Impact of BC2 and BC3 on simulated data, comparison

SAMPA MPW2 design review II Meeting
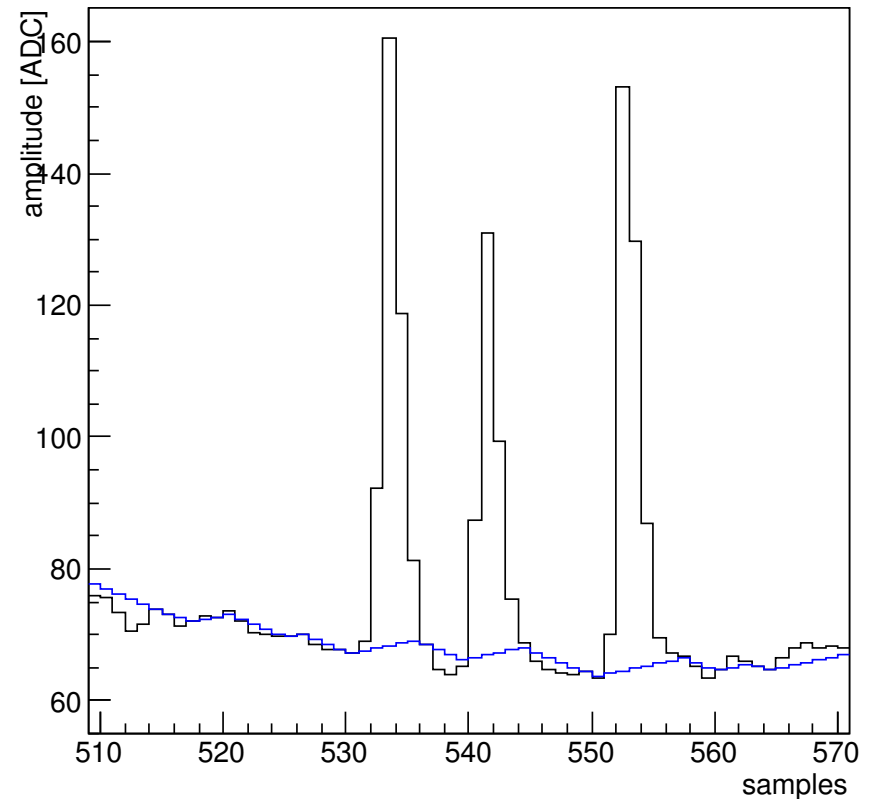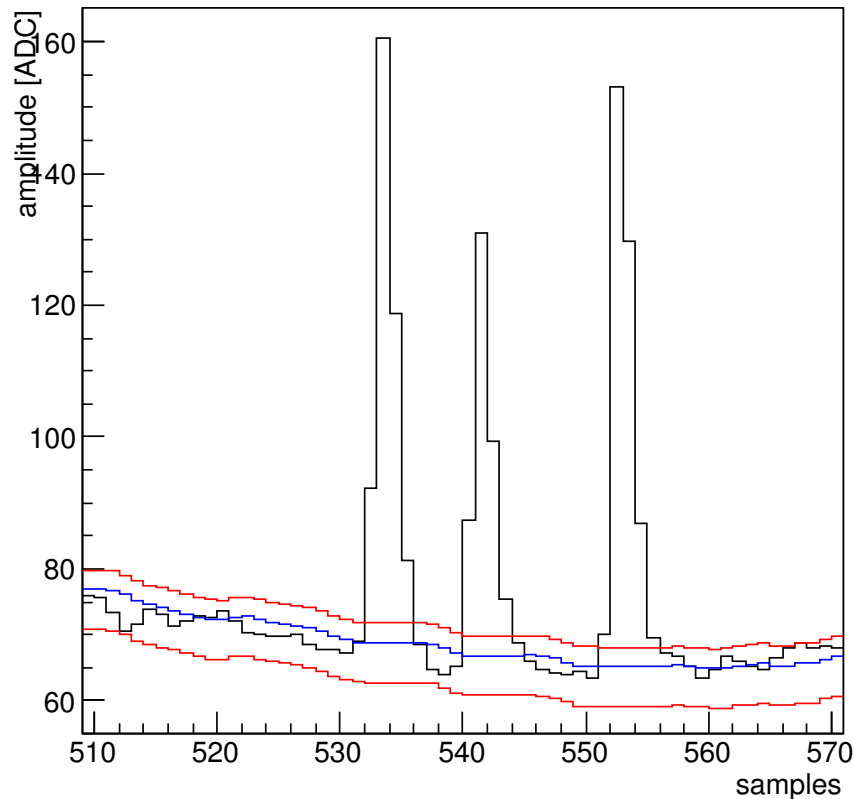
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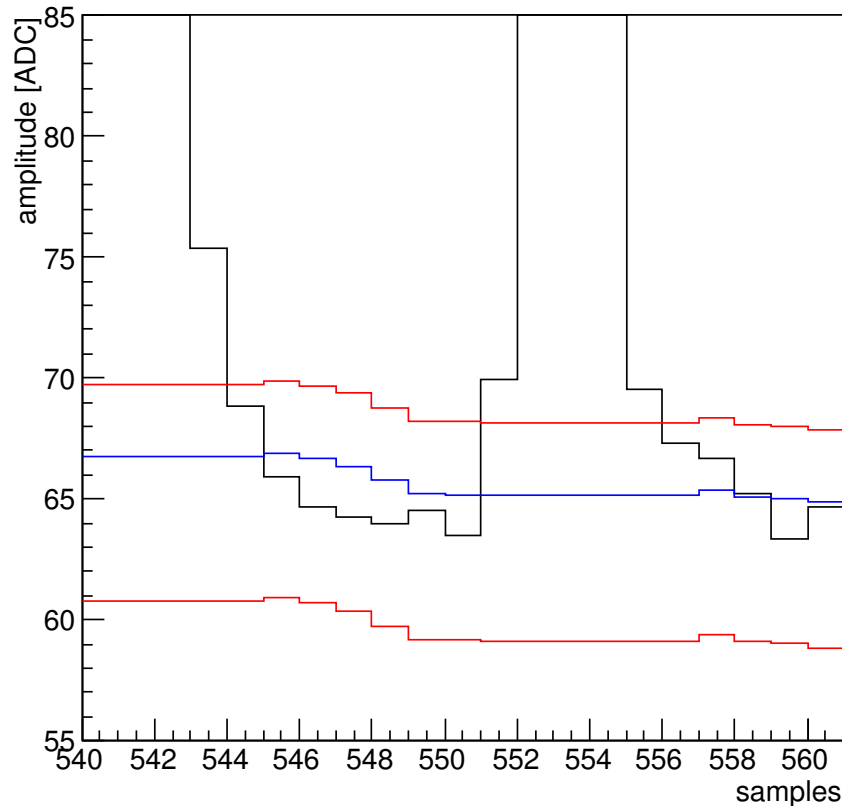
01.04.2015

BC2, BC3 operation principle
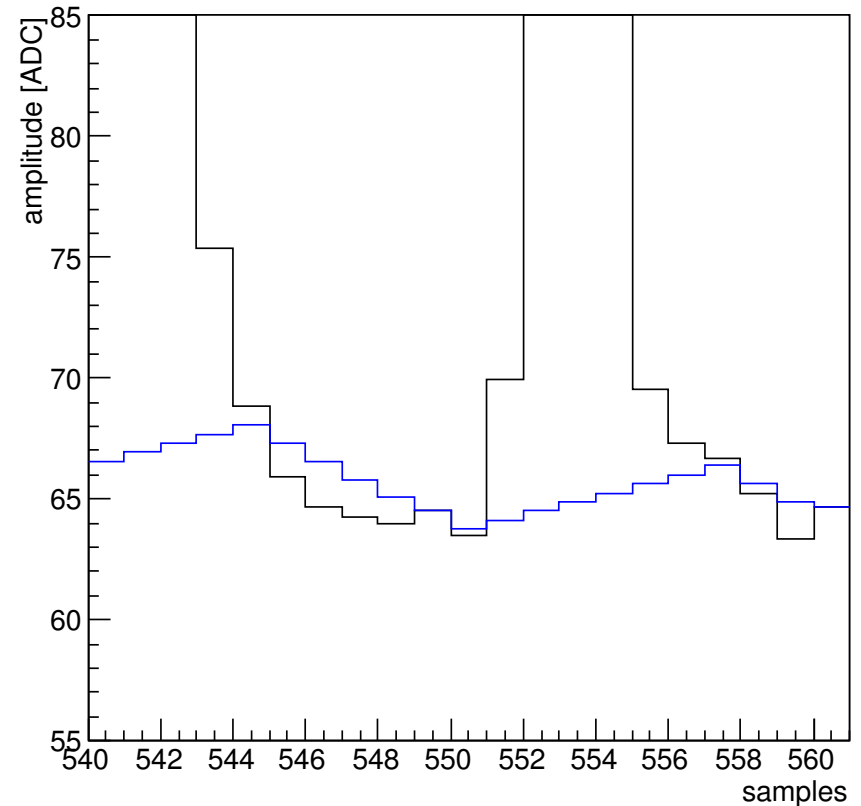
BC2 operation

BC3 operation

- BC2 is calculating average from values within thresholds
- BC3 is following the signal limited by slopes

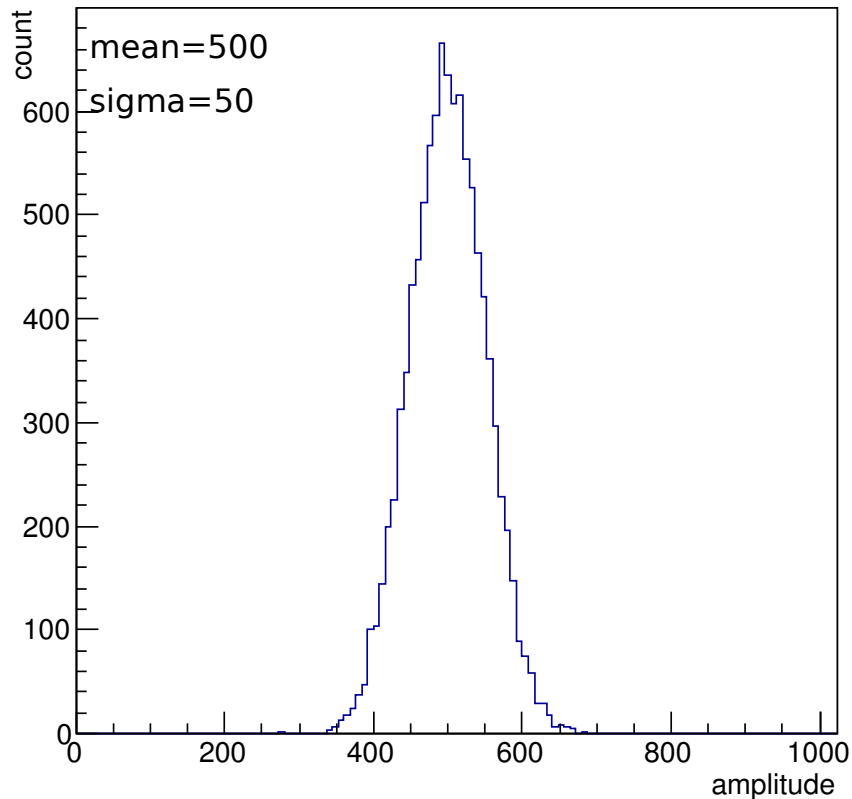# BC2, BC3 operation principle detail

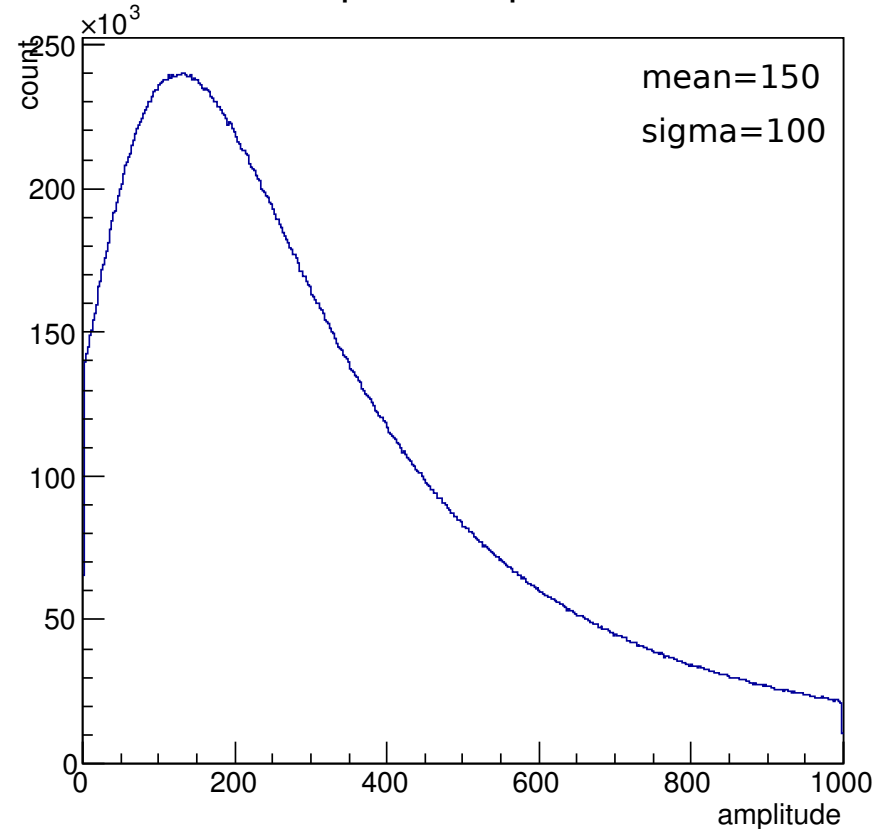BC2 operation detail

BC3 operation detail

- BC2 stays constant during peak data
- BC3 constantly follows but in a simple deterministic way

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simulation parameter

signal peak amplitudes
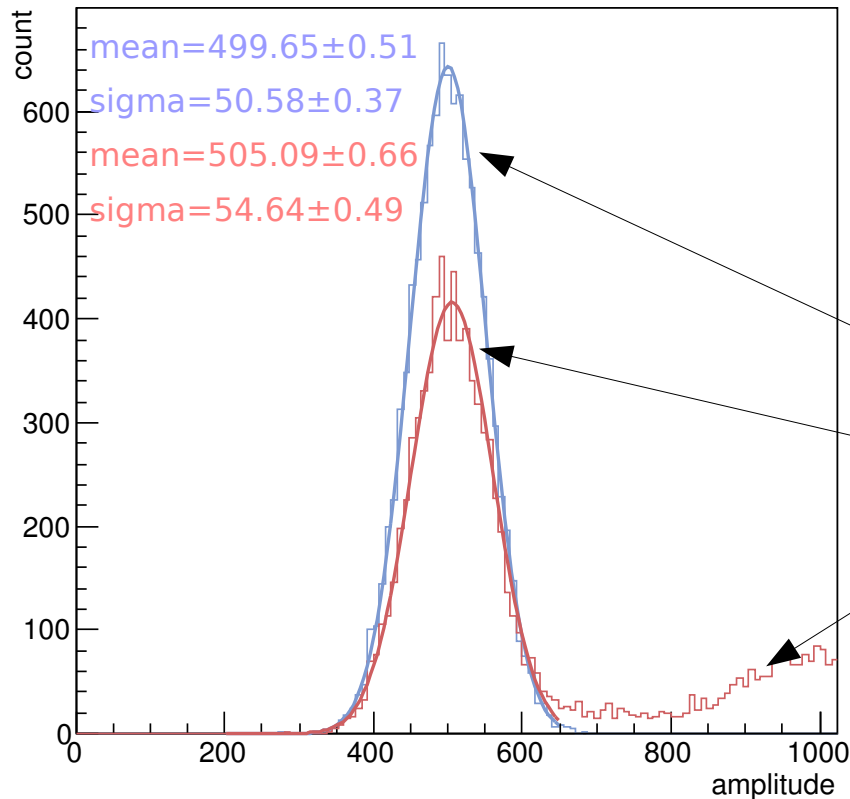
CM peak amplitudes

- sampling frequency=10MHz, t_p=160ns
- charge rate=2GHz (constant)
- Gauss and Landau distributed amplitudes

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minimal PSA

signal peak amplitudes

mean=499.65±0.51
sigma=50.58±0.37
mean=505.09±0.66
sigma=54.64±0.49

- simple minimal PSA used for peak evaluation
- peak amplitude computed by peak area
- signal spectrum is altered by minimal PSA
- no special handling of piled-up events
- Gauss fit of histogram
- signal spectrum of PSA is used as a reference to evaluate the impact of the filters to the signal
- error values from fit

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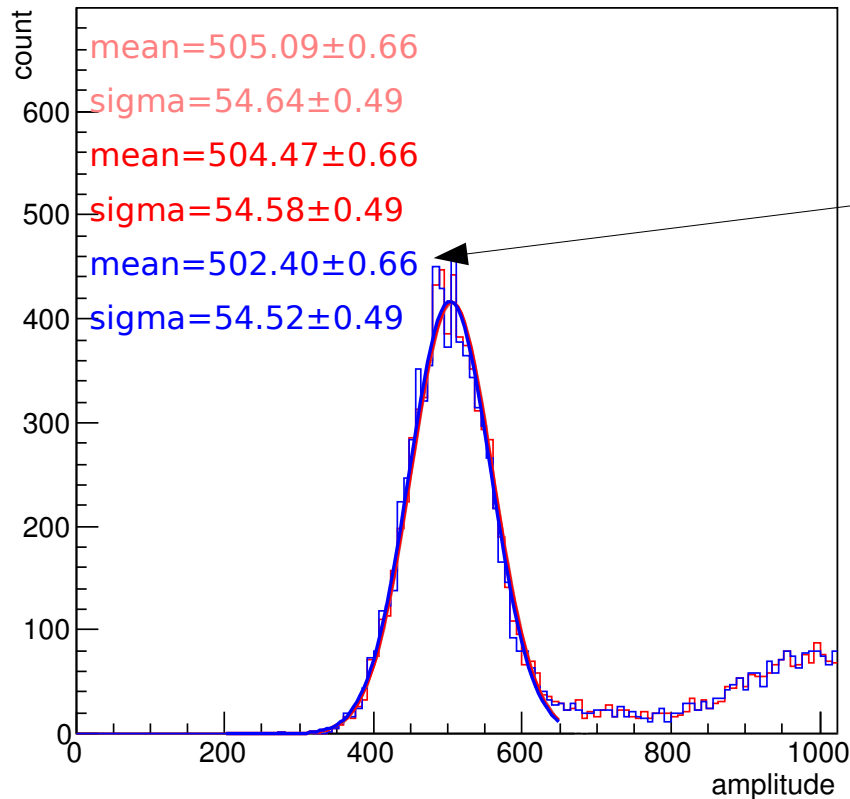
without common mode effect (1)

signal peak amplitudes
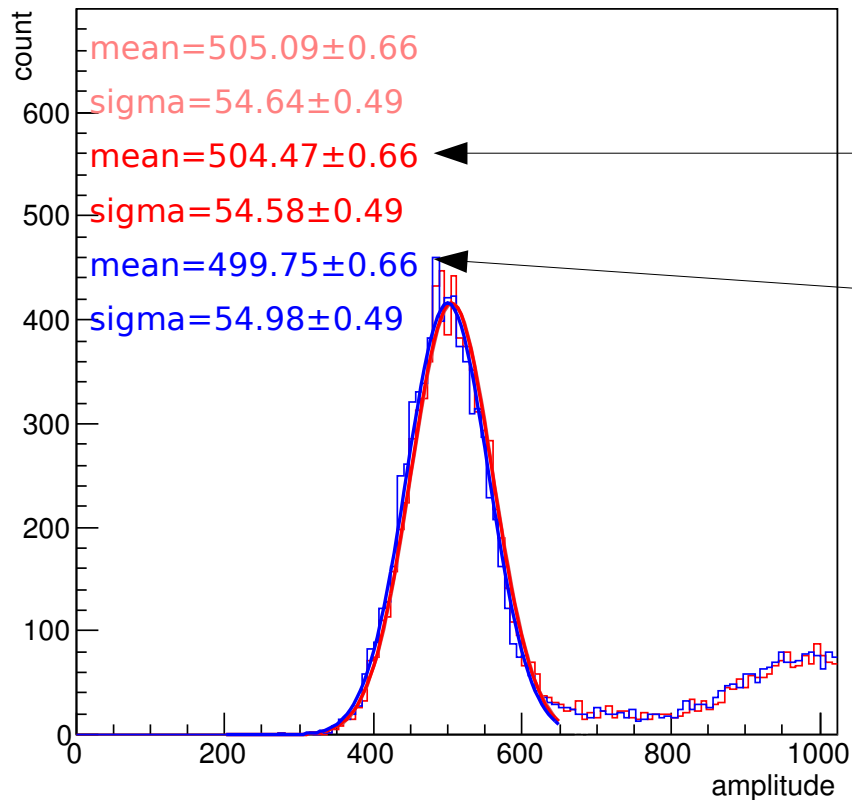
- results of both filters similar
- moving average filter BC2 is slightly closer to ideal value
- slope based filter BC3 without slope correction shows larger deviation

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without common mode effect (2)
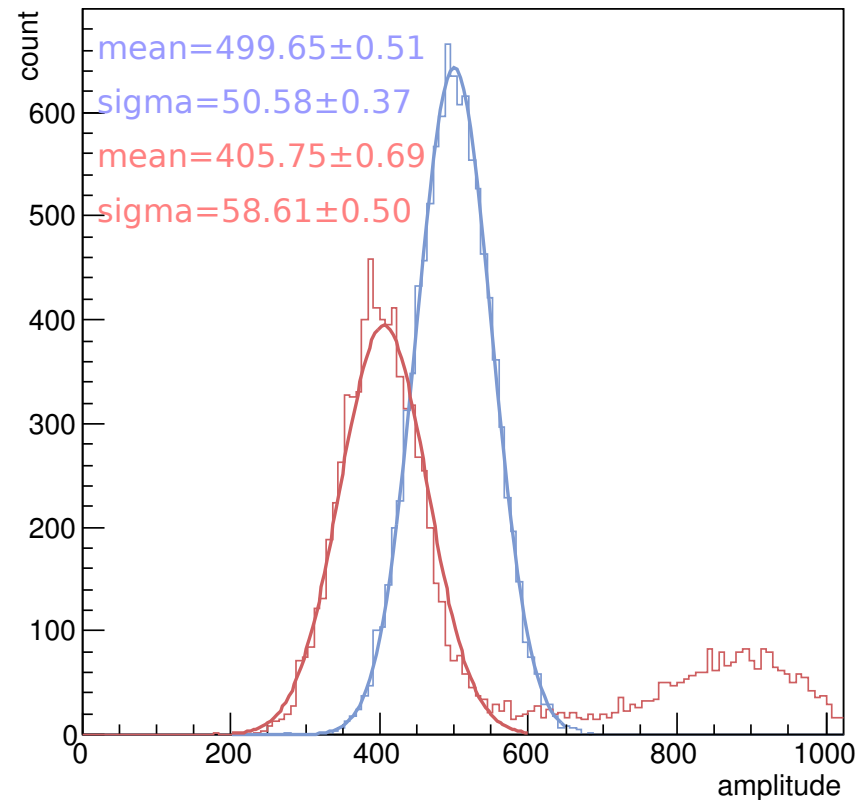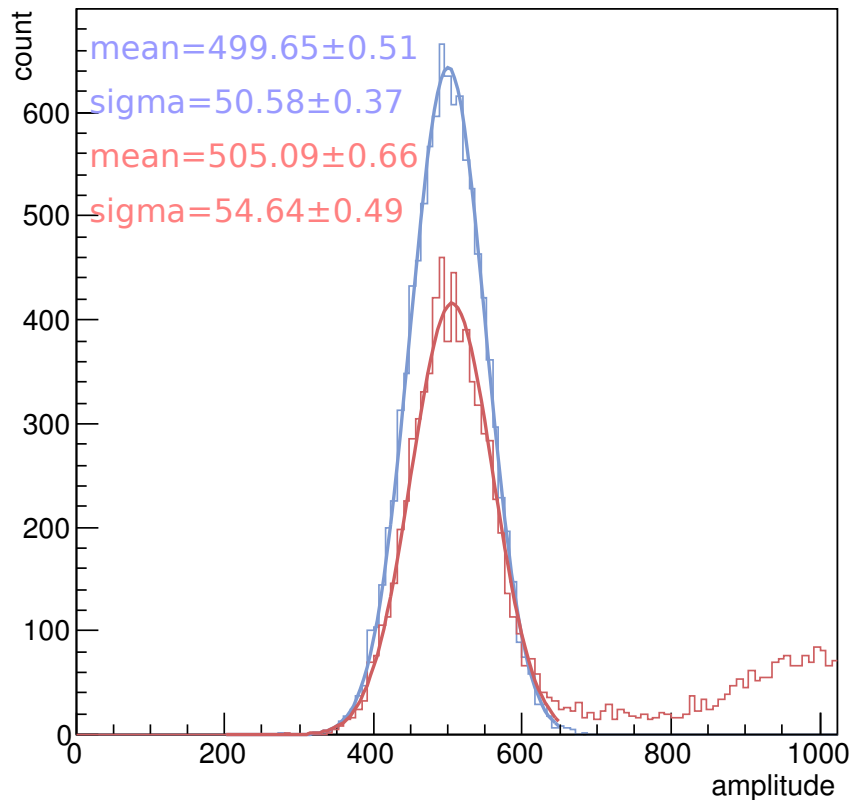
signal peak amplitudes

- slope based filter BC3 with simple slope correction is significantly closer to ideal value
- better correction is possible, not needed for SAMPA submission

with common mode effect (1)

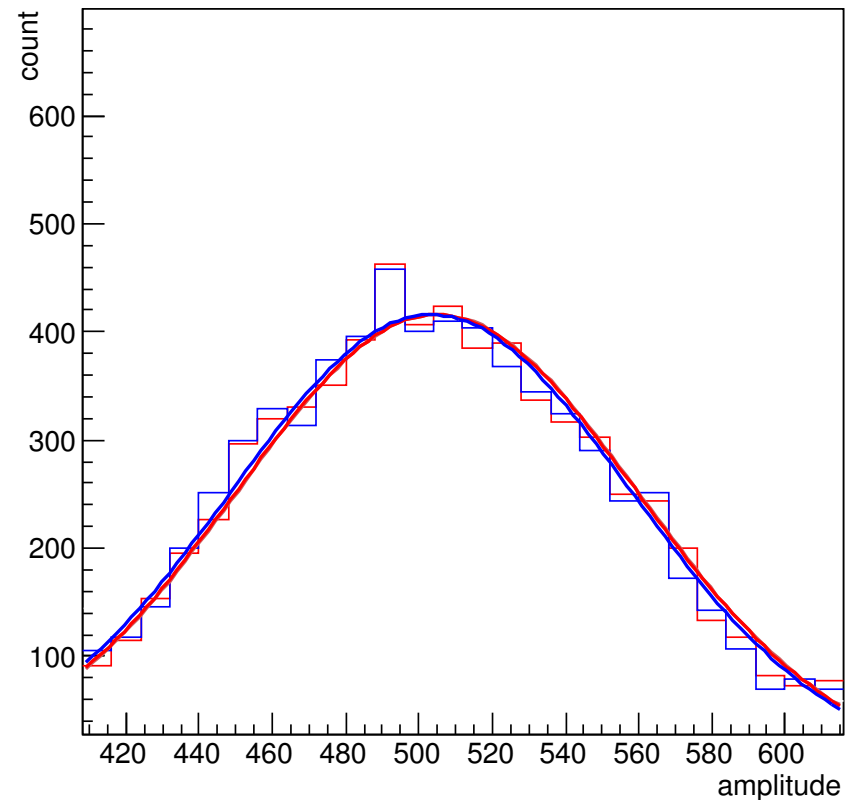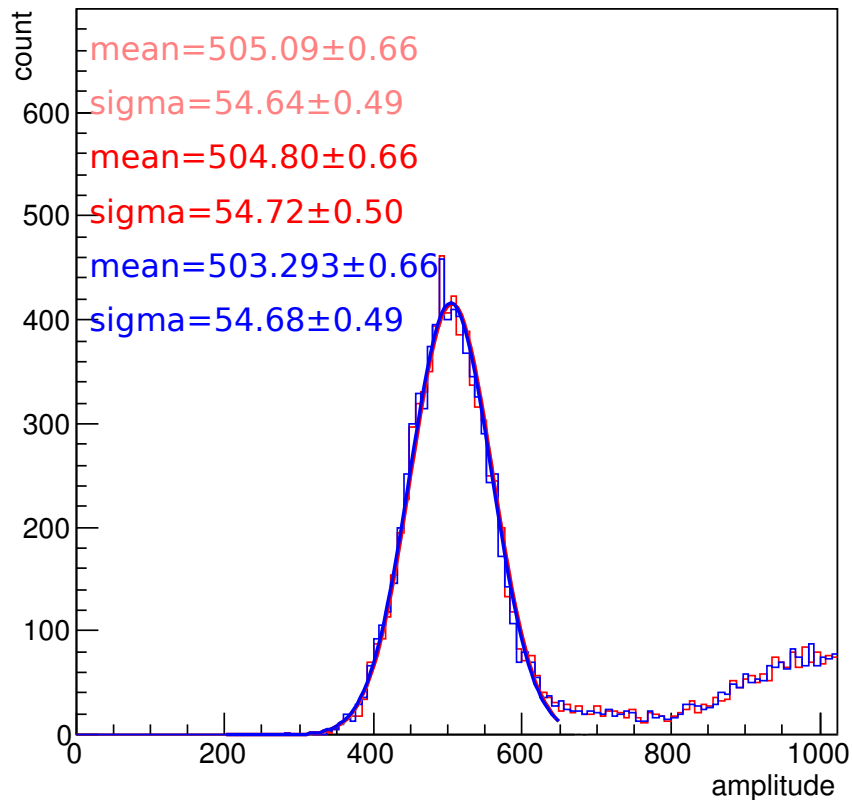signal peak amplitudes   signal peak amplitudes

- without baseline correction there is a significant deviation of mean value when common mode effect is present (right) compared to values without common mode effect (left)

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with common mode effect (2)

signal peak amplitudes   signal peak amplitudes

mean=505.09±0.66
sigma=54.64±0.49
mean=504.80±0.66
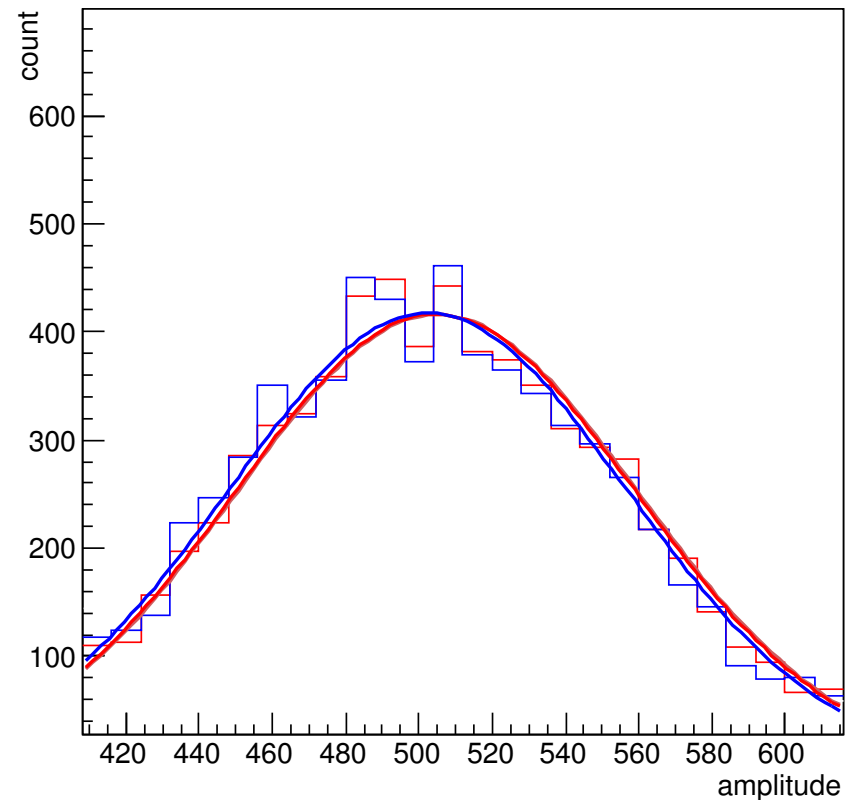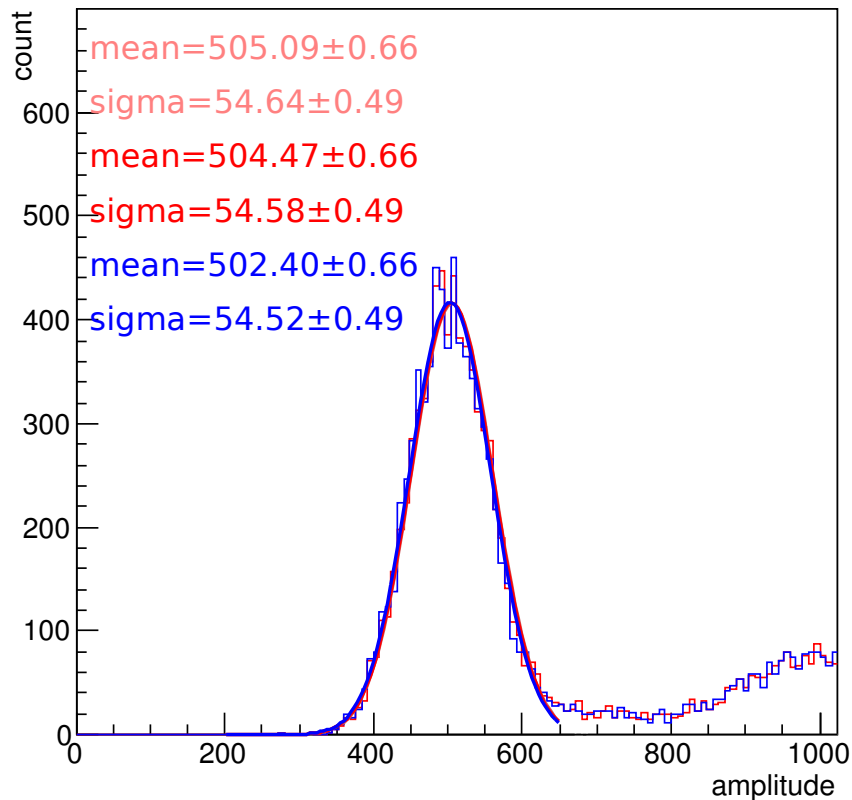sigma=54.72±0.50
mean=503.293±0.66
sigma=54.68±0.49

- with baseline correction the mean value is restored similarly well by both filters

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with common mode effect (3)

signal peak amplitudes

signal peak amplitudes

mean=505.09±0.66
sigma=54.64±0.49
mean=504.47±0.66
sigma=54.58±0.49
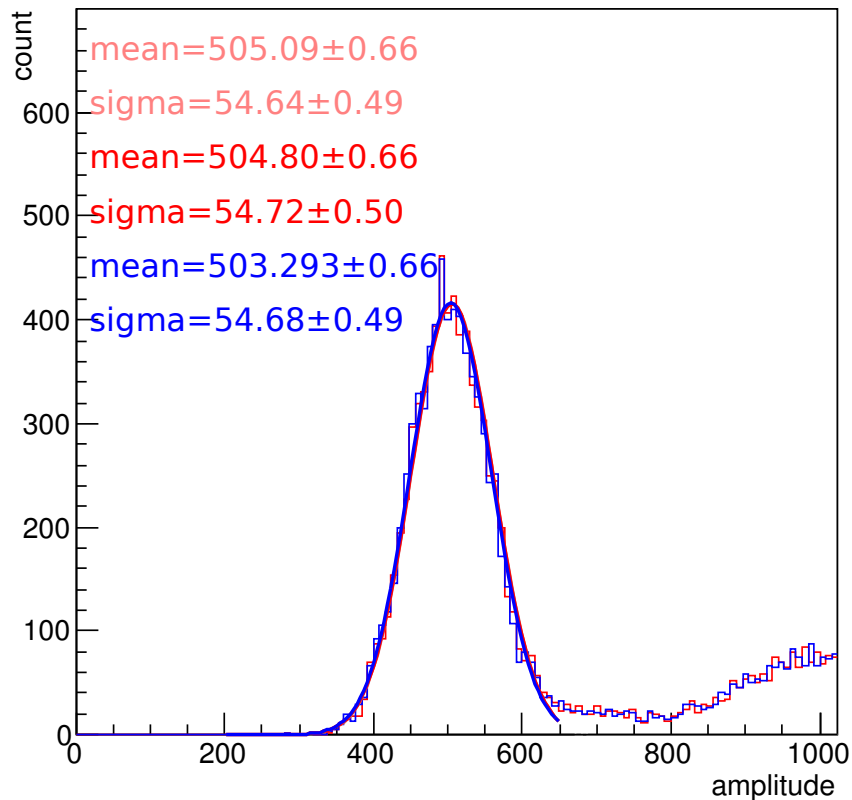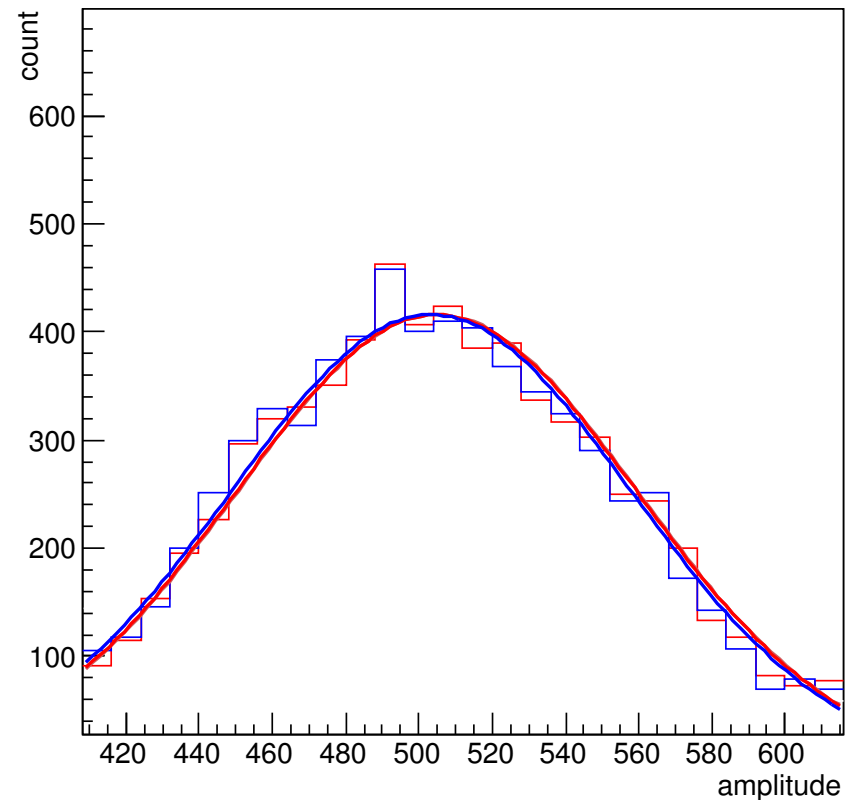mean=502.40±0.66
sigma=54.52±0.49

- compared to the values without common mode both filters are almost completely eliminating the shift

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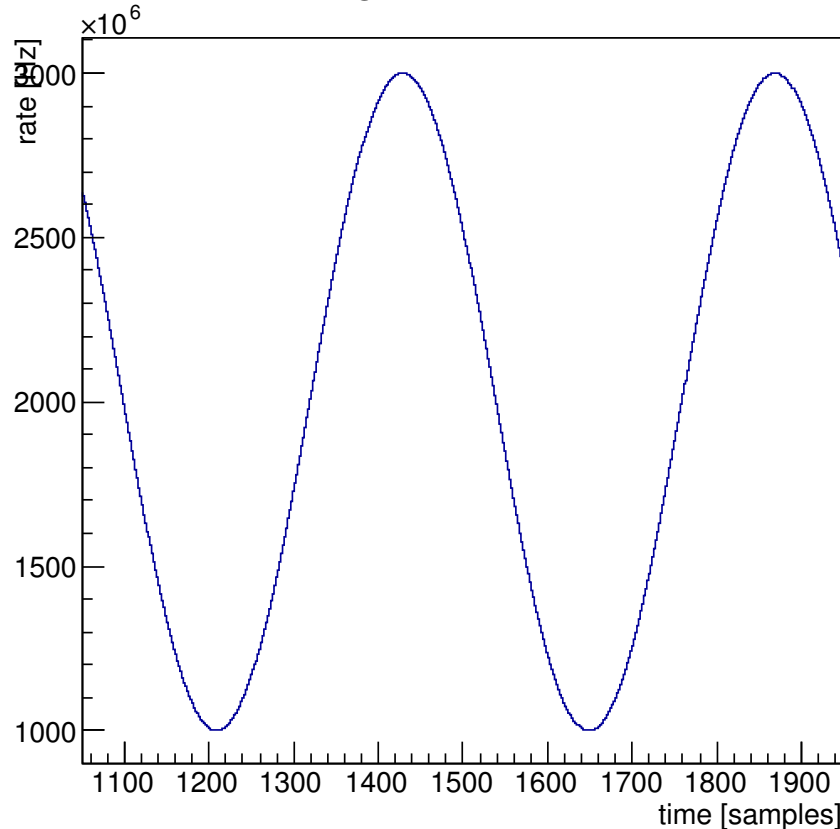# with common mode effect (4)

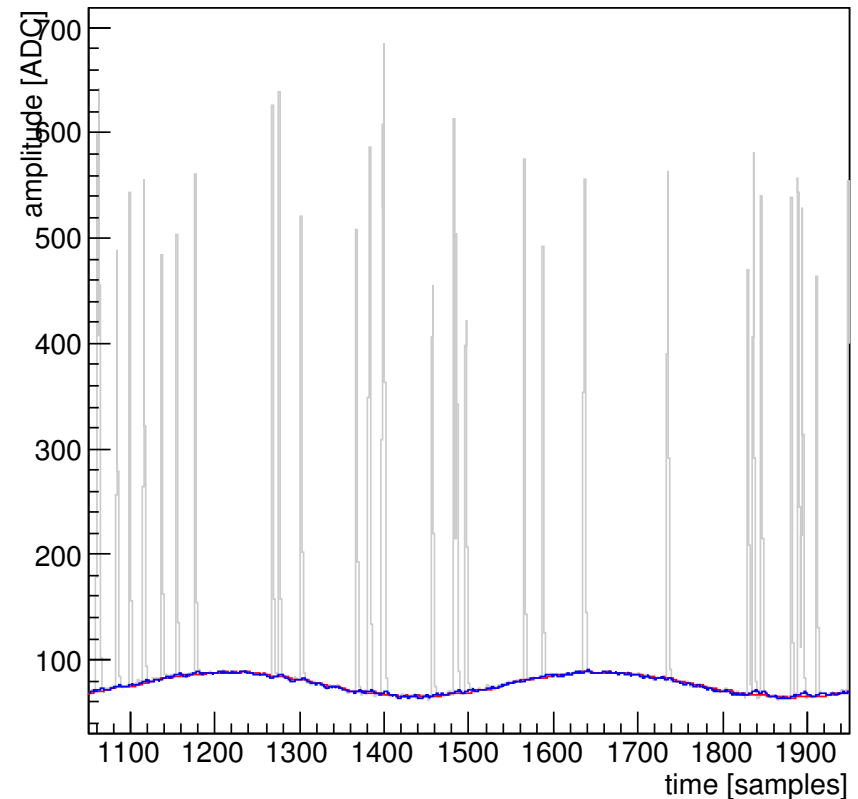signal peak amplitudes

signal peak amplitudes

- with baseline correction the mean value is restored similarly well by both filters

more realistic simulation
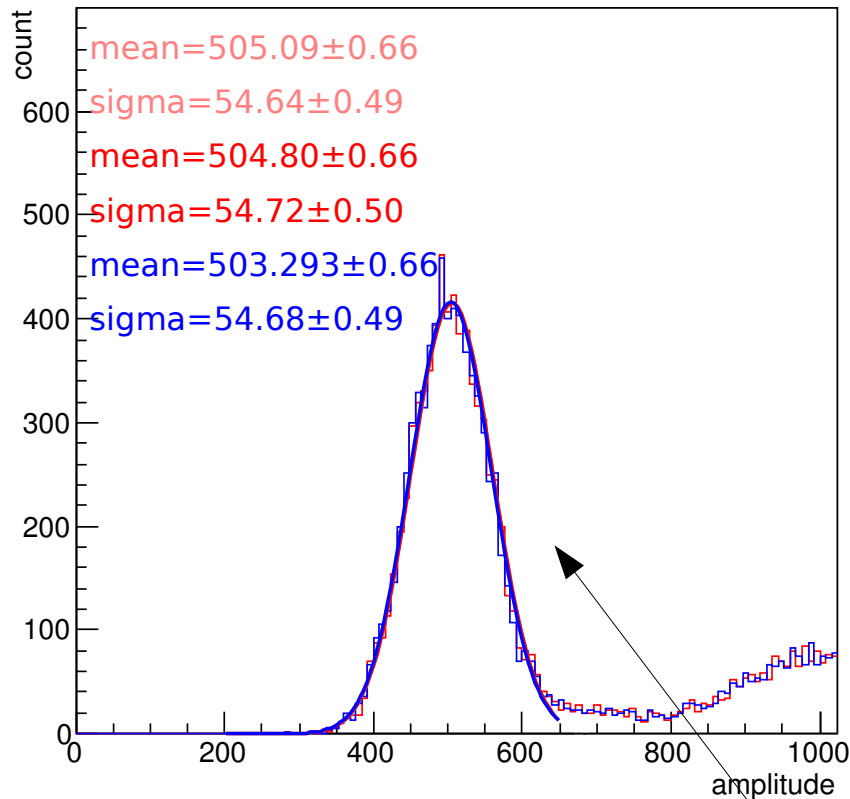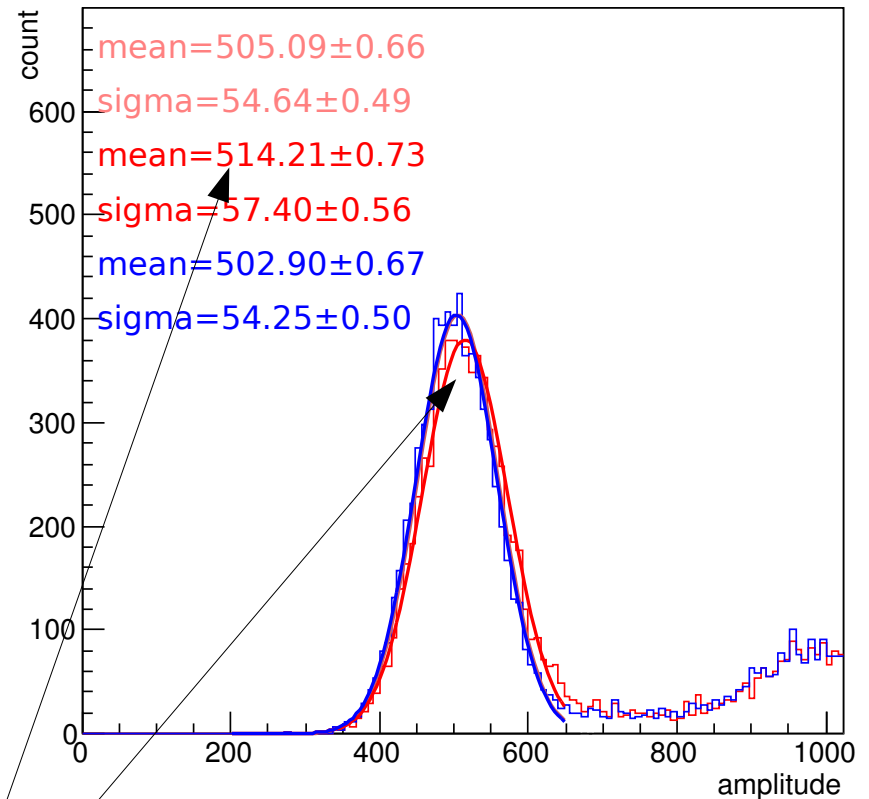
charge rate function

signal

- charge rate is not constant during data taking
- simulation with charge rate variation 1-3GHz
- sine wave variation for simplicity and to stay within limits of BC2 thresholds

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significant differences

signal peak amplitudes

signal peak amplitudes

mean=505.09±0.66
sigma=54.64±0.49
mean=504.80±0.66
sigma=54.72±0.50
mean=503.293±0.66
sigma=54.68±0.49

mean=505.09±0.66
sigma=54.64±0.49
mean=514.21±0.73
sigma=57.40±0.56
mean=502.90±0.67
sigma=54.25±0.50

- compared to result without charge rate variation, BC3 filter shows no significant deviation
- BC2 filter is hitting its limits

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further steps

- Adjustable slope range must be defined for finalizing SAMPA filter design as bit width of registers must be specified prior to submiting the chip for production, this is time critical.

- A better slope correction needs to be designed if shown deviations are a concern. This correction would be implemented in CRU/post processing, this is not time critical.

- More realistic validation/simulation of the filters using AliRoot may be done next week when Marian/Mesut are available.

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Questions?
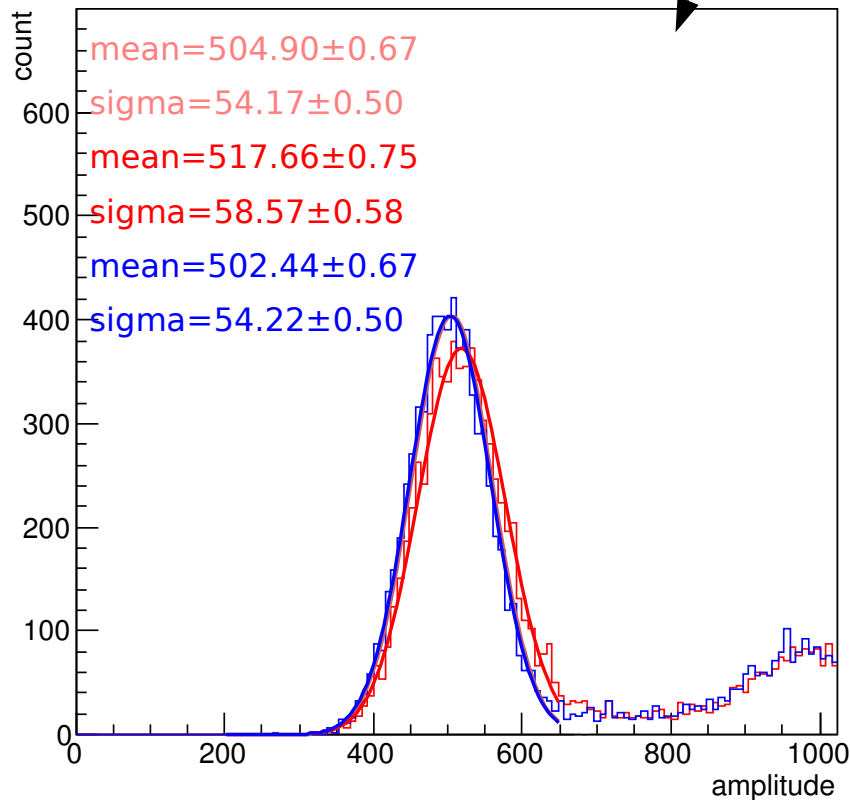# Comments?

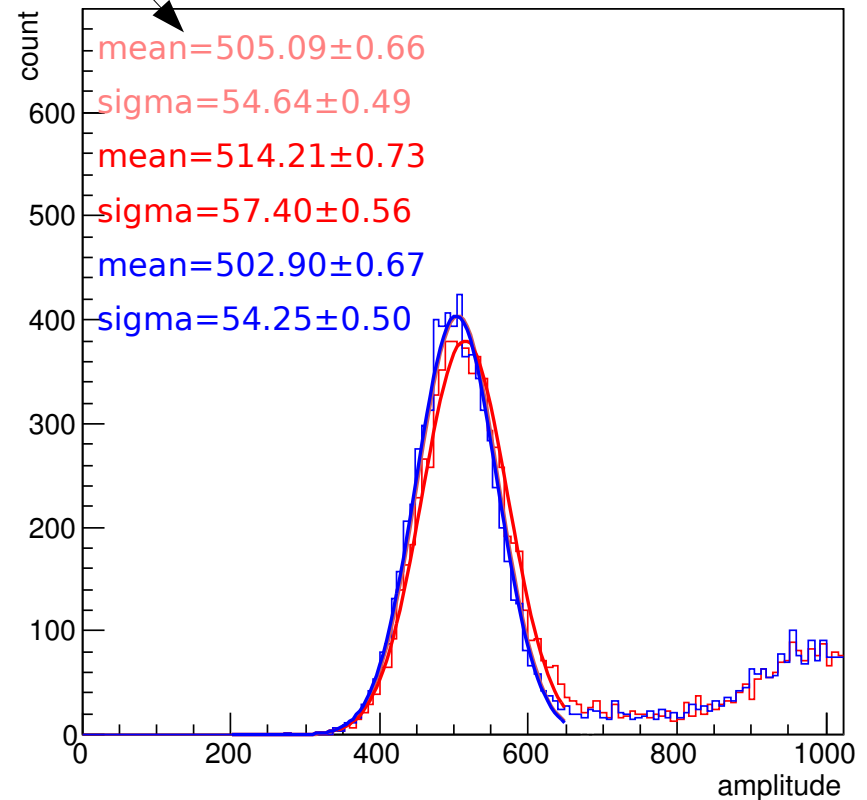universität**bonn**

Spares

Other simulation parameter

- Simulation statistics: 10000 simulated signal charges per histogram
- BC2 settings used:
  averaging length=8 samples
  upper=3 ADC
  lower=6 ADC
- BC3 settings used:
  upward=3/8 ADC/sample
  downward=6/8 ADC/sample

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integer/floating point

signal peak amplitudes

signal peak amplitudes

- simulation calculations done in floating point
- integer simulation differs only slightly

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