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Fri-Mo-Po.05-05: Structural Analysis of a Serpentine Superconducting Magnet for the Interaction Region of Electron Ion Collider

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The Electron Ion Collider (EIC) will collide high energy and highly polarized hadron and electron beams with luminosities up to $10^{34}/\text{cm}^2/\text{s}$. The magnet designs at the interaction region (IR) are challenging due to the close proximity of the hadron and electron beams. Several serpentine types of superconducting magnets have been designed due to the space restrictions at the IR. To validate the designs in terms of the mechanical strength and the allowed deformations, a detailed structural mechanical analysis for a 12-layer superconducting quadrupole serpentine magnet (Q1BpR) has been carried out using the finite element method (FEM) considering the prestress, shrinking due to cool down, and the electromagnetic force on the conductors in both 2D and 3D geometry. The 3D electro-magnetic (EM) simulations were performed using RAT, the structural mechanical analysis were performed using COMSOL by considering the contact elements.

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