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
EcalReadoutPad
EcalPhysicalPad
EcalMap
EcalAdc
EcalEnergy
EcalCalibration
EcalRawAdcExtractor
EcalPedestalCalculator
EcalEnergyCalculator
EcalHandler
EcalMonitor

HcalProdTile
HcalReadoutTile
HcalPhysTile
HcalMap
HcalAdc
HcalEnergy
HcalCalibration
HcalRawAdcExtractor
HcalPedestalCalculator
HcalEnergyCalculator
HcalHandler
HcalMonitor

TcmtReadoutStrip
TcmtPhysStrip
TcmtMap
TcmtAdc
TcmtEnergy
TcmtCalibration
TcmtRawAdcExtractor
TcmtPedestalCalculator
TcmtEnergyCalculator
TcmtHandler
TcmtMonitor

TriggerExtractor

VetoRawAdcExtractor
VetoMap
VetoHandler
VetoMonitor

Tdc
TdcChannel
Chamber
ChamberChannel
TdcMap
TdcExtractor
Track
TdcHandler
TdcMonitor

DatMgr
RunMgr
Handler

MonitorMgr
Monitor
SharedMonitor
SocketClient

MyMainFrame
MySpyMainFrame
MessageHeader
MessageObj
MyEventDisplay

■ 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
. . .

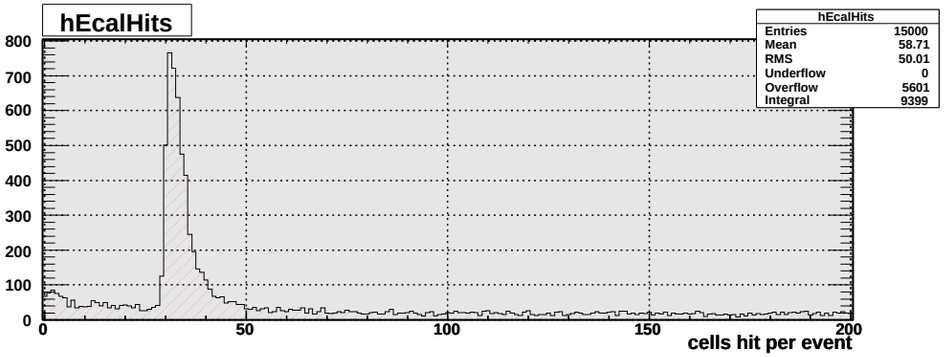
hTriggerRate
hBadReadout

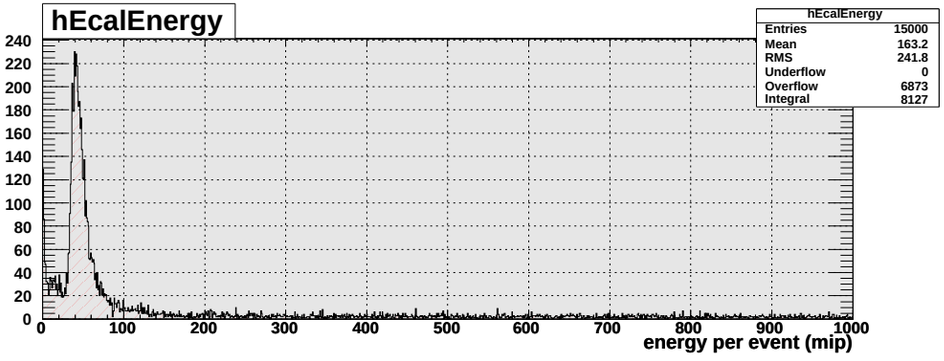
ParticleID
hEcalEnergyCherON/OFF
hEcalEnergyPerLayerCherON/OFF
hHcalEnergyCherON/OFF
hHcalEnergyPerLayerCherON/OFF

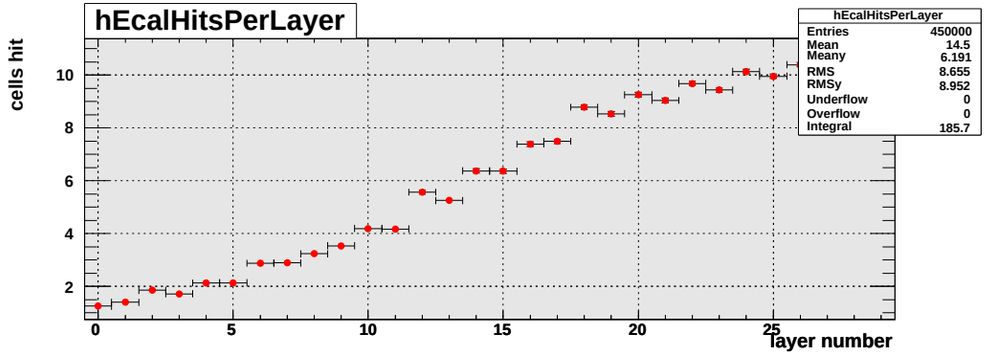
CrossChecks
hTrackBackX.vs.EcalFrontX
hTrackBackY.vs.EcalFrontY
hTrackBackX.vs.HcalFrontX
hTrackBackY.vs.HcalFrontY
hHcalFrontX.vs.EcalBackX
hHcalFrontY.vs.EcalBackY
hHcalEnergy.vs.EcalEnergy
hHcalHits.vs.EcalHits
. . .

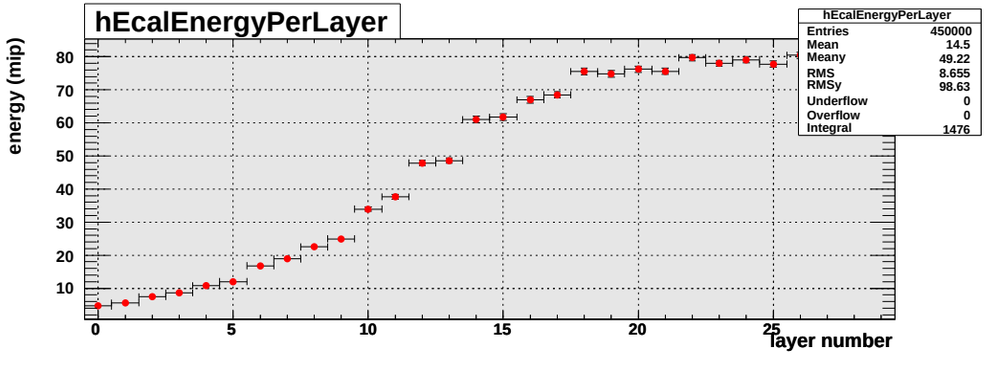
- arranged in 25+ gui panels (=printout pages)

ECAL Response

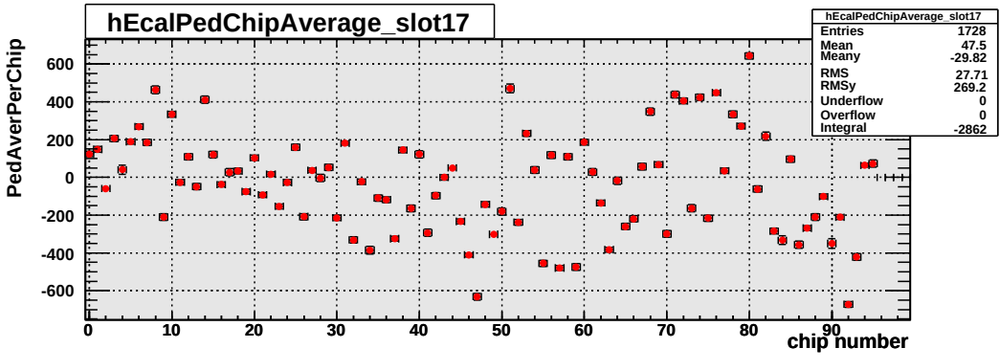


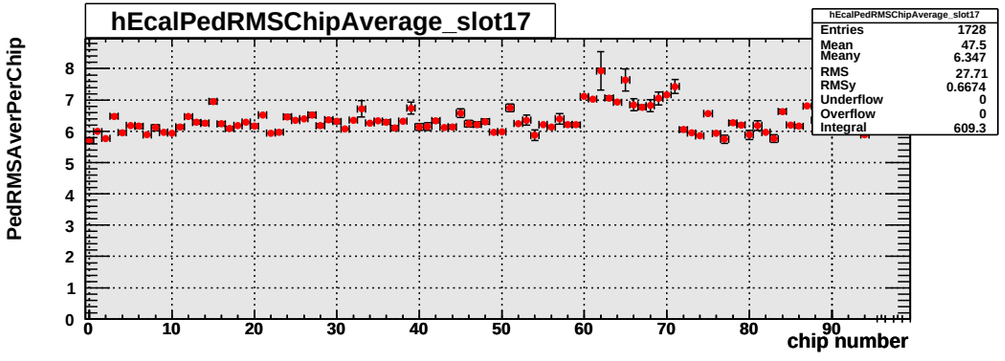


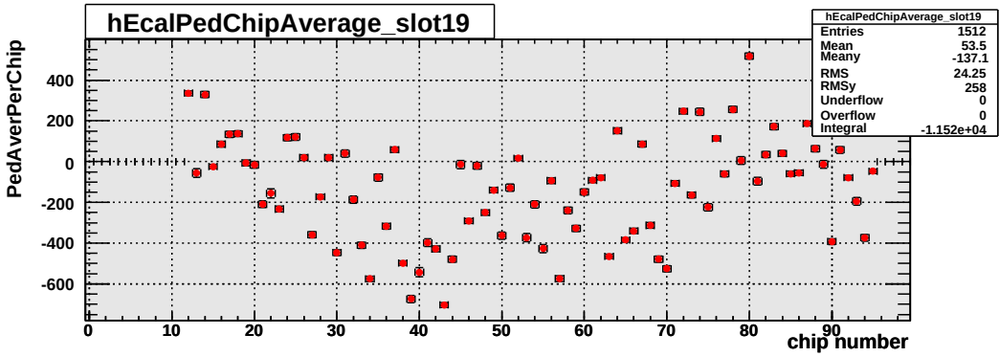


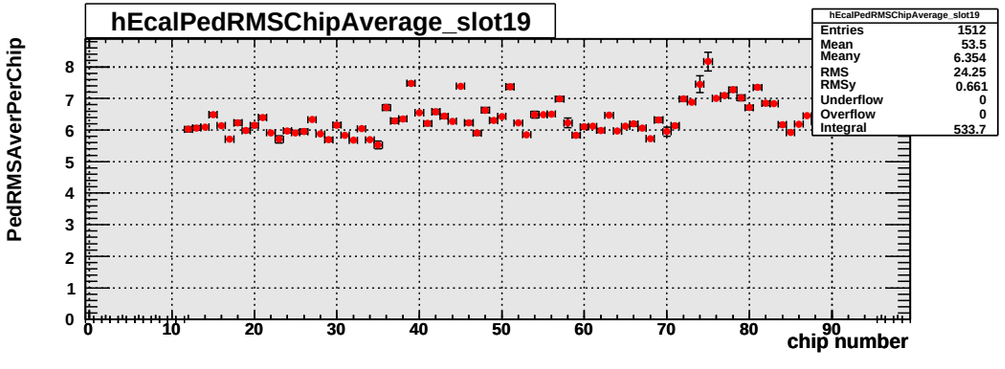


ECAL Pedestals/Noise

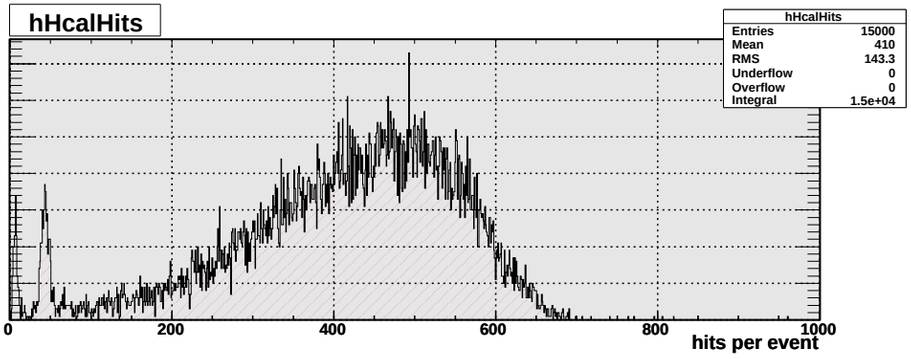


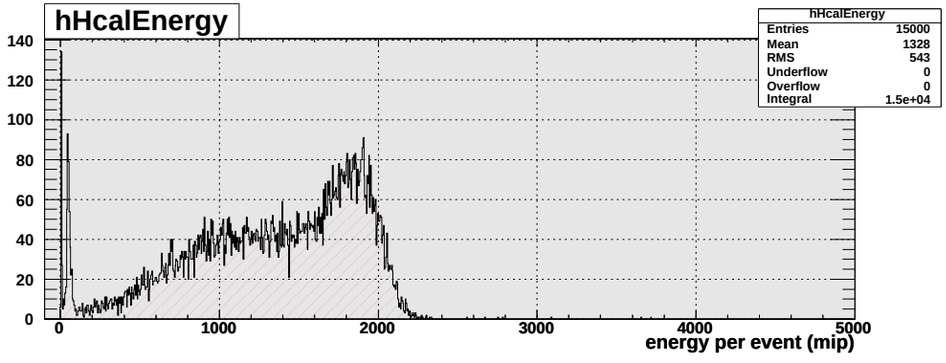


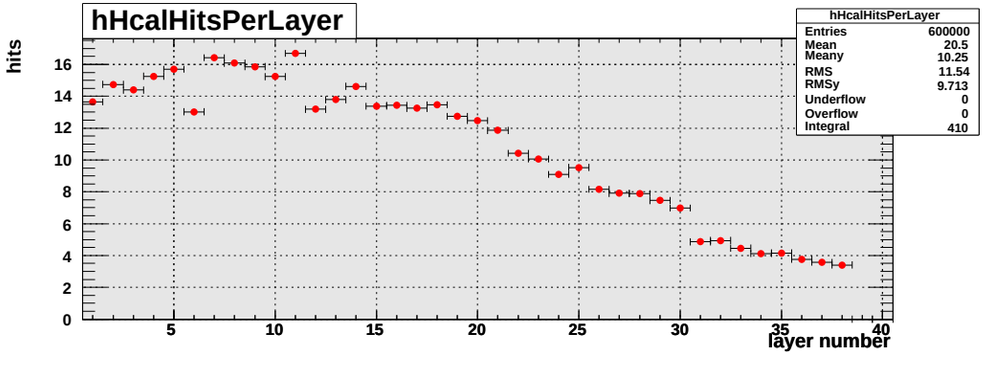


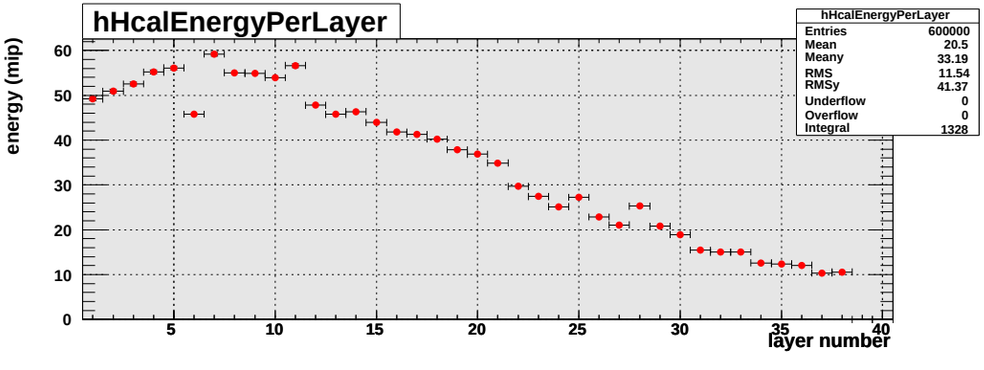


HCAL Response

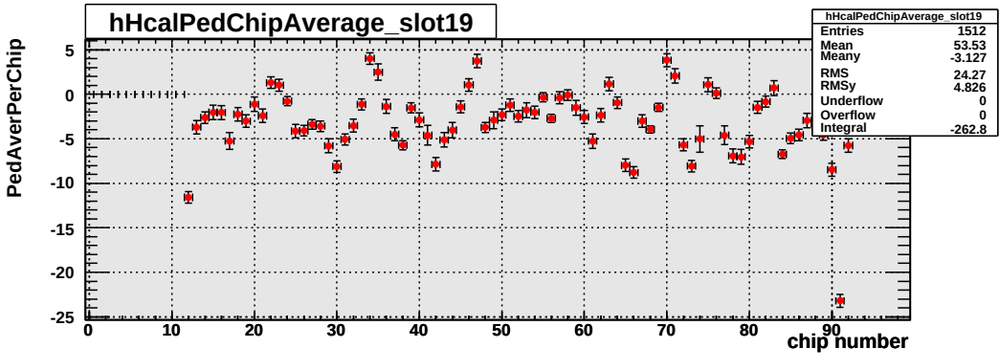


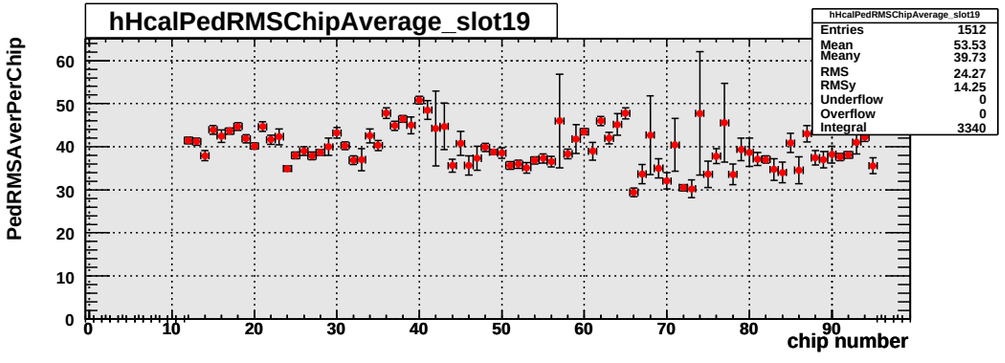


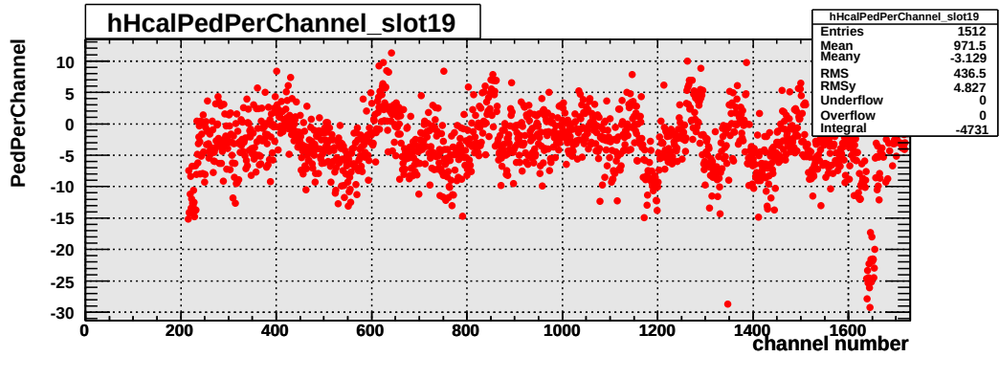


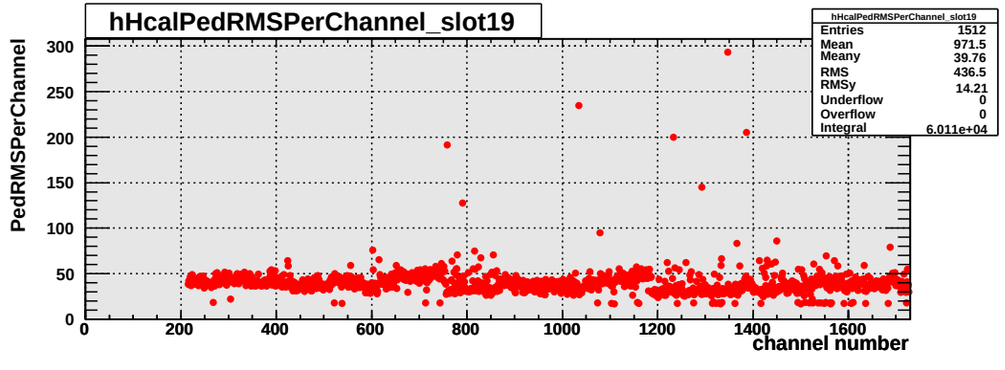


HCAL Pedestals/Noise

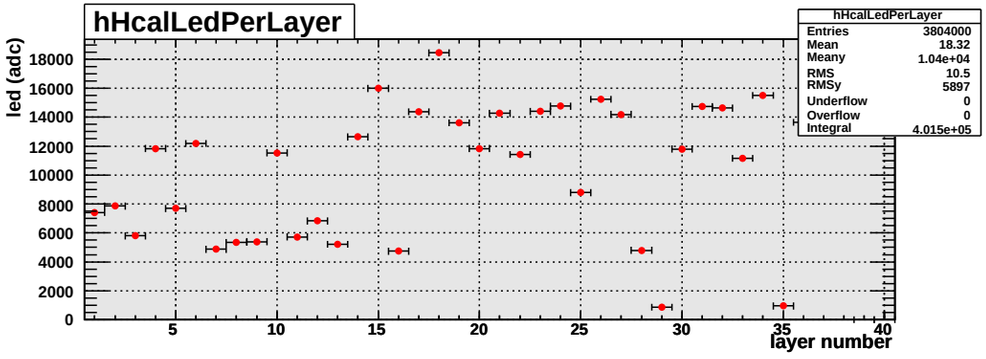


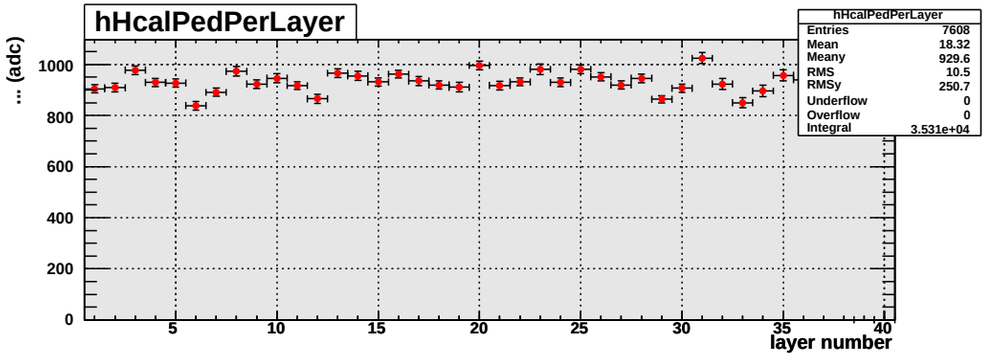


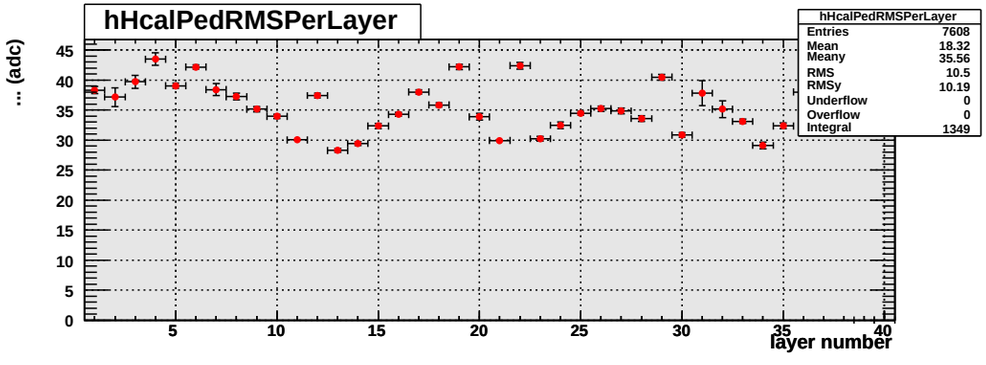




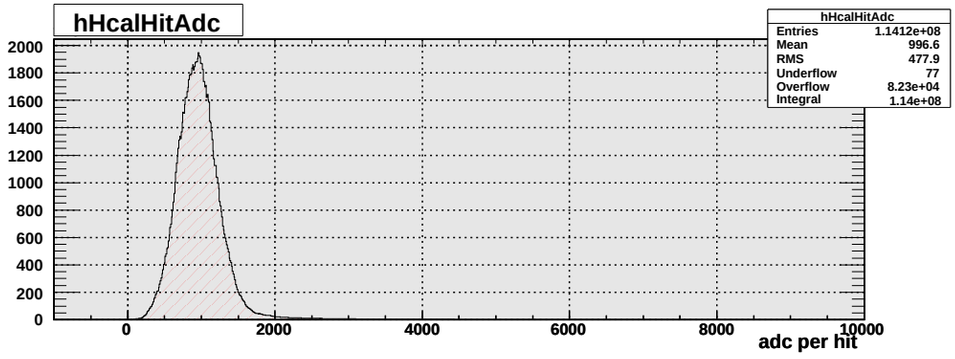
HCAL Leds

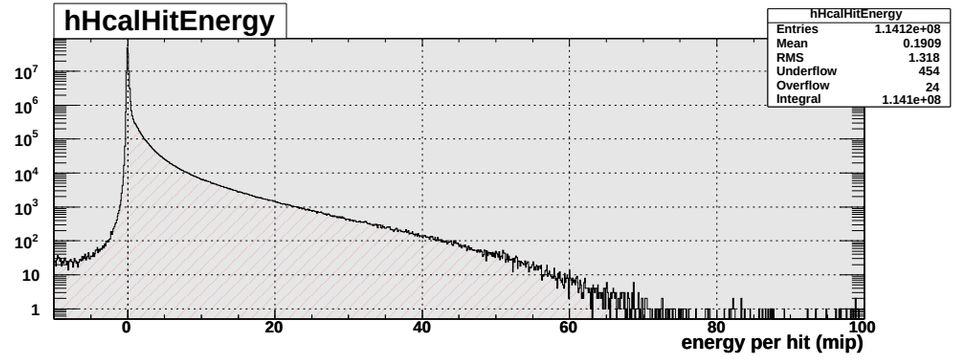


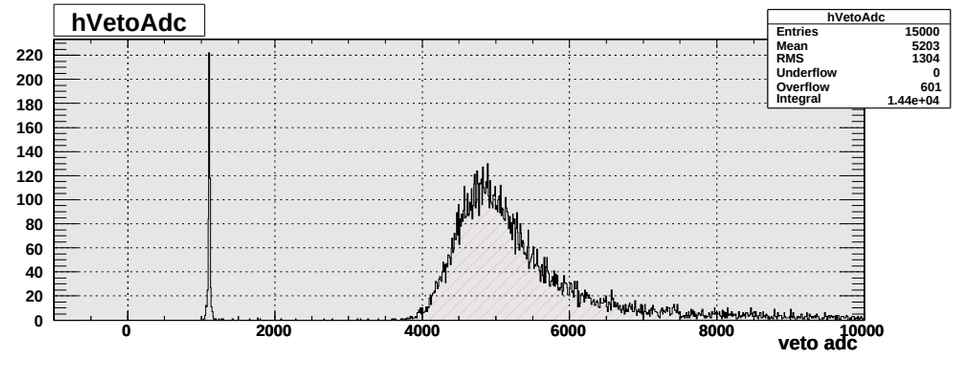




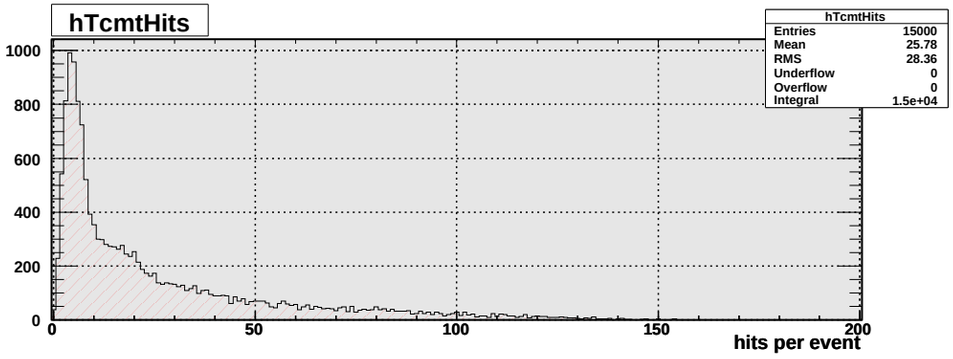
HCAL Misc

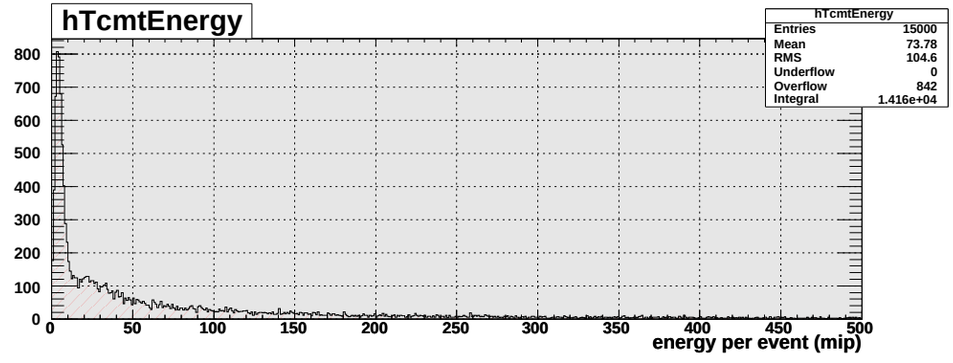


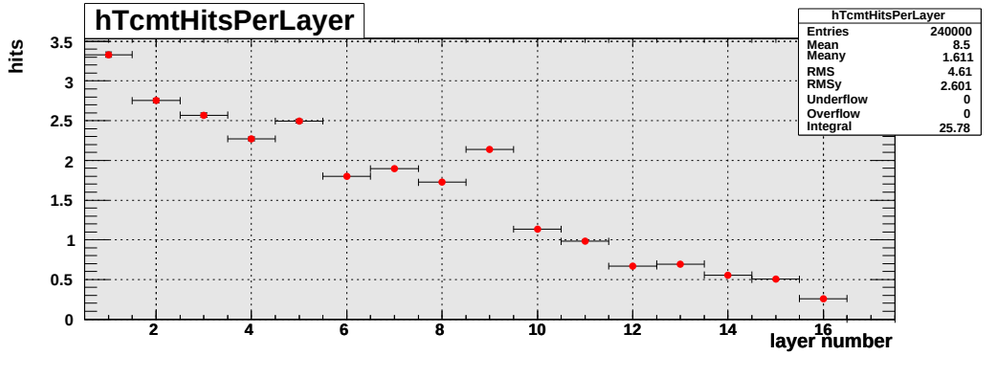


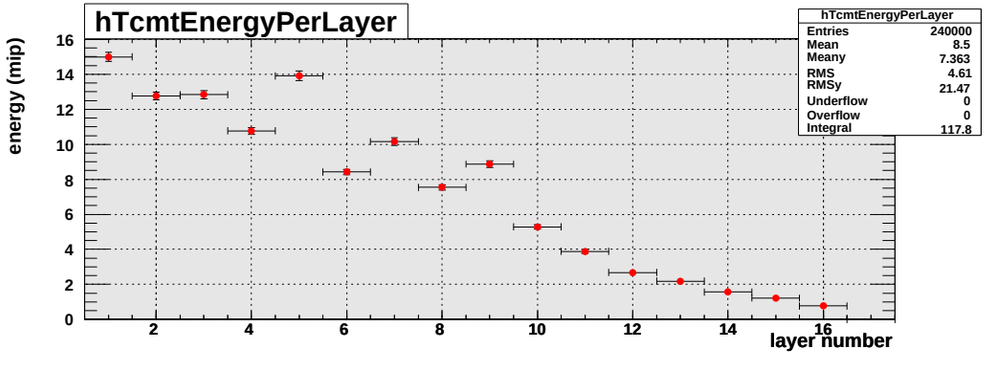


TCMT Response

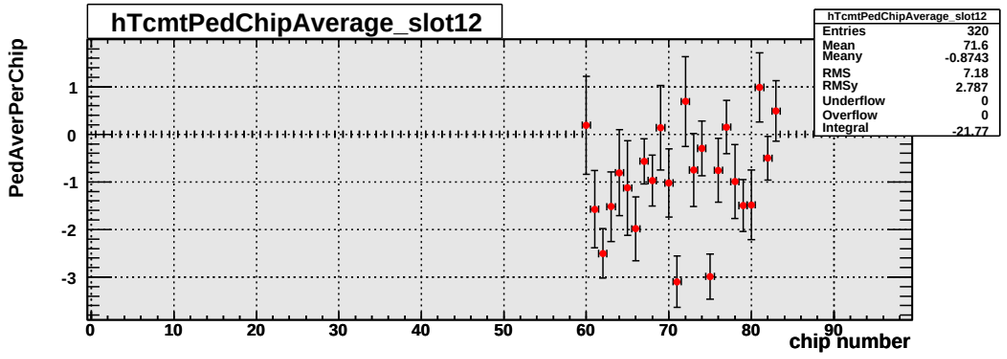


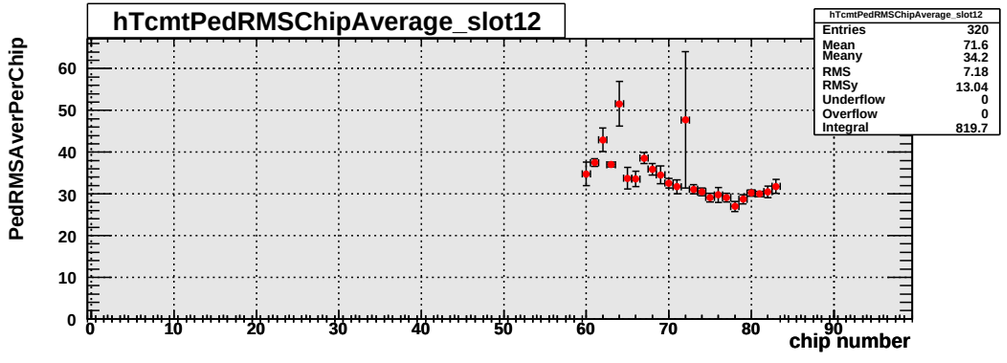


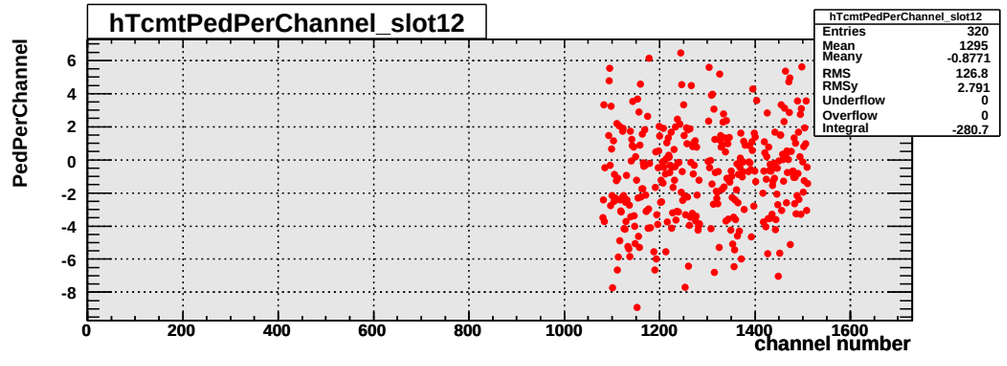


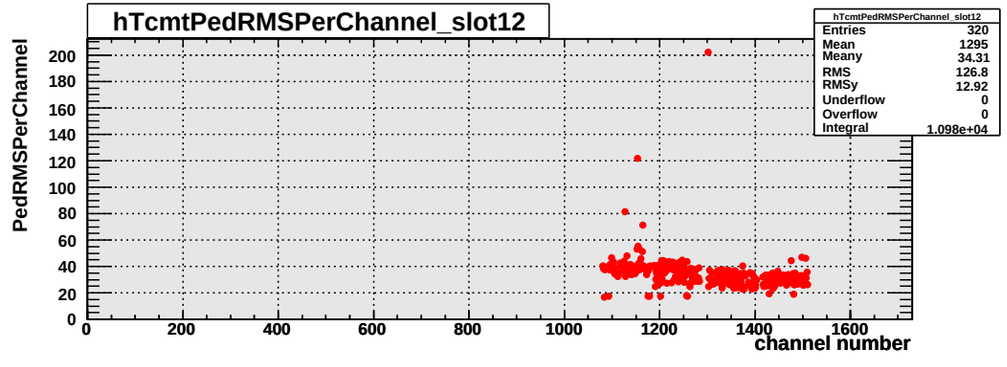


TCMT Pedestals/Noise

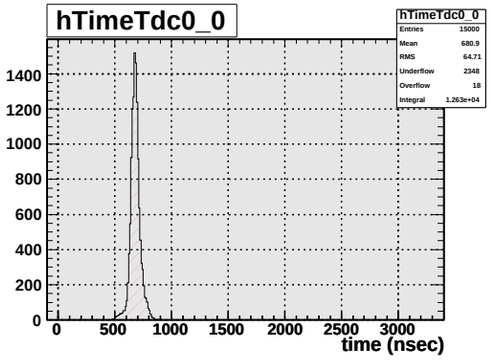


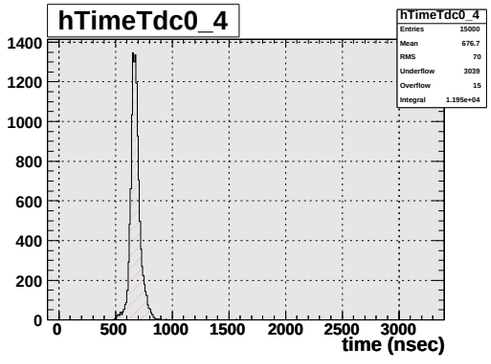


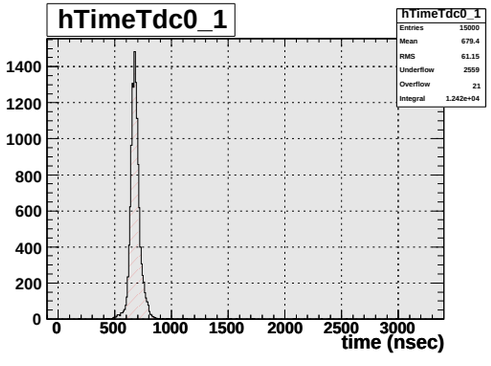


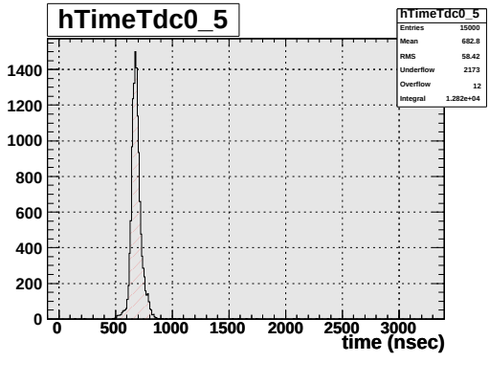


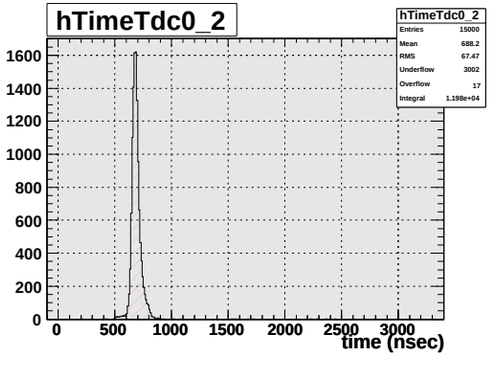
Tracker XY (time)

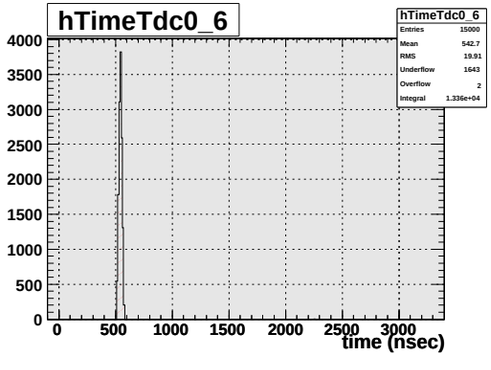


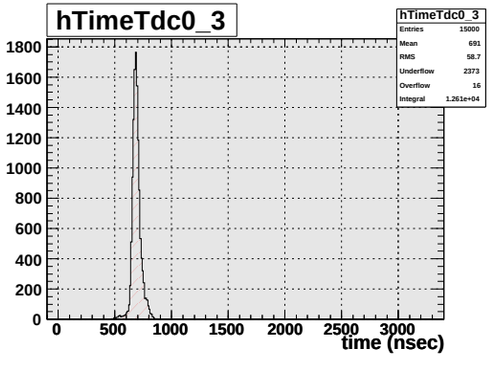


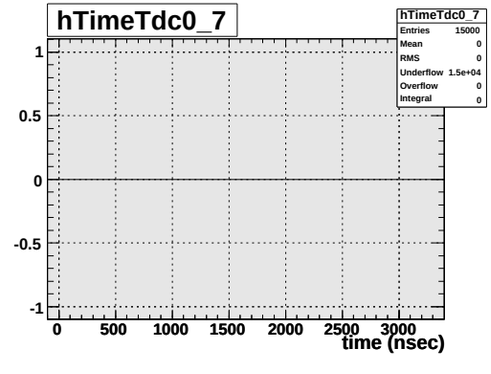




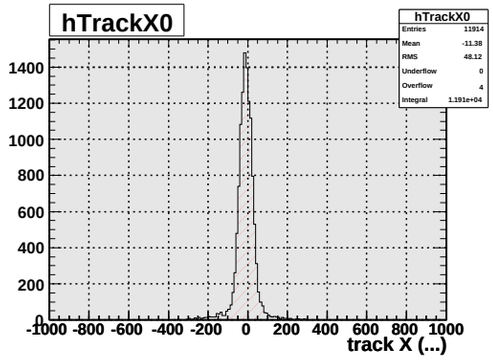


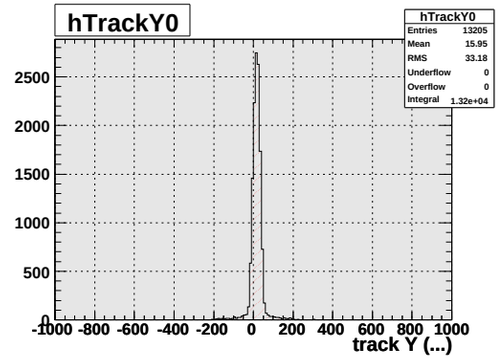


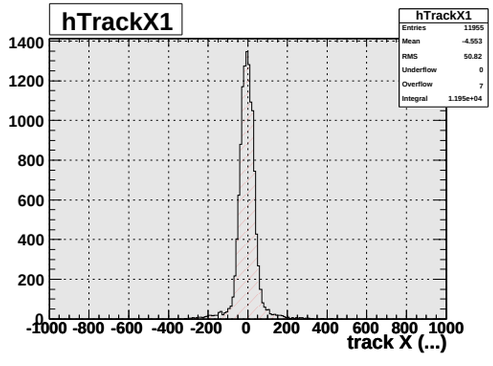


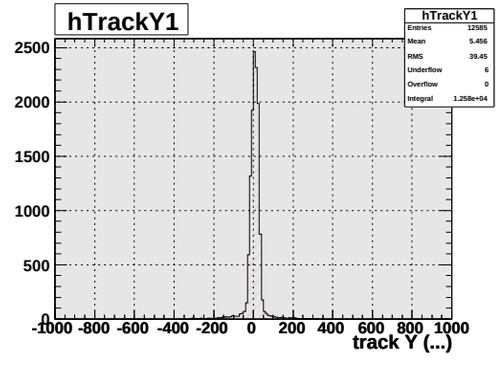


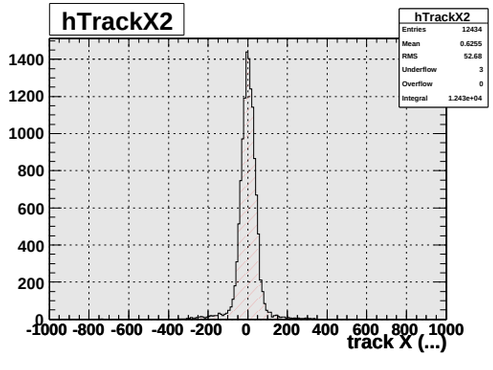
Tracker XY (space)

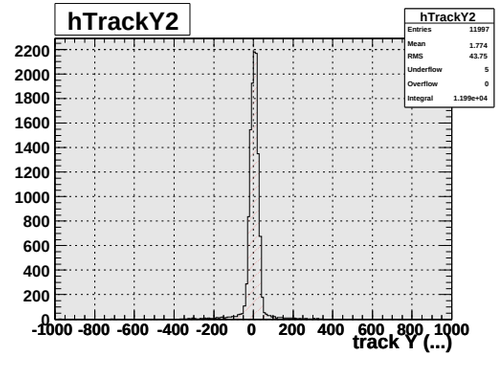




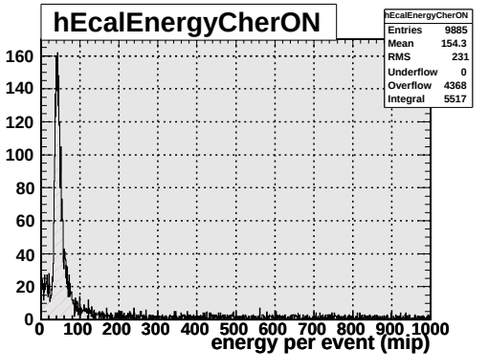


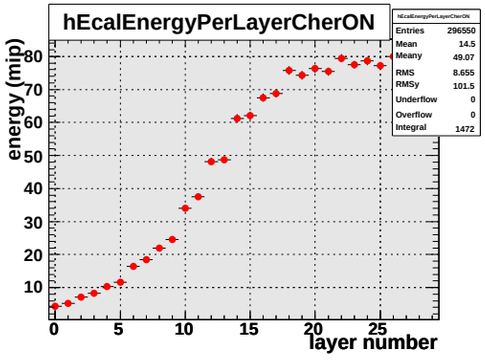


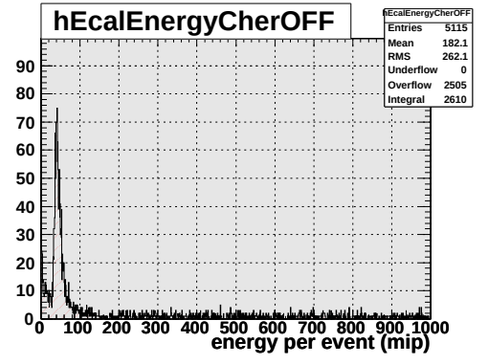


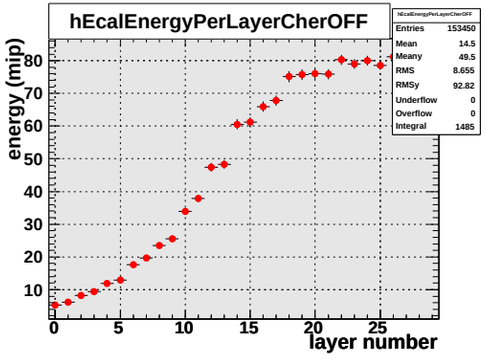


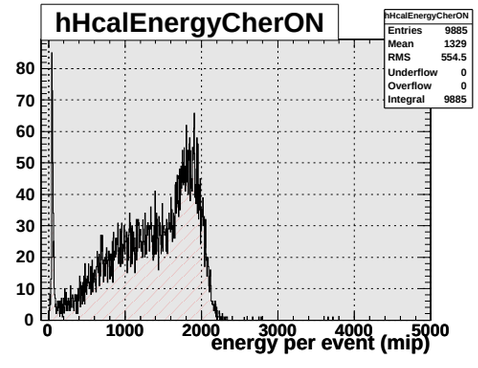
ParticleID

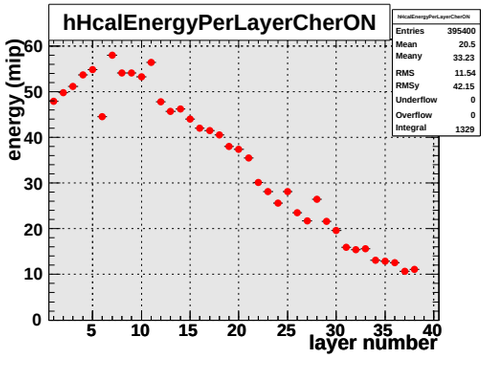


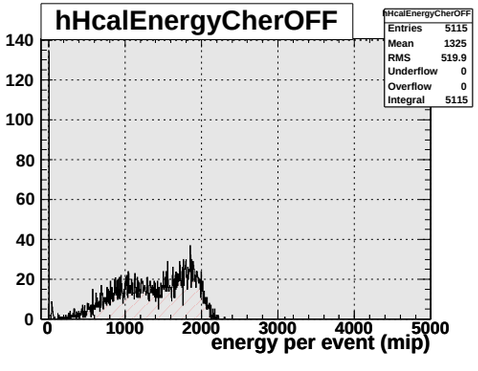


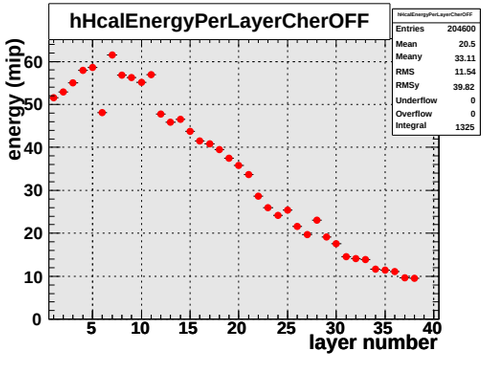




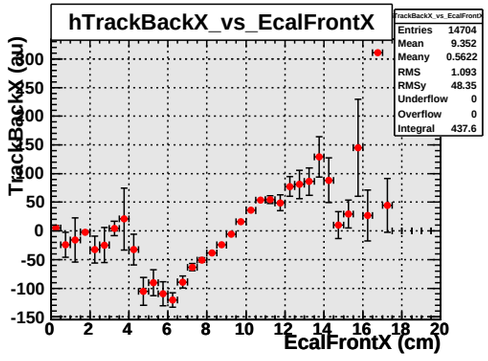


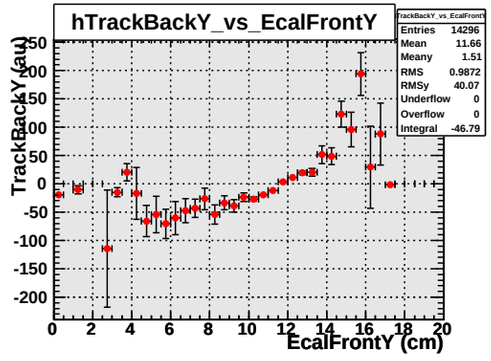


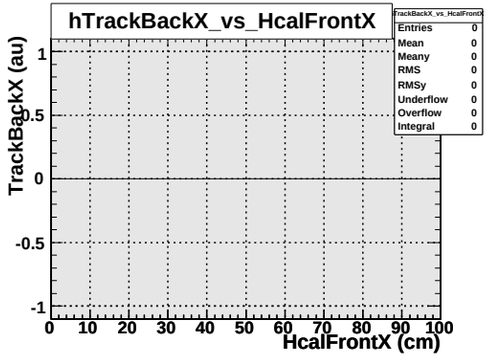


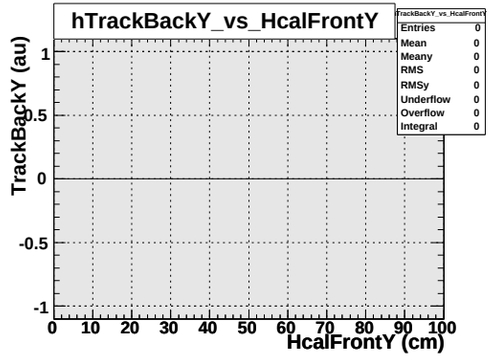


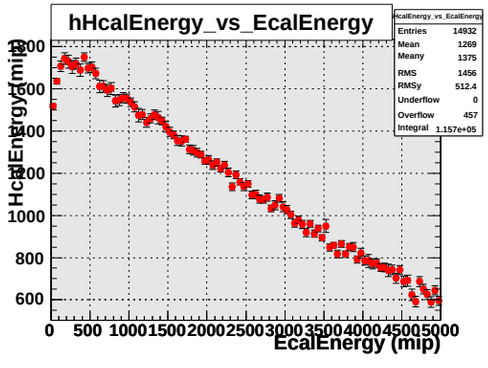
Cross checks

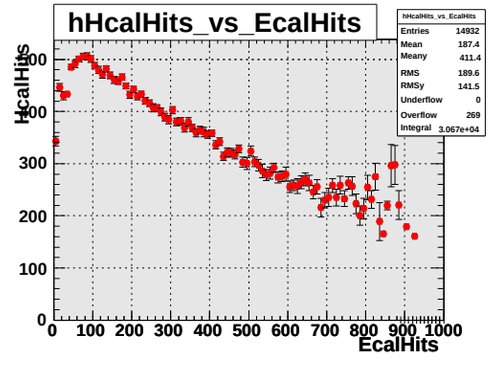


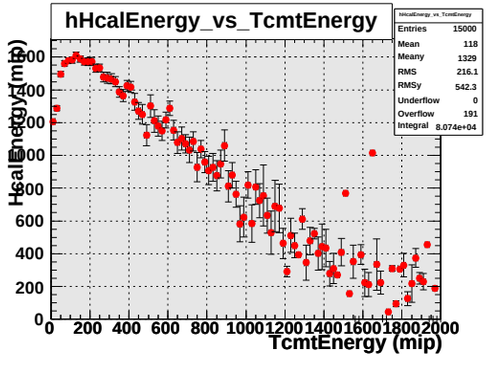


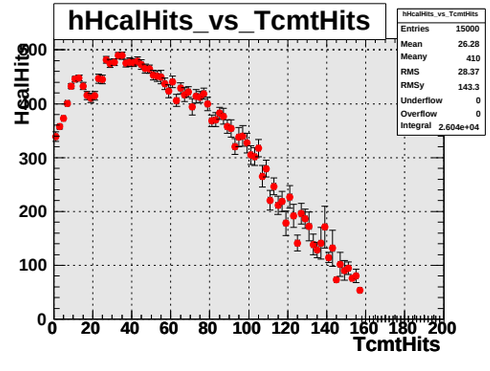




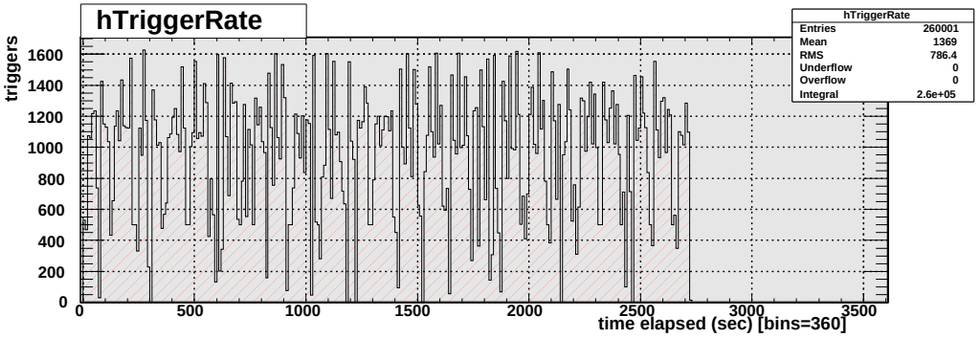


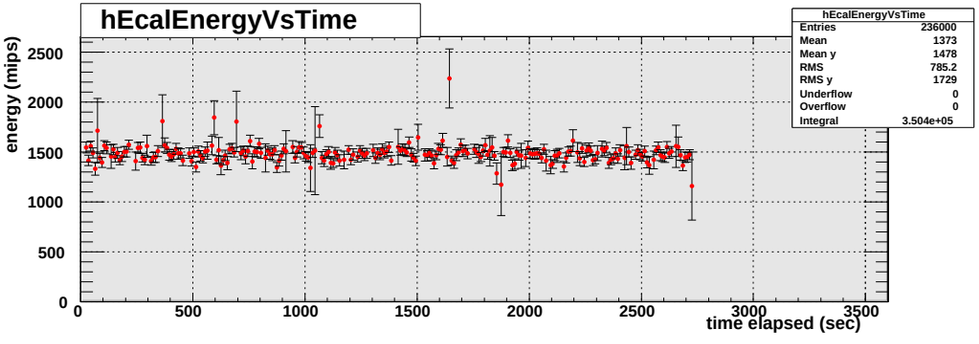


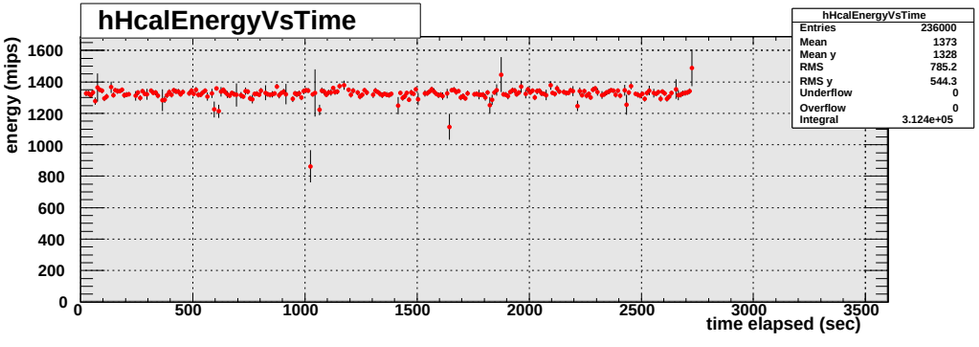


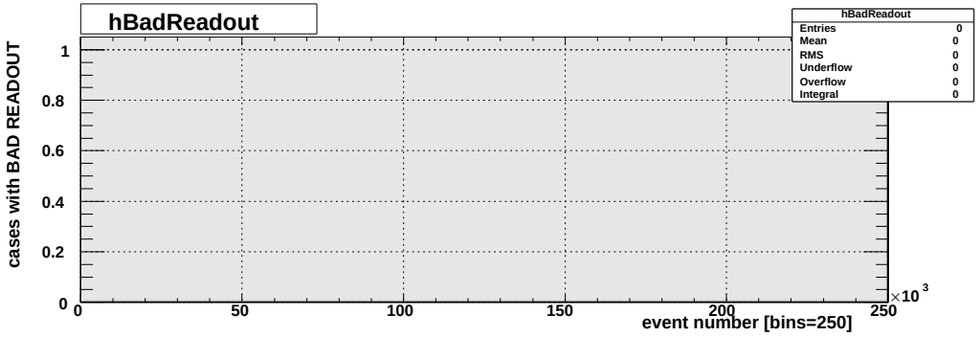


Main panel

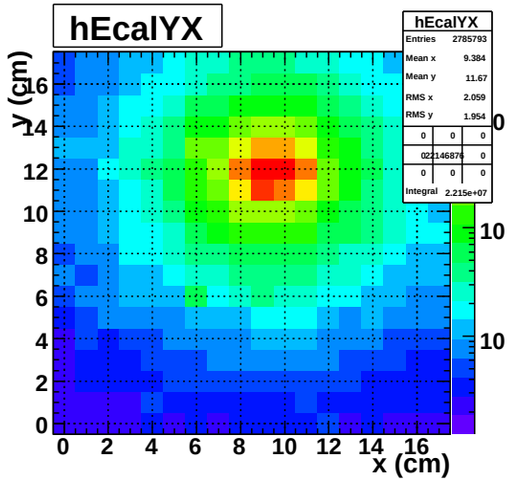


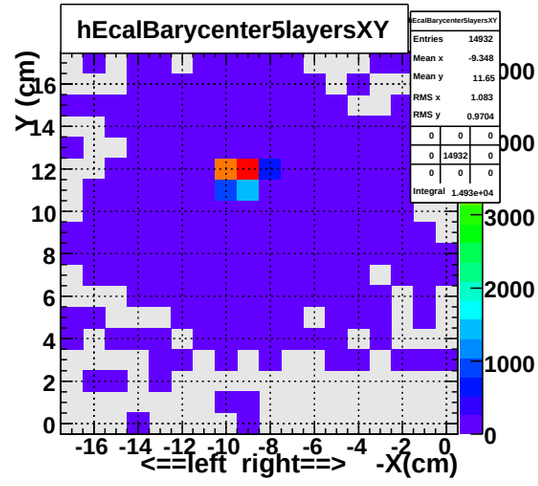


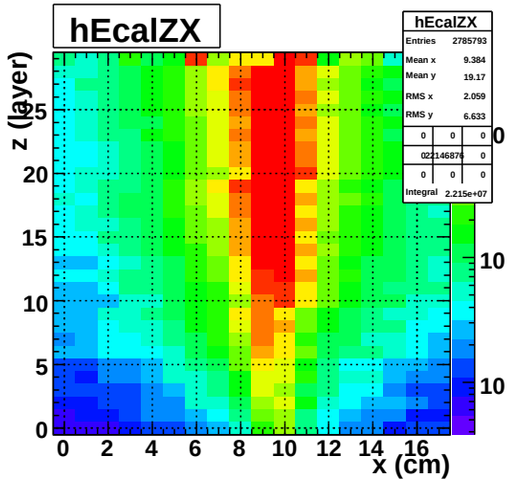


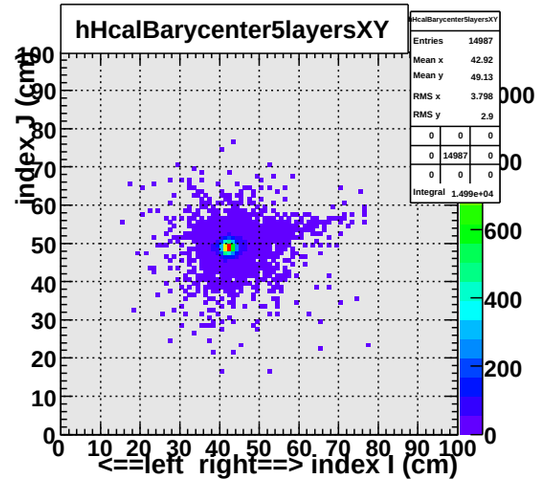


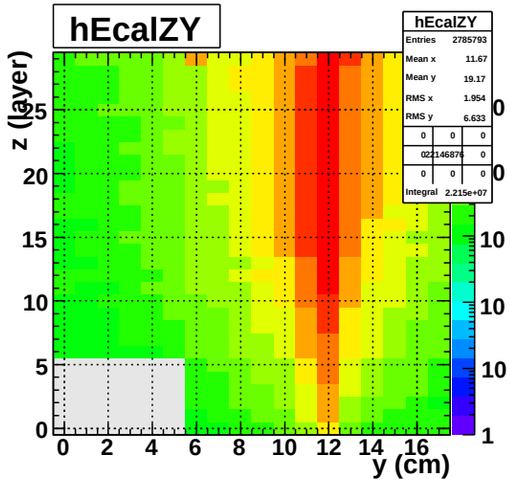
Shower Projections/Barycenters



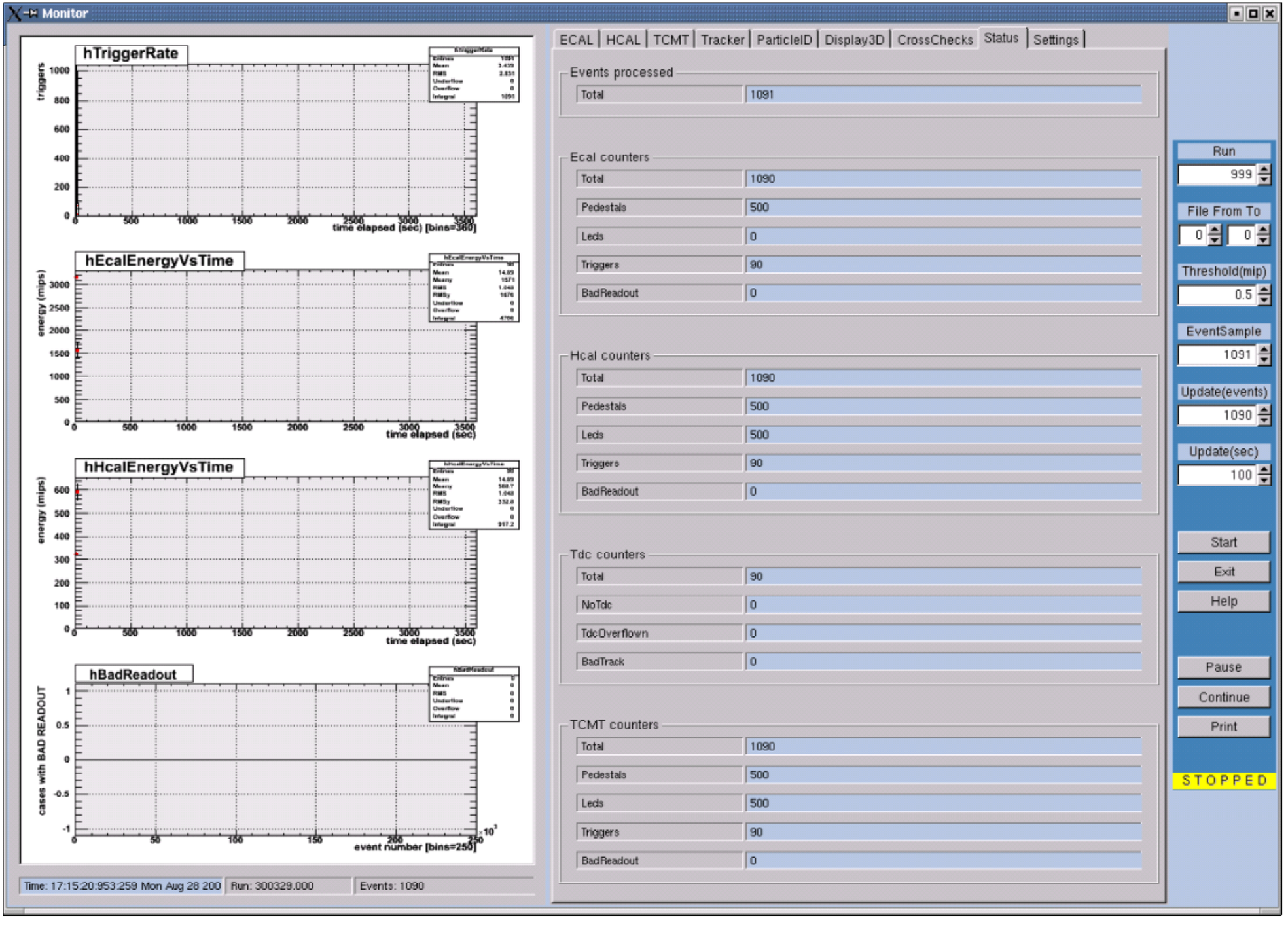








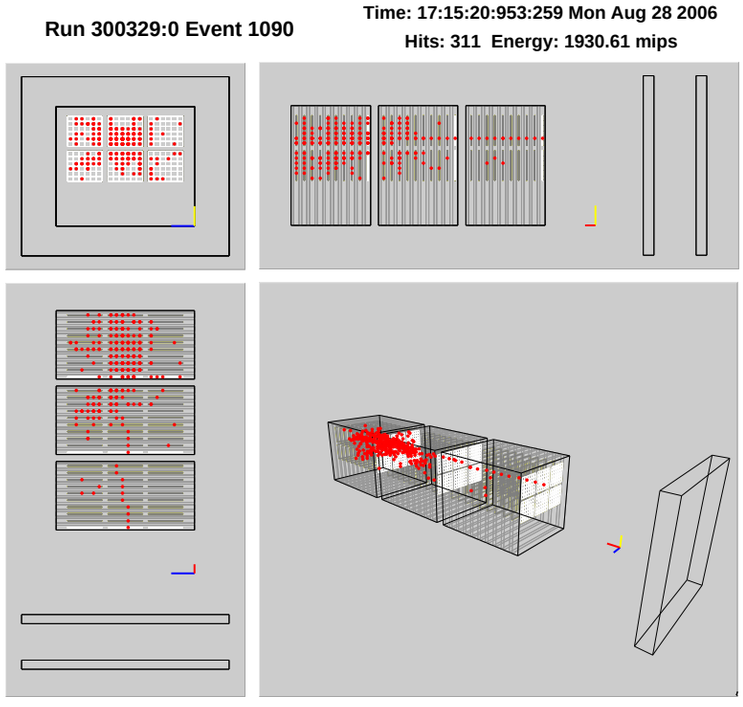
Status table

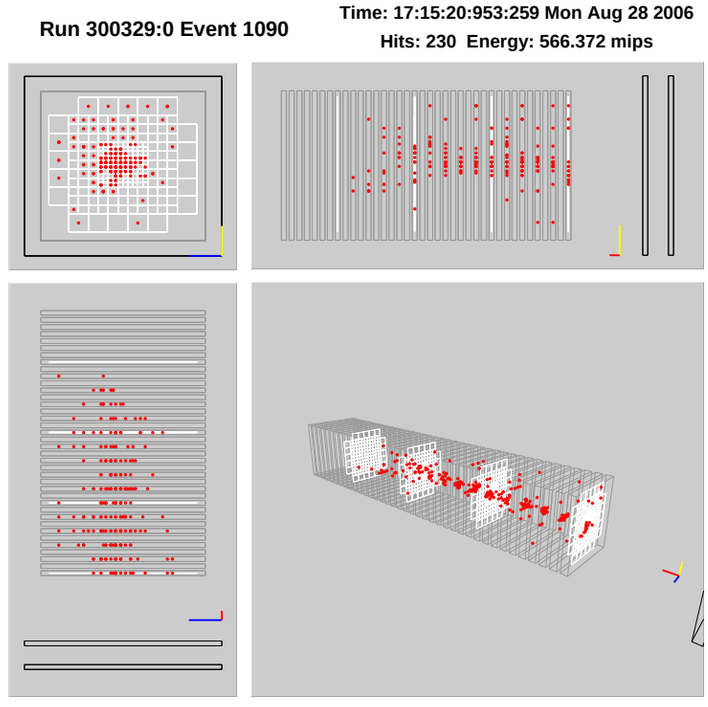


ECAL Display

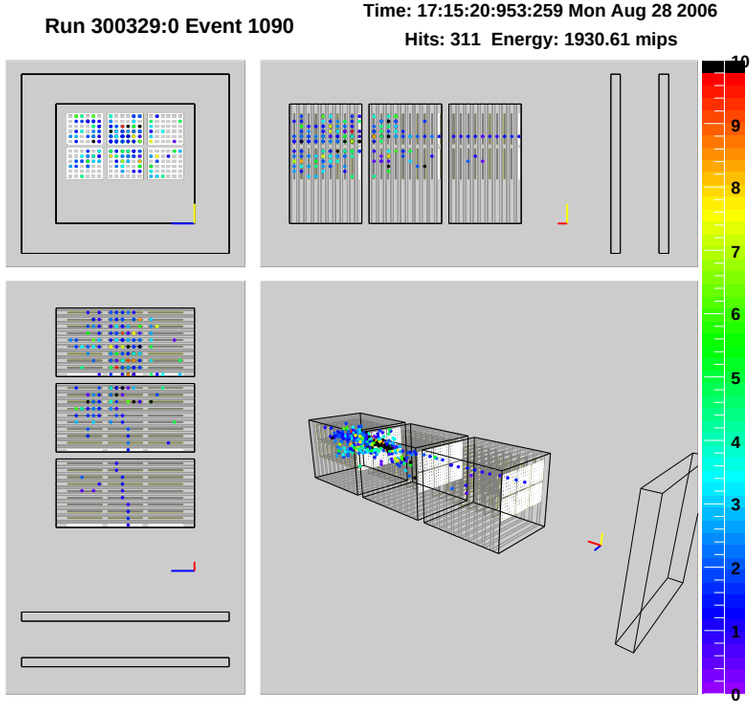
HCAL Display

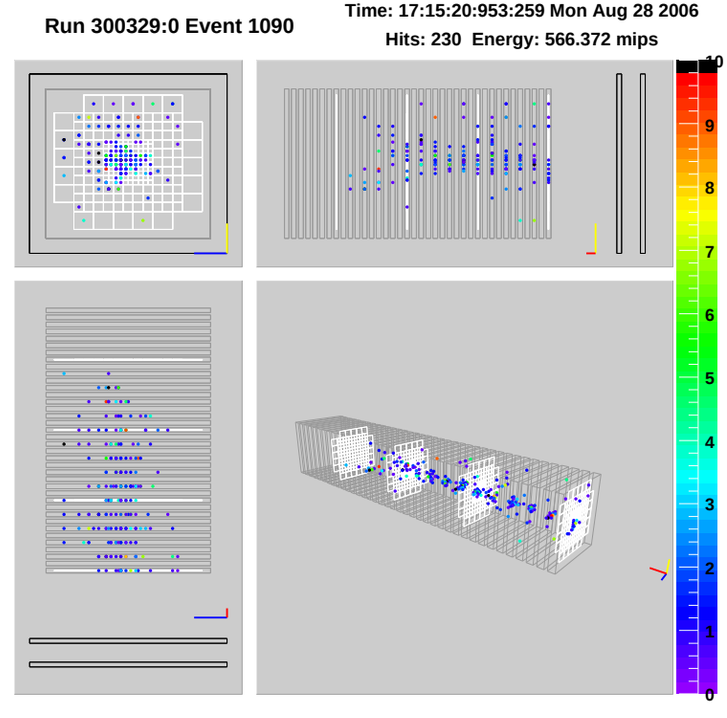
digital



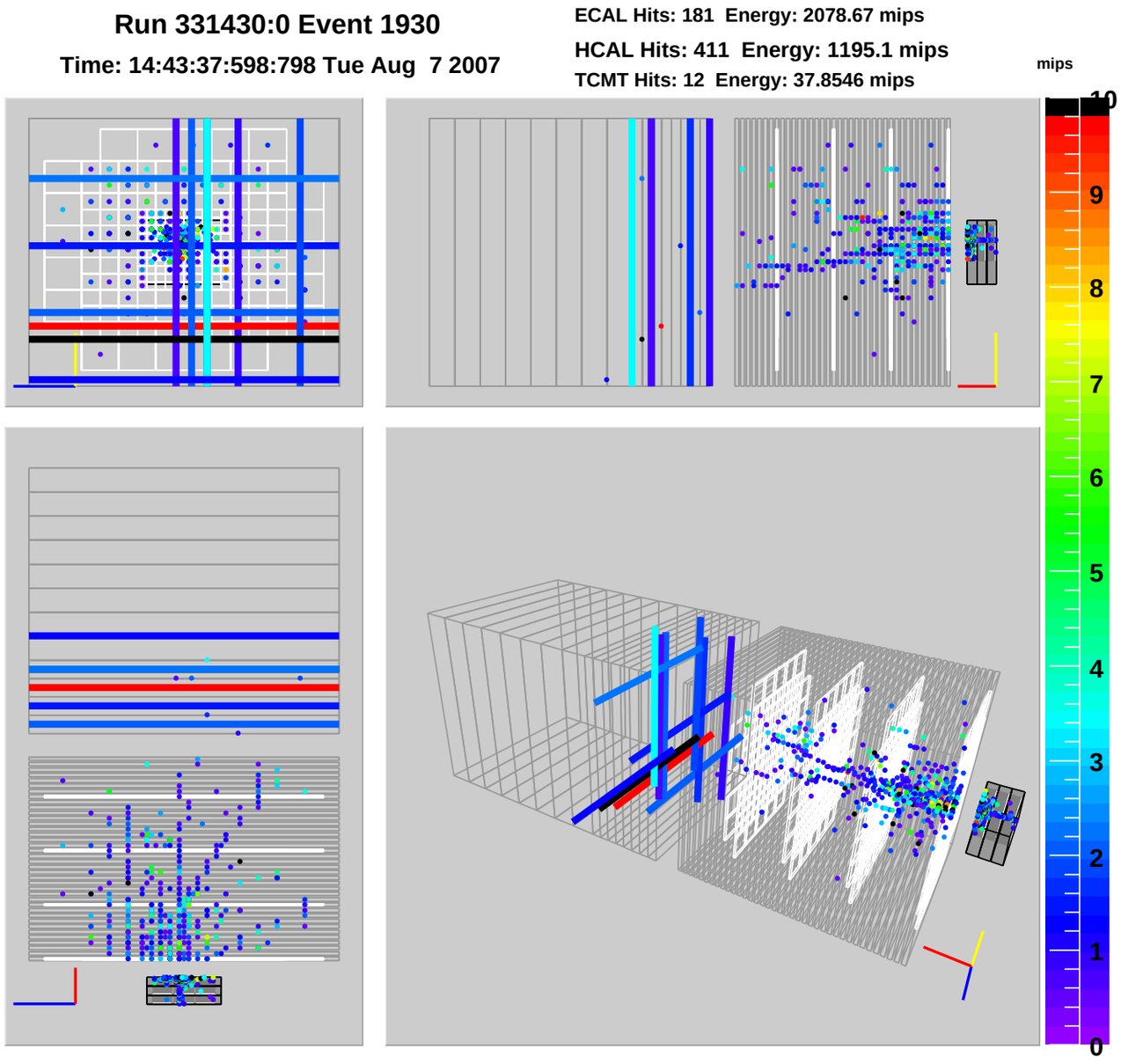


analogue





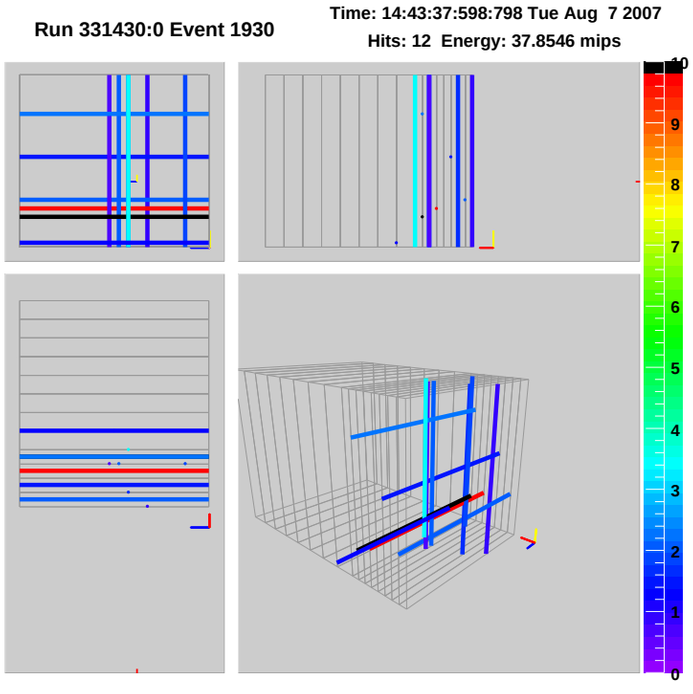
CALICE testbeam at CERN 2007



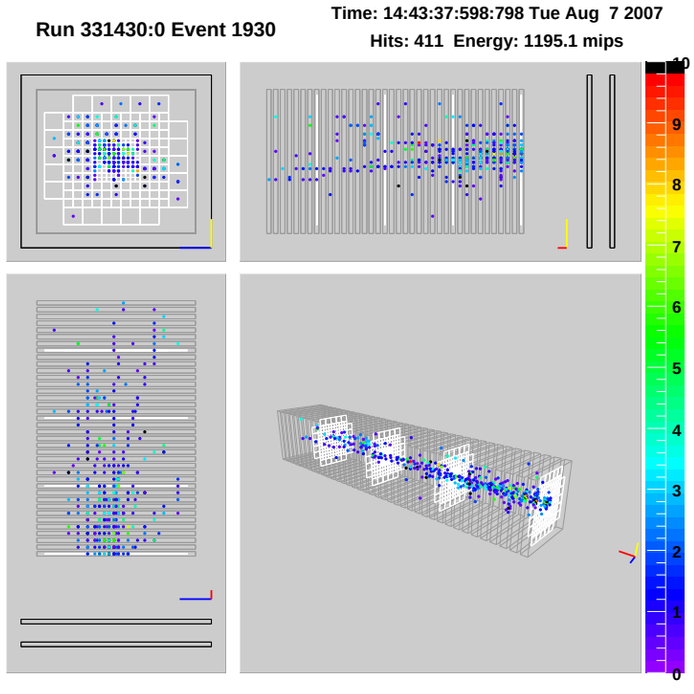
π^+ 80 GeV

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

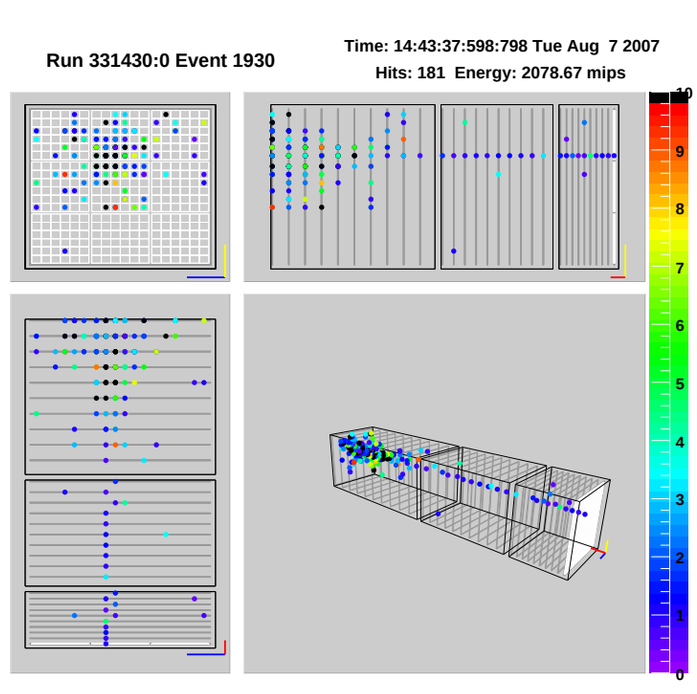
CALICE testbeam at CERN 2007



TCMT



HCAL



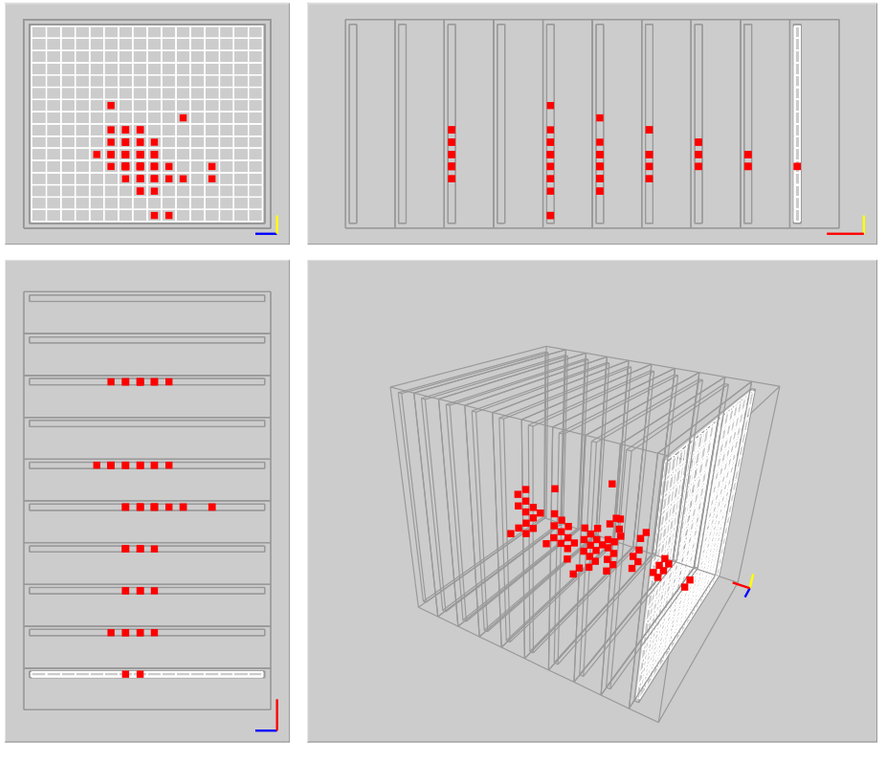
ECAL

DHCAL "slice test" at FNAL 2007

Run 241:0 Event 107

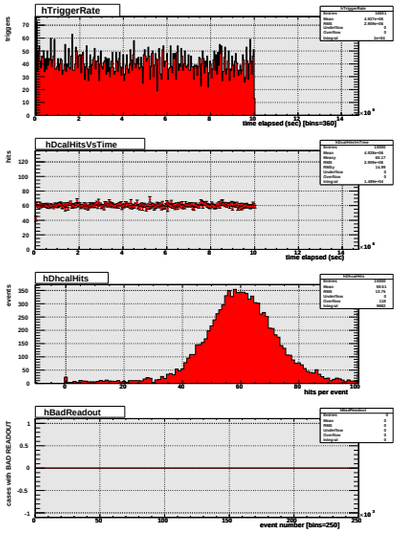
Time: 724491

Hits: 67 Energy: xxx mips

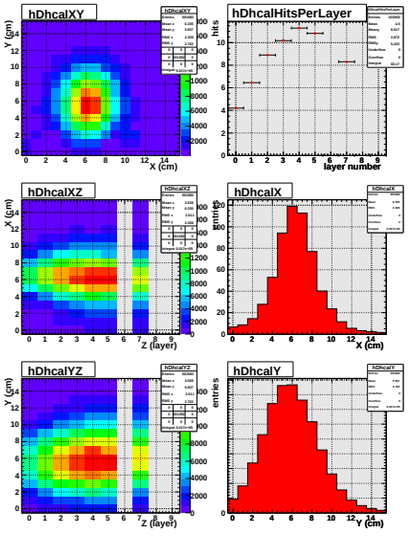


e^+ 8 GeV

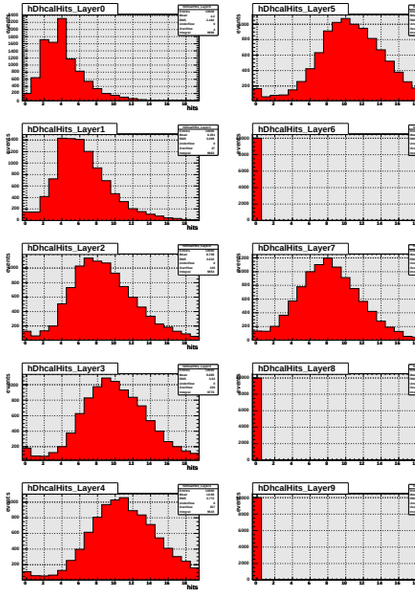
Main



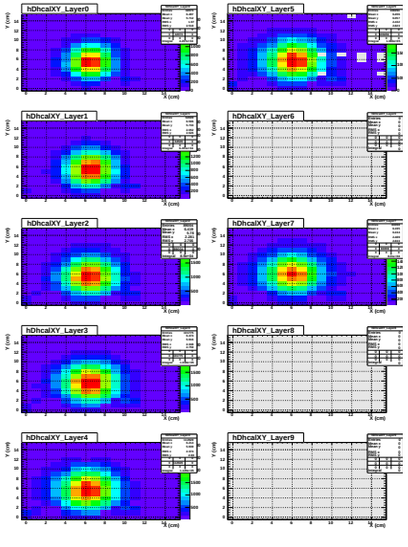
all layers



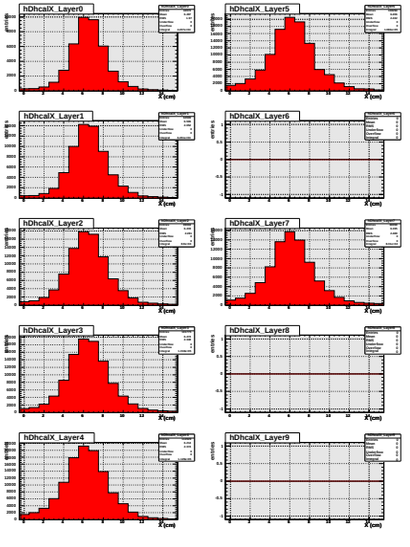
hits per layer



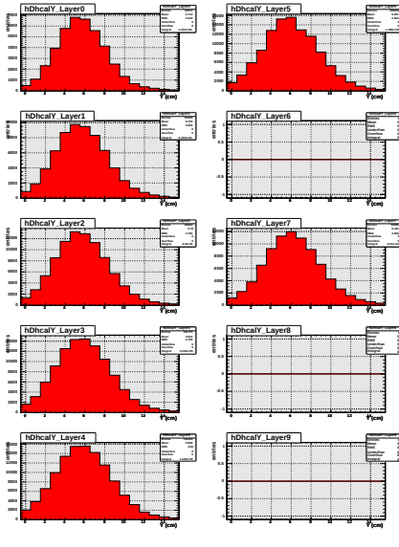
XY per layer



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