Title:
Simulation study for EBIT/S upgrade and LEBT beamline at NSCL

Author:
Kei Fukushima, Alain Lapierre, Takashi Yoshimoto, Qiang Zhao

Abstract:
ReA at the National Superconducting Cyclotron Laboratory (NSCL) at Michigan State University is a post-accelerator that reaccelerates rare isotopes produced by fast-projectile fragmentation (or fission). Before post-acceleration, rare-isotope beams are first thermalized in a gas cell and transported to a beam cooler and buncher. Afterwards, ion pulses are injected into an Electron Beam Ion Trap (EBIT) charge breeder. Highly charged ions beams are then extracted to a charge-over-mass (Q/A) separator, composed of electrostatic deflectors and a dipole magnet. After passing through a slit assembly, the selected beam in the Low-Energy Beam Transport (LEBT) beamline is transported to and accelerated by a Radio-Frequency Quadrupole (RFQ) linac and superconducting RF cavities to reach energies of up to 6 MeV/u.
The TEST Electron Beam Ion Source (EBIS) previously used as a test source at the Brookhaven National Laboratory was recently transferred to the NSCL. It can operate with an electron current of more than 4 A, allowing a charge capacity of up to the 10^11. This EBIS is being reassembled and will replace the ReA EBIT currently in operation to increase the intensity of beams delivered to experiments.
We report on beam transport simulations, starting from EBIS injection to transport to the Q/A separator. The ion beam simulations in the EBIS uses the electron beam potential obtained by particle tracking including space charge effect and an r-z electromagnetic map for external fields. In the LEBT section, an envelope tracking code was used to optimize the ion beam optics and maximize the mass resolving power while providing the matched conditions to the entrance of linac.