

Fabrication and Test of a 3.7 m Long Support Structure for the LARP Nb₃Sn Quadrupole Magnet LQS01

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Abstract—The 3.7 m long quadrupole magnet LQS01 represents a major step of the US LHC Accelerator Research Program (LARP) towards the development of long Nb₃Sn accelerator quadrupole magnets for a LHC Luminosity upgrade. The magnet support structure is a scale up of the 1 m long Technology Quadrupole TQS design with some modifications suggested by TQS model test results. It includes an aluminum shell pre-tensioned over iron yokes using pressurized bladders and locking keys (bladder and key technology). The axial support is provided by two stainless steel end plates compressed against the coil ends by four stainless steel rods. The structure, instrumented with strain gauges, has been fabricated and assembled around four aluminum “dummy coils” to determine pre-load homogeneity and mechanical characteristics during cool-down. After presenting the main magnetic and mechanical parameters of LQS01, we report in this paper on the design, assembly, and test of the support structure, with a comparison between strain gauges data and 3D finite element model results.

Index Terms — LARP, Nb₃Sn, Quadrupole magnet

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