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129th Meeting of the Machine Protection Panel

Participants: A. Apollonio, W. Bartmann, J. Boyd, L. Carver, B. Dehning, M. Deile, G. Kotzian, A. Lechner, D. Lazic, E. Metral, A. Mereghetti, Y. Nie, G. Papotti, V. Raginel, J. Uythoven ,D. Valuch, J. Wenninger, 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 Excitation by ADT and active bunch-by-bunch tune measurements – (D. Valuch)

The ADT system is composed of pickups in the tunnel (pt. 4), signal processing on the surface (SR4), driver amplifiers and controls in UX45, power amplifiers and kickers in the RF zone (UX451).

The ADT is routinely used to excite the beam:
- Coherent excitation used for **abort gap** and **injection gap** cleaning.
- Wideband white noise excitation used for transverse emittance blow-up, loss maps and MDs.
- External analogue input for BI signals.

It is proposed to do **4 type of measurements involving active beam excitation by repetitive single-turn kicks by the ADT at flat-top:**
- **Bunch by bunch tune measurement proposed by E. Metral** for e-cloud induced bunch by bunch tune shift along a batch.
    - The order of magnitude of the coherent tune shift along the batch at 6.5 TeV is expected to be ~1E-4.
    - The procedure will be to kick the selected batches with an excitation length of 1 turn (fixed in firmware), the amplitude still needs to be defined. The transverse feedback will be active during the test. The position data are recorded bunch by bunch.
    - A feasibility test is needed. Functionality exists already, as an expert diagnostics tool. No changes to the operational system are required.
    - If feasibility test is successful, the method should be properly implemented as operational tool involving FPGA code update with hard wired excitation limits.
    - It has been proposed to first do a test at injection to check if the gating works properly – a few injected batches should be sufficient. Only once successfully validated at injection one could envisage a test at flat top during as an end of fill MD with the full machine.
    - J. Uythoven said that after the feasibility test, this functionality should not be used anymore unitl it has been implemented properly and validated for safe and routine operation.

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ACTION (E. Metral and D.Valuch): Prepare an MD proposal for the test at injection and at flat top, mentioning how many bunches will be excited and with which amplitude.

- **Bunch by bunch controlled emittance blow-up proposed by J. Jowett:** in order to achieve better performance during the p-Pb run, it might be necessary to actively equalize individual bunch emittances of the proton beam:
    - No changes to the ADT, nevertheless if used operationally a proper application is needed
    - M. Zerlauth reminded that it has be envisaged that in case it was not possible to dump a circulating beam to gently blow out the beam to achieve a controlled scraping of the complete beam (over many tens of minutes). Thus the implementation needed for this proposed measurement should/could be done taking into account this emergency scenario. A dedicate MD/EOF proposal should be established.

- **ADT as quasi AC dipole requested by R. Tomas:** Instead of using the AC dipole, using the ADT for optics measurement. The excitation with the AC dipole is strong and can last for a few thousand turns. With the ADT it would be possible to get a more gentle excitation lasting for 50 to 100 thousand turns providing better results:
    - This requires changes in the FPGA code to implement ramps into the excitation amplitude.
    - Maximum excitation window length and amplitude must be fixed prior to any tests.
    - The first tests must be done with pilot bunches.

ACTION (D. Valuch and R. Tomas): Make a proposal for the maximum excitation window length and amplitude.

- **Pulsed excitation for the e-lens MD by M. Fitterer:**
    - It requires an FPGA code update. A special firmware could be downloaded for the time of the MD (resident in volatile memory only, which would be overwritten by the operational firmware upon reboot).
    - The proposal was accepted for limited intensities (12 bunches).

In order to avoid repeating the validation several times steps, it is proposed to implement all the modifications during one technical or year-end stop. Any changes in the ADT firmware should be communicated to (r)MPP in order to agree on an according re-validation program,

1.2 AOB - Update of BLM thresholds at collimators following 2016 loss maps and setting changes (A. Mereghetti)

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BLM thresholds were updated at collimators mainly due to collision debris (experimental IRs) and to betatron cleaning to avoid unnecessary dumps in case of drops in beam life-time (IR7 collimators, equipment nearby, TCTs). These changes were already approved by the LMC and are presented here to inform the MPP community.

- Collision debris:
    - High loss signals due to collision debris in the long runnings sums of TCLs and TCTs have already been observed in 2015 and thresholds were increased accordingly.
    - New calibration curves have been produced for each BLM covering all RS (BLM signal vs. peak luminosity). This allows scaling of the BLM signals to the expected peak luminosity, where only warning levels should be reached.
    - Flat Top correction of BML threshold, have only been applied for RS08-RS12 (640 ms - 82 s).
- Betatron cleaning:
    - BLM thresholds in IR7 + at TCTs have been updated to allow for a temporary lifetime drop with 200 kW beam losses (MF=0.4) up to 500kW (MF=1). Comparable adjustments have been performed in 2012 and 2015. The changes were required as the retraction between different collimator families and therefore the loss distribution in the collimators changed.

Daniel reminds that it was agreed to propose dedicated BLM thresholds for the collimators in IR7 for ion operation. Anton and Alessio confirmed this plan.

1.3 AOB - Status of MP relevant changes during TS1 and left over from before – (M. Zerlauth)

M. Zerlauth presented machine protection relevant changes that were implemented during the TS1 and the performed validations. The List can be found [here](#).