

123rd Meeting of the Machine Protection Panel

Participants: F. Alessio, J.C. Allica, A. Apollonio, S. Bart-Pedersen, W. Bartmann, C.Bracco, M. Deile, S. Gabourin, S. Jakobsen, M. Kalliokoski, A. Lombardi, C. Martin, S. Mazzone, B. Mikulec, D. Nisbet, M. Rijssenbeek, F. Roncarolo, R. Schmidt, M. Trzebinski, M. Valette, D. Wollmann, 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#122's minutes

- Actions from 122nd MPP:
 - BLM threshold changes are making good progress, most of the changes are already implemented.
 - MP3 will come back regarding the symmetric quench protection of the MQM(L).
- No additional comments were received for the minutes, therefore they are considered approved.

1.2 Status of BSRA hardware, the implementation of automatic checks and future plans (S. Mazzone)

- The setup is identical to 2015. New extraction mirrors and optics are more tolerant to source angle change.
- Automatic Voltage/Gain calibration of the photomultiplier with the LHC sequencer before injection, +/- 30% acceptance, can probably be lowered as it defines the accuracy of the measurement.
- Yet to be implemented: periodic calibration using FBCT readings, not trivial to perform automatically.
- Three thresholds: Start cleaning, Dump, Damage issuing two flags, AG cleaning and Dump. Stop cleaning threshold set at 75% of start cleaning (for hysteresis) to avoid continuous ON/OFF switching.
- AG population never exceeded dump threshold yet during standard operation.
- Auto-cleaning ON since June 2015 (LOW strength by default).
- The Beam Dump flag is masked.
 - Daniel: Is the SIS Beam Dump flag logged?
 - No but the data and thresholds are, so it can be reconstructed if required.
- Minimum number of charges for detection: Inj $3 \cdot 10^8$, Flat-top $2,4 \cdot 10^7$
- B2 precision lower at beginning of ion run because of low signal during setup phase.
- Improvements during YETS 2016:
 - Improvement of layout, now mounted on a sliding table.

- Better optical alignment and 2 times better sensitivity (light intensity not beam).
- Ready for start-up.
- A new amplifier has been developed; the tests are to be completed.
 - Daniel: What would be the upgrade?
 - Less noise leading to higher sensitivity
- System ready for automatic BD tests.
- ABT proposed a modification of the way abort gap population is calculated, taking into account only the relevant (initial) part of the abort gap; This can be implemented but preferably only after a few months of operation.
 - Jorg: Is it safe to change the calculation method during summer (during production?). LHC coordination might not agree.
 - We can wait until the end of the year and test in the lab in the meantime.
 - Chiara: Can the AG population of a specific slice be logged? 2/3 of AG is not dangerous (only 900ns/3μs is)
 - Changing of the cleaning strategy (focussing on first part instead of the integral of all bins) could be done after first experiences with beam.

1.3 Linac 4 commissioning with 100MeV MPS aspects (D. Nisbet)

- Beam operation scheduled in April (week 14).
- Commissioning of CCDTL cavities after the DTLs is completed.
- There will be an intermediary stop at 80 MeV energy because of delays with LLRF.
- Recommissioning will be required to first re-verify the 50 MeV stage.
- CCDTL 5-7 commissioning up to 105MeV foreseen until the end of April.
- The BIS has the same architecture at 50 and 100 MeV.
- A new source start input has been added to the BIS, allowing to operate the source when the beam stopper is IN without taking into account downstream inputs.
 - Markus: is the chopper commissioning 'ready for the next phase'?
 - The commissioning will be done as part of the intensity ramp up
- Chopper voltage is currently not monitored. L4LChopperQuad window had to be reset manually so a wider window was set up.
 - Bettina: full chopping functionality should be tested before the connection to the booster (including 'half-sector' tests).
 - David: we can set up a deadline to finish the voltage implementation.
 - Markus: if this cannot be tested in time, one might need to define a later commissioning phase with low intensity to clear out all the open points.
- The RFQ input to the BIS currently does not include any LLRF information, a failure could be invisible to the BIS.
 - Daniel: it could happen that the BIS indicates that everything is true, but parts of the RF might be off. Whether it is dangerous or not has to be determined.
- The Master BIC chopper takes input from slaves and the beam stopper.

- BIC L4: vacuum valves for 100 MeV are not connected.
- BLMs for the 100MeV phase are forced true, they are installed but the interlock logic is not activated yet. For the moment BI wants to gain experience with the amplitude of losses at 100MeV.
 - The SIS will set an operational limit to 100µs pulses if a beam device is in.
 - Jorg: Is the WIC monitoring PCs?
 - Markus: Yes this has been modified and the WIC is fully functional, including the removal of the beam permit in case of PC failures.
- Two documents for coordination: “Commissioning steps ...”, “Beam interlocks ...”
 - Machine Protection issues: BLM not present.
 - Is the absence of LLRF in the BIS a problem?
 - Chopper dump installed during RFQ commissioning?
- Markus: if something goes wrong with the source or LLRF can the beam damage the RFQ or something else?
 - Alessandra: For 30 MeV permanent quads ensure, that the beam is sufficiently diluted to not cause damage in equipment in case it does not reach the dump. At 50 MeV and higher they are not necessary, for 12 MeV it is not sure.
 - Rudiger: As a mitigation we could observe losses with the BCTs and set relative or absolute threshold, for protection absolute losses are relevant. It is important that the parameters are clearly visible and cannot be changed by accident.
 - Markus: The thresholds have already been studied and documented. We need a discussion to find the appropriate values, the corresponding document will be uploaded.
- Using the chopper dump in the very early phase of commissioning would require a change in the BIS.
 - Alessandra: probably not necessary, as it is a very short period (few hours, 1/2day). The biggest risk would be to steer the beam into an element. This could be mitigated by de-focusing the beam at the quadrupole, as has been done for the 50MeV start-up. It would condemn the 4 quadrupoles.
- **Decision: Implement an interlocking via a watchdog as long as BLMs are not operational. Condemn as well the 4 quadrupole circuits as for the 50MeV phase to avoid a focused beam to impact on equipment.**
 - Alessandra: the plan is to have the beam going always to the dump
 - Proposal: use the BCT after the chopper dump and then the Linac4 dump.
- **Action: propose the watchdog interlock threshold.**
- David: for the next phase (—> half sector test with 160MeV commissioning, 10/11.2016) the commissioning of the BIS will require significantly more efforts. **This and more general MP related issues could be treated during a half day review around June.**
- **Action: organize review on Linac4 MP in June in preparation of the 160MeV commissioning and half sector test.**

- **Action: Trigger discussion on how the commissioning will be performed on the long-term.** We need a viable solution every time, when a 12MeV setup needs to be performed, without condemning the quadrupoles?

1.4 Status of MPS commissioning after YETS 2015/16 (M. Zerlauth)

- Hardware commissioning almost complete.
- Linac2 fixed-> beam in the LHC ring expected during Easter weekend.
- A link to the [google doc](#) was sent: please follow up and complete the progress of your system's tasks.
- Most MPS documents are in approval, only the BLM and SIS documents are still missing.
- UPS tests were very successful.
 - SMP: most tests have been carried out, a failure of one of the new MENA20 processor boards occurred a few weeks ago.
- COLL movement and interlock tests planned for next Monday.
- VAC, INJ and LBDS are well progressing, most of the tests will be done once the BPL can be closed.
- A few slides from the BIS MPS:
 - BIS re-commissioning: a full (electrical) re-commissioning of all user interfaces will take months (e.g. 4 months after LS1). Therefore this is not done after a YETs.
 - The MPS document was mostly re-written to adapt to current test baseline: once connected 5 tests need to be done for BIS validation.
 - 180 users: 70% have automatic tests (COLL PIC VAC BLM FMCM WIC) for their functional tests with the BIS
 - Tests can be automatically done, but their execution is in the responsibility of the users.
 - Markus: integration of these tests into ACCtest will continue.
 - Rudiger: some systems don't distinguish the (normally redundant) CIBU inputs A and B.
- Other systems are less critical but if parts of the hardware or cabling are changed a full recommissioning has to be performed.
 - David: is there a mailing list to recall these rules and contact the concerned clients?
 - Markus: an email will be sent to MPP attendees.
- Status for the 5 automatic tests concerning the BIS:
 - A: Ongoing, all automated tests are done, manual tests of USER inputs only upon request (see above statement)
 - B: SIS to BIS to be performed with LHC operator (10')
 - C: setup beam flag through GMT: done! Test automatically performed with software.
 - D: Test links between BIS and LBDS. To be performed with the ABT experts (30').
 - E: Link from BIS to injection interlock system . Done. Test performed manually.
- **Action: Contact BIS users, without automatic test mode, to verify if changes have been performed during the YETS and recommission if necessary.**

AOB - all

- AFP will be participating in MPS tests in CCC together with ALFA and TOTEM.
- Next meeting on the 1st of April. **Update: 8th of April.**