SiW ECAL 2017 Beam Test preliminary results:

> Pedestal position monitoring in e.m. events

Analysis BT2017 working group

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Pedestal monitoring in e.m. shower events

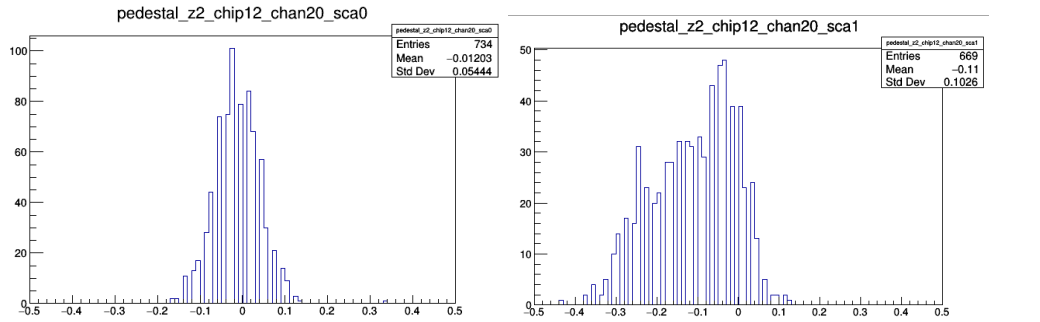
Pedestal study

- We study data files from the Tungsten program. For simplicity, we use the second configuration files.
- We use “reconstructed” data files:
  - Pedestals calculated from calibration data are subtracted.
  - MIP calibration is applied.
- We recalculate the pedestals for selected events:
  - At least 6 slabs with hits with E>0.5 MIP and bcid< 2850.
  - With these events, we recalculate the pedestal (should be near 0) for all channels and SCA with enough statistics (at least 50 entries)

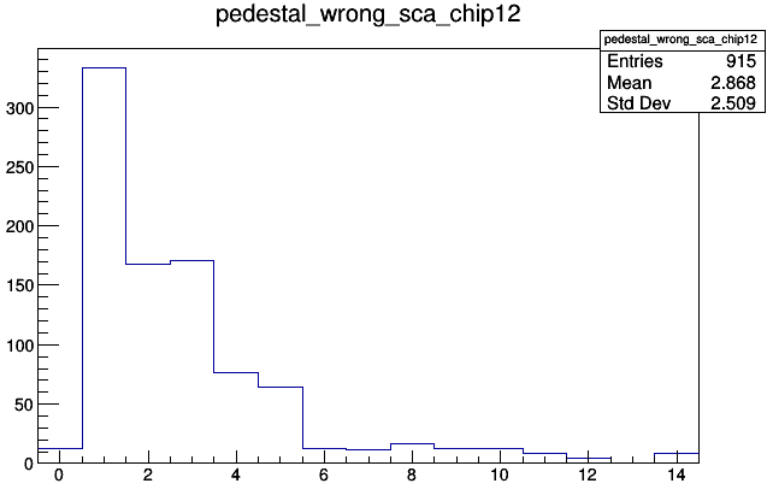
    Not fit to gauss, only using Mean and RMS of the histogram.
- Then we apply the new values to the data → “resubtraction”. All deviations of pedestals will, therefore, measured in MIP units.
  - If not pedestal is recalculated, we use the calculated in the original calibration run.

Pedestal recalculation for chips in the beam spot

- Conf2, 4 GeV electrons, beam hits chips 12-15. I look at chip 12. All chips located far from the beam spot have no change in the pedestal.



Distribution of the SCAs were the pedestal recalculated differs from the original in > |5|% MIPs

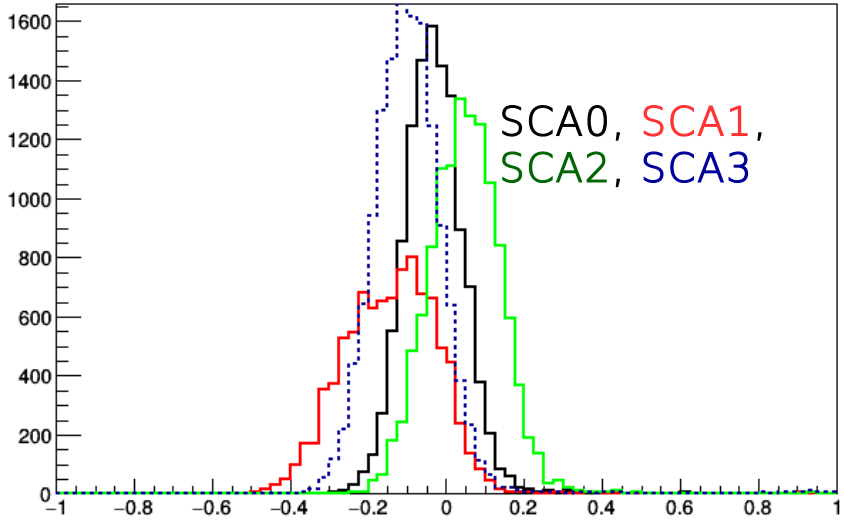


- The effect is large in SCA1,2,3 and gradually decreases. SCA0 looks perfect.

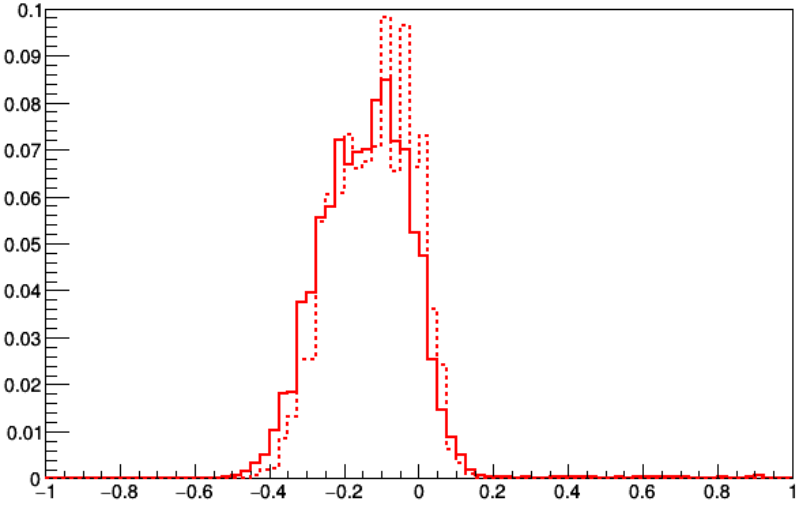
Pedestal recalculation for chips in the beam spot

- Conf2, 4 GeV electrons, beam hits chips 12-15. Pedestal shift related to the distance to the triggered channel? → no

Pedestal distribution for all channels (chip 12-15), when the closest triggered channel is in a neighbor channel

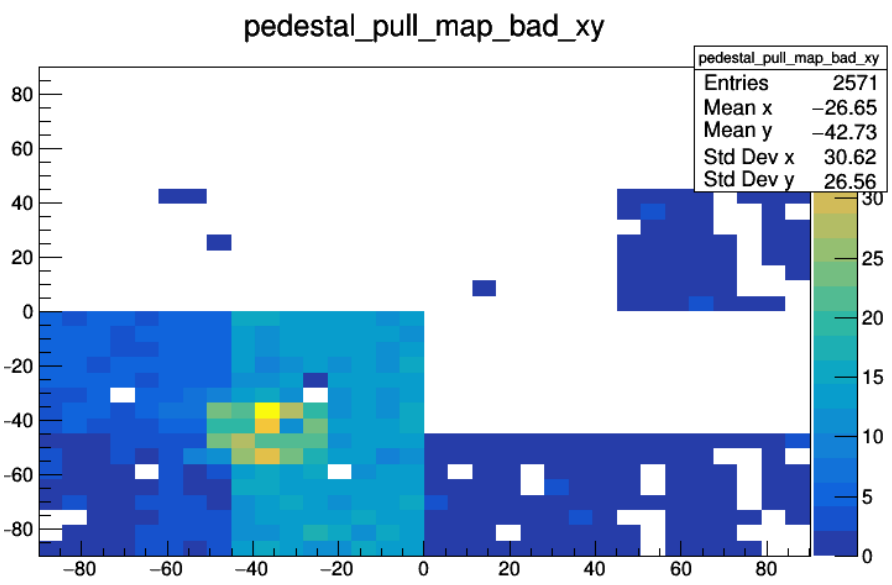


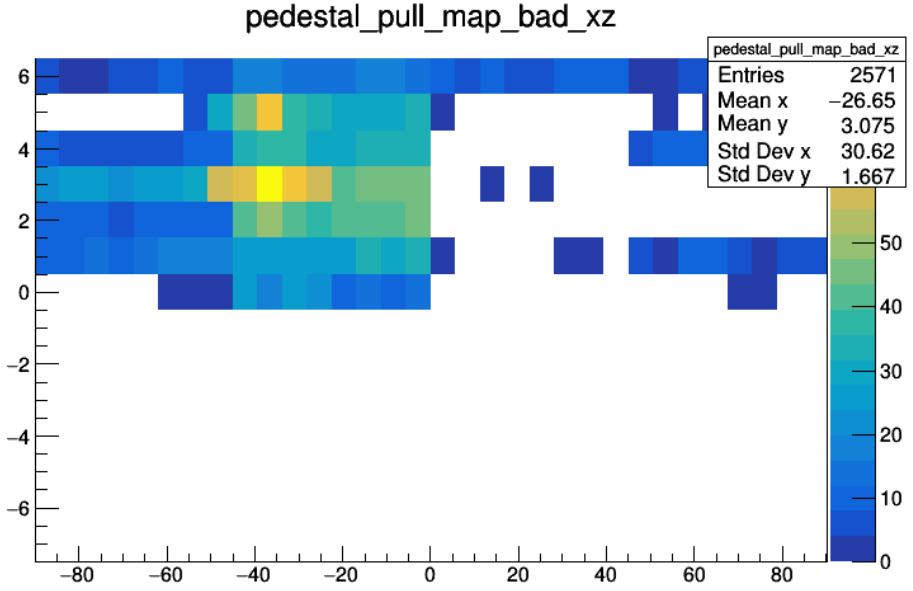
Comparison of pedestal distribution (normalized) for SCA 1 for channels with a hit in the neighborhood (continuous line) and channels far from hits, d>5 cells, in the event (dotted line)



Pedestal recalculation for chips in the beam spot

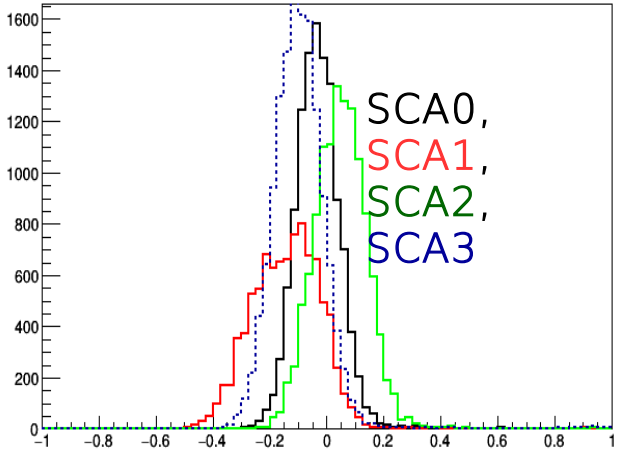
- Conf2, 4 GeV electrons, beam hits chips 12-15. Map of channels with recalculated pedestal > |5|% of MIP
  - Maximum concentration is in the beam spot and in the layer where the shower is maximum.



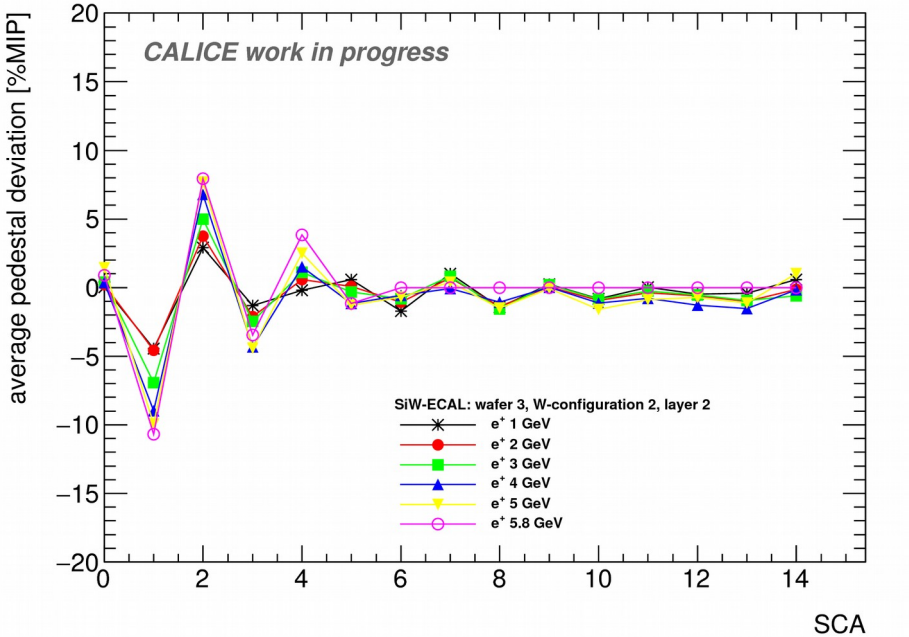


Pedestal shift

- Conf2, 4 GeV electrons, beam hits chips 12-15
- From the distribution of recalculated pedestals, we take the average for every energy, only for chip 12 and the fourth layer (similar behavior for the others).

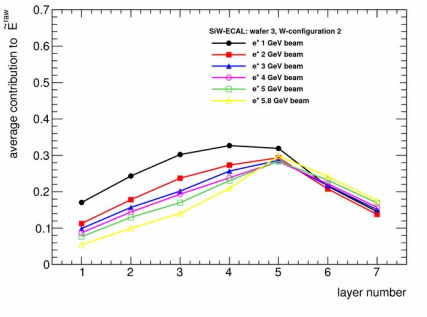


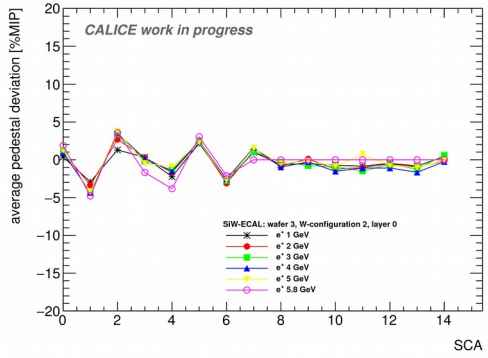
The mean of these distributions are used to create individual points in the plot of the right

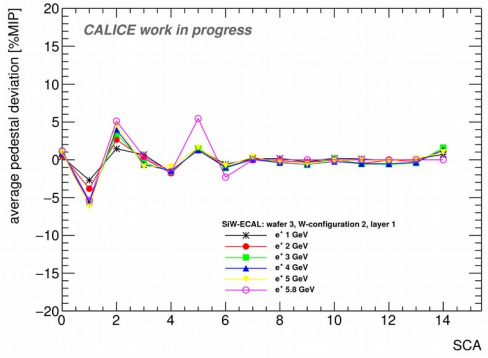


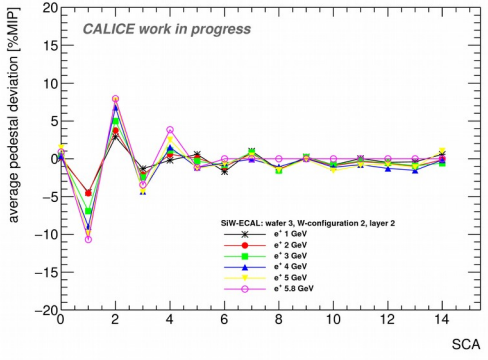
Pedestal shift

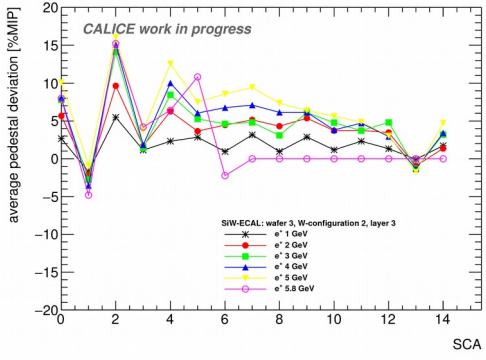
- What about different layers? (see first figure for profile)
- Some layers have also shift in SCA0, why? Same energy dependence is present in mostly all plots
- Maximum deviations of ~15%

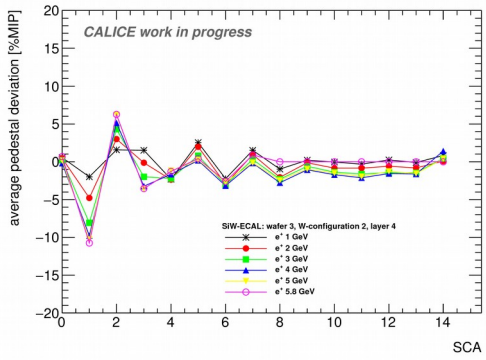


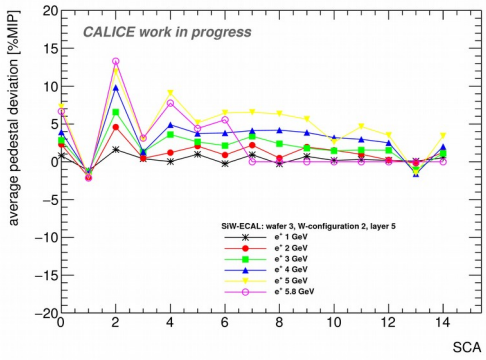


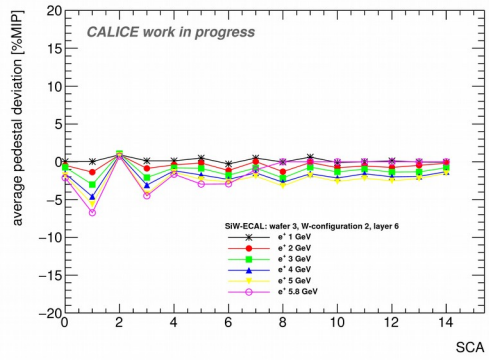






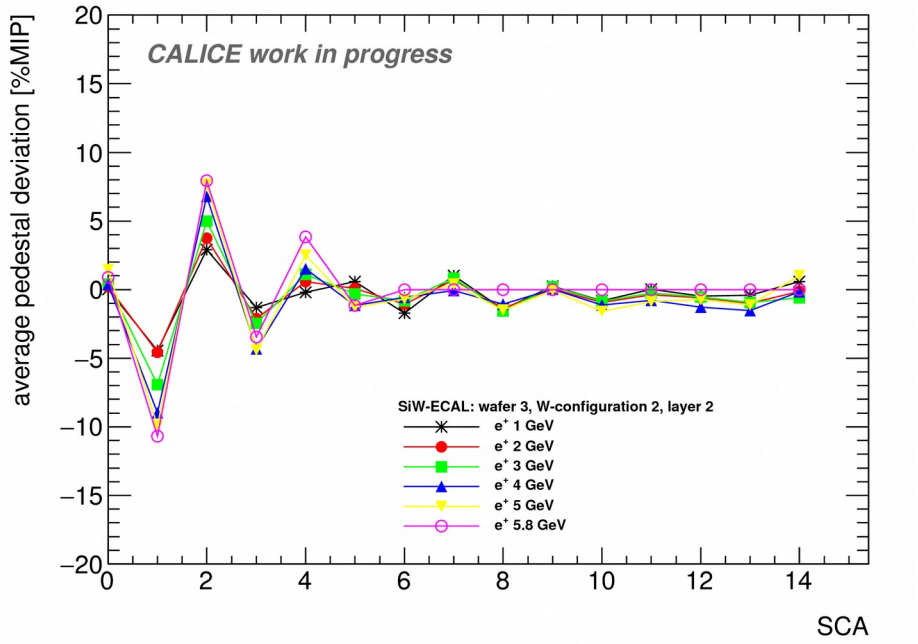


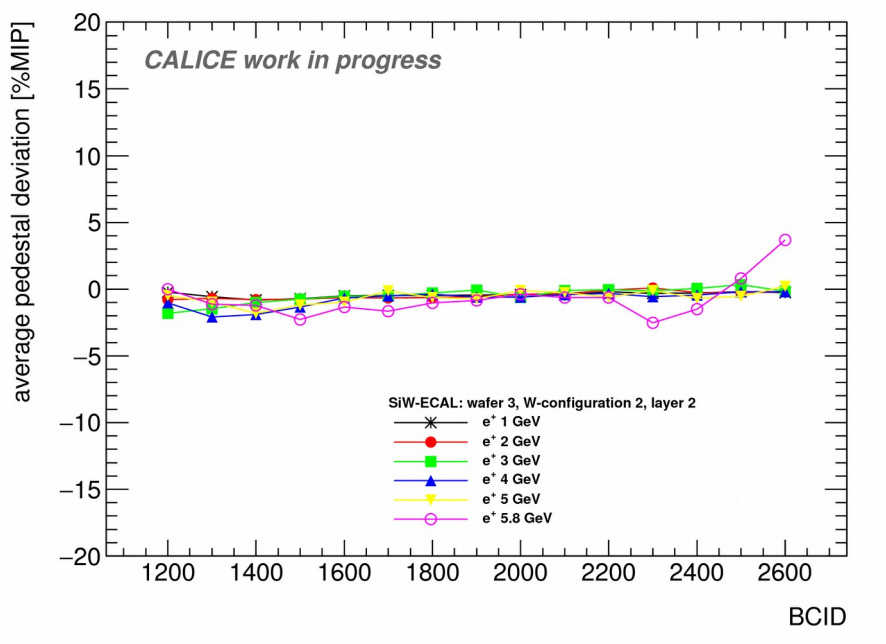




Pedestal shift

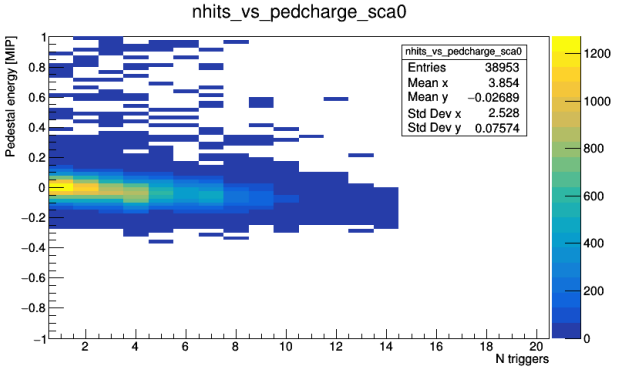
- Same, but vs bcid
  - The effect is diluted (SCA 1 compensated by SCA2, etc)

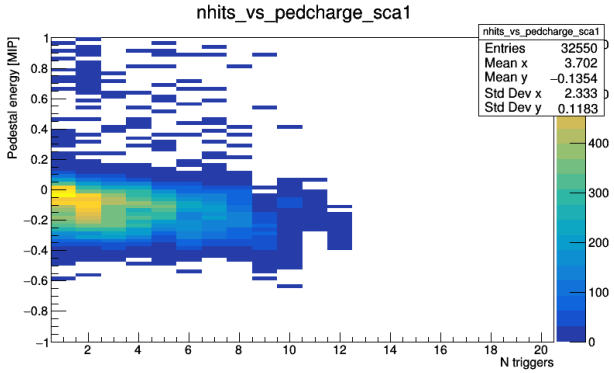


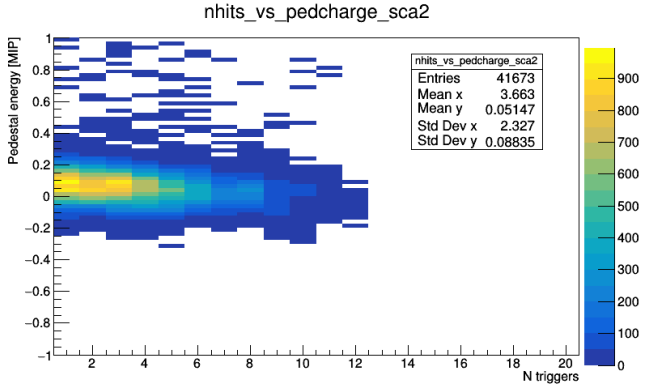


Pedestal vs number of triggers

- Relation between total charge collected by the chip and the pedestal shift?
- I study the correlations between the pedestal hits energy and the total number of triggers in the event (ONLY CHIP 12, fourth layer)
  - I have done the same for total energy, averaged energy per channel and the number of triggered channels with energy larger than certain thresholds… always same patterns are observed.



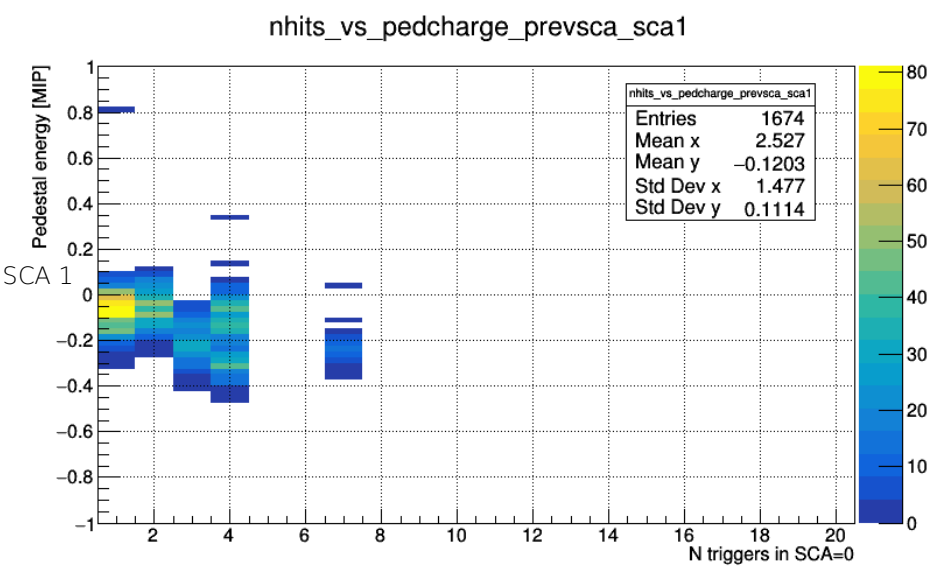


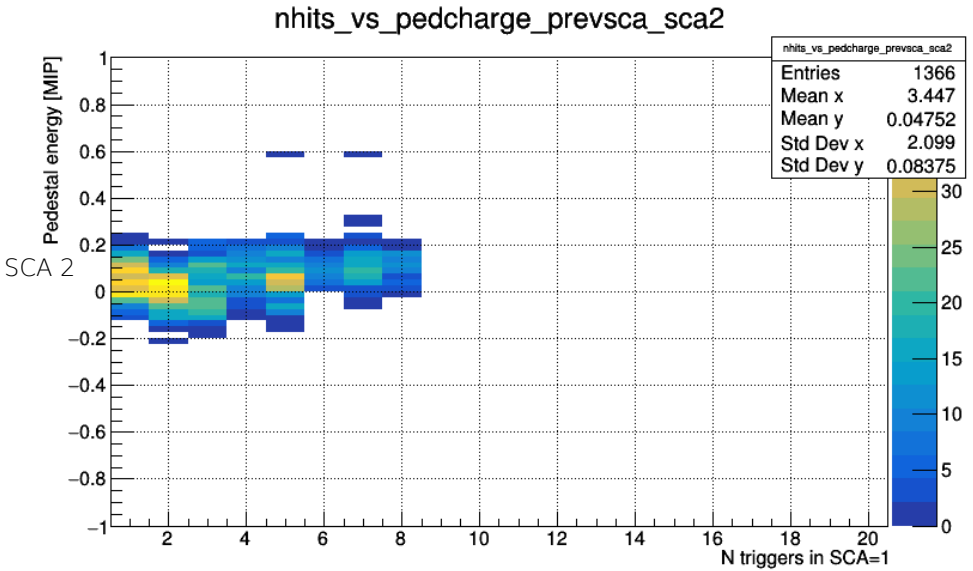


- In addition to the alternated global shift between SCAs, there is a correlation between number of hits and pedestal value: more hits, lower pedestal

Pedestal vs number of triggers

- Relation between total charge collected by the chip in SCA X-1 and the pedestal in SCA X ? (ONLY CHIP 12, fourth layer)



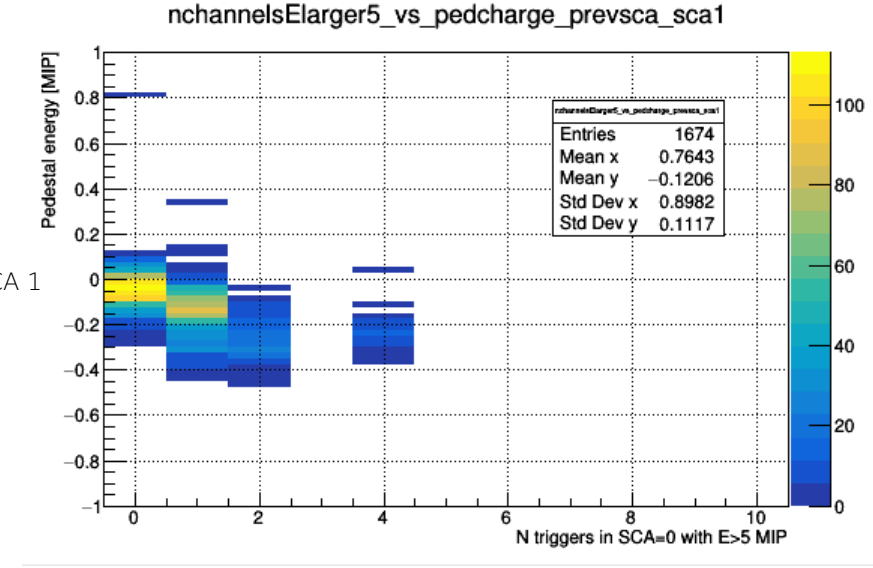


- The global shift in pedestal for alternate shifts seems to be correlated with the amount of charge in the previous SCA:
  - the more charge in SCA0, the lowest pedestal value in SCA 1
  - the more charge in SCA1, the larger pedestal value in SCA 2

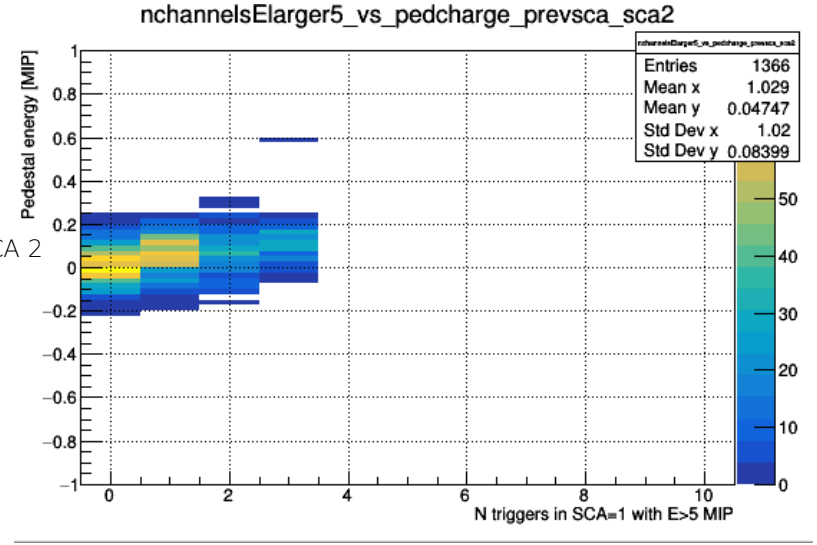
Pedestal vs number of triggers with high load

- This correlation is better seen if we plot the pedestal value vs the number of channels that were triggered and collected “a lot” of charge (E> 5 MIP)

SCA 1



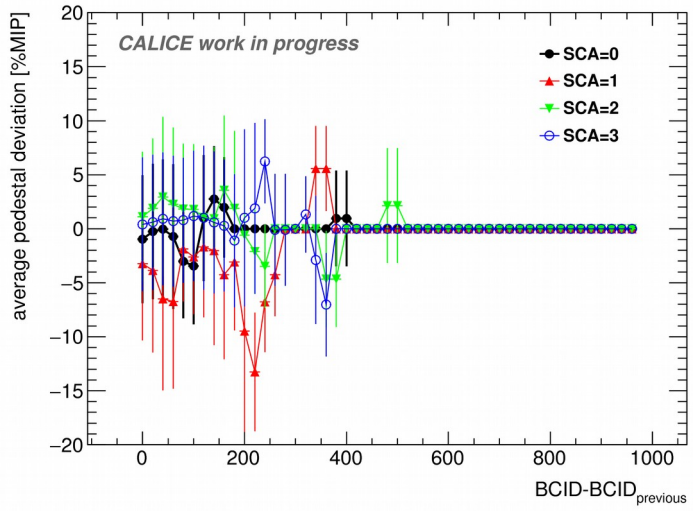
SCA 2

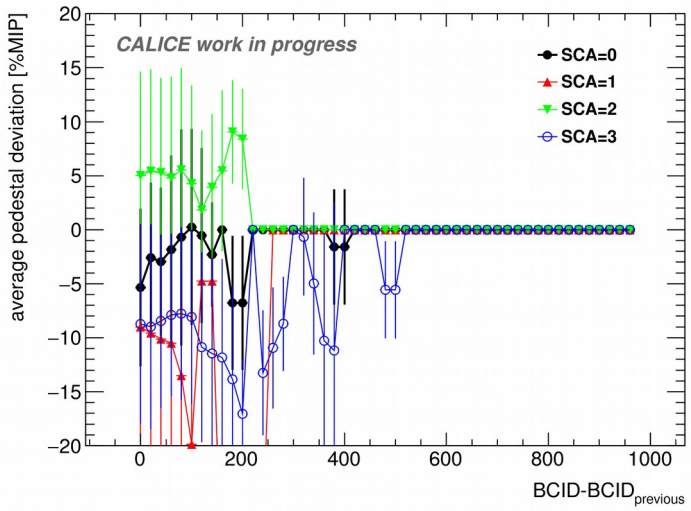


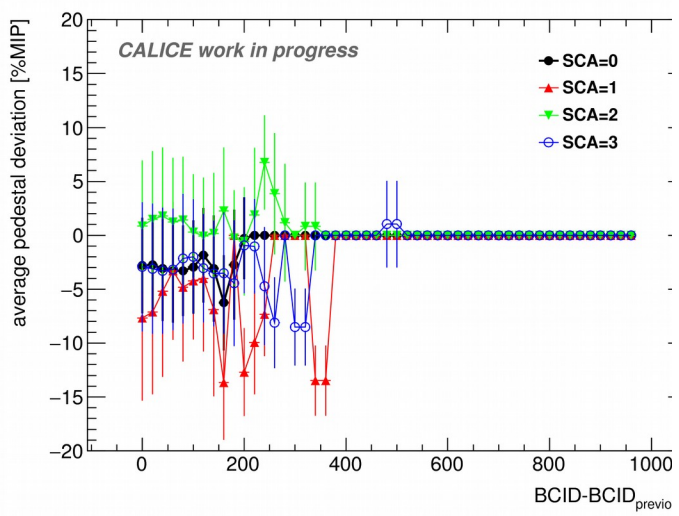
- The global shift in pedestal for alternate shifts seems to be correlated with the amount of charge in the previous SCA. Specifically, with the concentration of high loads.

Pedestal shift vs rates of hits (bcid- bcid previous)

- 4 GeV beam, layer 1, 4, 7 (from left to right)
- We don't observe any dependence of the pedestal value with the time distance of the previous hit.

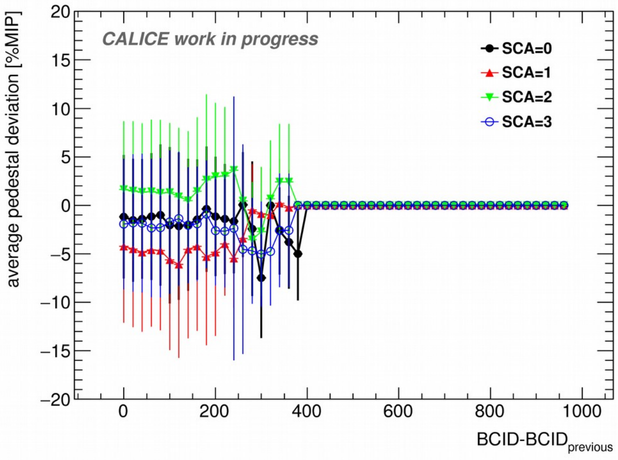


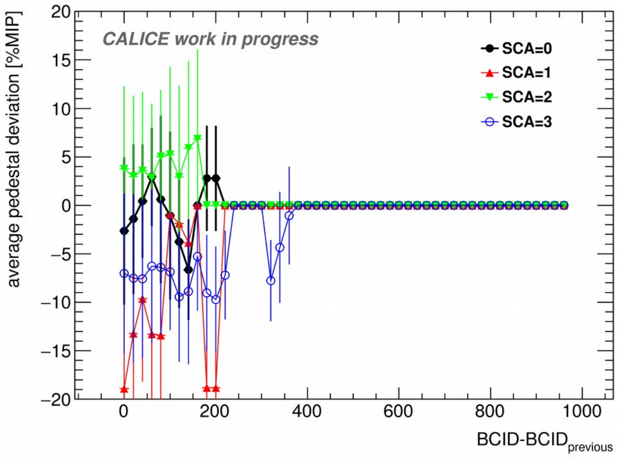


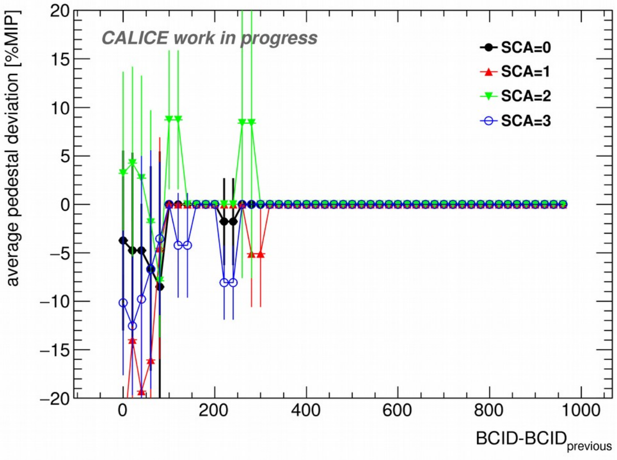


Pedestal shift vs rates of hits (bcid- bcid previous)

- Layer 4: 1, 3 and 5.8 GeV beam

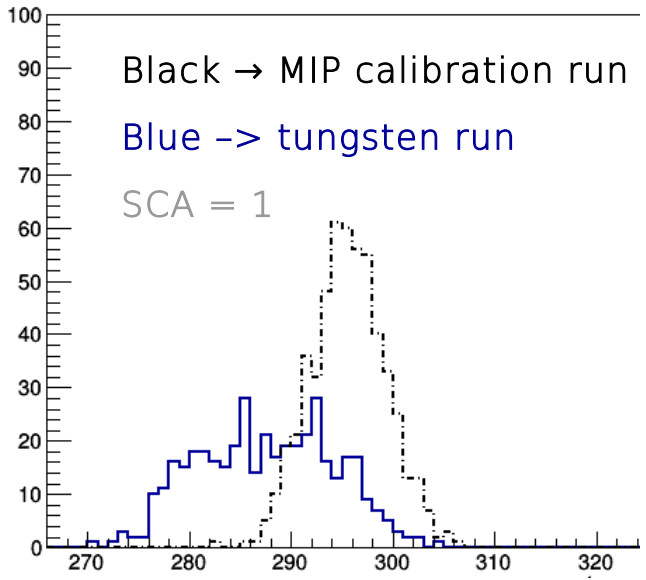






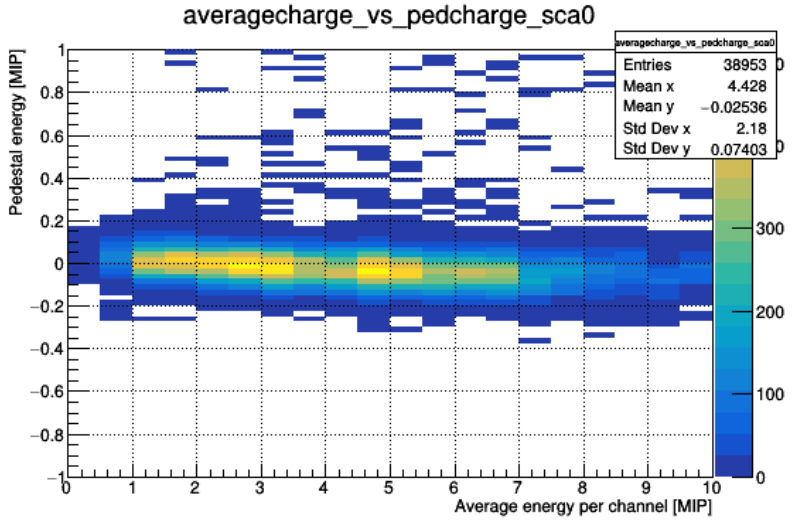
Pedestal shift for channels with disabled preamps

- We study the pedestal shift for:
  - Chip 12, channel 50 (trigger masked and preamps switch off) for a mip run and a a run with absorber (4 GeV, conf2)
  - This channel is classified as masked, therefore is not included in the reconstructed data. We use "raw data" → very simple event selection

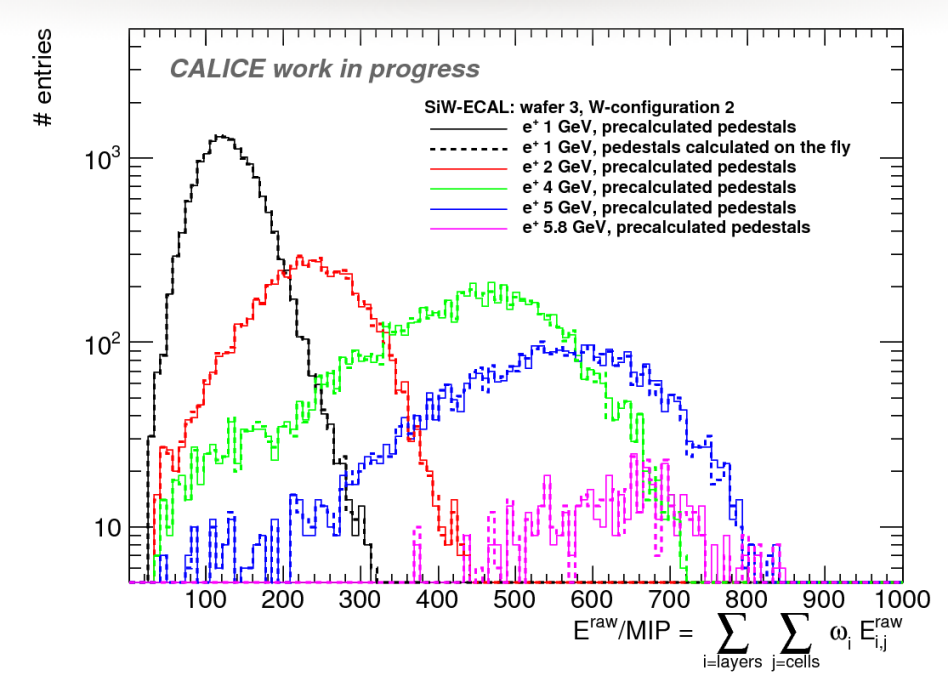


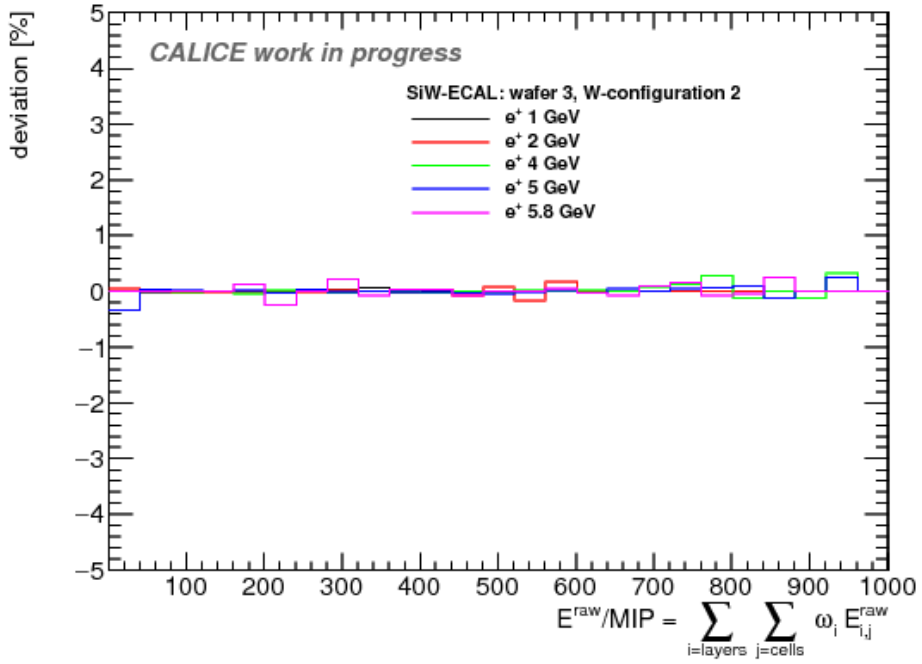
Energy reconstruction and pedestal shift

- How does the measured pedestal shifts affect to the Energy reconstruction ?
- We don't expect large effects since:
  - SCA 0 dominates the others (depending of the rates)
  - Shifts maximum of ~0.15 MIP and average deposition charge (for 4 GeV) ~> 3 MIP
  - The shift is alternated (shift in SCA1 is compensated by shift in SCA2, etc)



Energy reconstruction and pedestal shift





- The impact seems to be minimum, even compatible with statistical fluctuations, for the energy reconstruction but still few questions remain open...

Back-up