

Forward Tagger Status Report

Amanda Hoebel

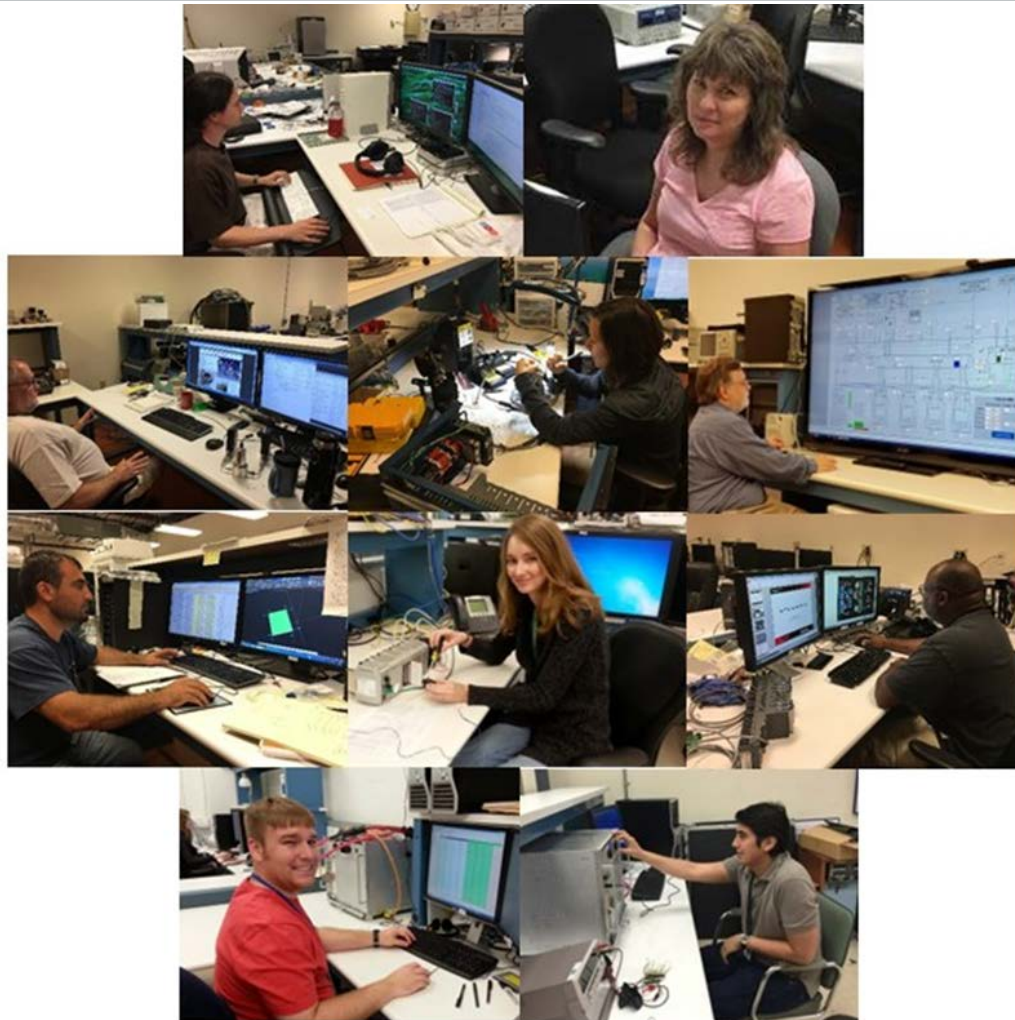


Contents

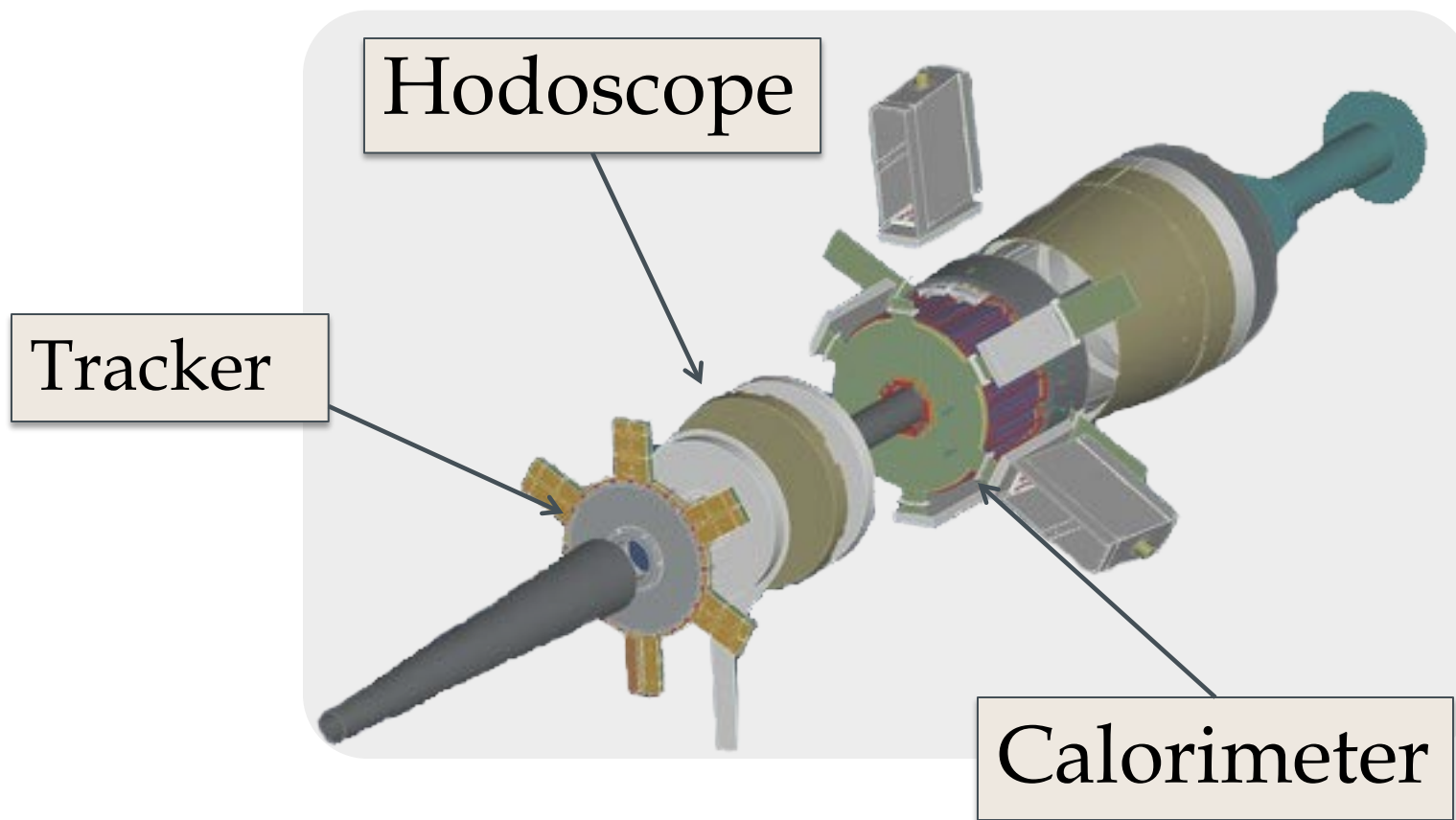
- FT Overview
 - Tracker
 - Hodoscope
 - Calorimeter
 - Slow Controls
 - Interlocks
- GUIs and Tests
- Debugging
- Future Plans
- Conclusion



DSG Staff

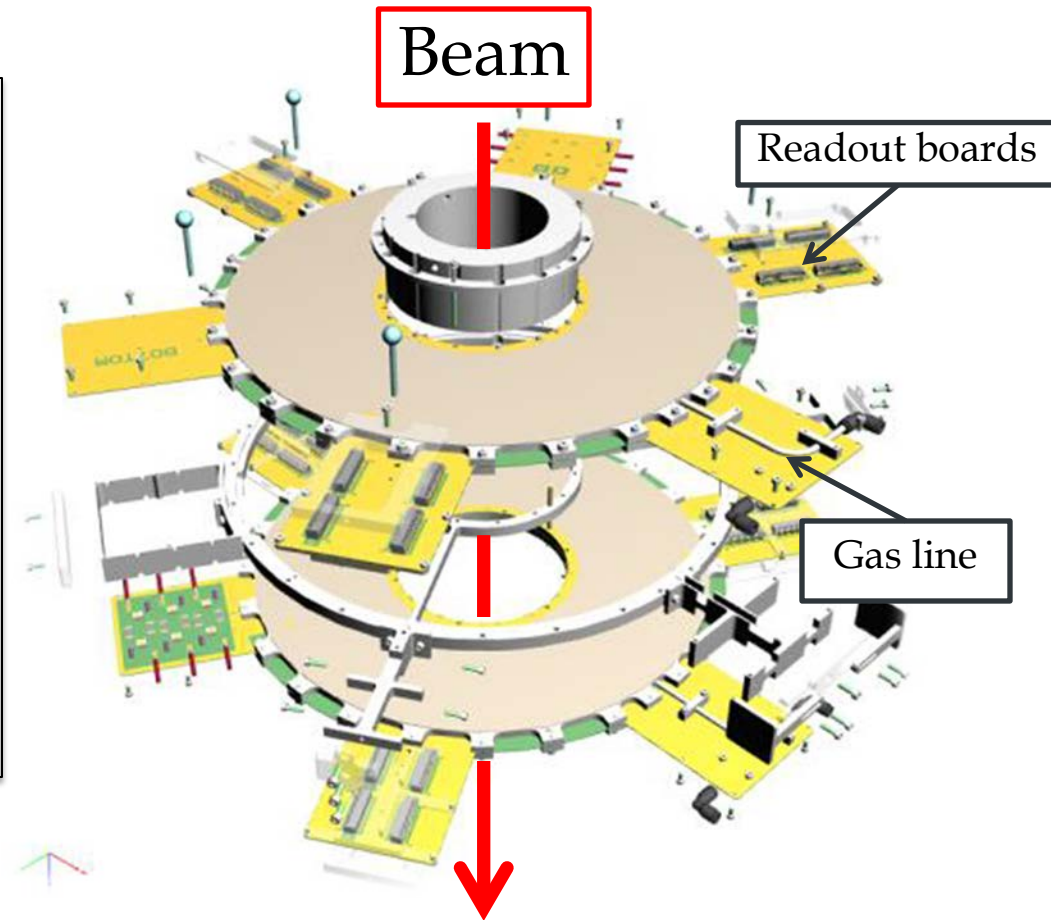


FT Overview

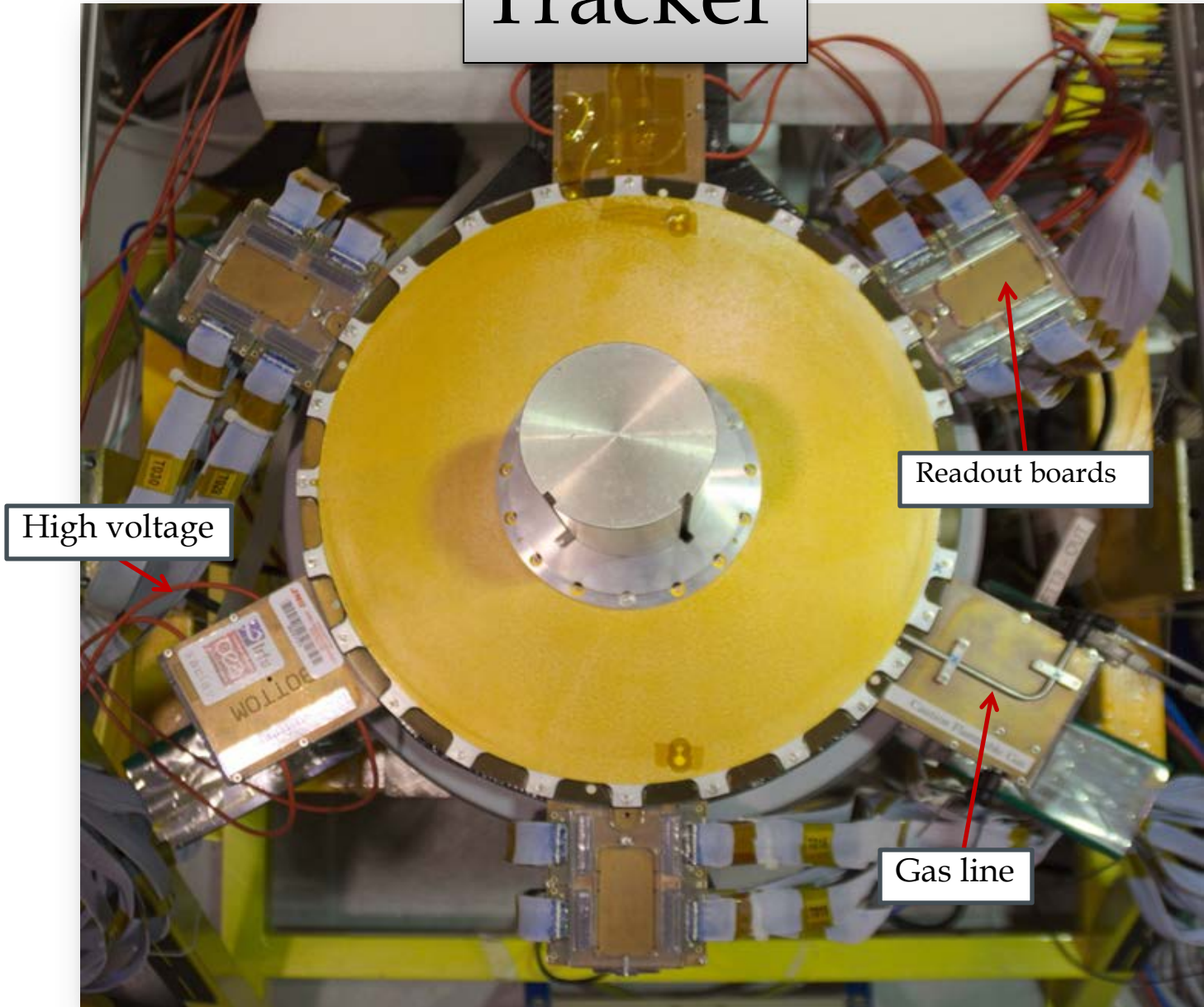


Tracker (FT-Trck)

- Measures scattered electron angles between 2.5° and 4.5°
- Two double-sided MicroMegas detectors
- 768 readout strips
- 90% argon, 10% isobutane

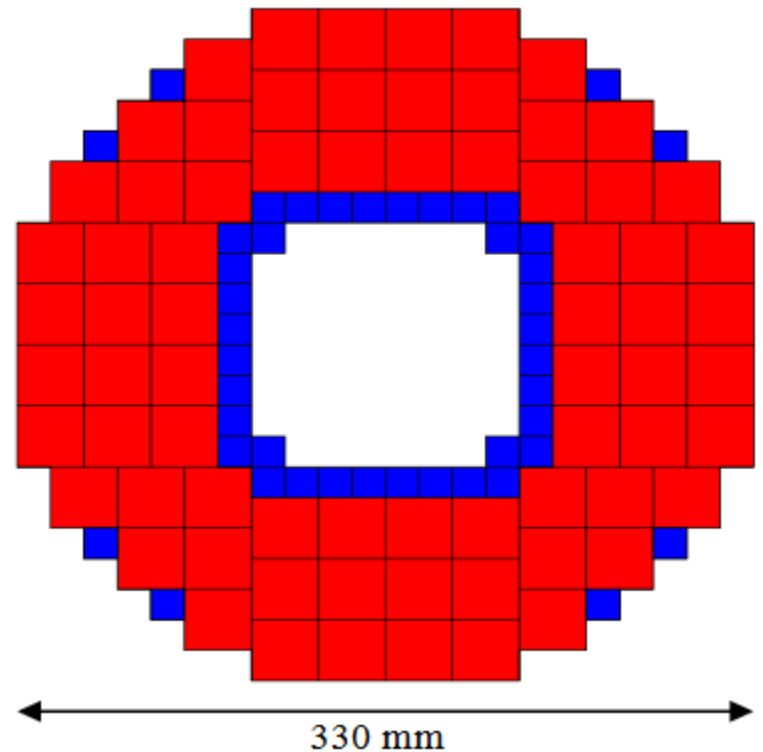


Tracker



Hodoscope (FT-Hodo)

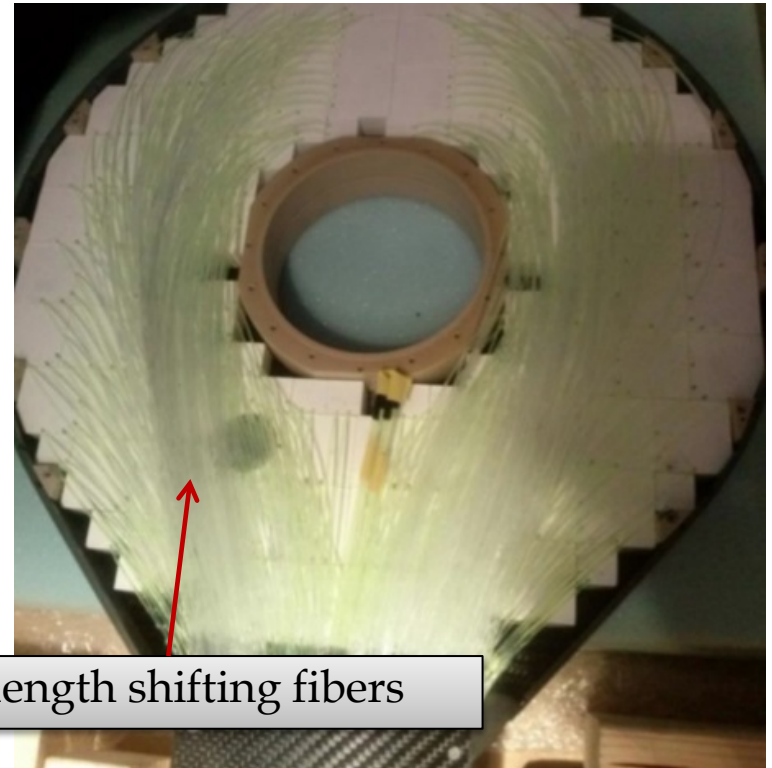
- Provides electron and photon discrimination
- Made of 2 layers
 - Thin layer (5 mm)
 - Reduces misidentified events
 - Thick layer (20 mm)
 - Provides large number of photoelectron events
 - ♦ Improves timing resolution
- Layout of plastic scintillator tiles
 - 44 small pixels (blue)
 - 15x15 mm pixels
 - 72 large pixels (red)
 - 30x30 mm



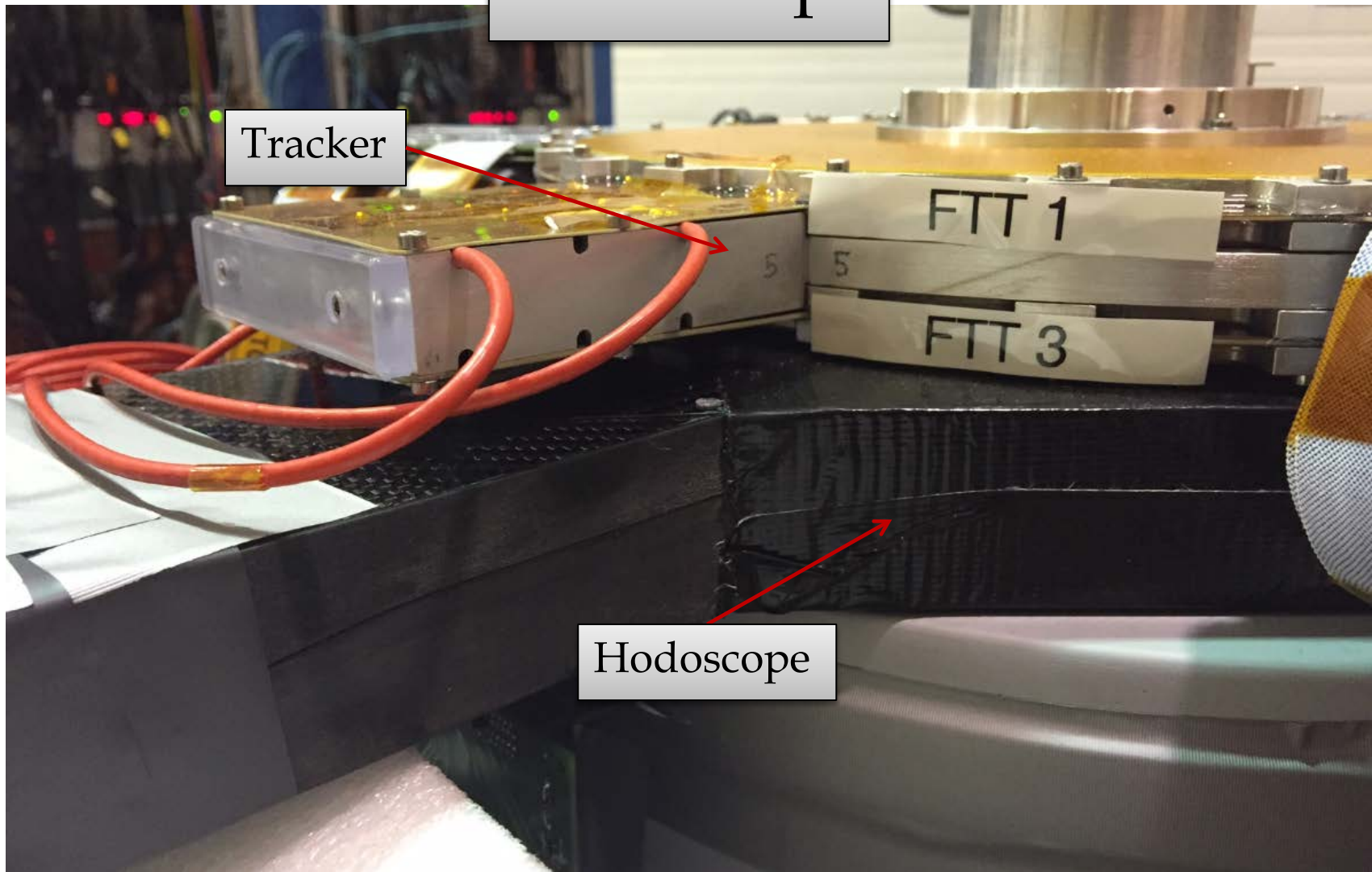
Hodoscope (FT-Hodo)

Light from pixels are

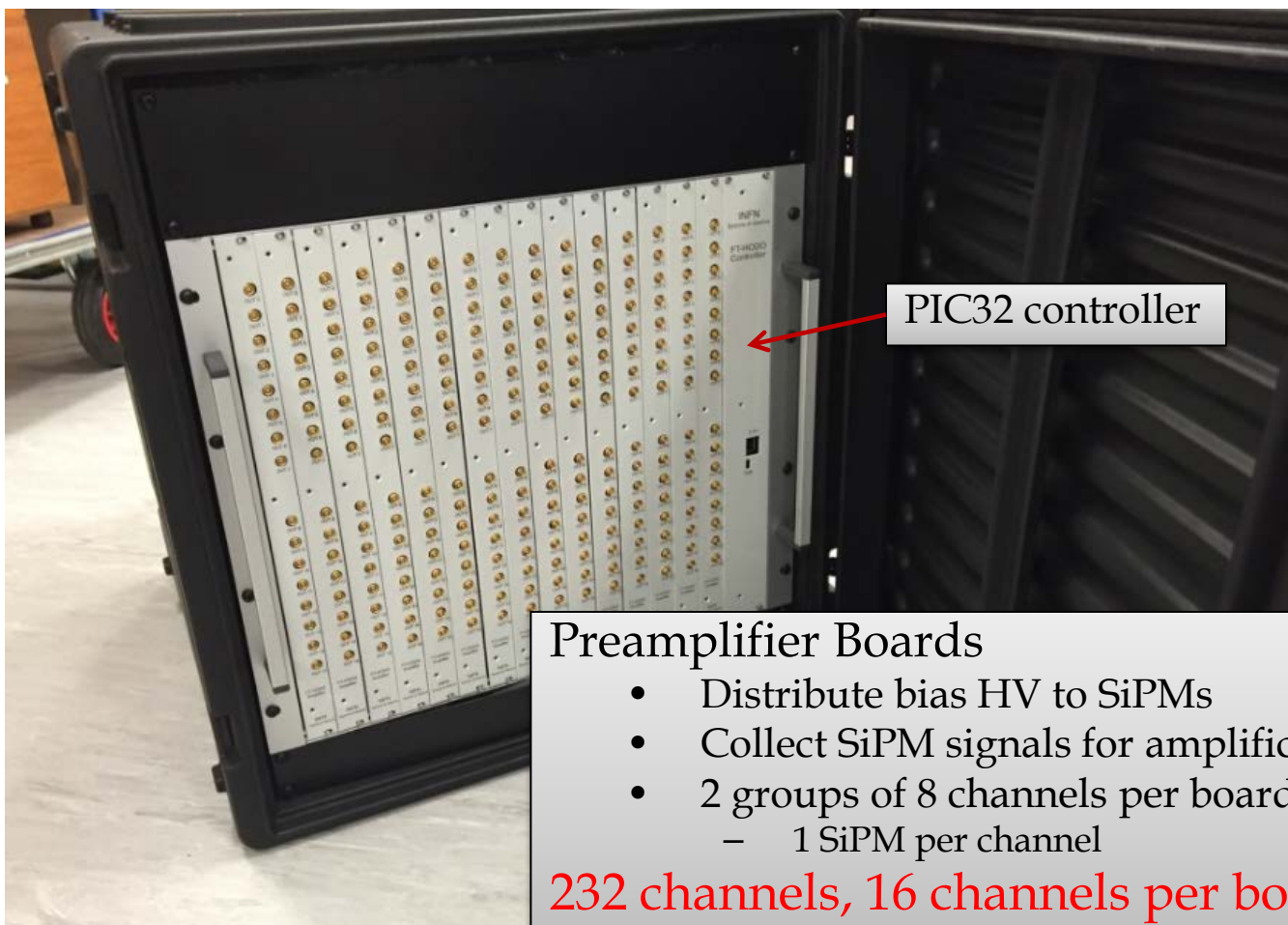
- Read out by wavelength shifting fibers
- Collected by 232 silicon photomultipliers (SiPMs)



Hodoscope



Hodoscope Mezzanine Crate

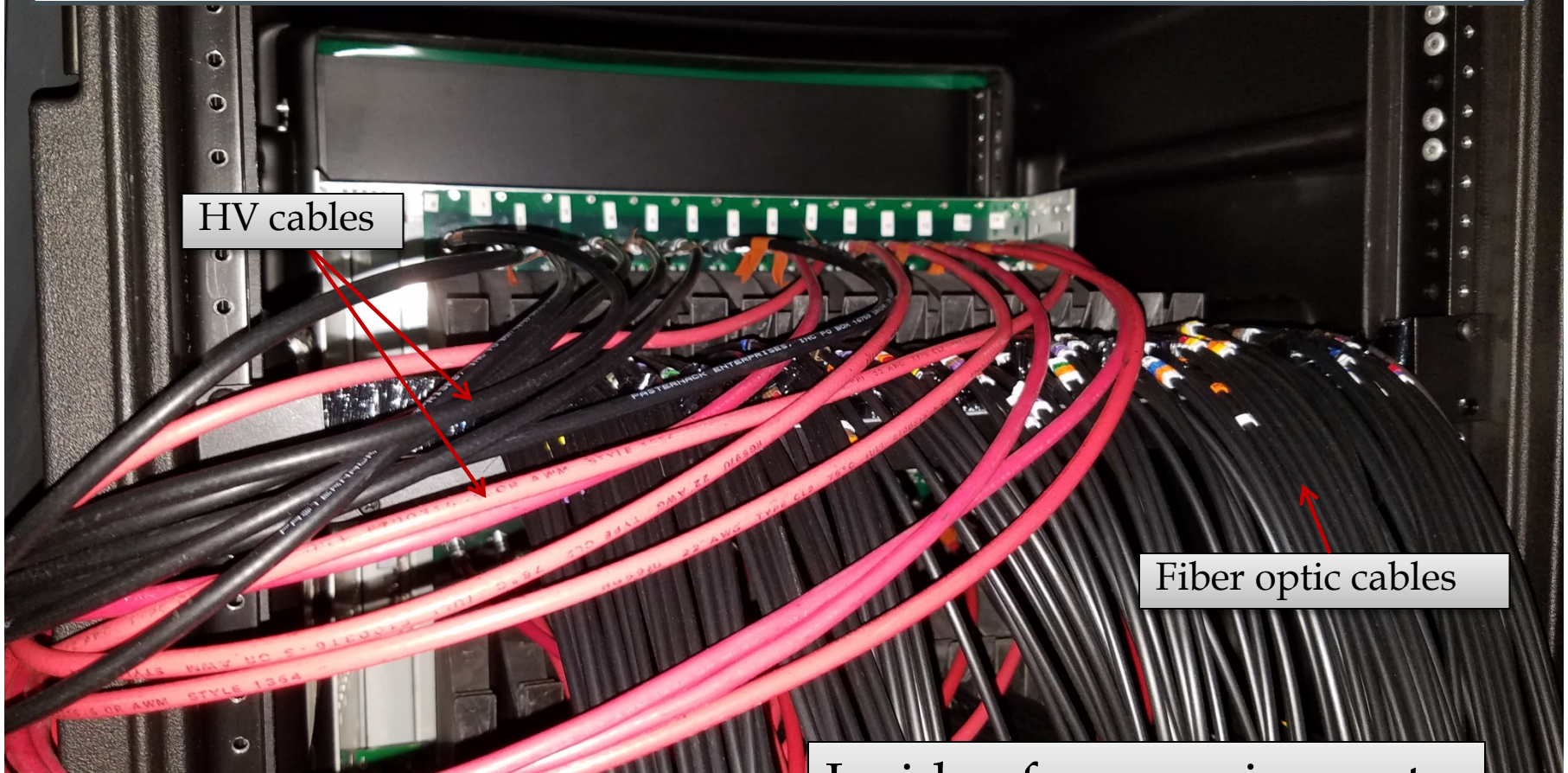


Preamplifier Boards

- Distribute bias HV to SiPMs
- Collect SiPM signals for amplification
- 2 groups of 8 channels per board
 - 1 SiPM per channel

232 channels, 16 channels per board= 15 boards

Hodoscope Mezzanine Crate



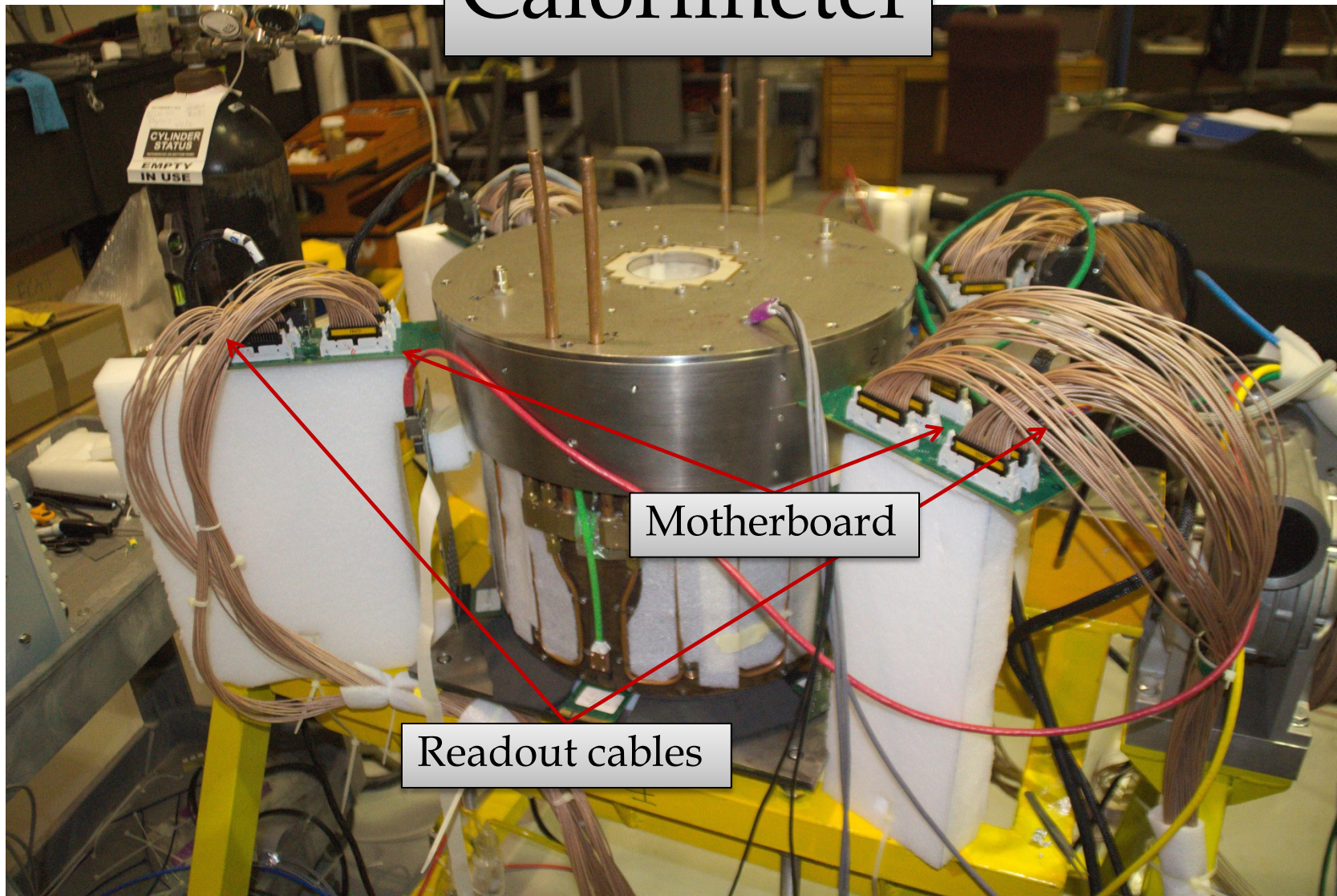
HV cables

Fiber optic cables

Inside of mezzanine crate



Calorimeter



Motherboard

Readout cables

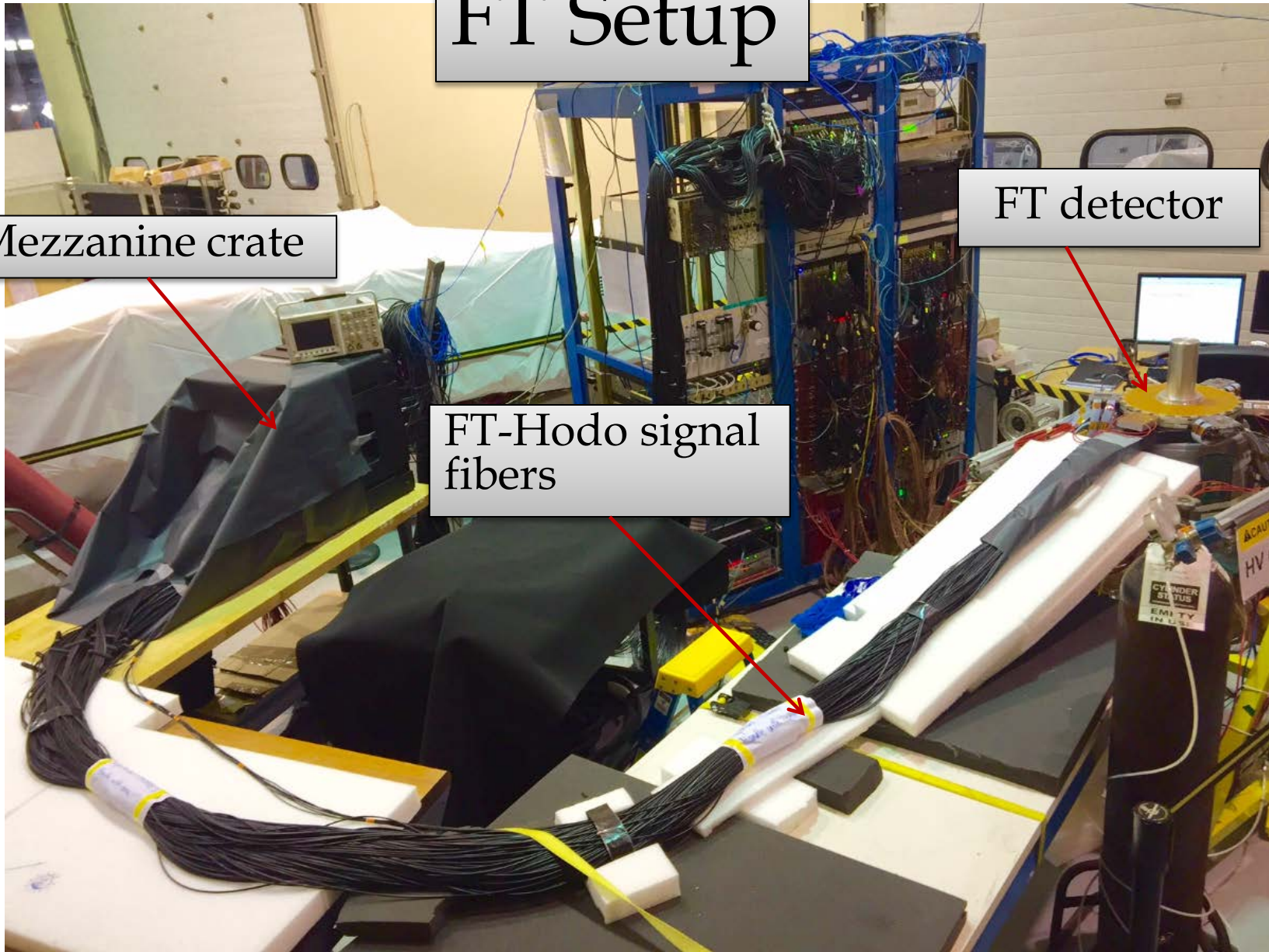


FT Setup

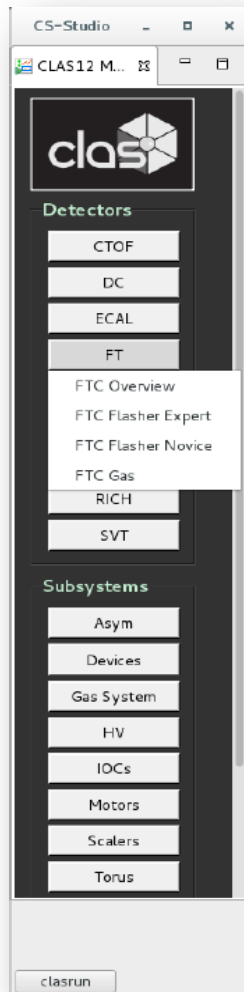
Mezzanine crate

FT detector

FT-Hodo signal fibers



Slow Controls



All FT controls accessible through EPICS

- FT-Cal
 - FTC Overview
 - FTC Flasher GUIs
 - FTC Gas
- FT-Hodo
 - FTH LV
 - Others being implemented



Interlocks

Backup system designed to protect detector from damage if main control system fails

- Takes corrective action if a monitored signal is outside of pre-programmed limits
 - Turns off HV and then LV
 - Disables chiller pump
 - Monitors gas flow



Interlocks

Signals monitored include:

- Calorimeter
 - Temperature
 - Humidity
 - Gas Flow
- Hodoscope
 - Temperature
 - Mezzanine crate's box-lid switch



Interlocks

Signal Name	Number of cRio NI Channels	Input / Output	Description
Calorimeter Temperature	6	RTD Inputs	NI 9216 Module – For PT100 RTDs
Hodoscope Temperature	2	RTD Inputs	NI 9216 Module – For PT100 RTDs
Calorimeter Humidity Hodoscope mezzanine box switch	2 1	Analog Voltage Inputs	NI 9205 Module and HIH-4000-003 sensors powered by a DIN rail-mounted +5 V power supply
Chiller Interlock	1	Analog Current Outputs	NI 9265 Module – Uses 4-20 mA interface to Lauda chiller LRZ 912 analog input module
HV Interlock	7	Relays	If CAEN front panel Crate Reset option is chosen, only one relay channel can be used
LV Interlock	2	TTL/Relay Outputs	Measures coolant temperature (external from chiller)
Calorimeter Gas Flow	0	Ethernet	Measures gas flow via network interface

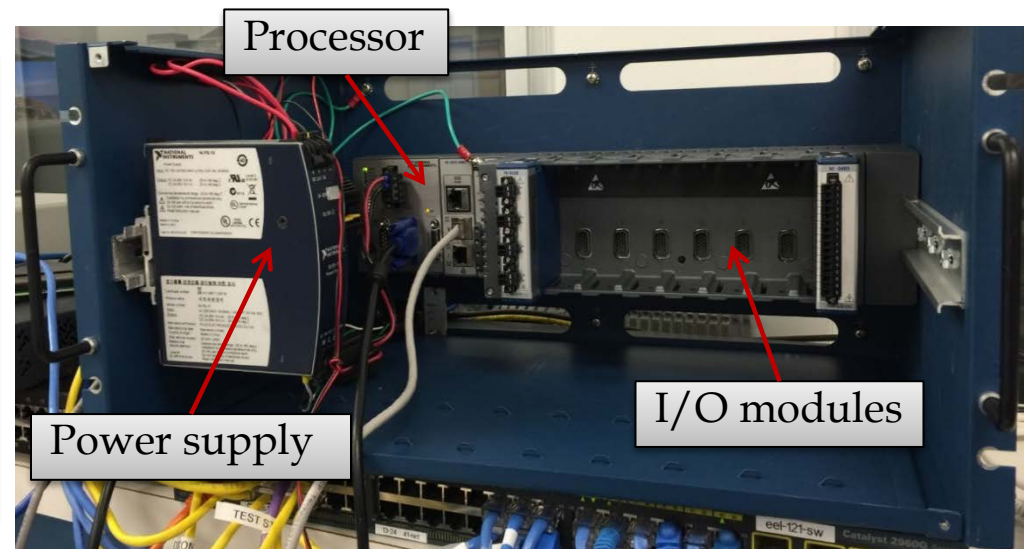


Interlocks

- National Instruments CompactRIO (cRIO) Programmable Automation Controller (PAC) platform

Hardware architecture

- I/O modules
- Reconfigurable field-programmable gate array (FPGA) chassis
- Embedded controller

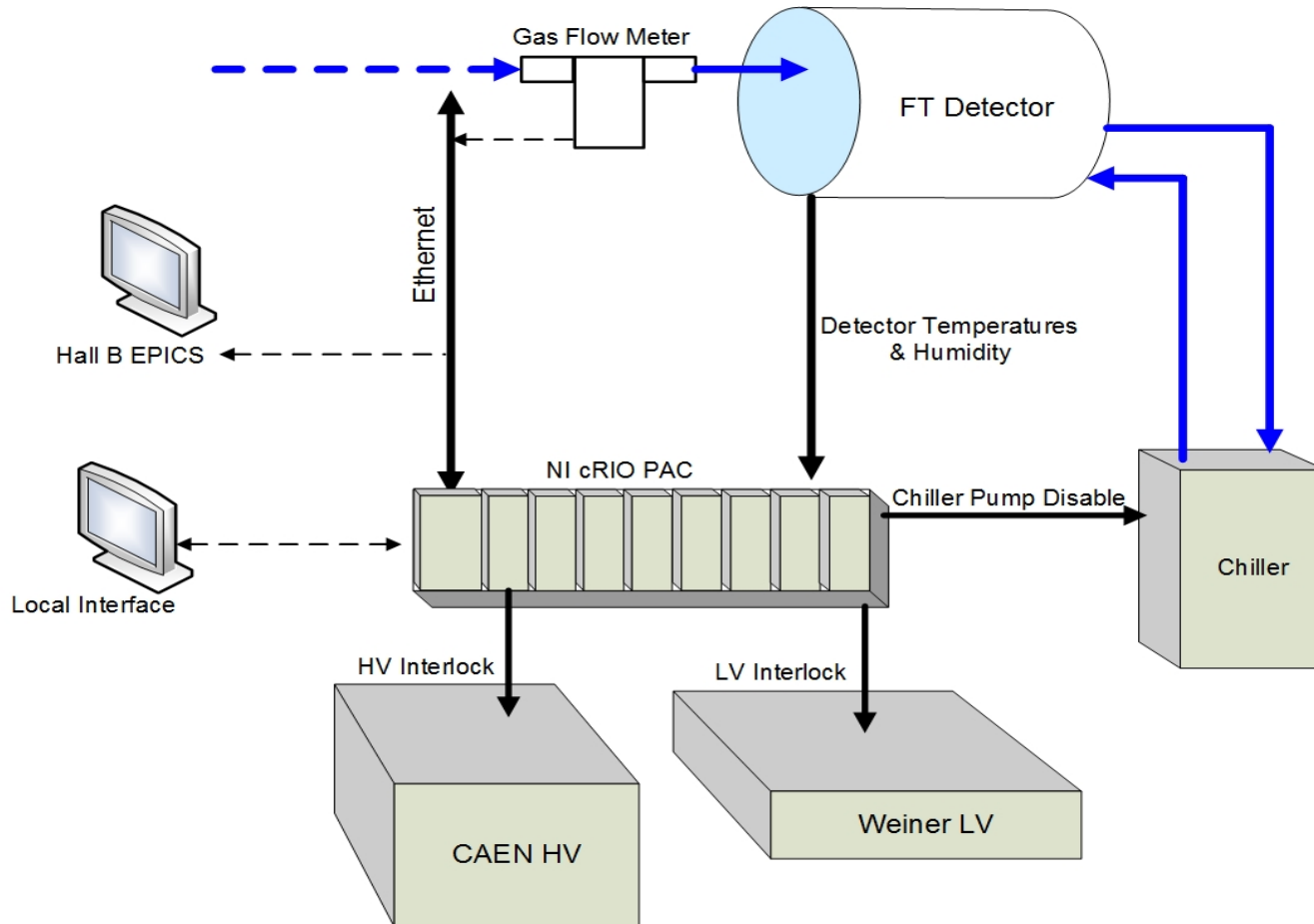


Interlocks

- cRIO obtains all monitored/interlocked signals via direct connections to sensors and instrumentation
- Instrumentation interlocks include:
 - Chiller
 - CAEN HV modules
 - Wiener LV modules
- Development of interlock system's EPICS interface will be coordinated with Hall B slow controls team



Interlocks

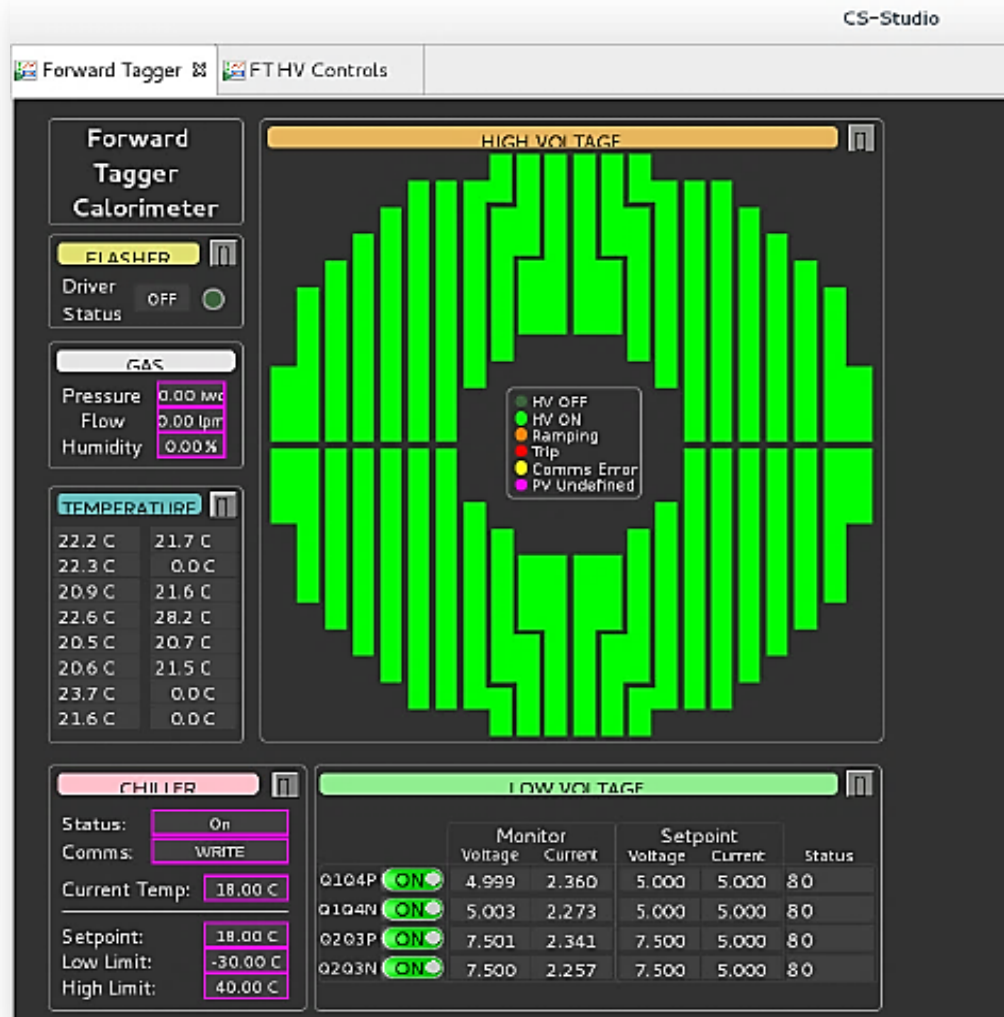


Schematic developed by Peter Bonneau



FT-Cal Main GUI

- Includes:
 - Temperature sensors
 - Chiller
 - HV and LV
- Turn on LV before HV and turn off HV before LV



LED Flasher GUI

Forward Tagger
Calorimeter flasher

Driver Control
ON OFF
Reset Controller

Sequence settings
/scripts/ftcFlasherSeq.sh
Upload new sequence
START STOP

Expert GUI

Board:	Channel
x coord	y coord
scaler rate	
1 12	2 68
-5 6	-10 -2
3 124	4 180
-3 -10	9 -6
5 236	6 292
7 2	3 5

Selected Driver Channel
265 264 267 Turn on
prev. x=7 next y=6

Amplitude 2700 4,095 Apply to all
Width 3000 3,000 Apply to all

Load data Save data

Scan settings
Time On (s): 0
Time Off (s): 0
Set LED: [cyan bar]
START STOP

Controller settings
Clock Mode: INT
Overwrite: ON
Freq (Hz): 62

Raw commands (expert)
Command: (40 char) max
SWITCH ON 317
Response: (40 char) max
3000

Network
IP Addr:
Netmask:
Gateway:
tftp serv:

LED pulse amplitude

- Select channel
- Change amplitude

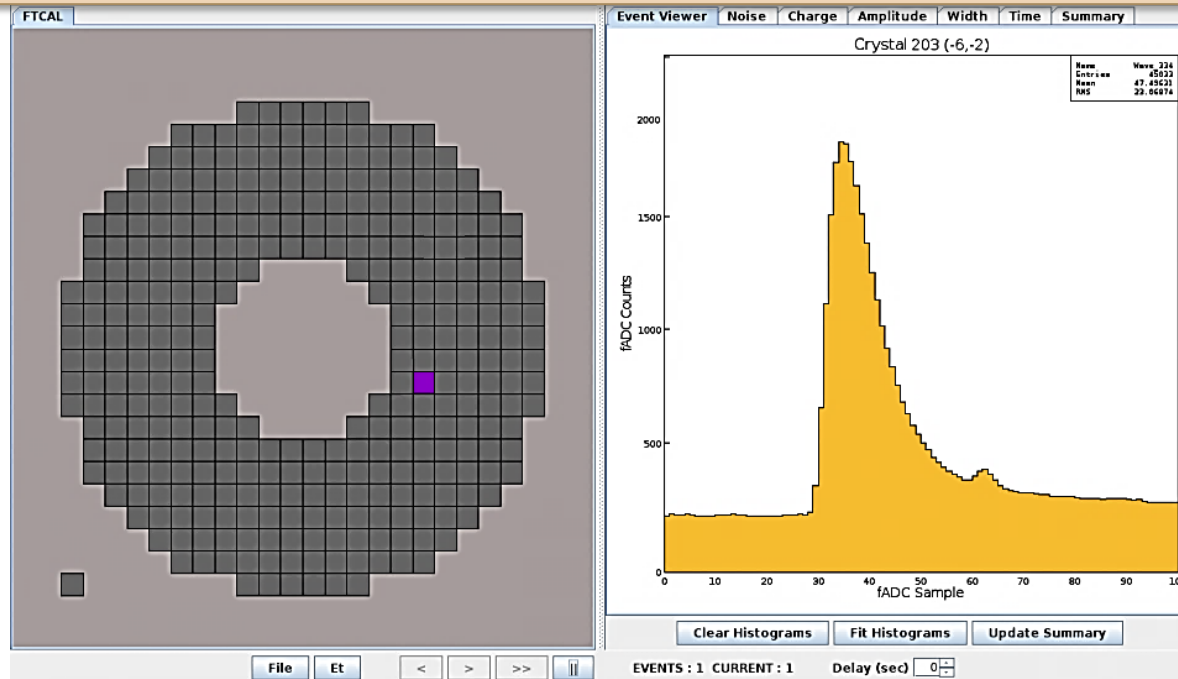


LED Flasher Test

FT-Cal LED run

- Checked functionality of channels
 - Evaluated gain variations

Ideal signal peak 1500-2000 fADC counts above pedestal value



CODA

RunControl
Rocs

File Preference

Run control Buttons

Control

Cancel

Reset

Disconnect

Transition

Configure

Static parameters

Database	Session	Configuration	rcServer
clasdev	fttest	unknown	jlab12daq1.jlab.org

Session status

Data file	wolf_er	adcecal1_er	hpsgtp_er
Config	wolf	ltcc0_noer	sector3
	test1	sector1_er	adcft1_test
	dvcs_er	hpsgtp	adcft2_test
	sector6_er	adcecal1	adcft3_test
	sector1	sector2	ctof1
	sector2_er	sector4_er	dcrb2
	sector3_er	dcrb1	FT
	test0	adcecal5	cnd1
	highbtest	sector5	ft
	sector6	FT_NOER	FT_test
	ltcc0	sector4	test2
	ctofest	sector5_er	
	ctofpc1	ECAL	

Run status: dormant

End time:

KBytes:

	Events/s	Rate (KB/S)
Integrated	62.0809	7210.7356
Differential	63.0000	7423.3800

```

INFO : adcft1 go....
INFO : ET81 go....
INFO : transition Go succeeded !
INFO : ET81 end....
INFO : adcft3 end....
INFO : adcft2 end....
INFO : adcft1 end....
INFO : EB81 end....
INFO : ER81 end....
INFO : transition End succeeded !
INFO : runNumber is now: 707
INFO : Run number is 707
    
```

File Preference
rocs

adcft1 on adcft1

```

roc_network *****
+ 3
WRITE THREAD EXIT
call: 'adcft1 close_links'
rocCloseLink reached
bb_cleanup 0: 0x080becb0
bb_cleanup 1: 0x09c26ed8
bb_cleanup 2
PROC THREAD EXIT
    
```

ET81 on jlab12daq1

```

UDP_standard_request >sta:ET81 downloaded<
UDP_standard_request >sta:ET81 downloaded<
UDP_standard_request >sta:ET81 downloaded<
UDP_standard_request >sta:ET81 downloaded<
UDP_cancel: cancel >sta:ET81 active<
codatUpdateStatus: updating request done
codatExecute done
CODAtcpServerWorkTask exit ?
CODAtcpServerWorkTask exit !
    
```

adcft2 on adcft2

```

roc_network *****
+ 3
WRITE THREAD EXIT
call: 'adcft2 close_links'
rocCloseLink reached
bb_cleanup 0: 0x080becb0
bb_cleanup 1: 0x0943fed8
bb_cleanup 2
PROC THREAD EXIT
    
```

title will be here

adcft3 on adcft3

```

roc_network *****
+ 3
WRITE THREAD EXIT
call: 'adcft3 close_links'
rocCloseLink reached
bb_cleanup 0: 0x080becb0
bb_cleanup 1: 0x089fded8
bb_cleanup 2
PROC THREAD EXIT
    
```

title will be here

EB81 on jlab12daq1

```

codatEnd 11
|||||
|||||
|||||
|||||
|||||
codatExecute done
CODAtcpServerWorkTask exit ?
CODAtcpServerWorkTask exit !
    
```

title will be here

ER81 on jlab12daq1

```

UDP_standard_request >sta:ER81 downloaded<
UDP_standard_request >sta:ER81 downloaded<
UDP_standard_request >sta:ER81 downloaded<
UDP_standard_request >sta:ER81 downloaded<
UDP_cancel: cancel >sta:ER81 active<
codatUpdateStatus: updating request done
codatExecute done
CODAtcpServerWorkTask exit ?
CODAtcpServerWorkTask exit !
    
```

title will be here

Thursday, August 18, 2016

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FT Status Report

Starting Runs in CODA

- Update pedestal
 1. “Configure”
 - FT_NOER
 - ♦ “No event recording”
 - ♦ Data not saved to disk
 - ♦ Used to show live events
 2. “Download”
 - ft_pedupdate.trg
 3. Start Run
 - At least 100 events
 4. End pedestal run
- Starting run
 1. “Configure”
 - FT or FT_NOER
 - ♦ “FT” records data
 2. “Download”
 - Ft_selftrigger.trg (cosmic)
 - Clasdev.trg (LED)
 3. “OK”
 4. “Prestart”
 5. “Go”

The screenshot shows the RunControl interface with the following sections:

- Run control Buttons:** Control (Cancel, Reset, Disconnect) and Transition (Configure).
- Static parameters:** Database (clasdev), Session (fittest), Configuration (unknown), rcServer (jlab12daq1.jlab.org).
- Session status:** A table listing various data files and configurations.
- Run parameters:** A table showing integrated and differential data.
- Log output:** A text area at the bottom showing system messages.

Data file	Session	Configuration	rcServer
wolf_er	adcecal1_er	hpsgtp_er	
wolf	ltcc0_noer	sector3	
test1	sector1_er	adcoft1_test	
dvcs_er	hpsgtp	adcoft2_test	
sector6_er	adcecal1	adcoft3_test	
sector1	sector2	ctof1	
sector2_er	sector4_er	dcrb2	
sector3_er	dcrb1	FT	
test0	adcecal5	ond1	
highbtest	sector5	ft	
sector6	FT_NOER	FT_test	
ltcc0	sector4	test2	
ctoftest	sector5_er		
ctofpc1	ECAL		
hates			

	Events/S	Rate (KB/S)
Integrated	62.0809	7210.7356
Differential	63.0000	7423.3800

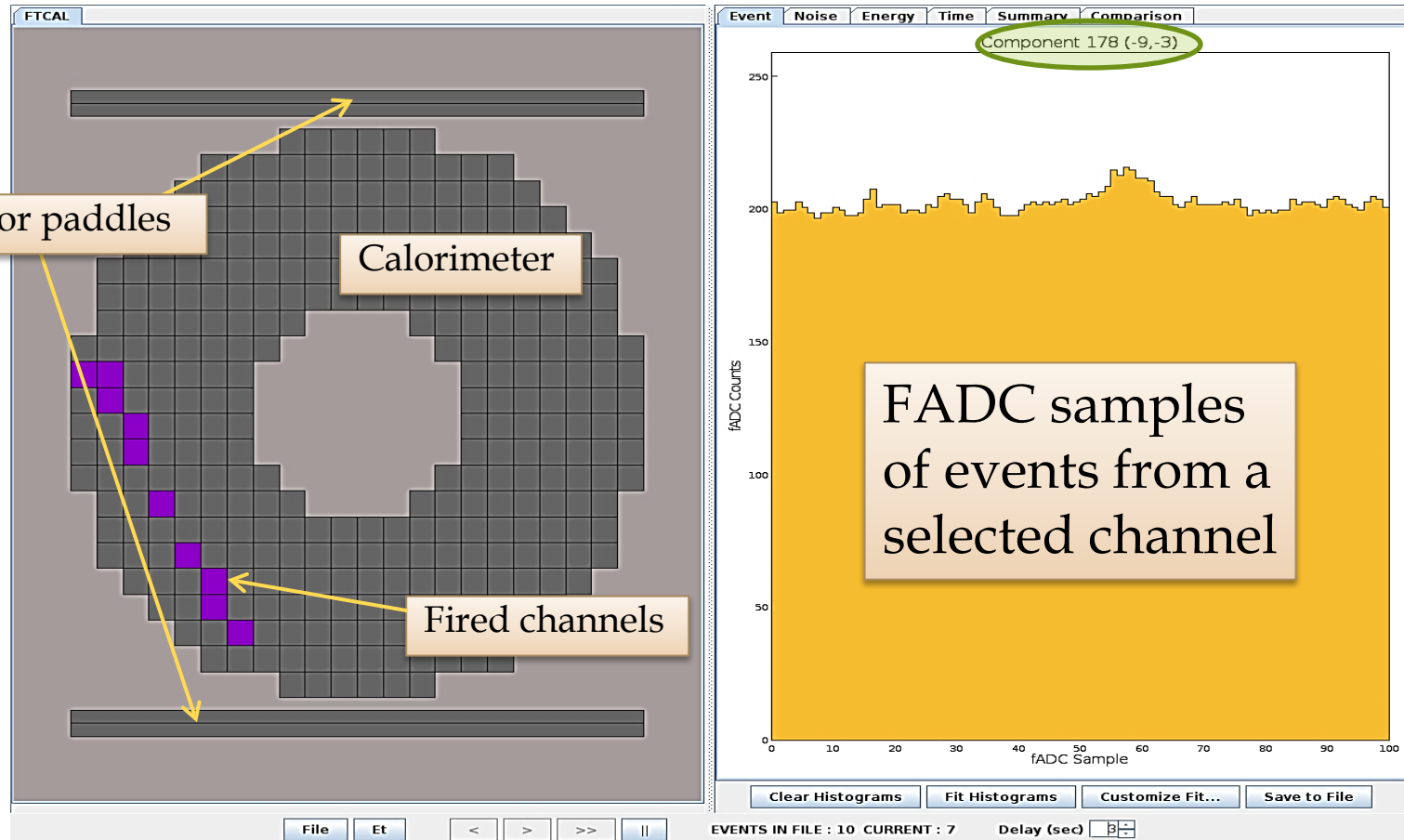
```

INFO : adcoft1 go.....
INFO : ET81 go.....
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INFO : adcoft2 end.....
INFO : adcoft1 end.....
INFO : EB81 end.....
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INFO : transition End succeeded !
INFO : runNumber is now: 707
INFO : Run number is 707
  
```



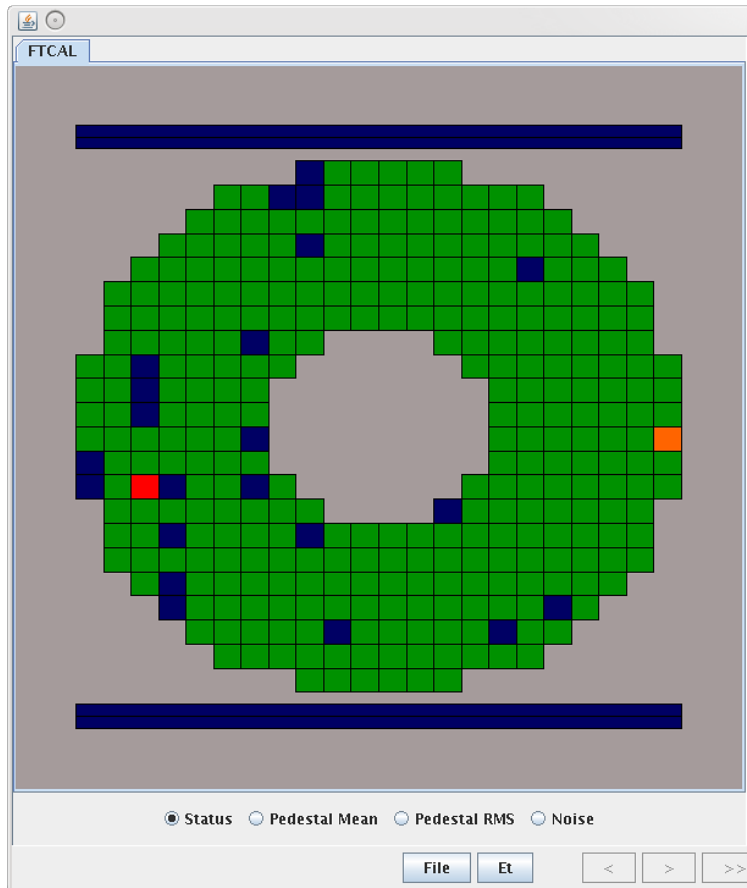
FT-Cal Events

Shown for detector in horizontal position



FT-Cal Noise

Channel color is determined by RMS of mean of channel noise



- Green
 - Noise within accepted range
- Blue
 - Possible problematic channels with some noise
- Orange
 - Problematic channels with high noise



Debugging

- Grounding issue
- Preamplifier saturation
- PIC32 connection error
- FT-Cal signal instability
- FT-Hodo light leak
- FT-Trck problems



Grounding Issue

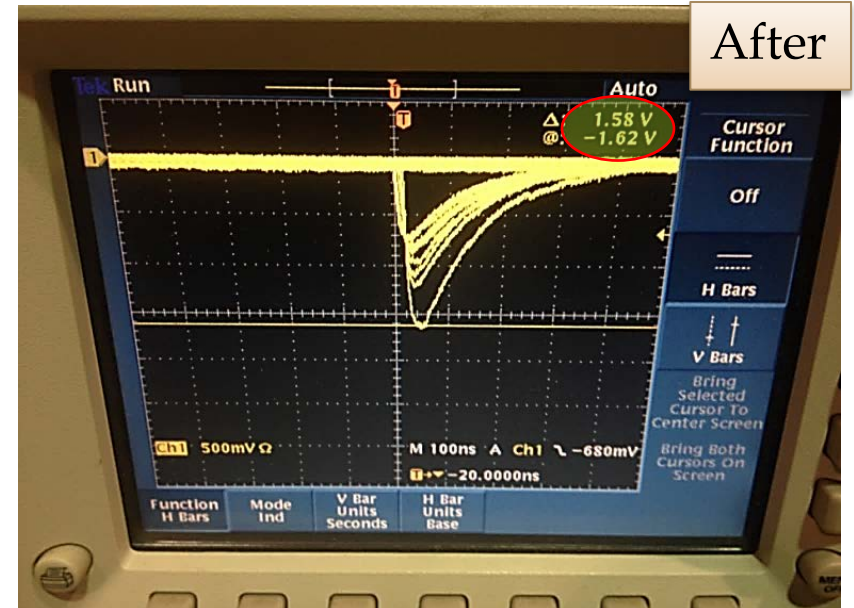
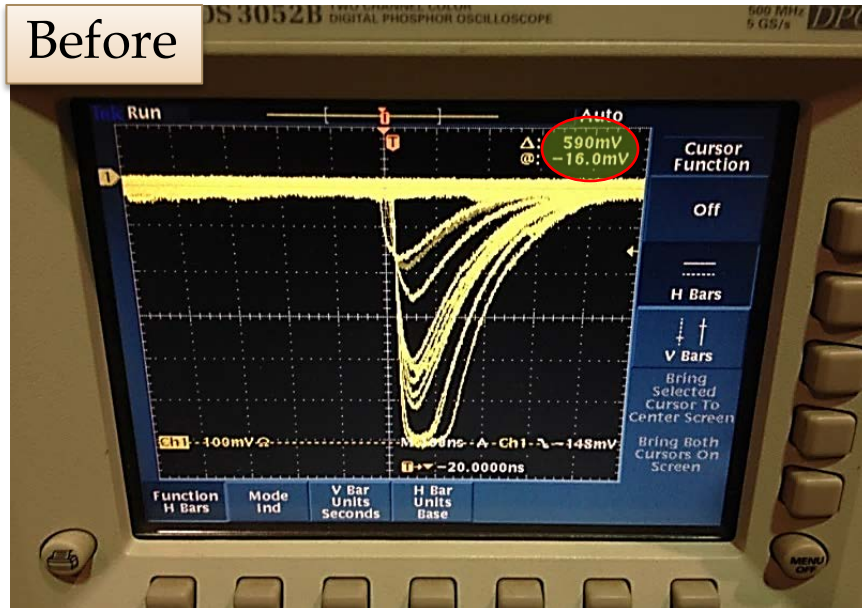
Signal instability at output in calorimeter

- Marc and Brian grounded racks
- FT-Cal and FT-Trck LV supplies may need further grounding



Preamplifier Saturation

- Modification of gain in preamplifiers caused saturation at 600 mV
- Several gain-change modifications to fix problem
 - Modifications allowed for no saturation at 1.6 V
 - Further modifications conducted to adjust gain and fix pileup
- Last modification will be tested in September, 2016



PIC32 Connection Error

- Connection to sensor boards through i²C bus stopped working after power down/up
- Commands sent to PIC32 caused microcontroller to freeze
- Level translator chip of SiPM controller board was exchanged

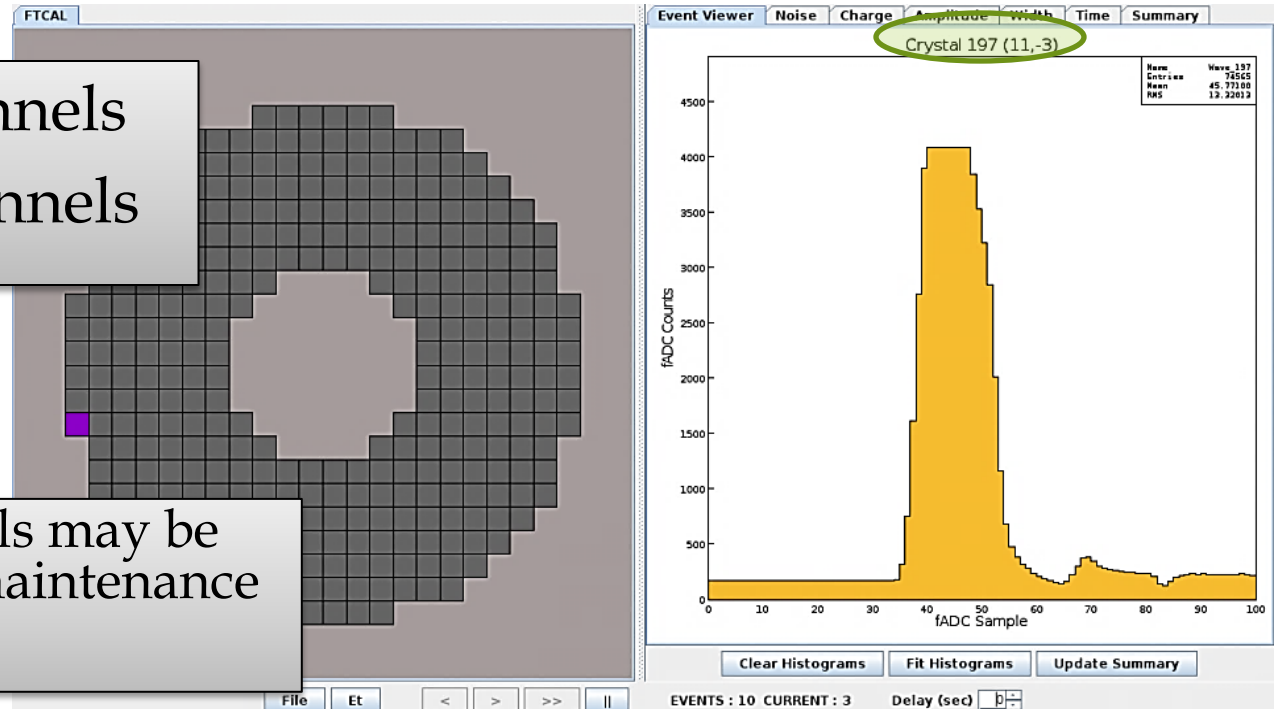


FT-Cal Signal Instability

- Channels with unstable signals causing detector to constantly fire
- Tests from turning on and off HV to detectors and taking runs found:

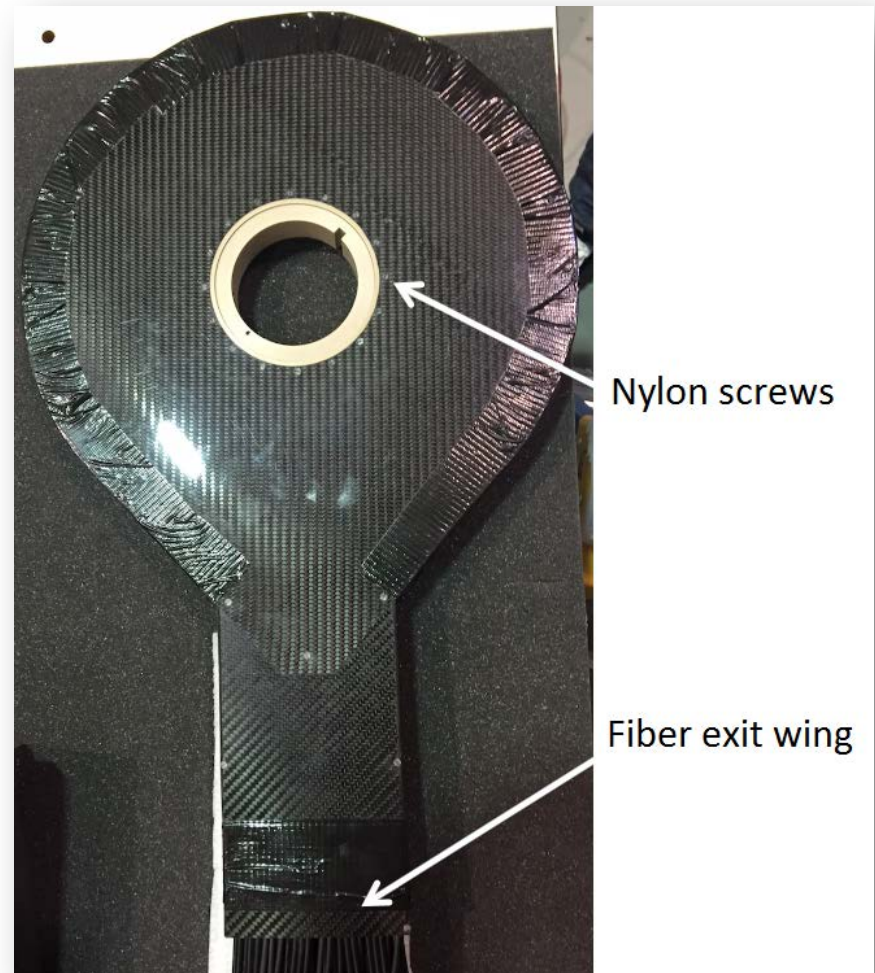
- 6 dead channels
- 3 noisy channels

Problematic channels may be fixed during final maintenance in October, 2016



FT-Hodo Light Leak

- Observed gain fluctuations during changes in ambient light
- Determined main culprit to be nylon screws
- Some light also leaking in from fiber exit wing
- Proposed using titanium screws and/or aluminum/Kapton tape



FT-Trck Problems

- Spike in current
- LV channels randomly tripping
- Saclay currently working on debugging
- Testing scheduled for September, 2016



Future Plans

- Forward Tagger HV, LV, gas turned off
 - Planned for power-up in September, 2016
- Installation planned for **November, 2016**



Conclusion

DSG assisting in fabrication, debugging, and overall support

- Gas systems support
 - George, Sahin, Marc
- Hardware support
 - Mindy and Sahin
- Slow Controls and interlocks development
 - Pete, Brian, Mary Ann, and Amanda
- Safety support from DSG
 - THA and OSP completed and displayed



Acknowledgement

Many thanks to collaborators for the opportunity to work with the Forward Tagger

- Marco Battaglieri
- Raffaella DeVita
- Erica Fanchini
- Gary Smith
- Harkirat Mann
- Talha Rehman





Thank you

