

121st 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 MPP#120's minutes

- Actions from 120th MPP:
 - 2 action from V. Kain's talk on TEDs
 - Further tightening of the time window for interlocking the beam extraction from the SPS.
 - Assess required reliability of the SPS intensity measurement, in case of inclusion in the interlock chain.
 - A brainstorming on the SPS extraction interlock should be done in conjunction with ABT colleagues
- No additional comments were received on the minutes, therefore they are considered approved.

1.2 Final interlock logic and deployment plan for FGClite in LHC (S. Uznanski)

- FGClite will replace FGC2 everywhere around the tunnel where there is radiation.
- ~1700 units to be deployed for 60/120/600 A-4/6/8 kA PCs.
- The power cycle requests can come from the front panel, the FGClite itself, the gateway via field bus and the absence of carrier on the field bus.
 - Markus: can the power cycle be inhibited on requests?
 - Power cycling of the FGClite in case of missing communication can be masked for 60A converters to avoid orbit excursions and allow the OFB to react.
- If the carrier of the WorldFip goes down (which probably means that a whole segment is affected) then the FGClite will perform a power cycle (independent on which power converter is connected).
- The ramp-down of the current is distributed in time as a function of the PC addresses between [0.4s-0.5s] after a 5s delay.
 - Jorg: could the delay be extended to 10s to allow sufficient time for the SIS and potentially the OFB to react and either avoid unnecessary dumps (60A circuits) or dump the beam safely before the power cycle.

- FGClite and FGC2 cannot be used at the same time on a given segment as it requires a change of the GW software: Pre-series of 70 to be installed and tested in one segment during 2016 (TS2 or TS3), not radiation tolerant. The rest will follow during EYETS, depending on FGC2 failure rate in radiation environment.
- Link to the FGClite specifications mentioned at the end of the presentation: <https://edms.cern.ch/ui/#!master/navigator/document?D:1361822820:1361822820:subDocs>
- **Action: Increase the ramp down delay period to 10s to allow the OFB and SIS to take action prior to a potential power cycle.**
- **Action: After deployment of the FGClite a reduced hardware commissioning has to be performed. The different steps will be defined in the coming months.**

1.3 PC Interlock - status, next steps and feasibility of optics interlocking (K. Fuchsberger, R. Bruce, M. Schaumann)

- The aperture margin could be increased best by changing the collimation hierarchy and the betatron phase advance between dump kickers and TCTs/triplets. This margin can then be used to go to a smaller β^* .
- This phase advance should ideally be brought close to 0 even if it is not used to squeeze β^* . The TCTs and the triplet would then be best protected against beam losses during an asynchronous beam dump. The aperture in the experiments is very large and therefore no issues are expected.
 - Jorg: if we have to interlock a phase advance in the order of 10-20 degrees there might be a problem with operational tune changes.
- Phase advance between MKD and TCT should not be above 30 degrees (i.e. a delta of 5-10 degree must be achieved for the currently expected phase advance: IP1 ~22 degree and IP5 ~14 degree).
- Comparison from PC to reference functions is done at 1Hz, Triplet, main RQD/F and IPQs have very stable currents with $\Delta I \sim 0.02A$ from fill to fill. , Only the trim quadrupoles show very large fill to fill variations. The total ΔI amplitude is ~3A.
- Varying each family of magnets, the total $\Delta\mu/\Delta I$ was determined and multiplied by the measured ΔI to derive a first proposal for interlocking windows.
 - About Michaela's table on measured ΔI and proposed interlocking values, KQTD and KQTF should have big margins as they are touched very often (by the QFB and for tune changes during the cycle), all other power converters could be interlocked tighter.
 - Jorg: besides the KQTD and KQTF for the other power converters the trimming could even be blocked after the first trims (looking into this possibility tbd directly in LSA with Greg).
 - Jorg: maybe another layer should be implemented to protect against human error, like unchangeable currents.

- This interlock will be active during the full cycle and therefore the interlock limits at injection, ramp and flat top should be very loose.
 - Jorg: probably one should separate this from the interlocking of the orbit correctors.
- Open questions: How are phase advances measured? Can we put everything to the limit and measure phase advances with low intensity beam?
- +/-10 degrees interlocking sounds feasible but tight.
- **Action: Trigger expert discussion to come to a machine protection statement, if such an additional interlock is mandatory to go to 40cm? The phase interlocking would be an additional safety layer but might not be mandatory. Which other conditions must be fulfilled? -> Second week of March.**

1.4 MPS re-commissioning for 2016 - a first look (M.Zerlauth, D.Wollmann)

The LHC start-up 2016 will contain: 2.5 weeks of powering tests, 4 weeks of beam commissioning, 0.5 weeks of scrubbing run (and then scrubbing during normal operation), Intensity ramp up and VdM before TS1.

- The release of the (re-)commissioning procedures was promised at Evian, most documents are 95% ready, they just need to be finished and sent for approval --> Let's all make an effort to finalize the MPS commissioning docs to have a validated reference..
- An XLS sheet was created for the various MPS subsystem commissioning. Please add your respective updates and comments on procedures ([MPS Commissioning 2016](#)).
- ACCTESTing will be used to perform the tests for PIC, WIC, FMCM and COLL.
- Vacuum: A lot of changes in interlocking levels.
- TOTEM has to be fully re-validated after the YETS, also as the TOTEM interlock cables had been destroyed and caused shorts in the TOTEM interlock box.
- Blindable BLMs functionality will be fully commissioned, but the blind out time will be set to zero.
- MKI flat top length has to be re-discussed to avoid satellites from SPS.

AOB - operational plans of AFP (M. Trzebinski)

- Installation of two horizontal roman pot stations 205 and 217m from ATLAS detector (IP1). Based on the comparable design as TOTEM.
- Installed 18/01, baked and under vacuum since 03/02. Motor motion calibration on 18/02.
- The controls and interlock logic (copy from ALFA) is ready for validation tests and commissioning.

- Commissioning of interlocks is requested as soon as possible, as detector commissioning is foreseen between March and May.
 - Detector tests could be done in garage position.
 - Jorg: Interlock commissioning should be done before the system is powered with beam on.
- After commissioning the detector could be switched on parasitically for calibration.
- Provisional planning is to perform standalone data taking with ~ 20 sigma insertion in low μ -runs May-June 2016.
 - Jorg: if the AFP pots should be inserted the beam-based alignment needs to be performed together with the other pots / collimation during the beam commissioning.
- Standalone insertion and data taking of AFP as end-of-fill during high intensity runs before September.
- Correlated data taking with ATLAS before mid-November
 - Markus: a common run with ATLAS in November sounds like an ambitious timeline.
- **Action: advance with interlock tests + documentation + give a summary on the interlock tests in the MPP next 2 weeks.**