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Laser Ion Acceleration from Shock Wave Generated Targets[1]
MICHAEL HELLE, DANIEL GORDON, DMITRI KAGANOVICH, ANTONIO TING, U.S. Naval Research Laboratory — Efficient acceleration of ions by means of high power laser radiation requires electron plasma densities at or in excess of the critical density. Traditionally, this has been achieved using solid targets. More recently, laser facilities at Brookhaven National Laboratory and the University of California in Los Angeles have achieved acceleration using Terawatt CO_2 interacting with gas jets. Gas targets are advantageous in that they are relatively simple and can be operated at high repetition rates; however, they typically operate at densities far below those required for optical wavelengths, where most of the world's terawatt lasers operate. To get around this and other issues, a new type of target, a "gas foil," has been developed at the Naval Research Laboratory. The target is created by igniting an optically driven hydrodynamic shock into the flow of a gas jet in vacuum. Experiments have shown that a laser-ignited shock is capable of producing <10 μm gradients, thicknesses ~ 100 μm, and peak densities >4 times ambient. These results have been incorporated into 3D PIC simulations. Results for a relatively compact and inexpensive 20 TW laser yielded protons with energies in excess of 5 MeV. Simulations as well as preliminary experimental results will be discus

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