## Automation of hot/dead channel finder

2023/11/13

Nara Women's University

M2 Yuka Sugiyama

## Development of the hot channel algorithm

## Completing hot channel analysis and proceeding MIP analysis

Goal in this workshop: [Establish hot channel algorithm for automation]

## My To-Do List

- Applying BCO cut in my hot channel algorithm I'll report today.
  - How many events are needed to decide the hot channel?
- Comparing the hot channel list with Jaein and Joseph
  - Jaein's and my algorithm is similar, but Joseph's is different.
  - Is each hot channel list consistent?
- Discussing about hot channel algorithm
  - Whose algorithm is adopted?
- MIP peak analysis with commissioning DAC scan data
  - Considering Z-vertex

Yuka Sugiyama (Nara Women's University)



## Definition of hot/good/cold/dead channels

I'm working on automating the hot/dead channel finder.

I did single-gaussian fitting on the # of hits distribution of beam data (Run20869).

- 1. Normalize # of hits/channel by chip length, acceptance, and # of events.
- 2. Make a # of hits distribution for each chip type.
- 3. Do single-gaussian fitting and define hot, good, cold, and dead channels.



## Map of hot/good/cold/dead channels

I made each channel maps from # of hits distribution. For example, I show each map in the following plots.



2023/11/13

INTT boot camp

BCO distribution and BCO cut

Run20869 (module 0 of Felix 1)





## Summary and plan

- I made dead, cold, good, and hot channel maps.
- I applied BCO cut and compared before and after BCO cut, and differences of BCO peaks.
- $\rightarrow$ With BCO cut, I could do single-gaussian fitting well.
- $\rightarrow$ I think we should apply BCO (peak-1) ~ (peak+1) cut because it has more hits.
- Compare hot channel list with Jaein and Joseph
- Analyze in other Runs
- Discuss which hot channel algorithm we should adopt
- Confirm how much minimum # of events we need to find hot channels.
- Confirm how much maximum # of events we need to find dead channels.



# **No BCO cut**

Felix 0~7

















# **Only BCO peak cut**

Felix 0~7

















## **BCO (peak-1) ~ (peak+1) cut** Felix 0~7

#### Activities felix0 -BCO (peak-1)~(peak+1) cut

Mon 01:41 felix0

### Run20869

Image: 0 →

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File Edit View Options Tools



### Activities felix1 $\sim$ BCO (peak-1)~(peak+1) cut

Mon 01:42 felix1

## •\ Ů •

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Help

0.0127

23/13

0.009478

61.46/13

 $306 \pm 8.4$ 

0.01386

0.01086

71.27/18

 $249.6 \pm 9.0$ 

0.01096 ± 0.00002

 $0.0004835 \pm 0.0000105$ 

11.51 / 10

 $251.3 \pm 8.8$ 

0.01385 ± 0.00001

 $0.0005052 \pm 0.0000109$ 

0.009485 ± 0.000015

0.0006551 ± 0.0000110

 $334.5 \pm 9.1$ 

 $0.01272 \pm 0.00001$ 

0.0006054 ± 0.0000097

Run20869

NhitsA\_L6

NhitsA L13

NhitsB L6

NhitsB L13



## Activities felix2 Mon 01:43 BCO (peak-1)~(peak+1) cut felix2



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Run20869

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#### Activities felix3 🕶 BCO (peak-1)~(peak+1) cut

Mon 01:43 felix3

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# Activities felix4 ~ Mon 01:43 BCO (peak-1)~(peak+1) cut felix4 Elle Edit Yiew Options Tools



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Run20869

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Help

### Activities felix5 -BCO (peak-1)~(peak+1) cut

Mon 01:44 felix5

NhitsA\_L3

0.01116

194.7/24

0.009979

15.77/10

 $387.9 \pm 11.2$ 

 $0.01147 \pm 0.00001$ 

 $0.0004765 \pm 0.0000083$ 

Mean

 $\chi^2$  / ndf

Mean

Sigma

Constant

## Run20869

NhitsA\_L6

NhitsA L13

Mean

Constant

Mean

Sigma

Mean

 $y^2$  / ndf

Mean

Sigma

Constant

44 x2 / ndf

200 F

File Edit View Options Tools NhitsA LO Mean 0.01198 Mean  $\chi^2$  / ndf 17.38/11  $\chi^2$  / ndf \$ 451 Constant  $442.8 \pm 12.1$ 

250 E

200

150

-Joor

Mean

 $\chi^2$  / ndf

Mean

Sigma

Mean

 $\chi^2$  / ndf

Mean

Sigma

Mean

Mean

28 Sigma

200

150

100

y2 / ndf

Constant

150

100

Constant

50

200

150

100

Constant

NhitsB L0

NhitsB L7

0.01193

12.3/10

0.01184

20.28/11

 $341 \pm 11.8$ 

0.01188 ± 0.00001

0.0003685 ± 0.0000074

 $255.7 \pm 8.8$ 

 $0.01193 \pm 0.00001$ 

0.0004955 ± 0.0000100





NhitsA L1





0.01123

0.01321

13.12/10

 $326.1 \pm 11.2$ 

0.01322 ± 0.00001

0.0003875 ± 0.0000076

23.49/8

 $326.2 \pm 10.8$ 

 $0.01123 \pm 0.00001$ 

0.0003845 ± 0.0000067

NhitsB L8

0

1.062e-11/0

 $2628 \pm 865.9$ 

 $0.1587 \pm 0.1047$ 

NhitsB L1

Mean

Mean

Sigma

Mean

Mean

Sigma

y2 / ndf

Constant

50

(0)

 $\chi^2$  / ndf

Constant

0.0115

23.09/11

 $461.4 \pm 12.2$ 



NhitsB L2

NhitsB L9

Mean

 $\chi^2$  / ndf

Mean

Sigma

Mean

Mean

25 Sigma

200 E

150

100

 $\gamma^2$  / ndf

Constant

210

150E

100

Constant

0.0105

85.63 / 10

0.01274

11.21/9

 $328 \pm 11.0$ 

 $0.01274 \pm 0.00001$ 

0.0003858 ± 0.0000070

 $347.8 \pm 13.0$ 

 $0.01082 \pm 0.00001$ 

 $0.0003191 \pm 0.0000072$ 

NhitsA L9

NhitsA L2

Mean

 $\gamma^2$  / ndf

Mean

Sigma

100

200

100

Constant

0.01072

51.15/16

 $540.6 \pm 14.5$ 

0.01077 ± 0.00001

0.0003684 ± 0.0000055







NhitsB L10

Mean

Mean

Sigma

 $\chi^2$  / ndf

Constant

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0.009551

125.5/22

 $347.4 \pm 12.8$ 

0.00993 ± 0.00001

 $0.0003315 \pm 0.0000073$ 



NhitsA L4

NhitsA L11

Mean

 $\chi^2$  / ndf

Mean

Sigma

Mean

 $\chi^2$  / ndf

Mean

sigma

200

150

100

Constant

256 F

200

150

100

Constant

0.01181

0.01348

19.4/10

 $392.8 \pm 10.4$ 

0.01348 ± 0.00001

 $0.0005162 \pm 0.0000077$ 

26.78/9

 $459.5 \pm 12.0$ 

0.01181 ± 0.00001

 $0.000439 \pm 0.000006$ 





NhitsA L5

NhitsA L12

NhitsB L5

Mean

500

300

200

100

400

300

200

150

 $\chi^2$  / ndf

Mean

Mean

 $\chi^2$  / ndf

Mean

Mean

 $\chi^2$  / ndf

Mean

Sigma

200

150

100

Constant

sigma

Constant

or Sigma

Constant

0.01033

12.95 / 11

0.01237

0.01036

9.385/7

 $352.5 \pm 12.0$ 

0.01036 ± 0.00001

0.0003598 ± 0.0000071

9.846/9

 $458.9 \pm 12.4$ 

0.01236 ± 0.00001

 $0.0004434 \pm 0.0000070$ 

 $544.8 \pm 14.4$ 

0.01032 ± 0.00001

0.0003726 ± 0.0000054







0.01069

0.01217

78.62/21

 $420.4 \pm 11.5$ 

0.01226 ± 0.00001

 $0.0004675 \pm 0.0000073$ 

38.91 / 19

 $438.4 \pm 12.3$ 

 $0.01074 \pm 0.00001$ 

0.0004585 ± 0.0000080

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#### Activities felix6 -BCO (peak-1)~(peak+1) cut

0.01188

NhitsA L1

0.01226

Mean

File Edit View Options Tools NhitsA LO

Mean

Mon 01:44 felix6

NhitsA L3

0.01089

Mean

NhitsA L4

Mean

0.01227

## 

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Help

0.01172

0.01018

0.01168

0.0101

31.35/9

 $288.2 \pm 11.1$ 

69.59/18

 $305.5 \pm 10.7$ 

 $0.01183 \pm 0.00001$ 

 $0.0003963 \pm 0.0000081$ 

15.23/11

 $444 \pm 12.5$ 

0.01055 ± 0.00001

 $0.0004084 \pm 0.0000064$ 

9.513/9

 $478.2 \pm 12.8$ 

 $0.01173 \pm 0.00001$ 

 $0.0004253 \pm 0.0000063$ 

Run20869

NhitsA\_L6

NhitsA L13

NhitsB L6

Mean

Mean

Sigma

Mean

 $\chi^2$  / ndf

Mean

Sigma

Mean

 $\chi^2$  / ndf

Mean

251 Sigma

50

100

Constant

30

Constant

 $\chi^2$  / ndf

Constant

 $\chi^2$  / ndf 75.12/21 χ<sup>2</sup> / ndf Constant 81.92/16  $y^2$  / ndf 40.23/14  $\chi^2$  / ndf 83.75/22  $\chi^2 \ / \ ndf \\ Constant$ 37.95 / 13  $\chi^2$  / ndf 8 500 Constant  $379.7 \pm 10.3$  $256.8 \pm 7.3$ Constant  $420.6 \pm 11.7$ Constant  $372.3 \pm 10.4$  $425.5 \pm 11.2$ Constant Mean 0.01198 ± 0.00001 Mean 0.01306 ± 0.00002 Mean  $0.01184 \pm 0.00001$ Mean  $0.01099 \pm 0.00001$ Mean 0.01228 ± 0.00001 Mean Sigma 0.0005183 ± 0.0000077 20 Sigma  $0.0007133 \pm 0.0000115$ Sigma 0.0004772 ± 0.0000081 Sigma  $0.0005263 \pm 0.0000086$ Sigma  $0.0004715 \pm 0.0000066$ aud Sigma 250 250 350 200 200 200 150 200 150 150E 100 100 100 100 NhitsA L7 NhitsA L8 NhitsA L9 NhitsA L10 NhitsA L11 0.01212 0.01108 0.01179 0.01077 0.01116 Mean Mean Mean Mean Mean Mean  $\chi^2$  / ndf 136.6/18 16.26/10  $\chi^2$  / ndf 42.64 / 19  $\chi^2$  / ndf 122.6/37  $\chi^2$  / ndf 15.97/11  $\chi^2$  / ndf  $\gamma^2$  / ndf Constant  $291.1 \pm 8.8$ Constant  $448.4 \pm 12.2$ Constant  $407.1 \pm 11.1$ Constant  $445.7 \pm 12.7$ Constant  $449.3 \pm 11.9$ Constant 0.01257 ± 0.00001 Mean Mean Mean Mean Mean  $0.01108 \pm 0.00001$  $0.01184 \pm 0.00001$ Mean  $0.01081 \pm 0.00001$  $0.01116 \pm 0.00001$ Sigma 0.0006012 ± 0.0000111 sigma  $0.0004528 \pm 0.0000073$ Sigma 0.0004916 ± 0.0000077 Sigma  $0.0004312 \pm 0.0000075$ Sigma  $0.0004511 \pm 0.0000065$ Sigma 300 260 E 150 200 200 150E 150 i de E-100 100 NhitsB L0 NhitsB L1 NhitsB L2 NhitsB L3 NhitsB L4 Mean 0.0114 0.01296 Mean 0.01167 Mean 0.01047 0.01237 Mean Mean Mean  $\chi^2$  / ndf 136.8 / 17  $\chi^2$  / ndf 67.26 / 16  $\chi^2$  / ndf 121.5/25 1 251  $\chi^2$  / ndf 12.36/9  $\chi^2$  / ndf 14.67/8  $\chi^2$  / ndf Constant  $253.1 \pm 9.2$ Constant  $194.7 \pm 6.4$ Constant  $298.7 \pm 10.9$ Constant  $249.7 \pm 9.7$ Constant  $317.7 \pm 11.2$ Constant Mean 0.01166 ± 0.00001 Mean  $0.01294 \pm 0.00002$ Mean  $0.01172 \pm 0.00001$ Mean  $0.01107 \pm 0.00001$ Mean  $0.01237 \pm 0.00001$ 306 Mean Sigma Sigma Sigma Sigma  $0.0004038 \pm 0.0000092$ Sigma Sigma  $0.0004512 \pm 0.0000095$ 0.000622 ± 0.000010 0.0003868 ± 0.0000084 0.0003974 ± 0.0000085 200 20 200F 200 F 150 110 150 100 60 F 100 100 NhitsB L7 NhitsB L8 NhitsB L9 NhitsB L10 NhitsB L11 Mean 0.01186 Mean 0.01102 Mean 0.01121 Mean 0.01047 Mean 0.01134 Mean  $\chi^2$  / ndf  $\chi^2$  / ndf 36.55 / 10  $\chi^2$  / ndf χ<sup>2</sup> / ndf Constant  $\chi^2$  / ndf 12.72/10 8 350  $\chi^2$  / ndf 6.956/9 131.3/20 34.06/10 8 25 8.50  $221.5 \pm 8.6$ Constant  $364.3 \pm 12.5$ Constant  $229 \pm 9.0$ Constant  $322.1 \pm 11.8$  $295.9 \pm 10.8$ Constant 351 Mean  $0.0123 \pm 0.0000$ Mean  $0.01101 \pm 0.00001$ Mean 0.01168 ± 0.00001 Mean  $0.01074 \pm 0.00001$ Mean 0.01136 ± 0.00001 Mean Sigma 0.0004846 ± 0.0000116 Sigma <sup>20</sup> Sigma 0.0004537 ± 0.0000111 Sigma 0.0003564 ± 0.0000079 Sigma  $0.0004212 \pm 0.0000100$ 300 Sigma 0.0003486 ± 0.0000069 200 250 F 150 150 200 150 50E 100 100 140 100 (0)E

NhitsA L2

Mean

0.01185



NhitsA L5

NhitsA L12

NhitsB L5

Mean

0.01102

22.14/9

0.009733

0.0111

6.028/7

 $351.5 \pm 12.1$ 

 $0.0111 \pm 0.0000$ 

0.0003617 ± 0.0000072

23.48/10

 $471.1 \pm 13.5$ 

 $0.01038 \pm 0.00001$ 

 $0.0004018 \pm 0.0000070$ 

 $508.5 \pm 13.9$ 

0.01102 ± 0.00001

0.0003976 ± 0.0000064

#### Activities felix7 -BCO (peak-1)~(peak+1) cut

Mon 01:44 felix7

## Run20869

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