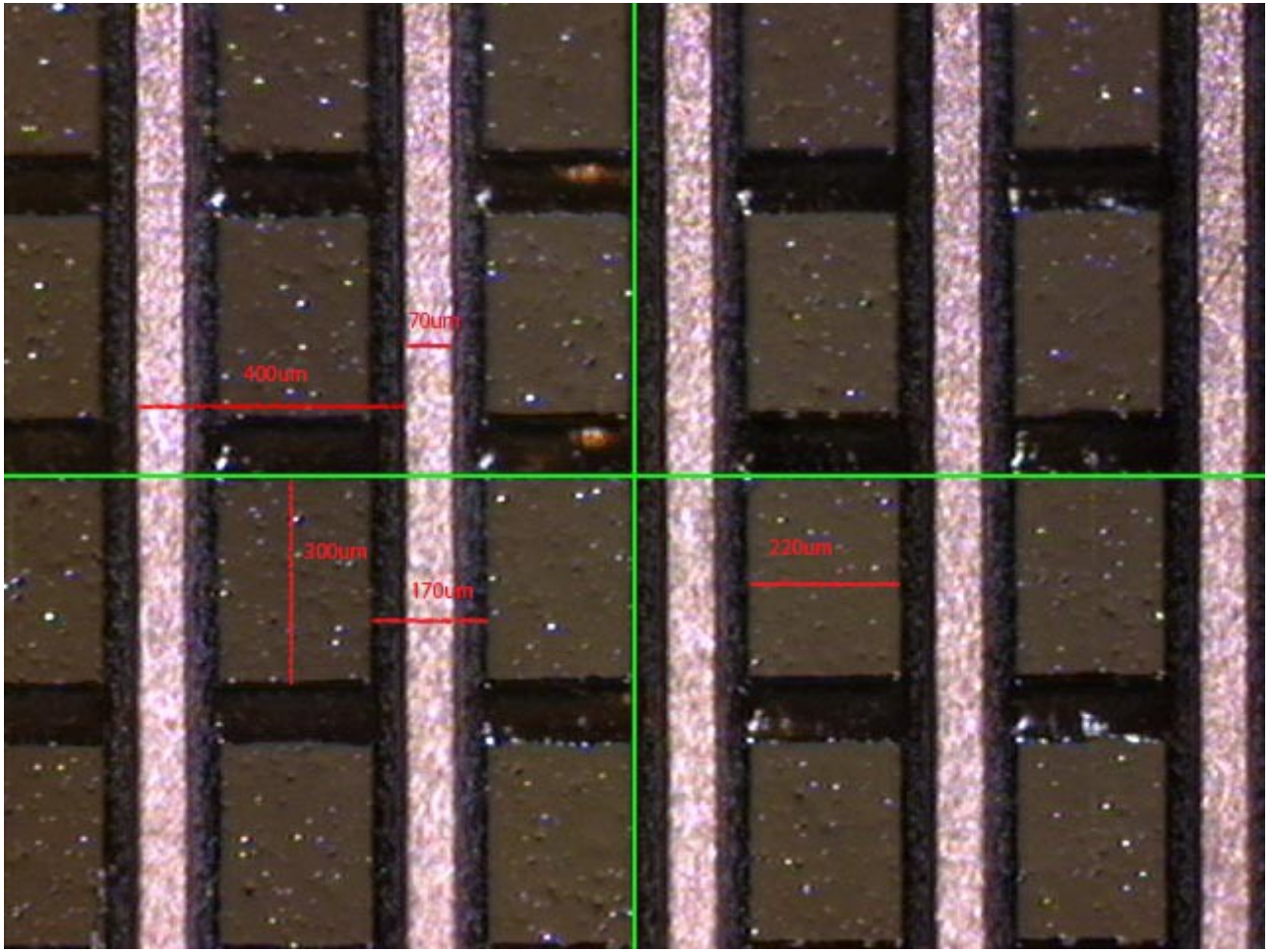
# Front Tracker Status

- **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**

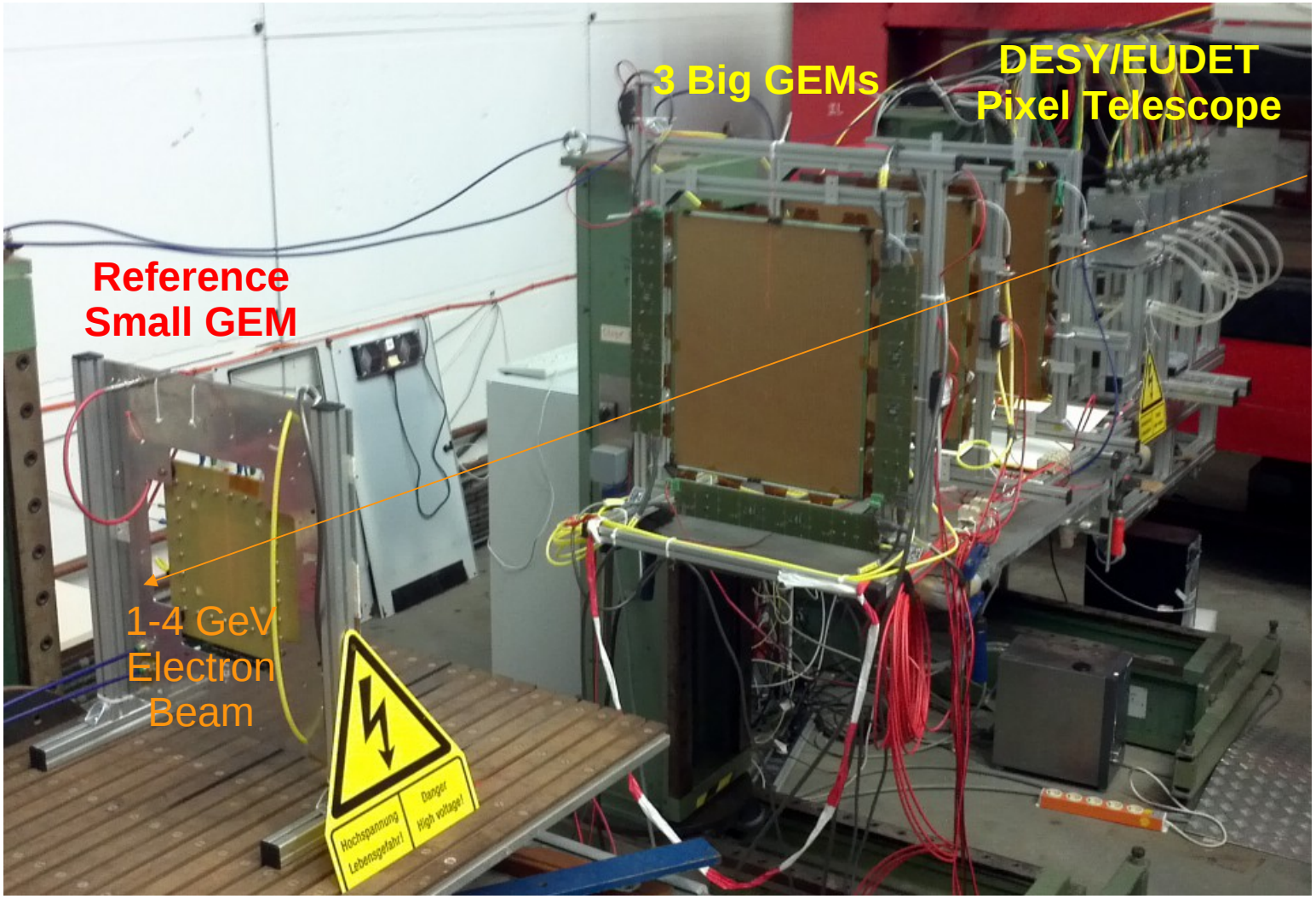
# Jan 2014 / New Beam Test @ DESY

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

Main Goals:

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

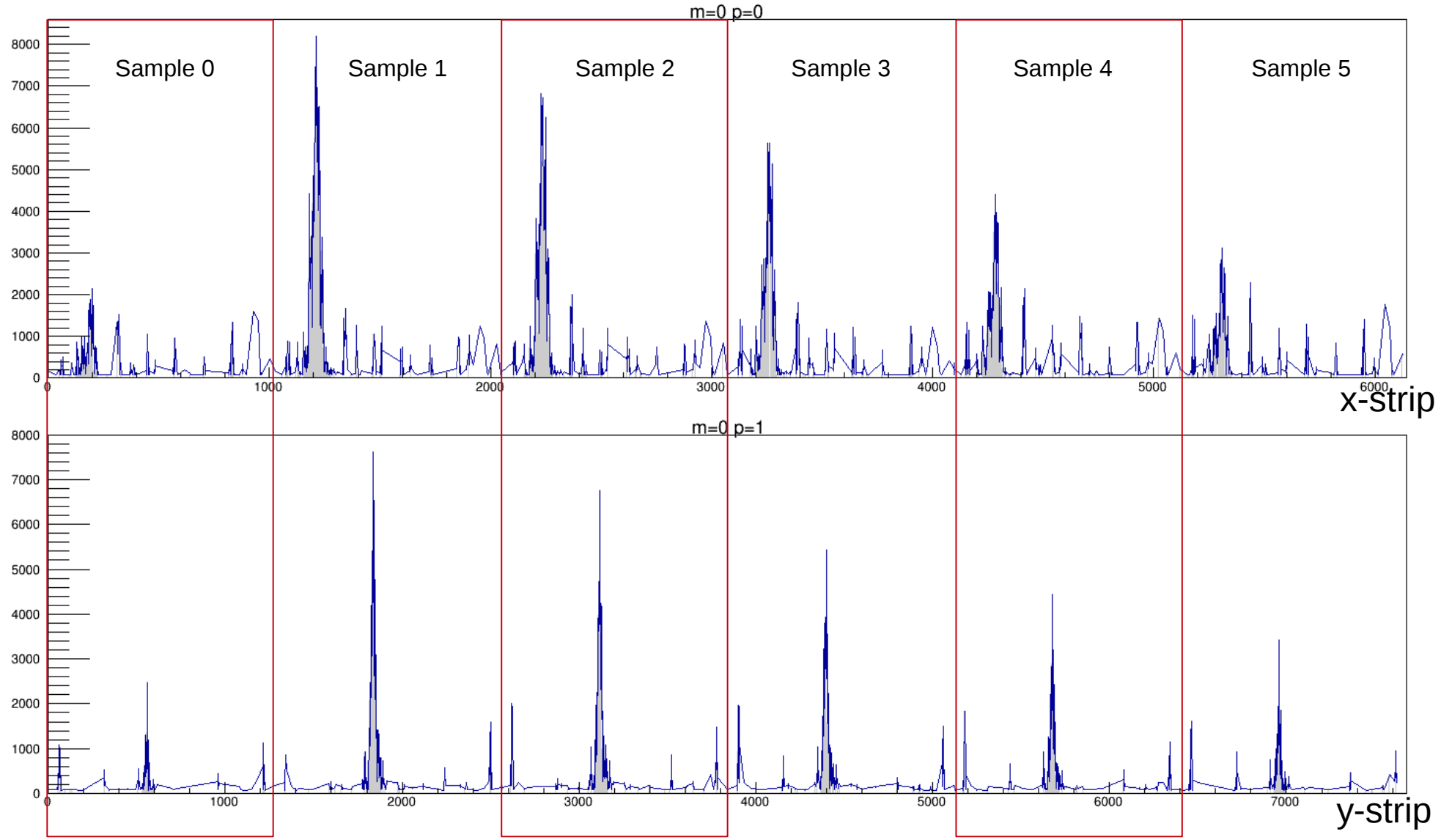
- Figure out the gain variation of the previous test




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

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

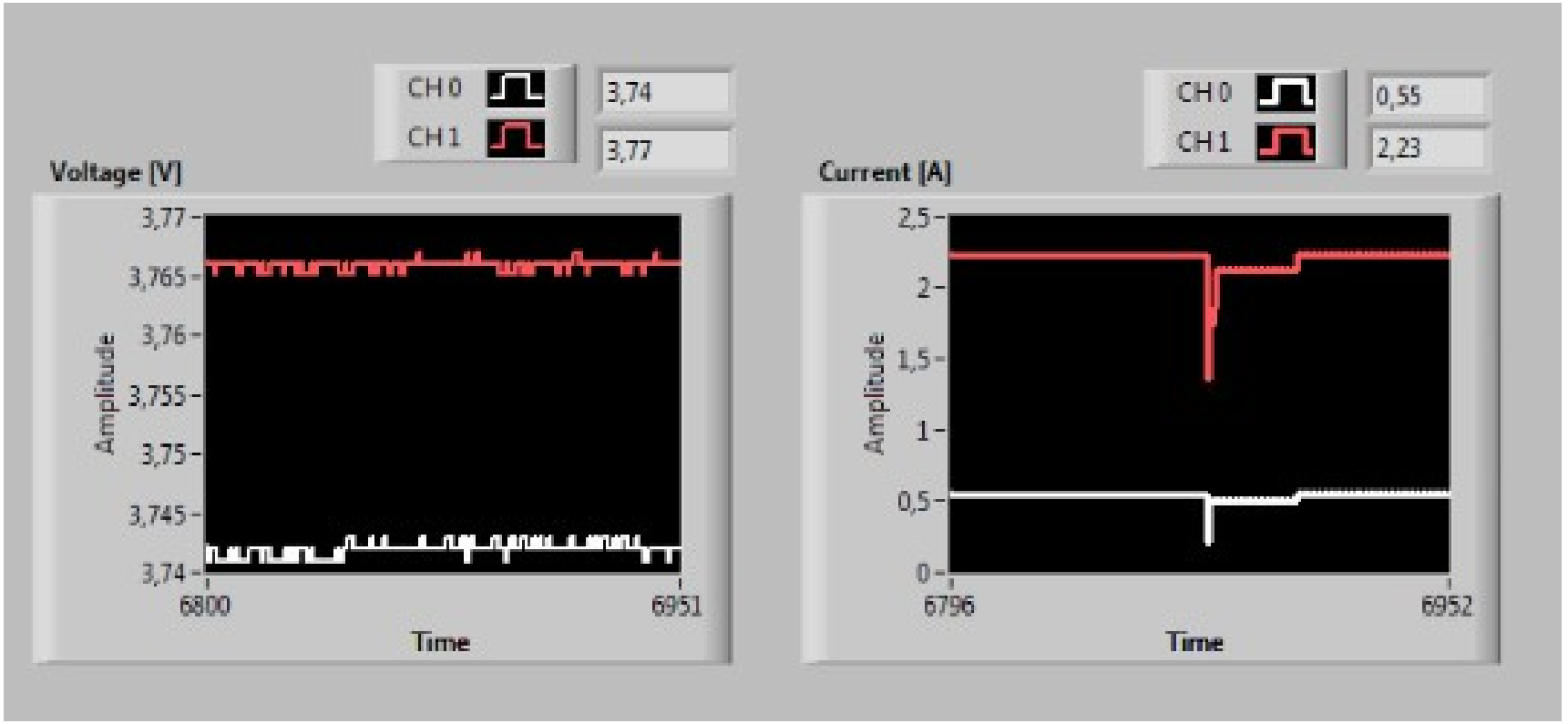
# Online beam profile




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

# Electronics Misconfiguration Issue

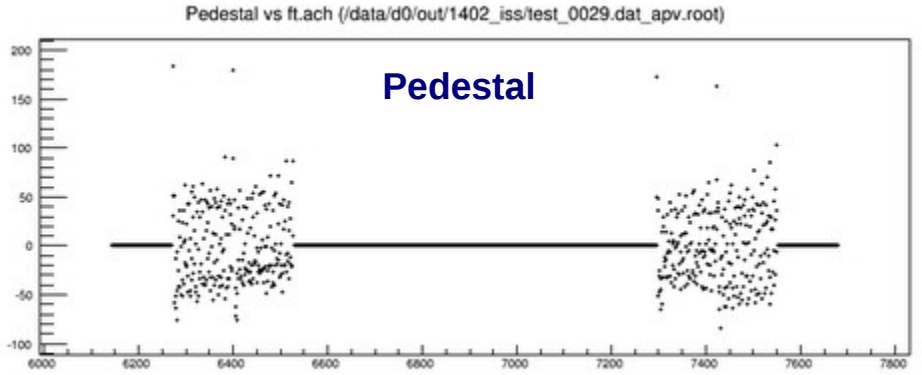
Electronics Low Voltage monitor



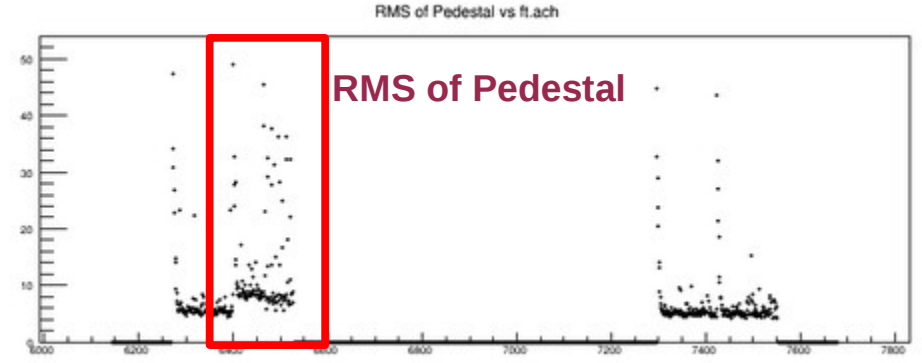

2 power lines for 2 groups of cards

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***



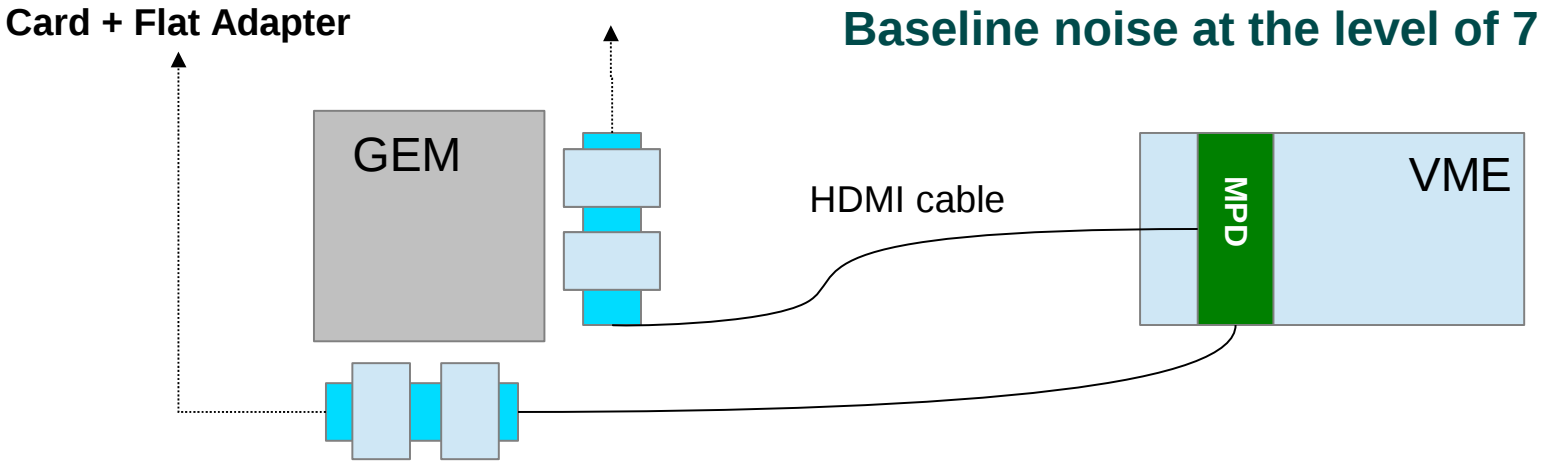

Condition:
4 cards connected to chamber (one by flat adapter)

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

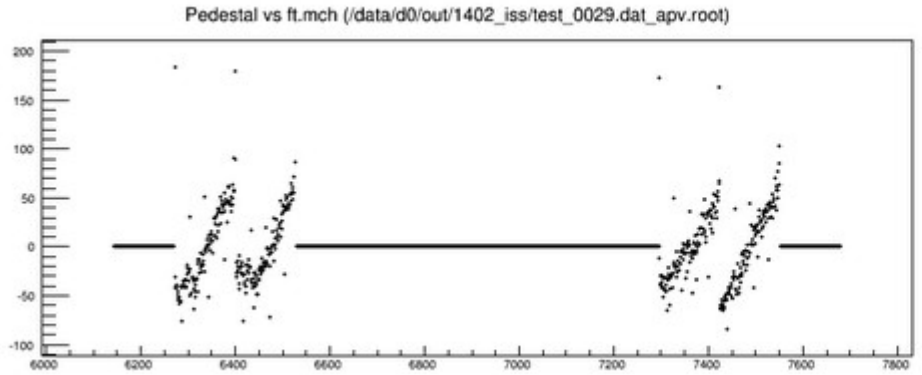
**Evident noise on first few (up to 8) channels of each card;**

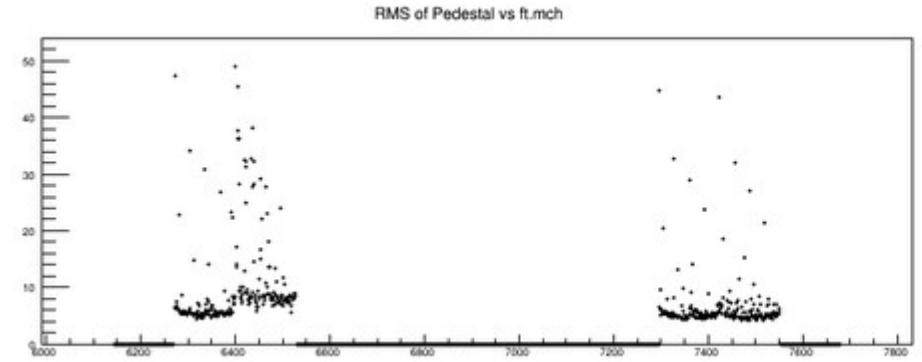
*This noise is somehow masked in the card with adapter (this is way we never put great attention to it in the past)*

**Baseline noise at the level of 7 ADC channel.**

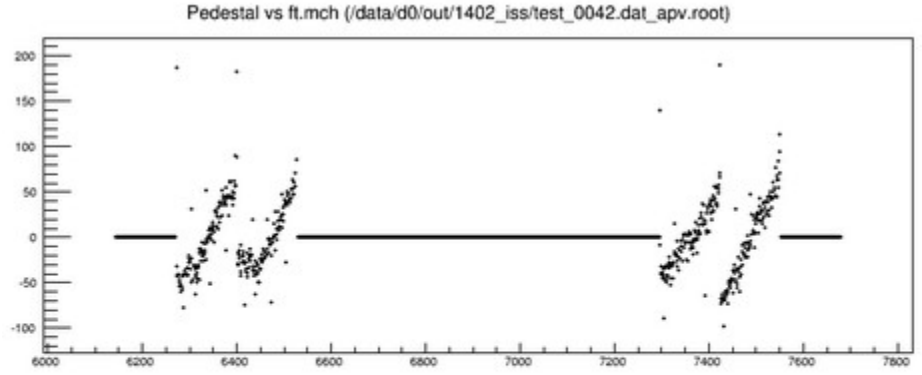


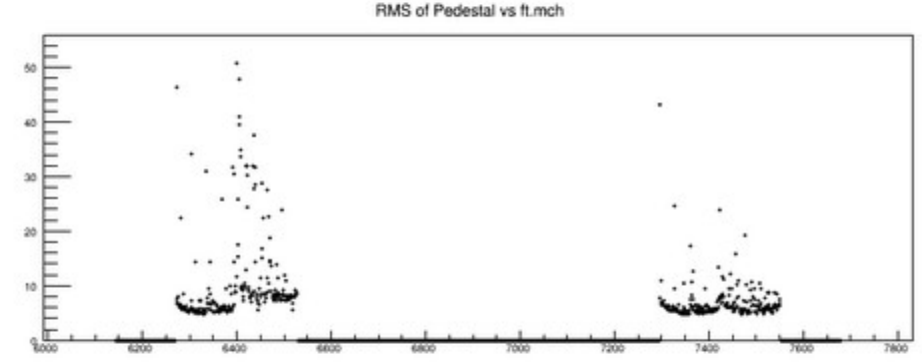
# “Residual Noise” vs cable length




***Strips, frame order***




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

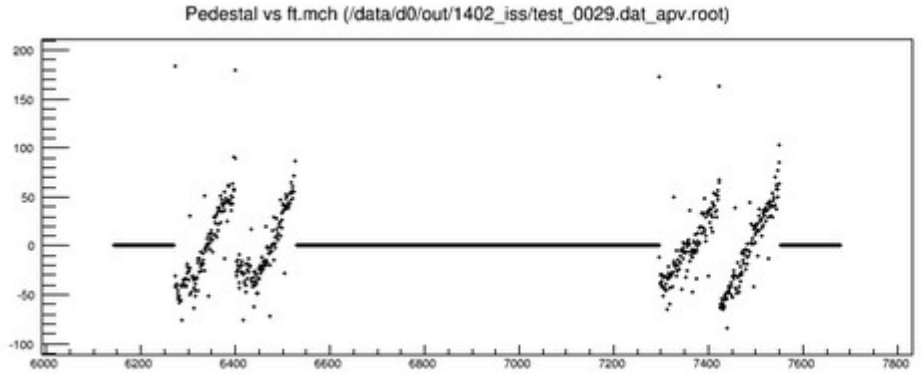
Same data as in the previous slide
Only ordering of the channels is different
Now channel order is the same used to send channel data over the HDMI cable

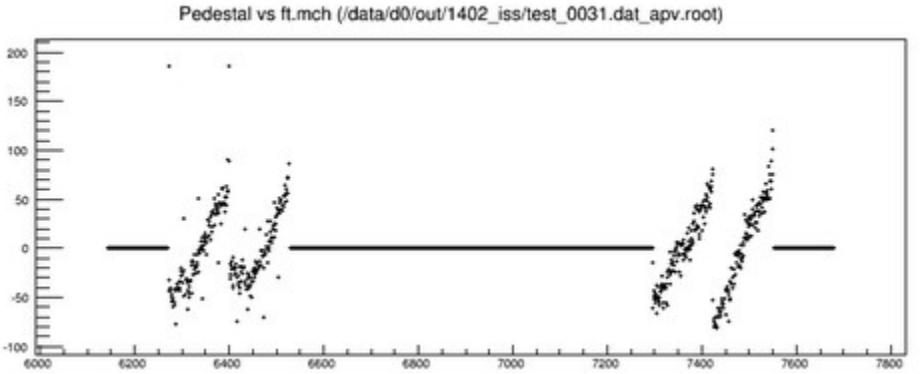
--- **10 m long cable on right channels** ---

The large noise reduces on the cards connected with shorter cable

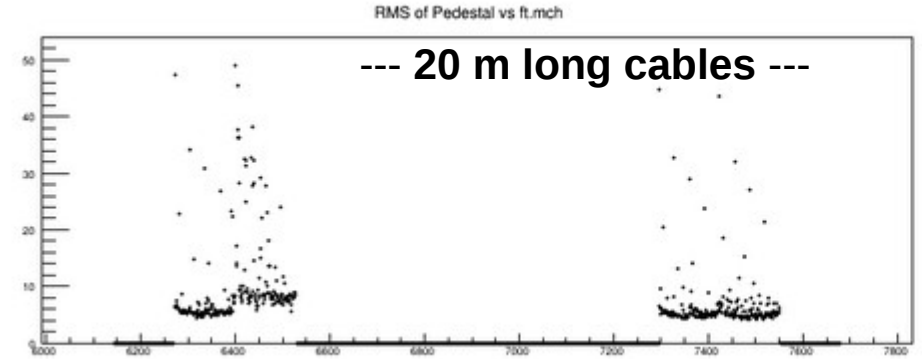
# “Residual Noise” vs cable length

**Frame order**

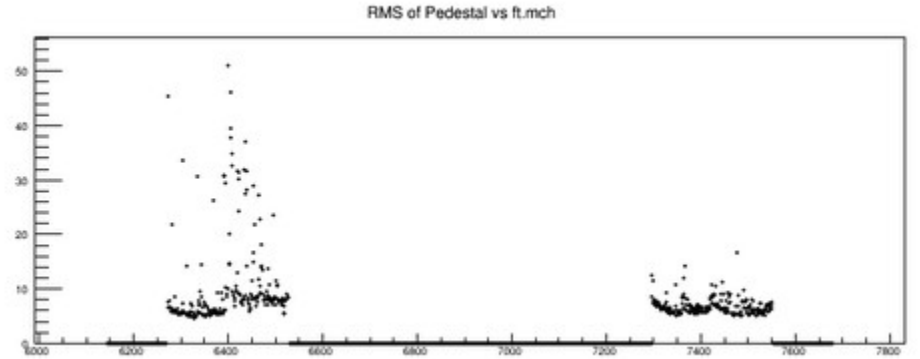


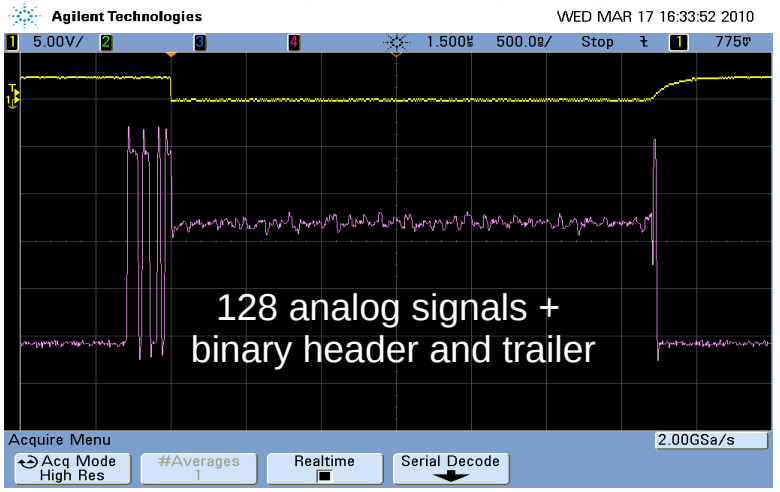




***Strips, frame order***




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



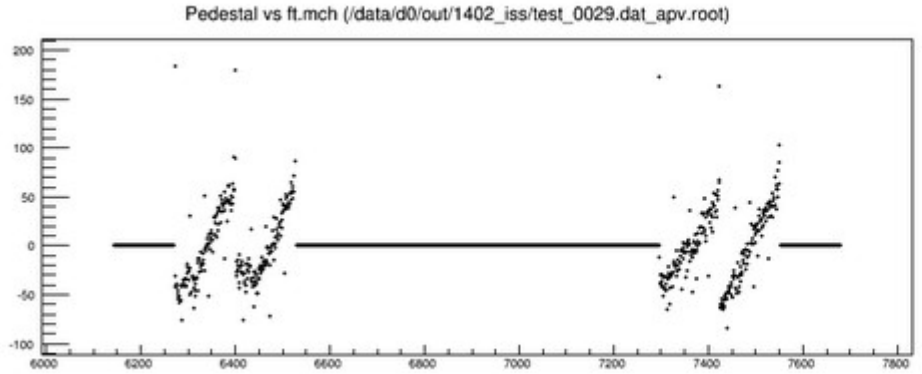

**--- 3 m long cable on right channels ---**

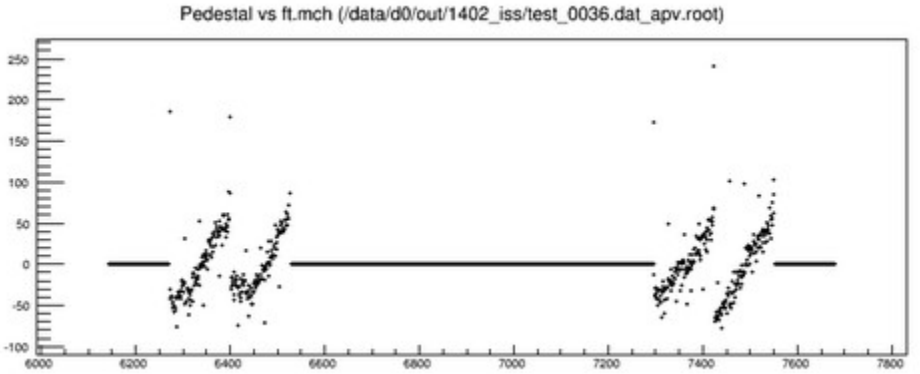
The large noise disappear on the cards connected with short cable

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

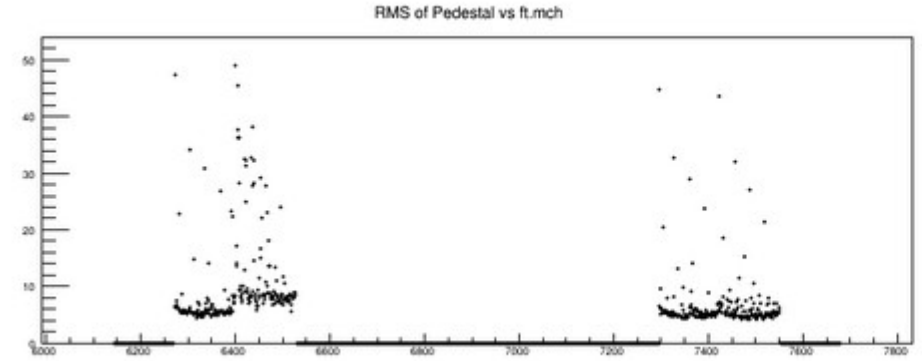
# “Residual Noise” vs termination resistance

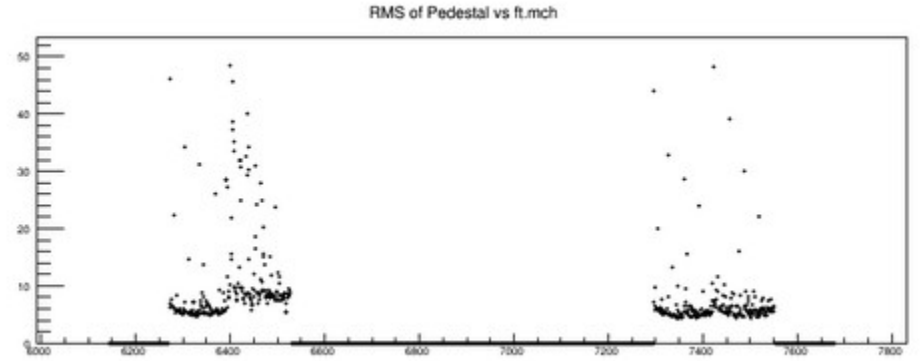
**Frame order**




***Strips, frame order***




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

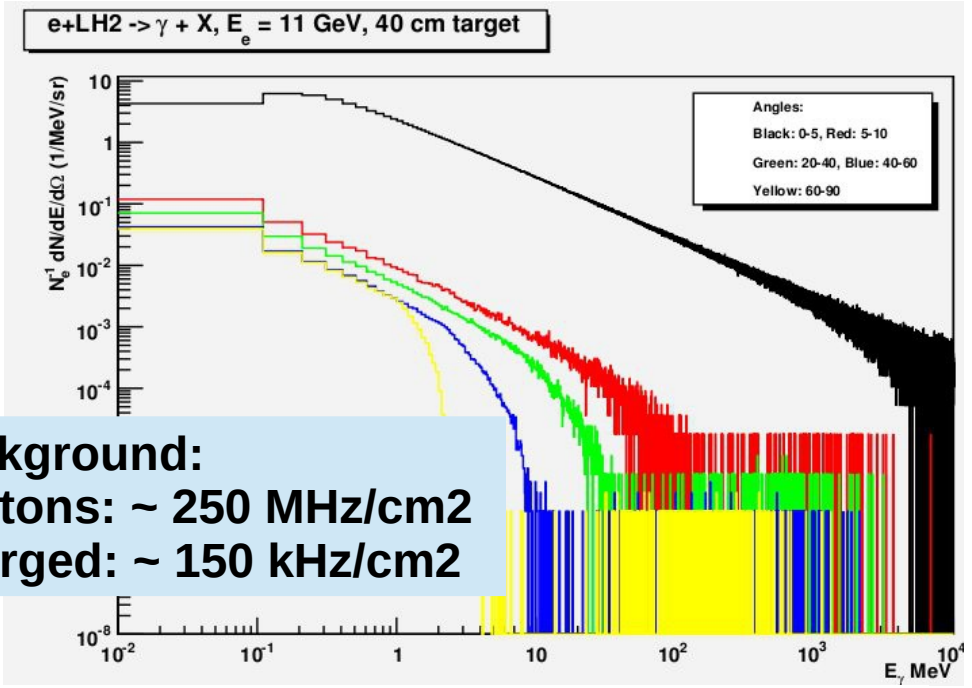
--- **20 m long cable 2x56 Ohm termination** ---
The large noise similar (but not identical) to the one with different termination.

HDMI Impedance 100 Ohm

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

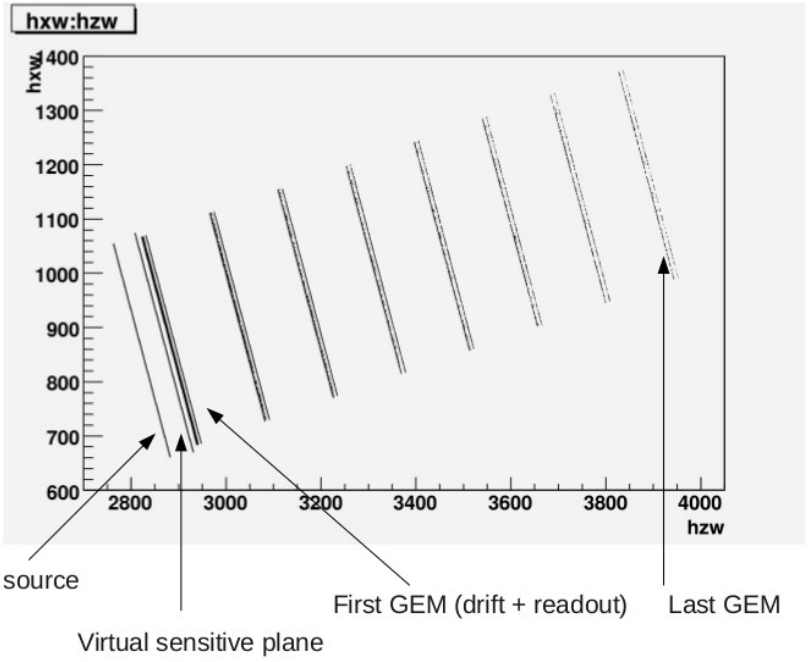
# SBS GEM MonteCarlo (2010-2011)

- 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)



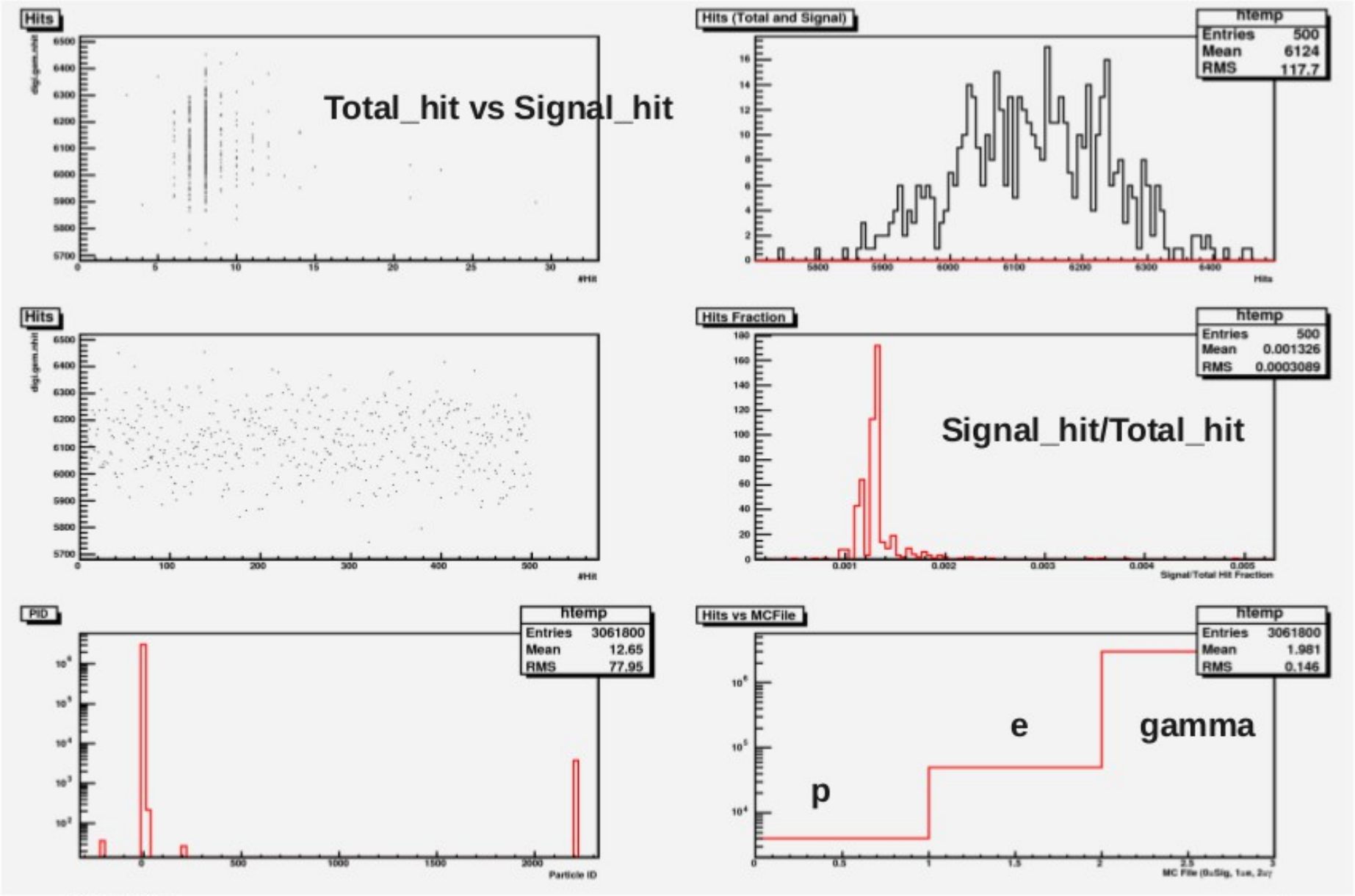

**Background:**
**Photons: ~ 250 MHz/cm2**
**Charged: ~ 150 kHz/cm2**

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)**

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