

Scalability of Paraview's Coprocessing Capability

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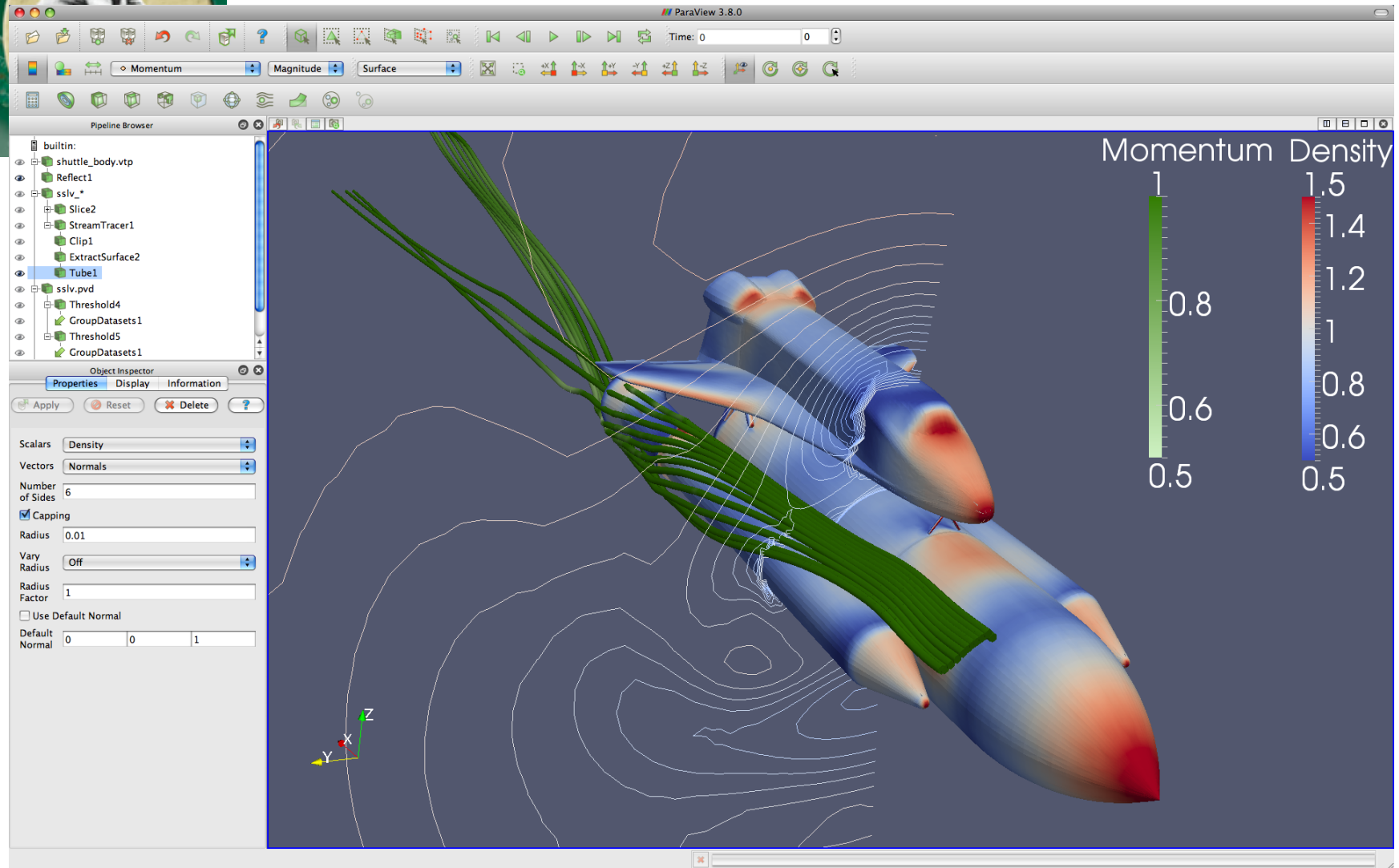
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SAND 2011-3226C

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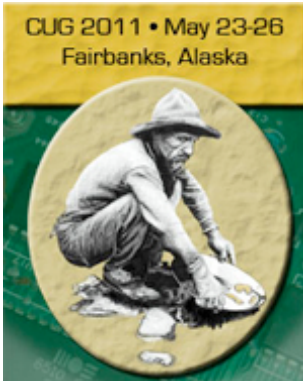
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What is ParaView



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Current ParaView Usage

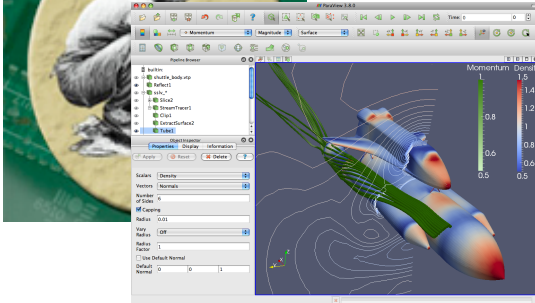
- Used by academic, government, and commercial institutions worldwide.
 - Downloaded ~3K times/month.
- Landmarks of SNL usage:
 - 6 billion structured cells (2005).
 - 250 million unstructured cells (2005).
 - Billions of AMR cells with 100's of thousands of blocks (2008).
 - Scaling test over 1 Trillion structured cells (2010).

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ParaView Application Architecture



ParaView Client

pvpython

Coprocessing

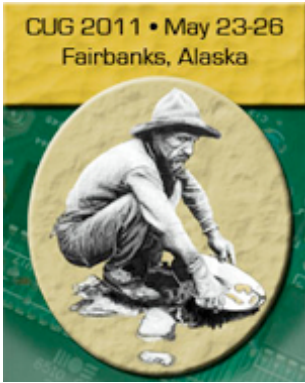
Qt Controls

Python Wrappings

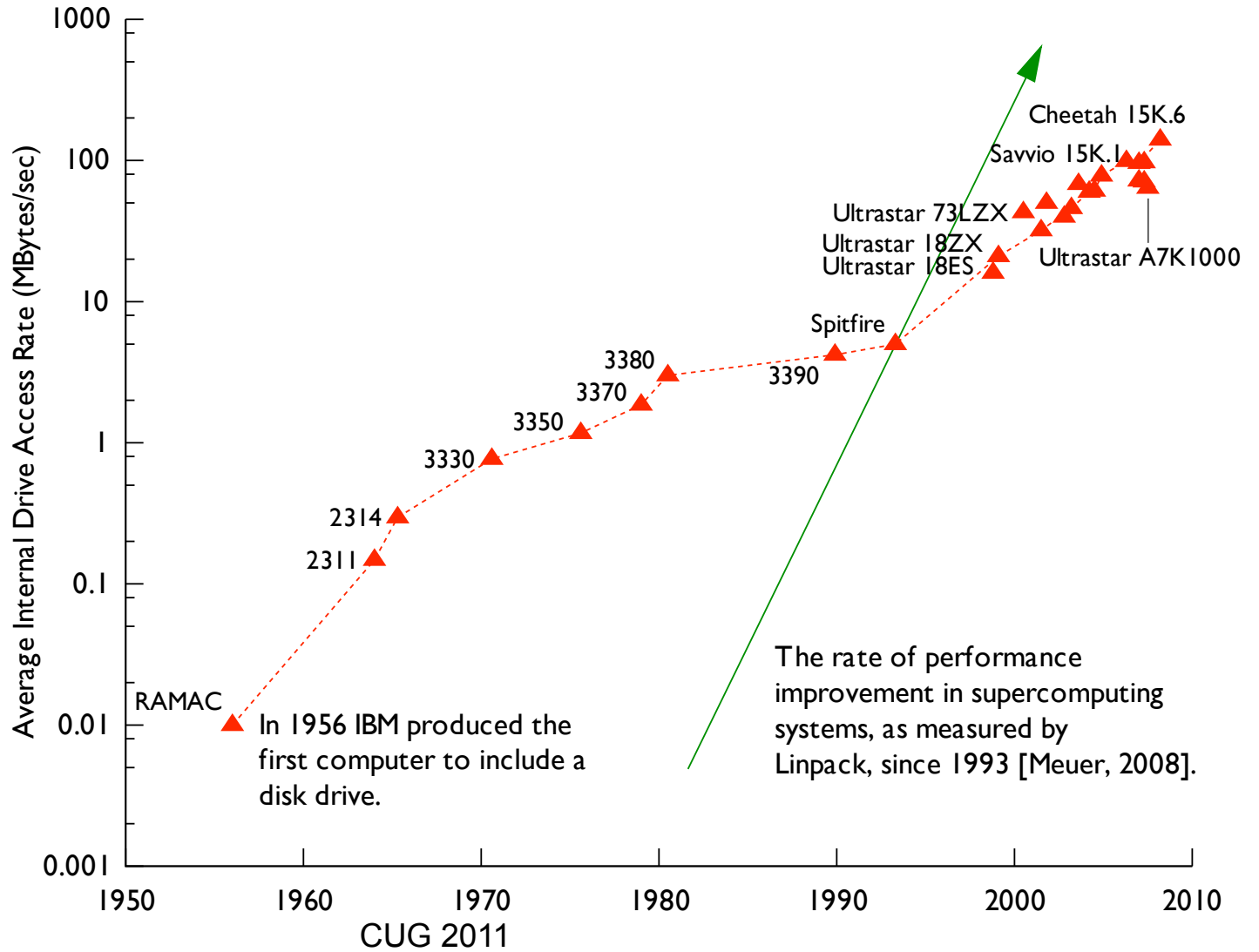
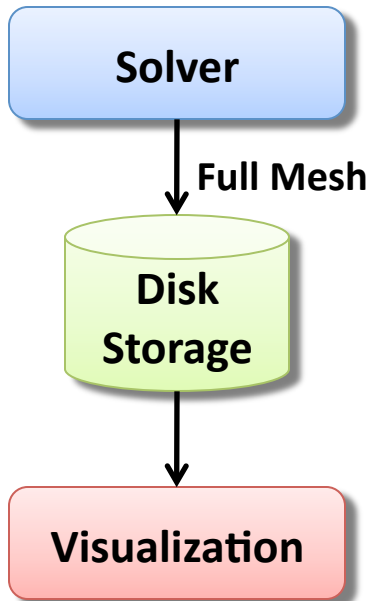
ParaView Server
Parallel Abstractions and Controls

VTK
Core Visualization Algorithms

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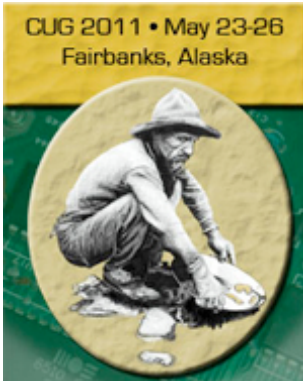


Traditional Visualization Workflow is Breaking Down



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Image from Rob Ross,
Argonne National Laboratory



Cielo Tips, updated February 22, 2011

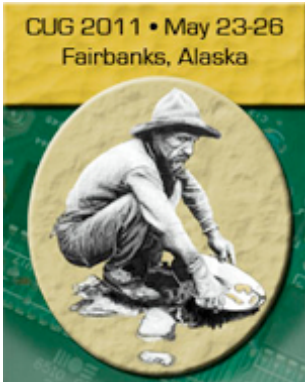
"...remember that the sweet-spot for I/O process count is maximal at 16 K, but it drops off substantially with larger numbers of procs issuing parallel I/O transfer requests."



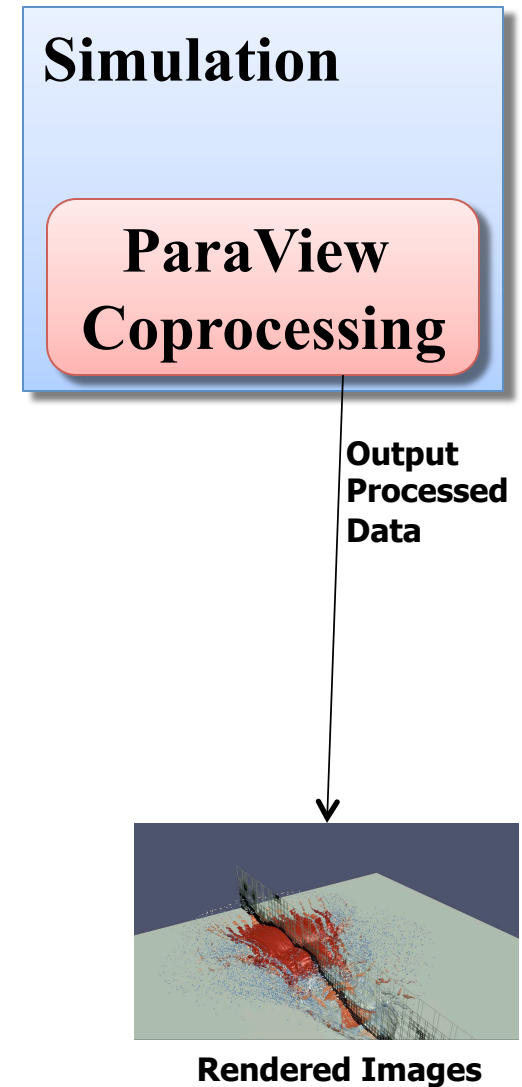
What is the ParaView Coprocessing Library?

Simulation

**ParaView
Coprocessing**

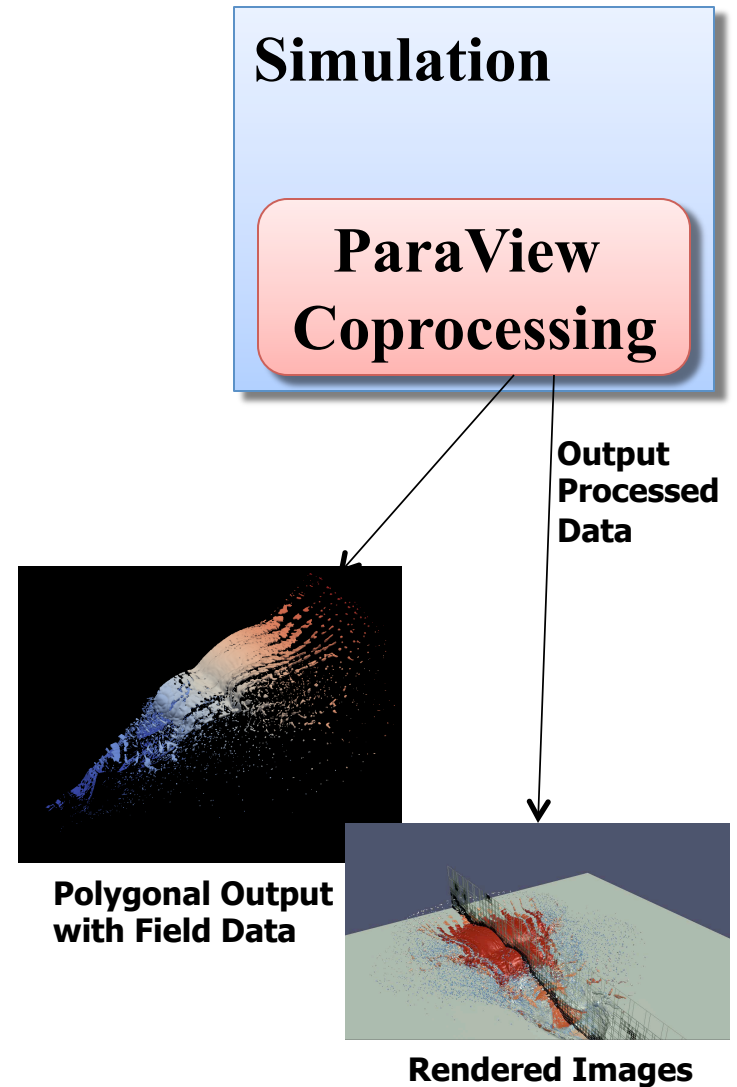


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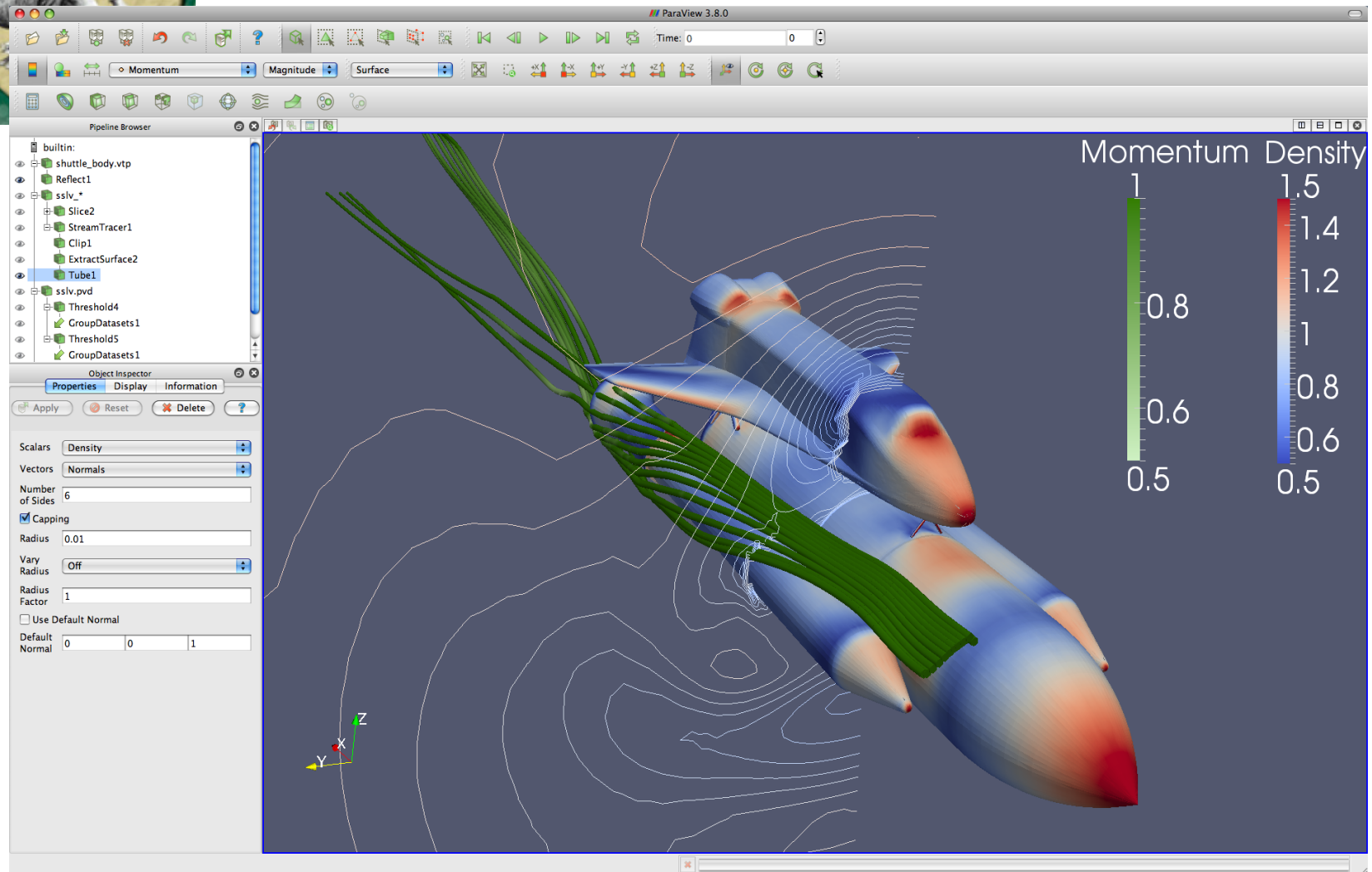


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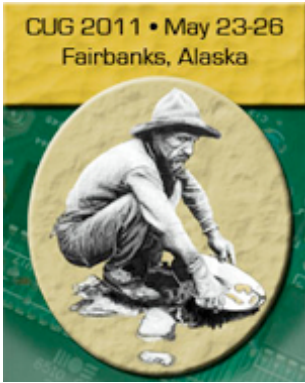




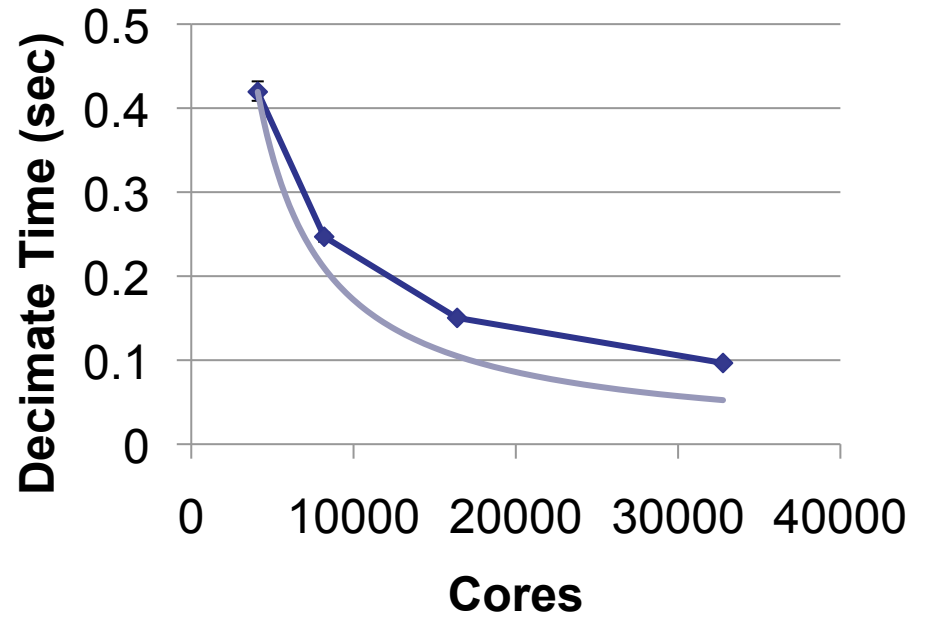
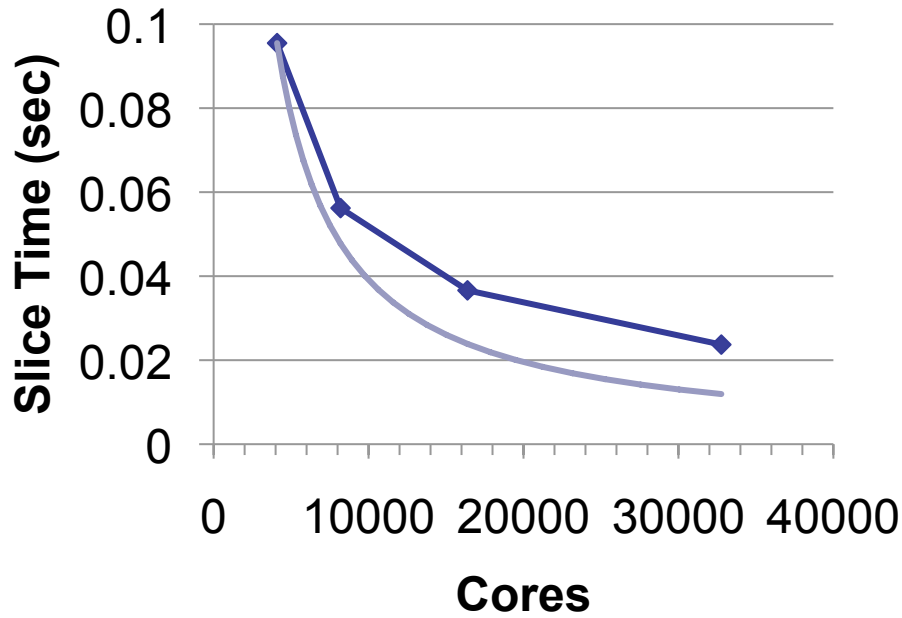
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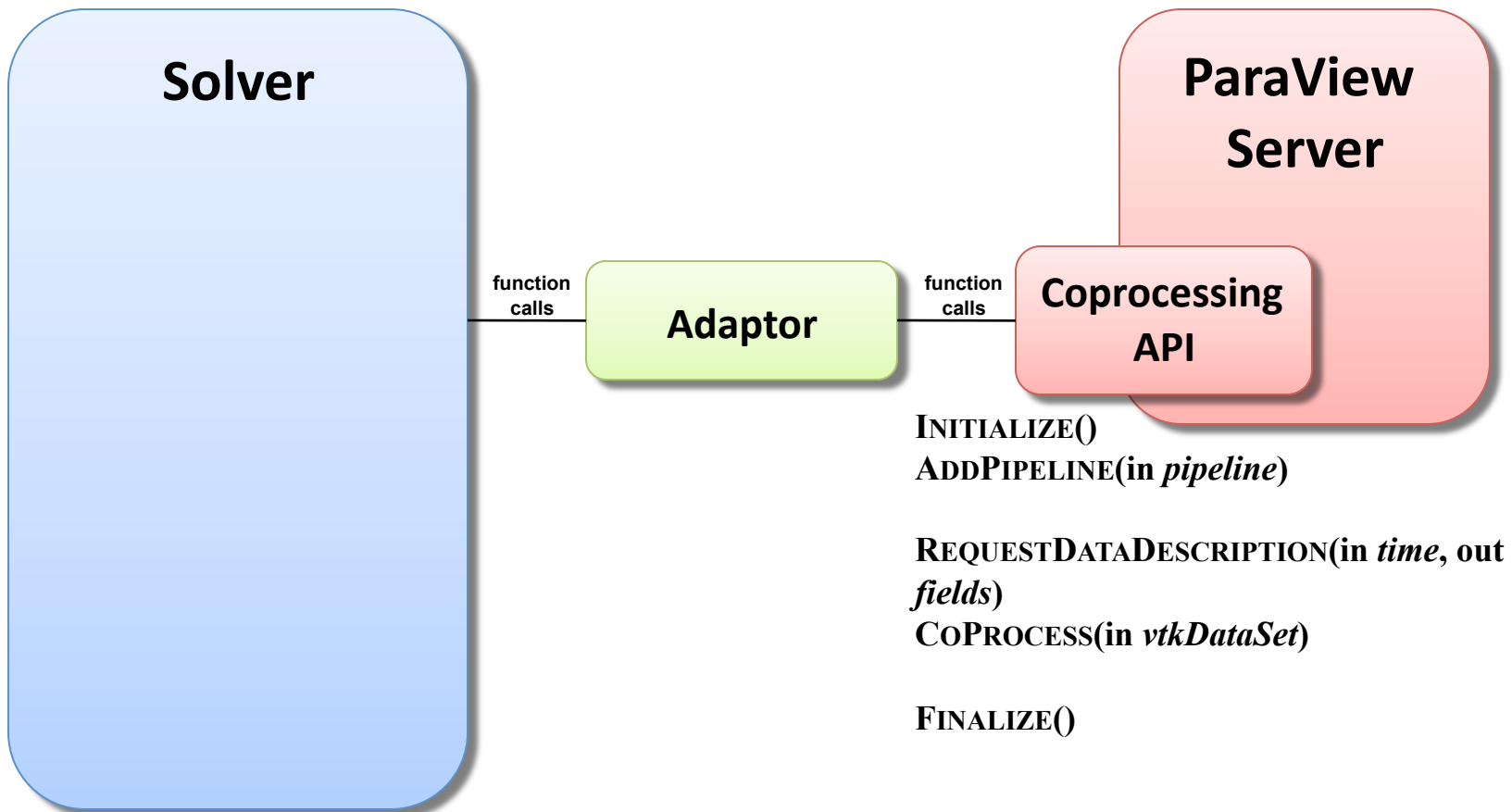


Solid Scaling Performance



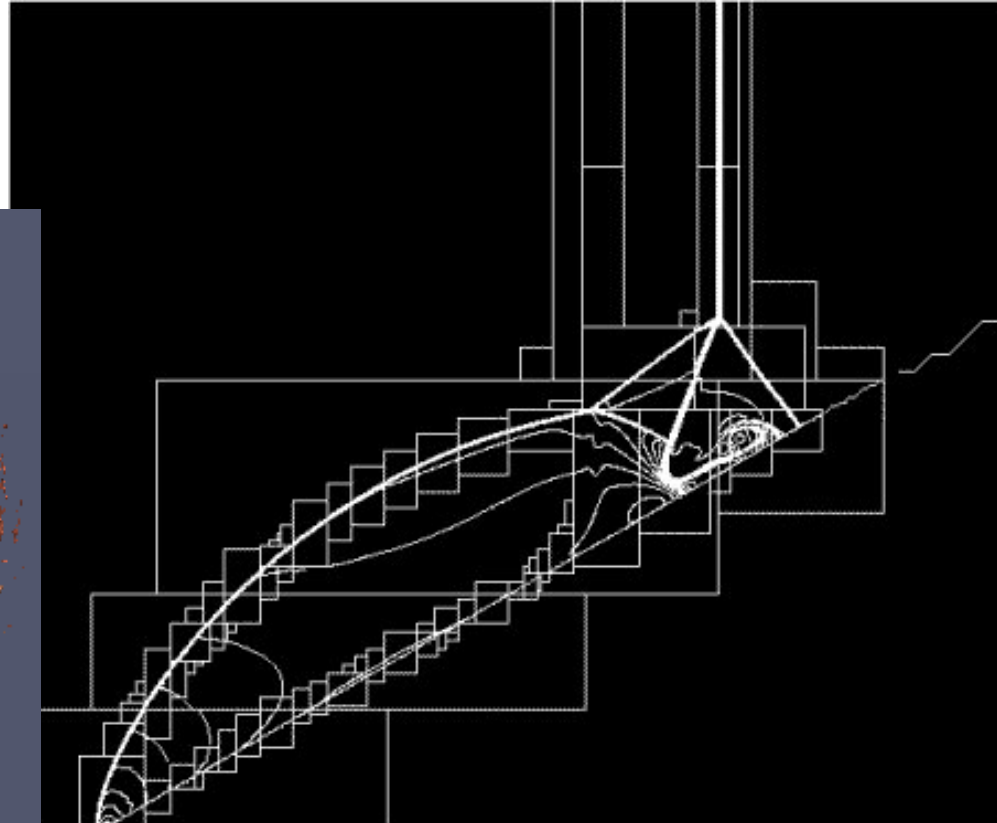
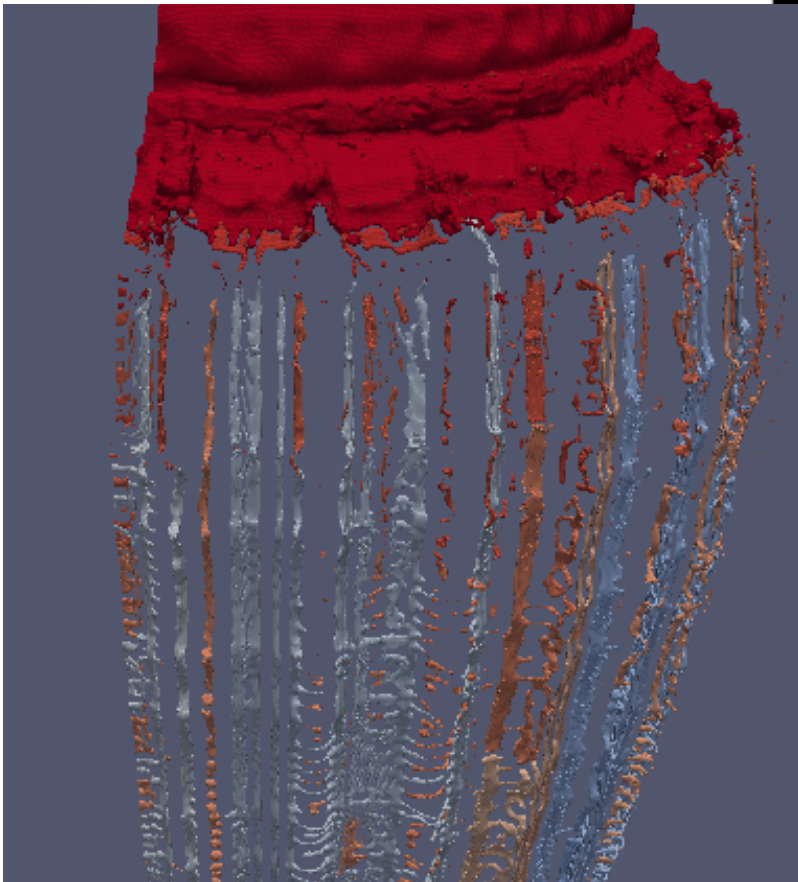


Coprocessing Library





CTH



Example of 2D AMR
image courtesy Wikimedia commons

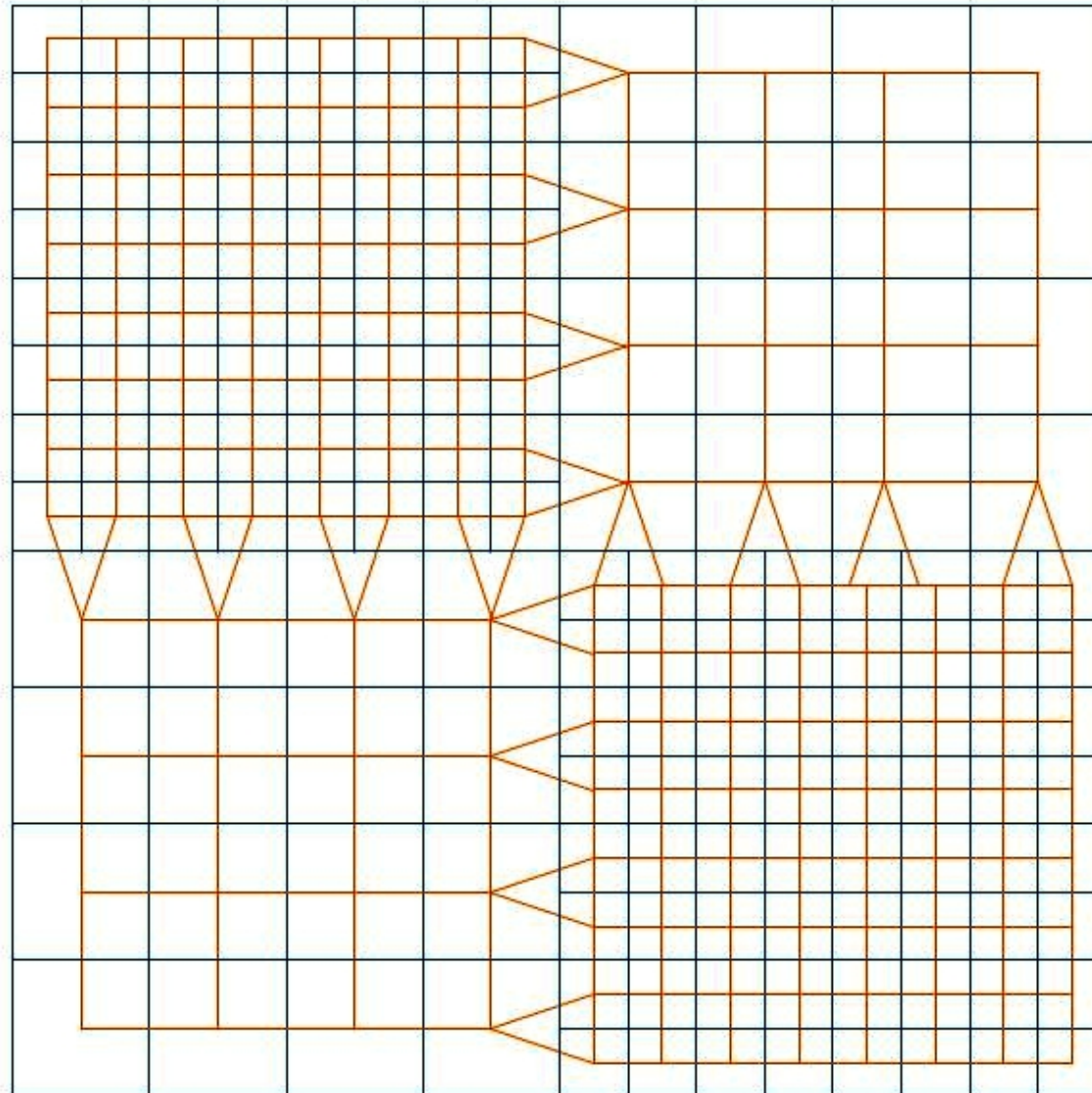
Fragment detection in a simulation of an exploding pipe CUG 2011

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Water tight surfaces



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Memory Limits

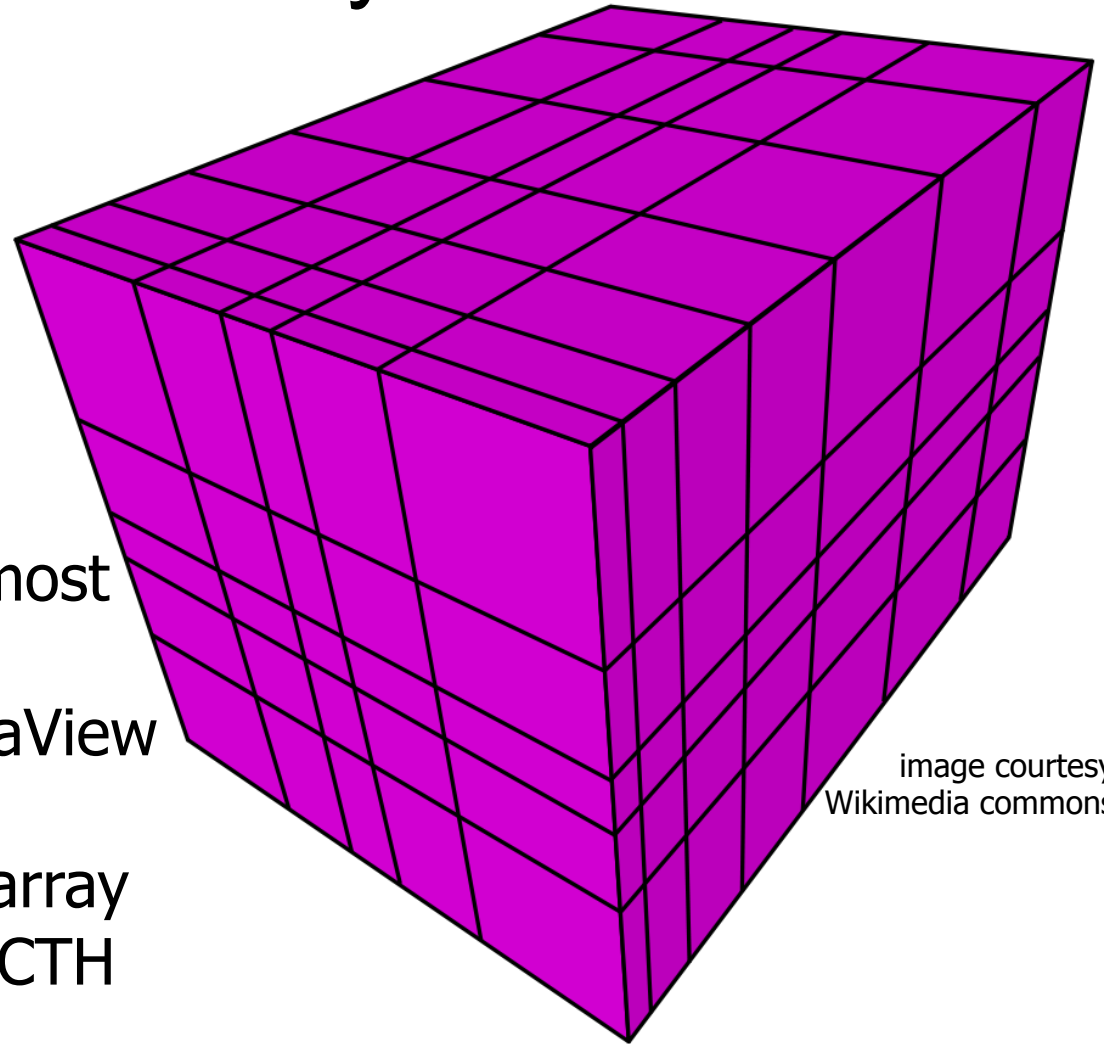


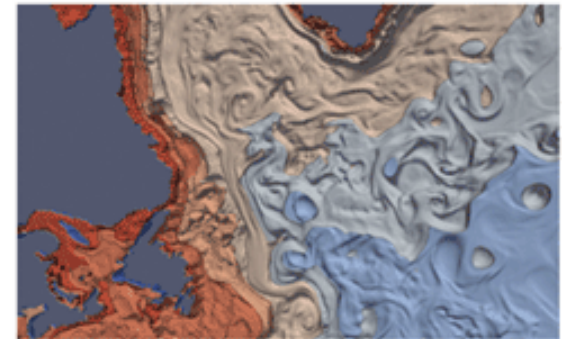
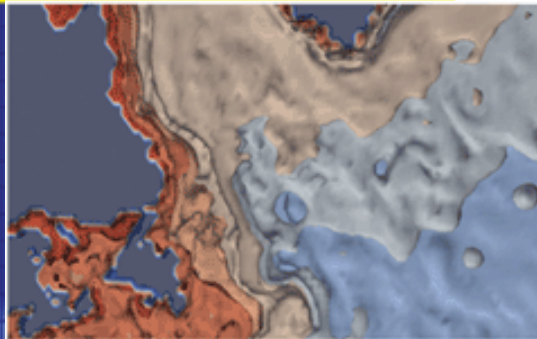
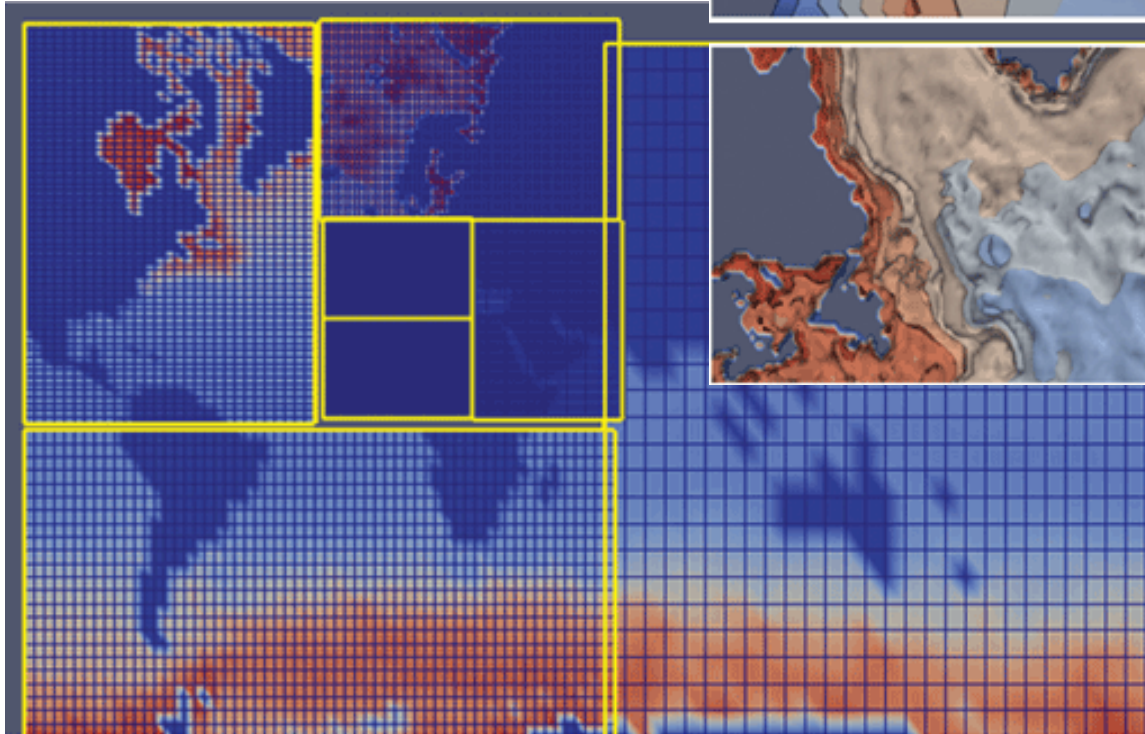
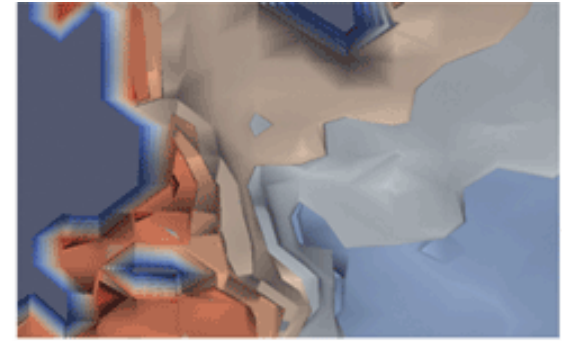
image courtesy
Wikimedia commons

- CTH often runs using most available memory
- Very little room for ParaView
- Solution:
 - Wrap existing VTK array
 - Maps VTK index to CTH index
 - Shallow copy the data

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ParaView Streaming



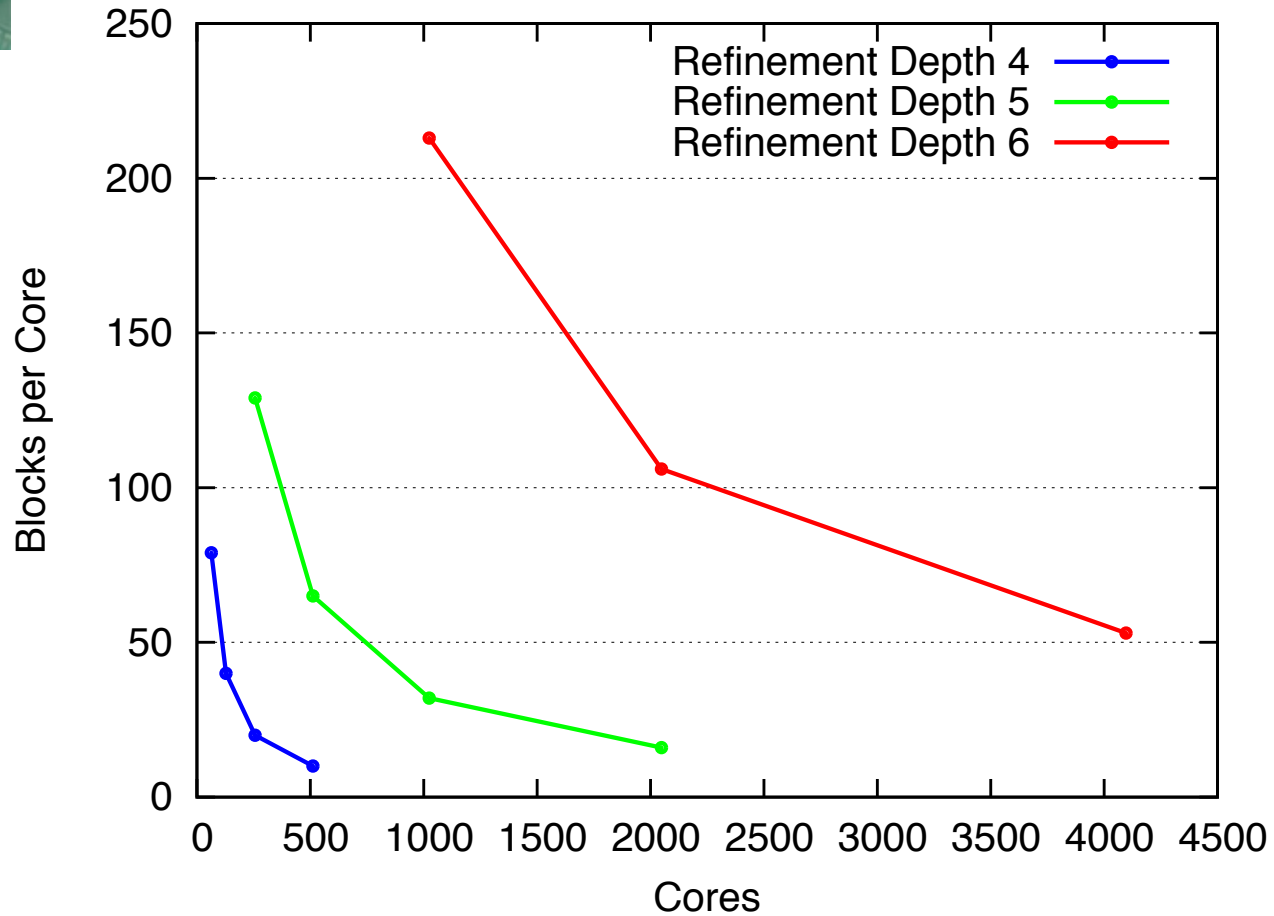
<http://www.kitware.com/products/html/MultiResolutionStreamingInVTKAndParaView.html>

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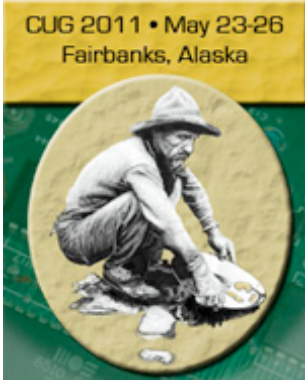
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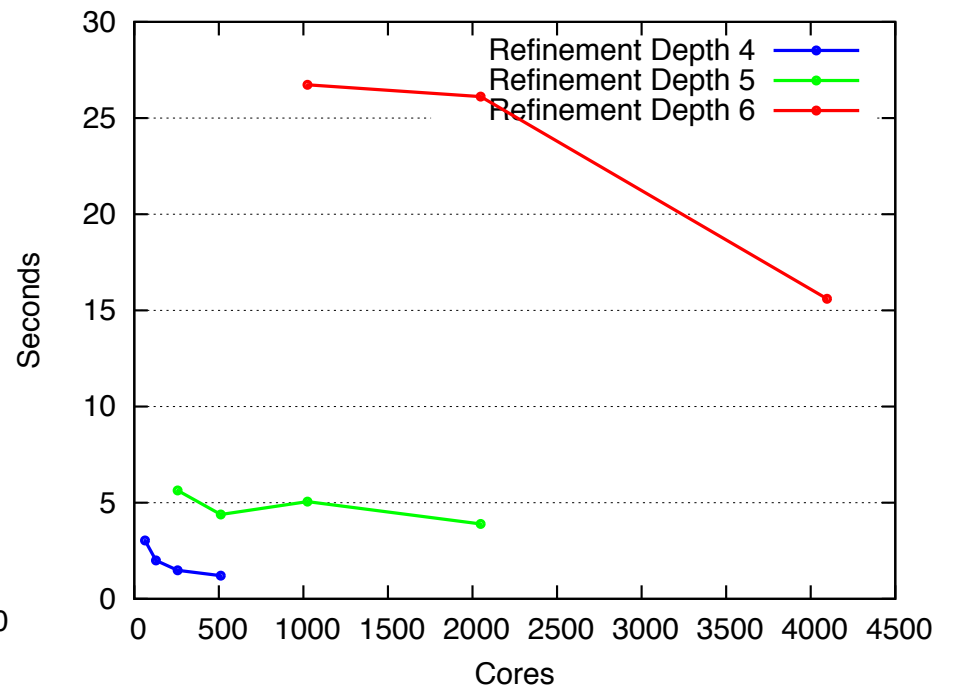
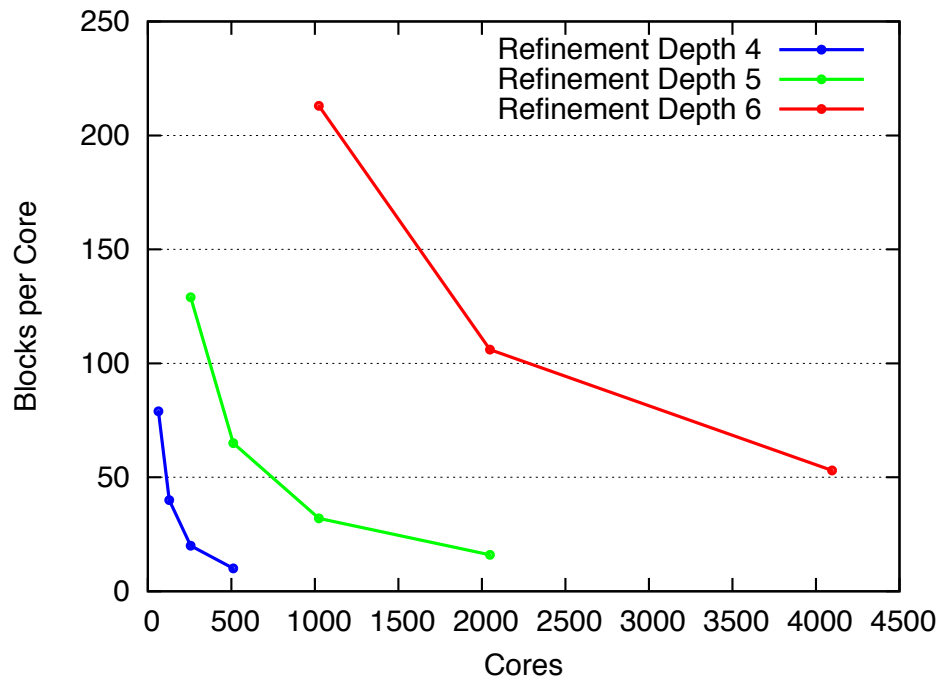
Semi-Strong Scaling



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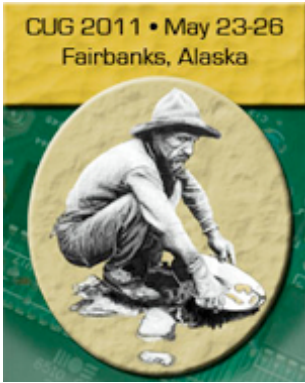


Low end Scaling

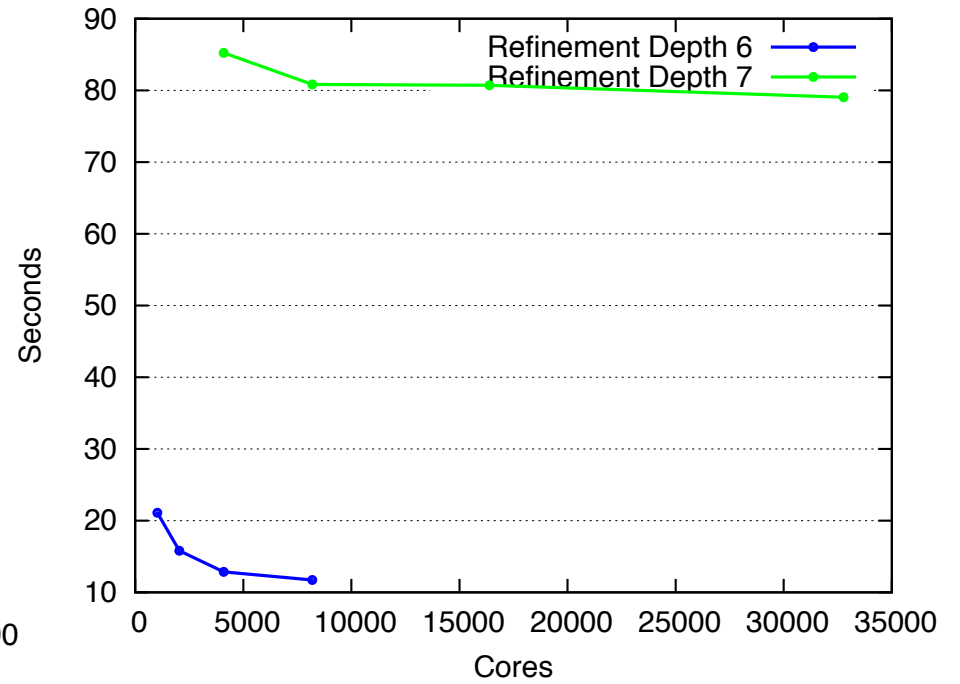
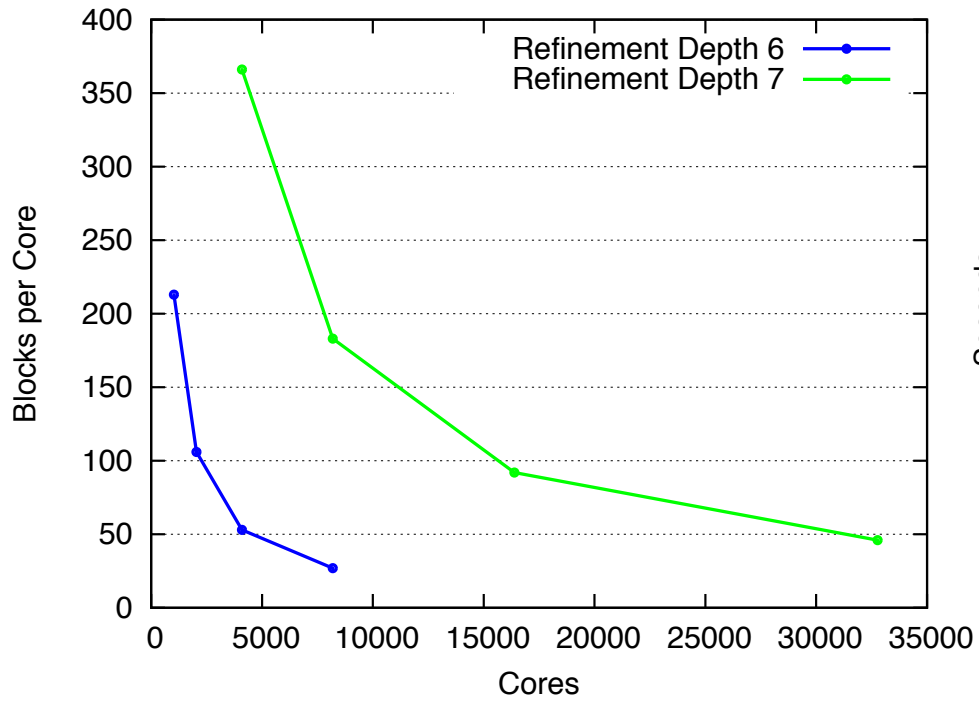


Redsky

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High end Scaling



Cielo

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Live Data to Vis nodes

