141st Meeting of the Machine Protection Panel

Participants: S. Gabourin, L. Jensen, P. Odier, I. Romera, C. Schwick, M. Valette, D. Wollmann, C. Xu, 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#140's minutes

- Actions from 140th MPP:
  - What is the time required until the TDE block can be filled with air due to a (most credible) worst case leak? (G. Pigny, G. Bregliozzi)
  - What is the maximum temperature allowed in the TDE block, when in air before it is severely damaged? (EN-STI)
  - Compare the reliability of the (new) hardware and the existing SIS interlock of the TDE N2 pressure data? (A. Apollonio, G. Pigny, G. Breggliozzi)
- No additional comments were received on the minutes; they are therefore considered approved.

1.2 24bit ADC DCBCTs for the LHC and SPS, redundant intensity signals in the SPS (P. Odier)

- Status of beam current measurement in the SPS:
  - Before the EYETS: The high intensity measurement (BA3) was connected via a copper cable to the SMP, the low intensity measurement (BA4) was connected via a copper link and an optical fibre.
  - In 2017 an optical link was added in BA4 to replace the copper link, in BA5, two new CERN made transformers were installed with 16 bits hardware and optical links. The noise level of these transformers is a factor 4 lower than the one in BA3.
  - The setup beam flag will now be derived from the BA3 and BA5 transformers and therefore the signal source will be fully redundant.
- Status of beam current measurement in the LHC:
  - Status before the EYETS: A/B system on both beams, the signals from the two beams for system A and B go each to one VME crate. In addition, there were four 24-bit serial links connecting the BCTs to a third VME crate. The signals from this third crate were successfully tested with the SMP during TS2.
  - For system A, beam 1 and 2 are equipped with 24 bits ADCs located next to the hardware in the tunnel, which provides signals with 1S.s^{-1} and 8e8 charges RMS noise.

  - System B is the same but the noise level is a factor two higher on the beam 2 system, which was mitigated using an additional software filter at the level of the FESA class.
  - In 2107, the 24-bit VME will be connected as system A to the SMP, which will allow maintaining the level of redundancy. No changes to the B system with 16 bits ADCs.

- The commissioning would include a precise calibration of the BCTDCs by measuring a reference current over 60 second.
- **Proposal:** the commissioning could happen in the first week of April.
  - Stephane added the BA3 and BA5 systems are used for the setup beam flag, the BA4 system is used for the probe beam flag. The limit for setup beam is 1e11 protons, which is a few times above the noise level.
  - Markus asked if there is consolidation foreseen in the mid-term, for the older systems for example.
    - BA3 and BA4 will be upgraded with standard acquisition systems. In the longer term nothing is foreseen until after LS2.
  - P. Odier added that this protection layer is not 100% hardware, for example the acquisition is done via a software layer (VHDL code, FESA class), whose deterministic behaviour can be discussed.
    - Daniel answered that we have redundant protection through other hardware systems such as the BLM system. These intensity measurements are mostly for the setup and safe beam flag. It is good that we now have redundancy for the Safe flag as we had problems with it last year and it involves higher beam currents.
  - Daniel asked if a revalidation was necessary for the B system with 16 bits in the LHC.
    - A full revalidation will not be required, only the usual calibration measurement. The higher noise in the B system comes from the BCT electronics, one of the cards is too noisy.
  - Markus added that it is now confirmed 7 TeV operation will be postponed to after LS2. It would anyhow be good to understand the source of this noise in the time frame of LS2 as the SMP threshold will be lowered with the increased particle energy afterwards.
    - P. Odier added that for reliability issues one has to take the peak to peak noise which can be 6 times higher than the RMS noise.

Action (MPE/MI, MPP): verification of the compatibility of the proposed commissioning date.

AOB - all

- Next time (17th of March) we start with the first set of presentations on the re-commissioning of MP systems.