Gain calibration

Work summary during the workshop - 2018

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HELMHOLTZ RESEARCH FOR GRAND CHALLENGES

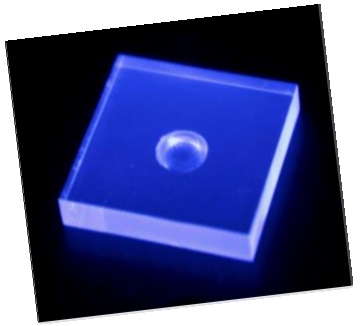
E-JADE
Europe - Japan Accelerator Development Exchange Programme

CALICE

DESY.

Understanding the calibration

Gain calibration



For trustworthy data measurements we need a well calibrated detector.

Gain calibration - LED system installed on each channel to monitor the stability of the SiPM in time (controlled by CALIB board on HBU).

Idea:

SiPMs monitored during test beam operation - light intensity from zero to the saturation level.

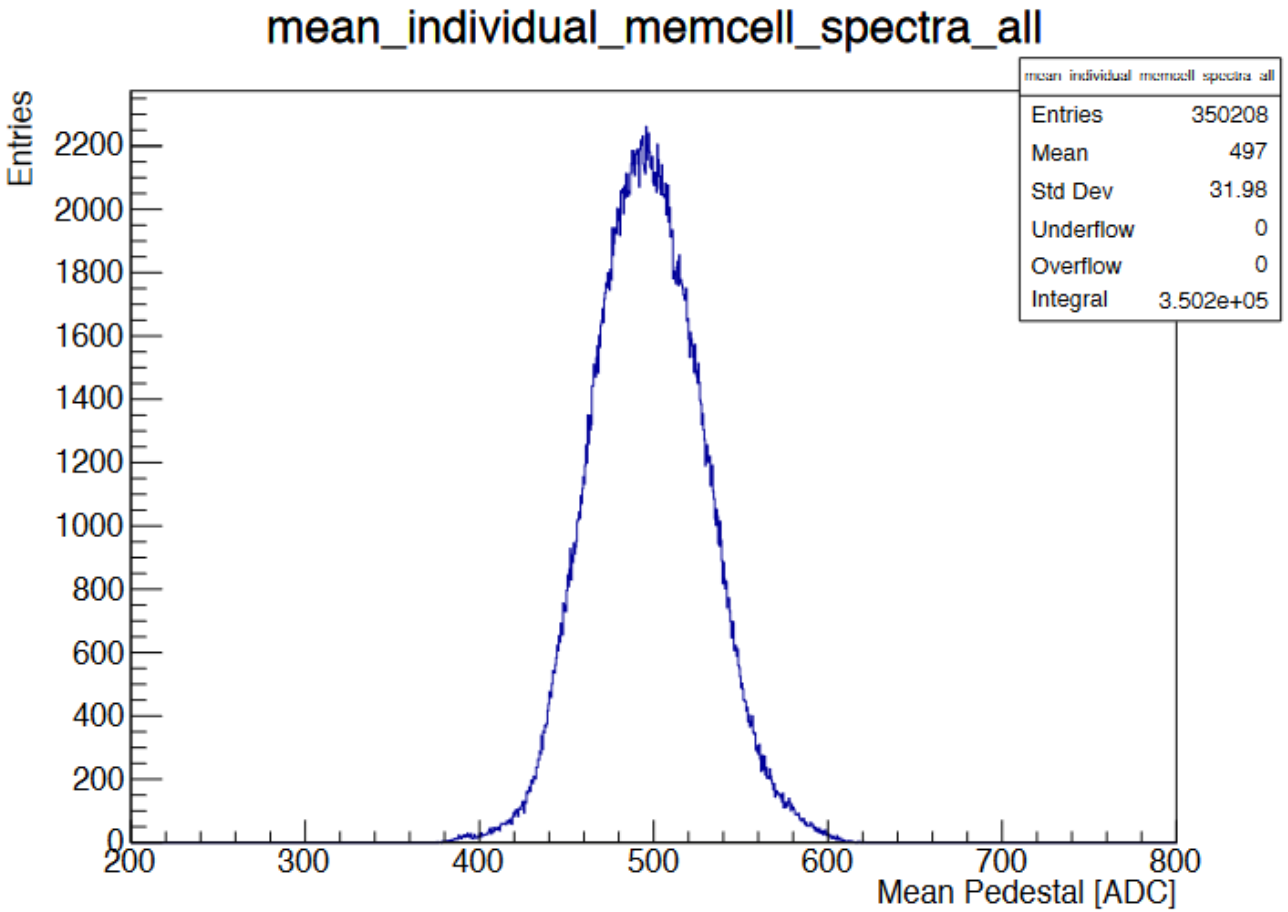
- Temperature dependence.
- To have a uniform response with all the channels.
- Identifying dead, noisy or unstable channels.
- Acquire constants needed for analytical study

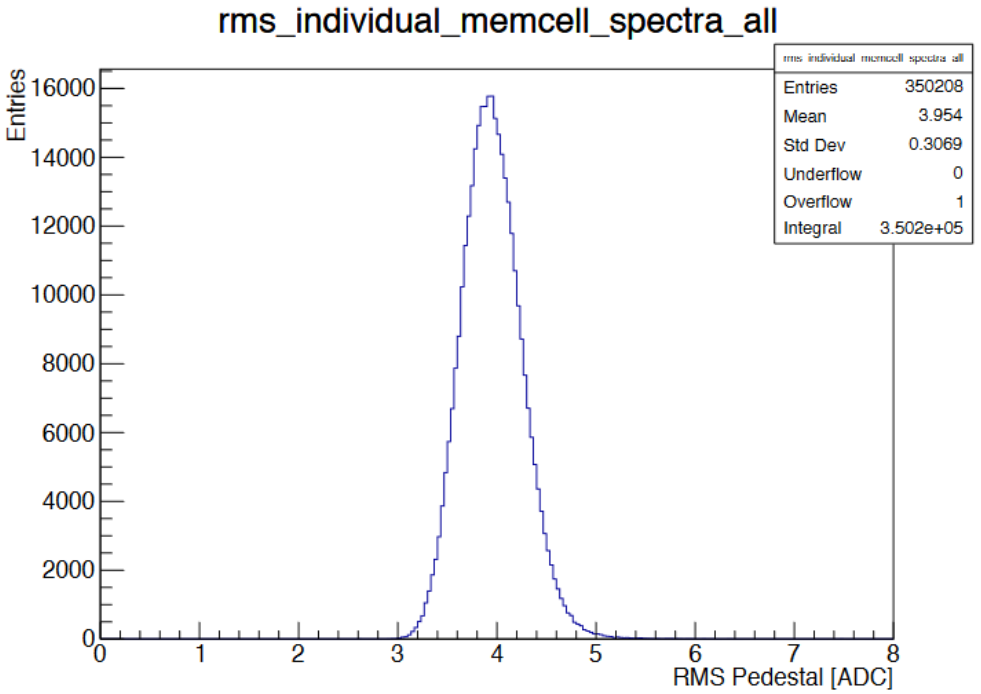
Pedestal level

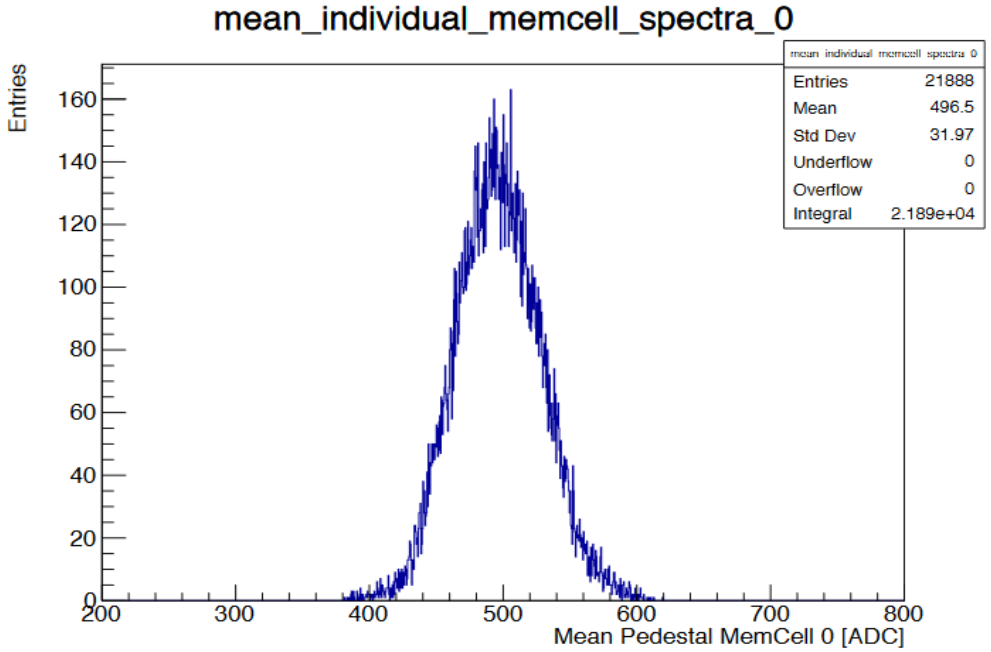
Gain calibration is performed in external trigger mode.

- Check the stability of the pedestal
- Calculate the pedestal, memory cellwise.
- The **pedestal** depends not only on the channel, also depends on the memory cells.
- Constraining the data from all memory cells to be merged.

Pedestal study





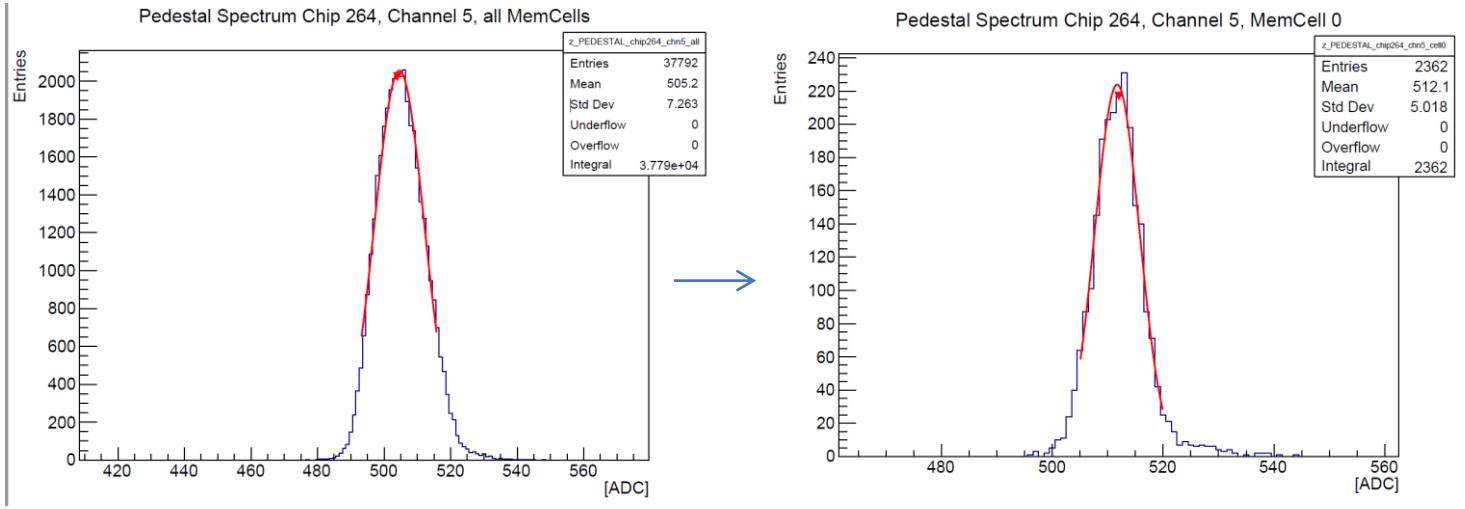


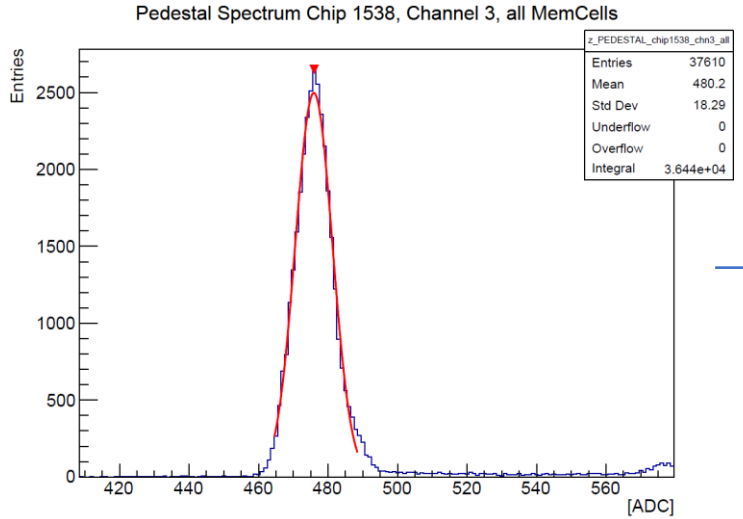
Dead and noisy cells

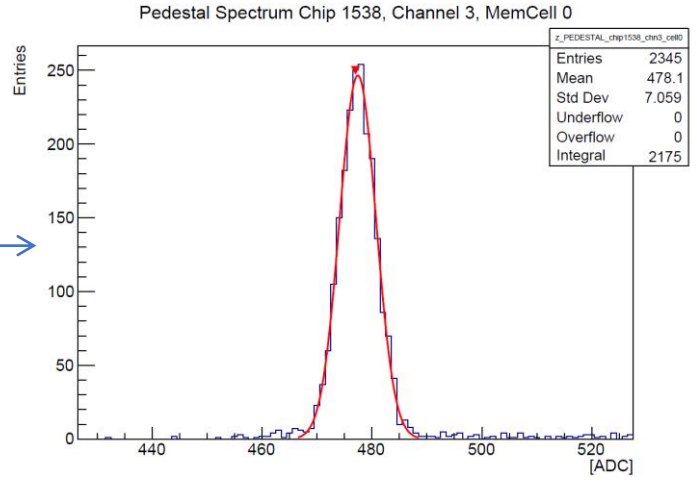
Module	Chip_ID	Chip(0-15)	Channel(0-15)	comments
1	264	8	5	MIP O.K., bad LED
3	523	11	12	no signal, dead
6	1538	2	3	noisy, dead
15	3848	8	32	no signal, dead
24	6145	1	19	noisy or too low LY
33	8455	7	5	no signal, dead
34	8765	1	9	LED O.K., bad MIP shape
37	9476	4	20	LED O.K., bad MIP shape
38	9743	15	14	Hit-Bit configuration not changing, empty pedestal, all memory cells

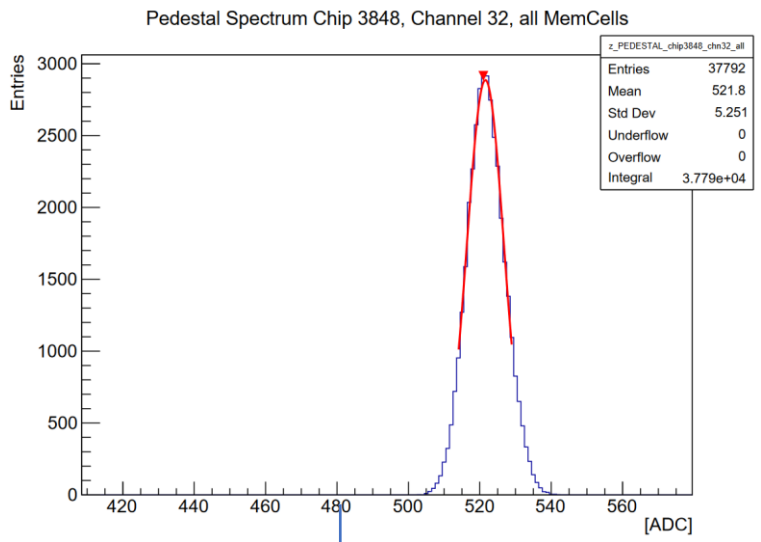
http://flcwiki.desy.de/AHCALTestBeamCERN2018-May

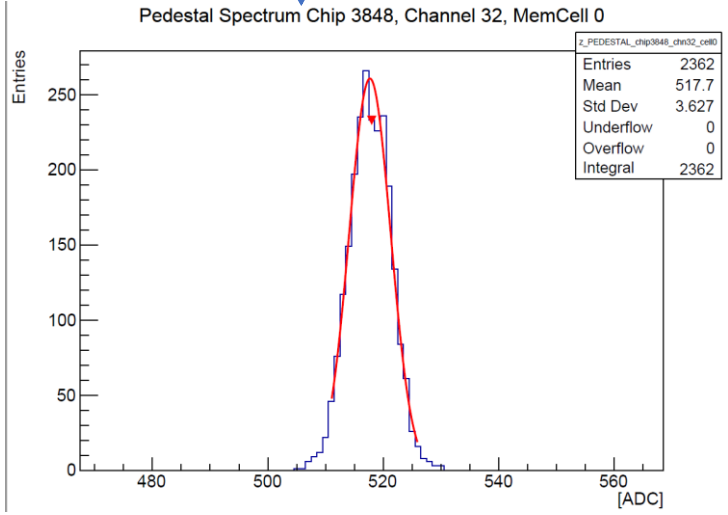
Revisit to dead and noisy cells





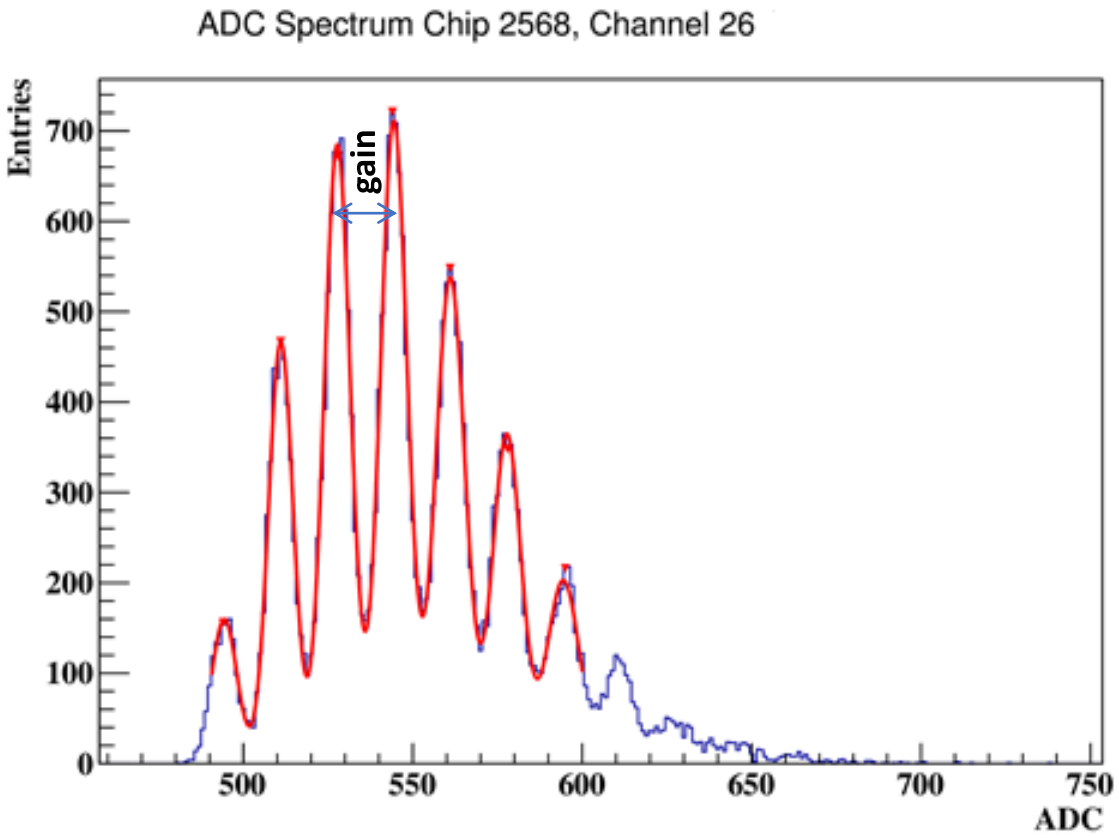






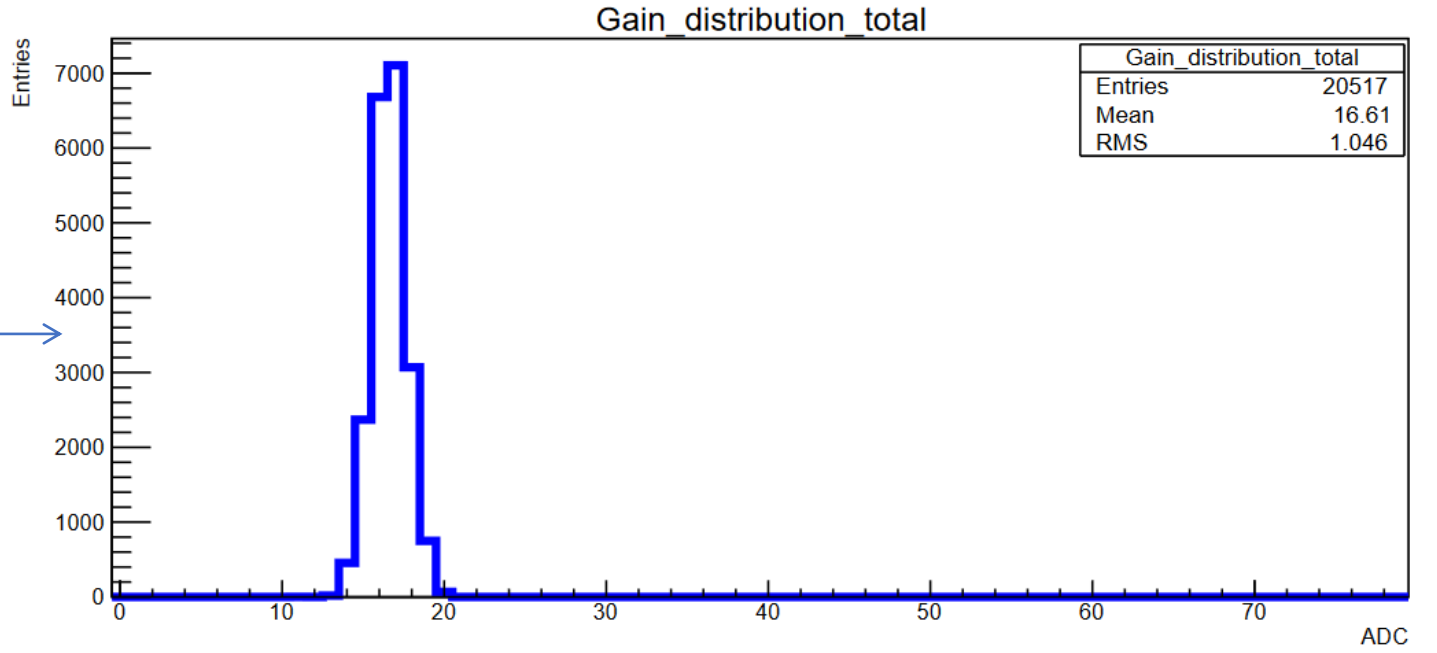
Single photon spectrum

- The **gain** is defined as a distance between 2 photopeaks in the single pixel spectrum.



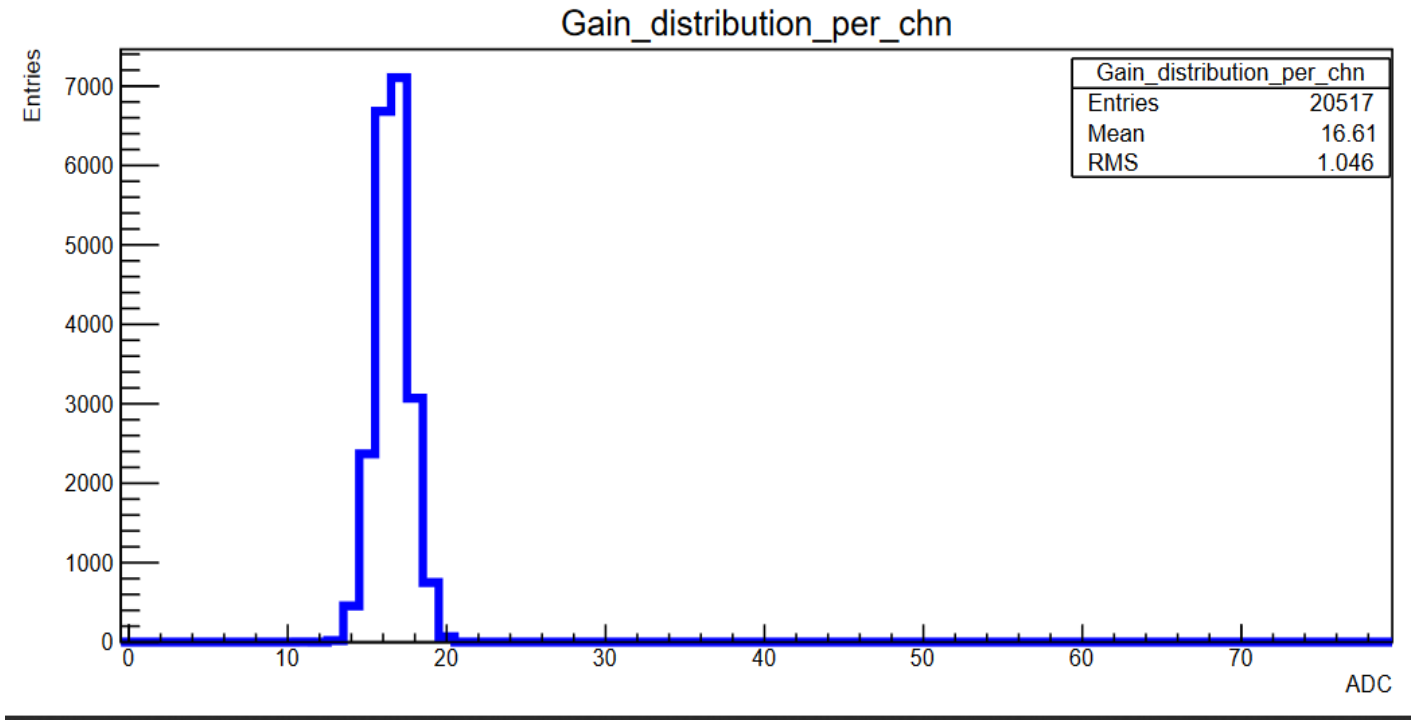
Gain Mean

Total Gain for all the channels(21,888)



Quality check of the gain: approximately 95% channels fitted.

- need to investigate the quality for the June data.



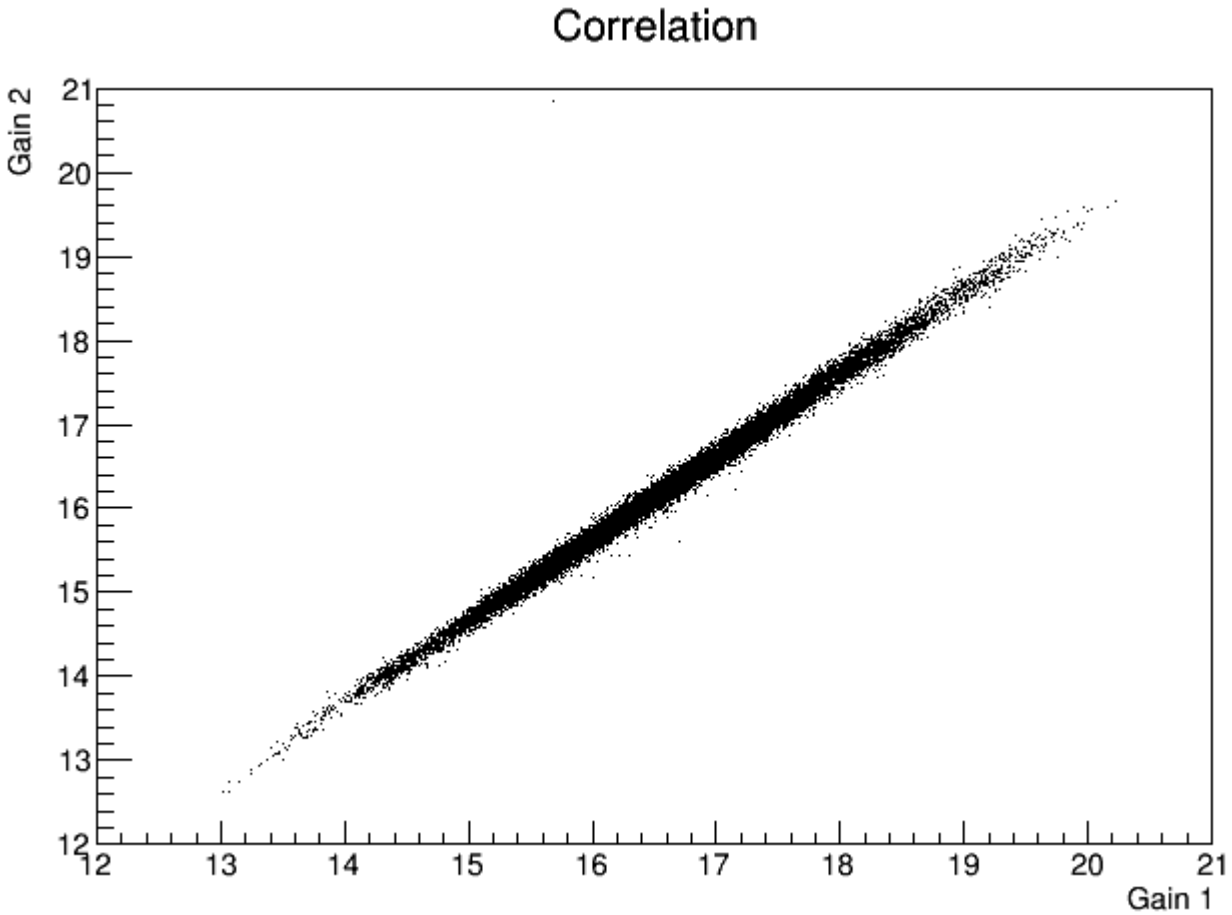
Checks

- Check for outliers: check for gain greater than 3 sigma

  Deviation = (|Gain – MeanGainALL|) / RMSALL

  - 37 entries found.

- Check the signal stability: on individual channel level, compare gain between two runs.



Channel wise stability

Conclusion and Outlook

- Checked the pedestal value and dependency on memory cell.
- Investigated the variation in gain between two run.
- Checked the quality from the gain fit (further improvements to be done).
- Documented in confluence the calibration chain.

- Performed the simulation chain and looked at the longitudinal profiles.
- Looked into the event display.
- Gathered a brief idea about the works in AHCAL.

- Upload constants in database.
- Compare the LED data from May and June 2018, with and without power pulsing.
- Check gain dependence on temperature.

Thank you