DPP17-2017-000531

Abstract for an Invited Paper
for the DPP17 Meeting of
the American Physical Society

The One-Dimensional Cryogenic Implosion Campaign on OMEGA: Modeling, Experiments, and a Statistical Approach to Predict and Understand Direct-Drive Implosions*

R. BETTI, Laboratory for Laser Energetics, U. of Rochester

The 1-D campaign on OMEGA is aimed at validating a novel approach to design cryogenic implosion experiments and provide valuable data to improve the accuracy of 1-D physics models. This new design methodology is being tested first on low-convergence, high-adiabat ($\alpha \sim 6$ to 7) implosions and will subsequently be applied to implosions with increasing convergence up to the level required for a hydro-equivalent demonstration of ignition. This design procedure assumes that the hydrodynamic codes used in implosion designs lack the necessary physics and that measurements of implosion properties are imperfect. It also assumes that while the measurements may have significant systematic errors, the shot-to-shot variations are small and that cryogenic implosion data are reproducible as observed on OMEGA. One of the goals of the 1-D campaign is to find a mapping of the data to the code results and use the mapping relations to design future implosions. In the 1-D campaign, this predictive methodology was used to design eight implosions using a simple two-shock pulse design, leading to pre-shot predictions of yields within 5% and ion temperatures within 4% of the experimental values. These implosions have also produced the highest neutron yield of $\sim 10^{14}$ in OMEGA cryogenic implosion experiments with an areal density of $\sim$100 mg/cm^2. Furthermore, the results from this campaign have been used to test the validity of the 1-D physics models used in the radiation–hydrodynamics codes. This material is based upon work supported by the Department of Energy National Nuclear Security Administration under Award Number DENA0001944 and LLNL under Contract DE-AC52-07NA27344. * In collaboration with J.P. Knauer, V. Gopalaswamy, D. Patel, K.M. Woo, K.S. Anderson, A. Bose, A.R. Christopherson, V.Yu. Glebov, F.J. Marshall, S.P. Regan, P.B. Radha, C. Stoeckl, and E.M. Campbell.