

DESIGN AND OPTIMIZATION OF A COS-THETA CROSS-SECTION FOR A HIGH FIELD DIPOLE

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The Next European Dipole (NED) activity supported by the European Union aims at the development of a high-performance Nb₃Sn conductor ($J_c=1500\text{A/mm}^2 @ 15\text{ T}, 4.2\text{ K}$) in collaboration with European industry and the design of a high-field dipole magnet making use of this superconductor. In the framework of the NED collaboration which coordinates the work of several collaborating institutes, CERN has contributed the electromagnetic design study of a cosine- θ , layer-type superconducting dipole with an 88 mm-wide bore that is able to reach at least 15 T. Part of the optimization process aimed at a reduction of the multipole coefficients so as to improve field quality while keeping an efficient peak field to main field ratio.

In this paper, we present the optimization of the coil cross section for field quality and the shape of the iron yoke to reduce saturation-induced field errors during ramp. The effects of persistent magnetization currents are estimated and different methods to compensate persistent current induced field distortions are presented.

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