



清华大学
Tsinghua University



DQ Check for CERN Test Beam 2007 data

Manqi Ruan

Discussing & Support: Roman, Francois, Vincent,
Supervisor: Z. ZHANG (LAL) & Y. GAO (Tsinghua))

Outline

- Statistic
- Ecal Response: Longitudinal Profile, Linearity & Resolution
- Problems & Noise Patterns observed in TB data

Statistic

- Scan over 1000 runs on /grid/calice/tb-cern/rec/monitor-cern07: (from run 330400 - run 331568, currently about 100 runs failed or missed in grid job submission)
- About 90 electron runs, 80 electron-pion mixed run and 160 pion runs are marked as **Most valuable runs**, with statistic $> 100k$ per run. (A few runs with statistic $< 100k$ was also marked as most valuable run for those run could combine together with other runs with same beam configuration to gain enough statistic).

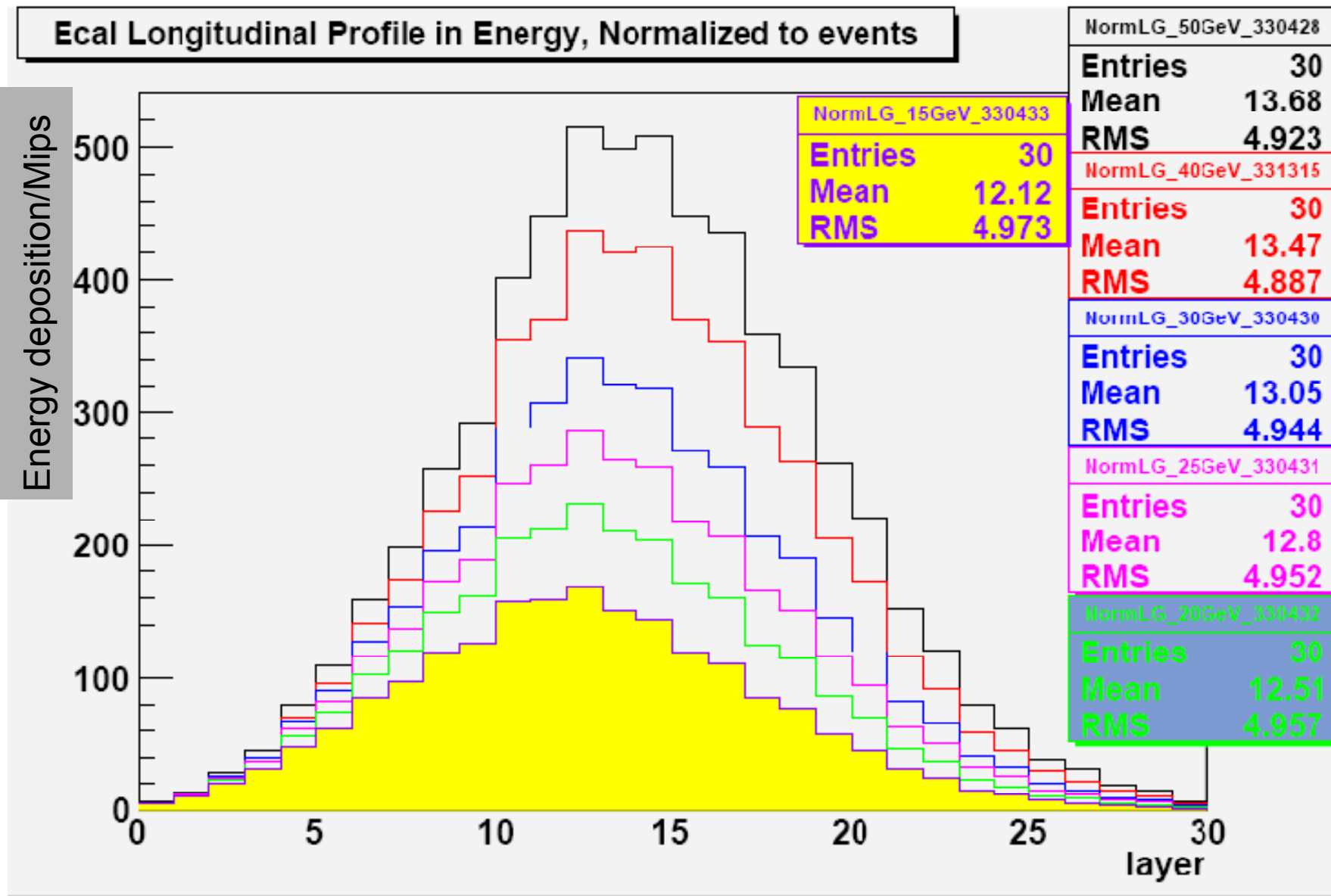
Ecal Response: Longitudinal Profile

| | 0 Degree | 10 Degree | 20 Degree |
|-------|----------|-----------|-----------|
| 50GeV | 330428 | 330986 | 331211 |
| 40GeV | 331315 | 330990 | 331207 |
| 30GeV | 330430 | 330993 | 331204 |
| 25GeV | 330431 | 330994 | 331202 |
| 20GeV | 330432 | 330995 | 331198 |
| 15GeV | 330433 | 330996 | 331194 |
| 12GeV | | 331015 | 331126 |
| 10GeV | | 331012 | 331128 |

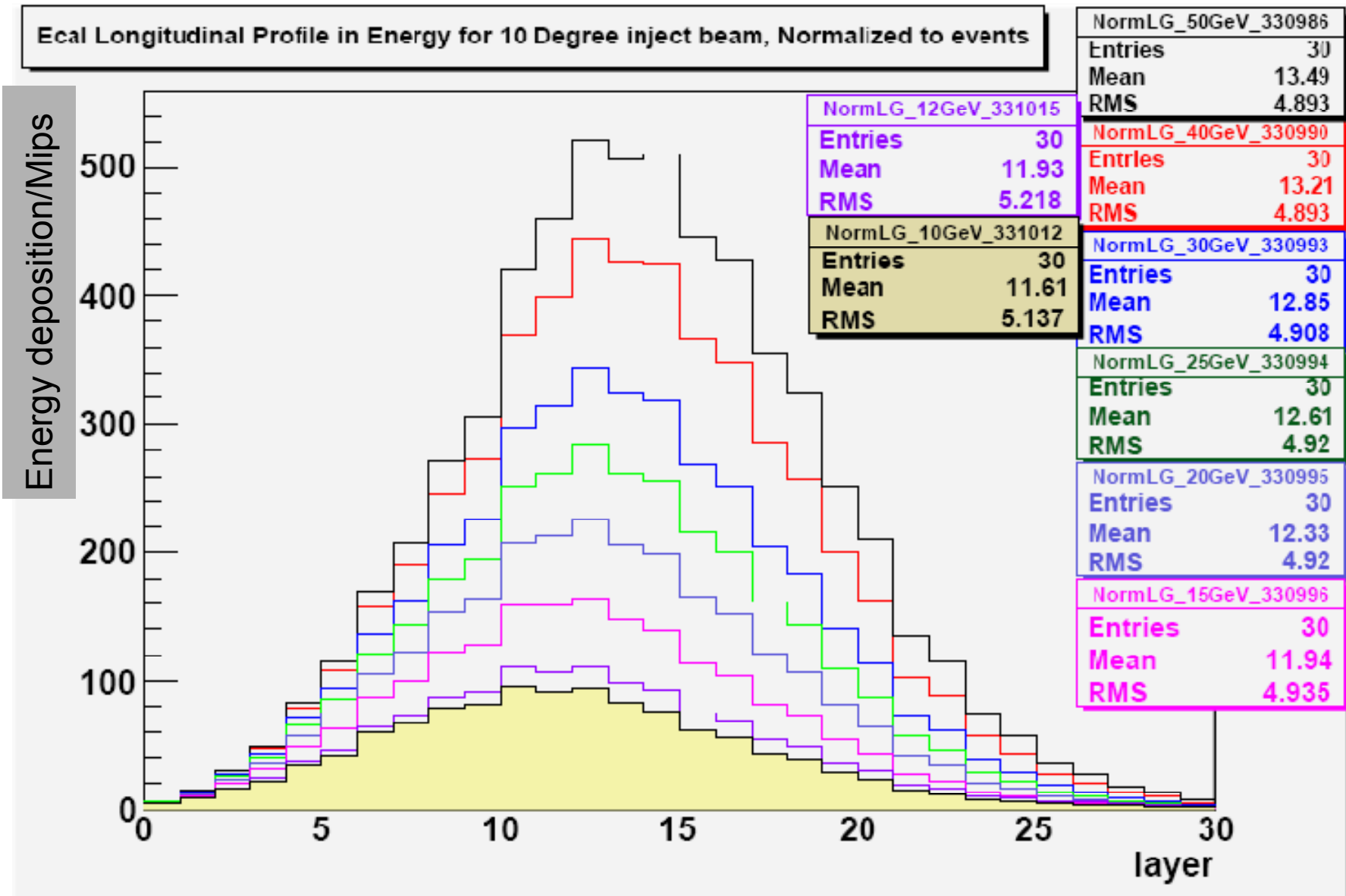
A set of most valuable electron runs are selected: with beam aim at wafer center.

Only the default cut (energy>0.5 mip) of reconstruction is applied

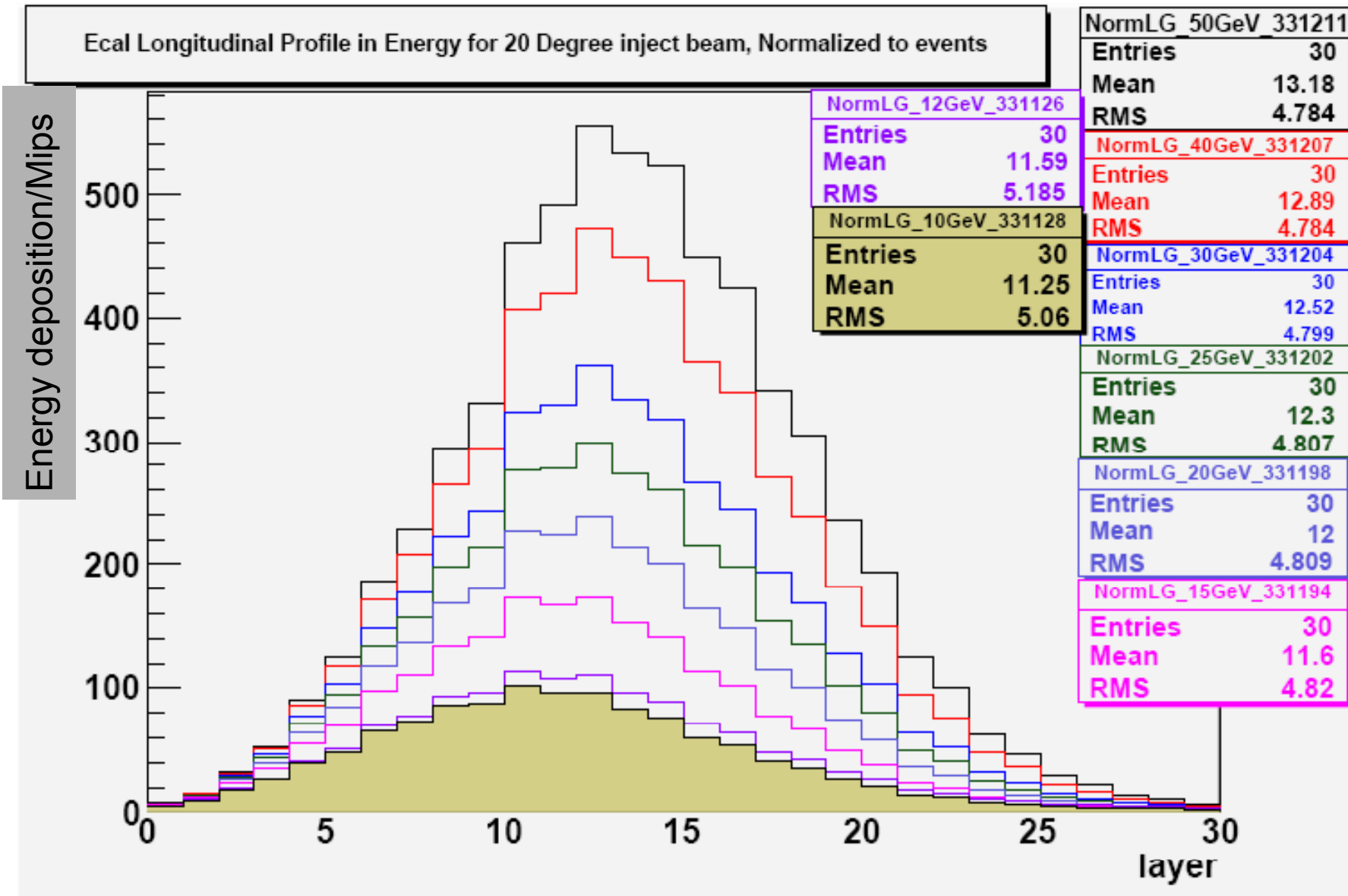
Normal inject beam:



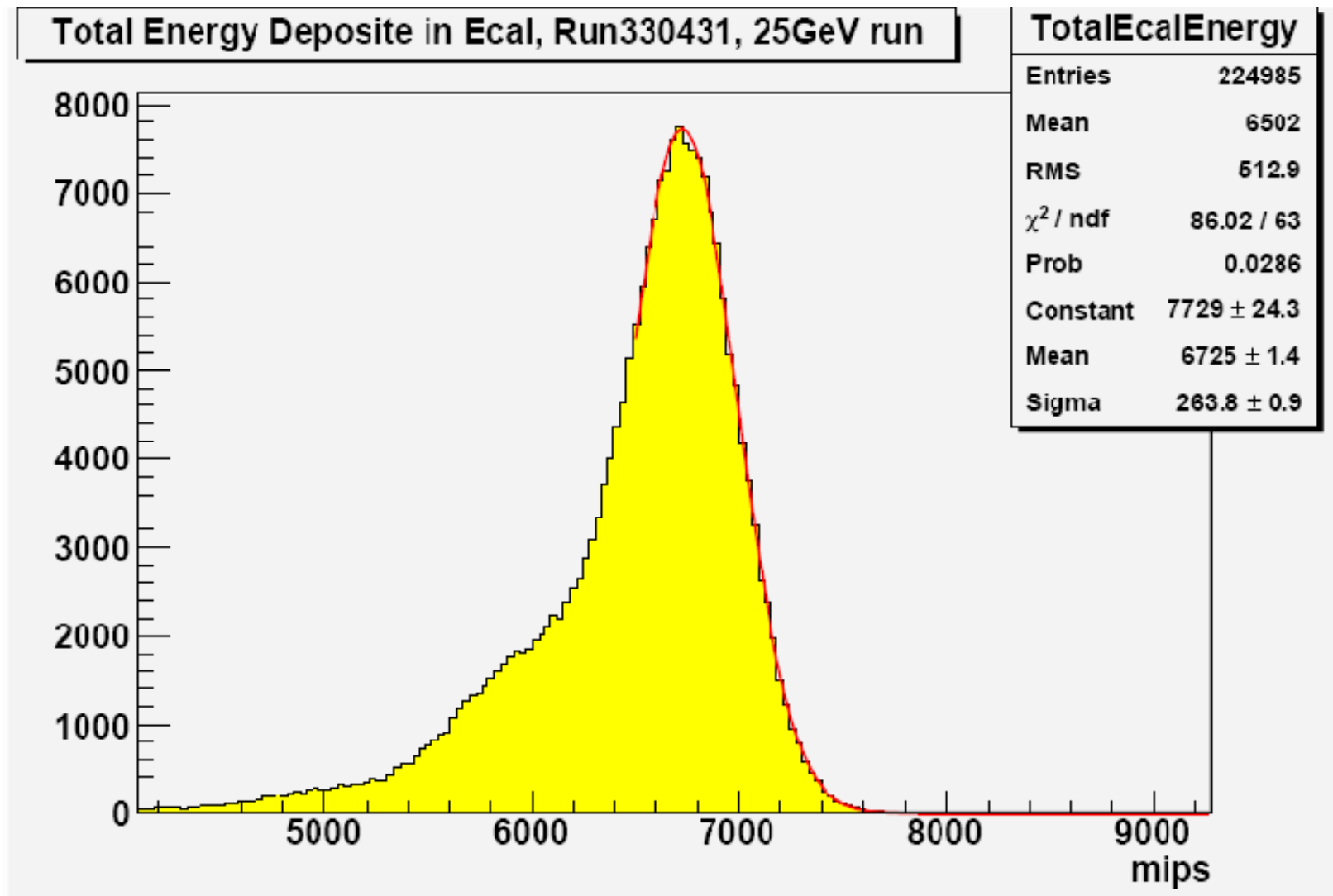
10° impact:



20° impact:



A Gaussian fit on the main peak of ECAL energy spectrum



11/09/2007

$$E_{\text{tot}} = \sum_1^{10} E_k + 2 \times \sum_{11}^{20} E_k + 3 \times \sum_{21}^{30} E_k$$

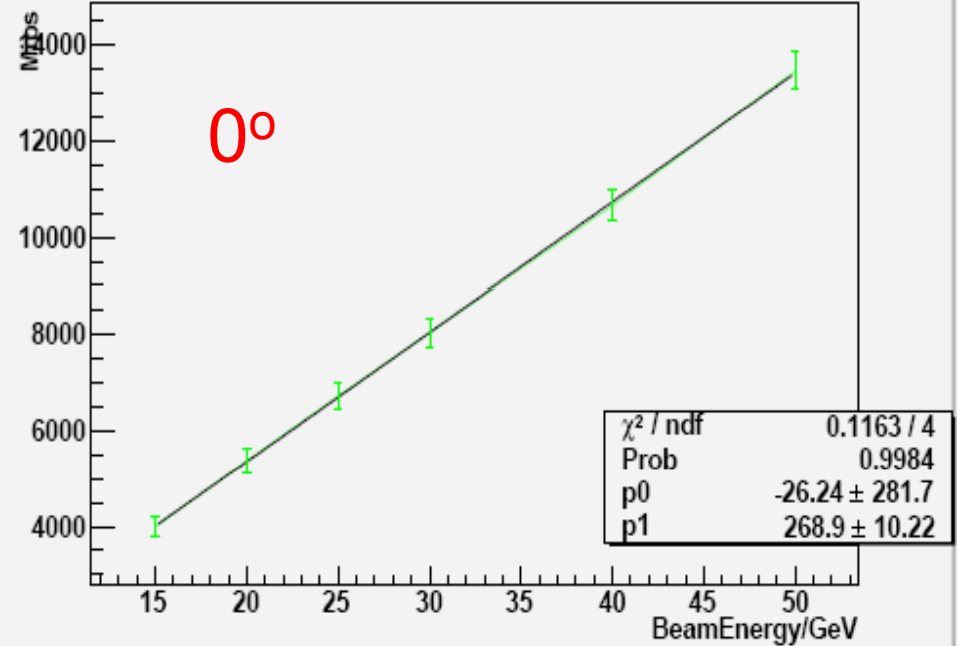
Linearity:

Without Any Cleaning & selection:

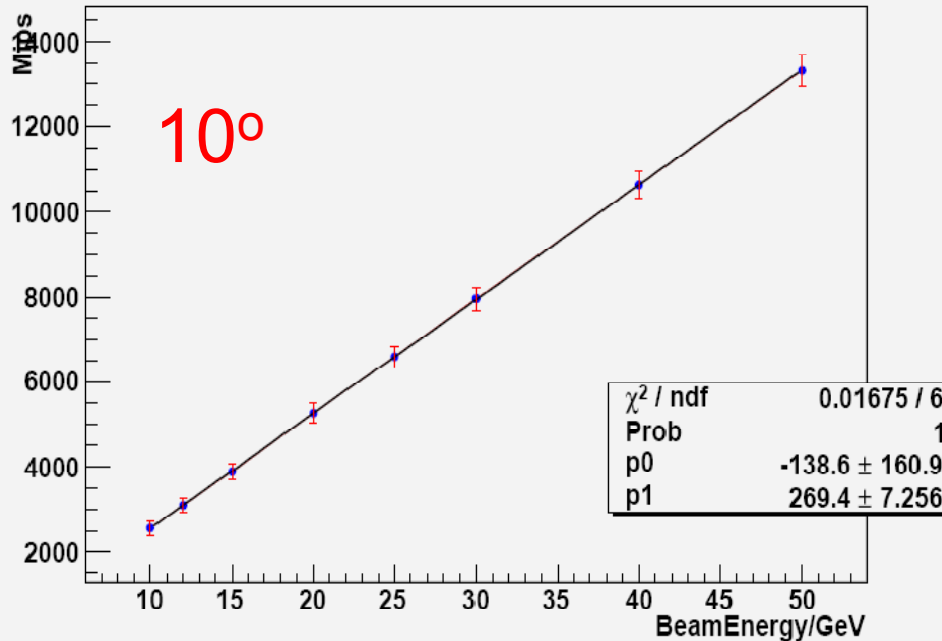
1GeV ~ 269 mips

(>233 mips (the value for last TB experiment) for **different cut applied?**)

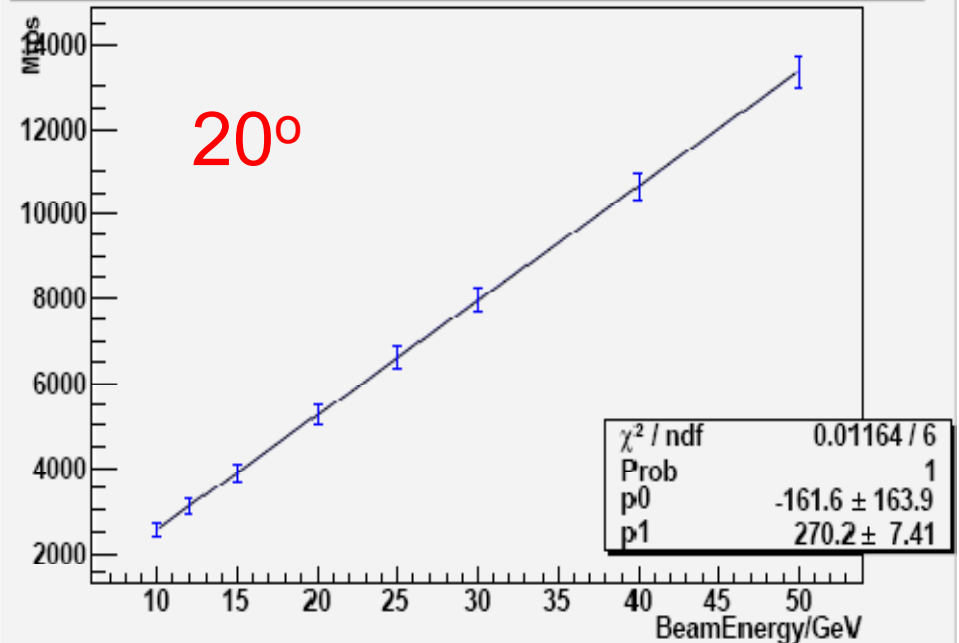
Result of Gaussian Fit for Mean Peak in Ecal: typical electron runs aim at wafer center. 0 Degree Case



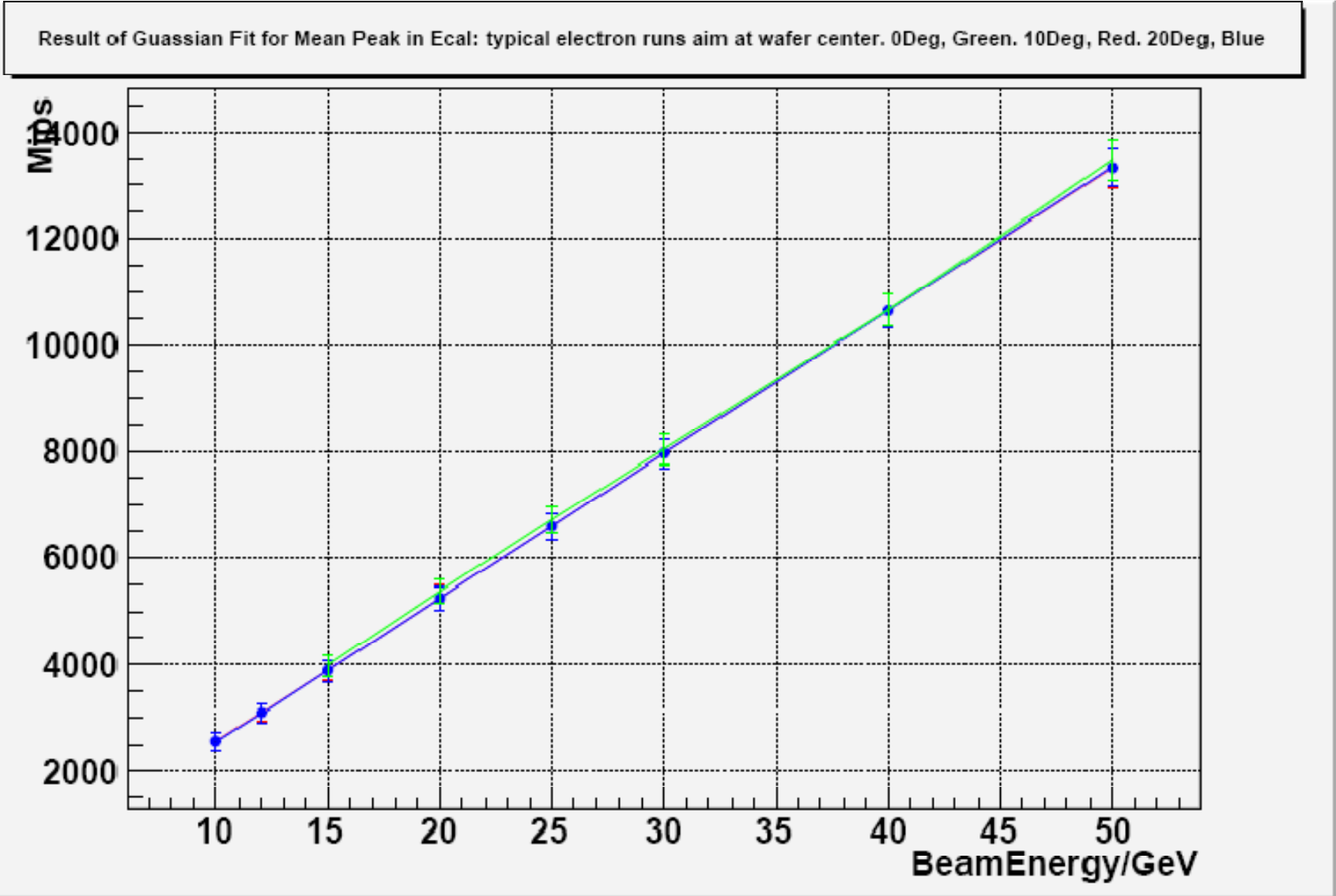
Result of Gaussian Fit for Mean Peak in Ecal: typical electron runs aim at wafer center. 10 Degree Case



Result of Gaussian Fit for Mean Peak in Ecal: typical electron runs aim at wafer center. 20 Degree Case



Linearity: overlay for 3 different inject angle

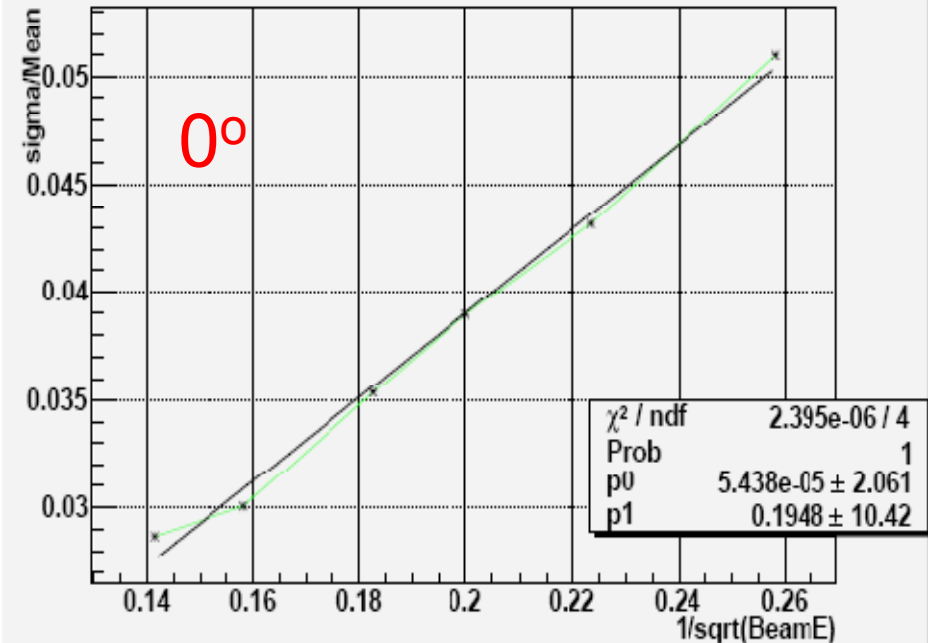


Resolution:

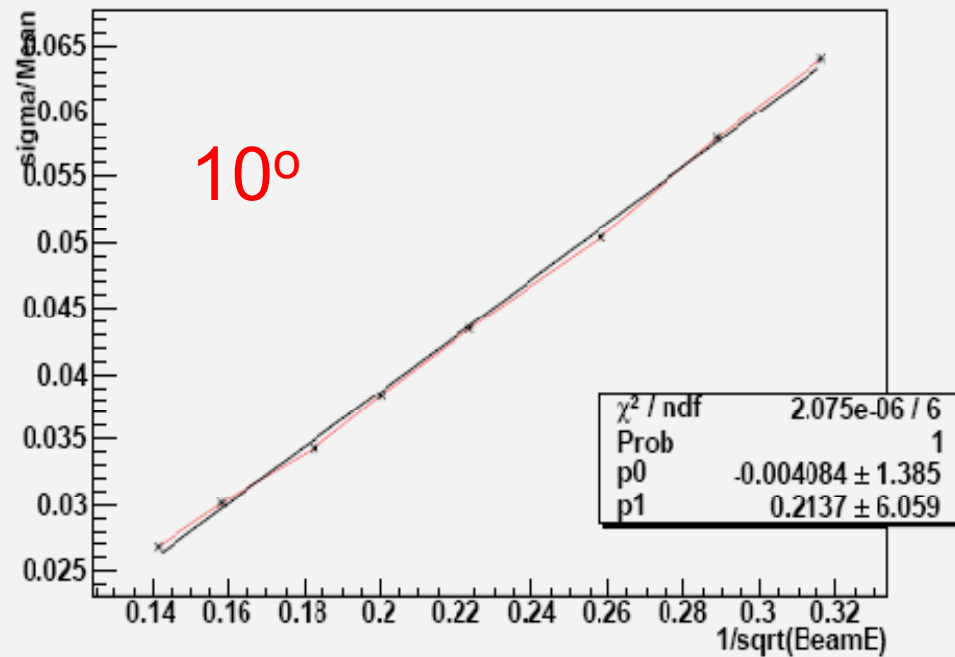
Without Any Cleaning & selection:

$$\sigma(E) \sim 0.2\sqrt{E}$$

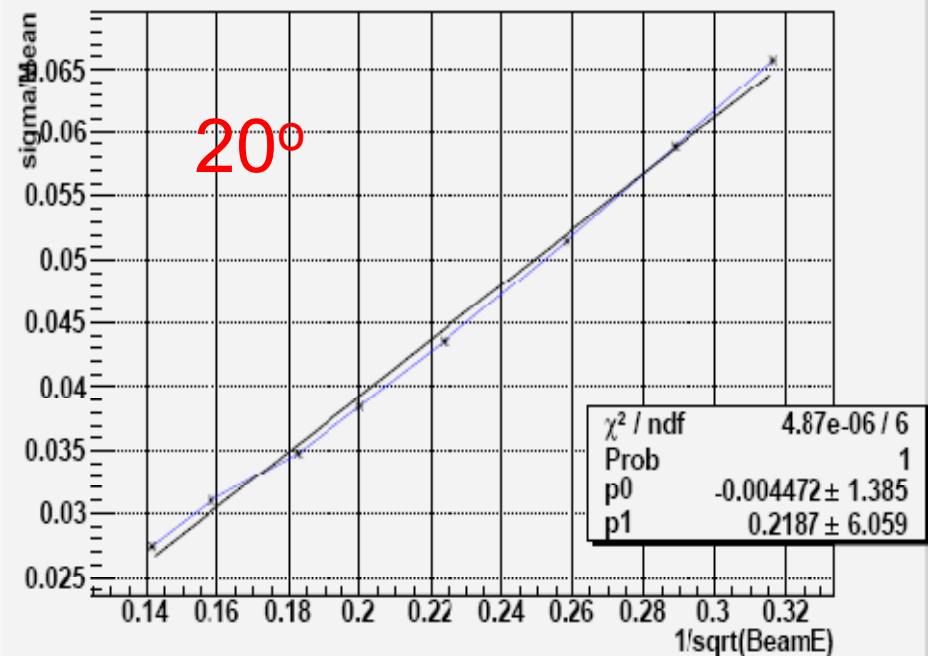
Ecal Energy Resolution Vary with Beam Energy, 0Deg



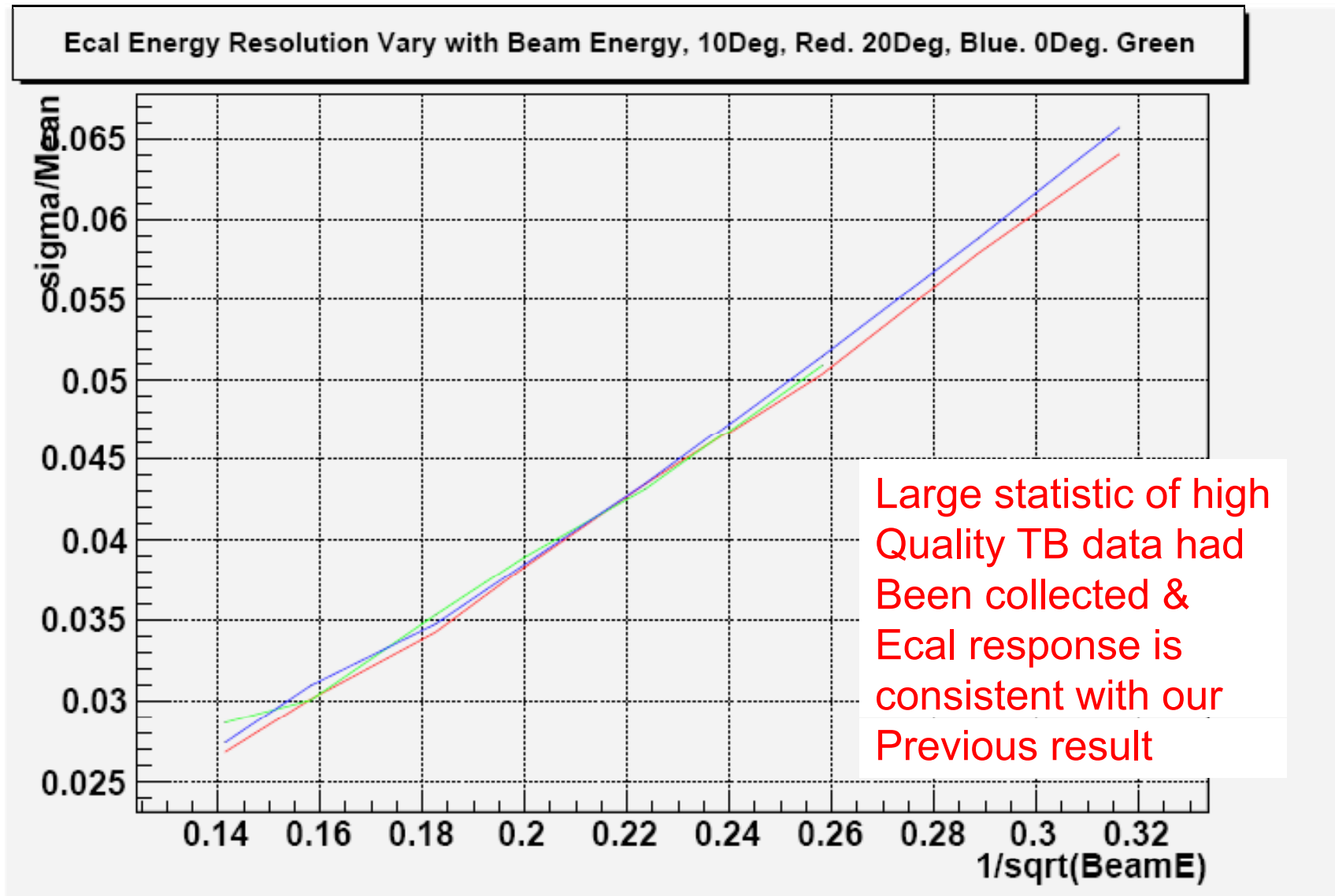
Ecal Energy Resolution Vary with Beam Energy, 10Deg



Ecal Energy Resolution Vary with Beam Energy, 20Deg



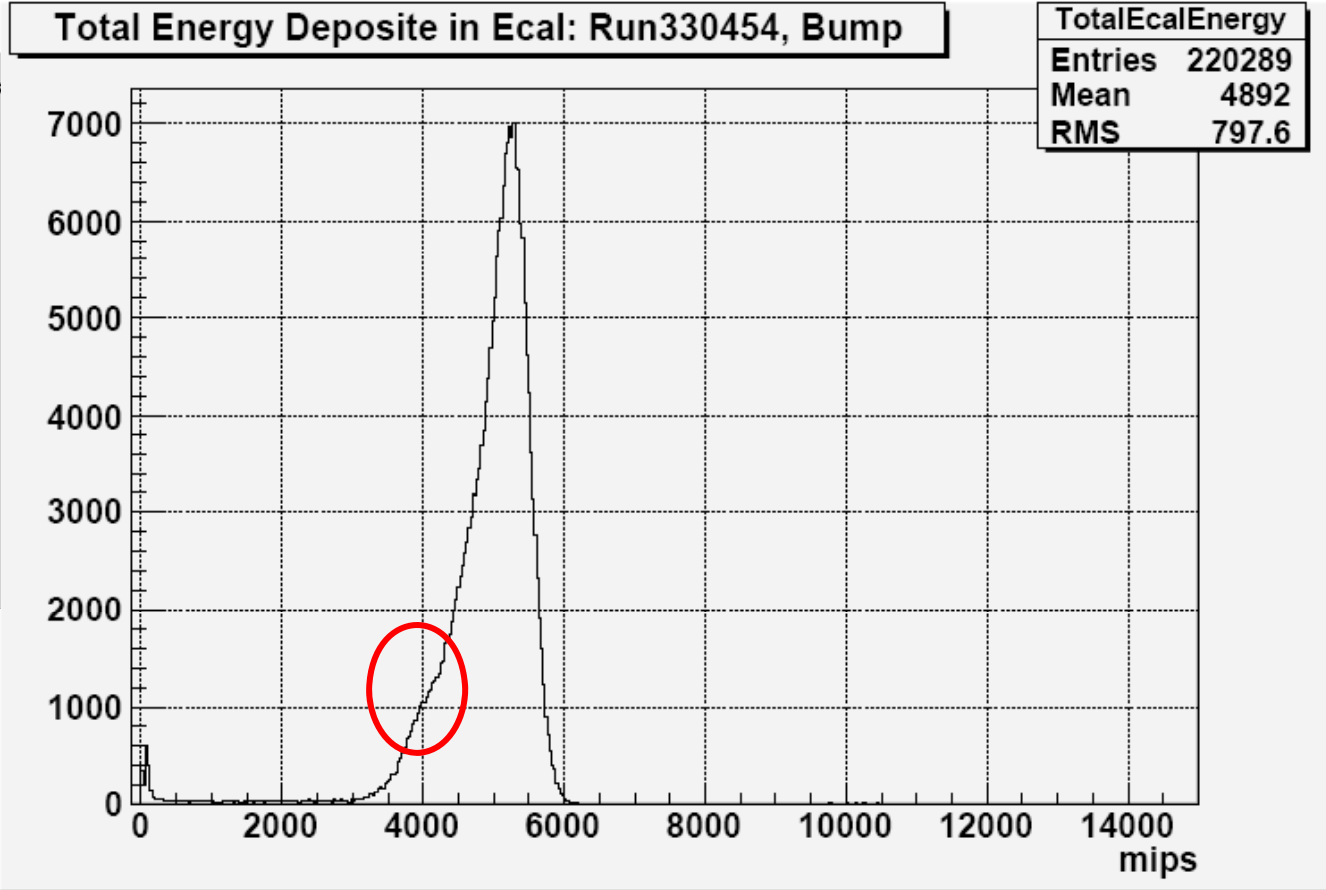
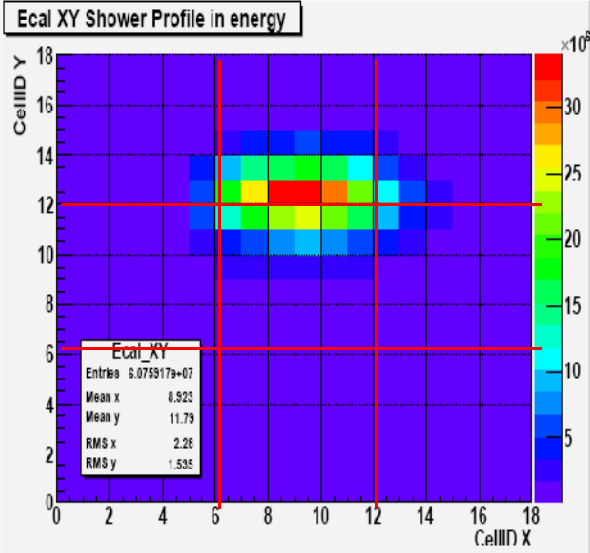
Resolution accuracy: overlay for 3 different inject angle



Noise & Problem Patterns observed

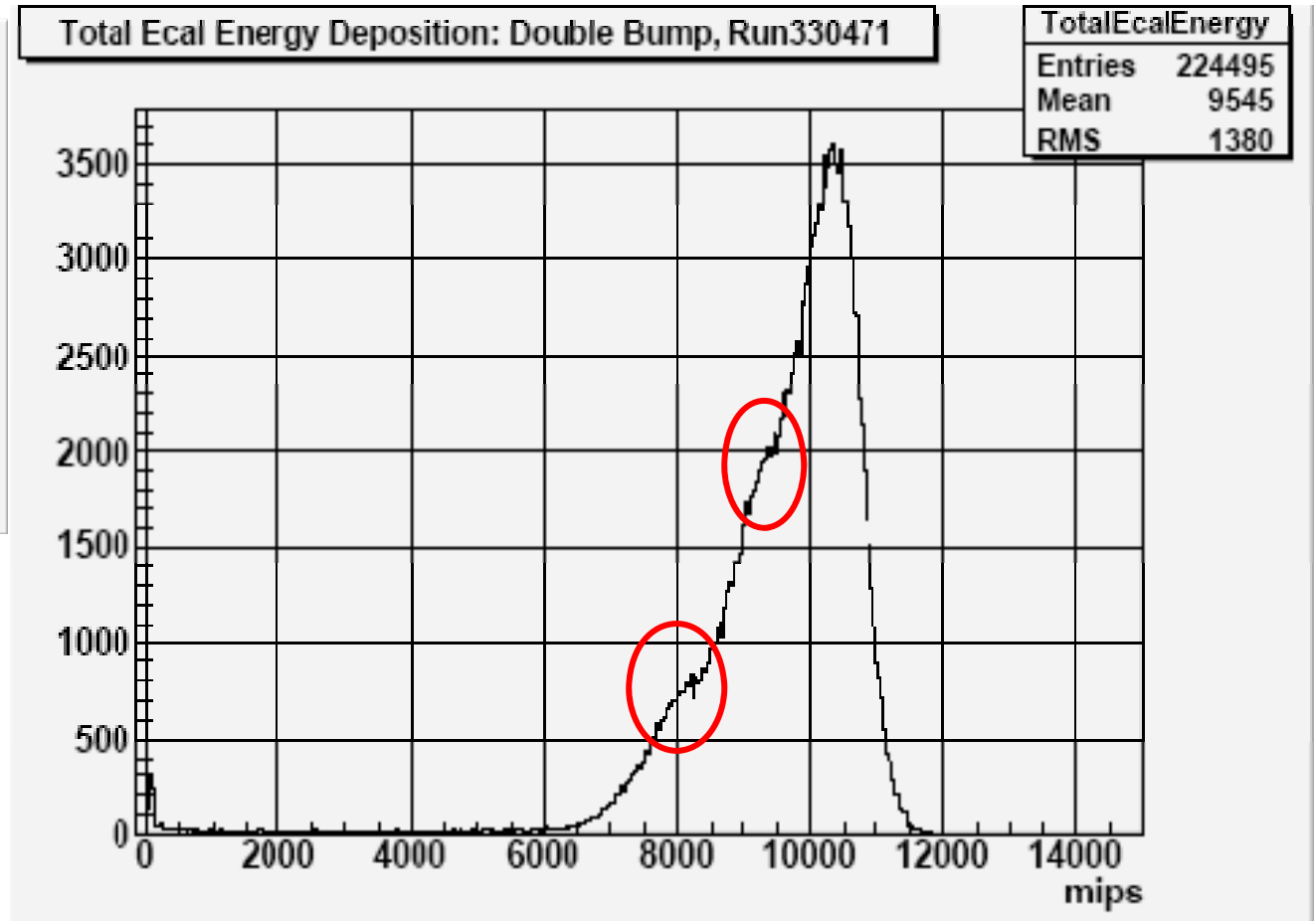
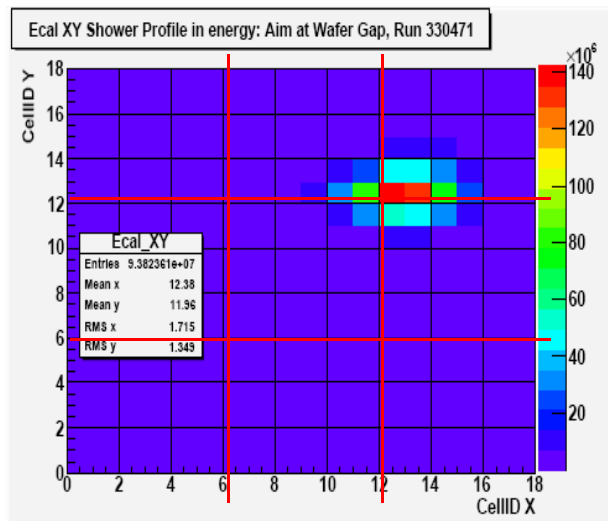
- Wafer Gap effect: Bump & Double bump in ecal energy spectrum
- Ecal: less hit in ecal last layer: almost affect every Pion Run (and high energy electron runs)
- Low energy noise in several ecal layer
- Disconnect of Up PCB in ecal layer 27
- Time dependent Noise
- Beam unstable or went off during the run

Bump pattern is observed for runs with beam aim at the wafer gap:

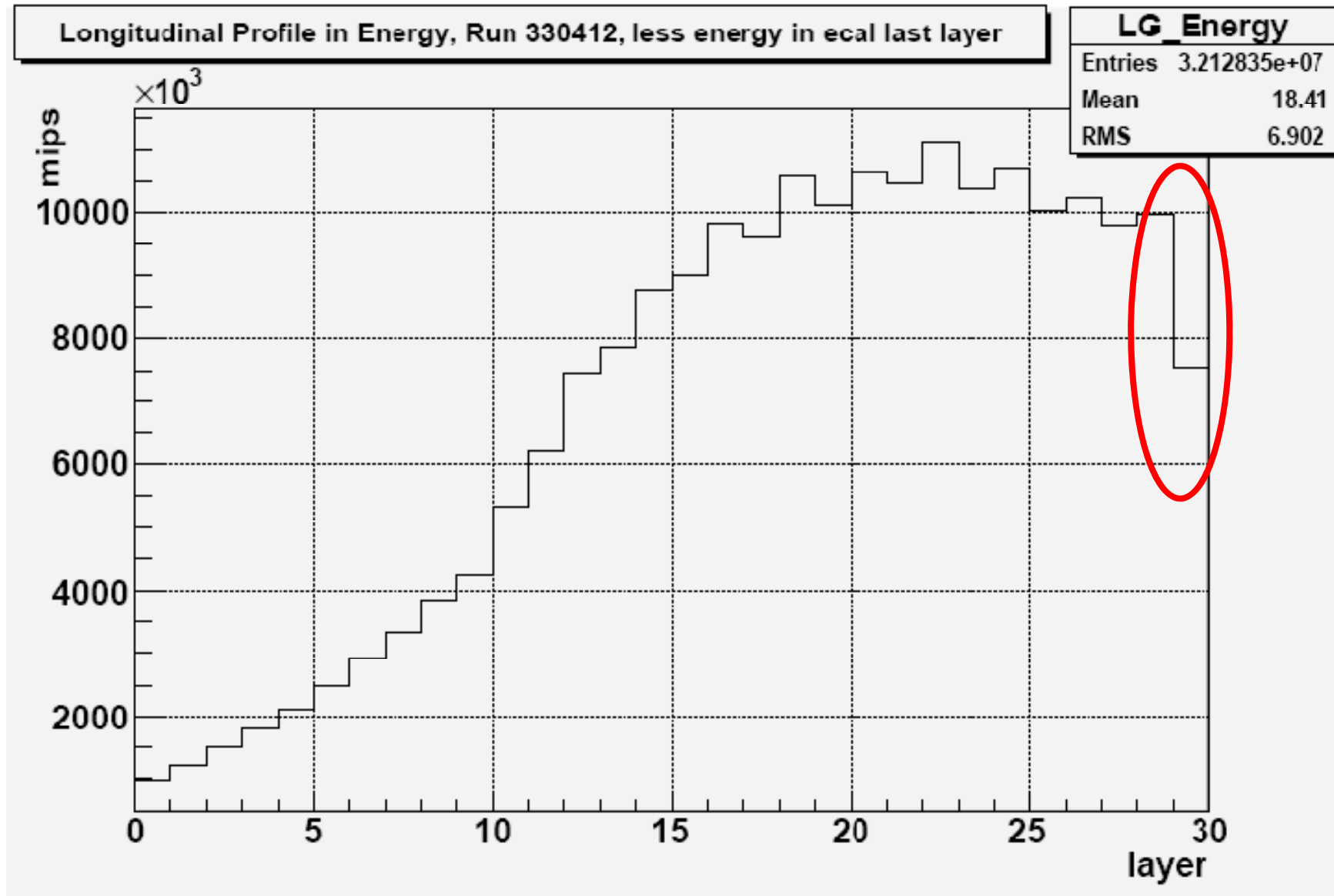


Double bump pattern is observed for run with beam aim at the wafer corner:

Some events loose more energy!

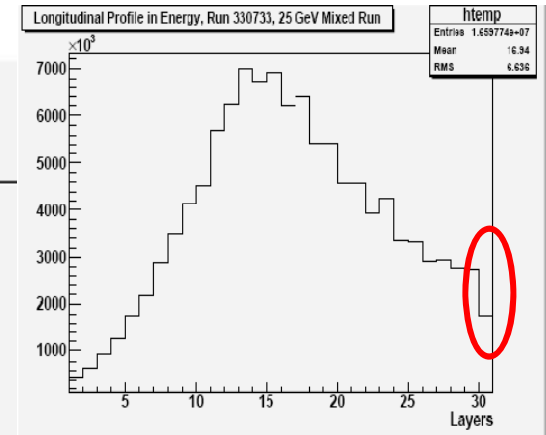
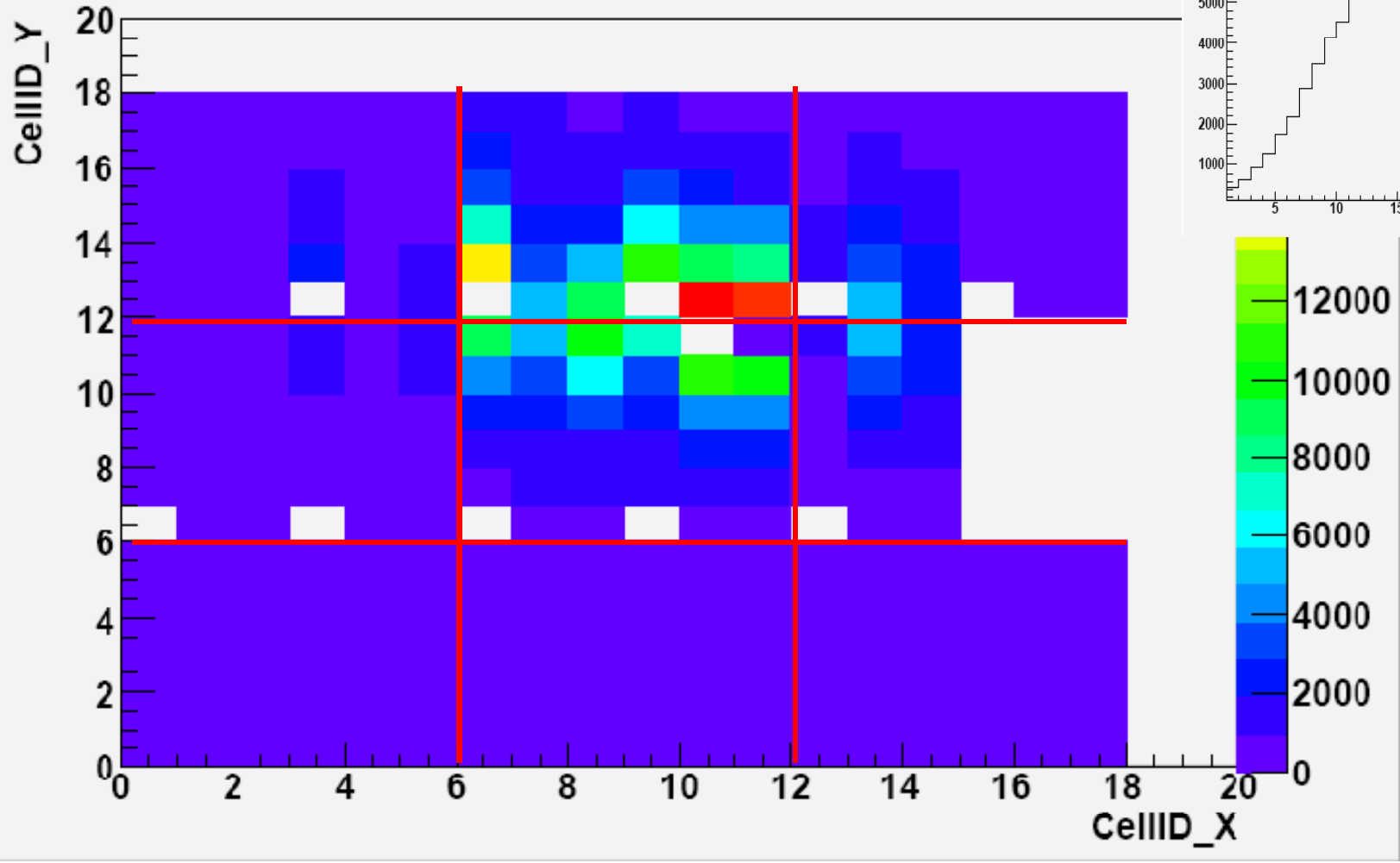


Less hits in ecal last layer:



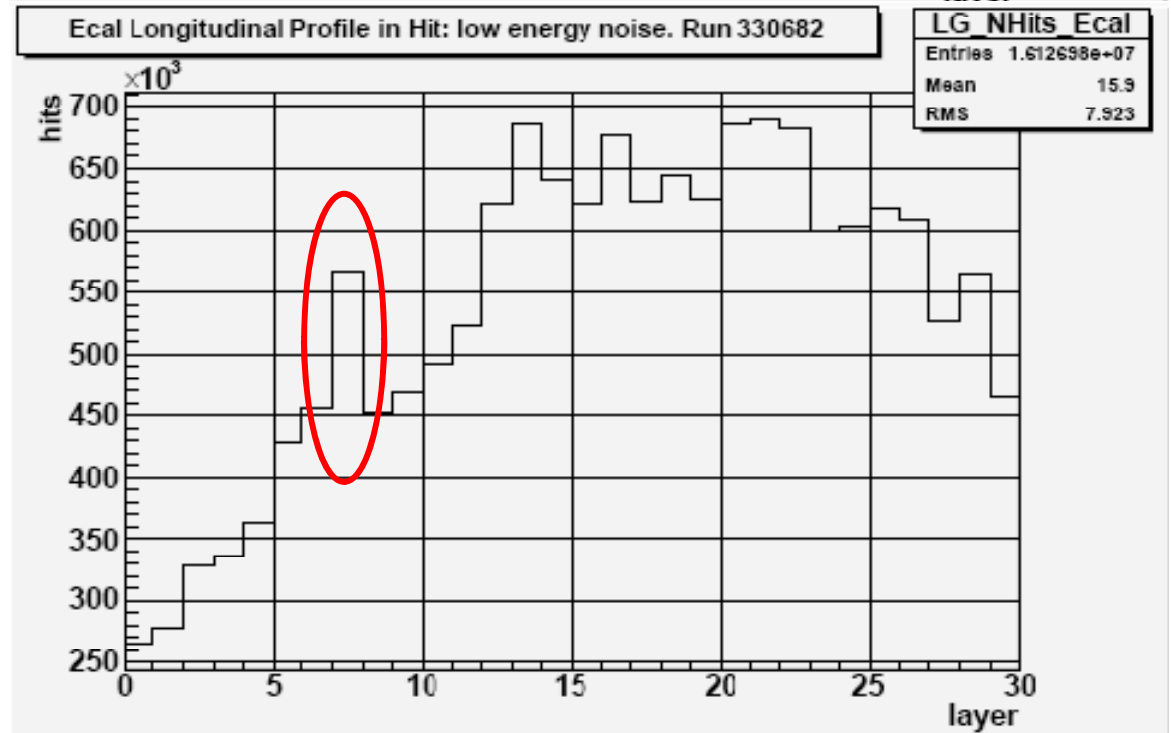
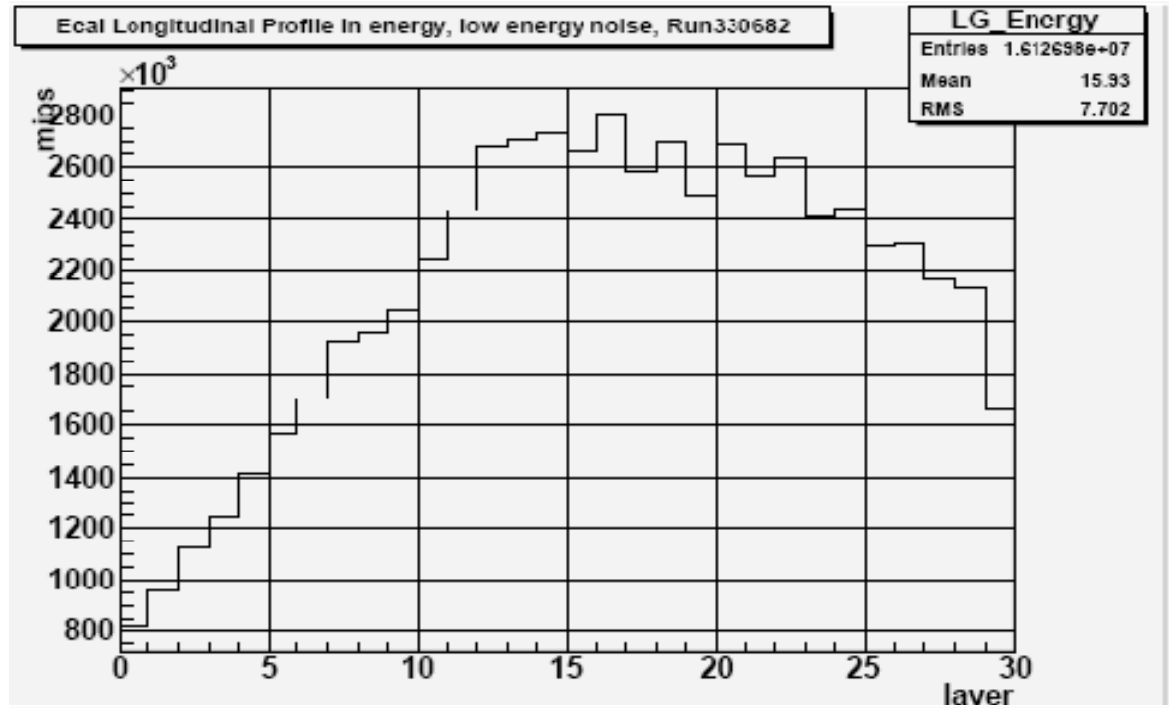
Many dead Cells and a whole dead half wafer on Ecal last layer: *Plots draw from first 120k events of Run 330733*

Shower Profile in XY plane of Ecal last layer: Run330733

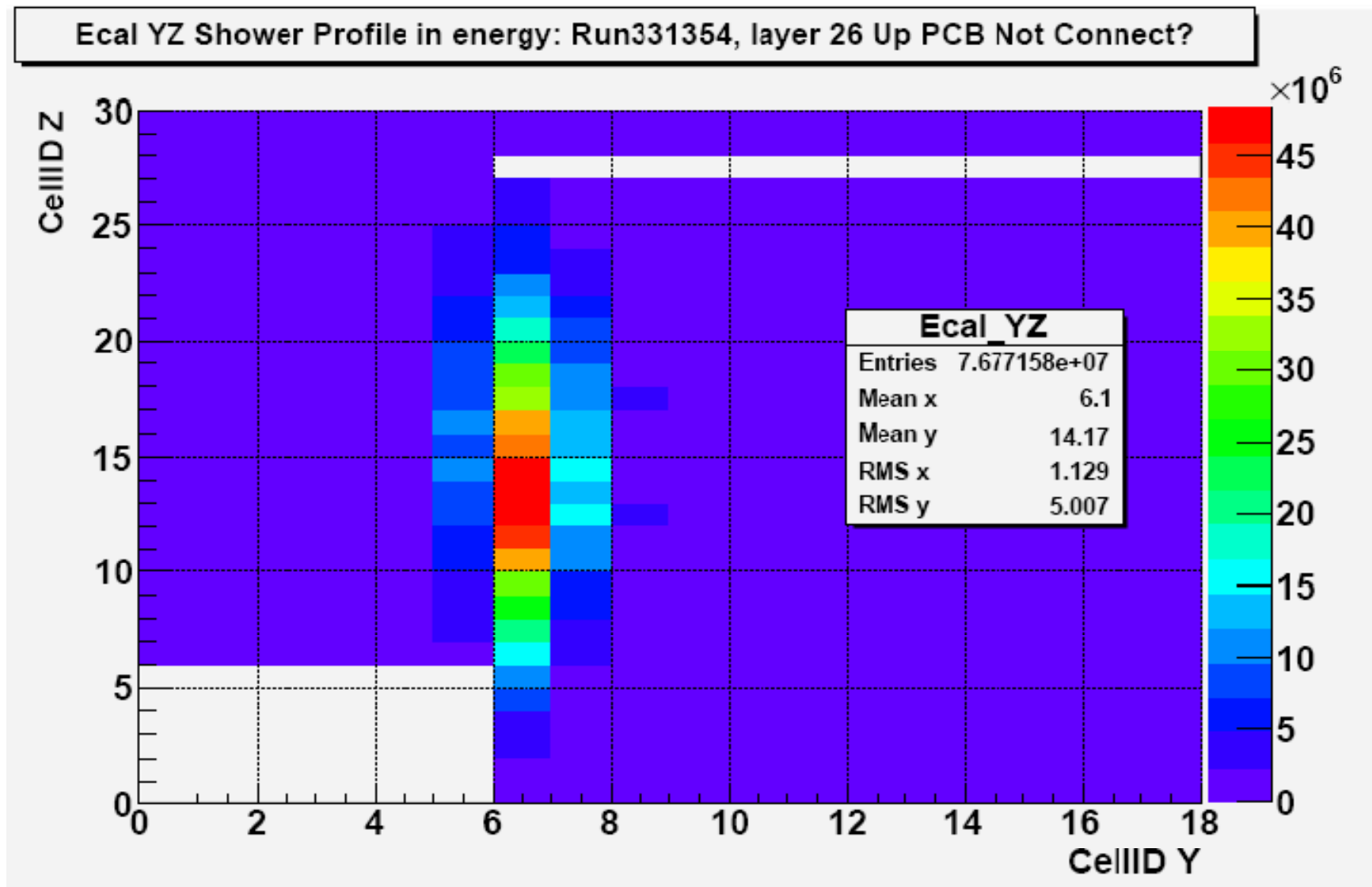


Low energy noise:

Amplitude for corresponding Layer in Longitudinal profile in hit increases a lot while Longitudinal profile in energy Does not change much



For run 331354-331389, the Up PCB of layer 27 seems not Connect!



Time dependent noise: some layer behavior anomaly during the run

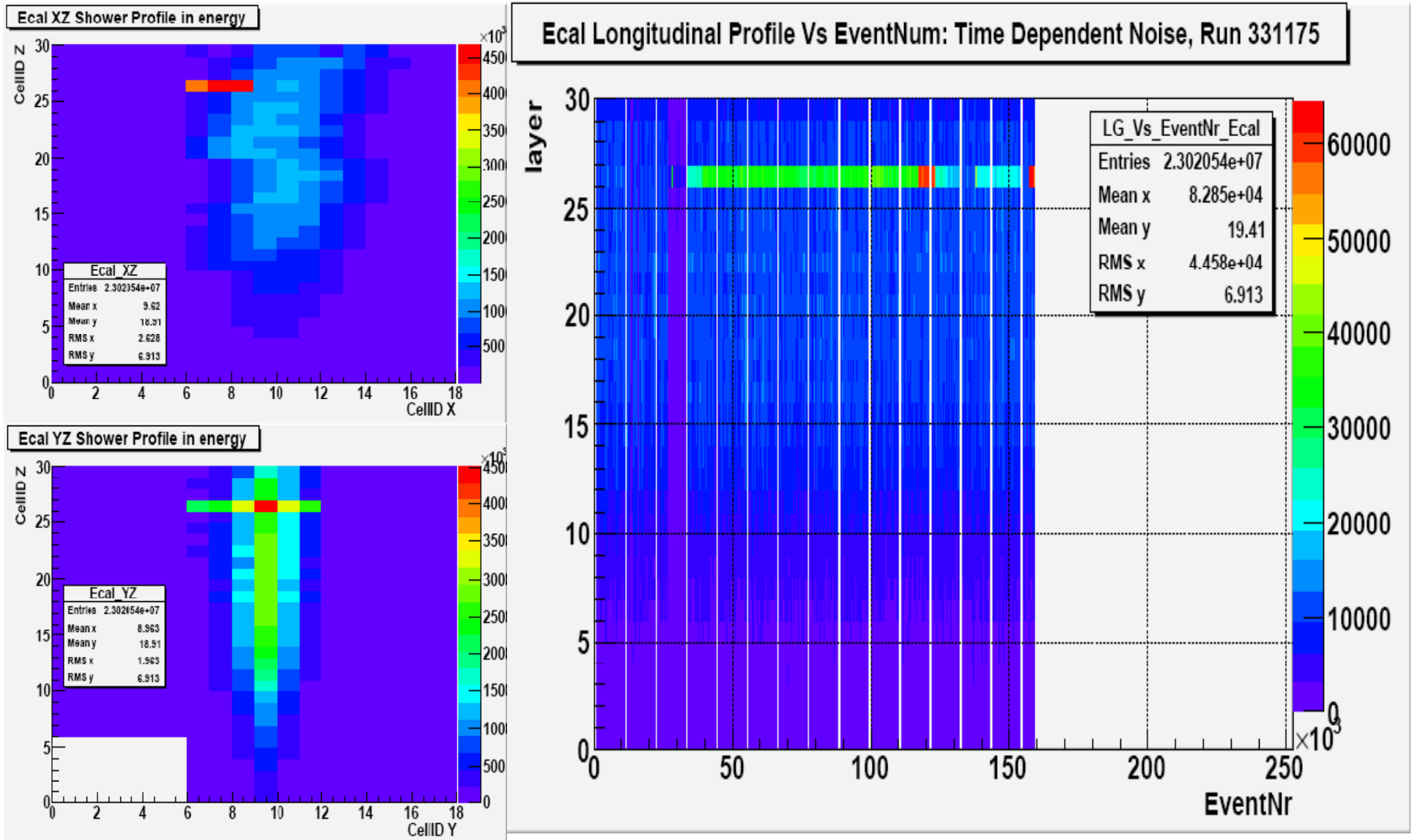
- ECAL

- Layer 10: 330877...
- Layer 11: 330330, 330950...
- Layer 26: 331131, 1134, 1173, 1175, 1065, 1246, 1221, 1251...
- Layer 29: 330732...

- HCAL

- Layer 6: 331286...
- Layer 13: 330839, 1143, 1198, 1244, 1246, 1258, 1308...
- Layer 32: 330411, 0461, 0475, 0590, 0606, 0733, 0808, 0826, 0853, 0937, 0947...

Noisy region could be located to a half wafer (one chip):

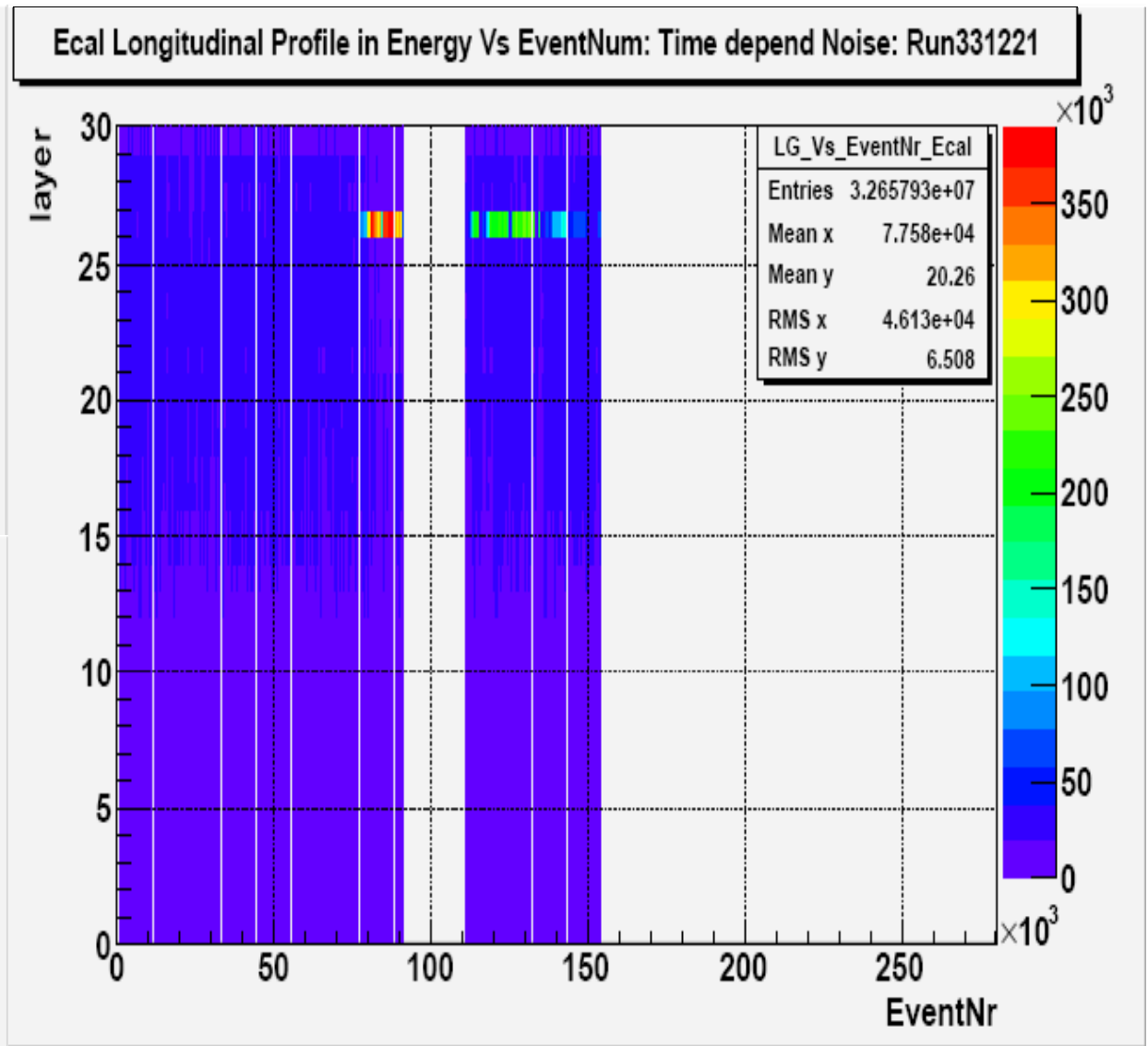
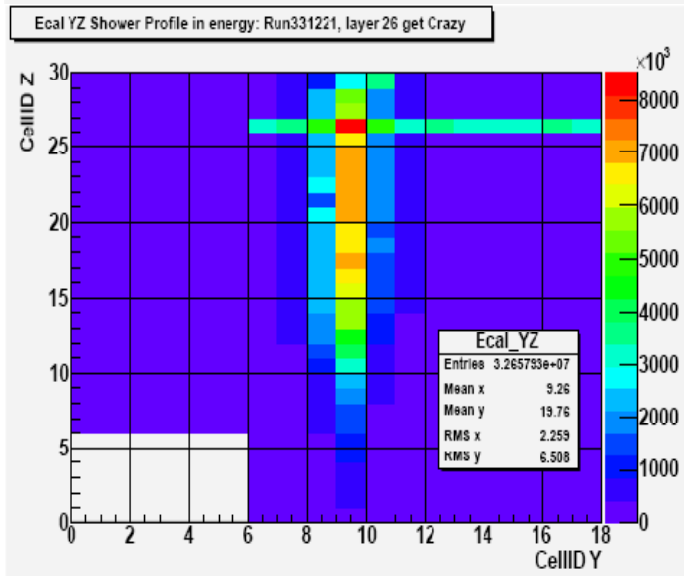
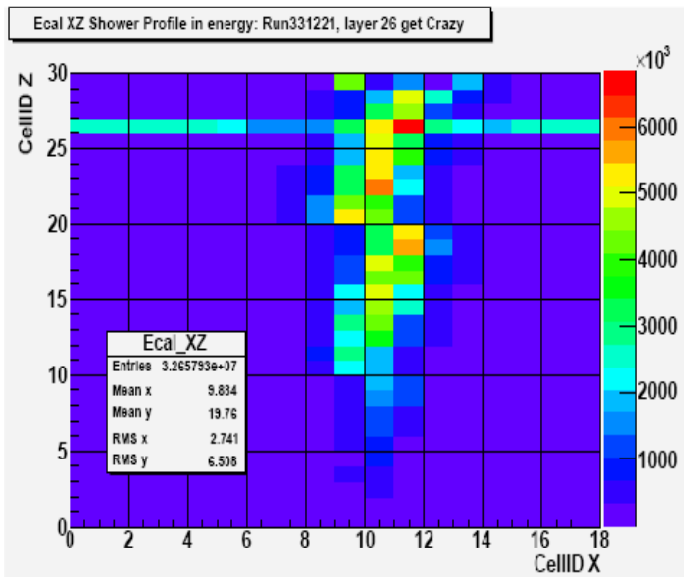


11/09/2007

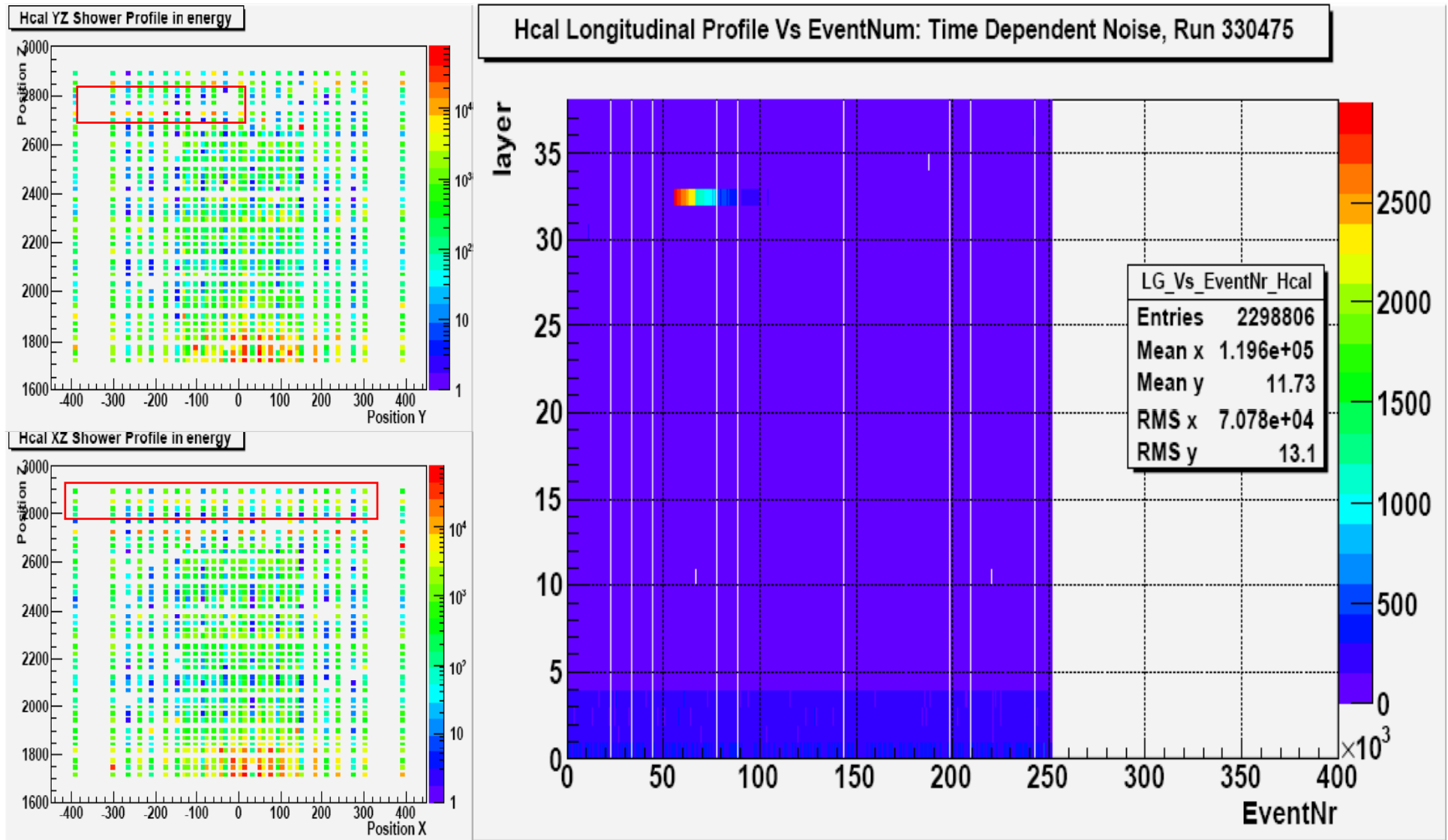
Calice@Prague

21

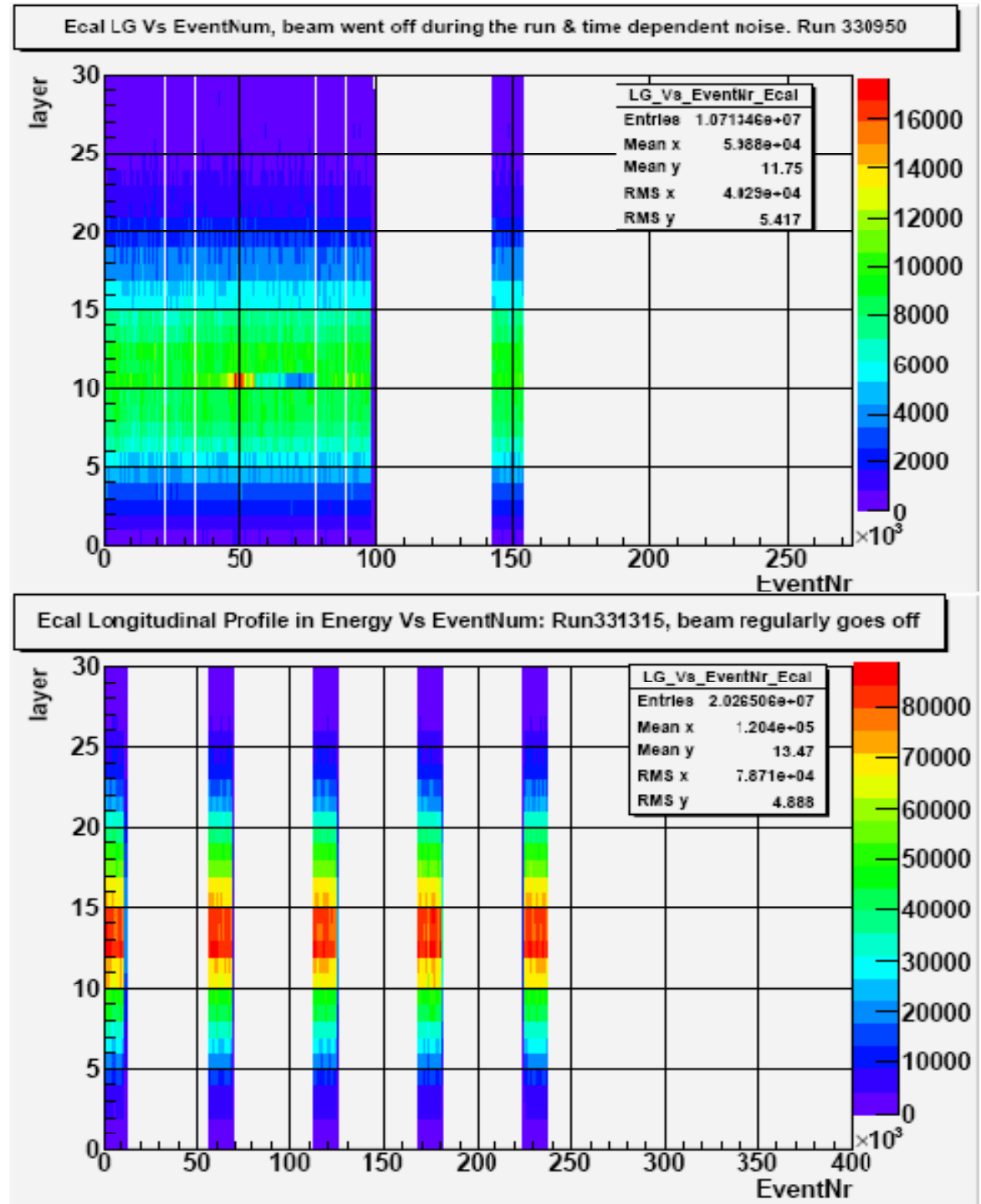
Or the whole PCB



Similar pattern could be observed in HCAL



Beam was quite stable during our data taking, but sometime it went off during the run:

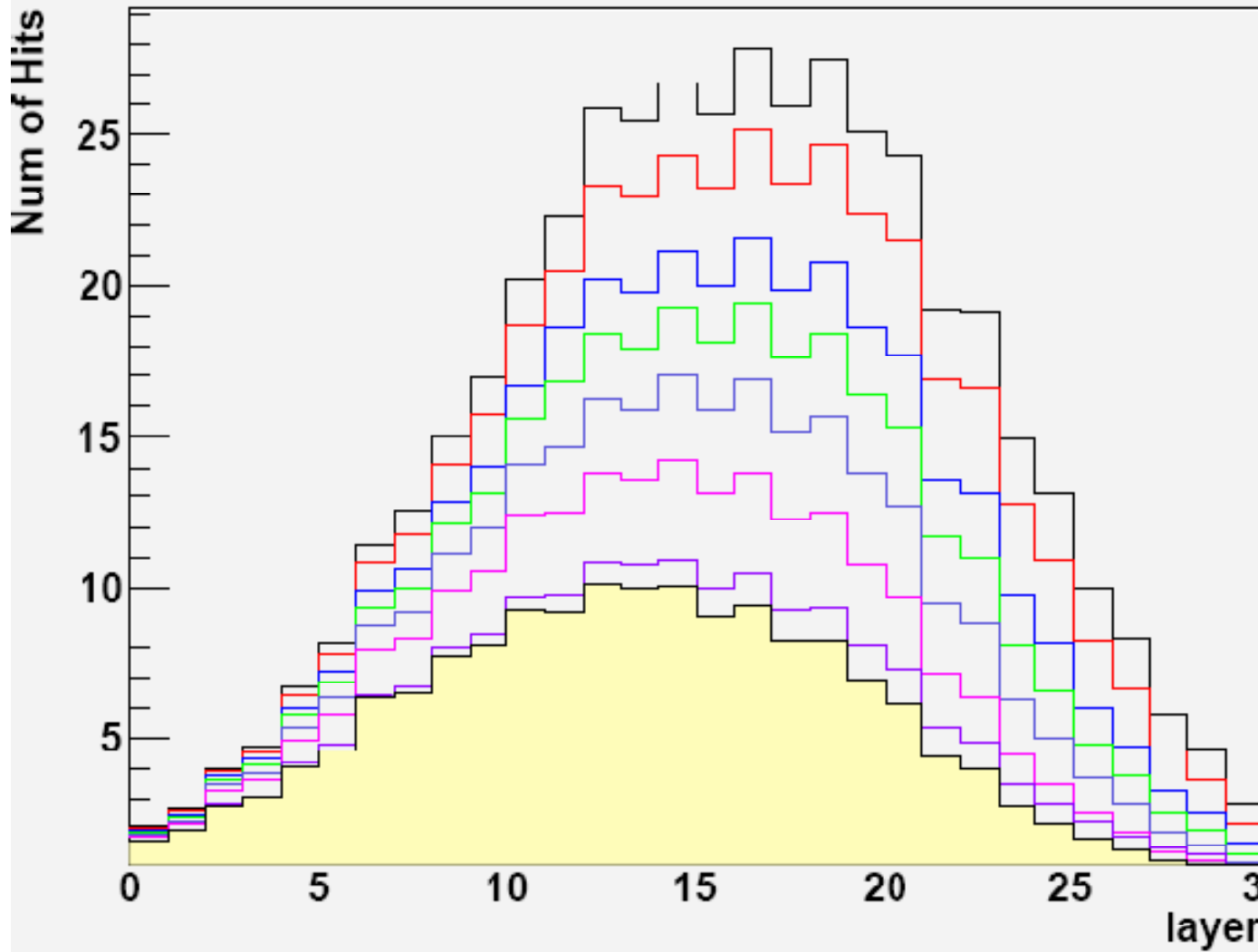


Summary

- Large statistic of high-quality test beam data had been collected;
- Energy resolution linearity and accuracy look consistent with our last test beam data result;
- Many new noisy pattern observed and requires carefully treatment

Back Up

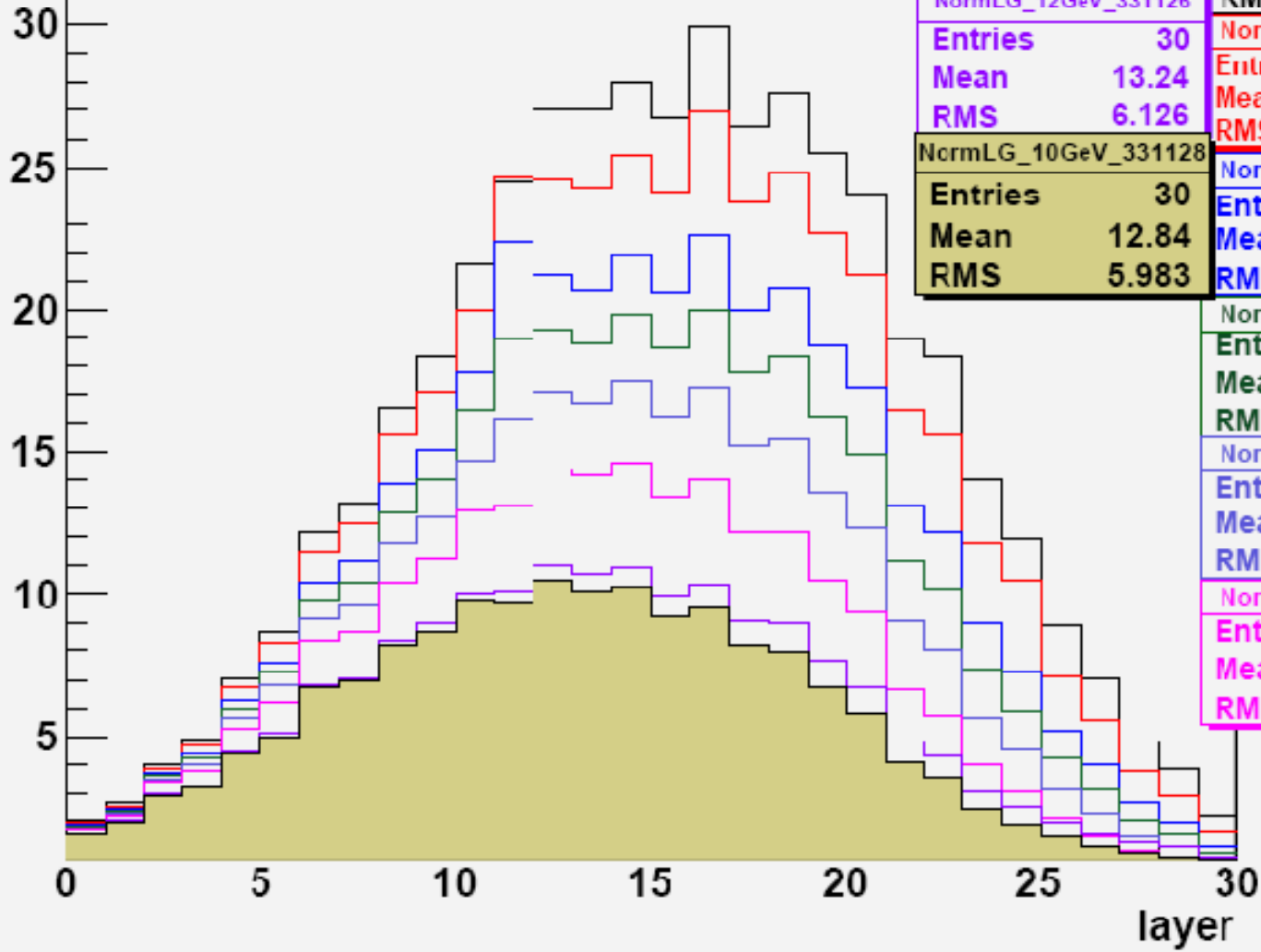
Ecal Longitudinal Profile in Hits for 10 Degree inject beam, Normalized to events



| | | |
|---------------------|---------|-------|
| NormLG_50GeV_330986 | Entries | 30 |
| | Mean | 15.31 |
| | RMS | 6.168 |
| NormLG_40GeV_330990 | Entries | 30 |
| | Mean | 15.07 |
| | RMS | 6.138 |
| NormLG_30GeV_330993 | Entries | 30 |
| | Mean | 14.68 |
| | RMS | 6.096 |
| NormLG_25GeV_330994 | Entries | 30 |
| | Mean | 14.39 |
| | RMS | 6.063 |
| NormLG_20GeV_330995 | Entries | 30 |
| | Mean | 14.07 |
| | RMS | 6.023 |
| NormLG_15GeV_330996 | Entries | 30 |
| | Mean | 13.6 |
| | RMS | 5.978 |
| NormLG_12GeV_331015 | Entries | 30 |
| | Mean | 13.56 |
| | RMS | 6.182 |
| NormLG_10GeV_331012 | Entries | 30 |
| | Mean | 13.15 |
| | RMS | 6.082 |

Ecal Longitudinal Profile in Hits for 20 Degree inject beam, Normalized to events

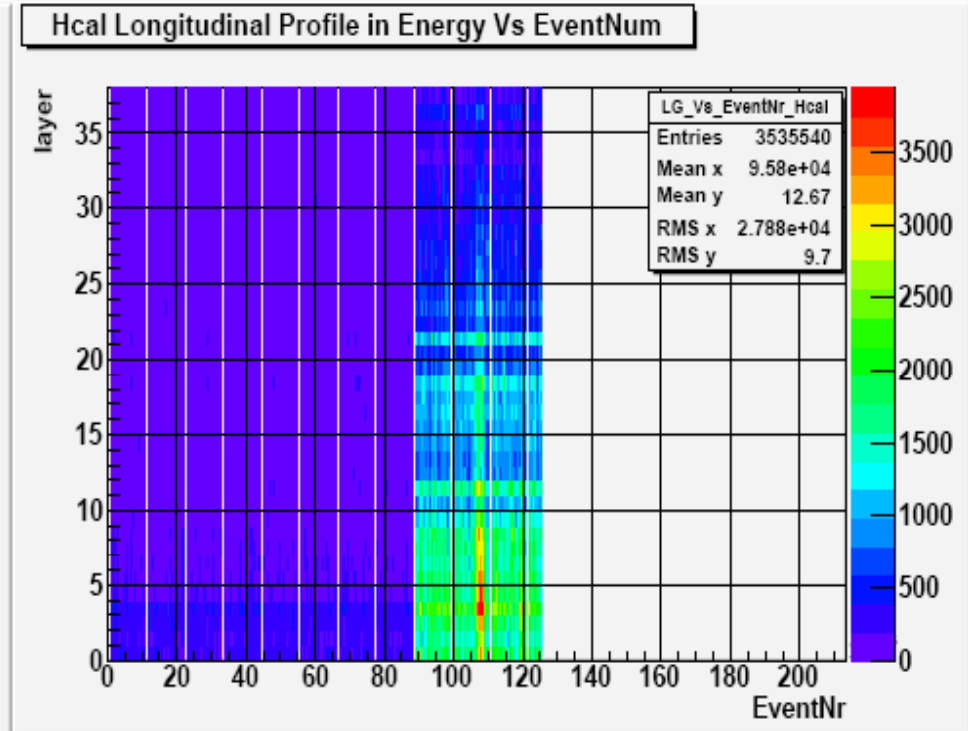
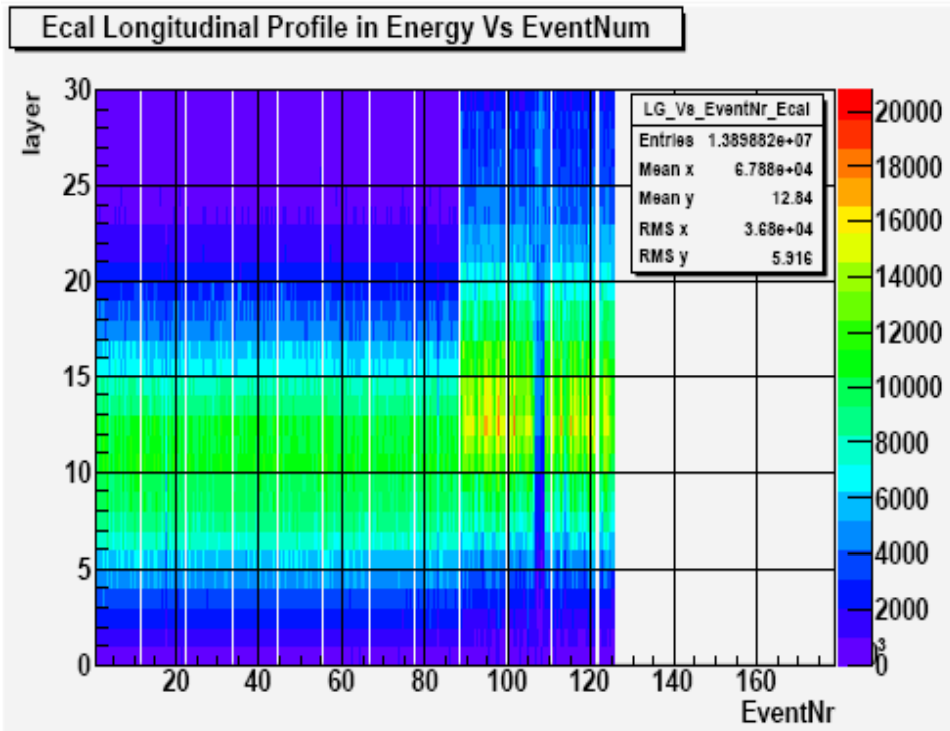
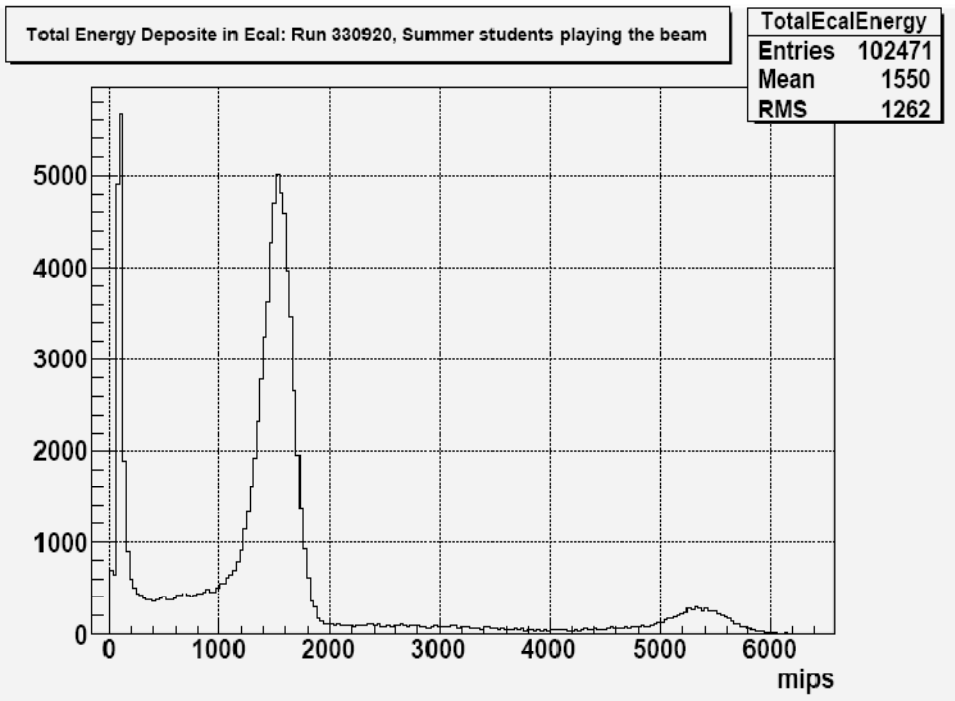
Num of Hits



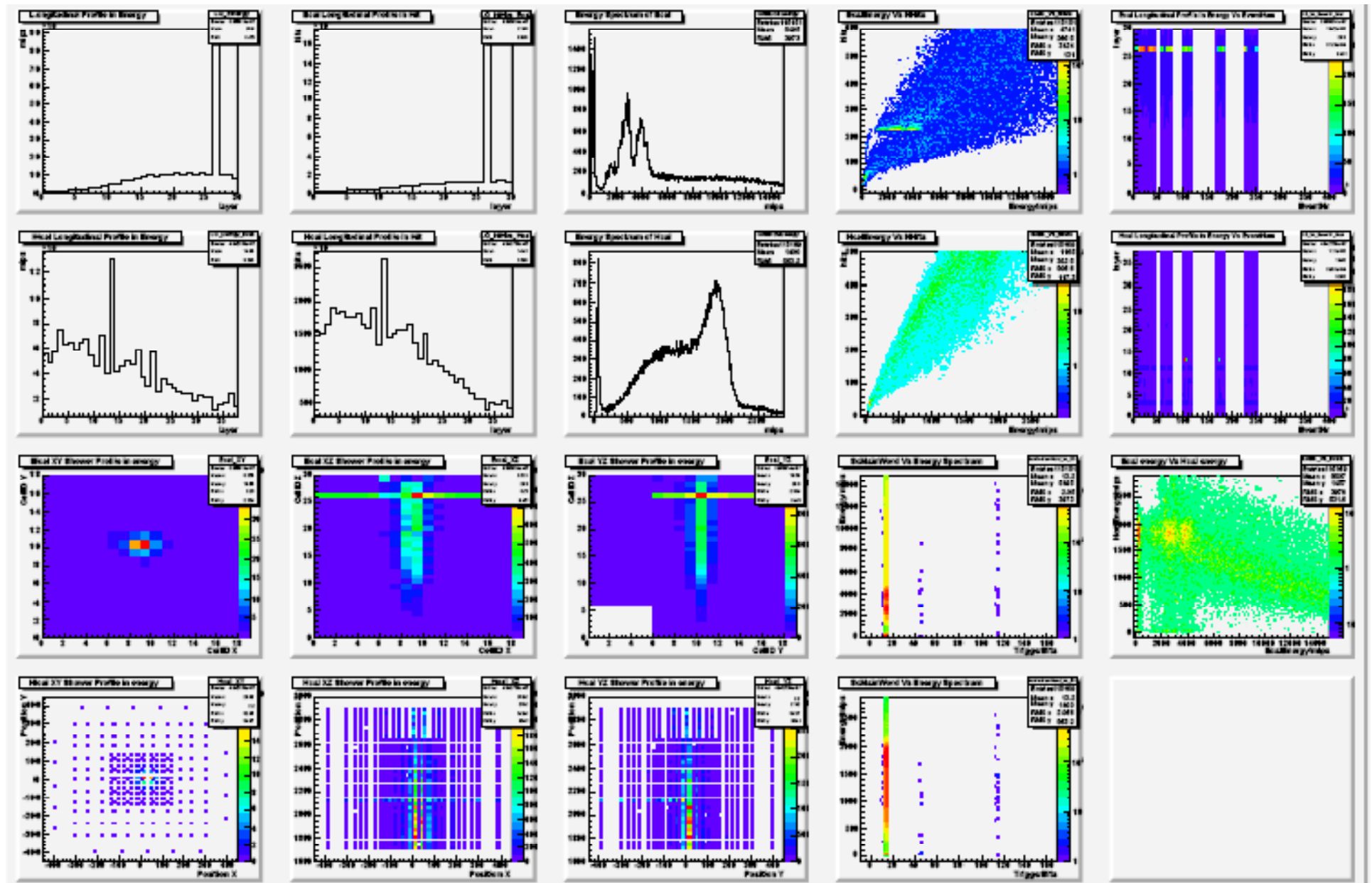
| | |
|---------------------|-------|
| NormLG_12GeV_331126 | |
| Entries | 30 |
| Mean | 13.24 |
| RMS | 6.126 |
| NormLG_10GeV_331128 | |
| Entries | 30 |
| Mean | 12.84 |
| RMS | 5.983 |

| | |
|---------------------|-------|
| NormLG_50GeV_331211 | |
| Entries | 30 |
| Mean | 15 |
| RMS | 6.038 |
| NormLG_40GeV_331207 | |
| Entries | 30 |
| Mean | 14.74 |
| RMS | 5.996 |
| NormLG_30GeV_331204 | |
| Entries | 30 |
| Mean | 14.36 |
| RMS | 5.943 |
| NormLG_25GeV_331202 | |
| Entries | 30 |
| Mean | 14.12 |
| RMS | 5.922 |
| NormLG_20GeV_331198 | |
| Entries | 30 |
| Mean | 13.79 |
| RMS | 5.889 |
| NormLG_15GeV_331194 | |
| Entries | 30 |
| Mean | 13.31 |
| RMS | 5.854 |

Funny pattern:
Summer
students change
the beam file



Run 331243: large noise in both ecal and hcal, beam off during the run;



Run 331069: Many Noise Cells in Ecal;

