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Simulations for a High-Current Electron Gun for the EBIT Charge Breeder of the ReA Post-Accelerator at FRIB

The Facility for Rare Isotope Beams (FRIB) at Michigan State University is nearing completion. In some cases, the RIB rates at FRIB are expected to exceed 10^{10} particles/s. The ReA EBIT charge breeder operates with an electron-beam current of 300 –600 mA for a density of 170 –340 A/cm². This current corresponds to a maximum capacity of 10^{10} elementary charges, which can be insufficient to handle high FRIB rates. To increase the EBIT electron-beam current and density, electron-beam simulations have been performed for a new electron-gun insert with a dispenser cathode having a larger emitting area. An electron beam of 2 A was the target current to reach a capacity of 5×10^{10} elementary charges. Parameter studies have been conducted to optimize beam transmission. A simulated current density at the trap was obtained to be 432 A/cm². The basic design of the insert and result of the simulations for the ReA EBIT will be presented.

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