DPP14-2014-000058

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

In-flight Density Profiles and Areal Density Non-uniformities of ICF Implosions[1]

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Implosion efficiency depends on keeping the in-flight ablator and fuel as close as possible to spherical at all times while maintaining the required implosion velocity and in-flight aspect ratio. Asymmetries and areal density non-uniformities seeded by time-dependent drive variations and target imperfections grow in time as the capsule implodes, with growth rates that are amplified by instabilities. One way to diagnose them is by imaging the self-emission from the implosion core. However this technique, besides only providing direct information of the shape of the hot emission region at final assembly, presents complications due to competition between emission gradients and reabsorption. Time resolved radiographic imaging, being insensitive to this effect, is therefore an important tool for diagnosing the ablator and the shell in inertial confinement fusion (ICF) implosions. Experiments aimed at measuring the density, areal density and areal density asymmetries of the shell in ICF implosions have been performed using two different radiography techniques on the National Ignition Facility. We will report the results from both 1D [1] and 2D [2] geometries using slit and pinhole imaging coupled to area backlighting and as close as 150 ps to peak compression. We will focus in particular on comparisons of the in-flight shell thicknesses and ablation front scale lengths between low- and high-adiabat [3] implosions, and the perturbations on areal density seeded both by time dependent drive asymmetries and by the membranes used to hold the capsule within the hohlraum in indirect drive ICF targets.

[1] Hicks, D. G. et al., Phys Plasmas 19, 122702 (2012)
[2] R. Rygg, et. al., Phys. Rev. Lett. 112 195001 (2014)
[3] O. Hurricane, et al., Nature 1–7 (2014)

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