# MITIGATION OF CROSS-BEAM ENERGY TRANSFER IN LAYERED DT CRYOGENIC DIRECT-DRIVE IMPLOSIONS ON OMEGA

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Cross-beam energy transfer (CBET) reduces the coupling of laser energy to the imploding shell of a direct-drive inertial confinement fusion target [1]. The lower ablation pressure resulting from CBET must be included in hydrodynamic simulations of direct-drive layered DT cryogenic targets to match all of the experimental observables. One proposed technique to reduce CBET is to drive the spherical target with overlapping laser beams having individual focal spots smaller than the outside diameter of the target [1]. An experimental campaign was conducted on the 60-beam, 30-kJ, 351-nm OMEGA laser with layered DT cryogenic implosion targets to examine the proposed CBET mitigation technique. The target was driven with three picket laser pulses followed by a main drive. The pulse shape was tuned to have calculated shell adiabats of either three or four. The laser beams were smoothed with SG5 phase plates, polarization smoothing, and two-dimensional smoothing by spectral dispersion (SSD). The outside diameter (OD) of the target was discretely varied (i.e., OD = 820 $\mu$m, 860 $\mu$m, 910 $\mu$m, 960 $\mu$m, 1000 $\mu$m), while the laser focal spot size was kept constant. The diameter of the laser far-field intensity distribution encircling 95% of the laser energy was 820 $\mu$m. The larger targets driven with 28 kJ of laser energy used dynamic bandwidth reduction, where the SSD is only applied to the pickets. The smaller targets driven with 26 kJ of laser energy had SSD on the entire pulse (i.e., pickets and main drive). The resulting ratio of the radius of the laser beam to the radius of the target ($R_{\text{beam}}/R_{\text{target}}$) had values in the range of 0.82 to 1.0. The energetics of the DT cryogenic implosions were diagnosed using laser scattering, shell trajectory, neutron production rate, gated hot-spot x-ray imaging, fuel areal density, and x-ray spectral measurements. The lowest level of CBET is expected to occur at $R_{\text{beam}}/R_{\text{target}} = 0.82$, where the highest level of laser drive nonuniformity is predicted. The CBET mitigation will increase the laser intensity at the quarter-critical electron density surface and could cause two-plasmon decay (TPD) instability. Suprathermal electron production from TPD was monitored with hard x-ray detectors. The layered DT cryogenic target implosion performance and the inferred hot-spot pressure will be reported for the CBET mitigation campaign.

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