THE NATIONAL IGNITION CAMPAIGN (NIC): RESULTS AND FUTURE PLANS

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The 192-beam National Ignition Facility (NIF), a football-stadium sized laser at the Lawrence Livermore National Laboratory (LLNL) in Livermore, CA, is now fully operational. With planned peak energy of 1.8 MJ in the ultraviolet, NIF will be approximately fifty times more energetic than any previous inertial confinement fusion (ICF) laser system. NIF has conducted 192-beam ICF implosion experiments with energies as high as 1.2 MJ, and has also demonstrated the unprecedented energy and pulse shaping control required for ignition experiments.

The successful commissioning of the NIF laser is the first essential step in demonstrating ICF ignition in the laboratory. The NIF ignition program is executed via the National Ignition Campaign (NIC)—a partnership between LLNL, Los Alamos National Laboratory, General Atomics, University of Rochester, Sandia National Laboratories, and a number of university and international partners. In the past several years the NIC team has developed diagnostic and other techniques at the Omega laser and other facilities. Since August 2009, the NIC team has performed ignition preparatory experiments at the NIF. The results from these initial experiments have been outstanding and show great promise for achievement of ignition. Capsule implosion experiments at energies up to 1.2 MJ have demonstrated laser energy absorption, radiation temperatures, and symmetry control that scale to ignition conditions. Of particular importance is the demonstration of peak hohlraum temperatures near 300 eV, with overall backscatter less than 10%. Cryogenic target capability and additional diagnostics are being installed in preparation for layered target deuterium-tritium implosions to be conducted later in 2010.

This talk will describe NIC results to date and outline future plans for the ignition program, including layered target experiments planned for later this year. The achievement of ignition at NIF will demonstrate the scientific feasibility of ICF and provide unprecedented opportunities for scientific advancement in national security, energy, and fundamental science.