Title:

Study of Geometrical Random Errors in Magnetic Field of Accelerator Magnets

Authors:

Boris Bellesia, Ezio Todesco (CERN, Geneva)

Abstract :

The magnetic field in a superconducting magnet is mainly determined by the positioning of the conductors. Hence, the main contribution to the random field errors comes from random displacement of the coil with respect to the nominal position. An analytical method and scaling laws to estimate the random magnetic field errors in different dipole configurations (from the simplest configuration of four wires to a more realistic block lay-out) are presented here. The dependence of the random errors on the aperture and coil width, on the precision of the coil layout and on the azimuthal position is discussed. We also focus on the origin of asymmetries between the random part of normal and skew components of the same order, which has been observed in measurements of magnet productions of several projects. Using this approach, we analyze the measured random field errors of the main dipoles of the LHC, Tevatron, RHIC and HERA projects in order to find out the precision of the conductor positioning reached during the production of these magnets. The method can be used to obtain more refined estimates of the random components for future projects.