Minutes of 108th Collimation Upgrade Specification Meeting

Participants: R. Bruce (RB), F. Carra (FC), M. d’Andrea (MdA), N. Fuster (NF), H. Garcia Morales (HG) (scientific secretary), A. Gorzawski (AG), A. Mereghetti (AM), D. Mirarchi (DM), J. Molson (JM), L. Nevay (LN), M. Patecki (MP), P. Racano (PR), S. Redaelli (SR) (chairman),

Indico event [here](#).

1 Actions

Actions from this meeting:

- Explore the possibility to perform scraping tests with ion beams (AG).
- Perform a comparison of diffusion speed measurements performed in different years/conditions (AG).

2 Review of aperture with remote alignment
(R. De Maria) [slides]

2.1 Summary of the presentation

- RdM presents a review of the aperture estimations taking into account remote alignment. He shows a summary of the changes in the layout with respect to the baseline concerning Q4 and Q5 (from version 1.3 to version 1.4 of the HL-LHC optics).

- RdM shows the aperture margins for round and flat optics before taking into account remote alignment. Then he shows the aperture estimates once the remote alignment is included. The minimum aperture is $13.1$ and $12.7 \sigma$ for round and flat optics, respectively, and is always found in Q23. RdM explains that WP8 could evaluate if a reduction of a few mm of TAXN aperture gives measurable improvements in the energy deposition.

- RdM shows the details on the aperture specifications for TCLX-TCTX and the aperture for vacuum layout. WP12 requested the beam envelope without any mechanical alignment and fiducialization. In general, the aperture is consistent with the present hardware and avoids additional aperture bottlenecks.

- Finally, RdM shows the details of the aperture for the TCT and TCL. He explains that due to the 30 mm stroke the TCT.6 and TCL.5 do not need remote alignment. It was noted that the full aperture is beyond that of the magnet’s beam screen.
2.2 Discussion

- After a general discussion, the working group agreed that there is no need for the implementation of remote alignment for TCL5 and TCL6. Therefore, this system will be required for a total of 20 collimator under the responsibility of WP5: two TCTX, one TCLX and 2 masks per beam per IP.

- RdM explains that the IP shift without any re-alignment (remote or manual) is very limited. The bump we can do today in the LHC, will make crab cavities un-operable and there is not enough orbit corrector strength to reach 2 mm of IP shifts.

- SR asked if the HL-LHC performance requirements can be fulfilled without remote alignment. RdM replies that indeed, the remote alignment is required.

3 Results of beam diffusion measurements in the LHC at 6.5 TeV (A. Gorzawski) [slides]

3.1 Summary of the presentation

- AG presents the results of the beam diffusion measurements carried out in the LHC at 6.5 TeV. He starts explaining the main factors that contribute to the diffusion of the particles. He explains the measurement technique based on collimator scans via both collimator steps inwards and outwards.

- AG explains the model used for determining the diffusion speed. The same model was used in previous LHC measurements and the Tevatron. The observables are the loss rates as a function of the collimator position. The loss rates are obtained from the ionization chambers (IC) at 100 Hz and the diamond BLMs (dBLM) at 1 Hz. AG summarizes the possibles sources of errors and recalls the measurements done at 4 TeV.

- AG then shows the results of the measurements from the last campaign with a varying number of bunches in the machine and always performed as an end of fill scans with beams in collisions. He shows first the results on the beam tail reconstruction which are clearly overpopulated compared to a Gaussian reference distribution.

- The diffusion speed varies from $8 \cdot 10^{-12}$ to $1.1 \cdot 10^{-8} \mu m^2/m$ for the actions between 0.006 and 003. AG shows the differences between this year measurements and previous years and explains the relationship between emittance and diffusion which seems to be in agreement with observations.

- AG explains that the results of the 1Hz loss rate data is in a good agreement with the 100 Hz data. A slight difference was observed between colliding and non colliding bunches.
• AG concludes that the obtained values of the diffusion speed are in larger spread than the ones obtained at 4 TeV and many differences were found with respect to the previous measurements. AG plans to complete the analysis of the data set with bunch by bunch data and train by train data from the BLMs.

3.2 Discussion

• SR comments on the importance of having a comparison of all measurements. AG comments that a comparison with profile reconstruction using collimator scrapings will be done.

• RB suggests to do the measurement as and end of fill during the ion run. He asks about how long would it take to perform the measurement. AG replies that a proper diffusion measurement takes between 1.5 h and 2 h. SR points out that spikes during the collimator scraping might be particularly high with ions.