UPGRADE OF THE TRIGGER SYNCHRONISATION AND DISTRIBUTION SYSTEM OF THE BEAM DUMPING SYSTEM OF THE LARGE HADRON COLLIDER

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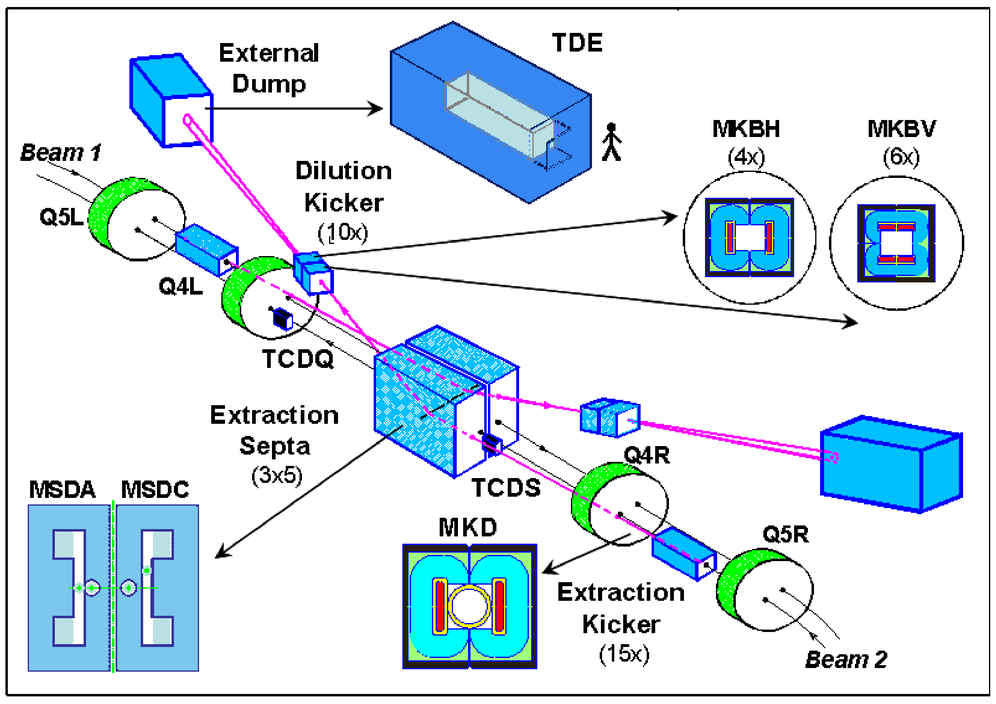
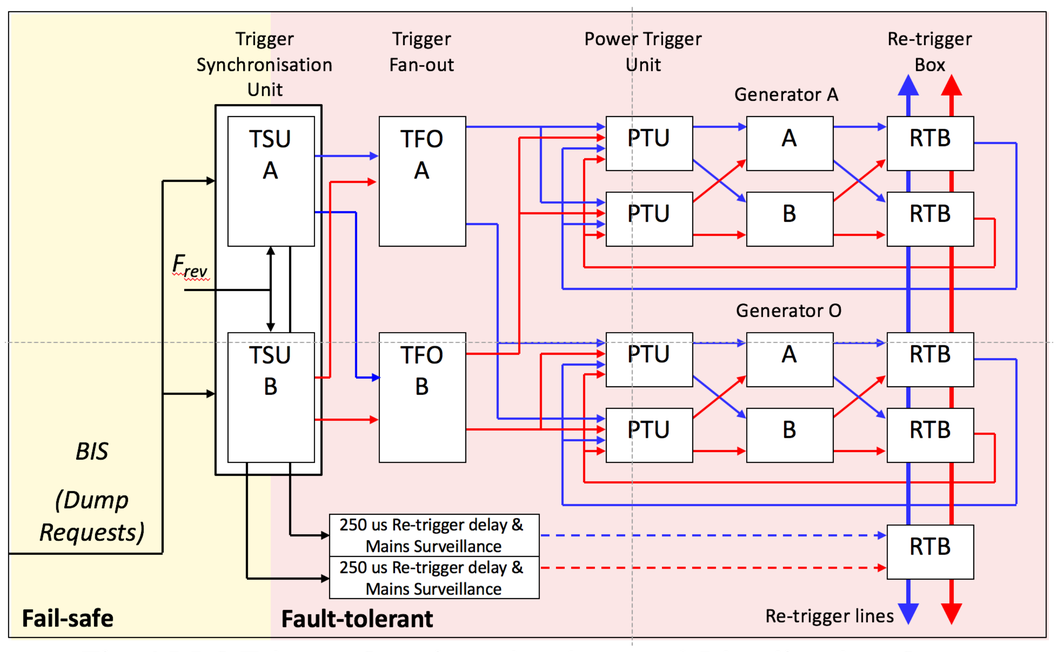
LHC Beam Dumping System



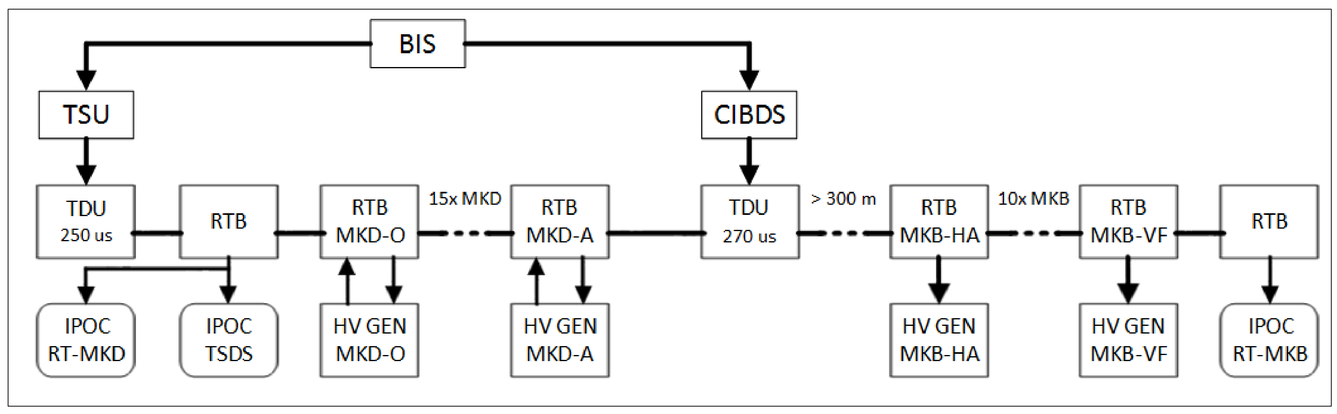
Schematic layout



The LBDS Trigger Synchronisation and Distribution System

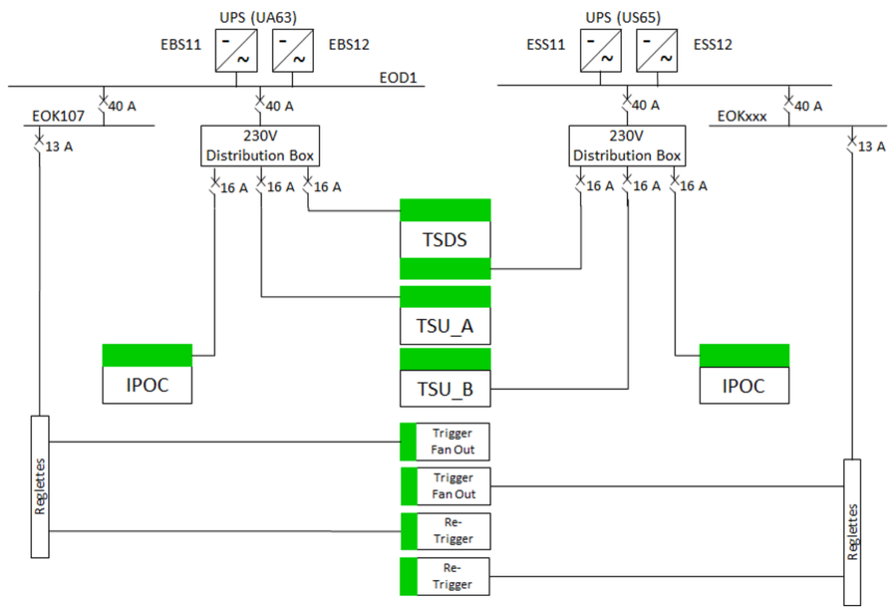
Re-Trigger System (RTS): Asynchronous triggering of LBDS

- In case of self-trigger of one MKD HVPG (internal pickups in HVPG injects pulses on the RTL)
- To cover the case of synchronous trigger distribution not working, the TSU cards systematically inject a pulse on the RTL through Trigger Delay Units (TDU) with a delay of 250 µs w.r.t. the synchronous trigger.



Simplified view of one Re-Trigger Line (RTL)

Upgrade Power Distribution



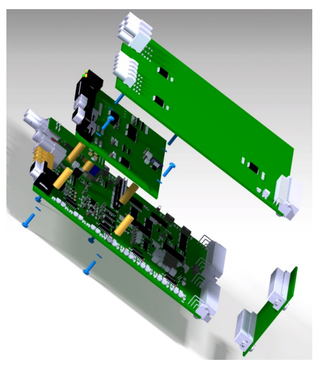
Full redundant electrical distribution

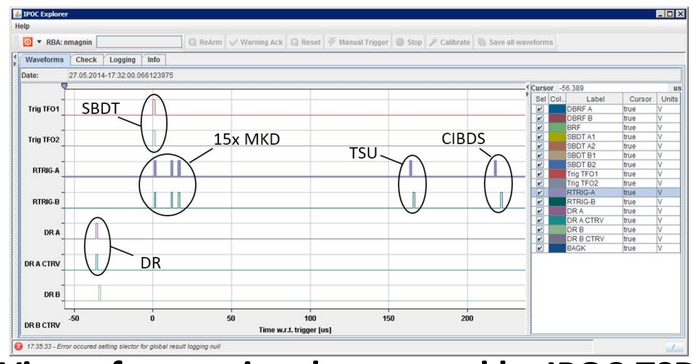
Motivation: During LHC Run I in 2012, one computer power supply unit (PSU) failed, causing the loss of one complete UPS.
Upgrade: - Addition of Distribution Boxes, with individual circuit-breaker for each computer PSU;
- Addition of a second fully redundant UPS for LBDS powering.

Direct Connection From BIS to RTS

Motivation: In case of simultaneous failure of both TSU cards, no Dump Request would be executed.
Upgrade: A redundant direct link has been established between the BIS and the RTS of the LBDS. A new CIBDS card will inject a pule on the RTL on a BIS DR through Trigger Delay Units (TDU) of 270 µs.

New Trigger Synchronisation Unit

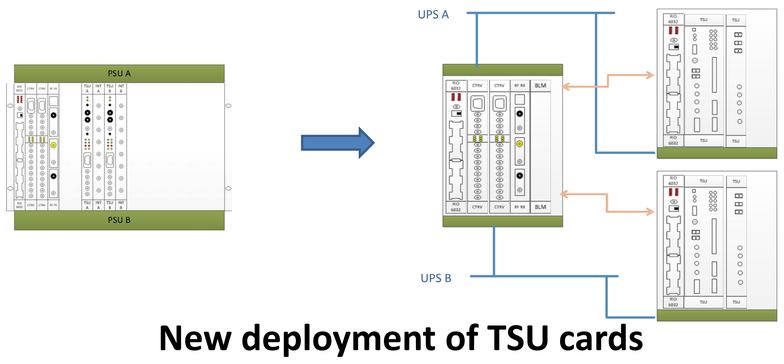




View of some signals captured by IPOC-TSDS

Motivation: External review recommendations follow-up.
Upgrade: - Surveillance of all internal voltages (DR is issued to the redundant card in case any power supply failure is detected);
- Internal surveillance of the CRC of the TSU programmable logic circuits (FPGA). In case of a Single Event Upset corruption a DR is issued to the redundant TSU.

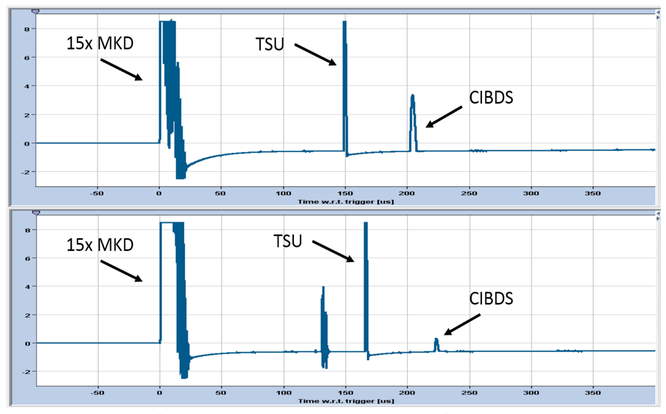
New Deployment of Trigger Synchronisation Unit



New deployment of TSU cards

Motivation: During LHC Run I, a new failure mode was identified: In case of failure of the +12V of the VME crate housing the two TSU cards, no dump trigger is issued.
Upgrade: The two TSU cards are deployed in individual VME crate, with redundant Power Supply Units.

Improve Monitoring of Re-trigger Lines



View of RTL IPOC signals at 450 GeV and 6.5 TeV.

Motivation: Check of re-trigger lines continuity.
Upgrade: -Implementation of an Internal Post Operational Check (IPOC) system at both extremities of the lines;
- Monitoring of re-trigger lines absorption.