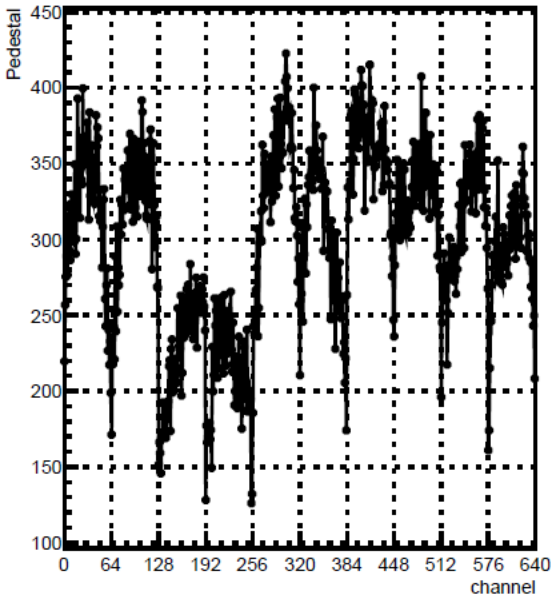
Accidental beam on FOOT, 7th Sep 2025

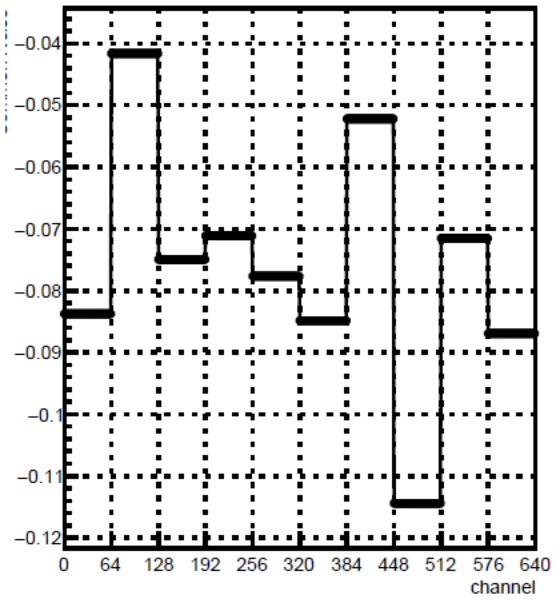
- In the morning of 7th September 2025 some spills of protons were sent in the experimental area
  - 60 MeV protons
  - ~4x10^{10} particles

- To evaluate damage on MSD, let's compare a pedestal run of 6th of September and one from 7th
  - Run 7810, 6th Sep (end of data acquisition)
  - Run 7929, 7th Sep

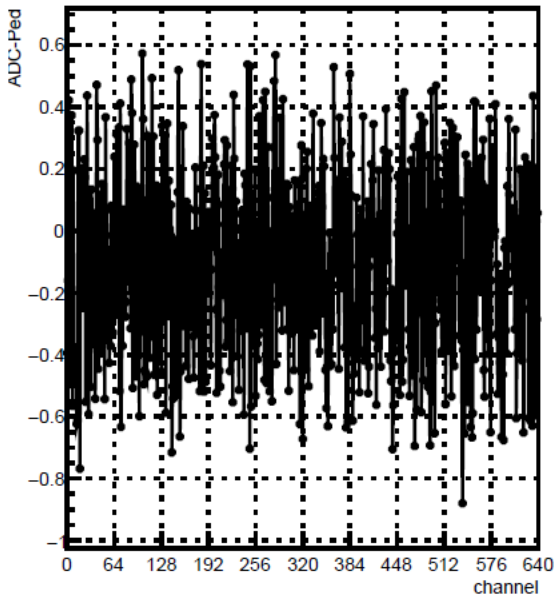
Pedestals for detector 0 RUN 7810



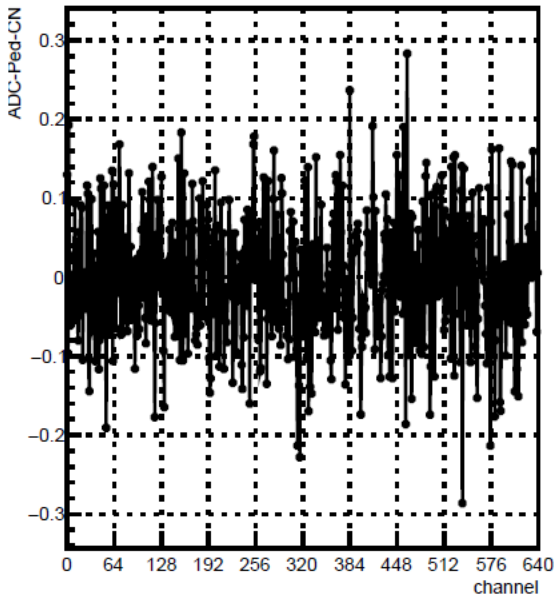
Common Noise for detector 0 RUN 7810



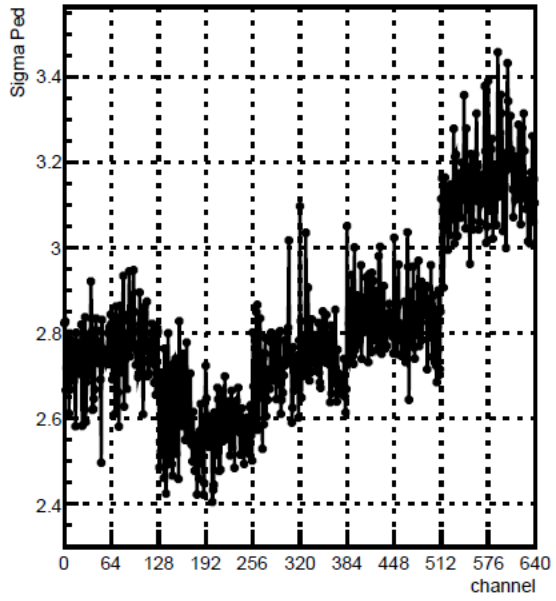
ADC-Pedestals for detector 0 RUN 7810



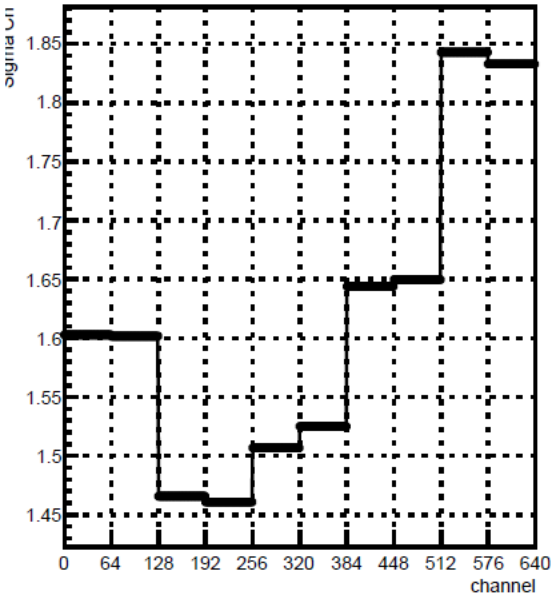
ADC-Pedestals-CN for detector 0 RUN 7810



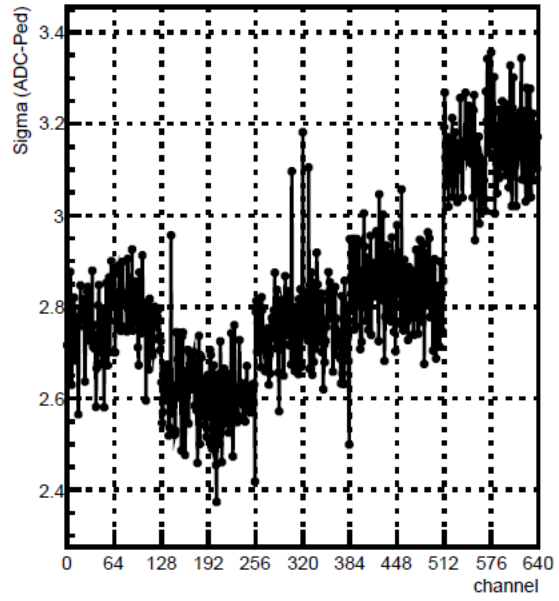
Sigmas from ped for detector 0 RUN 7810



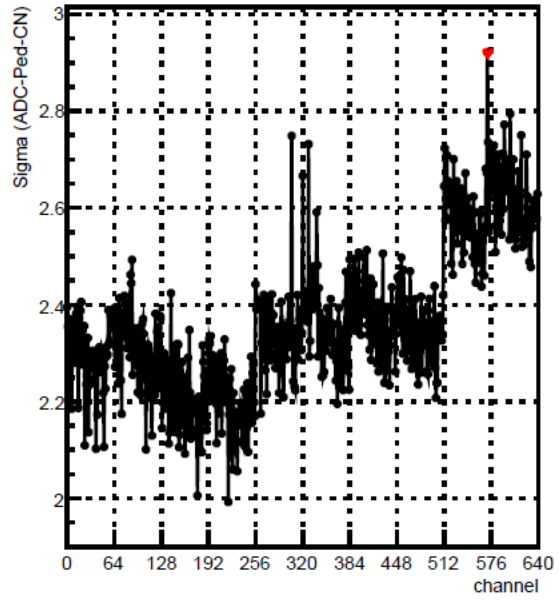
Sigmas from cn for detector 0 RUN 7810

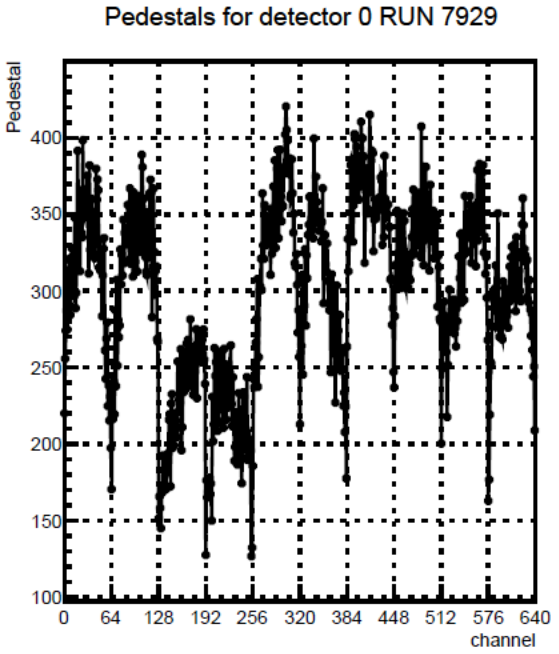


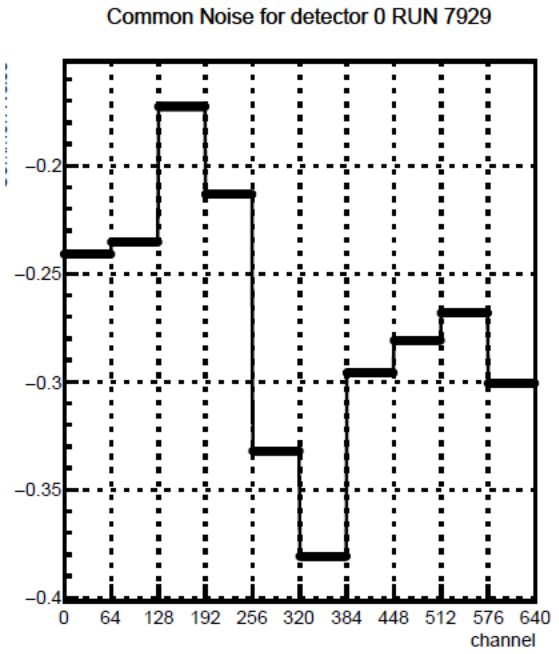
Sigmas from adc-ped for detector 0 RUN 7810

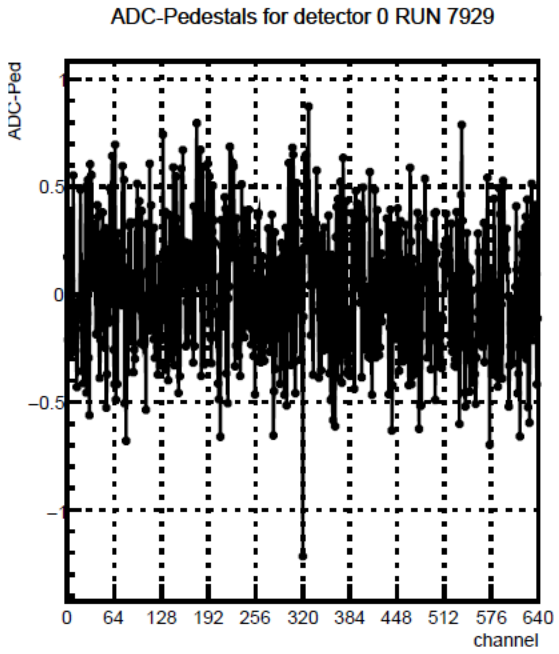


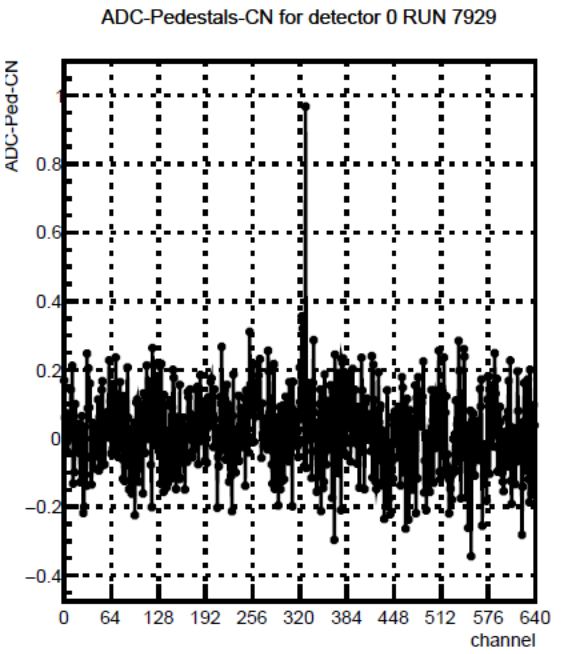
Sigmas from adc-ped-cn for detector 0 RUN 7810

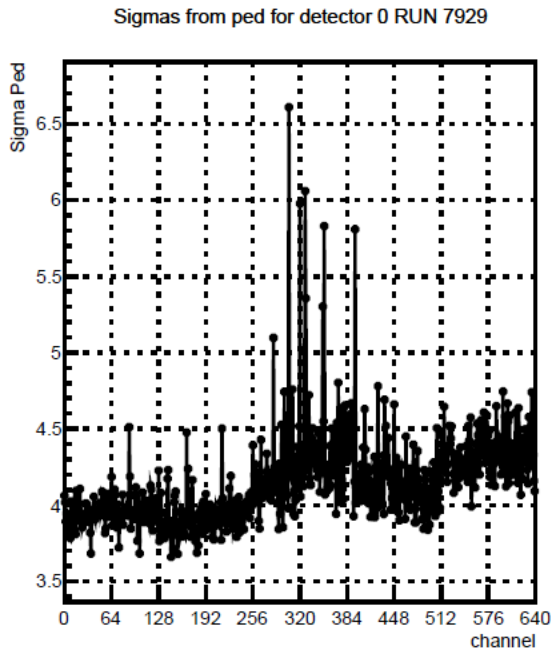


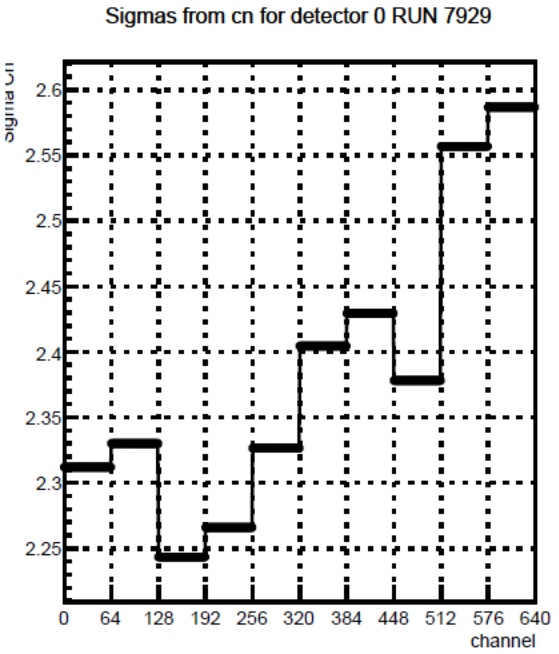

Pedestals for detector 0 RUN 7929
Pedestal
channel

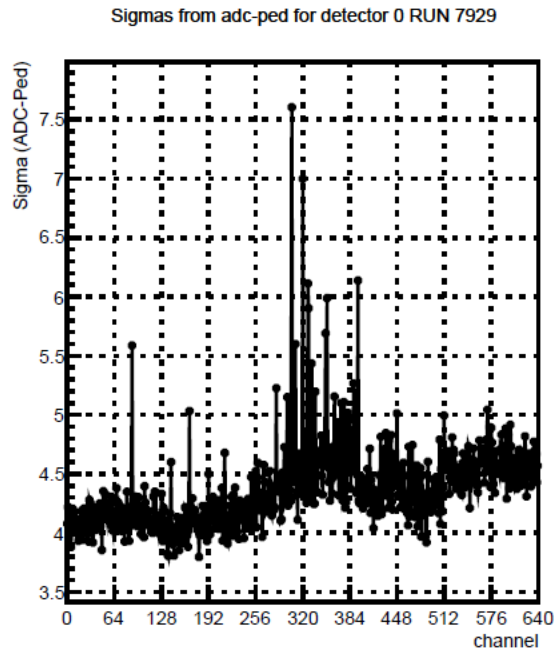

Common Noise for detector 0 RUN 7929
channel

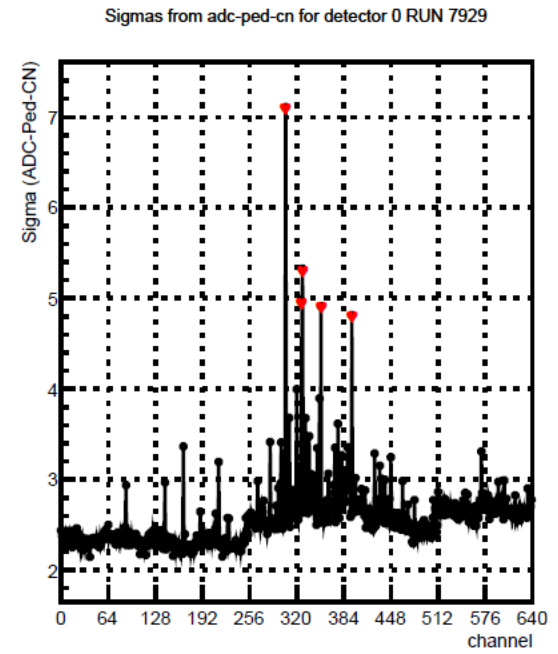

ADC-Pedestals for detector 0 RUN 7929
ADC-Ped
channel

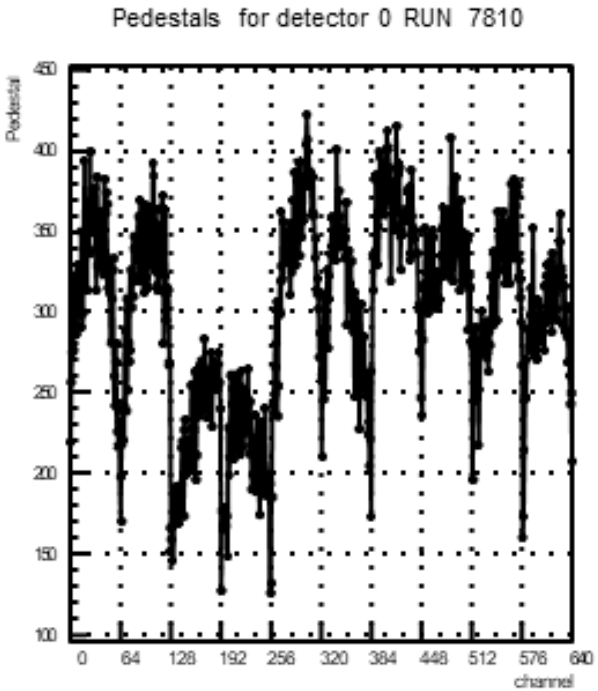

ADC-Pedestals-CN for detector 0 RUN 7929
ADC-Ped-CN
channel

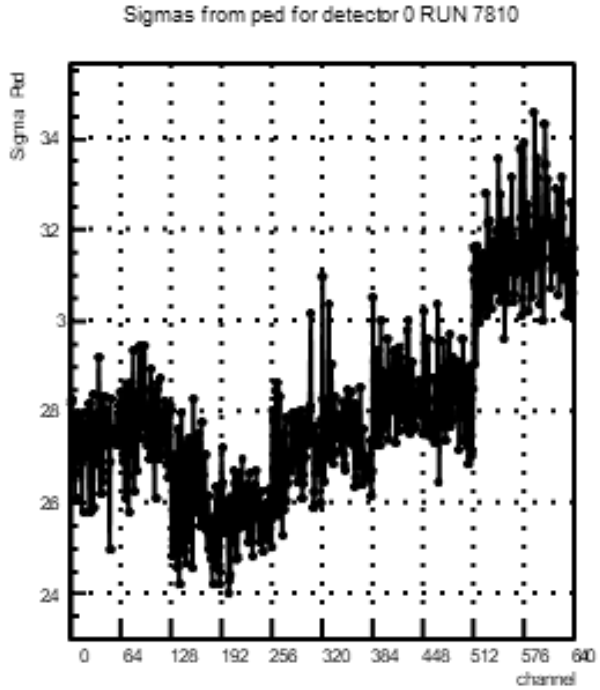

Sigmas from ped for detector 0 RUN 7929
Sigma Ped
channel

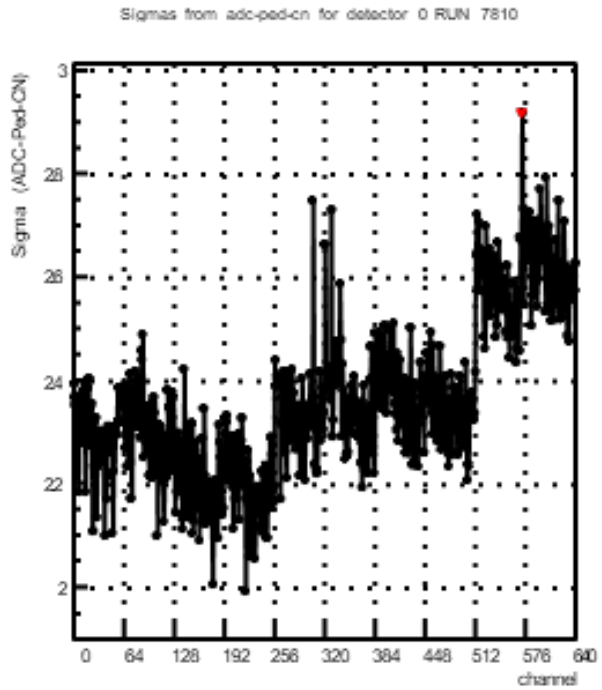

Sigmas from cn for detector 0 RUN 7929
channel


Sigmas from adc-ped for detector 0 RUN 7929
Sigma (ADC-Ped)
channel

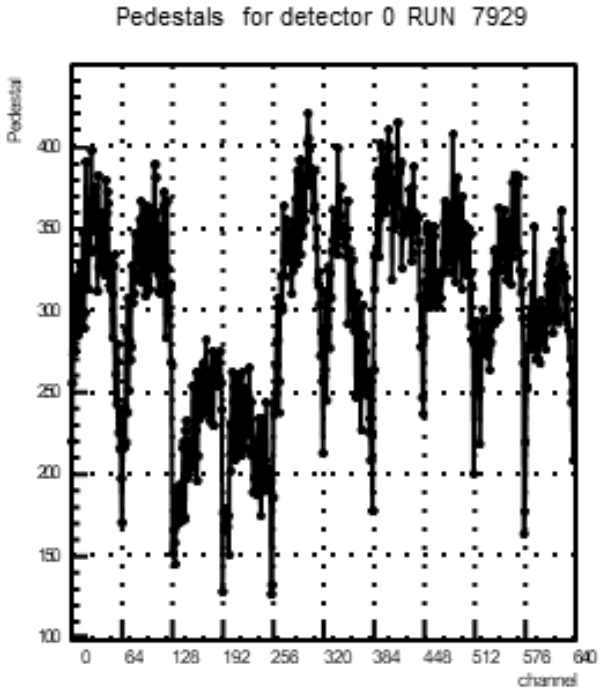

Sigmas from adc-ped-cn for detector 0 RUN 7929
Sigma (ADC-Ped-CN)
channel

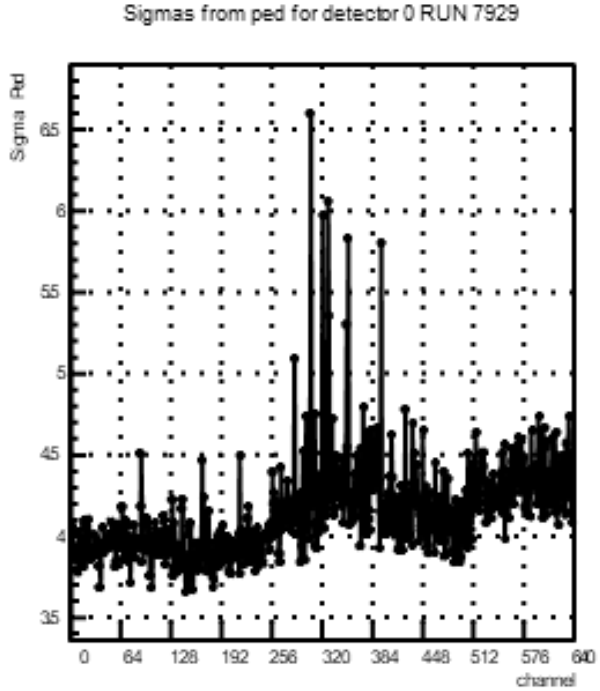


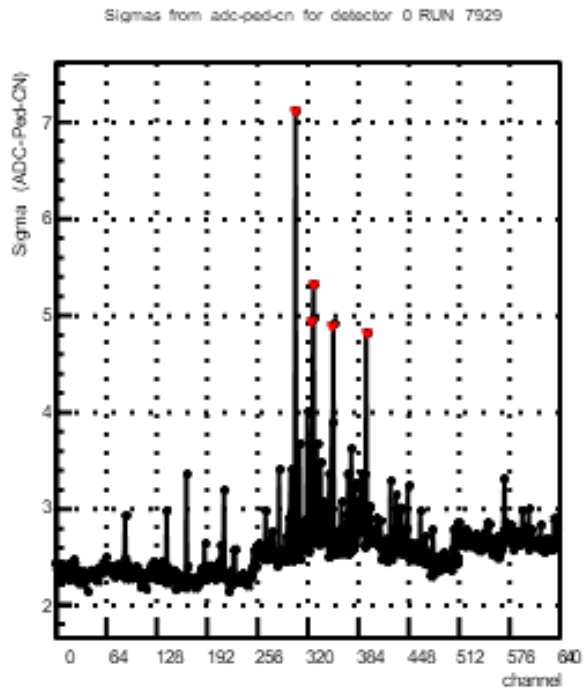




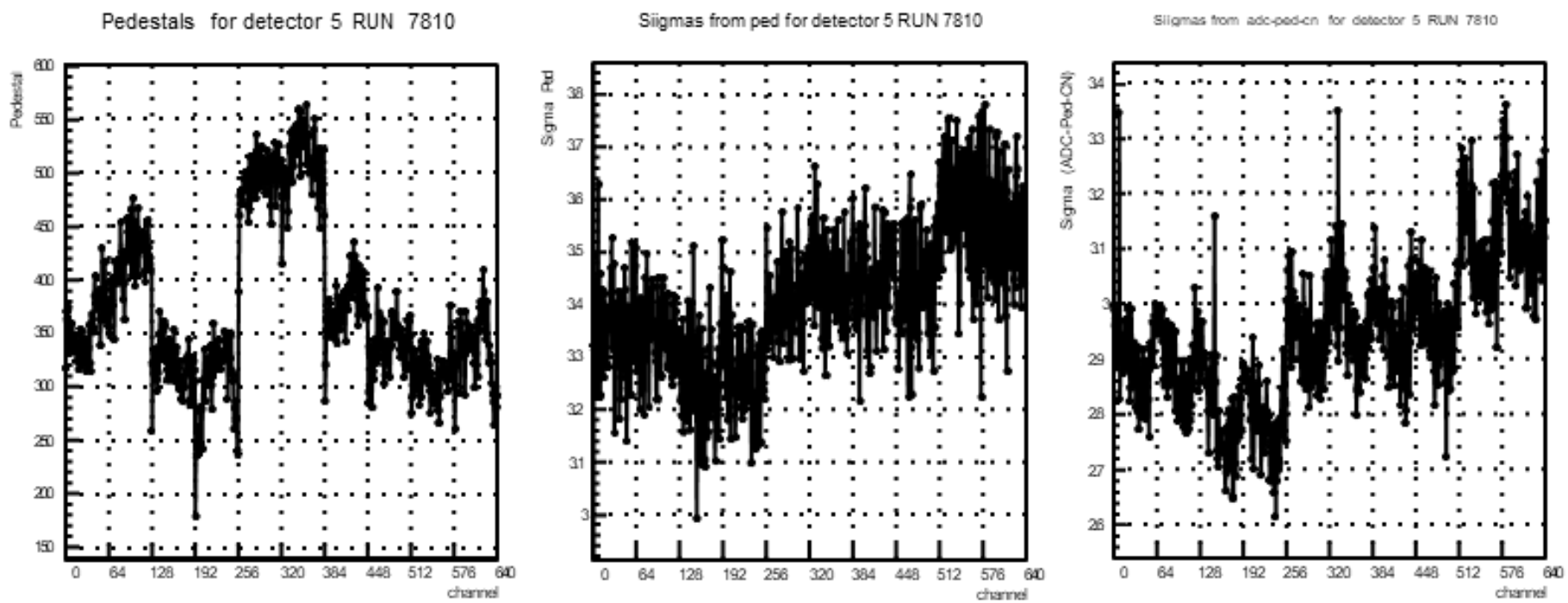
Run 7810, 6th Sep



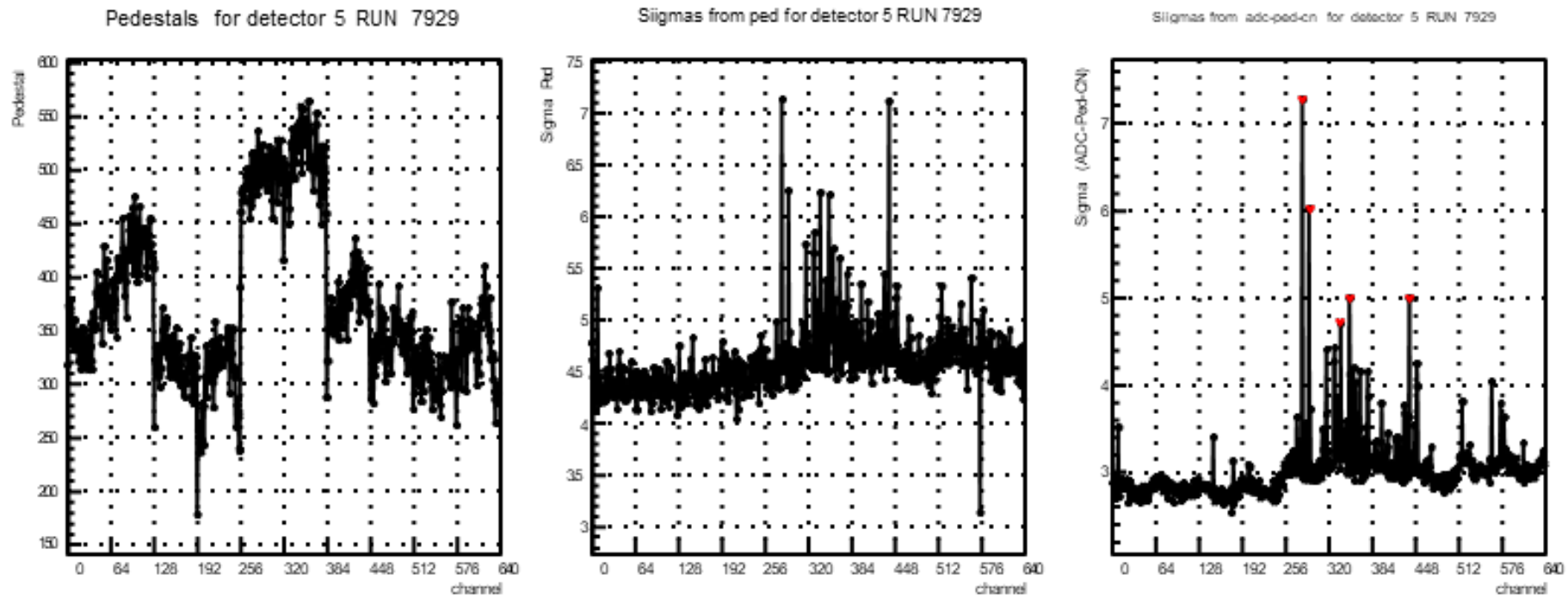




Run 7929, 7th Sep



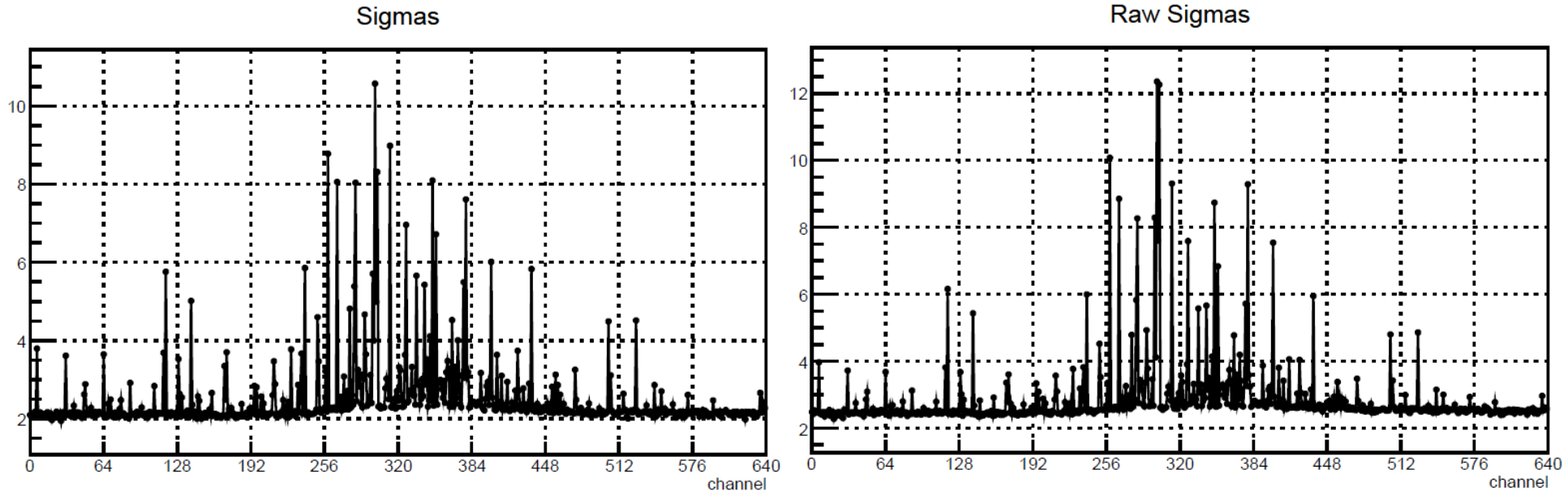
Run 7810, 6th Sep



Run 7929, 7th Sep

Sensors' Damage

- Increase in sigma where the beam passed
  - From few ADCs to 10s of ADCs
  - How much does impact in SNR for protons?
- Possible bulk and/or oxide damage
  - Can alter the inter-strip capacitance with trapped charges
  - Need dedicated studies (and gain calibration with particles?)



Possible Solutions 1/2

- Local expert suggests annealing of the detectors to recover the damage (or at least part of it)
  - 10 minutes at 80° Celsius OR 60 minutes at 60° Celsius
  - Needs the dismount of the detectors from the mechanics
  - We could start from 1 detector and see the results
- Use the sensors as they are now
  - Need to quantify SNR losses and verify it is acceptable
- Assemble a spare sensor packet
  - Not cheap, need to verify what we have

- In all cases: we need data with known particles for gain calibration

Possible Solutions 2/2

In all cases: we need data with known particles for **gain calibration**

- Dedicated data taking illuminating all front-ends
  - Cross on the area OR sweep of 9.6x9.6 cm^2
  - TriggerRate < 1 kHz
  - 5000 triggers per front-end
    - 20x5000=100 ktrigger in the cross case
    - 100x5000=500 ktriggers in the sweep case
- Last time we used 400 MeV C
  - Every beam combination is ok, but:
    - The higher the signal the better
    - No saturation
- MSD in nominal position?

My Proposal

From Mattia, still to be discussed internally :)

- Do the annealing ASAP
  - Start small, with one sensor. Check the result. Perform on all sensors.
- Start assembling a copy of the sensors' box
- Assemble the spare set of sensors
  - We possibly have 5 already built that we can use
- Acquire cosmic rays in lab to verify everything ok for both sets
- Perform the gain calibration when in CNAO