Abstract Submitted
for the DPP19 Meeting of
The American Physical Society

Ion Acceleration in Laser Generated Mega Tesla Magnetic Vortex.[1] STEPAN BULANOV, JAEHONG PARK, JIANHUI BIN, QING JI, SVEN STEINKE, CAMERON GEDDES, CARL SCHROEDER, Lawrence Berkeley National Laboratory, WIM LEEMANS, Lawrence Berkeley National Laboratory (now at DESY), JEAN-LUC VAY, THOMAS SCHENKEL, ERIC ESAREY, Lawrence Berkeley National Laboratory — Magnetic Vortex Acceleration (MVA) from near critical density targets is one of the promising schemes of laser-driven ion acceleration. 3D particle-in-cell simulations are used to explore a more extensive laser-target parameter space than previously reported on in the literature as well as to study the laser pulse coupling to the target, the structure of the fields, and the properties of the accelerated ion beam in the MVA scheme. The efficiency of acceleration depends on the coupling of the laser energy to the self-generated channel in the target. The accelerated proton beams demonstrate high level of collimation with achromatic angular divergence, and carry a significant amount of charge. For PW-class lasers, this acceleration regime provides favorable scaling of maximum ion energy with laser power for optimized interaction parameters. The mega Tesla-level magnetic fields generated by the laser-driven co-axial plasma structure in the target are a prerequisite for accelerating protons to the energy of several hundred MeV.

[1]This work was supported by U.S. DOE Office of Science Offices of HEP and FES, under Contract No. DE-AC02-05CH11231

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Date submitted: 03 Jul 2019 Electronic form version 1.4