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Escape of laser-accelerated MeV electrons through an extended low-density pre-plasma[1] SCOTT FEISTER, FLASH Center for Computational Science / Univ. Dayton Research Institute (UDRI), C. ORBAN, Ohio State Univ. (OSU), J.T. MORRISON, Innovative Scientific Solutions, Inc. (ISSI), G.K. NGIRMANG, J. SMITH, OSU, K.D. FRISCHE, ISSI, A.C. PETERSON, A.J. KLIM, OSU/UDRI, E.A. CHOWDHURY, OSU / Intense Energy Solutions, LLC., R.R. FREEMAN, OSU, W.M. ROQUEMORE, Air Force Research Laboratory, Dayton, USA — Ultra-intense laser experiments at the Air Force Research Laboratory demonstrated larger than expected conversion efficiencies from laser energy to ~MeV electrons from short pulse irradiation of a water stream target. We present Particle-in-cell (PIC) simulations of the pulse interaction that include highly-realistic 3D modeling of the pre-plasma phase of the target expansion using the FLASH hydrodynamic code. The addition of this FLASH pre-pulse modeling step resulted in a dramatic increase in over-120-keV electrons exiting the LSP simulation space. Removal of the low-density pre-plasma region in the LSP initial conditions was shown to re-create low efficiency results from earlier simulations due to energetic electrons failing to escape an isolated target. Analysis of particle trajectories indicates that energetic electrons travel relatively unimpeded through the extended pre-plasma, increasing the conversion efficiency significantly.

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