

Machine Protection Working Group

Minutes of the 36th meeting held on October 8th 2004

Present: E. Carlier, B. Dehning, R. Denz, E. Effinger, R. Fillipini, R. Giachino, E.B. Holzer, C. Ilgner, V. Montabonnet, B. Puccio, F. Rodriguez Mateos, M. Stockner, R. Schmidt, F. Szonczso, B. Todd, J. Wenninger, C. Zamantzas

Excused: D. Macina, J. Uythoven

Topics of this meeting:

- The LHC Beam Interlock System (B. Puccio)
- Overview of the activities on Machine Protection and their dependencies (R. Schmidt)
- AOB

Specification of the LHC Beam Interlock System (B. Puccio)

B. Puccio presented the main points of the LHC Beam Interlock System functional specification. The latest draft of the specification was distributed a week before this meeting to the members of the MPWG for comments. The final version will be available for approval in a few weeks.

The role of the Beam Interlock System is to permit injection into the LHC when all systems are ready for beam and to transmit dump requests to the LHC Beam Dumping System (LBDS). In addition, the system must avoid faulty triggers (to the LBDS), provide evidence for which system(s) requested a dump trigger (Post-mortem) and assist the OP crews with clear diagnostics. **B. Puccio** presented the detailed architecture of the system, the permit status, the conditions for interlock masking and the reliability issues. The details can be found in his presentation.

There are still a number of open points:

1. Do we need a connection from the injection kicker to the BIC? So far, only the connection BIC → injection kicker is foreseen.
2. What is the interface between the Beam Interlock System and the LBDS?
3. How many signals should the system receive from the users: one or two?
4. Which clients signal should never be masked?
5. How is the timing system triggered to generate the Post-mortem event?
6. In test mode: the users should be able to simulate an interlock on request.

In the discussion, **J. Wenninger** commented on point 1 that it is foreseen to interlock the SPS extraction with the injection kicker. This is cleaner since in that way the beam does not even leave the SPS. In addition, an injection kicker problem must not necessarily mean that the beam in the LHC needs to be dumped. Concerning question 2, **E. Carlier** explained that for the LBDS synchronization and triggering system, a delay line is automatically triggered in parallel: in case the normal trigger path does not work,

this delayed trigger ensures that the beam is dumped (but this will be an asynchronous dump). He proposed to use some of the signal redundancy in IR6 to implement a direct link between one of the BIC signals to the delay line. Concerning point 3, the number of signals from the users, everyone agreed that a redundant input from the user is only useful if the signals are generated by independent 'paths': a simple signal splitting will not provide any gain. **B. Dehning** wondered about the minimum duration for the user trigger: **B. Puccio** said that for the moment, the minimum duration is 2 μ s. After such event, the BIC needs to be re-initialised. **R. Giachino** asked if it was foreseen to also implement software interlocks. **R. Schmidt** answered that SW interlocks are foreseen but have not yet been studied. **R. Schmidt** pointed out that the energy-meter is very critical and that no system is able to 'take' over an energy-meter error. **E. Carlier** answered that there is also (also or only?) a direct link between the LBDS and the energy-meter, any problem leading to a direct (internal) trigger of the LBDS. **J. Wenninger** said that if the distribution of Safe Beam Flag and other safety critical parameters (SLP) fails, the beam should be aborted via a non-maskable channel. An open question is related to the interlocks for electrical circuits with normal conducting magnets: should the beam be dumped if one of the normal conducting orbit corrector magnets fails?

Overview of the activities on Machine Protection and their dependencies (R. Schmidt)

R. Schmidt presented a schematic layout of the systems involved in LHC Machine Protection, including their links and dependencies (see slides). Such an overview was requested by the LHC-OP working group to better understand the 'architecture' of the LHC machine protection. He also presented the MPWG mandate as it was defined in 2001 and asked if it was still valid or had to be modified. To some extent the MPWG has addressed protection issues and failure scenarios that have possibly gone beyond its mandate, but this was necessary since no other 'body' at CERN is covering such issues.

In the discussion of the system involved in Machine Protection, the criticality of the machine timing system was questioned, in particular for Post-mortem and for beam instrumentation (BPMs and BCTs). It was agreed that this point should be discussed at one of the coming MPWG meetings.

AOB

Following a presentation of the concept of Safe LHC Parameters by **R. Schmidt**, the LTC gave full support for this system.

The machine protection system review will finally take place in March 2005.

A 'Chamonix' workshop will be organized in January 2005 at CERN. Following a first preparation meeting, it seems clear that a number of machine protection issues will be discussed at this workshop.