Beam test of novel ASICs and sensors : DAQ , calibration and preliminary result.

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during the Desy – Zuethen summer school.

Aim of the Test Beam

- Prove front-end electronics operation together with sensor and automated triggered readout in a particle beam.
- Collect experiences for preparation of a BCM1F/BeamCal/LumiCal prototype subset – plane or sector ('deliverable' within MC-PAD).

Taken from H. Henschel presentation 13 April Cracow

Summer student work

We joined the test beam efforts at the last minute, and took part in preparation of:

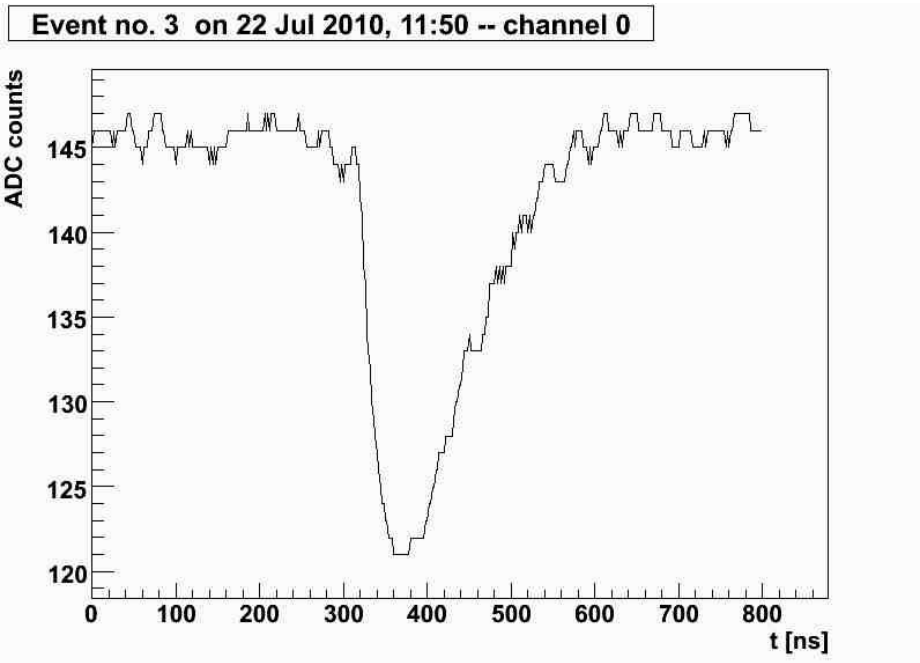
- DAQ.
- Calibration.

We participated in the test beam and contributed to preliminary analysis.

Preparation of Test Beam - DAQ

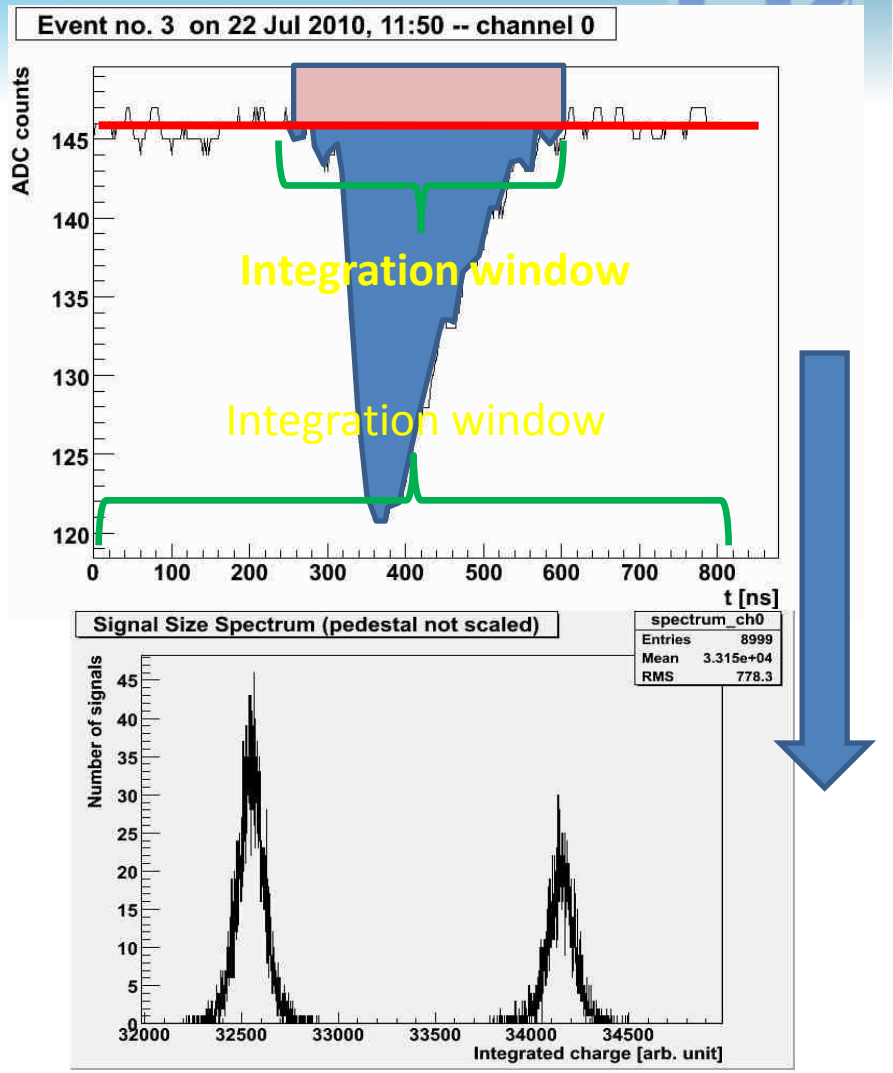
The only instrument that is not implement yet in the ASICs is the ADC. To digitize the signal a CAEN v1721 flash ADC was used:

- 8 channels.
- Time resolution of 2 ns.
- Connected via an optical link (rate of 500Mb/s).



Preparation of Test Beam - DAQ

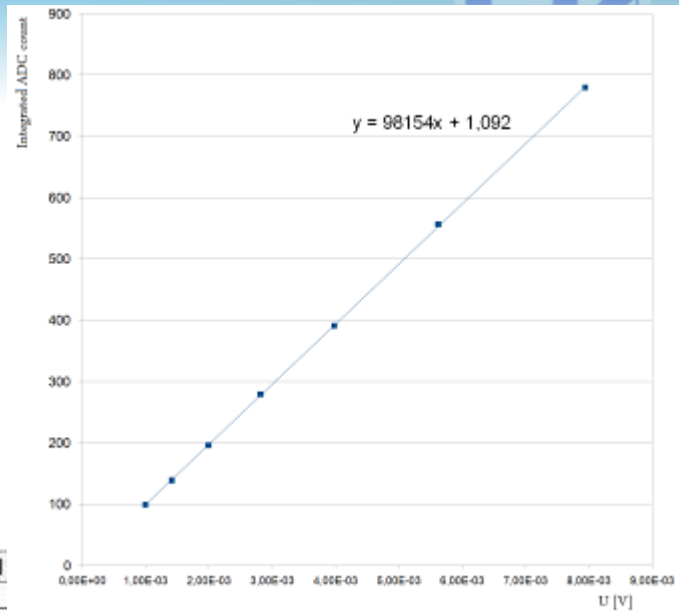
- Adapting software for readout device and DAQ to include semi-online analysis.
- To get the integrated charge, we first need to integrate the voltage (ADC counts).
- We can integrate between signal and the ADC MAX or the signal base line.

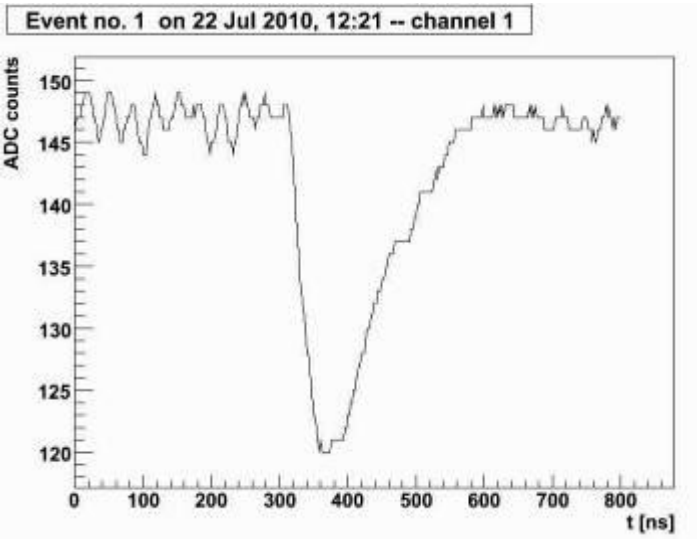


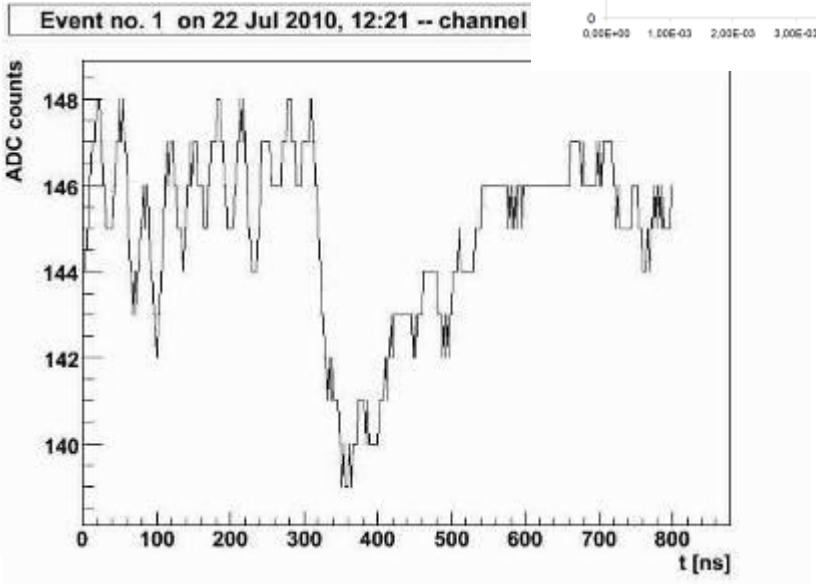
Preparation of Test Beam - Calibration

Using test pulses of 1V and attenuator we performed:

- We checked linearity of the ASICs amplification
- Cross talk was observed during this test and was measured between four channels.

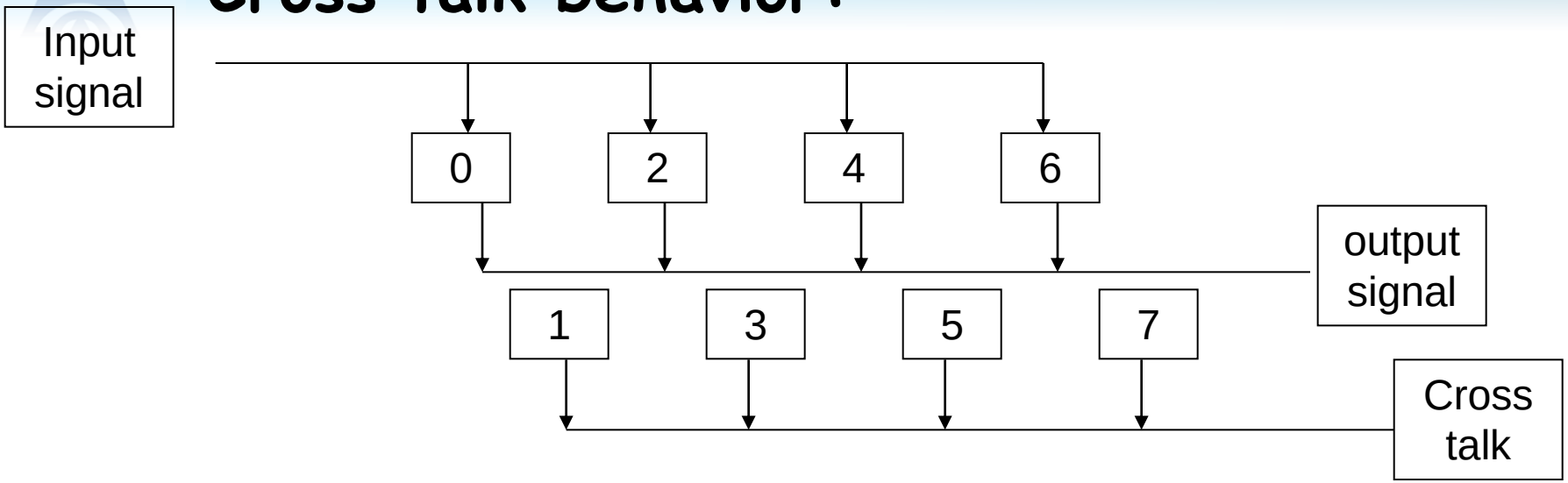


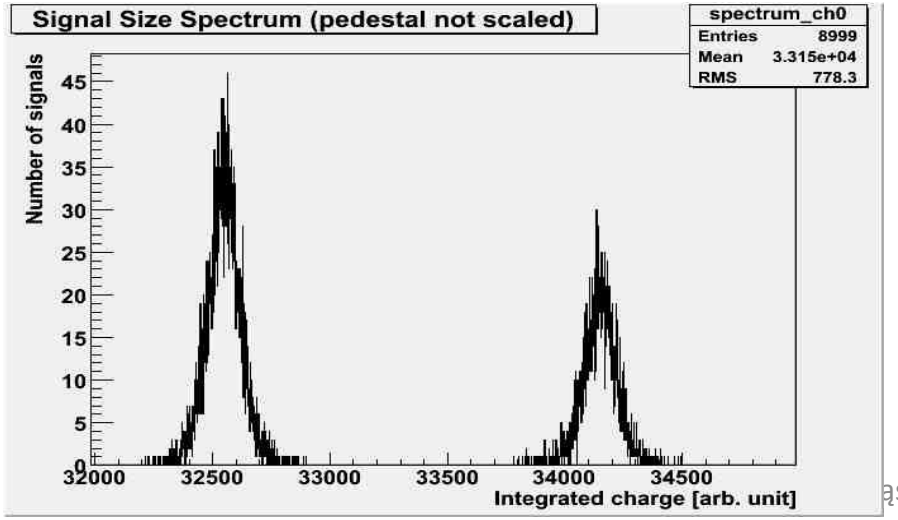


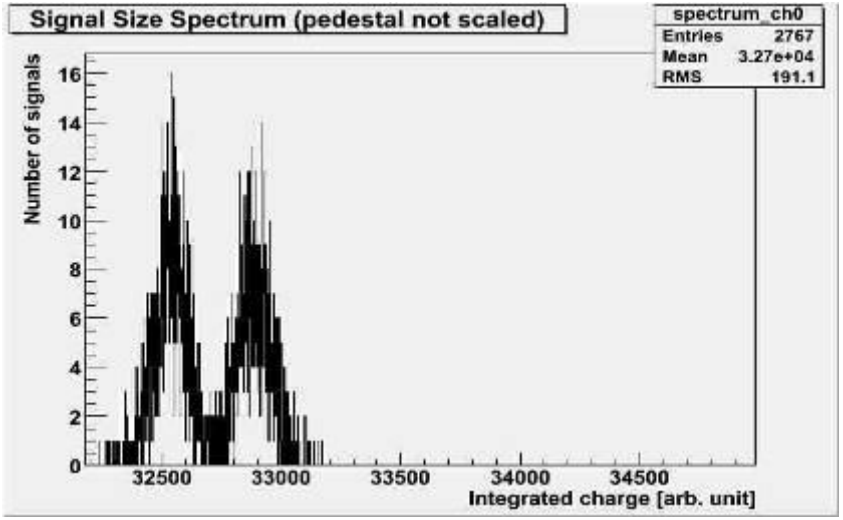


Preparation of Test Beam - Calibration

Cross talk behavior:







1 channel Cross talk

- Inconclusive: high level cross talk was measured in all channels - Between 10% and 20% of original signal in channel.
- The measured high level cross talk may come from the simultaneous injection to four channels.
- After test beam one more input was made (cluster 1 pad 1) to measure this cross talk. As a result cross talk much lower than before. For one channel injection cross talk was ~1%.

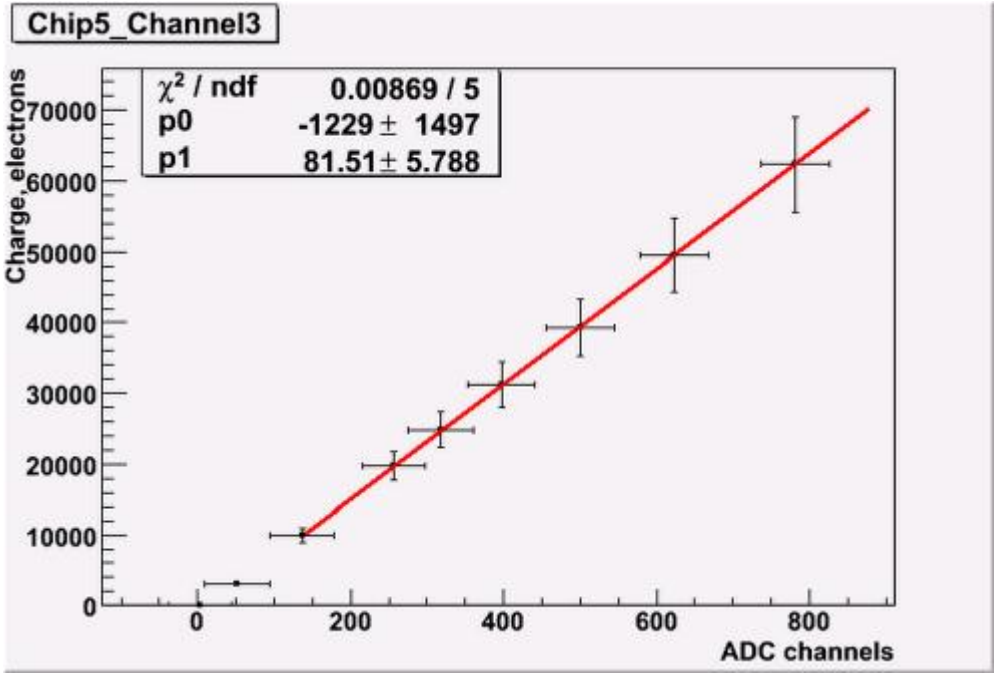
Calibration

- Because of different amplification used in the test beam, calibration measurement had to be done once again for all channels
- The converting constant is :

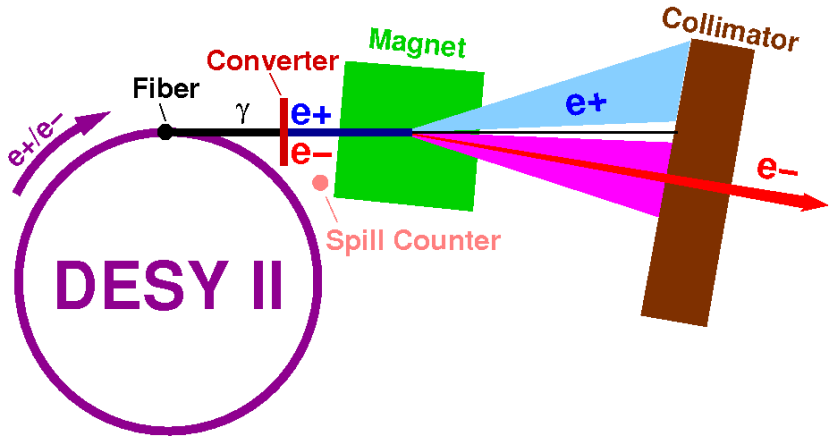
  a (FAT) = 160±11

  a (RC) = 80±6

[electrons/ADC counts]



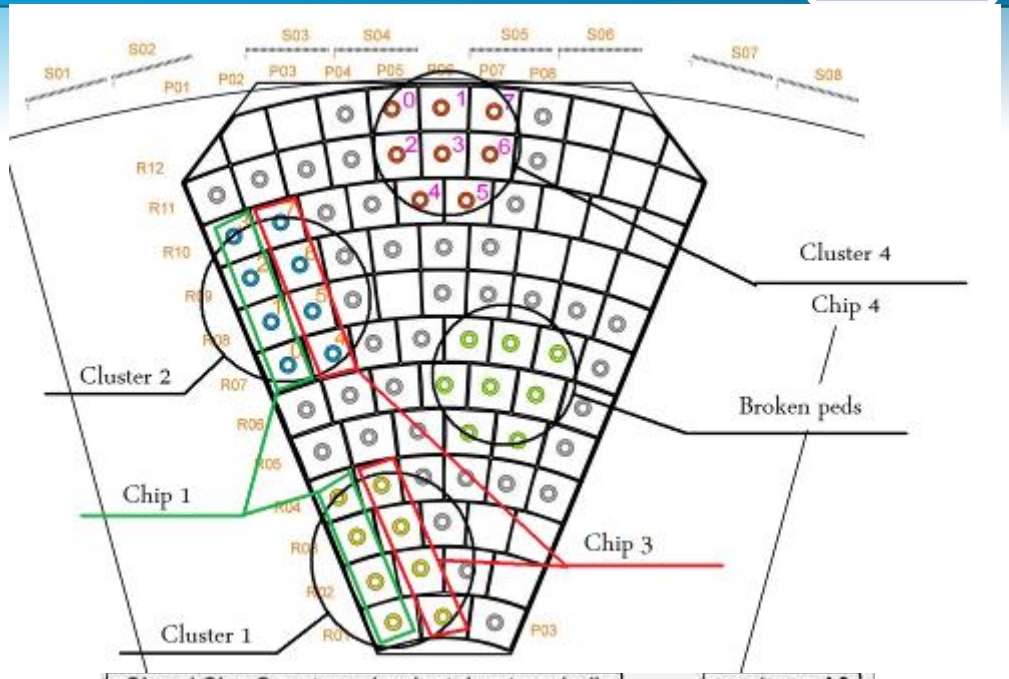
Test Beam facility

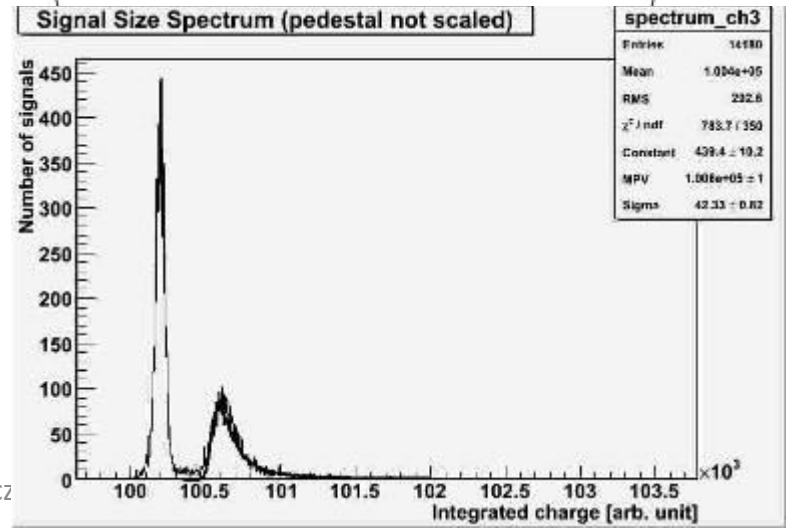


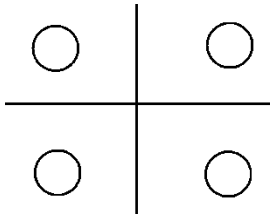
Test beam took place in beam line 22 of DESY II ring in Hamburg with 4.5 GeV electron beam. Measurements are the combination of our sensors, Zeus telescope and temperature monitoring

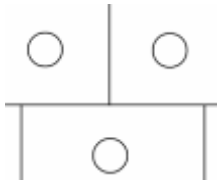
What we measured

- For each connected pad collected 4x50K events(cluster 2 and 4)
- Two high-statistic measurements (~2M events) for gaps between the pads
- We use broken bondings to measure cross talk.









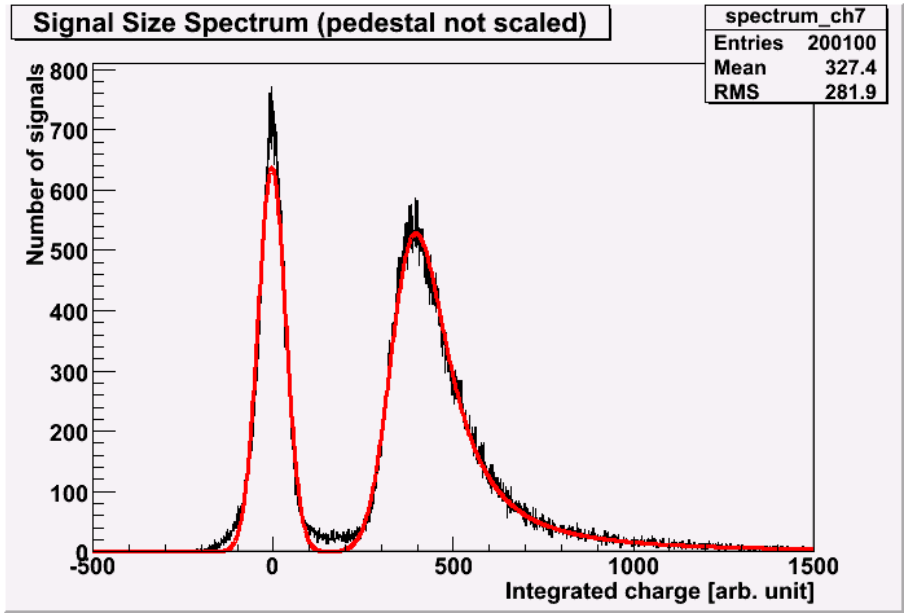
Fitting

Fitting was performed to convoluted Gauss and Landau distribution as a part of first analysis to calculate actual size of signal and to estimate signal to noise ratio and CCE and CCD for each pad.

CCE ~30%

S/n ~10%-15%

$$CCE = \frac{Q_{collected}}{Q_{induced}}$$



Summary

- more than 5M events on disk for 2 sensor (DAQ &Telescope).
- Calibration had been done for all measured channel.
- Simple fits were made to test beam data.
- Preliminary result for CCE of ~30% and S/N of ~ 15% were calculated.
- Cross talk needs to be calculated from data.

Thank you