

# BCO issues 2

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# What is the issue?

- One event in EVT file contains multiple BCO\_FULL hits.
  - See the figure
- To figure out what the problem is, I checked the binary data in the evt file

```
Packet 3001 68 -1 (sPHENIX Packet) 110 (IDINTTV0)
Number of hits: 19
# FEE BCO chip_BCO chip_id channel_id ADC full_phx full_ROC Ampl.
0 2 576431cd9b 0x0 4 97 4 0 0 0 0x82610000
1 2 576431cd9b 0x0 21 126 6 1 1 63 0xcafeff80
2 2 578a844ee4 0x0 0 0 0 0 0 0 0x00000000
3 3 578a844ee4 0x0 0 0 0 0 0 0 0x00000000
4 3 578a844ee4 0x0 21 126 6 1 1 63 0xcafeff80
5 6 578a844ee4 0x0 0 0 0 0 0 0 0x00000000
6 6 578a844ee4 0x6d 30 118 7 1 0 0 0xef7600ed
7 7 576431cd9b 0x0 4 97 4 0 0 0 0x82610000
8 7 576431cd9b 0x0 21 126 6 1 1 63 0xcafeff80
9 7 578a844ee4 0x0 0 0 0 0 0 0 0x00000000
10 9 576431cd9b 0x0 4 97 4 0 0 0 0x82610000
11 9 576431cd9b 0x0 21 126 6 1 1 63 0xcafeff80
12 10 578a844ee4 0x0 0 0 0 0 0 0 0x00000000
13 10 578a844ee4 0x0 21 126 6 1 1 63 0xcafeff80
14 11 578a844ee4 0x0 0 0 0 0 0 0 0x00000000
15 11 578a844ee4 0x0 21 126 6 1 1 63 0xcafeff80
16 13 5764312adc 0x0 4 96 4 0 0 0 0x82600000
17 13 5764312adc 0x0 21 126 6 1 1 63 0xcafeff80
18 13 576431cd9b 0x0 4 97 4 0 0 0 0x82610000
Packet 3001 68 -1 (sPHENIX Packet) 110 (IDINTTV0)
Number of hits: 24
```

# Checking the raw data

- Run 10433
  - Read binary directly

		31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	LSB16, MSB16が入れ替わっている
1		Header								fee				len				Header																header=0xF000CAF0
2	1	Hit-Header								BCO								Hit-Header																Hit-header
3	2	BCO																																
4	3	adc				chip_id				chan_id																AMPL	full ROC	full FPX	FPHX_BCO				hit	
5	4	adc				chip_id				chan_id																AMPL	full ROC	full FPX	FPHX_BCO				hit	
6	5	adc				chip_id				chan_id																AMPL	full ROC	full FPX	FPHX_BCO				hit	
7	6	adc				chip_id				chan_id																AMPL	full ROC	full FPX	FPHX_BCO				hit	
8	7	adc				chip_id				chan_id																AMPL	full ROC	full FPX	FPHX_BCO				hit	

data is NULL

Evt:2 68 68

0 0x

1 0x 20

2 0x

- Always len=7 on all data
  - len is supposed to correspond to the number of hits so len should be smaller than 7 at very end of the packet
  - ⇒ It's not so. It's always 7 ! ! !
- Detected issues.
  - The order (the data format) is different from what we thought. (FELIX)
  - The decoder(Martin prepared) has issue.

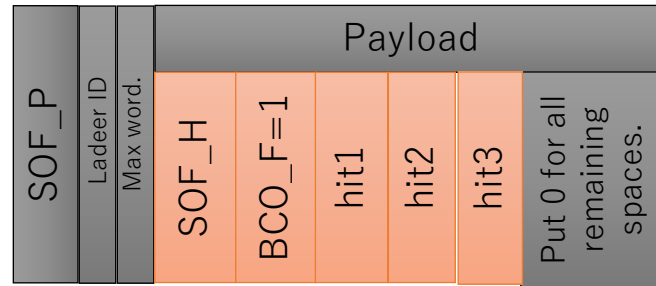
```
data is NULL
Evt:2 68 68 0
0 0x 44
1 0x 20bb9
2 0x 6e
3 0x 0
4 0xf06fcaf0
5 0xcd9b6431
6 0x82610000
7 0xef7f00f6
8 0xef7f00f6
9 0xef7f00f4
10 0xef7f00f5
11 0xef7f00f5
12 0xf0afcaf0
13 0xcafeff80
14 0xad57cade
15 0x2adc6431
16 0x82600000
17 0xcafeff80
18 0xad57cade
19 0xcd9b6431
20 0xf00fcaf0
21 0xad57cade
22 0x2adc6431
23 0x82600000
24 0xcafeff80
25 0xad57cade
26 0xcd9b6431
27 0x82610000
28 0xf01fcaf0
29 0x2adc6431
30 0x82600000
```

# Structure of the FELIX packets

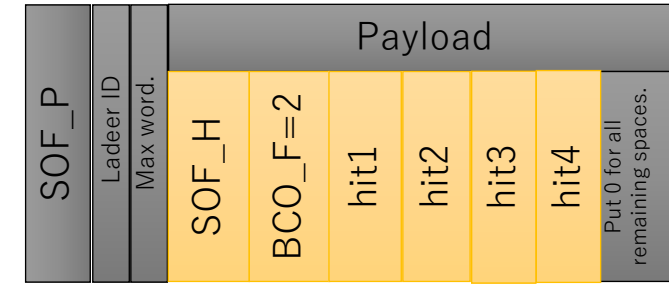
Consider about ladder 1 only here.  
First event has 3 hits and next one has 4 hits.

Planned format

packet1

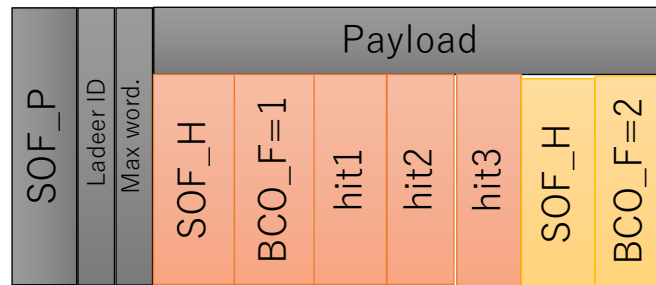


packet2

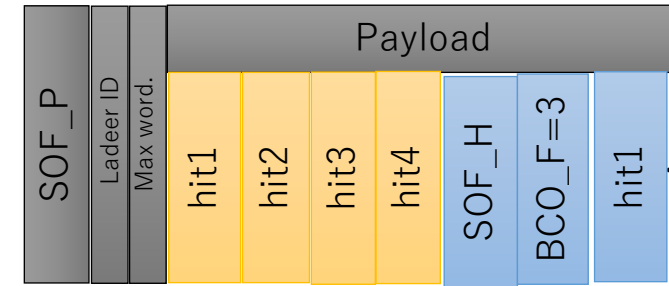


Actual format

packet1



packet2



Different colors show the different BCO events

- We think that the new FELIX packet is created when the new BCO\_FULL data come, but it's not happened. Hit data is continually packed up to 7 length no matter FELIX packets.
- Each ladder has the above structure, so the data such as time, hit and etc. seems to be messed up. (shown in next page.)
- Question! When the packet is not filled up to 7 yet but the next hit doesn't come for a while, is the last Felix packet created and sent ? Or it waits as long as the next event coming.

# Raw (binary) data for ladder 6

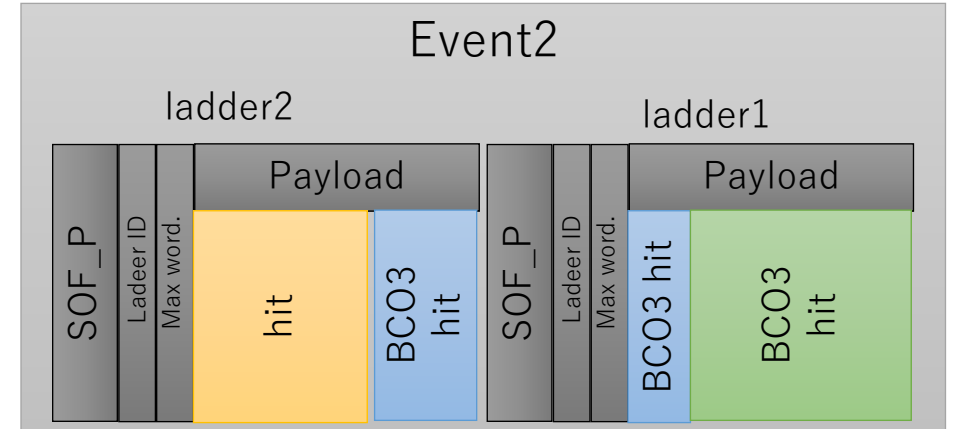
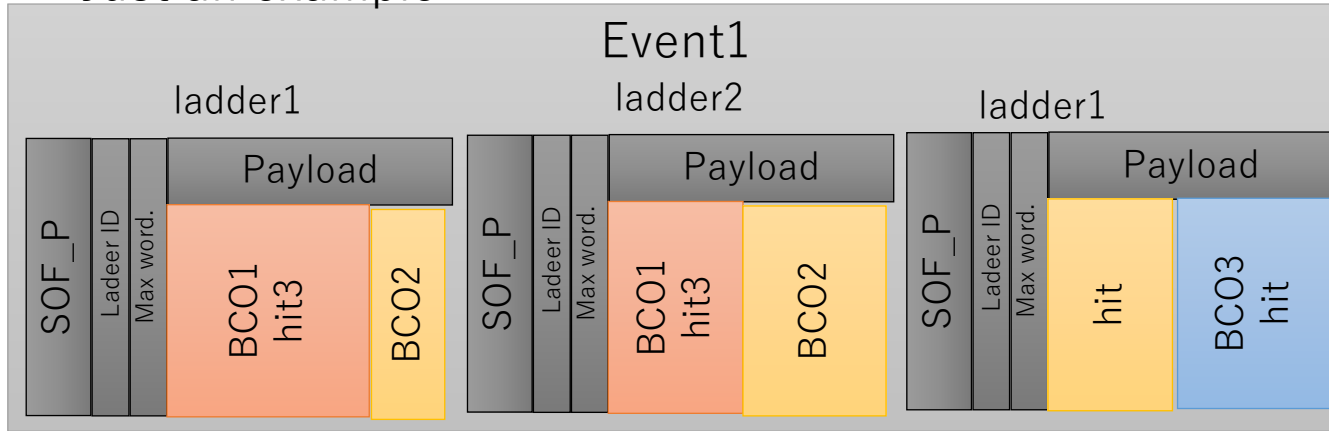
```
0 Evt:2 68 68 0
0 0x 44 :
1 0x 20bb9 :
2 0x 6e :
3 0x 0 :
4 0xf06fcaf0 : packet header : len, lad=7 6
5 0xcd9b6431 : hitdata :
6 0x82610000 : hitdata :
7 0xef7f00f6 : hitdata :
8 0xef7f00f6 : hitdata :
9 0xef7f00f4 : hitdata :
10 0xef7f00f5 : hitdata :
11 0xef7f00f5 : hitdata :
68 0x 0 :
Skip : 1
Skip : 1
data is NULL
0 Evt:5 68 68 0
0 0x 44 :
1 0x 20bb9 :
2 0x 6e :
3 0x 0 :
12 0xf06fcaf0 : packet header : len, lad=7 6
13 0xef7f00f5 : hitdata :
14 0xef7f00f5 : hitdata :
15 0xcafeff80 : hitdata :
16 0xad57cade : hitdata : -- hit header
17 0x4ee48a84 : hitdata : -- BCO 0x578a844ee4
18 0x 0 : hitdata :
19 0xef7600ed : hitdata :
68 0x 0 :
Skip : 1
```

```
data is NULL
0 Evt:8 68 68 0
0 0x 44 :
1 0x 20bb9 :
2 0x 6e :
3 0x 0 :
20 0xf06fcaf0 : packet header : len, lad=7 6
21 0xef7600ed : hitdata :
22 0xcafeff80 : hitdata :
23 0xad57cade : hitdata : -- hit header
24 0xf36d8a84 : hitdata : -- BCO 0x578a84f36d
25 0x 10000 : hitdata :
26 0xef7f00fa : hitdata :
27 0xef7f00fa : hitdata :
68 0x 0 :
Skip : 1
Skip : 1
data is NULL
0 Evt:11 68 68 0
0 0x 44 :
1 0x 20bb9 :
2 0x 6e :
3 0x 0 :
28 0xf06fcaf0 : packet header : len, lad=7 6
29 0xef7f00fa : hitdata :
30 0xcafeff80 : hitdata :
31 0xad57cade : hitdata : -- hit header
32 0x6e678a85 : hitdata : -- BCO 0x578a856e67
33 0x 20000 : hitdata :
34 0xef7f00f4 : hitdata :
35 0xef7f00f4 : hitdata :
68 0x 0 :
Skip : 1
```

```
data is NULL
0 Evt:14 68 68 0
0 0x 44 :
1 0x 20bb9 :
2 0x 6e :
3 0x 0 :
52 0xf06fcaf0 : packet header : len, lad=7 6
53 0xef7f00f2 : hitdata :
54 0xcafeff80 : hitdata :
55 0xad57cade : hitdata : -- hit header
56 0x11e38a86 : hitdata : -- BCO 0x578a8611e3
57 0x 30000 : hitdata :
58 0xef7e00ed : hitdata :
59 0xcafeff80 : hitdata :
68 0x 0 :
Skip : 1
Skip : 1
data is NULL
0 Evt:17 196 196 0
0 0x c4 :
1 0x 20bb9 :
2 0x 6e :
3 0x 0 :
196 0x 0 :
Skip : 1
Skip : 1
data is NULL
0 Evt:20 68 68 0
0 0x 44 :
1 0x 20bb9 :
2 0x 6e :
3 0x 0 :
4 0xf06fcaf0 : packet header : len, lad=7 6
5 0xad57cade : hitdata : -- hit header
6 0x8c188a87 : hitdata : -- BCO 0x578a878c18
7 0x 40000 : hitdata :
8 0xcafeff80 : hitdata :
9 0xad57cade : hitdata : -- hit header
10 0x562c8a89 : hitdata : -- BCO 0x578a8fde3c
11 0x 50000 : hitdata :
68 0x 0 :
```

# Order of the PRDF data with more than 1 ladders.

Just an example



- Each ladder is filled up with the hit data which sometimes don't belong to the same event.

# Raw data for ladder 5 and 6

```
0 Evt:5 68 68 0
 0 0x 44 :
 1 0x 20bb9 :
 2 0x 6e :
 3 0x 0 :

ladder 5

68 0x 0 :
Skip : 1
Skip : 1
data is NULL

0 Evt:8 68 68 0
 0 0x 44 :
 1 0x 20bb9 :
 2 0x 6e :
 3 0x 0 :
36 0xf05fcaf0 : packet header : len, lad=7 5
37 0xad57cade : hitdata : -- hit header
38 0x4ee48a84 : hitdata : -- BCO 0x578a844ee4 6429412
39 0x 0 : hitdata :
40 0xcafeff80 : hitdata :
41 0xad57cade : hitdata : -- hit header
42 0xf36d8a84 : hitdata : -- BCO 0x578a84f36d 42121
43 0x 10000 : hitdata :
68 0x 0 :
```

```
0 Evt:5 68 68 0
 0 0x 44 :
 1 0x 20bb9 :
 2 0x 6e :
 3 0x 0 :

ladder 6

> 12 0xf06fcaf0 : packet header : len, lad=7 6
> 13 0xef7f00f5 : hitdata :
> 14 0xef7f00f5 : hitdata :
> 15 0xcafeff80 : hitdata :
> 16 0xad57cade : hitdata : -- hit header
> 17 0x4ee48a84 : hitdata : -- BCO 0x578a844ee4 3759860
> 18 0x 0 : hitdata :
> 19 0xef7600ed : hitdata :

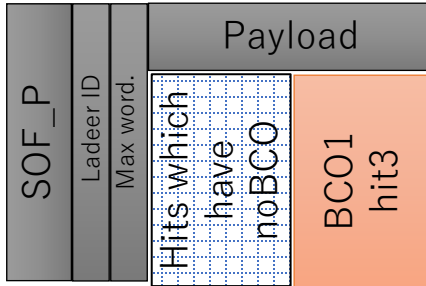
68 0x 0 :
Skip : 1
Skip : 1
data is NULL

0 Evt:8 68 68 0
 0 0x 44 :
 1 0x 20bb9 :
 2 0x 6e :
 3 0x 0 :
20 0xf06fcaf0 : packet header : len, lad=7 6
21 0xef7600ed : hitdata :
22 0xcafeff80 : hitdata :
23 0xad57cade : hitdata : -- hit header
24 0xf36d8a84 : hitdata : -- BCO 0x578a84f36d 42121
25 0x 10000 : hitdata :
26 0xef7f00fa : hitdata :
27 0xef7f00fa : hitdata :
68 0x 0 :
```

Diagram illustrating the relationship between ladder 5 and ladder 6 data:

- Ladder 5 (left) shows hitdata entries for BCO 0x578a844ee4 (address 6429412) and BCO 0x578a84f36d (address 42121).
- Ladder 6 (right) shows hitdata entries for BCO 0x578a844ee4 (address 3759860) and BCO 0x578a84f36d (address 42121).
- Arrows indicate that the BCO value 0x578a844ee4 from ladder 5 is used in ladder 6, and the BCO value 0x578a84f36d from ladder 6 is used in ladder 5.

# FELIX packet issues



1. In the very first data, there are some hit data which BCO info is missing. How do we treat them? Should we through away?
2. The size of the data at the end doesn't often match to the packet size. How do you treat them?

```

data is NULL
0 Evt:2 68 68 0
  0 0x 44 :
  1 0x 20bb9 :
  2 0x 6e :
  3 0x 0 :
  4 0xf06fcaf0 : packet header : len, lad=7 6
  5 0xcd9b6431 : hitdata :
  6 0x82610000 : hitdata :
  7 0xef7f00f6 : hitdata :
  8 0xef7f00f6 : hitdata :
  9 0xef7f00f4 : hitdata : Hits with missing
10 0xef7f00f5 : hitdata : BCO info
11 0xef7f00f5 : hitdata :
68 0x 0 :
Skip : 1
Skip : 1
data is NULL
0 Evt:5 68 68 0
  0 0x 44 :
  1 0x 20bb9 :
  2 0x 6e :
  3 0x 0 :
12 0xf06fcaf0 : packet header : len, lad=7 6
13 0xef7f00f5 : hitdata :
14 0xef7f00f5 : hitdata :
15 0xcafeff80 : hitdata : The firstBCO
16 0xad57cade : hitdata : -- hit header
17 0x4ee48a84 : hitdata : -- BCO 0x578a844ee4
18 0x 0 : hitdata :
19 0xef7600ed : hitdata :
68 0x 0 :
Skip : 1
Skip : 1
data is NULL
0 Evt:8 68 68 0
  0 0x 44 :
  1 0x 20bb9 :
  2 0x 6e :
  3 0x 0 :
20 0xf06fcaf0 : packet header : len, lad=7 6
21 0xef7600ed : hitdata :

```



# Problems on the current decoder

- Function of the decoder
  - It decode the data event by event.
    - It assumes that the first packet of the event always has BCO\_FULL.
- In deed, however, the first packet sometimes does not have BCO\_FULL. In that case, the corresponding hits are removed.

```
data is NULL
0 Evt:2 68 68 0
  0 0x 44 :
  1 0x 20bb9 :
  2 0x 6e :
  3 0x 0 :
  4 0xf06fcaf0 : packet header : len, lad=7 6
  5 0xcd9b6431 : hitdata :
  6 0x82610000 : hitdata :
  7 0xef7f00f6 : hitdata :
  8 0xef7f00f6 : hitdata :
  9 0xef7f00f4 : hitdata :
 10 0xef7f00f5 : hitdata :
 11 0xef7f00f5 : hitdata :
 68 0x 0 :
Skip : 1
Skip : 1
data is NULL
0 Evt:5 68 68 0
  0 0x 44 :
  1 0x 20bb9 :
  2 0x 6e :
  3 0x 0 :
 12 0xf06fcaf0 : packet header : len, lad=7 6
 13 0xef7f00f5 : hitdata :
 14 0xef7f00f5 : hitdata :
 15 0xcafeff80 : hitdata :
 16 0xad57cade : hitdata : -- hit header
 17 0x4ee48a84 : hitdata : -- BCO 0x578a844ee4
 18 0x 0 : hitdata :
 19 0xef7600ed : hitdata :
 68 0x 0 :
Skip : 1
Skip : 1
data is NULL
0 Evt:8 68 68 0
  0 0x 44 :
  1 0x 20bb9 :
  2 0x 6e :
  3 0x 0 :
 20 0xf06fcaf0 : packet header : len, lad=7 6
 21 0xef7600ed : hitdata :
```

Extracting the raw data on Ladder6

Ignored and removed.

The firstBCO

# Event count and footer words?

- It looks
  - 0x40000 : EVT counter
  - 0xcafeff80: footer
- Only EVT and FOOTER data exist. Is it we design??

```
data is NULL
0 Evt:20 68 68 0
  0 0x   44 :
  1 0x  20bb9 :
  2 0x   6e :
  3 0x    0 :
  4 0xf06caf0 : packet header : len, lad=7 6
  5 0xad57cade : 6
  6 0x8c188a87 : 6
  7 0x  40000 : 6
  8 0xcafeff80 : 6
  9 0xad57cade : 6
 10 0x562c8a89 : 6
 11 0x  50000 : 6
w : 0xad57cade : hit header
w : 0x8c188a87 : BCO: 0x578a878c18
w : 0x40000
w : 0xcafeff80
w : 0xad57cade : hit header
w : 0x562c8a89 : BCO: 0x578a89562c
w : 0x50000
BCO: 0x578a8611e3
hit: 0x30000
hit: 0xef7e00ed
hit: 0xcafeff80
status: done
BCO: 0x578a878c18
hit: 0x40000
hit: 0xcafeff80
status: done
BCO: 0x578a89562c
hit: 0x50000
status: continue
-- hitbuf size =0 6
```

Raw data (binary)

FELIX packet taken from raw data

BCO blocks in the FELIX packet