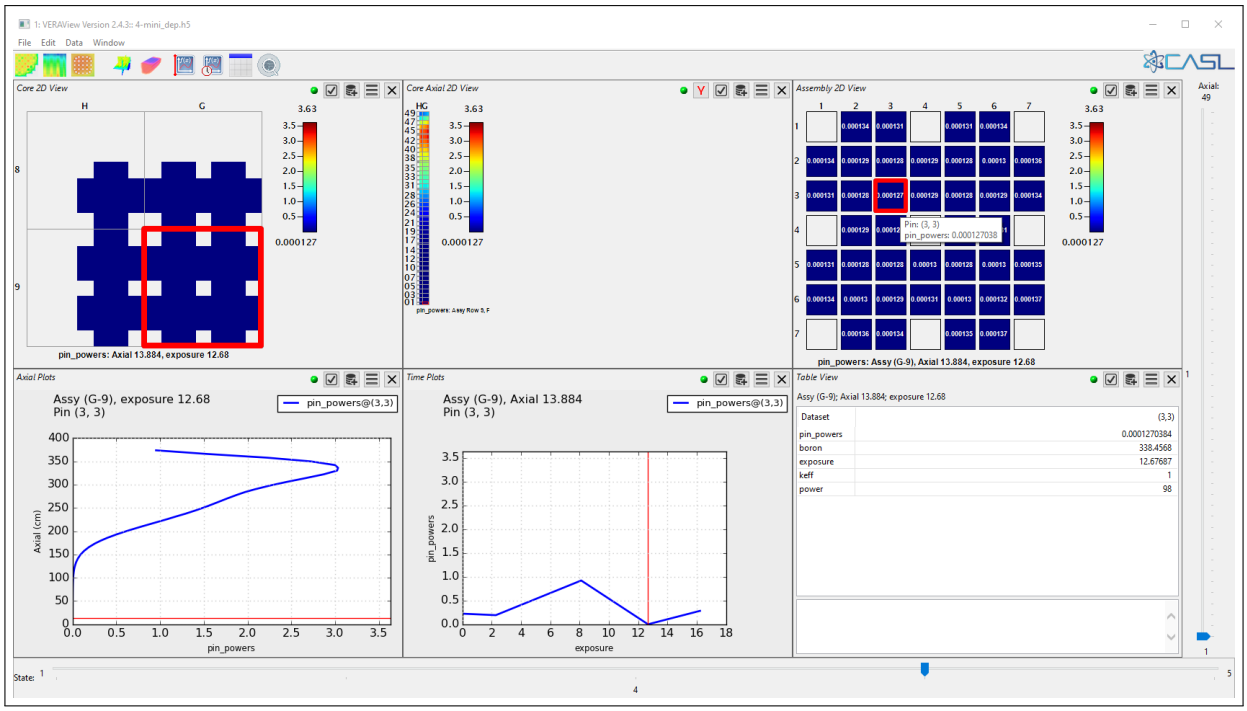


Test 16: Find Min Over All Assemblies Over All Time – Pin Power with Test File "4-mini_dep"

1. In the Core 2D View widget, right-click and hover mouse over "Find Minimum" in the dropdown menu, and then hover over "All Assemblies" and left-click on "All State Points".

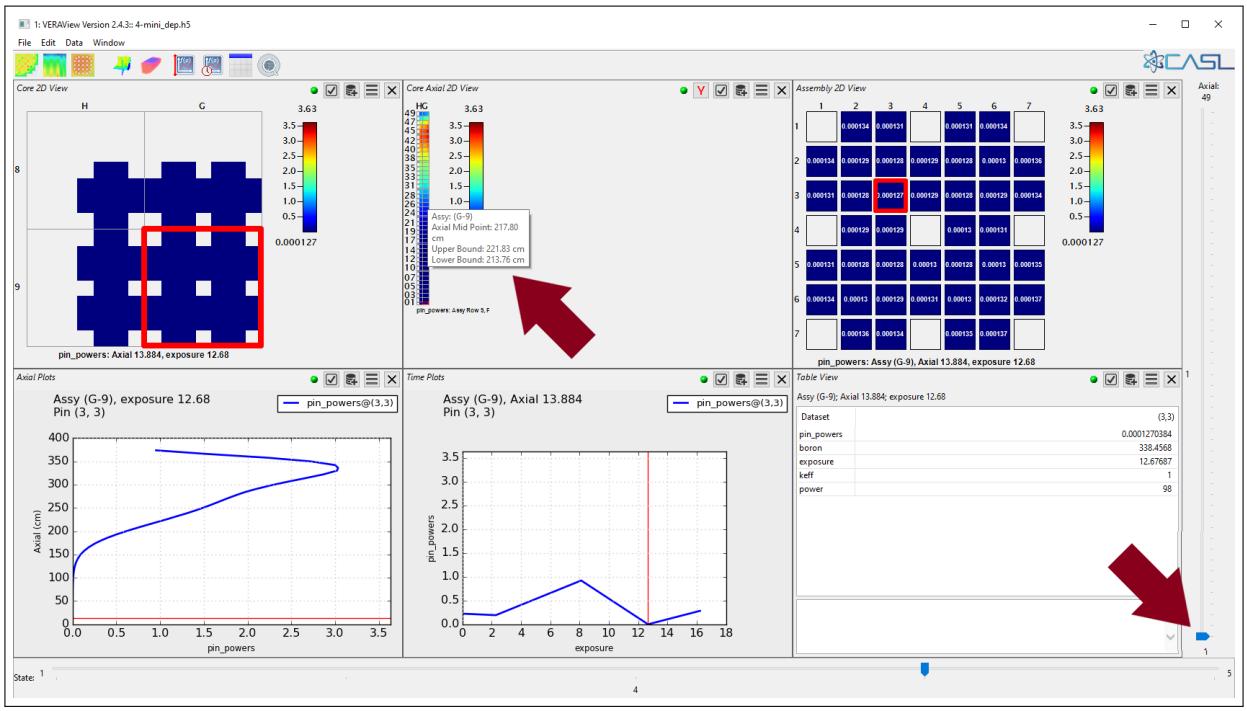


2. VERAView will automatically include a red border around the lowest value. Verify that the lowest value is in state 4, axial level 1, assembly G-9, pin (3,3), and with a pin power of 0.000127 (see below).



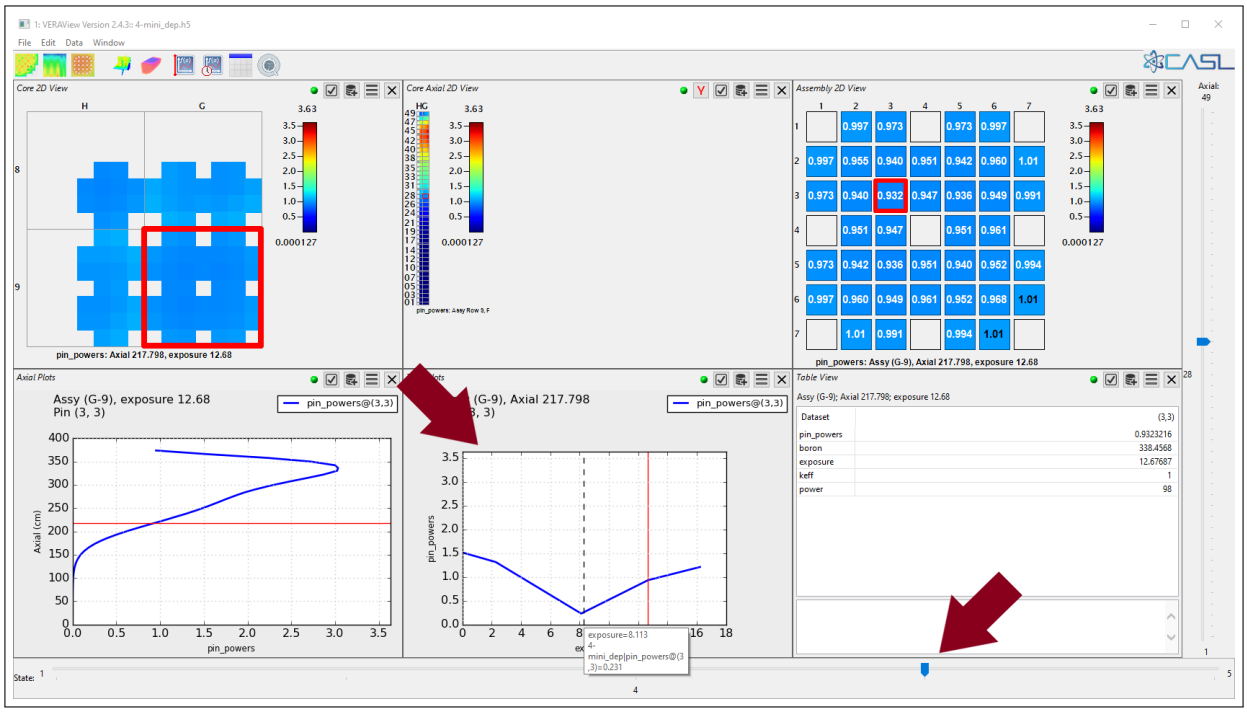
Test 17: Evaluate Moving Through Axial Levels (on slider and on axial plot widget) with Test File "4-mini_dep"

1. In the Core Axial 2D View widget, click on different axial levels of the problem. Also, click and drag the slider on the right, verifying that the data changes correctly.



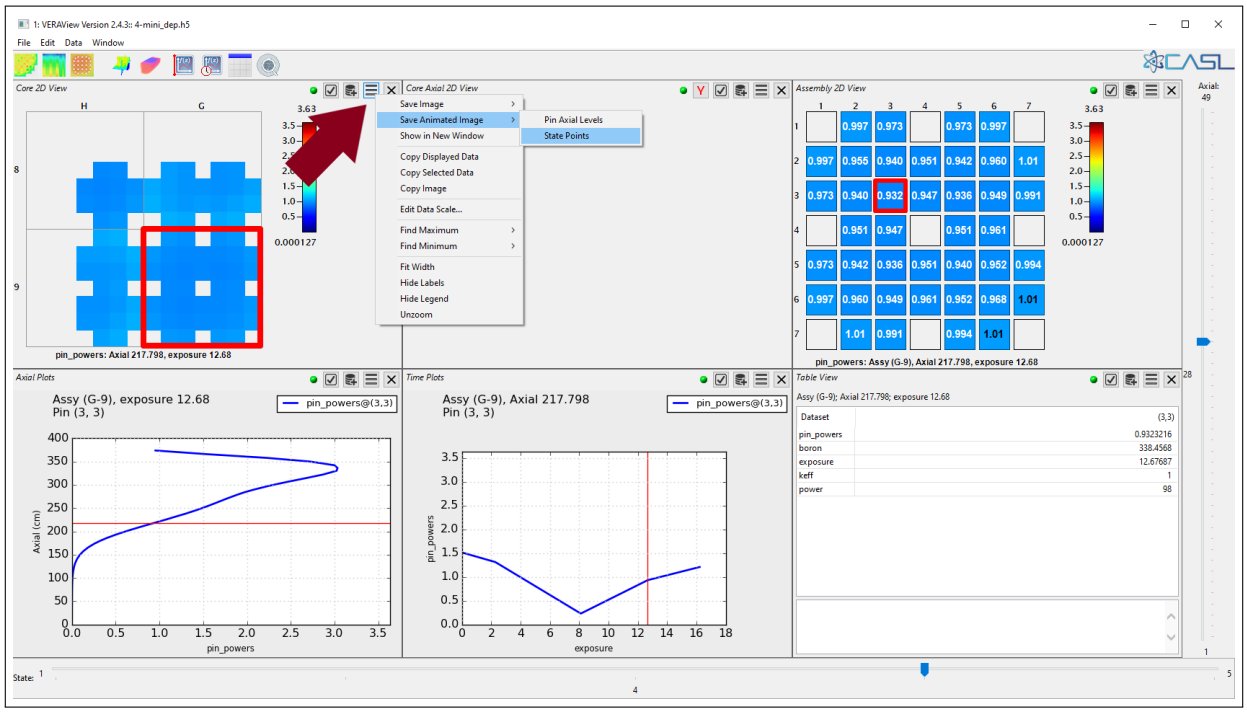
Test 18: Evaluate Moving Through Time (on slider and on axial plot widget) with Test File "4-mini_dep"

1. In the Time Plots widget, click on different states of the problem. Also, click and drag the slider on the bottom, verifying that the data changes correctly.

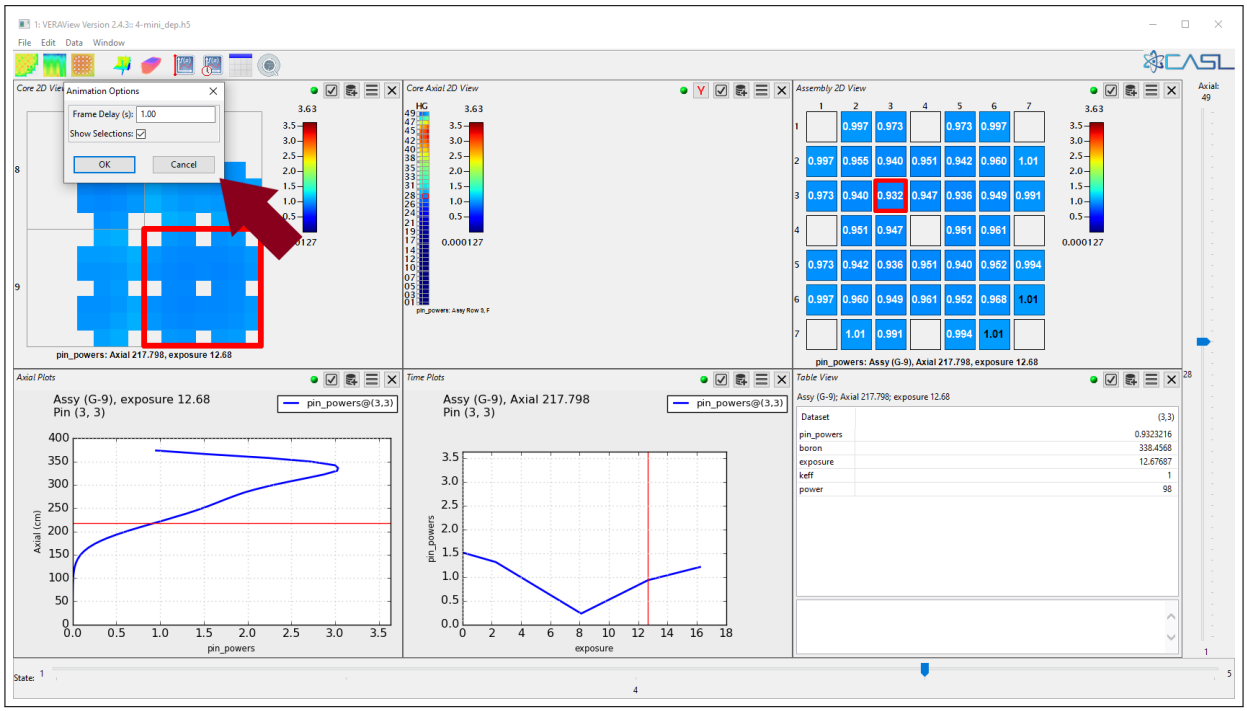


Test 19: Save Animated (GIF) Image Over Time – Pin Power with Test File "4-mini_dep"

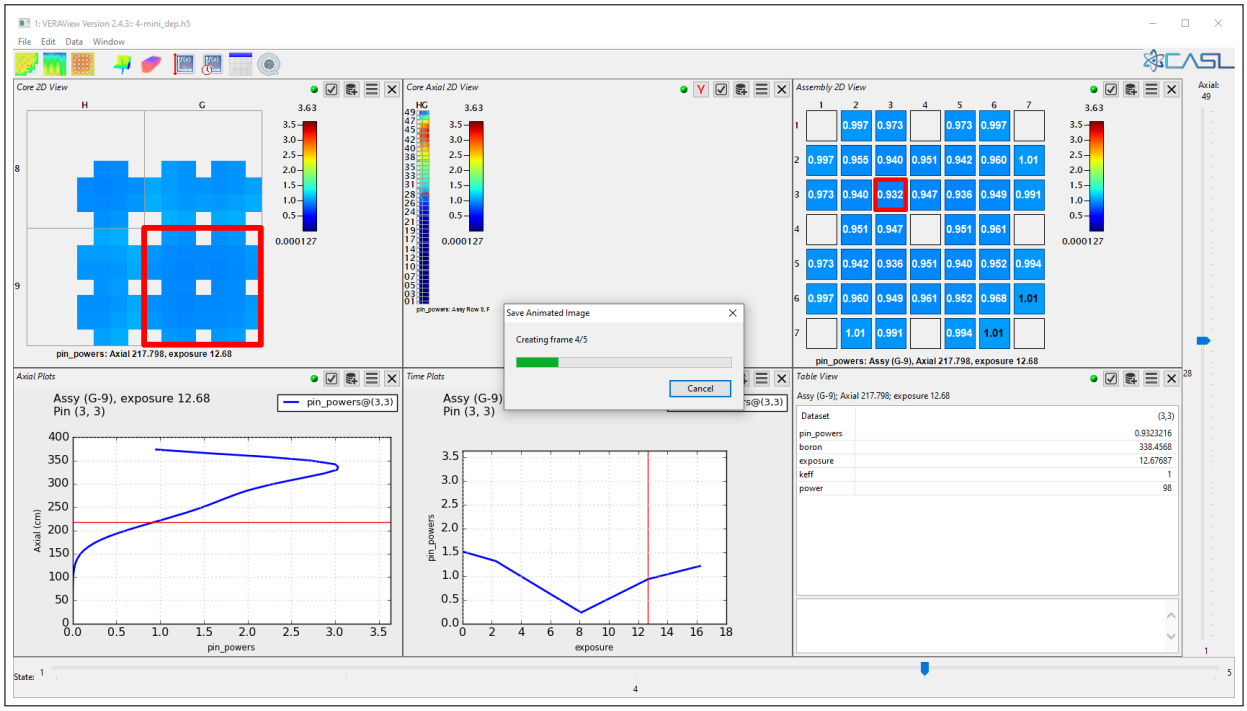
1. In the Core 2D View widget, click on the "Widget Functions" button. Hover over "Save Animated Image" and the click on "State Points".



2. In the Animation Options window, select the desired time per frame in seconds and choose whether the red selection outline should be included in the animation. Select "OK" and then save the gif in the desired location.

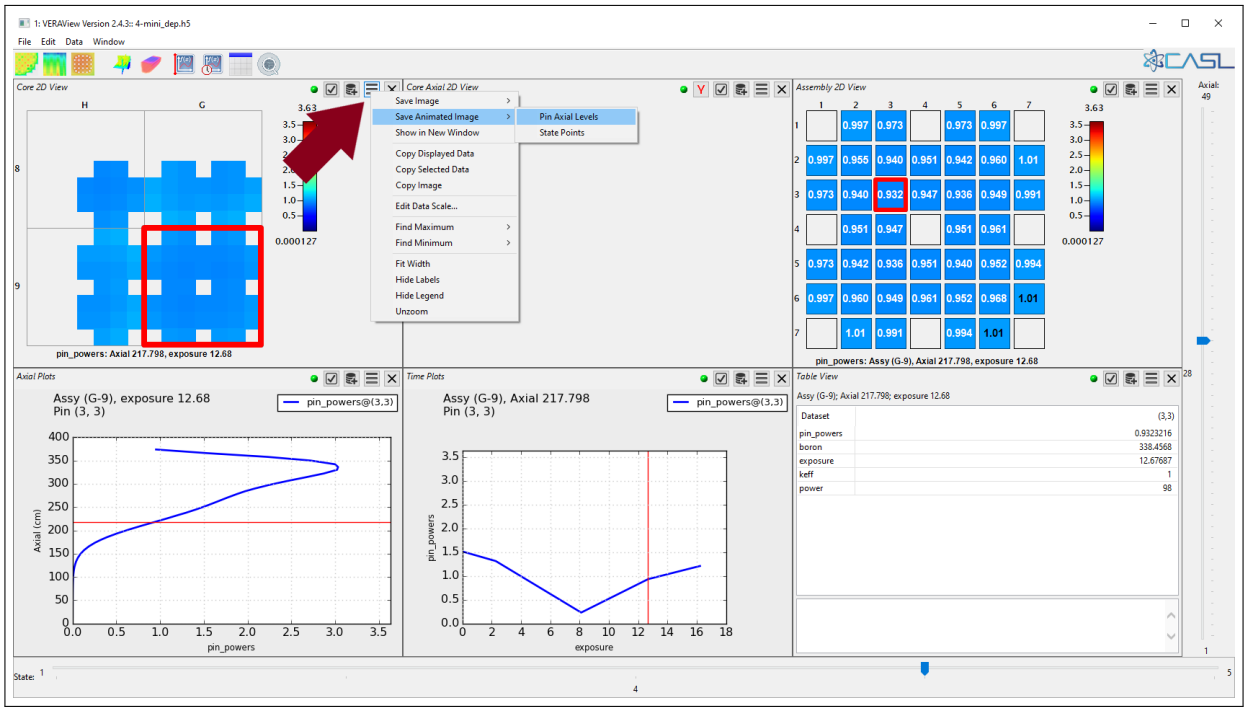


3. The animation will then be saved and can be viewed.

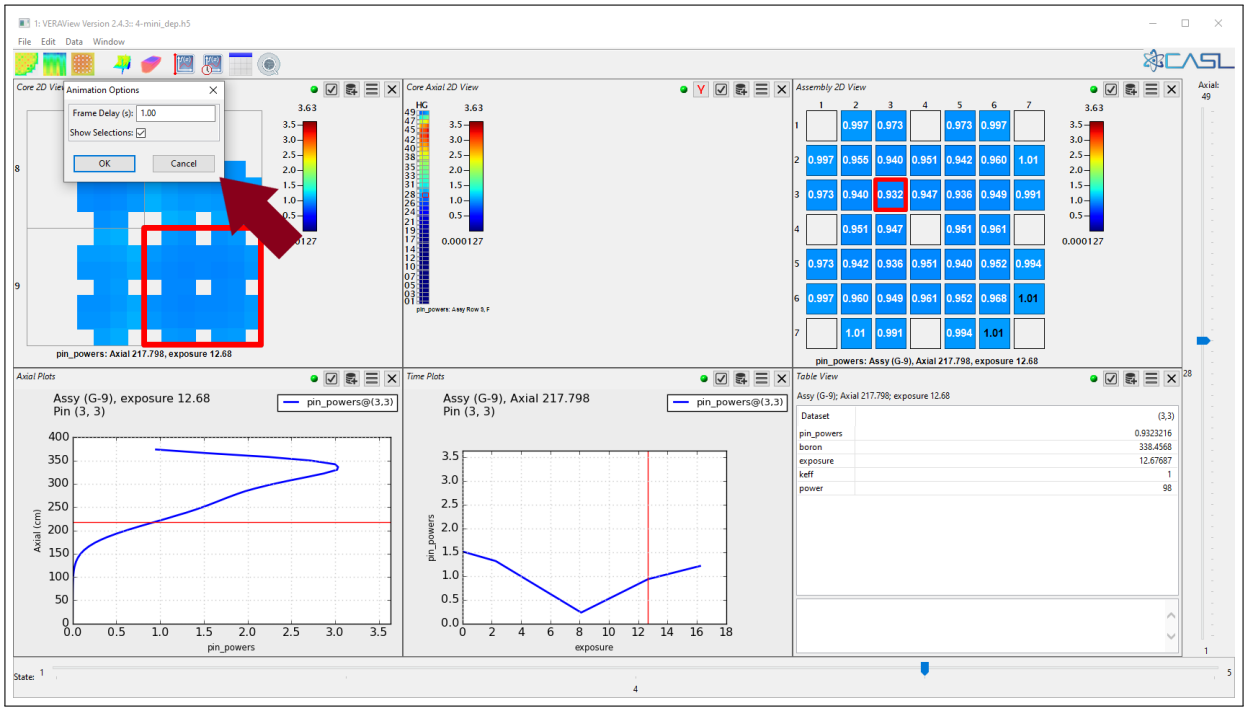


Test 20: Save Animated (GIF) Image Over Axial Levels – Pin Power with Test File "4-mini_dep"

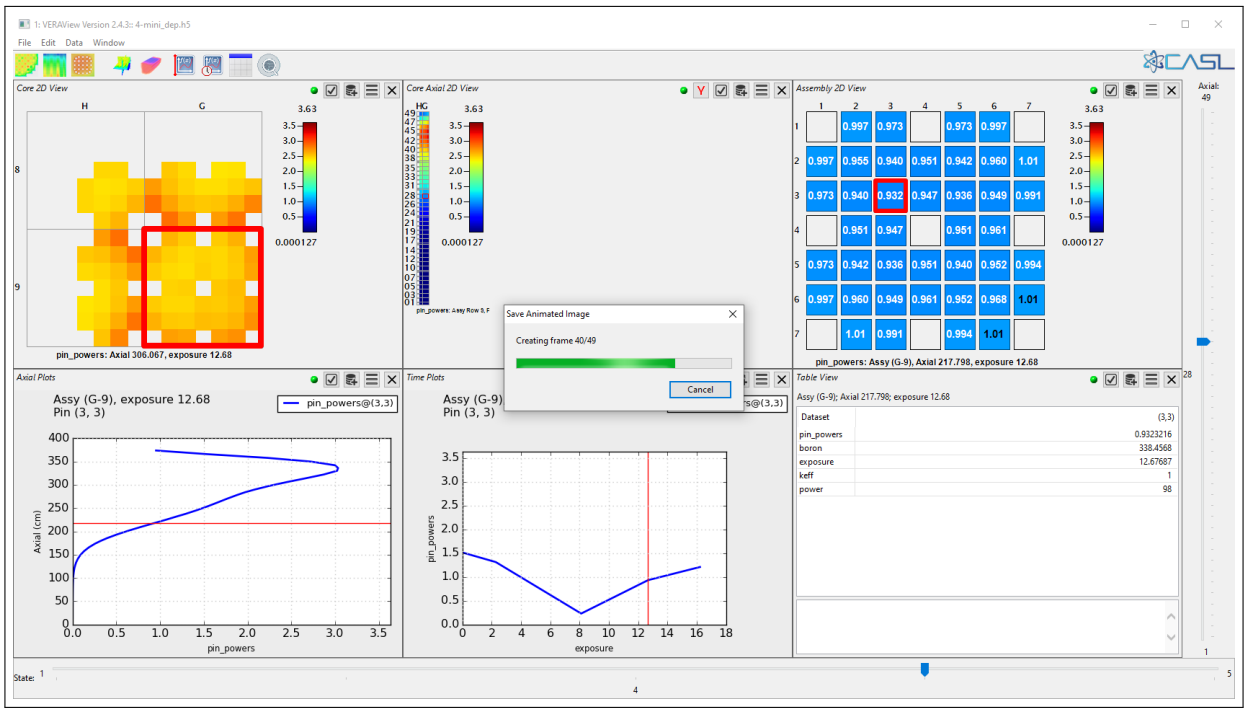
1. In the Core 2D View widget, click on the "Widget Functions" button. Hover over "Save Animated Image" and the click on "Pin Axial Levels".



2. In the Animation Options window, select the desired time per frame in seconds and choose whether the red selection outline should be included in the animation. Select “OK” and then save the gif in the desired location.



3. The animation will then be saved and can be viewed.



4. CONCLUSION

The software requirements determined in Section 1 provide clear guidance concerning the specific capabilities that VERAView is required to demonstrate. Those capabilities were demonstrated completely through the established test plan.

REFERENCES

[1] A. Godfrey. VERA Core Physics Benchmark Progression Problem Specifications. Technical Report CASL-U-2012-0131-004, Oak Ridge National Laboratory, 2014.