

ParaView Introduction

Scientific Data Analysis and Visualization for Petascale Computing

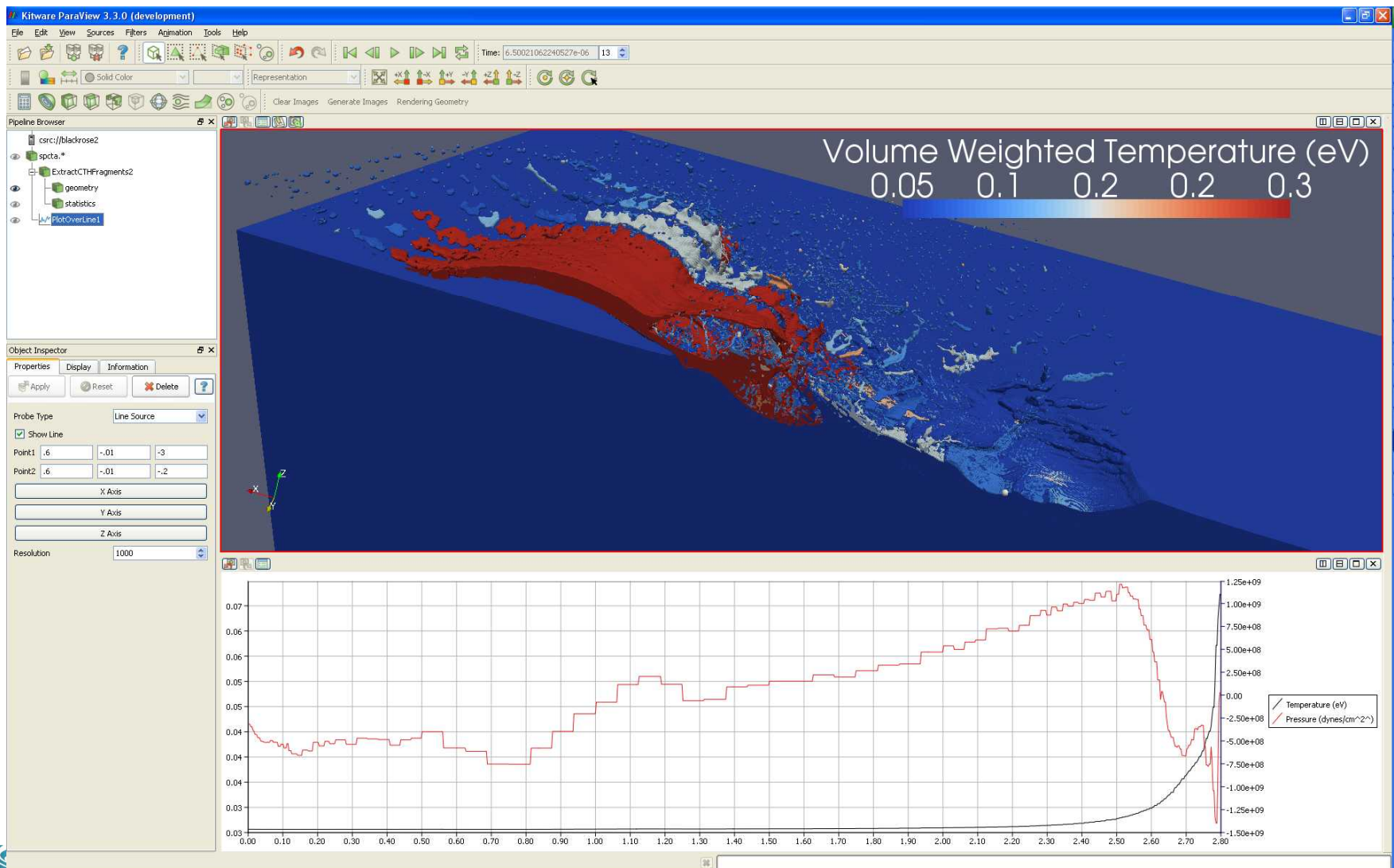
July 28, 2008

Kenneth Moreland
Sandia National Laboratories
SciDAC Institute for Ultrascale Visualization

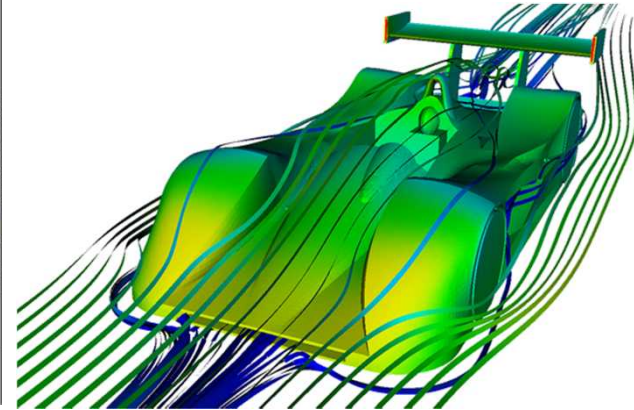
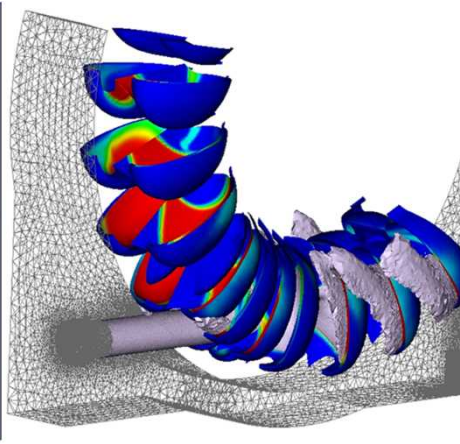
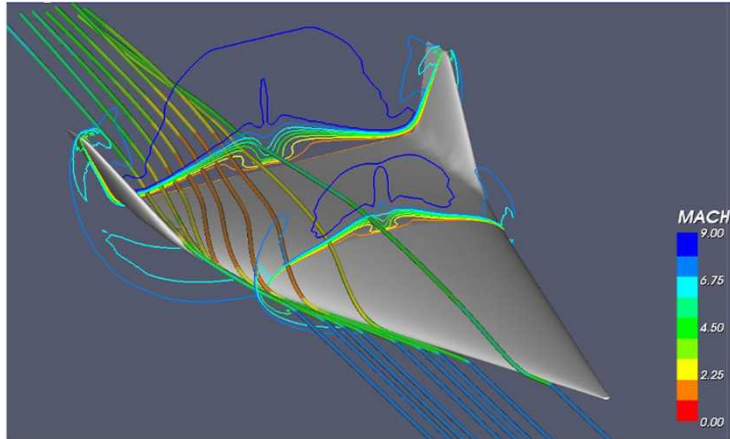


Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company,
for the United States Department of Energy's National Nuclear Security Administration
under contract DE-AC04-94AL85000.

General Visualization with ParaView



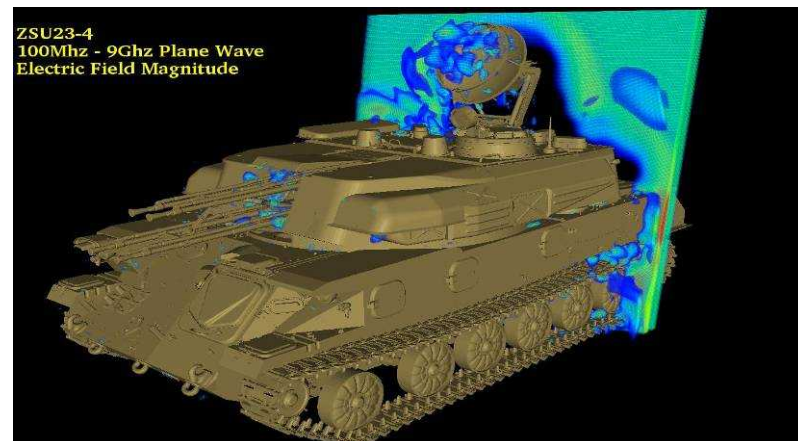
ParaView Usage: Around the World



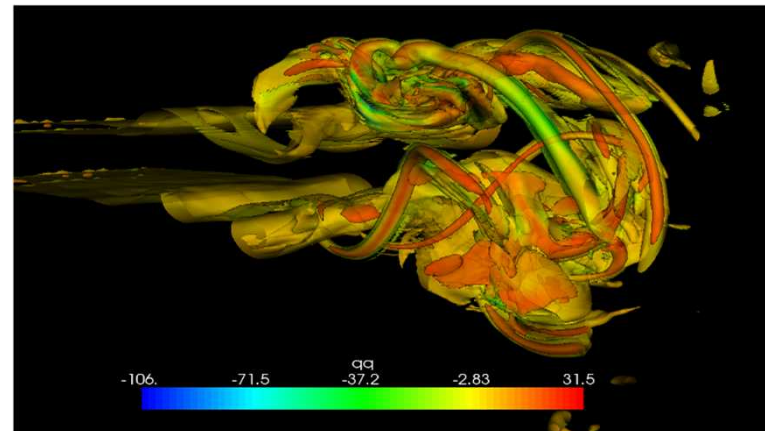
Analysis of the "ELAC" two-stage-to-orbit space system and an analysis of 3D unsteady free surface flows in PELTON turbines, Swiss Supercomputing Center (CSCS).

Sandia and CSCS recently authored two joint papers.

CFD group at NACAD/COPPE/UFRJ,
Rio de Janeiro, Brazil



ZSU23-4 Russian Anti-Aircraft planar wave. 2.5 billion cells, US Army Research Laboratory



DNS simulation of a planar jet. Vorticity norm colored by positive Q criterion. LASEF/IST, Lisboa, Portugal



ParaView used World Wide

DOE

INEEL: Idaho National Engineering and Environmental Laboratory

KAPL: Knolls Atomic Power Lab

LANL : Los Alamos National Lab.

LBNL : Lawrence Berkeley National Lab

National Energy Technology Laboratory

Pittsburgh Supercomputing Center

PNNL: Pacific Northwest National Laboratory

SNL: Sandia National Laboratories

DOD

ARL: Army Research labs

ERDC: Engineer Research and Development Center

MSRC : US Army Research Laboratory Major Shared Resource Center

NAVO: Naval Oceanographic Office

Notable

AWE: Atomic Weapons Establishment in UK

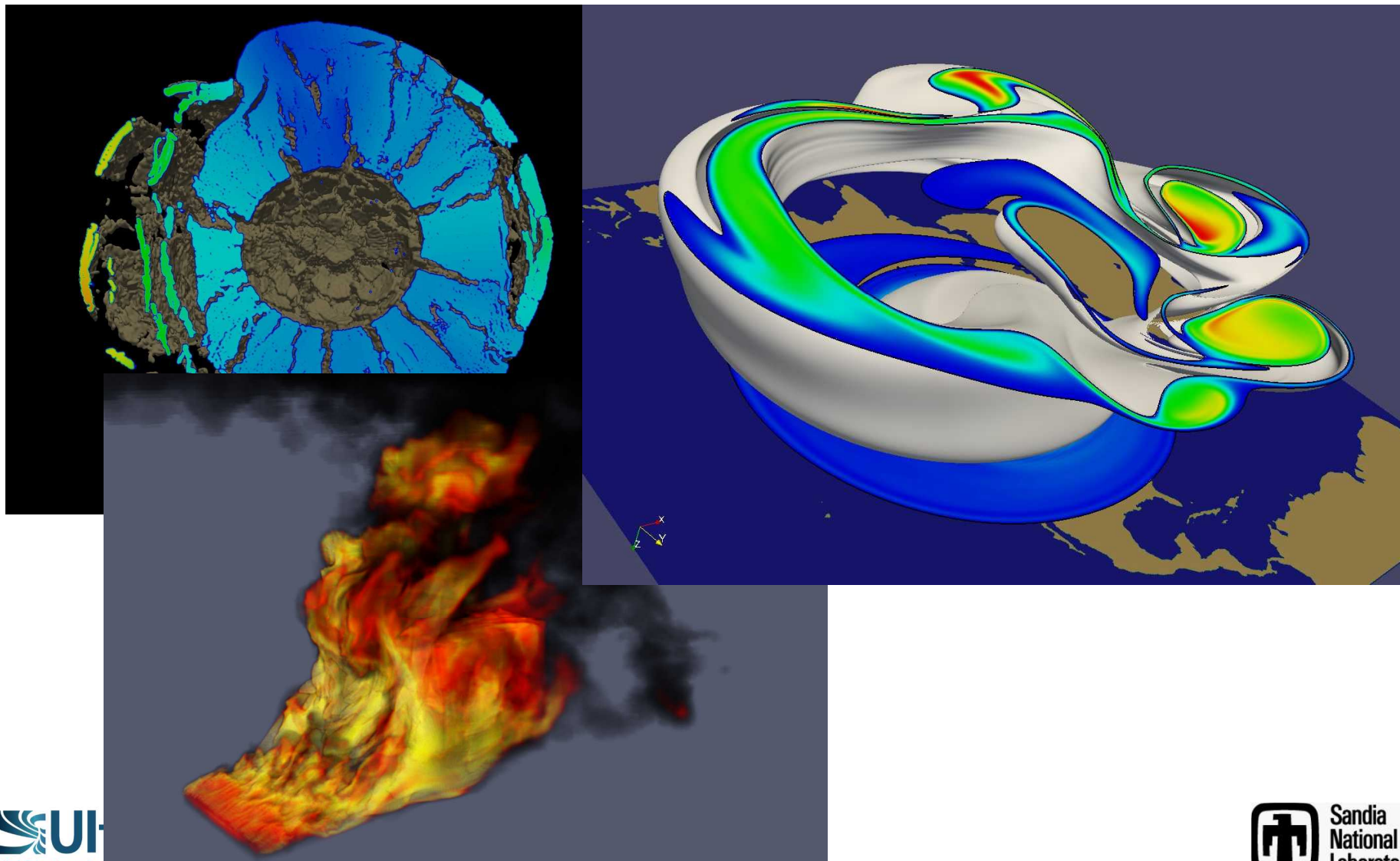
CSCS: Swiss National Supercomputer Center

Other

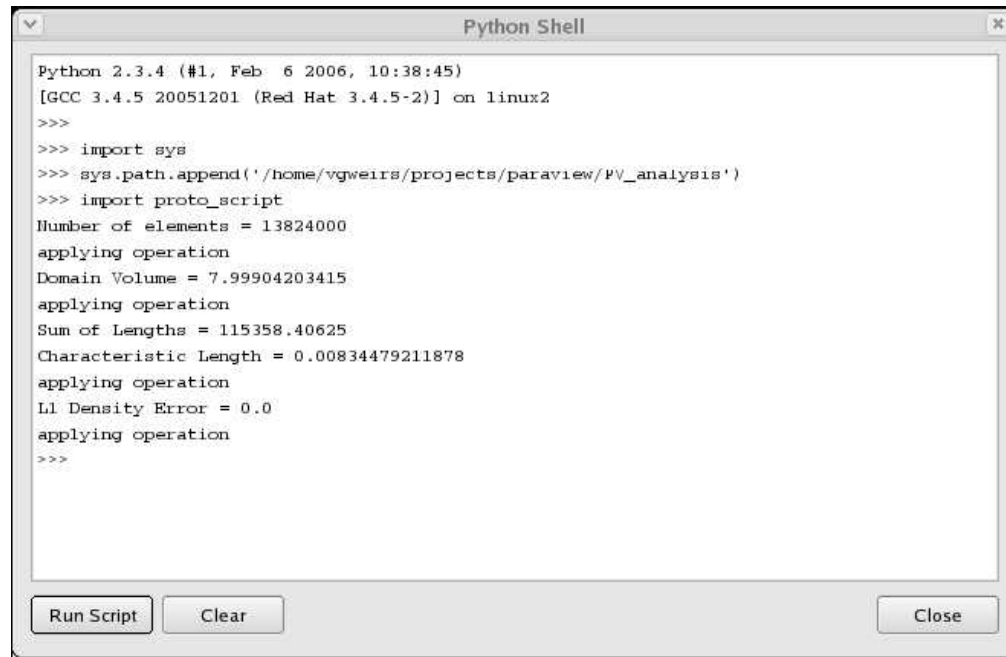
Stanford Linear Accelerator Center
Mirarco - Mining Innovation
EDF - Electricity de France
Alabama A&M University
Australian Centre for Field Robotics, Univ Of Sydney
Chalmers UoT (Sweden)
Charité
CNRS Centrale Paris
Curtin Univ. of Technology Sarawak Campus
Delft University of Technology
EPFL : Ecole Polytechnique Federal de Lausanne
ETH : Swiss Federal Institute of Technology, Zurich
Federal University of Rio de Janeiro
Golder Associates Ltd.
Goodyear
Indiana University
Lone Wolf Bioscience
Manchester Metropolitan University
Mario Negri Institute
FhG-IWM : The Fraunhofer Institute for Mechanics of Materials IWM
Centre for Biomedical Image Analysis, Faculty of Informatics Brno, Czech Republic
INRIA : French National Institute for Research in Computer Science and Control
Laboratoire de Mécanique des Fluides et d'Acoustique - Ecole Centrale de Lyon - France
LME: Laboratoire de Mécanique et d'Energétique (LME), Université de Valenciennes
ONERA: Office National d'Études et de Recherches Aérospatiales (France)
UT (University of Texas) Southwestern Medical Center
Moceon
National Research Council of Canada
North West Research Associates, CORA division
OpenCFD Ltd
Rolls-Royce
SRI International
Rensselaer Polytechnic Institute (RPI)
University Of Maryland at College Park
TU (Technische Universität) Darmstadt
TU (Technische Universität) Hamburg
UNAM : Universidad Nacional Autónoma de México
Univ of Manitoba
Universite Bordeaux
Université de Liège
University of Antwerp
University of Edinburgh, Edinburgh, UK
University of Jyväskylä
University of Pau - France
University of Texas
University of Toulouse



ParaView Usage: Large Scale Visualization

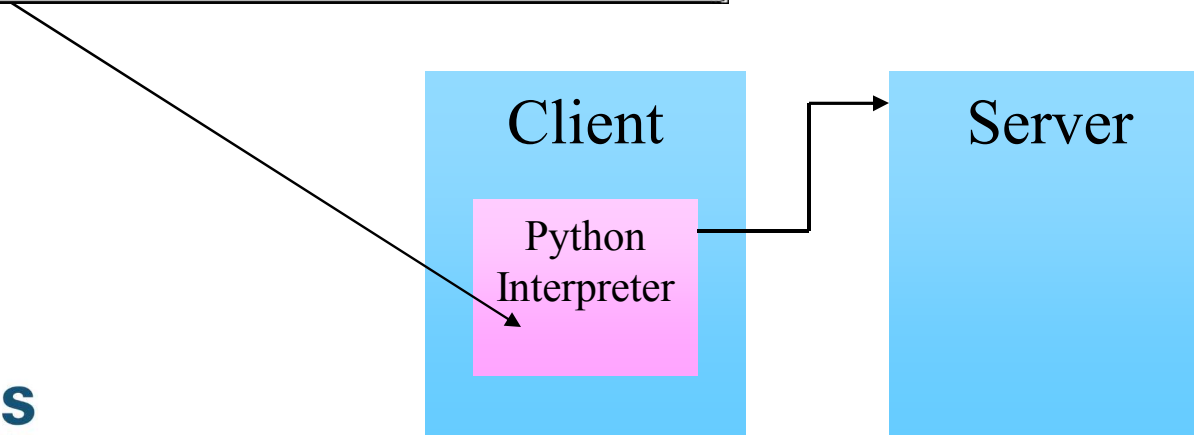


ParaView Usage: Scripting, Client Side

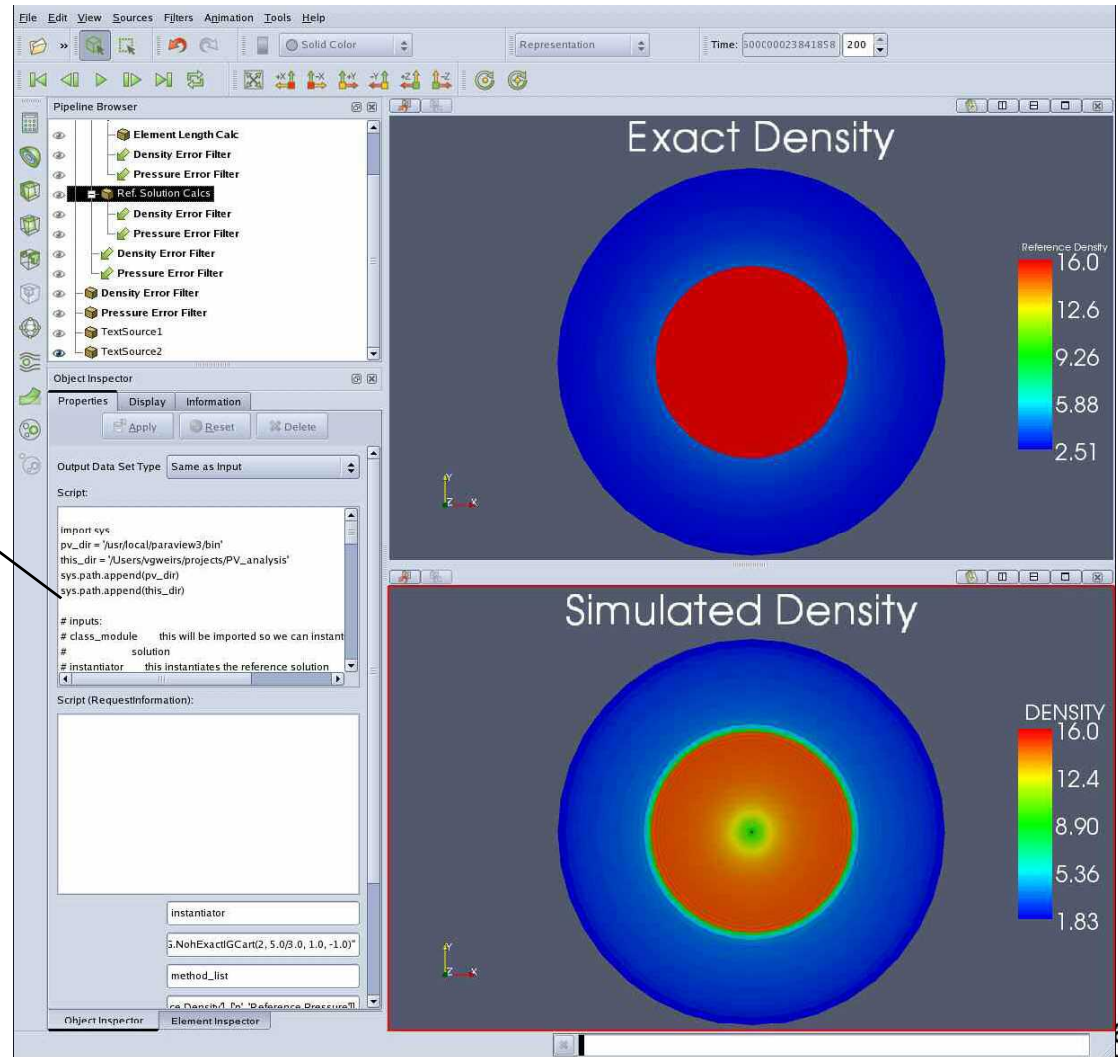
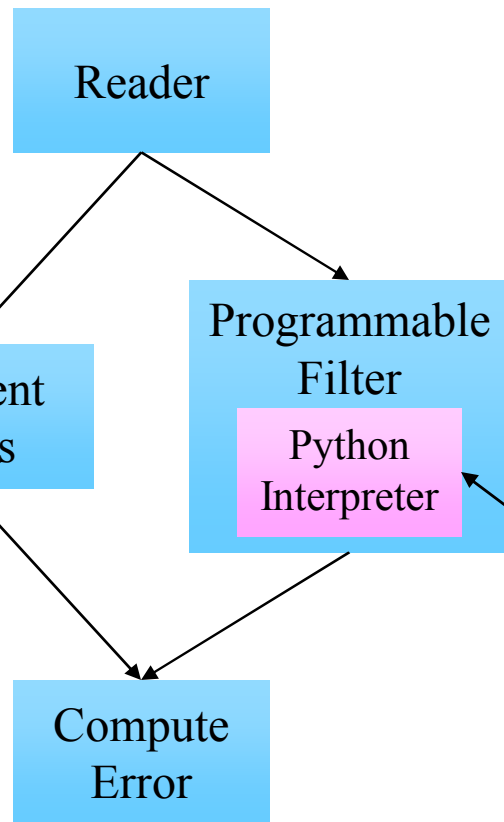


```
Python 2.3.4 (#1, Feb  6 2006, 10:38:45)
[GCC 3.4.5 20051201 (Red Hat 3.4.5-2)] on linux2
>>>
>>> import sys
>>> sys.path.append('/home/vgweirs/projects/paraview/PV_analysis')
>>> import proto_script
Number of elements = 13824000
applying operation
Domain Volume = 7.99904203415
applying operation
Sum of Lengths = 115358.40625
Characteristic Length = 0.00834479211878
applying operation
LI Density Error = 0.0
applying operation
>>>
```

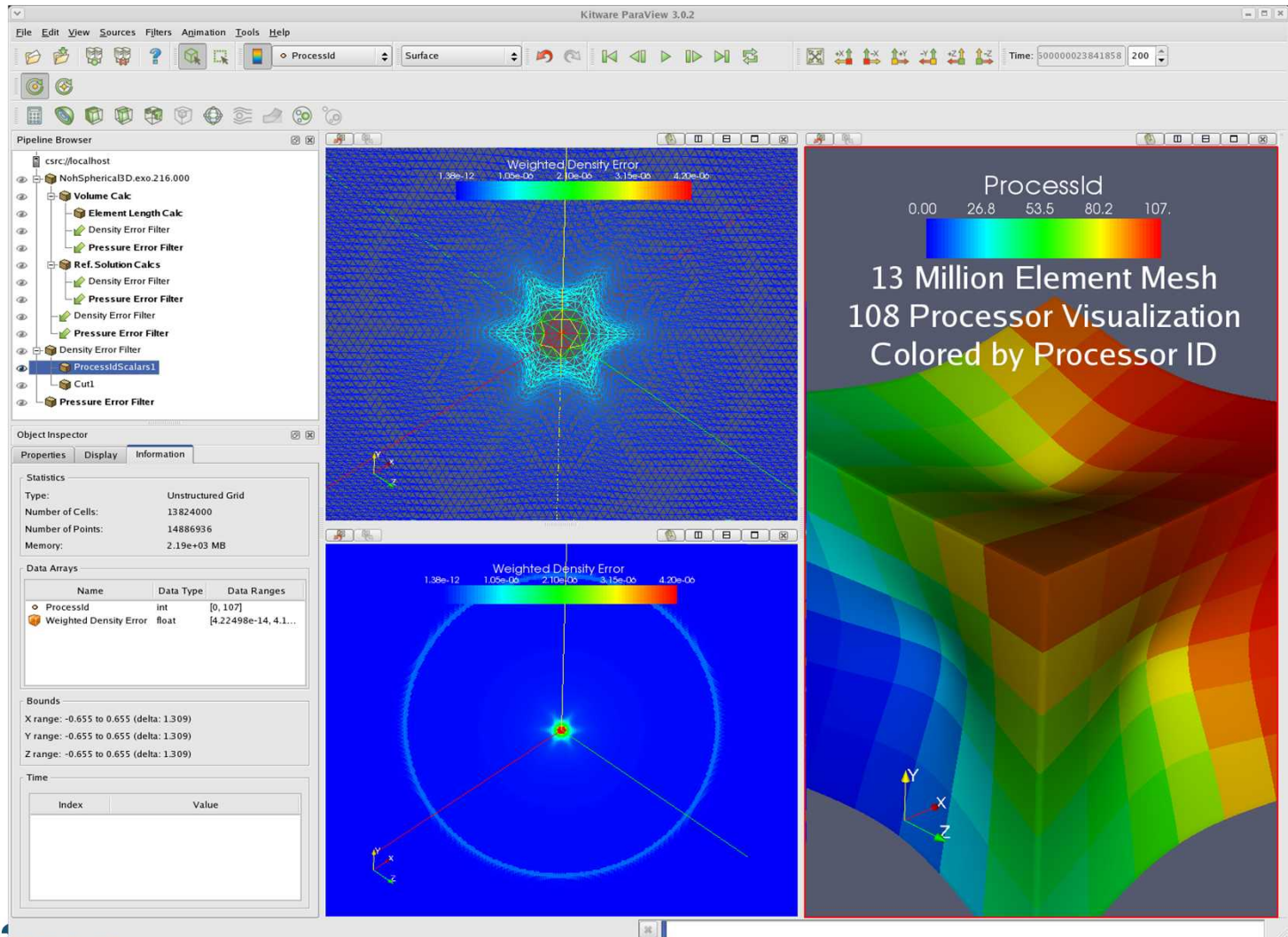
The screenshot shows a 'Python Shell' window with a standard Linux terminal interface. It displays the execution of a script that imports 'proto_script' and performs several operations on a dataset, including calculating the number of elements, domain volume, sum of lengths, characteristic length, and LI density error. The output is formatted with labels like 'applying operation' before each result line.



ParaView Usage: Scripting, Server Side

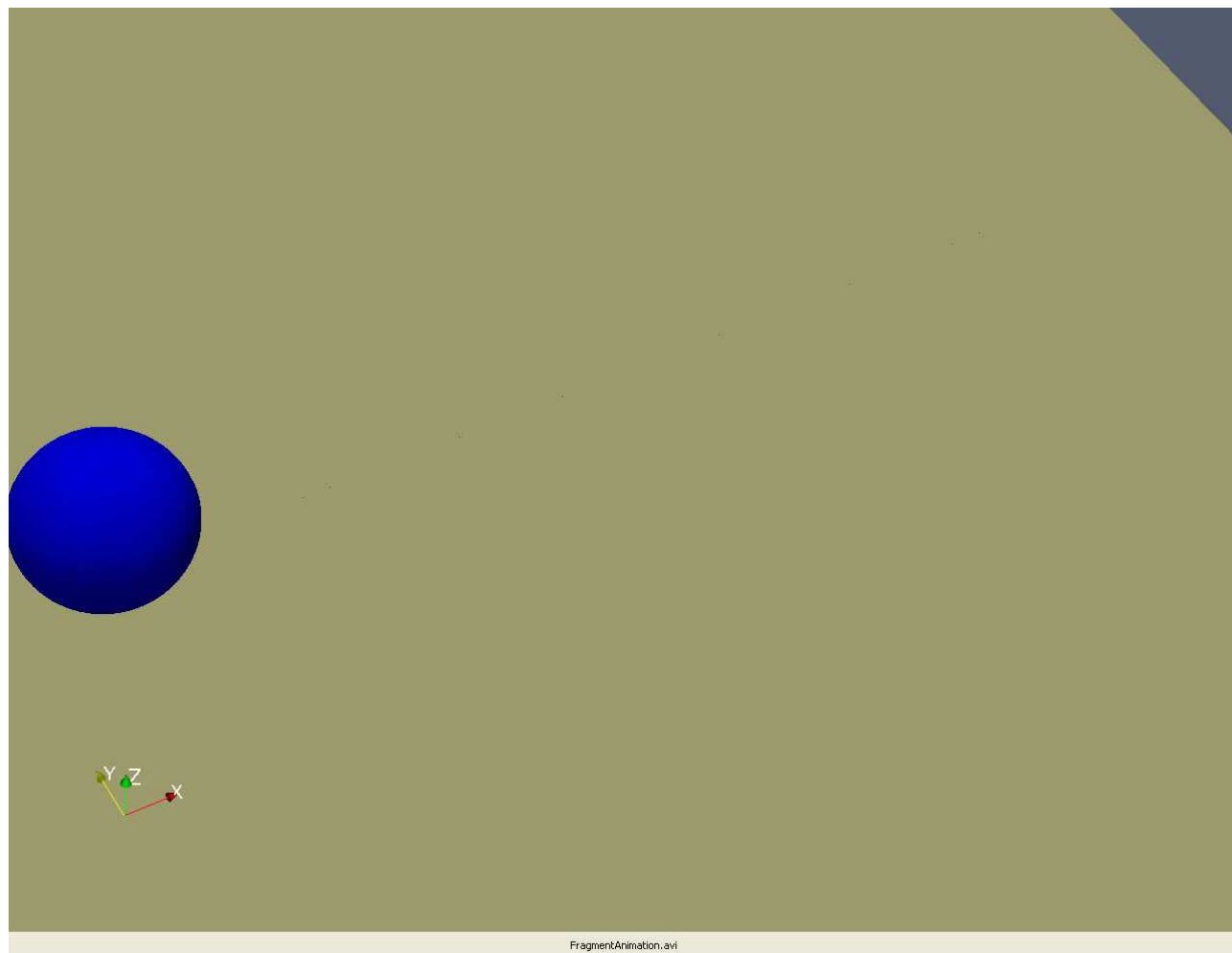
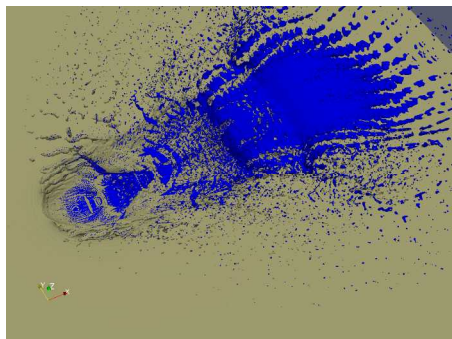
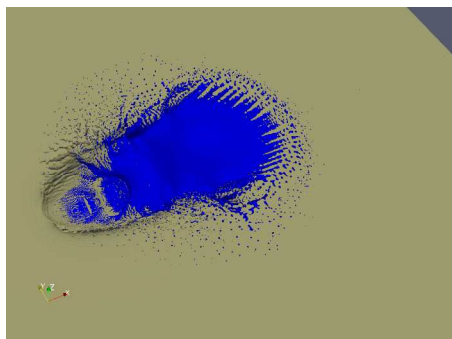
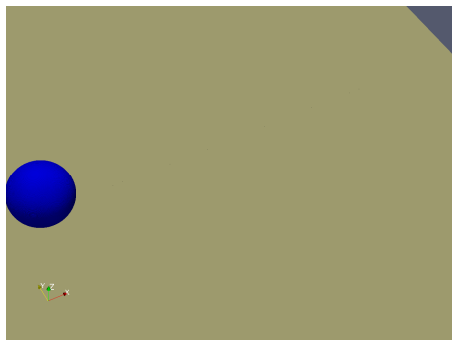


ParaView Usage: Scripting Scalability

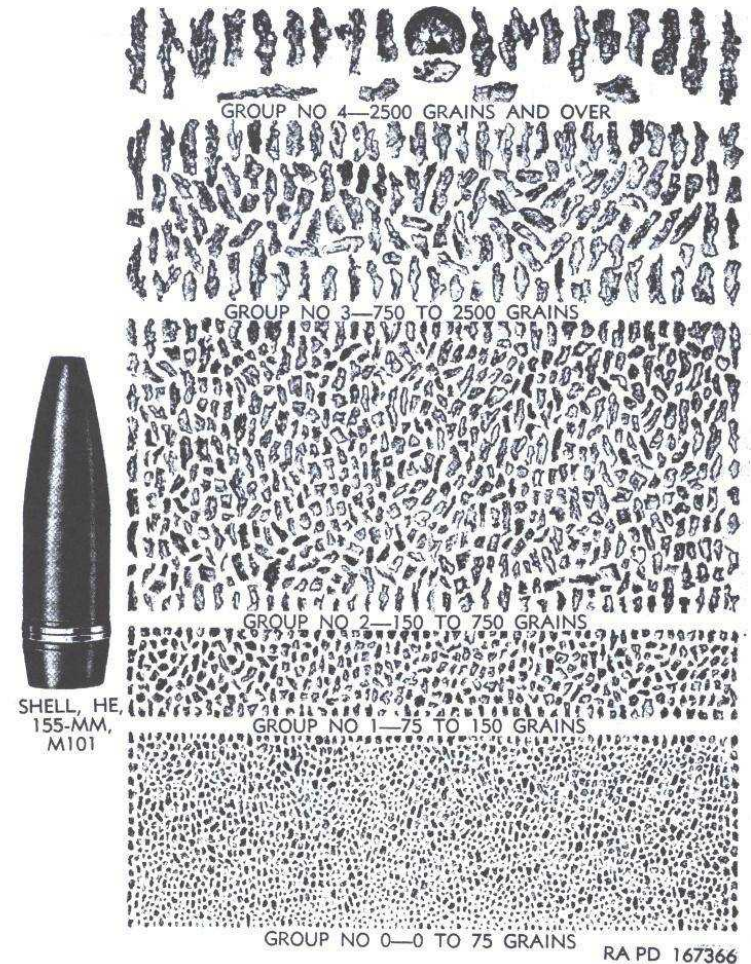
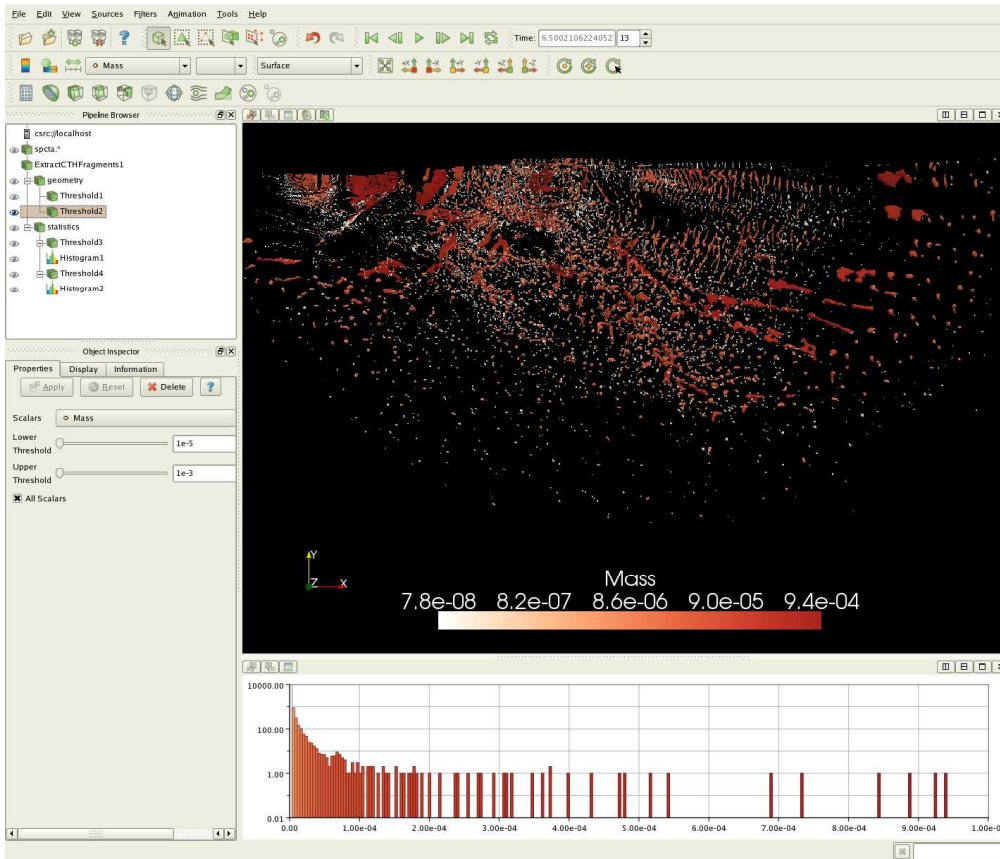




ParaView Usage: Large Data Fragmentation Analysis



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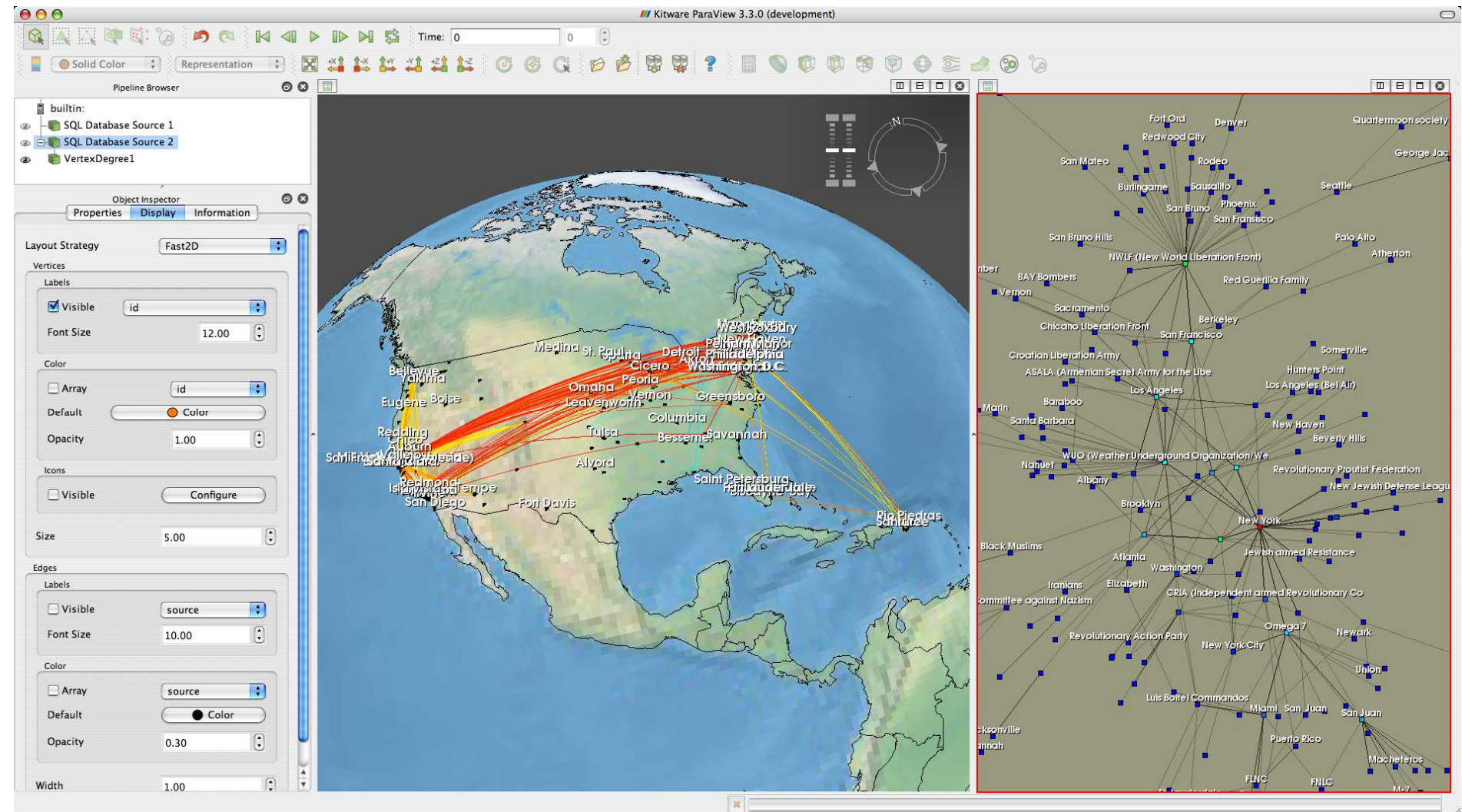




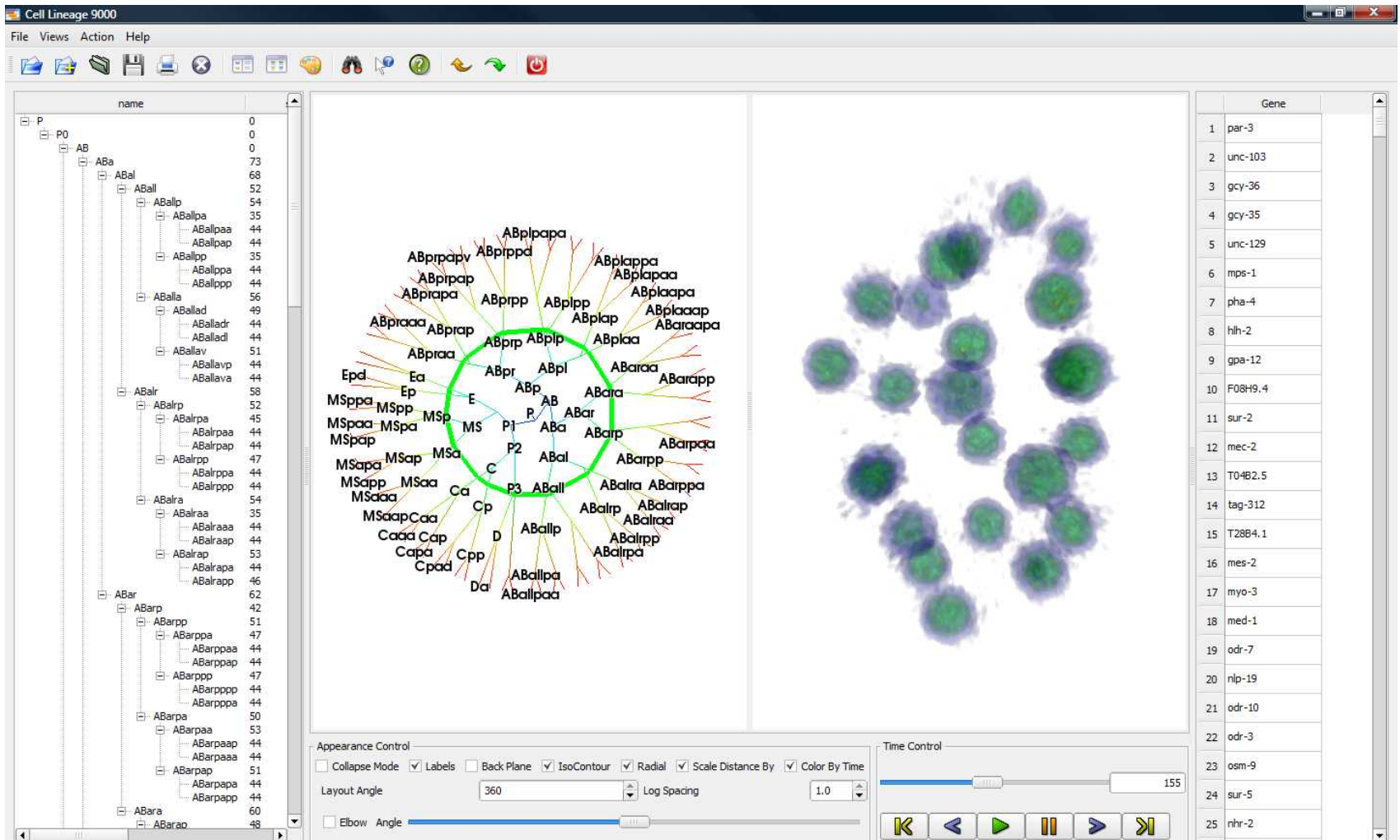
ParaView Availability

- Free to download and use (www.paraview.org).
- Cross platform.
 - Windows, Mac OS X, Unix (Linux, AIX, HP, Sun, IRIX, ...).
- Parallel Processing Servers.
 - Linux-based clusters (with and without GPU).
 - BlueGene/L.
 - Cray XT3 (RedStorm) (batch processing only).
 - ASC Purple.

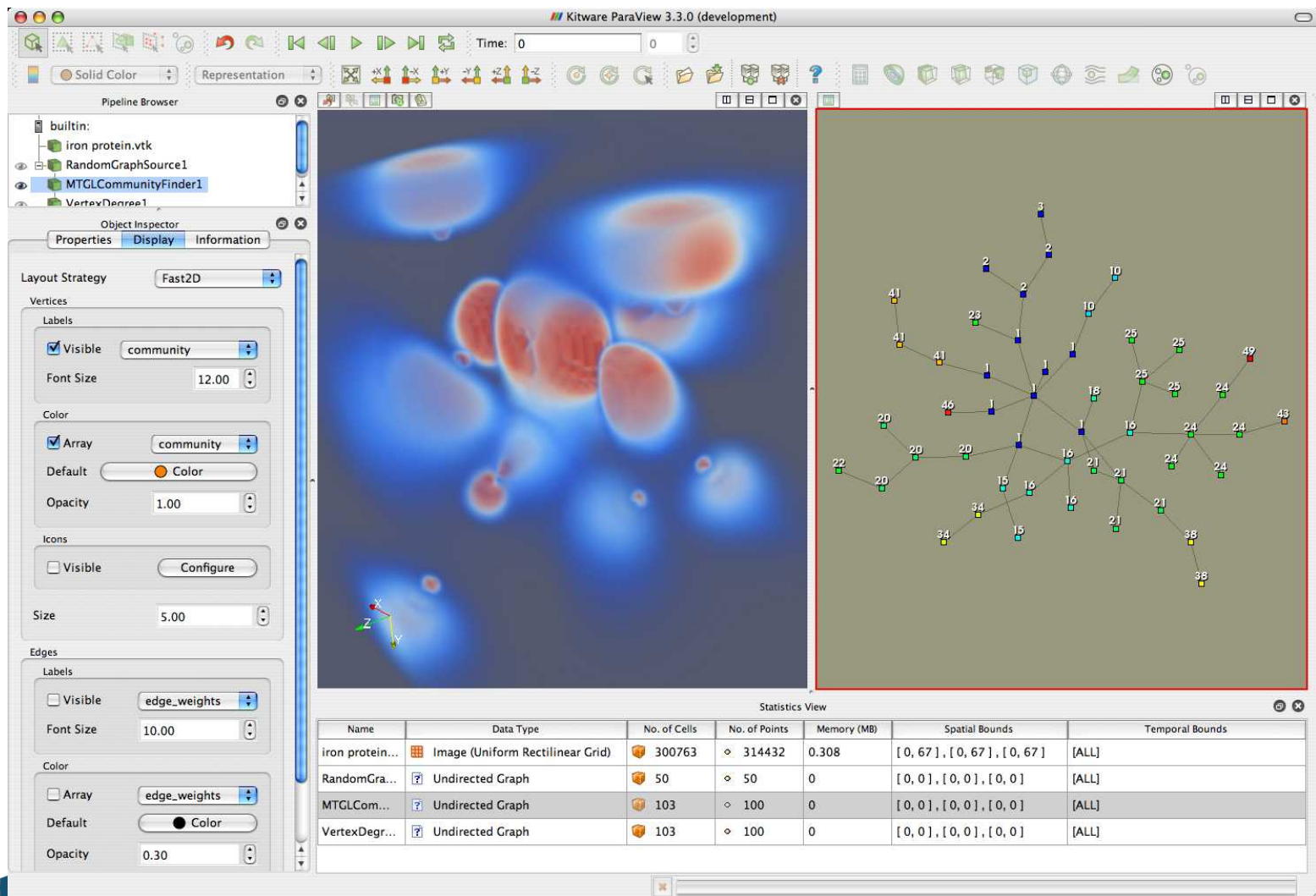
Future Work: InfoVis



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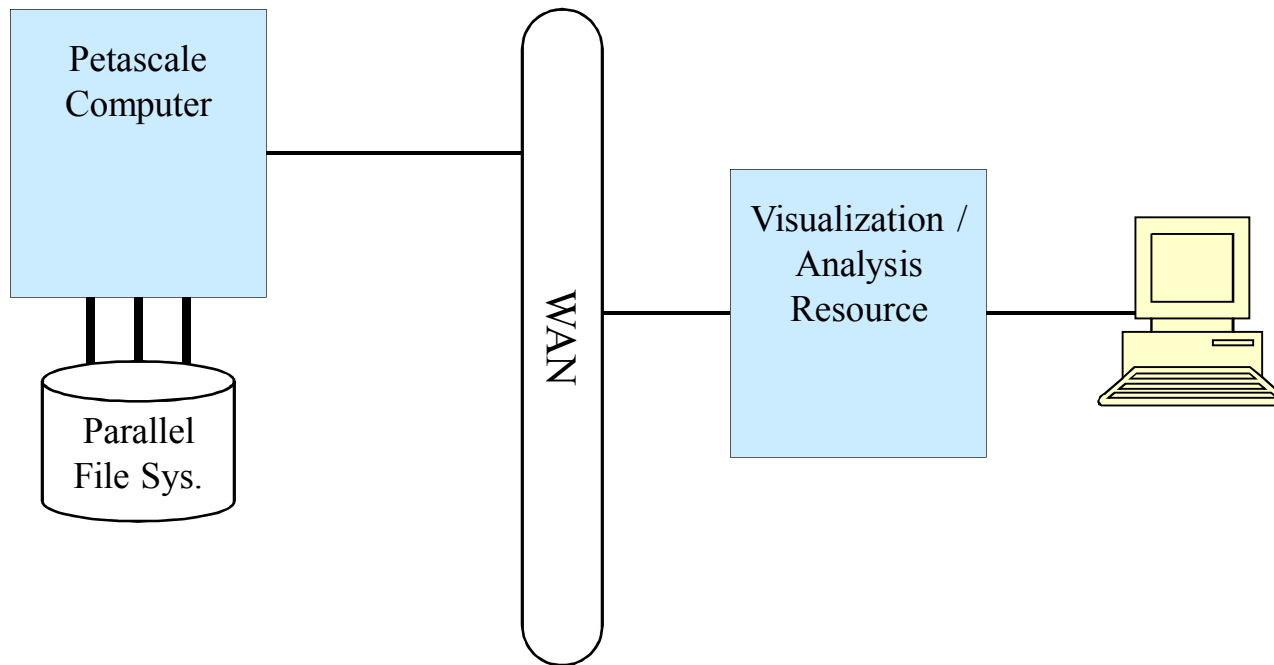


Future Work: InfoVis



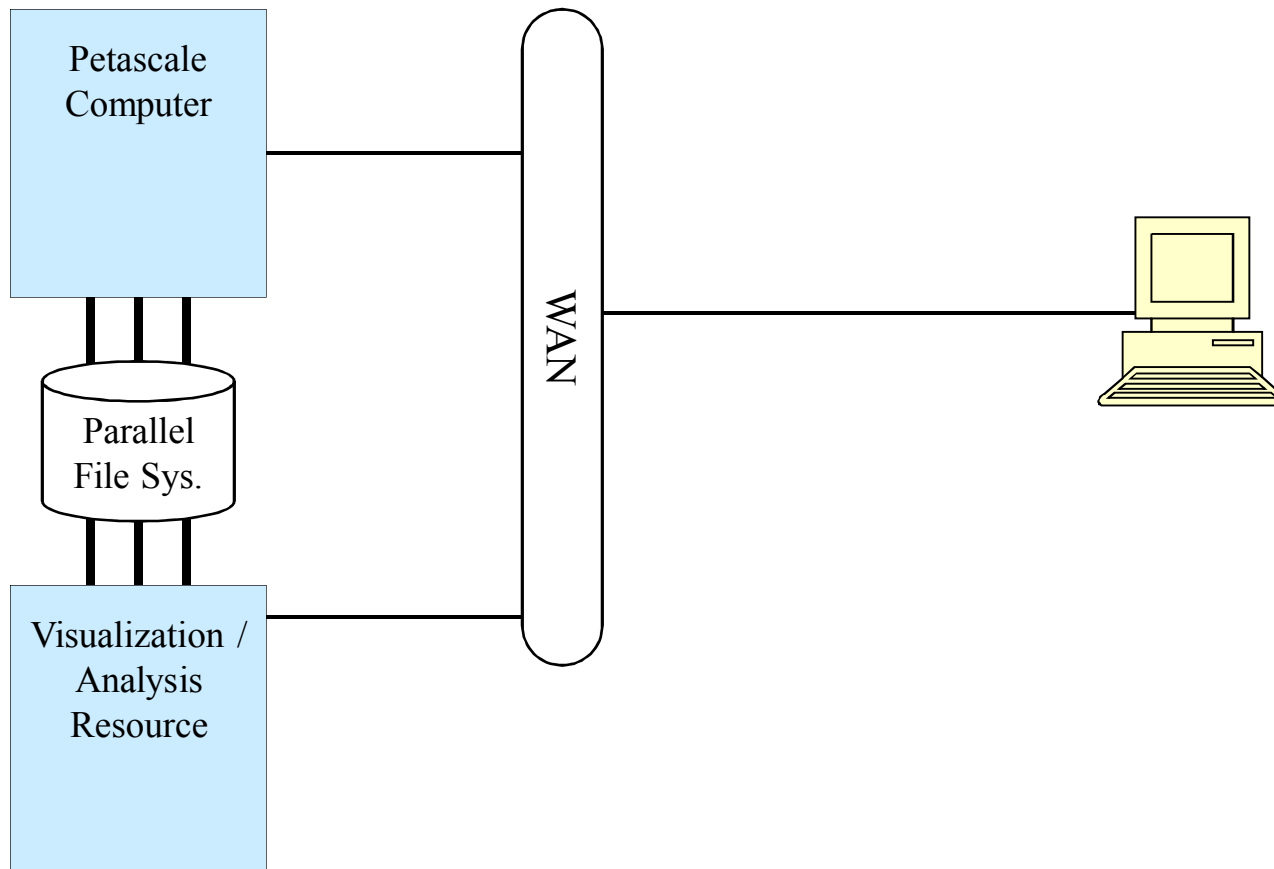


Future Work: I/O Dominating Factor

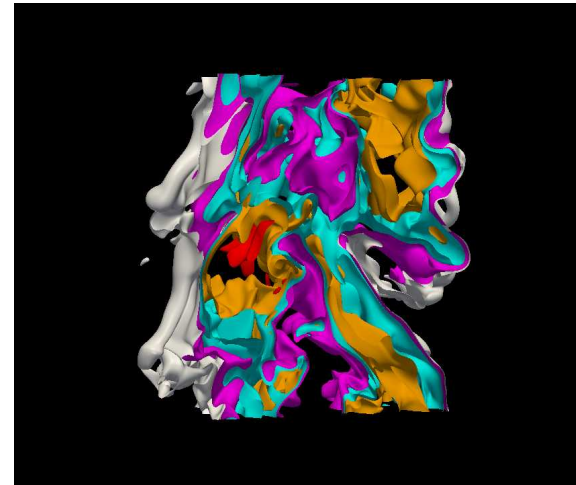
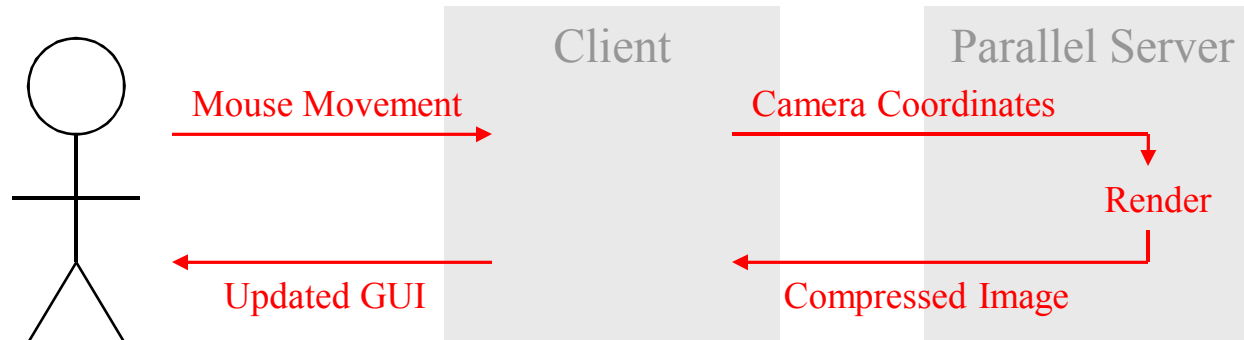




Future Work: I/O Dominating Factor

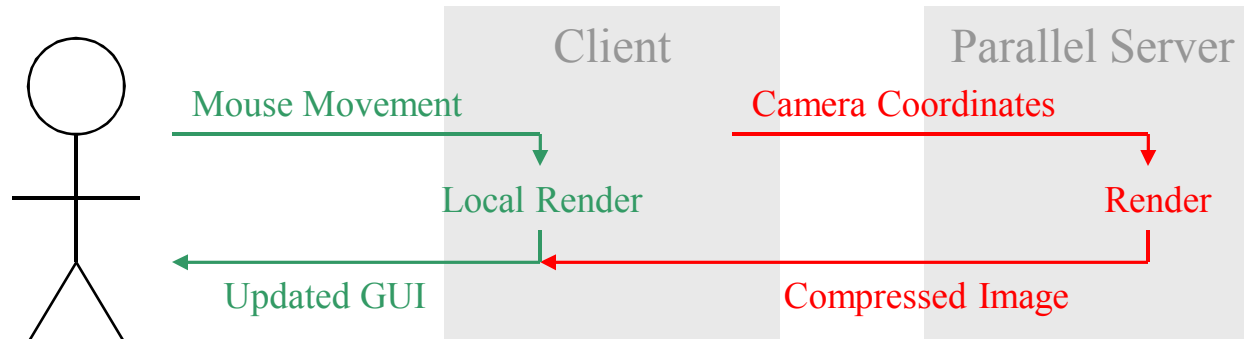


Future Work: Latency Tolerant Remote Rendering

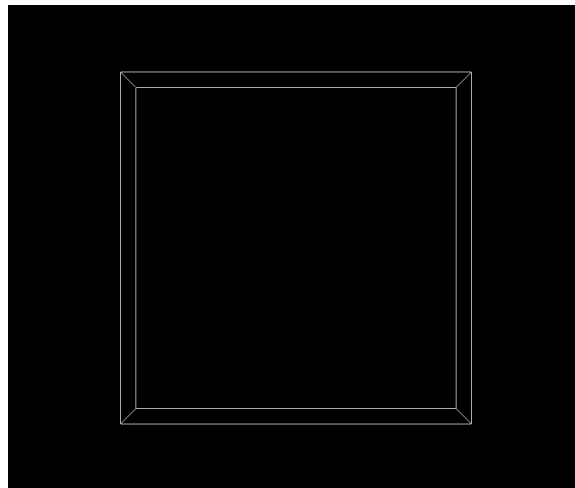


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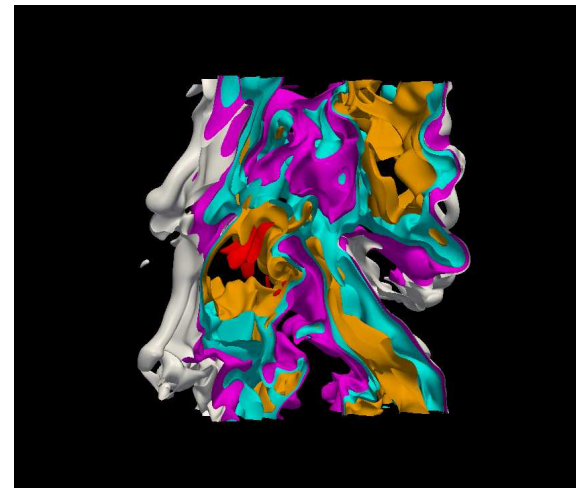
Future Work: Latency Tolerant Remote Rendering



- Approximate Interactive Render
- Full Quality Still Render

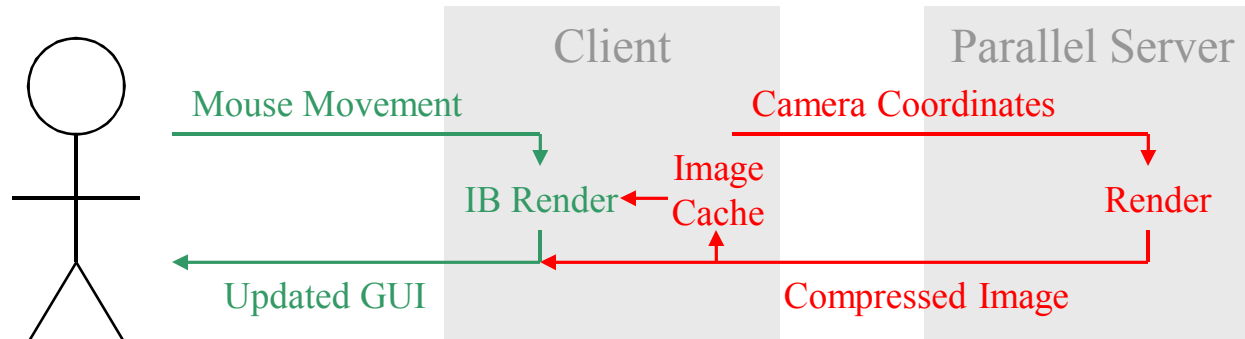


< 0.05 seconds

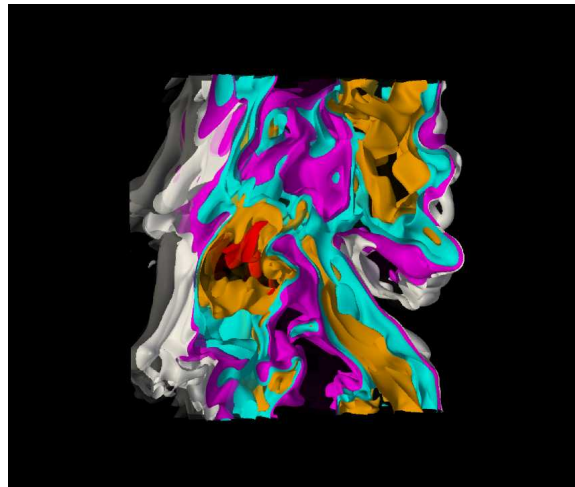


> 1 second

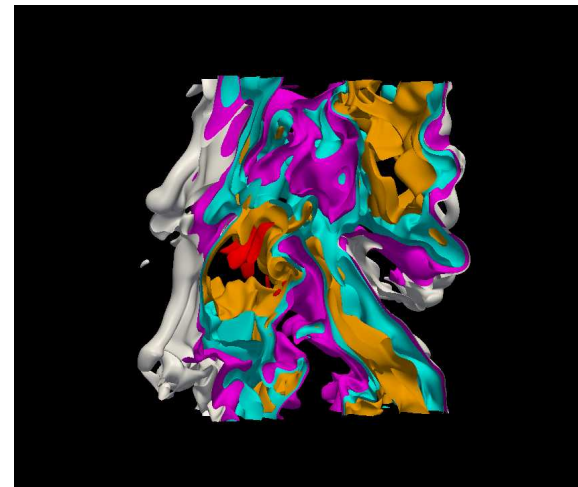
Future Work: Latency Tolerant Remote Rendering



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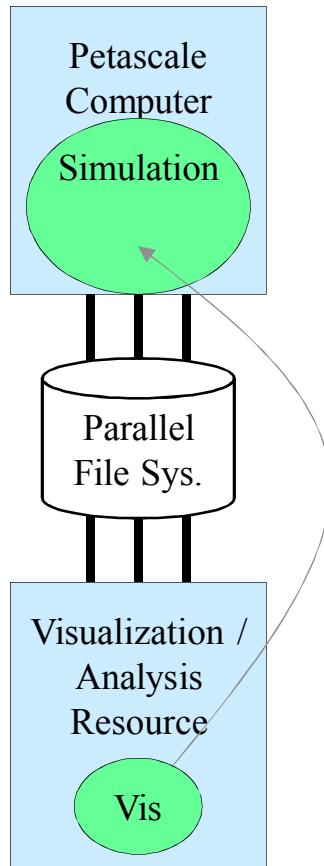


< 0.05 seconds



> 1 second

Future Work: I/O Dominating Factor





fin