



Production Readiness Review 11 T cold mass

53rd HL-LHC Technical Coordination Committee (TCC) meeting
12.07.2018

Diego Perini EN-MME



Outline

- Introduction, the 11 T – PRR.
- Remarks of the review panel.
- Conclusions – List of actions.



EDMS No. 1892005

HL-LHC Production Readiness Review

Scope

The HL-LHC project is progressing into construction phase. Prototypes of 11 T magnets, MQXF, Crab Cavity, low impedance collimators, SC links, etc. are under construction or under test.

The HL-LHC management decides on the production of the main and minor components. The committee is responsible for selecting the main components.

The main scope of production is to start the production phase. Components that are outside the scope of this review are not purchased "off the shell" and are considered industrial product. This list will be dynamically updated.

Mandate

The committee is invited to assess the production readiness of the equipment.

1. Scope of work: is there a clear definition and clear interfaces?
2. Procedures, construction specifications, executive drawings: are all in approved status, verified by due authority, and well documented?
3. Quality Assurance is it correctly in place: procedures, documentation, check/holding points, etc.?
4. Components:
 - a. Availability and delivery schedule margin.
 - b. Logistics (flow and storage).
5. Assembly tools
 - a. Availability, qualifications
6. Production planning robustness.

This general mandate will be customized and adapted according to the different nature of the various equipment under assessment.

Modus operandi

These series of reviews are organized by the chair of the committee in collaboration with the WP leaders, in agreement with the Group Leader(s) concerned. HL-LHC PL and DHs are informed well in advance to allow their participation or by their representatives. The reviews are intended also for equipment under in-kind contribution, when this is deemed appropriate by the collaborating Institute, the Project management and by the CERN equipment owner.

Mandate

The committee is invited to assess for each equipment:

1. Scope of work: is there a clear definition and clear interfaces?
2. Procedures, construction specifications, executive drawings: are all in approved status, verified by due authority, and well documented?
3. Quality Assurance is it correctly in place: procedures, documentation, check/holding points, etc.?
4. Components:
 - a. Availability and delivery schedule margin.
 - b. Logistics (flow and storage).
5. Assembly tools
 - a. Availability, qualifications
6. Production planning robustness.

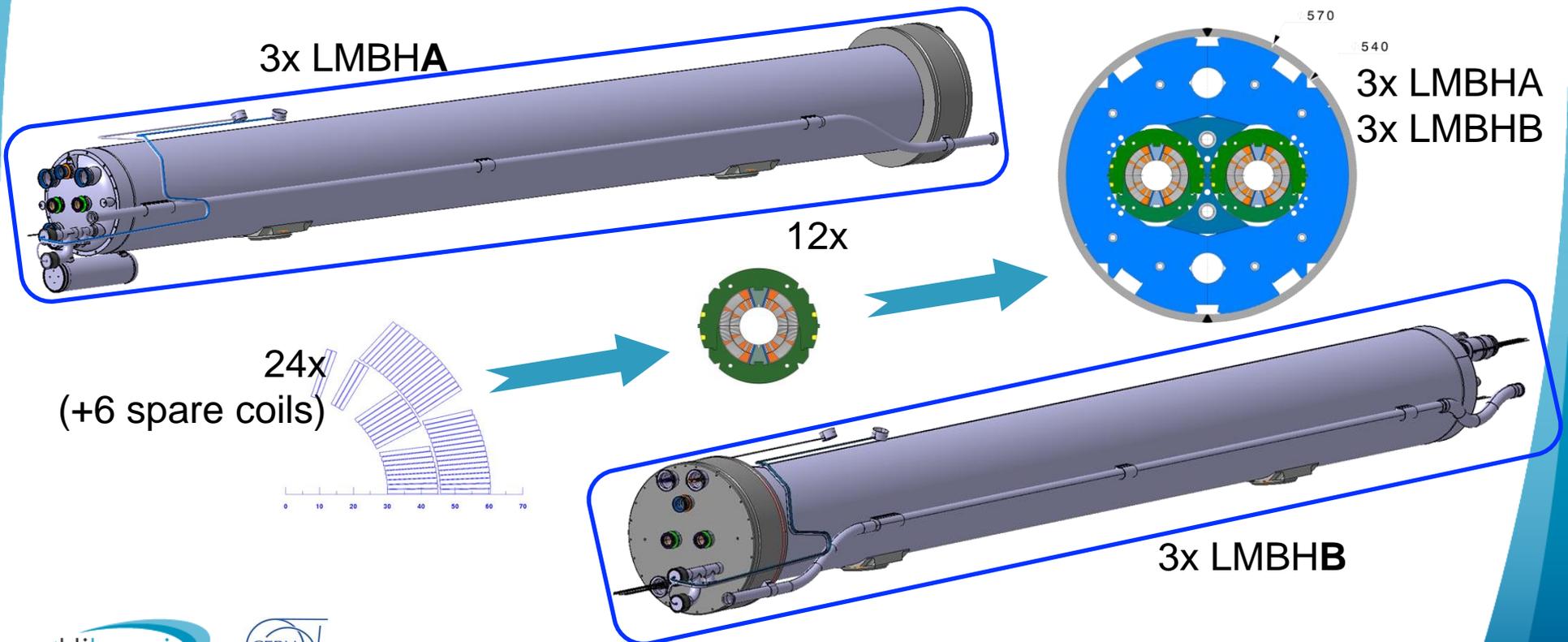
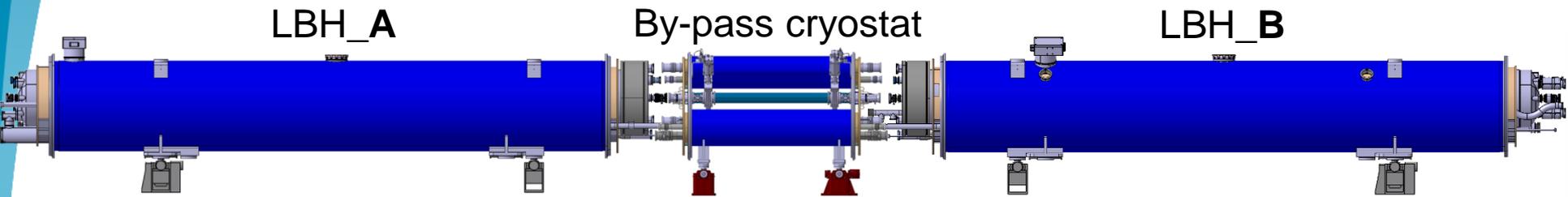
This general mandate will be customized and adapted according to the different nature of the various equipment under assessment.

11 T cold mass PRR

Reviewers:

Michele Modena,
Nuria Catalan Lasheras,
Hector Garcia Gavela,
Alessandro Bertarelli ,
Bertrand Nicquevert,
Diego Perini (chairperson).

The 11T Dipole Full Assembly (3x)



08:30	Part I: Description of the 11T and scope - Frederic Savary (CERN) (30-7-018 - Kjell Johnsen Auditorium)	 2018-07-04_PRR 11T_Description and scope_F Savary.pdf
08:45	Part II: Interfaces - Daniel Schoerling (CERN) (30-7-018 - Kjell Johnsen Auditorium)	 Schoerling_Inter
09:00	Q&A (30-7-018 - Kjell Johnsen Auditorium)	
09:10	General QA - Rosario Principe (CERN) (30-7-018 - Kjell Johnsen Auditorium)	 20180704_PRR_
09:40	Q&A (30-7-018 - Kjell Johnsen Auditorium)	
09:50	Manufacturing and Inspection Plan - Olivier Housiaux (30-7-018 - Kjell Johnsen Auditorium)	
10:20	Q&A (30-7-018 - Kjell Johnsen Auditorium)	
10:30	--- Coffee break ---	
10:50	Procedures (fabrication and inspection) - Friedrich Lackner (CERN) (30-7-018 - Kjell Johnsen Auditorium)	 Review_11T_procedures_
11:20	Q&A (30-7-018 - Kjell Johnsen Auditorium)	
11:30	Components procurement plan - Jose Luis Rudeiros Fernandez (CERN) (30-7-018 - Kjell Johnsen Auditorium)	 2018-07-04_Components Procurement Plan _JLRF
11:45	Infrastructure and tooling availability - Michael Daly (CERN) (30-7-018 - Kjell Johnsen Auditorium)	 03072018
12:00	Q&A (30-7-018 - Kjell Johnsen Auditorium)	
12:10	5.7 Production schedule and associated Resources (taking into account the other activities, e.g. LS2, WP3) - Frederic Savary (CERN) (30-7-018 - Kjell Johnsen Auditorium)	 2018-05-08_S917:TE_Delivery Schedule_Specification_12 Feb 2018_As per specification_Contractual_Updated.pdf  2018-06-29_Overall Planning CERN Dip
	 2018-07-04_PRR 11T_Production schedule and resources_F Savary.pdf  2018-07-04_PRR 11T_Production schedule and resources_F Savary.pptx	
12:40	Q&A (30-7-018 - Kjell Johnsen Auditorium)	
12:50	Closed session + lunch for reviewers (until 15:30) (30-7-018 - Kjell Johnsen Auditorium)	
15:30	--- Break for reviewers ---	
16:00	Conclusions (30-7-018 - Kjell Johnsen Auditorium)	

Comments of the reviewers

For each presentation the main comments and recommendations are summarized in the following slides.

Complete report will be soon in EDMS in the PRR structure (N. 2002125).

Frédéric Savary: **Description of the 11T and scope**

- Questions were raised concerning the share of responsibilities between the contractor and CERN during the construction since we are in presence of a service contract. Frédéric answered that at the beginning of each phase; each party accepts and take the ownership of the components delivered by the previous party.
- We remark that the S197 is not a procurement contract but a service contract. The Contractor has as well an active role in the preparation and writing of the Manufacturing Procedures. Therefore, the contract shows new aspects and challenges respect to the magnet procurement contracts we had for LHC magnets.
- **The panel recommends being aware to all of this kind of aspects and their possible contractual implications.**
- **The panel recommends that all relevant documents and drawings be released as soon as possible.**

Daniel Schoerling: Interfaces

- The panel notes that the issue with the heat deposition is very relevant and must be treated with high priority at the HL-TCC or at other panel/committees.
- Although this aspect is not under the mandate of the PRR, the panel endorses the proposal not to change the cold mass design at this stage, as this would adversely affect the schedule of the project.
- The panel also takes note that an interface specification is currently under preparation.

Rosario Principe: **General QA**

- The QA structure and QP are very well developed and structured. We advise to check the compatibility of the structure and templates, developed on the track of TE/MS-C-LMF QA, with HL-LHC QA structure .
- The QP foresees that “Audits will be conducted in the course of the Project...” (Section 3.1). Looking also at the experience of the LHC dipole procurement, **the Review strongly suggests conducting these types of audits from the start of the series manufacturing. They could be eventually sub-divided in Collared Coils and Cold Mass Assembly sub activities. The first could be held at the delivery of the first collared coil.**

- As a general aspect, the QA structure is deeply structured and very detailed. It is therefore important to have the correct track of the large number of documents existing and available in EDMS. **We recommend to keep under control the life cycle of the documents and declare obsolete what is not up to date.**
- Special care has to be given to the communication between the technical teams on procedure changes. We understand the necessity to further consolidate the procedures as the time for prototyping was reduced for this specific project, but it is expected that this process will quickly converge.
- If we have well understood the Project Organigram, at regime there will be two and half FTE dedicated to the 11T QA provided by CERN. The Contractors (GE) will provide all the other resources. This is an understandable choice given the short resources, but **we recommend being careful in keeping separate the manufacturing and the control both on CERN side and contractor side.**

Olivier Housiaux: **Manufacture and Inspection Plan**

- During the discussions, it was stated that all MIPs contain, specific Hold points to ensure that the components to be installed are accepted by the technical responsible.
- A question was raised about the validity of a holding point under the Contractor responsibility. Indeed the person in charge of filling the MIP is not the operator but the QA inspector of the contractor.

Our remark: the traceability of the version of the procedures used is indicated in the MIP but does not always follow to MTF. As it is not possible to change the applicable standard for each different coil, searches may be difficult. The only way to find for instance, all coils manufactured with the same procedure version will be to read the scanned versions of the MIP.

The process is not quick but in case of need it is possible.

Friedrich Lackner: **Procedures (fabrication and Inspection)**

- As already mentioned, we noted how the Contractor has an active part in the writing of the Manufacturing Procedures; this is a positive aspect for such type of contract.
- The review committee acknowledges the quality of the Manufacturing Procedures.
- **We recommend the consolidation and release of all the procedures as soon as possible. The same remark applies to all the drawings that are not yet approved.**
- At the moment, the most critical procedure seems to be the one for “collaring”, since it is depending on the results of the test ongoing these weeks on the revised collaring procedure and components (electrical insulation) (*see also conclusions*).

Jose Louis Rudeiros Fernandez: **Components procurement plan**

- All the main contracts are placed and the critical components are being received (those that have impact on the contract for the collaring coils). Some laminations and half shells for the spare magnets are not yet fully covered by contracts. Delays due to the issues with the raw material availability may happen.
- So far, no major NCR from the components that have been received.
- The most critical procurement seems to be the one for the half-shells for the shrinking cylinders (differently from the LHC Dipoles and special SSS, the full-size half shells for the 11 T will be obtained by welding two 1/2 half-shells. The procurement and manufacturing (tight tolerances required for the welding operation) are challenging.
- During the presentation, we did not see a clear table with columns giving the arrival date and the needed date of the different batches of components. E-mails and meetings assure the communication but **we recommend to prepare and keep updated a simple summary of the component situation.**

Michael Day: Infrastructure and tooling availability

- The situation seems in order. The tooling under manufacturing will be ready in time.
- The last concerns about some safety aspects of some special tooling (e.g. the impregnation tooling) are solved and the tooling have now the green light from HSE.
- **We recommend inserting the maintenance of the generic tooling (curing press, impregnation oven, collaring press) in the general planning and matching the two.**
- In principle, it seems there are not critical interferences between tooling needed for the 11T Project and for other HL magnets production. We were told that in case of conflicts, priority will be normally given to the 11 T project.

Frédéric Savary: Production schedule and associated resources

- The production schedule is very tight. A possible margin could be found moving the installation window within LS2 period. This has to be agreed with the LS2 coordination management.
- The shutdown of SM18 in Q2 2019 can be another bottleneck in case of delays. An adjustment of the shutdown period, if possible, could give some extra flexibility. Here as well, an agreement with SM18 management and Cryogenic Group should be found .
- **We recommend checking the possibilities of being flexible with the test windows in SM18 and the installation window in the machine. It should also be checked with SM18 Coordination when would be the last moment to negotiate a possible change of planning for SM18 shutdown activities.**
- For the use of the construction tools in parallel with MQXF, **we recommend to check the delays that the 11 T priority could cause to the quadrupole completion date.** In case of unacceptable time shift, some actions should be taken (double some tools, possible shifts for the use of the crane, etc.). **A common crosscheck of the 2 project (11T and MQXF) planning should be done systematically.**

Conclusions of the review

- The reviewers acknowledge the completeness of the documentation and the good advancement of the 11 T project. Generally, everything seems well defined and we spotted only a few points to be improved.
- We acknowledge that the dedicated Task Force analysed the behaviour of the prototypes and defined a new insulation scheme and a new collaring procedure. A short model with these features will be tested in July. This will be a critical milestone toward the completeness of the magnet design and its validation.
- **The panel opinion is that the production can start providing that the new features defined by the task force give satisfactory results and the suggested actions listed below are carried out.**

Actions recommended in order of priority:

- Define (or improve the definition of) a clear separation between production and controls with the Contractor.
- Clarify ASAP the technical open points with the Project (e.g. TCC) and other stakeholders.
- Finalize all the Procedures (Assembly, Documentation and Control) and release them.
- Clean the EDMS project tree (i.e. put in “Obsolete” status all procedures and documents not anymore valid).
- Check the flexibility of the SM18 test window (linked with 2019 Q2 Shutdown) and installation window. Negotiate with SM18 management and Cryogenic Group up to when the 2019 Shutdown could be eventually delayed.
- Check the flexibility of the 11T magnets installation windows in 2019 and 2020.

Further steps

- We recommend as well carrying out a first Manufacturing Audit after the completion of the first collared coil.



Thank you for your attention

