Experimental Investigation of Cross-Beam Energy Transfer Mitigation via Wavelength Detuning in Directly Driven Implosions at the National Ignition Facility

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Laboratory for Laser Energetics, U. of Rochester — Cross-beam energy transfer (CBET) affects directly driven, inertial confinement fusion implosions by reducing the absorbed light and the coupling of driver energy to the target. A mitigation strategy is to detune the laser wavelength of interacting beams ($\Delta \lambda \neq 0$) to reduce the CBET interaction volume. In polar-direct-drive (PDD) experiments at the National Ignition Facility (NIF) the CBET-imposed energy losses occur predominantly in the equatorial region. The NIF does not support a hemispheric wavelength detuning but does have $\Delta \lambda$ capabilities between inner and outer quads. Using a north–south asymmetric beam pointing, it is therefore possible to introduce a hemispheric wavelength difference of up to $\Delta \lambda = 4.6 \, \text{Å}$ in the UV. We report on experiments to test this CBET mitigation scheme in PDD experiments on the NIF. Using this asymmetric beam pointing, we have completed experiments with both $\Delta \lambda = 0$ and 4.6 Å. The effect of CBET on the driver–target coupling is diagnosed via implosion velocities, implosion shape, and scattered-light spectra and by comparing experimental data to 2-D DRACO simulations. This material is based upon work supported by the Department of Energy National Nuclear Security Administration under Award Number DE-NA0001944.

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