

Status of Injection Inhibit

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- Hardware solutions
- Software solutions

Hardware options

- Dedicated injection inhibit interlock loop:
 - This option was rejected by S. Myers at LHC WS@Divonne, at least as being part of the AB commitments. No reaction by any experiment representative - therefore AB work on this option stopped.
 - Alternative (without involving by AB): PH/TS take up the responsibility and provide a system to bring the injection inhibit signals of the experiments to IR2 and IR8.
- Standard beam interlock loop:
 - Solution is possible, but implies that the LHC MODE information must be used to send out such inhibits only at appropriate moments (during injection).
 - Drawback is that the any circulating beam is dumped at the same.

'Software' options

- On top of the hardware interlock system, both SPS and LHC (will) have a software interlock system.
- The software interlock system complements the HW systems :
 - Conceptually similar to a hardware interlock system.
 - Main different (by construction) : the signal acquisition and interlock logic are implemented in SW.
 - The SW interlock system is capable of dumping the beam and prevent injection.
 - Additional feature: the SW system also interacts with the machine timing system to stop the beams in the injectors if necessary. Very important at the SPS.

Software Interlock System (SIS)

- The 'advantage' of SIS:
 - A priori able to acquire any observable of the accelerator that is available in the control system and check it.
 - Possible to implement complex logic (across systems).
 - Cheap solution when a hardware solution cannot be implemented (money & resources) - frequent situation @ SPS.
 - Early warning of abnormal situations :
 - Example : can detected PC off in transfer line well before fast beam interlock system enters the action → stop the beam in injectors....
- The ISSUE : reliability and safety level
 - Very difficult to quantify safety level - obviously.
 - But : design of SIS flexible enough to allow various types of reaction in case data loss & communication errors.
 - Note that at the SPS very critical interlocks associated to the targets are implemented in SIS.

SIS Status

- The present SPS (LEP) SIS system is outdated and must be replaced:
 - Not adapted to the new SPS/LHC controls environment.
 - Not adapted to the fast multi-cycling needs of the SPS.
- I started a new SIS design in the fall of 2005 in collaboration with the AB-Controls group:
 - Most complicated requirements arise from the SPS.
 - An advanced proto-type is in place and running smoothly on the SPS.
 - The new SIS is able to dump the beams / stop injections & extractions by sending signals to the BIC modules (by Ethernet...).
 - The aim is to push the prototype into operational state this week (in parallel with the existing system). So far my impression is very good.
- By the end of 2006 we will have sufficient experience to judge the reliability of this system for the LHC (does not include reliability of the signals that are provided by LHC equipment).

SIS for Injection Inhibit

- Obviously an injection inhibit from the experiments could be part of the SIS at the LHC.
- Possible issues:
 - SIS collects information through AB middleware: the injection inhibit must be send to the AB middleware - beware of complicated channels.
 - SIS does not republish its state (in AB nobody is interested...) therefore no way to see if the signal has arrived, except by monitoring the BIC modules.
 - For the time being every signal is maskable without protection. Restrictions & protections (user-account like) are planned. Waiting for a more general solution with the new controls.