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New experimental measurements of electron clouds in ion beams with large tune depression

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New experimental measurements of electron clouds in ion beams with large tune depression*

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We study electron clouds in high perveance beams (K = 8E-4) with a large tune depression of 0.2 (defined as the ratio of a single particle oscillation response to the applied focusing fields, with and without space charge). These 1 MeV, 180 mA, K+ beams have a beam potential of +2 kV when electron clouds are minimized. Simulation results are discussed in a companion paper [J-L. Vay, this Conference].

We have developed the first diagnostics that quantitatively measure the accumulation of electrons in a beam [1]. This, together with measurements of electron sources, will enable the electron particle balance to be measured, and electron-trapping efficiencies determined. We, along with colleagues from GSI and CERN, have also measured the scaling of gas desorption with beam energy and dE/dx [2].

Experiments where the heavy-ion beam is transported with solenoid magnetic fields, rather than with quadrupole magnetic or electrostatic fields, are being initiated. We will discuss initial results from experiments using electrode sets (in the middle and at the ends of magnets) to either expel or to trap electrons within the magnets.

We observe electron oscillations in the last quadrupole magnet when we flood the beam with electrons from an end wall. These oscillations, of order 10 MHz, are observed to grow from the center of the magnet while drifting upstream against the beam, in good agreement with simulations.

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[1] M. Kireeff Covo, et al., to be submitted to Phys. Rev. Lett.

[2] A. W. Molvik, et al, to be submitted to Phys. Rev. Lett.