MPP meeting 6 March 2009

Original agenda:

- Summary of the TCDQ reliability study (J. Uythoven)
- AOB :
  - ions versus protons.
  - DESY failure list 'review'.
  - di/dt interlock

Present:

Daniela Macina, Jan Uythoven, Walter Venturini, Mario Deile (Totem), Siegfried Wenig (Atlas), Richard Jacobsson (LHCb), Massimiliano Ferro-Luzzi, Rudiger Schmidt, Verena Kain, Laurette Ponce, Juan Blanco, Markus Zerlauth, Alick Macpherson, Benjamin Todd, Bruno Puccio, Etienne Carlier, Nicola Bacchetta (CMS), Antonio Di Mauro (Alice), Jorg Wenninger, Brennan Goddard, Mike Koratzinos

Minutes:

AOB (Joerg) :

Jorg started first with a series of news and points of interest:

Specifications documents are progressing well, with PIC, WIC, FMCM ready. Markus would win the 'golden specification award' if it existed.

Kicker test modes: Jorg raised the point of how we test the kicker magnets.

Injection kicker (MKI) test mode: Currently, an LHC beam is needed to be able to pulse the MKI in remote (i.e with nominal triggers and conditions). And if any of the injectors is down, the kickers cannot be pulsed. The scheme is very safe but tricky to test. Aim to find a solution which is less heavy. However, note that we will still need LHC beam permit TRUE, injection permit TRUE and 450GeV. The proposal is for a new logic level controlled by a button or a key on the CCC external conditions panel. A key will probably necessitate cabling in the CCC. To get the beam and injection permits, quite a few non-maskable interlocks need to be closed: vacuum, powering, access, all experiments... so, not trivial. This will never be a routine test; this year we will probably need one shift to perform all necessary actions. Ruediger pointed out that the reason for all these interlocks is that a kicker accidentally kicking at 7TeV is one of the worse incident scenarios for the LHC.

SPS extraction kicker (MKE) test mode: here we need SPS extraction permit TRUE and SPS main bends pulsing to 450 GeV. This is much easier to establish than the conditions for the MKI. No change is needed in MKE trigger logic. Verena reminded us that the procedure used last year for this test was not rigorous from a safety point of view and should be avoided in the future.

Chamonix follow up: Joerg informed the meeting of any follow-up following Chamonix presentations. Regarding B. Holzer's list of things that went wrong in Hera: all points have been thought about. A brief discussion on some points follows: Jorg considers good practice that the sequencer resets all maskable interlocks before injecting. Hera had lots of problems with vacuum valves: at the LHC the valves are interlocked. Do we need to think a bit more about this? The Hera BCT interlock was very useful: trigger level was set at 1% of level of current. Ruediger: for the LHC we can do a factor of 10 better. The BI group has agreed to produce a specification that the MPP will be able to comment on.

Other points to follow up are: consider what happens if the dump does not work. We will find a volunteer to look into this. Walter wondered if we could actually decelerate. Quads ramp down slower than dipoles. Is this a problem?

Failure catalog: we need to catalog all failures (Ruediger: extend it to powering failures also); then brainstorm.

Safety Analysis of the TCDQ (Jan)

Jan summarised a seminar by Roberto Filippini – the full talk can also be found in the MPP web pages and a report will be published. Jan showed a selection of Roberto's slides (1/3) . Scope: Probability of failure of the TCDQ systems to protect the LHC elements from an asynchronous beam dump over 1 year of LHC operation, 400 fills (resulting in quenching Q4 and probably damage in the arc).

The TCDQ system has 5 modes of operation and the safety analysis has identified 80 failure events. A failure tree has been constructed. Assumption is 0.4 asynchronous beam dumps per beam per year. TCDQ safety figure of merit (likelihood of failure) is about 4x10-5 (SIL4). Highest contributor to failures is the PLC timing (60%). The analysis has assumed nominal component failures (taken from standard tables). Ruediger comments that those tables seem to be in the pessimistic side. However, no extra radiation-related failure is included. The typical estimate for the operator error probability is between 0.1% and 1%. Best value for HEP is 1% which seems rather low. The analysis assumes manual adjustments in 1 out of 10 fills. If for any reason there are manual adjustments on every fill with operator failure probability of 1%, then the system will move from SIL4 to SIL2 (which will be unacceptable). Brennan comments that we need to rethink the human error probability. He wondered if the sequencer could perform a check before every fill where it compares current settings with previous values. Then, in case of needed changes, the signing of an expert of any changes should be documented. Joerg comments that this issues concerns all interlock settings. The threshold beyond which the sequencer would signal a potential problem could be different for electronics and for manual

operator changes (wider for operators). Ruediger: we would probably need an iteration after some initial running and some experience.

Next meeting

In 2 weeks: Asynchronous beam dumps