Noise studies
DESY + CERN TB overview

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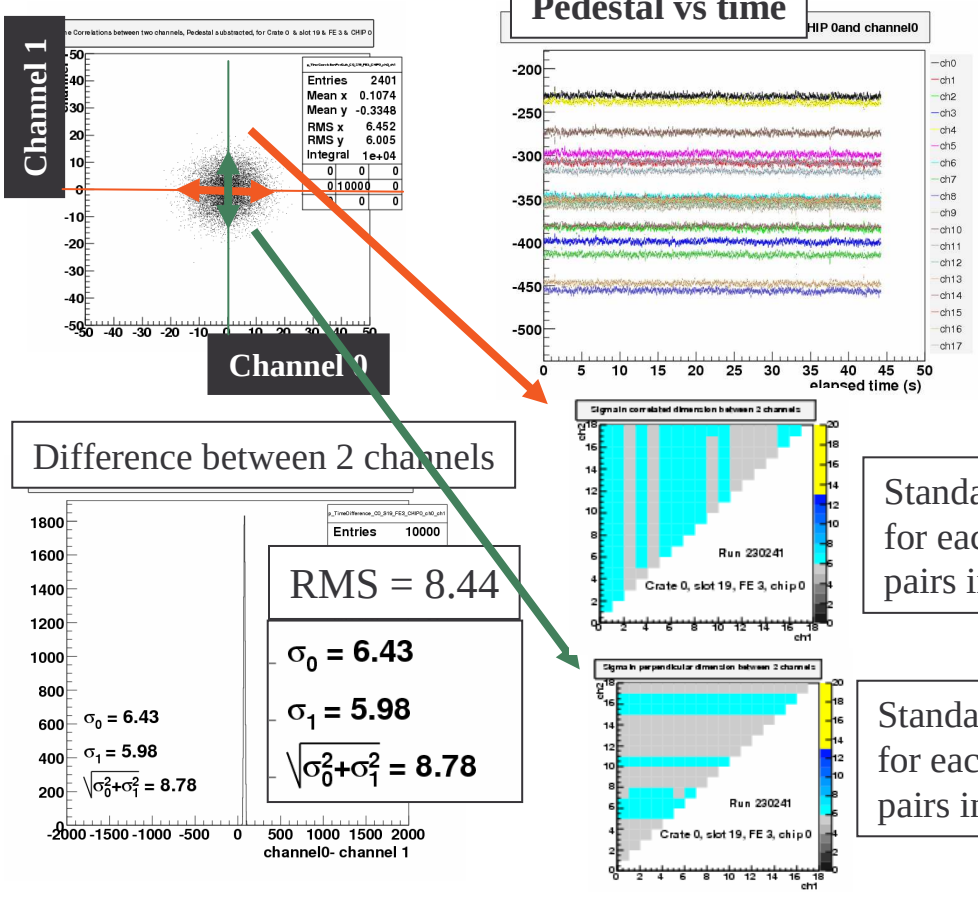
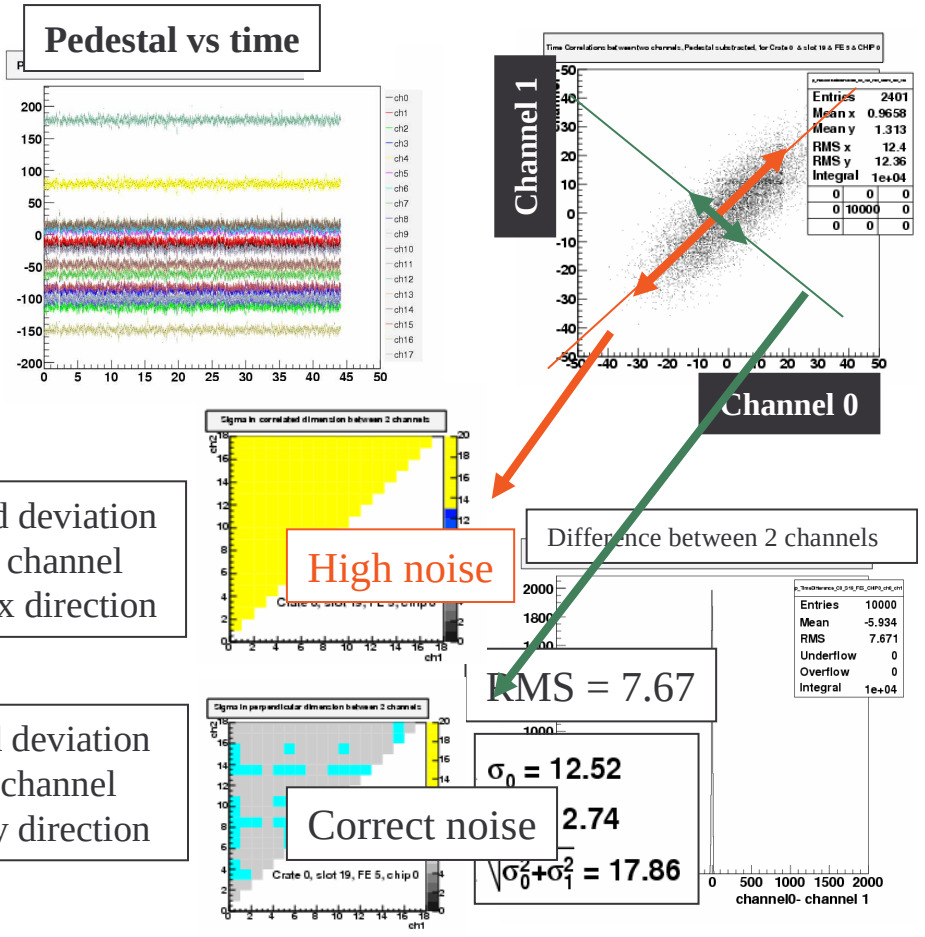
Method and Variables definition

"NORMAL" channel



"NOISY" channel



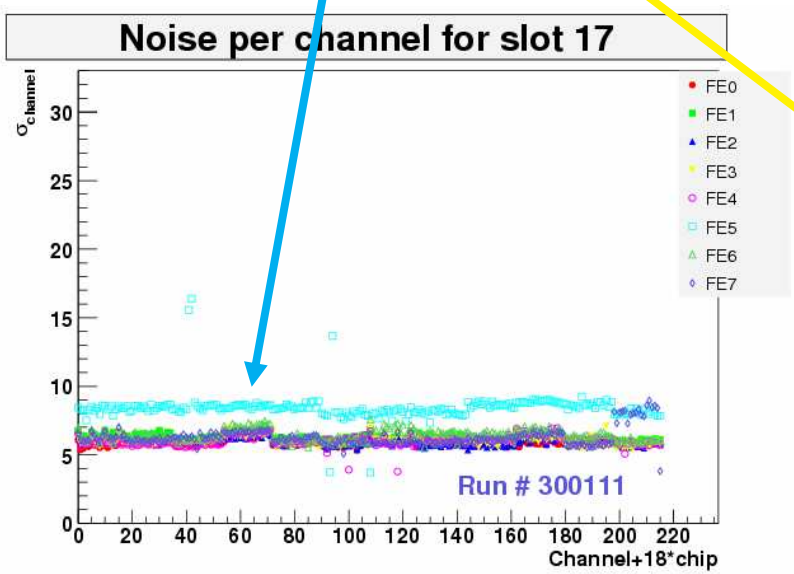
- Will now look at <σ>, <σ_1> and <σ_2> per chip, and per PCB
- And then average per PCB in function of run number (= time dependance)

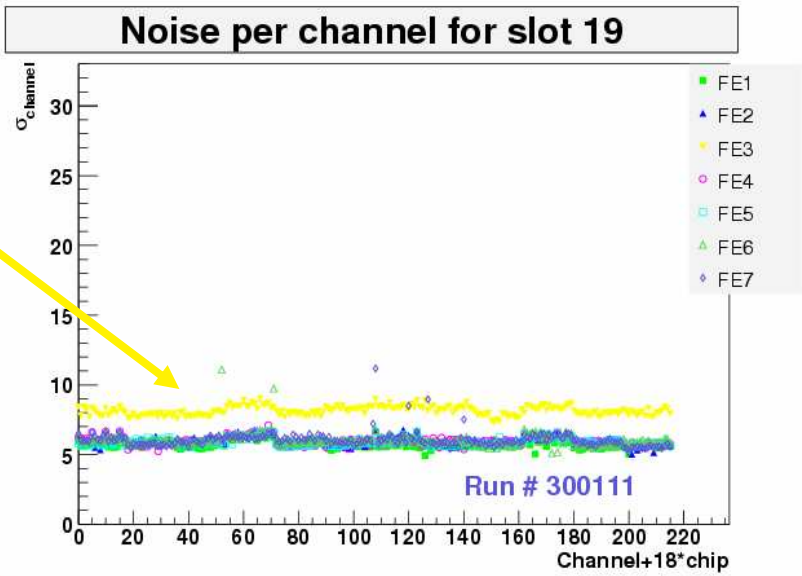
Conclusion for DESY

- Roughly stable noise, with some stable noisy layers (from 1 to 30) :
  - Layer 5 , PCB 8_C : ±3 ADC = ± 0.06 MIP correlated noise added to the standard 6 ADC = 0.12 MIP noise.
  - Layer 7 , PCB 4_C : ±3 ADC = ± 0.06 MIP correlated noise added to the standard 6 ADC = 0.12 MIP noise.
  - Layer 8 , PCB 5_C : ±6 ADC = ± 0.12 MIP correlated noise added to the standard 6 ADC = 0.12 MIP noise.
  - Layer 10 , PCB 12_C : ±1.5 ADC = ± 0.03 MIP correlated noise added to the standard 6 ADC = 0.12 MIP noise.
- Added in digisim. Feedback welcome by the way !!

Results for CERN : August period

- Relatively stable in time, a few noisy layers as well, same or different from DESY one's :
  - Layer 2 , PCB 12_C : ±2.5 ADC = ± 0.05 MIP correlated noise added to the standard 6 ADC = 0.12 MIP noise.
  - Layer 3 , PCB 4_C : ±3 ADC = ± 0.06 MIP correlated noise added to the standard 6 ADC = 0.12 MIP noise.
  - Layer 15 , PCB 18_C : ±3 ADC = ± 0.06 MIP correlated noise added to the standard 6 ADC = 0.12 MIP noise.

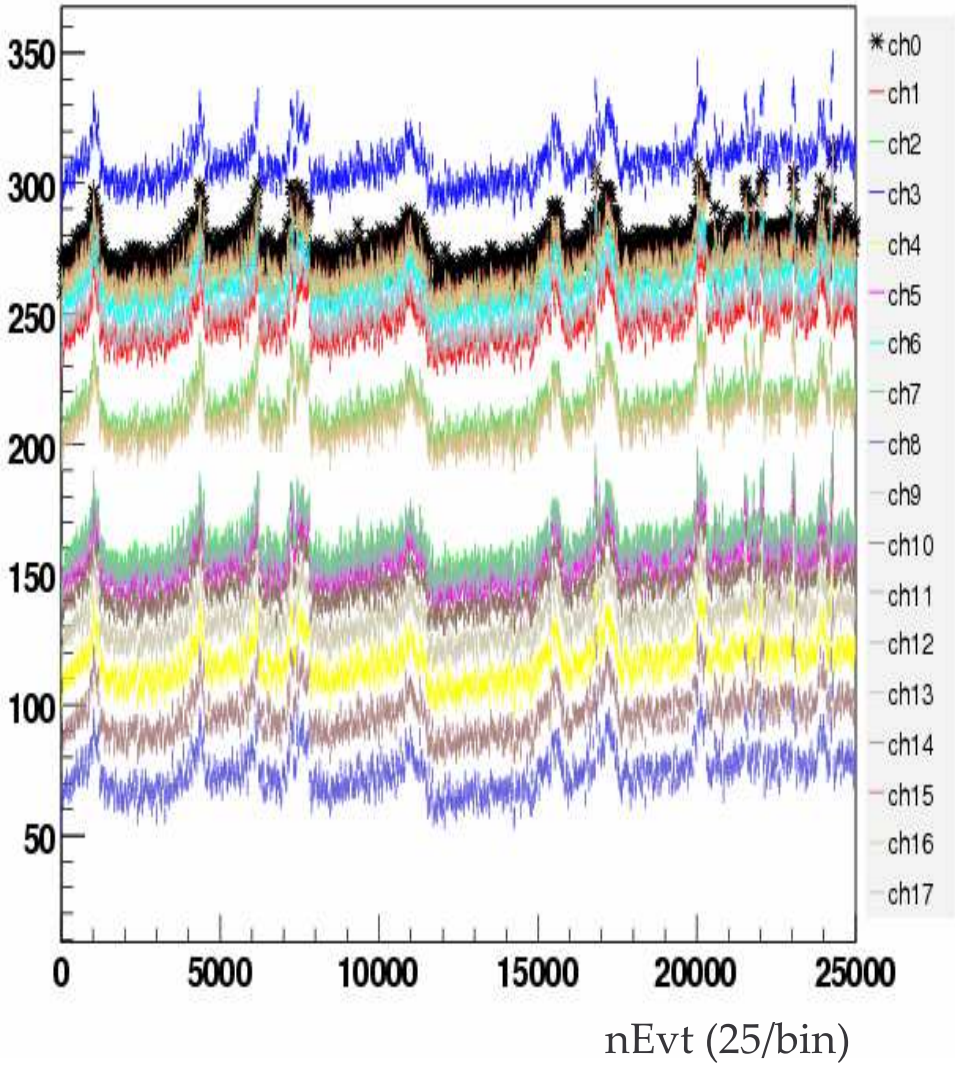




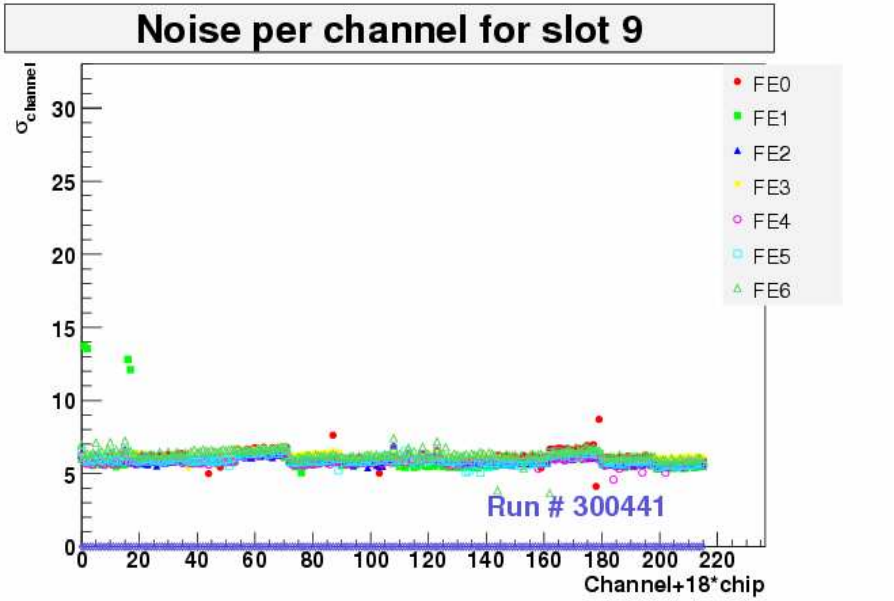
Results for CERN : October period

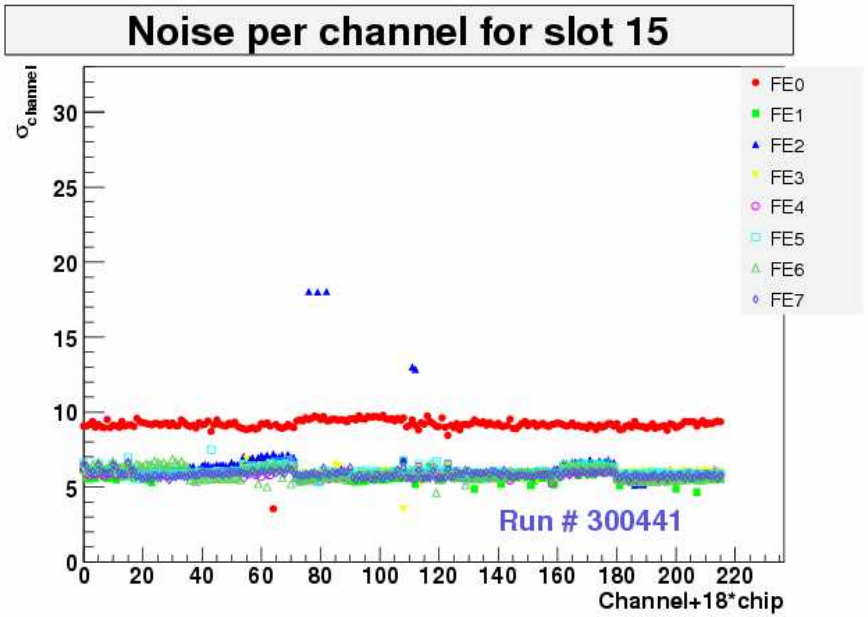
- Confused !! And really unstable in time.....
- 1st observation : more variations channel by channel
- 2nd observation : more variations between chips
- 3rd observation : the most important effect : pedestal unstabilities of up to 20-30 ADC counts Ł > 0.5 MIP

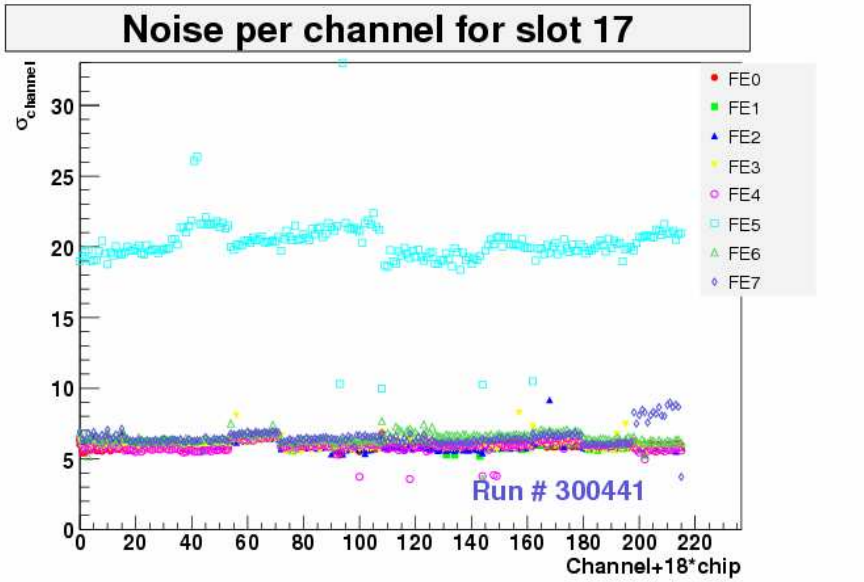
Ped vs Time,
Run 300490, slot 17, FE 5 (PCB 4_C, layer 2), chip 0

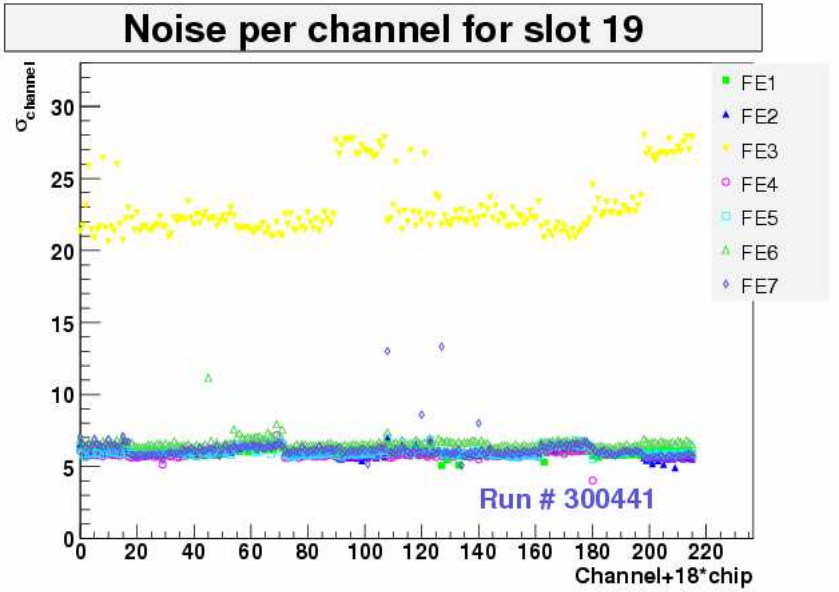


Results channel by channel

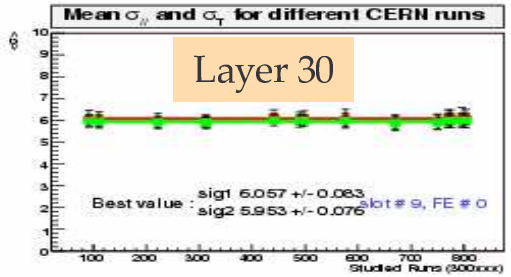


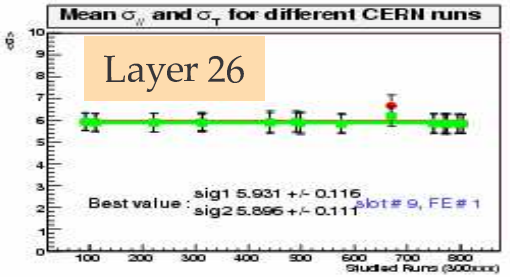


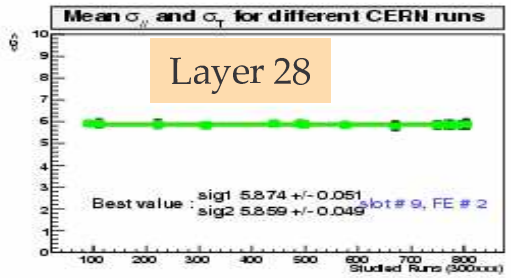


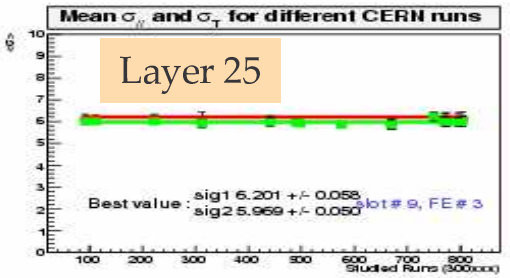


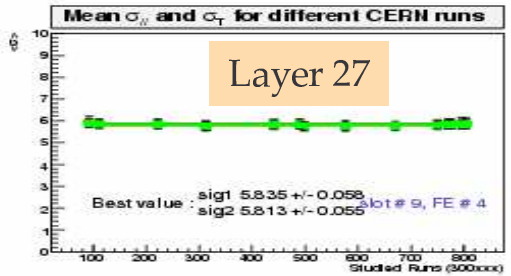
Average noise per run, over Aug and Oct data

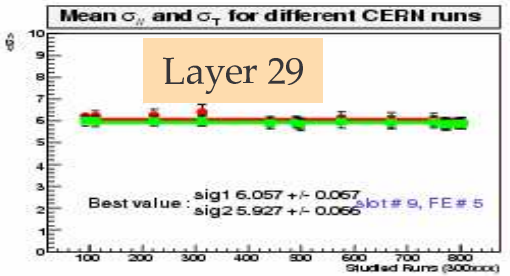


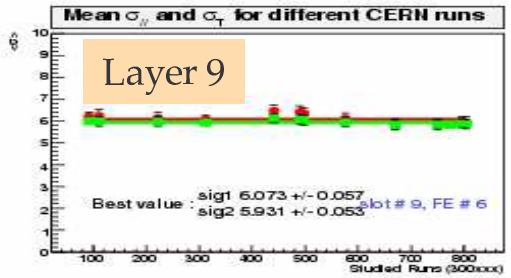






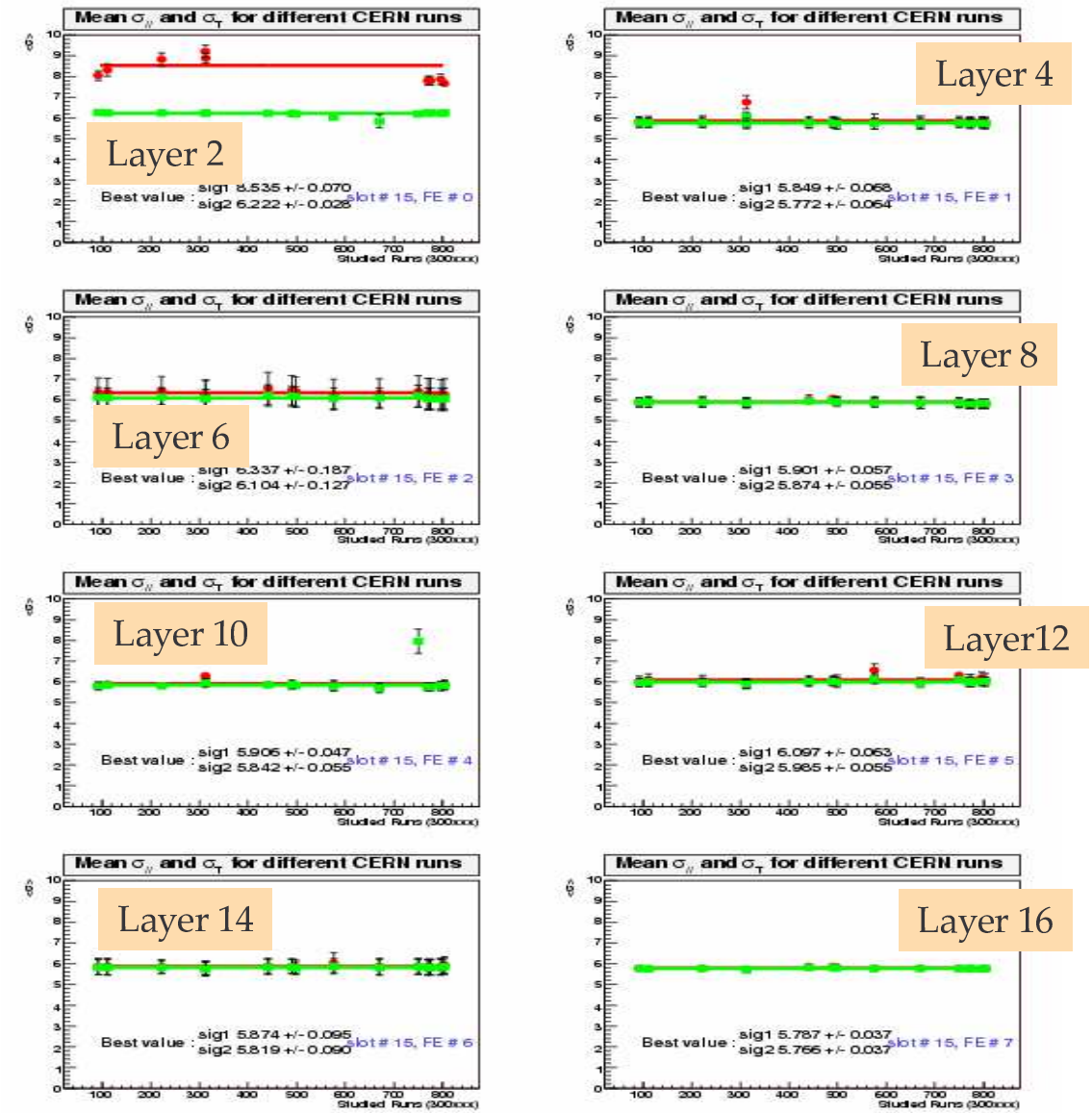






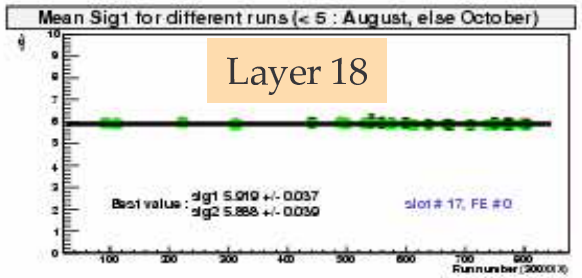
X-axis : run number (300XXX)
Y-axis : noise (0-10)

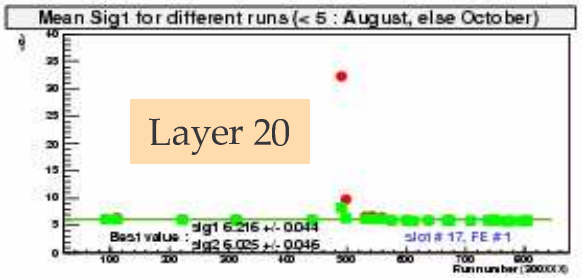
Average noise per run, over Aug and Oct data (2)

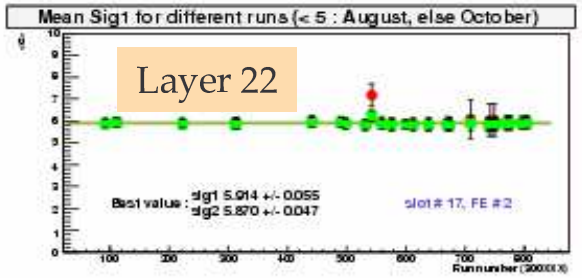


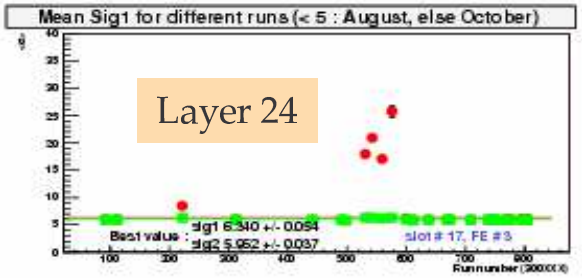
X-axis : run number (300XXX)
Y-axis : noise (0-10)

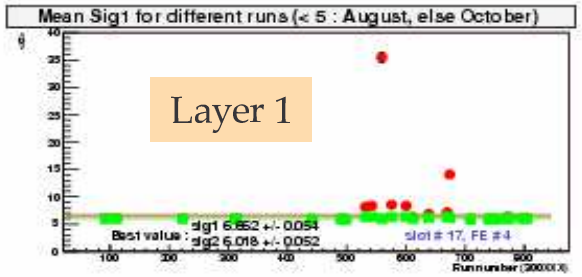
Average noise per run, over Aug and Oct data (3)

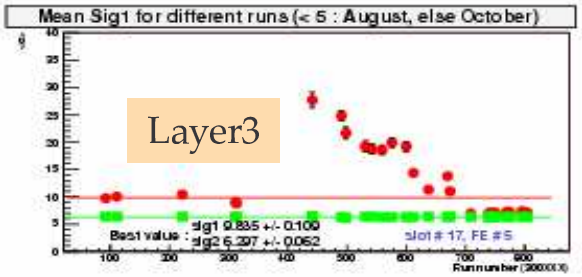


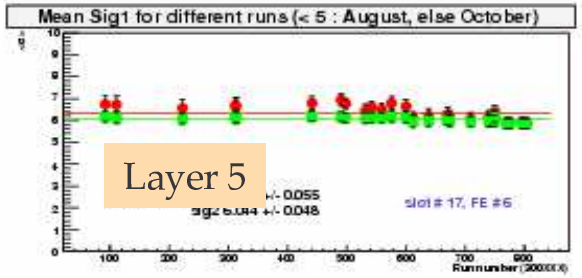


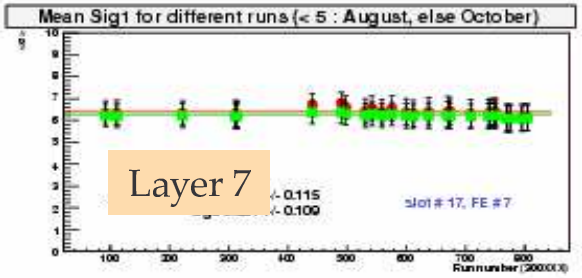






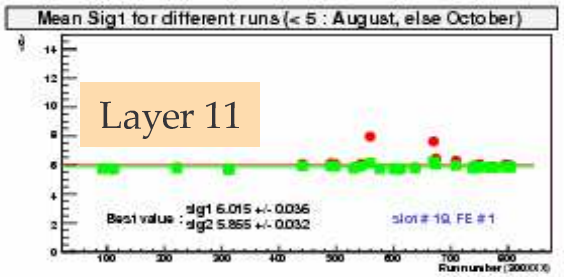


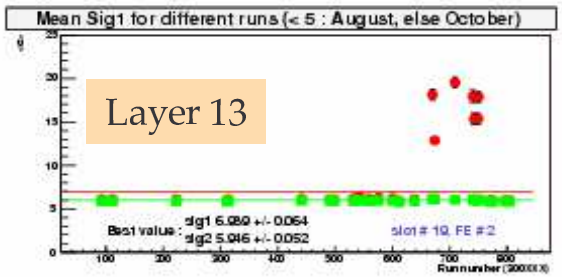


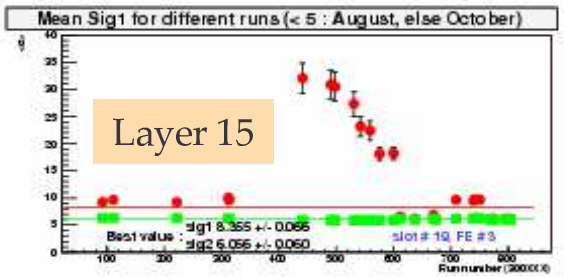


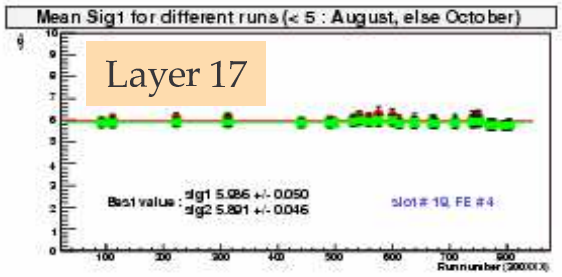
X-axis : run number (300XXX)
Y-axis : noise (0-10)
(0-40)

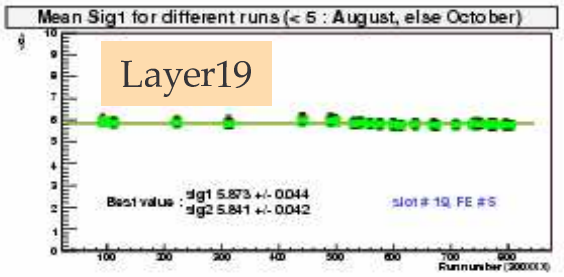
Average noise per run, over Aug and Oct data (4)

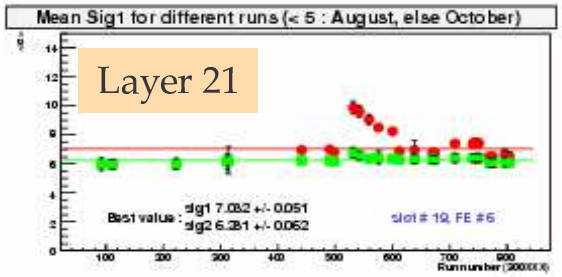


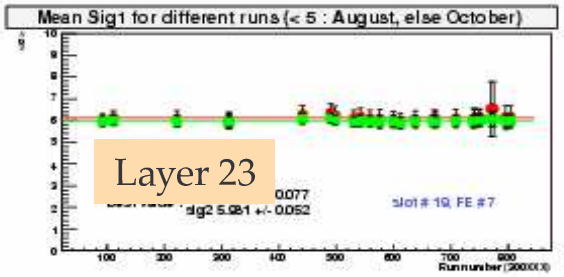












X-axis : run number (300XXX)
Y-axis : noise (0-10)
(0-40)

Already corrected by Goetz ??

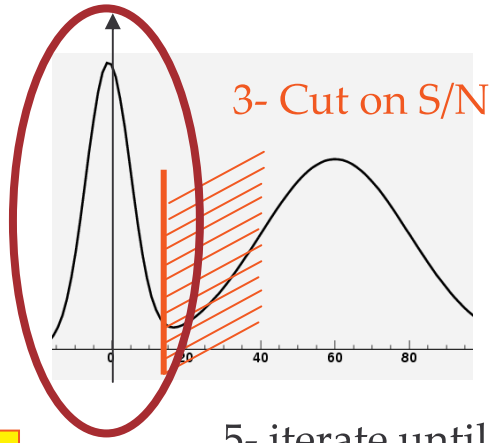
- Goetz procedure as I understand it, currently in the Reco :

500
Pedestal events

Pedestal per channel

Signal events

1- substract pedestal previously calculated
2- Event by event : look at ADC values



3- Cut on S/N to discard signal cells

4- Calculate mean and RMS of the remaining events

5- iterate until the mean is stable and the RMS is ~6 ADC counts on the negative side.

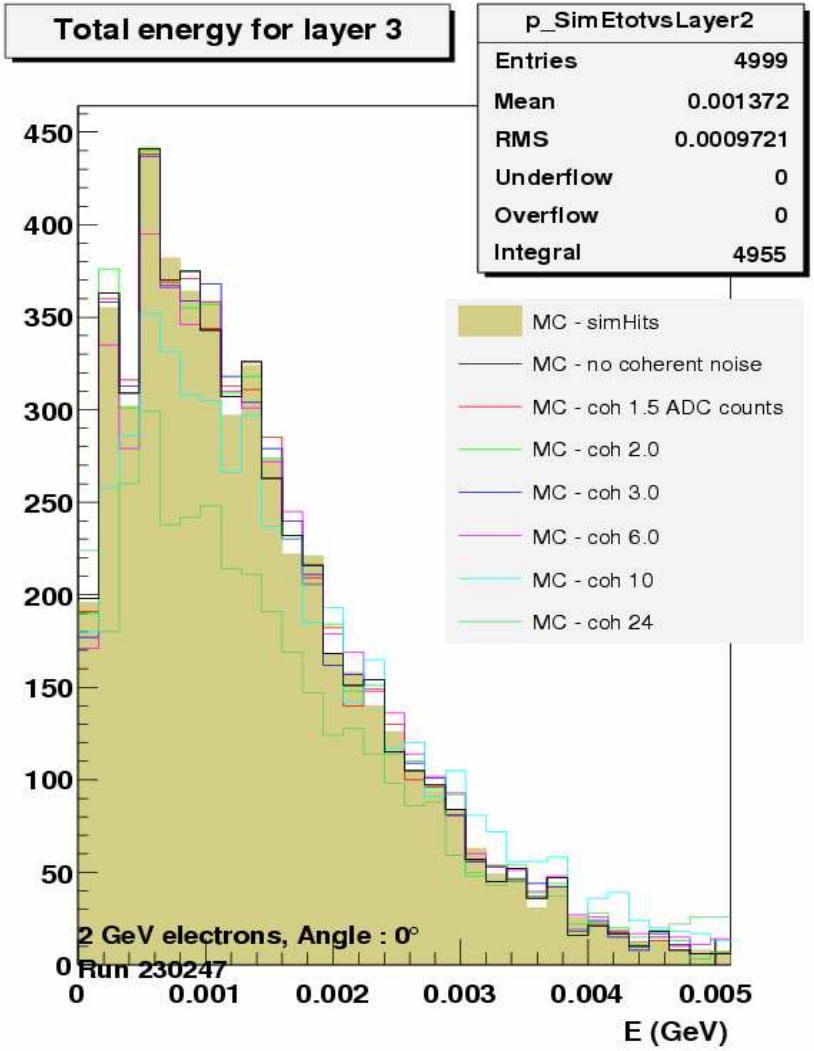
Ł This only works if there is enough channels without significant signal !!!

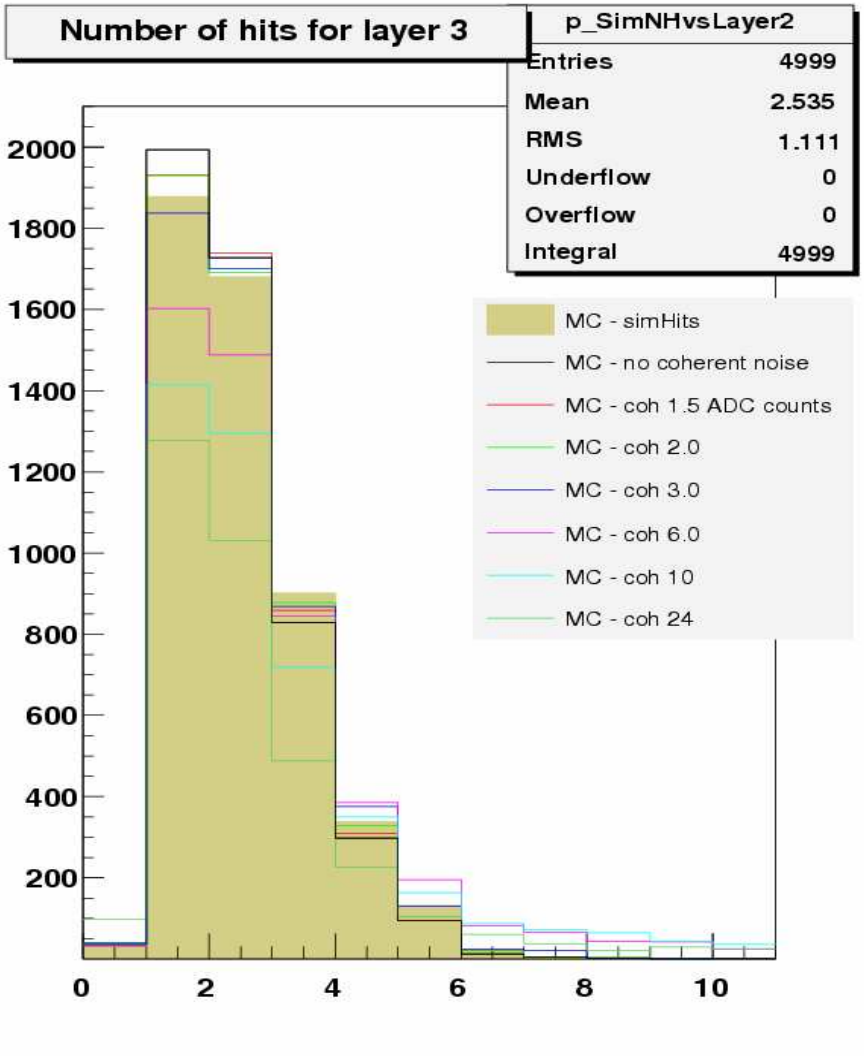
Preliminary conclusion

- Error finally from this procedure, due to rounding apparently (need to be check !) ~4%MIP
- Apply these 4%MIP remaining correlated noise to the MC, on top of the standard noise of ~6 ADC counts
- Need to study precisely the impact on MC....
- ... And the real value in the data !!! Because if the correction is inducing that big an error, we should apply it only on the bad PCBs... It's currently applied everywhere...

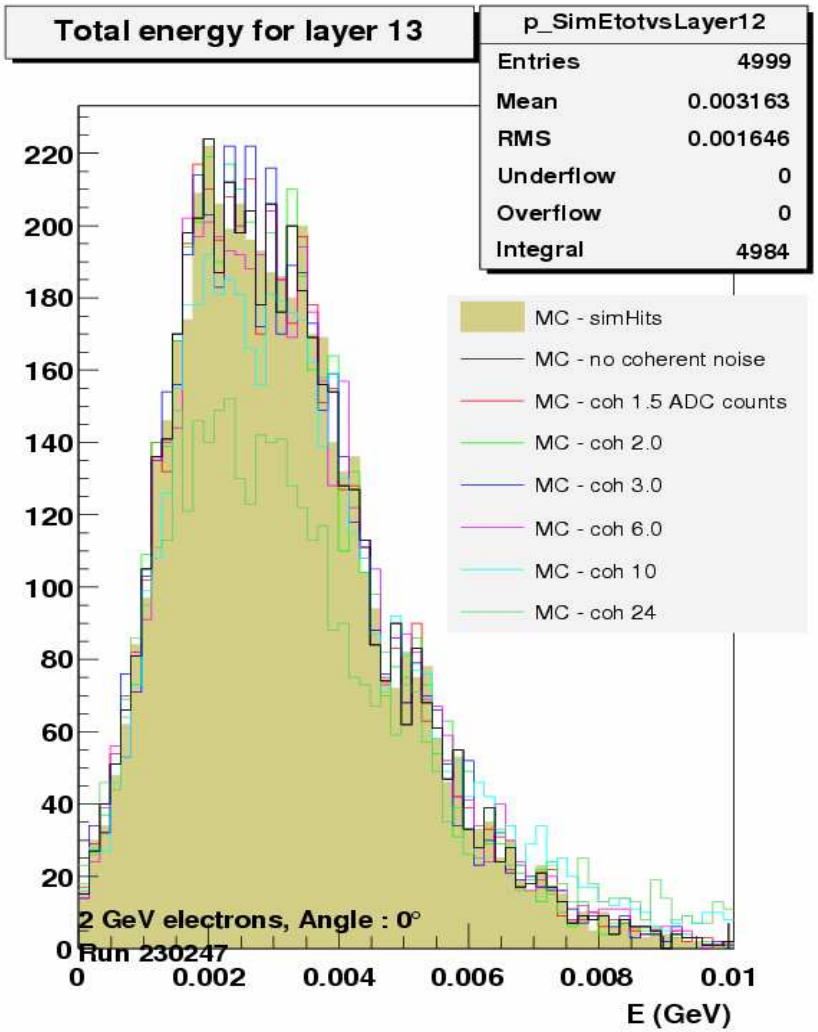
- Preliminary digisim steering files : will soon be released in CVS calice repositery, with the correlated noise before Goetz's corrections. To compare with actual reconstructed data files : need to test with or without adding a 4%MIP correlated noise everywhere instead of the values of the correlated noise put by default in the steering files ??!?
- Note : digisim doesn't release the position, as it's not linked to the database.... Another good reason to have a common reconstruction code for DATA and MC ASAP !!!!!!!!!!!!!!!!

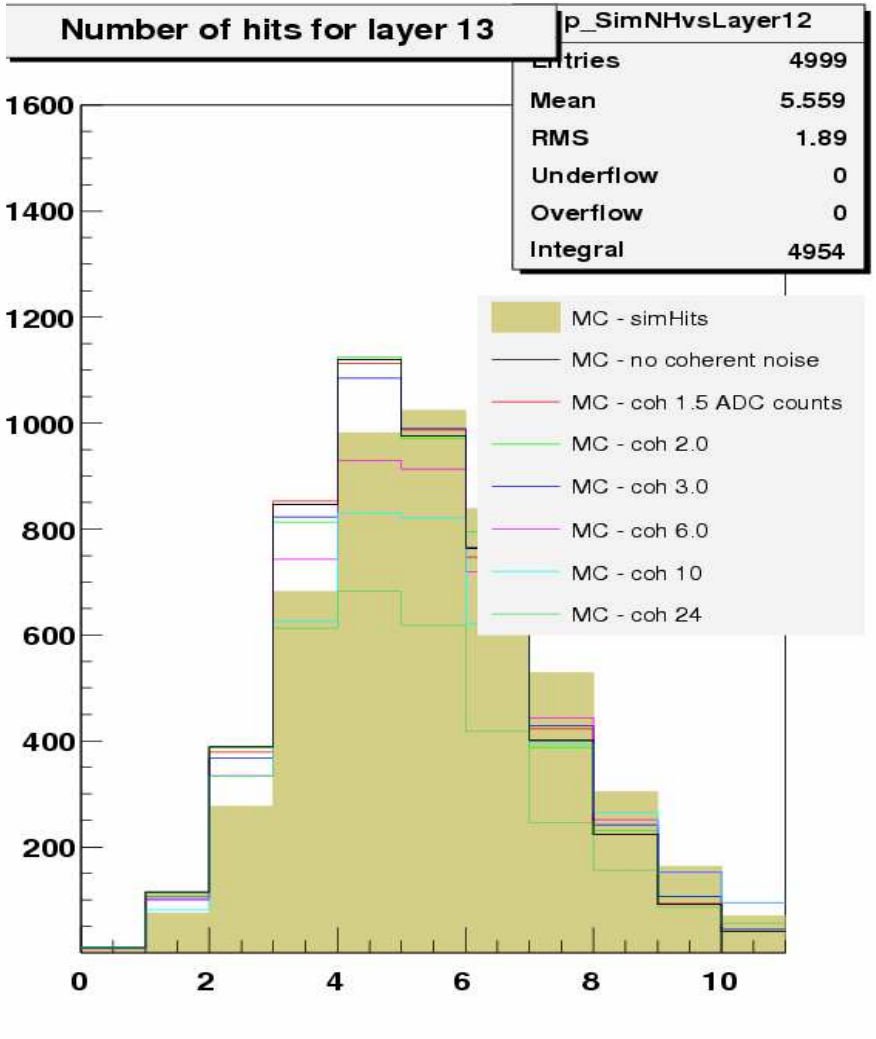
MC impact of correlated noise



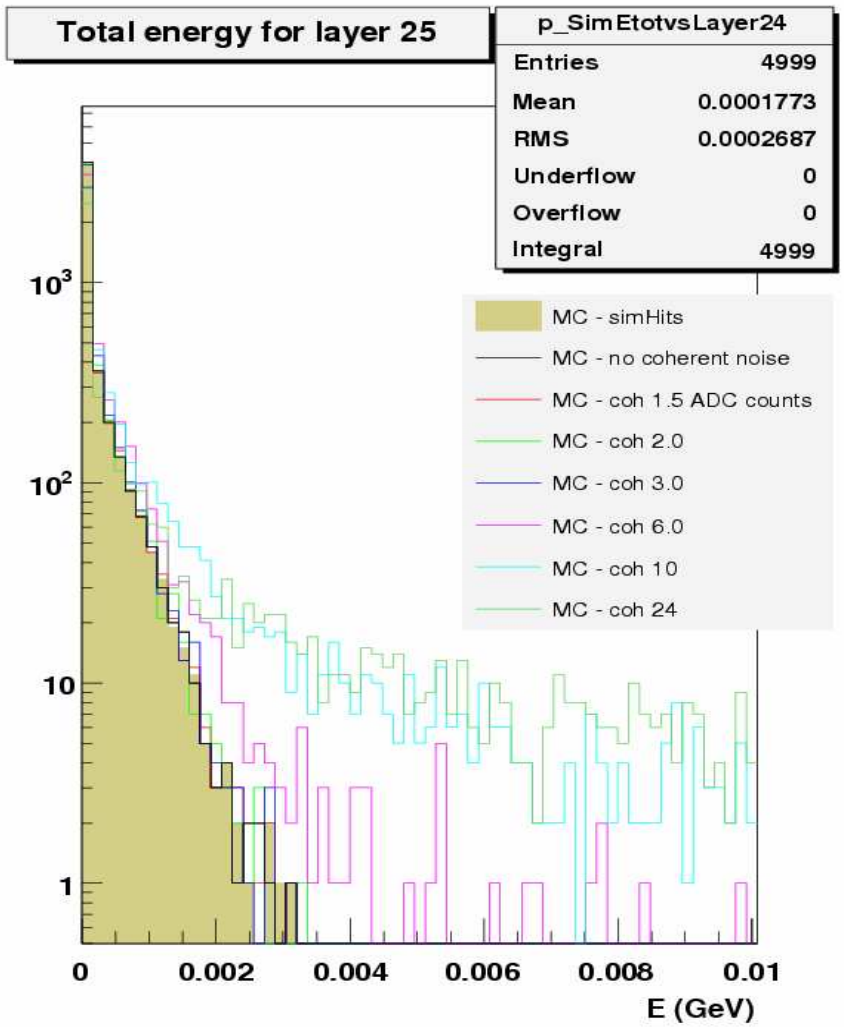


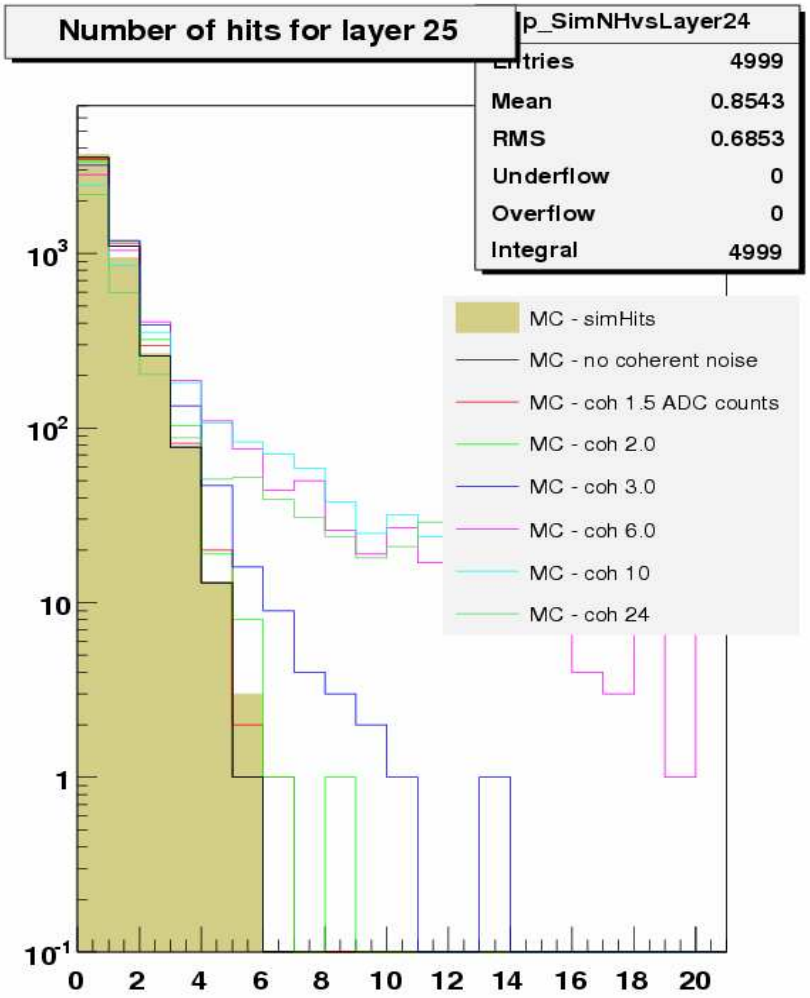
Layer 13


Total energy for layer 13
p_SimEtotvsLayer12
Entries 4999
Mean 0.003163
RMS 0.001646
Underflow 0
Overflow 0
Integral 4984
MC - simHits
MC - no coherent noise
MC - coh 1.5 ADC counts
MC - coh 2.0
MC - coh 3.0
MC - coh 6.0
MC - coh 10
MC - coh 24
2 GeV electrons, Angle : 0°
Run 230247
E (GeV)


Number of hits for layer 13
p_SimNHvsLayer12
Entries 4999
Mean 5.559
RMS 1.89
Underflow 0
Overflow 0
Integral 4954
MC - simHits
MC - no coherent noise
MC - coh 1.5 ADC counts
MC - coh 2.0
MC - coh 3.0
MC - coh 6.0
MC - coh 10
MC - coh 24

Layer 25


Total energy for layer 25
p_SimEtotvsLayer24
Entries 4999
Mean 0.0001773
RMS 0.0002687
Underflow 0
Overflow 0
Integral 4999
MC - simHits
MC - no coherent noise
MC - coh 1.5 ADC counts
MC - coh 2.0
MC - coh 3.0
MC - coh 6.0
MC - coh 10
MC - coh 24
10^3
10^2
10
1
0
0.002
0.004
0.006
0.008
0.01
E (GeV)


Number of hits for layer 25
p_SimNHvsLayer24
Entries 4999
Mean 0.8543
RMS 0.6853
Underflow 0
Overflow 0
Integral 4999
MC - simHits
MC - no coherent noise
MC - coh 1.5 ADC counts
MC - coh 2.0
MC - coh 3.0
MC - coh 6.0
MC - coh 10
MC - coh 24
10^3
10^2
10
1
10^{-1}
0
2
4
6
8
10
12
14
16
18
20