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Phase Space Tomography: A Simple, Portable and Accurate Technique to Map Phase Spaces of Beams with Space Charge DIKTYS STRATAKIS, RAMI KISHEK, HUI LI, SANTIAGO BERNAL, MARK WALTER, IRVING HABER, RALPH FIORITO, JAYAKAR TOBIN, BRYAN QUINN, MARTIN REISER, PATRICK O'SHEA, Institute for Electronics and Applied Physics
— Charged particle beams can be viewed as a one component non-neutral plasma where the averaged focusing force takes the place of a fixed neutralizing background. In order to understand the charged particle dynamics, e.g. the halo formation, density waves, emittance growth, x-y energy transfer and coupling, knowledge of the actual phase space is needed. Other the past decade there is an increasing number of articles who use tomography in order to map the beam phase space and measure the beam emittance. These works where performed at high energy facilities where the effect of space charge was neglible and therefore not considered in the analysis. This work extends the tomography technique to beams with space charge. In order to simplify the analysis linear forces where assumed. By carefully modeling the tomography process using the particle-in-cell code WARP we test the validity of our assumptions and the accuracy of the reconstructed phase space. Finally, we report experimental results of phase space mapping at the University of Maryland Electron Ring (UMER) using tomography (This work was supported by the U.S Department of Energy, the Office of Naval Research and the Joint Technology Office).

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