75th Meeting of the Machine Protection Panel

Participants: F. Burkart, B. Dehning, A. DiMauro, W. Hofle, S. Hutchins, R. Jacobsson, A. Lechner, I. Romera, B. Salvachua, R. Schmidt, J. Wenninger, D. Wollmann, M. Zerlauth

1 Presentations

The slides of all presentations can be found on the website of the LHC and SPS Machine Protection Panel:
http://lhc-mpwg.web.cern.ch/lhc-mpwg/

1.1 PP60A vs beam dumps + Changes of MPS systems during LS1 – (I. Romera)

- On 25.10.2012 the 60A orbit correctors in sector 56 experienced a slow power abort due to a network communication problem and the following removal of the powering permit by the PVSS SCADA of the powering interlock system . This lead to beam losses and the beams were dumped by the BLMs.
- There is no hardware interlock on the 60A orbit corrector circuits. The protection of the magnets is guaranteed by the power converters. The powering permit for the 60A circuits are derived from cryogenics and the powering conditions (PIC).
- Two similar events have been observed in 2010 without beam.
- The root cause of the event (including the two ones without beam) were traced down to a wrong implementation of the PVSS logic calculating the 60APP. With the correct PVSS logic a communication problem with only one PIC would not have caused a removal of the powering permit. The PVSS logic will be corrected in LS1 accordingly.
- Ivan discusses two options for a redundant software interlock.
    - 1st PC interlocks: PC interlocks are not fast enough to detect this type of failure (~500ms). The PC interlock is (so far) only active in the power converter (PC) states IDLE, ARMED, RUNNING.

- 2nd PIC-PVSS to dump the beam: PVSS could request also a slow power abort to all PICs in the sector. Then the PIC would also trigger a beam dump before losses appear. However as a general policy, protection features should not depend on the availability of PVSS or SCADA systems in general.
  - Jorg comments that a redundant interlock of the corrector circuits is already implemented in the SIS.
  - Jorg asks if we are sure that there is no other problem? It would be good to open the BIS loop, when the powering permit is removed.
  - Markus points out that we lost a fill but were still protected by the BLMs. Normally also the PCs should also only go down sequentially and not at the same time.
  - Jorg comments that one should probably look again into the Post Mortem of this event, as he remembers the orbit change as been quite dramatic. Maybe the sequential removal of the powering permit did not work as expected.

- Access Powering Interlocks:
  - After the incident in 2008 new rules for access have been implemented, which prevents powering above the so-called phase-I current limit during access.
  - The main problem is that there is a weak and unreliable long chain of different SW components.
  - To overcome this, an additional PLC at the PIC side will be added. The communication between the LACS and the PIC-PLC will then happen via hardwired signals. The PIC-PLC will then publish the access status to CMW. The PIC-PVSS will log all access interlock transitions.
  - An ECR (EDMS 1246780) was already approved and the changes will be implemented during LS1.
    - Jorg comments that there is a similar implementation in the SIS, which will not give a beam permit in the case of access.
- Masking of Global Protection mechanism:

- There is a global protection mechanism to avoid quench propagation to neighboring magnets, by performing an anticipated shutdown of the whole sector.
- During the HWC such a global protection is a bottleneck for testing and it would be preferable to deactivate the global protection mechanism.
- Therefore the global protection mechanism will be configurable via PVSS and the masking will clearly be visible from PIC SCADA.
  - Jorg asks if this means that this masks the global protection for the whole sector or if it is done circuit by circuit.
  - Markus responds that the implementation is circuit by circuit. The overall masking will be done sector by sector.
  - Ruediger asks, how we can minimize the risk of forgetting to deactivate the masking of the global protection mechanism. Maybe one can link this to the beam permit (SIS) or remove it when beam is present? Jorg adds that it maybe best to link the masking of the global protection to the injection permit in the SIS.

- Other activities:
  - PIC:
    - R2E relocation of 9 PICs to UL14/16 and UL557.
    - Re-commissioning of UPS hardware links following UPS renovation.
  - FMCM
    - R2E relocation of 1 FMCM from UJ56 to USC55
    - Improvement of immunity against external electrical network perturbations (in collaboration with EPC).
    - Renovation of controls in the SPS transfer lines.

1.2 Abort gap population measurements in ALICE (A. Di Mauro)

- After the loss of the BSRT in August Alice started to look into the possibility to provide information about the abort gap population.

- As Alice is running with main-satellite collisions, there should be enough sensitivity to see collisions of main bunches with debunched beam in the abort gap (AG). This would allow to measure the AG population.
- Basis of such a measurement would be the T0 detector, which consists of two arrays of 12 PMTs with Cherenkow quartz radiators. Its time resolution is better than 50ps and provides level 0 triggers and vertex positions below 7.5mm. The T0 detector has a small acceptance and high rejection of background.
- The T0 detector is surrounding the beam pipe with a diameter of 130mm.
- Antonello shows some measurement examples of the T0 signals of collisions around the abort gap.
- The analysis of the measurement data was performed using the standard equation for bunch-by-bunch luminosity.
- In a first attempt all beam parameters were assumed to be constant. The abort gap population measured by the BSRT could be reproduced in some cases, but especially for B2 there were some discrepancies.
- In the second attempt the beam separation and the beam lifetime were considered in the calculation of the abort gap population. With the new procedure the matching with the BSRTs could be significantly improved.
- After another iteration the estimation was improved by taking also the leveling knobs into account. The life time correction from above was neglected. Unfortunately there were not many useful fills after this last iteration. The agreement with the BSRT is not as good as for the second attempt, but applying the beam lifetime correction also in this method could compensate this.
    - Richard comments that the analysis may improve further by taking into account interaction with beam gas.
    - Markus comments that the different behavior of B2 is not explained. It would be useful to understand where the difference between B1 and B2 comes from. It could for example be caused by the BSRT itself.

Discussion:

- Markus asks what the plan for the measurement of the abort gap population with ALICE is. It would certainly be helpful to have this method as backup or as cross calibration.
- Ruediger asks if a T0 like detector could be used with the beam gas injectors (BGI) in IR4, as the diamond detectors installed in this region seem to be limited by afterglow from signals of the full beam.
- Richard comments that for this one would probably only need one scintillator.
- Bernd comments that there have been studies performed by BI in the SPS with scintillators, photo-multipliers and diamond detectors. The timing is faster with the diamonds. The advantage of the scintillator detectors is that they are directional and one can use this to distinguish the direction of the losses.
- Daniel asks if this information could be also added to the abort gap population monitor and integrated into an eventual automatic abort gap cleaning. Antonello responds that the T0 signal is already published through DIM. If the correction of the data can be reliably applied during the online analysis, the T0 signals could clearly give an input to the abort gap cleaning application.
- **Action:** Reflect what could be studied and tested during LS1 to test if this could be used with the BGI. (**Richard, Bernd**)

1.3 Planned displacement of the Access Safety Blocks (ASB) during LS1 – (S. Hutchins)

- For access into the LHC the safety chain 1 has to be tripped, which prevents circulating beam in the machine with different independent measures. One of these measures is moving the ASBs into the beam pipe. The ASBs are standard VAT 100mm vacuum valves.
- There is a risk that the ASB could move in with circulating beam and the blades would touch the beam.

- Originally the ASB positions were planned to be placed behind the D4 (symmetrically for both beams) upstream of the primary collimators in IR3.
- In the ECR proposed by Steve it is proposed to put them symmetrically with long clear downstream paths, to avoid damage in accelerator devices like collimators. If there is no risk of such an accident the ASBs could stay were they currently are.
    - Markus comments that these valves are heavily interlocked. In addition if the interlock does not work the BLMs would detect the first losses and dump the beam early enough to avoid damage.
    - Jorg comments that there are 300 more vacuum valves installed, which only have one single position sensor.
- **Action**: Look at the radiation map of IR3 to decide if there is a need to move the ASBs to ease maintenance. (**Steve**)
- MPP proposes for the moment to leave the ASBs, where they are currently installed. For the moment no machine protection issue was identified, which could motivate the moving of the ASBs.

1.4 MPP during LS1 and review of action list – (M. Zerlauth)

- MPP will go on during LS1 to digest issues and proposals from the upcoming MPP workshop (11. – 13.03.). As a frequency we plan to have the MPP every 3-4 weeks. As the Friday morning slot will be occupied by LS1 meetings, it maybe necessary to move to a different time slot.
- Markus shows the pending actions from the MPP website.