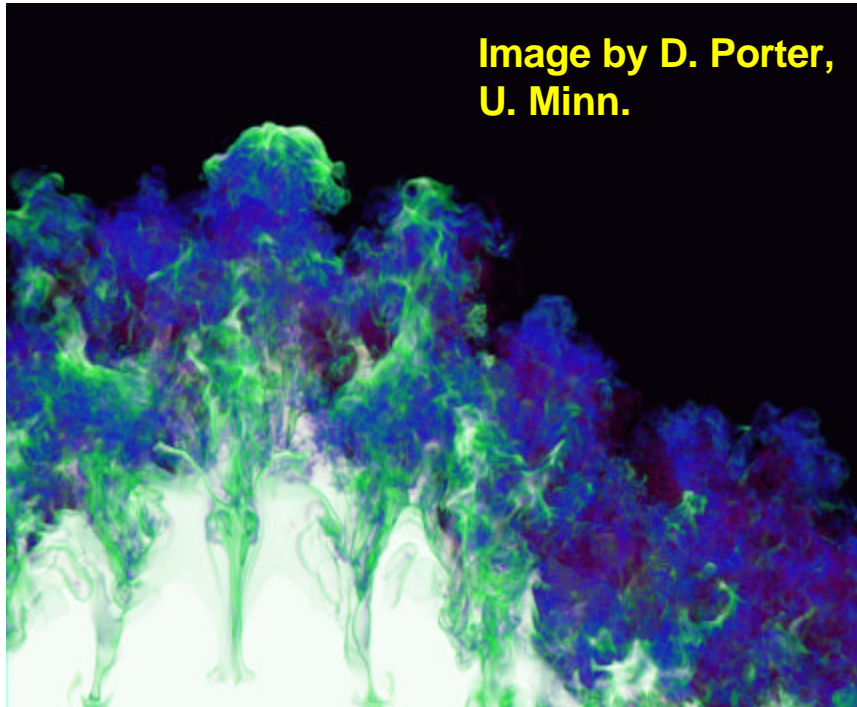

Multi-Resolution Techniques for Scientific Data Visualization

Mark Duchaineau
Data Science Group

April 3, 2001



Our research results enabled post-processing of Bell Prize-winning run



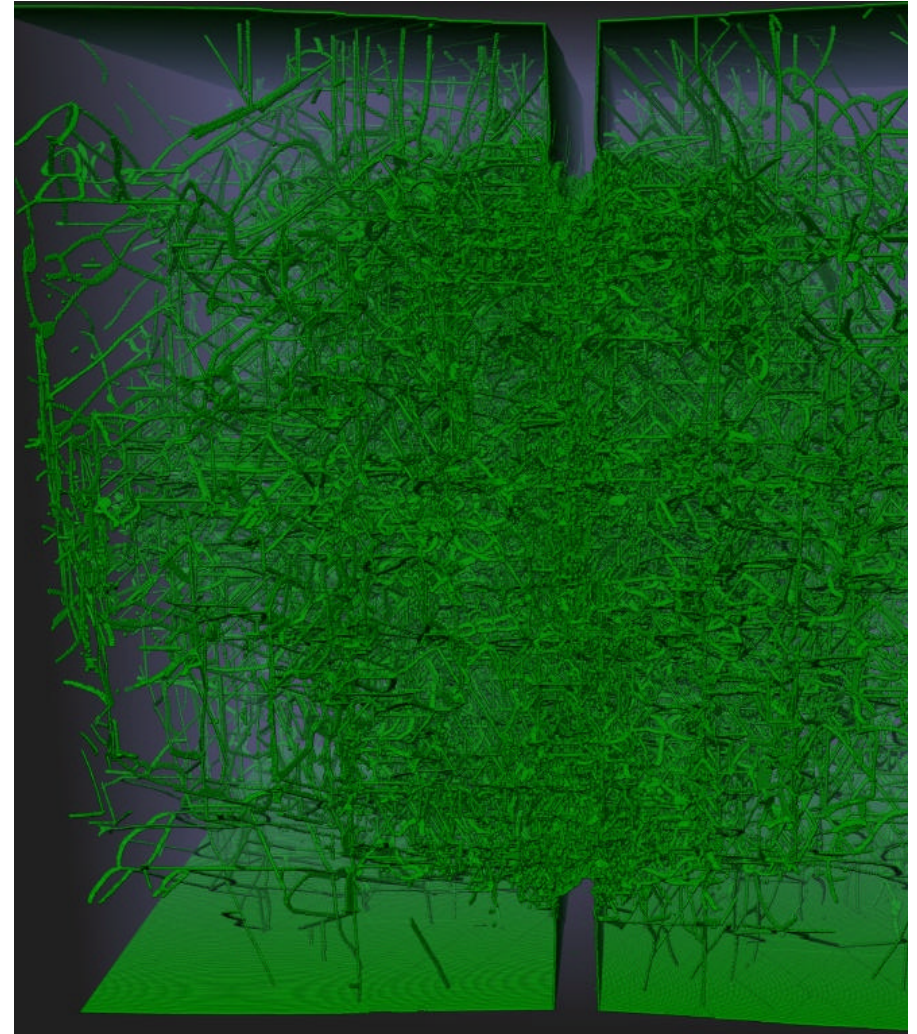
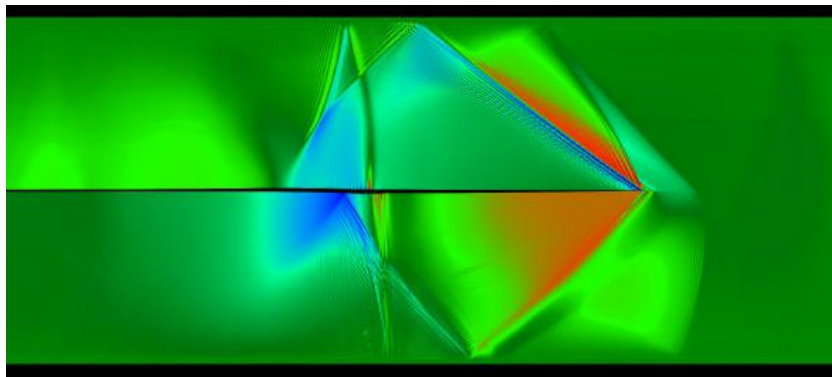
sPPM results: **visualization** of entropy toward end of shock tube simulation

LLNL, IBM, University of Minnesota

- LLNL-team won Gordon Bell Prize for largest Richtmyer-Meshkov run
- sPPM simulation with 24 billion zones ran on 5832 processors of Blue Pacific machine at 1.18TF
- 3D simulations show transition from coherent state to turbulence
- LDRD-funded research improved post-processing
 - could not store 2.4TB of data without compression
 - LDRD wavelets research reduced space 2X & time 10x

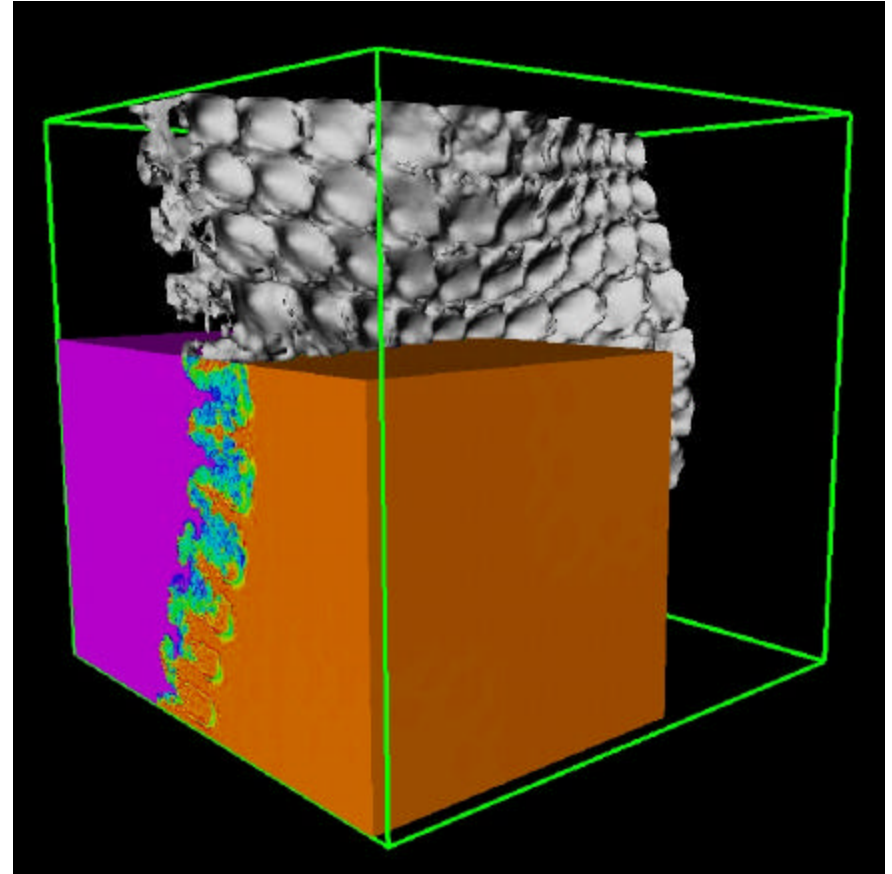
Largest ever crack and dislocation simulations made possible by wavelets

- 5120 ASCI White processors for largest run
- Billion-atom 3D MD studies
- 30X compression, from 25TB to under 1TB
- 10% co-process overhead
- With Farid Abraham/IBM



The LLNL *Terascale Browser* enables interactive exploration of large data sets

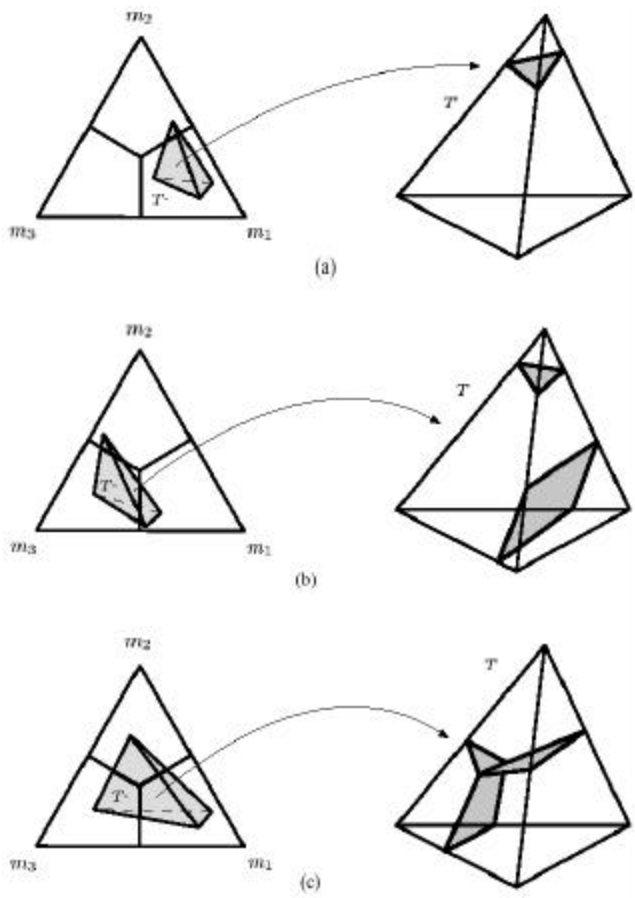
- Main capabilities
 - orthogonal slices
 - volume rendering
 - surfaces (iso, mat)
 - mesh on surface
- Tunable performance
 - fast load/decompress
 - cached slices/surfaces
 - zoom in to full detail
- Displays anywhere
- Deployed via VIEWS



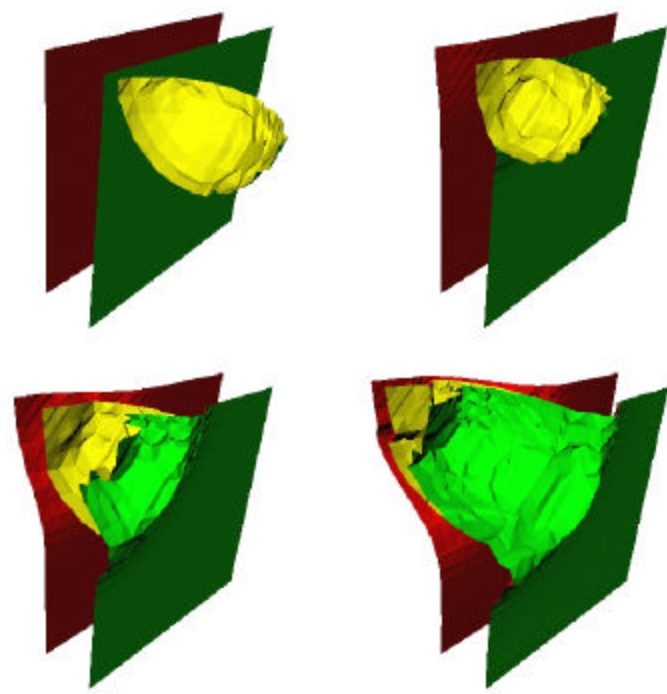
Current data-set challenge:
2048 x 2048 x 1920 x 274

Continuous material boundary extraction from volume fractions

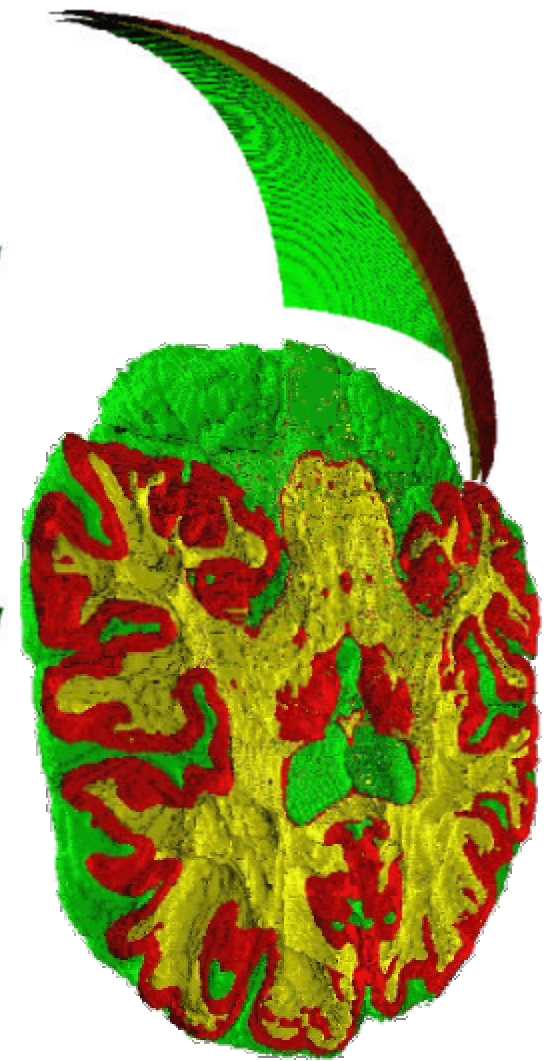
- Fractions treated as barycentric coordinates
- Intersect in N-D simplex and re-project to 3-D



CASC



Bonnell et al. Vis00
(summer student)



Parallel compression allows full-resolution output *and* interaction with terabyte volume data

- Problem: browse volume data with full space-time resolution
 - time+space knobs for orthoslices
 - space knobs for volume render
- Algorithm: parallel, demand-driven orthoslice decompress
 - resample to regular grid
 - batch-parallel wavelet compress
 - event-parallel decompress
 - interactive client

