PEDESTAL STABILITY OF HCAL DURING GLOBAL RUNS AND 2009 CASTOR DQM ANALYSIS

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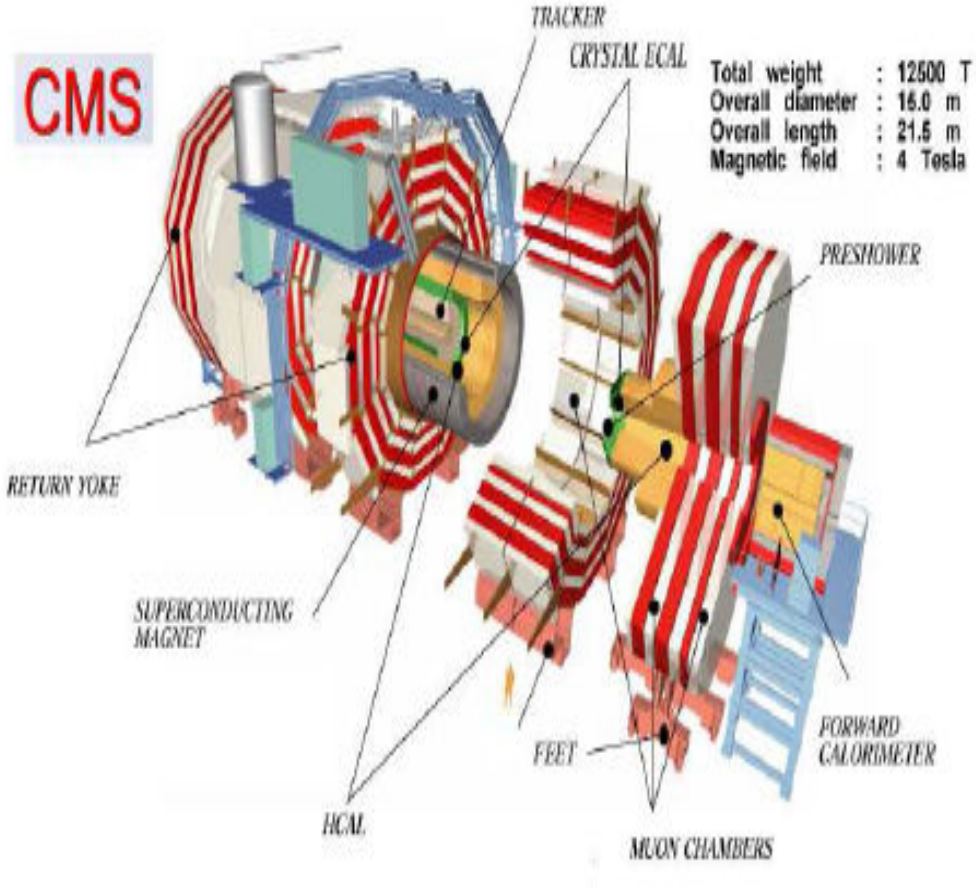
Outline

- Introduction
- The CMS Experiment
- The HCAL Calorimeter
  - Pedestal Stability of HCAL during global runs
- The CASTOR Forward Calorimeter
  - DQM analysis in CASTOR for Beam Splash data

Introduction

- My work contains two major studies.
  - Analysis of stability of HCAL pedestal by using global data.
  - CASTOR hardware and 2009 CASTOR DQM analysis.

The CMS experiment



•The CMS detector consist of subdetectors which are a silicon tracker, an electromagnetic calorimeter (ECAL) and a hadron calorimeter (HCAL) and muon detectors. Tracker, ECAL and HCAL are surrounded by a solenoid which generates a strong magnetic field of 4 T, in order to measure tracks, energy and momentum of photons, electrons, muons and the other particle over a large energy range

The HCAL Calorimeter

- **HCAL which will measure quark, gluon and neutrino directions and energies by means of measuring the energy and direction of particle jets and of the missing transverse energy flow, is an subsystem of the CMS detector.**
- **The HCAL consist of four subdetectors which are Hadron barrel (HB), Hadron endcap (HE), Hadron outer (HO) and Hadron forward (HF). HB covers the η range -1.4< η <1.4 and the HCAL endcaps (HE) cover the pseudorapidity range 1.3< η <3.0. HO covers the region -1.26< η <1.26.**
- **The HF calorimeters, the last subdetector of HCAL, are placed 11 m away from the interaction point. The HF calorimeter covers 3.0< η <5.0. In addition, the CASTOR calorimeter will be placed ±14 m from the IP which covers 5.2 < η < 6.4 .**

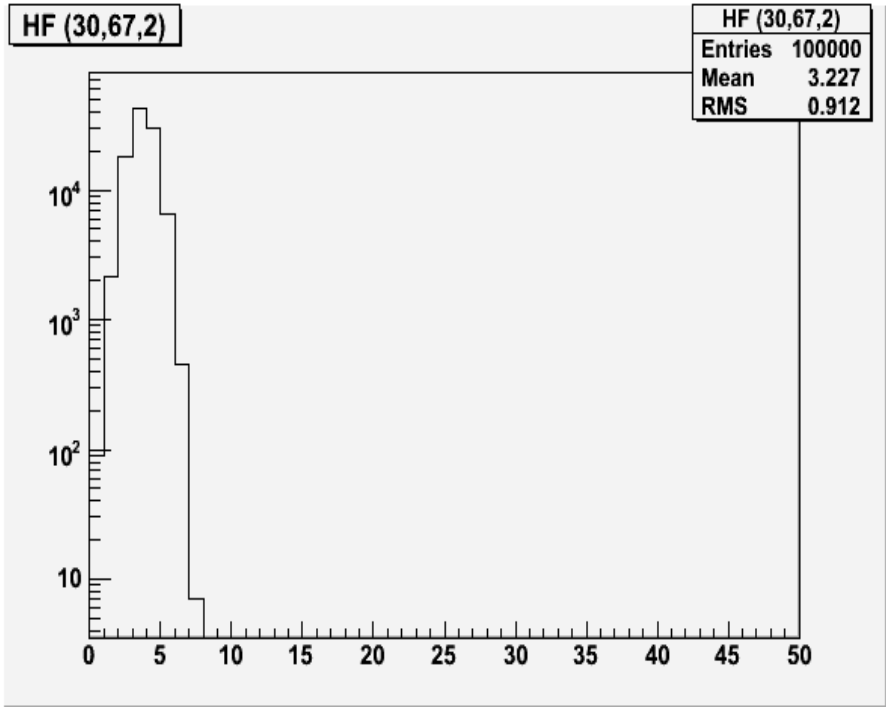
Overview

1. We analyzed stability of HCAL hardware pedestals using runs in the period from August 31 to December 16, 2009: ~ 300 global runs

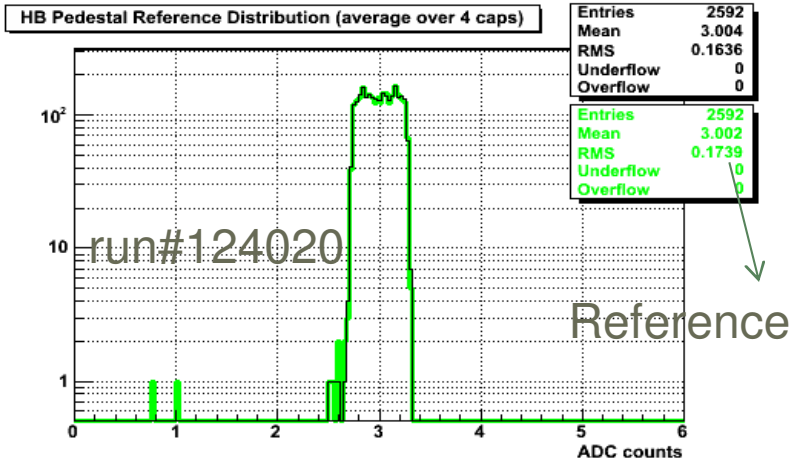
period	dates	run range
Beam09 @ 3.8T (wk50-wk..)	December 7 – December 16	123726 - 124301
Beam09 @ 3.8T (wk49)	November 30 – December 6	123151 - 123614
Beam09 @ 0T (wk48)	November 20-November 30	121942 -123149
InterSplash09 @ 0T(wk 46 - wk47)	November 9- November 20	118326 – 119950
SPLASH09a	November 6- November 8	119959 - 120042
CRAFTb (wk44 - wk45)	October 26 - November 6	118326 - 119807
MWGR41	October 8 - October 9	116629 - 116675
MWGR40	October 1 - October 2	115911 - 116136
CRAFT2_2009@B=0T	August 31 - September 1	112541 - 115871

2. We consider threshold=0.2 ADC/TS to define unstable channels
3. We categorized unstable channels as
   - •Single shift for few channels in a single run
   - •Shifting/drifting channels in several runs).

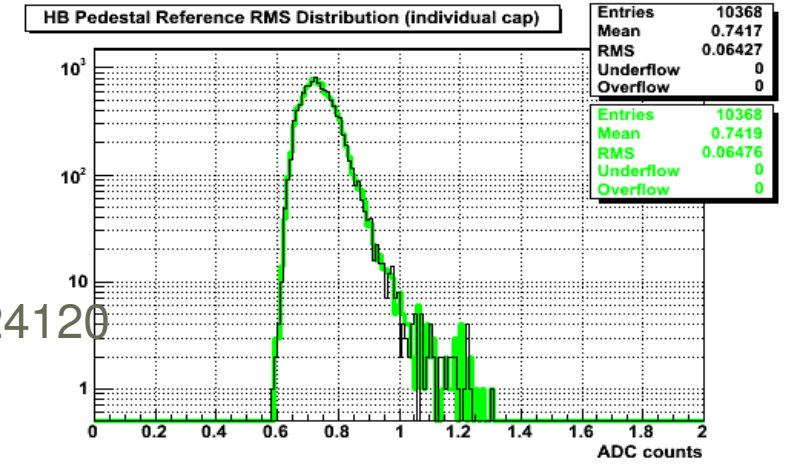
ADC counts distribution for local pedestal run 124041 (for 100k events)

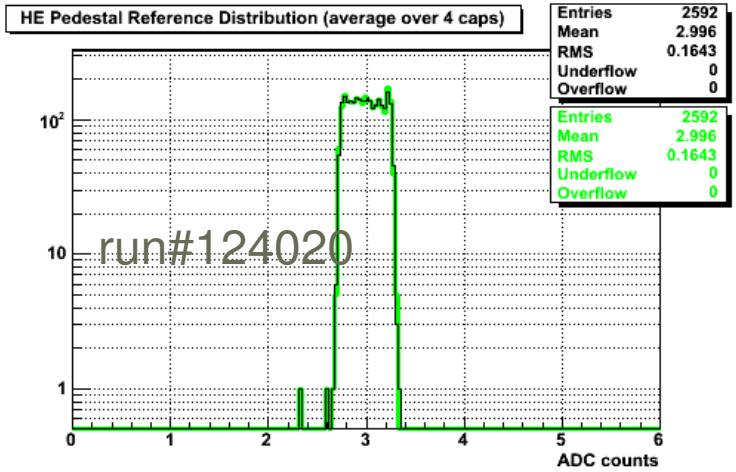


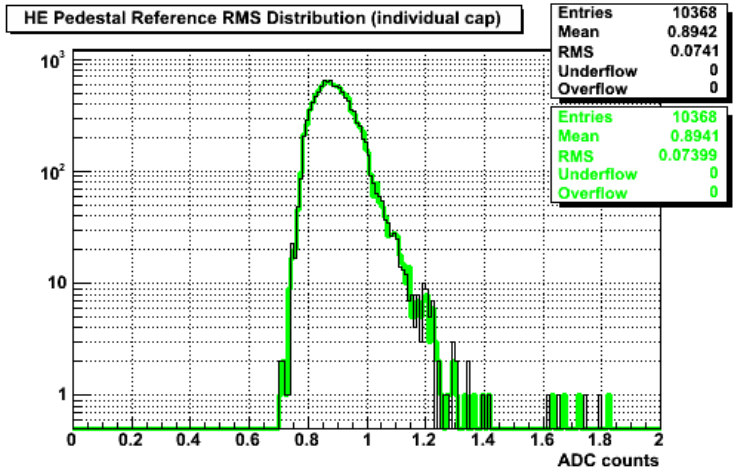
Pedestal distributions for HB and HE (Reference run 124120)



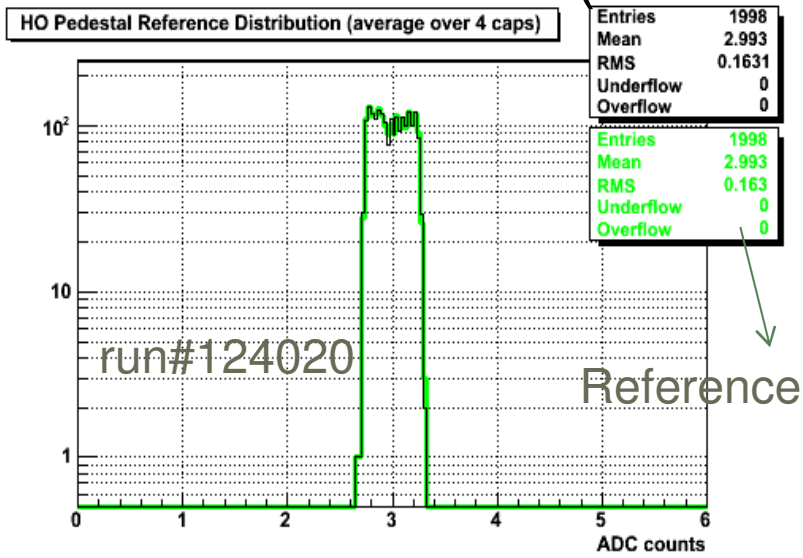
Reference run 124120



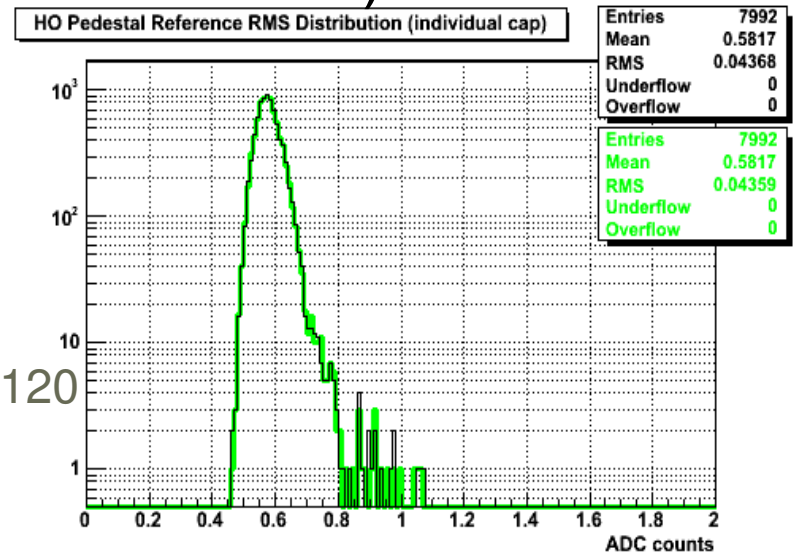


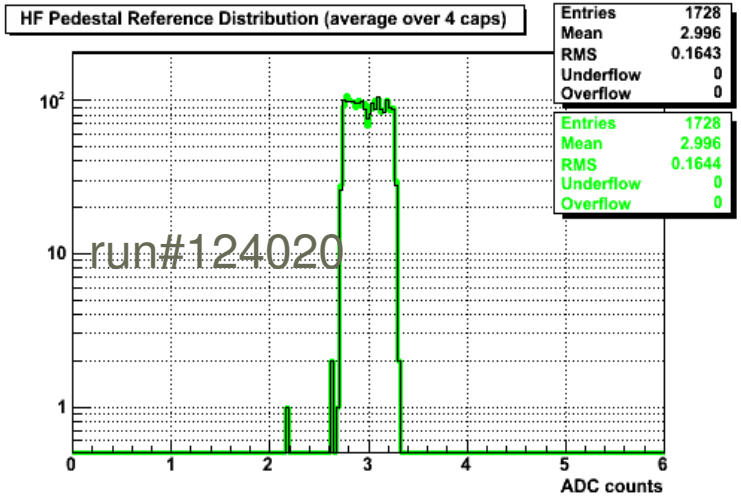


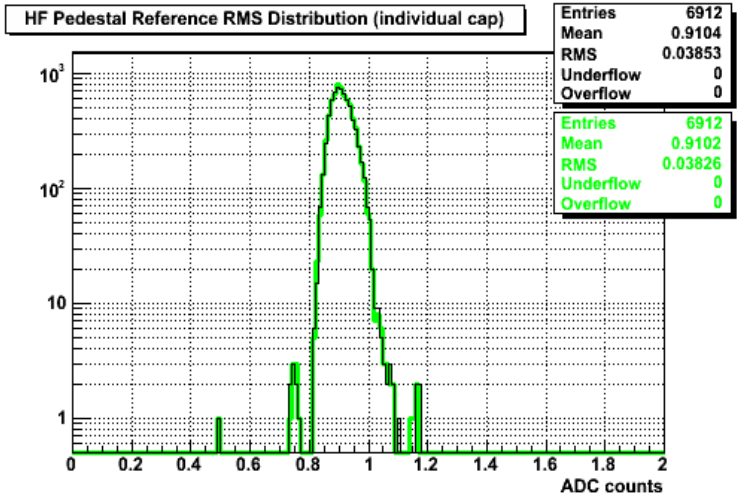
Pedestal distributions for HO and HF (Reference run 124120)



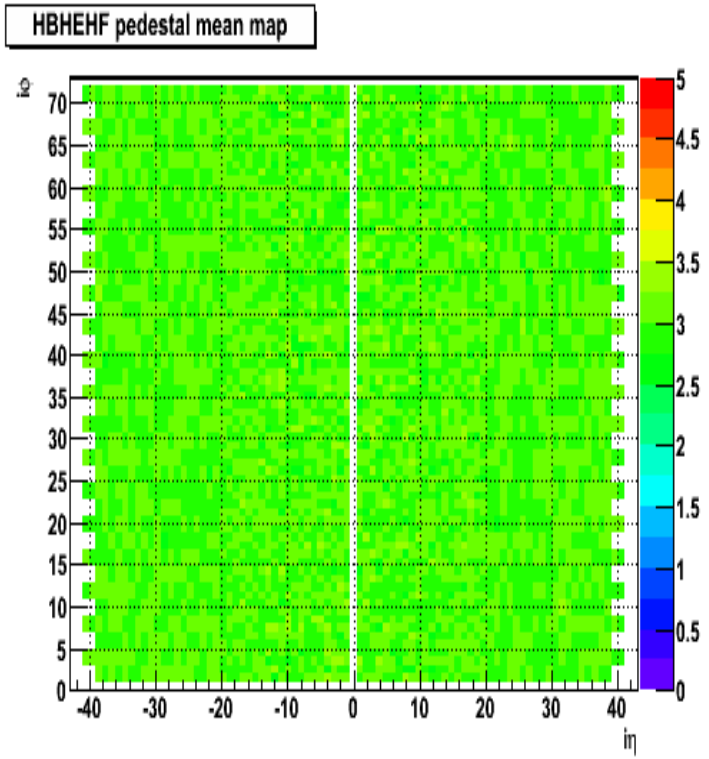
Reference run 124120

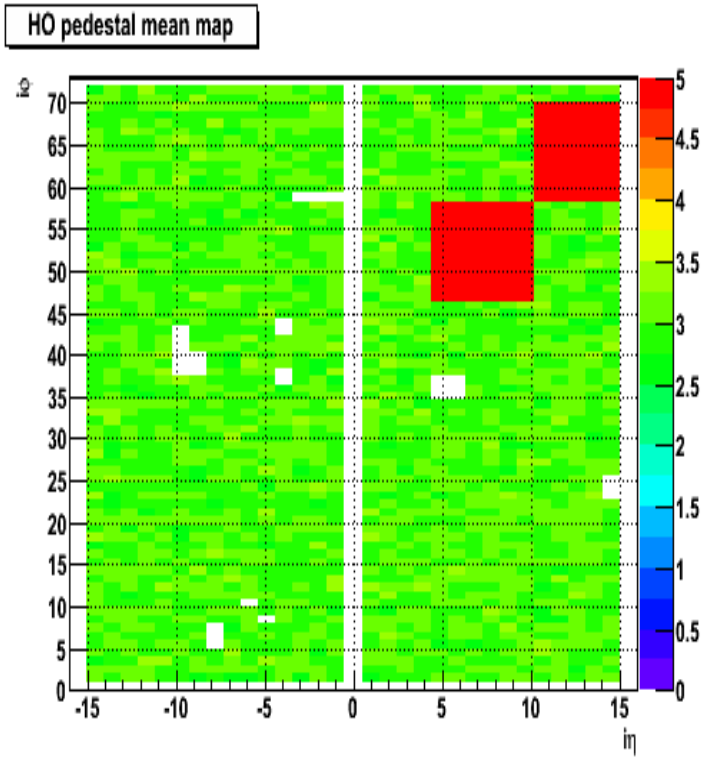






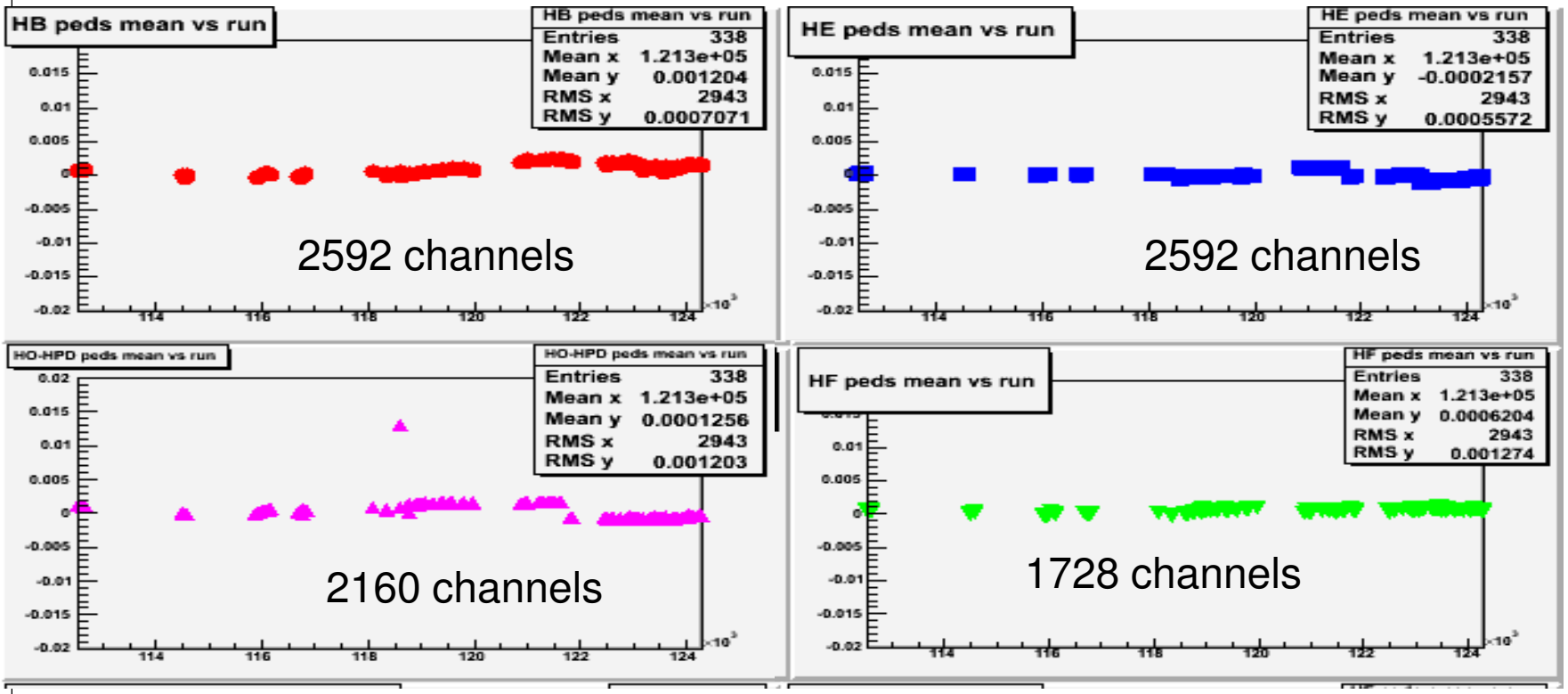
Status of pedestal :HB,HE,HF,HO





- Most of channels have pedestal mean ~2.7-3.3 ADC/Time Slice
- Generally there are 29 missing channels in HO

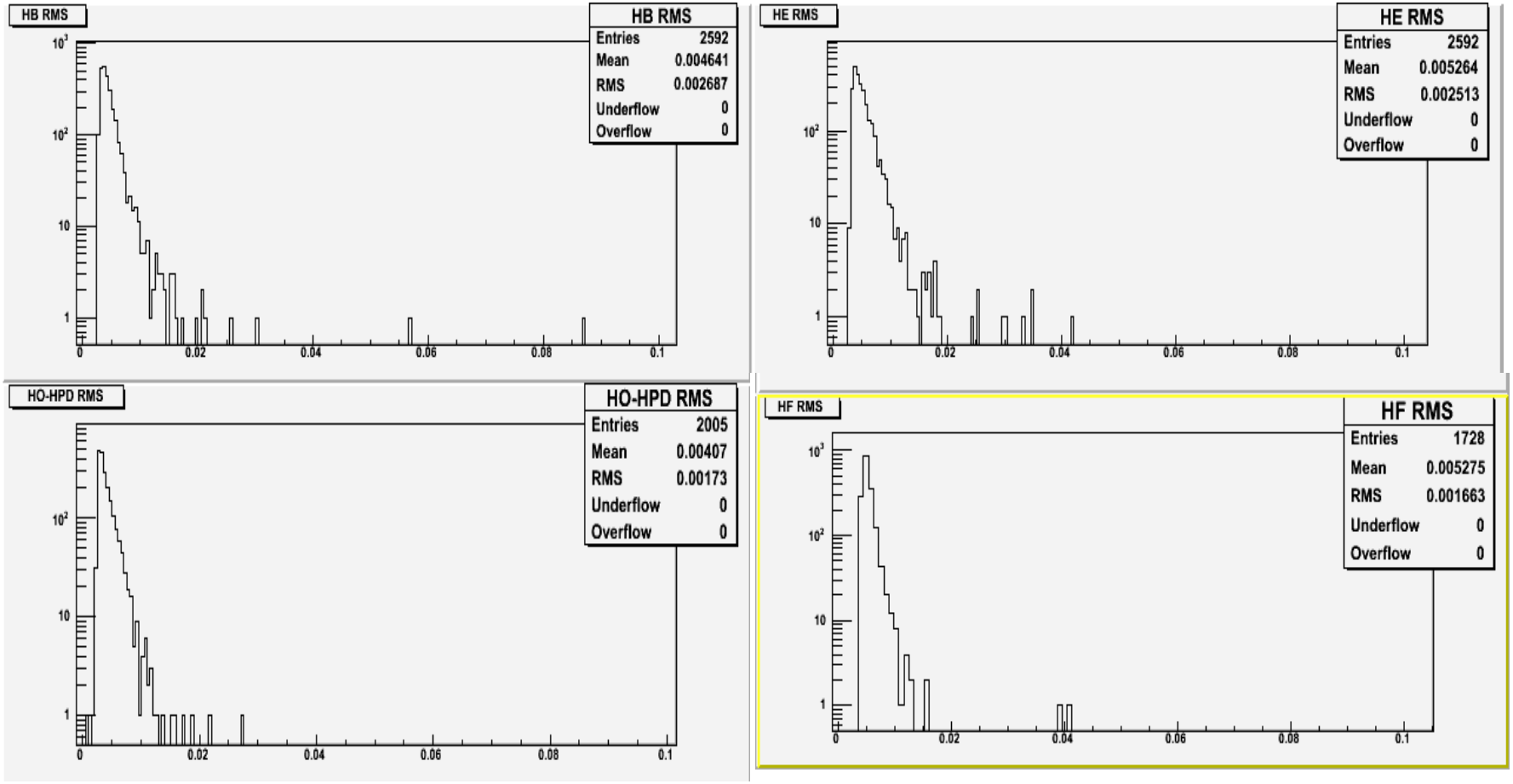
Average HCAL pedestal stability, referans run 124120



Each point corresponds to an average pedestal value for entire with respect to reference value

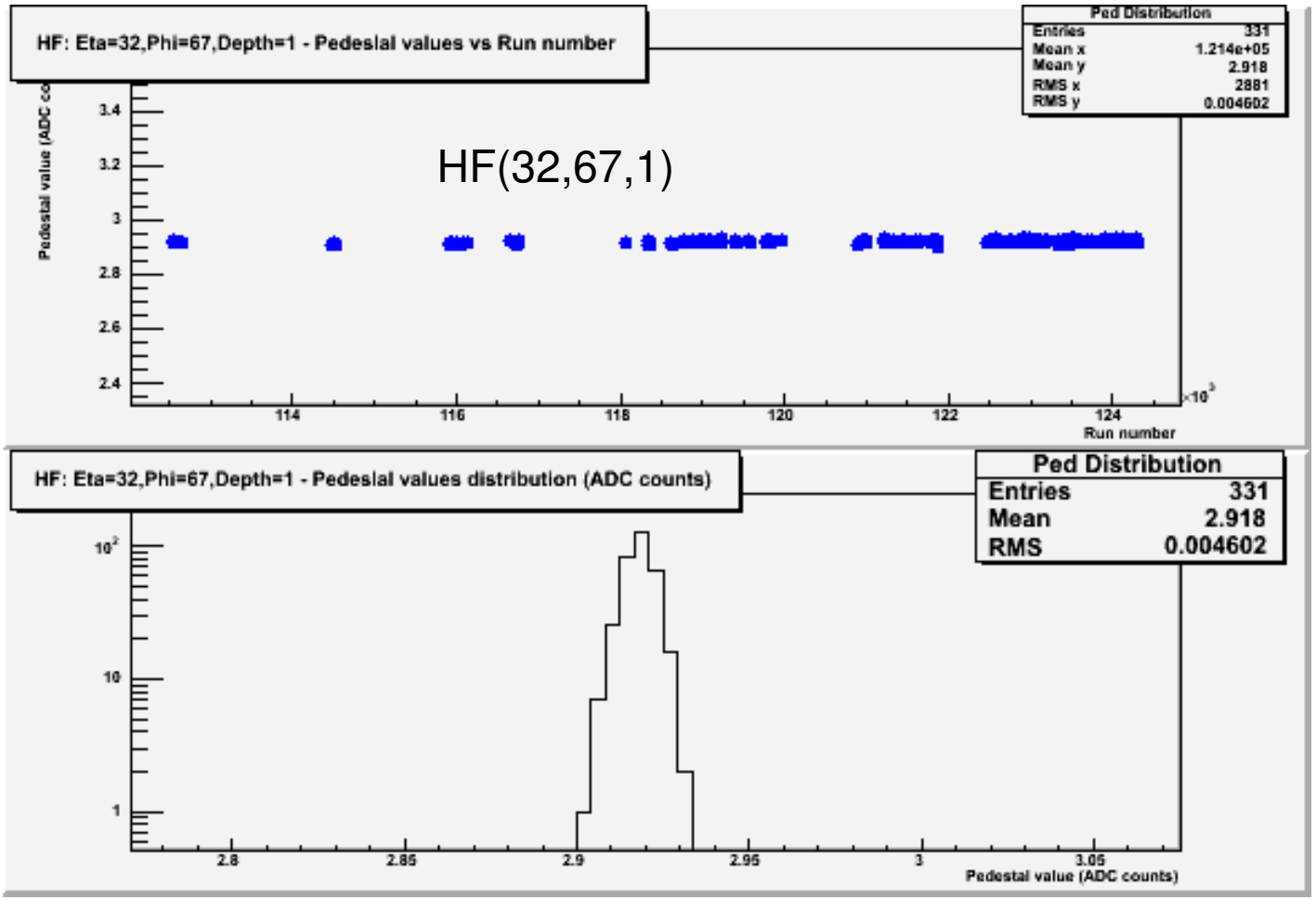
Data~for 340 global runs

RMS of pedestal means over many runs



Typical RMS~0.002 ADC/TS,

Example of pedestal stability of individual channels average pedestal in given run versus run number

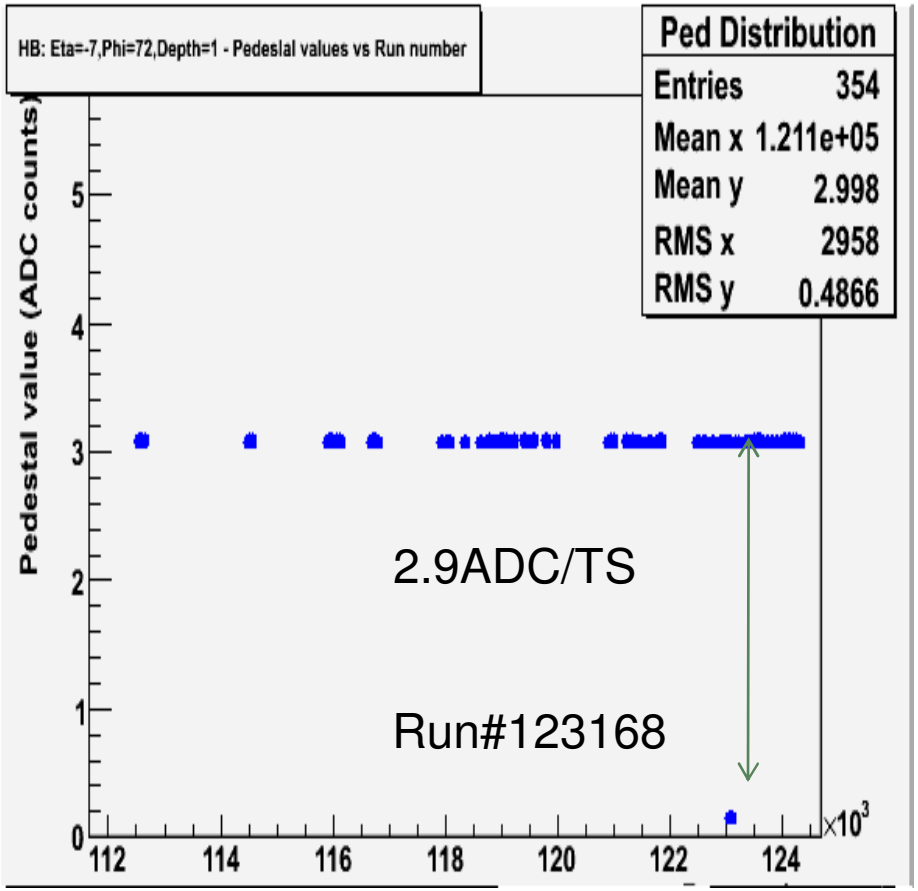


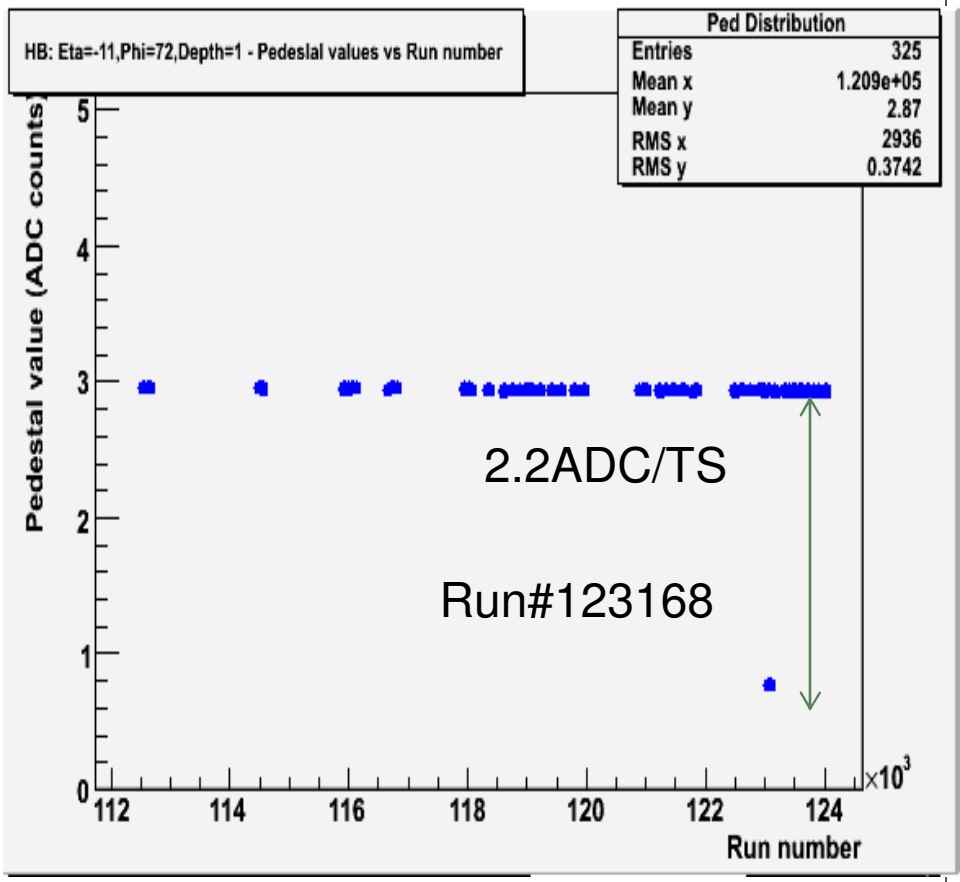
List Of Channels with Single Shift in Pedestal

Channels	comment
HB(-7,72,1)	Single Shift Run#123168
HB(-11,72,1)	Single Shift Run#123168
HE(16,28,3)	Single Shift Run#129024
HE(17,28,1)	Single Shift Run#129024
HE(24,51,2)	Single Shift Run#117924
HE(28,51,2)	Single Shift Run#117924
HE(-18,22,1)	Single Shift Run#129024
HE(-18,22,2)	Single Shift Run#129024
HF(41,67,1)	Single Shift Run#119017
HO(4,41,4)	Single Shift Run#116815

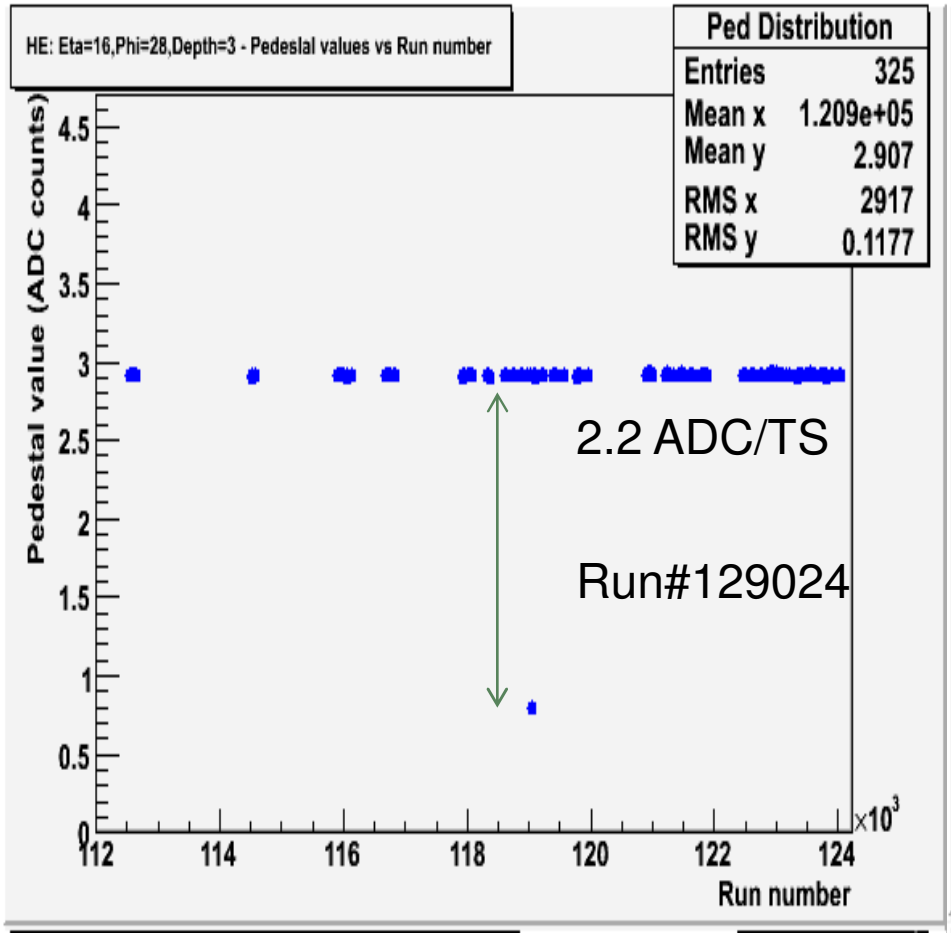
Example of Single Shift in Pedestal:

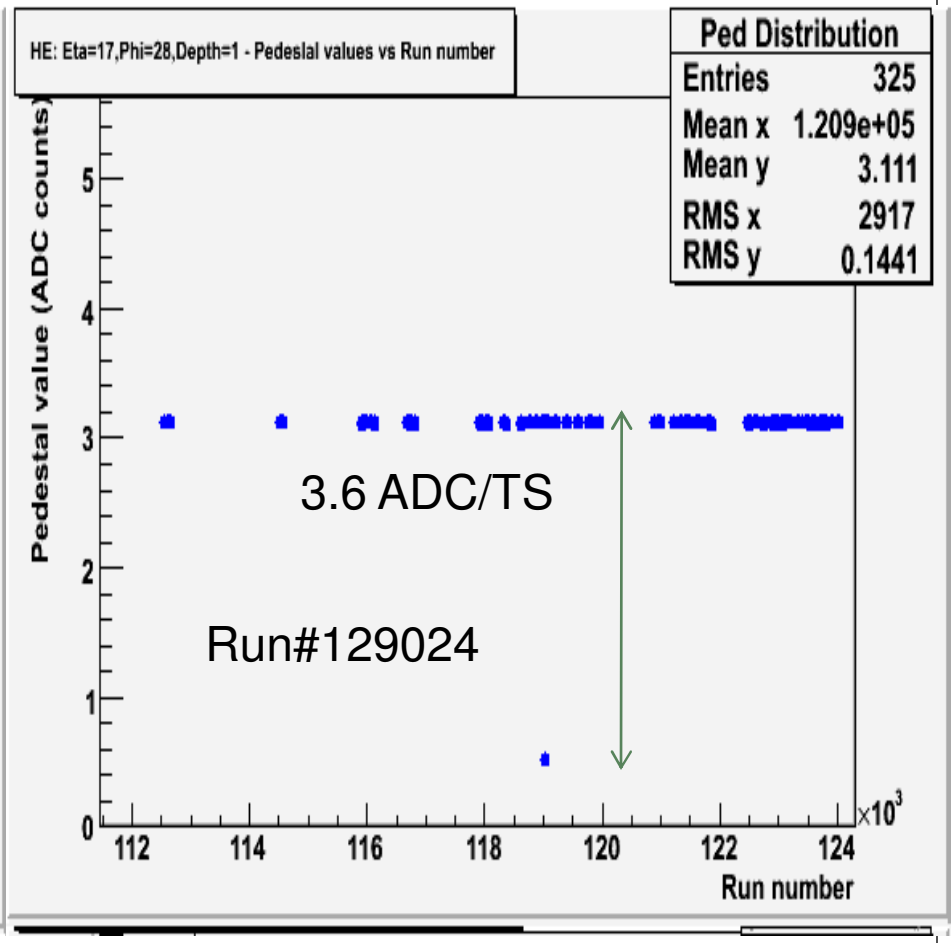
HB(-7,72,1) HB(-11,72,1)



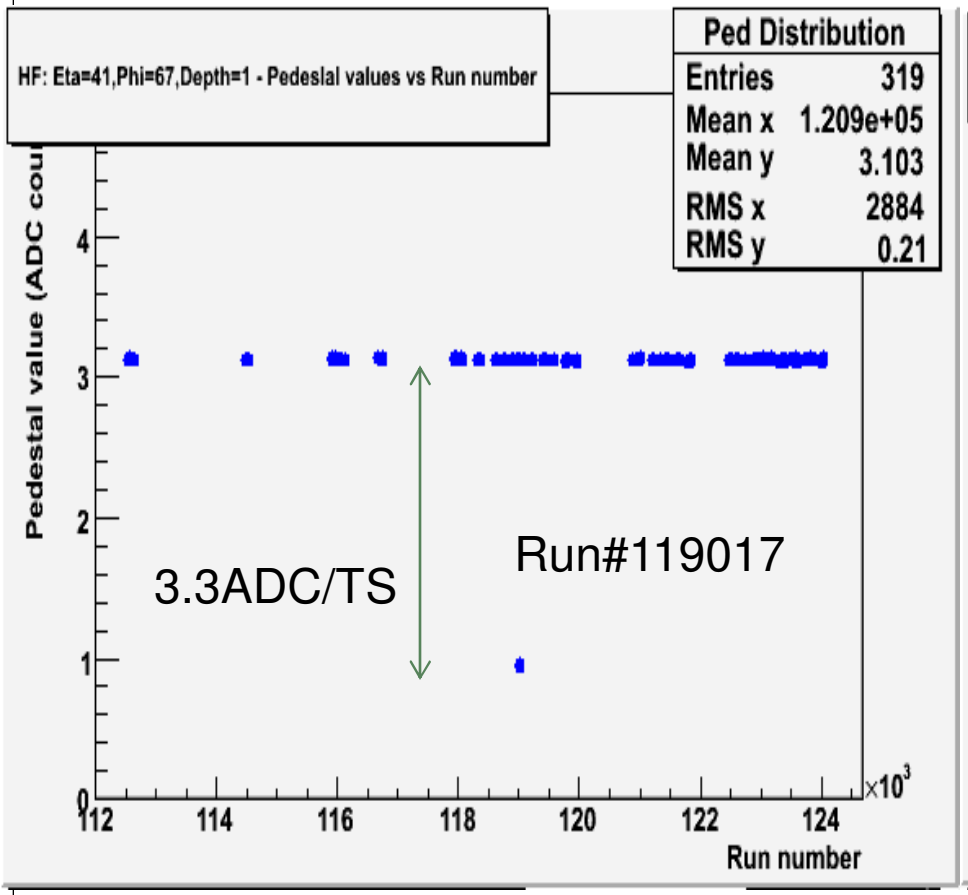


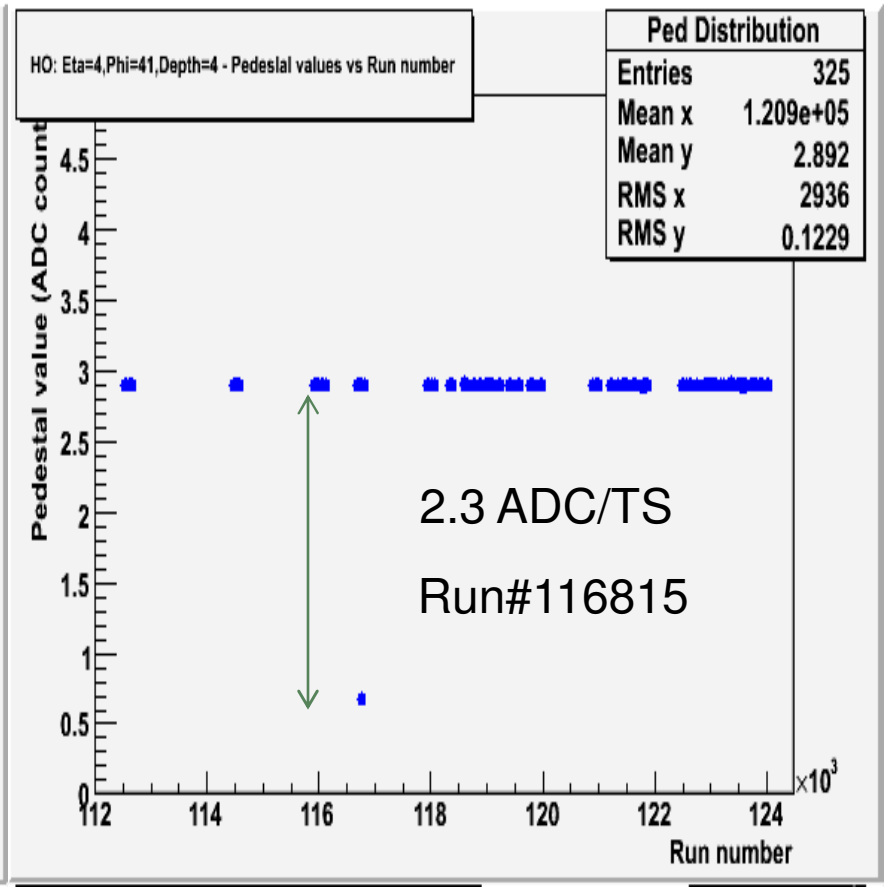
HE(16,28,3), HE(17,28,1)





HF(41,67,1) HO(4,41,4)

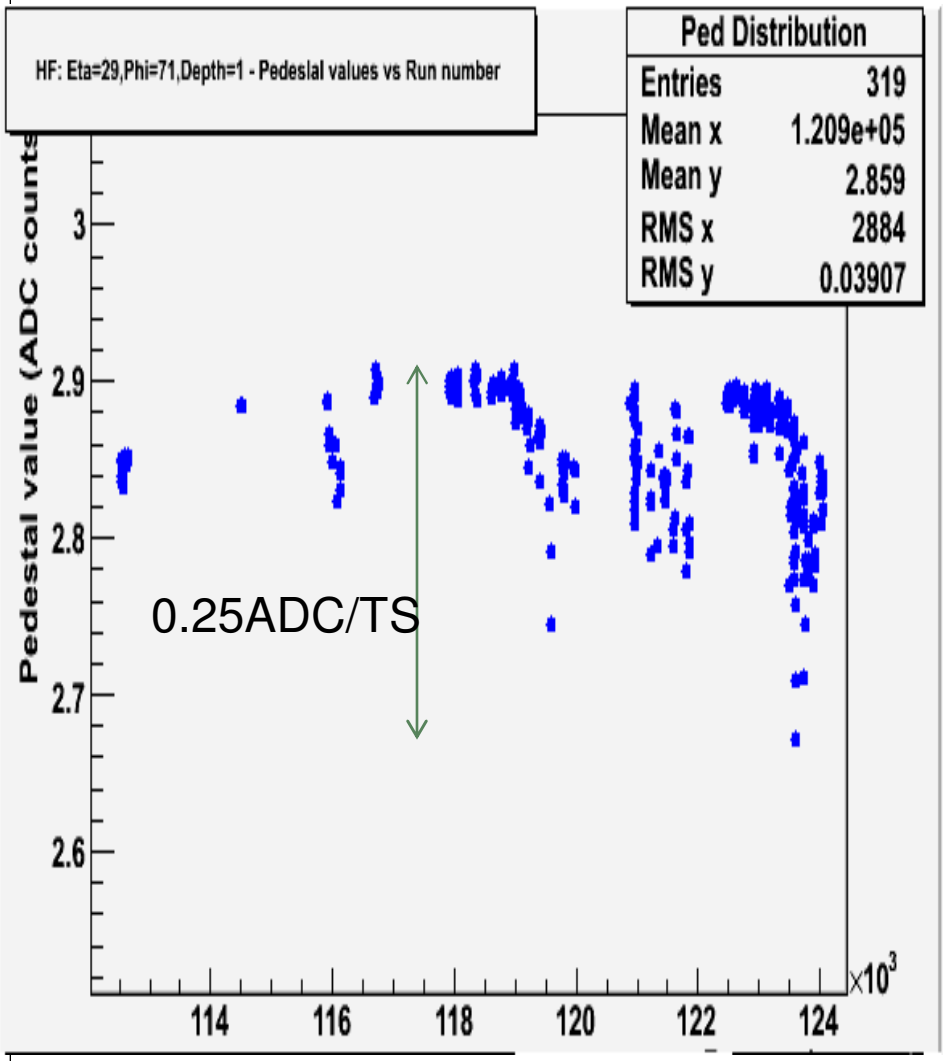


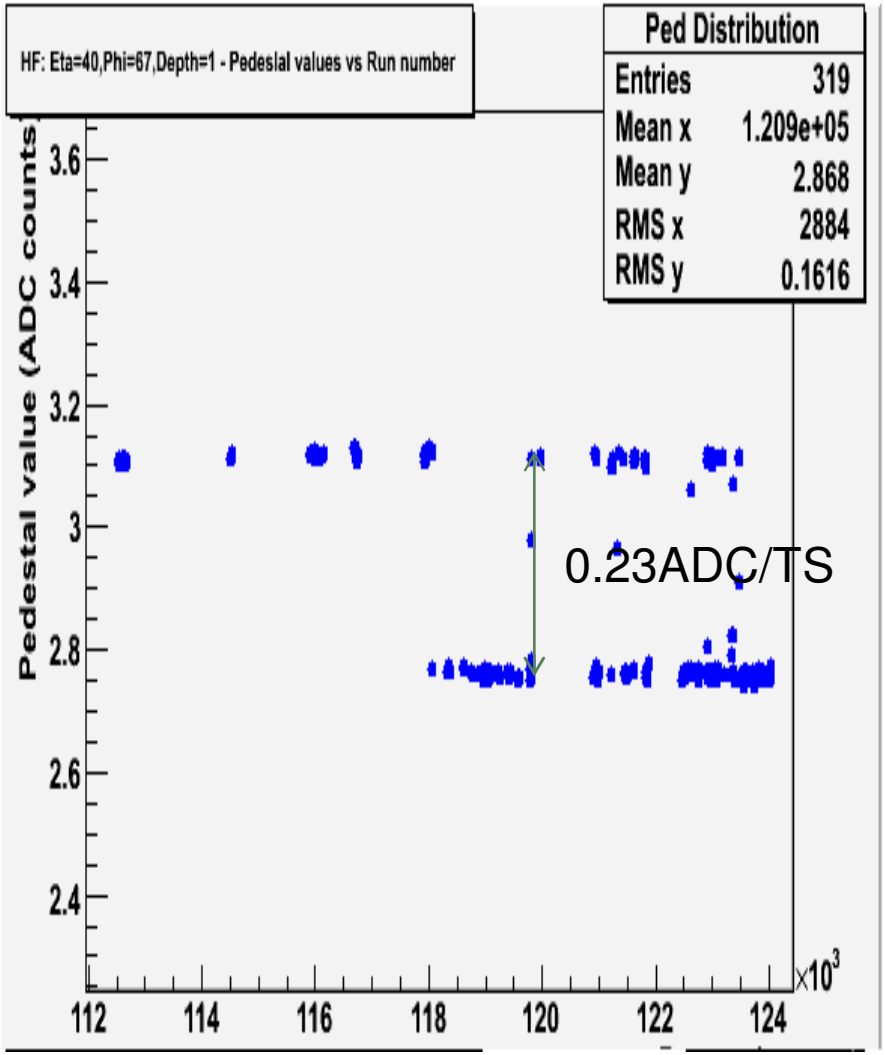


List of Channels with Shift/Drift in Pedestal

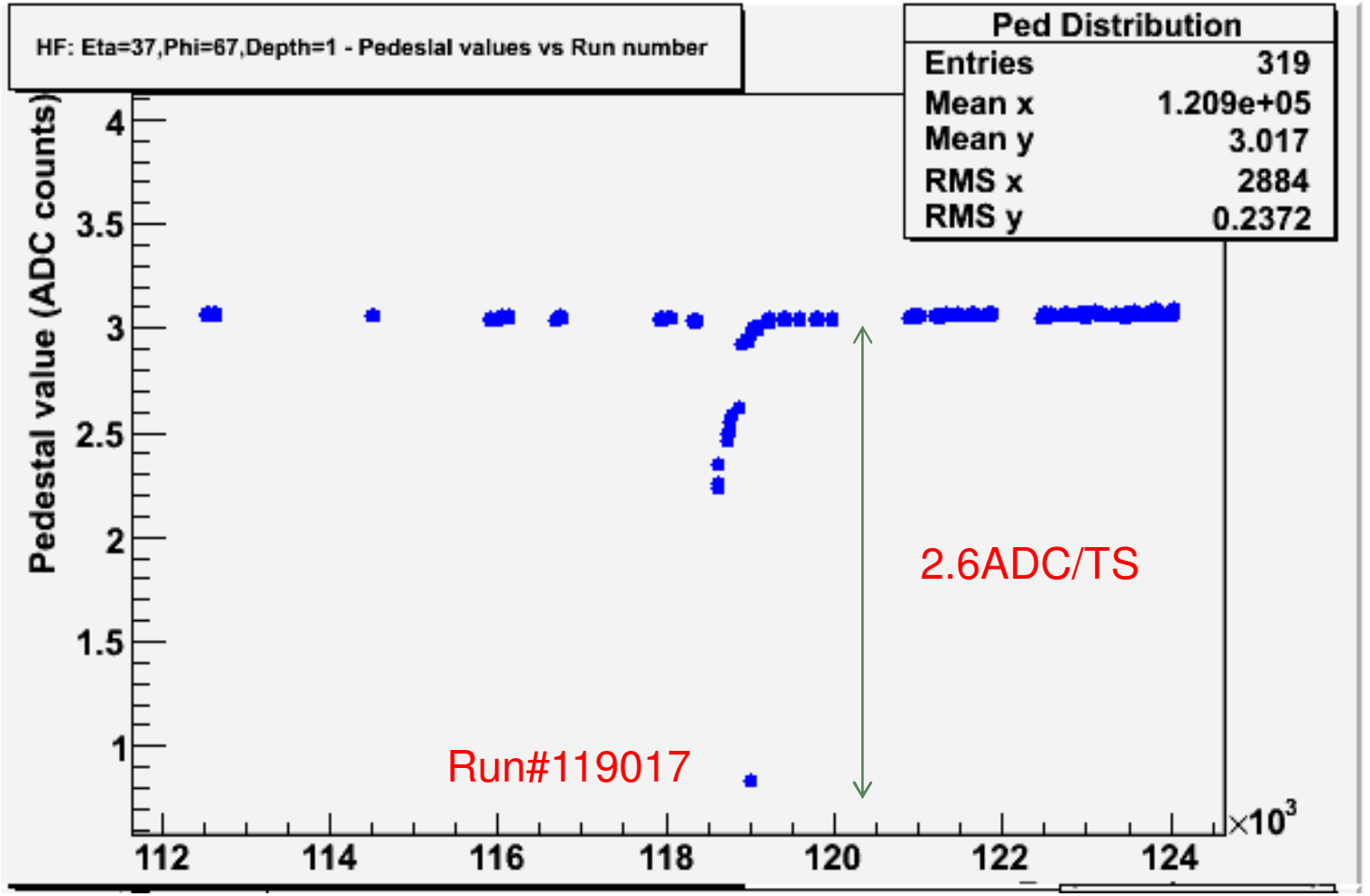
Channels	Comment
HB(4,36,1)	Shift/Drift in Pedestal
HB(14,31,1)	Shift/Drift in Pedestal
HF(29,71,1)	Shift/Drift in Pedestal
HF(32,53,1)	Shift/Drift in Pedestal
HF(40,67,1)	Shift/Drift in Pedestal
HF(33,61,1)	Shift/Drift in Pedestal

HF(29,71,1), HF(40,67,1)

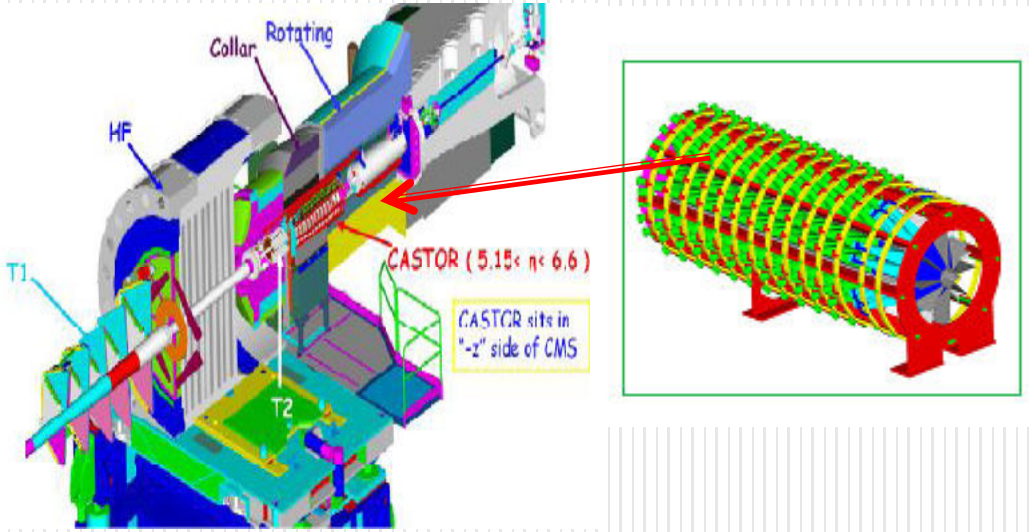


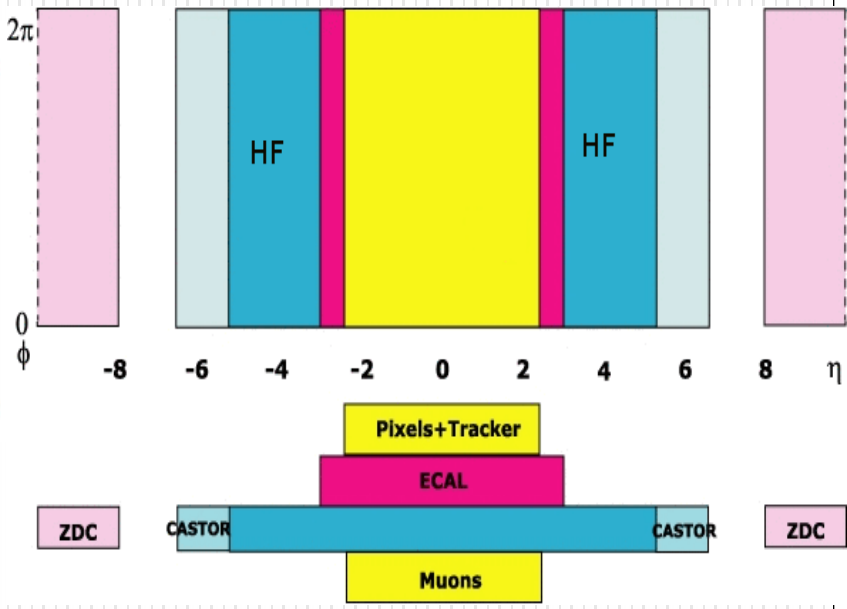


HF(37,67,1)


HF: Eta=37,Phi=67,Depth=1 - Pedestal values vs Run number
Ped Distribution
Entries 319
Mean x 1.209e+05
Mean y 3.017
RMS x 2884
RMS y 0.2372
Pedestal value (ADC counts)
4
3.5
3
2.5
2
1.5
1
2.6ADC/TS
Run#119017
112
114
116
118
120
122
124
×10³

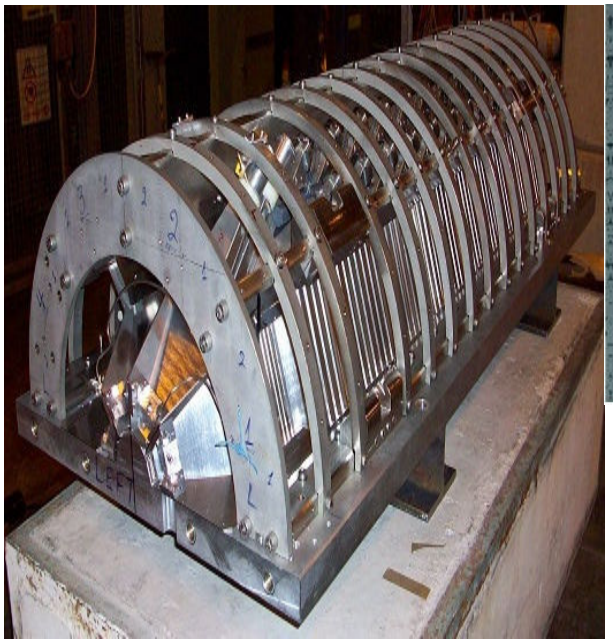
The CASTOR Forward Calorimeter

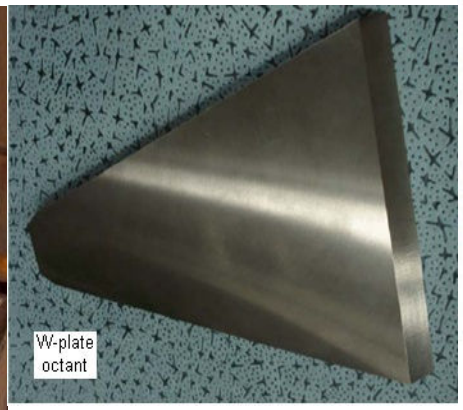


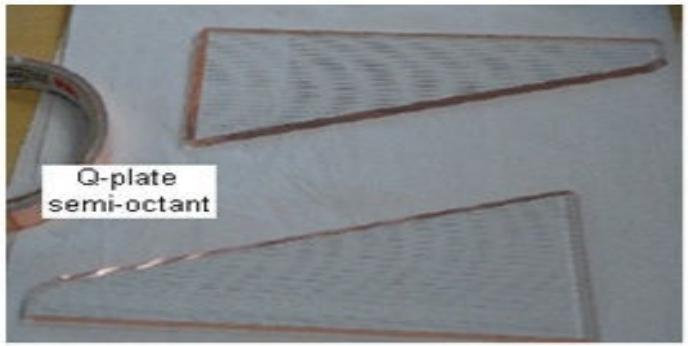


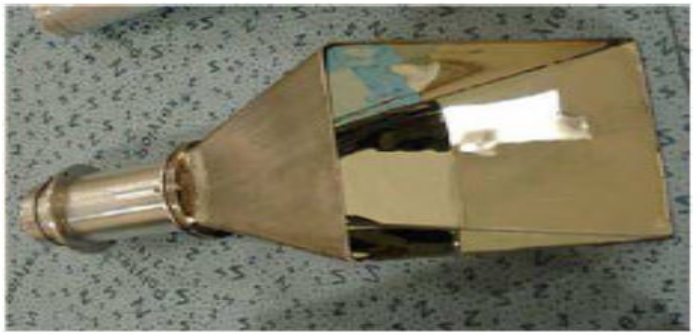
- The Centauro and Strange Object Research (CASTOR) calorimeter which will search Centauro-type events in heavy-ion collisions, is one of the forward detectors of CMS. The main goal of the CASTOR is to study some anomalous events like centauros and stranglets.
- CASTOR which is a tungsten/quartz Cerenkov electromagnetic and hadronic calorimeter, an octagonal cylinder in shape. It's outer diameter is 36 cm and inner diameter is 3.8 cm (to contain the beam pipe).
- Castor will cover the region $5.2 < \eta < 6.4$.

CASTOR Components

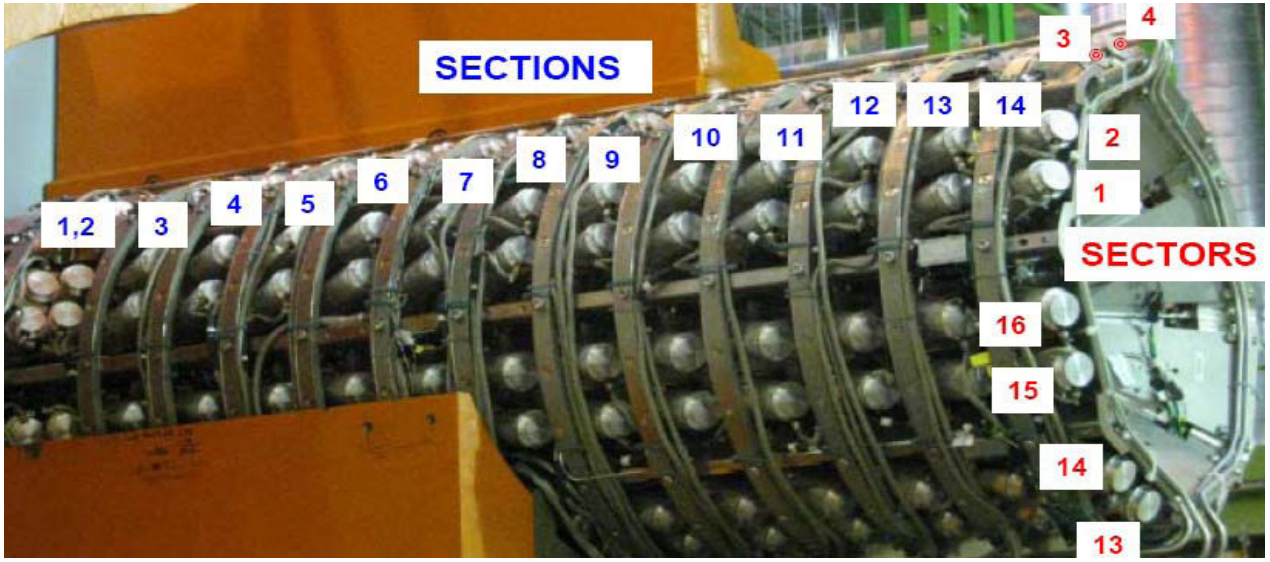


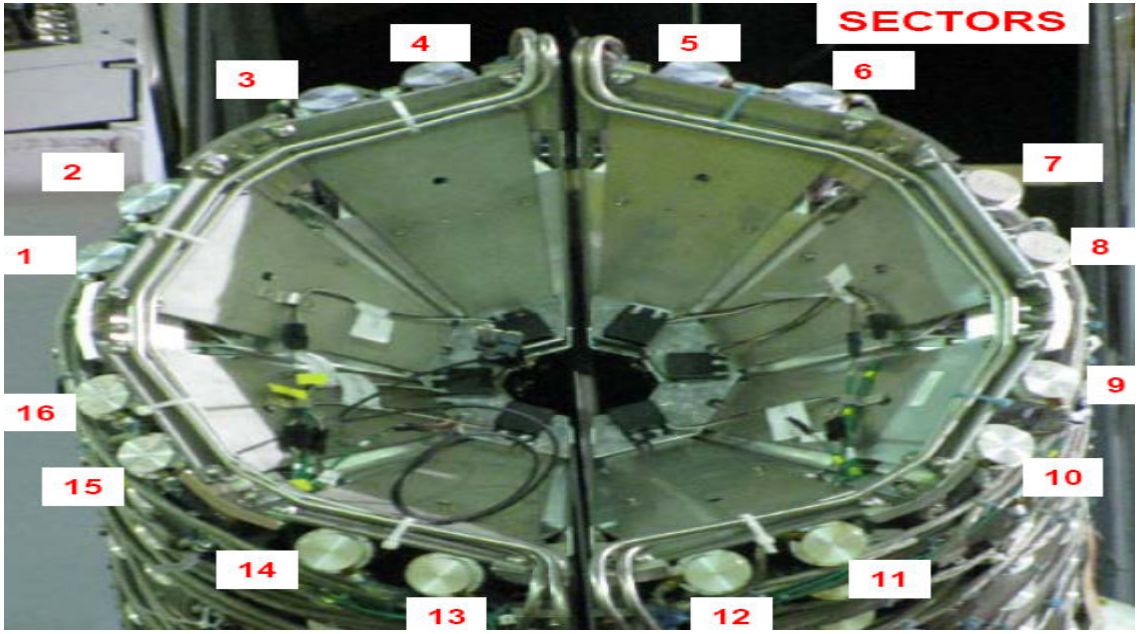






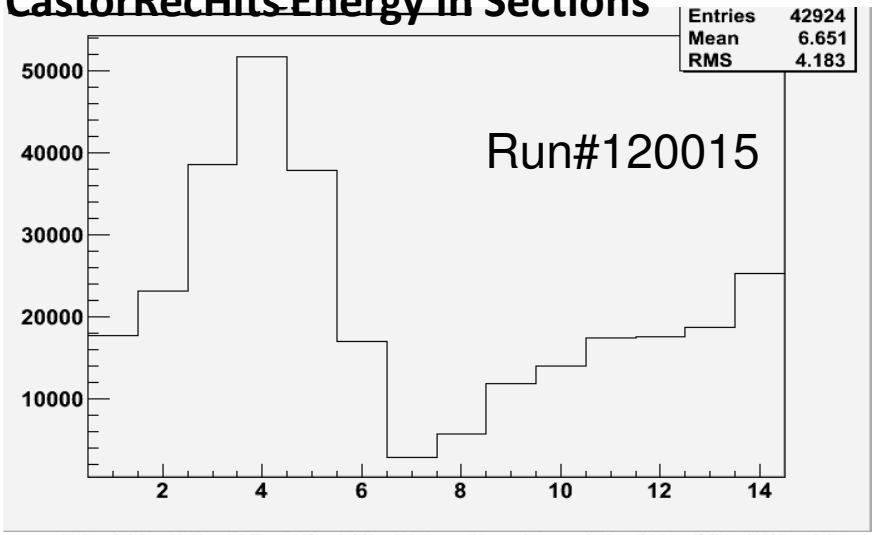
- It is divided into 16 sectors in azimuth, longitudinally into 14 sections, 2 section for the EM part and 12 section for the HAD parts in depth.
- The electromagnetic section has 2x16 channels and the hadronic section has 12x16 channels.
- CASTOR calorimeter consists of successive layers of tungsten plates (W) as absorber and fused silica quartz (Q) plates as active medium.
- There are 5 tungsten/quartz layers called Sampling Units (SU) in both the EM and HAD sections, each read by a Readout Unit (RU).

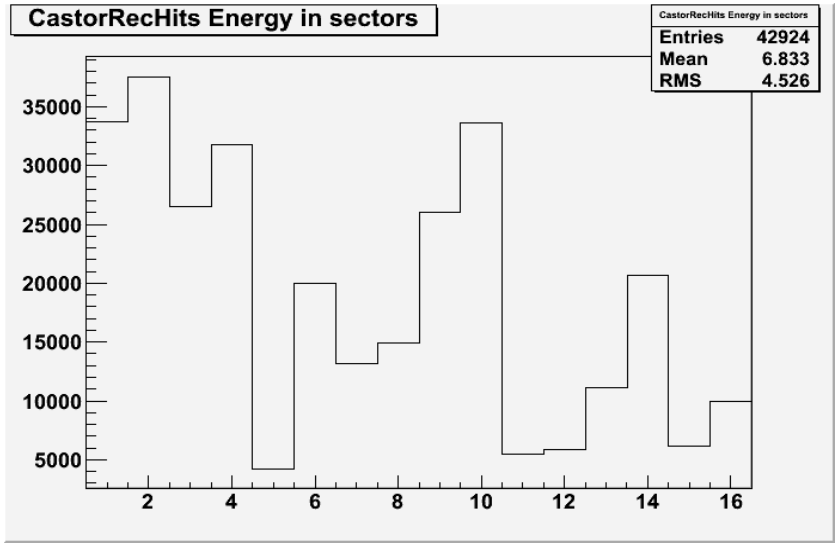

SECTIONS
1,2
3
4
5
6
7
8
9
10
11
12
13
14
3
4
2
1
SECTORS
16
15
14
13

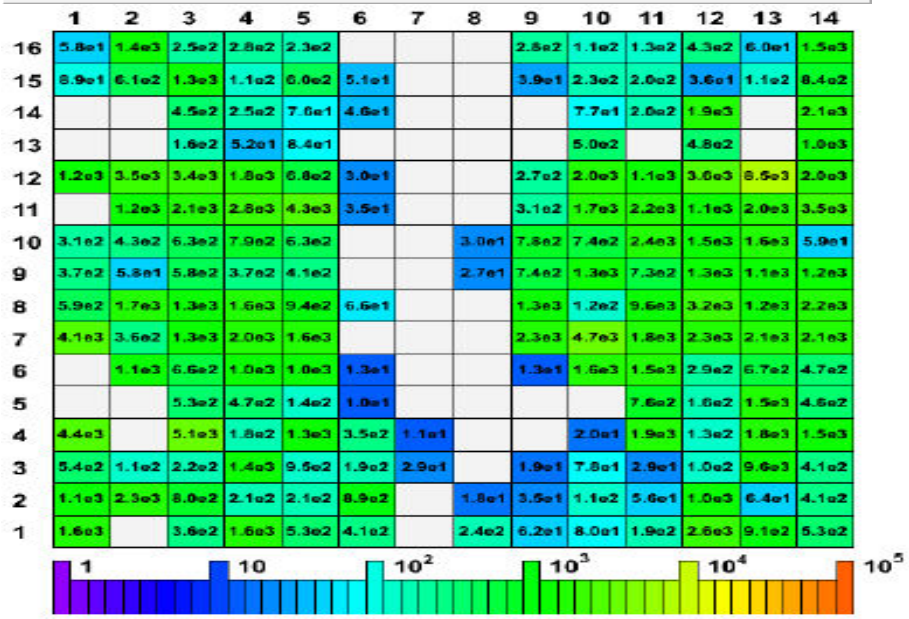

SECTORS
4
5
3
6
2
7
1
8
16
9
15
10
14
11
13
12

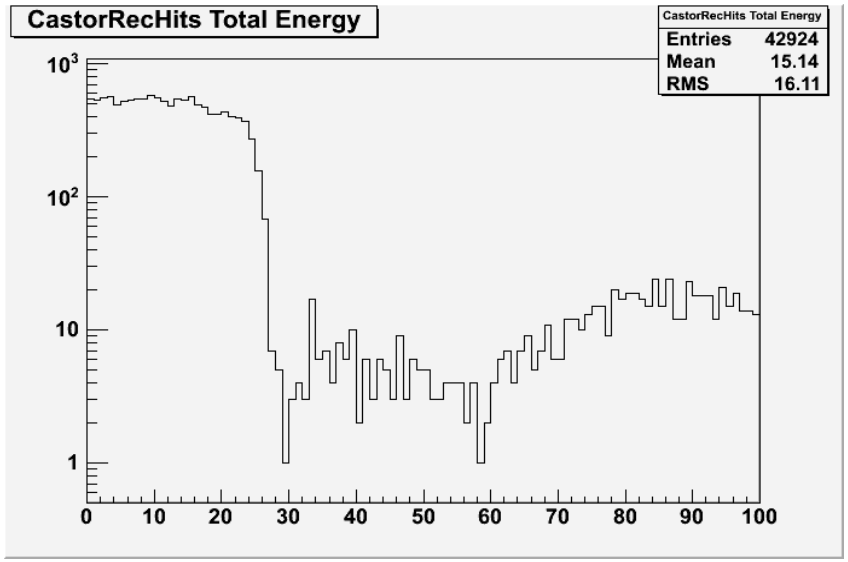
2009 CASTOR DQM analysis by using beam splash data

CastorRecHits Energy in Sections









Conclusion

1. 2009 CASTOR DQM analysis by using beam splash data
2. Analysis of stability of HCAL pedestal by using global data.
   a. Most of individual channels are stable with RMS of 0.001-0.002 ADC/TS.
   b. Some channels showed pedestal variation above the level of 0.2 ADC/TS.

- HCAL pedestal problems:
  - Shifting/drifting channels

    HB(4,36,1) HB(14,31,1) HF(29,71,1) HF(32,53,1) HF(40,67,1) HF(33,61,1) HF(41,47,2)
  - Channels which have single shift in a single run

    HB(-7,72,1) HB(-11,72,1) HE(16,28,3) HE(17,28,1) HE(24,51,2 HE(28,51,3) HE(-18,22,1)

    HE(-18,22,2) HF(41,67,1) HO(4,41,4)

- Presentations:

http://indico.cern.ch/conferenceDisplay.py?confId=66655

http://indico.cern.ch/conferenceDisplay.py?confId=67592

http://indico.cern.ch/conferenceDisplay.py?confId=73530

http://indico.cern.ch/conferenceDisplay.py?confId=75054

http://indico.cern.ch/conferenceDisplay.py?confId=77089

http://indico.cern.ch/getFile.py/access?contribId=9&resId=0&materialId=slides&confId=73980

- Detector Note about pedestal analysis:

http://cms.cern.ch:80/iCMS/jsp/openfile.jsp?tp=draft&files=DN2009_018_v1.pdf