Update of TSU Firmware & Additional Delay for Asynchronous Trigger of LBDS

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Update of TSU Firmware

Flashback

- TSU hardware and embedded software externally reviewed in 2010
- Recommendations for hardware & software consolidation (1 critical issue identified)
- Hardware recommendations will be implemented in new TSU_V4 hardware version foreseen for LS1
- Embedded software recommendations implemented in software release TSU_V2.3.7_2011 on TSU_V3 hardware version used in 2010
- TSU_V2.3.7_2011 embedded software successfully tested on test bench before deployment in the machine
- Decision at the 11/02/11 MPP meeting to deploy TSU_V2.3.7_2011 in operation for 2011 LHC run

Instabilities issues

- During machine re-commissioning with beam, instabilities (corruption of TSU FPGA state machine) noticed on TSU_B (TSU connected to the 8.375MHz BIS loop) for both beams

- Stable operational conditions on TSU_A (TSU connected to the 9.375MHz BIS loop) for both beams

- Retrofit 2010 TSU embedded software (TSU_V2.3.4_2010) doesn't solved the problem

- Replacement of "good" CIBO with "very good" CIBO from Ben's safe box + increase filtering on 1.2V FPGA powering circuit solved the problem (04/2011)

- No problem since these modifications

- Still running with TSU_V2.3.4_2010 embedded software

Embedded Software Upgrade

- TSU_V2.3.4_2010 → TSU_V2.3.7_2011
  - Filtering of all discrete input signals to prevent metastability effect
  - Redefinition of Local mode signal
  - ABDT trigger is issued in case of timing failure on both TSUs and on redundant TSU
  - Modification of switch debouncer time from 10msec to 1msec

  → Fully validated on TSU test bench (> 250000 cycles without failure)

- TSU_V2.3.7_2011 → TSU_V2.3.8_2012
  - Reduce AGK duration by 120ns (compensation of electronic delays and TSU & RF clocks asynchronisms)
  - Implementation of TSU internal IPOC analysis with 10ns resolution

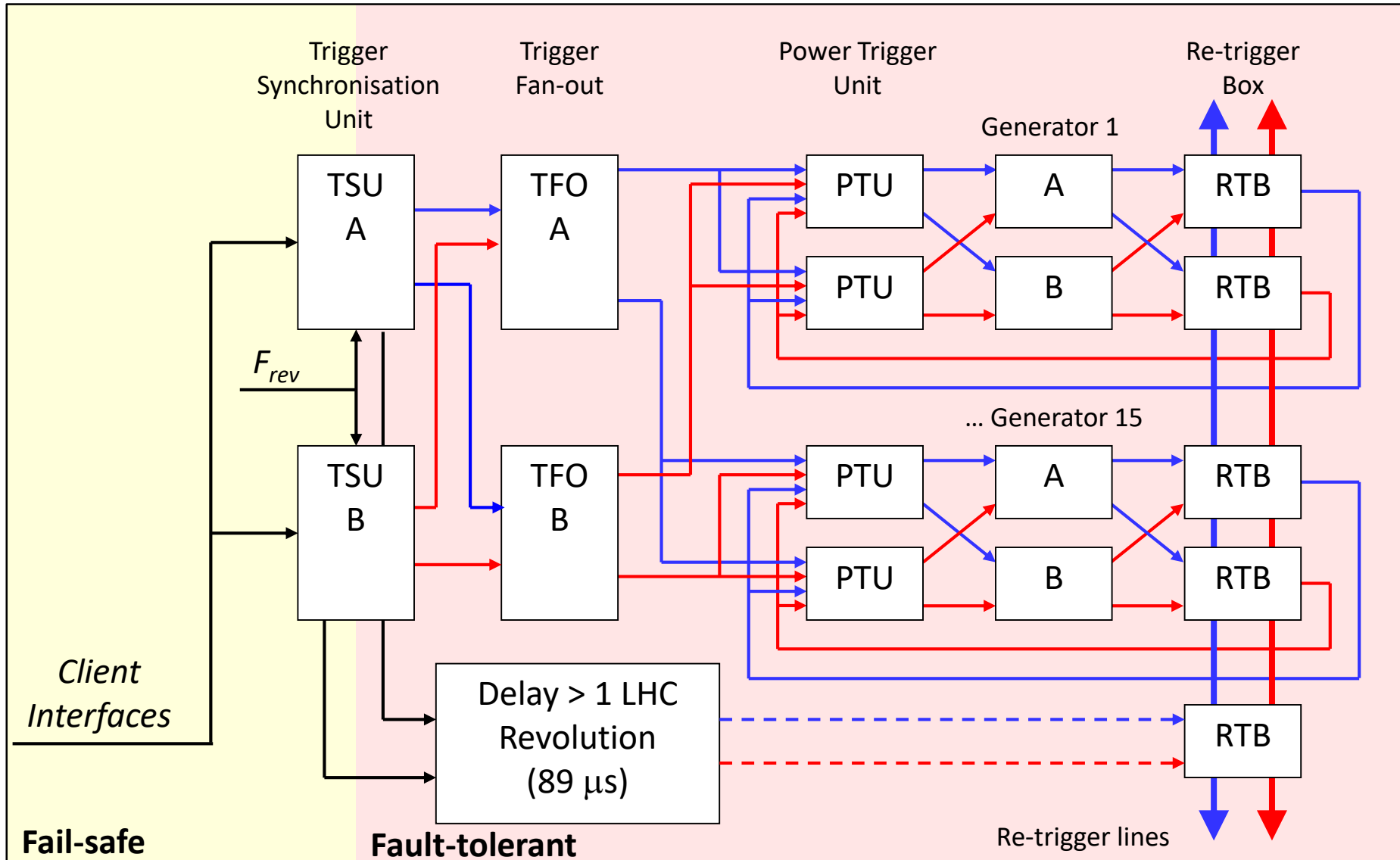 **→ Validation ongoing**

Question to MPP

Can we redeploy TSU_V2.3.7_2011 embedded software during next TS (W45);

or

Do we wait 2011/2012 TS for deployment of TSU_V2.3.8_2012 version?

Additional Delay for Asynchronous Trigger of LBDS

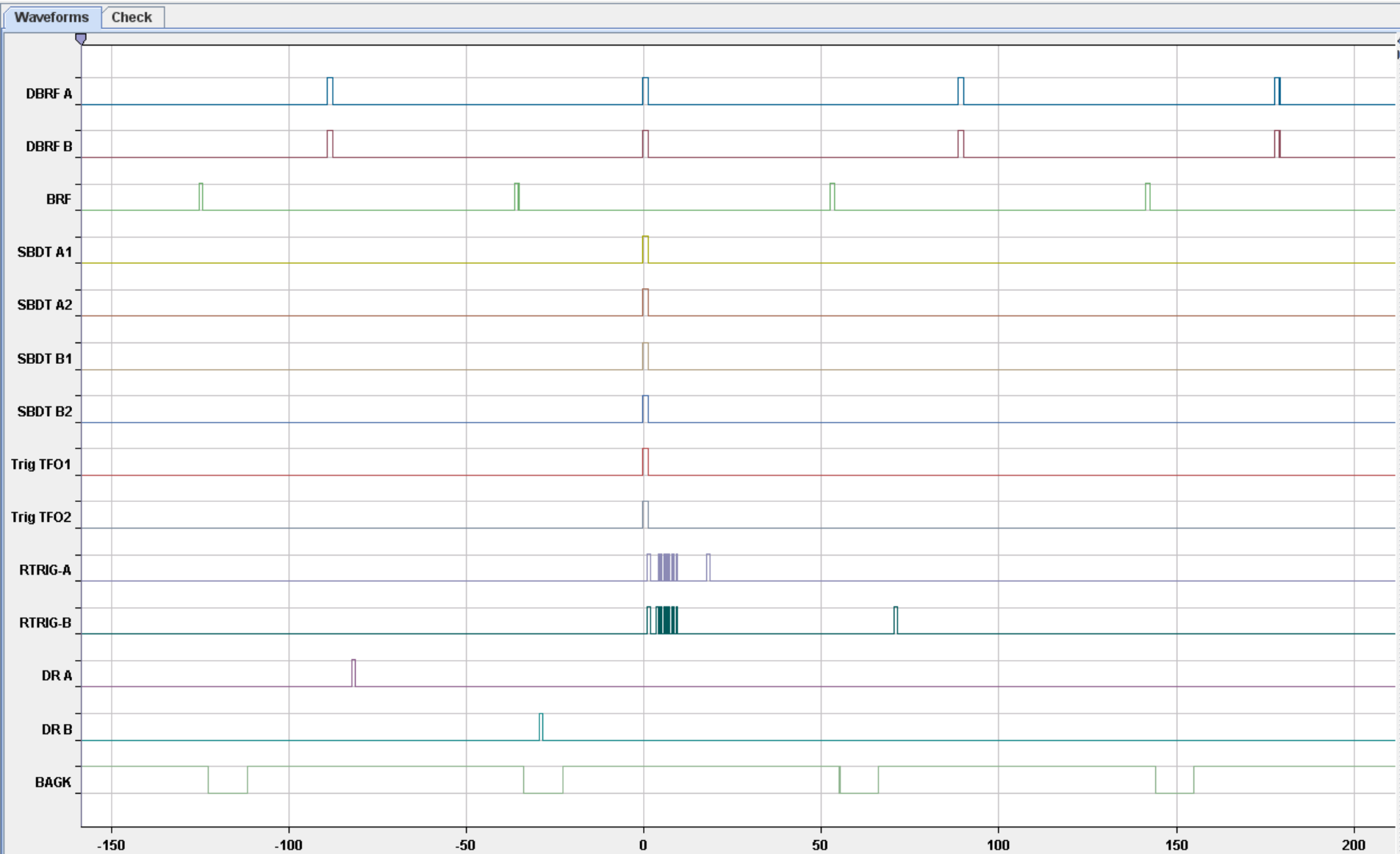# LBDS Trigger Synchronisation & Distribution

LBDS Triggering Experience

- Case 1:
  - 33% of the LBDS triggers are requested simultaneously by the both TSU's
  - Both dump requests from BIS loops A & B are received within one BRF period

Synchronous Beam Dump Trigger from both TSUs

LBDS Triggering Experience (cont.)

- **Case 1:**
  - 33% of the LBDS triggers are requested simultaneously by the both TSU's
  - Both dump requests from BIS loops A & B are received within one BRF period

- **Case 2:**
  - 66% of the LBDS triggers are requested by a single TSU, either by TSU-A or TSU-B
  - Dump request from the BIS loops A & B are received on 2 different BRF period (BIS loops A & B are cabled clockwise and counter-clockwise)

Synchronous Beam Dump Trigger
from one single TSU
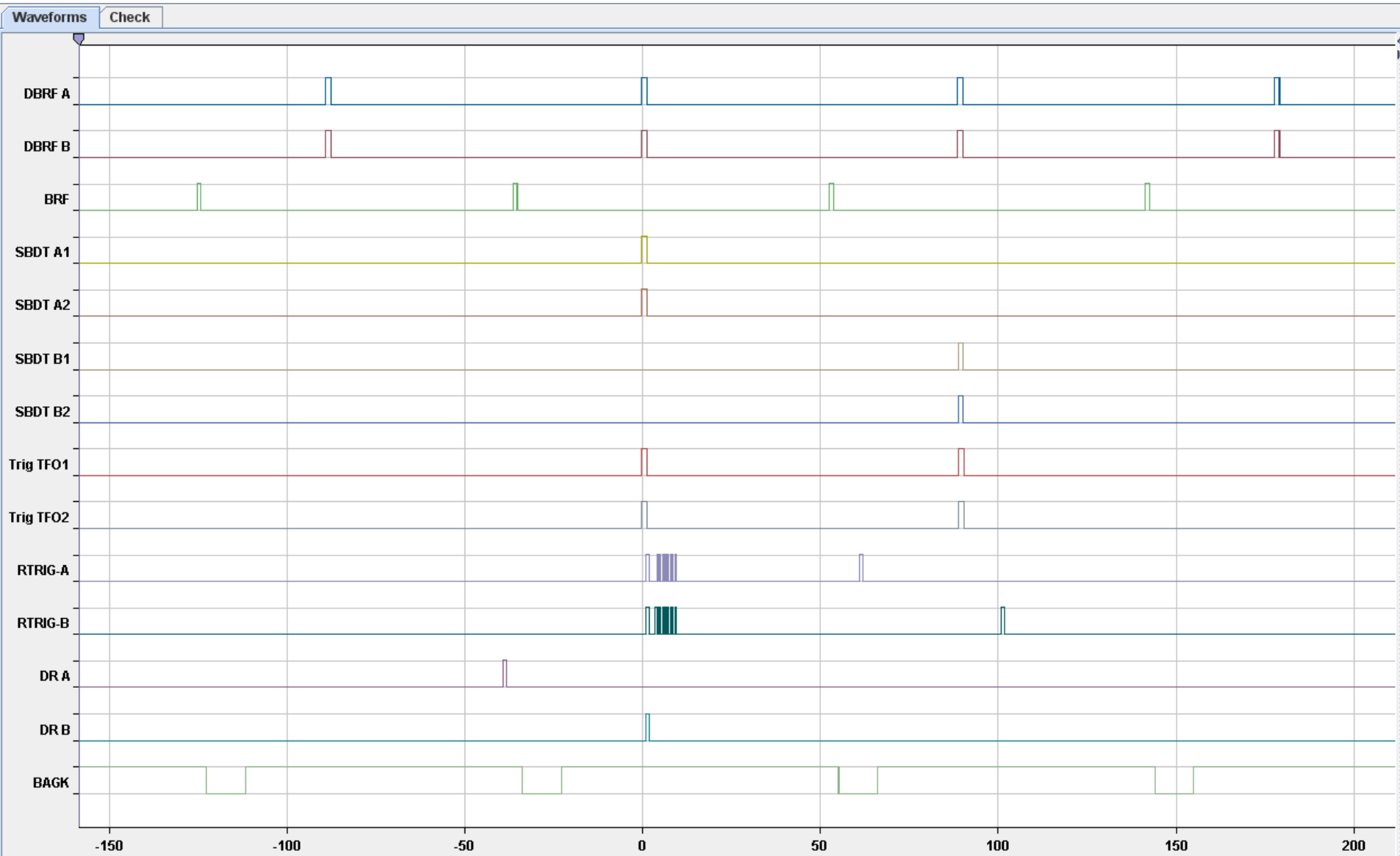
Re-trigger Mechanism

- In both cases, Re-trigger signals are generated 100µs after the detection of the dump requests

- Re-trigger signals will dump the beam asynchronously, if the dump has not been performed synchronously by the TSU

→**Case 1:**
- – Work fine

→**Case 2:**
- – If the TSU that has received the dump request fails to perform properly his action, a asynchronous dump will be performed while the redundant TSU is still available to perform a synchronous dump.

Question to MPP

Can we increase the re-trigger delay between the dump request and the asynchronous dump trigger from 100μs to 200μs in order to keep open the possibility to perform a synchronous dump with the redundant TSU in case of an internal failure of the TSU that have received the first dump request?