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Non-destructive ion-beam charge-distribution diagnostic

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A non-destructive ion-beam charge-distribution diagnostic

An e-beam diagnostic system for measuring the charge distribution of an ion beam without changing its properties is developed for HIF beam physics studies. Conventional diagnostics require temporary insertion of sensors into the beam, but these stop the beam, or alter its properties. In this new diagnostic a low energy, low current electron beam is moved transversely across the ion beam; the charge density profile of the ion beam is determined from the e-beam deflection. The e-beam is translated by dipole magnets in a chicane setup allowing the electron beam to traverse the ion beam at various positions from the beam axis. The background magnetic field (~0.5 G), which affects the trajectory of the low energy e-beam, is cancelled by a Helmholtz coil. The image of the e-beam spot on a YAP scintillator (18 photons/keV, 27 ns decay constant) is monitored using a gated-camera, then processed with image analysis software (Image-J). Figure 1 shows theoretical, experimental and overall performance of the e-beam diagnostic to measure an ion beam.

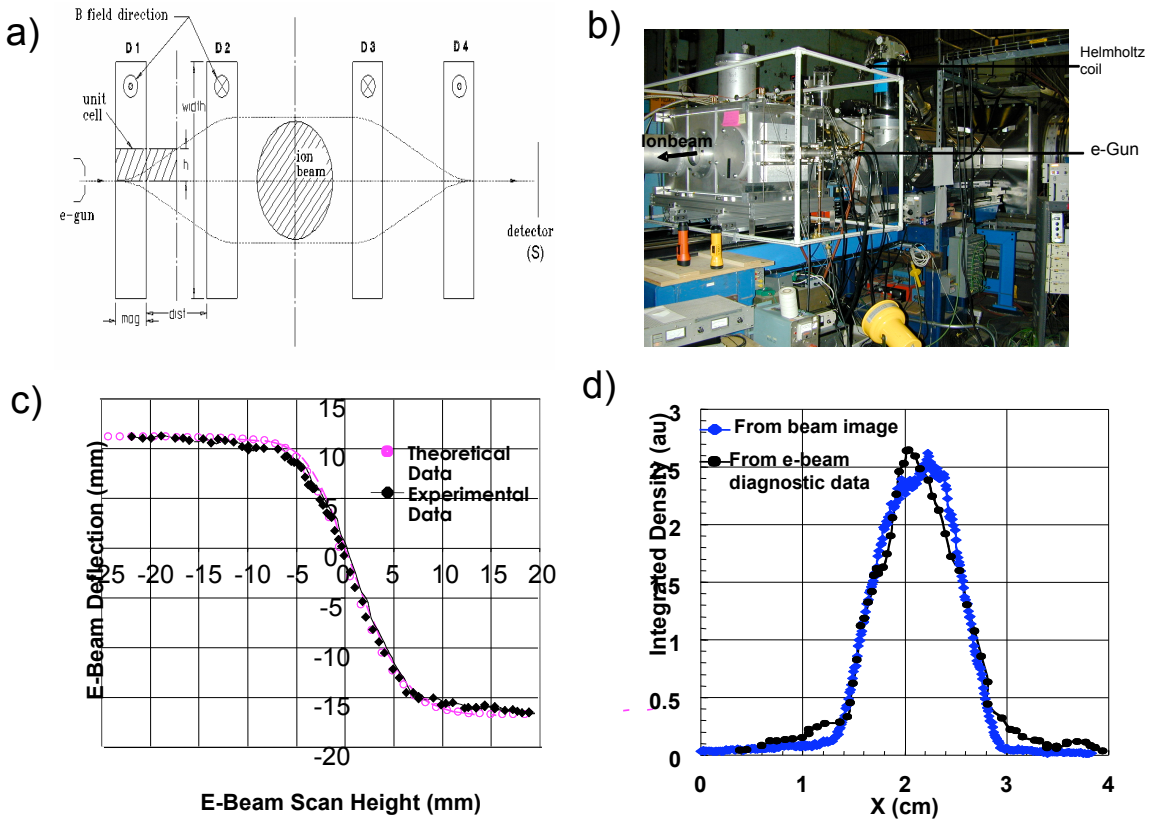

FIG.1: (a) A sketch of the e-beam diagnostic system, (b) e-beam diagnostic system in the NTX beamline, (c) theoretical and experimental data of the e-beam (8 keV, 1 A) deflection by the ion beam (264 keV, 25 mA, K^+), (d) the ion beam density profiles measured destructively (scintillator based image) and non-destructively with the e-beam diagnostic system. The integrated density profile by the e-beam diagnostic was obtained using a least square fit to calculate the derivative of the experimental deflection data. — *P. K. Roy, E. Henestroza, S. Eylon, F. Bieniosek, M. Amezcua, W. Greenway, and S. S. Yu*

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