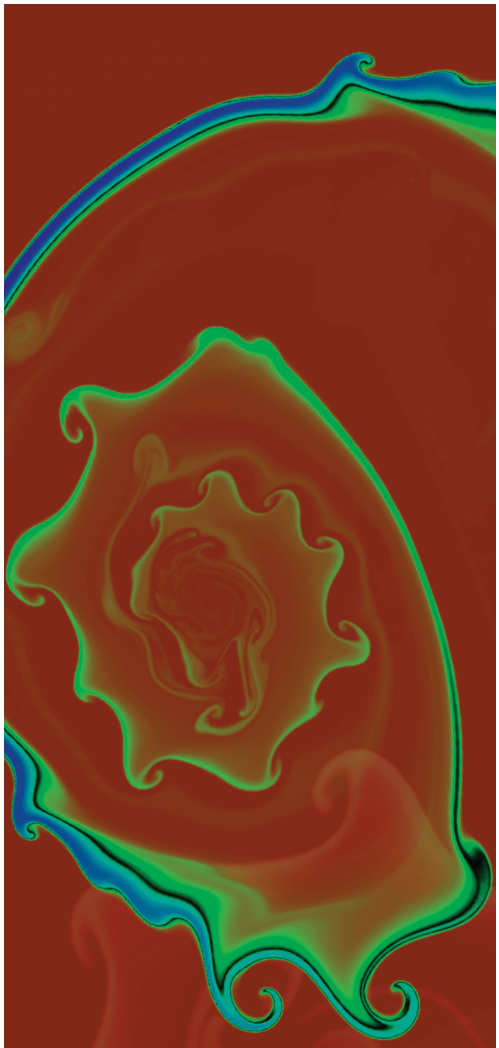
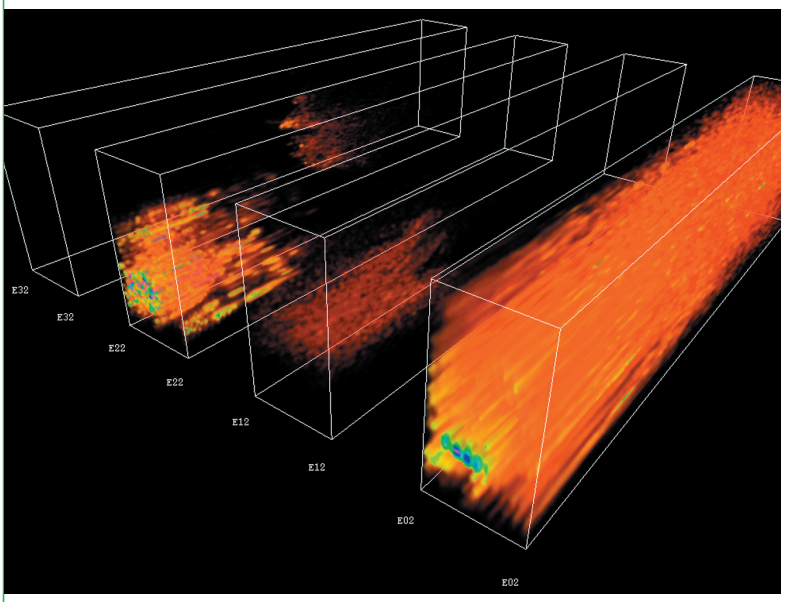


Achieving major milestones; successfully enabling simulations for national security.

Visualize the Difference

ASC Purple



Energy intensities of a laser and stimulated scatter, both backward (two types) and forward, resulting from laser-plasma interaction, as calculated by pF3d.

The Advanced Simulation and Computing (ASC) Program's IBM Purple system stands in testimony to the successful realization of the bold vision expressed one decade earlier—*the development of the complex three-dimensional integrated weapons performance applications and their demonstration on computers capable of successfully running these extraordinary codes.* On the Purple machine, these simulations can be validated against experimental data and applied, for the first time, to address stockpile issues with minimized interference from numerical errors due to limited mesh resolution or constraining approximations. ASC Purple has the speed and memory to enable simulations whose accuracy is tied directly to the fidelity of the physics and material models in the codes.

This capability resource will be used by the weapons laboratories—Los Alamos, Lawrence Livermore, and Sandia National Laboratories—to meet mission deliverables in 2006 and beyond. The power of ASC Purple will enable simulations with greater predictive capability to support the safety, performance, and reliability of the stockpile. It is a landmark step on the way toward predictive capability in weapons simulations. ASC Purple, in conjunction with the IBM BlueGene/L system, is essential to a strong and viable weapons program for national security in the absence of underground testing.

Between its 94 teraOPS classified and its 6 teraOPS unclassified environment, ASC Purple will achieve the major milestone set in 1996 for computing power of a peak 100 teraOPS. Acceptance testing of ASC Purple will be completed in November 2005, and tri-laboratory scientists are already taking advantage of this new tool for full weapon system simulation.

ASC Purple is huge by most metrics. The Federation input/output interconnect requires more than 17,000 cables totaling over 140 miles.

ASC™

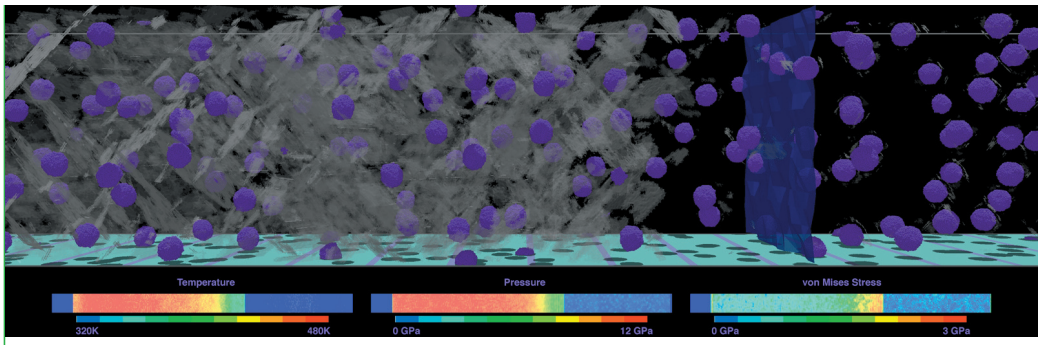
Advanced Simulation & Computing™

The ten-year goal of the original ASCI program was the creation of and successful execution of three-dimensional weapons applications codes on a computer capable of completing these calculations in weeks. This goal is about to be realized.

UCRL-BR-216393

This work was performed under the auspices of the U.S. Department of Energy by the University of California, Lawrence Livermore National Laboratory under Contract No. W-7405-Eng-48

NNSA National Nuclear Security Administration



Shock wave simulation run on ASC Purple. This side-view of the simulation cell has a 12-gigaPascals shock propagating from left to right. The blue surface is the shock front, the purple atoms represent helium atoms that are part of bubbles, and the transparent surfaces are stacking faults (dislocations) formed as a result of the reduction of the deviatoric stress brought upon by uniaxial loading of the shock wave.

Purple has 2 million gigabytes of storage from more than 11,000 Serial ATA and Fibre Channel disks. Purple is comprised of 131 node racks, 90 disk racks, and 48 switch racks. The final configuration includes 1,534 8-way Squadron IH compute/input/output nodes and two 32-way squadron H nodes partitioned into a total of four 16-way login nodes. Each login node has eight 10-gigabytes-per-second network connections for parallel file transfer protocol and two 1-gigabyte-per-second network connections for network file systems and secure shell protocol. The system has a three-stage 1,536 port dual plane Federation switch interconnect, AIX 5.3 operating system, and 2,000 terabytes global disk. Purple uses 4.8 megawatts of power to run the system and an additional 3 megawatts to cool it.

Purple was built and tested at IBM's Poughkeepsie, New York, facility before being shipped 3,000 miles to Livermore's new Terascale Simulation Facility. Now in its final configuration, the Purple system consists of 269 racks situated in a space of 6,720 square feet.

Purple will be used to run the most demanding 3D weapons performance codes. It will operate like a major experimental user facility in which the largest problems from the weapons laboratories will be prioritized and then sequenced on the machine. Operating Purple in this manner is possible because of the ASC Program's foresight in procuring sufficient capacity computing—consisting of mid-sized clusters—in the complex to successfully accommodate the myriad of smaller jobs that also need to be run. This leaves the large machine available for the task for which it was created: the execution of large memory applications that require tremendous internal bandwidth and possibly weeks to complete.

ASC Purple at Lawrence Livermore National Laboratory.

for more information

http://www.llnl.gov/NNSA/ASC