Elmer

Post-processing utilities

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CSC – IT Center for Science

Alternative Visualization tools for Elmer

- ElmerPost & VTK widget
  - Postprocessors of Elmer suite
- ParaView
- Visit
- Gmsh
- GiD
- OpenDX

Visualization tools – Poll (5/2015)

What visualization software do you use?

ElmerPost	12	17%
ElmerGUI VTK postprocessor	7	10%
Paraview	29	41%
ViSit	3	4%
Mayavi	0	No votes
Gmsh	3	4%
GiD	1	1%
Matlab	6	8%
gnuplot	4	6%
Something else (please specify)	6	8%

Total votes : 71

Exporting 2D/3D data: ResultOutputSolve

- Apart from saving the results in .ep format it is possible to use other postprocessing tools
- ResultOutputSolve offers several formats
  - vtk: Visualization tookit legacy format
  - vtu: Visualization tookit XML format
  - Gid: GiD software from CIMNE: http://gid.cimne.upc.es
  - Gmsh: Gmsh software: http://www.geuz.org/gmsh
  - Dx: OpenDx software
- **Vtu** is the recommended format!
  - offers parallel data handling capabilities
  - Has binary and single precision formats for saving disk space
  - Suffix **.vtu** in Post File does this automatically

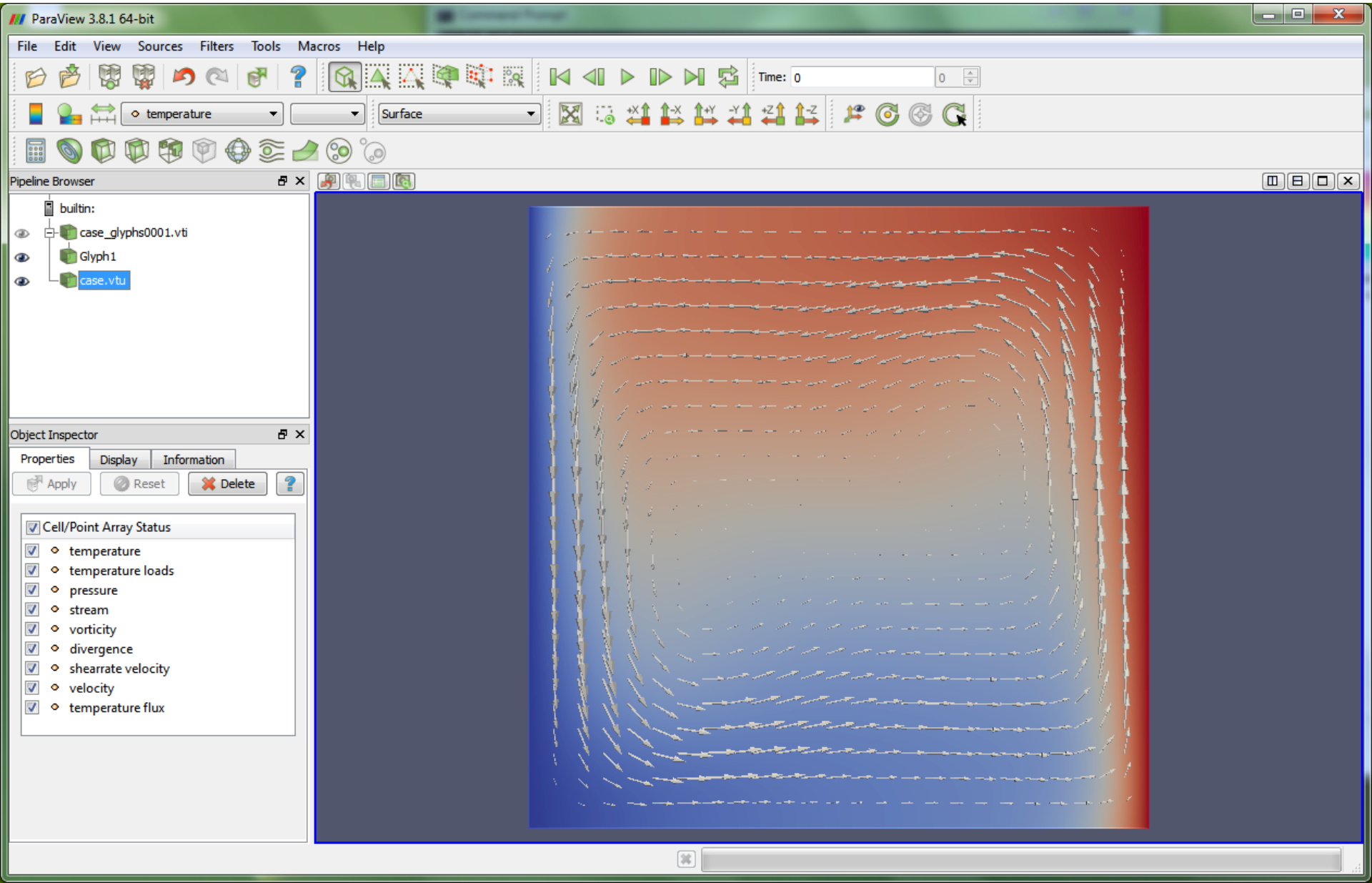
Exporting 2D/3D data: ResultOutputSolve

An example shows how to save data in unstructured XML VTK (.vtu) files to directory ”results” in single precision binary format.

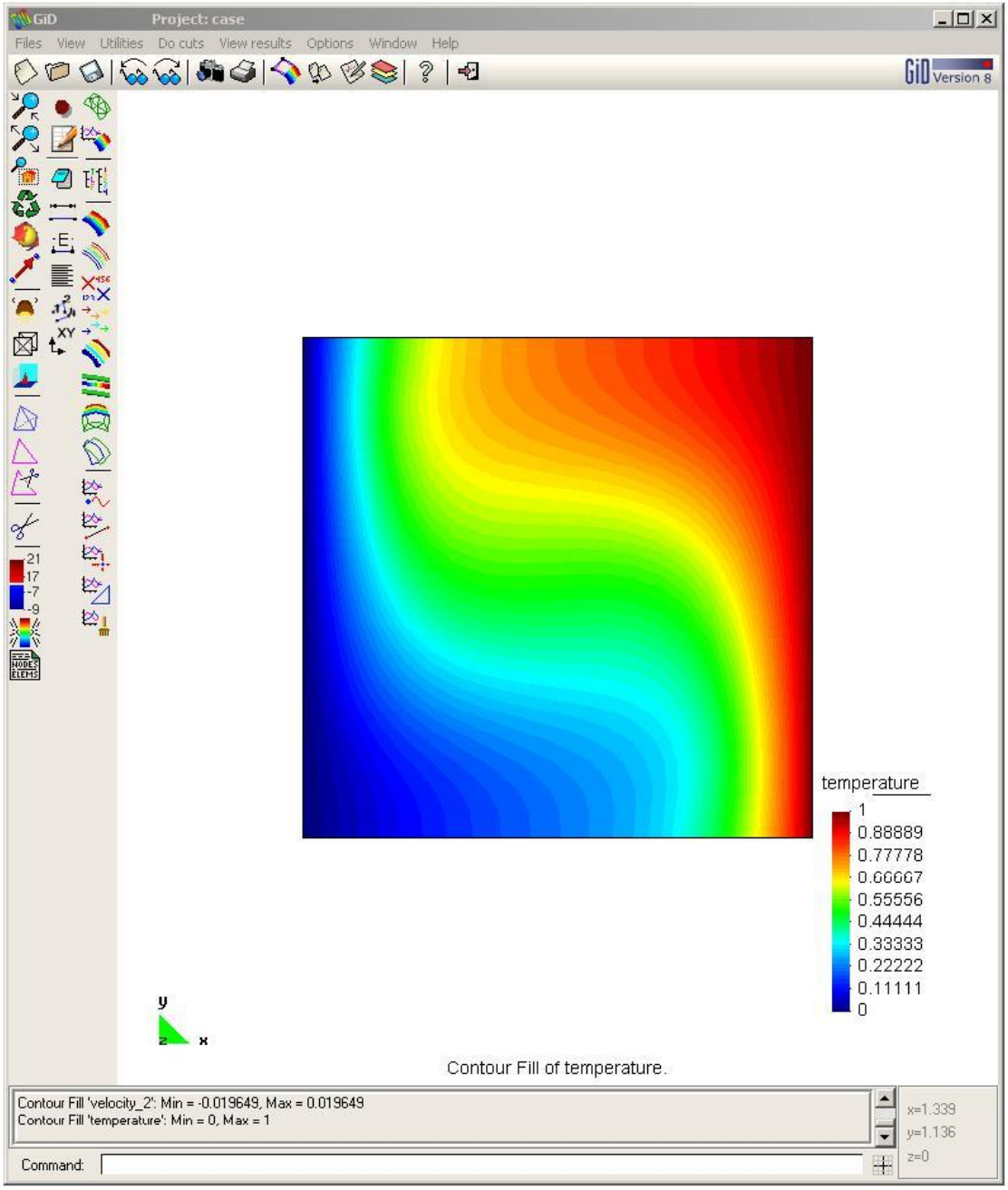
```
Solver n
  Exec Solver = after timestep
  Equation = "result output"
  Procedure = "ResultOutputSolve" "ResultOutputSolver"
  Output File Name = "case"
  Output Format = String ”vtu”
  Binary Output = True
  Single Precision = True
End
```

Basic functionality also just by adding suffix **.vtu** to the **Post File** in simulation section

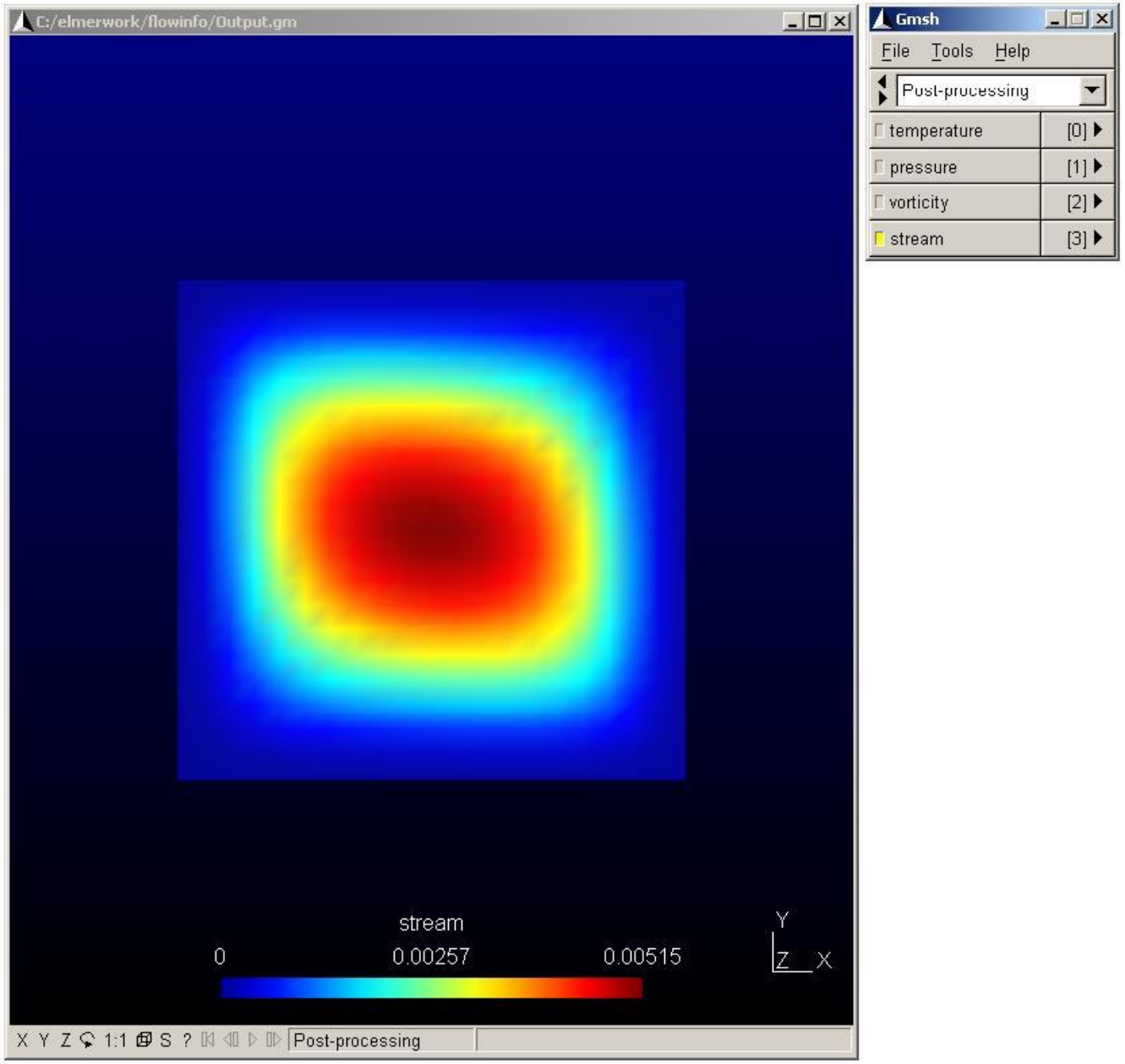
Case: View in Paraview



Example:
view in GiD



Example: view in Gmsh



Visualization with Paraview

Exporting 2D/3D data: ResultOutputSolve

By setting suffix for **`Post File`** to **`.vtu`** paraview format is saved automatically.

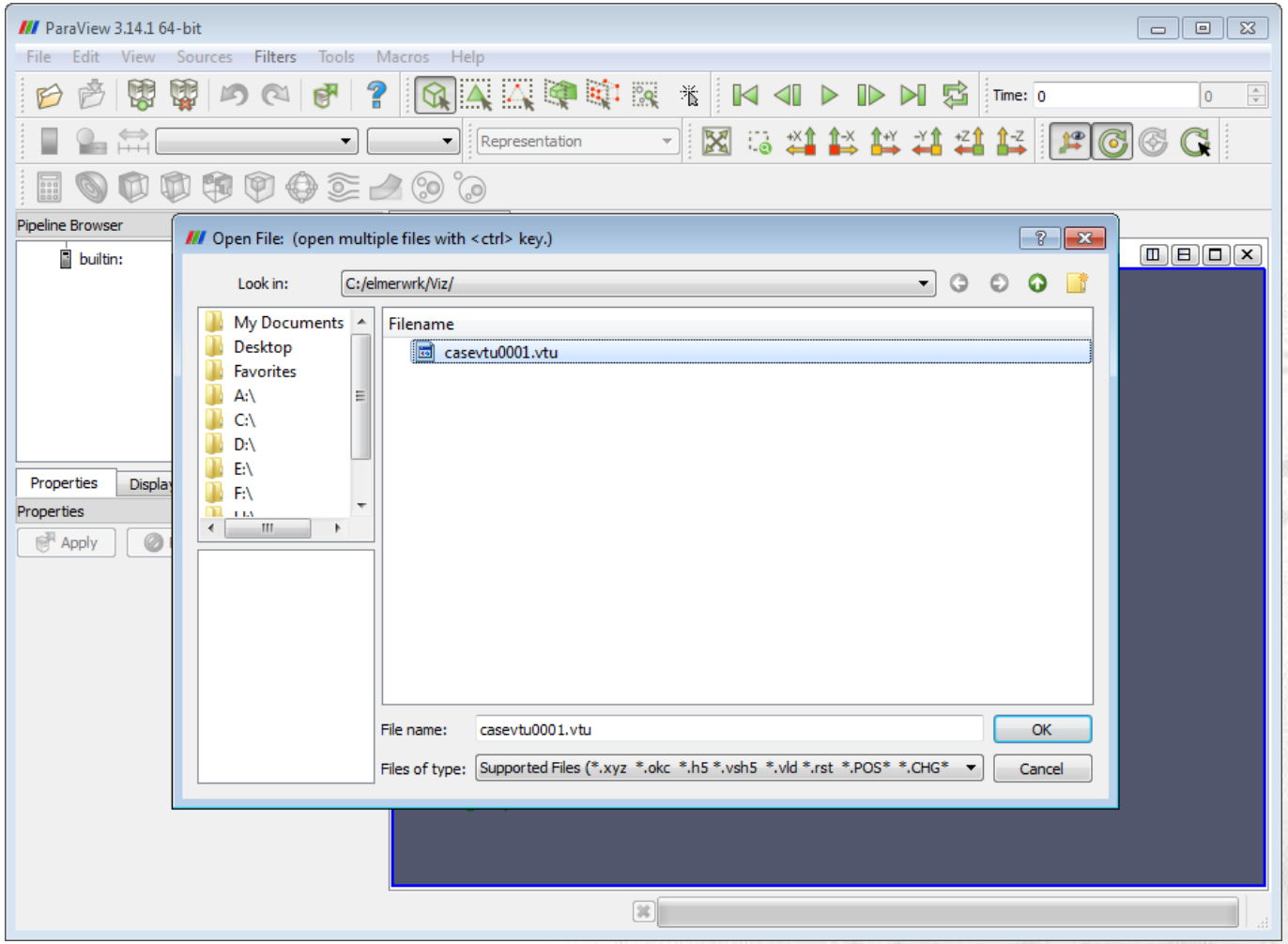
An example shows how to save data in unstructured XML VTK (.vtu) files to directory ”results” in single precision binary format.

```
Solver n
  Exec Solver = after timestep
  Equation = "result output"
  Procedure = "ResultOutputSolve“ "ResultOutputSolver"
  Output File Name = "case"
  Output Format = String ”vtu”
  Binary Output = True
  Single Precision = True
  Save Geometry Ids = True
End
```

Filename conventions

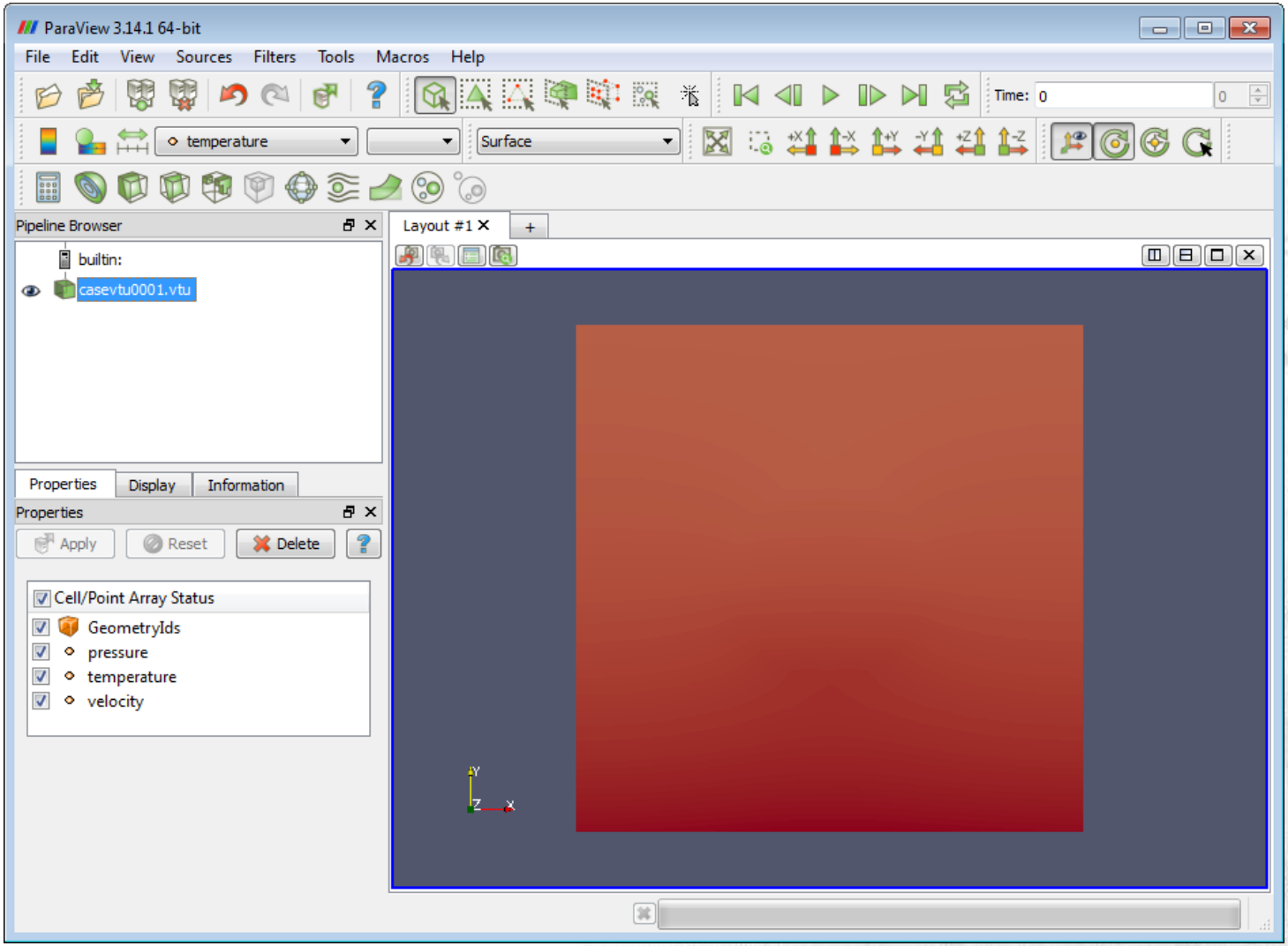
- Suffix of unstructured XML based VTU file is `.vtu`
- Timesteps numbered `#step`
- Partitions numbered with `#part`**par**`#step`
- Holder for vtu files in parallel is `.pvtu`

Loading data



Note: Paraview may have several datasets at the same time!

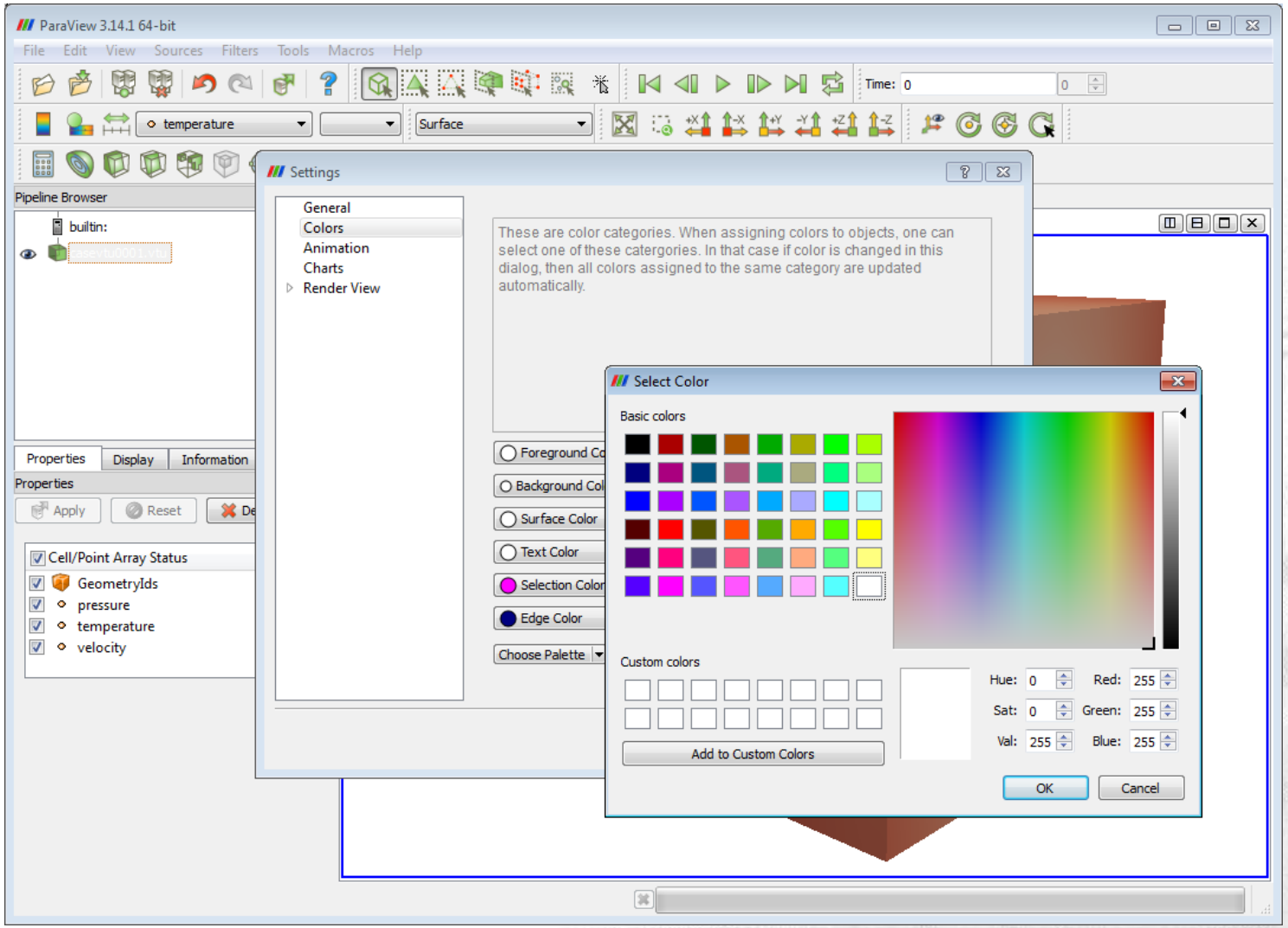
Solid color


ParaView 3.14.1 64-bit
File Edit View Sources Filters Tools Macros Help
Time: 0
temperature
Surface
Pipeline Browser
builtin:
casevtu0001.vtu
Layout #1
Properties Display Information
Properties
Apply Reset Delete
Cell/Point Array Status
GeometryIds
pressure
temperature
velocity

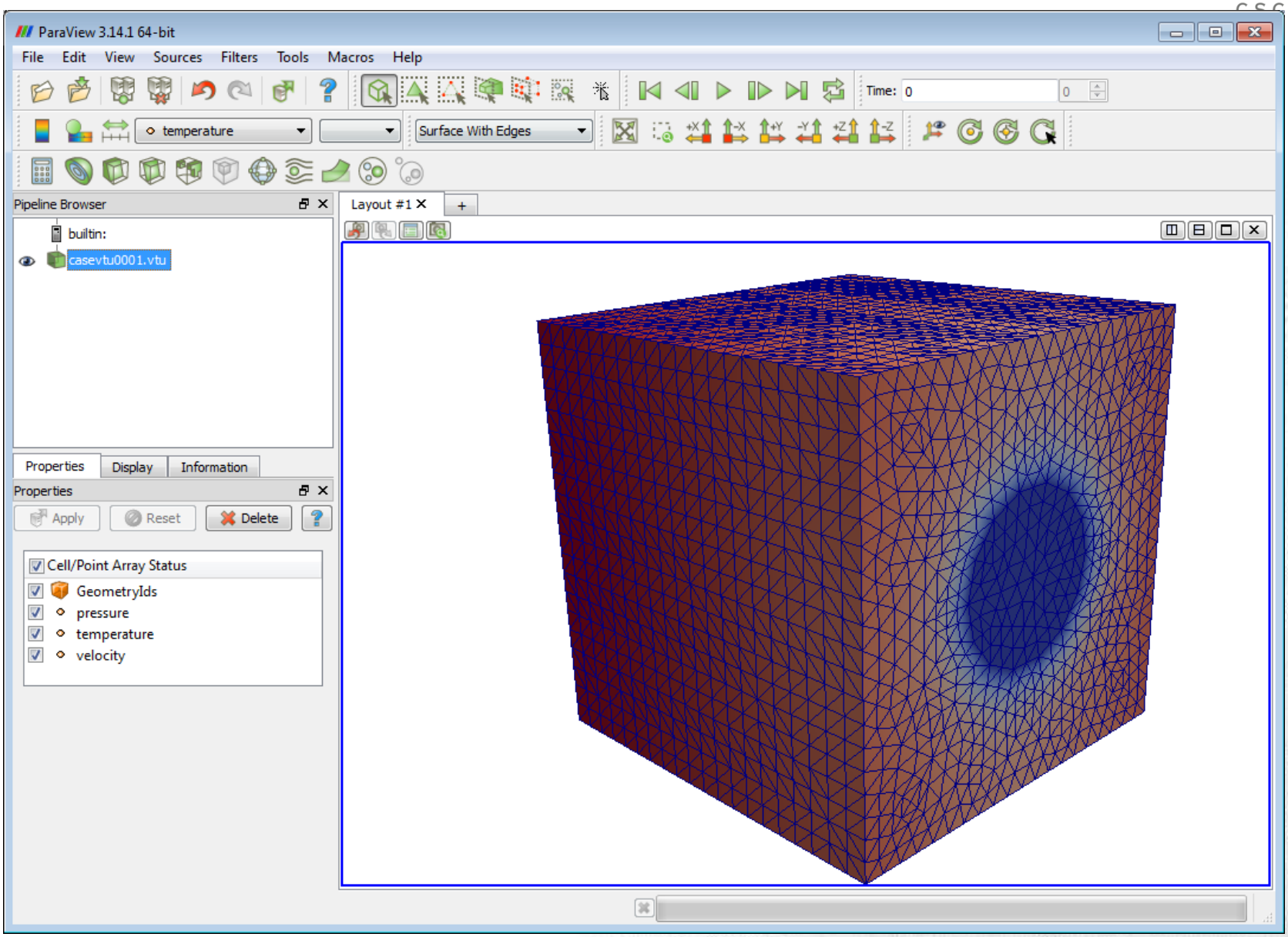
Moving object in Paraview

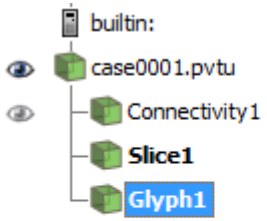
- Rotate
  - Mouse: Left bottom
- Scale
  - Mouse: Right bottom
- Translate
  - Mo*u*se: Center bottom

Setting background color



Color mesh with surface + edges

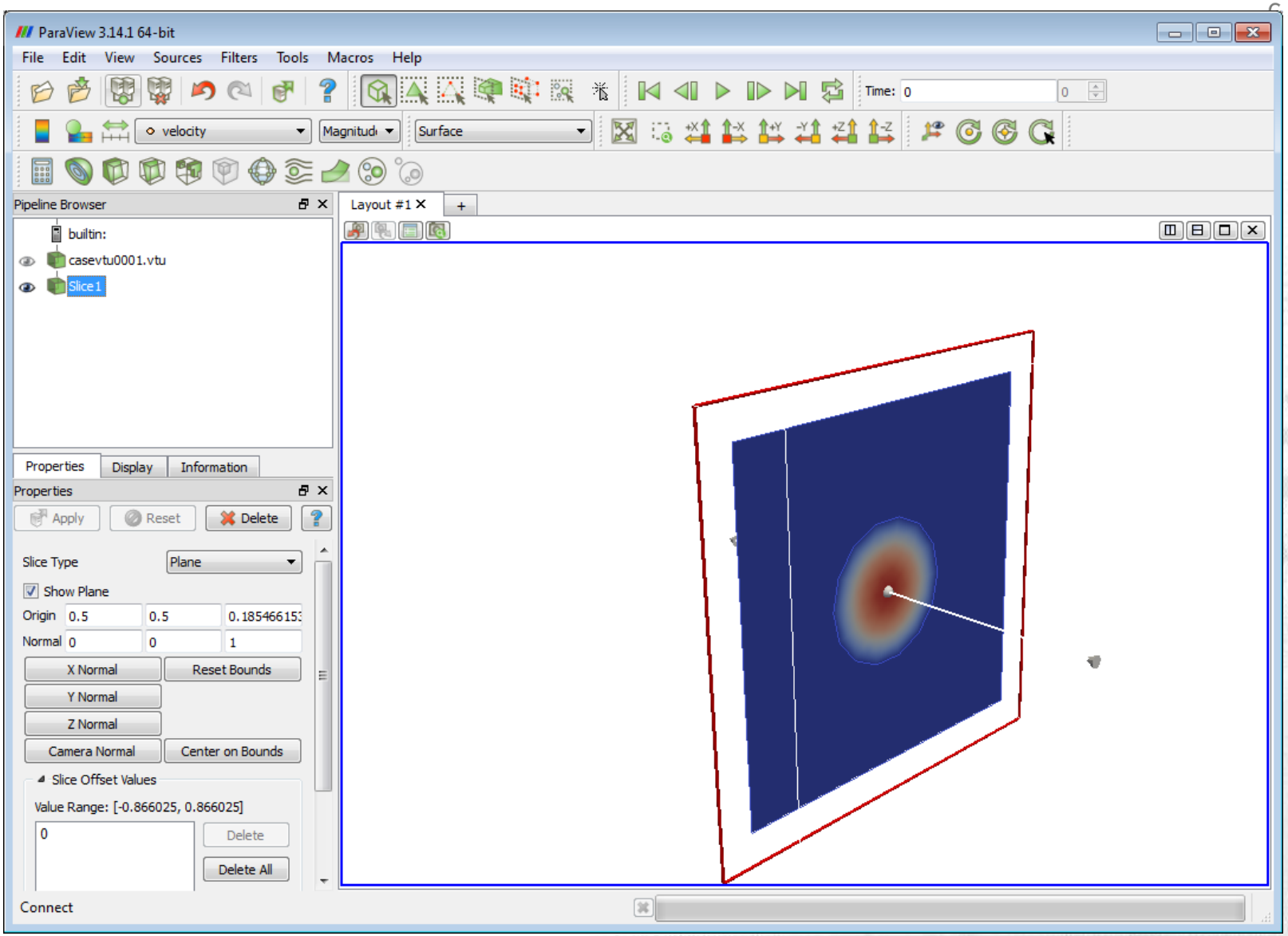




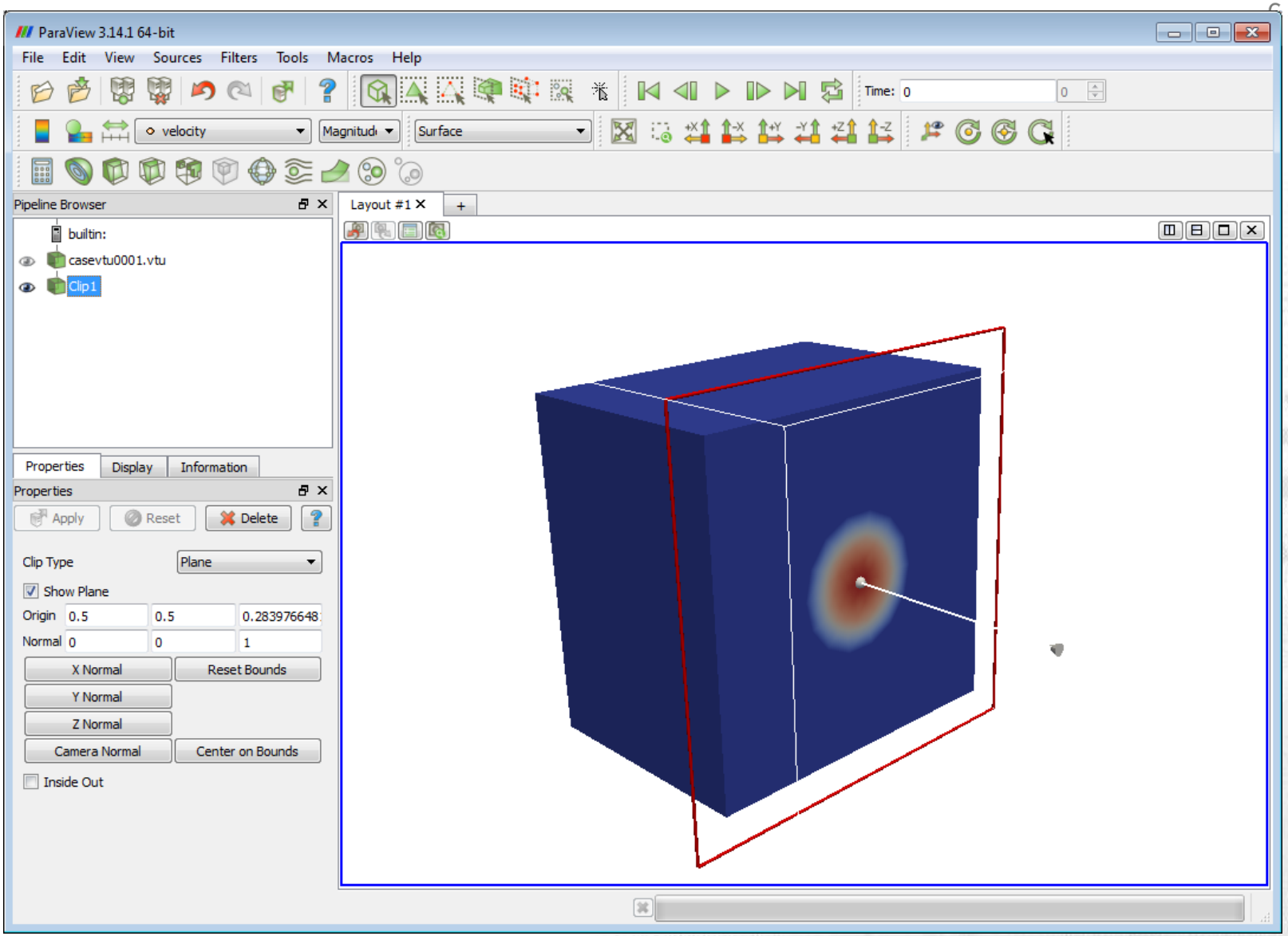
CSC

- Paraview uses extensively *filters* to create new datasets
- Filters and datasets may be set active or passive by clicking the eye
- Several datasets may be visualized at the same time

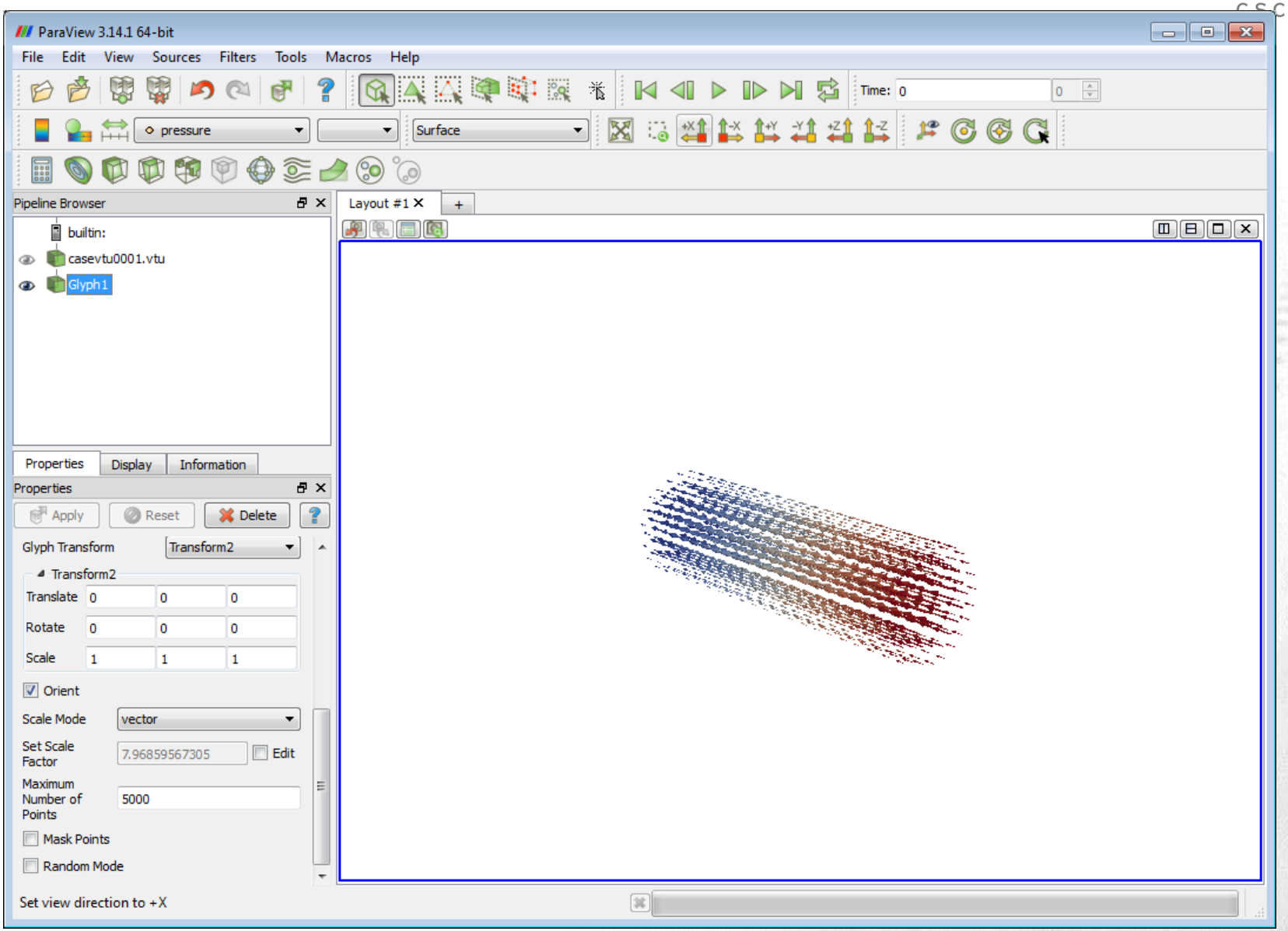
Plotting a slice



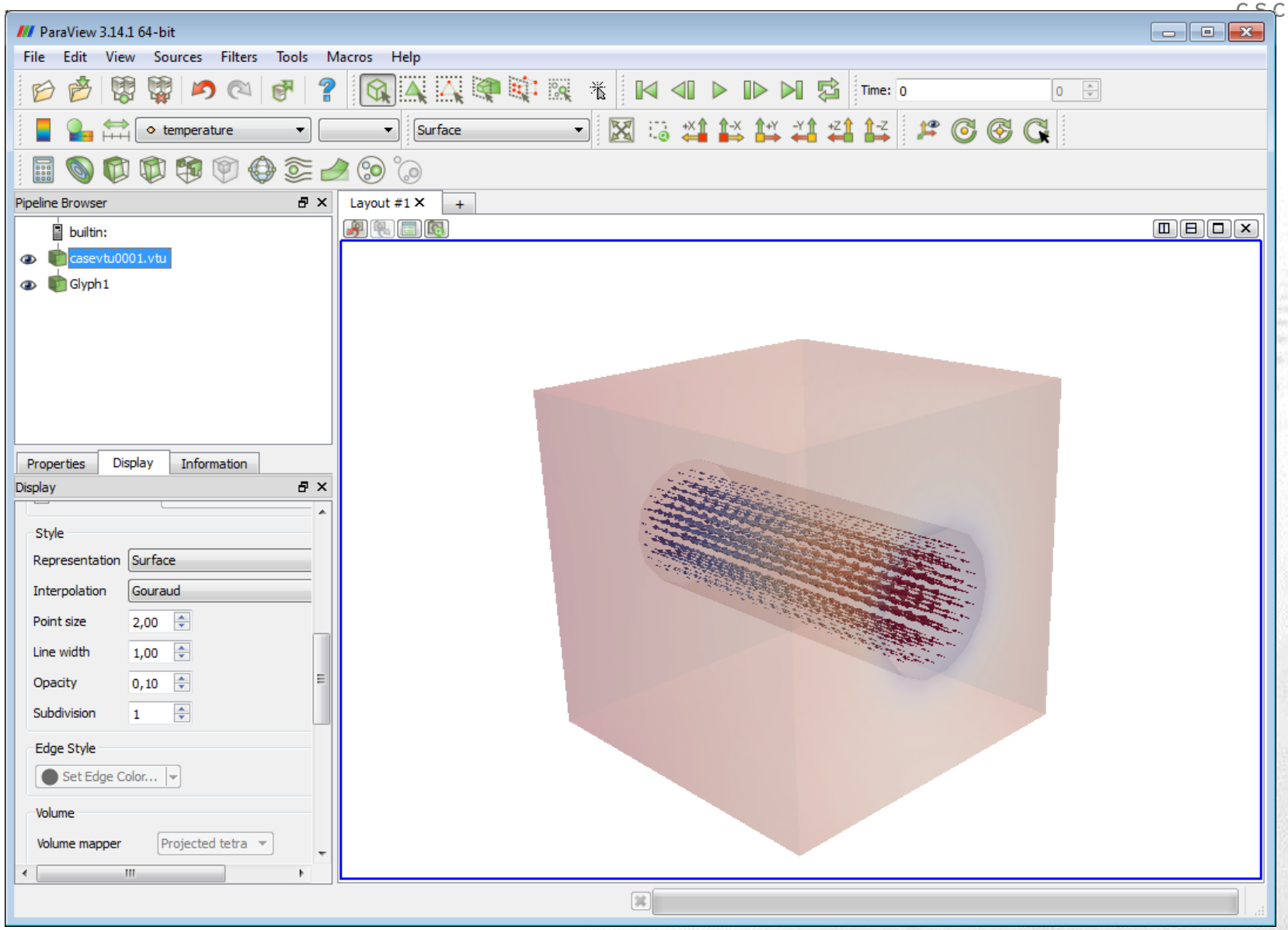
Plotting a clip



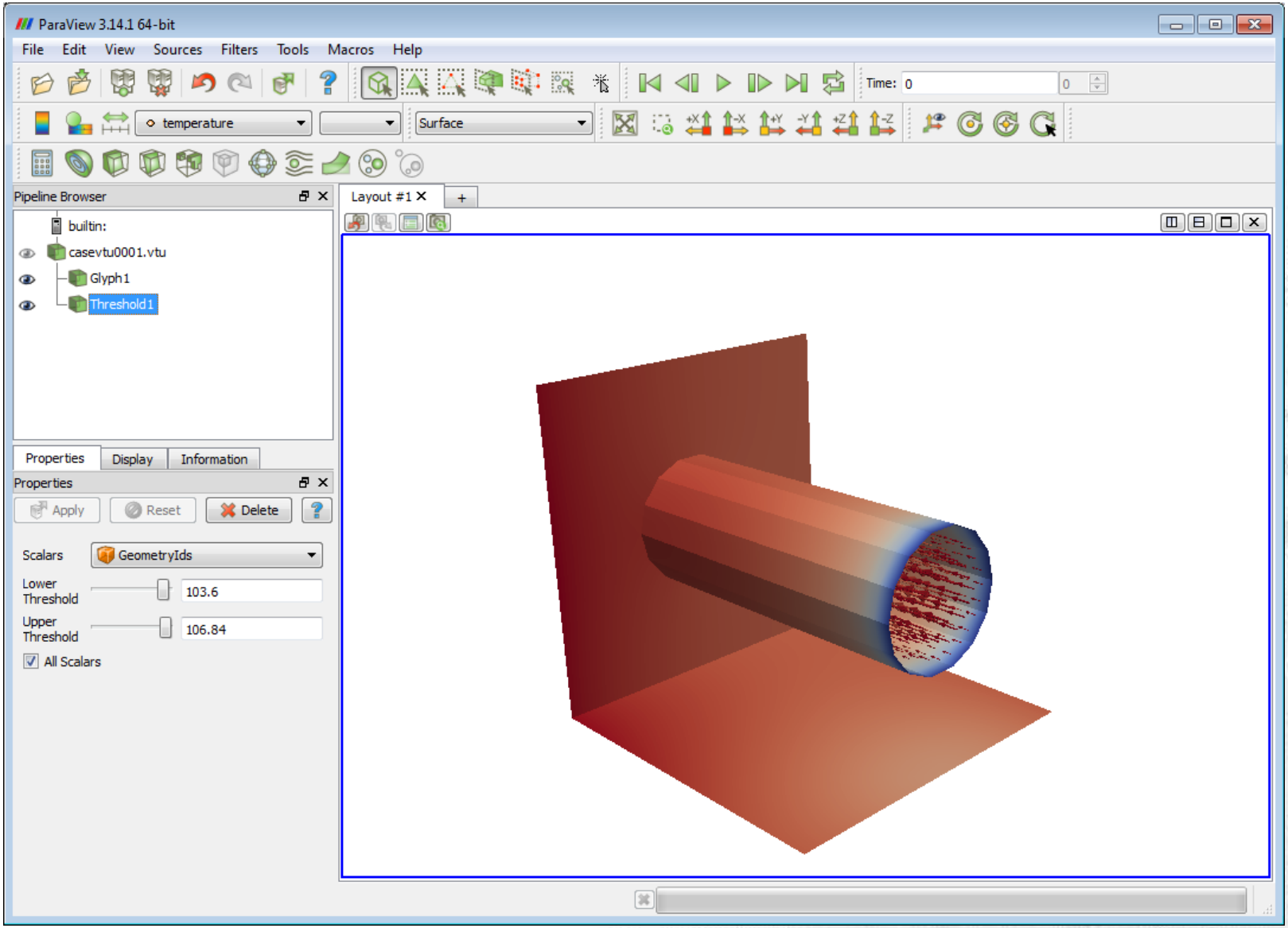
Vector plot


ParaView 3.14.1 64-bit
File Edit View Sources Filters Tools Macros Help
Time: 0
pressure
Surface
Pipeline Browser
builtin:
casevtu0001.vtu
Glyph1
Layout #1
Properties Display Information
Properties
Apply Reset Delete
Glyph Transform Transform2
Transform2
Translate 0 0 0
Rotate 0 0 0
Scale 1 1 1
Orient
Scale Mode vector
Set Scale Factor 7.96859567305 Edit
Maximum Number of Points 5000
Mask Points
Random Mode
Set view direction to +X

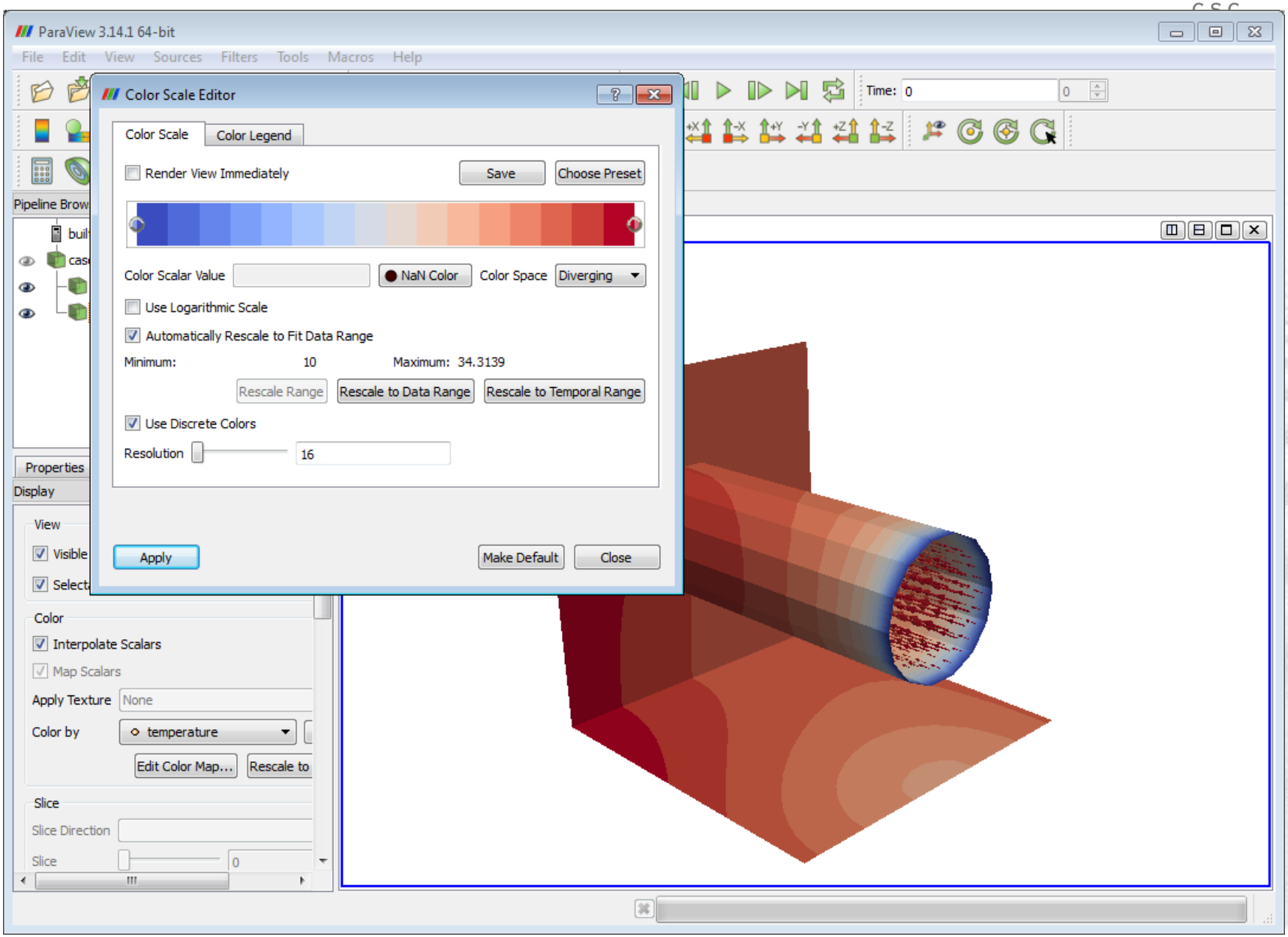
Vector plot + opaque solid surface



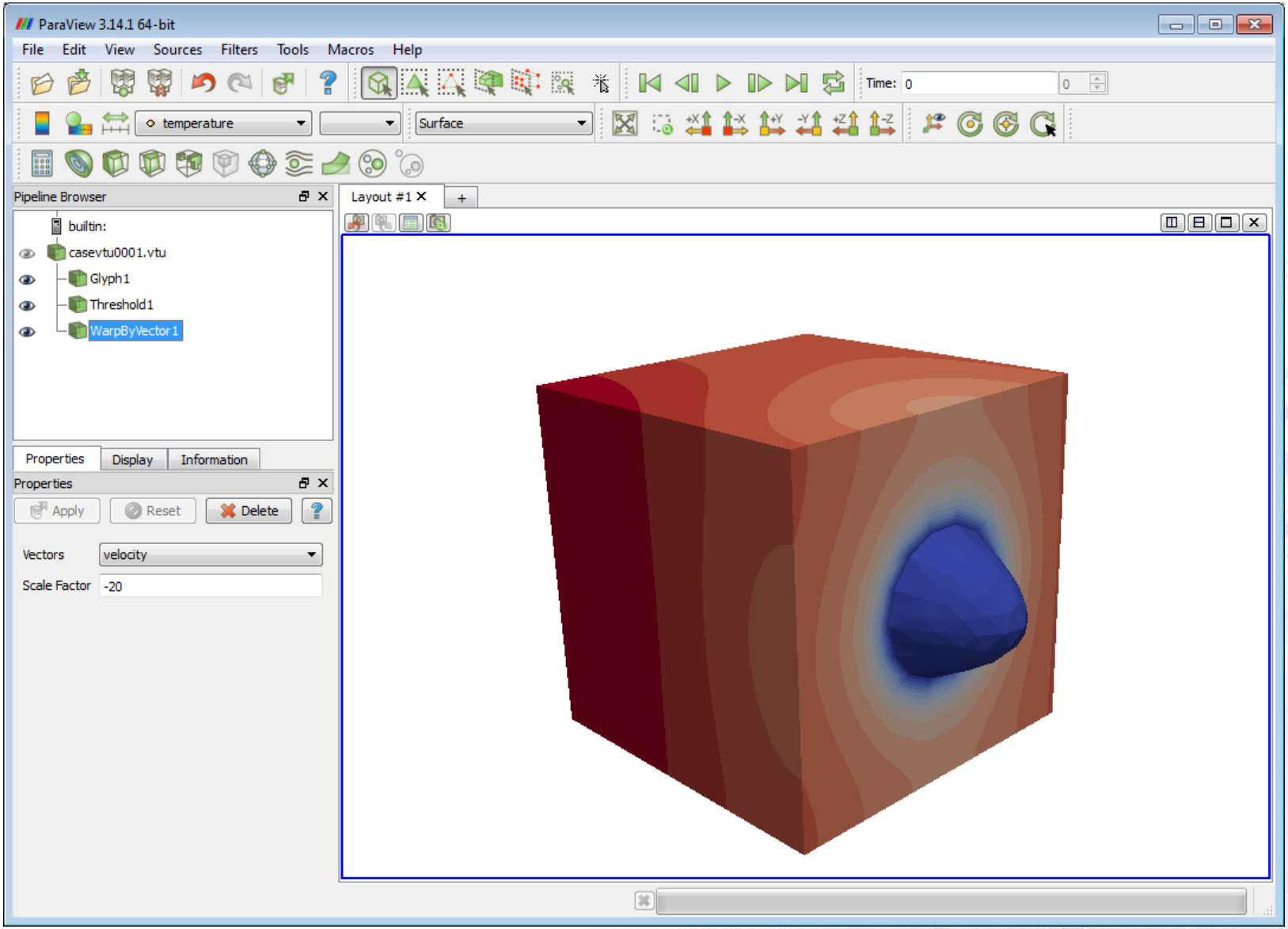
Vector plot + solid surface with Id treshold



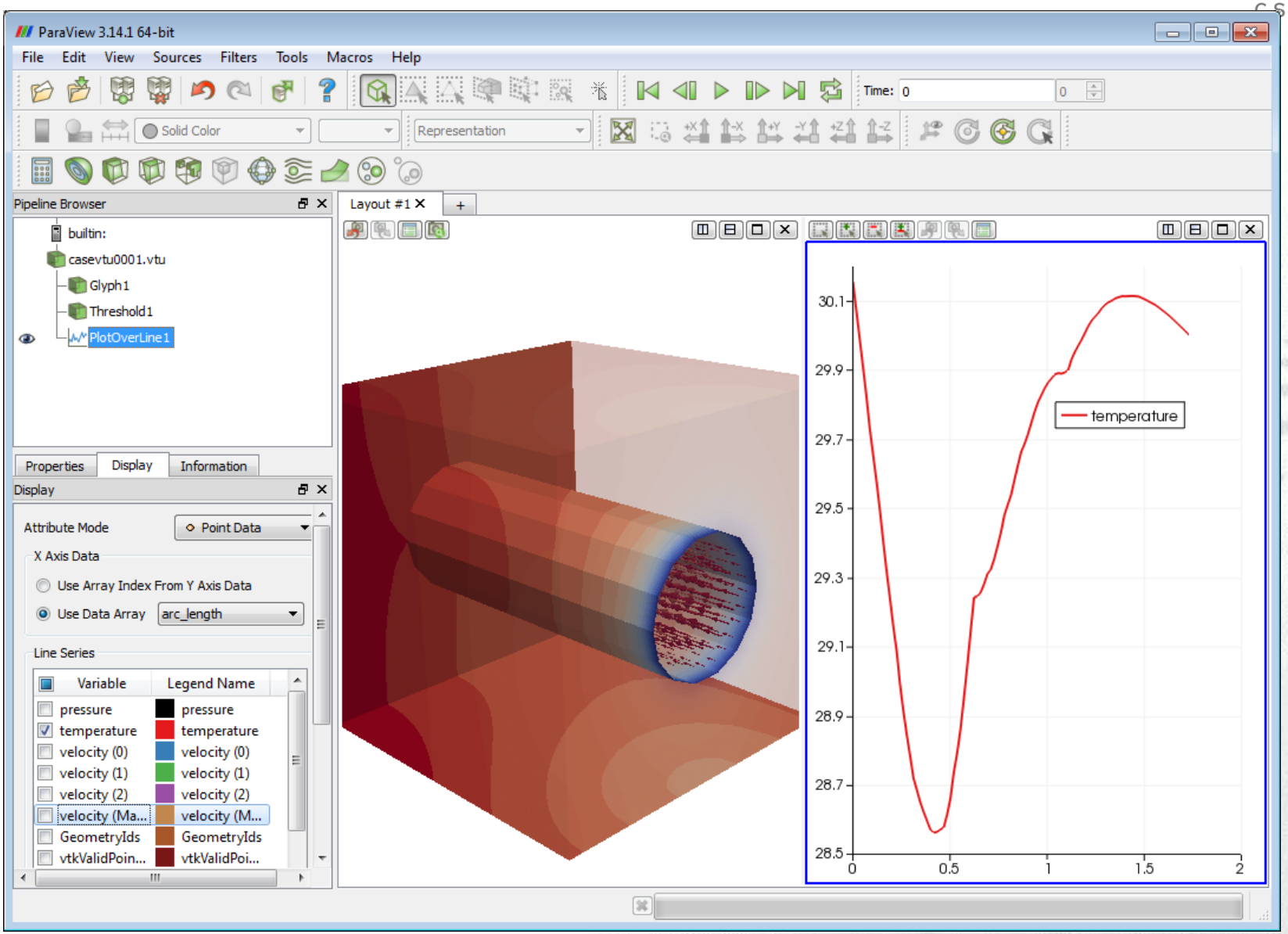
Change of colormap



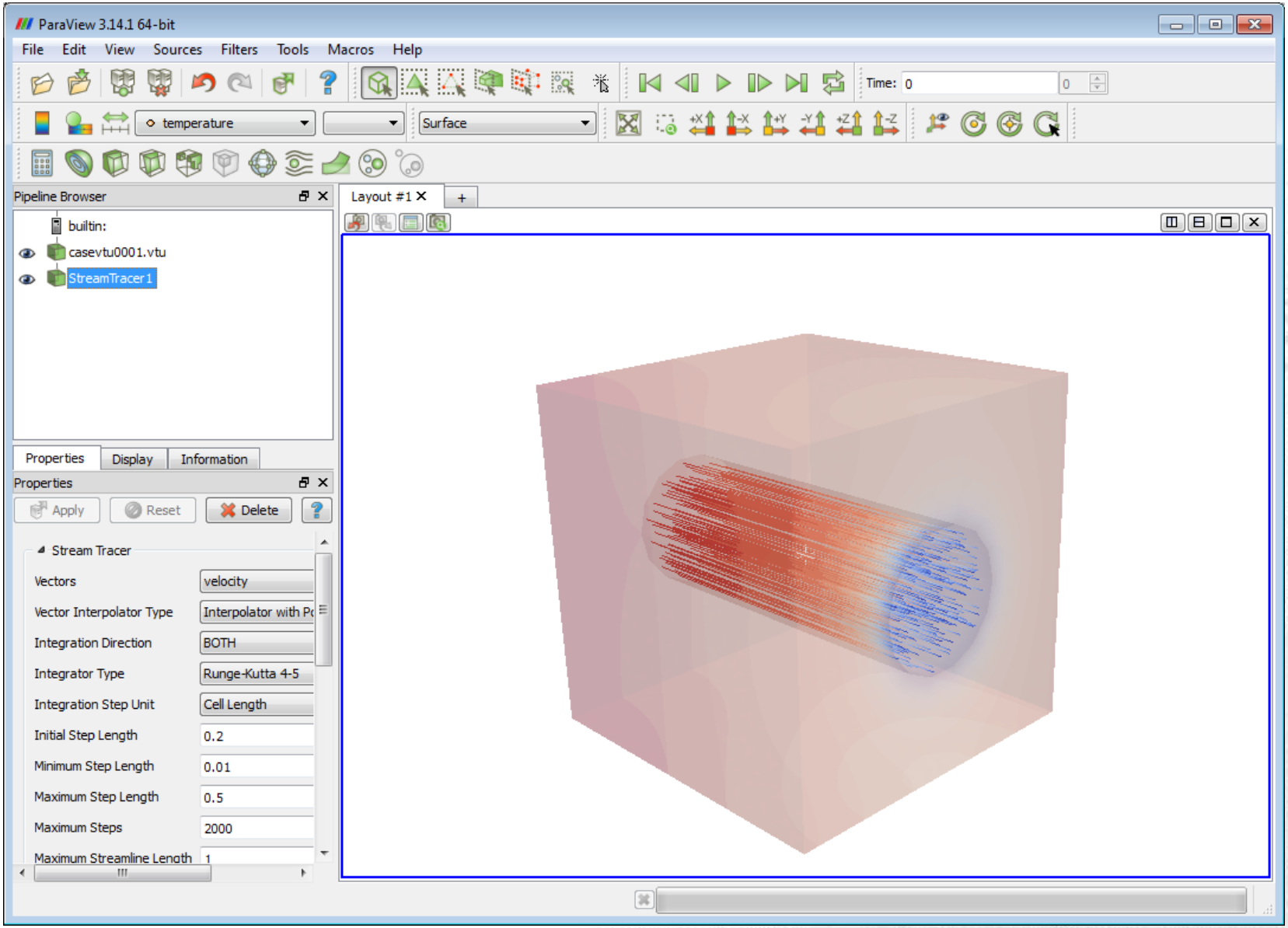
Deformation – WarpByVector filter



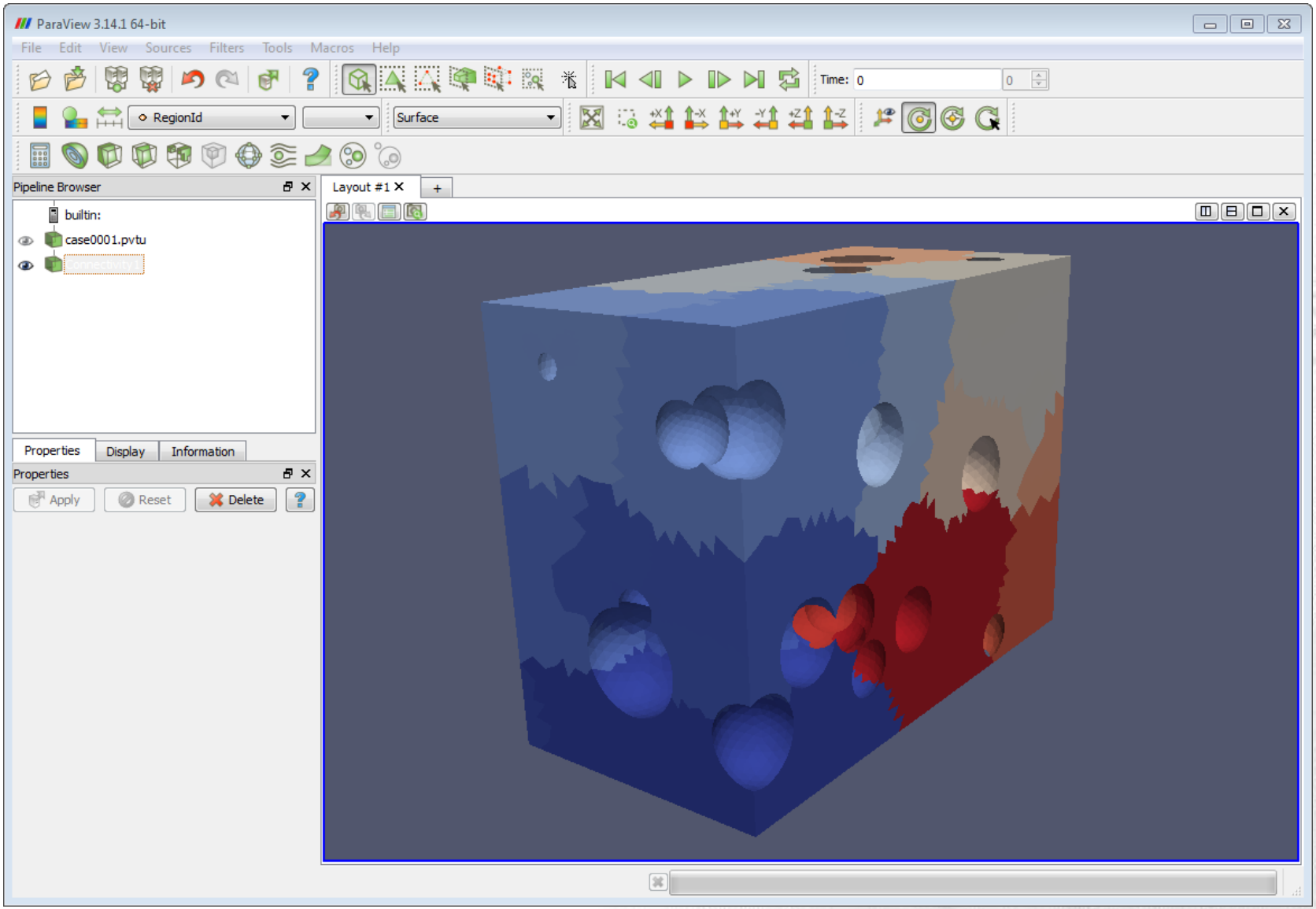
Plot line – PlotOverLine filter



Streamlines – Filter StreamTracer



Partitioning – Connectivity filter

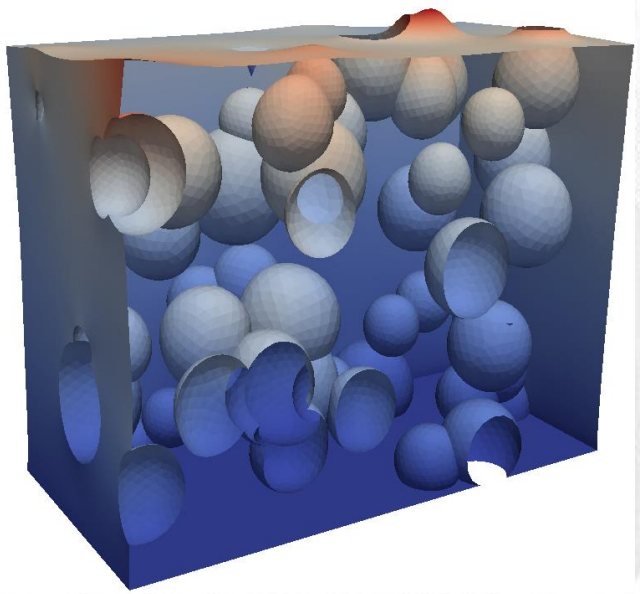


File size in Paraview output

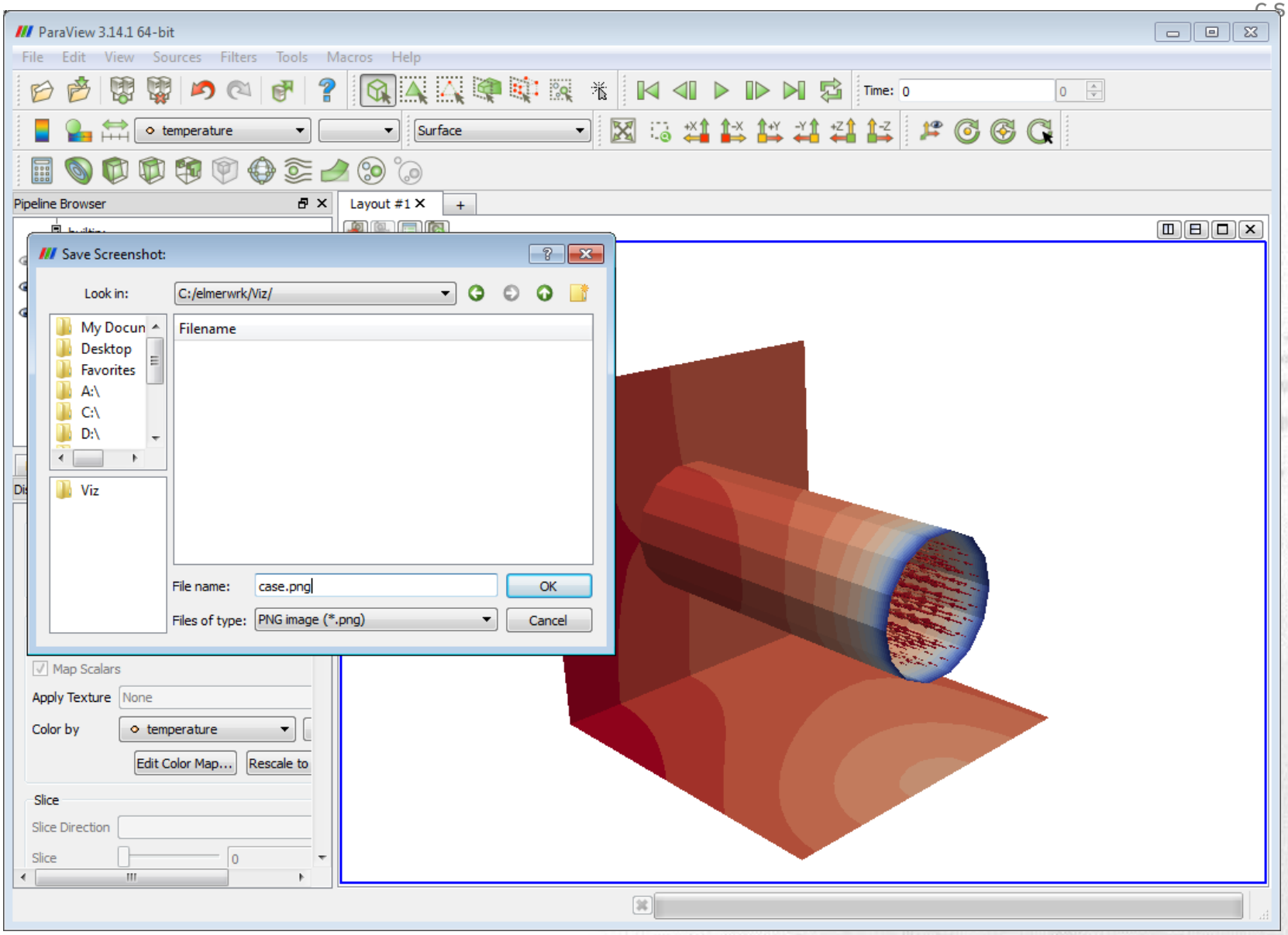
- Memory consumption of vtu-files (for Paraview) was studied in the ”swiss cheese” case
- Saving just boundaries in single precision binary format may save over 90% in files size compared to full data in ASCII
- With larger problem sizes the benefits are amplified

Binary output	Single Prec.	Only bound.	Bytes/ node
-	X	-	376.0
X	-	-	236.5
X	X	-	184.5
X	-	X	67.2
X	X	X	38.5

Simulation Peter Råback, CSC, 2012.



Saving figures



Saving animations with Paraview

- The only packing method that comes with Paraview by default is motion AVI
- It is advicable to save the animation as separate files
- You may use ElmerClips to make mpg animations of the separate PNG figures
- Or you may compose an animated GIF from single JPEG or PNG frames using *convert* (ImageMagik)

Conclusions

- Use Paraview and VTU format
- For large visualizations ViSiT could be an option