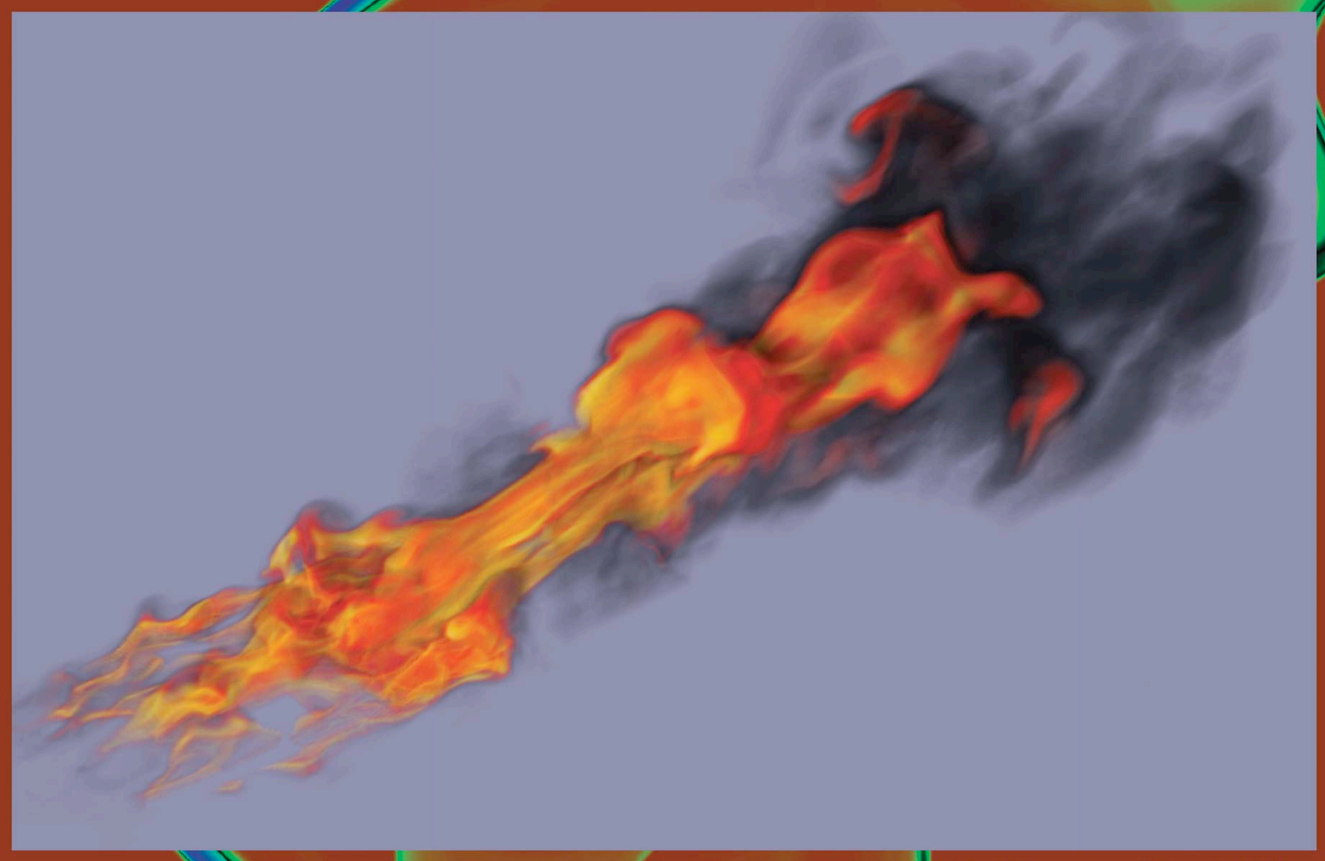
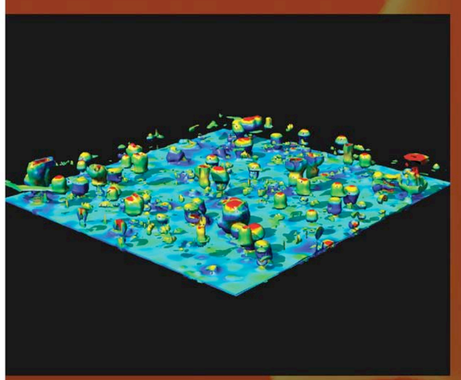
ASC Investments: Visualization



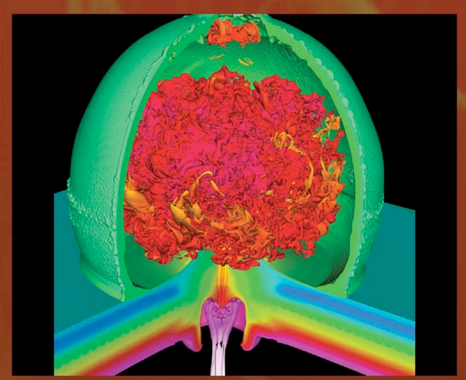
Parallel unstructured volume rendering in ParaView of pool fire simulation (SIERRA/Fuego/Calore/Syrnix) performed on 2048 nodes of Red Storm.

Visualizing Massive Data with Scalable and Parallel Solutions

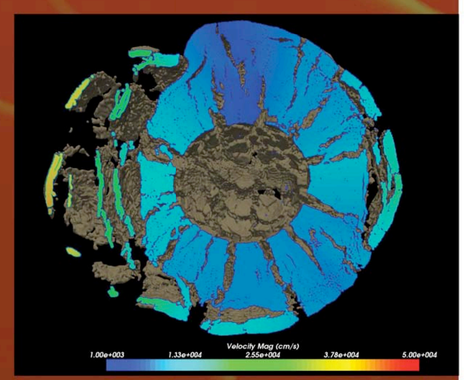
Advanced parallel visualization is essential to understanding the massive data produced in simulations for national security, enabling tri-lab scientists to investigate and understand complex results. ASC has met these challenges by strategically funding development of tools both in the commercial and open-source spaces. EnSight Gold, a fully parallel, commercial product developed by Computational Engineering International (CEI), is a general-purpose end-user post-processing tool for visualizing and analyzing terascale engineering and scientific data. ParaView and VisIt are open-source applications built on parallel VTK that support active collaboration on unique solutions to highly technical and demanding visualization problems. These leading edge technologies have been used to interactively visualize some of the world's largest datasets, and are now being improved to deliver cutting edge technologies that meet the new demands of the emerging ASC predictive modeling environments.



VisIt visualization software, developed at Lawrence Livermore National Laboratory, simulates a 3-D blast wave interacting with a perturbed density interface separating a dense and light gas. VisIt was designed to be a parallel visualization and analysis tool. It is extensible through the use of plug-ins, supports a sophisticated execution model that allows it to make optimizations tailored to the data and operations being performed, provides a rich data model, provides sophisticated parallel rendering capabilities, and has the ability to visualize data directly from a running simulation code.



Los Alamos National Laboratory 3D RAGE simulation of a supersonic jet experiment on the Omega laser designed to validate turbulent mix models. Visualization created with the EnSight Gold software from Computational Engineering International. EnSight Gold provides a wide variety of advanced features including support for large multi-panel displays and virtual reality environments, remote collaboration, and terascale distance visualization.



Asteroid Golevka measures about 500 x 600 x 700 meters. In this CTH shock physics simulation, a 10 Megaton explosion was initiated at the center of mass. The simulation ran for about 15 hours on 7200 nodes of Red Storm and provided approximately 0.65 second of simulated time. The resolution was 1 meter, with a 1 cubic kilometer mesh that contained a billion cells. The remarkable resolution of this simulation provides realism in crack formation and propagation not seen in lower-resolution models. Visualization performed in ParaView using over 100 cluster nodes.

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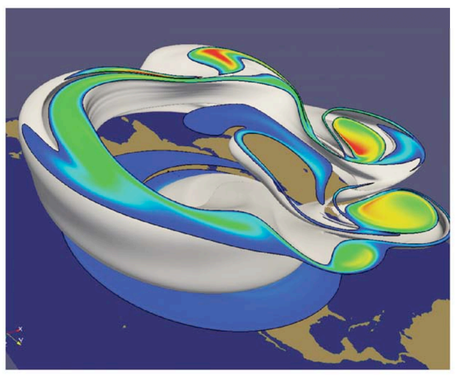

This is a simulation of the breakdown of the polar vortex, a circumpolar jet that traps polar air at high latitudes creating conditions favorable for ozone depletion. The breakdown of the vortex, which occurs once or twice a year in the polar wintertime stratosphere, can transport this ozone-depleted polar air well into the mid latitudes. Visualization performed in ParaView; applications built on ParaView in the future will enable comparison of test data and simulation data, promote data discovery among thousands of runs for predictive modeling, and utilize new visualization algorithms that promote scientific insight. Simulation performed on Red Storm with 7600 nodes.

Visualize the Difference

National Nuclear Security Administration