

The TAMU Visualization Portal

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TAMU HPRC

September 12, 2017

HPRC Short Course – Fall 2017



Outline

- Introduction to TAMU Visualization Portal
- Using the portal
- Introduction to ParaView

The TAMU Visualization Portal

- What is it?
- Who can use it?
- What's the benefit of using it?
- Is it free?
- What applications can be used with it?

The TAMU Visualization Portal

- A web service for submitting and viewing remote visualization jobs
- Ada users with our permission
- It supports major web browsers (IE, Firefox, Chrome) and can be accessed anywhere with Internet connection (VPN is needed from off-campus connections)
- It is free, but Ada allocations are charged
- Any GUI applications that support OpenGL can use the portal, including ABAQUS, ANSYS, COMSOL, Paraview, Matlab GUI, etc.

Workflow of the Portal

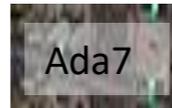
<https://ada7.tamu.edu/vis-portal>



End user

1. Submission request

visualization gateway



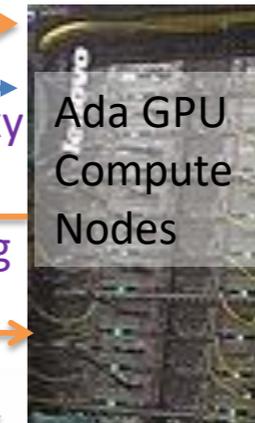
2. vncjob.submit

5. Gateway obtains the proxy port number

6. Set up port forwarding to the proxy port

7. Connect to vncserver

3. The job runs on a compute node with GPU



4. The job starts a VNC server and a websockify proxy server

Ada cluster

Accessing the Visualization Portal

- Please request permission to access the portal by sending an email to help@hprc.tamu.edu
- If you are off-campus, please first login to the TAMU VPN
- Using a web-browser open <https://ada7.tamu.edu/vis-portal/>
- Please confirm the security exception to access the site
- Use your TAMU Net-ID and password to log into the portal.

<https://ada7.tamu.edu/vis-portal>

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Welcome to the Ada Remote Visualization Portal

The visualization portal is access-restricted. Please contact us at helpdesk@hprc.tamu.edu to request access to the portal.

Please login with your TAMU NetID and password.

NetID:

Password:

login

Enter your TAMU Net-ID

For New Remote Visualization Users

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Home

Jobs

Help

You are logged in as pingluo, [\[logout\]](#)

Friday, September 29, 2017

-
- You must set your VNC password at least once. Click "password" to set your VNC password.

Password

Set your VNC password

Ada Remote Visualization Portal

help@hprc.tamu.edu



Setting Your VNC Password

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Home Jobs Help

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Your VNC password **MUST NOT** be the same as your netid password.

Your VNC password must have at least 6 characters.

Password:

Re-type Password:

OK

Ada Remote Visualization Portal

help@hprc.tamu.edu



Submitting a Visualization Job

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[Home](#) [Jobs](#) [Help](#)

You are logged in as pingluo, [\[logout\]](#)

Friday, September 29, 2017

- Customize your job specifications in the form below.
- Select a preset remote desktop resolution closest to your desktop resolution.
- Email is needed only if you want to be informed when your job starts running.
- Job specifications cannot be changed after the job is submitted.

Remote desktop resolution: width x height

Number of CPU cores:

Memory size (between 2 to 250): GB

Email (optional):

Submit a visualization job.

-
- Your VNC password has been set. If you want to change it, click "password."

Change your VNC password

Submitting a Visualization Job

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Home Jobs Help

You are logged in as pingluo. [Logout](#) Tuesday, June 06, 2017

- Customize your job specifications in the form below.
- Select a preset remote desktop resolution closest to your desktop resolution.
- Email is needed only if you want to be informed when your job starts running.
- Job specifications cannot be changed after the job is submitted.

Remote desktop resolution: width x height

Number of CPU cores:

Memory size (between 2 to 250): GB

Email (optional):

Submit a visualization job.

• Your VNC password has been set. If you change it, click "password."

Change your VNC password

Ada Remote Visualization Portal help@hprc.tamu.edu

Remote desktop resolution: width x height

Number of CPU cores:

Memory size (between 2 to 250): GB

Email (optional):

Submit a visualization job.

- Your VNC password has been set. If you

1024x768 ▼

1024x768

1280x960

1280x1024

1600x1024

1920x1080

2048x1280

2560x1440

3200x1800

3840x2160

4096x2304

4500x3000

Submitting a Visualization Job

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Home Jobs Help

You are logged in as pingluo, [\[logout\]](#)

ada7.tamu.edu says:
You job has been submitted.

OK

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Friday, September 29, 2017

- Customize your job specifications in the form below.
- Select a preset remote desktop resolution closest to your desktop resolution.
- Email is needed only if you want to be informed when your job starts running.
- Job specifications cannot be changed after the job is submitted.

***Your usage will
be charged!***

Remote desktop resolution: width x height

Number of CPU cores:

Memory size (between 2 to 250): GB

Email (optional):

Submit a visualization job.

The Job Control Page

Home Jobs Help

You are logged in as pingluo, [\[logout\]](#)

Friday, September 29, 2017

- When your job starts running, click **View** to connect to the VNC server. You will be redirected to a different page.
- Type your VNC password to login into the remote desktop.
- The GUI application must be launched with **vglrun** to use hardware acceleration.
- To go back to the main page, first toggle up the control bar at the leftmost center of your screen, and then click the disconnect button .
- Delete your job by clicking **Delete** when you are done with your visualization job.

Your job 6238264 is running.

Connect to the VNC server and start running GUI applications.

Delete the visualization job.

-
- Your VNC password has been set. If you want to change it, click "password."

Change your VNC password

Connecting to the VNC Server



Your connection is not secure

The owner of ada7.tamu.edu has configured their website improperly. To protect your information from being stolen, Firefox has not connected to this website.

[Learn more...](#)

Go Back

Advanced

Report errors like this to help Mozilla identify and block malicious sites

ada7.tamu.edu:10056 uses an invalid security certificate.

The certificate is not trusted because it is self-signed.
The certificate is not valid for the name ada7.tamu.edu.

Error code: [SEC_ERROR_UNKNOWN_ISSUER](#)

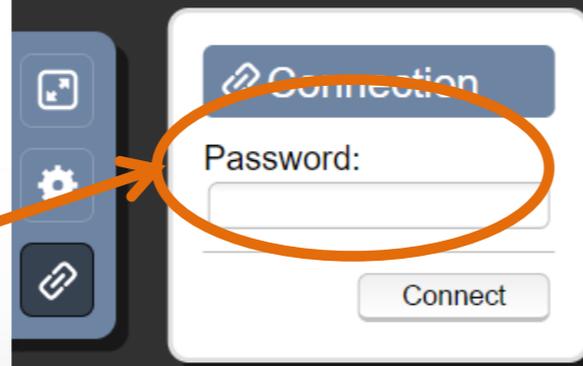
Add Exception...

***Add exception
and accept the
certificate***

Connecting to the VNC Server

TAMU
Vis-Portal

This is your VNC password, and not your TAMU NetID password

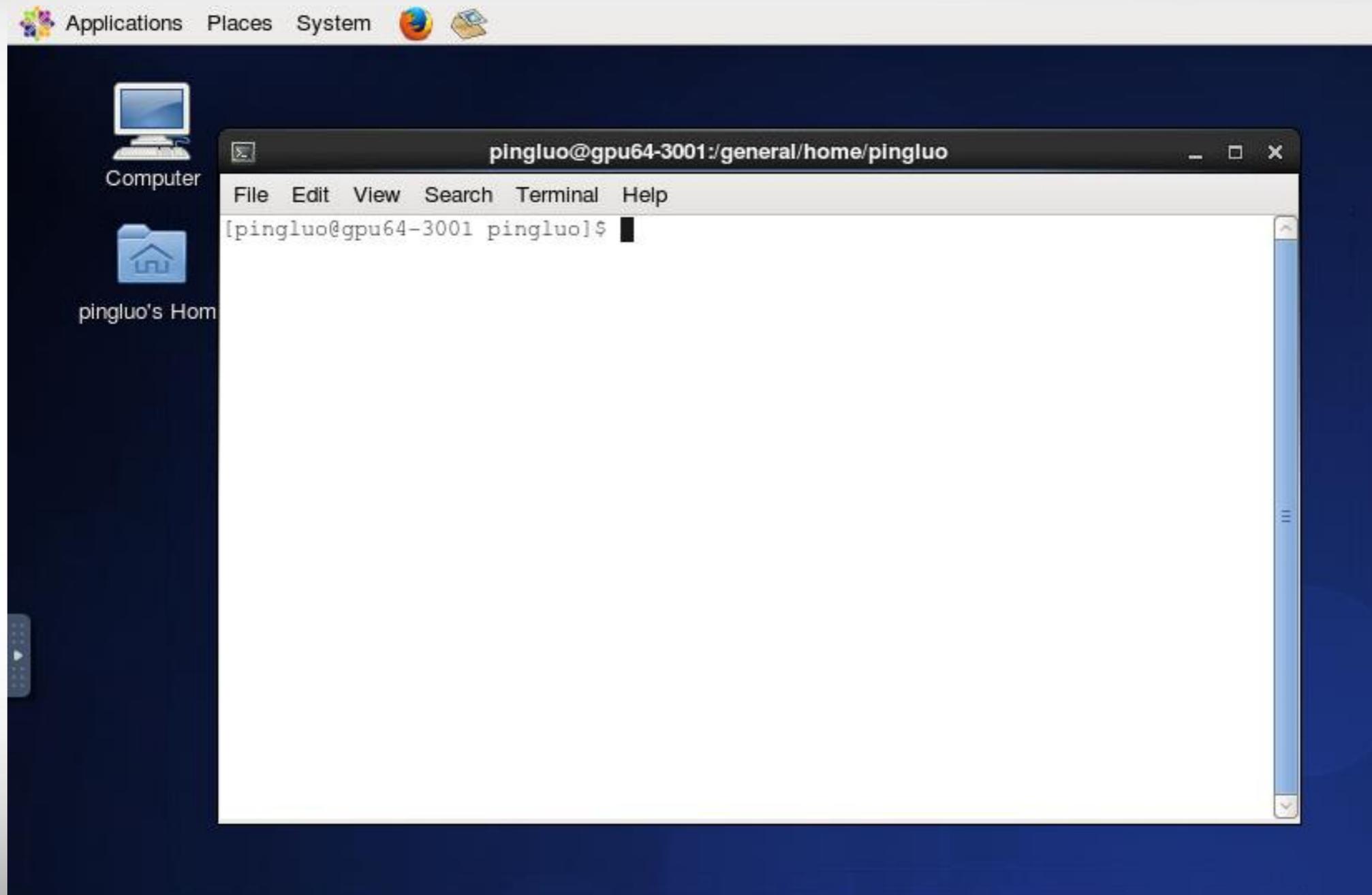


Connection

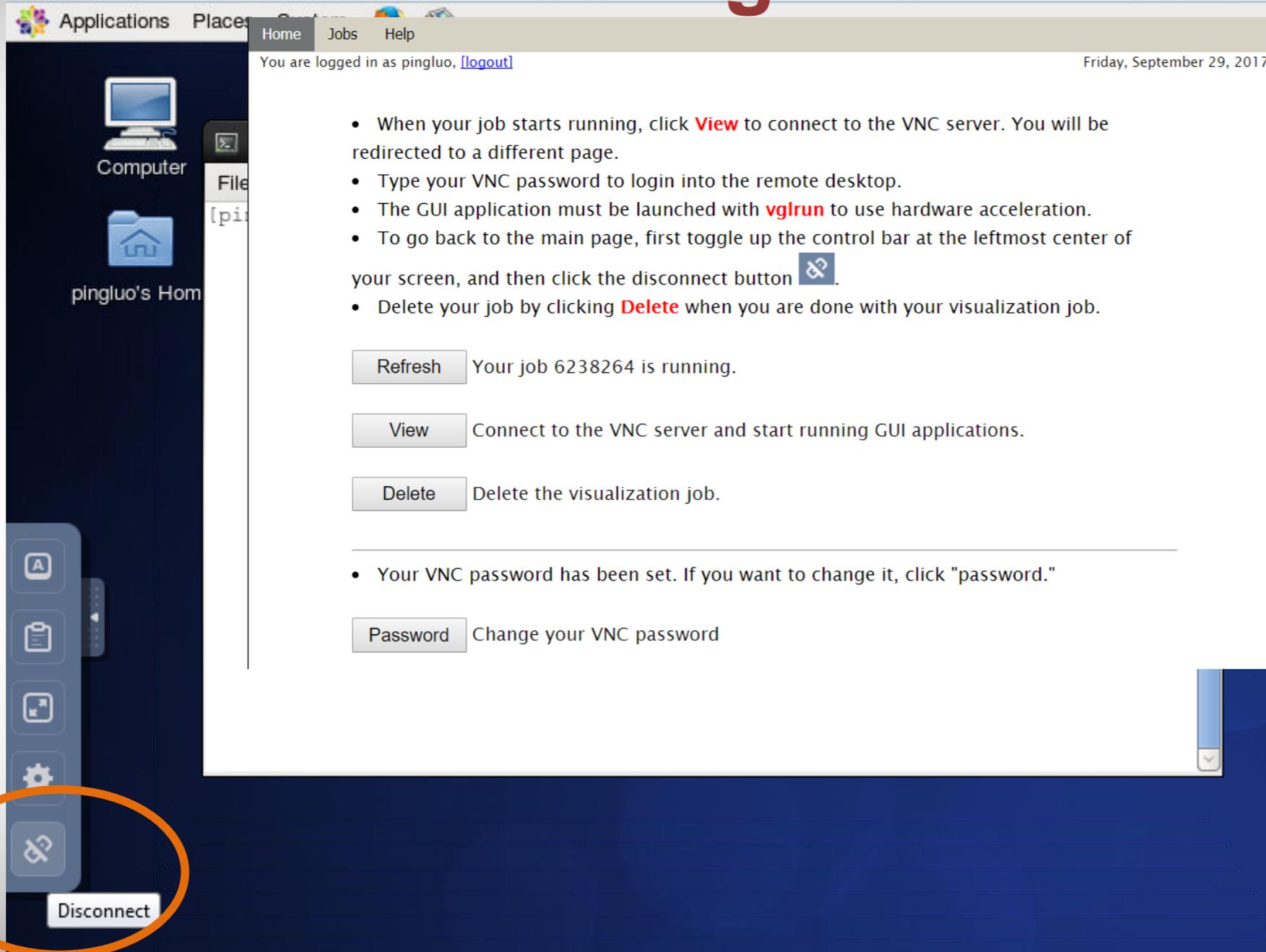
Password:

Connect

The Remote Desktop



Disconnecting From the VNC Server



The screenshot shows a web interface for managing VNC jobs. At the top, there are navigation tabs for 'Home', 'Jobs', and 'Help'. Below the navigation, it indicates the user is logged in as 'pingluo' with a 'logout' link and the date 'Friday, September 29, 2017'. The main content area contains instructions and controls for job management. A 'Disconnect' button is highlighted with an orange circle in the bottom left corner of the interface.

Applications Places Home Jobs Help

You are logged in as pingluo, [logout](#) Friday, September 29, 2017

- When your job starts running, click **View** to connect to the VNC server. You will be redirected to a different page.
- Type your VNC password to login into the remote desktop.
- The GUI application must be launched with **vglrun** to use hardware acceleration.
- To go back to the main page, first toggle up the control bar at the leftmost center of your screen, and then click the disconnect button .
- Delete your job by clicking **Delete** when you are done with your visualization job.

Your job 6238264 is running.

Connect to the VNC server and start running GUI applications.

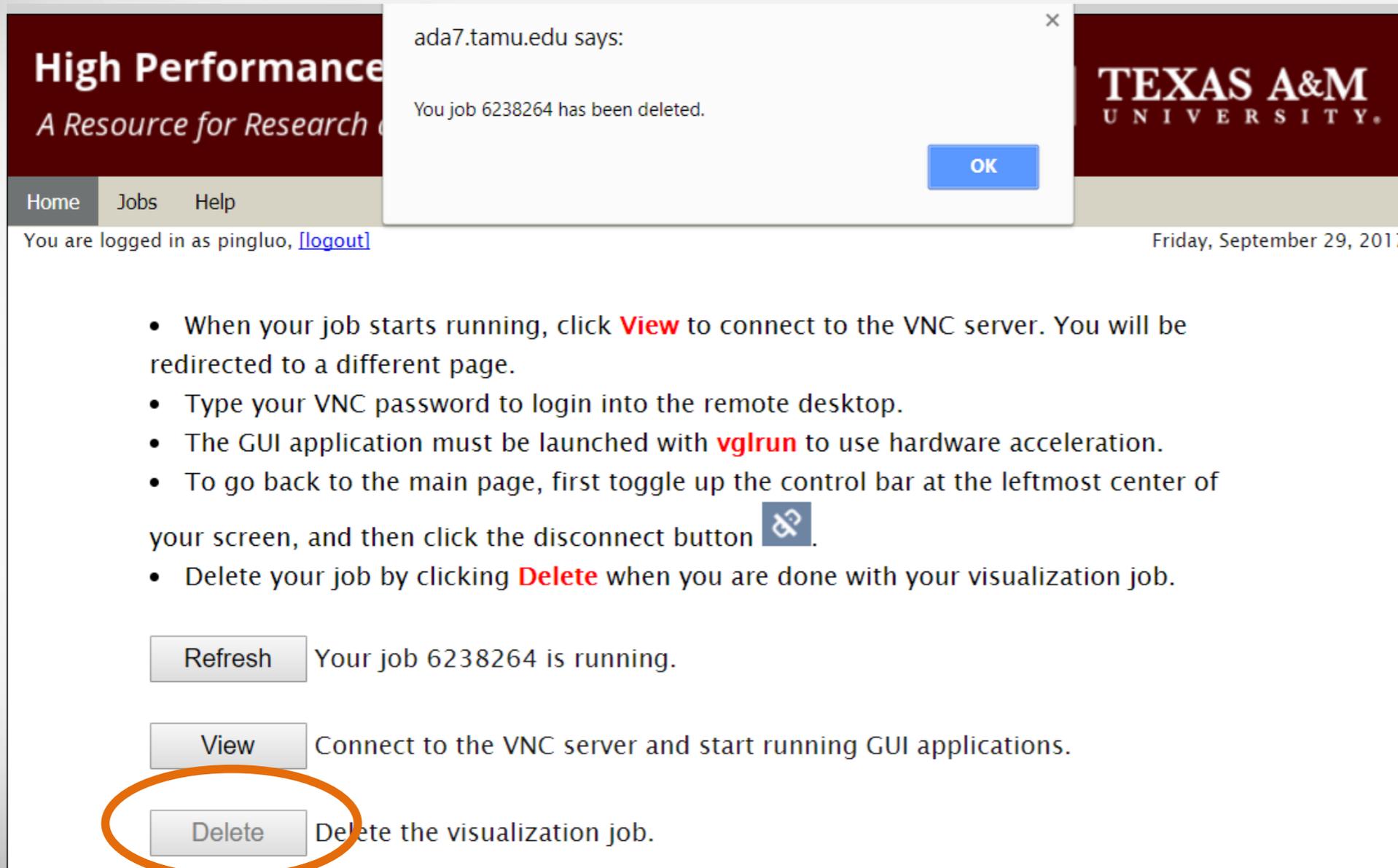
Delete the visualization job.

- Your VNC password has been set. If you want to change it, click "password."

Change your VNC password

- Disconnecting returns the user to the job control page
- The job continues to run and can be accessed by clicking “view” on the job control page.
- Charging continues till the job is deleted from the Job Control page

Deleting a Visualization Job



The screenshot shows the HPRC website interface. At the top left, there is a navigation menu with 'Home', 'Jobs', and 'Help'. Below the menu, it says 'You are logged in as pingluo, [logout]'. On the right, the date is 'Friday, September 29, 2017'. A modal dialog box is open in the center, titled 'ada7.tamu.edu says:', with the message 'You job 6238264 has been deleted.' and an 'OK' button. Below the dialog, there is a list of instructions for using the VNC server. At the bottom, there are three buttons: 'Refresh', 'View', and 'Delete'. The 'Delete' button is circled in orange.

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Home Jobs Help

You are logged in as pingluo, [\[logout\]](#)

Friday, September 29, 2017

ada7.tamu.edu says:
You job 6238264 has been deleted.
OK

- When your job starts running, click **View** to connect to the VNC server. You will be redirected to a different page.
- Type your VNC password to login into the remote desktop.
- The GUI application must be launched with **vglrun** to use hardware acceleration.
- To go back to the main page, first toggle up the control bar at the leftmost center of your screen, and then click the disconnect button .
- Delete your job by clicking **Delete** when you are done with your visualization job.

Refresh Your job 6238264 is running.

View Connect to the VNC server and start running GUI applications.

Delete Delete the visualization job.

- Deleting a job terminates it permanently
- Charging stops at this point
- You will be brought back to the job submission page.
- To submit a new job please repeat previous the steps

How Are SUs Charged

- Equivalent CPU cores based on memory request:

0 - 2.56G		1 core
2.56G – 5.12G		2 cores
5.12G – 7.68G		3 cores
⋮	⋮	⋮

- SUs are charged based on actual wall-time times the maximum of actual CPU cores and equivalent CPU cores

$$1 \text{ SU} = 1 \text{ core} \times 1 \text{ hour}$$

$$\text{SU}_{\text{charged}} = \text{Max}\{\text{num_cores}, \text{equiv_cores}\} \times \text{wall-time}$$

- Maximum wall-time is 6 hours (remote visualization is for pre-and/or post-processing, and short analyzing).

Getting Help!

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Home Jobs **Help**

You are logged in as pingluo, [\[logout\]](#) Friday, September 29, 2017

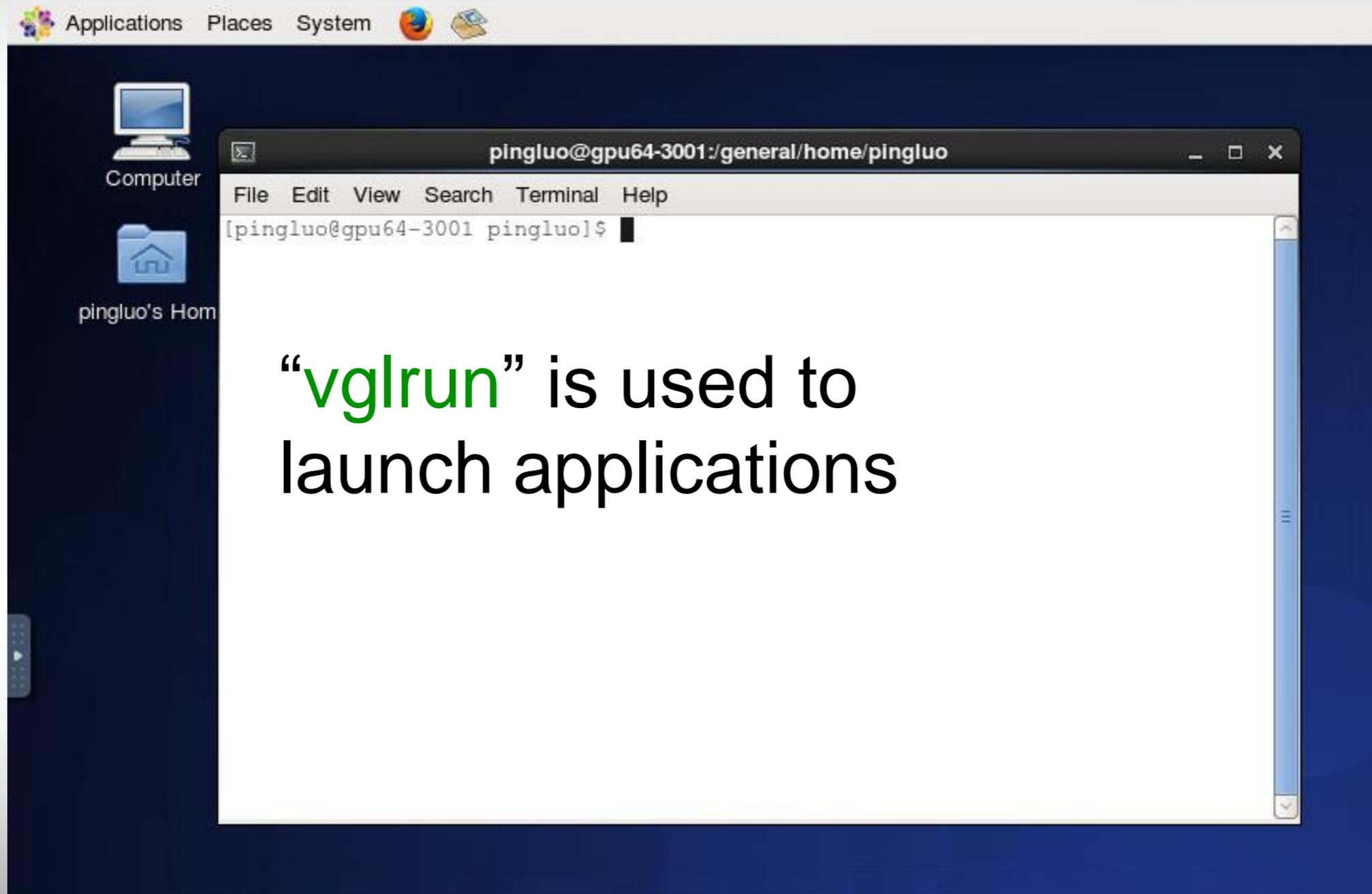
[Getting Started](#)

[FAQ \(under construction\)](#)

Ada Remote Visualization Portal help@hprc.tamu.edu

- https://hprc.tamu.edu/wiki/Ada:Remote-Viz#Alternative_Method:_Visualization_Portal
- helpdesk@hprc.tamu.edu

Launching Applications

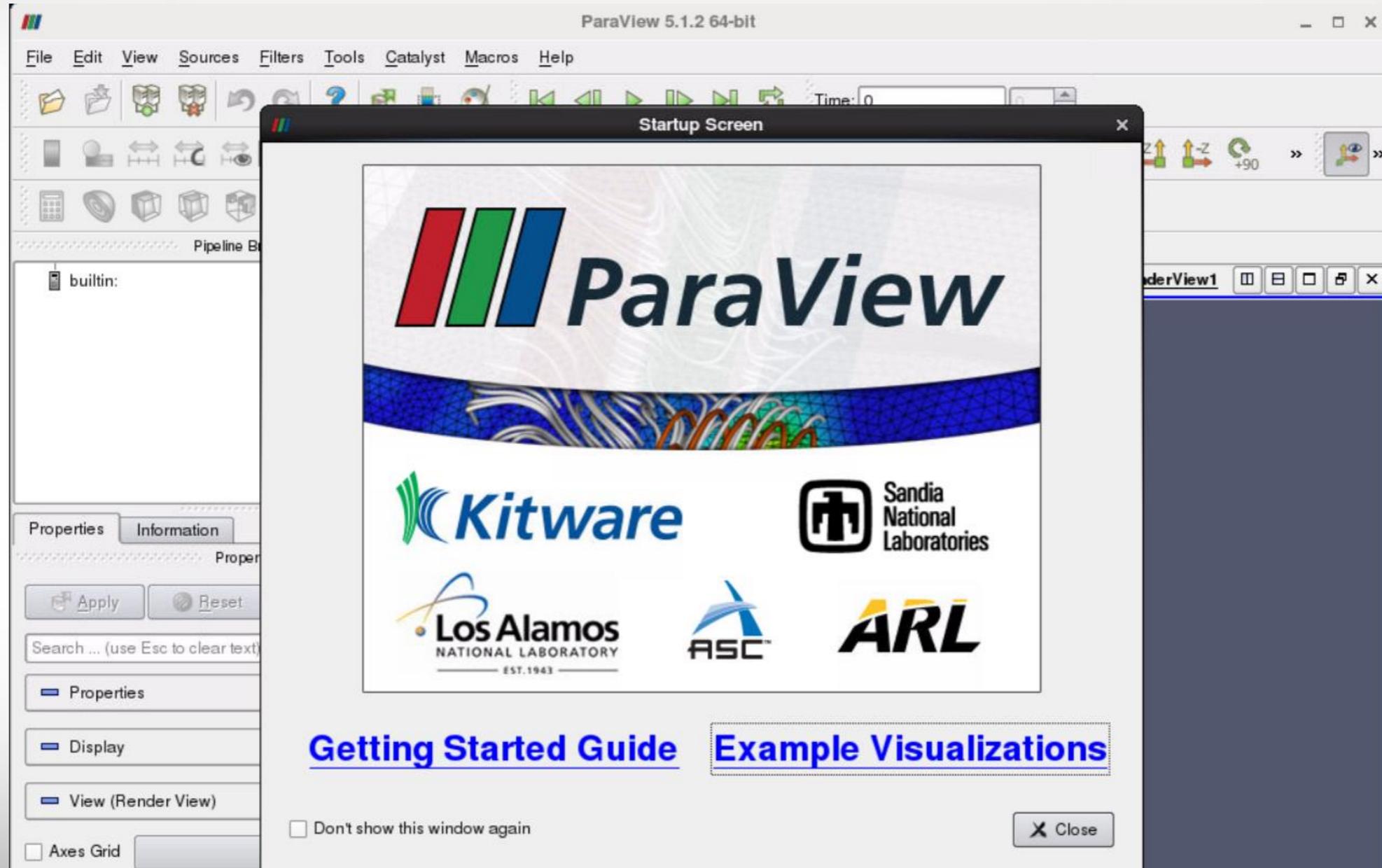


Launching ParaView

```
pingluo@gpu64-3002:/general/home/pingluo
File Edit View Search Terminal Help
[pingluo@gpu64-3002 pingluo]$ module load ParaView/5.1.2
[pingluo@gpu64-3002 pingluo]$ vglrun paraview
█
```

`vglrun paraview`

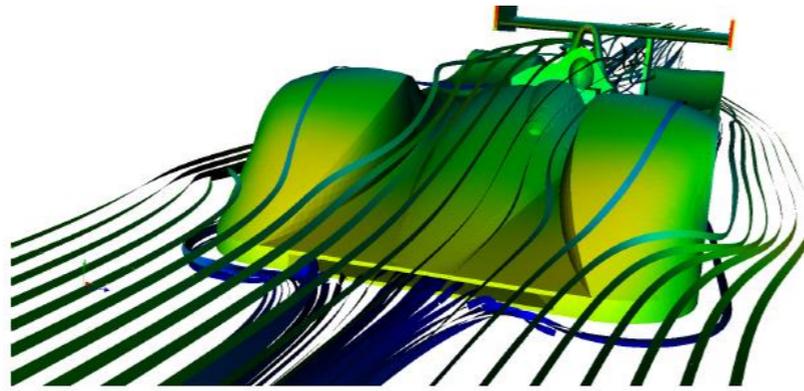
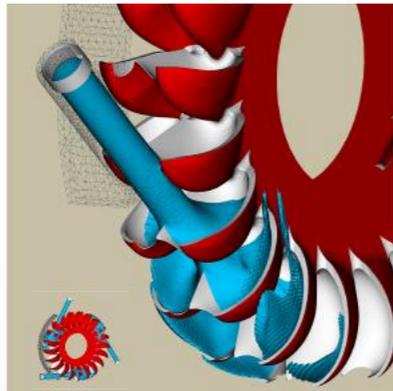
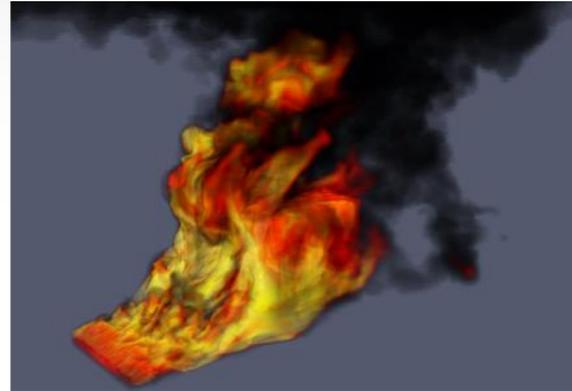
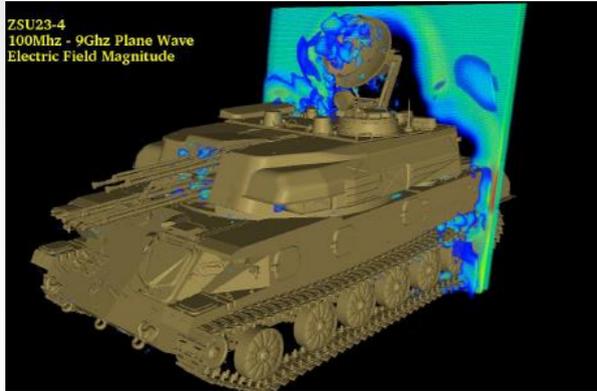
Launching ParaView



Introduction to ParaView

- What is ParaView
- The ParaView Architecture
- Hands-on: Basic Usage of ParaView
 - Getting Data
 - Interacting with 3D View
 - Representation and Field Coloring
 - Filter and Pipeline
 - Commonly used filters
 - contour, slice, clip, streamline, tube, glyph
 - Vector Visualization
 - Streamline, tube, glyph
 - Multiview
 - Plotting
 - Volume Rendering

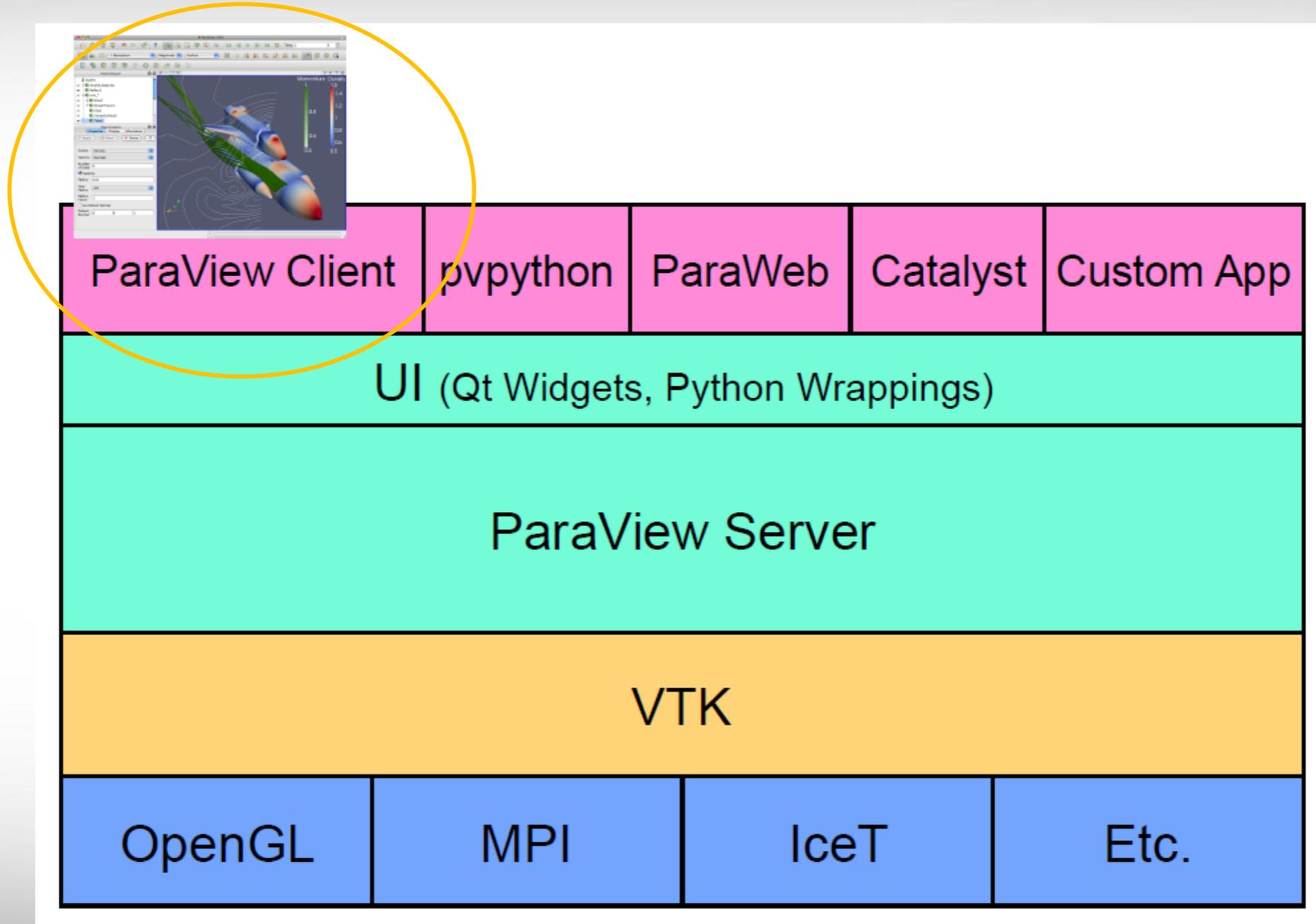
What is ParaView



- An open source visualization software for 2D/3D data sets
- Started in 2000 as a collaborative effort between Kitware Inc and Los Alamos National Laboratories
- Supports multi-platforms: Windows, Linux, MacOS
- Supports distributed computation for large data sets
- With an open, flexible, and intuitive user interface
- Has an extensible and modular architecture based on open standard
- Free for non-commercial usage

ParaView Architecture

Focus of this short course



Why Visualization

- A picture is worth a thousand words.

```
[pingluo@ada8 data]$ xxd disk_out_ref.ex2 |more
00000000: 4344 4601 0000 0001 0000 000a 0000 0019
00000010: 0000 000a 6c65 6e5f 7374 7269 6e67 0000
00000020: 0000 0021 0000 0008 6c65 6e5f 6c69 6e65
00000030: 0000 0051 0000 0004 666f 7572 0000 0004
00000040: 0000 0009 7469 6d65 5f73 7465 7000 0000
00000050: 0000 0000 0000 0007 6e75 6d5f 6469 6d00
00000060: 0000 0003 0000 0009 6e75 6d5f 6e6f 6465
00000070: 7300 0000 0000 2133 0000 0008 6e75 6d5f
00000080: 656c 656d 0000 1d30 0000 000a 6e75 6d5f
00000090: 656c 5f62 6c6b 0000 0000 0001 0000 000d
000000a0: 6e75 6d5f 6e6f 6465 5f73 6574 7300 0000
000000b0: 0000 0003 0000 000d 6e75 6d5f 7369 6465
000000c0: 5f73 6574 7300 0000 0000 0007 0000 000a
000000d0: 6e75 6d5f 7161 5f72 6563 0000 0000 0003
000000e0: 0000 0008 6e75 6d5f 696e 666f 0000 000a
000000f0: 0000 000e 6e75 6d5f 656c 5f69 6e5f 626c
00001000: 6b31 0000 0000 1d30 0000 000f 6e75 6d5f
00001010: 6e6f 645f 7065 725f 656c 3100 0000 0008
00001020: 0000 000b 6e75 6d5f 6e6f 645f 6e73 3100
00001030: 0000 0001 0000 000b 6e75 6d5f 6e6f 645f
00001040: 6e73 3200 0000 0001 0000 000b 6e75 6d5f
00001050: 6e6f 645f 6e73 3300 0000 0001 0000 000c
00001060: 6e75 6d5f 7369 6465 5f73 7331 0000 01a2
00001070: 0000 000c 6e75 6d5f 7369 6465 5f73 7332
00001080: 0000 006c 0000 000c 6e75 6d5f 7369 6465
00001090: 5f73 7333 0000 033c 0000 000c 6e75 6d5f
000010a0: 7369 6465 5f73 7334 0000 00d8 0000 000c
000010b0: 6e75 6d5f 7369 6465 5f73 7335 0000 00b4
000010c0: 0000 000c 6e75 6d5f 7369 6465 5f73 7336
000010d0: 0000 03c4 0000 000c 6e75 6d5f 7369 6465
```

Properties Information

Information

Statistics

Type: Multi-block Dataset

Number of Cells: 7472

Number of Points: 8499

Memory: 2 MB

Data Arrays

Current data time: 0

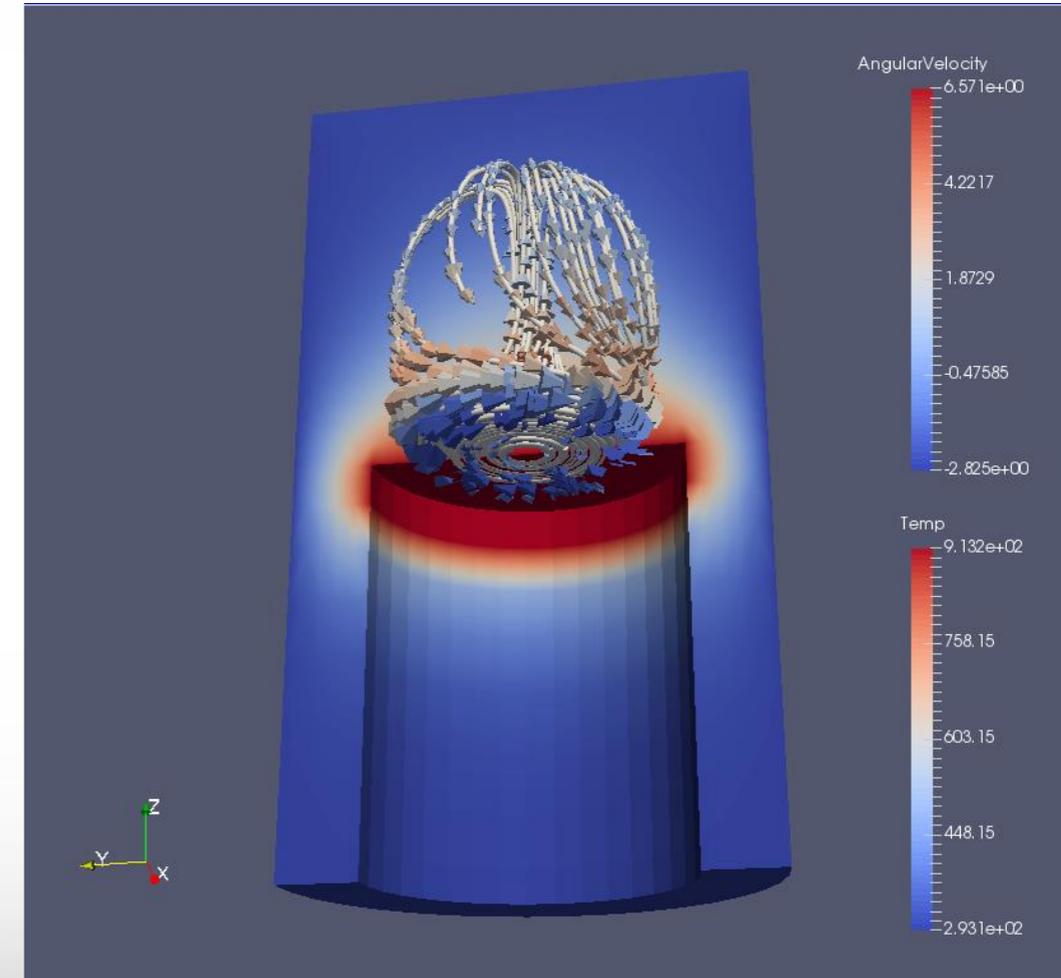
Name	Data Type	Data Ranges
AsH3	double	[0.0804768, 0.184839]
CH4	double	[0, 0.00117024]
GaMe3	double	[0.000222844, 0.007213...]
GlobalNodeId	idtype	[1, 8499]
H2	double	[0.807613, 0.917688]
PedigreeNodeId	idtype	[1, 8499]
Pres	double	[0.00678552, 0.0288185]
Temp	double	[293.15, 913.15]
V	double	[-19.9491, 19.9491], [-1...
GlobalElementId	idtype	[1, 7472]

Bounds

X range: -5.75 to 5.75 (delta: 11.5)

Y range: -5.75 to 5.75 (delta: 11.5)

Z range: -10 to 10.2 (delta: 20.2)



ParaView User Interface

Menu bar

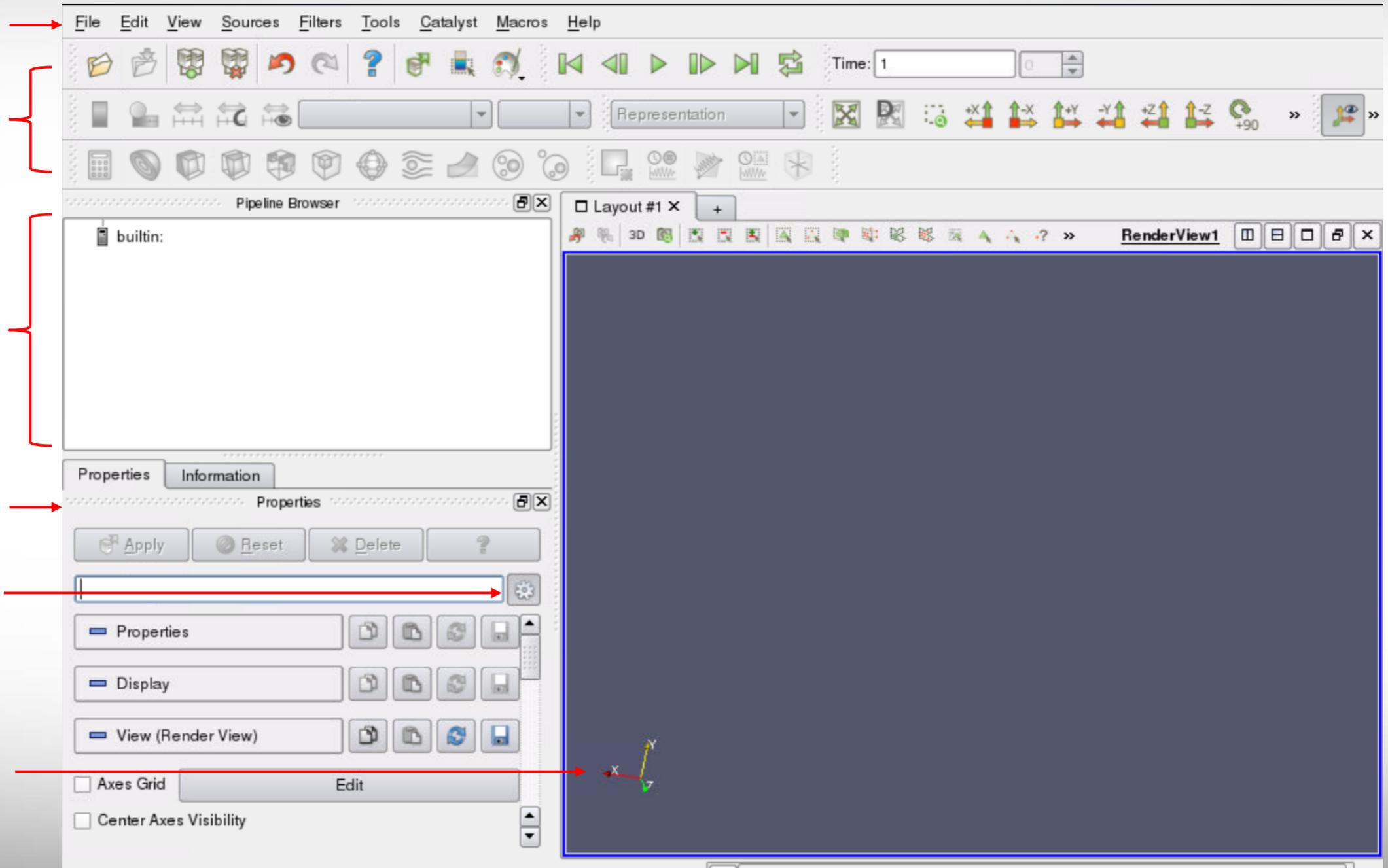
Toolbars

Pipeline browser

Property panel

Advanced toggle

3D view



Getting Data

- Creating a source from the menu Sources
- Loading from a file

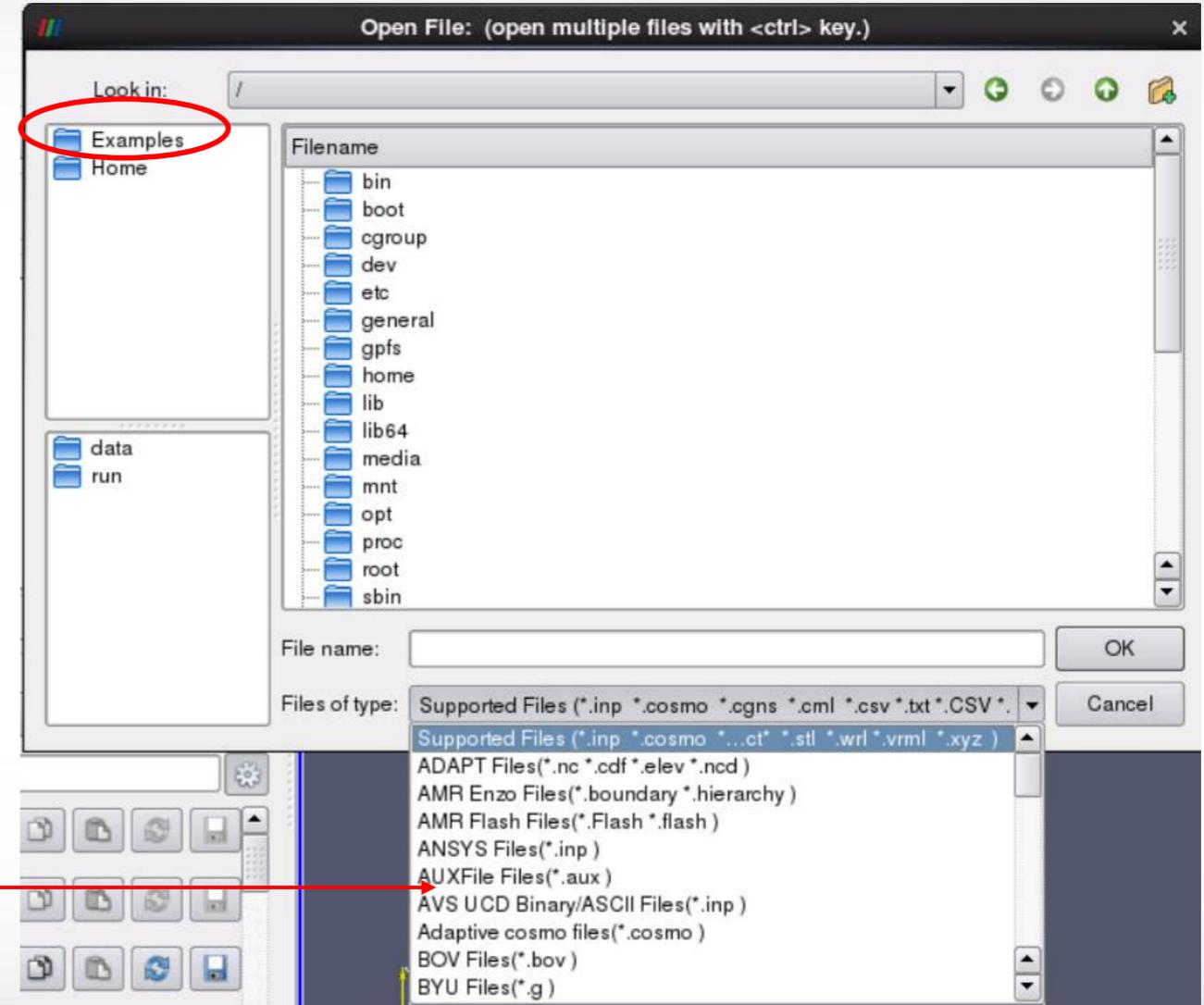
Interacting with a 3D View

- Create a Source: Sources -> Cylinder
- Change parameters: resolution -> 80
- Play with camera controls
- Play with center access controls

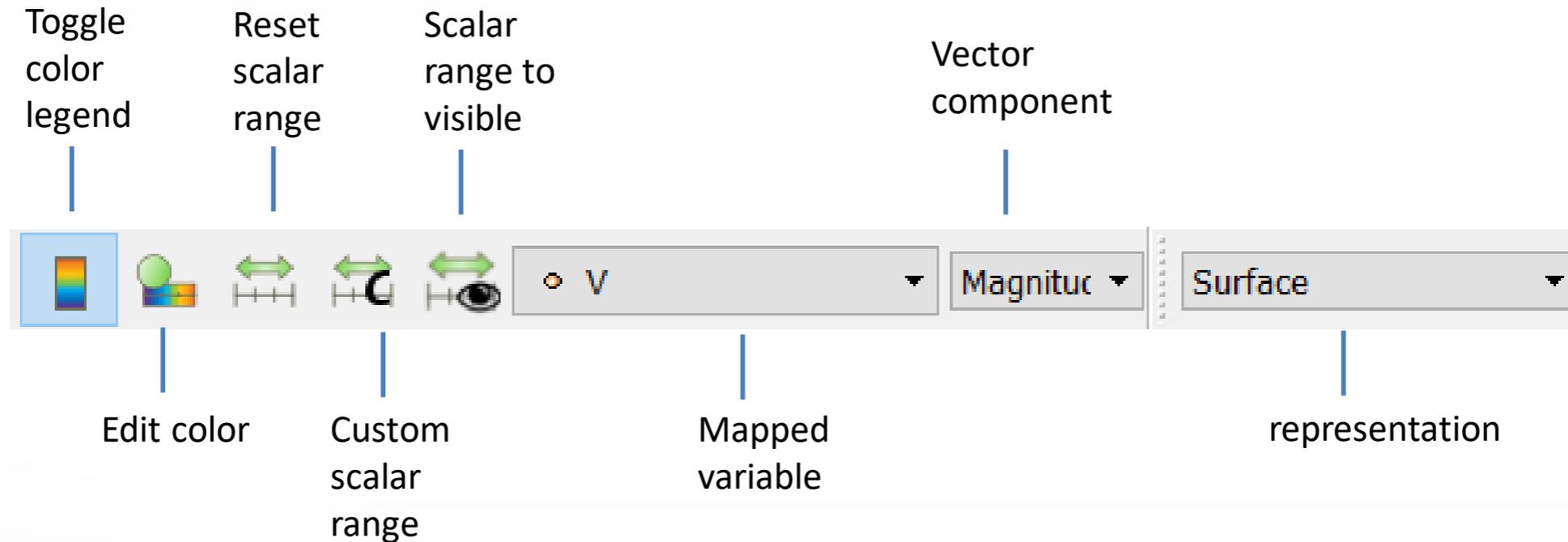


Loading from a File

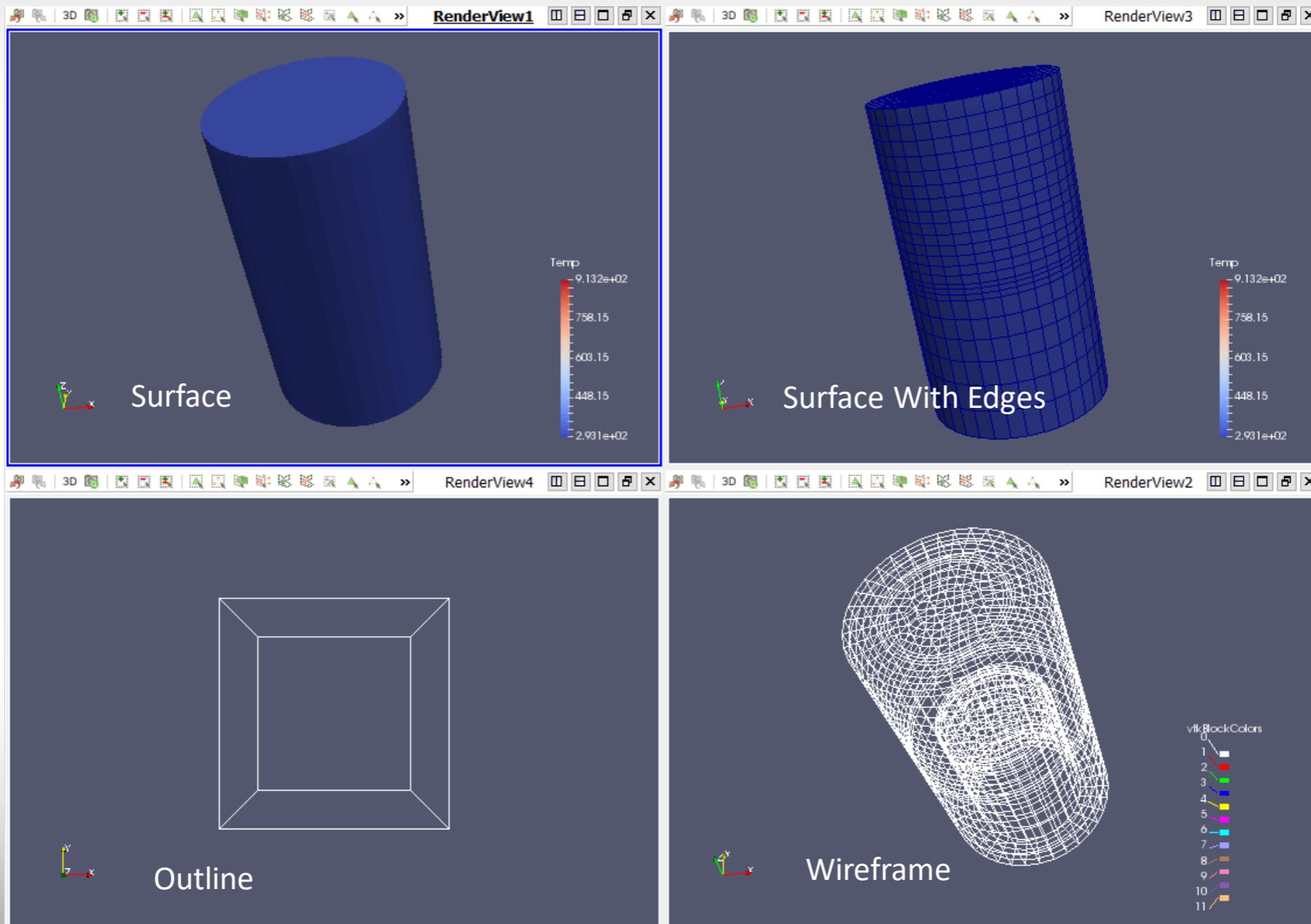
- ParaView provides different readers to read different types of input files.
- File -> Open -> Examples -> disk_out_ref.ex2
- To view the file, click the eye next to disk_out_ref.ex2 in the pipeline browser.



Representation and Active Variable Controls

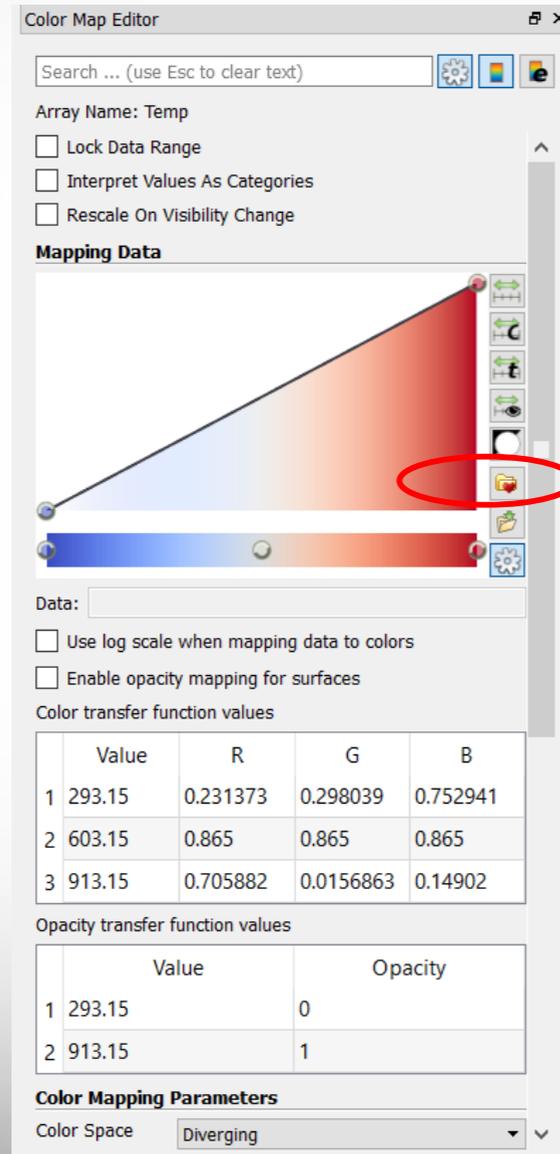


Representation



Change Color Map

- Edit Color Map -> Choose Preset  -> Black Body Radiation -> Apply



Color Map Editor

Search ... (use Esc to clear text)

Array Name: Temp

Lock Data Range

Interpret Values As Categories

Rescale On Visibility Change

Mapping Data

Data:

Use log scale when mapping data to colors

Enable opacity mapping for surfaces

Color transfer function values

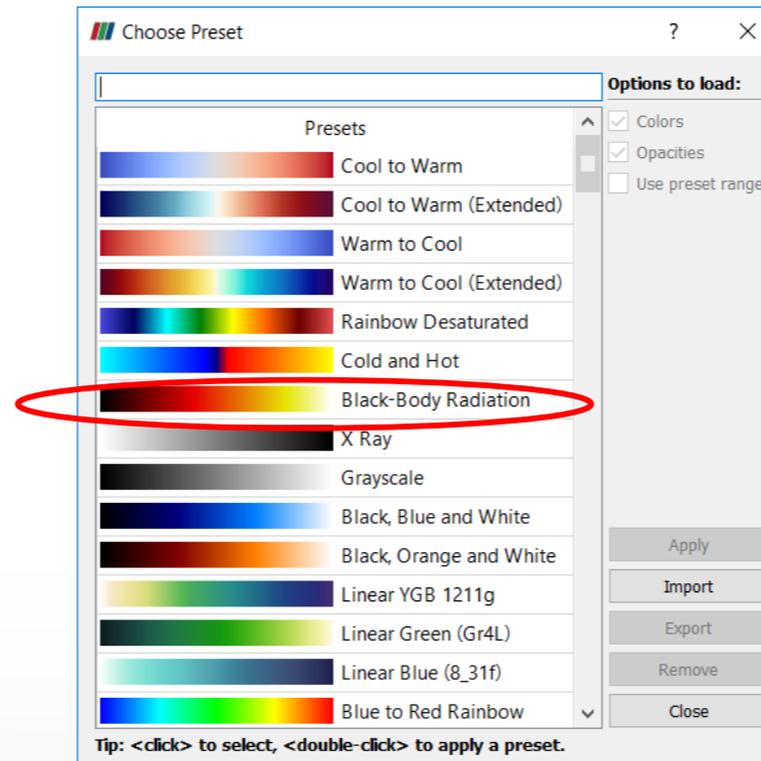
	Value	R	G	B
1	293.15	0.231373	0.298039	0.752941
2	603.15	0.865	0.865	0.865
3	913.15	0.705882	0.0156863	0.14902

Opacity transfer function values

	Value	Opacity
1	293.15	0
2	913.15	1

Color Mapping Parameters

Color Space: Diverging



Choose Preset

Options to load:

Colors

Opacities

Use preset range

Presets

- Cool to Warm
- Cool to Warm (Extended)
- Warm to Cool
- Warm to Cool (Extended)
- Rainbow Desaturated
- Cold and Hot
- Black-Body Radiation**
- X Ray
- Grayscale
- Black, Blue and White
- Black, Orange and White
- Linear YGB 1211g
- Linear Green (Gr4L)
- Linear Blue (8_31f)
- Blue to Red Rainbow

Apply

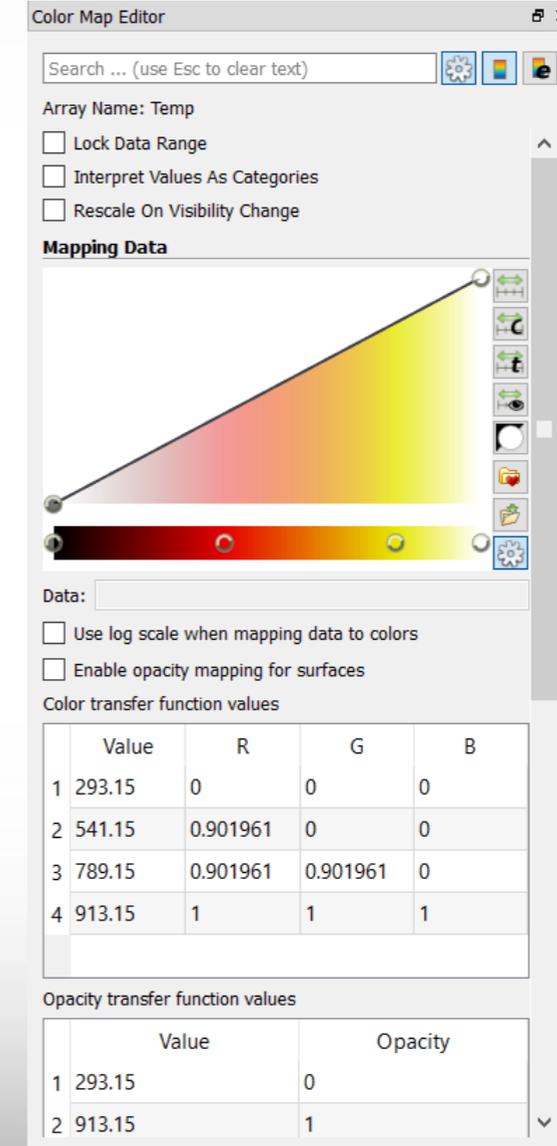
Import

Export

Remove

Close

Tip: <click> to select, <double-click> to apply a preset.



Color Map Editor

Search ... (use Esc to clear text)

Array Name: Temp

Lock Data Range

Interpret Values As Categories

Rescale On Visibility Change

Mapping Data

Data:

Use log scale when mapping data to colors

Enable opacity mapping for surfaces

Color transfer function values

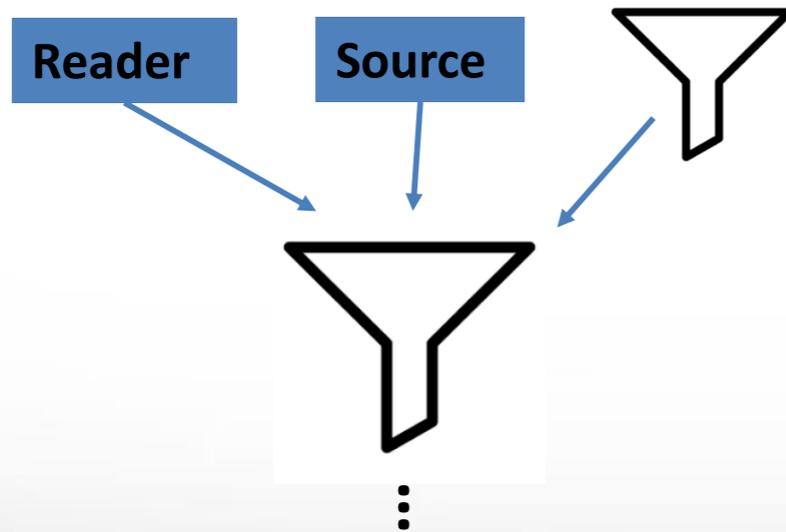
	Value	R	G	B
1	293.15	0	0	0
2	541.15	0.901961	0	0
3	789.15	0.901961	0.901961	0
4	913.15	1	1	1

Opacity transfer function values

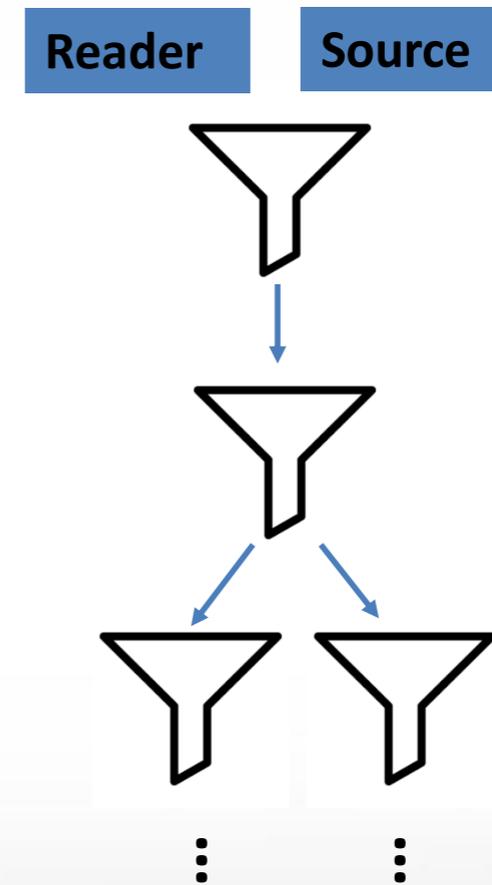
	Value	Opacity
1	293.15	0
2	913.15	1

Filter and Pipeline

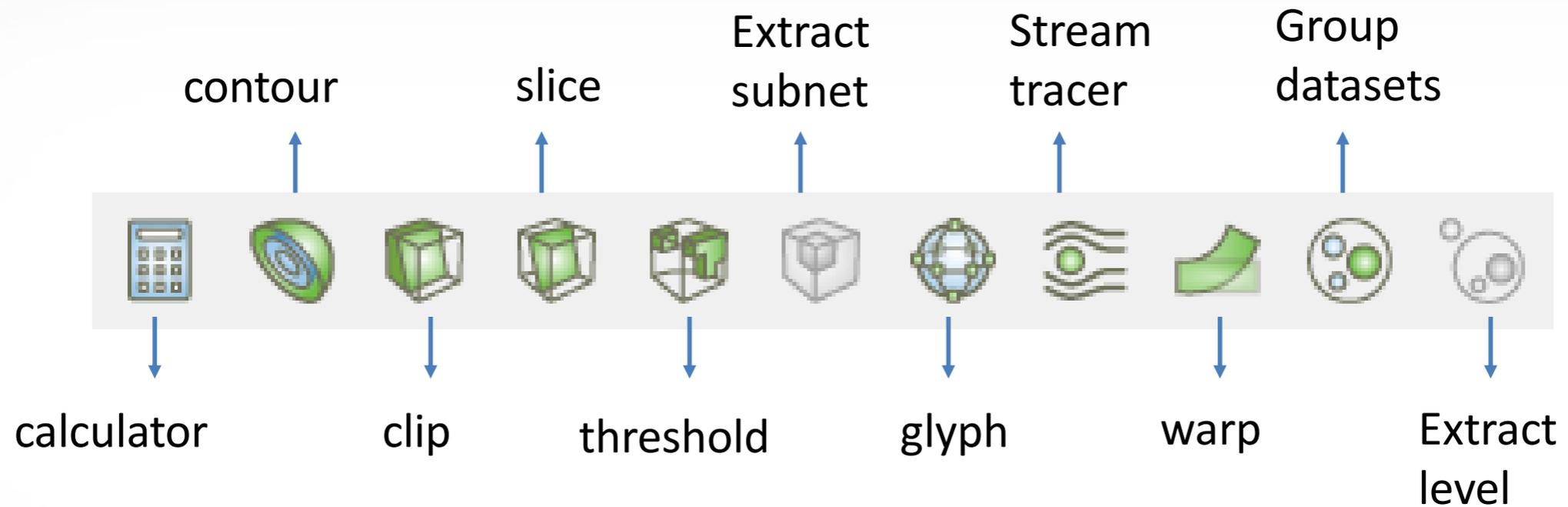
- **Filter:** a functional unit that processes the data to generate, extract, or derive features from the data.



- **Pipeline**

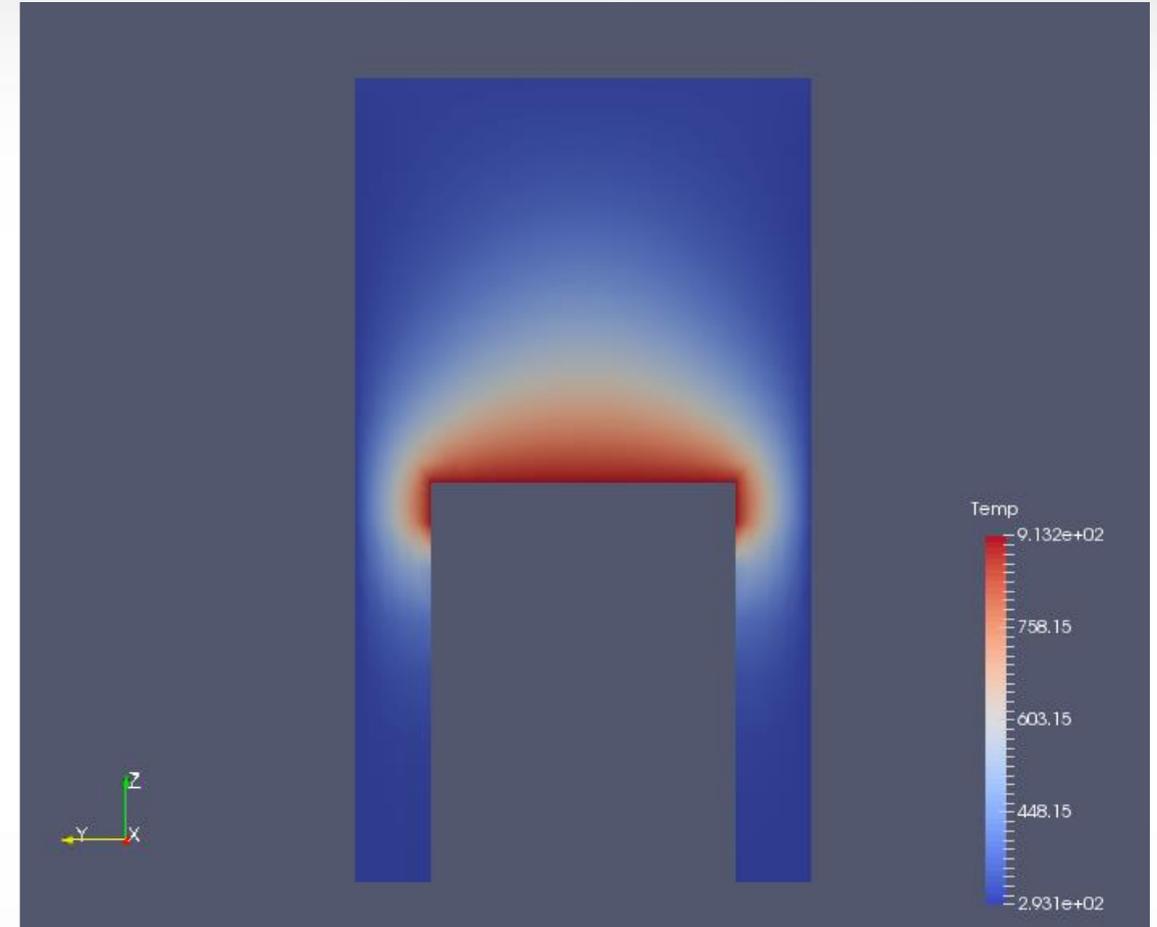


Commonly Used Filters



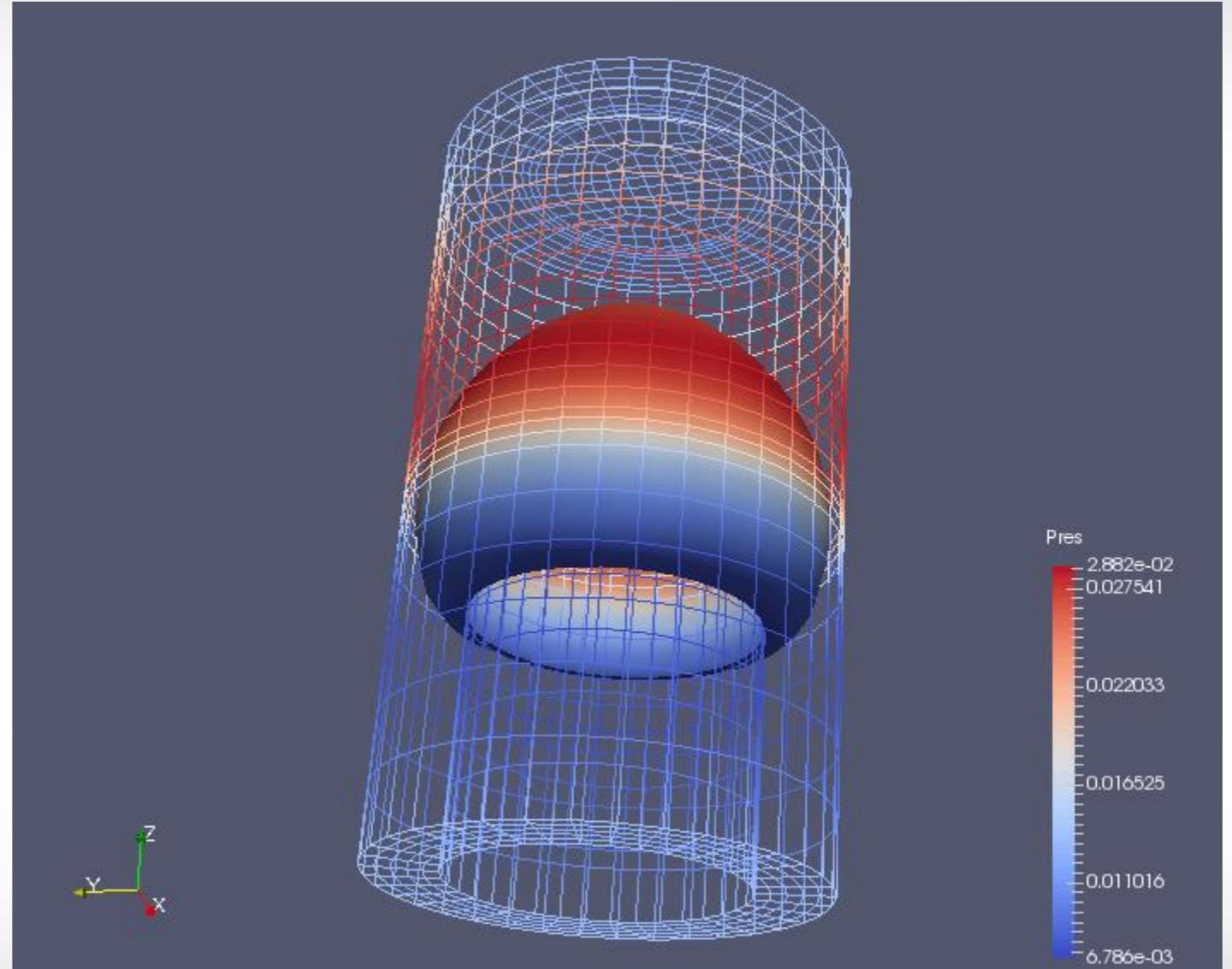
Slice

- Make sure `disk_out_ref.ex2` is loaded
- Click “slice” -> uncheck “show plane” in **Plane Parameters** -> **Apply**
- Change active variable to “temp”
- Set view direction to **+X**
- Rotate the slice to view from different angles



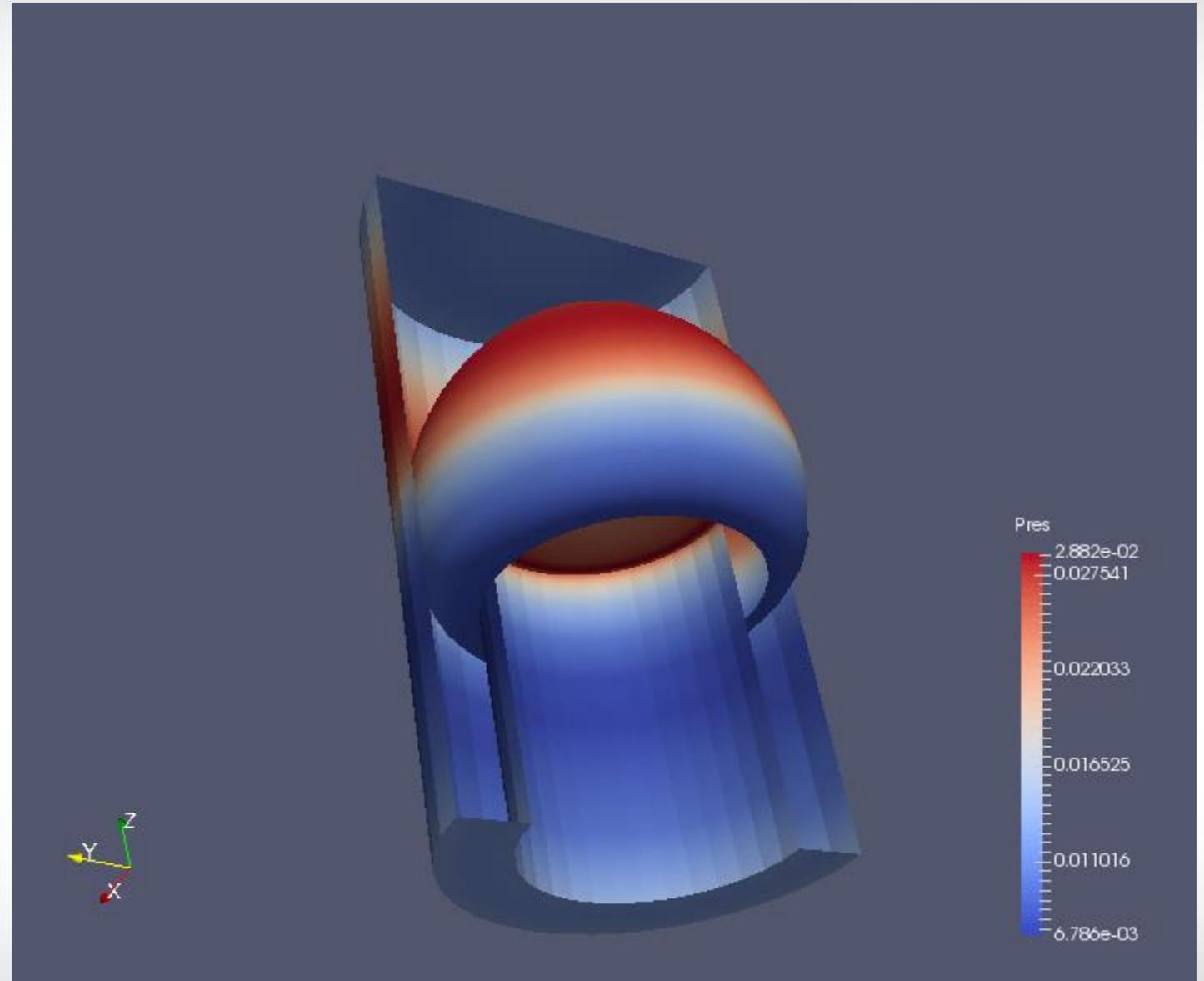
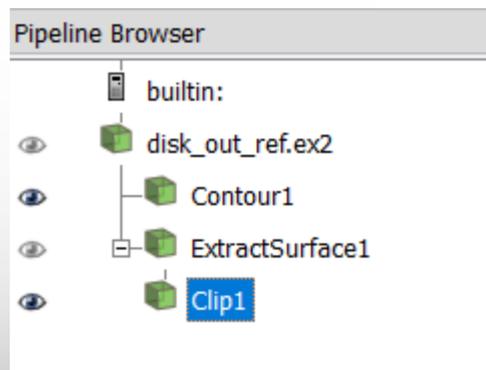
Contour

- Edit -> Reset Session
- Load `disk_out_ref.ex2` -> check all variables -> apply
- Active variable -> `pres`
- Representation -> Wireframe
- Contour -> In Properties tab click “temp” for “Contour by”
- Change “Isosurfaces” value to “400” -> apply



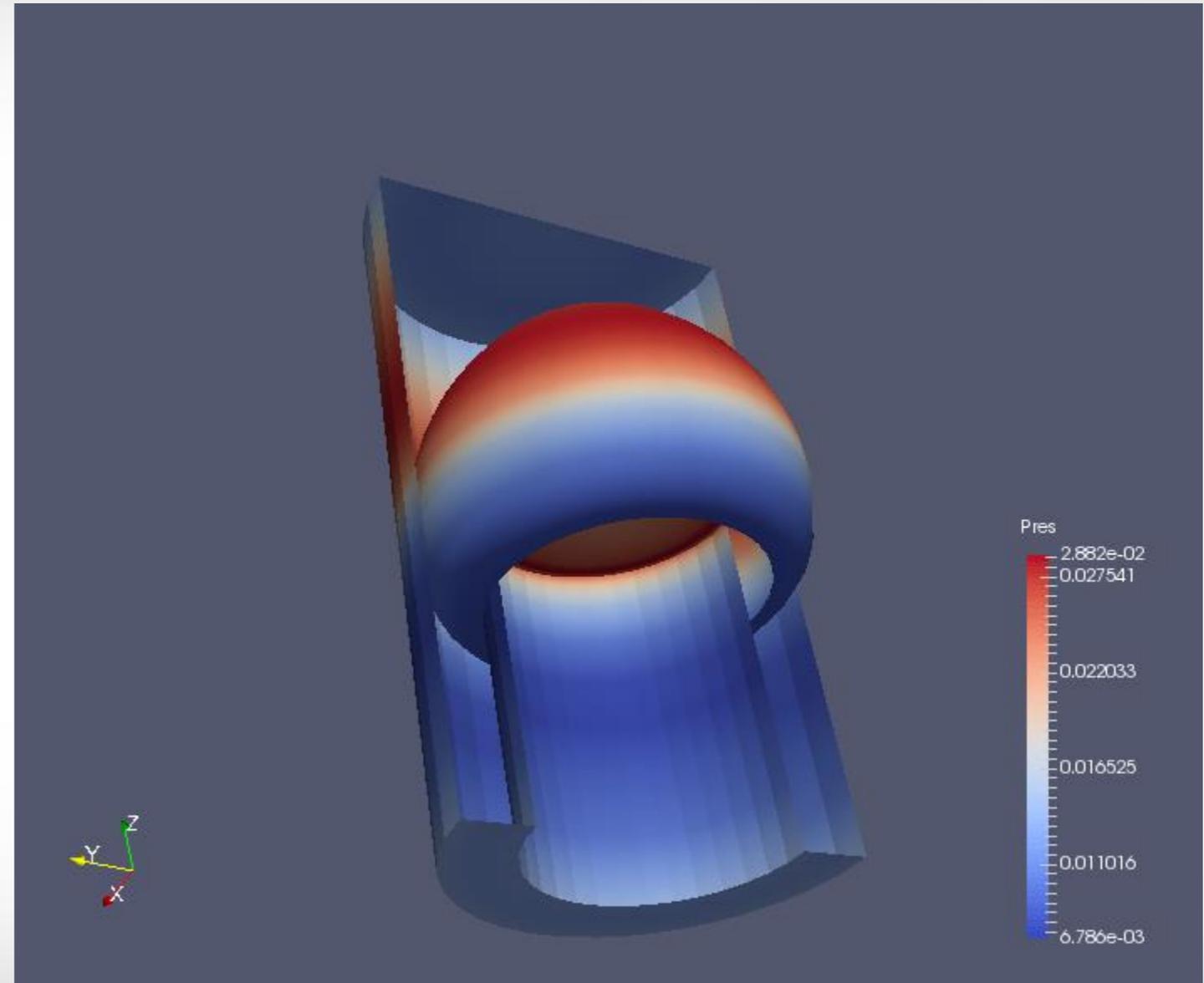
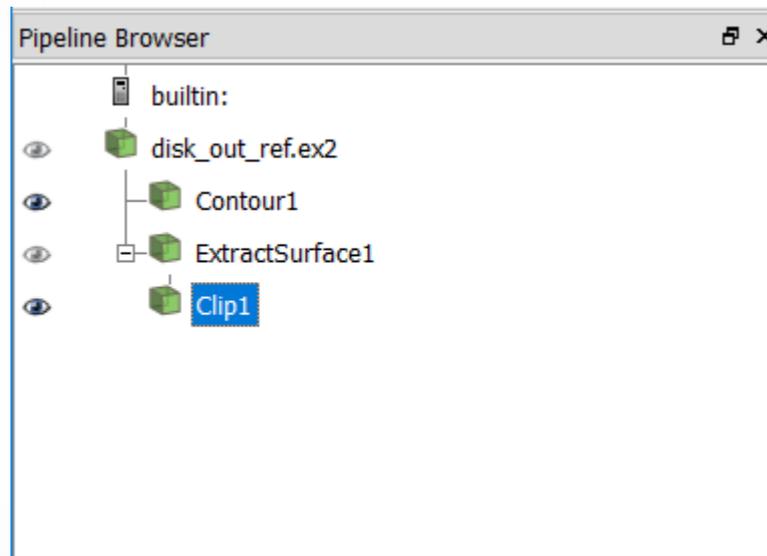
Extract Surface

- Continue from previous slide
- Representation -> Surface
- Filters -> Alphabetical -> Extract Surface -> apply
- Select “ExtractSurface1” -> Clip -> uncheck “show plane” in “Plane Properties” -> Apply



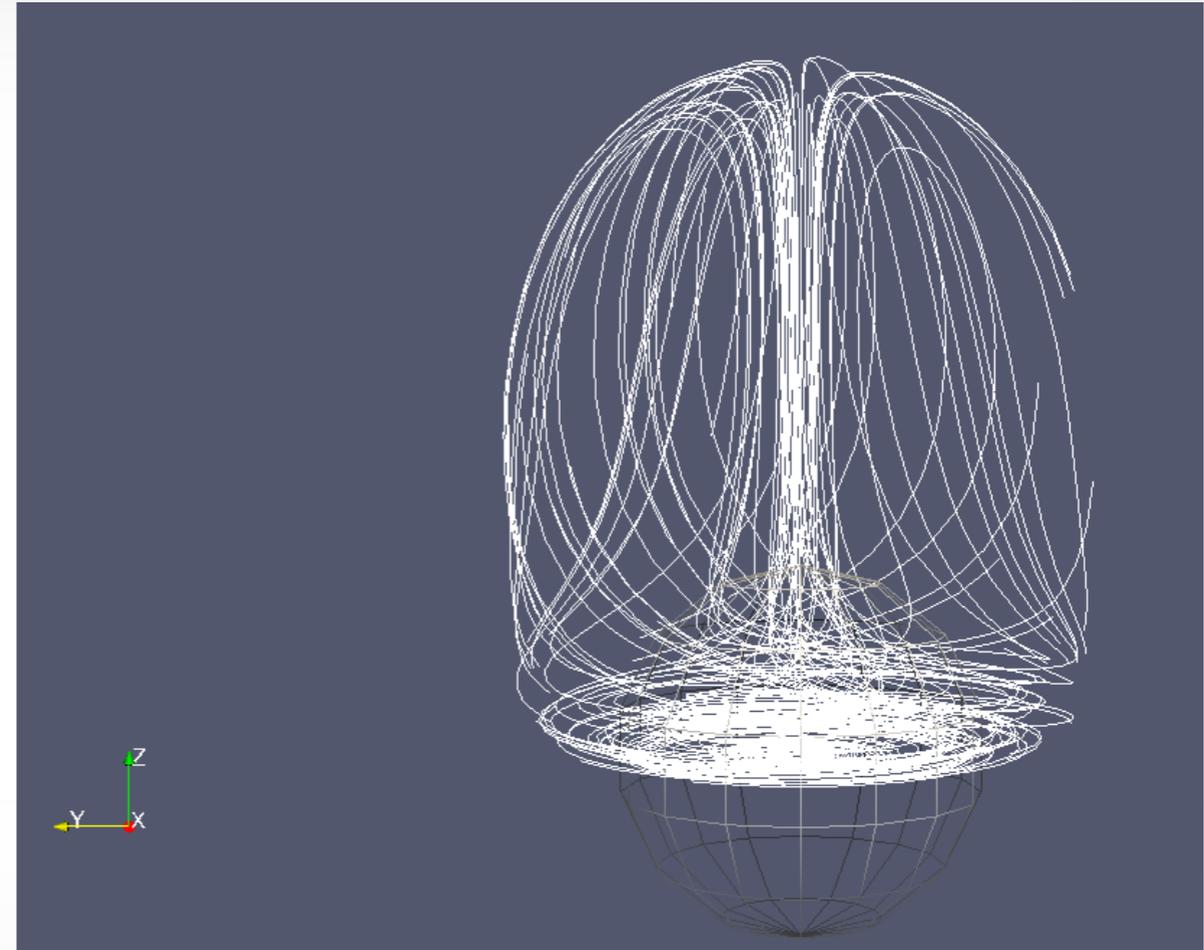
Save/Load State

- File -> Save State
- File -> Load State



Vector Visualization - Streamlines

- The data set has a velocity field describing the movement of the air over the heated rotating disk.
- The filter **Stream Tracer** can be used to determine the currents in the air.
- Click  **Stream Tracer** from common filters -> **Apply**



Enhanced Streamlines

- Stream Tracer draws 1d lines that has no thickness.
 - No shading
 - No direction
- Can be enhanced with other filters
 - **ctrl+space** (quick search) -> **Tube** -> **Apply**
 - **Glyph** -> **Apply**

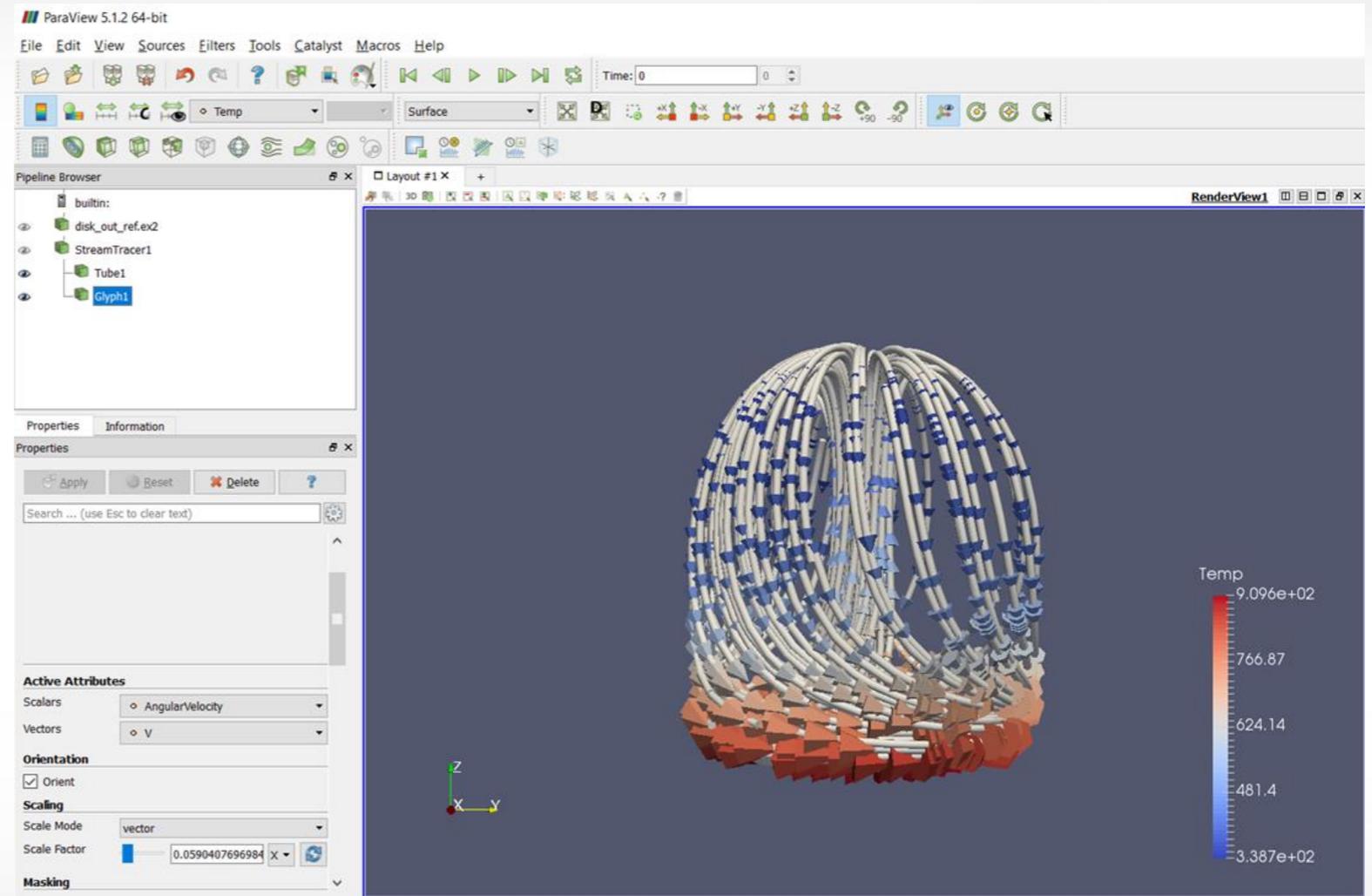
Glyph Properties:

Glyph Source: Glyph Type = cone

Active Attributes: Vectors = V

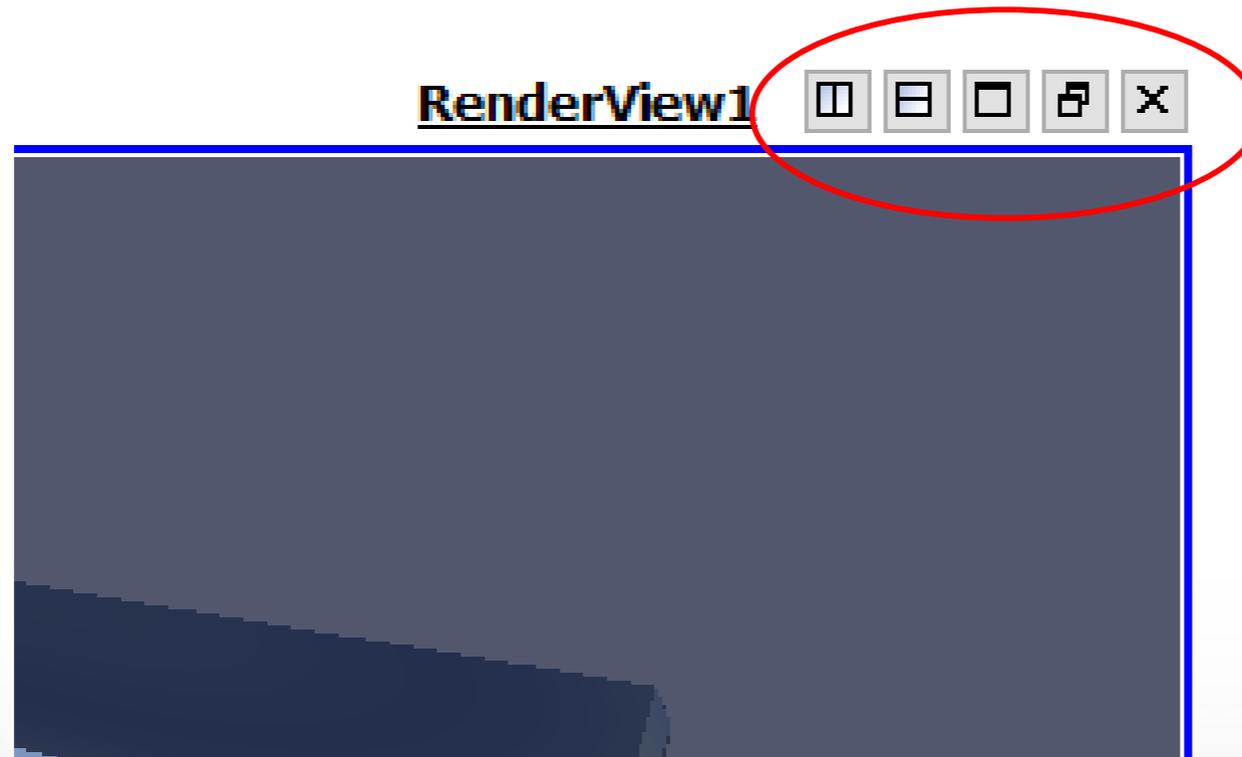
Scaling: Scale Mode = vector

Scale Factor = 0.5904.. (click  to set the value)



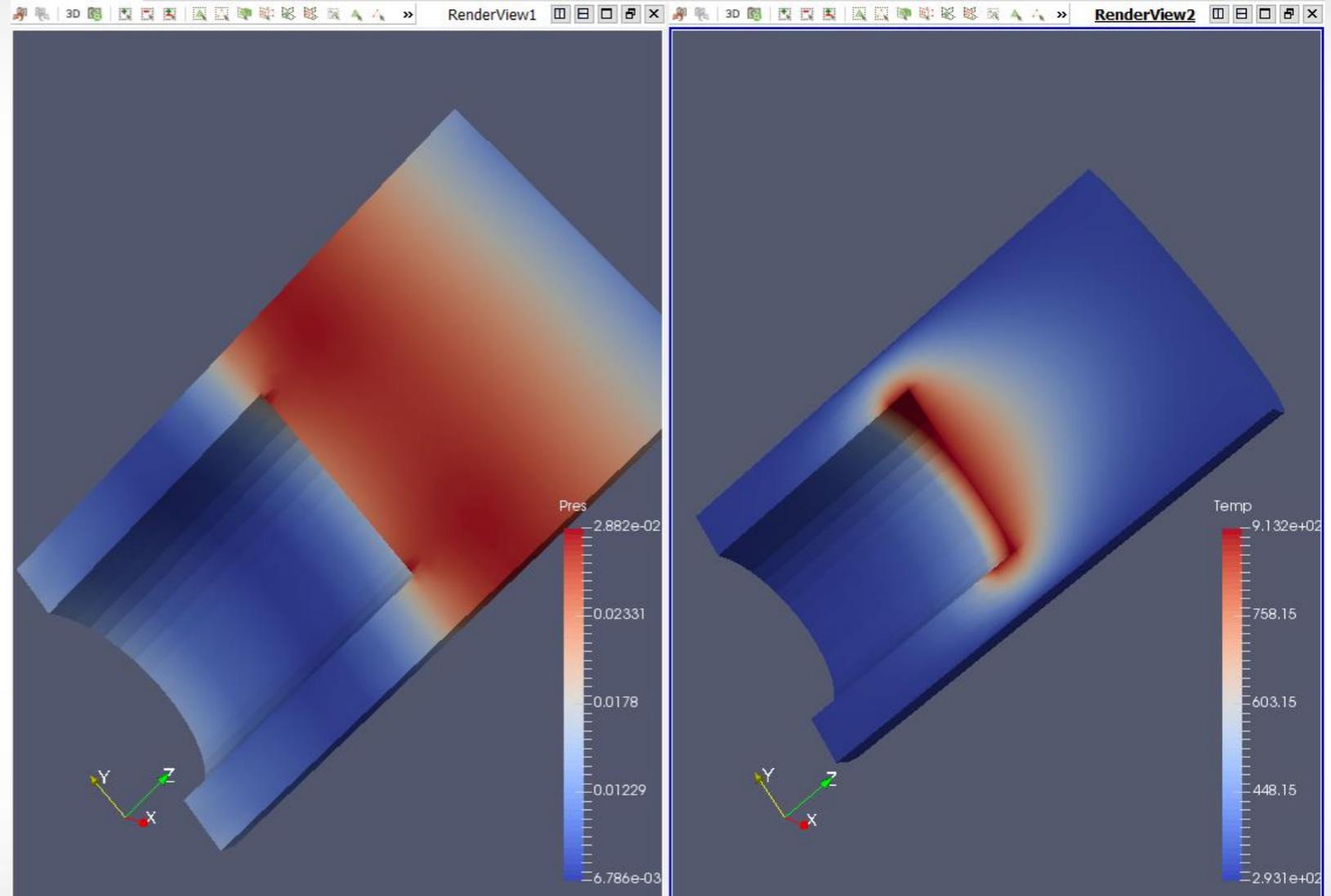
Multiview

- On top right of 'view', there are buttons for splitting, resizing, and deleting views.



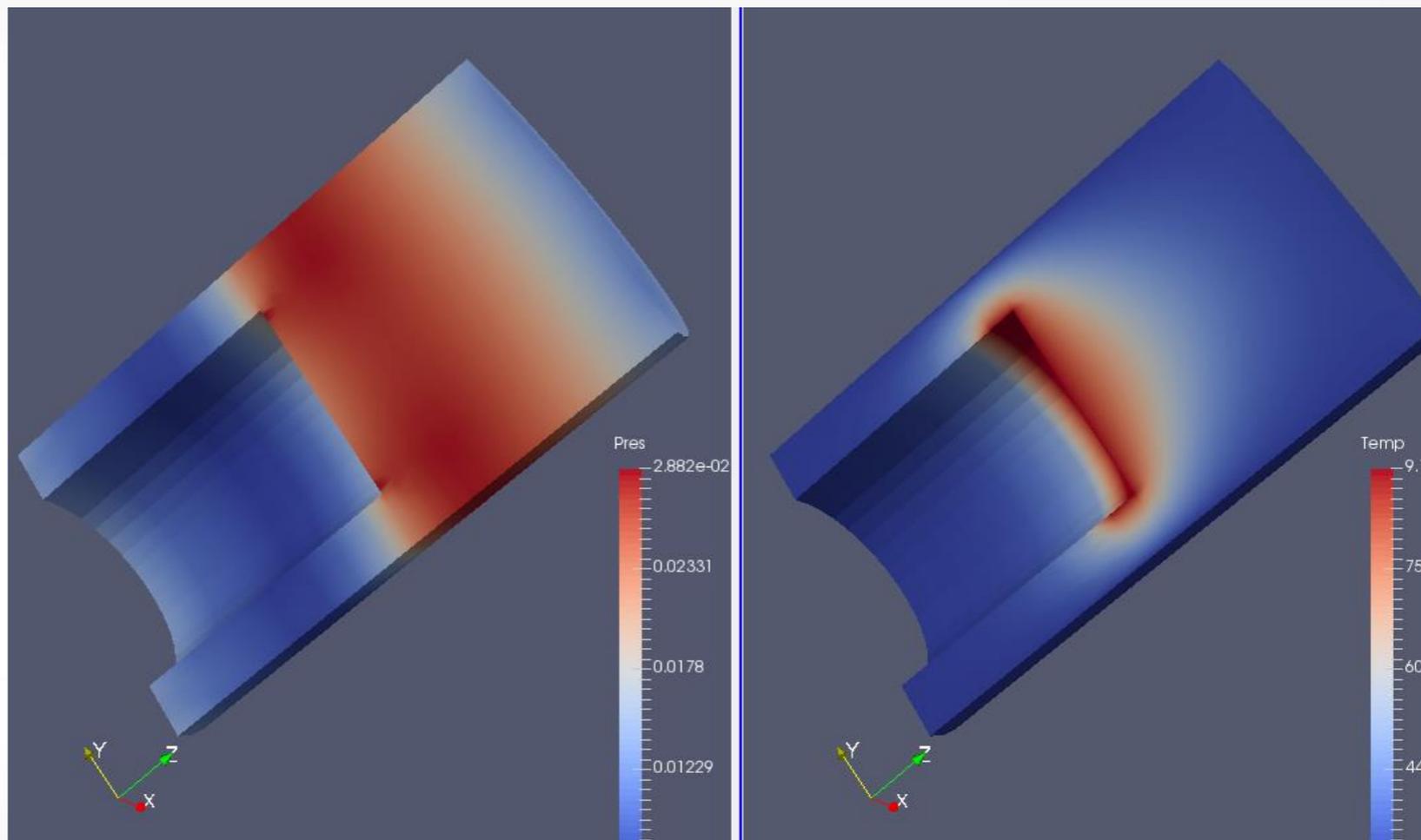
Using Multiview

- Edit -> Reset Session
- File -> Recent File -> disk_out_ref.ex2
- Clip -> color by Pres
- Split Vertically
- Click the right view
- Clip -> color by Temp



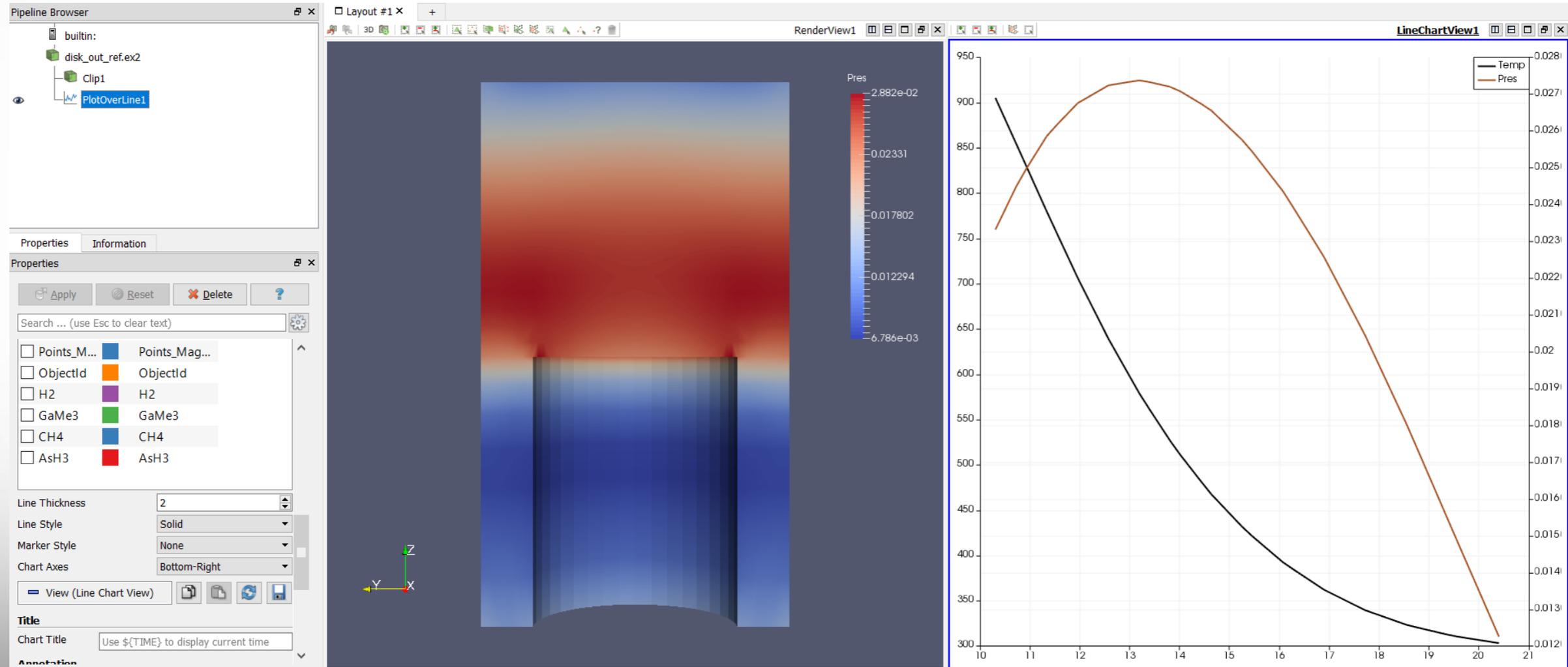
Linking Camera

- Right click one view
- Select “Linking Camera”
- Click the other view
- The two views are now using the same camera – rotating one view cause the other view to rotate in the same direction. Very convenient for viewing the value of different variables at the same location.



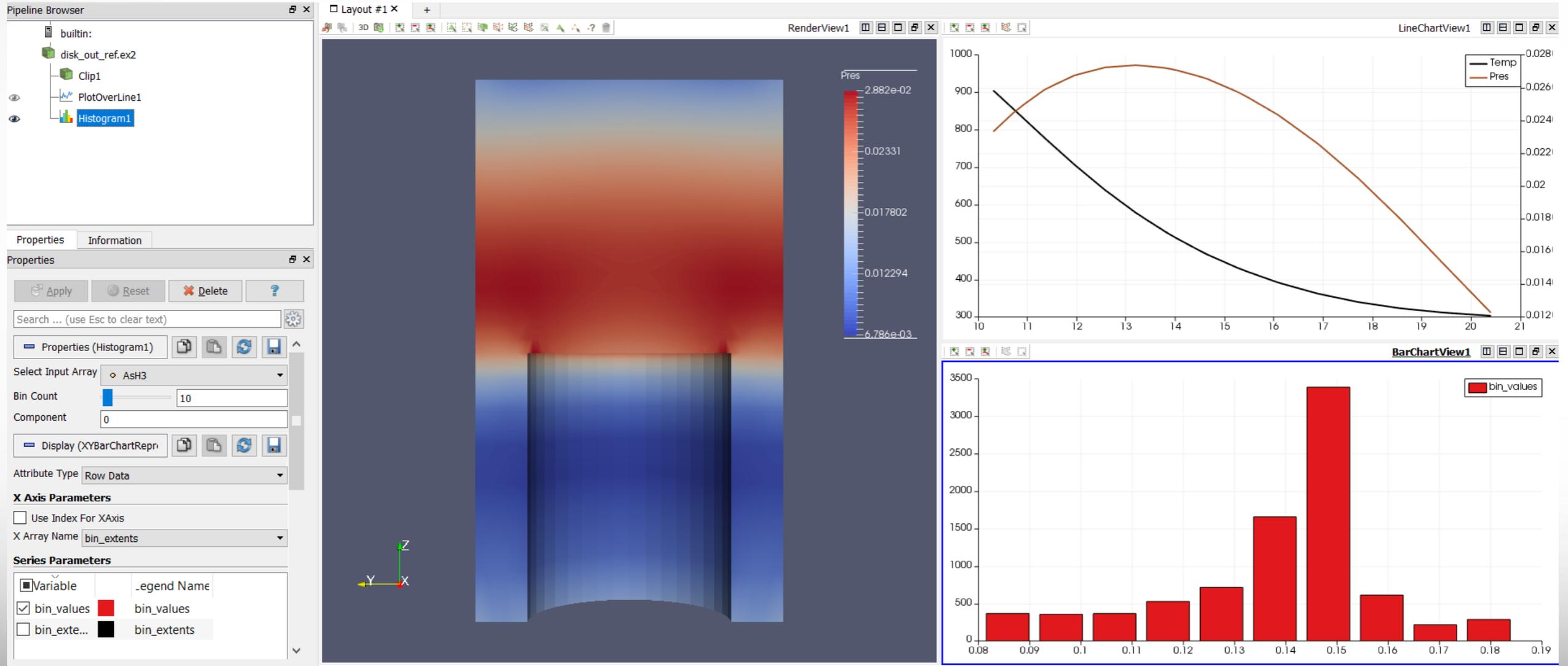
Plot Over Line

- Plot Over Line  -> adjust both ends -> Apply
- In “Series Parameters”, leave only “temp” and “pres” checked.
- Highlight “pres” -> select “Bottom-Right” for Chart Axes



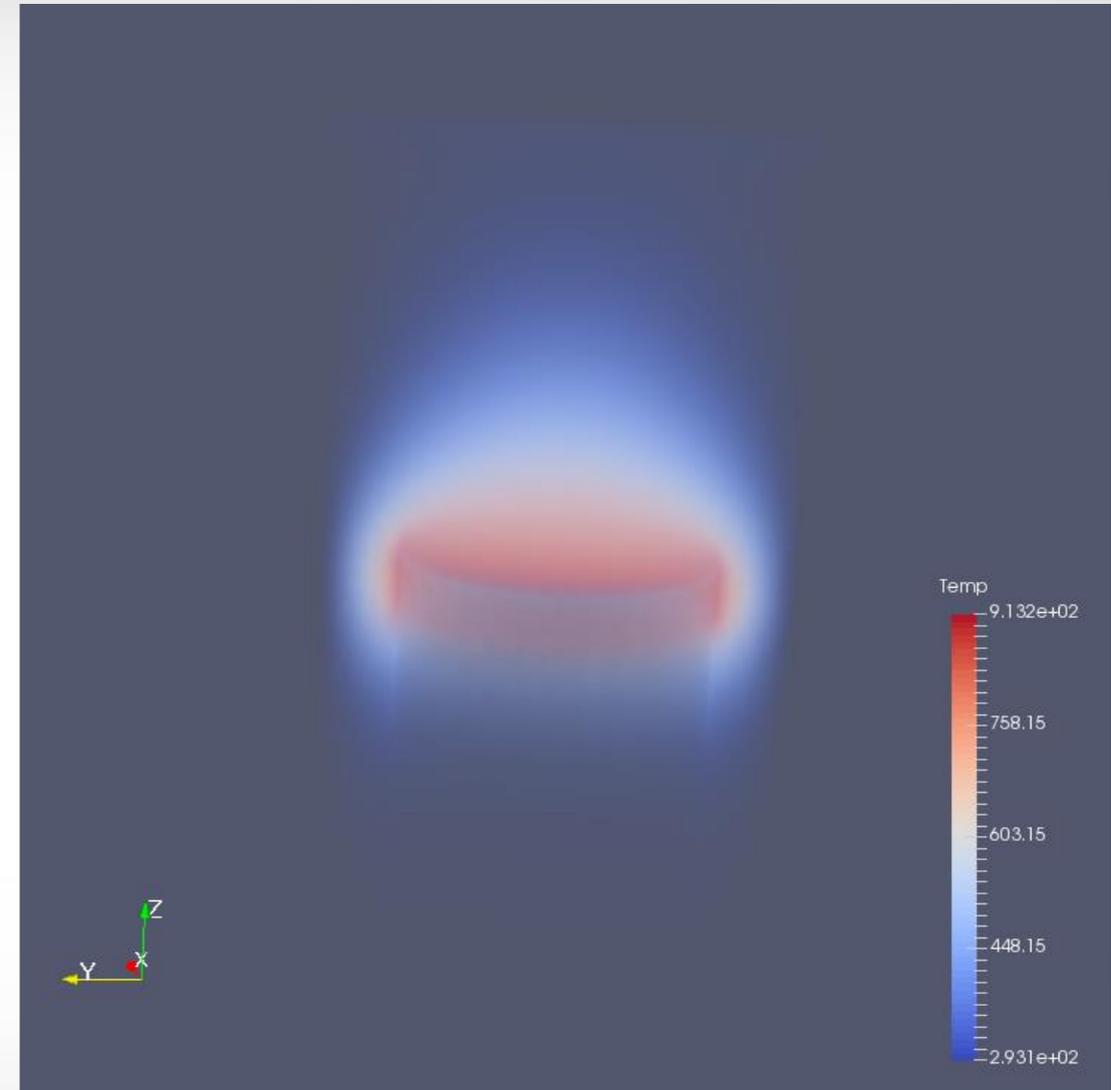
Histogram

- Select “disk_out_ref.ex2” in the pipeline browser
- Filters -> Data Analysis -> Histogram -> Apply



Volume Rendering

- A solid mesh is rendered as a translucent cloud, with the scalar field determining the color and density at every point in the cloud.
- The benefit is to see features all the way through a volume
- Filters -> Data Analysis -> Histogram -> Apply



Exercise 1

- Use Multiview to do volume rendering with temperature and pressure respectively.

Exercise 2

- Start with a new session.
- Add a streamline augmented with tube and glyph to the volume rendering with temperature.
- Change the transfer function to “Black-Body Radiation”.

Further Reading

- ParaView tutorial

https://www.paraview.org/Wiki/The_ParaView_Tutorial

- ParaView user guide

<https://www.paraview.org/paraview-guide/>

- Sandia National Lab ParaView tutorials

https://www.paraview.org/Wiki/SNL_ParaView_4_Tutorials