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Conceptual designs of a 20 T dipole based on hybrid HTS/LTS cos-theta coils

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20 T dipole magnets are being considered for the next generation of particle accelerators. The nominal operation field of 20 T is above the practical limit of Nb3Sn accelerator magnets and, thus, it requires using superconductors with higher critical parameters such as High Temperature Superconductors (HTS). The high cost of HTS and the more complicated technology of HTS coils makes attractive a hybrid approach, which uses both superconductors and technologies. This paper presents a design concept of an HTS/LTS hybrid dipole with 50 mm aperture and 20 T nominal field based on the cos-theta (CT) coil and cold iron yoke. The HTS part of magnet coil uses the REBCO Twisted Stacked-Tape cable. The LTS part is graded and made of Nb3Sn Rutherford cables with two different cross-sections. Due to high sensitivity of REBCO and Nb3Sn superconductors to large stresses and strains in the coil at high field, a Stress Management (SM) concept combined with the CT coil geometry is used. The results of magnet magnetic analysis are presented and discussed. The parameters of this design are compared with the parameters of similar LTS/HTS hybrid magnets based on block-type and canted cos-theta coils.

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