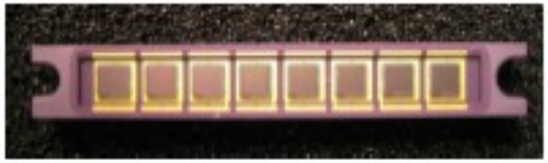
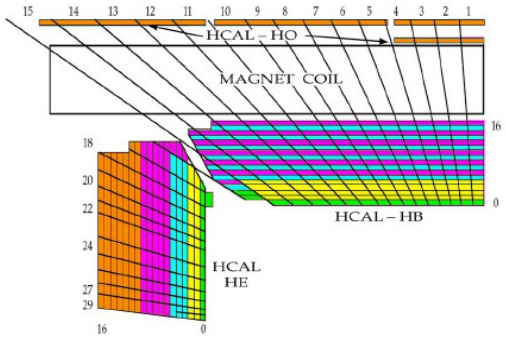
μTCA for the CMS HCal Upgrade (F. Costanza)

- Main goal: improving the performance of the CMS Hadronic Calorimeter in the harsher and harsher Large Hadron Collider environment:
  - Increasing number of pileup interactions
  - Increasing radiation

- How do we want to reach this goal?
  - currently hybrid photodiodes (HPDs) will be replaced by silicon photomultipliers (SiPM)
  - new charge-integrating ADC with an integrated Time to Digital Converter (TDC)
  - increasing the depth-segmentation
  - improving the data-link to 4.8 Gbps to handle an higher data volumes and provide more useful information to the calorimeter trigger system





- Back-end electronics need to be updated too.

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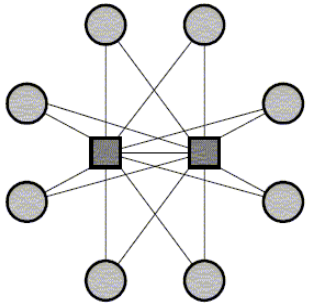
- Back end electronics requirements:
  - cope with an optical data rate of 4.8 Gbps
  - calculate trigger primitives and transmit them over optical fibers to the calorimeter trigger system keeping track of the bunch crossing number
  - collect data in case of a Level-1 trigger acceptance
  - Receive and process fast (LHC clock, orbit synchronization, …) and slow (temperature and power monitoring, …) control signals.

- To meet this requirements, the back-end will use boards with modern FPGAs and the μTCA crate architecture.

- μTCA: Micro Telecommunication Computer Architecture
  - Better power and cooling management
  - Hot swapping
  - Faster backplane communications
  - Redundancy implemented in a dual star topology
  - Smaller form factor



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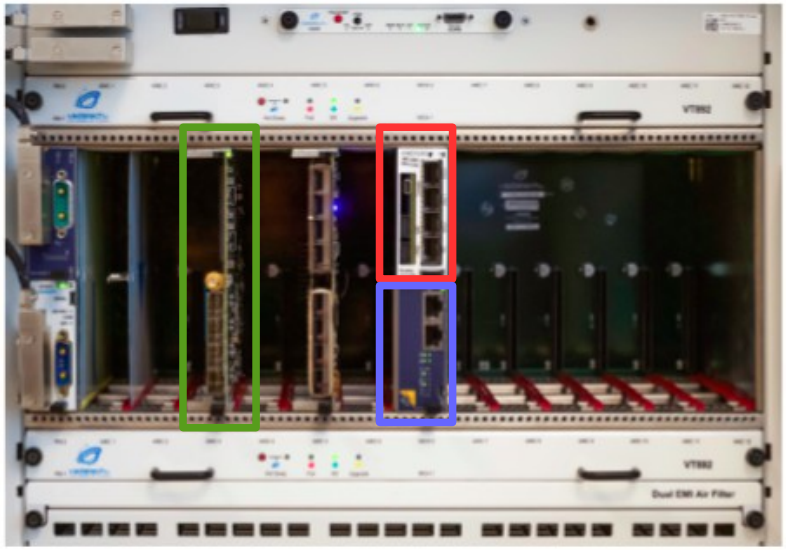
- This Lab focuses on the next-generation Front End Control (ngFEC) μTCA crate. The ngFEC:
  - organizes the control path between the front-end modules and the CMS control system
  - distributes the LHC clock to the front-end electronics
  - Each ngFEC is capable of controlling **72 front end crates!**

- The ngFEC consists of:
  - 1 **NAT-MCH**: responsible for the control of the power and cooling system of the crate
  - 1 **AMC13**: provides trigger, clock and DAQ functions to all uTCA modules in CMS.
    It mounts in the secondary MCH slot, which provides connections to all 12 AMC slots of the ngFEC crate.
  - upto 12 **GLIB v3**: communicate with the front end electronics using FPGA Mezzanines cards



crate you are actually going to setup in the lab

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- In this Lab you will:
  - setup a minimal but **fully-functional** version of the **ngFEC crate**
  - check the transmission of the fast controls through the μTCA back-plane
  - learn how to **monitor your newly built system** through the NAT-MCH interface and the Intelligent Platform Management Interface (IPMI)