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UltraVis
SciDAC Institute for Ultrascale Visualization

www.ultravis.org

U.S. Department of Energy

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Office of Science
U.S. DEPARTMENT OF ENERGY

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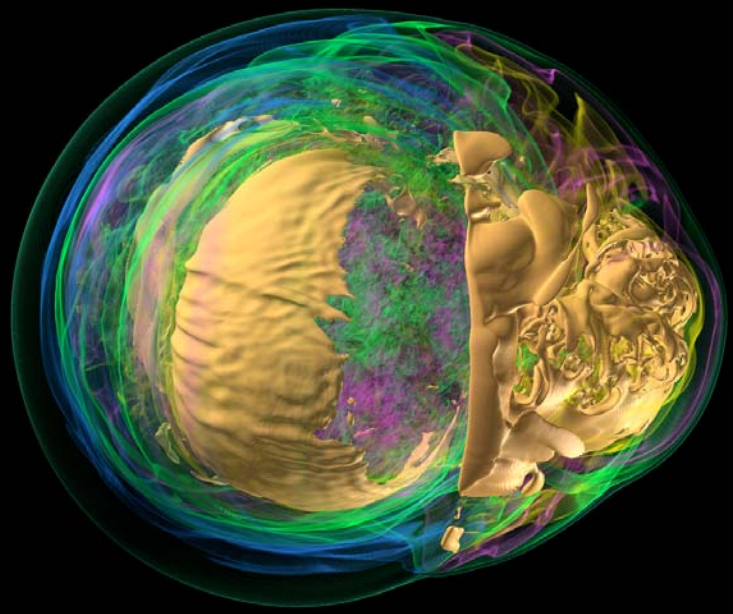
Novel Approaches to Visualization



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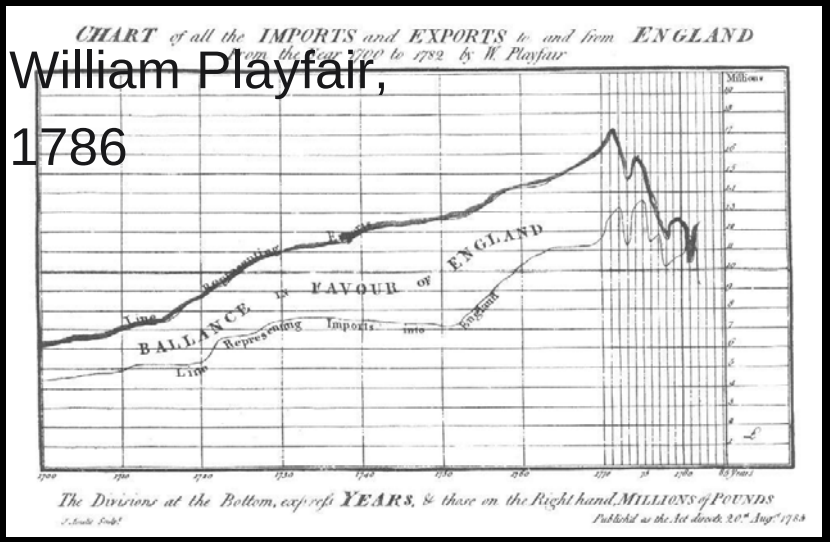
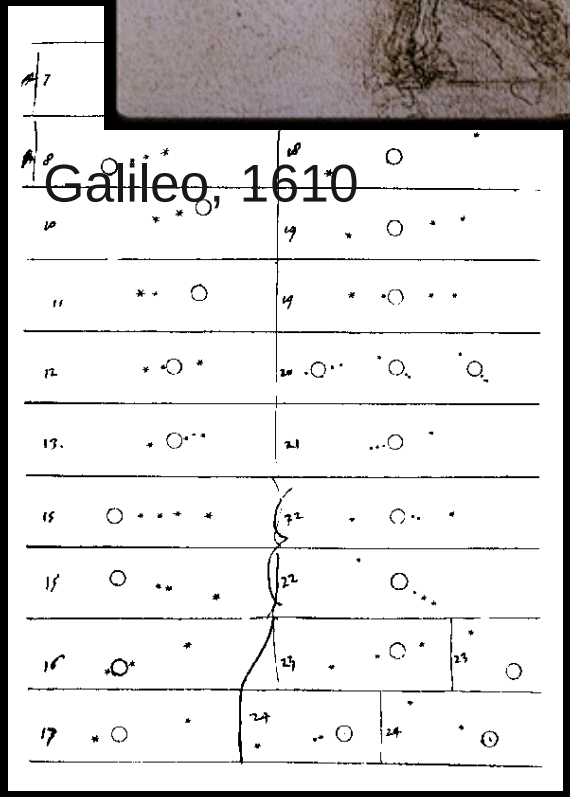
radix

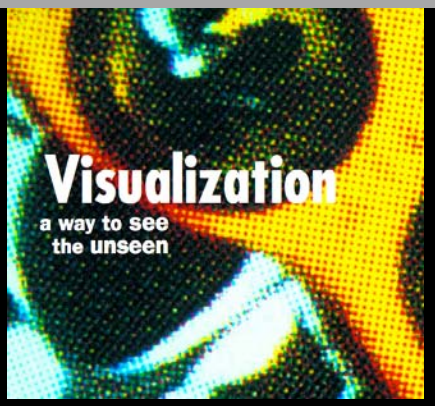
Some vis'tory



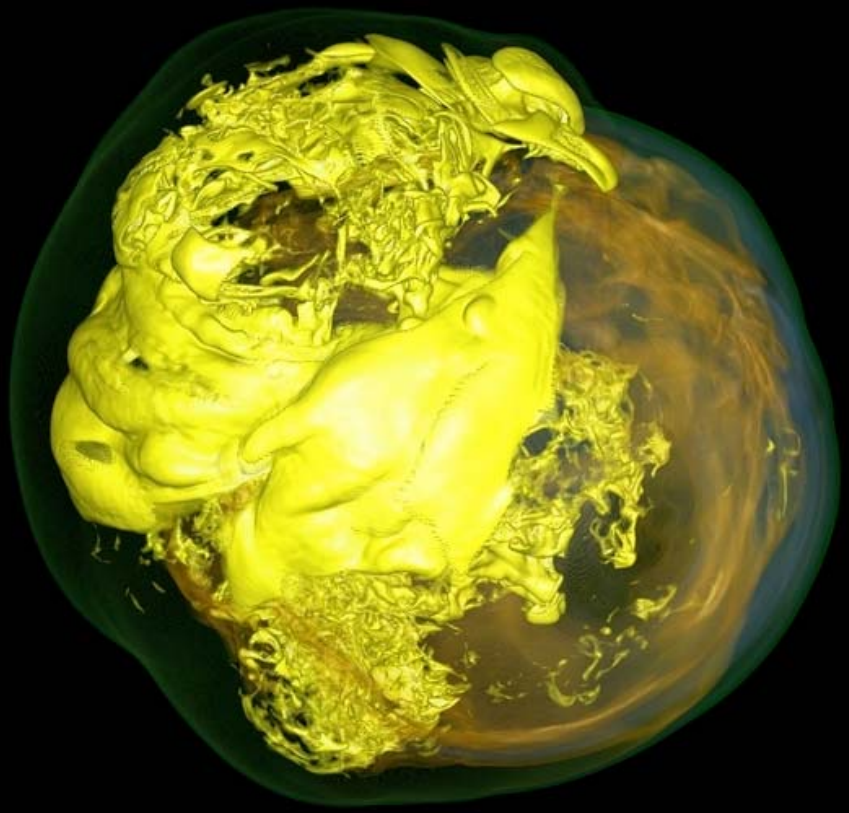
William Playfair, 1786

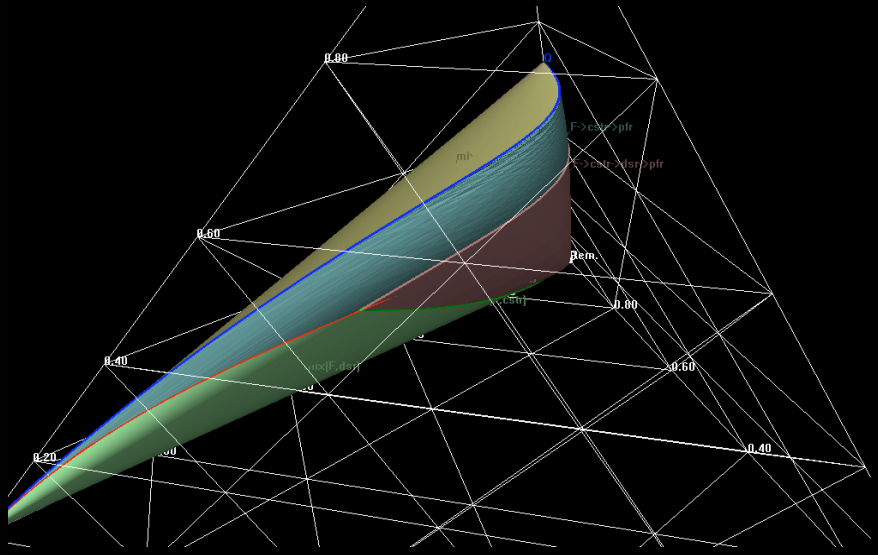


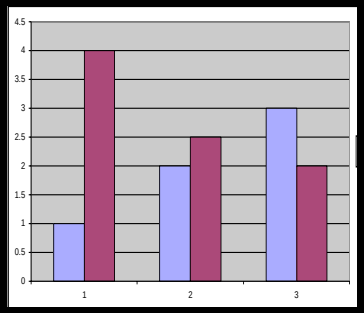
Vis. In Sci Comp., NSF advisory report, McCormick et al, 1987



More than just a pretty picture

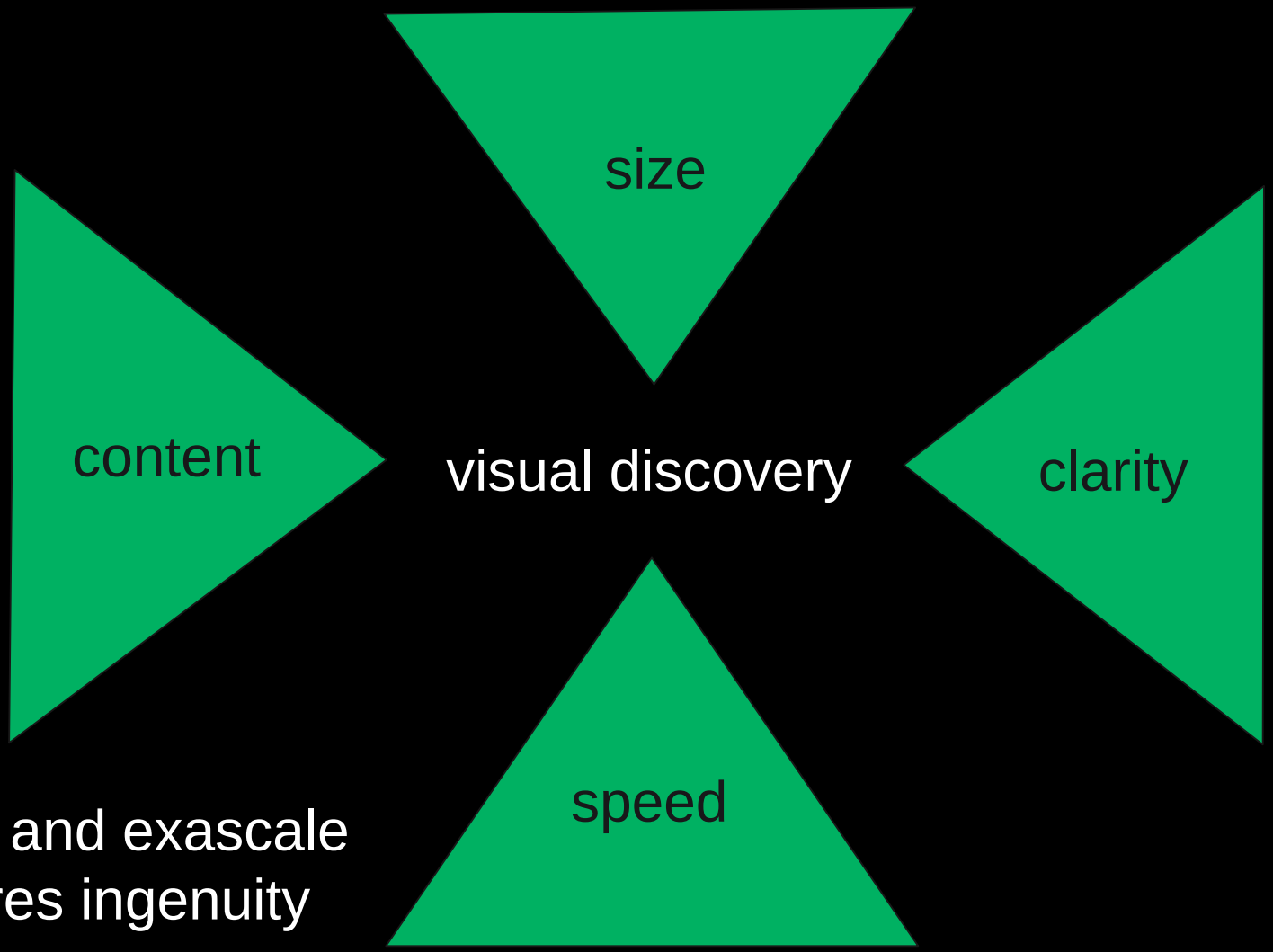






and definitely not
CHART JUNK!

Vis tradeoffs



Peta- and exascale requires ingenuity

Ingredients

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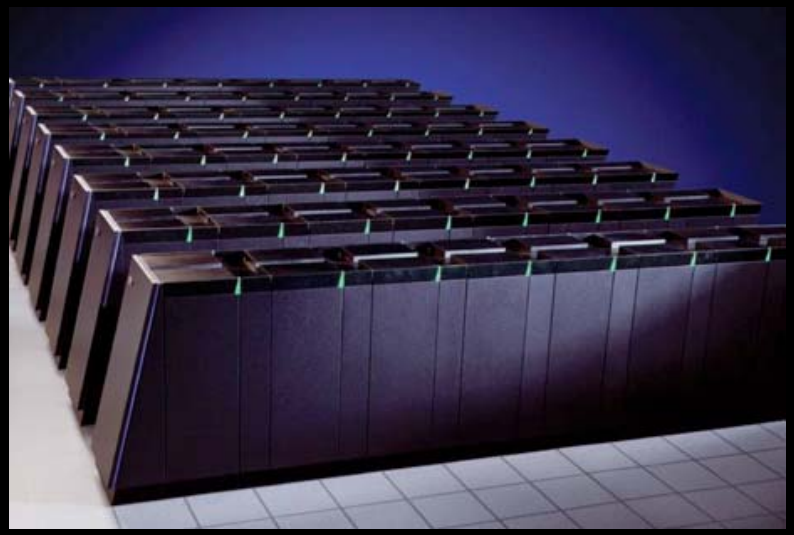
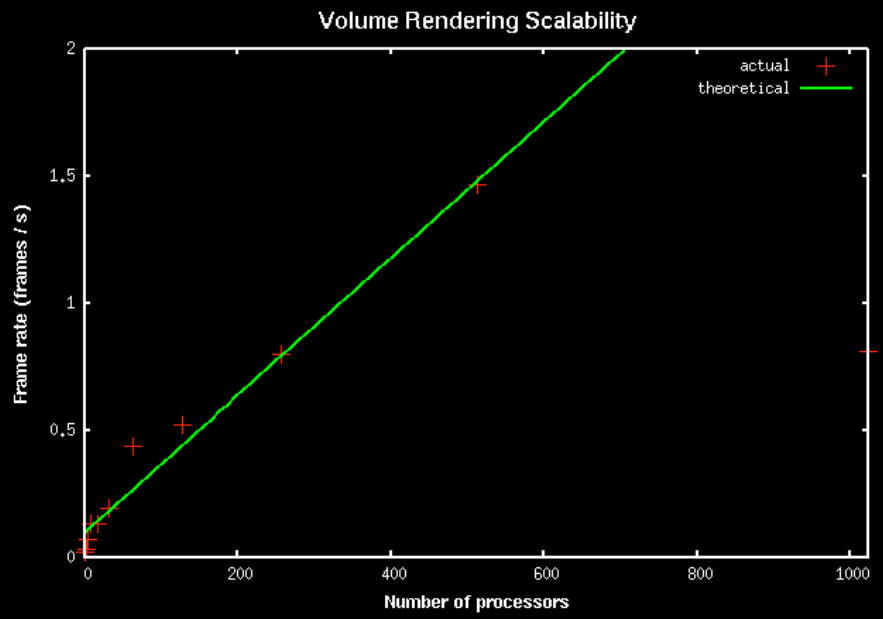
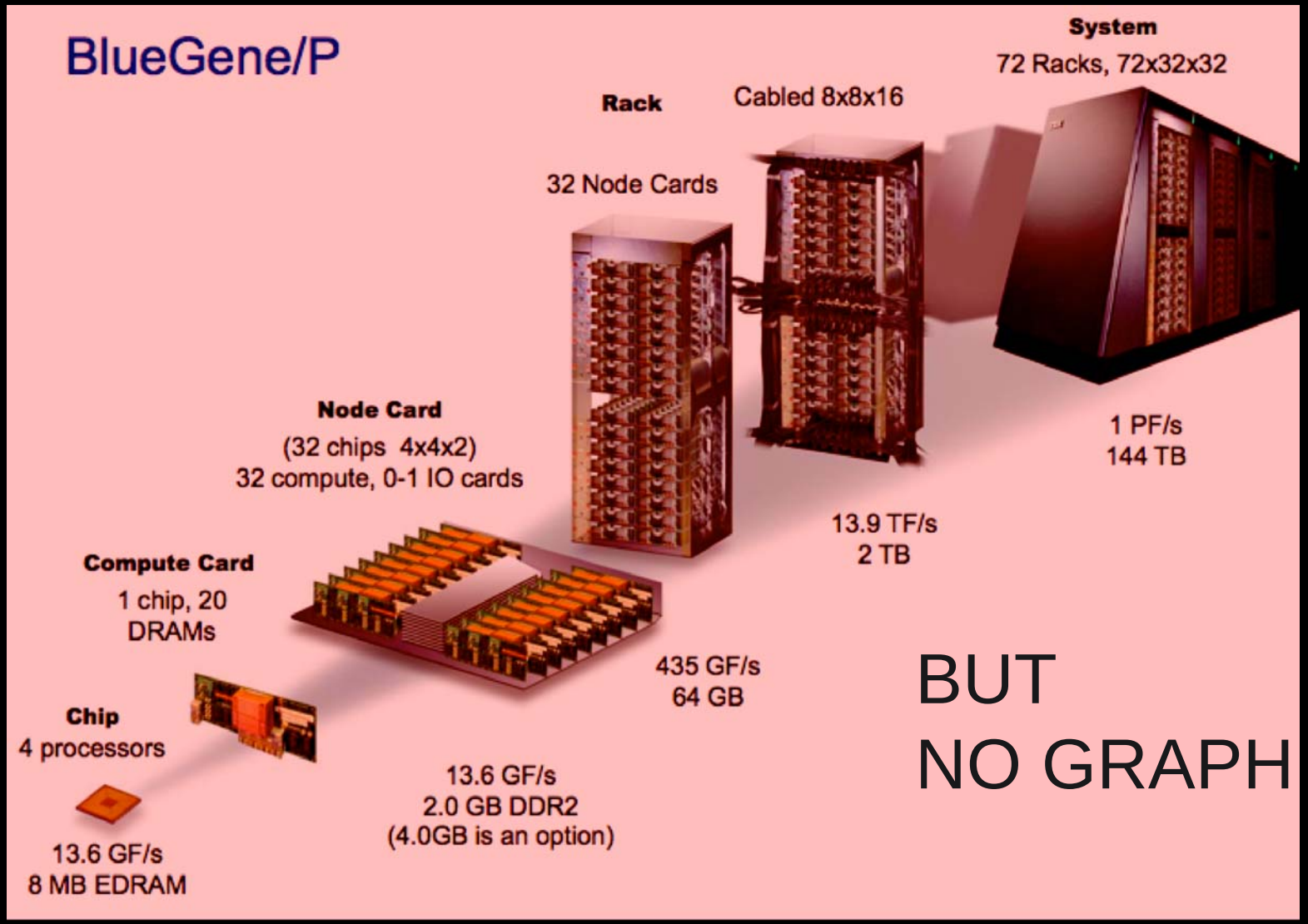
- Leadership computing infrastructure
- Parallel, scalable software rendering algorithms
- Interactive, immersive workspaces



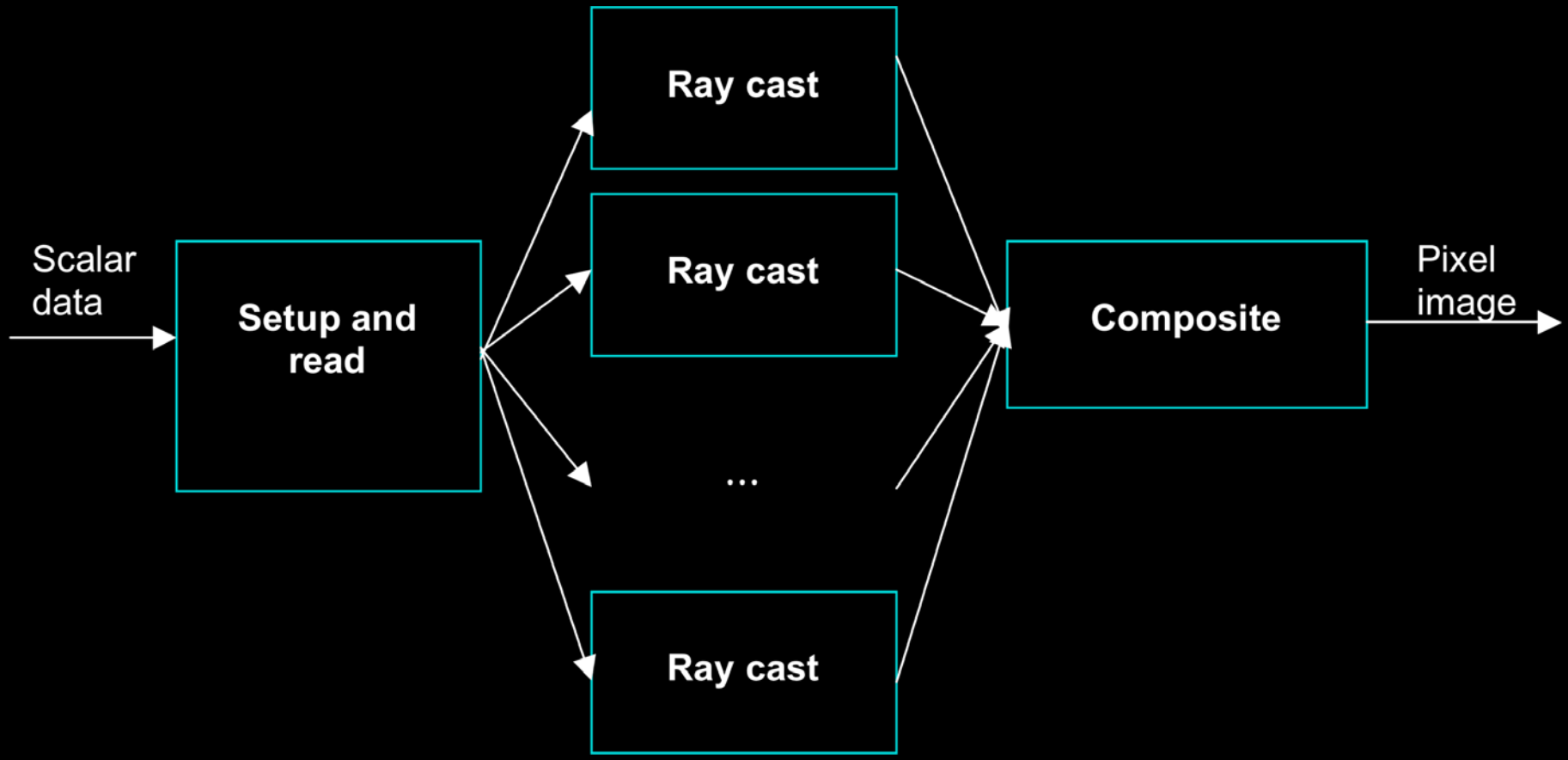


Big iron



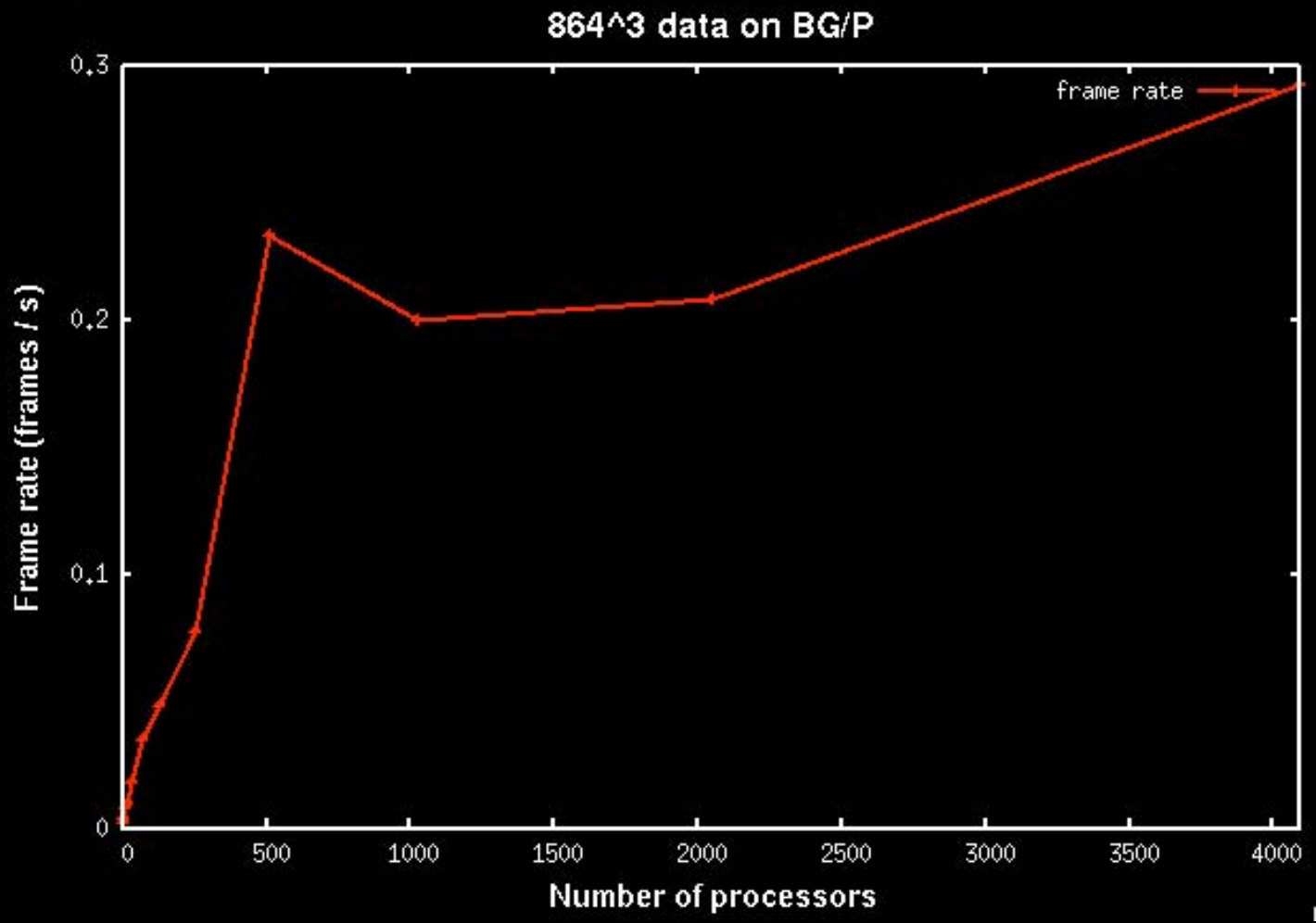
BUT
NO GRAPH ICS!

Massively parallel volume rendering



$$t_{frame} = t_{io} + t_{render} + t_{composite}$$

Scalability



- End-to-end results, including file I/O
- Largest result thus far, 1728^3, 5 Gvoxels, 20 GB, per time step, 1600^2 pixels, 2.5 Mpixels, 24 s

End-to-end performance juggling

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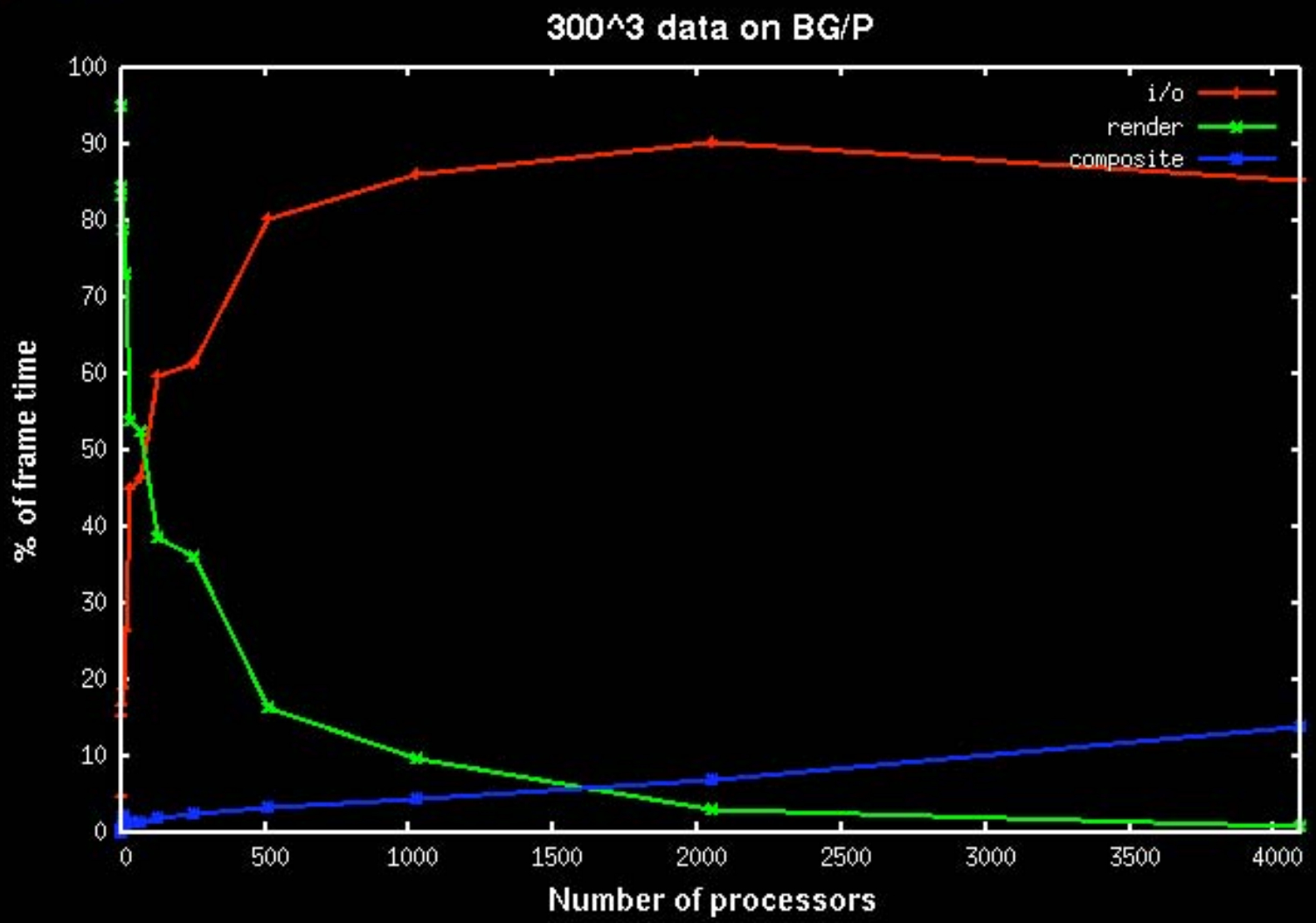

Profiling tools help

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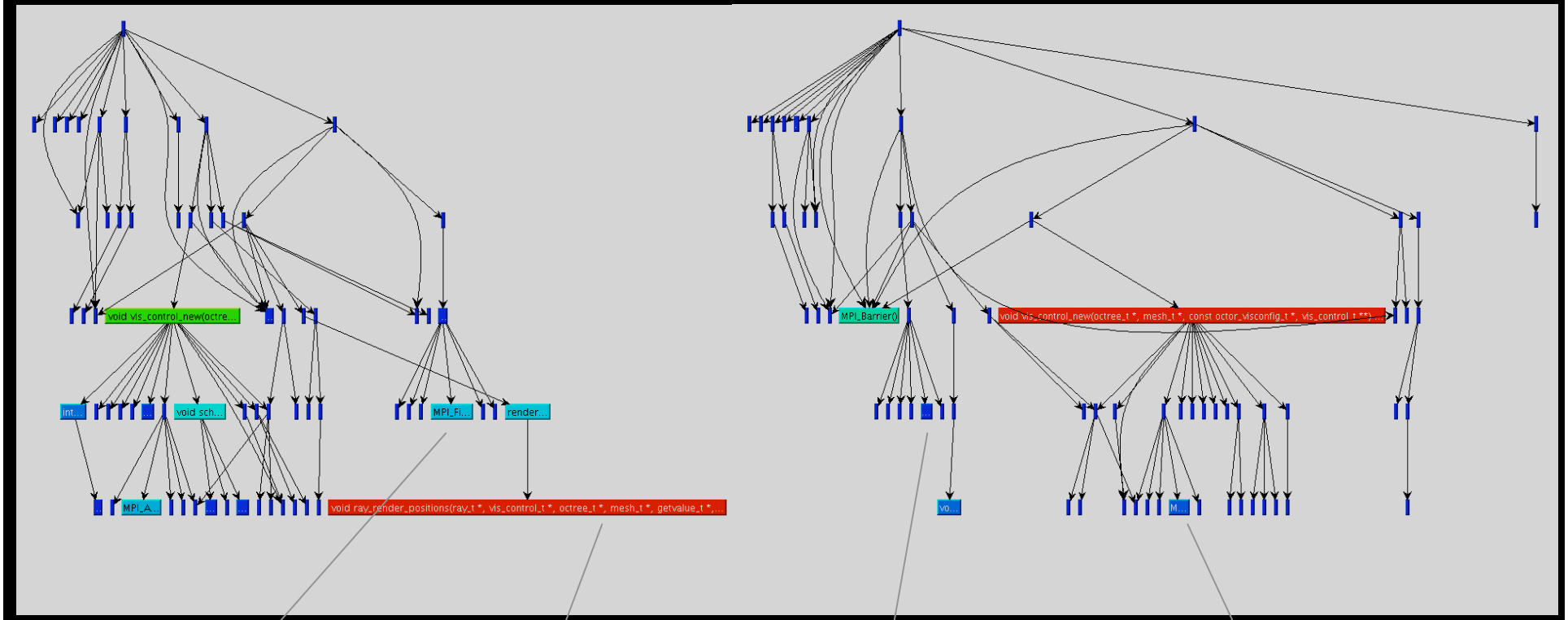
p = 4

p = 256



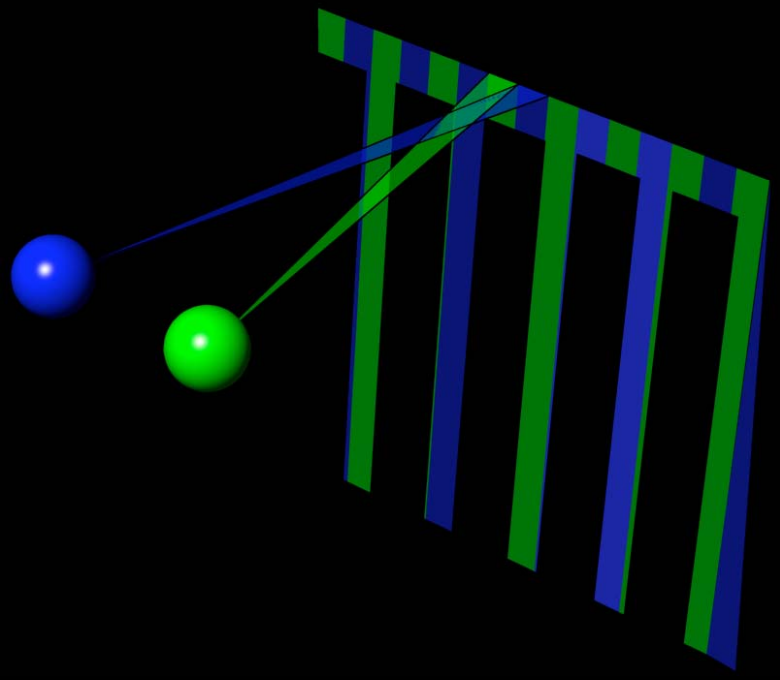
I/O

render

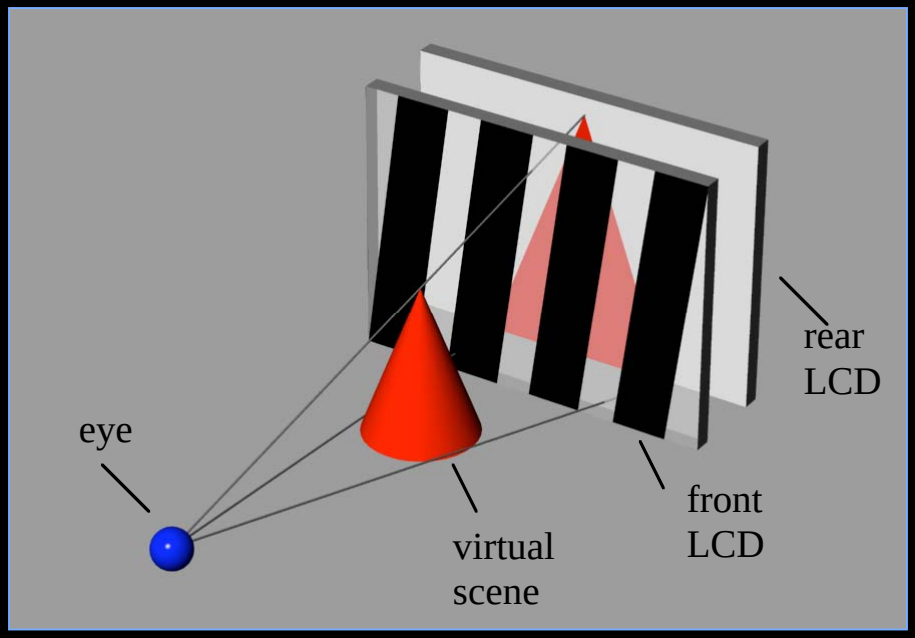
I/O

render

Parallax barrier autostereoscopy



Static parallax barrier



Active parallax barrier

Applicability

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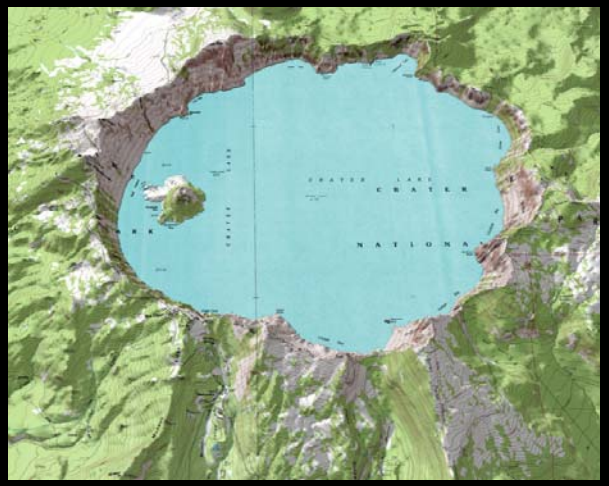
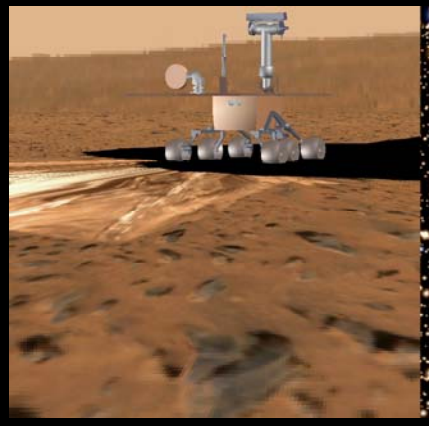
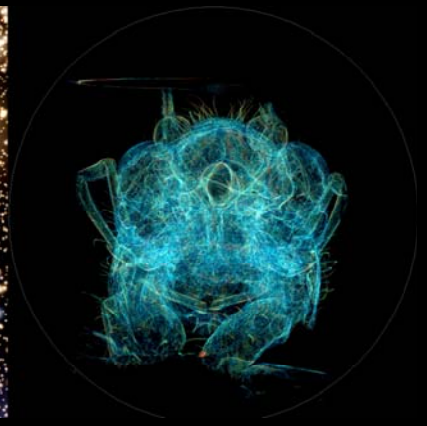
Geology



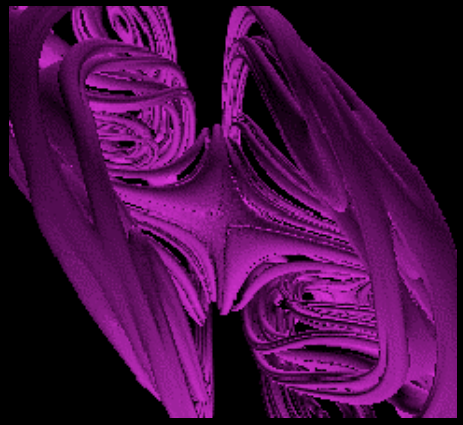
Communication



Astronomy



Biology



Mathematics

Accessibility

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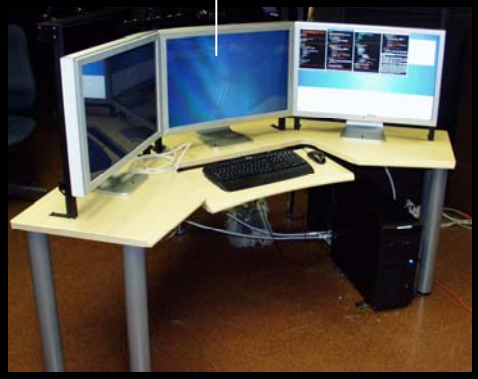
Mar 04 | Aug 05 | Jan 06 | Sept 06 | Jan 07

CV-35

FV-6



PV-3

PV-1

CV-65

Engaging, interactive workspaces

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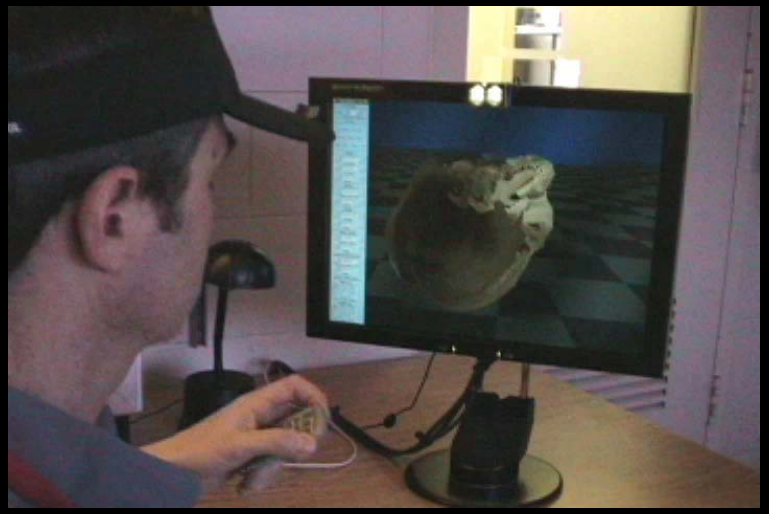

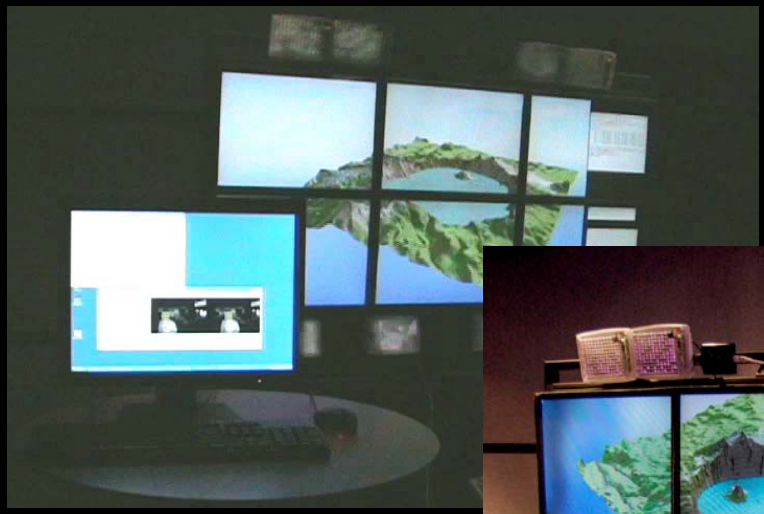

Lessons learned thus far

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- HPC visualization may appropriate at ultrascale
- End-to-end performance is a delicate balance
- I/O matters (E2E time, not just rendering time)
- Interaction is more than viewing data

Where do we go from here

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- Continue to scale to gigavoxels and megapixels
- Refine algorithms
- Adapt to less structured data
- Add interactivity
- Incorporate novel display environments
- Multi-process / multi-core hybrid model

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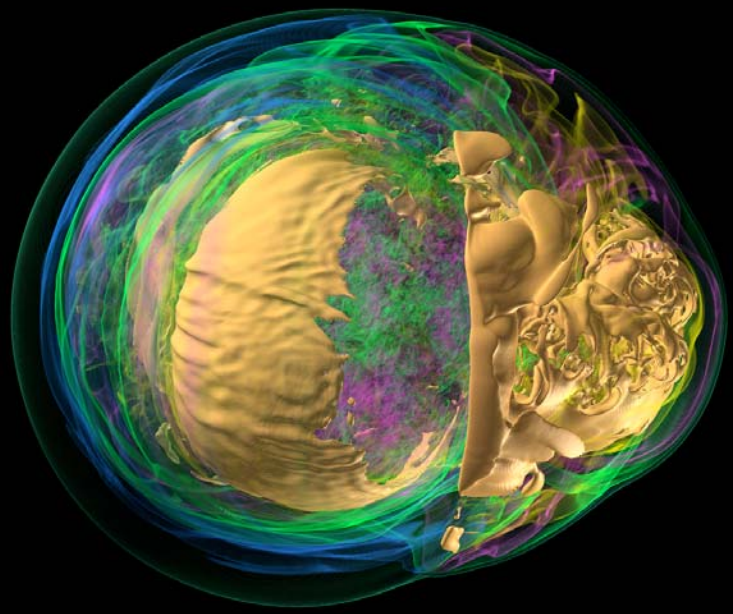

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