

Detailed Magnetic and Mechanical Design of the Nested Orbit Correctors for HL-LHC

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Abstract:

The high luminosity upgrade will enhance the discovery potential of the LHC in the next decade. Among other magnets and technologies currently under development, the MCBXF orbit correctors will be required to this end. In order to save space, they consist in two perpendicularly and coaxially arranged dipole coils under a large torque. Coils cannot be glued due to the high radiation dose expected, and mechanical clamping is mandatory. With the goal of turning the conceptual design into a tangible reality, this paper depicts the final magnetic design, with special attention to 3-D electromagnetic calculations and the different operation scenarios. It also includes more accurate mechanical FE models results, achieved by measuring the Young's modulus of impregnated cable stacks. Besides assembly spring-back, cool-down, and energization, simulations have been also carried out for the pressing process of both dipoles, analysing stress distribution, and displacements. Finally, a short mechanical model has been designed, fabricated, and tested. Its main purpose is to assess the feasibility of the proposed clamping structure, the reliability of the FE mechanical models and the design of an important part of the tooling required for the magnet fabrication.

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