120th Meeting of the Machine Protection Panel

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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 minutes

- Actions from 119th MPP:
  - 2 actions from Matteo's talk:
    - Discussion on a passive beam presence flag should be followed up
    - Systematic studies on beam scraping by collimators in case of non-working dump
  - Tests on BIS fiber optics should be followed-up
- No additional comments were received on the minutes, therefore they are considered approved.

1.2 Installation of Cherenkov detector in TT20 and connection to SPS-BIS – (S. Montesano)

- Simone presented the plans for installation of a Cherenkov detector in TT20 and the implications on the connection of this device to the SPS-BIS
- The implementation of a feed-forward system ('Autospill') on the main quadrupoles would improve the quality of the slow extraction spill in SPS, which has high importance for the experiments
- A Cherenkov detector can be used to monitor the time structure of the spill and provide the required feedback for optimization; it is already used to estimate the number of protons extracted by the crystal collimation setup in LSS5 (SPS-TQCD-EC-0001, EDMS 1562102)
- Cherenkov light is emitted when a particle is traversing a quartz bar at relativistic velocity
- The detector was designed to match the standard SPS beam pipe, thus not limiting the available aperture. The quartz bar can be moved towards the center of the pipe by a dedicated motor (standard LHC-collimator motor) with a speed of 12 mm/s. The moving speed will be reduced by a factor 10. A PMT allows collecting the Cherenkov light emitted by the quartz bar
- The position of the new detector must be interlocked via the SPS-BIS
  - Micro-switches define the 'IN' and 'OUT' position, which will be read using a FESA class
  - No beam is allowed unless the device is in 'OUT' position

    - It is proposed to connect the 'OUT' position switch to a maskable input of the SPS BA2 BIC (no dedicated BIS currently exists for TT20), to allow for operation during dedicated runs, MDs,…
    - In case the detector becomes an tool for standard operation in the long run, the interlock logic should be revised
- In the proposed configuration, it will be the responsibility of OP to mask/unmask the TQCD input when required
- Markus commented that the current usage of this device is on a non-continuous basis. In case of problems, leading to a false interlock (e.g. if the crate is down), there should be the possibility to mask the channel
- Experiments with a silicon crystal (similar to quartz) in HighRadMat, have shown that no damage to the device is expected even in case of direct impact of high intensity beam. In addition the development of particle showers will be very limit, so that no damage to downstream equipment is expected in this case.

1.3 LHC BCTDC Layout proposal for 2016 (S. Gabourin)

- Stephane introduced the new layout proposal for the LHC BCTDC in 2016
- The LHC BCTDC units provide LHC beam intensity data to the SMP in the LHC. These intensities are used for the calculation of the LHC Setup Beam Flag and forwarded to clients via the LHC Timing system.
- Presently, two BCTDCs, "A" and "B", using 16-bits ADC (VD 80), feed redundantly the SMP
    - BCTDC A provides Beam-1A and Beam-2A intensities
    - BCTDC B provides Beam-1B and Beam-2B intensities
- A "C" system was installed to test a 24-bit ADC with 1 prototype (VME RF MUX) and 1 operational module
- In 2016, the "C" system will be equipped with two operational modules VFC HIP and a new version of MTT (Master Timing Transmitter) for the connection to the SMP
- After full validation of the VFC HIP in System 'C', it will be decided, which different steps have to be taken to connect one of the channels of system C to the SMP
- A solution could be to replace the A system by system C to keep two full redundant chains of electronics and test the new system without risking to degrade the reliability of the connection
- Markus commented that in the long term the strategy is not replacing A and B entirely, but just replacing the 16 bits ADCs with 24 bit ADCs in both A and B systems. At the end of 2016, with one year of data available for the 24 bit ADC, a more detailed plan for EYETS can be defined
- For start-up in 2016 nothing will change in the SMP, then, depending on OP and the monitoring output of new MTT, it could be envisaged to connect one channel of the new system to the SMP during a TS (provided the necessary recommissioning is taking place).

- Stephane asked when will the new MTT be available. Patrick replied it will be ready within a few weeks

1.4 Changes of SPS extraction interlock strategy for LIU beams – (V. Kain)

- TEDs are movable beam absorbers in the transfer lines from the SPS to the LHC (about 4 m long, in air). They are designed to absorb LHC ultimate beam. There are 2 TEDs per LHC transfer line
- When the TED is IN, the status of systems downstream the TED is ignored when computing the beam permit. This is independent of the extracted intensity.
- The position of the TEDs is an input to the SPS Extraction Master BIC, to calculate the extraction permit
- If the TED is MOVING, beam extraction is inhibited, whereas it is allowed if the TED is IN or OUT
- Simulations were carried out by colleagues from EN-STI to verify the compatibility of TEDs with LIU beams
- The introduction of a Ti mask eliminates the risk of radioactive fire in case of too high beam intensities/brightness's impacting on the TED, but the risk of cracks remains
- As a summary of the simulations:
    - All run 2 beams are acceptable with Ti masks installed (up to 288b).
    - For run3 and HL-LHC: all beams up to 144 bunches are acceptable.
    - HL-LHC beams with 288 bunches imply the risk of cracks in the graphite for a single pulse
    - BCMS beams with 288 bunches, imply a high risk of cracks in the graphite of the TED for a single shot.
- No budget is available to develop LIU TEDs (possibly only the TT60, based on an old design, will be replaced)
- The proposal is to keep TEDs as they are, but to modify the interlocking strategy, e.g. as follows:
    - new SPS TED safe beam flag (reliability requirements to be assessed)
    - Modify the slave BIC logic to which TED "MOVING" is connected
- High intensity extraction on TED is only needed during setting up with high intensity (few times per year)
- It is foreseen to deploy Ti masks for every TED
- To cope with more extreme beam parameters the TED should become longer, but the size is limited by stringent space constraints
- Daniel commented that the new TDI was designed to withstand the impact of 288 bunches, but the TED is a beam stopper, so requirements are different
- Markus asked when would the interlock be needed. Verena replied that the TEDs were used consistently for the first LHC extractions, so the interlock should likely be ready for after LS2 in view of the LIU beam parameters, given the current limits on intensity set by RF to $1.3*10^{11}$

- The change of the interlock logic can be discussed (e.g. via a dedicated CIBU detecting BCMS beams + change of the MASTER BIC equation or via the SMP)
- **ACTION: Follow-up in collaboration with BI and the BIS team the reliability of intensity input to be possibly included in the interlock logic**

AOB

- Jorg mentioned the ongoing discussions for the definition of a possible 'phase advance interlock', depending on the β* (40 or 50 cm) in 2016.
- Markus announced that the recommissioning strategy of MPS systems after YETS and the approval of procedures will be discussed in February
- Etienne mentioned the possibility of interlocking the injection BETS, which would lead in case of problems to a SPS extraction inhibit. This could be envisaged already for the EYETS, certainly in view of Run 3. This could be part of the redefinition of the interlocking strategy for SPS extraction following Verena's talk
  ACTION: Assess with ABT the possibility of further reducing the delay of the beam interlock request for the injection BETS to reduce the possibility of beam impacts on the TDI