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Superconducting Magnets

Wednesday 11 May 2022 15:00 (1 hour)

In this lecture we first discuss the requirements of the magnets in terms of aperture and beam size, the relations between dipole field and accelerator energy, and conditions of beam stability on the quadrupole gradient. We then show how the superconducting technology enables a technological leap, with current densities in the windings 100 times larger than what can be achieved with resistive conductors. It took more than 50 years from the superconductivity discovery to the construction of sc magnets in the range of a few tesla: we will briefly outline the obstacles that had to be overcome, leading to the development of cables made of multifilamentary strands embedded in a copper matrix. A low-temperature superconductor can provide dipole fields up to 9 T (Nb-Ti) and 16 T (Nb3Sn). We conclude by outlining two areas in which superconducting magnets for accelerators reach the technological limit: the management of forces and stresses induced by electromagnetic forces and the challenges related to the magnet protection

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