

Engineering Design Review – Charge Quadrupole Cold Mass – MQXB

Background:

The US LHC Accelerator Project is responsible for providing CERN with integrated inner triplet magnet systems for the four interactions regions at points 1, 2, 5, and 8. Each inner triplet consists of four quadrupole magnets, half of which (Q2a and Q2b) are designed and built by Fermilab and half (Q1 and Q3) by KEK, correction coils provided by CERN, and absorbers to protect the magnets from secondary particles from the p-p collisions at the IP. These elements are assembled into three cryostats – Q1 plus correctors; Q2a, Q2b plus correctors; and Q3 plus correctors – by Fermilab. The subject of this review is the design of the Fermilab inner triplet quadrupole cold mass, end plate to end plate. The cryostat design, including the assembly of the several magnetic elements into complete helium vessels ready to insert into the cryostat, will be the subject of a separate review later this year.

The inner triplet quadrupole program includes:

- The design, construction and testing of a series of short (2 m) model magnets in order to develop the design features required to meet the functional requirements.

- The design, construction and testing of two full-scale prototype magnets a prototype cryostats.

- The design, construction and testing of 18 quadrupole magnets, including spares, and the assembly of them and the KEK-provided quadrupoles, together with the CERN-provided correction coils, into complete magnets in cryostats ready for installation in the LHC.

The model magnet program is, by the time of the review, expected to be complete, and the prototype construction is about to start. The intent is that the two prototype quadrupole cold masses are of the same design as will be used for the production series, with the exception of additional instrumentation.

Planned Design Reviews:

An EDR is to be conducted when most of the R&D is complete and the engineering design has been finalized. For a system to pass the EDR, it must be demonstrated that all of the technical and engineering challenges have been adequately addressed.

This Engineering Design Review (EDR) covers the Q2a and Q2b cold masses. It follows a Conceptual Design Review (CDR) that was held in October 1996 and an R&D review on 18-19 March 1999.

The EDR of the inner triplet cryostat, including the procedures for assembling several magnetic elements into a complete liquid helium cold mass, will be conducted at a later date. One or more Production Readiness Reviews (PRRs) will follow the EDRs before final production begins.

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Design Team:

The design is represented by:

- Jim Kerby, FNAL Project Manager
- Sasha Zlobin, FNAL
- Mike Lamm, FNAL
- Fred Nobrega, FNAL

Design Review Committee:

The design review committee members are as follows:

- Arnaud Devred, Saclay, Chair
- Phil Pfund, FNAL, Secretary
- Pierre Vedrine, Saclay
- Ranko Ostojic, CERN
- Tom Taylor, CERN
- Mike Anerella, BNL
- Akira Yamamoto, KEK
- Bob Schermer, consultant

Scope of the Review:

The review will cover the design of the Fermilab LHC inner triplet quadrupole magnet, which is, in principle, the same as the design to be used for the production magnet that will be installed in LHC. The review will cover the quadrupole magnet itself, from end-plate to end plate and will address the following items in particular:

- Superconducting cable
- Magnetic design
- Cold mass mechanical design
- Quench protection
- Magnet bus
- Cold mass cooling design
- Instrumentation
- Response of the designers to findings from the March 1999 R&D review.
- Extent to which the results from the R&D program supports the critical design choices
- Prototype program plan

The design review committee has the usual freedom to investigate other areas of the design that present a risk to the successful completion of the project, installation, and operation in the LHC.

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The review committee is asked to evaluate the design presented and recommend whether or not it is ready to be used in the construction of the prototype quadrupoles. The committee is asked also to comment on the extent to which the presented design is adequate to meet the requirements for installation and successful operation in the LHC.

Date of the Review Committee Meeting:

The review is scheduled for Thursday 16 March 2000 at Fermilab. It is anticipated to take one day, but the following morning is explicitly left open for follow-up activities, if required.

Results of the Review:

This review is a Level-3 project milestone, scheduled for completion 1 April 2000. The review will be complete with the issuing of a report summarizing the technical designs reviewed, committee recommendations, and action items. The forecast date for completion is 7 April 2000.

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Schedule for the Review:

EDR Schedule – MQXB Cold Mass

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| 18 Feb 2000 | Contents of preview package selected by the FNAL Project Manager and approved by the US LHC Project Manager. |
| 22 Feb 2000 | Preview package and draft agenda of review presentations posted on FNAL web site. Reviewers will be notified of the URL and given a list of material posted. Reviewers will be given subsequent notification when additional documents are posted or existing documents are modified. |
| 6 Mar 2000 | Reviewers provide preliminary comments to the Chairman. The comments will ensure that issues of specific interest to the reviewers will be adequately addressed during the review meeting. The comments are based on the material provided in the preview package and on each reviewer's previous knowledge of the project and technology. |
| 9 Mar 2000 | Agenda revised by the chairman based on preliminary comments from reviewers and discussions with the FNAL Project Manager. |
| 16 Mar 2000 | Design Review meeting conducted. |
| 24 Mar 2000 | Draft report of the review sent to reviewers by the Chairman. |
| 31 Mar 2000 | Reviewers return comments on the draft report to the Chairman. |
| 7 Apr 2000 | Final report of review approved by the US LHC Project Manager and issued by the Chairman. |

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Agenda for the Review Meeting

EDR Agenda – MQXB Cold Mass
16 March 2000
FNAL

Thurs. 16 March

8:45 am	Design Review Committee Planning Session
9:00 am	Presentation and Discussion of Design
12:30 pm	Lunch
1:30 pm	Presentation and Discussion of Design (cont.)
3:30 pm	Design Review Committee Working Session
5:00 pm	Design Review Wrap-up with Designers
7:00 pm	Dinner

Fri. 17 March morning

Tours, follow-up discussion if required.