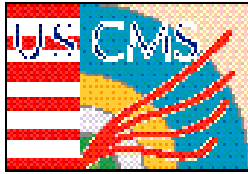


HCAL RBX PRR Overview

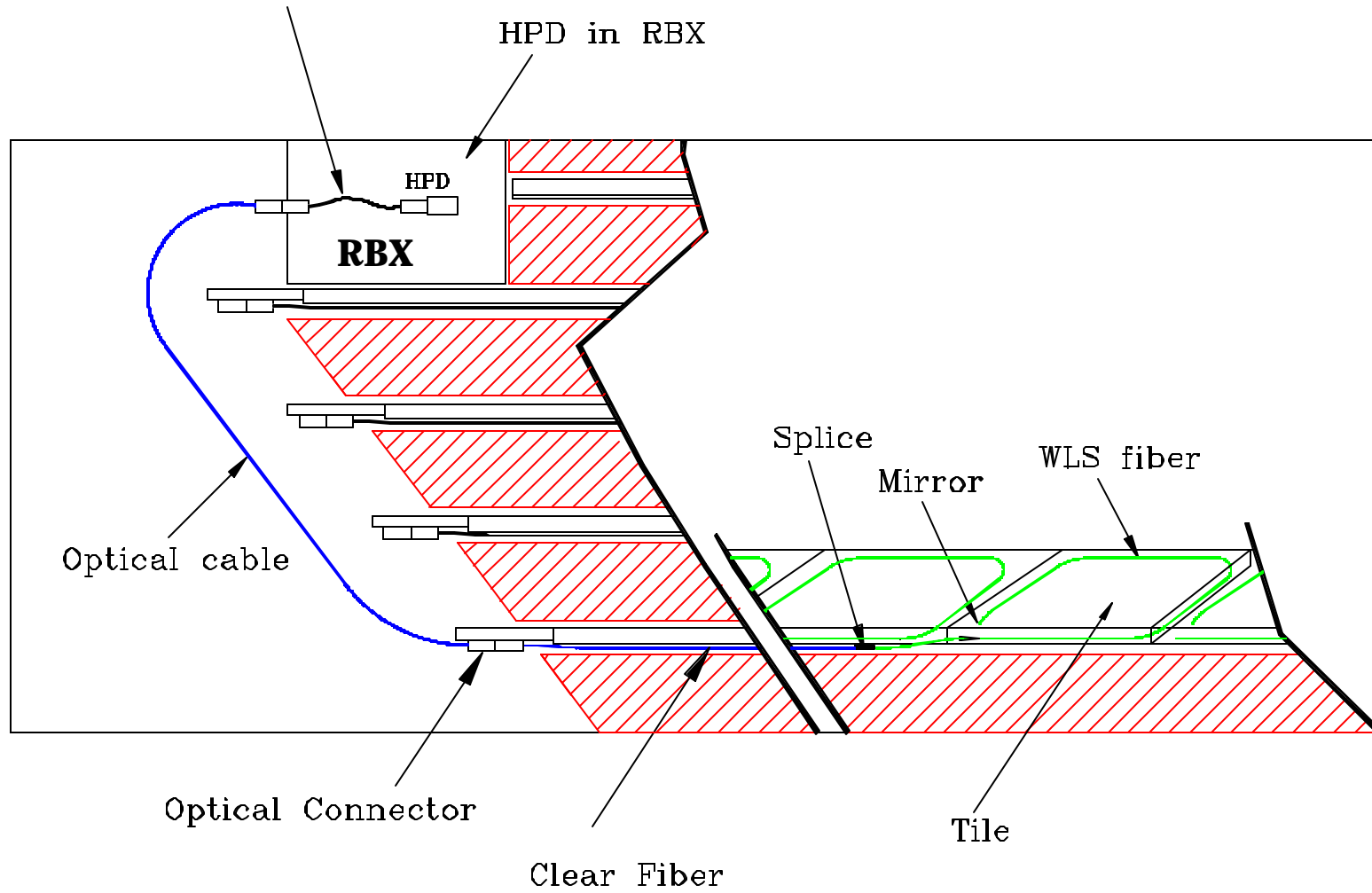
Jim Freeman

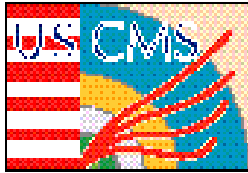
**RBX PRR
March 1-2, 2001**



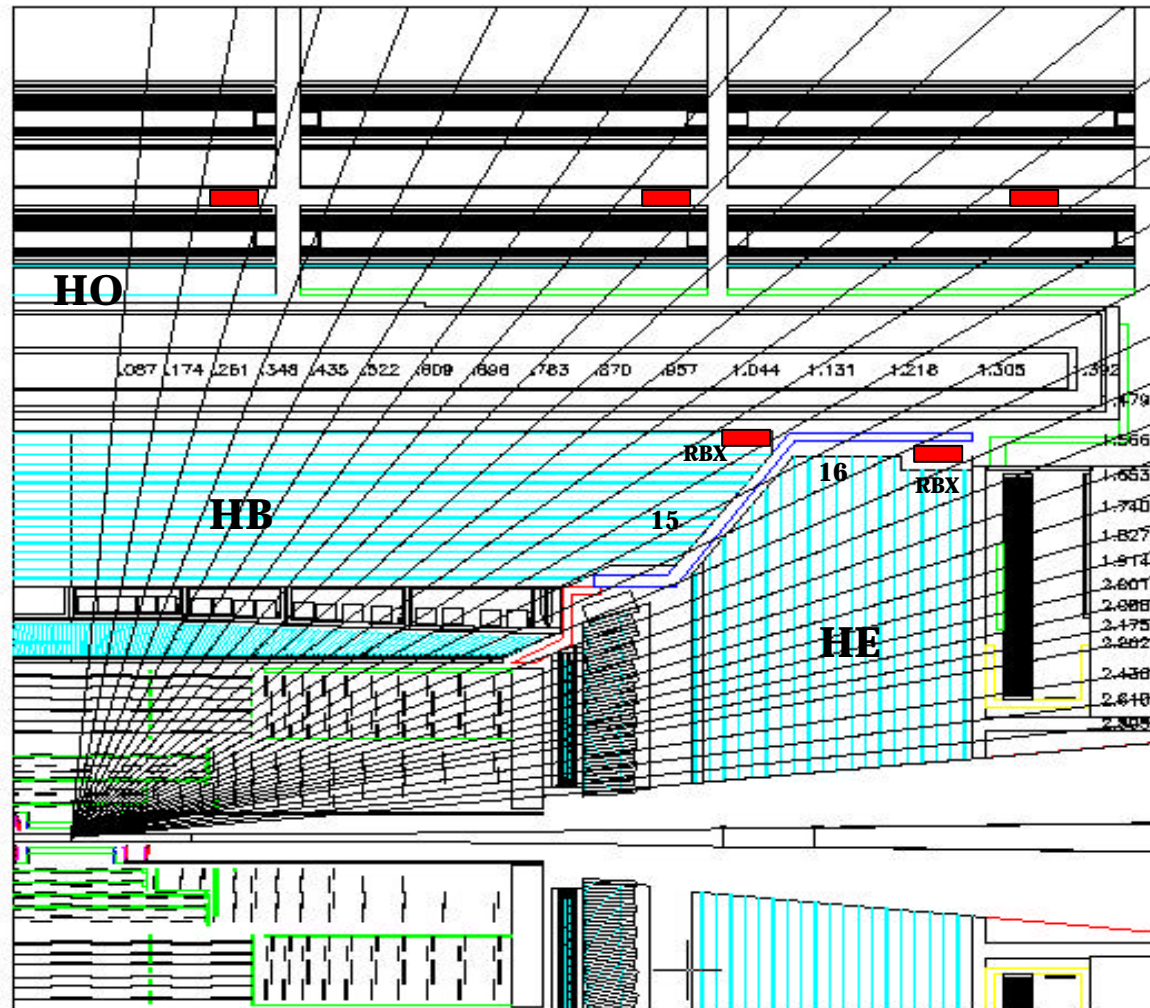
HB Optics Overview

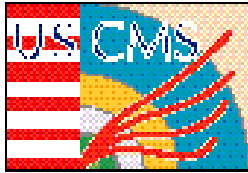
Layer to Tower Decoding Fiber





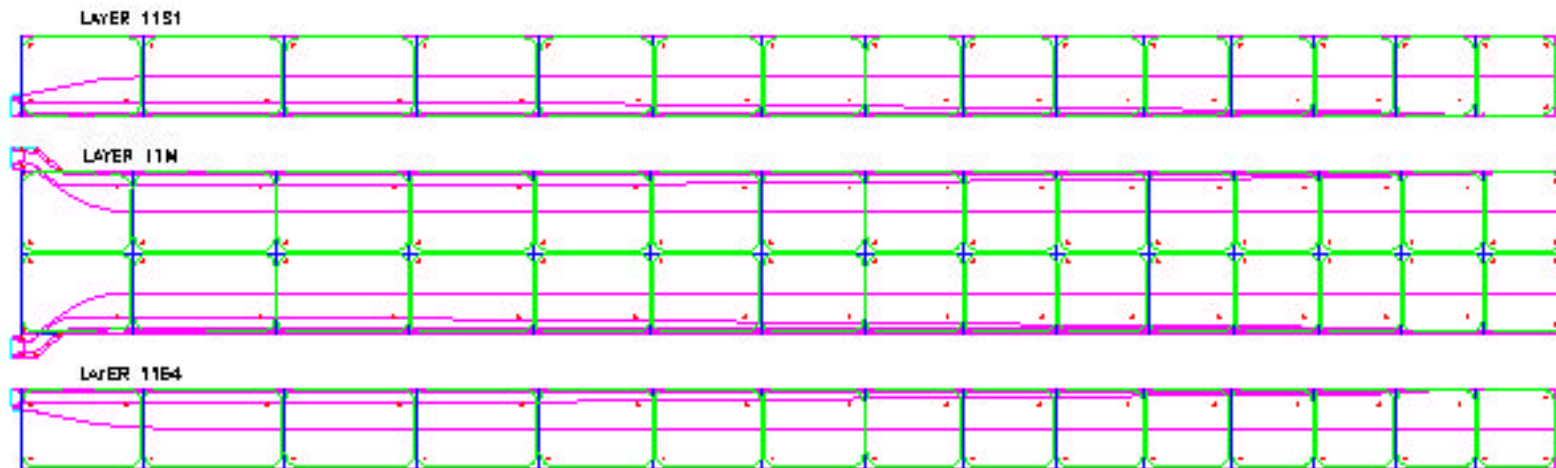
Central HCAL RBX's



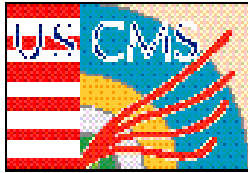


Optics-Megatiles

LAYER 11 MEGATILES, TOP VIEW

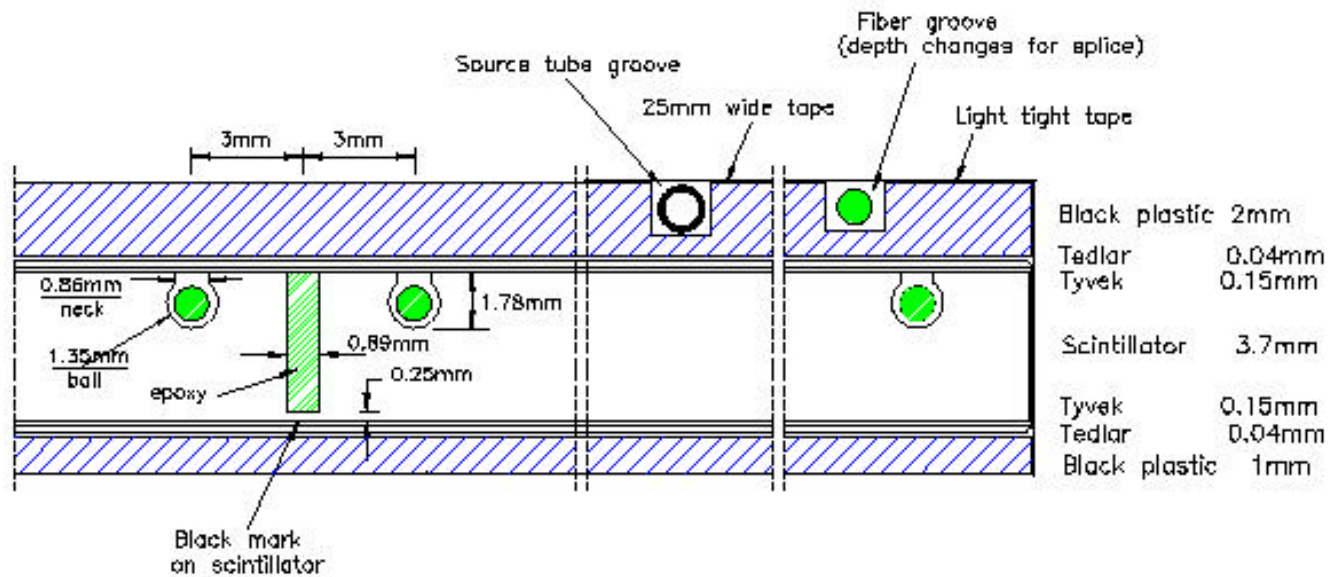


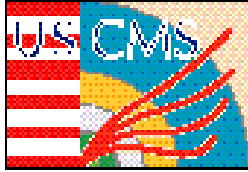
**Components are the machined scintillator plates, cover plates,
fiber assembly (WLS spliced to clear fiber, optical connector)
pigtaills**



Optics-Megatiles

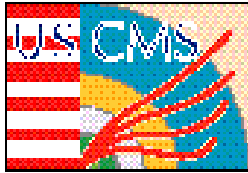
Cross section view of a megatile





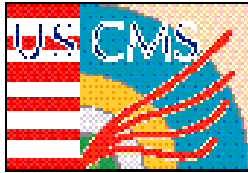
Installing Megatile



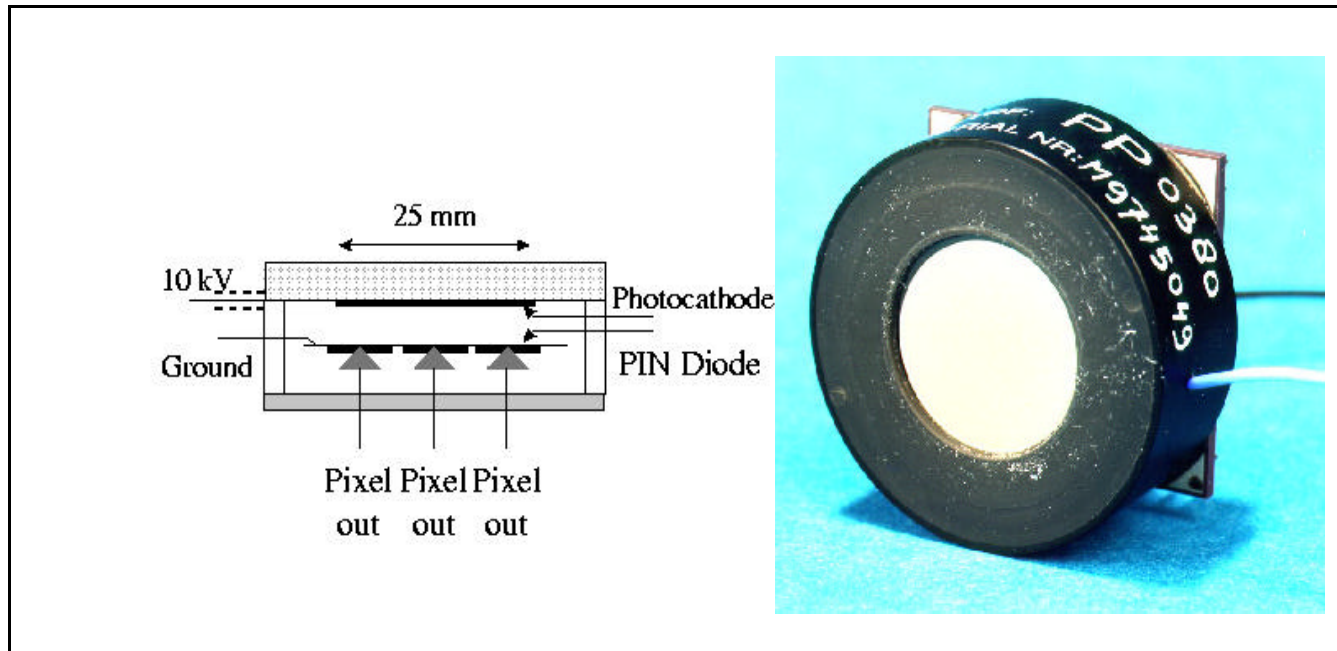


HB-

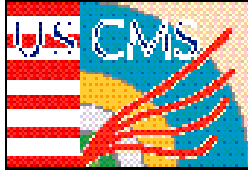




HPD



Hybrid PhotoDiode photon transducer for HB, HE, HO. Fiberoptic front window, conventional photocathode, pixelated diode (19 or 73 channels/device). From DEP, Holland. Need ~ 600 total.

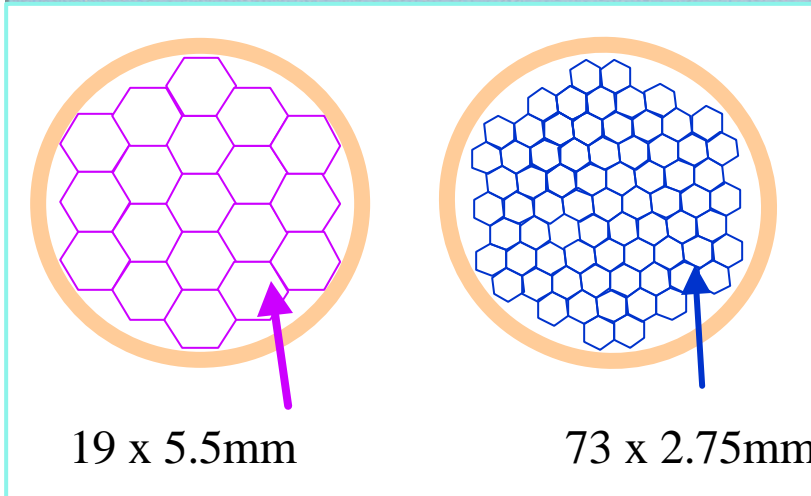


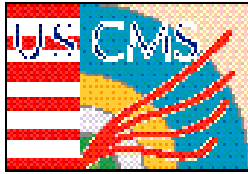
HPD



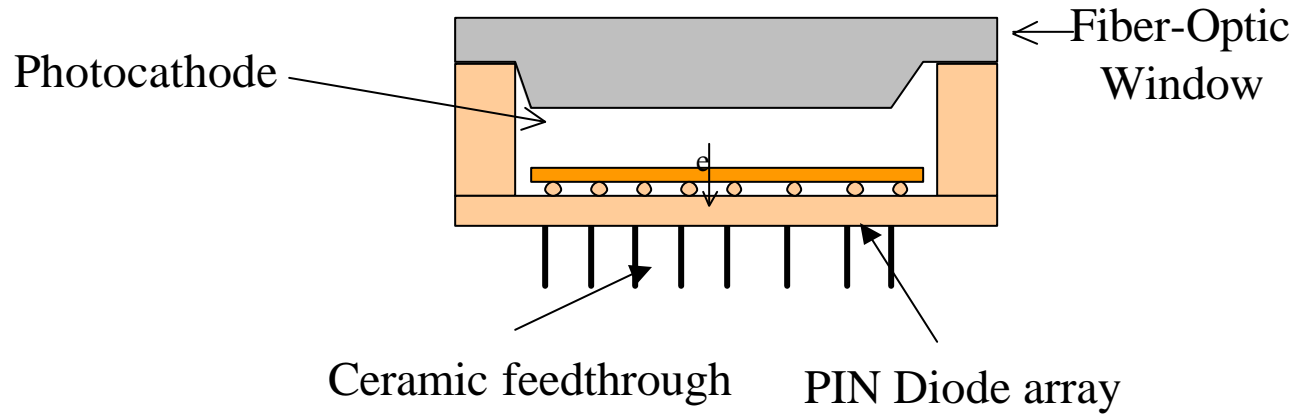
HCAL will use the DEP hybrid photodiodes for the photodetector.

There will be two types of tubes one with 73 and one with 19.

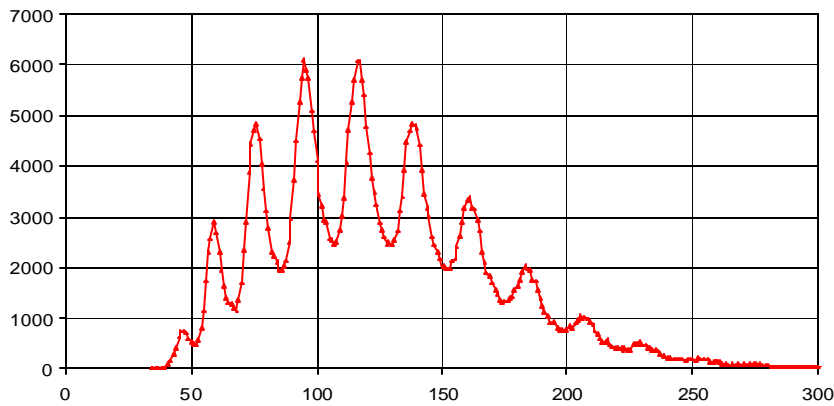




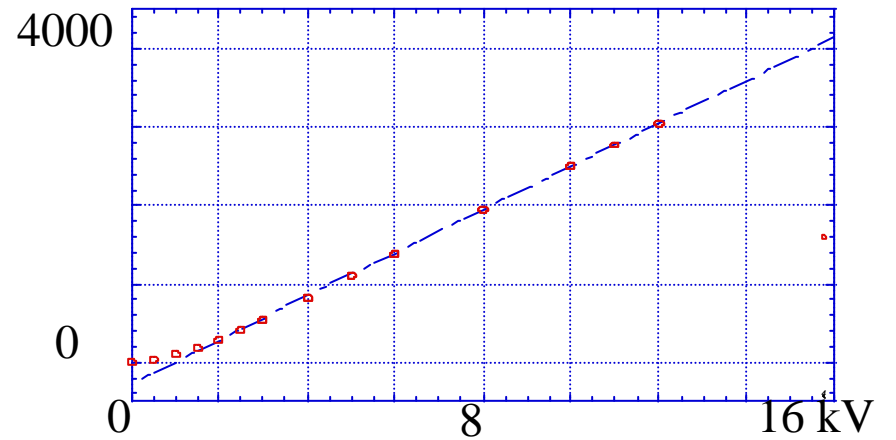
HPD

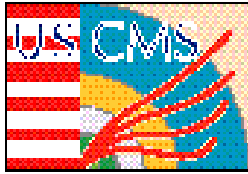


4 p.e spectrum

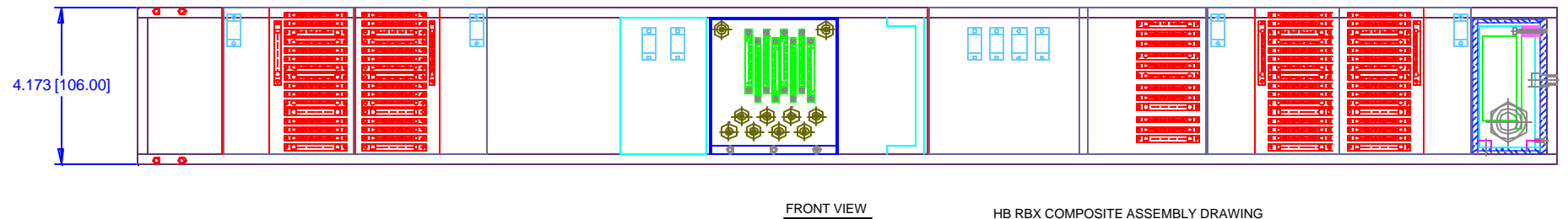
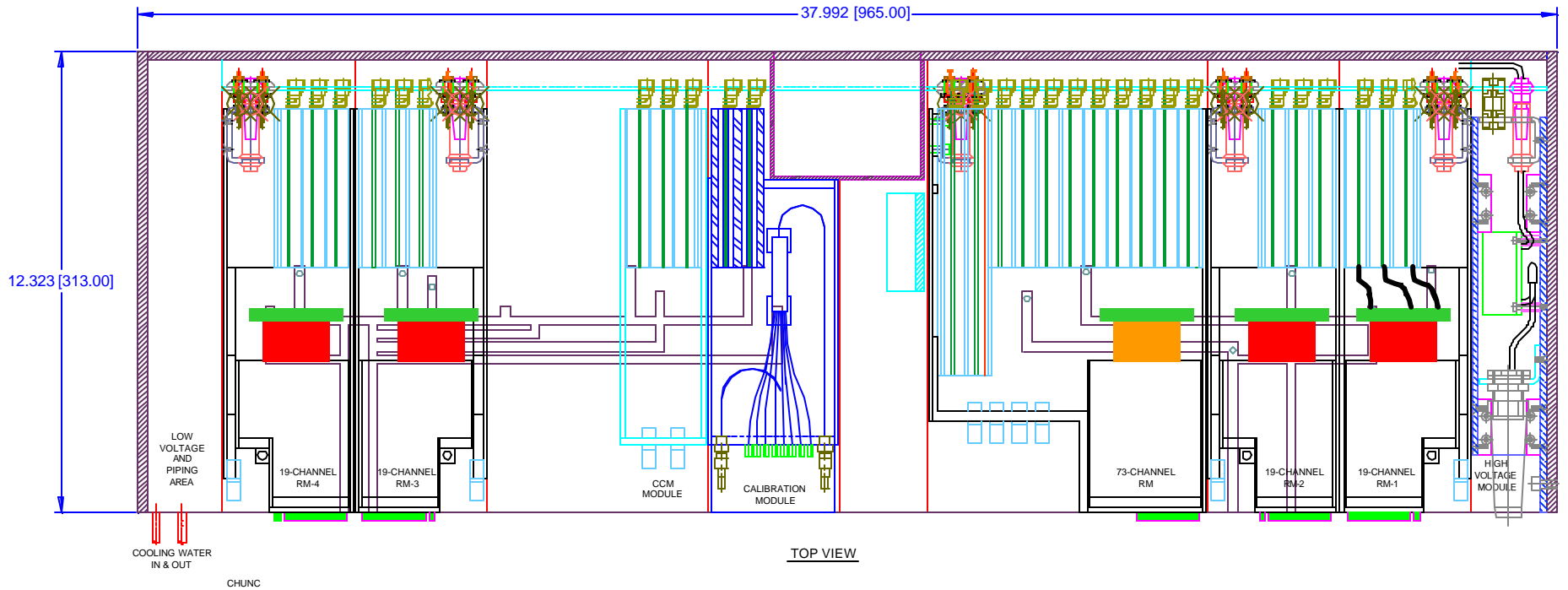


Gain



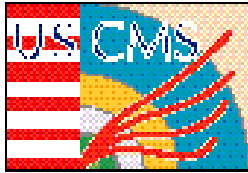


HB RBX Detail View



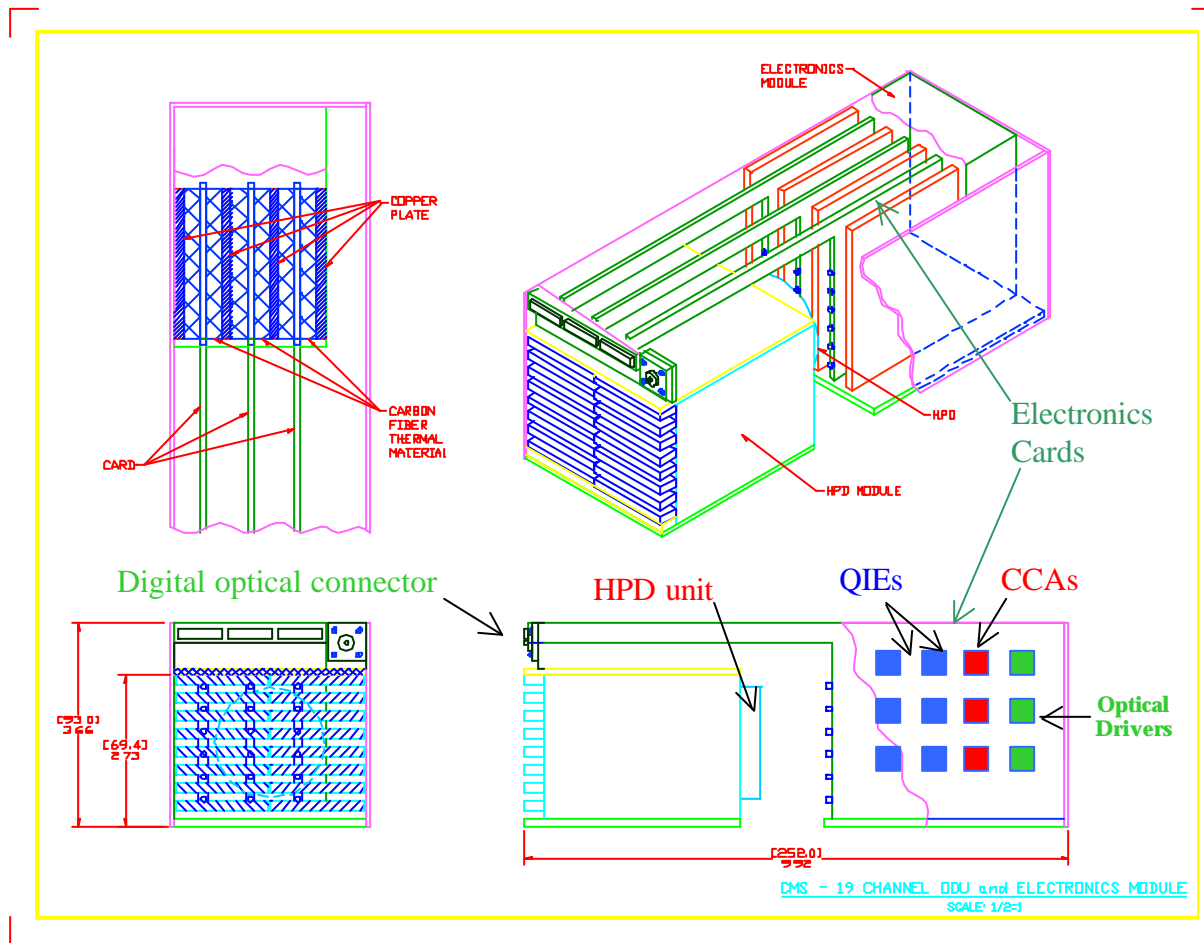
HB RBX COMPOSITE ASSEMBLY DRAWING

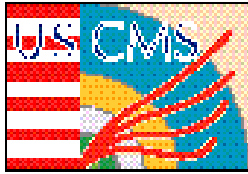
R. FOLTZ, FERMI LAB
 J. MARCHANT, UNIV. OF NOTRE DAME
 AS OF 23 FEBRUARY 2001



RBX Readout Module

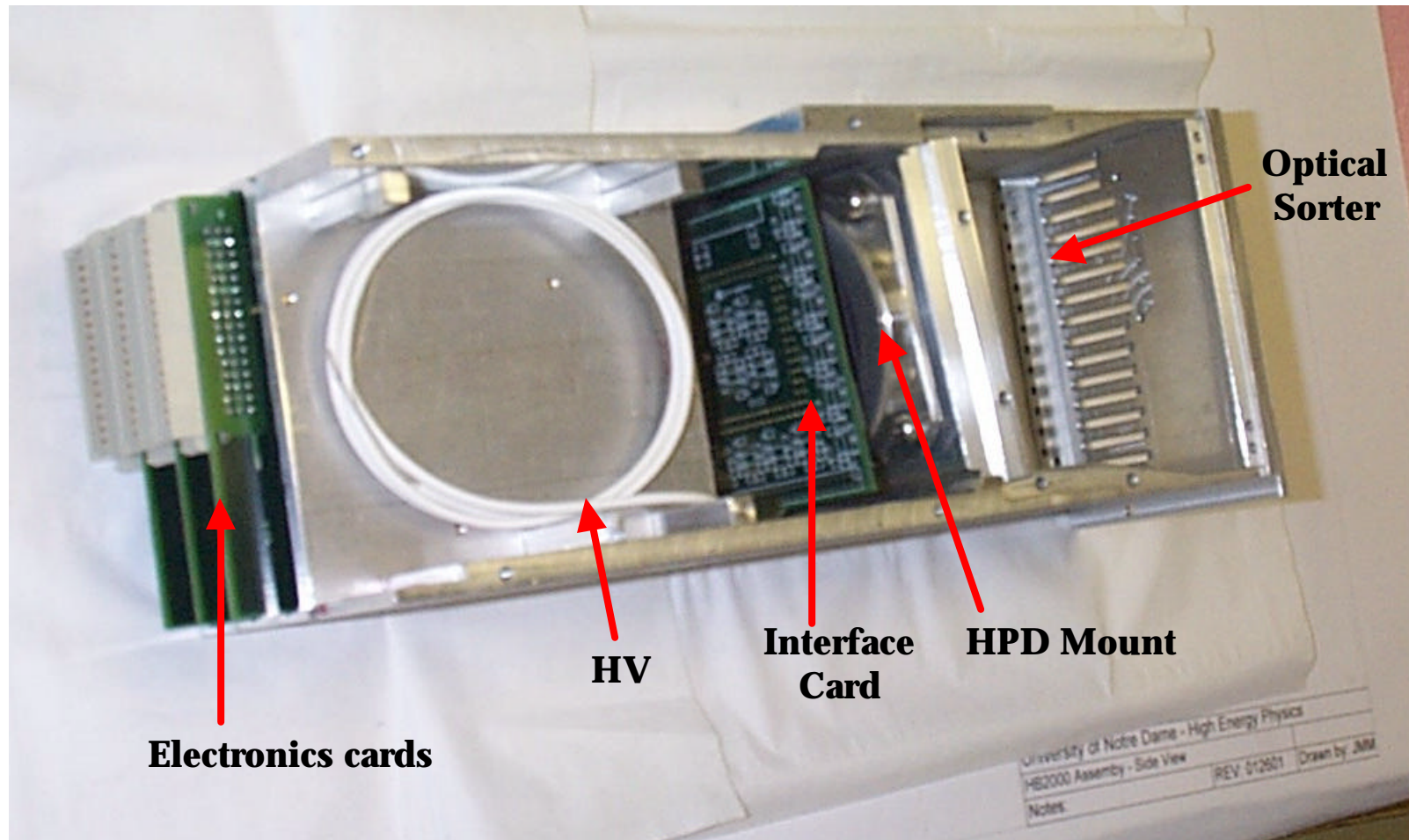
- The readout module (RM) integrates the HPD, front end electronics, and digital optical drivers.

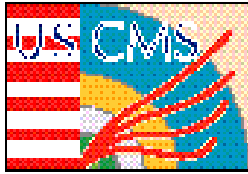




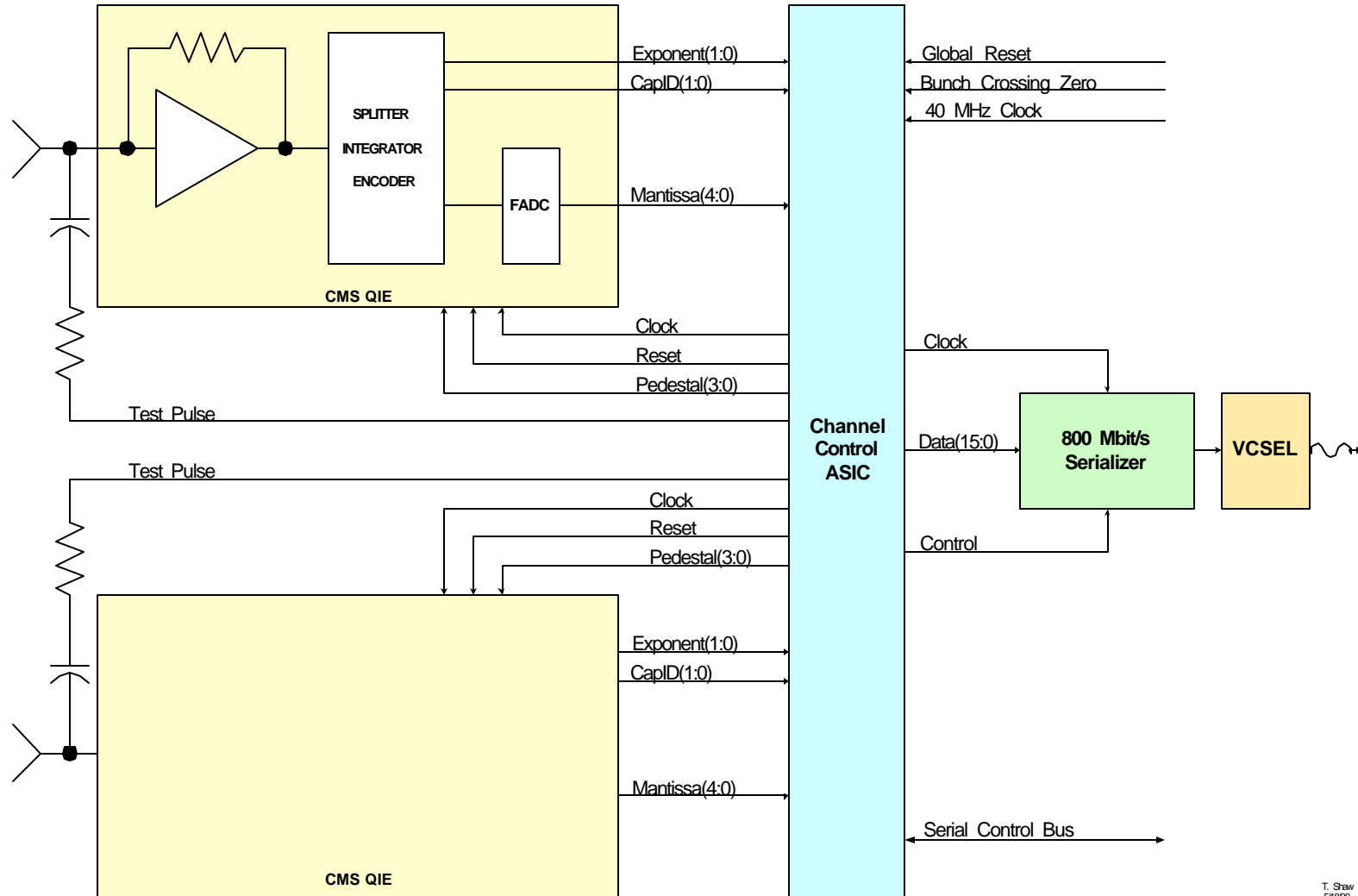
RBX Readout Module

- The readout module (RM) integrates the HPD, front end electronics, and digital optical drivers.



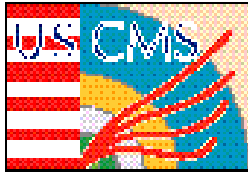


HCAL QIE-based Front End

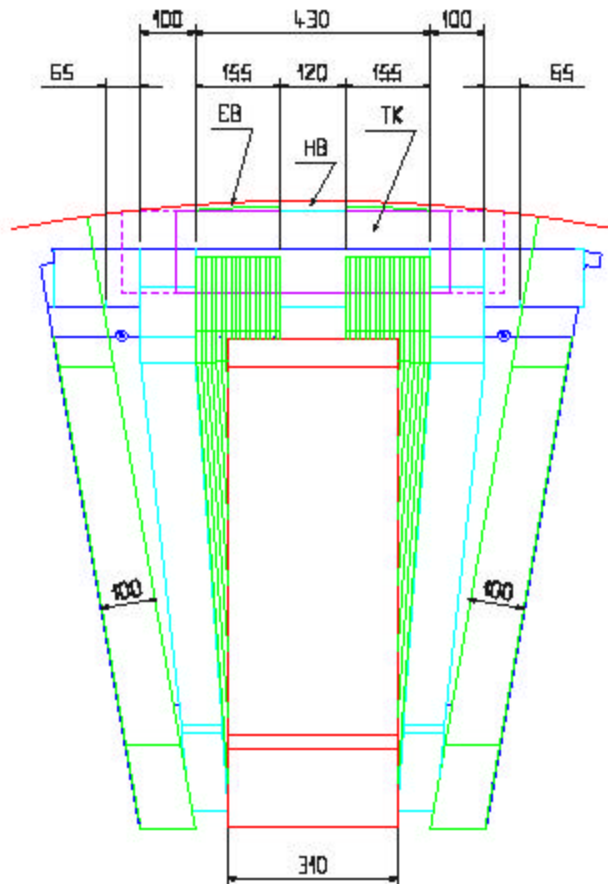


T. Shaw
5/18/00

CMS QIE Solution



Access to FE Electronics



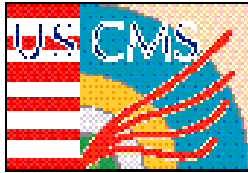
53 degree end of HB wedge.

Blue = HCAL services

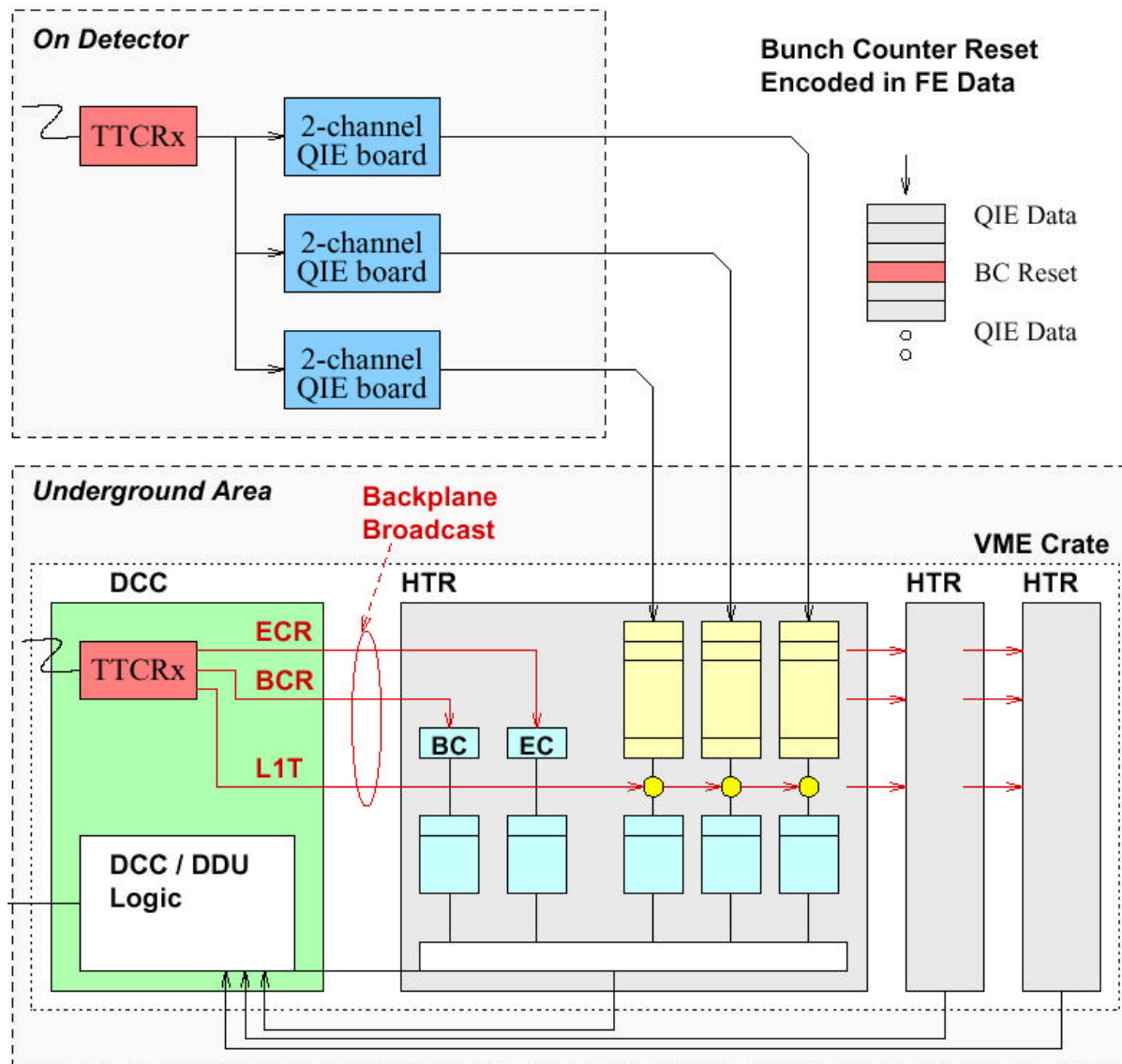
Green = ECAL

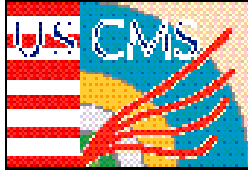
Red = Tracker

End of HB wedges obscured by cables and services from HB, EB, tracker. Servicing electronics nontrivial.



HCAL Electronics Overview





Calibration

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

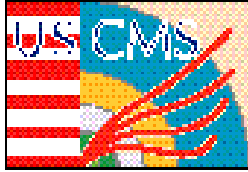
Laser Calibration System

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



Light Yield and Noise

Some Numbers

Light Yield **10 pe / GeV**

MIP Signal in HO **~10 pe**

MIP Signal in Layer 0 **~ 5 pe**

HPD Gain **2000X → MIP in HO is 20K e-**

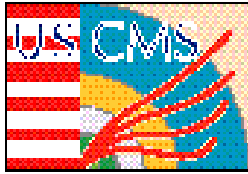
Desire well-separated signal from pedestal

→ **noise level of ~4000 e-**

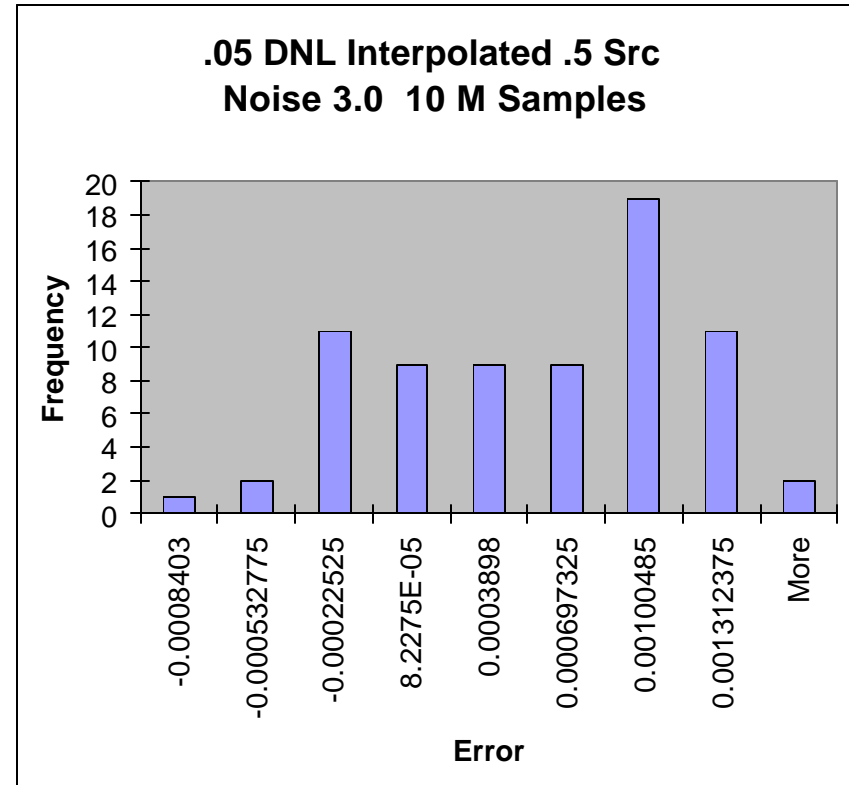
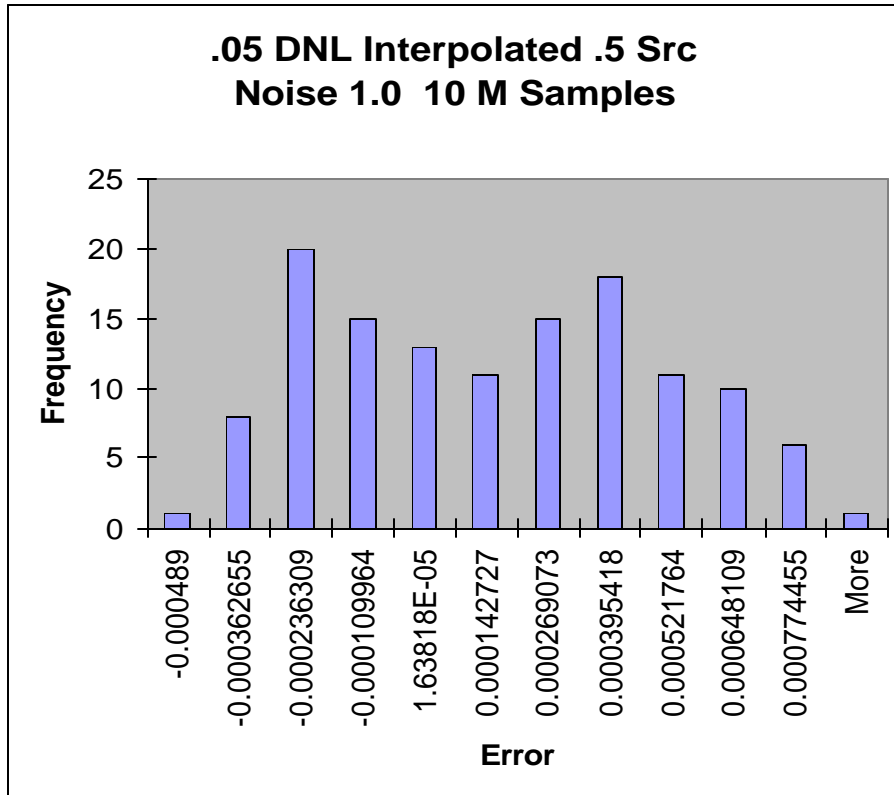
Radioactive Source Calibration (~5nA) uses 40Mhz path

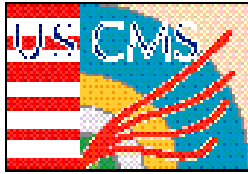
5 nA → ~0.4 pe/25 ns.

Radioactive source appears as pedestal shift/broadening. Measure by massive oversampling. (10^6 samples). Nr samples increases with pedestal width.



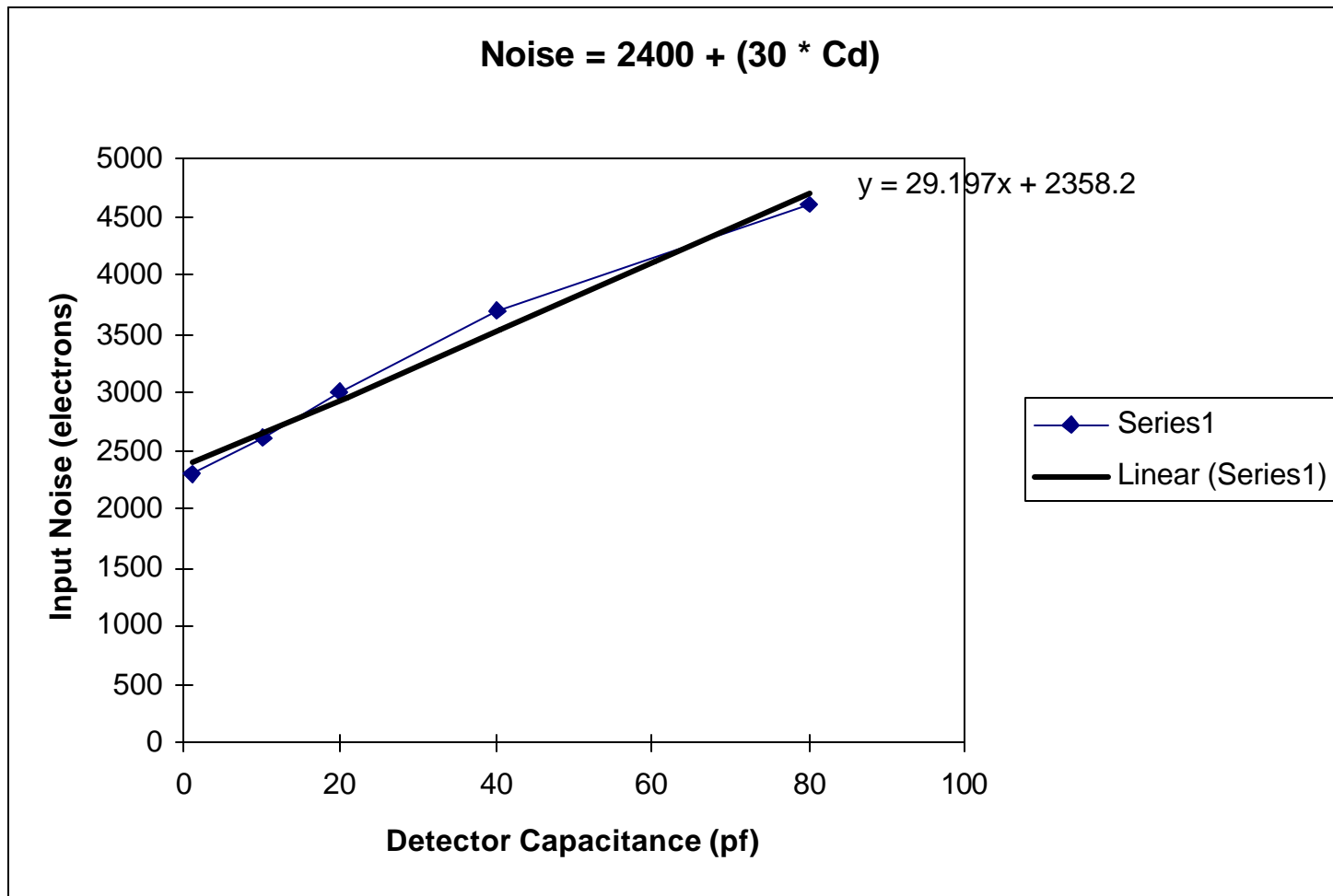
Influence on Ped width on Calibration measurement

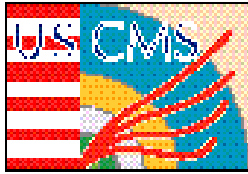




Noise vs Input Capacitance

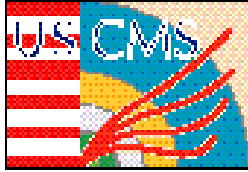
Spice model of QIE. 50 ohm cable ~ 1pf/cm





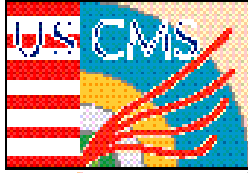
HB Schedule

Major HB Activity	2001						2002						2003						2004						2005						2006					
	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
Install Scintillators in HB- (186)																																				
Install RBX HB-																																				
QIE Calibration System Study (FNAL)																																				
Move HB- to SX5																																				
Assemble HB- (SX5)																																				
HB+ arrives 186																																				
Install Scintillators in HB+ (186)																																				
Test Beam H2																																				
Move HB+ to SX5																																				
Assemble HB+ (SX5)																																				
Install RMs into RBX (SX5)																																				
Burn-in period (SX5)																																				
HB Trial Insertion into Vactank																																				
HB Complete in UX5																																				



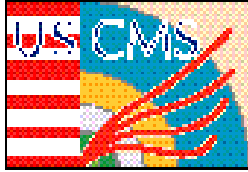
Design Criteria for RBX

- **Interfaces to other subsystems**
- **Accessibility/Serviceability**
- **Environment for Electronics (volume, cooling, power, clock, noise)**
- **Safety**
- **Manufacturability**
- **Cost**



Some of the tasks waiting until after PRR

- **Analog optical cable factory**
- **Optical cable shrouds**
- **Finalize backplane, power, clock distribution**
- **Connectors for card/backplane**
- **Card layout**
- **HV/LV cable procurement**
- **HV/LV Connectors**
- **Digital optical connectors**



RBX Situation

- **Have a very complete design**
- **Staff organized to immediately start factory**
- **Many HCAL design issues contingent on finalizing RBX**
 - **Electronics (geometry, card layout, backplane, grounding, cooling, noise, ...)**
 - **Optical cables (length)**
 - **HV/LV cables (acquisition)**
- **Need to finalize so design group can move on to next jobs (HE, HO)**
- **Delays = \$\$**