

145th Meeting of the Machine Protection Panel

Participants: A. Apollonio, G. Azzopardi, W. Bartmann, J. Boyd, R. Bruce, S. Gabourin, E. B. Holzer, S. Jakobsen, D. Lazic, A. Lechner, N. Magnin, C. Martin, S. Redaelli, V. Senaj, M. Valette, C. Weisner, J. Wenninger, D. Wollmann, C. Xu, M. Zerlauth.

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

<http://lhc-mpwg.web.cern.ch/lhc-mpwg/>

1.1 Approval of MPP#144's minutes

- Actions from 144th MPP:
 - C. Xu: prepare an overview list of all threshold changes for 2017.
 - The ECRs have been discussed and commented.
 - The overview list will be edited and distributed.
 - BIS Team: The turn-by-turn interlock of the SPS BIs in BA6 will be disconnected and the CIBU and BI hardware removed.
 - This was done.
- No additional comments were received on the minutes; they are therefore considered approved.

1.2 Collimation: Summary of changes and re-commissioning after EYETS (S. Redaelli)

- Recapitulation of the collimation system status and new hardware for 2017. 6 new collimators were installed: (a list of ECRs with links is available on the slides, as well as a list with the positions in the ring)
 - 1 primary collimator with pickups: a fully operational spare replacing TCP.C6L7 which had cooling problems. As it is a vital system for the LHC it has to be fully commissioned.
 - Daniel asked if the damage limits were lower due to the new design. Stephano answered MoGr was used for the inserts this time. The BPM functionality might be lost in case of an asynchronous beam dump but the collimator would remain functional.
 - 1 low impedance secondary collimator: with the final design after HiRadMat tests. It is coated with three different materials (Mo, MoGr, TiN). Equipped with three BPMs to know the beam position in the non-collimated plane. It was added to an empty position in the machine and is not meant for operations yet but only for MDs to measure the effect of surface resistance and also test movement on the 5th axis.
 - 2 crystal collimators for B2: the design is almost symmetrical to B1. The bending angle and goniometer controls are better and the collimator is bakeable. The MP logic is the same.

- 2 wire-in-jaw collimators in IP5: they were presented in the previous MPP meeting, they replace the operational tertiary and physics debris collimators so they need to be fully commissioned. As the area they will be operated in is very packed it is important to verify they don't interfere with other equipment when operated.
- Reminder on collimator interlocking: the functionality is tested by an automatic procedure for each collimator. A new interlock was added in the SIS: the beam is dumped if both BPMs on the collimator are out of tolerance for 6 seconds and after a minute if both acquisitions stop or have invalid data. PostMortem to be developed to integrate collimator gaps.
 - Markus commented this is advancing well.
- There would be no fundamental changes to the recommissioning tests without beam. **Proposal:** same recommissioning strategy as last year.
 - Full sequence for the new devices and the ones where connections were changed.
 - For the others, one collimator per FEC and type would be tested. The status interlock check would be done for one FEC.
 - For the Crystal collimators in B2 the interlock preventing beam if the replacement chambers are out has to be checked.
 - The tests are very fast but the documentation is tedious, it could be done that only the relevant changes are documented.
 - Interlocking of the wires would not be under the responsibility of collimation.
- The tests with beam would be the same as last year:
 - Alignment with reference machine, loss maps, ...
 - For SIS interlock implementation: repeat BPM calibration for all collimator BPMs.
 - The wire would require 1-2 extra shifts in commissioning as prerequisite of the MDs in order to:
 - check alignment after 5th axis movement
 - check BPM response and alignment
 - monitor LVDTs for nearby collimators as well as temperature and vacuum
 - Standards SIS checks with beam and usual checks by BE-OP.
- About the Roman Pots:
 - Mario will present something about TOTEM in the next MPP.
 - ALFA will not run this year, and the RPs will stay parked in safe mode.
 - AFP will want to start with safer margins, as for totem.
 - Jamie asked about the insertion strategy for the RPs. Stefano stated there would be no change of strategy. EDMs documents are in preparation and still waiting for a full OK.

Action (Mario, Sune, Maciej): Schedule a talk in MPP on the status of the Roman Pots, the presentation should include strategy during the intensity ramp up.

Action (MPP): joint meeting of the CWG and the MPP at the end of May to finalize the BPM and Roman Pots statuses during the intensity ramp up.

1.3 Summary of the LBDS reliability run (N. Magnin)

- Actions during the Christmas shutdown: The dump system was kept at 7 TeV for two weeks. One MKD generator was cleaned. The MKB trigger lines were decoupled. Weaknesses on some generators were confirmed, they were removed from operations.
- Actions during the EYETS: Renovation of generators, upgrade of the TSU and CIBDS cards. The retrigger delay was increased to 320 μ s.
- Objectives of reliability run: validate HV generator status, upgraded TSU and CIBU cards as well as PLC code. As time was short, this was made possible using a local BIS loop provided by MPE-MI and went well thanks to all the support from BE-CO&OP
 - A BETS simulator was used to generate cycles with 160 dumps at injection energy with a high frequency then a 21h flat top at 7 TeV.
 - A new XPOC server was implemented to validate the dumps.
 - Up to now the system spent ~400 hours at 7 TeV, ~100h at 6.5 TeV, and performed ~4000 dumps per beam.
 - The run will continue over the weekend and the system will be reconnected on Monday.
- Main issues recorded during the reliability run (full list on the slides):
 - Two self-triggers of MKBH on B1, the stacks were replaced then the generator was exchanged.
 - Switch ratio error on a B2 MKD, the stack was exchanged.
 - An erratic on MKD B2 which is not yet understood.
 - Roderick would want the waveforms from this erratic to look if it is worse than the type 2 erratic for collimators.
 - Tracking errors with the PLC, still under investigation over the weekend.
 - S. Gabourin commented one of the problems might have been caused by an operator action, even if the local loop was protected by RBAC roles.
- The retrigger pulse were monitored to validate the new delay. An automatic verification of the TSU and CIBDS pulses showed the delay between the pulses are constant, 250 and 320 μ s. There are no missing pulses so far.
- Following the results of the reliability run it was decided to operate at full MKBH voltage and apply the normal procedure in case of an erratic, then reduce the voltage. It would take 2 days to compute the new settings and set them up, this can be done during a TS.
 - Anton commented the dump window survival in case of an erratic was discussed in another meeting.
- In summary this reliability run went well and was very useful, it should be done at every YETS for a few weeks.
 - Daniel commented there is no need to roll back any of the systems which is a good news. Another good thing is to run with 100% voltage on the MKBH.
 - C. Martin asked when the reversion to the remote loop would happen. A decision will be taken on Monday when Jan is back.

Action (N. Magnin): provide waveforms to COLL from MKDf.B2 erratic (asynch beam dump type 2)

Action (CIBDS): request proposal from TE-MPE-MI on CIBDS performance during reliability run and sent invitation for after 8:30 meeting.

1.4 How to safely run with variable AGK (protection of settings, consistency checks with SPS beam preparation) and following changes in injection BIS (N. Magnin)

- Due to the limitations from the SPS dump, shorter trains were used last year and the LHC was not full because of the AGK.
- Failure modes have been identified for running with a variable AGK.
 - Beam can be shot on the TDI if the AGK is too short.
 - The first batch can be kicked out by the last injection, if it is too long.
 - Beam can be injected in the abort gap.
- The protections implemented during the EYETS include:
 - new firmware for the Fast Inhibit Board which checks if the AGK is within the window
 - SIS will check the AGK length and period, the MKI kick length as well as the filling pattern and will prevent injection in case of an inconsistency.
 - No extra protection was added on the SPS side.
- A new digital optical link and CTRV delay card were added to delay the signal and emit a shorter one with fine resolution (1 ns). The SPS to LHC inhibit was connected to the injection BIS to avoid injection with inhibited MKI and shooting beam at the TDI too often.
- Some tests are needed before unsafe beam is injected in the LHC:
 - Test of AGK monitoring by the FIB card
 - Revalidation of AGK edges
 - Tests of the SIS check of all AGK, MKI and filling pattern parameters
 - Stefano asked if this was already in the commissioning shifts list. It is and would have to be redone every time one changes the AGK length.
 - There are some concerns from the people responsible for the scrubbing who want a special filling. The filling with which operations will start should be decided and changed only once to avoid doing this procedure too many times.
- Jamie raised the concern that the AGK length might impact the filling of the LHC as it is now optimised to get 2550 bunches per beam. Wolfgang answered the SPS batch spacing is not influenced by the AGK and this would only lead to a jitter on the position of the first bunch. Jamie concluded one should go for an optimised batch spacing and make decisions early before operation resumes.

Action (N. Magnin): Produce procedure to be performed after any change of the AGK length.

Action (MC): confirm starting configuration for AGK 288b or 144b.

AOB - all

- We are now approaching the end of the series of presentations on the recommissioning. A list of the outstanding and most important tests with beam and issues to be discussed will be published by MPP.

Action (MPP): Distribute condensed list of MPS tests to be performed with beam

- In the program next week:
 - Proposal for the intensity ramp up
 - New implementation of the PIC
- Room change from next week on, for the transition period MPP will take place in 774-1-079.