Results from the first matched forward endcap submodules

M. Rossbach, M. Kube, C. Schmidt, U. Thoma

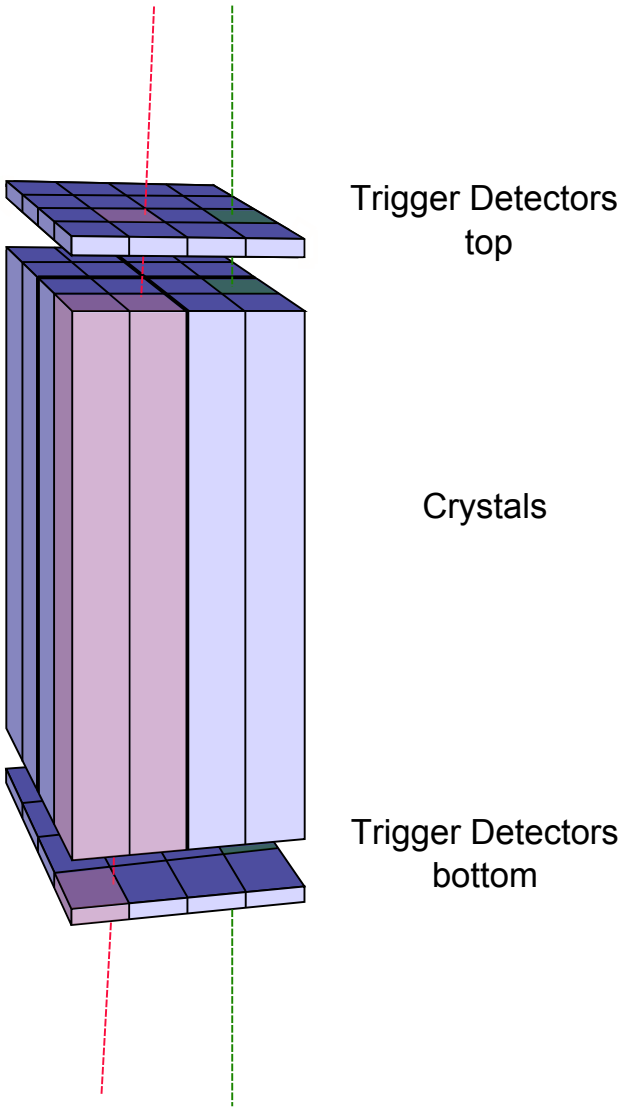
Helmholtz-Institut für Strahlen- und Kernphysik
der Universität Bonn

Supported by:

Bundesministerium
für Bildung
und Forschung

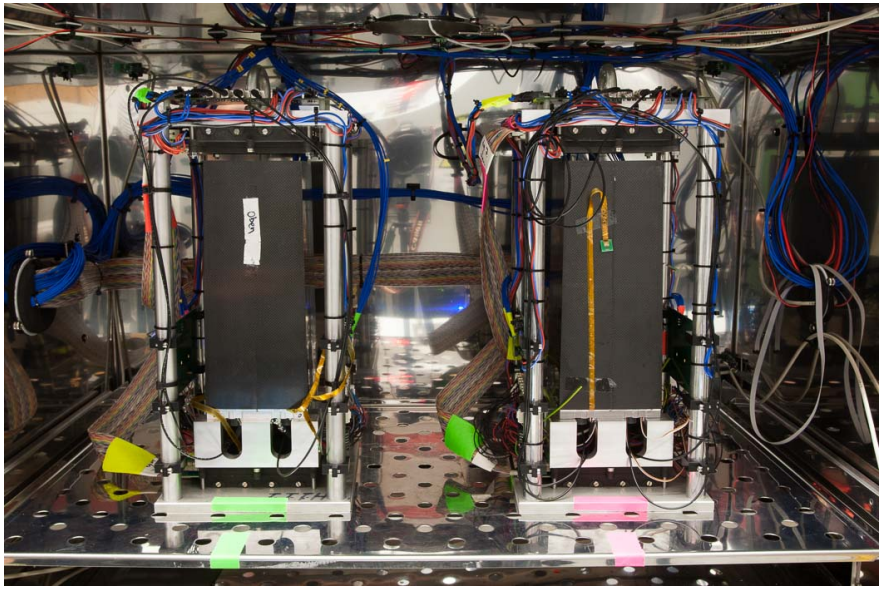
$\overline{\text{P}}$ANDA Meeting 2017-09-05

Motivation for the teststation



Motivation

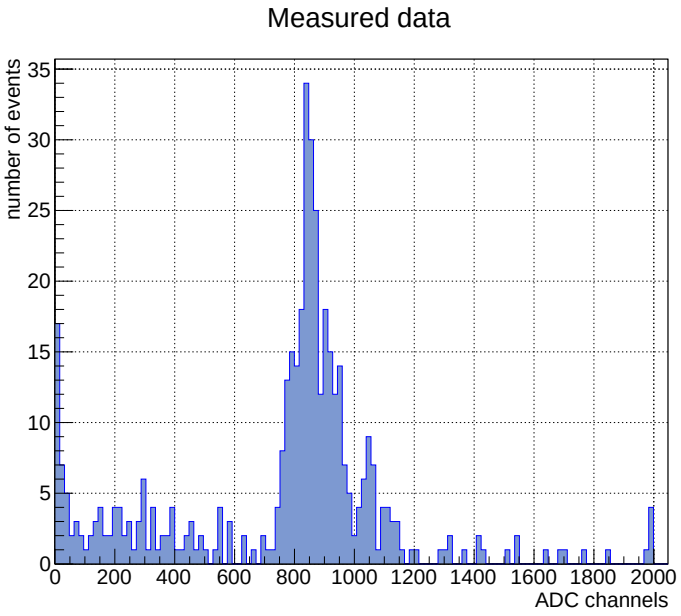
- Each detector submodule needs to be tested and can be relatively calibrated
- Measurement with cosmics

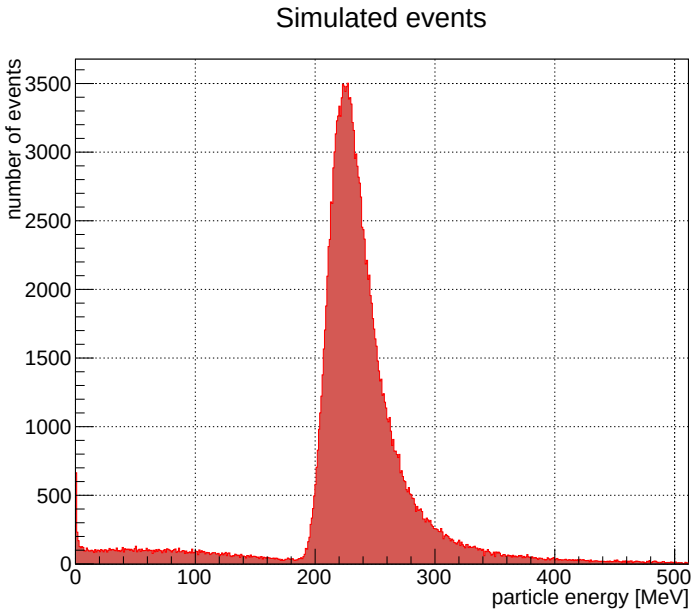


Analysis

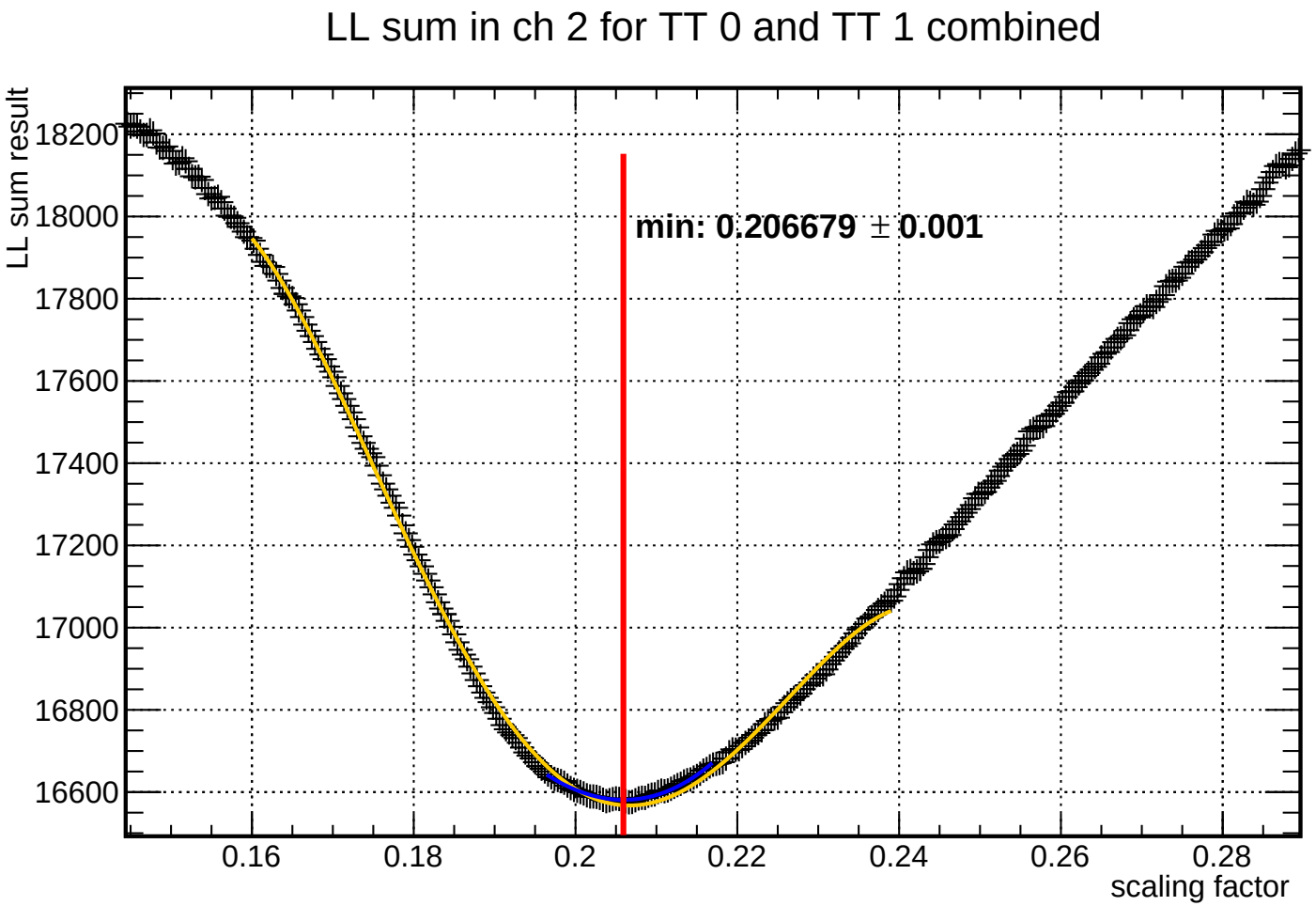
Goal of the analysis

- Compare measured and simulated data to obtain pre-calibration for each of the crystal channels
- Find a conversion from ADC bin to energy [MeV]



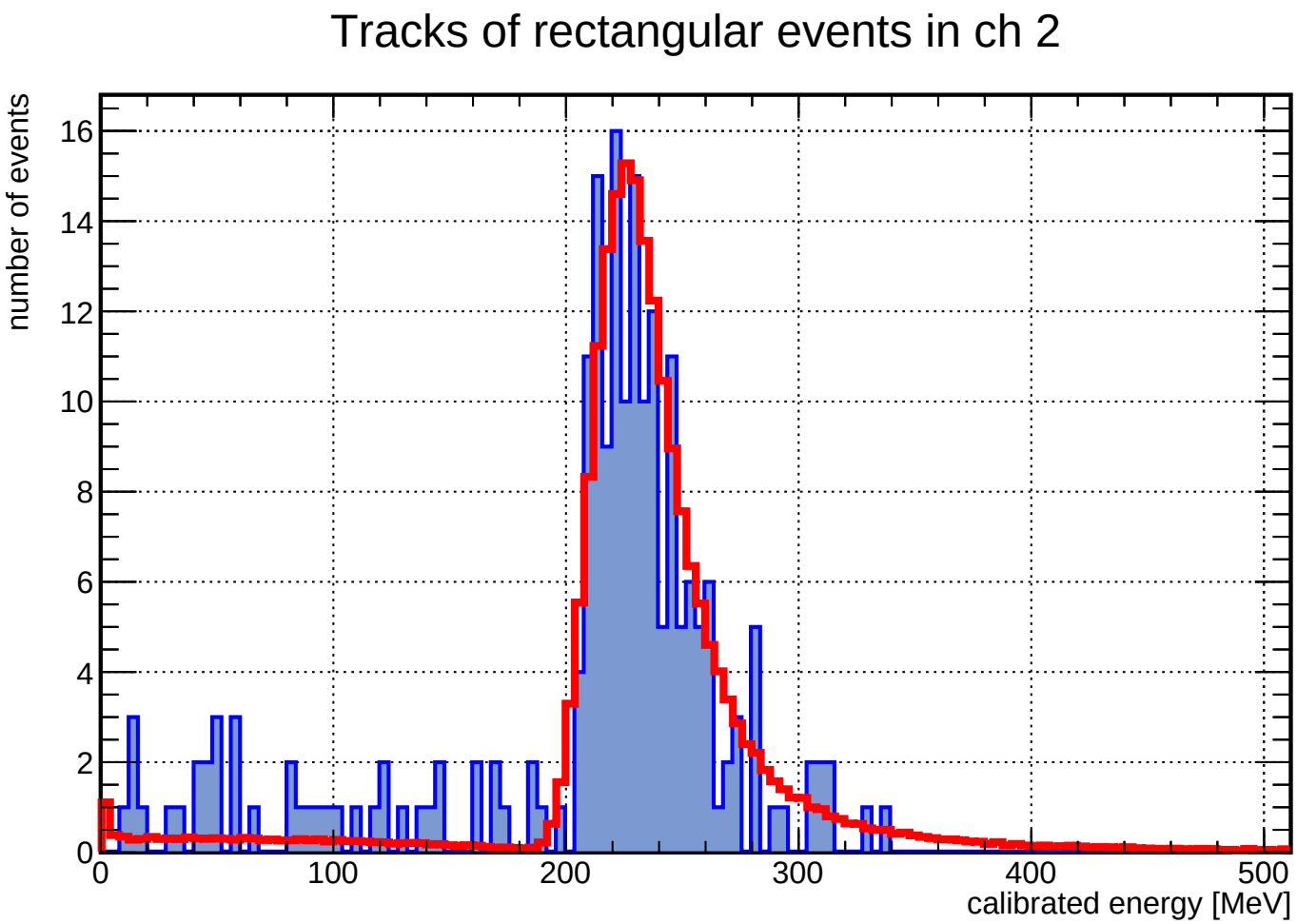


Measure for quality



Minimum found at 0.207 $\frac{\text{MeV}}{\text{ADC ch}}$

Exemplary result for realistic statistics



Minimum found at 0.207 $\frac{\text{MeV}}{\text{ADC ch}}$

Reminder: matching procedure

Positioning of crystal according to expected radiation profile

Matching VPTTs to positions, response formulated as:

gain(950V) · skb · gainLoss(B) · preamp gain · crystal LY

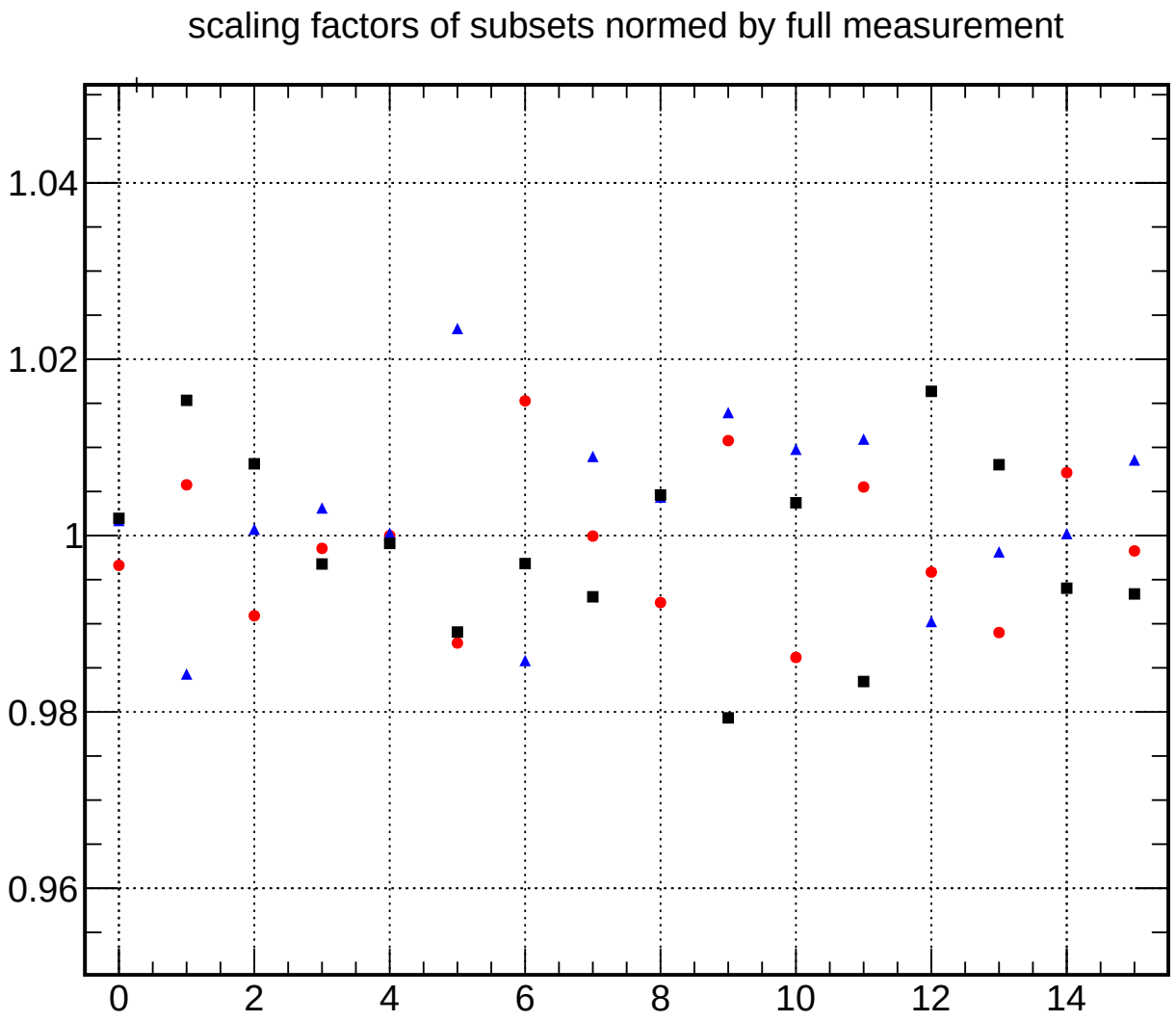
Minimizing quality variances in compartments by:

grouping VPTTs with same voltage dependence and adjusting optimal voltage for each compartment

Test measurements with 3 matched submodules

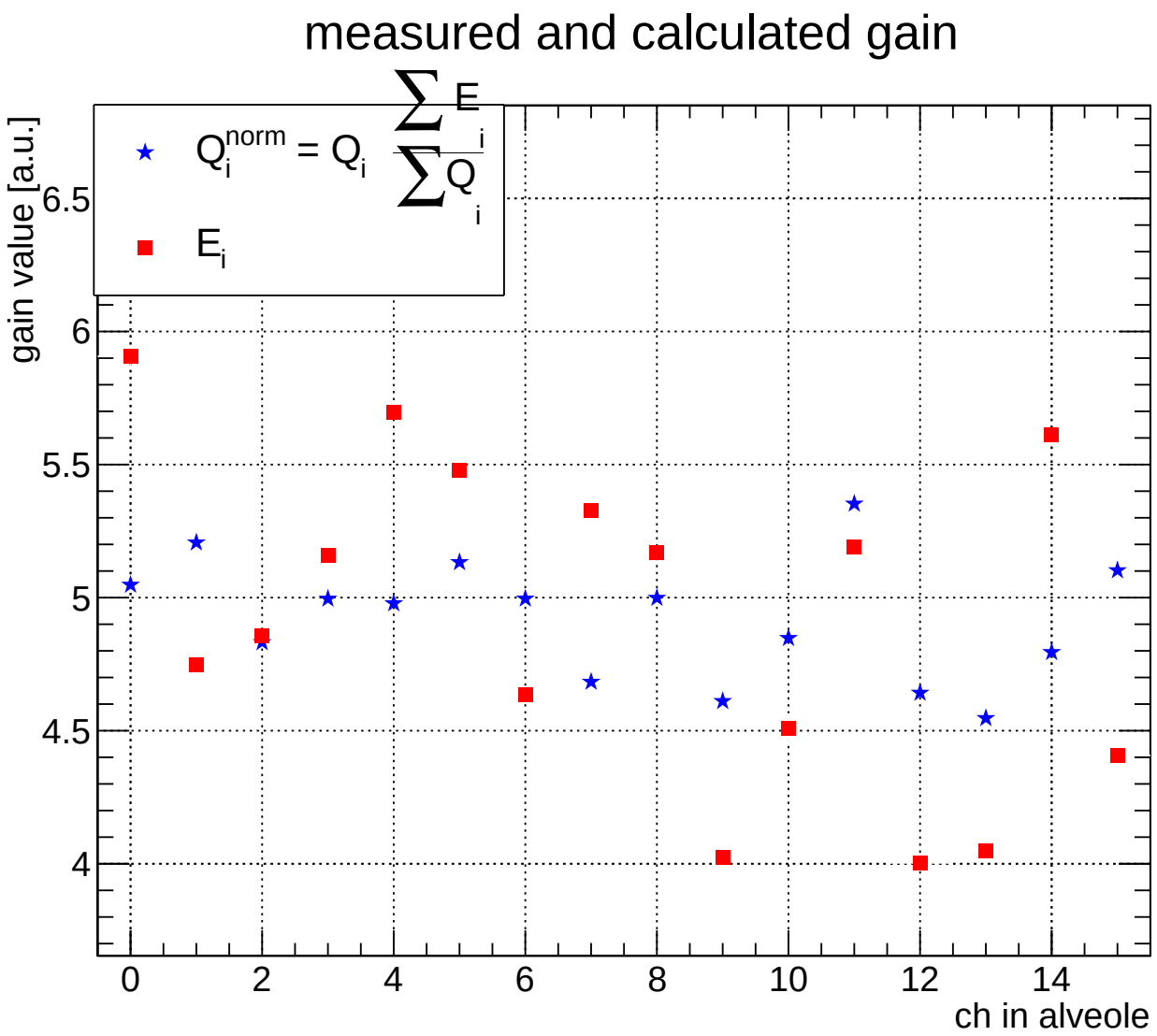
2-X1Y5	2-X3Y2	2-X2Y4

Longterm measurement split into subsamples



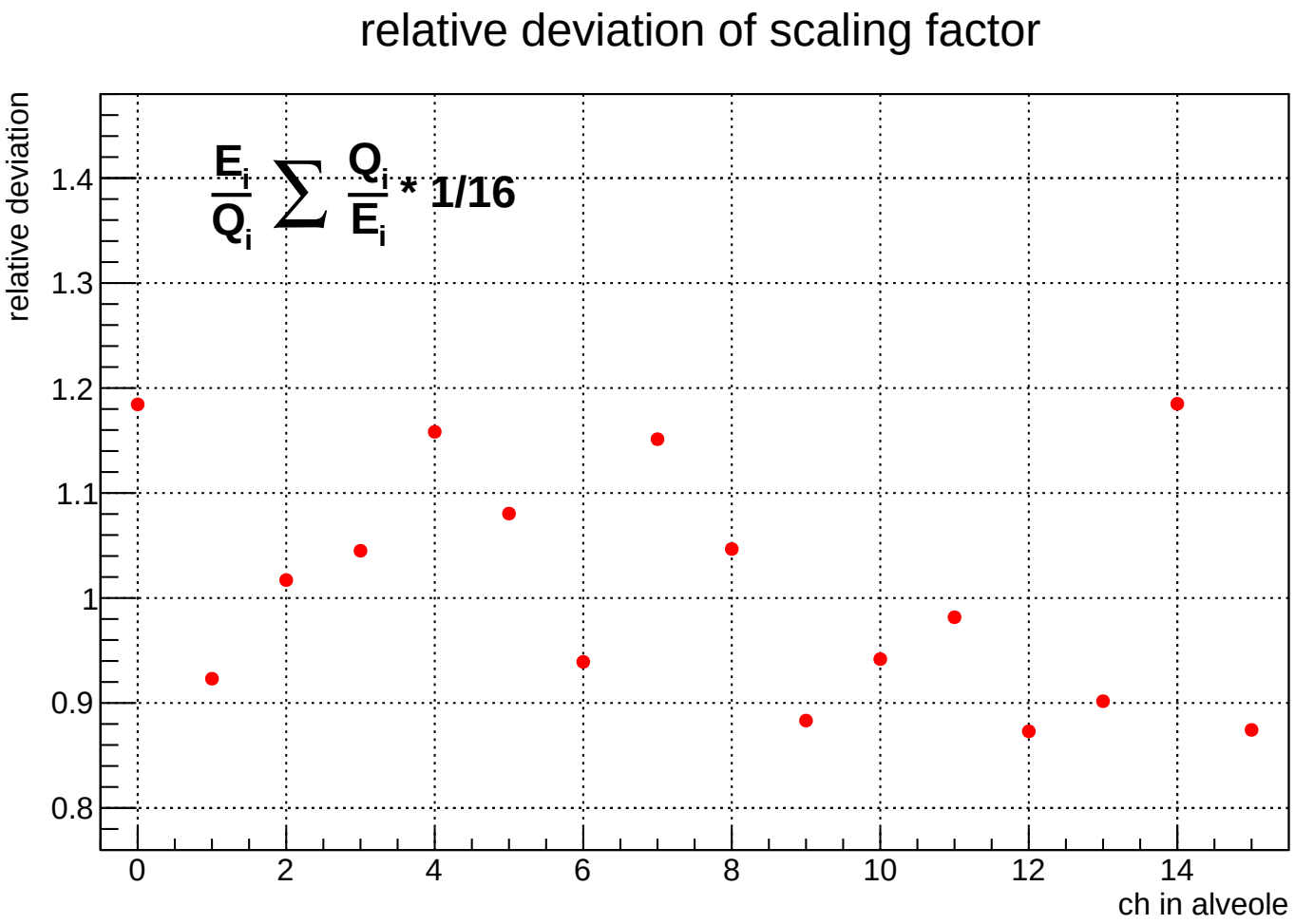
variation below $\approx 2.3\%$

Submodule 2-X1Y5 (run 1041)



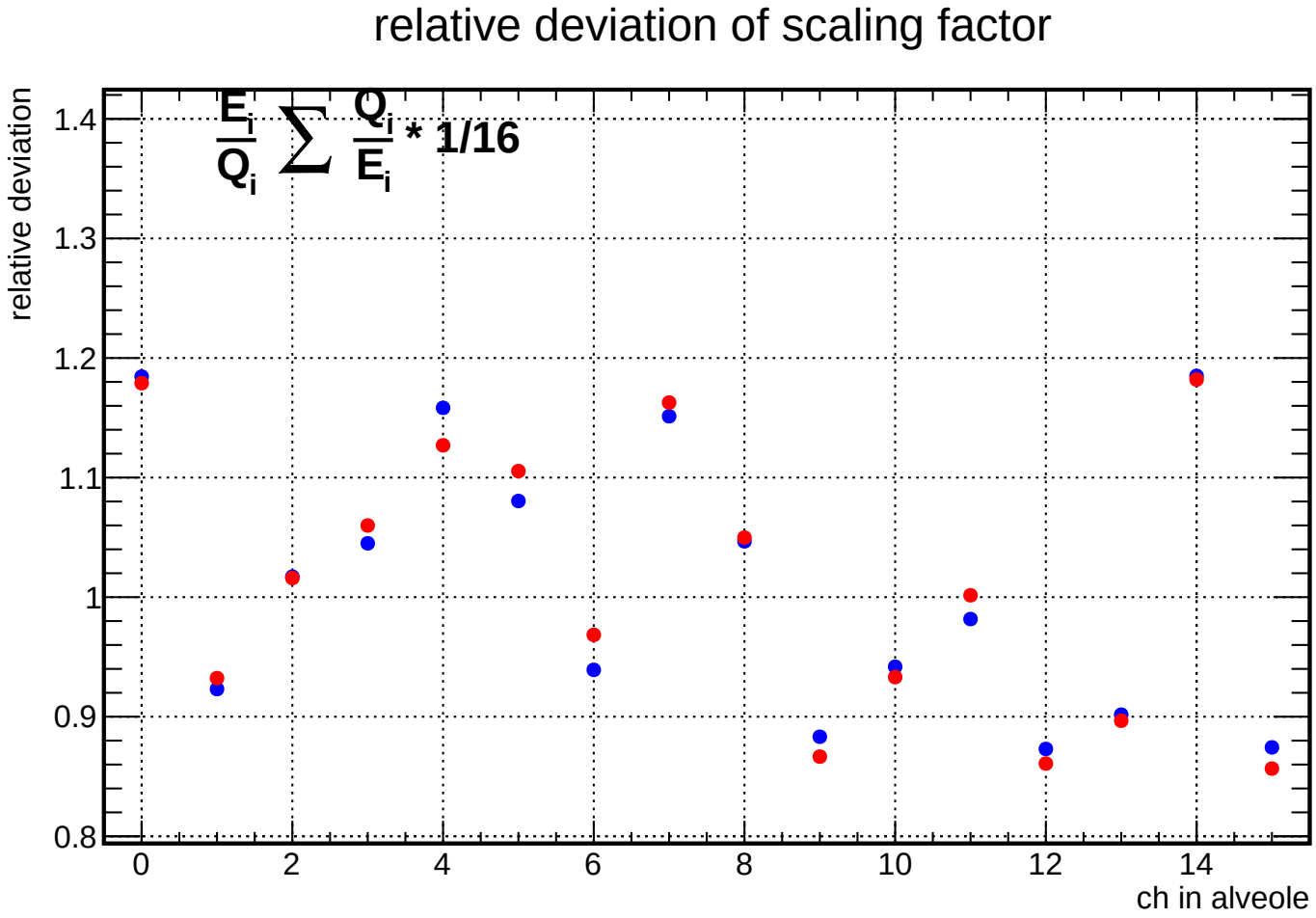
E_i: measured gain; Q_i^{norm}: expected gain normalized by mean ratio to measured gain.

Submodule 2-X1Y5 (run 1041)



normalized by mean ratio: calculated to measured gain.

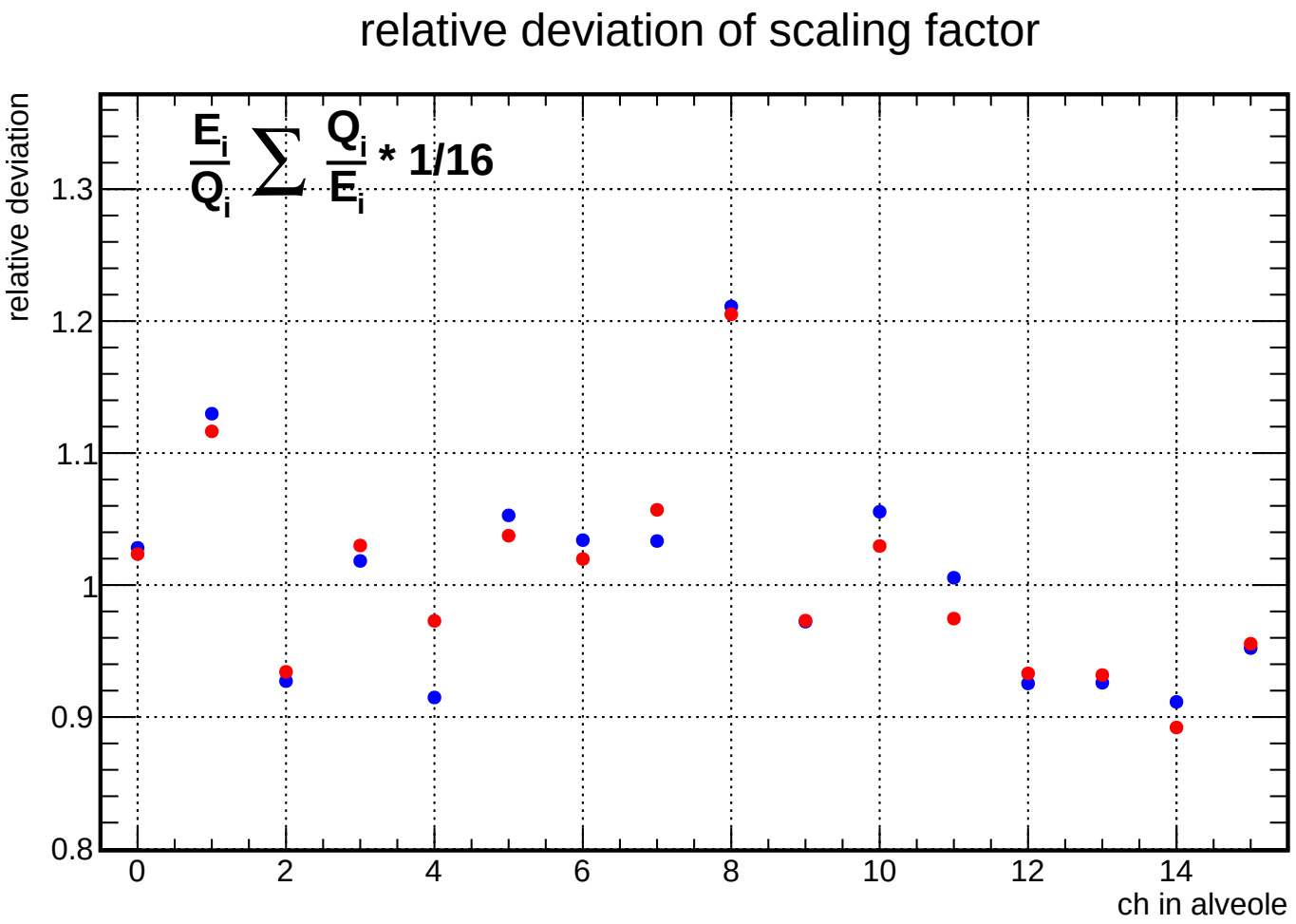
Submodule 2-X1Y5 (runs 1041 and 1215)



run 1215: red dot; run 1041: blue dot (same setup)

rel. deviations: ch 5$\approx 3.6\%$ ch 11 $\approx 3.7\%$

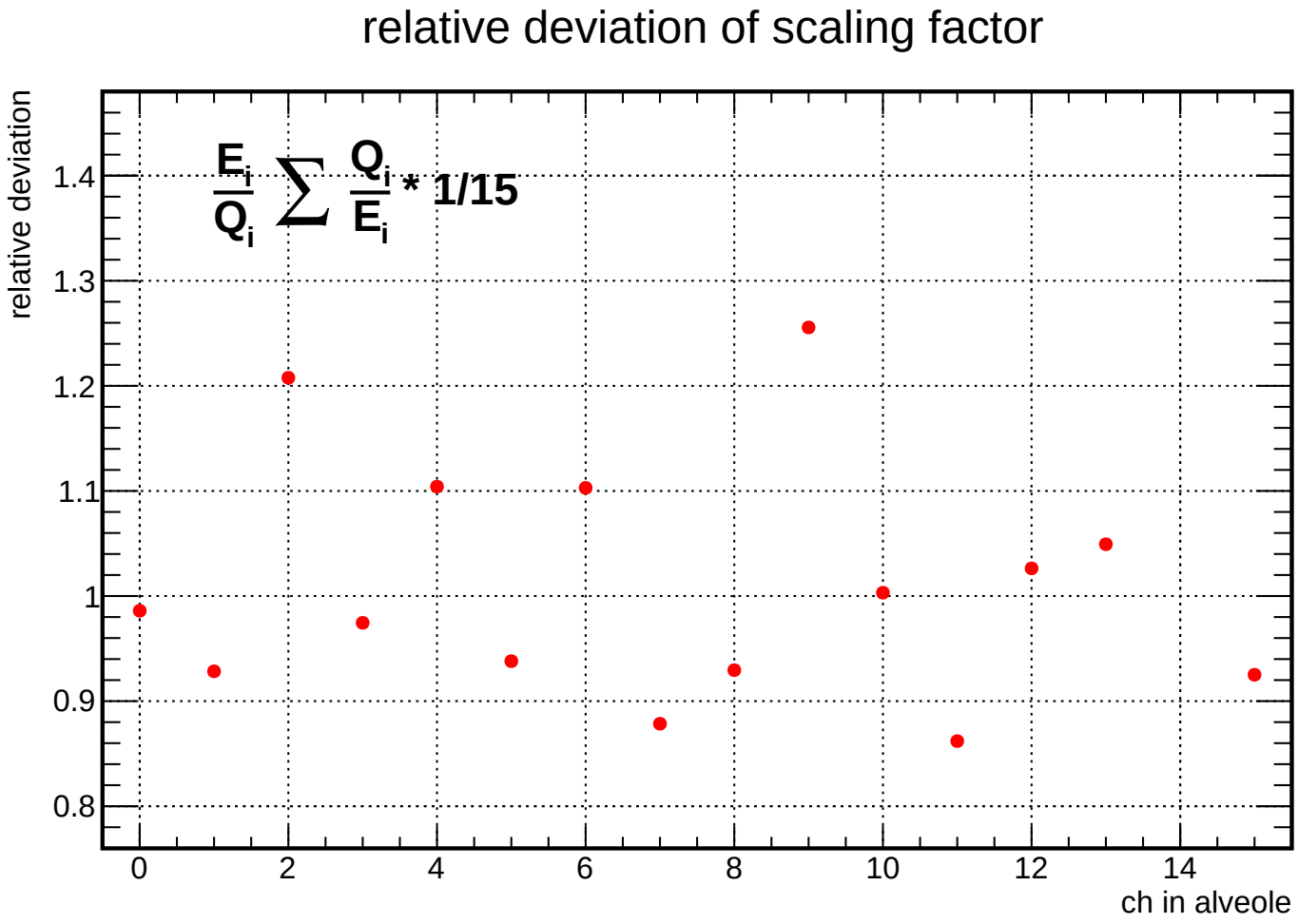
Submodule 2-X2Y4 (runs 1243 and 1216)



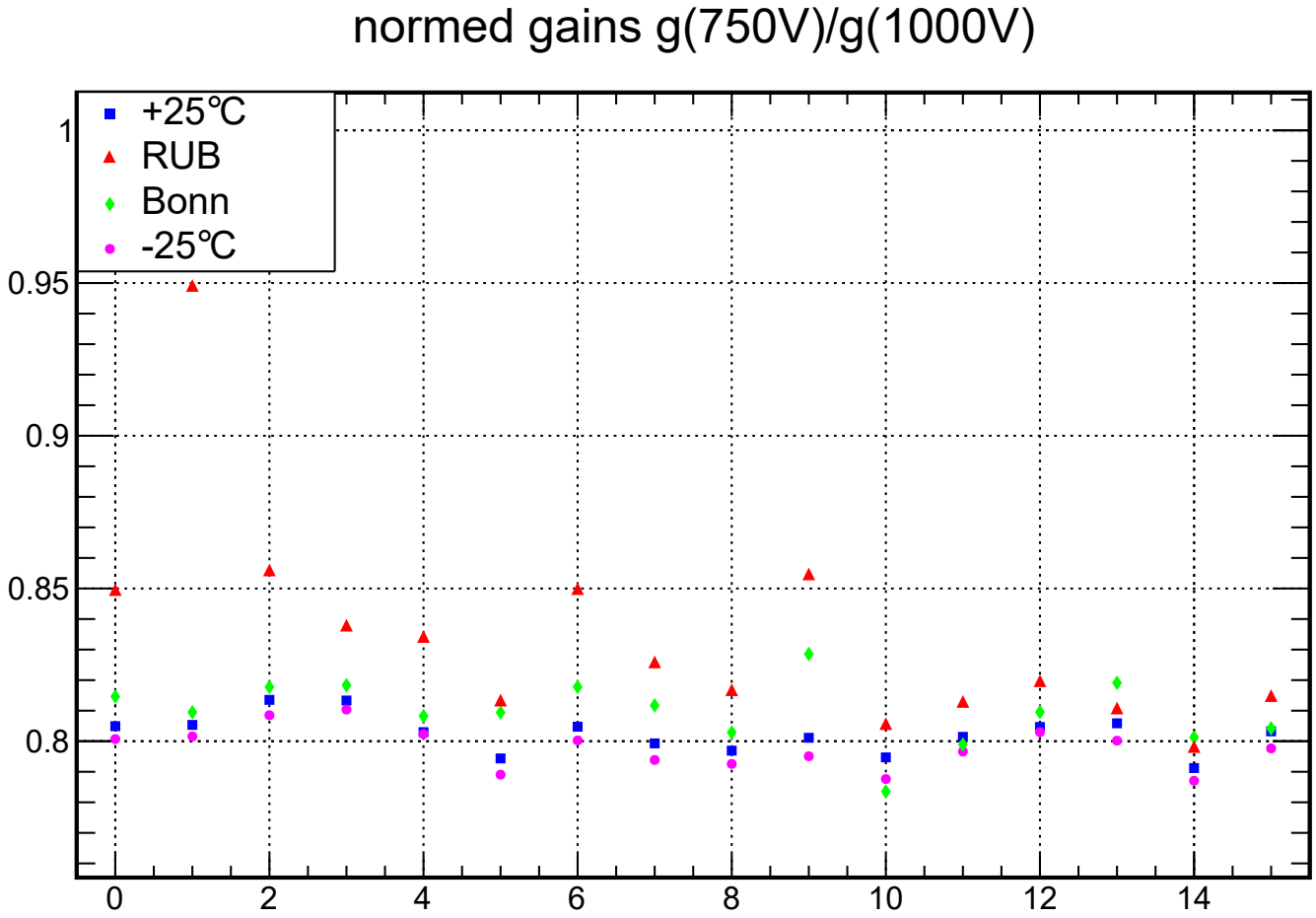
run 1243: red dot ; run 1216: blue dot (different setup)

rel. deviations: ch $4 \approx 7.8\%$ ch 7 $\approx 3.5\%$

Submodule 2-X3Y2 (run 1244)



Search for reason of discrepancy: gain(U)



Matching VPTTs to positions, response formulated as:

dcGain1000V · gainLoss(U) $\cdot skb \cdot$ preamp gain ·cry. LY

Summary

Summary

- Teststation design is developed and finished
- Measurement procedure optimised and finalised
- Method for data analysis is principally ready
- Measured gain variations need to be investigated
- 1 setup of the teststation almost ready for vptt submodules
- 2nd setup of teststation will be operational soon.
- First three matched submodules built and measured
- (Partial) re-matching necessary

Thank you for your attention!

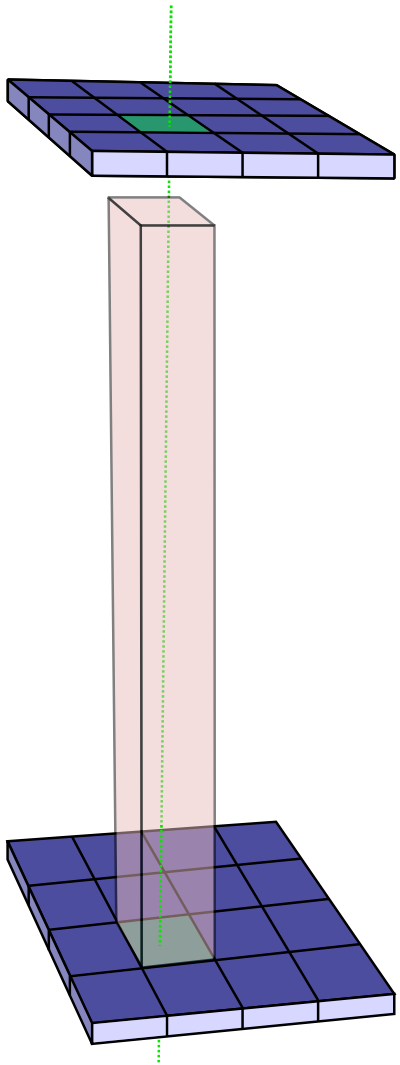
Enter submodule positions, Start Run

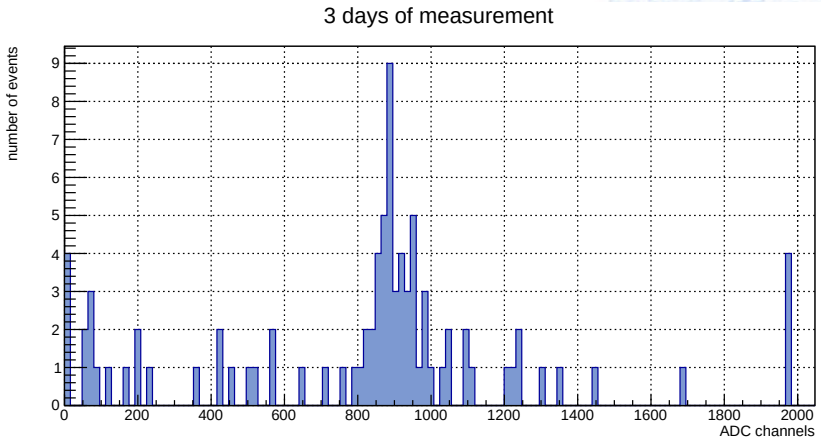
measurement run:

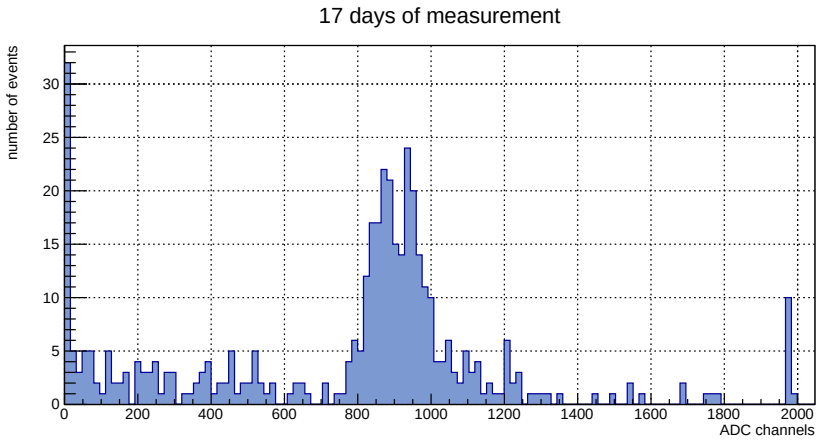
1. turn on LV
2. ramp up HV
3. pulser run, until accepted.
4. ramp down temperature with 8 °C/h to -25 °C and wait for 45 min once temperature is reached
5. datataking for 3.5 days
6. ramp down HV
7. turn off LV
8. ramp up temperature with 4 °C/h to 0 °C and wait for 20 min
9. ramp up temperature with 6 °C/h to 25 °C

Example data

Track type 0

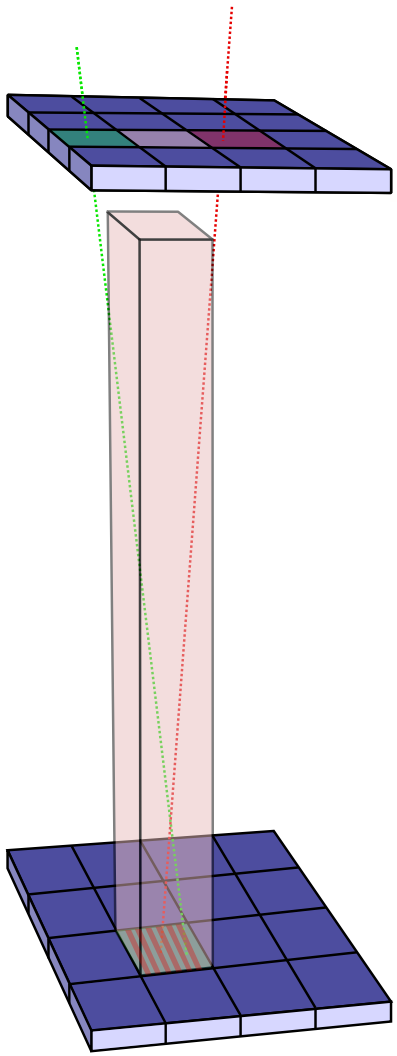


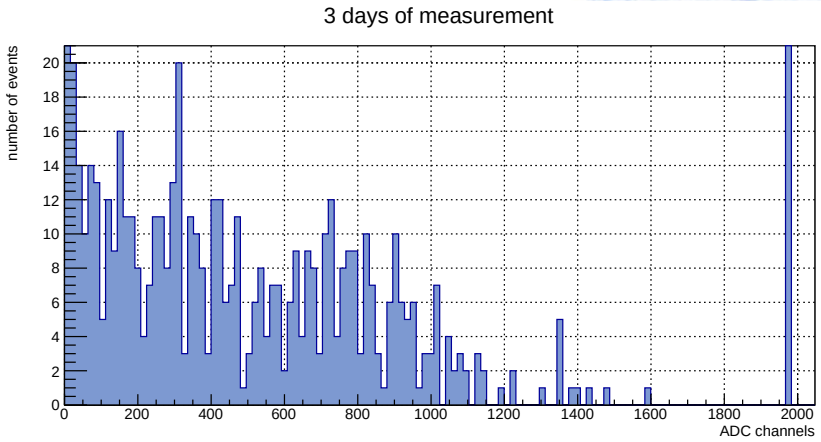


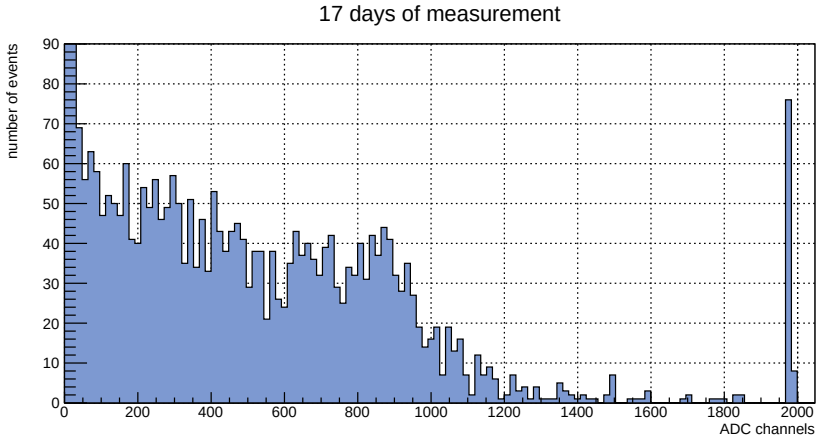


Example data

Track type 1

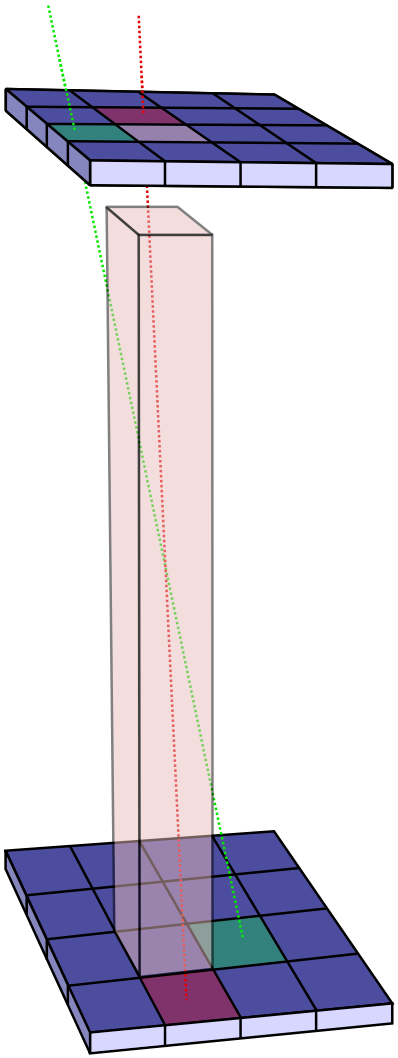


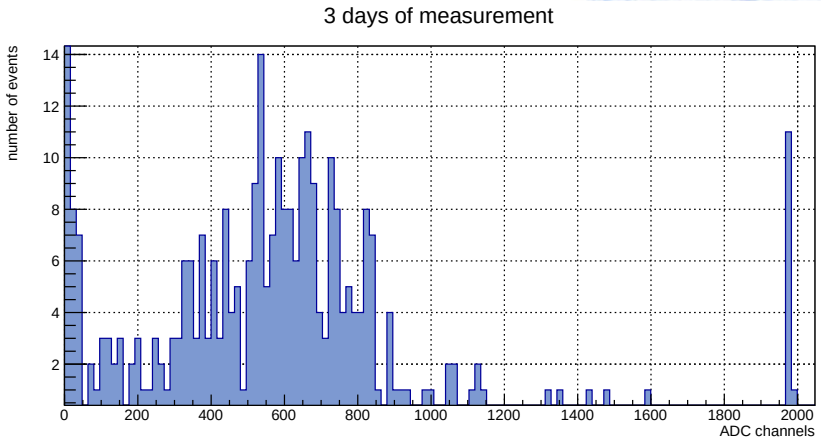


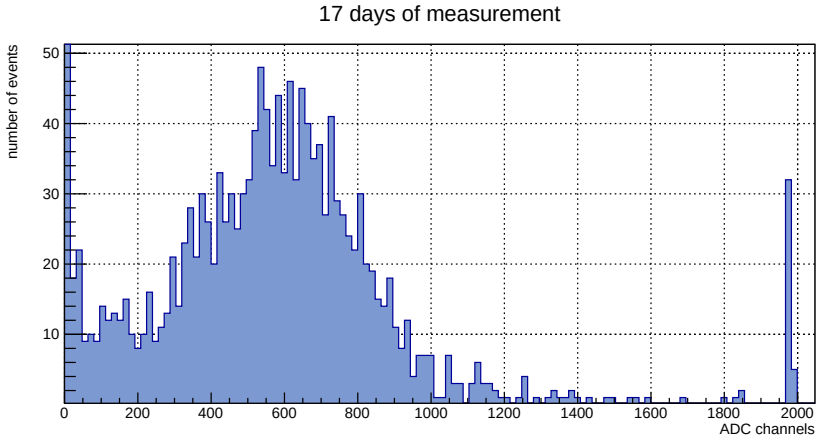


Example data

Track type 2

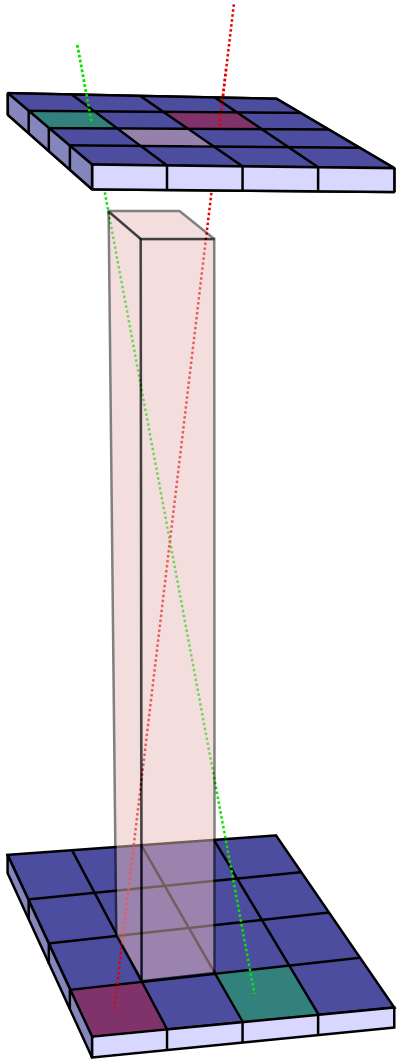


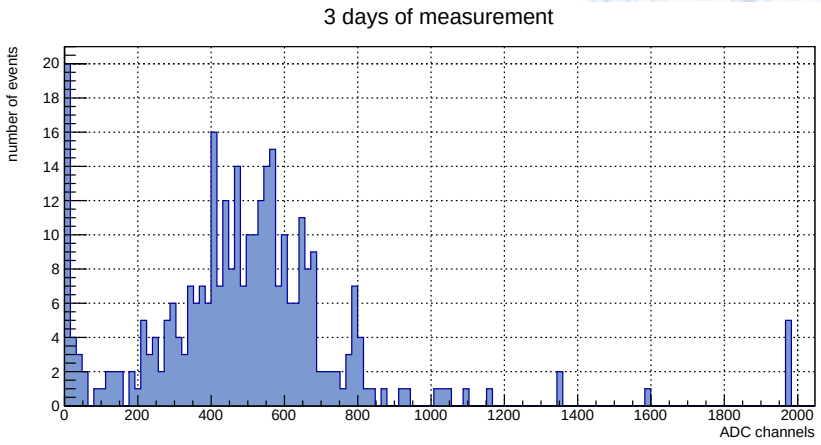


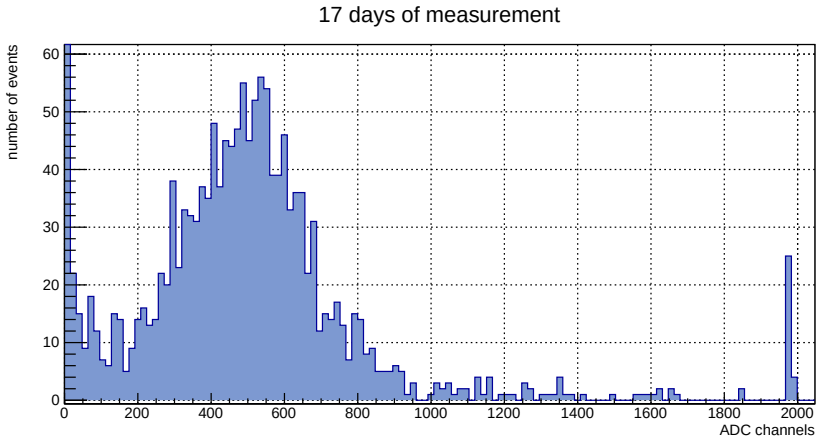


Example data

Track type 3

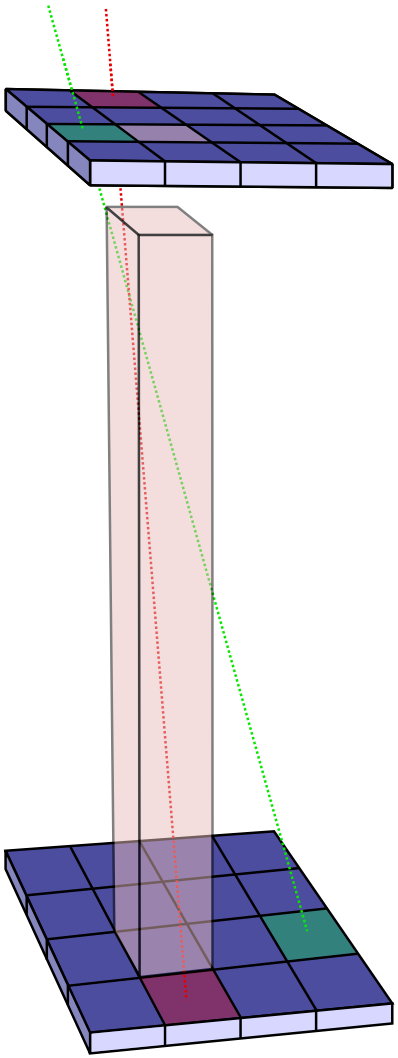


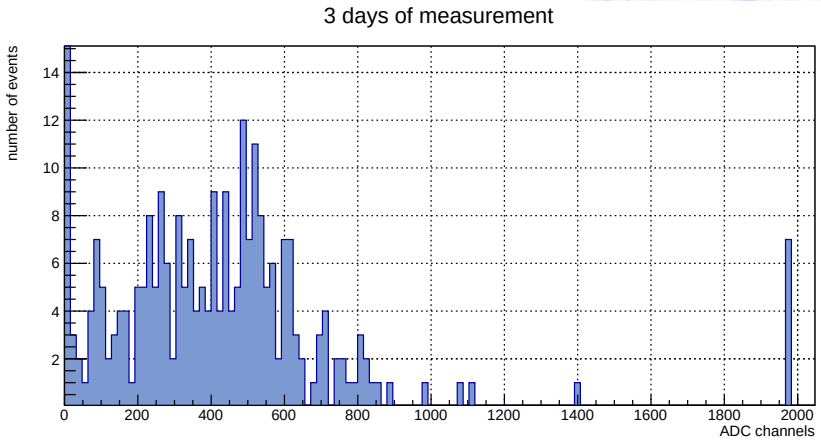


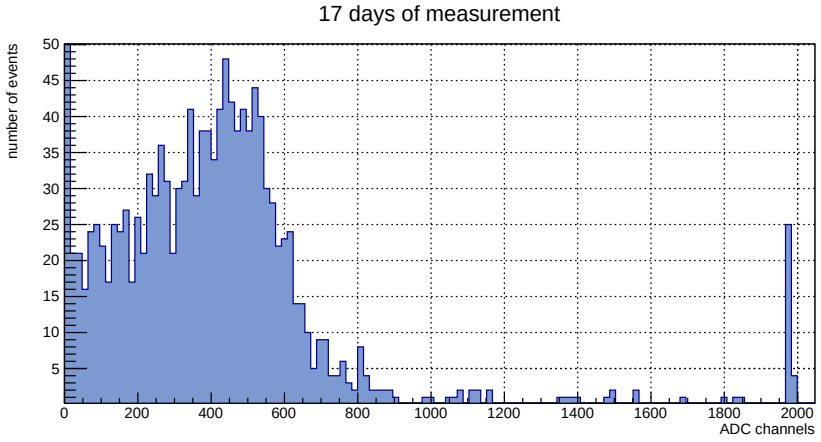


Example data

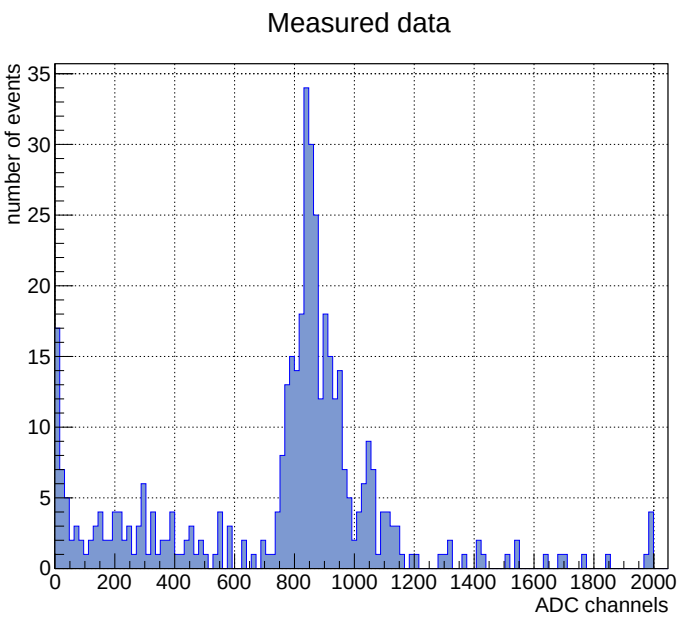
Track type 4

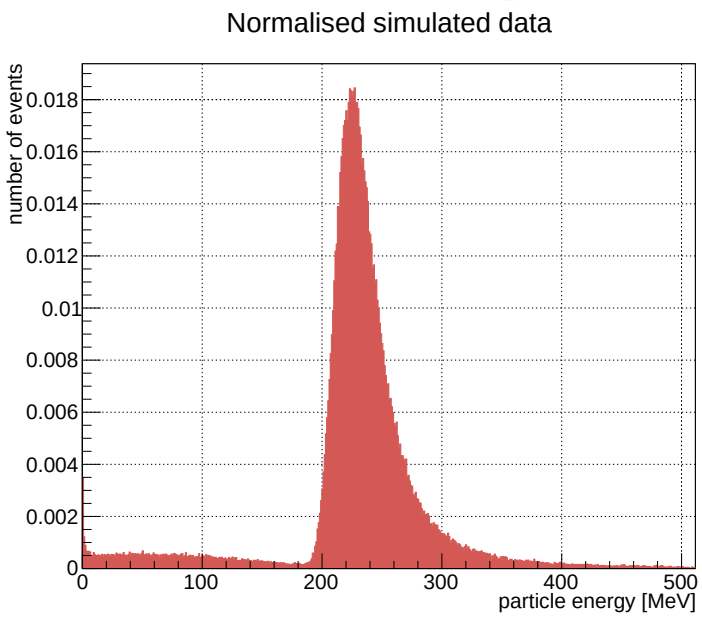






Method: Log Likelihood





Binned Log Likelihood fit

1. Vary scaling factor of simulated data to measured one
2. Get a measure for each of the scaling factors and find the best $L = 2\sum_{bins}\left(\mathrm{b_{meas}} - \mathrm{b_{sim}} + \mathrm{b_{sim}} \cdot \ln\left(\frac{\mathrm{b_{sim}}}{\mathrm{b_{meas}}}\right)\right)$

For all track types