

(r)MPP meeting: MPS commissioning status and TSU firmware issue

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Present: N. Magnin, N.Voumard, I.Romera, B.Goddard, C.Bracco, W. Hoefle, W.Bartmann, J.Boyd, J. Uythoven, M.Zerlauth, R.Giachino, E.B.Holzer, G. Pigny, D.Wollmann, S.Redaeli, J.Wenninger, M. Valette

A problem with the injection permit from the LBDS to the injection BIS was discovered during the LHC cold checkout on 28.04.2017 (N.Magnin, N.Voumard) – see slides in EMDS node.

In order to test this link, the TSU cards have to be armed and the AGK synchronisation checked, allowing for a comparison of the mutual synchronisation between the two redundant TSU cards. In 2016, this additional check for the AGK synchronisation was badly implemented and not functional (forced to TRUE). To overcome this and other problems in the previous firmware (V1.0.3), a new version was developed for the 2017 run (v1.0.4). This was checked in the lab, but the faulty check was not detected during laboratory tests due to a non-representative delay adjustment wrt to the LHC. The problem therefore only appeared during first operational tests. A corrected version (v1.0.5) was installed 28.04, which solved the problem. The algorithm adds one turn to avoid a negative delay time difference. New algorithm and presently installed algorithm based on rising edges instead of states.

Following the deployment, the full MPS validation of the TSU has been repeated.

Discussion:

- Nicolas points out that the problem was not caught during tests, which indicates the need for improvements of the VHDL test bench. It might be useful to organise a more detailed review of the critical code by other teams, as well as to improve the visualisation of the injection permit in the TSU expert application. The problem was also not seen during the reliability run - the injection permit was indicating false (did not change state) but nobody looked at it. A more detailed sequence and XPOC validation including this injection permit should be used for future reliability run.
- Nicolas proposes to check for every XPOC event (also during operation) the change of state from true to false when you dump.
- The main question is whether we keep the new firmware in operation or roll back to 2016 version?
 - 2017 version has solved several known issues in the 2016 TSU firmware version, amongst others the likelihood of asynchronous dumps.
 - Changes are minor, and a priori not touching other critical parts. However, the FPGA code had to be recompiled and re-loaded (was done with the same compiler version as v1.0.4).
 - Revalidation of TSU interlock channels done – following standard procedure, more important than standard procedure.
 - We can also profit from an additional validation period with low intensity beam during beam commissioning.
- Brennen G. mentions that we could have used the weekend for further TSU testing, as beams were foreseen for Monday instead of pushing for beam too early → procedures should be clearly written down and state which time is required for a given test. Jorg commented that many cold-checkout tests depend on a closed beam permit loop - if one could mask out experiments of BIS... it would be possible to start the cold checkout earlier. Procedures during reliability run to be updated, as we missed the injection permit issue.

- Nicolas shows the details of the code changes; the main change is the rising edge detection replacing a pure state change. Problem is however the recompilation of the code. The likelihood of an erroneous synthesis is however small, as the TSU code only occupies 50% of the available FPGA resources.
- Latest firmware version also tested in the lab since Saturday for synchronisation tests.
- Stefano asks about the BRF glitch, which has been fixed in new version. Nicolas replies that although never observed in the machine, the new firmware would avoid asynchronous dumps which could be induced by spikes/glitches on the BRF.

Recommendation of rMPP:

Maintain the latest version of the TSU firmware provided action 1&2 below are done before taking more than one nominal bunch up to full energy and assuming:

- It is important to maintain the functional improvements it brings wrt to the 2016 version
- we can profit from the still available time of beam commissioning for a validation with low intensity beam (e.g. BLM tests of today).
- the introduction of the CIBDS card (redundant triggering path) for Run2 will mitigate the risk of potential issues in the TSU firmware

Action 1: Review last code change & compilation report by another expert outside of ABT (e.g. B.Todd & S.Uznanski)

Action 2: Further exercise the TSU in Inject and dump mode (potentially using an optimised sequence to increase frequency of triggering >1/minute). Plan by Thursday from ABT.

Action 3: For long-term, the test sequence should also exercise BPL interruptions from various IRs to sample the different phases on the TSU and integrate fully in XPOC and BIS IPOC.

Progress of MPS validation and issues – see [detailed list](#):

- Finalisation of injection inhibit tests from the BIS to INJ BIS to be completed (following the correction of the TSU bug)
- Functional test of user input from RF to the BIS – to be functionally re-tested as RF changed the interface logic. Scheduled for this week – Action BIS and RF teams.
- Post Mortem problems – related to FGC-lite, but problem caused by an analysis module within the global PMA server, which was overloaded due to analysis sessions being erroneously triggered for each FGCLite buffers (which in turn also impacted XPOC and IQC). New version already deployed since this morning and working fine so far.
- The new QPS reset task related to the configuration management seems not to be executed as part of the nominal sequence, to be checked with Laurette and Mirko.
- The circuit trip of RCD.A78B2 was identified to be related to the ELQA instrumentation left in place for the investigation of the short circuit in RCO.A78B1 – Instrumentation to be removed during the access tomorrow.
- Some VAC valves blocked in open position in points 5 and 4. Need new cables for the one in IR5 and replace valve for other. For the time being we can continue as is, corrective actions to be taken during TS#1.
- FMCM RD34.LR3, three spurious triggers observed at injection during early days of beam commissioning. Suspect the origin to be the HV divider and isolation amplifier, which will be replaced tomorrow during the access.

- Collimator position interlock stuck to false in IR7 → low impedance collimator not properly taken into account at low level, successfully recommissioned after intervention of M.Di Castro. Temperature interlock in IR7 was identified as disconnected HW cable. Fixed and qualified.
- Chiara: TCDQ checks still outstanding. This week, possibly during/after access tomorrow.
- Wolfgang Bartmann: Abort gap keeper adjustment and validation of B2 was completed today. IQC limits remain to be updated to 288b by M.Barnes.
- Wolfgang Hofle: The test of total voltage interlock (via SIS) remains to be done.
- Markus Zerlauth: SIS interlock on the LLRB wire implemented and tested by Jorg (for initial interlock to +-10A during operation, which can be masked during MD). Polarity interlock (-10A to +300A) not yet tested (needs large current). However, temperature interlock by SIS remains to be implemented and tested.

Reported by J.Uthoven and M.Zerlauth