I.Bejar Alonso / M.Zerlauth

10th Meeting of the HL-LHC Parameter and Lay-out Committee

Participants: G.Arduini, V.Baglin, P.Baudrenghien, I.Bejar Alonso, O.Bruning, J.P. Burnet, S.Chemli, I. Efthymiopoulos, C.C. Gonzalez, P.Fessia, B.Goddard, R.Jones, C. Magnier, V.Montabonnet, H.Prin, S.Redaelli, E. Todesco, D.Wollmann, M.Zerlauth

Excused: -

The slides of all presentations can be found on the website and Indico pages of the PLC:

HL-LHC PLC/TC homepage: https://espace.cern.ch/HiLumi/PLC/default.aspx

Indico link: https://indico.cern.ch/event/325221/

Updated layout integration in IR5 left (P.Fessia - slides)

O.Bruning opened the meeting and reviewed the actions from the 9th PLC meeting. Concerning the approval of the new layout no objections have been received from any work package leader so far.

The discussion on studying the options of vertical cores (for the surface option for the crab-cavity RF power) will have to be postponed to the 15th of July when the relevant people are all able to attend. The result will be presented in a future TC meeting.

Work on studying the TAS aperture is ongoing in WP8, and should also be taken into account by WP5.

Concerning the action on the movable TAN, a first discussion within WP8 is foreseen for the 30th of – R.deMaria/G.Arduini for WP2 should also be invited.

The question of operating temperature for the corrector magnets has been clarified; all of them will operate at 1.9K (from Q1-Q6). This will be mentioned by P.Fessia in the following presentation.

The next layout iteration is planned for September/October this year, while the V1.1 versus the alternative for the Q4-Q5 types shall be shown in a TC in around a year from now.

Just before the USLARP meeting a presentation of the possible locations for the BBLR has been done, H.Schmickler is informed about the optimum position derived from this initial study.

E.Todesco is studying the situation for orbit correctors close to D2Q4. The space in the H/V plane is very tight and large crosstalk from between the two apertures and large multipole field errors are expected. The expected errors would have a sizeable effect on dynamic aperture There might not be enough longitudinal space for separated magnets unless nested magnets are considered.

HL-LHC Layout update ready for official release (P.Fessia - slides)

P.Fessia recalled that this presentation will be the final one before the approval of the presented layout version. Today's presentation will include the present reference from the TAS to the Q6 (included), currently only applied to 5R. It is the result of many separate discussions with the various involved work packages and groups and has been submitted to two reviews which yielded very useful comments from all main stakeholders. Additions have been done after these reviews still, namely concerning the completion of the naming convention, the inclusion of thermal contraction of the mechanical magnet length and the update of the corrector package following a first round of 3D magnetic optimizations.

The layout will soon be circulated as formal CDD approval after this meeting. It will contain a lateral view LHCLSXH_0001, a top view LHCLSXHT_0001 and an EDMS document providing for each magnet the magnetic center, magnetic length and BPM positions.

During summer the study of 5L, 1R and 1L to deal with the effect of the sloping tunnel will be completed along with an update of the 3D model of 5R.

P.Fessia highlighted the following issues that could still lead to important changes of the presented layout:

- No detailed design principle yet exists for the DFM object which is hence the only item which has not yet been introduced in the layout.
- The collimators to be installed between the TAXN and D2 do not fit into the available space and hence only the active length of the jaw is shown in the drawings. Other collimator options have to be identified or new hardware shall be developed.
- The correctors in the D2 and Q4 are in a very early development stage showing difficulty to deal with the cross talk between the 2 apertures. This could lead to the need of additional space allocations.
- The real needs for masks for the Q4, Q5 and Q6 will be revised during the summer by the energy depositions studies.
- The proposed approach for the alignment system is very invasive from a point of view of accessibility to the equipment for maintenance and may hence require investigating a completely new approach.

The TAS area might have to be completely redesigned because of the expected high levels of radiation, requiring for example remote tooling…

On the contrary the triplet is already quite well defined, with the corrector package (CP) located between the Q3b and the D1. At the interconnection between the Q3b and the CP a jumper connection is foreseen.

In the D1 the BPMSQ has been moved from the warm part into the cold part to solve the issue with the long non-bake able part after the D1.

O.Bruning asked whether the Q1, Q2, Q3 are supported by 3 feet or only 2. P.Fessia replied that they are drawn with 3 feet, but currently no clear baseline is defined. H.Prin commented that there is a proposal to use only 2 feet for these assemblies.

E.Todesco asked whether the sequence of correctors in the CP is till unchanged. P.Fessia confirmed this.

In cell 4 the BBLR have been integrated (assuming the worst case for longitudinal space, i.e. the e- gun with 2 elements of 10m each, and 8m of active part). An additional jumper has been placed at the beginning with an additional bellow for Vacuum equipment (bake out, connection for ion pump…).

The area between the TAXN and the Q4 is one of the most delicate ones, as there is not enough space for all equipment and both collimation and vacuum have agreed to investigate possibilities to modify these interfaces. The TAN (future TAXN) is still assumed as an LHC like object awaiting a first design of a movable version.

O.Bruning commented that the TAS aperture will be reassessed after summer and that it would be a good idea to look at the new TANX at the same time. P.Fessia and S.Redaelli agreed to attempt to review the situation and release a new layout before the next collaboration meeting (end of September). Currently there are some 3.8m 'free' in front of Q4 to eventually elongate the Q4 or place the correctors.

Stefano commented that the problem of longitudinal space is also coming from an influence of the 2nd beam. I. Efthymiopoulos should provide feedback on what length is required for the desired movable option.

G.Arduini asked whether in parallel the option of masks inside the cryogenic part should be studied, which would be more of an engineering type of study.

R.Jones added that the BPMs also need to be installed with a longitudinal offset, as one cannot get out the two instrumentation cables through the same instrumentation port.

The crab-cavity (CC) area now includes the recently agreed 4 modules/beam, which are integrated as 2 crab-cavities/cryo module. The space of connections between the CCs is needed for vacuum and instrumentation and has to be considered reserved space even if a final/detailed design does not yet exist.

P.Baudrenghien added that the CCs require a phase measurement of the beam at 400MHz (current pickups are only available in point 4). It would be preferable to be able installing one such pickup per beam per IP per side. If the bandwidth of the BPM proves sufficient (few Ghz required) maybe one could exploit the same pickup for the transverse plane and phase measurements. As a comparison, the pickup in IR4 is roughly 40cm long.

Between the Q4 and Q5 a rather long space is available, currently containing the roughing pump, the TCL to protect the Q5 from the collision debris, corrector magnets, and a VIA on either end of the Q5. Moving further to Q6 reveals no bigger issue of space in this region. The DFA has currently the same length as the present DFBA, as there is no particular need to reduce/optimize the length in this area.

P.Fessia concluded saying that the final version to be released will contain if possible as well the correct number of feet's of the triplet assemblies, the modularity of the TAN and the RF diagnostics for the crab-cavities.

S.Chemli added that the final CDD number will not be LHCLSXH_0001 but LHCLSXH_0010.

G.Arduini enquired about the BPMS in the triplet area. This will a priori be a design with tungsten shielding; BI still needs to perform the detailed engineering design which is also still pending final validation.

HL-LHC Parameter update (S.Fartoukh, M.Zerlauth - slides)

M.Zerlauth presented an updated version of the HL-LHC parameter table (prepared by S.Fartoukh), taking into account the RF curvature of the crab-cavities in the (generalized) geometric loss factor and a more precise calculation of the pile-up. The given RF parameters are reported more precisely following the LHC design repot for a Gaussian bunch distribution.

The parameters have been extended to include the BCMS scheme, and additional parameters like the number of bunches and collisions in the 4 experiments for the 50/25ns scheme, beam energy, pile-up density, parameters at injection… have been added.

Following a comment by O.Bruning, an additional footnote concerning the reduction of collisions in IR2/8 wrt to IR1/5 will be added.

S.Redaelli commented that, albeit the (peak) luminosity will normally never exceed the levelling vale of 5E34 cm^{-2} s^{-1} the agreed value used for equipment design (collimators...) includes 50% of design margin and hence is still considered as 7.5E34 cm^{-2} s^{-1}.

G.Arduini added that with the BCMS scheme emittances well below the 2.3µm will be possible at the SPS exit, even if we might not be able to fully exploit them in the LHC. An according footnote will be added.

P.Baudrenghien recalled that the minimum length of the abort gap must not only be maintained for the rise time of the dump kicker but it also contributes to the RF beam loading. Hence the current length of the abort gap of 3 μs must be maintained. An according footnote will be added.

The new set of parameters (Version 4.0) has been approved and has been published on the HL-PLC web-pages on the 5th of August 2014.