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Experimental basis for laser-plasma interaction predictions on the National Ignition Facility ignition designs[1]

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Recent laser plasma interaction experiments at OMEGA (LLE, Rochester) using gas-filled hohlraums shed light on the behavior of stimulated Raman scattering (SRS) in the hot, high-density plasma that laser beams will encounter near the capsule in NIF ignition hohlraums. We will present detailed results on the SRS thresholds for densities (10-15% critical) at ignition relevant intensities (10^{14} - 10^{15} W-cm^{-2}). These results follow the expected Landau damping scaling with density and quantitatively agree with full three-dimensional laser propagation simulations (pF3d) that rely on detailed hydrodynamic simulations (HYDRA), providing an experimental basis for forthcoming experiments on NIF. In addition to controlling plasma parameters, the National Ignition Campaign relies on optical beam smoothing techniques to mitigate backscatter. We will show that polarization smoothing, which was previously demonstrated to increase the stimulated Brillouin scattering threshold, is also effective at controlling SRS. Finally, we have performed a scaling of the interaction beam numerical aperture and measured its impact on backscatter, which relates directly to the evolution of a laser beam aperture as it propagates inside an ignition hohlraum. These results will also be compared with 3D simulations. Prepared by LLNL under Contract DE-AC52-07NA27344.

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