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Direct-Drive Measurements of Laser-Imprint–Induced Shock-Velocity Nonuniformities and Laser Imprint Mitigation[1] J. PEEBLES, S. X. HU, W. THEOBALD, V. N. GONCHAROV, N. WHITING, E. M. CAMPBELL, T. R. BOEHLY, S. P. REGAN, Laboratory for Laser Energetics, S. J. ALI, P. M. CELLIERS, Lawrence Livermore National Laboratory, G. DUCHATEAU, University Bordeaux-CNRS-CEA — In laser-direct-drive inertial confinement fusion, nonuniformities in the laser drive caused by laser speckle and beam-to-beam intensity variations, as well as mass modulations in the target, can seed the Richtmyer–Meshkov and Rayleigh–Taylor hydrodynamic instabilities and adversely affect the compression of the imploding shell. The physical energy transfer of the laser-intensity modulations to the shock front, called laser imprint, depends strongly on the initial plasma formation. Perturbations in the velocity profile of a laser-ablation driven shock wave seeded by laser imprint were recorded using a 2-D high-resolution velocimeter. The measured results for experiments with one, two, and five overlapping beams incident on target demonstrate a reduction in long-wavelength (>25-?m) perturbations with an increasing number of overlapping laser beams, consistent with theoretical expectations. These measurements are crucial to validate radiation-hydrodynamics simulations of laser imprint, since they highlight a threefold underestimation of the level of seeded perturbation when the microphysics processes for initial plasma formation such as multiphoton ionization are neglected.

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