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High quality electron bunch generation using a longitudinal density-tailored plasma-based accelerator in the blowout regime XINLU XU, FEI LI, WEIMING AN, PEICHENG YU, Univ of California - Los Angeles, WEI LU, Tsinghua Univeristy, CHAN JOSHI, WARREN MORI, Univ of California - Los Angeles — The generation of very high quality electron bunches (high brightness and low energy spread) from a plasma-based accelerator in the blowout regime using self-injection in tailored plasma density profiles is analyzed theoretically and with three-dimensional particle-in-cell simulations. The underlying physical mechanism that leads to the generation of high quality electrons is uncovered by tracking the particle trajectories of the electrons as they cross the sheath and are trapped by the wake. Details on how the intensity of the driver and the density scale length controls the ultimate beam quality are described.Three-dimensional particle-in-cell simulations indicate that this concept has the potential to produce beams with $\sim$0.5 nC of charge, peak brightnesses of $0.5 \times 10^{20} A/m^2/rad^2$ and with absolute projected energy spreads of $< 0.5 MeV$ using existing lasers or electron beams to drive nonlinear wakefields.

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