63nd Meeting of the Machine Protection Panel

Participants:
Mario Deile; Jorg Wenninger; Bertrand Jedrej; Vincent Chareyre; Rüdiger Schmidt; Siegfried Wenig; Giulia Papotti; Arjan Verweij; Jens Steckert; Antonello Di Mauro; Andrea Apollonio; Hughes Thiesen; Markus Zerlauth; Andrzej Siemko; Eva Calvo; Anton Lechner; Ivan Romera

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 The Interlocked BPMs of the LHC in Pt.6 – (E. Calvo)

- BPMSA (aperture = 80mm) and BPMSB (aperture = 150mm) type BPMs are installed in LSS6 located either side of the extraction septum. In order to avoid reflections for the high intensity bunches attenuators are installed on the signal cables between the BPMs and electronics.
- In Chamonix it was decided to lower the sensitivity thresholds. Errors in the MTF documentation led to wrong attenuation values on some BPM channels:
    - Attenuation for BPMSA.B4R8 was increased by mistake and detected while scrapping on 24/5. The attenuation was corrected on 25/05, however other channels remain to be reduced to a threshold of 2E10p as well (currently in the order of 4E10p).
- It is proposed to upgrade to a new firmware to separate badly acquired bunches (considered as errors) from bunches having large oscillation amplitudes.
- The new firmware functionality will be tested during BI MD.
- During TS2 BI will replace the attenuators of the channels in order to get a threshold of 2E10, and validate the changes with scraping tests.

Discussion:

- Markus points out that in order to avoid naming mistakes it is possible to define pseudonyms for experts in the database together with the official names.
- Jorg comments that bump tests are not very satisfactory as one cannot select which bunch to kick but only full beam. This check only guarantees that the correct BPM signal triggers.
- Markus asks whether the additional Post-Mortem data available from the new firmware version is going to change the format of the buffers sent. Eva says that the new format remains compatible with the old one but new data have been added.
- Rudiger suggests the creation of an ECR to inform other colleagues prior to any modification of BPM's firmware.
- **Action:** Eva will replace all attenuators of BPMSA.A4R6.B2, BPMSA.B4R6.B2 and BPMSB.A4R6.B1 and re-validate the changes with a scraping test. Eva will install the new firmware during the BI MD to perform first tests, but then roll back to the current version during the TS. During the next run the firmware will be installed for monitoring purpose in a parallel crate without being connected to the BIS (and possibly deployed in the operational systems when its functionality has been verified).

1.2 FLUKA simulations of accidental beam impact on TOTEM Roman Pots: new results (and corrigendum to previous results) - (A. Lechner)

- See presentation for input parameters
- Anton announced a correction of the presentation given during the last MPP meeting, where the failure case of an asynchronous dump with 3 sigma impact parameter was studied. The shown results wee in fact underestimated by a factor of 2.
- The results of the 2nd failure case, being a direct impact into the steel foil with 0.85/3 sigma impact parameter (representing the worst case scenario) were presented.

- In both cases the largest losses and consequently the highest deposited energy density is observed in matching section around the Q5, with a peak energy density of ~ 550 mJ/cm3. Also the first dipole magnets in the dispersion suppressor region like MB.A8L5 will see a considerable of ~150mJ/cm3, well above the currently assumed quench limits. The energy density in coils further downstream will be at least an order of magnitude lower.
- For the foil of the Roman pot (which is the most critical item to eventually break), the deposited energy has been estimated to a temperature increase in the hot spot of around 250K, which is still well below the melting point of stainless steel.

Discussion:

- Mario commented that the presented numbers are much lower than he recalls from initial simulations being done on this topic (which showed that the steel foil might actually melt under the impact).
- Rudiger commented that albeit Daniel has sown that for the current optics the asynchronous dump failure case will never deflect the beams towards the Roman Pots, the simulations are still very relevant for different optics used (high beta, HL-LHC,…)
- **Action:** Mario and Anton will cross-check the input parameters (number of impacting bunches, impact parameters, beam sizes,…) and compare the results of the two simulations.

1.3 LHC Machine Protection Considerations in UPS Replacement Project – (V. Chareyre)

- Vincent presents the motivation for replacement of the APC Silcon UPS systems during LS1. It will improve reliability/availability of UPS powering and will decrease downtime (EDMS 1151991).
- New UPS configuration affects RE zones and odd points of the LHC and provides a 2oo3 redundancy for powering both F3 and F4 distribution lines.

- Up to now the loss of a single UPS system triggered a PIC interlock, however with the new configuration it will require a double UPS failure to trigger the PIC.

Discussion:

- Jens asks about supervision tools to know the status of the UPS systems. Vincent replies that there will be a web tool to monitor the status of the UPS network. In addition, the PIC-PVSS provides already some information about the lost of UPS.
- Markus comments that in order to avoid spurious triggers, a delay of 30secs is currently implemented between the lost of a UPS and the PIC reaction.
- F4 distribution line was so far reserved for QPS equipments. As power increase for the next years, it will be required to define needs.
- **Action:** EN-EL and TE-MPE to study all UPS failure modes and the impact on the PIC logic to be implemented. The new logic must be tested while exercising all possible failure cases together with the MPE colleagues on a test-bed before deployment in the machine.
- **Action:** TE-MPE has to provide the requirements for powering after LS1 (specially whether the use of F4 line remains restricted to QPS clients or whether one may relax this constraint).

1.4 Analysis and follow-up of recent converter trip of RTQX2.L2-15.06.2012 – (H.Thiesen-I.Romera)

- Under normal circumstances all failures coming from the powering system of super-conducting magnets are detected by the PIC and then propagated to the BIS.
- In the event of 15.06.2012 a power converter failure triggered a beam dump on beam losses before being detected by the PIC.
- Small broken diode inside sub-converter 3 of RTQX2.L2 provoked some oscillations which put in conduction the free-wheeling diode, leading to a trip by over current in RTQX1.L2.

- FGC software protection exists that calculates the error between the output and reference current. It however only reacts when 3 consecutive samples are out of range (100ms/sample in IT converters).

Discussion:

- Rüdiger proposes to run some simulations using Pspice model to calculate which current change was actually seen by the triplet magnets at the moment of the dump.
- Andrzej suggests the installation of a DCCT to measure the real current on the magnets.
- Jorg comments that if we had had the same problem last year the BLMs would not have triggered due to more relaxed settings.
- **Action:** Arjan and Jorg will try to estimate the current changes actually seen by the magnets, once through simulations and secondly deriving it from the orbit excursions observed.
- **Action:** Hugues will reduce the over current protection thresholds LIMITS.I.POS and the allowed current error I_ERR to more adequate values for 4TeV operation. An ECR is required.