

# 165<sup>th</sup> Meeting of the Machine Protection Panel

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The meeting took place on June the 8<sup>th</sup> 2018 in 774/1-079.

Participants:

C. Bracco, N. Fuster-Martínez, Y. Nie, M. Rijssenbeek, S. Redaelli, B. Salvachua, C. Schwick, J. Uythoven, D. Wollmann, C. Zamantzas

The slides of all presentations can be found on the website of the Machine Protection Panel:

<http://lhc-mpwg.web.cern.ch/lhc-mpwg/> and <https://indico.cern.ch/event/734703/>

## 1.1 Approval of MPP#164's minutes

- Actions from the 164<sup>th</sup> MPP (<https://indico.cern.ch/event/727992/>):
  - None.
- No additional comments have been received on the minutes; they are therefore considered approved.

## 1.2 Recent AFP issues, status of the analysis, repairs and the precautions for the future (M. Rijssenbeek)

- Concerning the recent AFP issues in 2017 and 2018 such as auto-extractions, LVDT instabilities and spring-driven extractions not reaching the OUT position, several repairs and maintenance actions have been proposed for TS1.
  - At all AFP stations, additional soft springs are planned to be added to reach the OUT switches (which will increase the retraction force).
    - New BBA (beam based alignment) and loss maps would hence be needed after TS1.
    - Daniel commented that the installation of additional springs has to be reviewed in case there is further deterioration to be expected, otherwise adding of springs is discouraged as no lab testing has been done.
  - Proposed repairs on C-Near XRPH.A6R1.B1 include a check of the connector, replacing of the LVDT and the amplifier.
    - This will require the repetition of the functional interlock test on the user side.
    - If something is exchanged, new BBA and loss maps would be needed afterwards.
  - Assembly and installation of two new detector packages in FAR stations XRPH.B6R1.B1 and XRPH.B6L1.B2.
    - The work must be performed on the stations, so new BBA and loss maps will be needed.
- There were several unintended self-extractions of C-Near XRPH.A6R1.B1 in 2018. The XRP has been self-extracted twice to the HOME position on 1<sup>st</sup> and 2<sup>nd</sup> of June. Nothing was recorded in LHC OP, COLL logbooks and Timber, and nothing was seen by CCC or CALO shifter. The cause was probably an LVDT spike. The advice from EP-DT experts was to change an AMP board during a no-beam period and revalidate the BIS interface. All RPs remained inserted and

operated without such incident since then. The possible LVDT or connector problem needs to be addressed during TS1.

- During the past year, the HOME position is always reached (except on 15<sup>th</sup> April 2018). The OUT position is rarely reached in 2017 and has never been reached in 2018.
- On 15<sup>th</sup> of April 2018, XRPH.B6R1.B1 did not reach the HOME position during a test for spring-driven emergency extraction. This may be due to aging of the springs, aging of the radiation-hard grease of the linear motor screw, effects of cabling, or a combination of these. An intervention is necessary since if this happens during LHC operation, the LHC Beam Injection Permit will be blocked. Monitoring the problem to see if it will deteriorate significantly is proposed for the moment. During TS1, several solutions have been proposed:
  - add a spring of the appropriate spring constant in parallel to the existing spring.
  - add a gravitational weight plus pulley.
  - reconfigure cabling.
  - test the spring-driven extraction to ensure better operation.
- The LVDT resolver positions as a function of time were presented. No clear deterioration has been seen, except possibly in A-Far, where the large drift may indicate the need to change the LVDT AMP in the movement system.
  - Michael remarked that the majority is stable, except for occasional problems with the up and down movements.
  - Daniel commented that even though the LVDT drift has not caused any beam dump, it is not desired from the viewpoint of machine protection, as the drift allowed a closer position of the pot to the beam. This has been patched by a shift of the position and a change of the interlock limits, but as a long-term solution this is not acceptable. This issue may cause beam dumps in the future if not solved.
- Michael remarked that it should not be a big issue as long as the HOME switch is reached. Once mechanical work is performed, new BBA and loss maps will be necessary afterwards.
  - Christoph reminded that the alignment can be performed in parallel for the two beams, so it will be quite efficient.
- Daniel and Jan summarized that the MPP requests all the proposed LVDT revalidations. For the BBA and loss maps after these interventions, a plan should be made in advance together with the collimation and operations teams.

#### **AOB – Proposal for intensity ramp-up after TS1 (J. Uythoven)**

- Jan presented the intensity ramp-up for after TS1, based on the proposal presented in the LMC meeting on 28<sup>th</sup> of March 2018. The proposal is compatible with the [LPC Special Run Coordination \(SRC\)](#) with some additions. After very detailed discussions with Christoph etc, the proposal has been slightly modified. Christoph will update the LPC table accordingly.
- In short, the intensity ramp-up consists of steps with 2-3 nominal bunches, 150, 600, 1200 and 2460 bunches, with different requirements considering the

beam separation at collision. The following requirements have been considered.

- 1 h of head-on minimum for each step is OK.
- Move in RPs at each fill, starting from 150 bunches.
- Total separation not more than  $5 \sigma$  and one plane at a time.
- As of 1200 bunches onwards, start with finding the head-on before separating to low mu (in order to allow for settings feed-forward for high intensity fills).
- As of 1200 bunches onwards, go through crossing angle levelling and  $\beta^*$  exercises.
- A maximum separation of  $5 \sigma$  ( $\pm 2.5 \sigma$ ) in one plane has been decided for the moment. The collimation team will study how much margins are left if more separation is required.
- For the 90 m run, in the intensity ramp-up, 2 hours of stable beams at each intensity step are required, followed by a check of beam induced heating. For all the fills, the AGK should be adjusted to 288 b @ 25 ns. Together with the VDM we should aim for only two changes of the AGK settings, one before the 90 m – VDM period and another one to put it back to nominal physics settings afterwards.
  - Christoph proposed to replace the 12b train with an 18b train the case of 100 ns bunch spacing.. *Belen will check how the injection interlock limits are currently set and if 18 nominal bunches could replace the first 12b train.*

#### **AOB – Loss map validation after TS1 (N. Fuster-Martinez)**

- Nuria presented the loss map matrixes for 2018 normal operation optics, VDM optics and 90 m  $\beta^*$  optics.
- For the 2018 normal operation optics, in addition to the matrix, all betatron loss maps from 160  $\mu$ rad to 130  $\mu$ rad in a steps of 10  $\mu$ rad should be performed by the end of this year. Daniel and Jan proposed to already perform it now.