SELECTIVE DEUTERON ACCELERATION USING THE VULCAN PW LASER

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We report on the successful demonstration of selective acceleration of deuterium ions by target-normal sheath acceleration (TNSA) using the Vulcan PW laser at Rutherford Appleton Laboratory. TNSA ion beams are typically dominated by H^+, C^+, and O^+ ions due to hydrocarbon surface contaminants. Deuterium ions are accelerated by covering these contaminants with a microns thick layer of heavy water vapor, frozen onto a cryogenic target. The signal from a shot (200 J, 700 fs, $> 10^{20}$ W/cm^2, 1053nm) that produced an ion beam with >0.99 deuterium-ion-to-proton ratio and peak energy 14 MeV/nucleon is shown below. The bright yellow parabolic line, labeled D^+, is the deuterium signal; below it is the faint proton signal, labeled H^+. Within the range of our detectors (0-8.5°) we find laser-to-deuterium-ion conversion efficiency of 4.3% above 0.7 MeV/nucleon while a conservative estimate of the total beam gives a conversion efficiency of 9.4%.