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THE NATIONAL IGNITION FACILITY: THE WORLD'S LARGEST LASER*

Edward I. Moses
Lawrence Livermore National Laboratory
P. O. Box 808, L-466, Livermore, CA 94551
moses1@llnl.gov

The National Ignition Facility (NIF) is a 192 beam laser facility currently under construction at LLNL. When completed, NIF will be a 1.8 MJ, 500 TW ultraviolet laser system with a 10-meter diameter target chamber that can accommodate nearly 100 experimental diagnostics. Recently, four beamlines of NIF were simultaneously commissioned to demonstrate the integrated performance of the laser and target systems. This commissioning activity also involved the testing of the laser and target diagnostics, sub-micron alignment and picosecond timing systems. In addition, a sophisticated controls platform with over 700 processors has been assembled and tested. This configuration allows for a highly automated shot software and commissioning tools, which will allow for efficient building of the laser over the next several years. The initial experimental campaigns were primarily focused on Inertial Confinement Fusion and High Energy Density Science. A successful outcome of these campaigns provided confirmation that on a single beam basis NIF will meet its performance goals with the necessary precision and flexibility required in pulse shaping, pointing, timing and beam conditioning to accommodate a wide range of experiments.

Presently, the project is installing production hardware to complete the project in 2009 with the goal to begin ignition experiments in 2010. The bundle-based (8 beam) architectural building blocks allow for straightforward and efficient scaling through replication. An integrated plan has been developed including the NIF operations, user equipment such as diagnostics, cryogenic target capability, experiments and calculations to meet this goal. This talk will provide NIF status, the plan to complete NIF, and the path to ignition. In addition, it will address how the community at large will be engaged to collaborate as we envision that NIF will provide an international center to study inertial confinement fusion and the physics of matter at extreme energy densities and pressures.

In a parallel effort to develop fusion energy technologies we have recently commissioned a rep-rated solid-state laser system through the National High Average Laser Program. This Program represents a concerted effort to develop rep-rated components within a scalable architecture that meets efficiency, reliability, and cost requirements for IFE. The talk will conclude with a discussion of future technologies and architectures that are being considered for solid-state laser IFE.

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