CALCULATION OF MAGNETIC FIELD HYSTERESIS DUE TO SUPERCONDUTOR STRAND MAGNETIZATION IN CORRECTOR MAGNETS FOR THE LARGE HADRON COLLIDER.

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In the LHC, a large number of auxiliary magnets are used to trim key beam parameters and to correct multipole errors that are intrinsic to the main superconducting magnets. Since these corrector magnets are made of Nb-Ti based superconductors, they show magnetic hysteresis which produces field-dependent multipole errors. Most corrector windings are made of rectangular wires, which results in an angular dependence of the magnetization on the local field. In addition some of these magnets are of a nested type.
In this paper, we present the calculation of the main field and field errors in some LHC corrector magnets including their hysteretic component. In particular we calculate the possible error due to superconductor hysteresis that can occur for small random changes of the main field typical during accelerator operation. The influence of the angular dependence of the magnetization on the field errors is considered. We compare results with magnetic measurements taken at 1.9 K. The superconductor magnetization is deduced from recent measurements of strands and a 2-dimensional model of the filament magnetization based on the critical state model. The magnet geometries are simulated and the magnetic field is calculated by means of finite element models.

Poster presentation