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Requirements for quadrupole magnet conductor for the United States contribution to the high-luminosity upgrade of the Large Hadron Collider

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The LHC will undergo a replacement of the inner triplets at the two main interaction regions between 2020 and 2023. Leading up to this activity will be the production of approximately 90 quadrupole magnets starting in 2018, for which approximately 10 tons of Nb₃Sn conductor will be procured. The lead time for this conductor requires orders to be placed starting in 2016. This presentation will outline the proposed production specification, its relationship to magnet functional requirements, and its evolution from previous “baseline” conductor designs supported by the LHC Accelerator R&D Program and the U.S. Conductor Development Program. In particular, we describe how certain design trade-offs and pre-production statistics were evaluated, and how these considerations were propagated through a change in the final conductor diameter to 0.85 mm and its cascading effect on sub-element number, copper fraction, and so on. The present specification strives to achieve a nexus of property distributions that guarantees ample production margin, high yield, and low cost.

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