32nd Meeting of the HL-LHC Technical Coordination Committee – 29/06/2017

Participants: A. Apollonio, G. Arduini, V. Baglin, I. Bejar Alonso, F. Bertinelli, R. Bruce, O. Brüning (chair), H. Burkhart, R. Calaga, S. Claudet, R. De Maria, B. Delille, B. Di Girolamo, P. Fessia, A. Foussat, J. Gascon, S. Gilardoni, H. Mainaud Durand, M. Martino, R. Martins, E. Metral, D. Missiaen, M. Modena, Y. Papaphilippou, J. Perez Espinos, L. Rossi, F. Sanchez Galan, L. Tavian, G. Vandoni, R. Van Weelderen, D. Wollmann, M. Zerlauth.

Excused: M. Giovannozzi, R. Jones, J. Jowett

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

O. Brüning opened the meeting by reviewing the agenda. An AOB from F. Bertinelli on a memo for the hollow e-lens organisation was exceptionally added. The establishment of a Working Group on Alignment was also announced, the mandate of which will be presented during a future TCC. Regarding the minutes of the previous meeting, they have been approved with the comments sent to Y. Papaphilippou. The Indico Page contains the latest version. There were two actions during the presentation of C. Gaignant on the EIS compliance with HL-LHC parameters. The first action refers to the potential need for an upgrade of the TEDs in the LHC transfer lines. L. Rossi and O. Brüning will follow this up with LIU and consolidation (O. Brüning had a first discussion with Verena Kain and Markus Zerlauth after the meeting and V. Kain will finalize the Safety File for the TEDS over the coming weeks). Regarding the action on the clarification of the location and functionality of the door in P1 and 5, it will be followed within WP17.4, by T. Otto and T. Hakulinen.

Final layout of Q1-TAXS area, F. Sanchez Galan - slides

F. Sanchez Galan reported the work towards the finalization of the layout of Q1-TAXS area, on behalf of WP8. The emphasis is given on the VAX area, which can be found at around 20 m away from IP, with a lot of equipment, including BPM, sector valves, bellows, cabling and piping. It was necessary to integrate the BPM in Q1 and relocate the VAX equipment from the tunnel to the experimental side for improving access and minimizing interventions. Cabling also has to be changed following RP recommendations, by integrating in a set of boxes, fixed to the equipment with a new support, which also hosts all the VAX sector valves and bellows. This concept, similar to the one of collimators TAXS, has to be validated with a prototype.

The present proposal assumes a common layout for CMS and ATLAS, which differs only due to the shielding configuration. The idea is to integrate all new structures in the forward shielding and this was agreed with the CMS experiment. Some operations, like the installation of the support structure will be advanced to LS2, due to the tight schedule in LS3 for CMS. A radiation assessment was done, which showed that the only hot area is the one in front of the

TAS, with similar results for personnel and equipment. In the question of L. Rossi on the difference between the two radiation plots in slide 11, F. Sanchez Galan clarifies that the left is without the VAX, whereas the right includes it, in order to observe its impact. Calculations are in progress by the CMS BRIL team.

Regarding the ATLAS layout, there is also significant progress, and almost convergence to a final configuration. In that case, due to the ATLAS opening procedure, some shielding modification is necessary also 10 m away from the IP, at the JTT location. A solution is found with a minimal removal of shielding weight and needs to be approved by the experiment. A similar radiation assessment to that of the CMS IR was also performed for ATLAS, comparing the impact of TAXS on the dose. As for CMS, the experiment itself is not affected, as the only hot object is the TAXS itself.

Another consideration is the increase of the TAXS diameter from 34 to 60 mm, which increases slightly the background and residual dose in the machine side of TAXS (TAXS towards Q1). Finally, removal and installation scenarios were studied and a proposal exists, as the particular shielding cannot be installed in the usual way for safety reasons and special tooling is necessary.

In summary, a VAX layout was proposed common for both CMS and ATLAS, and CMS already approved it in the HL-LHC coordination group. ATLAS approval is pending upon agreement of some modifications. The radiation impact was assessed and no issues were found. What is still pending is the finalization of the background calculations for neutron/photon flux in CMS. The next steps are also presented. It is highlighted that the installation and de-installation schedules are now critical to be finalized.

G. Arduini would like to point that from the impedance point view, as recommended by B. Salvant, it is important to have shielded bellows.

Vacuum aspects of Q1-TAXS area, J. Perez Espinos - slides

J. Perez Espinos reported on the vacuum aspects of the Q1-TAXS area, by identifying the changes from LHC to HL-LHC and then presenting the different configurations. As mentioned previously, and from the layout of the area, the space is now constrained and the remaining allocated space is not much (reduced from 1 m to 570 mm) but there is another space which can be exploited. In particular, the ion pump and BPM will be moved towards the triplet.

Other issues are the aperture of the TAXS and triplet and the peak transversal movement that needs compensation. The aperture is reduced from 100 to 60 mm, and the first idea is to use bellows for compensating ± 10 mm transversally (although there are different optimal values for CMS and ATLAS). Standard LHC valves could be used but it is presently studied with a supplier the possibility to have a new 80 mm aperture valve, as compared to the 60 mm in the present LHC configuration.

The baseline foresees the use of bellows to compensate movements without RF fingers, and the access reliability has to be addressed. There is a slight difference between ATLAS and CMS, mainly on interface and alignment procedures. From the point of view of cabling, the needs

are similar for both experiments, but the routing is different. In the case of CMS, redundancy is obtained with other pumping lines, as they cross along the FIN parallel to the TAXS and is considered a “free maintenance area” which does not allow interventions.

There are two valve modules, as there is a need for vacuum sectorisation between the experiment and the machine. The vacuum instrumentation configuration comes from the LHC era. The impact on the experimental vacuum beam pipe is under study and some studies will be ready for LS2. The objective is to have a constant aperture of 80 mm.

The connection modules are based on known solutions and are the same for all connections with the requirement to allow remote handling. Already some parts are manufactured and connectors are to be ready soon. As mentioned, new HL-LHC valves with 80 mm aperture are under study with the supplier.

The idea for the ion pumps of the Q1-TAXS connection is to decouple the TAXS from the cryogenics of the triplet since the valves had to be moved to another area and there is no vacuum sectorisation. It is again considered as a “free maintenance area” and high quality components are necessary. A risk analysis is also needed, as there are not a lot of alternatives due to the reduced space.

In summary, the work on TAXS-Experiments and Q1-TAXS areas, which is coordinated by WP8, is well advanced. There is a baseline vacuum layout, but still some studies are pending, such as the new valve with increased aperture, bellows with or w/o RF fingers, etc. Specifications and studies are to be finished by 2017 to be ready for the LS2 preparation. A risk analysis for the Q1-TAXS area is also necessary.

Discussion

G. Arduini stressed that from the impedance point of view, a new design of RF fingers would be desirable. V. Baglin agreed that there is an iteration to be made in this respect. O. Brüning concluded that the TCC should accept the new baseline, but there may be details to be further studied and optimized. The present solution should be the subject of an ECR, where all the arising questions should be solved. F. Sanchez Galan stresses that indeed there was an effort to homogenize the apertures and increase diameters for impedance reduction, with already some positive results, with respect to the original considerations. G. Arduini agrees. F. Sanchez Galan adds that there are considerations on other type of bellows but the critical point to be evaluated for their compression is related to the need of remote handling. P. Fessia would like to comment that, regarding the Q1-TAXS interconnect concept, it would be wise to keep the possibility to test the Q1 with its interconnect separately. In that case, it is easier to intervene on the design. J. Perez Espinos agrees on that and answers that the problem is not the connection concept itself, but the accessibility in case of leak tightness problems or maintenance needs. P. Fessia understands this, but underlines that, in his opinion, testing a single element at a time is important. F. Sanchez Galan agrees that this is a good point, as the space is only around 500 mm long. J. Perez Espinos asserts that, in the case of CMS, the problem could be minor, as there is an aperture scenario where the accessibility to the area is granted through the experimental side, but for ATLAS there may be an issue. L. Rossi asks how advanced is the design with respect to a final solution for ATLAS. F. Sanchez Galan

answers that the JTT is well advanced and more resources were made available with 1 person dedicated on it. V. Baglin explains that it is necessary to know how much the shielding is modified, as there is an impact on the support, but there is no show-stopper, simply a matter of finalising the work. O. Brüning concludes that there are no indications that the presented new baseline has serious remaining issues. So, it should be accepted as a such, and can be revised, if something comes up, during the preparation of the ECR.

Decision: The TCC endorses the proposed Q1-TAXS area layout baseline, pending confirmation from ATLAS.

Alignment baseline- Review of the issues found/ modifications to the baseline and main open points, P. Fessia - slides

P. Fessia starts his presentation by explaining that from the integration point of view, there were two questions to be answered. First, if the present alignment is adequate with the needs of HL-LHC, and second, if there is a coherent list of specifications. Here, the second question is addressed, i.e. whether the specifications are self-consistent. A dedicated remote alignment review was organised in April, and the presentations are summarized. A set of questions were prepared for that meeting (see slide 3) and, in particular for remote alignment, this meeting addressed its extended need and its potential in reducing aperture tolerances and requirements on orbit corrector strengths.

A critical revision of the ground motion impact had to be undertaken (table of J. B. Jeanneret, LHC project report 1007), taking into account the present LHC experience and the potential of orbit correction and remote alignment capabilities. The possibility to compensate ± 2.5 mm of IP shift (rigid movement but also every element with respect to nearby one) opens the route for larger available aperture, and reduced load in orbit correction, so it is important to understand what are the needs to achieve this.

From the vacuum point of view, the main advance is the new design of deformable RF bridges allowing ± 10 mm radial offset, but with tighter deformation limits imposed by impedance considerations. At the same time, the advantage is somehow counterbalanced by the need to have better longitudinal position control of the interconnection flanges. The warm section pipes are designed such that there is enough freedom for re-alignment, without stressing the components. The presently limiting elements are the cold to warm transitions and the standard room temperature vacuum sector modules. It would be desirable to have designs for these transitions allowing similar offsets as for the other elements. It is indeed necessary to monitor the offset with the adjacent elements to know the final position with respect to nominal. This means that there is a need to have tracking of each interconnect, which is different to the past and present practice. The impact on impedance of the deformable bellows should be taken into account and if considered large, the alignment system should be simplified.

From cryogenics point of view, there are bellows allowing very large movements but not in operational conditions. During operation, they could in principle allow ± 2.5 mm. Replying to a question of O. Brüning, P. Fessia explains that non-operational conditions refer to when the

cryostat is empty and S. Claudet adds that these large displacements are allowed at warm conditions. Presently, there is no knowledge of how much the interconnect has moved during installation and the available margin needs to be understood. To the question of O. Brüning regarding the shrinking of 3 mm for cold conditions, P. Fessia explains that these considerations are for the transverse not the longitudinal direction.

For RF and in particular the CCs, the issue is the connection of elements with the double-decker. A deformable RF guide allowing ± 2.5 mm is foreseen but needs to be validated. The vertical solution has still to be identified and integration should be analysed. Interventions are foreseen in order to relax the accumulated mechanical energy in the element and have to be made during a TS, as the works require 2 days.

Regarding the Q4-Q5 magnet masks, FLUKA simulations were undertaken for the impact of the aperture enlargement by 2 mm, for avoiding re-alignment. For Q4, the impact on the dose is important, as in the 1st corrector it would be increased from 7 to 35 MGy (for luminosity of 3000 fb^{-1}), whereas for Q5, the impact is minor. In this respect, the Q4 masks should be remotely aligned and maybe also for the Q5, just for coherency.

Regarding the BPM, it is important to know the position with respect to adjacent optics elements. For cold magnets, it is necessary to define the maximum acceptable shift and integrate it to the BPM functionality. The warm BPMs after D1 and D2, can be remotely aligned and connected to a stable reference, if found necessary.

The collimators, mainly referring to the ones between TAXN and D2, should follow the remote alignment of the other elements. There are two options, either integrate remote alignment to the presently used support system or add an additional Hardware (HW) layer inspired from CLIC.

In summary, there are 3 possible schemes for alignment: remote (i.e. during operation), during YETS, and during long shut-down, which can function under different machine conditions, maximum strokes and time needed. One of the important considerations is the strategy after LS3, depending on the position of the detector with respect to the machine. For misalignments smaller than 2.5 mm, remote alignment is applied waiting for a full alignment during the YETS. In the case that the offset is larger than 2.5 mm, the idea is to measure in one of the TSs and correct during YETS.

A summary of the changes with respect to the HL-LHC baseline that have a certain cost impact is given. The linking of the warm BPM between D1 and D2 to a stable reference system and the alignment system of TCTs and TCLs are for HL-LHC era. The approach to trace position of elements through the life of the machine impacts HL-LHC but also current LHC operation. ALARA considerations are also pointing towards remote or semi-remote alignment procedures.

L. Rossi asks if the point on bellows was already the strategy for the LHC. P. Fessia answers that the strategy of the LHC was to measure the position of the elements at assembly. He finishes his presentation with a few points to be verified, regarding the stiffness of bellows with respect to a 2.5 mm movement, the need of repartition of single interconnect bellow

misalignments among different sources, providing the window in which the bellows can operate.

R. De Maria would like to stress that it is important for the correction strategies to specify if the CCs are connected to a remote alignment system. D. Missiaen questions where this widely adopted 2.5 mm tolerance comes from. P. Fessia replies that it is based to the observed shift of the experiment and values in the LSS, but it should be considered more as a reference number that can be certainly reviewed.

Alignment baseline- How to technically tackle and implement the required changes and achieve the proposed performance, H. Mainaud Durand- slides

H. Mainaud Durand gives first an outline of the presentation, reminding the present alignment concept baseline and then showing solutions for determination and re-adjustments of positions of components.

For the main components from Q1 to Q5, there is remote alignment piloted from the CCC, with 6 Degrees of Freedom (DOF) determination and 5 DOF adjustment. For the other components, the LHC system is considered, with a wire providing vertical and radial offset and hydrostatic sensors. There is an addition of monitoring inside the system, with interferometers in a feedthrough of the cryostat and reflector, with the ability to achieve micrometric alignment level.

Then, the required changes are shown (slide 13 of P. Fessia's presentation). A reminder of the environmental conditions, as calculated and presented in the last integration meeting by C. Adorisio, show the cartography of the ultimate dose during LS4 in LSS5. At walking distance after one week of cooling, there are doses that exceed 2.5 mSv/h, and even after one month remain at 1 mSv/h, in some locations, inticating the need of remote alignment, when possible.

There are two solutions for determining the position of components: using sensors and inclinometers for continuous determination of position, or using remote instrumentation for a determination during TS and YETS, with local permanent targets in each component.

For the first solution, it is necessary to first test the integration feasibility of components, as the wire is already integrated and a support is needed for both methods. Then, it is important to estimate the cost and then a detailed design and integration should be undertaken.

The study started with collimators showing that it is indeed feasible, by adding a support, which can be dismantled during transport and then re-installed. For the second solution, there is the possibility of remote determination during YETS with a measurement train. It is developed for collimators in P7, and can be upgraded for this purpose. In this respect, O. Brüning inquires about the impact of this upgrade. H. Mainaud Durand answers that the configuration has to be changed with targets to the components and an upgrade of the camera and sensor. Other techniques could be also foreseen.

Regarding the solutions for adjustment, the idea is to standardise the support in order to enable the same type of adjustments and add knobs on the transport side. There are two possibilities, either with a permanent motorization enabling adjustment during operation or with plug-in motors for adjustments during YETS.

A micrometric supporting system for the CLIC project was developed that could be simplified and adapted for the LHC purpose. A short movie is also shown for the concept of the plug-in motor.

A summary of the different components and the proposed solutions to achieve the necessary performance are presented. Regarding cost, the remote determination per component corresponds to 30 kCHF, and the remote adjustment to 40 kCHF. It is important to find out if this budget can be allocated by the different WPs responsible for the hardware. To the question of O. Brüning on the cost impact of the train, H. Mainaud Durand replies that the design is still to be finalised and then if it could be shared by several projects.

In summary, technical solutions to achieve the required performance exist, for both determination and adjustment of position. The impact in the budget has to be further discussed.

Discussion

G. Arduini asks if the system for measuring the cold mass position could be made faster, i.e. running at 10 Hz, enabling the measurement of vibrations. H. Mainaud Durand replies that the current system has a response time of a few seconds, and for a faster measurement, the sensors have to be changed. O. Brüning asks if this is possible with a stretched wire. P. Fessia explains that the wire can measure the position of the cryostat and we assume that the cold mass follows it. L. Rossi asks if there is an optical system that can be faster. H. Mainaud Durand answers that interferometry needs a few seconds. P. Fessia, agreeing with the comment of G. Arduini on understanding the impact of vibrations, states that he contacted M. Bajko in order to investigate the possibility to do some measurements during the string test in SM18.

G. Arduini asks if it is not conceivable to attach the masks with their motor in the cryostat. P. Fessia thinks that this is not feasible, as bellows are needed and the component is quite heavy.

S. Claudet suggests to have a better estimation on the impact of direct radiation on the corresponding heat-load. H. Mainaud Durand replies that there will be a test this summer which will allow to have a better estimate within a few cm. S. Claudet adds that by knowing the total surface the impact on cryo could be better understood.

O. Brüning announces the formation of working group on alignment, co-chaired by P. Fessia and M. Giovannozzi, which will be formally presented with its mandate in the next TCC. This working group comes quite timely, as there are several topics to be followed up.

Status of crab cavity test in SPS, G. Vandoni - slides

G. Vandoni was asked to give an update on the status of the SPS CC installation progress with

respect also to the time available during the YETS. The outline of the presentation is given, including an overview of the SPS CC test scope, the master schedule and status, the YETS in the SPS and the SM18 test plans. The conclusions include the open points.

G. Vandoni proceeds by recalling the scope of the upcoming SPS CC tests. It is necessary to qualify the cryomodules with beam. The test of 1st cryomodule has to be done before LS2 in the SPS, with the 2nd cryomodule prepared during LS2. The LHC pre-series are currently in preparation, followed by series production and installation.

The master schedule is presented with the two cavities in preparation closely following each other and converging to the string assembly, the cryomodule and finally the installation in the SPS. The string assembly has started and the next milestone is the finalisation of the assembly by the end of July, followed by the next important milestone, the CM assembly in December.

Regarding the status of the cryomodules, the cavity 1 and 2 passed successfully the tests, achieving desired performance. L. Rossi would like to have more news on the results of the cavity 2 tests as they were not widely communicated. O. Brüning agrees that this is a good point to be addressed in the next TCC by a short AOB. G. Vandoni proceeds by explaining that Cavity 2 is not dressed, whereas Cavity 1 is dressed and includes pick-ups. There will be actually a review tomorrow with experts for a leak manifesting only in superfluid helium, observed most likely in the beam port of the cavity 1 or in a pumping line. RF tests are on-going and after some days a report could be presented. L. Rossi asks if this problem generated a delay or can be absorbed in the schedule. R. Calaga answers that there is indeed a contingency of 2 weeks which is eaten up by this problem. Regarding the cryomodule, the pieces are arriving, leak tests are done and it is assembled in SM18 in a dedicated area.

Regarding the SPS, the contract is made and the transport table arrives before the beginning of YETS for an installation during its duration. Regarding cryogenics, the helium buffer tanks were transported to BA6, and an underground visit with the refrigeration contractor is foreseen for TS2. The RF power is installed and will be pre-commissioned soon. The LLRF contract is placed and discussions are on-going with the potential supplier. There is also progress on the underlying infrastructure, including cables, connectors and water manifolds.

The SPS test stand area is presented, outlining the little space available in the SPS 4 m-wide tunnel. The YETS scheme is further detailed, with the transfer of the table at the beginning of the YETS, including a large amount of work between December 2017 and end of February 2018, where access is stopped, followed by cold check-out and HW tests for 4 weeks. The cryomodule arrives at the end of January, it is connected to the service box and work starts in December, followed by the refrigeration. The cold box and compressor installation are scheduled for mid-January to be connected to the distribution and start commissioning. Then, the cool down can start and access is forbidden for safety reasons. After the cooldown, leak tests will take place and the establishment of the safety chains. The earliest possibility for cooldown of the cryomodule in SPS is on the 23rd of February from the cryogenics point of view. The cooldown will occur during the cold check out were punctual access is still possible. L. Rossi suggested to include in the planning the date when beam is foreseen not only in the SPS but also in the LHC, as this is a harder constraint.

The mandatory tests in SM18 are the pressure test, safety release valves testing and vacuum components at cold. For RF safety, no test is mandatory as RF power is interlocked with the access in the SPS. For operation, it is important to check all instrumentation and the ability to cool down the cryomodule. Beam and installation vacuum should be validated, including the cavity position monitoring system.

The SM18 cooldown is not needed for safety issues and it is also not needed if the tunnel can be liberated in 6 days. However, logistical constraints into the SPS are more important, so that small problems could be indeed fixed there but larger ones need the SM18.

The sequence of tests for RF validation tests are also presented and mainly done at low RF power. They can be partially done in the shadow of the cool-down. The SM18 RF tests are desirable but not mandatory. The proper RF qualification requires more time than available in planning.

The planning of the SM18 bunker tests is displayed, where it is foreseen to prepare cryomodule to be connected to the service box and to be ready for cooldown after Christmas. The RF tests are done in the shadow and if possible more could be done including alignment tests.

In conclusion, there is no request for an extension of YETS. The milestone of the dressed cavity 1 test results in September is important to revaluate the schedule, but alternative scenarios are being studied. The SM18 tests represent an essential validation of the sequence and SM18 has the dedicated tools for repairs. Six days are needed from the beginning of warm up to getting out of the tunnel. L. Rossi asks is six days are also needed to get the system into the tunnel. G. Vandoni replies that actually nine days are needed for getting it into the tunnel, as it is important to test the leak tightness of the welds. Some derogation on pressure tests could be done. L. Rossi further asks if it is not possible to use an LHC TS to install the cavity. G. Vandoni replies negatively. O. Brüning concludes that there is indeed a loss of margin in the schedule but we are still on track. L. Tavian comments that in the SM18 schedule it should be taken into account that the cryogenics are stopped during Christmas, so there should be a period of restart included. S. Claudet replies that some margin is available, as the Isolde cavities do not require a cryomodule and can be warmed up before.

F. Bertinelli asks when the Y chamber is needed for the CCs. G. Vandoni replies that the exact sequence is not finalised yet but it would be desirable to have it available when the cryomodule is installed. She reminds that it should be coated and needs also qualification from the vacuum point of view. There was some recent rescheduling moving the installation from mid-October to mid-November, leaving adequate time for vacuum qualification. O. Brüning points out that from his understanding the next key point is the string assembly at the end of July. It would be desirable to come in the TCC at that time with a status report. He further asks if it is possible to do RF tests while the CC are in the tunnel in parking position. R. Calaga answers positively, this is indeed the foreseen operation.

Action: A report on the progress of the string assembly should be given in the TCC by the end of July.

AOB: Presentation of the memo on the e-lens organisation, F. Bertinelli - slides

F. Bertinelli reports on a document prepared for how three different groups will collaborate in the study of the hollow e-lens. O. Brüning stresses that it is a good initiative to have this document presented in the TCC as it affects several WPs. The logic is following the procedure for the collimators. There is a project leader (S. Redaelli) being charged with the overall coordination of the study, the equipment owner which is Beam Instrumentation (A. Rossi), and the mechanical and material work is under the responsibility of MME. This memo clarifies the responsibility of all parties. The project leader is responsible for the justification of the e-lens, the underlying beam dynamics and for managing budget. The equipment owner is responsible for the technical design (i.e. the technical systems required to run the HEL – control electronics, BI, etc.) and – in case of approval of the project - future long-term operation of the HEL. Then, the senior engineer (D. Perini) is responsible for the engineering design, optimal integration, the cost estimates for mechanics and materials, in case of approval of the project, supervision of fabrication drawings, components, etc.

O. Brüning mentions that the memo is attached to the TCC Indico site, and is good to disseminate in the project of how the HEL study is organised. L. Tavian asks if this equipment is part of the baseline. F. Bertinelli answers that it is a study as clarified in the document. O. Brüning adds that it would be desirable to have it in the baseline but it needs some clear cost and schedule integration optimisation, that have to be reviewed. L. Rossi agrees that the idea to have a pre-defined structure is good, as we target for a technical readiness review in September and this organisation helps in the coordination of activities.

AOB: Implications of civil engineering works next year on cabling in Point 1, B. Di Girolamo - slides

B. Di Girolamo reports on issues with old cables discovered in point 1, which is an old SPS point, in preparation of the CE tests. Actually, there were three unknown cables found, one identified as a telephone cable, a green one, which was found to be an old Ethernet cable and a black one, looking like an alarm cable and appearing to be going from BA6 to BA5. This is still not identified and thereby cannot be cut. Some more investigation took place, and found that this is a multi-contactor with shielding. Some steps were further done for completing identification. In the meantime, the document about the proposed length of YETS2017-18 was circulated and the HL-LHC project raised a warning concerning the cable issue, as during spring 2018 the CE work should start.

Further investigations to identify cables from BA6 to BA5 were undertaken and one cable was found as a possible candidate. It is in 1 km of distance between the two points. It is a cable 1009 which is a back-up cable of the alarm system. The uncovered part has no identifier, so it is difficult to know if this is the black cable. If it is this the one it is fine, as it is a reserve alarm cable that can be rerouted. During the next TS, the continuity of the cable will be checked including further electrical tests. If this is not the cable, more investigations are needed, probably uncovering it in longer length and try to find its destination. It is not likely

though that this issue will affect YETS. O. Brüning suggested that, as the TS tests will be known by the next TCC, they are presented in a short AOB.

AOB:

P. Fessia would like to announce that during the 26th of September a meeting will be organised for discussing what equipment repairs are for the nominal LHC and should be part of consolidation and what is part of HL-LHC. Machine parts will be mainly addressed followed by services. The necessary work is not presently known, but we need to identify the non-conformities that could becoming blocking in the HL-LHC configuration of the collider and discuss with the equipment groups.

The next TCC meeting will take place on the 13th of July 2017.