Analysis of 2007 ECAL data

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- energy resolution, linearity

- # hits

- shower shape

- fluctuations and correlations

data

Selection of e- runs taken at CERN in 2007
- Beam momentum of 6 -> 50 GeV/c
- Normal incidence on ECAL

simulation

Small private samples of Mokka simulation (temporary)
- just three energy points: 10, 30, 50 GeV
- zero energy spread
- uniform beam profile across calorimeter
- simple digitisation
- “new” G10 definition

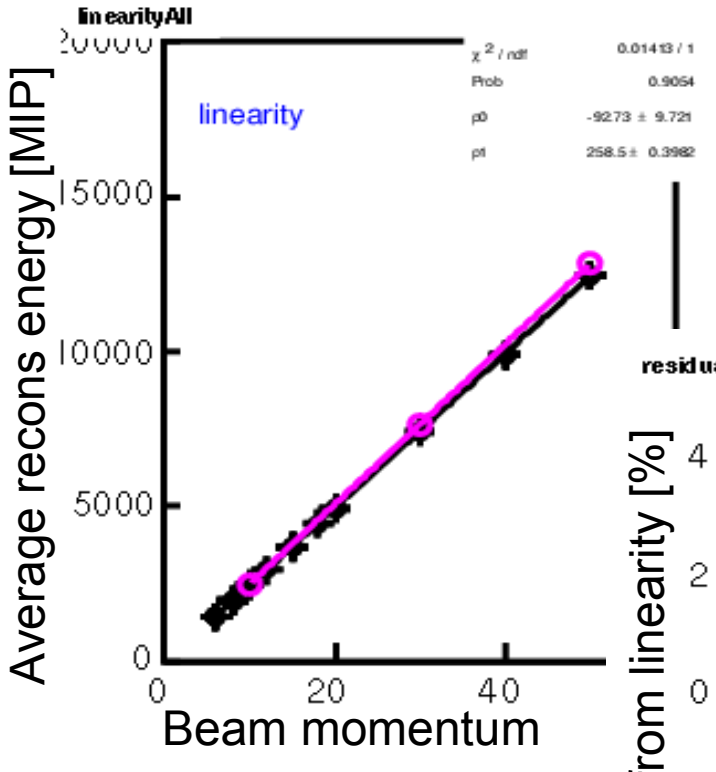
event selection

Same electron event selection as used for 2006 data:
- loose ECAL energy criteria
- reject double cluster events e.g. upstream showers

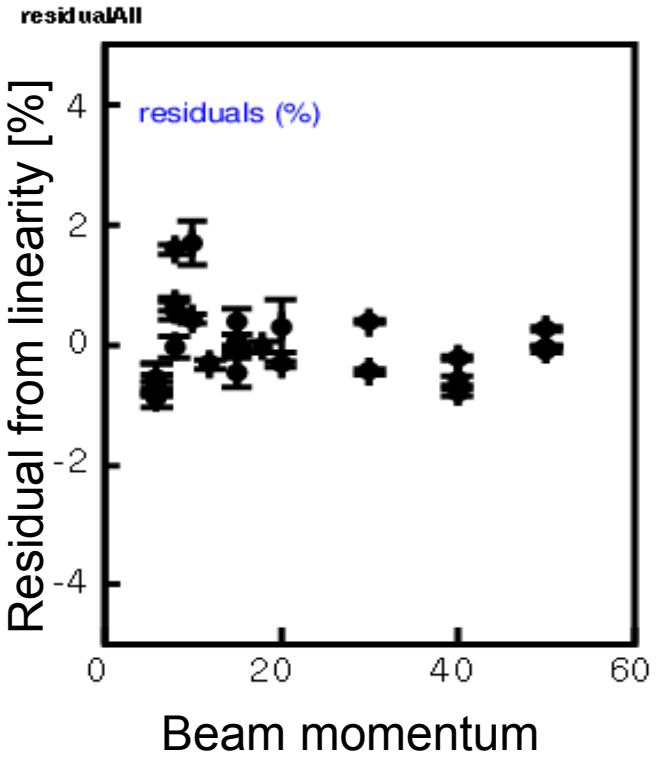
Stack energies weighted by factors 1./2./3.
odd/even layer correction of 7.2% applied

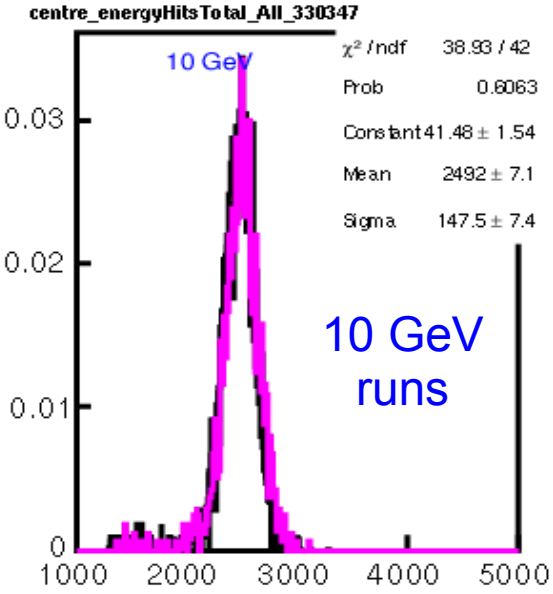
Linearity and resolution of energy response

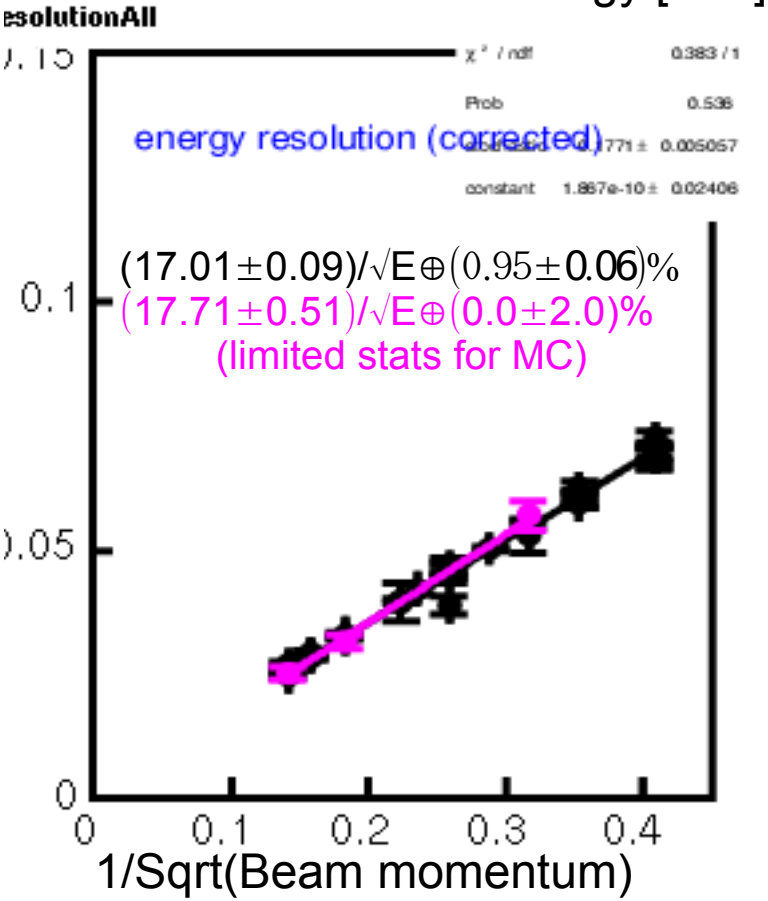
Select events far from inter-wafer gaps and detector edges
- minimise leakage



2007 e- data (one per run)
Mokka simulation



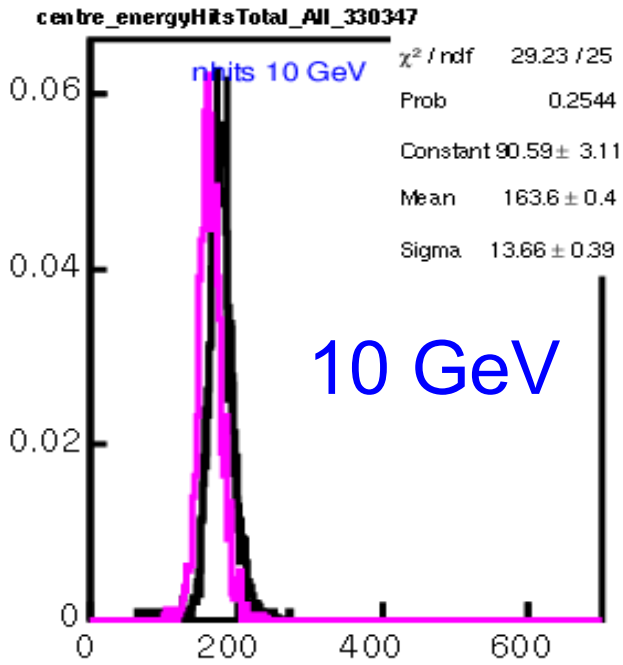


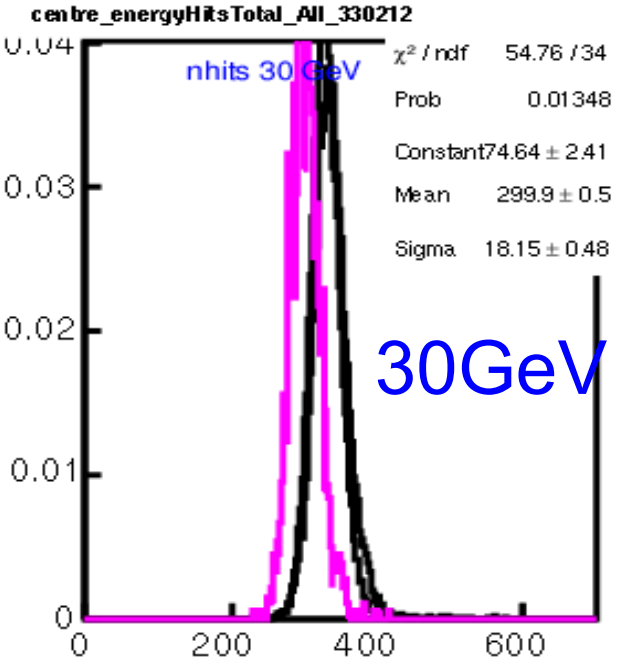


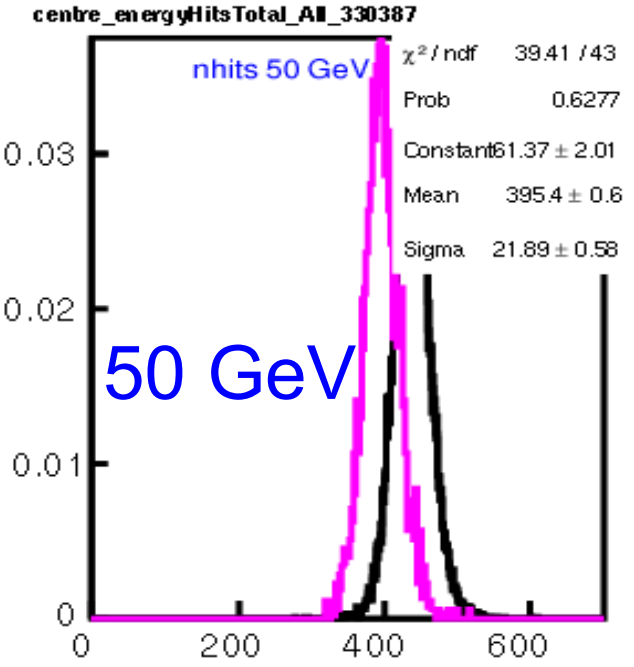
Number of hits (cells with energy > 0.6 MIP)

events far from inter-wafer gaps and detector edges

2007 e- data (one per run)
Mokka simulation





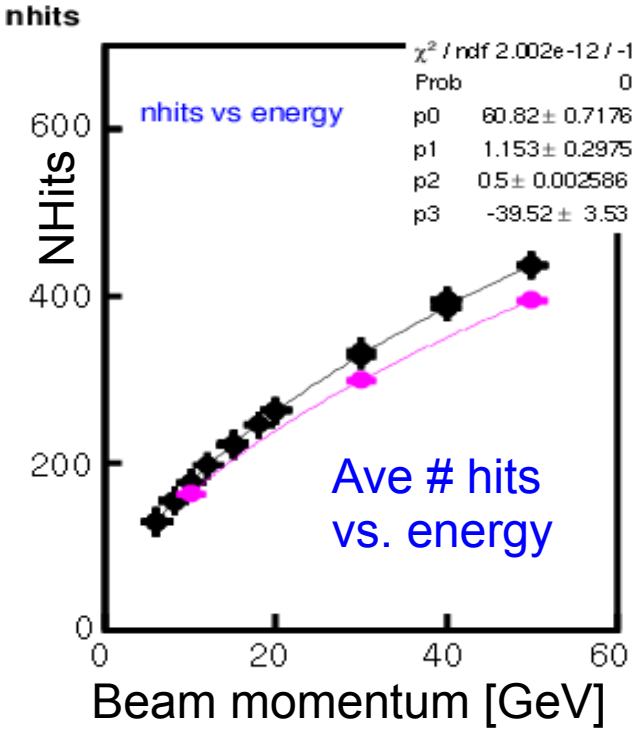


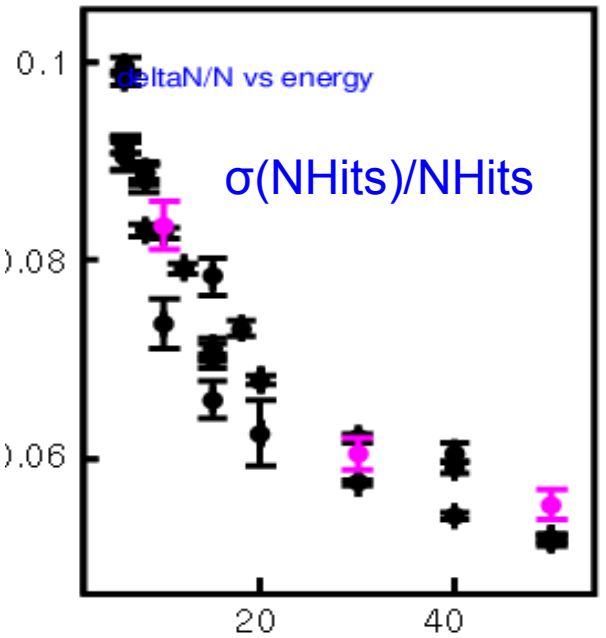
Number of hits

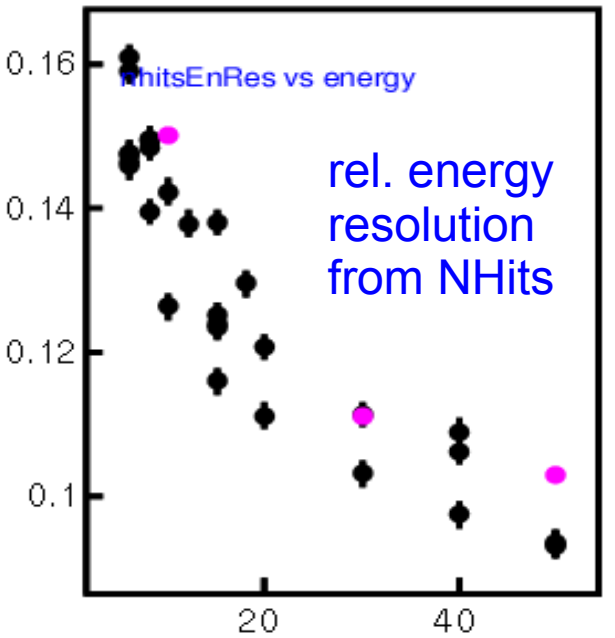
significantly more hits per event in data than simulation
- energy dependent difference

NHits cont...

2007 e- data (one per run)
Mokka simulation



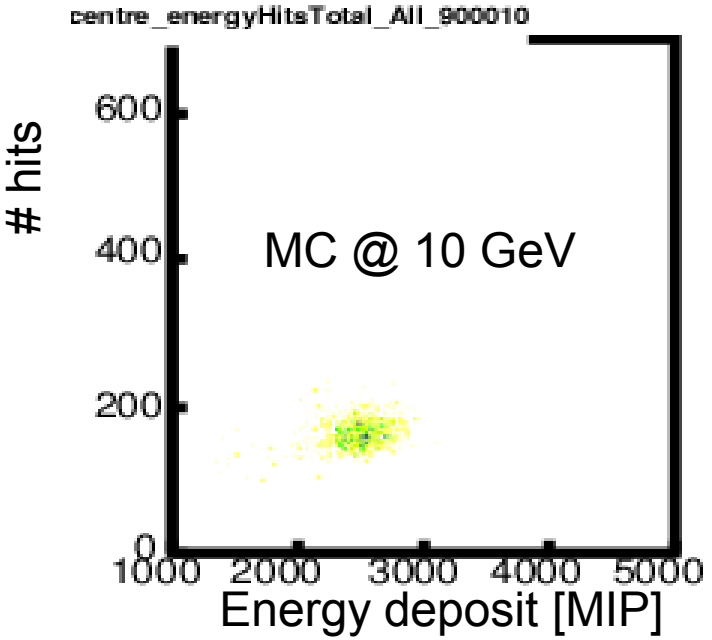


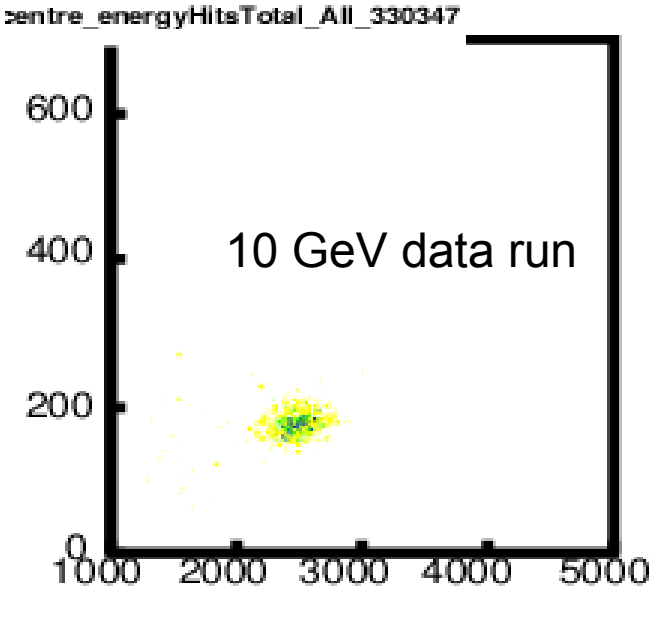


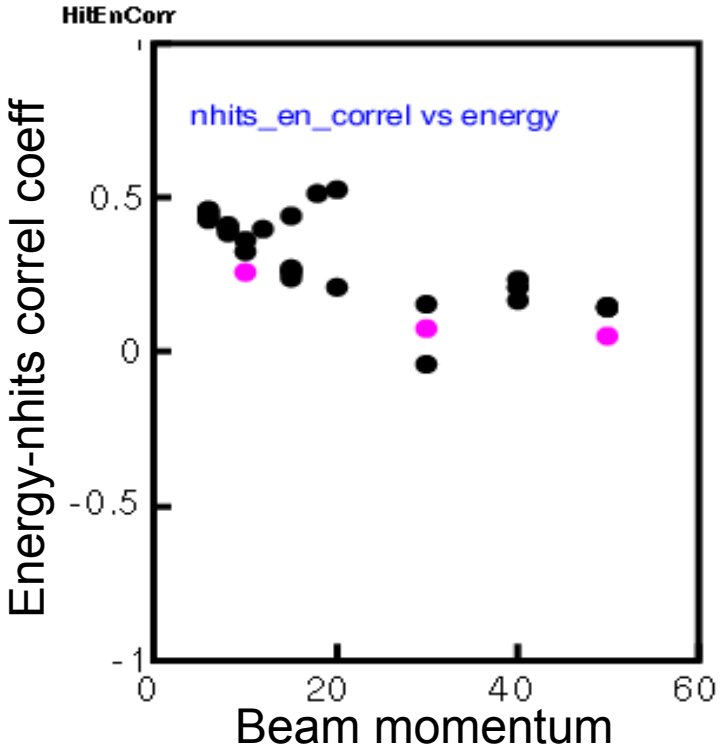
Significant run-to-run variation in width of Nhits distribution

width of Nhits distribution perhaps better described than mean (?)

Correlation between energy & NHits







2007 e- data (one per run)
Mokka simulation

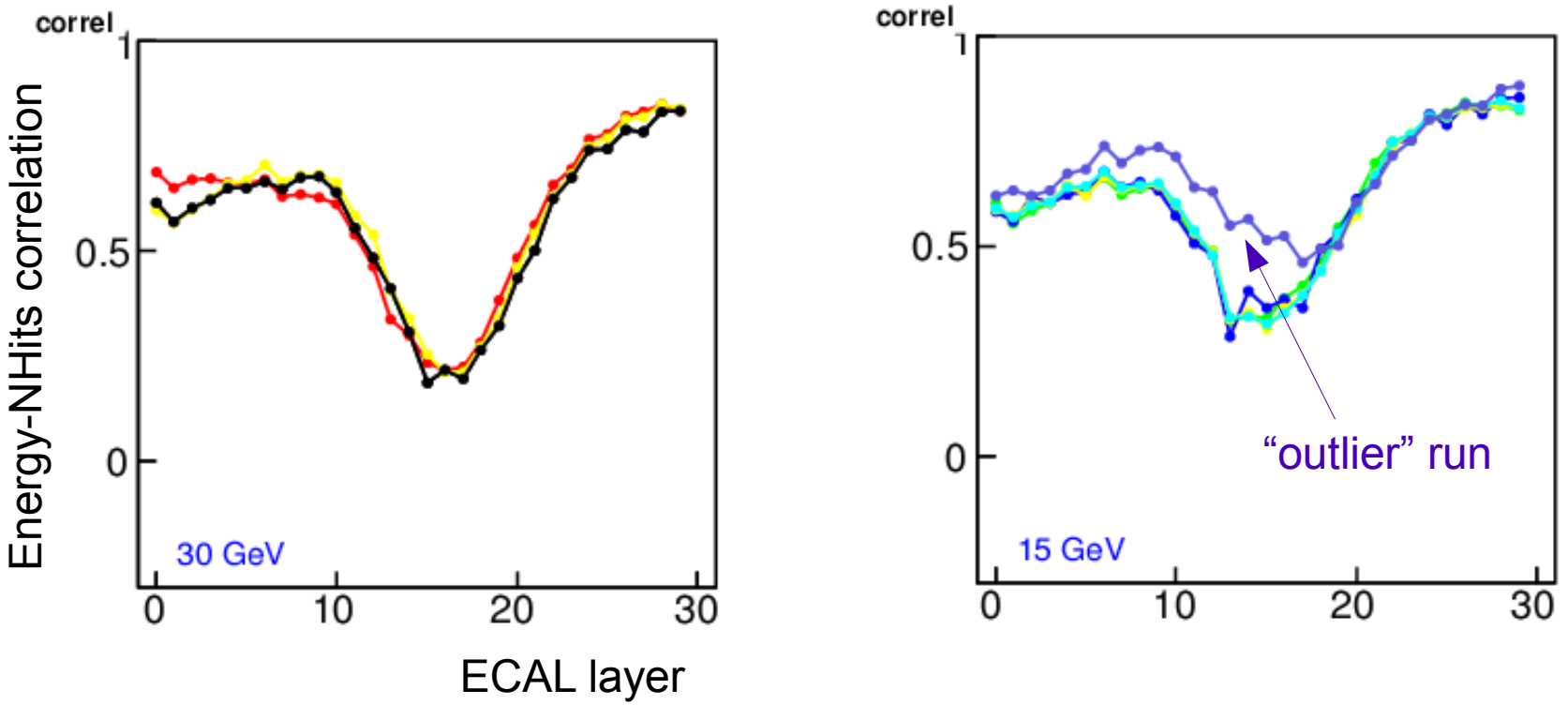
Relatively weak correlation, smaller at high energy

Rather large run-to-run variations

Sensitive to beam conditions (e.g. pion fraction)

Energy-NHits correlation per layer

Black = simulation, colors = different data runs



Interesting shape:

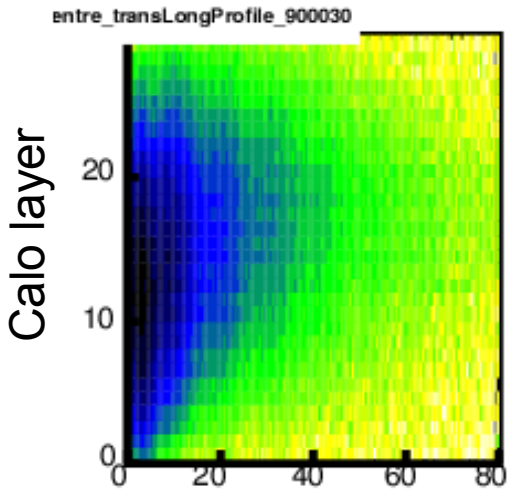
- correlation weakest @ shower max

quite well modeled in simulation

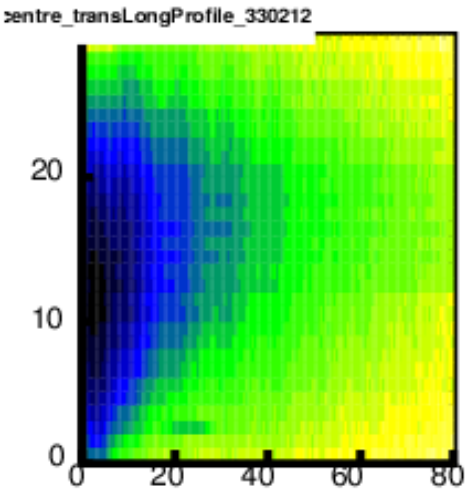
Some runs seem to behave differently, reason under study (pions?)

Shower shape: energy deposit

MC@30 GeV

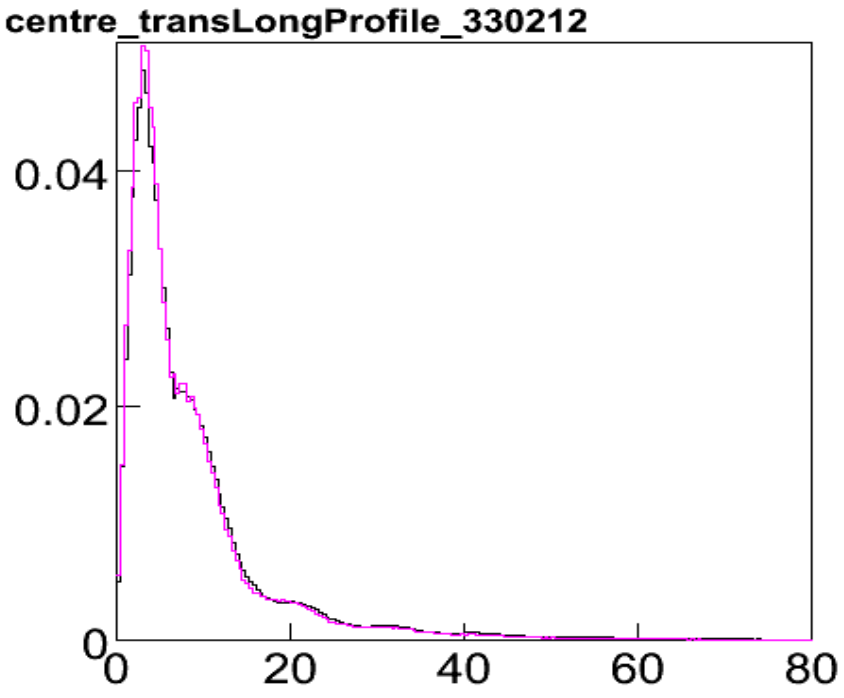


data run@30 GeV

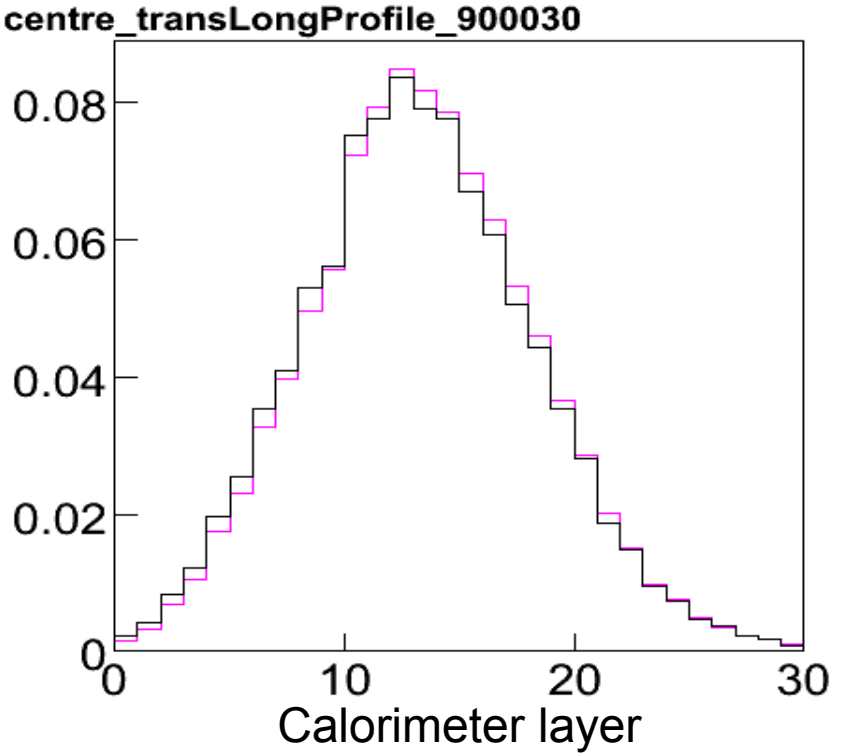


Distance from shower axis [mm]

Colour = Mean energy deposit (log scale)

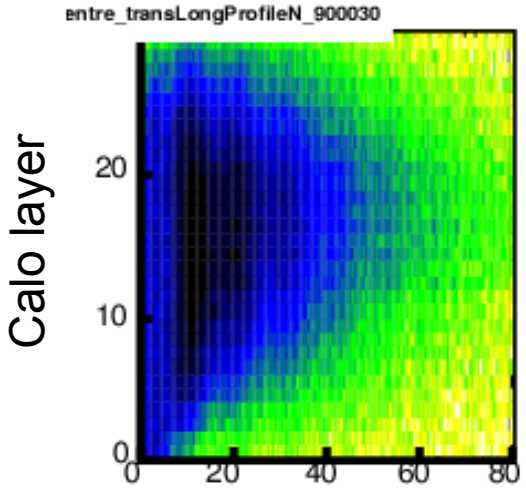


Projections

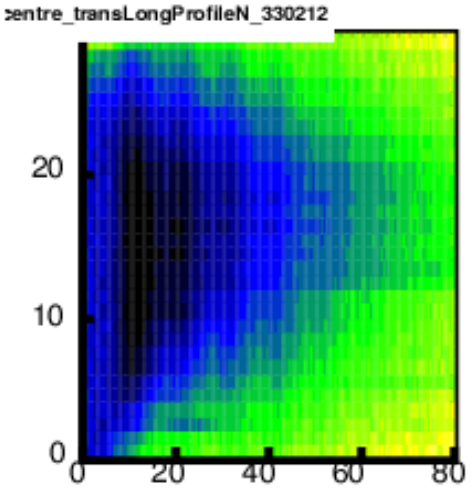


Shower shape: # hits

MC@30 GeV

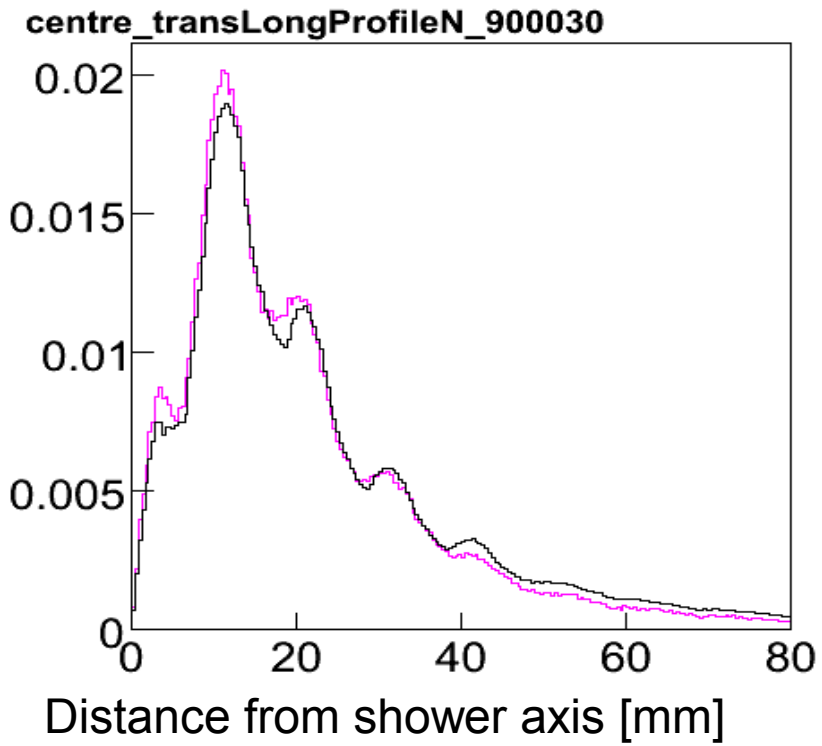


data run@30 GeV



Colour = Mean # hits (log scale)

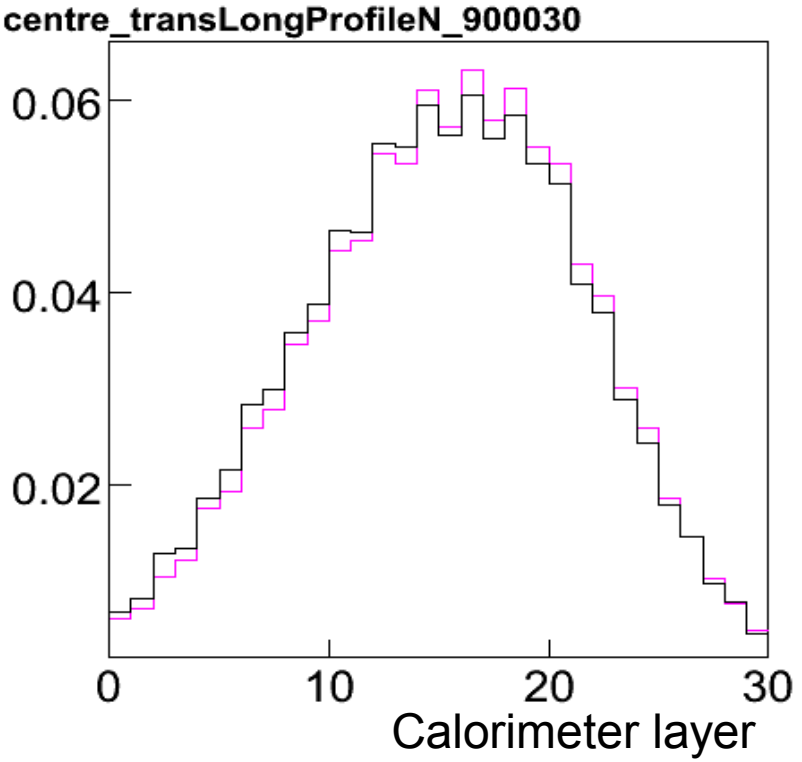
Distance from shower axis [mm]



Distance from shower axis [mm]

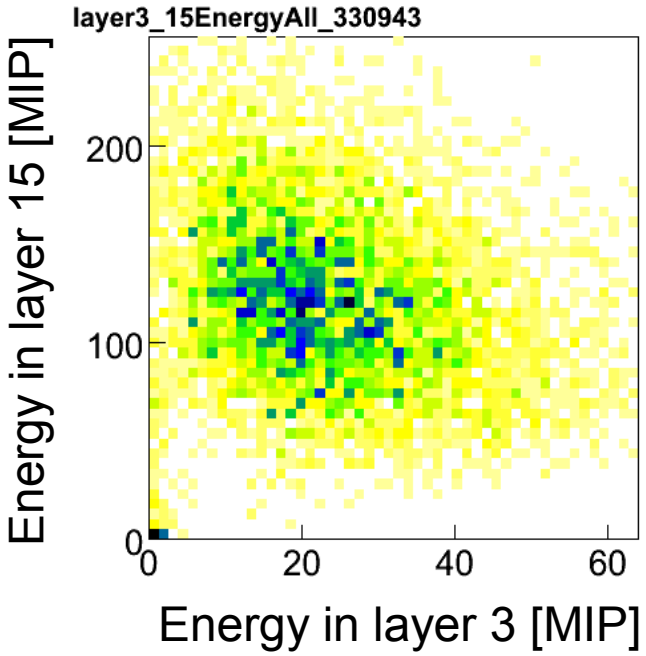
Projections

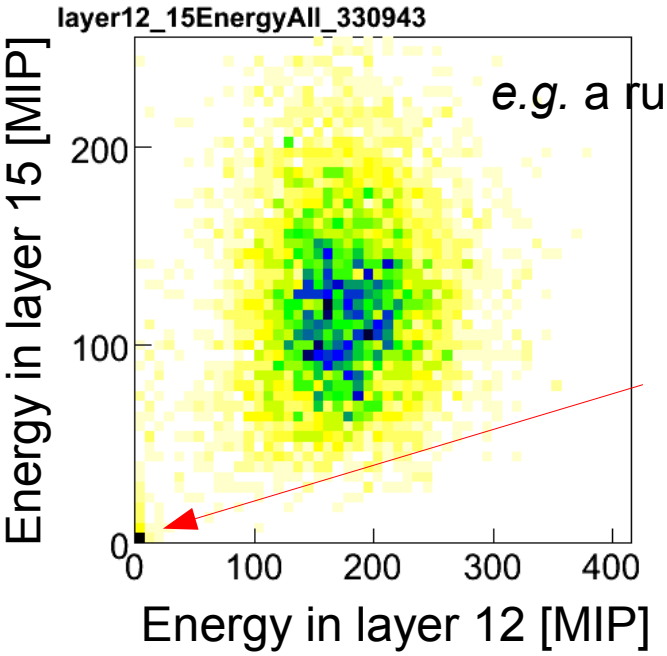
quite well modeled in simulation



Calorimeter layer

Layer-to-layer correlations



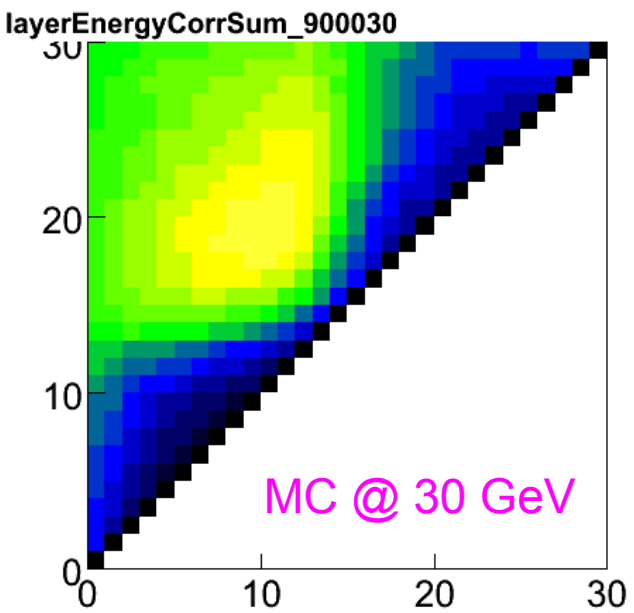


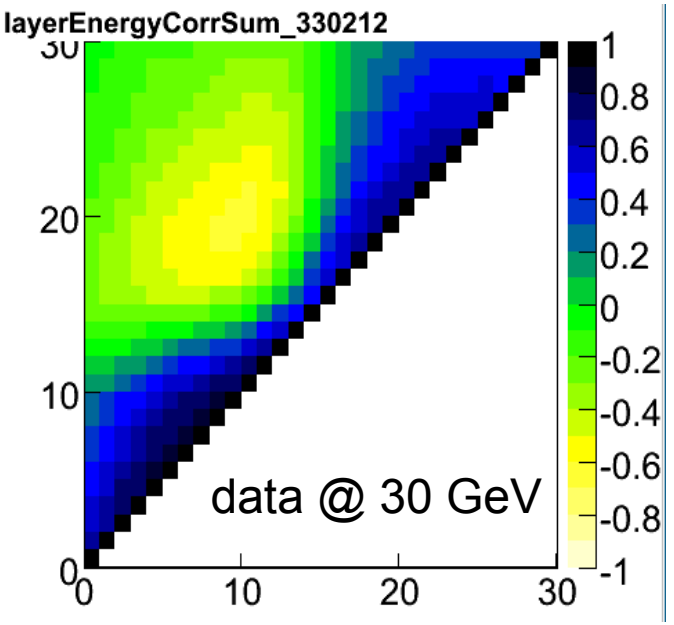
e.g. a run @ 8 GeV

Probably somewhat sensitive to non-electron component

Correlation between energy deposits in different layers

Seems to be quite well modeled





Conclusions

CERN 2007 e- data

- energy linearity and resolution (copy of 2006 analysis)

- number of hits

- correlations: energy-hits, layer-to-layer...

- preliminary simulation:
  # hits not well modeled
  correlations quite well described

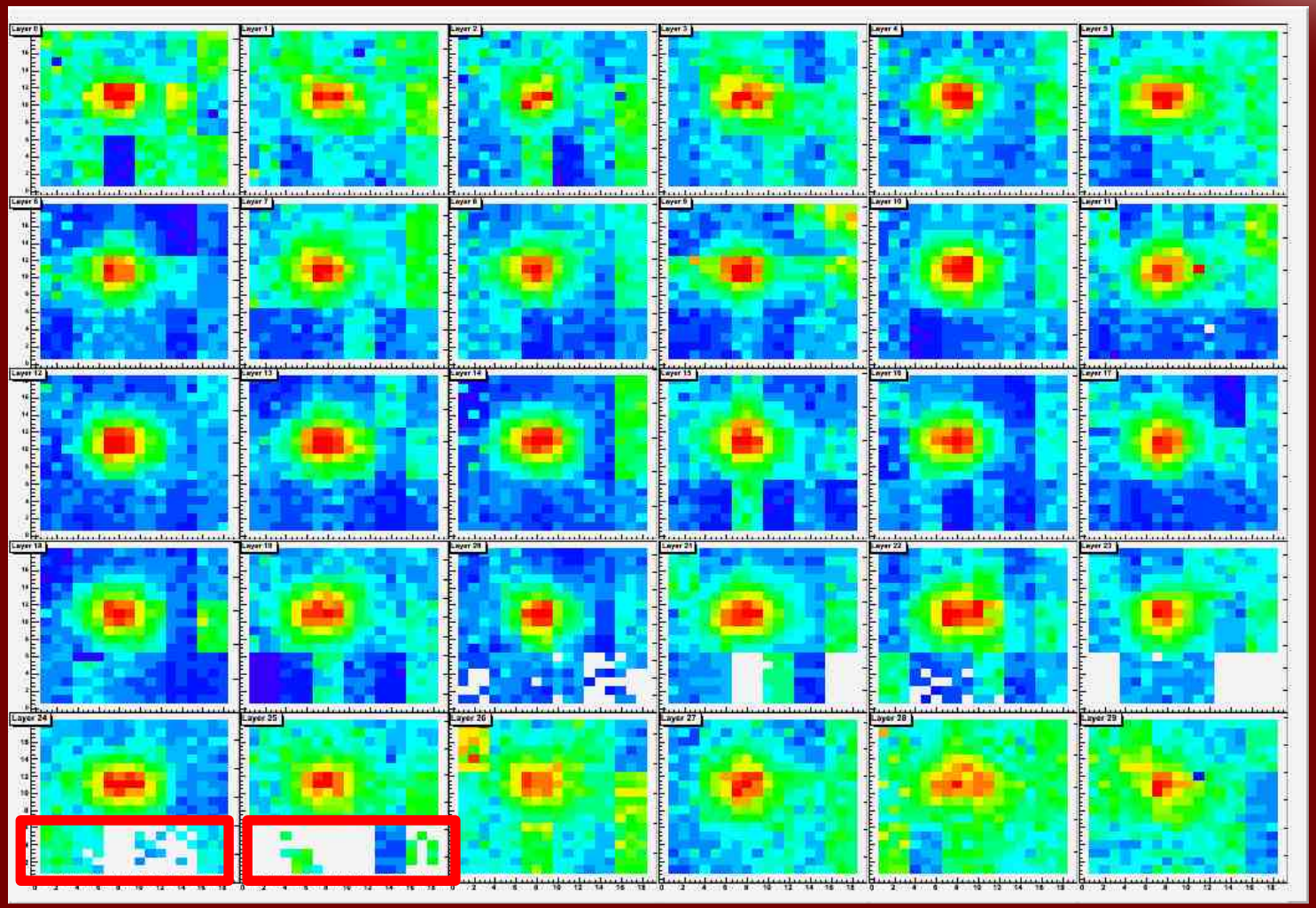
- still a few data features to understand...

Plans

- request official MC: realistic momentum spread, beam profiles
- more sophisticated digitisation (?)

- document in a CAN (started...)

Dead chips in '08



Could not be cured by changing cable, FE connector, CRC board...

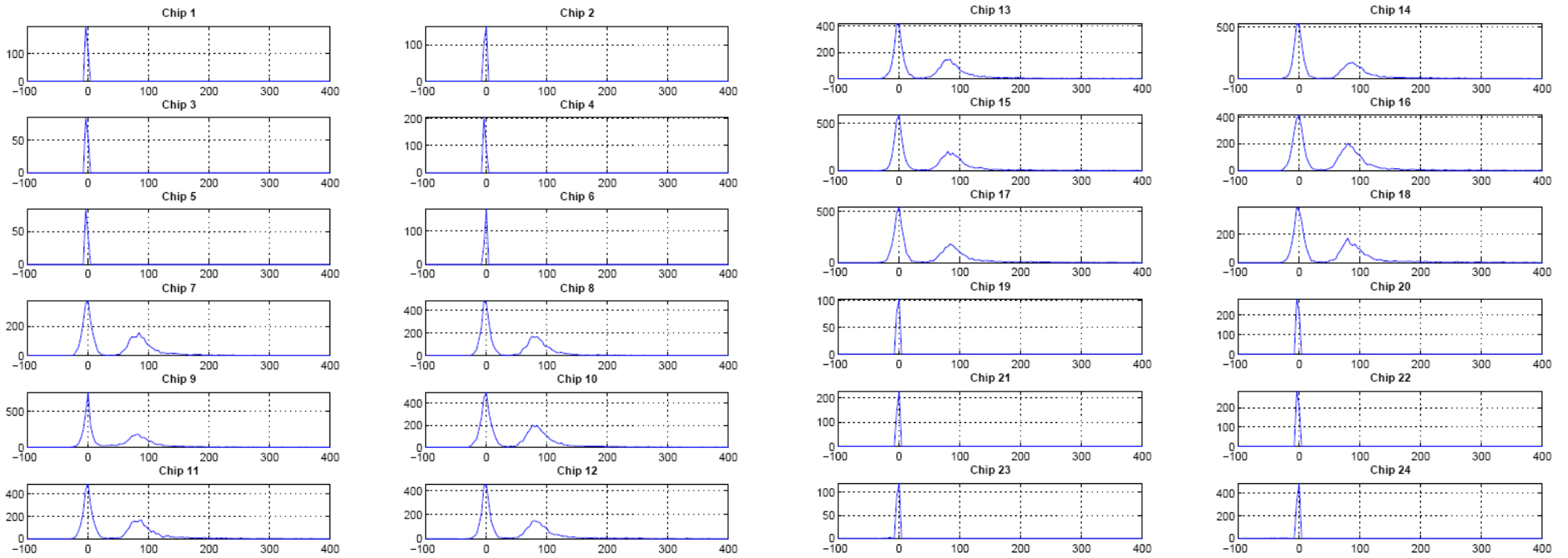
Tests with cosmic muons

- Tested bottom part PCB's with cosmics test bench at LLR: thanks to Jean-Charles Vanel, Franck Gastaldi, Simon Chollet

Cosmics tests '09

PCB_5_G - Layer 24

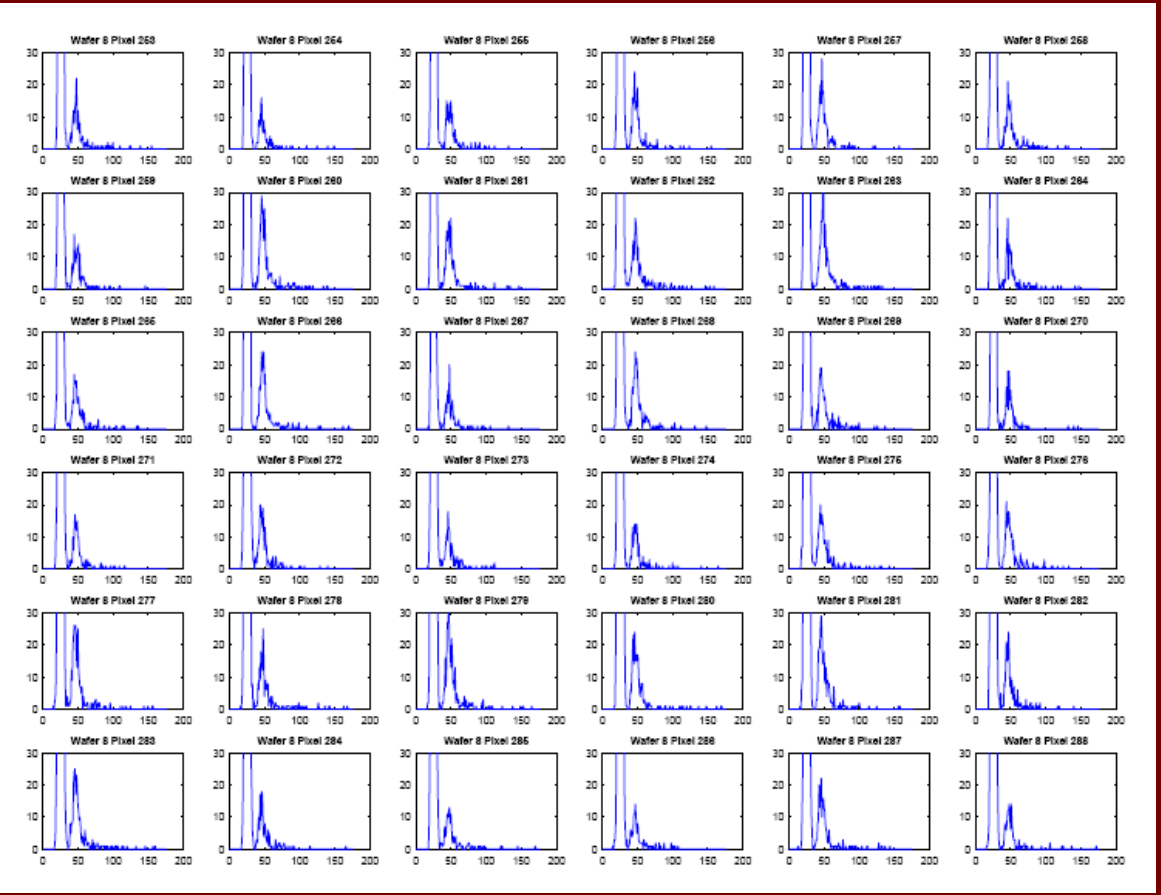
PCB_5_D - Layer 25



All chips work fine

Cosmics test '09 - II

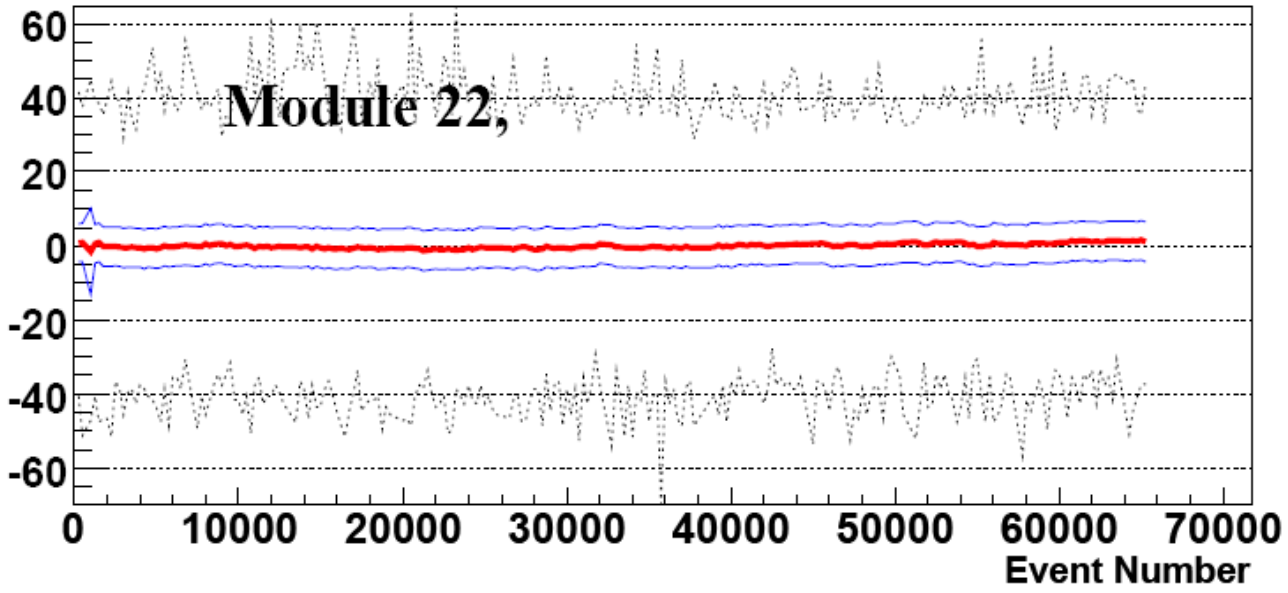
PCB_5_D - Layer 25 – Middle wafer



All pads work fine

Pedestal Instabilities

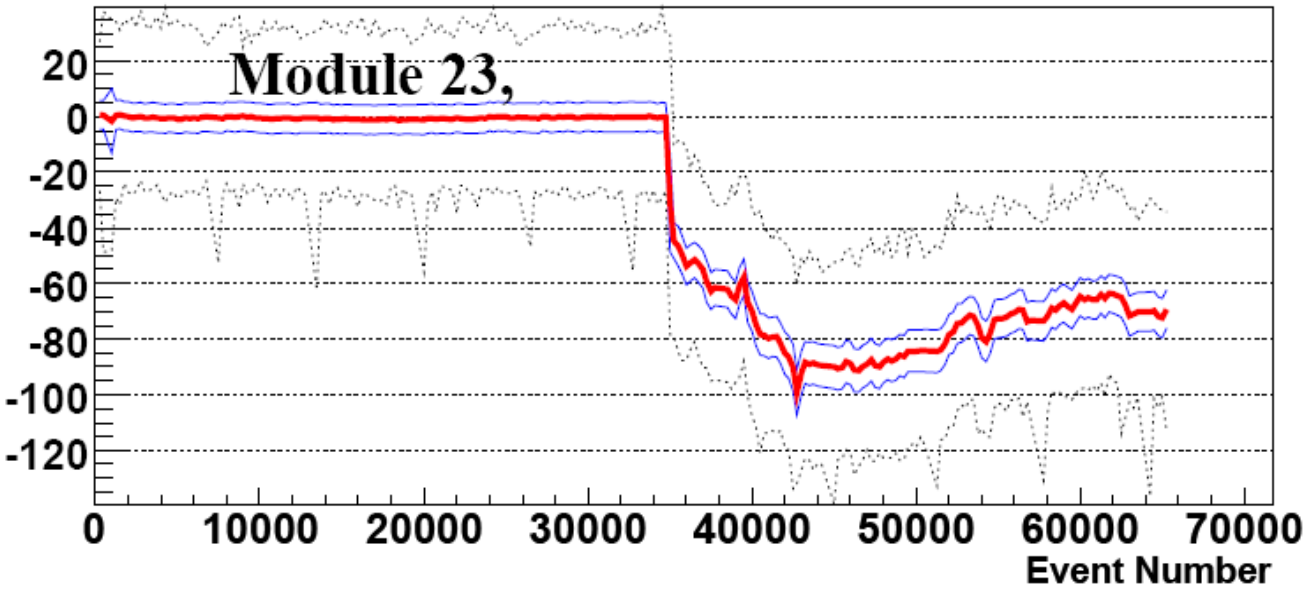
Pedestal as a function of the time :



(A good PCB)

Pedestal Instabilities

Pedestal as a function of the time :



(A PCB with unstable pedestals)

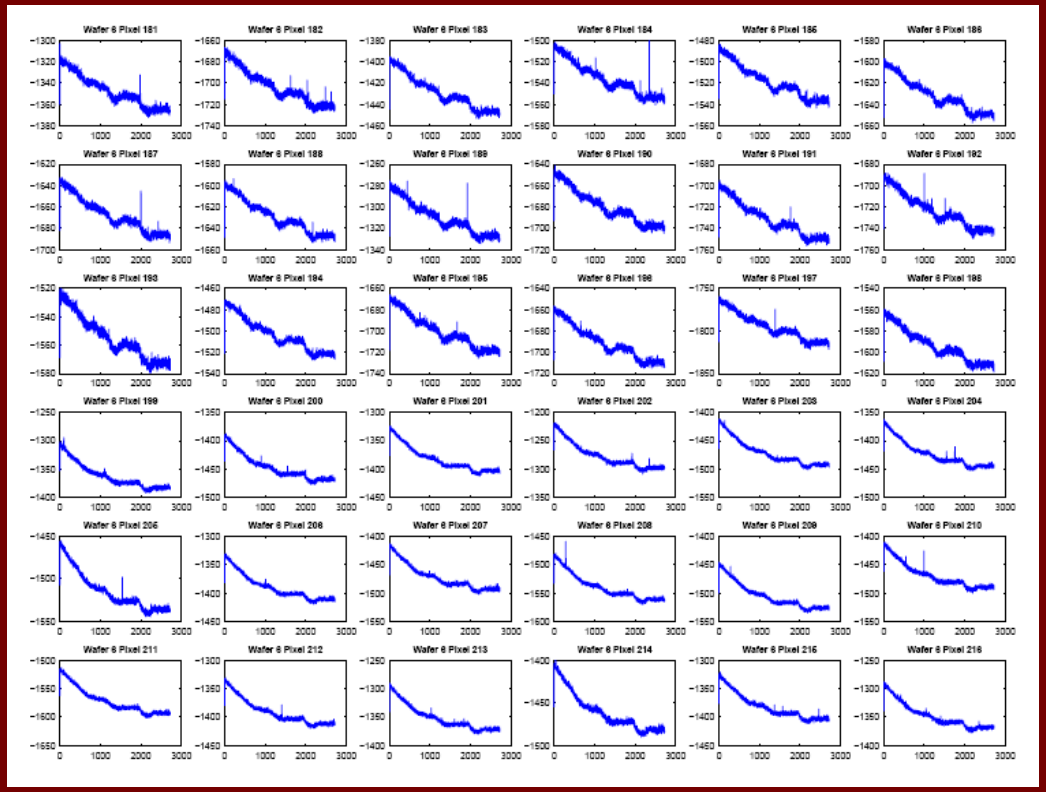
Pedestal correction (evt-by-evt)

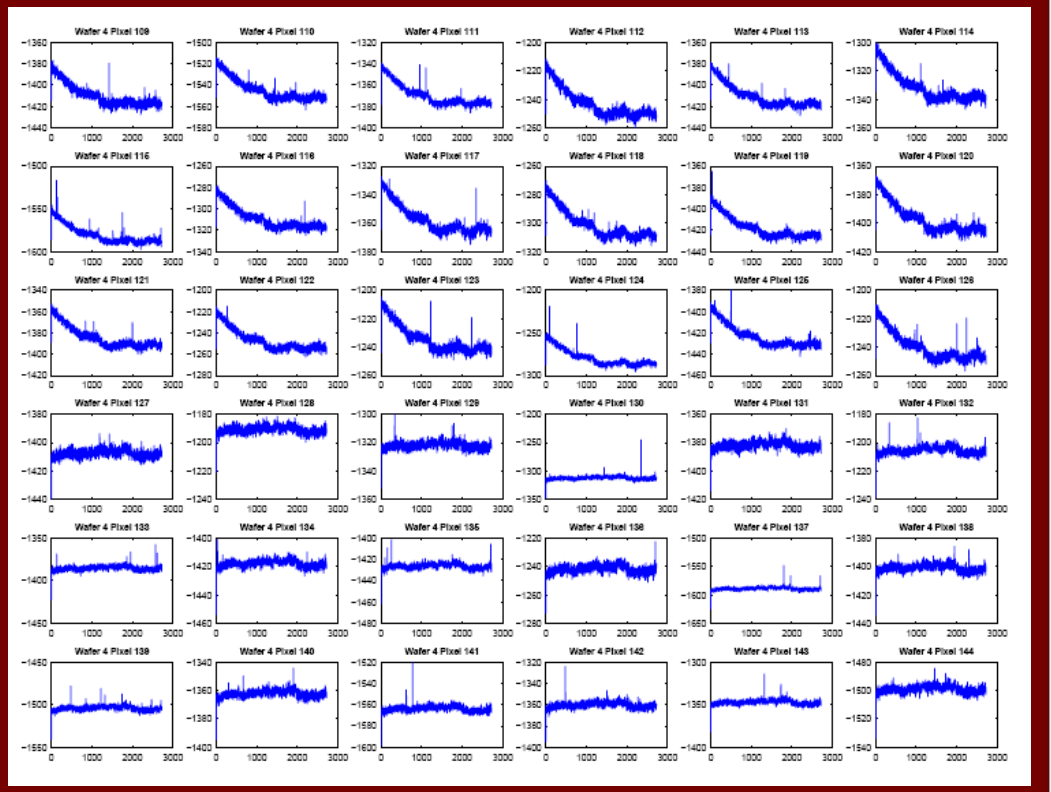
- Start with rough guess of shift
- Reject hits with S/N criterion
- Iterative adjustment of pedestal and S/N criterion until RMS agrees with mean noise of PCB

Correction per PCB, but...

Pedestal shift per chip

PCB_5_G - Layer 24 – wafer 4 & 6





Pedestal shift is different from chip to chip

Conclusions II

- Dead pads at FNAL'08 worked fine in cosmics tests
- Why ???
- Pedestal shifts are per chip and not per PCB
- Revise pedestal correction ???