

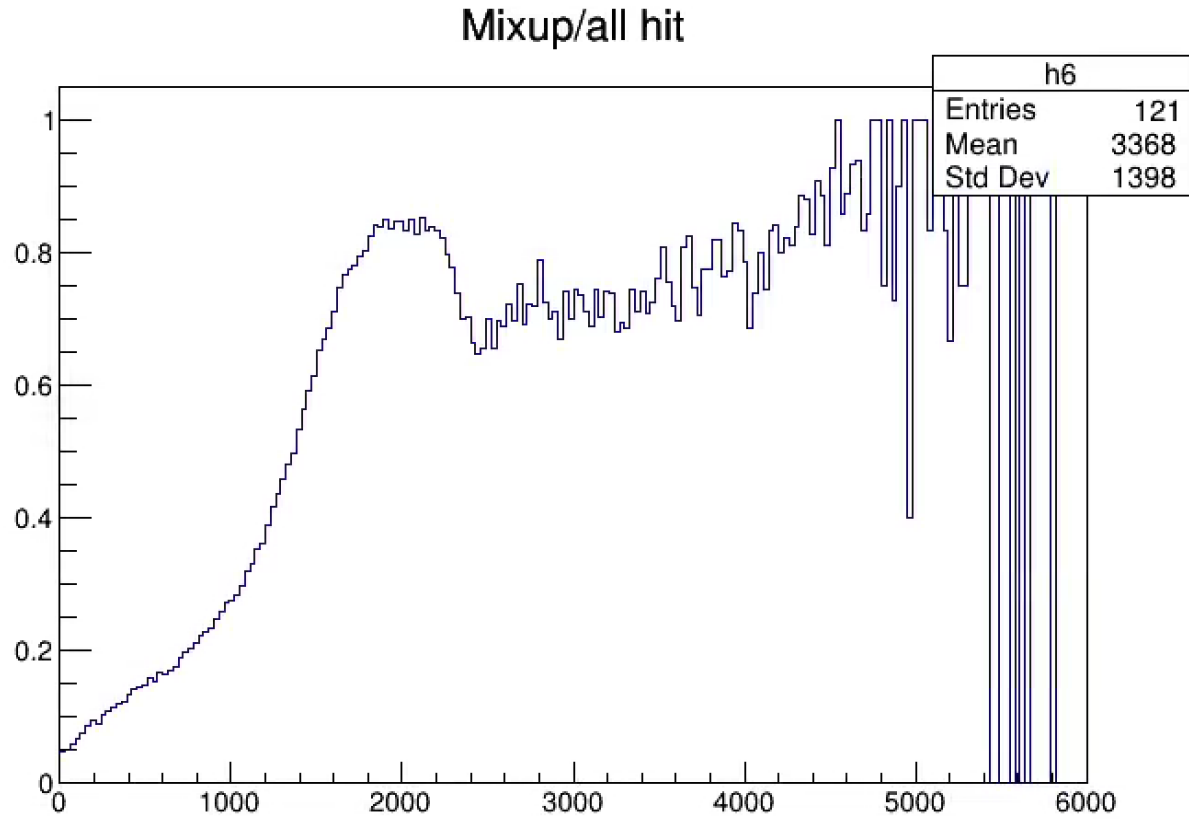
# Flush report

NWU

Mai Kano

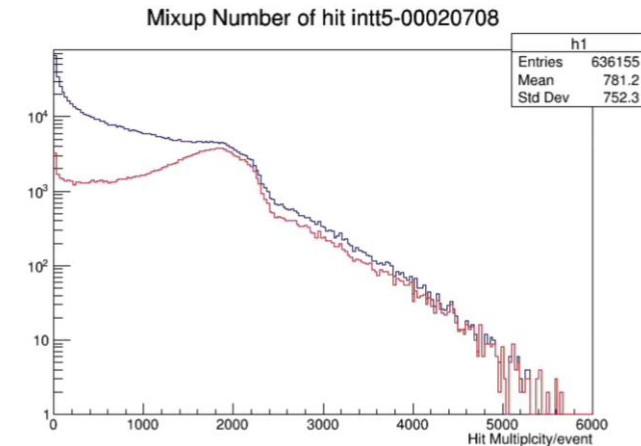
2023/11/10

# Multiplicity dependence $\text{Mixup event } N_{\text{hit}} / \text{All event } N_{\text{hit}}$ (ratio) Run20708



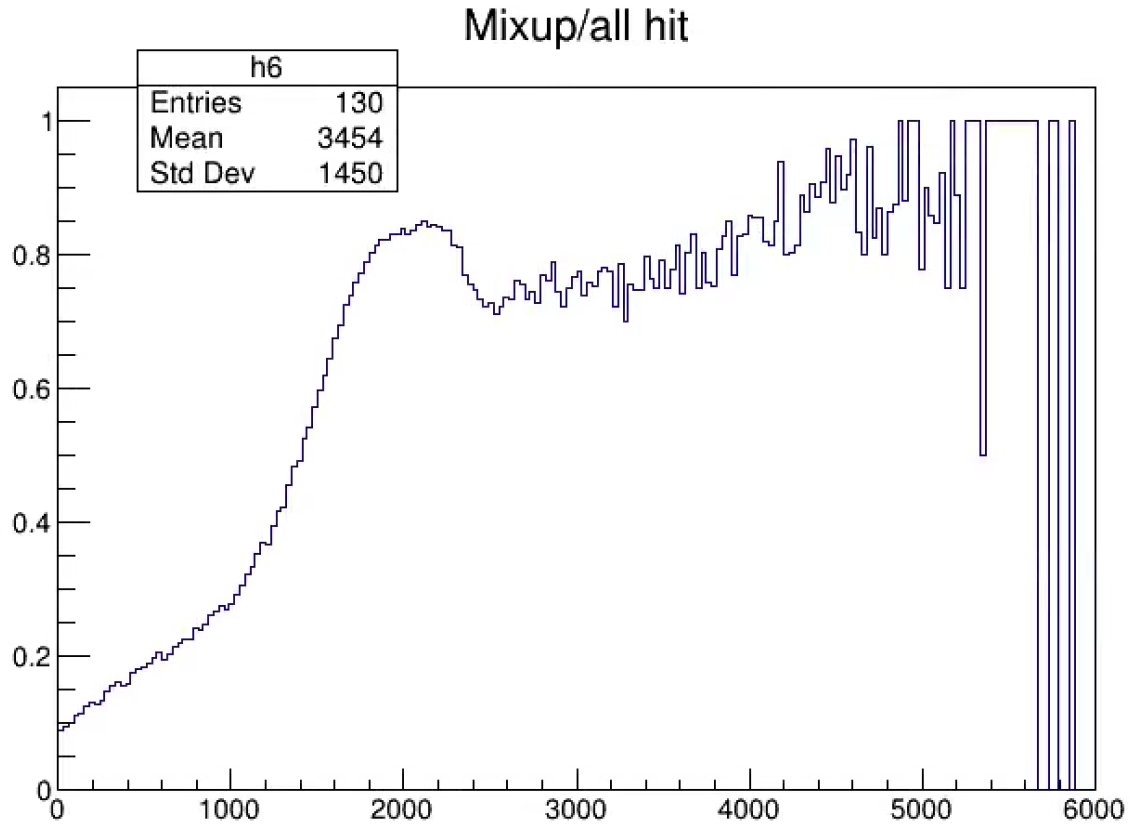
The left figure shows the distribution obtained by dividing the red and black lines of the Multiplicity distribution in the lower right.

I still don't understand why ratio shape.



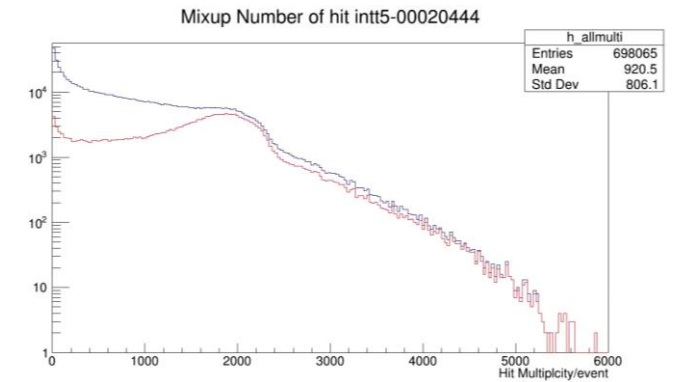
Multiplicity dependence can be quantitatively determined.

# Multiplicity dependence $\text{Mixup event } N_{\text{hit}} / \text{All event } N_{\text{hit}}$ (ratio) Run20444



The left figure shows the distribution obtained by dividing the red and black lines of the Multiplicity distribution in the lower right.

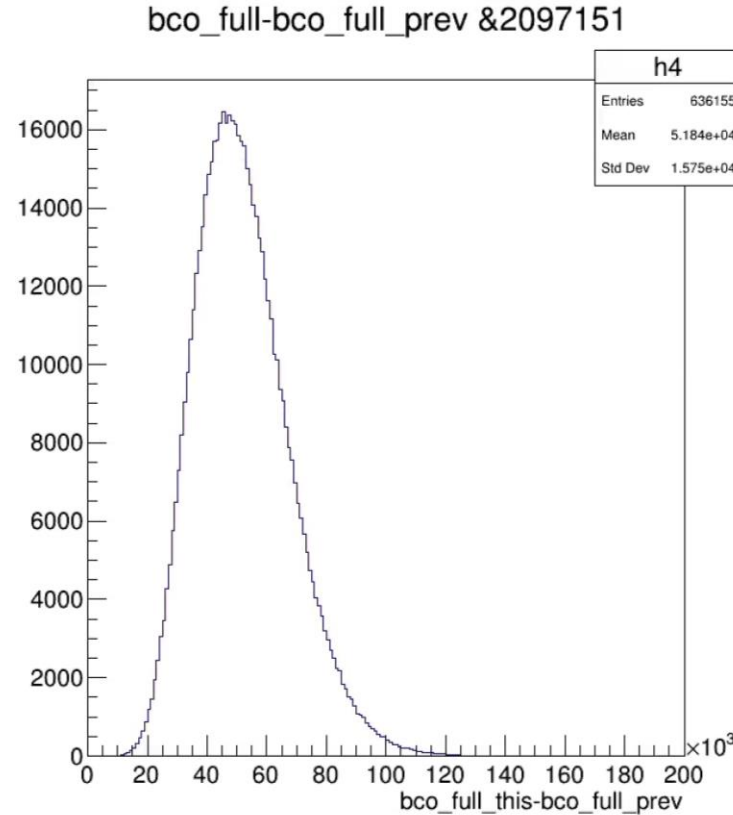
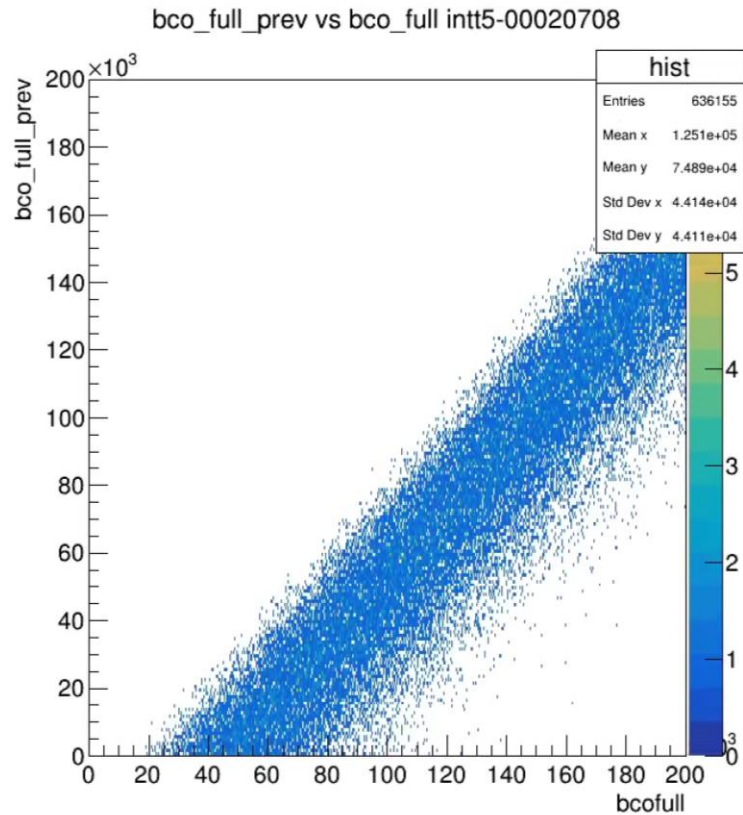
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Multiplicity dependence can be quantitatively determined.

# Collision interval dependence

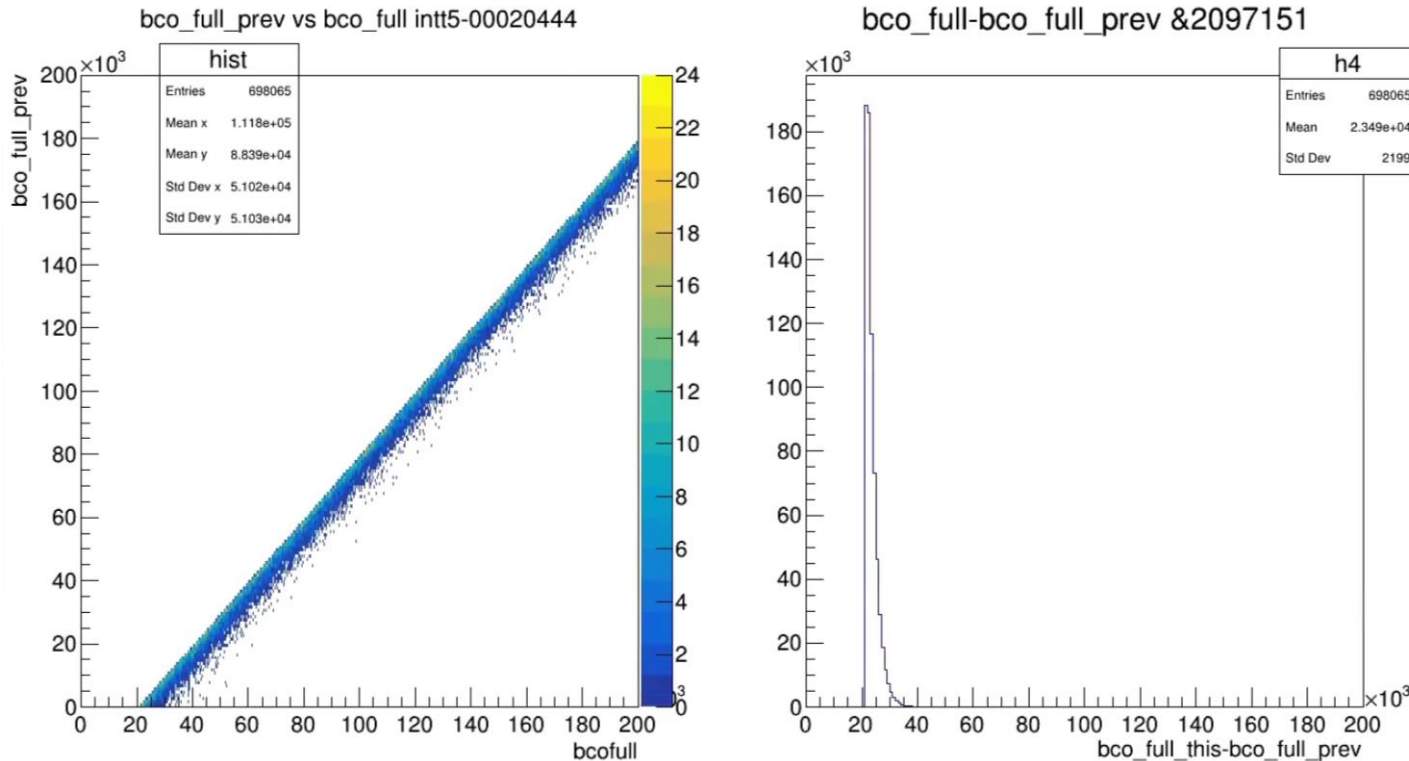
- BCO\_Full\_this-BCO\_Full\_prev &0x1FFFF (Lower 21 bits)Run20708



To examine collision interval dependence, I first made a plot of BCO\_Full\_this-BCO\_Full\_prev(Lower 21bits). This result shows that this run has a collision interval of about  $50 \times 10^3$  Beam clocks.

# Collision interval dependence

- BCO\_Full\_this-BCO\_Full\_prev &0x1FFFF (Lower 21 bits) Run20444 INTT trigger rate 450Hz



This result shows that this run has a collision interval of about  $20 \times 10^3$  Beam clocks.

The difference in shape from the previous plot is likely due to the different trigger rates.

My next step is to find out the collision interval and the incidence of mixup.  
→ I will make a plot of BCO\_Full\_this-BCO\_Full\_prev vs Mixup Multiplicity

# Event Mixup

**Mix-up hits from previous event and this event.**

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**Goal in this workshop:** Examining the incidence of Event Mixup.

## My To-Do List

- Checking collision interval dependence
  - Making plot of BCO\_Full\_previous – BCO\_Full\_this others run
  - Making plot of interval vs Mixup Multiplicity
- Checking open time scan dependence
- ~~Examining multiplicity dependent quantitatively~~
- Cutting out the non-mixed hits when taking a mix-up event
- ~~Creating a document about of Event Mixup to inform Raul~~
- Checking N-2,N-3,N+2,N+3
- Checking Multiplicity Ladder by ladder
- Checking others Felix

Back up

# What is Event Mixup?

- The definition of the Event is the group of hits comes from the same collision.
- We observe some suspicious events which are likely to be mix-up hits from previous event and this event. We call them “Mixed-up Events” hereafter.
- The mix-up event will screw up track reconstruction of INTT in offline analysis and has to be fixed ASAP.

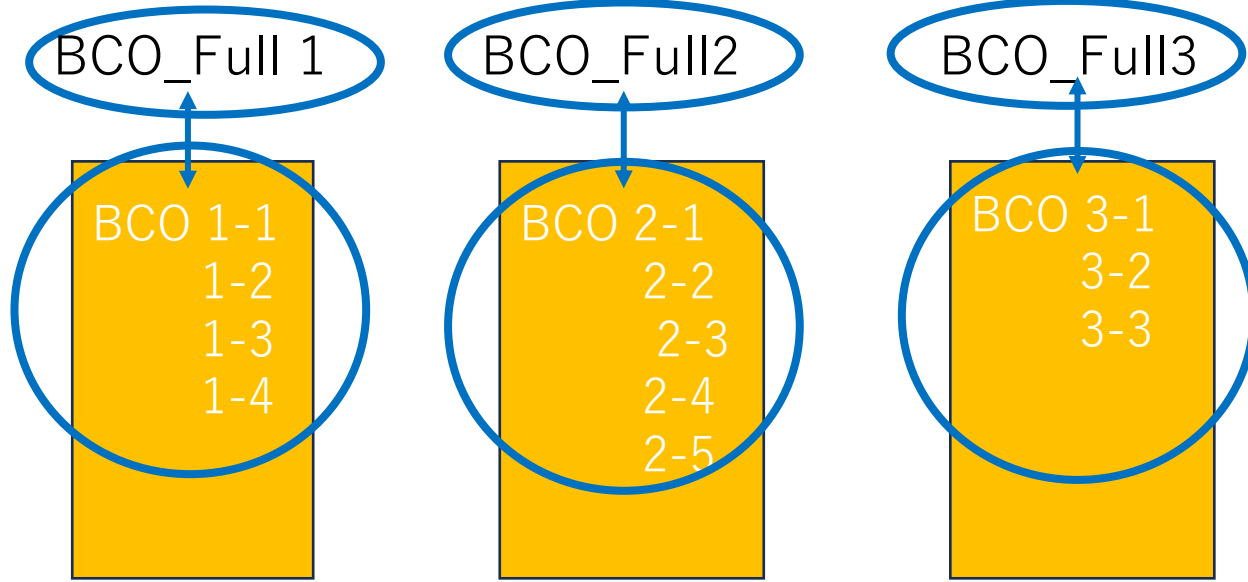


# BCO Correlation in for NO mix-up

(Previous)

(This)

(Next)



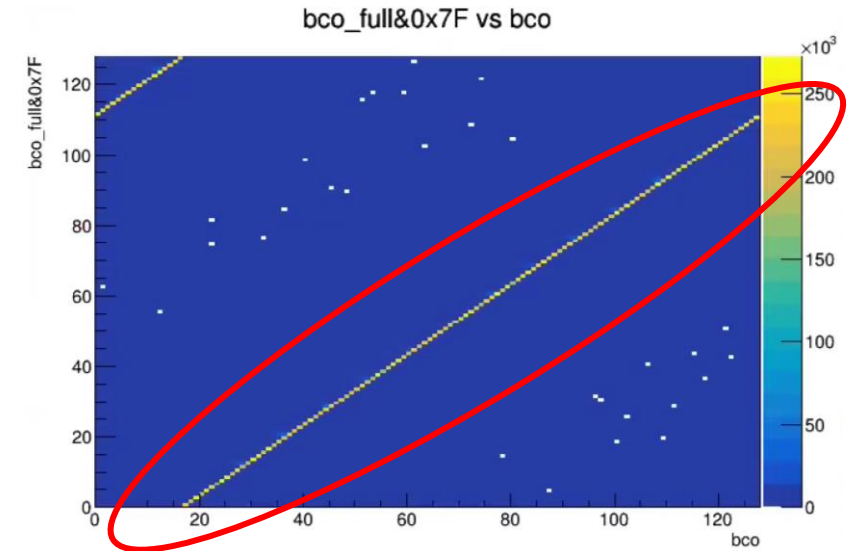
For example, suppose that when normal and no mixup is occurring, the above figure is shown.

The figure on the right shows the correlation between BCO(x-axis) and the lower 7 bits of BCO\_Full(y-axis).

BCO\_Full and BCO in the same event are correlated (hit from collision).

Run23648 intt5

Same event BCO\_Full & 0x7F vs BCO



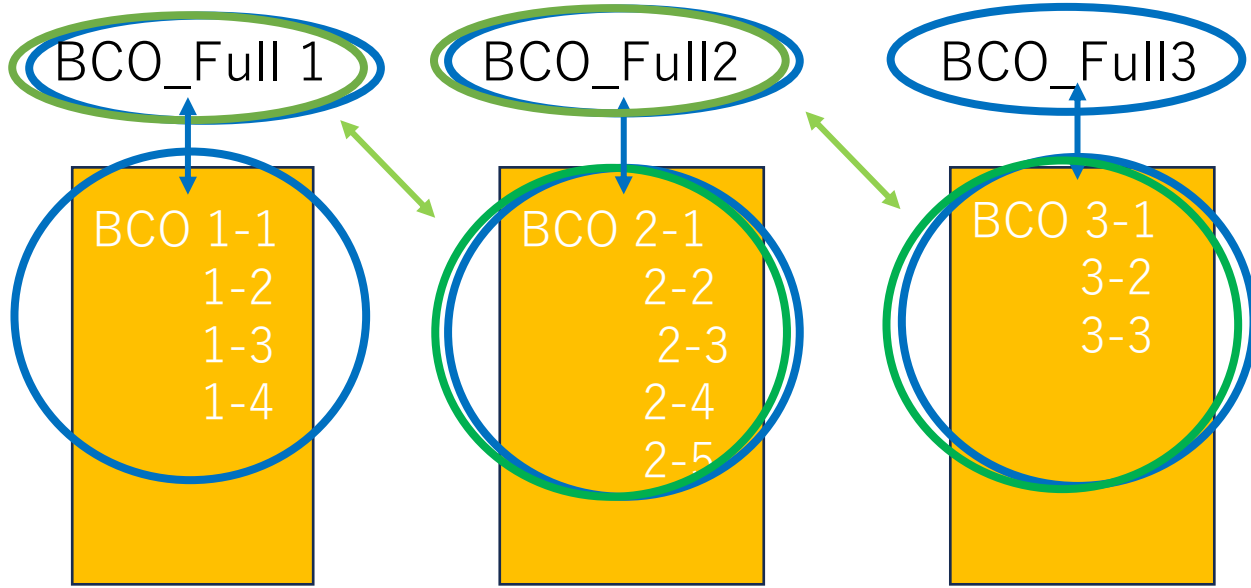
Perfect correlation observed as expected

# BCO Correlation in for NO mix-up

(Previous)

(This)

(Next)



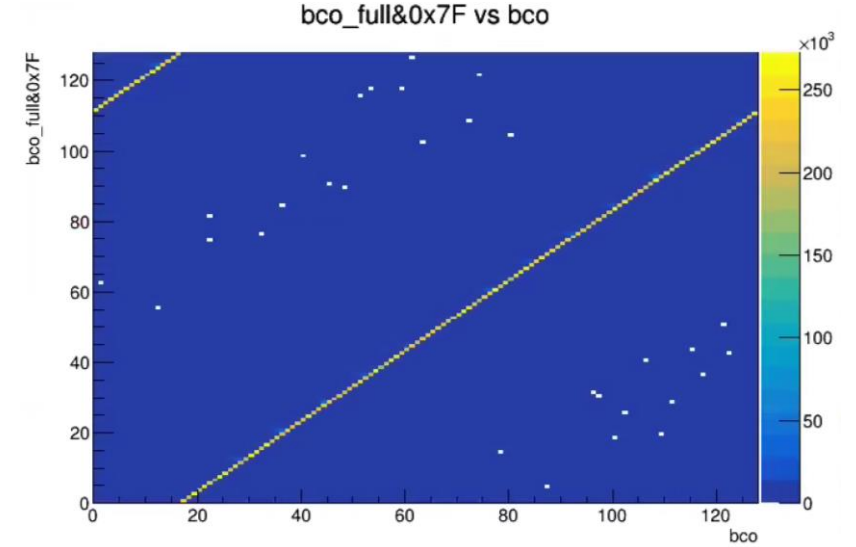
For example, suppose that when normal and no mixup is occurring, the above figure is shown.

The figure on the right shows the correlation between BCO(x-axis) and the lower 7 bits of BCO\_Full(y-axis).

If we look at the plot of BCO of one event and BCO\_Full of the previous event here, we don't see the correlation as we expect.

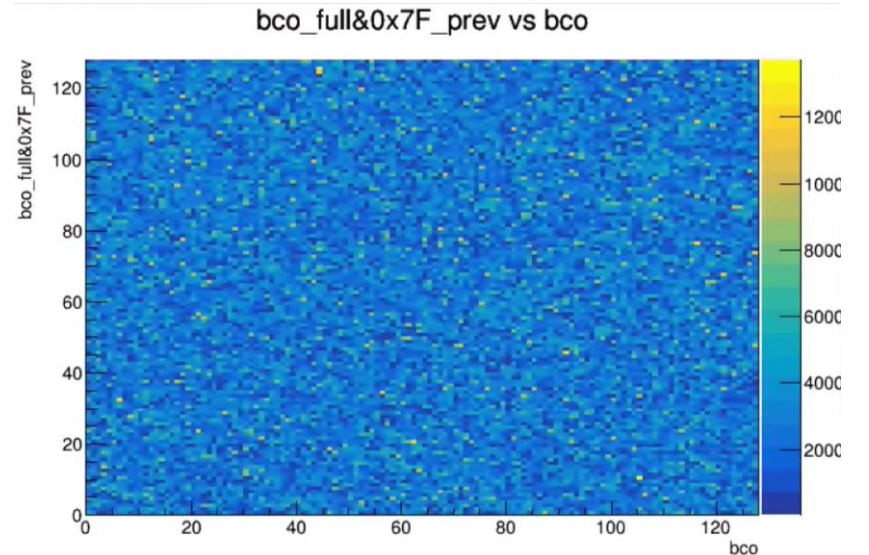
Run23648 intt5

Same event BCO\_Full & 0x7F vs BCO



Run23648 intt5

Previous event BCO\_Full & 0x7F vs BCO

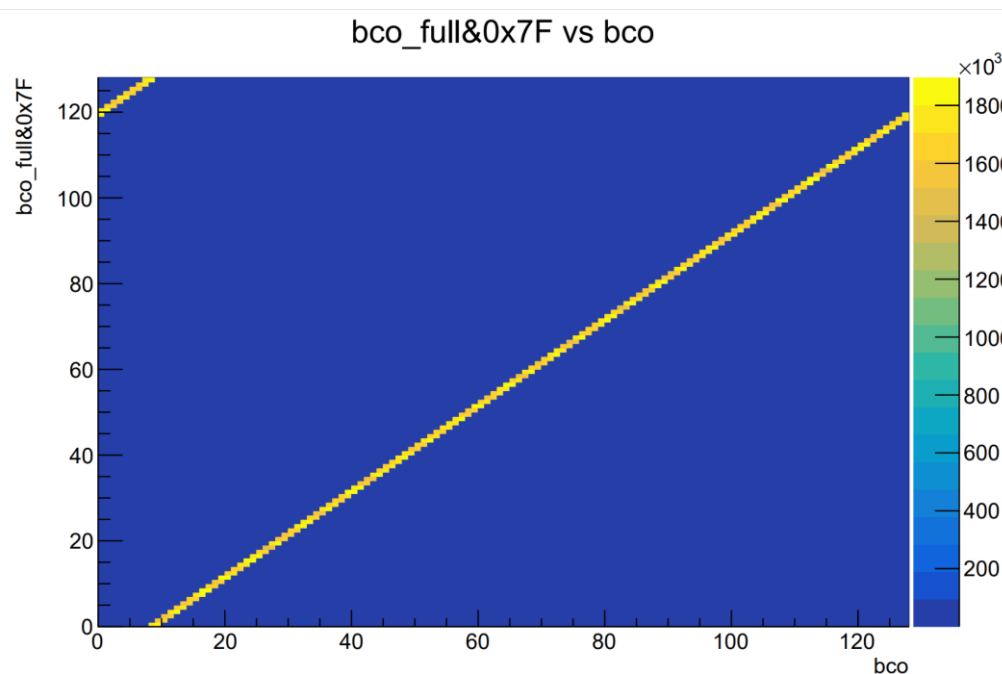


# BCO Correlation in for mix-up

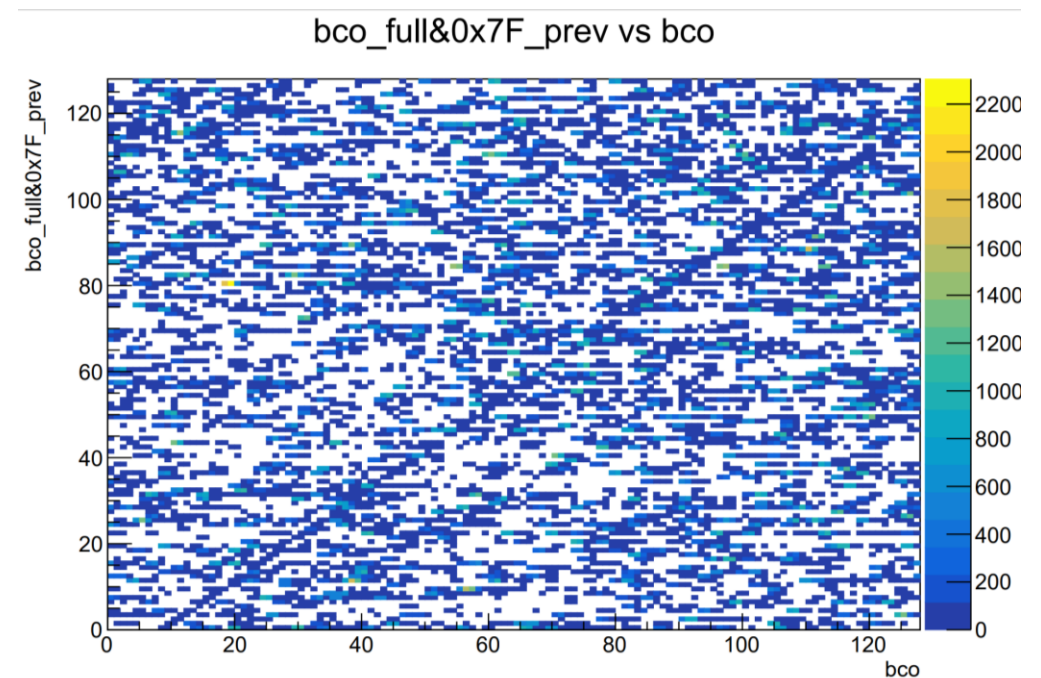
Run20444 intt5

However, the plot of BCO\_Full vs BCO showed that there is a correlation in the results of some runs.

Same event BCO\_Full &0x7F vs BCO



Previous event BCO\_Full &0x7F vs BCO



There should be no correlation between the BCO\_Full of the previous event and the BCO of this event, but the correlation as shown on the right figure suggests that the data from the collision of the previous event has been mixed up with this event. → **Event Mixup is occurring.**

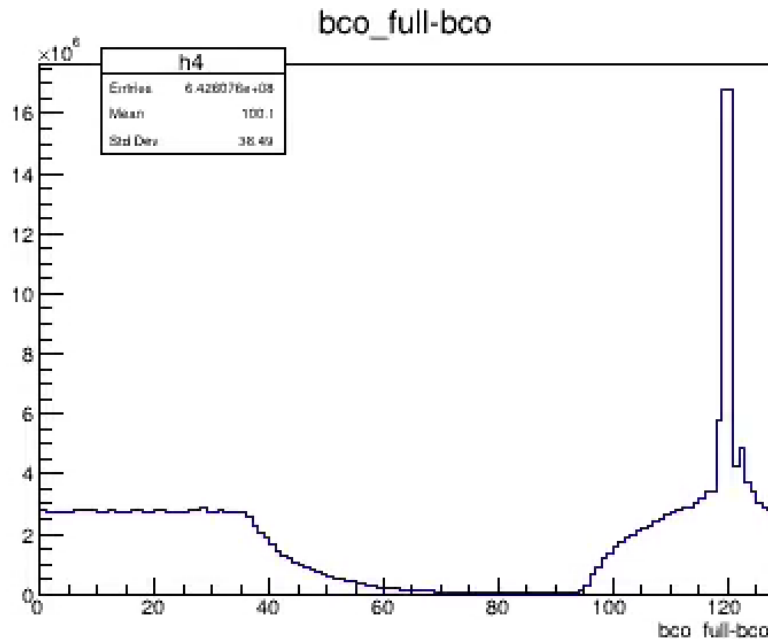
# BCO\_Full\_prev-bco Mixup

Run20444 intt5

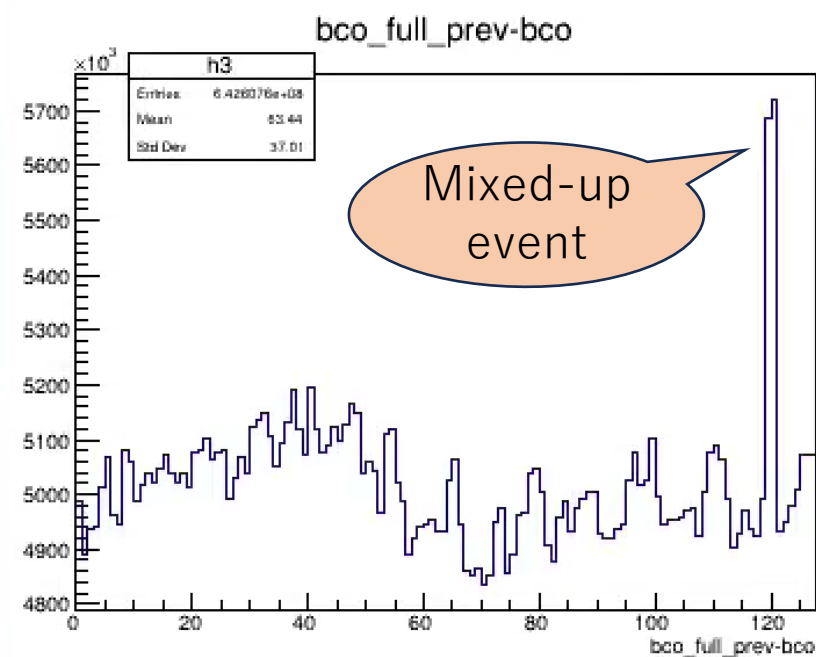
This Run was measured with n\_collision=127

- Also, when looking at the BCO\_Full of the previous event -BCO at the Run where the Mixup is believed to have occurred, I could see the peak standing in the same position as the BCO\_Full-BCO of the same event

Same event BCO\_Full & 0x7F - BCO



Previous event BCO\_Full & 0x7F - BCO



From this result, I think that the data from the collision of the previous event has been mixed up.

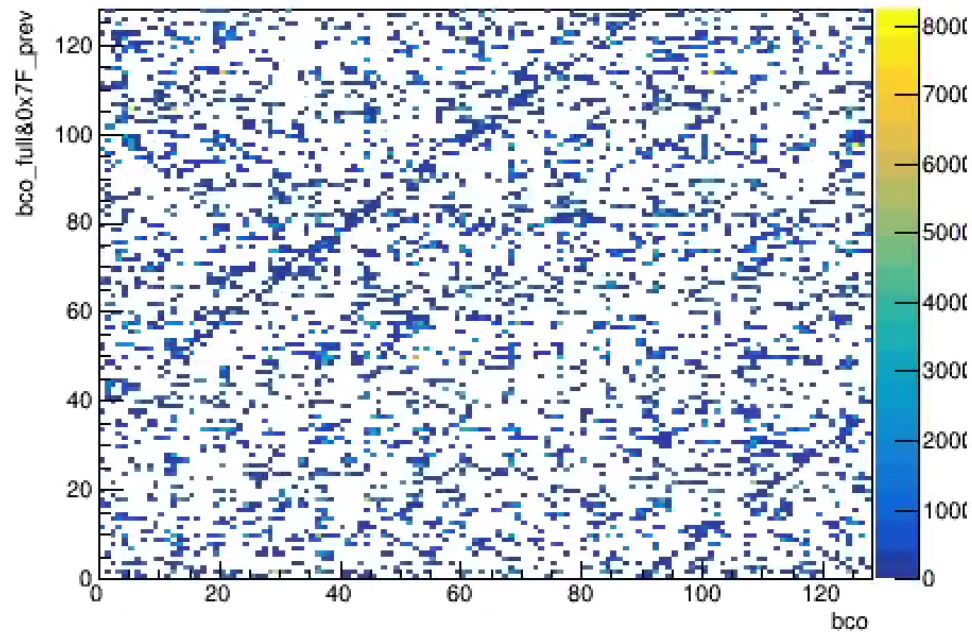
# How about the correlation between “This” and “Next” events?

Run23896 intt5

This Run is what I think the Mixup is occurring

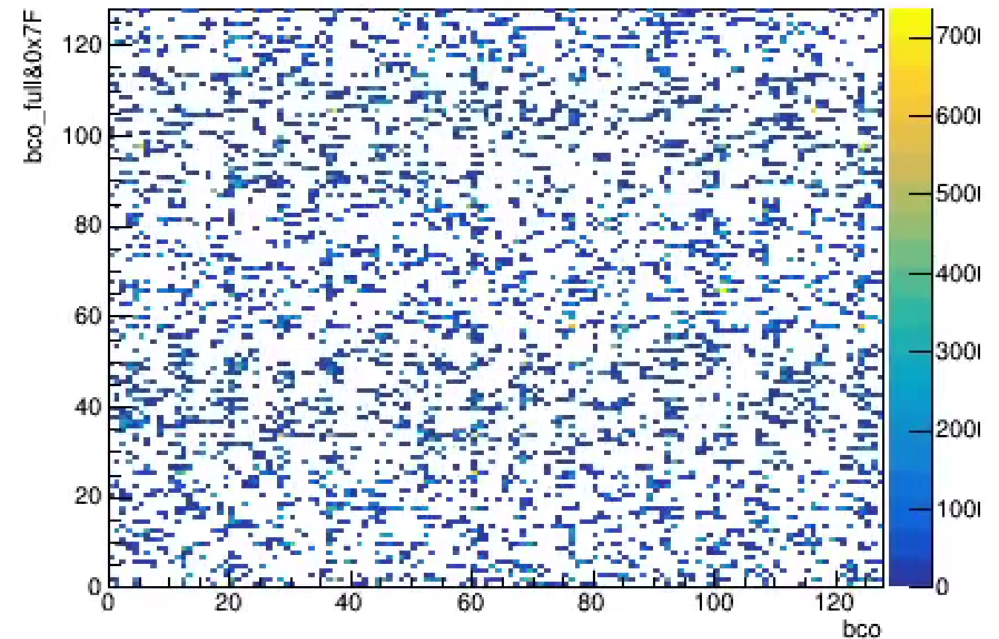
## BCO vs previous event BCO\_Full

bco\_full&0x7F\_prev vs bco intt5-00023896



## BCO vs next event BCO\_Full

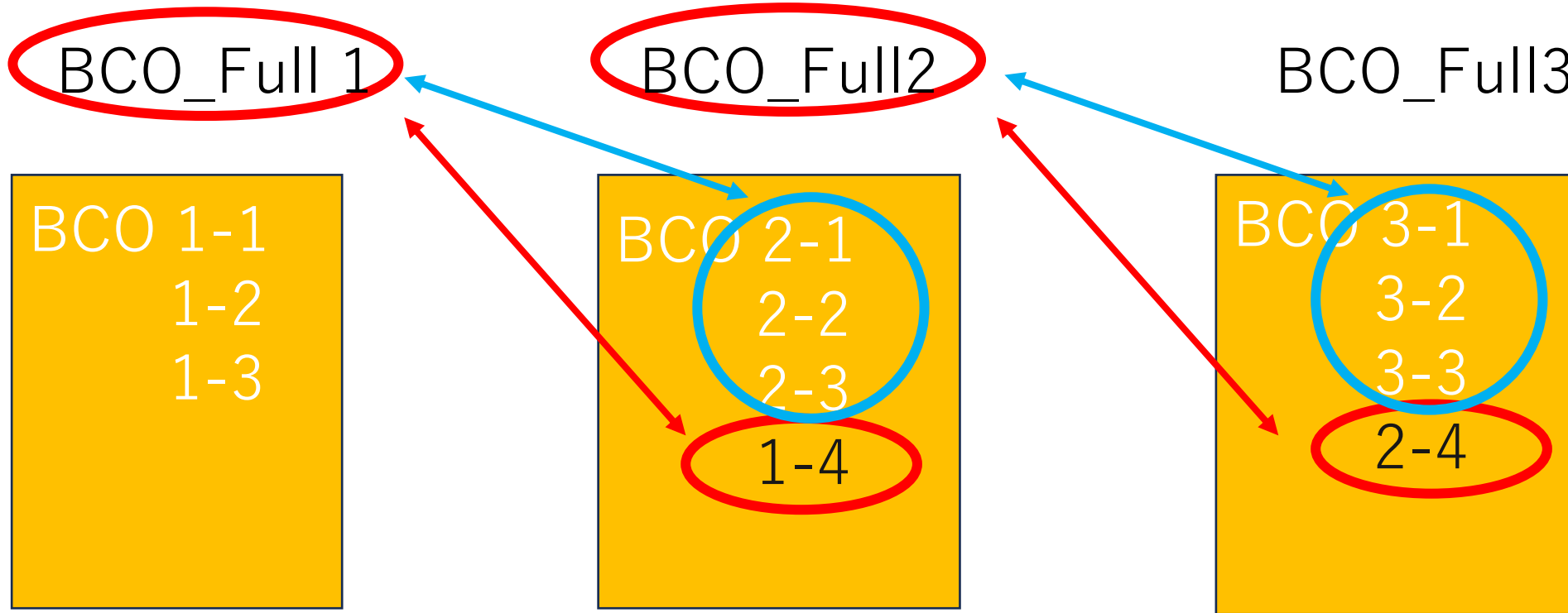
bco\_full&0x7F\_next vs bco



Next I looked at BCO\_Full for the next event vs BCO and the correlation that was there when looking at BCO\_Full for the previous event disappeared.



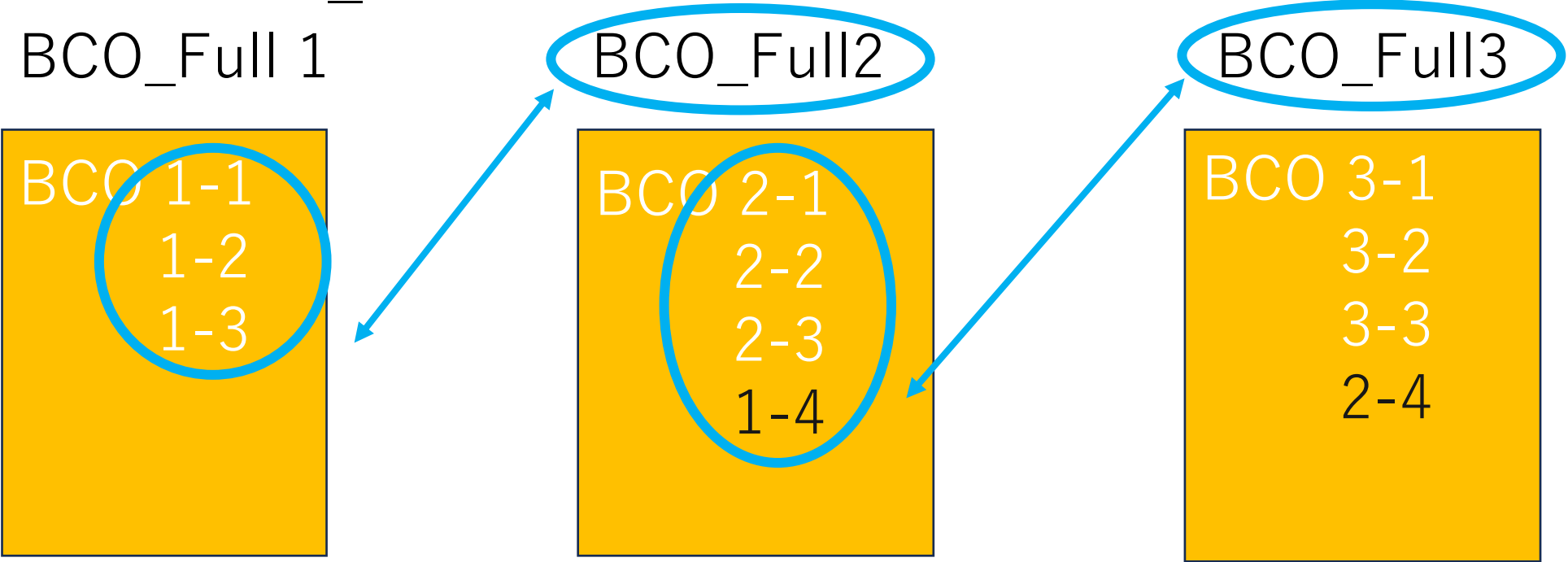
Why this event BCO vs prev event BCO\_Full have correlation



The red circled areas are correlated because the information is from the same collision.

The blue circled area do not match, so there is no correlation.

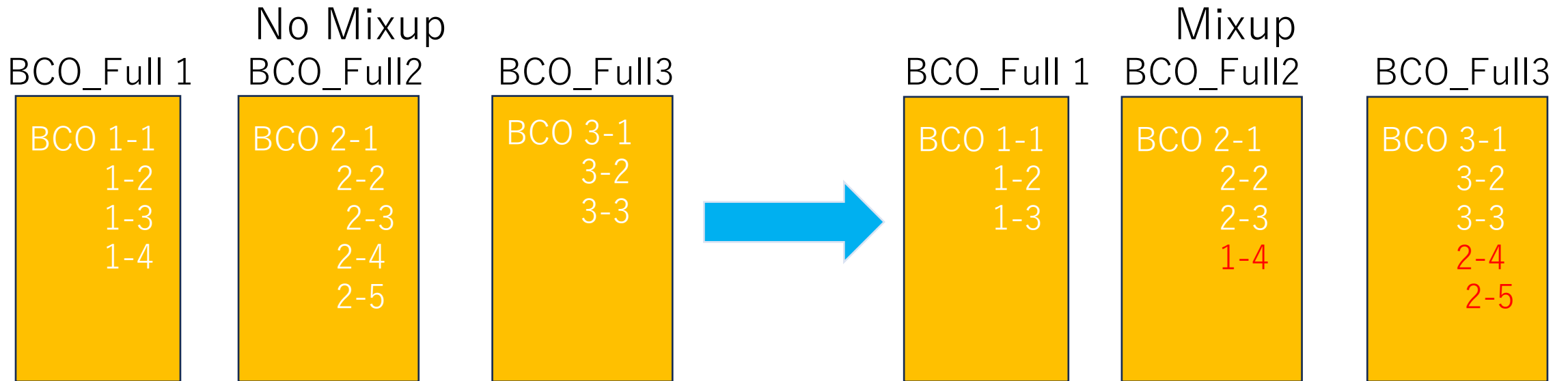
Why we don't observe the correlation in this event BCO vs next event BCO\_Full



There is any combination of data for the same collision and there is no correlation because the labels do not match, as shown in the blue circles.

# What's happening in the case of Event Mix-up?

- From the results so far, Event Mixup is in the form that hit information from the previous event is mixed up with the next event, as shown in the following figure.
- I know that there are Runs where this is happening and Runs where this is not happening, I suspect high multiplicity event causes the event mixup.



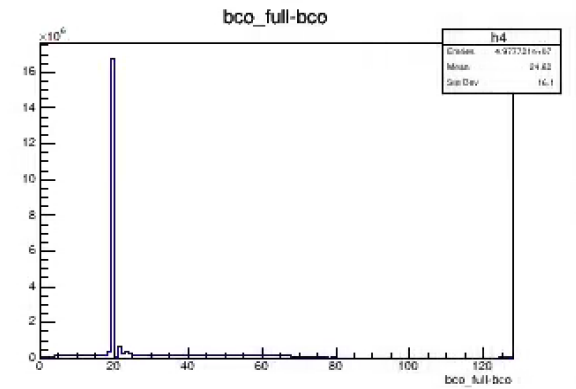
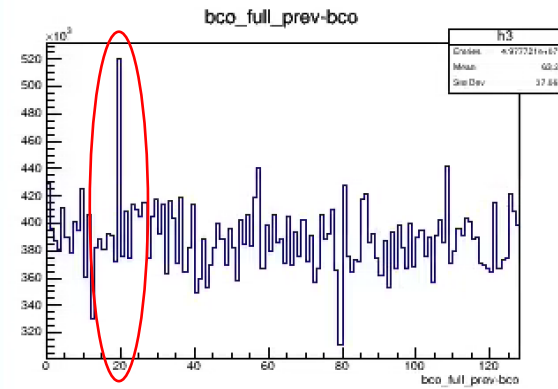
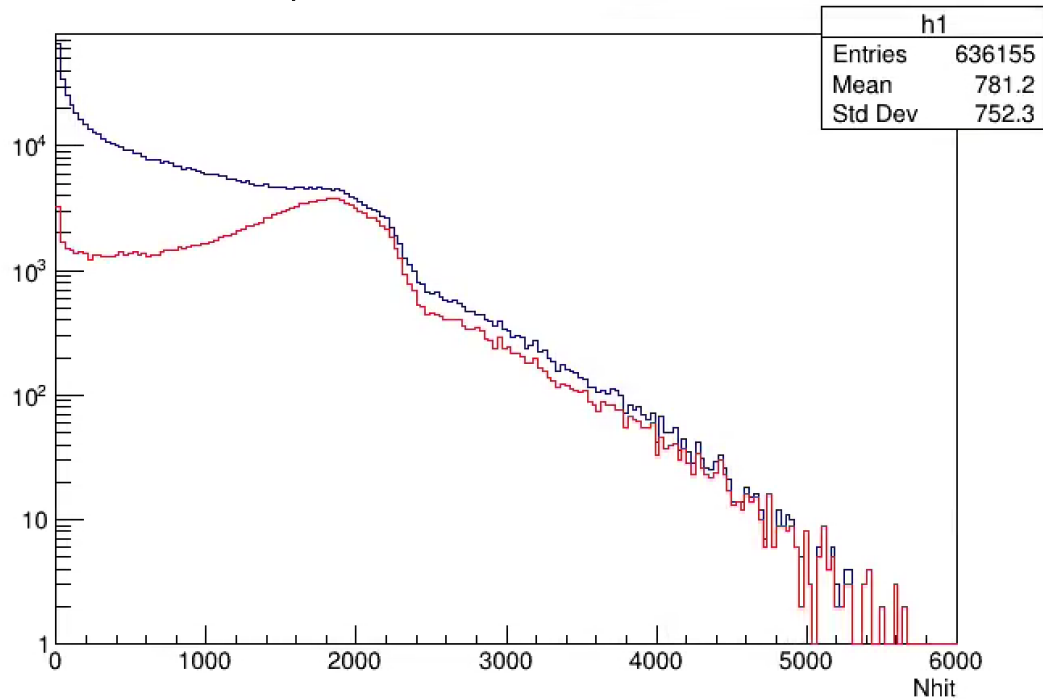


# Multiplicity dependence

Run20708 intt5

Black: All events    Red: Mixup events

Mixup Number of hit intt5-00020708



- Number of hit are plotted in black for all events and in red only for events where mixup are occurring.
- I had selected  $BCO\_Full\_prev - BCO = 19$  events for Mixup.
- Left plot shows that **there is multiplicity dependence in the mixup.**
- Many mixup is occurring where Multiplicity is high.