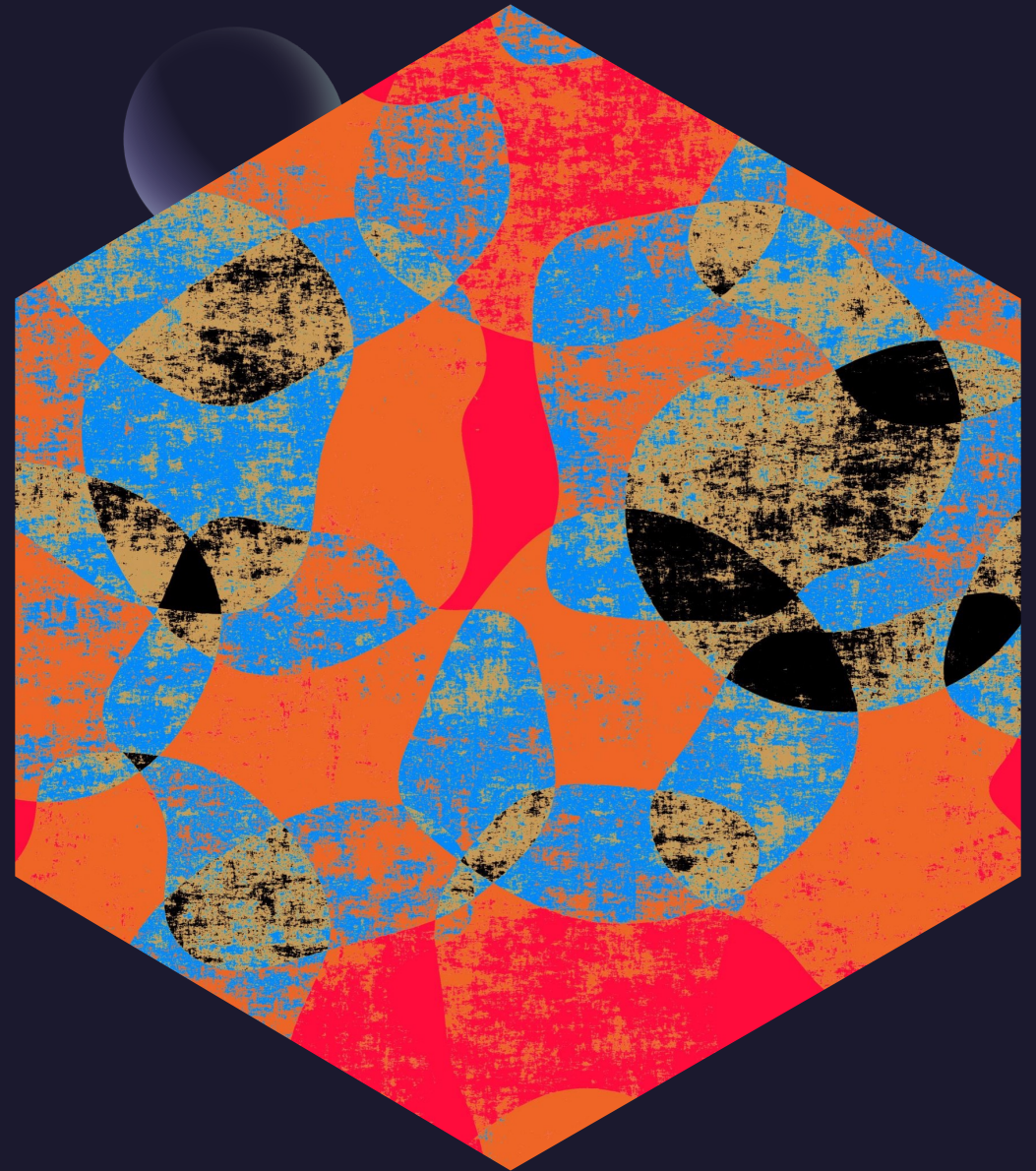


Visualisation in Paraview

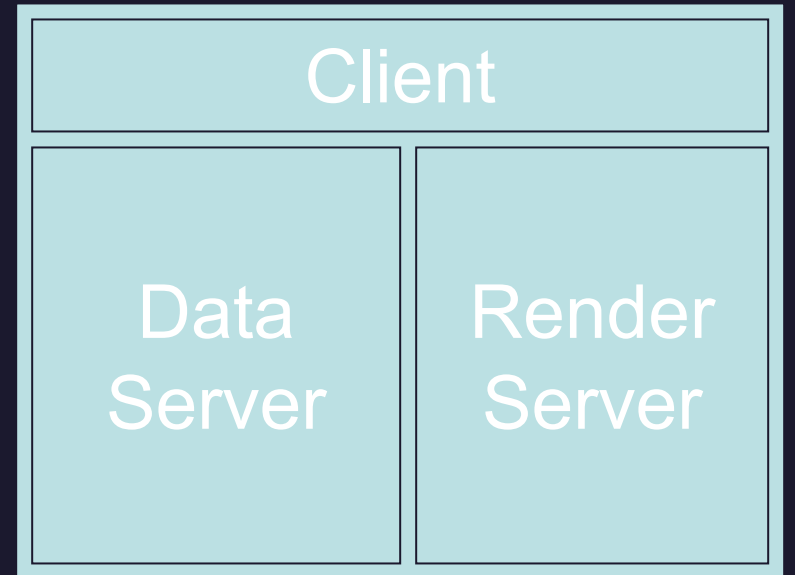


About & Installation

- Paraview is an open-source, scalable, multi-platform visualization application.
- Install from the website: <http://www.paraview.org>

If you wish to visualize the data from a cluster

- Make sure you download the same version on your PC, as the Paraview module installed on the cluster you are using.
- You should have *direct ssh* access to a cluster.



Client-server mode: Add a server

- Open Paraview on your local machine and add a server by clicking on



Name: Pick a name

Server type: Client/Server

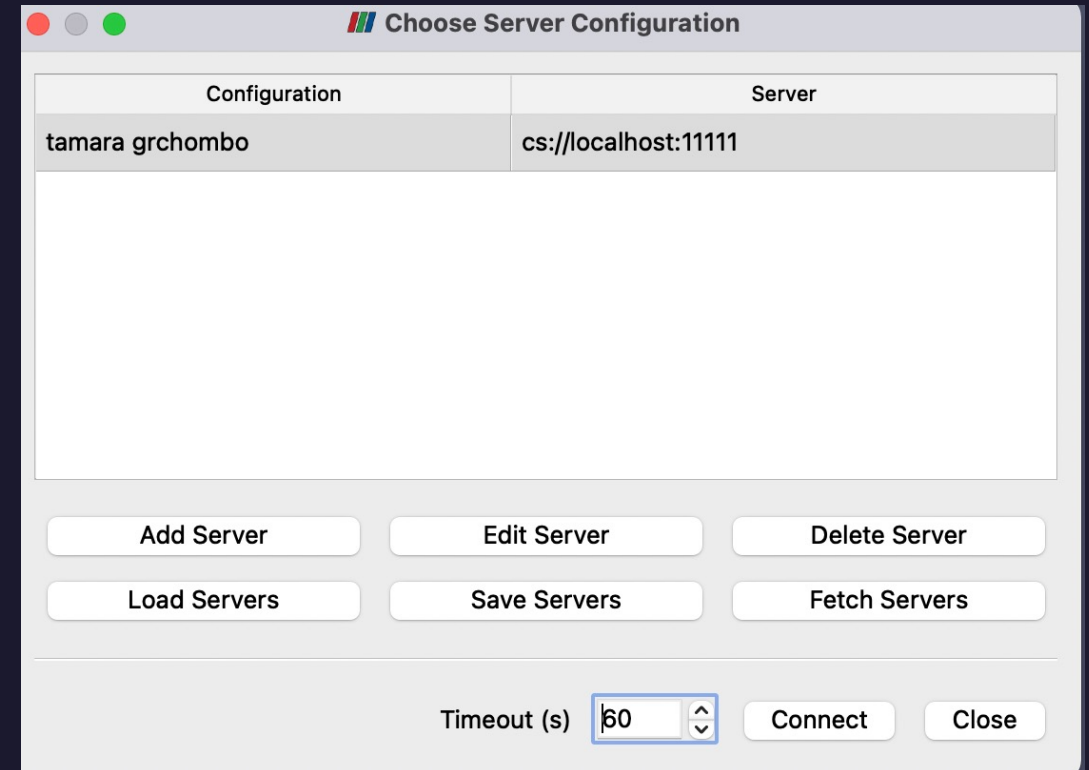
Host: localhost

Port: 11111

- Click Configure.
- On the next screen, set:

Startup Type: Manual

- Accept by clicking Save and Close.



Client-server mode: Connect Part I

- Ssh into your chosen cluster and load Paraview module e.g. **module load paraview/5.6.0/upstream**
- Start a Paraview server by running **pvserver**
- Your screen will look as though it has 'hung' .

```
(base) te307@mn01:~> module load paraview/5.6.0/upstream
(base) te307@mn01:~> OSPRAY_THREADS=8 KNOB_MAX_WORKER_THREADS=8 pvserver

Waiting for client...
Connection URL: cs://mn01:11111
Accepting connection(s): mn01:11111
█
```

NOTE:

- Sometimes to avoid using OpenGL, need to specify one of the mesa flags
- For large datasets, it is a good idea to submit a job to the queue and run pvserver with a modified environment

--mesa-swr-avx2 or **--mesa-swr**

OSPRAY_THREADS=8 KNOB_MAX_WORKER_THREADS=8 pvserver

- Sometimes someone else would be on default port 11111, you can specify your own by

pvserver --server-port=<your_port> (e.g. <your_port>=11112)

Client-server mode: Connect Part II

- Open a new Terminal window on your local machine.
- Tunnel to your cluster, by running in the new terminal window


```
ssh -NL 11111:localhost:<your_port> account@computer.ac.uk
```

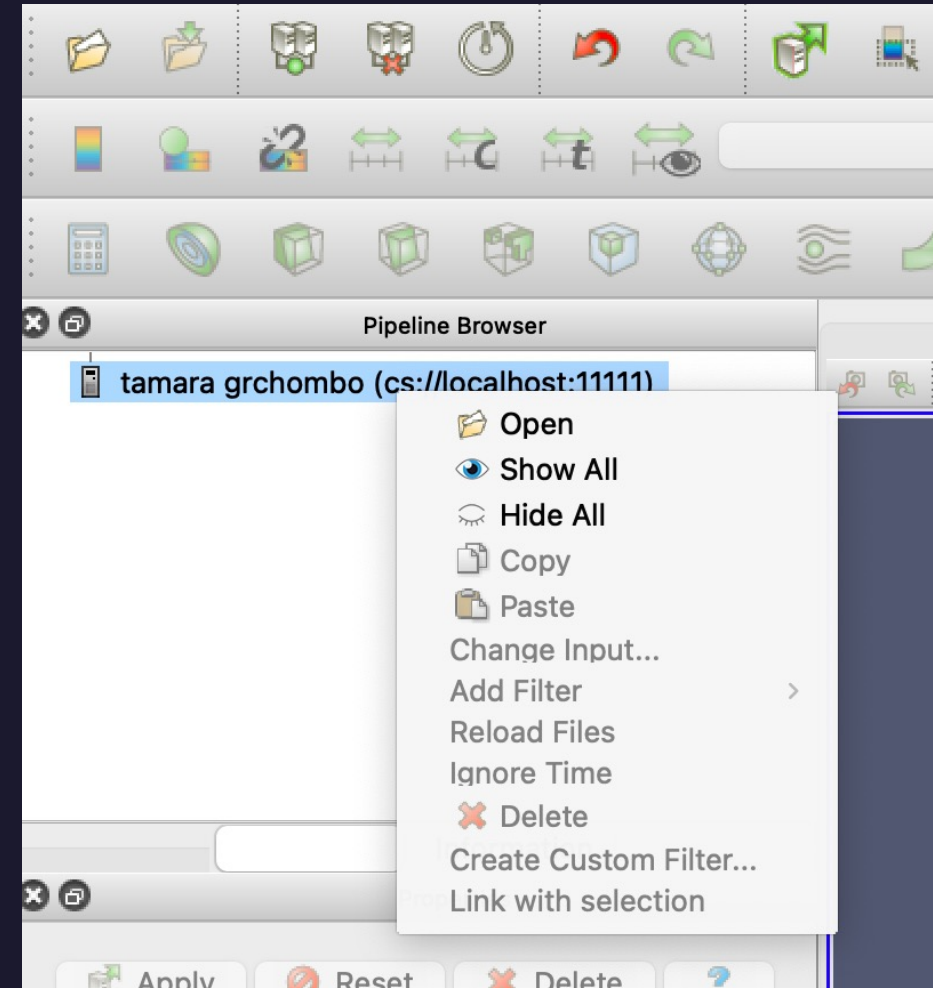
- **<your_port>** is what you specified in the pvserver port command or if using default, then **<your_port> = 11111**
- Again, there will be no prompt.

```
MBP-MacBook:~ macbookpro$ ssh -NL 11111:localhost:11111 te307@fawcett.maths.cam.ac.uk
```



Basic Usage: Open a file


- Connect to the added server as described in the previous slides.
- To connect click 
- Right click on the sever in the Pipeline Browser on the left to open a file from the cluster (e.g. hdf5 plot files from GRChombo output).
- Choose to open plot files using VisItChomboReader in the next window that appears.

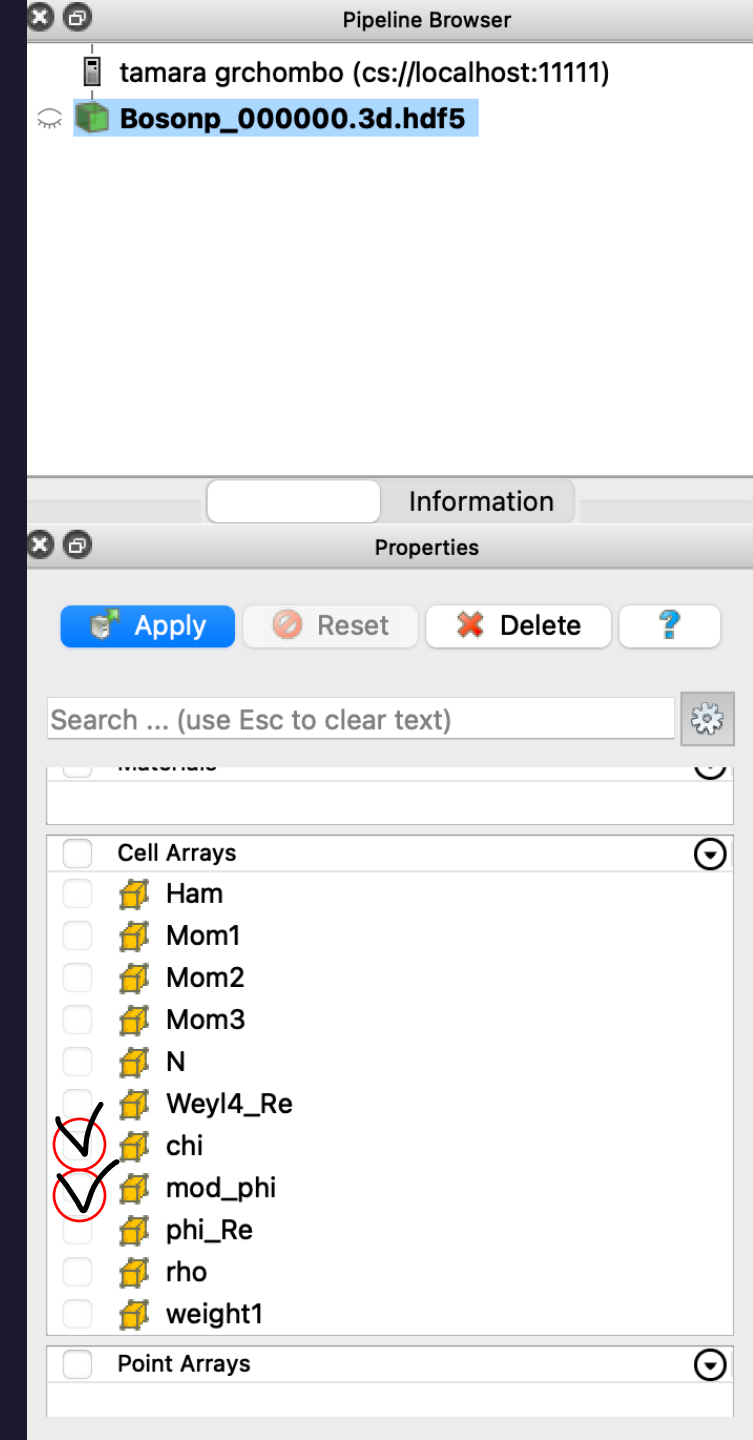


Basic Usage: Variables

- Tick variables to be plotted in Properties window on the left.

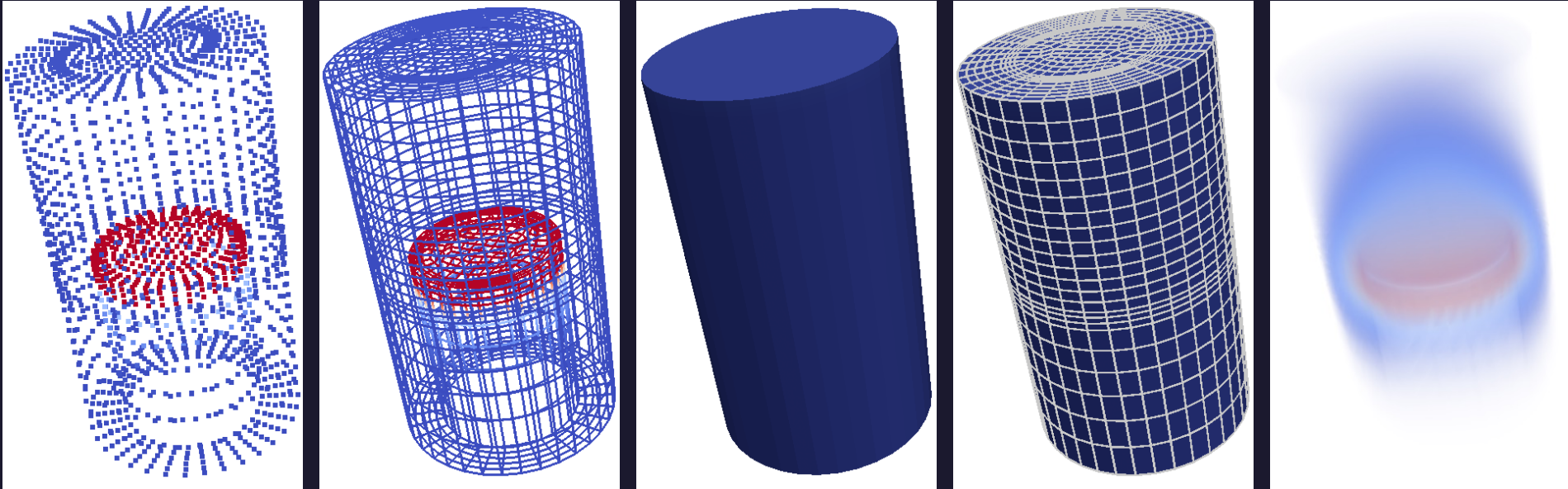
- **NOTE**

To see anything being plotted, click Apply button. When applying filters, click **Apply** to see any changes. You can enable auto application of changes by clicking 

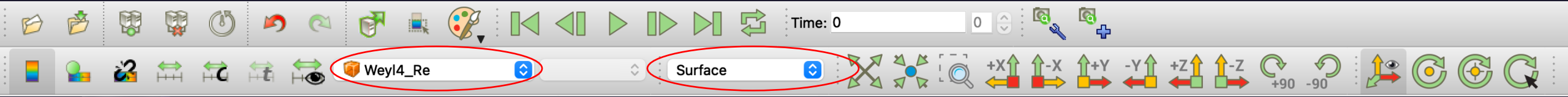


Geometry representation

- For the plotted variable, choose a suitable geometry representation, e.g. surface.



Points Wireframe Surface Surface with Edges Volume



Variable

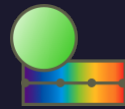
Geometry representation

Some useful 'buttons'

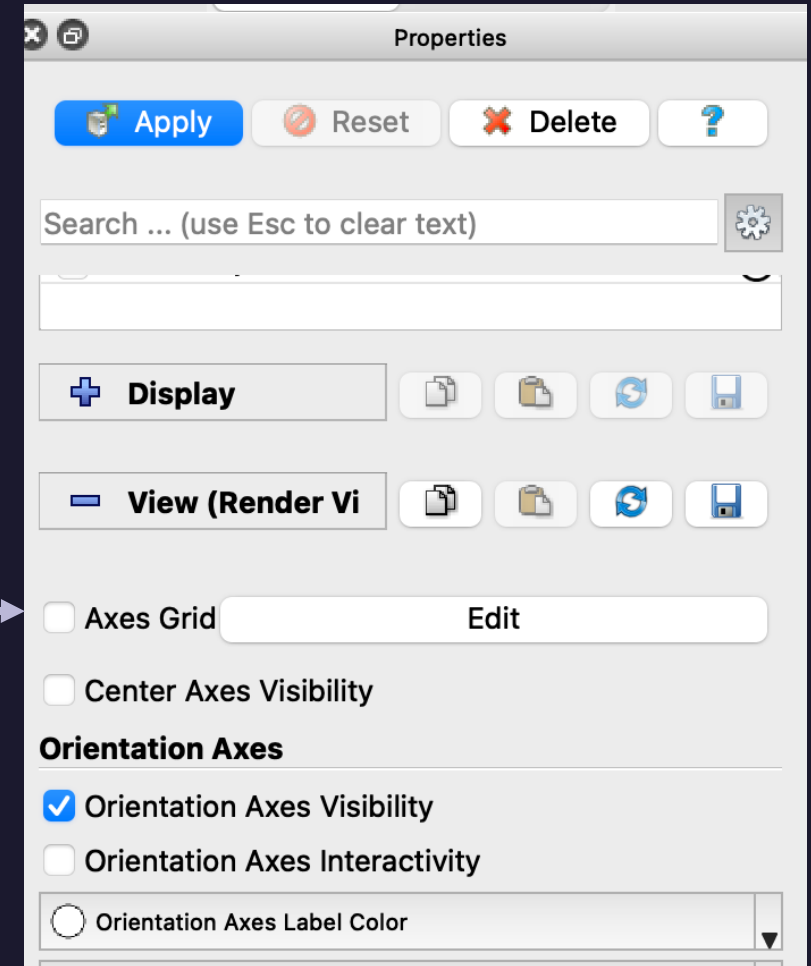
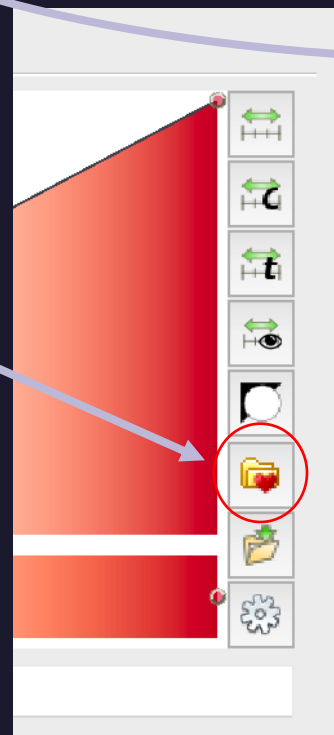
In properties window on the left

- Axes grid
- Shade
- Enable OSPRay

Edit Color Map button



- Control how data mapped to colours
- Choose preset to change the colour scheme



Common Filters



Calculator



Contour



Clip



Slice



Threshold



Extract Subset



Glyph



Stream Tracer



Warp (vector)



Group Datasets



Extract Level



Filters potentially useful for NR...

- Slice 
- Countour 
- Cell Data To Point Data (Filters -> Alphabetical -> Cell Data To Point Data)
 - Plot Over Line 
 - Find Data (Edit -> Find Data)
 - Extract Level 



Shortcut when looking for filters

On Mac

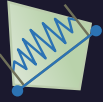

Option + Space

Everywhere else

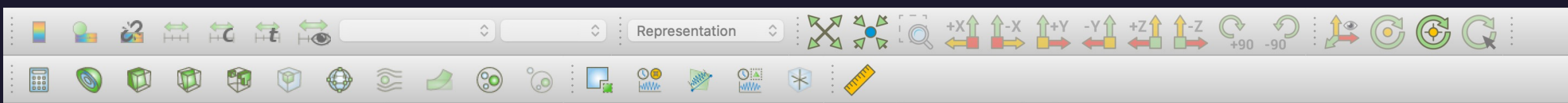
Control + Tab



Example: Plot Over Line

- Choose variable to be plotted.
- Choose appropriate geometry representation .
- Choose **Plot Over Line** by clicking . The icon shows a green square with a blue wavy line and a blue line segment, with small blue dots at the ends of the line segment.
- Choose starting point (**Point1**) and end point (**Point2**) along which the variable is plotted in the Properties window on the left.
- The graph will pop up in the additional window (you might need to split the window horizontally into two for this to happen; for this click on ).





Pipeline Browser

- tamara grchombo (cs://localhost:11111)
 - Bosonp_000000.3d.hdf5
 - PlotOverLine1**

Information

Properties

Apply Reset Delete ?

Search ... (use Esc to clear text)

Properties (Plot) [Icons]

Probe Type: High Resolution Line Source

Line Parameters

Length: 20

Show Line

Point1	500	512	0
Point2	520	512	0

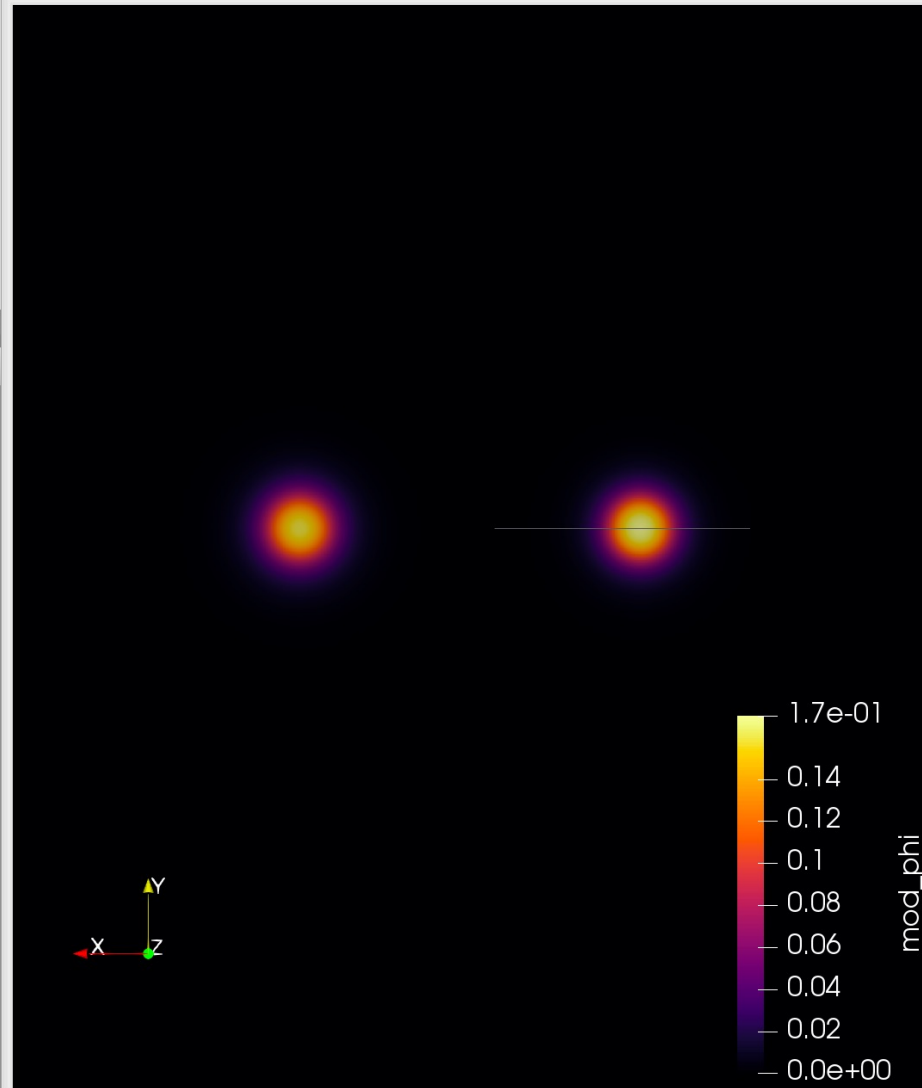
Note: Use 'P' to place alternating points on mesh or 'Cmd+P' to snap to the closest mesh point. Use '1'/'Cmd+1' for point 1 and '2'/'Cmd+2' for point 2.

X Axis Y Axis Z Axis

Center on Bounds

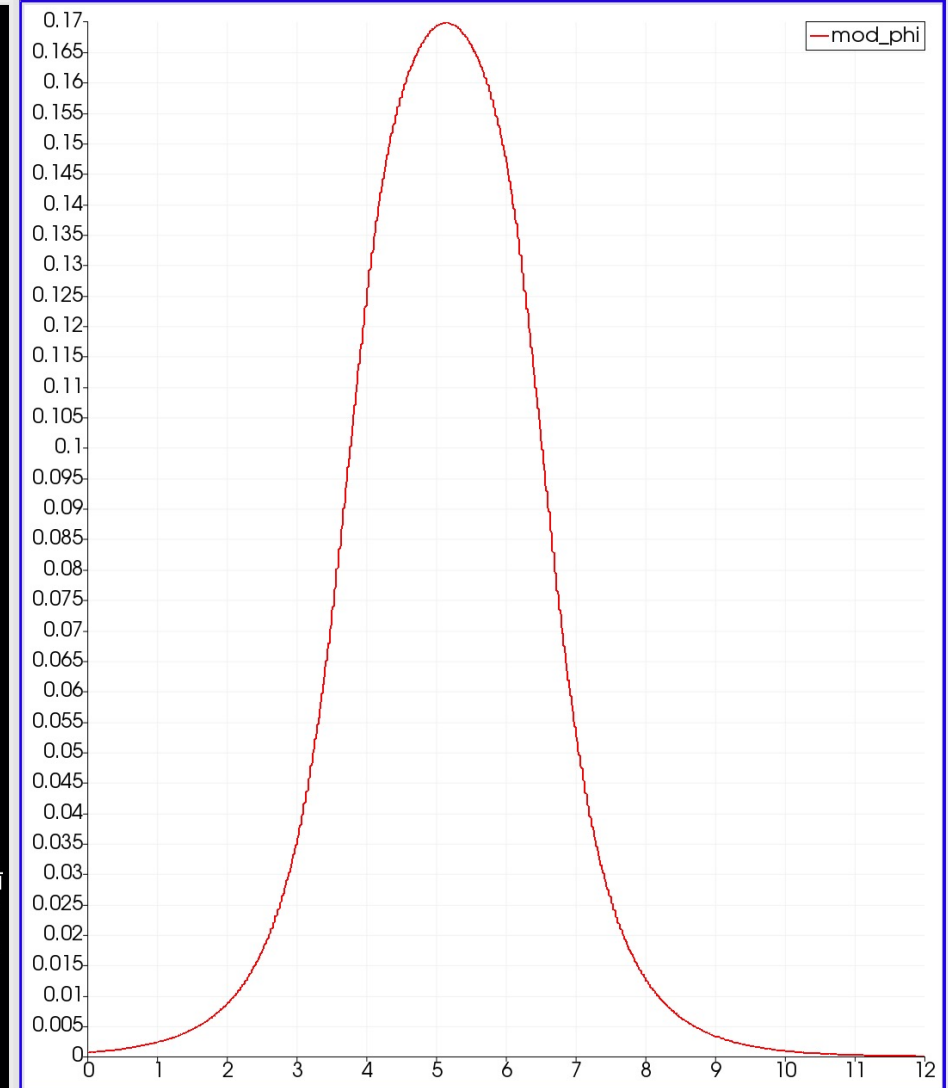
RenderView1

3D [Icons]




LineChartView1

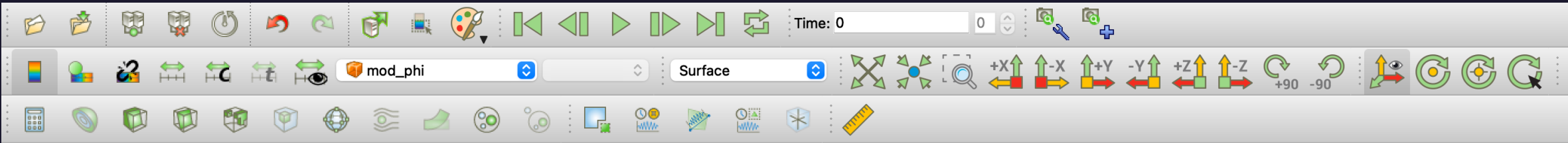
[Icons]



Example: Slice

- Choose variable to be plotted.
- Click on **Slice** 
- Choose appropriate variable and choose geometry representation to be **Surface**
- Choose appropriate **Origin** and **Normal** in the Properties window.
- Tick **Crinkle data**
- Click **Apply**





Pipeline Browser

- tamara grchombo (cs://localhost:11111)
- Bosonp_000000.3d.hdf5
- Slice1**

Information

Properties

Apply Reset Delete ?

Search ... (use Esc to clear text)

Properties (Slice1)

Slice Type **Plane**

Plane Parameters

Show Plane

Origin 512 512 0

Normal 0 0 1

Note: Use 'P' to pick 'Origin' on mesh or 'Ctrl+P' to mesh point

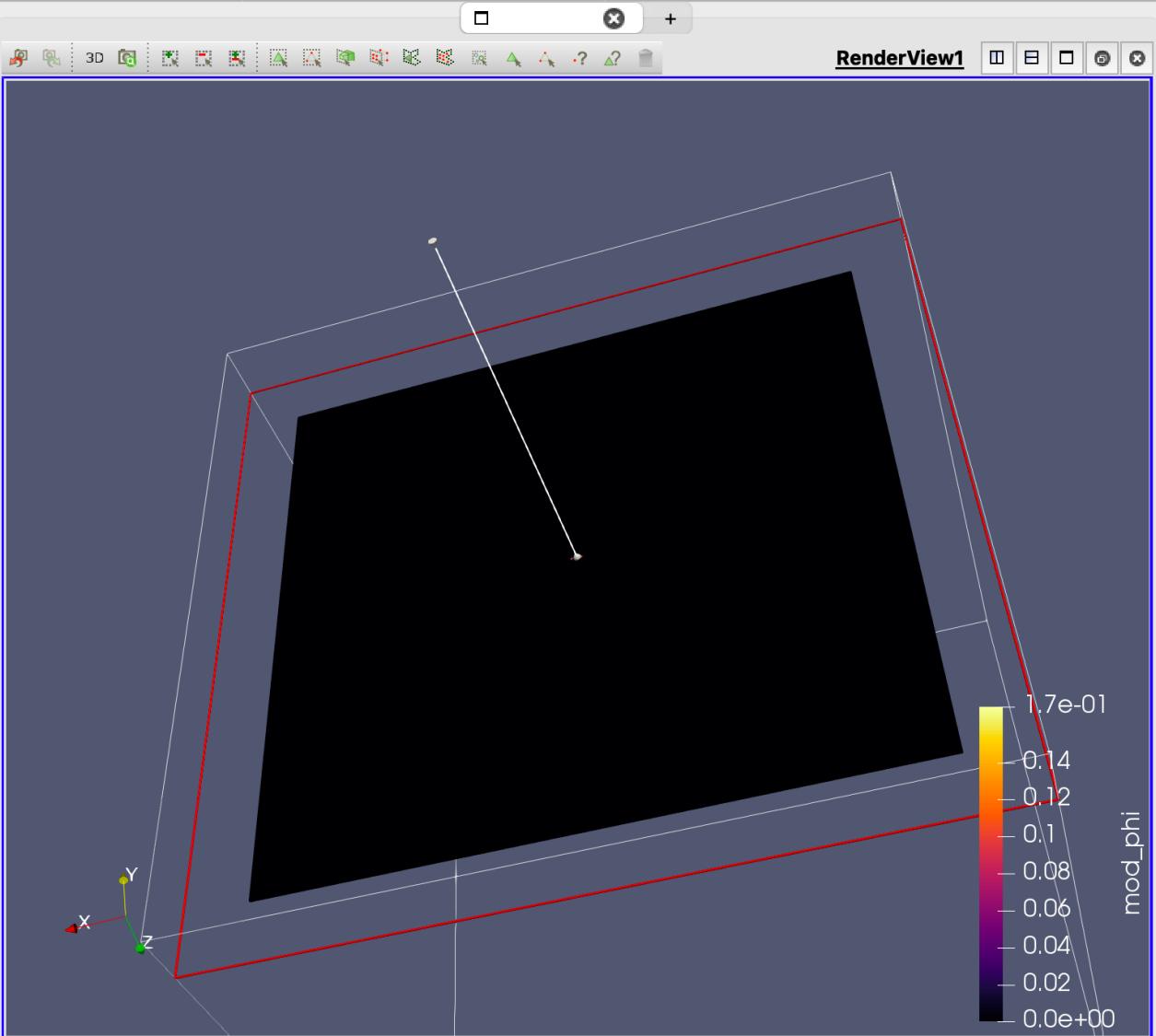
X Normal Came

Y Normal

Z Normal

Reset Camera to Normal

Reset to Data Bounds



Color Map Editor

Search ... (use Esc to clear text)

Array Name: mod_phi

Automatic

Rescale Range **Grow and update on 'Apply'** Mode

Interpret Values As Categories

Rescale On Visibility Change

Mapping Data

Data: 0

Use log scale when mapping data to colors

Enable opacity mapping for surfaces

Use log scale when mapping data to opacity

Color Mapping Parameters

Color Space **Diverging**

Nan Color

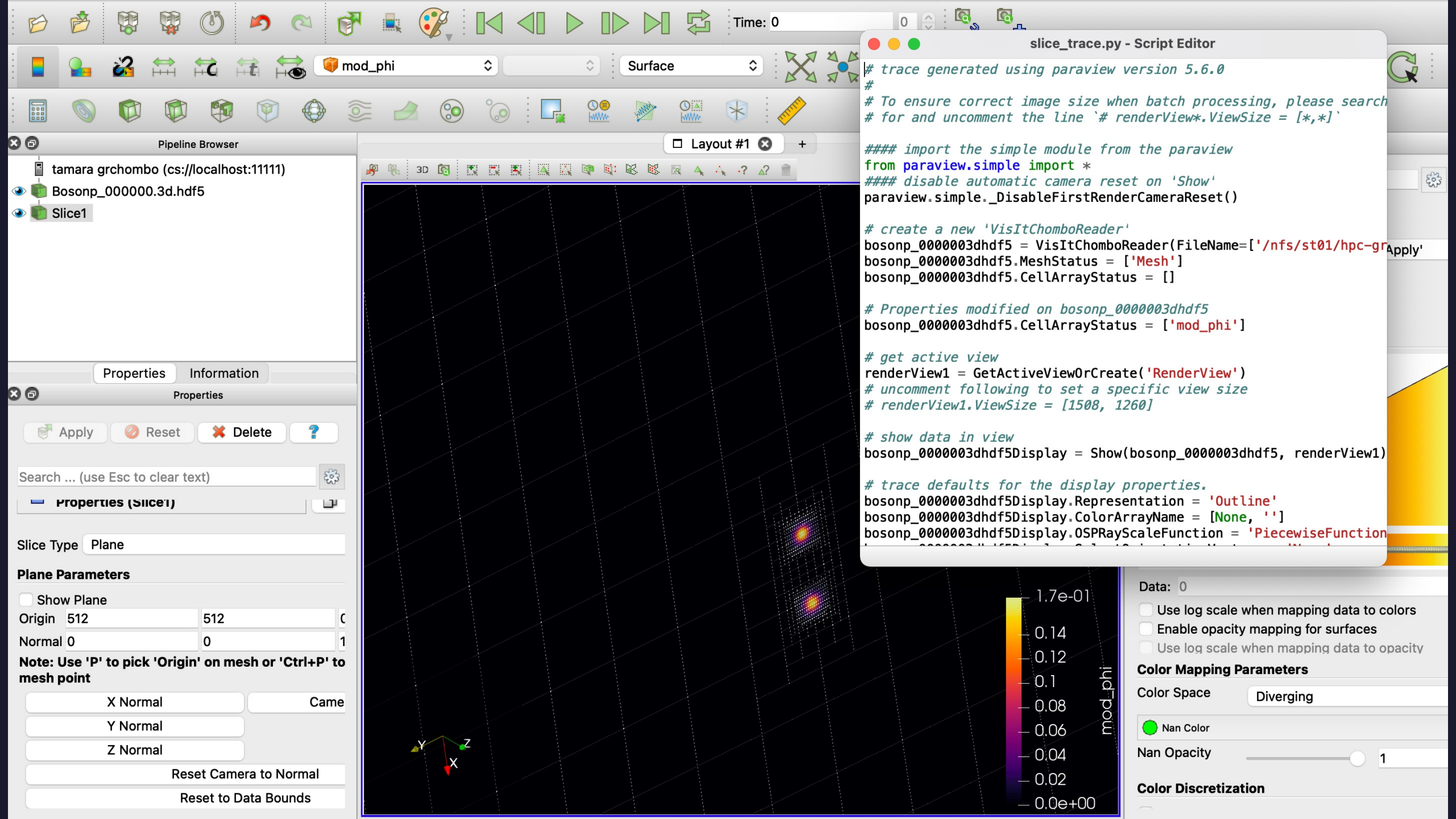
Nan Opacity **1**

Color Discretization

Python with Paraview

- Best way to learn how it work is to use **Trace**
- The **Paraview GUI's Python Trace** feature allows one to very easily create Python scripts for many common tasks.
- Go to **Tools -> Start Trace**
- Open file, choose variables, change colors, apply as many filters as you wish.
- When done a Python script will be generated when you go **Tools -> Stop Trace**
- If you load data in the same way all the time and use filters, you can save the script as a **Macro** by going to **File -> Save as Macro**, which can then be activated in the **Macros menu**.





```
slice_trace.py - Script Editor
# trace generated using paraview version 5.6.0
#
# To ensure correct image size when batch processing, please search
# for and uncomment the line `# renderView*.ViewSize = [*,*]`

#### import the simple module from the paraview
from paraview.simple import *
#### disable automatic camera reset on 'Show'
paraview.simple._DisableFirstRenderCameraReset()

# create a new 'VisItChomboReader'
bosonp_0000003dhdf5 = VisItChomboReader(FileName=['/nfs/st01/hpc-gr...Apply'
bosonp_0000003dhdf5.MeshStatus = ['Mesh']
bosonp_0000003dhdf5.CellArrayStatus = []

# Properties modified on bosonp_0000003dhdf5
bosonp_0000003dhdf5.CellArrayStatus = ['mod_phi']

# get active view
renderView1 = GetActiveViewOrCreate('RenderView')
# uncomment following to set a specific view size
# renderView1.ViewSize = [1508, 1260]

# show data in view
bosonp_0000003dhdf5Display = Show(bosonp_0000003dhdf5, renderView1)

# trace defaults for the display properties.
bosonp_0000003dhdf5Display.Representation = 'Outline'
bosonp_0000003dhdf5Display.ColorArrayName = [None, '']
bosonp_0000003dhdf5Display.OSPRayScaleFunction = 'PiecewiseFunction'
```

Pipeline Browser

- tamara grchombo (cs://localhost:11111)
- Bosonp_000000.3d.hdf5
- Slice1

Properties

Apply Reset Delete ?

Search ... (use Esc to clear text)

Properties (Slice1)

Slice Type Plane

Plane Parameters

Show Plane

Origin 512 512 0

Normal 0 0 1

Note: Use 'P' to pick 'Origin' on mesh or 'Ctrl+P' to mesh point

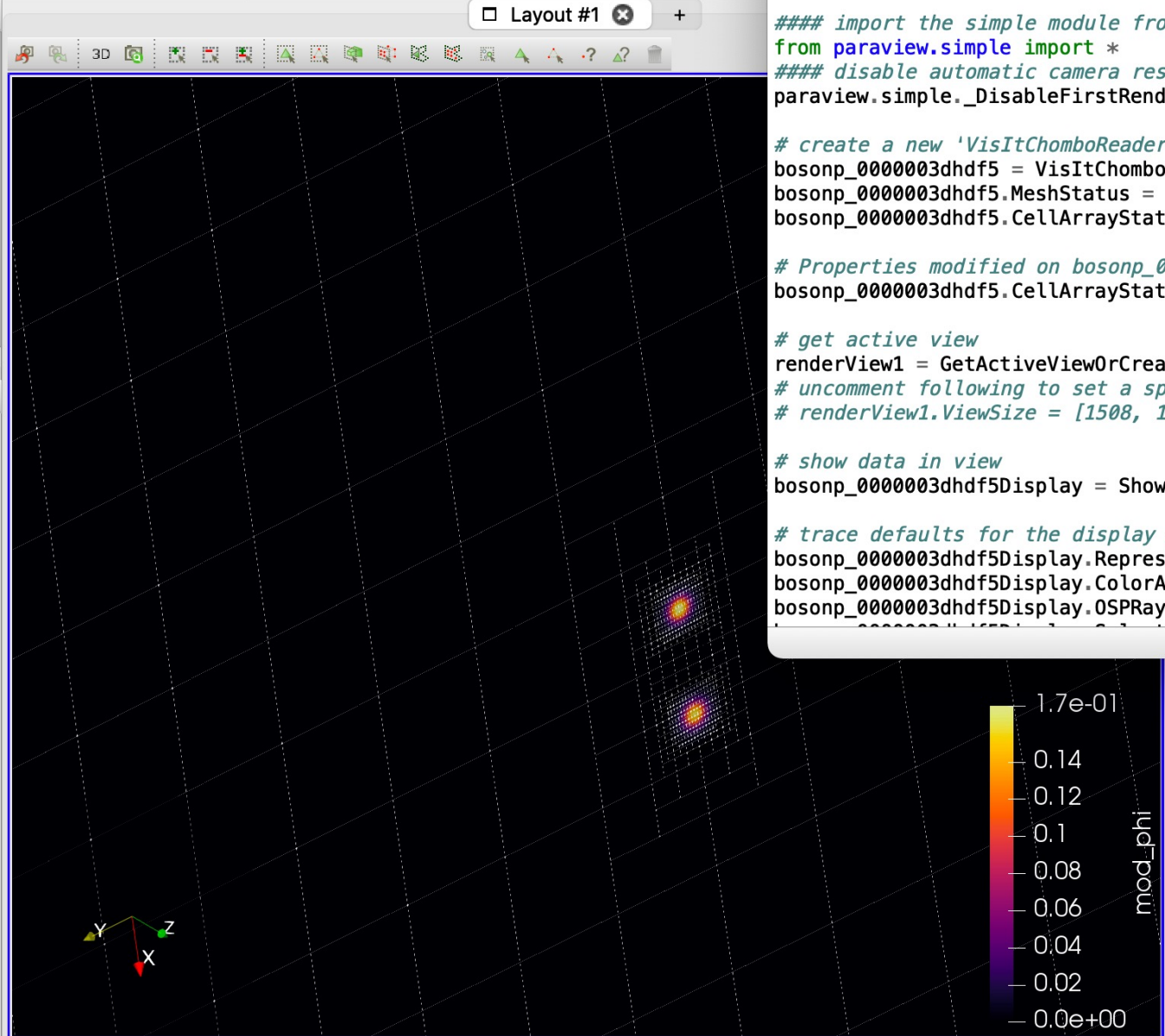
X Normal Came

Y Normal

Z Normal

Reset Camera to Normal

Reset to Data Bounds



Data: 0

Use log scale when mapping data to colors

Enable opacity mapping for surfaces

Use log scale when mapping data to opacity

Color Mapping Parameters

Color Space Diverging

Nan Color

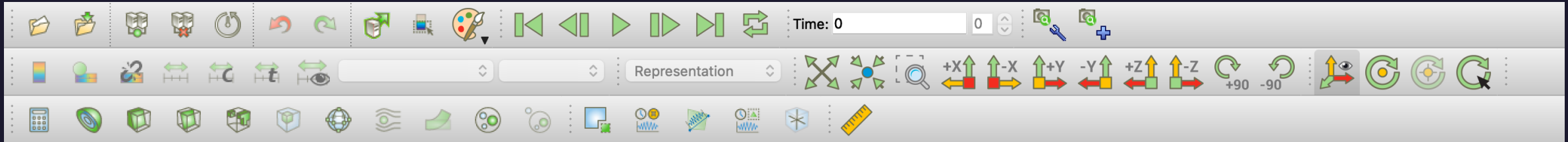
Nan Opacity 1

Color Discretization

Example: Python script with ExtractSelection

- Choose a variable to be plotted.
- Go to **Filters -> Alphabetical -> Cell Data To Point Data**
- Click **Apply**
- Choose the variable to be plotted and the geometry representation.
- Go to **View -> Python Shell**
- Python shell will pop up where you can type in the code now.

```
>> reader = GetActiveSource()
>> selection=SelectPoints()
>> election.QueryString= 'mod_phi>0.1'
>> selection.FieldType = 'POINT'
>> selection.UpdatePipelineInformation()
>> mySelection = ExtractSelection(Input=reader, Selection=selection)
<>> mySelection.UpdatePipeline()
```



Pipeline Browser

- tamara grchombo (cs://localhost:11111)
- Bosonp_000000.3d.hdf5
- CellDatatoPointData1
- ExtractSelection1**

Information

Properties

Apply Reset Delete ?

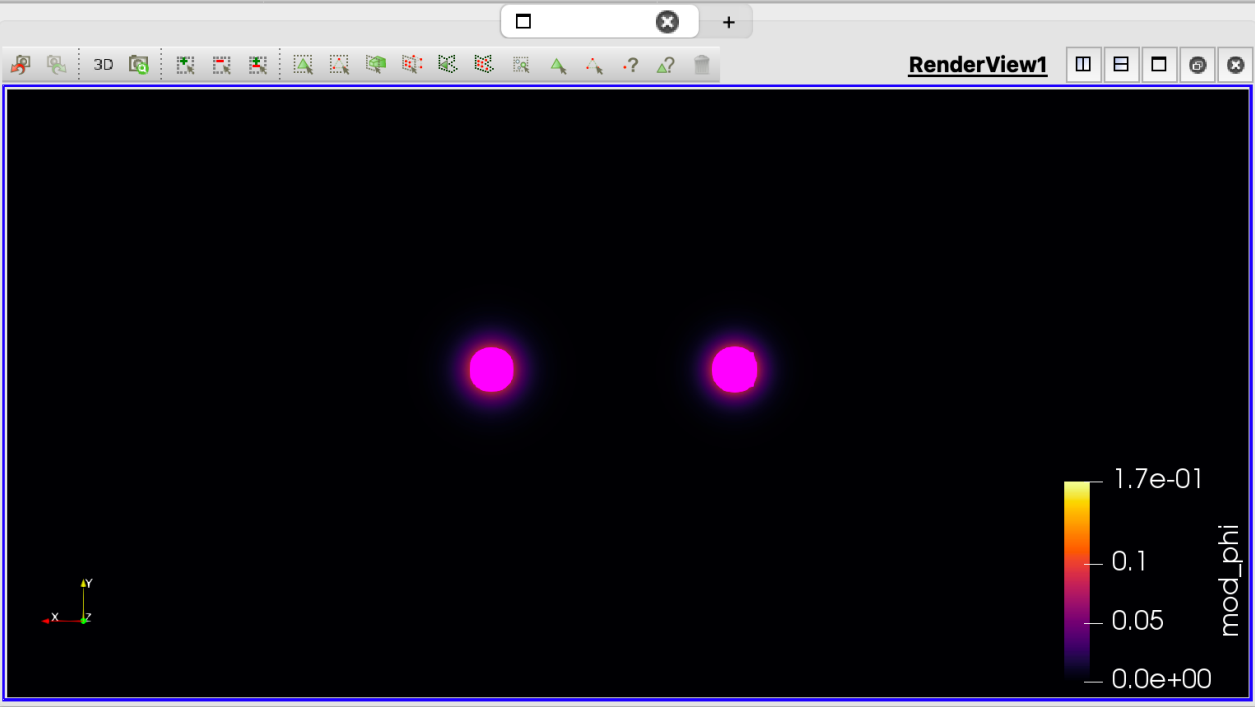
Search ... (use Esc to clear text)

Properties (Extr) [Icons]

Copy Active Selection

Copied Selection

Type: Query
mod_phi>0.1
Elements: Points



Python Shell

```
>>> reader = GetActiveSource()
>>> selection=SelectPoints()
>>> selection.QueryString='mod_phi>0.1'
>>> selection.FieldType='POINT'
>>> selection.UpdatePipelineInformation()
>>> mySelection = ExtractSelection(Input=reader, Selection=selection)
>>> mySelection.UpdatePipeline()
>>>
```

Run Script Clear Reset

Color Map Editor

Search ... (use Esc to clear text)

Array Name: <none>

Render Views

Useful resources

- PDF manual with examples

<https://www.mn.uio.no/astro/english/services/it/help/visualization/paraview/paraviewtutorial-5.8.1.pdf>

- Manual pages for different versions

<https://kitware.github.io/paraview-docs/latest/python/index.html>

- Amelia's instructions on how to connect to server (example on Fawcett cluster)

https://github.com/GRChombo/GRChombo/tree/training/fawcett_amelia

