

147th Meeting of the Machine Protection Panel

Participants: J. Baechler, J. Boyd, R. Bruce, V. Chareyre, M. Deile, E.B. Holzer, S. Jakobsen, T. Medvedeva, I. Romera, M. Rijssenbeek, C. Schwick, M. Trzebinski, J. Uythoven, M. Valette, J. Wenninger, 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#146's minutes

- Actions from 146th MPP:
 - B. Lindstrom, D. Valuch: prepare a detailed procedure and provide sample data to prepare for the online post-processing.
 - MPP: verify with Rogelio and the tune spread team what intensities and ADT parameters they want to use for their measurements.
 - MPP: Add Tatiana to the MPP membership from BI side.
- No additional comments were received on the minutes; they are therefore considered approved.

1.2 CT-PPS - XRP commissioning results and status (M. Deile)

- Mario presented a summary of the activities on CT-PPS performed during the EYETS: Some mechanical modifications were made on the 26 roman pots (RP) and a new pressure gauge was installed to trigger an RP extraction interlock in case of vacuum loss in the RP volume.
 - Daniel asked for more details on the collimator control application. It is a subversion of the main collimator control app which was developed by Gianluca and is still maintained by the collimation team.
- The CT-PPS collaboration wants to use the roman pot group B during high intensity-low beta operation and not only standalone operation. The part of the pots facing the beam were modified because they were initially made of rectangular ferrites which proved non-ideal impedance wise (and eventually heating of the pots). The vacuum was broken in the process so a bake-out was performed. All detector packages were removed and upgraded during the bake-out. The motor movement was recalibrated with laser measurements.
- Since the inside of the pot is under vacuum, if there is a leak and a loss of pumping capability, the inside of the pot would be at atmospheric pressure of 1 bar and the pot window would bulge by up to 0.5 mm removing a lot of the position margin. If the pressure is above 200 mbar (for reference the nominal pressure inside the rectangular pots is ~10 mbar, up to a 100 mbar in the cylindrical ones) the pots would be retracted with springs (the first 0.5 mm of retraction would happen in 33 ms) and reinsertion would be

prevented. This safety measure is not as fast as the BLMs but adds an additional protection layer.

- Jamie asked about the reliability of the pressure measurement as it could affect availability. The measurement errors are in the order of 1 mbar and 10 times redundant with all the pots. This is not a concern for machine availability as it will not dump the beams but retract the pots. As the volume under vacuum is large (all pots connected together), a leak is believed to result only in a slow pressure increase, which can therefore be easily captured by the pressure measurement.
- The interlock functionality was simplified, the user permit is removed if any pot is outside the position limits or outside garage in the wrong beam mode. Injection Permit is removed if a pot is outside garage.
- Basic functions were verified for each pot, the user permit is removed and the RPs are retracted when required. The beam mode dependent tests were not done because of the many possible combinations and the time consumed by such a test. The interlock logic box which is enabling the functionality was not modified in the EYETS. The verification was done by artificially changing the limit as the motor will refuse moving into a forbidden area. This test was done for all 26 RPs, even the ones which will not be used this year. An archaeological feature of dumping if the pot is further out than the garage position was left but not verified.
- In case the interlock logic box is damaged, one fully functional and tests spare is available. The detailed procedure to exchange the interlock card was presented. If needed, an electrical revalidation of the user connection would be performed by the BIS team. It would require an intervention to verify the status of the pot, cut the motors and disconnect the interlock.
 - Jan commented the BIS team has no piquet service but is based on best effort.
 - Sune commented the situation is different for AFP/ALFA as their signals go through the ATLAS interlock box, a physical verification would be needed but they would be then masked inside ATLAS.
- Regarding the intensity ramp up, it was agreed that the RPs would be inserted after 2h in the second fill and then immediately at the start of the third (and any additional) fill for each intensity step. It would be good that the TOTEM pots are not inserted at the same time as AFP to disentangle the effects on the beam and to avoid a coherent spike of excitation.
 - Jamie asked how much later would be required. One minute should be enough, the insertion is quite fast. It should simply not be part of the same sequence.
- The horizontal B, E and D pots would also be occasionally used throughout the year. The C one is now empty, and the detectors package will be installed later. The A pot will be out all year. For the vertical pots, D and B would be needed for calibration runs, A and C would stay out. Several hardware groups would be needed to maintain flexibility.
 - Jan commented all pots that might be used throughout the year have to be fully aligned and validated and have to be included for the intensity ramp up to validate them, then during physics fills TOTEM

can use the ones they need. Jamie added the pots are part of the intensity checklist in the collimation tab. For each intensity step, the vacuum, temperature, and BLM signals will be verified. The result after 1000b should be presented either to the CWG or the MPP, during the TS for example. Same for AFP.

- The RPs will be aligned as part of the collimator alignment with squeezed beams, maybe not in the same fill.

1.3 AOB: AFP - XRP status of movement system and commissioning plans (S. Jakobsen)

- Sune briefly presented the status of the AFP roman pots (RP). The system is almost ready. The missing things are the interlock box and to verify all sub-functionalities and beam mode dependent behaviour. There are only 4 AFP RPs (compared to the 26 of CT-PPS) so it is expected to be fast.
- Sune asked when the margins could be removed and proposed September after TS2.
 - Jamie answered, that Stefano had proposed in between TS1 and TS2. Daniel confirmed there would be a review on that topic in July. Markus added the margins would not be removed from one fill to the next but progressively to be able to spot any problems. Ideally this could be combined e.g. with a special physics run and/or an MD period to profit from a short intensity ramp-up thereafter.
 - A last comment was made that the pot position is not logged in timber as it was requested last year.

1.4 Summary of UPS power distribution validation for machine protection systems (I. Romera)

- Ivan presented the outcome of the third UPS test campaign after the one during LS1 and the one last year. The new procedure consists in cutting the power to minimize impact on sensitive equipment. It was done after the ELQA tests.
- In the LHC, there is no backup power for general services, critical systems are backed up by the UPS F3 system, as well as cryogenics and vacuum, and redundant machine protections are powered by UPS F4.
- The LBDS showed some non-conformities in the first campaigns, not in this one. A collateral effect was observed as some power supplies failed during the power-cut.
- For the QPS, the non-conformities were sorted in four categories: real, collateral and non-faults. Some real faults were discovered previously but cleared this time. The others are collateral or none. Four new non-conformities were identified which could not be correlated to any interventions during 2016 or the EYETS. Follow-up required with the QPS team.
- The BLMs are monitored by an application that allowed observing a power supply was dead. BI appreciated that the new validation procedure is much

more transparent from them and eventually saves time and interventions which is good for lifetime.

- Collimators in point 7 are redundantly powered and did – as expected - not lose power during the tests.
- On the BIS, three non-conformities were observed in the first campaign, none ever since. Some CIBUs are not redundantly powered as they are directly in the user rack and some are powered by F4 instead of F3, e.g. WorldFIP and timing. Some racks were moved during LS1 due to radiation issues, they were therefore reconnected to the F4 at their new location.
- In conclusion: most users benefited from this test campaign. The impact on cryogenic was successfully reduced as estimated time to recover is between three and four hours when it took 1.5 days for final physics configuration.
 - Ivan asked the MPP if it is required to do this test every year, or just after Long Shutdowns and EYETS. Markus answered it is very useful to repeat the tests after longer shutdowns, the recent validation campaigns allowed however to considerably reduce the number of non-conformities, and the likelihood to introduce new once during a shorter YETS is low. The final decision will come from the LMC, but MPP would recommend to repeat the tests as of now only after longer shutdowns (typically an LS or an EYETS). More frequent, but local tests for particular systems (such as LBDS in IR6) can be considered or performed upon request of the user, as the impact on the schedule would remain small. Jan added if the fault rates rise up again (or in case of extended changes) one could still decide to redo these tests after specific YETS.

AOB - all

- There will be an MPP next week but not for the ascension long weekend.