HCAL Status

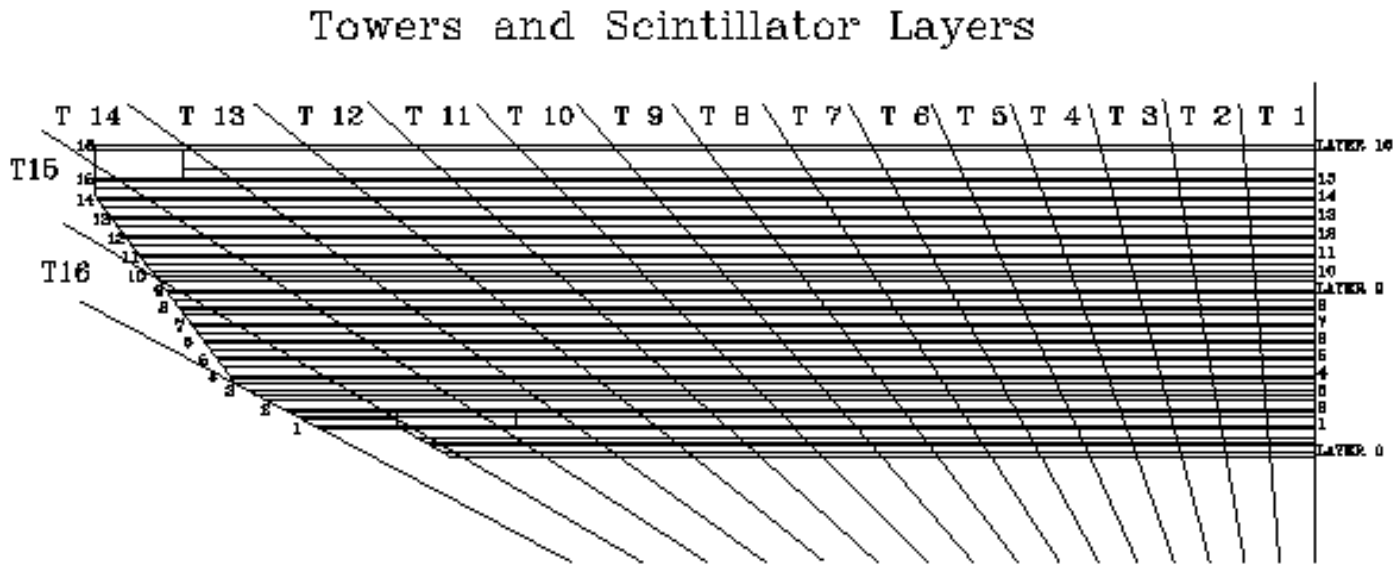
CMS HCAL Status

Jim Freeman

Outline

- Absorber
- Optics
- Status at CERN
- HPDs
- Front End Electronics
- Higher Level readout
- Radioactive Source Test Milestone
- HF
- Summer 2002 Testbeam
- Longer Term Schedule

HB wedge design



Absorber

HB- at SX5 at CERN →

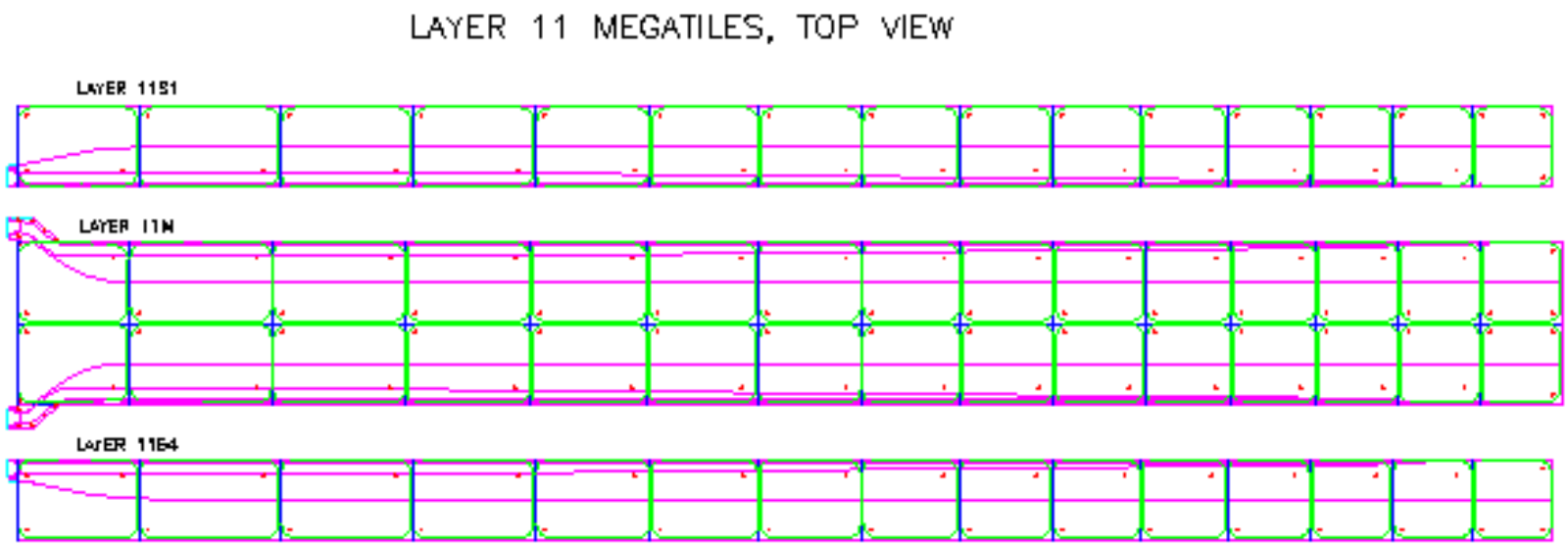
- 17 HB+ wedges at CERN in Building 186. (Wedge 16 being repaired)
- Optics installed, QC Testing in progress

HB Wedges at Bldg 186

HB- wedge 16 Damage

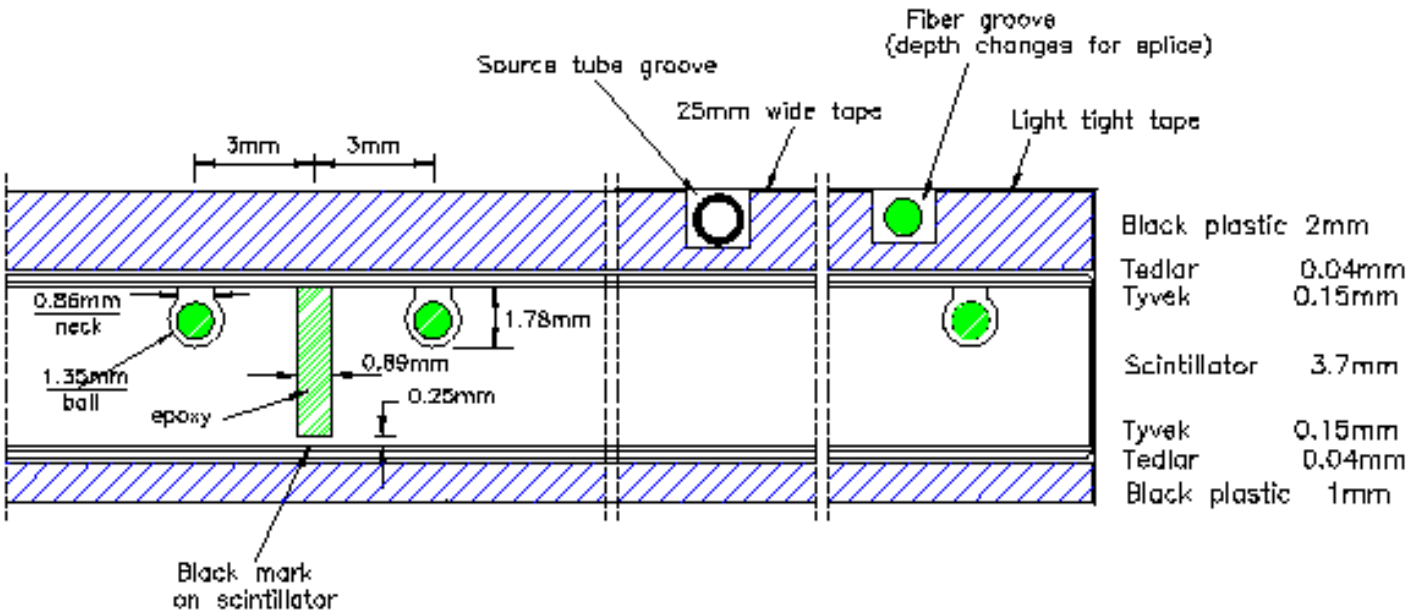
HE + at Minsk

Megatile design, top view

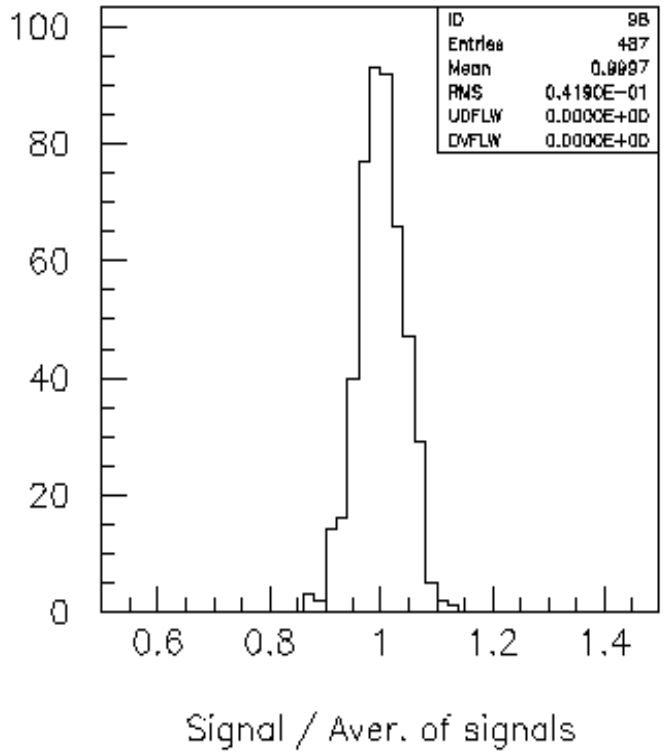


Components are the machined scintillator plates, cover plates, fiber assembly (WLS spliced to clear fiber, optical connector) pigtails

Megatile cross-sectional view



Protvino - Pig Tail QC

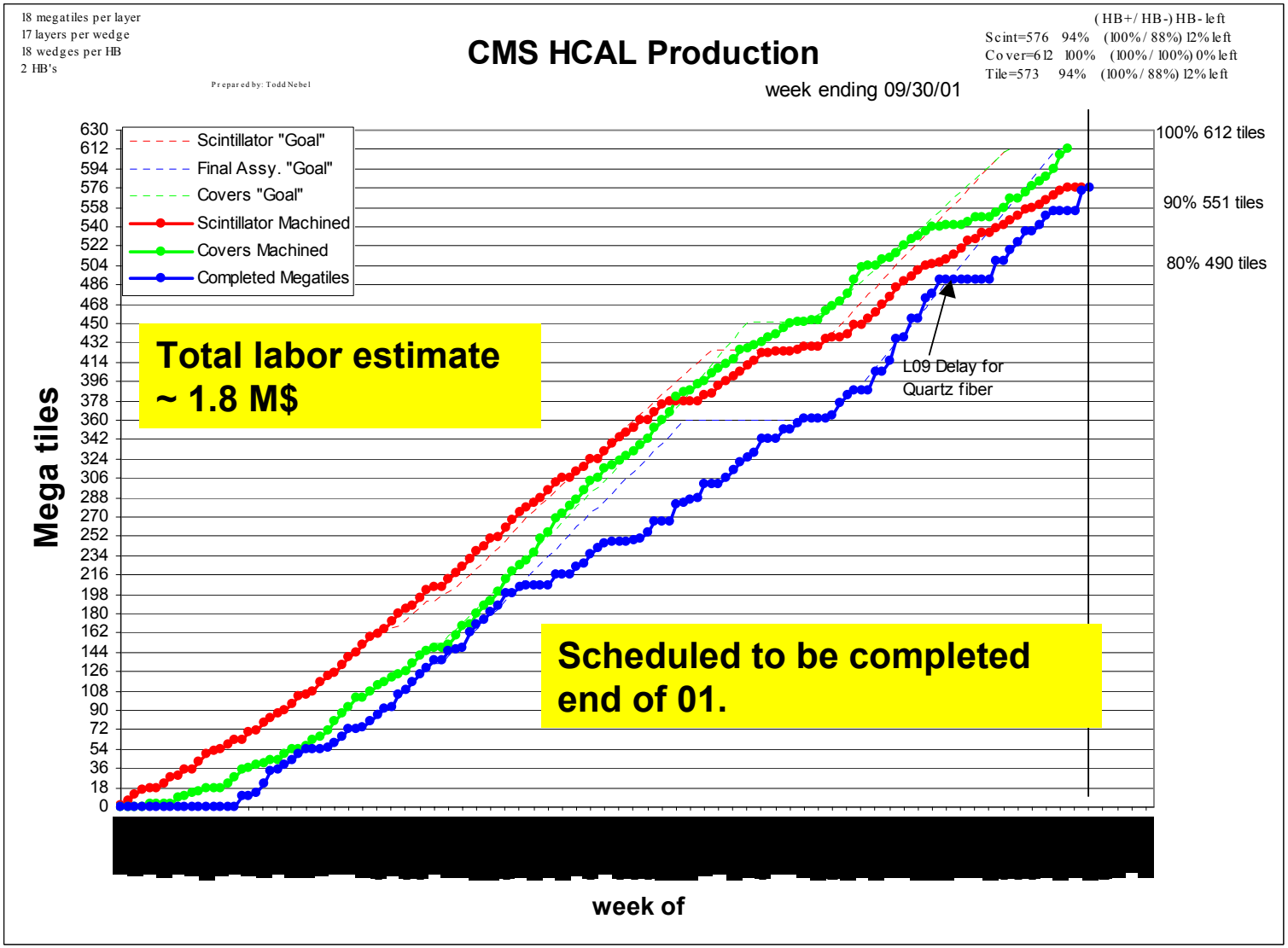


RMS of the light yield transmission is less than 5%.

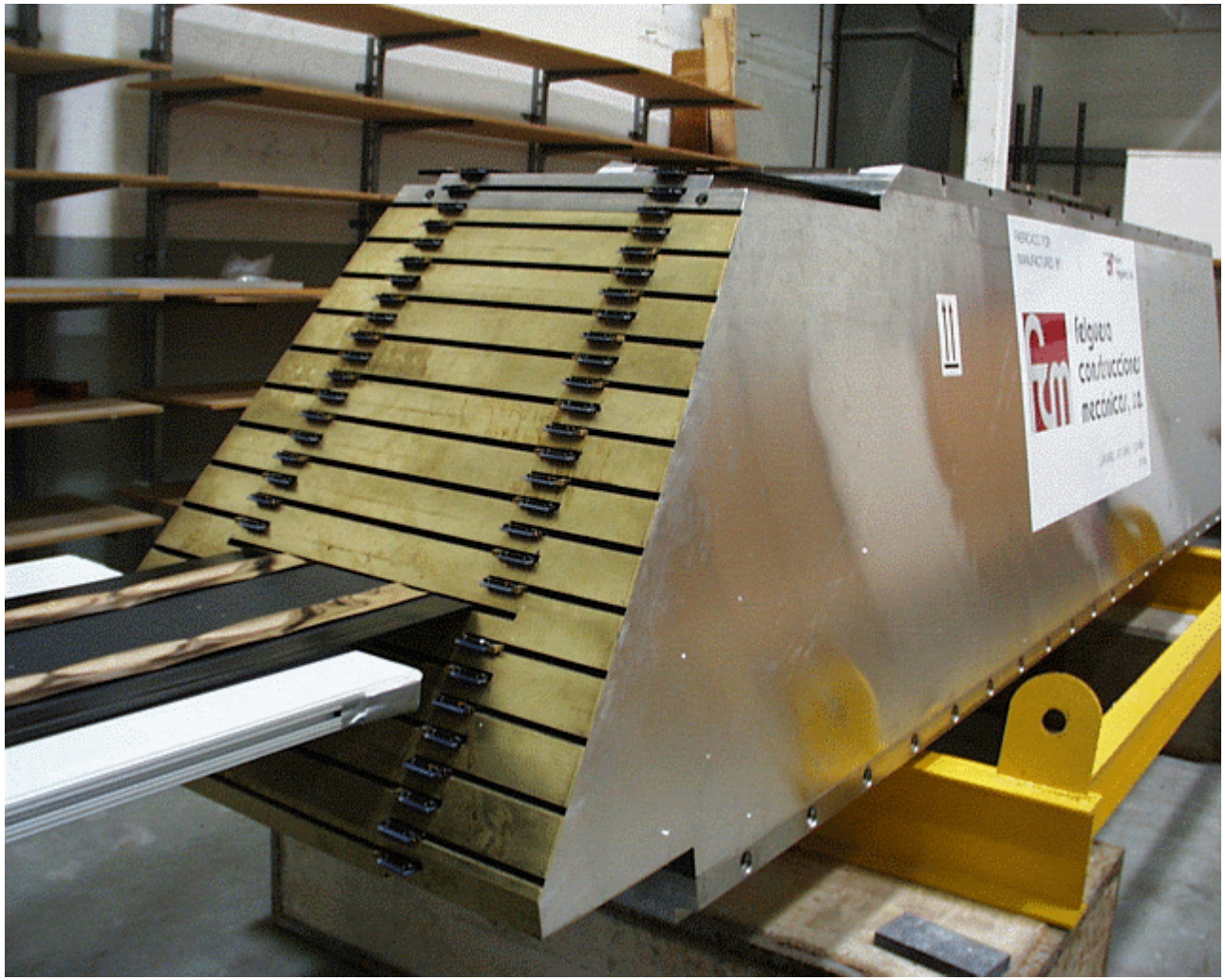
Megatile Manufacture -HE

10 megatiles/day at Protvino

HB Megatile Production



Installation at CERN



Optics Factory at FNAL

- HB Optics factory in final phase. Will be finished in 2 weeks.
- Reduce staffing from 13 to 5.
- Factory will redirect to work on components for RBX's, HV, LV, electronics components.

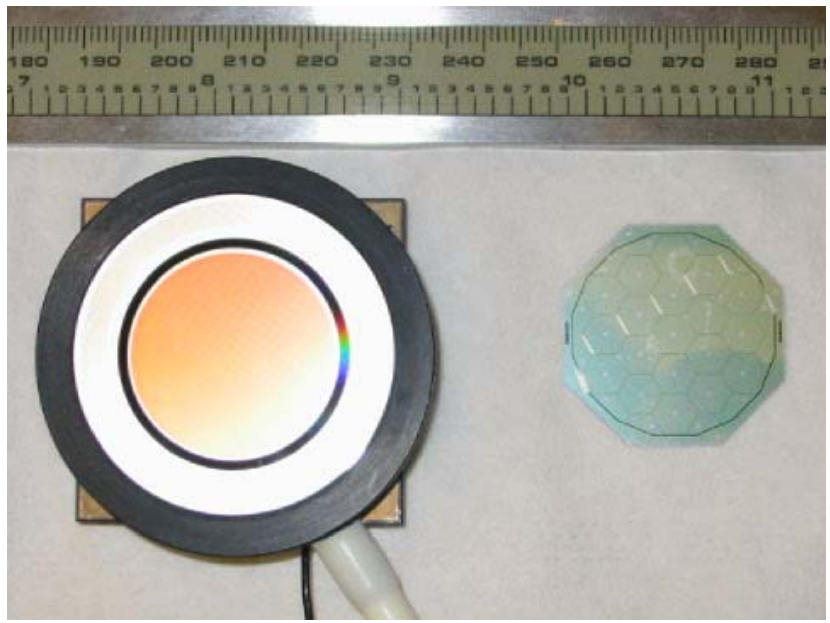
HPD Delivery Schedule

Letter of Intent received by DEP Oct 12, 01

Spare Tubes (20)	Dec 20, 01
Spare Tubes (30)	Mar 1, 02
HB- (72)	May 12, 02
HE- (72)	Aug 23, 02
HB+ (72)	Nov 3, 02
HE+ (72)	Jan 28, 03
HO (146)	Jun 23, 03

So far, 20 at Minnesota. ~ on schedule

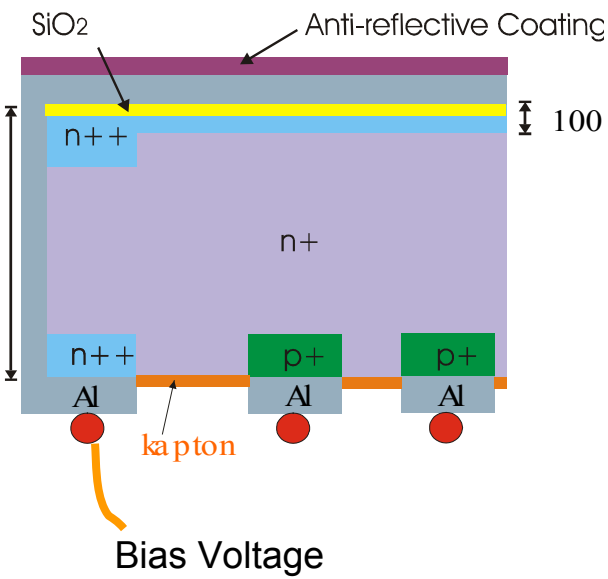
First Production HPD

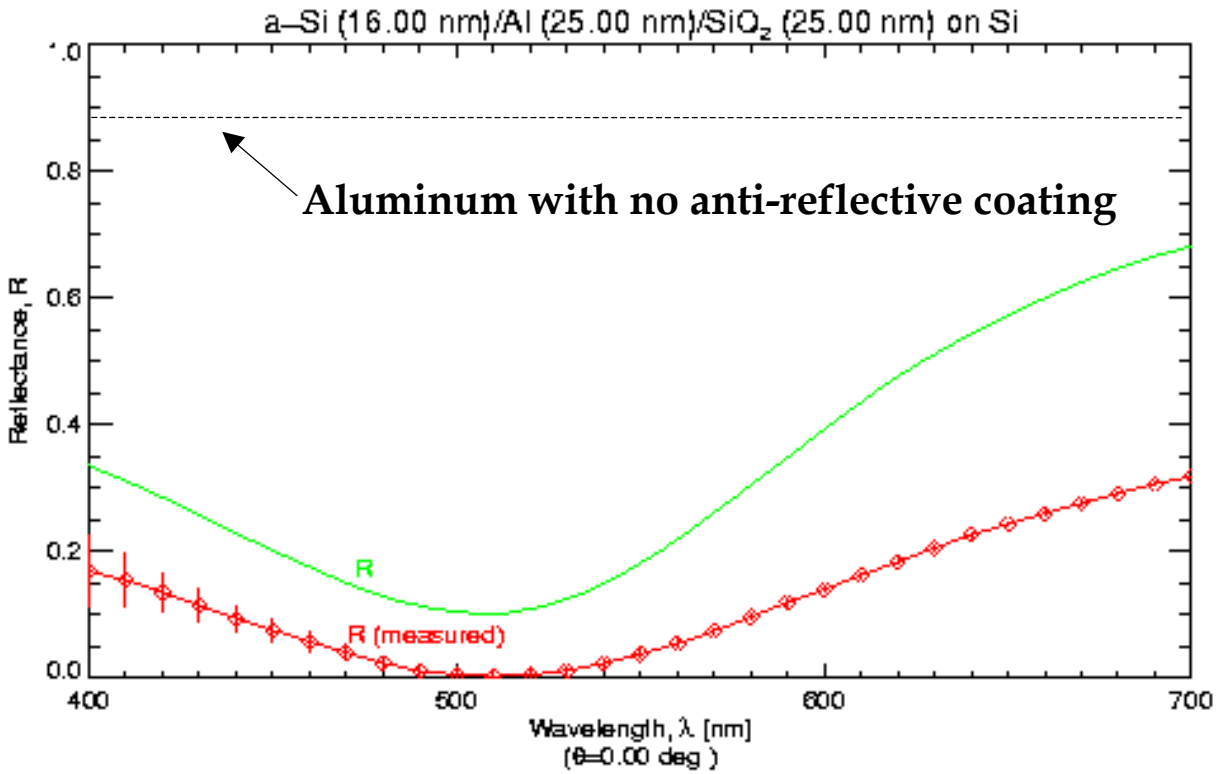


HPD Anti-Reflective Coating

3 layer coating on top of HPD Diode.

New Diode Structure

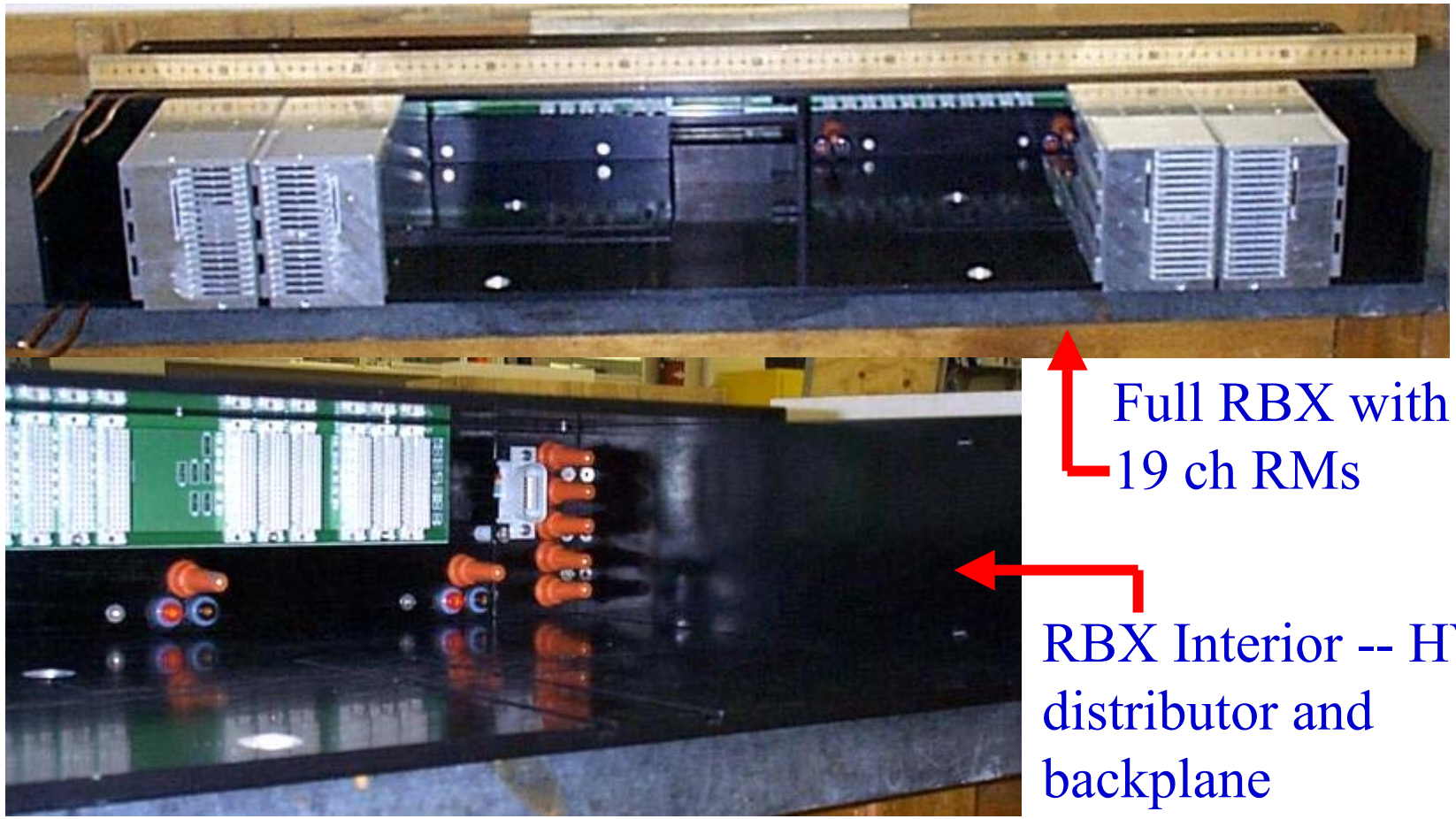




RBX Status

- HB RBX in production (Mississippi). Should be complete by April 02.
- ODU's for HB complete (Notre Dame) 2-3% rms.
- HE RBX in design. Design should be complete by April 02
- Production of HE RBXs late spring
- HE ODUs to be built in ND factory in summer.
- Design HO RBX. Build over summer
- HO ODUs in fall (ND)

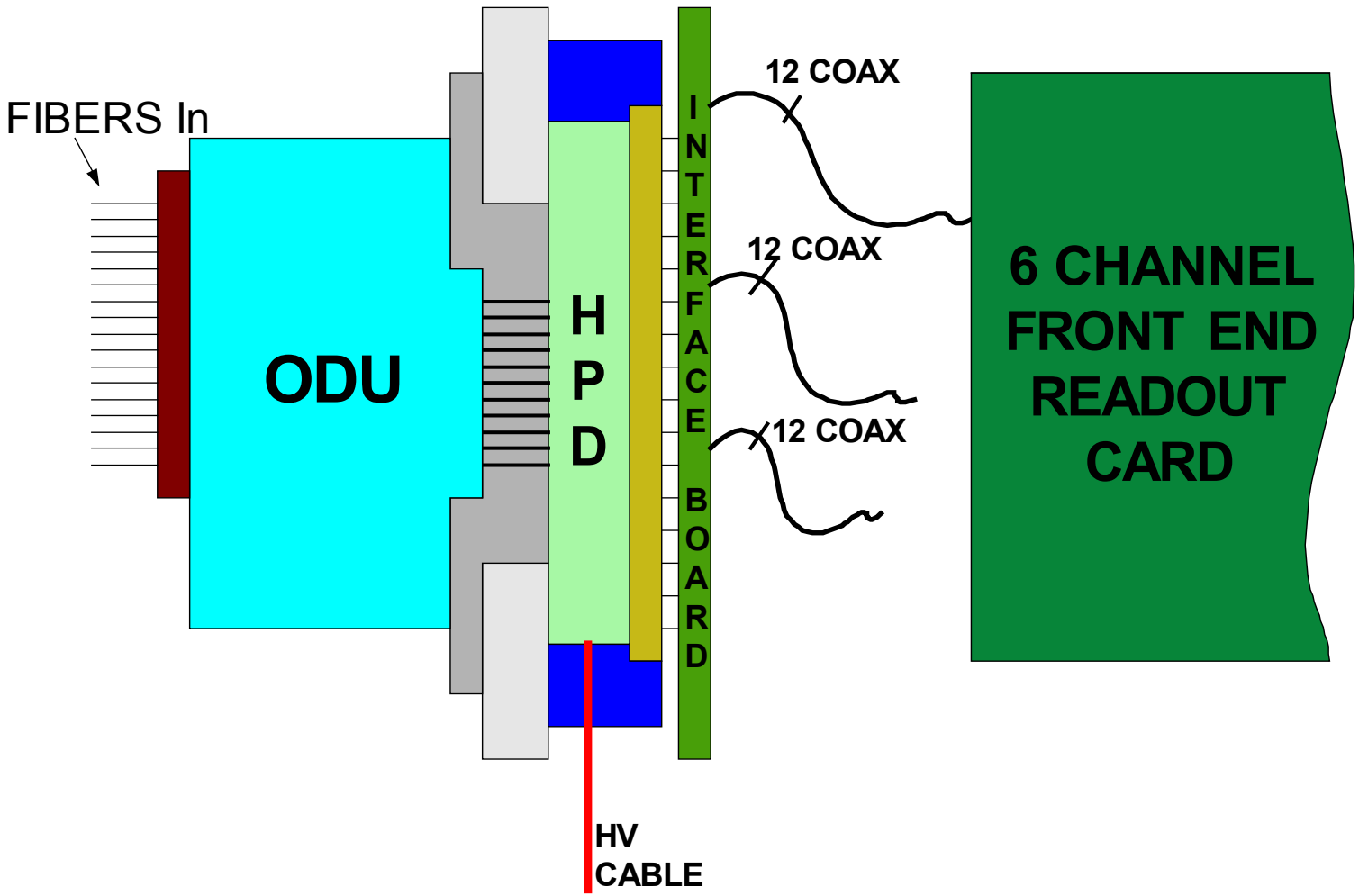
HB RBX Assembly



Full RBX with 19 ch RMs

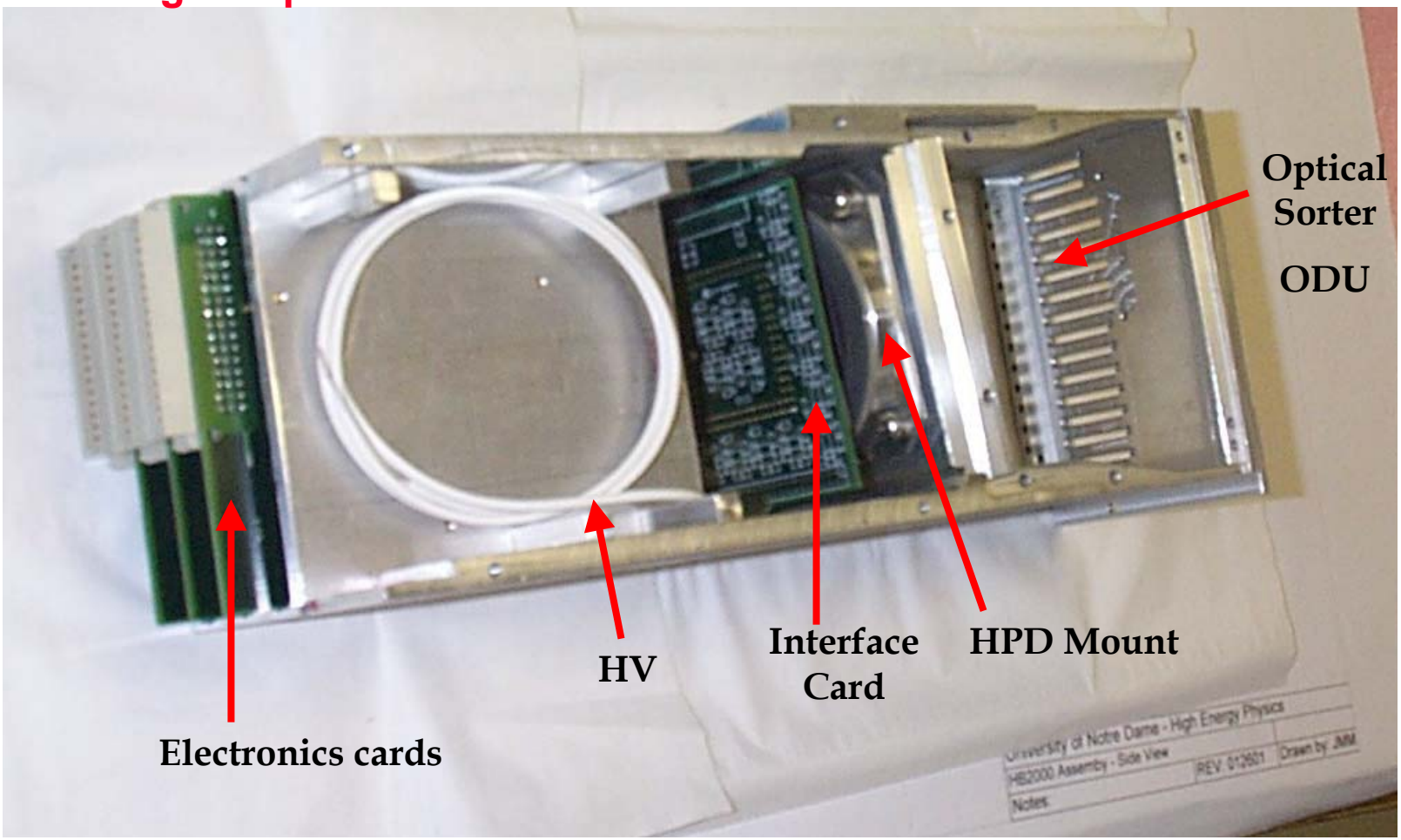
RBX Interior -- HV distributor and backplane

Readout Module (RM) Overview



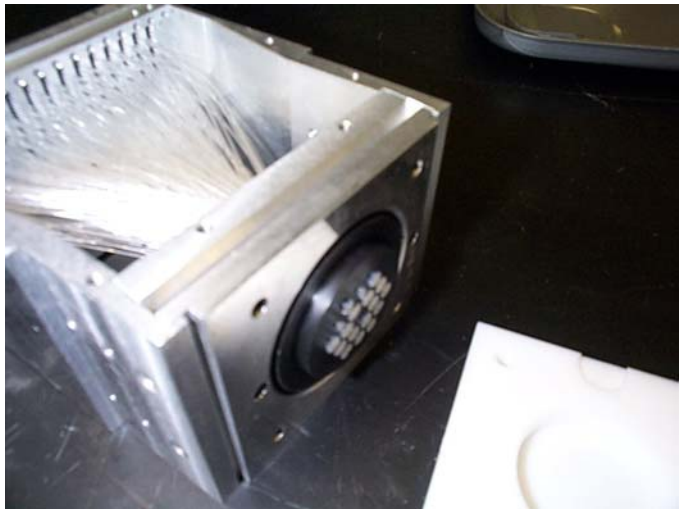
RBX Readout Module

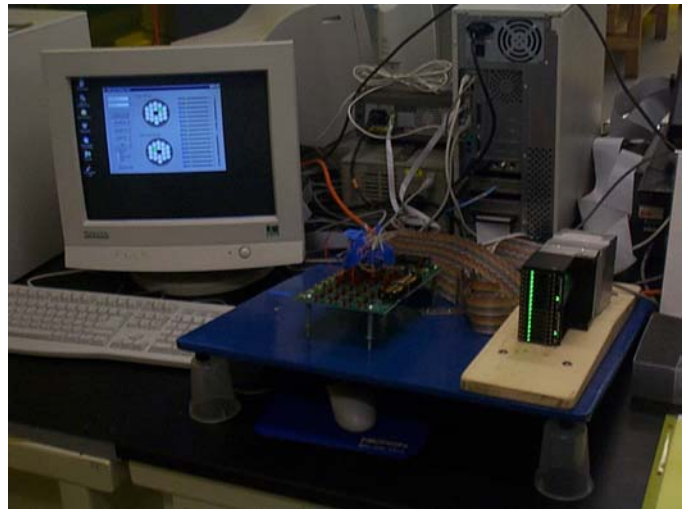
- The readout module (RM) integrates the HPD, front end electronics, and digital optical drivers.

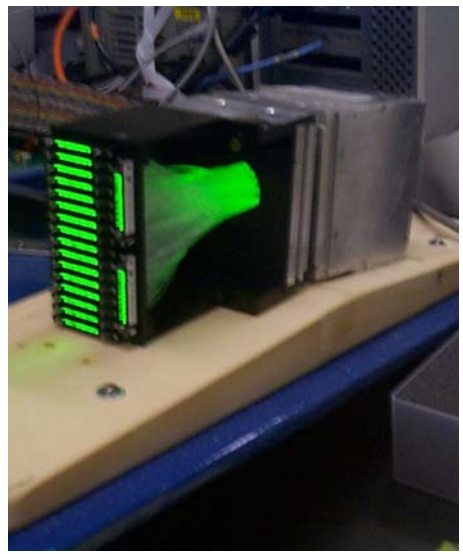


ODU production at Notre Dame

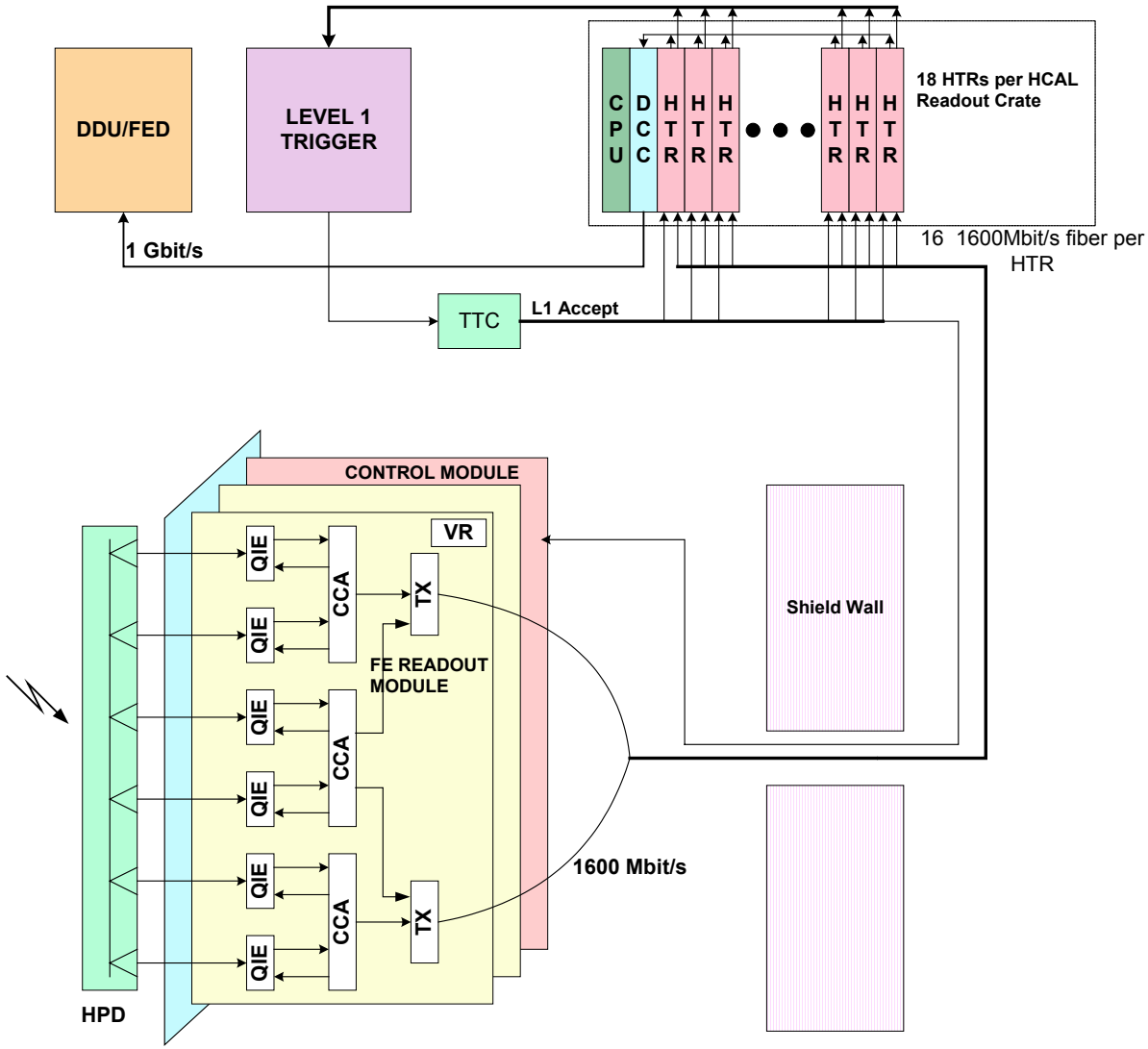
ODU QC



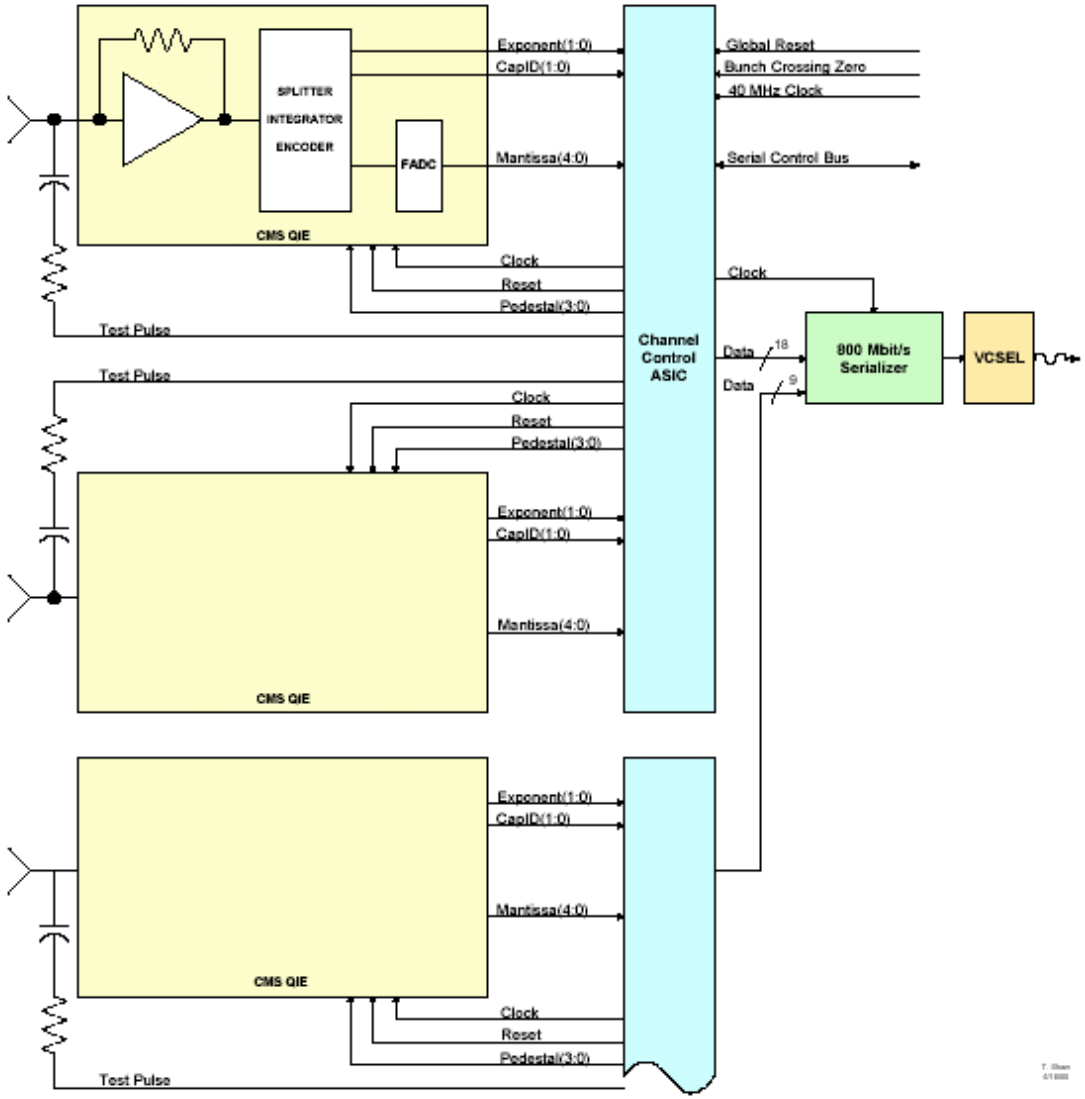




FE/DAQ Readout



FE Channels


SPLITTER
INTEGRATOR
ENCODER
FADC
CMS QIE
Exponent(1:0)
CapID(1:0)
Mantissa(4:0)
Clock
Reset
Pedestal(3:0)
Test Pulse
Channel Control ASIC
Global Reset
Bunch Crossing Zero
40 MHz Clock
Serial Control Bus
Clock
Data
18
9
800 Mbit/s Serializer
VCSEL

FE Status

Past 6 months

- Tested proto CCA Asic – looks good
- Tested proto QIE Asic
  - Does not run at 40MHz (easy fix)
  - Noise levels under study
    - 3000e- rms with soldered coax connections btw HPD and QIE
- HB Backplane layout complete
- Proto GOL (serializer) tested - OK
  - Gigabit Ethernet protocol
  - 1600 Mbits/s
- Proto VCSEL and custom package tested – ok
- Rad qualified “glue” logic parts

CMS QIE Status

Full chip submitted 3/13/01

Received 5 wafers 6/1/01

Testing shows chip fully functional

- **Chip does not run at 40 MHz**
- **Noise as a function of input capacitance being studied**
- **Noise of 3000e- rms achieved with soldered coax connections btw HPD and QIE**

Goal is to submit production part by April '02

CCA Status

CCA submitted June 25, 2001

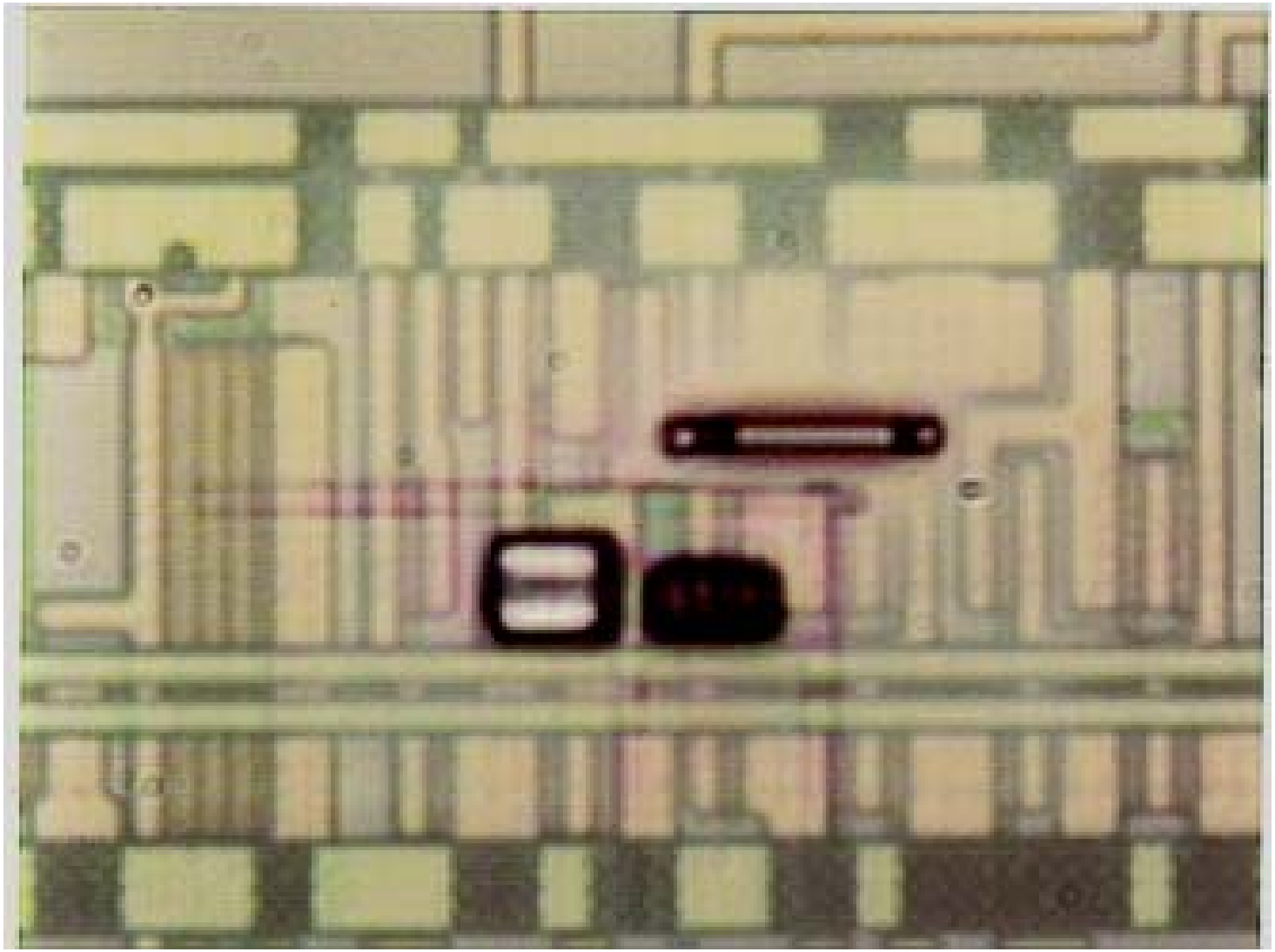
25 parts back Oct 11, 2001

Chips under test

- **Problem with reads/writes to internal registers**
- **Problem with writes fixed with repair on chip (jumped out inverter)**
- **Problem with reads under study**
- **Other than reads, the CCA appears to be fully functional**

Engineering run chip submitted on Feb 11. Due back April 8.

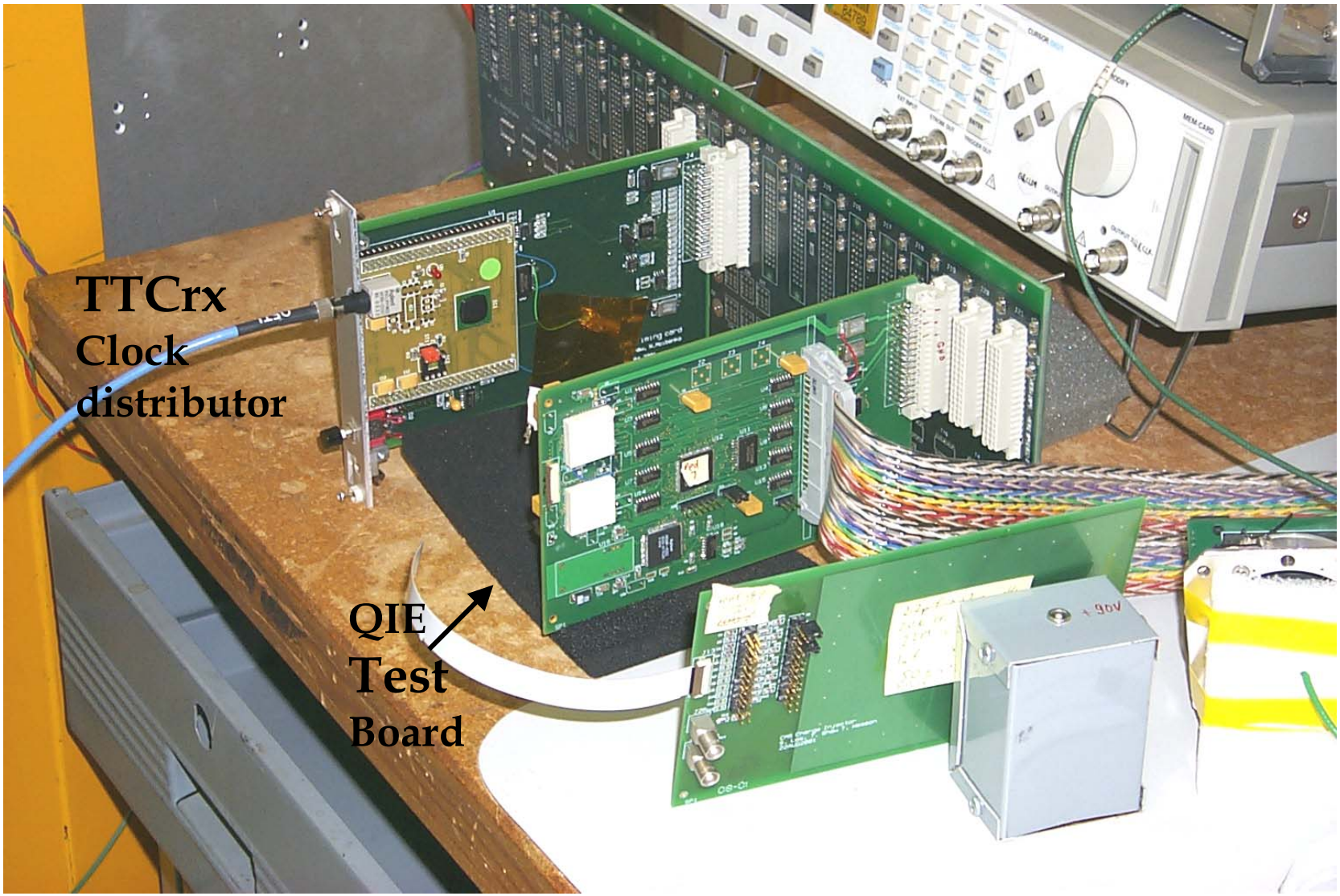
CCA ASIC Repair



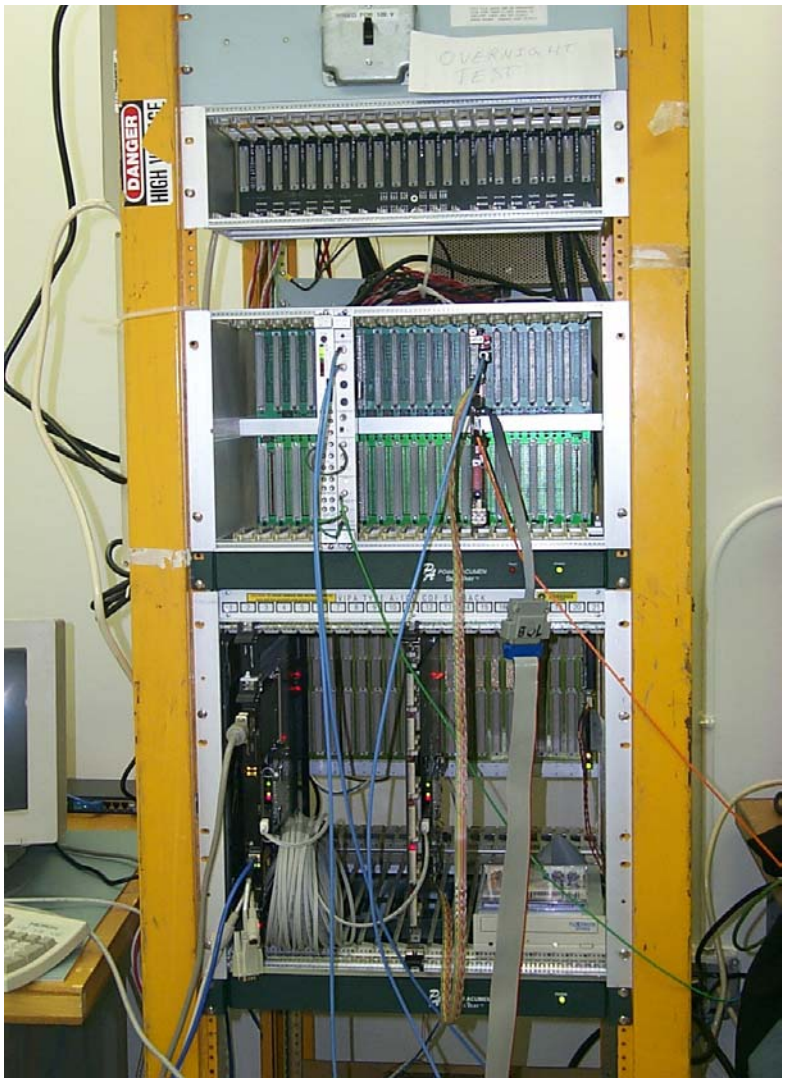
Radioactive Source Vertical Slice

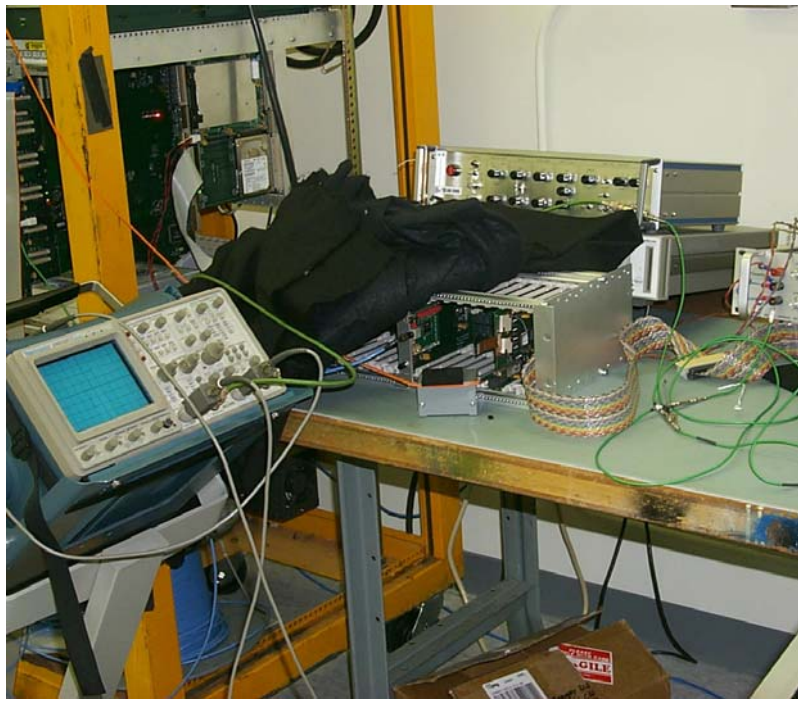
- **Exercise a single channel of HCAL readout from scintillator to computer**
  - **Radioactive Source**
  - **Scintillator**
  - **Optical Fiber**
  - **HPD**
  - **QIE**
  - **Digital optical readout**
  - **HTR**
  - **DCC**
  - **Computer**
- **First complete ~40Mhz readout of HCAL Channel**
- **Successful demonstration of radioactive source measurement for calibration.**

QIE under test



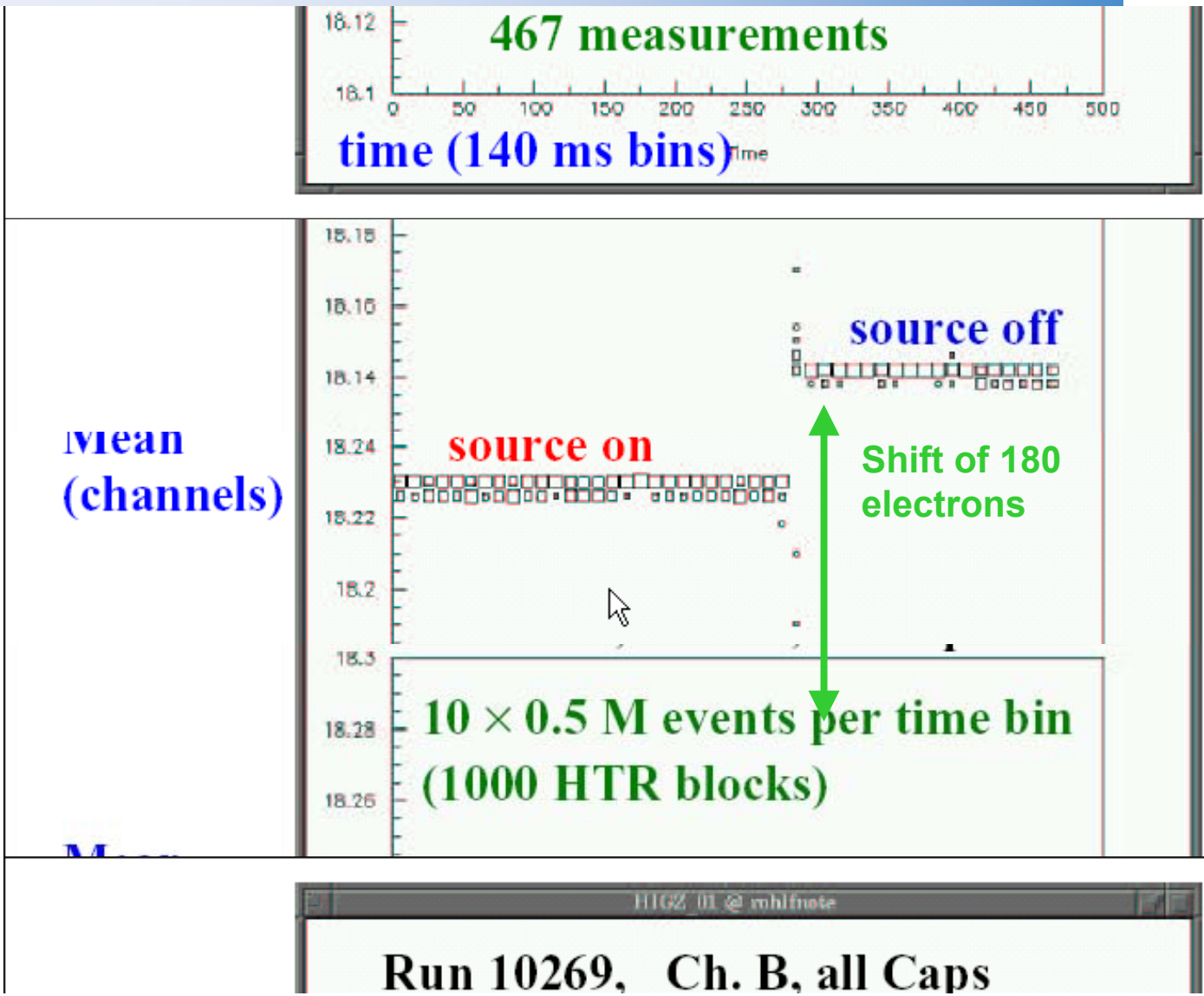
DAQ System





Radioactive Source Test

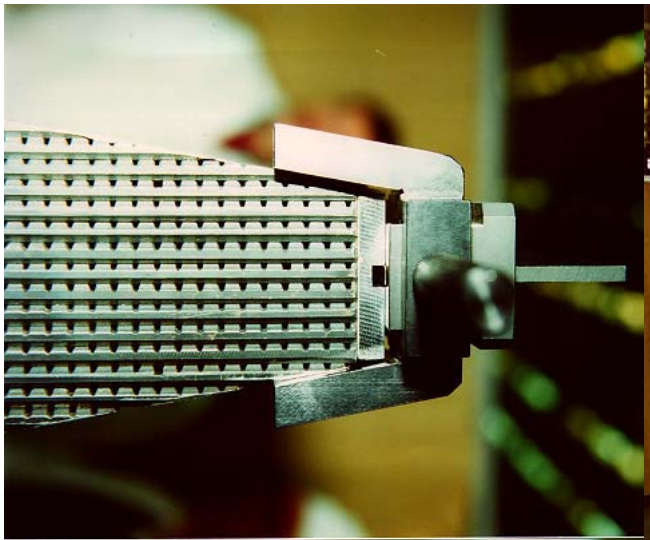
Response as source is removed from scintillator

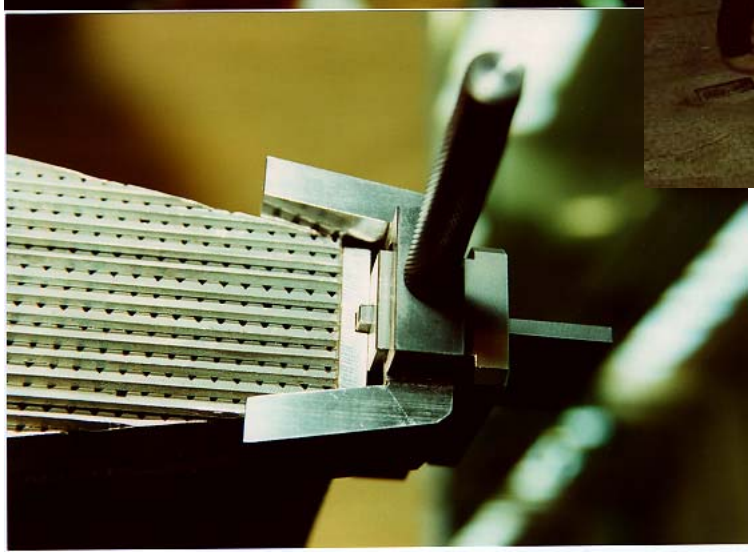


HF Status

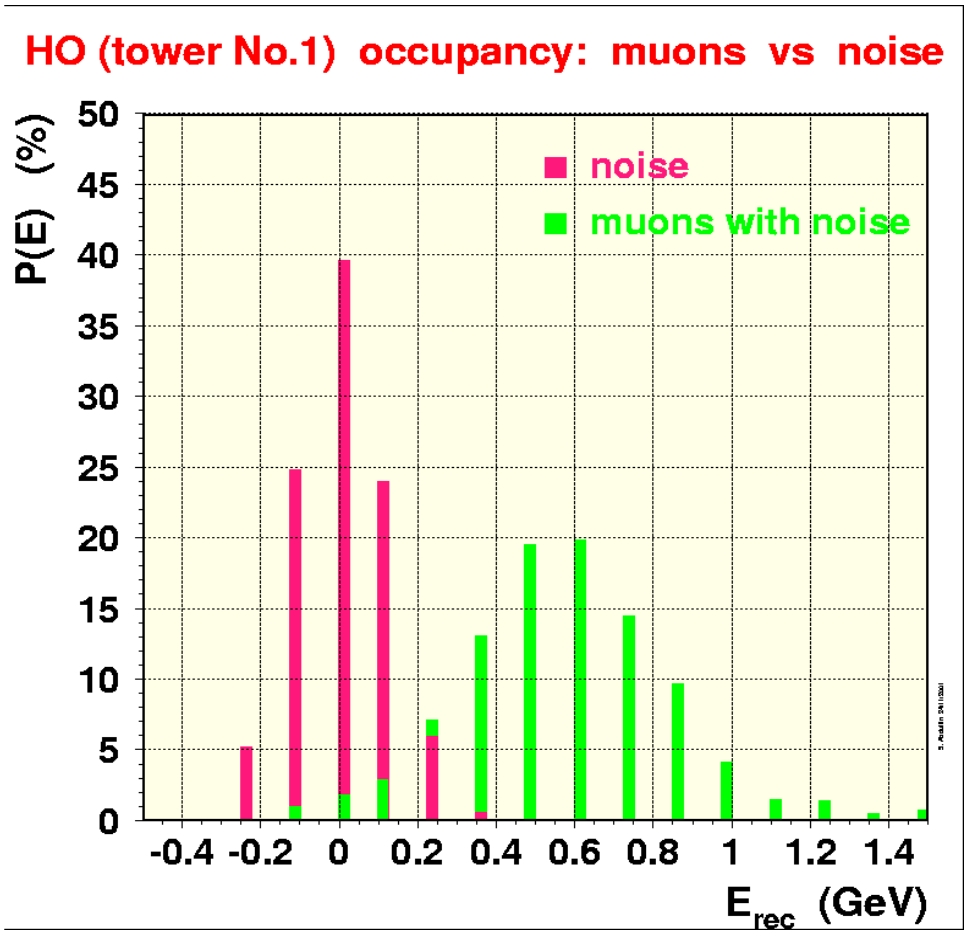
- 10 HF absorber wedges finished. 5 at CERN
- Fiber ordered. First delivery to CERN
- Phototubes ordered.
- Expect first complete wedge (fibers, pmts) at CERN in early June 02.
- Expect to test in H2 test beam this summer.

First Production HF Wedge





Idea to use HO for muon trigger, vertical slice trigger



Expect ~ 2 p.e. of noise and ~ 8 p.e. of signal for a single muon at normal incidence.

Toy montecralo with 5000 e- noise, 8 pe/mip in HO

Testbeam Motivation

- HB- assembled in September 01
- HB+ will be assembled in September 02
- Only chance for testing production wedges with fast (engineering run ASICS) electronics is Summer 02.
- Desire to test 2 to 4 production wedges from HB+.
- Get absolute calibrations to carry from H2 to UX5.

Testbeam Goals

- Prepare test beam DAQ to read out prototype HTR cards.
- Electronics will be 6-channel RBX cards, using first run QIE and engineering run CCA. GOL and fiber-optic readout.
- Rochester ECAL module on table, with new motion mechanism.
- Take ~ 4 production wedges into beam.
- Measure radioactive source fingerprints.
- Scan with pions as function of eta and phi.

Testbeam Responsibilities

- H2 Test beam beamline, DAQ – Laza
- RBX FE cards – Terri Shaw
- RBX mechanics, optics – Randy Ruchti
- Check out / test RBX's – Anatoly Ronzhin
- System integration FE card to HTR – Jim Rohlf
- Radioactive source system – Virgil
- Calibration System --Vasken, Sergey Los
- Refurbish table – George Ginther
- ECAL Module, new motion – Pawel
- HV System – Sergey Los
- HPD checkout and setup – Arjan Heering

Testbeam Conclusions

- Test Beam 2002 very important goal for HB group.
- Only chance to test production wedges
- Important step in system integration in preparation for SX5 activities in late 02, early 03.

Conclusions

- HCAL absorber and optics making good progress
- Front end and Higher level electronics progressing
- Finished with absorber, optics.
- HPDs under control
- ASICs under control
- HF fibers and pmts ordered.
- Looking forward to test beams in summer 02
- Install electronics Spring 03
- Vertical Slice Tests in SX5 in 03