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Resistance of splices in the LHC Main Superconducting Magnet Circuits at 1.9 K

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The electrical interconnections between the LHC main magnets are made of soldered joints (splices) of two superconducting Rutherford cables stabilized by a copper busbar. In 2009, a number of splices were found not properly stabilized and could have burnt through in case of quench at high current. The LHC was therefore operated at reduced energy and all Rutherford-cable joints were continuously monitored by a newly installed layer of the Quench Protection System (QPS). During the first Long Shutdown (LS1) in 2013-14 the high-current busbar joints were consolidated to allow a safe operation of the LHC at its design energy, i.e. 14 TeV center-of-mass. The SMACC project (Superconducting Magnets And Circuits Consolidation) has coordinated the consolidation of the 10170 13 kA busbar splices. Since 2015 the LHC runs at the energy of 13 TeV center-of-mass. This paper will briefly describe the QPS data analysis method and will present the results and comparisons of the Rutherford-cable splice resistance measurements at 1.9 K before and after the LS1, based on an unprecedented amount of information gathering during long-term operation of superconducting high-current joints. A few outliers that were still found after the splice consolidation will also be shortly discussed.

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