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Investigation of radiation effects on Si cryogenic detectors in the framework of CERN-RD39 collaboration program and LHC upgrade

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The superconducting magnets of the Large Hadron Collider (LHC) located close (within a few tens of meters) to the Interaction Points of the proton beams are exposed to high-radiation fields due to the collision debris. The Beam Loss Monitoring (BLM) system measures the particle showers from beam losses. Due to the foreseen increase in the LHC luminosity, the discrimination between the collision products and possible magnet quench-provoking beam losses of the primary proton beams is becoming more critical for safe accelerator operation. We report the ongoing CERN-RD39 research efforts of the development of the new BLM system based on semiconductor detectors. They will be located as close as possible to the superconducting coils of the triplet magnets, meaning that the BLM will be immersed in superfluid helium inside the cold mass and operate at 1.9 K, with expected irradiation tolerance of 1x10^16 proton/cm2. The overview of the activities aimed on testing silicon and diamond detectors in the conditions of their operation as BLMs (in situ irradiation by 23 GeV protons at 1.9 K) and the status of the experiment are described. The results of the study have been used for the development of the pilot BLM modules currently installed on the magnets in the area with high debris intensity.

Collaboration

CERN-RD39

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