Abstract Submitted
for the DPP06 Meeting of
The American Physical Society

Analytical model for charge and current neutralization of an ion beam pulse propagating in a plasma in a solenoidal magnetic field JEFFREY PENNINGTON, IGOR D. KAGANOVICH, Princeton Plasma Physics Laboratory — An analytical model is developed to describe the self-magnetic field of a finite-length ion beam pulse propagating in a cold background plasma in a solenoidal magnetic field. Previously, we developed an analytical model to describe the current neutralization of a beam pulse propagating in a background plasma. In the presence of an applied magnetic field, however, the system of equations describing the self-magnetic field becomes much more complicated. Importantly, the slice approximation fails, i.e., the current profile in different transversal cross sections of the beam pulse cannot be treated independently. Nevertheless, the two-dimensional problem can be solved analytically in Fourier space. These results shed light on the effects of the applied magnetic field on the degree of charge and current neutralization and on the complex structure of electron density perturbations generated by the beam pulse. For a strong enough applied magnetic field, two poles emerge in Fourier-space. These poles are an indication that whistler and low-hybrid waves have been excited by the beam pulse.

Igor Kaganovich
PPPL

Date submitted: 21 Jul 2006 Electronic form version 1.4