DPP13-2013-000124

Abstract for an Invited Paper
for the DPP13 Meeting of
the American Physical Society

Dynamic Symmetry of Indirectly Driven ICF Capsules on NIF[1]

R.P.J. TOWN, Lawrence Livermore National Laboratory

In order to achieve ignition it is important to control the growth of low-mode asymmetries as the capsule is compressed. Understanding the time-dependent evolution of the shape of the imploding capsule, hot spot and surrounding fuel layer is crucial to optimizing implosion performance. A design and experimental campaign to examine the sources of asymmetry and to measure the symmetry throughout the implosion has been developed and executed on the NIF. For the first time on NIF, two-dimensional radiographs of the capsule during its implosion phase have been measured to infer the symmetry of the radiation drive [1]. Time dependent equatorial symmetry has been measured of gas-filled capsules and capsules with cryogenic DT layers. These measurements have been used to modify the hohlraum geometry and the wavelength tuning to improve the inflight implosion symmetry. The technique is being extended to study azimuthal symmetry by imaging along the hohlraum axis. We have also expanded our shock timing measurements [2] by the addition of extra mirrors inside the re-entrant cone to allow the simultaneous measurement of shock symmetry in three locations on a single shot, providing a measurement of asymmetries up to mode 4 in both the equatorial and azimuthal planes. The shape of the hot spot during final stagnation is measured using time-resolved imaging of the self-emission, and information on the shape of the fuel at stagnation can be obtained from Compton radiography [3] using a wire-backlighter. In addition to x-ray diagnostics, a series of neutron and proton measurements of the low-mode areal density of the fuel at peak compression and at shock-flash time have been made. This talk will discuss the new imaging techniques, the results, and the analysis of the experiments done to date and their implication for ignition on NIF. The sensitivity of the in-flight and final implosion symmetry to imposed changes will be presented and compared to model predictions.

[1] R. Rygg, et al, to be submitted to *Phys. Rev. Lett.*
[2] H. F. Robey et al, *Phys. Rev. Lett.* **108**, 215004 (2012)
[3] R. Tommasini, et al, *Phys. Plasmas*, **18**, 056309 (2011)

[1]This work performed under the auspices of the U.S. Department of Energy by LLNL under Contract DE-AC52-07NA27344.