



**Report of the
MQXFA20
Structure & Shims Review**

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US HL-LHC Accelerator Upgrade Project

**Report of the MQXFA20 Structure & Shims
Review**

January 23rd 2025

- Peter Wanderer, chairperson (BNL)
- Mike Anerella (BNL)
- Susana Izquierdo Bermudez (CERN)



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1. Goal and scope

The HL-LHC AUP project is starting the assembly of MQXFA20 quadrupole magnet. If MQXFA20 meets MQXFA requirements [1] it will be used in a Q1/Q3 cryo-assembly to be installed in the HL-LHC.

MQXFA20 coils were presented and approved at the MQXFA20 Coil Acceptance Review [2].

Discrepancy or Non-Conformity Reports are generated whenever a component does not meet specifications [3-4].

The goal of this review is to evaluate MQXFA20 structure and the proposed shim plan including tapered load shims.

Committee

Peter Wanderer, chairperson (BNL)

Mike Anerella (BNL)

Susana Izquierdo Bermudez (CERN)

Date and Time

January 23, 2025.

Start time is 7:00/9:00/10:00/16:00 (LBNL/FNAL/BNL/CERN)

Location/Connection

Video-link by Zoom, info by email.

Link to agenda with talks and other documents

<https://indico.fnal.gov/event/67718/>



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2. Review Charges responses

The committee is requested to answer the following questions:

1. Have all recommendations from previous reviews [5] been adequately addressed?
Yes. The mechanical properties of the non-lead end are being studied with FEM.
2. Have discrepancies and non-conformities been adequately documented and processed?
Yes
3. If there are major/critical non-conformities, have they been adequately documented and processed?

Yes. There were no major/critical non-conformities on the assembly. However, the four coils to be assembled in MQXFA20 have critical non-conformities. The NCRs do not affect the magnet assembly, except the delamination on the mid-plane of coil 146 which has an impact on the assessment of the coil size, which has an impact on the definition of the shims.

4. Are the proposed shims adequate for allowing MQXFA20 to meet MQXFA requirements [1]?

Yes. AUP is exploring the possibility to decrease the radial shim to get closer to the MQXFB assembly parameters and potentially improve the training performance. In the Fuji coil pack, the 0.005" (125 μm) G11 radial shim layer is replaced with 0.003" (75 μm) Kapton to have a (50 μm) smaller coil pack. The committee supports this decision; however, we suggest that the final coil pack is built using the standard procedures to give sufficient time to analyze in detail the feedback from the Fuji and introduce the change in the next magnet if the outcome is positive (MQXFA21). Since MQXFA20 is assembled using coils that were previously on-hold, the priority should be given to minimize the differences with respect to previous magnets.

5. Do you have any other comment or recommendation to assure MQXFA20 is going to meet requirements?

The LBNL assembly staff is to be commended for planning to verify that the delamination of the midplane insulation in coil 146 would have no effect on the size of the assembled coil. If it does not have a large impact on the assembly planning and is deemed useful, fuji paper could be introduced in the coil mid-planes during the fuji coil pack assembly to confirm that the delamination does not have a significant impact on the pre-stress level.

3. Comments

The LBNL staff is to be commended for its quick response to the discussions at the review.



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4. Recommendations

Proceed with the assembly of MQXFA20 as currently planned.

5. References

- 1) *MQXFA Functional Requirements Specification*, US-HiLumi-doc-36.
- 2) *MQXFA20 Coils Acceptance Review*, US-HiLumi-doc-5434.
- 3) *MQXFA Series Magnet Production Specification*, US-HiLumi-doc-4009.
- 4) *Handling of Discrepancies and Nonconformances*, US-HiLumi-doc-2484.
- 5) *MQXFA19 Structure and Shims Review*, US-HiLumi-doc-5381.