

The National Ignition Facility: Laser Performance and First Experiments

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Abstract

The National Ignition Facility (NIF) at the Lawrence Livermore National Laboratory is a stadium-sized facility containing a 192-beam, 1.8-Megajoule, 500-Terawatt, ultraviolet laser system together with a 10-meter diameter target chamber with room for nearly 100 experimental diagnostics. NIF will be the world's largest and most energetic laser experimental system, providing a scientific center to study inertial confinement fusion (ICF) and matter at extreme energy densities and pressures. NIF's energetic laser beams will compress fusion targets to conditions required for thermonuclear burn, liberating more energy than required to initiate the fusion reactions. Other NIF experiments will study physical processes at temperatures approaching 10^8 K and 10^{11} bar, conditions that exist naturally only in the interior of stars, planets and in nuclear weapons. NIF has successfully activated, commissioned and utilized the first four beams of the laser system to conduct over 300 shots between November 2002 and August 2004. In doing so, NIF laser scientists have established that the laser meets all performance requirements on a per beam basis for energy, uniformity, timing, and pulse shape. Using these four beams ICF and high-energy-density physics researchers have conducted a number of experimental campaigns, resulting in high quality data that could not be reached on any other laser system. This presentation discusses NIF's early light commissioning and performance program, NIF's current and future experimental capability, and potential enhancements to NIF such as green laser operation and high-energy short pulse operation.

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