# The TAMU Visualization Portal

Ping Luo

TAMU HPRC

HIGH PERFORMANCE RESEARCH COMPUTING
TEXAS A&M UNIVERSITY

September 12, 2017

HPRC Short Course – Fall 2017

# Outline

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

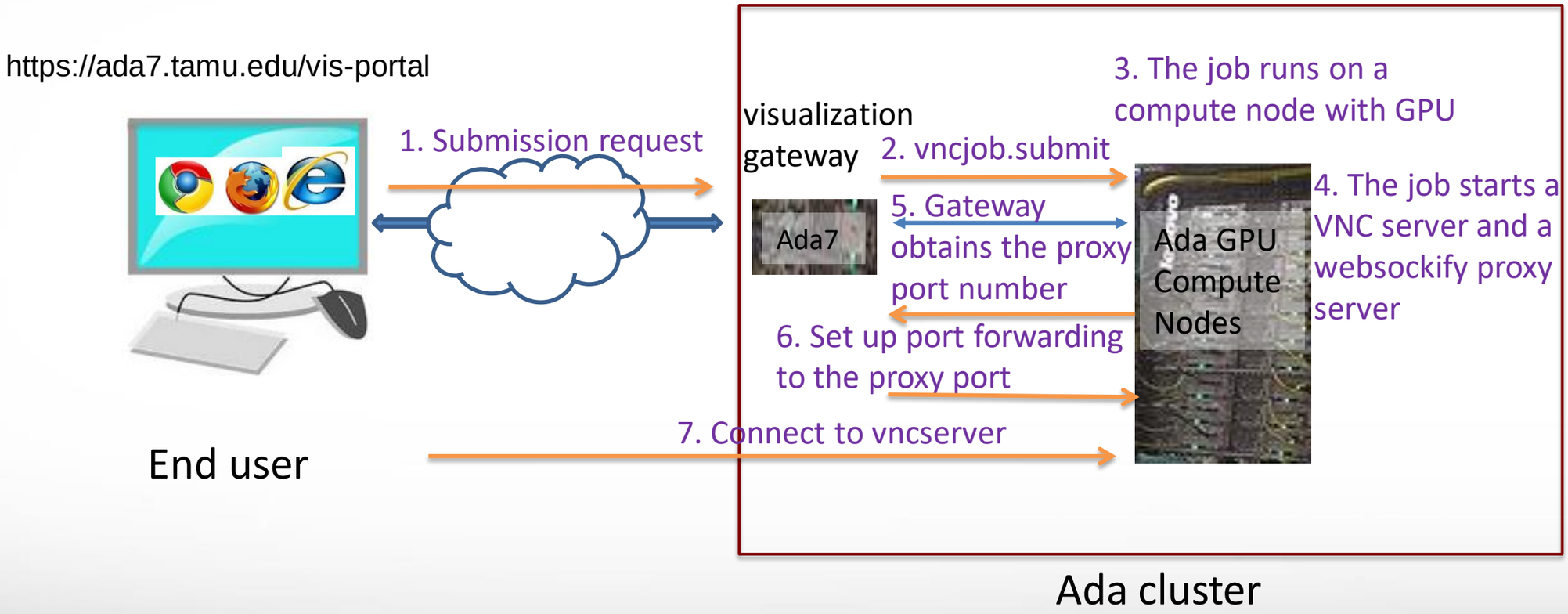
# The TAMU Visualization Portal

- 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.

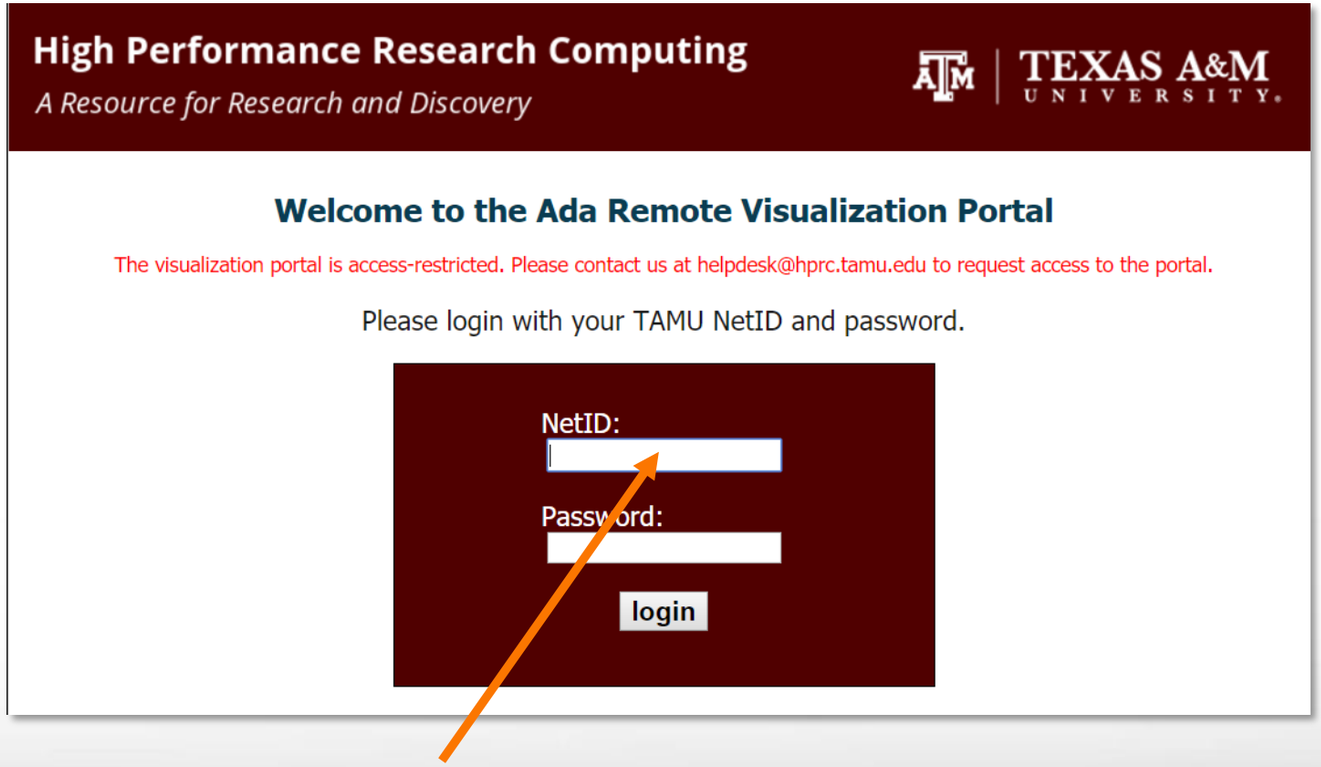
# Workflow of the Portal



# Accessing the Visualization Portal

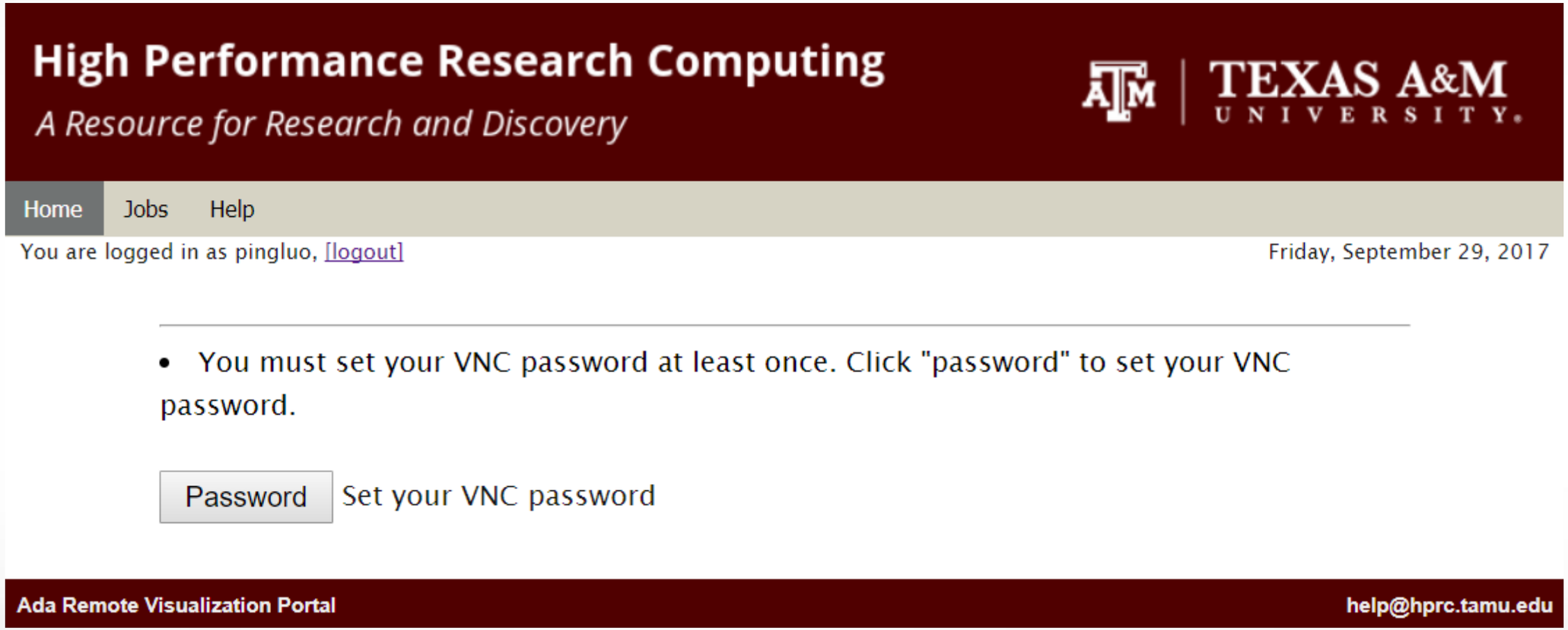
- Please request permission to access the portal by sending an email to help@hprc.tamu.edu
- If you are off-campus, please first login to the TAMU VPN
- Using a web-browser open https://ada7.tamu.edu/vis-portal/
- Please confirm the security exception to access the site
- Use your TAMU Net-ID and password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

**https://ada7.tamu.edu/vis-portal**

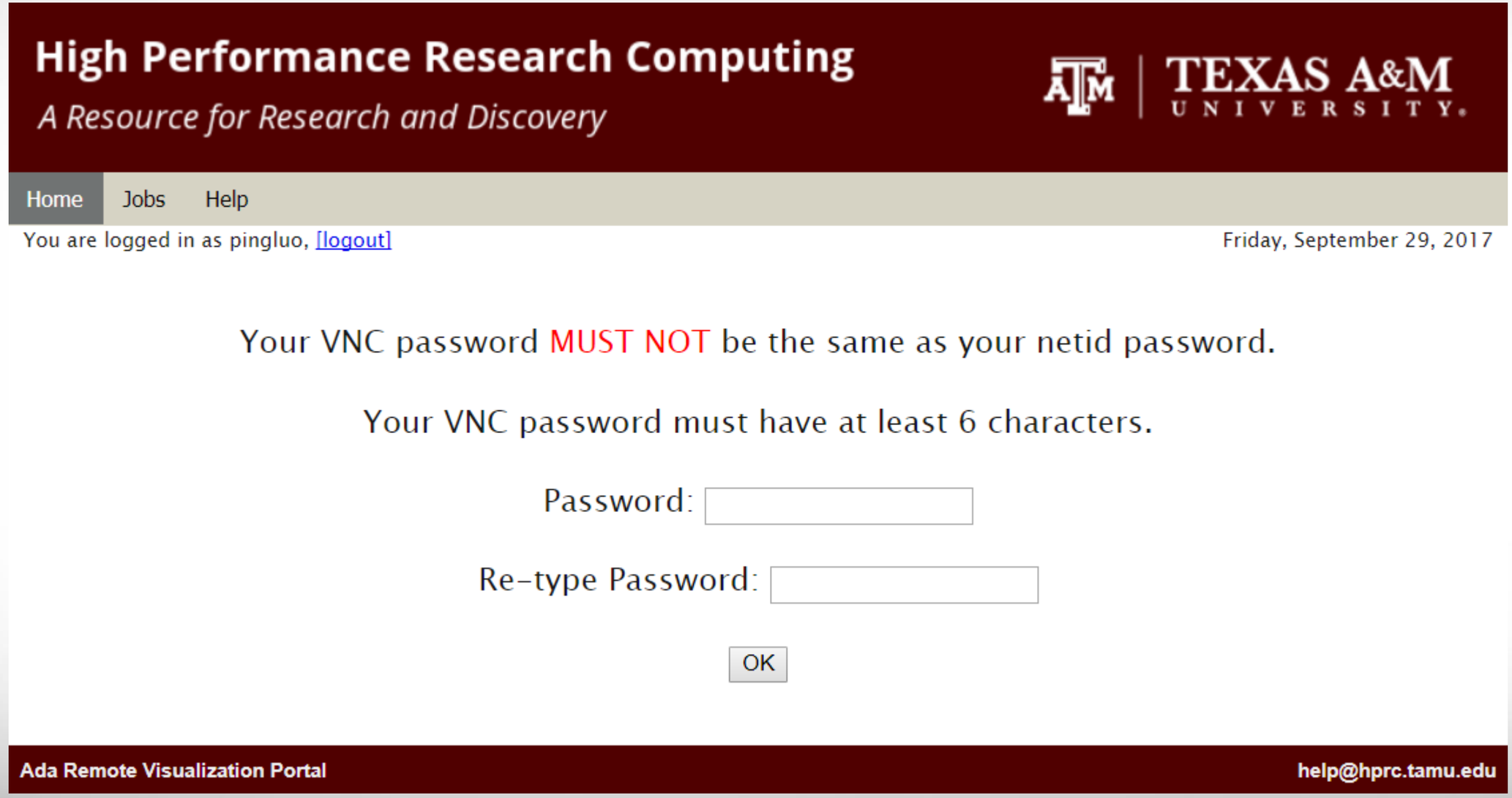



Enter your TAMU Net-ID

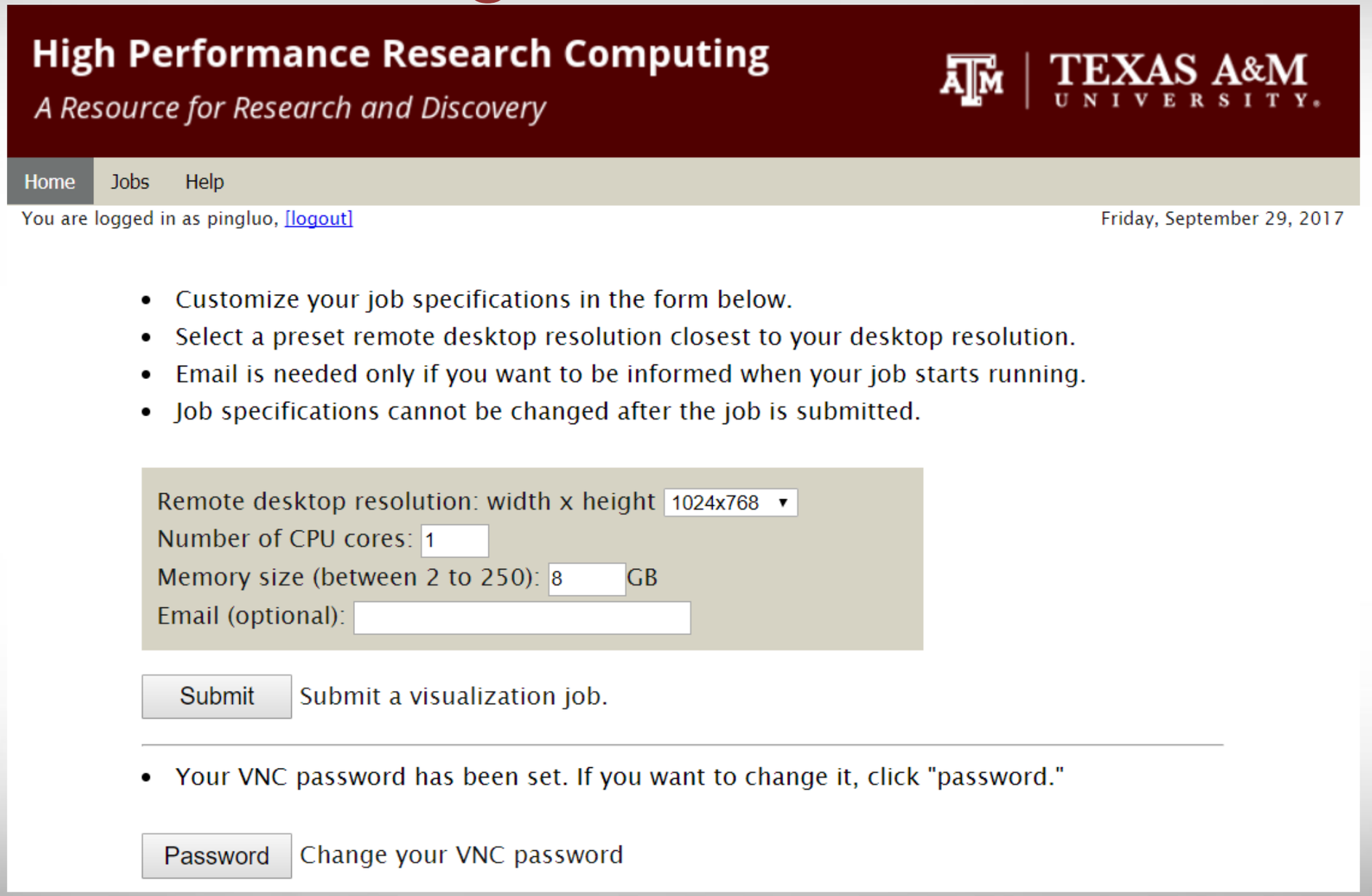
# For New Remote Visualization Users



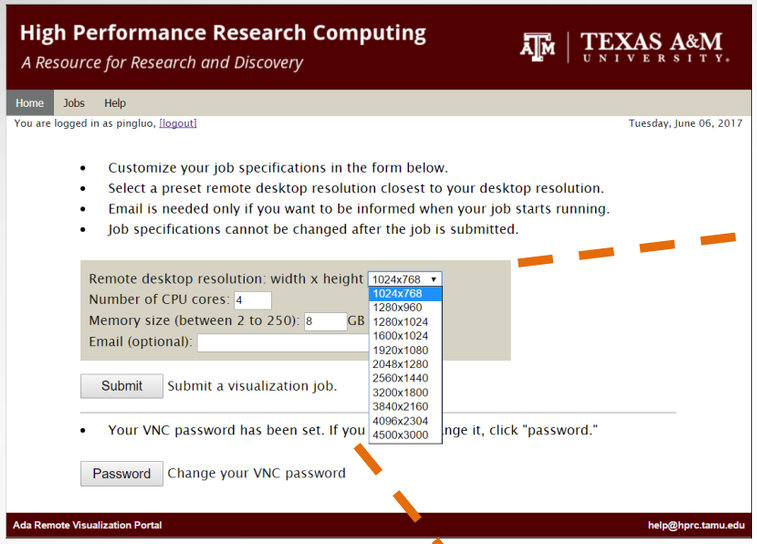
# Setting Your VNC Password

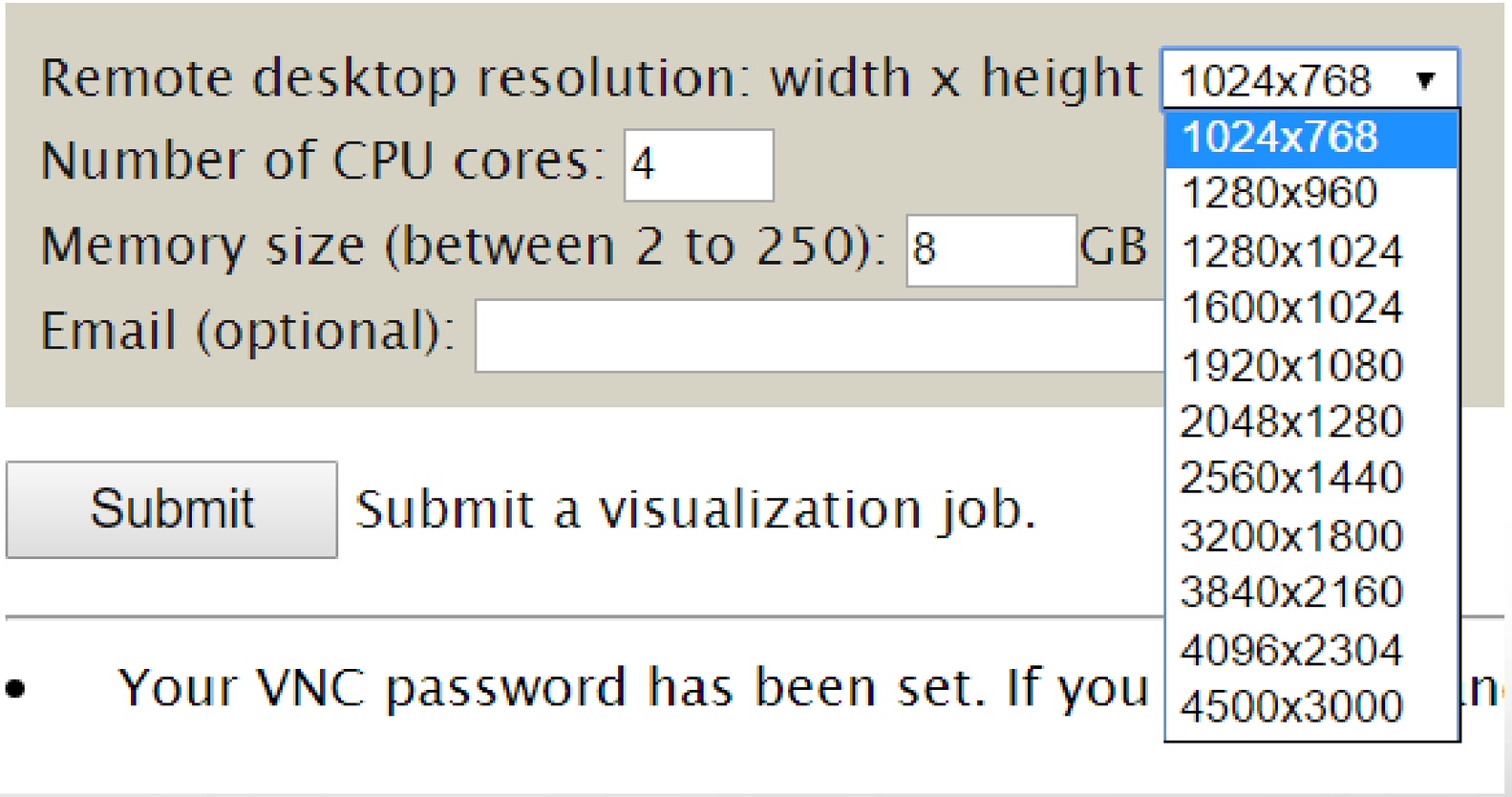


# Submitting a Visualization Job

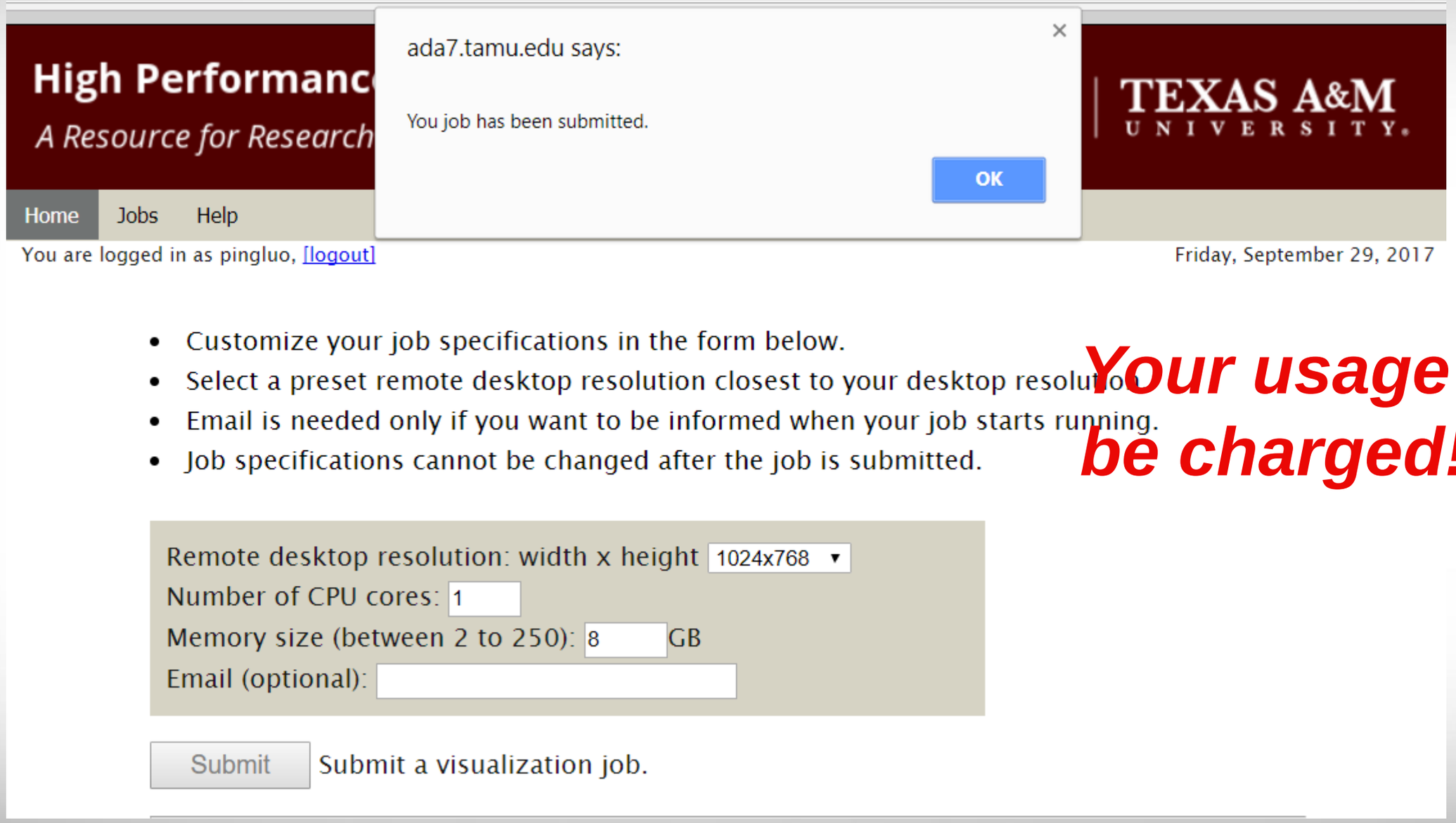


# Submitting a Visualization Job



# Submitting 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.

Refresh Your job 6238264 is running.

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

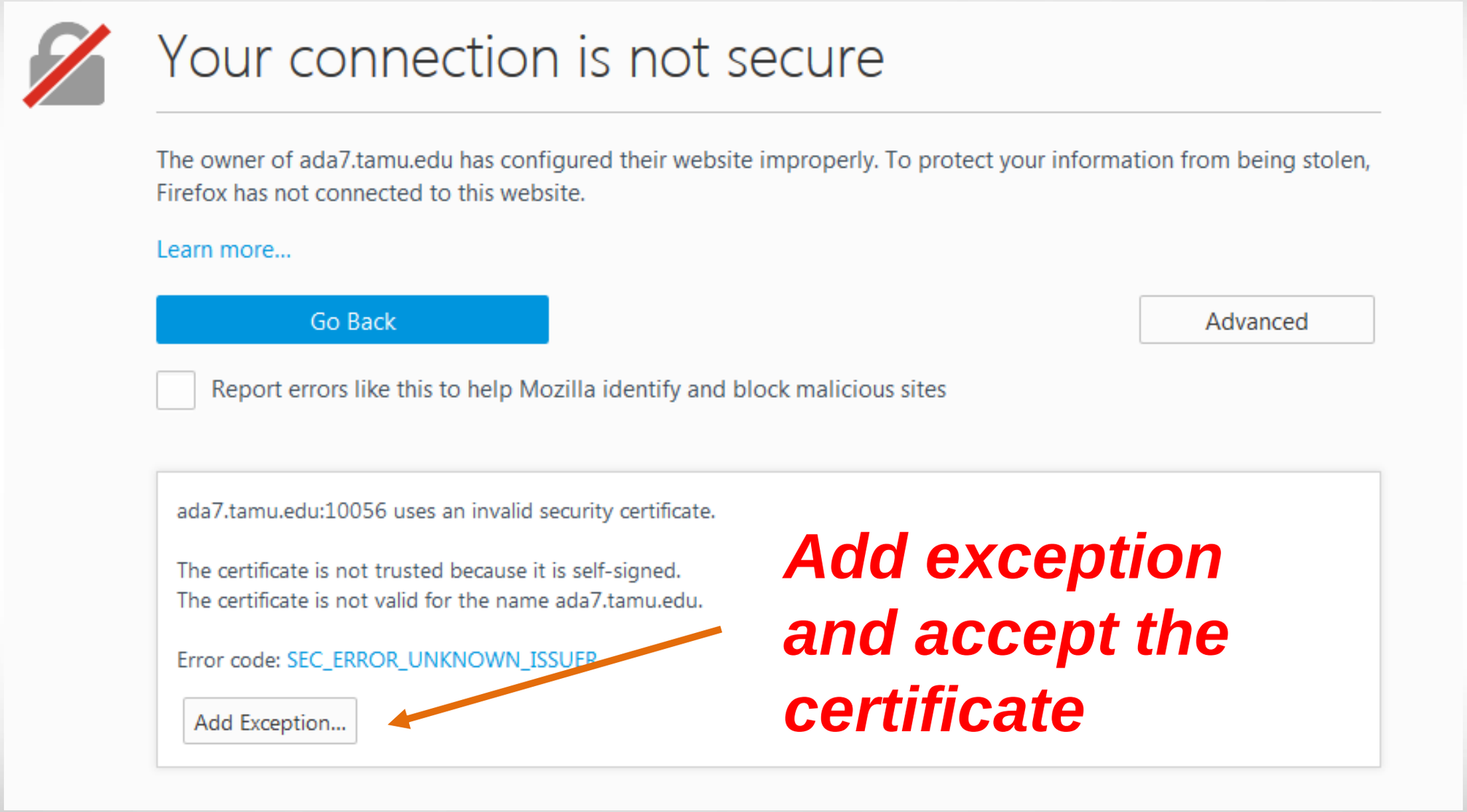
Delete Delete the visualization job.

---

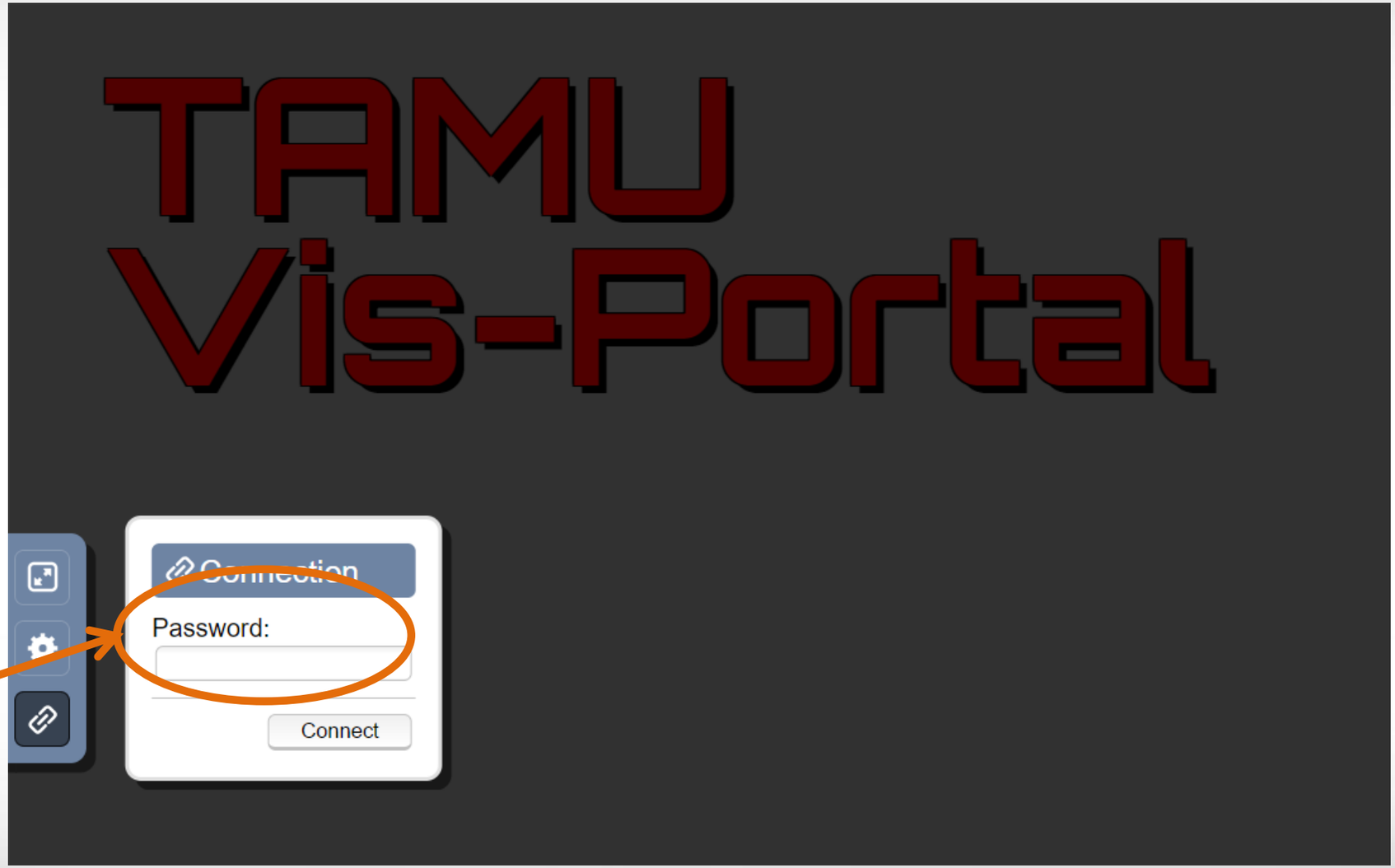
- Your VNC password has been set. If you want to change it, click "password."

Password Change your VNC password

# Connecting to the VNC Server

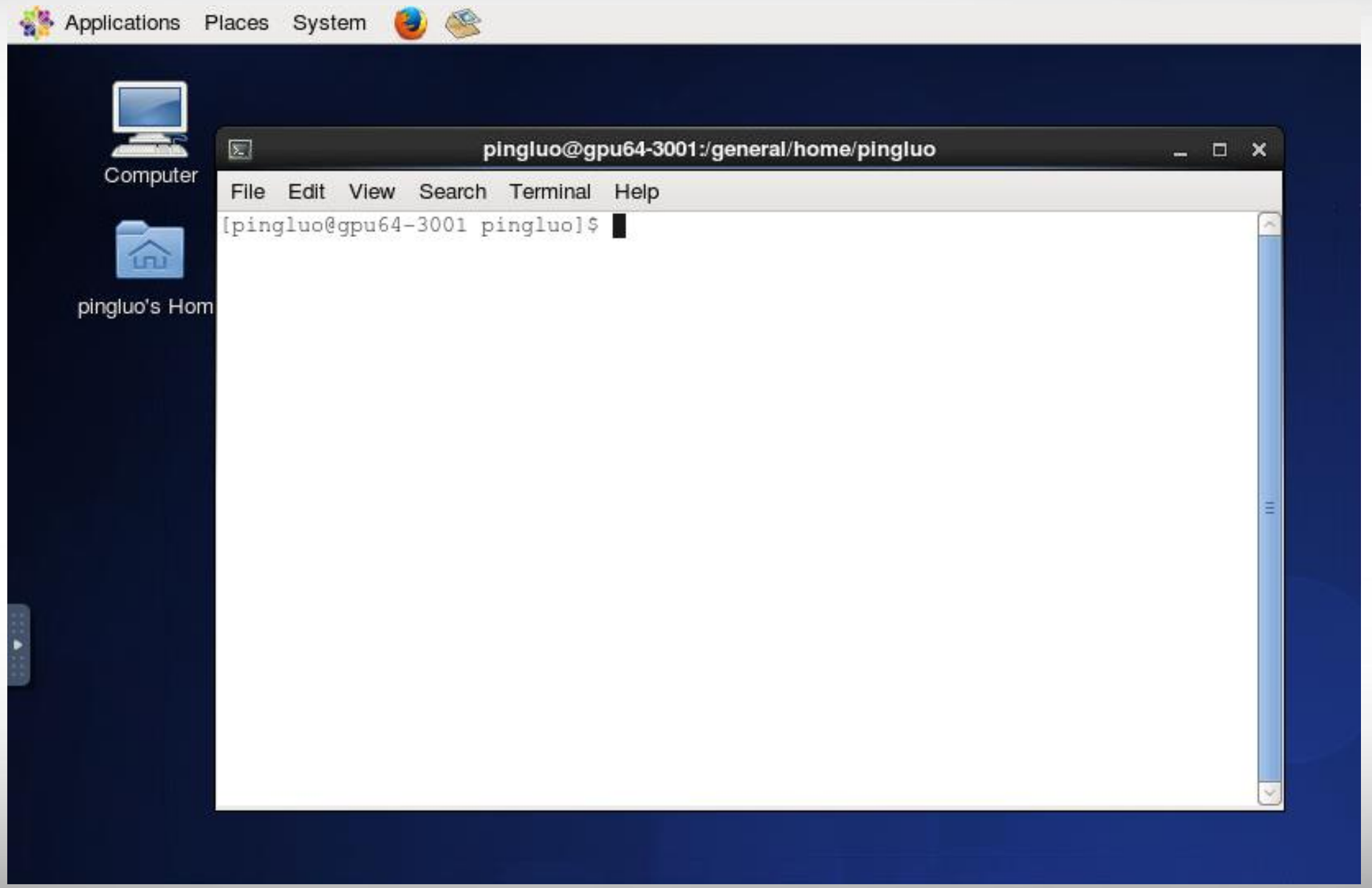


# Connecting to the VNC Server

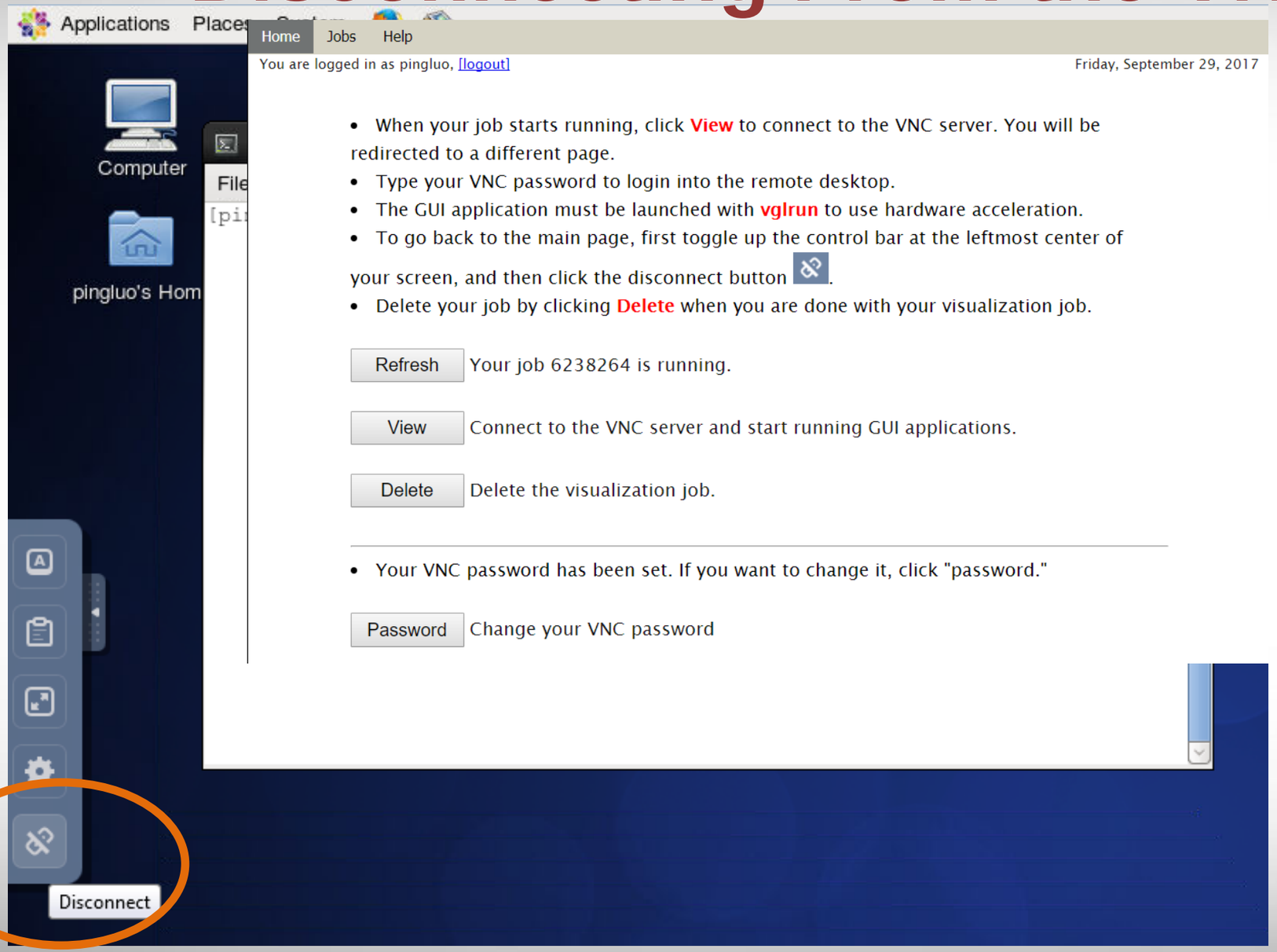



***This is your VNC password, and not your TAMU NetID password***

# The Remote Desktop

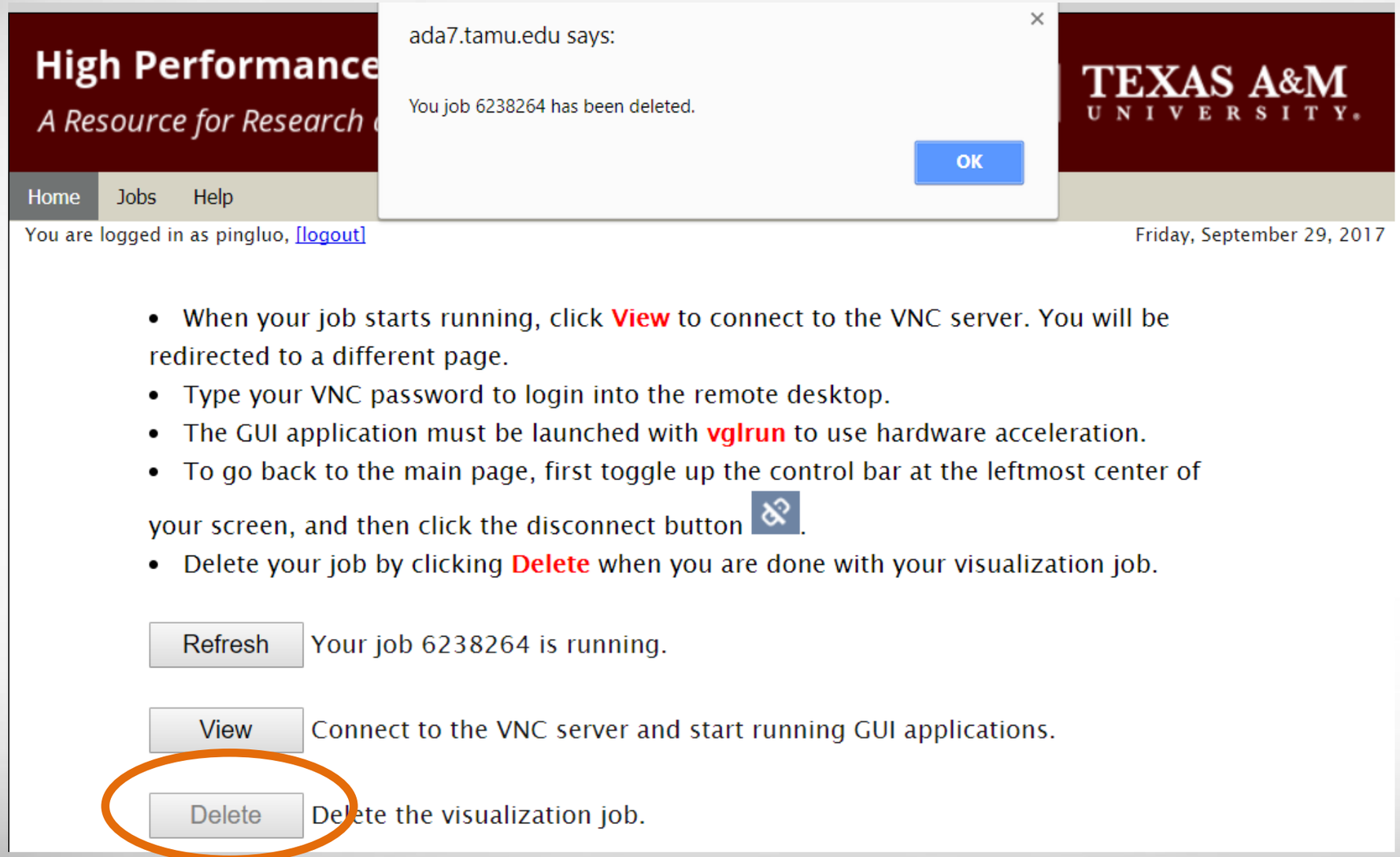


# Disconnecting From the VNC Server




- 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




- 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 SU = 1 core x 1 hour

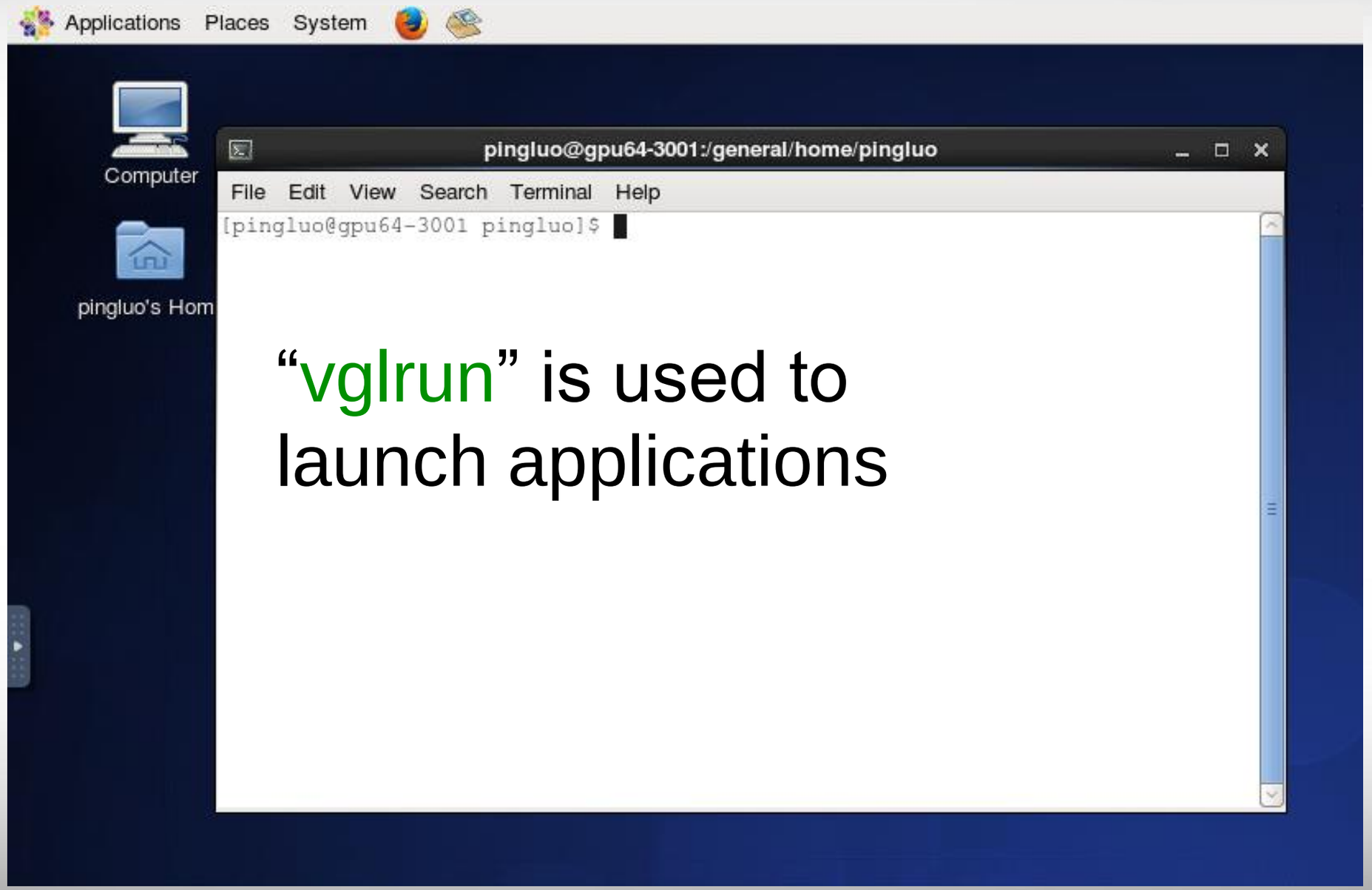
  $SU_{charged}$ = Max{num_cores, equiv_cores} x wall-time

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

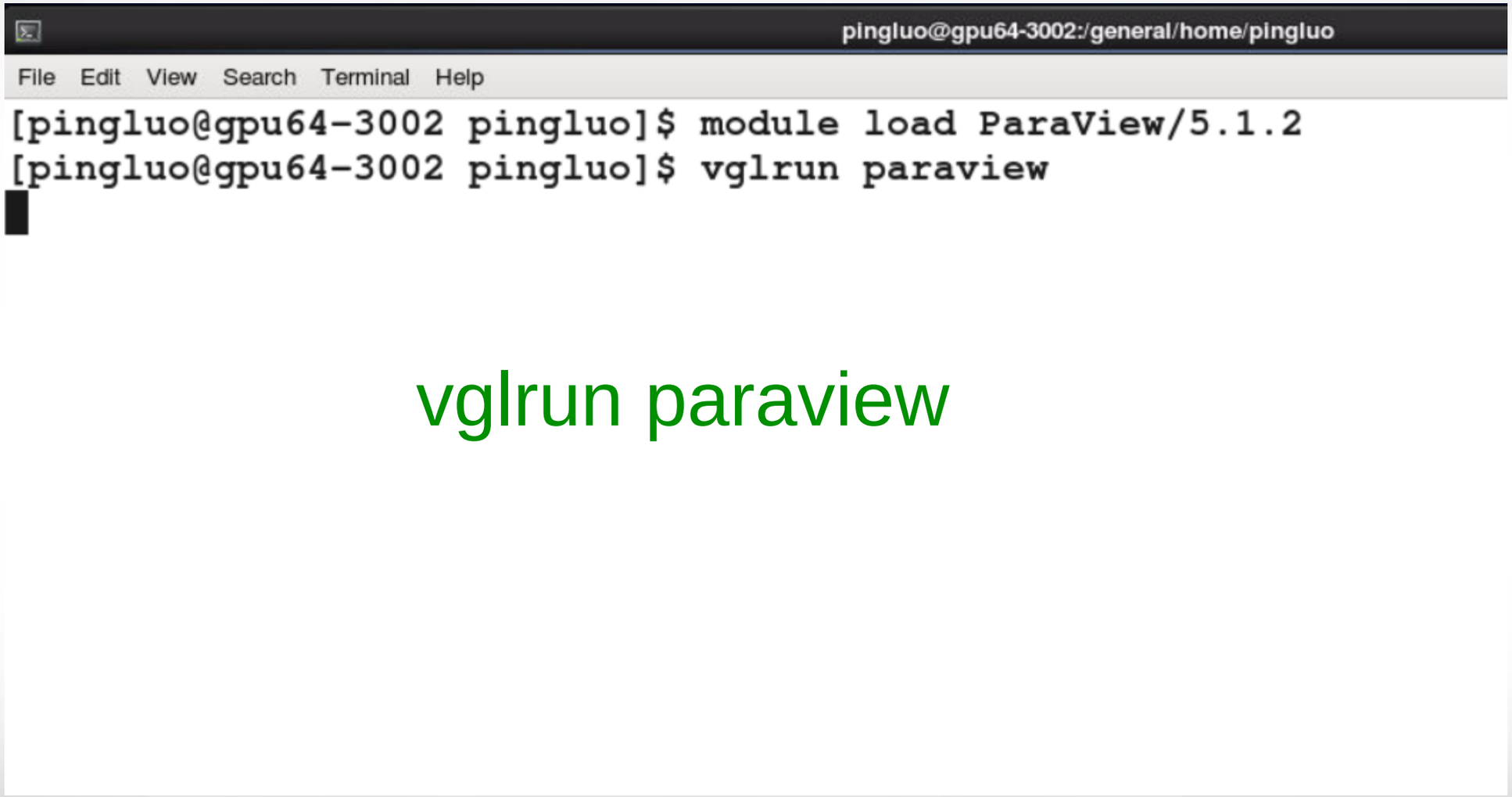
# Getting Help!


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

# Launching Applications

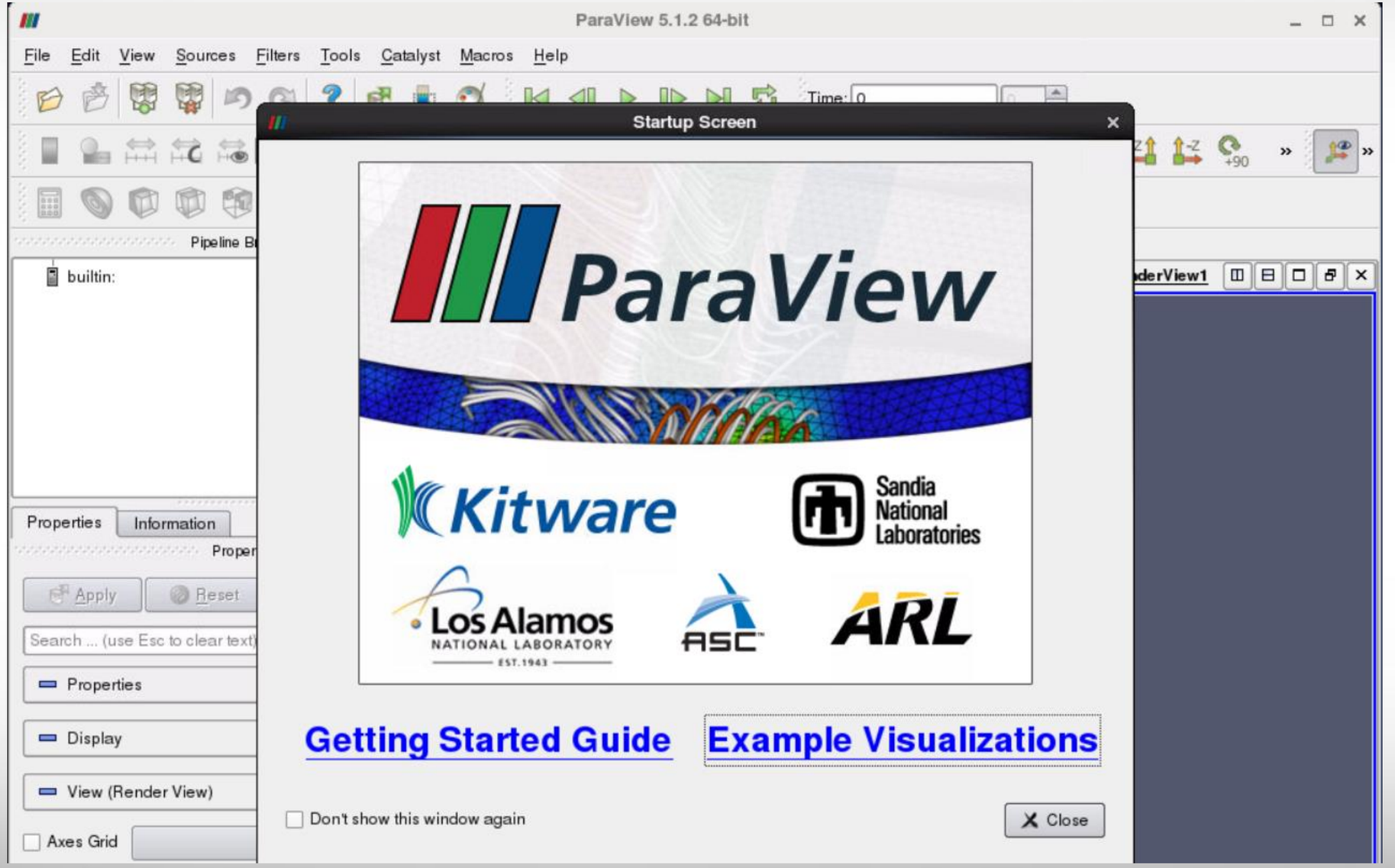


# Launching ParaView




vglrun paraview

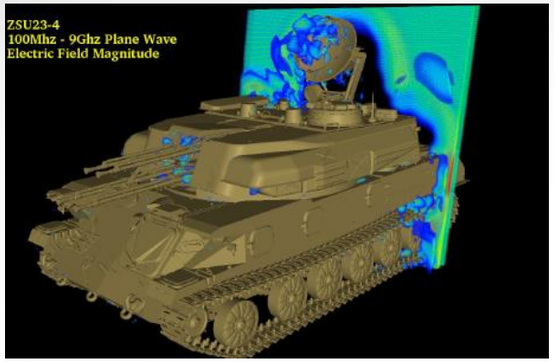
# Launching ParaView

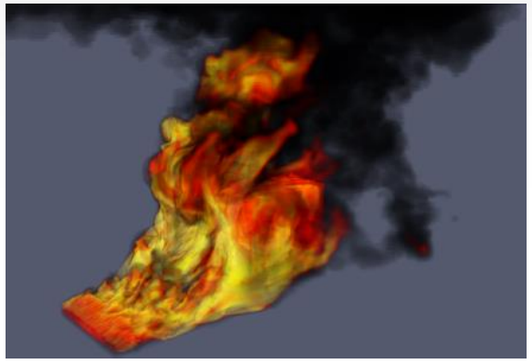


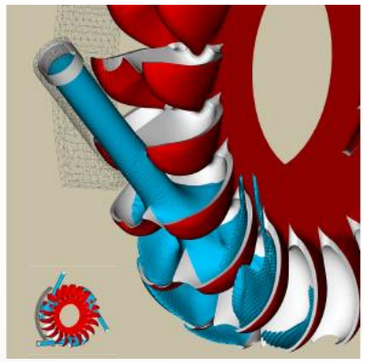
# Introduction to ParaView

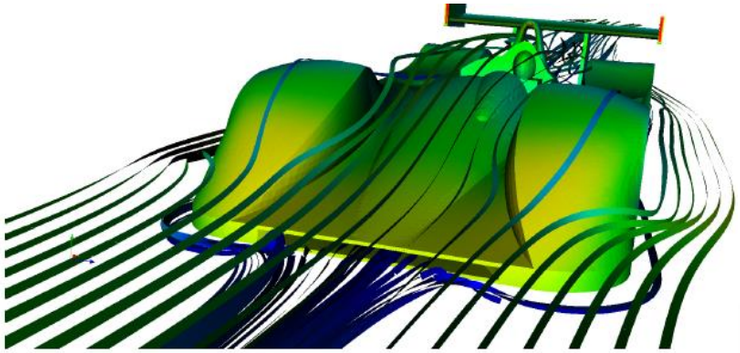
- What is ParaView
- The ParaView Architecture
- Hands-on: Basic Usage of ParaView
  - Getting Data
  - Interacting with 3D View
  - Representation and Field Coloring
  - Filter and Pipeline
  - Commonly used filters
    - contour, slice, clip, streamline, tube, glyph
  - Vector Visualization
    - Streamline,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

# What is ParaView



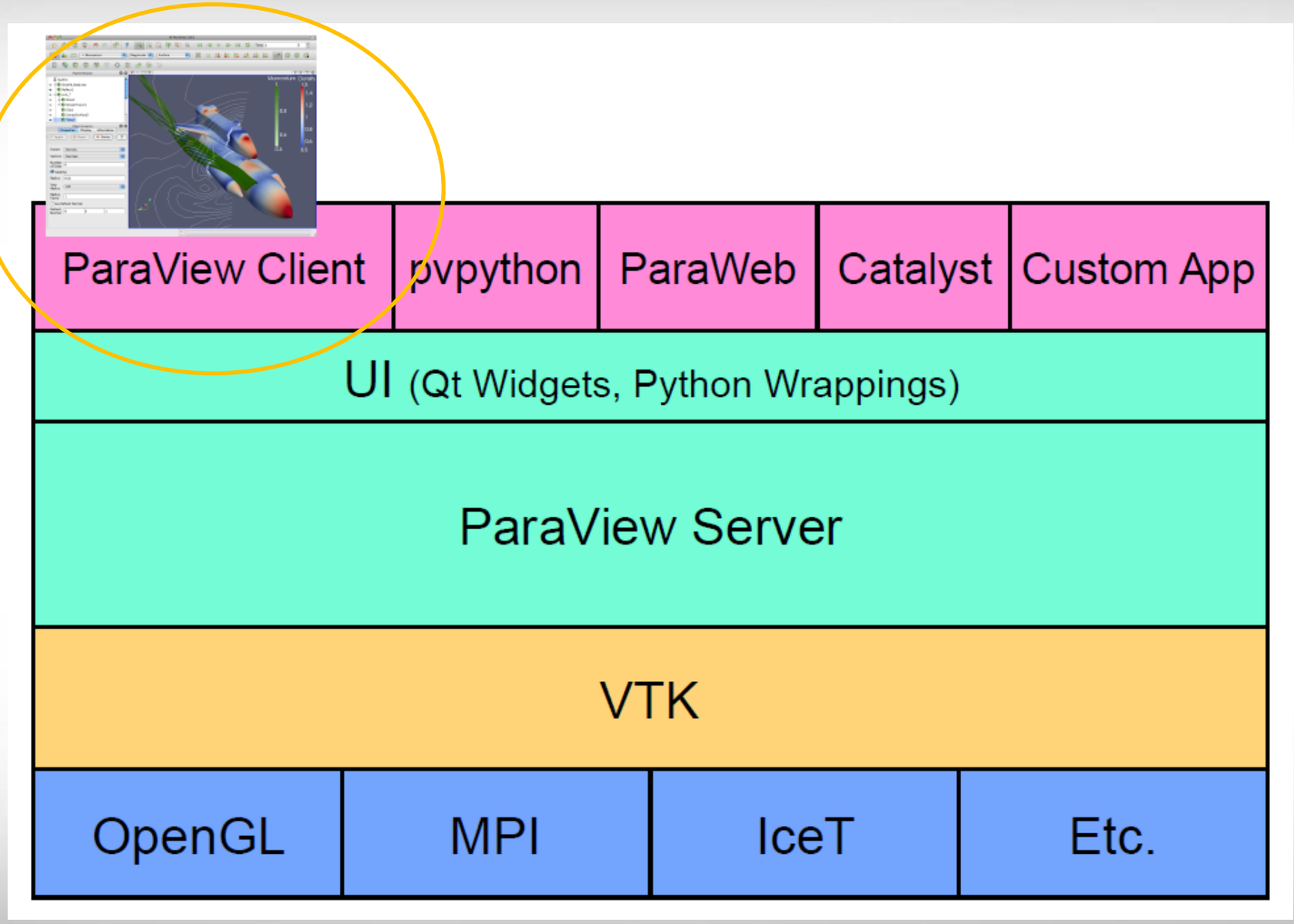




- An open source visualization software for 2D/3D data sets
- Started in 2000 as a collaborative effort between Kitware Inc and Los Alamos National Labratories
- Supports multi-platforms: Windows, Linux, MacOS
- Supports distributed computation for large data sets
- With an open, flexible, and intuitive 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
0000000: 4344 4601 0000 0001 0000 000a 0000 0019
0000010: 0000 000a 6c65 6e5f 7374 7269 6e67 0000
0000020: 0000 0021 0000 0008 6c65 6e5f 6c69 6e65
0000030: 0000 0051 0000 0004 666f 7572 0000 0004
0000040: 0000 0009 7469 6d65 5f73 7465 7000 0000
0000050: 0000 0000 0000 0007 6e75 6d5f 6469 6d00
0000060: 0000 0003 0000 0009 6e75 6d5f 6e6f 6465
0000070: 7300 0000 0000 2133 0000 0008 6e75 6d5f
0000080: 656c 656d 0000 1d30 0000 000a 6e75 6d5f
0000090: 656c 5f62 6c6b 0000 0000 0001 0000 000d
00000a0: 6e75 6d5f 6e6f 6465 5f73 6574 7300 0000
00000b0: 0000 0003 0000 000d 6e75 6d5f 7369 6465
00000c0: 5f73 6574 7300 0000 0000 0007 0000 000a
00000d0: 6e75 6d5f 7161 5f72 6563 0000 0000 0003
00000e0: 0000 0008 6e75 6d5f 696e 666f 0000 000a
00000f0: 0000 000e 6e75 6d5f 656c 5f69 6e5f 626c
0000100: 6b31 0000 0000 1d30 0000 000f 6e75 6d5f
0000110: 6e6f 645f 7065 725f 656c 3100 0000 0008
0000120: 0000 000b 6e75 6d5f 6e6f 645f 6e73 3100
0000130: 0000 0001 0000 000b 6e75 6d5f 6e6f 645f
0000140: 6e73 3200 0000 0001 0000 000b 6e75 6d5f
0000150: 6e6f 645f 6e73 3300 0000 0001 0000 000c
0000160: 6e75 6d5f 7369 6465 5f73 7331 0000 01a2
0000170: 0000 000c 6e75 6d5f 7369 6465 5f73 7332
0000180: 0000 006c 0000 000c 6e75 6d5f 7369 6465
0000190: 5f73 7333 0000 033c 0000 000c 6e75 6d5f
00001a0: 7369 6465 5f73 7334 0000 00d8 0000 000c
00001b0: 6e75 6d5f 7369 6465 5f73 7335 0000 00b4
00001c0: 0000 000c 6e75 6d5f 7369 6465 5f73 7336
00001d0: 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

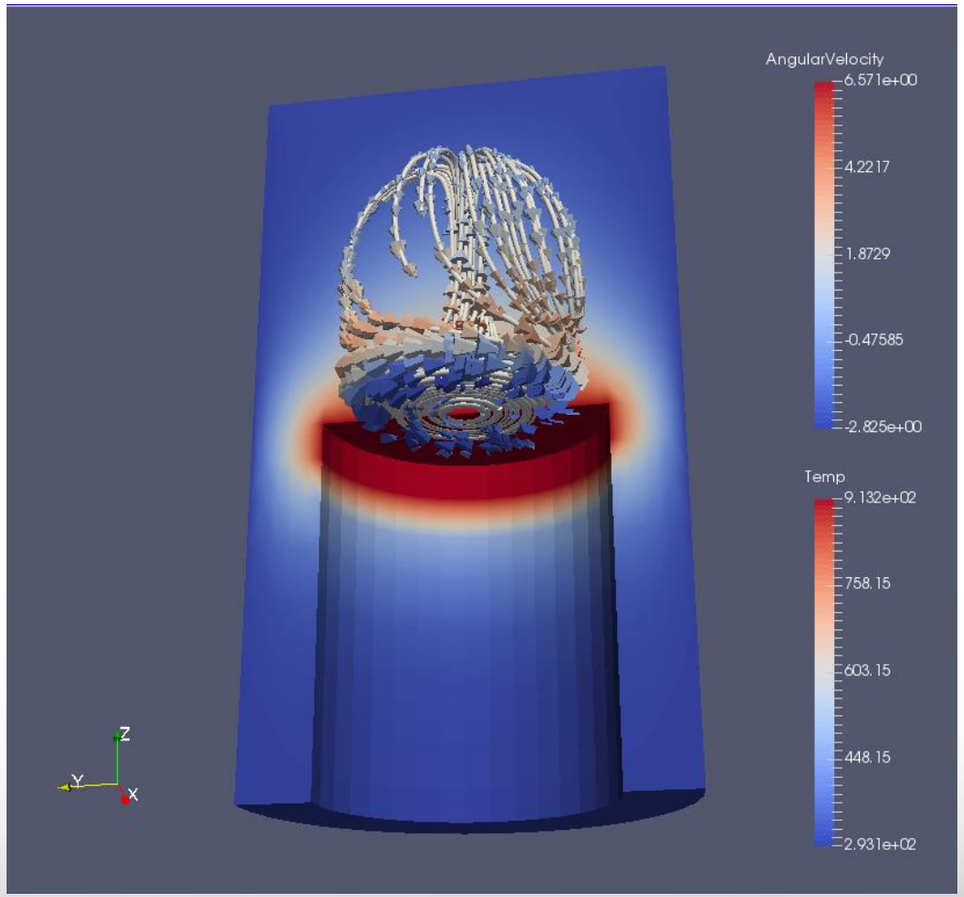
| Name | Data Type | Data Ranges |
|---|---|---|
| AsH3 | double | [0.0804768, 0.184839] |
| CH4 | double | [0, 0.00117024] |
| GaMe3 | double | [0.000222844, 0.007213... |
| GlobalNodeId | idtype | [1, 8499] |
| H2 | double | [0.807613, 0.917688] |
| PedigreeNodeId | idtype | [1, 8499] |
| Pres | double | [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

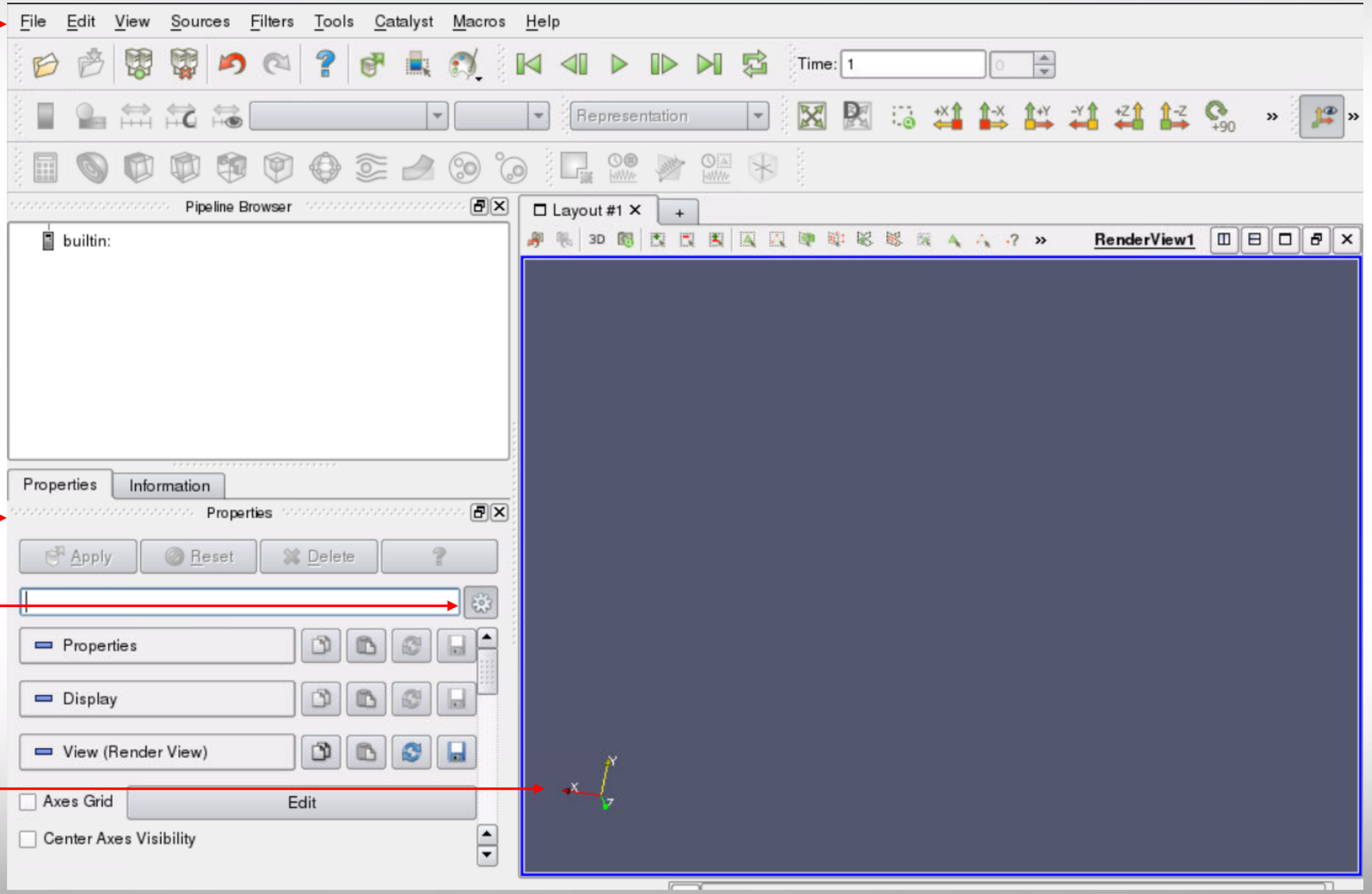
Toolbars

Pipeline browser

Property panel

Advanced toggle

3D view



# Getting Data

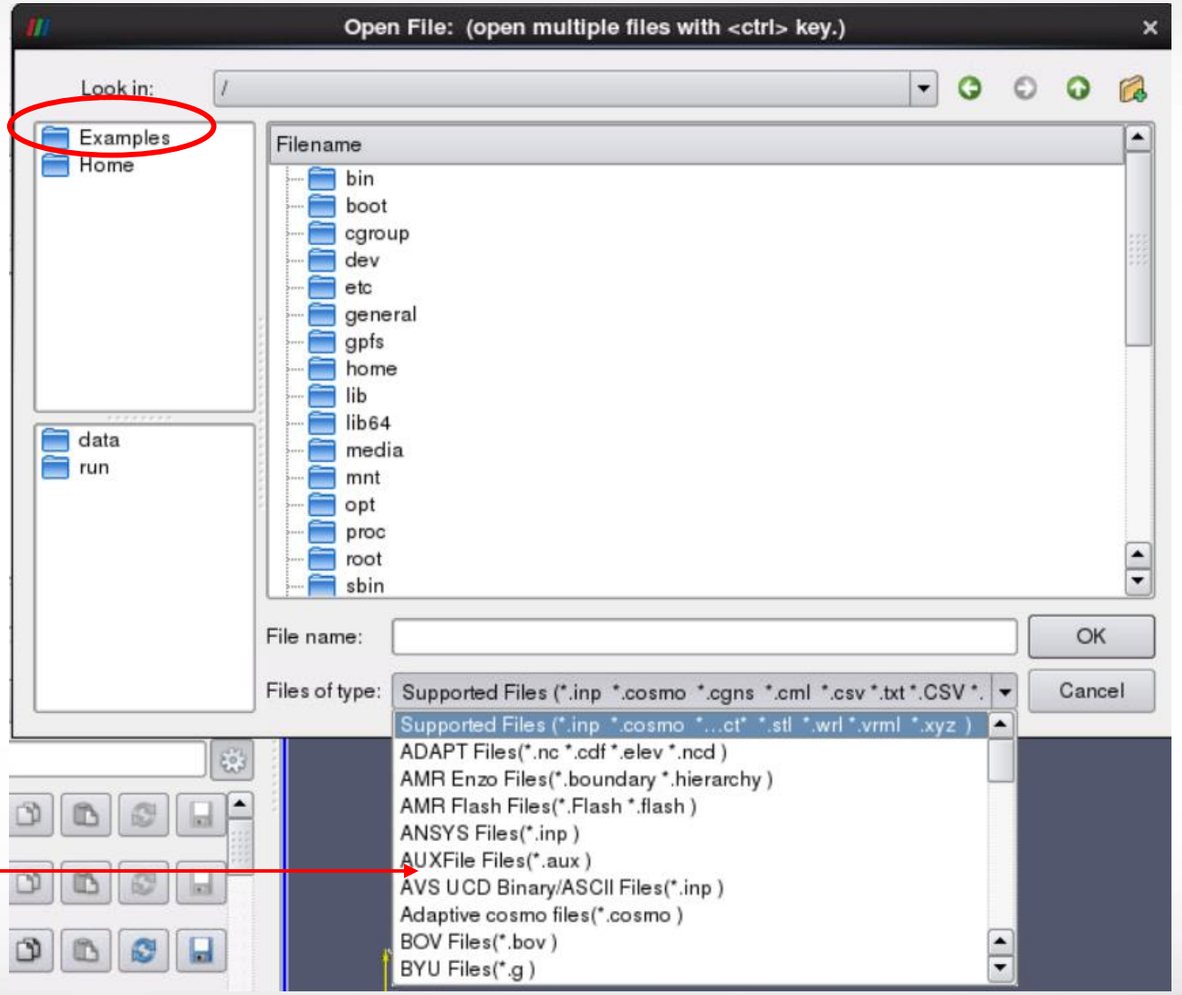
- Creating a source from the menu Sources
- Loading from a file

# Interacting with a 3D View

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

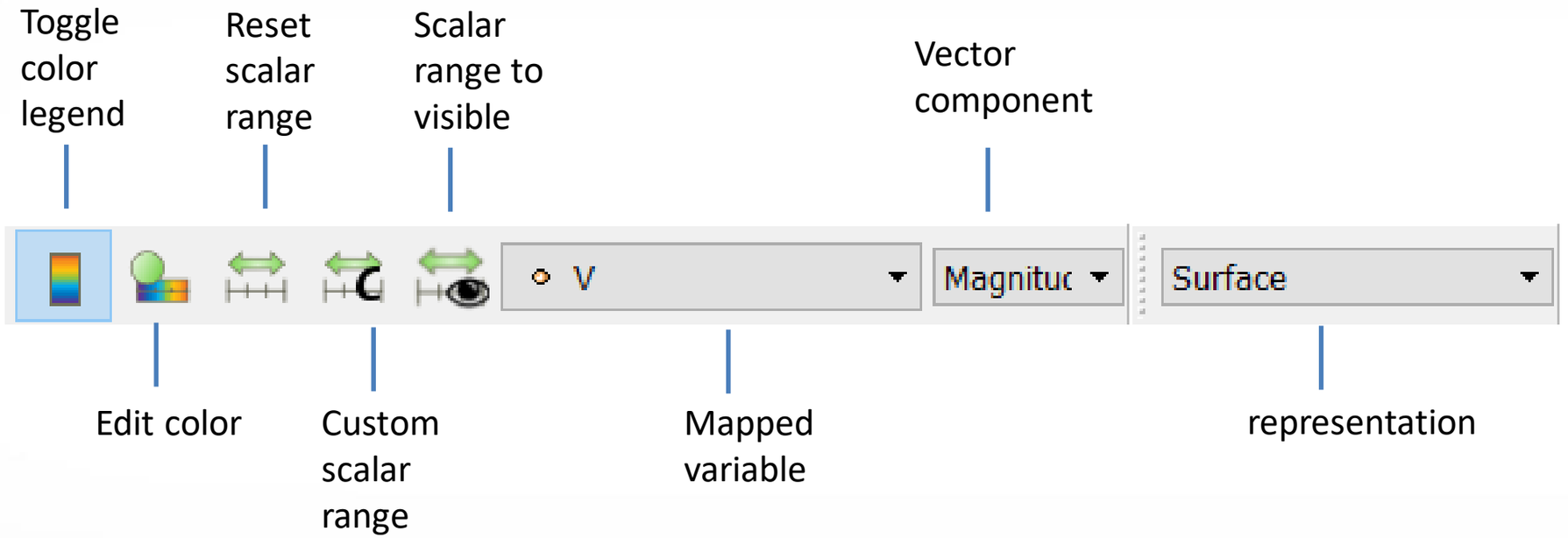

# Loading from a File

- 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.

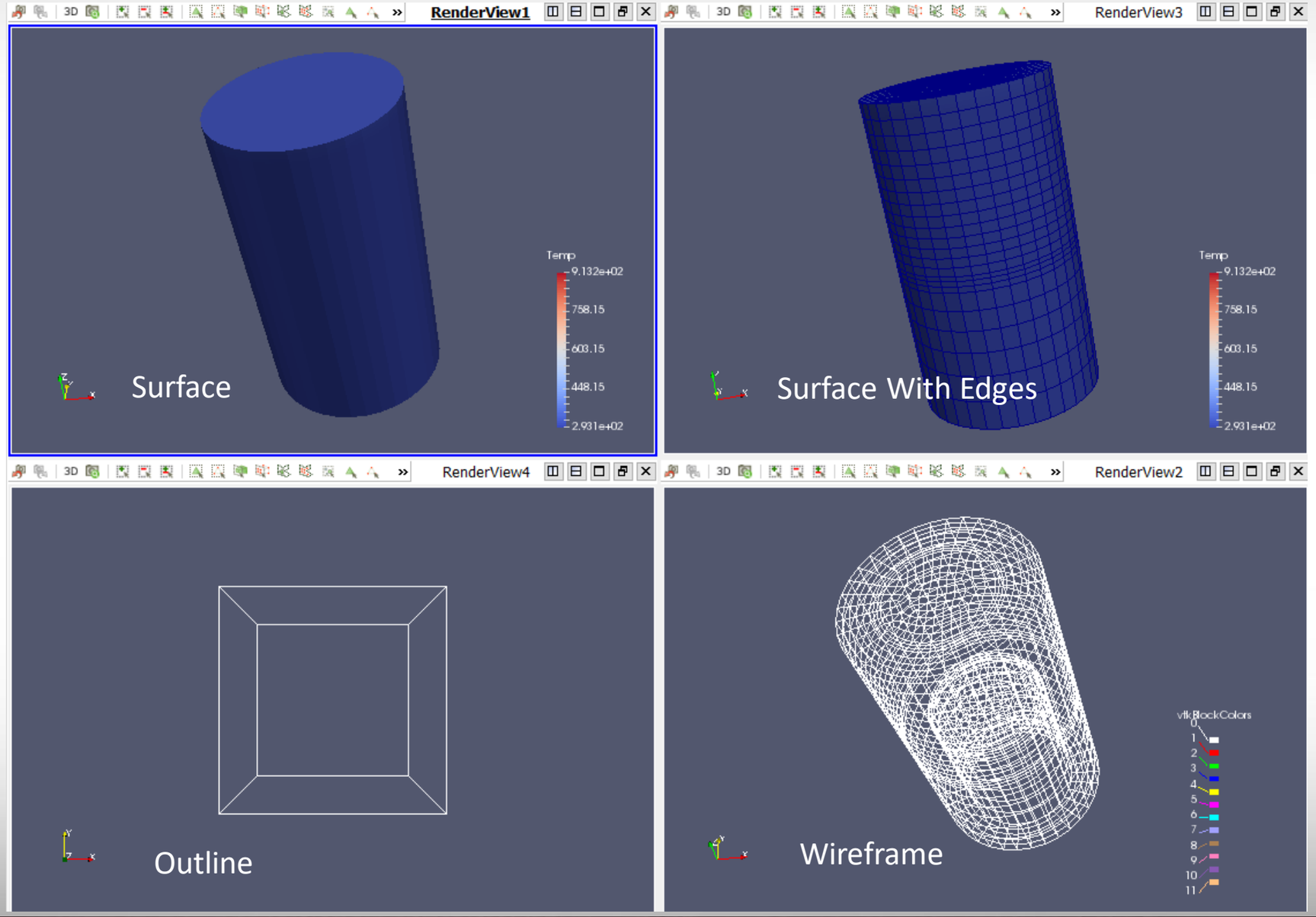



Scroll down to see a list of supported file types

# Representation and Active Variable Controls

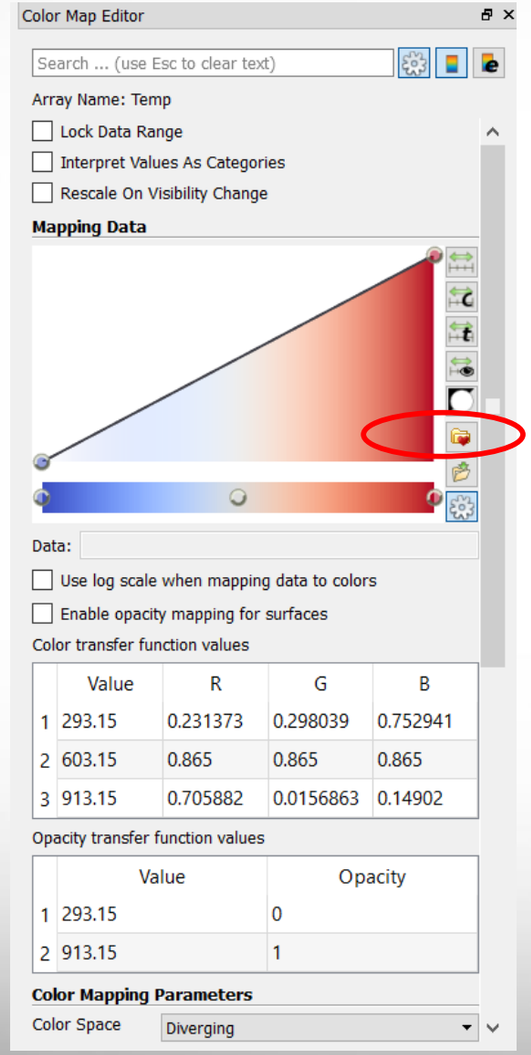


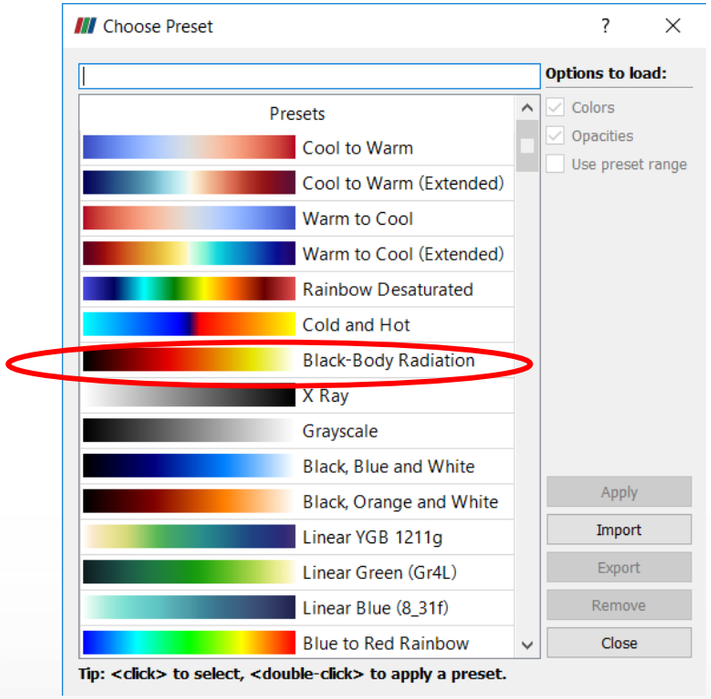
# Representation

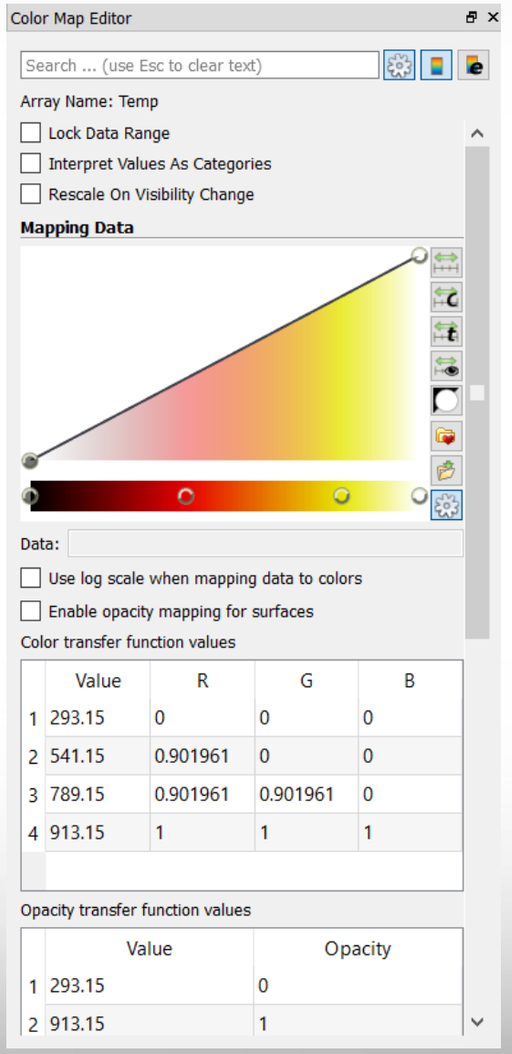


# Change Color Map

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

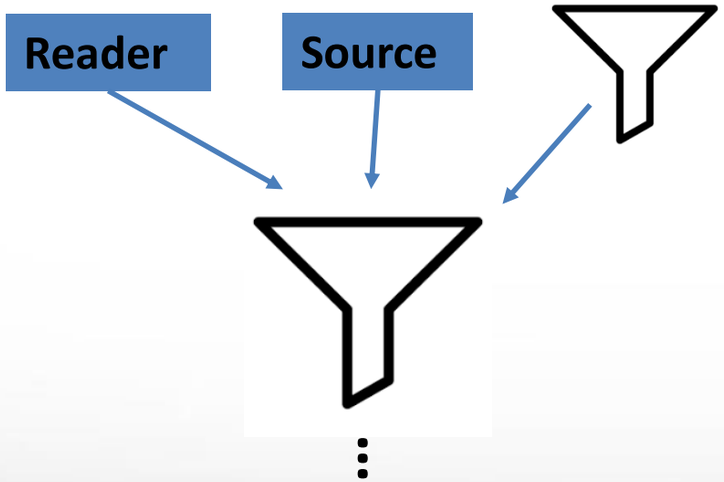


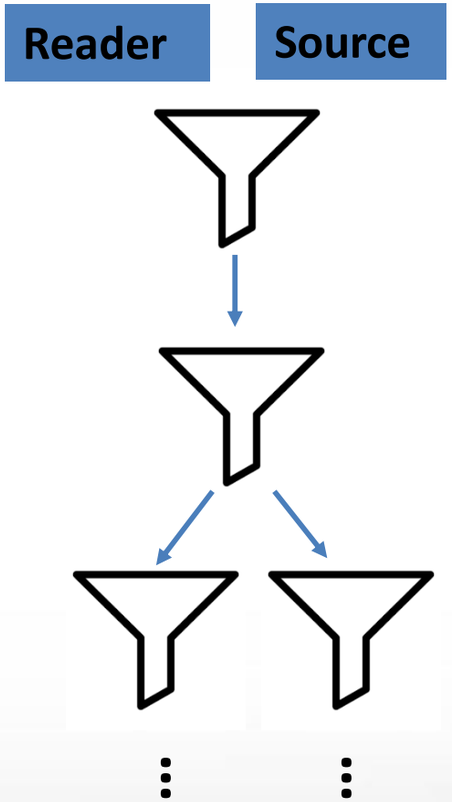



# Filter and Pipeline

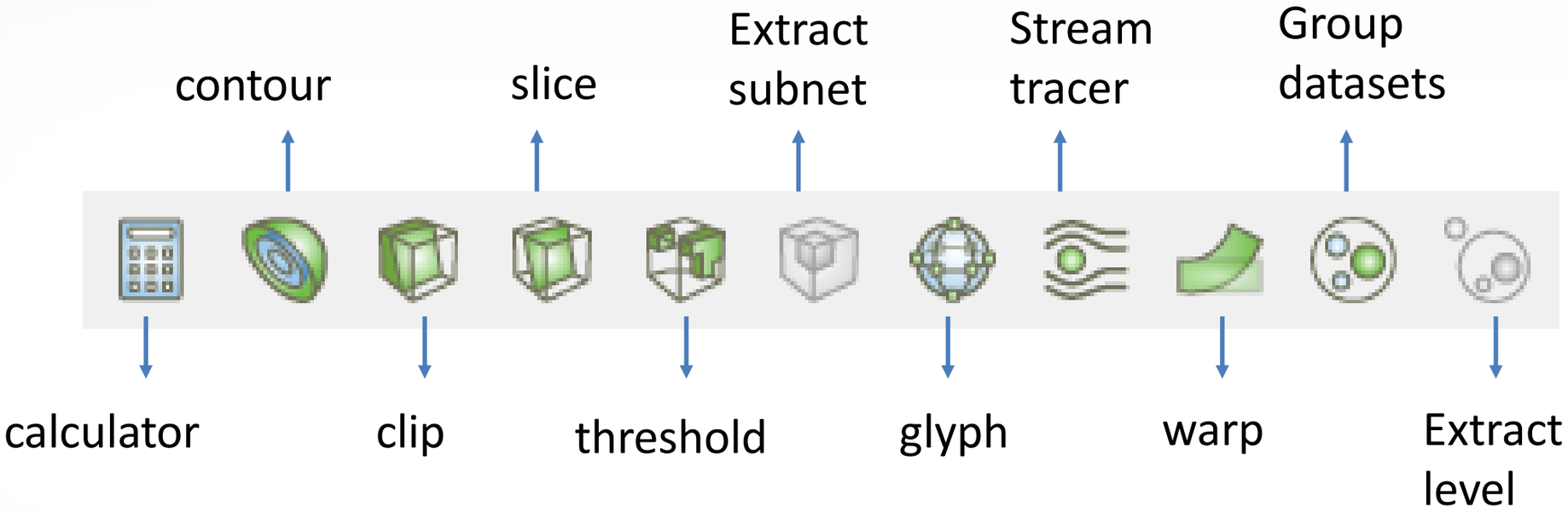
- Filter: a functional unit that processes the data to generate, extract, or derive features from the data.




- Pipeline

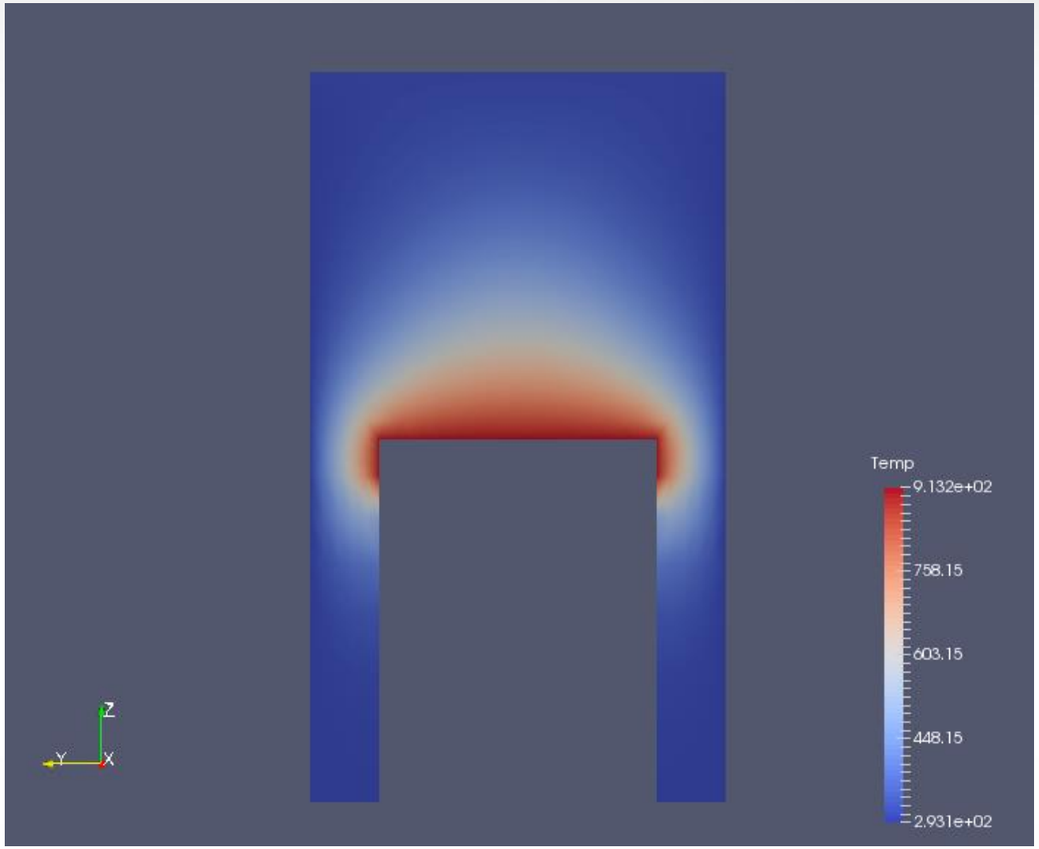


# Commonly Used Filters



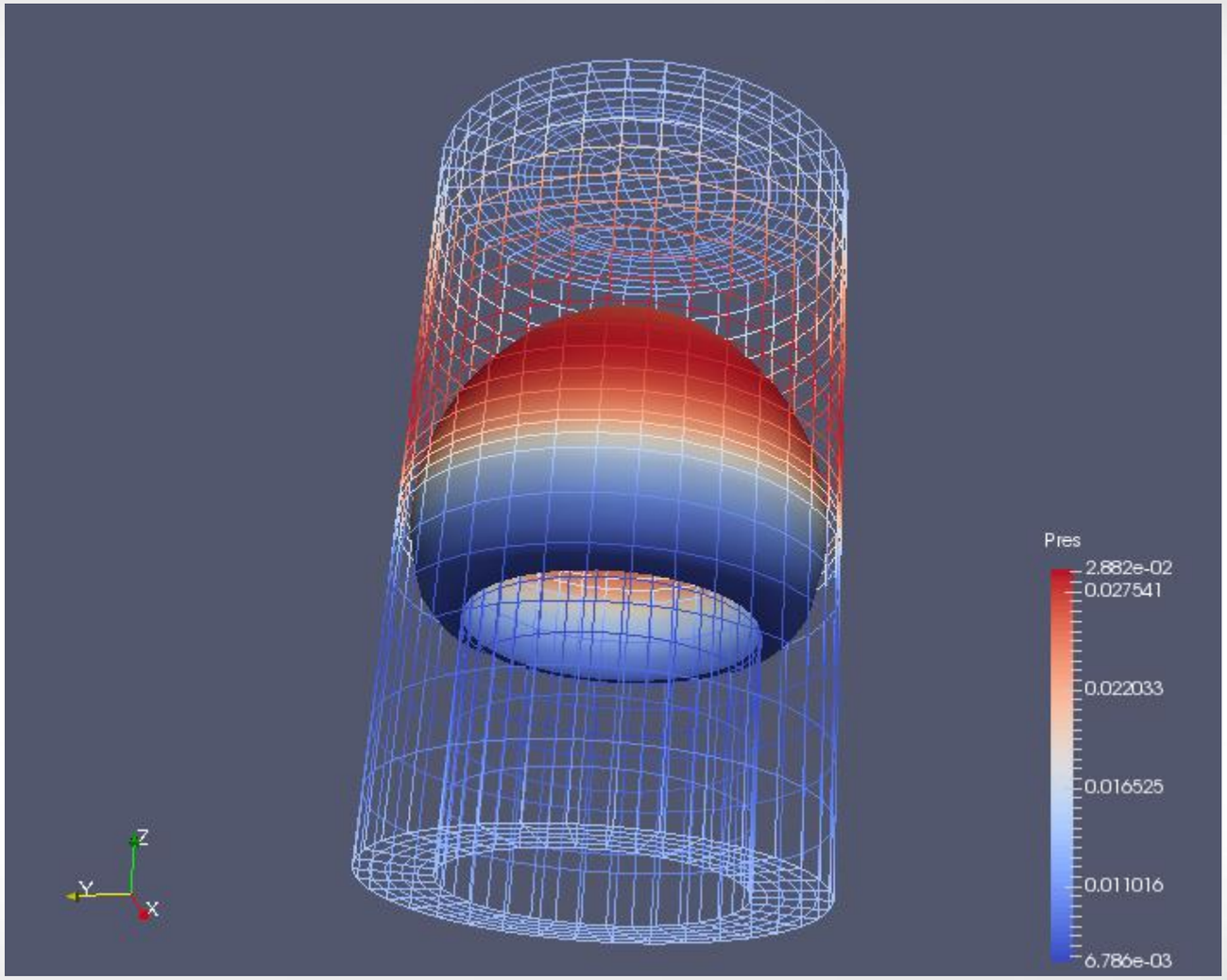
# Slice

- 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



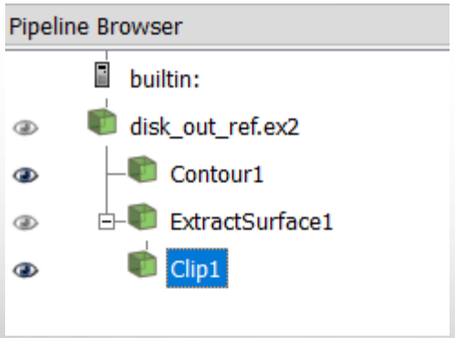
# Contour

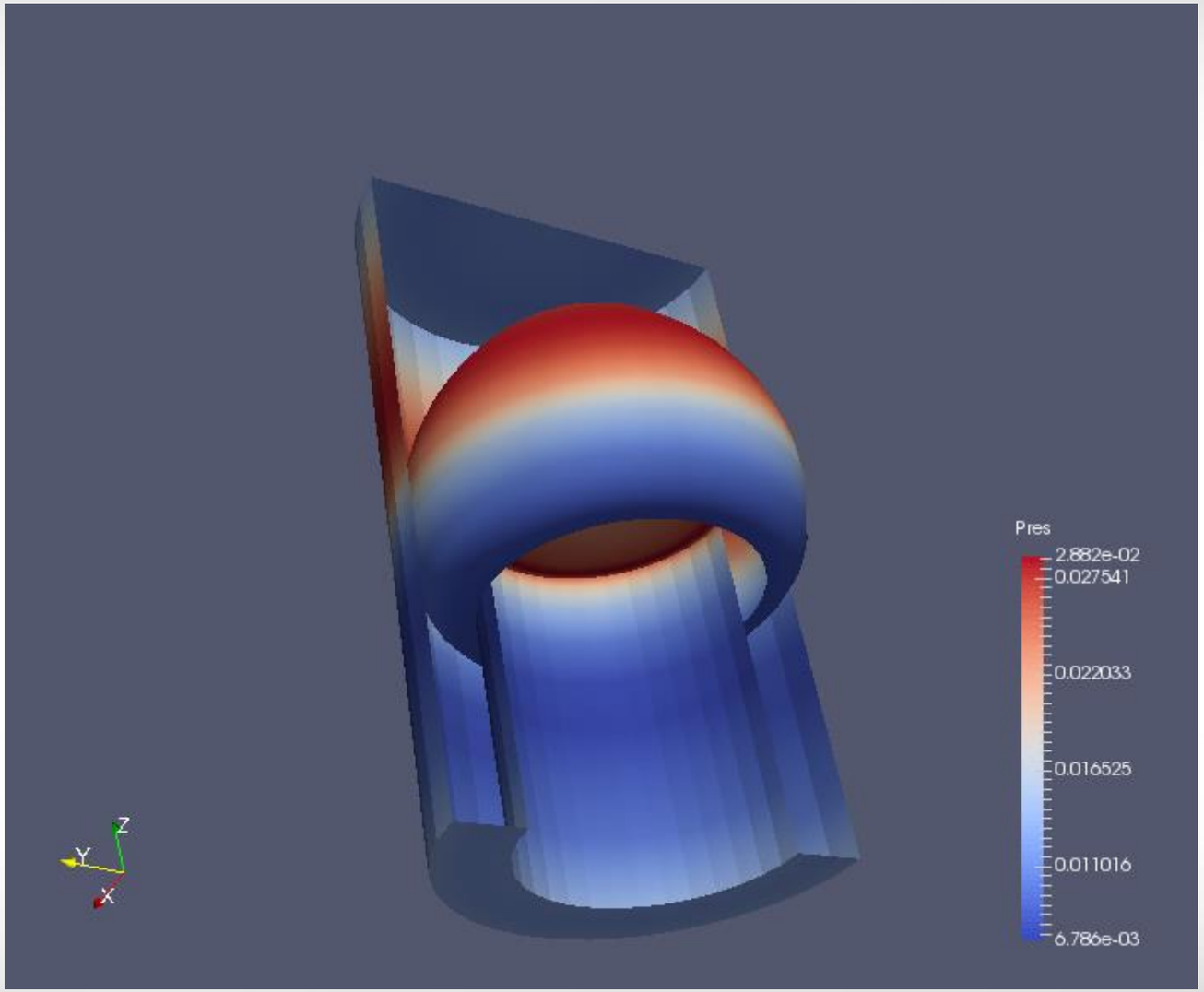
- Edit -> Reset Session
- Load disk_out_ref.ex2 -> check all variables -> apply
- Active variable -> pres
- Representation -> Wireframe
- Contour -> In Properties tab click “temp” for “Contour by”
- Change “Isosurfaces” value to “400” -> apply



# Extract Surface

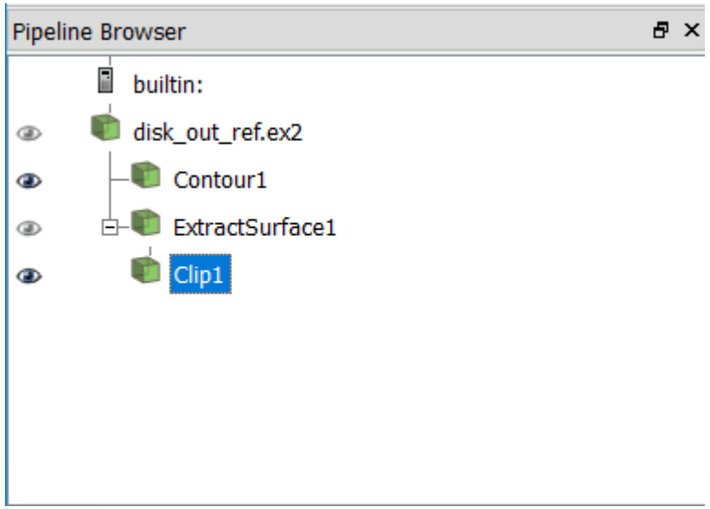
- Continue from previous slide
- Representation -> Surface
- Filters -> Alphabetical -> Extract Surface -> apply
- Select “ExtractSurface1” -> Clip -> uncheck “show plane” in “Plane Properties” -> Apply

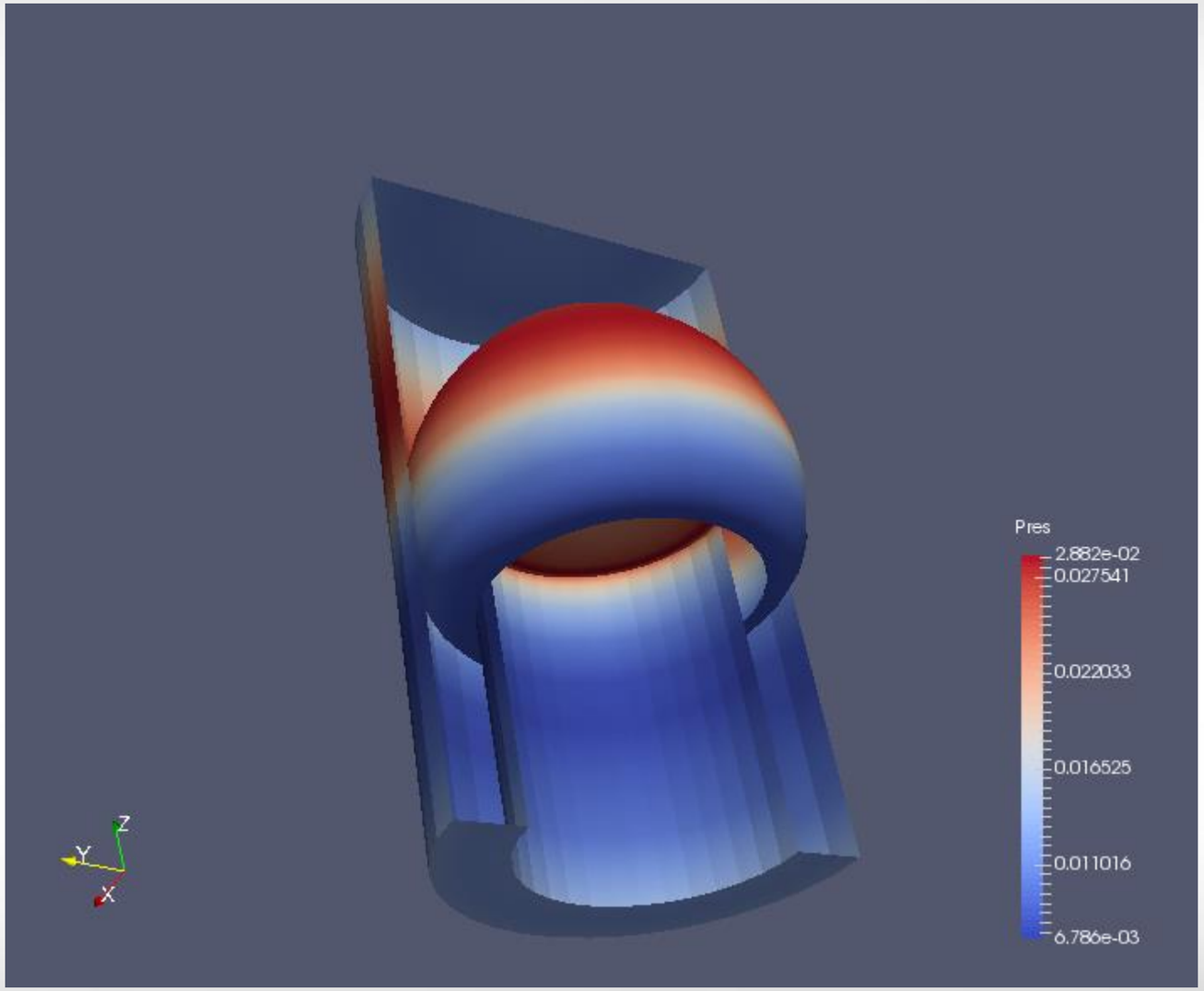


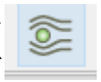
# Save/Load State

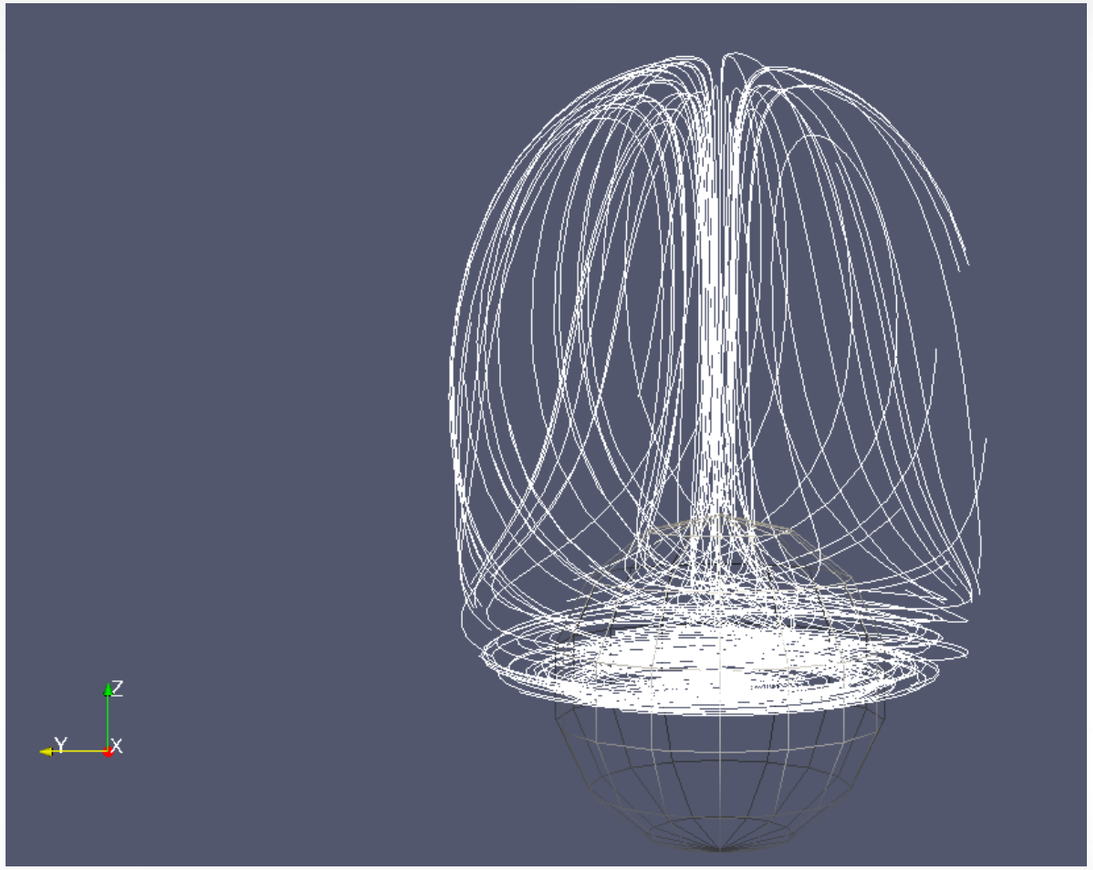
- File -> Save State
- File -> Load State



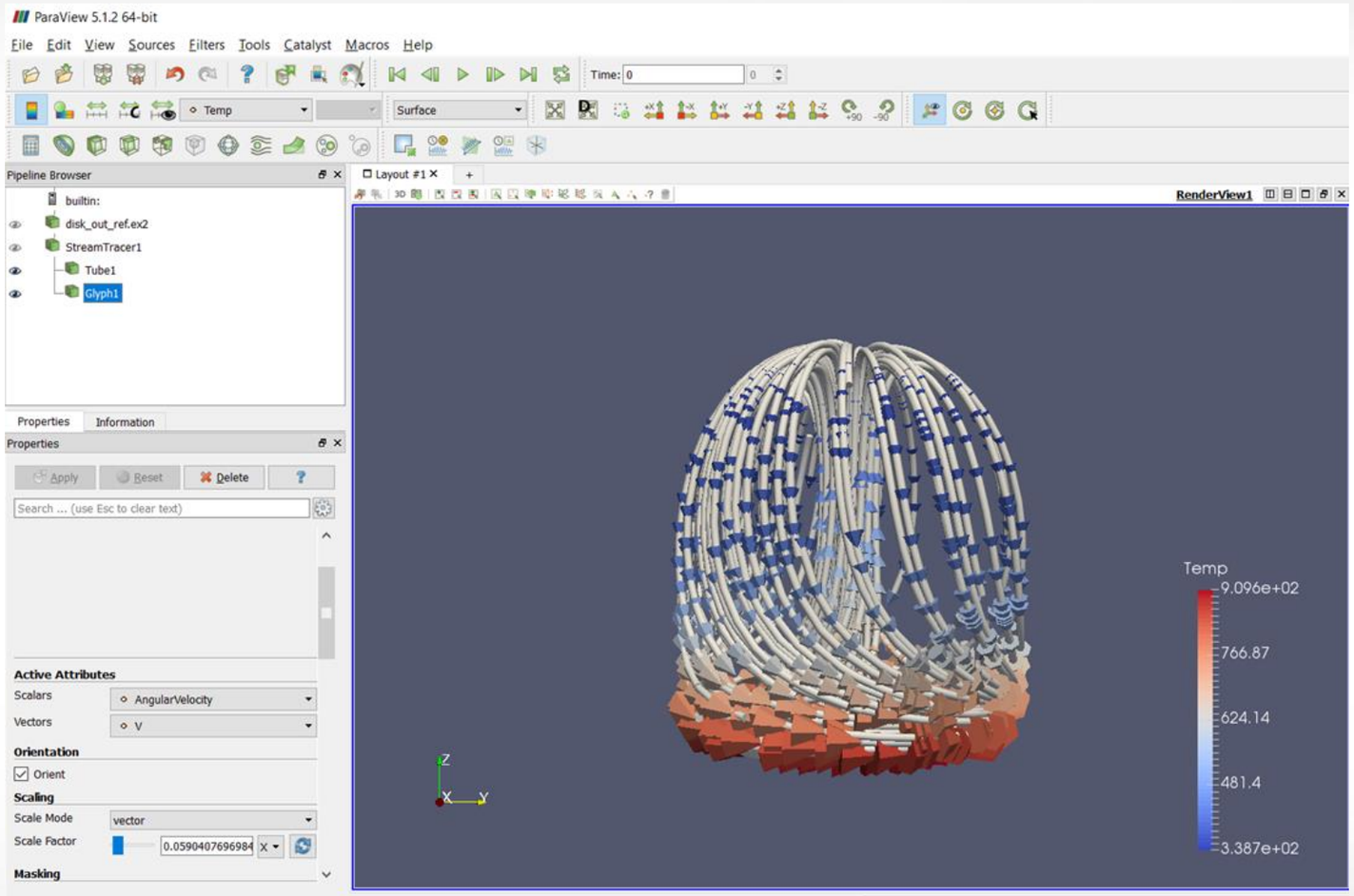
# Vector Visualization - Streamlines

- 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

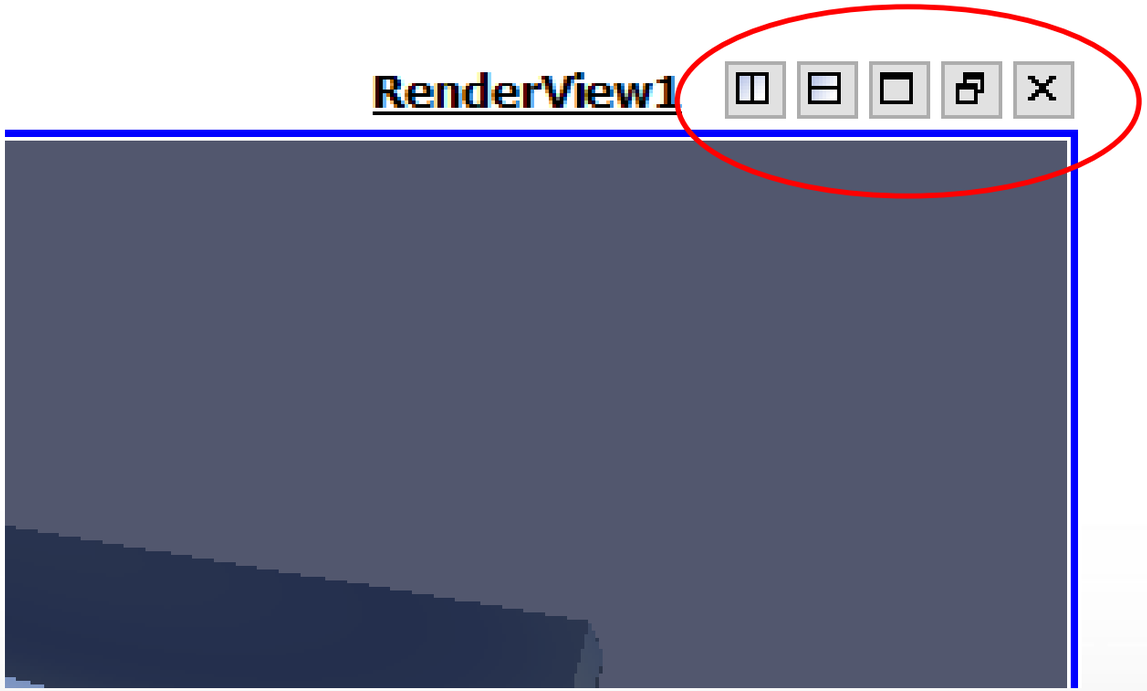
- Stream Tracer draws 1d lines that has no thickness.
  - No shading
  - No direction
- Can be enhanced with other filters
  - ctrl+space (quick search) -> Tube ->Apply
  - Glyph -> Apply




Glyph Properties:
Glyph Source: Glyph Type = cone
Active Attributes: Vectors = V
Scaling: Scale Mode = vector
Scale Factor = 0.5904.. (click to set the value)

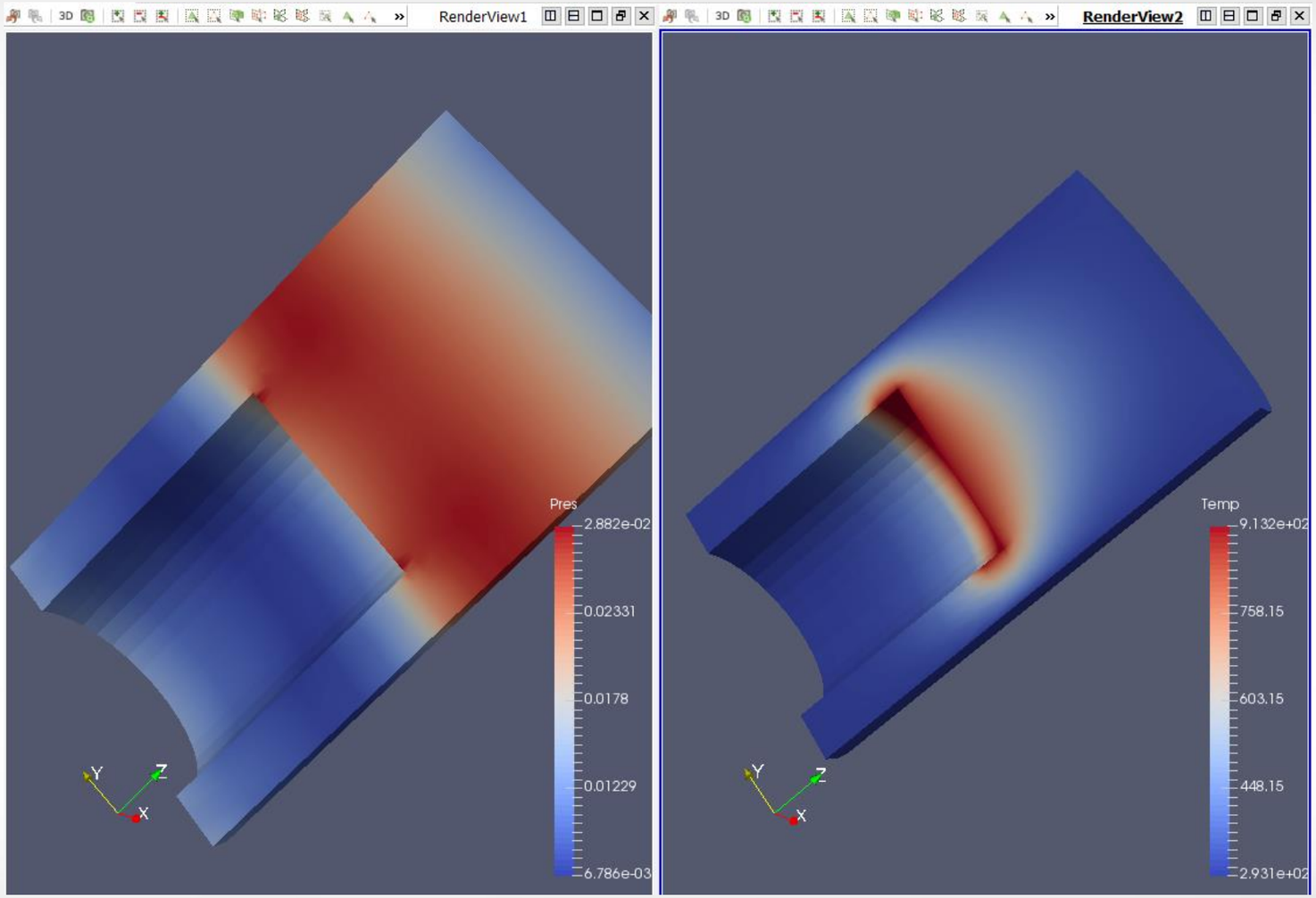
# Multiview

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



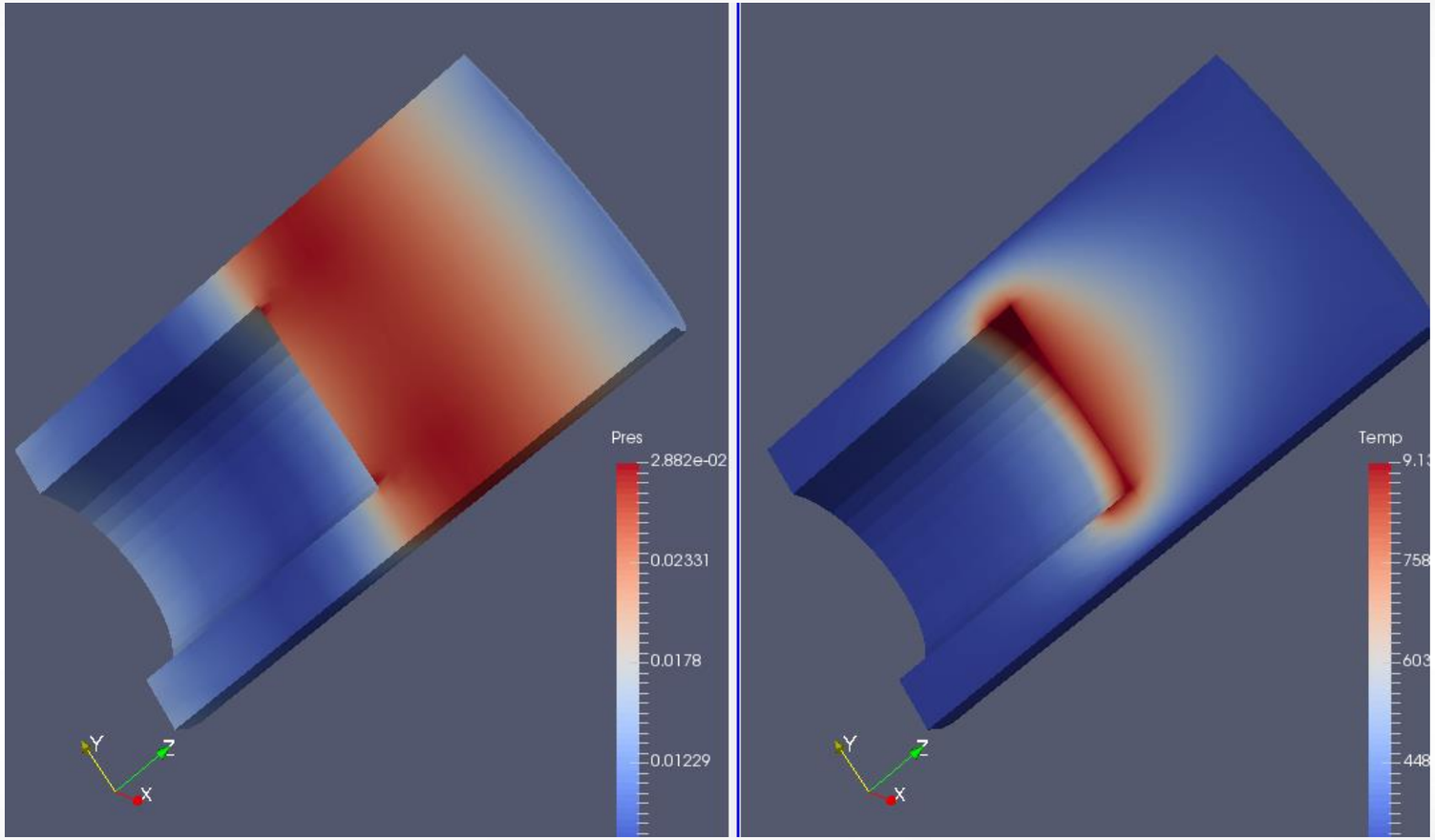
# Using Multiview

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



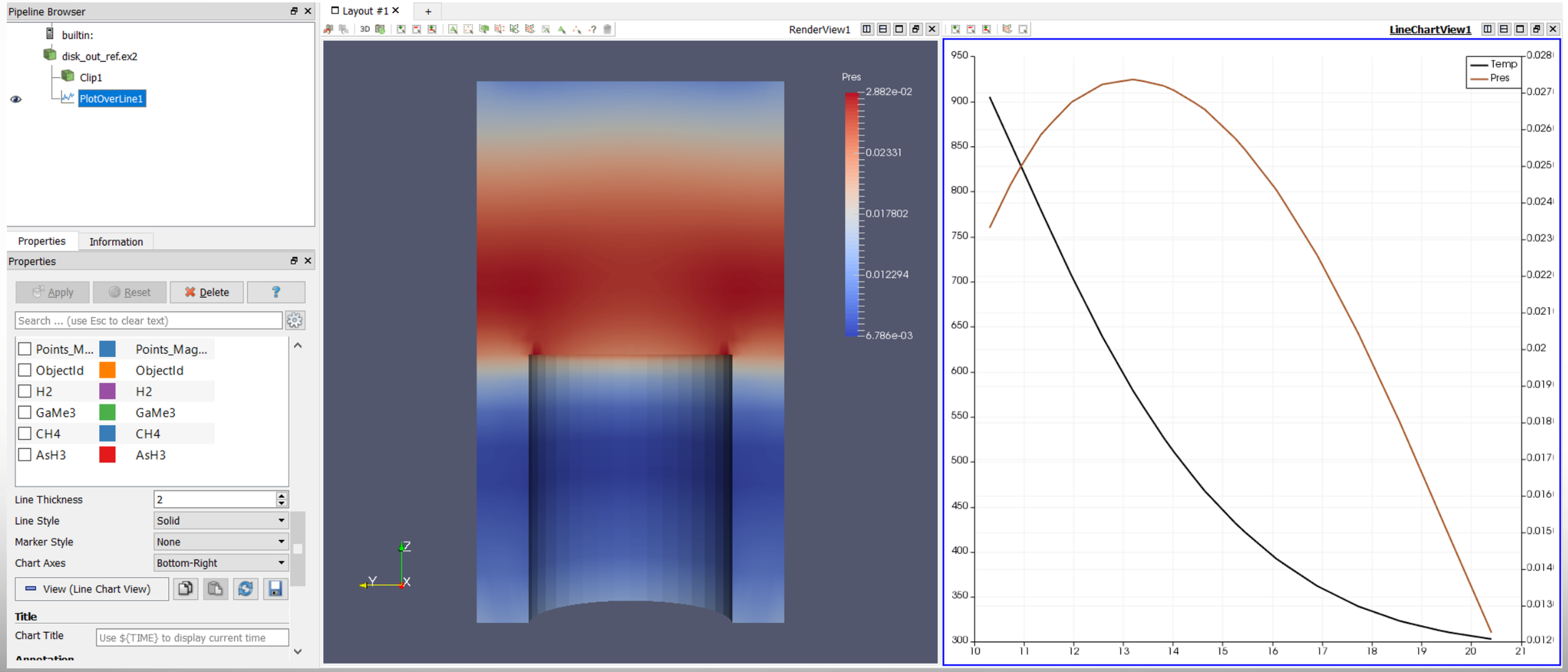
# Linking Camera

- 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.



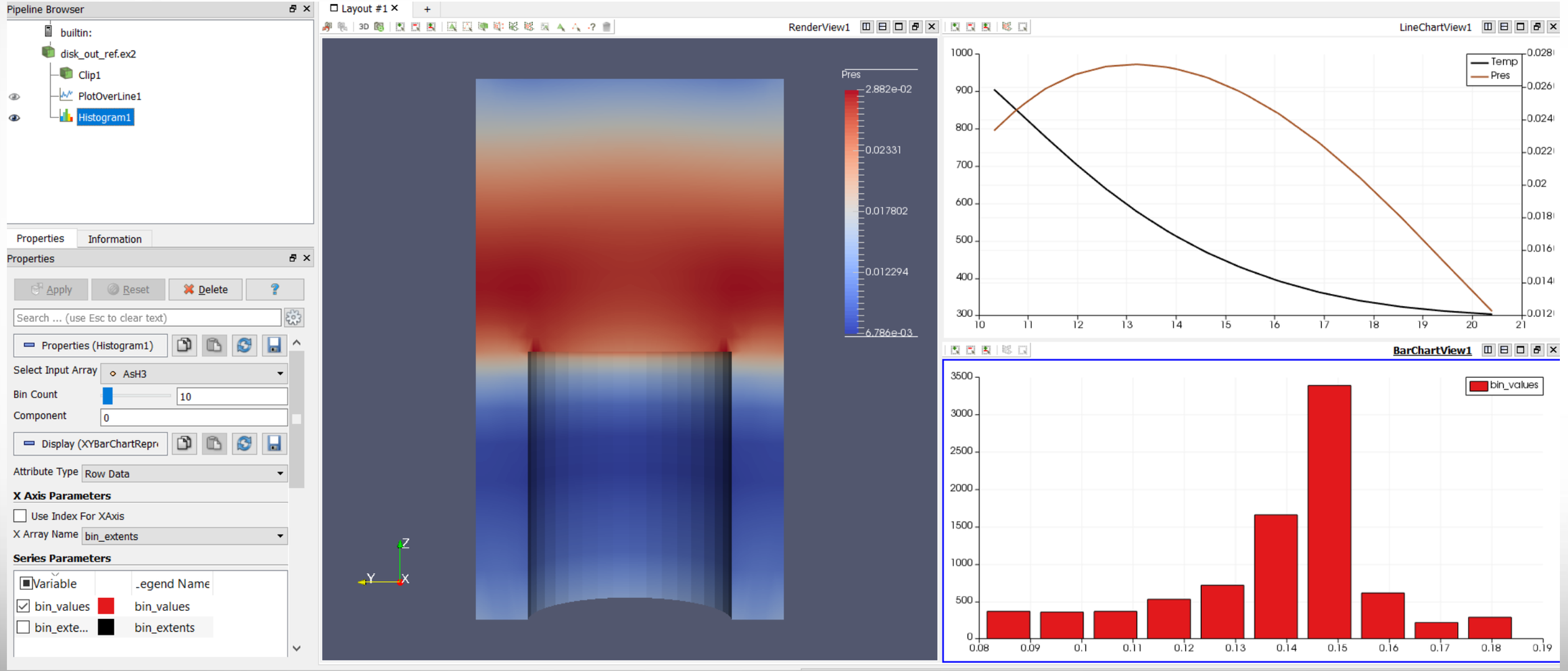
# Plot Over Line

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



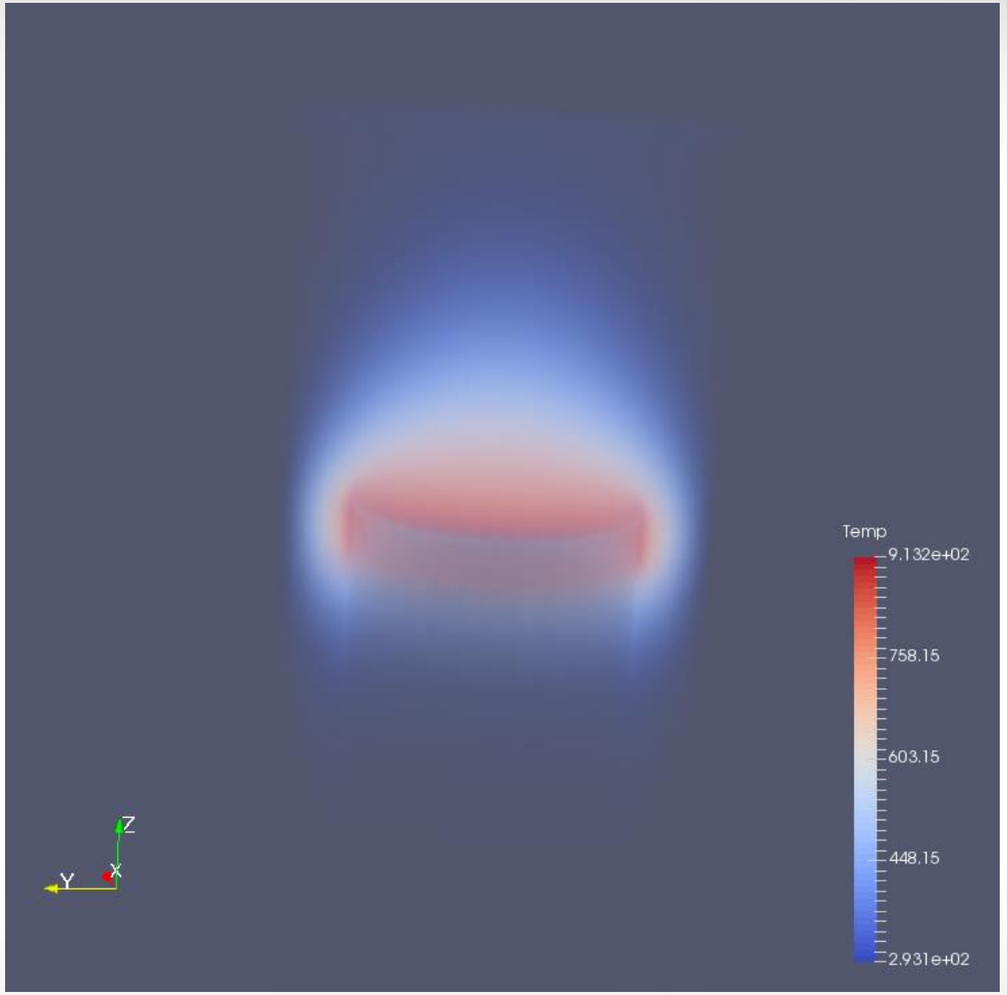
# Histogram

- 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