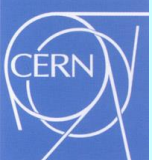


## Agenda

- Comments to minutes
- Recommendations and conclusion of the Beam Interlock System Audit (S.Lüders and B.Puccio)
- Interlocking of injection and extraction line screens (B.Goddard)
- AOB



# Introduction to the Audit of the Beam Interlock System

- Safe operation of the LHC in presence of the energy stored in each beam of up to 362 MJ requires as a key system the Beam Interlock System
- Failures are detected by beam loss monitors and other beam instruments, by the quench protection system and other hardware related equipment. Beam dump requests are transmitted via the Beam Interlock System to the beam dumping system.
- There has been a review on the Machine Protection System. One recommendation was to organise more detailed reviews of the most critical systems (Beam Interlock System and Beam Dumping System).

The architecture of the LHC machine protection is recalled. The functionality of the Beam Interlock System with respect to machine protection is presented.

**Main emphasis is on the safety critical aspects of the Beam Interlock System.**

**This event is an audit of the Beam Interlock System. This is the last option for (limited) design changes, before starting series production of the electronics.**

# Participants

- **Experts:** Matthias Werner; Javier Serrano; Yves Thurel; Philippe Farthouat; Reiner Denz; Stefan Lueders
- **Members of the interlock team:** Bruno Puccio; Benjamin Todd; Rudiger Schmidt; Philippe Nouchi; Markus Zerlauth; Christophe Martin; Arend Dinius; Samir Hamnache
- **Collaborators giving other presentations:** Jorg Wenninger; Etienne Carlier
- **Guests:** Bernd Dehning; Jan Uythoven; Rossano Giachino; David Belohrad
- **Group Leader:** Hermann Schmickler

- Today
  - presentations
  - providing the experts with all required material (specifications, layout of the electronics, test results, ...)
  - showing the prototypes of the electronics
- Second day 25/9/2006
  - asking questions
  - discussions of findings
  - formulating recommendations
  - presenting the outcome
- The week between 18/9 and 25/9 could be used to further understand and discuss details of the interlock system, if the experts consider this to be useful.
- We might organise a demonstration of the operating system at the SPS

# Some comments....

- Audit NOW since.....
  - we have experience from CNGS (10-20% of LHC type hardware is operating)
  - all electronic boards are in the final design phase
- Not the purpose to propose alternative ideas for interlocking the High Energy CERN accelerators
- The purpose is to identify critical parts, to understand the function of those parts, to validate their design or propose modifications
  - split the audit in two parts, and leave some time for discussions / investigations in between
- Possible impact of the audit
  - many comments might not have an impact on the hardware
  - small HW mods: could possibly be still implemented
  - larger HW mods: maybe only for LHC, possibly via an upgrade

# Programme

Machine protection and Beam Interlock System				
09:00		0	Introduction to the Audit	Hermann Schickler 10
09:10		1	Machine Protection and the Beam Interlock Systems	Rudiger Schmidt 15
09:30		2	Beam Interlocking of the SPS / CNGS and LHC	Bruno Puccio 20
10:00		3	Realisation of the Beam Interlock System	Benjamin Todd 30
10:40	Coffee			
11:05		4	Dependability and signal integrity	Benjamin Todd 20
Hardware of the Beam Interlock System				
11:35		5	Beam Permit Loops and Optical cards	Benjamin Todd 20
12:05		6	Module with safety matrix: CIBM and variants (CIBG, Master CIBX, CIBV verifier)	Philippe Nouchi 30
12:45	Lunch			
13:45			<i>Meeting among the experts (if required)</i>	
14:10		7	Interface to the user: CIBU and CIBD	Christophe Martin 20
14:40		8	Testing the Beam Interlock System: CIBT	Benjamin Todd 20
15:10		9	Beam Interlock System Hardware Implementation	Arend Dinius 20
15:45	Coffee			
16:15		10	Interfaces to the Extraction System and Injection Systems	Etienne Carlier 15
Other aspects				
16:40		11	Outlook and operational aspects of the Beam Interlock System	Rudiger Schmidt + B.Puccio 15
17:10		12	Experience from the 2006 SPS / CNGS run	Jorg Wenninger 20
17:50			<i>Executive session of the experts</i>	

# Questions to the experts

- Do you consider the requirements for the Beam Interlock System adequately defined?
- Does the proposed realisation of the Beam Interlock System fulfill the requirements?
- Do you see any specific risks with the electronics?
- Do you see any failure modes that should be considered?
- Are the interfaces between the Beam Interlock Systems and the other systems clearly specified?
- Would you expect that the Beam Interlock System allows for safe operation (reliability)?
- Would you expect that the Beam Interlock System allows for efficient operation (availability)?
- Based on experience elsewhere: what is most critical and where have been surprises?

# Some comments – after the audit

- Not everyone was convinced that such an audit at this late stage makes sense, but all members of the interlock team fully supported it.
- The time that we invested in the preparation was a few days – not more.
- We were pretty sure that we proposed a solid system, and therefore we did not expect findings that would create great difficulties, however, if the experts would have found a major problem, we rather like to know now.
- We made it clear to the experts that we were not looking for bright ideas and alternative solutions.
- I see many reasons for having an audit, and the (only?) reasons of not having it is lack of time for the preparation.
- I would have been very nervous without the audit - I am not an electronics engineer, and cannot judge detailed aspects of our system.
- The findings at the evening of the first day would have been moderately useful.
- **Due to the intense work of the experts (many many hours between the first day and the second day a week later), I consider the audit to be very useful for our project**