Abstract Submitted
for the DPP15 Meeting of
The American Physical Society

**Laser acceleration of monoenergetic protons with a near-critical, optically-shaped gas target** YU-HSIN CHEN, Research Support Instruments, Inc., Lanham, MD, MICHAEL HELLE, ANTONIO TING, DANIEL GORDON, Plasma Physics Division, Naval Research Laboratory, Washington, DC, MIKHAIL POLYANSKIY, IGOR POGORELSKY, MARCUS BABZIEN, Accelerator Test Facility, Brookhaven National Laboratory, Upton, NY, ZULFIKAR NAJMUDIN, Blackett Laboratory, Imperial College London, UK — Laser-based ion acceleration is studied using the intense terawatt CO2 laser pulse with a near-critical hydrogen gas target. The gas density profile is tailored by a hydrodynamic shock, which is launched by ablation of solid with a moderate-energy, nanosecond Nd:YAG laser pulse in the vicinity of the gas jet. A sharp density gradient is thus created near the edge of the gas column, resulting to $\sim$ 6X local density enhancement up to several times of critical density within $\lesssim$ 100 micrometers before CO2 laser pulse arrives. With such density profile, we have observed quasi-monoenergetic proton beams with energies >1 MeV and good shot-to-shot reproducibility. In contrast, no protons were observed when the hydrodynamic shock is absent. Results from experiments and simulations will be presented. This work is supported by U.S. Department of Energy.

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Date submitted: 24 Jul 2015 Electronic form version 1.4