MC request for new AFB-q(off Z-pole) study at high energy

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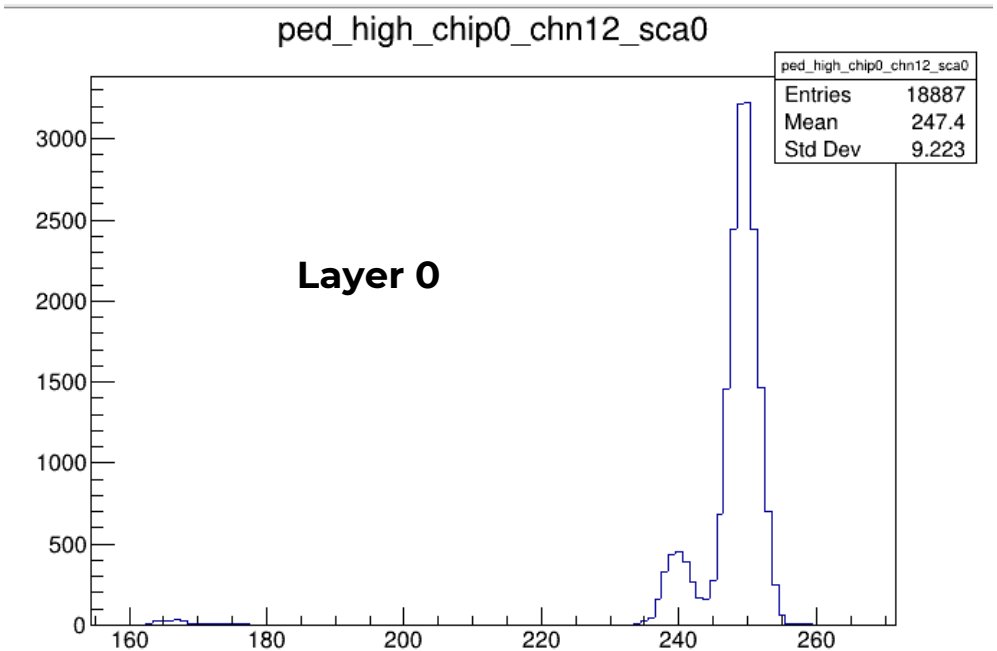
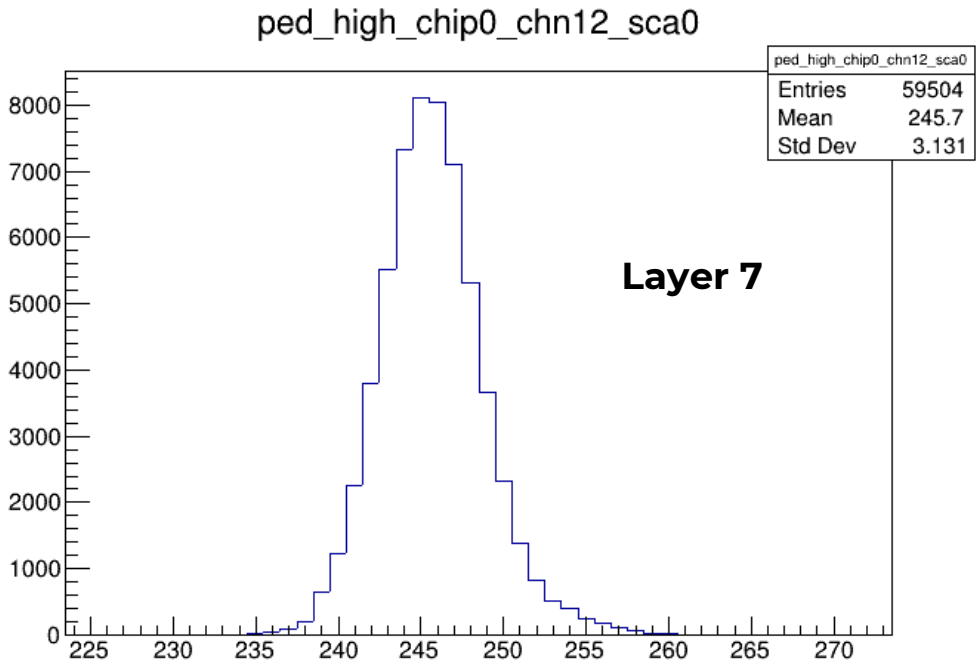
Pedestal / MIP calibration

- Selection
  - 90 runs for MIPscan – > 3GeVMIPscan runs
  - At least 10 layers in coincidence (+-1 BCID) (coincidence in the same chip ID)
  - Only store the charge if only 1 hit per chip
  - Avoid noise sources: burst at bcid 0, burst at bcid 999.
  - Avoid also last sca (prompt to be filled by retriggers…) → maybe too conservative

Pedestal

- Selection
- Perform a fit layer/chip/chn/sca wise
  - Gaussian, around the center of the largest peak

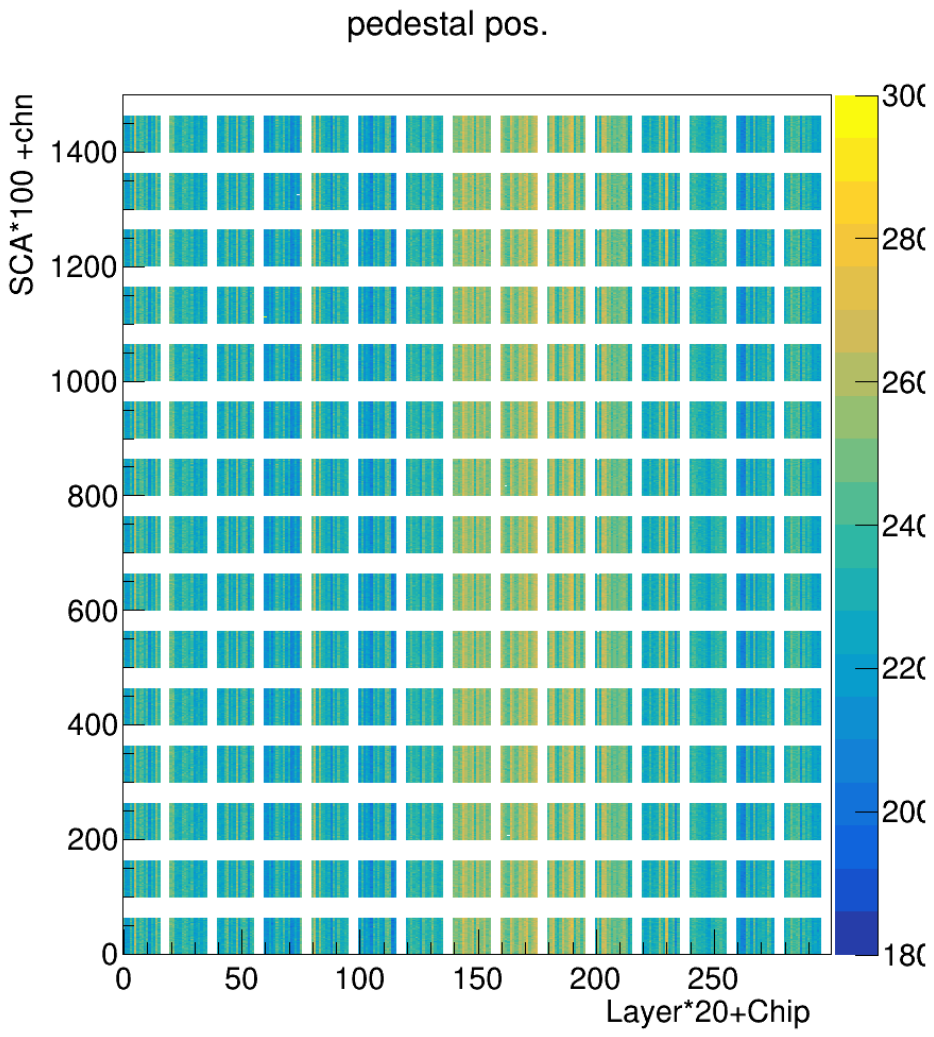


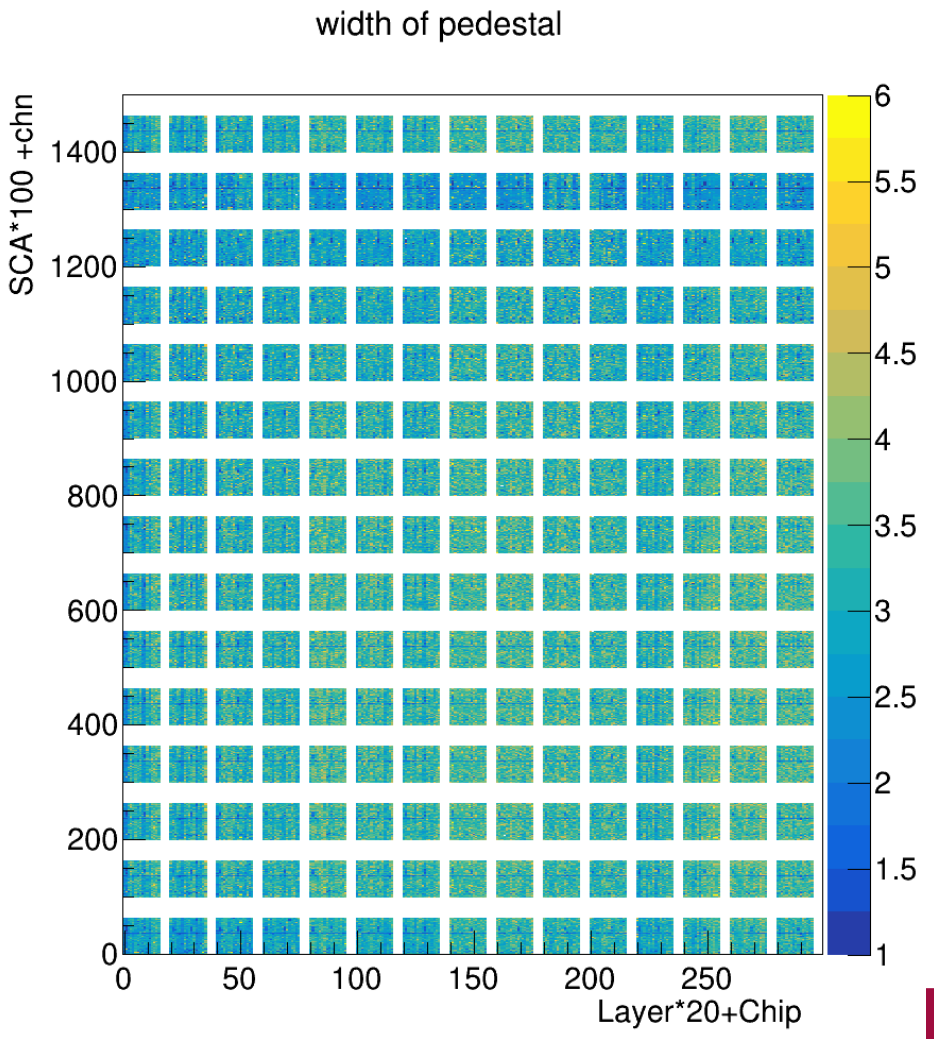


Pedestal

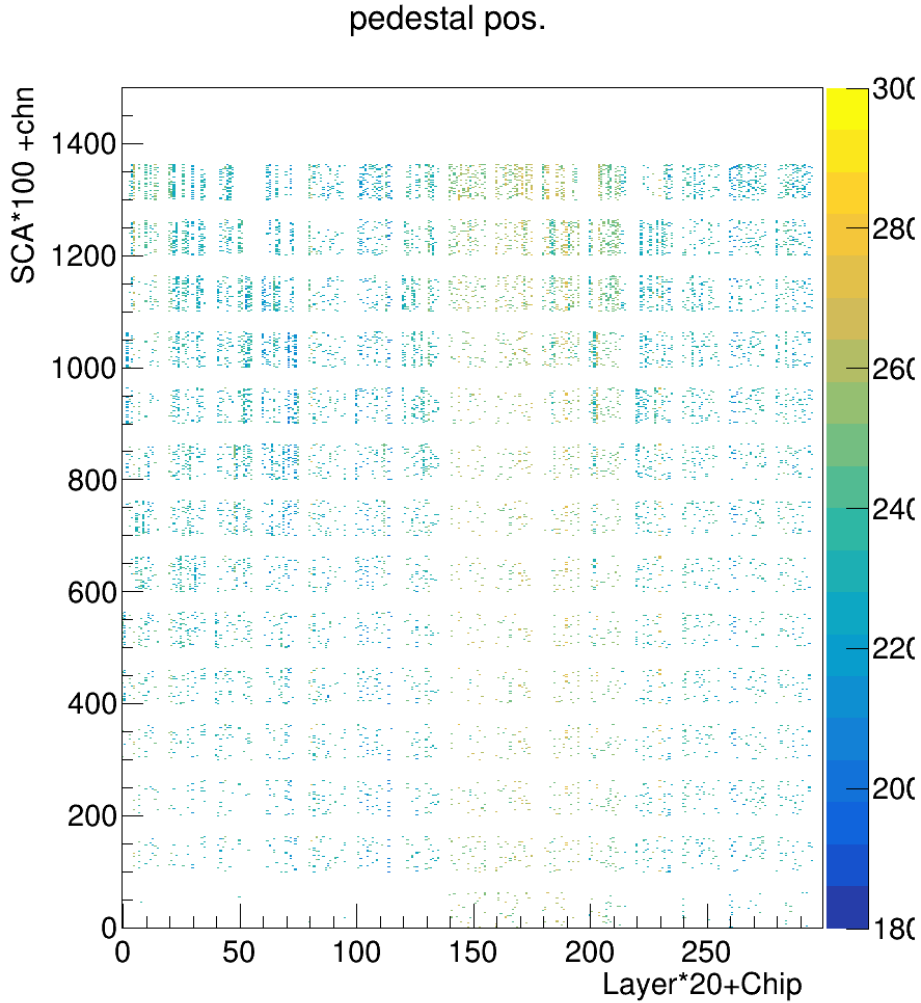
- Selection
- Perform a fit layer/chip/chn/sca wise
  - Gaussian, around the center of the largest peak
- Pedestal values stored in txt files
- I store 3 numbers per chn/sca:
  - Mean, error_mean_from_fit, width
  - If more than two peaks are found or the fit doesn't converge I store the average of mean and width (over the 15scas) and **error_mean_from_fit=-5**
  - If there is no enough statistics I store the average of mean and width (over the 15scas), and **error_mean_from_fit=-10**

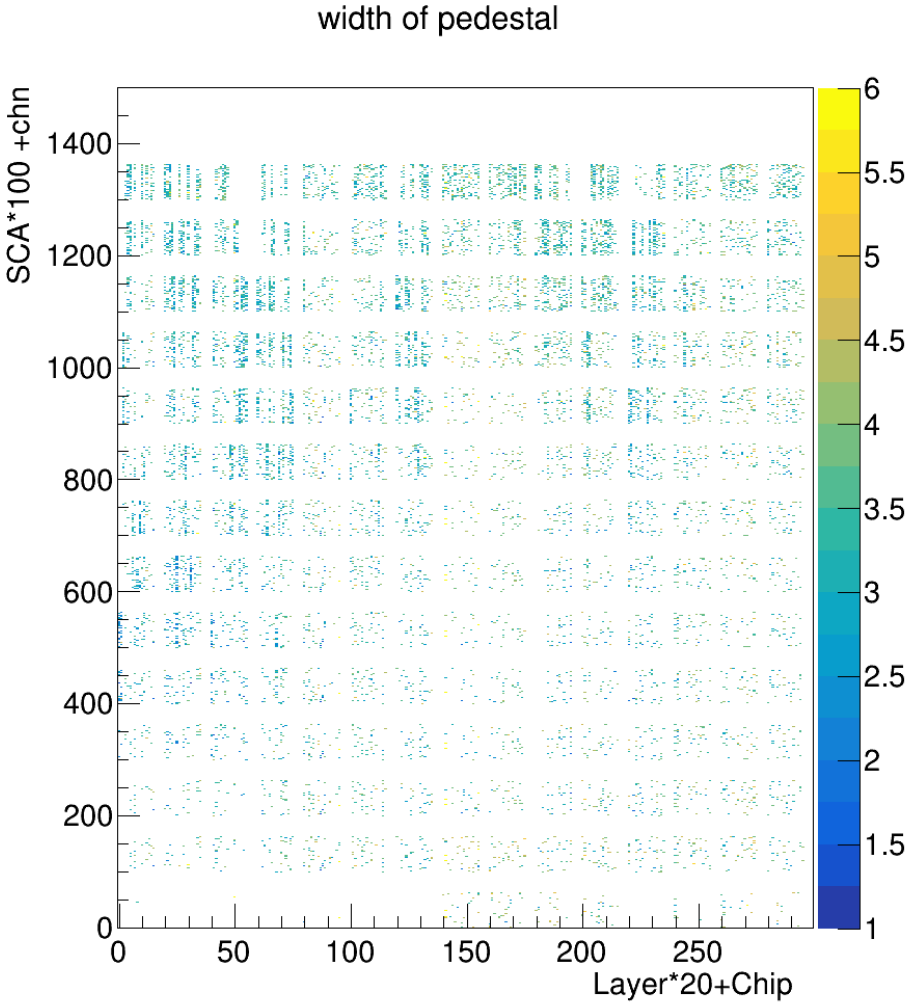
Pedestal (all scas, high-gain)





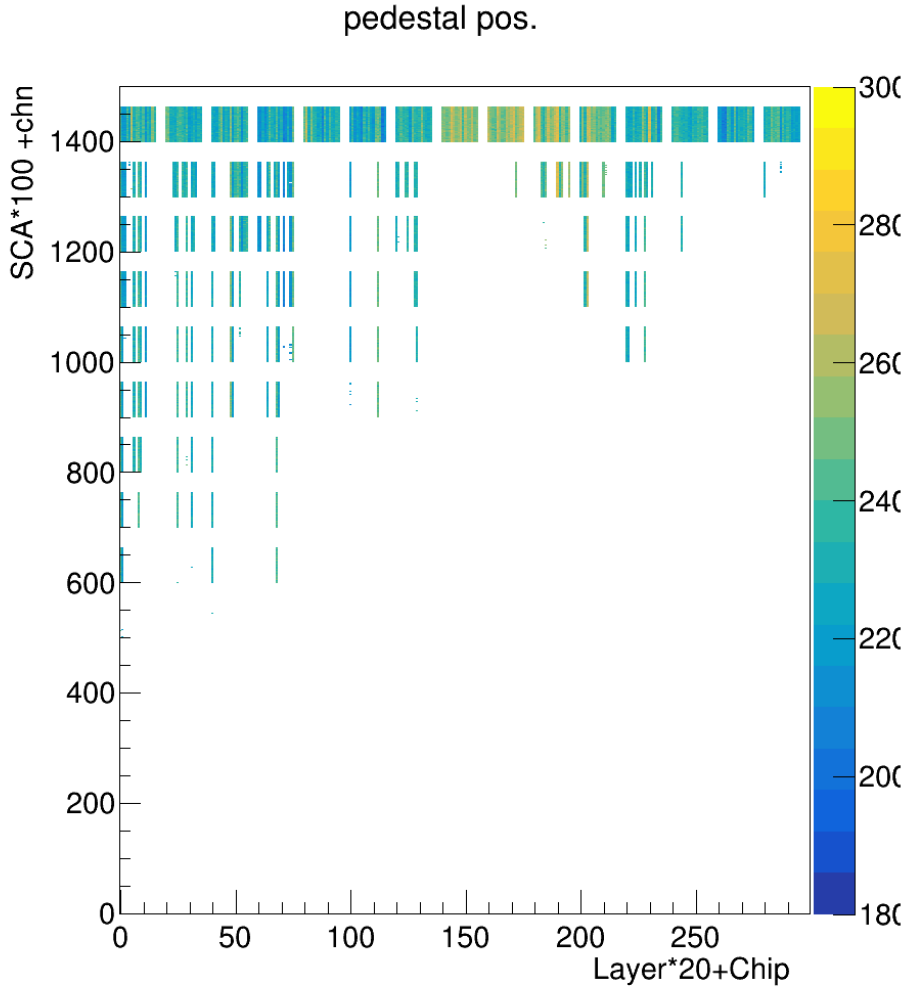
Pedestal (bad-fits, high-gain)

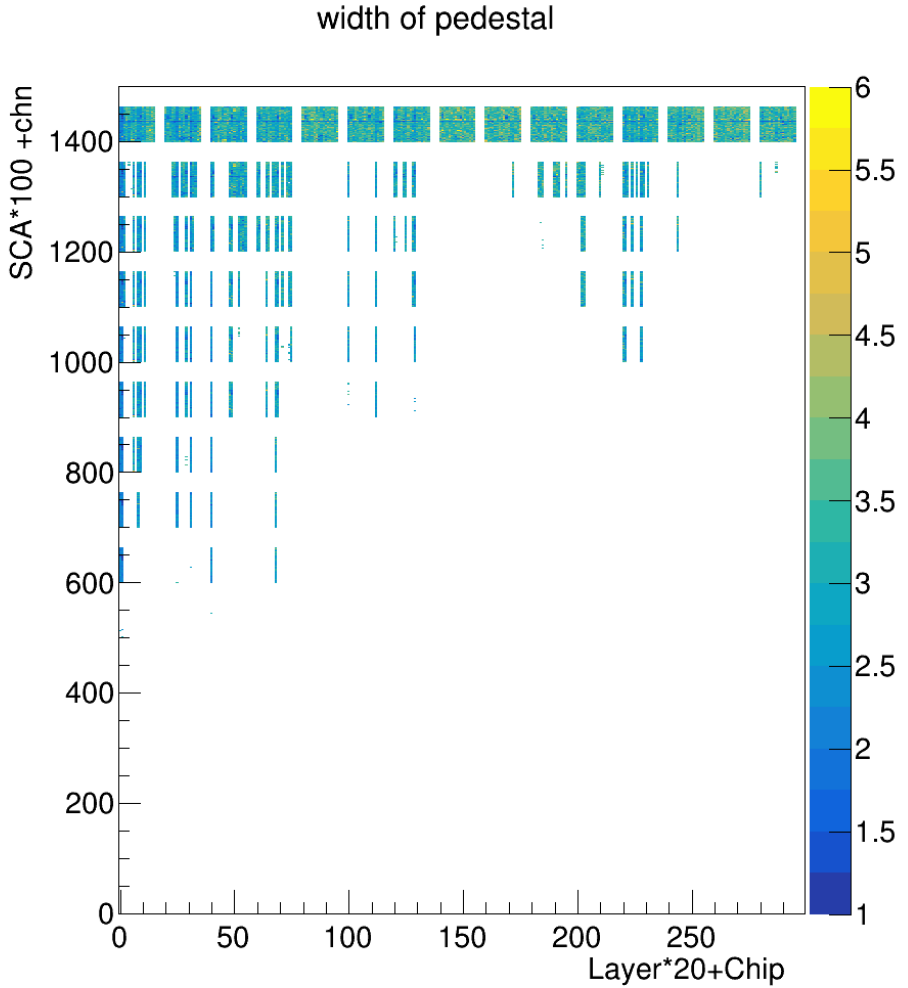




4.8% of histograms

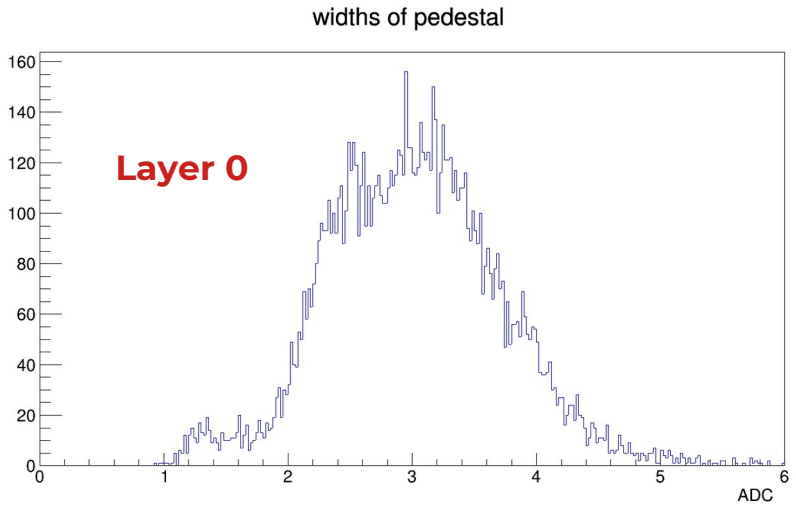
Pedestal (no stats, high-gain)

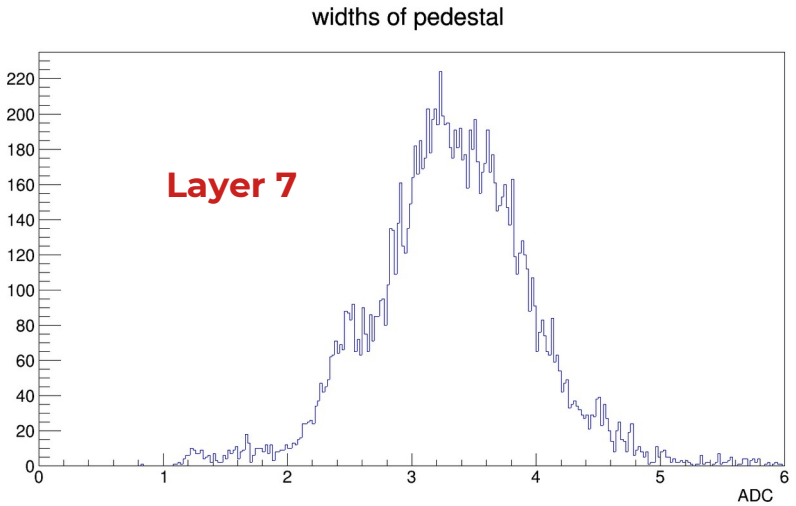




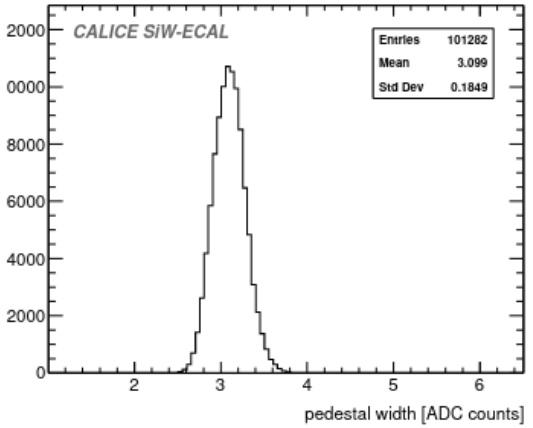
12% of pedestals but located in the last sca

Distributions of widths per layer



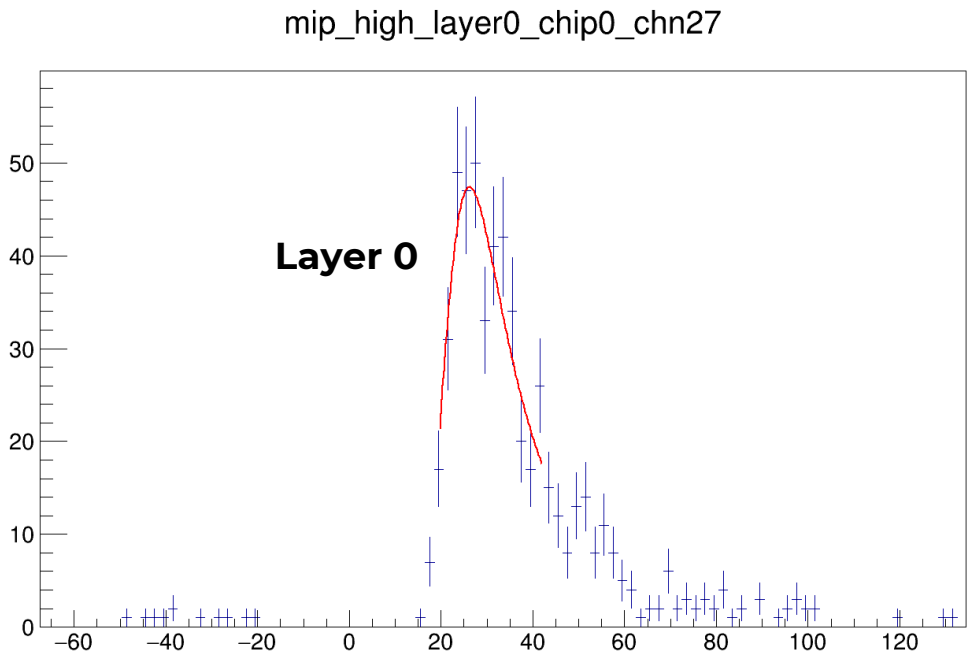


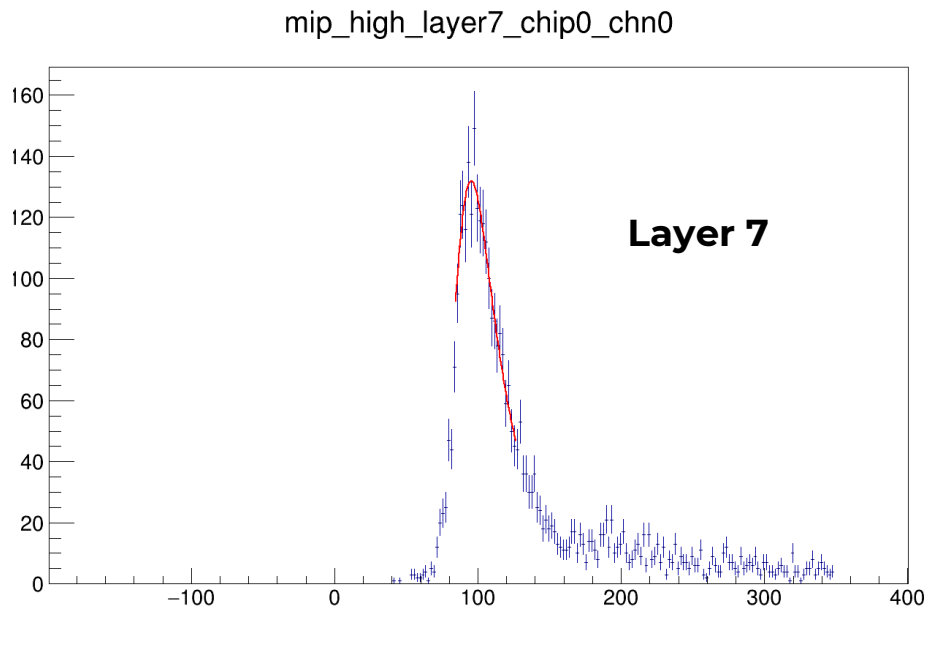
- Larger spread than at 2017
- Layer 7 has thicker wafer



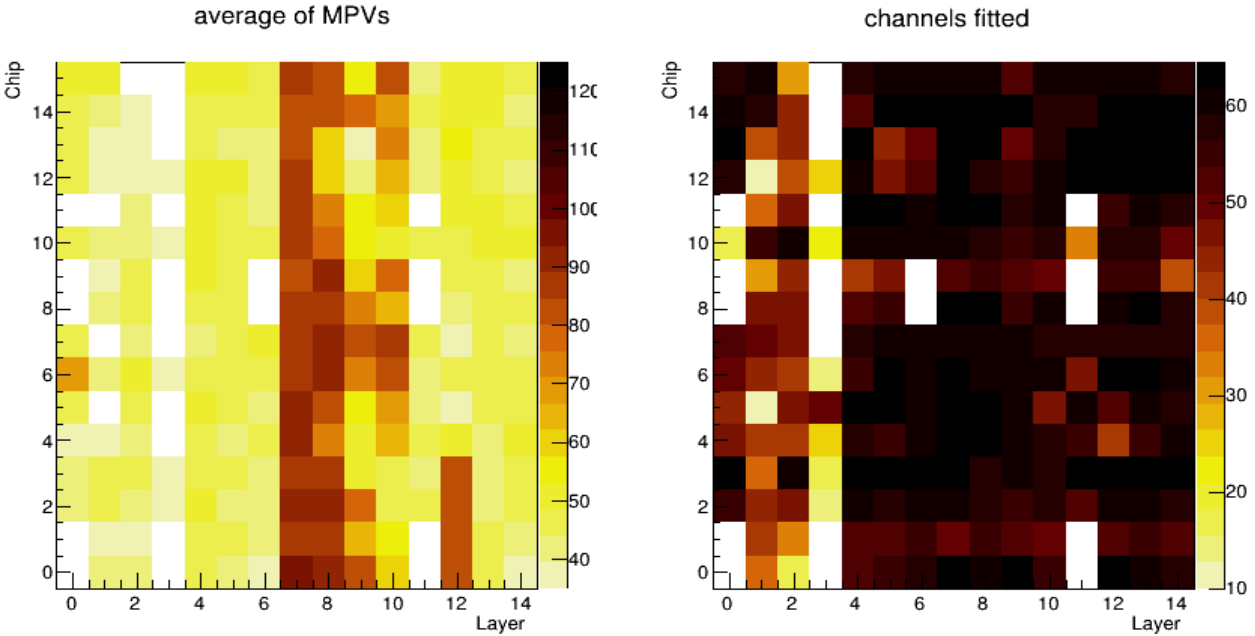
MIP

- Selection (same as pedestal)
- Perform a fit layer/chip/chn wise after pedestal subtraction (sca wise)
  - Langaus (landau convoluted with gaussian)





MIP



- Larger noise and more difficult to perform the pedestal calibration and subtraction
- This causes that:
- Some layers have very low MIP values
  - Layer 0, layer 4, some chips in layer 11
- Layer 3 (FEV10, slab15) has almost no good hits…
  - Only noise? Desynchronized events ?
- Layers 9 and 10 are also weird
  - And these were supposed to be good ones…
  - FEV12 glued last year. What's different ?
  - Different equipment ?
  - Different glue/viscosity ?

In general there are different noise conditions than in 2017
Higher HV?, more slabs, no power pulsing (nor big capacitor), more density …

other approach: covariance matrix method

https://arxiv.org/pdf/1401.7095.pdf

Coherent noise source identification in multi channel analysis

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- "The goal is to identify and characterize dissociable noise sources in a multi channel systems. This method cannot separated noise sources which affect exactly the same set of channels. In this case, the noises sources are processed as a single source. We consider a system with N channels. "
- "Each channel **k** is affected by an incoherent noise source **I_k** and Nc coherent noise sources (**C1_k, C2_k,... CN_k**). We assume that all noise source distributions are Gaussian and independant."

other approach: covariance matrix method

$$\sigma_i^2 = \sigma_{I_i}^2 + \sum_{j=1}^{N_c} \sigma_{C_i^j}^2 \quad (1)$$

The covariance matrix element from the two channels i and k is expressed by:

$$cov(i,k) = \delta_{ik}\sigma_{I_i}\sigma_{I_k} + \sum_{j=1}^{N_c} \sigma_{C_i^j}\sigma_{C_k^j} \quad (2)$$

where:

$$\delta_{ik} = \begin{cases} 1 & \text{if } i = k \\ 0 & \text{if } i \neq k \end{cases} \quad (3)$$

The covariance matrix element can also be determined from the data:

$$cov_{Data}(i,k) = \frac{\sum_{n=1}^{N_{event}} (A_i(n) - \mu_{A_i})(A_k(n) - \mu_{A_k})}{N_{event}} \quad (4)$$

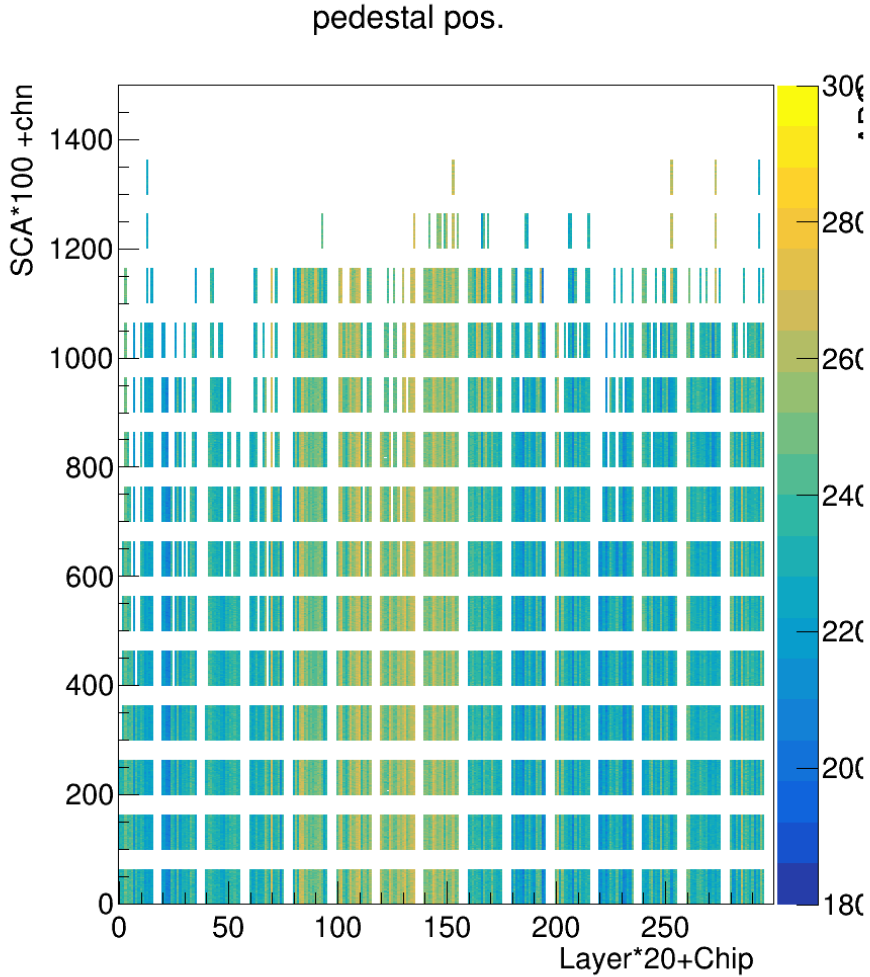
Measured amplitud if no hit

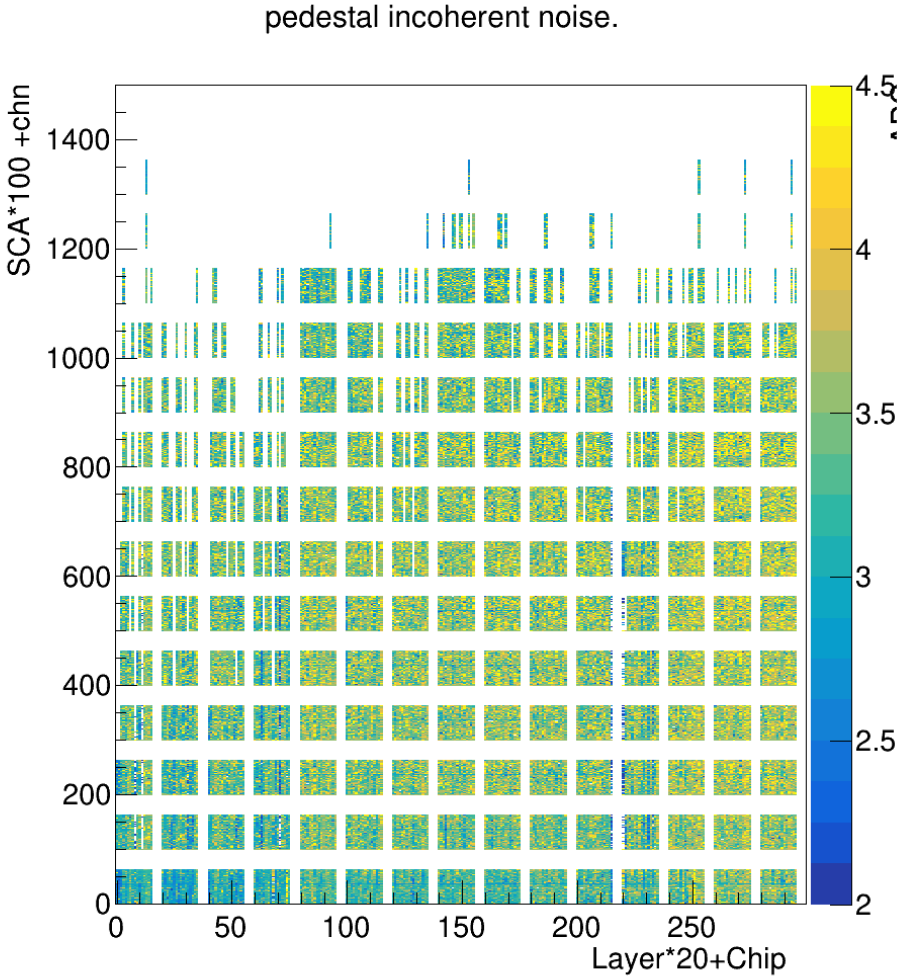
Pedestal position → calculated as simple histogram Mean

other approach: covariance matrix method

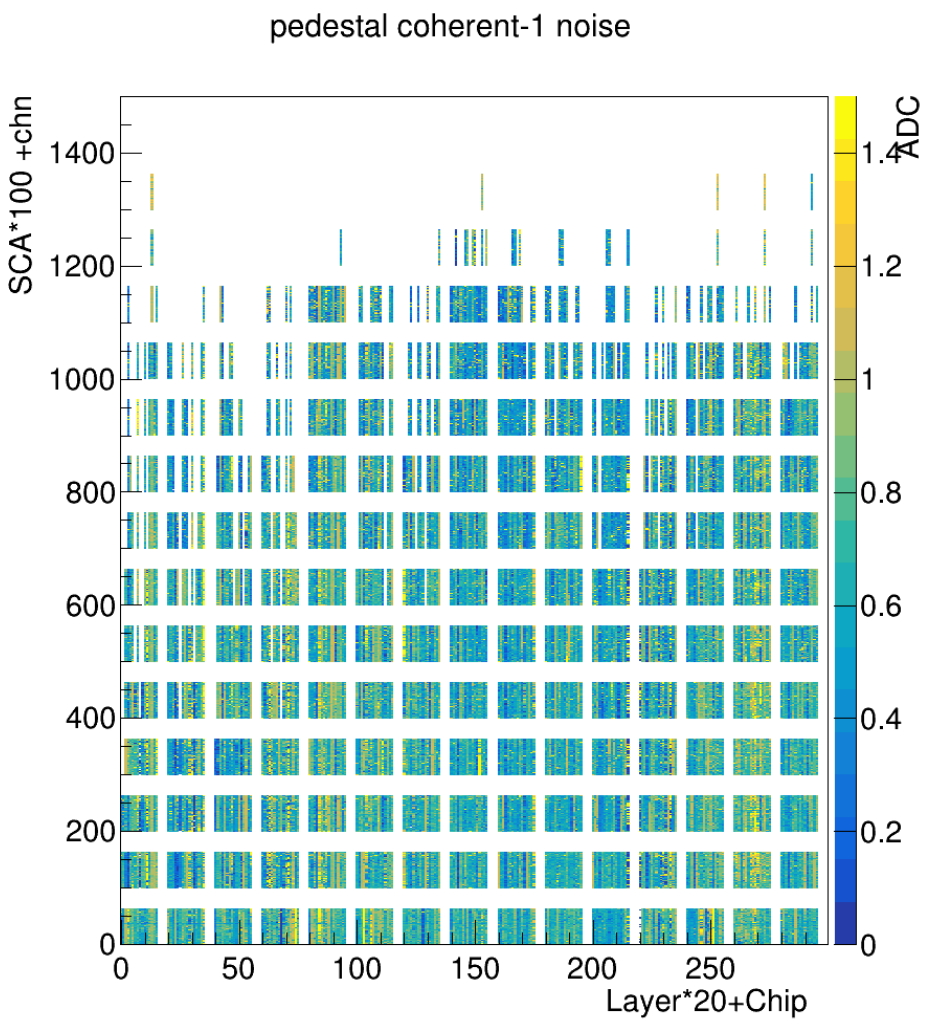
- We use the same selection as described in page 2
- The average pedestal is calculated on the fly
  - No gaussian fit is performed
- Following same recipe than in the CALICE note, we get the convergence with 2 coherent noises

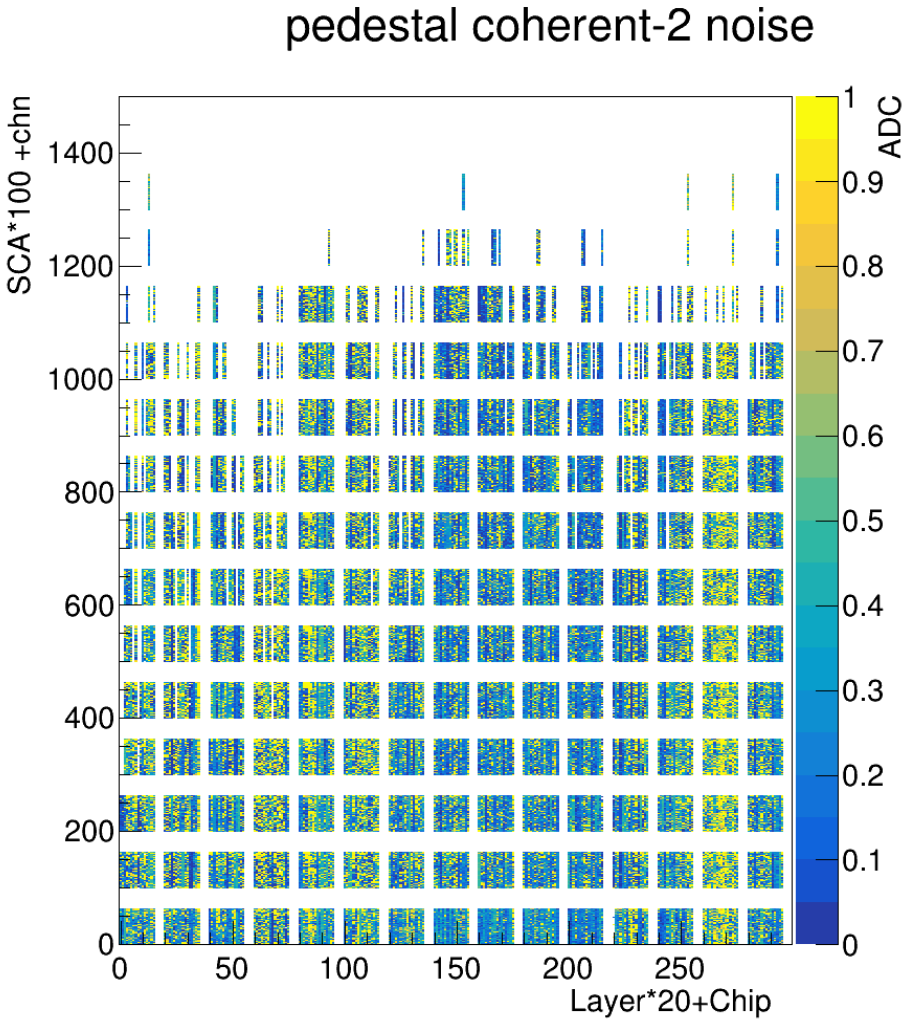
Pedestal position and incoherent noise



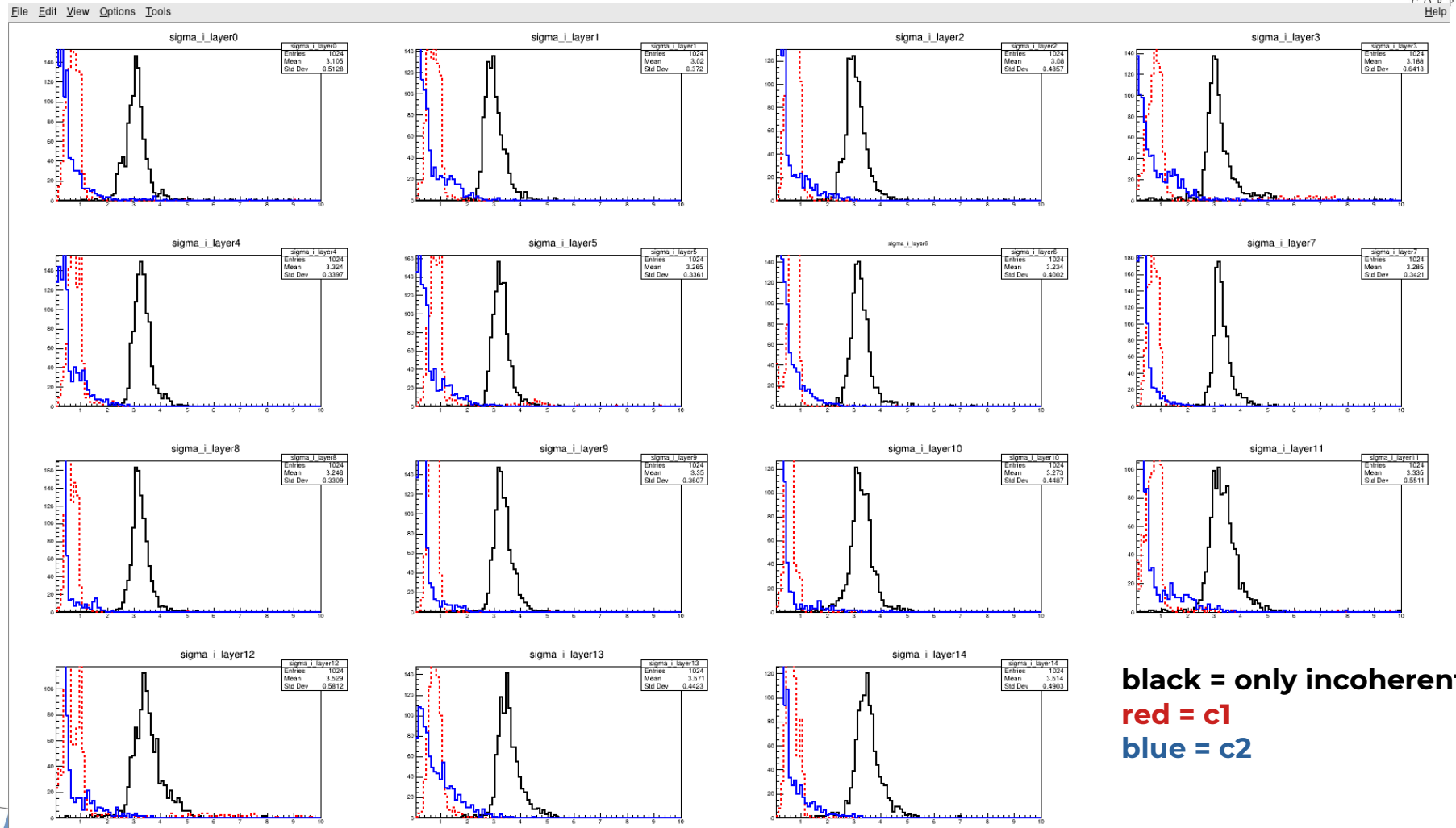


Coherent noises





Noises



black = only incoherent

red = c1

blue = c2

Distributions of widths per layer

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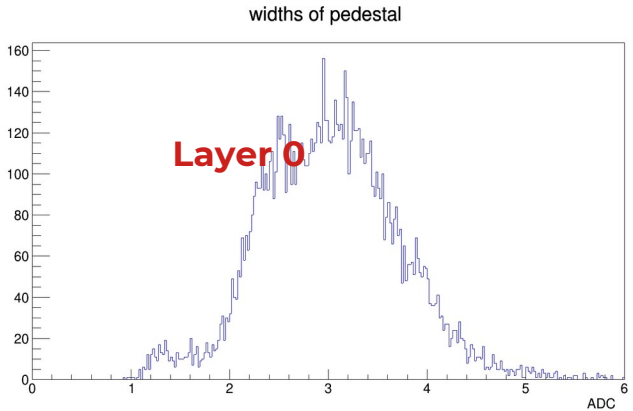
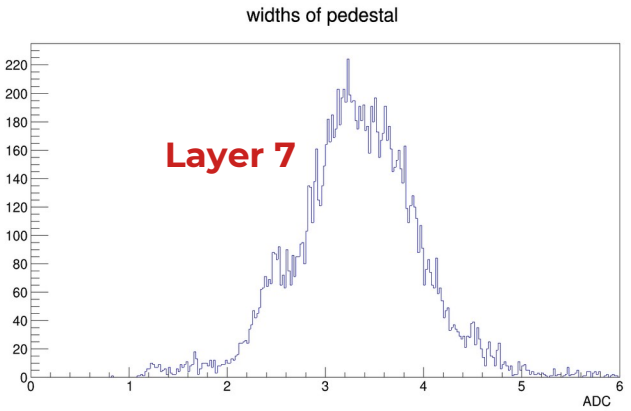
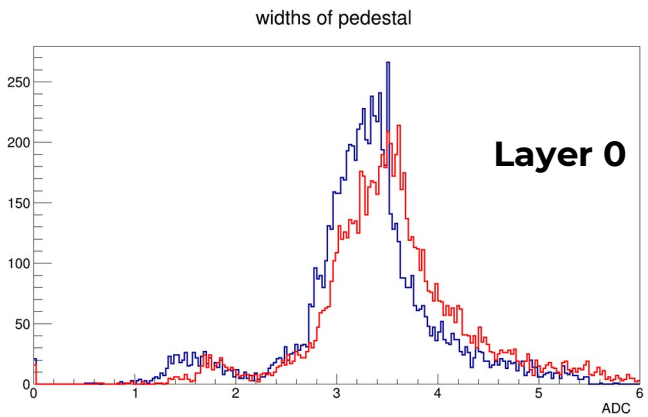
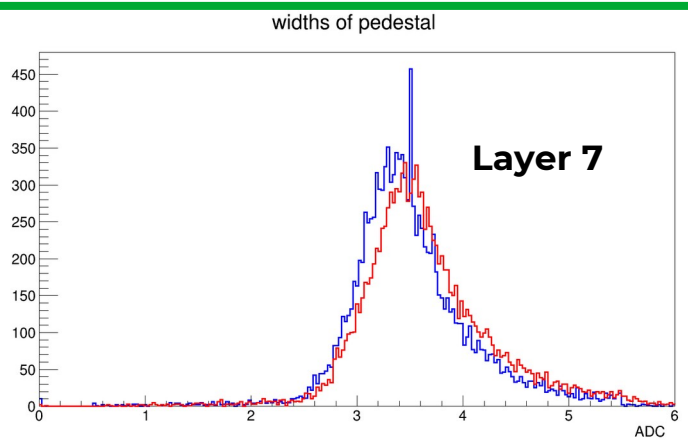
Traditional approach





covariance approach

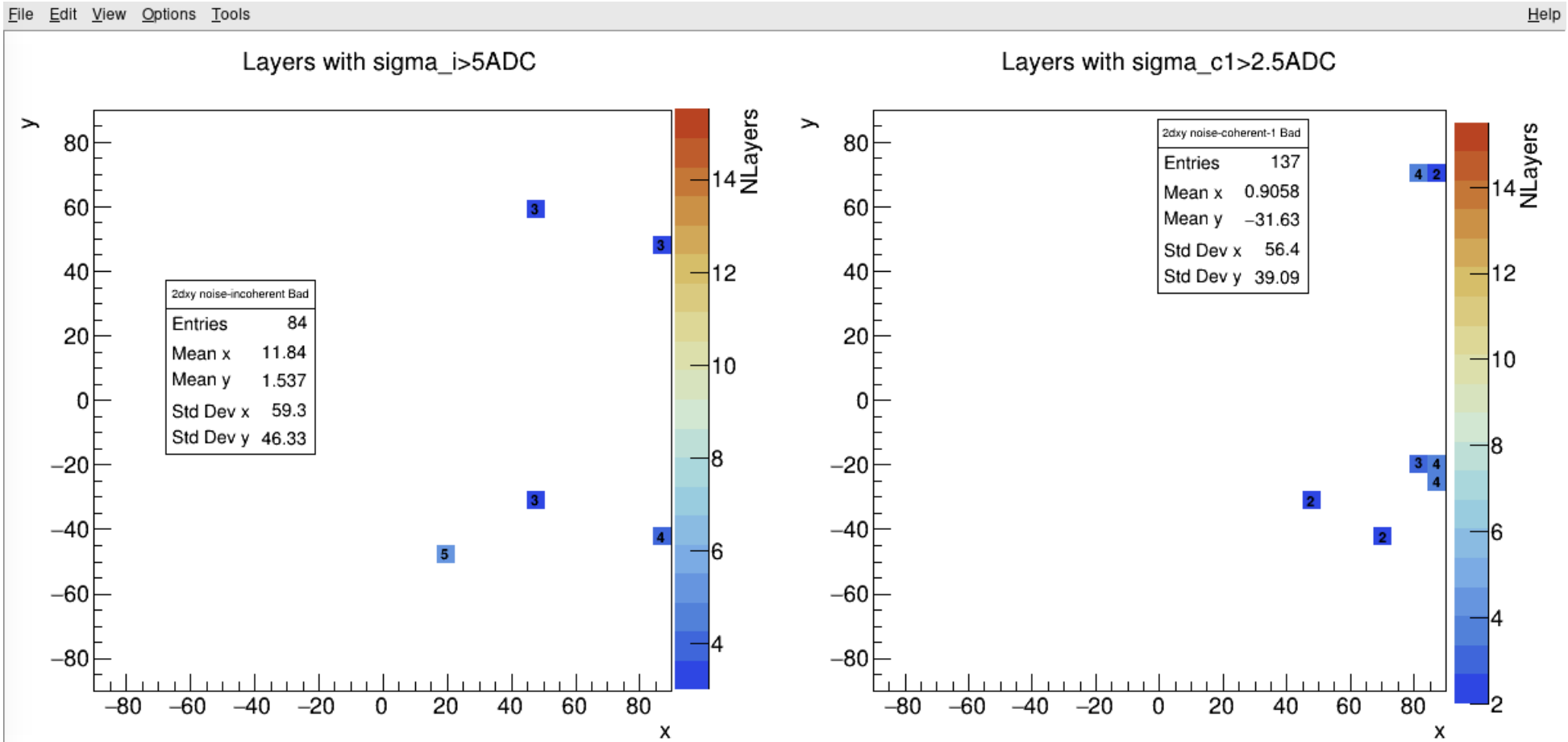




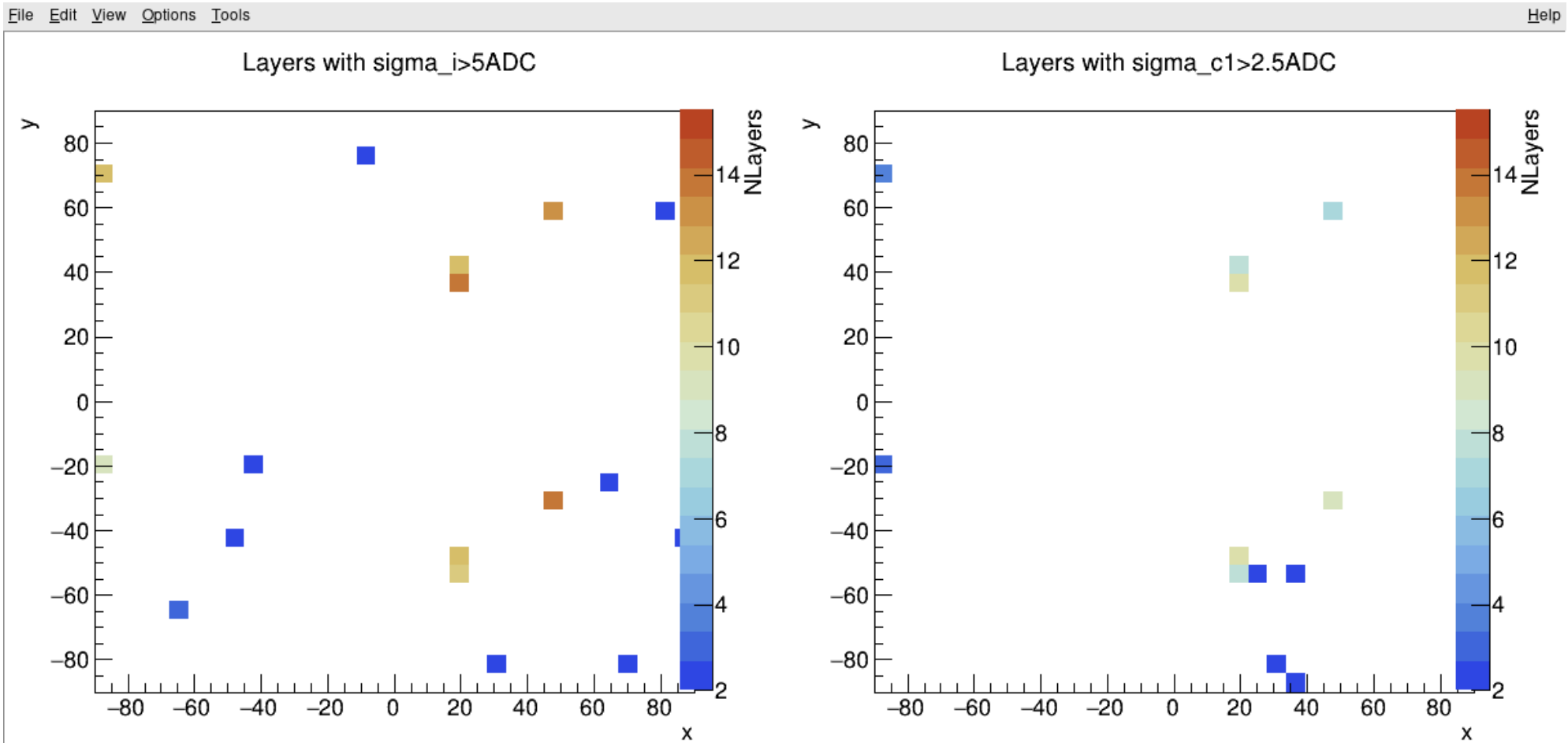
Blue = only incoherent

Red = sqrt(sigma_i²+sigma_c1²+sigma_c2²)

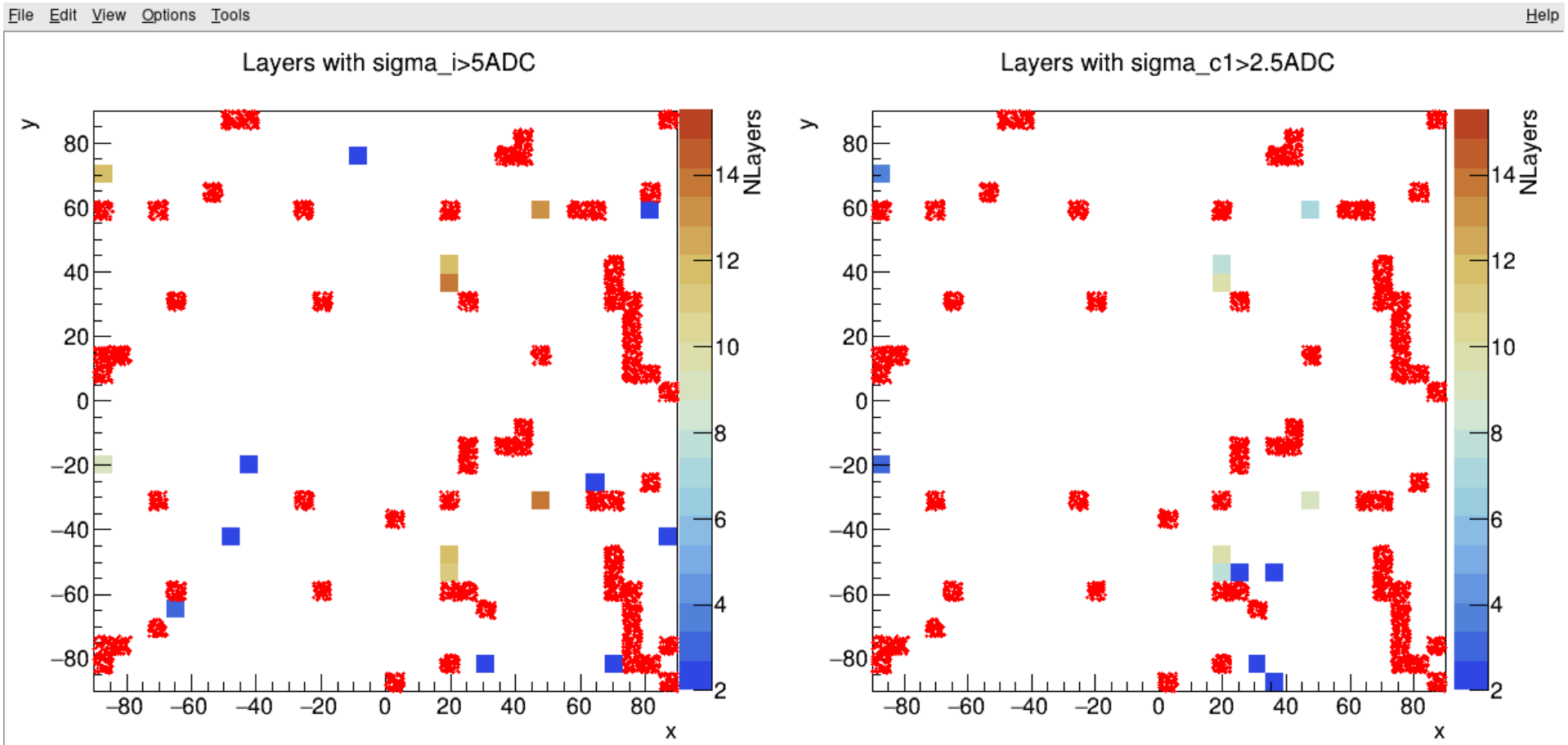
Noise “geometry” (SCA0)



Noise “geometry” (SCA1)



Noise “geometry” (SCA1) + default masking



To do

- Gradual optimization of the calibration
  - For example not being so much conservative in the selection (allowing sca=14, more than 1 hit etc, bcid+-2 ?)
- Repeat the MIP & S/N analysis using the new pedestal calculations
- Upload new calibration files to the eos
- Low vs High gain comparisons