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Mapping the stray magnetic field at the Relativistic Heavy Ion Collider tunnel

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A new Rapid Cycling Synchrotron (RCS) [1] is designed to accelerate the electron bunches from 400 MeV up to 18 GeV for the Electron Ion Collider (EIC) [2] being built at Brookhaven National Laboratory (BNL). One of the two Relativistic Heavy Ion Collider (RHIC) rings will serve as the Hadron Storage Ring (HSR) of the EIC. Beam physics simulations for the RCS demonstrate that the electron beam is sensitive to the outside magnetic field in the tunnel. Significant magnetic fields are expected due to the HSR and the Electron Storage Ring (ESR) being at full energy during the RCS operation. The earth magnetic field at the location of the RCS center was measured throughout the circumference of 3870 m tunnel without RHIC operation. In addition, the fringe magnetic field from RHIC magnets at several locations during RHIC operation was measured and compared with simulation at different ramping currents. A robotic technology is being developed to automatically measure the stray magnetic field at any location during the RHIC (or future EIC) operation.

Footnotes

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