MPP meeting 24 June 2011

Original agenda:

1) Summary of BLM Review (C.Zamantzas)
2) Abort Gap cleaning – operation at 450GeV and how to use safely at 3.5TeV? (D.Valuch)
3) RF interlocks – What interlocks can/will dump the beam + modifications during upcoming TS (A.Butterworth)
4) AOB

Present:

Jonathan Emery, Aurelien Marsili, Eduardo Nebot, Sigrid Wagner, Ben Todd, Mariusz Sapinski, Anton Lechner, Moritz Guthoff (CMS), Matteo Solfaroli, Antonello Di Mauro (Alice), Andrew Butterworth, Nicola Bacchetta (CMS), Bernd Dehning, Chris Zamanzas, Ruediger Schmidt, Jorg Wenninger, Annika Nordt, Giulia Papotti, Richard Jacobsson (LHCb), Juan Blanco, Markus Zerlauth, Mike Koratzinos.

Minutes:

Summary of BLM Review (C. Zamantzas)

Chris presented the results of the BLM audit. The auditing company was from Canada (thanks to Ben), and the whole chain was reviewed. Rather exhaustive review, including technical choices, performance, documentation, etc. Results will be presented in an upcoming conference. Executive summary: “with one minor reservation, we have found no reason to be concerned…” the minor reservation: the whole system is not fully redundant, mostly the threshold comparator FPGA (the processing part). Reason for this is that at the time of the design, the FPGA chosen was the most performant, but did not allow duplication or triplication of the code.

More on the findings: it was found that the design is conservative, with substantial provision for error detection. Cons: it includes single points of failure, and the system does other things apart from protection.

Two of the FPGAs are 80% to 94% utilized, limiting future development. The auditors found the successive running sums very complex.

There was some more minor criticism, like lack of comments in VHTL code; difficult to assess the verification process; lack of safeguards to protect against human error.

The panel gave a series of recommendations: should be a clear policy statement as to what changes are allowed; engineering documentation should be improved; do not modify the code in a way that increases the (already full) FPGA code; try to find ways to reduce utilization (no more to be gained from optimizing); more in-line comments; master verification plan to be created (unify the testing procedure); to not try to override the connectivity checks (which in any case is difficult); find a place where test results are stored (similar to what happens with hardware commissioning tests for circuits); more safeguards to reduce erroneous inputs; a comprehensive procedure for monitoring status (maybe a vistar page); determine the risk associated with the dependency of the BLMs on other systems.

In conclusion: lengthy (3+ months) and thorough procedure; professional approach from the auditors; good experience.

List of modifications: short term: improve documentation; improve other limitations of the system: inhibit beam dump request at injection; dedicated data for collimator alignment; deployment of 'study' buffer; continuous high-voltage check; add VME block transfer.

Question: any plans for a re-design of the system? No, system conceived to last the lifetime of the LHC. Markus cautioned that there might be outside factors that will force a re-design. Some discussion about when will VME be phased out (in favour of micro TCA). What is the lab's policy? Ruediger: it would be nice to have a follow up meeting in 6 months. The report will be attached to the minutes.

Abort gap cleaning (D. Valuch)

Daniel presented the status of the abort gap cleaning at 450GeV and the plans for 3.5TeV. Both the abort gap and the injection gap are cleaned as follows: Cleaning mode: ADT (transverse damper) excites the beam in a defined time window by a synthesized signal. The excitation amplitude is currently 10% of available kick strength. Gating window: 3useconds (abort gap) 11usec (injection gap cleaning). Then on top of the window, a sinusoidal function.

Abort gap cleaning: coherent vertical excitation in 15 steps triggered by 1000ms timing, stops after 11240 turns. Procedure: set parameters, inject pilot, AGC activated, inject physics beam, AGC deactivated.

Injection gap cleaning: similar, now horizontal excitation, cleaning bucket programmed on the fly. Procedure: set parameters, inject pilot; injection sequencer starts the cleaning; cleaning stopped 3ms before injection; cleaning is stopped if empty injection; process switched off before prepare ramp.

For 3.5TeV operation some settings will be different (but critical settings identical). Cleaning is not compatible with the tune measurement. Need to decide on the cleaning strategy (must avoid high losses when we start cleaning).

Summary: abort/injection gap cleaning is routinely used at injection; no technical issues to run it at flat top.

Question: Can we run it continuously with a very small amplitude (which will not inhibit the tune measurement?) Jorg: will try to use the system at the end of a fill in adjust mode. We will choose one fill after the TS.

RF beam interlocks (A. Butterworth)

Andrew presented a proposal for the modification of the interlock scheme for the RF. He started by reminding us the RF system topology: 8 cavities per beam, grouped in groups of 4. Each of 4 groups powered by a klystron. There 3 types of interlocks: a/ RF interlocks (16 of them) they switch off the RF drive to one klystron; b/ HV interlocks – they switch of the HV power converter (4) c/ Beam interlocks – HW connection to the BIC. d/ software interlocks via the SIS.

Since 17 June an RF veto also generates a beam interlock. Reason is that current high-intensity beam can return back to a switched-off RF cavity more power than it gets when it is working. The various conditions that can generate an RF veto and therefore a beam interlock are shown in slide 6. Examples are: power coming back through the (actively tuned) circulator; helium pressure indicating a cavity quench.

Cavity sum (total voltage) interlock: currently a software interlock; hardware interlock foreseen.

Proposed modification for the technical stop: reprogram module 0 to reduce the probability of false dumps. Downsides: the Wattcher LO, cryo OK, Cavity vacuum will no longer generate an interlock. (The group prefers that they do).

Conclusions: current situation is conservative but safe; no dumps due to spurious RF trips seen to date; new firmware prepared; will decide before the TS if to install it; in the long term, reorganization of RF interlock system is under study. The meeting recommended to observe the system over the next 10 days or so till the technical stop. If no false dumps are seen, leave the system as it is now.