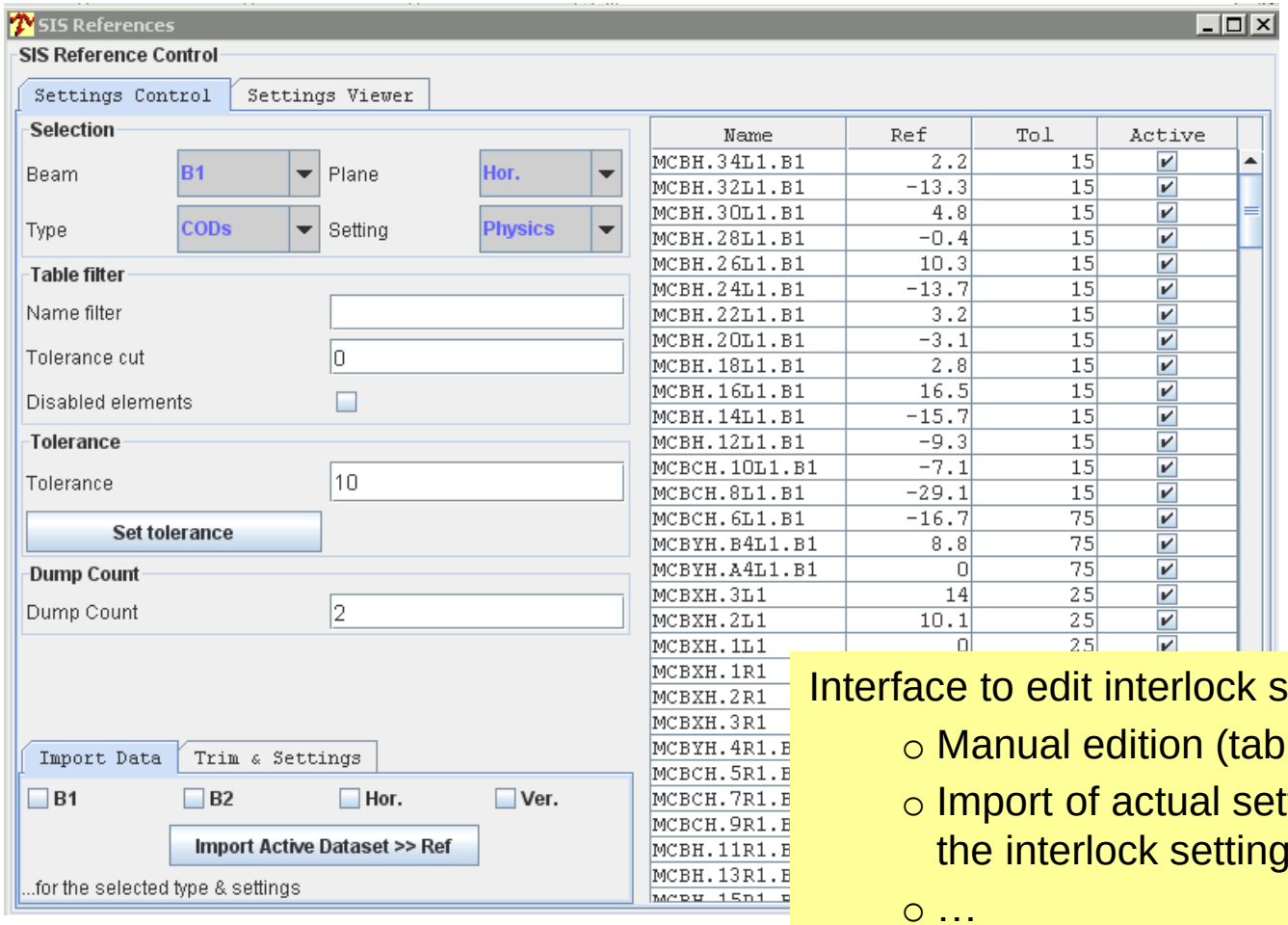
SIS for Orbit and Correctors

- First implementation of SIS interlocks on beam position and CODs settings commissioned and made operational in STABLE BEAMS (CODs only).
  - Beam position from concentrated data of Orbit Feedback.
  - COD data directly from PCs (~1000 subscriptions).
  - Reference settings and tolerances stored in the LSA DB, controlled through the LHC steering application (YASP).
    - Reference, tolerance, enabled for interlock (per COD/monitor), no. out-of-tolerance elements to trigger dump.
    - Defined as critical settings with limited access.
  - Configured to dump the corresponding beam.
  - One group of settings for injection+ramp+squeeze, one group for stable beams.
    - To be validated by experience.
  - Independent of the interlocks for injection for the experiments (triplet CODs and sep. dipoles).

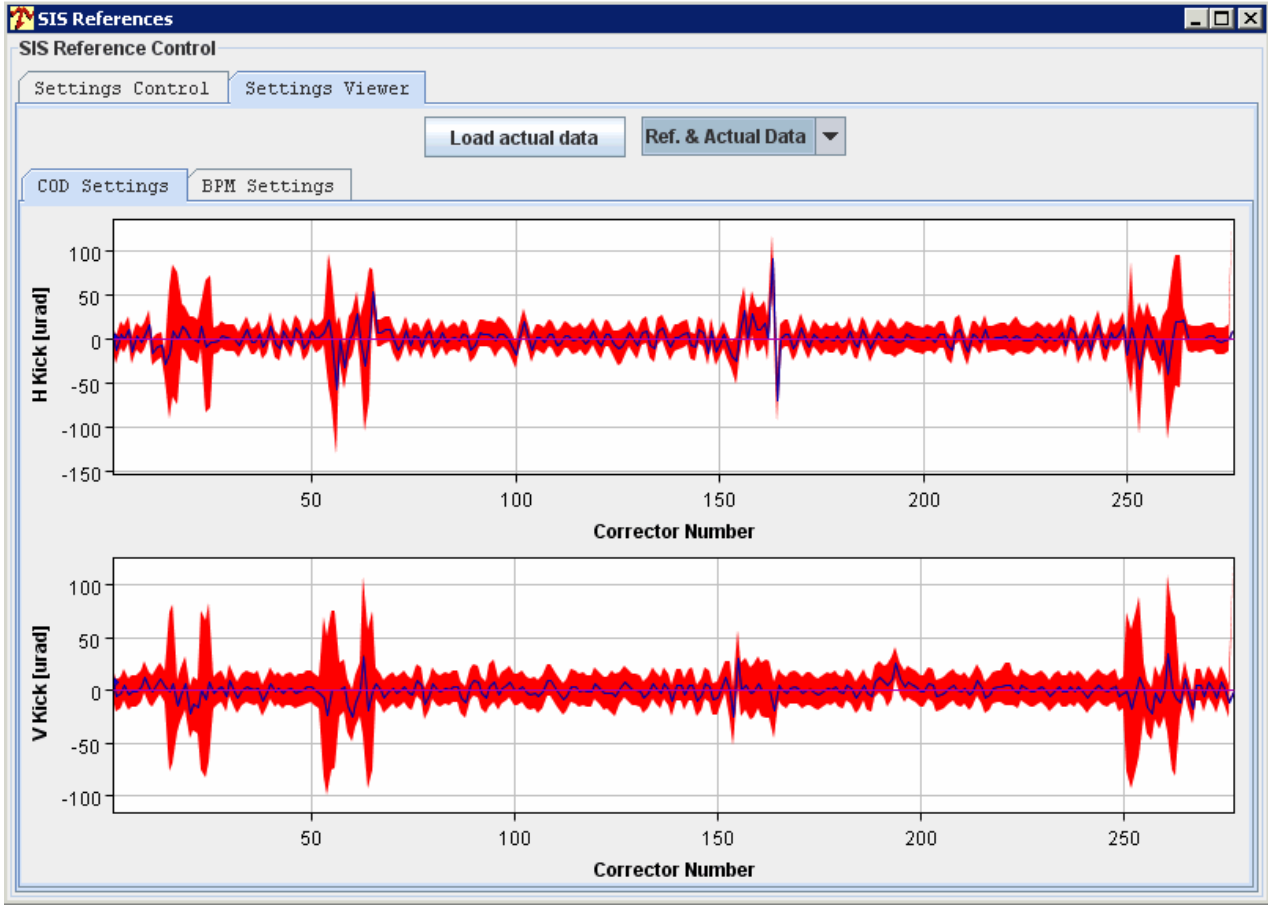
Orbit Interlock Settings Control (I)



Interface to edit interlock settings.

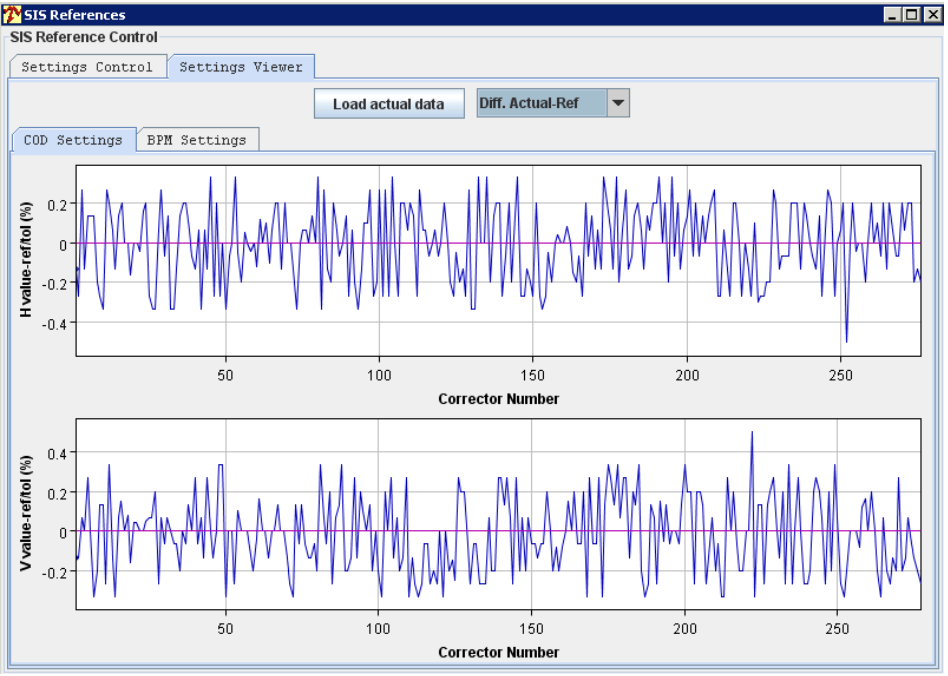
- Manual edition (table)
- Import of actual settings/readings into the interlock settings.
- …

Orbit Interlock Settings Control (II)

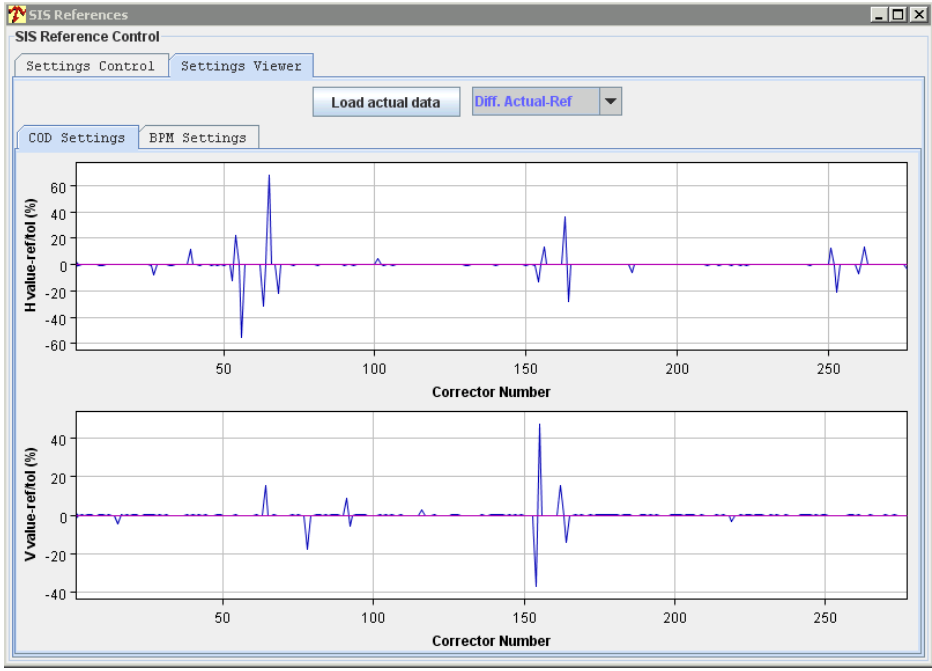


Display of interlock reference (green line), interlock tolerance (green band) and actual orbit/settings (here COD settings).

Orbit Interlock Settings Control (III)



Good !

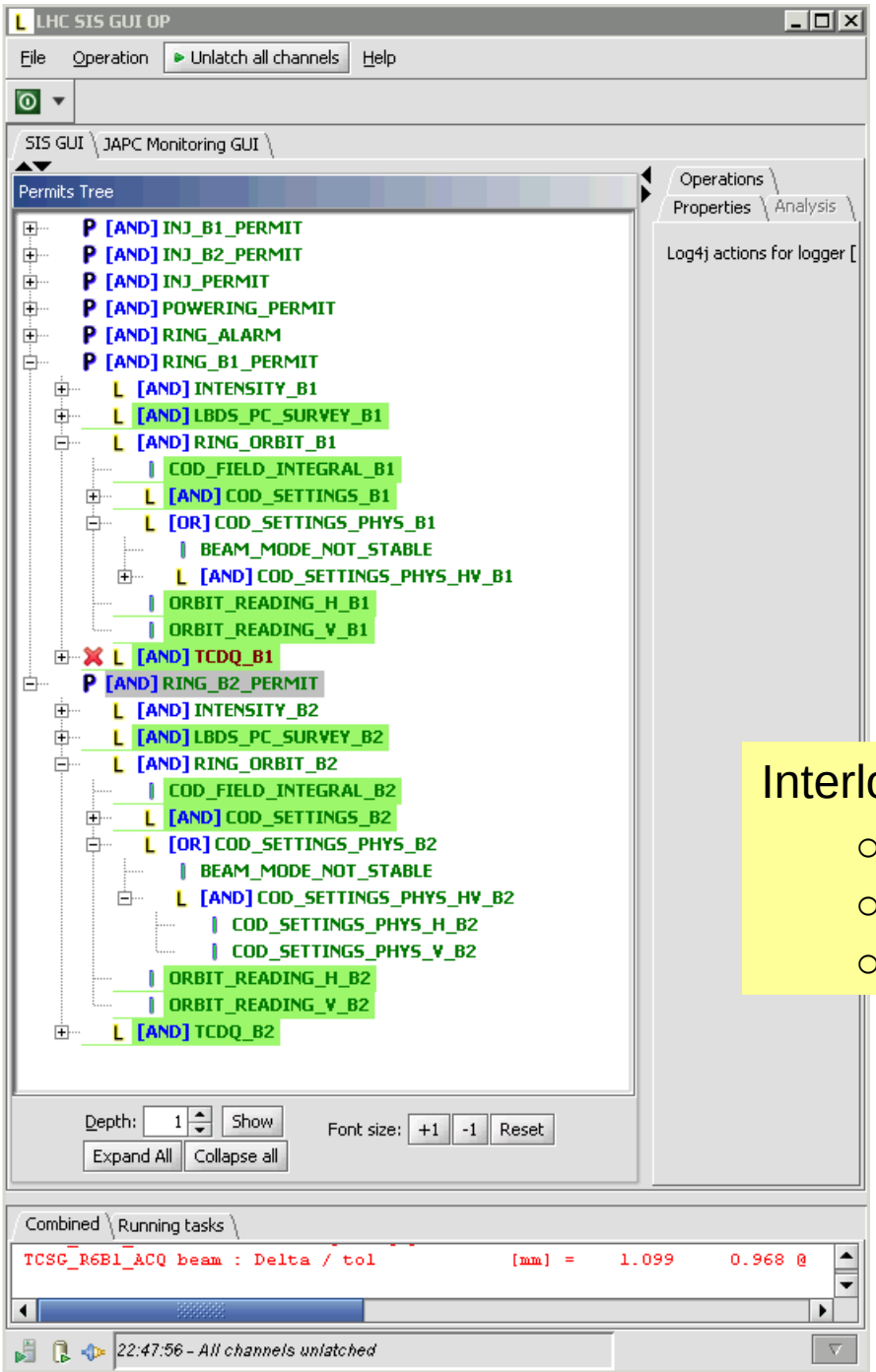


! Critical situation !

Some CODs close to 70% of tolerance margin.

Display of difference actual-ref normalized to tolerance.

SIS UI



Interlocks implemented in SIS.

- Interlocks by plane and by beam.
- Trigger a dump of corresponding beam.
- Interlocks are latched >> catch ‘transients’

interlocks / MPP / JW

Configuration choices

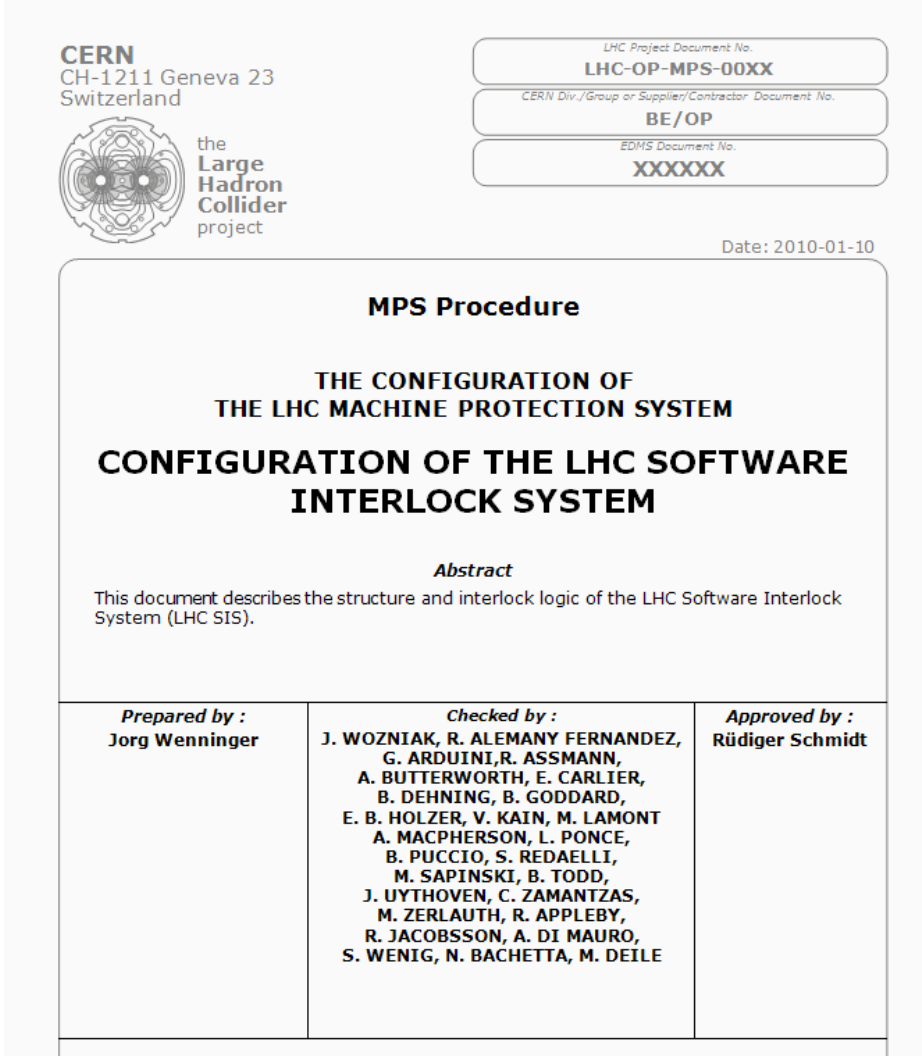
- For the orbit correctors, the interlocks are only applied when the PC is ON. Elements that are OFF are ignored.
  - No attempt (for the moment) to protect against failing PCs.
- For moment correctors that are not delivering data are ignored.
  - Logic to be changed in 2010 – set a limit on number of missing elements.
- Tolerances were set to 20-25 microrad in December 2009 – corresponds to ~ 2 sigma.
  - To be fine tuned with more experience (margin for correcting the orbit without settings update for 1-2 weeks – if possible).
- Interlock triggers on correctors if 2 correctors are out of tolerance (logic applied per beam & plane).
- For the moment the interlocks are LATCHED.
  - Better diagnostics in case of short transients.

Operation

- The corrector interlocks were activated for STABLE BEAMS.
  - No problems, except one fill that was dumped because latched interlock was not reset at appropriate time → dump at the moment STABLE BEAMS was declared.
- The monitor interlocks were running but remained masked.
  - Need more experience on orbit stability (+ monitor reliability).

Interlock description

- The logic of all interlocks of SIS will be described in a EDMS document – in preparation.
  - Submitted for comments/approvals after Chamonix.
  - Expect frequent changes for the coming few months !



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the Large Hadron Collider project

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XXXXXX

Date: 2010-01-10

MPS Procedure

THE CONFIGURATION OF THE LHC MACHINE PROTECTION SYSTEM

CONFIGURATION OF THE LHC SOFTWARE INTERLOCK SYSTEM

Abstract

This document describes the structure and interlock logic of the LHC Software Interlock System (LHC SIS).

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