Abstract Submitted
for the DPP09 Meeting of
The American Physical Society

Relativistic Electron Beam Propagation in the Presence of Plasma Electron-Ion Collisions CARL SIEMON, VLADIMIR KHUDIK, GENNADY SHVETS, University of Texas at Austin — The physics of relativistic electron beam propagation through a collisional background plasma and electromagnetic Weibel Instability is described. A reduced hybrid approach treats the beam electrons as macro-particles, plasma electrons as a fluid, and assumes stationary plasma ions. This treatment, along with the assumption of quasi-neutrality, provides a simplified, computationally efficient framework for solving this system. Collisional simulation results are presented, which sharply contrast collisionless dynamics in several areas. One striking feature of these simulations is the enhancement of beam stopping. The most obvious mechanism for this effect is a persistent stopping electric force along the propagation direction. During the merging of filaments, the coupling of Weibel Instability with collisions leads to beam deflection in addition to electric stopping, slowing the beam down further. This coupling occurs because of increased magnetic field strength due to enhanced current imbalance from collisions. The increased field strength decreases filament merging time, thus augmenting transverse thermalization, which occurs when filaments merge. Transverse thermalization results in a loss of beam momentum in the propagation direction. Other interesting phenomena present in collisional simulations include the reversal of the return current direction in selected regions.

Carl Siemon
University of Texas at Austin

Date submitted: 16 Jul 2009 Electronic form version 1.4