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Title: SDAV Visualization Area: VTK-m and In-Situ Highlights at Los Alamos

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SDAV Visualization Area: VTK-m and In-Situ Highlights at Los Alamos

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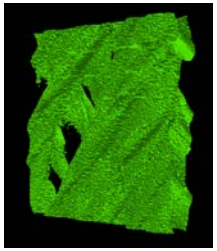
Objectives

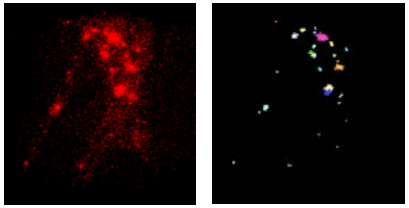
- **VTK-m framework**
  - Develop a portable data-parallel vis & analysis framework (PISTON)
  - Enhance ParaView to make use of multli-core and accelerator parallelism
- **In-situ visualization and analysis in LCF codes**
  - VPIC (Vector Particle in Cell): a kinetic plasma simulation code
  - POP (Parallel Ocean Program): a climate simulation code
  - HACC (Hardware/Hybrid Accelerated Cosmology Code): a cosmology simulation code

Impact

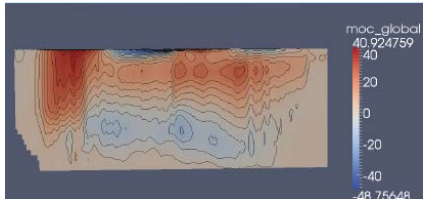
- **VTK-m framework**
  - PISTON allows a developer to write an algorithm once using data-parallel primitives and then compile it to run on different multi- and many-core architectures, taking advantage of available parallelism
- **In-situ visualization and analysis in LCF codes**
  - Saves disk space by saving only images rather than data dumps
  - Usually allows producing images at greater temporal resolution
  - ParaView Catalyst in-situ library allows user to define visualization and analysis pipelines with Python scripts (optionally created in GUI)
  - In-situ PISTON halo finder can use data already on GPU in HACC, and allow user to explore halos with different linking lengths



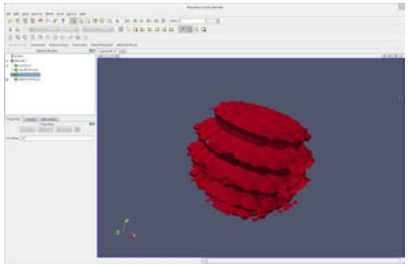
Contour produced in-situ using PISTON in VPIC simulation



Dendrogram-based halo finder written with PISTON



Parallel Meridional Overturning Circulation for POP data



PISTON integration with VTK and ParaView

Accomplishments - FY13

- **VTK-m framework**
  - Developed the PISTON framework by extending the backends of NVIDIA's Thrust library and implementing several key visualization and analysis algorithms using these data-parallel primitives
  - Worked with Kitware to integrate PISTON with VTK and ParaView
- **In-situ visualization and analysis in LCF codes**
  - Developed in-situ adaptors using the ParaView Catalyst coprocessing library for VPIC (including PISTON pipelines) and (in progress) for POP
  - Improved existing HACC halo finder; writing new dendrogram-based halo finder using PISTON in collaboration with University of Utah
- **Publications**
  - "Portable Data-Parallel Vis. and Anal. in Dist. Mem. Envs" LDAV '13.
  - "The SDAV Software Frameworks …" Ultrascale Vis '12.
  - "PISTON: A Portable Cross-Plat. FW for Data-Par. Vis. Ops" EGPGV '12.

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