



# Special WP2/WP5 Meeting

Tuesday 24<sup>th</sup> August 2021, 9:00 – 12:00

*Chair:* Stefano Redaelli, Rogelio Tomás

*Speakers:* Björn Lindström

*Participants (zoom):* Gabriella Azzopardi, Hannes Bartosik, Roderik Bruce, Xavier Buffat, Rongrong Cai, Federico Carra, Fritz Caspers, Gregory Cattenoz, Mario Di Castro, Joschua Werner Dilly, Alex Fomin, Brennan Goddard, Pascal Dominik Hermes, Gianni Iadarola, Anton Lechner, Nicolas Mounet, Laurie Nevay, Joao Oliveira, Yannis Papaphilippou, Konstantinos Paraschou, Marcin Patecki, Tobias Persson, Axel Poyet, Belen Maria Salvachua Ferrando, Matteo Solfaroli Camillocci, Natalia Triantafyllou, Frederik Van Der Veken, Markus Zerlauth

## AGENDA

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## MEETING ACTIONS

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<b>WP5 and Riccardo</b>	Clarify that Beam 1 IR7 losses really come from new optics and, if so, seek for mitigations
<b>All</b>	Address the last open points of the Run 4 scenario document. Aiming to distribute a complete draft before HL-LHC annual meeting.

## GENERAL INFORMATION (STEFANO REDAELLI, ROGELIO TOMÁS)

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The minutes of the [193rd WP2 meeting](#) and [194th WP2 meeting](#) have been circulated.

Regarding the minutes of the last meeting, comments were provided by **Riccardo**: a study in the back-up slides of **Sofia**'s talk shows that DA with a reduced crossing angle is better after phase advance optimization. **Riccardo** highlighted that this is to be kept in mind as well as the fact that a large crossing angle increases the sensitivities to field imperfections and reduces the cross talks between the two beams (which is the reason for the increase with respect to the previous scenario). The last two effects are not quantified as far as he knows. **Sofia** answered to the comment by saying first that indeed these results still lack a clear understanding why the DA improves when reducing the crossing angle and applying a phase advance optimization. She also mentioned news on the phase advance optimizations for the start of leveling ([results](#)), where she followed the same approach as the injection studies (full tune scans for two IP1-5 phases that looked optimal, namely  $D_{\text{mux}+}=0.1/D_{\text{muy}+}=0$  and  $D_{\text{mux}-}=0.15/D_{\text{muy}+}=0$ ), showing some general improvement. Still, in the regime of interest (tune split of  $5e-3$ ) only a few working points that meet the DA target appear, hence the improvement is not very significant. For the range under investigation  $D_{\text{mux}-}=0.15/D_{\text{muy}+}=0$  is the best phase shift with two acceptable working points.

The schedule of the meeting then followed as foreseen.

### 1. COLLIMATION STUDIES FOR RUN 4 (BJORN LINDSTROM)

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**Björn** presented the collimation studies that he performed for the Run 4 configuration. The previous collimation studies for HL-LHC were performed with the optics version 1.3. These studies are instead done with the optics version 1.5. Moreover, the aperture model has been improved using the layout database, relaxed collimator settings are implemented to improve beam stability, the TCLDs are expected not to be available.

With tight collimation settings, simulated loss maps for v1.3 and v1.5 are similar for  $\beta^*=15$  cm. Nevertheless, TCT losses are visibly different and 15% more DS losses are observed in B1 (which should be acceptable as they are in line with B2). The increased losses in beam 1 can be explained by the larger single pass dispersion in IR7.

When the relaxed collimation settings are applied, the global inefficiency increases by 10% and the DS losses increase by 7%. B4V TCT losses in IR1 reach  $1.2e-3$ . Observing the minimum scattering angle at the TCTs shows no concern at  $\beta^*=20$  cm. Instead there might be issues for  $\beta^*=15$  cm, which could be mitigated by adjusting the phase advance, retracting the TCTV in IR1, or inserting the TCP.D or the TCS.

Simulations have been run also for  $\beta^*=20$  cm, with results similar to  $\beta^*=15$  cm except for the TCT losses. The case  $\beta^*=64$  cm was also simulated, finding a larger collimation inefficiency by 6%.

Energy deposition simulations (FLUKA) should be performed for the final validation of these scenarios.

- **Nicolas** asks whether the solution of closing collimators could be applied only at the end of the fill, as this would solve the issue coming from instabilities. **Stefano** answers that moving the primaries in stable beams is challenging because there are concerns about loss spikes (even with e-lens, it remains to be demonstrated that this is possible in standard operation). Moving secondaries is easier in this sense. **Roderik** comments that the margin between primaries and secondaries is tight. Therefore, it might be challenging to guarantee that the hierarchy is not broken.
- **Rogelio** mentions that the goal to finalize the 15 cm scenario can be set for 2022. Therefore, there is time to address the different mitigation options. One possibility that could be studied is to move the TCPs very slowly.
- **Rogelio** asks whether the update of the layout database is being followed up. **Bjorn** answers that it is being followed up by Riccardo and that the most recent version is much better than the past ones.
- **Stefano** comments that plans to perform final validations with energy deposition studies have been discussed with **Anton Lechner**. They can be carried out only after the annual meeting. In particular for this study the FLUKA simulation model needs to be updated with the most recent layout. The post-doc active on these studies finishes in Sep. and a new one needs to be trained.
- **Rogelio** asks whether, without Fluka simulations, we can already consider the 20 cm scenario validated. **Stefano** answers that these simulations look encouraging, and that no surprises are expected. **Roderik** added that it would be good to recover the degradation from the dispersion in IR7 (**Action: WP5 and Riccardo**).
- **Gianni** asks whether it is possible to validate the hypothesis that the source of larger losses in the DS is indeed the dispersion, by changing the energy deviation of the particles. **Roderik** answers that this needs to be done by changing the scattering model, because the losses come from secondary particles from the collimators.

## 2. DISCUSSION ON RUN 4 OPERATIONAL SCENARIOS (ALL)

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The draft document with the updated operational scenario is reviewed by **Rogelio**.

- A few values that still need to be finalized are highlighted.
- **Elias** suggests that management decisions that determined changes with respect to the previous document could be spelled out.
- The addition of the Full Remote Alignment System should be mentioned.
- **Stefano** mentioned that, if limitations from loss spikes are observed in Run 3, the commissioning of the electron lenses must be advanced and decoupled from the commissioning of the CCs.

- The transverse damper settings should be finalized. **Xavier** mentions that one could assume 50 turns damping time and bunch-by-bunch bandwidth at flat top and 10 turns damping time and low bandwidth in collisions (to mitigate crab cavity noise).
- **Rogelio** mentions the comment from **Tobias** to add that to achieve the specified coupling control requires dedicated fills with a special filling scheme once every two weeks.
- **Xavier** and **Gianni** mention that the chromaticity in collision can be specified at 15 units. Nevertheless a comment could be added saying that it should be possible to reduce it in collisions to improve DA.
- **Nicolas** mentions that another parameter might need to be included to fully define the Q-Gaussian profile (after the meeting, it was clarified that no other parameter is needed).
- **Gianni** mentions that the plot with the DA at injection combines the emittance of the standard beam (2.3  $\mu\text{m}$ ) and the octupoles needed for the BCMS (1.5  $\mu\text{m}$ ). It would be better to rescale the DA in the plot using 1.7  $\mu\text{m}$ , consistently with the BCMS scenario.
- **Gianni** suggests removing the sentence on TDIS settings to mitigate possible e-cloud issues as low-SEY coatings are applied in these devices.
- **Roderik** asks whether the collimator settings in millimeters could be removed.
- It is suggested to explicitly mention at the beginning of the document that these scenarios refer to optics version 1.5.

### 3. ROUND TABLE (STEFANO REDAELLI, ROGELIO TOMÁS)

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The next WP2 meeting is not yet definitely scheduled - it should take place on September 7th.

*Reported by Gianni Iadarola*