KLauS2v0
Uniformity and Noise Measurements

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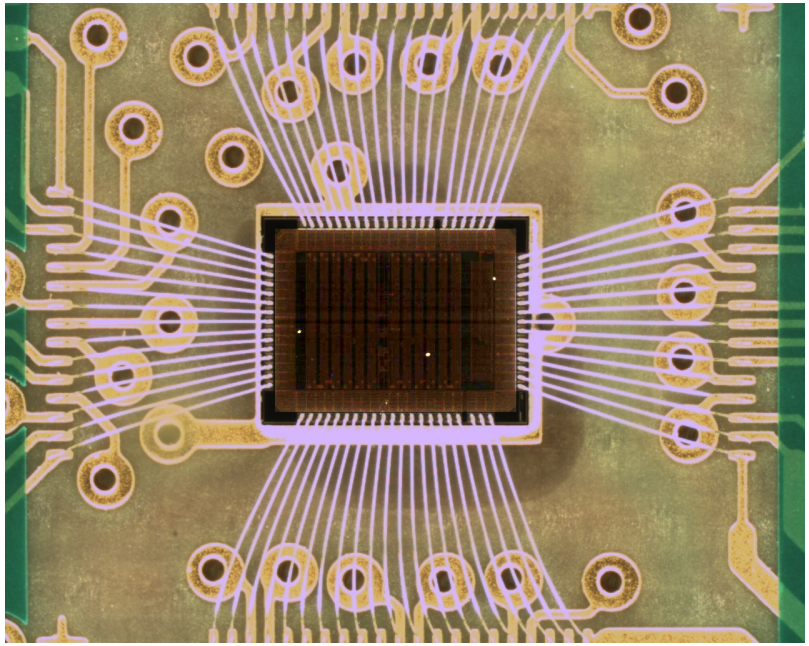
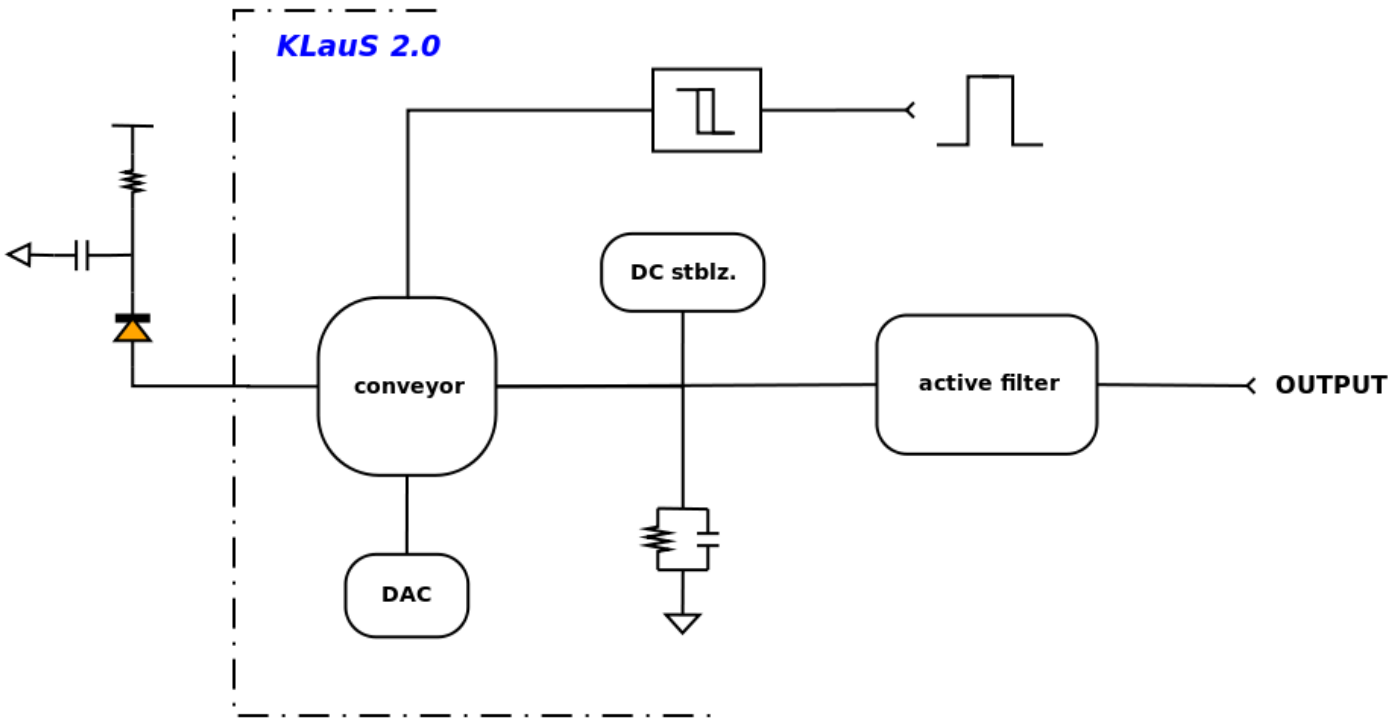
Reminder: KLauS2v0



KLauS2v0

- 12 channels
- Support for Power Gating
- Low Power Consumption
- High Dynamic Range
- Signal to Noise Ratio > 10
- SiPM Bias Tunable
- SiGe 0.35 μm Technology
- Implementation into SPIROC planned

Channel Diagram of KLauS2v0



Analog chain: passive integration + DC stabilization + active filter

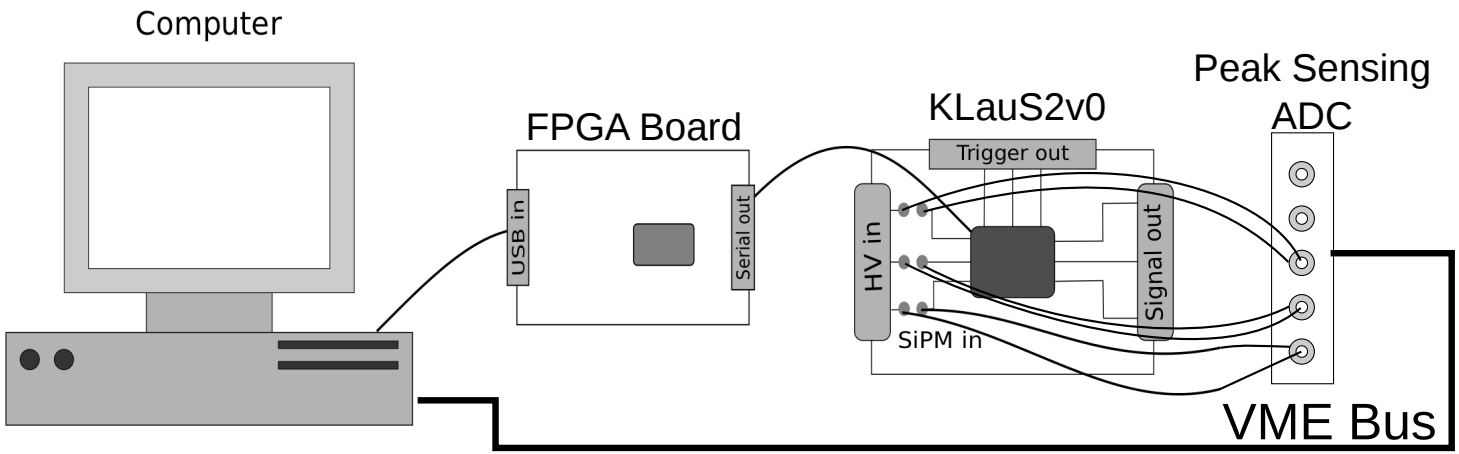
Modified current conveyor supports power gating

Conducted Measurements

Channel Uniformity	$\rightarrow$	DAC Linearities
Detector Capacitance	$\rightarrow$	Charge Conversion Factors
	$\rightarrow$	Noise Measurements for different Detector Capacitances

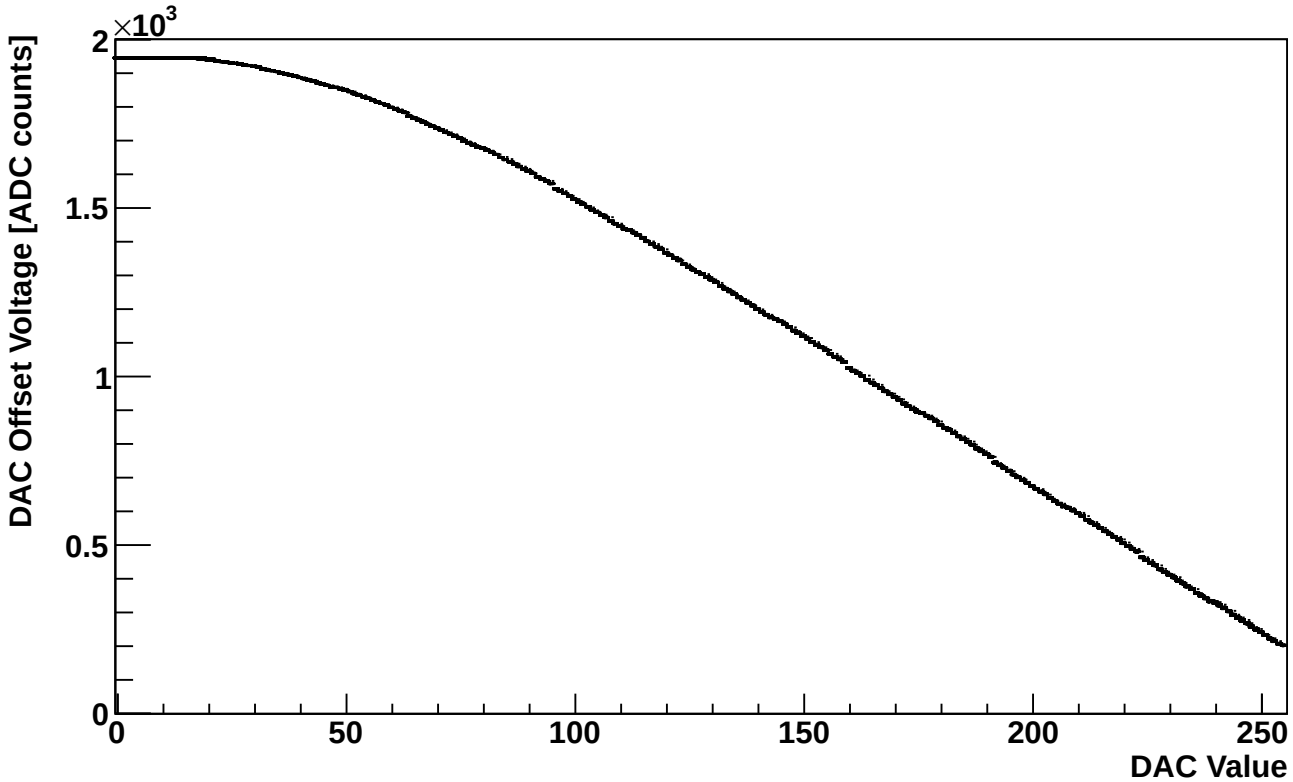
An automated characterization is being developed to perform the needed measurements.

Input DAC Uniformity Setup



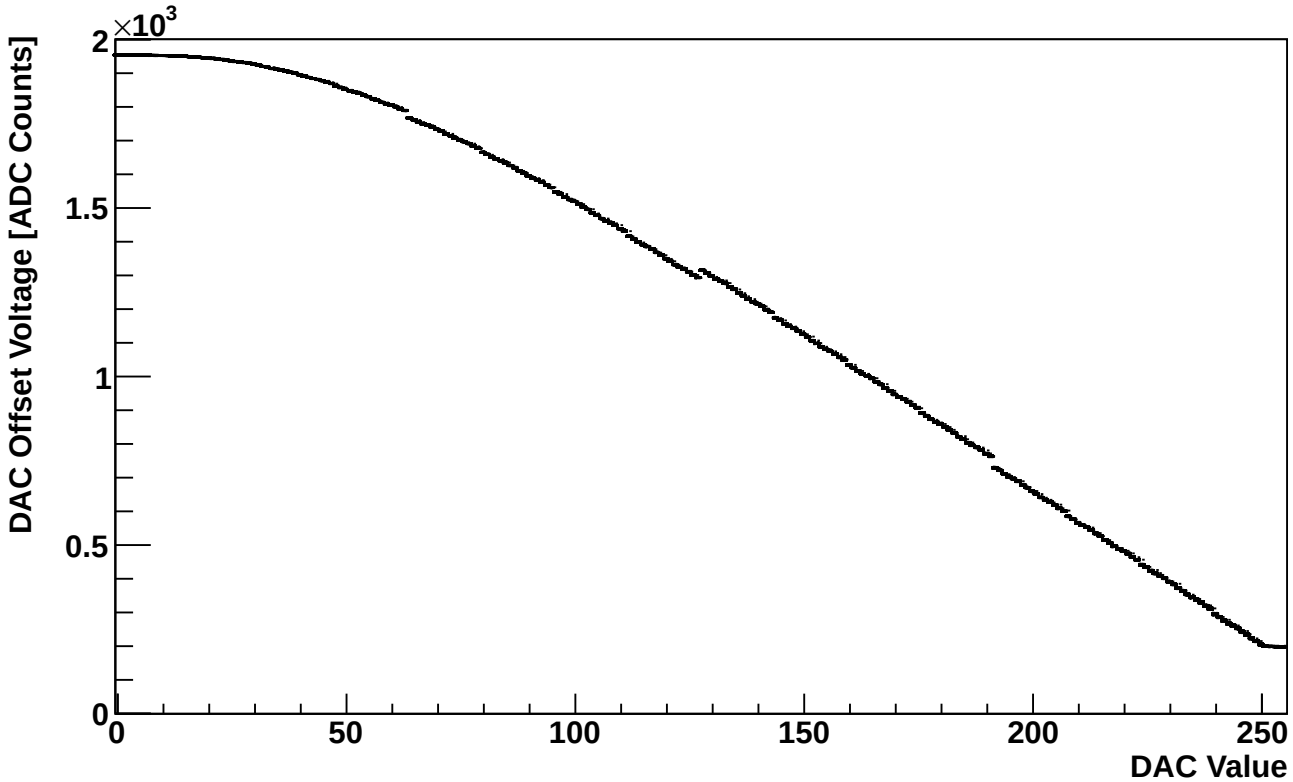
The voltage at the input terminals is measured for every DAC configuration.

Raw Data



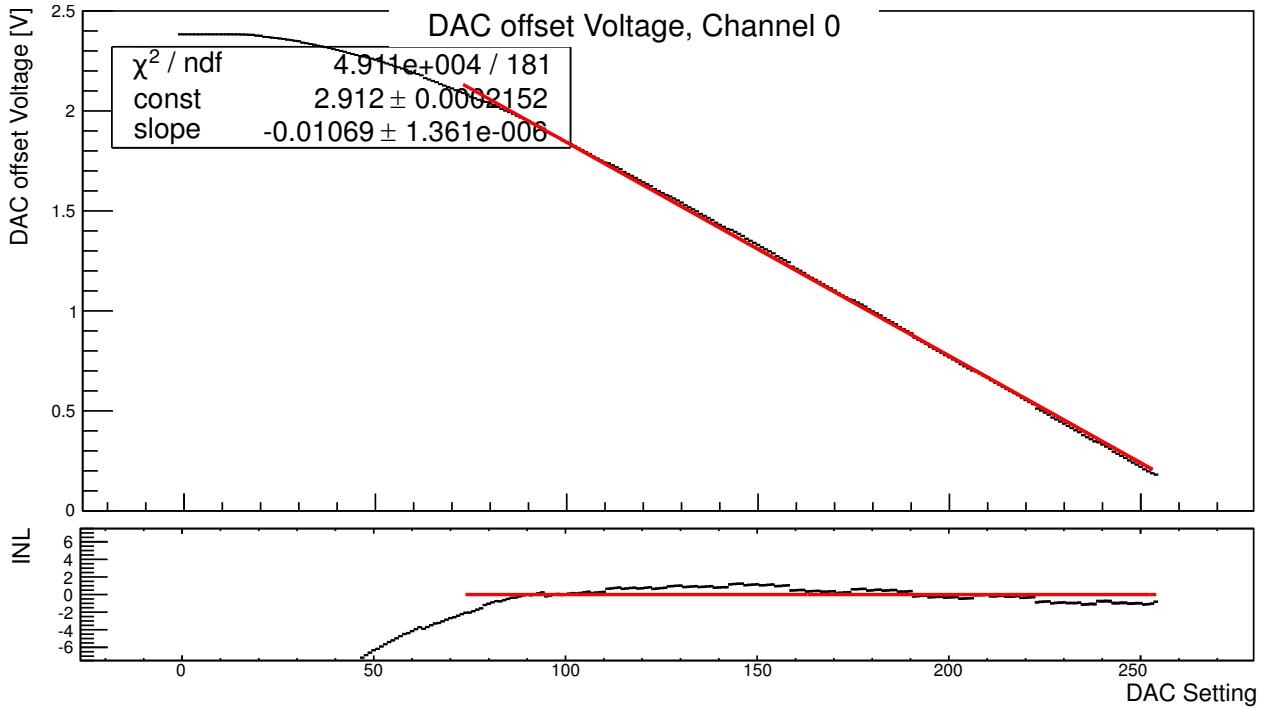
Channel 0 DAC Measurement

Raw Data



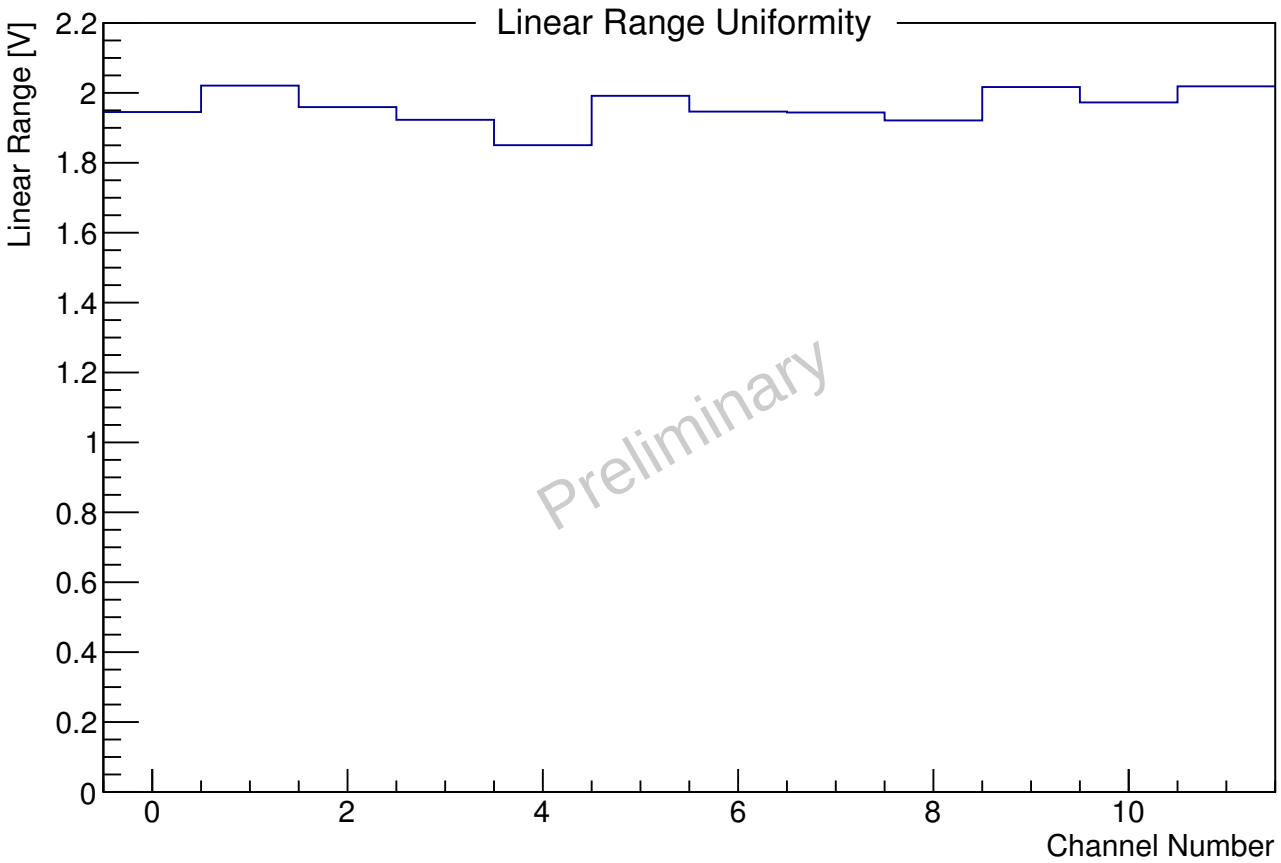
Channel 7 DAC Measurement

Conducted Measurements



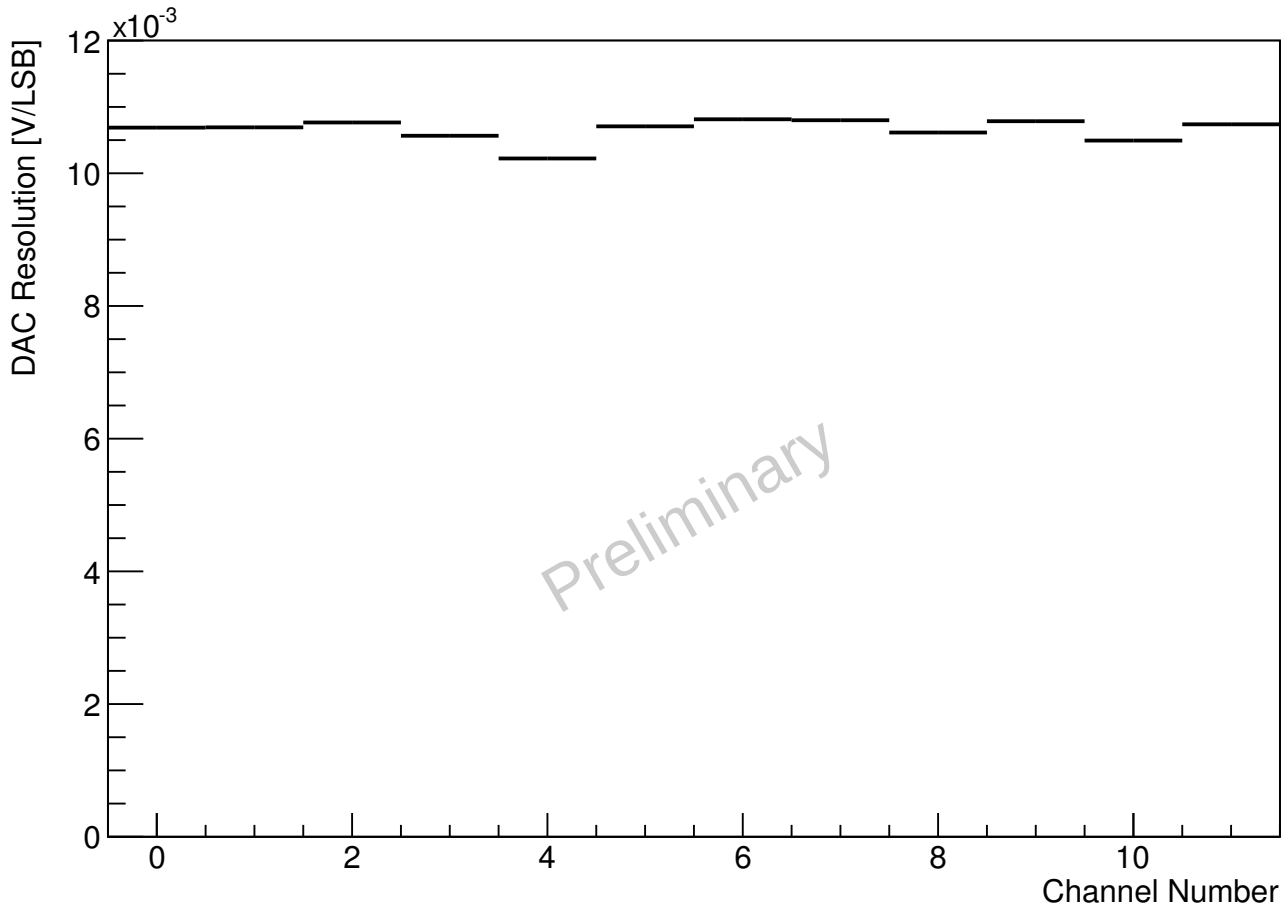
- DAC Resolution from the slope of the fit
- Linear Range at INL $< 2.5\,\%$

Uniformity of the DAC Linearity



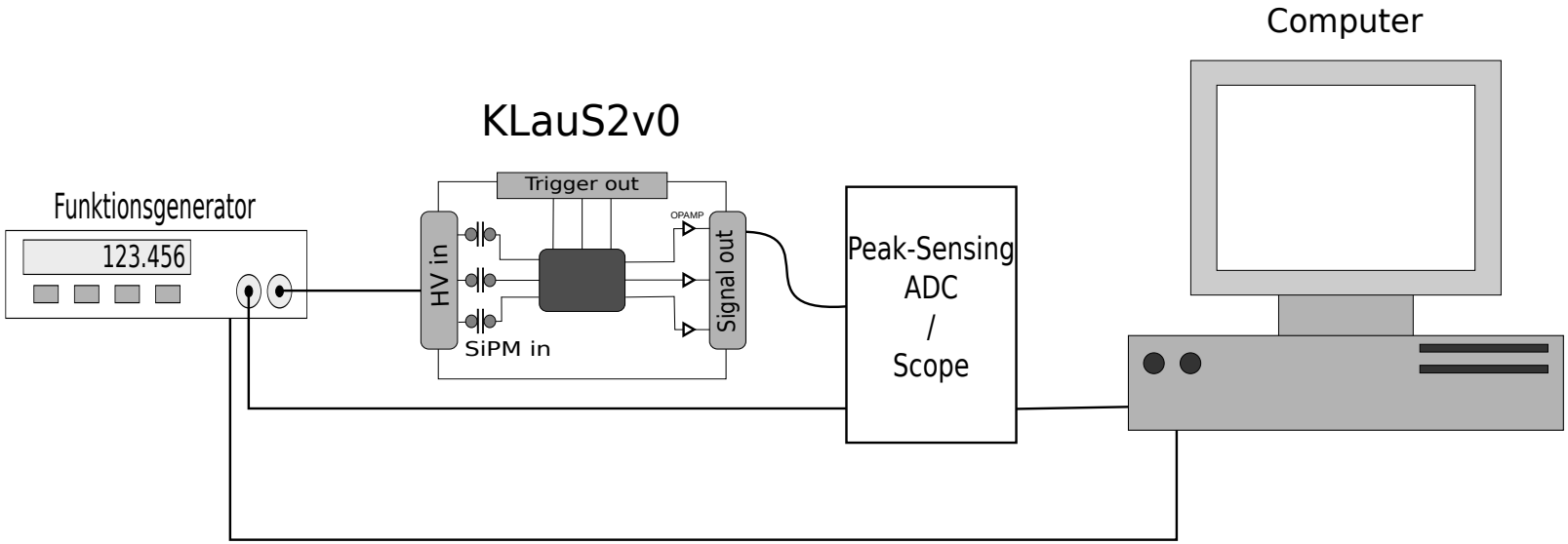
Channel to channel variations $< 5\,\%$

Uniformity of the DAC Resolution



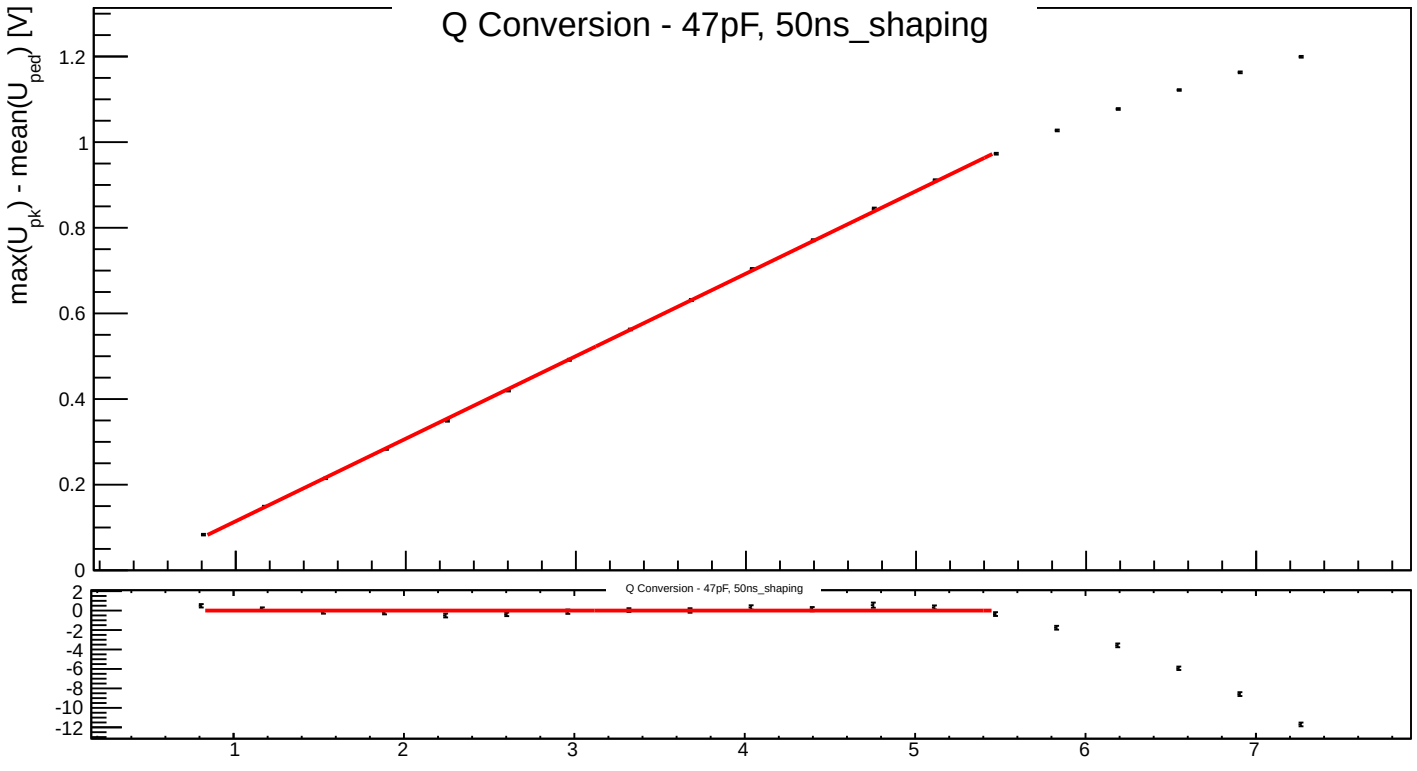
Channel to channel variations $< 5\,\%$

Charge Conversion Setup



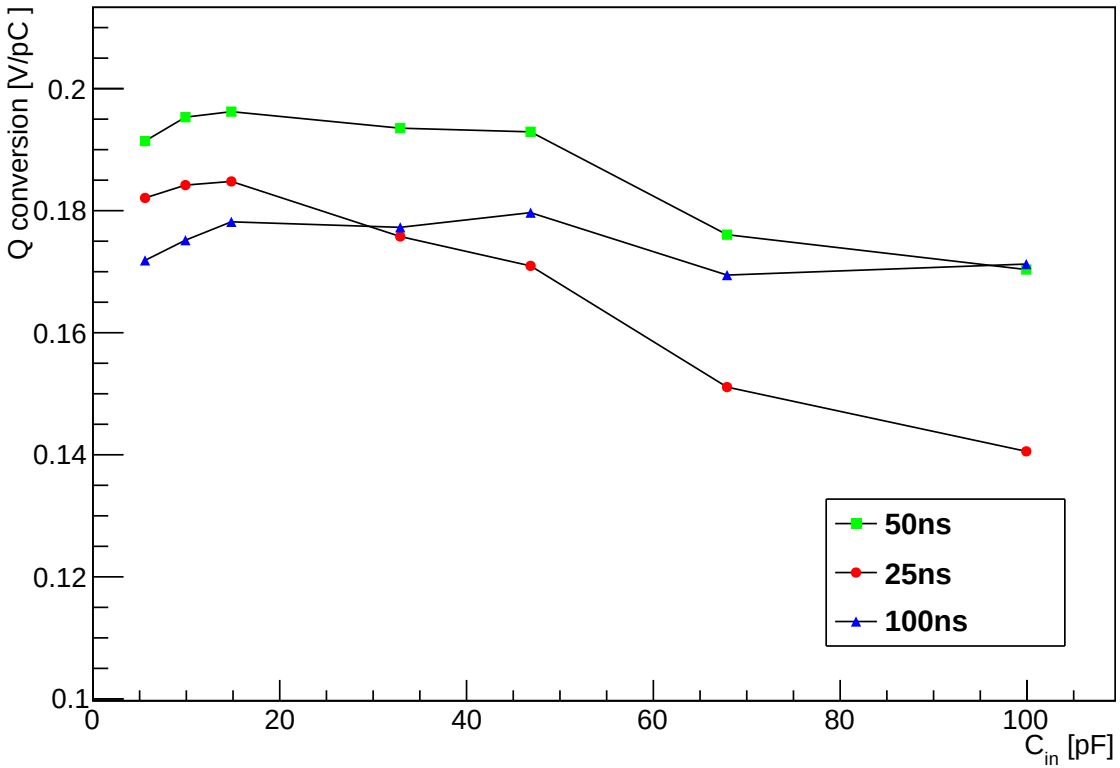
The signal amplitude is measured for defined charge signals injected by different capacitances.

Conducted Measurements



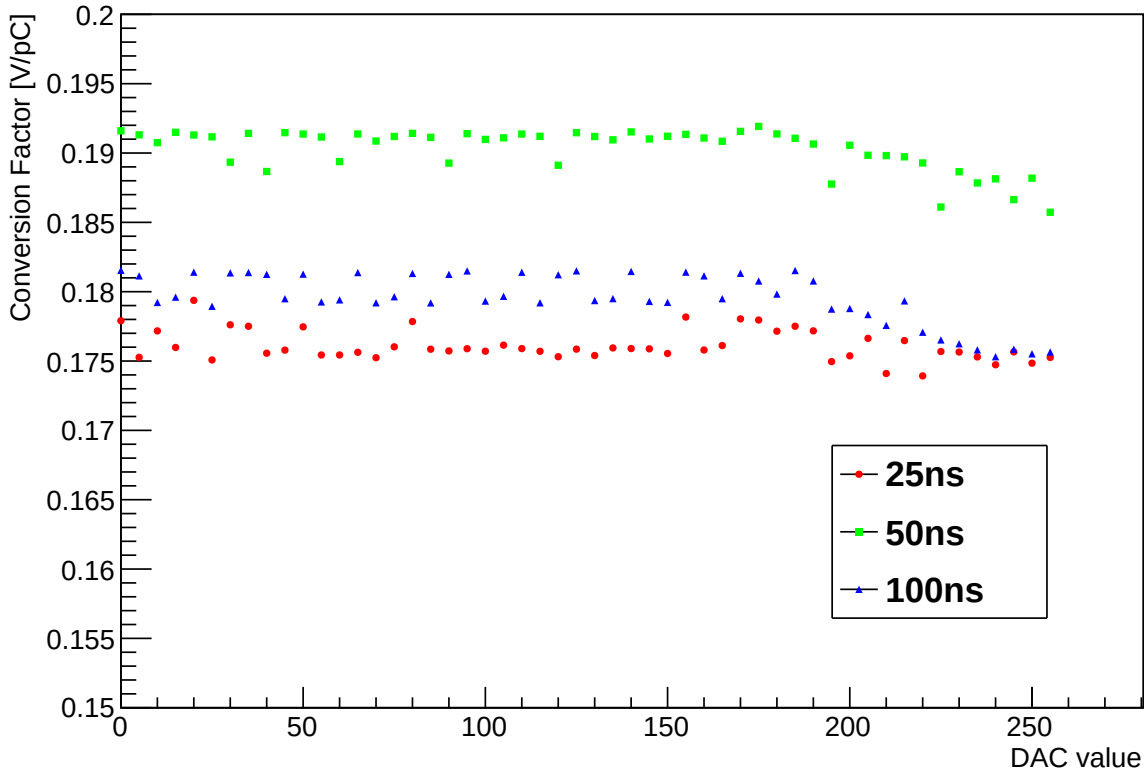
- Charge conversion for different detector capacitances
- Conversion factor for different DAC configurations

Influence of the Detector Capacitance

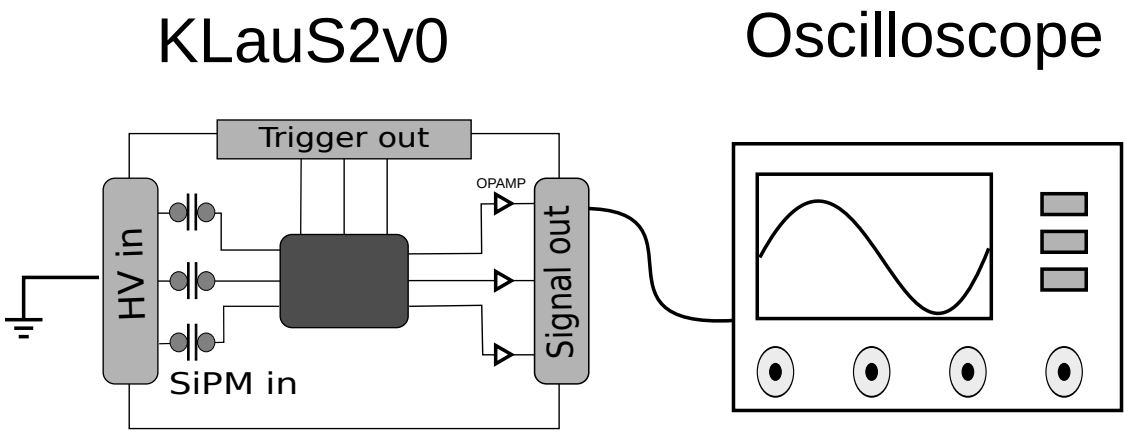


The conversion factor with 25 ns shaping time is reduced due to the external amplifier bandwidth

Influence of the DAC Configuration

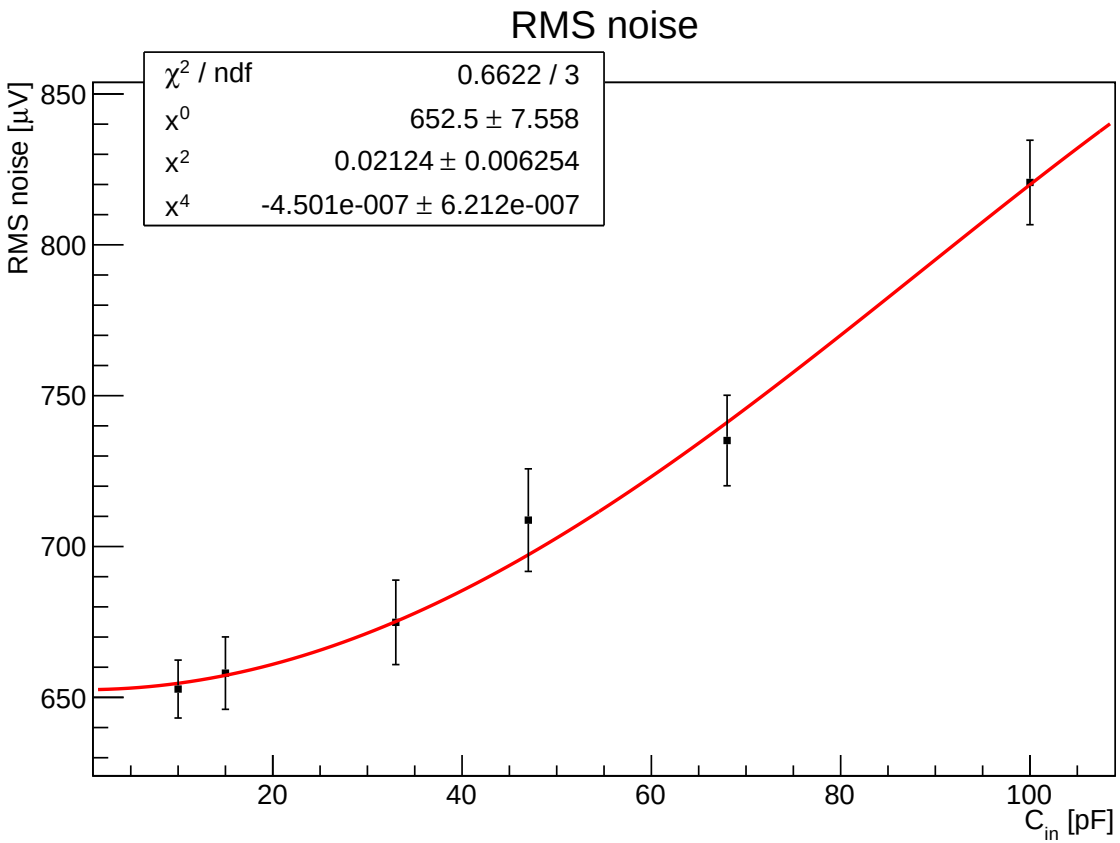


Noise Measurement Setup



The signal noise is measured for different detector capacitances.

Channel Noise

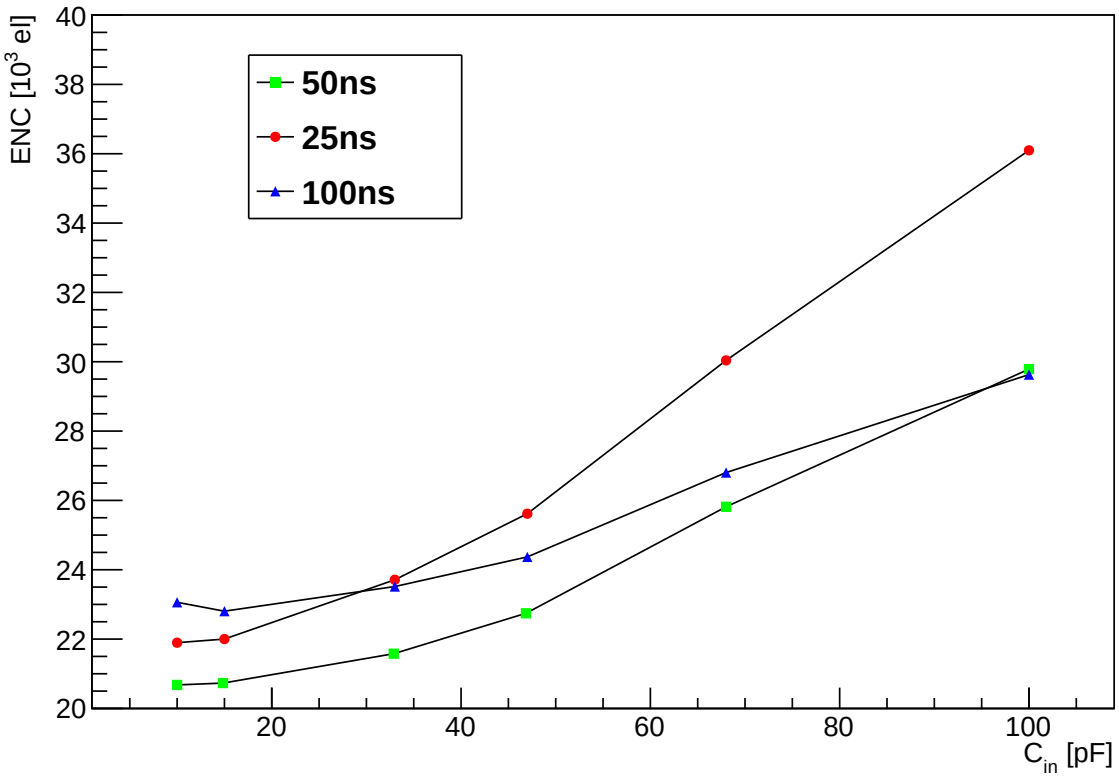


The measured noise can be described analytically by:

$$\sigma_{\text{noise}} = \sqrt{ax^2 - 4ax^4 + b}$$

Equivalent Noise Charge

The ENC can be calculated from the gain and noise measurements



For a MPPC with $C_d = 40\,\text{pF}$ and a gain of 2.75×10^5 we expect a SNR > 10

Conclusion

- An automated characterization setup is being developed
- Preliminary bias DAC results show a channel variation of $< 5\,\%$
- Charge conversion behaves as expected
- Bandwidth of external amplifier reduces the output signal at 25 ns shaping time
- Measured noise behaviour can be analytically described
- ENC is consistent with previous measurements

Outlook:

- Chip to chip uniformity measurements
- Further characterization of the power gating functionality