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Low-Adiabat, High-Compression Cryogenic Deuterium–Tritium Implosions on OMEGA

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The performance of cryogenic deuterium–tritium (DT) spherical implosions using triple-picket designs is reported. These designs facilitate control of shock heating in low-adiabat inertial confinement fusion targets. The perturbation growth in triple-picket designs is controlled by the adiabat shaping imposed by a series of decaying shocks launched by individual pickets. Taking advantage of enhanced ablative stabilization of Rayleigh–Taylor instability makes it possible to simplify target design by replacing wetted foam in the pusher material with solid plastic (CH). As reported previously,[1] areal density up to 300 mg/cm^2, the highest ever measured in cryogenic-DT implosions, have been measured using these designs with the implosion velocity $\sim 3 \times 10^7$ cm/s. This talk will summarize the results on improving target performance and the progress in theoretical understanding of cryogenic implosions on OMEGA. To identify the main limiting sources in target performance and to improve target yield and ion temperature at the peak compression, extensive 2-D simulations using the hydrocode *DRACO* have been performed. Using these simulations, target sensitivities to different levels of laser-nonuniformity smoothing, ice roughness, laser-power imbalance, and target offset were identified. To minimize both the effective beam mispointing and pulse-shape distortion induced by a 1-Thz, 1-color-cycle SSD system, 0.3-Thz, 3-color-cycle SSD smoothing was implemented on the OMEGA Laser System. In addition, to improve target quality, isolated defects in the ice at the point of contact of the stalk mount with target surface were mitigated by applying IR heating (ice shimming). This work was supported by the U.S. Department of Energy (DOE) Office of Inertial Confinement Fusion under Cooperative Agreement No. DE-FC52-08NA28302.

[1]V.N. Goncharov *et al.,* Phys. Rev. Lett. **104**, 165001 (2010).