

204th Meeting of the Machine Protection Panel

LHC topics

February 19th, 2021 via Zoom

Participants:

Federico Alessio (EP-LBC), Alain Antoine (TE-MPE), Roderik Bruce (BE-ABP), Andrea Calia (BE-OP), Daniel Calcoen (TE-MPE), Joao Carlos Oliveira (SY-RF), Mario Deile (EP-CMT), Antonello Di Mauro (EP-AID), Yann Dutheil (SY-ABT), Cedric Hernalsteens (TE-MPE), Grzegorz Kruk (BE-CSS), Dragoslav Lazic (EP-UCM), Christophe Martin (TE-MPE), Filip Moortgat (EP-CMG), Brian Petersen (EP-ADT), Belen Salvachua (SY-BI), Brad Schofield (BE-ICS), Raffaello Secondo (TE-MPE), Andrzej Siemko (TE), Matteo Solfaroli (BE-OP), Georges Trad (BE-OP), Jan Uythoven (TE-MPE), Christoph Wiesner (TE-MPE), Daniel Wollmann (TE-MPE).

The slides of all presentations can be found on the [website of the Machine Protection Panel](#) and on [Indico \(204nd meeting\)](#).

Minutes from the 202nd MPP meeting (LHC topics)

Daniel recalled the actions of the 202nd MPP meeting on the Run 3 changes to the TDEs and the minutes were approved.

MPS re-commissioning in the MPP (Daniel Wollmann)

Daniel highlighted the goals of the MPS re-commissioning exercise in the MPP: the review of the changes in MP systems during LS2, the update and re-release of commissioning procedures, the discussion of the re-commissioning plans and the production of a MP check list for the commissioning together with BE-OP, HW experts and the MPP.

A summary table with all the MP systems, including the dates of the presentations at the MPP, the EDMS procedure number and the release date, was presented.

Re-commissioning of the interlock systems BIS, SMP, WIC, PIC and FMCM after LS2 (Raffaello Secondo)

Raffaello presented a system-by-system summary of the re-commissioning procedures and LS2 changes.

PIC (EDMS-896390 v. 4.0)

The sequence of tests first includes a PLC and CPLD software validation on the testbench, followed by tests on the 36 PICs deployed in the LHC:

- UPS and AUG tests done with EN-EL
- CRYO tests done with CCC-TI
- QPS-PC tests with OP via Acctestng
- PIC-BIC tests with OP via Acctestng

The main change in the PIC during LS2 is the automated masking of the Global Protection Mechanism (GPM) for low circuit energies. The GPM activation is from now on dependent on the current in the main circuits for the arcs. The GPM automated masking isn't activated for the matching sections and inner triplets.

PLC software upgrade during LS2 has been tested successfully on the PIC automated test bench (IST). In addition, 16 tests (2 per arc) were added to the commissioning of the PIC. They must be carried out manually by OP to validate the Automated GPM function:

- Start at least one circuit (power permit)
- Set an essential circuit to Fast Power Abort (FPA)
- Start and ramp the RB or RQD or RQF above the threshold (1kA)
- Check all started circuits go to FPA.

The PIC commissioning procedure still requires to be updated with the changes on the GPM.

Discussion and comments

Matteo proposed to couple tests of RB and RQ (ramp RB and test both PIC PLCs), so the number of required tests can be reduced from 16 to 8. Alain replied that it makes sense, and that the procedure should be updated accordingly. The procedure should state that it must be done with the RB and one circuit per side must be started to see the effect on both sides.

Action: Update PIC commissioning procedure (EDMS-896390) with the validation of the new current dependent GPM function, including coupling the tests of RB and RQ circuits (Alain Antoine).

FMCM (EDMS-896393 v. 3.2)

Raffaello detailed the changes during LS2. Two FMCM devices protecting TT60 (MBS and MBB magnets) were exchanged to add extra monitoring capabilities (new version). The tests need to be repeated in January 2022.

There was no change in the commissioning procedure of the FMCM.

Discussion and comments

Jan asked if all the FMCM systems should be tested or just a subset. Alain and Daniel replied that all systems have to be tested after the long shutdown.

Daniel commented that the FMCM is not required for pilots. Daniel asked if we would allow nominal bunches without FMCM (during the 2021 pilot run). Jan replied that we need to test the FMCM with pilots before going to nominal bunches at full energy. There is no need to test FMCMs with beam for the beam tests in 2021, but will need to be done for all FMCM for the run starting 2022.

WIC (EDMS-896395 v. 3.0)

All 8 WIC PLCs were upgraded to the latest version of the generic code (v. 3.12). Changes in the matrices of the WIC were introduced for P1, P5 and P7. The WinCC_OA supervision has been upgraded. The status of redundant “user permit” signals sent to the BIS are now shown on the main display. In P1 and P5, two WIC systems were modified to request a beam dump in case of the over-heating of the beam beam wire compensator wire (BBCW) and in case of a fault of the BBCW power converter. In case of a BBCW failure that is not repairable within a reasonable amount of time, BI will bridge the BBCW signal to the WIC and no modifications are required on the WIC side.

In IR7, two magnets, MQWA.E5L7 and MQWA.E5R7, were removed (replaced by absorbers). The WIC matrix and connections were modified accordingly and tested successfully.

The WIC IST tests are done in 3 steps:

1. Test the magnet connections to the WIC
2. Test the PC connections with EPC
3. Test the WIC/BIS connections.

Steps 1 and 2 are almost finished. Step 3 will be done when all conditions are met.

SMP (EDMS-1112187 v. 1.0)

The TED beam flag has been added to the SMP of the SPS with the TED intensity limit set at $3.5E13$ p⁺. The SMP beam flags in the SPS (setup, TED, probe) have already been commissioned. The BIS extraction timing configuration has been changed in BA4 and BA6. The threshold of the SBF equation generated by SMP in the LHC called BEAM_RESTRICTED has been changed to $4E10$ p⁺, and is planned to be used during optics measurements. A new version of the SMP firmware has been deployed.

There is no change in the commissioning procedure for SMP in the LHC but changes for SMP in the SPS. The MI team is currently aiming for the commissioning of the SMP-LHC in September 2021 (2-3 days). However, for OP a commissioning in May 2021 would be preferred. This needs to be agreed between MI and OP. The tests will not be repeated in January 2022.

Discussion and comments

Daniel asked about the test duration (2-3 days minimum). Raffaello replied that this is the time for the part which does not involve OP.

BIS (EDMS-889281 v. 3.0)

Raffaello first presented the LHC BIS hardware modifications:

- CCR BIC: Two new connections added on CIBV to provide PM signal to BI
- There is no new LHC CIBU user connection, but some user interfaces have been or will be relocated:
 - o The LHCb VELO CIBU will be moved (May 2021)
The interlock BPMs in P6 will be evaluated in “test mode” (YETS 2021) and connected to a disabled BIS input (only for monitoring). Therefore, in P6, 4 CIBUs will be moved from SRs to UAs (2022) after validation of the new BPM electronics.

The software modifications include:

- All FECs have been upgraded to CC7 and the FESA classes to FESA3
- There is a new JavaFX-based BIS GUI
- COSMOS checks for diagnostics as replacement to DIAMON

The BIS local loops in UA63 and UA67 have been in place since January 2021. All users must power the CIBUs in their racks by the end of May (CIBUs can only be remotely put in test mode, if they are powered). After the end of May, the users must ensure that the racks hosting CIBUs remain powered.

During June, the BIS LHC optical fibers will be checked and cleaned. The fiber attenuation will be measured. This is outside the BIS procedure, but it is essential for the BIS availability.

End of June the BIS optical fibres will be checked and cleaned. For the IST the BIS loop must be closed in test mode (A or B). A duration of 10 days is foreseen.

For the BIS IST tests the BIS loop needs to be closed. It needs careful coordination between MPE, the LBDS and OP teams. The tests will be performed from the CCC with no need for access.

The MPS test document states that “Users have to provide User permit A & B independently during these tests”, in order to check the redundancy. Currently, 54 out of 147 users cannot set A & B independently. In this case, the redundancy cannot be verified.

It was requested in the LMC to re-activate the local BIS loop for additional tests of the LBDS until the final cold check-out in spring 2022. One half-day is required to set-up the local BIS loop (with access in UA63 and UA67). To return to the normal loop the following BIS tests must be repeated:

- Partial BIS MPS tests (~5 days)
- Machine checkout tests (half day).

Discussion and comments

Jan commented that all user connections whose tests are listed as “on demand” should be tested (e.g. experiments, RF, programmed dump, push buttons, etc. – the full list is on slide 28). Daniel agreed with Jan and reminded the representatives from the experiments to communicate on that. Dragoslav confirmed that this is being followed up on the CMS side.

Daniel asked about the connections from the “Crystal collimator (UA9 experiment)” inputs. Raffaello and Roderik will verify what is connected there. After the meeting it was confirmed, that this input is indeed the interlock channel for the operational crystal collimators.

AOB

Mario raised a point about the machine protection aspects of the Roman pots. It has already been added to the agenda of a future MPP meeting early spring to review what has been done during LS2 and plans for recommissioning.

One particular point concerns the movement of the RP during the fill. As the final collimation scheme will not be available immediately, one option remains to have a few Roman pots move in the middle of the fill to adapt the position to the requirements of the optics and of the TCTs. The movement during the fill is not a problem, however it was mentioned that it also requires a change in the position limits. A discussion is required to think about the possibility to change them during the fill.

Daniel commented that this topic should be discussed during a joint MPP / Collimation Working Group meeting. Roderik agreed. Daniel will add the Roman Pots to the list of systems whose re-commissioning should be discussed at the MPP.

Summary of actions

The actions from the meeting are:

- Re-commissioning of the interlock systems BIS, SMP, WIC, PIC and FMCM after LS2:
 1. Update PIC commissioning procedure (EDMS-896390) with the validation of the new current dependent GPM function, including coupling the tests of RB and RQ circuits (Alain Antoine).