

# HIT MAP OF LARGE Z CLUSTER

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# topics

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- I made Hit map with Z Cluster size= 8

# Why I made hit map?

- Purpose : to understand whether large Z Cluster is
- due to particles moving almost parallel to the beam axis,
- due to accidental coincidence,

channel4				
channel1				
	chip1			chip4

channel4				
channel1				
	chip1			chip4

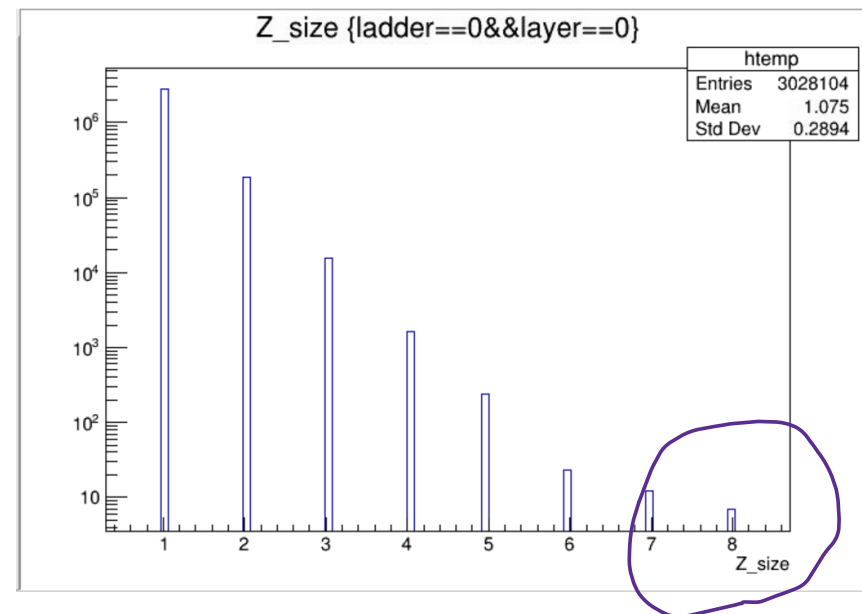
# Using data information

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- I used run20869,Au+Au,No Magnetic field.
- Number of event is 100k
- Original data was Decode by Genki, (it was same as data using ToyMC model study.)
- Bco cut,hot cut were applied, but I didn't confirm that same cut were applied between cluster and row hit.

# Select one ladder

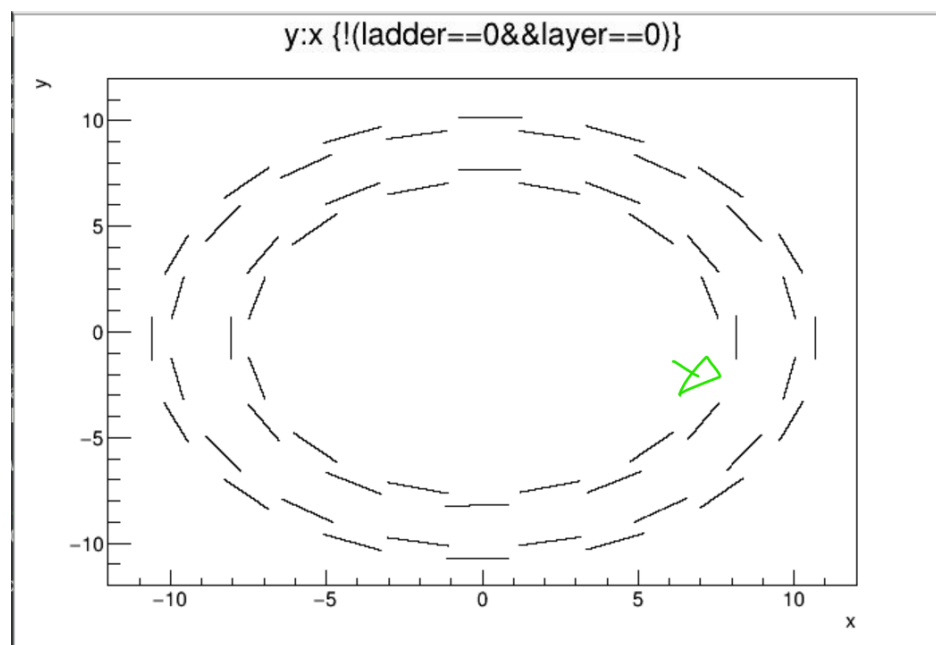
- For simplicity,
- I selected one ladder(layer=0&ladder=0).
- I made hit map of this ladder event by event when this ladder has z size =8 cluster.
- Plot1.Z size distribution with ladder 0&&layer0.



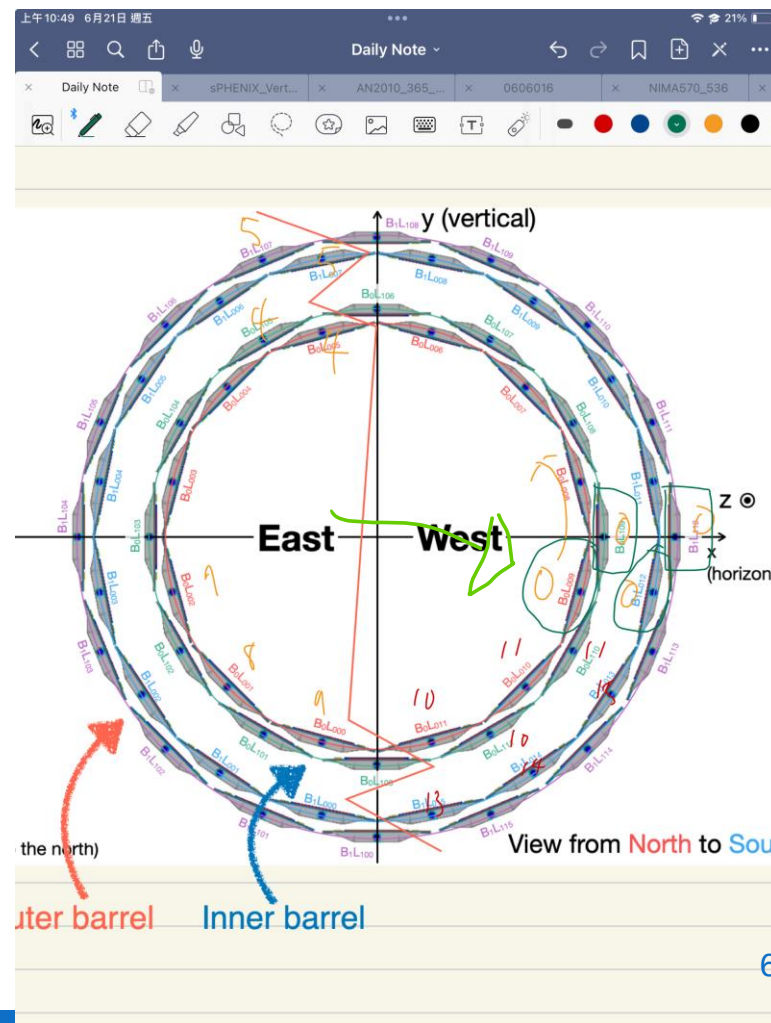
7 EVENTS 5

# check the ladder name

- Compare plot2 to plot3, name of ladder0 & layer0 is B0L009.
- Plot2. x:y position of ladder0 & layer0.



- Plot3.



# result

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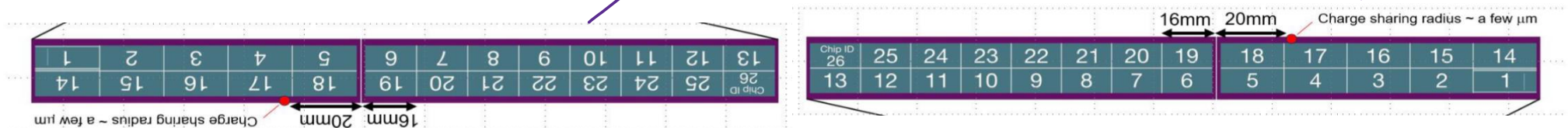
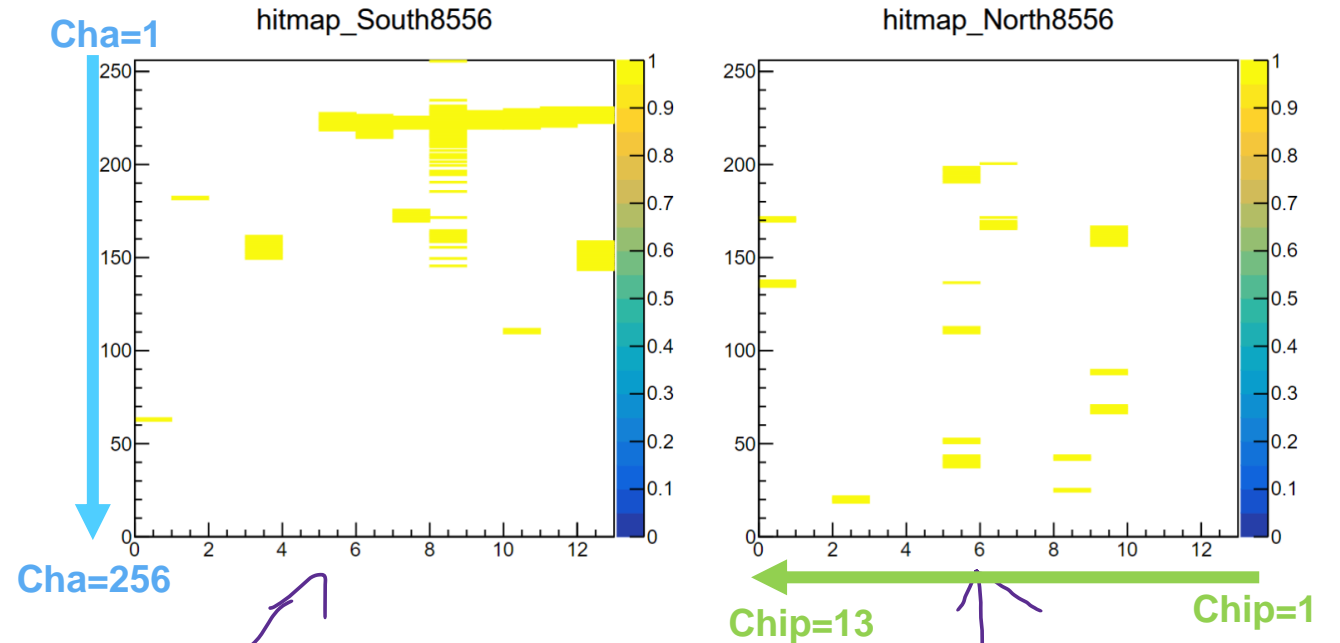
- In this ladder, I found 7 events which has z size=8.
- It is written in the following order,
- name of ladder , event number , zID(zID=0 and 1 are south,zID=2,3 are North),Zsize,Phi size

```
root [0]
Processing hitmap3.cc...
lay0ladder0 EVENT NUMBER=8556,zID=0, Z_size=8, Phi_size=23
lay0ladder0 EVENT NUMBER=22900,zID=0, Z_size=8, Phi_size=49
lay0ladder0 EVENT NUMBER=45103,zID=2, Z_size=8, Phi_size=57
lay0ladder0 EVENT NUMBER=60198,zID=0, Z_size=8, Phi_size=23
lay0ladder0 EVENT NUMBER=61455,zID=0, Z_size=8, Phi_size=42
lay0ladder0 EVENT NUMBER=65569,zID=2, Z_size=8, Phi_size=33
lay0ladder0 EVENT NUMBER=83185,zID=0, Z_size=8, Phi_size=13
```

# result2

Plot3.hit map event number is 8556

- I made the both South and North hit maps.
- Vertical axis is channel id.
- Horizontal axis is chip id.
- to reproduce actual geometry,
- Channel id was reversed in South side.
- Chip id was reversed in North side.

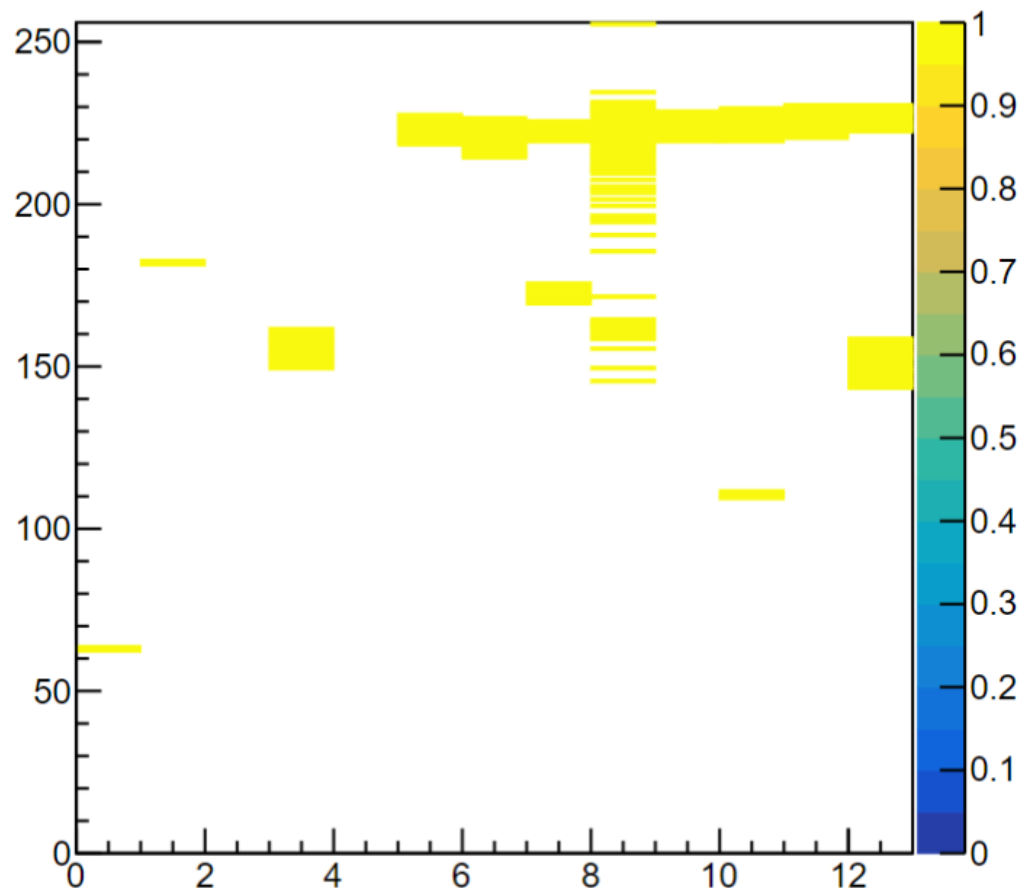


Z vtx

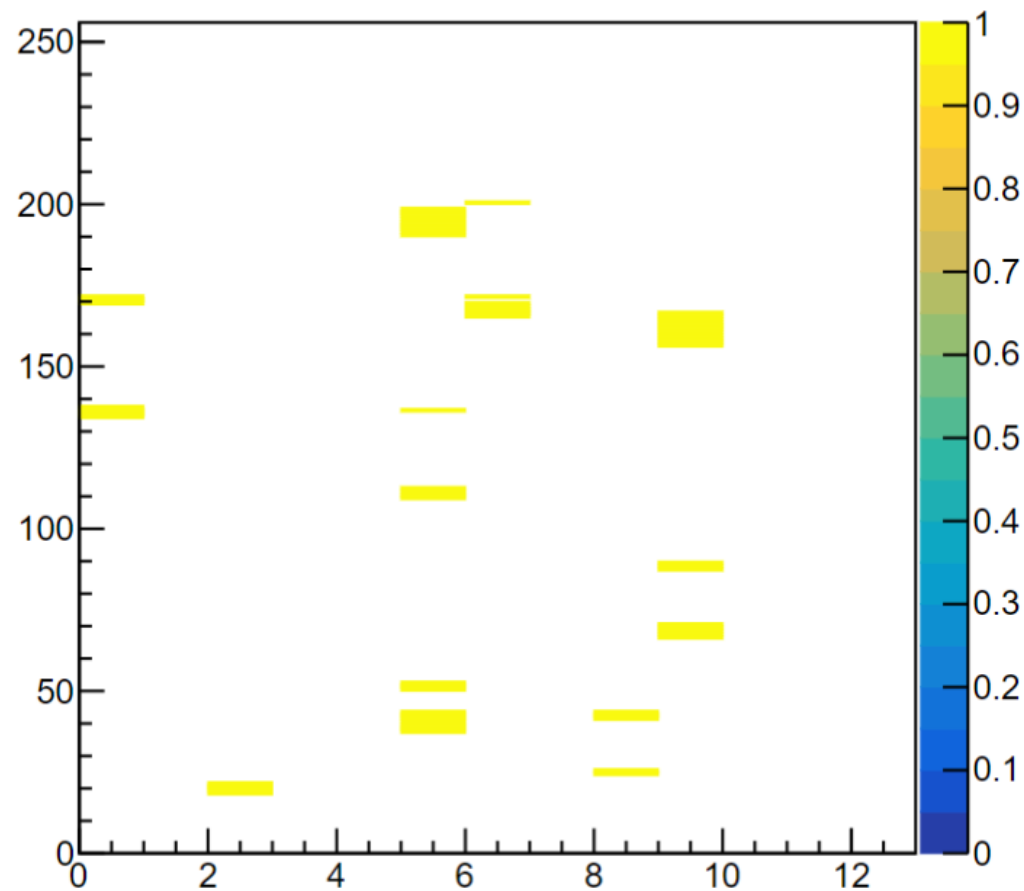


# Phi size = 23

hitmap\_South8556



hitmap\_North8556

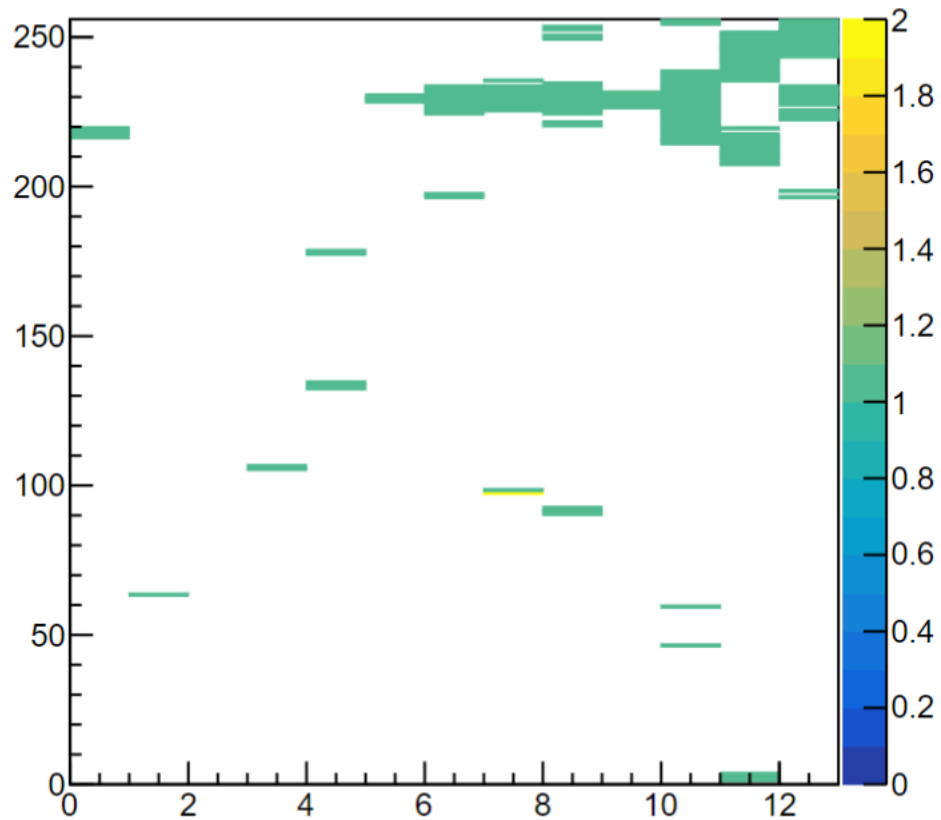


# Phi size = 49

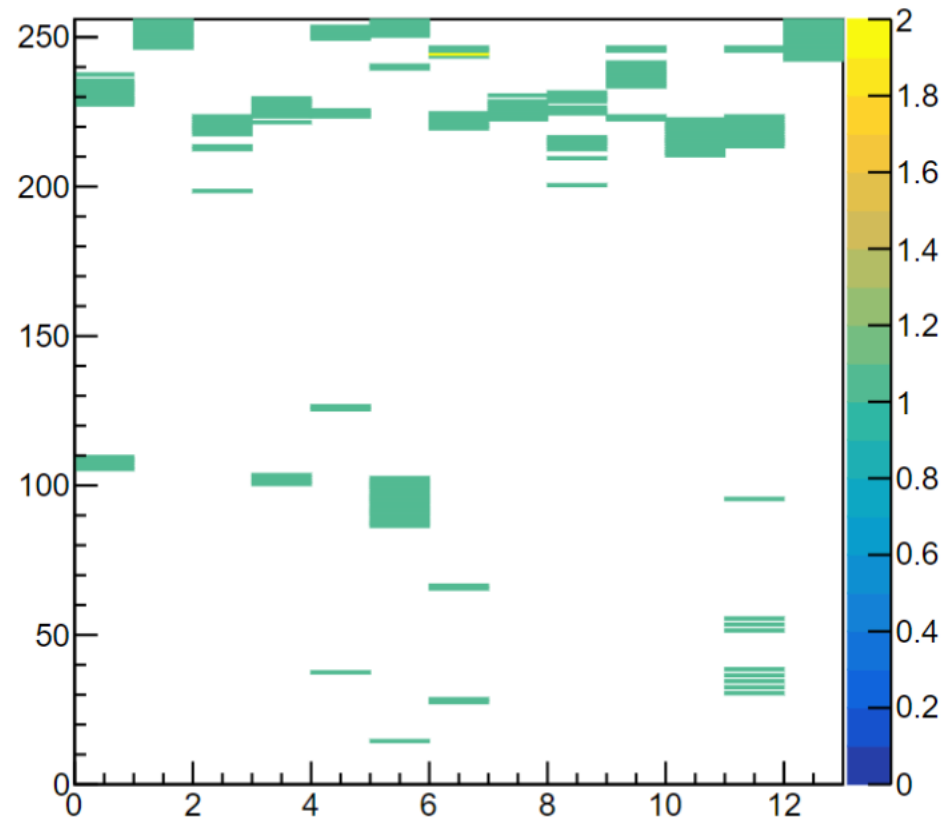
Point

\*It looks like the accidental coincidence due to large phi size.

hitmap\_South22900



hitmap\_North22900



# Phi size = 57

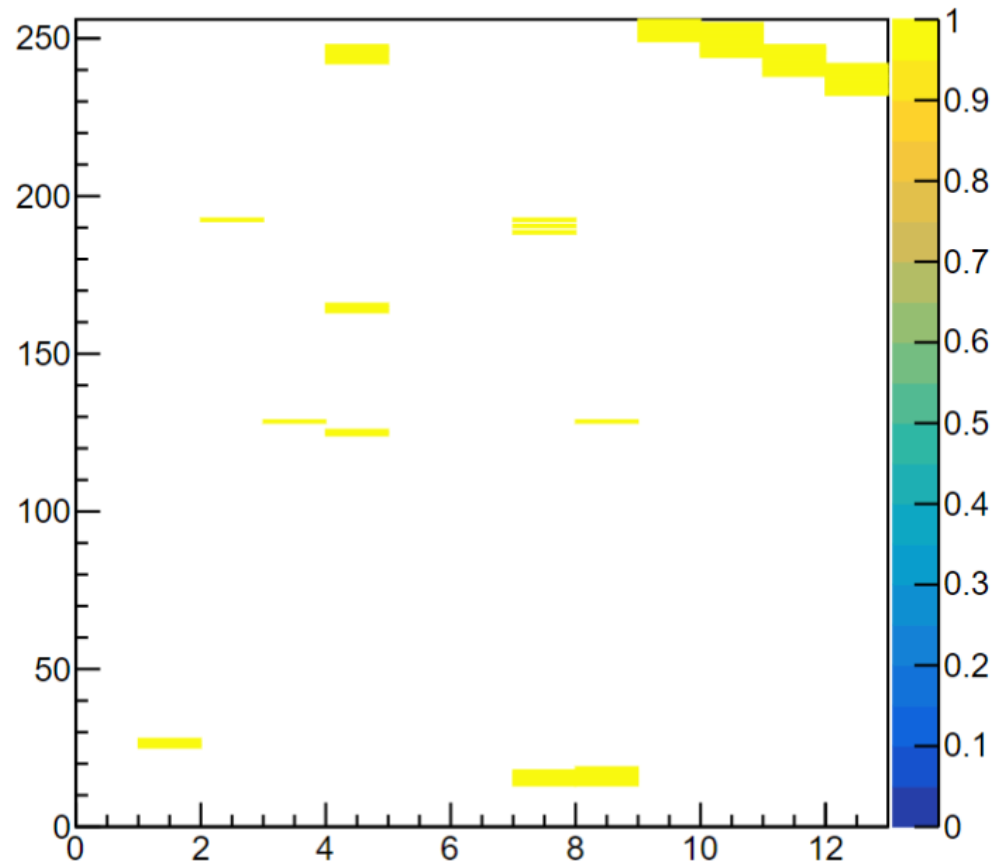
Point

\*Connection between South and North was found.

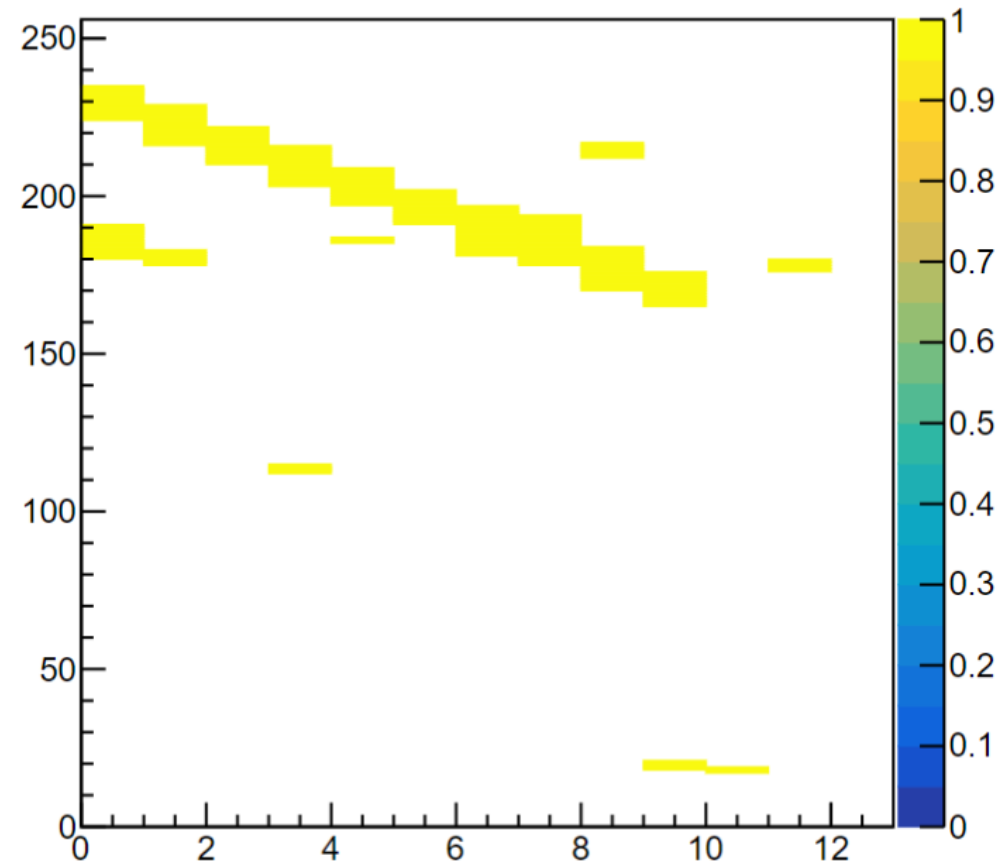
\*Connection between type A and type B was found.

\*There are not charge sharing between S and N ,A and B.

hitmap\_South45103



hitmap\_North45103

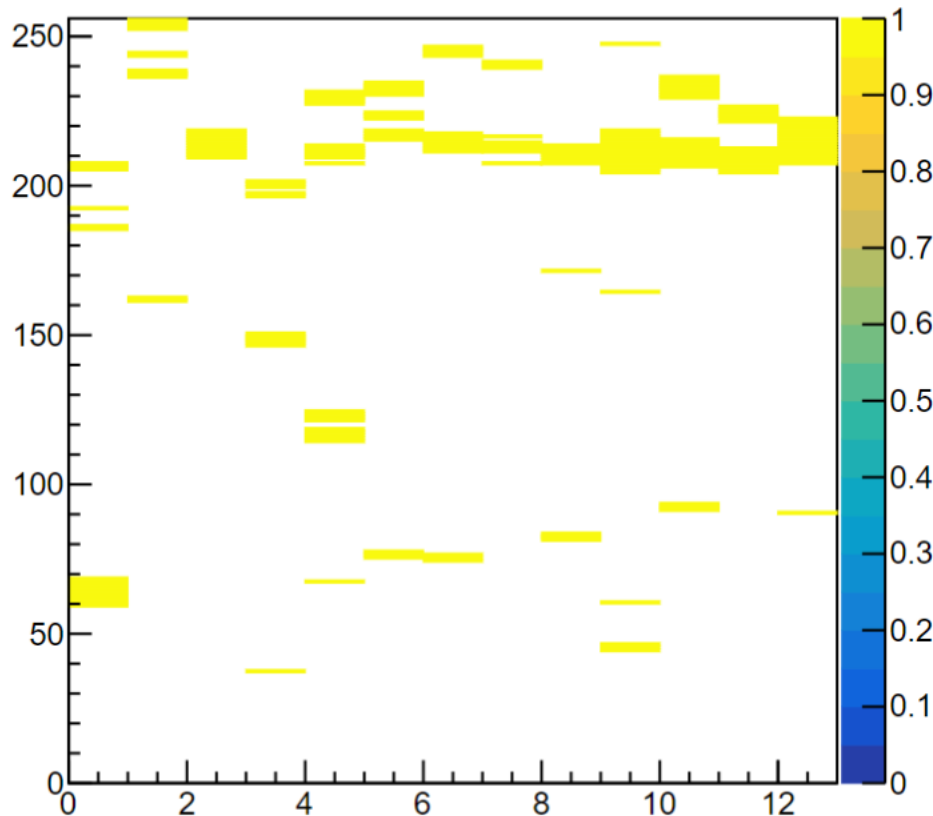


# Phi size = 23

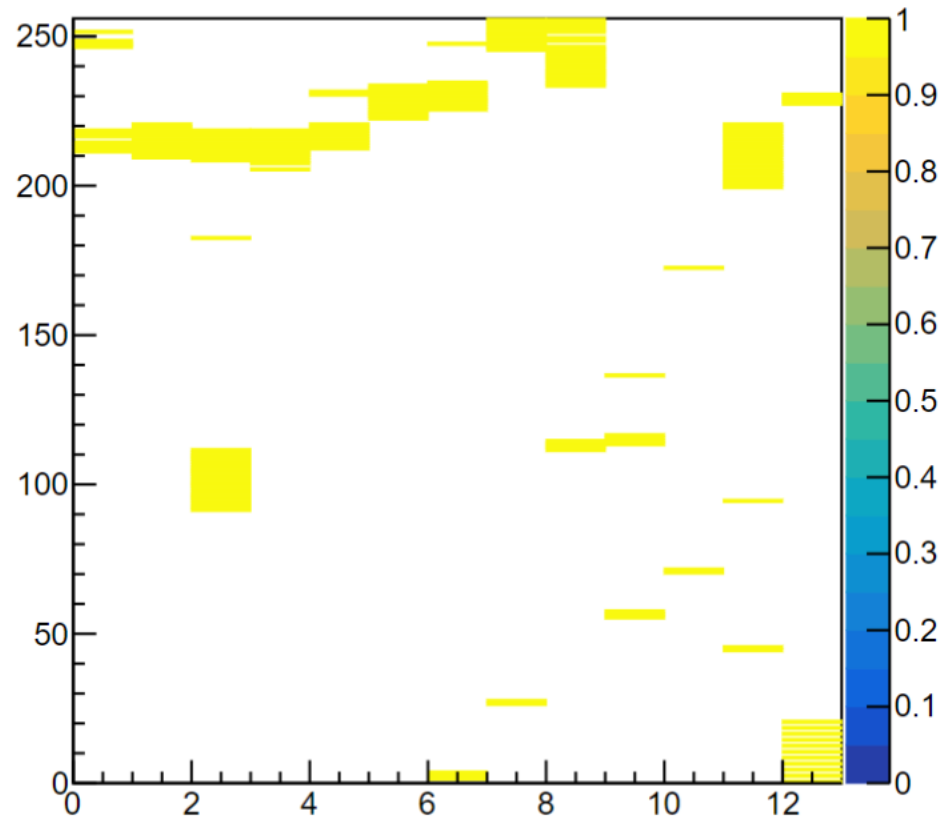
Point

\*It is hard to make comment because connection between S and N might be found, but line was not clearly line.

hitmap\_South60198



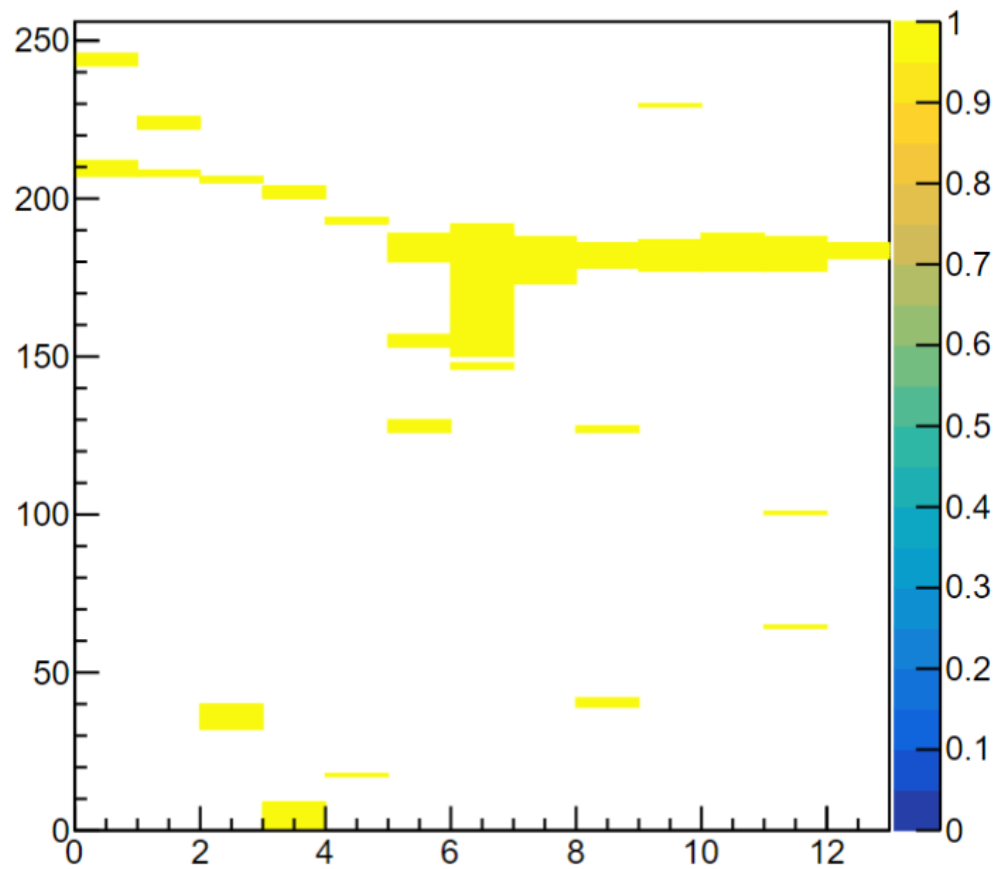
hitmap\_North60198



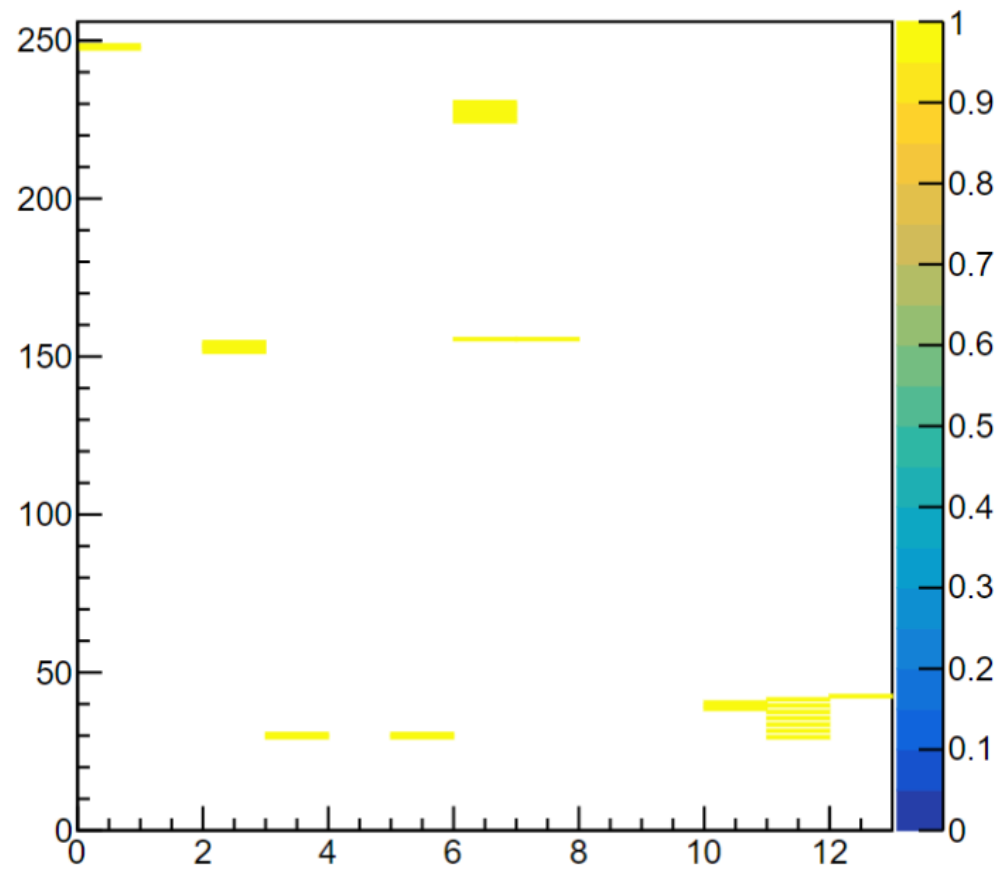
# Phi size = 42

Point  
\* .....

hitmap\_South61455



hitmap\_North61455



# Phi size = 33

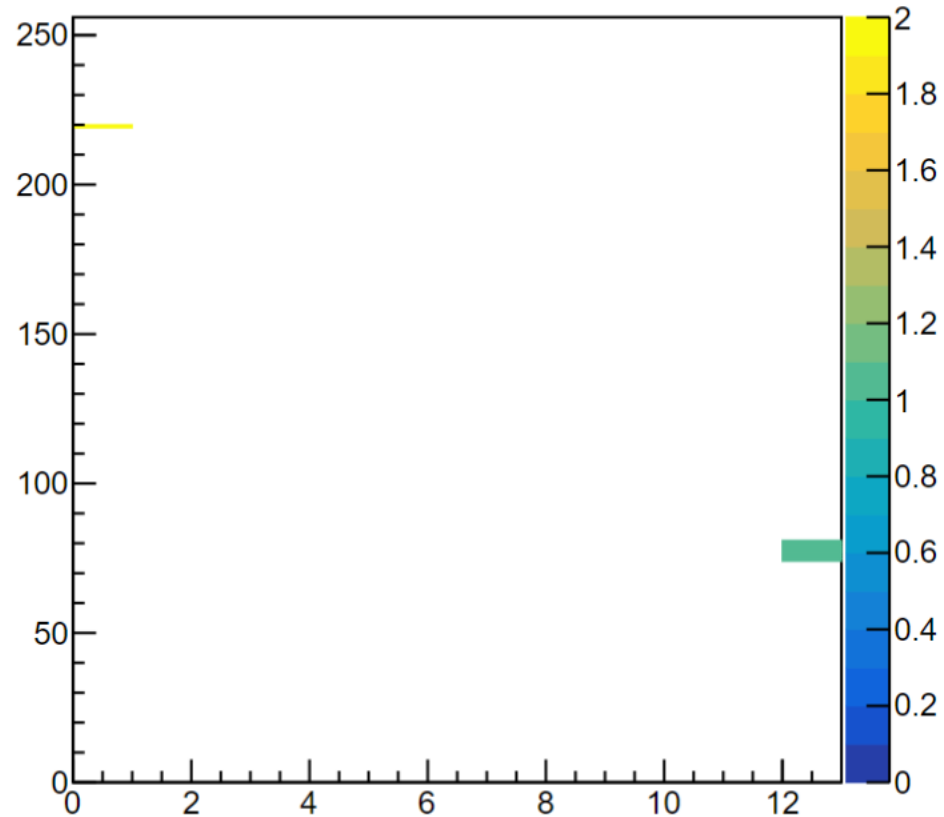
Point

\*Connection between South and North might be found.

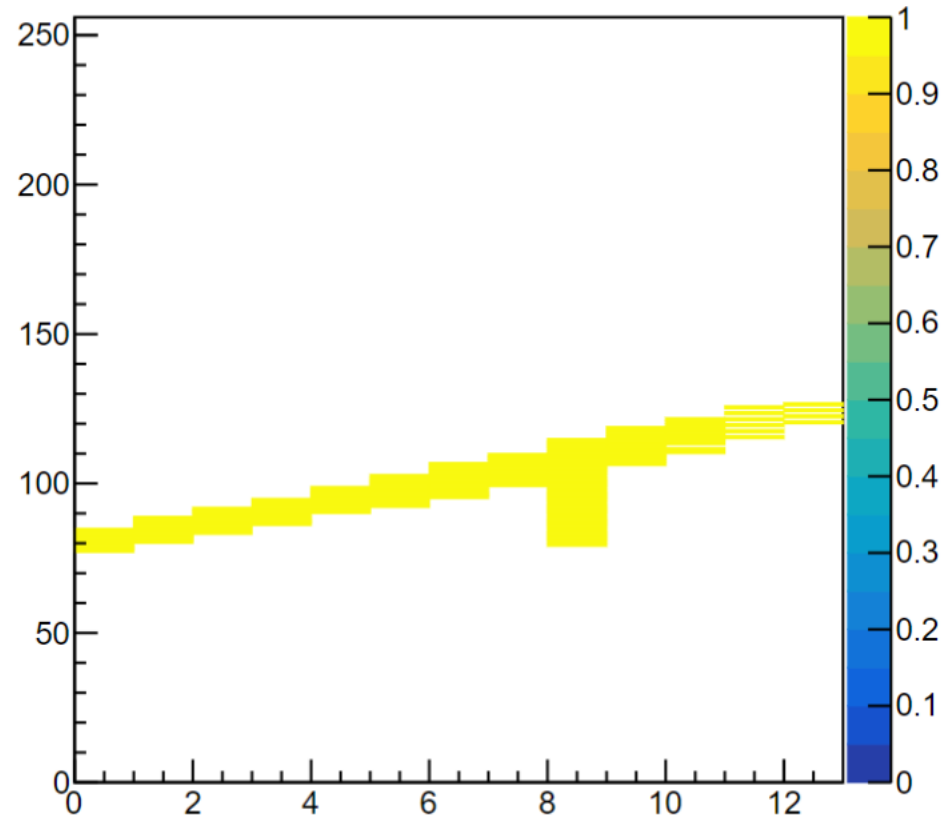
\*Connection between type A and type B was found.

\*There are not charge sharing between S and N ,A and B.

hitmap\_South65569



hitmap\_North65569



# Phi size = 13

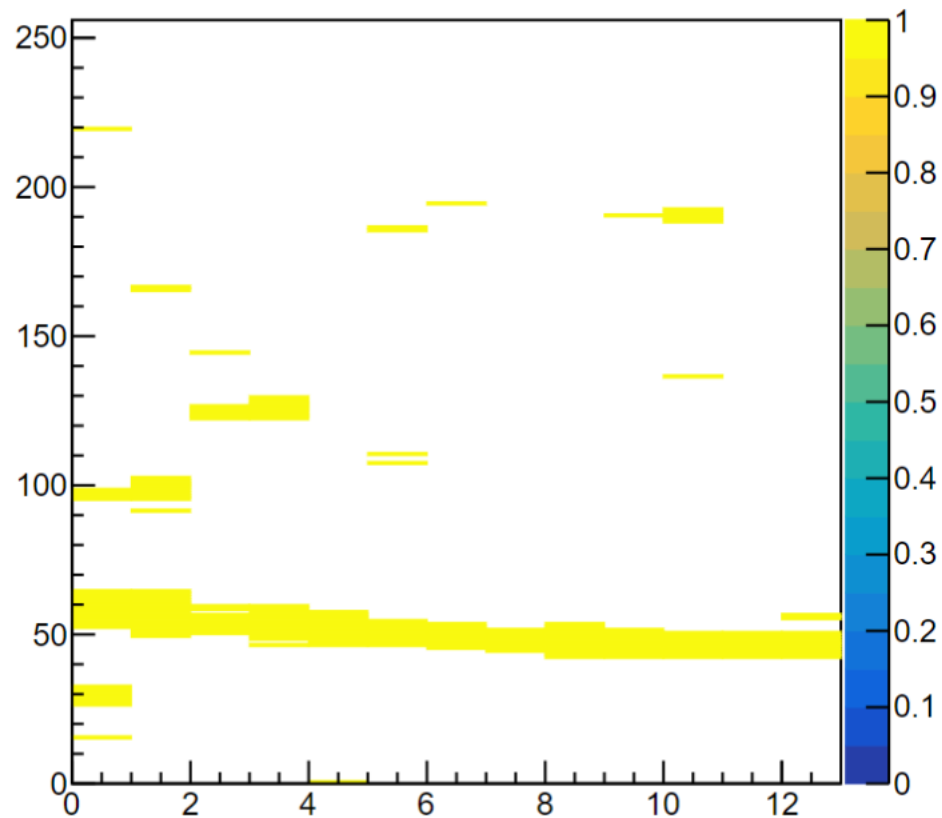
Point

\*Connection between South and North was found.

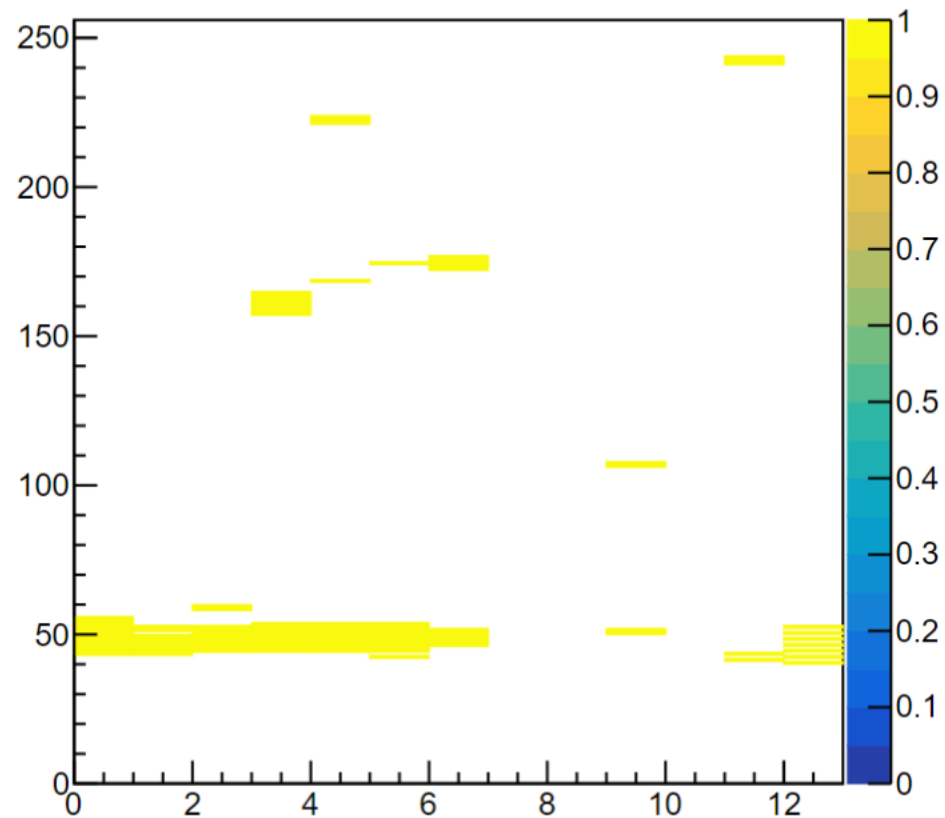
\*Connection between type A and type B was found.

\*There are not charge sharing between S and N ,A and B.

hitmap\_South83185

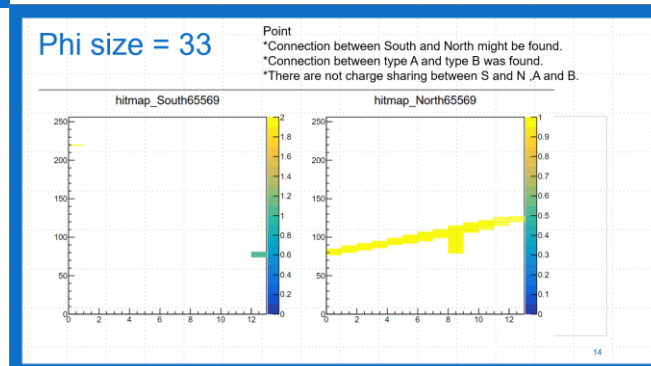
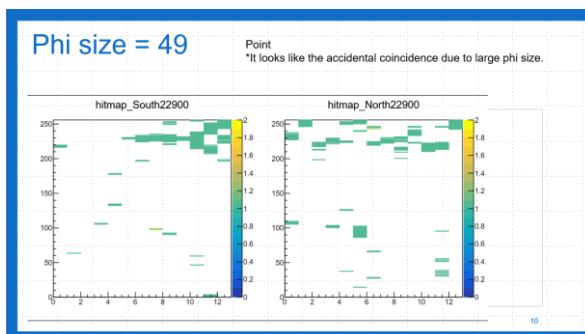


hitmap\_North83185



# ToyMC model

- Discussion from compere data to ToyMC model and this result is consistent.



## Result of the Toy-MC model

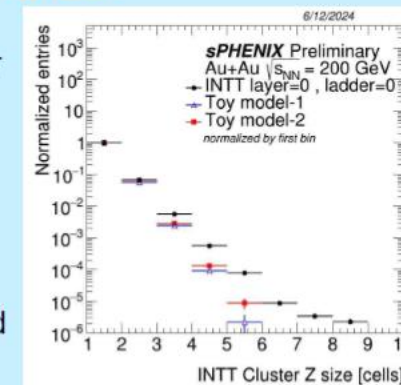
### Model-1. The proof of principle test.

**One expects** the chance to form z-cluster would get smaller and smaller as the size gets larger.

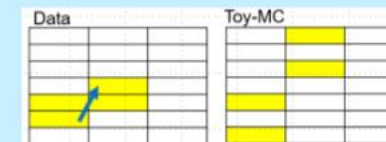
However, the model-1 distribution falls faster than Au+Au data.

### Model-2. Realistic Hit Rates.

**Agreement** between Au+Au data and toy-MC model-2 result is better than that of model-1.



However the MC still undershoots data in higher z-cluster region.



The possible reasons for this disagreement are:

1. Even hit rate is data driven, the hit patten is not sufficiently realistic in MC, e.g. missing correlated hit cluster.
2. Possibility of real trajectories parallel to the beam line.

**Work in progress, Please give me your idea!**



# conclusion

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- I made hit map of Z size =8.
- I found the both accidental and particle.

# BACK UP

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How did I make hit map

# Flow of make hit map

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- 1 Select one ladder
- -> I selected layer=0&&ladder=0
- 2 check the ladder name
- 3 change the ladder name to Felix id and ladder id
- 4 using TrkClusterContainer, I find event number which has z size = 8 in layer=0&&ladder=0.
- 5 using RawhitContainer, I get raw hit information,
- 6 convert chip and channel
- 7 if (event number and Felix id and ladder id are all expected, hist was filled)

# Using data information

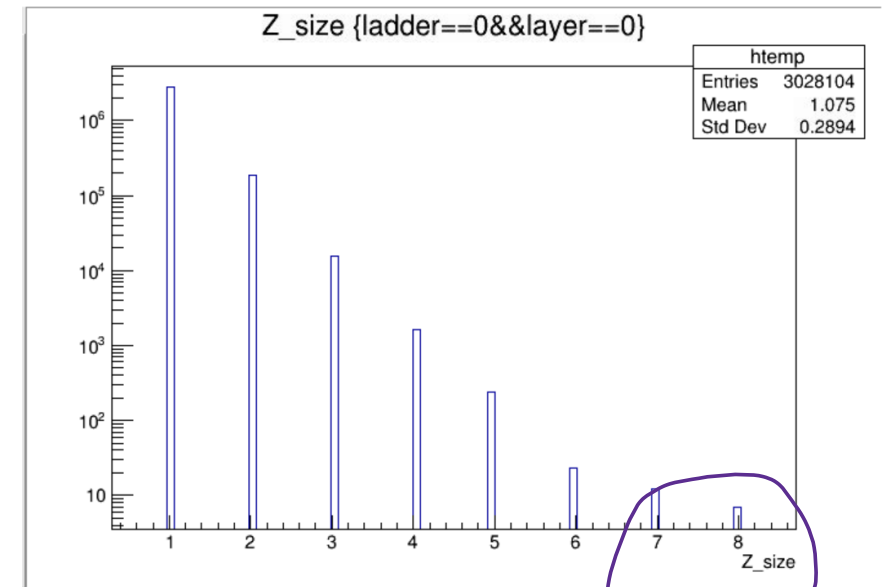
---

- I used run20869,
- Number of event is 100k
- Original data was Decode by Genki, it was same as data using ToyMC model.
- Bco cut, hot cut were applied, but I didn't confirm that same cut were applied between cluster and row hit.

# 1 Select one ladder

- I selected layer=0&&ladder=0
- Select reason,
- It is easy for me to compare past result.

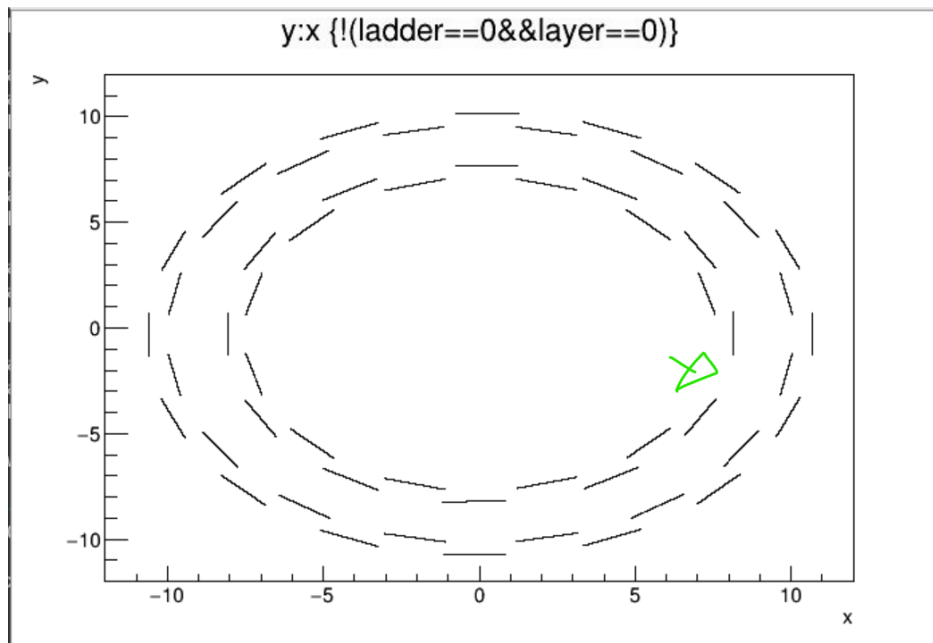
- Plot1.Z size distribution with ladder 0&&layer0.



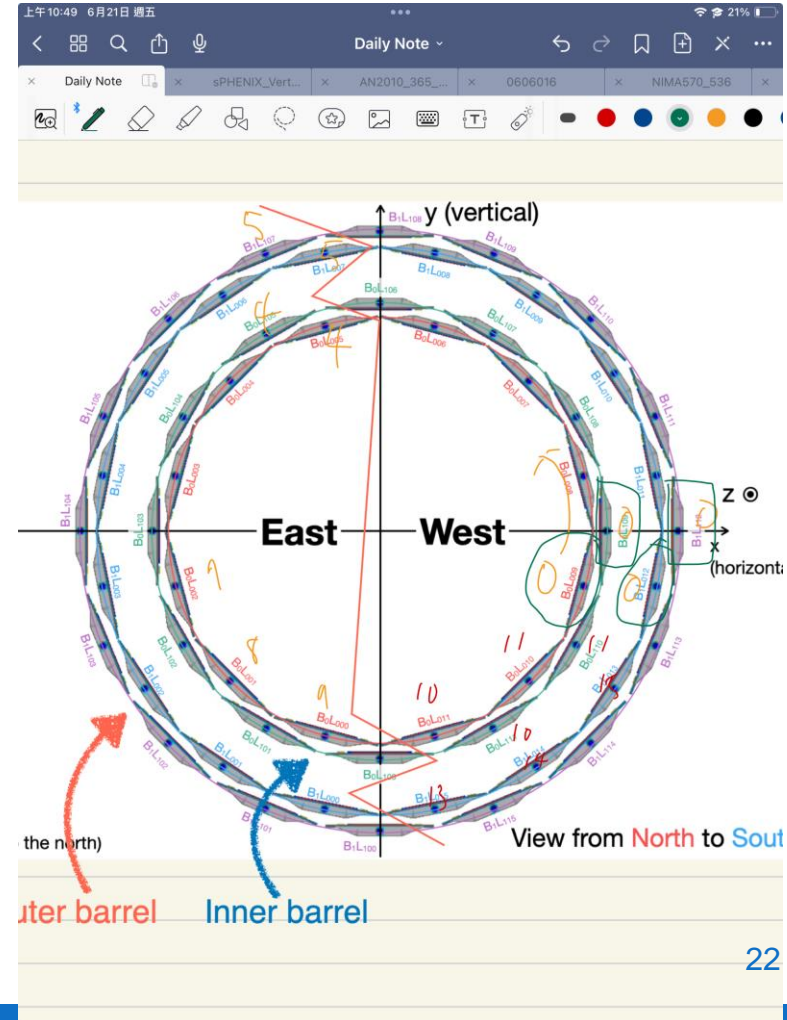
7 EVENTS

# 2 check the ladder name

- Compare plot2 to plot3, name of ladder0 & layer0 is B0L009.
- Plot2. x:y position of ladder0 & layer0.



- Plot3.



# 3 change the ladder name to Felix id and ladder id

- Using the map of ladder.
- Place of map,
- ssh Intt0, cd  
INTT/map\_ladder/2024/intt0\_map\_20240226\_1730.txt
- From plot4 and plot5, B0L005 is (Felix,ladder),(5,11) and (1,8)

## • Plot4. map intt5

```
#felix_ch      ROC_port      Ladder
0      C1      B0L003N
1      B1      B0L104N
2      D2      B0L103N
3      D1      B1L004N
4      A2      B1L005N
5      C2      B1L104N
6      A1      B1L105N

7      C3      B1L107N
8      B1      B1L007N
9      C1      B1L006N
10     D2      B1L106N
11     A1      B0L005N
12     C2      B0L105N
13     D1      B0L004N

# source : ver20230306_INTT_sort_box_mapping.XLSX
# log 1 : made by CW_shih, time : 2023-03-26, 18:00
# ROC1 : RC-2N
# ROC2 : RC-3N
intt5_map_20240308.txt (END)
```

```
#felix_ch      ROC_port      Ladder
0      C2      B1L105S
1      C1      B0L104S
2      A2      B0L103S
3      B3      B1L004S
4      A1      B1L104S
5      B1      B0L003S
6      D2      B1L005S

7      C2      B1L107S
8      C1      B0L005S
9      A1      B0L004S
10     B3      B1L006S
11     A2      B1L106S
12     B2      B0L105S
13     D1      B1L007S

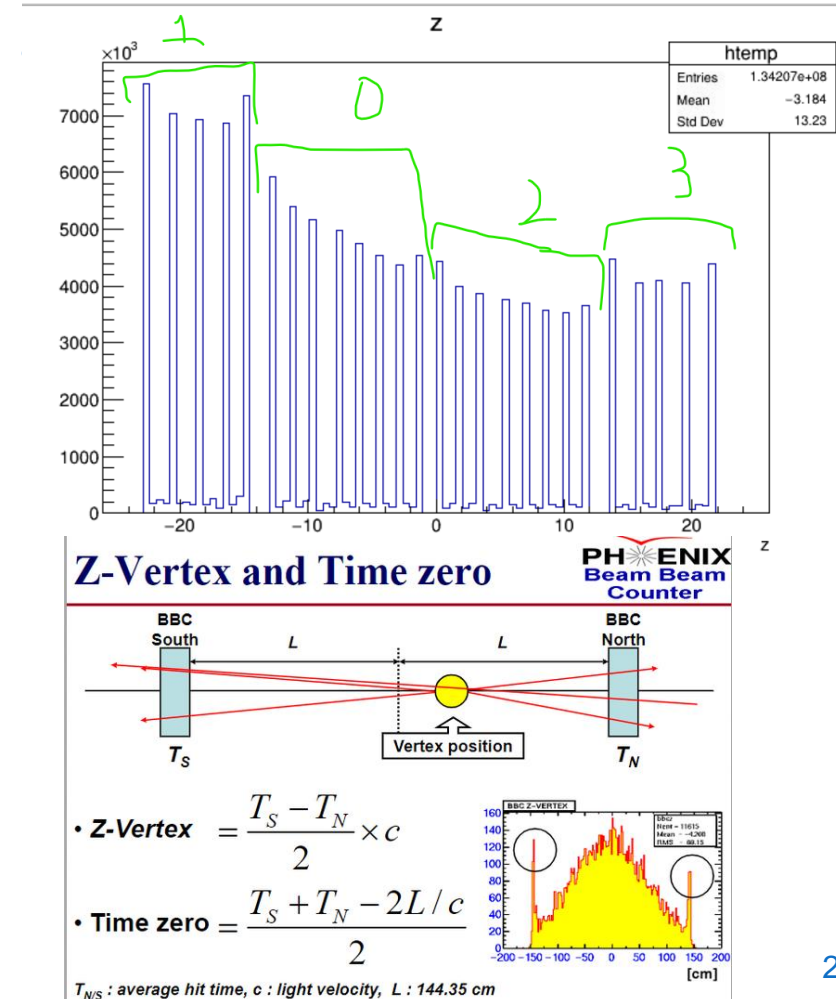
# File : /home/inttdev/map/RC-2S_3Smap.txt
# Time : 2023-03-29 13:08:29.491312
# ROC1 : RC-2S(SE0)
# ROC2 : RC-3S(SW5)
intt1_map_20240303_1230.txt (END)
```

## Plot5. map intt1

# Decide whether Z size=8 in north or south

- In trkcluscontainer, it has zID information.
- zID is correspond to ¼ silicon.
- From plot7, z<0 is south, then zID =0,1 is south.
- So I can know (Felix,ladder) form Cluster.
- I made both of north and south hit map to confirm exist of z size>8,>13

- Plot6. zID means. Plot7.z vertex





# Flow 4 and 5

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- 4 using TrkClusterContainer, I find event number which has z size = 8 in layer=0&&ladder=0.
- 5 using RawhitContainer, I get raw hit information,
- Code is here,  
[/sphenix/u/tomoya/work/24.05/v2\\_own\\_dst\\_ana/macro/result/hitmap/hitmap2.cc](/sphenix/u/tomoya/work/24.05/v2_own_dst_ana/macro/result/hitmap/hitmap2.cc)
- Plot7. event number which has  
Z size = 8 and zID.

```
root [0]
Processing hitmap2.cc...
lay0ladder0 EVENT NUMBER=8556, zID=0
lay0ladder0 EVENT NUMBER=22900, zID=0
lay0ladder0 EVENT NUMBER=45103, zID=2
lay0ladder0 EVENT NUMBER=60198, zID=0
lay0ladder0 EVENT NUMBER=61455, zID=0
lay0ladder0 EVENT NUMBER=65569, zID=2
lay0ladder0 EVENT NUMBER=83185, zID=0
```

# convert chip and channel

---

- Channel calculation and Chip calculation are below,

```
int chip_fix_N = -1;
int channel_fix_N = -1;

int chip_fix_S = -1;
int channel_fix_S = -1;

channel_fix_N = int(chip / 13) * 255 + pow(-1, int(chip/ 13)) * channel ;
chip_fix_N = 12 - static_cast<int>(chip)%13 ;

channel_fix_S =255 - (int(chip / 13) * 255 + pow(-1, int(chip / 13)) * channel);
chip_fix_S = static_cast<int>(chip)%13 ;
```

# TITLE

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Tomoya Kato (form Rikkyo University)

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