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Narrow energy spread proton and ion spectra from high-intensity laser interactions[1] F. DOLLAR, T. MATSUOKA, C. MCGUFFEY, S.S. BULANOV, V. CHVYKOV, G. KALINCHENKO, A.G.R. THOMAS, L. WILLINGALE, V. YANOVSKY, A. MAKSIMCHUK, K. KRUSHELNICK, CUOS, Univ. of Michigan, G. PETROV, J. DAVIS, NRL, Wash. DC — Experiments were performed to investigate proton and ion acceleration from thin foil targets, using a high contrast, ultra-short laser pulse from the HERCULES laser at the Univ. of Michigan. Experiments were performed with 30 TW, 32 fs pulses after two plasma mirrors with an $F/1$ off-axis parobolic mirror to attain an intensity of $> 10^{21}$ Wcm^{-2} on Si_3N_4 and Mylar targets of thicknesses ranging 50 nm to 13 μm with ASE contrast of 10^{-13}. Using a short prepulse, proton beams with energy spreads below 75% $\Delta E/E$ were observed from all thicknesses, with a maximum energy of 10 MeV and a minimum energy spread of 25%. Similarly narrow energy spreads were observed for O, N, and C ions for Si_3N_4 thickness of 50 nm, with energies up to 2 MeV per nucleon and energy spread of 23%, with energy spread increasing with increased thickness. Maximum energies were confirmed with CR39 track detectors, while a Thomson ion spectrometer was used to measure energy spectra. Two dimensional particle-in-cell simulations were also performed and will be presented.

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