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Summary of test results of MQXFS1 - the first short model 150 mm aperture Nb₃Sn quadrupole for the High-Luminosity LHC upgrade

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The development of Nb₃Sn quadrupole magnets for the High-Luminosity LHC upgrade is a joint venture between the US LHC Accelerator Research Program (LARP) and CERN with the goal of fabricating large aperture quadrupoles for the LHC interaction regions (IR). The inner triplet (low- β) NbTi quadrupoles in the IR will be replaced by the stronger Nb₃Sn magnets boosting the LHC program of having 10-fold increase in integrated luminosity after the foreseen upgrades. Previously LARP conducted successful tests of short and long models with up to 120 mm aperture. The first short 150 mm aperture quadrupole model MQXFS1 was assembled with coils fabricated by both CERN and FNAL. The magnet demonstrated strong performance at the Fermilab's vertical test facility reaching the LHC operating limits. This paper reports the latest results from MQXFS1 tests with changed pre-stress levels. The overall magnet performance, including quench training and memory, ramp rate and temperature dependence, is also summarized.

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