

LARP NB₃Sn Quadrupole Magnets for the LHC Luminosity Upgrade

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Abstract - The US LHC Accelerator Research Program (LARP) is a collaboration between four US laboratories (BNL, FNAL, LBNL, and SLAC) aimed at contributing to the commissioning and operation of the LHC and conducting R&D on its luminosity upgrade. Within LARP, the Magnet Program's main goal is to demonstrate that NB₃Sn superconducting magnets are a viable option for a future upgrade of the LHC Interaction Regions. Over the past four years, LARP has successfully fabricated and tested several R&D magnets: 1) the subscale quadrupole magnet SQ, to perform technology studies with 300 mm long racetrack coils, 2) the technology quadrupole TQ, to investigate support structure behavior with 1 m long cos² coils, and 3) the long racetrack magnet LR, to test 3.6 m long racetrack coils. The next milestone consists in the fabrication and test of the 3.7 m long quadrupole magnet LQ, with the goal of demonstrating that NB₃Sn technology is mature for use in high energy accelerators. After an overview of design features and test results of the LARP magnets fabricated so far, this paper focuses on the status of the fabrication of LQ: we describe the production of the 3.4 m long cos² coils, and the qualification of the support structure. Finally, the status of the development of the next 1 m long model HQ, conceived to explore stress and field limits of NB₃Sn superconducting magnets, is presented.

Keywords - LARP, NB₃Sn, quadrupole magnets, LHC Interaction Regions.

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