DPP14-2014-000067

Abstract for an Invited Paper
for the DPP14 Meeting of
the American Physical Society

Higher Velocity High-Foot Implosions on the National Ignition Facility Laser[1]

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After the end of the National Ignition Campaign on the National Ignition Facility (NIF) laser, we began a campaign to test capsule performance using a modified laser pulse-shape that delivers higher power early in the pulse ("high foot") [1,2,3,4]. This pulse-shape trades one-dimensional performance (peak compression) for increased hydrodynamic stability. The focus of the experiments this year have been to improve performance by increasing the implosion velocity using higher laser power/energy, depleted uranium hohlraums, and thinner capsules. While the mix of ablator material into the hotspot has been low for all of these implosions, the challenge has been to keep the implosion shape under control. As the peak laser power is increased, the plasma density in the hohlraum is increased – making it more and more challenging for the inner cone beams to reach the midplane of the hohlraum and resulting in an oblate implosion. Depleted uranium hohlraums have higher albedo than Au hohlraums, which leads to additional drive and improved implosion shape. Thinner ablators increase the velocity by reducing the amount of payload; thinner ablators also put less mass into the hohlraum which results in improved inner beam propagation. These techniques have allowed us to push the capsule to higher and higher velocity. In parallel with this effort, we are exploring other hohlraums such as the rugby shaped hohlraum to allow us to push these implosions further. This talk will summarize the progress of the high foot campaign in terms of both capsule and hohlraum performance.

[1] H.-S. Park, et al, PRL, 112, 055001 (2014)
[2] T. R. Dittrich, et al, PRL 112, 055002 (2014)
[3] O. A. Hurricane, et al, Nature 506, 343 (2014)
[4] O. A. Hurricane et al., Physics of Plasmas, 21, 056314 (2014)

[1]This work was performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under contract DE-AC52-07NA27344.