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Shock-Tuned Cryogenic DT Implosion Performance on OMEGA

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Cryogenic-target-compression experiments with low-adiabat ($\alpha \sim 1$ to 3) continuous and multiple-picket-drive pulses are performed on the OMEGA laser to understand the physics of fuel assembly in inertial confinement fusion. Continuous-drive-pulse designs require accurate modeling of the compression wave generated by the gradual rise in laser intensity. Uncertainties in the ablator/fuel equation-of-state modeling and laser coupling can lead to uncertainties in the predicted shock coalescence and fuel adiabat. The multiple-picket-drive pulse designs replace the gradual intensity rise of the continuous pulse with two or three narrow pickets (each picket is approximately 100 ps long). These picket designs facilitate shock tuning using an experimental cone-in-shell platform[1] developed for the National Ignition Campaign. The coalescing shocks are measured with VISAR. The required shock-timing accuracy is achieved by adjusting the energies of the individual pickets. The shock-tuned, multiple-picket-drive pulses have been used to drive cryogenic DT targets to implosion velocities ($>3 \times 10^7$ cm/s) that exceed those reached using continuous-pulse designs.[2] This talk will present new multiple-picket shock-timing results and target performance data (yield, areal density, and ion temperature) from shock-tuned implosions on OMEGA. The areal density is inferred from the spectra of knock-on deuterons and the primary neutron down-scattered fraction using a magnetic recoil spectrometer (primary DT neutrons that scatter in the dense fuel end up with energies well below 14 MeV; the ratio of this yield to the primary yield is proportional to the fuel areal density). Properly tuned implosions produce nearly 1-D areal densities. This work was supported by the U.S. Department of Energy Office of Inertial Confinement Fusion under Cooperative Agreement No. DE-FC52-08NA28302.

[1] T. R. Boehly *et al.*, Phys. Plasmas **16**, 056302 (2008).
[2] T. C. Sangster *et al.*, Phys. Rev. Lett. **100**, 185006 (2008).