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Two Stage Proton Acceleration from Ultrathin Foils via High Intensity, High Contrast Laser Pulses[1] S.A. REED, T. MATSUOKA, S.S. BULANOV, V. CHVYKOV, FOCUS Center and CUOS, University of Michigan, A. BRANTOV, V. BYCHENKOV, Lebedev Physics Institute, G. KALINCHENKO, C. MCGUFFEY, P. ROUSSEAU, V. YANOVSKY, FOCUS Center and CUOS, University of Michigan, D. LITZENBERG, Dept of Radiation Oncology, University of Michigan, K. KRUSHELNICK, A. MAKSIMCHUK, FOCUS Center and CUOS, University of Michigan — Laser driven proton acceleration from submicron targets using high intensity ($4x10^{20}W/cm^2$), high contrast (10^{-11}) laser pulses has been investigated. PIC simulations show two distinct acceleration stages: first, a charge separation at the target front due to the laser's ponderomotive force, and second, the rear TNSA mechanism. The two acceleration stages were experimentally distinguished through target selection. The maximum proton energy observed for hydrogen containing targets (CH) was two times higher than for non-hydrogen containing targets (Si_3N_4). For H containing targets the protons are accelerated first by the pondermotive potential, propagate through the target and receive additional acceleration from the rear sheath, whereas Si_3N_4only receives TNSA thus yielding lower proton energy.

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