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Quench Behaviour of the HL-LHC Twin Aperture Orbit Correctors

Tuesday 29 August 2017 09:30 (15 minutes)

As part of the High Luminosity LHC (HL-LHC) upgrade, a novel type of canted cosine theta (CCT) twin aperture beam orbit corrector, the so-called MCBRB, is being developed that will provide 5 Tm of bending power per aperture in the approach to the ATLAS & CMS experiments. This CCT coil is a novel type of dipole coil, featuring aluminum formers with specially prepared slots that maintain the superconducting Nb-Ti strands in the correct configuration. The quench behaviour of this type of coil is intrinsically three-dimensional in which both the axial quench propagation and the transverse thermal exchange between neighbouring strands, the strands and formers, neighbouring turns, adjacent formers, and towards the helium bath play a role. A three-dimensional quench propagation simulation tool is being developed to investigate how the peak hotspot temperature and internal voltages are affected by the design choices of the CCT coil. The implications of conductor composition, strand insulation, external energy extraction, former insulation, helium cooling, bypass diodes, and quench back are presented. The calculation results are compared to experimental observations of the quench behaviour of a CCT model and the results of this comparison are used to formulate quench-protection-related design choices for the final design.

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