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Using laser ionization to design a plasma wakefield accelerator that preserves beam emmittance CHRISTOPHER DOSS, MICHAEL LITOS, ROBERT ARINIELLO, Univ of Colorado - Boulder — Beam-driven plasma wakefield accelerators (PWFA) are a strong candidate for future high energy particle accelerators, particularly for electrons and positron. The PWFA has demonstrated multi-GeV/m acceleration in experiment, though a remaining concern is conserving the emmitance (spread of particles in phase-space) of a beam as traverses the plasma. One solution is to guide the beam into the PWFA using a precisely ionized plasma source generated with a high intensity laser pulse. We present simulations that show ionization of suitable plasma density profiles and plan on implementing these results in laboratory experiment. A tandem lens system propagates a laser pulse into $10^{16}\,\mathrm{cm}^{-3}$ density Argon gas and can ionize a plasma column on the order of 50 cm in length. We also explore implementation of thin plasma lenses to supplement the main plasma source as a secondary strong focusing element. We show generation of a suitable thin plasma lens by using an asymmetric Gaussian laser pulse to ionize a small, dense plasma between two Argon gas jets.

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