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Numerical Study of the Current Filamentation Instability of an Accelerator Beam in a Capillary Plasma[1] B. ALLEN, P. MUGGLI, University of Southern California, V. YAKIMENKO, J. PARK, K. KUSCHE, M. BABZIEN, Brookhaven National Laboratory, C. HUANG, University of California Los Angeles
— Current Filamentation Instability, CFI, is of central importance for the propagation of relativistic electron beams in plasmas. In the laboratory it could influence the energy deposition by hot electrons in fast-igniter concept for inertial confinement fusion. It could also play an important role in the generation of magnetic fields and of radiation in the after-glow of gamma ray bursts. Using the particle-in-cell code QuickPIC, we simulate the propagation of the BNL-ATF beam in a cm-long plasma produced by a capillary discharge. The occurrence of the instability is investigated as a function of electron beam parameters (including charge and emittance) and plasma parameters (density and length) by evaluating the beam density and magnetic energy. The results show that with beam and plasma parameters achievable at the BNL-ATF the CFI should be observed after only 2 cm of plasma. We present simulation results, discuss further simulation refinements, suggest criteria and threshold parameters for observing the presence of CFI and outline the experiment we will perform at the BNL-ATF.

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