Abstract Submitted
for the DPP20 Meeting of
The American Physical Society

Experimental Study on Laser Pulse Guiding in Capillary Plasma Waveguides[1] MARLENE TURNER, ANTHONY GONSALVES, CARLO BENEDETTI, CHRISTOPHER PIERONEK, KEI NAKAMURA, LIESELOTTE OBST-HUEBL, JEROEN VAN TILBORG, CARL SCHROEDER, CAMERON GEDDES, ERIC ESAREY, Lawrence Berkeley National Laboratory — Laser driven plasma wakefield accelerators can accelerate charged particles with GeV/cm gradients. To sustain these gradients over cm-scale distances, laser pulse guiding is typically required. Control and tunability of the laser pulse guiding process are key ingredients to enable charged particle acceleration that results in high bunch quality with GeV energies. In this contribution we study the stability, reproducibility, quality and limits of optical guiding in 9 and 20 cm-long plasma channels. We show that a discharge in a hydrogen-filled capillary can provide a plasma channel that is controllable and reproducible. We also show that when guiding low power laser pulses, the waveguide preserves laser pulse transverse phase space, pointing and spot size fluctuations. This work demonstrates an important technological basis for reproducible and repeatable acceleration of electron beams in laser plasma wakefield accelerators that use capillary discharge waveguides as guiding structures.

[1]This work was supported by the Director, Office of Science, Office of High Energy Physics, of the U.S. Department of Energy under Contract Nos. DE-AC02-05CH11231 and DE-FG02- 12ER41798.

Marlene Turner
Lawrence Berkeley National Laboratory

Date submitted: 02 Jul 2020 Electronic form version 1.4