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Conceptual design optimization of a 20 T hybrid cos-theta dipole superconducting magnet for future High-Energy particle accelerators.

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High energy physics research will need more and more powerful circular accelerators in the next decades, in order to explore unknown regions of particle physics. It is therefore desirable to have dipole magnets able to produce the largest possible magnetic field, in order to keep the machine diameter within reasonable size. A 20 T dipole is considered a desired achievement, since it would allow the construction of an 80 km machine, able to circulate 100 TeV proton beams.
In order to reach 20 T, a hybrid Low Temperature Superconductor (LTS) - High Temperature Superconductor (HTS) magnet is needed, since LTS technology is presently limited to ˜16 T regarding accelerator magnet design. In this paper, we present the design of 6 layers 20 T hybrid dipole magnets using Nb3Sn (LTS) and Bi2212 (HTS). We show what different design choices can be done to optimize the size, the cost, the performance, the mechanic and the protection of the magnet, presenting different cross-sections that are focused on the optimization of a specific parameter.

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