

# Commissioning of LHC machine protection systems – beam related

- We need starting some detailed work now
- To have a detailed strategy for begin 2006 (“Chamonix”?)
- How to go about next years SPS tests (high intensity beam for CNGS)?
- What can we learn from Hardware Commissioning?
- What is being provided by Hardware Commissioning?

Today:

- starting the discussions
- agree on some terminology
- ask different teams to do some homework
- synthesis starting by September

# Commissioning of LHC machine protection systems – beam related

1. Commissioning without beam
  - A. Individual system tests – relying only on the system itself and utilities (electricity, controls, water, ...), but not on other systems
  - B. Protection systems commissioning – several systems must work together
  
2. Commissioning with beam
  - Definition of phases, corresponding to the risks, example:
    - A. phase A with safe beam at all energies (pilot intensity)
    - B. phase B with safe beam at injection energy (up to 12 nominal bunches)
    - C. phase C with unsafe beam already at injection energy

During each phase 2, both individual system tests, and protection system commissioning is required

# What systems ?

1. Quench Protection System – discussed in detail in HCWG, upcoming soon
2. Powering Interlock System(s) – discussed in detail in HCWG
  - will start soon, required for hardware commissioning
  - protection functionality with respect to beam LATER (MZ + PD + RH ?)
3. LHC Beam Interlock System (BP + BT ?)
4. Beam Loss Monitor System (who?)
5. Beam Dumping System (who?)
6. Safe LHC Parameters (who?)
7. Beam Instruments for protection (BPMs, BCTs)
8. SPS – CNGS – Transfer Lines – LHC Beam Interlock System (JW?)
9. Injection Protection (CWG, InjWG, MPWG, ...who?)
10. Collimators (for protection) – discussed in CWG
11. Other systems and their interfaces to Machine Interlocks (vacuum, experiments, RF, power converters via PIC, injection, ...)

# Proposal

- Profit from the strategy that has been developed for hardware commissioning
- For the different systems, propose commissioning procedures for individual system tests
  - using the same terminology
  - using similar strategies
- Without beam
  - identify what systems can be commissioning together, what tests can be done
- With beam
  - to be done in the future

# Example: Beam Interlock Individual System Test

## 1. Stand Alone Testing of one BIC (repeat of BIC lab test)

What is required to start

- BIC installed, all user boxes for this BIC installed
- inputs that are not used must be disabled
- connected to computer network (Ethernet)
- connected to timing system

Outcome of the test

- communication with all user boxes is working correctly
- BIC Matrix functionality works
- open / close command Beam Permit Loop works

## 2. Beam Permit Loops Testing – without users

What is required to start

- all 16 BICs stand alone tests finished
- optical fibres for BIC around LHC installed and operational

Outcome of the test

- beam permit **can** be established for : loop A OR B
- beam permit **cannot** be established for : loop A AND B

# Example: Machine Interlock System Test

1. Testing with users giving permit signals
2. Beam Dump Trigger Testing
3. Testing with Injection Interlocks

.....to be done in the future

# documentation: machine interlock commissioning

