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Polarization preservation methods for the electron storage ring of the EIC

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The Electron Storage Ring (ESR) of the Electron-Ion Collider (EIC) to be built at Brookhaven National Laboratory will provide spin-polarized electron beams at 5, 10, and 18 GeV for collisions with polarized hadrons. Electron bunches with polarizations parallel and anti-parallel to the arc dipole fields will co-circulate in the ring at the same time, and each bunch must be replaced once it is sufficiently depolarized by synchrotron radiation. In this work, we detail the unique challenges posed by designing such a collider ring to operate at different energies, and their solutions. This includes satisfying spin matching conditions, calculating optimal energies for polarization, determining best figures-of-merit, maintaining high polarization without a traditional longitudinal spin match, restoring the spin match with random closed orbit distortions, and implementing global coupling compensation and vertical emittance creation schemes that preserve high polarization. Nonlinear tracking results are presented showing polarization requirements are exceeded.

Footnotes

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