SiW ECAL 2017 Beam Test Analysis meeting

- Data samples
- Pedestal, MIP, S/N single slabs
  - Two ways of determining the pedestals (data selection)
- Results for MIP scan
- Results for 43.6 degrees run
- Results for PCMAG runs

A. Irles, LLR, 3rd August 2017

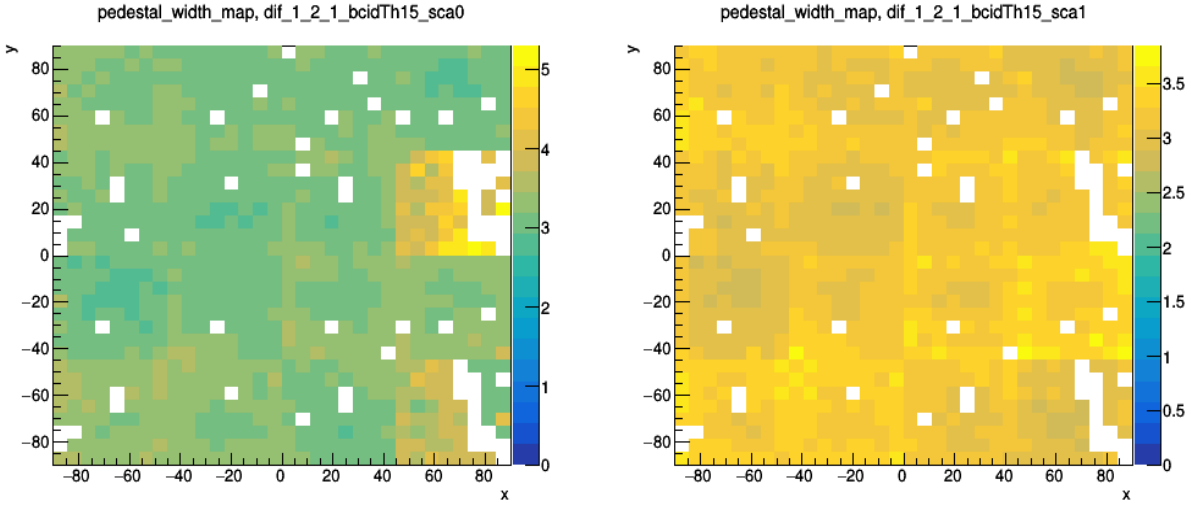
Data location

- https://cernbox.cern.ch/index.php/s/E8QfjrsuhU7wFdE
- /eos/user/a/airqui/TB2017/Tbdata/
  - MIPscan/rootfiles_bcidTh15 (dif_1_X_X.raw.root and grid by grid files)
  - MIPangle/rootfiles_bcidTh15 (dif_1_X_X.raw.root, no dif_1_1_1 in the run)
  - Magnet/XXT_YY_3GeV/date/run_Z_dif_1_1_1.raw.root (XX= magnetic field, YY=conditions,Z, run)
  - Tungsten/confX/gridY/dif_1_Z_Z.raw.root (X=1,2,3, Y=20,24)
- For scan, angle and Tungsten → create files with built events.

- Group space ?

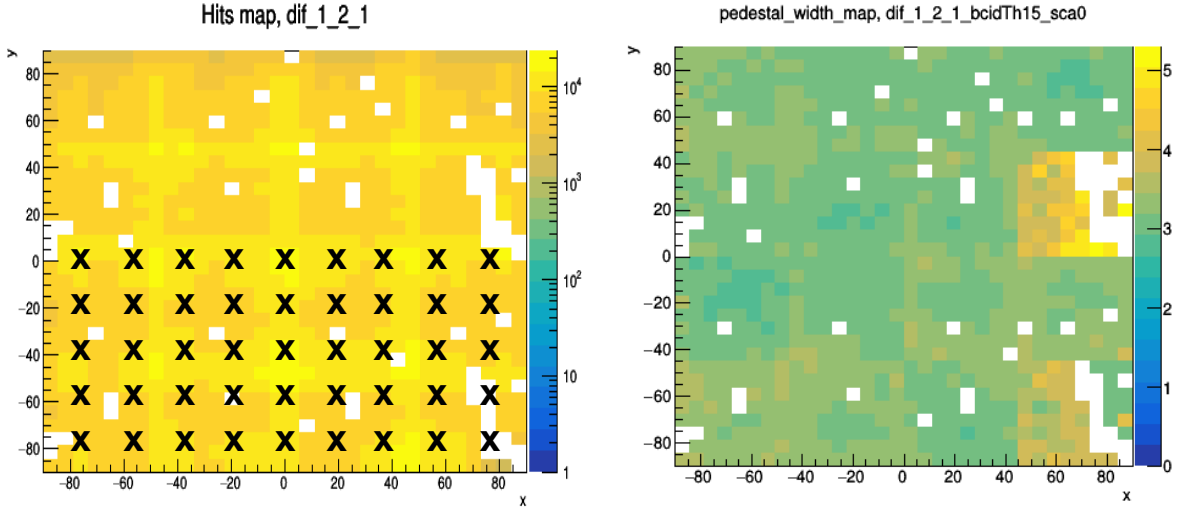
S/N correlation with nhits

- It is seen that we have different S/N (pedestal width) in some areas:
  - First guess: lower S/N in the areas where different runs had beamspot overlap, therefore, smaller S/N in areas where nhits is larger because of worst pedestal distributions



S/N correlation with nhits

- It is seen that we have different S/N (pedestal width) in some areas:
  - First guess: lower S/N in the areas where different runs had beamspot overlap, therefore, smaller S/N in areas where nhits is larger because of worst pedestal distributions
- Observing more carefully: it is not clear that the patters agrees with the beamspot overlaps
  - Second guess: are these areas physically different ? (border of the chips)

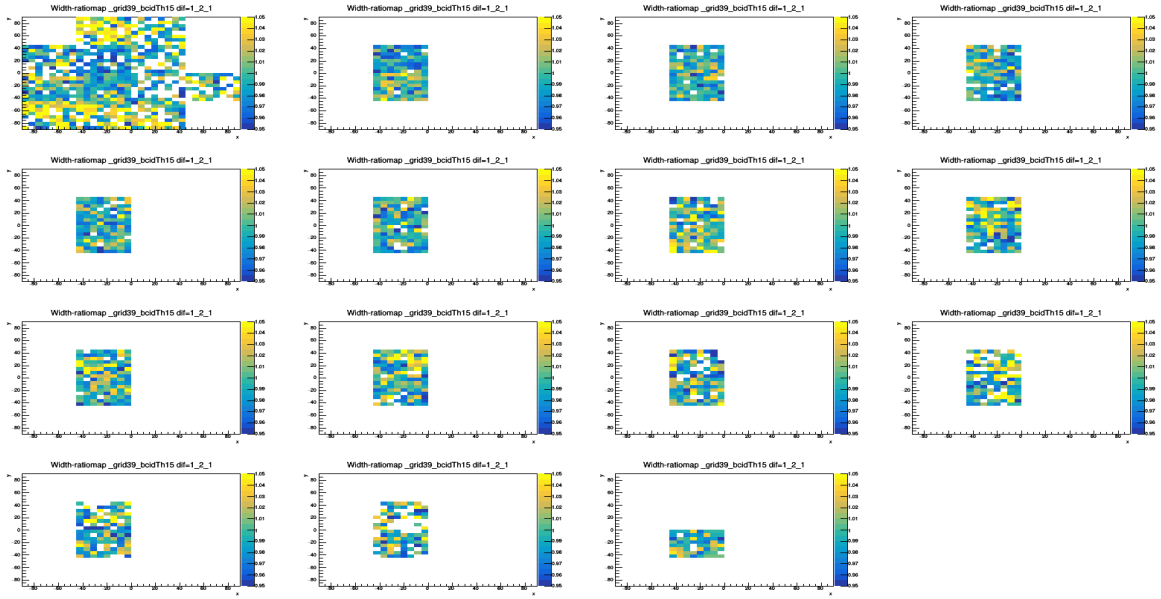


Pedestal calculation: two approaches

- Merge all MIPscan files (grid by grid)
  - Integrate all positions of the beam after a standard filtering
  - High stats, simpler analysis
  - But: Pedestals/hits far from the beam spot have larger chances to be "bad events" (simple noise , retriggers, etc) even after filtering (for low SCAs)→ widening of the pedestal distributions ?
- Calculate pedestals only in the beam spot and merge the results afterwards
  - One chip produces input for pedestal analysis at several grid points
  - 80 independent analysis done point by point, we only write down the pedestals of a channel > 13 SCAs are filled.
  - Duplicated information is logged → if duplicated pedestal info is given as input, the analysis considers only the one with smaller fit uncertainty.

Pedestal calculation: two approaches

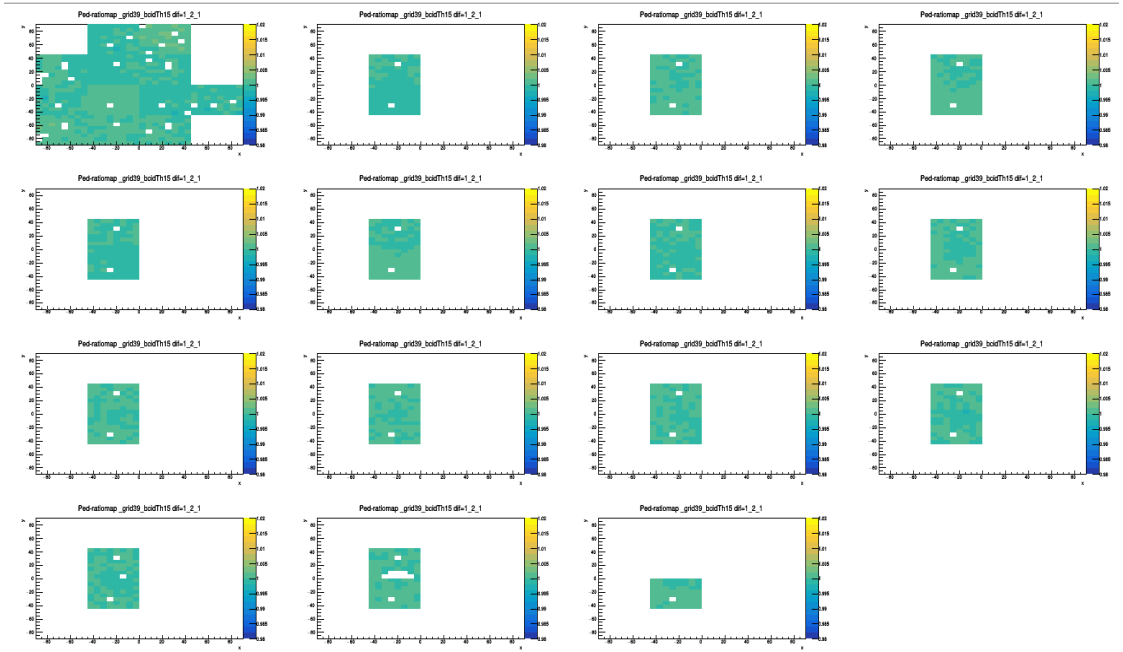
- Compare the pedestal width calculated for one single point with the pedestal calculated with all merged runs : approach 2 (only one grid point) / approach 1
  - Scale **0.95-1.05**
  - Each canvas = 1 sca
  - Most of yellows are only in SCA 0



- In principle, following approach 2 the pedestal for SCA 0 will be better estimated

Pedestal calculation: two approaches

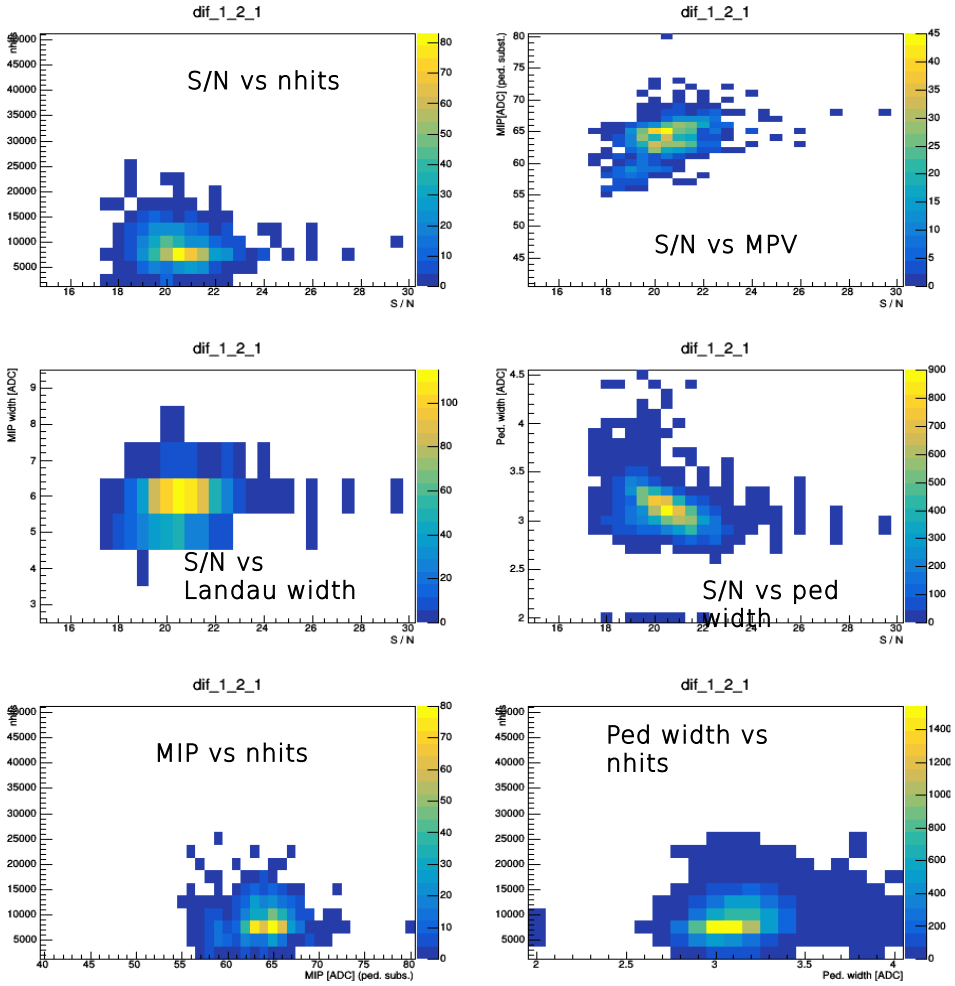
- Compare the pedestal mean calculated for one single point with the pedestal calculated with all merged rus : approach 2 (only one grid point) / approach 1
  - Scale 0.98-1.02



- Both approaches give exactly the same pedestal position.

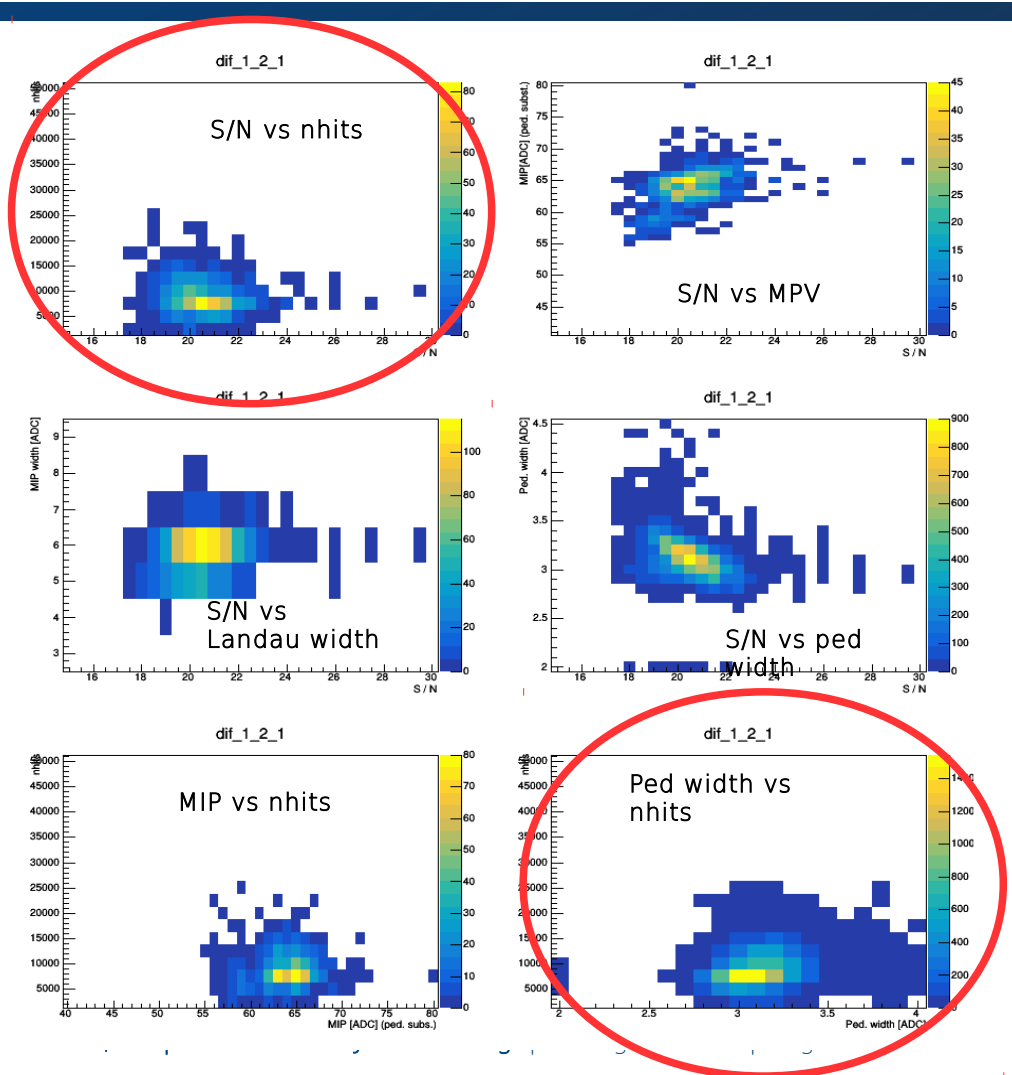
MIP, S/N, ped width & nhits correlation plots

- Approach 1



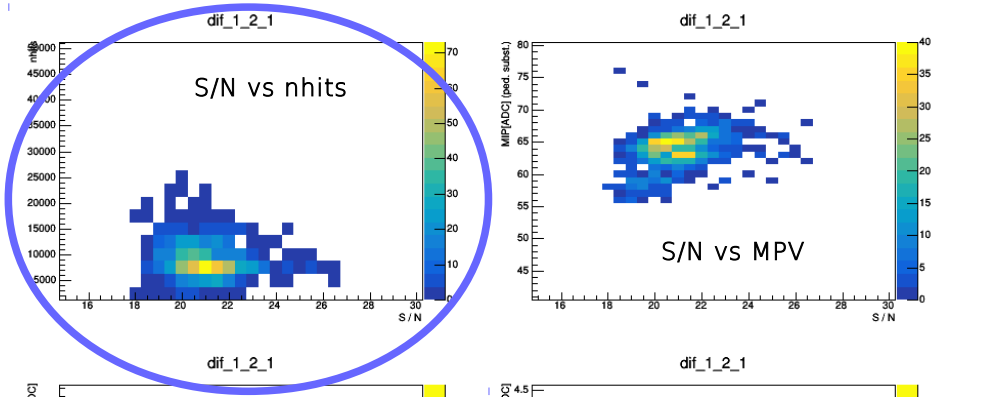
MIP, S/N, ped width & nhits correlation plots

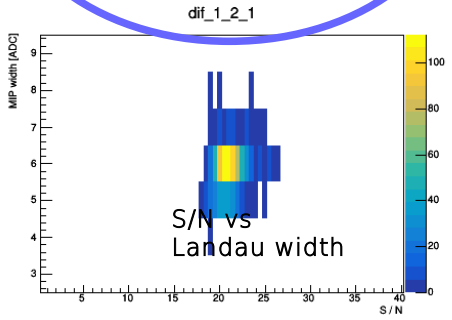
- Approach 1

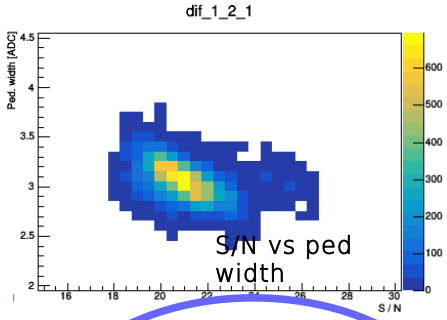


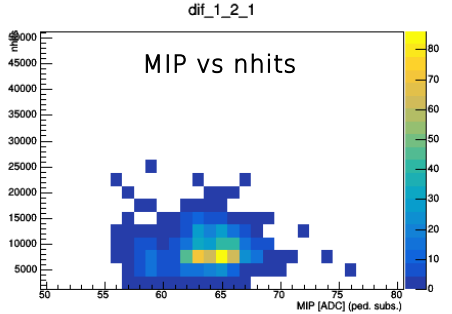
MIP, S/N, ped width & nhits correlation plots

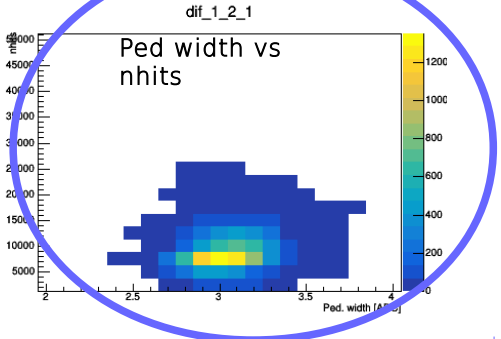
- Approach 2





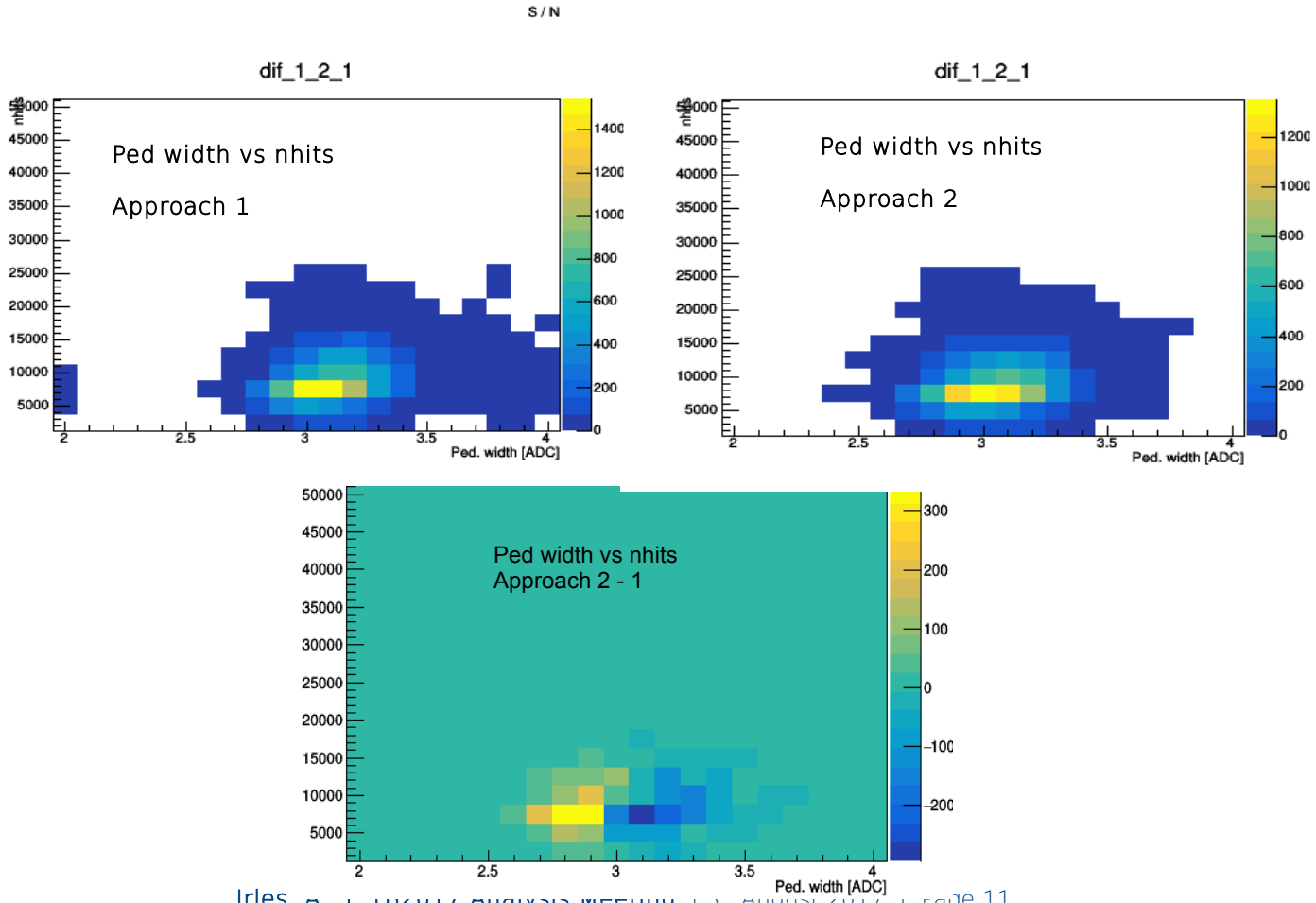




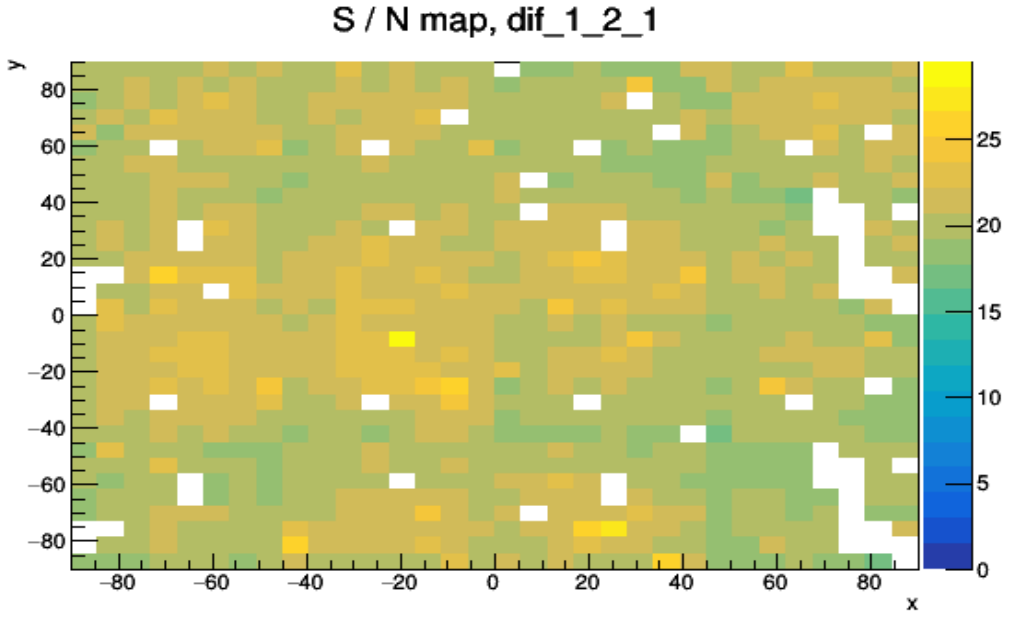


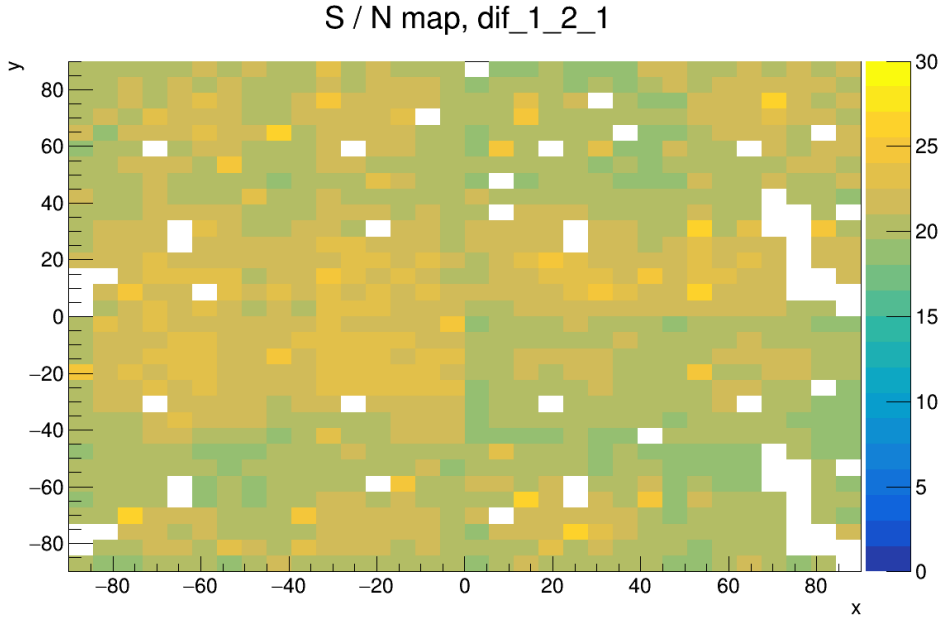
MIP, S/N, ped width & nhits correlation plots

- Comparison

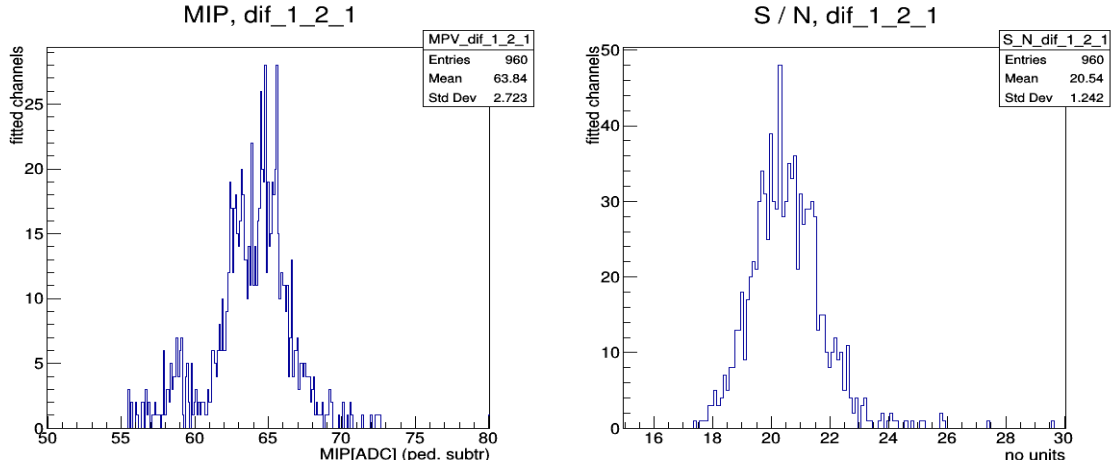


- Approach 1 (left) vs 2 (right)
  - Slight but not obvious improvement





- Approach 1 (up) vs 2 (down)

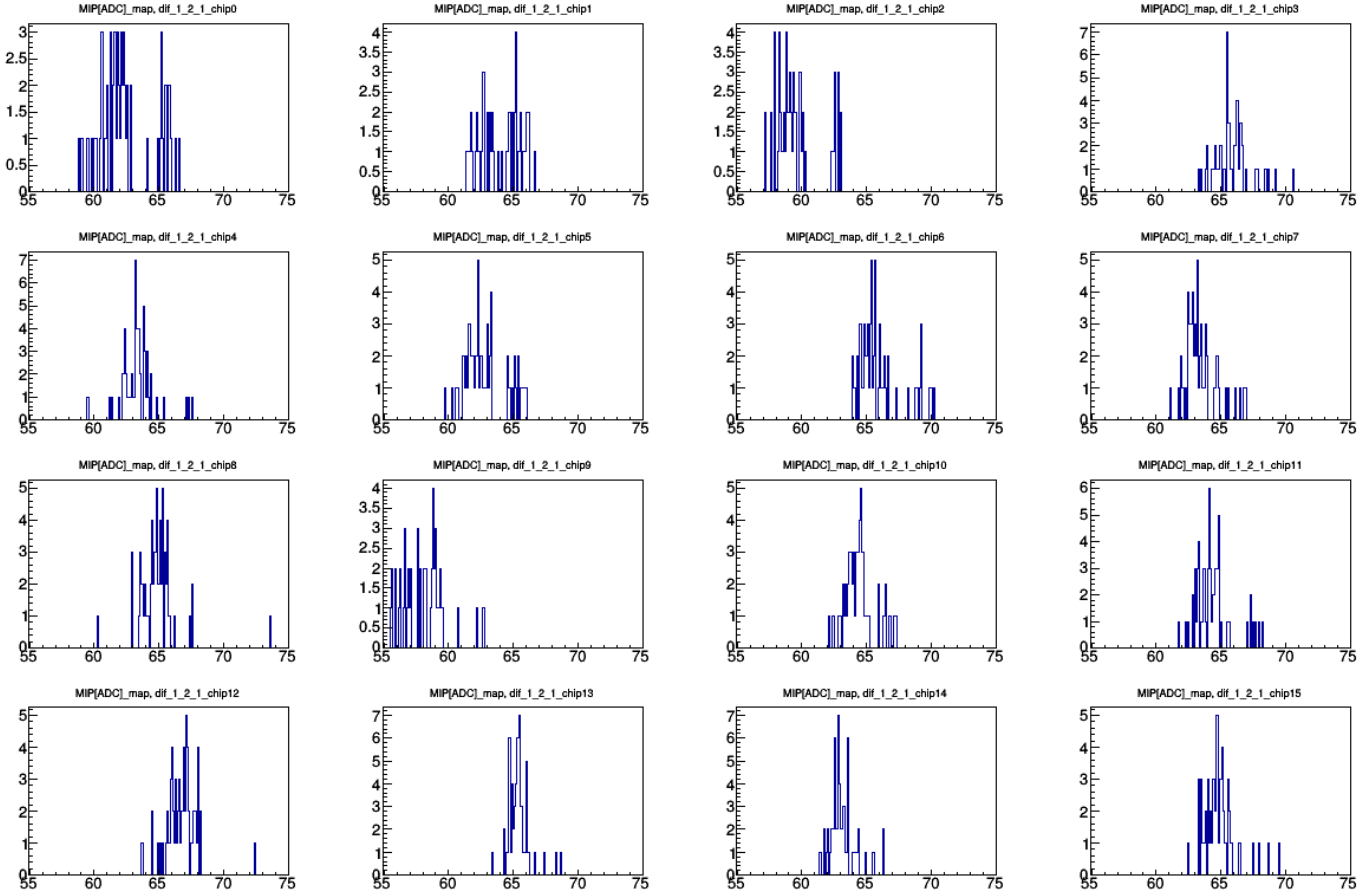


MIP, S/N, ped width & nhits correlation plots

- There is not apparent correlation between MIP (width/position) and the number of hits.
- But there is some correlation between the pedestal width and the nhits.
  - Approach 2 reduces a bit this effect → better selection and therefore construction of the pedestal distribution observable.
  - The pedestal position remains unchanged whatever is the approach followed.
- Not big changes in any case.

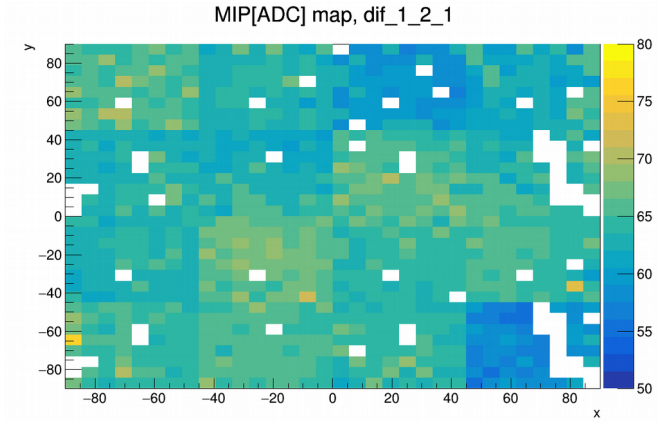
MIP scan results: dif_1_2_1

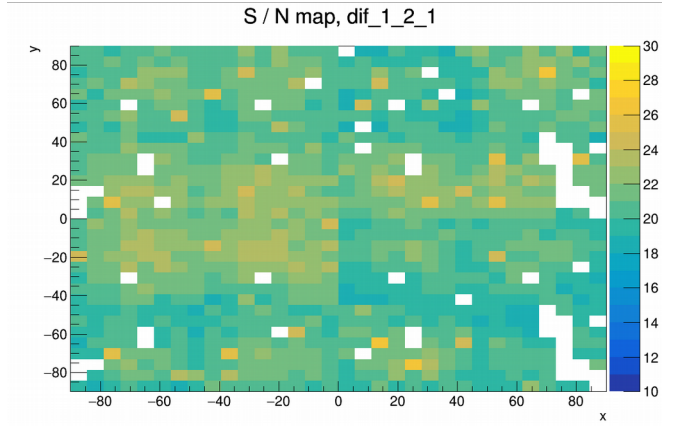
- MPV per chip (pedestal subtracted)

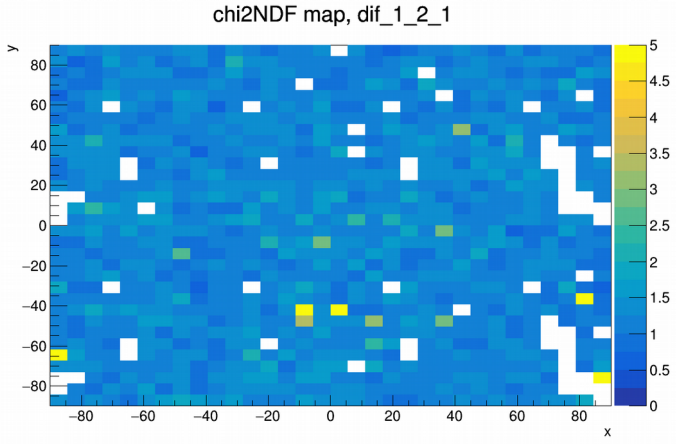


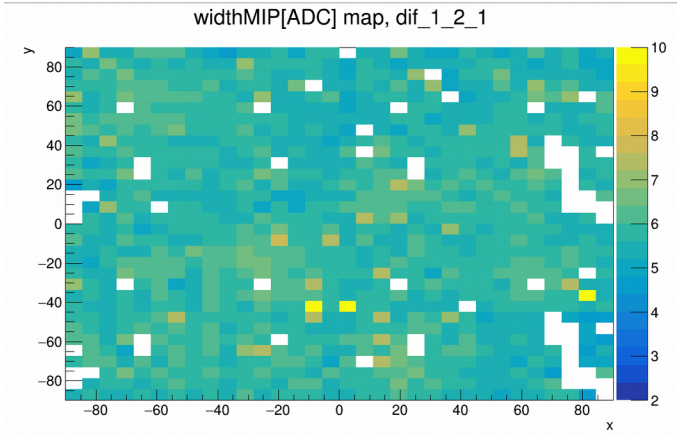
MIP scan results: dif_1_2_1

- Signal analysis maps (pedestal subtracted)

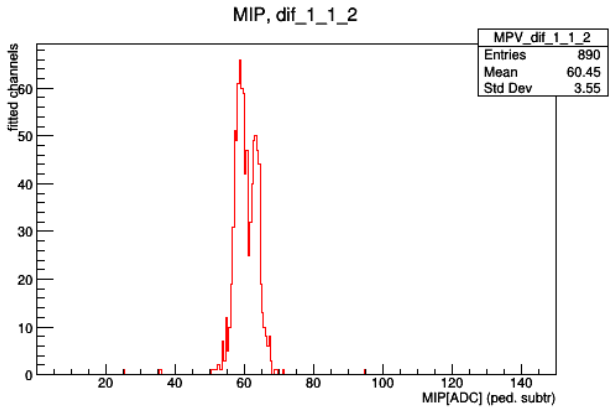


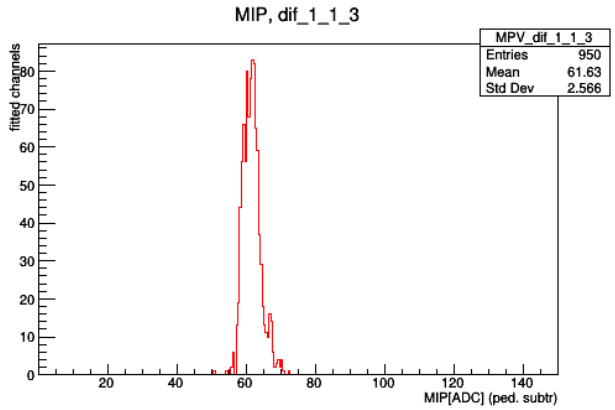


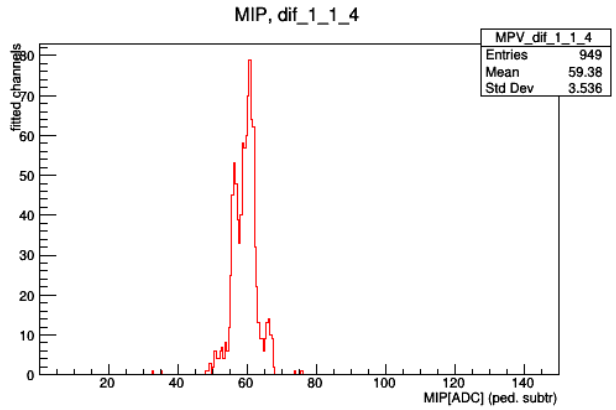


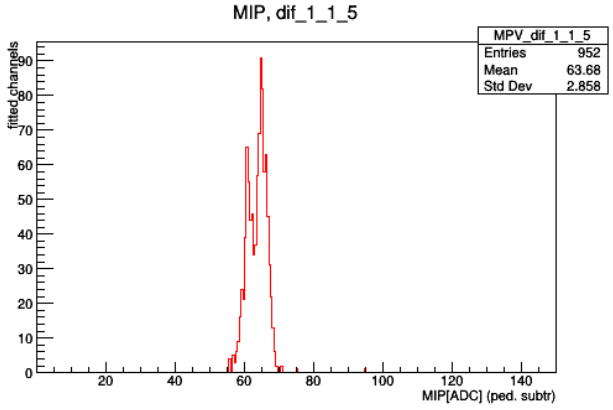


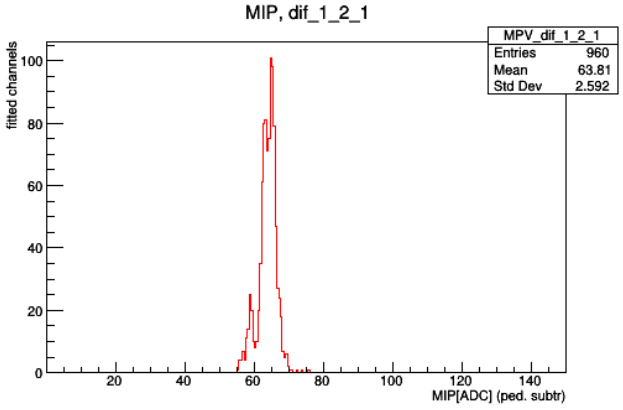
MIP scan results: summary I

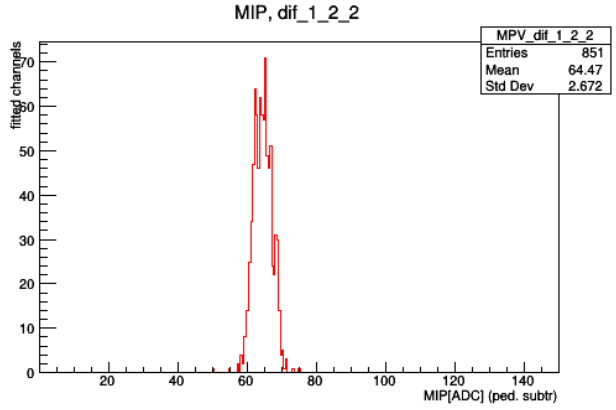






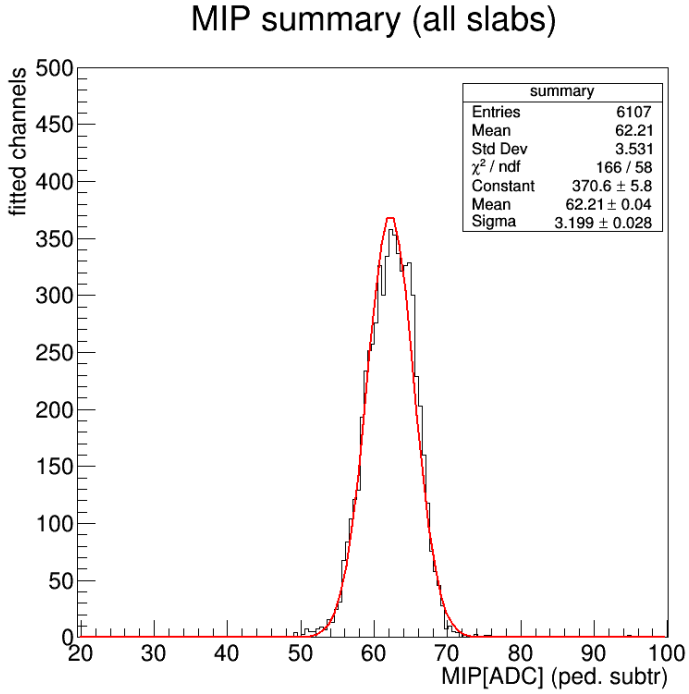


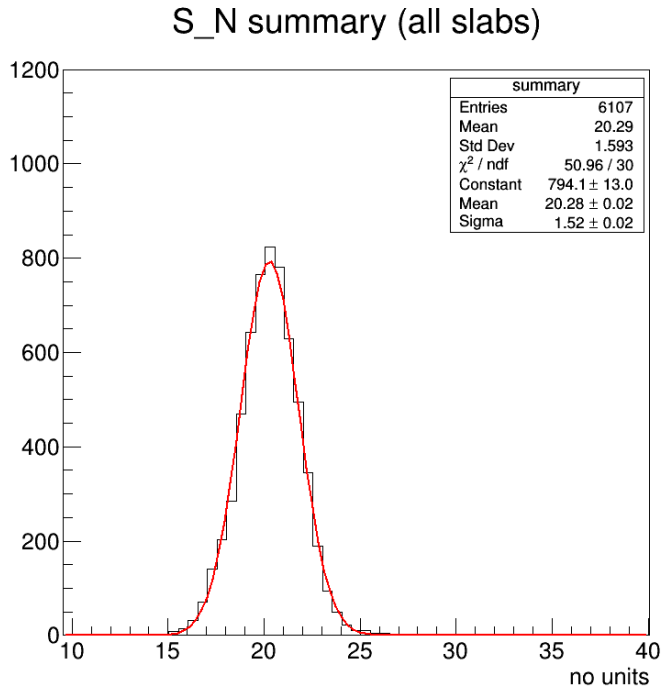




MIP scan results: summary I

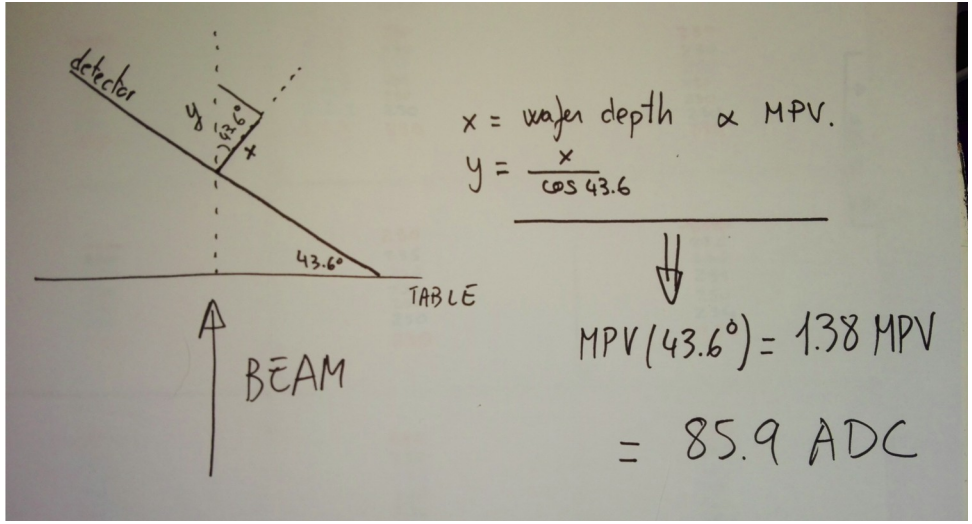
- Ignoring the broken wafer, we fit the 88.3% of channels
- MPV = 62.2 ADC, sigma= 3.2 ADC (dispersion of 5.1 %)
- S/N = 20.3, sigma = 1.52
- Not really good gaussian fit : inhomogeneities

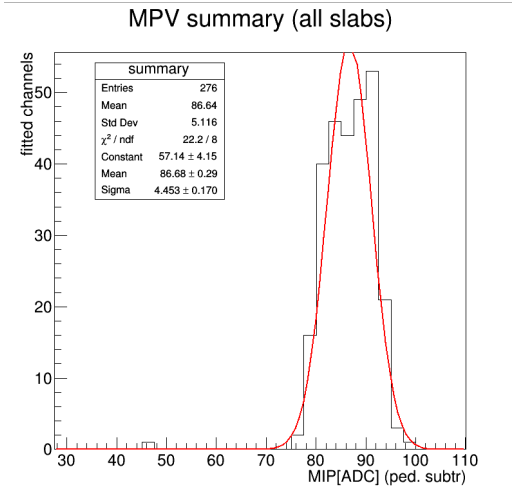


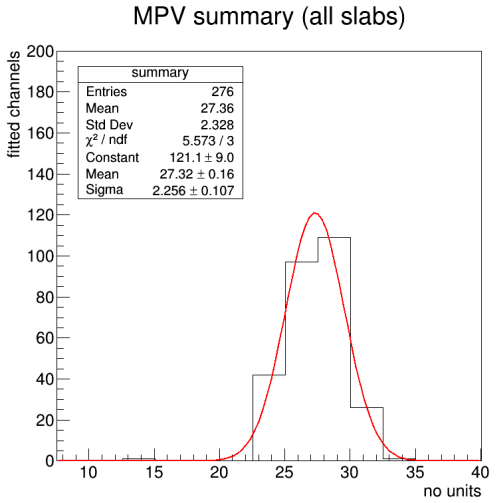


MIP electrons shooted at 43.6degrees

- Detector tilted by 43.6 degrees, only one position shooted by the beam.
- Better fit quality.
- The MIP is where expected: 86.7 ADC

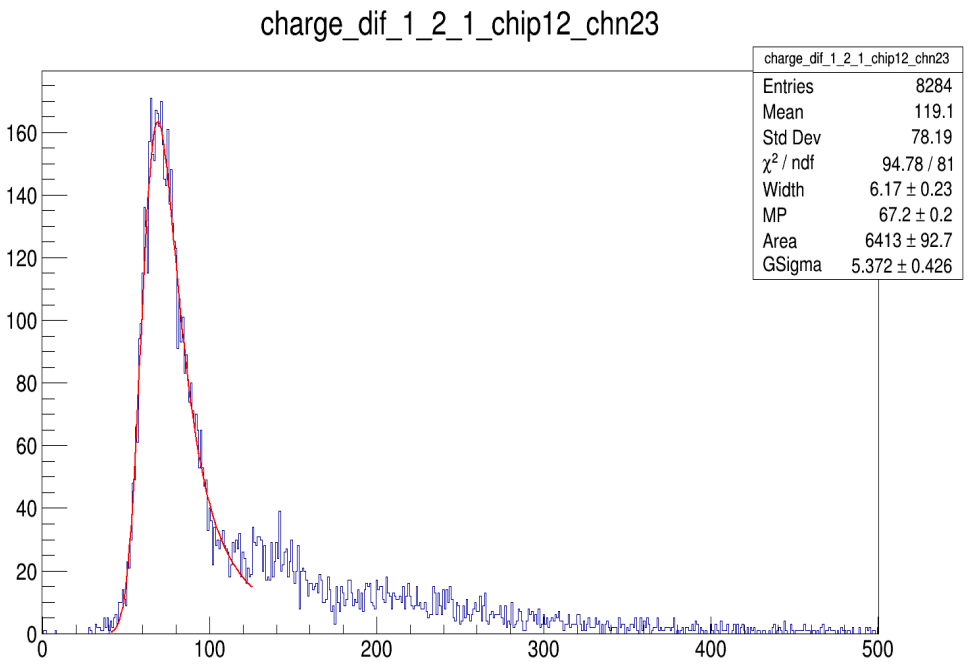


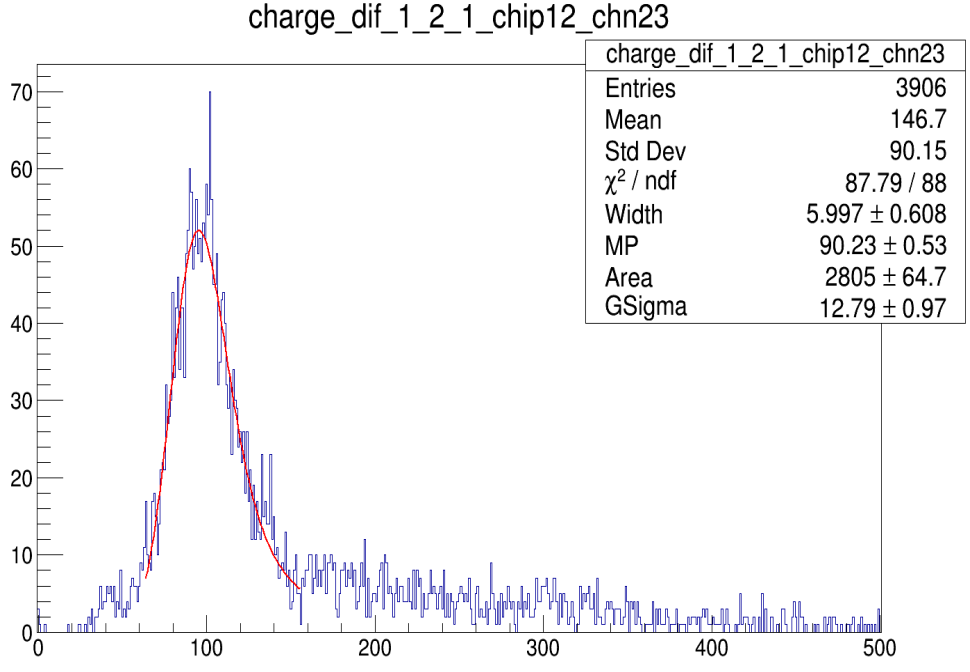




MIP electrons shooted at 43.6degrees

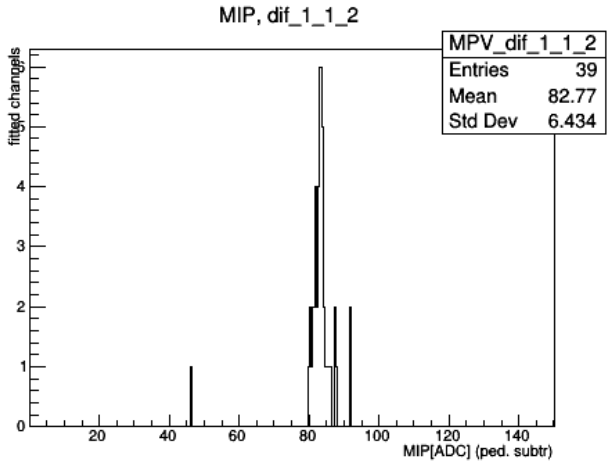
- Perpendicular beam (left) vs angled (right)

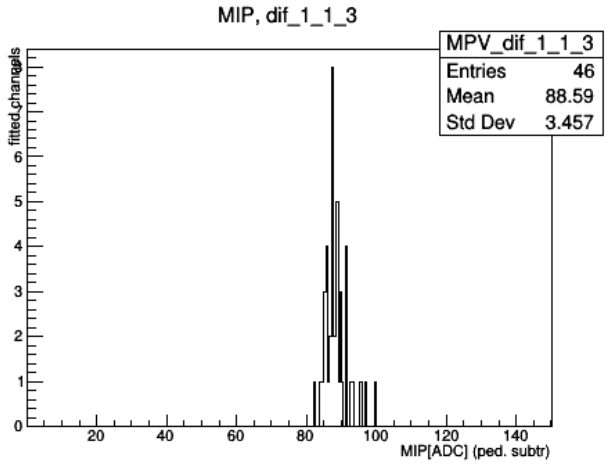


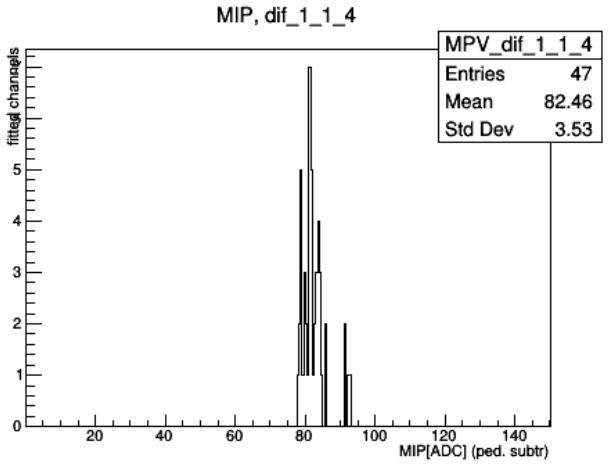


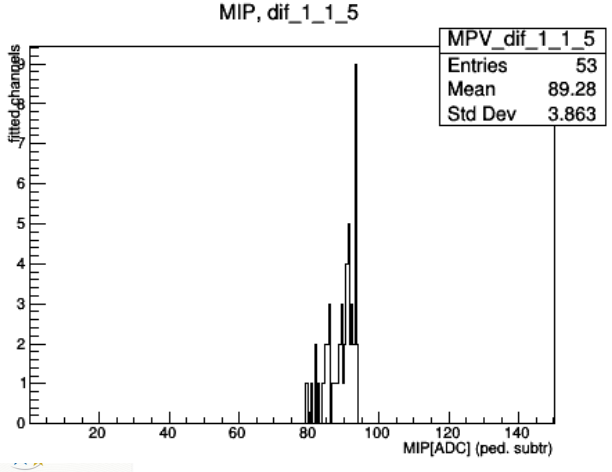
- MIPs are well reconstructed at both configurations → reasonable thresholds

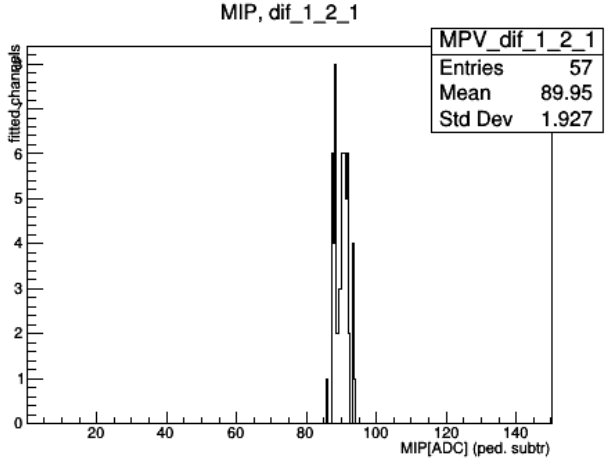
MIP electrons shooted at 43.6degrees

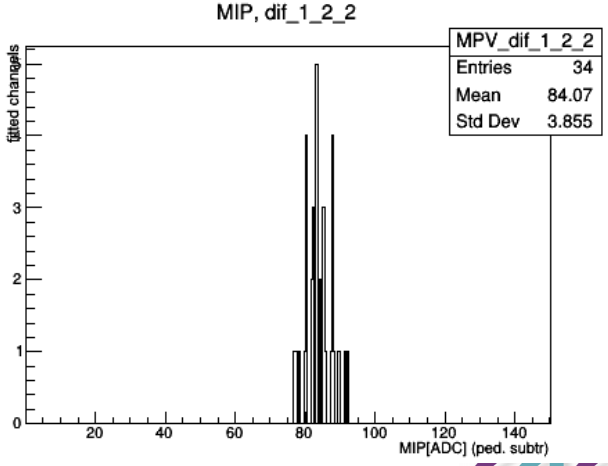










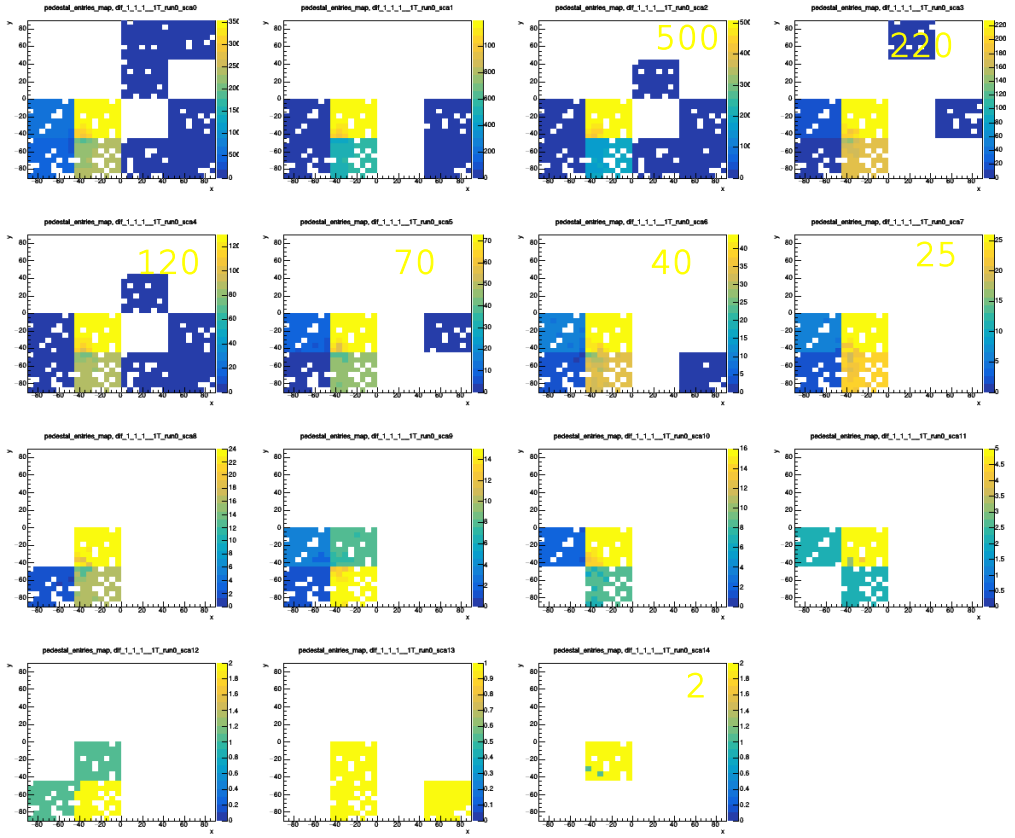


MIP electrons shooted at 43.6degrees

- Conlcusion:
  - Seems that we had a good threshold setup :)
- To do: correlation plot (channel wise) between MPV at 90 and 43.6 degees

MIP electrons in magnetic field

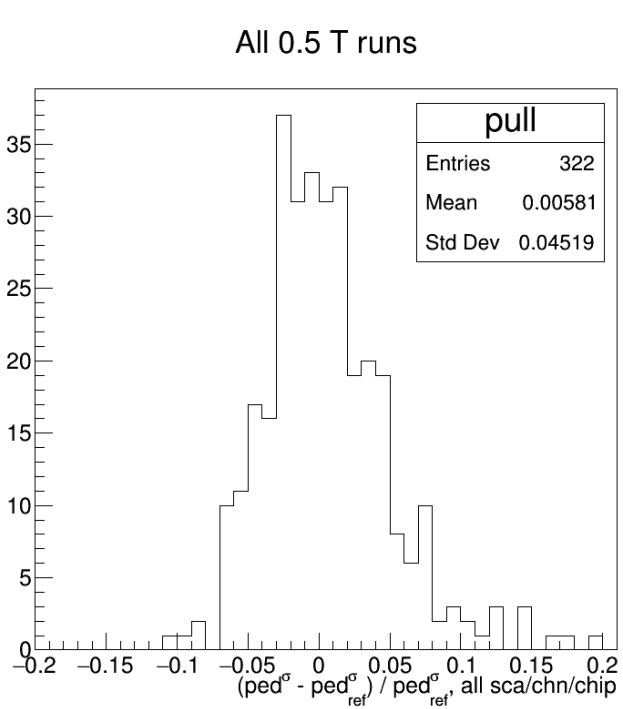
- Slab 21, (dif_1_1_1)
  - 1 run of reference at 0T
  - 13 runs at 1 T
  - 3 runs at 0.5 T
  - Another run at 0T
- Lower occupancy:
  - lower rates due to spread of beam and second collimator between 24 & 24/1
  - More silent configuration ?
- Analysis approach: calculate pedestals and MIPS on the fly.
  - Only few SCAs available for MIP/pedestal analysis

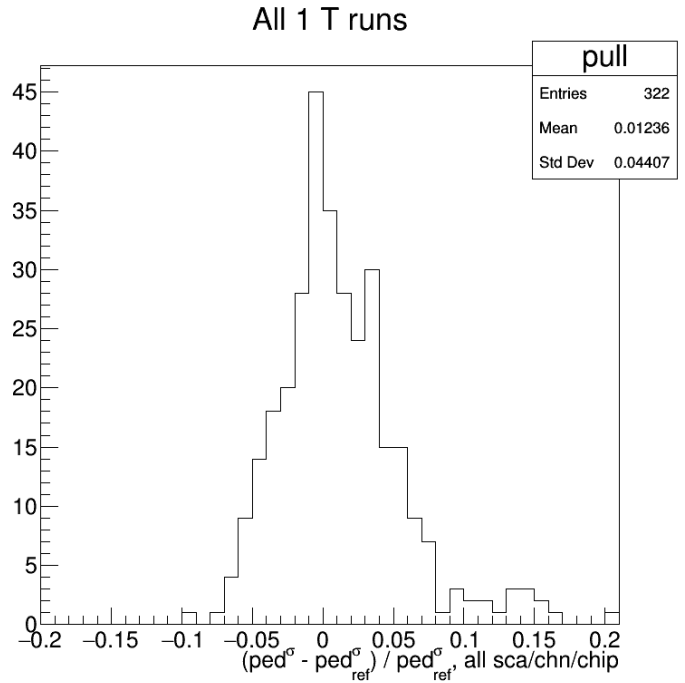


- 15 Maps (one per each SCA) of number of entries in pedestal histogram. In yellow, the maximum scale.

MIP electrons in magnetic field

- Analysis approach: calculate pedestals and MIPS on the fly.
- But first: check pedestal stability comparing the values with the reference run.
  - Compare pedestal mean and pedestal width using "pull-like distributions"

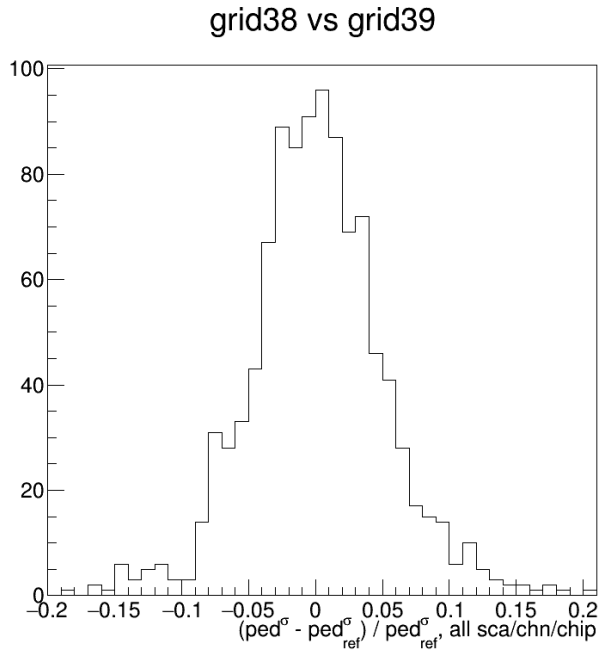




MIP electrons in magnetic field

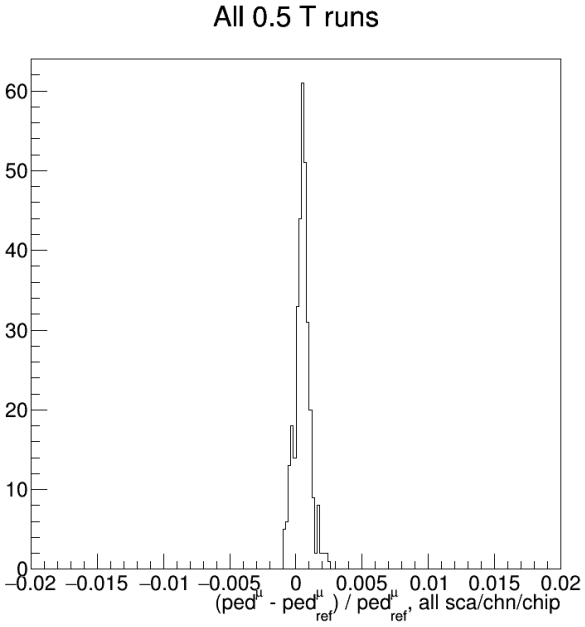
- Analysis approach: calculate pedestals and MIPS on the fly.
- But first: check pedestal stability comparing the values with the reference run.
  - Compare pedestal mean and pedestal width using "pull-like distributions"

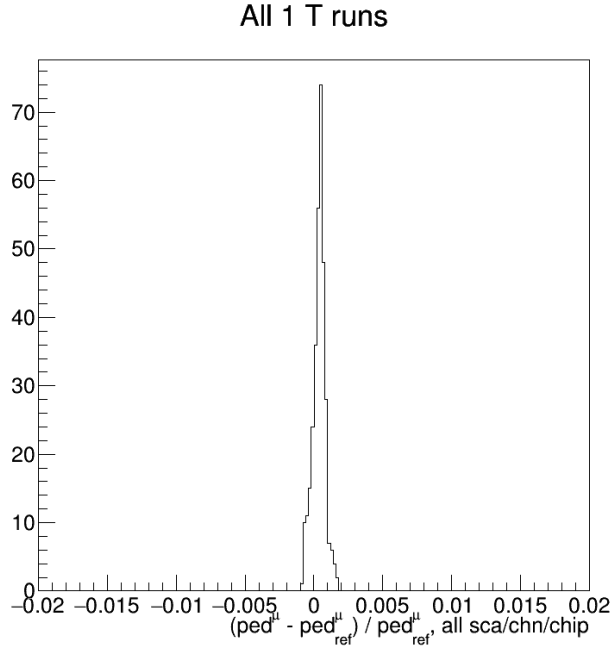
- The width spread is common also for "standard" runs



MIP electrons in magnetic field

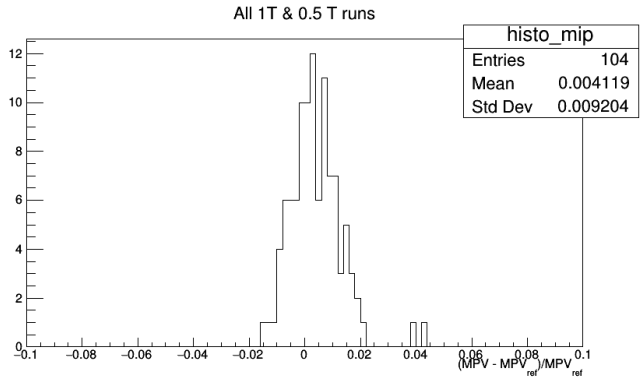
- The pedestal mean remains constant for all data taking period inside the magnet

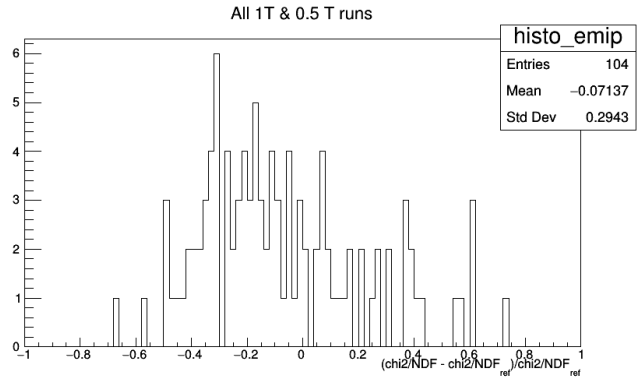


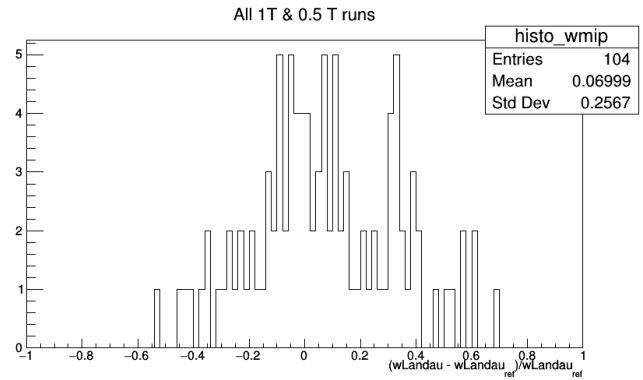


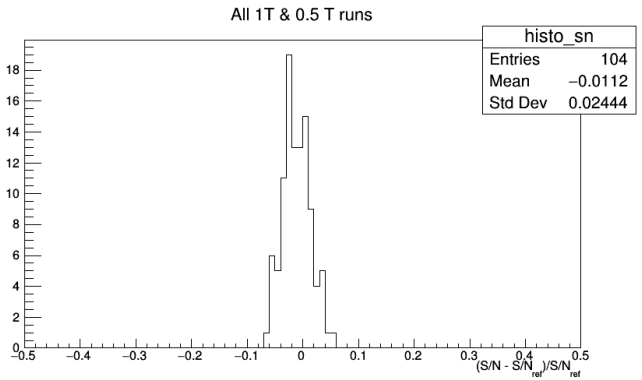
MIP electrons in magnetic field

- Quality of signal (all runs included, run by run), compared with previous MIPscan data for the same DIF
- Relative change of:
  - 1: MPV
  - 2: chi2/NDF
  - 3: landau width
  - 4: S/N

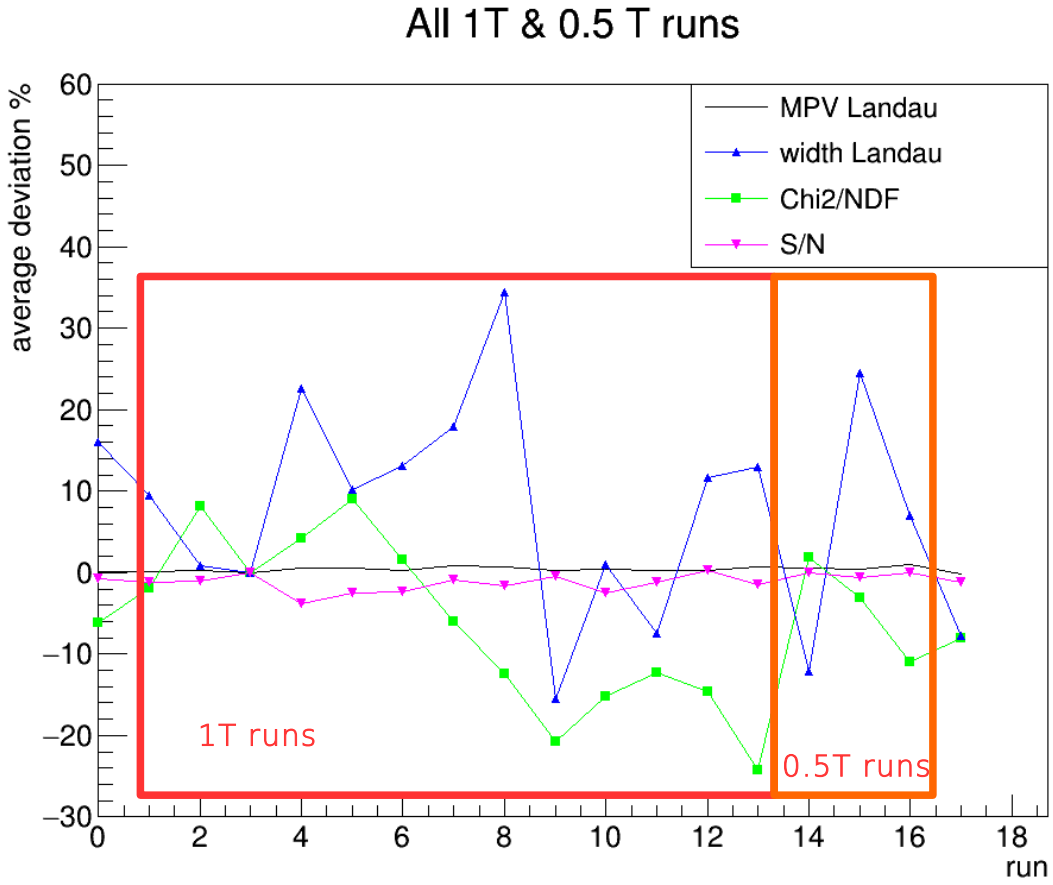




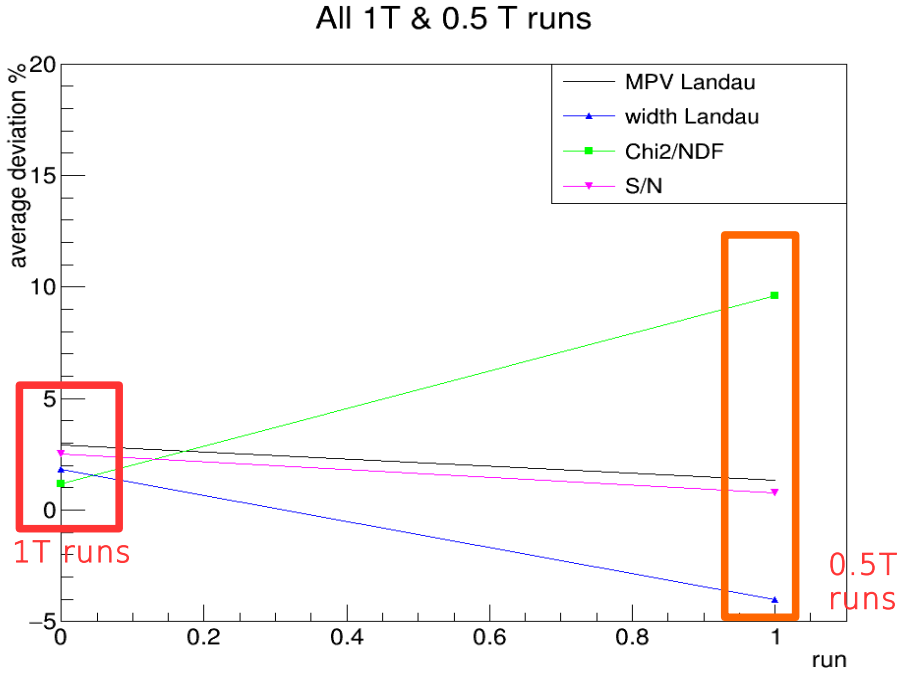


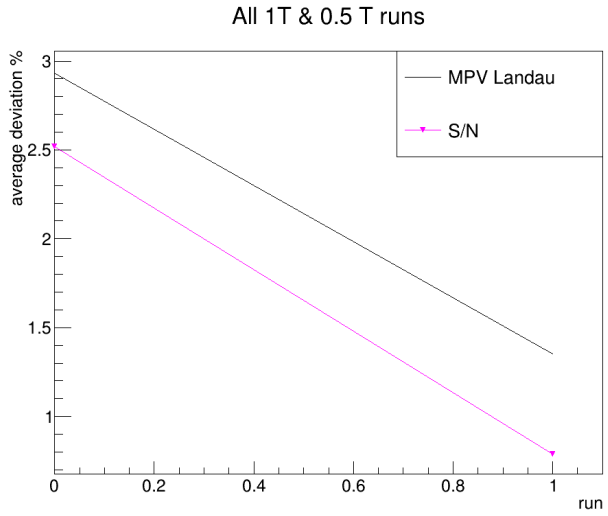


- Same, but averaging the distributions run per run.



- Same, but now merging files:
  - Linear increase of S/N and MPV under magnetic field ? Due to curvature (angle of incidence) ?
  - 1.029 xMPV means and incident angle of 13.6 degrees (need to find my EM books !!)





Summary

- Single slab analysis is finished:
  - Polish style, find summary plots etc
  - Absolute numbers: filtered events, rates, etc