53rd Meeting of the HL-LHC Technical Coordination Committee – 12/07/2018

Participants: C. Adorisio, A. Apollonio, G. Arduini, V. Baglin, M. Bajko, R. Bruce, F. Bertinelli, S. Bertolasi, O. Brüning (chair), R. Calaga, D. Delikaris, B. Delille, A. Devred, C. Gaignant, N. Grada, R. Jones, I. Lamas Garcia, E. Mainaud Durand, P. Martinez Urios, M. Martino, R. Martins, M. Menoes, V. Montabonnet, Y. Papaphilippou, D. Perini, M. Pojer, L. Rossi, F. Savary, J. Serrano, L. Tavian, R. Tomas Garcia, D. Wollmann, S. Yammine, M. Zerlauth.
Excused: L. Bottura, F. Cerutti, M. Giovannozzi, J. Jowett, M. Modena, S. Redaelli.

The slides of all presentations can be found on the website and Indico pages of the TCC.

O. Brüning first reviewed the agenda of the meeting. An AOB was added, regarding the status of the Crab Cavities in the SPS, by D. Delikaris and R. Calaga. Regarding the minutes of the last meeting, they were approved without further comments. There were two actions: F. Rodriguez Mateos should report in a future TCC the outcome of the circuit layout and protection studies for the hollow e-lens after analysis in the MCF. The second action was regarding the cooling capacity of the 11 T-dipole. R. Bruce informed that there is some on-going work and discussions within WP5 and WP11. O. Brüning stresses that it is quite urgent to address this issue, as the magnet will have to be installed during LS2 and it may be too late for any adjustments.

11 T cold mass production readiness review, D. Perini - slides

D. Perini introduced his presentation by briefly recalling the mandate of the production readiness review and the corresponding reviewers for the 11 T cold mass which took place last week. He reminded the TCC that the assembly is comprised of three parts: the cryostats, 12 colared-coils and three cold masses. The agenda had presentations during the morning and the draft conclusions given during the afternoon.
The assembly is done by a contractor and this raised questions, for the responsibility of the production procedure. In principle, there is an acceptance procedure put in place for each step. The committee remarked that this is not a procurement but a service contract, so new aspects and challenges have to be taken into account. The panel recommended to clarify fully all the contractual implications and release soon all relevant drawings and documents. Regarding the interfaces, the panel noted that heat deposition could affect the design and should be treated with high priority in the HL-LHC TCC.
For the quality assurance, the panel gave the following recommendations: The foreseen audits should be conducted from the start of the series manufacturing first for the collared coils (with the contractor) and then an internal one for the Cold Mass assembly. Most documents are almost in order, albeit a few corrections should be made, in particular regarding the compatibility of the edms. Finally, it was recommended to keep separate the manufacturing and the quality control both at CERN and the contractor.
Regarding the manufacturing and inspection plan, a scanned paper document with the results of the measurements filled by the operators, is uploaded to MTF. In the question of L. Rossi if

the panel recommends an electronic version, D. Perini answered that this is a choice for the project which, although complicated, could be implemented.
The fabrication procedures are very clear and they are produced as a joint venture between the contractor and CERN. It is understandable that some of them evolve with the project but it is important to freeze the procedures ASAP. The most critical is the one of collaring, as the results are needed for the model to be tested in a few weeks.
The main contracts for the components are put together, a few parts for the spare magnet are not ready, with the most critical being the external cell. No major non-conformities were observed on the delivered components. The panel remarked that there was not a clear table with the components' arrivals and the date they are needed and recommended a formalisation of the process.
Tooling is in the process of being manufactured or already delivered, with no major issues. The maintenance of tooling should be put in the general planning. It seems that there is no major interference with tooling for other HL magnet production and the 11 T magnet, which has priority, in case of conflicts.
The schedule seems tight but feasible. It is recommended to find some margins regarding the time for installation during LS2, provided that it is possible and compatible with other operations. It is indeed important to check the availability in SM18 with respect to the other LS2 activities. Even if the 11 T magnets have priority over the quadrupoles, with respect to the tools, as mentioned above, it is recommended to cross-check systematically the compatibility of both plannings, in order to anticipate conflicts. Following a question of O. Brüning, F. Savary stressed that it is important to check the progress of the production and then do a first revision of the planning estimation during 09/2018 and then by the end of the year.
In conclusion, the panel recommended that the production can start provided that the short model to be tested during July gives satisfactory results (following the suggestions of the corresponding task force) and the suggested actions listed above are carried out.

Discussion

F. Savary mentioned that the main goal of the task force was the optimisation of the collaring process, including the reduction of the thickness of the cabling insulation for all models made. Up to now, the last short-model showed the best behavior as compared to all other short models, achieving the nominal current in quench number 4. There is on-going work for implementing the procedures and insulation system to the long coil, including the shimming plan. Following a question of O. Brüning, M. Bajko answered that the tests should be finished by the 15th of August. D. Delikaris pointed out that it is important to check the flexibility of the SM18 window, as it may impact not only cryogenics' work but also civil engineering and others. M. Bajko agreed and added that, at present, the probability of allowing this flexibility is very low. V. Mertens as project leader, will have to check if this is possible. L. Rossi stresses that 11 T should be treated as proprietary, as it is the most important HL-LHC hard-ware entering in the LHC during LS2. Following a question of C. Gaignant, F. Savary clarified that the service contract obliges the contractor to provide good construction but they are not responsible for the design. M. Pojer mentioned that the installation of the 11 T magnets is foreseen at the latest moment possible during LS2. Looking through the schedule and the subsequent hardware commissioning, it looks quite difficult to allow any delays. Following the question of L. Rossi, D. Perini replied that the by-pass cryostat will be reviewed in October.

Circuit disconnector boxes for HL-LHC circuits in the UR, S. Yammine - slides

S. Yammine reviews the work on the circuit disconnector boxes carried out mainly in the MCF. He reminded the TCC of the situation in the LHC, where the warm-cold transition around the DFBs is a very tight area with respect to space, making work quite difficult, in particular for

ELQA. After some discussion between L. Rossi, M. Pojer and M. Zerlauth regarding the number of interventions since 2007, it was clarified after the meeting by M. Bednarek that in addition to the yearly disconnection of the 13 kA, there were at least ~25 ELQA interventions during three operational years, on one of these 24 circuits in the LHC, which is in average one circuit per sector per year.
S. Yammine explained that the current leads have to be manipulated with care, assuring good contact quality. Extrapolating to the HL-LHC case, estimates given by G. D'Angelo for the present LHC, result to 500 minutes of intervention per IP side, without including mobility and preparation. The Inner Triplet main circuit correspond to 30% of this time.
CERN has wide experience with disconnector boxes, for example in SM18 (16 kA), POPS (3 kA), Fresca 2, etc. The proposed solution relies on the use of switchable fingers for 18 and 13 kA circuits, and rotatable positions for circuits with less than or equal to 2 kA. A PLC and a panel key ensures correct manipulations. A negligible resistance of less than 2 μΩ per polarity for the 18 kA circuit is introduced. Following a question of L. Rossi regarding the working principle (the use of a spring) and the eventual risk, S. Yammine replied that this is a standard solution implemented in several areas. M. Zerlauth adds that a link can be foreseen to the powering interlock, ensuring machine protection.
The present baseline is being recalled including the circuits with disconnector boxes (CDBs). The present study includes all circuits in the URs. The integration concept with CDBs and distributed current leads was discussed between WP6a and WP6b. In particular, there are no consequences on the defined Civil Engineering. The concept maximizes energy recuperation, the access and handling space is respected, and a minimum resistance is ensured. Following a question of L. Rossi, S. Yammine and M. Martino explained that the integration concept ensures that the disconnector box is located far enough from the 13 kA to allow a minimum resistance required by this 1-Quadrant converter; the connection will then be made by means of bus-bars. A detailed scheme for the integration concept with CDBs is being currently worked out by WP15.
The estimated cost is 2 MCHF which reduces the cost of WP17 by 2.9 MCHF. M. Pojer mentions that there is probably additional gain for the cost in SM18 which is not yet quantified. Following a question of L. Rossi, S. Yammine replied that there will be no impact on installation, as it is included in the power convertor budget. Regarding man-power, M. Martino mentioned that this needs to be further refined.
C. Gaignant stressed that this solution looks good for safety pending detailed evaluation of the principle in an ECR. L. Rossi proposes that the TCC endorses this solution, in particular due to the potential increase of safety and cost reduction.
Following a question of M. Zerlauth regarding the situation with an opening of the circuit when magnets are energized and the possibility to have a short-circuit, L. Rossi suggests that the safety of the operation should be clarified in the ECR to be issued. S. Yammine added that a tentative guideline and procedure will be indeed detailed. C. Gaignant stressed that this should be part of the failure mode of the equipment.

AOB: Safety requirements for TCLD exchange, C. Gaignant, N. Grada - slides

C. Gaignant introduced the subject regarding a global risk assessment for different scenari during the lifecycle of the TCLD, and in particular the scenario where an exceptional exchange is needed for a TCLD collimator. In this situation, a mechanical damage is considered on a nearby cryogenic equipment, leading to an helium spill. A distinction is made depending on the position of the four collimators regarding the emptying of the LHe from the relevant arc sectors, cryo by-pass and QRL. The arc warm-up constraint could be reconsidered if there is a reliable procedure for handling. Regarding installation, no particular constraints are imposed

from safety with the warm sectors, but this needs to be re-assessed if there is a change of schedule. D. Delikaris mentioned that accessing the warm sectors was already encountered at least twice, and there is definitely no risk for installation. On the other hand, a mechanical damage for the QRL should be prevented, by avoiding transport through all sectors of QRL with bellows. C. Gaignant agrees and adds that a passerelle to pass above the beamline and a platform above the QRL are foreseen. L. Tavian points out that it will be good to mention that only the sub-sectors concerned should be emptied and not the full arc sector. C. Gaignant agrees and adds that a case-by-case decision will be taken.

AOB: SPS CC cryo progress – D. Delikaris, R. Calaga

D. Delikaris gave a short update on the progress with the cryogenics of the CCs in the SPS. There were several issues with the liquid nitrogen where it was not possible to have the nominal flow in the transfer line due to impurities, even after several thermal cycles. There was no other option but to warm-up until the end of July. Operation at 2 K is now foreseen for week 33. R. Calaga added that this is compatible with the MD scheduled on the 29th of August. The MD during next week will be done with the CCs at 4.5 K which may be sufficient. The cryoplant was stopped twice due to the fact that the cooling water temperature was high and work is being carried out with EN/CV, in order to solve this. In addition, the plant was stopped due to an electrical glitch on the 9th of July, where all the accelerator complex suffered. Following a question of L. Rossi, D. Delikaris answered that the recovery required 24 h. The availability was very low, and the plant runs since yesterday and continues until mid-July for the full regeneration.
R. Calaga added that there was normally an MD foreseen for the day 11th of July and another was foreseen for the 19th of July. Conditioning started and will continue through the week-end. Following a question of O. Brüning, R. Calaga pointed out that conditioning is always needed following a thermal cycle but, in general, it is much faster, as compared to when done for the first time. R. Jones mentioned that it is important to know how long RF conditioning takes in the future during HL-LHC operation, as it constraints interventions on BI equipment in IR4, for the main RF system. Although the situation is different for the CC which are installed in IR1 and 5, a discussion followed with the agreement that an operational procedure for their conditioning should be established. R. Calaga added that five MDs are foreseen at 2 K if stable operation is achieved. A dedicated slot (24 h) is scheduled for high intensity beam tests. The MD of next week will attempt the first rephasing of both cavities and some optics measurements.

The next TCC meeting will take place on the 2nd of August 2018.