



# Quantifying Differences Between Positive and Negative Pulses in PDHD Induction Channels

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@BrookhavenLab

# New Metrics

## Peak Height Ratio (PHR)

$$\text{PHR} = \frac{|Max_{Tail}|}{|Max_{Main Peak}|}$$

- If PHR is Large → Significant Tail (relative to main peak).
- If PHR is Small → Weak Tail (relative to main peak).

## Tail Area Contribution (TAC)

$$\text{TAC} = \frac{|Area_{Tail}|}{|Area_{Main Peak}|}$$

- If TAC is Large → Tail contributes significantly to signal.
- If TAC is Small → Tail is a minor contribution to waveform.

## Baseline RMS ( $B_{rms}$ )

$$B_{rms} = \sqrt{\frac{1}{N} \sum_i (A_i - \bar{A})^2}$$

- $A_i$  = Bins before the main peak.
- $\bar{A}$  = Mean baseline ADC value.

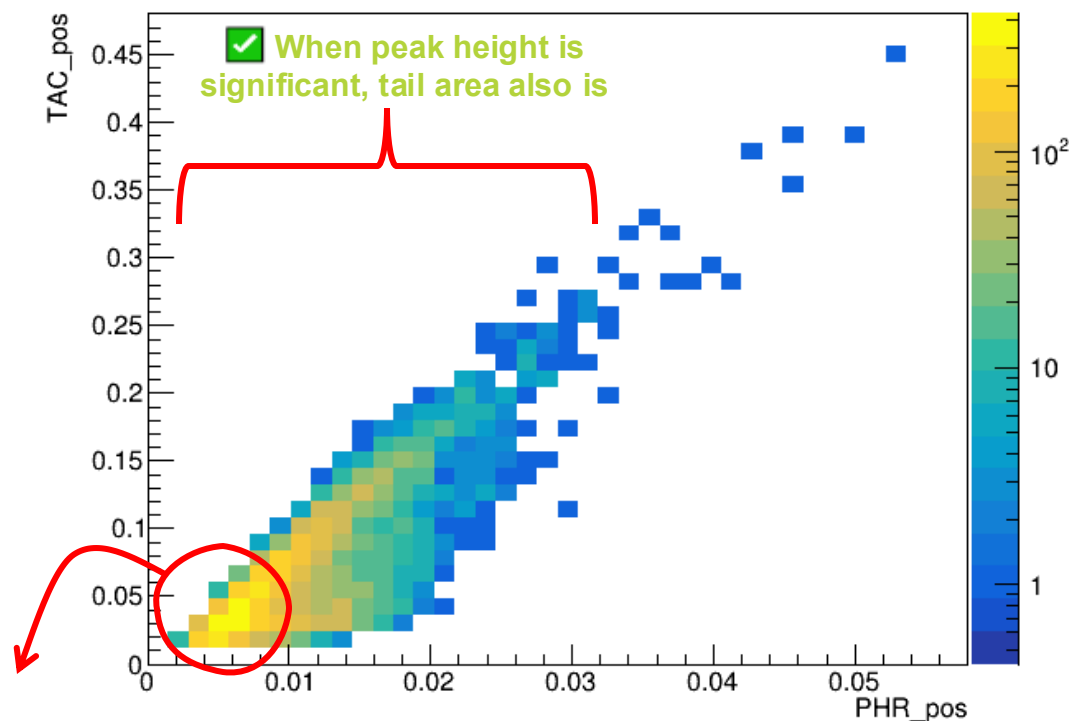
The higher  $B_{rms}$ , the noisier the channel.



# Implementing these metrics on our data (single run)

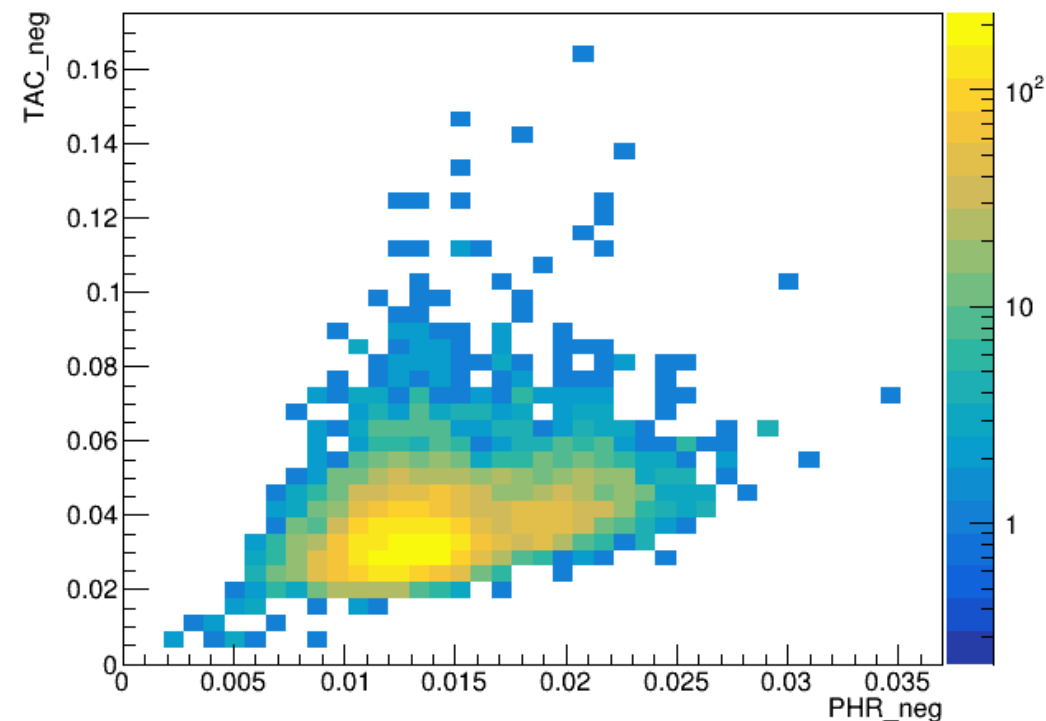
*Looking for correlations amongst these metrics*

TAC vs. PHR for Positive Peak



✓ Most waveforms have small tails relative to their peaks

TAC vs. PHR for Negative Peak



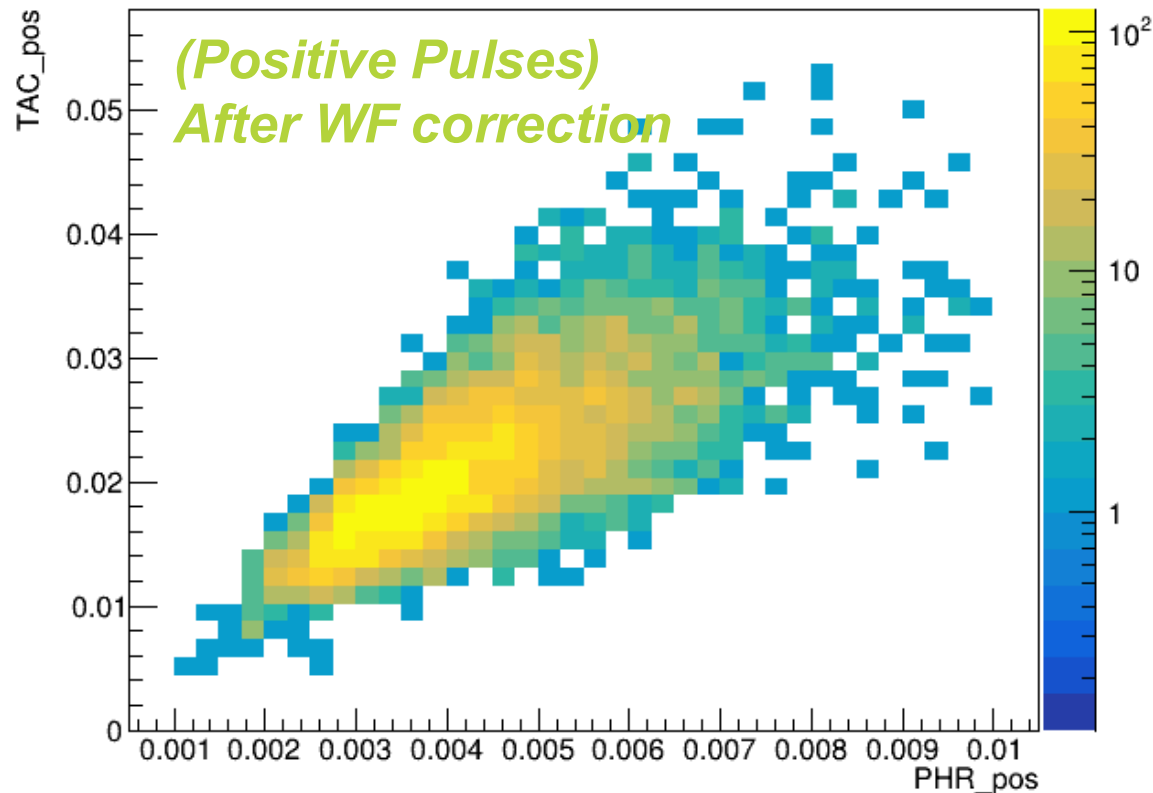
Wider spread but same positive correlation.

# Next: Applied waveform correction

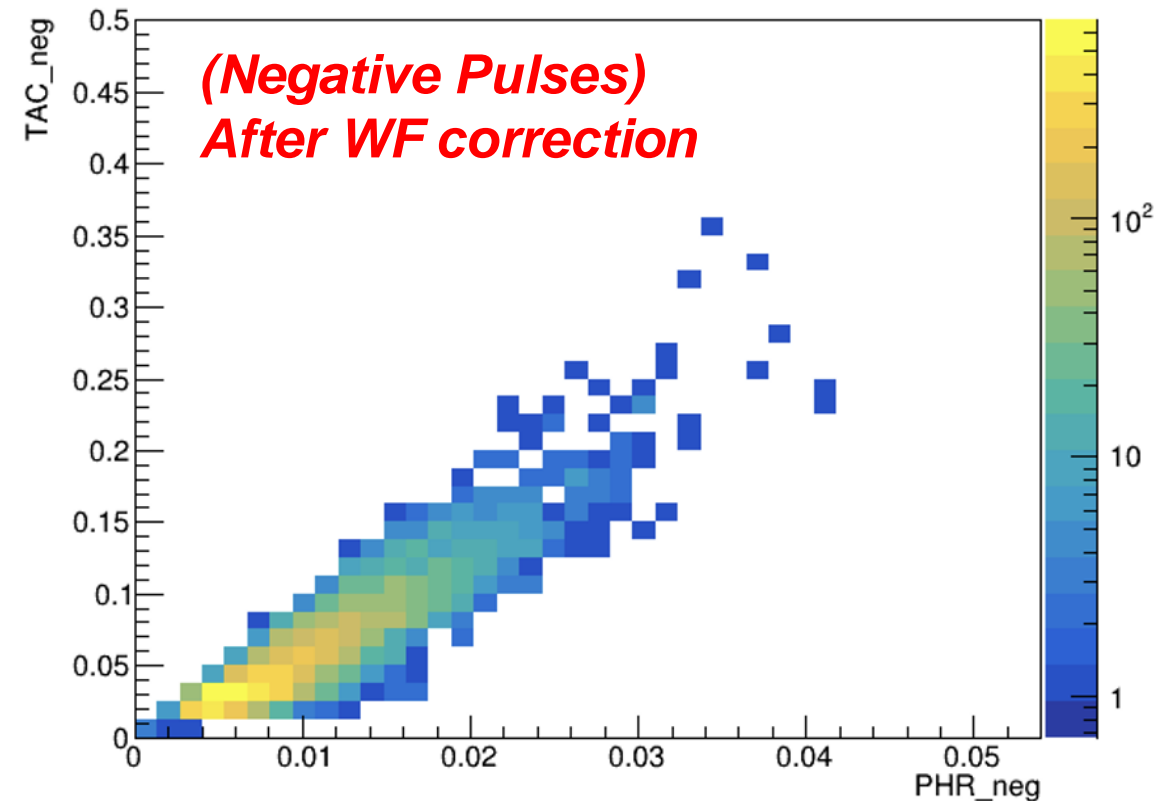
Applied same Electronics Response on both + and – pulses

→ Take the corrected waveforms and apply our metrics:

TAC vs. PHR for Positive Peak



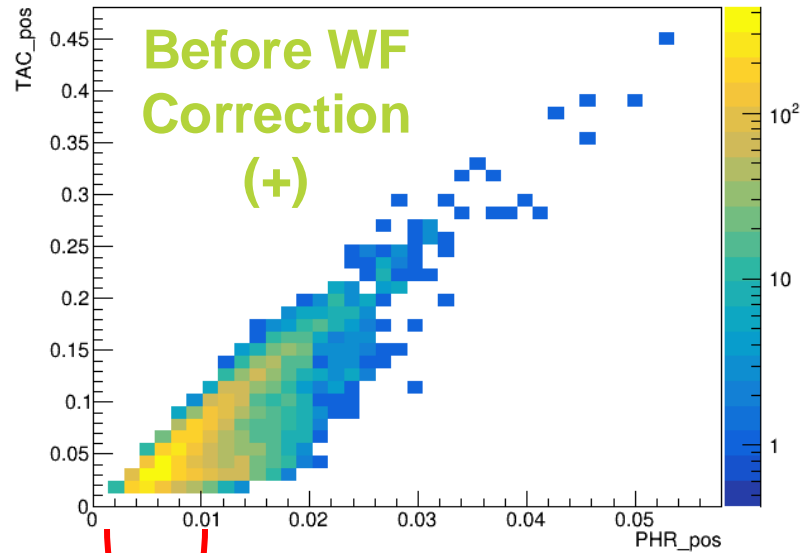
TAC vs. PHR for Negative Peak



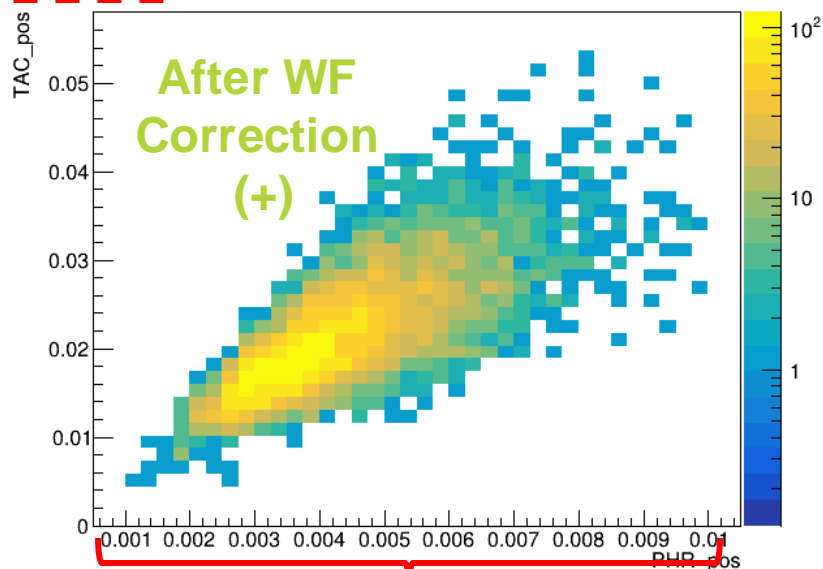


# Comparing *Before* & *After* Waveform Correction

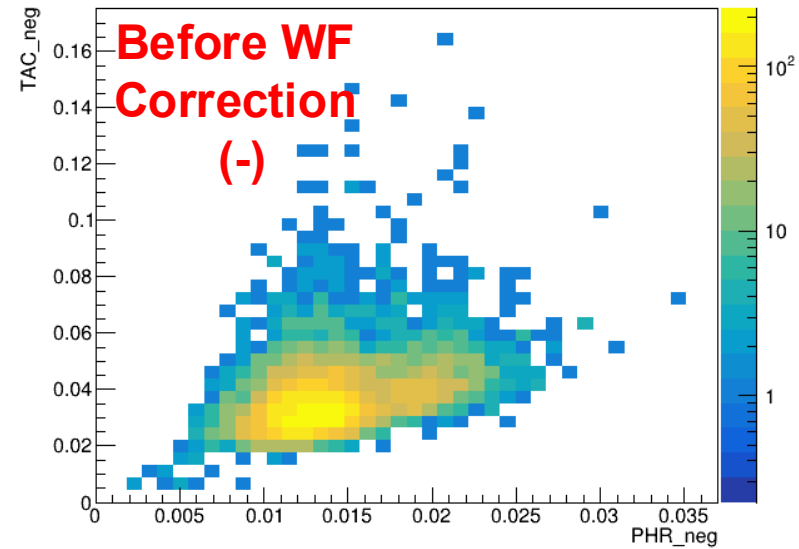
TAC vs. PHR for Positive Peak



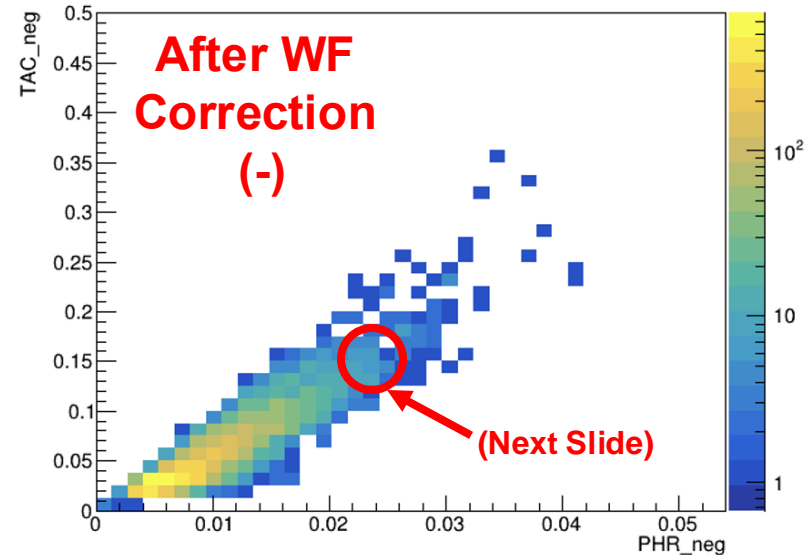
TAC vs. PHR for Positive Peak



TAC vs. PHR for Negative Peak



TAC vs. PHR for Negative Peak

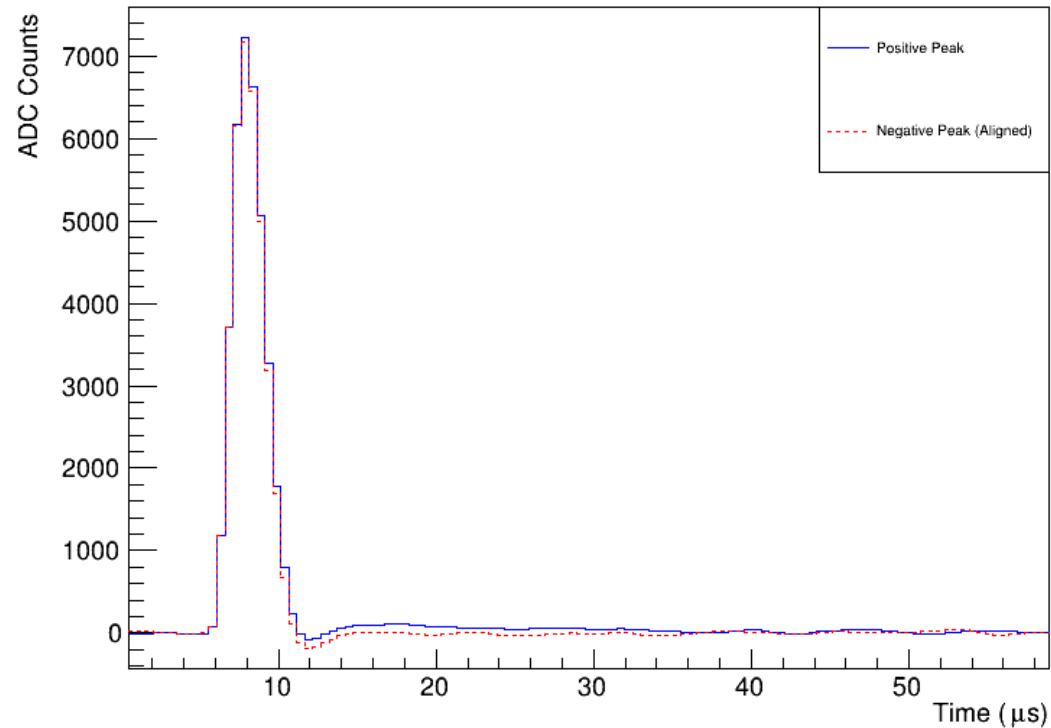


✓  
Significant  
reduction  
of the  
range  
=  
more well-  
behaved  
tails

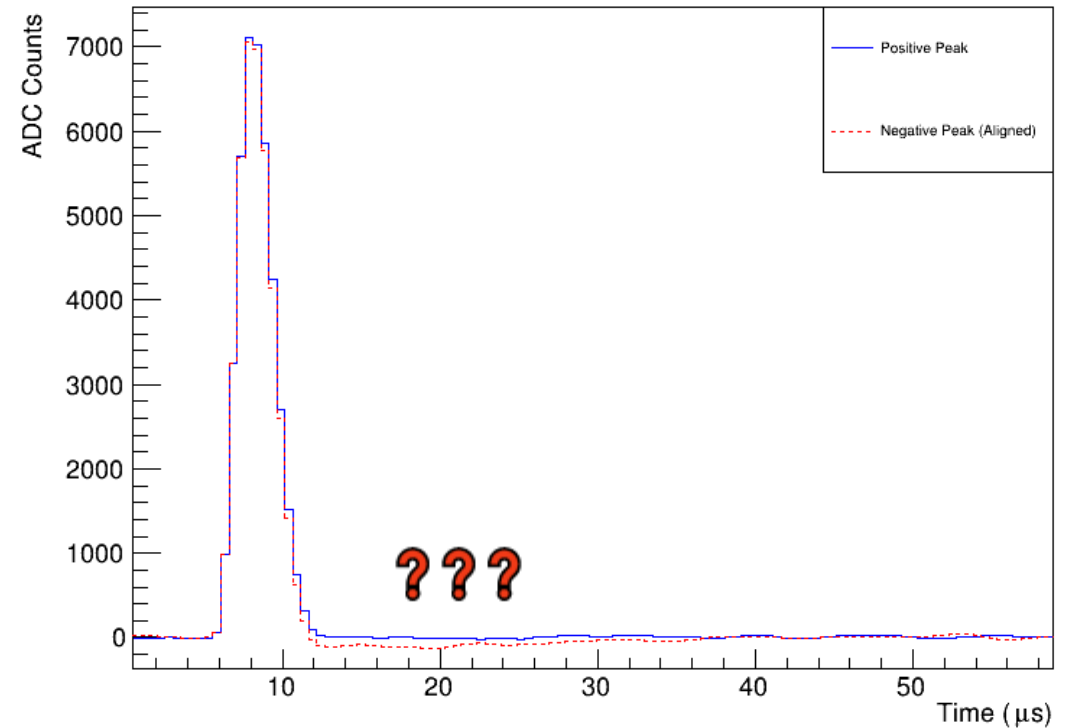
✗  
Why does  
the  
corrected  
case look  
worse than  
the non-  
corrected  
for (-)  
pulses?

# What is going on with (-) pulses?

Peak Comparison Before Correction, Ch. 160

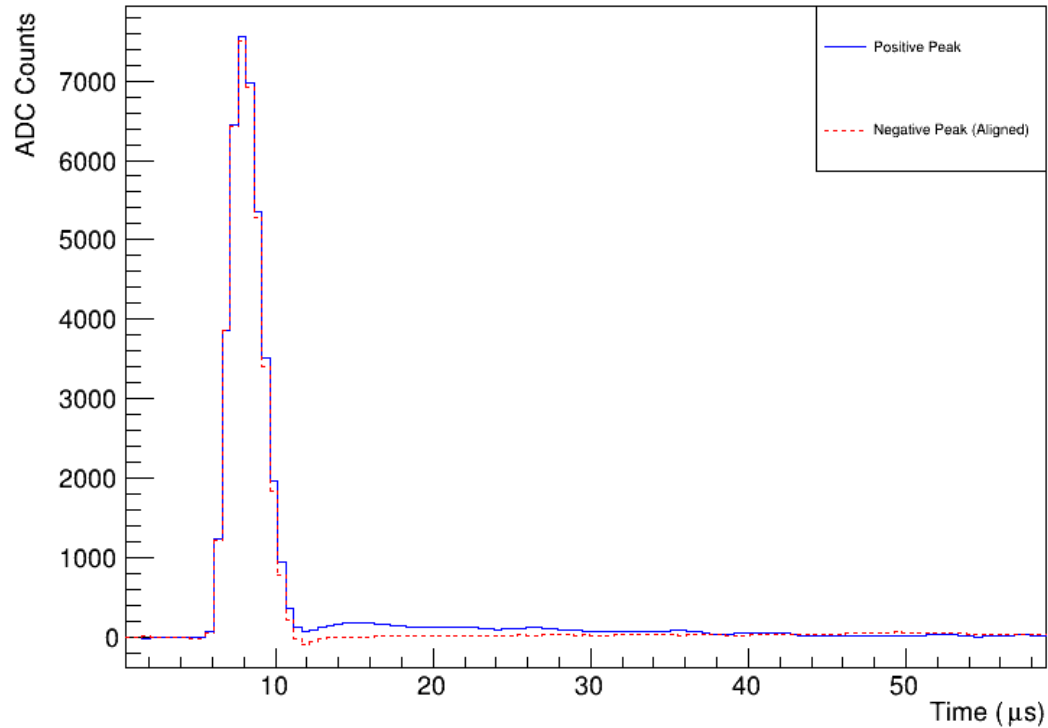


Peak Comparison After Correction, Ch. 160

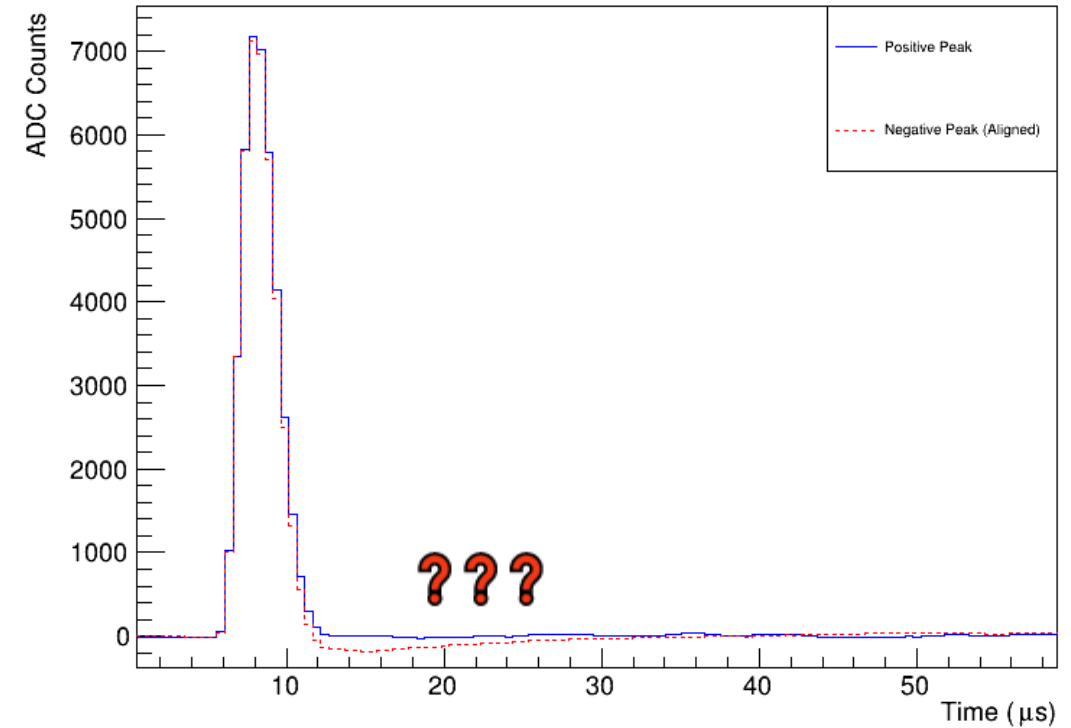


# What is going on with (-) pulses?

Peak Comparison Before Correction, Ch. 9277

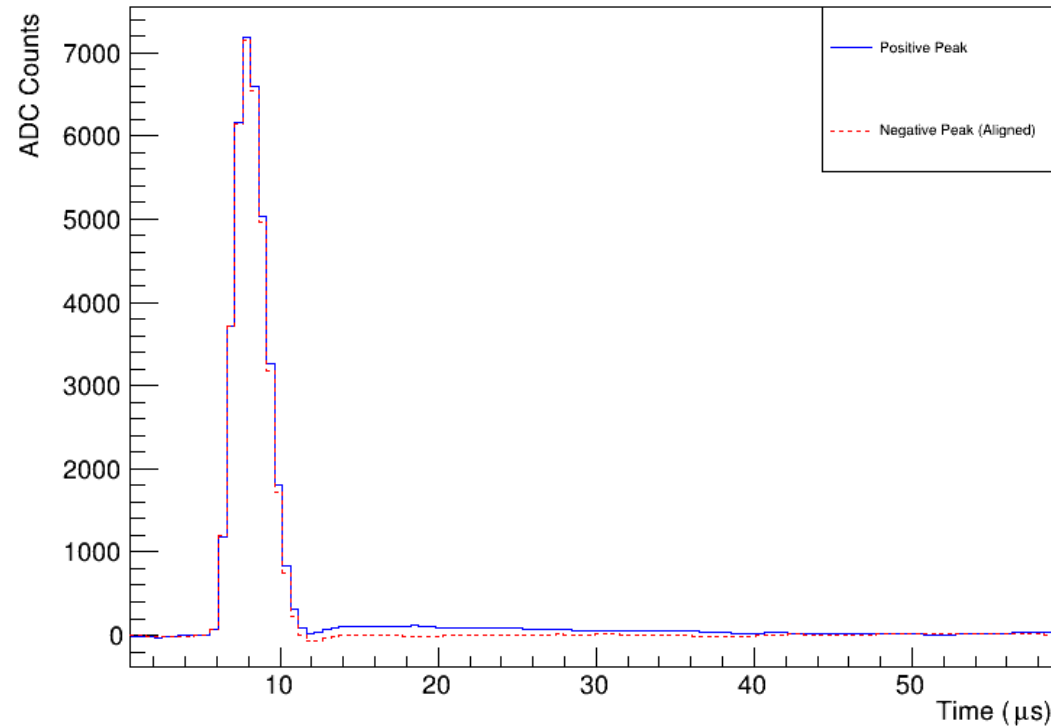


Peak Comparison After Correction, Ch. 9277

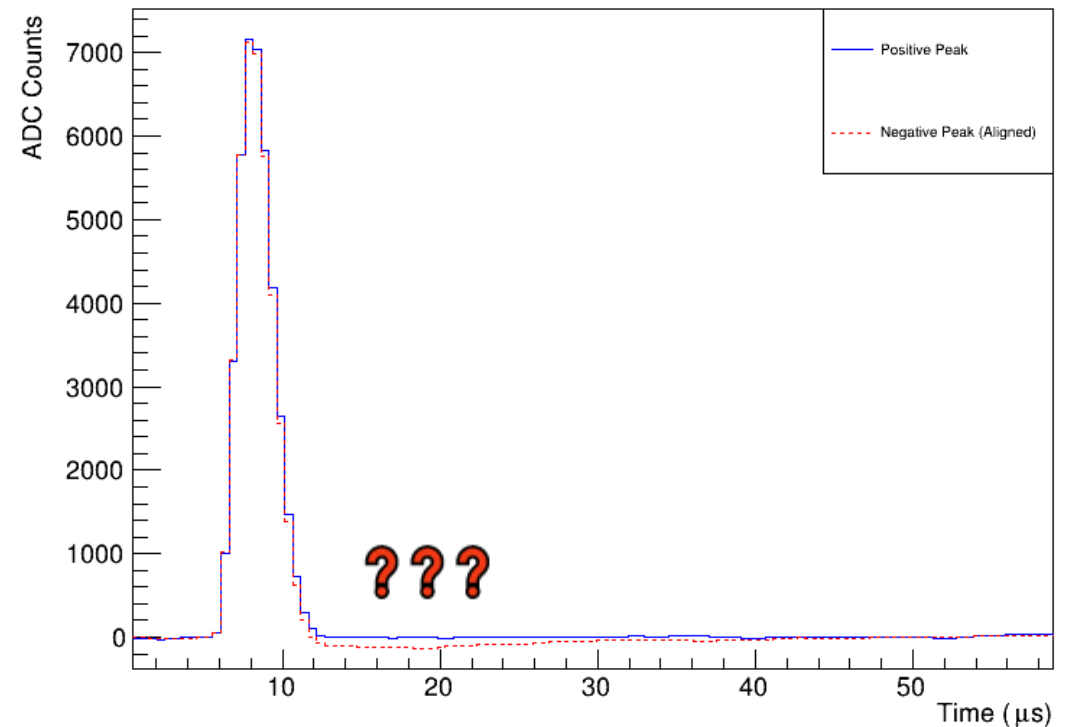


# What is going on with (-) pulses?

Peak Comparison Before Correction, Ch. 9260



Peak Comparison After Correction, Ch. 9260



In progress...



