Interlocking of LHC experiments

Wrapping up of functional spec approval….

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Masking…

- On the issue of masking experimental interlock signals, we agree that :
  - The interlocks are NOT maskable.
  - Each experiment must ensure that their interlock signals do not disturb the machine commissioning.
  - The interlock signals must be made operational during the 2 month (?) machine check-out period before first beam is injected into the LHC.

Interlocking of magnets /1

- During a discussion in February 2005 involving E. Sbrissa, R. Schmidt & J. Wenninger, we decided to foresee hardware interlock inputs to the LHC BIC system for ALL LHC magnets, i.e. spectrometers & solenoids.

- A powering failure of the spectrometer magnets of ALICE & LHCb leads to a transverse beam movement of ~ 1σ in 700 ms. That is sufficiently fast to make a connection to the interlock system mandatory. In any case the machine cannot continue to operate normally after the failure.

- For the solenoids, the effect on the beam is expected to be small(er) and the time constants are longer. At 7 TeV the beam may well survive, but with a stored energy of 360 MJ / beam we must be careful…

  → Prepare the connections and decide later (tests during commissioning – to be revisited at every comm. step !) if the signal is used or not.

Interlocking of magnets / 2

- The interlock signal from the magnet surveillance systems must be send to the BIC at least 1 ms before the same signal is send to the PC to switch off (beam out first !).

- I will modify the chapter on magnet interlocking in the following way:
  - Connections to the BIC system are prepared for all magnets.
  - For the spectrometer magnets the signals will be connected.
  - For the solenoids the connection will be made based on beam tests to be performed during commissioning, to be revised possibly at each commissioning step (intensity increase).

Signal names

- I propose to change the names of the signals that so far were called
  - READY-FOR-INCREASED-RISK-PROCEDURE
  - INCREASED-RISK-PROCEDURE-REQUEST

  to
  - READY-FOR-ADJUST(-MODE)
  - ADJUST(-MODE)-REQUEST

  since in the latest definition this signal is used to switch to adjust mode….

Injection interlocking /1

- The possibility to act on the beam injection without dumping the beam (injection inhibit) is requested by:
  - All experiments.
  - The LHC beam dumping system (IR6) for safe arming of the machine protection system.
- The next step requires to define and solve
  - The hardware implementation and the responsibilities.
  - The financial issues.

Injection interlocking /2

- Possible implementations :
  - Injection permit loop similar to beam permit loops + associated VME BIC system.
    + Re-use existing solution.
    - Expensive solution for single channel / IR…
  - Point-to-point connections of each client to IR2 and IR8.
    + Possibly cheaper.
    - Hardware solution is not yet available (within AB). Some development & tests are progress.