Electron Beam Ion Traps

# Principles

Components: e-gun, solenoidal magnets, axial electrostatic trap, e-collector

Primary Purpose: Charge Breeds Ions through electron impact ionization

Electron beam is generated, and compressed through ion trapping region and collected on the other side.

Ions can be injected, or generated with ambient gas in vacuum vessel.

Cylindrical electrostatic plates centered on axis provide axial confinement. The uniformity and depth of the electrostatic well within the trap can also be adjusted.

Radial confinement performed by the space-charge potential of the e-beam.

Keep in mind that in order to accelerate the beam, the whole source, and all of it’s components must be kept on a voltage platform.

Keeping it all at 4K helps reduce contamination and allows feasible magnet design for a longer trapping region.

# Key Parameters

Magnetic Field: ~4T

E-Beam Current: <1.4A, but typically ran around 300mA for stable operation

Current density: (@300mA) ~170A/cm^2

E-Beam energy: < 30 keV (e.g., Ne-like U82+)

Length of Trapping Region: ~0.64m

# Emittance

# Ionization Factor