

# INTT various update

Cheng-Wei Shih  
National Central University & RIKEN

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國立中央大學  
National Central University



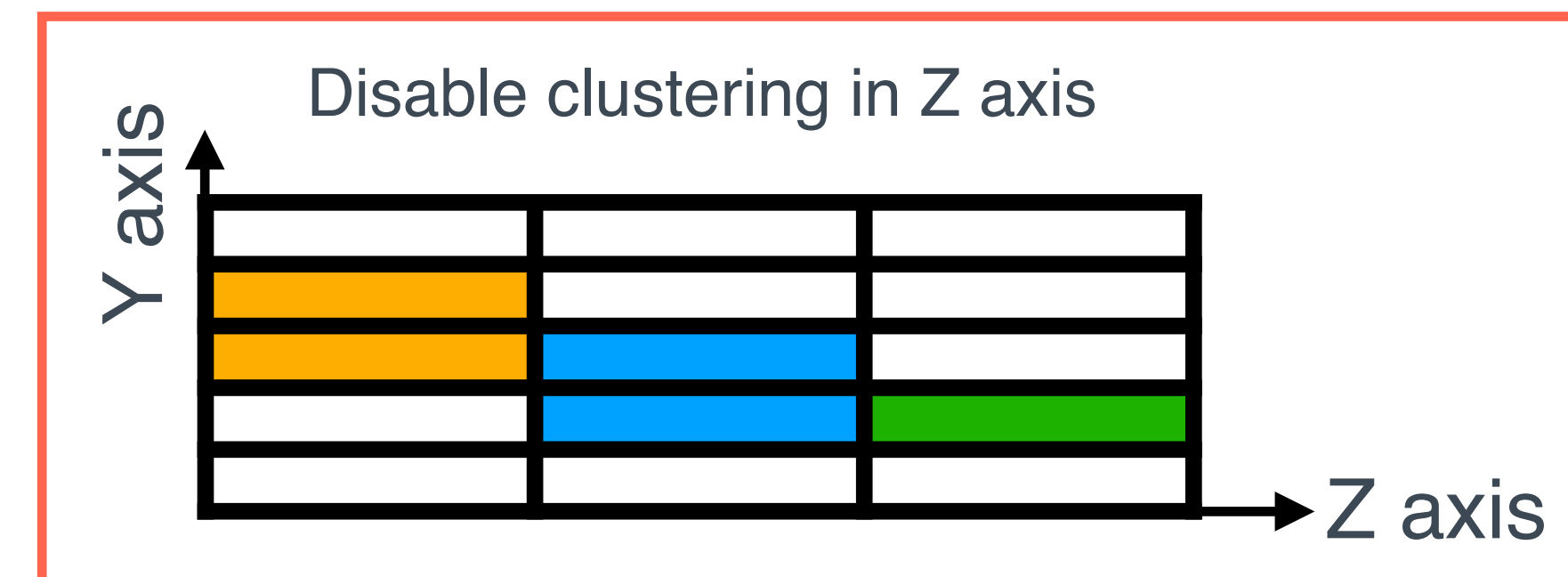
# One way to remove the beam background

- If the clustering in Z axis is disable for the INTT for all future sPHENIX physics analyses\*
  - The property of the beam background doesn't work (see right)
  - We first pick up the beam background by the beam background identifier
  - In each event, we save the information of the hits that make up this beam background into a CDB file (RawData\_info, TRKRHITKEY, etc)
  - In the (second-round) TrkrCluster production, we read this CDB file, find the corresponded event ID, and remove the beam-background hits from the TRKRHITSET
  - We then do the clustering (Z axis cluster disable)
- In any case, we should study the feasibility of beam background identifier

A beam background



Clus1: phi size 3 and z size 3



Clus1: phi size 2 and z size 1

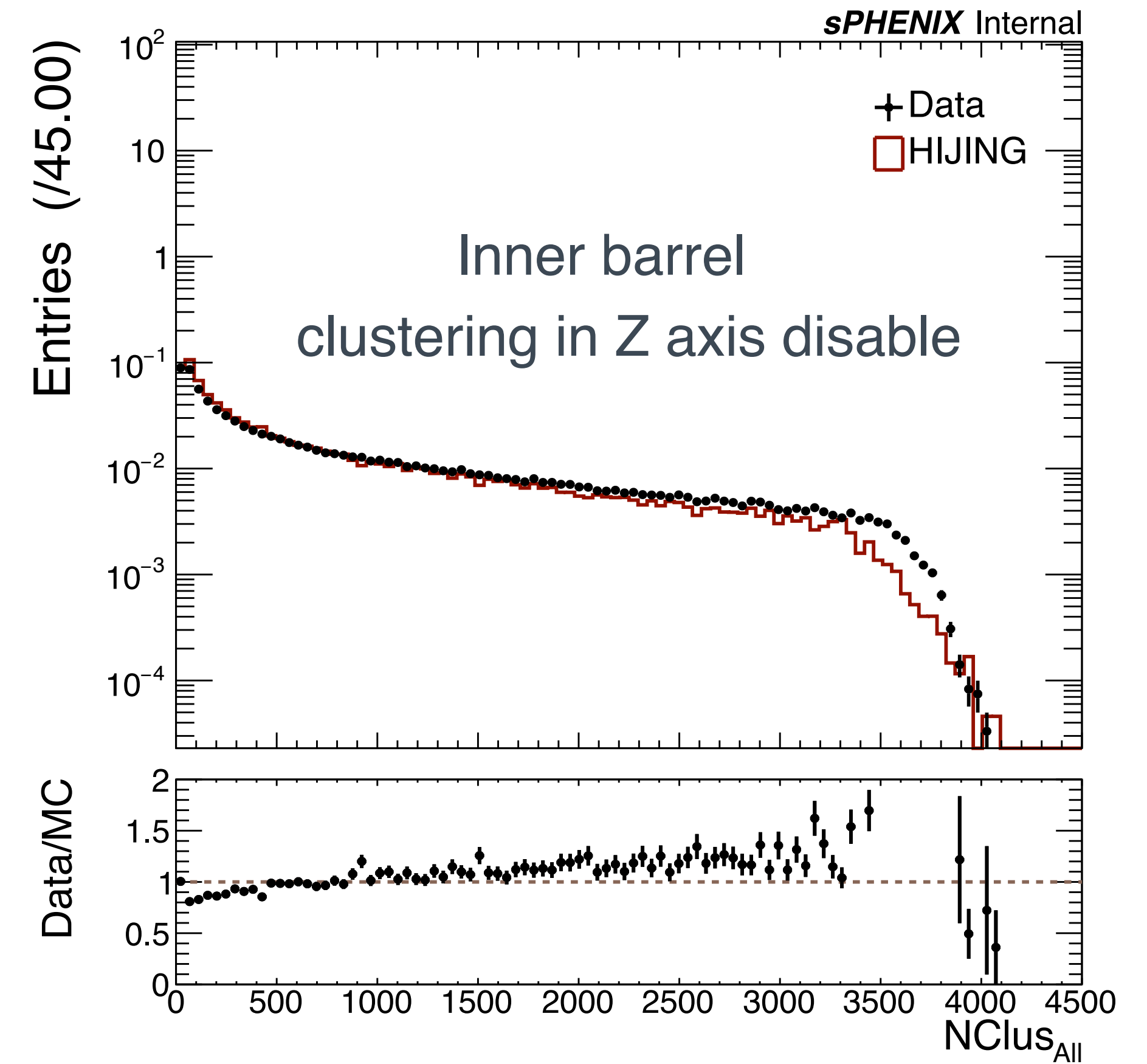
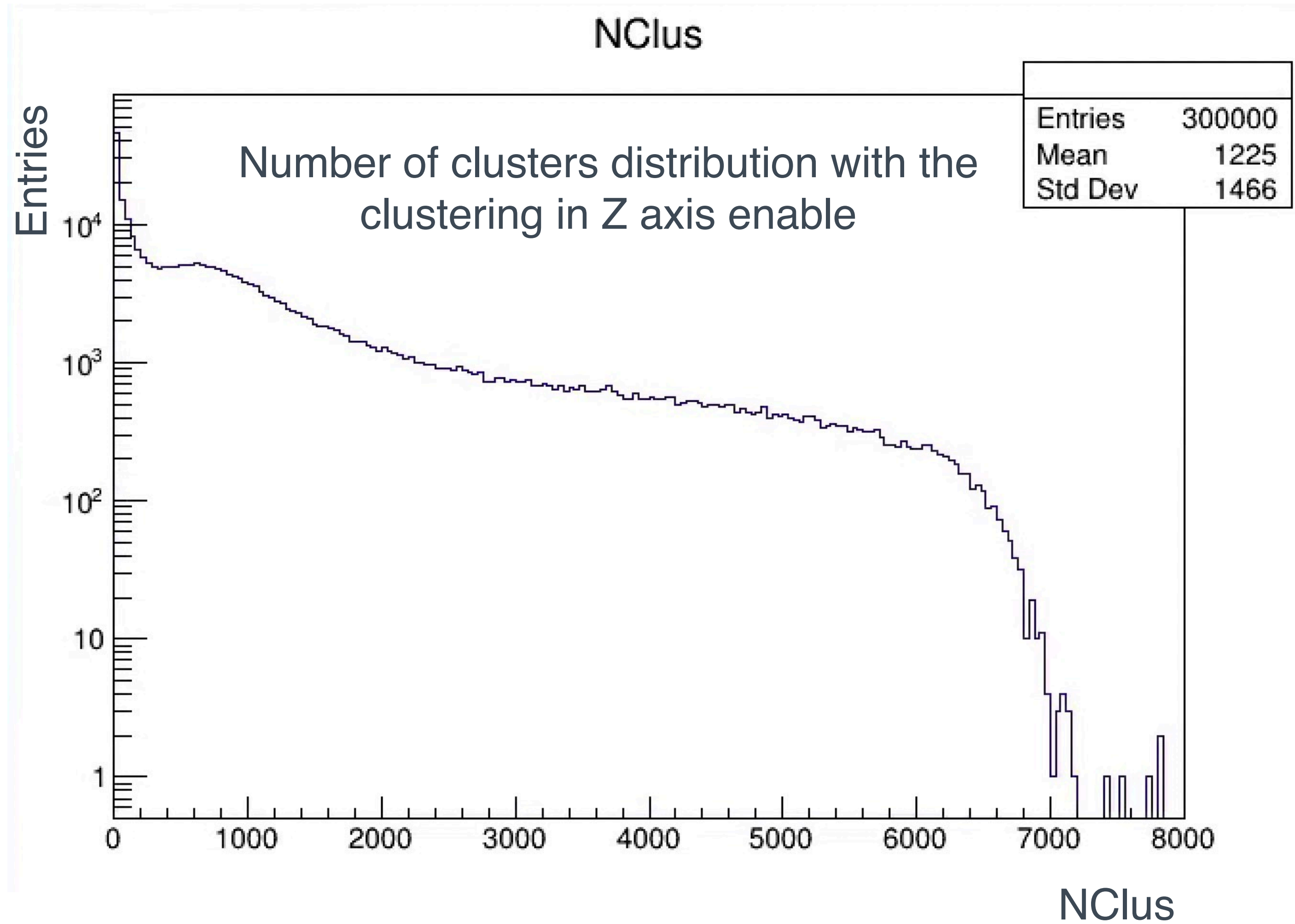
Clus2: phi size 2 and z size 1

Clus3: phi size 1 and z size 1

\* lcwHO: 99.99% that this will be the case

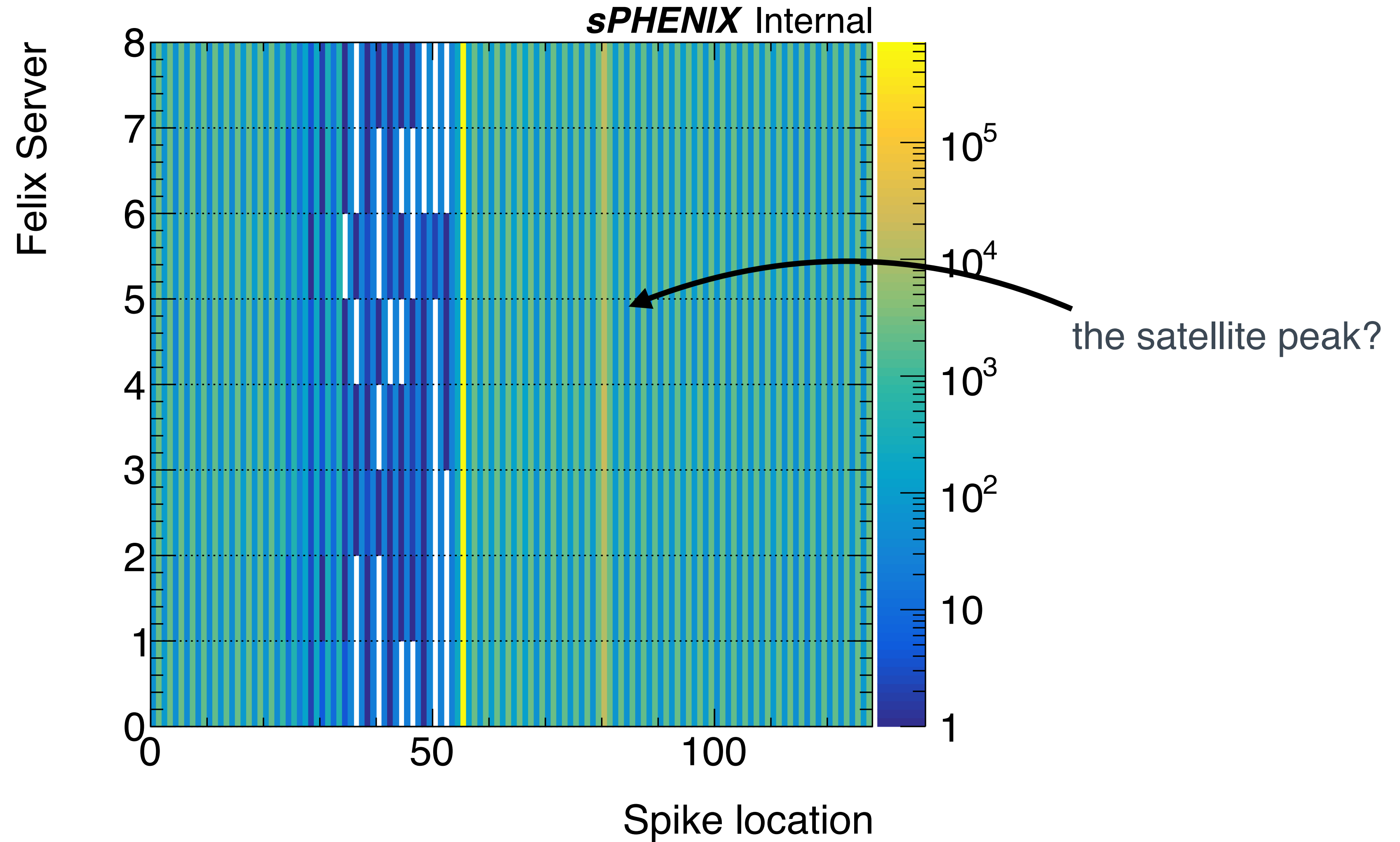
# Abnormal structure of NClus distribution

Number of clusters distribution with the clustering in Z axis enable



# Recap - sanity check of run 54280

- Hot channel mask (Jaein's map), hitQA, clone hit removal were applied



Not all the events have the peaks at the expect location

# Bug found in ROOT?

```
int F4A_bcodiff_test()
{
    std::vector<int> out_felix0_bcodiff(128,0);

    int Nele = out_felix0_bcodiff.size();
    int sort_entry_index[Nele];
    TMath::Sort(Nele, &out_felix0_bcodiff[0], sort_entry_index);

    std::cout<<"sort_entry_index[0]: "<<sort_entry_index[0]<<std::endl;

    return 0;
}
```

```
[ecie9969@sphnx03 code_test]$ root -b -q F4A_bcodiff_test.C
-----
Welcome to ROOT 6.26/06 https://root.cern
(c) 1995-2021, The ROOT Team; conception: R. Brun, F. Rademakers
Built for linuxx8664gcc on Jul 28 2022, 18:08:51
From tags/v6-26-06@v6-26-06
With g++ (GCC) 12.1.0
Try '.help', '.demo', '.license', '.credits', '.quit'/'.'q'
-----

Processing F4A_bcodiff_test.C...
sort_entry_index[0]: 80
(int) 0
[ecie9969@sphnx03 code_test]$
```

```
[chengweishi@MacBook-Pro-2 09:38:30 test_code] $ root -b -q F4A_bcodiff_test.C
-----
Welcome to ROOT 6.32.02 https://root.cern
(c) 1995-2024, The ROOT Team; conception: R. Brun, F. Rademakers
Built for macosx64 on Jun 18 2024, 03:44:55
From heads/master@tags/v6-32-02
With Apple clang version 15.0.0 (clang-1500.3.9.4)
Try '.help'/'.'?', '.demo', '.license', '.credits', '.quit'/'.'q'
-----

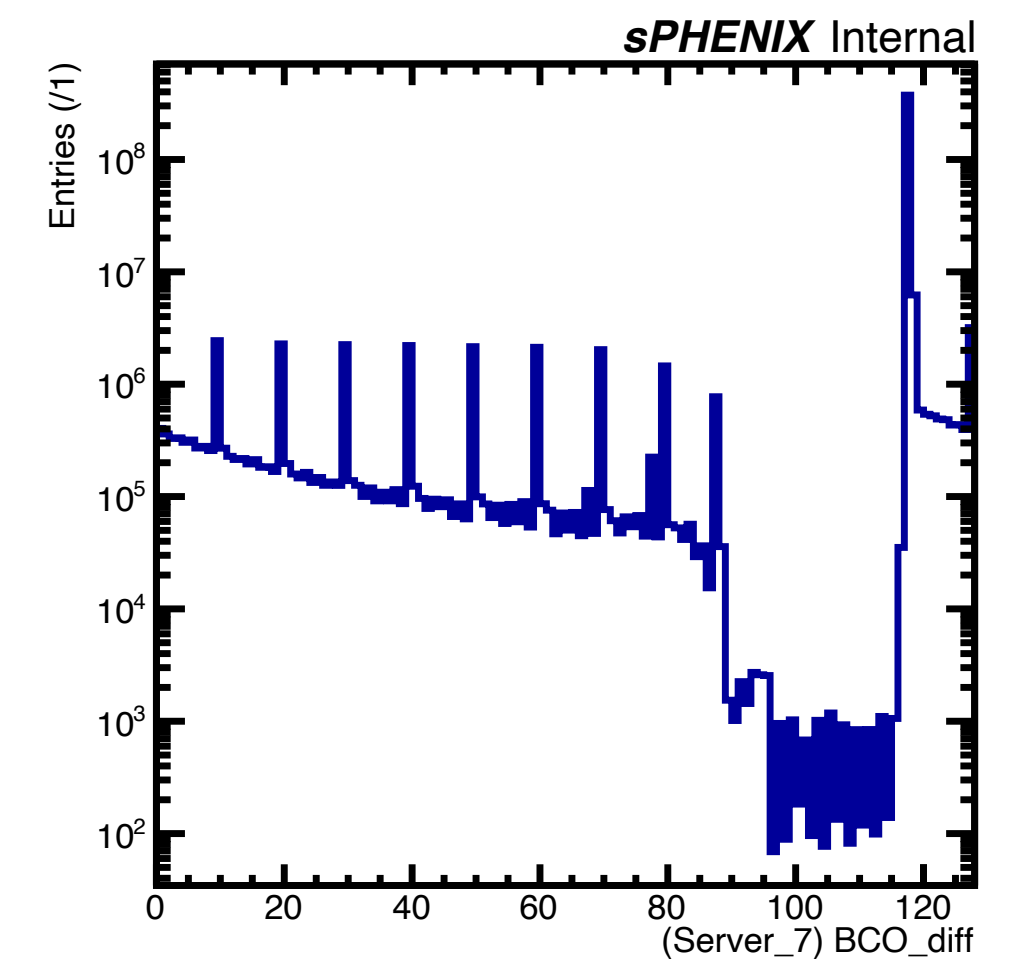
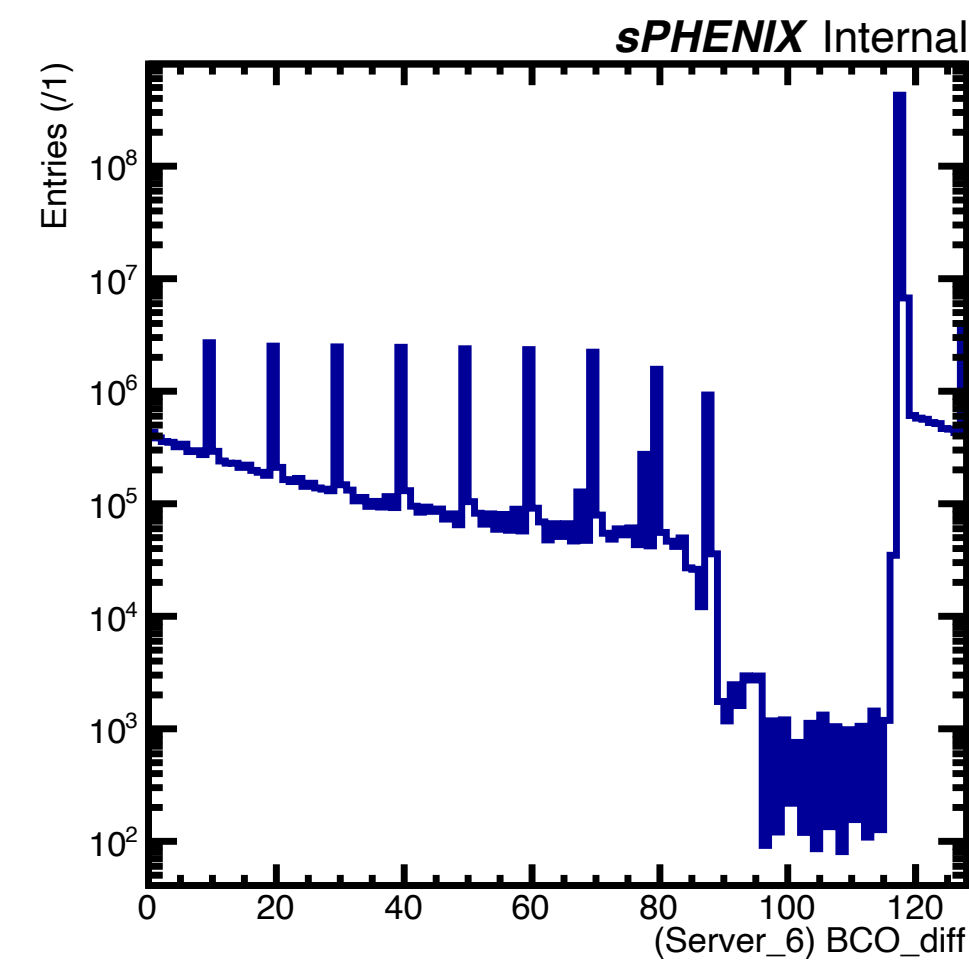
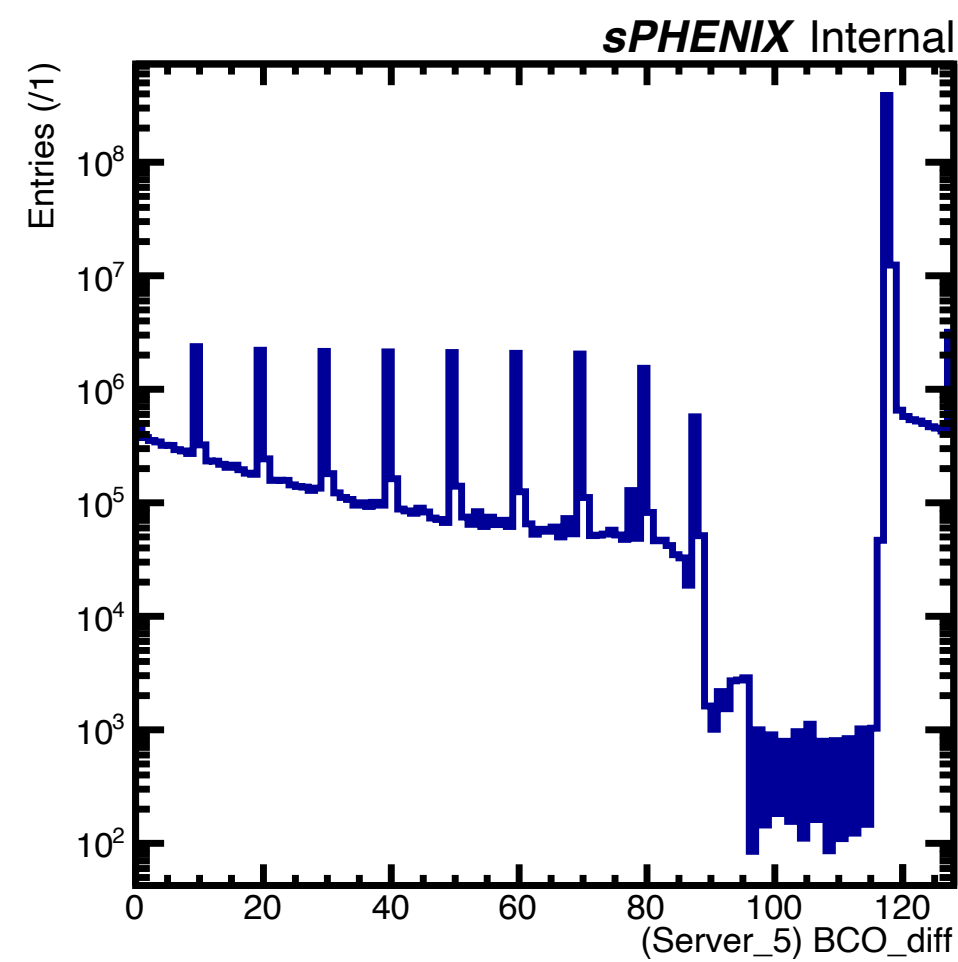
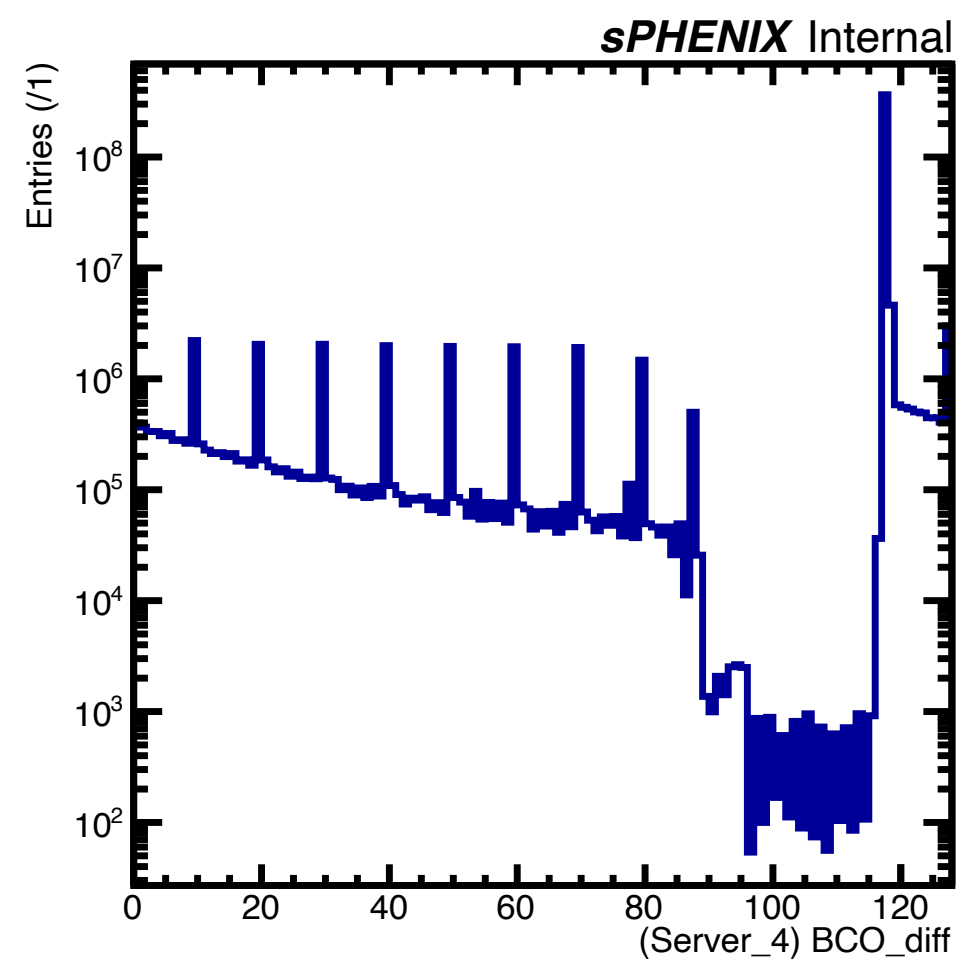
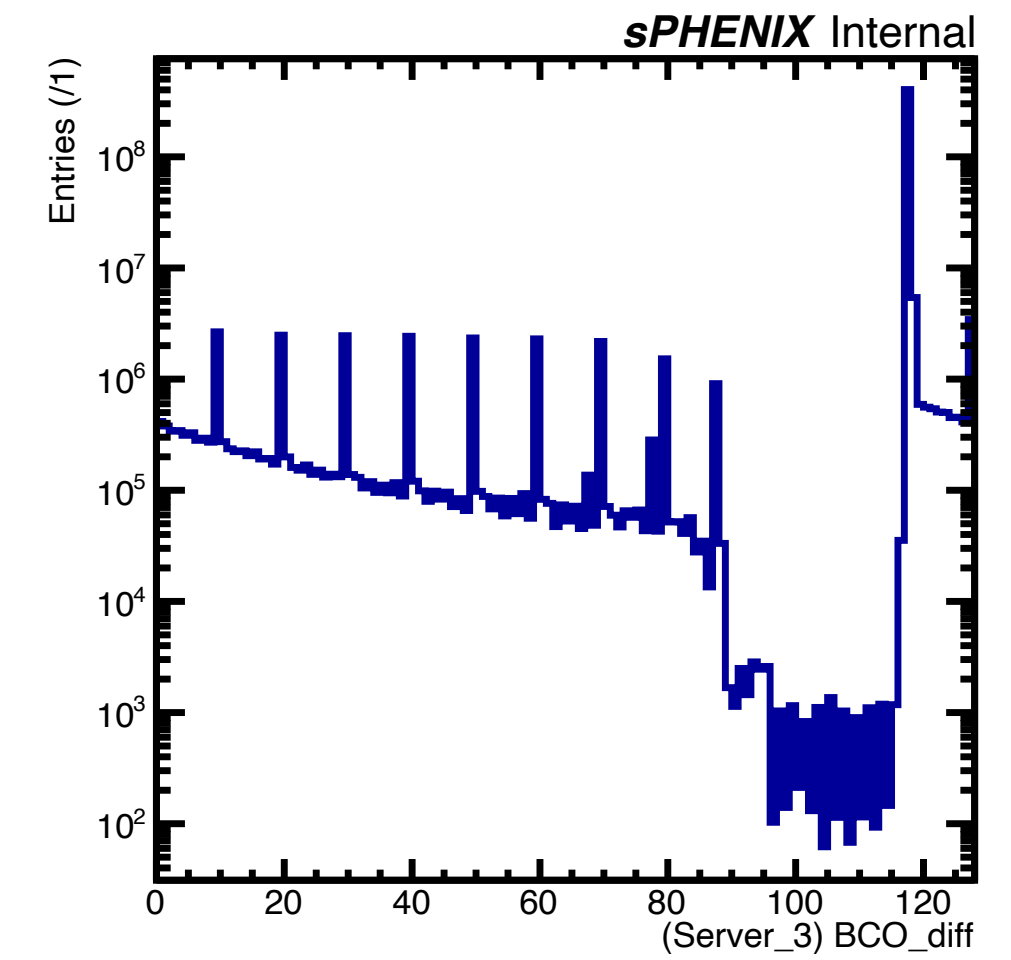
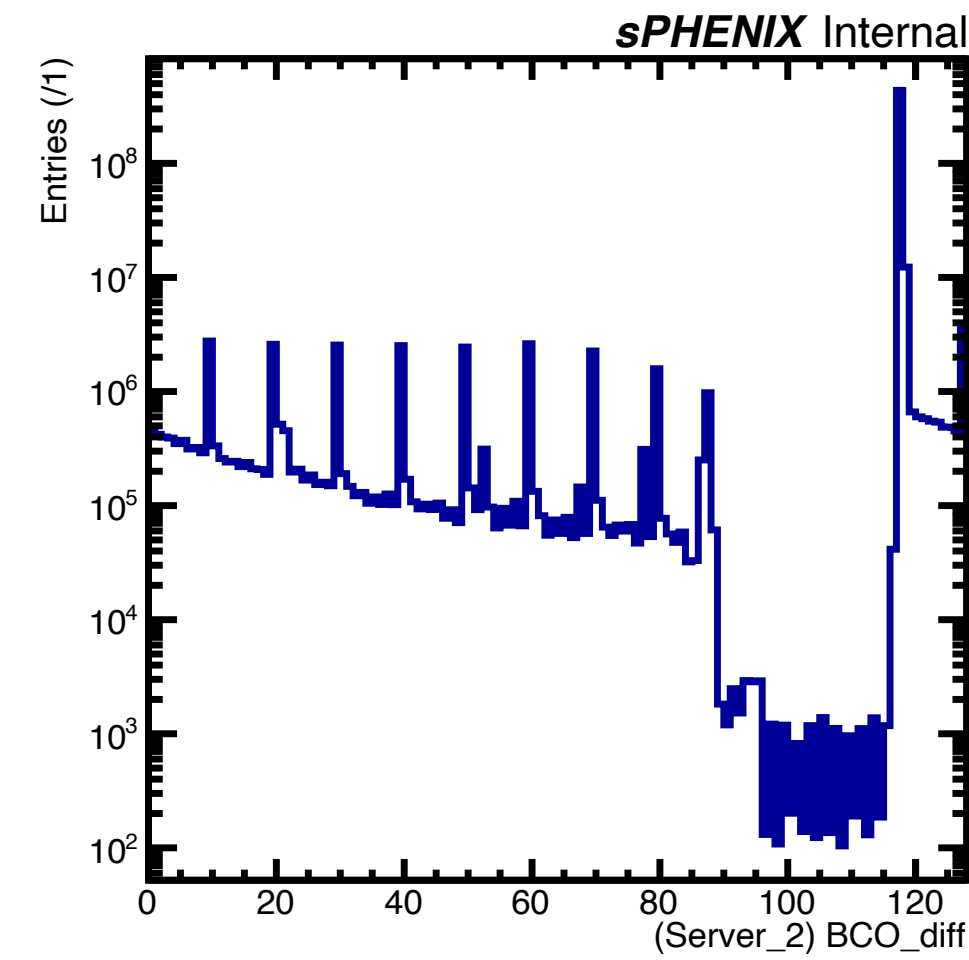
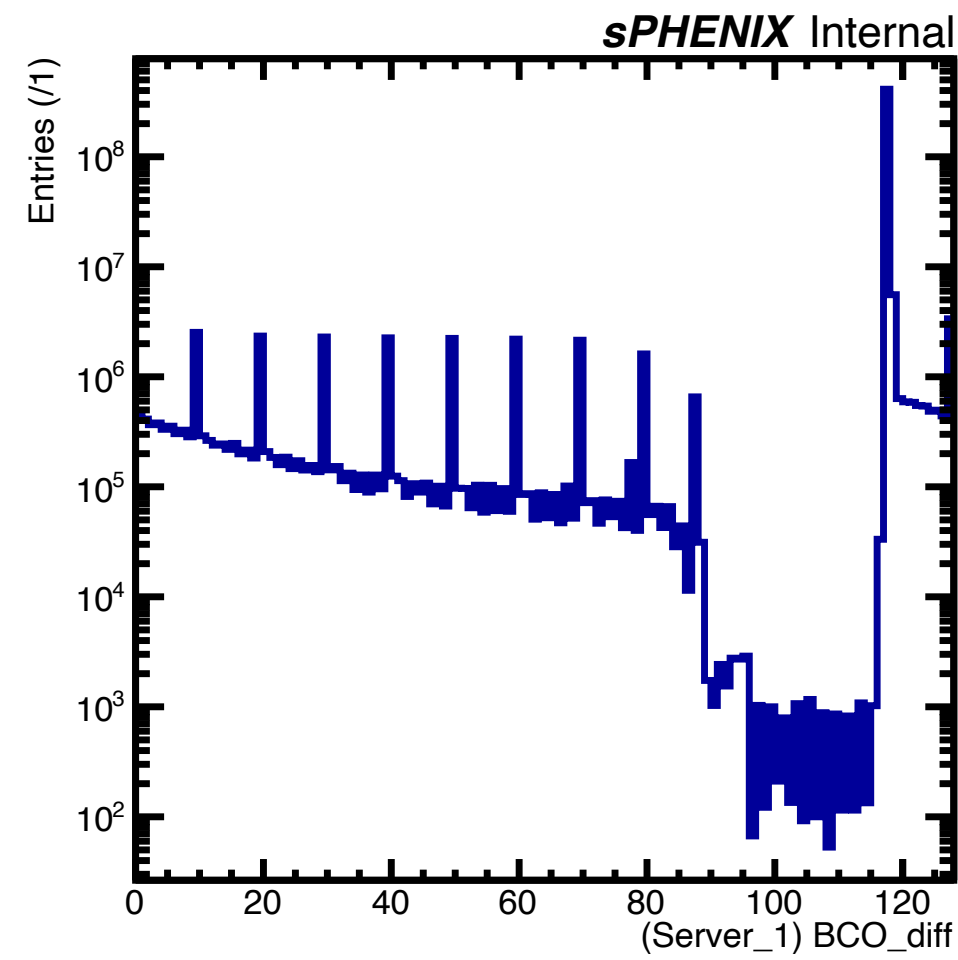
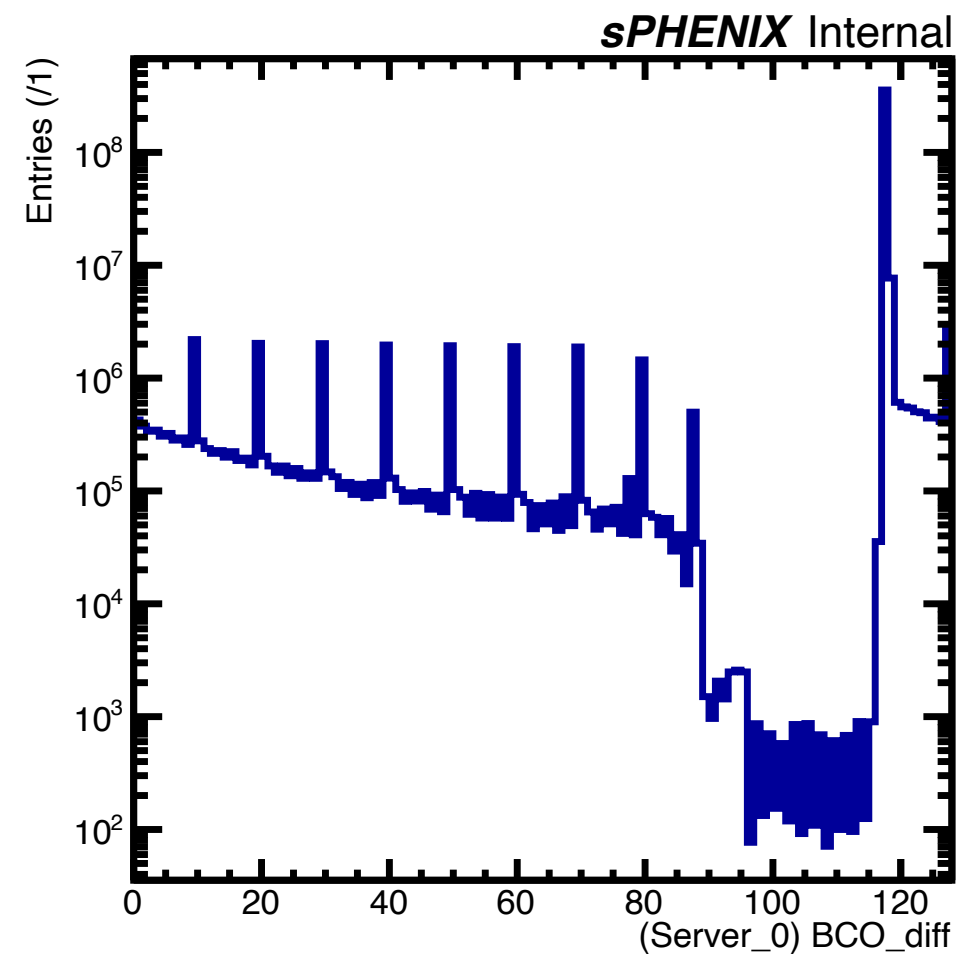
Processing F4A_bcodiff_test.C...
sort_entry_index[0]: 0
(int) 0
```

Different versions of ROOT give different results

# Run 54373 bco\_diff distribution



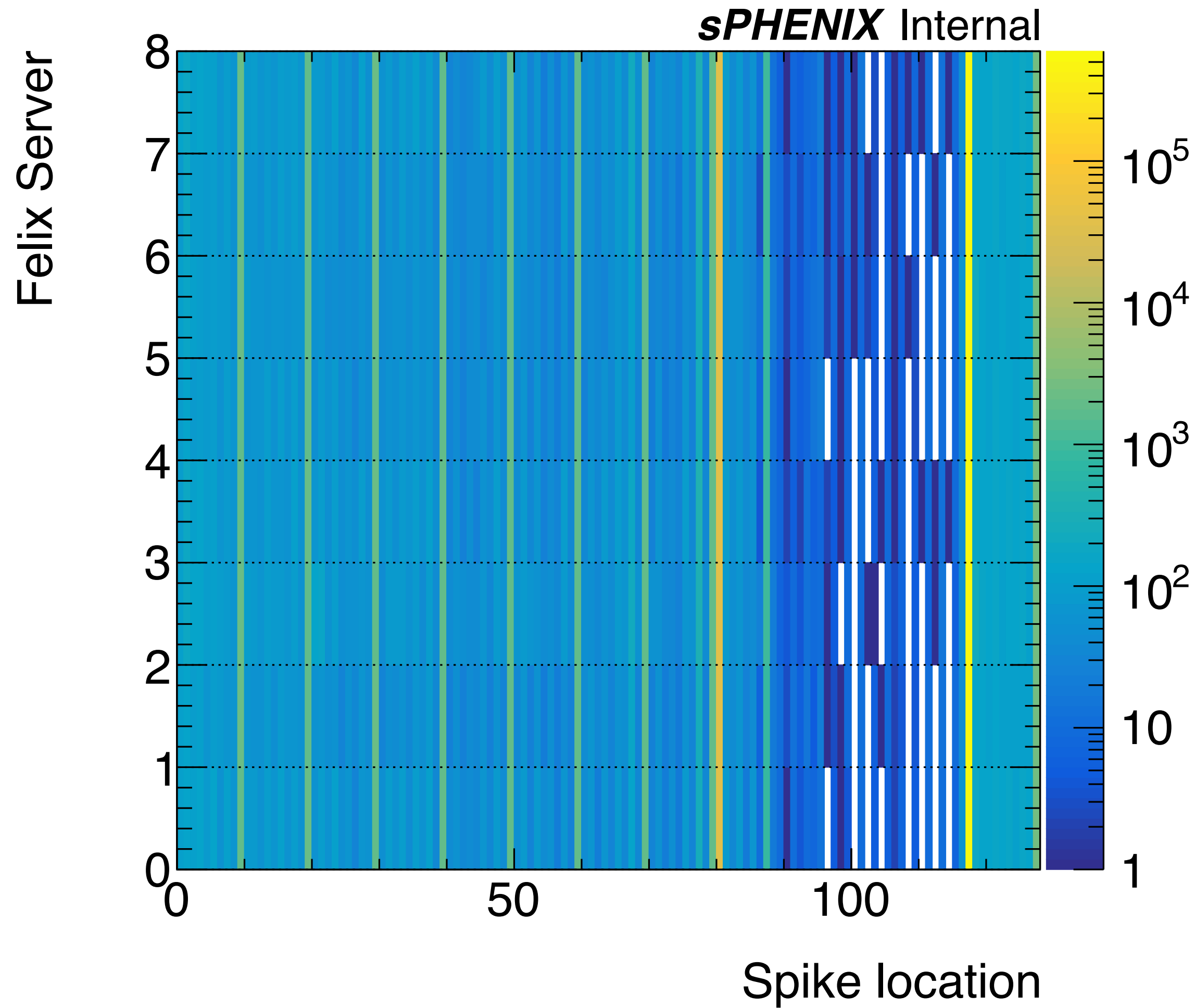
12 x 12 bunches configuration



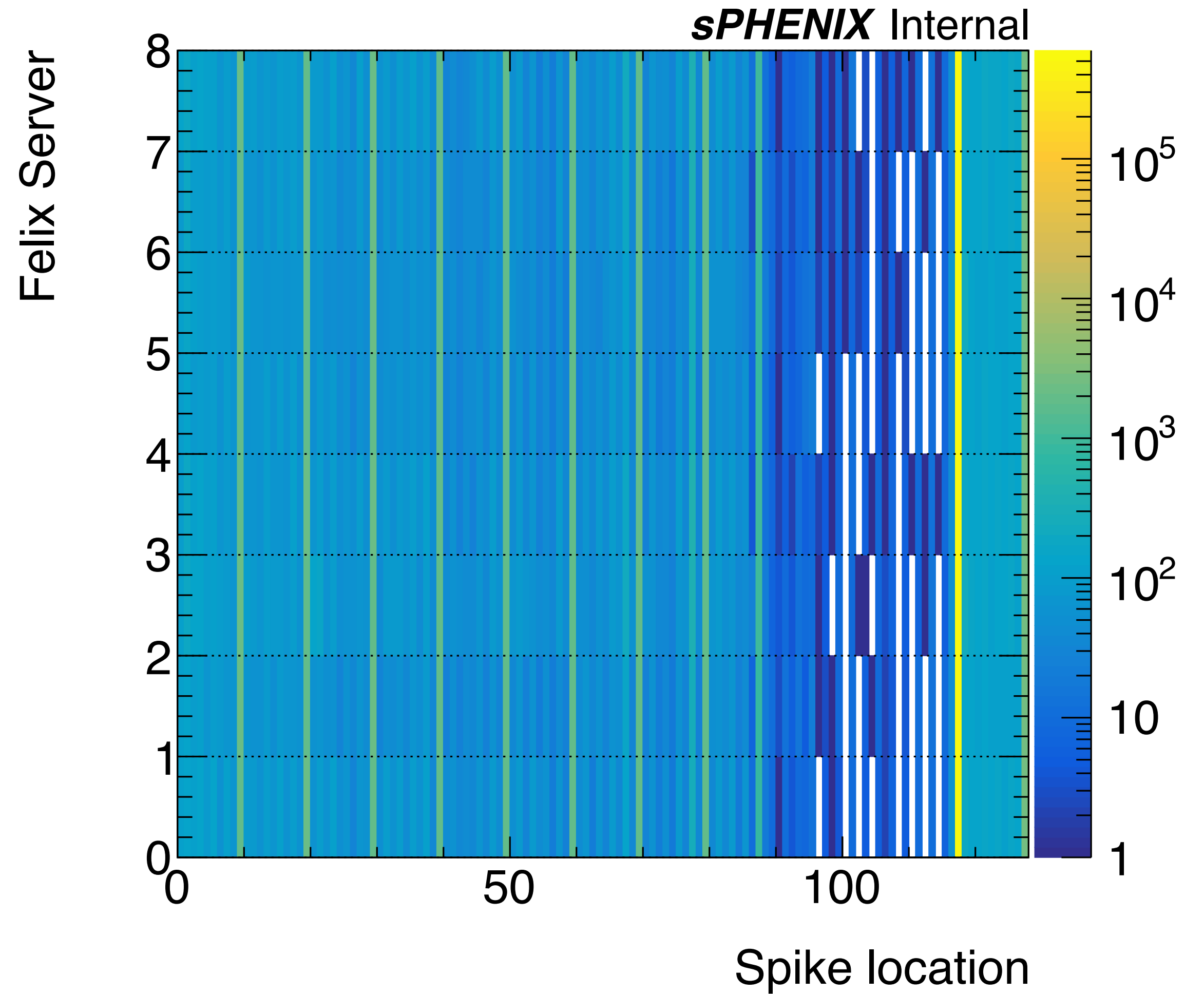
# Run 54373 peak location



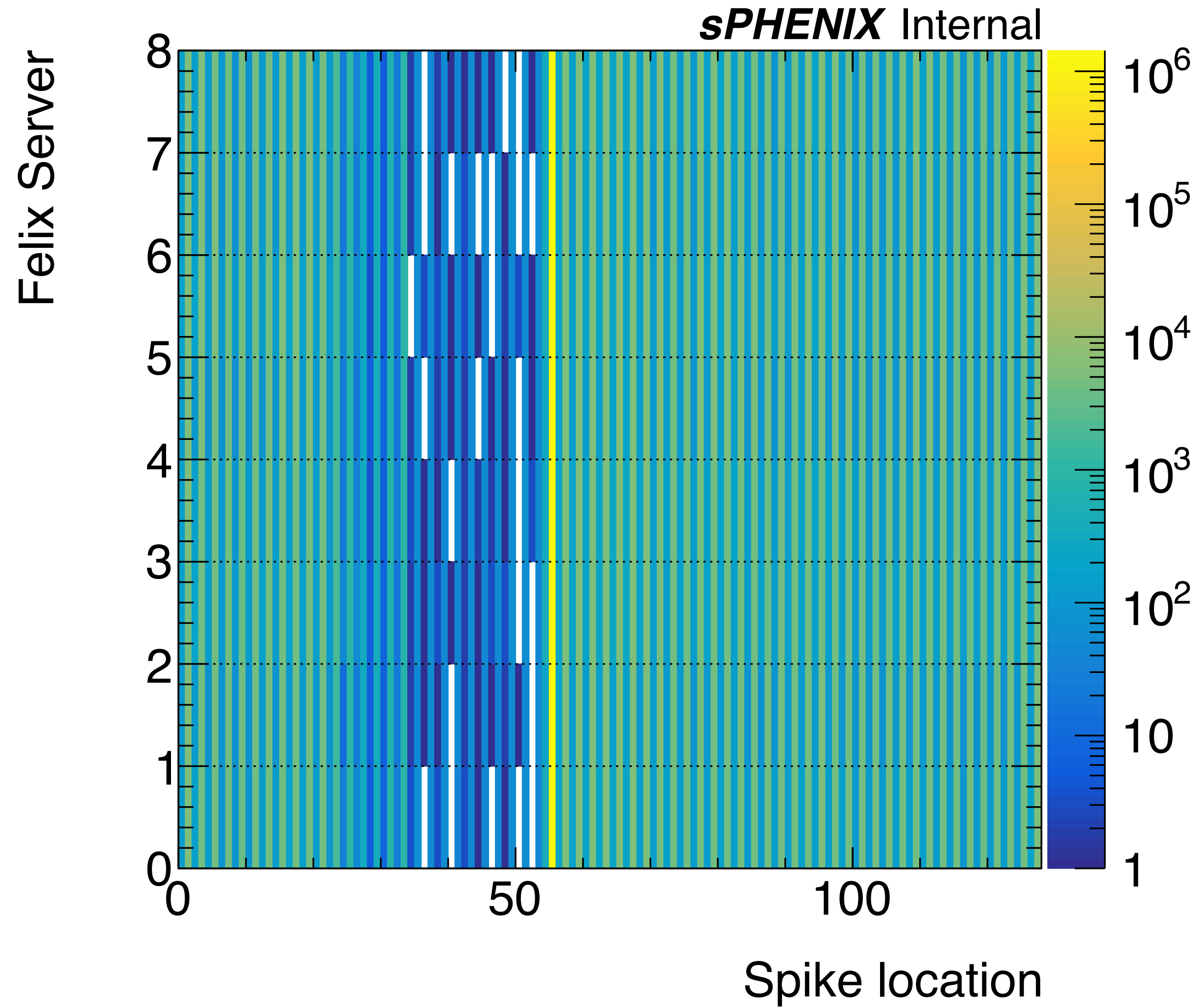
Before



After



Seems to be more reasonable



Looks good



# Justification of bco\_diff cut (low survival rate)



Run 54373

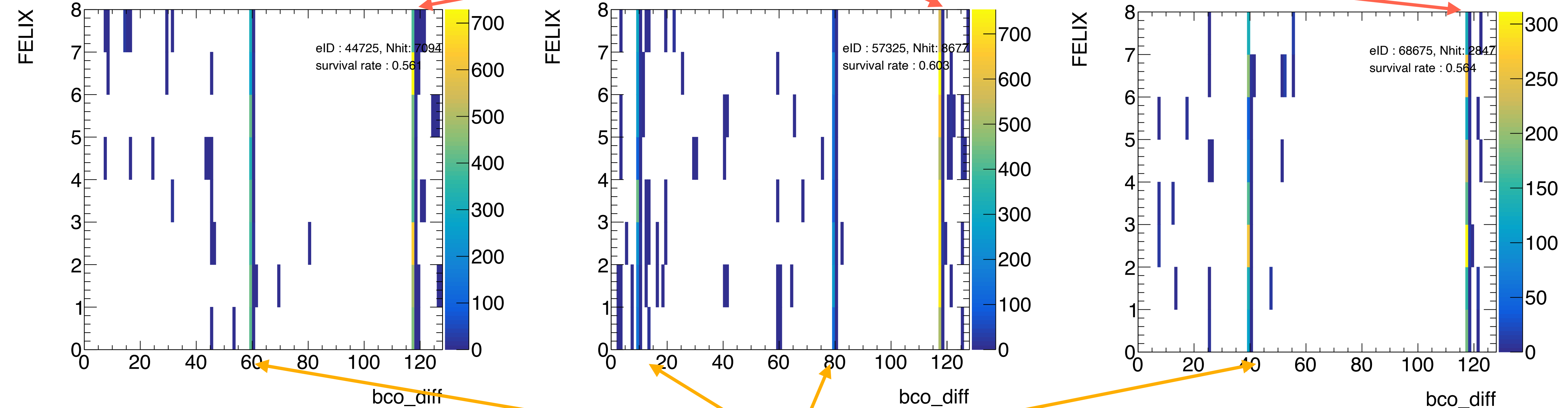
Survival rate: number of hits within  $\pm 1$  of peak timing / total hits

Trigger timing

Survival rate : 0.561

Survival rate : 0.603

Survival rate : 0.564



Other collisions

As far as I checked, the reason of low survival rate is simply because of multiple collisions in one time frame  
In the other words, I don't find any obvious showstopper of having the bco\_diff cut for the AuAu runs

# The low average cluster ADC

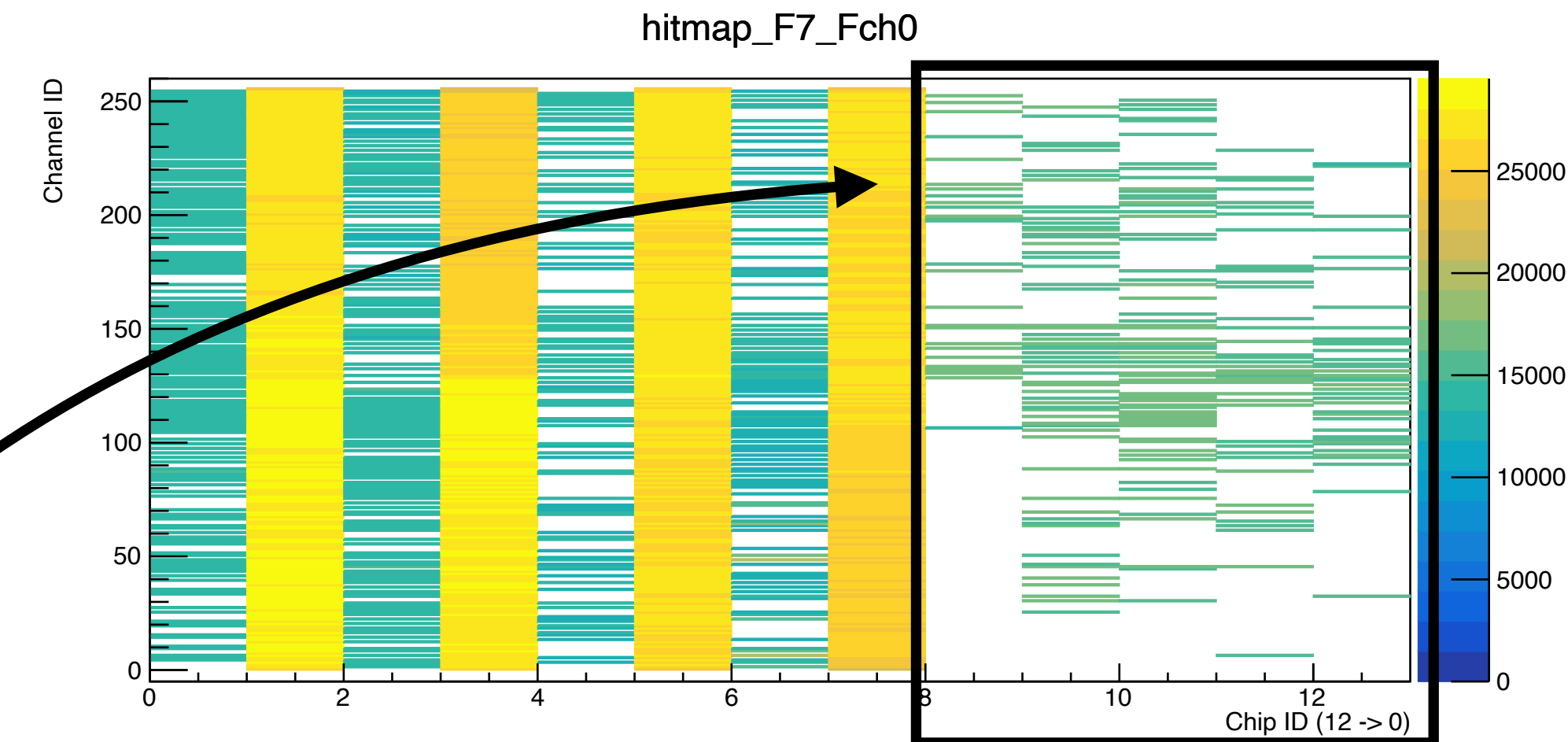
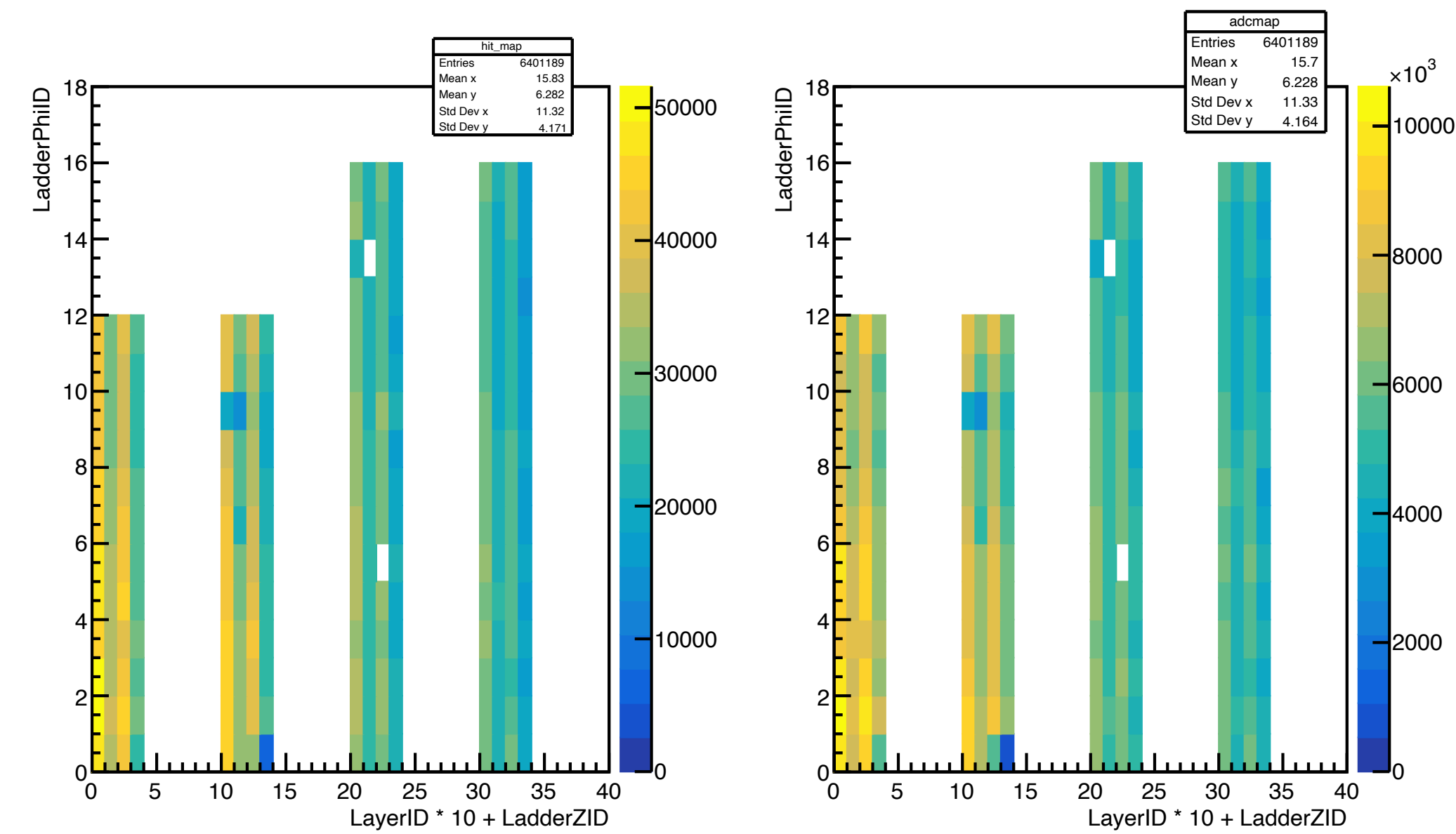
Run 54280 (AuAu run in Zero field)

w/ the current hot\_channel\_map  
(loose requirement in cold channel)

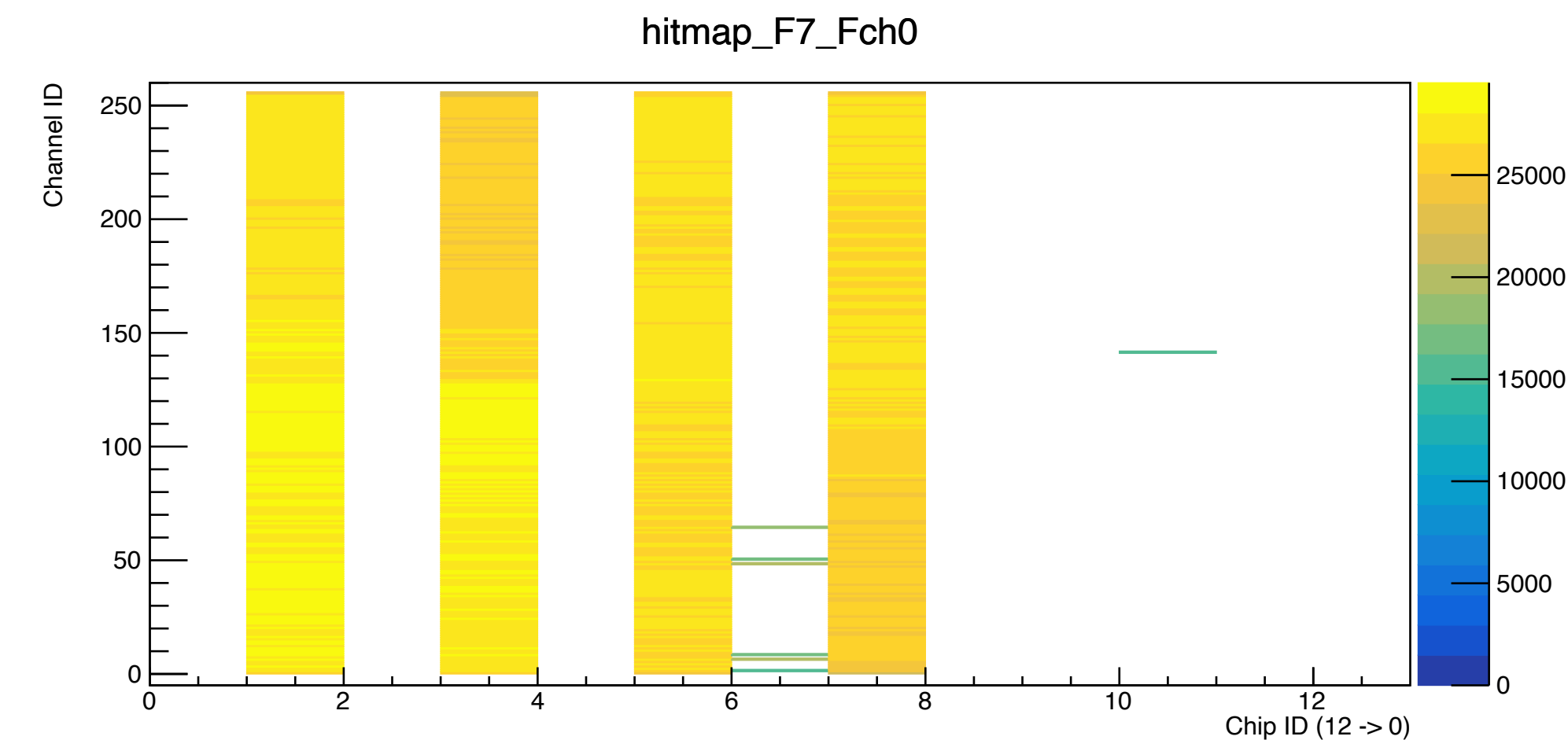
H1: HitMap

H2: Filled by cluster ADC

H3: H2/H1



w/ the updated hot\_channel\_map



The sensor at **LayerID 4, LadderZID 3** and **LadderPhiID 0** has very low average cluster ADC

The maps is provided by Jaein. The issue should be addressed in the next data production

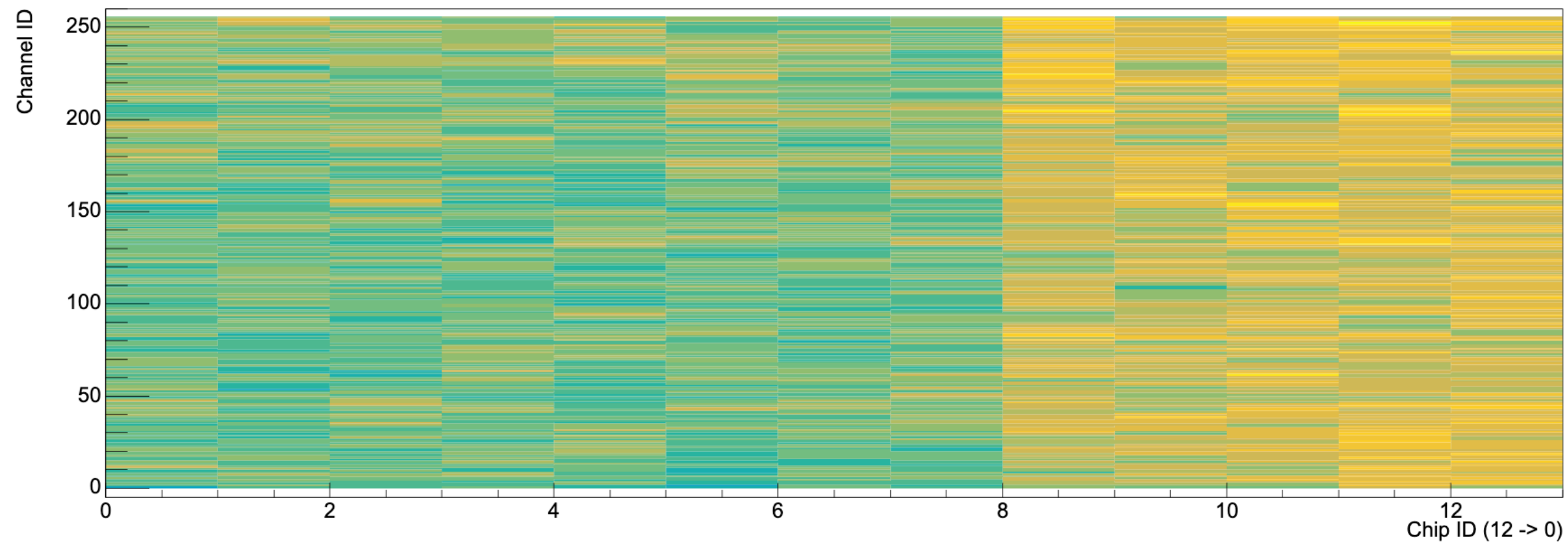
# Data, issue spotted



Run 54280 HitMap of Server\_2, FelixCh 9, post hot channel mask, bco\_diff cut, hitQA, clone hit removal

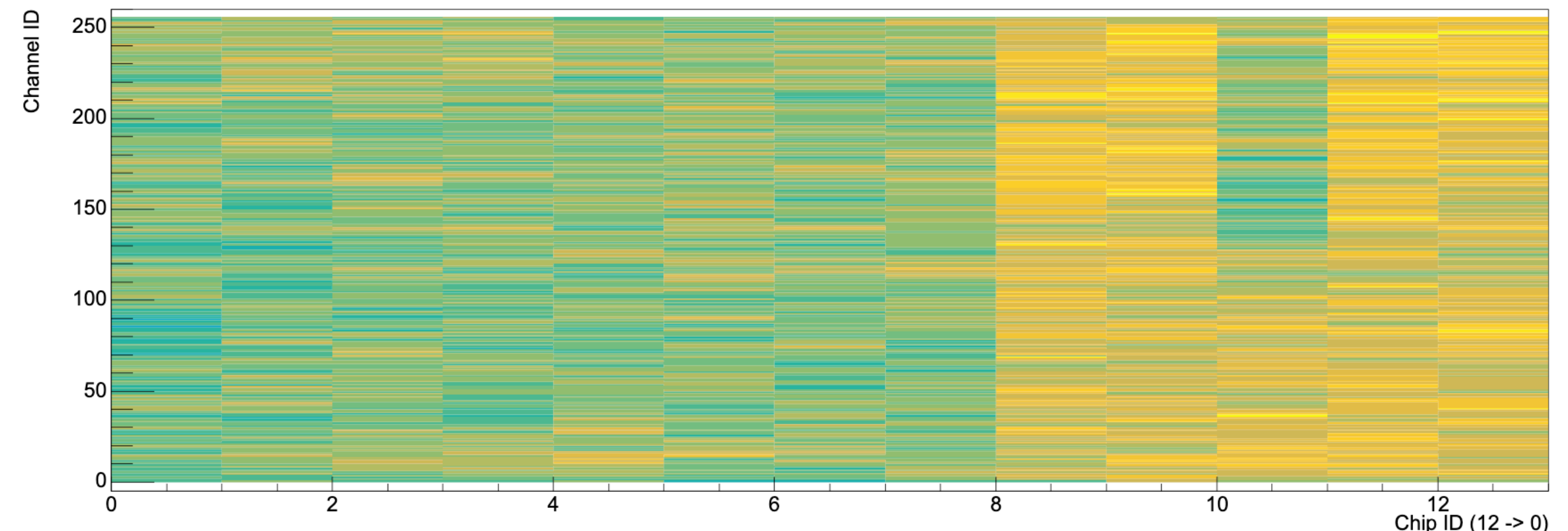
Event 20000 - 29999

hitmap\_F2\_Fch9



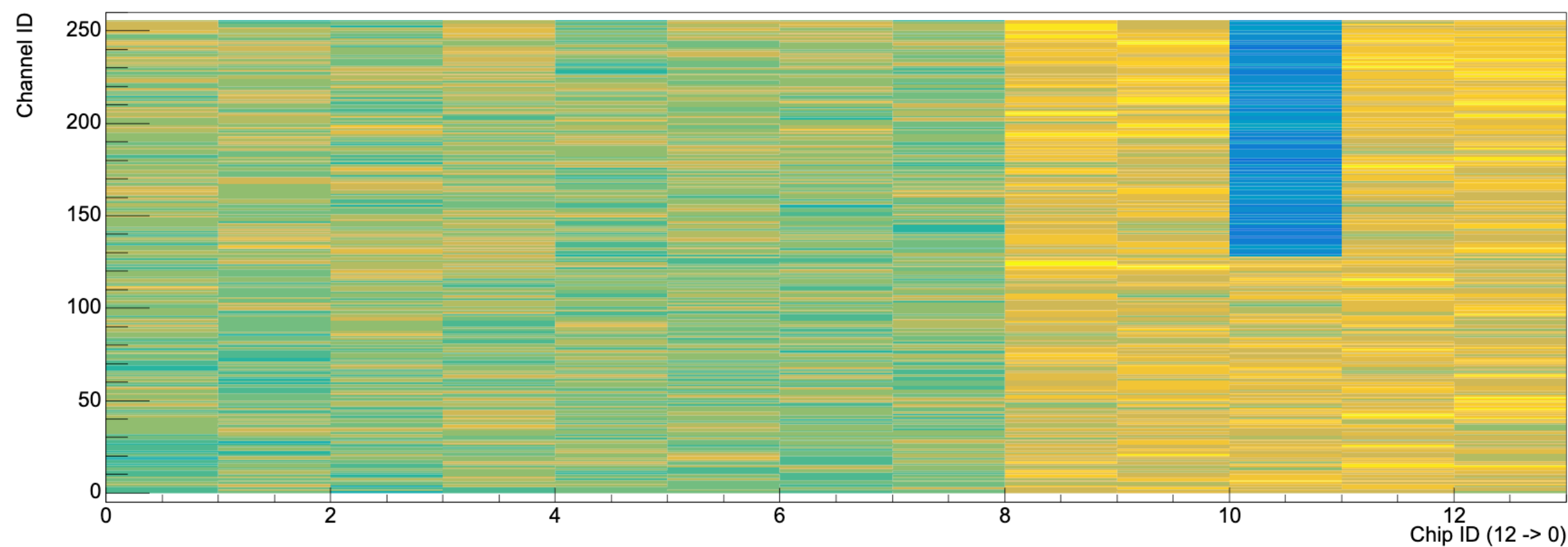
Event 30000 - 39999

hitmap\_F2\_Fch9



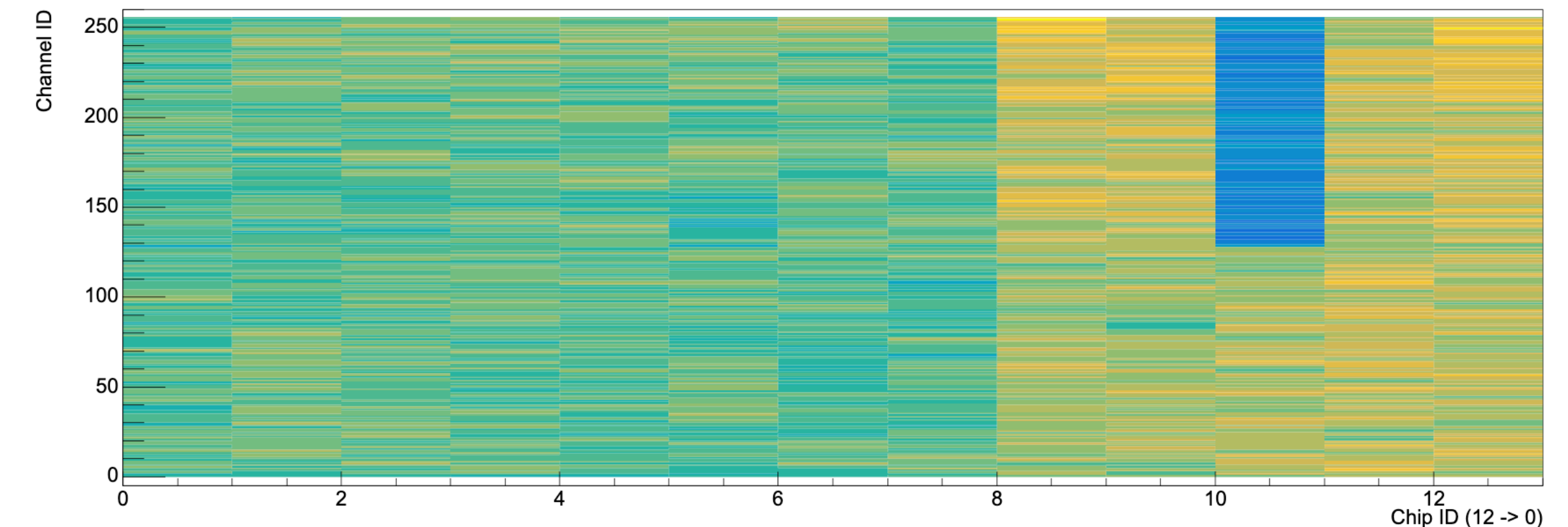
Event 40000 - 49999

hitmap\_F2\_Fch9



Event 50000 - 59999

hitmap\_F2\_Fch9



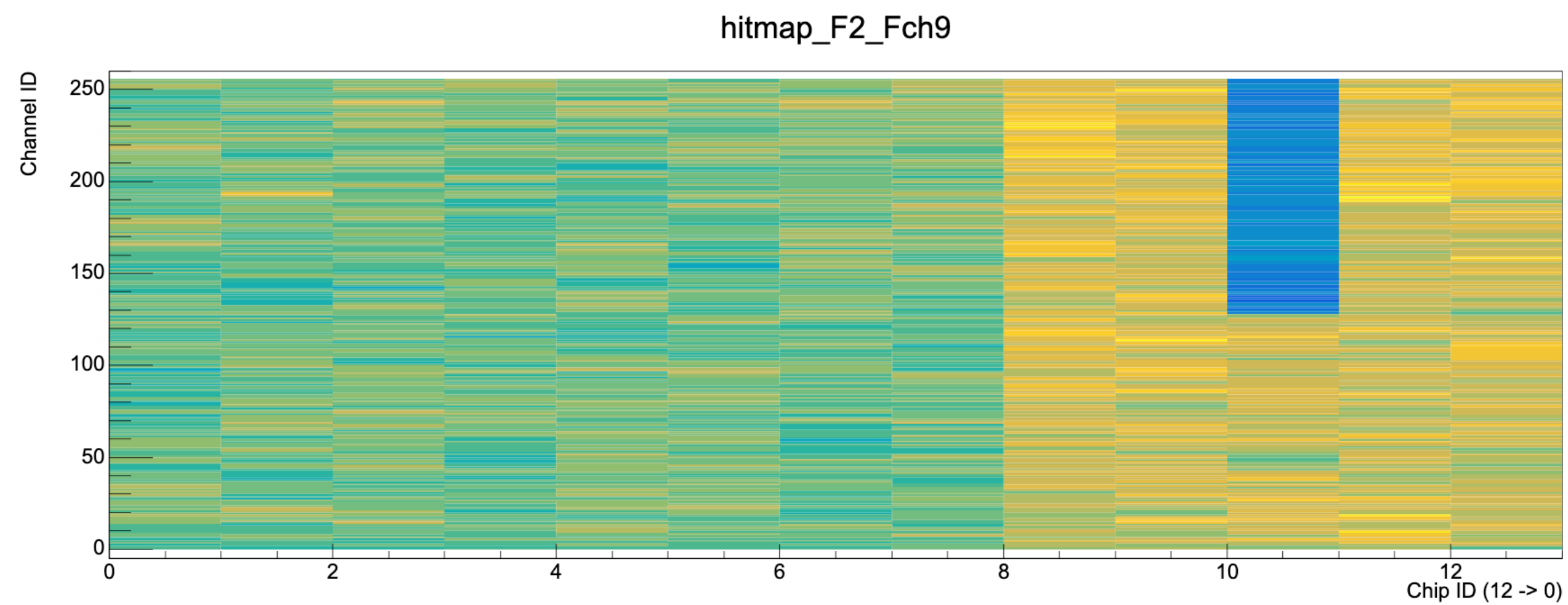
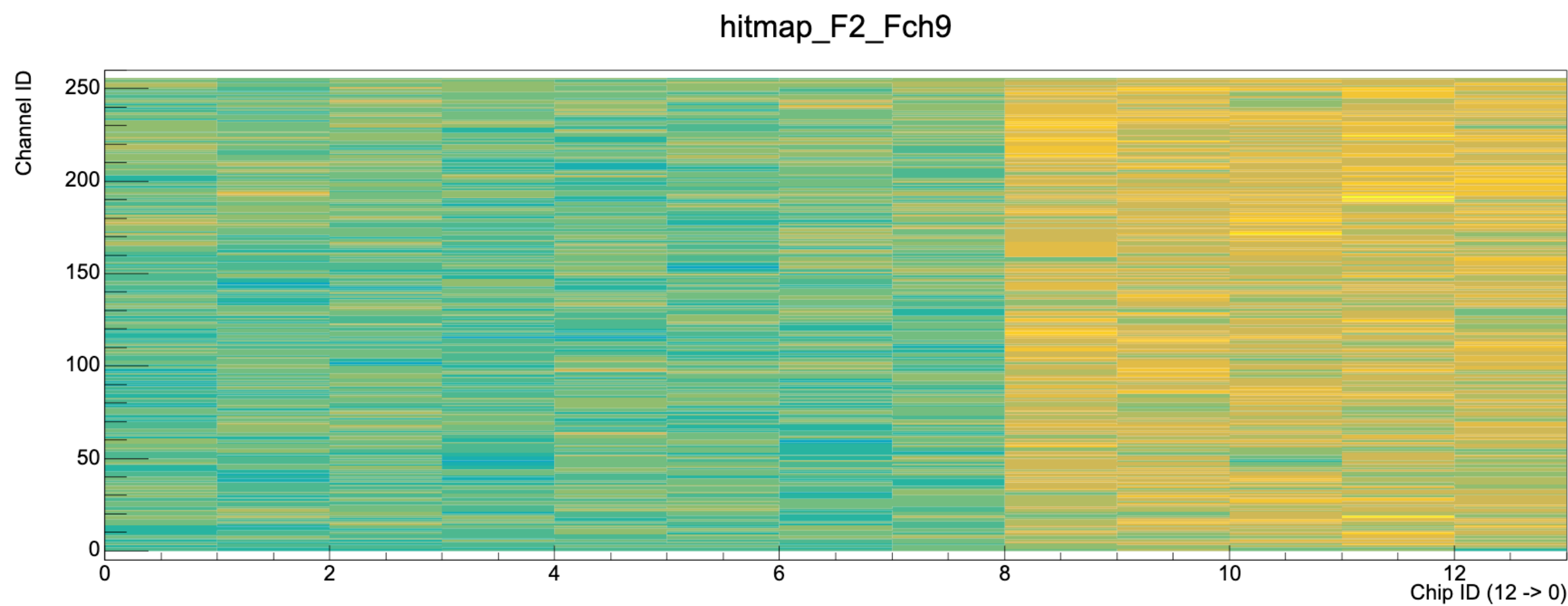
It's possible that the INTT timing varied during the data taking

Run 54280

## Event 990000 - 999999

Hot channel masked

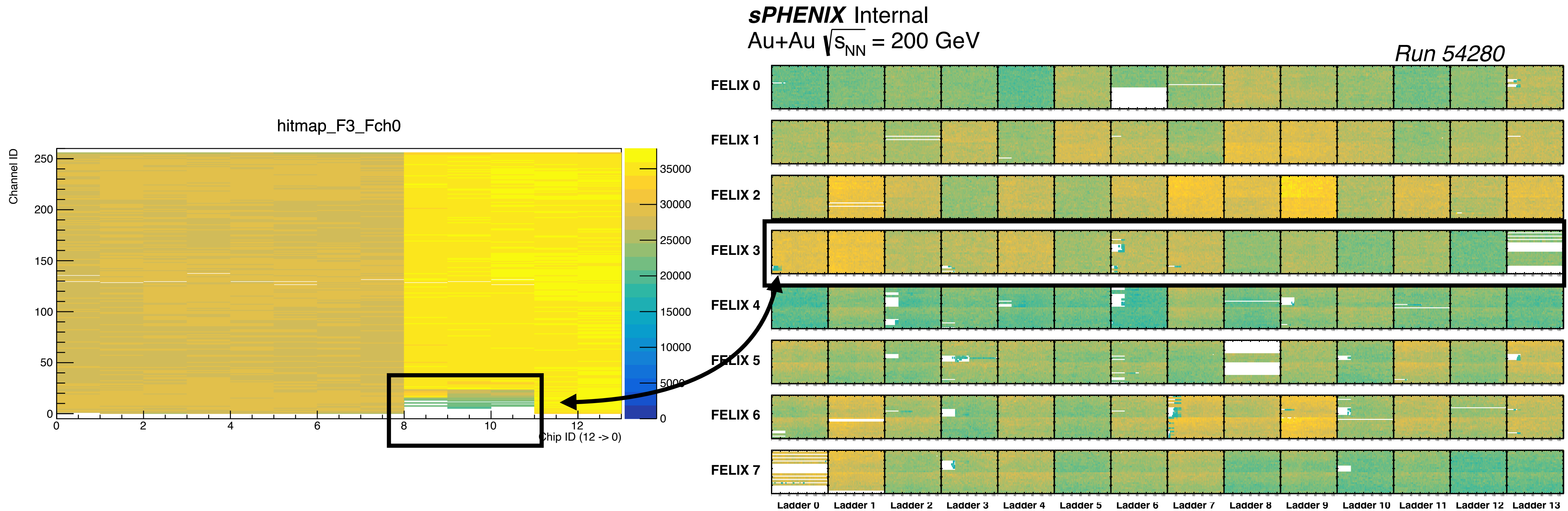
Hot channel masked && bco\_diff cut applied



**The behavior can not be revealed if the timing is not included in the hot\_channel\_identifier  
It seems to be fine to have the BCO\_diff in the hit selection with the AuAu runs, but how about the pp run....?**

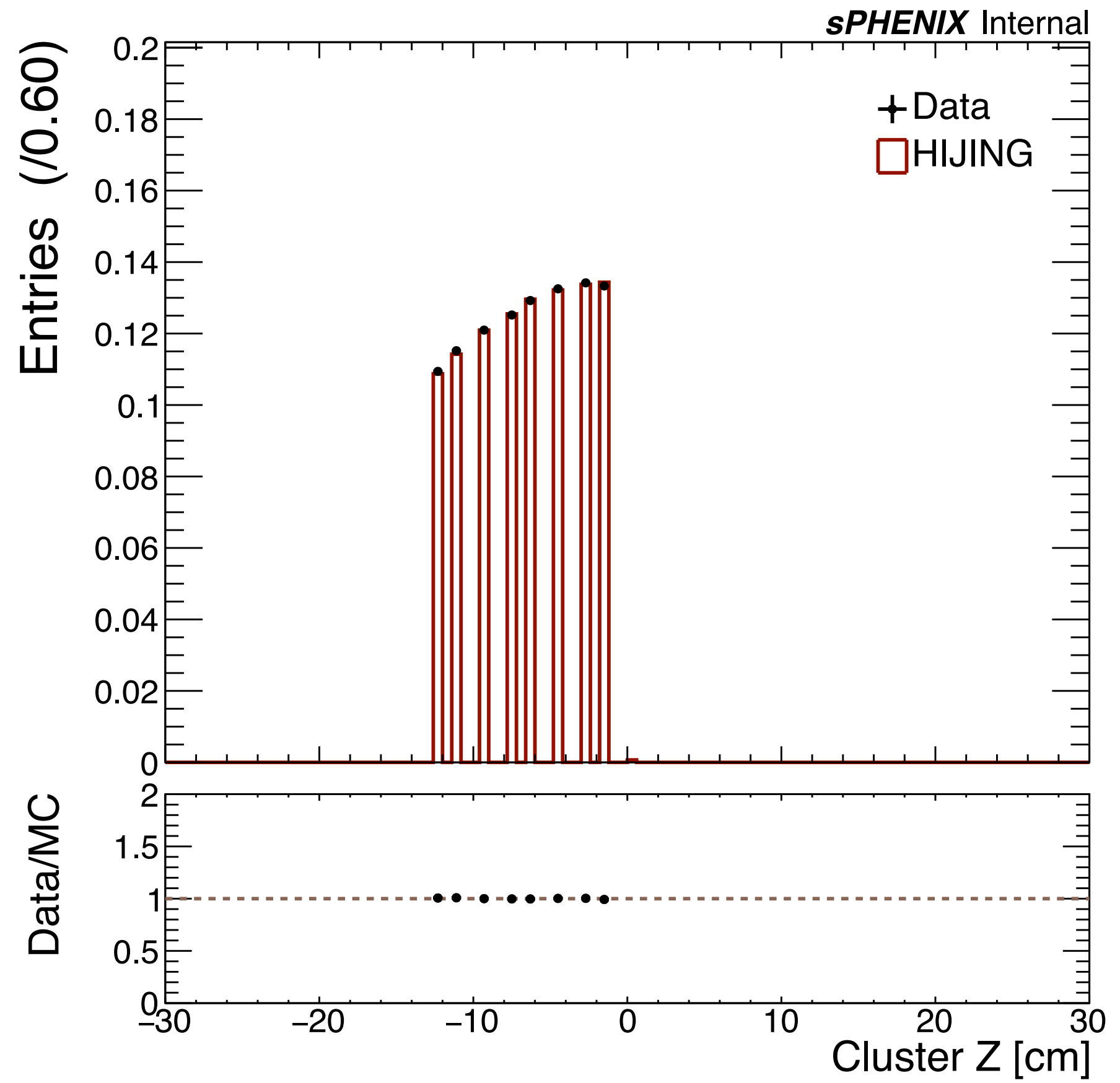
# Run 54280, some remaining cold channels

- Used hot channel : /sphenix/user/jaein213/macros/inttcalib/hotmap\_cdb\_1031/hotmap\_run\_00054280.root



- Now the bad channels are identified based on the hit\_rate distribution of each server (It's good enough if one only looks into data)
- Given the hit rate variation half-ladder by half-ladder in one server, some rather cold/hot channels can not be picked up
  - It would affect the data -MC comparison by  $\sim 1$  to 2 % (rough estimation)
- **Data suggests to investigate the feasibility of having the hit\_rate distribution (half-)ladder by (half-)ladder**

**Back up**



nEvent\_post\_trigger\_cut: 656545

nEvent\_good\_spike: 548308

Good spike ratio: 0.835142

nEvent\_post\_trigger\_cut: 656545

nEvent\_with\_clone\_hit: 166455

clone hit ratio: 0.253532

nEvent\_post\_trigger\_cut: 656545

nEvent\_BCOcut\_98survival: 71114

BCOcut\_98survival\_ratio: 0.108316

spike\_content\_ratio\_P123 -> GetMean(): 0.974153

spike\_content\_ratio\_P123 -> GetStdDev(): 0.0308426

spike\_content\_ratio\_PM123 -> GetMean(): 0.974038

spike\_content\_ratio\_PM123 -> GetStdDev(): 0.0310952



- Oct 25
- /sphenix/user/jaein213/macros/inttcalib\_new/hotmap\_cdb/hotmap\_run\_00054280.root
  
- Oct 31
- /sphenix/user/jaein213/macros/inttcalib/hotmap\_cdb\_1031/hotmap\_run\_00054280.root

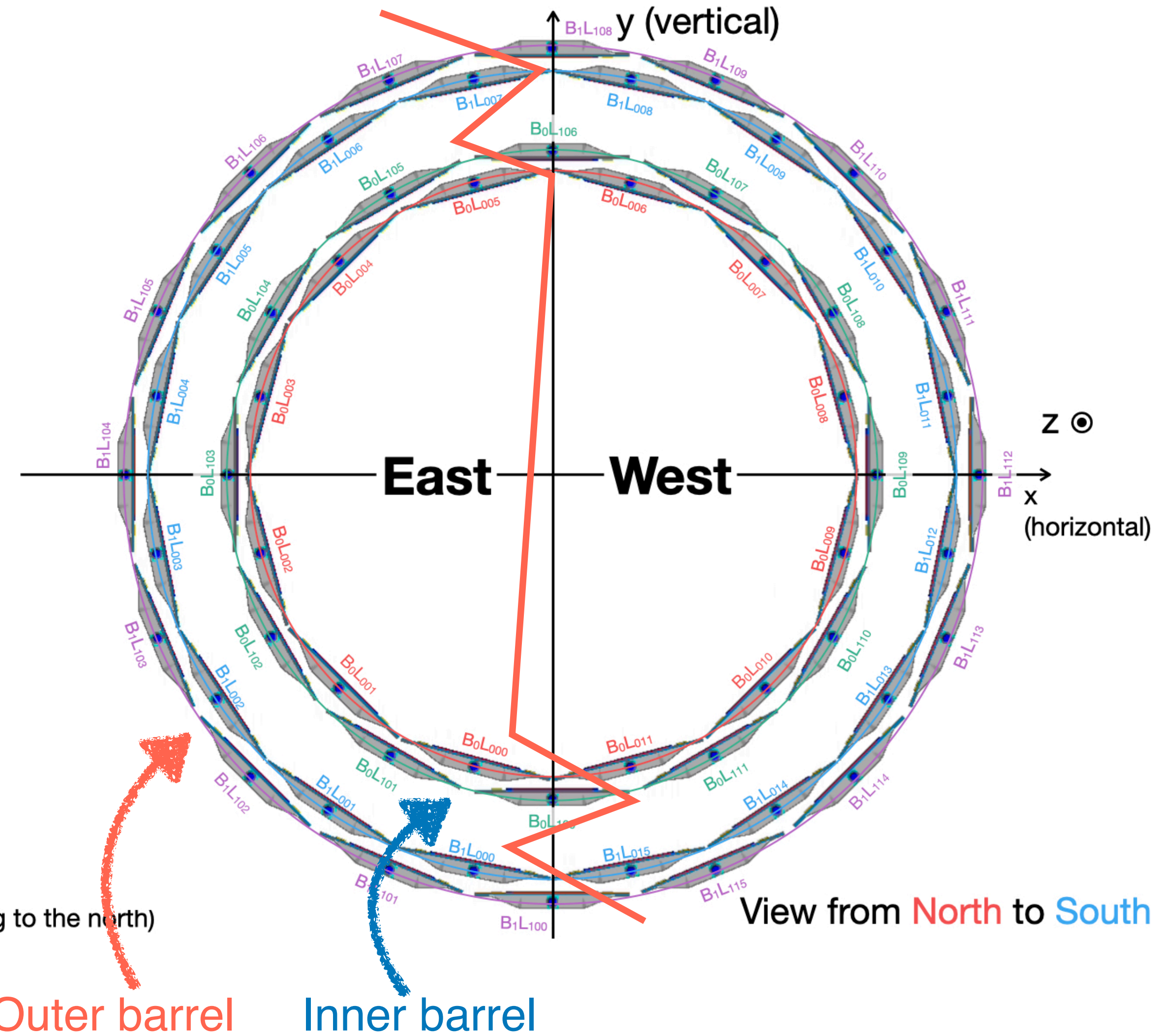
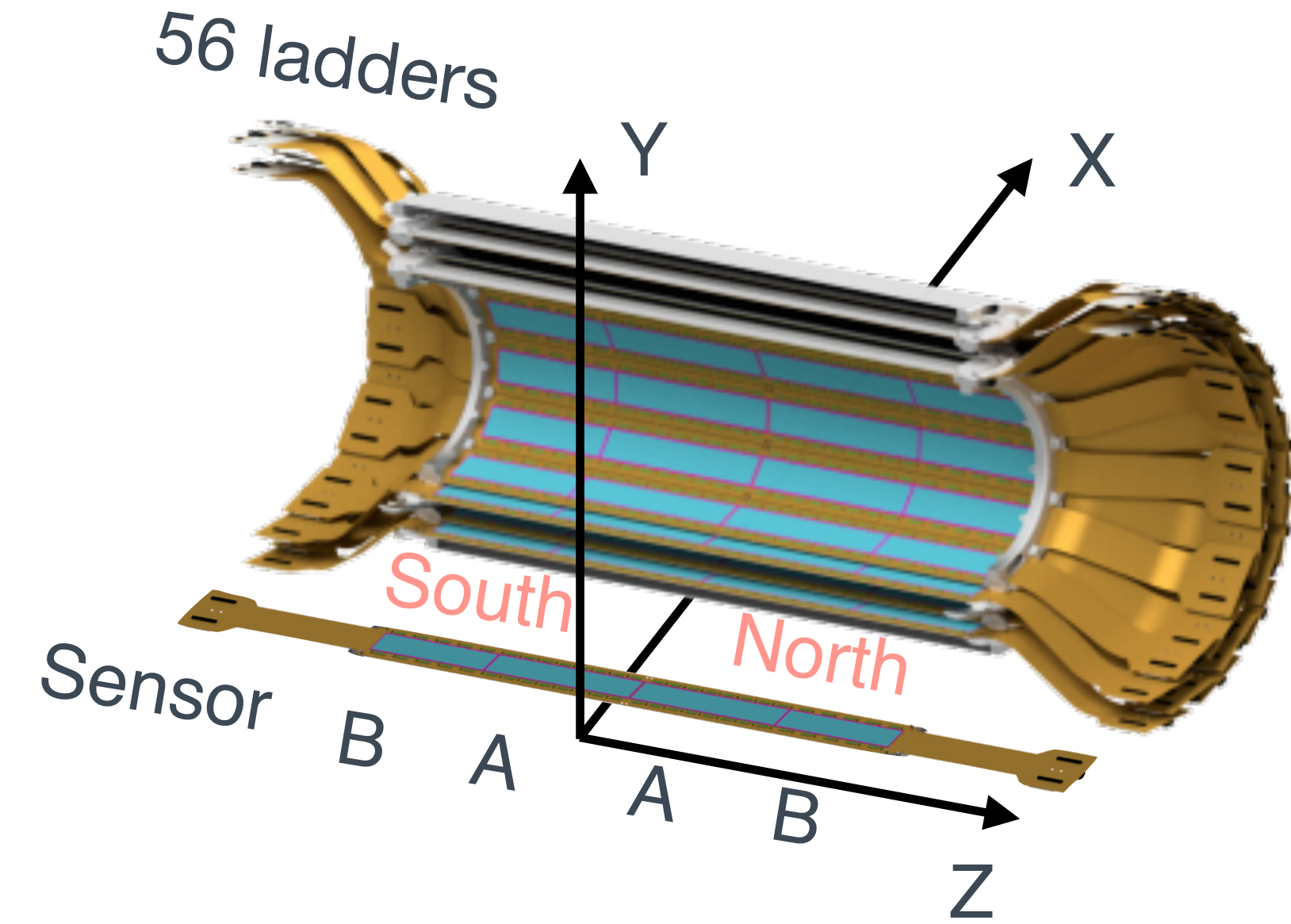
# run 54373 hot channel map



- /sphenix/user/jaein213/macros/inttcalib/test/hotmap\_cdb\_1106/  
hotmap\_run\_00054373.root

INTT: 2 sensors X 2 sides of half-ladders X 56 ladders = 224 sensors

Notation:  $B_xL_yz_z$   
 x: Barrel ID (0 for inner or 1 for outer)  
 y: Layer ID (0 for inner or 1 for outer)  
 zz: Ladder ID (from 0 to 15)



Axis (Right-handed coordinate)  
 x-axis:  $\vec{y} \times \vec{z}$   
 y-axis: Vertically upward direction  
 z-axis: The blue beam direction (pointing to the north)