**Analysis of the mechanical performance of the 4.5 m long MQXFA Pre-Series magnets for the Hi-Lumi LHC Upgrade**

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Under the U.S High Luminosity LHC Accelerator Upgrade Project (HL-LHC AUP), the 4.5 m long, 150 mm bore, high-field Nb3Sn low-β MQXFA quadrupole magnets are being fabricated, assembled and tested for the CERN Hi-Luminosity LHC (HL-LHC). To date, five Pre-Series magnets and two Series magnets have been fabricated and tested, MQXFA03 thru MQXFA07, and MQXFA08 and MQXFA10, respectively. Strain gauge measurements are critical to the understanding of each magnet’s performance, both to verify the validity of the FEA models as well as to confirm mechanical integrity of the structure. As the project has transitioned to the Series magnet production, understanding and predicting the mechanical performance of the magnet’s structure through these measurements throughout each thermal cycle is vital since all the strain gauge instrumentation will be removed prior to cold mass assembly. This paper summarizes the available strain gauge data from the tested magnets, including both resistive and optical fiber measurements, as they relate to the FEA models, and attempts to predict the long-term performance of these magnets even after the instrumentation has been removed.

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