

MEASUREMENT AND SIMULATION OF THE UMER BEAM IN THE SOURCE REGION*

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Abstract

As the beam propagates in the University of Maryland Electron Ring (UMER) complex transverse density structure including halos has been observed. A primary objective of the experiment is to understand the evolution of a space-charge-dominated beam as it propagates over a substantial distance. It is therefore important to understand which details of the beam structure result from propagation of the beam in the ring and which characteristics result from the specific details of the initial distribution. Detailed measurements of the initial beam characteristics have therefore been performed. These include direct measurement of the density using a phosphor screen, as well as pepper pot measurements of the initial transverse distribution function. Detailed measurements of the distribution function have also been obtained by scanning a pinhole aperture across a beam diameter, and recording phosphor screen pictures of the beam downstream of the pinhole.

Simulations of the beam characteristics in the gun region have also been performed using the WARP P.I.C. code. From these simulations, the observed behavior has been attributed to a combination of perturbations to the transverse distribution by a cathode grid that is used to modulate the beam current, as well as the complex transverse dynamics that results from the combination of the nonlinear external focusing fields of the gun structure and the nonlinear space charge forces.

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