# rMPP meeting on MD2 2022 approval

The meeting took place on **October 28th 2022, 10.00-11.30,** via zoom.

Participants: Chiara Bracco (SY-ABT), Roderik Bruce (BE-ABP), Andy Butterworth (SY-RF), Felix Simon Carlier (BE-ABP), Marco D'Andrea (BE-ABP), Maël Le Garrec (BE-ABP), Pascal Hermes (BE-ABP), Cedric Hernalsteens (TE-MPE), Michi Hostettler (BE-OP), Anton Lechner (SY-STI), Björn Lindström (BE-ABP), Ewen Maclean (BE-ABP), Lotta Mether (BE-ABP), Daniele Mirarchi (BE-OP), Filip Moortgat (EP-CMG), Konstantinos Paraschou (BE-ABP), Brian Petersen (EP-ADT), Volodymyr Rodin (SY-STI), B. Salvachua Ferrando (SY-BI), Rende Steerenberg (BE-OP), Guido Sterbini (BE-ABP), Jan Uythoven (TE-MPE), Arjan Verweij (TE-MPE), Christoph Wiesner (TE-MPE), Daniel Wollmann (TE-MPE)

The slides of all presentations can be found on Indico. The MD procedures can be found on ASM.

## 1 Introduction

J. Uythoven welcomed the participants. He detailed that, prior to the meeting, rMPP members had reviewed the MD procedures and selected two MDs (#8043 and #7224) that will be presented in more detail. In addition, comments and questions to several other MDs will be given and discussed.

## 2 rMPP comments on MDs

The initial rMPP comments and questions can be found here. The following remarks and clarifications were given in the meeting:

- MD#6805 (Instability growth rate at injection) - Lorenzo Giacomel
  - **The collimator settings and limits should be explicitly stated in the MD procedure.**
    - R. Bruce commented that the MD plan is to inject single pilot bunches and then close the primary and secondary collimators in IR7 to have higher impedance. He remarked that the exact collimator settings are not yet defined but that similar steps as for an MD performed in 2018 (injection with tighter settings) are envisaged. **R. Bruce agreed that the settings should be clearly defined in the MD procedure and added that he would transmit the message to the MD requesters.**
- MD#6945 (RF power limitation and instability thresholds) - Rama Calaga, Theodoros Argyropoulos, Helga Timko, Ivan Karpov
  - For simplicity, an **operator dump (switch) should be used instead of a programmed dump during the ramp.** A. Butterworth agreed.
  - J. Uythoven recalled that there are other machine elements beyond the RF system that might limit the bunch intensity. Therefore, **the involvement of ADT and injection experts should be ensured.**
  - J. Uythoven recalled that **the Run 3 limit is $1.8 \times 10^{11}$ protons per bunch (ppb) and the MD should be limited to this value**. A. Butterworth agreed.
  - C. Bracco commented that the protection elements could accept higher intensities, but the challenge would be the injection of the high-intensity trains.

- MD#7203 (Rematched IR7 optics for improved cleaning performance and impedance - Part II) – Bjorn Lindstrom
  - J. Uythoven asked why the updated MD procedure foresees the use of a nominal bunch for MD part 2. B. Lindstrom answered that the nominal bunch is required for the impedance measurements.
  - **The needed custom beam requirements must be defined and filled in the MD request. B. Lindstrom confirmed that it will be updated accordingly.**
  - Replying to a question from D. Wollmann, B. Lindstrom clarified that the first fill will be used for optics measurements using the AC dipole, while loss maps will be performed in the second fill.
- MD#8403 (E-cloud heat load scaling with intensity) and #8404 (E-cloud heat load with 8b4e with 1.8e11 p/b) - Lotta Mether, Konstantinos Paraschou
  - The limit of the bunch intensity is $1.8x10^{11}$ ppb. **For the high bunch intensities, the support of ADT and Injection experts have to be ensured where required.**
  - C. Wiesner confirmed that **it is considered acceptable as proposed in the MD procedure to start with the higher bunch intensity of $1.8x10^{11}$ and then reduce to $1.6x10^{11}$ and $1.4x10^{11}$ ppb**. The reasoning is that for the protection elements the order of the fills is not relevant, and the total heat load is expected to be lower than in routine operation due to the reduced number of bunches. However, **the heating behaviour should be closely monitored during the MD.**
- MD#8523 (Measurements of detuning and skew-octupole at flattop and squeeze) - Ewen Maclean
  - J. Uythoven asked which changes to the RF settings are planned. E. Maclean clarified that chroma measurements at flat top are foreseen in a larger dp/p range than for a regular chroma measurements. It is planned to go to ~dp/p of $2\text{-}3x10^{-3}$, corresponding to ~400 **he required changes have to be added to the MD procedure.**

The above MDs were approved understanding that the comments and modifications above will be included in the procedures.

## 3 MD8043: Beam-beam wire compensation (Guido Sterbini)

The slides presented can be found on Indico. The following comments and clarifications were made in the meeting:

- **The MD procedure has to be updated considering that due to the earth fault only the wires of Beam 2 can be used.** G. Sterbini confirmed that the procedure has already been updated accordingly.
- For the MD, it is planned to reduce the crossing angle in order to have a larger beam-beam effect. The MD will start with the nominal 160 urad half-crossing angle and then foresees to reduce to 150 urad, 140 urad, and 130 urad.
  - The expected changes of the beam position at the TCTs and TCLs are between 250 um and ~400 um (see slide 5) when going from 160 urad to 130 urad half-crossing angle.
  - The new thresholds for the TCTs and TCLs have been prepared and the orchestration was tested without beam on October26, 2022 by BE-OP. An asymmetry of the TCT positions of ~25um was observed when moving in and out.
    - For IP5, a difference in the sign of the TCTPH movement for R5 and L5 was noted. **M. Hostettler commented that this is likely caused by the different**

**conventions of the coordinate system in MAD-X and for the LVDT. He suggested that it should nevertheless be verified.**

- J. Uythoven asked if the TCT limits will be changed. D. Mirarchi clarified that the thresholds will indeed be opened by ~0.6 sigma for the TCTs and ~1 sigma for TCL6 to accommodate the movement.
- J. Uythoven asked if the crossing-angle changes should be validated with low-intensity beam before performing it directly with high-intensity beam.
  - D. Mirarchi remarked that the TCT movements mechanics can be verified without beam. J. Uythoven replied that, however, the correct beam movement can only be verified with beam in the machine. Following a suggestion by M. Hostettler, **it was agreed to initially move in very small steps (i.e. 2 um instead of the usual 10 um) and closely monitor the beam behaviour with the collimator BPMs to verify that the beam remains centred.**
  - M. Hostettler recalled that the operational dump limits for the TCTs are 400 um around the nominal position.
- G. Sterbini explained that the **luminosity signal is needed** after the crossing angle change and for the optimisation. However, there is no need to declare Stable Beams and the experiment's detectors can remain in OFF state. **B. Petersen confirmed to inform the experiments.**
- C. Wiesner asked about the planned scraping of the beam with the TCPs. G. Sterbini clarified that it's planned to move in the TCPs by 1.5 sigma, starting from 5 sigma, for measuring the diffusion with and without compensation. P. Hermes confirmed that the procedure for this is well established and has been successfully performed with similar beam intensities. G. Sterbini commented that the wires will be switched off during the scraping and no special recovery is needed.
- G. Sterbini mentioned that in the parallel MD one of the UPS in Point 4 would be put in battery mode for noise measurements. A. Butterworth commented that this should not be an issue but that the recovery in case of a power cut always takes a considerable amount of time. J. Uythoven commented that the UPS manipulation was already tested at injection energy and that no effect on the RF was observed.

The MD was approved understanding that the comments and modifications above will be included in the procedure.

## 4 MD7224: Collimation quench test with protons (Pascal Hermes)

The slides presented can be found on indico. The following comments and clarifications were made in the meeting:

- The goal of the MD is to induce beam losses at the collimation system in IR7 to quench a DS MB magnet. The target level is 1 MW losses for 10 s, ramping the losses from 0 to 1 MW in ~5 s by exciting the beam with the ADT.
- The plan is to first use nominal collimator settings in IR7 (5/6.5/10 sigma). In case no quench is achieved, a second test with relaxed settings (5/8.5/10 sigma) is foreseen. Loss maps for both configurations have been performed, even though not with the same collimator functions, and are the basis to redefine the BLM thresholds for the MD.
- It was discussed what would be the optimum bunch intensity and number of bunch trains to be used for the MD.

  - It was agreed that **using directly two trains for the first ramp with nominal collimator settings is acceptable** and would increase the efficiency of the MD.
  - P. Hermes clarified that trains of 4x48b with $1.2x10^{11}$ ppb or alternatively 3x48b with $1.4x10^{11}$ ppb would be required to reach the desired stored beam power.
  - D. Mirarchi commented that trains with 36b and $1.4x10^{11}$ ppb are now regularly used during operation. A train of 4x36b with $1.4x10^{11}$ ppb would correspond to the desired 22 MJ beam energy. **It was therefore concluded that two trains of 4x36b with $1.4x10^{11}$ ppb should be used for the MD and that the procedure should be updated accordingly.**
- A. Lechner commented that **it is not feasible and not recommended to change the BLM master thresholds during the MD between the two fills**. Only the change of individual BLM monitor factors is deemed possible if really required. He stressed that instead of relying on fine-tuning BLM thresholds on the fly during the MD, a thorough preparation and definition of the thresholds before the MD is needed (see dedicated presentation below). D. Wollmann agreed with the approach of only changing the monitor factors.
  - B. Salvachua Ferrando commented that an additional threshold adaptation during the MD is not expected for the BLMs that showed high losses during the Loss Maps but might be required for the BLMs for which the signal was hidden in the background noise during the Loss Maps.
- B. Salvachua Ferrando asked, in case no quench had been achieved with nominal collimator settings, **if the relaxed collimator settings could be loaded directly during the fill**, since the collimators are only moving out. D. Wollmann asked if it's sensible to do this with high-intensity beam in the machine. D. Mirarchi commented that there would be no difference in loading the settings in the second fill since anyhow the settings will not be ramped but a discrete point will be used. **J. Uythoven concluded that it therefore makes sense to foresee this possibility and that it should be mentioned explicitly in the procedure.**
- J. Uythoven asked about the performed Loss Maps for the relaxed settings. He mentioned that **it should be ensured during the MD that the actual collimator settings are identical to the desired ones, which were used during the loss map. This verification should be added to the MD procedure.**
- A. Verweij confirmed that the MD was discussed and approved in the MP3.
- C. Wiesner reminded that no asynchronous beam dump test is foreseen for the validation of the relaxed collimator setting. He commented that the IR6 settings will not be changed and that in IR7 only the secondary collimators will be retracted more outwards. P. Hermes added that, since the MD would be performed at Flat Top, the TCTs are open at 18 sigma and there is plenty of horizontal aperture for Beam 2. R. Bruce, C. Bracco, and C. Wiesner agreed that no asynchronous dump test is required for the validation.

The MD was approved understanding that the comments and modifications above will be included in the procedure.

# 5 Change of BLM thresholds for MD7224 (Anton Lechner, Belen Maria Salvachua Ferrando)

The slides presented can be found on Indico. The following comments and clarifications were made in the meeting:

- A. Lechner stressed that with the present BLM limits, it would not be possible to reach the required power losses of ~1 MW for the quench test.
- The proposed approach is as follows:
    - The thresholds for the required BLMs in IR6 and IR7 (see slides 7-9) must be adapted before the MD based on the already performed Loss Maps. A change of the monitor factors would not be sufficient, and the master thresholds have to be changed.
    - To avoid changing BLM thresholds during the MD, a single set of thresholds for both, nominal and relaxed, collimator settings should be used.
    - For this purpose, new dedicated BLM families will be created for the MD.
    - The threshold will only be changed for the required active energy level 28 corresponding to 6.8 TeV.
- A. Lechner stressed that the change of the monitor factors during the MD should only be done after a discussion in the CCC with the people concerned.
- J. Uythoven asked about the rolling back of the thresholds. A. Lechner replied that it should be done carefully during working hours. B. Salvachua Ferrando agreed and emphasized that ~4 hours are required for rolling back and validating. This approach was endorsed by the rMPP. **J. Uythoven proposed to foresee a slot between 8.00 and 12.00 o'clock on the day following the MD for the BLM threshold recovery. He will discuss the schedule with R. Steerenberg.** (Note that the proposed recovery slot was confirmed and added to the accelerator schedule after the meeting.)
    - D. Wollmann reminded that the same people and the same time are required for the initial change of the thresholds before the MD and that these 4 hours have to be taken into account in the planning.
- It was agreed to **hold a BLM Threshold Working Group meeting, with representatives from rMPP/MPP and the collimation team to decide on the final thresholds for the MD**.

J. Uythoven congratulated all the presenters for the thorough presentation of their MDs and closed the meeting.