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Stability Analysis of the Interconnection of the LHC Main Superconducting Bus Bars

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The operation of the Large Hadron Collider (LHC) calls for a better understanding of the thermo-electric behavior of the 13 kA superconducting bus bars interconnecting its main magnets. A deep insight of the stability of the bus bars interconnections is required to ensure the protection of the accelerator against undesired effects of resistive transitions. This is especially important in case of defective interconnections which can jeopardize the operation of the whole LHC.
This paper presents a numerical analysis of the interconnections between the main dipole and quadrupole magnets, aiming at determining the thermal stability and its dependence on the heat transfer towards the cooling helium bath, quality of manufacturing, operating conditions and protection system parameters. Defective interconnections featuring a lack of bonding among the superconducting cables and the copper stabilizer components are considered, as those present in the machine. The critical defect length limiting the maximum stable current for powering the magnets is evaluated. This computation is a contribution to the evaluation of the maximum allowed beams collision energy.

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