

OverView of ParaView

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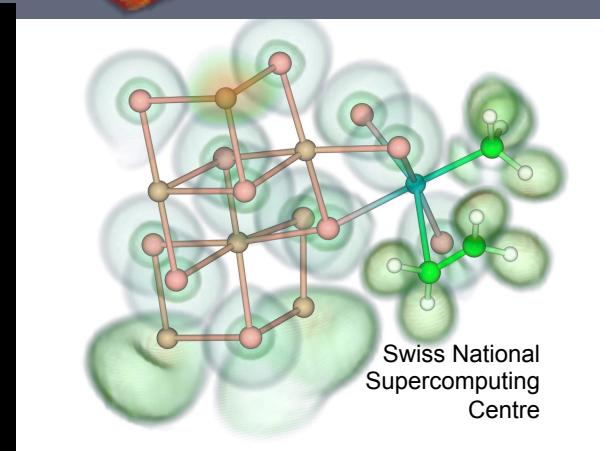
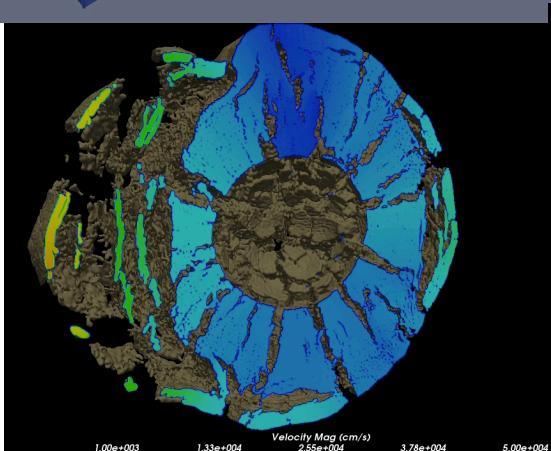
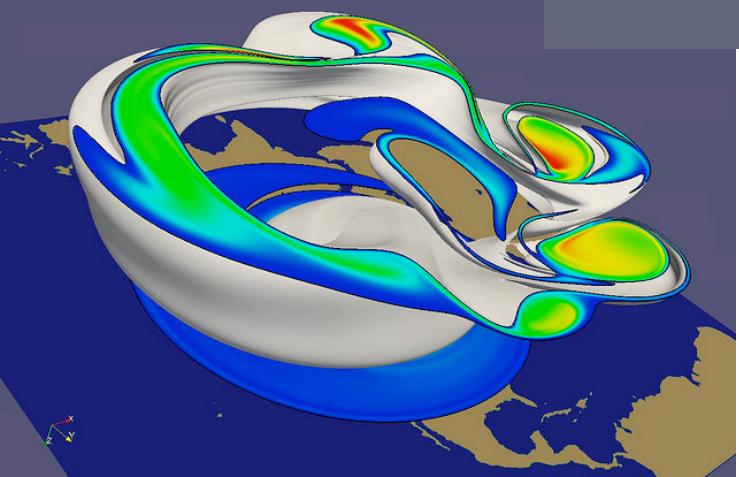
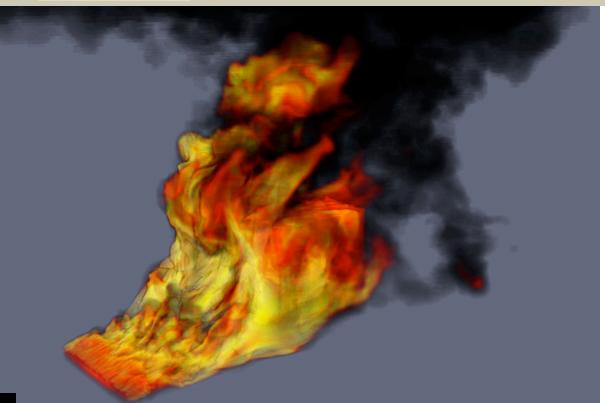
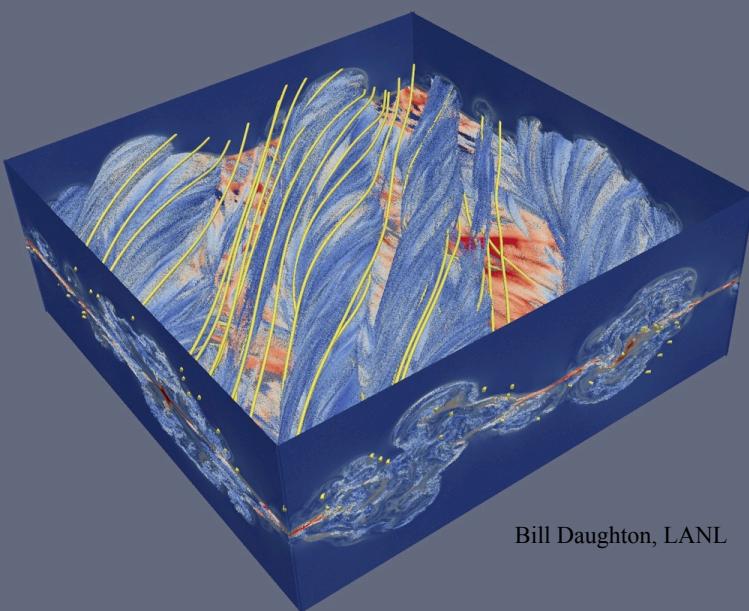
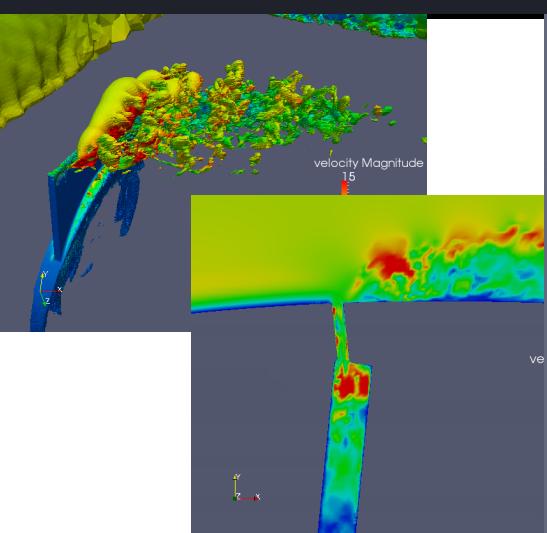
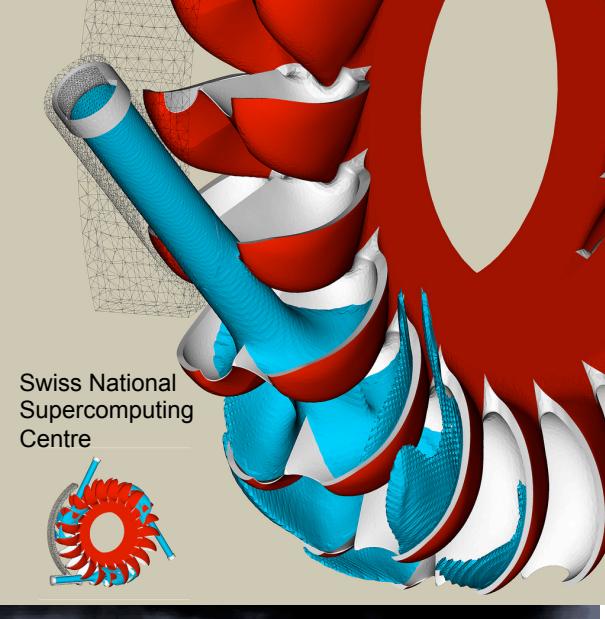
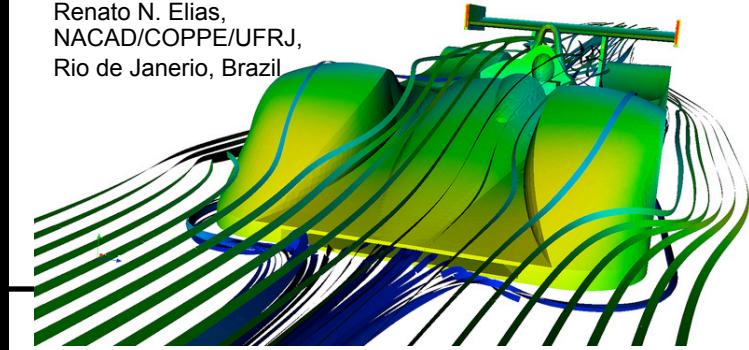
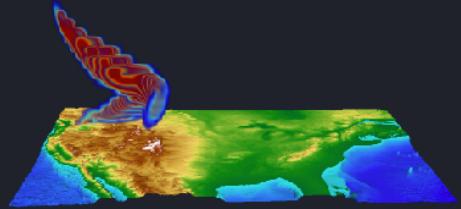
Quick OverView of ParaView

- Content borrowed/stolen from SC14 Tutorial delivered by Kitware, Sandia, Los Alamos, Argonne staff
- Resources
 - Current version is 4.3 – download at: www.paraview.org
 - www.paraview.org/Wiki/images/f/f4/ParaViewTutorial42.pdf
 - www.paraview.org/Wiki/BEGINNING_GUI
 - ParaView mailing list: paraview@paraview.org
 - Maybe a zillion other online tutorials and guides – ask Mr Google
- Similar tools
 - VisIt
 - Vapor
 - VMD
 - ...

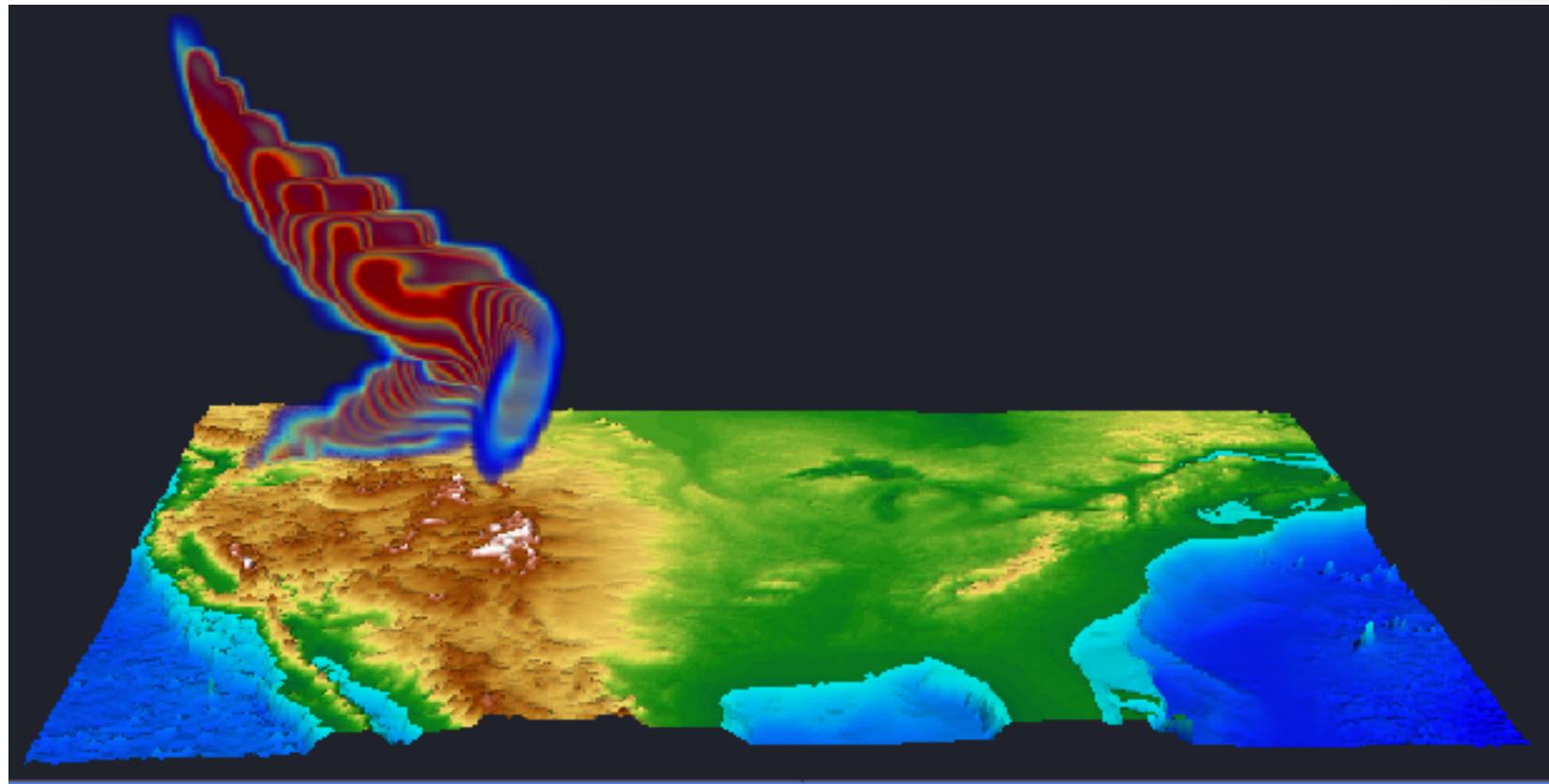
What Is ParaView?

- Open-source, scalable, multiplatform visualization application
- Can process large datasets
- Flexible and intuitive (*so they claim*) user interface
- Based on open standards
- Built on top of VTK
- Commercial maintenance and support with funding by various government, academic, international organizations
- Downloaded ~100K times per year
- Many rah-rah awards
- Development started in 2000 by Los Alamos and Kitware

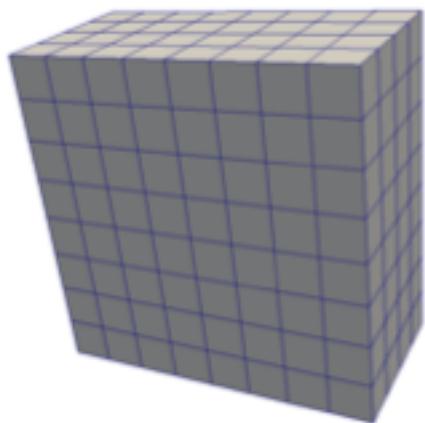
Renato N. Elias,
NACAD/COPPE/UFRJ,
Rio de Janerio, Brazil



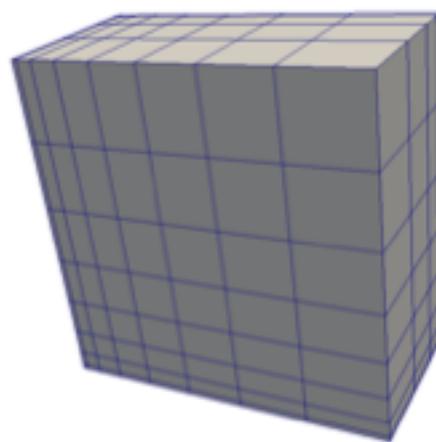
Swiss National
Supercomputing
Centre



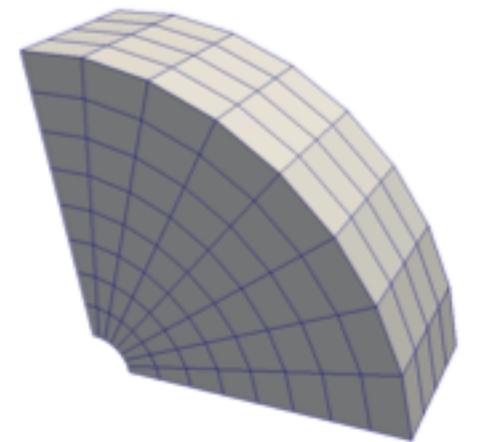
Data Types



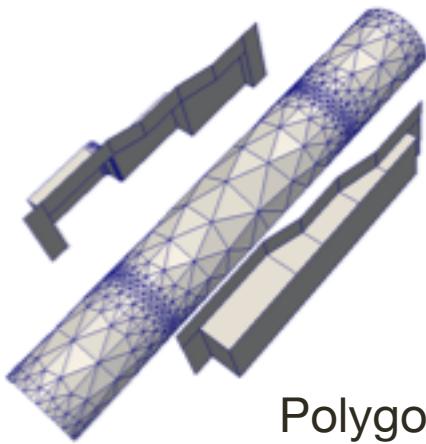
Uniform rectilinear



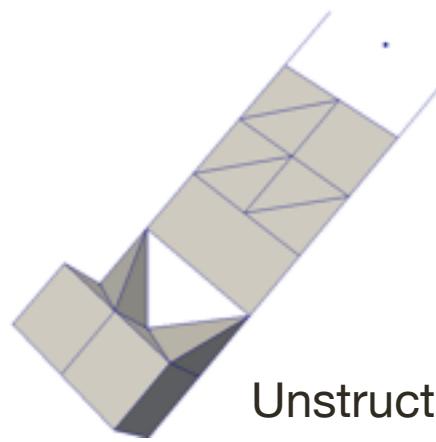
Non-uniform rectilinear



Curvilinear



Polyhedral



Unstructured grid

Supported Data Formats

- ParaView Data (.pvd)
- VTK (.vti, .vtu, .vtm, .vts, .vtr)
- VTK Legacy (.vtk)
- VTK Multi Block (.vtm, .vtmb, .vtmg, .vthd, .vthb)
- Partitioned VTK (.pvtu, .pvti, .pvtv, .pvtv)
- 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)
- LAMPPS Dump (.dump)
- LAMPPS 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, .vrt)
- 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 (.xml, .xdmf)
- XMol Molecule

ParaView User Interface



Menu Bar →

Toolbars →

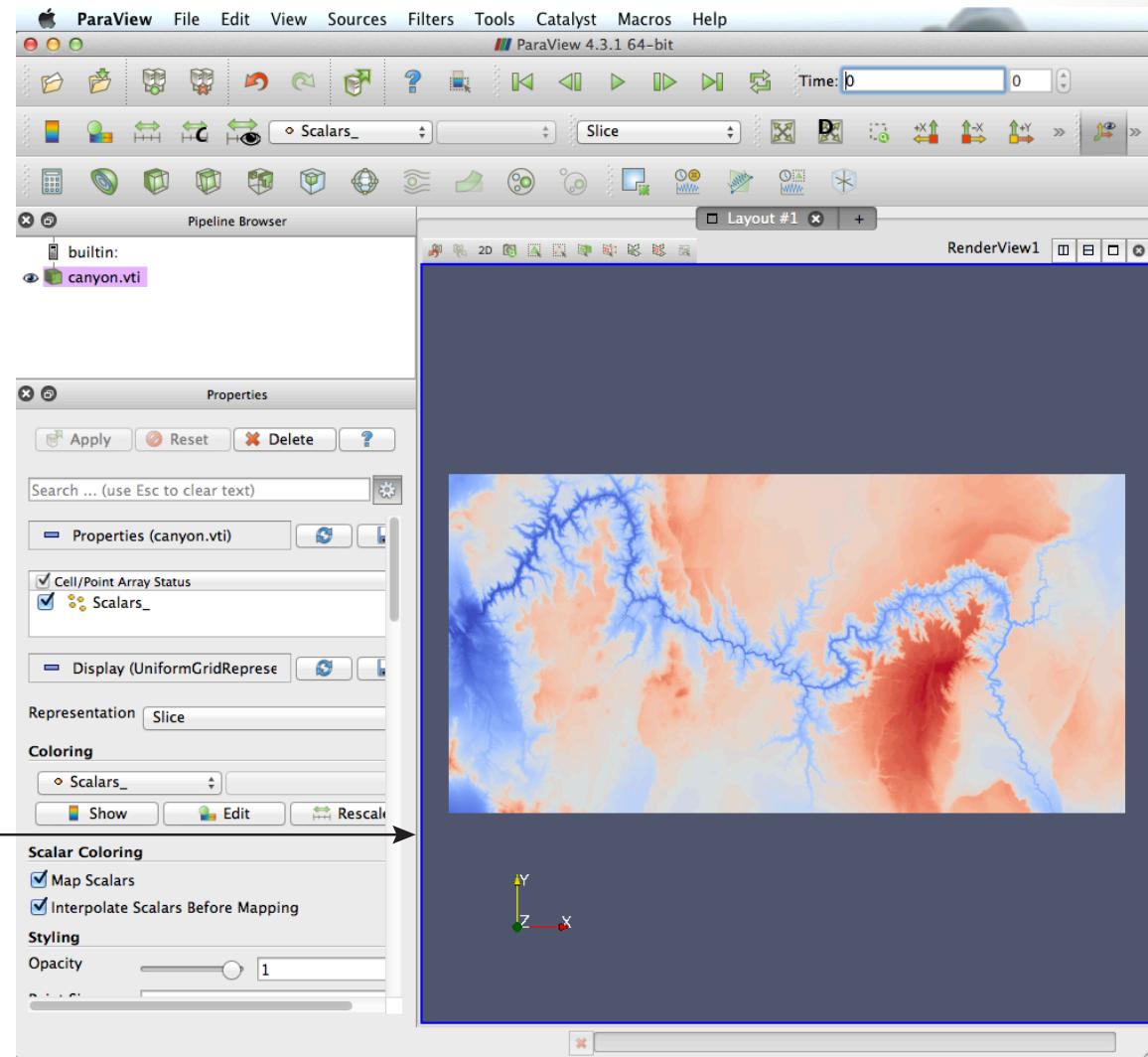
Pipeline Browser →

Properties Panel →

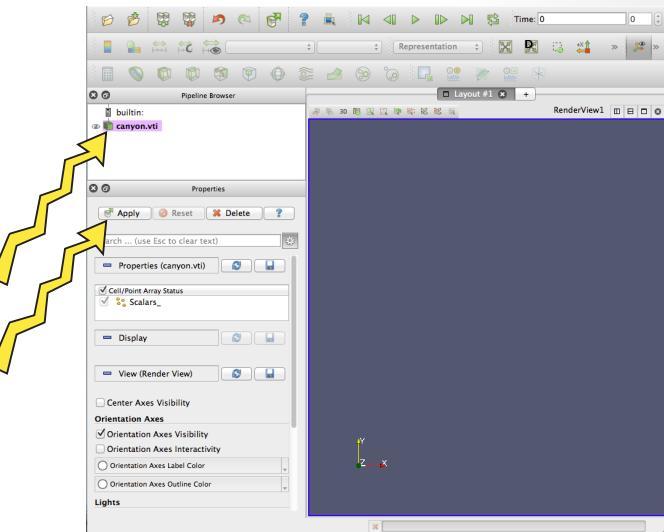
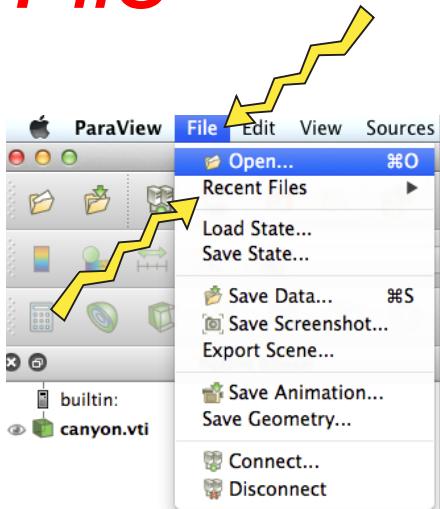
Advanced Toggle →

Search ↗

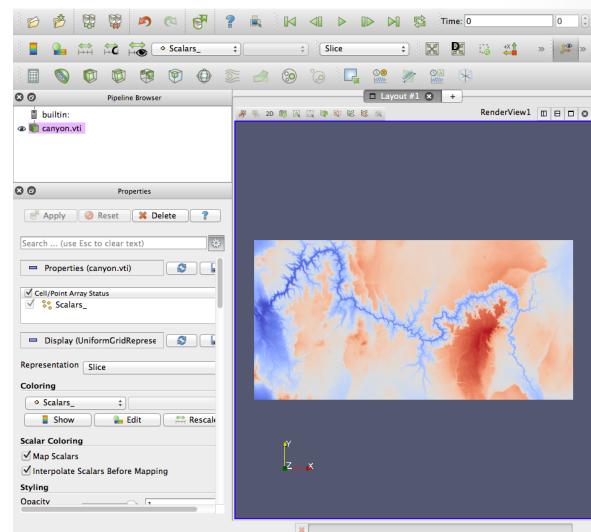
3-D View →



Open a File

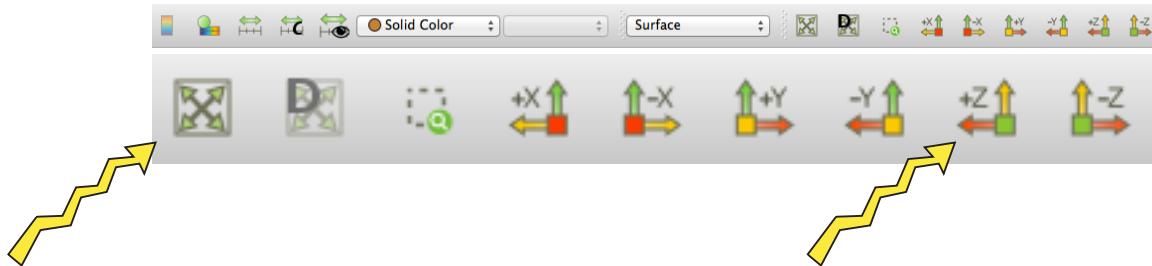


- Open *canyon.vti*
- Click *Apply* to accept default parameters
- The button to the left of the blue “?” is *Auto Apply*

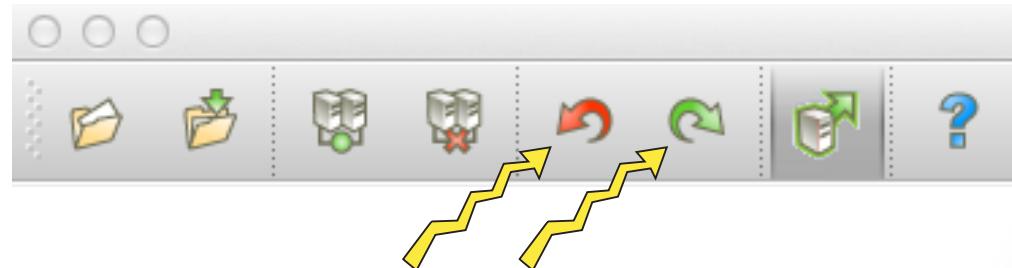


Camera Manipulation

- Drag left, middle, right rodent buttons for rotate, pan, zoom
- Also use shift, control, option, alt to modify
- Reset and Reorient

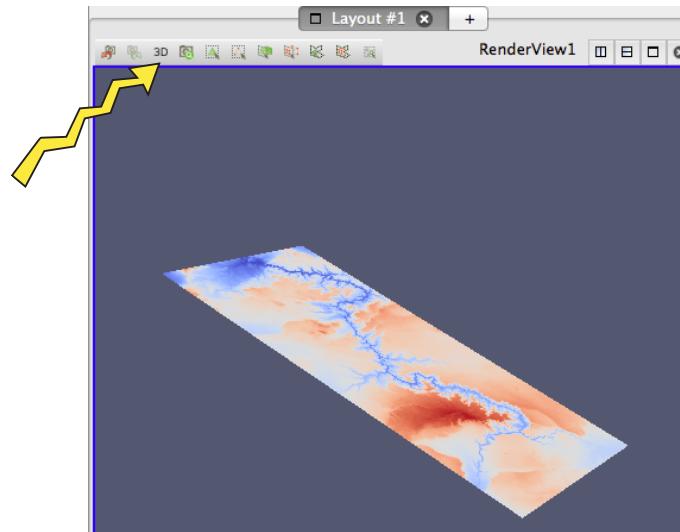
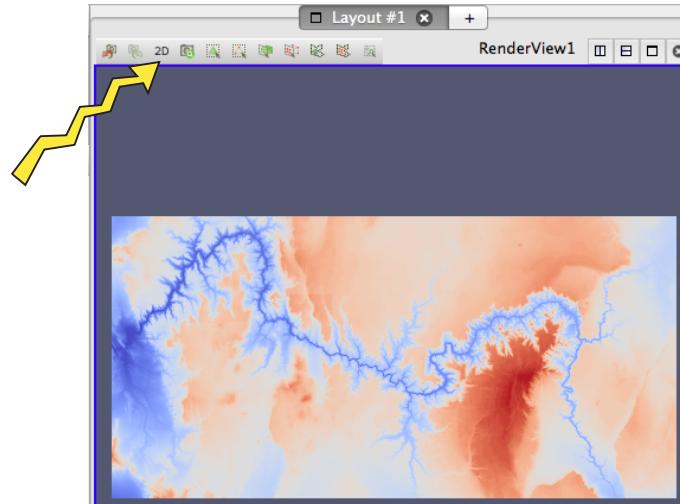


- Undo and Redo

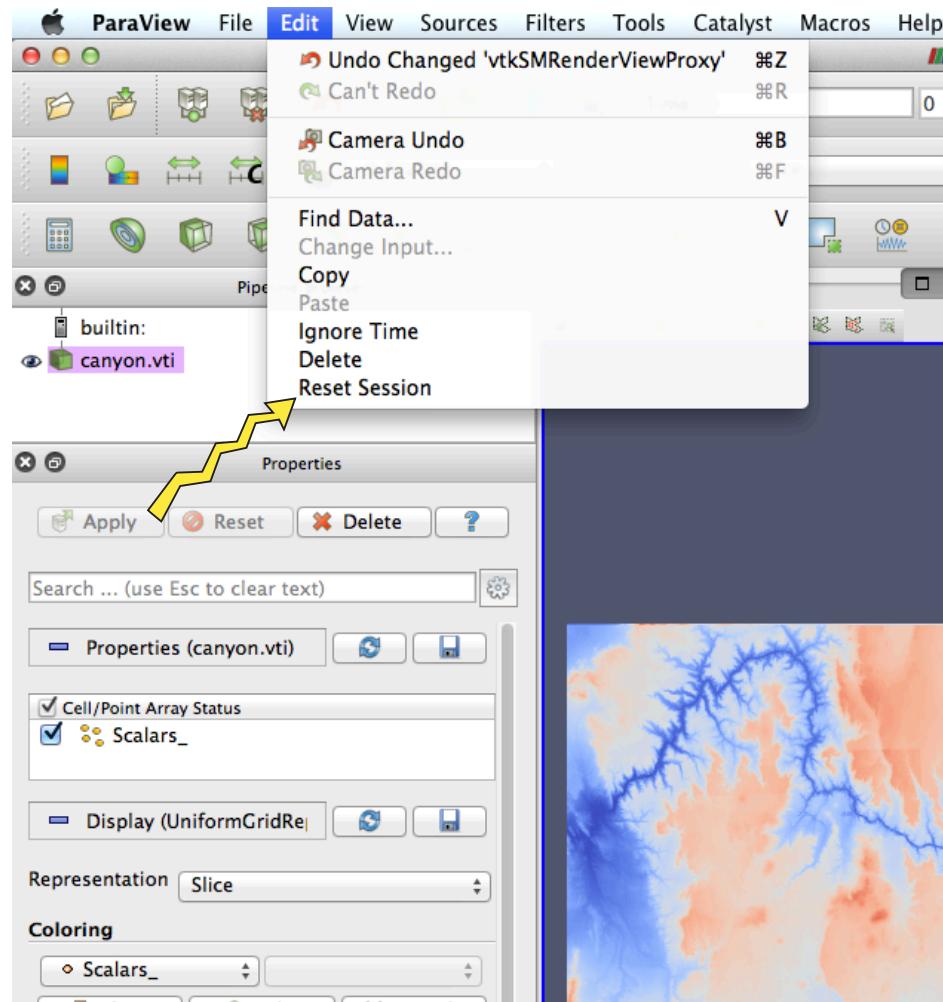


Camera

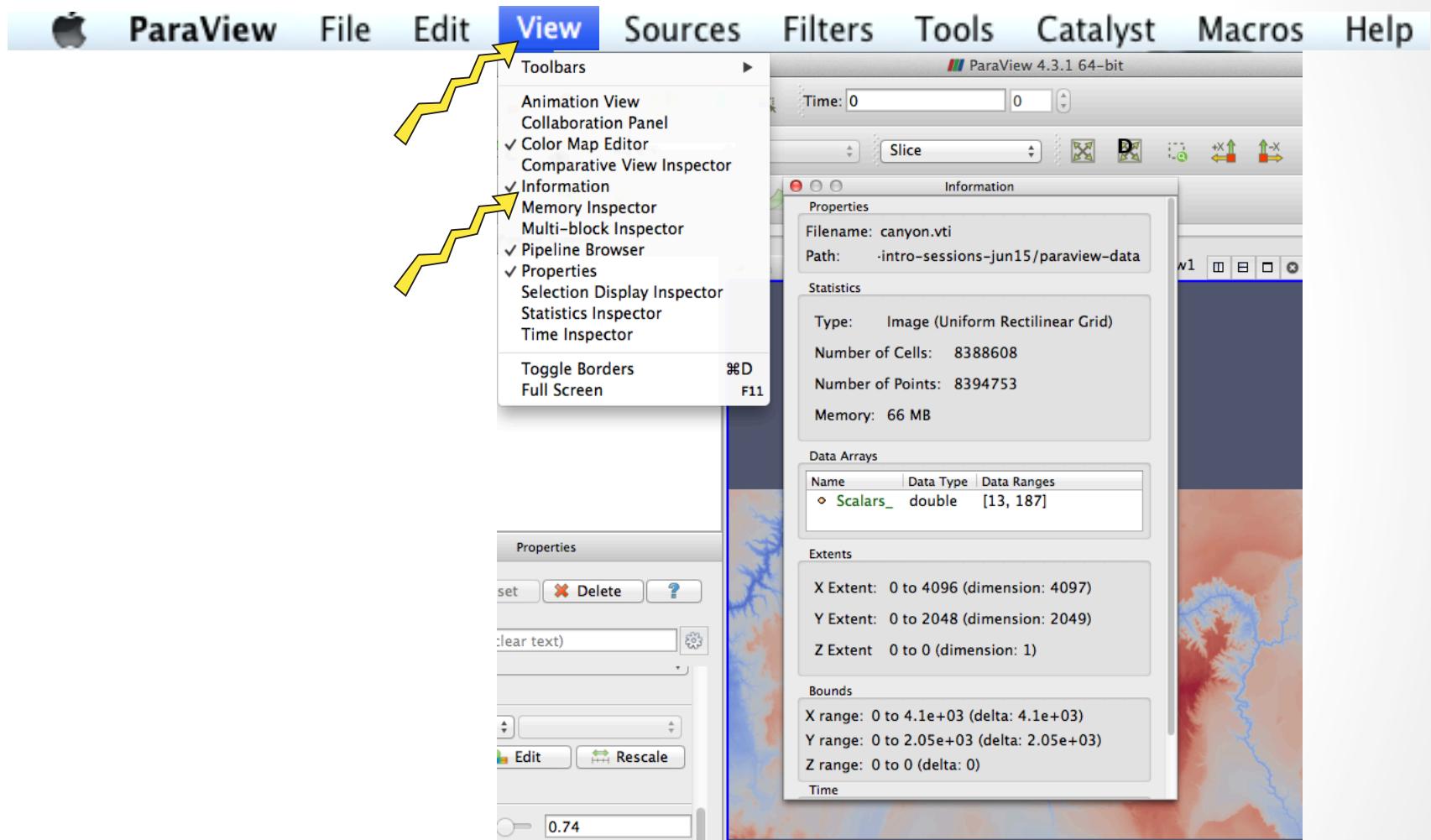
- Maybe change our 2D slice into a 3D object to explore rotation
- Then back to 2D, reset size, reset direction view



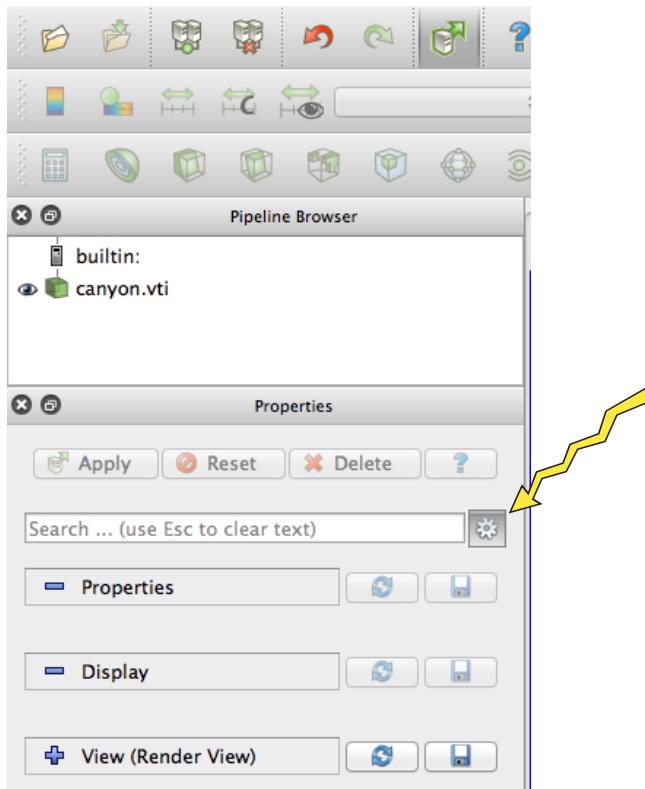
Reset Session



File Information

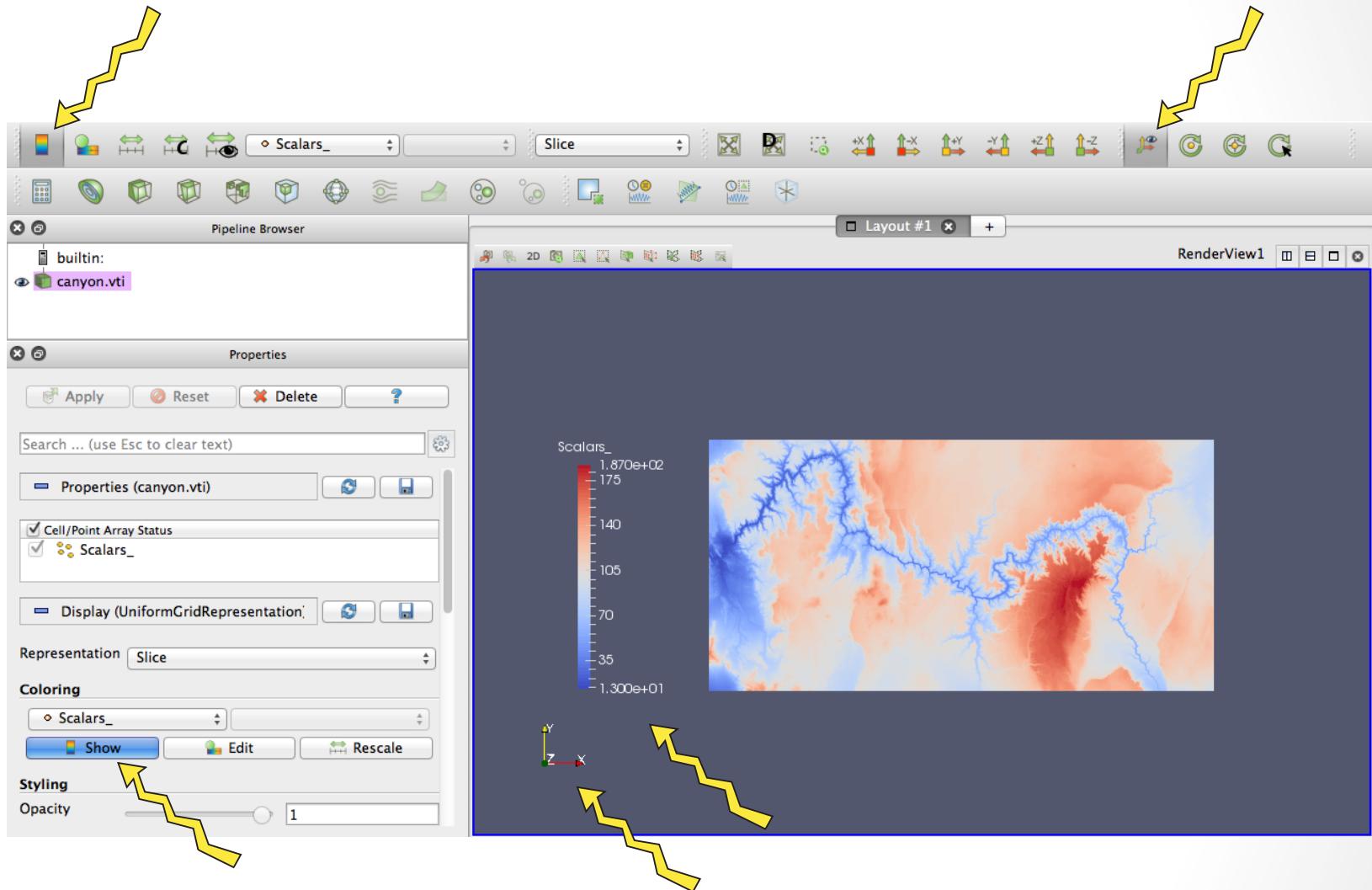


Toggle Advanced Properties

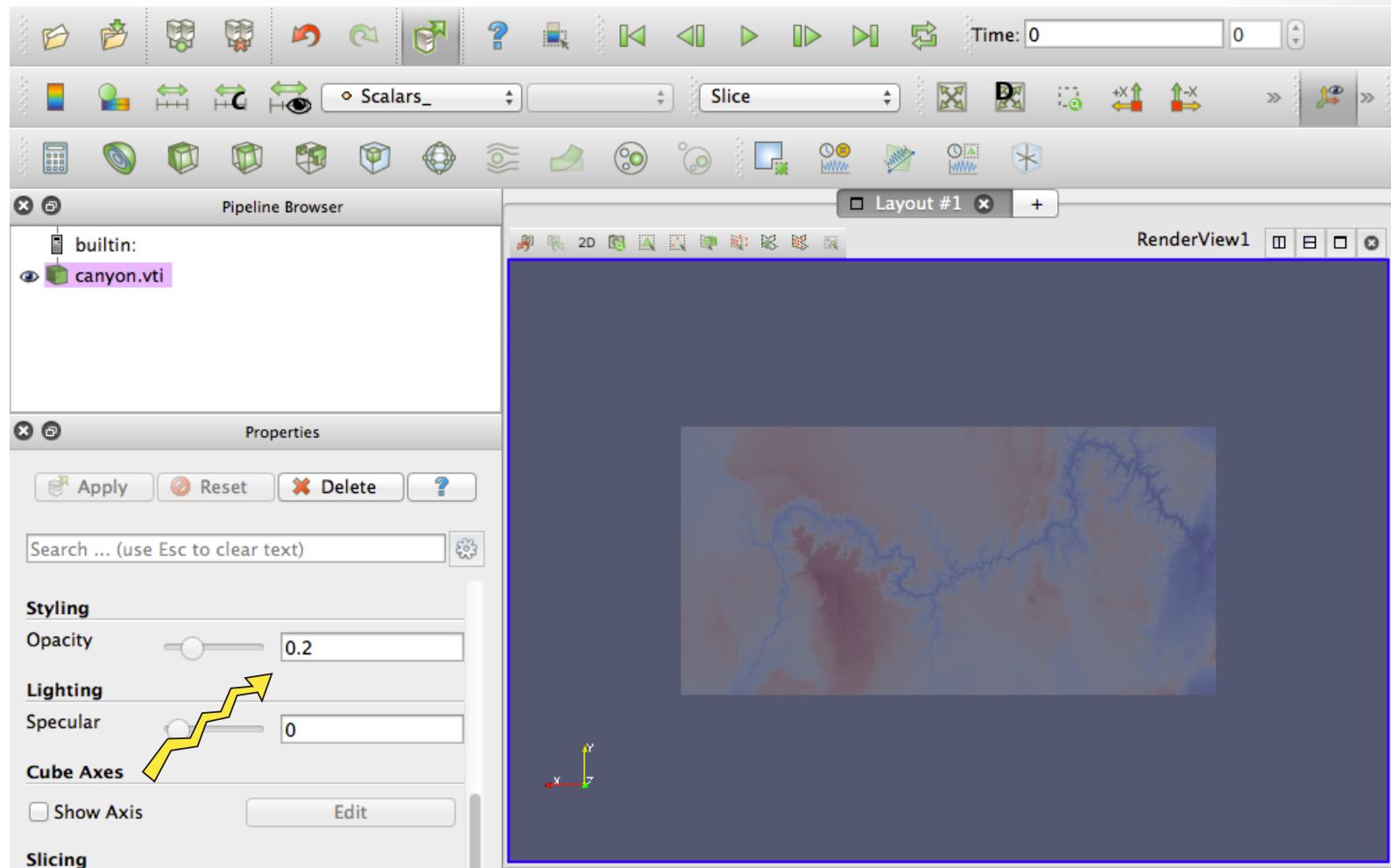


- *Advanced Properties* include options for lighting and color and edges and background and ...

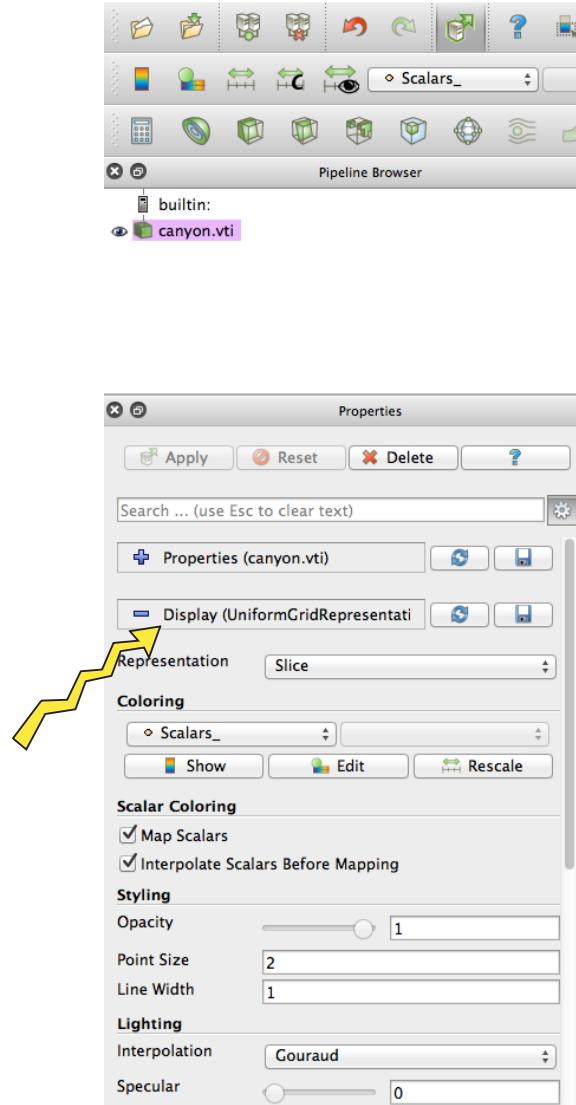
Toggle Legend and Axes



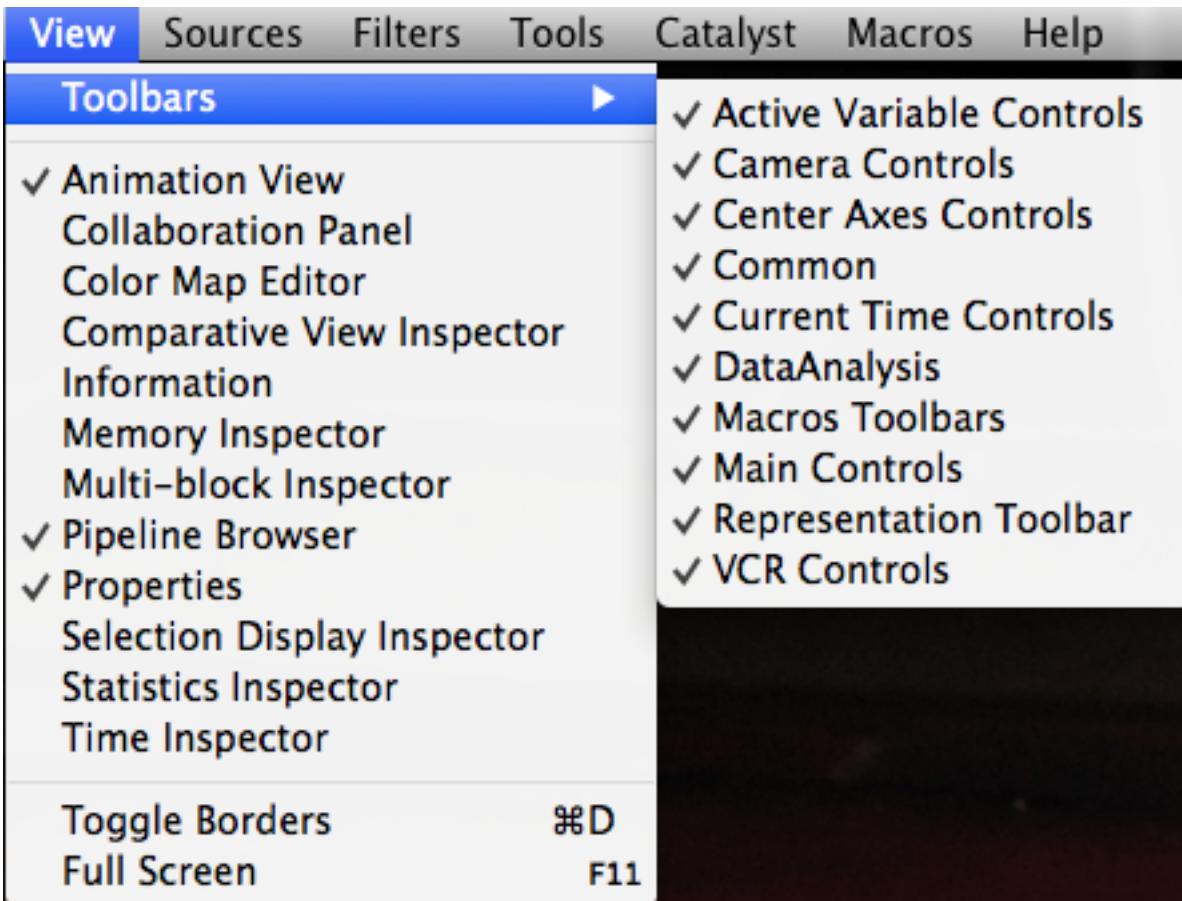
Adjust Opacity



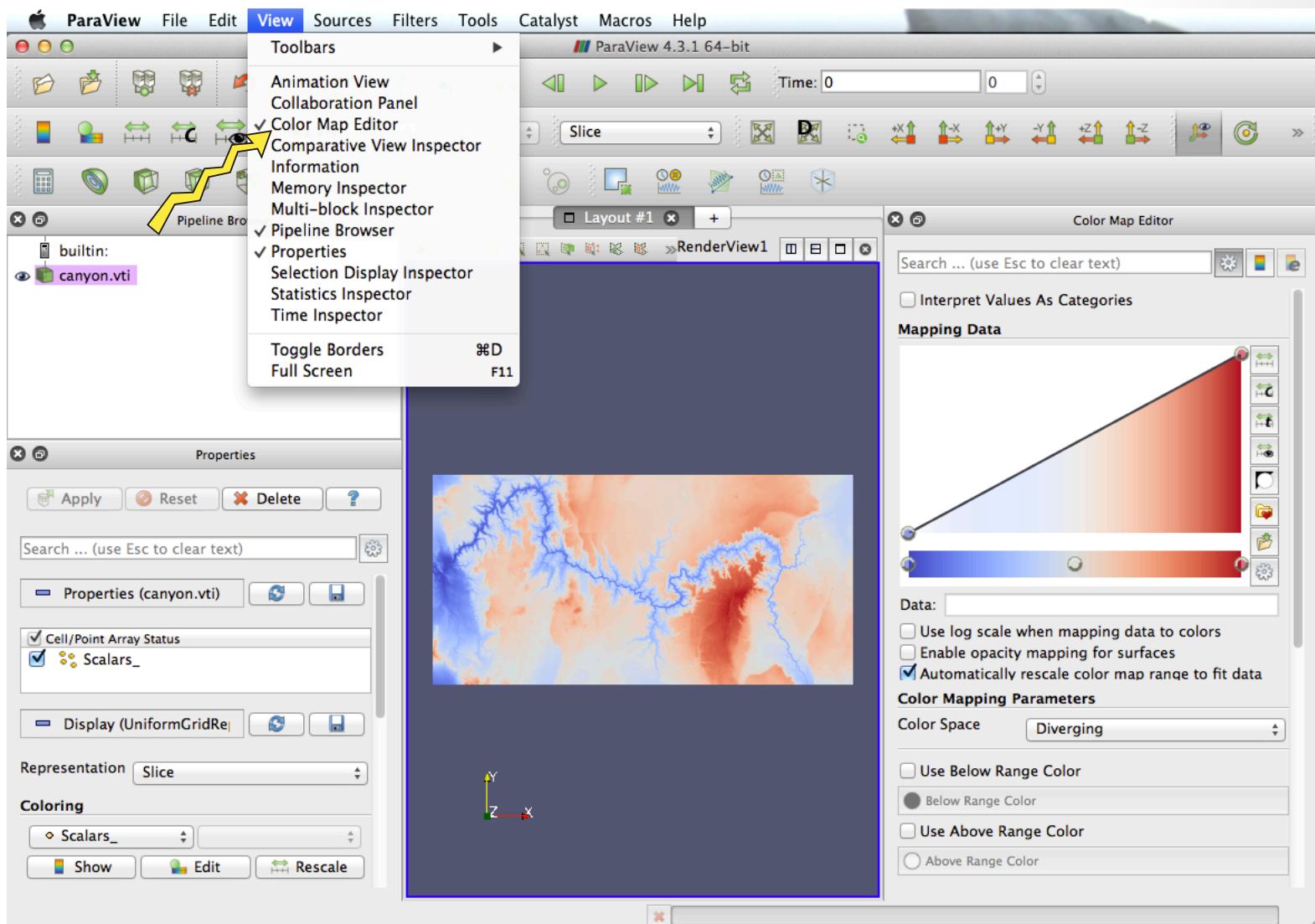
Display Properties



GUI Components



Open Color Map Editor



Start with Preset Color Scales

The image shows two software windows side-by-side. On the left is the 'Preset Color Scales' window, which lists various color scales with their names and color spaces. On the right is the 'Color Map Editor' window, which allows for customizing a color map. A yellow arrow points from the 'Color Map Editor' window towards the 'Color Scales' window.

Preset Color Scales

Name	Color Space
Cool to Warm	Diverging
Blue to Red R...	HSV
Red to Blue R...	HSV
Grayscale	RGB
X Ray	RGB
Blue to Yellow	RGB
Black-Body R...	RGB
CIELab Blue t...	CIELAB
Black, Blue an...	RGB
Black, Orange...	RGB
Cold and Hot	RGB
Rainbow Desa...	RGB
Rainbow Blen...	RGB

Color Map Editor

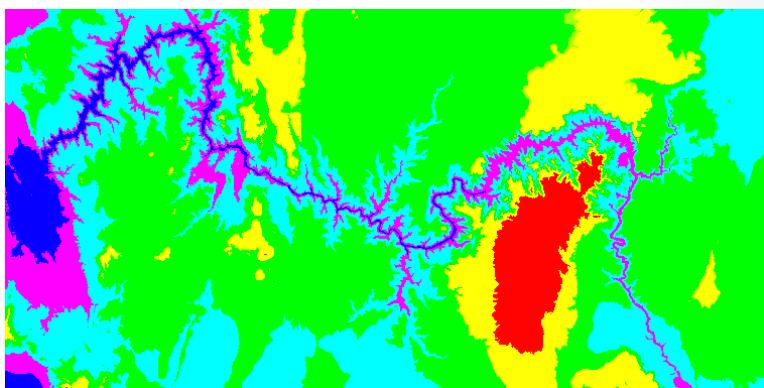
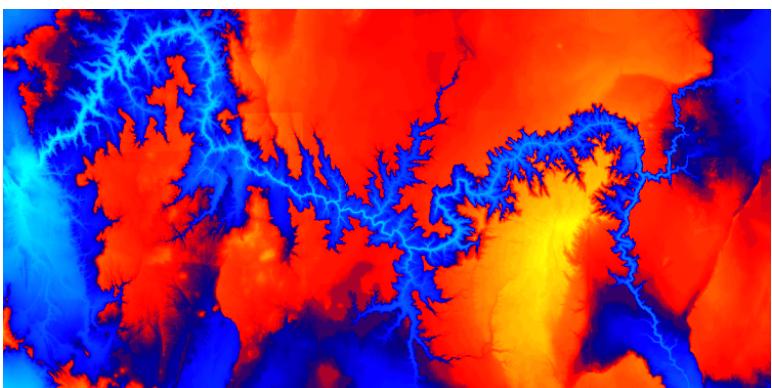
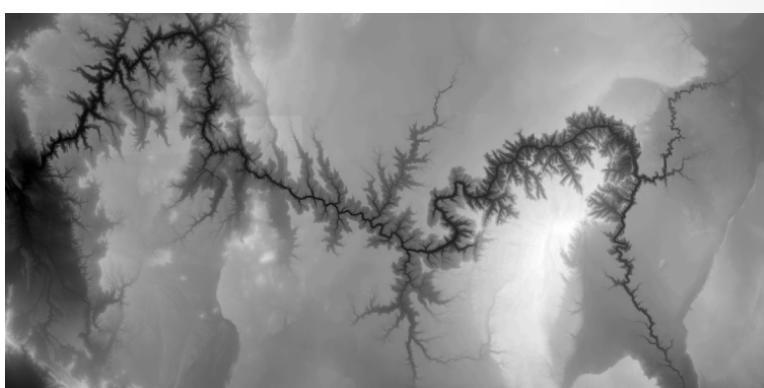
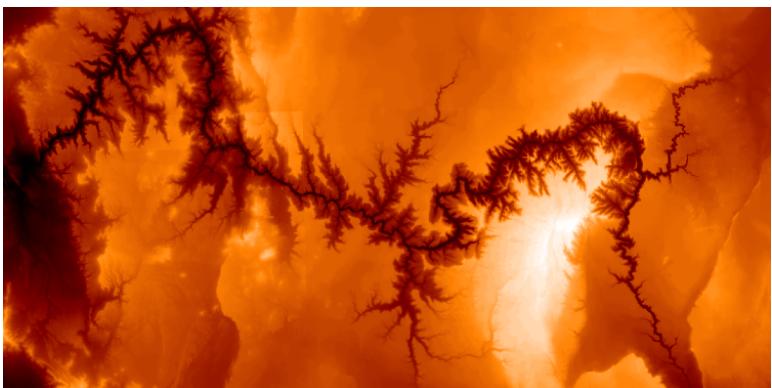
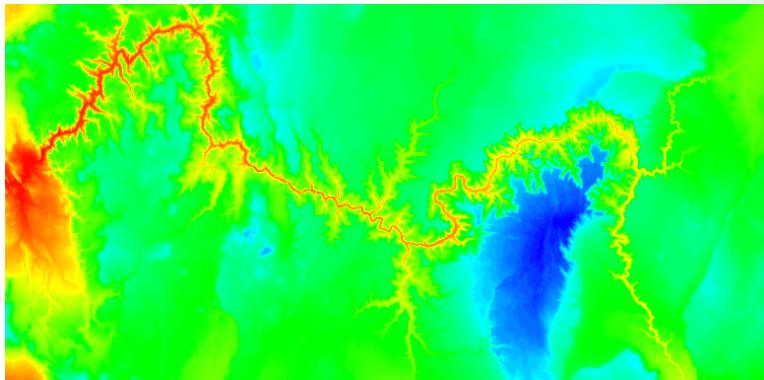
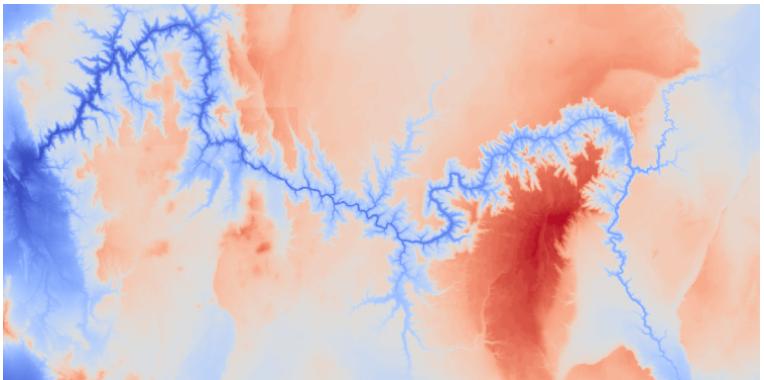
Search ... (use Esc to clear text)

Interpret Values As Categories

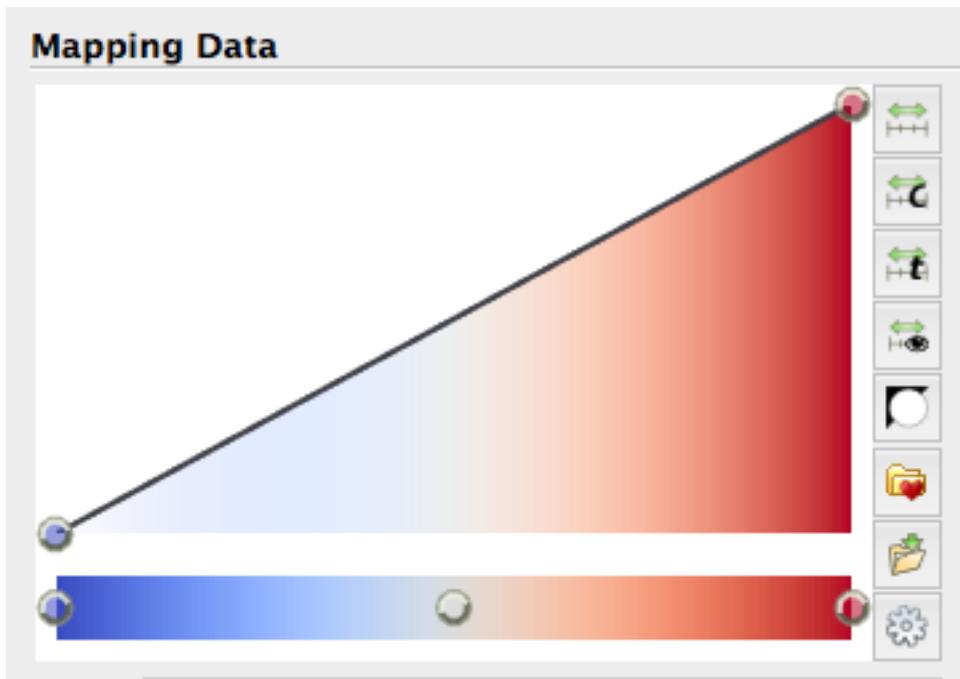
Mapping Data

Data: []

Use log scale when mapping data to colors



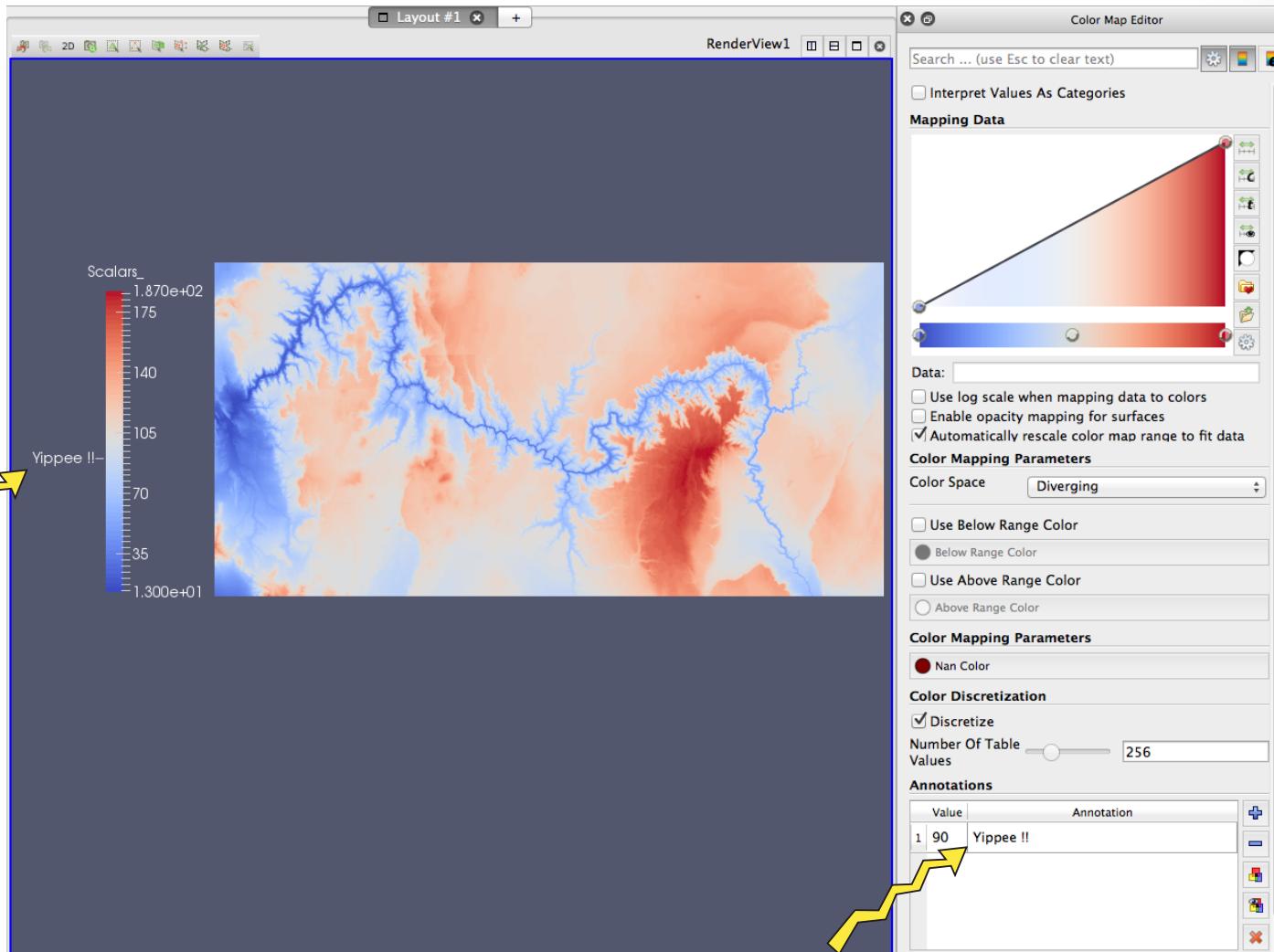
Modifying the Color Map



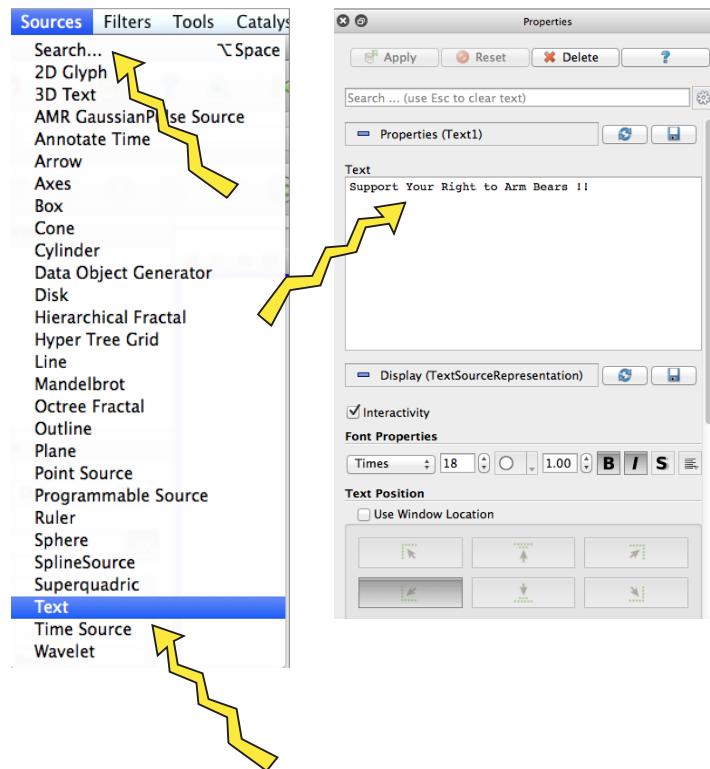
- Rescale to data range
- Rescale to custom range
- Rescale using all timesteps
- Invert the transfer function
- Manually edit transfer function

Annotation for Legend

Toggle
Advanced
Properties

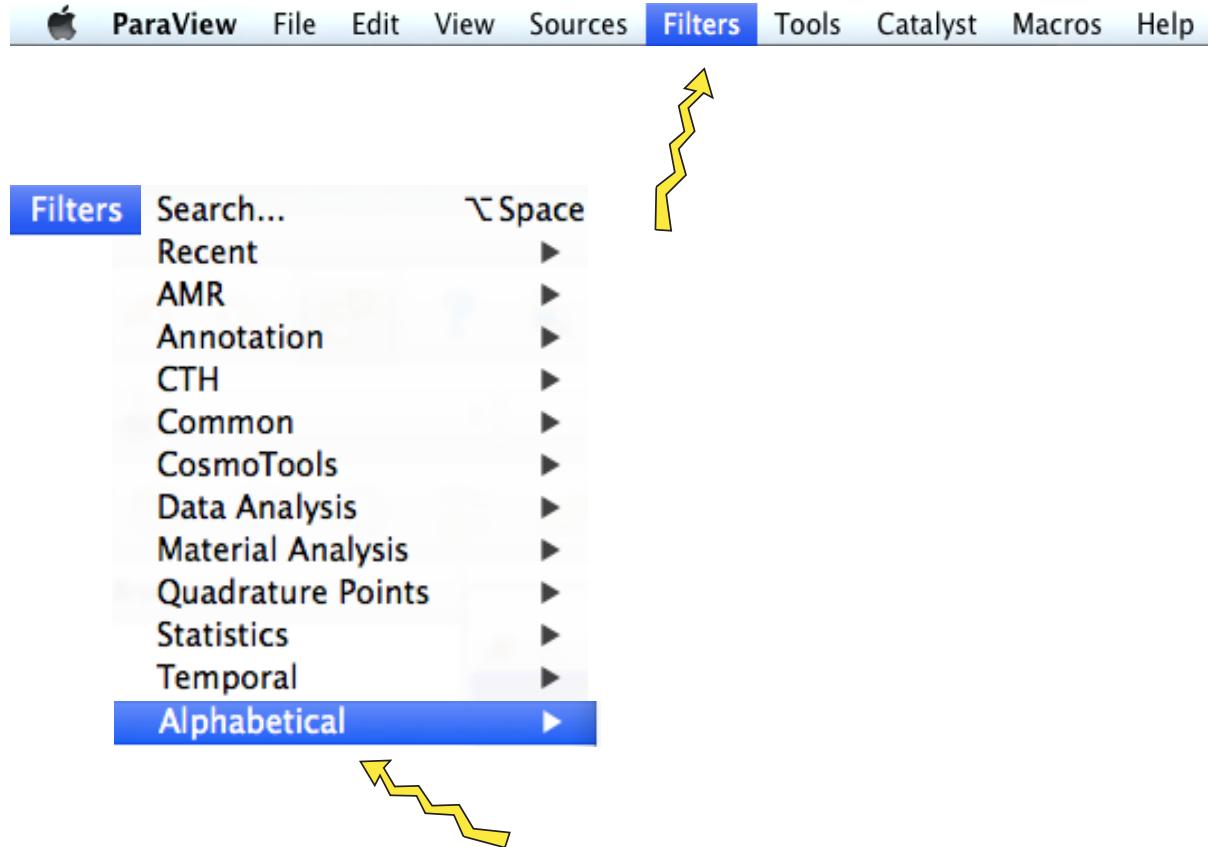


Add Text



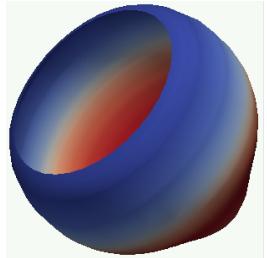
Filters

- *Filters* let us look inside a 3D mesh
- ParaView has *many many many* filters

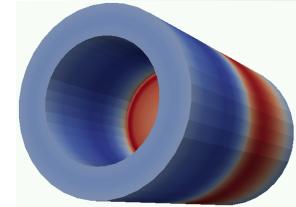
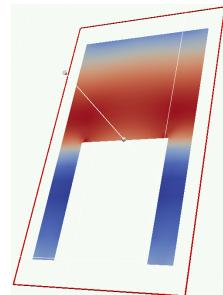


AMR Connectivity
AMR Contour
AMR CutPlane
AMR Dual Clip
AMR Fragment Integration
AMR Fragments Filter
Annotate Attribute Data
Annotate Global Data
Annotate Time Filter
Append Attributes
Append Datasets
Append Geometry
Block Scalars
Calculator
Cell Centers
Cell Data to Point Data
Clean
Clean Cells to Grid
Clean to Grid
Clip
Clip Closed Surface
Clip Generic Dataset
Compute Derivatives
Compute Quartiles
Connectivity
Contingency Statistics
Contour
Contour Generic Dataset
Convert AMR dataset to Multi-block
Curvature
D3
Decimate
Delaunay 2D
Delaunay 3D
Descriptive Statistics
Elevation
Extract AMR Blocks
Extract Bag Plots
Extract Block
Extract CTH Parts
Extract Cells By Region
Extract Edges
Extract Generic Dataset Surface
Extract Level
Extract Location
Extract Selection
Extract Subset
Extract Surface
FFT Of Selection Over Time
Feature Edges
Gaussian Resampling
Generate Ids
Generate Quadrature Points
Generate Quadrature Scheme Dictionary
Generate Surface Normals
Glyph
Glyph With Custom Source
Gradient
Gradient Of Unstructured DataSet

Common Filters



Contour
Extract
isosurface

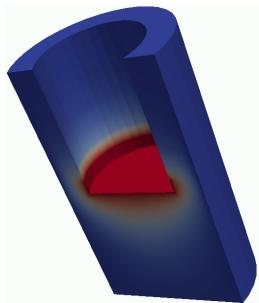


Slice
Intersect geometry
with a plane

Stream Tracer
Seeds and traces
a vector field

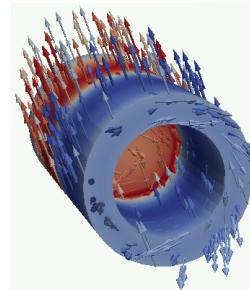
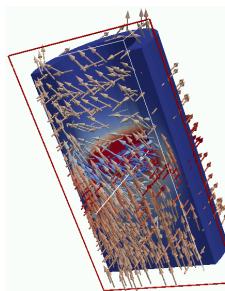


Clip
Intersect geometry
with a half space

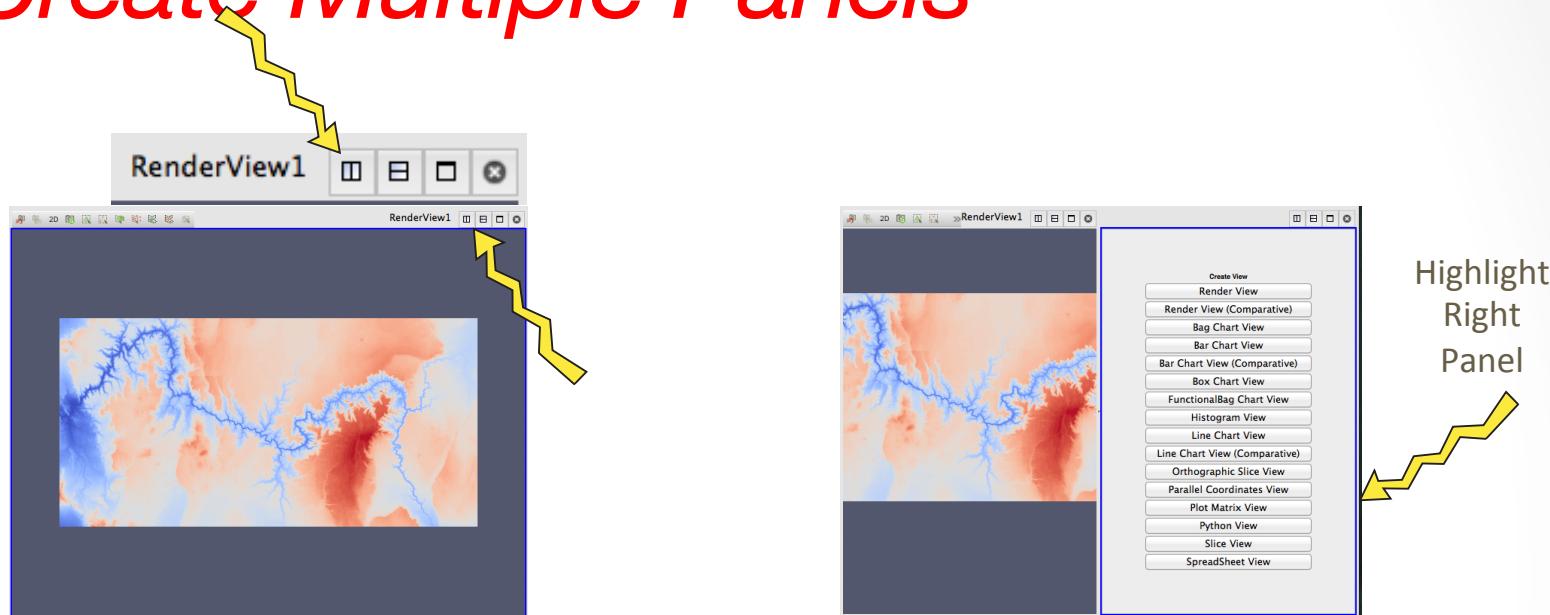


Threshold
Extract cells
in a range

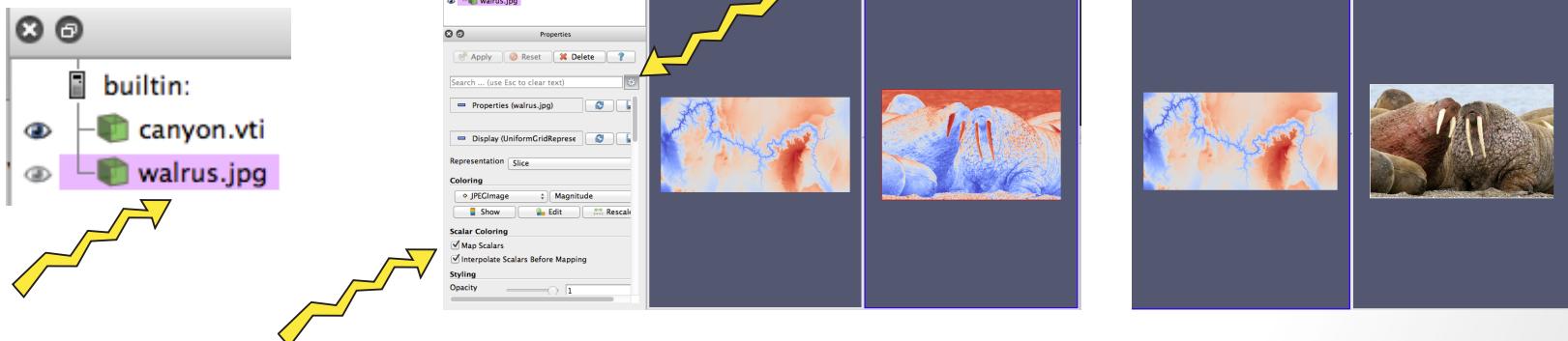
Glyph
Places a simple
shape at each point



Create Multiple Panels

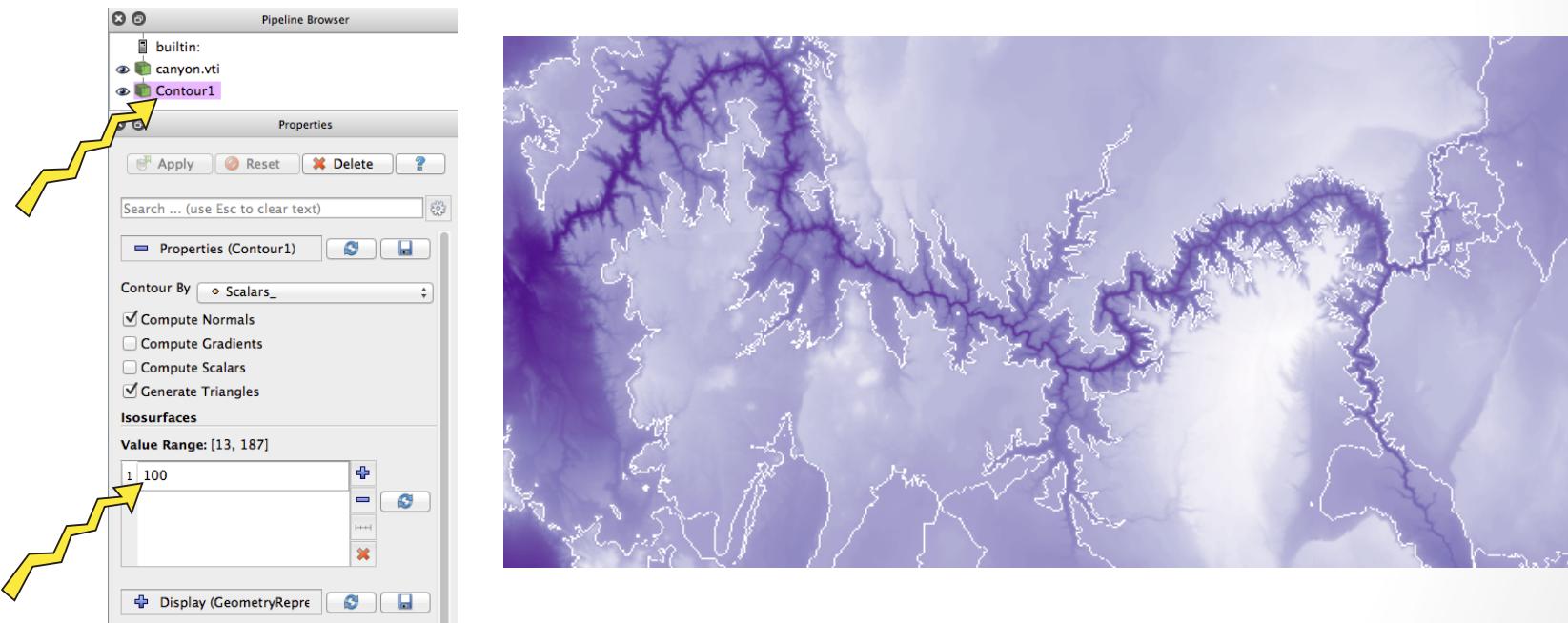


Open another file
(jpg of my pet walrus)



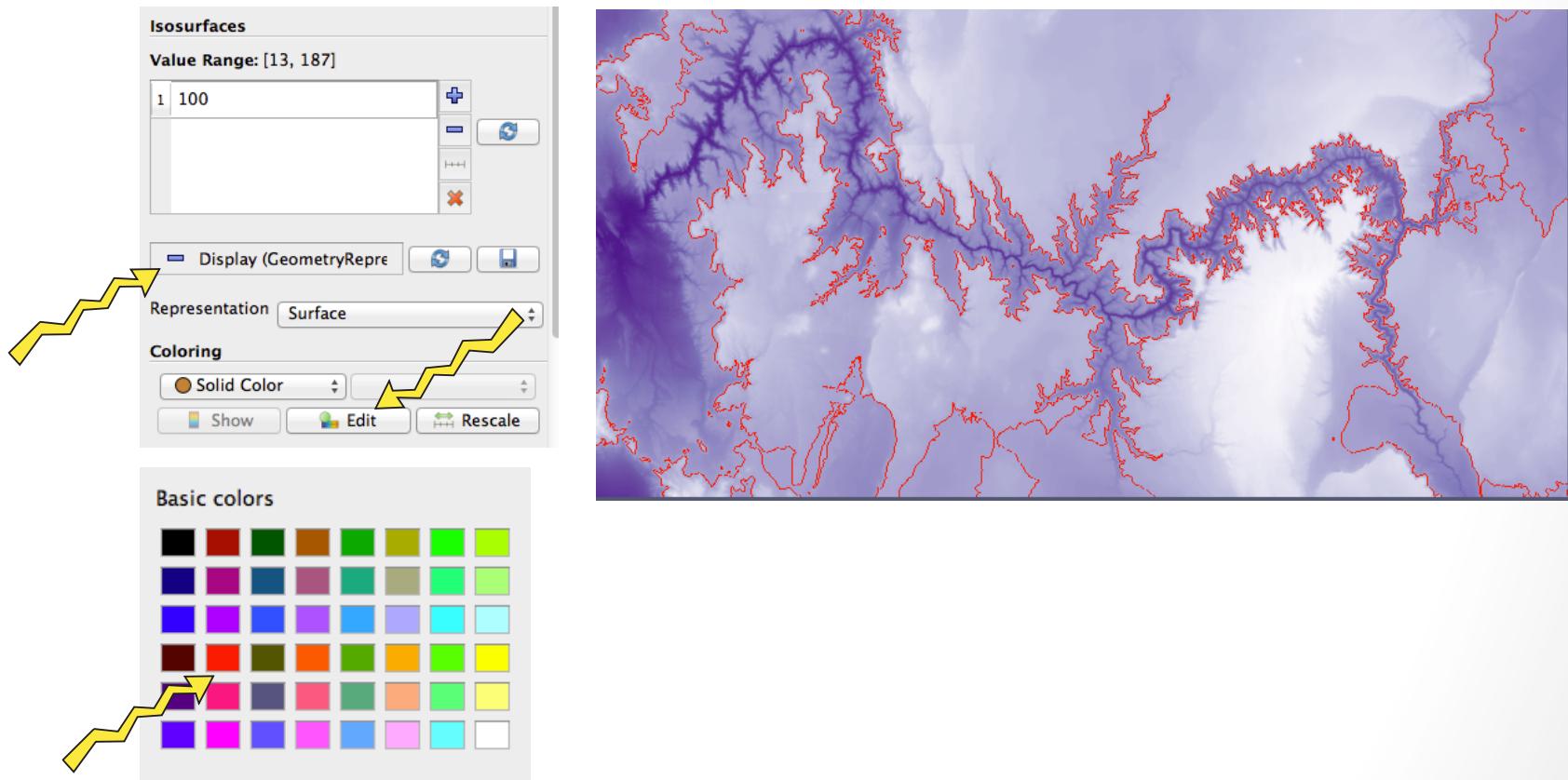
Contours and Isosurfaces

- Maybe use a *color map* that shows contours more clearly (I picked *Purples*)
- Click on *Contour* filter
- Range is (13,187) – default is one contour at 100



Color Contour Line

- Open *Display* in *Properties*
- Click on *Edit* and pick (maybe) red



More or Different Contours

Isosurfaces

Value Range: [13, 187]

1	100	

- Add new entry
- Remove current entry
- Add a range of values
- Remove all entries

Select *Add a range of values*

Add Range

From: 13

To: 187

Steps: 10

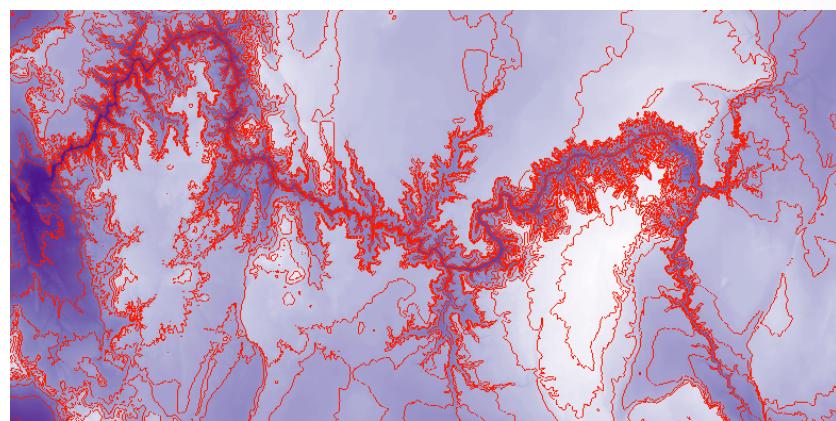
Use Logarithmic Scale

OK Cancel

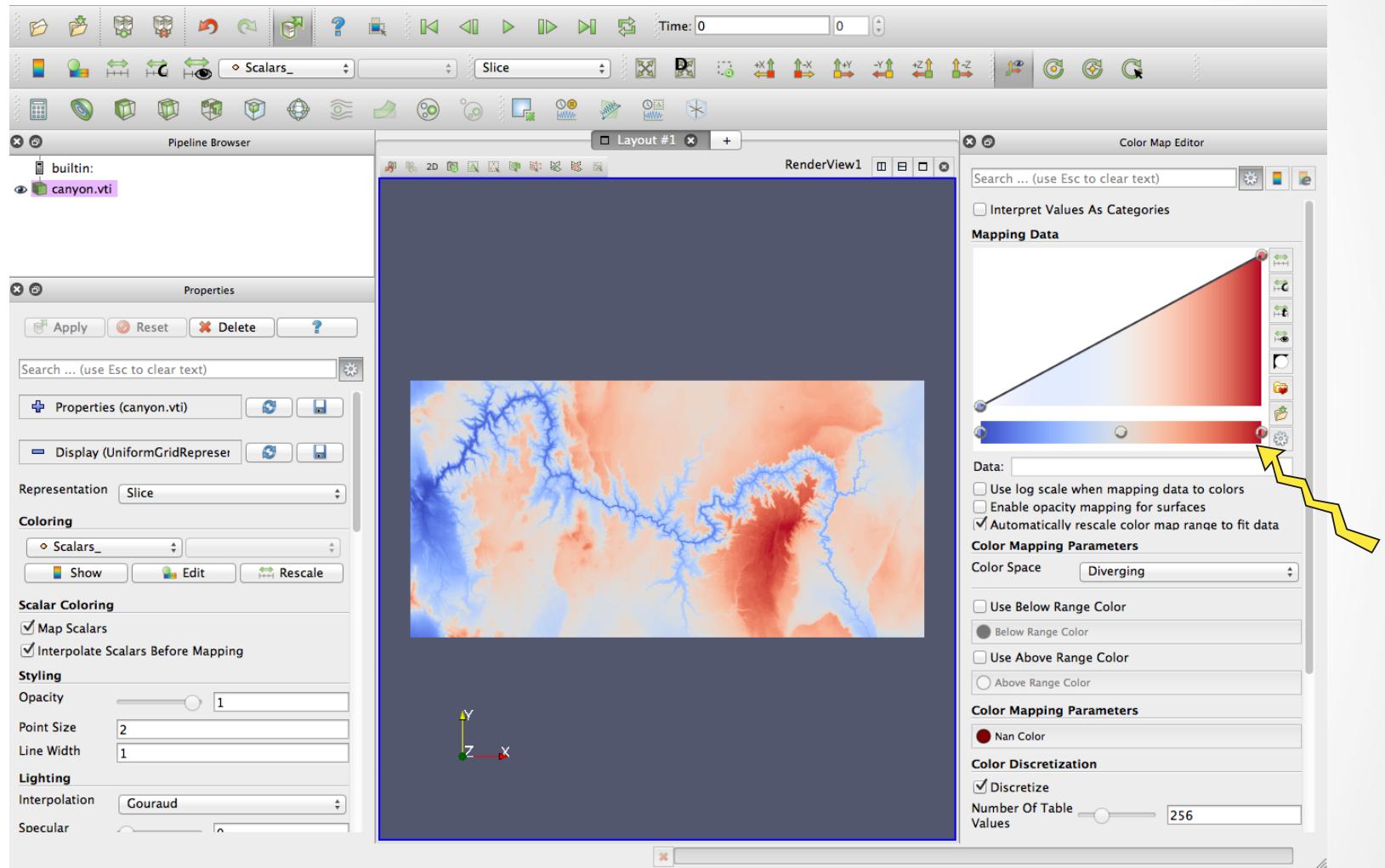
Isosurfaces

Value Range: [13, 187]

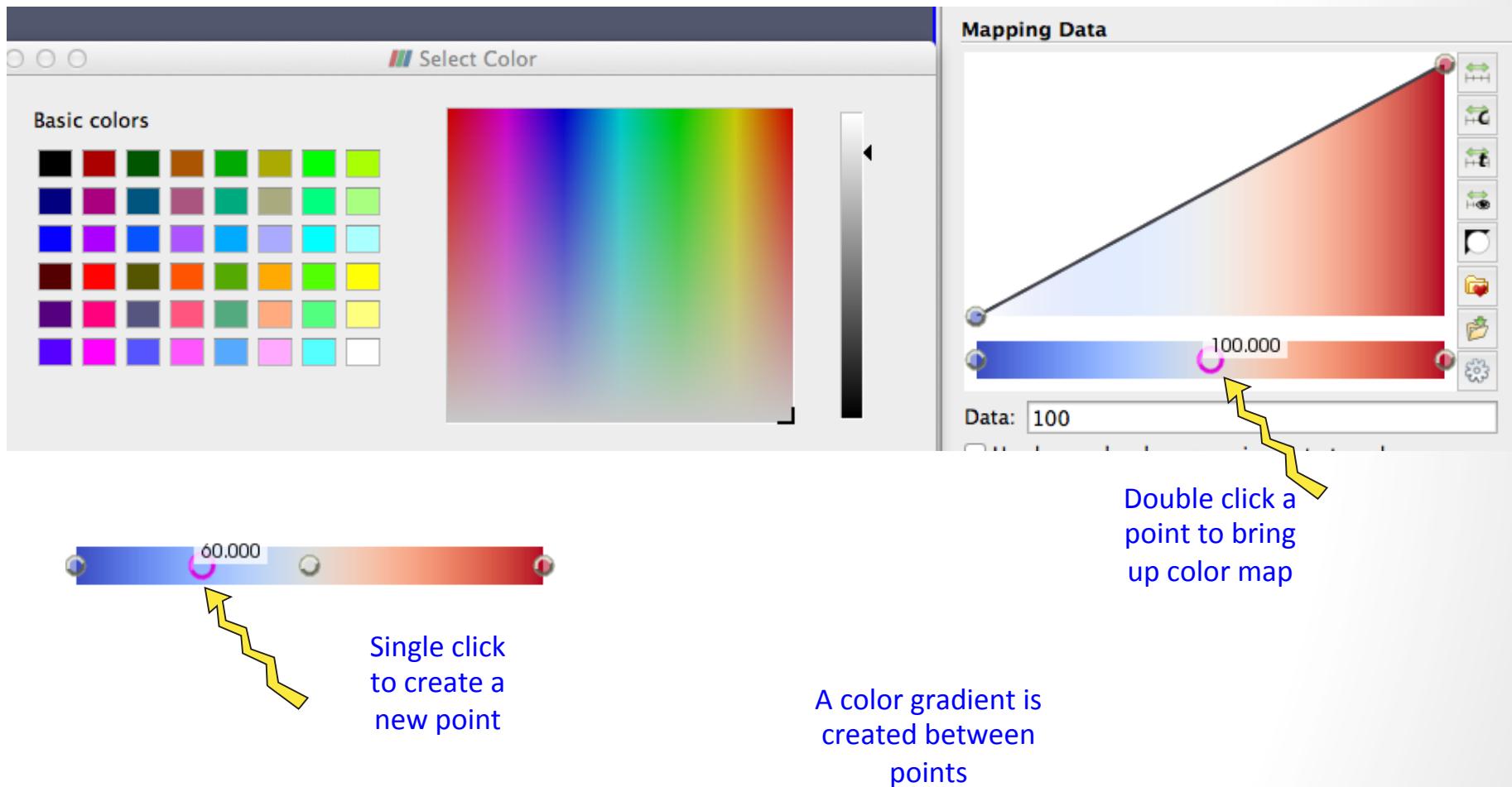
1	100	
2	13	
3	32.3333	
4	51.6667	
5	71	
6	90.3333	
7	109.667	
8	129	
9	148.333	
10	167.667	



Edit Color Map

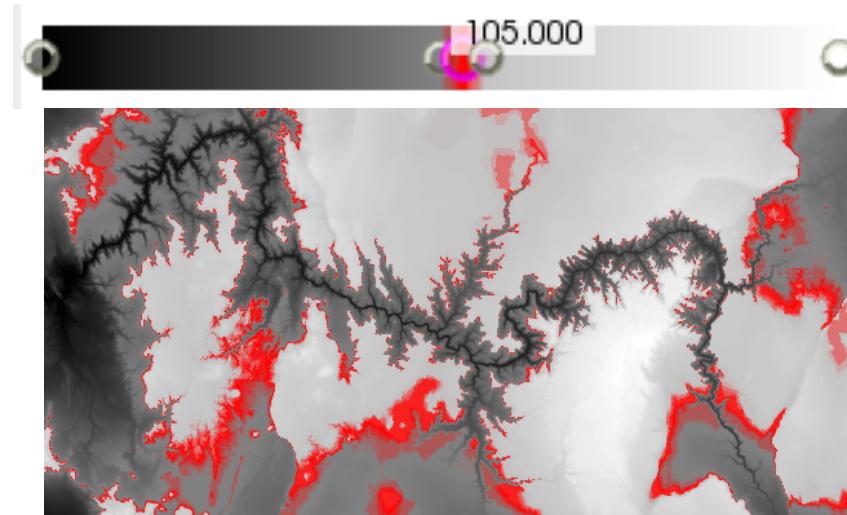


Edit Color Map



Exercise

- Start with a preset color map
- Add points and set a color for each point
- Emphasize a set of features
- Or interpret the data as other than a canyon
- Or emphasize land use
- Or ...
- Be prepared to explain your choices





Plotting Walri

	A	B	C	D	E	F	G
1	Walrus	DateTimeUTC	Xcoord	Ycoord	Behav	Longitude	Latitude
2	271	5/31/08 19:25	95,616.95	-528,324.60	1.009	-167.9560949	65.24871506
3	271	6/1/08 3:24	84,741.71	-511,653.75	1.0005	-168.1779869	65.40121711
4	271	6/1/08 11:24	71,834.45	-491,176.95	1.00625	-168.4443605	65.58796906
5	271	6/1/08 19:24	65,275.80	-478,935.62	1.02025	-168.5802843	65.6991429
6	271	6/2/08 3:24	69,343.24	-473,948.91	1.00775	-168.4892154	65.74298362
7	271	6/2/08 11:24	72,634.53	-457,308.67	1	-168.4082441	65.89142326
8	271	6/2/08 19:24	73,253.86	-425,586.14	1	-168.3764825	66.17566325
9	271	6/3/08 3:24	79,223.97	-401,784.87	1.00975	-168.2291622	66.38754225
10	271	6/3/08 11:24	77,052.23	-382,920.49	1.20225	-168.2658694	66.5571914
11	271	6/3/08 19:24	73,380.11	-379,615.25	1.24225	-168.3464858	66.58772689
12	271	6/4/08 3:24	67,572.75	-380,607.03	1.2725	-168.4778405	66.5801826
13	271	6/4/08 11:24	62,271.16	-375,738.69	1.2905	-168.5947316	66.6249585
14	271	6/4/08 19:24	59,480.60	-370,911.58	1.29425	-168.6553177	66.66879335
15	271	6/5/08 3:24	60,918.11	-367,031.90	1.27575	-168.6208749	66.70328847
16	271	6/5/08 11:24	56,781.80	-361,809.93	1.23975	-168.7120264	66.75090872
17	271	6/5/08 19:24	54,894.44	-353,876.89	1.195	-168.7511903	66.82237894
18	271	6/6/08 3:24	58,606.00	-345,341.95	1.1565	-168.6625788	66.89819298
19	271	6/6/08 11:24	60,397.06	-339,209.14	1.12825	-168.6185904	66.95281579
20	271	6/6/08 19:24	65,730.69	-336,317.89	1.083	-168.4950345	66.97760921
21	271	6/7/08 3:24	75,490.71	-331,831.28	1.06975	-168.268801	67.01551794
22	271	6/7/08 11:24	84,767.05	-325,728.19	1.08175	-168.0517897	67.06772396
23	271	6/7/08 19:24	94,131.49	-326,567.29	1.10825	-167.8374094	67.05739181
24	271	6/8/08 3:24	100,062.89	-327,001.16	1.14575	-167.7016343	67.05157102
25	271	6/8/08 11:24	104,235.79	-331,415.81	1.174	-167.6098039	67.01058664
26	271	6/8/08 19:24	107,125.22	-337,685.94	1.1915	-167.5493183	66.95338716
27	271	6/9/08 3:24	113,706.33	-345,592.86	1.238	-167.406526	66.88012432
28	271	6/9/08 11:24	113,950.33	-346,474.15	1.239	-167.4018121	66.87213666
29	271	6/9/08 19:24	112,140.24	-339,284.85	1.219	-167.4362376	66.93722569
30	271	6/10/08 3:24	110,084.20	-327,925.54	1.214	-167.4725685	67.03975617
31	271	6/10/08 11:24	113,726.37	-324,012.53	1.192	-167.385244	67.07344299
32	271	6/10/08 19:24	119,595.60	-323,747.92	1.1475	-167.2502051	67.07351315
33	271	6/11/08 3:24	126,878.43	-327,031.10	1.1125	-167.0865576	67.04109351

Open *.csv file with Walrus Data

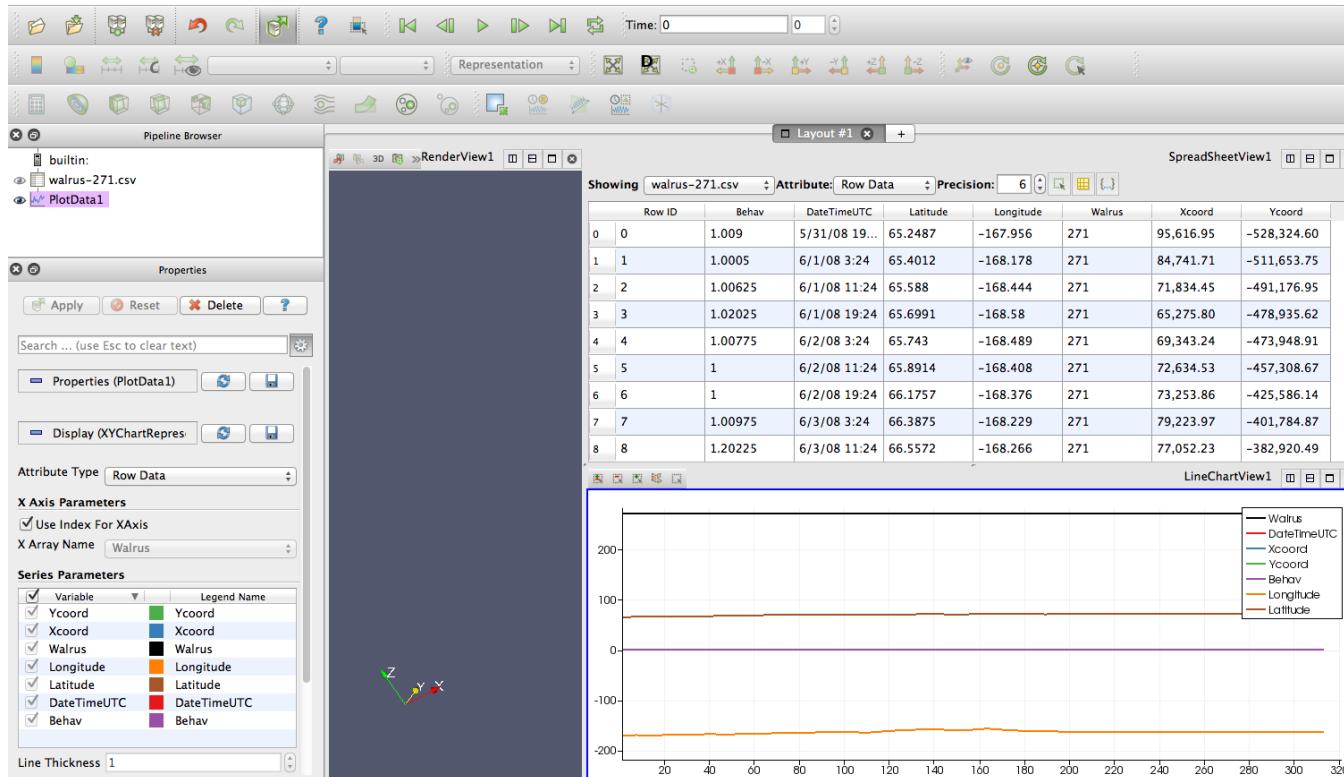
The screenshot shows the Walrus software interface. At the top is a toolbar with various icons for file operations, search, and navigation. Below the toolbar is a second toolbar with icons for representation and coordinate transformations.

The main window features a "Pipeline Browser" on the left, which lists a file named "walrus-271.csv". A yellow arrow points from the Pipeline Browser to the "SpreadSheetView1" window. The "Properties" panel is also visible on the left, containing settings for the selected file, including checkboxes for "Detect Numeric Columns", "Use String Delimiter", and "Have Headers", and fields for "Field Delimiter" and "Merge Consecutive Delimiters".

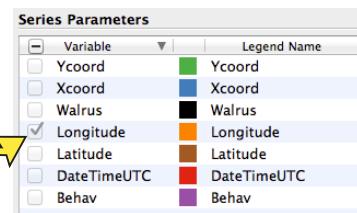
The "SpreadSheetView1" window displays a table of data with 19 rows and 8 columns. The columns are labeled: Row ID, Behav, DateTimeUTC, Latitude, Longitude, Walrus, Xcoord, and Ycoord. The data represents walrus tracking information, with coordinates ranging from approximately -167.956 to -168.495 and latitudes from 65.2487 to 66.9776. The first few rows of data are as follows:

Row ID	Behav	DateTimeUTC	Latitude	Longitude	Walrus	Xcoord	Ycoord
0	1.009	5/31/08 19...	65.2487	-167.956	271	95,616.95	-528,324.60
1	1.0005	6/1/08 3:24	65.4012	-168.178	271	84,741.71	-511,653.75
2	1.00625	6/1/08 11:24	65.588	-168.444	271	71,834.45	-491,176.95
3	1.02025	6/1/08 19:24	65.6991	-168.58	271	65,275.80	-478,935.62
4	1.00775	6/2/08 3:24	65.743	-168.489	271	69,343.24	-473,948.91
5	1	6/2/08 11:24	65.8914	-168.408	271	72,634.53	-457,308.67
6	1	6/2/08 19:24	66.1757	-168.376	271	73,253.86	-425,586.14
7	1.00975	6/3/08 3:24	66.3875	-168.229	271	79,223.97	-401,784.87
8	1.20225	6/3/08 11:24	66.5572	-168.266	271	77,052.23	-382,920.49
9	1.24225	6/3/08 19:24	66.5877	-168.346	271	73,380.11	-379,615.25
10	1.2725	6/4/08 3:24	66.5802	-168.478	271	67,572.75	-380,607.03
11	1.2905	6/4/08 11:24	66.625	-168.595	271	62,271.16	-375,738.69
12	1.29425	6/4/08 19:24	66.6688	-168.655	271	59,480.60	-370,911.58
13	1.27575	6/5/08 3:24	66.7033	-168.621	271	60,918.11	-367,031.90
14	1.23975	6/5/08 11:24	66.7509	-168.712	271	56,781.80	-361,809.93
15	1.195	6/5/08 19:24	66.8224	-168.751	271	54,894.44	-353,876.89
16	1.1565	6/6/08 3:24	66.8982	-168.663	271	58,606.00	-345,341.95
17	1.12825	6/6/08 11:24	66.9528	-168.619	271	60,397.06	-339,209.14
18	1.083	6/6/08 19:24	66.9776	-168.495	271	65,730.69	-336,317.89

Plot Variables that Are Numeric



Control
variables
to plot



Walrus File Information

Information

Properties

Filename: walrus-271.csv
Path: usgs-paraview-intro-sessions-jun15/paraview-data

Statistics

Type: Table
Number of Rows: 314
Number of Columns 7
Memory: 0.035 MB

Data Arrays

Name	Data Type	Data Ranges
Walrus	int	[271, 271]
DateTimeUTC	string	[1e+299, -1e+299]
Xcoord	string	[1e+299, -1e+299]
Ycoord	string	[1e+299, -1e+299]
Behav	double	[1, 1.99625]
Longitude	double	[-168.751, -155.546]
Latitude	double	[65.2487, 72.0413]

Plot Data Filter

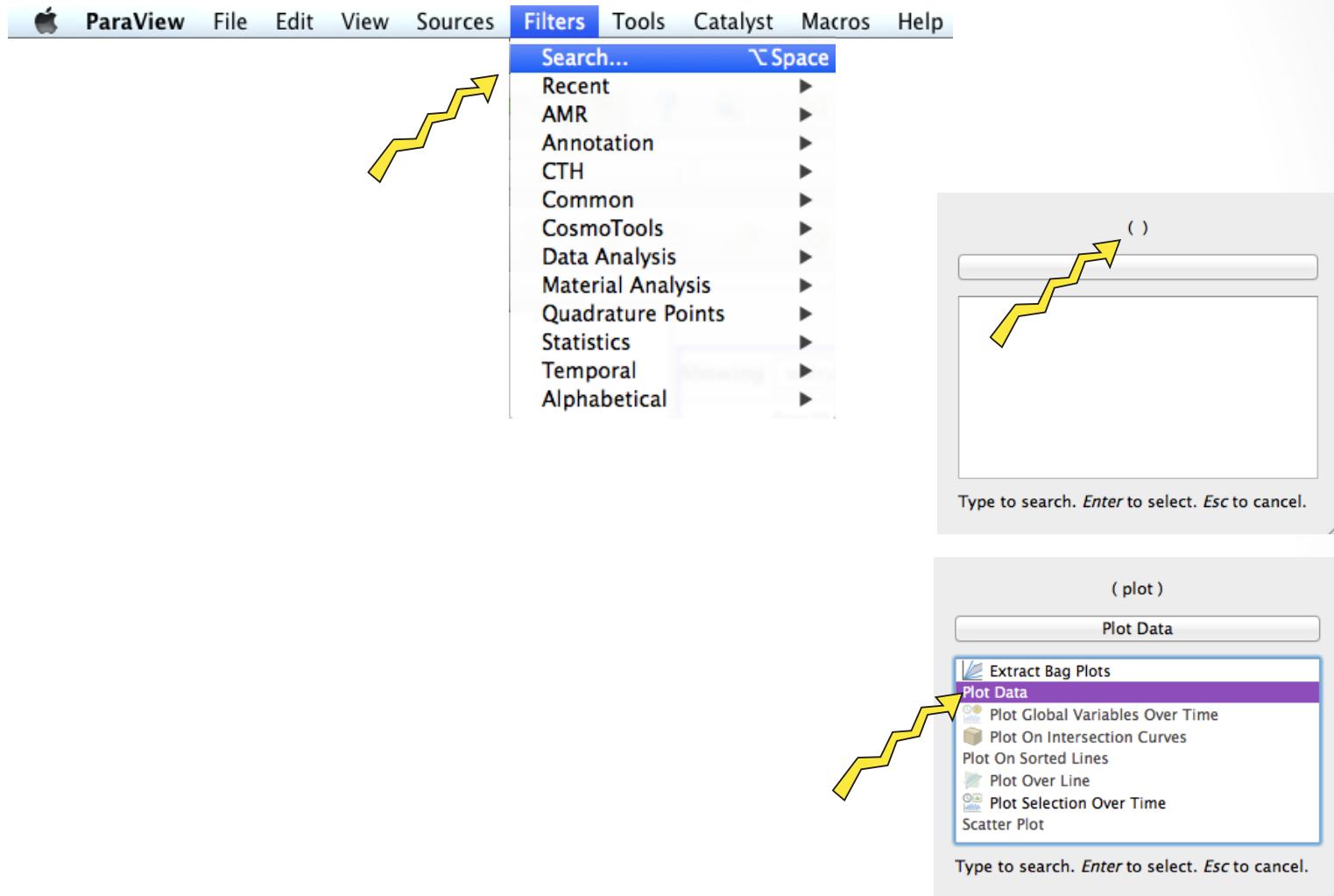


Table to Points Filter

