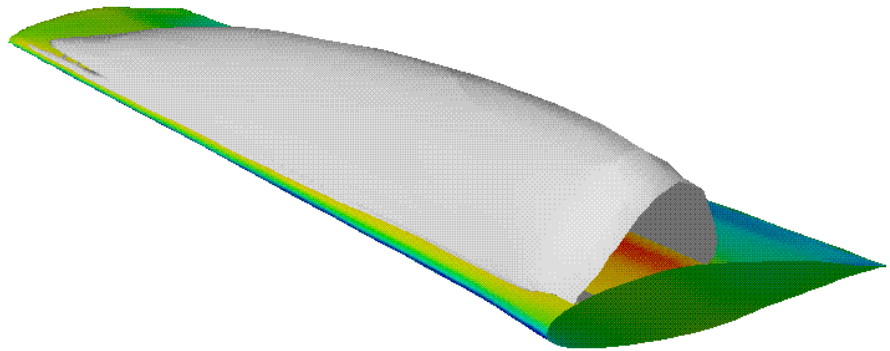
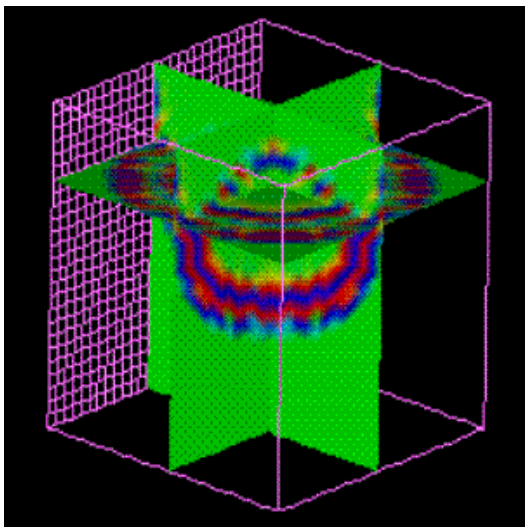
CUMULVS Demonstration



NeSSI Workshop

Dr. James Arthur Kohl
Computer Science and Mathematics Division
Oak Ridge National Laboratory



October 14, 2003

12:30pm – 1:00pm

Research sponsored by the Applied Mathematical Sciences Research Program, Office of Mathematical, Information, and Computer Sciences, U.S. Department of Energy, under contract No. DE-AC05-00OR22725 with UT-Battelle, LLC.

Potential Benefits from Computer Science Infrastructure:

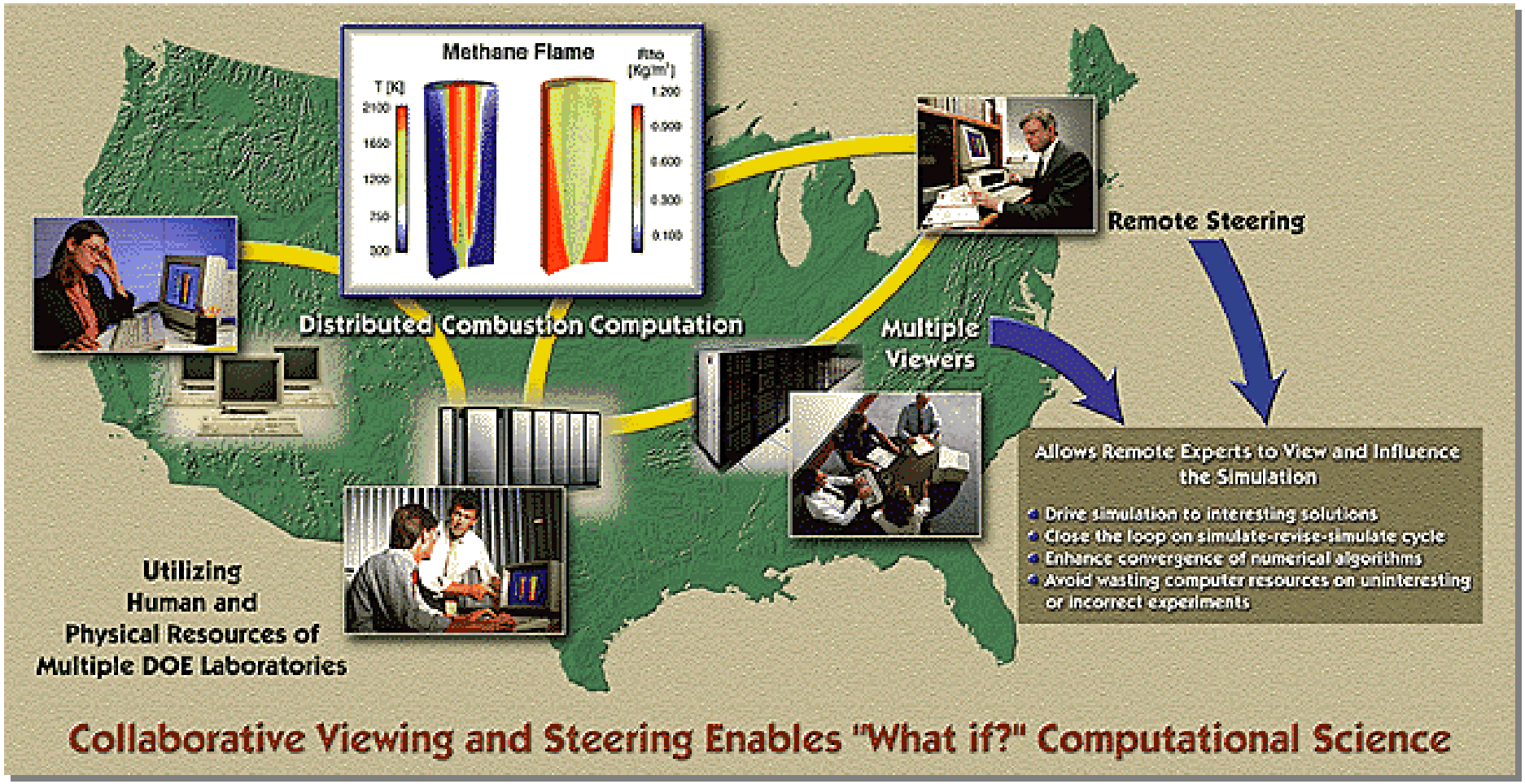
- On-The-Fly Collaborative Visualization
  - ⇒ Interactive Access to Intermediate/Online Results
  - ⇒ Remote Monitoring of Experiment by Team
  - ⇒ Comparative Analysis of Model and Experiment
- Computational Steering
  - ⇒ Apply Visual Feedback to Alter Experiment Course
  - ⇒ "Close Loop" on Experimentation Cycle
    - → (Instrument Control…?)

Note: NOT a Climate Modeling Tool… ☺

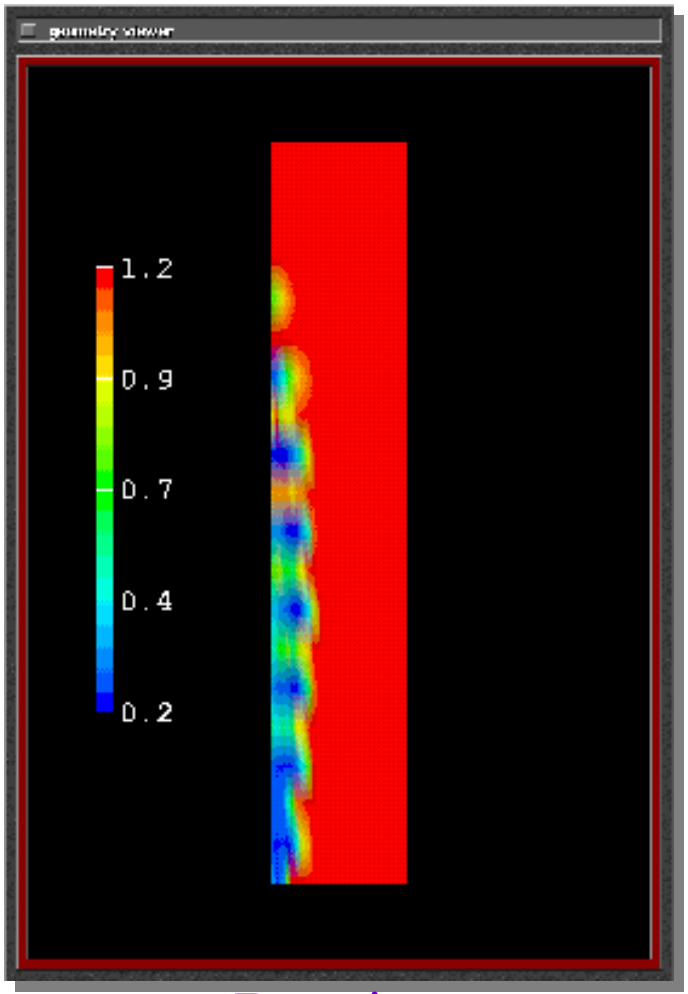
(Collaborative, User Migration, User Library for Visualization and Steering)

- Collaborative Infrastructure for Interacting With Scientific Simulations (or Experiments)
  - ⇒ Middleware for Run-Time Visualization
    - → Multiple, Independent Viewers (Several Provided)
    - → Can Be Geographically Distributed…
    - → Attach as Needed, Minimize Overhead
  - ⇒ Coordinated Computational Steering
  - ⇒ Heterogeneous Checkpointing / Fault Tolerance
  - ⇒ Coupled Models… (Verification vs. Live Data?)

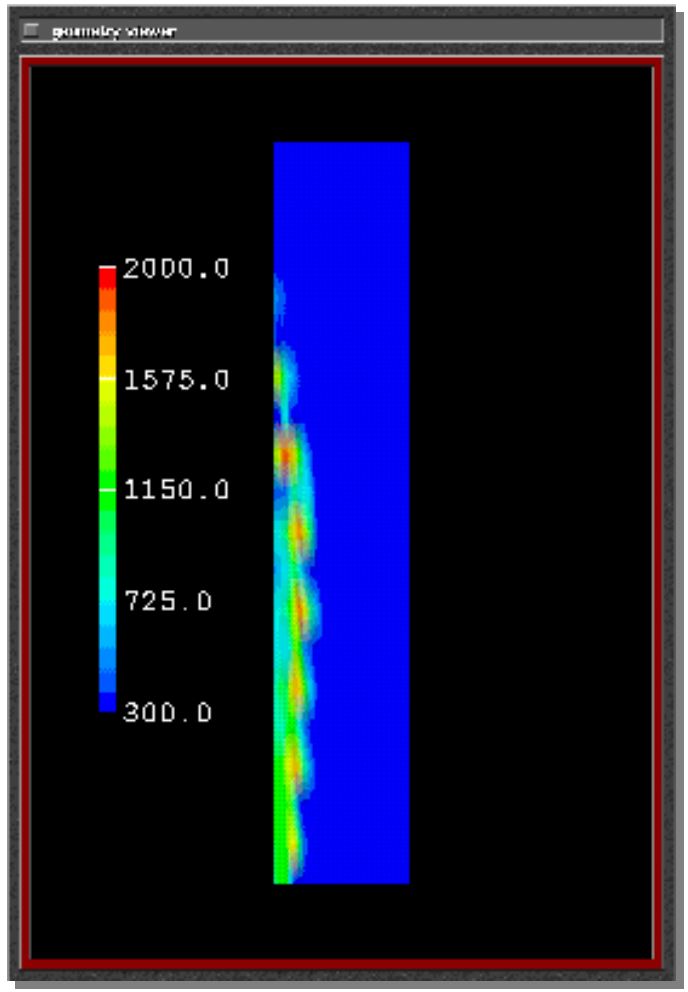
Collaborative Combustion Simulation



Multiple Simultaneous Views

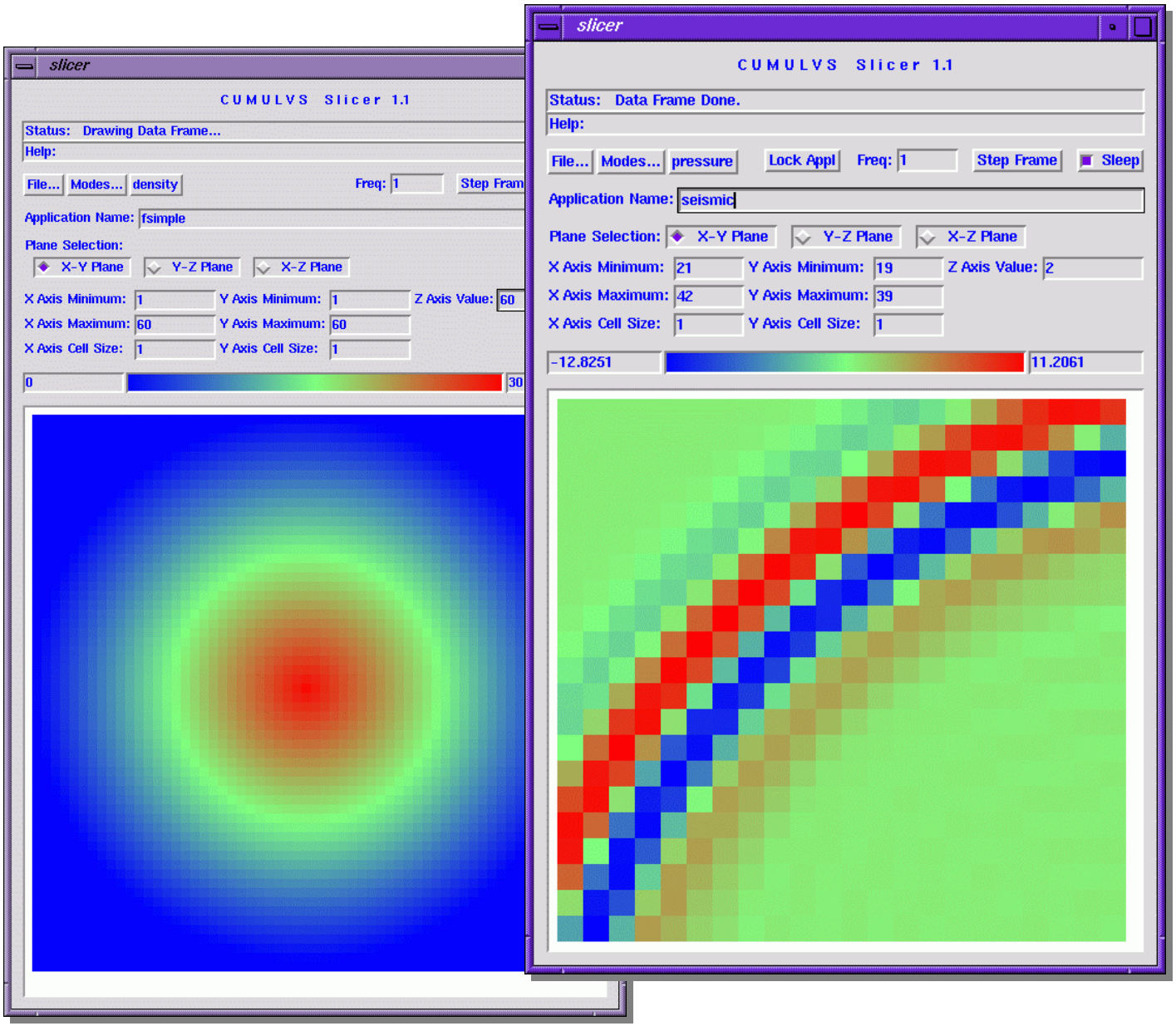


Density

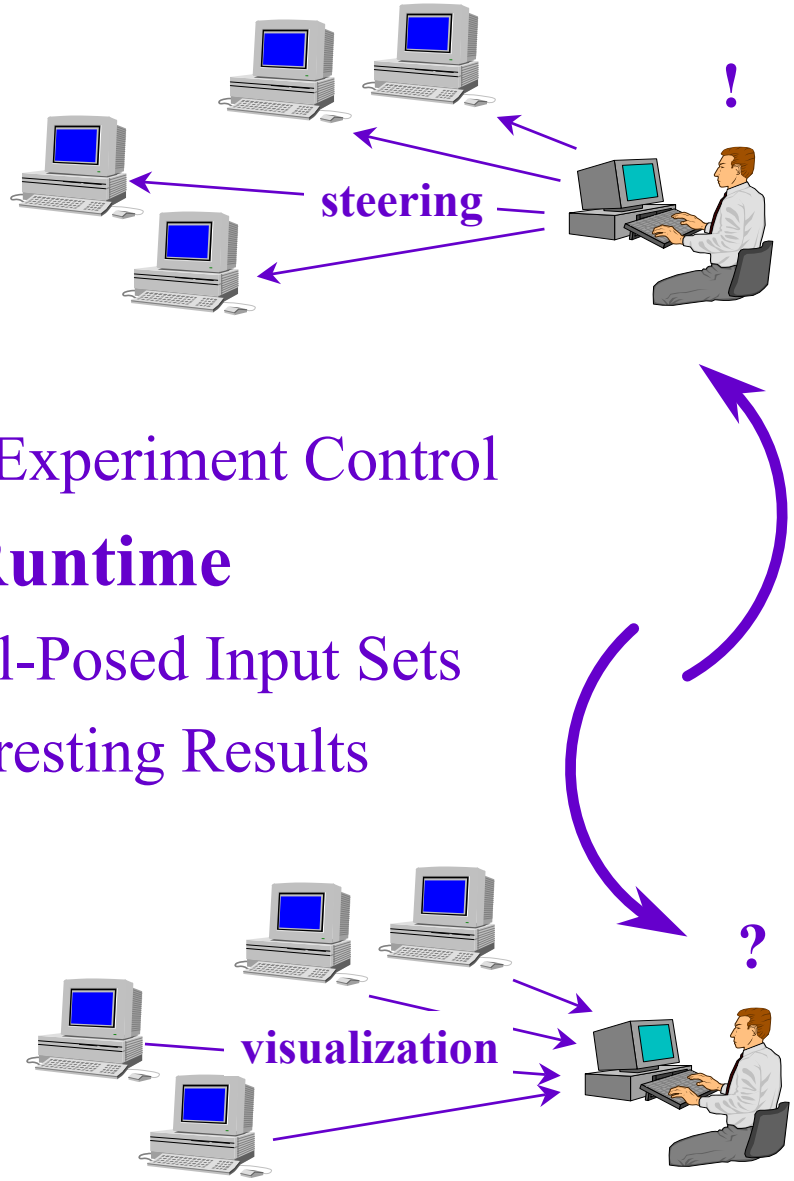


Temperature

Multiple Distinct Views



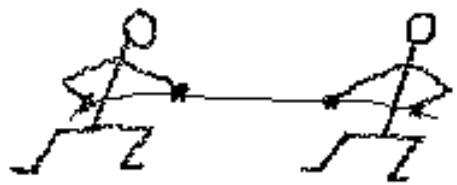
CUMULVS
Steering Features



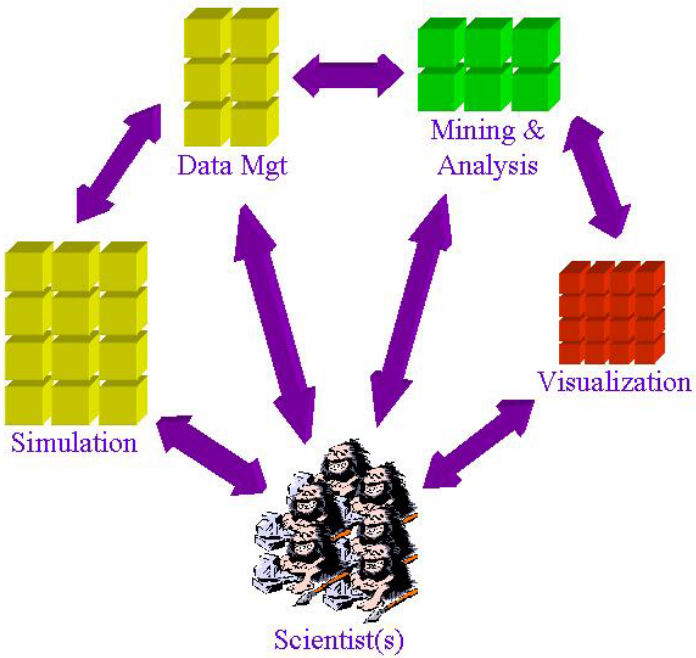
- **Computational Steering**
  - ⇒ API for Interactive Application/Experiment Control
- **Modify Parameters During Runtime**
  - ⇒ Eliminate Wasteful Cycles of Ill-Posed Input Sets
  - ⇒ Drive Experiments to More Interesting Results
- **Closes Loop of Standard Experimentation Cycle**

Coordinated Steering

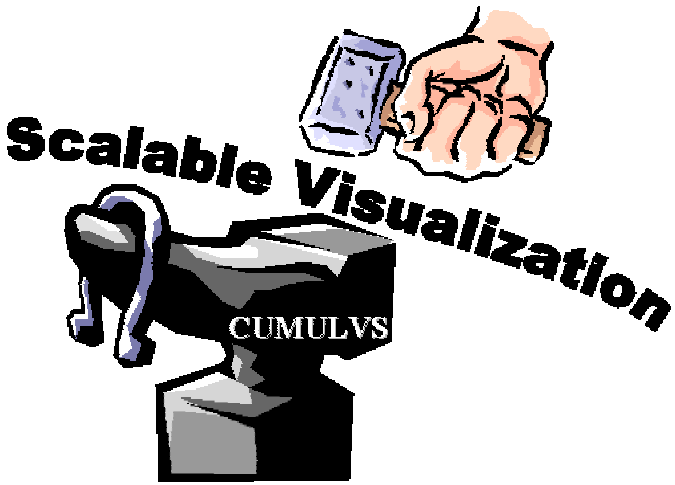
- Multiple, Remote Collaborators
- Simultaneously Steer Different Parameters
- Cooperate with Collaborators
  - ⇒ Parameter Locking Prevent Conflicts
  - ⇒ Vectored Parameters…
- Parallel / Distributed Interactions
  - ⇒ Synchronize with Concurrent Tasks
  - ⇒ All Tasks Update Parameter in Unison



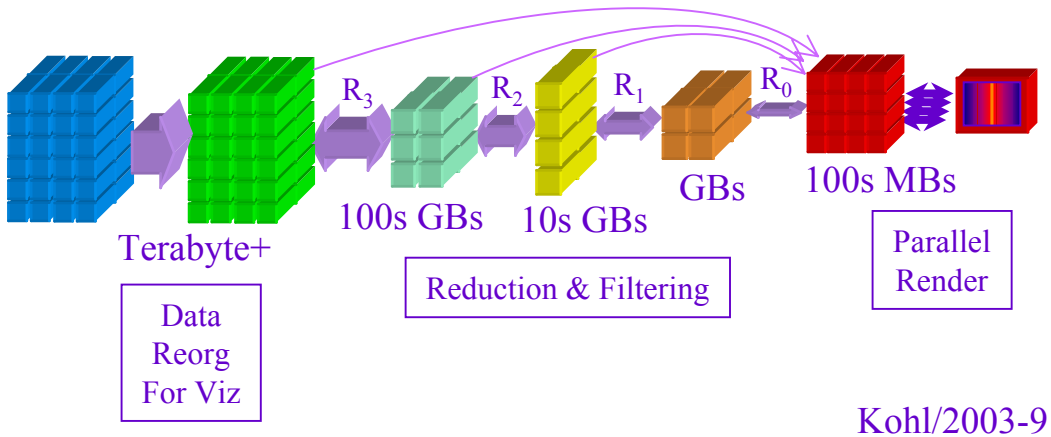
CUMULVS as a Foundry to Forge New Technology



Proposed "Fully Connected"
User-Centric Simulation Cycle



Scalable Visualization Cache Architecture



CUMULVS Summary

- Interact with Online Simulations & Experiments
  - ⇒ Dynamically Attach Multiple Viewers
  - ⇒ Steer Experiment Parameters On-The-Fly
- And Now, The Demo… ☺

http://www.csm.ornl.gov/cs/cumulvs.html