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Tue-Af-Po2.18-05 [37]: Design of radiation hard spare units for the orbit corrector dipoles of LHC

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In the Large Hadron Collider (LHC) at CERN, it is expected that 35 out of the 122 MCBC and MCBY orbit corrector dipoles will receive up to 20 MGy of gamma radiation over the High-Luminosity (HL)-LHC lifetime. Since these magnets were not designed to withstand such high gamma doses, new MCBC and MCBY magnets have to be designed and produced using radiation hard impregnation insulation and materials.
The MCBC and MCBY magnets are located close to the interaction points, are operated at about 60% on the load line and are epoxy impregnated. The MCBC (resp. MCBY) magnet is a dipole with 3.1 T (resp. 2.5 T) central magnetic field and 56 mm (resp. 70 mm) aperture diameter. It is operated at 1.9 K (resp. 4.3 K) and uses 14 (resp. 15) rectangular Nb-Ti wires insulated with PVA (polyvinyl acetate) enamel which are glued together in a Ribbon cable. Over the HL-LHC lifetime, it is expected to receive up to 20 MGy (resp. up to 5 MGy) of gamma radiation.
In this paper, we describe the new design and technologies that will be used for the production of new radiation hard units of MCBC and MCBY magnets. These new solutions include for example the selection of polyimide enamel instead of PVA enamel as insulator or the use of the MCBY coils for both MCBC and MCBY magnets in order to reduce their manufacturing cost as well as the gamma dose seen by the MCBC magnet. Indeed, since the new MCBC magnet will use a coil with larger bore, a radiation shield can be placed between the aperture and the inner part of the coil.

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