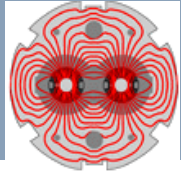
SIS status, changes & proposed changes

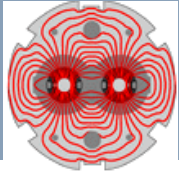
J. Wenninger

LHC SIS overall status



- The SIS core is operational since the start of powering since it makes the link between the access conditions and powering.
- As of today almost all existing (run1) clients are connected and alive.
  - *Only the roman pots & the abort gap cleaning are missing.*
- Tests are currently defined and tracked in a Google spreadsheet, roughly 30% of the non-beam tests have been performed.
  - *Satisfying progress rate.*
  - *Next larger batch of tests requires PCs to be switched on – at least in simulation – and coherent machine ramps.*
- Updated EDMS document with test description.
  - *To be completed with a few open points. See below.*

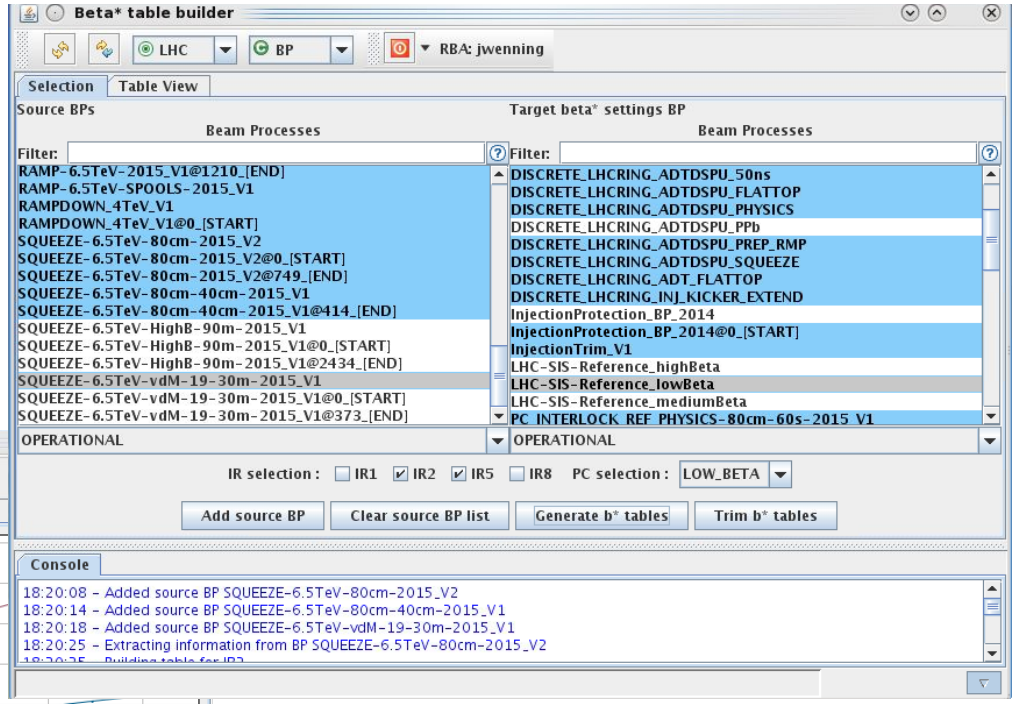
β* reconstruction

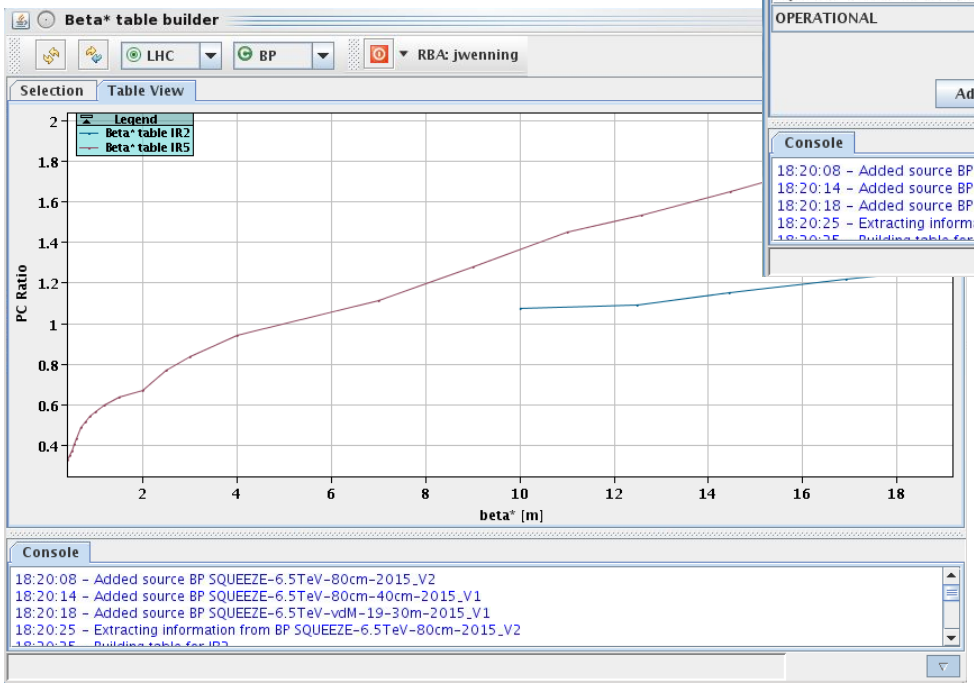


- The reconstruction of β* from a pair of converters (current ratio) to track the squeeze progress is still made in SIS.
  - *Pre-calculate table of PC current ratio versus β*.*
  - *Results are injected into the timing system through the SMP.*
- The reconstruction code has been modified to move away from tables in CSV files. Settings are now in LSA, with one table per IP and per hypercycle.
  - *It is possible to change the PC pairs for different hypercycles → ATS can be handled properly.*
  - *The settings should become critical any time now (I hope !).*
  - *There is also a setting to switch to simulation mode.*
- An application is available to build the tables and trim them into a beam process of the selected hypercycle.
  - *A later stage it will be possible to select the PC pairs in the application (currently only 2 choices / IP).*

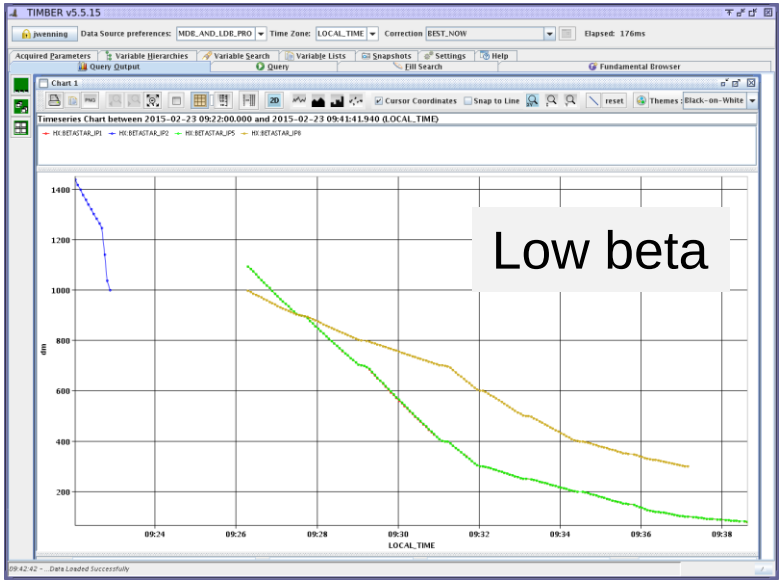
β* table generation

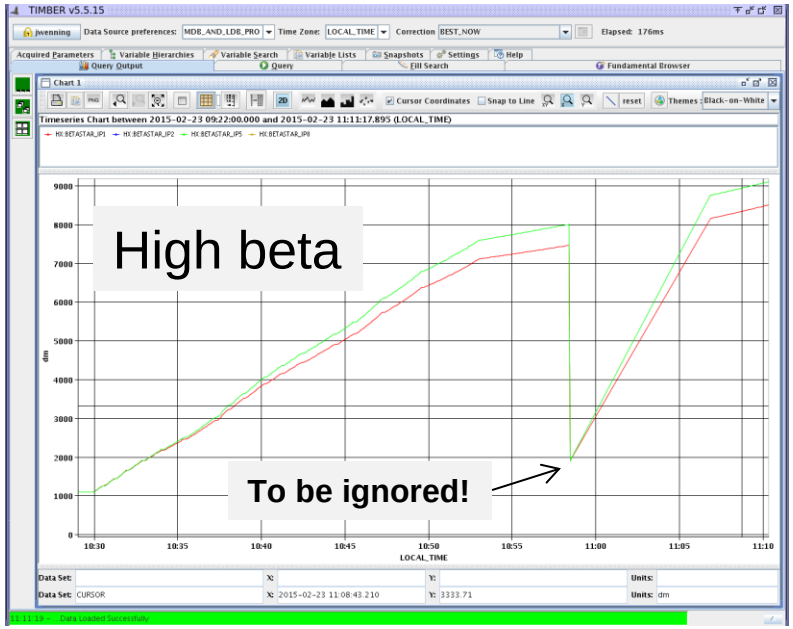
- β* table generation application.



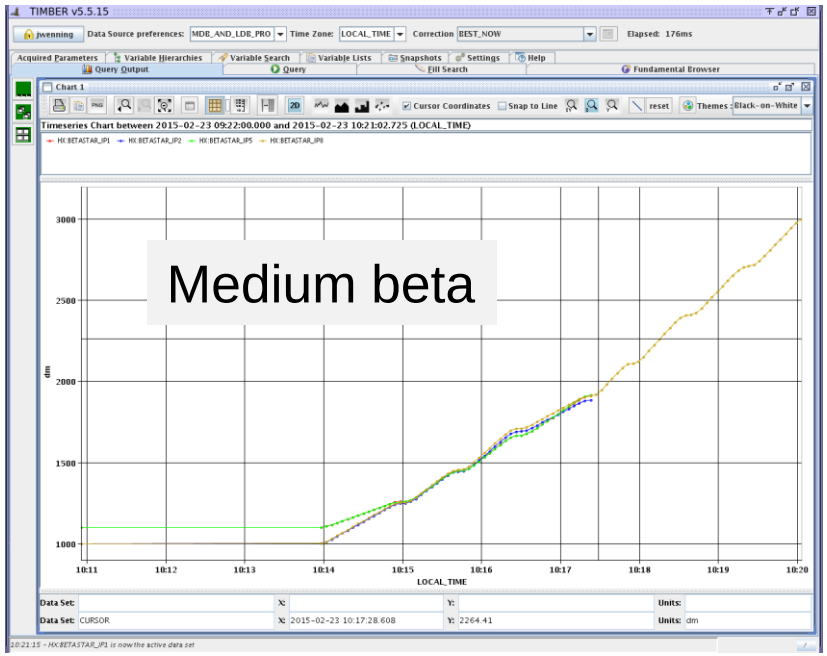


β* reconstruction test

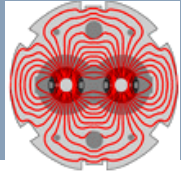




- Test with PCs in simulation (with SMP and MTG).
- Full chain validated.



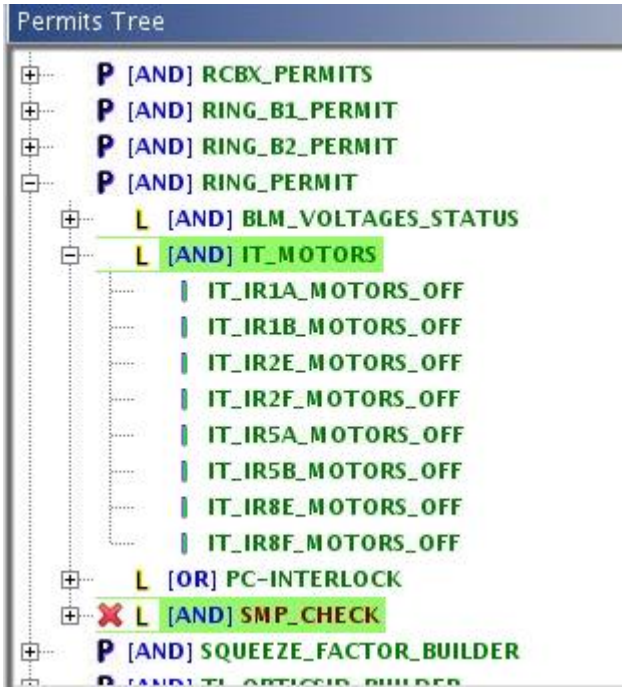
Optics ID



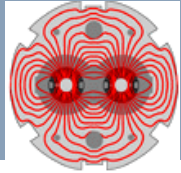
- The reconstruction of the TI2 / TI8 optics ID from all TL quadrupoles PC currents is operational and fully tested.
  - *Uses the FEI interlock references as input values and not the measured currents to avoid latching collimator interlocks when the lines do not pulse (dynamic economy).*
- A reference table with the PC names, reference currents, optics ID and tolerance (default 1%) is stored in each LSA hypercycle.
  - *Similar to the β^* table, but in synch with the TL collimator settings.*
- An application is available to extract the required parameters from a SPS cycle and to fill the settings for SIS.
- The only missing ingredient is the export of the IDs to the SMP and then the distribution in the LHC.

Triplet motors

- At an LMC during LS1 (?) the interlocking of the triplet motors re-surfaced.
- Such an interlock was present at the beginning of run1, but it was removed after I had observed a few false interlocks, probably due to FEC connection issues (+ the motors are in principle locked during operation).
- The interlocks are back (to be tested) – question is whether it is worth to keep them at the risk of a false dump?
- The position monitoring of the triplets (Wire Position System) is always active for INJECTION.
  - *After TS's I frequently have to reset the reference positions because of work carried out by SU on the WPS.*



Collimator BPMs



- Interlocking the beam position in the new TCTP and TCSP collimators should be rather ‘straightforward’. The most useful way is probably to interlock in units of beam sigma.
  - *17 collimators x 2 beam positions.*
- For each collimator a table of β at collimator versus β^* should be generated for each hyper-cycle. In combination with a tolerance (in sigma) and a standard emittance (+energy) the logic is easy to implement.
- I propose to put such interlocks (masked) in place at an early stage.
  - *Settings infrastructure will be prepared in the coming 2 weeks.*

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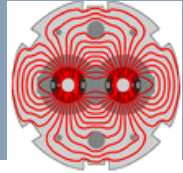

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  - *17 collimators x 2 beam positions.*
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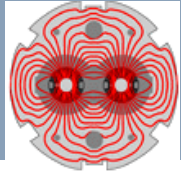
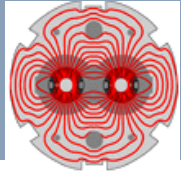
Roman pots



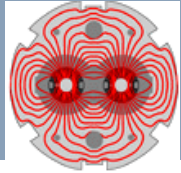
- SIS has currently interlocks on the beam position at RPs with tolerances at the level of 0.5mm. Dump beam if out of tolerance.
  - *Active only when the RPs are IN and SBF is FALSE.*
- The interlocks were fully implemented during run1, but never activated because TOTEM did not really operate regularly with high intensity (mainly test runs).
- If TOTEM starts to operate on a regular basis, we should consider using such an interlock.
  - *Already adapted to new configuration (one RP station group).*
  - *More BPMs → better voting logic.*
- I propose however that instead of dumping the beams, one moves out the RPs (or prevents moving in).
  - *Much more efficient than dumping the beam. This would also generate less 'waves' if ever the interlock strikes!*
  - *Avoids false dumps on bad BPM readings…*

Roman pots



- Ideally SIS should send a permanent signal to the RPs indicating if a movement is allowed (RP_MOVE_ALLOWED).
  - *If RP_MOVE_ALLOWED = TRUE, the RPs can move IN / stay IN.*
  - *If RP_MOVE_ALLOWED = FALSE, the RPs must stay OUT or (slowly) move OUT.*
- Unfortunately there is no such property in their FESA class (my idea came late !).
- What can be done currently:
  - *Check by OP that the interlock is OK → can move in the RPs.* ***This is probably also the most important part.*** *But only by procedure (maybe a check in the sequencer if it is used to drive the RPs).*
  - *Vocal warning in the CCC that the RPs should be taken out.*

Roman pots - proposal



- ***Procedural check and vocal warning could be considered as sufficient for the start of run*** – I propose to change the beam dump action to a vocal warning.
  - *If the orbit moves globally, SIS will eventually dump.*
  - *The TCTP interlocks will also provide partly redundant position interlocks.*
- If the RPs will really be used frequently in high intensity runs (also includes AFP !) we should consider a change of the FESA class to incorporate the SIS **RP_MOVE_ALLOWED** flag.

Post-mortem

- Currently the SIS only sends the tree with the interlock that dumped to the PM.
- This information is a bit too coarse for a precise diagnostics.
- I have asked the SIS development team to be able to send a String buffer with detailed information to the PM to improve the diagnostics.
  - *This buffer already exists for the complex (JAVE class) interlocks.*
- I hope to get this functionality asap.

Summary

- LHC SIS is already in good shape, many tests are already done.
- β* reconstruction is now much more flexible, already operational.
- Optics ID is ready, waiting for SMP + FESA class to export.
- The abort gap cleaning part is not yet there – waiting for the FESA class.
- I propose to change the RP dump interlock to a vocal warning, and consider a modification of the RP FESA class in the longer term (later this year or 2016).