DPP12-2012-001574

Abstract for an Invited Paper
for the DPP12 Meeting of
the American Physical Society

Inflight Properties of NIF Ignition Capsules Inferred from Convergent Ablator Experiments[1]

NATHAN MEEZAN, Lawrence Livermore National Laboratory

Convergent ablator (ConA) experiments on the National Ignition Facility (NIF) are indirect drive implosions that study the inflight dynamics of an imploding capsule. Side-on, back-lit radiography provides data used by the National Ignition Campaign to infer time-dependent properties of the capsule ablator, including its center of mass radius, velocity, unablated mass, shell thickness, and peak density. Previously, Callahan[2] and Hicks reported ConA experiments demonstrating velocities approaching those required for ignition. Here, we present the findings from a full year of NIF ConA experiments where we have shot more than 20 targets at energies greater than 1 MJ to study the inflight dynamics of ignition-like implosions. These include:

- Studies of ablator center of mass motion vs. time, suggesting that the drive history differs substantially from that predicted by standard modeling
- Pulse shape scalings studying the dynamics of a "fifth shock" that can significantly increase the entropy of the DT fuel in an ignition implosion.
- Performance of different ablators, including CH ablators with graded Si doping, CH ablators with uniform Si doping, and other ablators.
- ConA experiments using capsules with cryogenic ice layers, demonstrating that gas-filled capsules are adequate surrogates for DT layered implosions.
- Studies of thicker capsules shot at powers and energies surpassing 500 TW and 1.8 MJ as we work to meet the ignition implosion velocity requirement in the presence of hydrodynamic instabilities.

Finally, we describe insights into hydrodynamic instabilities that we have gained through this large database, from variations in capsule performance (neutron yield and T_{ion}) as well as from the impact of mix on observed late-time ablator properties.

[1]Prepared by LLNL under Contract DE-AC52-07NA27344.

[2]D. A. Callahan *et al.*, Phys. Plasmas **19**, 056305 (2012)