Analysis of MIP peaks for determination of appropriate ‘BWSel’

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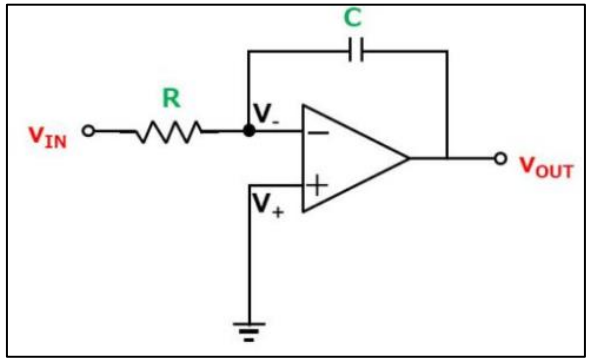
For determination of appropriate ‘BWSel’

I want to determine the BWSel, which is one of the parameters of the FPHX chip.

BWSel is a parameter that adds capacitance (to the integrator circuit of the FPHX chip).

The FPHX chip specifications state that BWSel=4 is desirable when GSel=2. However, BWSel=8 is currently used on test benches at NWU and RIKEN.

I measured cosmic rays and performed a DAC scan. I analyzed the ADC distribution and MIP peak values for BWSel=4 and 8.



The integrator circuit

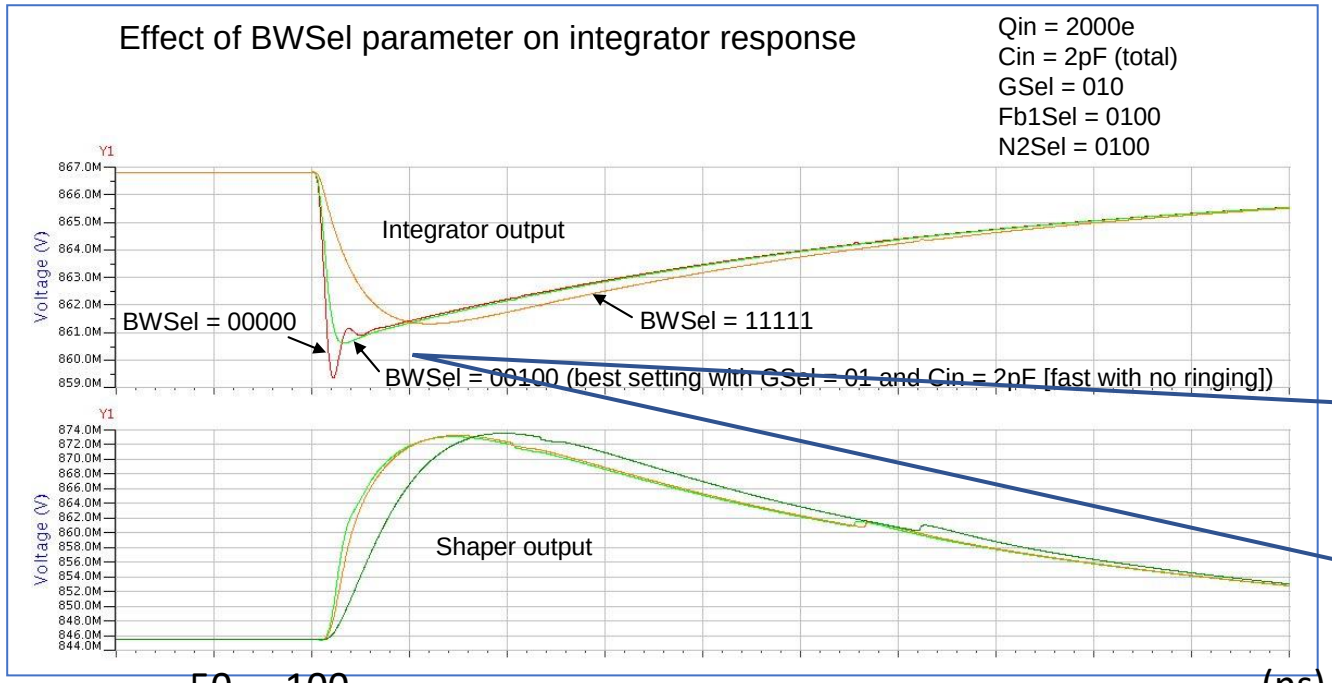
For Cin = 2 pF (1.5 pF detector + 0.5 pF parasitic):
- If **GSel** = 000, set **BWSel** = 00000
- If **GSel** = 010, set **BWSel** = 00100
- If **GSel** = 100, set **BWSel** = 01000
- If **GSel** = 110, set **BWSel** = 01100

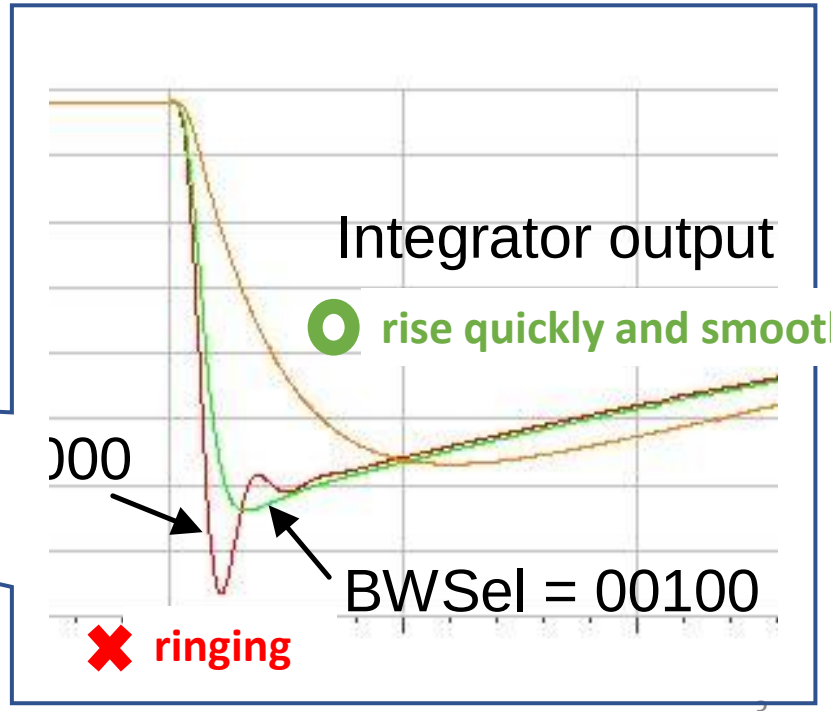
The FPHX chip specifications

Effect of BWSel parameter

When BWSel=00000, the signal may be overestimated due to **ringing** (a phenomenon in which the waveform oscillates due to signal reflection).

It is preferable for the signal to **rise quickly and smoothly** in a single peak, as in BWSel=00100.

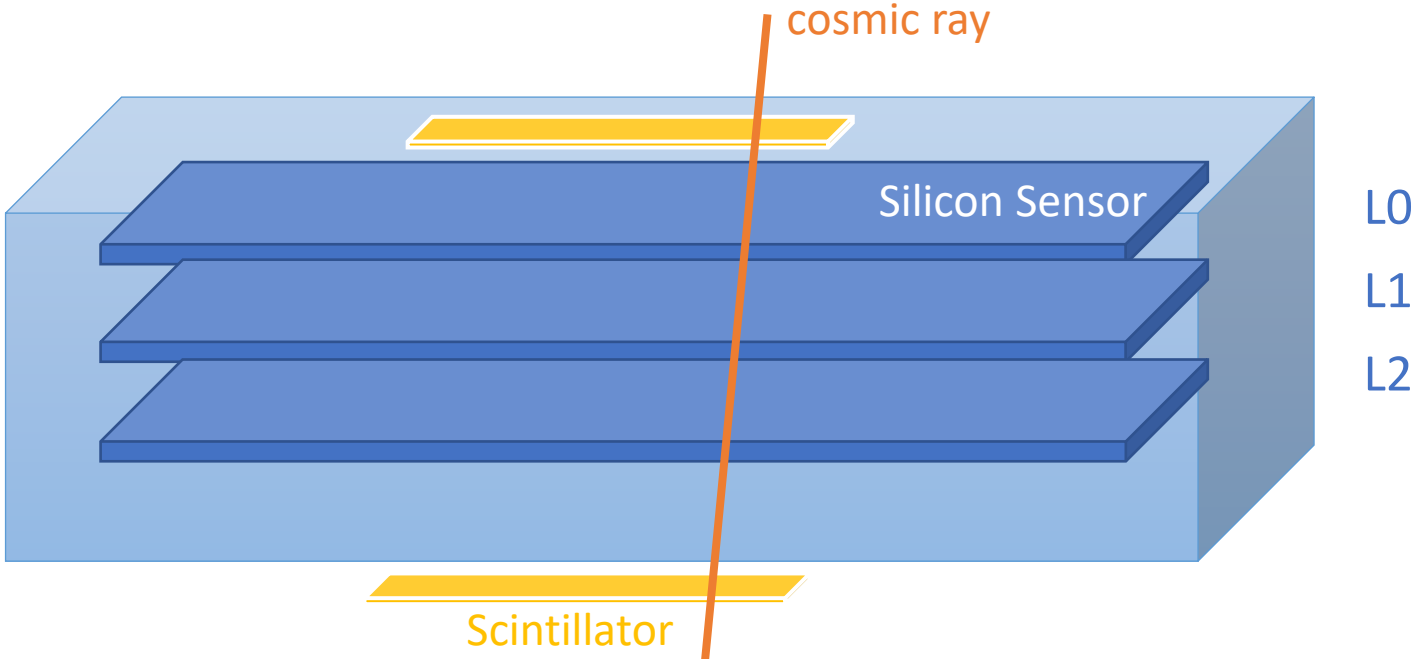




The FPHX chip specifications

Setup

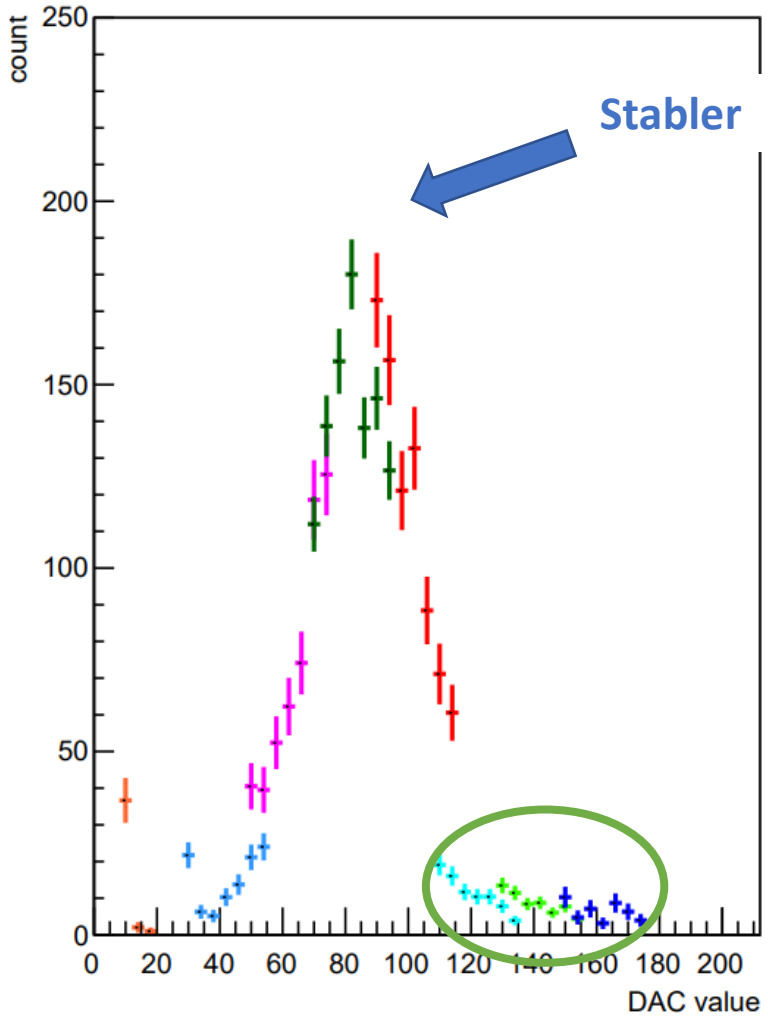
Three halves of a ladder were used, and two scintillators were installed as external triggers upstream and downstream of them, respectively.



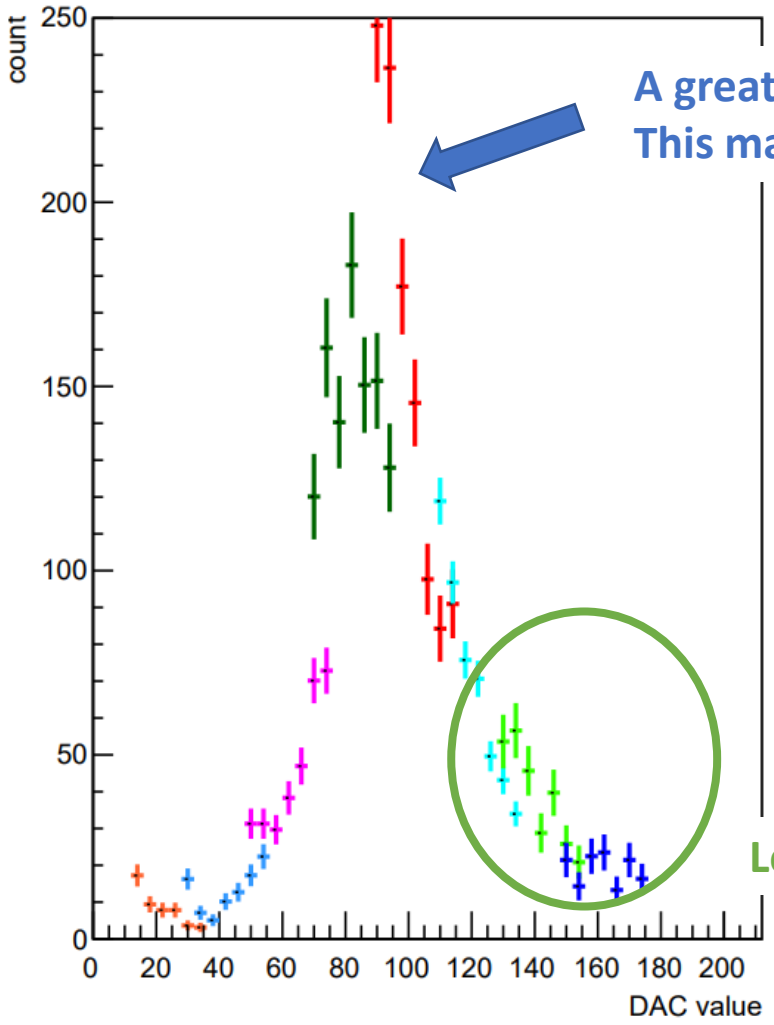
Next page will show the comparison of the ADC distribution for BWSel=4 and 8.

Comparison of the distribution for BWSel=4 and 8

BWSel=8, L2, Single hit



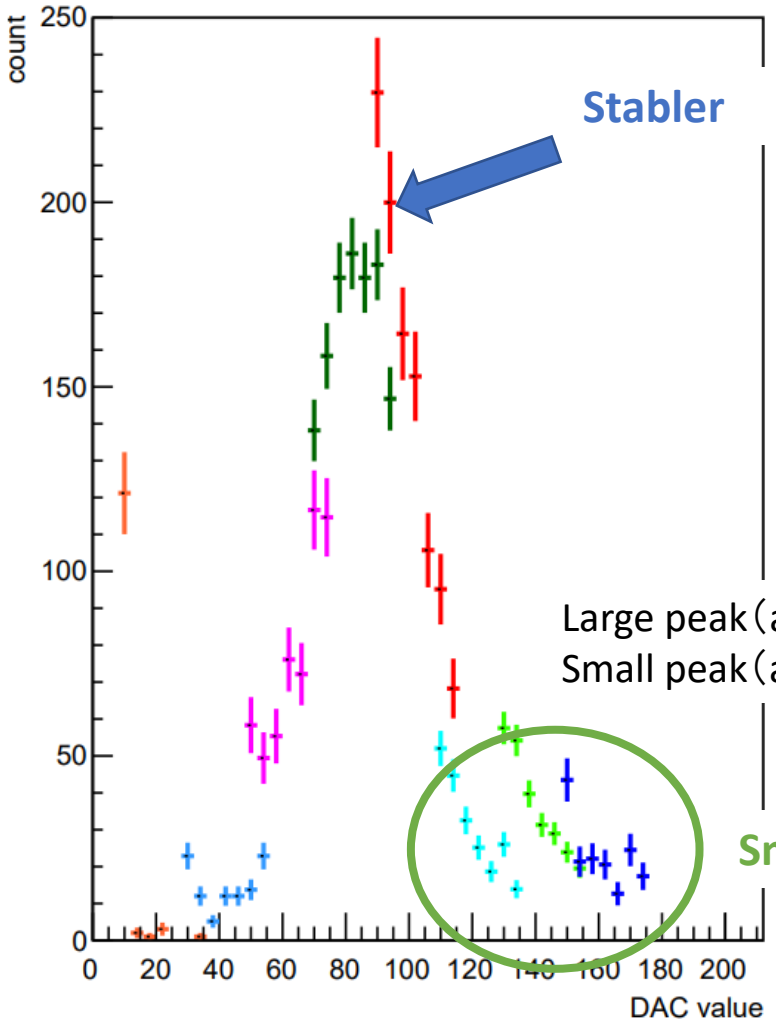
BWSel=4, L2, Single hit



For BWSel=8, the shape of the distribution is stabler than for BWSel=4.

Comparison of the distribution for BWSel=4 and 8

BWSel=8, L1, Single hit

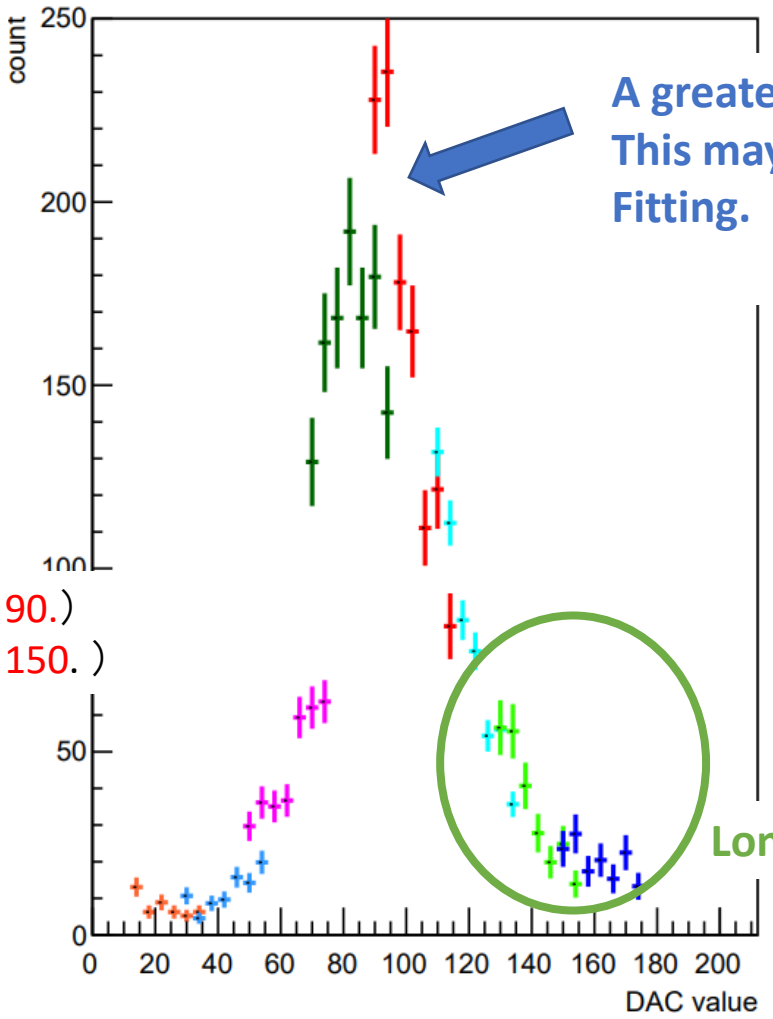


Stabler

Large peak（around the DAC value of 90.）
Small peak（around the DAC value of 150. ）

Small peak

BWSel=4, L1, Single hit



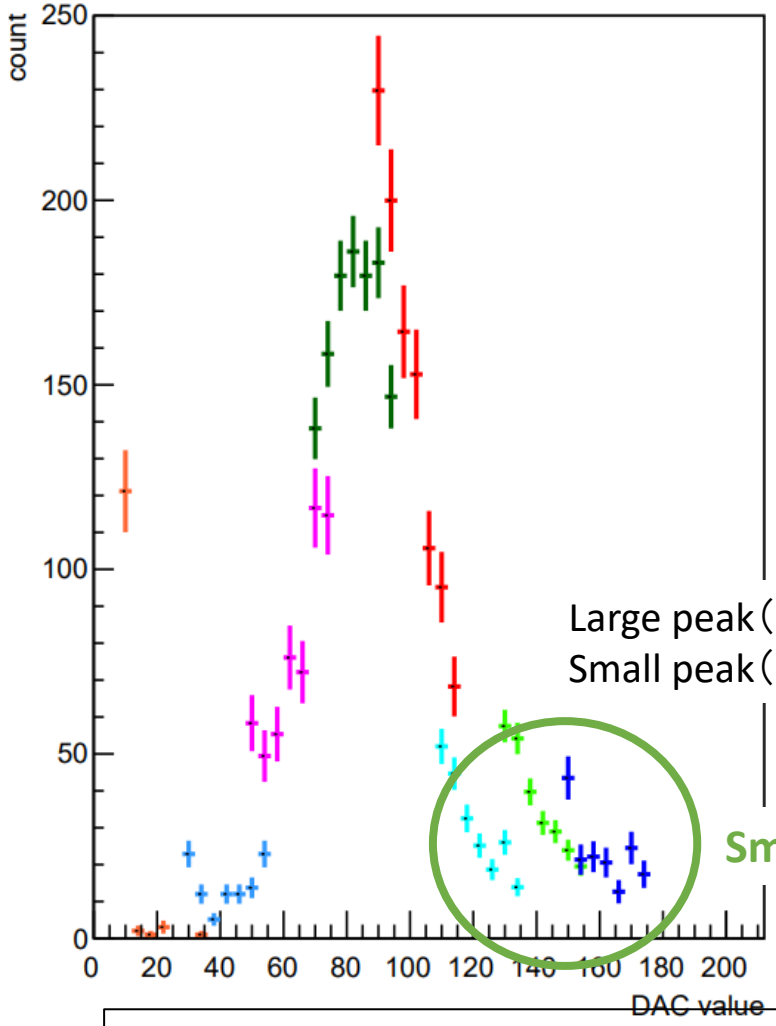
A greater variation in entries. This may affect the accuracy of Fitting.

Longer tail

For BWSel=8, the shape is stabler than for BWSel=4, as well as L2. -> I think BWSel=8 would be preferable.

Comparison of L1 and L2 distribution for BWSel=8

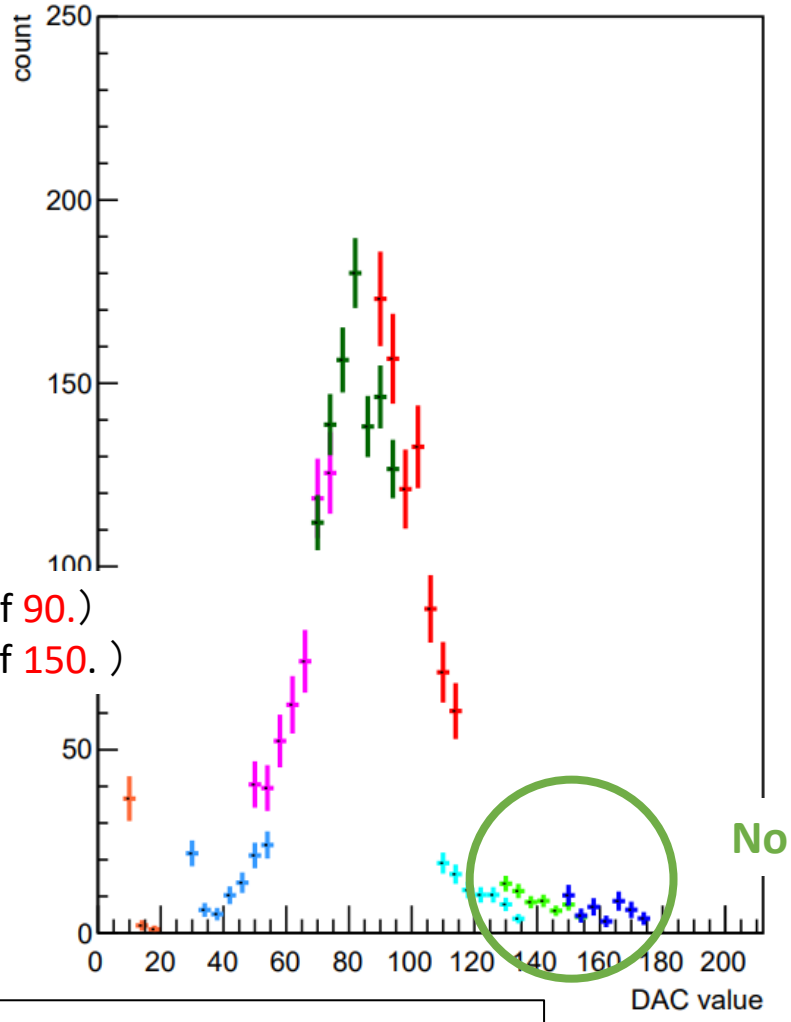
BWSel=8, L1, Single hit



Large peak（around the DAC value of 90.）
Small peak（around the DAC value of 150. ）

Small peak

BWSel=8, L2, Single hit



No small peak

When BWSel=8, there may or may not be a small peak.
-> The cause of small peak is more likely related to ladder position than BWSel.

Summary

I analyzed MIP peaks for BWSel=4 and 8 to determine the parameter of FPHX chip “BWSel”.

- For BWSel=4, there is a large variation in entries, which may affect the accuracy of Fitting.
- For BWSel=8, the distribution is relatively smooth and does not necessarily have small peaks.

Therefore, I think BWSel=8 would be preferable.

I’d like you to measure with multiple values (BWSel=2,4,8, etc...) during commissioning to determine an appropriate value for BWSel.

Back Up

Data analysis（Single hit）

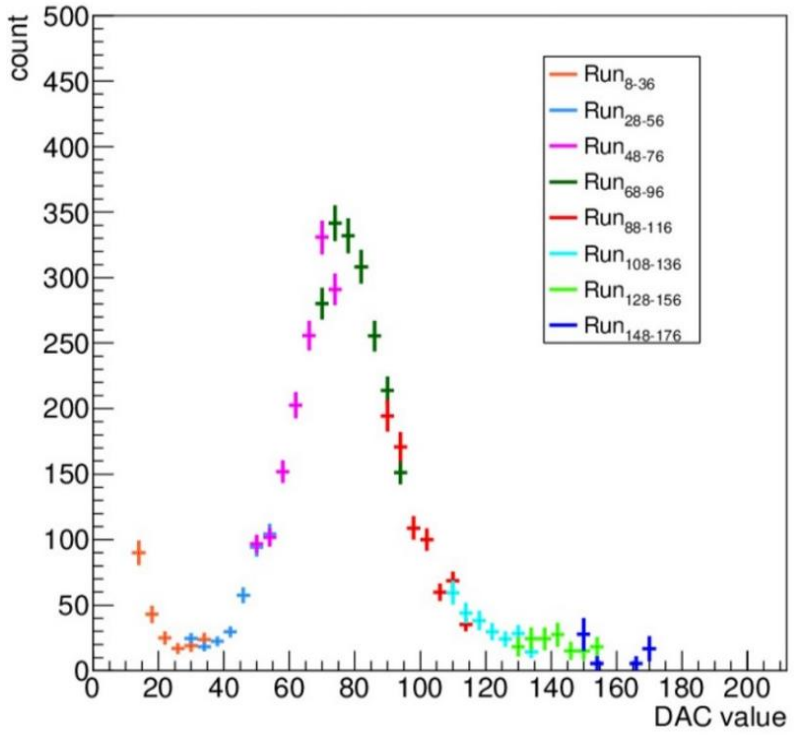
1. Event select (cut of hit to hot channel, etc…)
2. Make the ADC distribution for each chip（Limit number of clusters to 1）
3. Make the ADC distribution for all chips, Normalize, and Collect

Notes:

“Single hit” is a hit that has passed through only a strip.

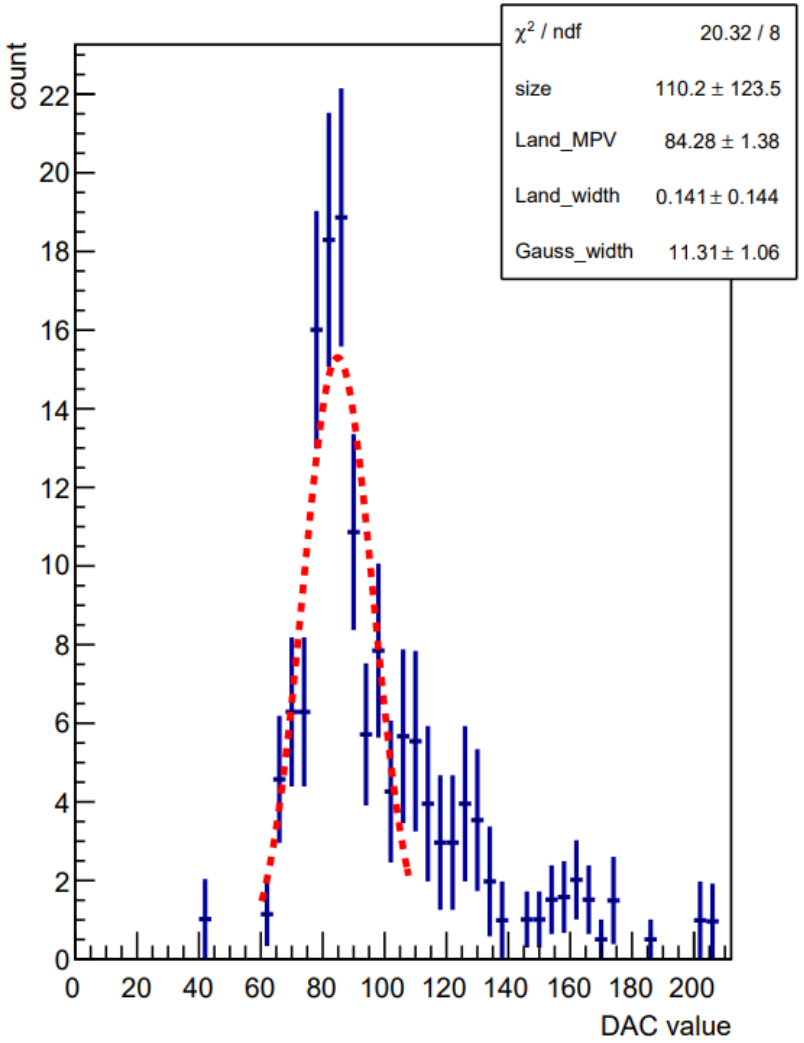
It is normalized by each measured time.

The distribution after normalization.

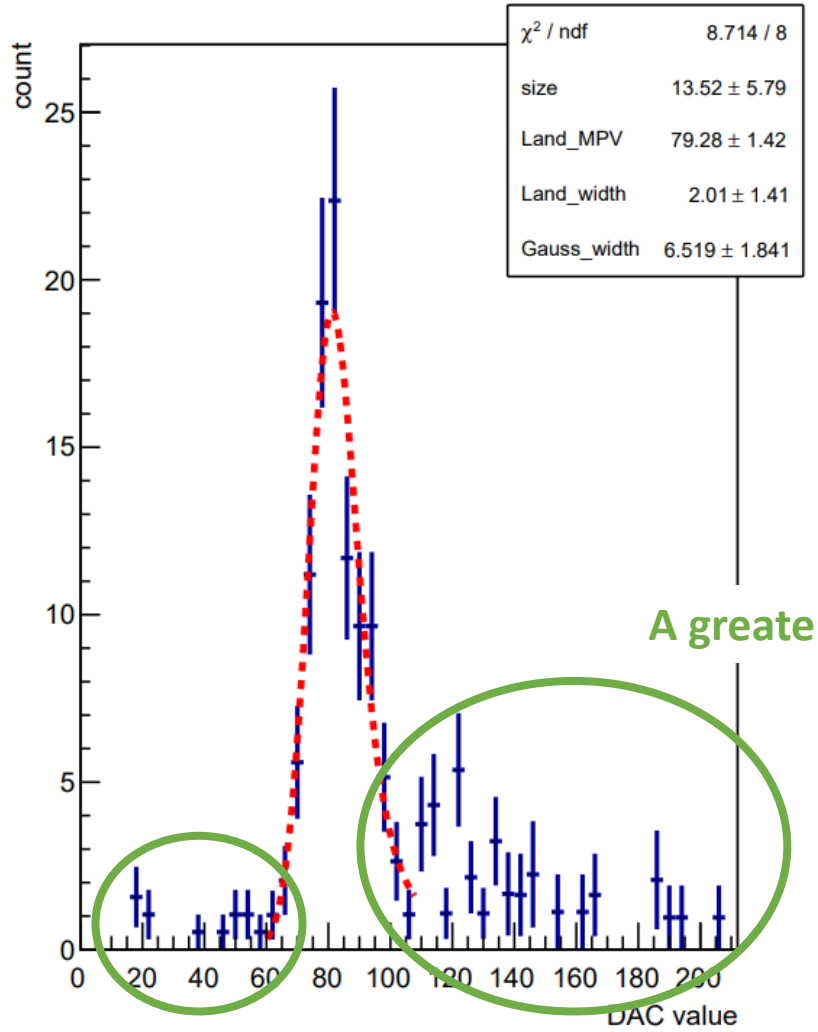


Comparison of MIP peak analysis for BWSel=4 and 8

BWSel=8, Bias100V（L1）Multi hit



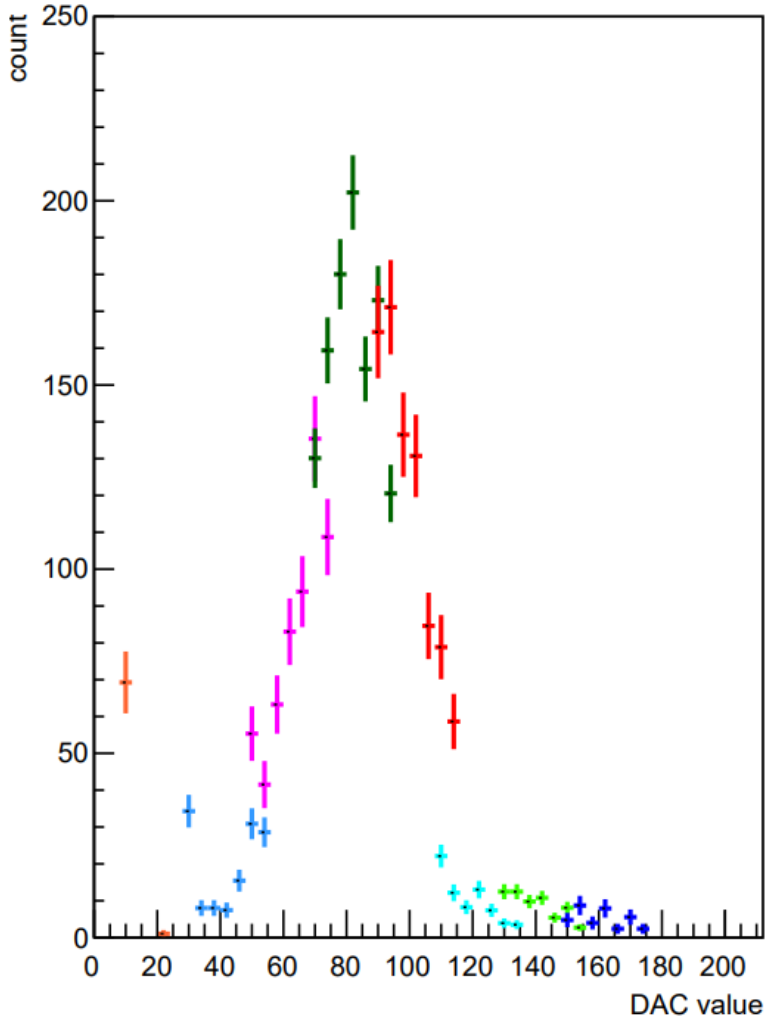
BWSel=4, Bias100V（L1）Multi hit

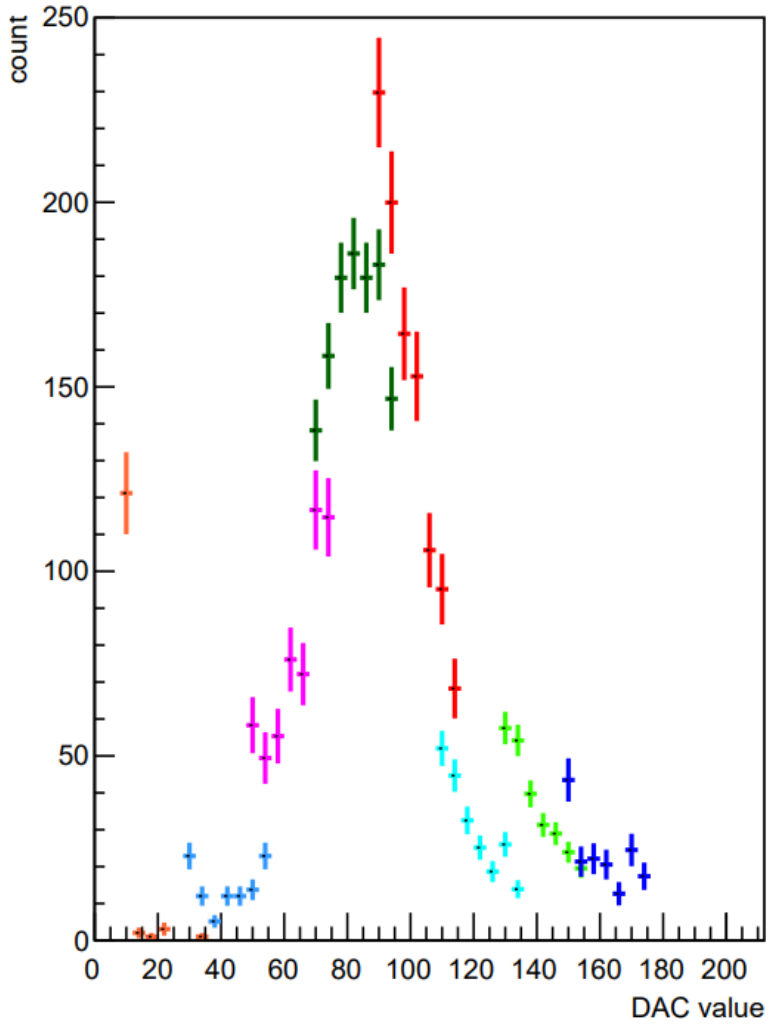


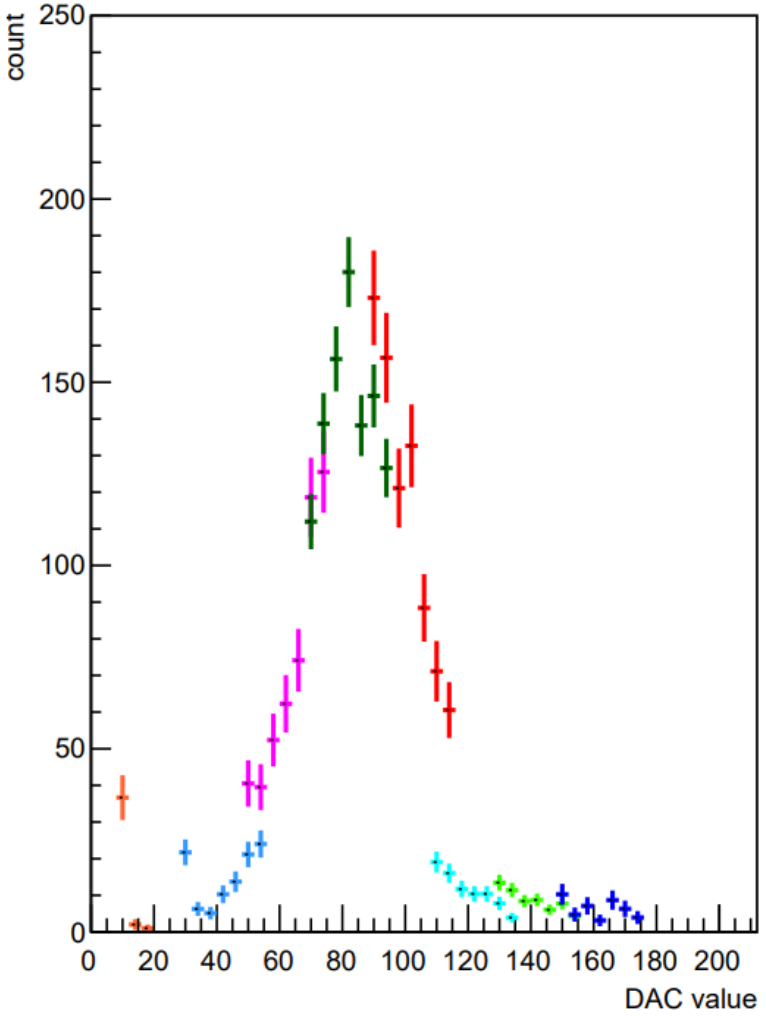
A greater variation in entries.

The behavior of the tail of the distribution is different for BWSel=4 and 8.

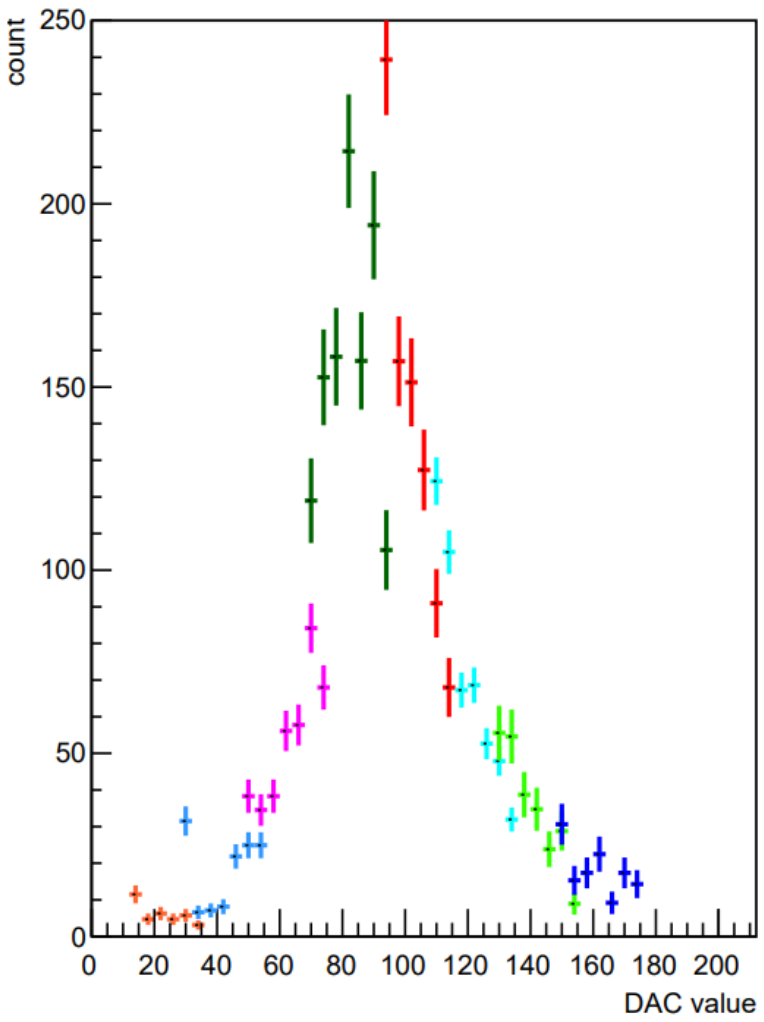
NWU Single hit（Bias75V,100V,100V）, BWSel=8

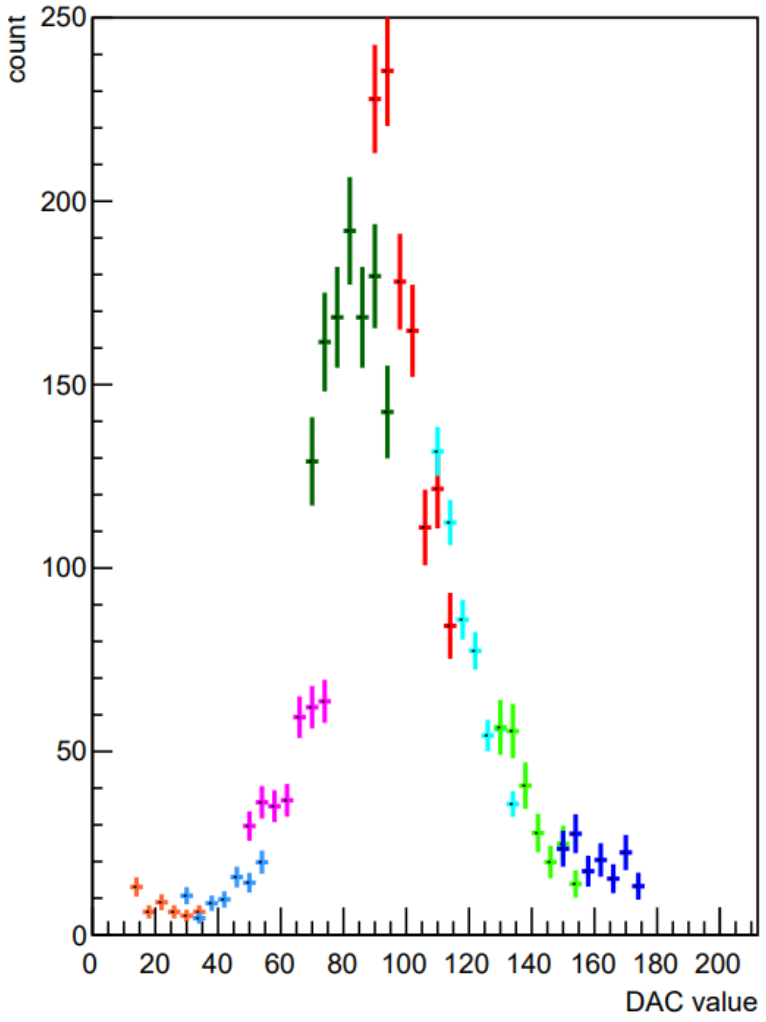


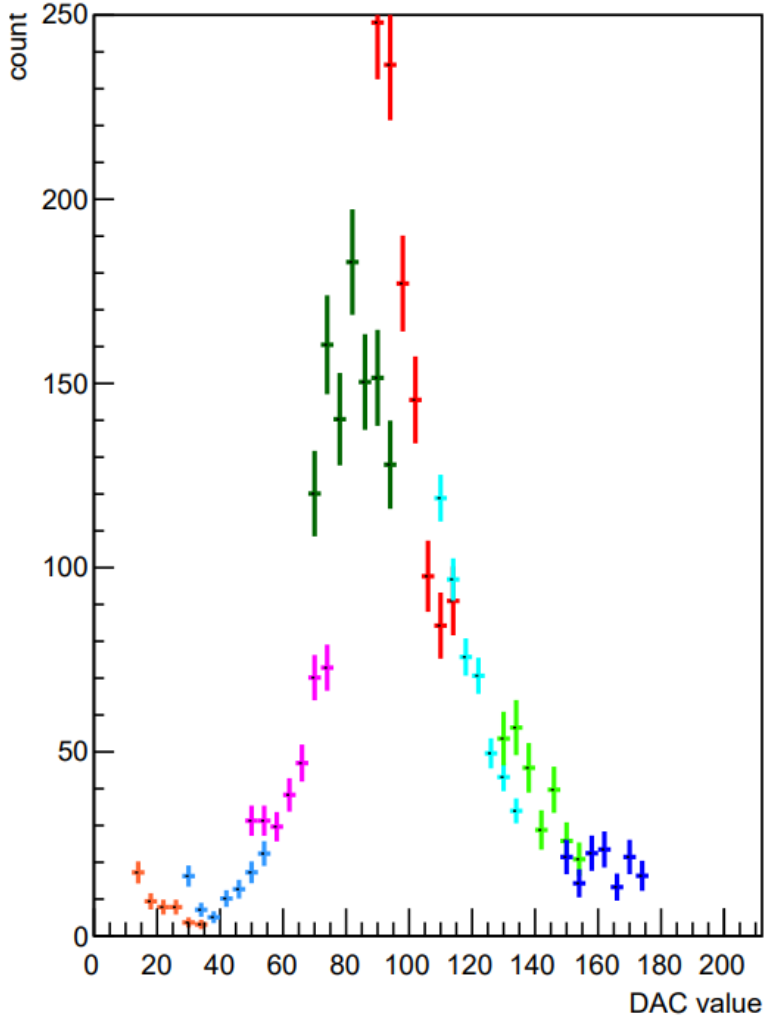




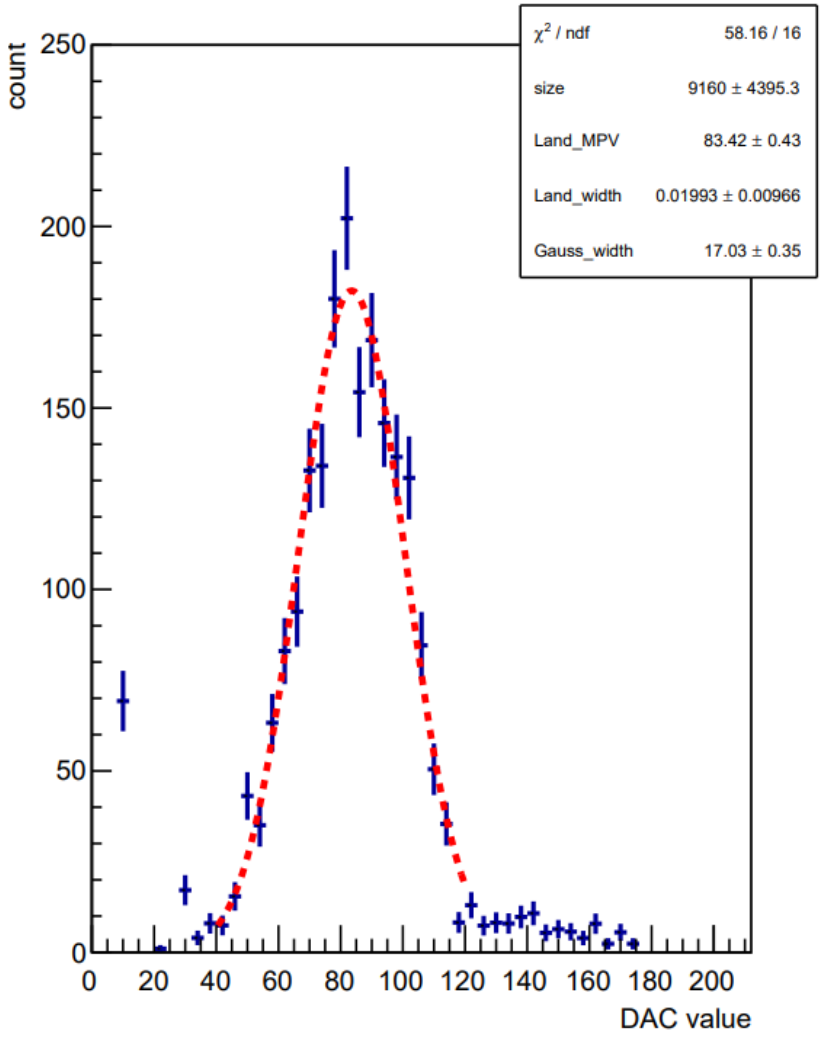
NWU Single hit（Bias75V,100V,100V）, BWSel=4

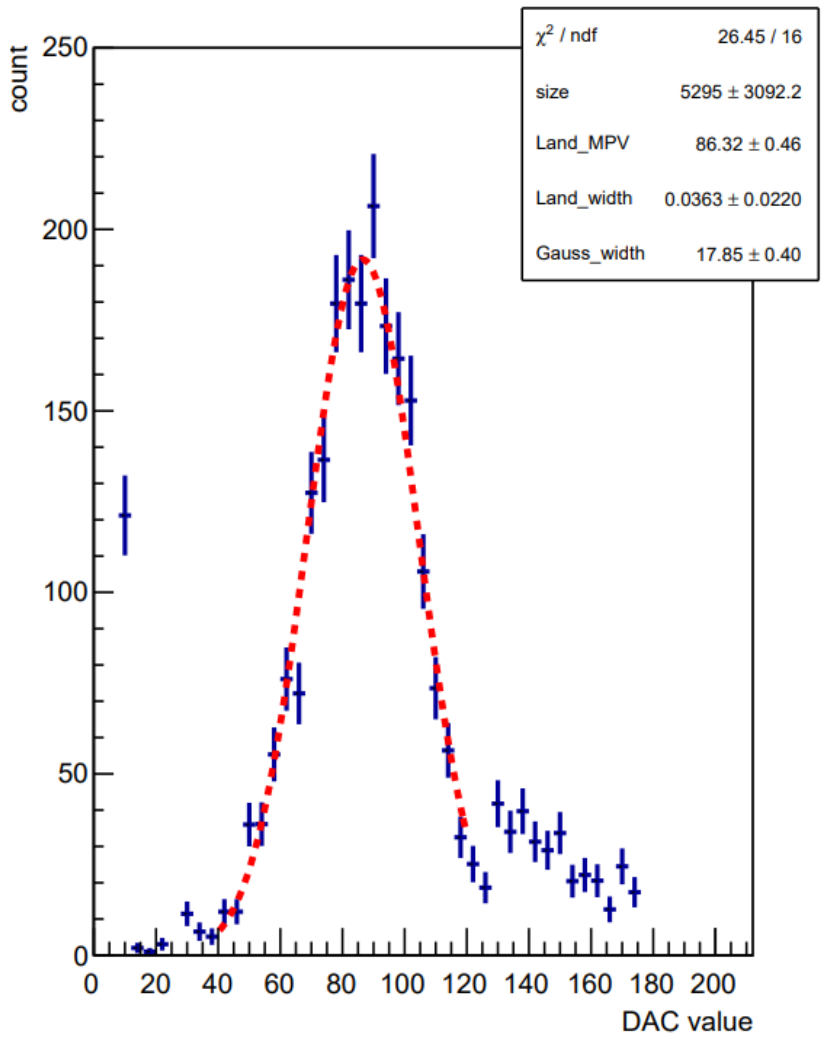


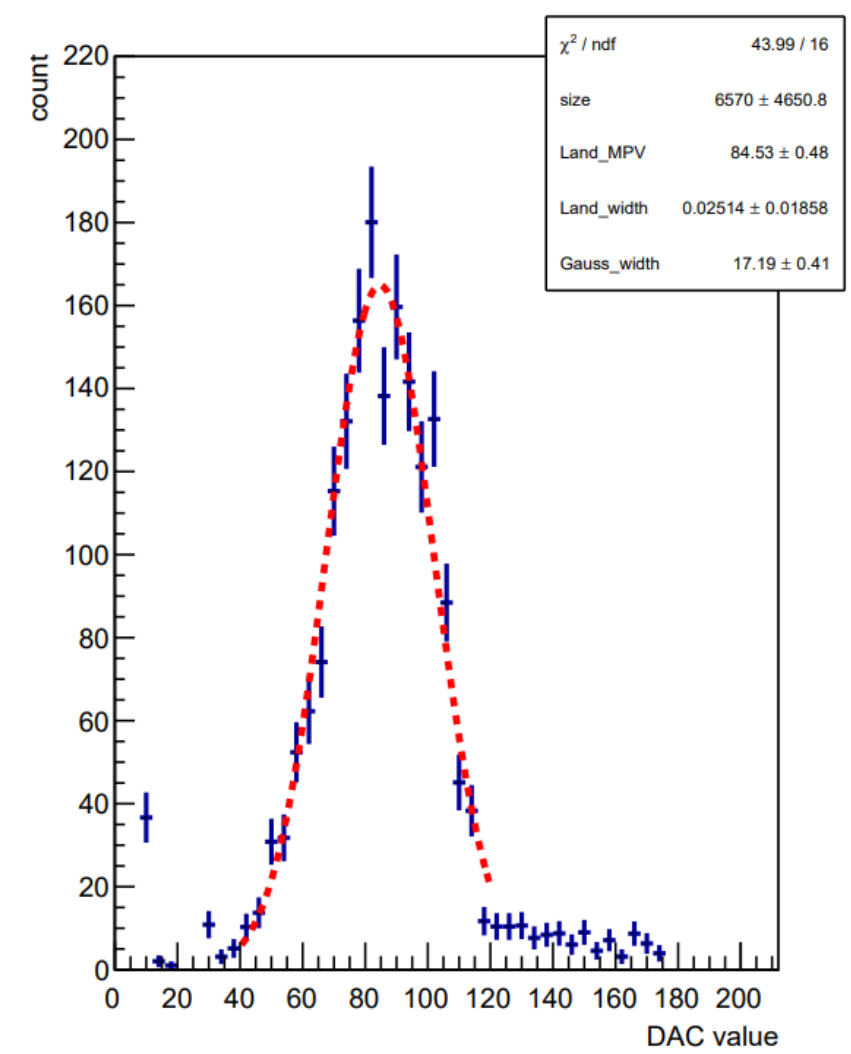




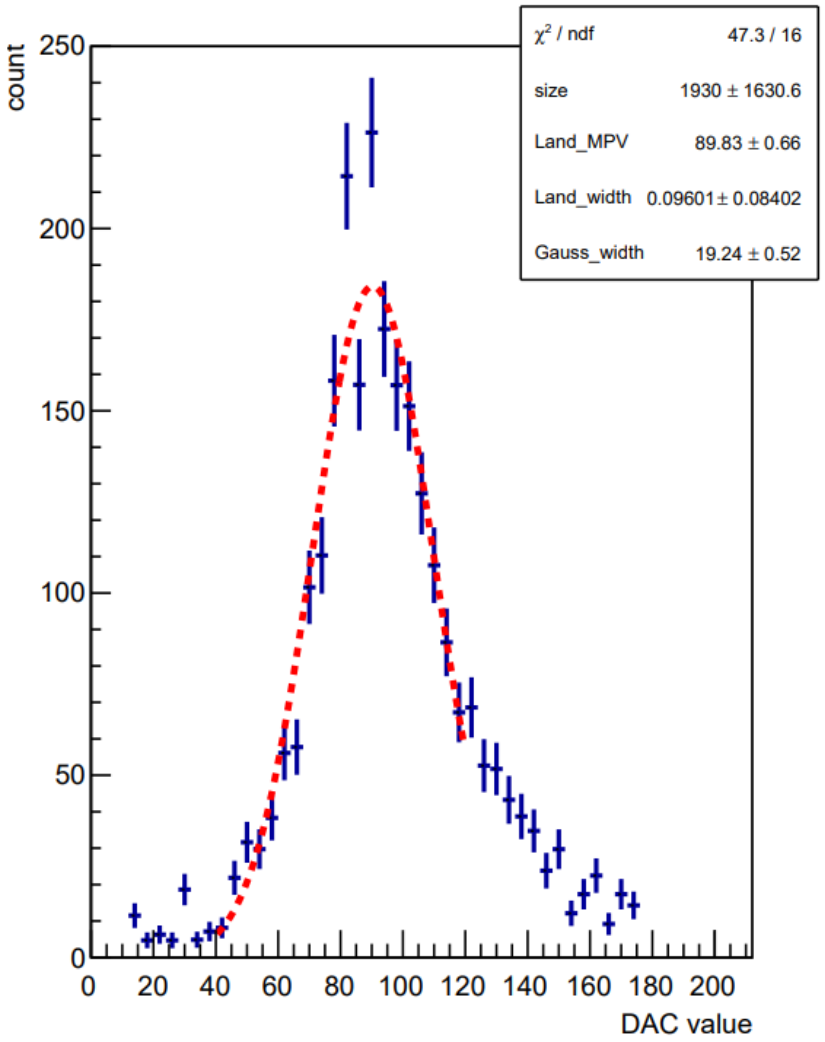
NWU Single hit（Bias75V,100V,100V）, BWSel=8

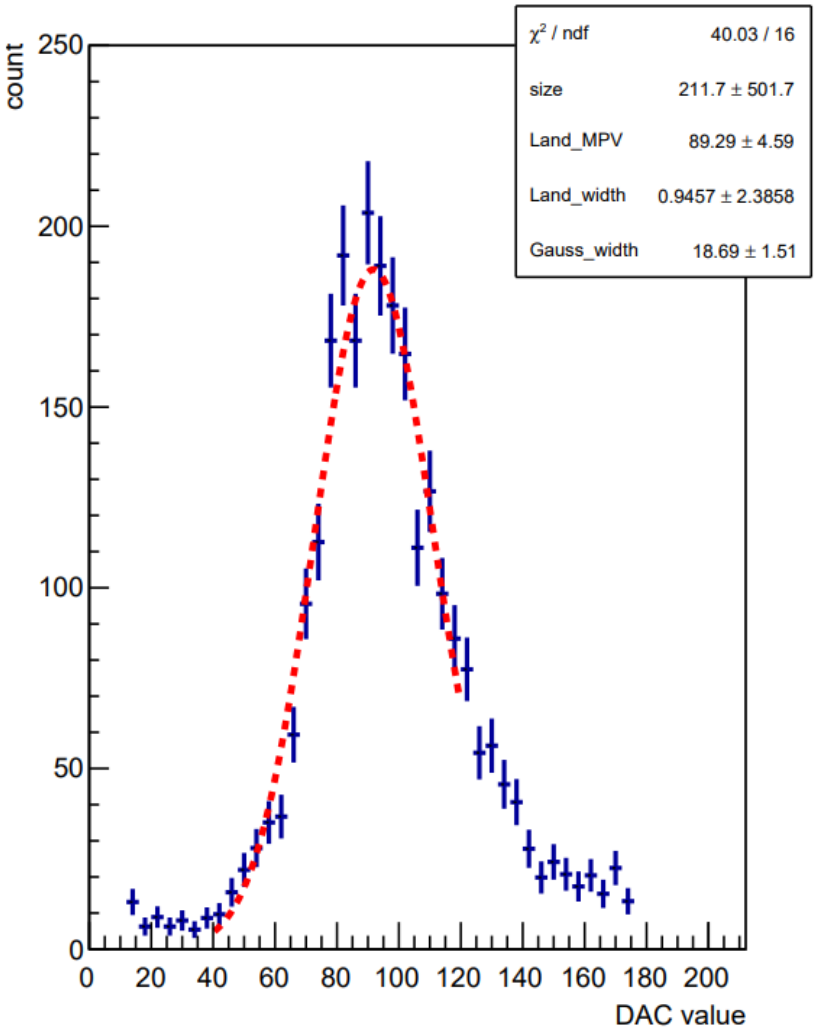


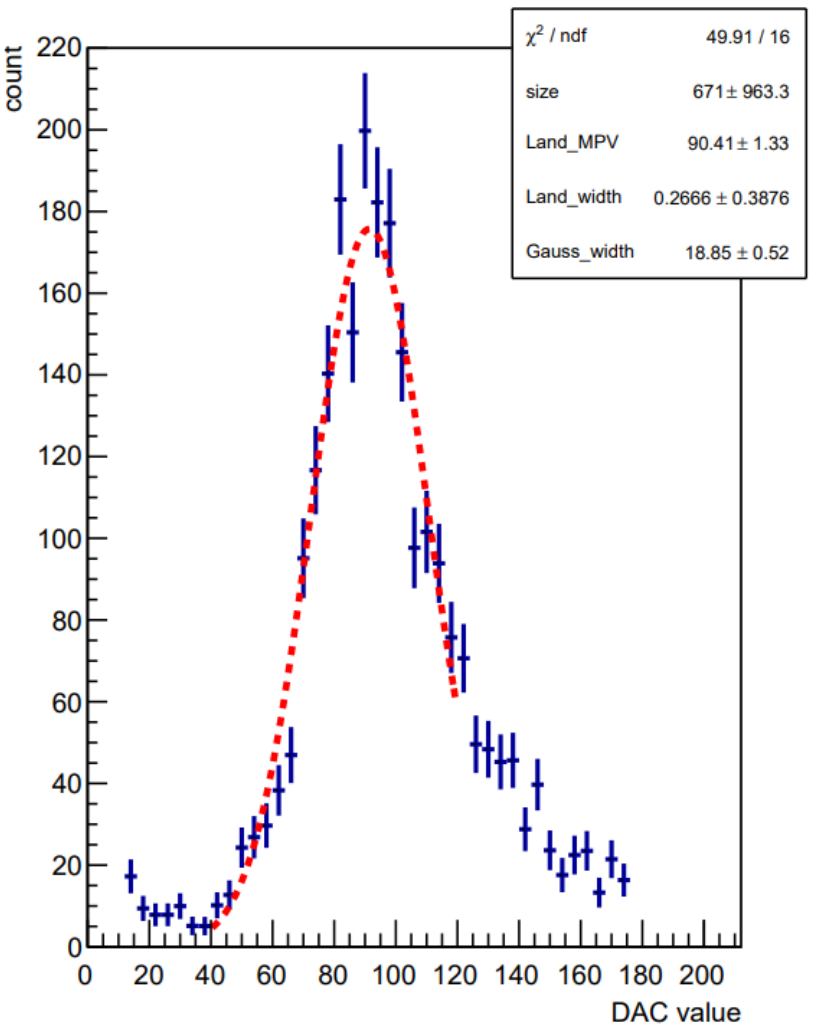




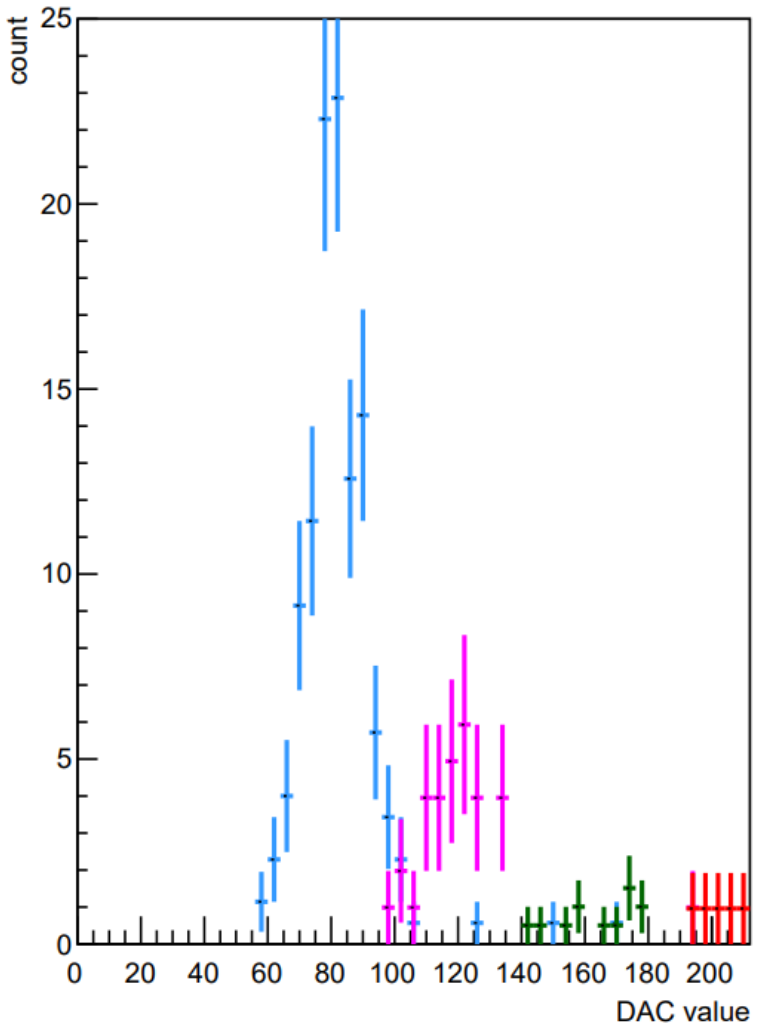
NWU Single hit（Bias75V,100V,100V）, BWSel=4

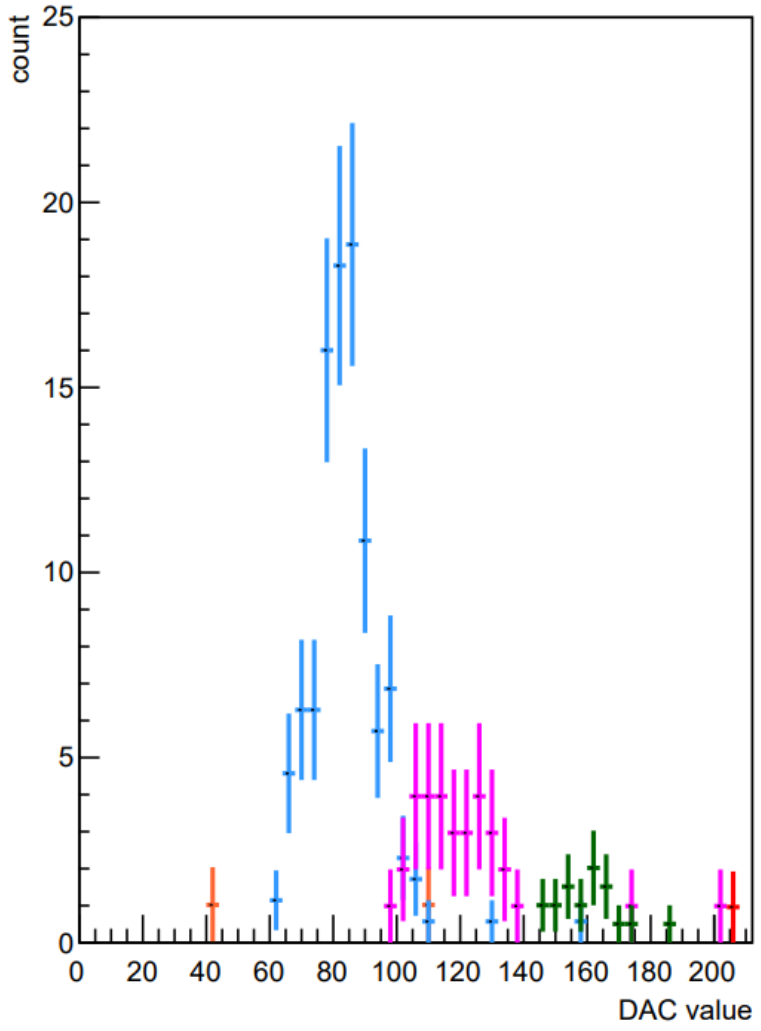


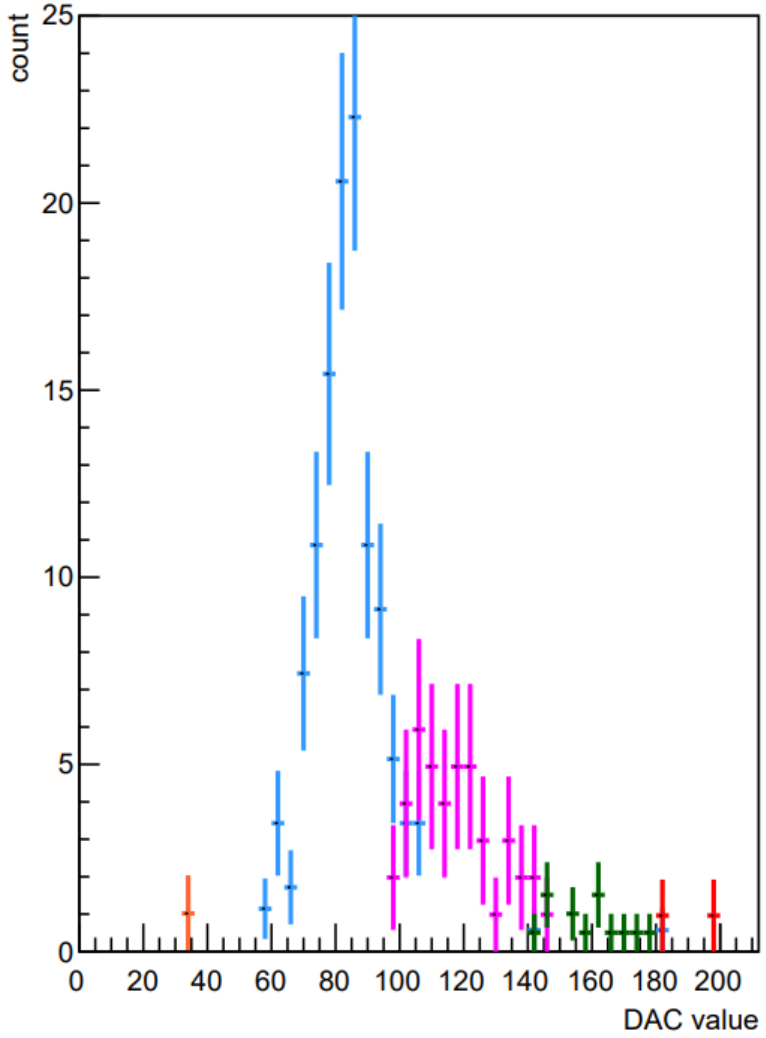




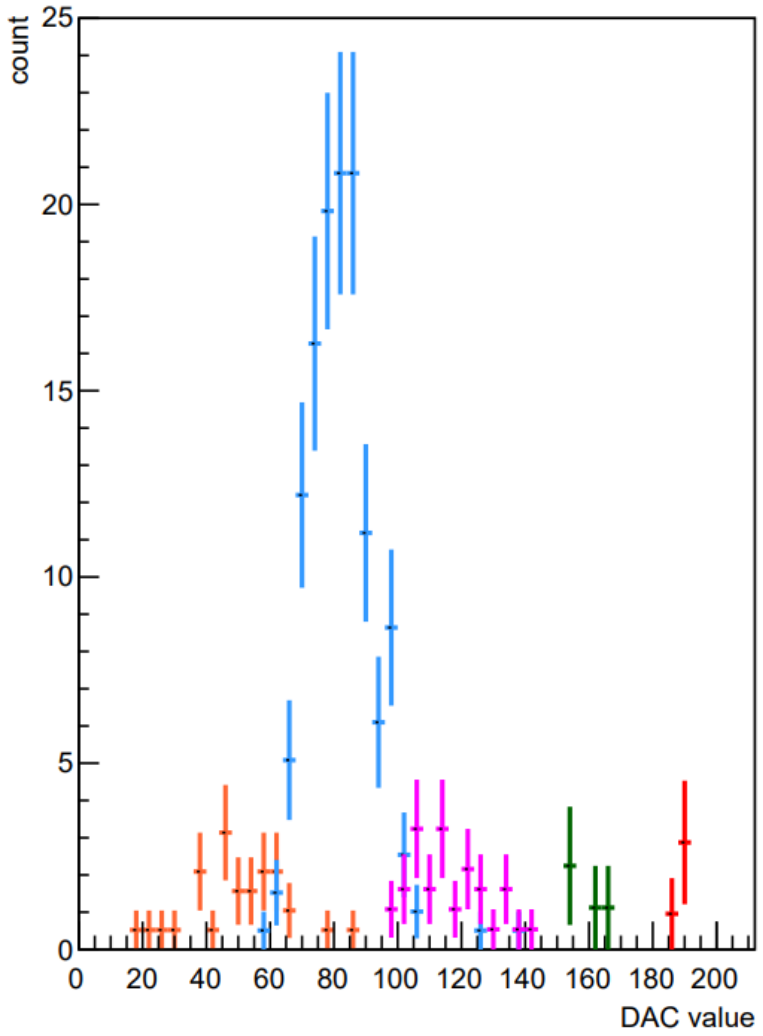
NWU Multi hit（Bias75V,100V,100V）, BWSel=8

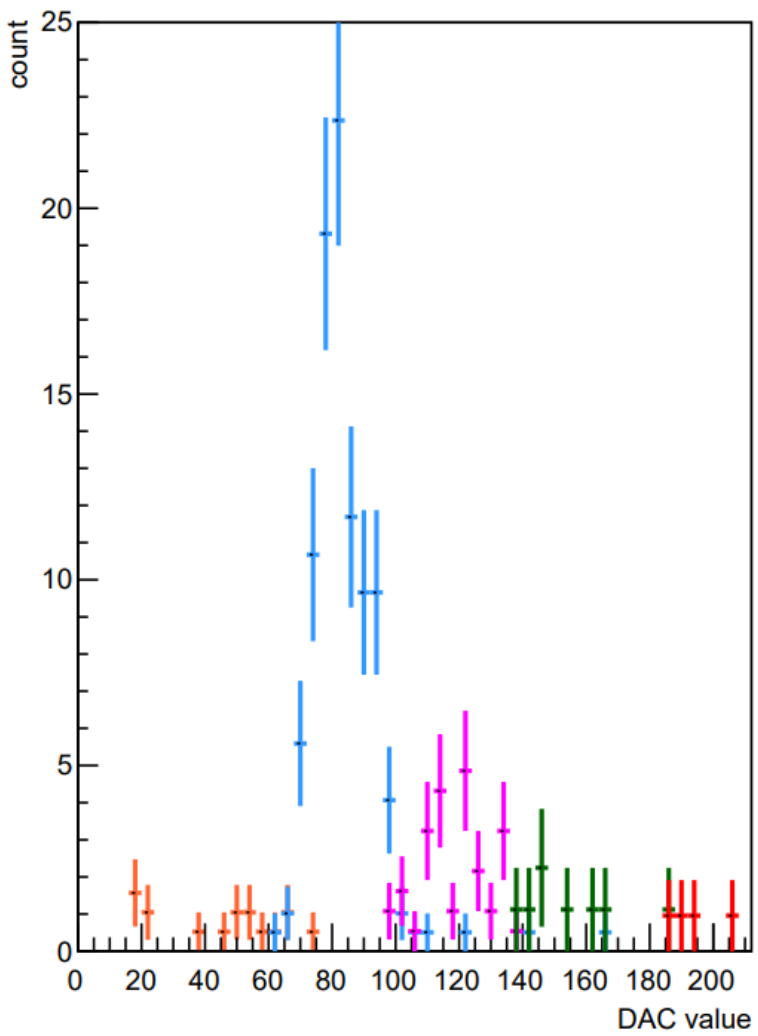


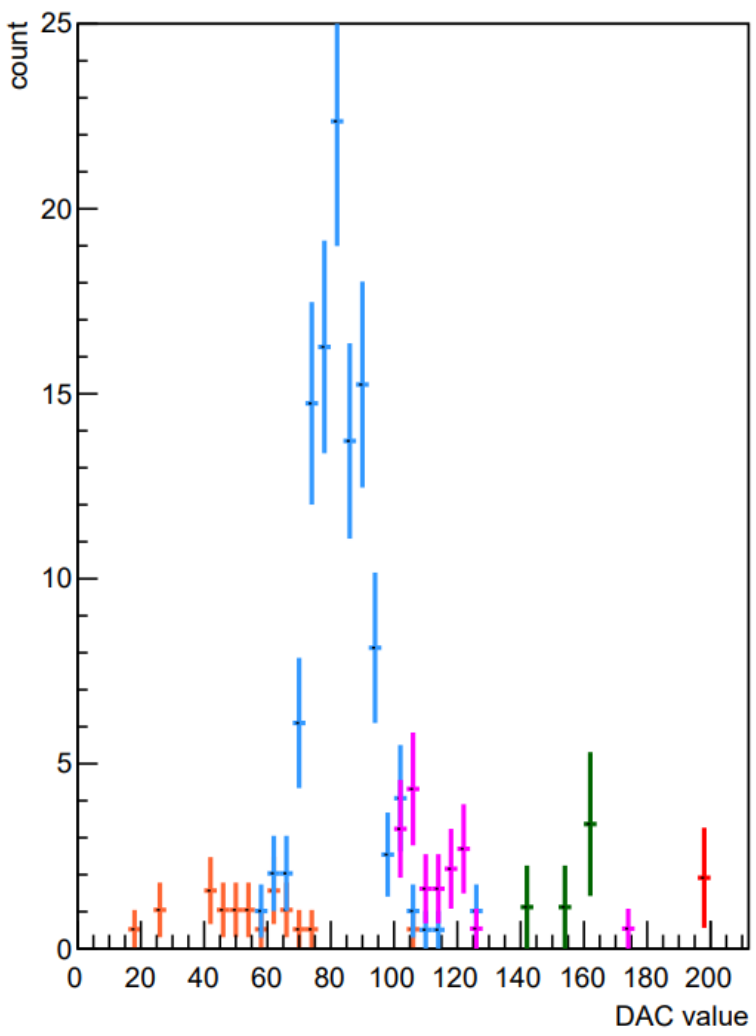




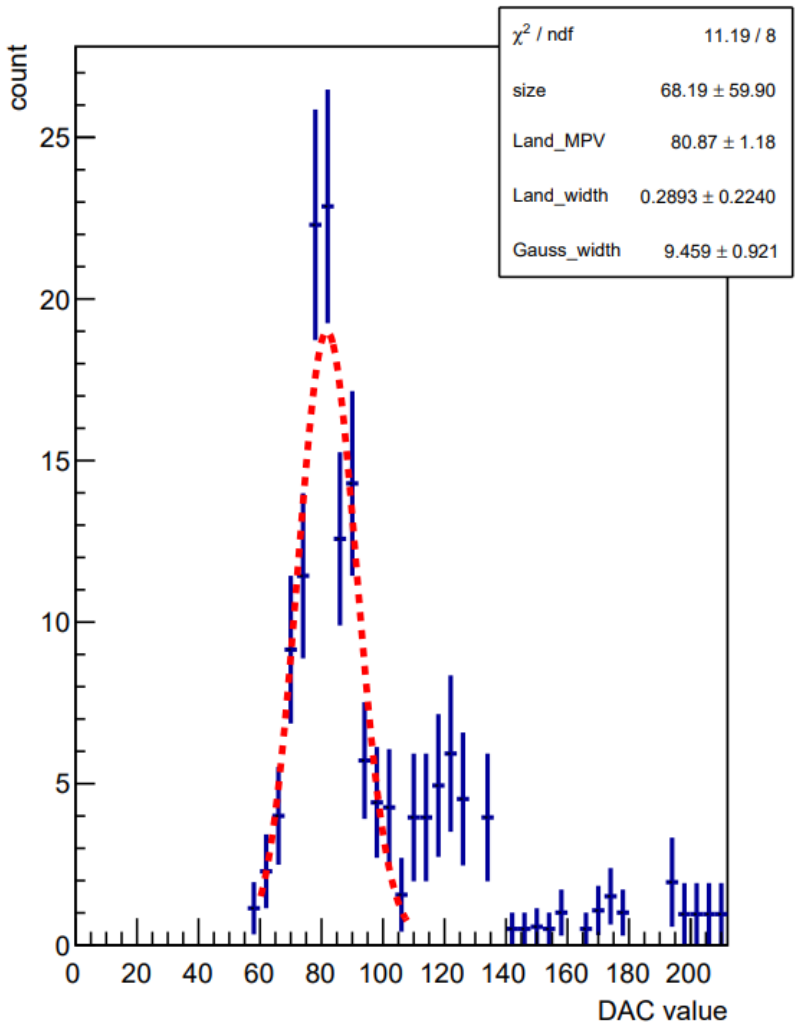
NWU Multi hit（Bias75V,100V,100V）, BWSel=4

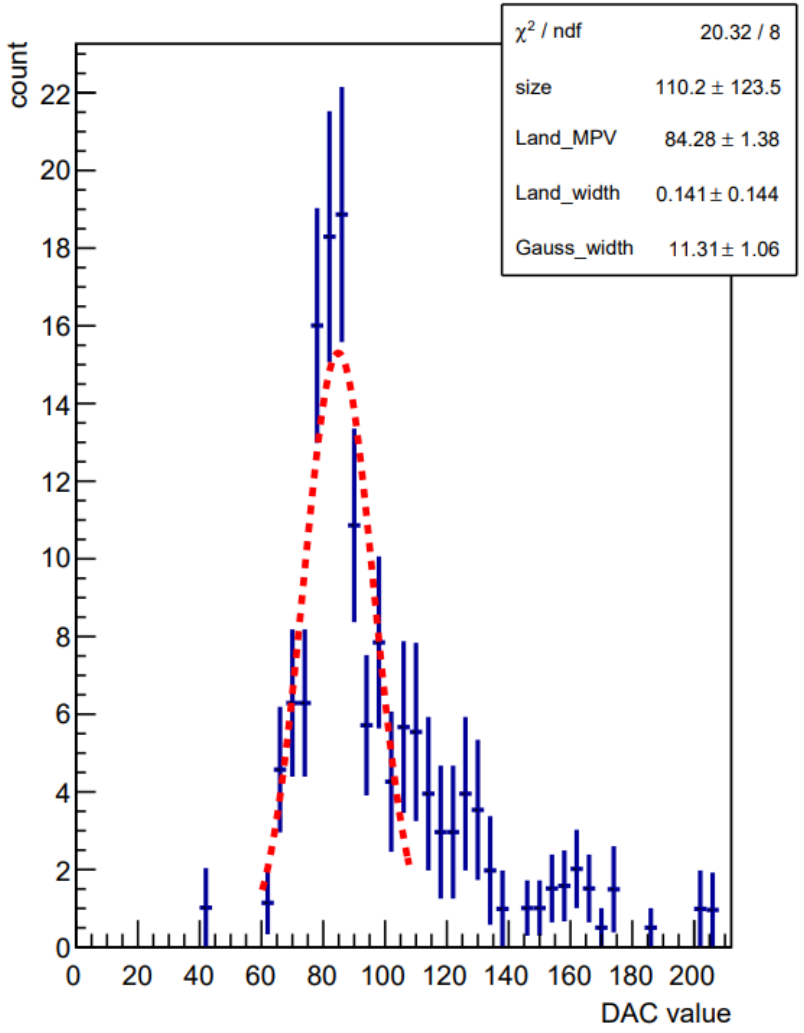


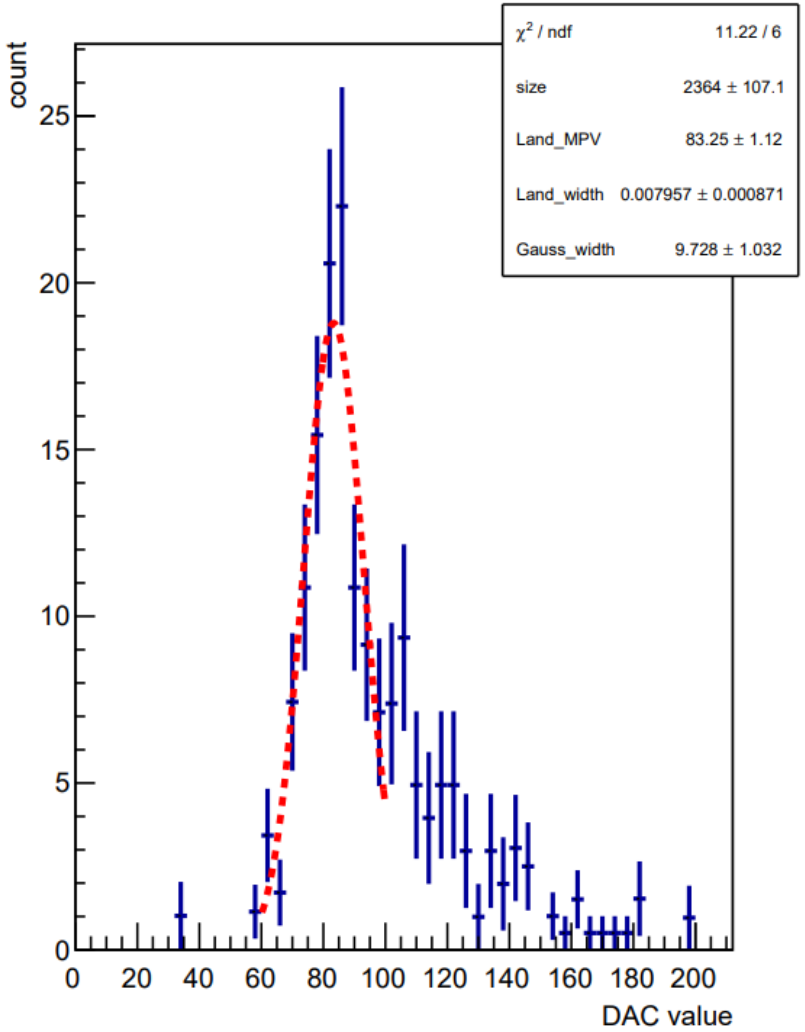




NWU Multi hit（Bias75V,100V,100V）, BWSel=8







NWU Multi hit（Bias75V,100V,100V）, BWSel=4