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First Electron Beam and Status of the High-Current EBIS Charge Breeder for the FRIB

The ReA post-accelerator of the National Superconducting Cyclotron Laboratory employs an Electron-Beam Ion Trap (EBIT) as a charge breeder to reaccelerate rare-isotope beams to several MeV/u. The Facility for Rare-Isotope Beams (FRIB) is near completion and will provide RIB rates expected to exceed in some cases 10^{10} particles/s. The ReA EBIT operates with an electron current of 300 –600 mA, corresponding to an electron current density of 170 –340 A/cm² and maximum trap capacity of 10^{10} elementary charges, which can be insufficient to handle high FRIB rates. A High Current Electron-Beam Ion Source (HCEBIS) has been constructed based on the backbones of the TestEBIS from Brookhaven National Laboratory. By using a 4A electron beam, a beam current density of 298 A/cm² and a maximum trap capacity of 2.4×10^{11} elementary charges can be achieved. This paper presents the status of the HCEBIS, including the simulation results and first electron-beam tests.

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