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Analyses of laser-plasma interactions in National Ignition Facility (NIF) ignition targets[1]

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Achieving indirect drive ignition on NIF requires hohlraum targets (high-Z cylinders) that provide good symmetry with acceptable energetics. In these first ignition targets we have elected to optimize ignition hohlraums in a linear regime for laser-plasma interactions (LPI), i.e. where laser light resonantly scatters off linear ion acoustic or electron plasma waves. In this regime we can quantitatively analyze how backscatter affects propagation and deposition of the laser beams within the target. We use pF3D[2] to calculate the reflectivity and deposition profile along a laser beam path in our ignition designs. pF3D is a wave optics beam propagation code designed to model stimulated scatter in the linear regime. It has recently been shown to successfully model NIF-relevant LPI experiments shot on the Omega laser. Unprecedented simulations of whole and near-whole laser beam propagation in ignition targets have been performed. These simulations propagate a realistic laser beam from where it enters the target to the target wall, and include both axial and transverse gradients in the plasma profiles. Such calculations are massively parallel, requiring more than 8000 cpus. We present simulations of 300 eV, 285 eV and 270 eV ignition designs driven at 1 to 1.3 MJ of laser energy at wavelength 351 nm. We discuss the total reflectivity, importance of ensuring good speckle statistics and show the role of re-absorption of the backscattered light on the laser energy deposition rate.

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[2]R. L. Berger, C. H. Still, E. A. Williams, and A. B. Langdon, *Phys. Plasmas* **5**, 4337 (1998).