

150th Meeting of the Machine Protection Panel

Participants: A. Apollonio, J. Baechler, R. Bruce, M. Deile, A. Gorzawski, S. Jakobsen, D. Lazic, A. Lechner, B. Lindstrom, S. Ravat, C. Schwick, J. Uythoven, 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#149's minutes

- Actions from 149th MPP:
 - MPE-PE: review other failure cases for RD1 and estimate the associated FMCM signals.
 - Matthieu: determine how many times the different RQS circuits went into fault in the past year.
 - The logged data on the RQS circuits suggests that the RQS would lead – if interlocked - to 4 dumps a year on average. Which would have a visible effect on availability.
 - MPE-MI: make a final proposal for the implementation of the RQS in the maskable interlocks during TS#2 or the YETS 2017/18 via an ECR.
- No additional comments were received on the minutes; they are therefore considered approved.

1.2 First experience with DOROS BPMs in TCTs after update of calibration and roadmap until un-masking the interlock (A. Gorzawski)

- Arek presented a recap of the monitoring of DOROS BPM interlocking (currently still masked) in the SIS log. The implementation of this interlock is done within the SIS based on the orbit measured via the embedded collimator BPMs of the upgraded collimators (TCTs and TCLs in IR1 and IR5). The interlock limit of 600 μm was derived from 2016 operations, updated by Jorg with optics considerations and tighter settings for the IPs.
- The interlock log-file was checked and showed 42.000 entries from the DOROS interlock logic (the number is that high as a log entry is created with every new calculation of the SIS tree, ie every few seconds). If one removes the 30 cm and ATS optics commissioning the number is reduced to 16.000. Most of the triggers result from crossing angle leveling tests and the deployment of the new OFB, which suggest this interlock will have to be masked during special operational phases like MDs. One of the event clusters showed 100 entries until the beam was dumped by the IR6 BPMS.
 - Daniel asked what happened at that time: the measured orbit shift was due to an injection oscillation which dumped.
- Some issues also turned up, e.g. the TCTPH in IP1 was missing from the logging. Arek thinks another month might be required before unmasking to

finalise these minor issues, however no spurious triggering was observed until now.

- Daniel suggested that, as the interlocking threshold is 4σ all the time and tightened after the squeeze one might want to relax the thresholds when performing safe tests, which might have an effect on the orbit.
- Markus added there were trips due to missing communications, which were skipped in this study, it should be checked that these don't happen anymore with the latest update of the SIS.
- An update will be presented in a later joint MPP and CollWG.

1.3 CT-PPS firmware upgrade (filtering of LVDT reading, ...), results of revalidation and plans for intensity ramp-up after TS1 (J. Baechler, M. Deile)

- Mario presented a summary on the spurious dump on July 24th as well as the new firmware and ramp up plans, which were already approved by the LMC.
- On the 24th of July a spurious interlock by the CT-PPS movement system dumped the beam when the pots were taking data. There was a $\pm 10\ \mu\text{m}$ ripple of the LVDT position readout which is not enough to explain the interlocking, it is also very unlikely that this was caused by R2E. The 1Hz timer data does not allow for sufficient precision to observe the true cause of the dump. A similar thing happened to ALFA two years earlier and their solution to only interlock after 3 consecutive readings outside tolerance was applied to CT-PPS to fix the issue. This solution was approved by MPP for AFP and ALFA in the past.
- S. Ravat implemented the same logic for the movement system of CT-PPS as he did for ALFA. There is now one PXI for movement and one for position reading. If the interlock conditions are invalid for three consecutive readings of 10 ms a dump is issued. When a dump is triggered, 1 second of the 1 ms data buffer is saved to a file. Post mortem analysis of the initial lab validation test showed that it is possible to identify the change of status of the interlock and the extraction of the pots.
 - Markus asked if it was possible to send the data to PostMortem as CT-PPS already uses FESA. Mario answered that a file is saved locally after each interlocking. There have been no interlocks registered since the implementation. Daniel insisted for the long term it would be better to have this saved to the standard PM system to avoid saturation of the local drive in case interlocking becomes frequent. Mario commented that FESA will be disabled for the pots after LS2 and only PXIs will be used. Markus confirmed there was still a way to push files to PM.
- No spikes in position which could lead to an interlock have been observed since the implementation. The moveable device flag could also be saved which would allow diagnostics of a glitch in the interlock box.
- The revalidation was done similarly to last spring by testing only the parts that were modified. The interlock functionality was tested for each pot.

- For restart after TS1, two empty pots have been removed from the hardware group. The vertical pots will only be used for calibration and inserted during a special fill on the weekend.
 - Daniel commented it would still be very difficult to diagnose if the glitch came from a cabling error in the current conditions.

AOB - BLM threshold changes in TS1 and MF changes for TCP / TCSG / TCLA in IP7 (A. Lechner)

- Anton presented a summary of changes related to BLM thresholds during TS1.
- The flat top corrections for the pp debris in IP1/5 were increased by 14%. The signal should no longer reach warning (30% of dump thresholds) levels in the long running sums. In principle, the highest instantaneous luminosity digestable by the cryogenics was recently increased from 1.75 to $2.2 \cdot 10^{34} \text{ cm}^2 \cdot \text{s}^{-1}$. Only one of the BLMs would be in warning level if $2.2 \cdot 10^{34} \text{ cm}^2 \cdot \text{s}^{-1}$ is reached. The changes are mostly minor, the TCT thresholds should be adjusted once luminosities of $1.7 \cdot 10^{34} \text{ cm}^2 \cdot \text{s}^{-1}$ are reached.
- For IP8, there was an archeologically higher threshold for energy level 26 (just below 6.5 TeV) which was removed, now it is the same as for 6.5 TeV and higher. The LHCb luminosity is a little higher than last year and warning levels were reached in a few fills, flat top correction were increased.
- Leakage to Q6R7 reached warning levels last week, with higher losses just at the end of the ramp, still to be explained. This behavior is seen in all 2556b fills. No adjustments were implemented but this will be monitored.
- Recently, losses due to 16L2 have been impacting availability. The pattern is consistent, low losses for hundreds of milliseconds followed by a spike in IR7 which leads to a dump. Monitor factors for the IR7 TCPs, TCSGs and TCLAs were temporarily increased from 0.4 to 0.8 which will allow for a maximum power loss of 400 kW for less than 10 seconds and 80 kW in steady state conditions.
 - About 16L2, MP3, LBOC and the LMC are looking into it, there is no obvious solution yet from the survey, maybe a small RF finger is responsible. The electroics there see more radiation and might be changed in the next TS.

AOB - all

- This was the 150th MPP, a small drink was therefore held at the end of it.
- Thank you all for your collaboration and efficient work in the past years to keep the LHC running safely.