sPEHNIX - INTT commissioning
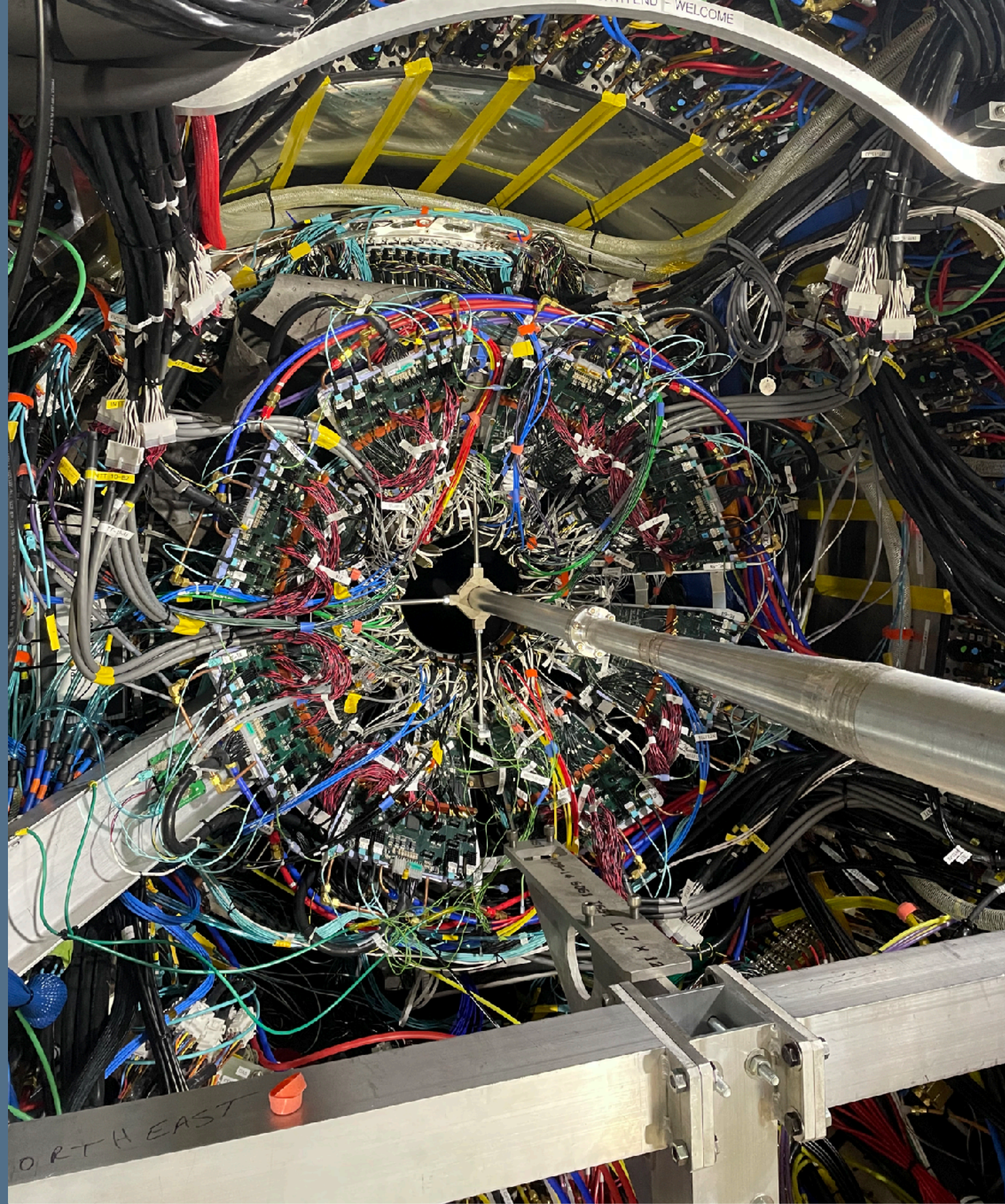
Cheng-Wei Shih, Chia-Ming Kuo
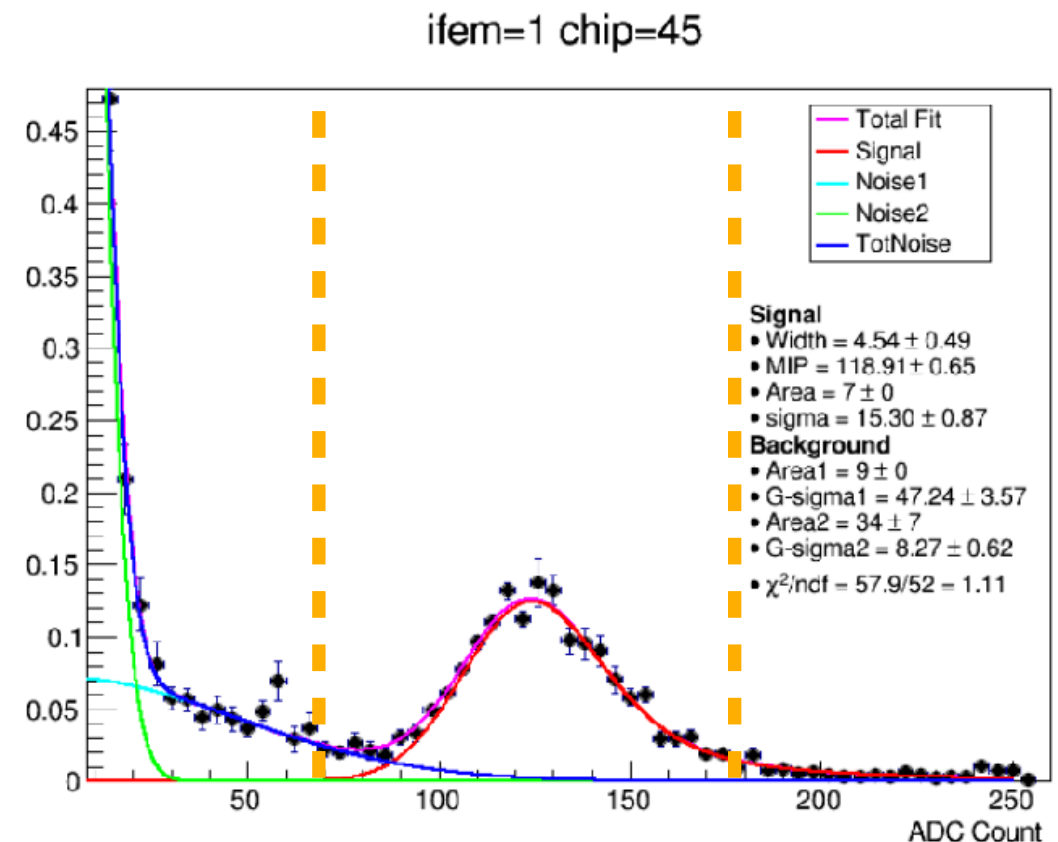
National Central University

Cosmic run 25952

- It was a 12 hours run (trigger rate 50 Hz) with threshold 15 adc
- Trigger events : 2020991
- INTT events : 2020998 (Post 8-file merge)

- With following criteria : 20106 good tracks → 80424 clusters → 42368 single-hit clusters
  - fNhits < 2000
  - One HL masked, hot channel cut = 10
  - 1-hit cluster with adc0 included
  - Cluster size < 5
  - N clusters 4 to 7
  - Fitting reduced chi2 < 5 (both xy and rz planes)

- All clusters can be used :
  - the effected is limited by ~ 3% (In terms of pass length)
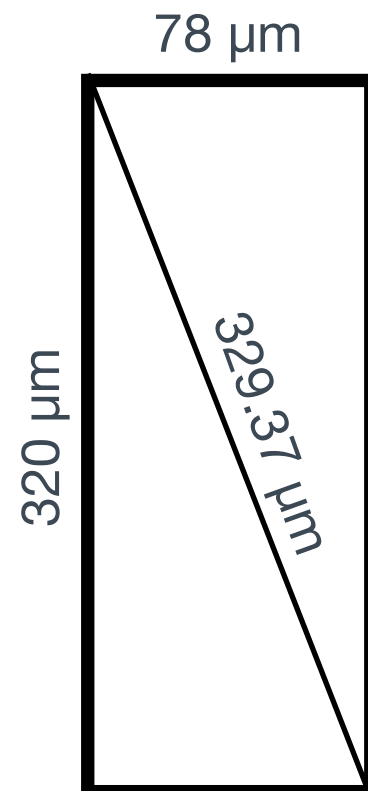
78 μm
320 μm
329.37 μm

- 12 hours, full adc spectrum : 42368 single-hit clusters

- N valid clusters (adc0 to adc6, adc7 : overflow bin, not used)
    - adc0 68   → 0.04, Nclu : 1702   → 3 * 12 hours
    - adc0 88   → 0.24, Nclu : 10301 → 1 * 12 hours
    - adc0 108 → 0.46, Nclu : 19849 → 1 * 12 hours
    - adc0 128 → 0.34, Nclu : 14735 → 1 * 12 hours
    - adc0 148 → 0.13, Nclu : 5901   → 1 * 12 hours

- In total 3.5 days
    - From DAC run 8 to DAC run 4

* Noise component is not considered
* With high threshold, the cluster size tends to be smaller, which is not considered. But with current rather advanced tracking method, such effect can be suppressed.
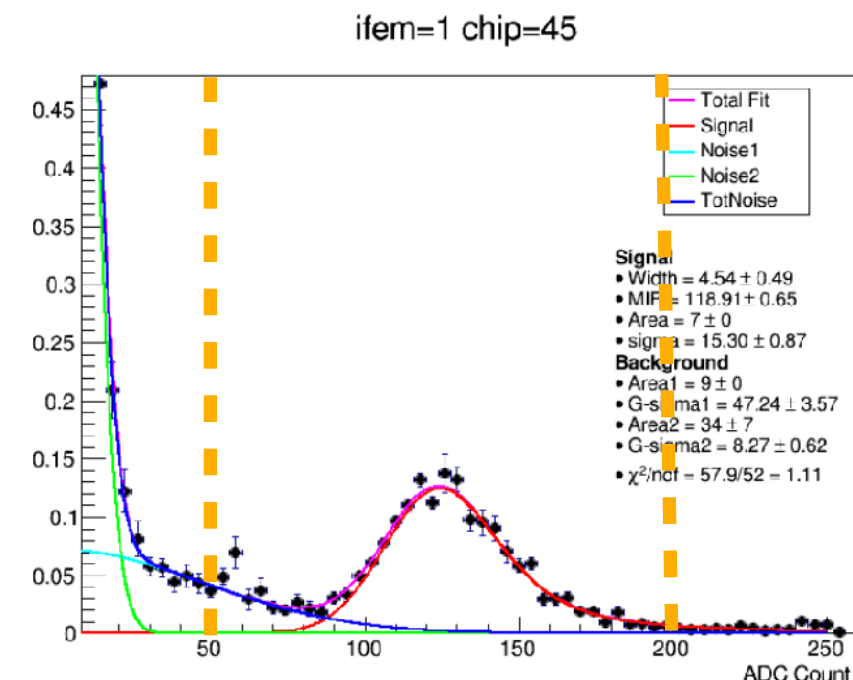

ifem=1 chip=45

Legend:
- Total Fit
- Signal
- Noise1
- Noise2
- TotNoise

Signal
- Width = 4.54 ± 0.49
- MIP = 118.91 + 0.65
- Area = 7 ± 0
- sigma = 15.30 ± 0.87

Background
- Area1 = 9 ± 0
- G-sigma1 = 47.24 ± 3.57
- Area2 = 34 ± 7
- G-sigma2 = 8.27 ± 0.62
- χ^2/ndf = 57.9/52 = 1.11

ADC Count

- 12 hours, full adc spectrum : 42368 single-hit clusters

- N valid clusters (adc0 to adc6, adc7 : overflow bin, not used)
  - adc0 48   → 0.0017, Nclu : 75 (noise not considered) → 2 * 12 hours   run3
  - adc0 68   → 0.04,   Nclu : 1702   → 3 * 12 hours
  - adc0 88   → 0.24,   Nclu : 10301 → 1 * 12 hours
  - adc0 108 → 0.46,   Nclu : 19849 → 1 * 12 hours
  - adc0 128 → 0.34,   Nclu : 14735 → 1 * 12 hours
  - adc0 148 → 0.14,   Nclu : 5901   → 1 * 12 hours
  - adc0 168 → 0.05,   Nclu : 2271   → 2 * 12 hours   run9

- In total 3.5 + 2 days
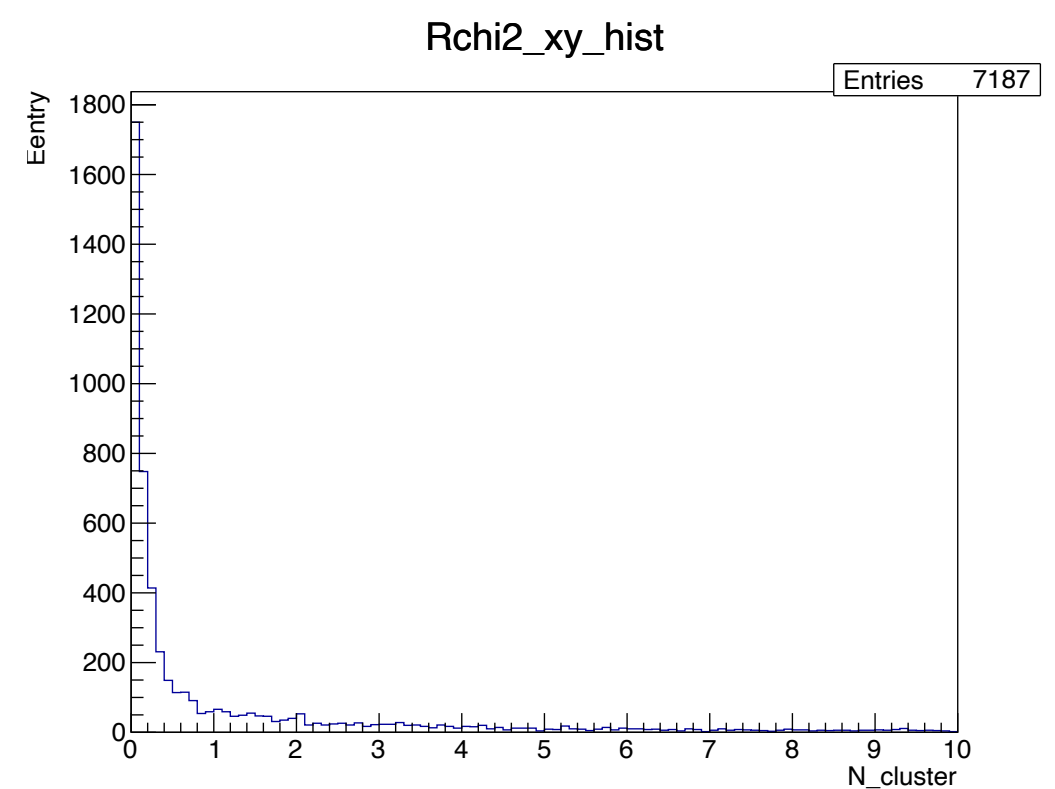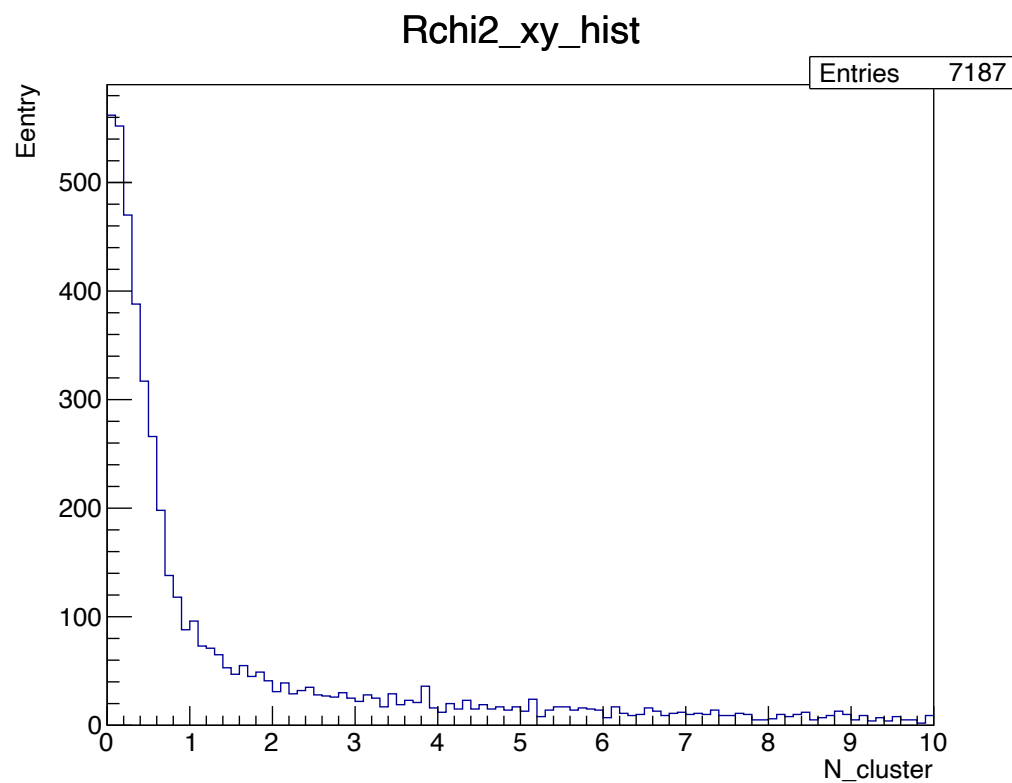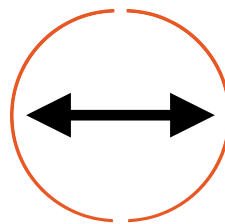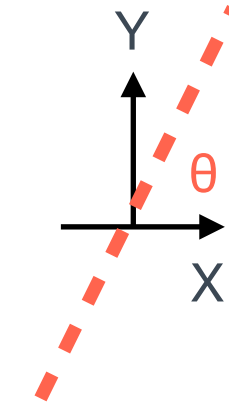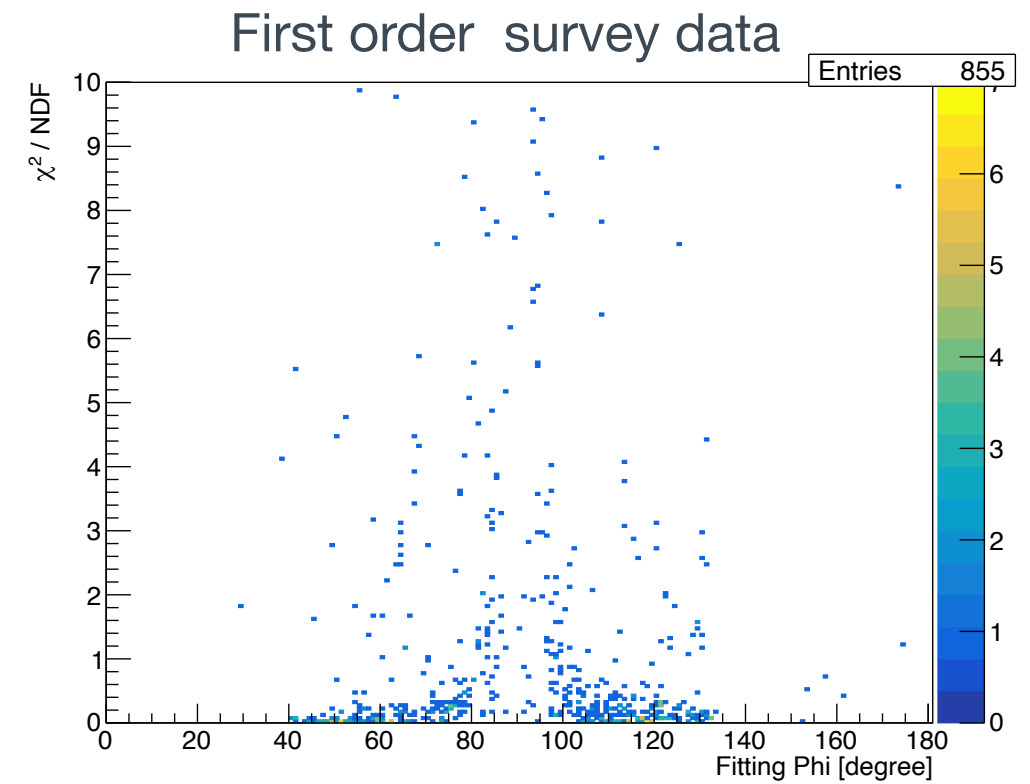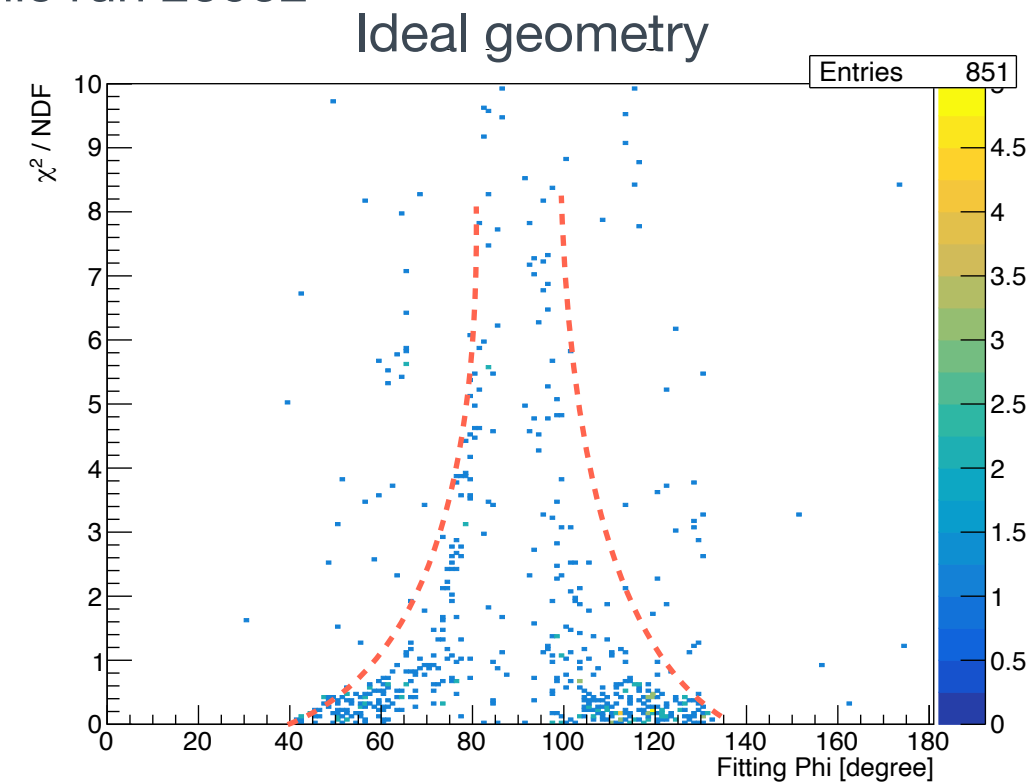 - From DAC run 9 to DAC run 3
  - Priority : run3

* Noise component is not considered
* With high threshold, the cluster size tends to be smaller, which is not considered. But with current rather advanced tracking method, such effect can be suppressed.


ifem=1 chip=45

Signal
- Width = 4.54 + 0.49
- MIP = 118.91 + 0.65
- Area = 7 ± 0
- sigma = 15.30 ± 0.87
Background
- Area1 = 9 ± 0
- G-sigma1 = 47.24 ± 3.57
- Area2 = 34 ± 7
- G-sigma2 = 8.27 ± 0.62
- χ^2/ncf = 57.9/52 = 1.11

Total Fit
Signal
Noise1
Noise2
TotNoise

ADC Count

Cosmic run 25952

The hint implies that the INTT barrel was not well close

Survey data seems to be the right way to go

Cosmic run 25952

- Intt0_1 (B0L101S, RC-0S, Port C1)
  - → Seems to be new

- Intt0_6 (B0L100S, RC-0S, Port A1)
  - → Found to have unstable TLK issue in calibration test
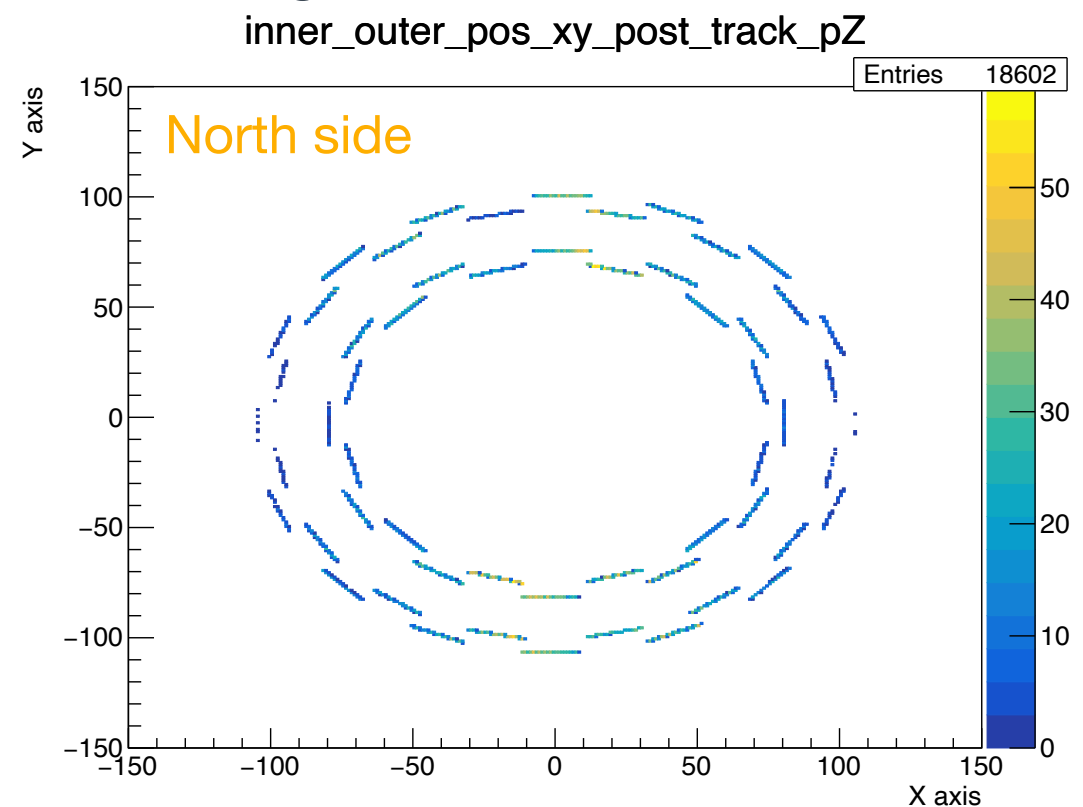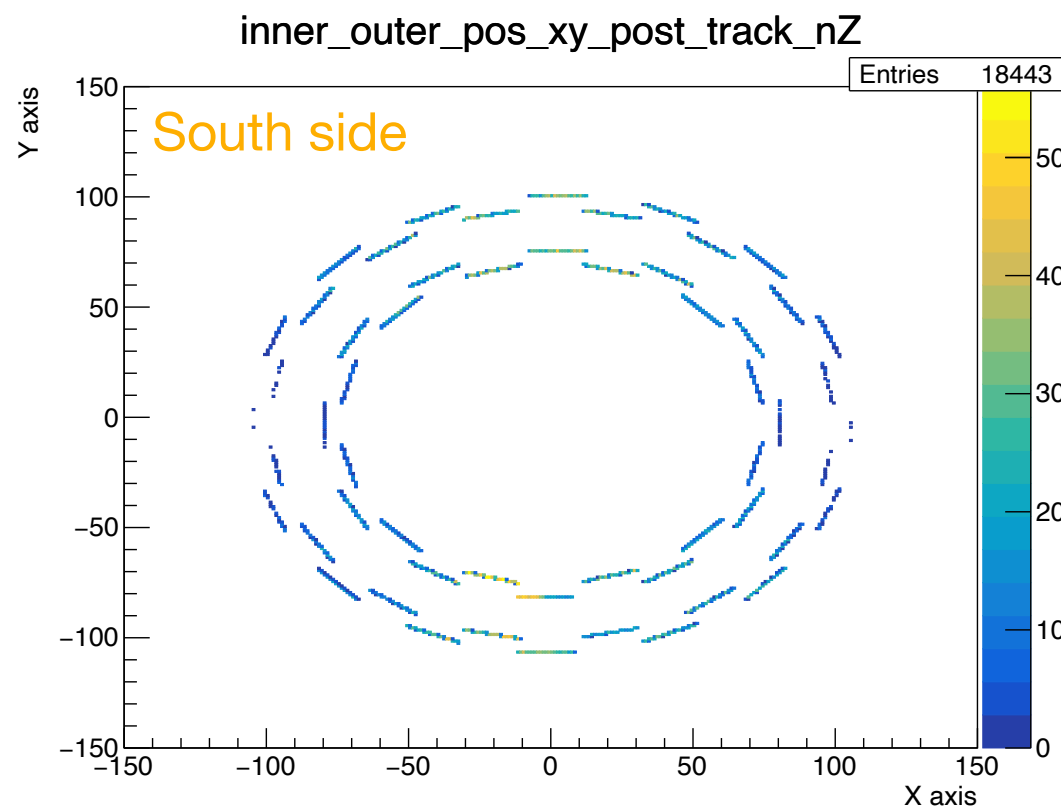
- Intt3_8 (B0L111S, RC-7S, Port B1)
  - → seems to be new

Post clone-hit removal, number of hits in the half-ladder
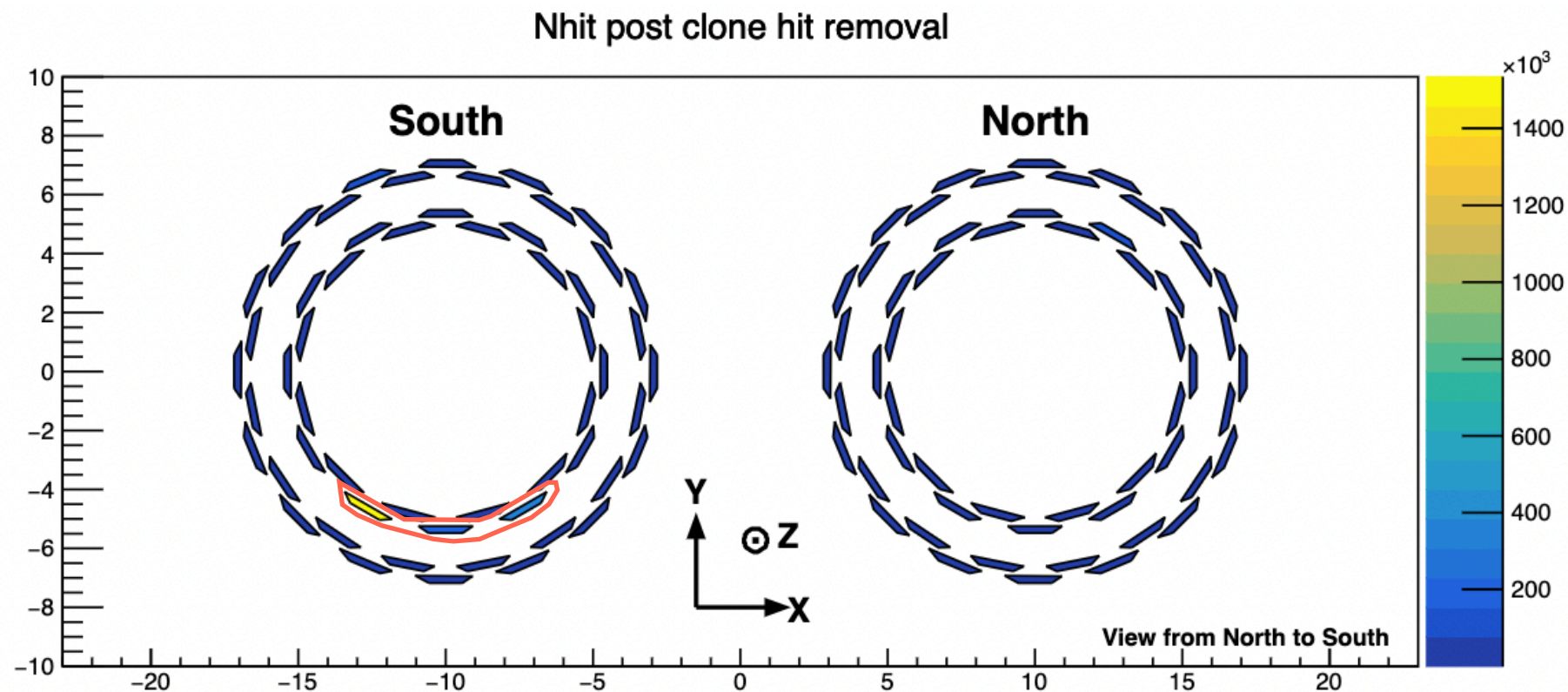
Problematic half-ladders further check

Cosmic run 25952

No hot channel, half-ladder masked,
adc0-single-hit cluster removed

Inner cluster φ

Outer cluster φ

All cluster φ, post tracking
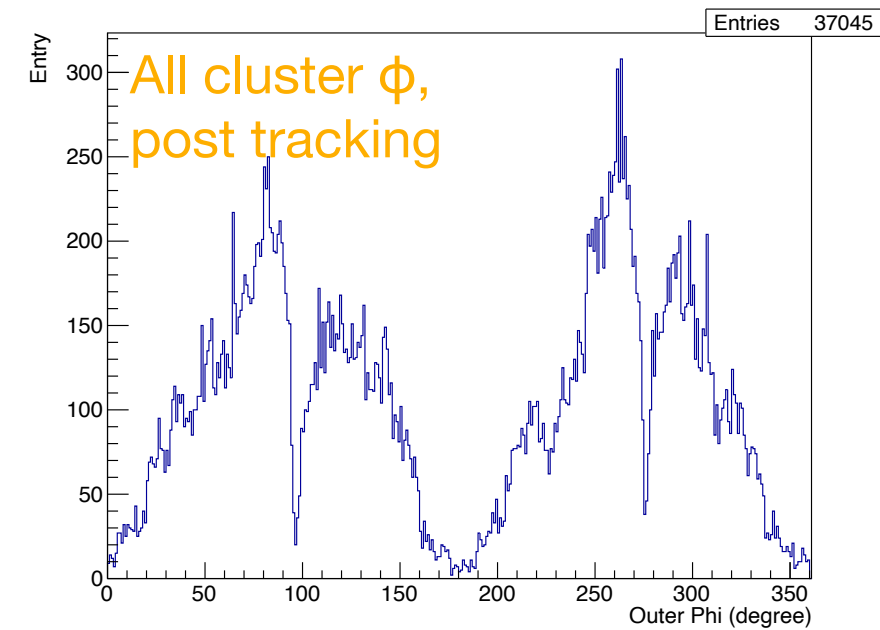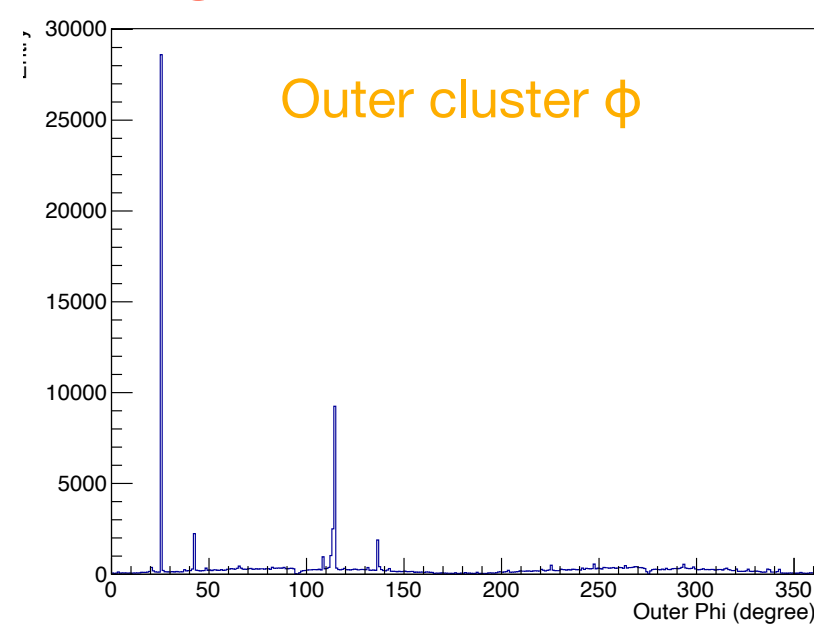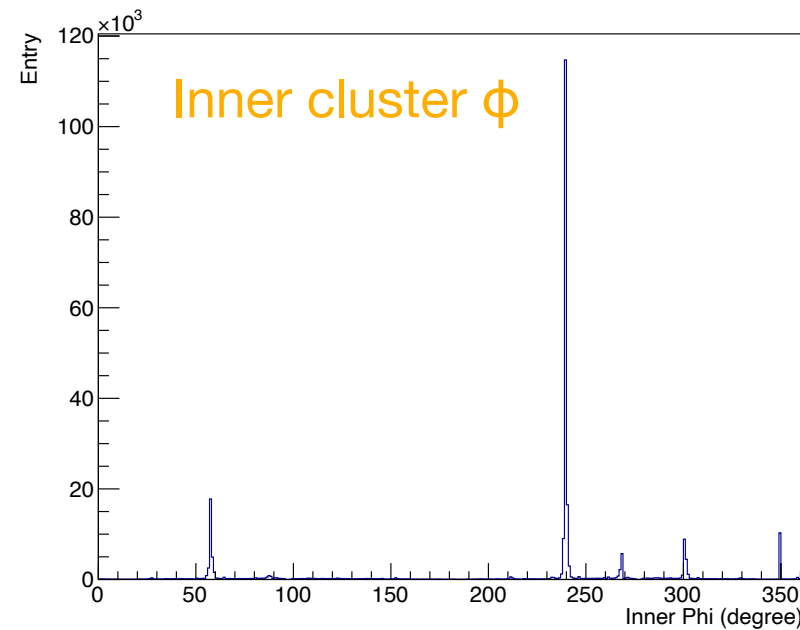
Cluster Pos$_{xy}$ post tracking

inner_outer_pos_xy_post_track_nZ

inner_outer_pos_xy_post_track_pZ

South side

North side

Those ladders seem to be able to provide good clusters…?

Summary

- Currently, ~ 20k good tracks can be found in a ~ 12 hours cosmic run

- The cosmic DAC Scan run from run8 to run4 is proposed
  - Minimum time required : 3.5 days
  - If possible, run with triggered mode
  - If possible, do the run3 and run9 one day for each

- The correlation of reduced chi2 and track phi implies that the barrel was not close well
  - Survey data seem be able to improve the fitting. It's a right way to go

- The three "problematic" half-ladders seem to be able to provide good clusters. Just hot…?
  - If possible, calibration is the powerful tool to ping done this

Backup

- Landau-Gaussian convolution function for signal region, parameters given by edep distribution from beam test 2019

- [Integral (run threshold, adc7 value) / Integral(15,3000)] * 42368

ifem=1 chip=45

func_fit

ifem=1 chip=45
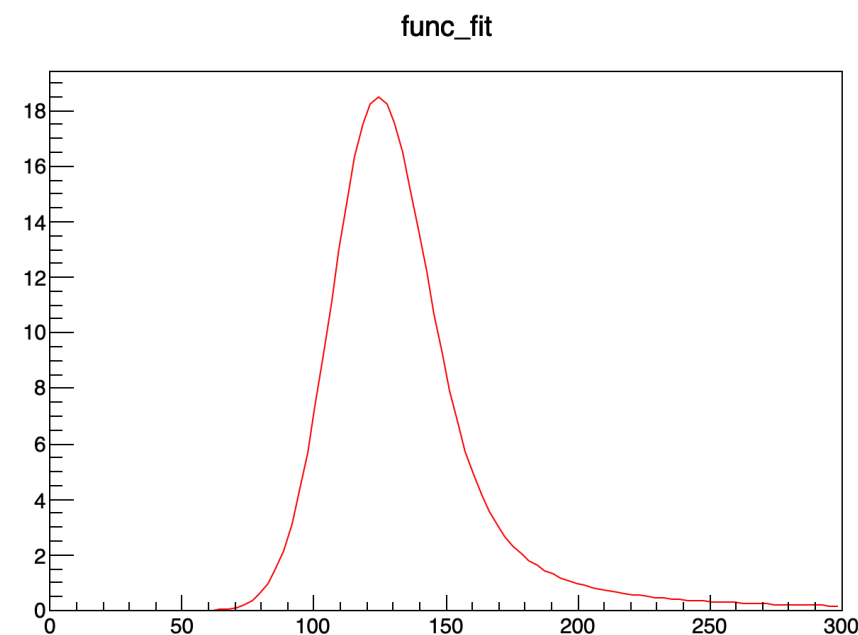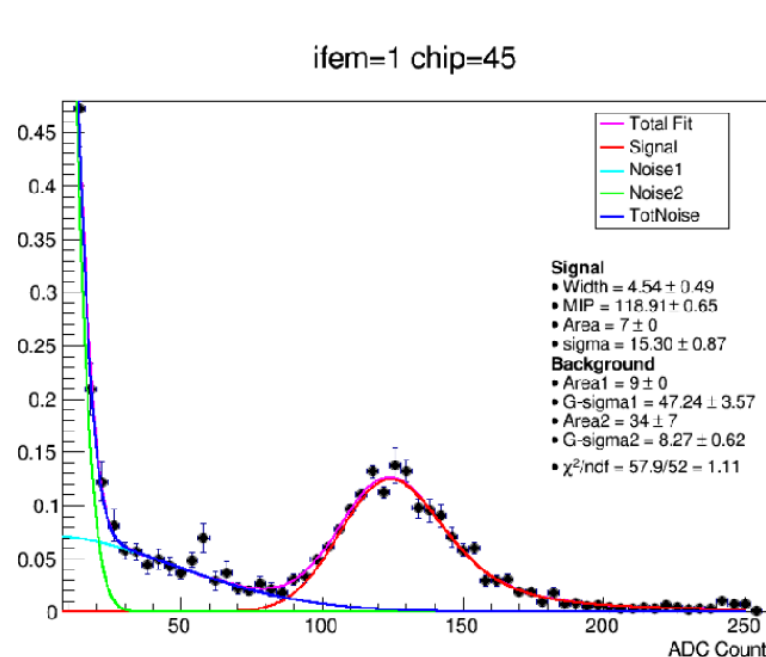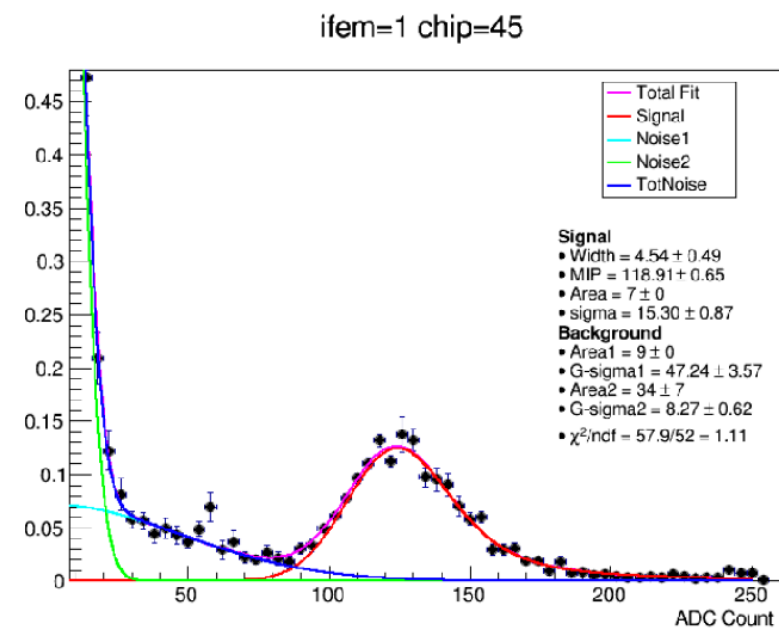
DAC Scan

Extend to max range

Scan	1	2	3	4	5	6	7	8	9	10	11	12
DAC0	8	28	48	68	88	108	128	148	168	188	212	236
1	12	32	52	72	92	112	132	152	172	192	216	240
2	16	36	56	76	96	116	136	156	176	196	220	244
3	20	40	60	80	100	120	140	160	180	200	224	248
4	24	44	64	84	104	124	144	164	184	204	228	252
5	28	48	68	88	108	128	148	168	188	208	232	255
6	32	52	72	92	112	132	152	172	192	212	236	255
7	36	56	76	96	116	136	156	176	196	216	240	255

- BigPartition together with MBD (Must) no need to be a dedicated run
- Can be done with n_collision=127 (w/o waiting for asynchronous timing issue btwn intt servers.
- 12 settings
- > 1M events at ~400Hz
- ~ 12 hours total
- If the series of data are interrupted by the beam dump, repeat the same setting as the last run at the last store.
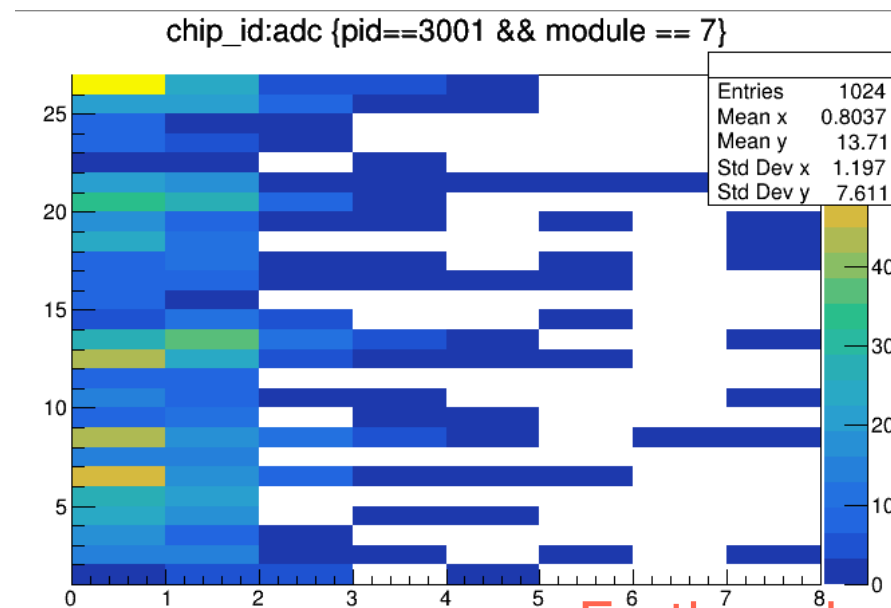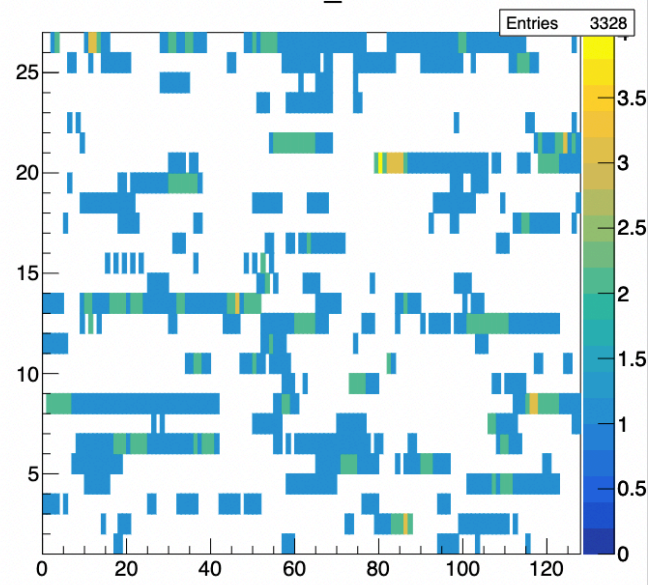
3

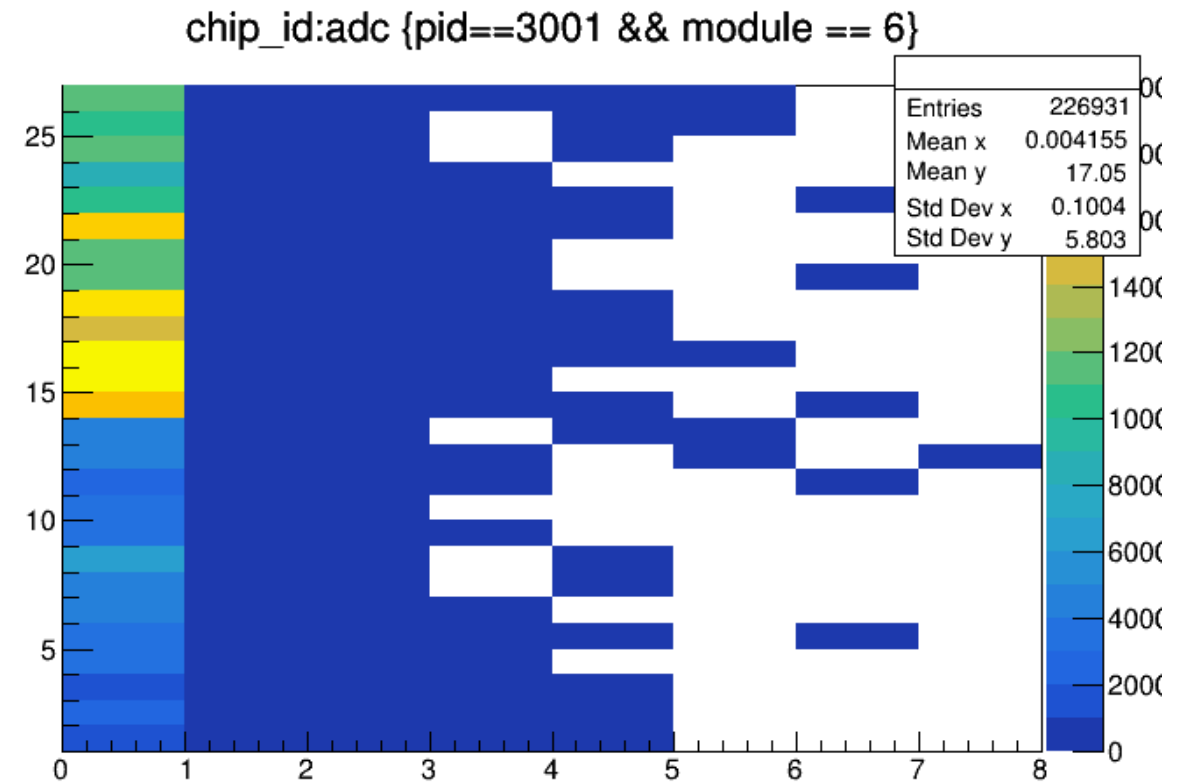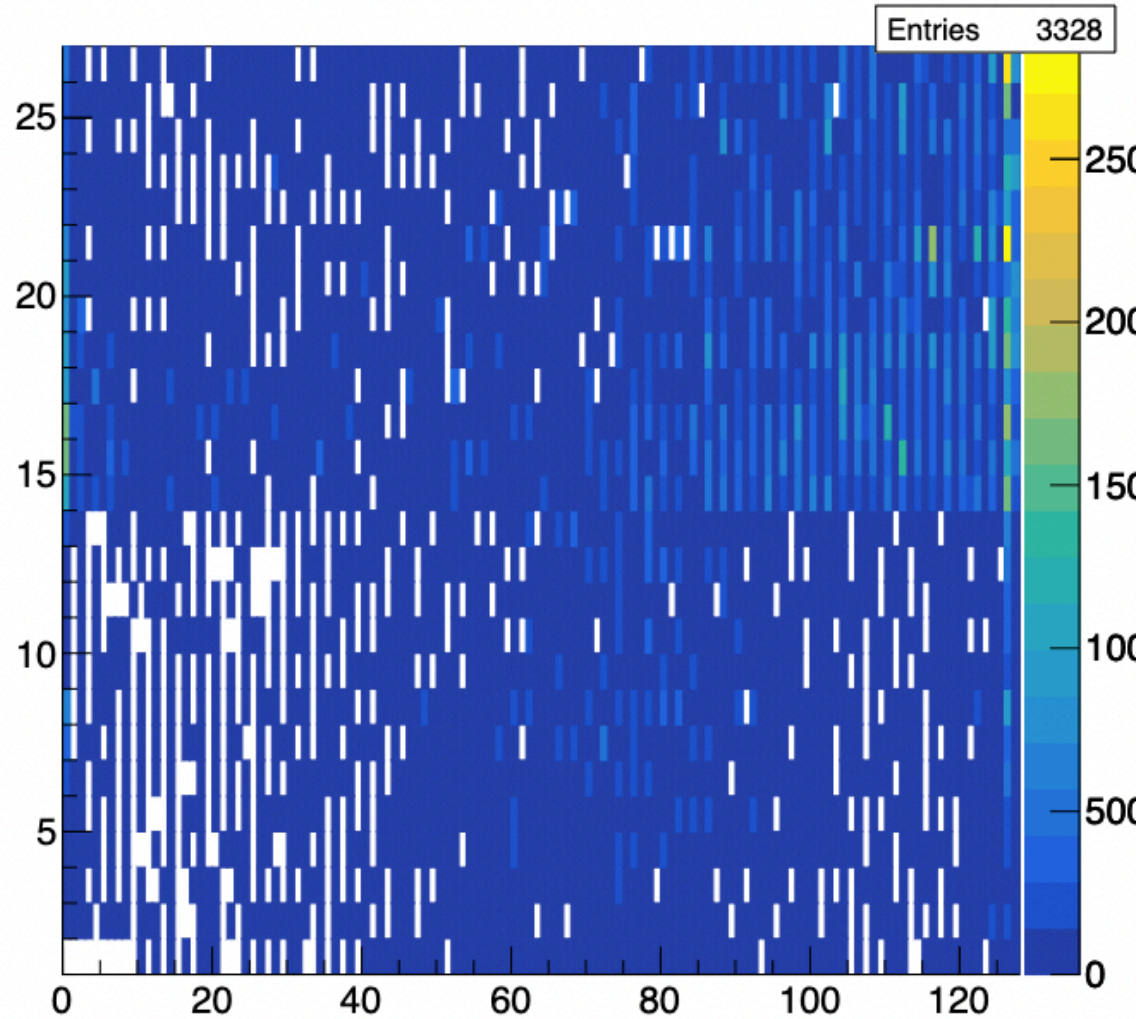# Intt0_1 (B0L101S, RC-0S, Port C1)

Cosmic run 25952
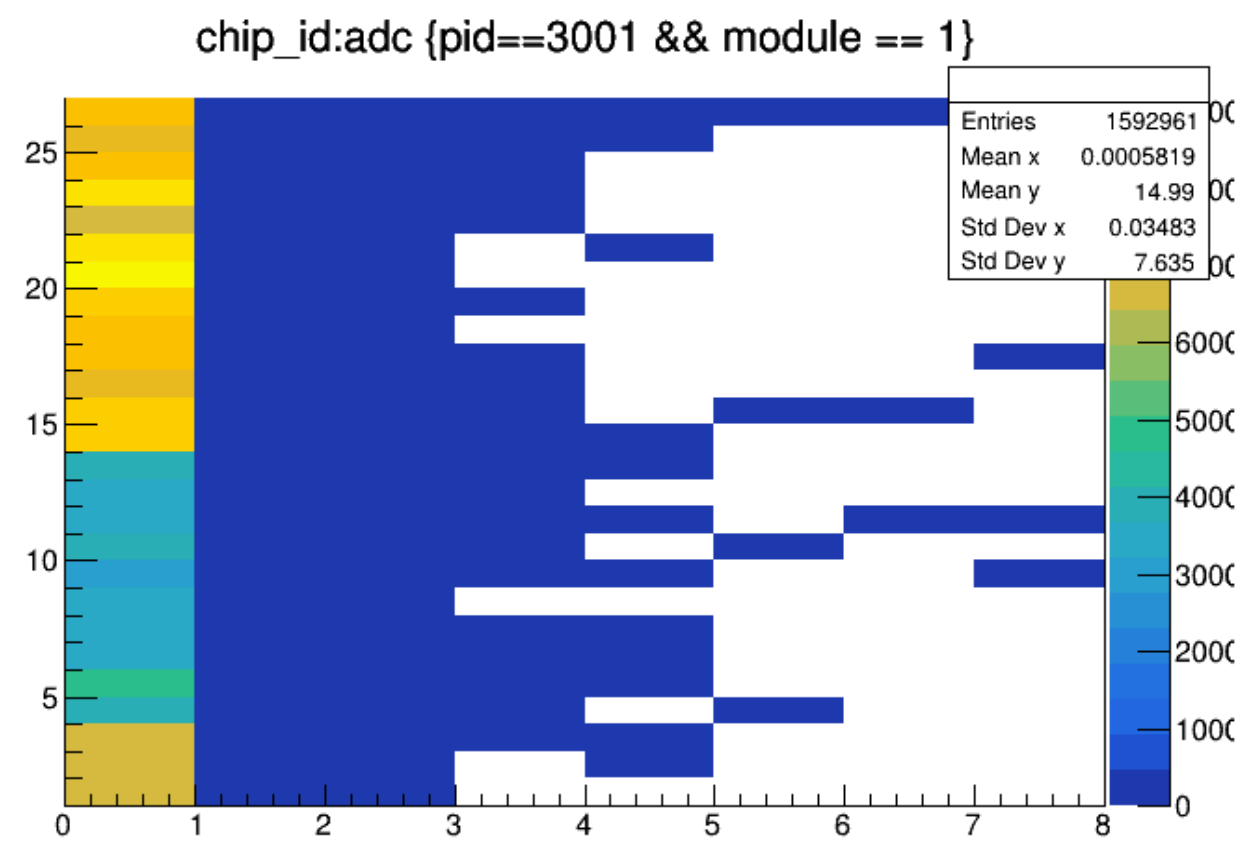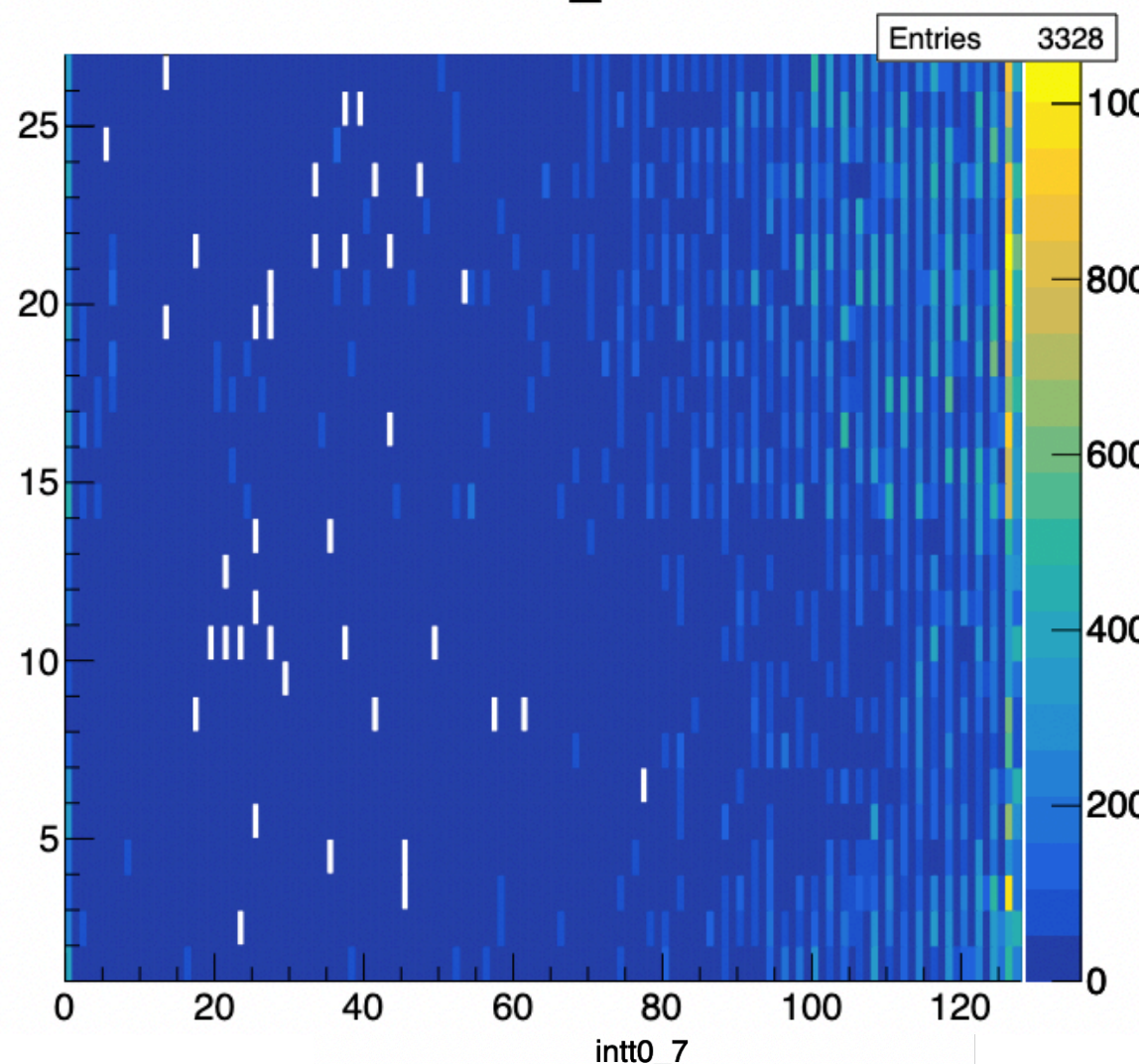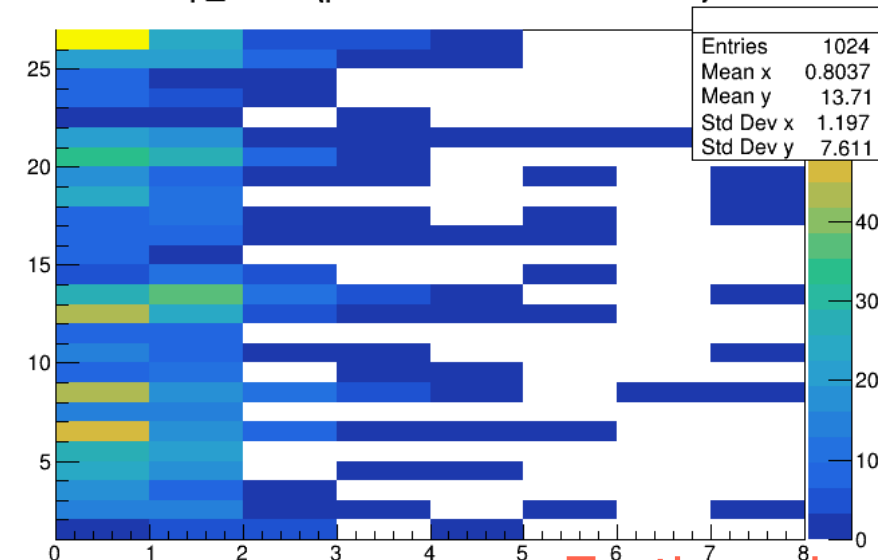
Nominal

Further checks needed

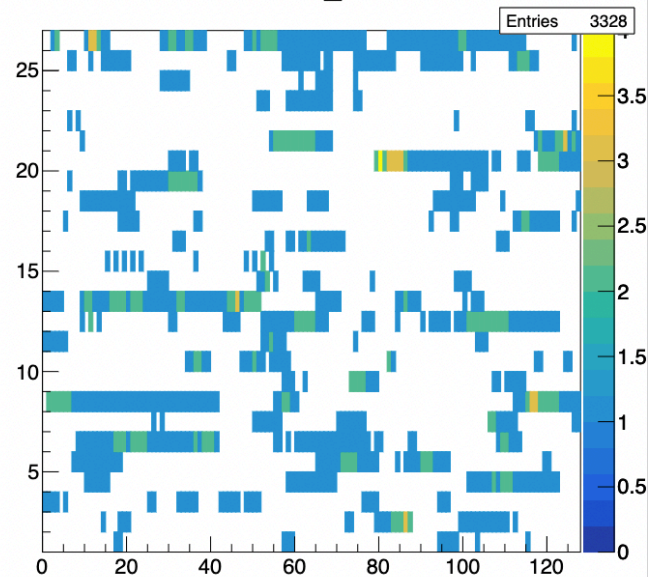Cosmic run 25952

Nominal

Further checks needed

Cosmic run 25952
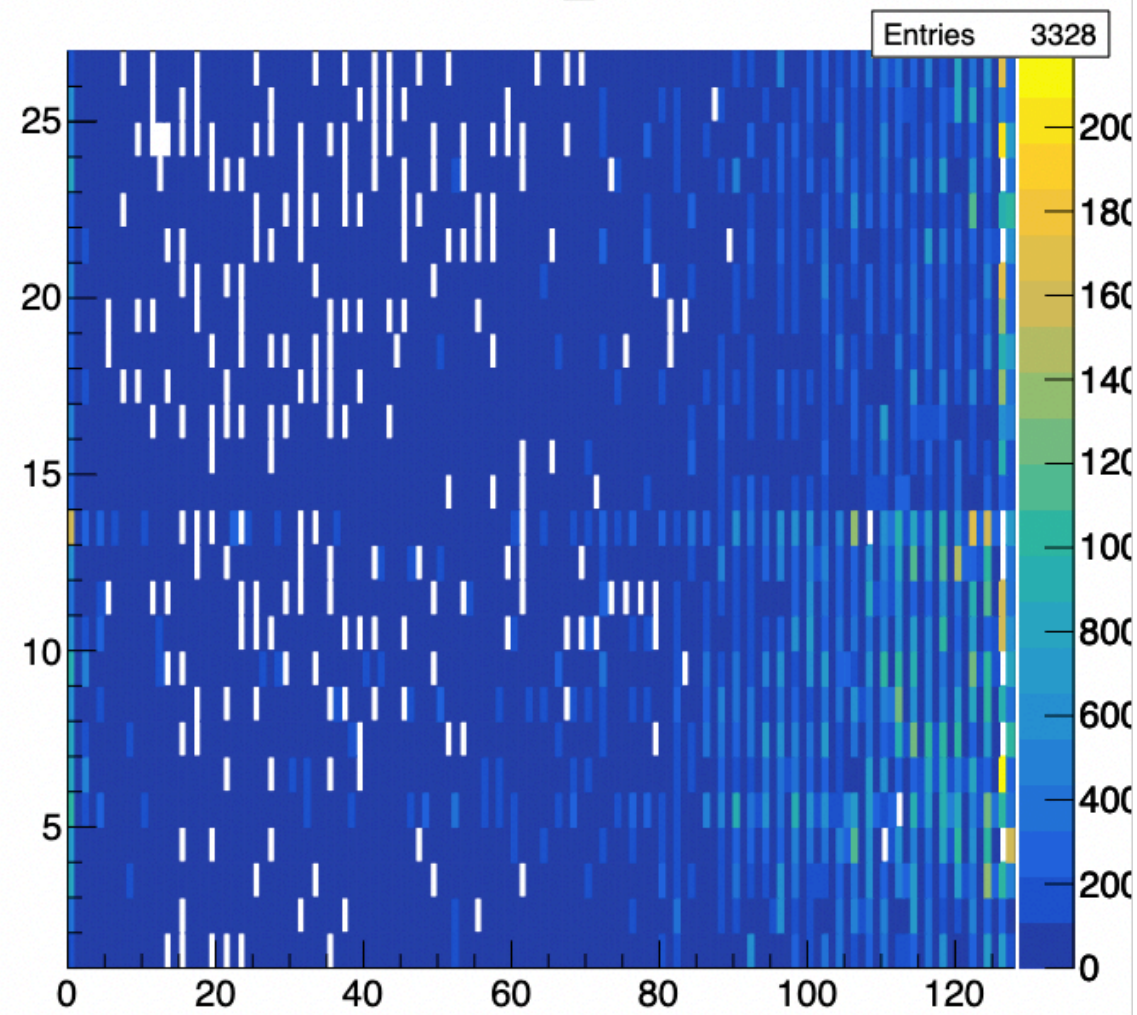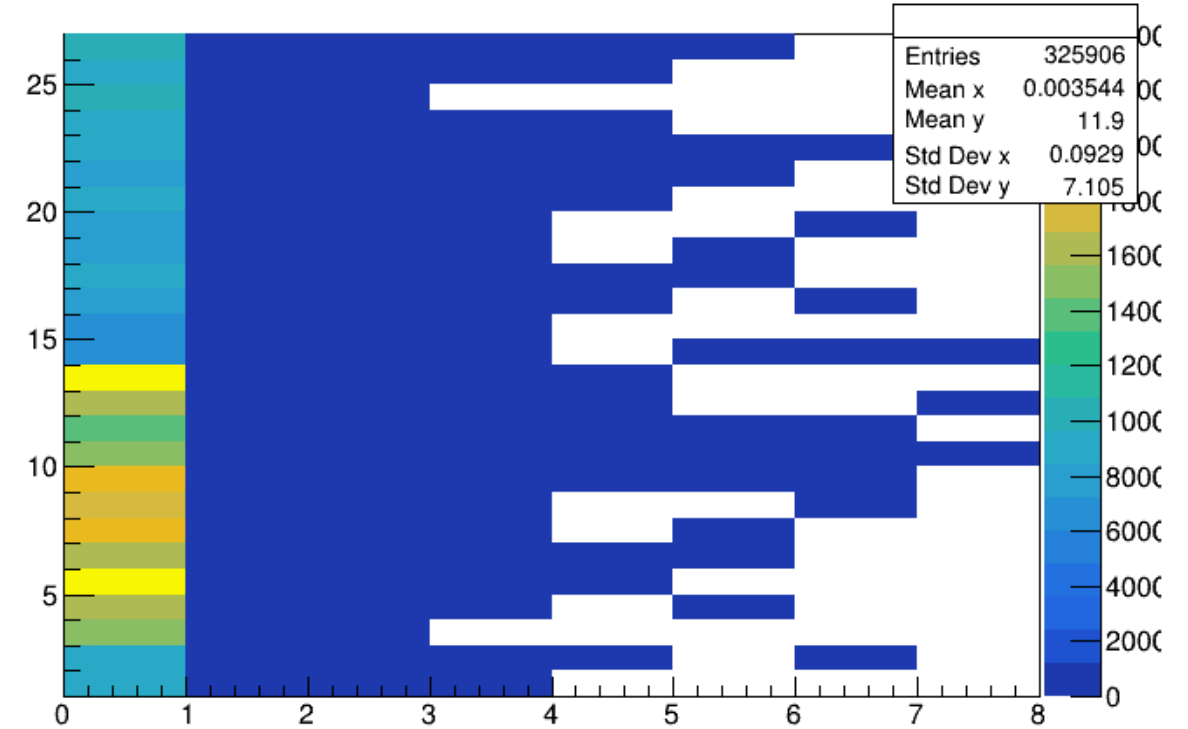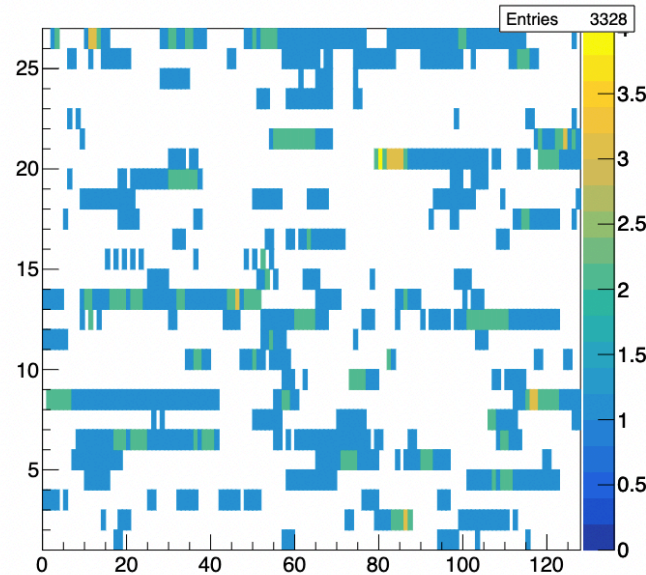
Nominal
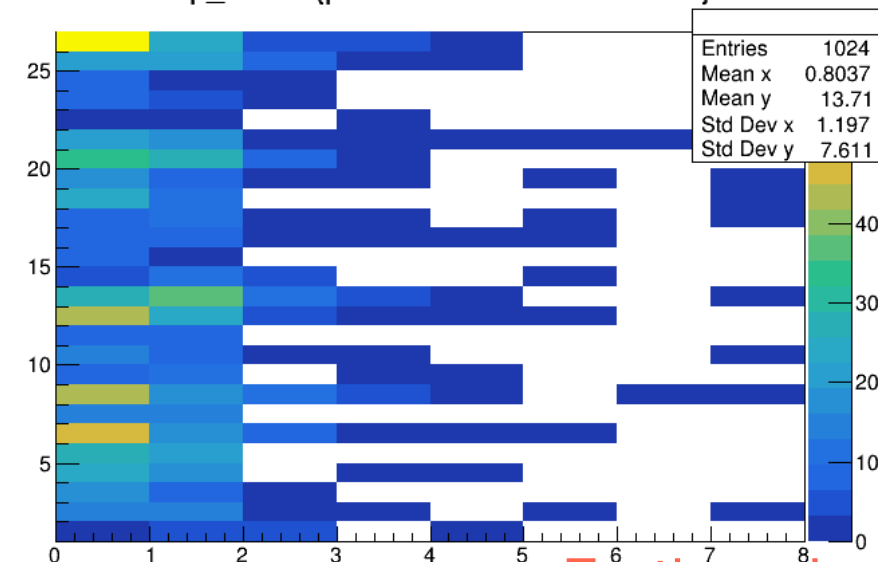
Further checks needed

Plot has to be mirrored

TH2INTT - current INTT chip alive efficiency

Chip alive : the chip that can read the **collision** data

According to : Latest INTT status on wiki

INTT chip alive efficiency, May 24 2023

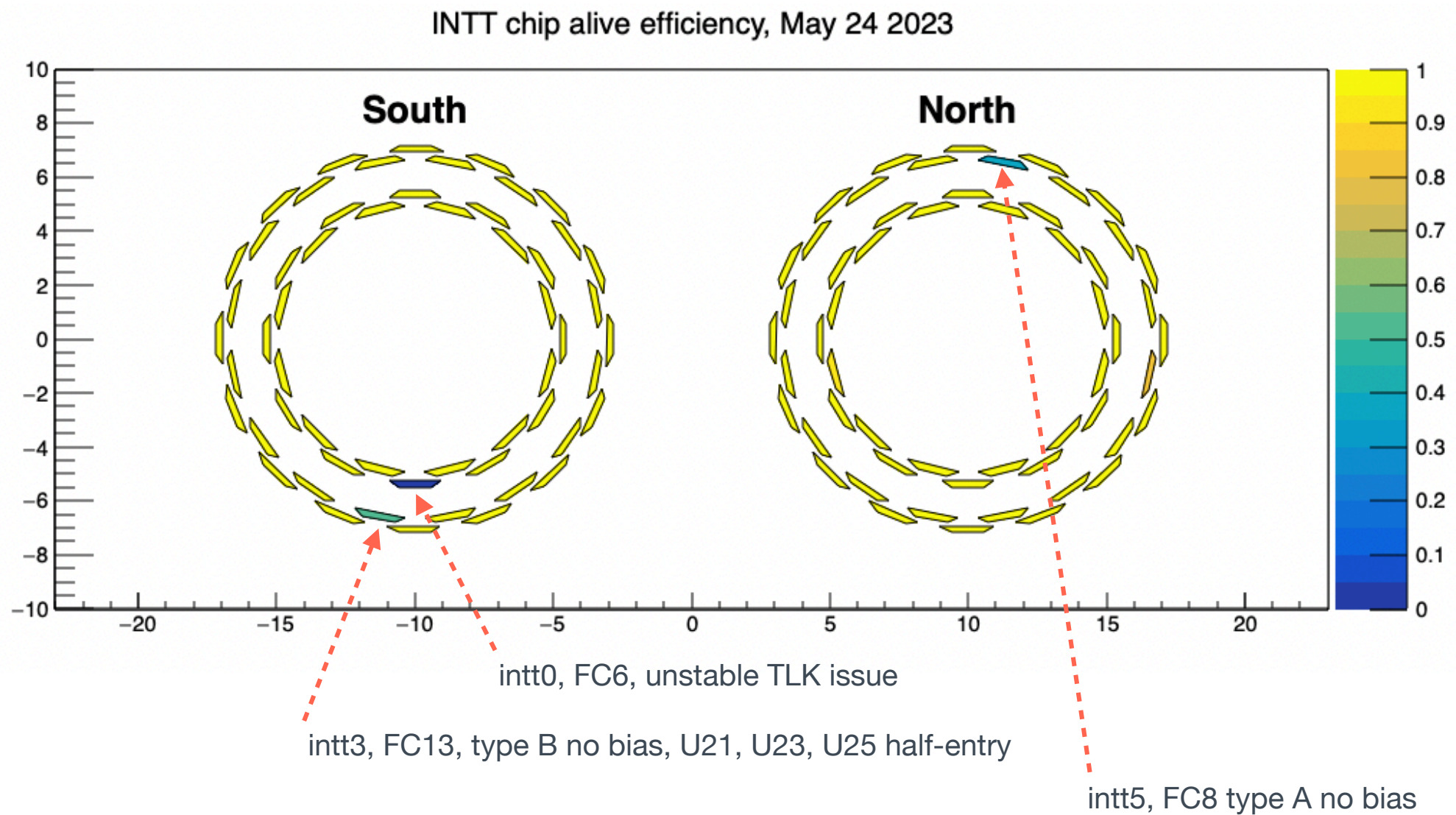South   North

intt0, FC6, unstable TLK issue

intt3, FC13, type B no bias, U21, U23, U25 half-entry

intt5, FC8 type A no bias

General speaking (only up to chip level) : 2849 / 2912 chips are good

INTT meeting   Cheng-Wei Shih (NCUHEP, Taiwan)   2

Double_t **Chisquare** (TF1* f1, Option_t* option = "") const

Return the chisquare of this graph with respect to f1.
The chisquare is computed as the sum of the quantity below at each point:

$$\frac{(y-f1(x))^2}{ey^2+(\frac{1}{2}(exl+exh)f1'(x))^2}$$

where x and y are the graph point coordinates and f1'(x) is the derivative of function f1(x).
This method to approximate the uncertainty in y because of the errors in x, is called
"effective variance" method.
In case of a pure TGraph, the denominator is 1.
In case of a TGraphErrors or TGraphAsymmErrors the errors are taken
into account.
By default the range of the graph is used whatever function range.
 Use option "R" to use the function range