M. Valette

161st Meeting of the Machine Protection Panel

The meeting took place on March the 23rd in 774/1-079.

Participants: R. Bruce, E.B. Holzer, D. Lazic, Y. Nie, B. Petersen, B. Salvachua, C. Schwick, J. Uythoven, M. Valette, J. Wenninger, C. Wiesner, D. Wollmann, C. Zamantzas, 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#160's minutes

- Actions from the 160th MPP:
    - A. Rossi: send schematics of interlock to MPE to verify the interlock card and if re-testing is required.
- No additional comments were received on the minutes; they are therefore considered approved.

1.2 MPS re-commissioning after YETS 2017/18: SIS (J. Wenninger)

- Jorg gave a summary of the changes to the SIS during the YETS.
- There were major changes in the masking. Until now there was a single role for SIS expert and OP shift person. There is now an expert masking level, since the issue with AGK change. This role is owned by Jorg, Markus Albert and one member of the rMPP (to be defined). The most critical settings used only for tests now require this role to be modified (AGK, SMP, BBLR …), and at the same time will avoid the need to re-release SIS completely.
- Other small modifications were done, such as the interface for BSRT alignment, the redundant powering of LBDS FECs and the bunch length interlock during the ramp. Some clean-up was performed to remove the BSRA dump interlock, which was masked for three years, and the IT motors which caused false dumps in the past and was equally masked for two years.
- A decision has to be taken on the TDE pressure interlock, for injection veto and dump.
    - o Daniel and Markus were in favour of removing the dump threshold based on the conclusions from MPP#153 that the TDE would survive a dump with a leak, however coherent injection interlocks between the SIS and XPOC should be re-established.
    - o Jan added that one does not gain by dumping at the beginning of the leak development; the threshold is now set to a very low over-pressure, which can be re-evaluated.

Action (Jorg): the interlocked should be masked with the new expert mode and unmasked when needed; the injection veto interlock will not be touched.

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- New redundant devices were added to the DOROS system which can be extended to 8 BPMs. It requires one good reading if two valid BPMs are available and two good readings if three or four BPMs are valid. For the devices in IP2 and IP8 a crate fault will dump if it is interlocked. The option not to interlock is unsafe which has to be weighed against false dumps.
    - Jan asked how critical the position of individual bunches in 2 and 8 would be as the average orbit is already interlocked. There is some margin and no false interlocks were triggered since the beginning. One may still want to protect against special scenarios, so Jorg is waiting for feedback from Stefano.
- Two wire collimators were installed in IP1 (see MPP#160) the threshold for the bipolar power supply was set to 355 A which can only be removed via the abovementioned expert role. An unsafe logic was discovered: the interlock was not latched (which is inherent to such a software interlock), so one could continue testing by re-setting the converter after the interlock was triggered once. An off signal is now sent every minute to the power converter once the interlock is triggered.
- A SIS interlock was added for the crystal collimators to verify the replacement chamber was either in or out. As there are hardware interlocks as soon as it is out of parking, the SIS interlock will only be on at injection to prevent false dumps.
    - Daniel commented the main goal is not to have the chamber in beam position with high intensity because it is not qualified for impedance reasons.
    - Markus added temperature interlocks were added and tested by ELQA but never activated; e.g. for the DFB temperature. It was supposed to remove permits for all converters on the circuits connected to that DFB and aimed at technical stops to re-trigger ELQA tests if temperatures exceeded the critical value of 80K. This needs to be reviewed.

Action (MPP): verify with MP3 if a SIS interlock is required or if it is sufficient to take care of this via procedures.

1.3 MPS re-commissioning after YETS 2017/18: BLM System (C. Zamantzas)

- Christos presented an overview of the YETS activities and plans for commissioning as well as long-standing issues and future developments.
- 8 hardware checks and 3 checkout tests were completed, the details are available in the MPS EDMS document. The pending tasks include: exchange of a BLM card in the SR6.R crate at the surface, renaming of dump monitors in LSA, inclusion of new monitors for wire collimators and grounding for 31L2 and 16L2 for human safety.
- The tests with beam include five tests: interlock request functionality from BLMs and BLETC, latency measurement, direct dump BLMs and injection

inhibit functionality. This last test should be performed first with pilots then with trains.

- o The MPP proposes to perform the test following the procedure from last year, which does not require changes of the BLMs.
- Issues resolved during the YETS include: replacement of cards, cables and connectors. Implementation of acquisition card reset via WorldFIP, which should reduce the number of interventions; a GUI, is being prepared. Upgrade of LTIMs to FESA3. Links attenuation were measured and compared with trends from previous years. Aging links were replaced. All concentrators were moved to new servers.
- The extra BLMs in 16L2 and 31L2 were rearranged; the bundles were connected to spare fibres. New BLMs were installed around the dump, on dedicated poles without filters and with radiation tolerant cables; they should be followed up during the intensity ramp-up.
- Long-standing issues include:
  - o Faulty sanity checks for which the BI software team will review the code.
  - o In a few cases, the global PostMortem was showing saturated channels for some cards. The PostMortem buffer not working properly comes from an issue on SRAM recordings. The apparent spikes are markers between channels. It was fixed and should be signalled if seen again. There is a 1 ms misalignment in some data, which can be due to data read from the wrong buffer.
  - o The signal drop for IR3 BLM observed during loss maps is due to specificity of the location with 3 km long High Voltage cables, the network is to be simulated.
- Future developments include:
  - o BE-CO working on bringing BLMs to the next generation Logging database (NXCALS), which should be operational for after LS2. Due to the HDFS infrastructure of this system, analysis tasks can be directly executed close to the data. Post Mortem data will be there as well with a common API for extracting logging and PM data.
  - o A new VFC based processing module for the BLMs. 1150 units are under construction with 700 for the BLMs. It will be a common board across all accelerators and allow changing sub-components in case of faults, which is faster and easier for interventions.
  - o A new dBLM acquisition system is being prepared for the SPS and LHC and will run in parallel of the scopes and ROSYs with the goal of running only the new system after LS2.
- In summary, there were minor changes. The BIS loop will be ready by Monday as requested by OP. There are no known machine protection critical issues.
  - o Jorg added there was an issue with the missing BLM in the layout database, because the request was made late.
  - o Christos commented the layout will be rebuilt after LS2.

1.4 Proposal for intensity ramp-up and check list after YETS 2017/18 (D. Wollmann)

- The LMC made a request for an intensity ramp up proposal. Daniel presented the proposed scenario.
- In 2107, 1225 bunches were reached after 15 days and 2500 bunches after 24 days. The beam dumps were documented in 11 checklists, 8 for intensity ramp-up, 1 for scrubbing, 1 after TS1 and 1 for the cruise, which was huge.
- This year there were less interventions (wire collimators, MKI replacement, PPLP ramp, …) so the plan is straightforward, with steps at 3-12-72-300-600-900-1200-1800-2400-2550 bunches. The heating of critical element should be monitored in an intermediate checklist, which will be done after 300 bunches. During the cruise, it is proposed to have a checklist every 6 weeks to have more manageable number of dumps to review. The dates would correspond to TS1, July, TS2, TS3 and the ion run to minimise the configurations in a given checklist.
- The insertion of Roman pots was discussed in the CollWG, they will be inserted 2 hours into the second fill at a given step and from the beginning of the third fill.
- A list of responsibles and deputies for the systems in the checklist is presented in the slides any changes should be submitted before April the 13th. Matteo should replace Laurette for OP and as Roderik will be away for a while, a third collimation responsible might be necessary. The format of the checklist tabs should be reviewed and updates required before April the 13th as well.
- Two strategies for ramp up after interventions are proposed, for massive and small intervention on software and hardware, with four (pilot-50b-600b-1/2 of pre-stop intensities) and two (3b-600b) fills for ramp up respectively.
  - o Jorg commented that in some cases without 48h of stop or any interventions, like triplet quenches, one would need a full revalidation with 2-3 b. Jan proposed to make a third category, which would also include asynchronous beam dumps.
- As of this MPP, all MPS presentations are done and documents are released or under approval. A list of tests for MPs recommissioning was edited from these documents and should be updated regularly.
- In conclusion, the successful ramp up from 2016 was the basis for the 2017 and 2018 strategy. Checklists have proven important and useful to analyse and document the correct functioning of MP critical systems.
  - o Christoph mentioned that the experiments would like a fill with 250 individual bunches, he will write a request document.

AOB: Proposal for machine protection envelope during the Easter WE (J. Wenninger)

- Jorg proposed two scenarios for the MP envelope during the Easter weekend.
- If the MPs tests for the BIS and LBDS have not been performed before the weekend the intensity will be limited to a probe bunch at injection.

- Otherwise, a probe bunch at top energy or a nominal bunch at injection will be the limits. This would allow performing coarse alignment of collimators and preliminary loss maps. Belen will be available for the Collimation sign-out. If the ADT is not available, the loss maps will be performed with 3rd order resonance crossing. The ramp will be performed with a flat machine so TCT settings are not a concern.