Minutes of 107th Collimation Upgrade Specification Meeting

Participants: C. Bahamonde (CB), A. Bertarelli (AB), R. Bruce (RB), F. Carra (FC), H. Garcia Morales (HG) (scientific secretary), M. Grosso (MG), J. Jowett (JJ), D. Kodjaandreev (DK), A. Lechner (AL), A. Mereghetti (AM), J. Molson (JM), L. Nevay (LN), K. Puthran (KP), P. Racano (PR), S. Redaelli (SR) (chairman), R. Van Weelderen (RvW).

Indico event [here].

1 Actions

Actions from this meeting:

- FLUKA team: quantify and redefine the scaling approach for IR7 losses.
- FC: review the need for masks on both apertures of each protected matching section quad: Q4, Q5, Q6.
- SR and FC: study of the mask shielding integration in the HL-LHC.

2 AOBs: Crystal Collimation Day and status of LS2 ECRs (S. Redaelli)

- SR comments on the status of the LS2 ECRs which can be consulted in the ColUSM website.
- SR announces that just after the HL-LHC annual meeting held at CERN, there will be a dedicated day for crystal collimation studies where a summary of the current activities will be presented. The meeting mandate and agenda can be consulted at the [https://indico.cern.ch/event/752062/overview](https://indico.cern.ch/event/752062/overview)

3 Update of the TCAPM (L. Gentini) [slides]

3.1 Summary of the presentation

- LG presents the update on the design of the TCAPM absorber. He shows an overview of the absorber including the support. He summarizes the weight of the different components for a total mass of 2.6 tons.
- LG shows the assembly procedure in surface and the alignment both in surface and in the tunnel. The transport in surface will be done using a crane while in the tunnel will be done by 2 transport carriages.
- LG explains that the integration is exactly the same for B1 and B2 and new holes are required in the tunnel floor.
• LG summarizes the status: the design and drawing is complete and the manufacturing is expected to last about 1 year with a cost of about 100kCHF for 2 units. The installation is expected for mid 2020.

3.2 Discussion
SR recalled that the final ECR is in preparation. He is the main editor of this ECR and is still pending a chapter on the vacuum layout, which will be provided by G. Bregliozzi (Action to complete the ECR: SR with input from VSC).

• The working group approved the new design. A few aspects need to be sorted out for the final ECR document.
• Final decision on the BLM previously attached to the magnet that will be removed: SR stated that this is not needed for the operation. He will check with C. Zamantas if it can be removed.
• SR will also contact the SU team to have an explicit OK on this design.
• as pointed out by Ph. Schwarz, there is a potential issue with a electrical junction box located under the magnet that will be replaced. SR will check with integration and EL how to proceed with that.
• Otherwise, the TCAPM design presented here is approved.

4 Update on IR7 losses from 2018 experience (R. Garcia Alia)

4.1 Summary of the presentation
• RG presents the update on IP7 losses from 2018 experience. He presents the assumptions taken for a scenario of $10^{18}$ protons lost for 3000 fb$^{-1}$ for the HL-LHC. RG shows the comparison of the simulated dose in the IR7 region with the measured dose for the 2015 run. Then, RG shows the scaling of lost protons for the different runs until HL-LHC.

• RG shows how the losses evolved along the years 2016, 2017 and 2018 including examples of the representative fills each year. In 2016, B1 losses are higher than B2 but there was a quick ramp down of losses in stable beams. In 2017, the impact of the crossing angle levelling is already visible in losses. In 2018 there is a strong impact due to quasi-continuous crossing angle and $\beta^{*}$ levelling. Finally, RG shows the situation in IR3 and DS sections.

• RG concludes that the 2018 measurements reveal that the integrated intensity normalized losses in IP7 increased by a factor 2-3 with respect to previous measurements in Run 2. These losses are linked with the crossing angle and beta levelling. The situation in 2018 is near the limit in terms of IR7 losses and this case is more representative of the HL-LHC scenario. Therefore, **ACTION:** the scaling approach for the HL-LHC to be quantified and redefined.
4.2 Discussion

- RdM asks about how total integrated luminosity is estimated. RG says that this is estimated following Andrea Apolonio’s availability model.

- SR asks about the specific aspects that make of 2018 run more representative for HL-LHC. RG replies that the main aspects are the crossing and beta levelling.

- SR asks about the radiation resistance of the warm magnets in these conditions. AL answers that there is still a significant margin.

5 Review of mask layouts for the HL-LHC IR1/5
(F. Cerutti)

5.1 Summary of the presentation

- FC gives a review of the mask layouts to be installed for the HL-LHC in IR1/5. He shows the new matching section including the masks in front of Q4, Q5 and Q6.

- FC shows a summary of the power density and dose on the different magnets of the region. He presents the two different mask designs (TCLM4 and TCLM6) made of inermet with an inner layer of 1 mm of copper. The length of the masks is 1 m.

- FC presents the alignment requirements. He explains that the warm masks are designed to match the beam screen aperture of the respective magnet.

- He shows that the peak dose in the first Q4 corrector inner coils is expected to rise from 7 to 35 MGy (for 3000 fb-1) in case of a 2 mm misalignment of the mask.

- He explains that in the present machine there is in place a dedicated shielding for the RR alcoves consisting of 4 concrete blocks on the beam line (plus an additional iron block - ALFA related - in Point 1). Towards the HL-LHC, there is the need to assess the interest in installing iron shielding in the location of the TCLM5 and TCLM6 space reservations. This is to be followed up as for the moment not such studies were performed for HL.

5.2 Discussion

- AB wonders what would happen if the thickness of the inner copper layer is 2 or 3 mm instead. FC replies that there would be no significant change although he will crosscheck. SR replied that in light of the number presented, we assume that there is no need for cooling. The detailed mask design will tell if this conclusion can be confirmed.
• AL asks about the cooling system of the mask system. SR replies that this needs to be answered yet.

• SR comments that there shielding of the masks migh clash with the lack of space in the HL-LHC. **ACTION**: He proposes to launch a quick study if this is really needed.

• There was a discussion on the number of masks. SR recalled that presently, it was assumed to have all mask (3 per beam per IP) covering both apertures of the magnets Q4, Q5 and Q6. This should be taken as input for the first design work. In parallel, the FLUKA team can review if for all magnets, both apertures really need protection (action).