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Energy Loss of High Intensity Focused Proton Beams Penetrating Metal Foils[1] C. MCGUFFEY, B. QIAO, J. KIM, F.N. BEG, UC San Diego, M.S. WEI, M. EVANS, P. FITZSIMMONS, R.B. STEPHENS, General Atomics, S.N. CHEN, J. FUCHS, LULI, P.M. NILSON, D. CANNING, D. MASTROSIMONE, LLE, U Rochester, M.E. FOORD, LLNL — Shortpulse-laser-driven intense ion beams are appealing for applications in probing and creating high energy density plasmas. Such a beam isochorically heats and rapidly ionizes any target it enters into warm dense matter with uncertain transport and stopping properties. Here we present experimental measurements taken with the 1.25kJ, 10ps OMEGA EP BL shortpulse laser of the proton and carbon spectra after passing through metal foils. The laser irradiated spherically curved C targets with intensity 4x10^{18} W/cm^2, producing proton beams with 3 MeV slope temperature and a sharp low energy cutoff at 5 MeV which has not been observed on lower energy, shorter pulse intense lasers. The beam either diverged freely or was focused to estimated 10^{16} p+/cm^{2}ps by a surrounding structure before entering the metal foils (Al or Ag and a Cu tracer layer). The proton and ion spectra were altered by the foil depending on material and whether or not the beam was focused. Transverse proton radiography probed the target with ps temporal and 10 micron spatial resolution, indicating an electrostatic field on the foil may also have affected the beam. We present complementary particle-in-cell simulations of the beam generation and transport to the foils.

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