First calibration studies

for the 2007 HCAL data

by
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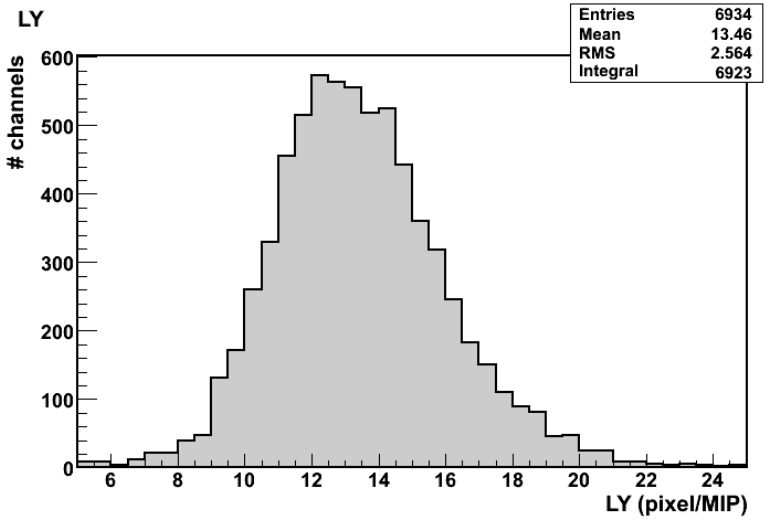
Remarks

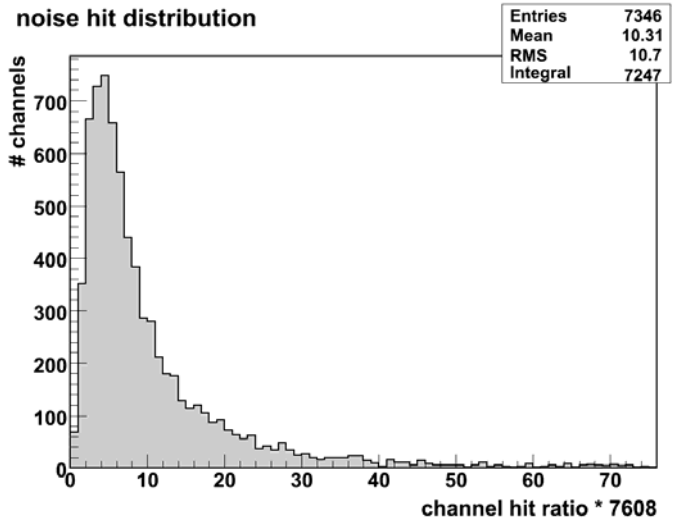
Unless specified other:

The values presented in this talk are averaged over all available calibrations.

The variations shown include both accuracy of the single measurement and changes of environmental conditions (mainly temperature).

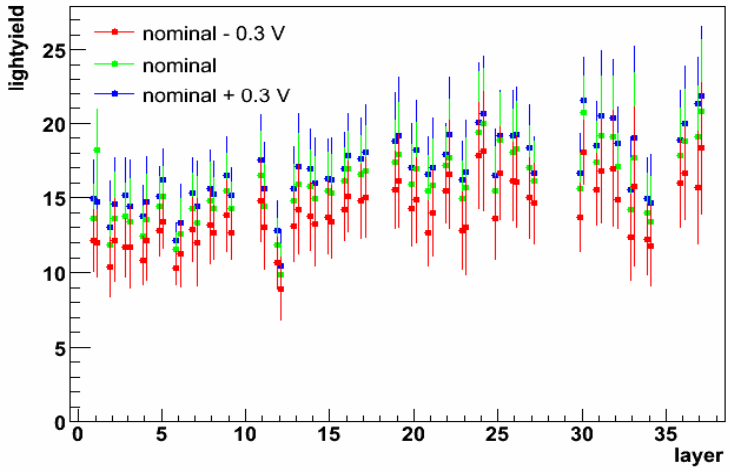
Figures of merit

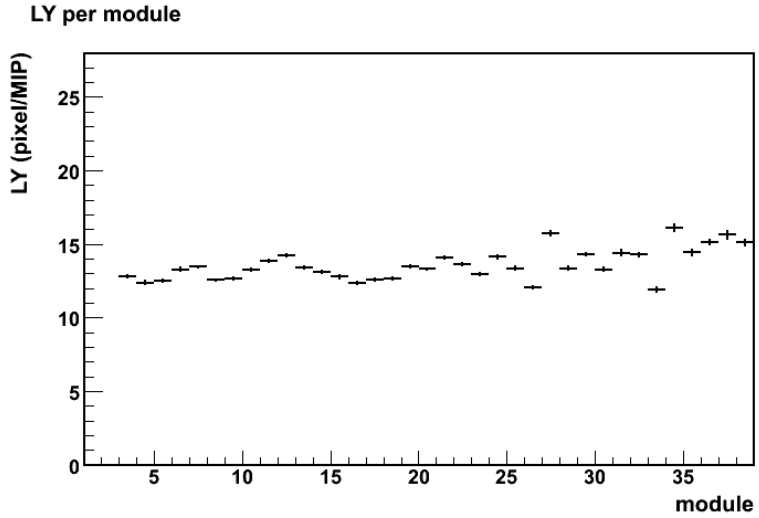




- light yield (LY) determines MIP detection efficiency
  15 pix/MIP & 0.5 MIP threshold ➔ 95% eff
- noise determines neutron detection capability

Working point adjustment





goals:

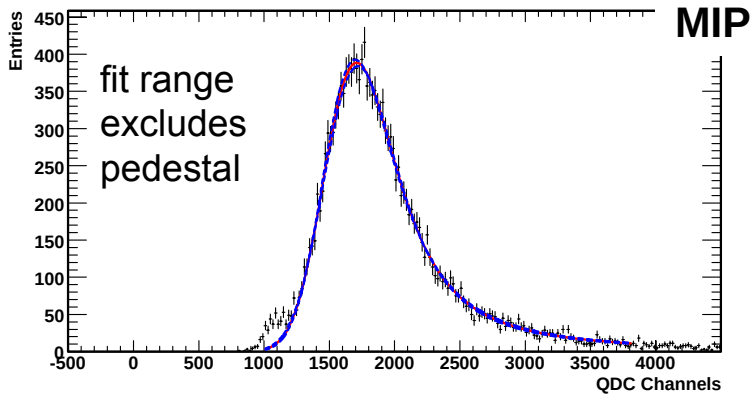
- homogeneity
- 15 pixel per MIP
- low noise

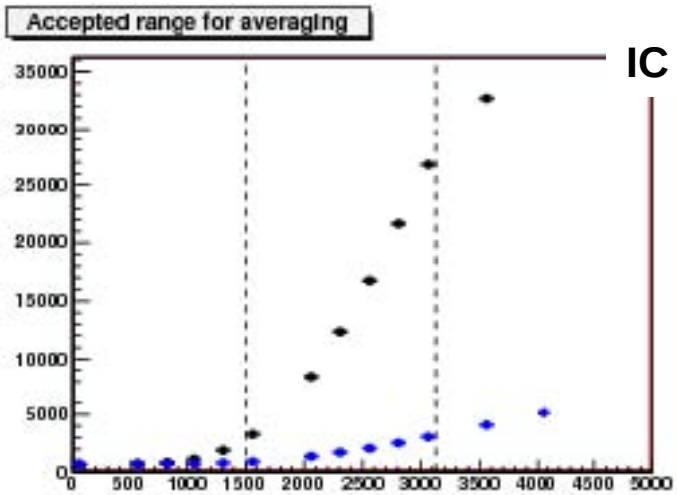
reached:

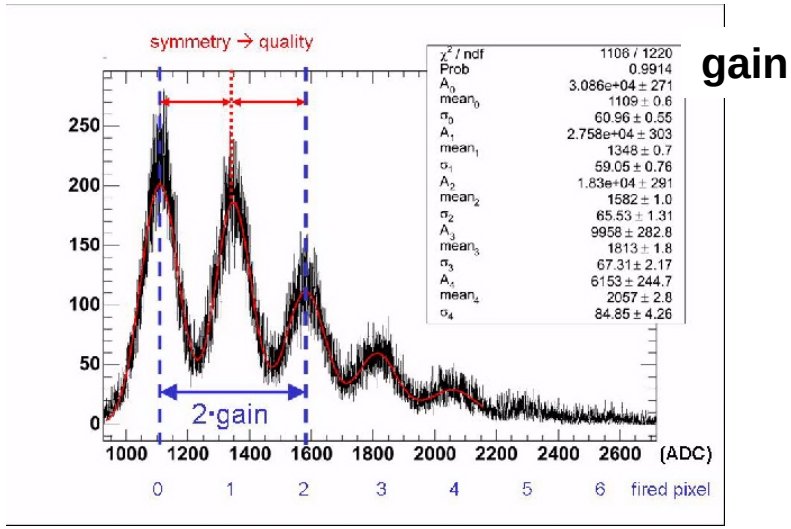
- good homogeneity
- 13.5 pixel per MIP
- noise ?

How we measure light yield

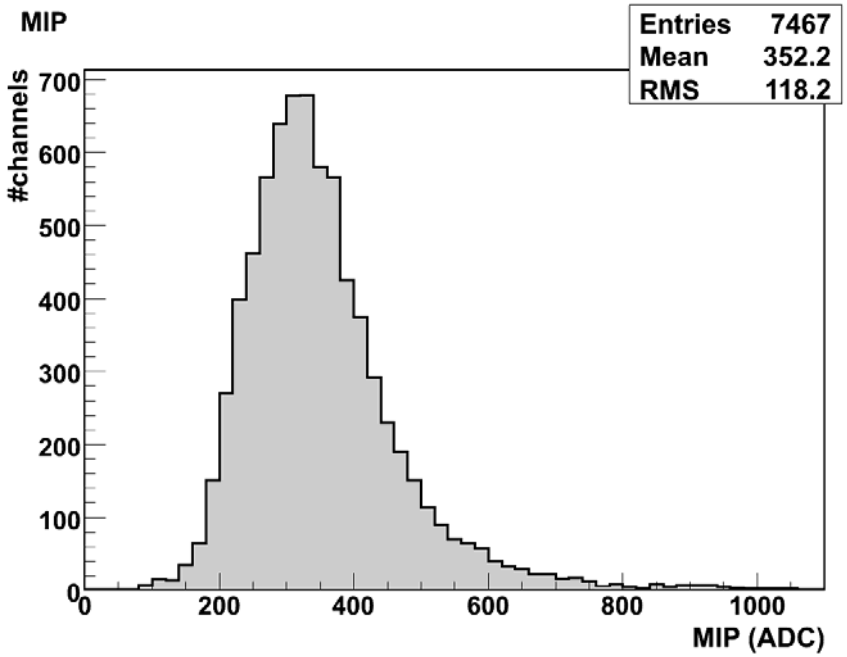
$$LY = \frac{MIP \bullet IC}{gain}$$







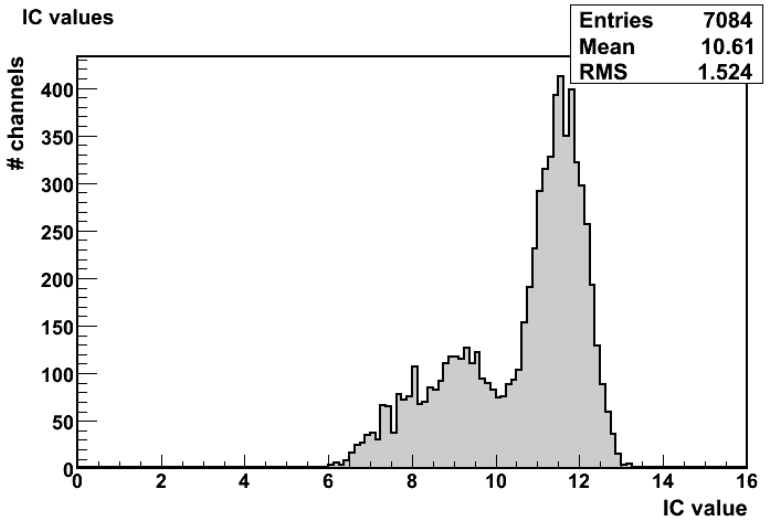
MIP

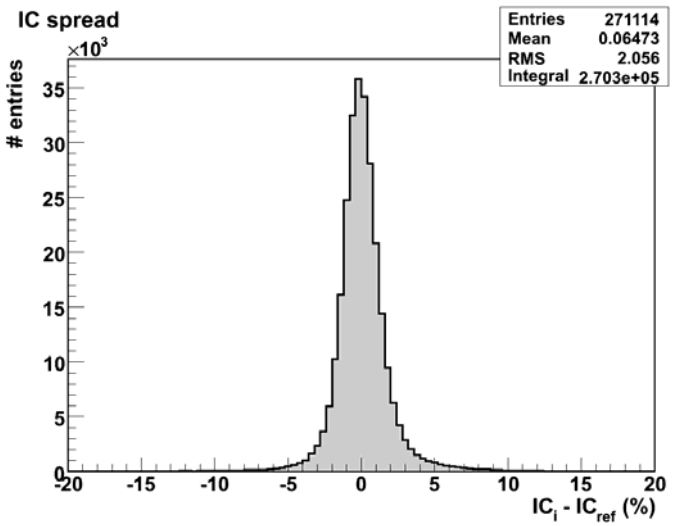


- values for 98% of **all** channel
  (remaining 2% are probably dead channels)
- two independent analysis
  - different event selection
  - different fit method

more details later…

IC



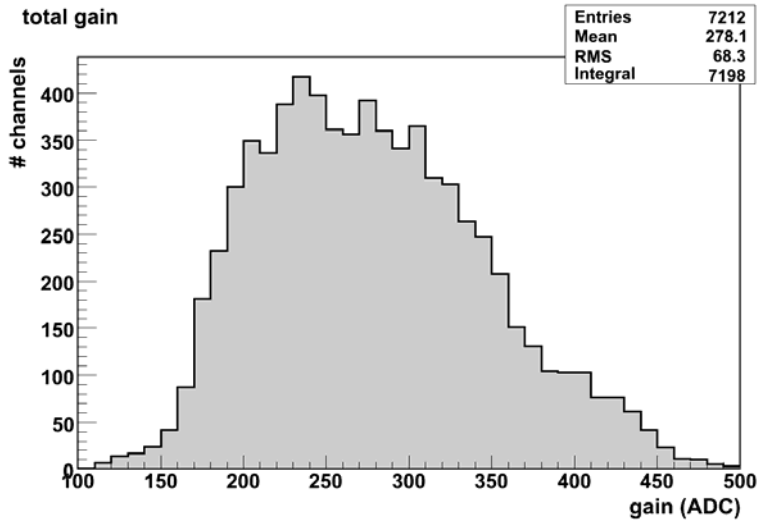


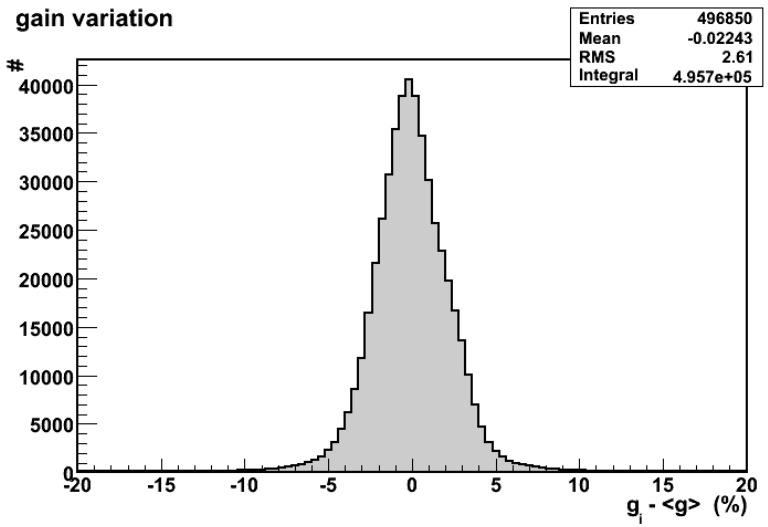
- values for 93% of **all** channels
- ≈ 4% of channels failed due to problems with the CMB hardware
- ≈ 2% dead channels

➔ method efficiency near 100%

- stability: 2% RMS over data taking period
- tails are under investigation

gain



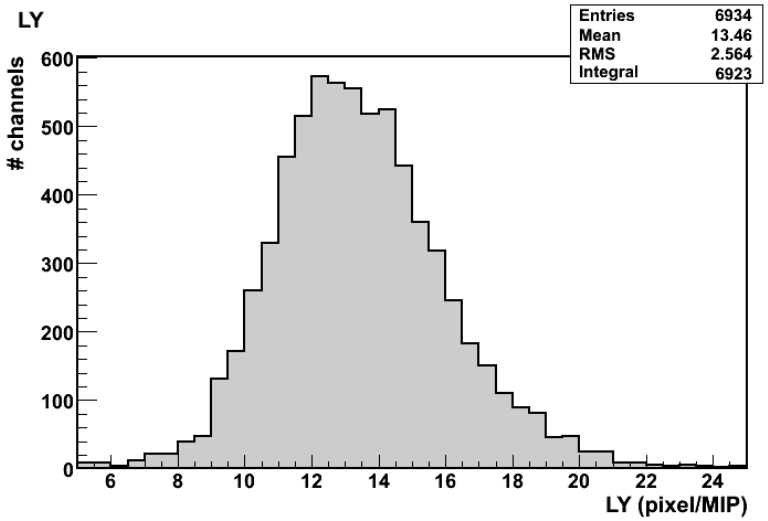


- values for 94% of **all** channels
- 4% of channels failed due to problems with the CMB hardware
- ≈ 2% dead channels

➔ method efficiency near 100%

- 2007: improved efficiency for single measurement
  typically 97% of channels return value in single gain run
- stability: 2.6% RMS including temperature variation
- low statistic for 3 modules due to problems with CMB hardware
- no values for 1 module due to CMB hardware problems

Full calibration – LY



- 91% of all channels are fully calibrated
- + 2% dead

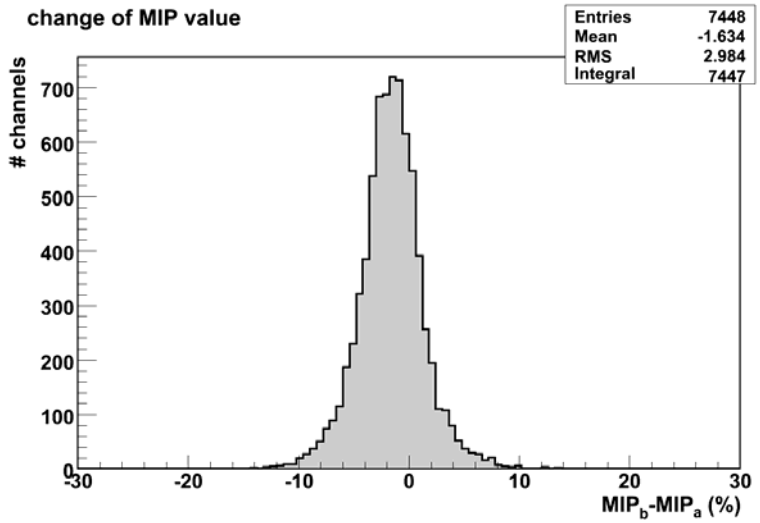
➔ 7% need more investigation

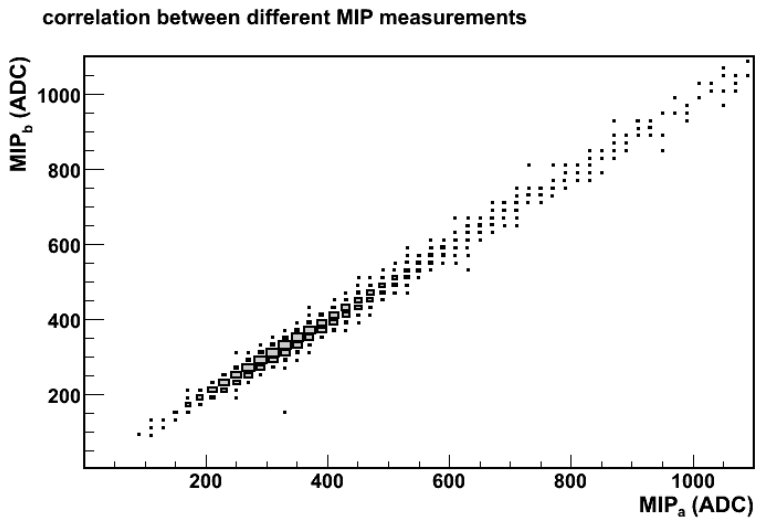
calibration strategy:

- use full calibration if available
  - saturation correction
- use default otherwise

➔ we have a first set of calibration for reconstruction for all non dead channels

Systematic studies
Gauss fit around MPV

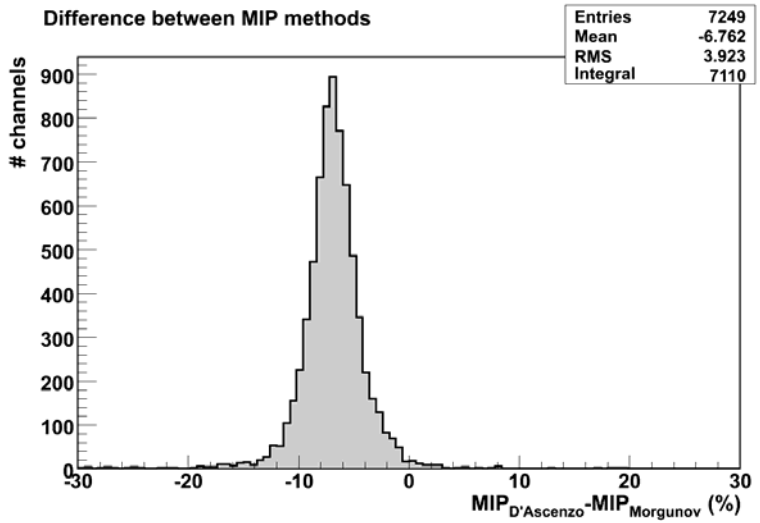


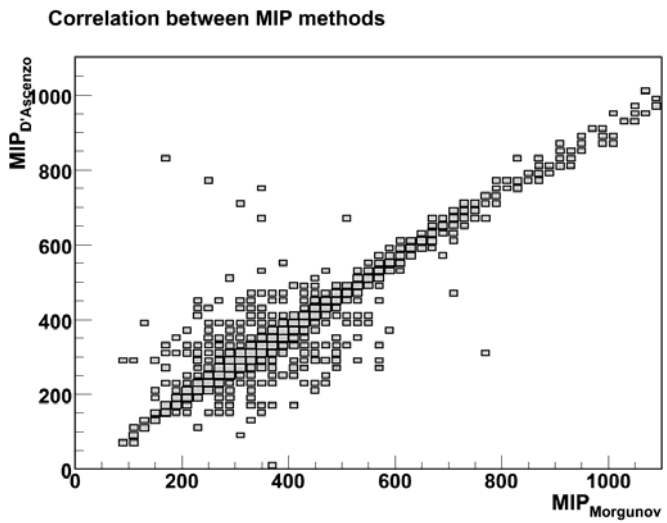


- two set of runs
- same selection & fit method

→ results are consistent within temperature fluctuation and statistical fluctuations, precision ~2%

Different methods

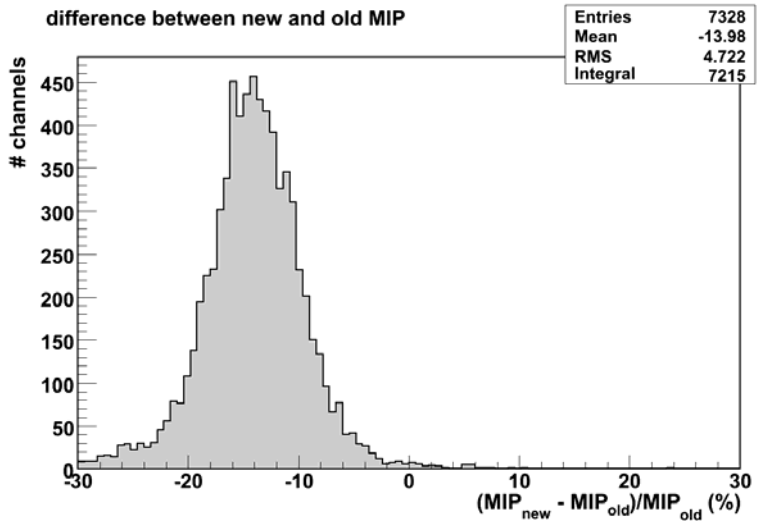


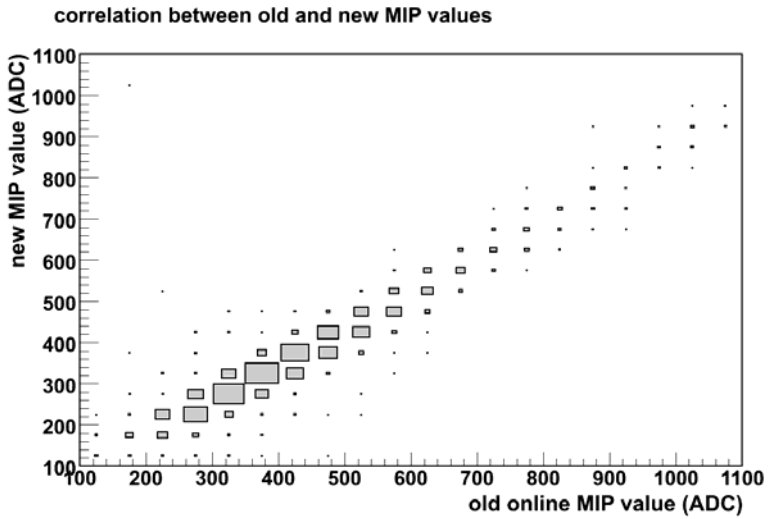


- different data
  - runs 330523 – 330529
  - versus 330527 – 330541
- different selection
- different fit method
  - Gauss around MPV
  - Landau convoluted with Gauss over full signal

→ 7% shift, 4% spread, tails
more systematic investigation necessary

Actual calibration & online monitor calibration



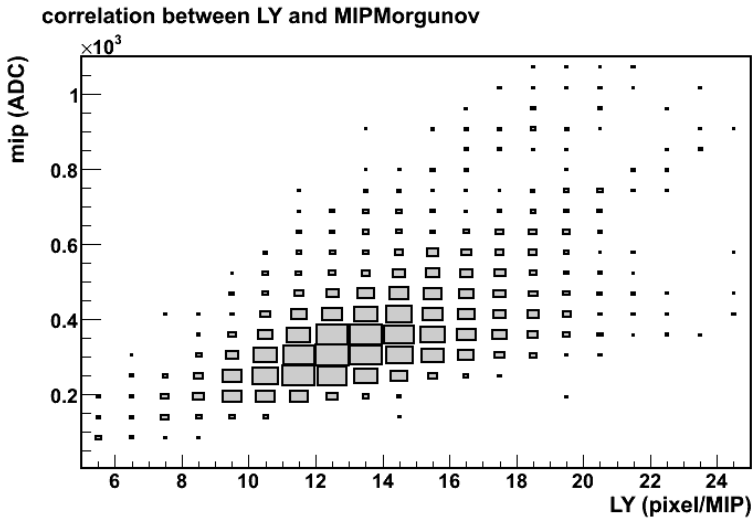


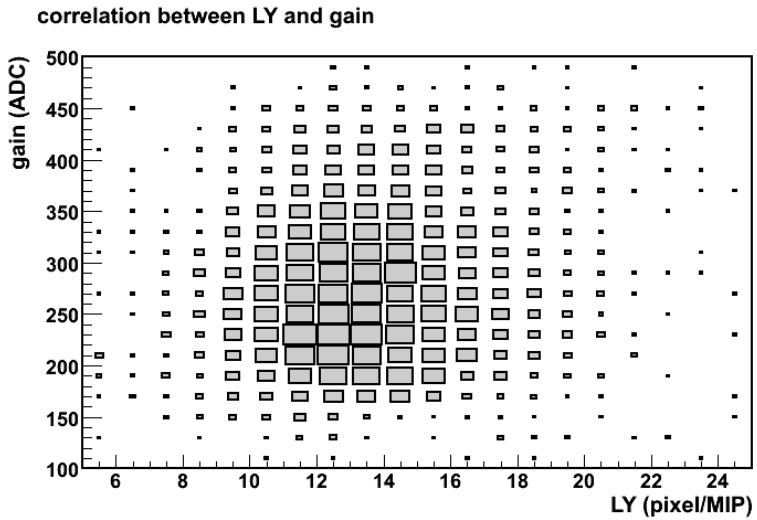
- online monitor was using very first estimation of MIP values

➔ We need to reprocess runs with actual calibration data as soon as possible!

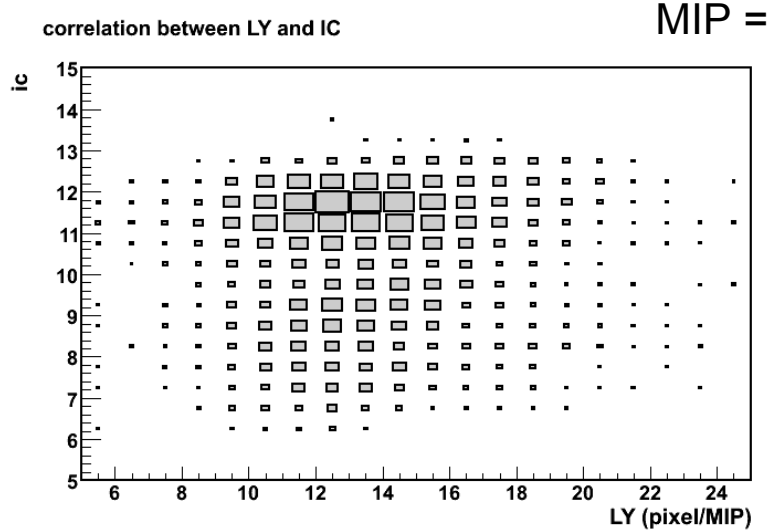
➔ We need standardized and fast analysis feedback for future running

LY correlations





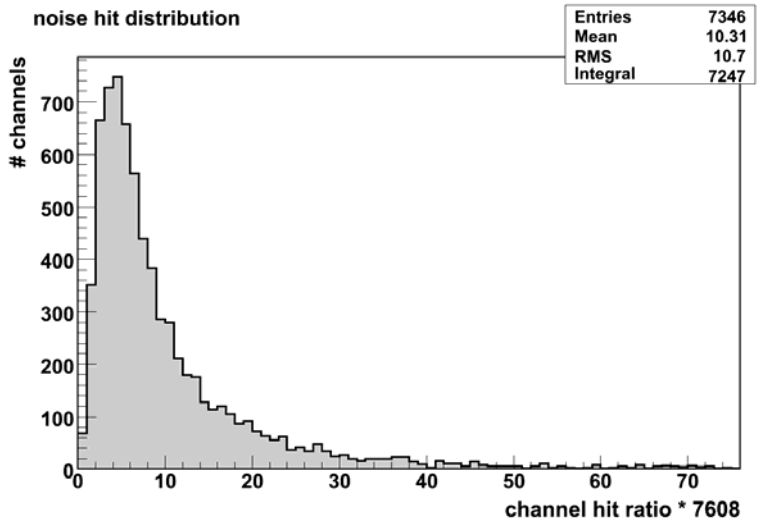
MIP = LY * gain / IC

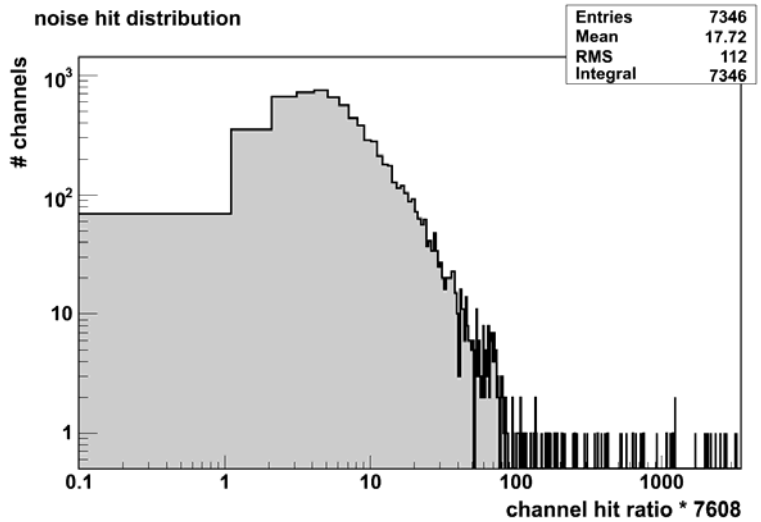


- LY is correlated to MIP
- no correlation to gain & IC

Optical coupling determines the LY

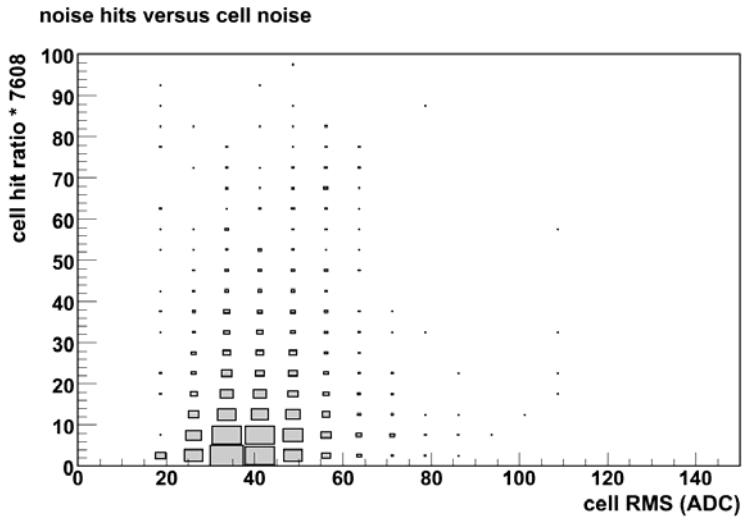
Noise estimate from pedestal run

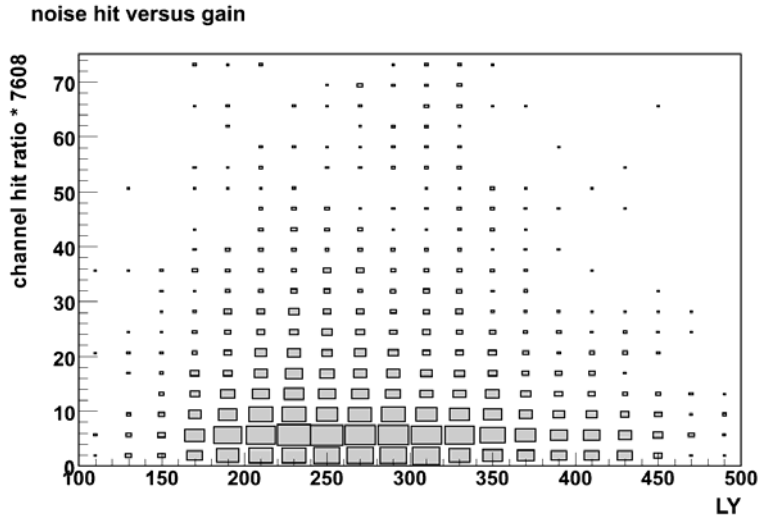


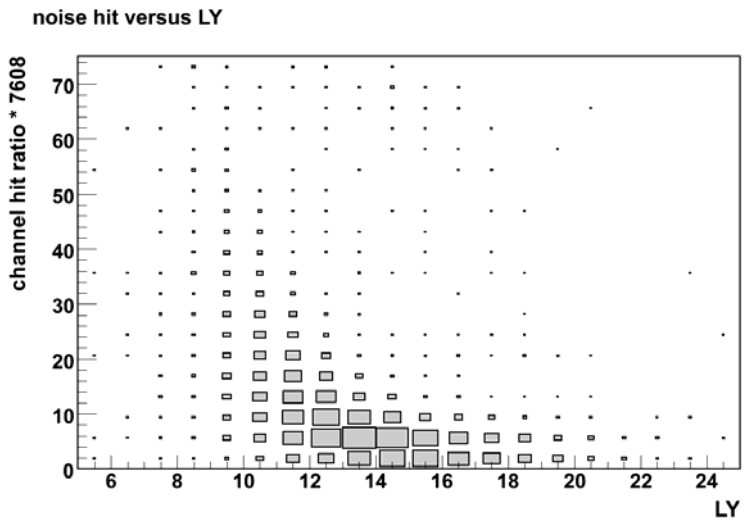


- noise is higher as expected: 17.7 hits/event for full detector
- 100 most noisy channels (~1%) generate 42% of noise hits

Where can we treat the noise behavior?







- absolute SiPM noise is hardly correlated with noise hits
- gain resp. SiPM working point is also not correlated
- the main influence on noise comes from LY resp. absolute MIP

Conclusions & outlook

status:

- ≈ 2% dead channels
- first set of calibrations for all non dead channels
- 91% of channels fully calibrated
- missing calibrations due to CMB problems
- higher noise than expected due to some (1%) very noisy channels
- first systematic calibration studies ongoing

plans:

- complete CMB dependant calibrations @ DESY
- complete systematic studies of calibrations
- investigate the tails
- time/temperature dependant gains