US HL-LHC Accelerator Upgrade Project

Report of the MQXFA12 Structure & Shim Review

August 25th 2022

– Peter Wanderer (chairperson), LBNL
– Susana Izquierdo Bermudez (CERN)
– Rodger Bossert (FNAL)

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1. Goal and scope

The HL-LHC AUP project is starting the assembly of MQXFA12 magnet. This is the fifth series magnet of the MQXFA low beta quadrupoles to be used in Q1 and Q3 for the High Luminosity LHC. If MQXFA12 meets MQXFA requirements [1] it will be used in a Q1/Q3 cryo-assembly to be installed in the HL-LHC.

MQXFA12 coils were reviewed on July 12, 2022 [2].

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

The goal of this review is to evaluate MQXFA12 structure and shim plan. Reviewers should also assess that discrepancies and non-conformities of the magnet structure have been adequately processed, and that the shims will allow MQXFA12 to meet MQXFA requirements [1].

Technical details

Committee

Peter Wanderer (chairperson), LBNL
Susana Izquierdo Bermudez (CERN)
Rodger Bossert (FNAL)

Date and Time

August 25, 2022. Start time is 7/9/10/16 (LBNL/FNAL/BNL-FSU/CERN)

Location/Connection

Video-link by Zoom, info by email.

Link to agenda with talks and other documents

https://indico.fnal.gov/event/55924/

2. Review Charges responses

The committee is requested to answer the following questions:

1. Have all recommendations from previous reviews [5] been adequately addressed?
Finding: Yes.
Comment: The status of the recommendations is:

- Evaluate CERN method of applying preload via bladders – parts on order
- Incorporate Belleville washers – will be used on this magnet for the first time
- List magnets that will need customized cliq cables – done
- Study decrease of coil size – one study performed, but no cause determined
- Study pole gap size vs. torque – not yet performed

Recommendation: carry the not-yet-completed recommendations over to the next magnet

2. Have discrepancies and non-conformities been adequately documented and processed?
Finding: Yes.
Comment: So far, magnet 12 has 13 NCRs
Recommendation: none

3. If there are major non-conformities [4], have they been adequately documented and processed?
Finding: No major non-conformities.

4. Are the proposed shims adequate for allowing MQXFA12 to meet MQXFA requirements [1]?
Finding: Yes.
Comment: The shims have been chosen to achieve preload targets that are the same as for magnets 03 – 06 and 10. These magnets met performance requirements.

5. Do you have any other comment or recommendation to assure MQXFA12 is going to meet requirements?
Finding: Yes.
Comment: There is probably an issue with the PH wires in the first CM in this region. It appears that the connection opened after welding the cold mass. LBNL pointed out a few non-conformities at this region that they had to repair. (It can also be that the CM1 issue is somewhere else, but it is an important issue so better to check.)
Recommendation: LBNL shall carefully check the coil production procedures in this region. Since the CM1 has very early production coils, it would be good to check if at the time the process in that region was different and if it is more robust now or if it is a potential weak spot. Provide a list of which wires needed repair.