Calibration of testbeam FEB - B0 initial results

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Plan of the presentation

1. Motivation
2. Method of calibration
3. Example of calibrated results

Motivation

To improve the quality of the analysis, we need to calibrate each readout channel of B0 FEB. One type of calibration is measurement of relative gain between channels.

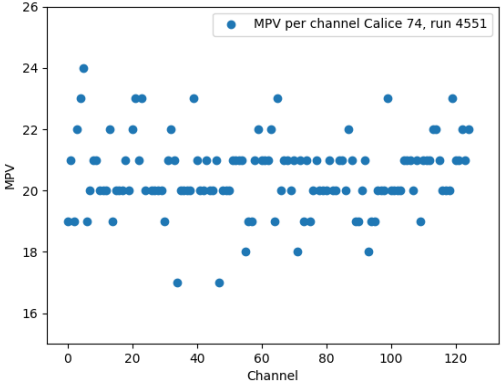

Fig. 1: Calice 74 run 4551 MPV position in function of channel

Calibration method

Using a simple single-channel injector, it was possible to inject same charge for each channel.

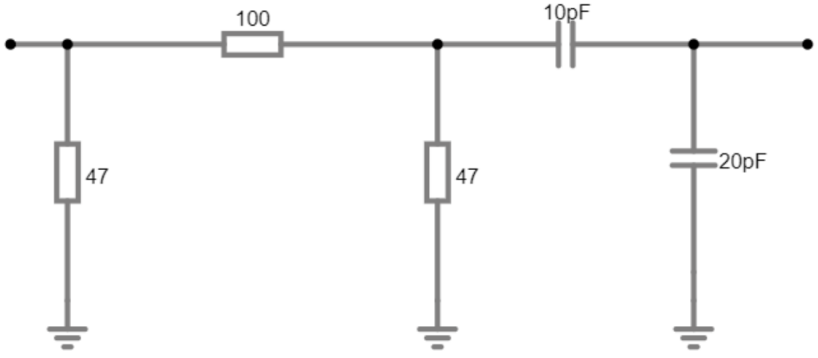

Fig. 2: Injector circuit

Calibration method

For each channel and injected charge amplitude of signal was reconstructed using online deconvolution and also fit CR-RC theoretical step response to raw data.

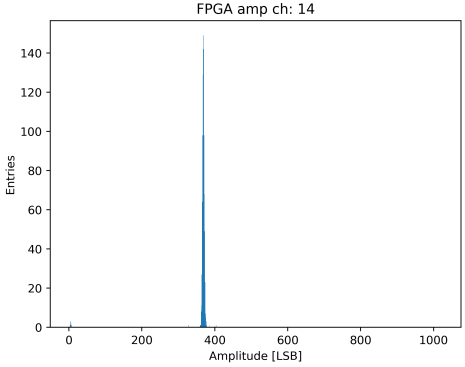

Fig. 3: Amplitude distribution online reconstruction ch 14

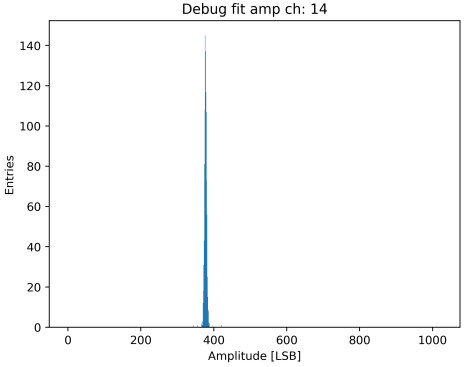

Fig. 4: Amplitude distribution fitted CR-RC to raw data ch 14

Linear regression

After calculating MPV for each channel and charge linear regression was applied (6 channels was classified as bad)

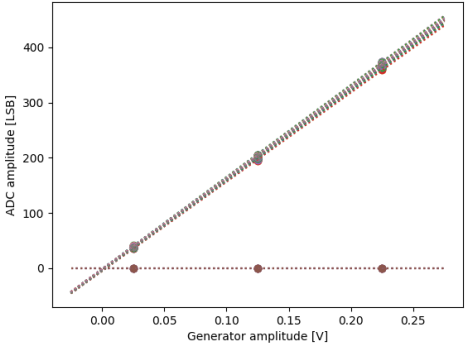

Fig. 5: Online reconstruction with linear regression applied

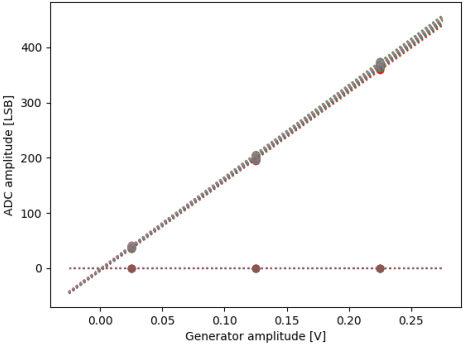

Fig. 6: Offline raw data reconstruction with linear regression applied

Linear regression - intercept

We can look closely for 4 interesting point on that plot

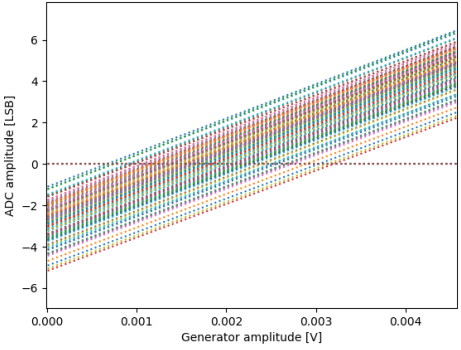

Fig. 7: Online reconstruction with linear regression applied

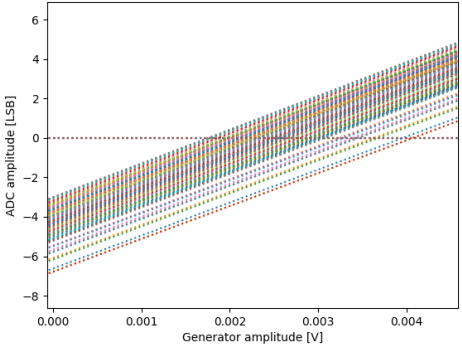

Fig. 8: Offline raw data reconstruction with linear regression applied

Linear regression - first injected charge

We can look closely for 4 interesting point on that plot

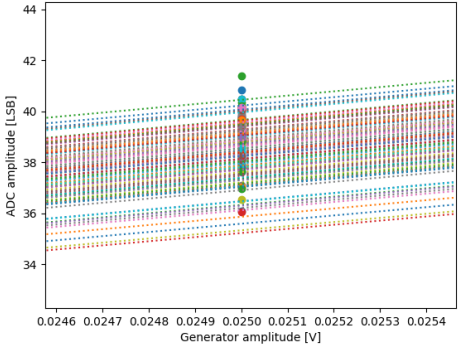

Fig. 9: Online reconstruction with linear regression applied

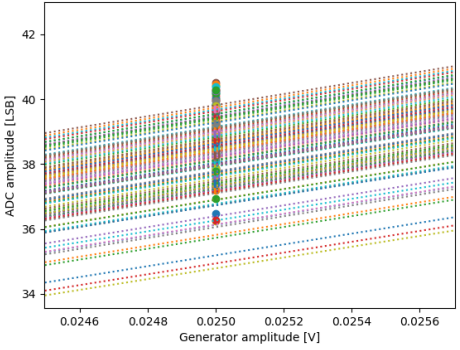

Fig. 10: Offline raw data reconstruction with linear regression applied

Linear regression - second injected charge

We can look closely for 4 interesting point on that plot

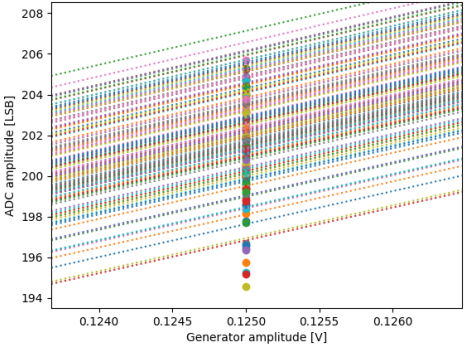

Fig. 11: Online reconstruction with linear regression applied

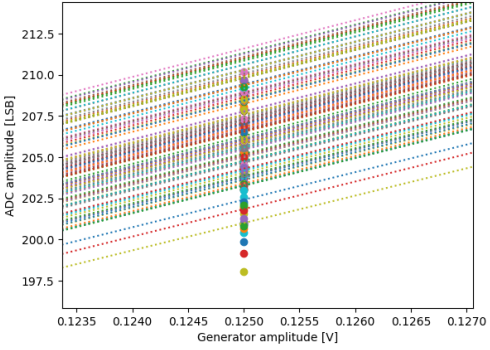

Fig. 12: Offline raw data reconstruction with linear regression applied

Linear regression - third injected charge

We can look closely for 4 interesting point on that plot

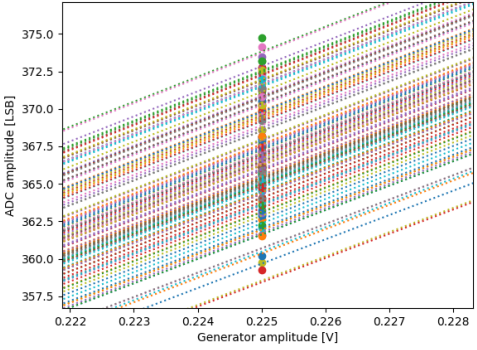

Fig. 13: Online reconstruction with linear regression applied

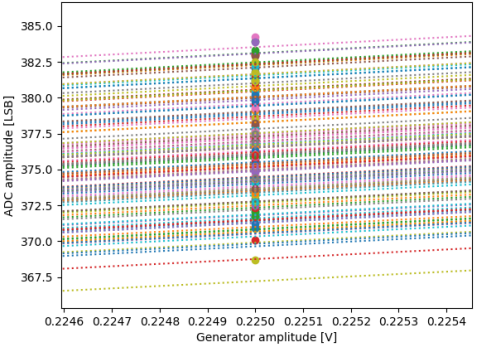

Fig. 14: Offline raw data reconstruction with linear regression applied

Linear regression - slope

From linear regression we can read information about slope and after normalisation to all channels to one of them we have relative gain.

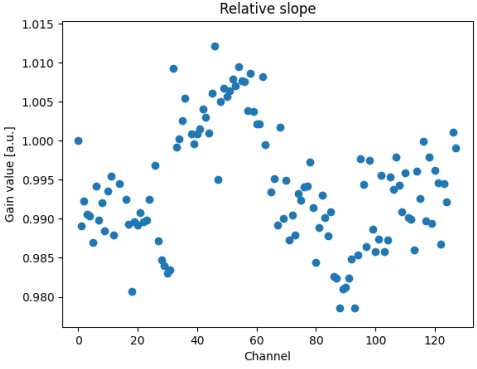

Fig. 15: Relative gain - online reconstruction

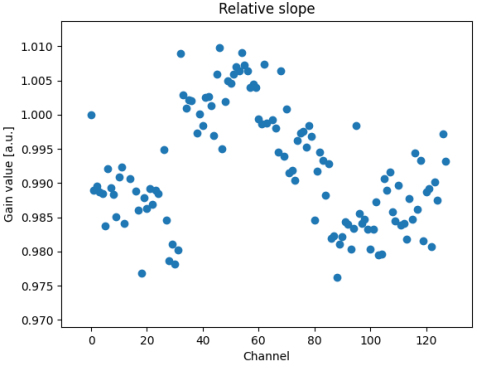

Fig. 16: Relative gain - offline reconstruction from raw data

Linear regression - slope histogram

From linear regression we can read information about slope and after normalisation to all channels to one of them we have relative gain.

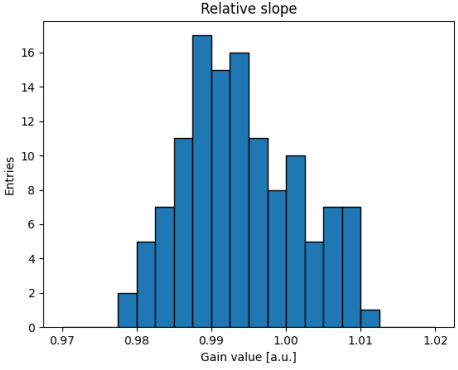

Fig. 17: Relative gain histogram - online reconstruction

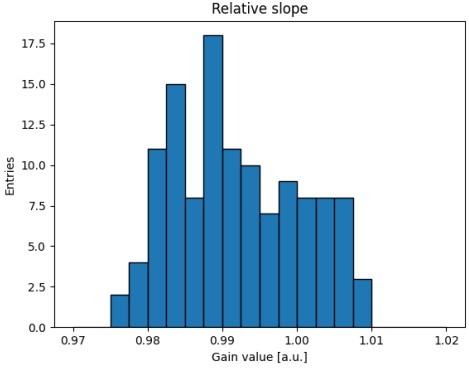

Fig. 18: Relative gain histogram - offline reconstruction from raw data

Linear regression - intercept

From linear regression we can read information about intercept which can be interpreted as validation of baseline calculation.

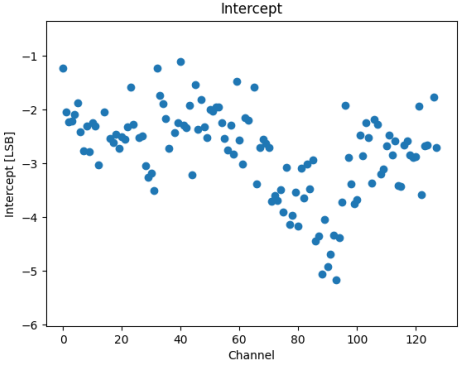

Fig. 19: Intercept - online reconstruction

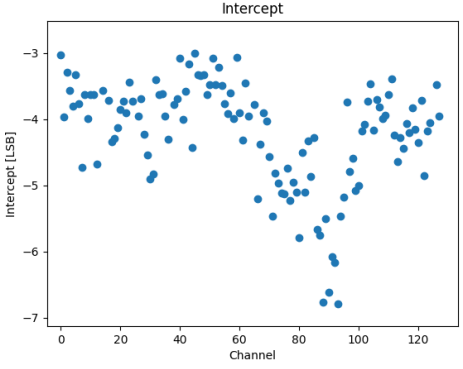

Fig. 20: Intercept - offline reconstruction from raw data

Linear regression - intercept histogram

From linear regression we can read information about intercept which can be interpreted as validation of baseline calculation.

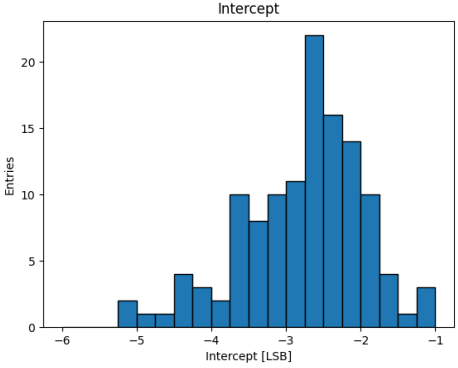

Fig. 21: Intercept histogram - online reconstruction

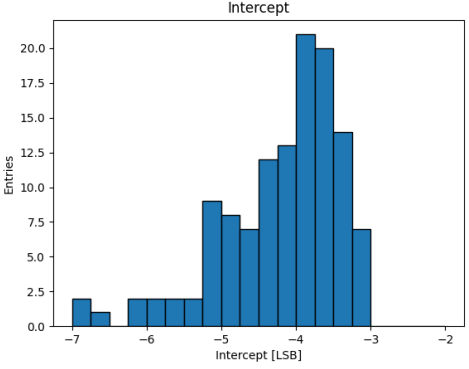

Fig. 22: Intercept histogram - offline reconstruction from raw data

Linear regression - R^2 value

From linear regression we can read information about R^2 value which describes error of output linear parameters in relation to the measurement data.

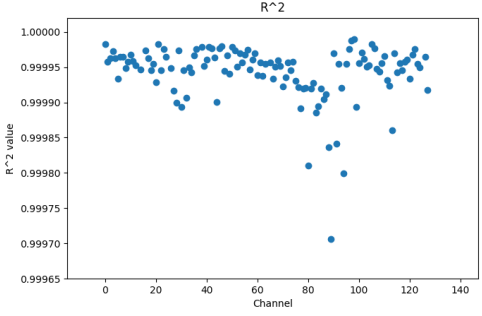

Fig. 23: R^2 value - online reconstruction

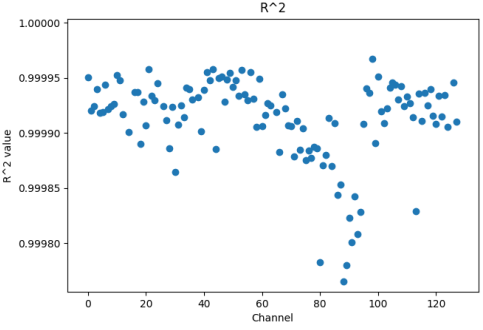

Fig. 24: R^2 value - offline reconstruction from raw data

Linear regression - R^2 value histogram

From linear regression we can read information about R^2 value which describes error of output linear parameters in relation to the measurement data.

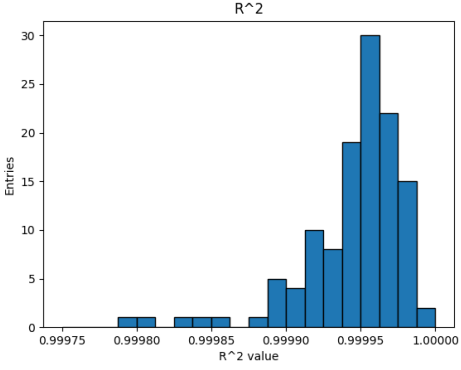

Fig. 25: R^2 value histogram - online reconstruction

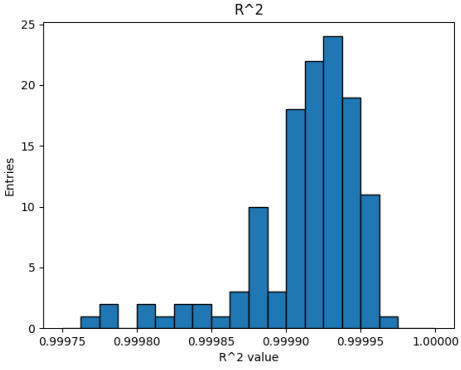

Fig. 26: R^2 value histogram - offline reconstruction from raw data

Example of calibrated results

Taking account relative gain for each channel we can perform gain correction for B0 board. As you can see gain difference has no significant influence on MPV position.

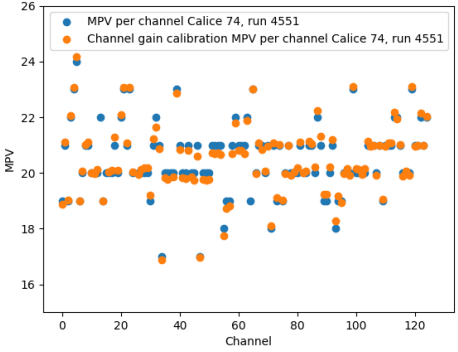

Fig. 27: Corrected MPV position relative gain from online reconstruction

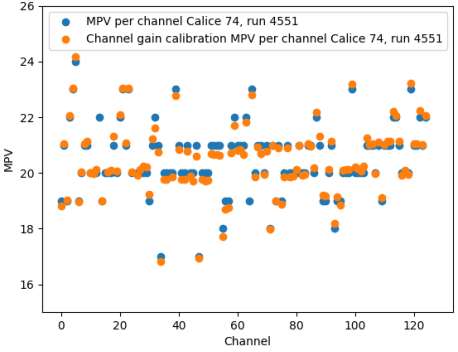

Fig. 28: Corrected MPV position relative gain from raw data

Conclusions

- Gain differences between channels do not vary to much $\pm$ 1.5 %
- Intercept value are not exactly as we expected
- Probably injected charge was to big

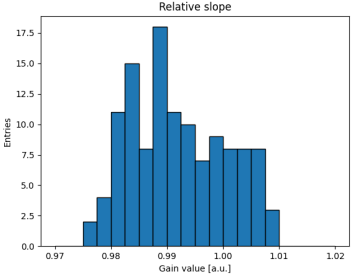

Fig. 29: Relative gain histogram - offline reconstruction from raw data

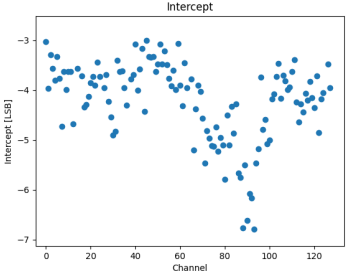

Fig. 30: Intercept - offline reconstruction from raw data

Thank you for attention