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**Mitigate ionization induced beam head erosion in a plasma wake field accelerator** WEIMING AN, M. ZHOU, N. VAFAEI-NAJAFABADI, K. MARSH, C. CLAYTON, C. JOSHI, W. MORI, University of California, Los Angeles, W. LU, Tsinghua University, E. ADLI, S. CORDE, M. LITOS, S. LI, S. GESSNER, J. FREDERICO, M. HOGAN, D. WALZ, J. ENGLAND, J. DELAHAYE, SLAC, P. MUGLLI, MPI — We explore methods for mitigating ionization induced beam-head erosion in a plasma wake field accelerator (PWFA). In the beam’s field ionized plasma, the beam head may continuously expand due to either the lack or reduction of the focusing force from the plasma wake. This can eventually terminate the wake formation before the beam is depleted of its energy. We can mitigate this effect by controlling the beam parameters or the plasma conditions. In this work, we focus on the latter and show that the beam head erosion rate can be dramatically reduced in the field ionized plasma when using a combination of the lowest ionization potential atoms for plasma formation and a precursor laser pulse to generate a narrow plasma filament in front of the beam. We also perform QuickPIC simulations on the “two-bunch PWFA experiments” at the FACET facility. The simulation results show that the energy gain of the trailing beam can be significantly increased by employing these techniques.

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