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Shock Wave Acceleration of Ions on Omega EP D. HABERBERGER, Laboratory for Laser Energetics, U. of Rochester and U. of California, Los Angeles, S. TOCHITSKY, C. GONG, W.B. MORI, C. JOSHI, U. of California, Los Angeles, F. FIUZA, R.A. FONSECA, L.O. SILVA, Instituto Superior Tecnico —
For the past decade, laser-driven ion acceleration (LDIA) has typically produced ion beams with continuous energy spread and poor peak ion energy scaling with laser power. Recent experimental results using shock-wave acceleration (SWA) driven by a CO_2 laser in an H_2 gas-jet plasma have shown the possibility of producing proton beams with energy spreads down to 1% and energies of up to 20 MeV using a modest peak laser power of 4 TW.[1] Here we propose to investigate the scaling of the SWA mechanism to higher laser powers using the 1-μm OMEGA EP Laser System at LLE. UV nanosecond laser beams will be used to ionize a thin plastic target with a fixed delay from the main pulse such that the desired characteristics optimal for SWA are met—peak plasma density is overdense for the 1-μm main pulse and the plasma profile exponentially decays over a long scale length on the rear side. A 4ω probe will be used to experimentally characterize the plasma density profile. Scaling from simulations of the SWA mechanism shows that ion energies in the range of 100 MeV/amu are achievable with a focused a_o of 5 from the OMEGA EP Laser System, surpassing the current scaling in LDIA results. This work was supported by the U.S. Department of Energy Office of Inertial Confinement Fusion under Cooperative Agreement No. DE-FC52-08NA28302.

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