

Title:

Unprecedented Quality Control Techniques applied on a Large-scale Production of Superconducting Dipole Magnets for the LHC Project at CERN

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Abstract :

The LHC accelerator, under construction at CERN, is characterized by the use on a large scale of high technology super-conducting dipoles: the 27 km ring requires 1232 15-m long dipole magnets providing a peak field of 9 tesla. The coils are wound with Rutherford-type cable based on copper-stabilized Nb-Ti superconductors. The magnets will be operated at 1.9 K in superfluid helium. The challenge that had to be faced has been an efficient, cost-effective and reproducible mass-production to very tight tolerances: the field quality control must be controlled to 10^{-4} and the geometry of the beam tube and magnet to 0.1 mm over the whole length, any deviation being liable to induce delays and significant cost increase. This paper presents the methods and tools chosen to face successfully this challenge, both contractual and adhoc, based on the experience gained over several years of fabrication. With over 80 % of the magnets produced, it becomes possible as well to identify the issues that would have found better solutions in view of future large scale production of similar devices.