HCAL DCS Overview

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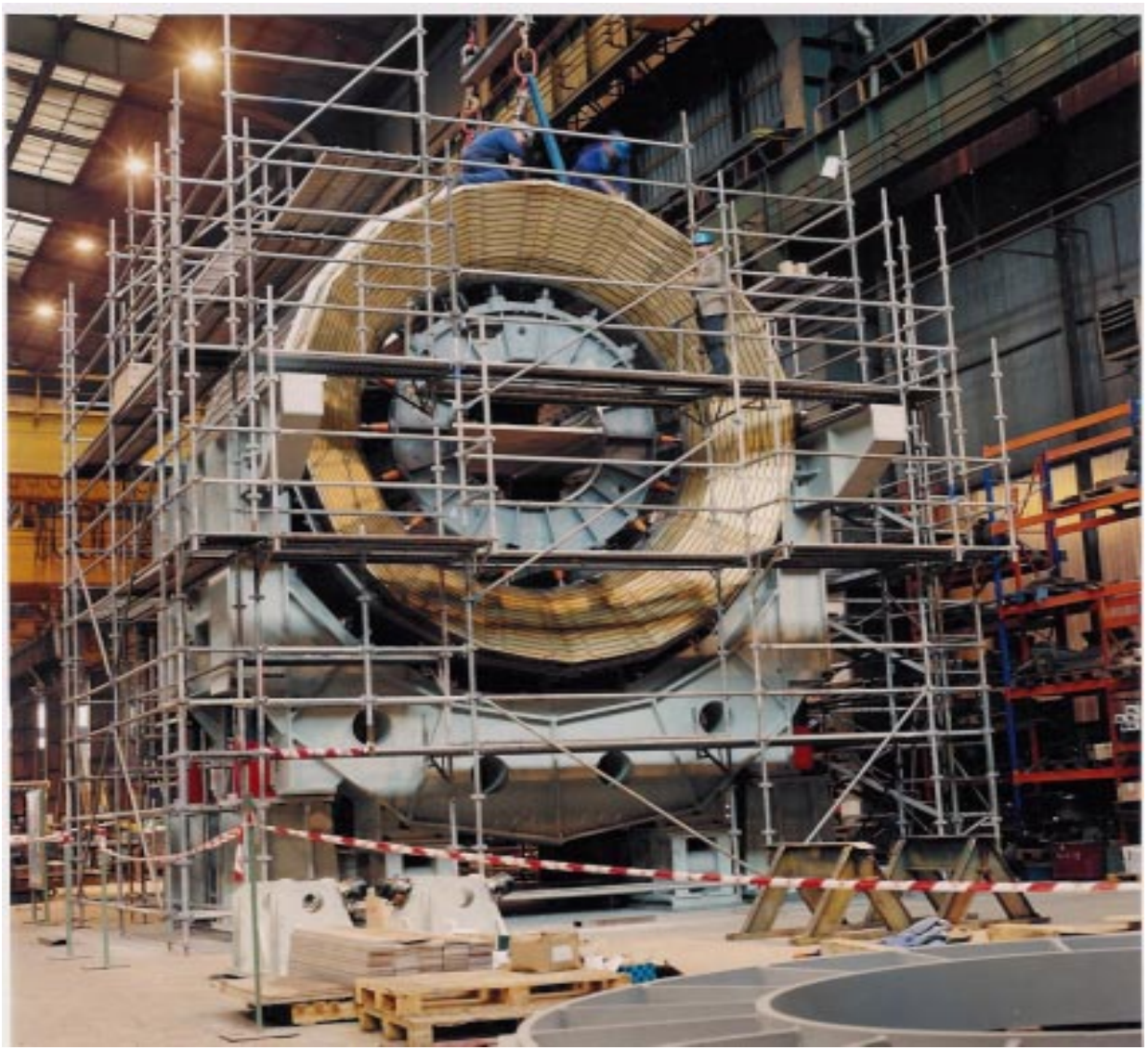
HCAL DCS

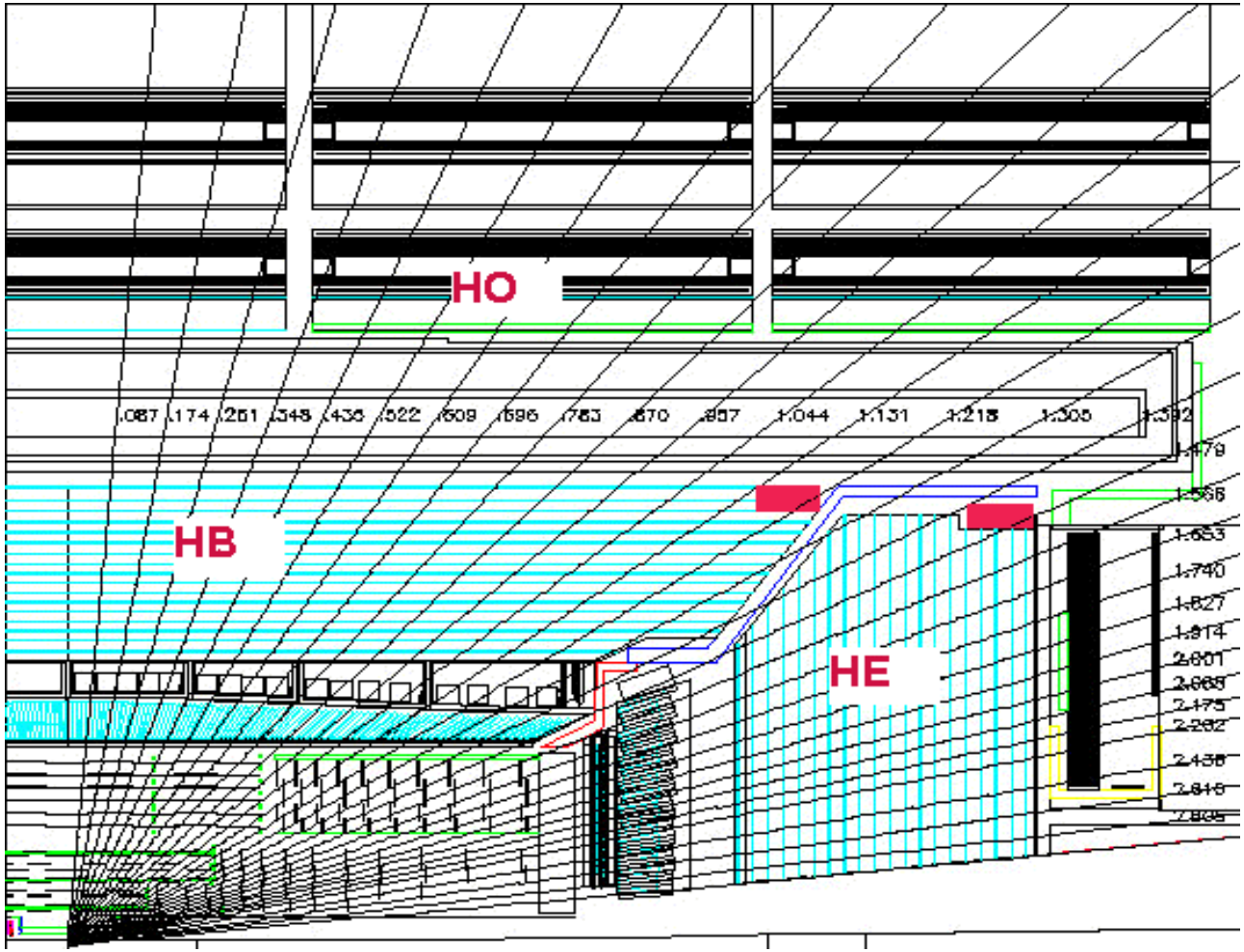
D.Lazic, FNAL

HCAL half-barrel

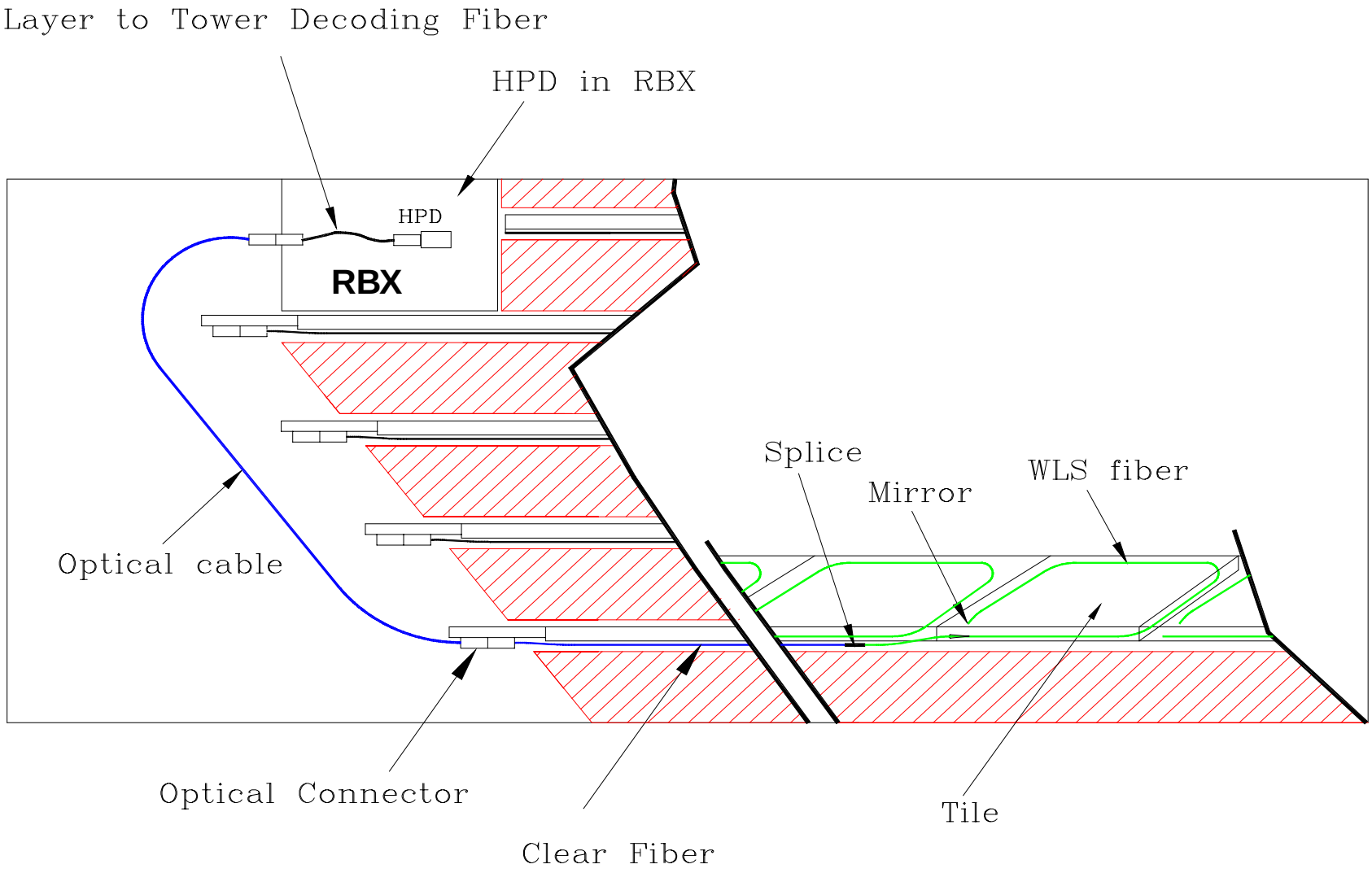


Building 186 - today

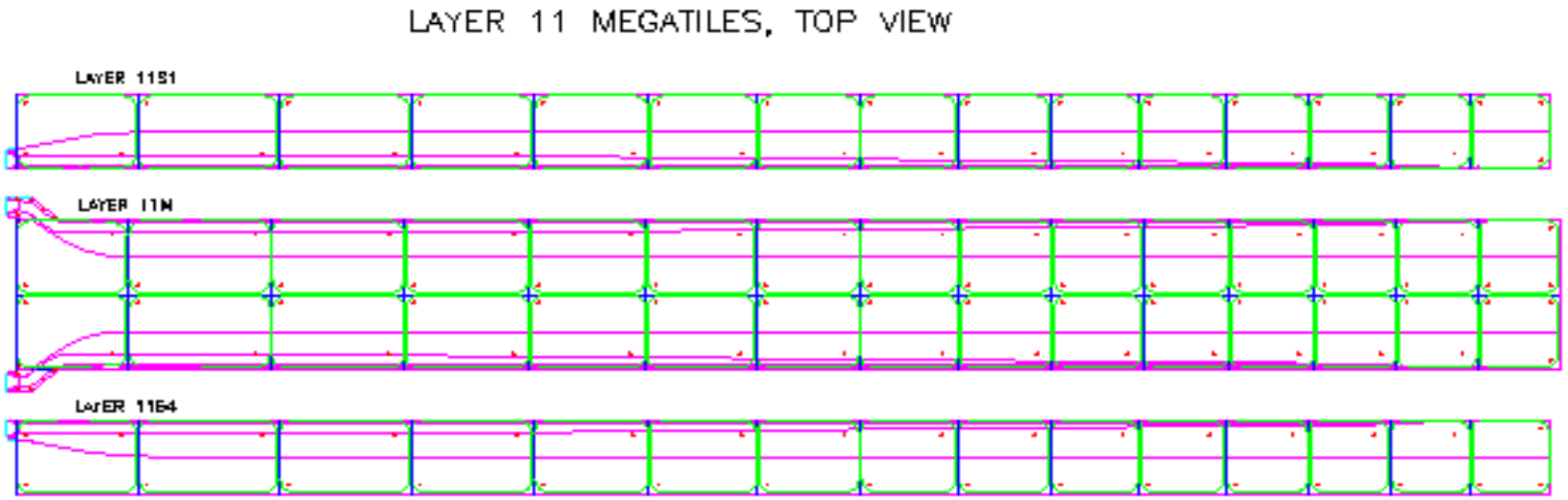
Overview of RBX Placement



HB Optics Overview



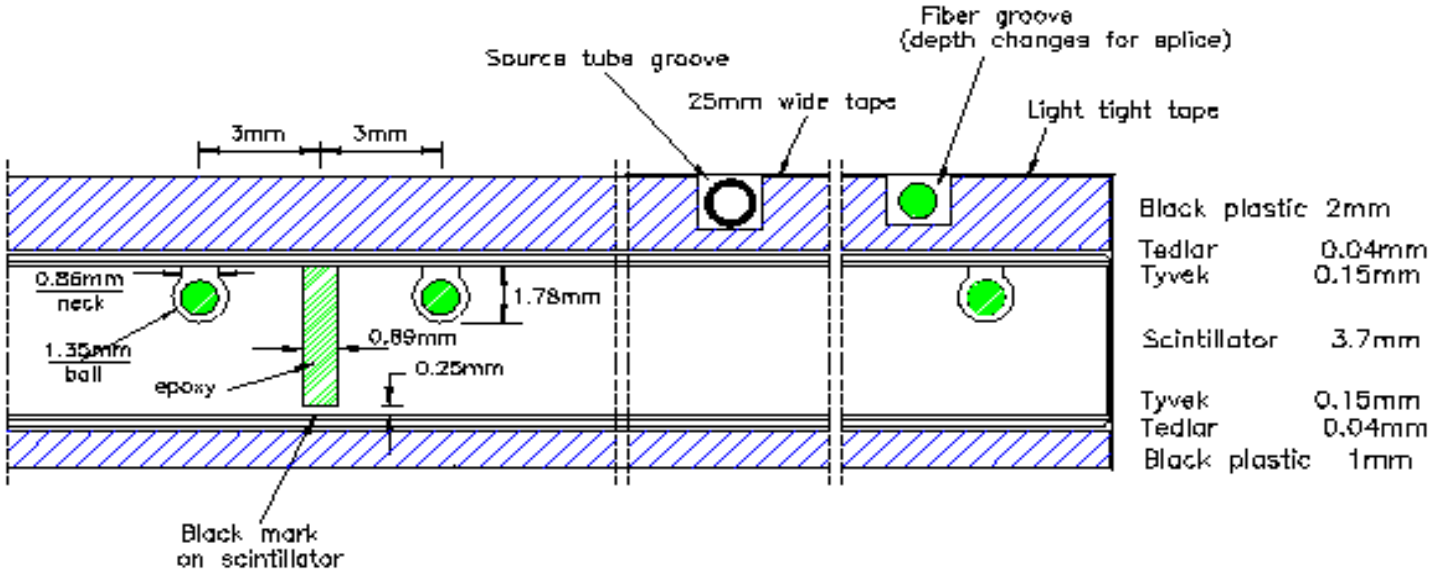
Optics-Megatiles



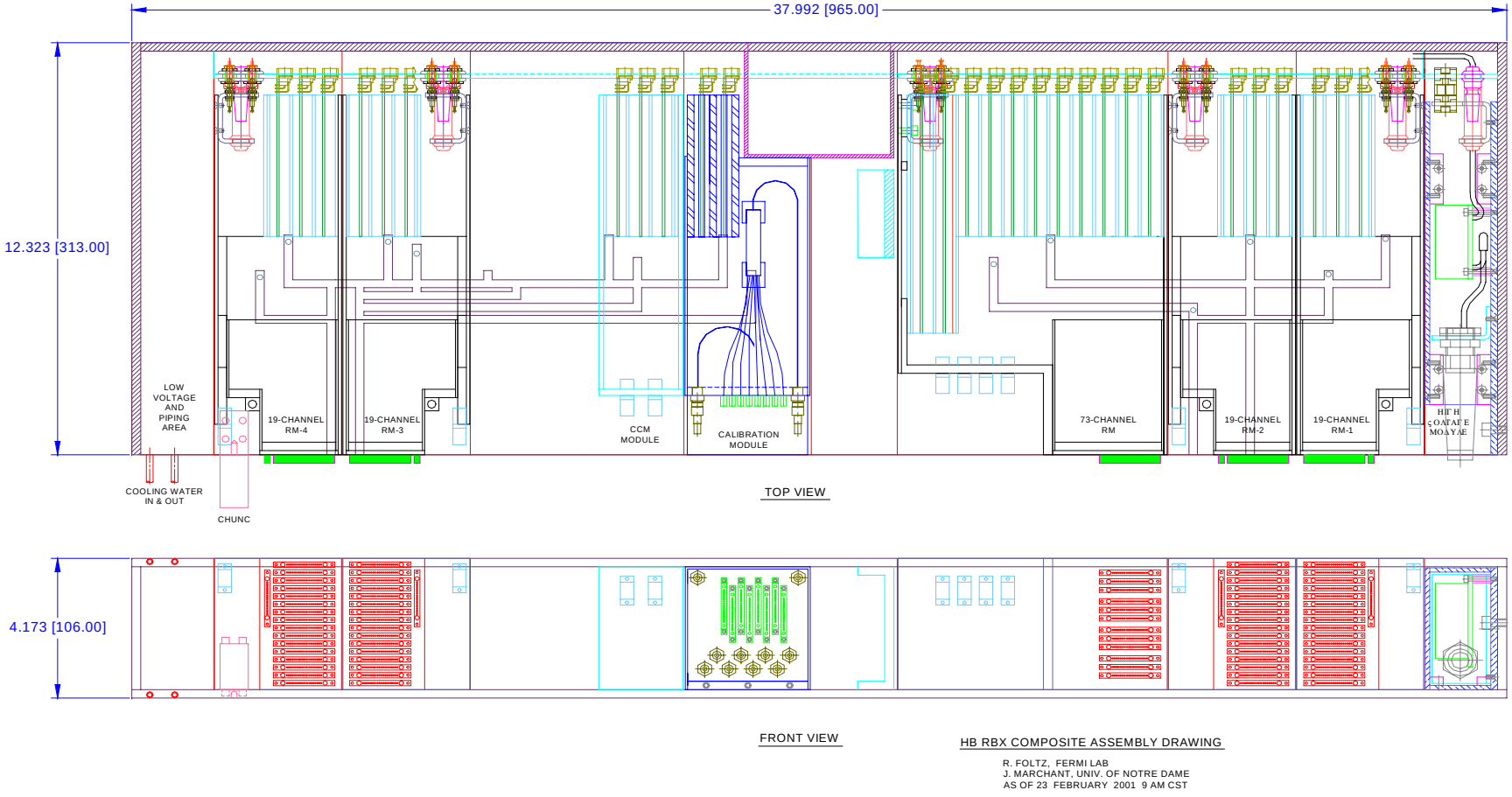
Components are the machined scintillator plates, cover plates, fiber assembly (WLS spliced to clear fiber, optical connector) pigtails

Optics-Megatiles

Cross section view of a megatile



HB RBX (rϕ,z) view and (rϕ,r) view



RBX Summary

HB :	36 RBX, 4968 channels
HE:	36 RBX, 3672 channels
HO:	36 RBX, 2304 channels
HF:	36 wedges, 2484 channels

DCS Tasks

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- HV power supplies
- LV power supplies
- Monitor RBX temperatures
- Downloading FE constants
- Laser Calibration System
- LED Calibration System
- Source Calibration System

RBX

- Communication through CAN-bus interface
- Contains Clock and Control Module (including TTCrx)
- Contains calibration module with LED driver and fiber splitter for laser light
- Monitoring of temperatures and LV in RBX

Status

Systems

- LV control system
- HV control system
- Radioactive source calibration system
- Laser and LED calibration system
- RBX control and monitoring

More info at *http://cmshcal.web.cern.ch/cmshcal/DCS/*

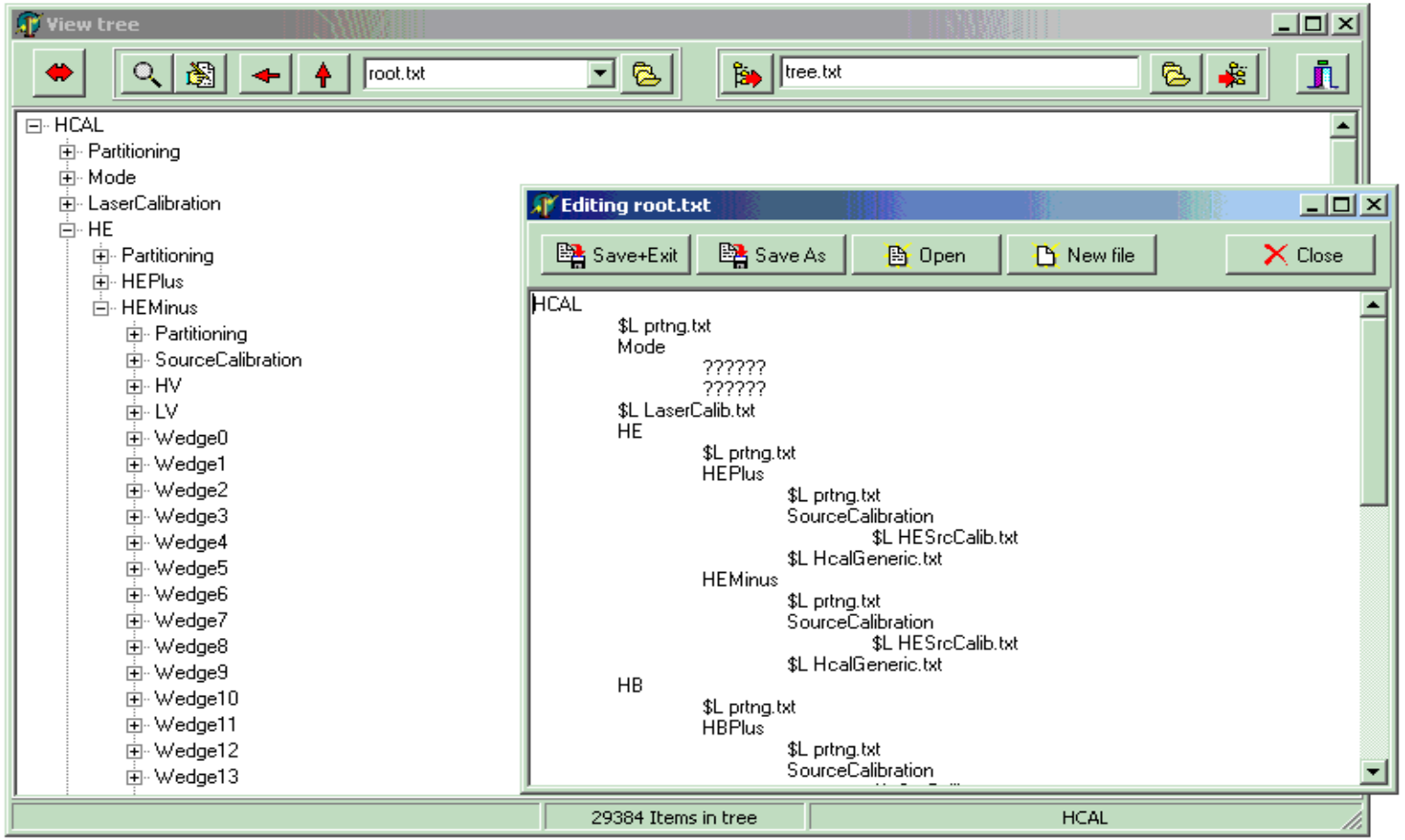
The systems that were described up to now are only “leaves” and “nodes” in PVSS II parlance.

HCAL Tree (I)

What about the whole tree?

S. Sergueev is studying that issue too. A program that reads structure of HCAL PVSS II tree has been developed in order to better see the tree structure, number and interdependence of data points. It is certainly not the final version, but we still got some time to fix it.

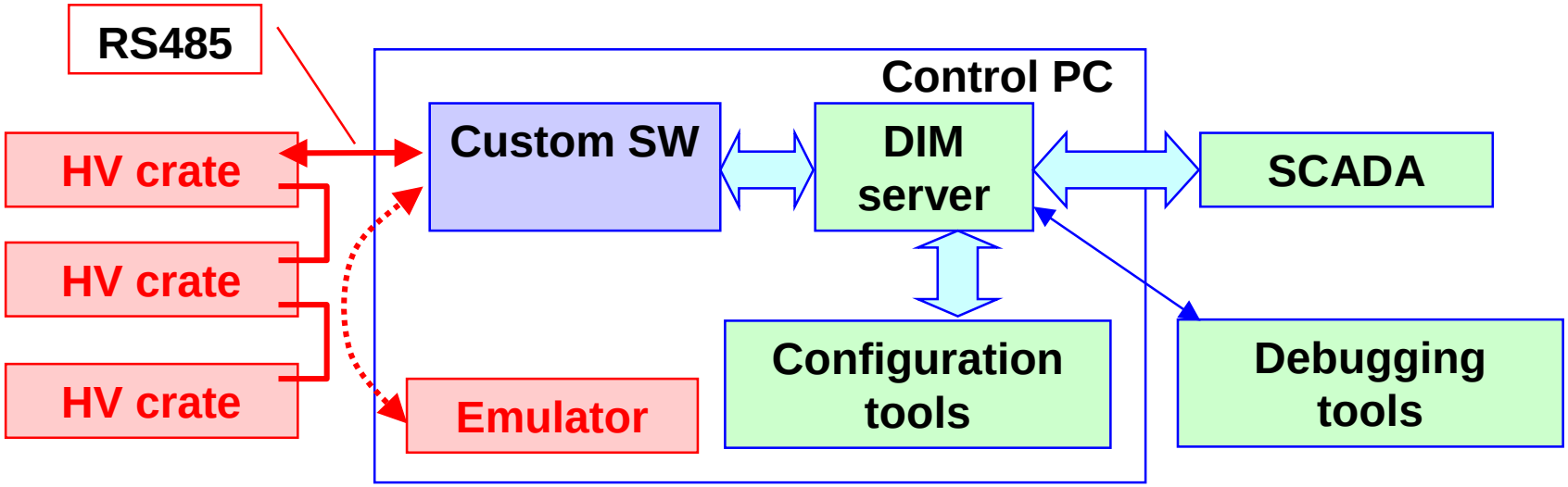
HCAL tree (II)



Tree browser and editor at

http://home.cern.ch/sergueev/hcal

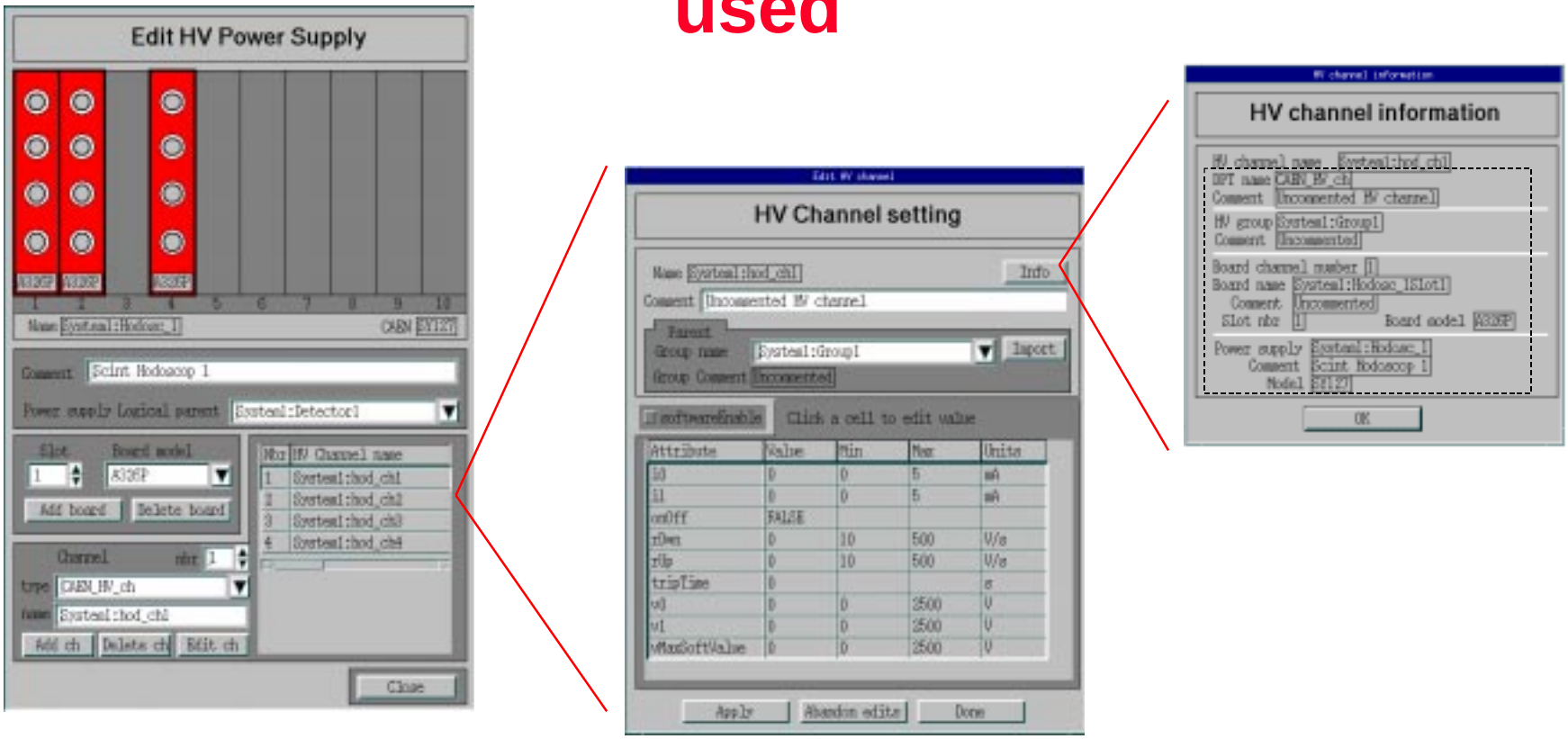
HV Control system (I)



- Main elements are ready
- Prototype is working
- Needs modification

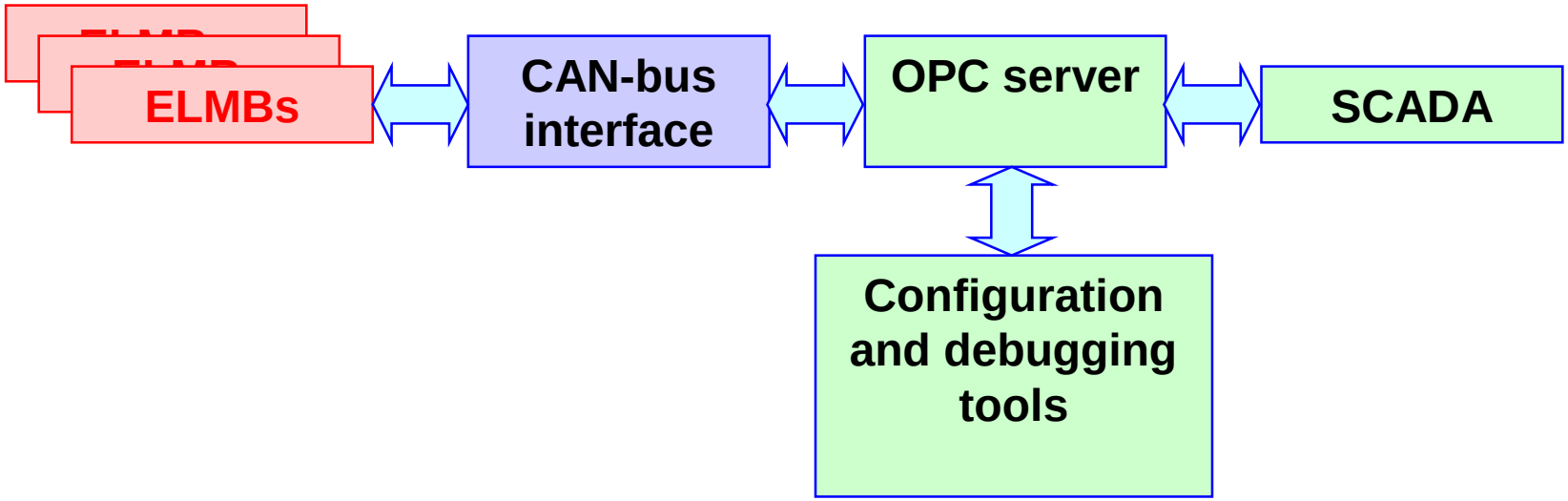
HV Control system (II)

To control HV system the Framework will be used

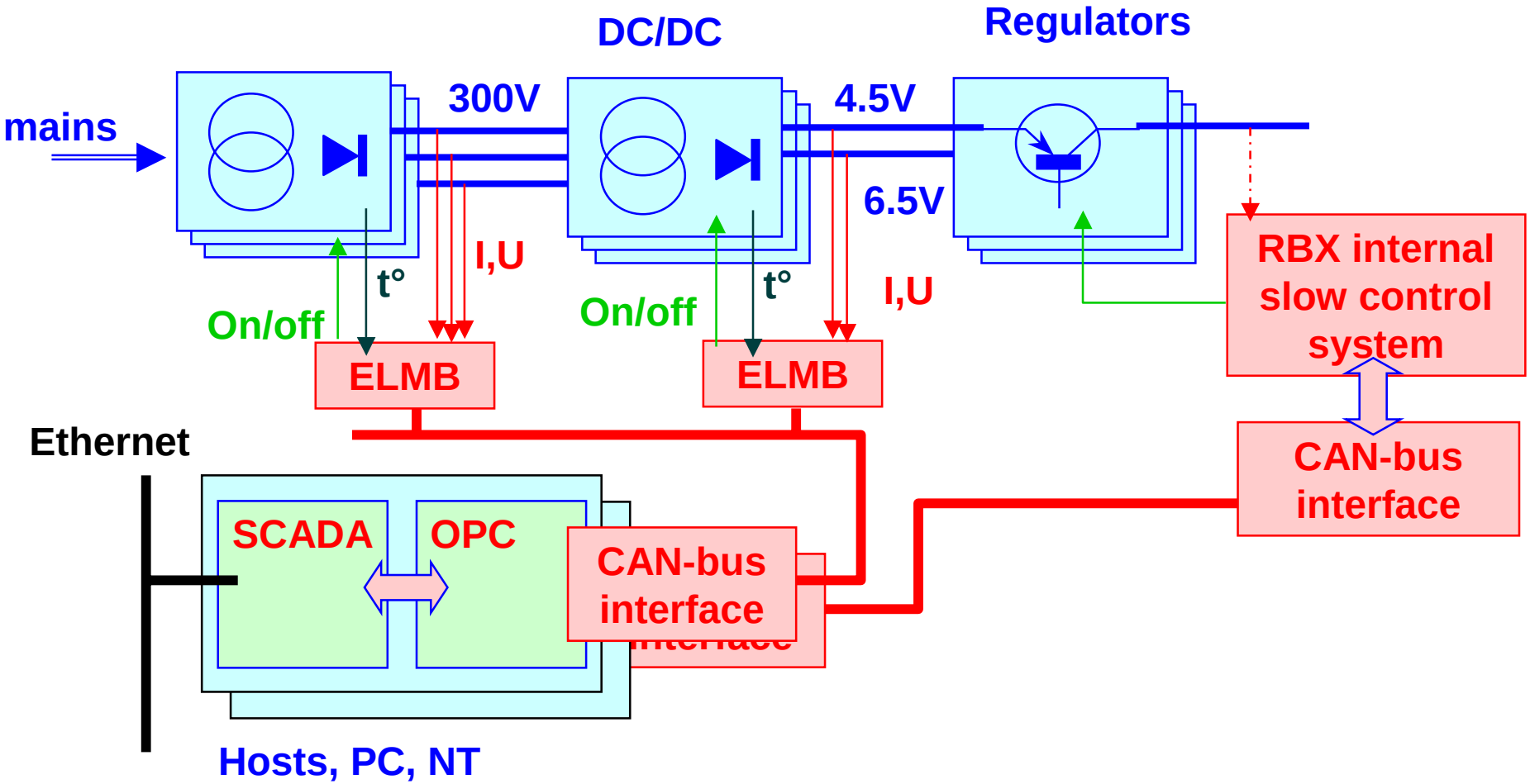


LV Control system (I)

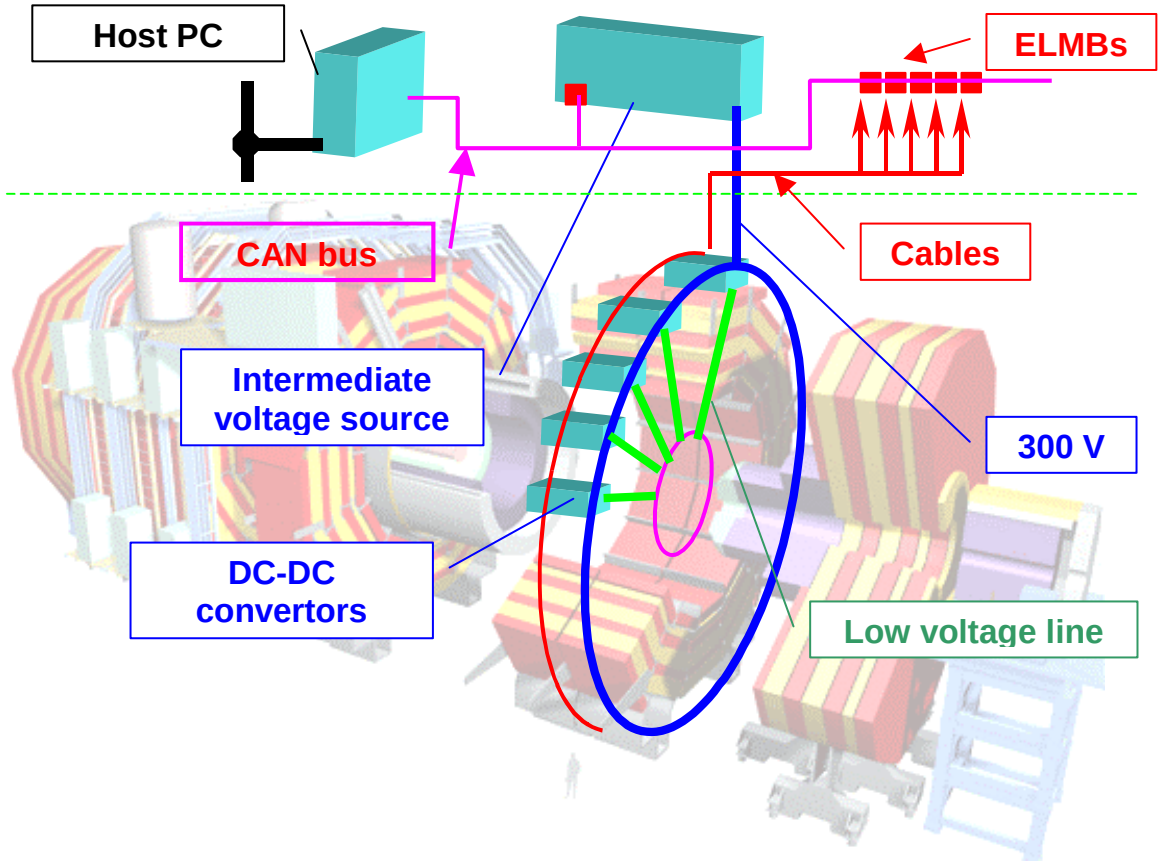
- **Based on ELMB**
- **Classic task for SCADA => could be solved by SCADA tools**
- **Use of ATLAS design**



Low Voltage control system (II)



Low Voltage control system (III)



Clock and Control Module(I)

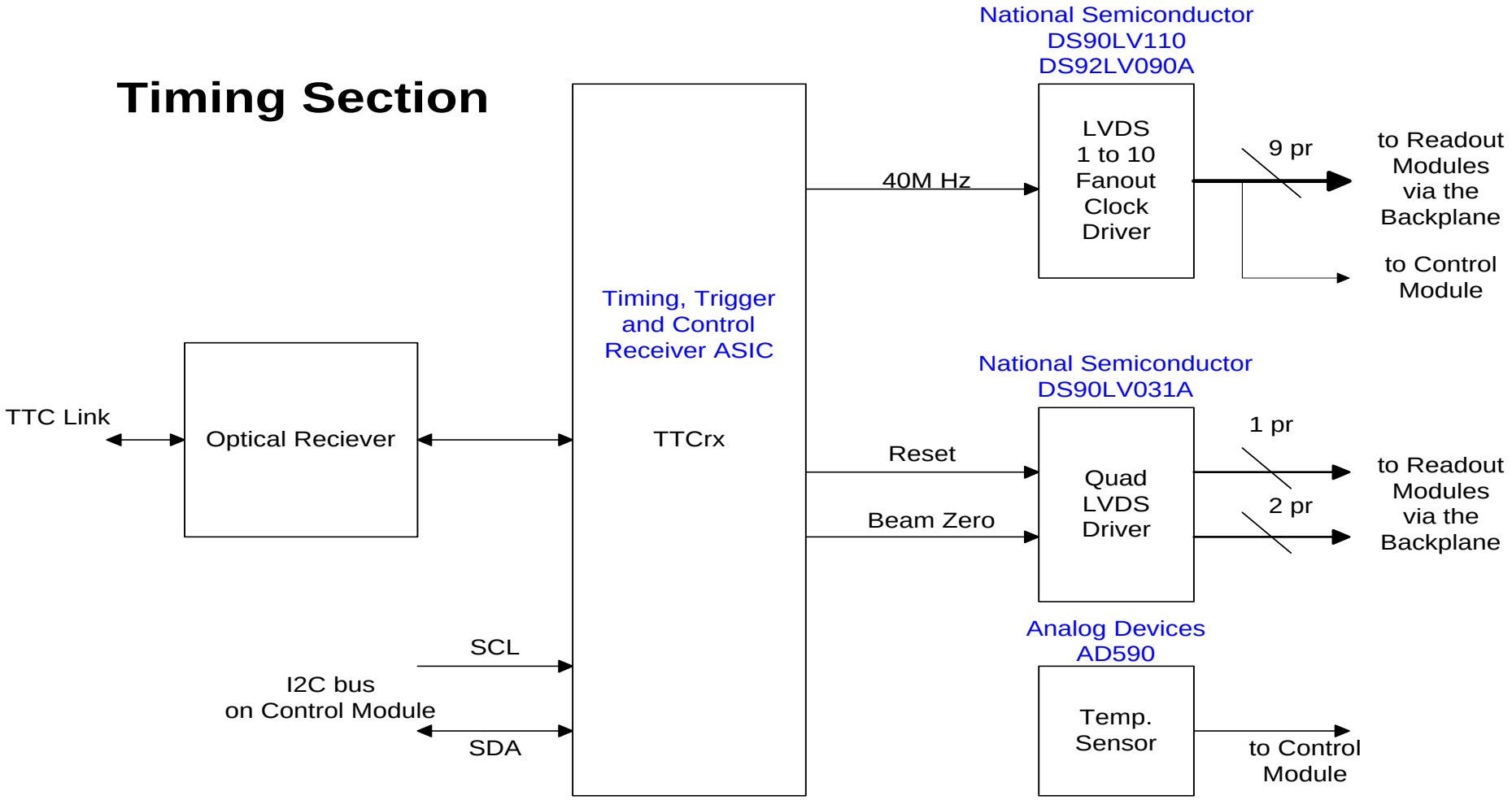
One clock and control module per RBX

- Star configuration, not daisy chained

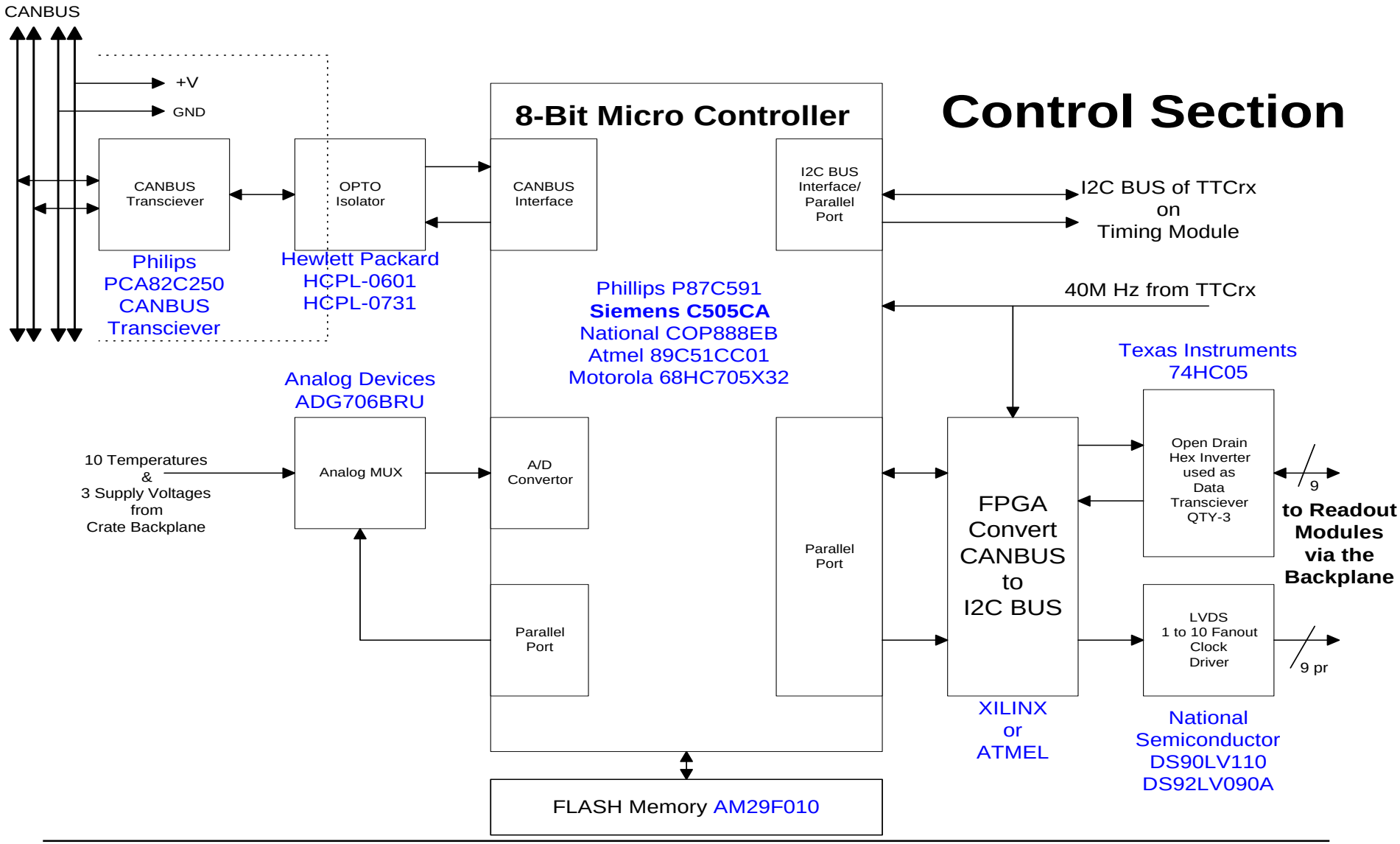
Control functions

- Download the Channel Control ASICs
- Readback (verify) the Channel Control ASICs
- Configure the TTC Rx
- Readback the electronics temperatures
- Readback the low voltage supply values
- Execute master reset on command
- Translate between fieldbus and RBX serial bus

Clock Distribution



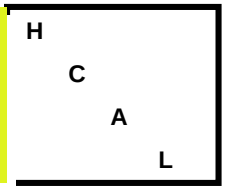
Control Block Diagram



Candidate Parts

Part Number	Availability	Radiation Tolerance
Philips PCA82C250N	Checking	ATLAS Tile Calorimeter & ATLAS DCS
Hewlett Packard HCPL-0601/0731	Stock	ATLAS Tile Calorimeter & ATLAS DCS
Analog Devices ADG706BRU	Checking	Fermi Lab will test.
Siemens/Infineom SABC505CA4EMTR	Checking	ATLAS Tile Calorimeter used a C501
Philips P87C591VFAA	18 wk – Lead time	Checking if fab process is similar - PCA82C250N
AMD AM29F010	Stock	ATLAS Tile Calorimeter
Texas Instruments 74HC05	Stock	Fermi Lab will test.
National Semiconductor DS90LV110	Preliminary Part	Checking with National in regards to possible testing.
National Semiconductor DS92LV090A	Production/Samples	Checking with National in regards to possible testing.
National Semiconductor DS90LV031A	Stock	National Semiconductor Enhanced Solutions Radiation Assured Product
Analog Devices AD590KH	Stock	Fermi Lab will test.
XILINX Virtex FPGA	Stock	http://www.xilinx.com/appnotes/VtxTest.pdf

Clock and Control Module (II)



Note that:

- This module performs a number of DCS tasks
- We are relying on CAN bus as the communication medium with CCM
- There is a number of possible components under investigation
- Reliability and simplicity are dominant criteria

Calibration

All HCAL calibration tasks are done at low rate outside data-taking runs.

DCS provides excellent tools for these tasks.

Moving Wire radioactive source calibration

Source Co60, 2mC

Carries calibration from test beam to CMS detector by taking ratio of source/(test beam), then re-measuring source at CMS.

Generates about 5nA current into the electronics

Laser Calibration System

Exercise electronics over full dynamic range, get slopes/crossovers for QIE ranges.

Set up timing of detector. Hits every channel with pulse of known timing.

LED Calibration System

Useful in factory for "heartbeat" signal or for troubleshooting between runs.

Source Calibration System

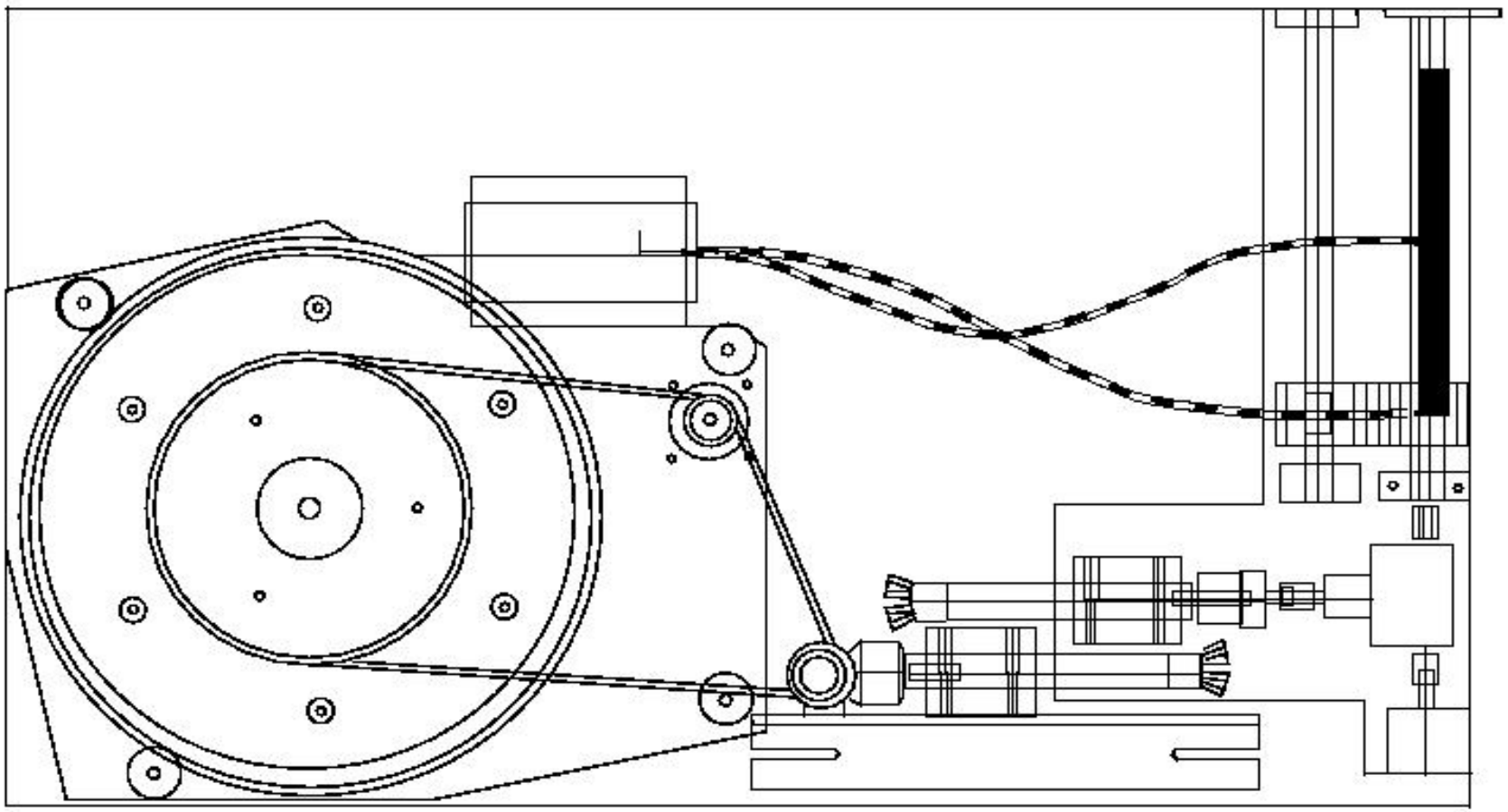
The number of source drivers per HCAL subsystem is: 6 for HE, 4 for HB, and 4 for HF. One PC can control up to eight source drivers. Each driver is controlled by 8 bits sent through PCI TTL I/O card (max 8 cards) to the corresponding Control box.

There are three distinct tasks for the control of the source system:

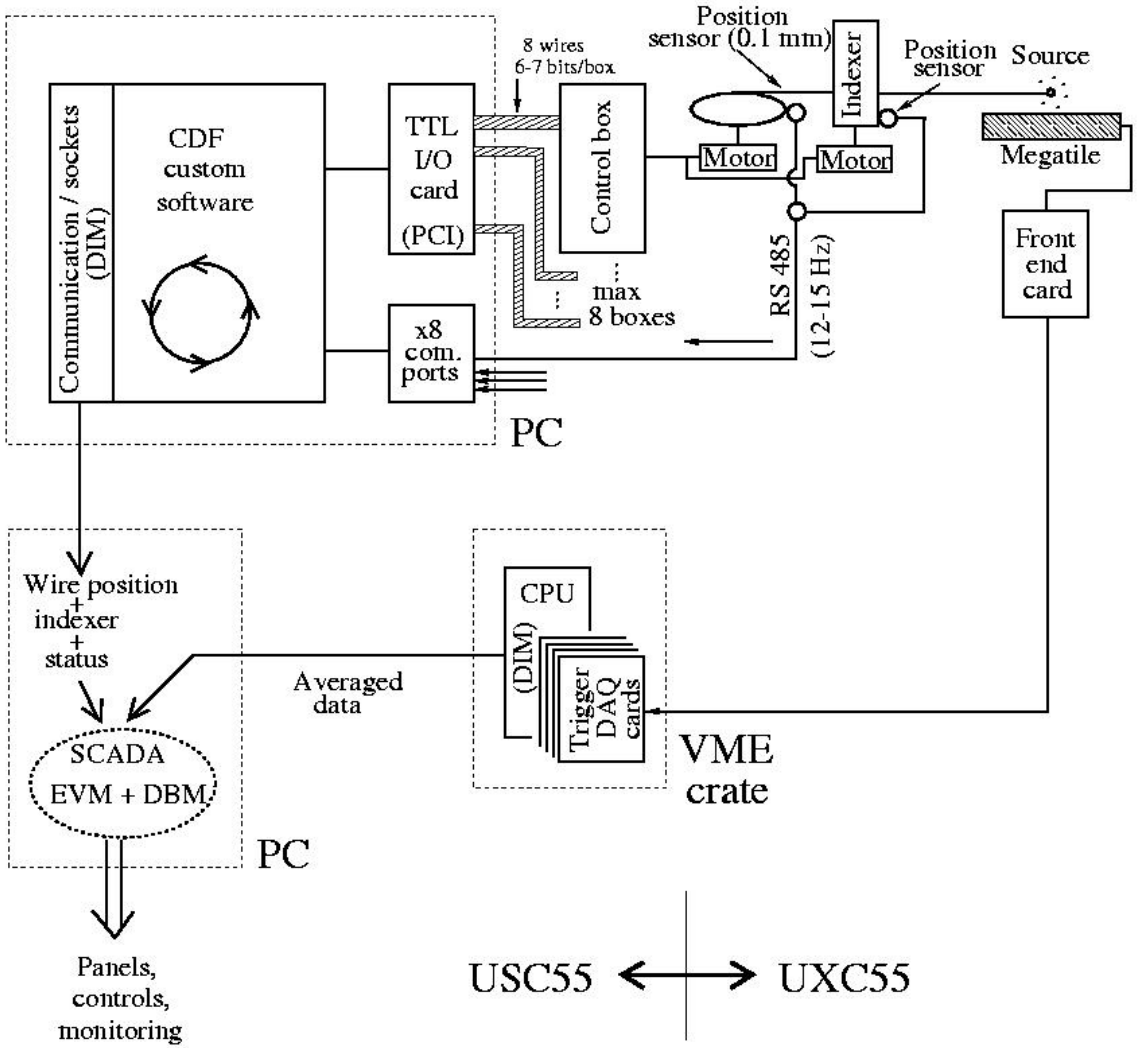
1. Program and control source movements;
2. Read out the electronics and
3. Collate the source position with the readout values

There is a stand-alone system at CERN, used in HCAL test beams. CDF has similar system integrated in their DAQ/DCS.

Source Driver



Source Driver Scheme



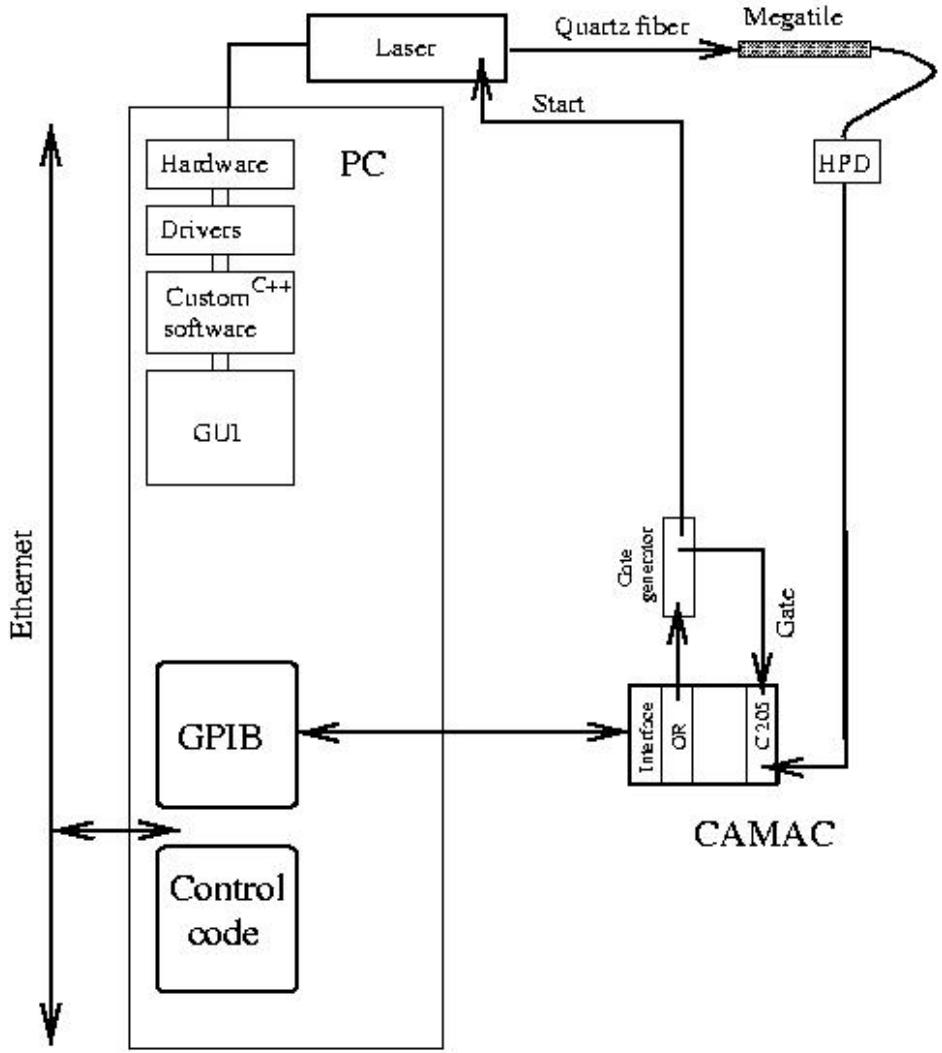
Laser and LED Calibration

LED driver is being integrated into the calibration module right now. We can deal with it only when the design work is finished. Up to then, we will use the NIM format of the same driver.

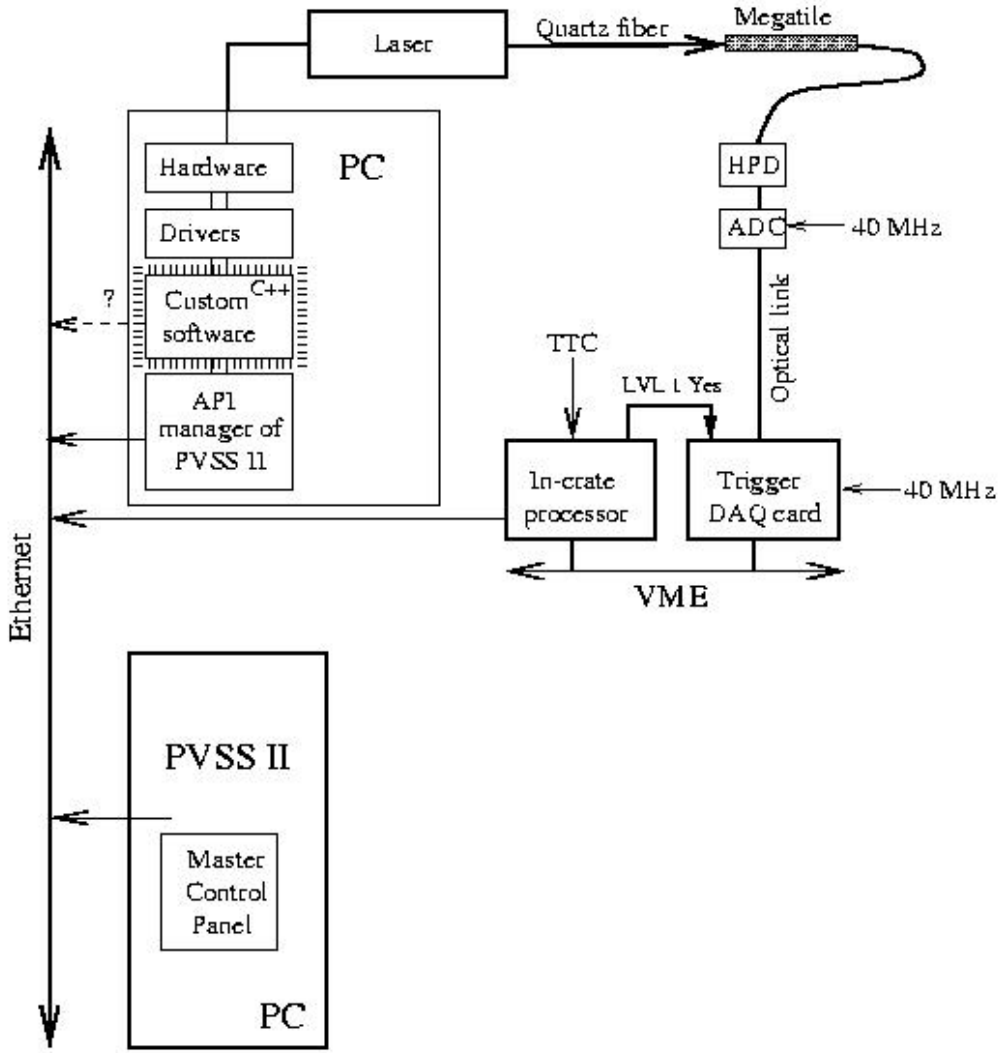
Calibration module contains splitter for laser light coming from a single UV laser situated in the underground control room. The task for the near future is to translate into PVSS II or put a wrapper around the driver code of the stand-alone laser system.

Calibration Module

Stand-alone Laser System



Integrated Laser System



Summary

- Half of the HB is here. This summer we will have to load scintillators and perform radioactive source scans as a part of QC/QA.
- It is an excellent opportunity to work on a small scale DCS - majority of components will be here.
- All systems exist in stand-alone version, some of them are under transition towards PVSS II compatible systems. More to come...
- We identified the most important tasks and detailed requirements for each of them are being defined.
- We are not forgetting “the big picture”, i.e. the place of HCAL DCS within entire CMS (naming scheme is becoming urgent, JCOP (CMS) framework also).

Important points:

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1. Keep it simple
2. Use modular design
3. Decouple custom software from PVSS II
4. Reuse existing software wherever possible