Retraining of the 1232 Main Dipole Magnets in the LHC

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Abstract — The LHC is a complex accelerator requiring more than 1700 main Nb-Ti superconducting dipole and quadrupole magnets and about 150 insertion magnets of several types, all distributed along a circumference of 26.7 km. The main dipole and quadrupole magnets are powered in 24 main electrical circuits with nominal current of 11850 A. These magnets contain protection diodes to by-pass the current in case of a quench, and quench heaters to reduce the hot spot temperature. Both sides of the 8 interaction points of the LHC contain a variety of insertion dipole and quadrupole magnets, operating either at 1.9 K or at 4.5 K with nominal currents ranging from 3.6 to 6.6 kA. Finally, both sides of the 4 collision points are equipped with an inner triplet assembly, each consisting of 4 quadrupole magnets, with nominal currents up to 12.0 kA. Besides reaching magnetic fields with substantial margins above the required nominal range, all of the main LHC magnets must meet stringent requirements for their protection and electrical integrity. In this paper the operational performance of the main LHC magnet circuits, as observed during Run-1 will be reviewed with focus on the encountered problems specific to the magnet circuit protection. The results observed on the entire circuits will be as well compared to the test results obtained during the reception tests of the individual magnets.

Keywords (Index Terms) — Accelerator magnet, LHC, protection, NbTi.