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Electron and Ion Beam Simulations for the BNL Extended EBIS at Brookhaven National Laboratory

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The Electron Beam Ion Source (RHICEBIS) provides various types of ions with the Relativistic Heavy Ion Collider and the NASA Space Radiation Laboratory at Brookhaven National Laboratory. RHICEBIS will be extended in length to provide a factor of 1.4 increase in the extracted Au^{32+} ion beam as well as internal gas injection capability for light ions. Two unshielded 5T superconducting solenoids, similar to the existing RHICEBIS solenoid, but reinforced to withstand the forces of close axial proximity, will be used to provide the magnetic field necessary for foring the EBIS electron beam with current density ~600 A/cm^2. The axial spacing between the solenoid coils will be $\geq$ 45 cm, resulting in an dip in the magnetic field to less than 1T and a corresponding increase in the electron beam diameter in that region. The drift tube structure throughout the Extended EBIS must be designed to allow for transport and trapping of ions, accounting for the variation of electric potential along axis of the varying diameter electron beam. To investigate the processes of ion injection, trapping, and extraction, we calculated the electric potential for several electrode configurations between the solenoids, and study the influence on ion beam trajectories by computer simulation. Estimates of radial offsets of the electron and ion beams at the electron collector due to misalignments of magnetic system will also be presented.

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