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Parametric Study of Laser Driven Proton Beams from a Critical Density Gas Jet[1] D. HABERBERGER, F. TSUNG, S. TOCHITSKY, W. MORI, C. JOSHI, UCLA — Laser driven ion acceleration (LDIA) is studied via particle-in-cell simulations in a novel parameter space for laser-plasma interactions of a relativistic laser pulse with a gas jet target at the critical plasma density (n_c). Previous LDIA studies have been based on the interaction of a 1μm laser pulse with either a solid foil ($n \sim 100 n_c$) or a gas jet ($n \leq 0.1 n_c$). Here we propose focusing a high power CO_2 laser pulse at a H_2 gas jet which is tunable around the critical plasma density for 10μm radiation (10^{19}cm^{-3}). A rectangular H_2 gas jet operated near n_c lends itself to efficient coupling of the laser light to forward directed electrons instigating the target normal sheath acceleration mechanism to produce a beam of protons. Results are presented here on a parametric study of the peak plasma density and plasma profile to find optimal conditions for total charge, divergence, and energy of the accelerated proton beam. These simulations support an ongoing LDIA experiment at the Neptune Laboratory at UCLA using a 3ps 1TW CO_2 laser pulse for the production of collimated proton beams.

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