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Gas and Electron Effects on Intense, Space Charge Dominated Ion Beams in Magnetic Quadrupoles; Comparison of Experiments and Simulations

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Gas and Electron Effects on Intense, Space Charge Dominated Ion Beams in Magnetic Quadrupoles: Comparison Of Experiments and Simulations[1] P.A. SEIDL, LBNL, D. BACA, LBNL, F.M. BIENIOSEK, LBNL, J-L VAY, LBNL, R. COHEN, LLNL, A. FRIEDMAN, LLNL, D. GROTE, LLNL, M. KIREEFF COVO, LLNL, S.M. LUND, LLNL, A.W. MOLVIK, LLNL, B.E. ROSENBERG, UCB, HIF-VNL COLLABORATION — Accelerators for inertial fusion energy, high-energy density physics and other high intensity applications have an economic incentive to minimize the clearance between the beam edge and the aperture wall. This increases the risk from electron clouds and gas desorbed from walls. Using the High Current Experiment at LBNL, we have measured the beam (0.18 A, 1 MeV K^+) distribution upstream and downstream of a short lattice of magnetic quadrupoles where the 2rms beam size is $\geq 50\%$ of the quadrupole aperture, and the generalized perveance is $\approx 10^{-3}$. Between magnets, the transverse beam distribution is also imaged. The beam potential is 1-2 kV, large enough to trap electrons produced by, for example, K^+ - gas collisions. The measurements are compared to WARP PIC simulations that include the self-consistent tracking of electrons and ions.

[1]This work was performed under the auspices of the U.S. Department of Energy by University of California, Lawrence Livermore National Laboratory under contract No. W-7405-Eng-48, and by Lawrence Berkeley National Laboratory under Contract DE-AC02-05CH11231

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