Interactive Visual Analysis Tools – ParaView –

Tutorial: Interactive Visual Analysis of Scientific Data

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What Is ParaView?

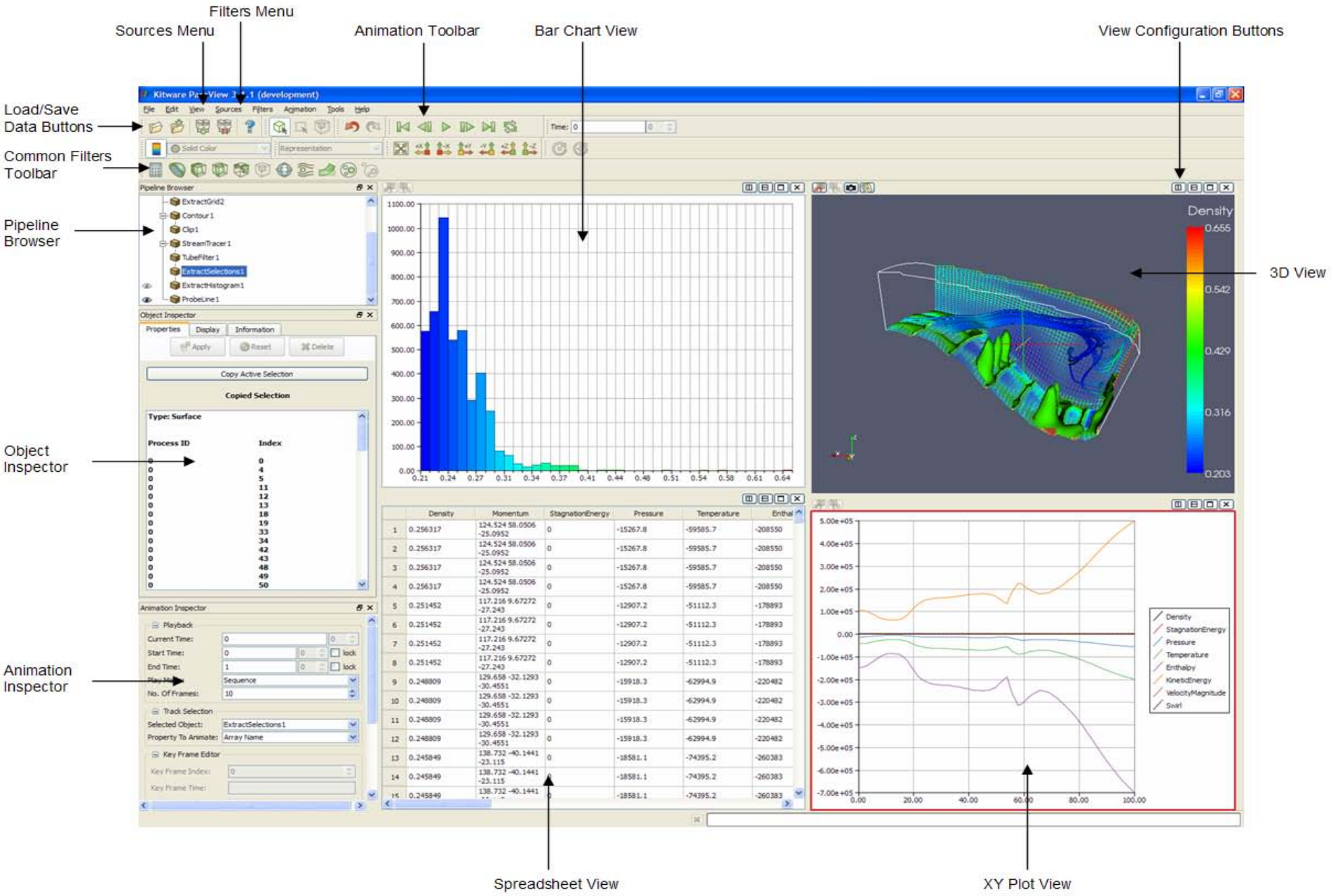
- Open-source, cross-platform application for visualization and analysis of 2D/3D/4D datasets
- Developed by *Kitware*, based on *Visualization Toolkit (VTK)*
- Modular, scalable distributed-memory parallel architecture
- Client/Server visualization
- Pipeline-based data processing
- Extensive scripting and batch processing capabilities

- Tutorial part is based on ParaView's Version 3.14.1
- See http://www.paraview.org/ for download, extensive documentation and application examples

Which Data Formats Can Be Handled?

Name	
LSDynaReader	Read LS-Dyna databas
PVD Reader	Load a dataset stored i
XML PolyData Reader	Reads serial VTK XML
XML Unstructured Grid Reader	Reads serial VTK XML
XML Image Data Reader	Reads serial VTK XML
XML Structured Grid Reader	Reads serial VTK XML
XML Rectilinear Grid Reader	Reads serial VTK XML
XML Partitioned Polydata Reader	Reads the summary file
XML Partitioned Unstructured Grid Reader	Reads the summary file
XML Partitioned Image Data Reader	Reads the summary file
XML Partitioned Structured Grid Reader	Reads the summary file
XML Partitioned Rectilinear Grid Reader	Reads the summary file
XML MultiBlock Data Reader	Reads a VTK XML mult
XML Hierarchical Box Data reader	Reads a VTK XML-bas
Legacy VTK Reader	Reads files stored in V
Partitioned Legacy VTK Reader	Reads files stored in V
EnSight Reader	Reads EnSight 6 and G
EnSight Master Server Reader	Reads files in EnSight's
Tecplot Reader	Reads files in the Tecpl
NetCDF Reader	Reads regular arrays fr CF conventions.
NetCDF Reader	Reads regular array CF conventions.
BYU Reader	Reads Movie.BYU fi
Wavefront OBJ Reader	Reads Wavefront .O
proSTAR (STARCD) Reader	Reads geometry in
XDMF Reader	Reads XDMF (eXte
PDB Reader	Reads PDB molecu
XYZ Reader	Reads XYZ molecul
PLOT3D Reader	Reads ASCII or bina
Spy Plot Reader	Reads files in the SP
Restarted Sim Spy Plot Reader	Reads collections of
spcth history reader	Reads an spcth hist and properties.
DEM Reader	Reads a DEM (Digi
VRML Reader	Load the geometry f
PLY Reader	Reads files stored in
STL Reader	Reads ASCII or bina
Gaussian Cube Reader	Produce polygonal data by reading a Gaussian Cube file.
Image Reader	Reads raw regular rectilinear grid data from a file. The dimensions and type of th
POP Reader	Reads data files from the Parallel Ocean Program (POP).
AVS UCD Reader	Reads binary or ASCII files stored in AVS UCD format.
Meta File Series Reader	Reads a series of meta images.
Nrrd Reader	Reads raw image files with Nrrd meta data.
FacetReader	Reads ASCII files stored in Facet format.
PNG Series Reader	Reads a PNG file into an image data.
JPEG Series Reader	Reads a series of JPEG files into an time sequence of image datas.
TIFF Series Reader	Reads a series of TIFF files into an time sequence of image datas.
Phasta Reader	Reads the parallel Phasta meta-file and the underlying Phasta files.
Enzo Reader	Reads multi-block dataset from an Enzo file.
Flash Reader	Reads multi-block dataset from a Flash file.
SESAME Reader	Reads SESAME data files, producing rectilinear grids.
CSV Reader	Reads a comma-separated
MFIXReader	Reads a dataset in MFIX file
FLUENTReader	Reads a dataset in Fluent fil
OpenFOAMReader	Reads OpenFOAM data file
COSMO Reader	Reads a cosmology file into
ExodusIIReader	Reads an Exodus II file to pr
Restarted Sim Exodus Reader	Reads collections of Exodus
SLAC Data Reader	
SLAC Particle Data Reader	
Particles Reader	Reads particle data.
VPIC Reader	Reads distributed VPIC files
WindBlade reader	Reads WindBlade/Firetec s
NetCDF CAM reader	Reads unstructured grid dat a cell connectivity file set as
NetCDF POP reader	Reads rectilinear grid data f
Parallel NetCDF POP reader	Reads rectilinear grid data f
NetCDF MPAS reader	Reads unstructured grid MP

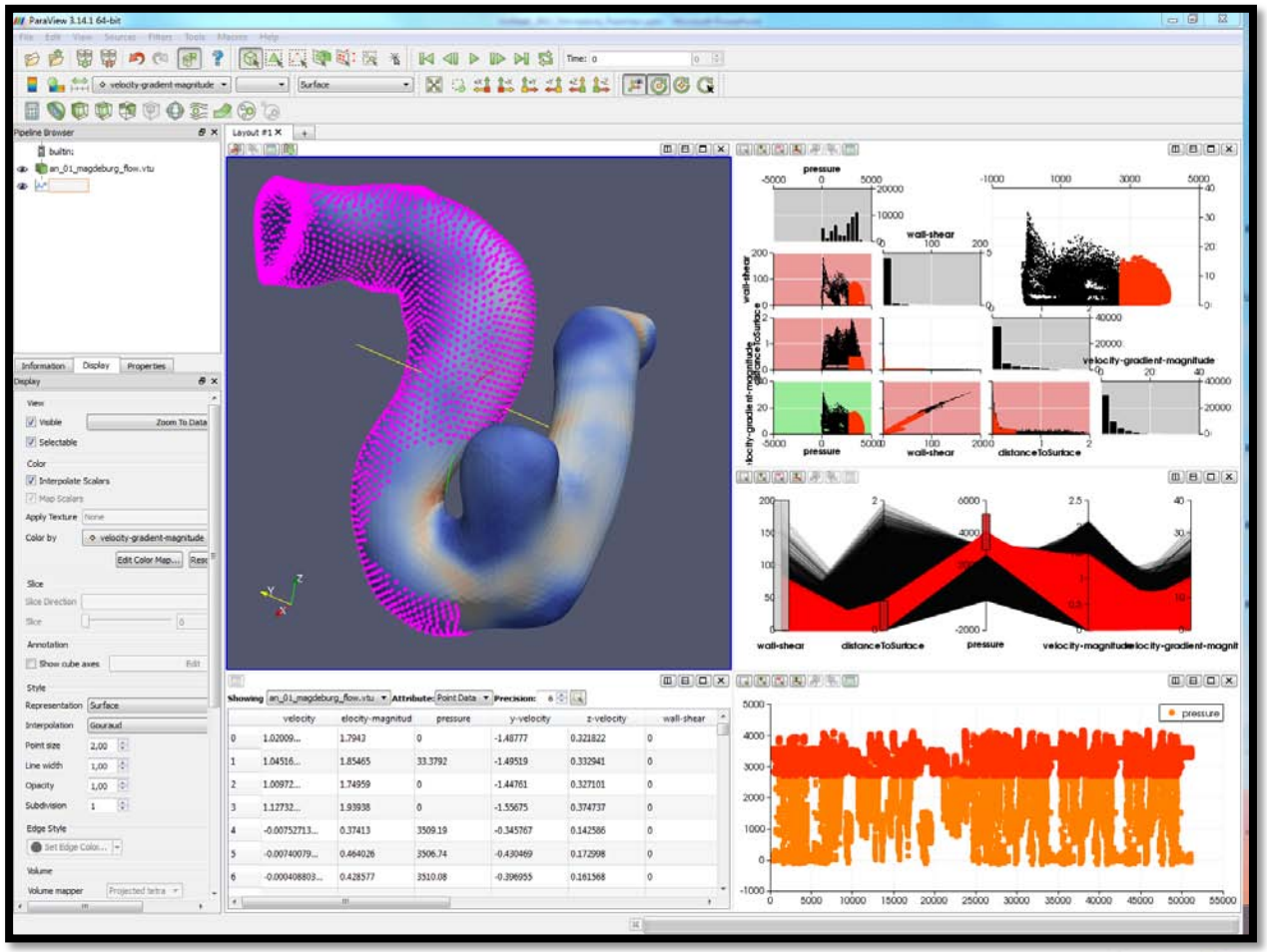
User Interface



Live-Demo

IVA of a Cerebral Aneurysm

- Volume mesh composed of 181K tetrahedra
- 9 vertex attributes and 1 cell attribute



Summary

- ParaView facilitates brushing in physical and attribute space
- Views are linked with each other
- Integrated InfoVis views: table, histogram, scatter plot, scatter plot matrix, parallel coordinates
- Features may be extracted, stored and further investigated
- Analysis sessions may be stored and loaded or even applied to another dataset (works only partially)

- Integrating IVA is a big step in a promising direction
- Drawbacks of current implementation:
  - Workflow and plot GUIs not always intuitive
  - Some minor bugs hamper the workflow

More Tools

- Not many tools incorporate attribute AND physical views
- Latter crucial for scientific data to depict spatial relations
- Other IVA tools (tiny selection):
  - Comvis: www.ii.uib.no/vis/... (send E-mail to: Kresimir Matkovic)
  - Visplore: www.cg.tuwien.ac.at/... (send E-mail to Harald Piringer)

  Include no physical views:
  - GGobi: www.ggobi.org/
  - XmdvTool: davis.wpi.edu/xmdv/

  Include special views for geospatial data:
  - Tulip: tulip.labri.fr/TulipDrupal/ (physical view in related project *Systrip*)
  - Mondrian: rosuda.org/Mondrian/Mondrian.html

  Commercial:
  - Tableau: www.tableausoftware.com/products
  - Spotfire: spotfire.tibco.com/
- Comprehensive, sorted list: www.wikiviz.org/wiki/Tools
- Tools and more information: www.visual-analytics.eu/related/