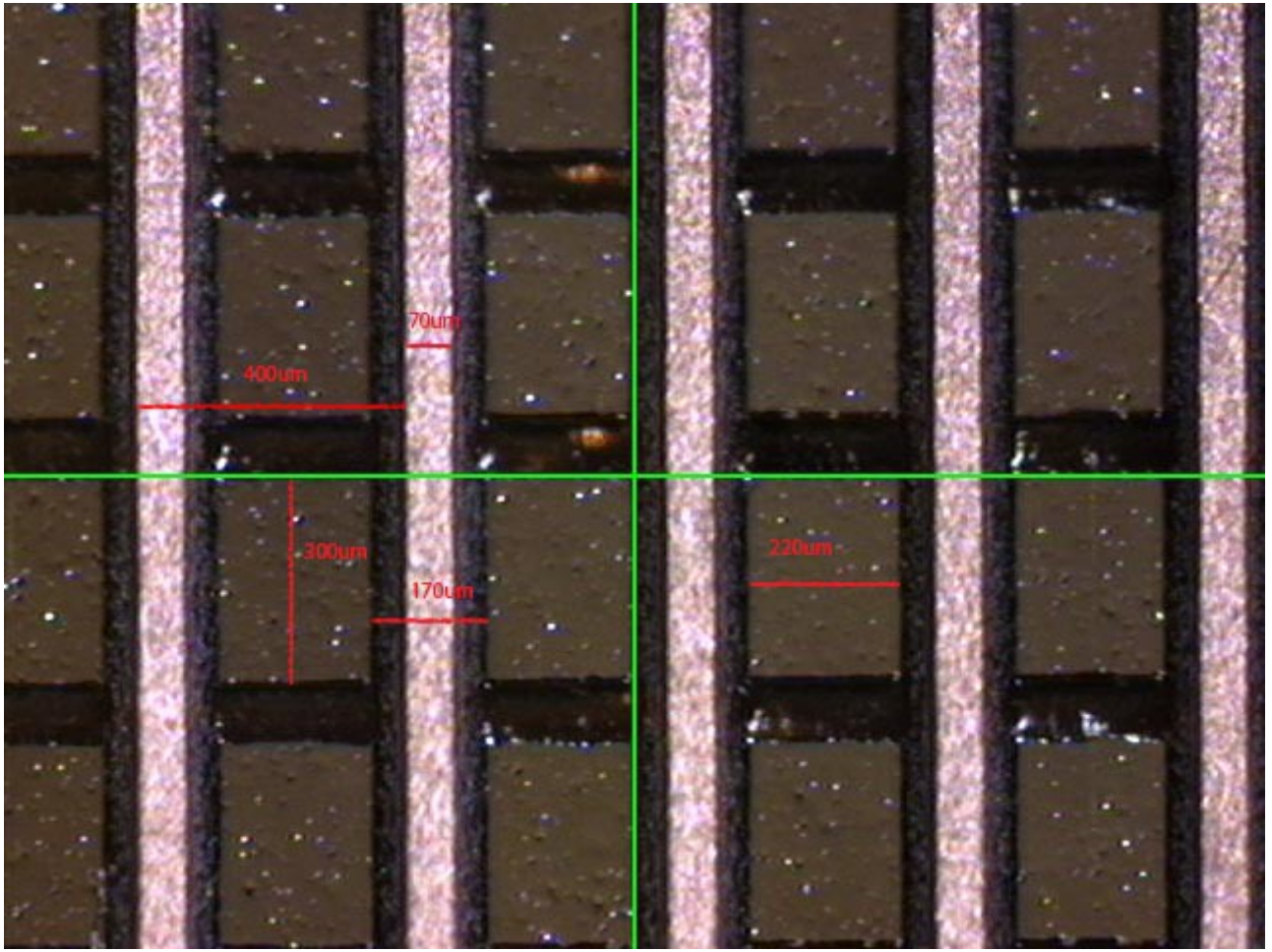
Front Tracker Status

- **GEM assembling**
  - 4th chamber (new GEM foil design) assembled; waiting to be shipped to Rome
  - Readout foil quality (→ slide)
- **GEM characterization**
  - Latest DESY Test (→ slide)
- **Electronics/DAQ**
  - Analysis of “residual noise” (→ slide)
- **Software:**
  - Tracking: Clustering based on Neural Network / reconstruction based on Kalman Filter
  - Info on Old MC (→ slide)

Readout foil issue

Thanks to INFN/CT colleagues



Our readout foils present the same issue discovered at UVa

Not clear how to proceed (we already have most of the readout foils)!

Pitch = 400 um
Upper copper strip width = 70 um
Lower copper strip rectangle = 300 (v) x 230 (h) um
50+50 um of exposed kapton between upper and lower layers

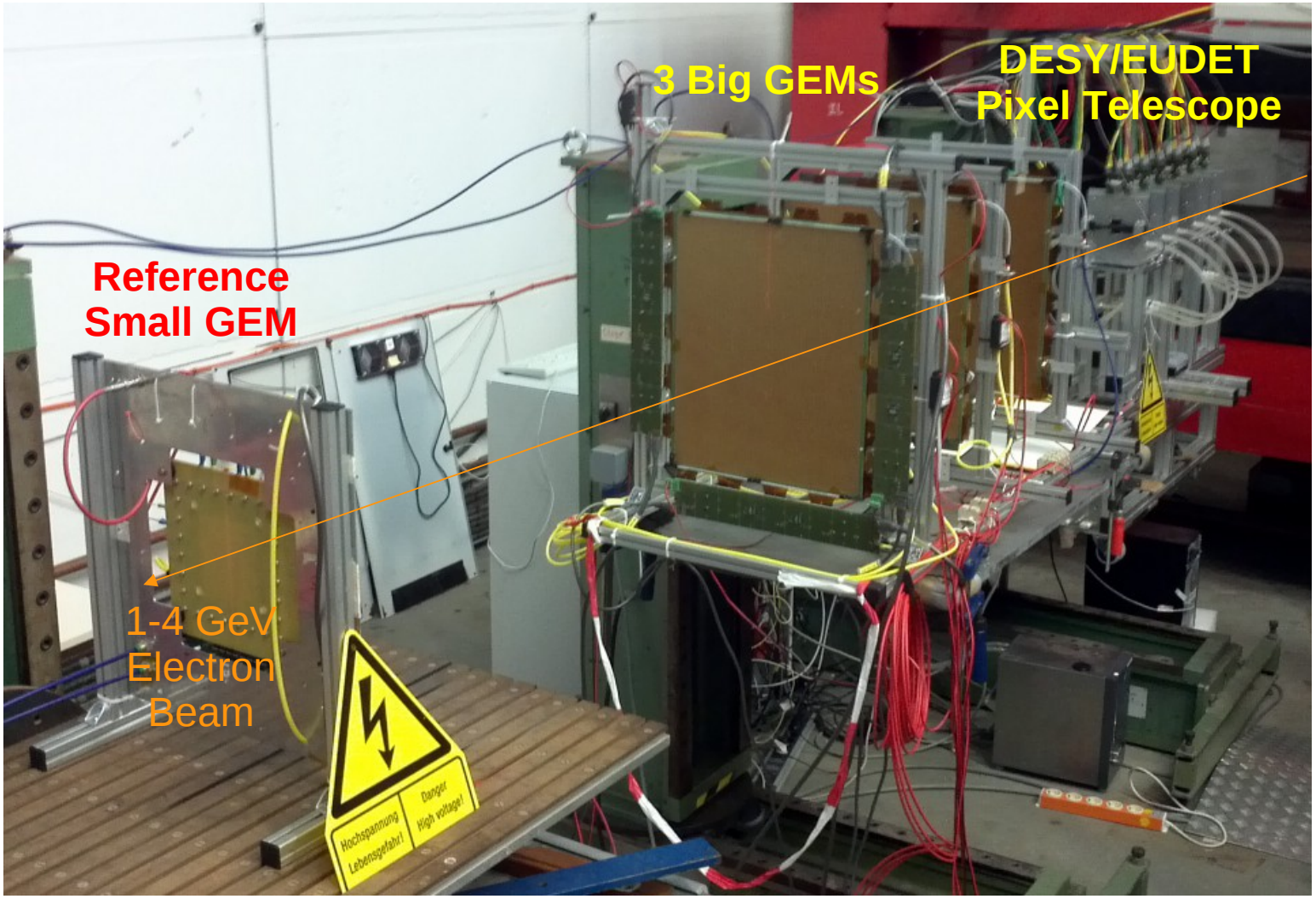
Jan 2014 / New Beam Test @ DESY

Small scale final system (gas, LV, HV monitored)

Main Goals:

- Characterize chambers in terms of efficiency and spatial resolution at different HV, gas mixture.

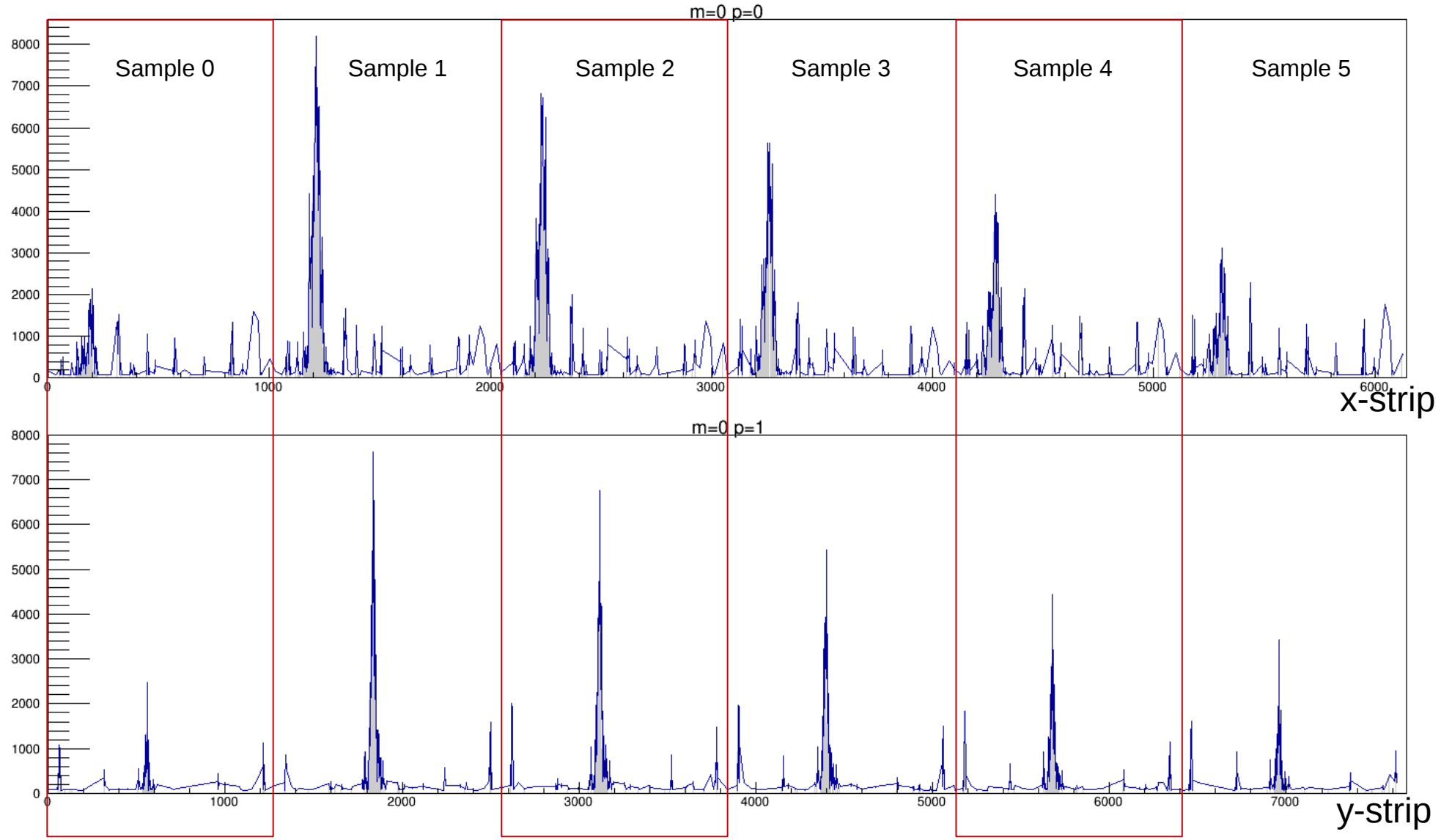
- Figure out the gain variation of the previous test



→ Got lot's of good data with high spatial resolution information from pixel telescope

→ No gain drops during test (all conditions carefully monitored)

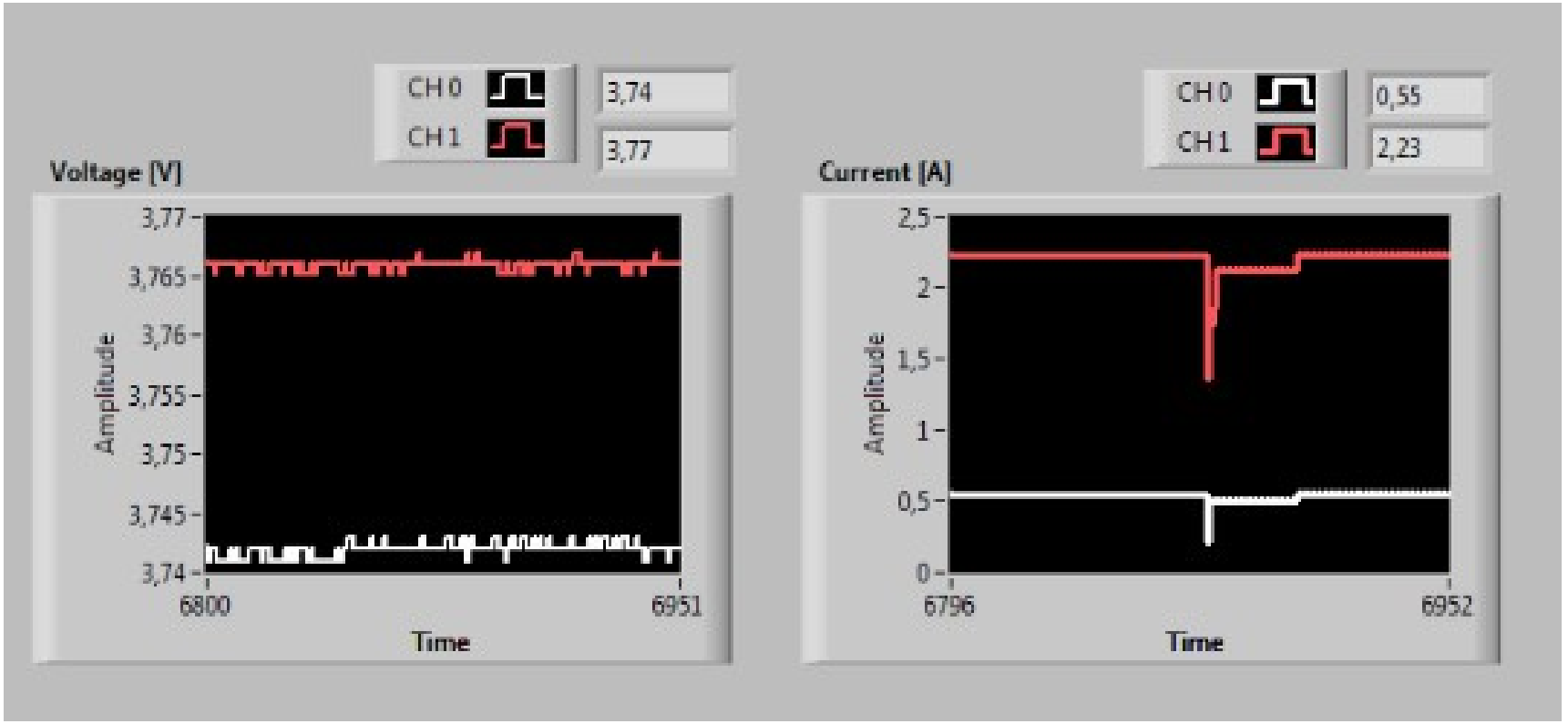
Online beam profile



DESY beam pretty narrow with ~1000 electrons/cm2/s, Energy in the range of 1-6 GeV

Electronics Misconfiguration Issue

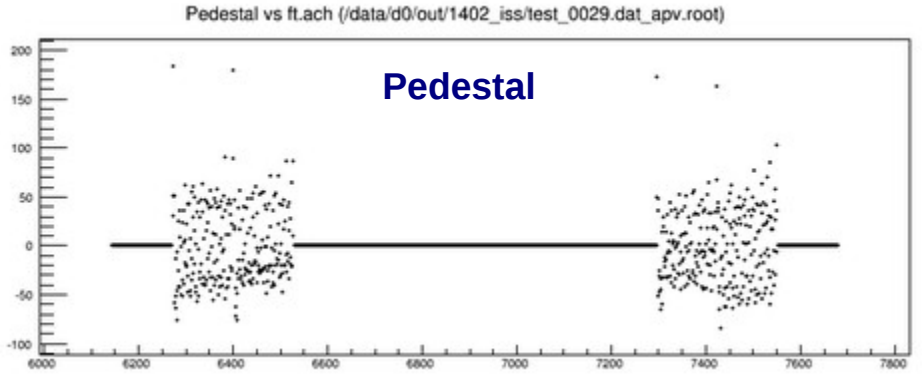
Electronics Low Voltage monitor



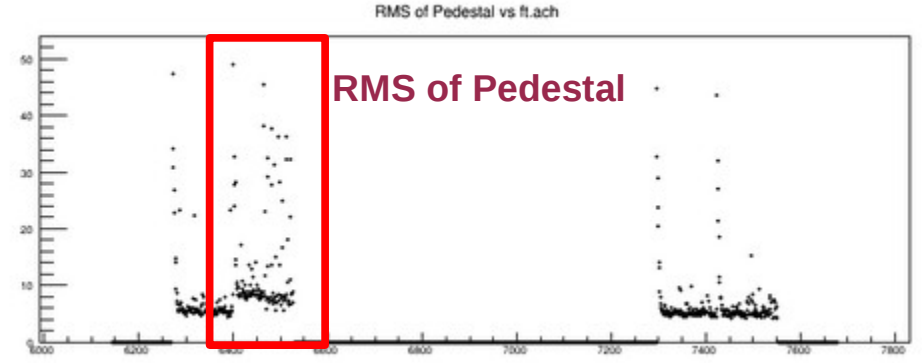
2 power lines for 2 groups of cards

Small current drop during APV configuration; the “normal” level must restore
In case of proper configuration; otherwise the electronics does not work properly
Chamber appears inefficient → this likely explain the gain issue in previous test.

“Residual Noise” on first APV channels



Strips, physics order



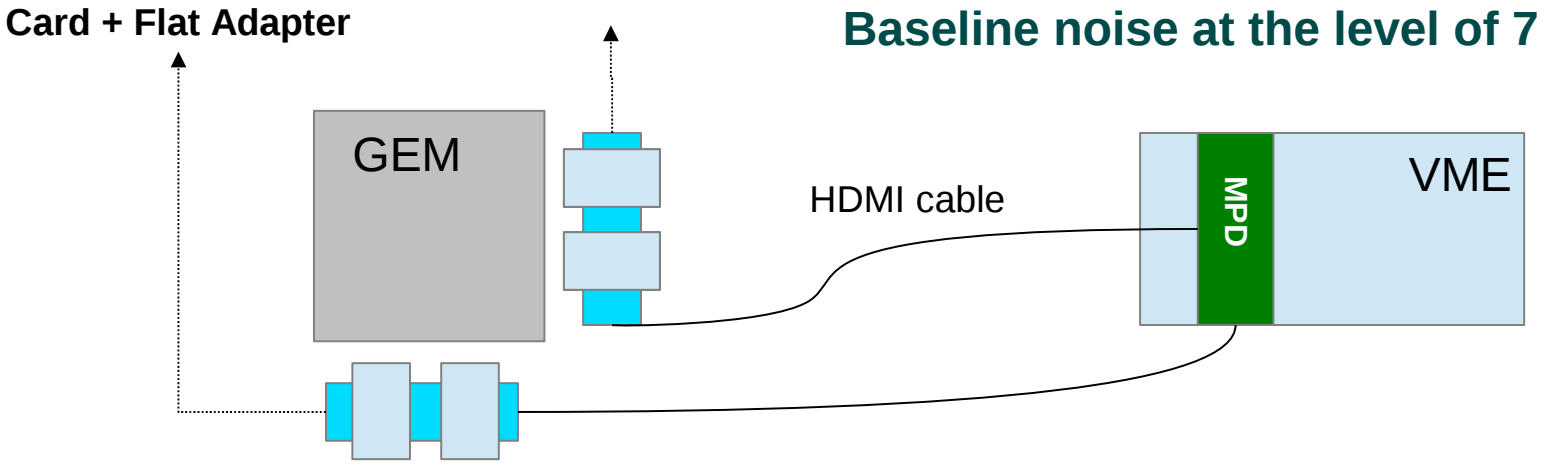
Condition:
4 cards connected to chamber (one by flat adapter)

Cards connected to VME by **20 m** long HDMI cables

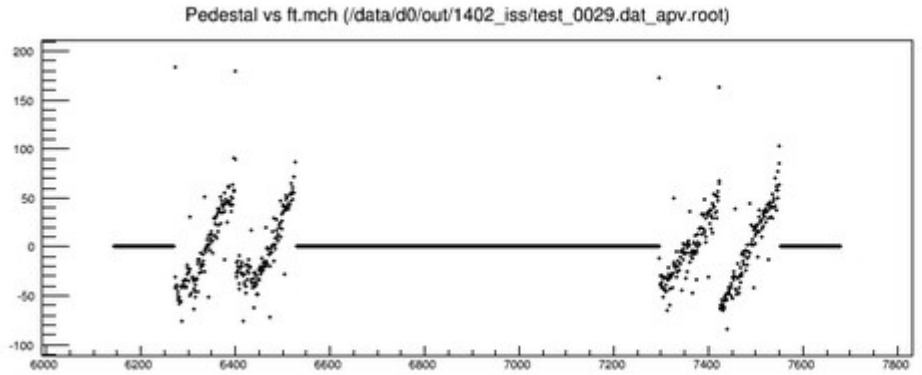
Evident noise on first few (up to 8) channels of each card;

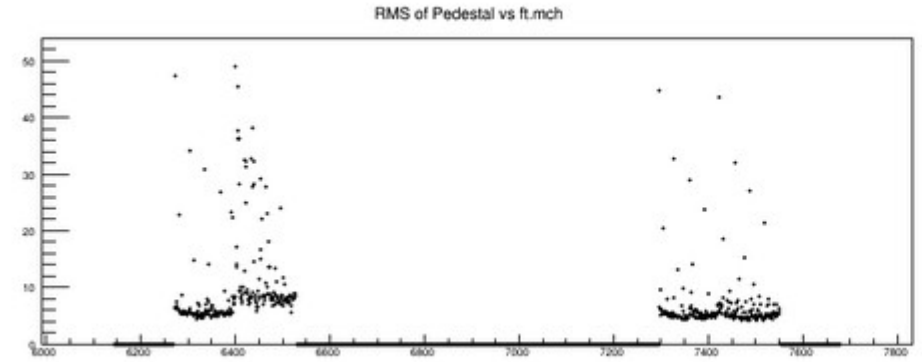
This noise is somehow masked in the card with adapter (this is way we never put great attention to it in the past)

Baseline noise at the level of 7 ADC channel.

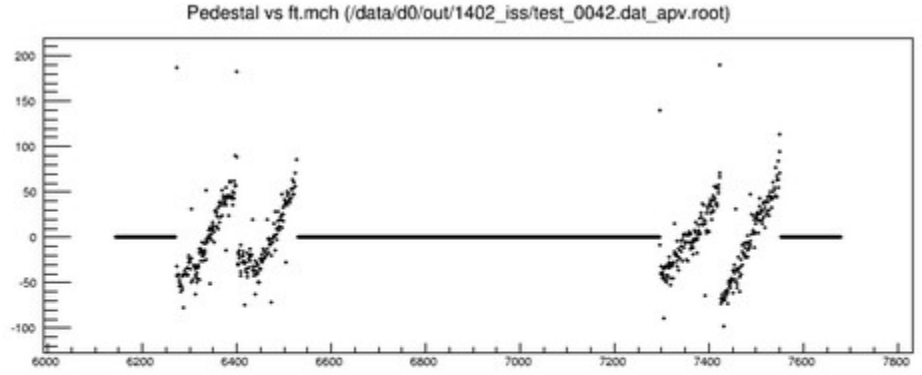


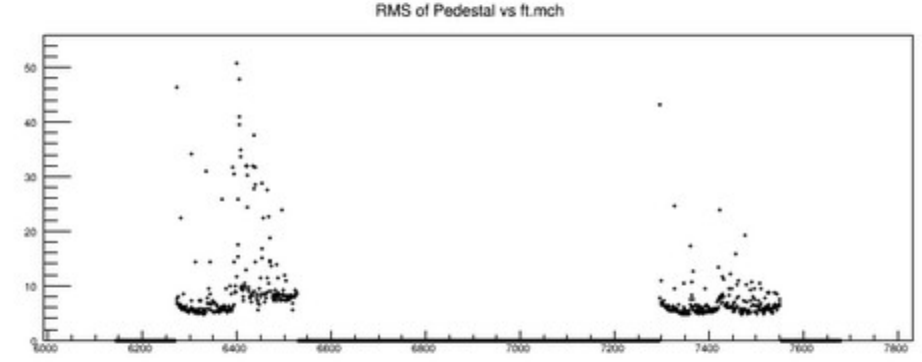
“Residual Noise” vs cable length





Strips, frame order





--- **20 m long cables** ---

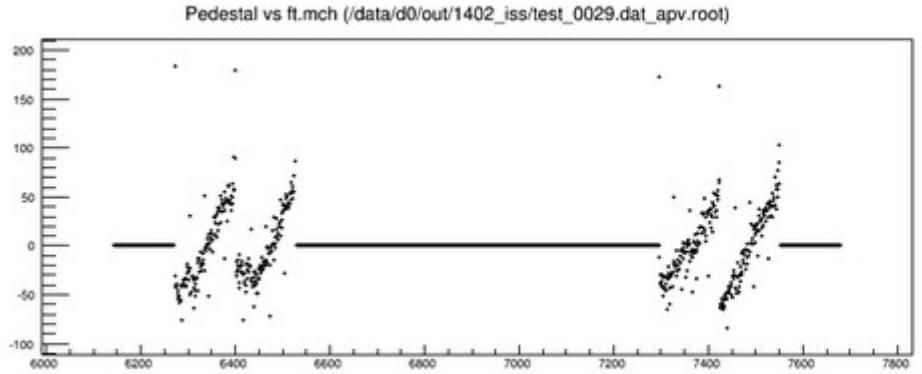
Same data as in the previous slide
Only ordering of the channels is different
Now channel order is the same used to send channel data over the HDMI cable

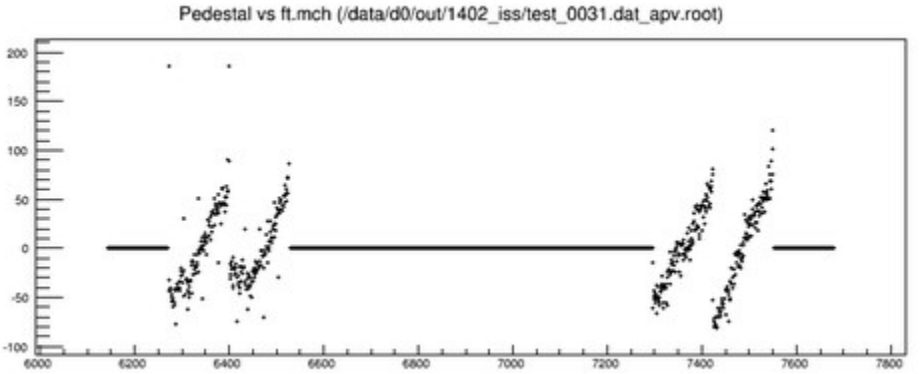
--- **10 m long cable on right channels** ---

The large noise reduces on the cards connected with shorter cable

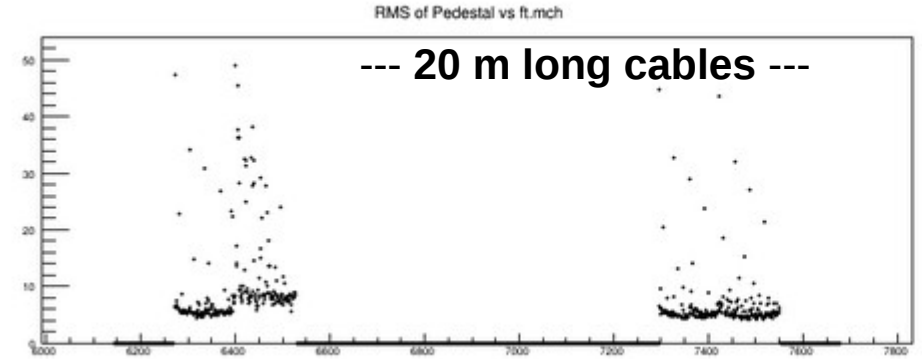
“Residual Noise” vs cable length

Frame order

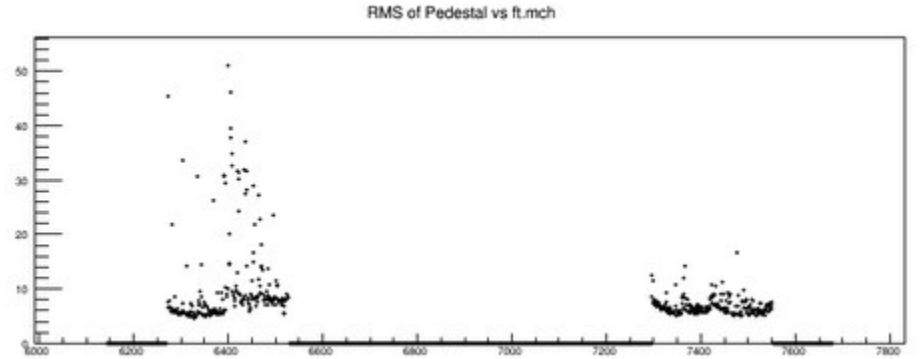


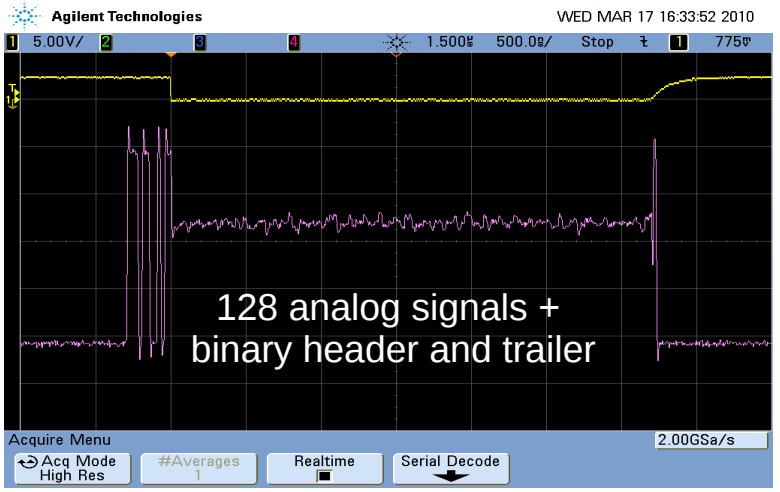


Strips, frame order



--- 20 m long cables ---





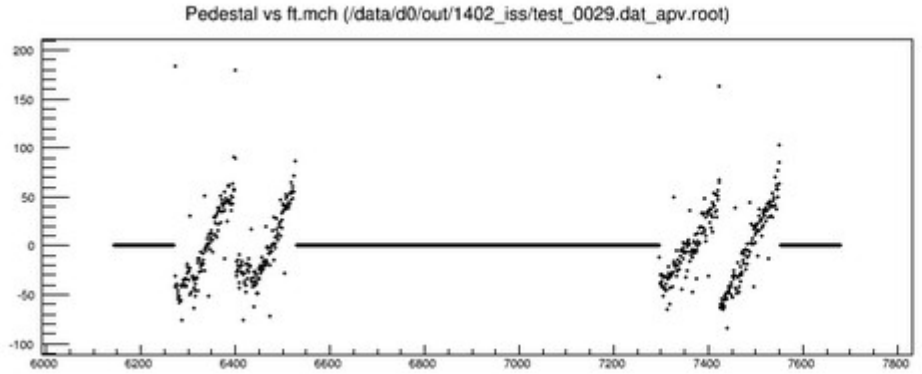
--- 3 m long cable on right channels ---

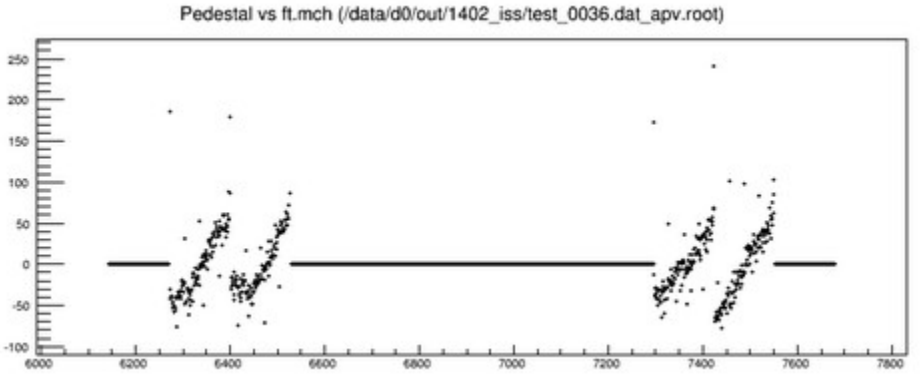
The large noise disappear on the cards connected with short cable

Is the noise related to signal reflection along the cable due to impedance mismatch ?

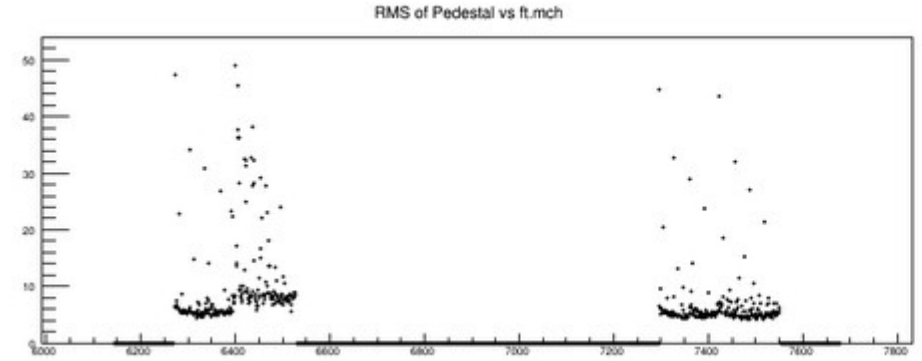
“Residual Noise” vs termination resistance

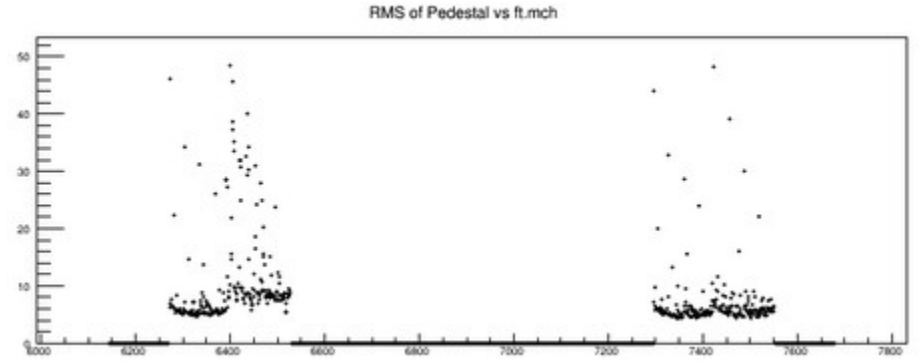
Frame order





Strips, frame order





--- **20 m long cables 2x50 Ohm termination** ---

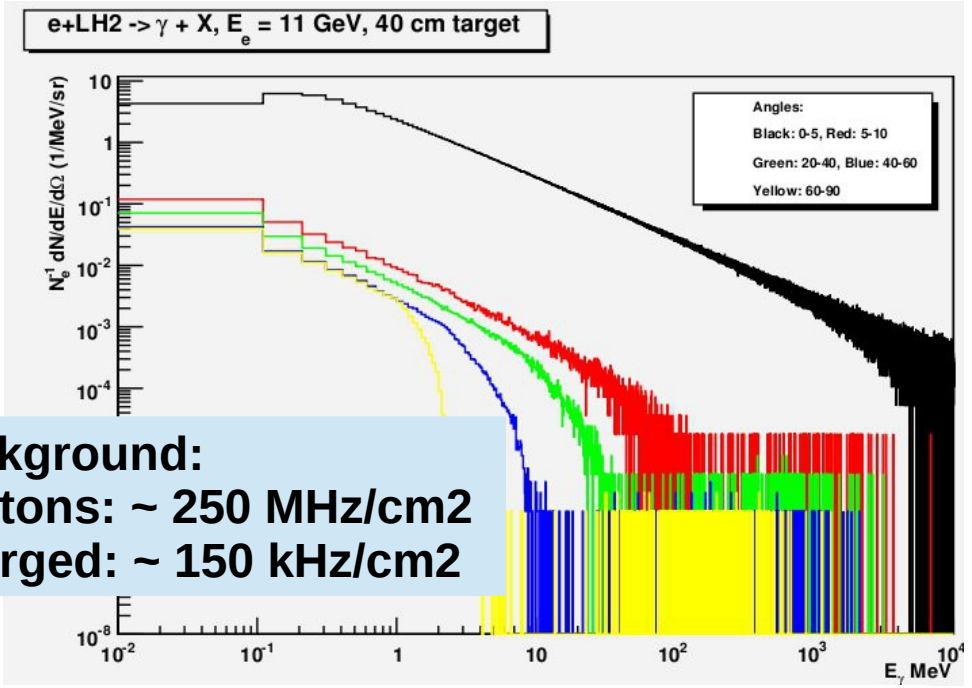
--- **20 m long cable 2x56 Ohm termination** ---
The large noise similar (but not identical) to the one with different termination.

HDMI Impedance 100 Ohm

No significant effect moving from 50 to 56 Ohm termination (expected larger from signal simulation)

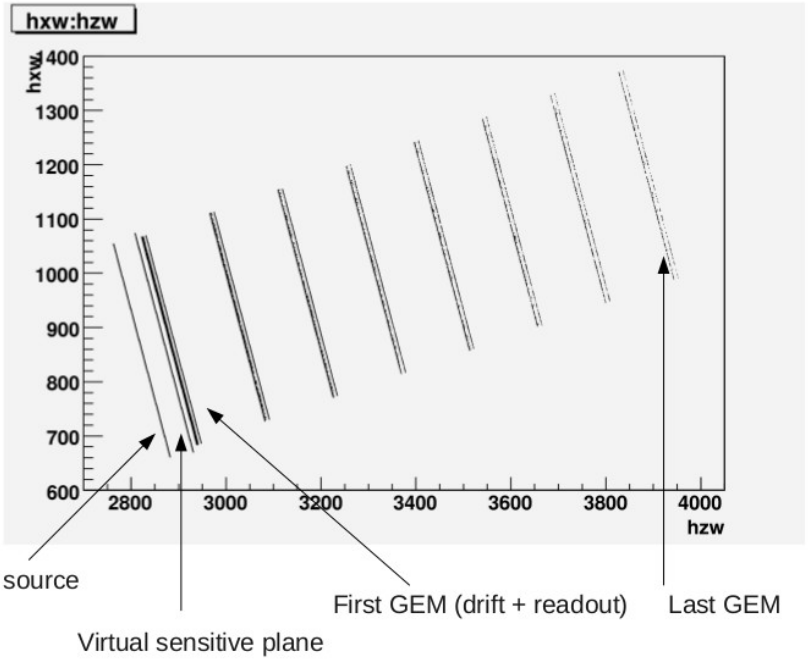
SBS GEM MonteCarlo (2010-2011)

- Uniform (spatial) electrons and gamma background from a plane which is in front of the GEM tracker (see plot on slide n. 4)
- Assume isotropic angular direction (+/- 4 deg around the normal direction)
- Assume Nelyubin MC Background Energy distribution and rate:
  - Gamma 0 – 10 MeV (Rg = ~~1.12~~ **5.32** E-7 /cm^2/e)
  - Electron 0 – 100 MeV (Re = 3.38 E-10 /cm^2/e)



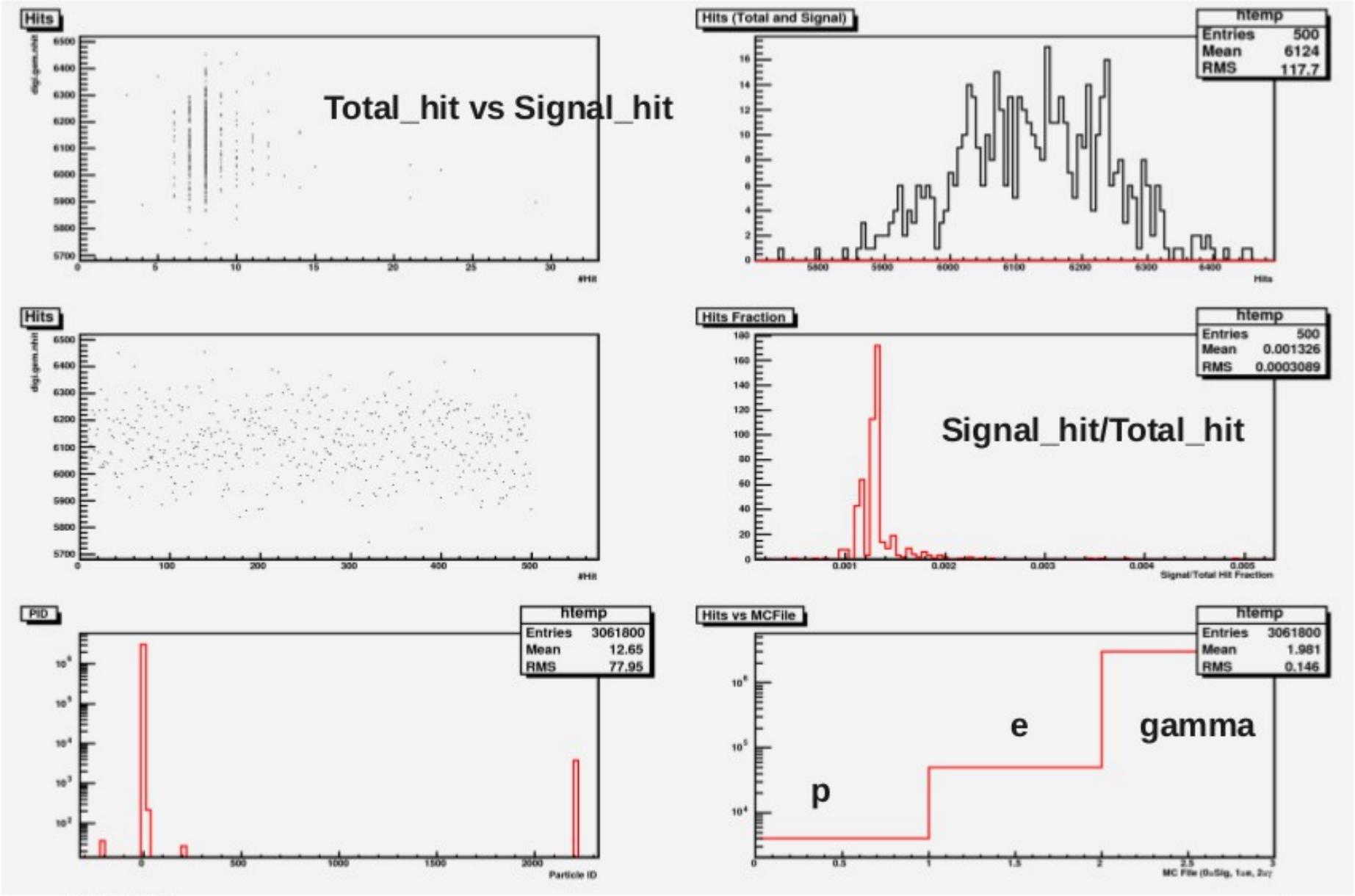
Background:
Photons: ~ 250 MHz/cm2
Charged: ~ 150 kHz/cm2

Geometry (seen by hit distribution)



- 8 Identical GEM chambers (A = 40x50 cm2)
- SBS at 16.9 degree
- Magnet off
- Beam Current = 75 uA (I=46.9 E13 e)
- Coincidence Time: dT = 500 ns
- Proton signal from production g17
- Estimated Background Normalization:
  - Electron: **Ne= Re*I*dT*A = 160 e/chamber/event**
  - Gamma= **Ng=Rg*I*dT*A = 246000 gamma/chamber/event**

#Hits/Event (100% Background)



18/April/2011

(All 8 chambers)

8