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Lifetime studies of superconducting magnet protection systems for the Large Hadron Collider at CERN

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In the architecture of the protection of the superconducting magnets of the Large Hadron Collider (LHC), systems such as Quench Heater Discharge Power Supplies (HDS), Local Protection Interface Module (LIM), Linear Redundant Power Supplies (LPR), and Power Packs (LPUS) are crucial. Thousands of these devices, some in operation since 2007, directly impact LHC's availability and reliability.

This paper delves into comprehensive lifetime studies on these critical systems. The methodology involves estimating their remaining operational lifespan through detailed analyses of failure modes, assessing electronic component criticality, accelerated aging of electrolytic capacitors, inspections, and irradiation tests at both component and system levels. The study concludes by presenting essential findings, including the estimated remaining lifetime of each equipment. Additionally, the paper recommends future developments to enhance system robustness, offering valuable insights for maximizing the longevity of these critical devices. This research significantly contributes to ensuring the sustained reliability and performance of the LHC's magnet protection systems.

Footnotes

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Europe

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