Minutes of 9th Collimation Upgrade Specification Meeting

Participants: R. J. Barlow (RJB) (Huddersfield University), A. Bertarelli (AB), R. Bruce (RB), R. de Maria (RdM), L. Lari (LL), A. Marsili (AM) (scientific secretary), D. Mirarchi (DM), V. Previtali (VP) (Fermilab), E. Quaranta (EQ), B. Yee Randon (BYR), S. Redaelli (SR) (chairman), J. Resta Lopez (JRL), A. Rossi (AR), B. Salvachua (BS). Remote: M. Serluca, J. Molson.

1 Update on the loss maps simulations of the ATS optics (A. Marsili)

Slides are available at this link.

1.1 Summary of the presentation

AM presented an update on the multi-turn cleaning simulations with the ATS optics, as a follow of various actions identified at the last ColUSM. New simulations were ran with the dedicated dispersion correction flag ON as pointed by RdM. AM presented plots showing that the dispersion along the ring is now correct. This solved the problem of beam impact parameters too high on the primary collimators. AM also updated the tables with the correct values of crossing angles in IP1 and IP5.

AM also corrected his script that shows the impacts in the different collimators. Before, it assigned to the TCP particles that were actually impacting on other collimators, resulting in too large impact parameter. AM shows the distributions of impacts for various simulations configurations. The simulation setup is now consistent to what is used for the standard optics.

AM presented the percentage of particles hitting the primaries and the first impacts distributions for both cases. It was found that about 0.9 % of input particles touch first a collimator different than the TCP. This problem must be understood [**Action: AM**].

AM presented the new loss maps with the corrected simulation setup. The distribution of particles absolved in the collimators around the ring looks now more reasonable (as opposed to the previous simulations with large impact parameters that showed losses only in IR7). The simulation setup includes the loss maps calculations however the aperture model in the IRs is not updated for the ATS layout. This will be done as next step [**Action: AM,SR**].

1.2 Discussion

RdM asked if there will be simulations of collimation cleaning also for the different optics configurations, as there are presently different options for β^* values. SR replied that this will be the case. He also commented that we should perform the simulations at intermediate cases during the ATS pre–squeeze, in order to validate the collimation performance for the full squeeze functions.

SR reported a problem encountered by BYR with the simulations setup of SixTrack with collimators and crab cavities: BYR found wrong distributions of particles absorbed in the collimators. SR suggested the BYR and AM cross check SixTrack input files to make sure

that they are using the same configuration for the ATS simulations with collimators [**Action: AM/BYR**].

SR also pointed out that the loss maps should be presented in normalized units to allow the calculation of cleaning inefficiency.

2 Measurements of TCL losses in physics fills (A. Marsili)

Slides are available at this link.

2.1 Summary of the presentation

AM presented the analysis of the data from the TCL scans performed on the 4th of July 2012. The TCLs are absorbers for physics debris, located on both sides of IP1 and 5, and set at $10\,\sigma$ since 2012. The scans consist in moving the jaws out ($60\,\sigma$) and then back in. Symmetric scans with both jaws at the same time and asymmetric scans with one jaw moved at a time were performed. Only the symmetric scans were considered in this first analysis.

The data analysis is done by normalizing the measured BLM signals with the instantaneous luminosity at the experiments. Losses at different warm and cold elements in the IR are given as a function of time and of TCL gap. The longitudinal profile of the ratios between the losses with and without the TCL was also presented.

When TCLs are set to 10 sigmas, there are higher losses in elements immediately downstream ($\sim 20\,\mathrm{m}$) but the losses decreases in the cold magnets up to the Q8, by a factor up to 50. The losses at the Q9 are not affected significantly by the TCL settings.

AM presented the normalized losses plotted versus the collimator gap. There is an excellent reproducibility between a scan out and a scan in after normalizing with the luminosity signal. The detailed behaviour observed at the different elements must be understood by comparing the measurements with detailed tracking and energy deposition studies. AM is working on the setup of these simulations with SixTrack.

2.2 Discussion

It was pointed out that AM do not use the appropriate collimator layouts for B1 and B2 in the plots. This will be corrected.

RB commented that according to FLUKA simulations, IR5 should be worst that IR1 in term of losses in the cold magnets. Is this conclusion confirmed by the measurements? AM replied that he did not compare the absolute loss rates in the 2 IR's. This will be done [**Action: AM**].

3 Status of non-linear collimation system (J. Resta Lopez, L. Lari)

Slides are available at this link.

3.1 Summary of the presentation

JRL introduced the non-linear (NL) collimation concept: it uses extra non-linear optics elements (sextupoles, octupoles) to increase the beam size to allow the collimators to be more retracted. This concept was originally developed for high-energy linear colliders and then adapted to the LHC by adding closed non-linear bumps in IR7. This work is being carried out in collaboration with the University of Valencia (SP).

JRL presented the collimator settings used, where TCSGs located within the non-linear bump are used as primary collimators, and the preliminary beam tracking studies.

LL presented the cleaning efficiency studies, comparing the non-linear collimation system with the current one. Losses in the collimators in IR2, 3 and 8 are larger for the NL scheme whereas the local cleaning in the DS of IR7 is roughly the same as in the present system. LL also presented energy deposition studies done with FLUKA from the SixTrack loss maps, and the peak power density in primary and secondary collimators. The focus of present studies is to see if a NL scheme could be integrated in IR3. The effect on multipole errors and of other imperfections will also be studied. The possibility to study this scheme with beam at the SPS is also ongoing.

3.2 Discussion

RdM asked if it is normal that the dispersion in IR7 is not zero for the NL system. SR replied that also for the present system it is not null.

RB asked if the failure cases were studies for this layout. For example, can we maintain the same phase-space coverage as for the present system? This studies have not been done yet. JRL and LL agree to follow this up. SR suggested to verify if the NL bump remains closed also for trajectories of particles that experience an asynchronous dump.

4 Next meeting

The next meeting will be held on:
27th July 2012, 16:00–17:30. Room: 874-1-011 (above CCC).

Tentative agenda:
V. Previtali: Hollow electron lenses.
J. Molson: Status of loss maps simulations with Merlin.