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High-power, kilojoule class laser channeling, surface wave generation and particle acceleration from underdense plasma L. WILLINGALE, K. KRUSHELNICK, A.G.R. THOMAS, A. MAKSIMCHUK, C. ZULICK, University of Michigan, P.M. NILSON, R.S. CRAXTON, C. STOECKL, T.C. SANGSTER, LLE, University of Rochester, H. CHEN, LLNL, J. COBBLE, LANL, P.A. NORREYS, R.H.H. SCOTT, Rutherford Appleton Laboratory — Experiments performed on the Omega EP laser facility (750 J of energy in 8.4 ps or 55 J - 300 J of energy in 0.9 ps), provide extreme conditions relevant to fast ignition studies. A CH plasma plume is used as the underdense target and the interaction of the laser pulse channeling through the plasma is imaged using proton radiography. Early time expansion, channel evolution, filamentation and self-correction is measured on a single shot via this method. Structures observed along the channel walls are interpreted as having developed from surface waves, and are a likely injection mechanism of electrons into the cavitated channel for acceleration. High-energy electron and proton spectra are measured and compared for the different pulse lengths from the experiment. Two dimensional particle-in-cell simulations give good agreement to these phenomenon. This work was supported by the National Laser Users' Facility (NLUF) and the DOE (Grant No. DE-NA000874).

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