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Space Charge Compensation Study of High Intensity Ion Beams

The space charge effect is one of the key factors affecting ion beam transport and ion beam quality, especially for low-energy high-intensity ion beams. It can be partially compensated by the secondary electrons produced from the ionization of residual gas molecules in the beam pipe, and we are interested in the accurate value of this compensation degree. In this paper, we use a Three-grid Energy Analyzer (TEA) to measure the secondary ion energy distribution of the beam, which is corresponding to the compensated beam potential distribution. To have accurate evaluation of the compensation degree, it is essential to adopt a proper transverse distribution of the ion beam, other than using the Gaussian theorem for uniform beams. The results of space charge compensation degree study for singly charged ion beams with a 2.45GHz microwave ion source and multiply charged ion beams with a high charge state ECR ion source are presented.

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