Beam test of novel ASICs and sensors

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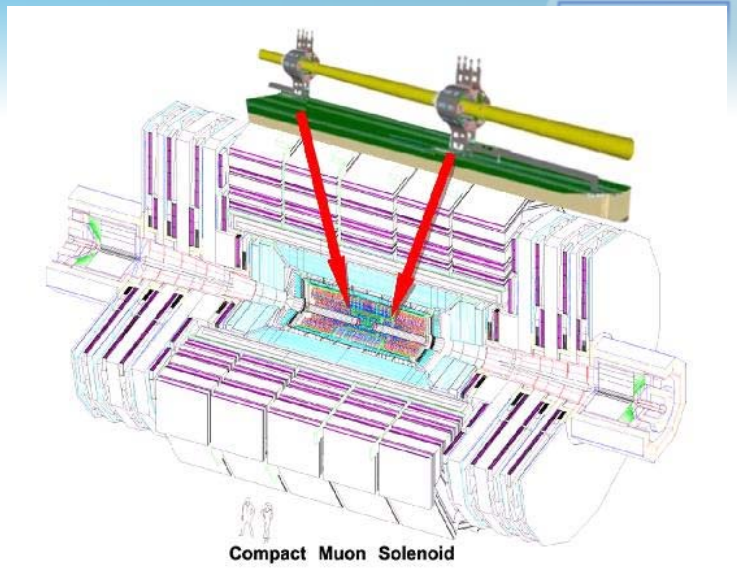
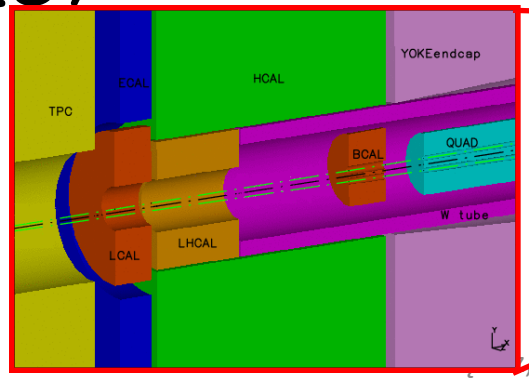
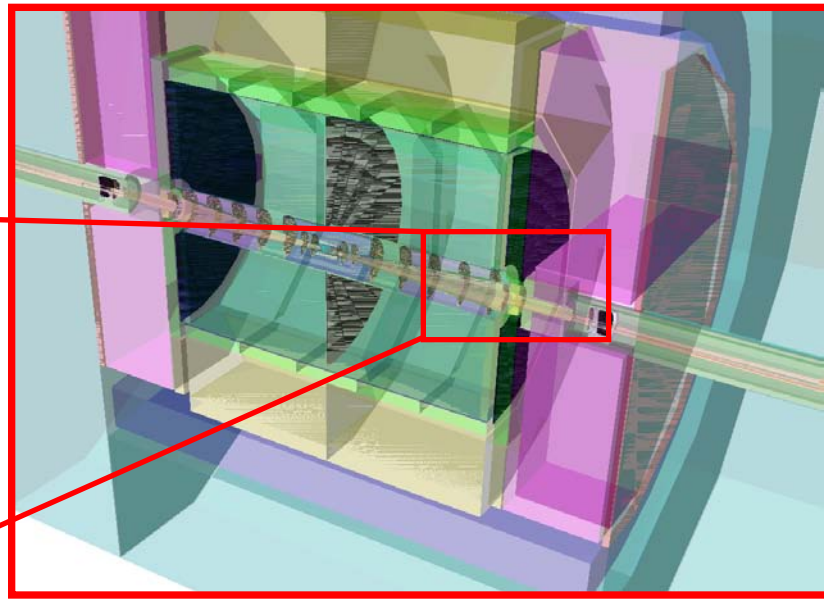
Motivation

- In 2016 LHC will shutdown, during which BCM1 is planned to be replaced (GaAs?)
- R&D for FCal for ILC, CLIC (BeamCal/LumiCal)
- We joined the ongoing efforts to develop sensor and ASICs in the CMS/FCAL group at DESY

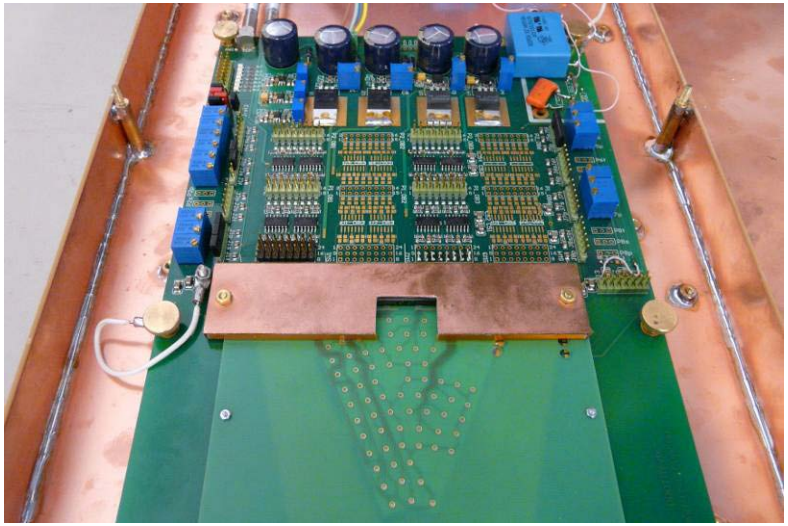


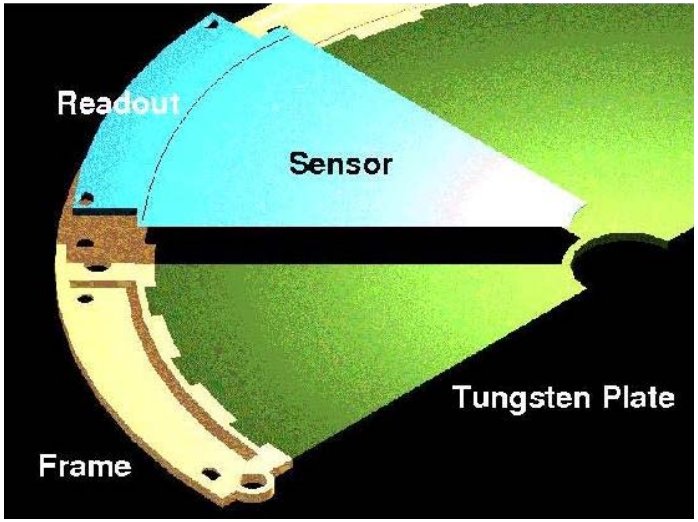




Senor and ASICs

- All of the detectors are planned to be semiconductor, absorber sandwich calorimeters
- Prototype of sensors and front-end ASICs are available.
- For the first time sensors are connected to front-end ASICs





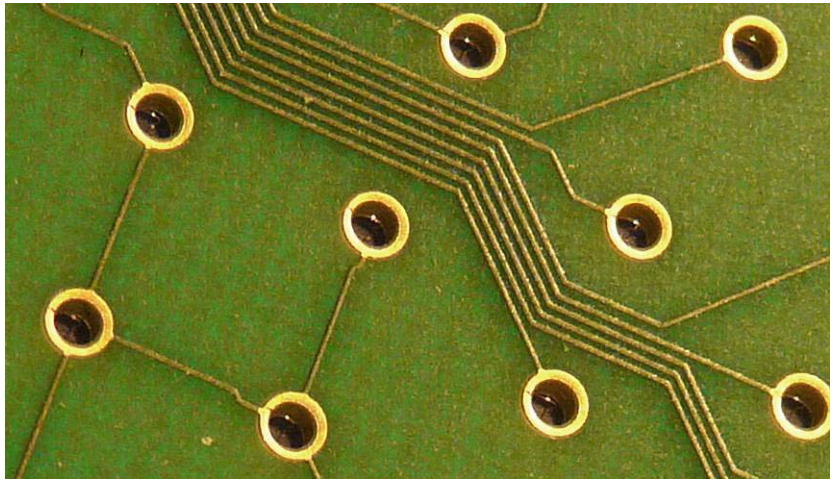
Aim of the Test Beam

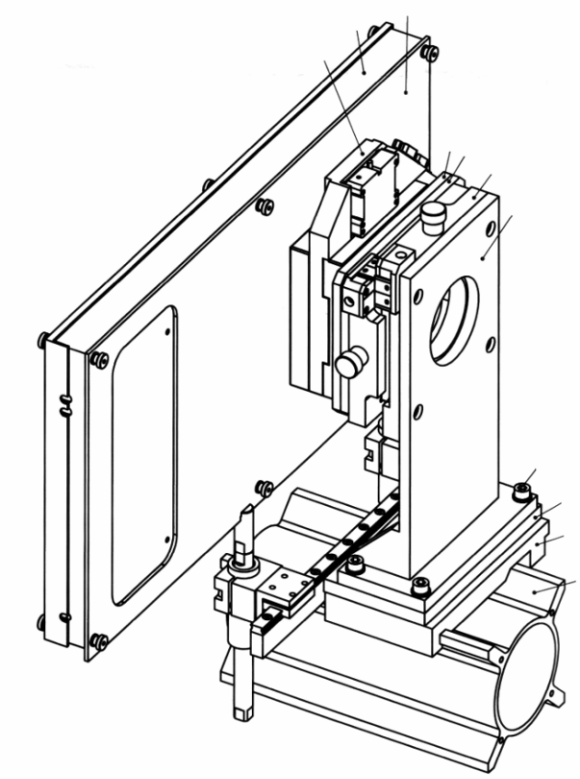
- Prove frontend electronics operation together with sensor and automated triggered readout in a particle beam.
- Collect experiences for preparation of a BCM1F/BeamCal/LumiCal prototype subset – plane or sector ('deliverable' within MC-PAD).

Taken from H. Henschel presentation 13 April Cracow

Preparation of Test Beam

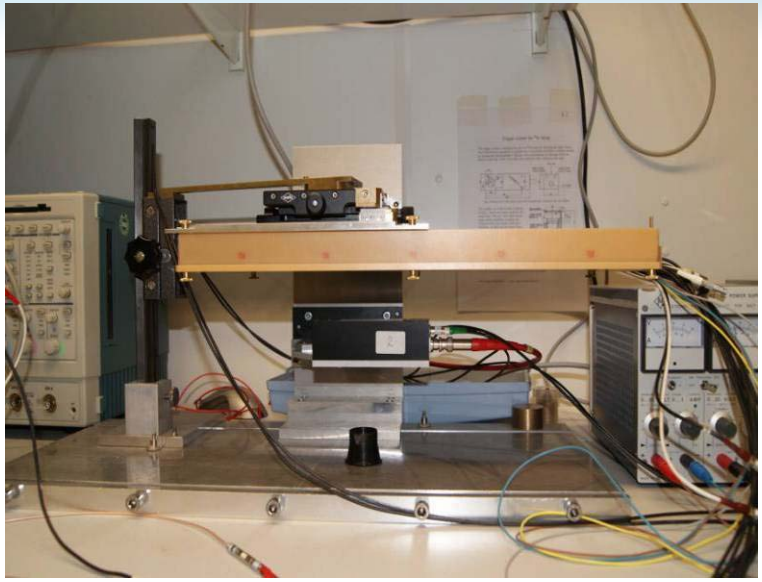
- Bonding ASICs and sensor.
- Remote control XY table.

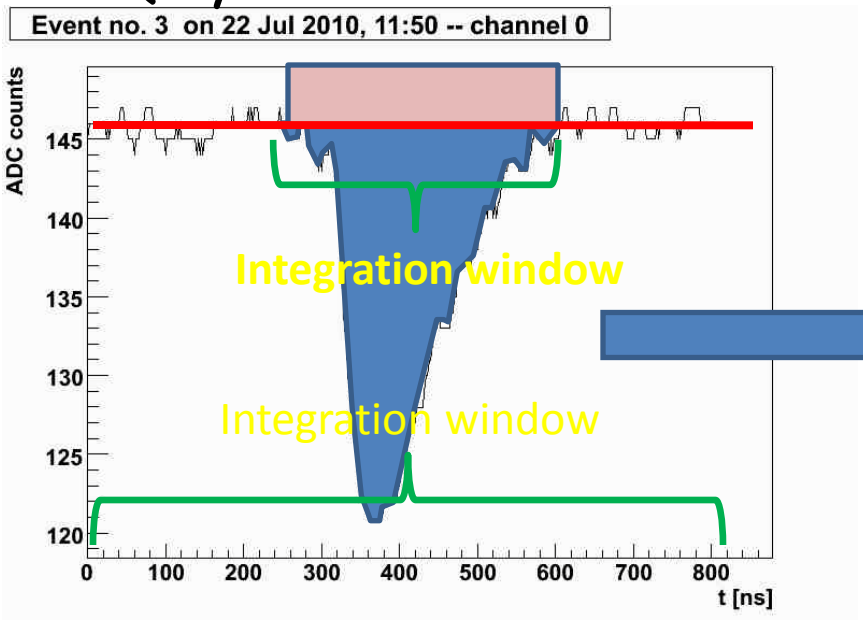


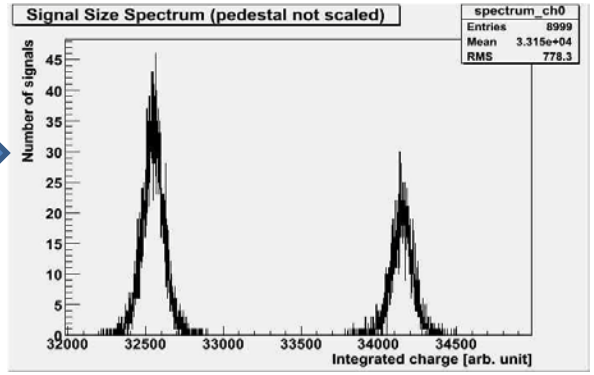


Preparation of Test Beam

- Preparing the readout device (V1721 Flash ADC).
- Adapting software for readout device and DAQ.
- Integrating semi-online analisis in the DAQ system.



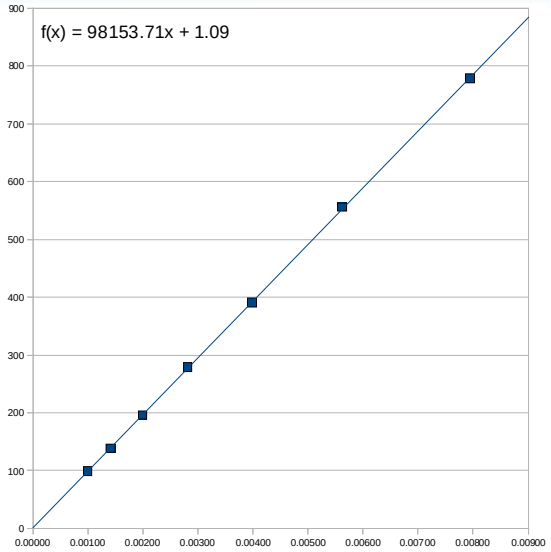


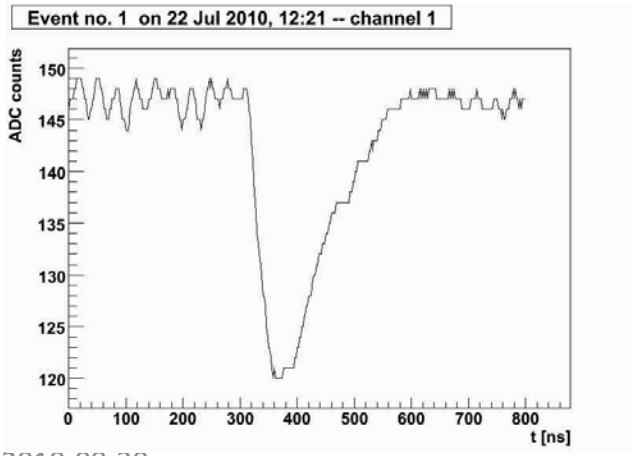


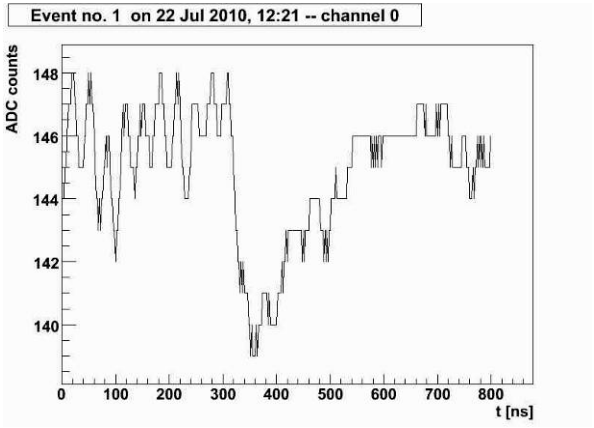
Preparation of Test Beam

Using test pulses of 1V and attenuator we performed:

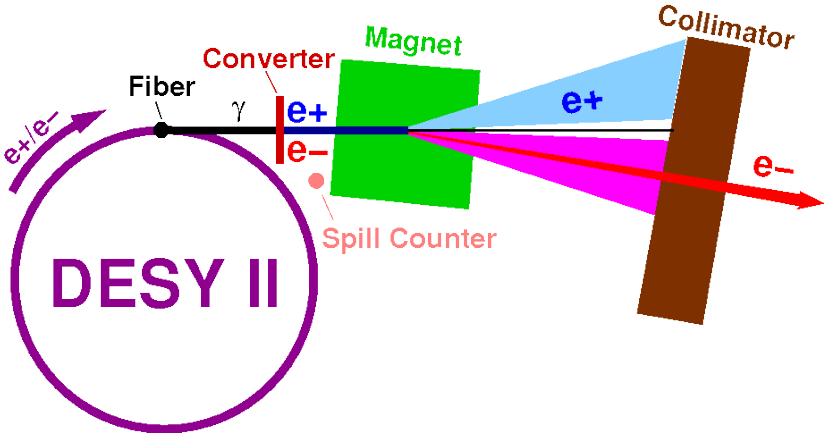
- We checked linearity of the amplification of the ASICs
- Cross talk was observed during this test and was measured between four channels.







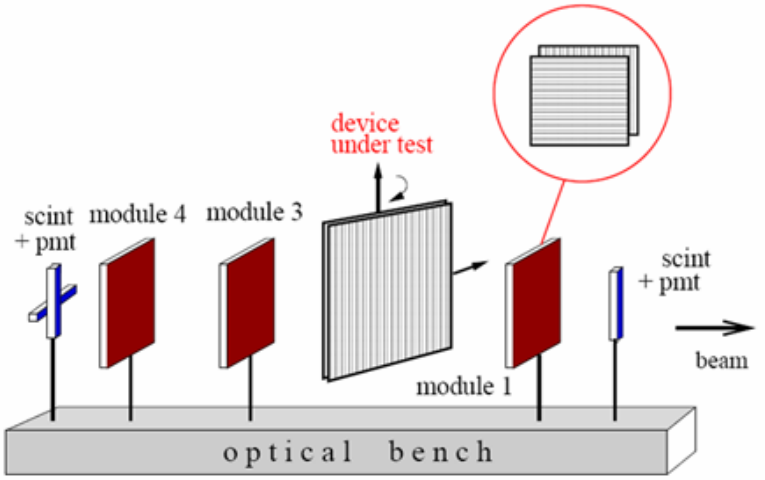
Test Beam



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

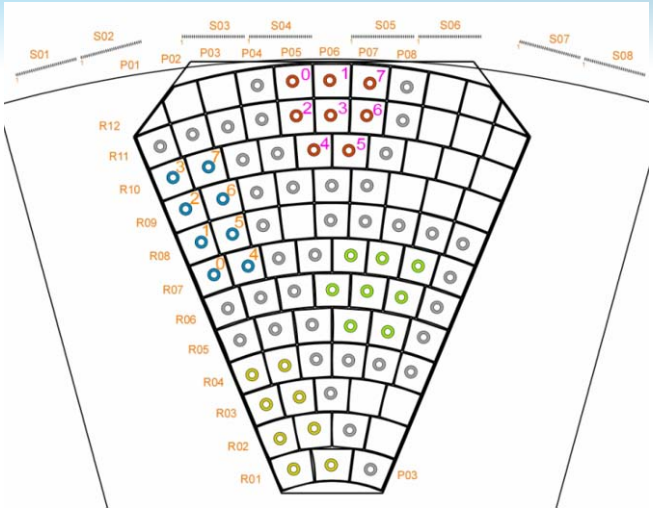
Eudet telescope

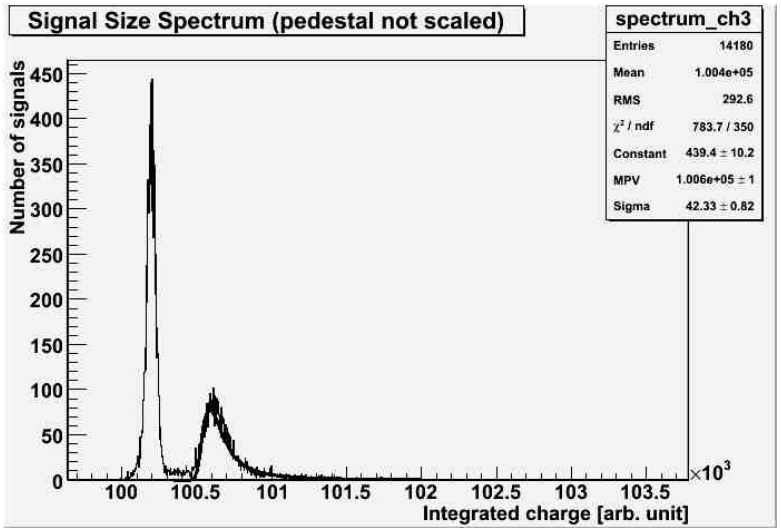
- 32X32 mm Si sensor
- 25μm strip pich
- 50μm strip readout

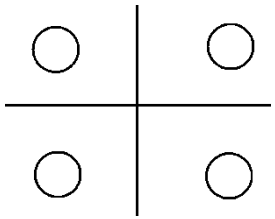


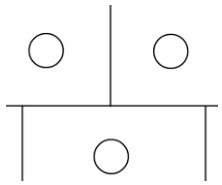
What we measured

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



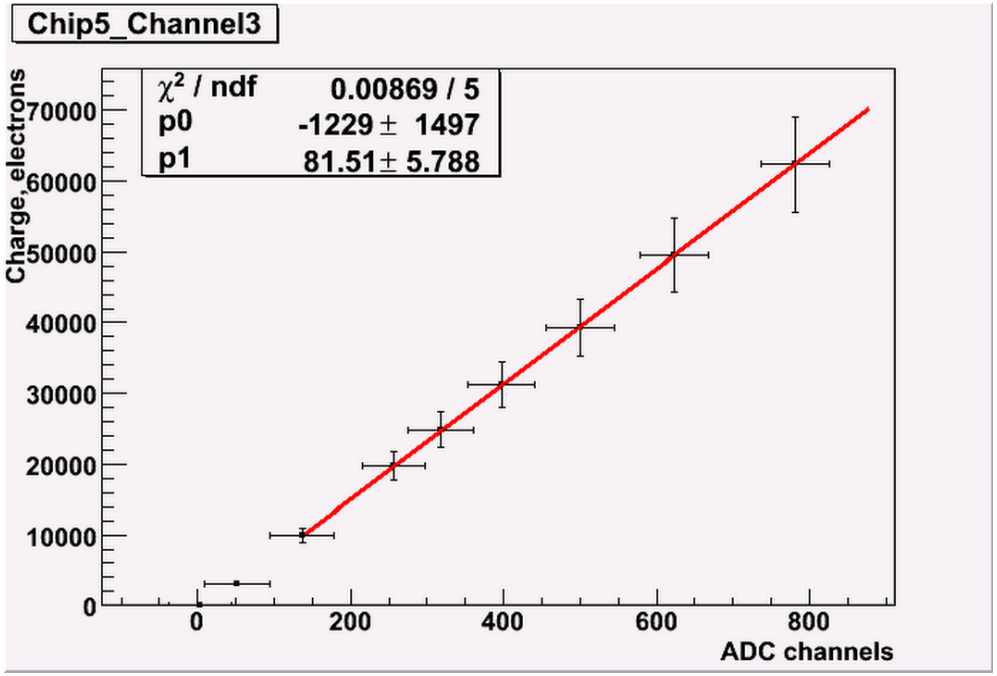






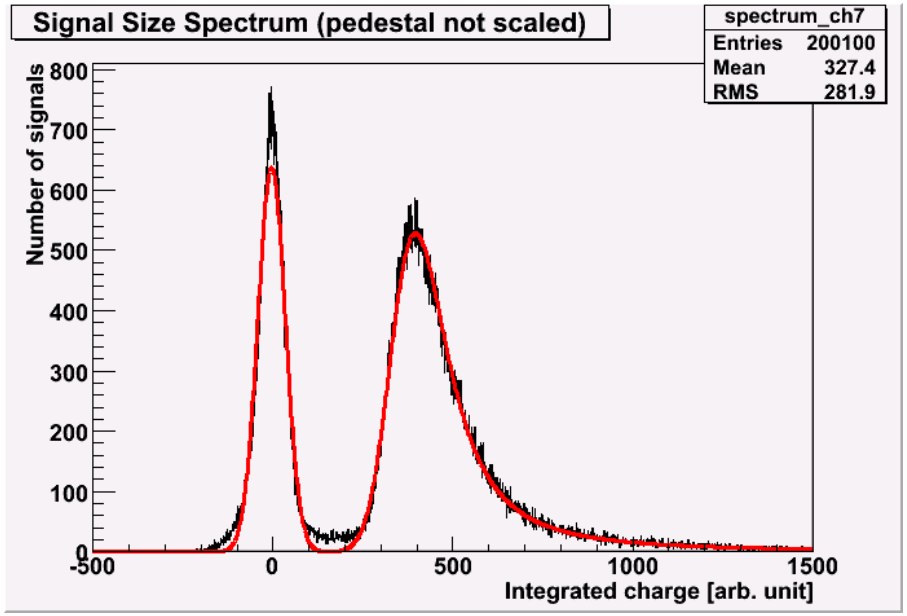
Calibration

- Because of different amplification used in the test beam, calibration measurment had to be done once again for all channels.



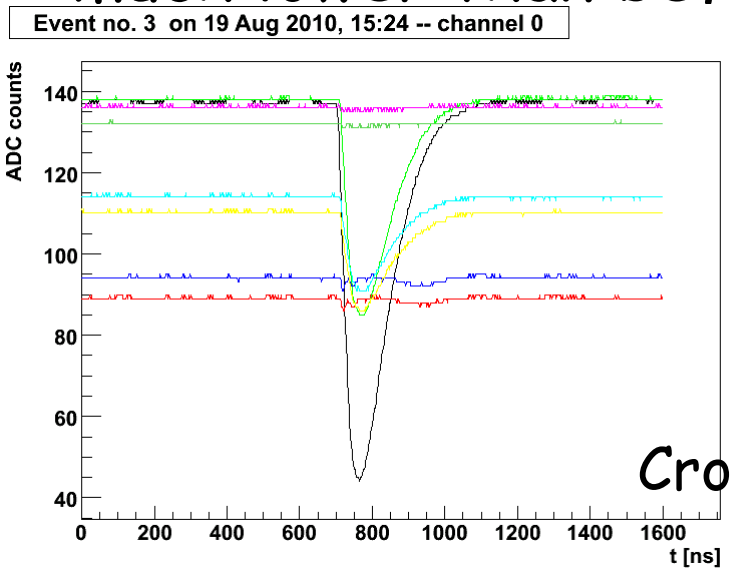
Fitting

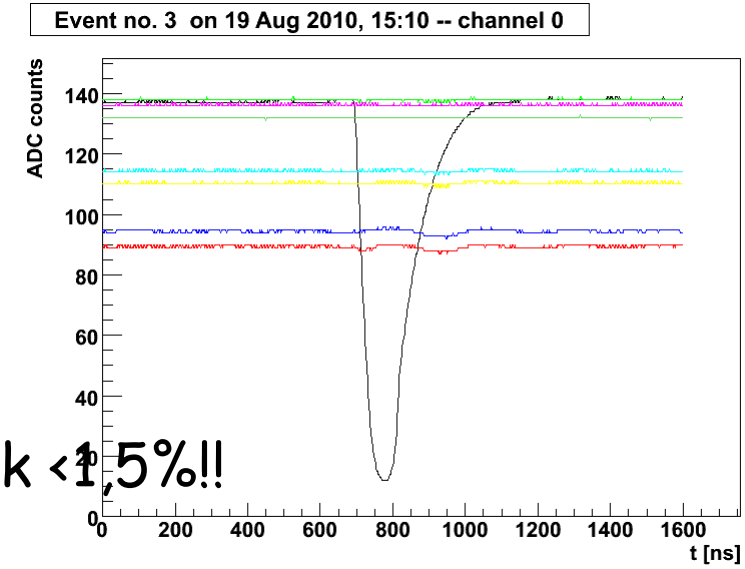
- Fitting was performed to covoluted gauss and landau distribution as a part of first analysis to calculate actual size of signal and to estimate signal to noise ratio and CCE and CCD for each ped.



1 channel Cross talk

- The measured Hi-level cross talk may come from simultaneous feeding in four channels.
- One more input was made (cluster 1 pad 1) to measure this cross talk. As a result cross talk much lower than before.





Cross talk <1,5%!!

Summary

- We collected more then 5M event on disk for 2 sensor (DAQ &Telescope) during the 2 weeks of test beam.
- Next step is to combine data from TELEna with our DAQ for complete analysis .

Thank you
for your attention