Characterization of the PCA16

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PCA16 - modes of operation

Shaper Mode

3rd Order semi Gaussian Shaper (32 different configurations)			
Polarity	Positive (MWPC-like signals)		Negative (GEM-like signals)	
Conversion Gain (mv / fC)	12	15	19	27
Peaking Time (ns)	30	60	90	120

Preamp Mode

Classical CSA w/o PZ cancellation (32 different configurations)			
Polarity	Positive (MWPC-like signals)		Negative (GEM-like signals)	
Conversion Gain (mv / fC)	5.25	5.5	5.8	6.5
Rise Time (ns)	10	30	60	80
Decay Time (µs)	Continuous in the range [1:10]			

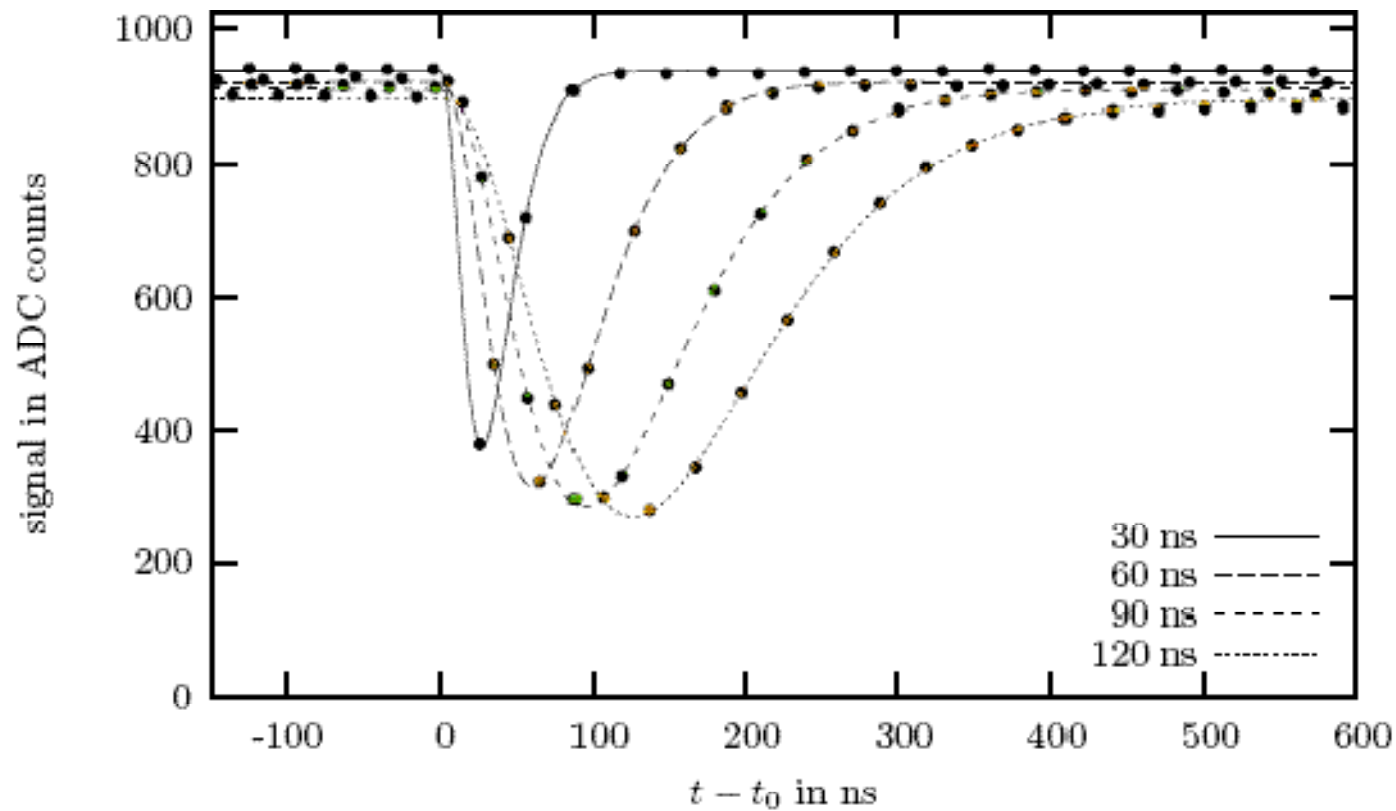Performance very close to the design specifications in all modes of operation

The output signal is modelled by a semi Gaussian peak on top of a constant base line:

$$f(B, A, t_0, \tau, k; t) = B + Ae^k \left(\frac{t - t_0}{\tau}\right)^k \exp\left(-k\frac{t - t_0}{\tau}\right) \theta(t - t_0) \qquad (1)$$

with base line B, amplitude A, starting time t_0, peaking time τ and order k. It is normalized such that A and τ are the co-ordinates of the peak.

Positive Polarity (MWPC-like Input Signal)
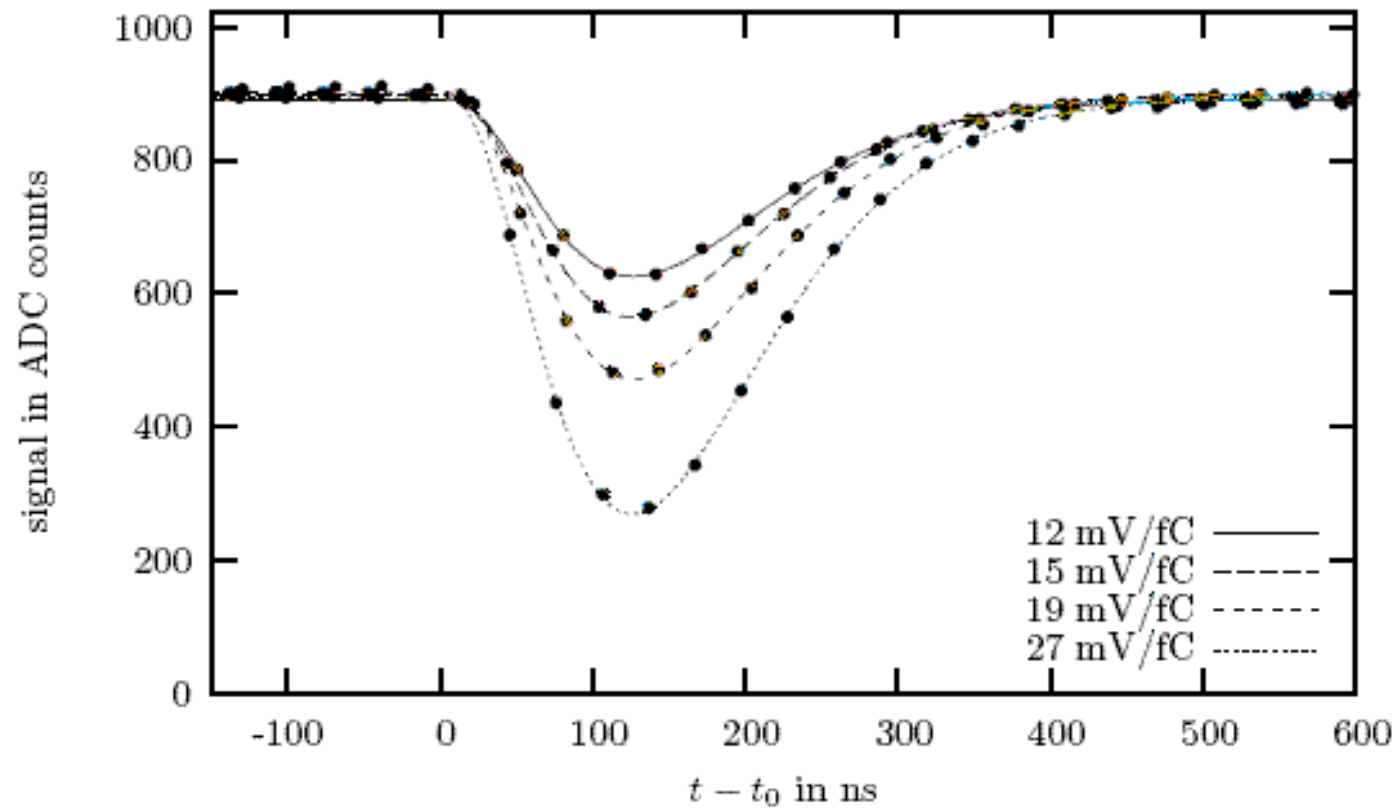

(a) different peaking times, fixed conversion gain: 27 mV/fC

Figure 1: Sample fits of the impuls response function Eq. (1).

Positive Polarity (MWPC-like Input Signal)
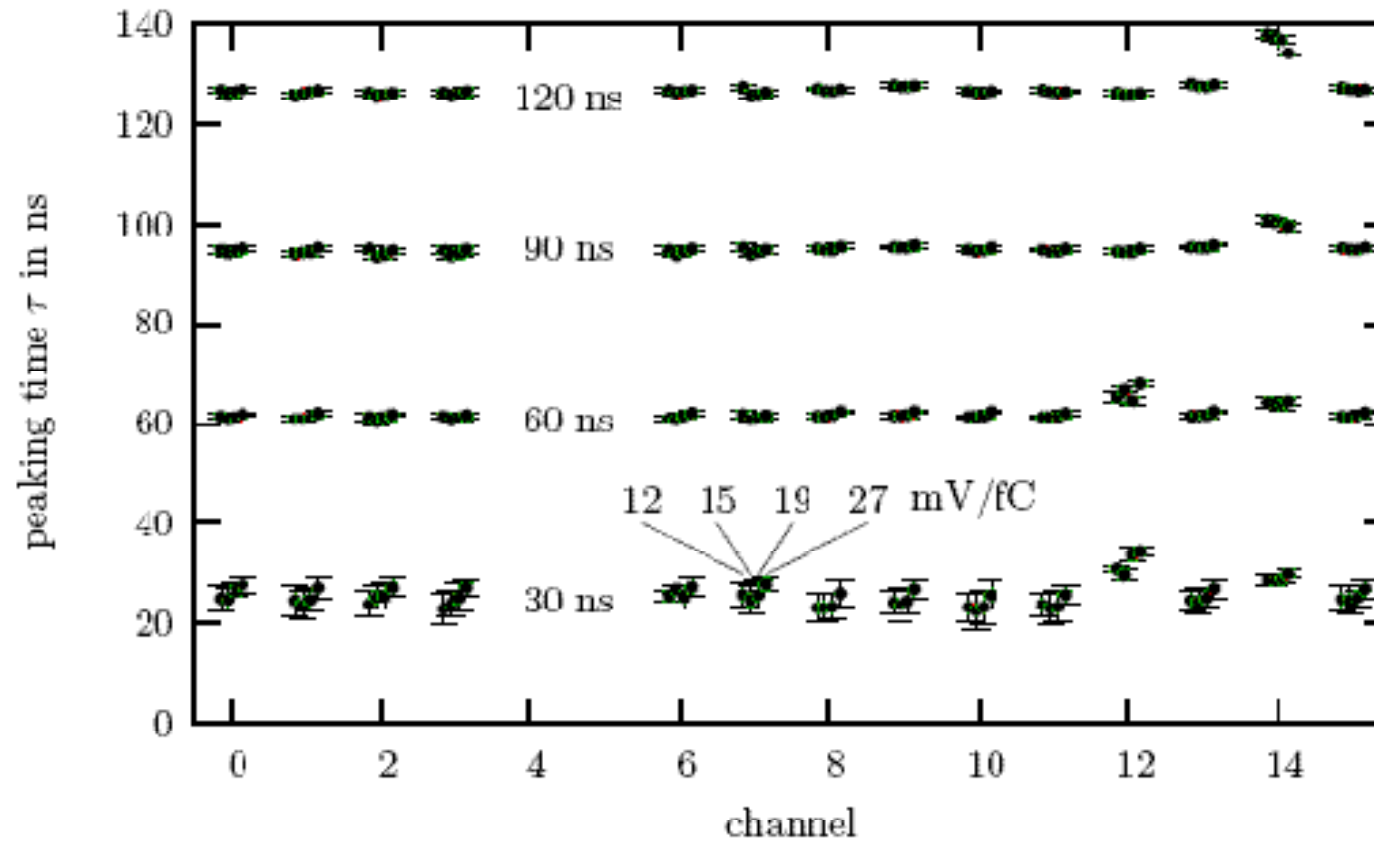

(b) different conversion gains, fixed peaking time: 120 ns

Figure 1: Sample fits of the impuls response function Eq. (1).
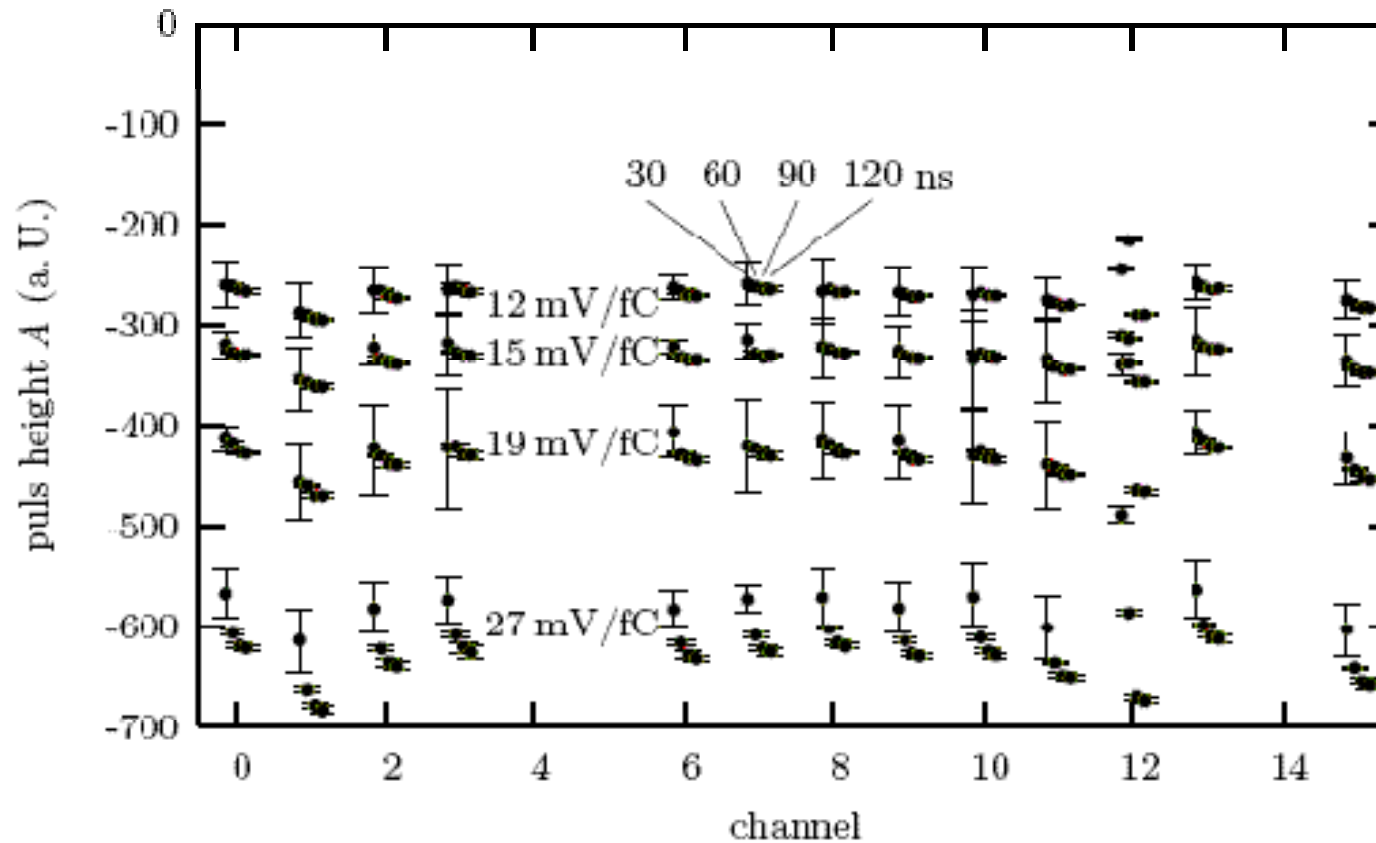
Positive Polarity (MWPC-like Input Signal)

(a) Spread in peaking time.

Figure 2: The parameter spread for different settings of peaking time and amplication gain. The shown errorbars display the RMS spread of the deduced parameters of around 100 events.
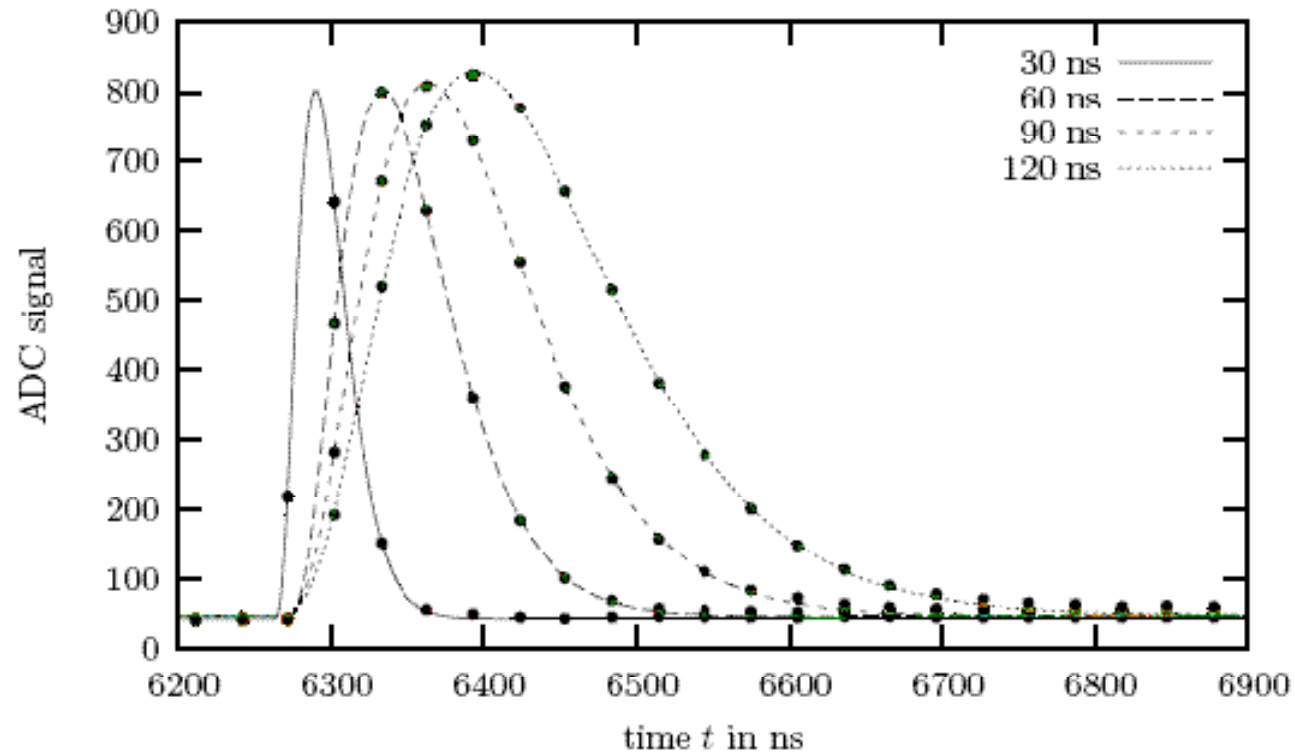
Positive Polarity (MWPC-like Input Signal)

(b) Spread in signal height.

Figure 2: The parameter spread for different settings of peaking time and amplication gain. The shown errorbars display the RMS spread of the deduced parameters of around 100 events.
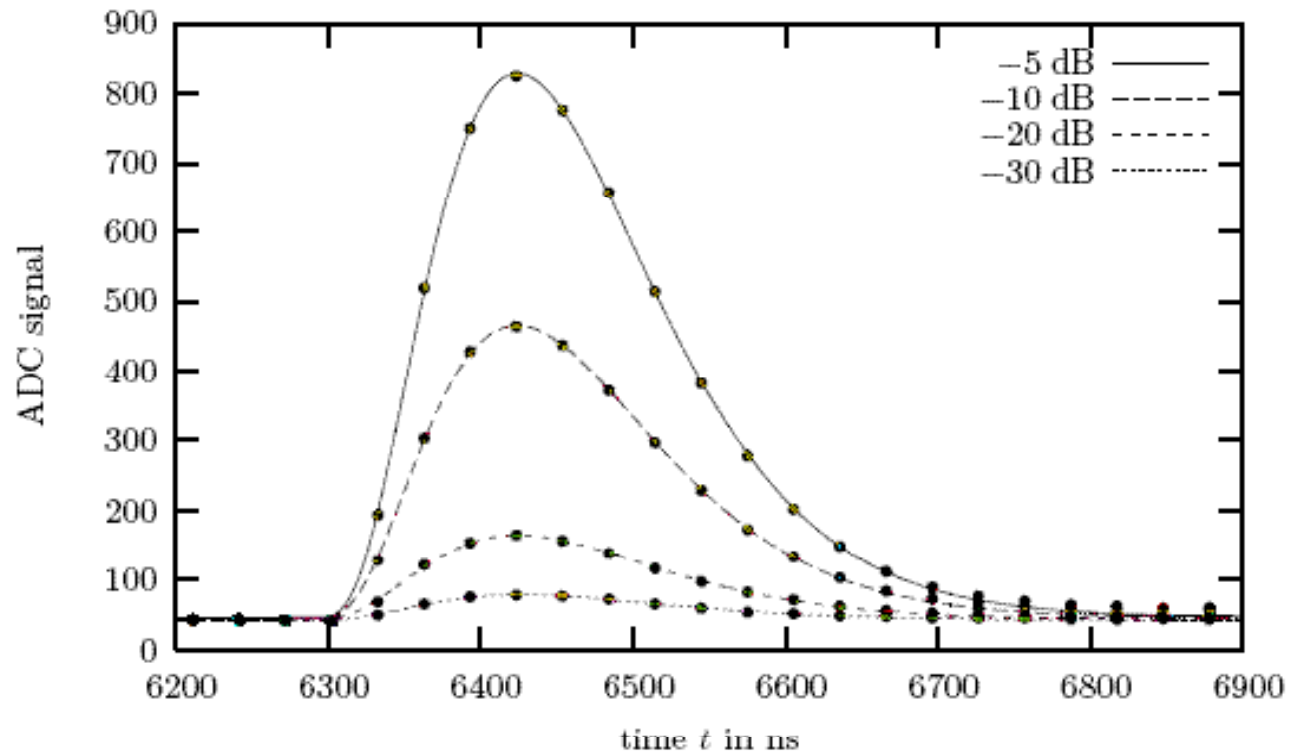
Negative Polarity (GEM-like Input Signal)

(a) different peaking times, fixed input −5 dB

Figure 3: Sample fits of the impuls response function Eq. (1).

Shaper Mode – Some Results
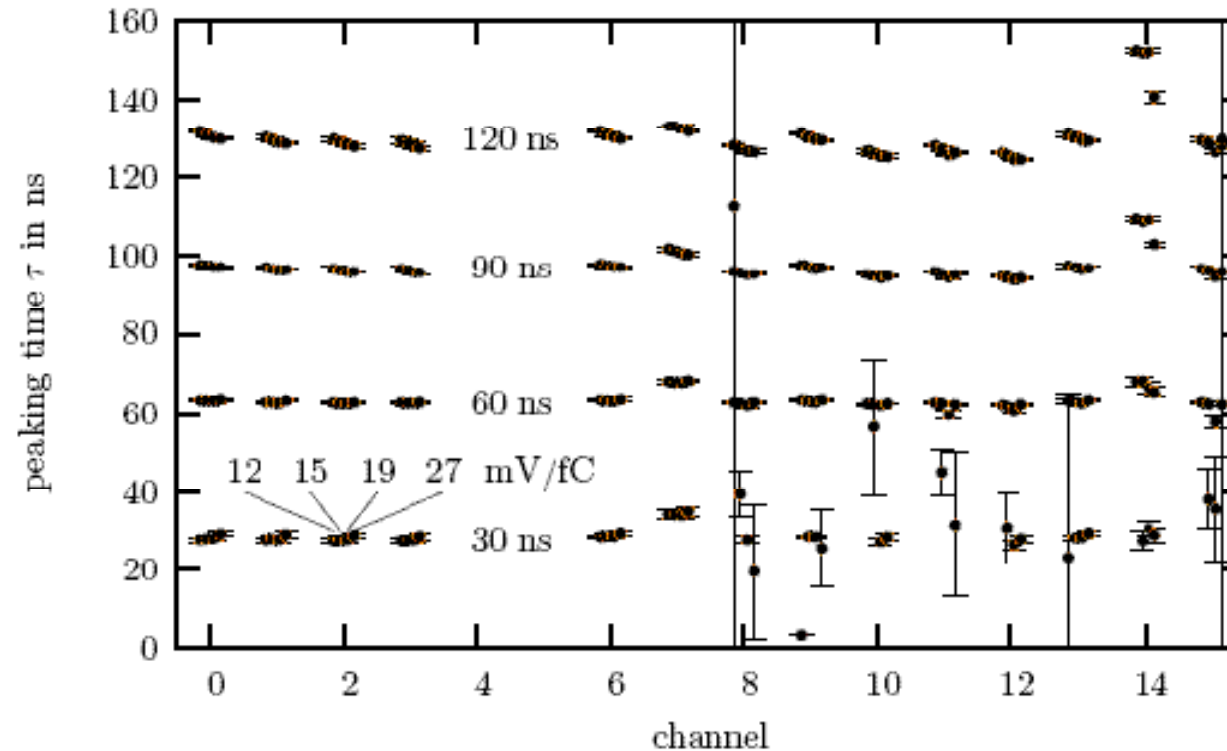
Negative Polarity (GEM-like Input Signal)

(b) different input signals, fixed peaking time: 120 ns

Figure 3: Sample fits of the impuls response function Eq. (1).
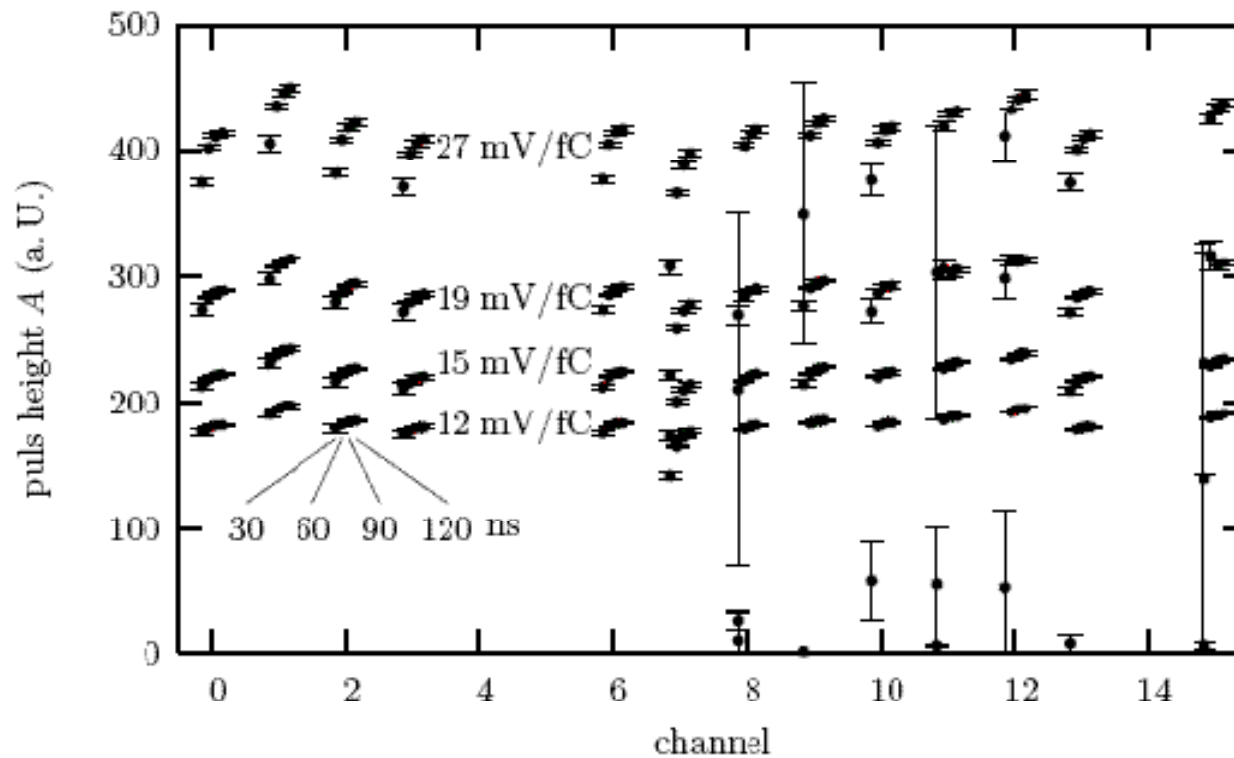
Negative Polarity (GEM-like Input Signal)

(a) Spread in peaking time.

Figure 4: The parameter spread for different settings of peaking time and amplication gain. The shown errorbars display the RMS spread of the deduced parameters of around 100 events.
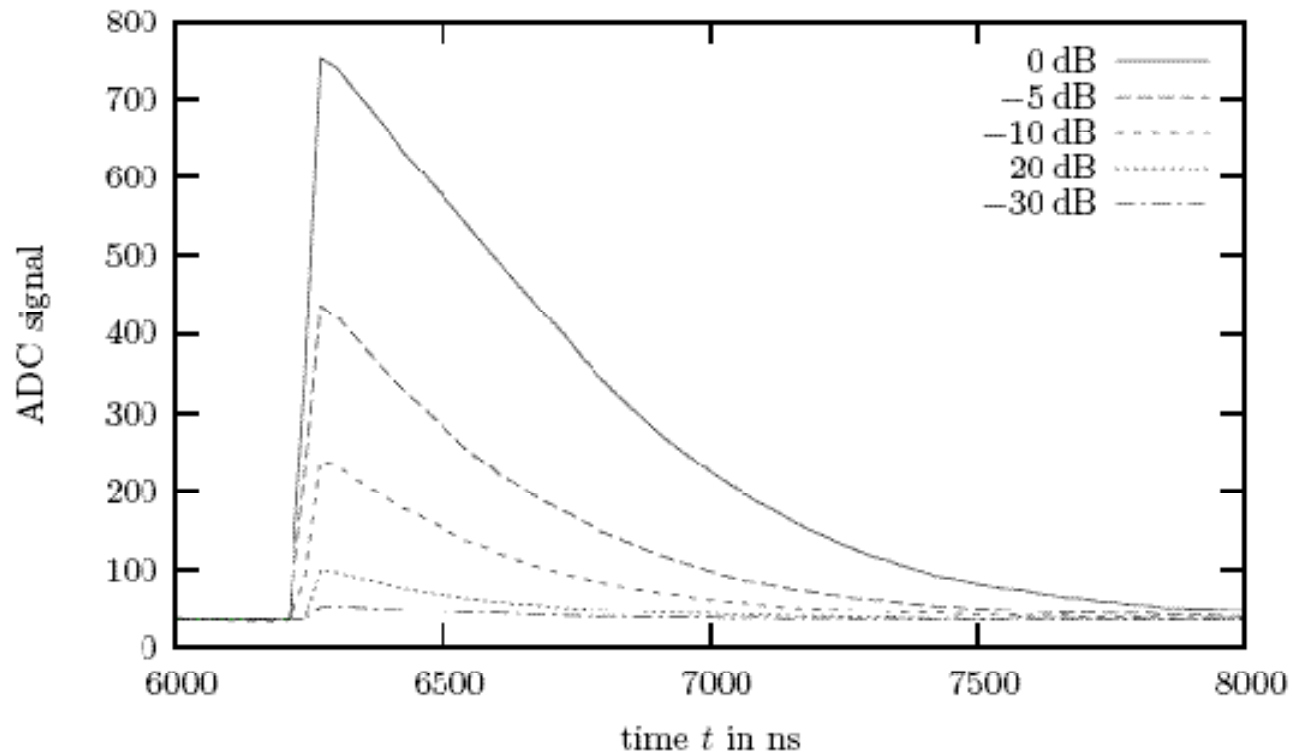
Negative Polarity (GEM-like Input Signal)

(b) Spread in signal height.

Figure 4: The parameter spread for different settings of peaking time and amplication gain. The shown errorbars display the RMS spread of the deduced parameters of around 100 events.
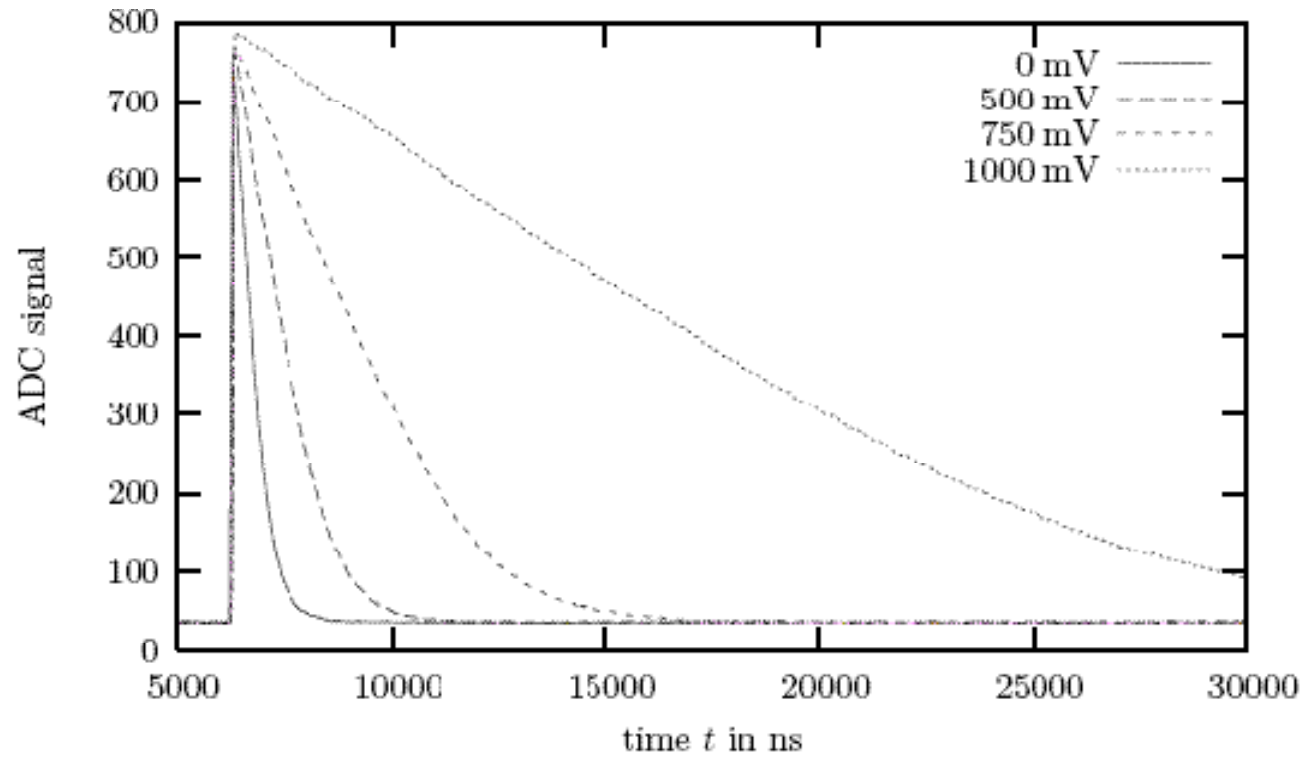
Negative Polarity (GEM-like Input Signal)

(a) different intput signals

Figure 6: Impuls responce functions for selected combination of parameters.

Negative Polarity (GEM-like Input Signal)

(b) different decay times

Figure 6: Impuls responce functions for selected combination of parameters.
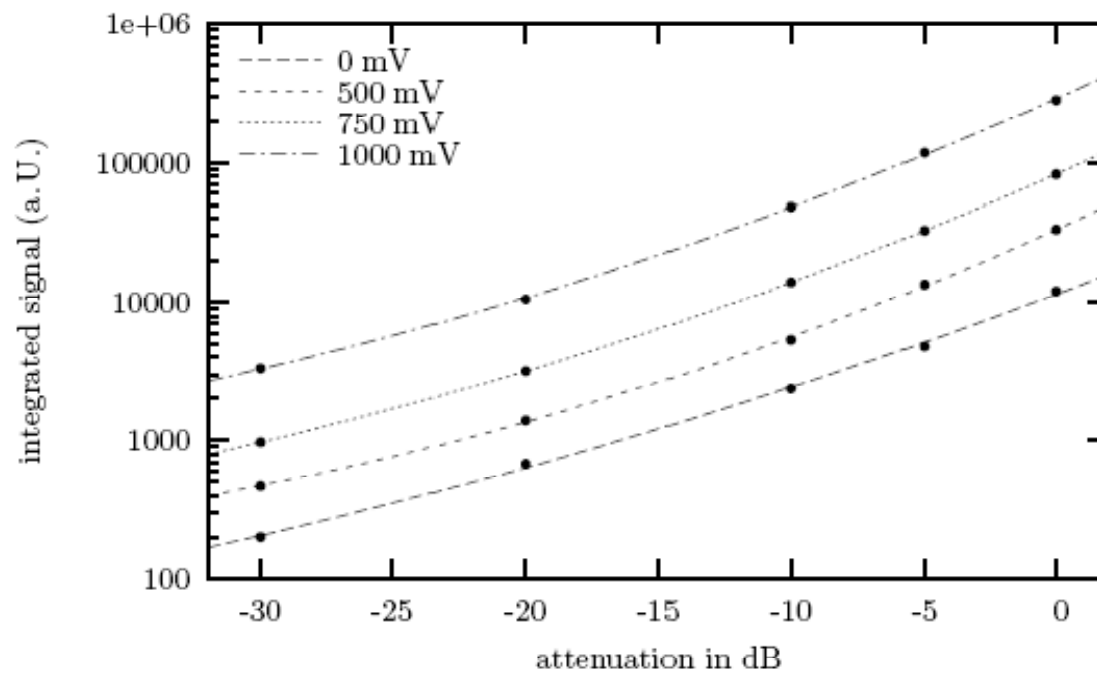
Negative Polarity (GEM-like Input Signal)

Figure 7: Gains
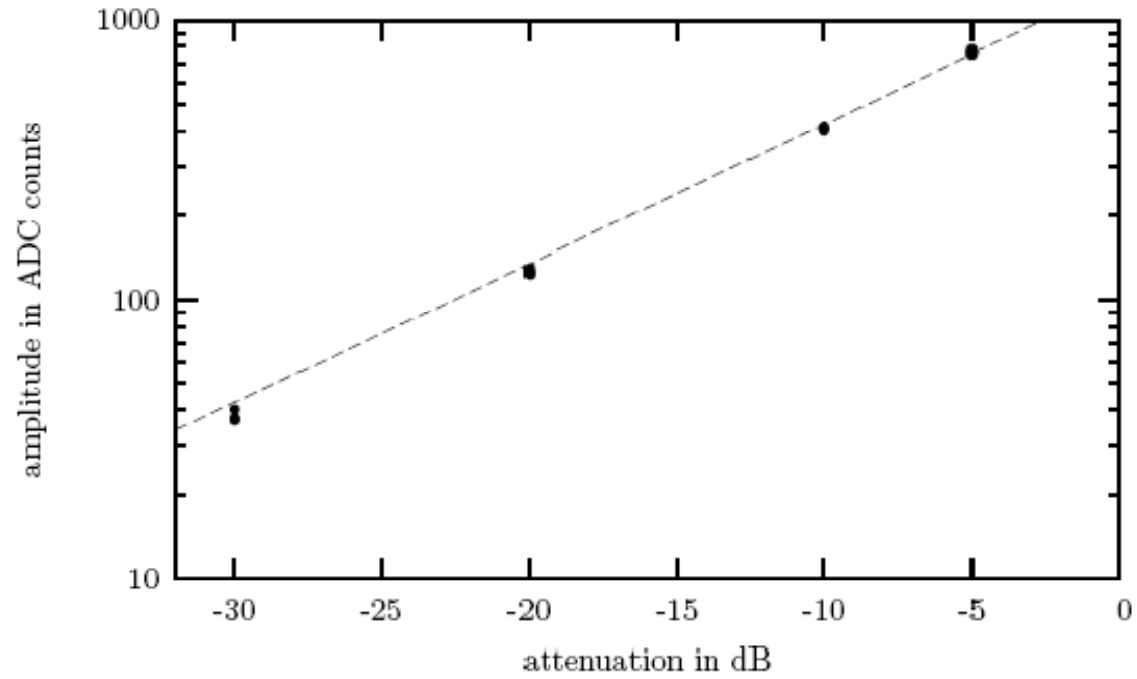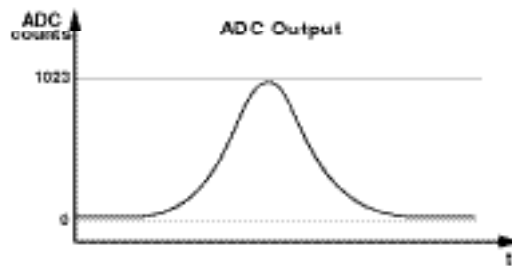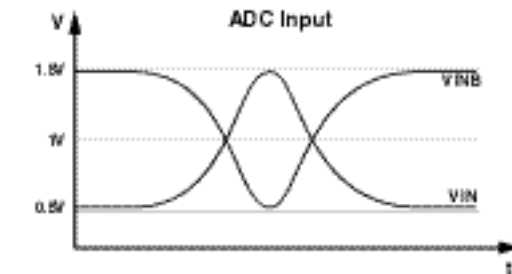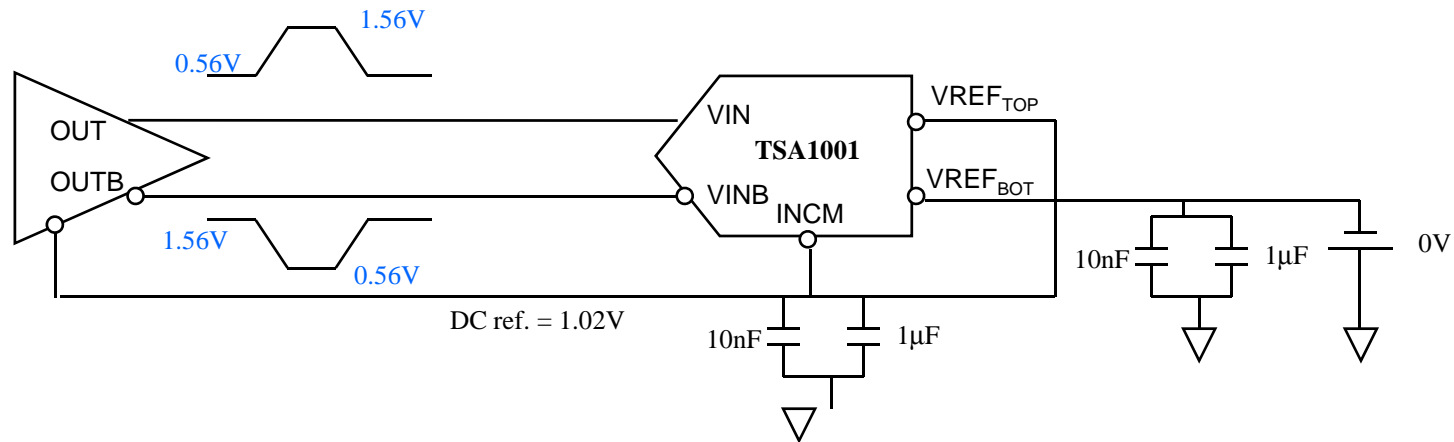
Negative Polarity (GEM-like Input Signal)

Figure 8: Gains
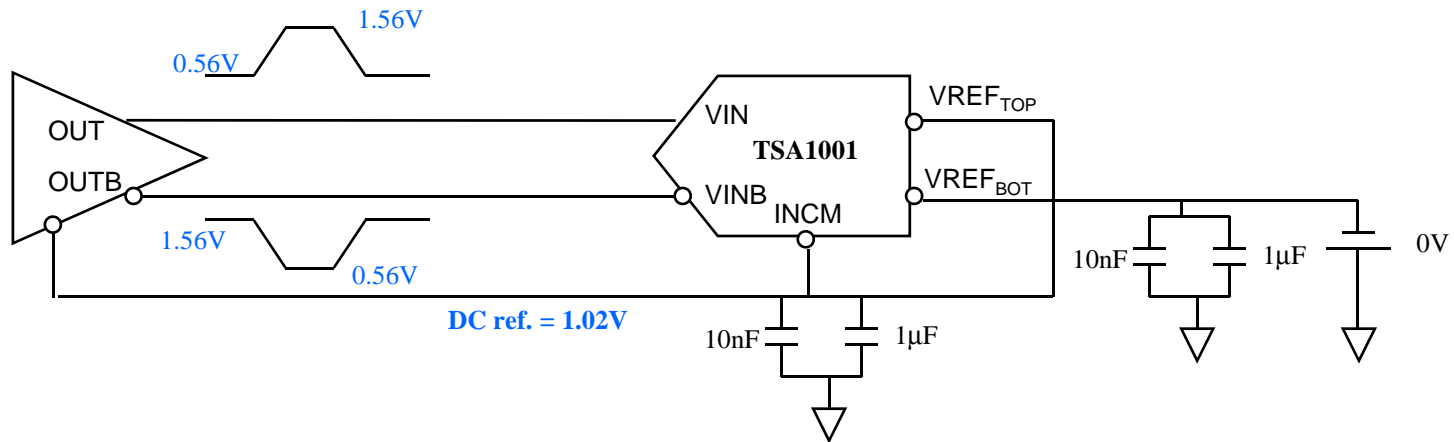
ALTRO Reference Voltages

ALICE PASA Configuration

- Reference Range (RR) = $VREF_{TOP} - VREF_{BOT}$

- Dynamic Range (DR) = [-RR ; + RR]

- Conversion Gain: CG = 1024 / (2 x RR)

- Digital Output Code = $(V_{IN}-V_{INB})$ x CG + 512
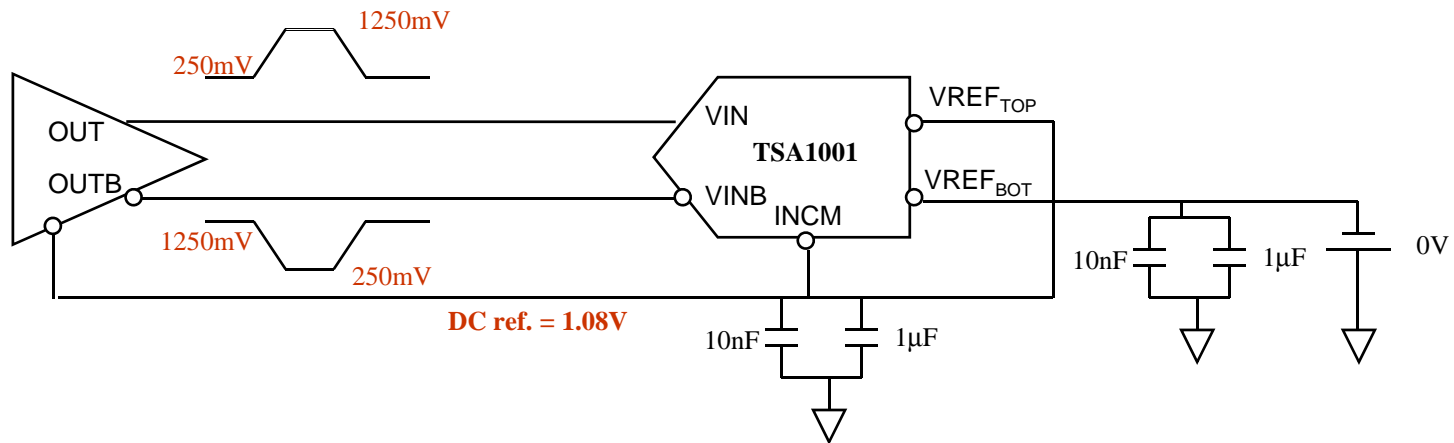
- Digital Output Code Range = 0:1023

ALICE PASA Configuration

Example of PCA16 Configuration (different for different settings)

ALTRO Reference Voltages
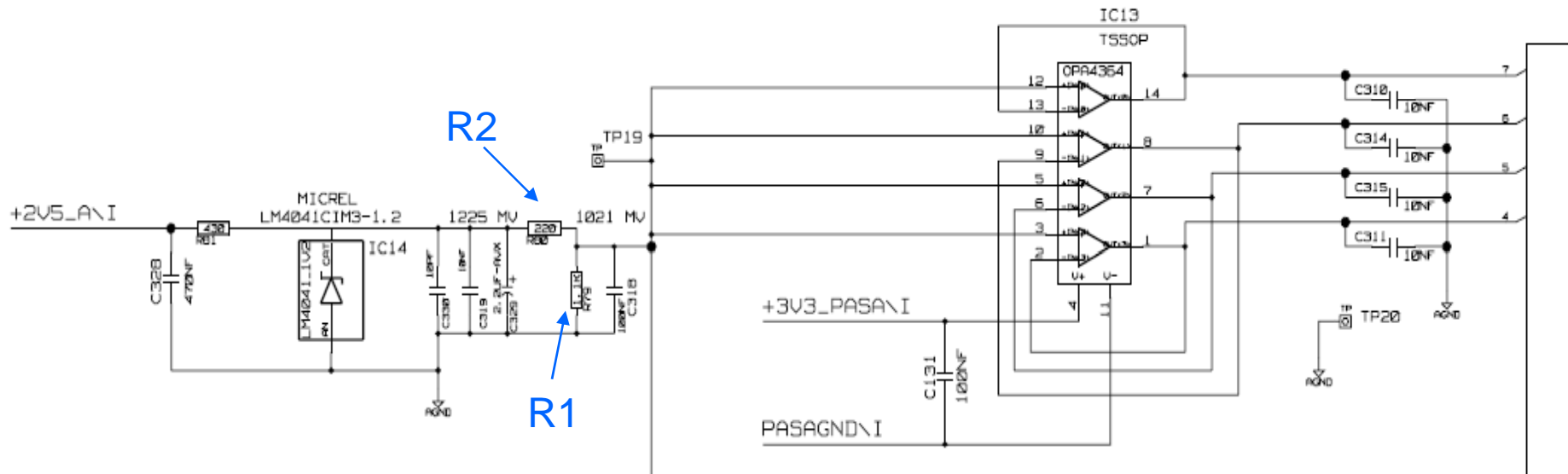
The DC levels of the PCA16 shaping amplifier vary with the CG

SHAPER MODE				
Negative Polarity, Peaking Time (τ) = 120 ns, decay bias = 750 mV, SCLK = 33MHz				
CG (mv/fC)	12	15	19	27
V_{TOP}(mV)	1050	1092	1140	1200
Baseline (ADC)	42	42	42	42
PREAMP MODE				
Negative Polarity, Rise Time = 120 ns, decay bias = 750 mV, SCLK = 33MHz				
CG (mv/fC)	5.25	5.5	5.8	6.5
V_{TOP}(mV)	1000	1078	1078	1078
Baseline (ADC)	338	297	212	46

ALICE TPC values:	220 Ω , 1100 Ω	➡	V_{TOP} = 1020mV
Proposed new values:	150 Ω, 1100 Ω	➡	V_{TOP} = 1078mV

ALTRO Reference Voltages

The DC levels of the PCA16 shaping amplifier vary with the CG

SHAPER MODE				
Negative Polarity, Peaking Time (τ) = 120 ns, decay bias = 750 mV, SCLK = 33MHz				
CG (mv/fC)	12	15	19	27
V_{TOP}(mV)	1078			
Baseline (ADC)	49	33	15	-
PREAMP MODE				
Negative Polarity, Rise Time = 120 ns, decay bias = 750 mV, SCLK = 33MHz				
CG (mv/fC)	5.25	5.5	5.8	6.5
V_{TOP}(mV)	1078			
Baseline (ADC)	348	297	212	46