

226th Meeting of the Machine Protection Panel

LHC topics

June 10th, 2022, via Zoom

Participants:

A. Apollonio (TE-MPE), T. Argyropoulos (BE-OP), C. Bracco (SY-ABT), A. Butterworth (SY-RF), E. Calvo (SY-BI), M. Deile (EP-CMT), M. Di Castro (BE-CEM), Y. Dutheil (SY-ABT), C. Hernalsteens (TE-MPE), G. Kotzian (SY-RF), G. Kruk (BE-CSS), D. Lazic (EP-UCM), A. Lechner (SY-STI), M. Milovanovic (EP-ADO), D. Mirarchi (BE-OP), F. Moortgat (EP-CMG), S. Morales Vigo (SY-BI), D. Nisbet (SY-EPC), B. Petersen (EP-ADT), M. Saccani (SY-BI), B. Salvachua Ferrando (SY-BI), R. Secondo (TE-MPE), M. Solfaroli Camillocci (BE-OP), M. Trzebinski (EP-UAT), D. Wollmann (TE-MPE), C. Zamantzas (SY-BI).

The slides of all presentations can be found on the [website of the Machine Protection Panel](#) and on [Indico \(226th meeting\)](#).

Minutes and actions from the 225th (LHC topics)

Daniel recalled the action from the previous meeting regarding the assessment of the development of macroscopic cracks in the graphite blocks of the TCDS. Yann commented that this was already discussed within WP14, and Chiara confirmed that the replacement of the blocks is foreseen following the analysis. The action is closed.

Readiness of Machine Protection and related systems for a full machine at injection (scrubbing) and things open before taking a 12-bunch train up to top energy

LBDS and injection protection (Y. Dutheil)

Yann presented the remaining tests and pending issues for the injection protection. The RBAC protection issue is still pending. The ABT devices are being updated but still require manual changes.

Daniel asked if the RBAC configuration update can be done globally or needs to be done individually. Matteo replied that this needs to be discussed with the RBAC team.

Action: Follow-up on the RBAC protection of the settings of machine protection equipment (MPP, RBAC team).

Christos commented check MCS enable on all crates. Matteo pointed out that this check will only verify that the MCS is activated but not if it is properly configured, which is the issue in the case described by Yann.

The remaining tests to be completed for train injection are:

- TDIS: 2 out of the 6 modules could not be setup yet due to the large, measured angles. The setup and validation will be performed today.
- MKI failure protection
- Validation of correct hierarchy between injection protection devices and collimators.

Yann added that the blindable BLMs are not strictly needed for trains, but beam loss crosstalk from the transfer lines may limit operation.

Daniel asked if the TDIS BETS configuration still needs to be performed. Yann confirmed that this will be done following the TCDIS setup.

Daniel commented on the necessity to perform loss maps. Matteo commented that the loss maps with the final collimation settings still need to be performed and will include the injection protection and dump protection devices.

Anton commented on the blindable BLMs. If they are needed, the monitor factors should be fine-tuned. If blindable BLMs are required for specific locations, it should be discussed at a rMPP meeting.

Yann then listed non-critical pending items regarding the LBDS:

- BTV interlocking thresholds will be set during the intensity ramp-up
- BLM data missing in XPOC, improvement is present, but it still occurs sporadically
Christos commented that the issue has been sorted by BI about two weeks ago and asked Yann to send him the timestamps if the issue appears again so that it can be studied in detail by the BI team.
- The tests of interlocking on RF trim are on-going
- The XPOC thresholds (BLMs in particular) need to be updated as the intensity is ramped-up
- BCT and BPMDD modules in XPOC are currently not working and need to be checked by Nicholas. The issue might be due to a change of the data format following the switch to FESA3
- The Abort Gap Monitoring and Cleaning.

Daniel mentioned that the abort gap cleaning has already been successfully tested. It was found that the first bunch was affected by the cleaning. Has this already been adjusted? Matteo confirmed the abort gap cleaning is working and stated that the adjustment has still to be done.

- Direct BLM dump check
- TDE monitoring

Three items must be completed prior to the injection of trains:

- TCDQ (& TCSP) setup and validation at injection and at flat-top. This will be performed at injection prior to the scrubbing run.
- The direct interlock BPM must be tested.
- Check of clean extraction with maximum allowed closed-orbit excursion in IP6.

Collimation (D. Mirarchi)

Collimation everything is fine and ready. All settings were generated. The injection protection collimators and TCDQ centers will need to be trimmed once the final alignment has been performed. The settings in place are without the angular alignment (parallel jaws). Then the settings will be validated with a full loss-map and asynchronous dump campaign.

Roman Pots (Mario Deile)

Mario reported that the configuration is used regularly in operation, with the insertion of the pots during injection energy collisions.

ARP (M. Trzebinski)

Maciej confirmed that Alfa and AFP are both ready. The AFP detector commissioning is ongoing, and the ALFA commissioning will follow with a lower priority. The ALFA pots will remain in garage position.

Both teams were asking for the date of the roman pot alignment, as they need to ensure the availability of experts. MPP asked the teams to get in contact with the machine coordinators and OP.

BIS/WIC/FMCM (R. Secondo)

Raffaello reported on the status of the WIC, PIC, SMP and FMCM. The WIC and PIC are fully operational, and all tests have been performed.

The FMCM tests have proven difficult as the WIC was found to be triggering first. A new fast abort procedure has been used last night to test the FMCM of RD1.LR1. This method can be used to test the other circuits. The procedure will need to be updated to reflect the fast abort method. Same procedure will be used to test RD1.LR5 and the RD34 circuits as end of fill tests.

The BIS is commissioned but a few user link connections still need to be validated:

- RF
- BCCM
- BPM (point 6)
- LHCb Velo

Daniel asked about these items (except for the BCCM which will not be used operationally this year) and if they were tested already. Raffaello replied that they have been tested from the point of view of the electrical circuit, however the user system tests must be performed. They are masked at the moment. Daniel asked Raffaello to contact the responsible system experts to organize the testing with them.

Andy confirmed that he has foreseen the final testing of the RF is schedule for the coming days.

A few SMP test corresponding to high-intensity or transitions during the ramp still need to be tested.

SIS (J. Wenninger)

Joerg sent an email before the meeting with the following information: some tests for which we need trains are still missing, they will be performed next week.

BLM system (M. Sacconi)

Mathieu summarized the status of the BLM system. The test on the missing HV detection and propagation to the SIS is still missing for the machine checkout. This will be performed next week. Two beam tests are missing:

- Direct BLMs with beam (already tested on the hardware side)
- Injection interlock inhibit (to be done with ABT with a 12-bunch train).

Mathieu then provided the status on recent issues. The equipment was replaced regarding the VME power supply failure. A temperature issue was present in IR2 triggering optical link error interlocks. The alarm, which were inactive are now enabled and CV has turned the water flow to the maximum. Multiple cards have been exchanged to better resist higher temperature. Weak optical links were present and could trigger interlocks. The modules have been replaced. Sanity checks issues were blocking OP before injection. The sequence has to be fully run through, otherwise it fails. This issue will be finally fixed in the YETS as it requires a new release.

The blindable BLM channel functionality is now present in all crates and is disabled by default. It acts only on the maskable BLM channels. Only the output to the BIC is inhibit, the rest is left untouched (running sums and logging are all active). The feature will be tested with 12 bunches next week and the required blind out time will be measured.

Belen and Anton recalled the strategy for the use of blindable channels for this year. They confirmed that the goal is to first attempt to avoid using them by increasing the thresholds via the monitor factors.

Mathieu summarized the BLM beam test principle to test the interlock functionality and to measure the latencies. All BLM latencies are below 3 turns (including transmission time of the signal through the cables from the detectors to the CIBUs). Daniel asked for the reason the latency difference between B1 and B2 for IP3. The main reason is the measurement method. The latency is measured from the injection pulse to the signal from the BLM. Christos commented that the cables in IR3 are much longer, which contributes the larger latency. Daniel proposed to correct the measurements for the known time of flight. If this is taken into account all the delays are below 100us, which is an excellent result.

The firmware on the 4 optical link reception chains on the surface processing boards has been modified to add a delay constraint for all data lines and to improve the clock domain crossing mechanism. All the rest of the HDL code remains the same as before. The new firmware

(v.1.2.0) is deployed and has been tested with beam. The software has been modified to avoid losing CTIM events because of high CPU activity.

Daniel summarized, that the commissioning of the machine protection systems is well advanced and that the missing tests before the injection of trains and going to a full machine at injection energy are identified and scheduled. He thanks all the teams for the work done. MPP will follow the progress and is available for discussions if required.

Summary of actions

The actions from the meeting are:

- Injection protection
 1. Follow-up on the RBAC protection of the settings of machine protection equipment (MPP, RBAC team).