

# An RPC-based Technical Trigger for the CMS Experiment

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In the CMS experiment, sub-detectors may send special trigger signals, called “Technical Triggers”, for special purposes like test and calibration during the off-beam periods. The Resistive Plate Chambers are part of the Muon Trigger System of the experiment, but might also be used to produce a cosmic muon trigger as Technical Trigger to be used during the Cosmic Challenge and the later running of CMS. The proposed implementation is based on the development of a new board, the RBC; the test results on prototypes and their performance during the Cosmic Challenge will be presented.

## Summary

In the CMS experiment, sub-detectors may send special trigger signals, called “Technical Triggers”, for special purposes like test and calibration during the off-beam periods. The Resistive Plate Chambers are part of the Muon Trigger system of the experiment, but might also be used to produce a cosmic muon trigger to be used during the Commissioning of the detectors to check the efficiency of the installed chambers and, as Technical Trigger, during the Cosmic Challenge and the later running of CMS.

Since this project started only few months ago, when the electronics and cabling in the experimental hall were frozen, this RPC trigger system for the detection of cosmic muons must use as much as possible the existing functionalities and infrastructures and don't introduce major modifications to the existing electronics. Another constraint is the capability to generate a trigger signal both locally and globally. The local trigger involves the chambers of one Barrel sector and can be used during the Commissioning of the RPCs and the Cosmic Challenge. The global trigger, used as Technical Trigger, involves the whole Barrel and requires infrastructures in the counting room.

In the proposed scheme, the RPC-based Technical Trigger will be implemented by two types of electronic boards: the RPC Balcony Collector (RBC) housed in the cavern and Technical Trigger Unit (TTU) housed in the Counting Room.

Since the RPC signal cables are connected to the Link Boards (LB) for synchronization, data compression and optical conversion, the RBC could access only an OR signal of 96 strips produced by each LB. So each RBC collects the Ors from two Barrel sectors, produces two independent sector-based cosmic trigger as “local” triggers and transmit optically the input Ors to the Counting Room, where the TTU will produce a wheel-level cosmic trigger, to be sent as technical trigger to the Global Trigger of the experiment.

The most convenient position for the RBC is inside the crate housing the LBs. In fact from the backplane can take the power supplies and the slow control signals, while the ORs can be easily taken from the LBs by means of Front-Planes.

The RBC has been designed using FPGA to allow easy upgrades of its firmware by means of JTAG bus. Three prototypes of RBC have been produced, tested and used during the Cosmic Challenge to provide a cosmic trigger from the two barrel sectors equipped with RPC.

In this work the overall scheme of the proposed implementation, the RBC project design, the prototype tests and their performance during the Cosmic Challenge will be shown.

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