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A Dipole Scheme for the Electron Storage Ring at the Future Electron-Ion Collider

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The Electron-Ion Collider, which is currently being designed for construction at Brookhaven National Laboratory, will collide polarized electron beams (5-18 GeV) with polarized hadron beams (41-275 GeV) at luminosities up to 10ˆ34 cm−2 s−1. The electron storage ring will contain about 750 dipoles. These dipoles must fulfill not only complex geometric constraints but also requirements set by spin polarization. 576 dipoles will be located in the arcs and arranged as super-bend triplets, which provide reverse bending at 5 GeV to increase the emittance and damping decrement. The rest will be situated in the interaction region and insertion regions around the ring. Tight orbit tolerances driven by beam-beam effects at the interaction point result in very tight field-ripple requirements. While these could be mitigated by powering all dipoles in series, due to the super-bend configuration the dipoles do not all scale similarly with energy. A novel scheme has been developed using variable-turn coil designs and trim coils to achieve the required fields across the energy range. This contribution presents the unique dipole layout developed for the electron storage ring.

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