Status report

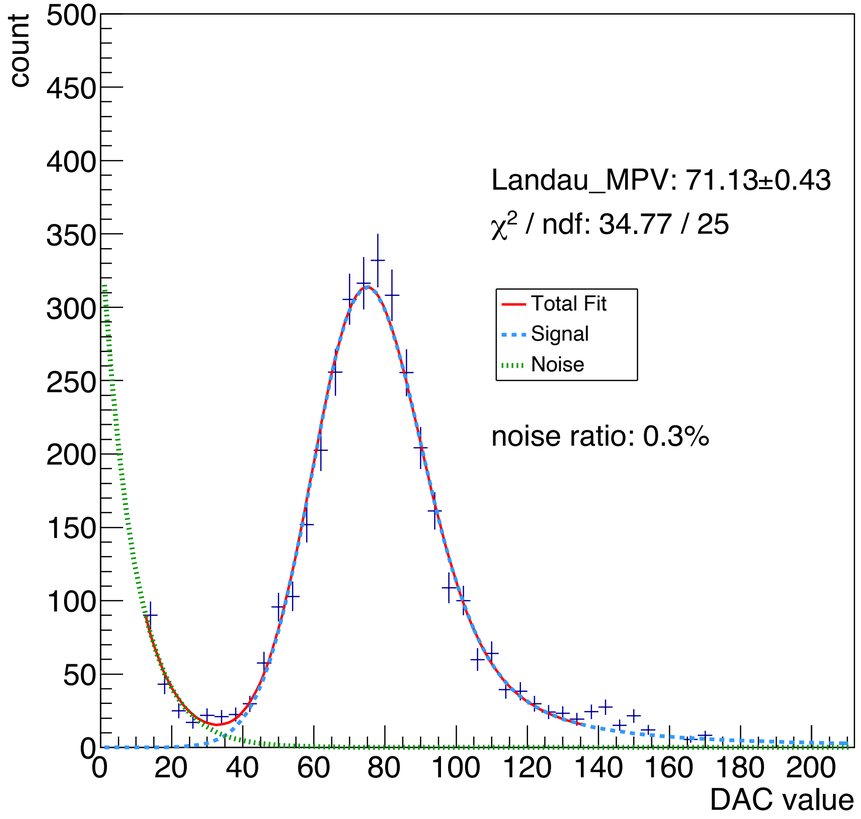
Cheng-Wei Shih, National Central University

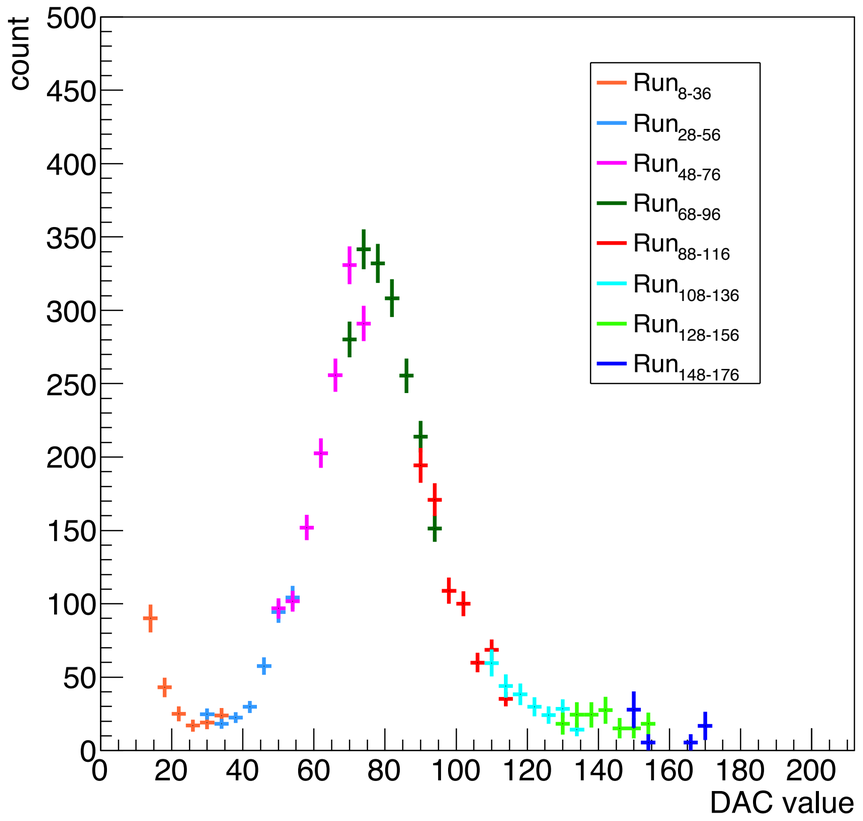
Scope of publication

- INTT MIP distribution by DCA scan measurements
- Ladder detection efficiency
  - Efficiency + statistic + systematic
  - Efficiency as a function of position (uniformity)
- N track comparison (comparison of data and MC)
- Residual distribution (comparison of data and MC)

DAC Scan by Yuka

- Included in the ELPH report





It may not be consistent with the case with bias voltage 100 V applied. But it shows that the adc cut we applied can still keep > 99% of signal

Ladder detection efficiency

- Included in the ELPH report

The detection efficiency in percentage was defined as Equation 3:

$$\frac{N(L0 \cap L1 \cap L2)}{N(L0 \cap L2)} \times 100\% = \frac{N_{\text{good}}}{N_{\text{good}} + N_{\text{far}} + N_{\text{no\_hit}}} \times 100\%.$$

The efficiency of ladder L1 was

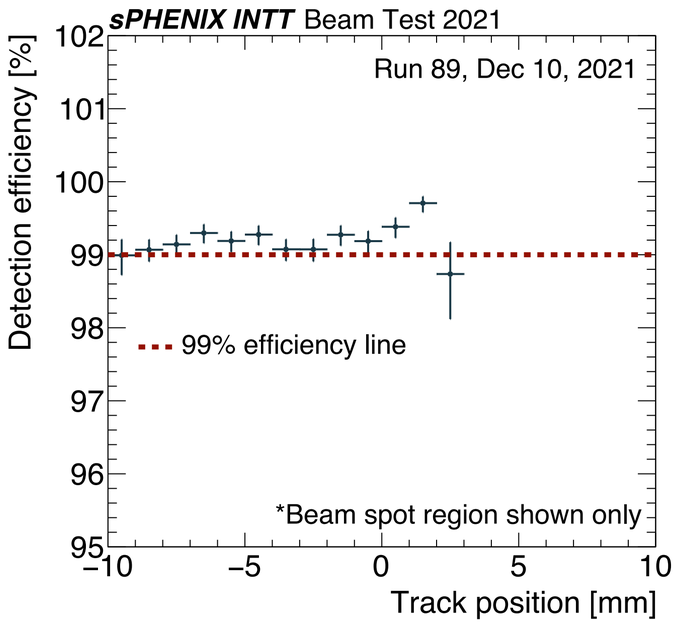
$$\frac{45498}{45498 + 186 + 123} \times 100 = 99.33\%.$$

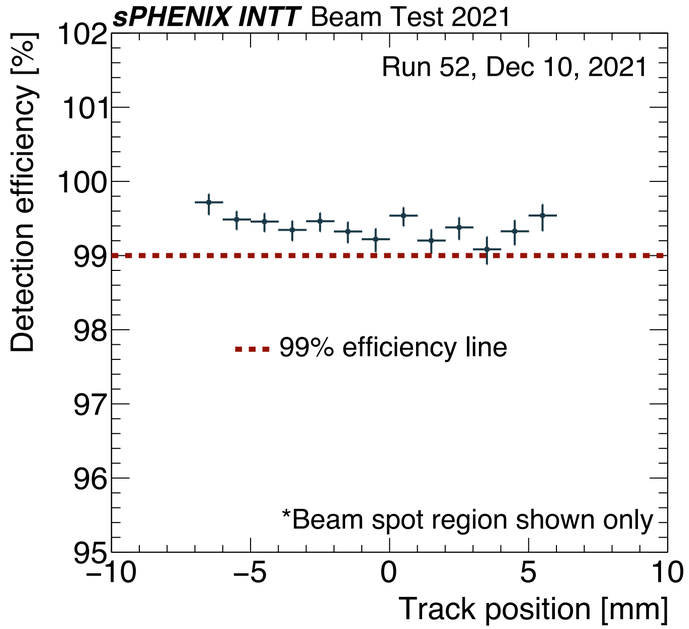
The statistical error was estimated using binomial distribution to be $\pm 0.04\,\%$.

Sources	Scan range	Uncertainty (%)
Residual cut	0.164 mm–0.304 mm	0.063
Slope cut	0.0088–0.0112	3×10^{-3}
Edge effect	0 ch–10 ch	4×10^{-4}
Total		0.063

the detection efficiency of $99.33 \pm 0.04(\text{stat}) \pm 0.06(\text{sys})\,\%$

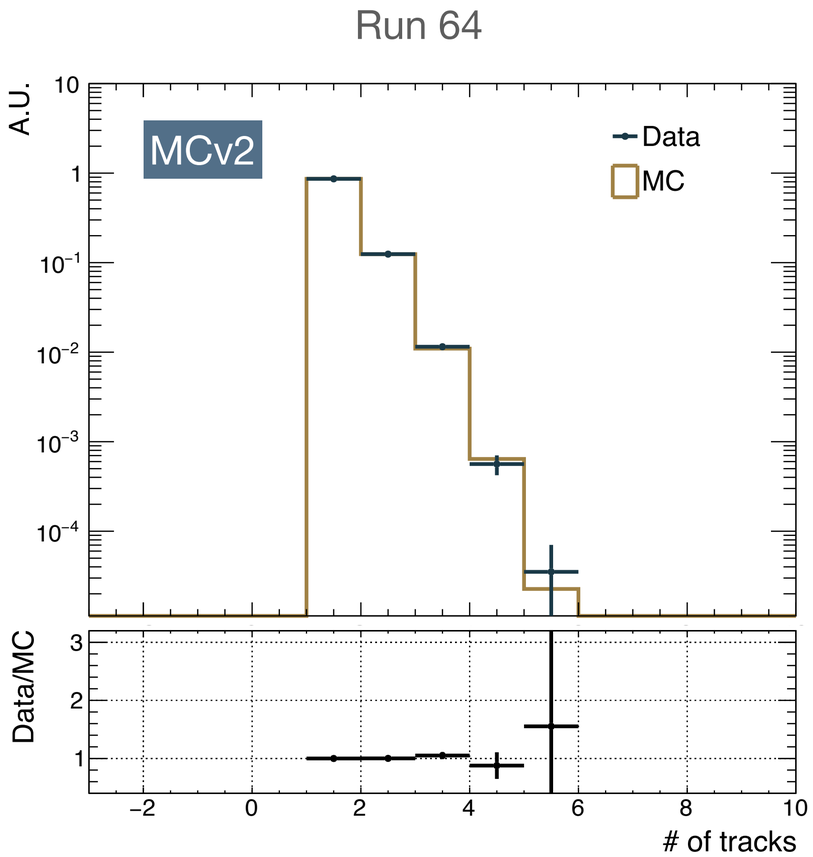
Error bars : statistics uncertainty





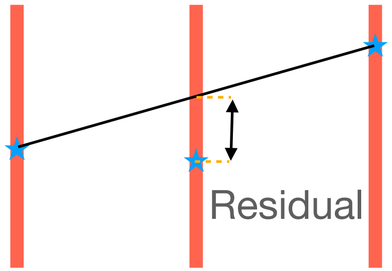
With lead plate, N of tracks

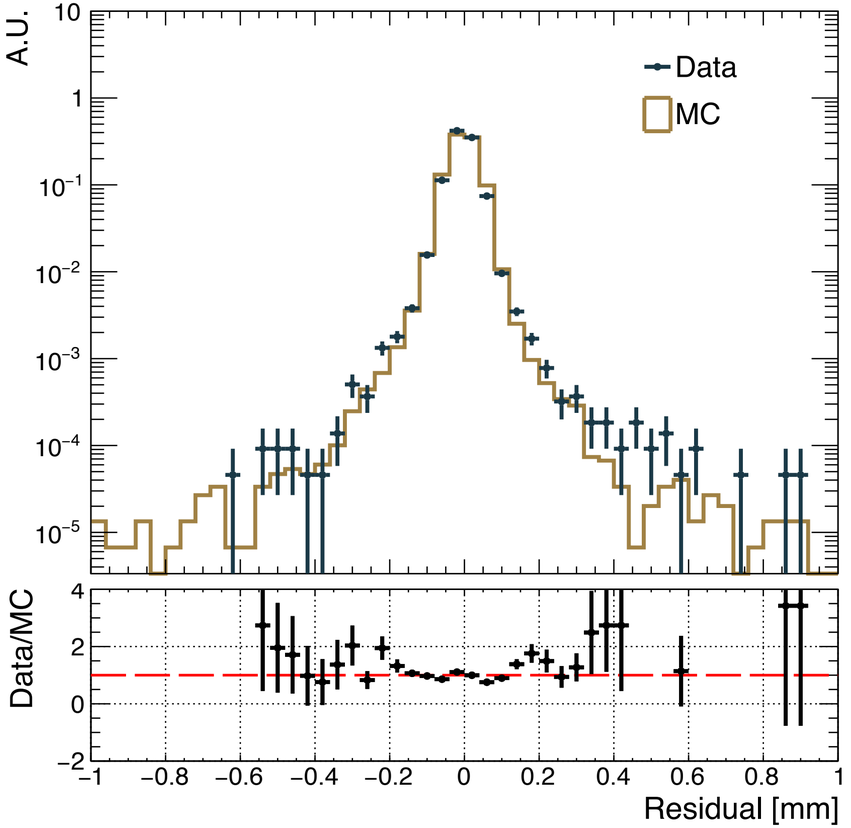
- Not included in the ELPH report
- Run 64 : a metal plate in front of the beam
  - Generates multiple tracks
- The plot : comparison between data and MC



Residual distribution

- Not included in the ELPH report
- Run 52, comparison between data and MC





Cosmic run 25566 - streaming readout

N event : 2,275,396

432	Mon Aug 14 14:55:06 2023	Misaki Hata

8/14 streaming readout mode

default : n_coll =128 . mode bit= 95. opentime =35 . DAC0=15 .

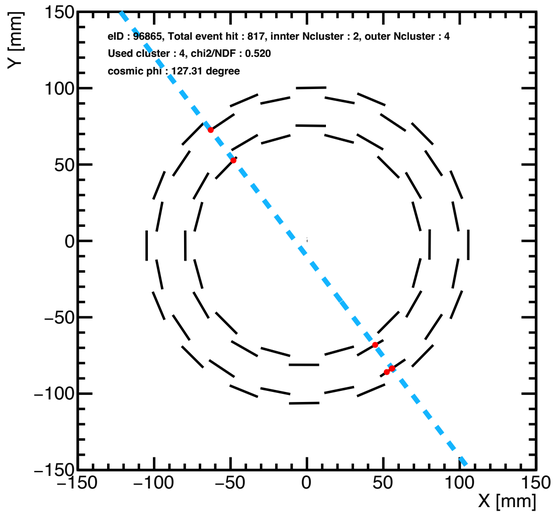
conclusion :

run 25566 : DAC0=25

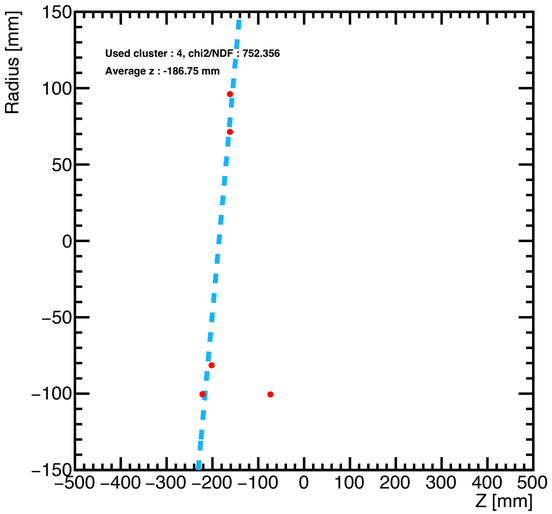
run 25568 : We tried to mask the chip for some hot channels which cannot be masked by channel level.
But, we could not mask even we used chip mask.

Time	Run	Run Length (min)	Event(intt0s packet)	setting	trigger	porpose
14:57	25563		1766219(roughly)			
16:02	25564		4890121			test the chip mask command
16:37	25565	2	13G			update masking list & rate cut 0.4 from run 25564
16:45	25566	2	6462729			threshold is changed
17:14	25567	2	6662387			update masking list & rate cut 0.2 from run 25564
17:49	25568		647587			short run & test the chip masking for some hot channels
18:04	25570	10	20422893			long run

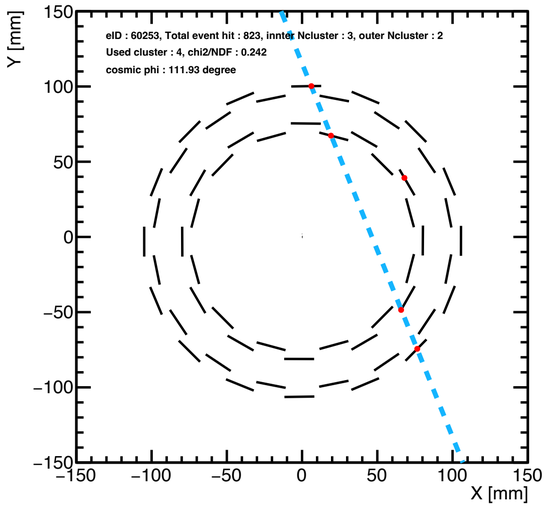
INTT event display X-Y plane



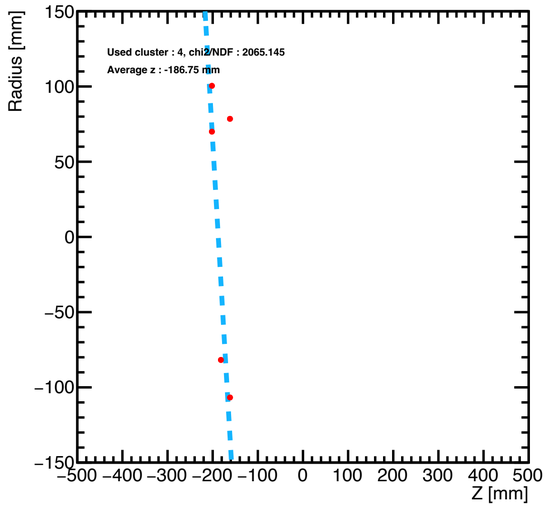
INTT event display r-Z plane



INTT event display X-Y plane



INTT event display r-Z plane



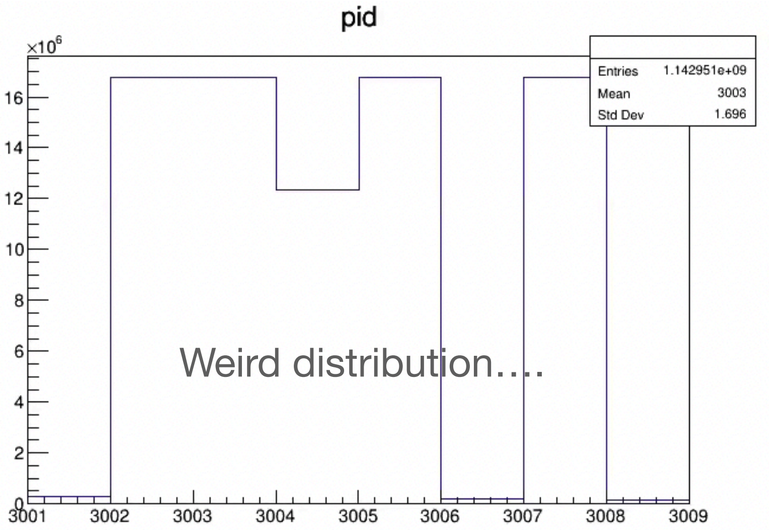
Were able to find some cosmic track candidates

Cosmic run 25566 - streaming readout

N event : 2,275,396

"roc_id, felix_ch, port_id, chip_id, chan_id, ch_entry, ch_entry_ampl_cut, turn_on, width, profile"

Checked mask file : /home/phnxrc/INTT/sphenix_inttpy/run_scripts/mask_ch_south_v{1..2}.txt

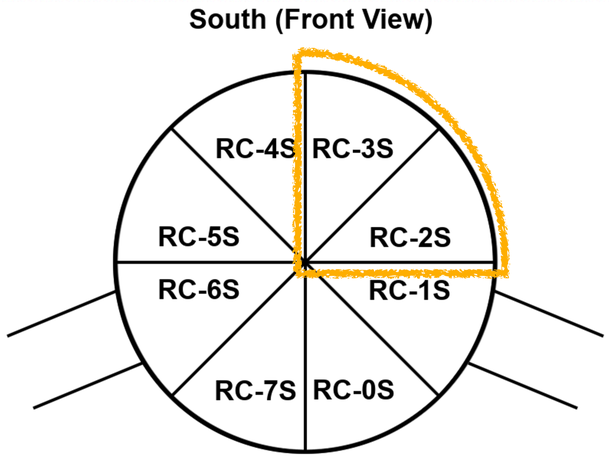


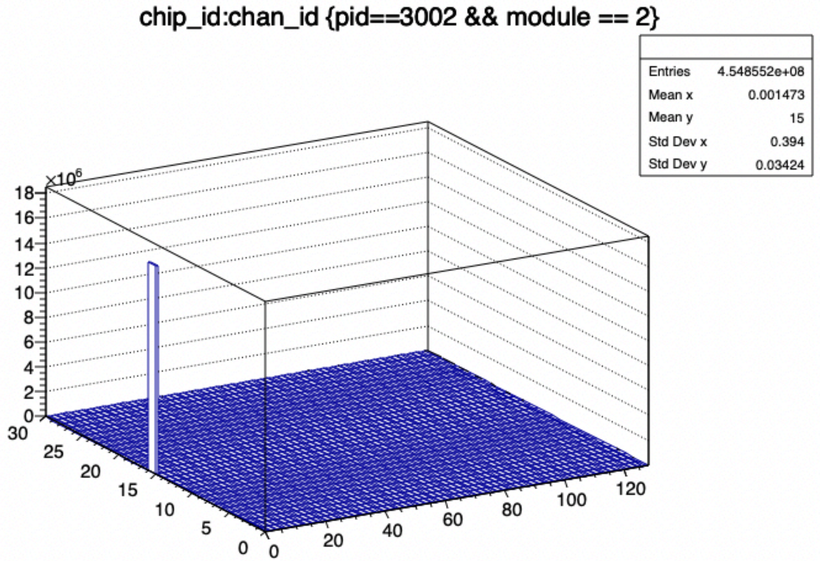
Version 1

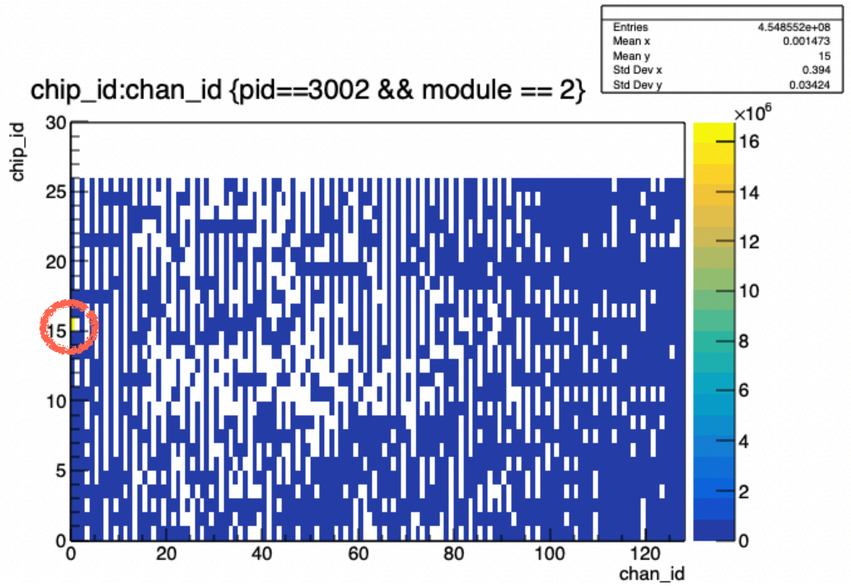
```
2 0 7 7 23 19 0 25.000 3.500 12
3 10 4 18 83 950 175 17.619 7.500 0
3 11 1 6 31 19808 2797 5.000 0.000 128
3 11 1 16 110 2521 373 5.000 0.000 128
2 2 1 15 0 240 59 26.360 4.963 28
2 4 0 16 127 9314 1320 5.000 0.000 128
2 4 0 18 77 20051 2924 5.000 0.000 128
2 4 0 18 105 766 113 15.000 7.500 8
3 7 7 7 84 4248 627 5.000 0.000 128
3 7 7 14 65 34402 4867 5.000 0.000 128
```

Version 2

```
2 2 1 15 128 66 0 0 0 0
2 2 1 16 122 66 0 0 0 0
2 4 0 3 0 51 0 0 0 0
2 4 0 3 127 108 0 0 0 0
```



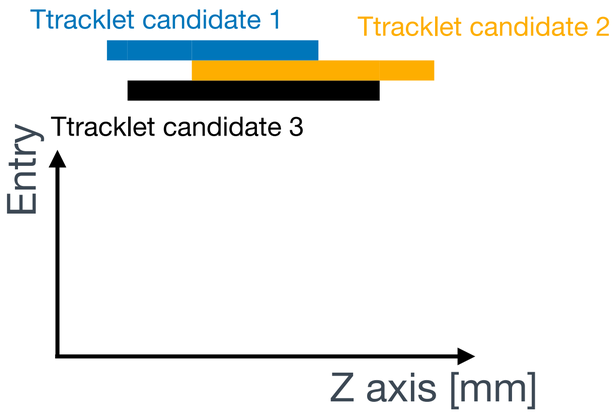




The channel (pid 3002, module 2, chip15, channel 0) was masked, but still hot!

Recap - new Z vertex determination

Run 20869



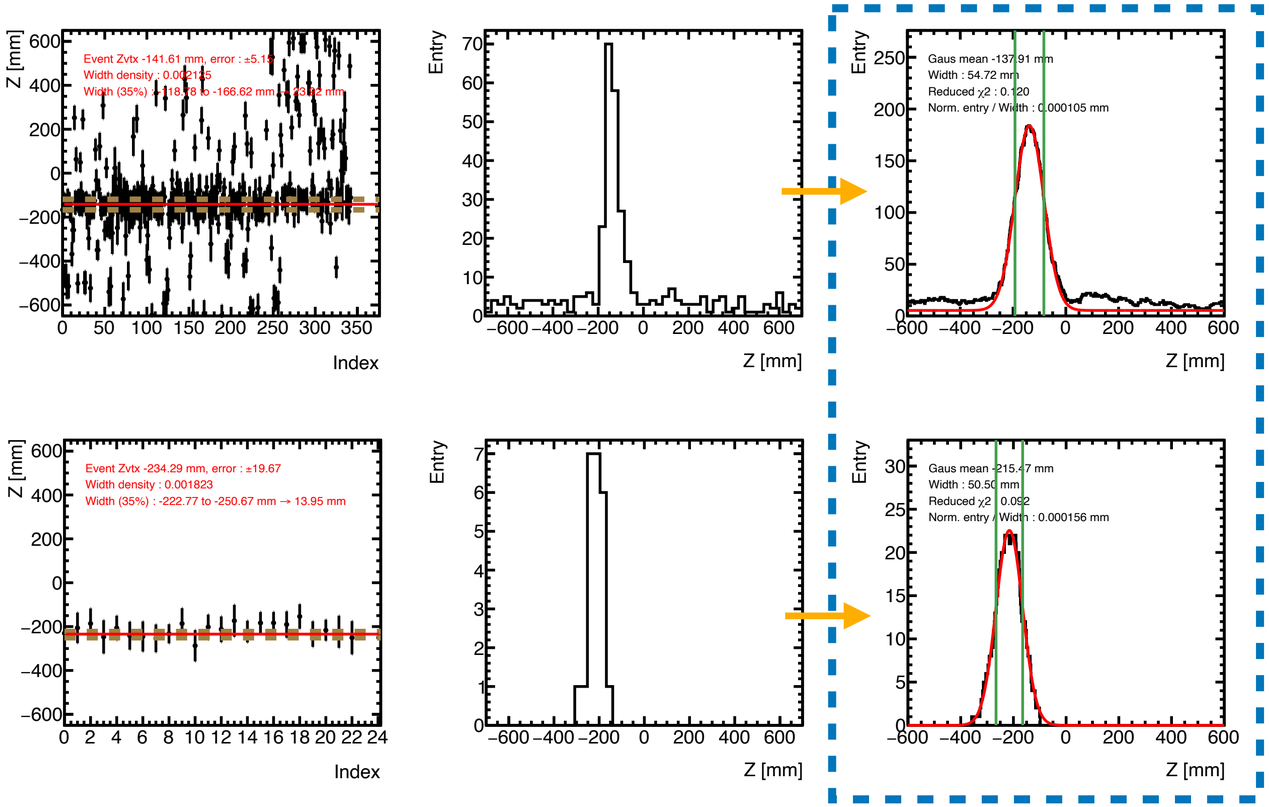
Hard to achieve perfectly in reality 😞

→ substitution : fine binning histogram

→ 0.5 mm bin width

→ Fill the line into histogram

Filled by mid point of the possible range



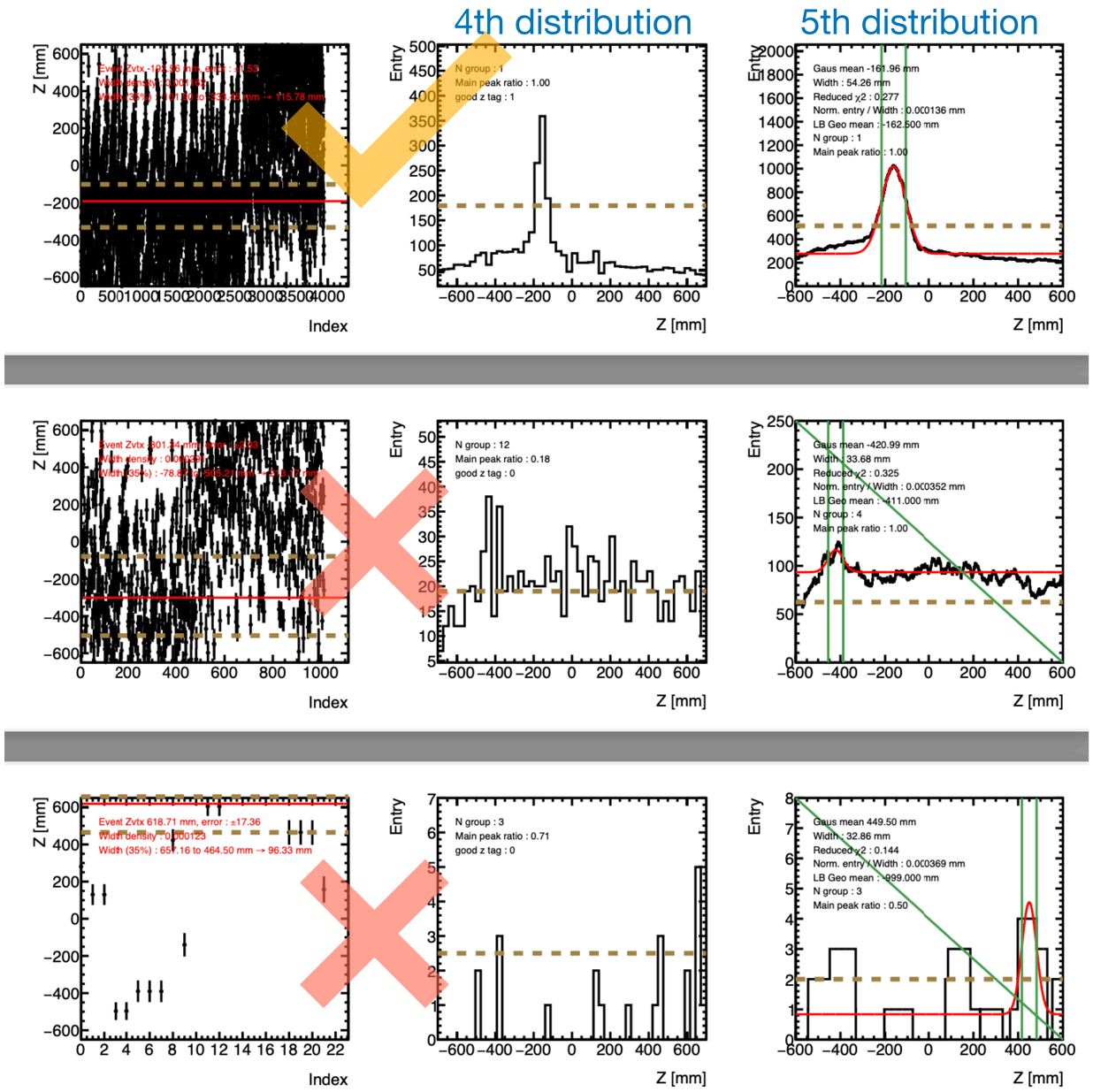
Before DATA implantation - event selection

Not all the events have clear z vertex distribution

Current event selection :

1. For both 1D distributions, remove the background :
    1. For all bins, bin content - $\frac{peak\_bin\_content}{2}$
2. Count the clusters (group), the content ratio and group width
3. Cut on the group width based on the distributions
4. Cut on the content ratio (0.6 for 4th and 0.9 for 5th)
5. Cut on N group (4 for 4th and 7 for 5th)

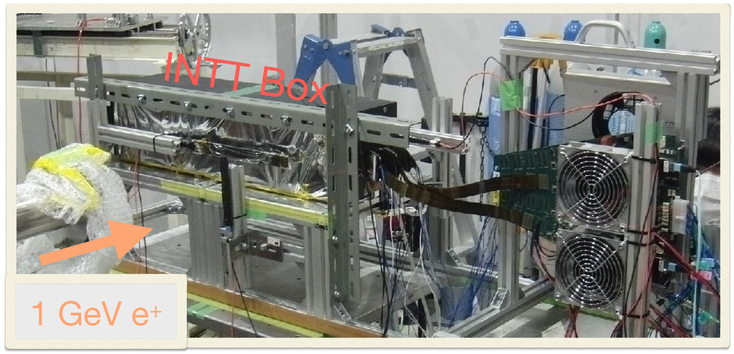
Currently, works well with run 20869, first 20k events

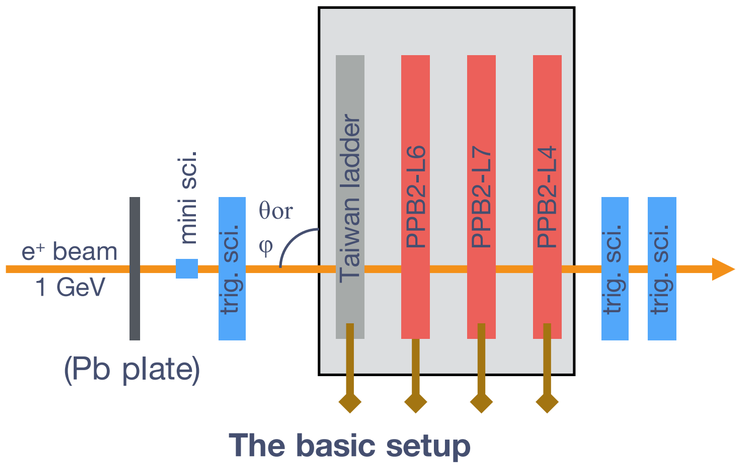


Back up

Beam Test 2021 @ ELPH Tohoku

- Beam : Positron beam with energy of ~ 800 MeV
- Configuration : 3 layers of INTT ladders + 2 scintillators (trigger)
- Bias voltage : 50 V





The basic setup

DAC Scan (previous, 2022 Jan. 20)

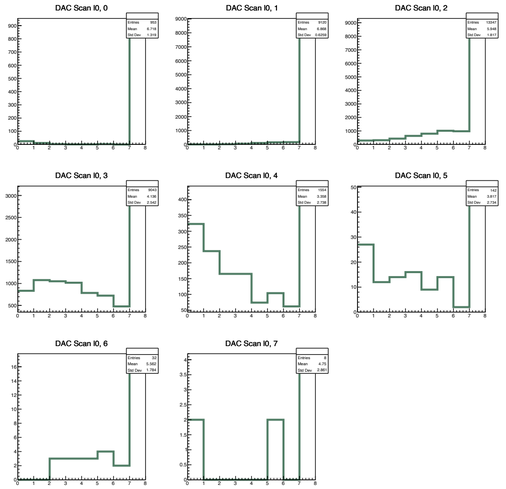
- Not included in the ELPH report

- Algorithm is same as Testbeam2019 :
  - 6th, 7th bins : histogram matching
  - 8th bin : overflow, neglect

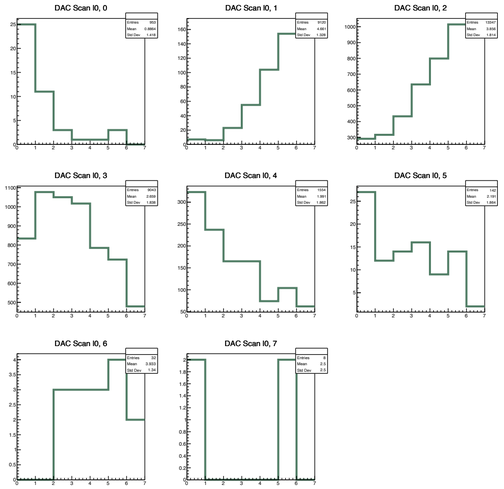
- Criteria :
  - Event profile has to be 111
  - single hit for each layer only

run1	run2	run3	run4	run5	run6	run7	run8
8	28	48	68	88	108	128	148
12	32	52	72	92	112	132	152
16	36	56	76	96	116	136	156
20	40	60	80	100	120	140	160
24	44	64	84	104	124	144	164
28	48	68	88	108	128	148	168
32	52	72	92	112	132	152	172
36	56	76	96	116	136	156	176
40	60	80	100	120	140	160	180

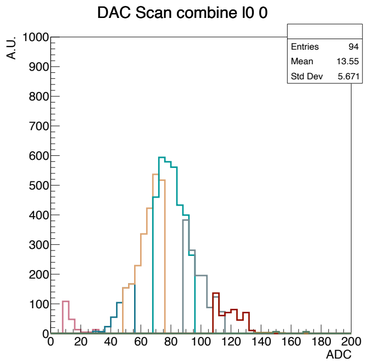
With 8th bin, L0

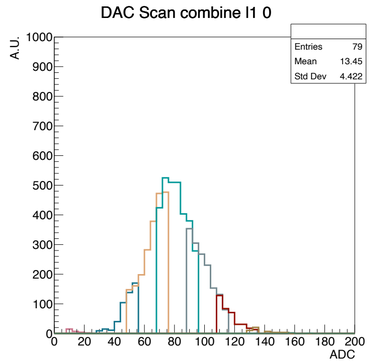


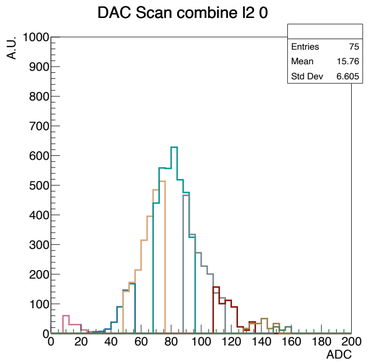
Without 8th bin, L0



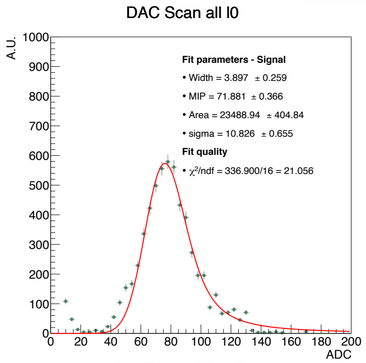
- Event profile has to be 111
- single hit for each layer only



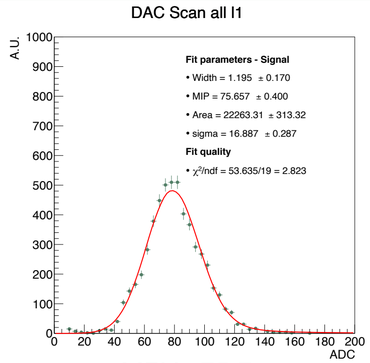




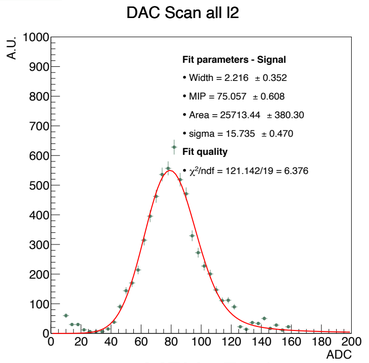
Fitting function : Landau convolute with Gaussian



MPV : 71.9



MPV : 75.7



MPV : 75.1

It may not be consistent with the case with bias voltage 100 V applied. But it shows that the adc cut we applied can still keep > 99% of signal

QM2023 Proceeding

The Intermediate Silicon Tracker of sPHENIX

Cheng-Wei Shih[1,*] for the sPHENIX Collaboration

[1]Department of Physics, and Center for High Energy and High Field Physics, National Central University, Taoyuan, Taiwan

Abstract. The sPHENIX project is a new detector experiment at the Relativistic Heavy Ion Collider at BNL. Its aim is to study strongly interacting Quark-Gluon Plasma and cold-QCD by measuring photons, jets, jet correlations, and the Upsilon family with high precision. To achieve these goals, a precise tracking system is necessary. The tracking system of the sPHENIX detector consists of MVTX, TPC, TPOT, and the Intermediate Silicon Tracker (INTT). INTT is a two-layer barrel silicon tracker that plays a unique role among the tracking detectors. It is capable of bridging the tracks of MVTX and TPC. In addition, its precise timing resolution enables INTT to associate individual tracks and events to eliminate pile-up events. The INTT barrel installation and cabling were completed in March 2023. We have since commissioned and confirmed installation procedures and detector responses. The INTT status, and performance evaluation by beams and cosmic rays are presented in this talk.

1 Introduction

Your text comes here. Separate text sections with

2 Section title

For bibliography use [1]

2.1 Subsection title

Don't forget to give each section, subsection, subsubsection, and paragraph a unique label (see Sect. 2).

For one-column wide figures use syntax of figure 1

Figure 1. Please write your figure caption here

For two-column wide figures use syntax of figure 2
For figure with sidecaption legend use syntax of figure
For tables use syntax in table 1.

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