IDAV Report

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Participants

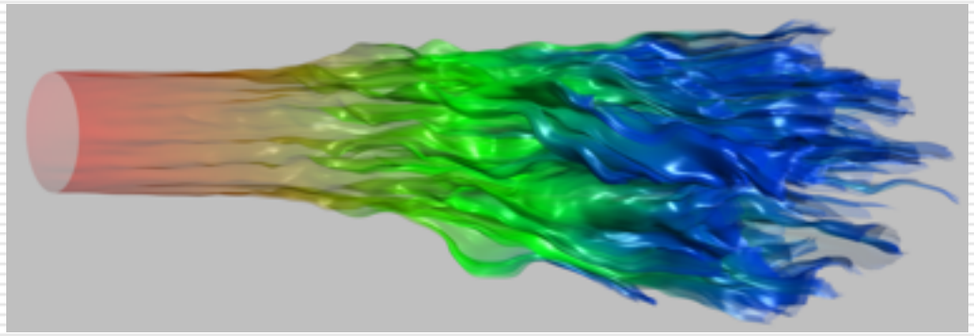
- Faculty
  - Ken Joy, John Owens, Bernd Hamann, Nina Amenta, Nelson Max, Michael Neff
- Researchers/Adjuncts
  - Hank Childs, Oliver Kreylos, Hans Hagen, Owen Carmichael
- Postdocs/Graduate Students
  - 6 postdocs, 40 graduate students.

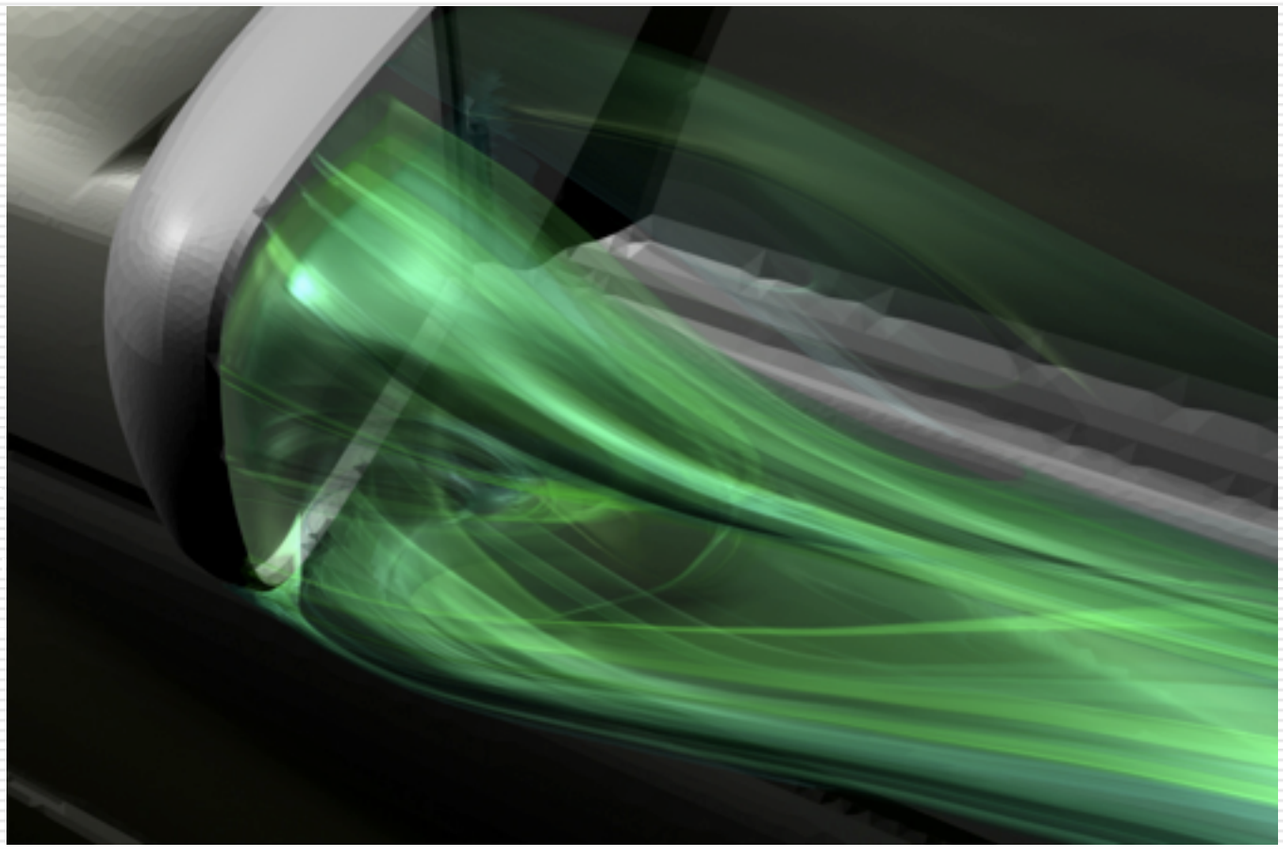
Christoph Garth moves to the Technical University of Kaiserslautern, July 2011

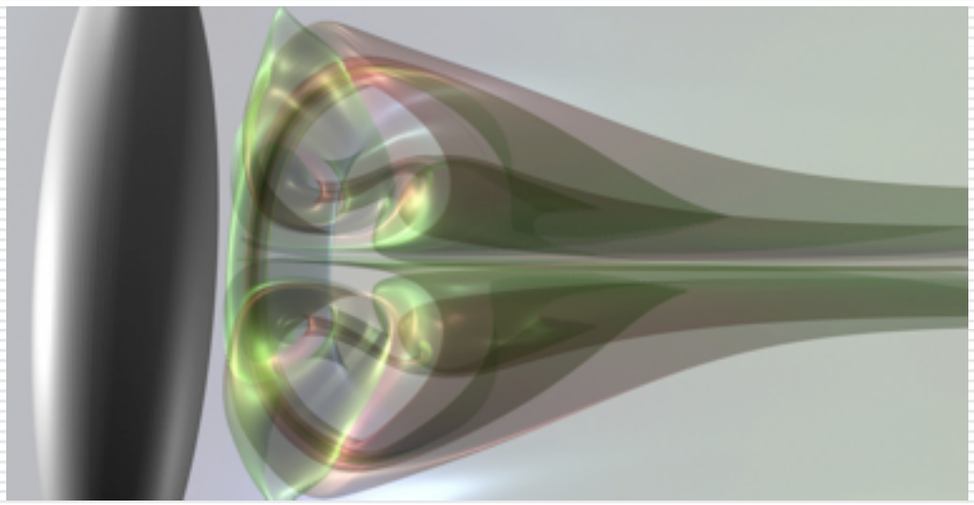
Institutes/Centers

- Institute for Data Analysis and Visualization
- Institute for Ultrascale Visualization
- Visualization and Analytics Center for Enabling Technologies (VACET)
- KeckCaves (Visualization in the Geosciences)

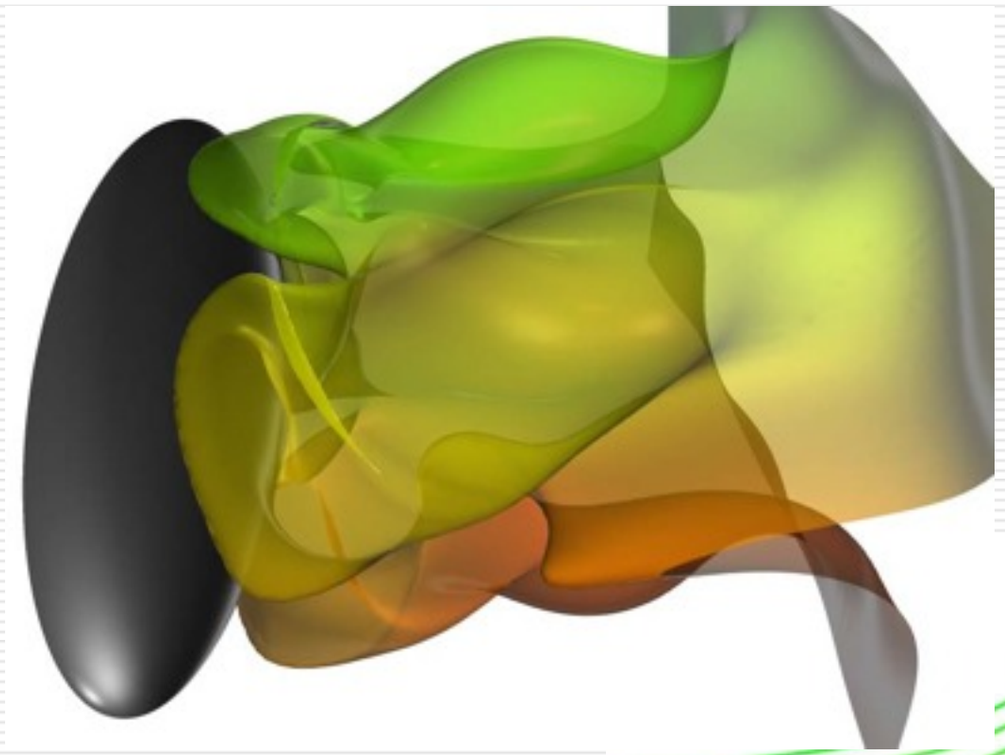
Streamlines and Stream Surfaces

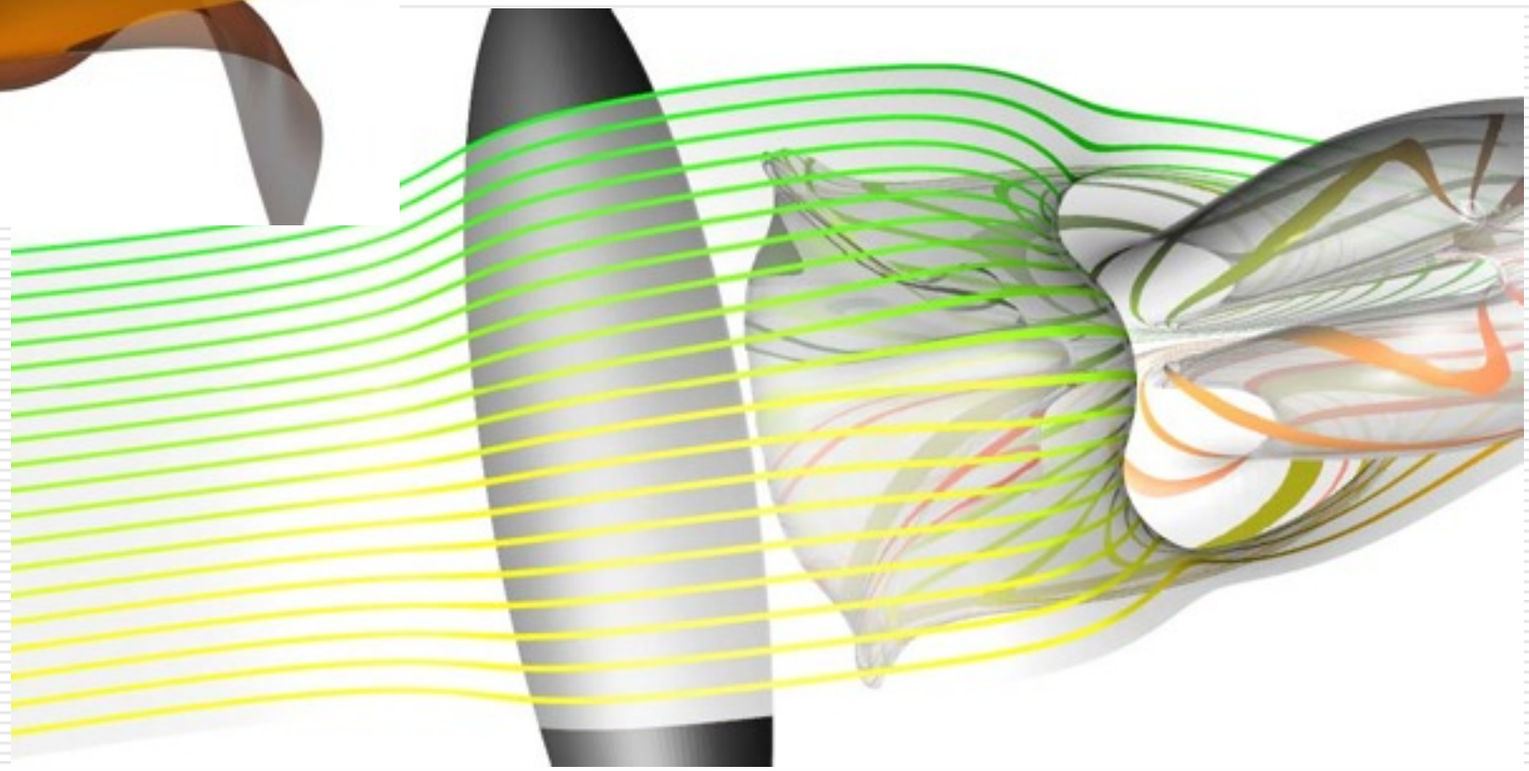






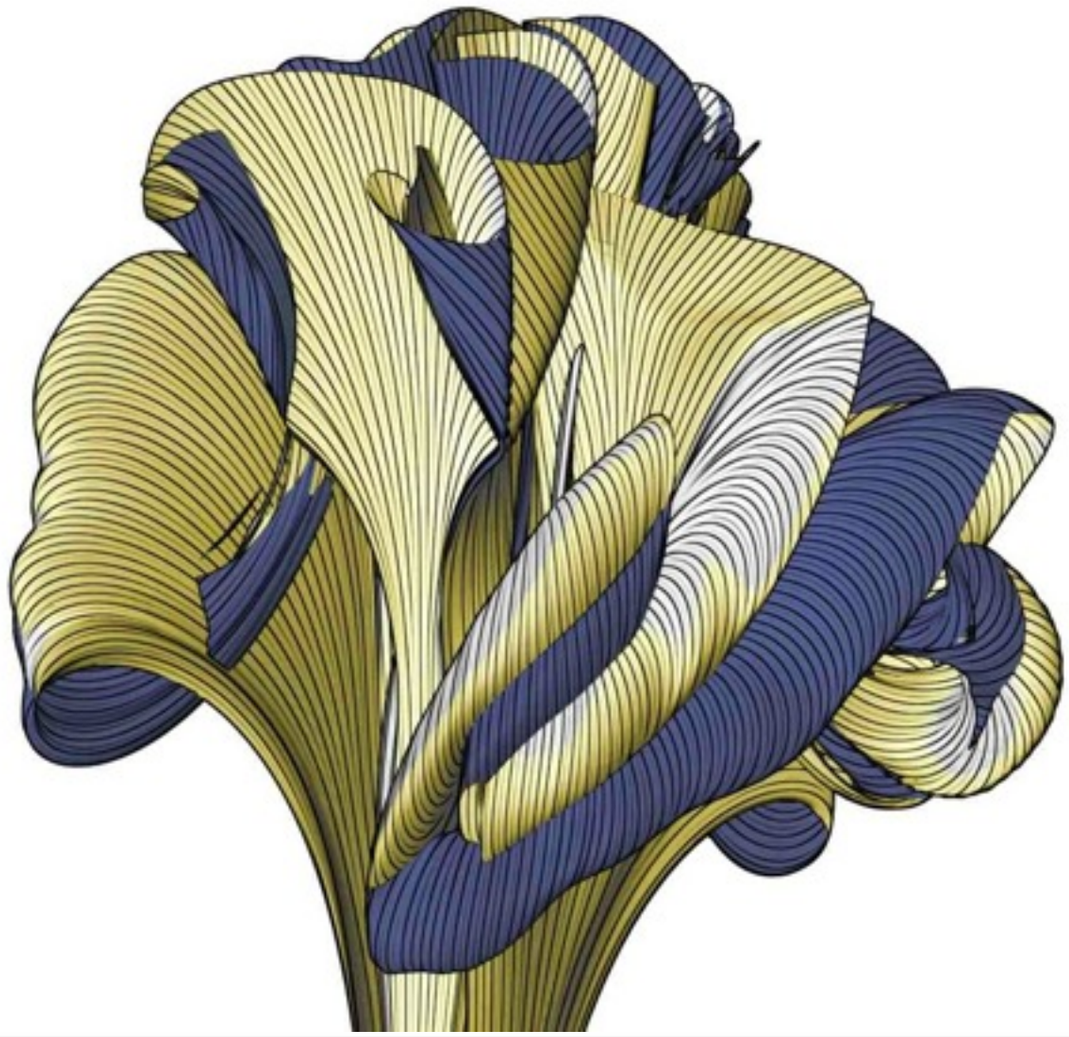
Time and Streak Surfaces





Vortex Breakdown Bubble

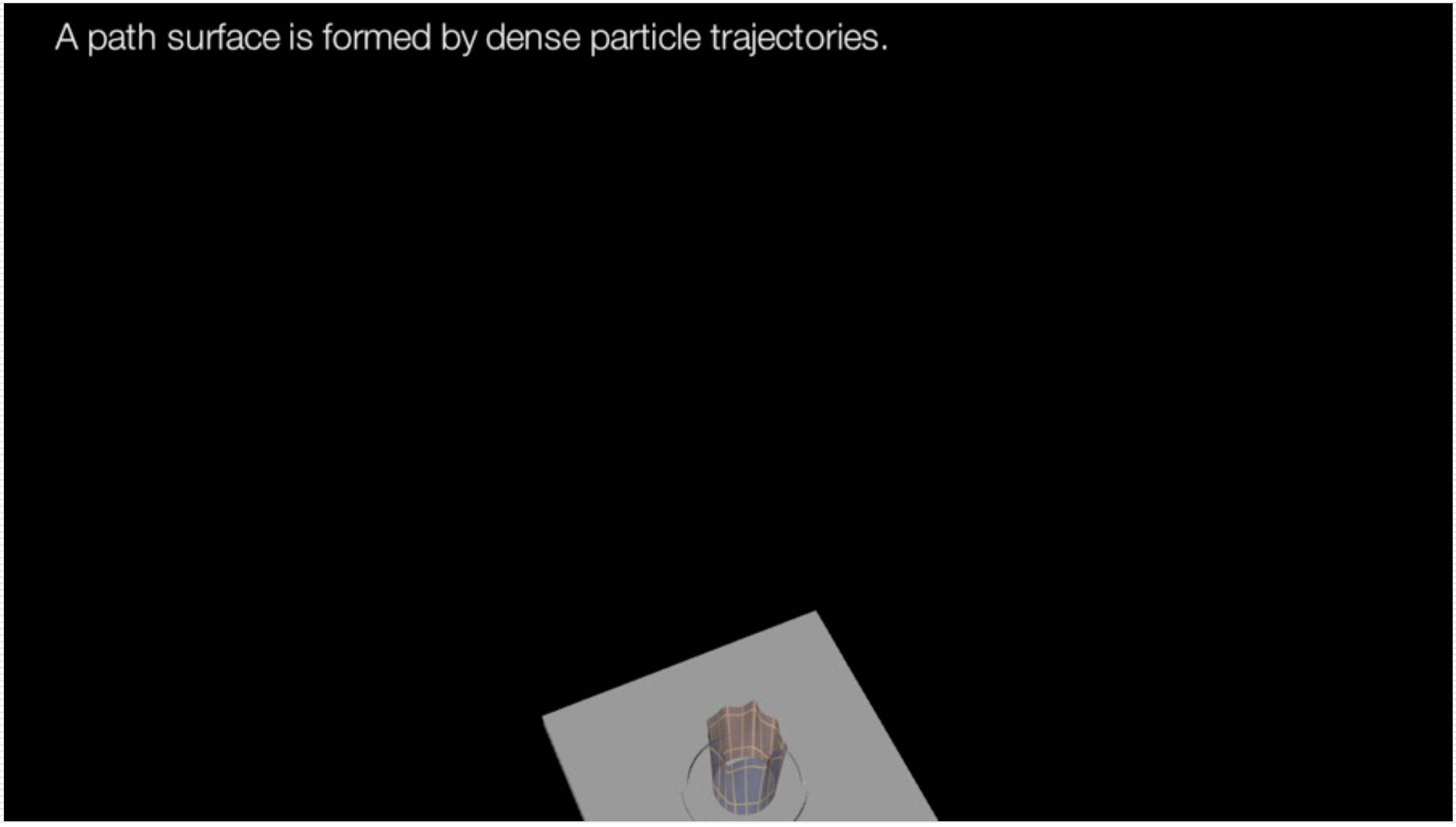
Non-Photorealistic Rendering



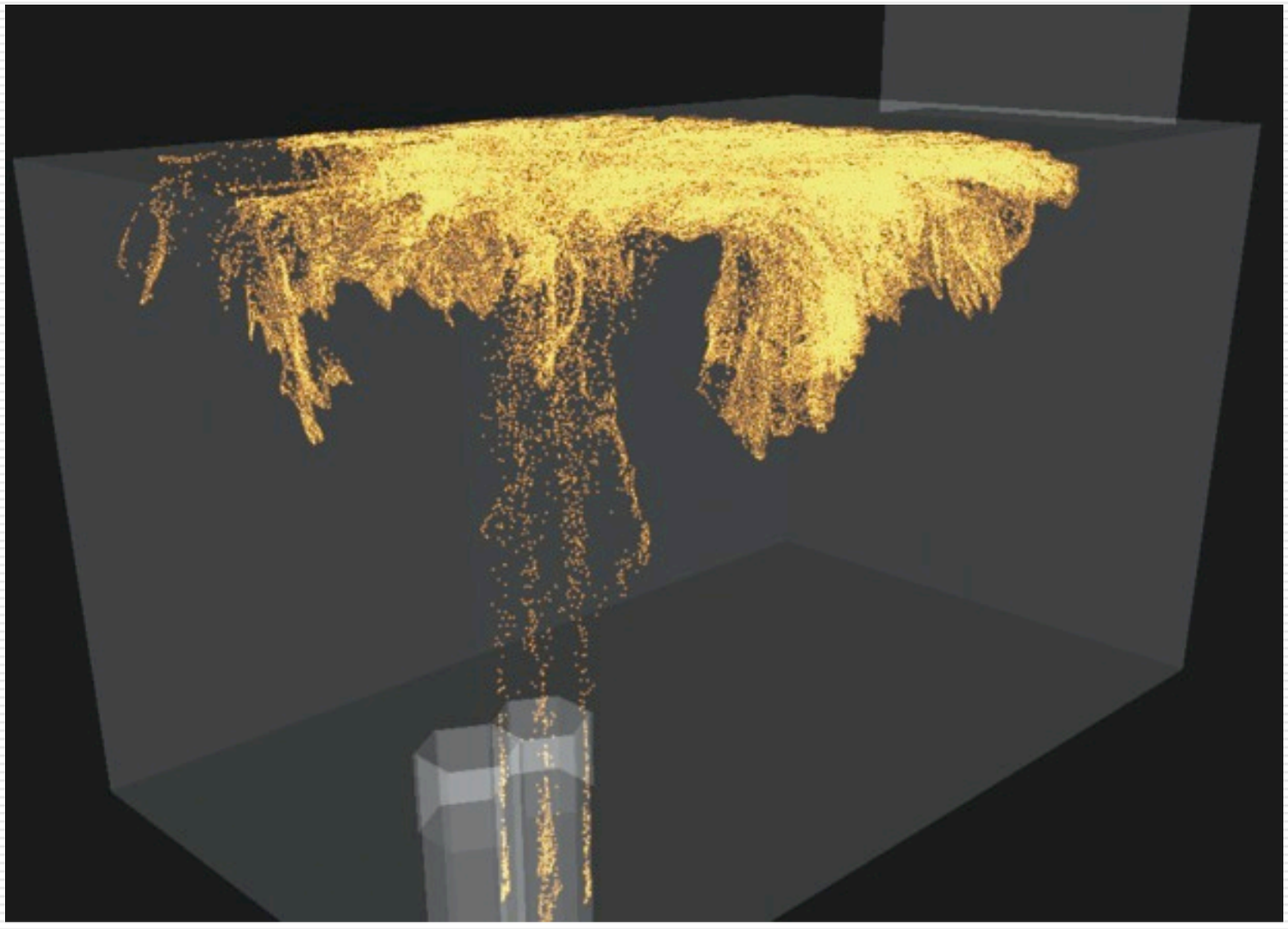
Duplicating the Dahlman Images

IEEE Visualization 2010

Non-Photorealistic Rendering

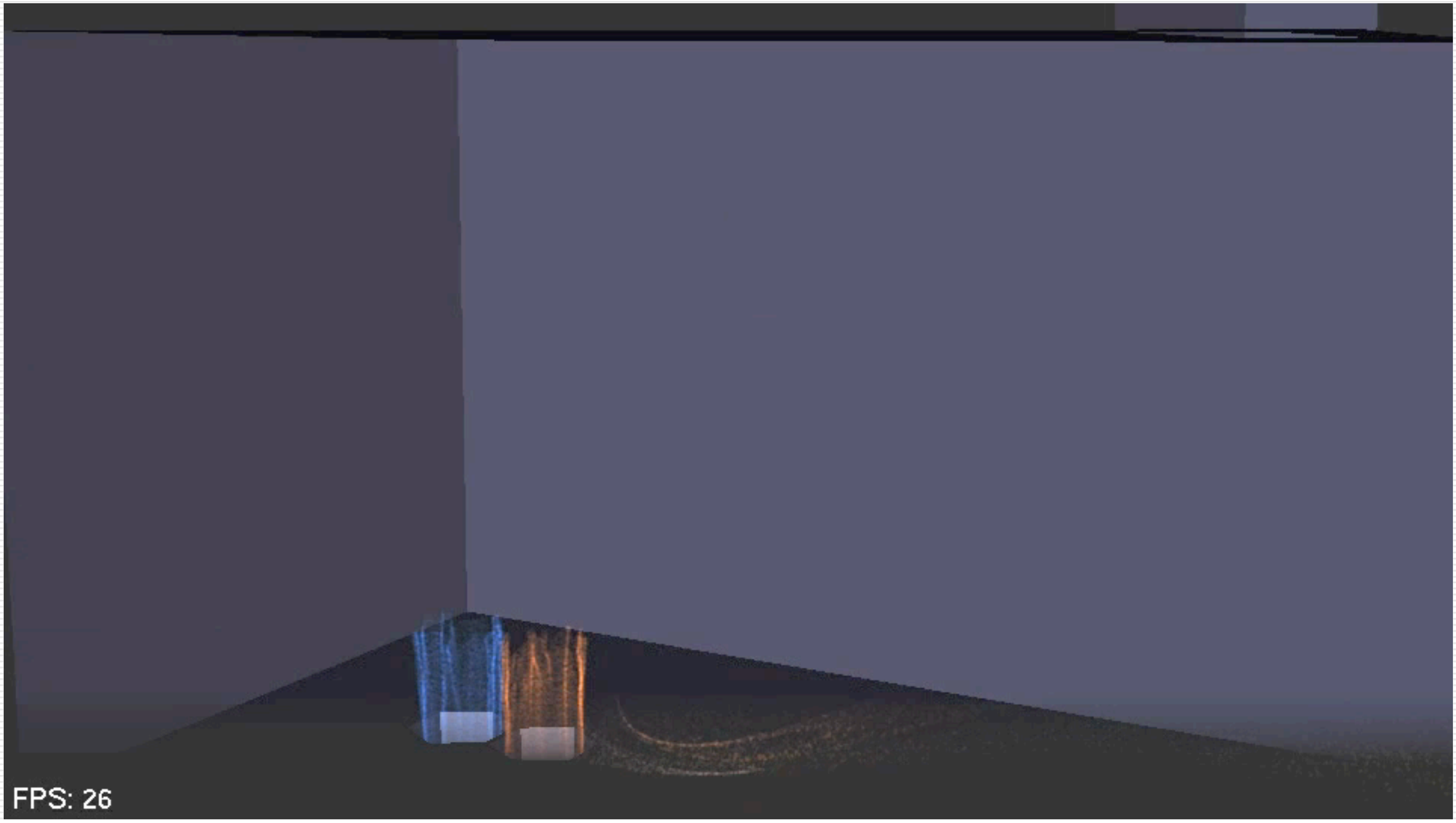


New Data Structures for Flow Visualization



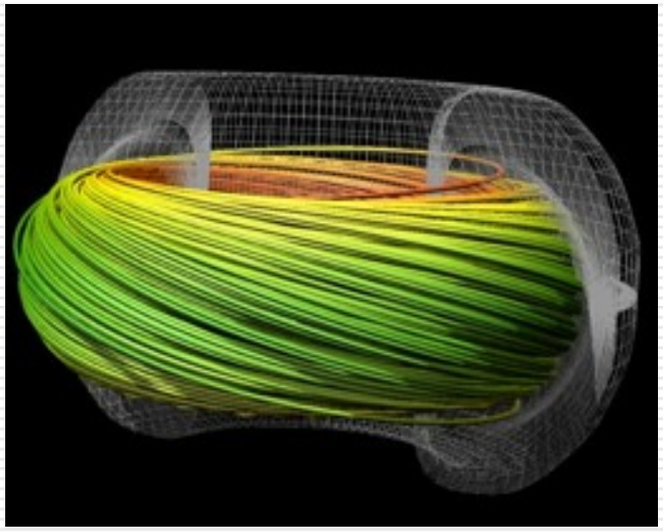
IEEE Visualization's Best "Imp" Paper

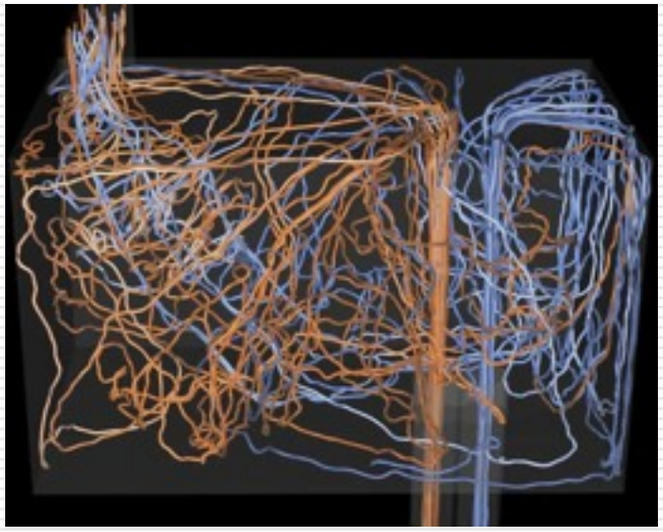
Running on the GPU



Streamlines and large scale parallelism

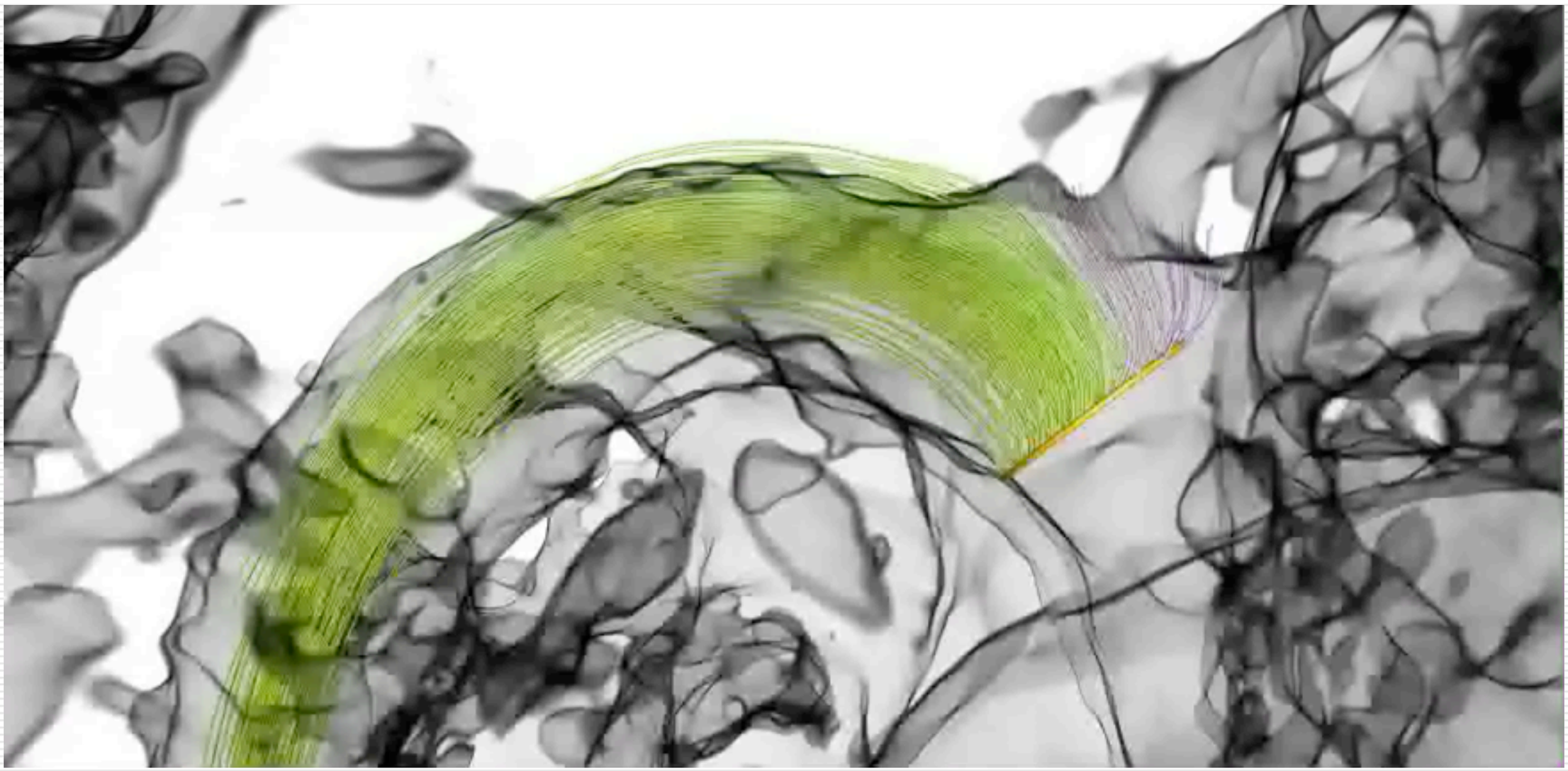
- "Scalable Computation of Streamlines on Very Large Datasets", in "SC '09





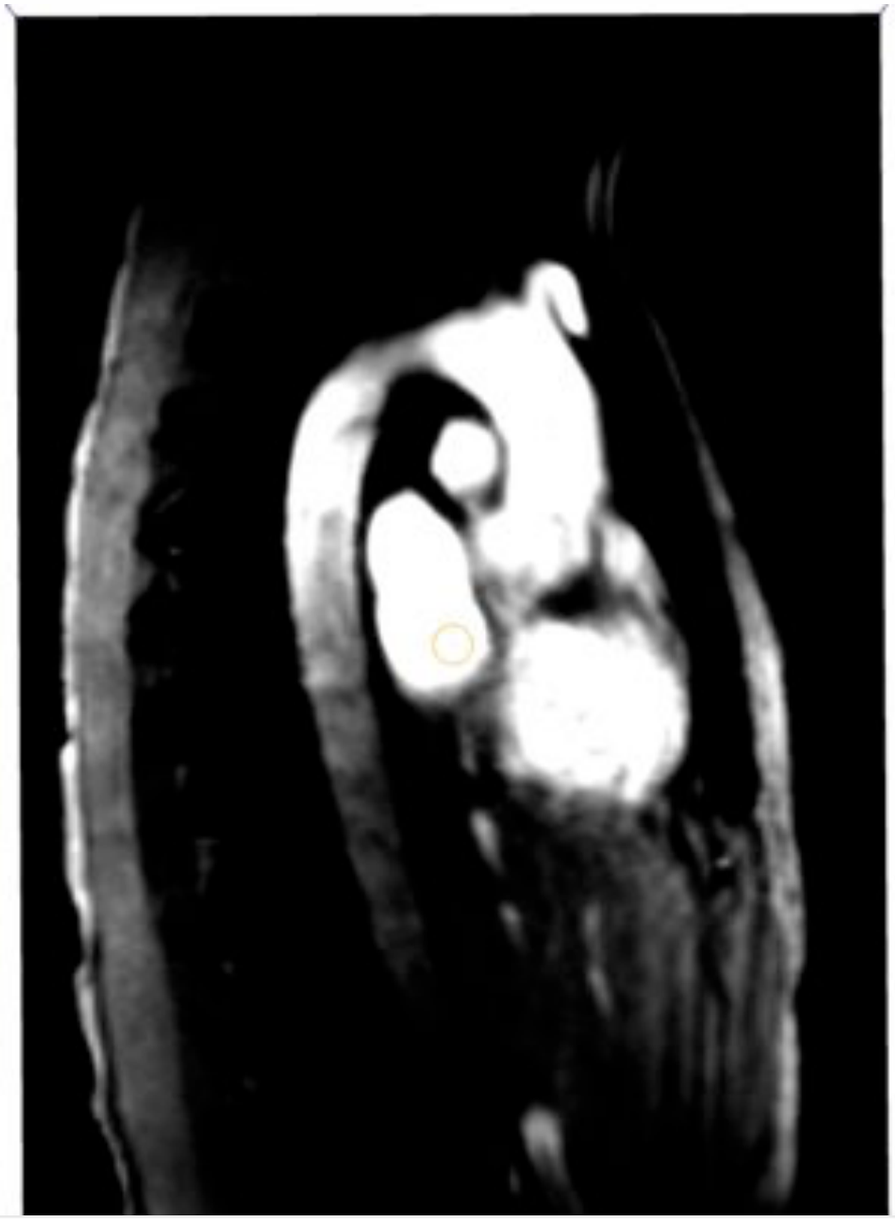
- Using Hybrid Parallelism
  - In TVCG -- Coming

Applications to Flow-Sensitive MRI

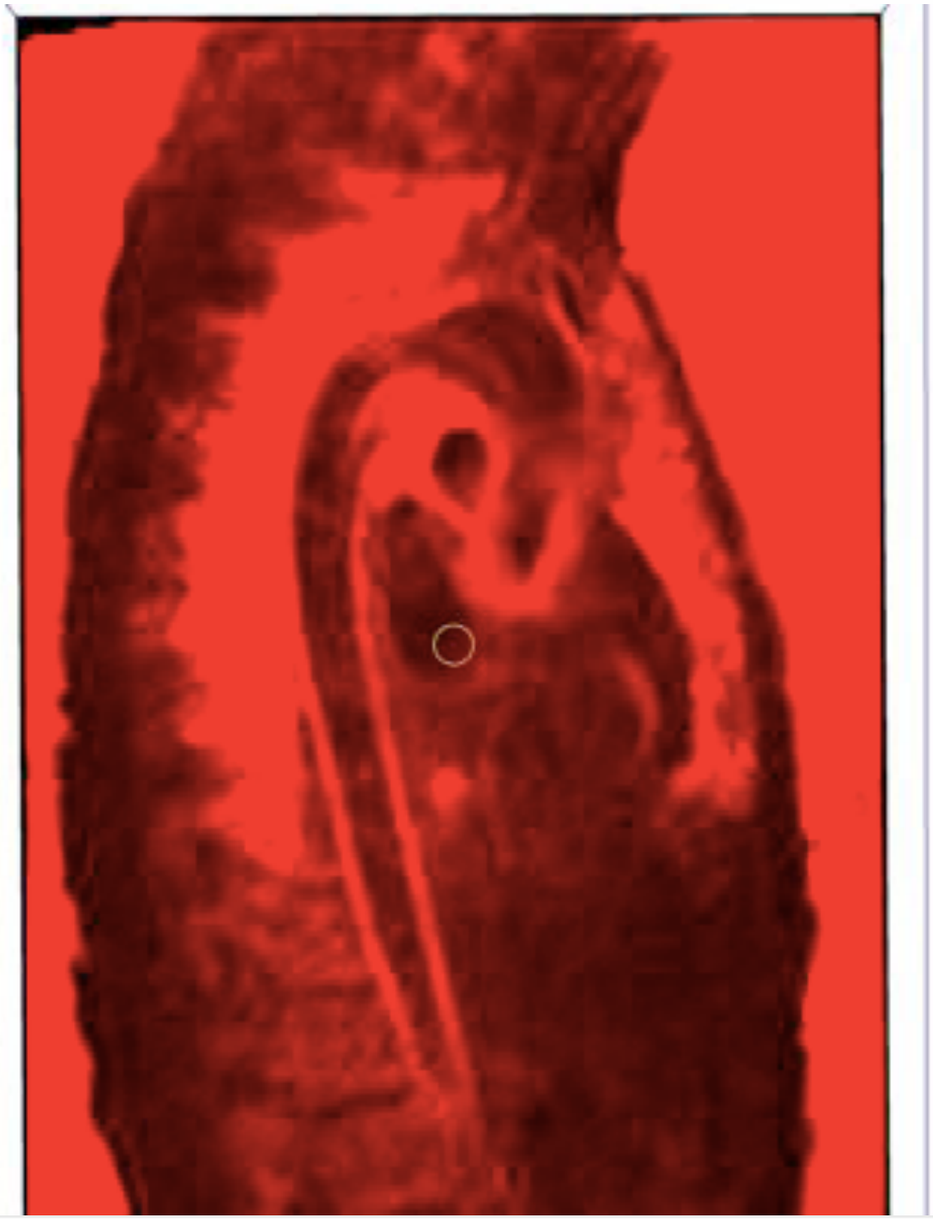


Accepted for IEEE TVCG

Using FTLE to segment flow



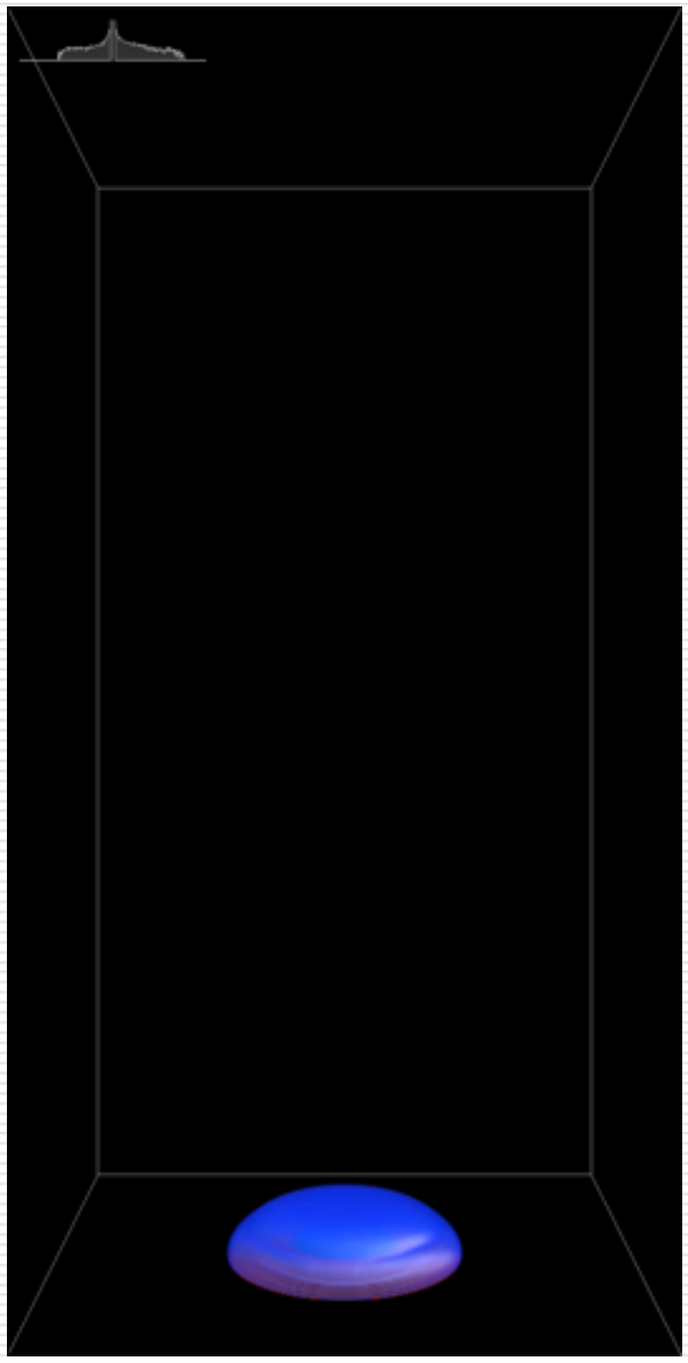
Velocity Map



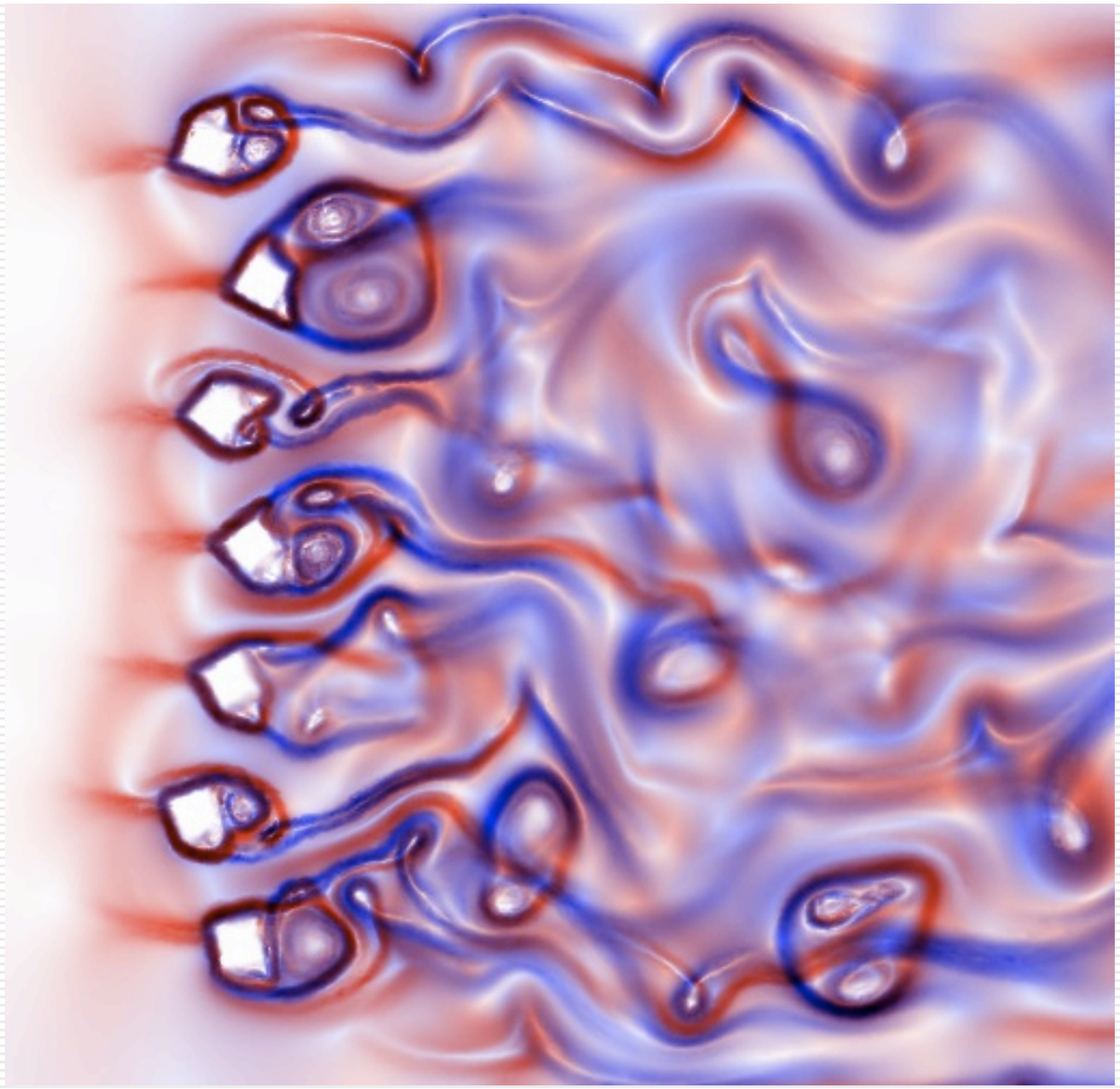
FTLE Map

FTLE

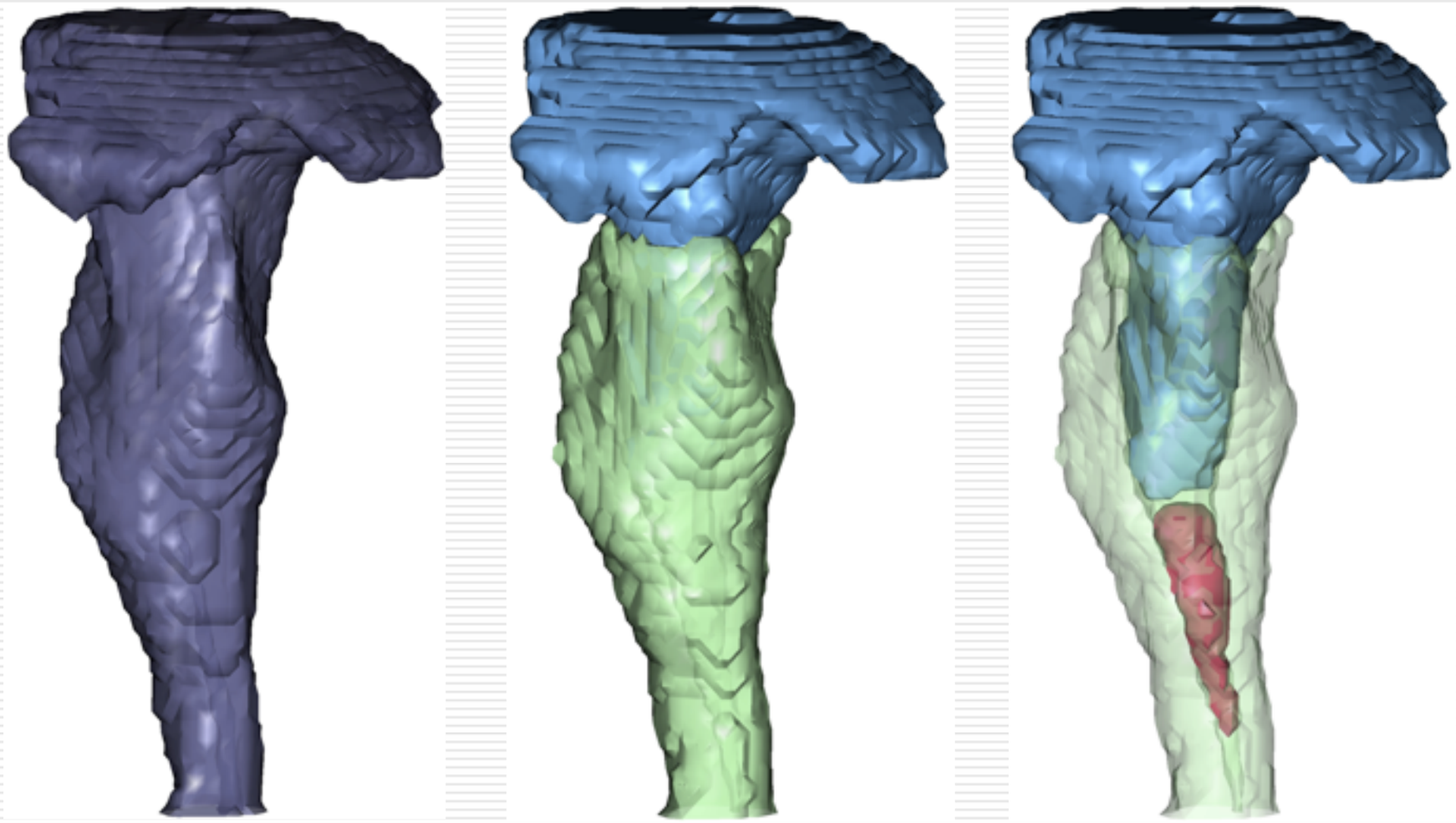
- Using finite-time Lyapunov exponent methods



Improving computation time for FTLE methods



Query-Driven Visualization

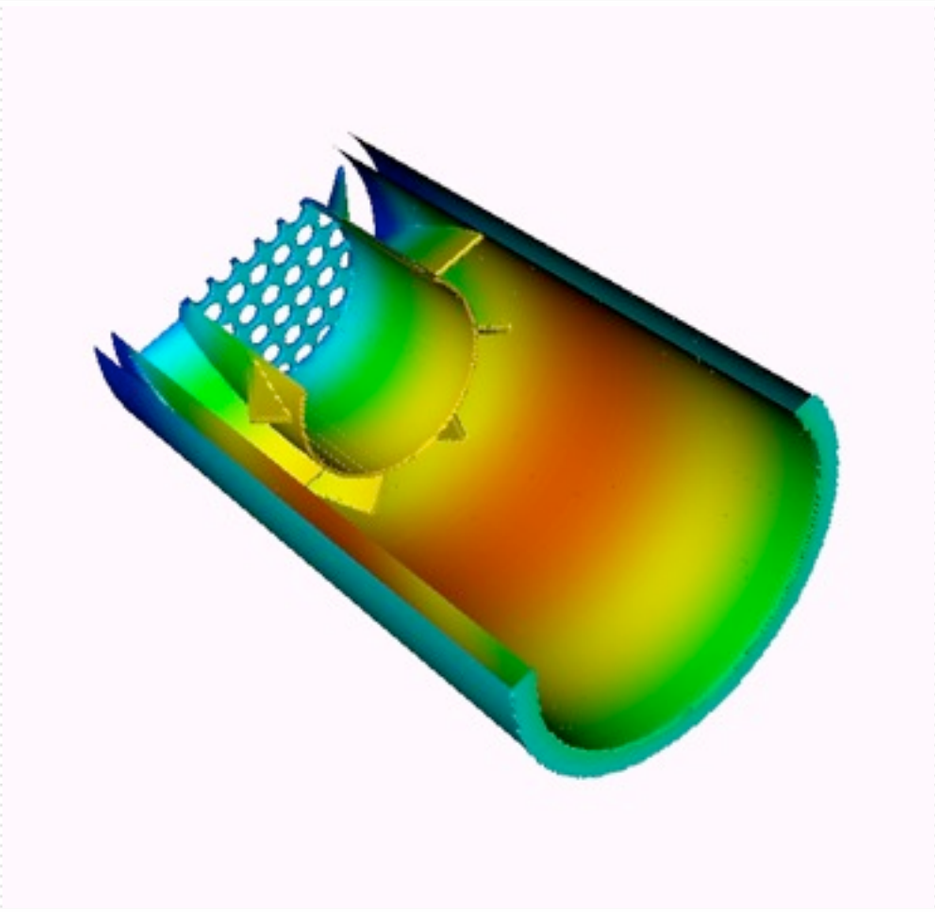


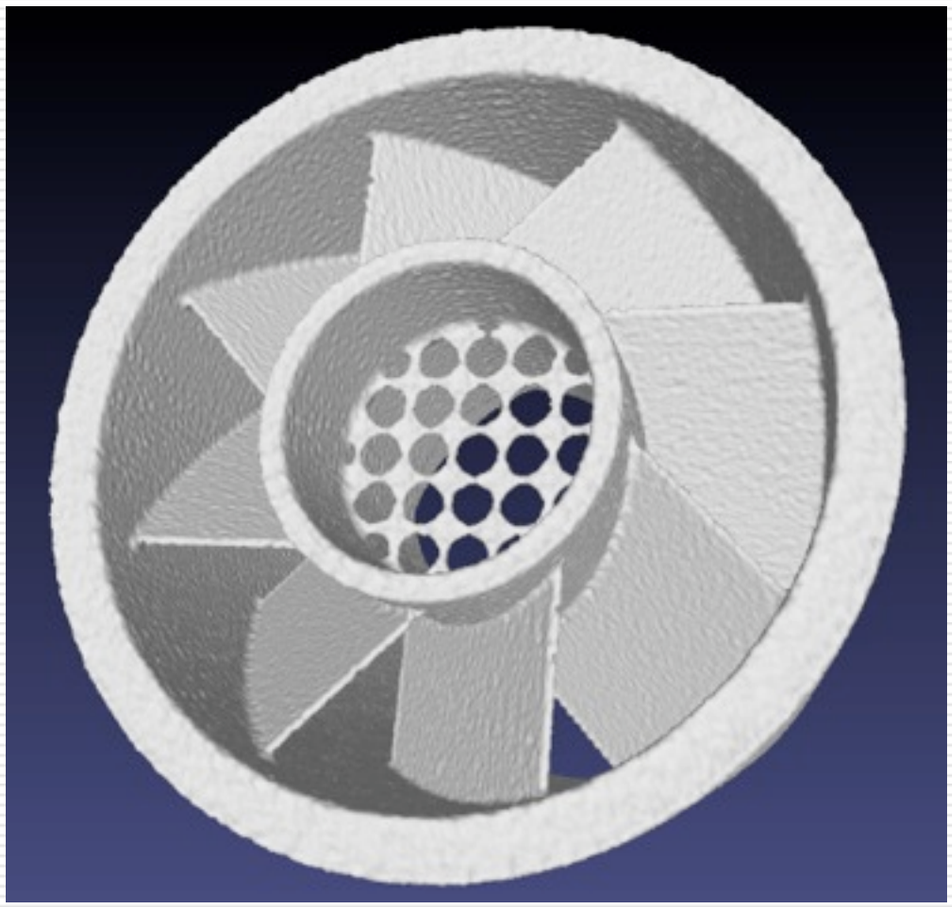
Using a combination of Query-Driven Methods and Uncertainty

March, IEEE TVCG

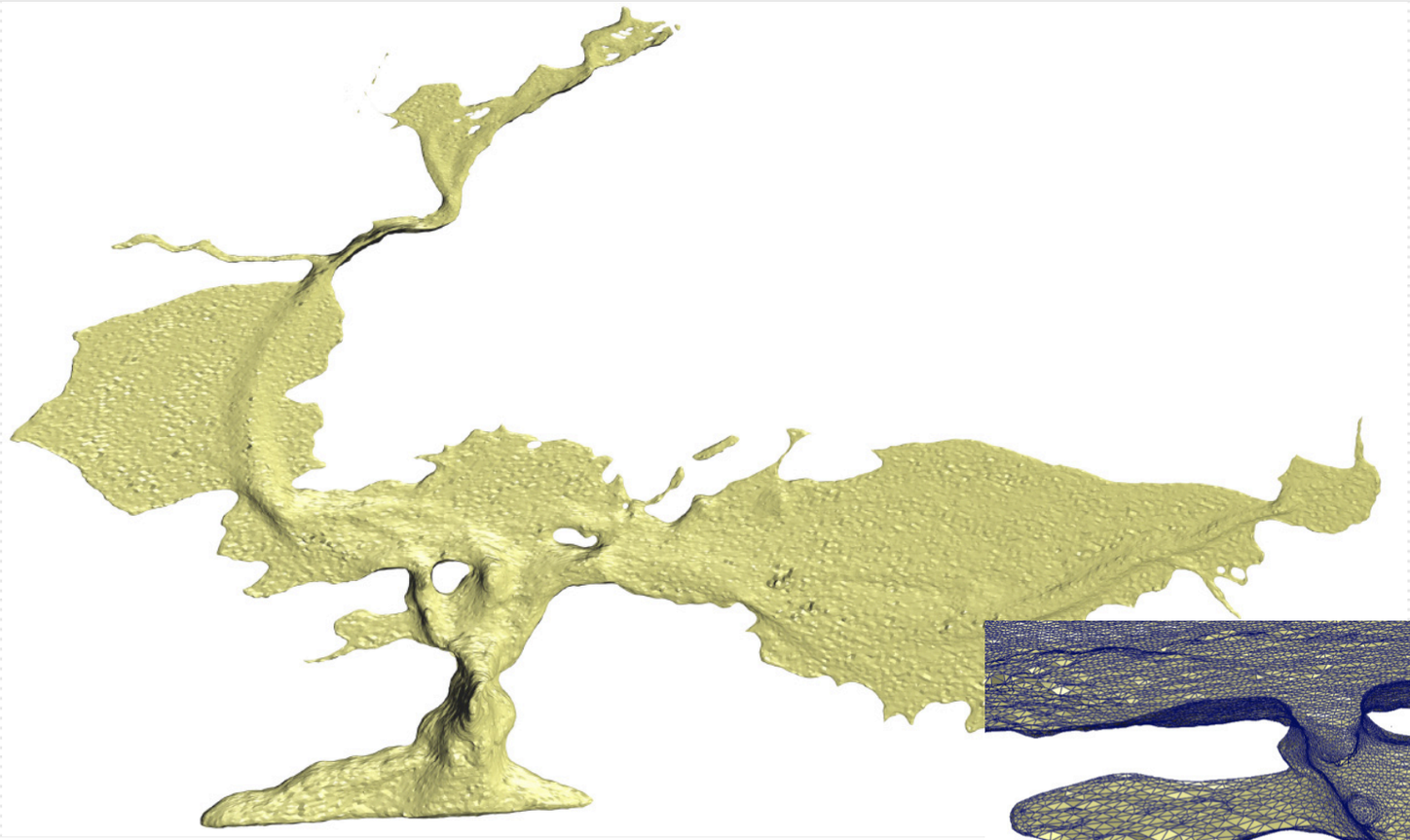
General Idea: Treat large-scale data like databases, and use fuzzy queries

Embedded Boundary/Material Interfaces

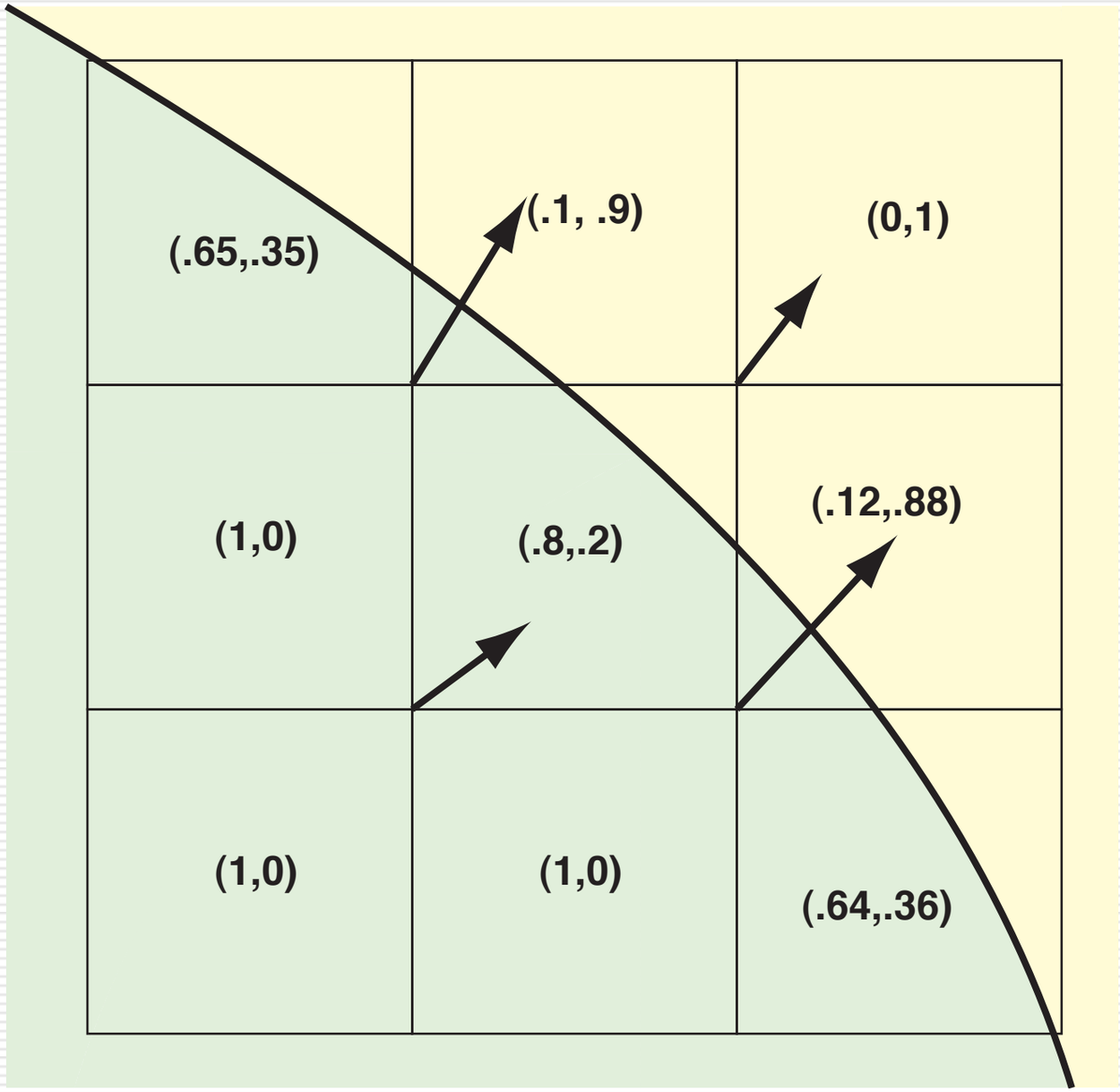




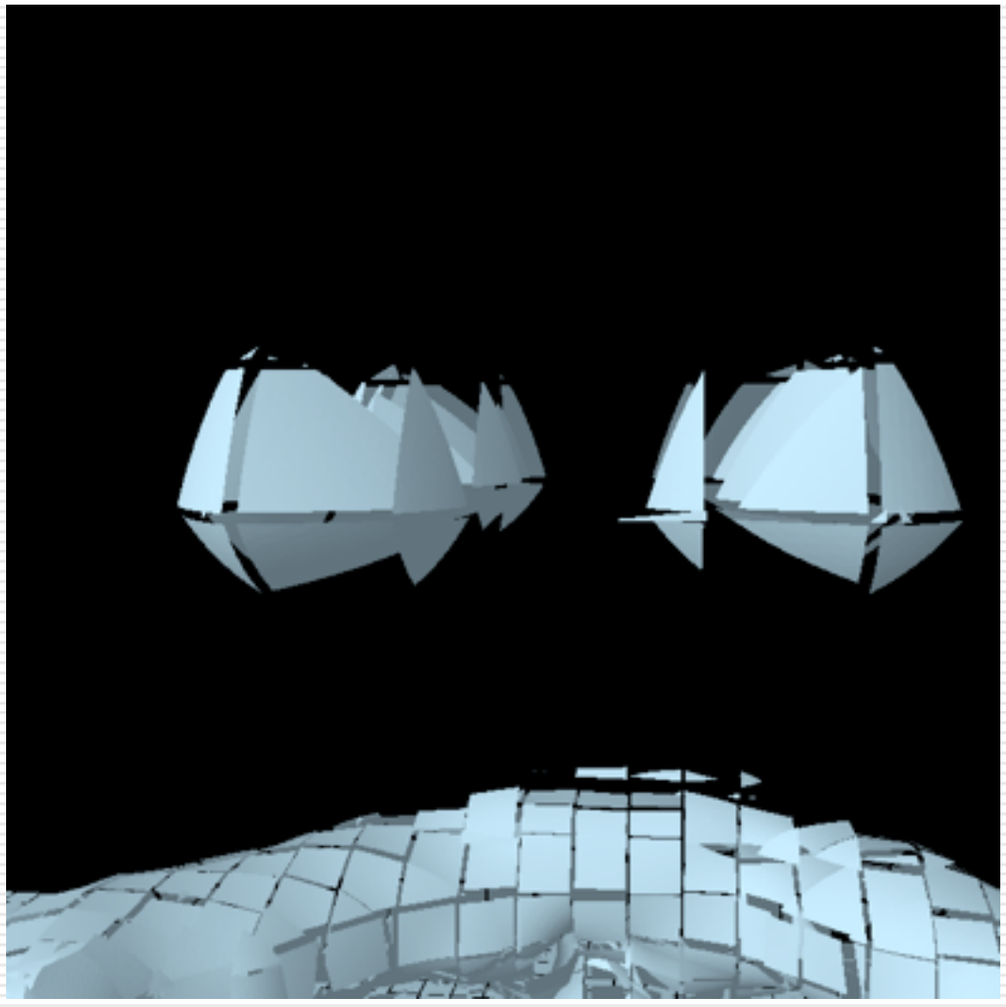
Embedded Boundary/Material Interfaces



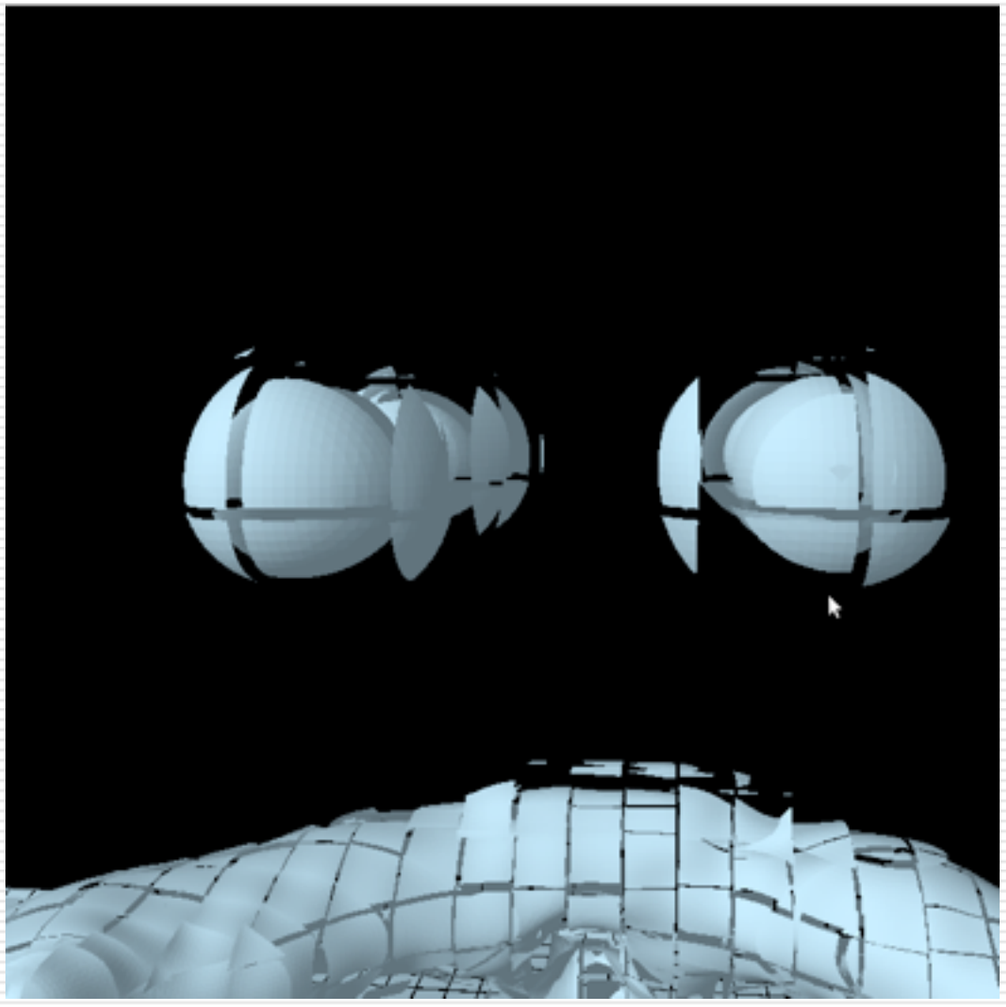
New Material Interface Methods



Material Interface Methods

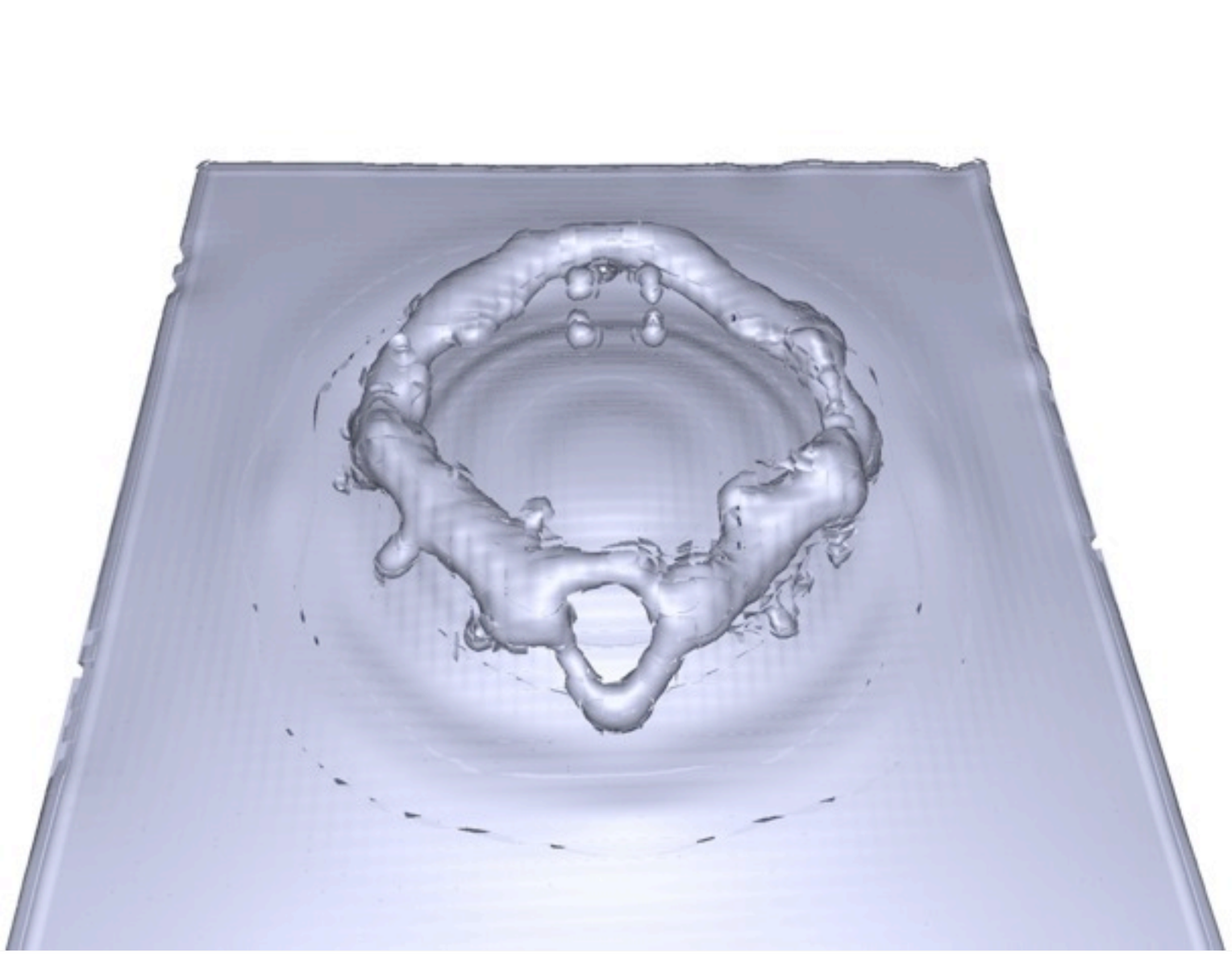


Linear-like approximations

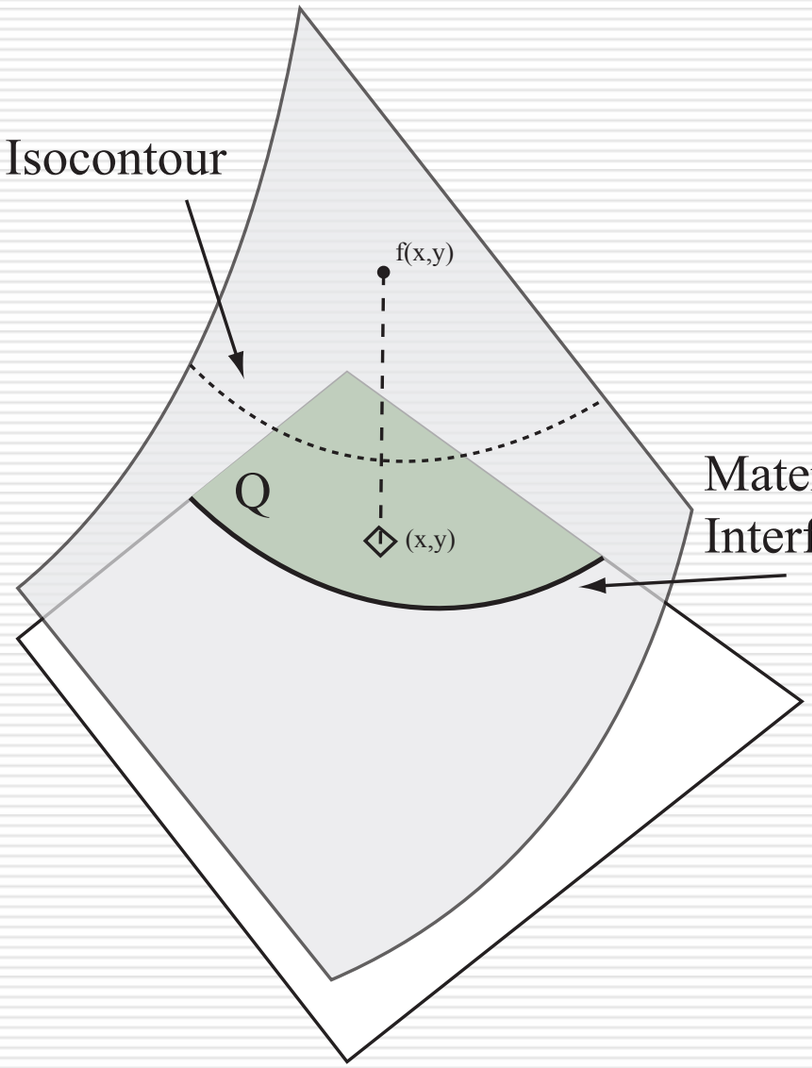


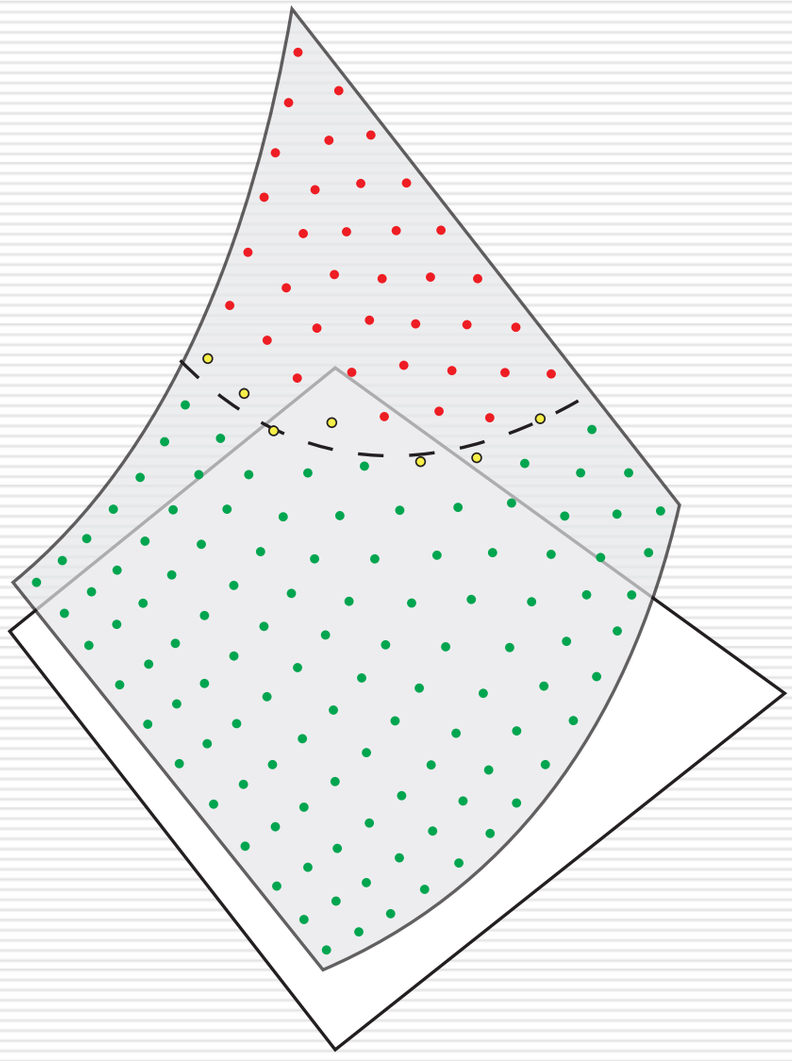
New Approximations

Material Interface Methods



How it Works!



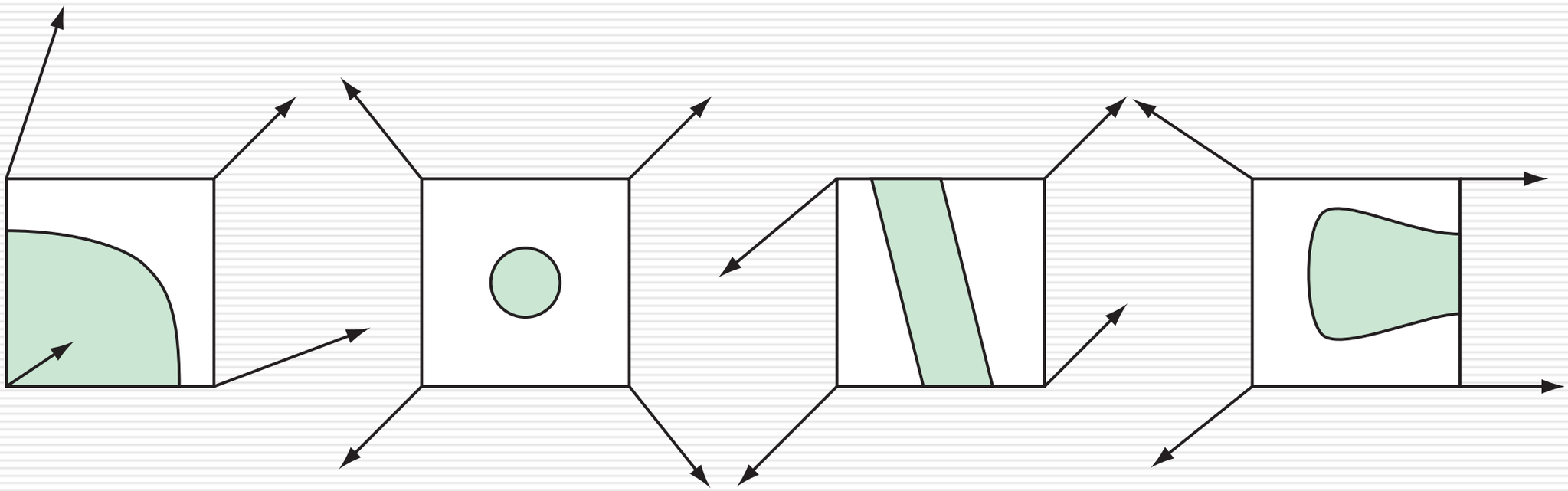


Looks like an isosurface problem????

But we must determine the isovalue so that the volume fractions match

We do this discretely!

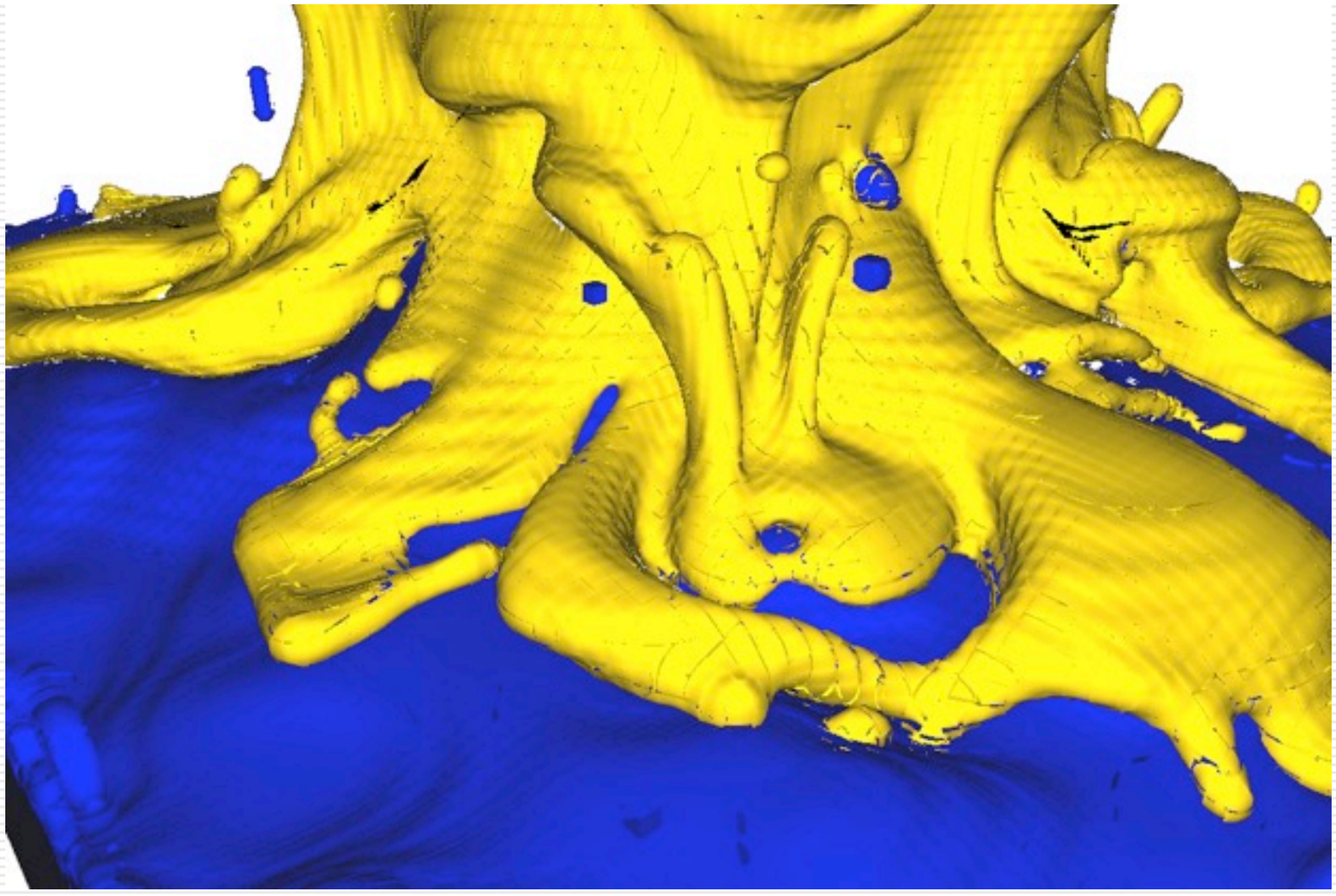
Possibilities



Gives a much greater variety of possibilities

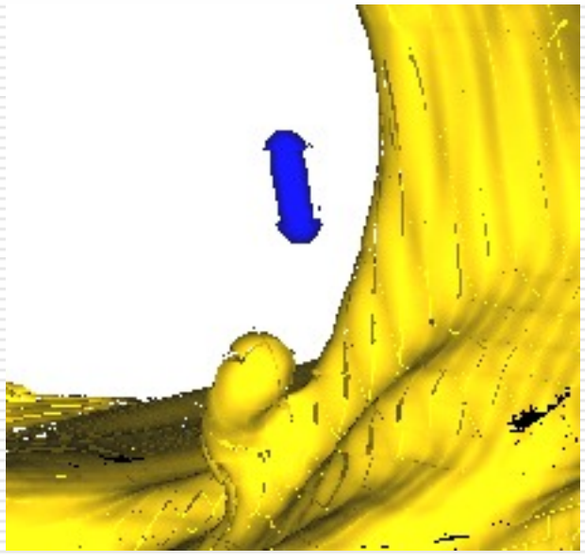
Better capturing fine detail!

Multi-Material Works Also

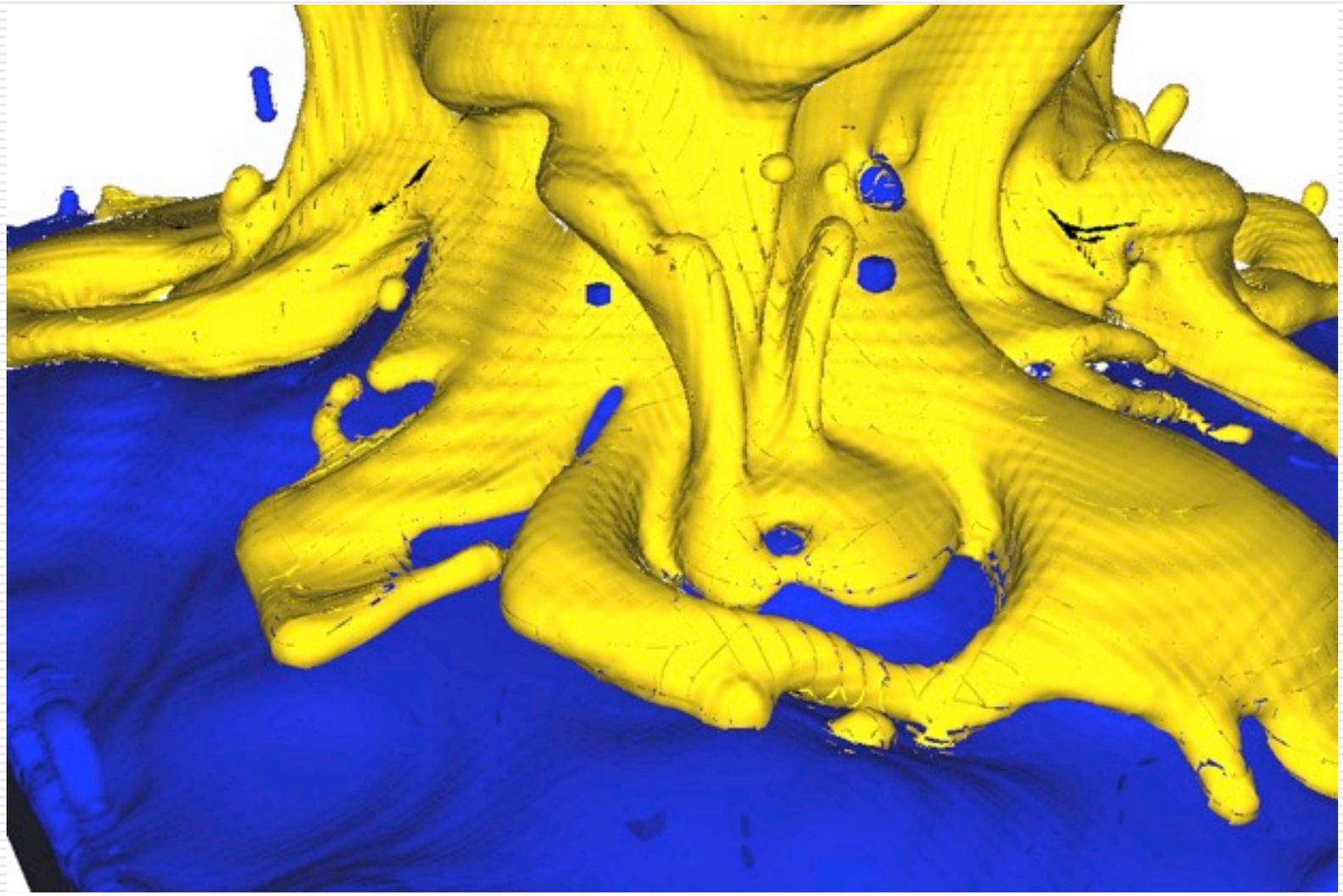


Three-Material Example

Better Reproduces Fine Detail



Elongated Bubble



Three-Material Example

Passes the Hank Test!

- Little Geometry
  - Yep. Actually geometry-less is possible.
- Accurate
  - Yep, within a chosen error bound. Captures fine detail better.
- Fast, Parallelizable
  - All calculations local -- within a one-ring of a cell
- Continuous
  - No! But close!
- Multi-Material Works
  - Yep

Other Activities

- Uncertainty Quantification (PNNL, just started)
- Aerial Surveillance (LLNL)
- Visualization of Function Fields

Summary of Activities

- Visualization of Flow (LBNL, ORNL, LANL, ParaView Team)
- Large-scale visualization methods (LBNL, VisIt Team)
- Material Interface Reconstruction (LLNL, LBNL, LANL)
- Query-driven Visualization (LBNL, PNNL)
- Large-scale methods for unstructured meshes (LBNL, new)
- Uncertainty Quantification (PNNL, just started)
- Aerial Surveillance (LLNL)

Thank You!

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