



65th Meeting of the HL-LHC Technical Coordination Committee – 17/01/2019

Participants: A. Apollonio, G. Arduini, V. Baglin, M. Bajko, A. Ballarino, I. Bejar Alonso, R. Bruce, O. Brüning (chair), H. Burkhardt, R. Calaga S. Claudet, D. Delikaris, R. De Maria, B. Delille, B. Di Girolamo, P. Fessia, H. Garcia Gavela, J. Gascon, R. Jones, H. Mainaud Durand, P. Martinez Urios, M. Martino, M. Mendes, M. Modena, Y. Papaphilippou, F. Rodriguez Mateos, L. Rossi, M. Rodriguez Perez, F. Sanchez Galan, J. Serrano, L. Tavian, D. Wollmann, S. Yamine, M. Zerlauth.

Excused: S. Gilardoni, S. Redaelli, A. Rossi.

The slides of all presentations can be found on the [website](#) and [Indico pages](#) of the TCC.

After a review of today's agenda, the minutes of the two previous meetings were approved without further comments. The following actions were noted: WP3 and WP9 should issue an ECR regarding the operating temperature of Q5.L6 and Q5.R6. WP1 and M. Bajko should clarify with EN-EL the availability of cables for pre-series module tests in SM18. L. Rossi mentioned that he had already a discussion with M. Jimenez (LS2 committee chairman) and discussions will follow with M. Bajko and L. Bottura. Another action refers to the implications of the SC link waviness (WP16 and WP6a). A. Ballarino mentioned that this should be indeed part of the installation process and will discuss further with P. Fessia. The last action is for F. Rodriguez Mateos who should give a report in one of the upcoming TCCs on the technical discussions regarding the disconnecter boxes. He mentions that there is good progress and the findings will be reported soon. Before entering to the usual agenda, it was recalled that following reviews are scheduled: the beam dump system review (February 5th), the collimation review (February 11th-13th) and the CC review (June 19th-21st). A. Ballarino also added that the conceptual design review of the DFX will take place on the 31st of January. Finally, P. Fessia reminded that the LHC cabling which needs to be maintained during HL-LHC has to be confirmed by the end of January. The WPs have to contact ASAP M. Modena. The work should not be underestimated as it may have an important cost impact.

Update for HL-LHC TDR + HiLumi book – C. Noels, O. Brüning, L. Rossi - [slides](#)

O. Brüning indicated the deadlines for the update of the HL-LHC TDR and HiLumi book, as reported during the 63rd TCC by C. Noels and I. Bejar Alonso. The first drafts are due by the end of February. It is reminded that existing text from the previous TDR and HiLumi book can be extensively used. Mainly, the re-baseline changes should be reflected in this TDR version. The target is to finish by the end of the year and be ready for the forthcoming C&S review. The text should be indeed relatively short. Following a question of D. Wollmann, O. Brüning clarified that the timeline and editorial deadlines for the HiLumi book and the TDR are not exactly the same. Concerning the book, the purpose is to include all scientific explanations and not to re-write all chapters. L. Rossi stresses that reusing the same picture and text is indeed permitted, as the book is printed by the same publisher. The contact persons for each chapter can decide to split them into smaller parts.

G. Arduini mentions that there are several events during February, including the LHC performance workshop in Evian and the LIU days. He adds that a prior discussion during the PSM would have been helpful. For WP2, the revision of the TDR will be the first priority, following by the HiLumi book. It is not clear though that these tight deadlines can be respected. L. Rossi asks to keep the deadlines and adds that there will be some flexibility, as the papers will have to be read by the project management for comments in the sequence that they are received. R. Calaga also supports the logic and arguments to prioritize the writing of the TDR before the book chapters. R. Bruce emphasized that WP5 is very busy with the preparation of the collimation review and cannot commit to deliver the texts on the deadline. O. Brüning understands that this is quite a busy period but encourages the WP leaders to deliver a first draft as fast as possible. R. Calaga asks if the various options should be kept in this version of the TDR. L. Rossi answers that the only option kept in the WP chapters should be the e-lens. O. Brüning will write a dedicated paragraph listing all possible options. P. Fessia questions if the configuration of the machine should be the one reflected by all the endorsements given by the TCC and asks if the ECRs should be issued in time to be included in the TDR. O. Brüning answers that all aspects that are discussed in the TCC, for which there is confidence that the corresponding ECR will be approved, should be included in the TDR. The project management should be contacted in case of doubts. As examples, he mentions the powering options and the change of the 11-T location, which should be described in the TDR, although the corresponding ECRs are not yet approved. L. Rossi explains that all options endorsed by the TCC should be included in the TDR. G. Arduini stresses that WP2 considers that optics version 1.4 is the baseline. He adds that the scope of the exercise should be clear in order to avoid confusion.

Open action follow-up: Water cooled cables for the 120A/200A circuits of the HL insertion regions – P. Fessia, [slides](#)

P. Fessia presents a follow-up on the water-cooled cables option for the 120A/200A circuits, as discussed during the 60th TCC of last November the 1st. The TCC endorsed the removal of the 120 A and 200 A super-conducting wires from the SC link but the connection to the PC and its location is still pending. The following options were discussed: Case A (and its update A') involve the use of warm cable running through the ULs and SC link core, with the PC located in the UR. This implies the core modification to allow the air-cooling of the warm copper cable. Case B corresponds to the installation of the PC in the LHC service galleries around the IPs. A water-cooled cable option (case A'') was further considered and analyzed. As shown during the 60th TCC, case A' costs 134 kCHF more, to be compared to case B which reduces cost by ~200-300 kCHF. Following a question by L. Rossi, P. Fessia explains that Case A' is just an updated version, including the cost for the cooling of the cables. A schematic on the ATLAS zone with the different areas is shown, indicating the baseline location and the one in the UL for the PCs (total of 8 racks), where space is available. The cables are passing from the upper floor through the cores and going down to the tunnel. The right part of Point 5 is very similar conceptually to Point 1 and there is free space for the PCs. For the left side of P5, the second floor of the UCS55 cavern can be used to install the PC racks. This cavern belongs to the accelerator, but there is also some experiments' equipment. The area occupancy will be further organized by installation.

A schematic view of the power cables' routing is shown. The length of the water-cooled cable is around 200-250 m. The expected leakage current of 100 μ A/circuit is at least one order of magnitude higher as compared to the typical current to be measured (~1-10 μ A). The junction box is installed in the quite complex area of D1 with increased radiation. A technical solution is presented with the advantage of reducing the thermal load, but with a number of technical disadvantages including a high cost of around 800 kCHF without including the development cost and connection boxes, which can bring the cost to around 1 MCHF.

Following the question of L. Rossi regarding the interference of the plug with the DFX, A. Ballarino does not have an immediate answer, this has to be further scrutinized. P. Fessia adds that there is some cost associated to the core enlargement in order to bring up slightly the metallic flange (closure) on the tunnel ceiling. Following a question from L. Rossi, M. Martino confirms that there is no particular issue with the location of 120 A PCs, as they are radiation tolerant by design. The same can be done for the 200 A PCs, with no extra cost associated, as this development is on-going. Only the cost for the spare is needed (~50 kCHF) and ~75 kCHF related to the control. There is no issue with availability, as the systems are redundant, as it will be explained and documented in the ECR. The water-cooled cable option implies the need of ELQA interventions in the tunnel, which cannot be accepted from the radiation point of view. O. Brüning concludes that, if there is no objection, the TCC can endorse Case B, and the project leader can approve it pending the corresponding ECR. This modification should be indeed included in the TDR and HiLumi book. L. Rossi thanks P. Fessia and the involved colleagues for all the work done.

DECISION: The 200 A and 120 A convertors powering the corrector packages should be installed in the LHC galleries around the IP1 and 5 (ULs).

HL-LHC TCC in 2018: Open action review – A. Apollonio, [slides](#), [link](#)

A. Apollonio reviews the pending actions of 2018. All open actions are listed in the TCC web-page. A column with the due date is included and the goal is to fill this column in order to organize the future TCC agendas. Following a question of R. Calaga for the ADT optics checks, it is clarified that this came up during the presentation of R. De Maria on the optics version 1.4. Following a question of A. Ballarino concerning the action on the availability of cables for tests of pre-series modules in SM18, L. Rossi re-iterates the information given at the beginning of the meeting for the follow-up of this action with M. Bajko and M. Jimenez.

The TCC decisions extracted from the minutes are also presented. Regarding the consideration of cold diodes as baseline, D. Wollmann will give a short report in the next TCC regarding the annealing tests. The results are confirming the considerations as presented during the TCC of last October. L. Rossi would like to have a confirmation with an official statement by WP3 and WP6a and to launch subsequently the corresponding ECR.

Regarding the 11 T location, P. Fessia mentions that, a final iteration will take place in the integration meeting of next Friday, to close the loop. O. Brüning recalled the comment on the ECR by J. Wenninger with respect to flux-jumps. G. Arduini answered that this was indeed already discussed in the ECR text by M. Giovannozzi and M. Martino. This remains an open issue and a better characterization of the phenomenon is required.

Regarding the decision on the STRING configuration, M. Bajko mentions that after a careful analysis, the operation is closer to 1.5 year, which is still a 0.5 year reduction (up to mid 2023). This was already reported in the PSM and she is ready to come back to the TCC for clarification.

P. Fessia mentions that although the optics is approved, there are a lot of missing items in order to converge to a final layout. This is indeed a concern for the edition of the TDR and HiLumi book. The matching section optimization was indeed approved. Following a question of S. Claudet for the approval of the remote alignment, O. Brüning clarifies that the TCC indeed endorsed the proposal but the final decision is taken with the approval of the ECR. P. Fessia states that decisions cannot be taken on items that studies are still pending. He clarifies that the move of the collimators in the layout is significant (around 3 m) and R. Bruce adds that the concrete shielding should be fixed. Regarding the position of the CCs, S. Claudet clarifies that although the position is fixed, a solution for the cooling, installation and maintenance has to be worked out.

O. Brüning mentions that the decision for the operating temperature of Q5 (4.5 K) from the previous TCC was also added in the decision list. R. Jones finally clarifies that octagonal BPMs are only for the triplet and D1.

Database needs for HL-LHC - Survey results and analysis – M. Modena, [slides](#)

At an enquiry was launched one year ago, regarding the status and database (DB) requirements for future LHC activities and HL-LHC runs. Thirteen answers were received by various groups which were classified in three main categories: DBs that exist and are suitable for HL-LHC, DBs that exist but are not suitable and three new DB proposals.

The first category includes five DBs, two from VAC (control and HW location), one from TE-MPE (QPS), one from TE-MSA (magnet test analysis) and one from TE-EPC (PC maintenance and accounting).

The second class includes also five DBs. The first one is the optics database which is not correctly linked to the layout database, with various inconsistencies. An inter-departments working group was launched last summer (after the DB enquiry) in order to follow-up and solve the issues. The MMSMA DB is used for storage of geometry data, but for external users (e.g. approval from MEB during the LHC installation). The survey team has its proper expert database (GEODE). The structure of the MMSMA DB is very rigid with a lot (up to 30) data tables for each magnet, and specialist work (not in Survey Team competences) will be necessary to integrate the HL-LHC new magnet families. This opens the question about modification of the existing MMSMA DB (correctly working but in a certain way “obsolescent”) or the development of a new DB replacing the MMSMA. This question will be discussed in the alignment WG and then reported to the TCC. The Magnetic and Field Quality Measurement DBs seem to be adequate for HL-LHC magnets. The responsibility is on WP3 and its status could be reported in a future TCC.

The Standard CERN-LHC-Injector DB (layout, MTF, LSA, etc.) is linked with LHC Mechanical and Electrical DBs for commissioning, operation and maintenance purposes of LHC. Modification request will be covered by the aforementioned WG on “LHC Layout DB upgrade”. Finally, the CALS logging DB is presently evolving into NXCALS which should be capable to cover future LHC configurations.

A proposal for a new HiLumi ECR DB does not seem necessary, as it is covered by EDMS under the responsibility of HL-LHC QA. The DB for storing the results of all robotic interventions seems a good idea but can be probably developed independently from HL-LHC. The same is true for the DB proposal from VAC, focusing on documentation and manufacturing follow-up. In summary, the overall assessment is that there is on-going work to adapt some important DBs but nothing is very critical. R. De Maria adds that the work on the layout DB is on-going but not yet HL-LHC consistent. O. Brüning stresses that this work is indeed with very high priority and recalls that it was very important for the LHC to be able to generate the sequence from the layout DB. P. Fessia explains that the LHC debugging is almost finished and the WG is ready to address the HL-LHC issues. G. Arduini asks whether there is the possibility to access complementary data from a single entry point. He believes that it is indeed important to have a bridge between the various DBs. Usually, if one has to deal with various DBs, the cross comparison is very difficult. M. Modena answers that the present status comes from some historic “independent” developments. A major step is necessary in order to optimize and uniformize all DBs. G. Arduini further asks if vacuum pipes are included in the layout DB and P. Fessia answers positively. S. Claudet mentions that there is another DB collecting the temperature sensors which is linked to the layout DB.

HL-LHC ECR: WP4 Field Antenna Modifications for Crab Cavities – R. Calaga, [link](#)

R. Calaga presents the ECR for the modification of the CC field measurement antennas. A direct beam coupling was discovered during the beam passage is passing, impacting the accurate cavity field measurement and hence RF feedback. Beam measurements in the SPS showed a modulation of 80 kV, from the beam passage. New specifications were issued in order to mitigate this effect, which, extrapolated to HL-LHC, gives approximately 200 kV modulation, an order of magnitude above the specification of 40 kV peak-to-peak.

The reduction of direct beam coupling was implemented at the source (field antenna) achieved for the DQW with an additional coupler. For the RFD, the only way to achieve the required reduction of around a factor of 4, is through a rotation of the field antenna port. The ECR was issued and the idea of this presentation is to collect eventual comments and implement changes. The only major change is the cryomodule design. G. Arduini asked about the impact of the modification to the impedance spectrum. R. Calaga replied that studies are on-going, but it seems that this should be equivalent. Roughly 200 kCHF should be considered for the extra antenna.

For the cost impact, the level of detail is not yet accurate enough to precisely evaluate it. Roughly 200 kCHF should be considered for the extra antennas on the DQW. Following a question of O. Brüning, R. Calaga answered that the ECR is circulated and comments should be provided by the end of January. S. Claudet asked if the antenna needs any extra cooling and R. Calaga answered that the estimates show that there is no major impact, but rather a slight improvement with respect to heat load.

HL-LHC ECR: WP17 - Modification of the technical galleries and building interfaces at HL Point 5 and P1 – L. Tavian, [slides](#)

L. Tavian summarizes the modification of surface buildings interfaces, on behalf of WP17 and 15. The context of the two ECRs is that service and infrastructure integration resulted in the modification of technical galleries and building interfaces. This iteration impacts CE design (consultant contracts) and construction work. Detailed drawings are shown before and after the Space Modification Requests (SMRs) with the modifications of technical galleries and buildings in point 1 and 5. P. Fessia mentions that in P1, fire doors were not integrated in the previous version. O. Brüning asks about the need to relocate some services for the reduction of noise. L. Tavian answers that a special building permit is needed and, in that case, the 66 kV cable has to be moved on the outside. There is no need for any further modification.

For the presented SMRs, there is no impact in performance and schedule but there is a total cost impact of 774 kCHF. The TCC endorses these changes. L. Rossi stresses that it will be very hard from now on to have further modifications. G. Arduini questions whether the cost is only for CE or if also the length of the pipe is included. L. Tavian answers that CV has no big impact but the situation may change for the SMRs in the interior of buildings. In any case, these two SMRs are the costliest ones. B. Delille mentions that the modifications in the underground and galleries and some coming from surface buildings were implemented in the active baseline and changes of scope.

DECISION: The TCC endorses the modification of the technical galleries and building interfaces at HL Point 1 and 5.

The next TCC meeting will take place on the 6th of February 2019.