



Flexible system of the CMS ECAL OD electronics firmware update



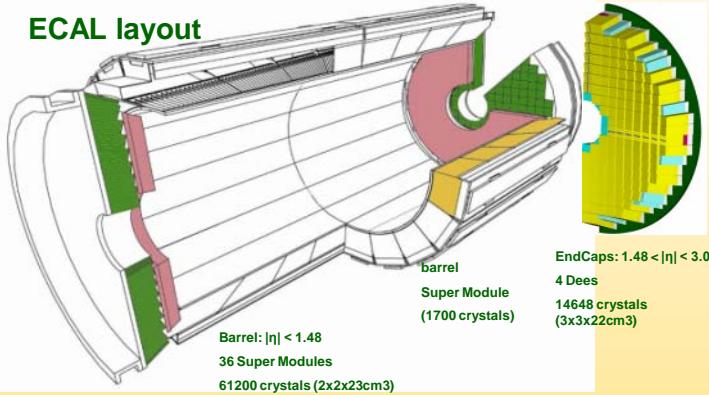
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CMS Electromagnetic CALorimeter Detector

Main CMS goal: search for Higgs and new physics

ECAL layout



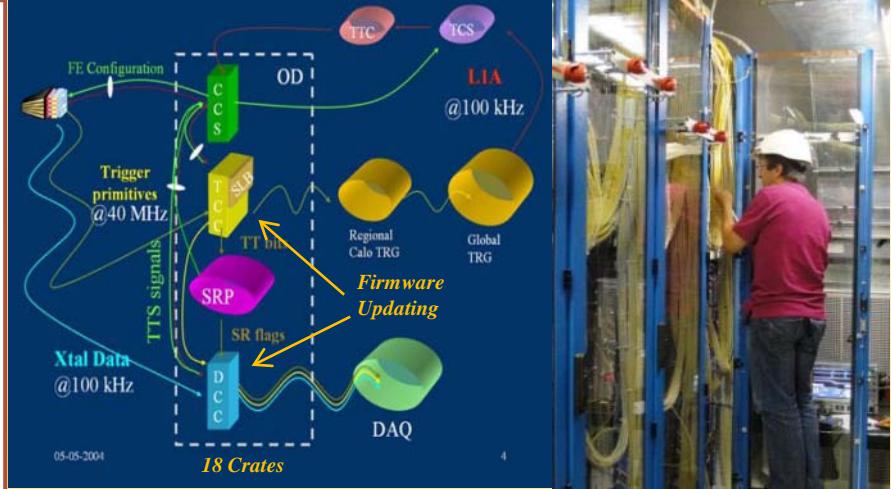
For a light Higgs (as suggested by present data)
H→γγ best channel. Narrow width, irreducible background:
ECAL resolution crucial!

ECAL Off Detector (OD) electronics

for efficient Data and Trigger processing

This is the implementation of a flexible system for the electromagnetic calorimeter (ECAL) Off Detector (OD) electronics firmware update and the corresponding software tools designed to manage the update operation. The idea is to equip each of 18 ECAL VME64x crate with the new JTAG Distribution Board (JDB) that access XILINX and ALTERA FPGAs JTAG chains for trigger (TCC68) and data acquisition (DCC) boards. It allows:

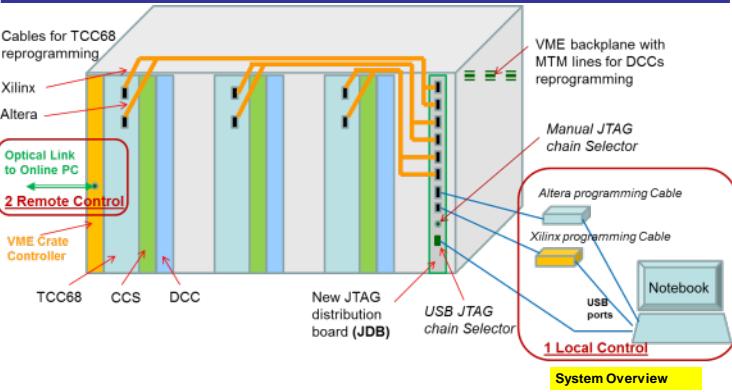
- ❖ Improve access flexibility and reduce the time needed to reprogram TCCs and DCCs firmware.
- ❖ Increase mechanical safety, excluding any touching of the fragile fibers connected to OD electronics every time the update is performed;
- ❖ Perform the firmware update via remote (VME-MTM) mode.



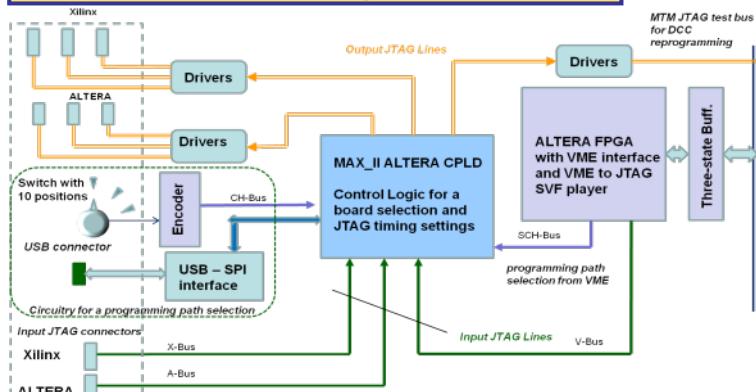
ECAL Off Detector Electronics Layout and photo of the racks in the P5 counting room

Electronics of the JTAG distribution System

1. Firmware upload System Overview



2. JDB architecture and specification



Specification:
New FPGAs programming code can be loaded to the OD electronics FPGAs through the specific Programming Cable from a dedicated PC connected to JDB or from VME-MTM bus.

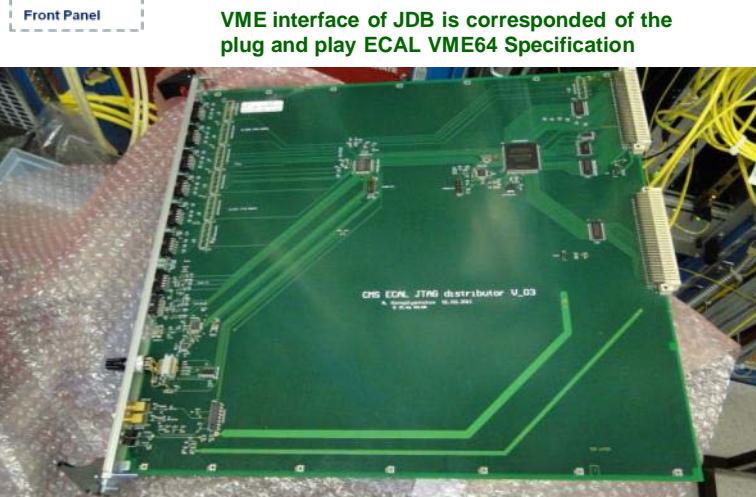
One JTAG distribution board serves the FPGA reprogramming of the three TCC68 and three DCC boards placed in one OD electronics crate:

- The DCC's ALTERA and XILINX FPGAs are programmed through the backplane MTM test lines;
- The TCC68 ALTERA and XILINX FPGAs are programmed by using six JTAG cables connected at the front panel of the JDB ;

On the JDB there are three modes to select the JTAG path:

- manually, via a ten position switch placed on the front-panel.
- from a PC through USB port.
- from the VME/JTAG interface implemented on a FPGA.

The system has been installed in CMS counting room (USC55) and used for the firmware upgrades of the CMS electromagnetic calorimeter data acquisition and trigger system electronics.



VME interface of JDB is corresponded of the plug and play ECAL VME64 Specification

Software for the JTAG distribution System

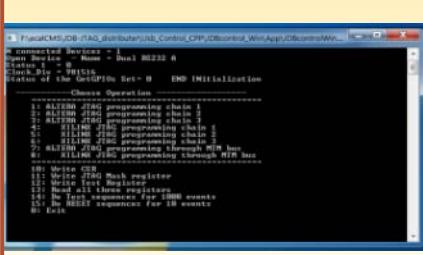
1. Local PC software for JTAG chain selection

JDB board operational mode is selected by the 10 positions rotary switch placed on the front panel. It defines programming data source and JTAG programming direction.

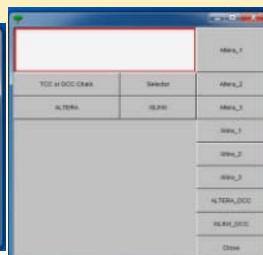
In case if the switch position in range from 1 to 8: programming source is a dedicated PC connected to JDB by programming cables and a switch position defines the output 10 pin connector, which will transmit JTAG data;

If switch position = 9: programming source is a dedicated PC connected to JDB by programming cables and a the output 10 pin connector transmitted JTAG data defined by a register programmed through USB interface;

If switch position = 10: programming source is a VME SVF player connected to JDB through VME bus and a the output 10 pin connector transmitted JTAG data defined by a register programmed through VME interface too;



Simple terminal application



GUI application

In local mode the firmware uploading is performed with a dedicated programming PC. This PC has pre-installed ALTERA and Xilinx programming software and connected to JDB board with standard programming cables (ALTERA byte-blaster and Xilinx programming Cable).

For selecting a needed JTAG chain with USB interface, two programs were written. One is a simple terminal application and other one is a program with a GUI interface.

2. Software for remote firmware upload

- JDB VME interface is based on ALTERA FPGA. It's firmware includes VME interface and VME to JTAG SVF player.
- Each ECAL OD electronics VME64 crate is connected to individual online PC with Lynux operational system.
- There is a program on this PC for reading a SVF file prepared on Windows platform by ALTERA and XILINX programming software and sending corresponded data to SVF player on the JDB.
- This technics allows to perform remote firmware update simultaneously on all OD crates.

