

ParaView – Scientific Data Visualization

2017 하계 CDE학회 튜토리얼

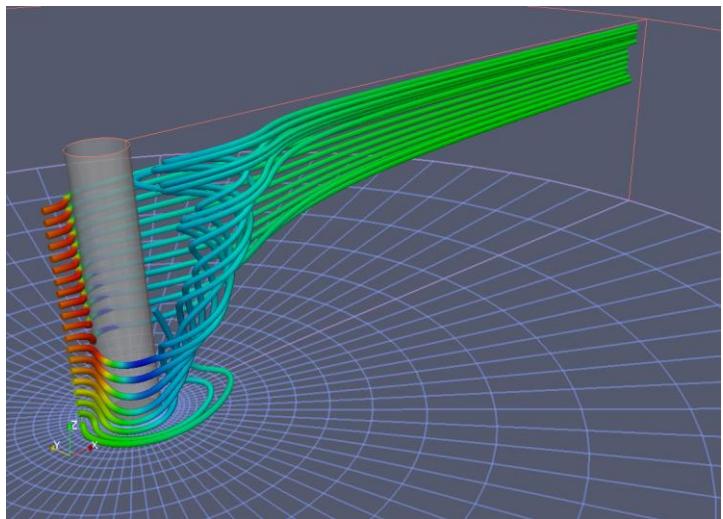
2017.08.18

한국과학기술연구원

김 영 준

Overview

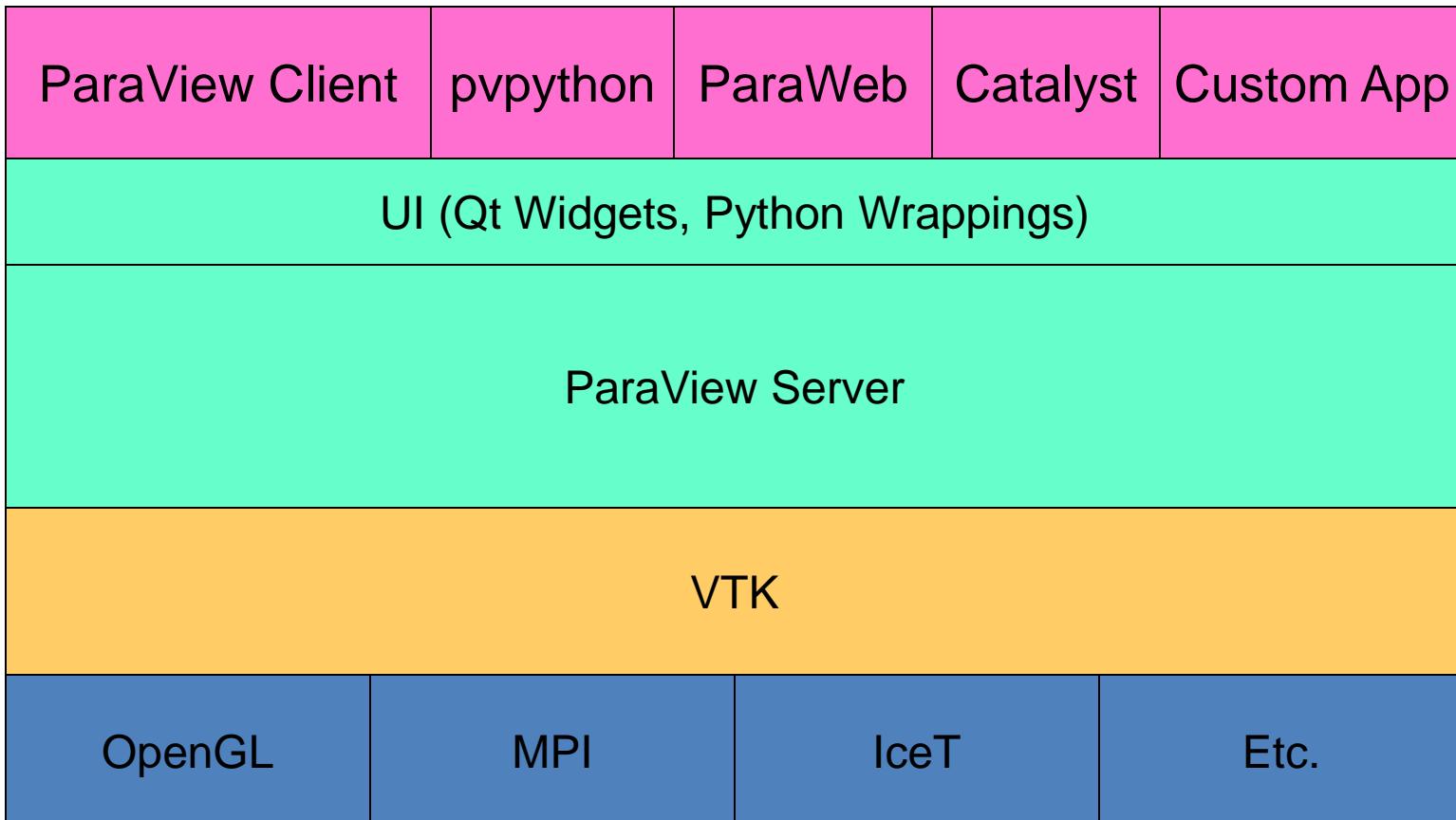
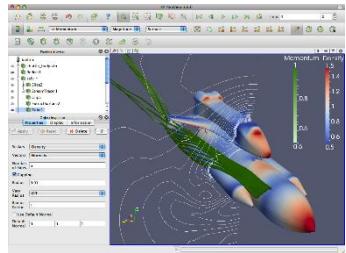
- Open-source, multi-platform visualization application.
- Support distributed computation models to process large data sets
- Open, flexible, and intuitive user interface.
- Extensible architecture based on open standards.



Large Data Visualization Made Easier

- ParaView is an open-source, multi-platform data analysis and visualization application.
- ParaView users can quickly build visualizations to analyze their data using qualitative and quantitative techniques.
- ParaView runs on distributed and shared memory parallel and single processor systems. It has been successfully deployed on Windows, Mac OS X, Linux, SGI, IBM Blue Gene, Cray and various Unix workstations, clusters and supercomputers.
- Under the hood, ParaView uses the Visualization Toolkit (VTK) as the data processing and rendering engine and has a user interface written using Qt®.

ParaView Application Architecture



ParaView Development

Started in 2000 as collaborative effort between Los Alamos National Laboratories and Kitware Inc. (lead by James Ahrens).

September 2005: collaborative effort between Sandia National Laboratories, Kitware Inc. and CSimSoft to rewrite user interface to be more user friendly and develop quantitative analysis framework.

Data Ranges

Used for all ranges of data size.

Landmarks of SNL usage:

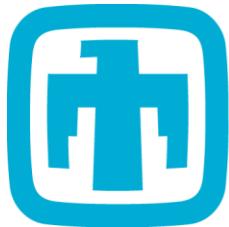
6 billion structured cells (2005).

250 million unstructured cells (2005).

Billions of AMR cells (2008).

Scaling test over 1 Trillion cells (2010).

Funding



**Sandia
National
Laboratories**



ARL

ERDC

US Army (SBIR)

US Air Force (STTR)

ONR

Support Contracts

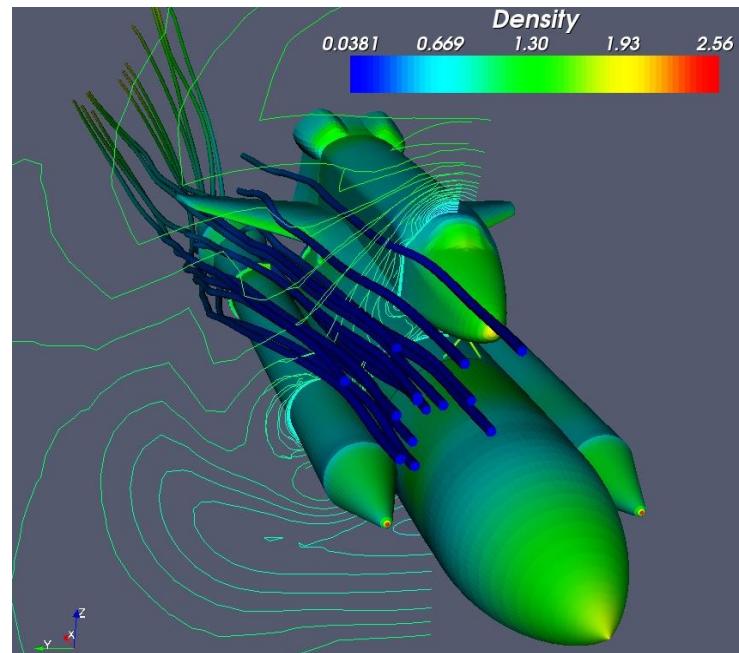
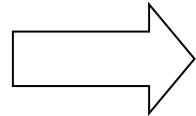
Electricity de France

Microsoft

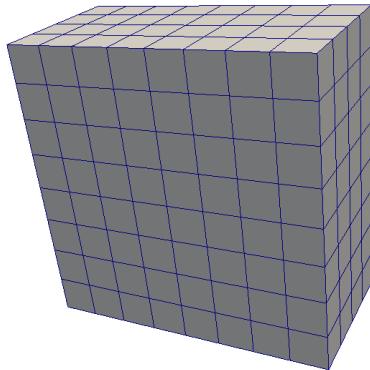
- Other contributors
 - Swiss National Supercomputing Centre
 - DOE SLAC
 - Ohio State
 - Mississippi State
 - RPI

Basics of Visualization

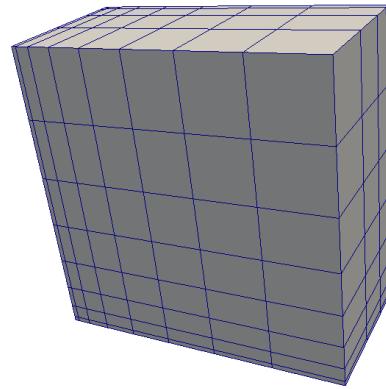
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0266000 171317 116055 155117 134444 167210 041405 147127 050505  
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0266160 040223 050170 055164 164634 047154 126525 112514 032315  
0266200 016041 176055 042766 025015 176314 017234 110060 014515  
0266220 117156 030746 154234 125001 151144 163706 136237 164376  
0266240 137055 062276 161755 115466 005322 132567 073216 002655  
0266260 171466 126161 117155 065763 016177 014460 112765 055527  
0266300 003767 175367 104754 036436 172172 150750 043643 145410  
0266320 072074 000007 040627 070652 173011 002151 125132 140214  
0266340 060115 014356 015164 067027 120206 070242 033065 131334  
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0266440 133614 106171 144160 010652 007365 026416 160716 100413  
0266460 026630 007210 000630 121224 076033 140764 000737 003276  
0266500 114060 042647 104475 110537 066716 104754 075447 112254  
0266520 030374 144251 077734 015157 002513 173526 035531 150003  
0266540 146207 015135 024446 130101 072457 040764 165513 156412  
0266560 166410 067251 156160 106406 136770 030515 064740 022032  
0266600 142166 123707 175121 071170 076357 037233 031136 015232  
0266620 075074 016744 044055 102230 110063 033350 052765 172463
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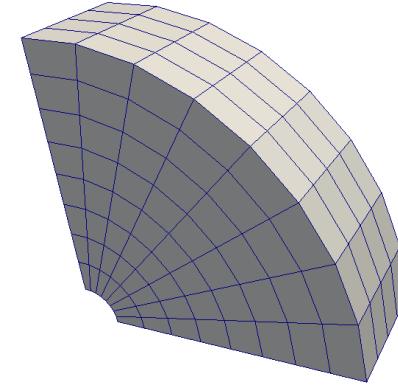
Data Types



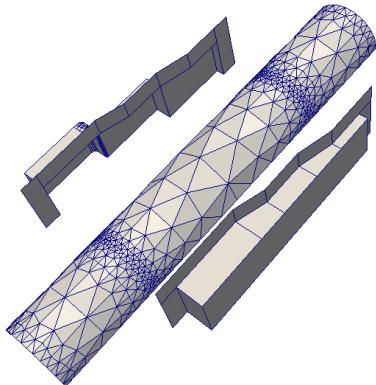
Uniform Rectilinear
(vtkImageData)



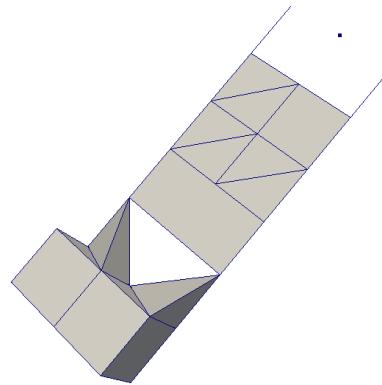
Non-Uniform Rectilinear
(vtkRectilinearData)



Curvilinear
(vtkStructuredData)



Polygonal
(vtkPolyData)



Unstructured Grid
(vtkUnstructuredGrid)

Multi-block

Hierarchical Adaptive
Mesh Refinement (AMR)

Hierarchical Uniform
AMR

Octree

Publications

Referencing ParaView

If you are working with ParaView and need to formally reference it, please use one of the following:

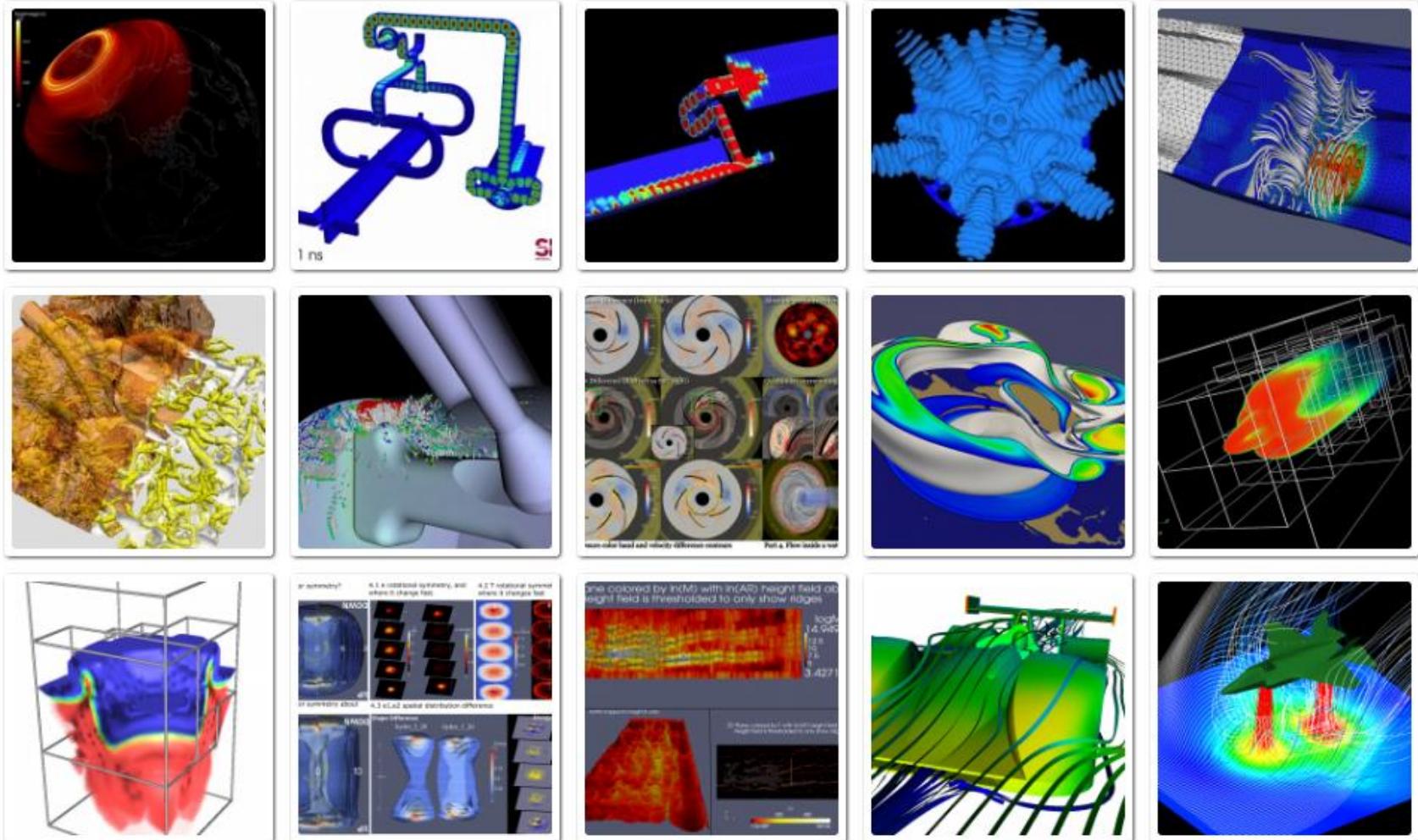
- Ahrens, James, Geveci, Berk, Law, Charles, *ParaView: An End-User Tool for Large Data Visualization*, Visualization Handbook, Elsevier, 2005, ISBN-13: 978-0123875822
- Ayachit, Utkarsh, *The ParaView Guide: A Parallel Visualization Application*, Kitware, 2015, ISBN 978-1930934306

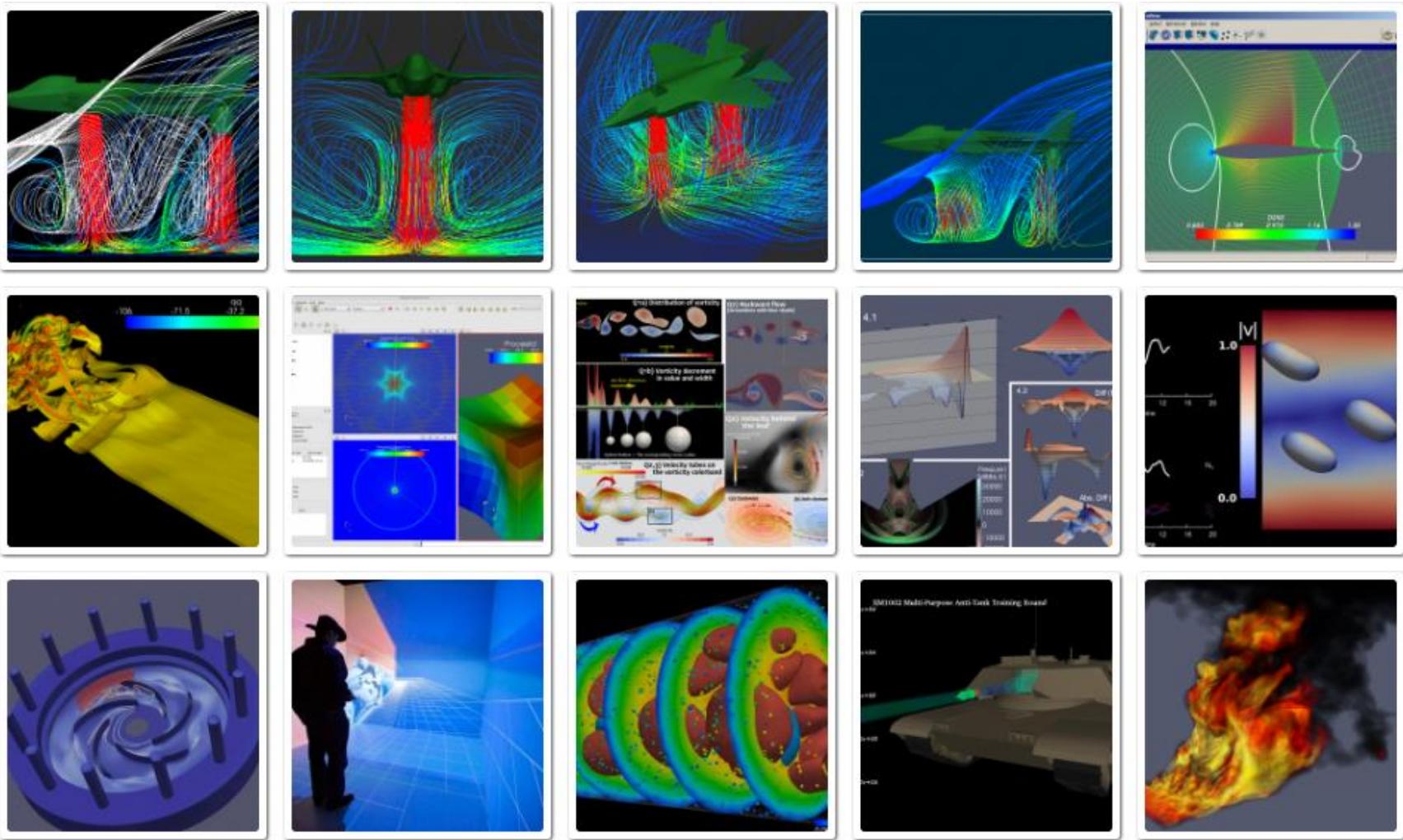
Recent ParaView Publications

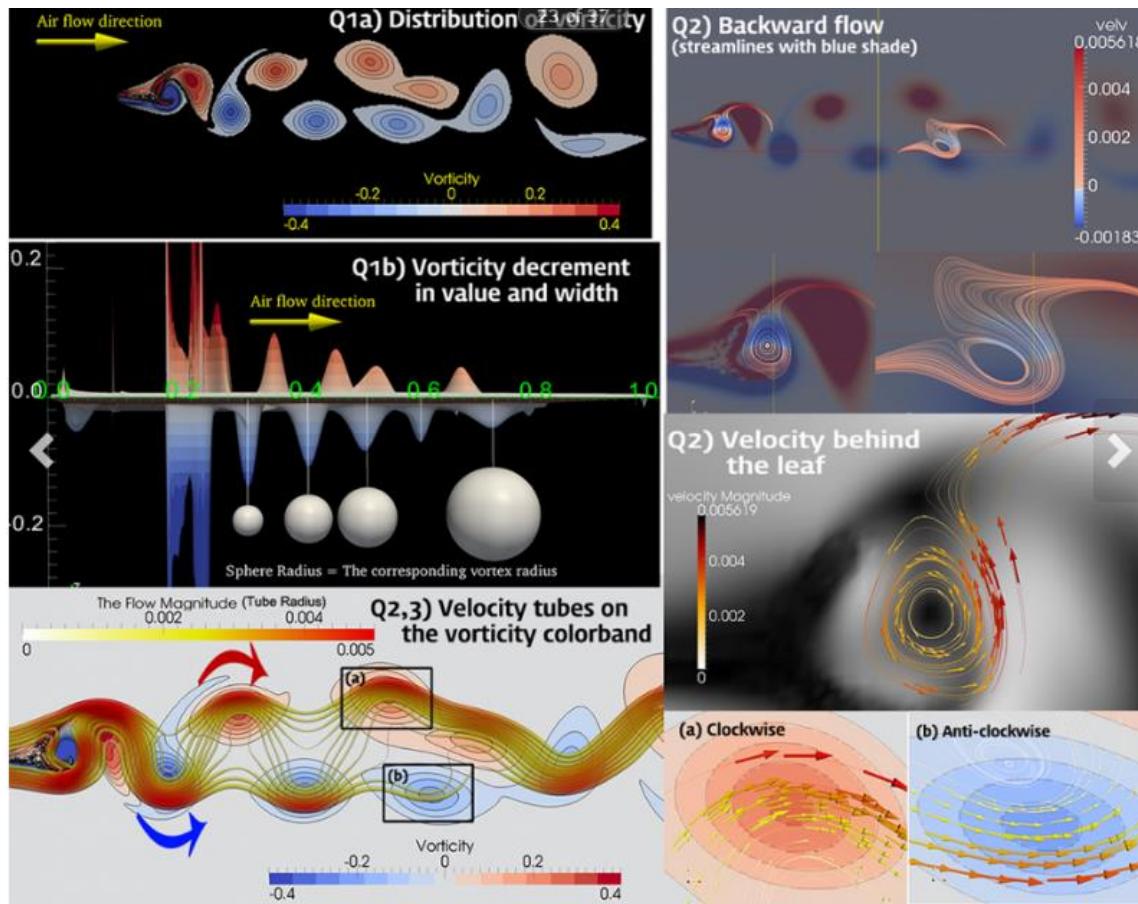
As an active open-source project, ParaView is well represented in recent publications. The list below represents a sample of recent publications.

- Nov-2014. James Ahrens, Sébastien Jourdain, Patrick O'Leary, John Patchett, David H Rogers, Mark Petersen. *An image-based approach to extreme scale in situ visualization and analysis*, Proceedings of the International Conference for High Performance Computing.
- Oct-2014. Woodring J., Ahrens J., Tautges T., Peterka T., Vishwanath V., Geveci B., *On-demand unstructured mesh translation for reducing memory pressure during in situ analysis*, UltraVis '13 Proceedings of the 8th International Workshop on Ultrascale Visualization.
- Oct-2014. Karimabadi H., Loring B., O'Leary P., Majumdar A., Tatineni M., Geveci B., *In-situ visualization for global hybrid simulations*, Proceedings of the Conference on Extreme Science and Engineering Discovery Environment: Gateway to Discovery.
- June-2014. Karimabadi H., Roytershteyn V., Vu H.X., Omelchenko Y.A., Scudder J., Daughton W., Dimmock A., Nykyri K., Wan M., Sibeck D., Tatineni M., Majumdar A., Loring B., Geveci B., *The link between shocks, turbulence, and magnetic reconnection in collisionless plasmas*, Physics of Plasmas, AIP Publishing.
- Dec-2013. Nouanesengsy B., Patchett J., Ahrens J., Bauer A., Chaudhary A., Miller R., Geveci B., M Shipman G., N Williams D., *A model for optimizing file access patterns using spatio-temporal parallelism*, Proceedings of the 8th International Workshop on Ultrascale Visualization.
- Sep-2013. DeMarle D., Geveci B., Ahrens J., Woodring J., *Streaming and Out-of-Core methods*, High Performance Visualization: Enabling Extreme Scale Scientific Insight, CRC Press

<http://www.paraview.org/gallery/>

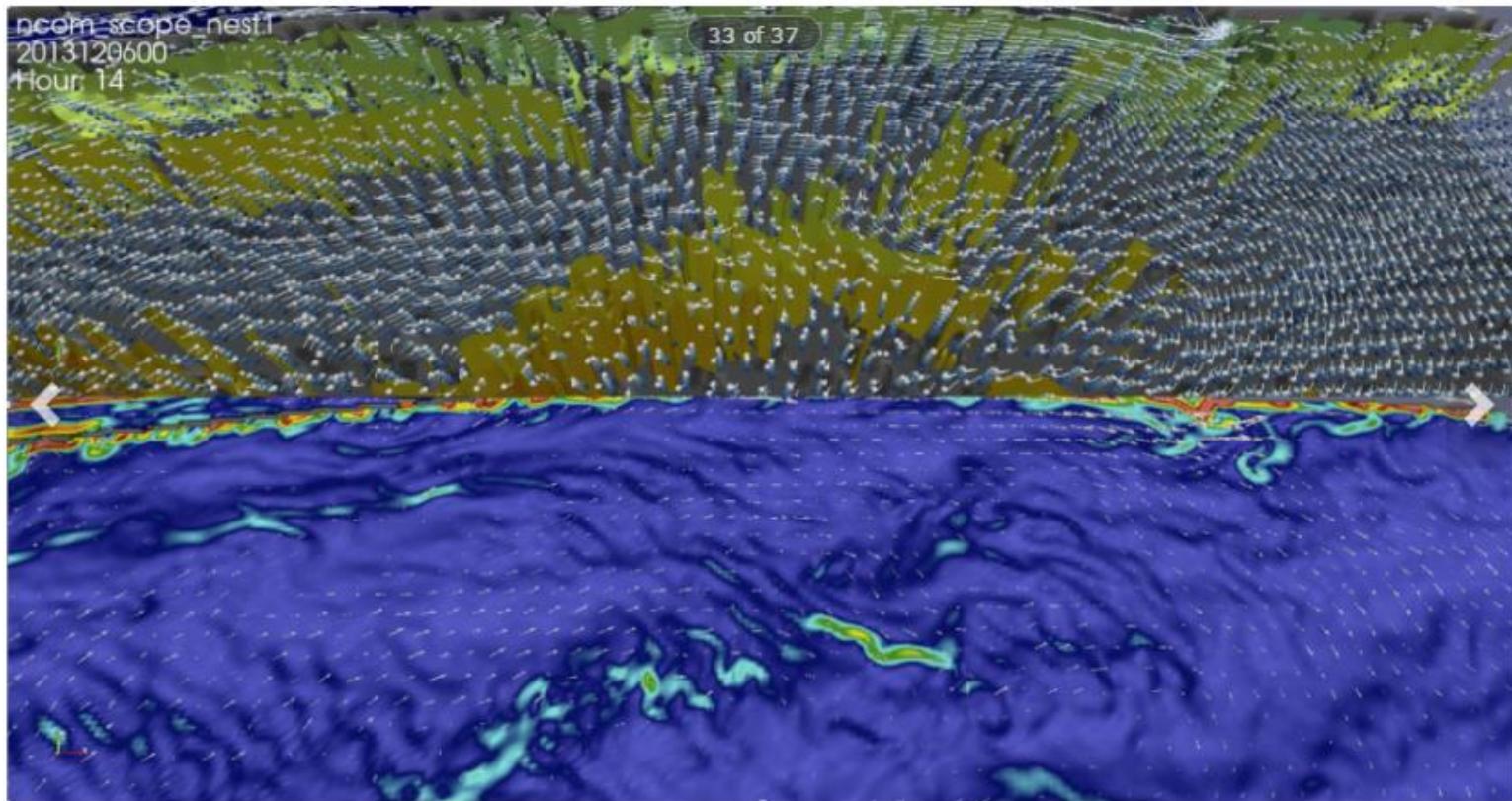






Simulation of airflow around a leaf, showing how both the leaf and the flow respond to vortices shed by the leaf.

ParaView was recently used in Russell Taylor's Comp 715: Visualization in the Sciences class at the University of North Carolina at Chapel Hill. Author: Joo Hwi Lee and Namdi Brandon Copyright: Data courtesy of Laura Miller, UNC Applied Mathematics



N C O M

Visualization of Navy Coast Ocean Model data showing both internal and surface flow.

Image courtesy Sean Ziegler at DoD HPCMP PETT for the Naval Research Laboratory. The model is being coupled with wave and atmospheric models. It is producing true 3D features in the shape of "donuts" that appear both in temperature and current velocity fields. The features' effect upon the velocity is more important, but the temperature gradients seem to show the features in better detail, so we found a way to show both. Then the oceanographers can correlate the locations/sizes of the features to the current velocity effects to determine if they are true physical phenomena or some artifact of the model coupling.

Flavors | ParaView

www.paraview.org/flavors/

About Flavors Domains Resources Developer Tools Download

ParaView

ParaView is an extensible, reconfigurable framework that is used to inspect data in many forms. The entire project is open source with a very liberal license and has been designed from the start to be reused and extended wherever its capabilities are useful. The familiar desktop application platform is just one configuration of the modular, parallel components that make up ParaView. Other “flavors” include the extensible and reproducible python interface, immersion in advanced display environments, in situ coupling with simulation code via Catalyst, ubiquitous access through web based visualization and of course scalable processing in High Performance Supercomputing (HPC) platforms.

ParaView Desktop

ParaView Python

ParaView HPC

ParaViewWeb

ParaView In Situ

ParaView Immersive

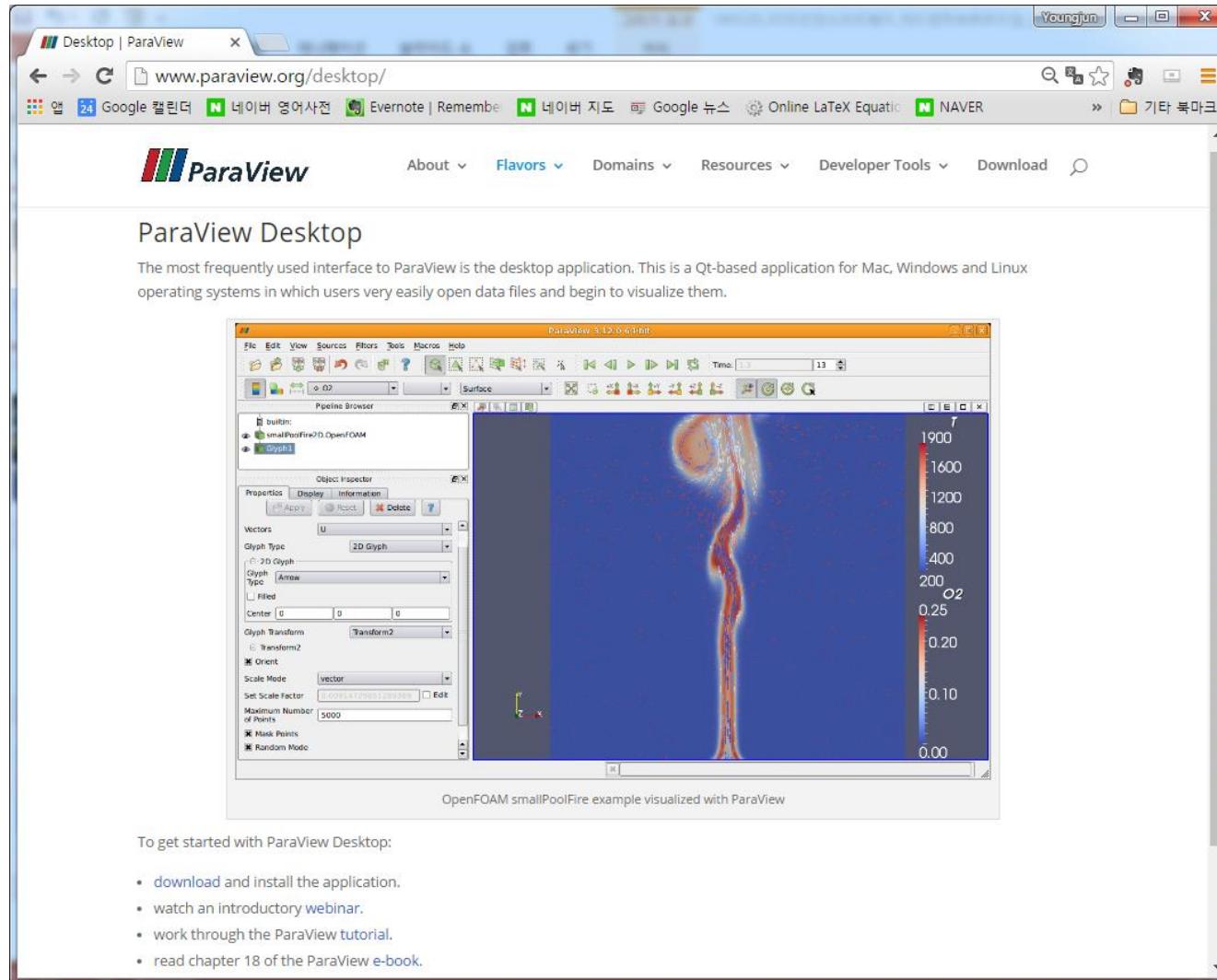
VeloView

Website license and management

Kitware

f t g+

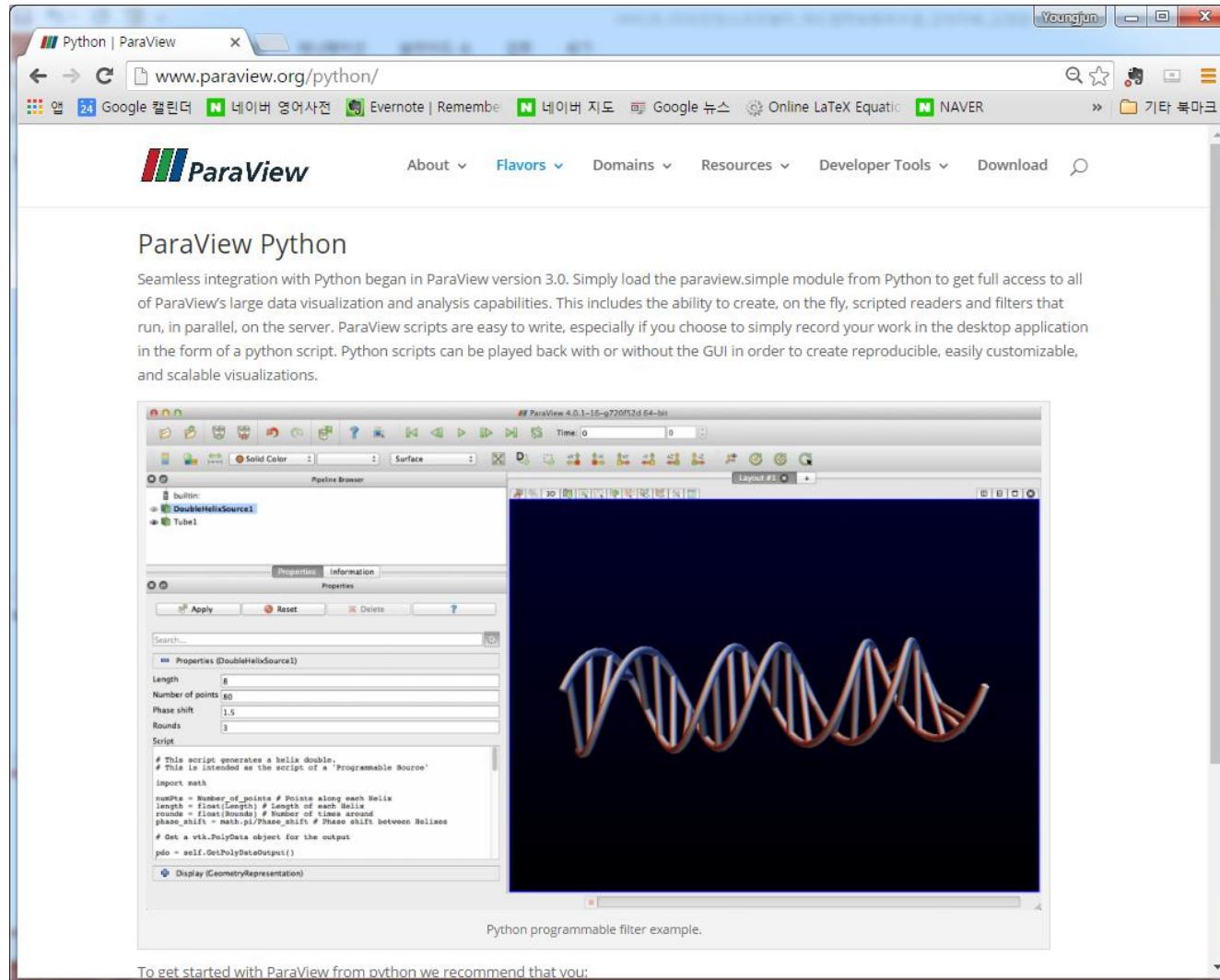
<http://www.paraview.org/desktop/>



To get started with ParaView Desktop:

- download and install the application.
- watch an introductory [webinar](#).
- work through the ParaView tutorial.
- read chapter 18 of the ParaView e-book.

http://www.paraview.org/python/



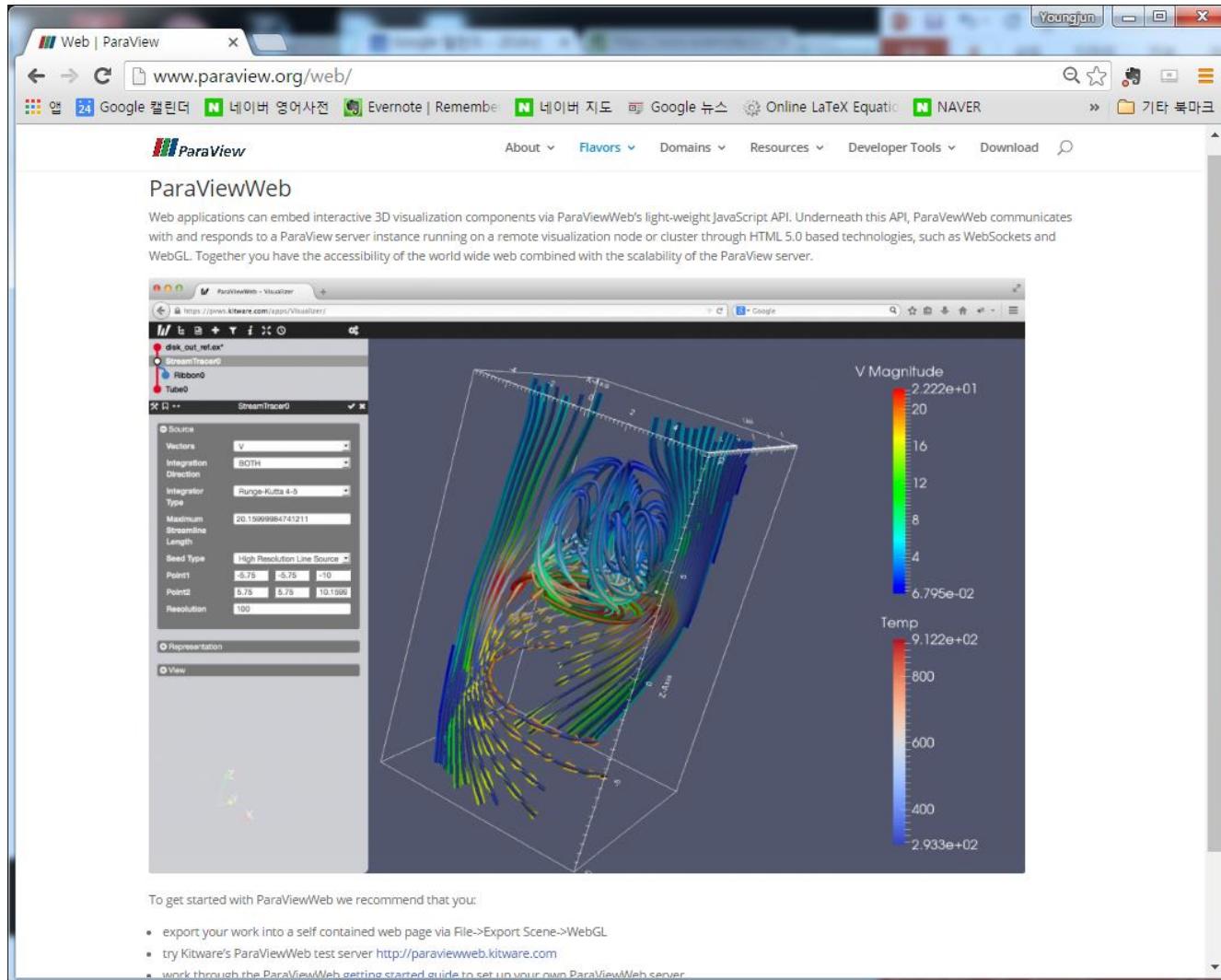
To get started with ParaView from python we recommend that you:

<http://www.paraview.org/hpc/>

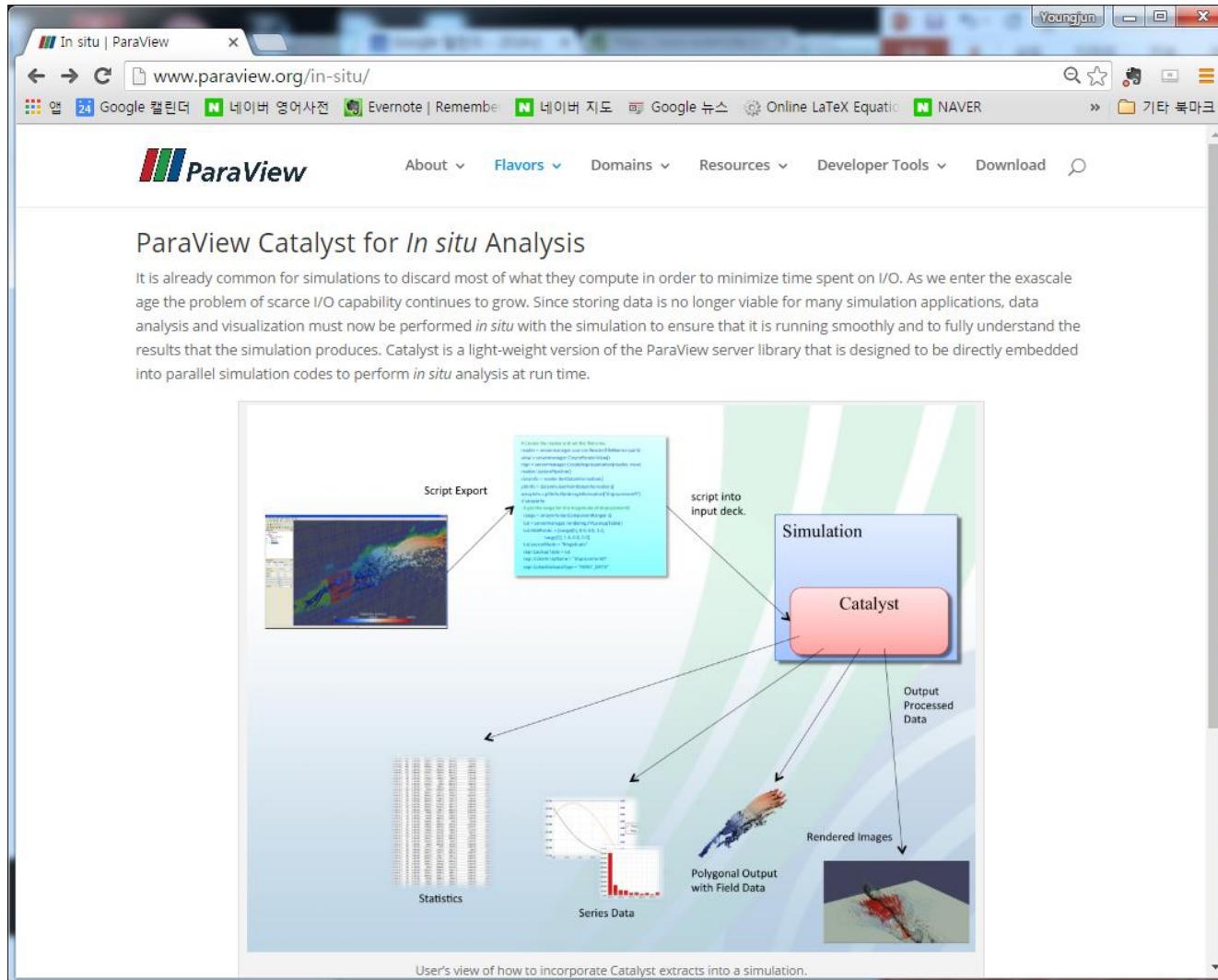


The screenshot shows a web browser window titled "HPC | ParaView". The address bar displays the URL "www.paraview.org/hpc/". The page content is the "ParaView for HPC" section. It features the ParaView logo and navigation links for About, Flavors, Domains, Resources, Developer Tools, and Download. A search bar is also present. The main text describes ParaView's ability to handle large scientific results by scaling across clusters or supercomputers. Below the text is a large image of the "Titan" supercomputer, which is a massive black rectangular block composed of many smaller server units. The text "ParaView on Titan" is overlaid on the image. A caption below the image reads "just '> module load paraview'". At the bottom, there is a note: "To get started using ParaView on large problems we recommend that you:" followed by a bulleted list: "watch this webinar." and "if your supercomputer doesn't have ParaView yet ask for it."

http://www.paraview.org/web/



<http://www.paraview.org/in-situ/>



<http://www.paraview.org/immersive/>



The screenshot shows a web browser window with the title bar "Youngjun" and the address bar displaying "www.paraview.org/immersive/". The browser's toolbar includes various icons for search, bookmarks, and navigation. The main content area features the ParaView logo and navigation links for About, Flavors, Domains, Resources, Developer Tools, and Download. Below this, a section titled "ParaView Immersive" contains text about the benefits of using high-resolution displays for complex data visualization. It mentions 3D stereo display modes, efficient rendering engines, and VRPN tracking interfaces. A photograph shows four people interacting with a large-scale visualization system at the Idaho National Lab CAMS facility. A caption below the photo reads "ParaView on Idaho National Lab CAMS visualization facility." At the bottom, there is a list of recommendations for getting started with ParaView in immersive environments.

Youngjun

www.paraview.org/immersive/

Youngjun

Paraview

About Flavors Domains Resources Developer Tools Download

Paraview Immersive

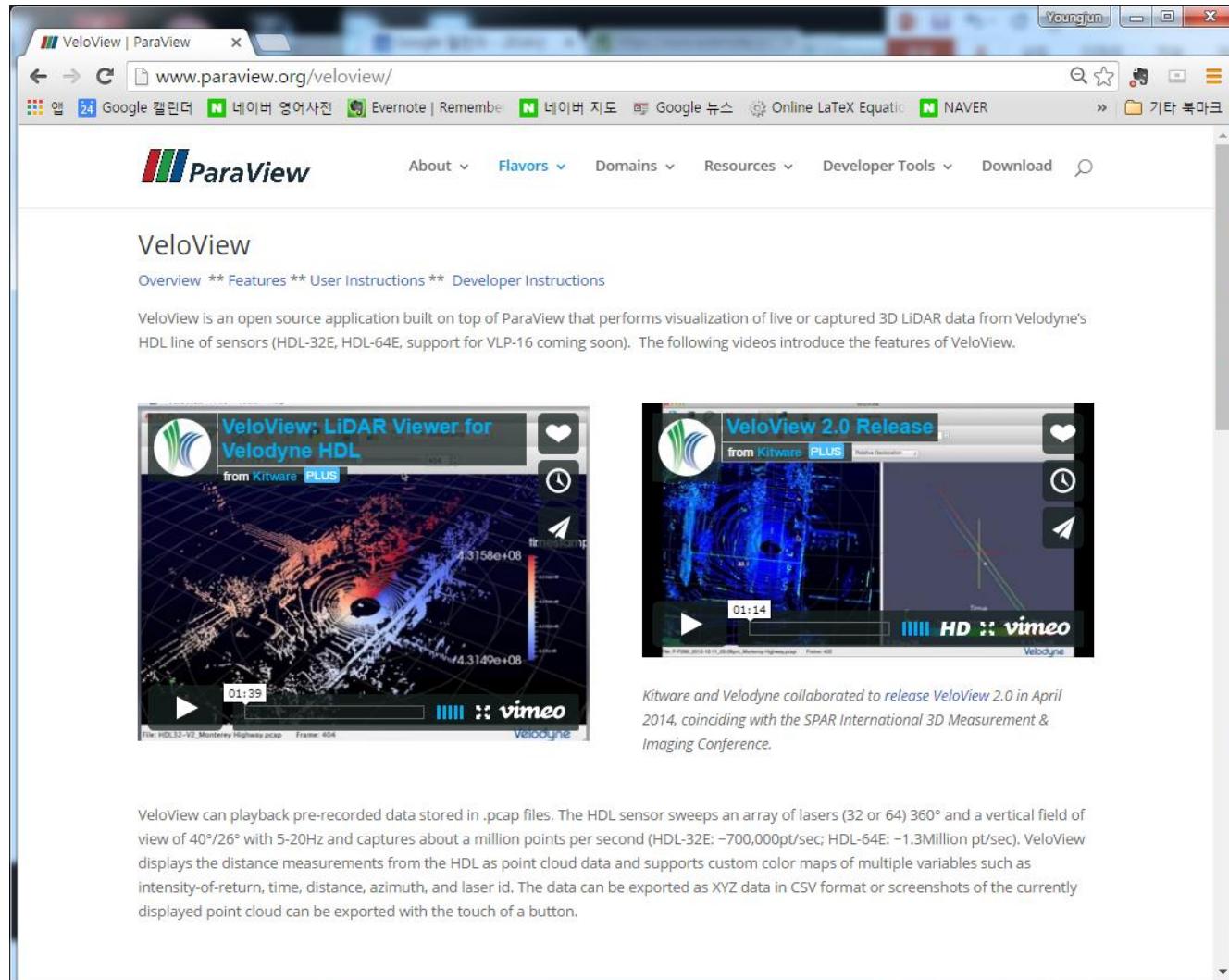
Sometimes the best way to understand and explain complex high resolution data, is to show it on a very high resolution display. It is better still sometimes to look at the data in 3D and even walk around inside it. That way the relationships between the small and large scales become apparent. Paraview's stereo display modes, efficient tile and cave rendering engine, and VRPN tracking interfaces make such immersion in the data possible.

Paraview on Idaho National Lab CAMS visualization facility .

To get starting with Paraview in immersive environments we recommend:

- read chapter 13 of the Paraview e-book.
- see this section of the Paraview wiki.
- see this Kitware Source article.

<http://www.paraview.org/veloview/>



Domains

The screenshot shows a web browser window displaying the ParaView Domains page. The title bar reads "Domains | ParaView". The address bar shows the URL "www.paraview.org/domains/". The page content includes the ParaView logo, a navigation menu with links to About, Flavors, Domains (which is the active page), Resources, Developer Tools, and Download. Below the menu is a paragraph of text explaining ParaView's flexibility in handling various scientific domains. At the bottom, there are four icons representing different application domains: Structural Analysis (a grid), Fluid Dynamics (a drop), Astrophysics (a spiral galaxy), and Climate Science (a sun and clouds). A footer bar at the bottom features a Creative Commons license logo, a "Website license and management" link, the Kitware logo, and social media links for Facebook, Twitter, and Google+.

Domains | ParaView

www.paraview.org/domains/

About Flavors Domains Resources Developer Tools Download

ParaView is flexible enough to work with data from many areas of computational science. In fact, the standard desktop application can read well over 100 different file formats that cover a wide range of application domains. ParaView is especially well suited to scientific areas that use techniques like the finite element, finite volume, and point set methods. Typically these techniques are applied to compute results on entities that are embedded in a three-dimensional space that we might see and recognize as shapes in the real world. ParaView inherits VTK's data model, which is extensible but tailored primarily to this type of data. If a reader exists for a scientific data set or it can otherwise be translated into one of VTK's data structures, ParaView will let you to view and analyze it easily.

Structural Analysis

Fluid Dynamics

Astrophysics

Climate Science

Website license and management

Kitware

f t g+

Resources



Mailing Lists



Documentation



Request a New Feature



ParaView Tutorial



User's Guide



Webinars



Services

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

Get the ParaView Guide!

The ParaView Guide is the official user's manual and reference guide for ParaView. There are several ways of obtaining the latest version of the ParaView Guide.

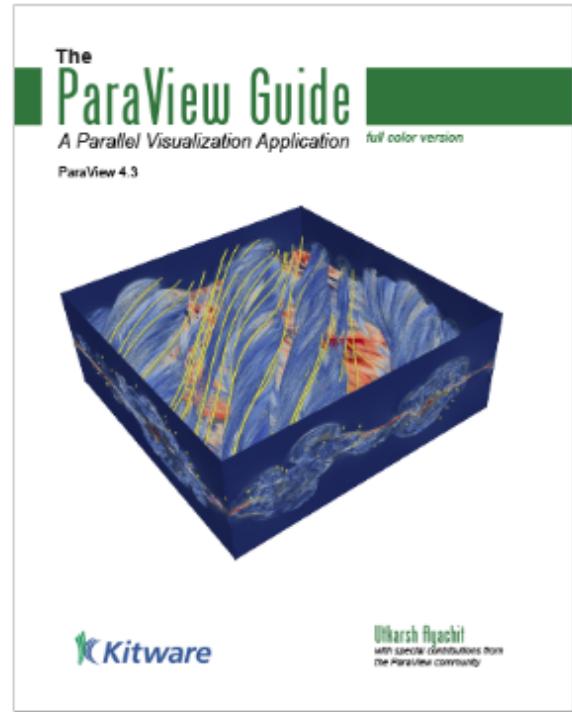
Community Edition (CE)

The ParaView Guide (CE) is distributed as a free download in PDF form [here](#). The LaTeX source files used to generate the PDF for the ParaView Guide (CE) are released under [CC BY 4.0](#) and are available [here](#).

Printed Editions

The ParaView Guide is offered in [two print versions](#): our standard version (ISBN 978-1930934290) and a full color version (ISBN 978-1930934306). Both versions are available through various [US](#) and international Amazon sites.

In addition to the chapters in the community edition, the printed versions include 3 extra chapters that cover using ParaView for CFD analysis, AMR processing, and case-studies.



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

The screenshot shows a web browser window with the title "The ParaView Tutorial" in the tab bar. The address bar displays the URL "www.paraview.org/Wiki/The_ParaView_Tutorial". The browser interface includes a toolbar with various icons and a menu bar with Korean text. The main content area is titled "The ParaView Tutorial". It contains a brief introduction, a history of the tutorial, and instructions for getting started. It also links to "The ParaView Tutorial Data" in tar/gzip and zip formats. A sidebar on the left provides navigation links for the site, including "Main page", "Recent changes", "Random page", and "Help". Other sections include "Search" with a search bar and "Tools" with links like "What links here" and "Page information". A "print/export" section offers options to create a book, download as PDF, or print. A "Contents [hide]" box lists sections such as "Translations", "Previous Versions", "Presentation Slides", and "LaTeX Source". At the bottom, there is a note about translations and a download progress bar for "ParaViewGuide-CE-v...p..." at 9.9/178MB, 53분 남음.

The ParaView Tutorial

The ParaView Tutorial is an introductory and comprehensive tutorial. It teaches using ParaView through examples that start at basic usage and continue through more advanced topics such as temporal analysis, animation, parallel processing, and scripting.

This tutorial is sometimes referred to as the supercomputing tutorial because it originated as the handout documents for a series of tutorials at supercomputing. However, because the tutorial was designed for the beginning user, the material was general enough to be useful to a broad audience and became a popular document for learning ParaView. As time passes we are starting to add more advanced topics from tutorials in more specific domains. This tutorial has become something of a repository for teaching materials, hence simply *the* tutorial.

To get started, you will need the document itself.

- [The ParaView Tutorial \(for version 4.4\)](#)

You will also need the data referenced in the document. (The two archives below contain the same data. Just download the one with your preferred archive format.)

- [The ParaView Tutorial Data \(in tar/gzip\)](#)
- [The ParaView Tutorial Data \(in zip\)](#)

Additional material for the IEEE SC14 presentation is here:

- [Additional Material](#)

Of course, you will also need ParaView itself. You can get the most recent version of ParaView from <http://www.paraview.org>.

If you want to reference this version of The ParaView Tutorial as a publication, please use the following:

Kenneth Moreland. *The ParaView Tutorial*, Version 4.4. Technical Report SAND 2015-7813 TR, Sandia National Laboratories, 2015.

Contents [hide]

- 1 Translations
- 2 Previous Versions
- 3 Presentation Slides
- 4 LaTeX Source

Translations

Some individuals have been good enough to translate the tutorial in other languages. When they become available, we will post them here. Please

다운로드 항목 모두 표시...

SNL ParaView Tutorials

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

The screenshot shows a web browser window titled "SNL ParaView Tutorials". The address bar displays the URL "www.paraview.org/Wiki/SNL_ParaView_4_Tutorials". The page content is titled "SNL ParaView Tutorials" and includes a sidebar with navigation links for "navigation", "search", and "tools". The main content area contains a "Contents" section with links to various training lessons, followed by sections for "ParaView training data", "Beginning training lessons", and "Advanced training lessons".

navigation

- Main page
- Recent changes
- Random page
- Help

search

Search

tools

- What links here
- Related changes
- Special pages
- Permanent link
- Page information

print/export

- Create a book
- Download as PDF
- Printable version

SNL ParaView Tutorials
(Redirected from SNL ParaView 4 Tutorials)

This page contains beginning and advanced tutorial sets, each presented as 3 hour classes internally within Sandia National Laboratories.

Contents [hide]

- 1 ParaView training data
- 2 Beginning training lessons
- 3 Advanced training lessons
- 4 Python and batch training lessons
- 5 Targeted lessons
- 6 Acknowledgements

ParaView training data

ParaView binaries are downloaded from here: <http://www.paraview.org/paraview/resources/software.html>

Paraview data referenced in this tutorial is also located at the download site here:
<http://www.paraview.org/paraview/resources/software.html>

Beginning training lessons

[Beginning ParaView](#)
[Beginning Sources and Filters](#)
[Beginning GUI](#)
[Beginning Plotting](#)
[Beginning Pictures and Movies](#)

Advanced training lessons

ParaView Wiki

<http://www.paraview.org/Wiki/ParaView>

The screenshot shows a web browser window displaying the ParaView Wiki page. The title bar reads "ParaView - KitwarePublic". The address bar shows the URL "www.paraview.org/Wiki/ParaView". The browser's toolbar includes various icons for search, refresh, and navigation. The main content area features the ParaView logo, which consists of three vertical bars in red, green, and blue followed by the text "ParaView" in a large, bold, sans-serif font, with "Parallel Visualization Application" in a smaller font below it. To the left of the main content is a sidebar with the "Public Wiki" logo at the top. Below it is a "navigation" section with links to "Main page", "Recent changes", "Random page", and "Help". Under "search", there is a search input field and "Go" and "Search" buttons. The "tools" section includes links for "What links here", "Related changes", "Special pages", "Permanent link", and "Page information". The "print/export" section offers options to "Create a book", "Download as PDF", and "Printable version". At the bottom of the sidebar is a "Contents [hide]" section listing various documentation topics:

- 1 ParaView In Use
- 2 Documentation
 - 2.1 License
 - 2.2 Compile/Install
 - 2.3 Server Setup
 - 2.4 Importing Data
 - 2.5 Finding Data
 - 2.6 Analyzing Data
 - 2.7 Animation
 - 2.8 Plugins
 - 2.9 Python Scripting
 - 2.10 GUI Features
 - 2.11 Other Features
 - 2.12 Books and Tutorials
 - 2.13 Design & Implementation
 - 2.14 ParaView based Applications
 - 2.15 Web Visualization with ParaView
 - 2.16 *In situ* Analysis with ParaView

http://www.paraview.org/Wiki/ParaView_In_Action

#Computational_Model_Building

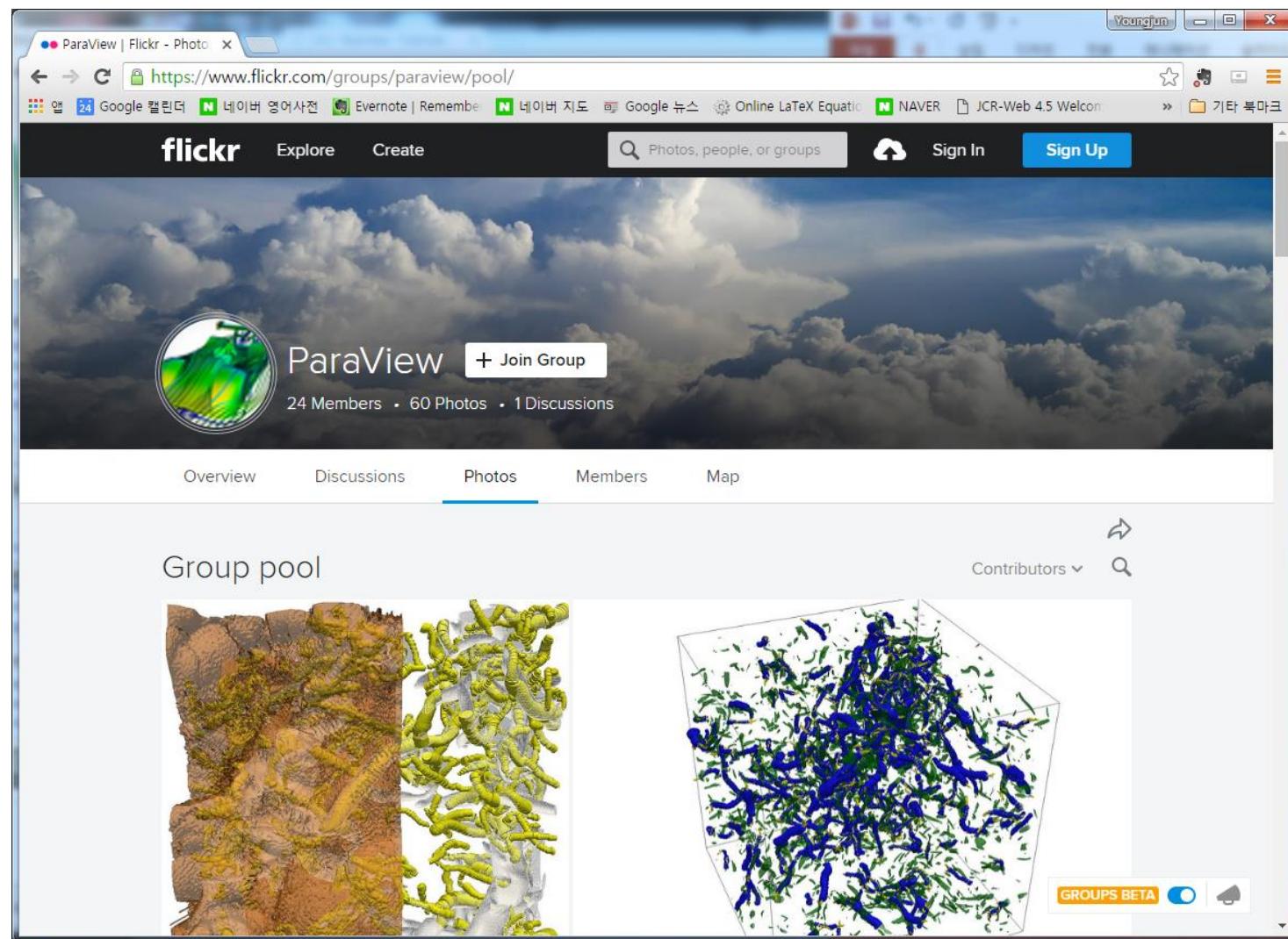
The screenshot shows a web browser window displaying the "ParaView In Action" page from the Paraview.org Wiki. The browser's address bar shows the URL: www.paraview.org/Wiki/ParaView_In_Action#Computational_Model_Building. The page content includes a sidebar with navigation links for Main page, Recent changes, Random page, Help, and various search and export options. The main content area displays a list of 18 examples under the heading "Contents [hide]". The first example listed is "3D Rayleigh-Benard convection problem", which is described as a problem used to investigate EdgeCFD's code performance in a large scale simulation. The description includes details about the simulation setup, including a rectangular 3D domain of aspect ratio 4:1:1, a 501x125x125 mesh, 39,140,625 tetrahedral elements, a Rayleigh number Ra=30,000, and a Prandtl number Pr=0.71. The simulation was run on 128 cores of a SGI Altix ICE 8200 cluster at the High Performance Computing Center NACAD of Federal University of Rio de Janeiro UFRJ. The visualization shows a 3D volume with complex, swirling convective patterns colored by temperature.

3D Rayleigh-Benard convection problem

This problem was used to investigate EdgeCFD's code performance in a large scale simulation. EdgeCFD is an implicit edge-based coupled fluid flow and transport solver for solving large scale problems in modern clusters, supporting stabilized and variational multiscale finite element formulations JNMF2007. The benchmark corresponds to a rectangular 3D domain of aspect ratio 4:1:1 aligned with the Cartesian axes and subjected to a temperature gradient. The simulation was made on a 501×125×125 mesh, resulting in 39,140,625 tetrahedral elements. The figure shows the convective rolls obtained at Rayleigh number $Ra=30,000$ and Prandtl number $Pr=0.71$. This solution was obtained on 128 cores of a SGI Altix ICE 8200 cluster installed at High Performance Computing Center NACAD of Federal University of Rio de Janeiro UFRJ. Every time step employed an Inexact Newton method and two nonlinear systems of equations, for flow and temperature, respectively with 31M and 7.8M equations. Time step solutions were stored using the Xdmf file format in a temporal collection of geometry collections scheme, summarizing 1936 files for 15/2955 (stored/total). The simulation took about 170 hours (1 week approximately) and the post-processing was done using ParaView in a remote-client x server offscreen rendering scheme.

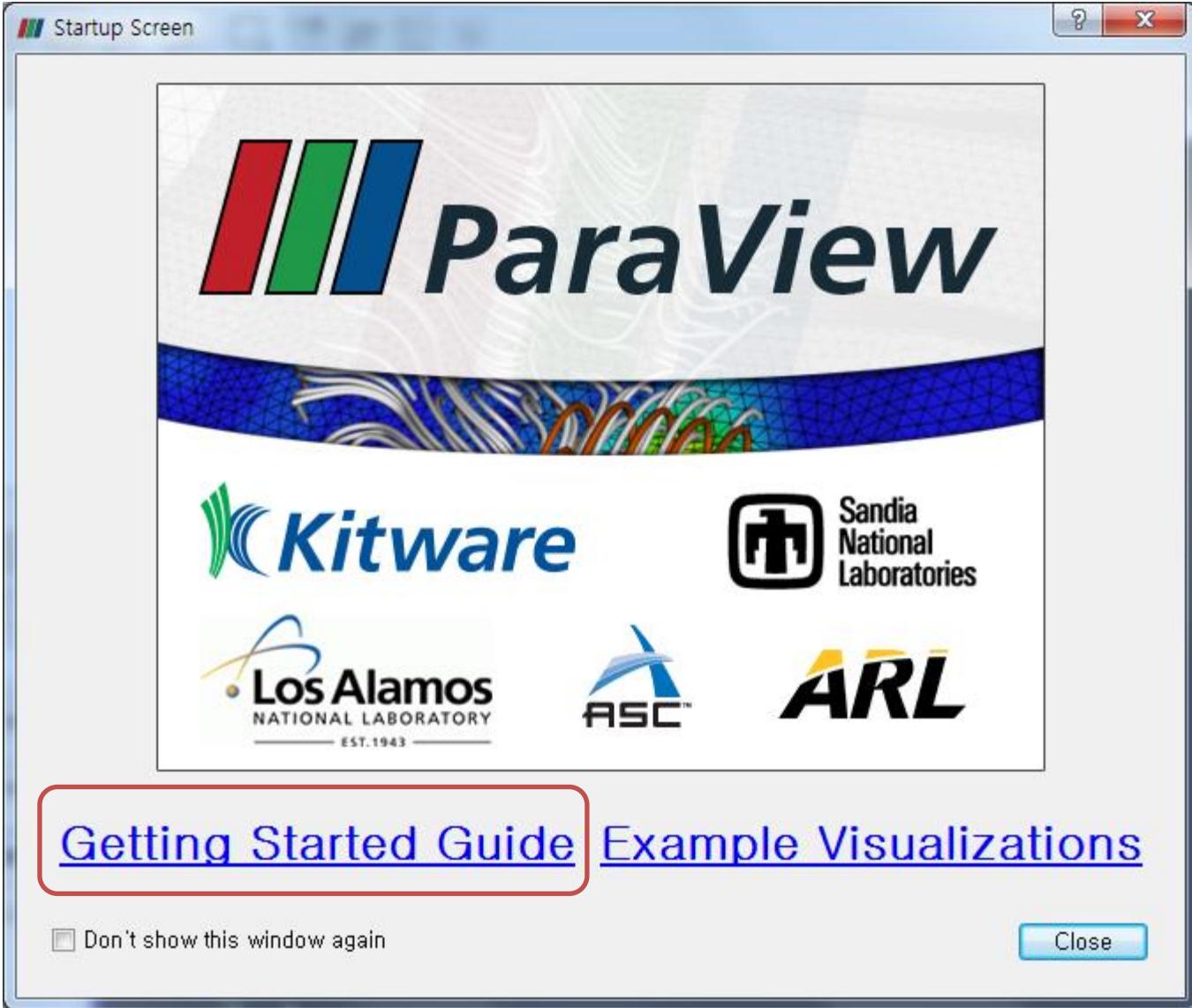
3D Rayleigh-Benard problem

<https://www.flickr.com/groups/paraview/pool/>



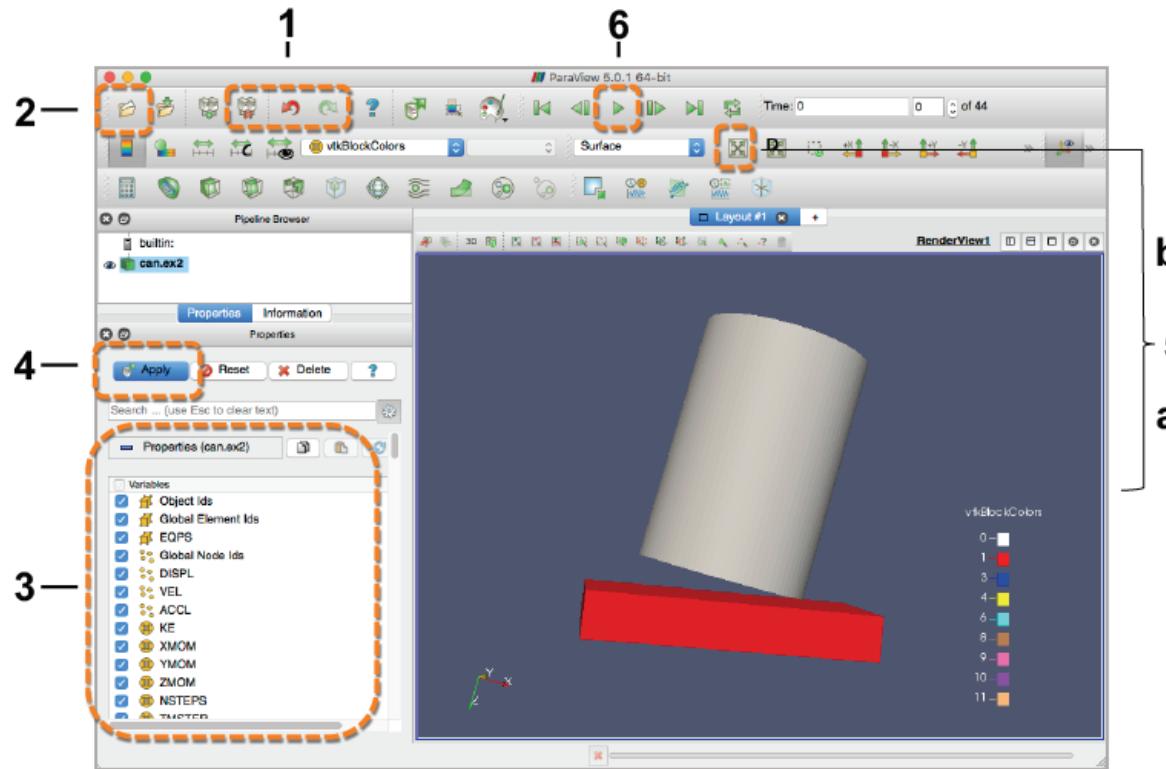
http://www.paraview.org/download/

The screenshot shows a web browser window with the URL <https://www.paraview.org/download/> in the address bar. The page itself is titled "Download" and features the Paraview logo. A navigation bar at the top includes links for "About", "Flavors", "Domains", "Resources", "Developer Tools", and "Download". Below the navigation bar, there is a note about specific license information and export regulations. The main section is titled "Releases" and contains four dropdown menus: "Version of ParaView" (set to v5.4), "Type of Download" (set to "ParaView Binary Installers"), "Operating System" (set to "Windows 64-bit"), and "File to Download" (set to "ParaView-5.4.1-RC4-Qt5-OpenGL2-Windows-64bit.exe"). Below these dropdowns are two buttons: "Download" and a link icon. Another section titled "Nightly Builds" is visible at the bottom, showing a dropdown menu with "AcuSolveReaderPlugin-Qt5-MPI-Linux-64bit.tgz" and a "Download" button.





ParaView Getting Started Guide

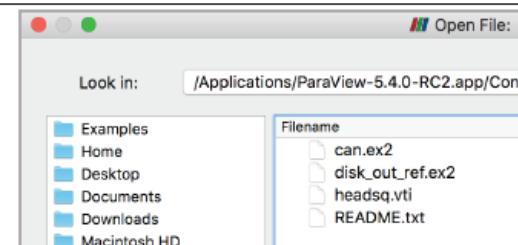


Reset Session

- At any time, click to reset ParaView to its initial state when the program is first started. The **Undo** and **Redo** buttons are also available to undo/redo individual changes.

Open File

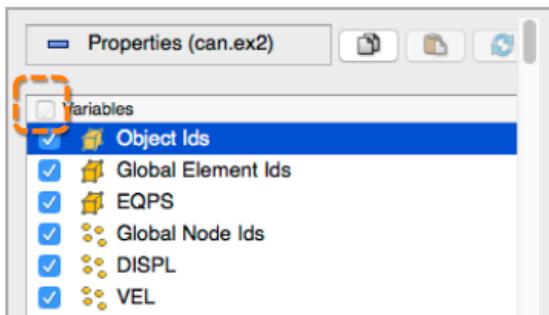
- Click the folder icon or choose **File -> Open**. From the **Examples** directory, open the file **can.ex2**. Doing so creates a **file reader** in the **Pipeline Browser**.



Select Data Variables

3

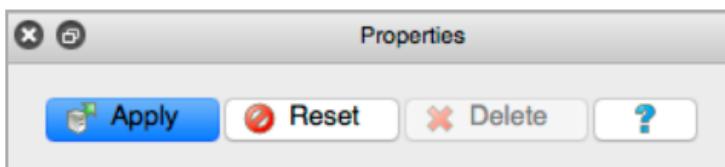
Before the data are loaded, you can choose which variables to load in the **Properties** panel (lower left, ParaView window). Click the checkbox next to **Variables** to load all variables. Note: many controls in ParaView are located in this panel.



Apply Data

4

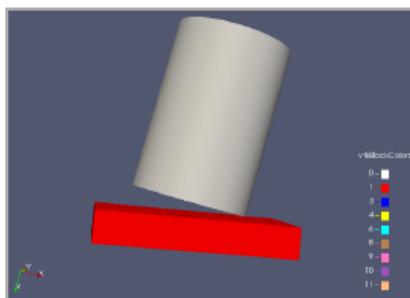
Click the **Apply** button to load the data. If you change any file reader properties, click **Apply** to update the visualization.



Interact with 3D View

5

a. Click the left mouse button and drag to rotate, the middle mouse button to translate, and the scroll wheel or right mouse button to zoom. For one- or two-button mice, hold down Shift and Control keys while clicking and dragging to tilt, translate, and zoom.
b. To re-center the data in the view, click .

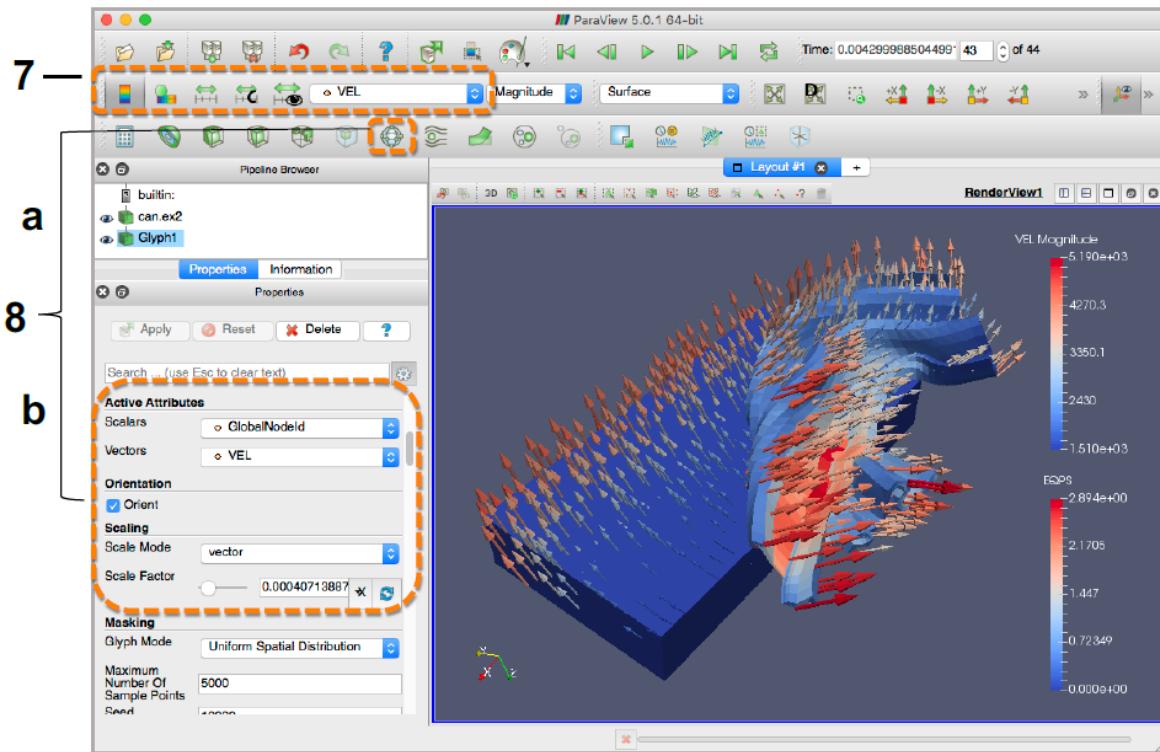


Animate the Data

6

Press the play button and watch the can get crushed. Other buttons enable moving to different timesteps.





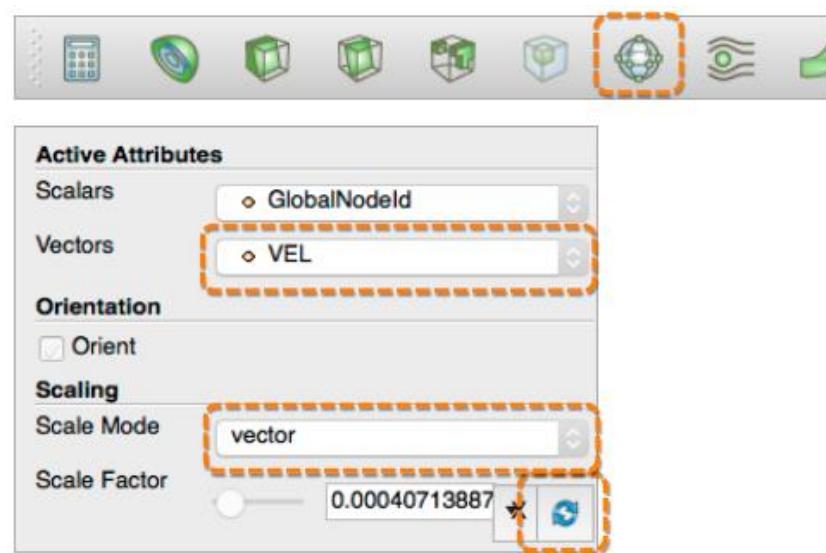
- 7** Apply a Color Map to a Variable
7 Click on the drop-down menu in the variables toolbar and select the **EQPS** variable.



Add Vector Glyphs

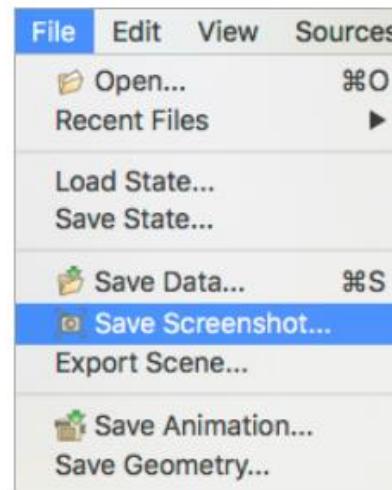
a. Ensure `can.ex2` is selected in the **Pipeline Browser**. Click the **Glyph** filter icon  in the toolbar to add a **filter** to the pipeline that will add arrow glyphs to the visualization.

- 8 b. In the **Properties** panel under **Active Attributes**, choose **VEL** from the **Vectors** property menu. Change the **Scale Mode** to **vector**. Click  to rescale the vectors to an appropriate length. Click **Apply** to update the visualization. Use the variables toolbar to color the glyphs by **VEL** (see previous step).



Save Screenshot

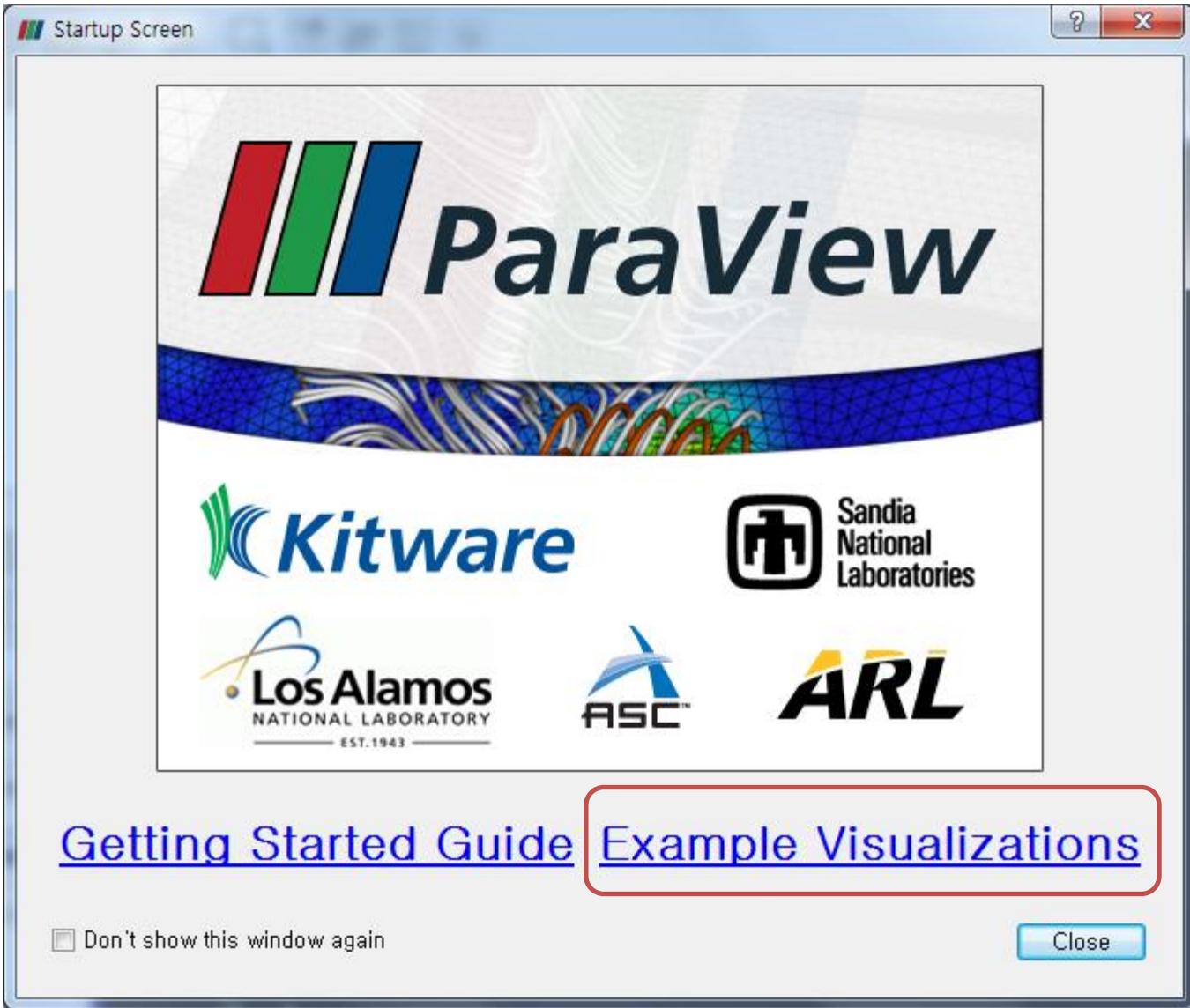
Save an image for presentation or publication by choosing **File -> Save Screenshot...**

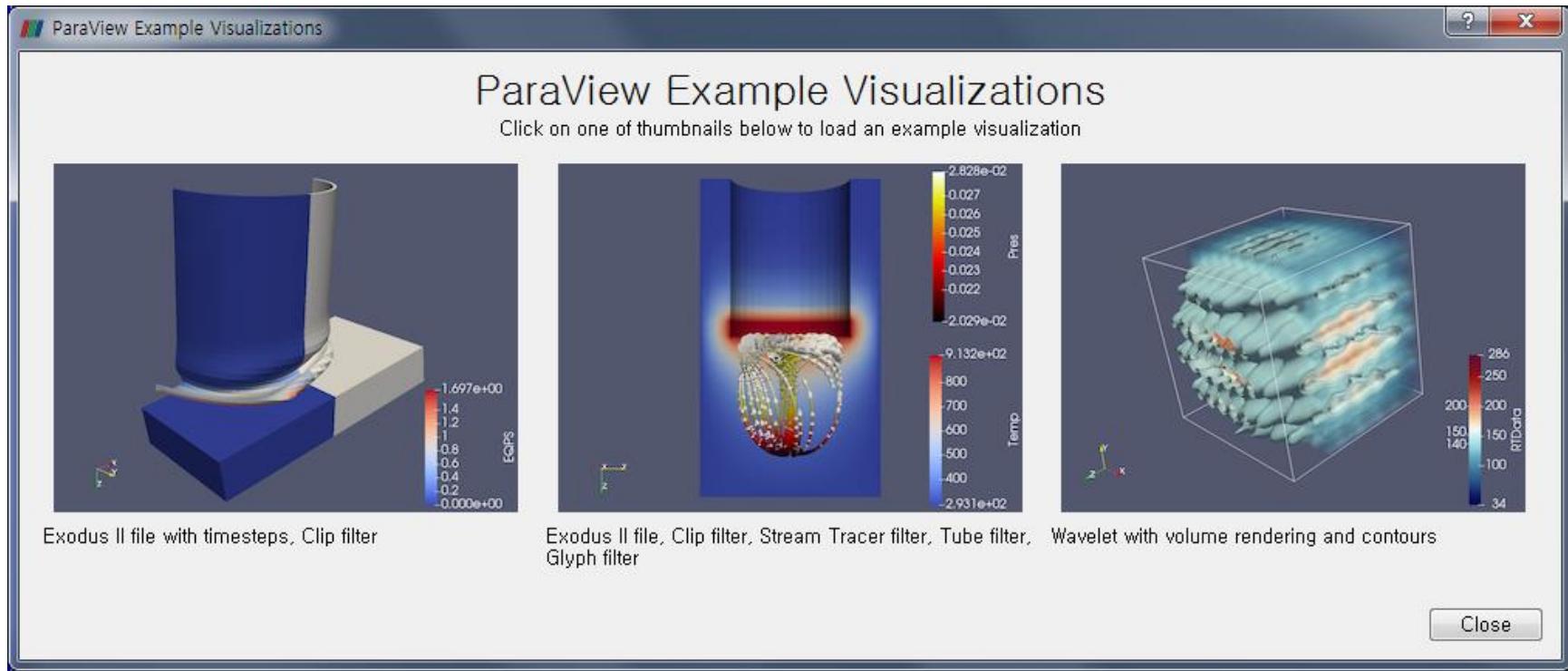


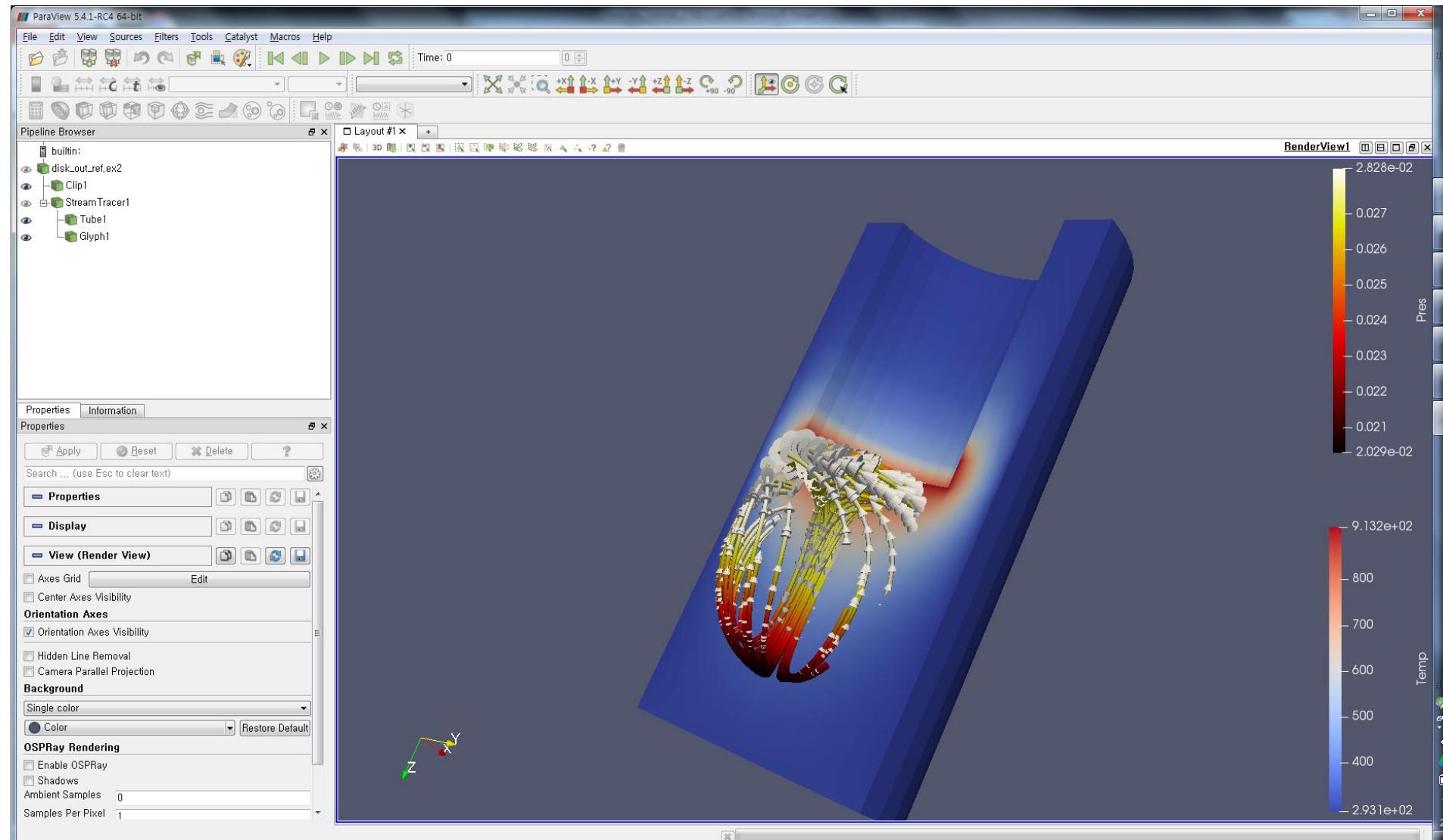
Get Additional Help

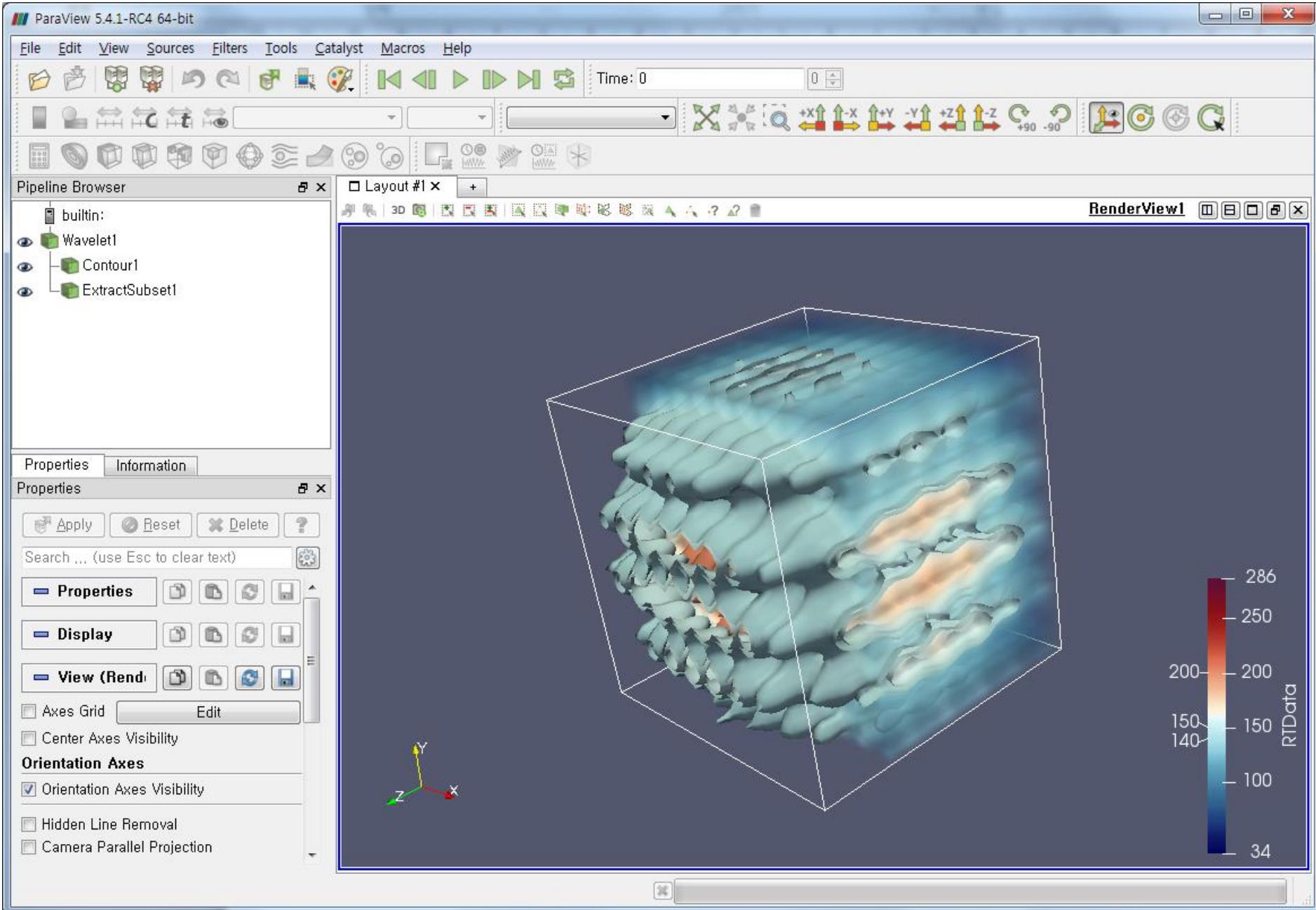
Additional resources for learning about **ParaView** are available in the **Help** menu.

- [ParaView Guide](#) – comprehensive user guide for ParaView
- [Help](#) – online help for file readers and filters
- [Online Tutorials](#) – in-depth tutorials for ParaView
- [Online Blogs](#) – informative blog posts on new features in ParaView









Large Scale Visualization with ParaView

Supercomputing 2014 Tutorial

November 16, 2014

Kenneth Moreland

W. Alan Scott

Sandia National Laboratories

Sebastien Jourdain

David DeMarle

Robert Maynard

Kitware, Inc.

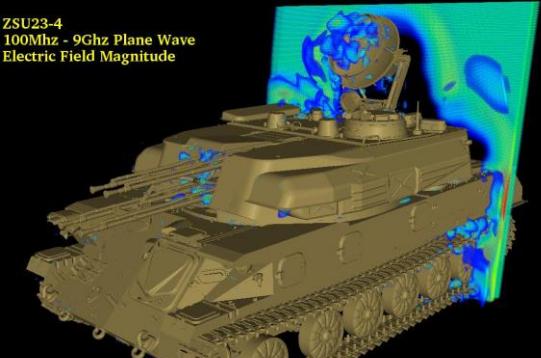
La-Ta Lo

Los Alamos National Laboratory

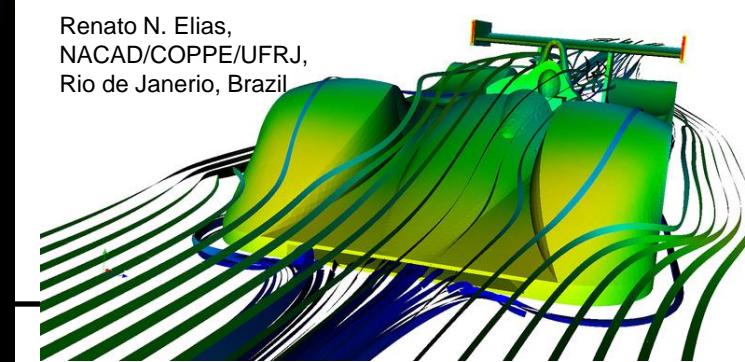
Joseph Insley

Argonne National Laboratory

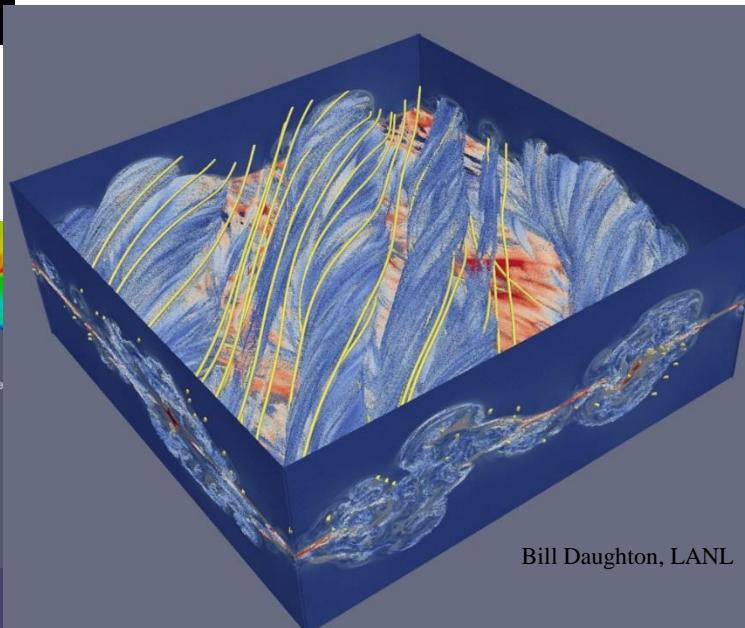
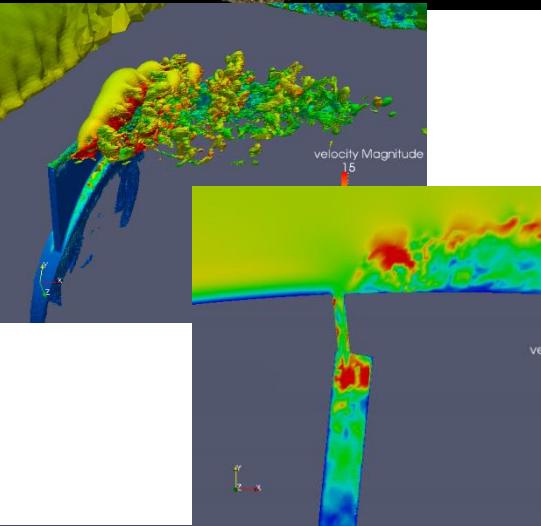
ZSU23-4
100Mhz - 9Ghz Plane Wave
Electric Field Magnitude



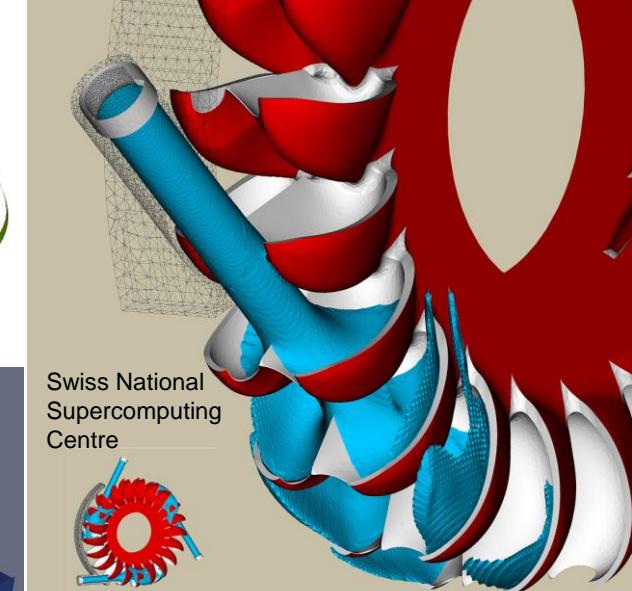
Jerry Clarke, US Army Research Laboratory



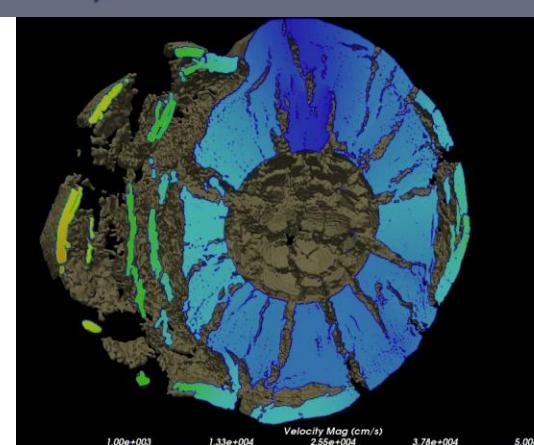
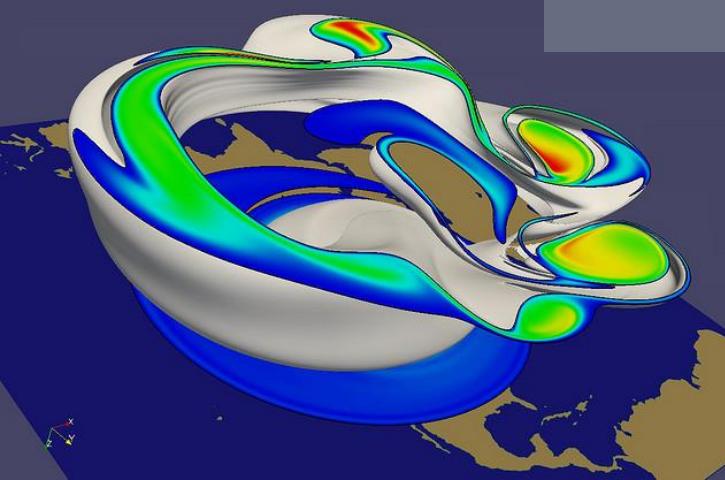
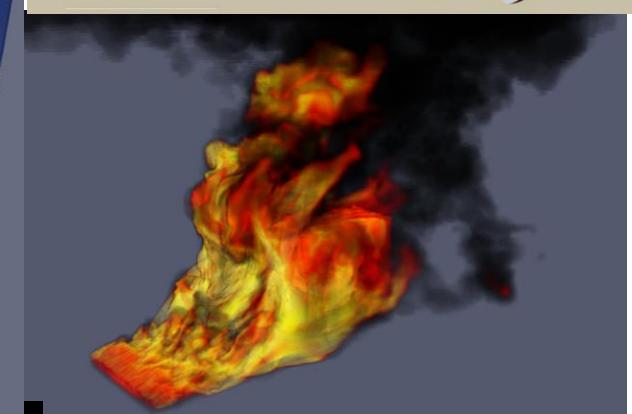
Renato N. Elias,
NACAD/COPPE/UFRJ,
Rio de Janerio, Brazil



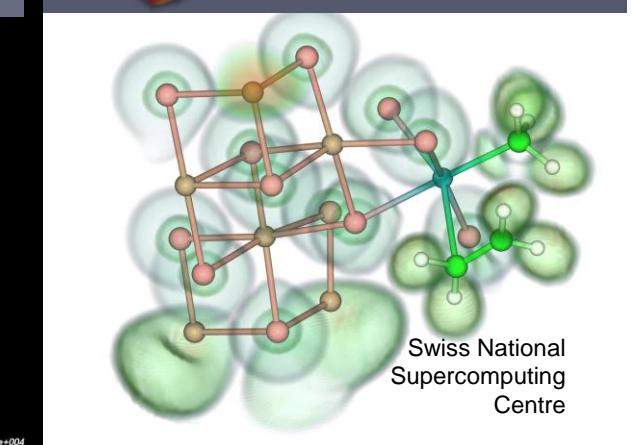
Bill Daughton, LANL



Swiss National
Supercomputing
Centre



Velocity Mag (cm/s)
1.00e+003 1.33e+004 2.55e+004 3.78e+004 5.00e+004



Swiss National
Supercomputing
Centre

Basic Usage

User Interface

Menu Bar

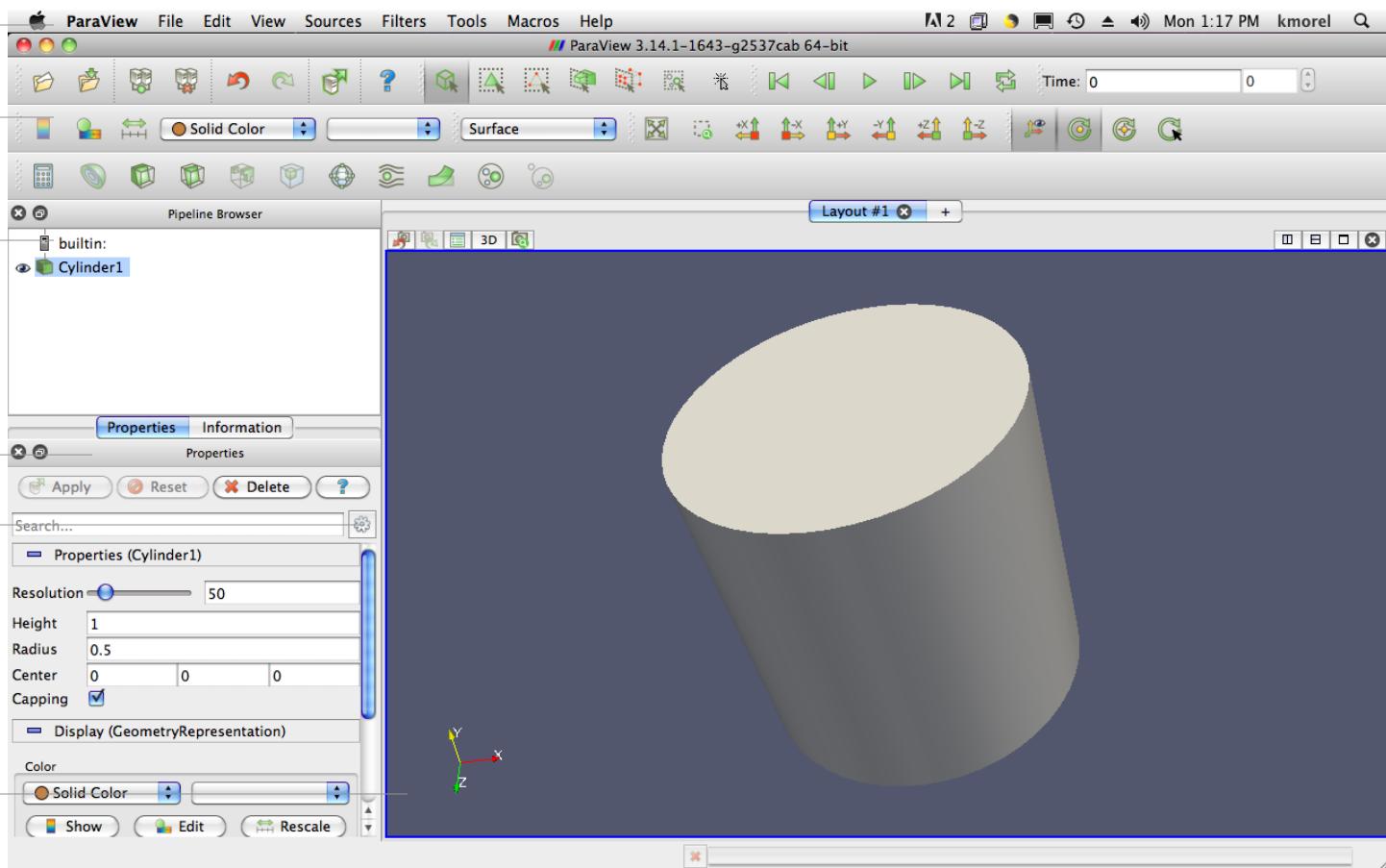
Toolbars

Pipeline Browser

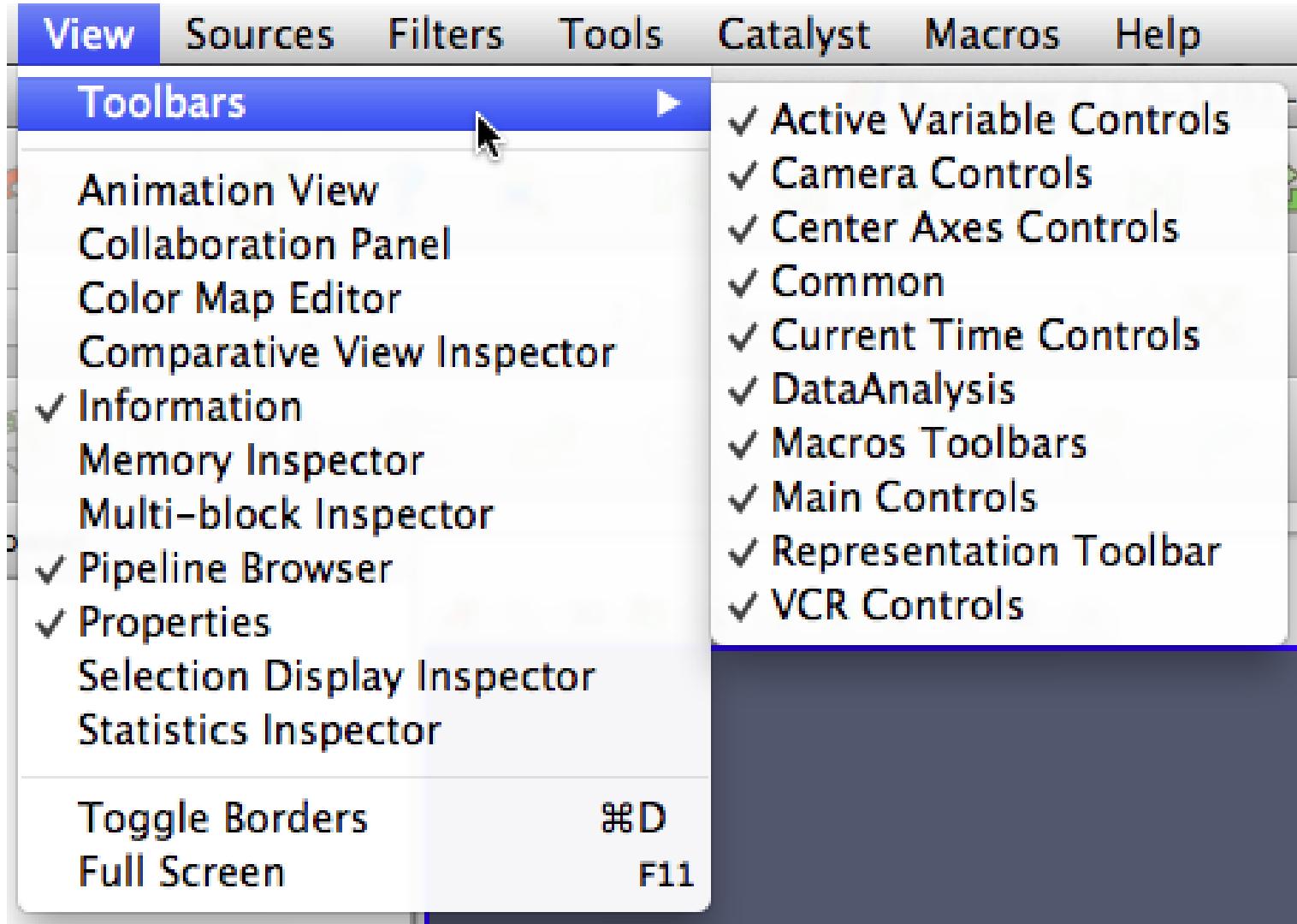
Properties Panel

Advanced Toggle

3D View



Getting Back GUI Components



The screenshot shows the Paraview application interface. The top menu bar includes "View", "Sources", "Filters", "Tools", "Catalyst", "Macros", and "Help". The "View" menu is currently selected and highlighted in blue. A dropdown menu titled "Toolbars" is open under "View", listing various components that can be enabled or disabled. The "Toolbars" menu contains the following items:

- Animation View
- Collaboration Panel
- Color Map Editor
- Comparative View Inspector
- ✓ Information
- Memory Inspector
- Multi-block Inspector
- ✓ Pipeline Browser
- ✓ Properties
- Selection Display Inspector
- Statistics Inspector

Below the "Toolbars" menu, there are two additional items:

- Toggle Borders ⌘D
- Full Screen F11

Creating a Cylinder Source

1. Go to the Source menu and select Cylinder.
2. Click the Apply button to accept the default parameters.



Simple Camera Manipulation

- Drag left, middle, right buttons for rotate, pan, zoom.
 - Also use Shift, Ctrl, Alt modifiers.



Creating a Cylinder Source

1. Go to the Source menu and select Cylinder.
2. Click the Apply button to accept the default parameters.
3. Increase the Resolution parameter.



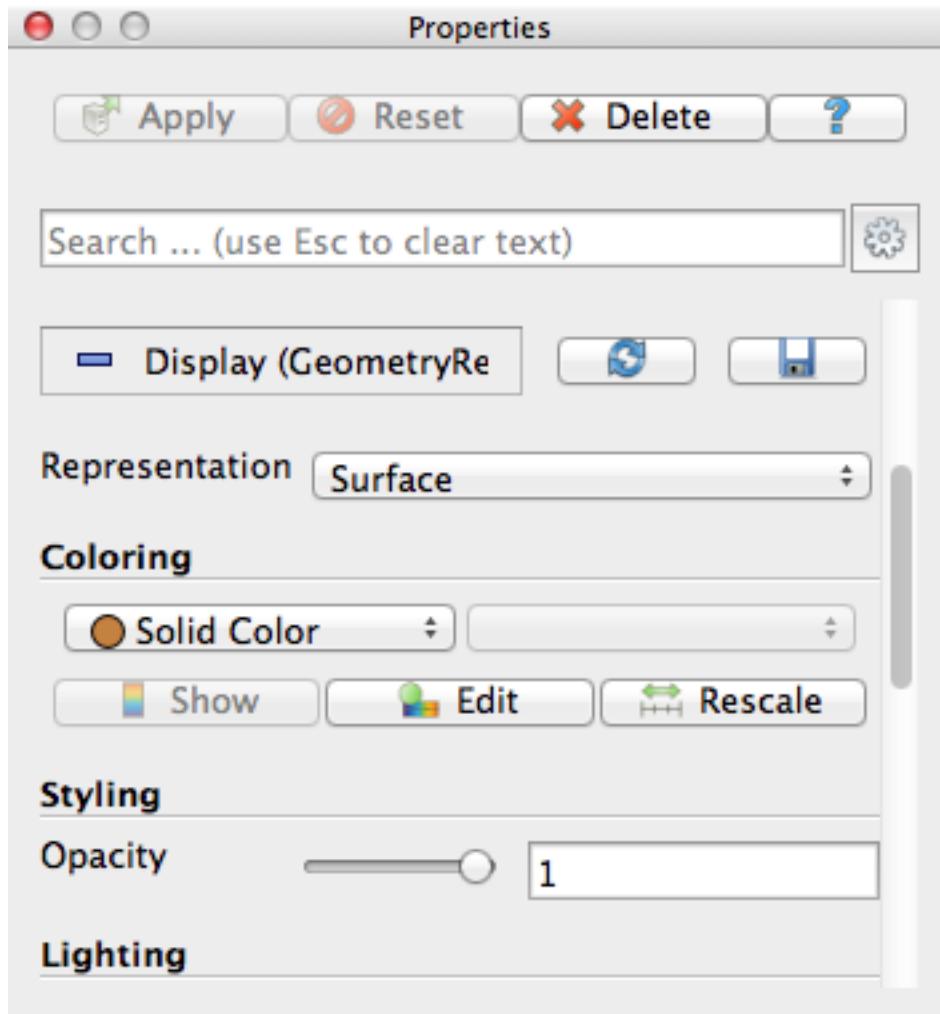
Resolution 6

4. Click the  button again.

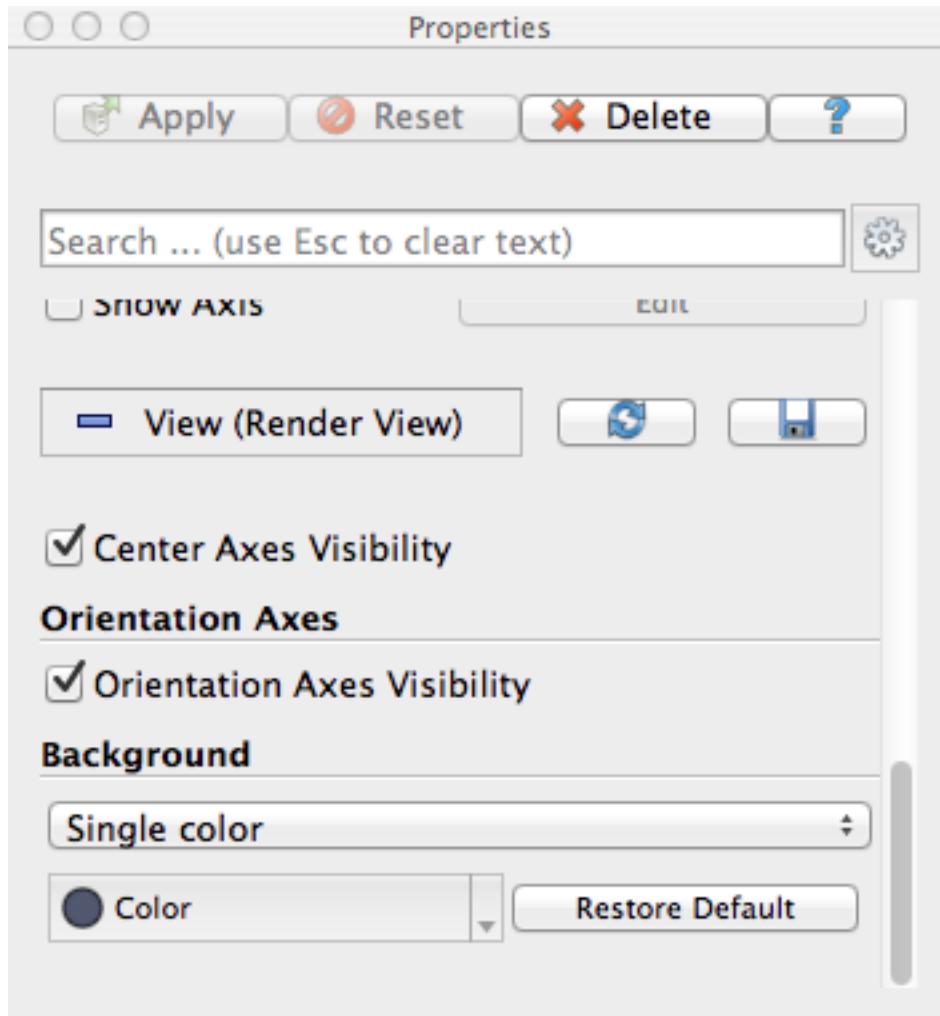
Pipeline Object Controls



Display Properties



Render View Options



Undo Redo



Undo



Redo



Camera
Undo



Camera
Redo

Creating a Cylinder Source

1. Go to the Source menu and select Cylinder.
2. Click the Apply button to accept the default parameters. 
3. Increase the Resolution parameter.



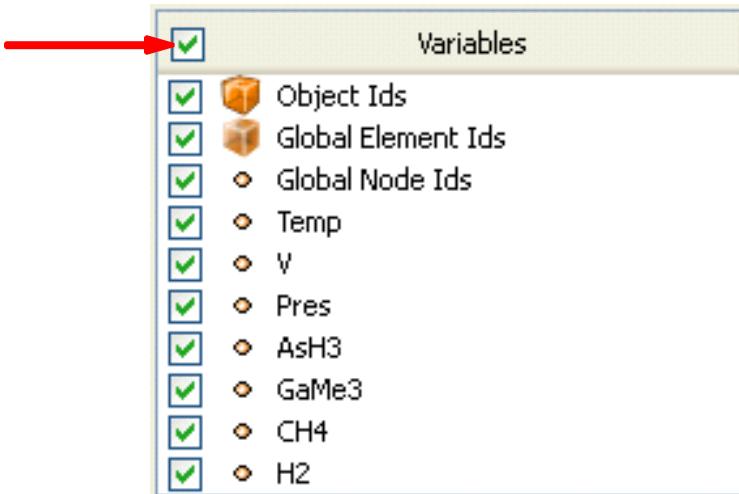
4. Click the  button again.
5. Delete the Cylinder. 

Supported Data Types

- ParaView Data (.pvd)
- VTK (.vti, .vtu, .vti, .vts, .vtr)
- VTK Legacy (.vtk)
- VTK Multi Block (.vtm,.vtmb,.vtmg,.vthd,.vthb)
- Partitioned VTK (.pvtu, .pvti, .pvtis, .pvtre)
- ADAPT (.nc, .cdf, .elev, .ncd)
- ANALYZE (.img, .hdr)
- ANSYS (.inp)
- AVS UCD (.inp)
- BOV (.bov)
- BYU (.g)
- CAM NetCDF (.nc, .ncdf)
- CCSM MTSD (.nc, .cdf, .elev, .ncd)
- CCSM STSD (.nc, .cdf, .elev, .ncd)
- CEAucd (.ucd, .inp)
- CMAT (.cmat)
- CML (.cml)
- CTRL (.ctrl)
- Chombo (.hdf5, .h5)
- Claw (.claw)
- Comma Separated Values (.csv)
- Cosmology Files (.cosmo, .gadget2)
- Curve2D (.curve, .ultra, .ult, .u)
- DDCMD (.ddcmd)
- Digital Elevation Map (.dem)
- Dyna3D(.dyn)
- EnSight (.case, .sos)
- Enzo boundary and hierarchy
- ExodusII (.g, .e, .exe, .ex2, .ex2v.., etc)
- ExtrudedVol (.exvol)
- FVCOM (MTMD, MTSD, Particle, STSD)
- Facet Polygonal Data
- Flash multiblock files
- Fluent Case Files (.cas)
- GGCM (.3df, .mer)
- GTC (.h5)
- GULP (.trg)
- Gadget (.gadget)
- Gaussian Cube File (.cube)
- JPEG Image (.jpg, .jpeg)
- LAMMPS Dump (.dump)
- LAMMPS Structure Files
- LODI (.nc, .cdf, .elev, .ncd)
- LODI Particle (.nc, .cdf, .elev, .ncd)
- LS-DYNA (.k, .lsdyna, .d3plot, d3plot)
- M3DCI (.h5)
- MFIX Unstructured Grid (.RES)
- MM5 (.mm5)
- MPAS NetCDF (.nc, .ncdf)
- Meta Image (.mhd, .mha)
- Miranda (.mir, .raw)
- Multilevel 3d Plasma (.m3d, .h5)
- NASTRAN (.nas, .f06)
- Nek5000 Files
- Nrrd Raw Image (.nrrd, .nhdr)
- OpenFOAM Files (.foam)
- PATRAN (.neu)
- PFLOTRAN (.h5)
- PLOT2D (.p2d)
- PLOT3D (.xyz, .q, .x, .vp3d)
- PLY Polygonal File Format
- PNG Image Files
- POP Ocean Files
- ParaDIS Files
- Phasta Files (.pht)
- Pixie Files (.h5)
- ProSTAR (.cel, .vtk)
- Protein Data Bank (.pdb, .ent, .pdb)
- Raw Image Files
- Raw NRRD image files (.nrrd)
- SAMRAI (.samrai)
- SAR (.SAR, .sar)
- SAS (.sasgeom, .sas, .sasdata)
- SESAME Tables
- SLAC netCDF mesh and mode data
- SLAC netCDF particle data
- Silo (.silo, .pdb)
- Spherical (.spherical, .sv)
- SpyPlot CTH
- SpyPlot (.case)
- SpyPlot History (.hscth)
- Stereo Lithography (.stl)
- TFT Files
- TIFF Image Files
- TSurf Files
- Tecplot ASCII (.tec, .tp)
- Tecplot Binary (.plt)
- Tetrad (.hdf5, .h5)
- UNIC (.h5)
- VASP CHGCA (.CHG)
- VASP OUT (.OUT)
- VASP POSTCAR (.POS)
- VPIC (.vpc)
- VRML (.wrl)
- Velodyne (.vld, .rst)
- VizSchema (.h5, .vsh5)
- Wavefront Polygonal Data (.obj)
- WindBlade (.wind)
- XDMF and hdf5 (.xmf, .xdmf)
- XMol Molecule

Load disk_out_ref.ex2

1. Open the file disk_out_ref.ex2.
2. Load all data variables.

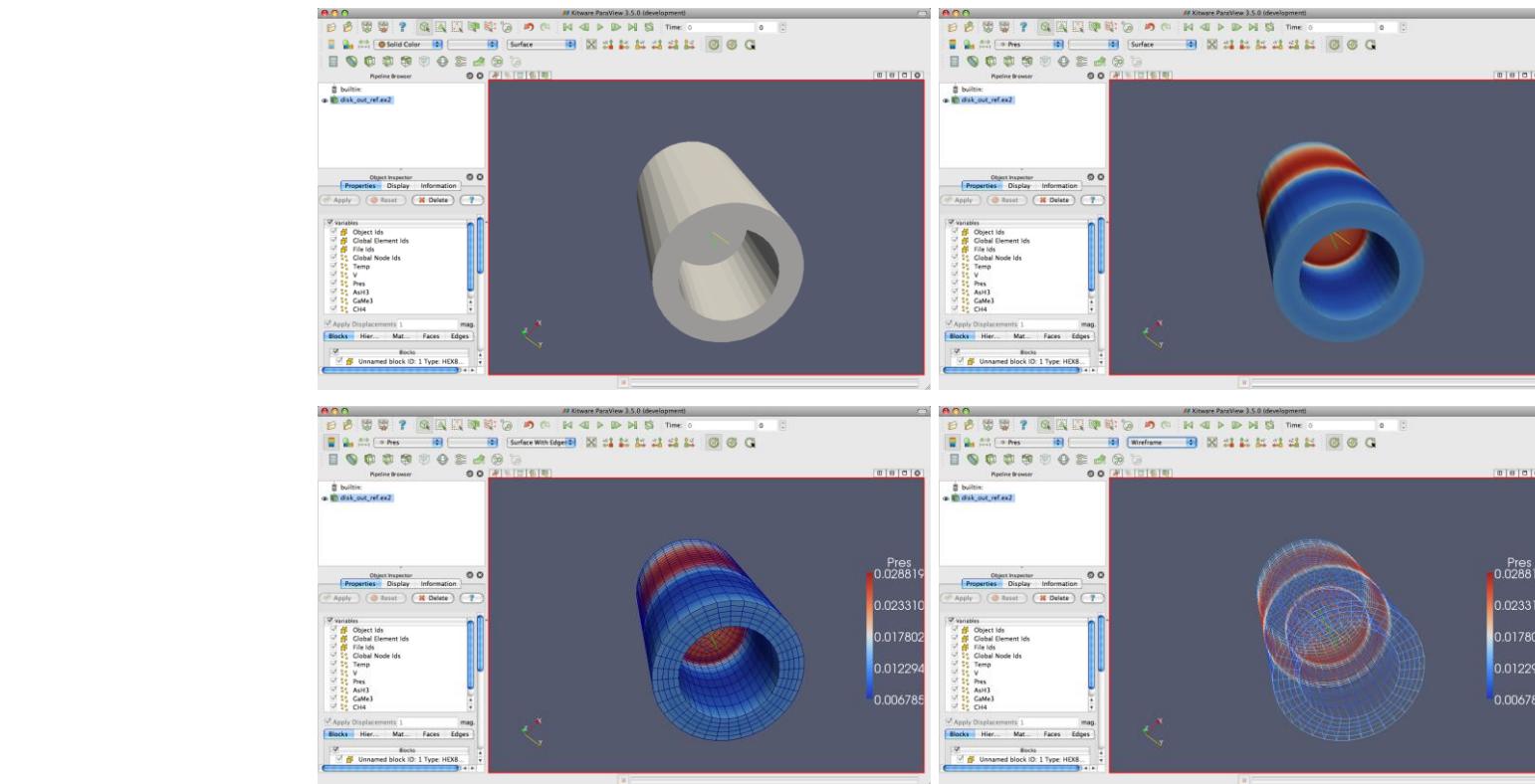


3. Click 

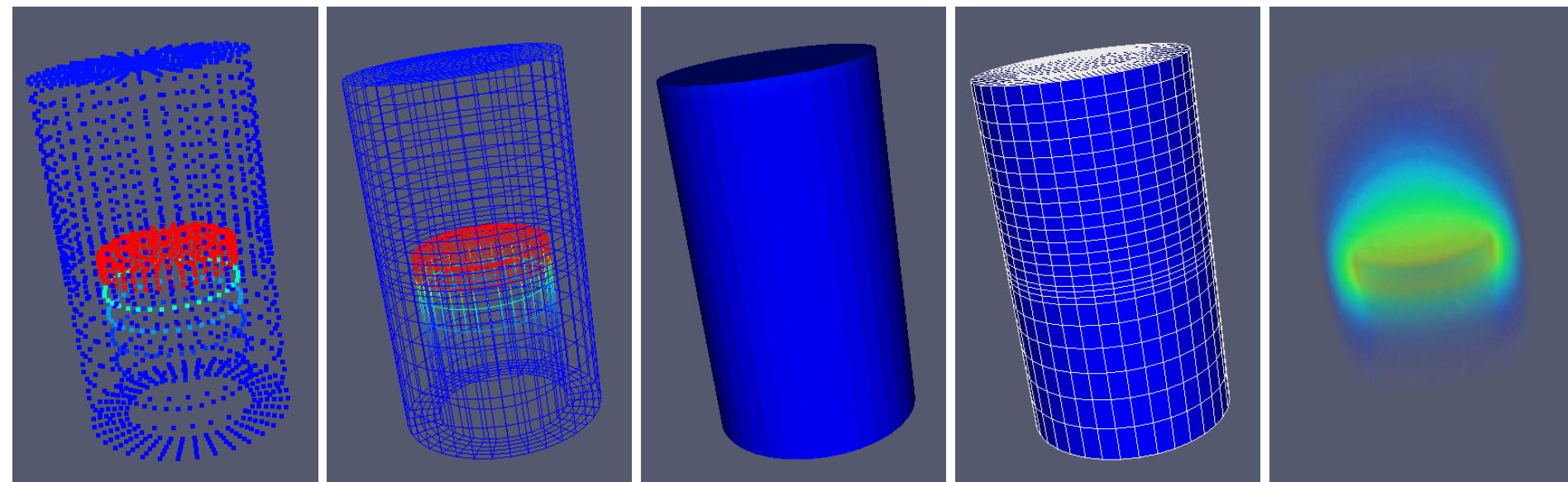
Data Representation



Edit Colors Custom Scalar Range



Geometry Representations



Points

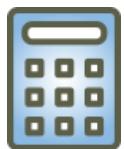
Wireframe

Surface

Surface
with Edges

Volume

Common Filters



Calculator



Contour



Clip



Slice



Threshold



Extract Subset



Glyph



Stream Tracer



Warp (vector)

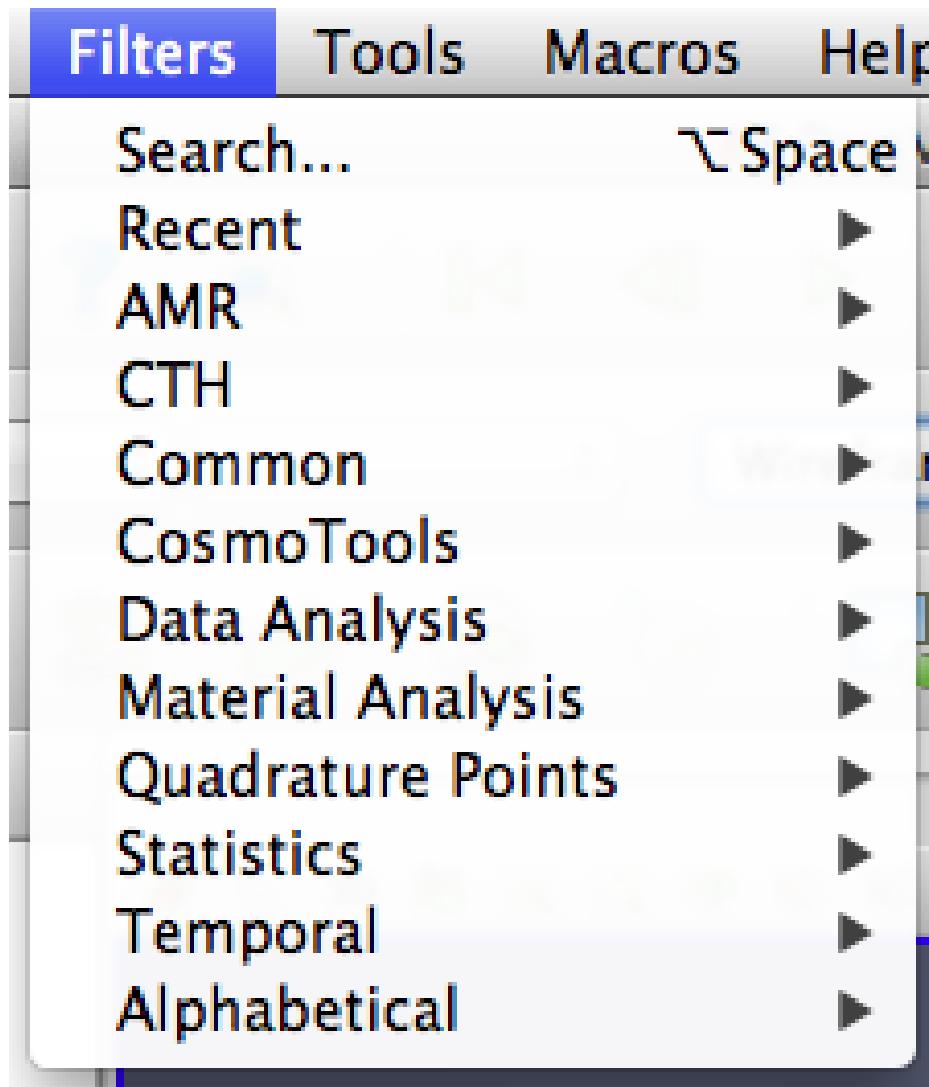


Group Datasets

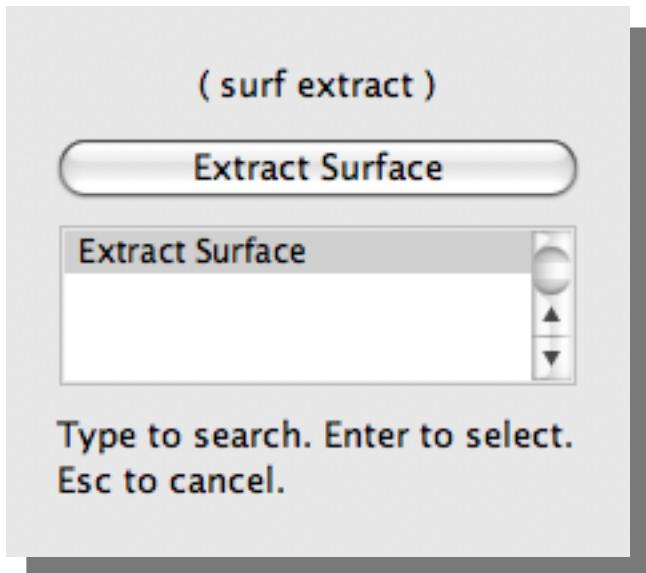


Extract Level

Filters Menu



Quick Launch



- Used for searching for filters by name
- Keyboard shortcut
 - Ctrl-space for Windows & Linux
 - Alt-space for Mac

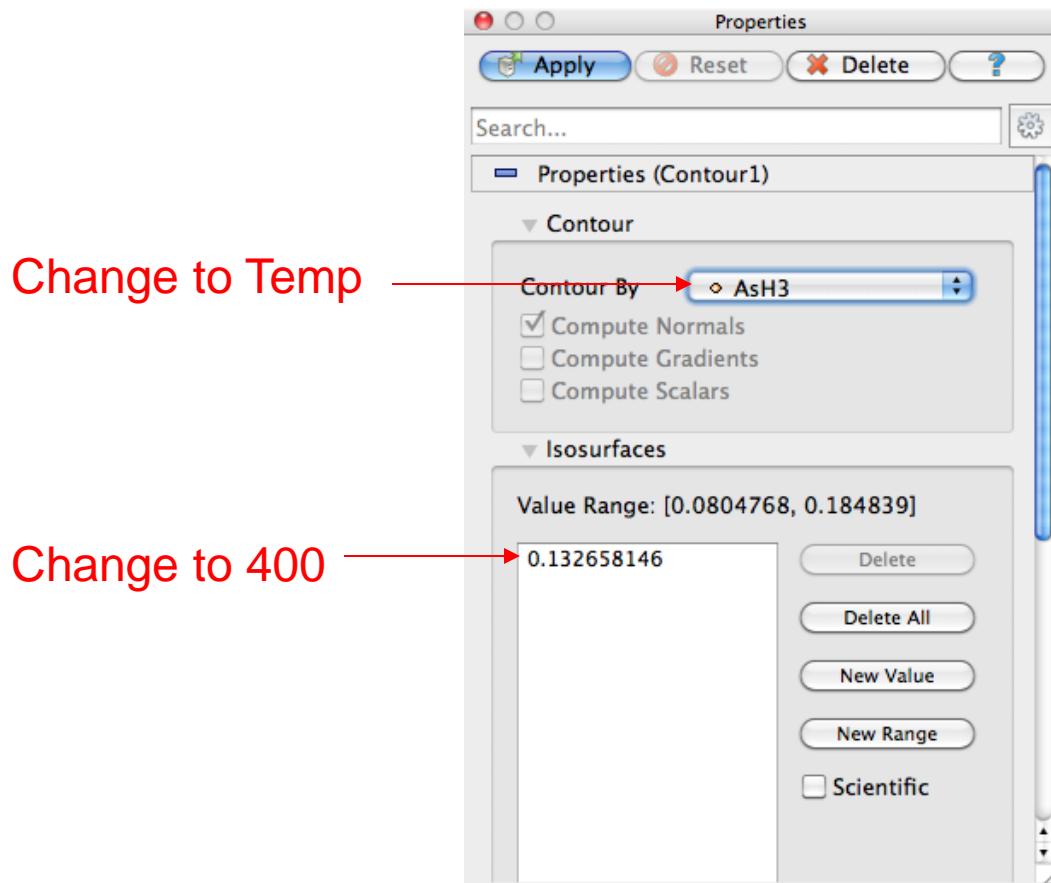
Apply a Filter

1. Make sure that disk_out_ref.ex2 is selected in the pipeline browser.
2. Select the contour filter.



Apply a Filter

3. Change parameters to create an isosurface at Temp = 400K.



Apply a Filter

1. Make sure that disk_out_ref.ex2 is selected in the pipeline browser.
2. Select the contour filter. 
3. Change parameters to create an isosurface at Temp = 400K.
4. 

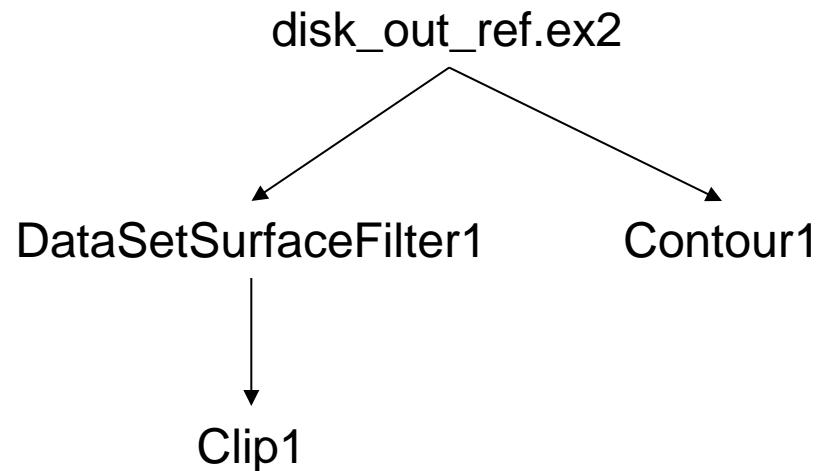
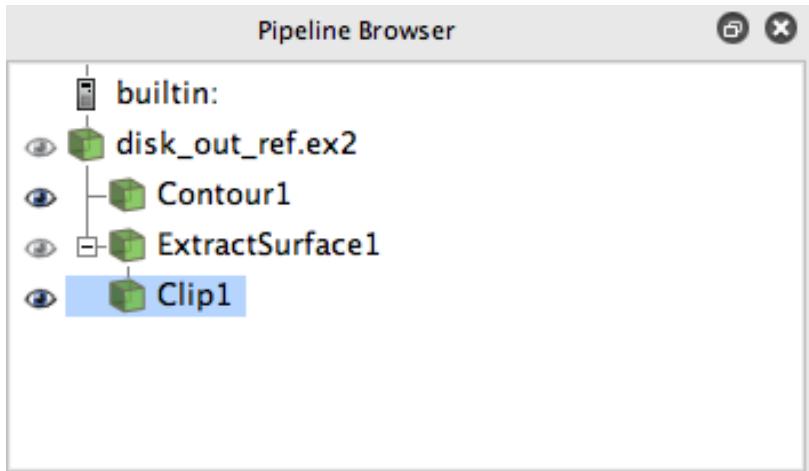
Create a Cutaway Surface

1. Select `disk_out_ref.ex2` in the pipeline browser.
2. From the quick launch, select Extract Surface.
3. 

Create a Cutaway Surface

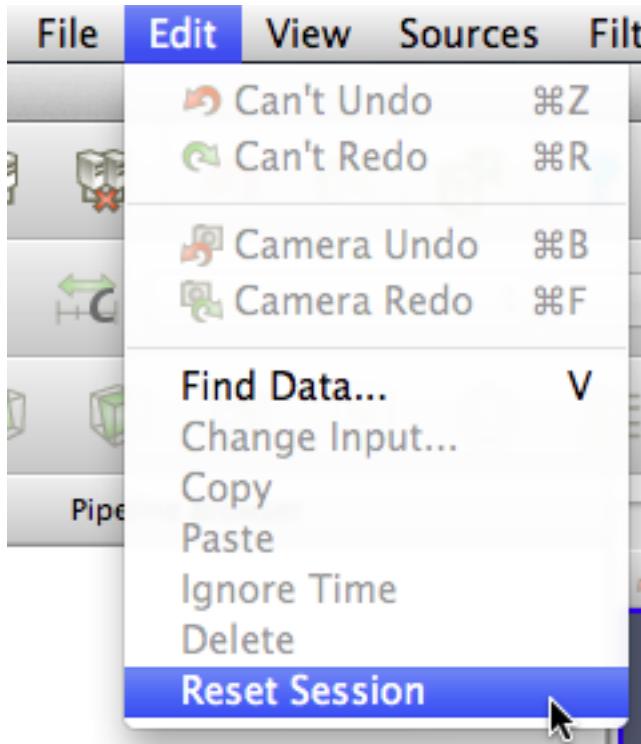
1. Select `disk_out_ref.ex2` in the pipeline browser.
2. From the quick launch, select Extract Surface.
3. 
4. Create a clip filter. 
5. Uncheck Show Plane. 
6. 

Pipeline Browser Structure

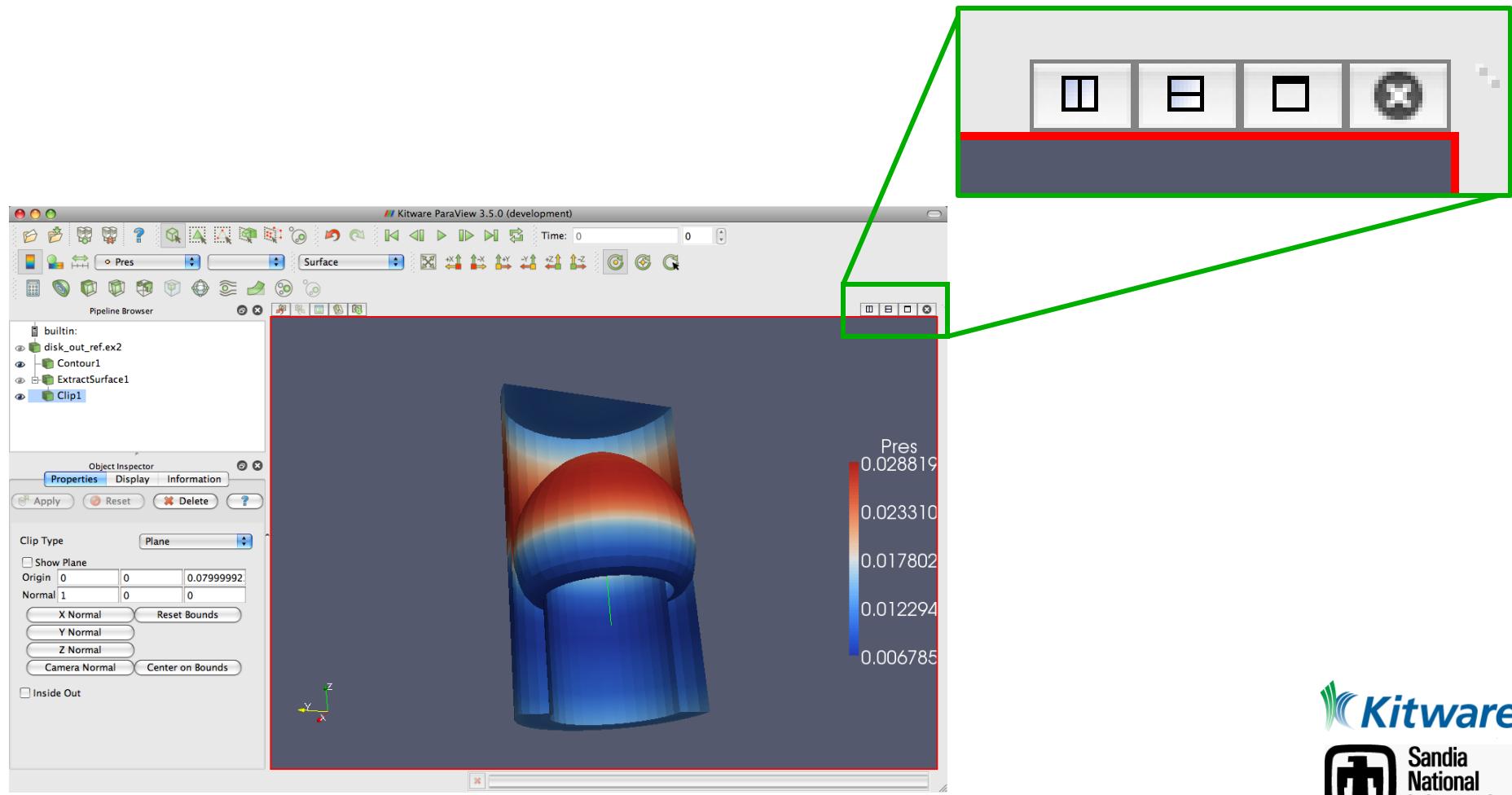


Reset ParaView

Edit → Reset Session



Multiview



Multiview

1. Open disk_out_ref.ex2. Load all variables.



2. Add Clip filter.



3. Uncheck Show Plane.



Show Plane

- 4.



5. Color surface by Pres.



Multiview

6. Split the view horizontally. 
7. Make Clip1 visible. 
8. Color surface by Temp.

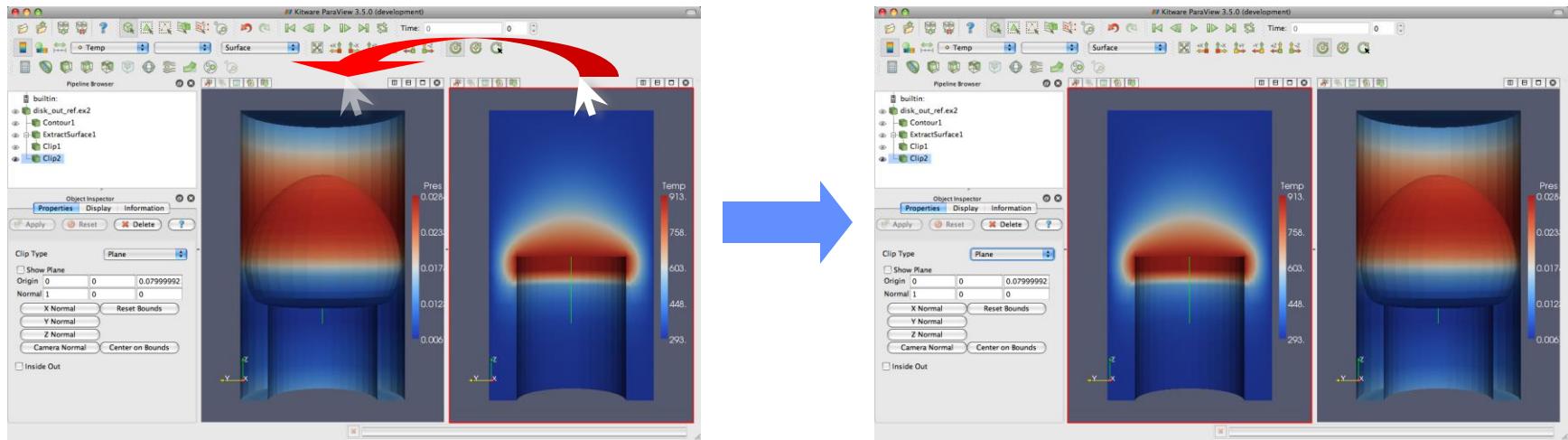
Multiview

6. Split the view horizontally. 
7. Make Clip1 visible. 
8. Color surface by Temp.
9. Right-click view, Link Camera...
10. Click other view.

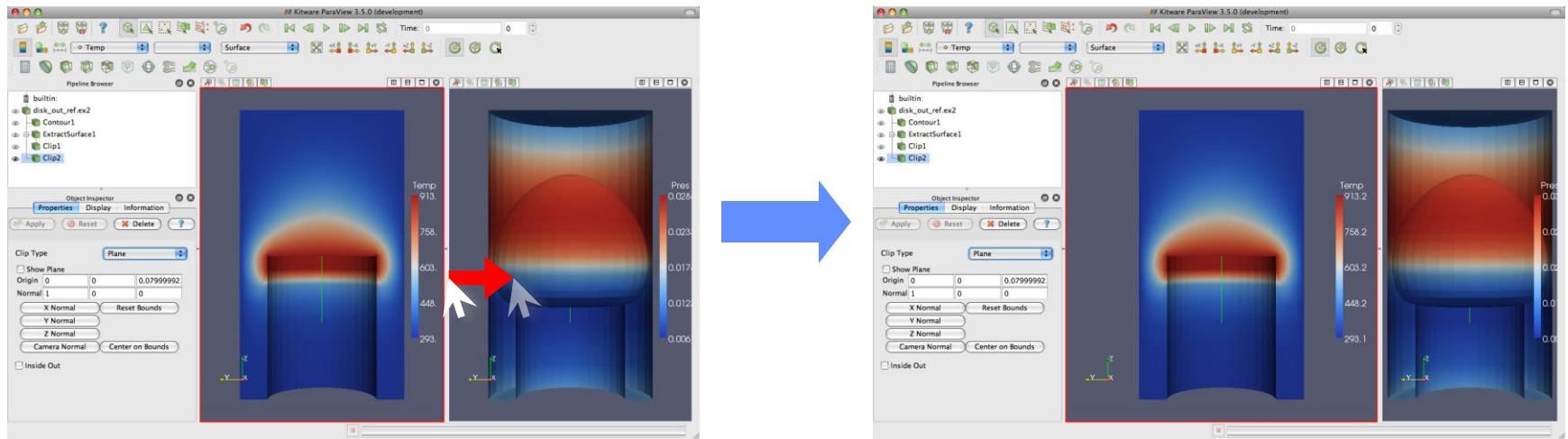
Multiview

6. Split the view horizontally. 
7. Make Clip1 visible. 
8. Color surface by Temp.
9. Right-click view, Link Camera...
10. Click other view.
11. Click 

Modifying Views

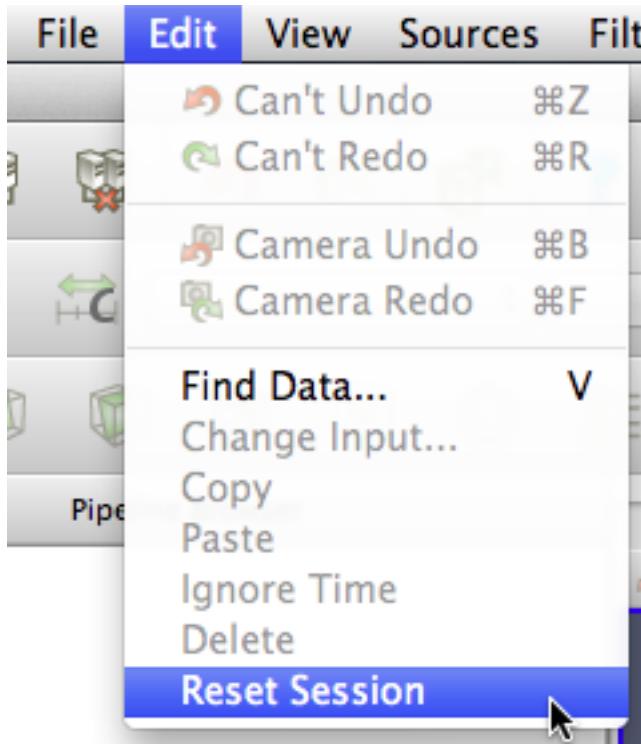


Modifying Views



Reset ParaView

Edit → Reset Session



Streamlines

1. Open disk_out_ref.ex2. Load all variables.



2. Add Stream Tracer.



- 3.



Streamlines

1. Open disk_out_ref.ex2. Load all variables.



2. Add Stream Tracer.



- 3.



4. From the quick launch, select Tube

- 5.





Getting Fancy

6. Select StreamTracer1.
7. Add Glyph filter.

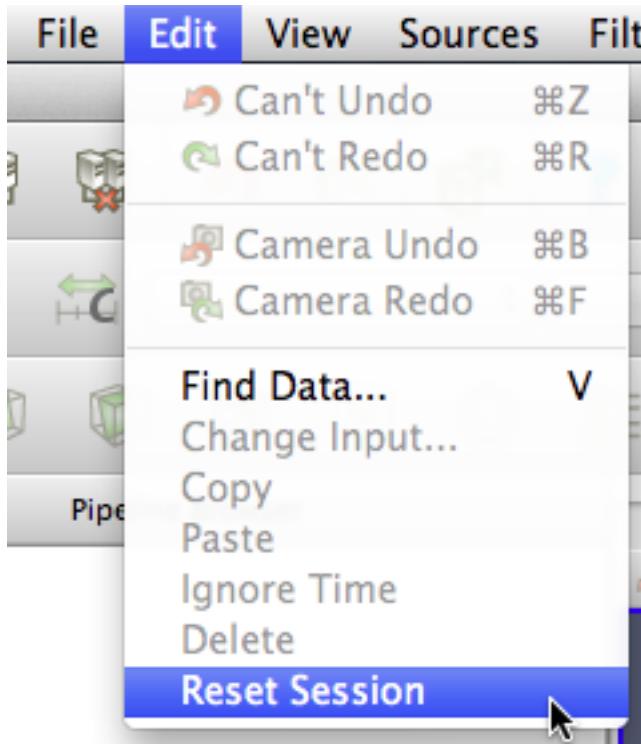
8. Change Vectors to V.
9. Change Glyph Type to Cone.
10.  **Apply**

Getting Answers

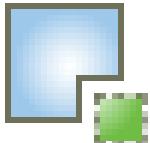
- Where is the air moving the fastest?
Near the disk or away from it? At the center of the disk or near its edges?
- Which way is the plate spinning?
- At the surface of the disk, is air moving toward the center or away from it?

Reset ParaView

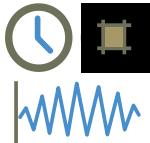
Edit → Reset Session



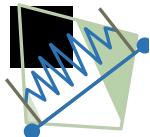
Common Data Analysis Filters



Extract Selection



Plot Global Variables Over Time



Plot Over Line



Plot Selection Over Time



Probe Location

Plotting

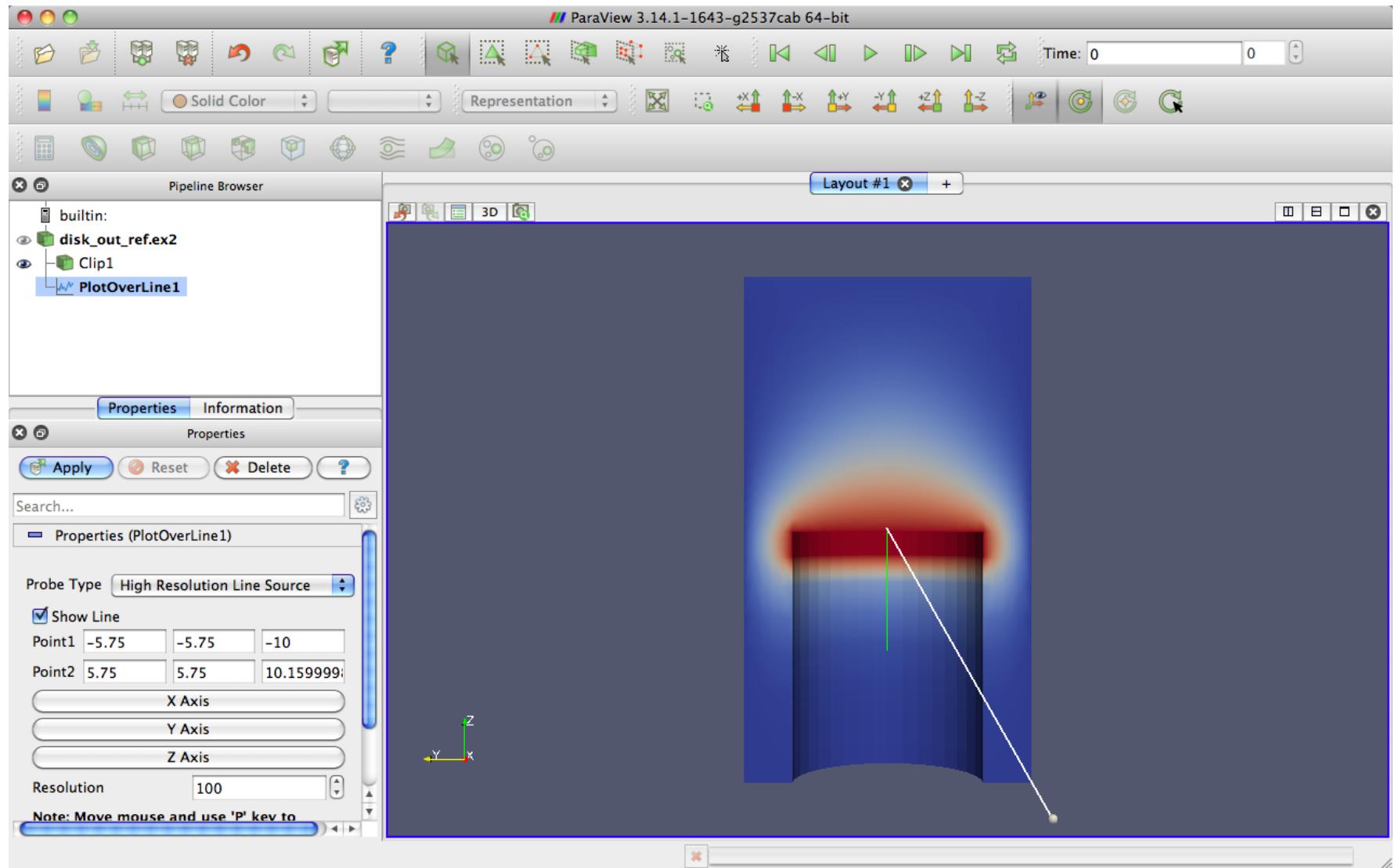
1. Open disk_out_ref.ex2. Load all variables.



2. Clip,  uncheck, Show Plane ,
3. Select disk_out_ref.ex2.
4. Add Plot Over Line filter.



3D Widgets



Plotting

1. Open disk_out_ref.ex2. Load all variables.



2. Clip,



Show Plane



3. Select disk_out_ref.ex2.



4. Add Plot Over Line filter.



5. Once line is satisfactorily located,

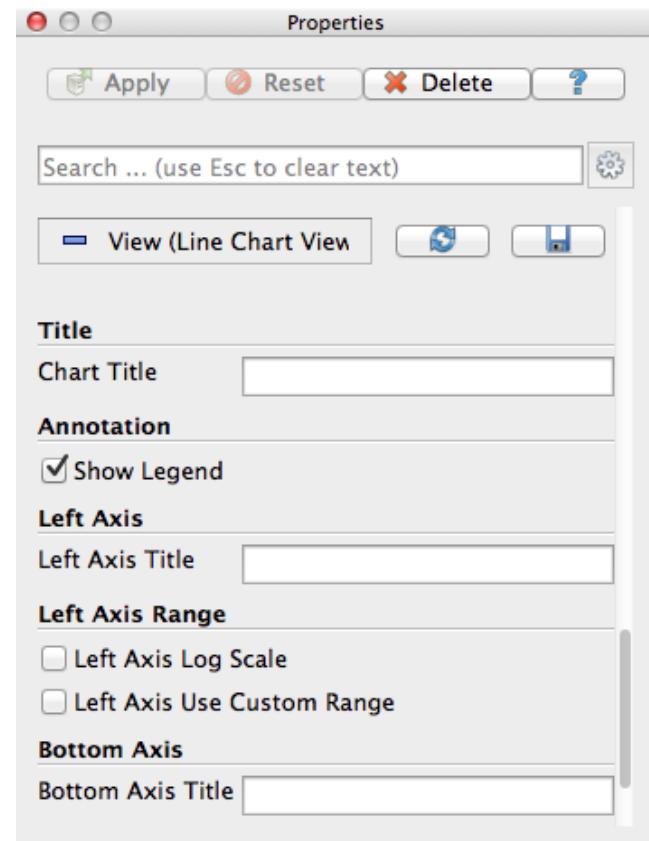
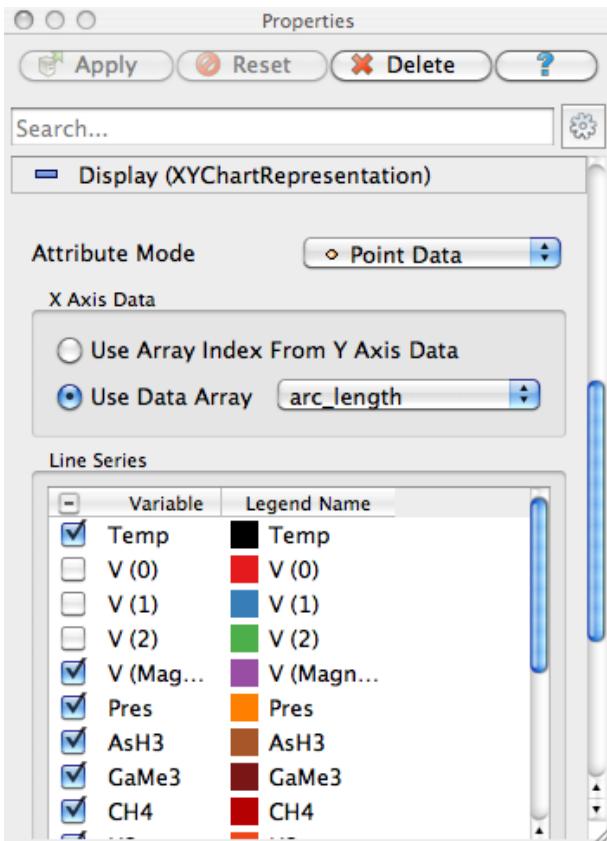


Interacting with Plots

- Left, middle, right buttons to pan, zoom.
- Mouse wheel to zoom.
- Reset view to plot ranges. A small square icon containing a black 'X' symbol with four green arrows pointing outwards from its sides, representing a reset or refresh function.

Plots are Views

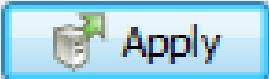
- Move them like Views.
- Save screenshots.



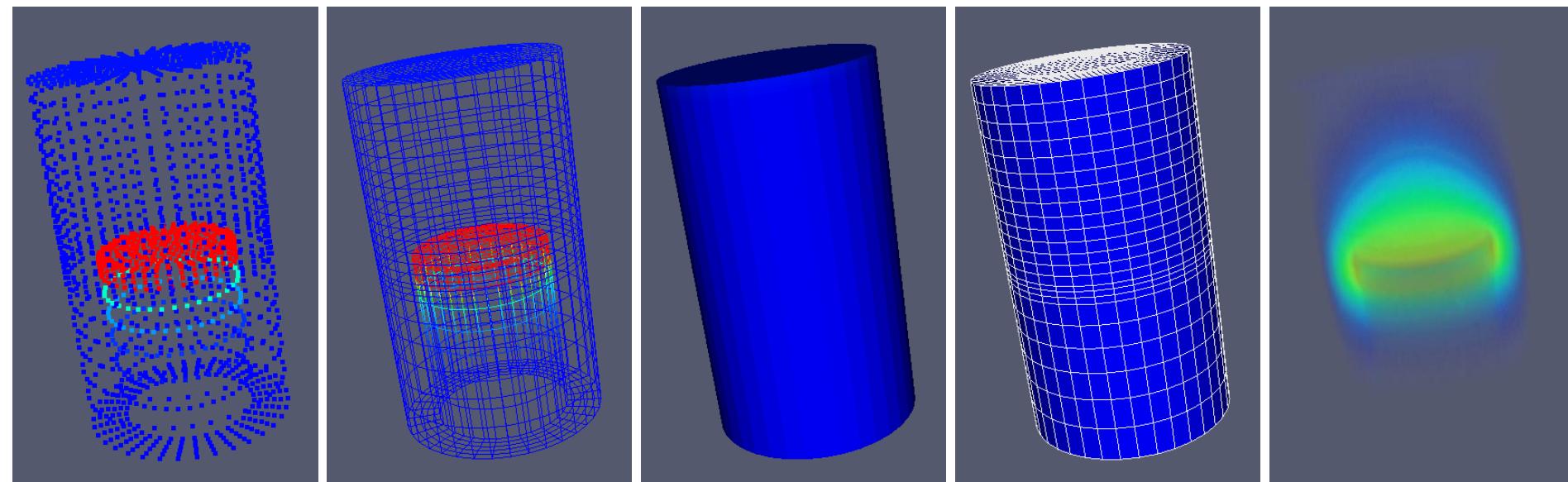
Adjusting Plots

1. In Display section of properties panel, turn off all variables except Temp and Pres.
2. Select Pres in the Display options.
3. Verify the relationship between temperature and pressure.

Histogram / Bar Chart

1. Select disk_out_ref.ex2.
2. Filters → Data Analysis →
Histogram 
3. Change Input Array to Temp.
4. 

Geometry Representations



Points

Wireframe

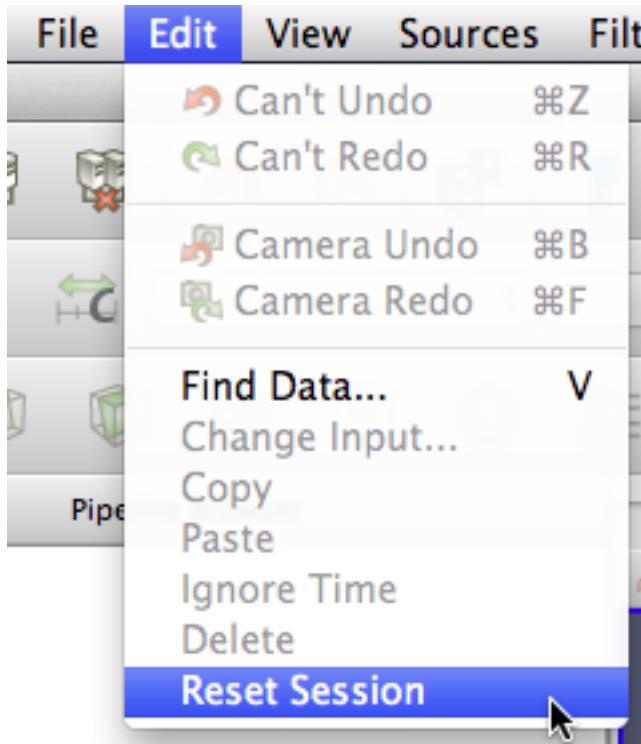
Surface

Surface
with Edges

Volume

Reset ParaView

Edit → Reset Session



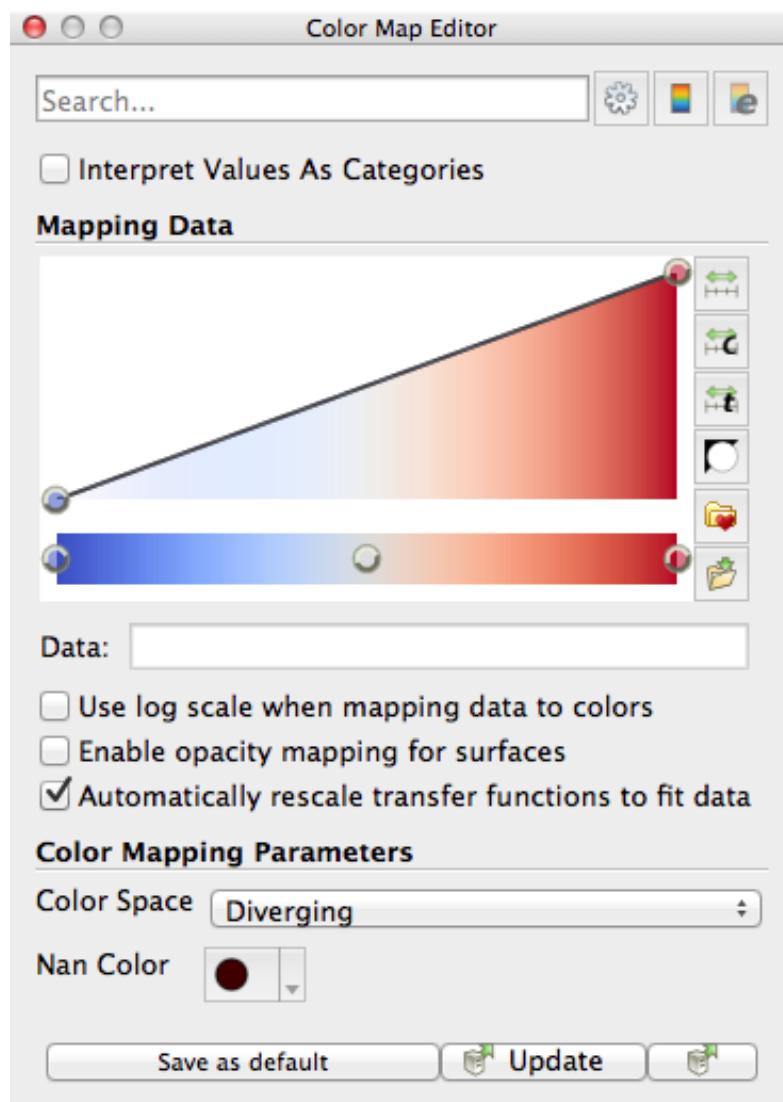
Volume Rendering + Surface Geometry

1. Open disk_out_ref.ex2. Load all variables. 
2. Change variable viewed to Temp.
3. Change representation to Volume.

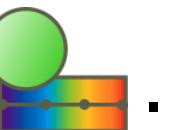
Volume Rendering + Surface Geometry

1. Open disk_out_ref.ex2. Load all variables. 
2. Change variable viewed to Temp.
3. Change representation to Volume.
4. Add Stream Tracer.  
5. Optional: Add Tubes and Glyphs.

Transfer Function Editor



Modify Transfer Function

1. Select disk_out_ref.ex2.
2. Click Edit Color Map .
3. Click Choose preset .
4. Select Black-Body Radiation.
Close.
5. Try adding and changing control points.

Volume Rendering (data\headsq.vti)

