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Thu-Mo-Po4.07-03 [48]: Magnetic Measurements of MQXFA Prototype Quadrupoles during Magnet Assembly

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The High-Luminosity LHC Accelerator Upgrade Project (HL-LHC AUP) is preparing for production of the US-contributed Q1 and Q3 Interaction Region Quadrupoles (MQXFA). These magnets are based on Nb₃Sn conductor and need to satisfy stringent requirements for operation in HL-LHC. Magnetic field measurements are performed during magnet assembly to monitor key parameters such as integrated quadrupole, magnetic axis, field angle, higher order harmonics and to correct the field errors with magnetic shims if needed. This paper presents the magnetic measurements and analysis of the most recent prototype (MQXFAP1b) which includes one new coil and three coils previously tested in MQXFAP1. The results are compared with HL-LHC requirements, numerical calculations and measurements from a previous prototype (MQXFAP2) and several short models. Project plans for assessing magnet field quality and applying corrections at the assembly stage are reviewed in light of these results.

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