Negative, Positive, and Infinite Mass Properties in a Rotating Electron Beam[1] DAVID FRENCH, Y.Y. LAU, R.M. GILGENBACH, University of Michigan, BRAD HOFF, Air Force Research Lab — Electrons rotating under a general combination of axial magnetic field B and radial electric field E have an effective mass in the azimuthal direction which can be positive, negative, or infinite depending upon the magnitude and sign of E [1]. No prior simulations have systematically studied such properties. This work was also motivated by our recent invention of the recirculating planar magnetron [2], where rapid start up utilizes the negative mass instability in the inverted magnetron configuration (that has a positive E). The transition between positive and negative mass is the infinite mass case where the electrons hardly respond to an azimuthal electric field. We present the results of particle-in-cell simulations using MAGIC for general E and B showing positive, negative, and infinite mass behavior of the electron beam.

[1] D. Chernin and Y. Y. Lau, Phys. Fluids 27, 2319 (1984).
[2] R. M. Gilgenbach et al., in this conference; also, Proc. IVEC, p. 507 (2010).

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