MPP meeting 2 September 2011

Original agenda:

- Review of FMCM thresholds and possible mid-/long-term measures to decrease sensitivity to mains perturbations (T.Baer, M.Zerlauth)
- Update of TSU firmware + additional delay for asynchronous trigger of LBDS (E.Carlier)
- Modification of CMS BCM thresholds (N.Bachetta, A.Dabrowski)]
- AOB

Present:

M. Zerlauth (TE/MPE), A, Siemko (TE/MPE), R. Jacobsson (PH/LHCb), M. Sapinski (BE/BI), J. Wenninger (BE/OP), J. Uythoven (TE/ABT), E. Carlier (TE/EBT), S. Wenig (PH/ADO), N. Bacchetta (PH/CMX), A. Dabrowski (PH/CMX), M. Guthoff (PH/CMX), H. Thiesen (TE/EPC), A. Nordt (BE/BI), A. Di Mauro (PH/ALICE), J. Burdalo (TE/MPE), M. Galetzka (TE/MPE), B. Todd (TE/MPE), S. Gabourin (TE/MPE), I. Romera (TE/MPE), S. Wagner (TE/MPE), P. Sollander (BE/OP), T. Baer (BE/OP), J. Blanco (TE/MPE).

Minutes:

Review of FMCM thresholds and possible mid/long-term measures to decrease sensitivity to mains perturbation (T. Baer, M. Zerlauth)

Tobias presented simulations for ΔI=+1A on three circuits: RD1, RD34 and RBXWTV in the event that FMCM doesn't trigger a beam dump. This study investigates the implications and the feasibility of increasing the thresholds of some FMCM circuits in order to be more isolated from 18 kV network peaks.

- RD1

For beta star 1.5 m and 1A current change in RD1 the excursion on the MKD is around 800um. The phase advance between RD1.L1 and RD1.R1 is 180° (but opposite defection) and so failure adds up. A 1A current change in RD1.LR1 and RD1.LR5 gives 1.6 mm excursion at MKD.

All simulations assume a current change of 1A and then scale it with $\frac{\Delta I}{E}\sqrt{1/\beta^*}$. For injection optics and 450 GeV, scaling factor 2.8, the maximum excursion at MKD is 3.2 mm. For Collision optics beta star = 0.55 m, scaling factor 1.7, the maximum excursion at MKD is 2.7 mm.

If the FMCM does not dump the beam then BLM will dump it due to losses on collimators.

- RD34

The maximum excursion at MKD is 80 um for +1 A in RD34.LR3, collision optics and 1.5 m beta star. At 450 GeV the excursion is 7 times bigger.

RD1 will always trigger if RD34 triggers, therefore we don't gain anything increasing RD34 thresholds without increasing the RD1 ones.

- RBXWTV

The maximum excursion at MKD is 800 um for +1 A in RBXWTV.LR2. Phase advance is 130°, so colective errors add up. The phase advance is fixed, pure geometrical.

Markus commented that the worst case only takes into account for collective perturbations where on same cases error cancels out. The worst case is not smaller that the individual failure of 1 magnet.

Markus made a presentation questioning if the FMCM is too sensitive and if something could be done to cure it. He reviewed all the FMCM constrains and FMCM dumps reasons. The major part of the dumps 66%, are due to electrical perturbations on the 400V/18kV/400kV networks. Those are short perturbations <100ms with a -20% of the network voltage.

On these cases, when FMCM dumps, normally no other equipment is tripping on the shadow. Can something be done to avoid these dumps?

A) Increasing thresholds: delicate especially for RD1. No gain in increasing only RD34 and RBXWTV.
B) Reduce perturbations see by the magnet chain. In between the three possibilities the best one is to improve the converter rejection of perturbations by changing the converter type.

Hugues pointed out that RMSD circuits in point 6, which are connected to the 18kV network, don't have too many problems. It should be understood why others trip and not these ones as the PC is the same.

Markus commented that a factor of 7-8 in the thresholds will allow the orbit to move up to the natural drift. **Jorg** said that testing this will be difficult as one would have to inject global network perturbations. **Markus** added that the effects of a mayor global perturbation along the machine have never been calculated.

Update of TSU firmware + additional delay for asynchronous trigger of LBDS (E. Carlier)

Etienne gave an overview over the TSU firmware updates during this year. Version 2.3.7_2011 was deployed, as agreed on the MPP meeting of 11th February 2011, and shortly rollback to previous version due to instabilities. These instabilities are thought to come from either the 1.2V power or the CIBO board, or a combination of both. Actions have been taking to improve the filtering of the 1.2V and replacing the CIBO (+fibers); so far no problem has been detected. Version 2.3.7_2011 has been validated (no failures) on a test bench for more than 250k cycles.

A new firmware version, TSU_V2.3.8_2012, has been developed and validation is ongoing.

Should the TSU_v2.3.7_2011 be redeployed during next TS (week 45) or should be waited for the 2011-2012 shutdown to deploy TSU_v2.3.8_2012?

Etienne remarked that in order to arm the system the LBDS needs all external conditions.

The panel decided that is advisable to do the upgrade in two steps, firstly version 2.3.7_2011 and then version 2.3.8_2012, and that the time slot to do it should be decided once it is been announced.

Concerning the additional delay for the asynchronous trigger, **Etienne** explained that increasing this delay by 100 us opens the possibility to still dump the beam synchronously in case of a TSU internal failure at the expense of increasing the worst case dump reaction time by one turn.

Ben commented that the highest propagation time of the beam permit loop is 190 us and therefore the delay should be increased by at least this value. (See **Ben** presentation for BPL)

The fastest loss is an injection loss that occurs in less than 1 turn. For UFO's an additional turn, in the worst case, increases the risk of magnet quench but this is better compared to an asynchronous beam dump. Other fast losses happen within 5-10 turns, thus there is no impact on them.

The panel agreed that the benefit of avoiding asynchronous beam dumps in those failure cases is greater than the carried risk.

Modification of CMS BCM thresholds (Moritz Guthoff)

Moritz presented the modifications of the CMS BCM (thresholds and beam abort triggering) that have been implemented during the last TS. The BCM system consists of six diamond detector rings placed at both sides of the IP5. Each detector ring can trigger a beam abort under certain circumstances. So far, only two rings of detectors, one at each side, have been connected to the beam abort.

A brief description of thresholds and motivation for each running sample implemented on the detectors are the following (a more detailed one can be found in EDMS 1157274):

- RS1 (40 us): Defined as x1000 times the damage threshold on the tracker (10^9 MIP/cm^2).
- RS10 (5.2 s): Defined to protect the HV filters. Only implemented in BCM2.
- RS12(83.9s): Defined to protect the pixel detector from long time bad conditions. Three times the expected luminosity.

Modifications:

RS12 with current luminosity was at 50% of the abort threshold value. As the signal on RS12 is linear with the luminosity, new thresholds have been extrapolated for luminosity of 3E34/cm2/s; on average a factor of 2.5 has been applied. Every channel within a detector has its own threshold, this is because each diamond detector has a different efficiency and therefore its signal scales different w.r.t the luminosity.

BCM1L has been connected to the beam abort system, to gain redundancy. RS1 and RS12 have been calculated using the same method as for BCM2.

Moritz commented that UFO's would trigger on RS05 but it is not implemented (only RS01).