

Testbeam monitoring

(Data Quality Monitor)

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* (also with **FERMILAB**)

Outline

- ▶ **General/Features**
- ▶ **Input/Output**
- ▶ **Code structure/Classes**
- ▶ **Info displayed**
- ▶ **Summary**

General

- ▶ **application for testbeam monitoring**
 - : code arranged in client-server parts (**GUI** and **SENDER**)
 - : the different parts communicate through a socket
i.e. can live and run at the same pc or at different pc's
- ▶ **tasks**
 - : **GUI's** task
 - ▷ to provide a basic functionality through entry fields and action buttons
 - ▷ to display the info that the sender sends
 - : **SENDER's** task
 - ▷ to process the data and send plots and numeric info to gui
 - ▷ to create persistent output (.root, .printout.ps, .log.txt, etc)

General features



- : requires ROOT 4.02/04 or higher
- : communication through secure connection using ssh is possible
i.e. gui and sender running in pc's that are behind different firewalls
- : multiple types of transmission can occur,
currently one light and very frequent (say every 10events) and
one heavy and less frequent (say every 1000s events or some minutes)
- : modular arrangement of components/detectors
easy to add/handle new ones
- : gui's display pads invoke ROOT interactively
- : it is a light application, easy to install/run

General features

▶ info transmitted and displayed

▷ numerical

: event labels (eg run#, event#, time)

: counters per detector (eg beam, pedestal, led events)

▷ graphical

: 3d event display

: daq rate, badreadout, time series ...

: tdc time signal, track coordinates

: Ecal hits, energy, pedestals/noise ...

Hcal hits, energy, pedestals/noise, leds ...

Tcmt hits, energy, pedestals/noise, leds ...

: shower barycenter in Ecal, Hcal and 1d, 2d projections

: particle id plots, veto signal

: cross check plots, Tracker vs Ecal vs Hcal ...

Input/Output

▶ **input**

- : .bin data files produced by DAQ
- + mapping files for Tdc, Ecal, Hcal, Tcmt ...
- + calibration constants for Ecal, Hcal, Tcmt ...

▶ **output**

- : Monitor<run>.<file>.root
- Monitor<run>.<file>.printout.ps
- Monitor<run>.<file>.log.txt
- + for Hcal and Tcmt Monitor<run>.<file>.HcalLed.dat, ..Ped.dat

Classes

▶ v01.00 (60+ classes)

EcalPcbPad	HcalProdTile	TcmtReadoutStrip	TriggerExtractor	DatMgr
EcalReadoutPad	HcalReadoutTile	TcmtPhysStrip	VetoRawAdcExtractor	RunMgr
EcalPhysicalPad	HcalPhysTile	TcmtMap	VetoMap	Handler
EcalMap	HcalMap	TcmtAdc	VetoHandler	MonitorMgr
EcalAdc	HcalAdc	TcmtEnergy	VetoMonitor	Monitor
EcalEnergy	HcalEnergy	TcmtCalibration	Tdc	SharedMonitor
EcalCalibration	HcalCalibration	TcmtRawAdcExtractor	TdcChannel	SocketClient
EcalRawAdcExtractor	HcalRawAdcExtractor	TcmtPedestalCalculator	Chamber	MyMainFrame
EcalPedestalCalculator	HcalPedestalCalculator	TcmtEnergyCalculator	ChamberChannel	MySpyMainFrame
EcalEnergyCalculator	HcalEnergyCalculator	TcmtHandler	TdcMap	MessageHeader
EcalHandler	HcalHandler	TcmtMonitor	TdcExtractor	MessageObj
EcalMonitor	HcalMonitor		Track	MyEventDisplay
			TdcHandler	
			TdcMonitor	

■ general analysis classes

■ gui related classes

Classes (modular arrangement)



COMPONENTS-DETECTORS

(DHCAL)

DhcalReader
DhcalEvt

DhcalMap
DhcalReadoutPad
DhcalPhysPad

DhcalHandler
DhcalRawHitExtractor
DhcalHits
DhcalEnergy
DhcalMonitor

(ECAL)

...

(ECALSCINT)

...

(HCAL)

...

(TCMT)

...

(TDC)

...

(VETO)

BACKBONE

DatMgr
RunMgr
Handler
ClosableMgr
Closable

MonitorMgr
Monitor
SharedMonitor
SocketClient

MyMainFrame
MySpyMainFrame
MessageHeader
MessageObj
MyEventDisplay

■ general analysis classes

■ gui related classes

Histograms

▶ v01.00 (100+ histos)

ECAL

hEcalTriggerEvents
hEcalBadReadout
hEcalHits
hEcalEnergy
hEcalEnergyPerLayer
hEcalHitsPerLayer
hEcalEnergyVsTime
hEcalPedChipAverage.slot7
hEcalPedRMSChipAverage.slot7
hEcalPedChipAverage.slot15
hEcalPedRMSChipAverage.slot15
hEcalPedChipAverage.slot17
hEcalPedRMSChipAverage.slot17
hEcalPedChipAverage.slot19
hEcalPedRMSChipAverage.slot19
...

HCAL

hHcalTriggerEvents
hHcalBadReadout
hHcalHits
hHcalEnergy
hHcalEnergyPerLayer
hHcalHitsPerLayer
hHcalEnergyVsTime
hHcalHitEnergy
hHcalHitAdc
hHcalLedPerLayer
hHcalPedPerLayer
hHcalPedRMSPerLayer
hHcalPedChipAverage.slot9
hHcalPedRMSChipAverage.slot9
hHcalPedPerChannel.slot9
hHcalPedRMSPerChannel.slot9
...

TCMT

hTcmtTriggerEvents
hTcmtBadReadout
hTcmtHits
hTcmtEnergy
hTcmtEnergyPerLayer
hTcmtHitsPerLayer
hTcmtEnergyVsTime
hTcmtHitEnergy
hTcmtHitAdc
hTcmtLedPerLayer
hTcmtPedPerLayer
hTcmtPedRMSPerLayer
hTcmtPedChipAverage.slot12
hTcmtPedRMSChipAverage.slot12
hTcmtPedPerChannel.slot12
hTcmtPedRMSPerChannel.slot12
...

Tracker

hTimeX0
hTimeY0
hTimeX1
hTimeY1
hTimeX2
hTimeY2
hTimeX3
hTimeY3
hTrackX0
hTrackY0
hTrackX1
hTrackY1
hTrackX2
hTrackY2
hTrackX3
hTrackY3
...

hTriggerRate
hBadReadout

ParticleID

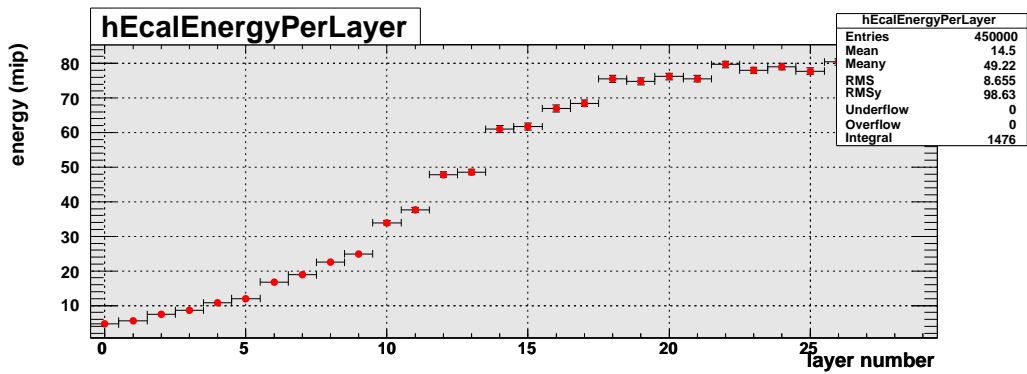
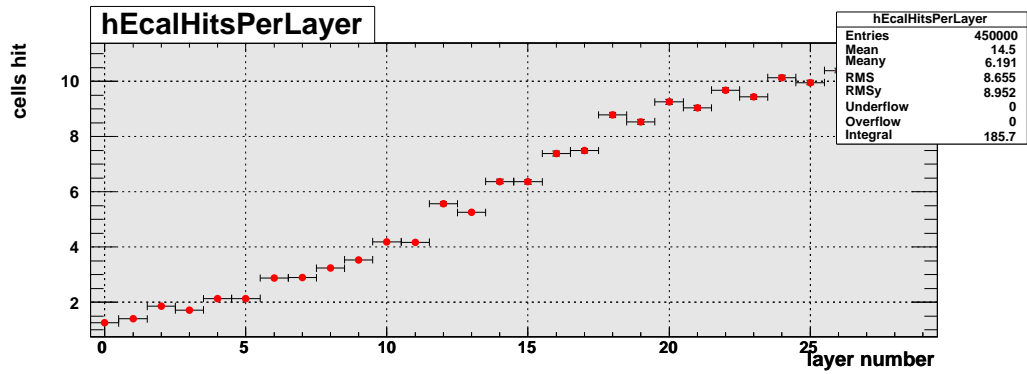
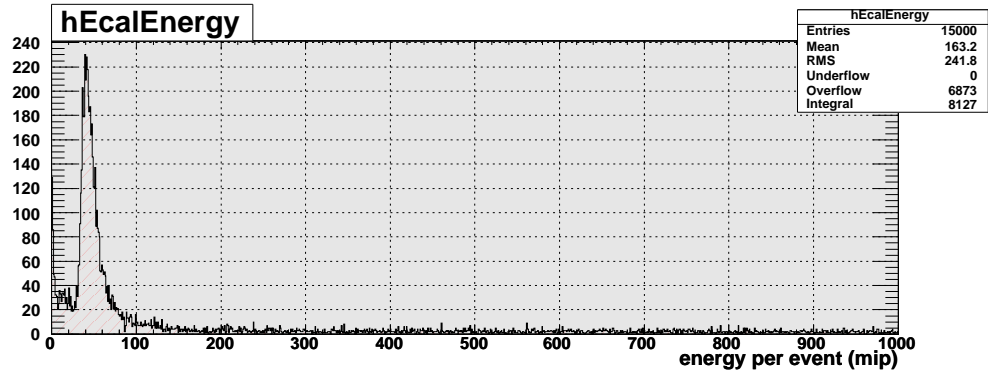
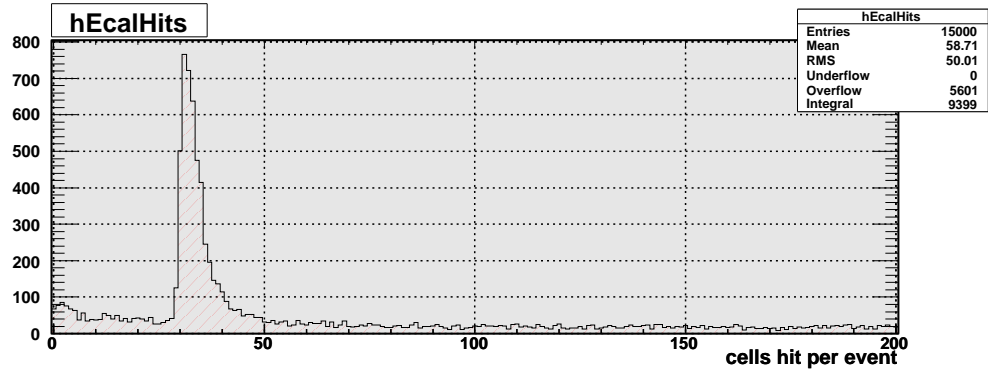
hEcalEnergyCherON/OFF
hEcalEnergyPerLayerCherON/OFF
hHcalEnergyCherON/OFF
hHcalEnergyPerLayerCherON/OFF

CrossChecks

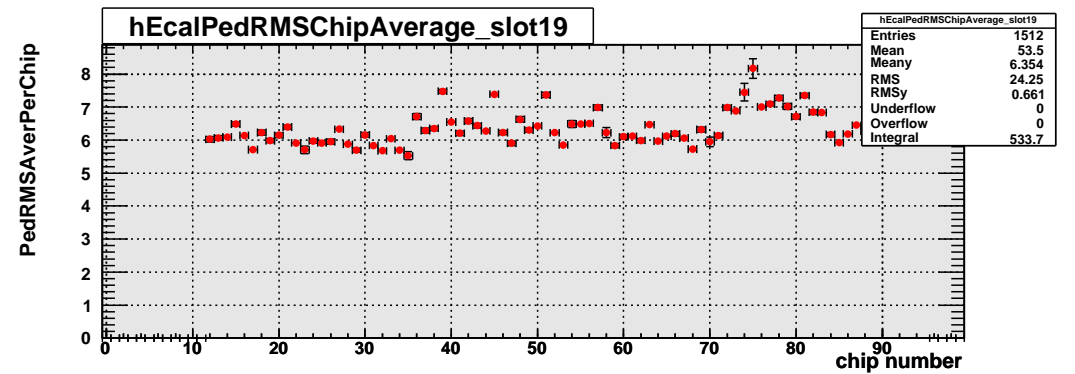
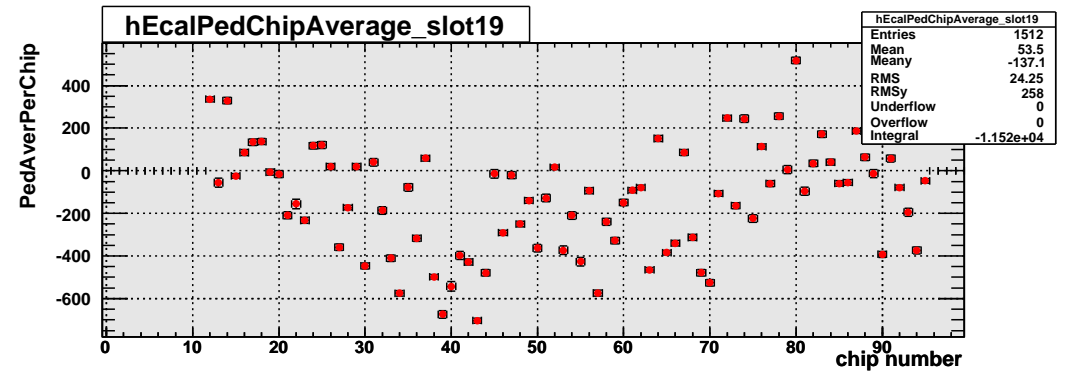
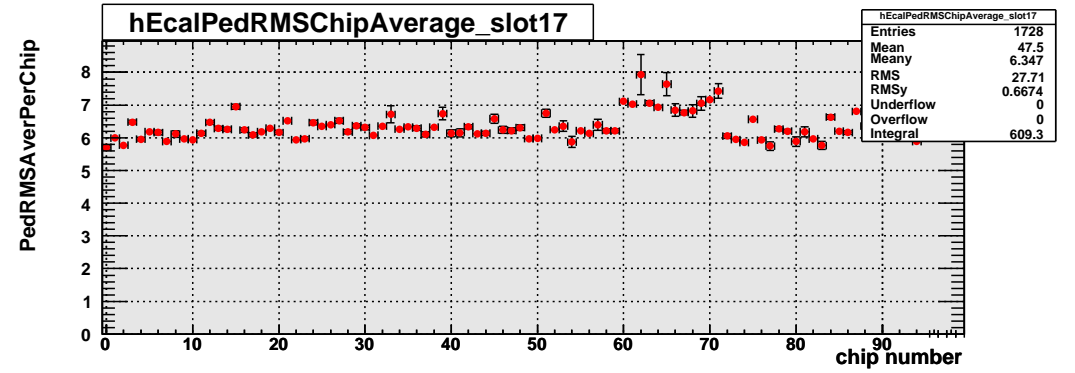
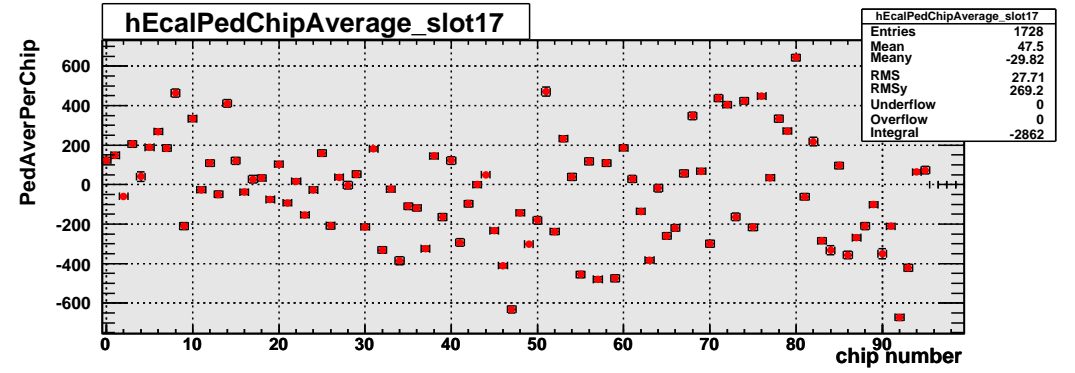
hTrackBackX.vs.EcalFrontX
hTrackBackY.vs.EcalFrontY
hTrackBackX.vs.HcalFrontX
hTrackBackY.vs.HcalFrontY
hHcalFrontX.vs.EcalBackX
hHcalFrontY.vs.EcalBackY
hHcalEnergy.vs.EcalEnergy
hHcalHits.vs.EcalHits
...

▶ arranged in 25+ gui panels (=printout pages)

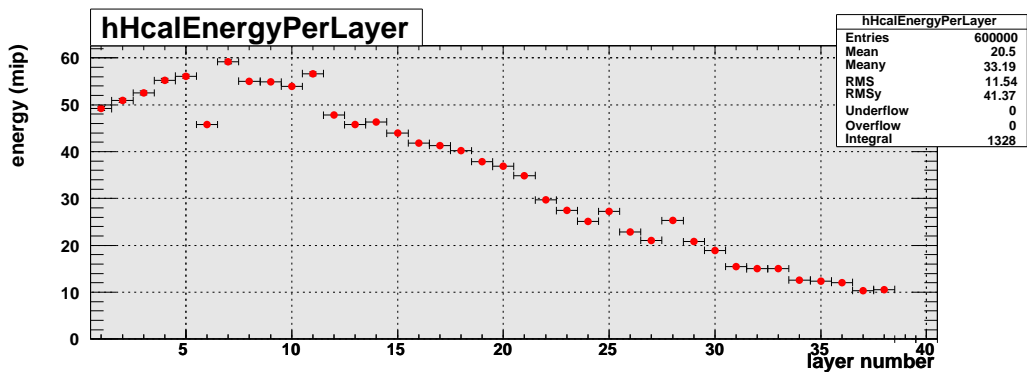
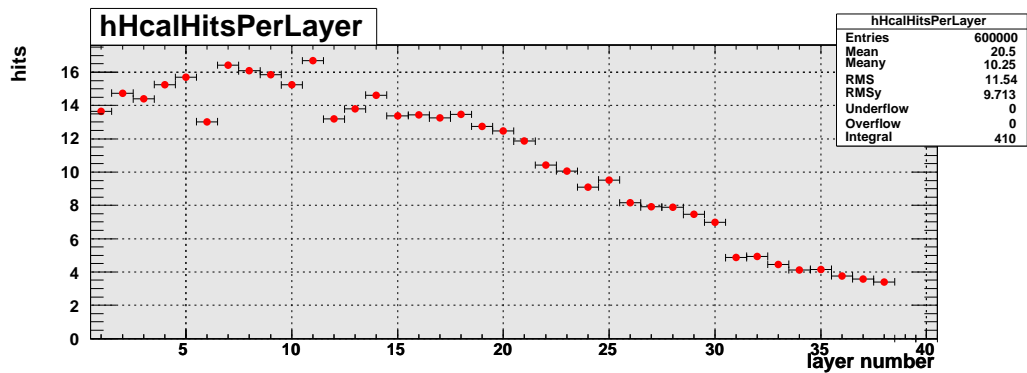
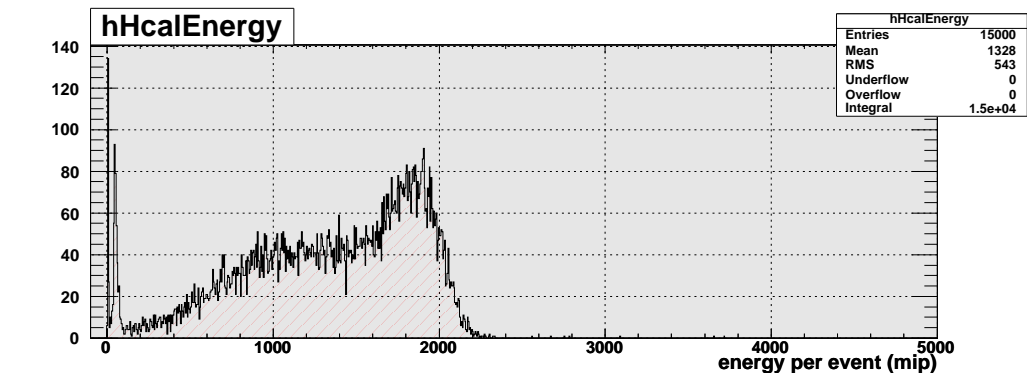
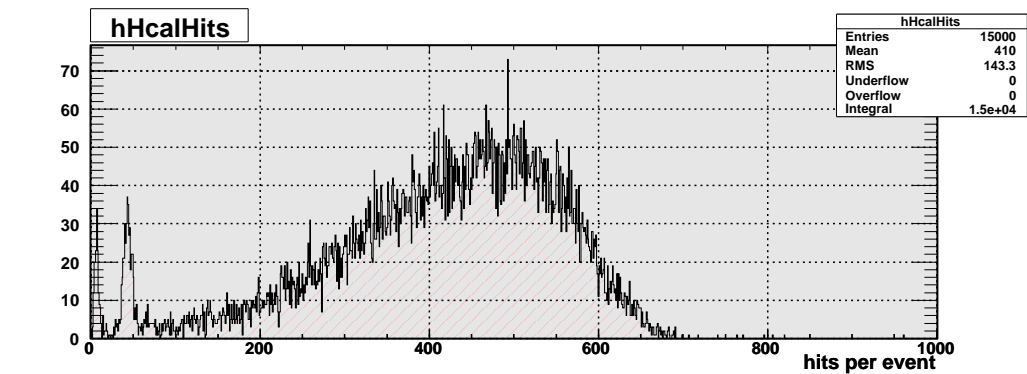
ECAL Response



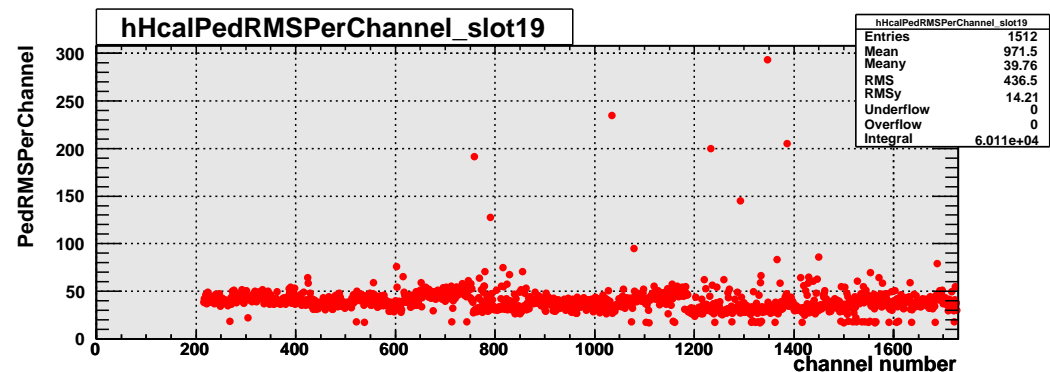
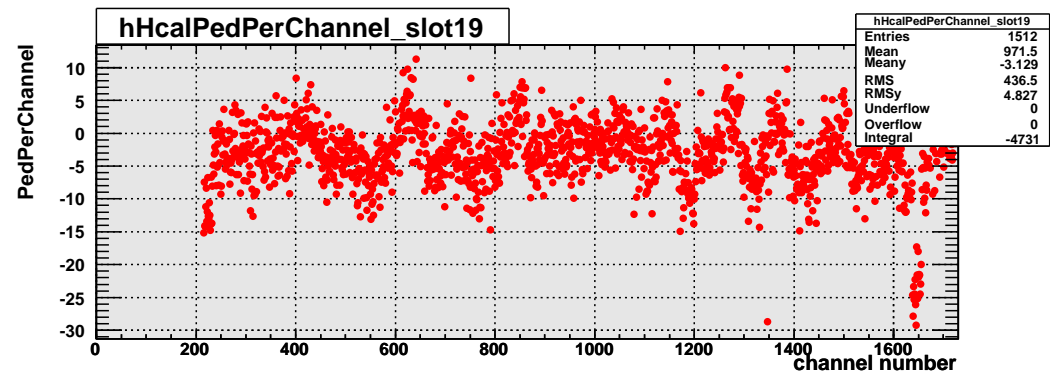
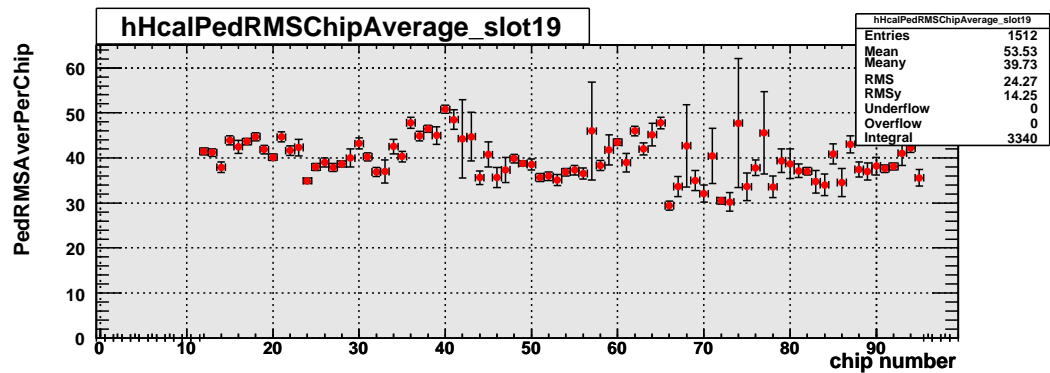
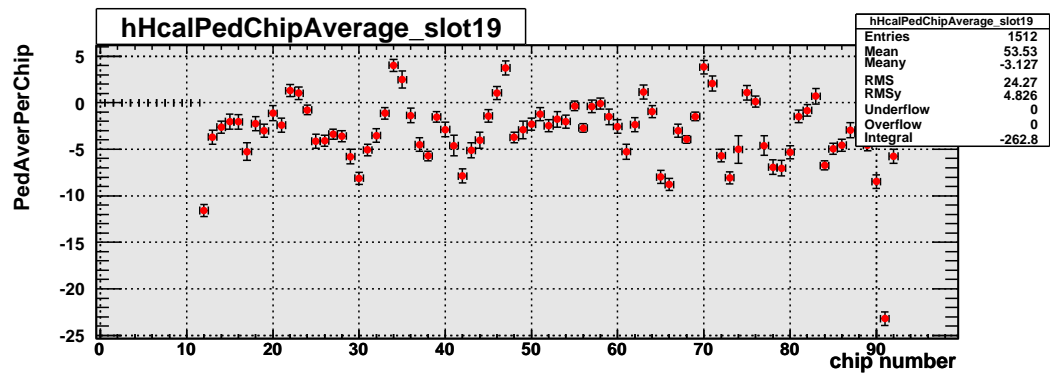
ECAL Pedestals/Noise



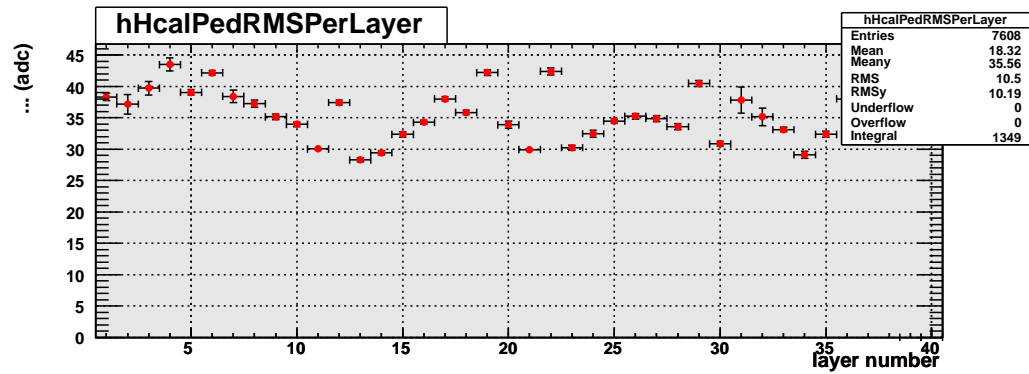
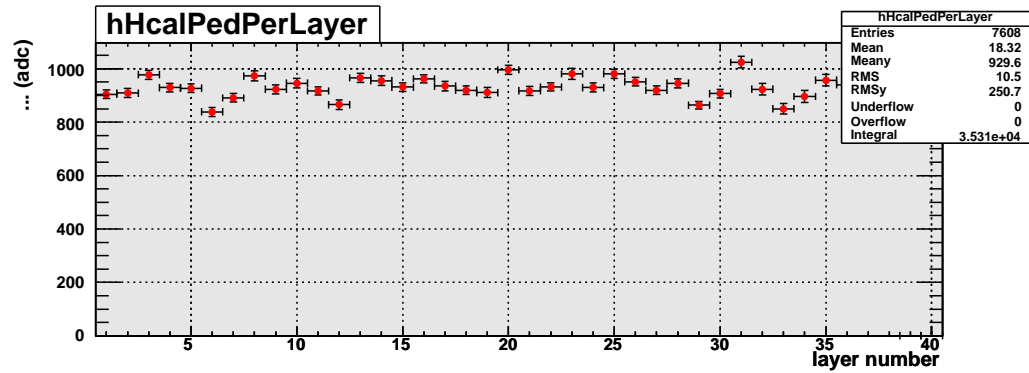
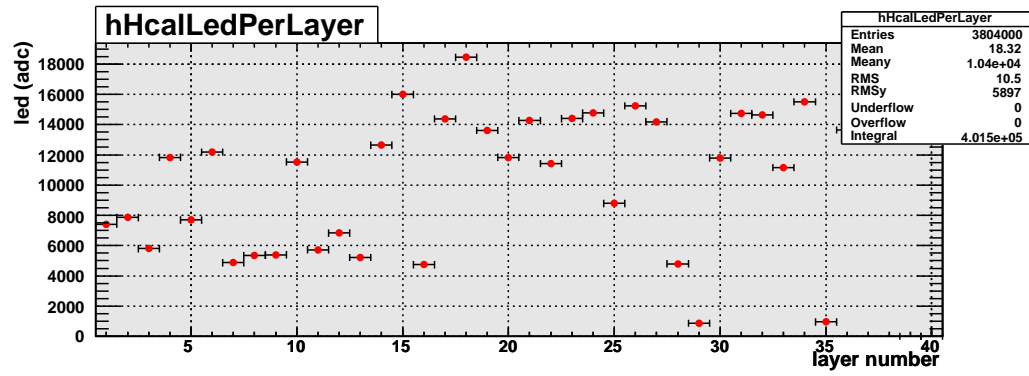
HCal Response



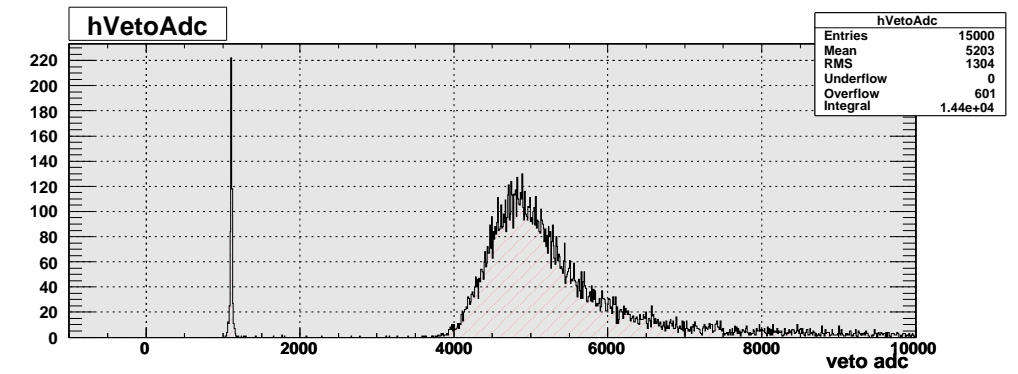
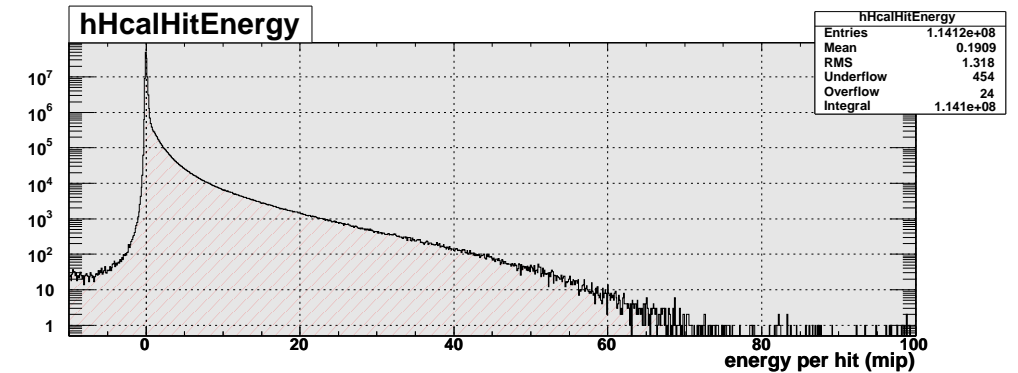
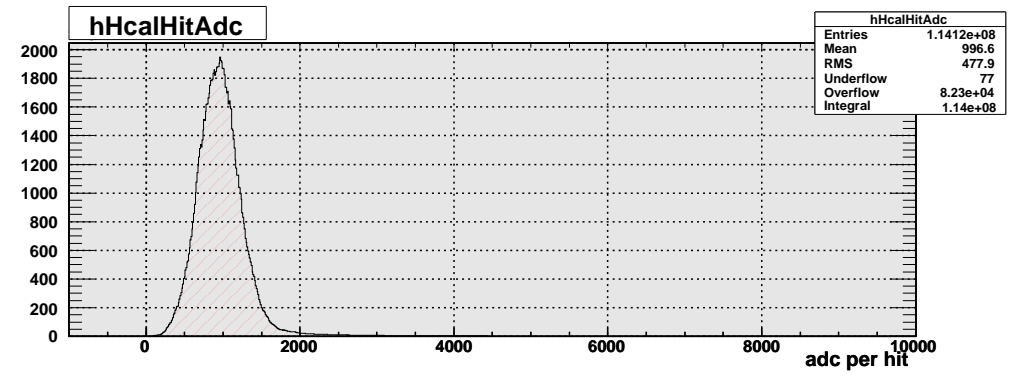
HCal Pedestals/Noise



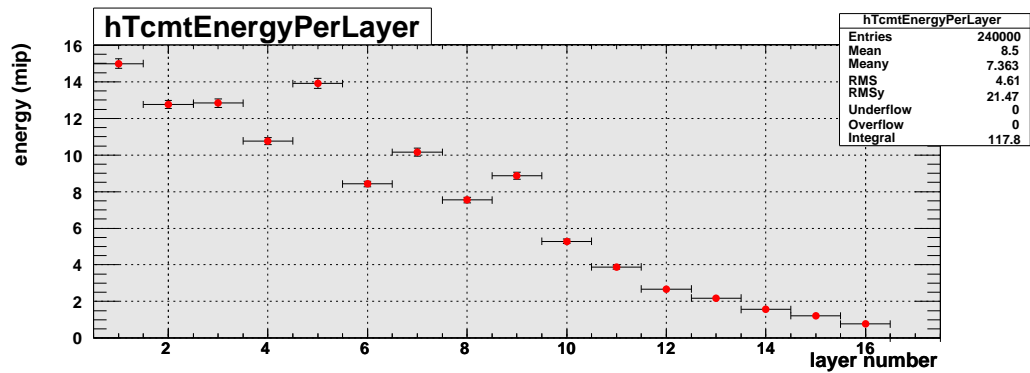
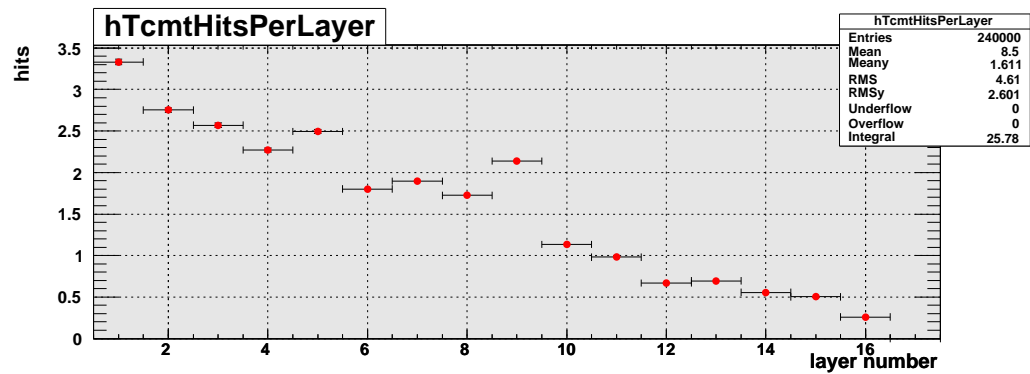
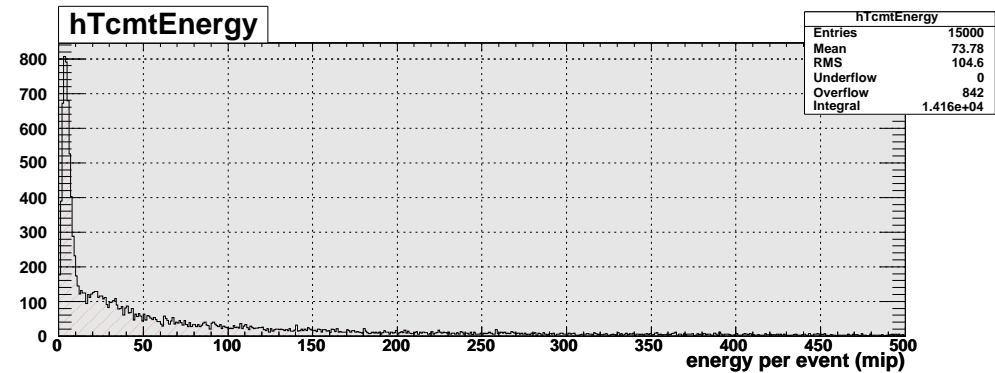
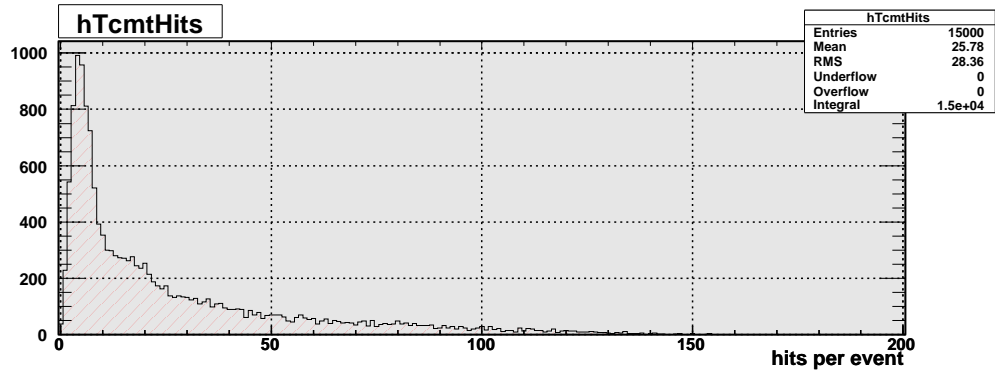
HCAL Leds



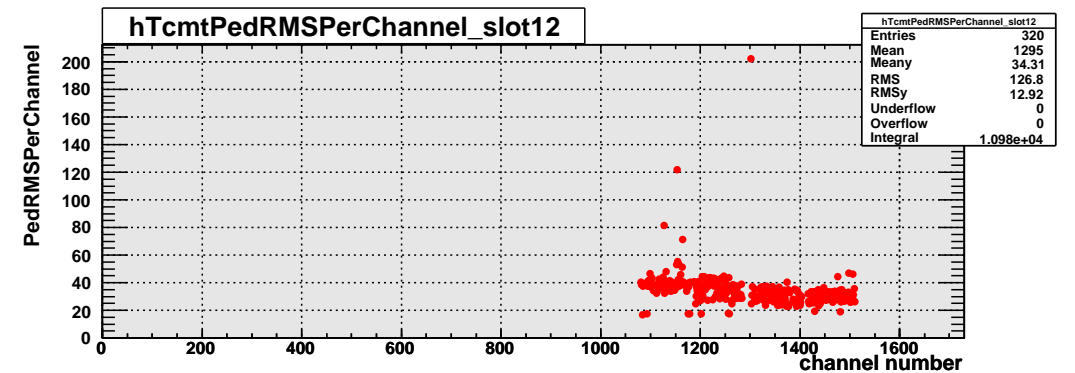
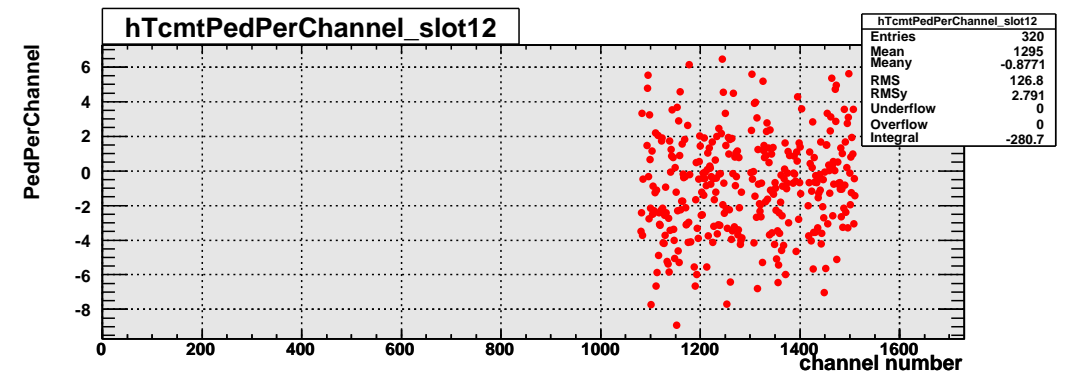
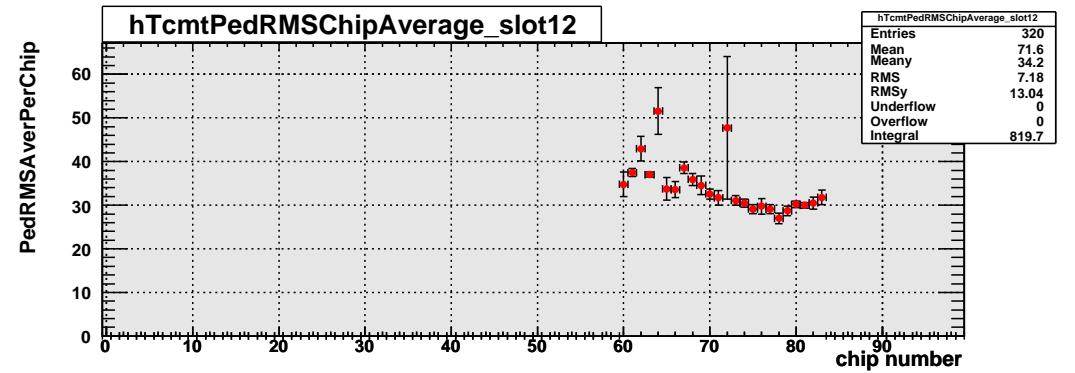
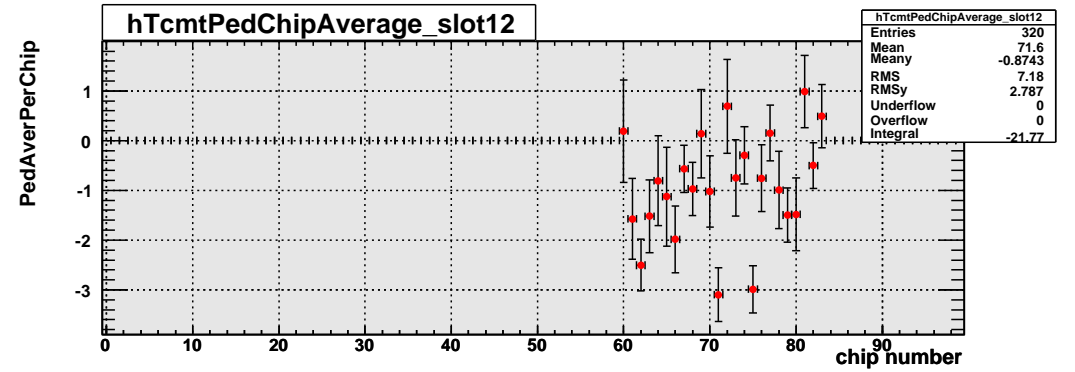
HCAL Misc



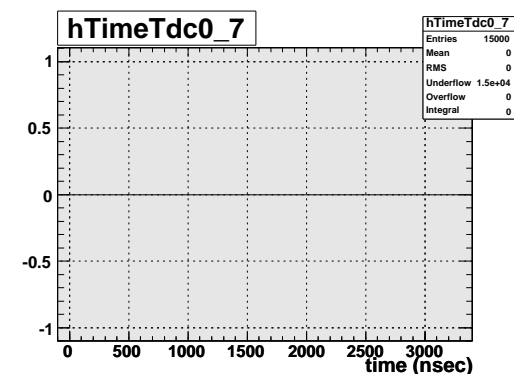
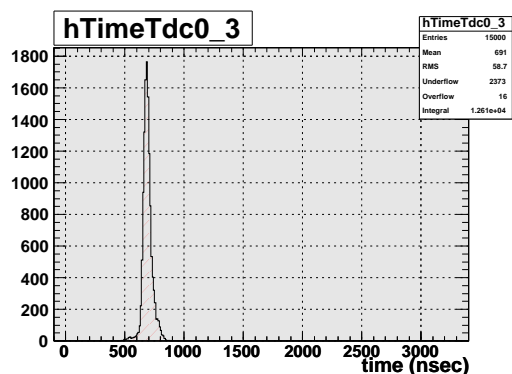
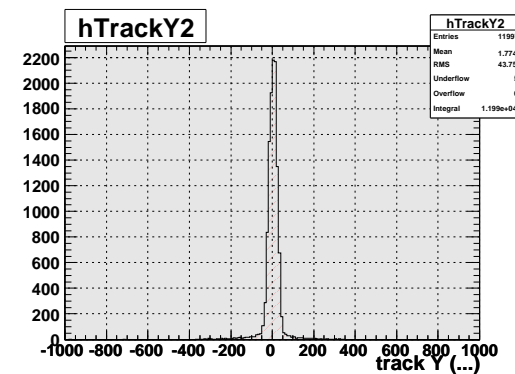
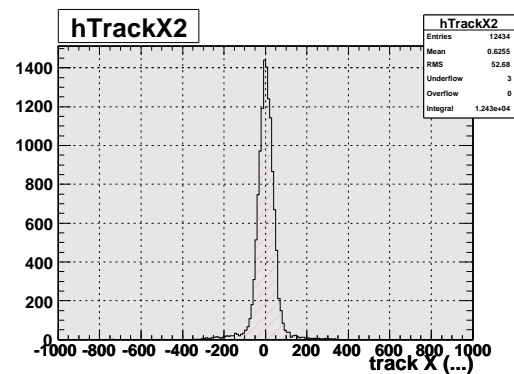
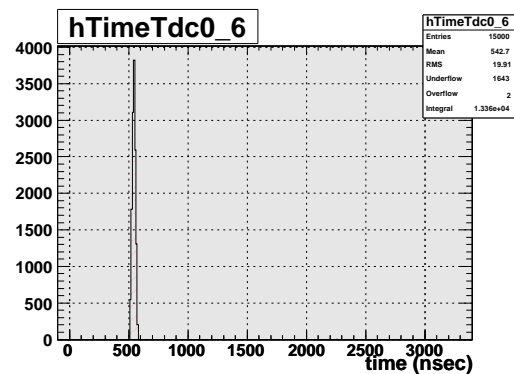
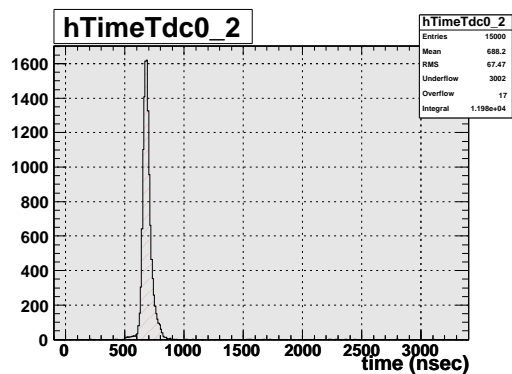
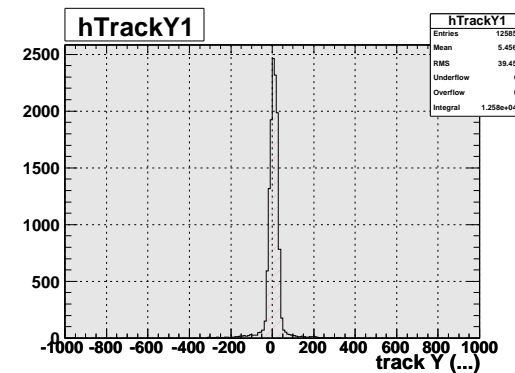
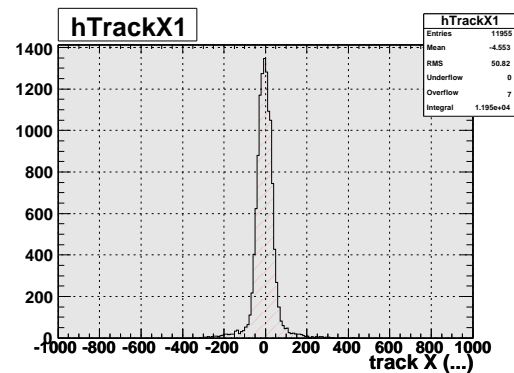
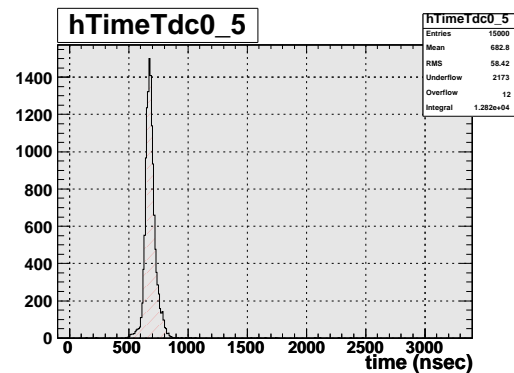
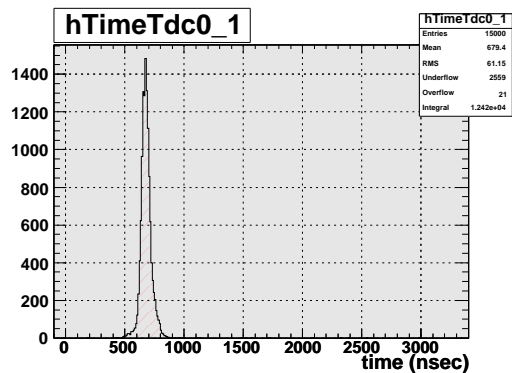
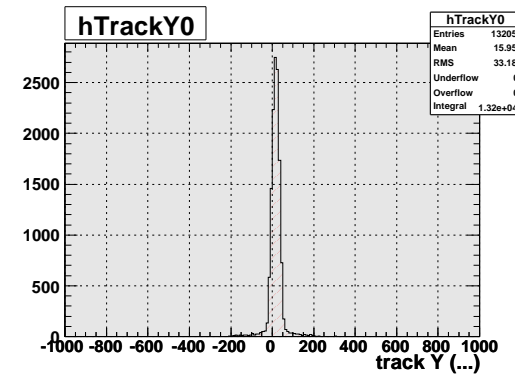
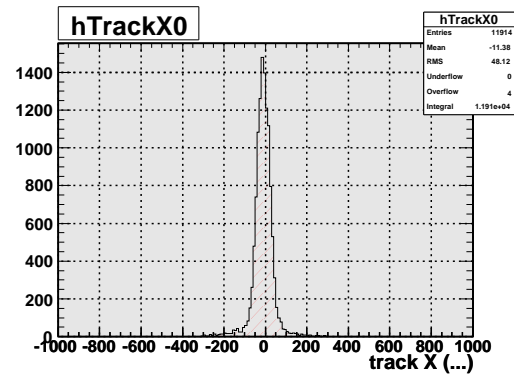
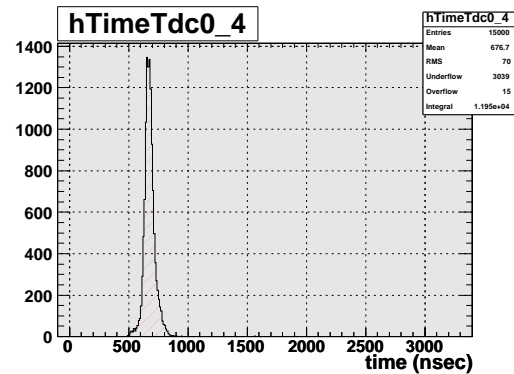
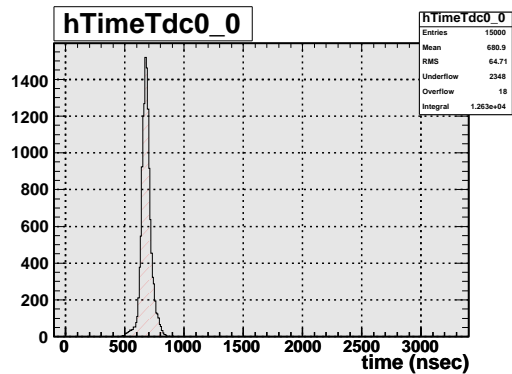
TCMT Response



TCMT Pedestals/Noise

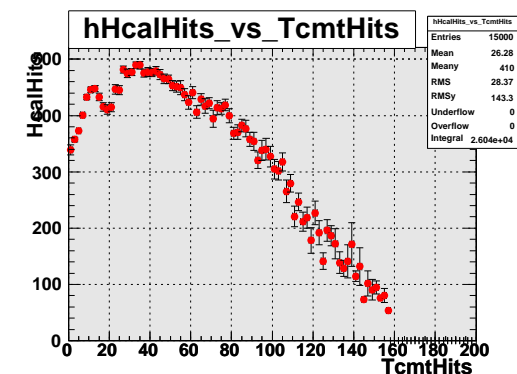
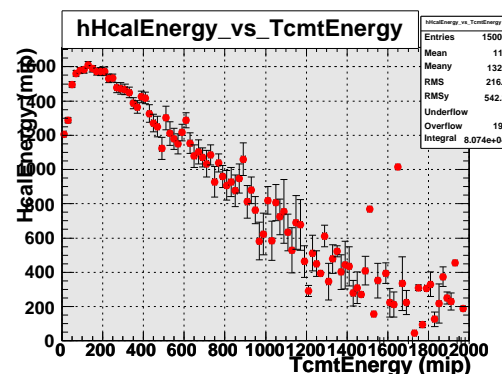
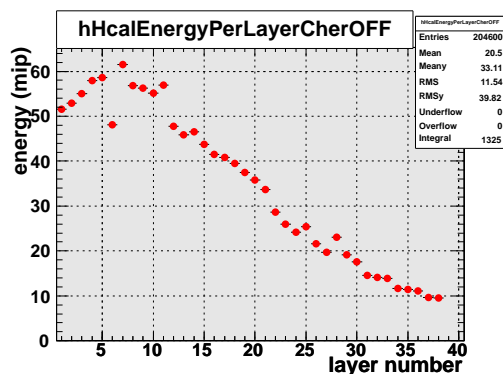
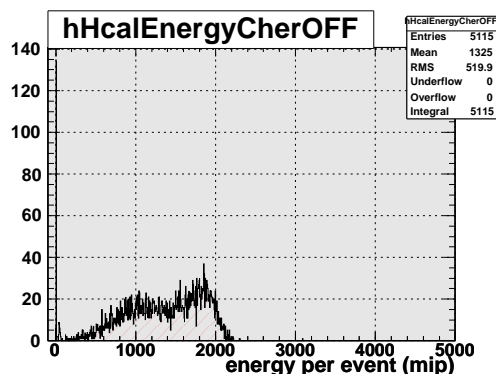
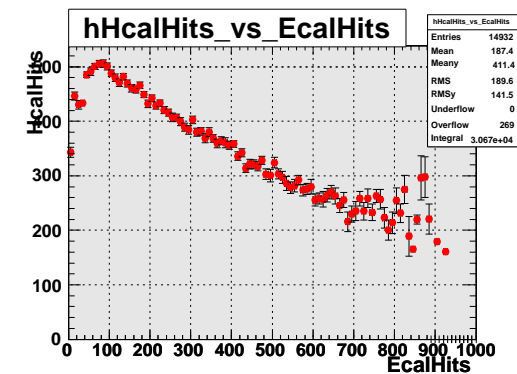
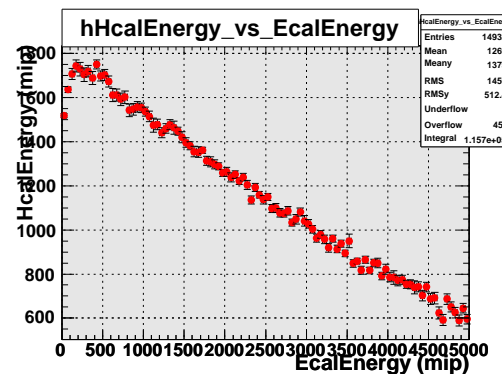
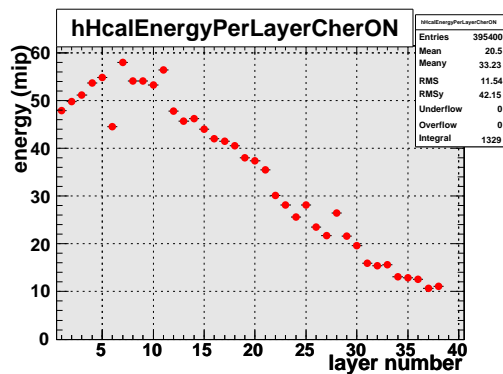
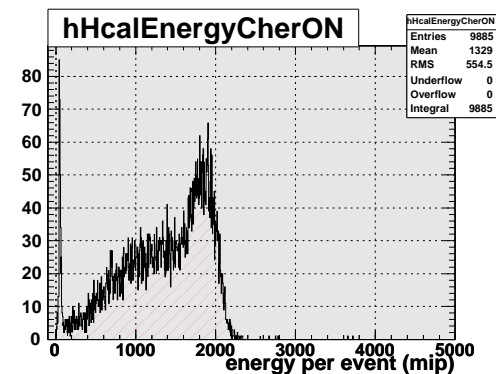
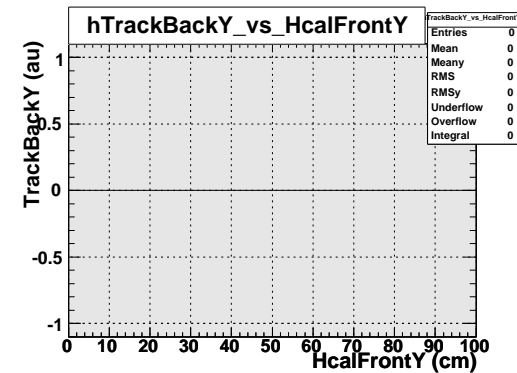
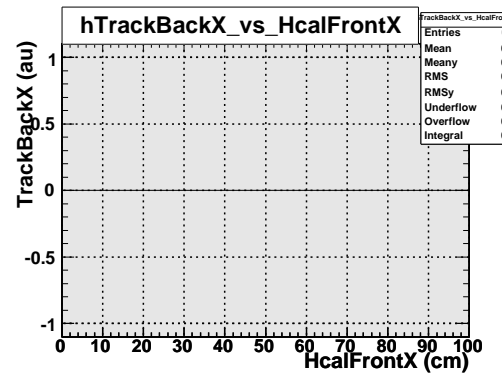
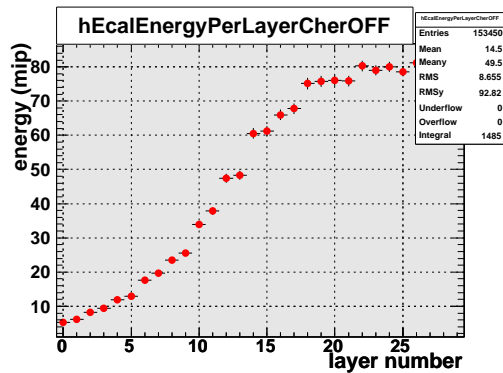
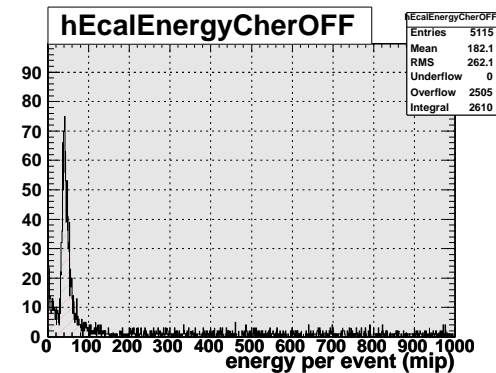
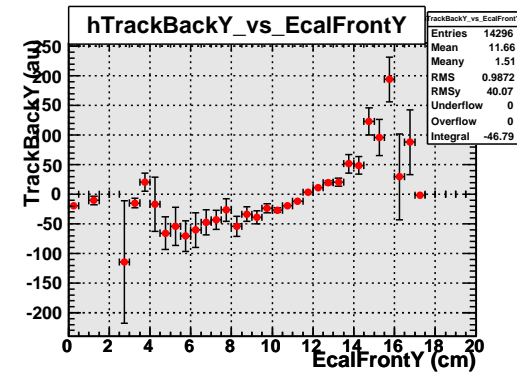
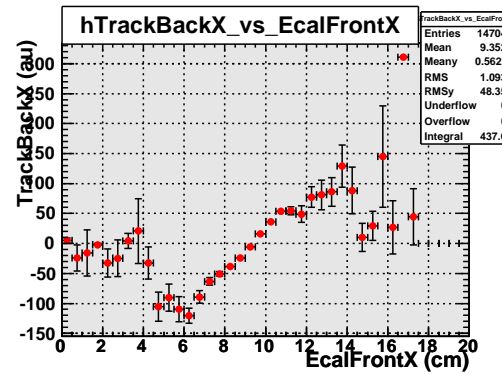
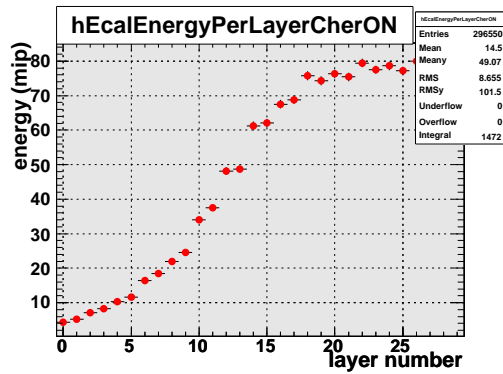
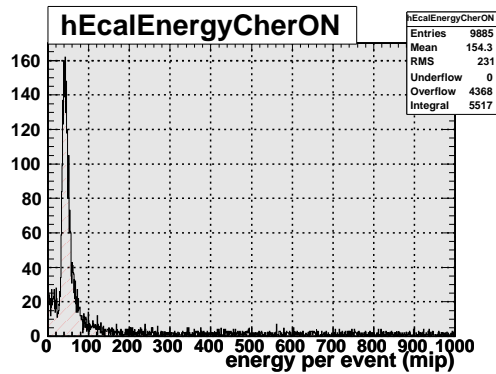


Tracker XY (time)

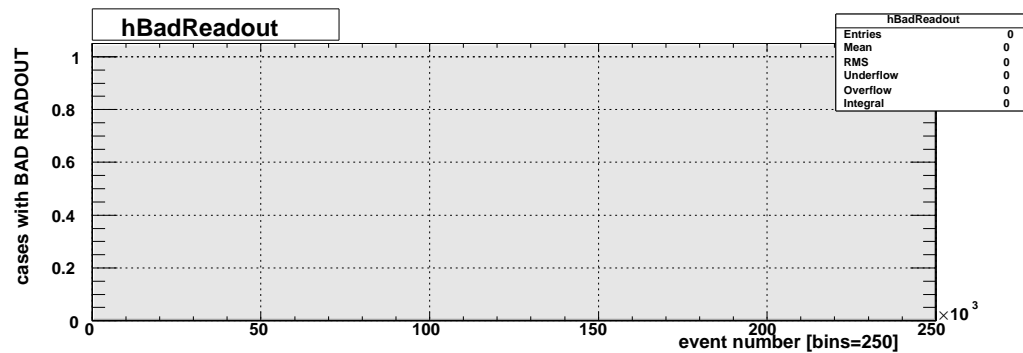
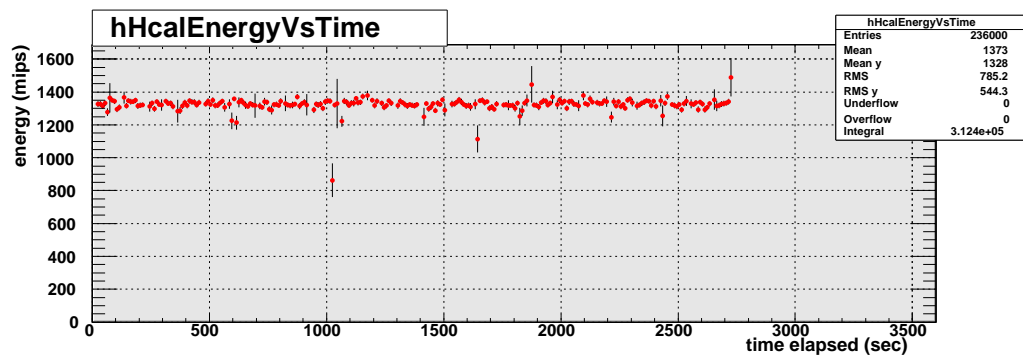
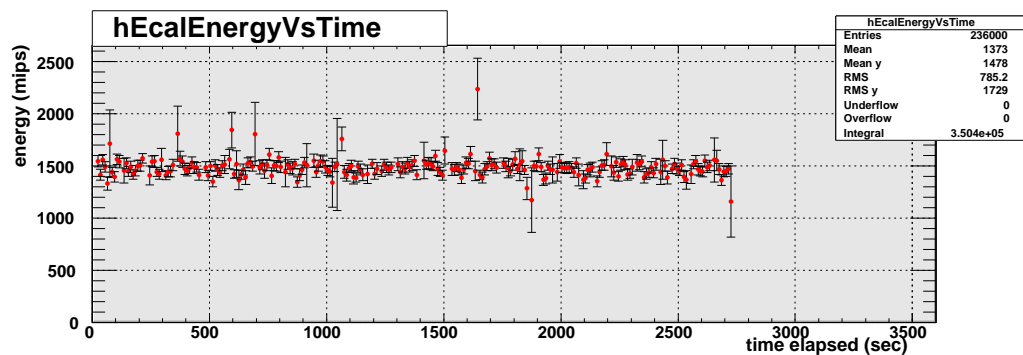
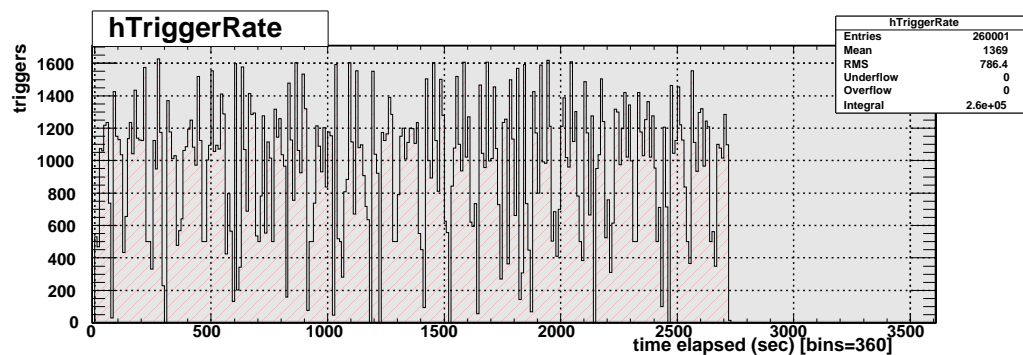


ParticleID

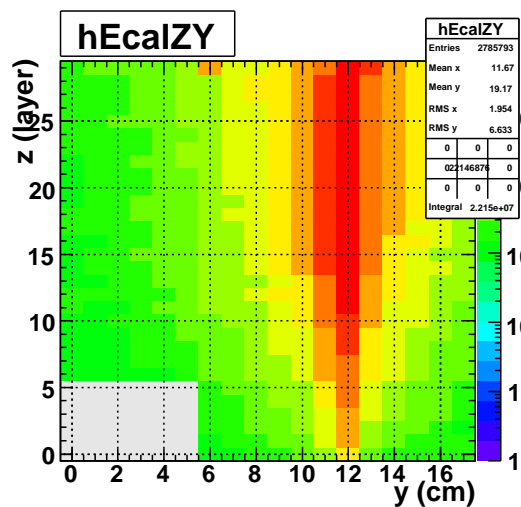
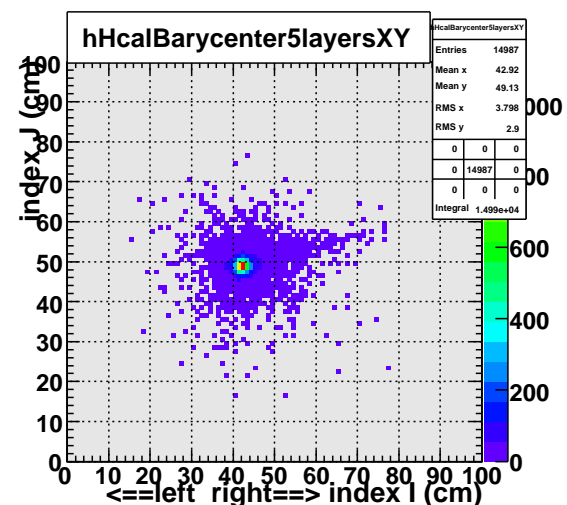
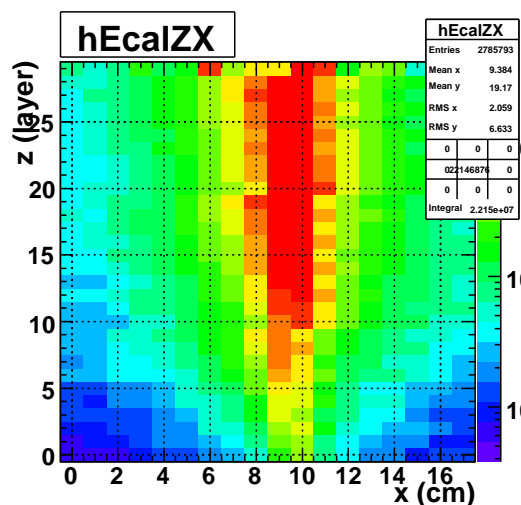
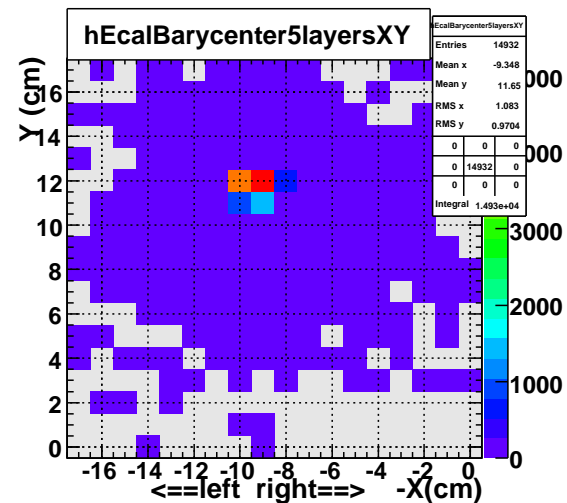
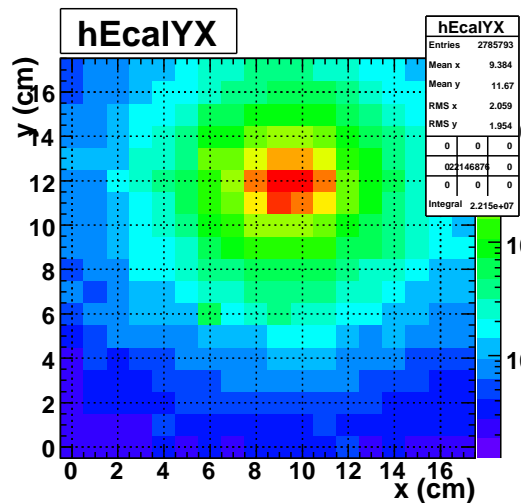
Cross checks



Main panel



Shower Projections/Barycenters



Status table

Monitor
ECAL | HCAL | TCMT | Tracker | ParticleID | Display3D | CrossChecks | Status | Settings

hTriggerRate

Entries	1291
Mean	3.439
RMS	2.831
Underflow	0
Overflow	0
Integral	1091

hEcalEnergyVsTime

Entries	90
Mean	14.89
MeanY	1271
RMS	1.248
RMSY	1676
Underflow	0
Overflow	0
Integral	4768

hHcalEnergyVsTime

Entries	90
Mean	14.89
MeanY	589.7
RMS	1.048
RMSY	332.8
Underflow	0
Overflow	0
Integral	317.2

hBadReadout

Entries	0
Mean	0
RMS	0
Underflow	0
Overflow	0
Integral	0

Events processed

Total	1091
-------	------

Ecal counters

Total	1090
Pedestals	500
Leds	0
Triggers	90
BadReadout	0

Hcal counters

Total	1090
Pedestals	500
Leds	500
Triggers	90
BadReadout	0

Tdc counters

Total	90
NoTdc	0
TdcOverflow	0
BadTrack	0

TCMT counters

Total	1090
Pedestals	500
Leds	500
Triggers	90
BadReadout	0

Run

999

File From To

0 0

Threshold(mip)

0.5

EventSample

1091

Update(events)

1090

Update(sec)

100

Start

Exit

Help

Pause

Continue

Print

STOPPED

Time: 17:15:20:953.259 Mon Aug 28 200 Run: 300329.000 Events: 1090

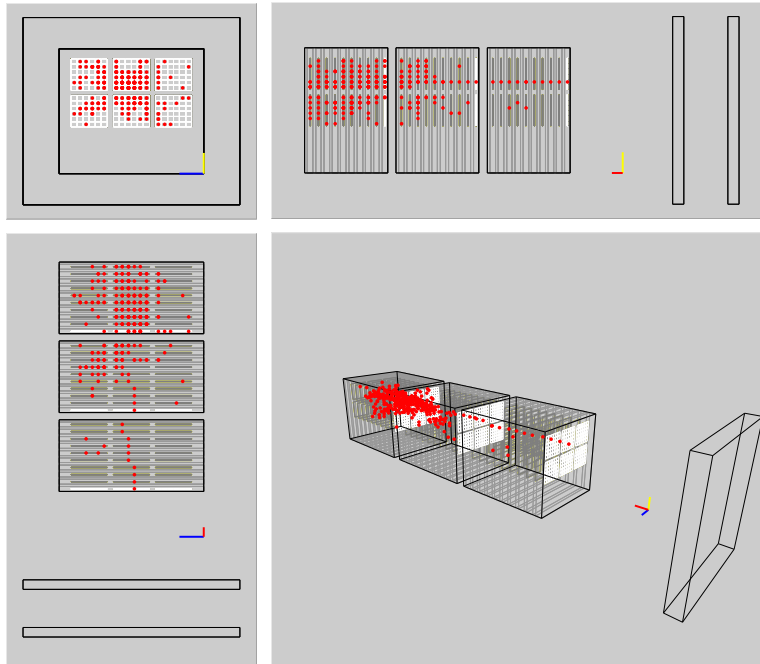
ECAL Display

HCAL Display

digital

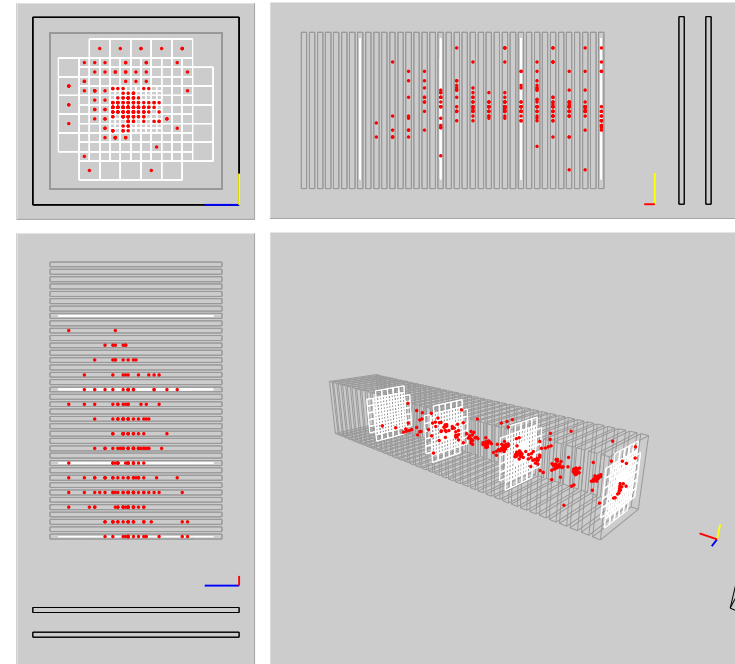
Run 300329:0 Event 1090

Time: 17:15:20:953:259 Mon Aug 28 2006
Hits: 311 Energy: 1930.61 mips



Run 300329:0 Event 1090

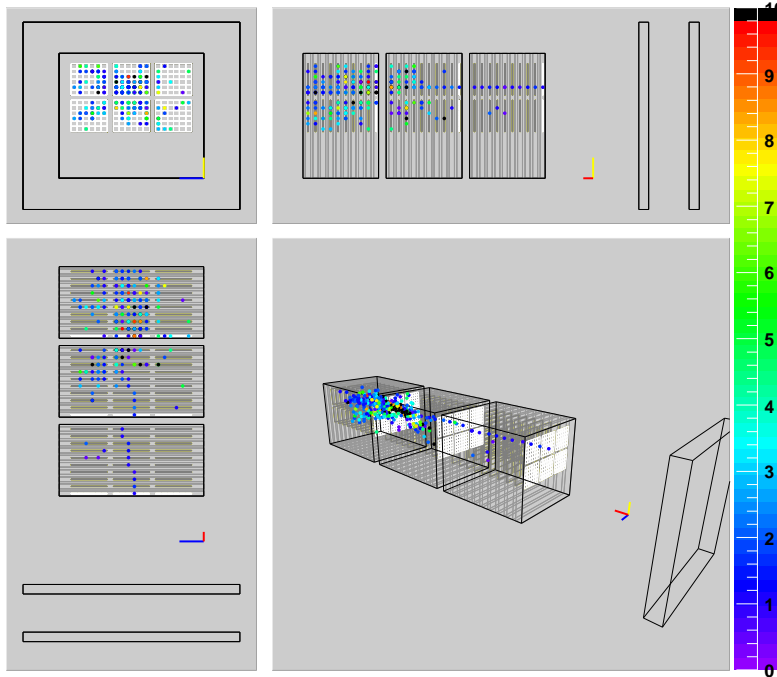
Time: 17:15:20:953:259 Mon Aug 28 2006
Hits: 230 Energy: 566.372 mips



analogue

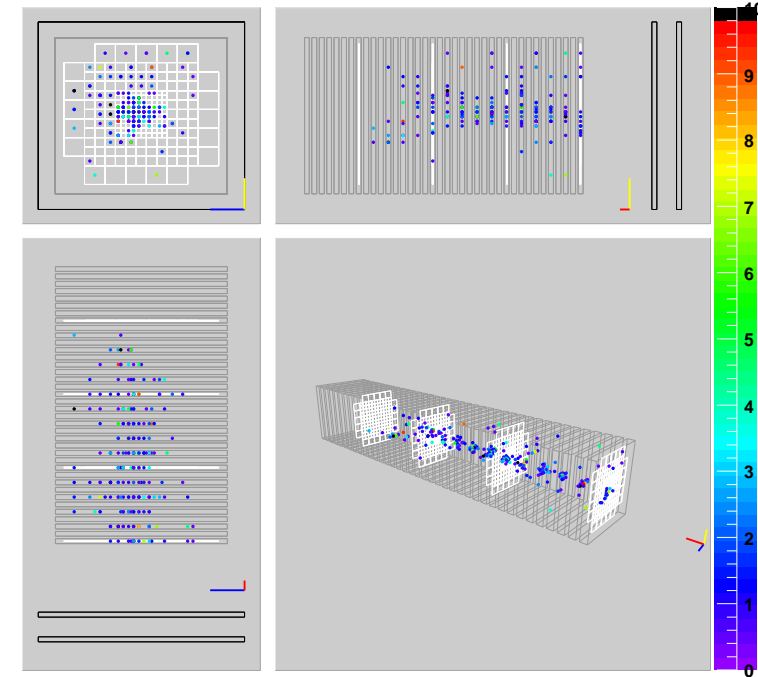
Run 300329:0 Event 1090

Time: 17:15:20:953:259 Mon Aug 28 2006
Hits: 311 Energy: 1930.61 mips



Run 300329:0 Event 1090

Time: 17:15:20:953:259 Mon Aug 28 2006
Hits: 230 Energy: 566.372 mips



CALICE testbeam at CERN 2007

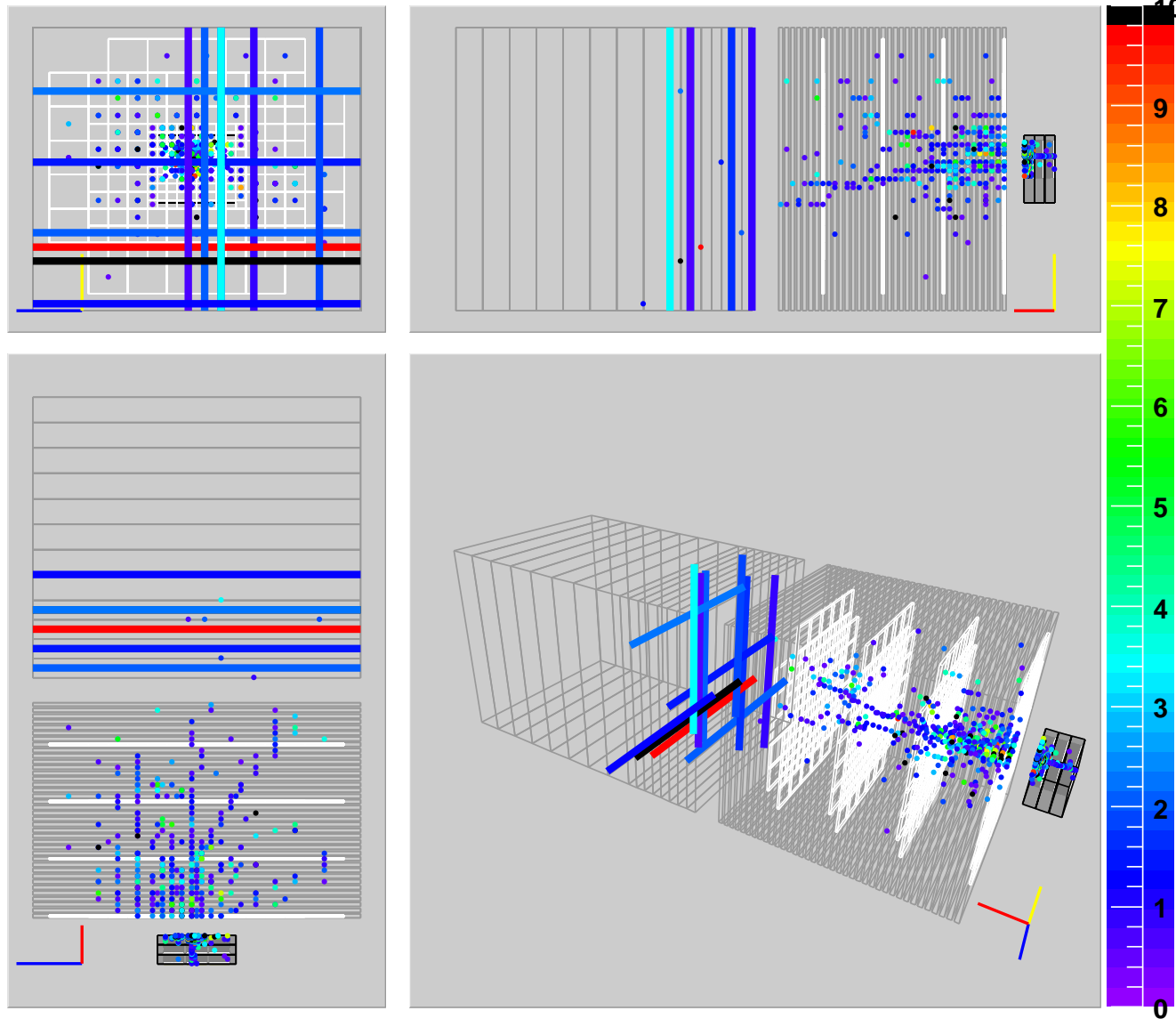
Run 331430:0 Event 1930

Time: 14:43:37:598:798 Tue Aug 7 2007

ECAL Hits: 181 Energy: 2078.67 mips

HCAL Hits: 411 Energy: 1195.1 mips

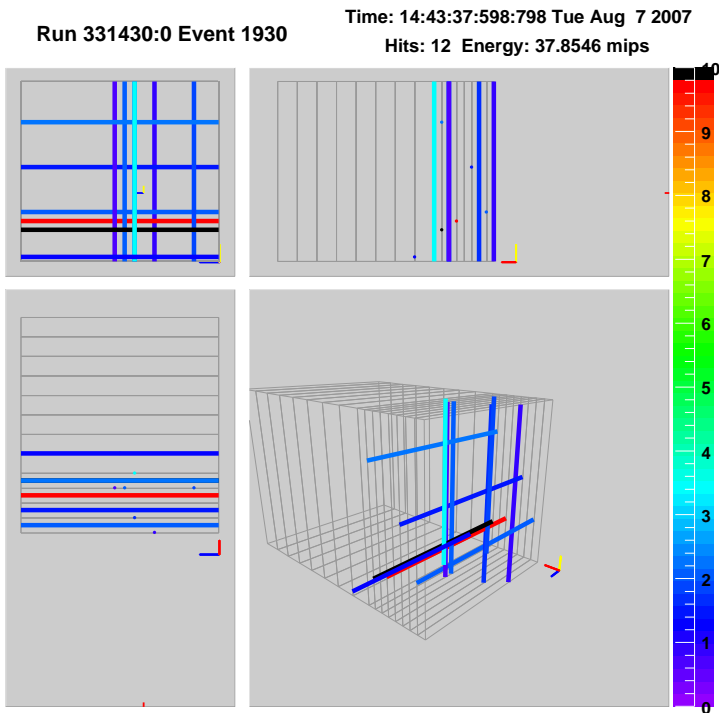
TCMT Hits: 12 Energy: 37.8546 mips



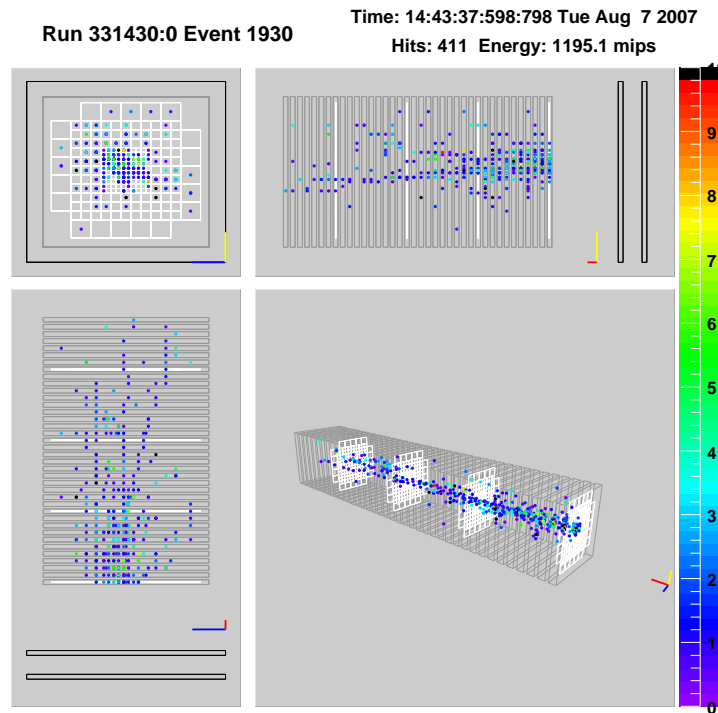
π^+ 80 GeV

ECAL threshold = 0.5 mip
HCAL threshold = 0.5 mip
TCMT threshold = 0.7 mip

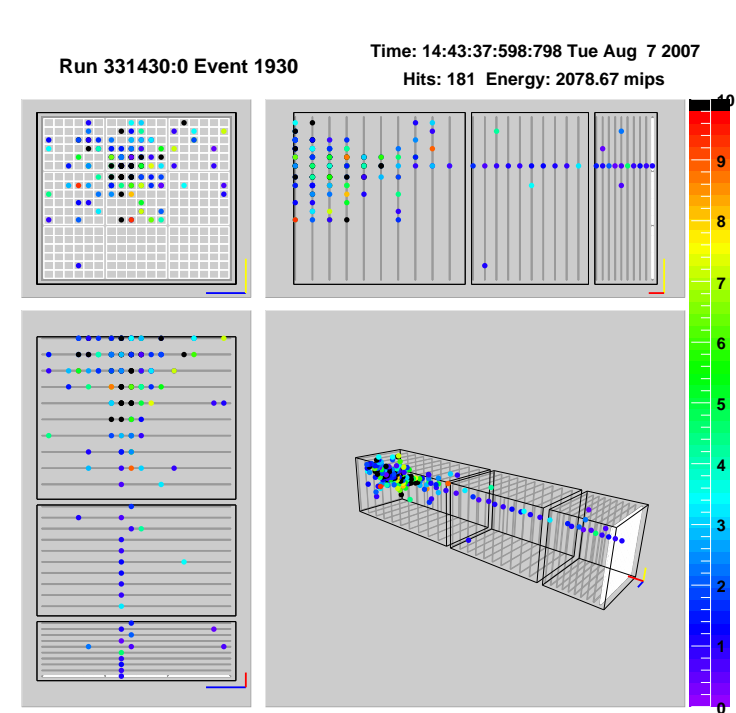
CALICE testbeam at CERN 2007



TCMT



HCAL

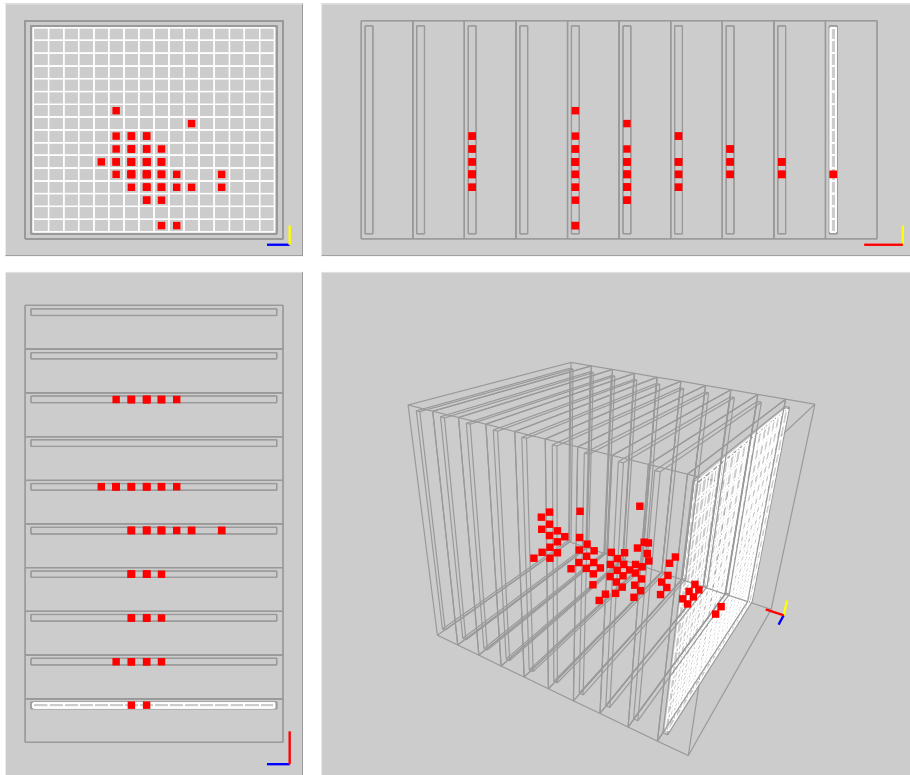


ECAL

DHCAL "slice test" at FNAL 2007

Run 241:0 Event 107

Time: 724491
Hits: 67 Energy: xxx mips

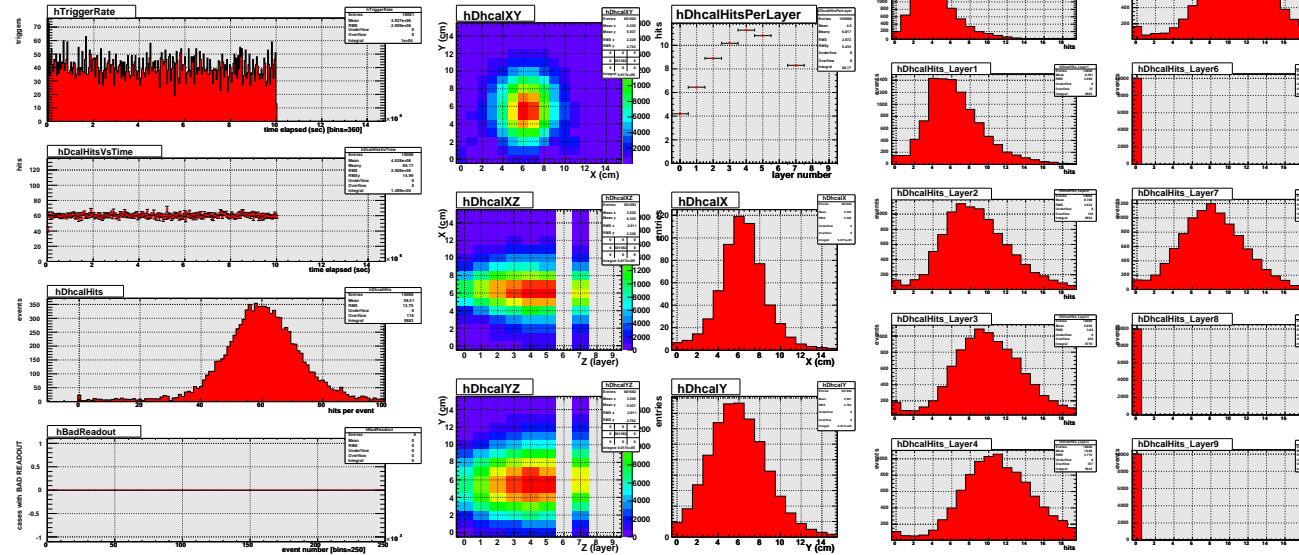


e^+ 8 GeV

Main

all layers

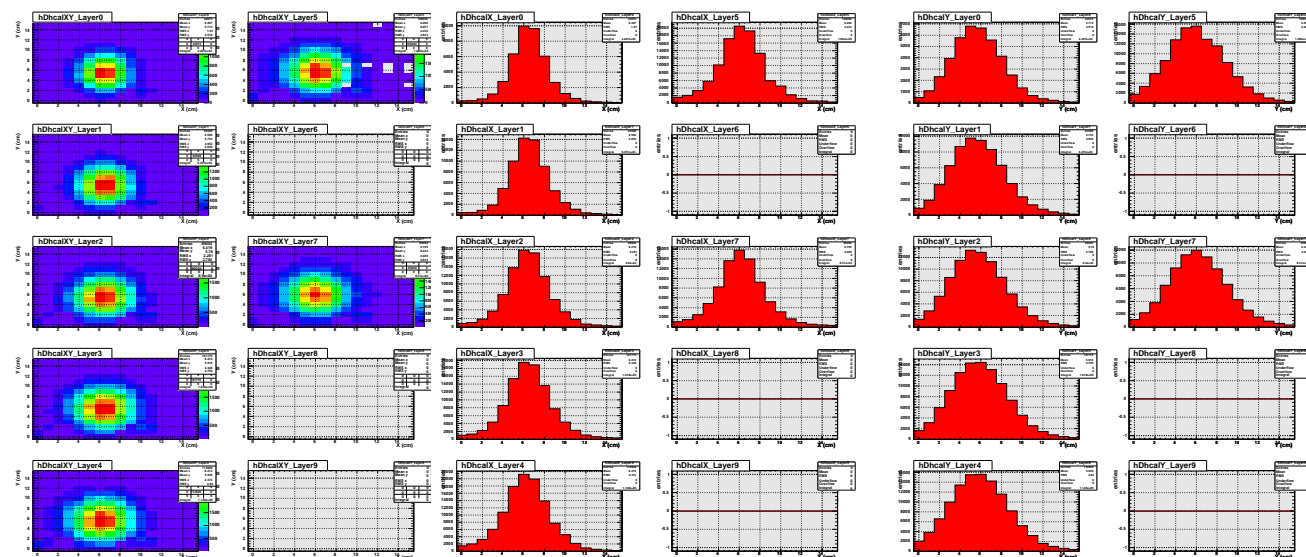
hits per layer



XY per layer

X per layer

Y per layer



CALICE Testbeam Program 2006

(full monitor support provided)

- ▶ • **DESY, 22 May - 31 May 2006**
 - : **ECAL(W/Si)** testbeam with electrons at 1-6 GeV

- ▶ • **CERN, 24 Aug - 3 Sep 2006**
 - : **ECAL(W/Si)** testbeam with electrons at higher energy
 - : **AHCAL, TCMT** commissioning
 - : **AHCAL** technical run with electrons/pions

- ▶ • **CERN, 12 Oct - 24 Oct 2006**
 - : combined **(ECAL+AHCAL+TCMT)** physics run with electrons/pions

CALICE Testbeam Program 2007

(full monitor support provided)

- ▶ • **DESY, 2 Mar - 26 Mar 2007**
: **ECAL(W/scint.strip)** testbeam with electrons at 1-6 GeV
- ▶ • **CERN, Jul - Aug 2007**
: combined **(ECAL+AHCAL+TCMT)** physics run with electrons/pions
- ▶ • **FNAL, Jul 2007**
: **DHCAL** "slice test" with positrons/pions at 1-16 GeV

several 1000s of monitor output files on disk
(ps printouts, histogram files, etc)

CALICE Testbeam Program (continued)

- ▶ • FNAL, late 2007
: **ECAL/HCAL(W/scint.strip)** testbeam with electrons/hadrons
- ▶ • FNAL, in 2007/8 (?)
: **DHCAL** "slice test" 2nd round of tests
- ▶ • FNAL, in early/mid 2008 (?)
: combined **(ECAL+AHCAL+TCMT)** physics run with electrons/hadrons

full monitor support will be provided,
adapted to specific needs of each case

Summary

- ▶
 - : a self-contained, light and robust application to do reconstruction and first level analysis for comprehensive detector and data quality monitoring during or after data taking
 - : highly adaptable tool, accommodates different detectors, evolves with detector/user needs and requests
- ▶
 - : used extensively in the control rooms at DESY, CERN, FNAL for debugging, beam tuning, data taking
 - : produced a wealth of valuable info to assist shift crews/experts in data taking and analysis
(+ 100s of plots for talks, reports, logbooks etc.)
- ▶
 - : plays a significant role in the success of the CALICE testbeam program