



# 216<sup>th</sup> HiLumi WP2 Meeting

Tuesday 25<sup>th</sup> July 2023, 09:30 – 11:00

*Chairs:* Rogelio Tomas

*Speakers:* Thomas Pognat, Hannes Bartosik.

*Participants (15):* Yannis Angelis, Hannes Bartosik, Roderik Bruce, Xavier Buffat, Lorenzo Giacomel, Lotta Mether, Nicolas Mounet, Konstantinos Paraschou, Thomas Pognat, Giovanni Rumolo, Rogelio Thomas

## AGENDA

---

<b>Meeting actions</b>	<b>1</b>
<b>1. General Information (Rogelio Tomas)</b>	<b>1</b>
<b>2. Follow-up on MQXFA simulations (Thomas Pognat)</b>	<b>2</b>
<b>3. News from the LIU beam performance ramp-up (Hannes Bartosik)</b>	<b>2</b>
<b>4. AoB</b>	<b>2</b>

---

## MEETING ACTIONS

---

### Actions:

- 1: Rogelio** Contact WP3 to ask for MCBXF field errors to continue study of field quality.
- 2: Hannes** Plan bunch-by-bunch reproducibility study in the SPS.

(see [action list](#) on the WP2 webpage, for the complete list of current actions).

## 1. GENERAL INFORMATION (NICOLAS MOUNET)

---

Nicolas reported on the recent news:

- TCC 06/07: WP2 was asked to check the EDMS document (with extra time given) on FRAS hazard identification, risk analysis and protection layer ([EDMS 2727128](#)).
- TCC 20/07: The cost and schedule review was announced for 13-16 November.
- Many discussions around the Run 4 baseline (and pile-up) have been taking place following the HL Coordination Group meeting in June.

Minutes of the last meeting were circulated, and they were approved.

## 2. FOLLOW-UP ON MQXFA SIMULATIONS (THOMAS PUGNAT)

---

**Thomas** presents a follow-up on MQXFA simulations after the report that the field errors a4 and a6 for the prototype magnets are larger than anticipated. The simulations consider the field quality of all HL-LHC magnet families except MCBXFs, for which the data is not available. The simulations show that the IT correctors MCOSXF and MCTSXF can effectively mitigate the decreased field quality as there is no impact on the DA with correction. The required corrector strength is nevertheless increased with the increased errors. Although the required strength stays within the specifications, reaching at most up to 70% of the maximum strength, the available margin is reduced. Without correction, in particular the a4 field error significantly reduces the DA, while the impact of a6 is small.

Discussion:

- **Rogelio** summarises the conclusions from the study to be passed back to WP3: The increase in field error is OK, but it comes with a reduction in margin on corrector currents. MCBXF errors are not included in the analysis, and it is now necessary to obtain the expected field errors for MCBXF so that a full study with final field quality of triplet and MCBXF magnets can be done. (**Action: Rogelio** to contact WP3.)
- **Nicolas** asks for clarification about the expected DA for a6R without correction on slide 14 and **Thomas** explains that it is close to the middle simulated a6R value, while the column marked 'new' on the right is the expected DA with all the errors in.
- **Rogelio** asks if the corresponding simulations with flat optics have been started as well. **Thomas** confirms that he has started but says there are still many simulations that remain to be done.

## 3. NEWS FROM THE LIU BEAM PERFORMANCE RAMP-UP (HANNES BARTOSIK)

---

**Hannes** recounts the status of the LIU beam performance ramp-up. As expected, both in the PSB and the PS, the LIU performance was quickly achieved after LS2, while the SPS is foreseen to reach the LIU target by the end of 2024. Whereas the PSB has been delivering beams of LIU brightness and beyond since 2021, the standard production scheme beam in PS reached LIU brightness after the commissioning of the 3eVs longitudinal emittance in the PSB in 2022 with the BCMS beam following closely behind.

In the SPS, the intensity ramp-up goal for 2022 of  $1.8e11$  p/b was reached with the BCMS beam, but the intensity and train length were strongly limited by vacuum pressure rise in the injection and dump kickers at flat top. After a long scrubbing in 2023 with dedicated measures to increase scrubbing efficiency at flat

top, the standard beam with 288 bunches and  $2.2 \times 10^{11}$  p/b could be accelerated to flat top with a bunch length of 1.6 ns and around 95% transmission (excluding scraping). With the commissioning of the new RF system nearly finished, longitudinal beam stability and bunch length control are very good. Impedance-induced instabilities can be mostly mitigated by chromaticity, octupoles and the transverse damper, although precise tune control is required for the latter. For the standard beam, the LIU target brightness was reached at the end of the flat bottom (the BCMS beam has not yet been studied in 2023), but large transverse tails remain, despite successful mitigation measures in the PSB and PS. With the 8b+4e beam, two trains of 56 bunches with  $2.2 \times 10^{11}$  p/b were accelerated to flat top in the single study performed so far in 2023, overcoming the 2022 limitation from pressure spikes around the 800 MHz cavity.

Discussion:

- **Rogelio** asks about the conditioning time that is required in general. **Hannes** replies that the limitations are mainly caused by critical elements such as kickers, septa, and cavities. Some of these show a seemingly non-reproducible behaviour, which makes scrubbing more difficult. However, even in general parts of the machine, after each intervention a possibly significant amount of time will be needed to recondition the sector and one should consider measures that could be taken to reduce this time. In addition, deconditioning of the surfaces is also still a concern and more experience is needed to fully understand the phenomenon.
- **Rogelio** asks if there will be more MD time this year to advance on some of the outstanding issues. **Hannes** confirms that there most likely will be more time. The top priorities for the coming studies will be to push the bunch intensity to  $2.3 \times 10^{11}$  p/b with the standard beam, and to continue the studies on the transverse tails. If there is more time after this, it could be used for trying to progress on the ramp-up of the 8b+4e beam. Overall, it will be possible to progress on some of the outstanding issues, but not all.
- **Rogelio** proposes to look also at the bunch-by-bunch reproducibility. **Hannes** confirms that he will add it to the list of outstanding issues. (**Action:** **Hannes** to plan bunch-by-bunch reproducibility study in the SPS.)

## 4. AoB

---

Concerning the Cu-coating on TCSPM taperings, the conductivity of the coating cannot be measured. WP5 is asking if this is ok for us and **Nicolas** thinks it's probably fine as long as we know there is coating. The taperings are not currently in the impedance model but are being added. This point will be brought back when the impact of taperings on impedance/stability are presented.

There will be a short crab-cavity SPS MD on July 26<sup>th</sup>, checking in particular the e-cloud effect with 8b+4e vs 72 bunches.

The next meeting will be announced in due time and could take place in a few weeks' time.

*Reported by Lotta Mether*