

Qualification of the round REBCO cables of the SC-Links of HL-LHC

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CERN is developing high-current superconducting links (SC-Links) to power the superconducting magnets of the High Luminosity upgrade of the Large Hadron Collider (HL-LHC). These SC-Links consist of up to 120 m long magnesium-diboride (MgB₂) cables containing multiple insulated circuits and feature a total DC capability of up to 120 kA at a temperature of 20 K. The MgB₂ cables are spliced on one side to multiple, round NbTi cables that are operated in LHe and on the other side to about 3 m long, round high-temperature superconducting (HTS) rare-earth-barium-copper-oxide (REBCO) cables that bridge the 20 K to 55 K temperature gap and connect to the current leads.

As the round REBCO cables will be part of the LHC powering circuits rigorous quality control measures have been implemented to ensure the optimal performance. In addition, as multiple REBCO cables connected in parallel are used for high current rating circuits, a homogeneous internal resistance of all constituent tapes is essential in assuring balanced current distribution among the parallel cables and their tapes. Quality control measurements are therefore performed in three stages: Firstly, after tape reception to validate the transport properties and to determine the internal resistance. Secondly after cabling to exclude with extracted tape measurements any cabling related degradation and lastly after splicing of the cable extremities to validate the transport properties of each cable.

These measures are essential for assuring the integrity and performance of the superconducting material, for the homogenization and for the validation of the produced REBCO cables. Only fully qualified REBCO cables without any cabling related degradation are used for the SC-Links of the HL-LHC.

In this work, we present the quality control procedures and measurements as well as the statistical distributions of the results.

Submitters Country

Switzerland

Author: SABA, Aisha (CERN)

Co-authors: Dr BASKYS, Algirdas (CERN); Dr BALLARINO, Amalia (CERN); Dr BARTH, Christian (CERN)

Presenter: SABA, Aisha (CERN)

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