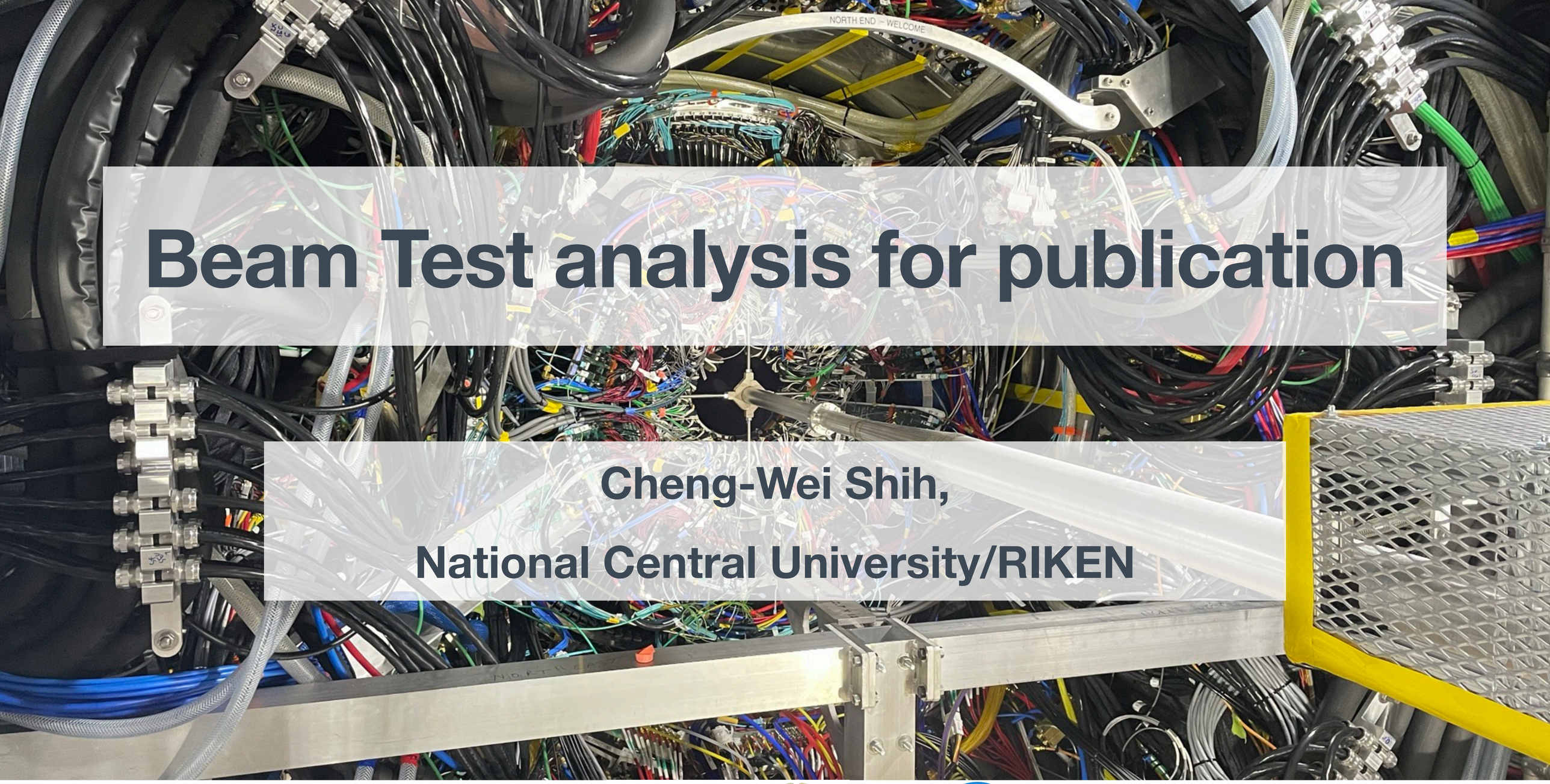

Beam Test analysis for publication

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National Central University/RIKEN

April 25th, 2025
INTT meeting

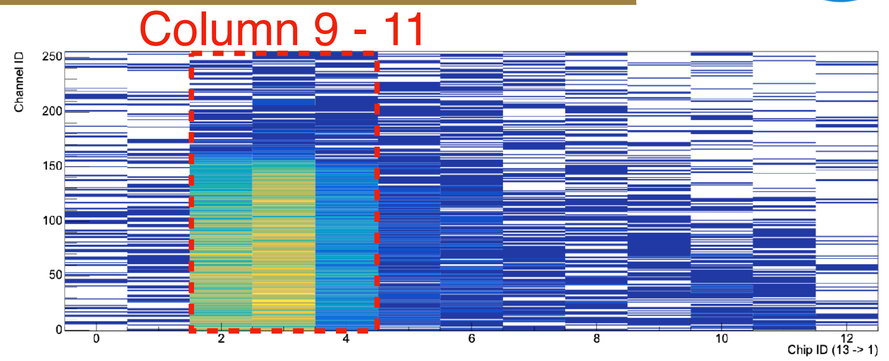
sPHENIX INTT sPHENIX 國立中央大學 National Central University RIKEN

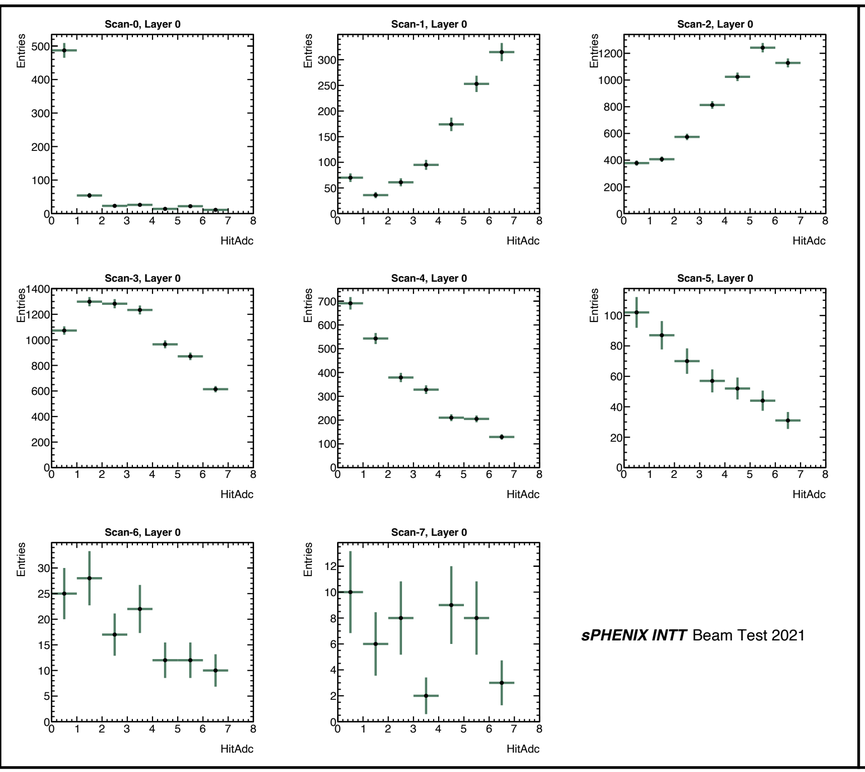
Overview

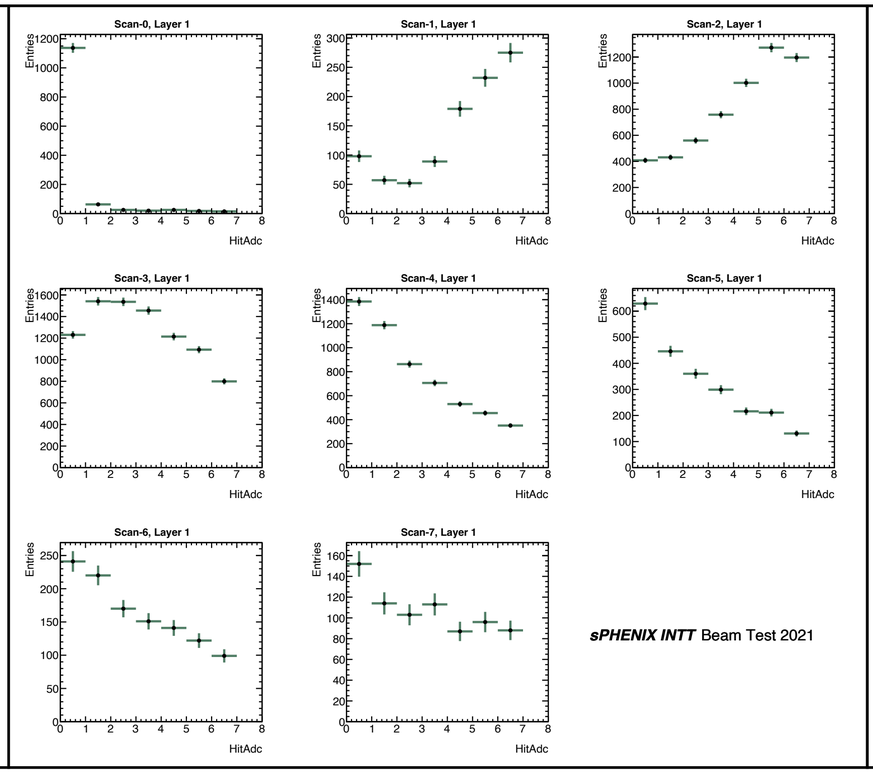
- Energy deposit distribution (DAC Scan)
  - Done
- Scattering relevant distribution compared with MC
  - Probably tonight
- Hit detection efficiency
  - Next Week
  - Would like to combine two runs
  - Would like to re-estimate the syst. uncertainty
- Number of reconstructed tracks compared with MC
  - The run with lead plate in between beam and trigger scintillator
- Analysis note
  - Progressing

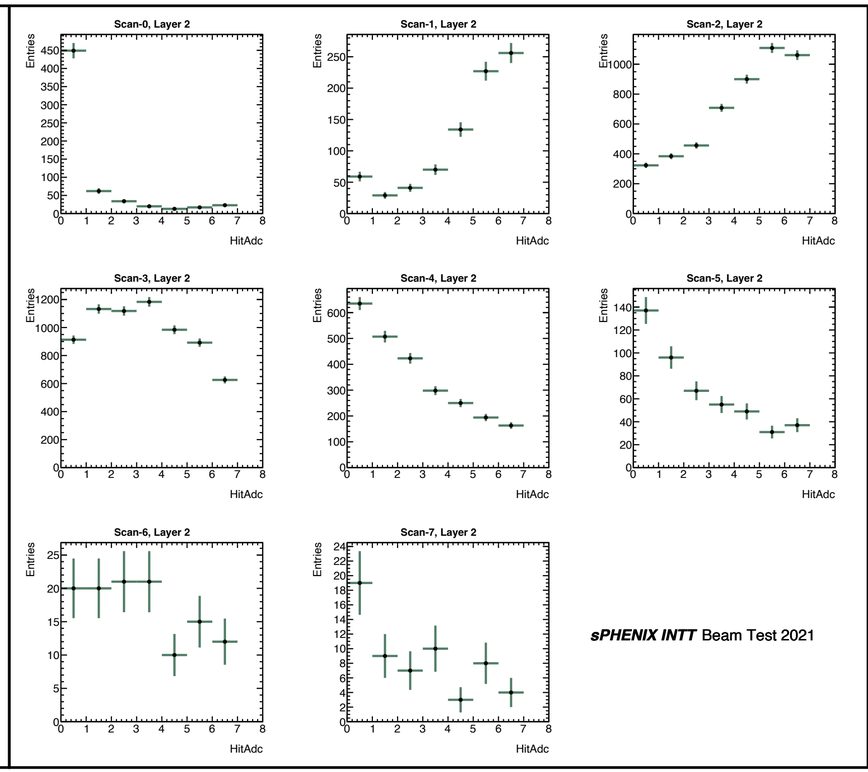
DAC Scan - the matrices

- Run 71 - 78 (Total coverage: 8 to 176 with the span of 4 adc)
- Requiring single cluster or no cluster in each layer (inclusive to location, and cluster size)
- Clone-hit events removed
- Columns within beam spot selected (Column9, 10, 11)
- Single-hit clusters selected
- Overflow bin (bin 8th) removed in each scan





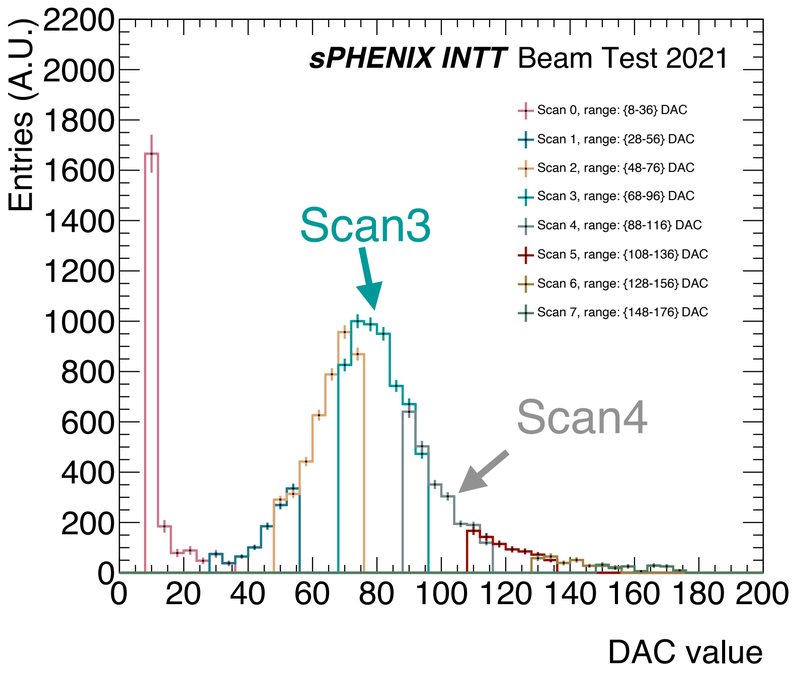




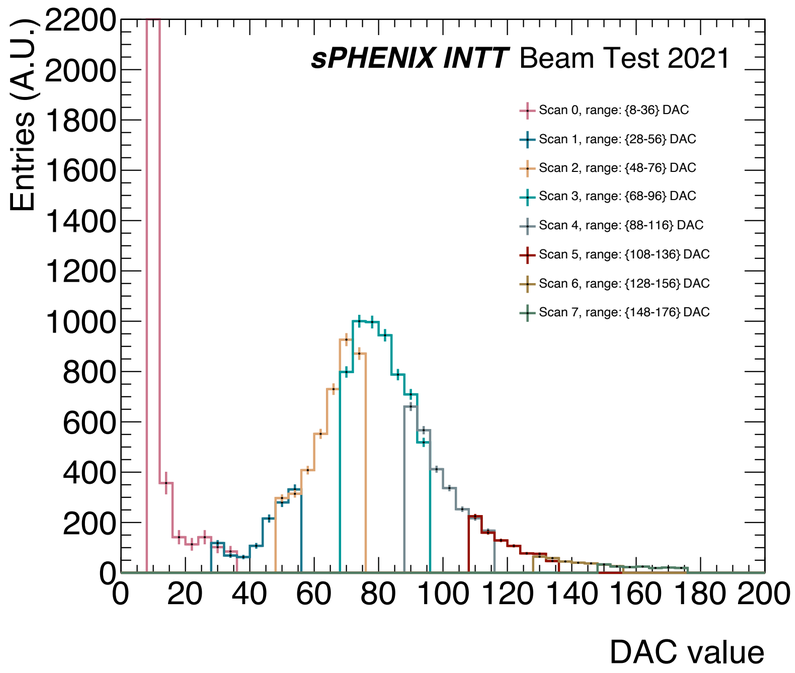
L0 L1 L2

DAC Scan - matching b/w scans

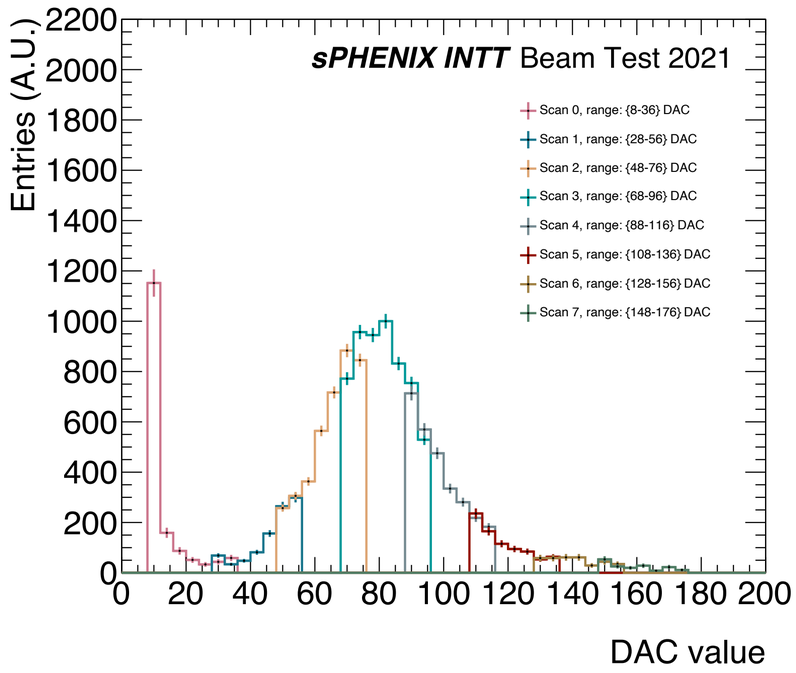
- In each scan, two bins overlapped with its following scan, which are used for matching
- Scan3 as reference, introducing scales to the adjacent scans to match the distributions, sequentially
- Example: scale applied on scan4 = $(Size_{bin_6}^{scan3} + Size_{bin_7}^{scan3})/(Size_{bin_0}^{scan4} + Size_{bin_1}^{scan4})$
- (Same method used previously)



L0



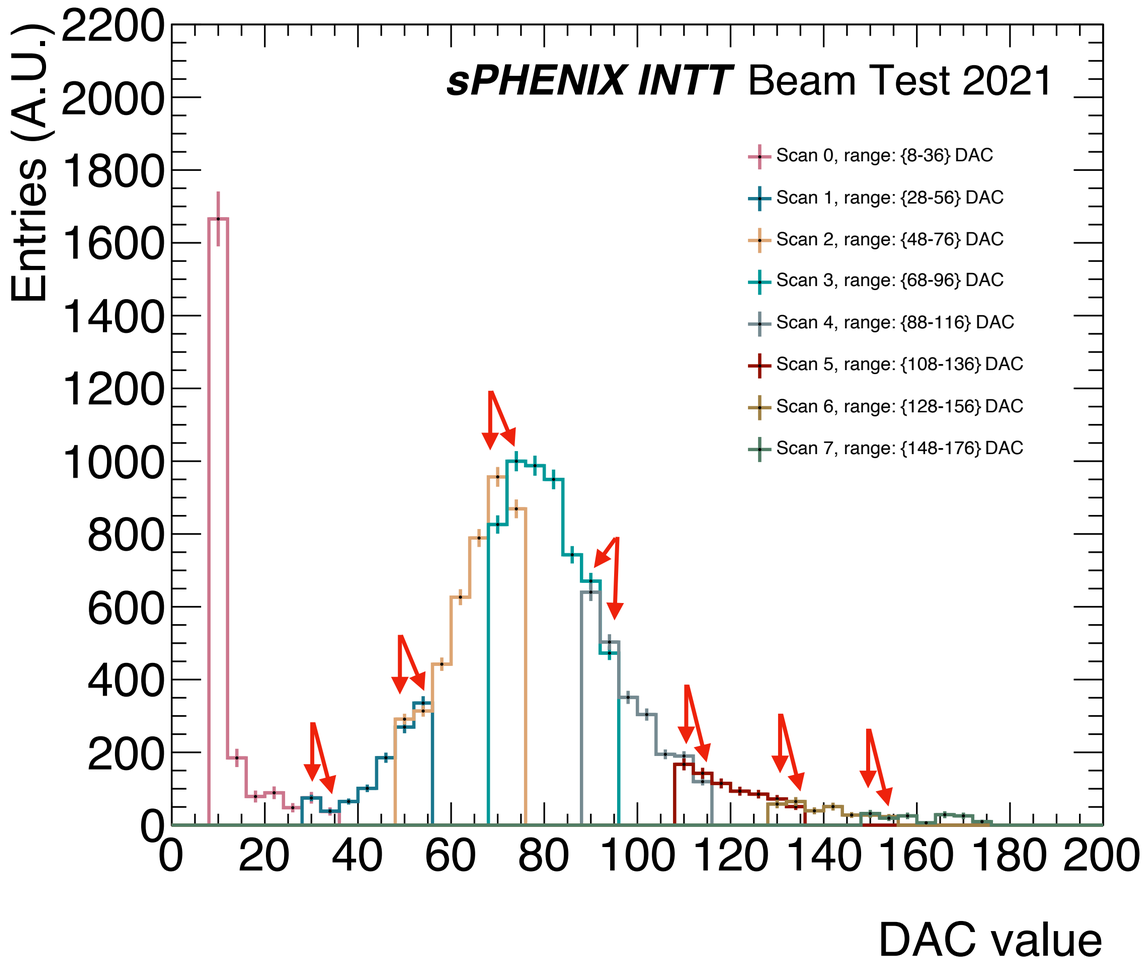
L1



L2

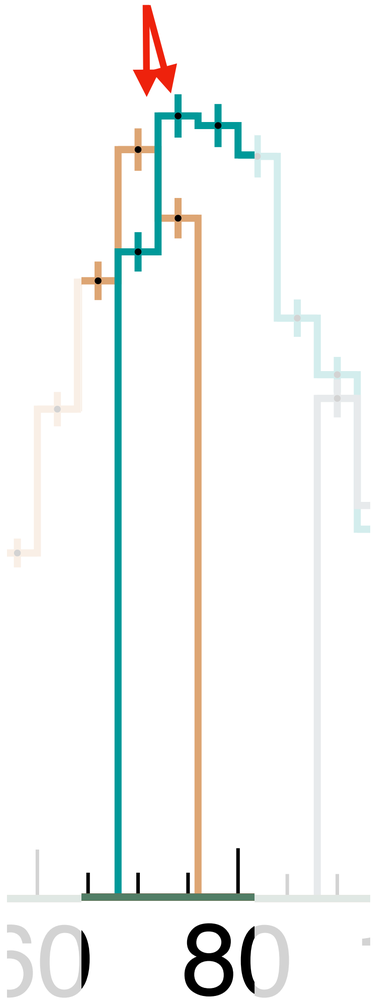
DAC Scan - Combine bins

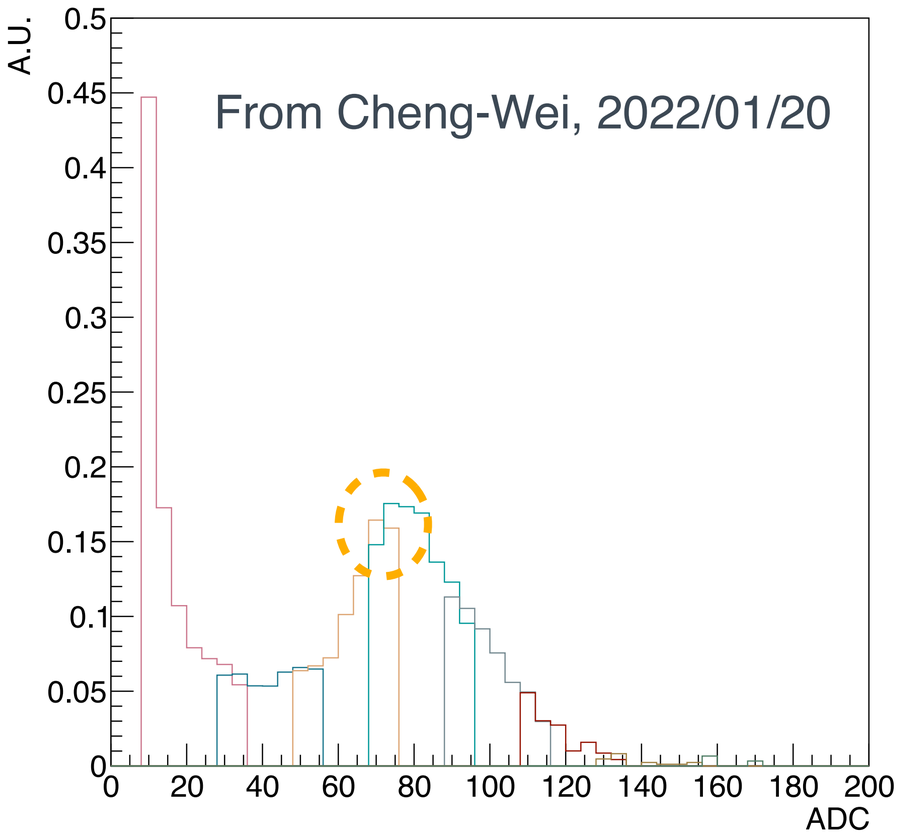
- The overlap bins are statistically combined
- $$\bar{X} \pm \sigma_X = \frac{A \cdot w_A + B \cdot w_B}{w_A + w_B} \pm \sqrt{\frac{1}{w_A + w_B}}$$
- *A*: bin content of the bin1
- w_A : 1 / [(statistical error of bin1)^2]
- *B*: bin content of the bin2
- w_B : 1 / [(statistical error of bin2)^2]
- If reduced $\chi^2 > 1$, $\sigma_X \rightarrow \sigma_X \cdot \sqrt{\chi^2/NDF}$
  - Method introduced by PDG

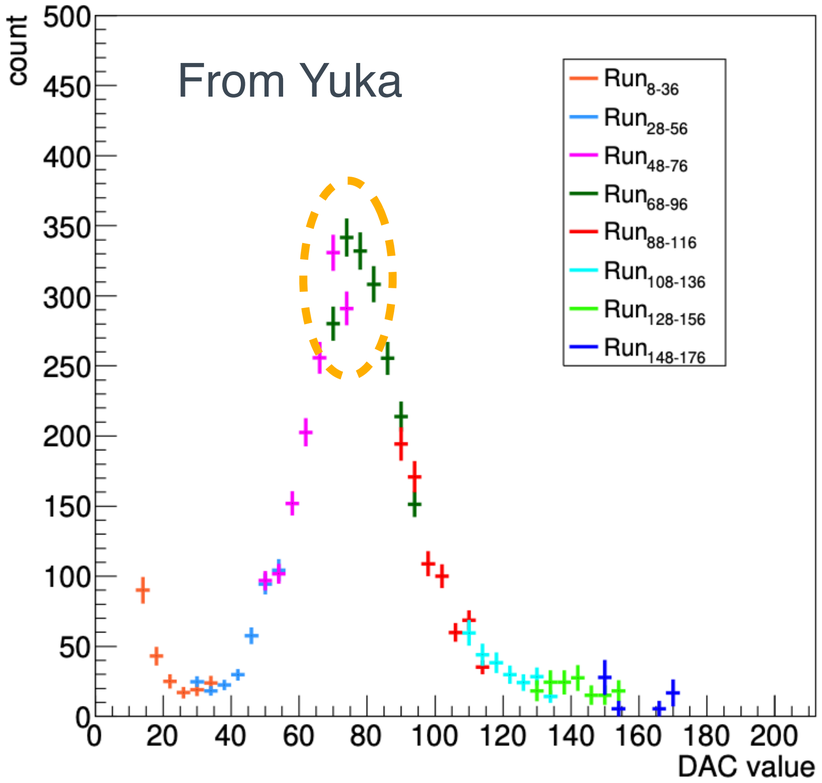


DAC Scan - Combine bins

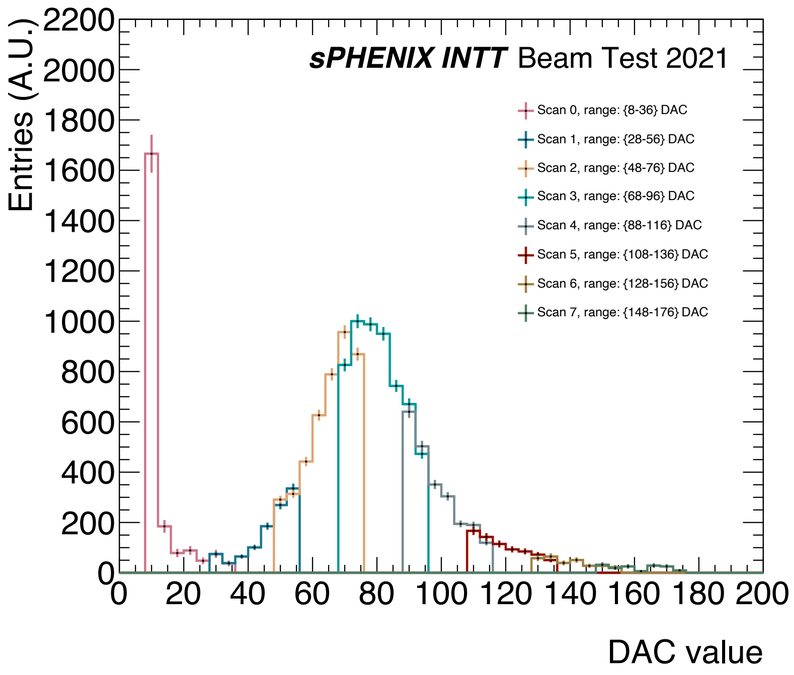
The disagreement in the overlap bins between scan2 and scan3, observed multiple times



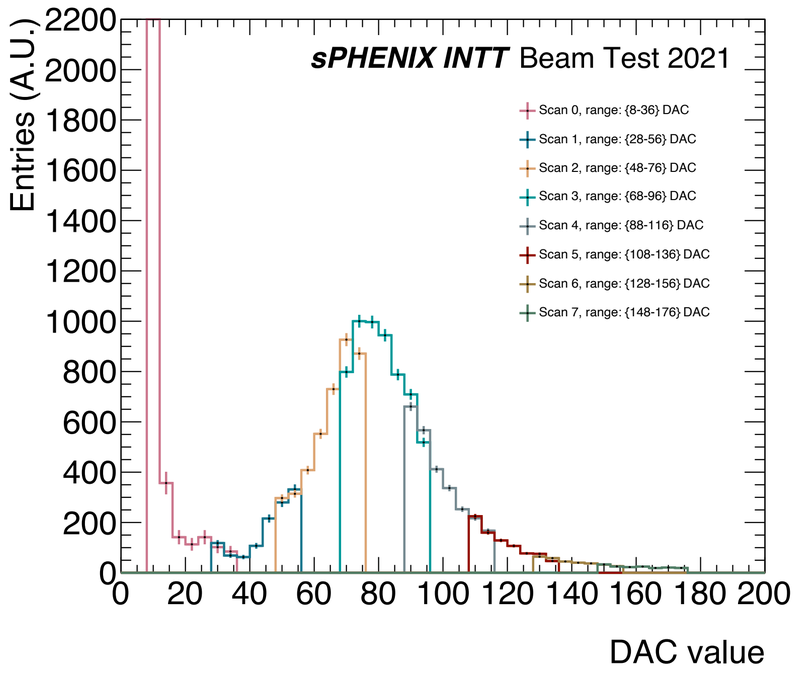




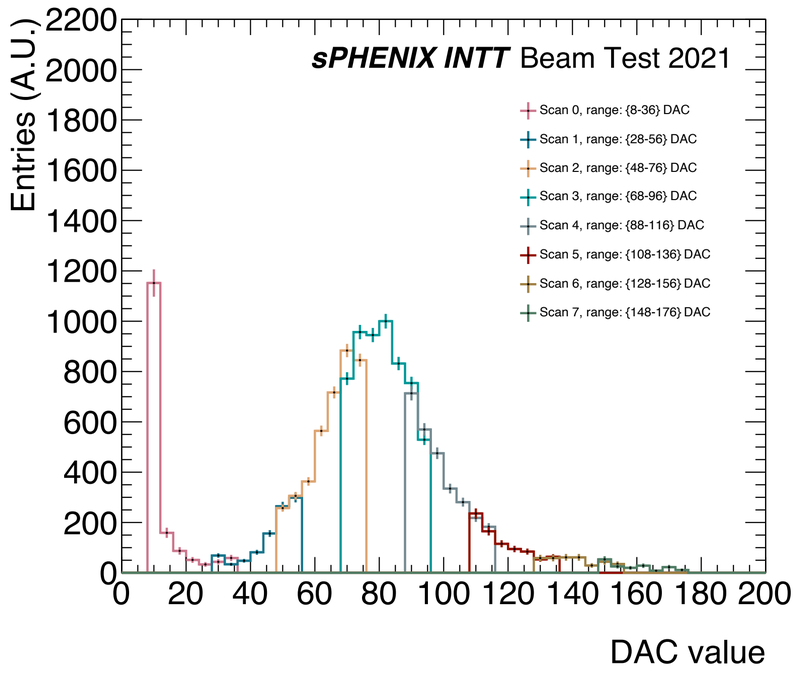
DAC Scan - matching b/w scans



L0



L1

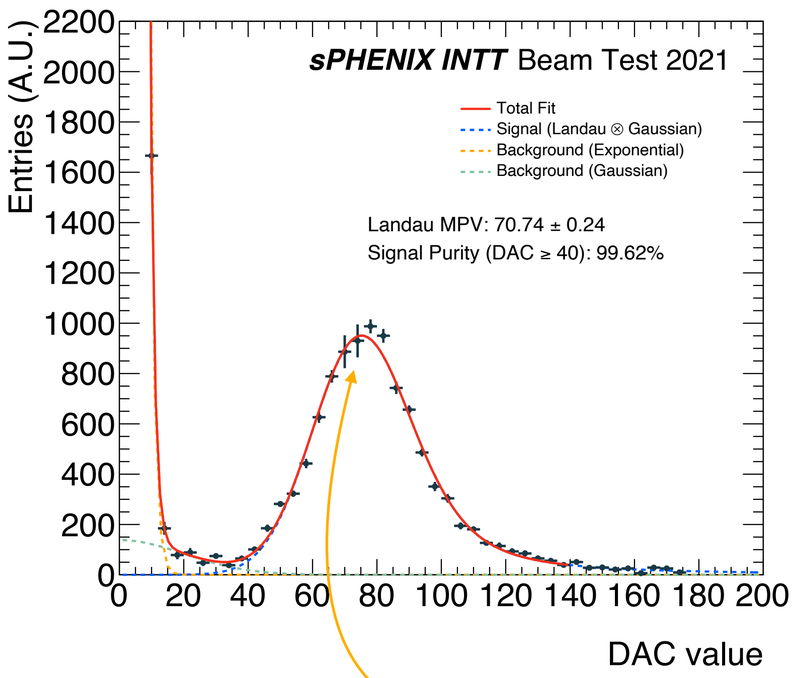


L2

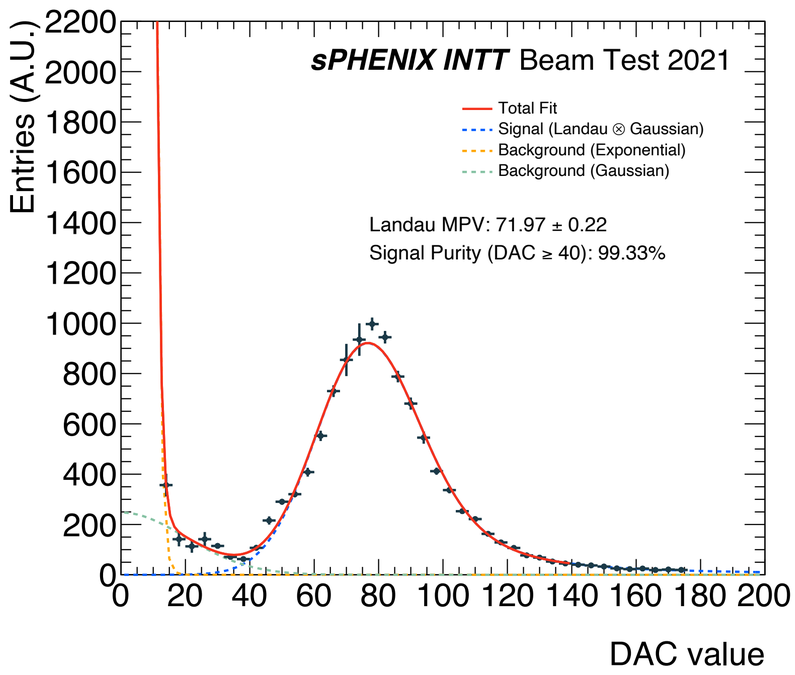
DAC Scan - final with fit

- Signal component: Landau-Gaussian convolution
- Background: Exponential + Gaussian
- Fit range: 8 to 140 DAC
- Signal Purity {DAC ≧ 40}: > 99.3%

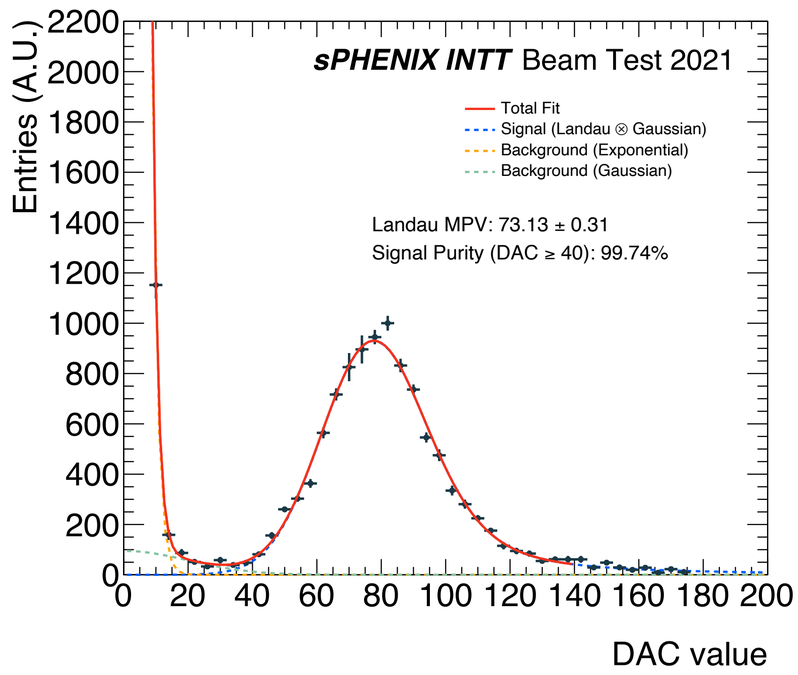
L0



L1



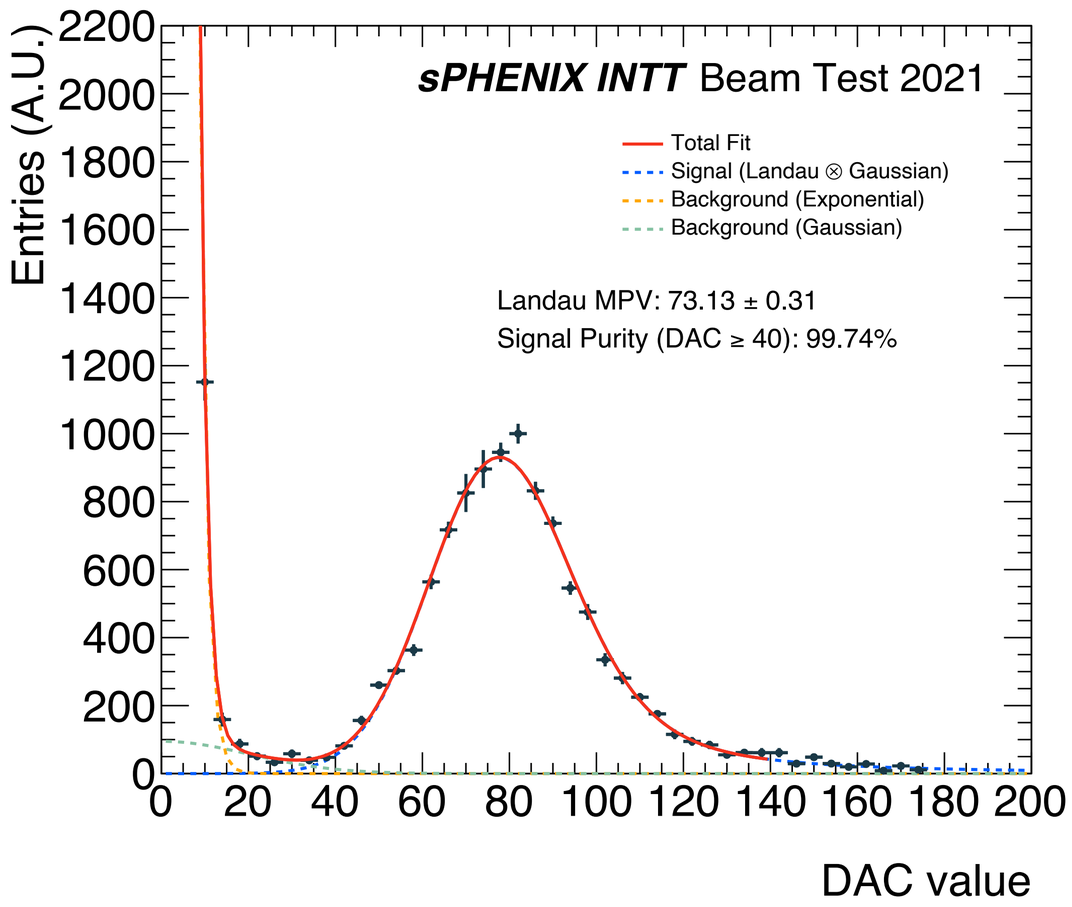
L2



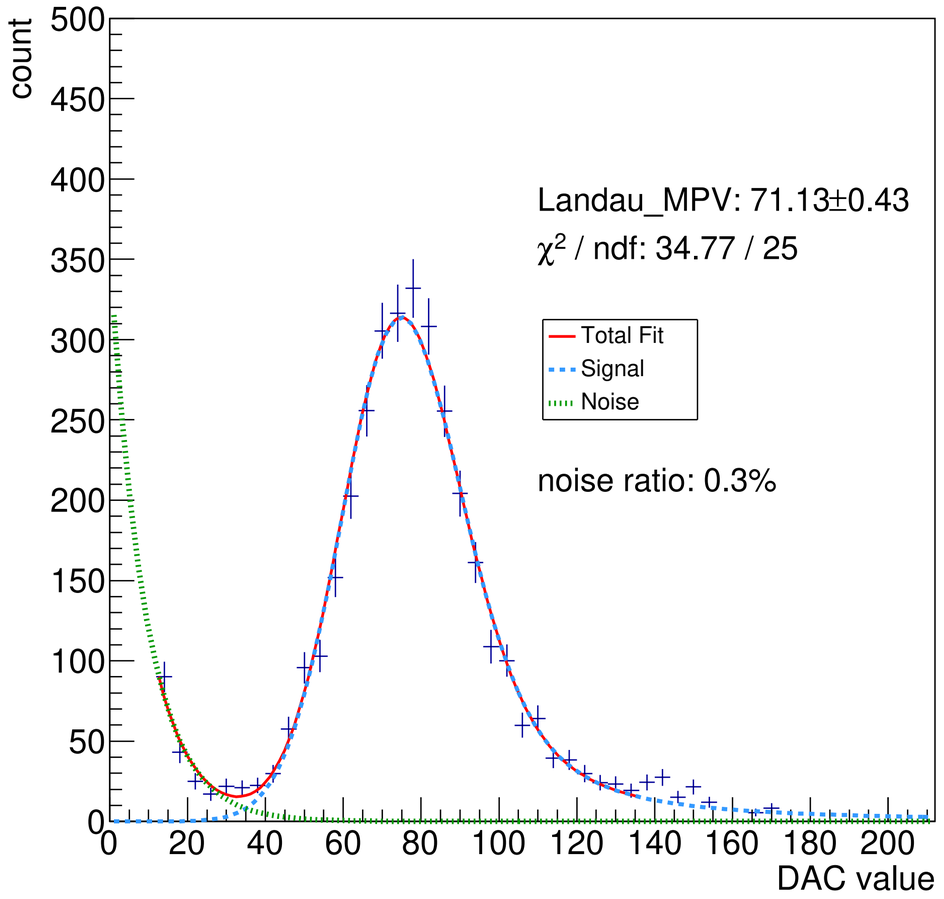
Relatively larger error bars due to the disagreements

Comparison

L2



The plot in the ELPH annual report 2021 by Yuka



Back up