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The Nb₃Sn superconductor procured for the High Luminosity Upgrade of the Large Hadron Collider

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For the High Luminosity upgrade of the Large Hadron Collider (HL-LHC), CERN has procured about 20 tons of high critical current density J_c (>1200 A/mm² at 15 T, 4.22 K) and high RRR (>150) wire from Bruker-EAS and Bruker-OST (1135 km of the 0.7 mm 108/127 RRP wire; 590 km of the 0.85 mm 192 bundle-barrier PIT wire and; 2180 km of the 0.85 mm 108/127 RRP wire). This conductor has been used for 11 T dipoles (0.7 mm wire) and for the low-beta quadrupoles (0.85 mm wire) of the new HL-LHC interaction regions. For the low-beta quadrupoles, the US-AUP collaboration is also procuring about 2000 km of the same 0.85 mm RRP wire. This is the first large procurement of high- J_c Nb₃Sn conductor for accelerator type magnets. The wire was produced in 50 kg billets each resulting in approximately 12 km of the 0.7 mm wire and 9 km of the 0.85 mm wire. To qualify the material produced, for each billet about four critical current and four RRR measurements were performed both by the suppliers and by CERN in addition to copper to non-copper, geometrical and mechanical measurements. The I_c measurements were performed between 12 T and 15 T at 4.22 K. In the paper, a statistical analysis of the procured wire properties is reported and discussed.

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