MIP peak position

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Analysis Plan during INTT workshop

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Institution : NWU

- Analysis topic (Write your topic)

  Chronological study of the MIP peak position using pp data
- Current knowledge (What you know)

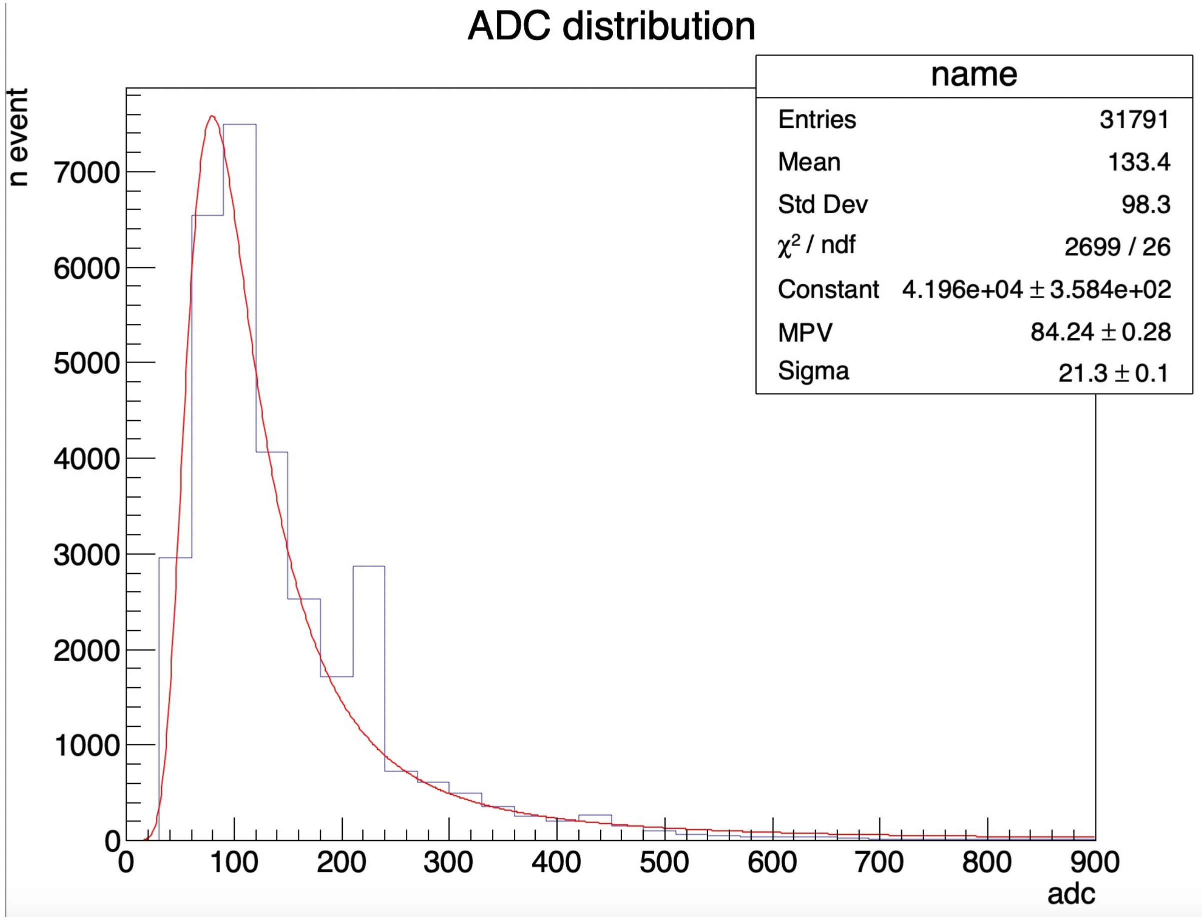
  Radiation damage increases the bias voltage of Si sensors. As radiation damage larger, the position of the MIP peak should be lower due to changes in sensor performance.
- status of this topic (What you have)
- I reproduced Genki's analysis and I found the MIP peak by applying a cut of the tracking θ to the ADC distribution. Then I fitted it with using Landau function.
- Goal for the workshop (Your goal; Please write down with priority

  1. Updating the fitting method by using a convolution function of Landau and Gaussian
- 2. Determination of z_vtx with better precision
- Milestonzes to reach to your goal

  (Write down what you need to learn/study for reaching to your goal)

  1. Learn more about the fitting process and implement the new method
- 2. Learn about z vertex analysis and collaborating with Mahiro for the implementation

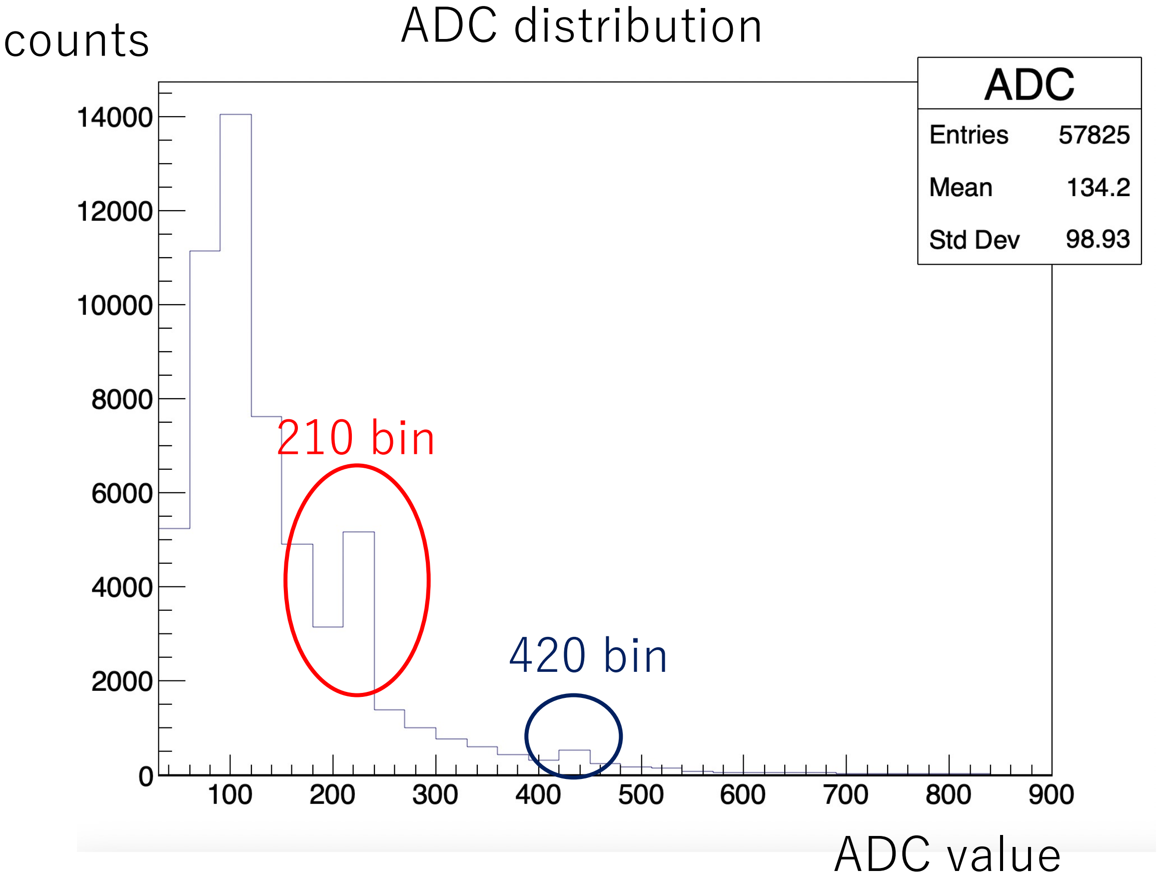
Fitting with Landau function (last week presentation version)



The plot on the left is the MIP peak by applying a cut of the tracking θ to the ADC distribution.

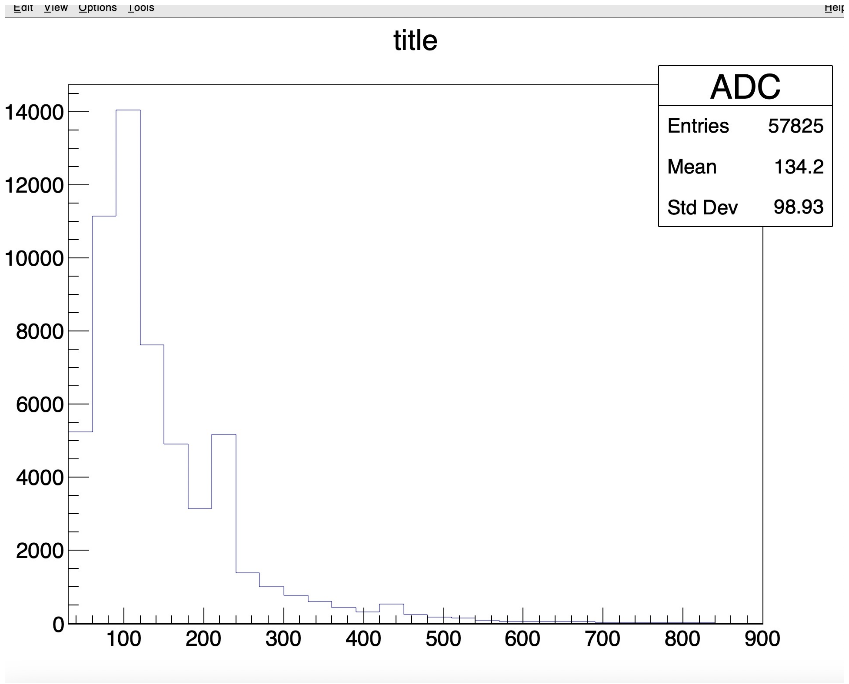
I fitted with Landau functions, but because of the noise of sensors, I would like to use Gaussian and Landau collaboration functions and Updating the fitting .

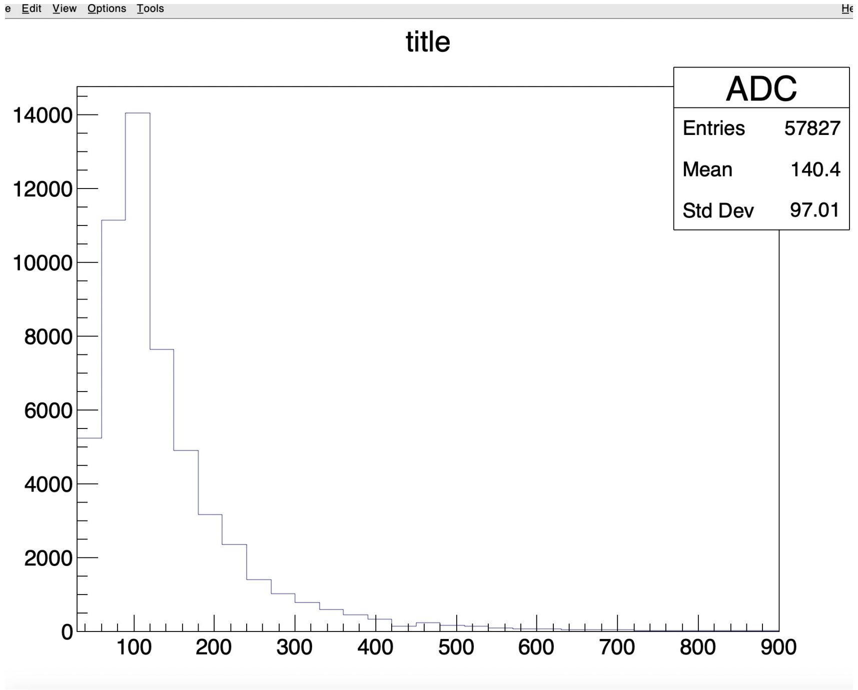
About second peak and third peak



- After clustering, all single clusters with a DAC value of 210 or higher are counted in ADC7. It causes overflow.
- Same thing happen in double-hit clusters.
- If single-hit clusters with DAC 210 are not removed, a peak appears at DAC 210 and $210 \times 2 = 420$.
- Though their contribution is too high, removing all of them is overkilling.

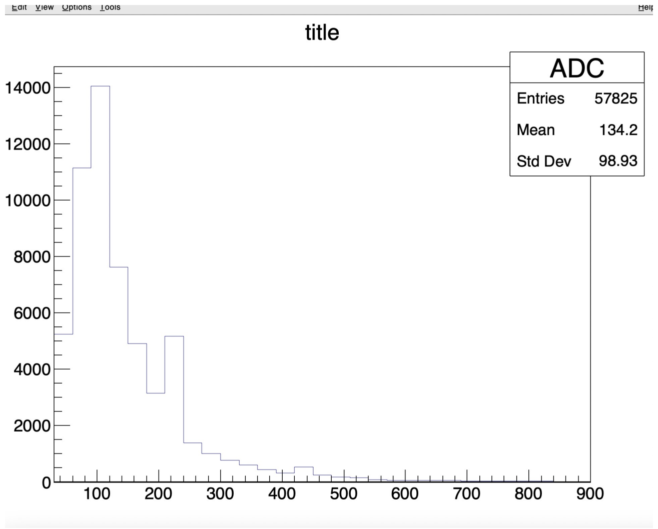
Delete second peak and third peak

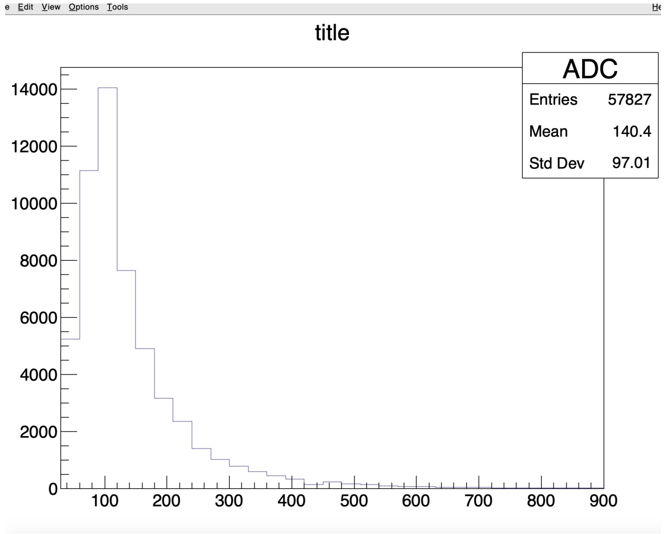




- 210 bin: (The number of single hit clusters) × 1/3 + (Multiple hit clusters)
- 420 bin: (The number of double hit clusters) × 1/9 + (Multiple hit clusters)

Delete second peak and third peak

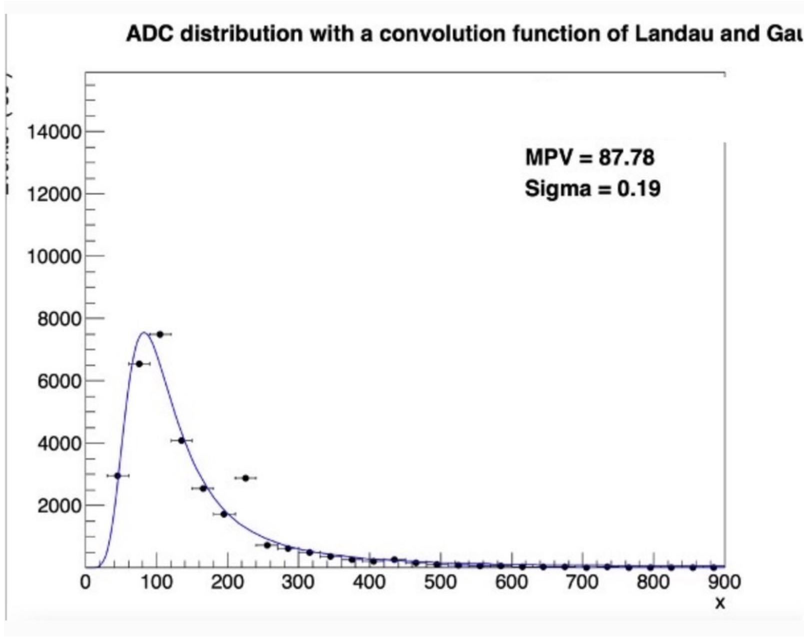


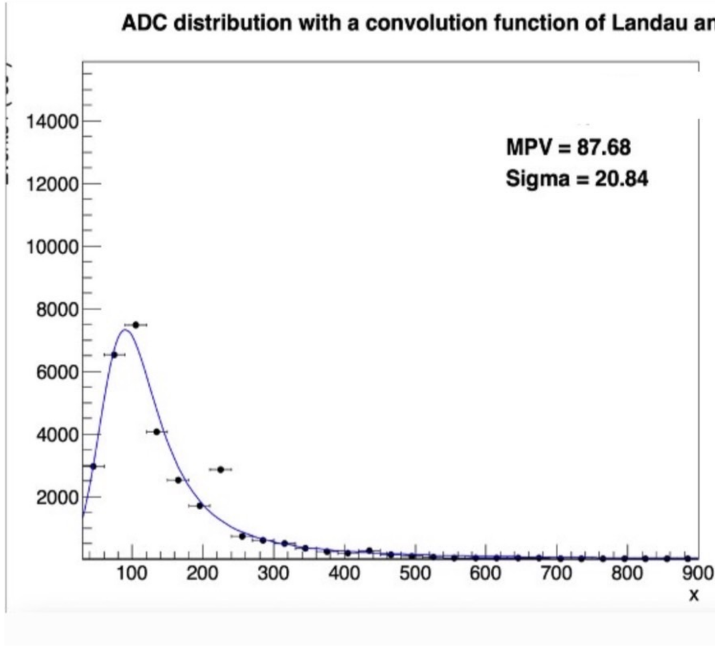


- 210 bin: (The number of single hit clusters) × 1/3 + (Multiple hit clusters)
- 420 bin: (The number of double hit clusters) × 1/9 + (Multiple hit clusters)

As said in the previous slide, the 210 bin contains single cluster 210 or higher values, plus multiple hit clusters.
Based on the Genki's analysis, I reduced the single clusters by 1/3, in order to remove the overflowing values. For the double hit clusters (third peak), I did same thing by 1/9
I changed the correction from Genki's analysis, so I still need to recalculate this value.

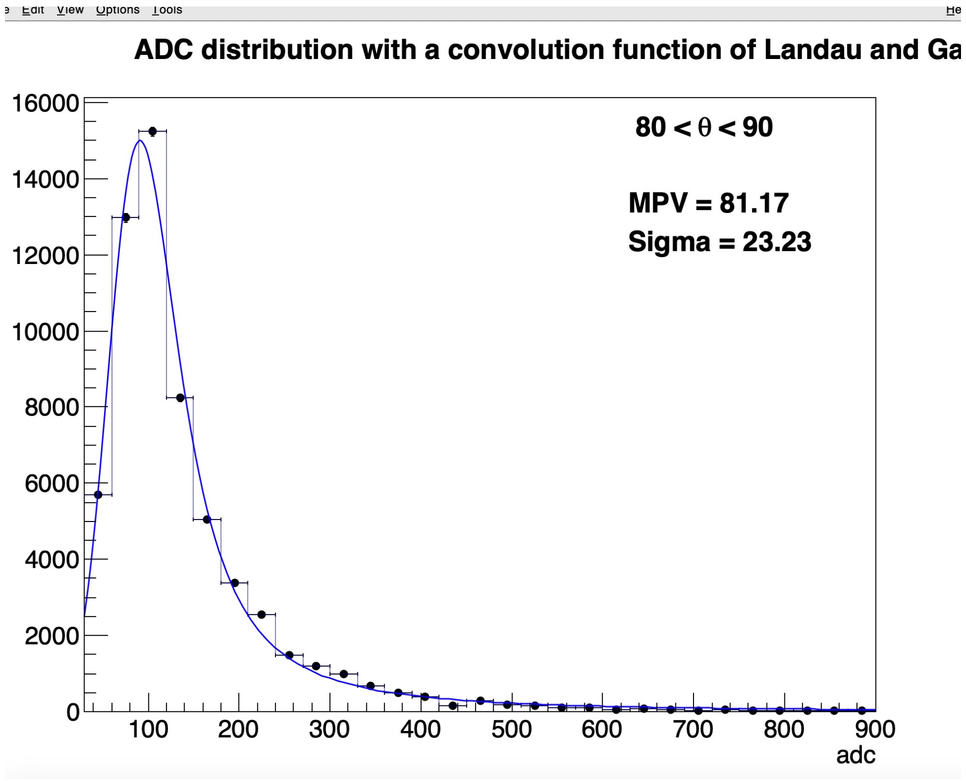
Cut update





- Changed the fitting range to not include (0.0), and adjusted the fitting
- Although the distribution includes zero points when graphed, in reality the distribution does not include zero points because silicon sensors have noise.
- so that the point (0.0) is not included in the fitting
- By including (0.0) in the fit, the line was pulled to 0, but now the line is smooth

Update fitting (with a convolution function of Landau and Gaussian)



Though I could not determine yet how much of an effect the noise has, I added new fitting method by using a convolution function of Landau and Gaussian

Summary and to do list(plan)

- delete 210 bin peak and 420 bin peak
- Change fitting method(including noise): I will examine more detail about the effects of noise
- z_vtx update: not yet

- Many Thanks to Genki, Takashi, Maya, Koyuki

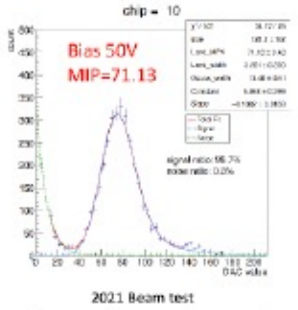
BACK UP

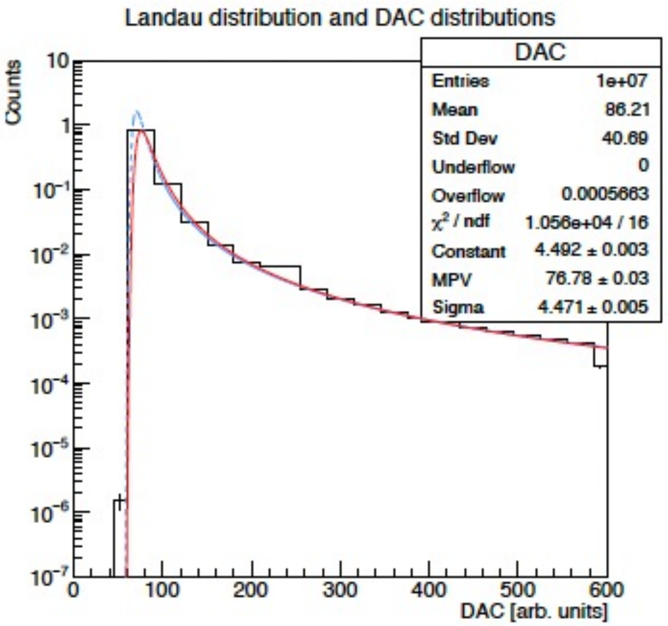
The modification factor for hits with ADC7

Parameters of landau distribution were taken from Yuka’s study of DAC scan in the test beam experiment:

- MPV: 71.13
- width: 3.251

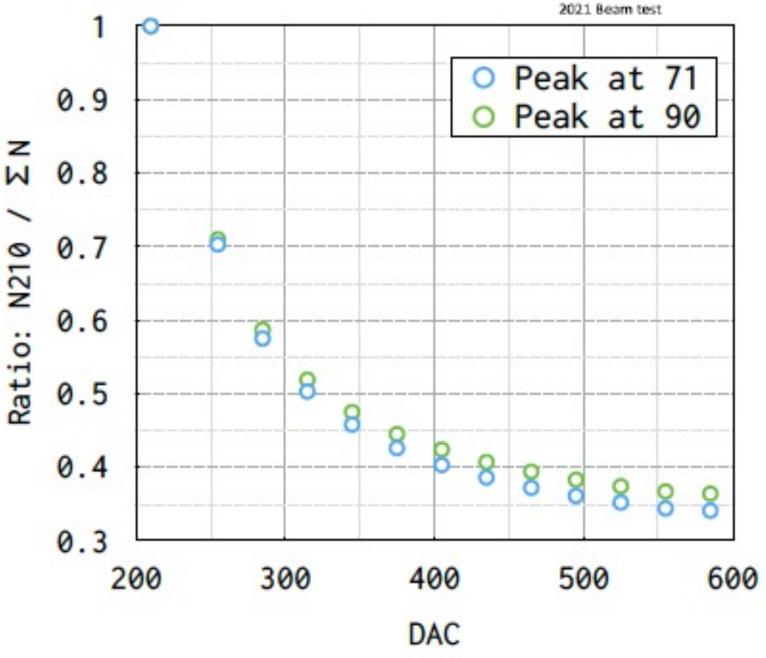
Note: The peak position is expected to at DAC 90





$$\frac{N(\mathrm{DAC}=210)}{\sum_{\mathrm{DAC}=210}^{\mathrm{DAC}'} N}$$

ADC	DAC	Value	Ratio
9	210	0.00651	100%
10	255	0.00276	70.3%
11	285	0.00206	57.5%
12	315	0.00162	50.3%
13	345	0.00127	45.8%
14	375	0.00105	42.6%
15	405	0.000869	40.3%
16	435	0.000726	38.6%
17	465	0.000632	37.2%
18	495	0.00054	36.1%
19	525	0.000472	35.2%
20	555	0.000421	34.4%
21	585	0.000181	34.1%



0.35 is reasonable for the modification factor

Fitting with a convolution function of Landau and Gaussian