Limits to High Field Magnets for Particle Accelerators

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Abstract - What is the ultimate limit to high fields in superconducting magnets for particle accelerators? In this paper we review the present status of the technology, outlining the main limitations. We first analyse the needed margin for operating a magnet in an accelerator. We then review the relation between current densities, coil widths, and fields in the magnets build so far. The issue of stress and the dependence on the coil lay-out is then discussed: a careful optimization between current density and coil width can be needed to keep the forces and associated strain within acceptable limits. The main issues related to cable lay-out (strand diameter, filament size) are then discussed. We conclude by giving a hint on the requirements on a HTS conductor, and a summary of Nb-Ti and Nb_3Sn.

Index Terms - superconducting accelerator magnets, dipoles, quadrupoles, low-temperature superconductors

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