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Modeling Electron Clouds in High-Current Ion Accelerators with Solenoid Focusing*

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Contamination from electrons is a concern for solenoid-focused ion accelerators being developed for experiments in high-energy-density physics (HEDP). These electrons, produced directly by beam ions hitting lattice elements or indirectly by ionization of desorbed neutral gas, can potentially alter the beam dynamics, leading to beam deflection, increased emittance, halo, and possibly electron-ion instabilities. The electrostatic particle-in-cell code WARP is used to simulate electron-cloud studies on the solenoid-transport experiment (STX) at Lawrence Berkeley National Laboratory. We present self-consistent simulations of several STX configurations to show the evolution of the electron and ion-beam distributions first in idealized 2-D solenoid fields and then in the 3-D field values obtained from probes. Comparisons are made with experimental data, and several techniques to mitigate electron effects are demonstrated numerically.

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