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Experimental Study of the Current Filamentation Instability[1]
BRIAN ALLEN, University of Southern California, PATRIC MUGGLI, Max Planck Institute for Physics, LUIS O. SILVA, JOANA MARTINS, Instituto Superior Técnico - GoLP/Instituto de Plasmas e Fusao Nuclear, VITALY YAKIMENKO, MIKHAIL FEDURIN, KARL KUSCHE, MARCUS BABZIEN, Brookhaven National Laboratory, CHENGKUN HUANG, Los Alamos National Laboratory, WARREN MORI, University of California at Los Angeles — The Current Filamentation Instability (CFI) is of central importance for the propagation of relativistic electron beams in plasmas. CFI has potential relevance to astrophysics, afterglow of gamma ray bursts, inertial confinement fusion, energy transport in the fast-igniter concept, and places an upper limit on the plasma density and accelerating gradient in PWFA's. An experimental study at the Accelerator Test Facility at Brookhaven National Laboratory with the 60MeV e^- beam and cm length plasma. The experiment included the systematic study and characterization of the instability as a function of the beam charge and plasma density. The transverse beam profile is measured directly at the plasma exit using OTR. Experimental results show the transition from plasma focusing to CFI near $k_p\sigma_r$=1 characterized by the appearance of multiple (1-5) beam filaments and scaling of the transverse filament size with the plasma skin depth. Suppression of the instability is seen by lowering the growth rate of the instability by reducing the beam charge. The experimental results are in excellent agreement with theory and simulations and we present and discuss simulation and experimental results.

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