

Abstract Submitted
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Emittance preservation through density ramp matching sections in a plasma wakefield accelerator¹ YUJIAN ZHAO, University of California, Los Angeles, WEIMING AN, Beijing Normal University, XINLU XU, SLAC National Accelerator Laboratory, FEI LI, LANCE HILDEBRAND, University of California, Los Angeles, MARK HOGAN, VITALY YAKIMENKO, SLAC National Accelerator Laboratory, CHAN JOSHI, WARREN MORI, University of California, Los Angeles — In plasma wakefield acceleration, the witness beam's emittance needs to be preserved when it propagates through a plasma stage. The plasma includes density ramps at both the entrance and the exit. Using the Wentzel-Kramers-Brillouin (WKB) solution of a single particle's motion, analytical expressions for the evolution of the beam emittance and the Twiss parameters in an arbitrary adiabatic plasma profile are provided neglecting the acceleration of the beam inside the plasma. It is shown that the beam emittance can be preserved under the matching condition even when the beam has an initial energy spread. It is also shown that the emittance growth for an unmatched beam is minimized when it is focused to the same vacuum plane for a matched beam. The emittance evolution from 3D QuickPIC simulation results agree well with the theoretical results. The theoretical and simulation results are also used to analyze parameters for a proposed experiment on the FACET II facility.

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