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Generating high quality multi-GeV electrons beams using an evolving electron beam driver[1] THAMINE DALICHAOUCH, University of California, Los Angeles, XINLU XU, SLAC National Accelerator Laboratory, ADAM TABLEMAN, FEI LI, FRANK TSUNG, WARREN MORI, University of California, Los Angeles — The generation of high quality multi-GeV beams using plasma wakefield acceleration (PWFA) has attracted significant interest in applications involving compact particle accelerators and next generation x-ray light sources. Recently, we proposed a new method of injection that relies on reducing the phase velocity of the plasma wake by focusing an electron drive bunch. Two regimes were examined in which the driver was focused by either conventional optics or by the plasma wake. In both regimes, we were able to generate beams with peak normalized brightness as high as $\sim 10^{20}$ A/m^2/rad^2, projected energy spreads of $< 1\%$, and energies up to ~ 1.86 GeV for plasma densities of 10^{19} cm^{-3}. In this talk, we will examine how driver parameters, such as emittance, energy and duration, affect the final energy and current of the injected beam in the regime where plasma self-focusing effects are dominant. Particle-in-cell simulation results using OSIRIS indicate that it may be possible to generate beams with energies of up to ~ 18.3 GeV, projected energy spreads of $\sim 0.5\%$, and normalized brightness as high as $\sim 10^{20}$ A/m^2/rad^2 for plasma densities of 10^{19} cm^{-3}.

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