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Electromagnetic design of the prototype dipole for the FAIR SIS300

Design activities, conductor R&D and model coil construction are under way for developing a curved fast cycled superconducting dipole for the SIS300 synchrotron at FAIR. The main target is the construction within 2009 of a half-length prototype magnet (cold mass fully integrated in a horizontal cryostat). This magnet is designed for a maximum central field of 4.5 T in a bore of 100 mm, with a ramp rate of 1 T/s. The magnetic length of the prototype is 3.8 m with a curvature radius of 66.67 m (27 mm of sagitta).

This paper describes the magnetic design of the dipole. Emphasis is given also to the study of the losses due to the eddy currents in collar and yoke, and to the other losses in the conductor during the fast cycling of the magnet. The study has been performed with finite element codes, and it allowed to optimize the configuration in order to minimize both the peak field on the conductor and the total losses.