Abstract Submitted
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Improvement of electron beam quality in optical injection schemes using negative plasma density gradients[1] GWENAEL FUBIANI, ERIC ESAREY, CARL SCHROEDER, WIM LEEMANS, LBNL — Enhanced electron trapping using plasma density down ramps as a method for improving the performance of laser injection schemes is proposed and analyzed. A decrease in density implies an increase in plasma wavelength, which can shift a relativistic electron from the defocusing to the focusing region of the accelerating wakefield, and a decrease in wake phase velocity, which lowers the trapping threshold. The specific method of two-pulse colliding pulse injector was examined using a three-dimensional test particle tracking code. A density down-ramp with a change of density on the order of tens of percent over a length greater than the plasma wavelength led to an enhancement of charge by two orders in magnitude or more, up to the limits imposed by beam loading. The accelerated bunches are ultrashort (fraction of the plasma wavelength), high charge ($>$ 20 pC at modest injection laser intensity $\sim 10^{17}$ W/cm^2), with a good beam quality (relative energy spread of a few percent at a mean energy of 25 MeV, and a normalized RMS emittance on the order 0.5 mm.mrad).

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