



UltraVis

SciDAC Institute for Ultrascale Visualization

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Sandia National Laboratories



Mission

The mission of the UltraVis Institute is to enable extreme-scale knowledge discovery by advancing the state of visualization technologies, fostering awareness of and communication about new visualization technologies, and by putting these technologies into the hands of application scientists, especially SciDAC application teams. These goals are being achieved by:

- **Performing basic research in algorithms, interfaces, and architectures for visualization, publishing the results of the work, and incorporating successful technologies into a handful of state-of-the-art tools for knowledge discovery across multiple application domains**
- **Working one-on-one with SciDAC application scientists to accelerate the adoption of Institute tools by these teams**
- **Organizing workshops, panels, and tutorials that foster interaction within the community and between visualization experts and application scientists**
- **Educating the next generation of visualization researchers**



Ultravis Institute Investigators

- **Director: Kwan-Liu Ma, UC Davis (parallel visualization)**
- **Associate Director: Robert Ross, ANL (parallel I/O)**

- **Jian Huang, University of Tennessee (distributed visualization)**
- **Greg Humphreys, University of Virginia (parallel systems)**
- **Nelson Max, UCD (rendering algorithms and flow visualization)**
- **Kenneth Moreland, Sandia National Laboratory (visualization tools)**
- **John Owens, UCD (graphics hardware)**
- **Han-Wei Shen, The Ohio State University (visualization algorithms)**



Research

- **Science application driven**
- **Enabling scientists to see the previously unseen and more effectively communicate with others their findings**
- **Parallel visualization**
- **In situ visualization**
- **Novel interface and interaction designs**
- **Advanced flow visualization techniques**
- **Trustworthy visualization**
- **Scalable visualization**
- **Integrated solutions**
- **Remote and collaborative visualization**



Ongoing and Following Projects

- In situ data reduction and packing, and visualization
- Feature extraction, tracking, and classification
- Remote and collaborative visualization/analysis interfaces
- Novel flow visualization techniques
- Time-varying multivariate data visualization
- Multi-GPU computing
- Parallel visualization algorithms and libraries
- Visual analysis of Leadership Computing System Performance
- Next generation visualization systems



SciDAC Collaborators

- **VACET (MultiGPU applications, multivariate data vis, workshops)**
- **SDM (Vis/analysis dashboard, indexing)**
- **CDEPS (Data transferring)**
- **CScADS (Workshops)**
- **ESG-2 (web interfaces for climate modeling)**
- **CSCAPES (mesh partitioning, mesh visualization)**
- **Petascale Data Storage Institute (test cases for POSIX I/O)**
- **COMPASS**
- **CEMM**
- **GPS-TTBP**
- **GSEP**
- **Groundwater Simulations**
- **Climate Modeling**
- **Supernova Simulations**
- **Combustion Simulations**

Outreach and Education

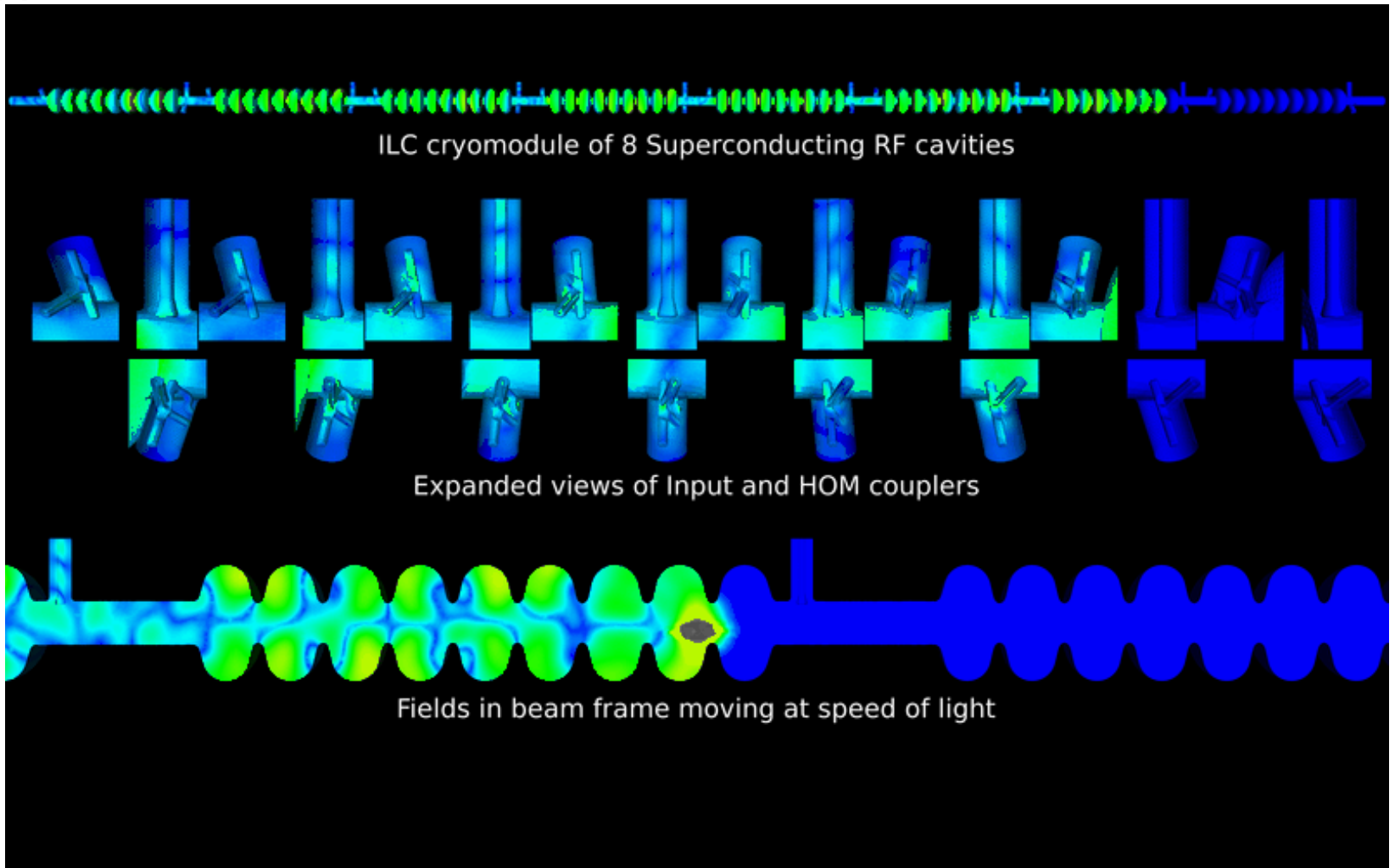
- **Workshops: Annual Ultrascale Visualization Workshop**
- **Tutorials: SC, VisWeek, SIGGRAPH, SIAM, ...**
- **Courses: UCD, UVA, UT, Ohio State**
- **Panels: Meet the Scientists, ...**
- **Data repositories: VisFiles**
- **Beyond SciDAC: NOAA, Harvard Smithsonian Center for Astrophysics, NCAR, NSF PetaApps Earthquake Modeling Project, ...**
- **Upcoming: Software deployment and distributions, benchmarks, International collaborations, webcast lectures, ...**



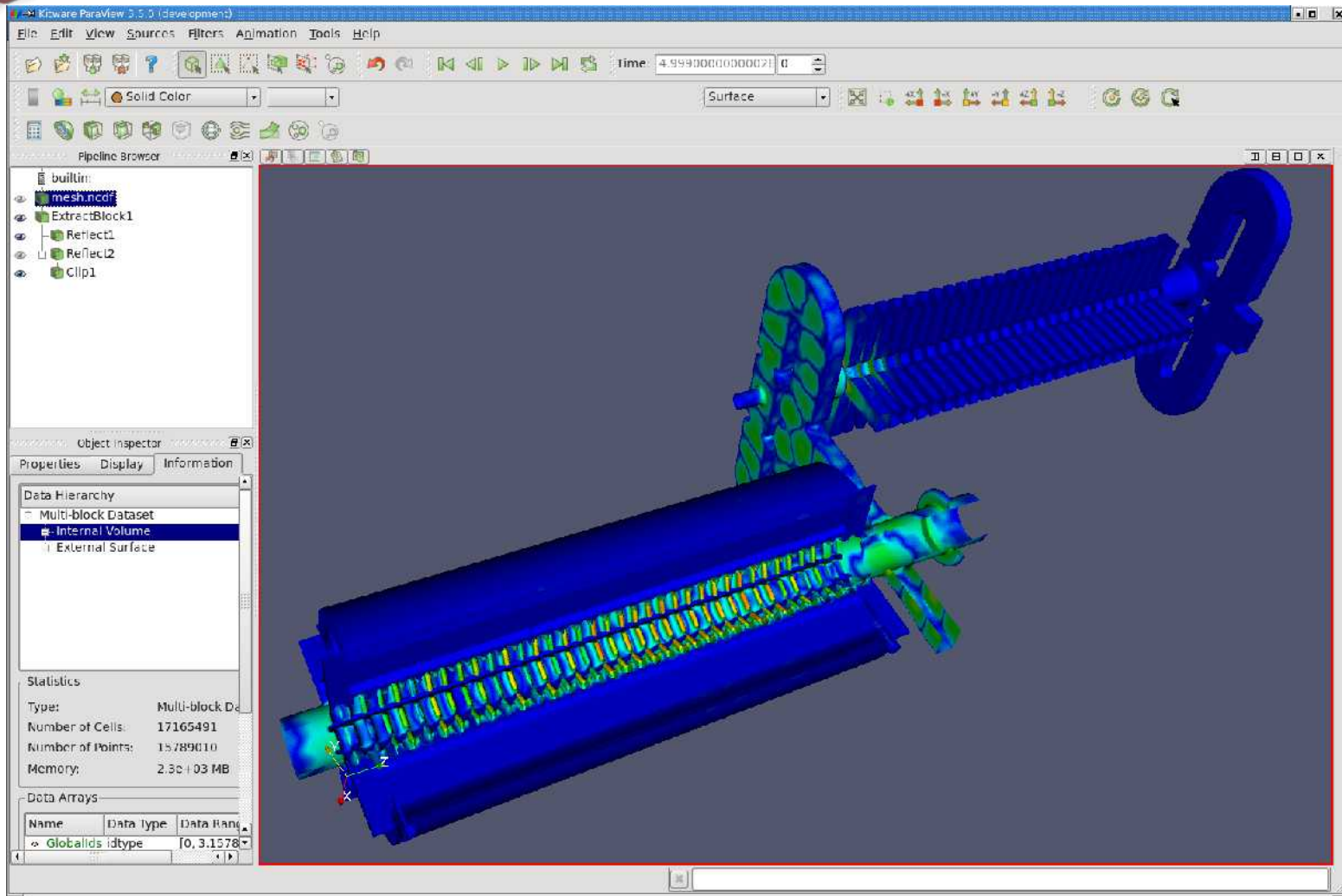
Software

- **Research prototype systems**
- **Direct deployment in the scientist's laboratory**
- **Open Source Software Distribution via ParaView**
- **Libraries**
- **Tech Transfer to Commercial Software Toolkits**

SLAC/COMPASS

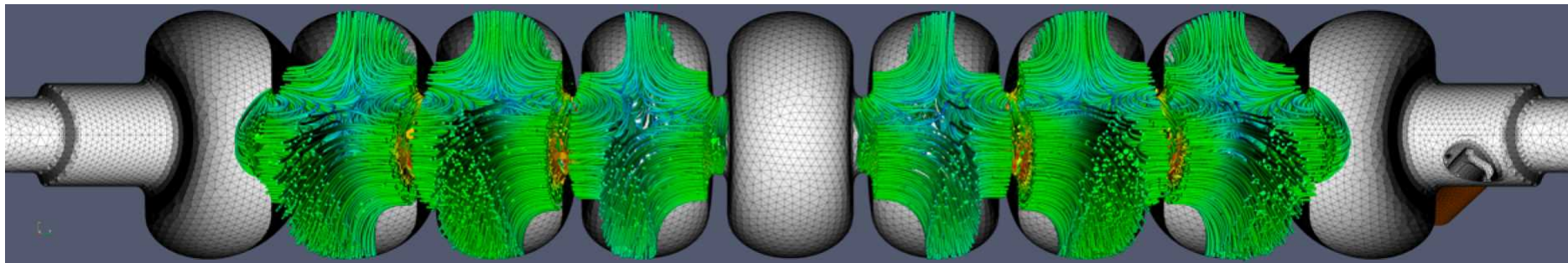
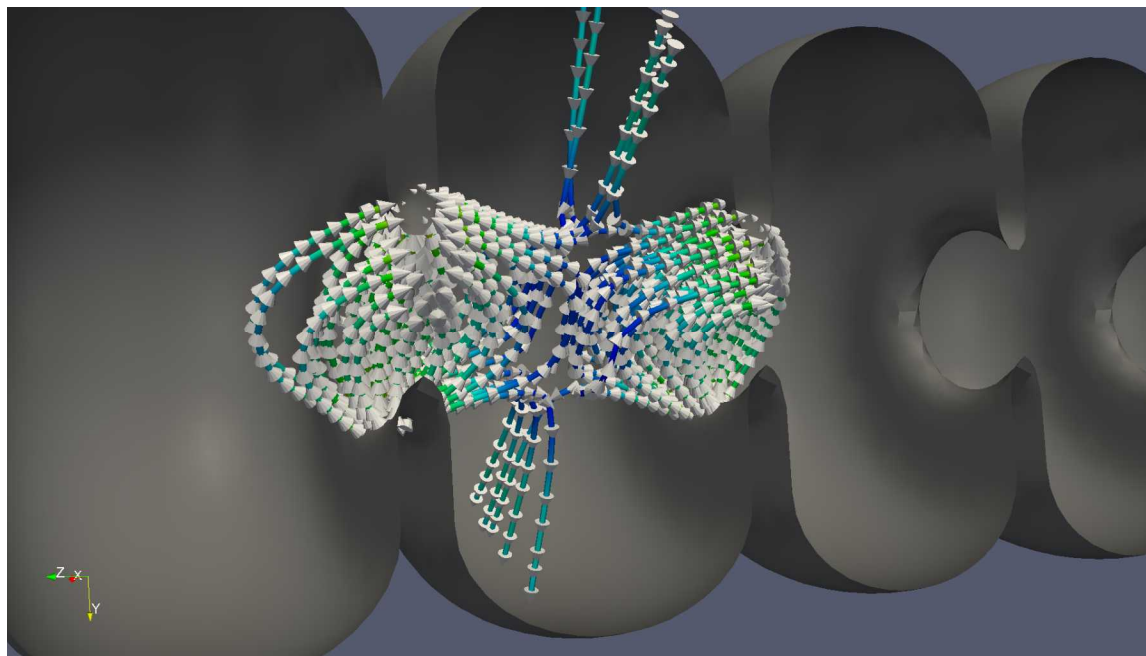


ParaView Adoption for Parallel Vis

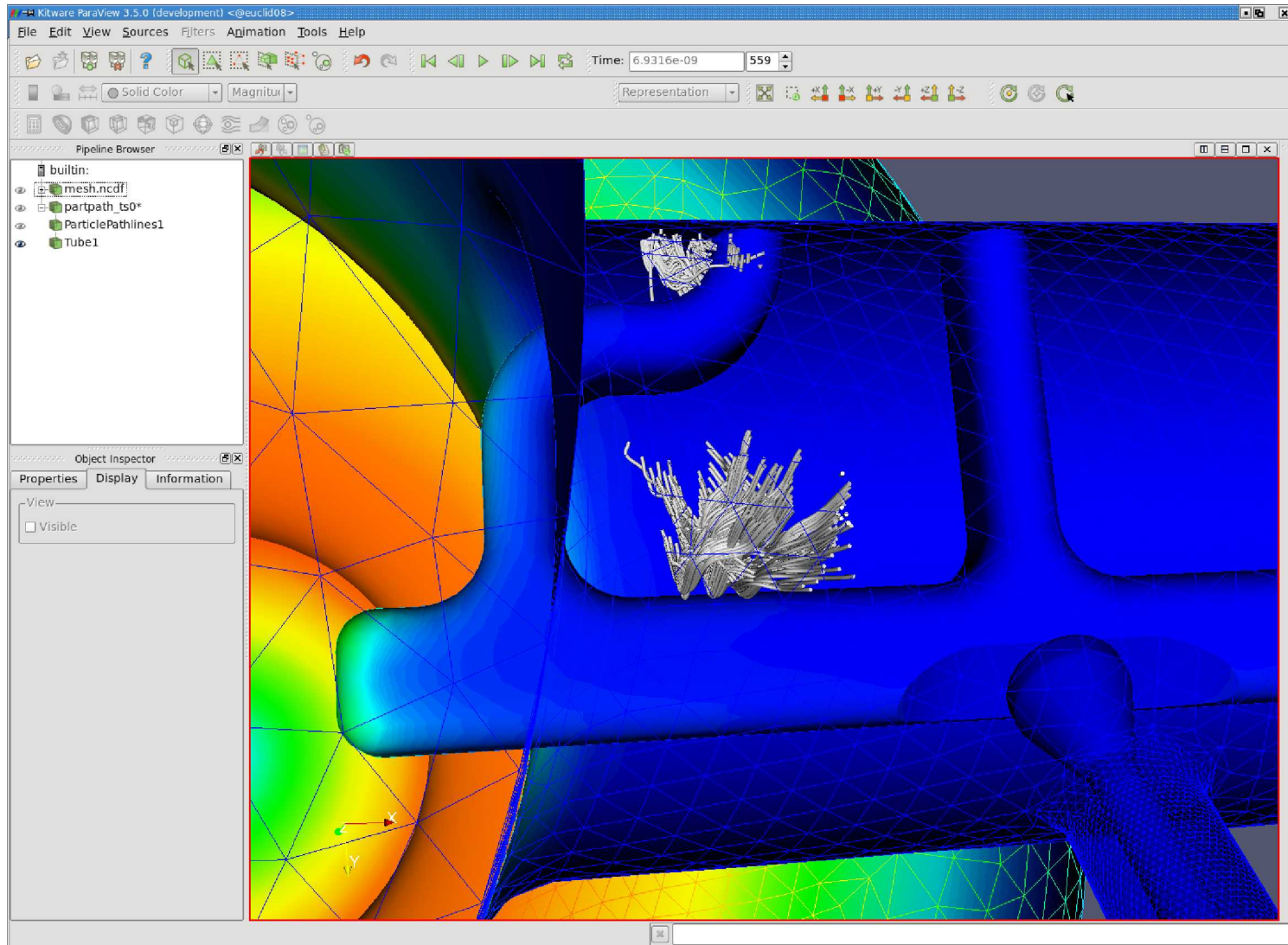


Accelerator structure with > 17 million tetrahedral elements

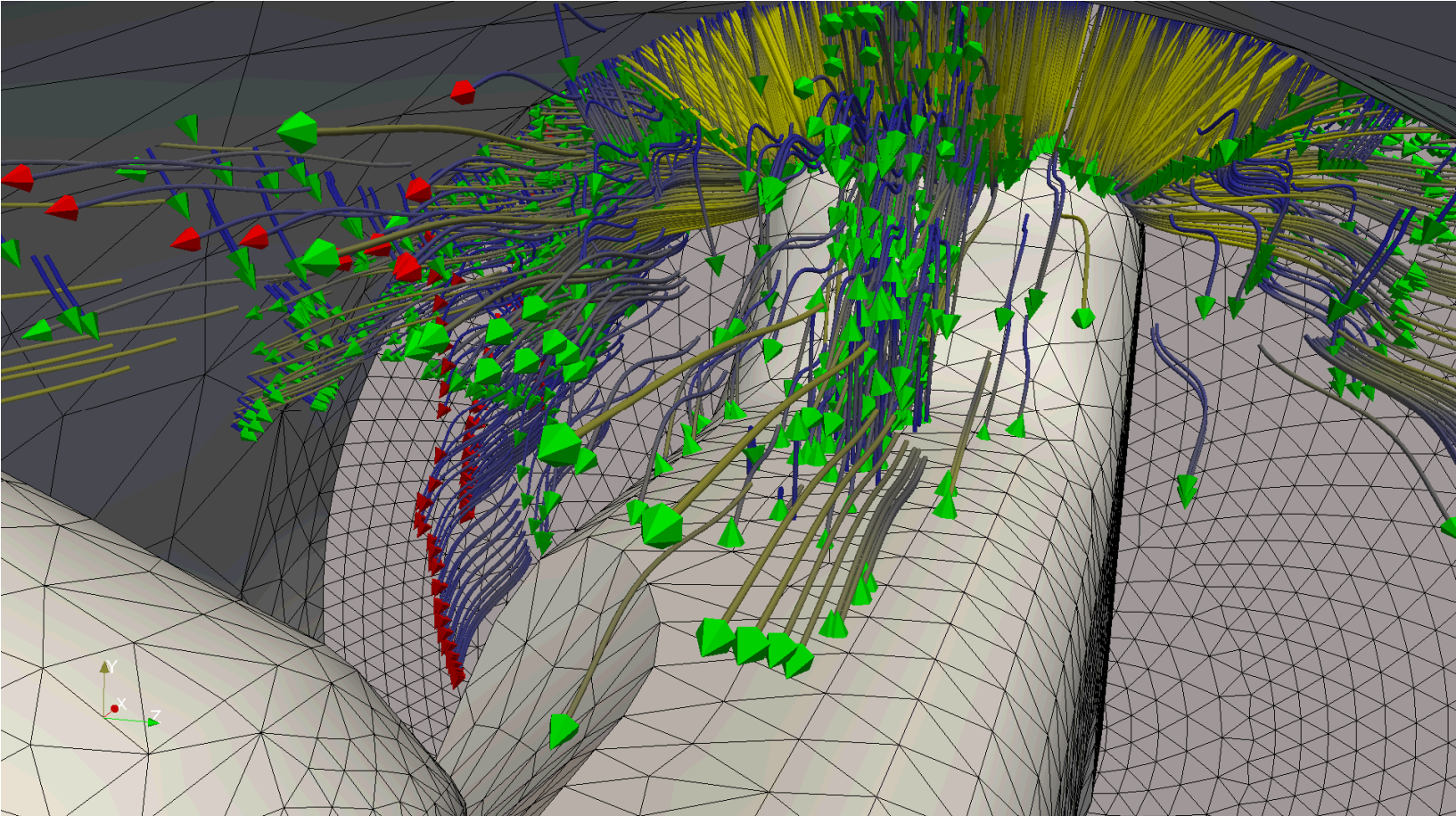
Rapid Visualization Construction

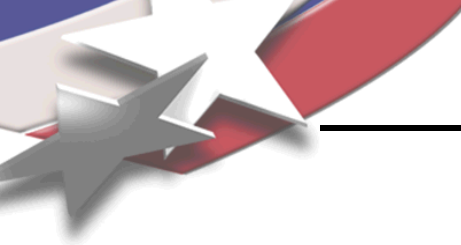


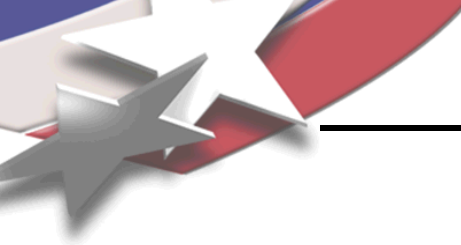
New Integrated Features



Time Dependent Processing







Future Plans

- **Add Accelerator Toolbox**
 - Minimize learning curve of using ParaView
 - Use terms familiar to accelerator scientists
 - Add accelerator simulation postprocessing capabilities
- **Promote ParaView to the accelerator community**
 - Well suited for showing results from SLAC's parallel codes.
 - ParaView will be used with SLAC's simulation codes at SLAC's code workshop this fall.