

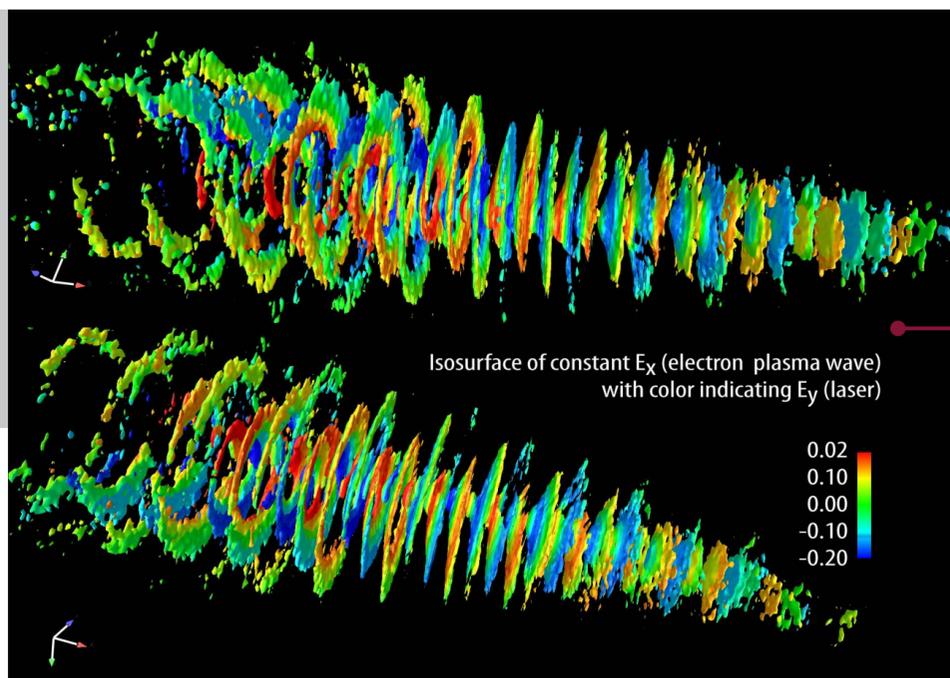
Roadrunner Performance Drives 2008 Gordon Bell Prize Finalists



Within a week of reaching a petaFLOPS of sustained performance, IBM gave LANL early access to Roadrunner to begin running three scientific codes on the full machine (17 Connected Units) in the Poughkeepsie, New York, plant. All three applications—VPIC, SPaSM, and PetaVision—achieved record-breaking levels of performance. SPaSM and VPIC code teams are finalists for the 2008 Gordon Bell Prizes.



The speed of light is... too slow.



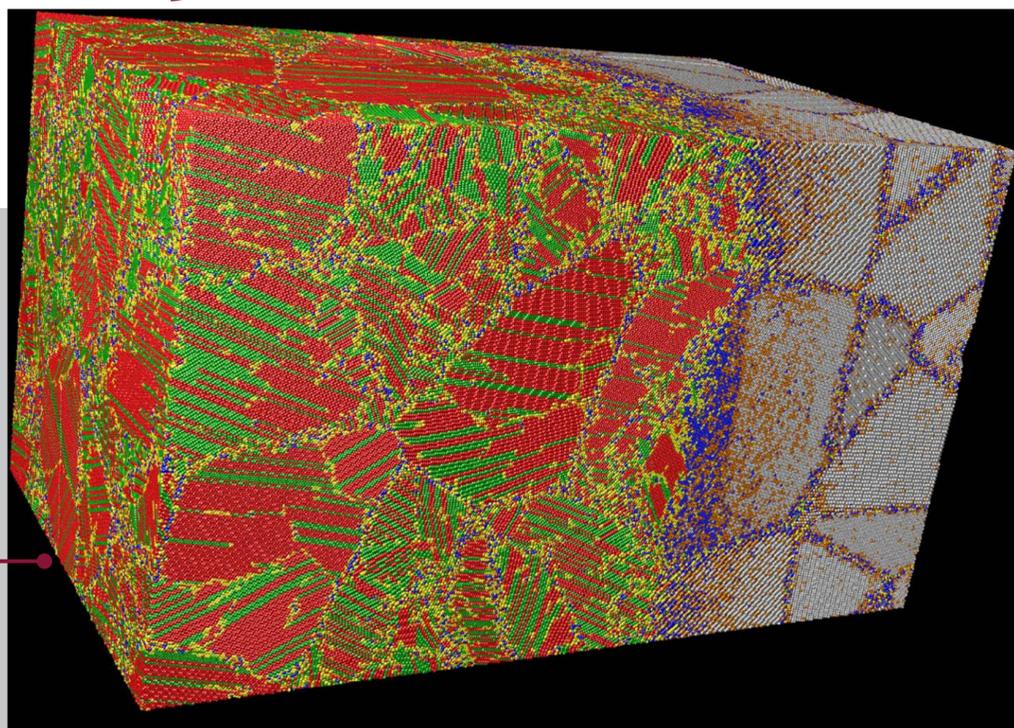
VPIC

"0.374 petaFLOPS Trillion-Particle Particle-in-Cell Modeling of Laser Plasma Interactions on Roadrunner" – *Kevin J. Bowers and the VPIC Team*

"Due to physical limitations, such as the speed of light, moving data between and even within modern microchips is more time consuming than performing the actual calculations," says Kevin Bowers. Three-dimensional simulations on Roadrunner are the largest plasma particle-in-cell simulations to date.

Fully relativistic, charge-conserving, 3D explicit particle-in-cell code, VPIC, simulates plasma physics. VPIC achieved a sustained 374 teraFLOPS on the full Roadrunner system.

Not just...



SPaSM

"369 teraFLOPS Molecular Dynamics Simulations on the Roadrunner General-Purpose Heterogeneous Supercomputer" – *Sriram Swaminarayan and the SPaSM Team*

"In the past 10–15 years, the models have been developed empirically by guessing on the underlying physics and fitting that to experimental data, says Tim Germann, SPaSM team member. "Roadrunner lets us bridge the gap between simulation and experimentation. With Roadrunner now it's almost simulation driving experiment."

Scalable Parallel Short-range Molecular Dynamics code, SPaSM, is a framework for materials science research as well as epidemiology, fluid instabilities, and turbulence. SPaSM achieved a sustained 361 teraFLOPS on the full Roadrunner system.

A shock front traveling through polycrystalline iron causing a phase transformation from the bcc (gray) to hcp (red) and fcc (green) structure

a pretty picture.

Other LANL researchers recognized by the Gordon Bell Award through the years

1998 Second Place, Price-Performance: Simulation of a shock wave propagating through a structure of 61 million atoms, 64.9 gigaFLOPS/1 M using a 70 PE system of DEC Alphas (533 Mhz.)

1997 First Place, Price-Performance: Modeling suspensions, 10.8 gigaFLOPS/1 M on 28 DEC Alphas

1997 First Place, Price-Performance Part 2: Galaxy formation following 10,000,000 self-gravitating particles, 18 gigaFLOPS/1 M on a cluster of 16 Intel Pentium Pros (200 Mhz.)

1993 Honorable Mention, Performance: Simulating the micro-structure of grain boundaries in solids, 50 gigaFLOPS on a 1,024 processor CM-5

1992 First place, Performance: Simulation of 9 million gravitating stars by parallelizing a tree code, 5 gigaFLOPS on an Intel Touchstone Delta