Abstract Submitted
for the DPP09 Meeting of
The American Physical Society

Laser Wakefield Acceleration with Shaped Laser Modes[1] ESTELLE CORMIER-MICHEL, ERIC ESAREY, CAMERON G.R. GEDDES, CARL B. SCHROEDER, Lawrence Berkeley National Laboratory, DAVID L. BRUHWILER, BEN COWAN, KEVIN PAUL, Tech-X Corporation, WIM P. LEEMANS, Lawrence Berkeley National Laboratory — LBNL is currently pursuing a collider design based on meter-long 10 GeV laser-plasma accelerator stages, and Thomson gamma source designs at $\sim$1 GeV, that will operate in the quasi-linear regime. This regime allows symmetric acceleration of electrons and positrons and has the property that the transverse fields are proportional to the transverse gradient of the laser intensity profile. We show that higher order laser modes can tailor this gradient and hence the focusing forces in the plasma, allowing control over the radius and the emittance of the accelerated bunch. We present simulations, using the VORPAL framework, of the design of 1-10 GeV stages. In particular, we show that, by using shaped laser modes, it is possible to increase the matched electron beam radius and hence the total charge in the bunch while preserving the low bunch emittance required for applications.

[1]Work supported by the U.S. Department of Energy NA-22 and HEP Contract No. DE-AC02-05CH11231, SciDAC, and SBIR.

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Date submitted: 18 Jul 2009 Electronic form version 1.4