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
0 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
```

  - 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！！！

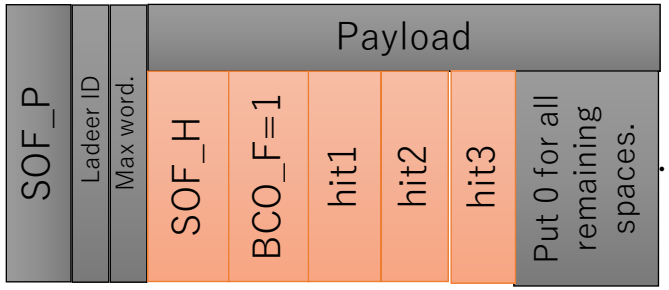
- Detected issues.
  - The order (the data format) is different from what we thought. (FELIX)
  - The decoder(Martin prepared) has issue.

Structure of the FELIX packets

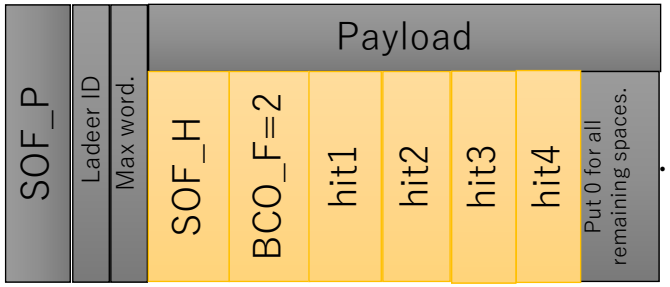
Consider about ladder 1 only here.
First event has 3 hits and next one has 4 hits.

Planed format

packet1

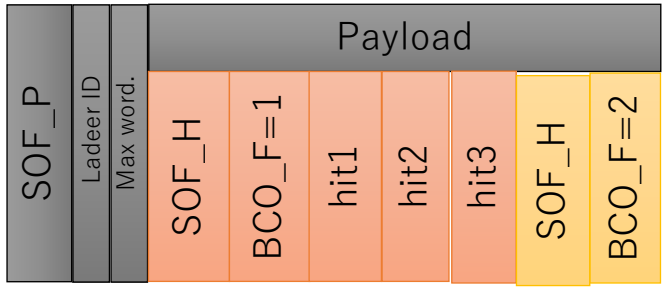


packet2



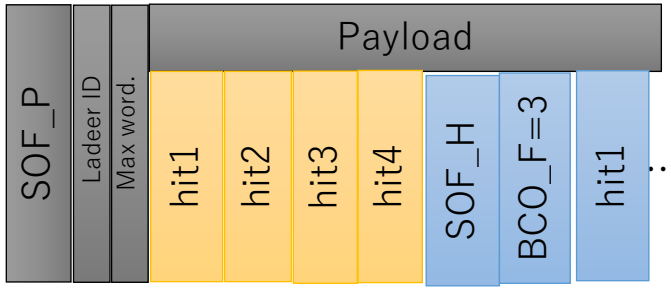
Actual format

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

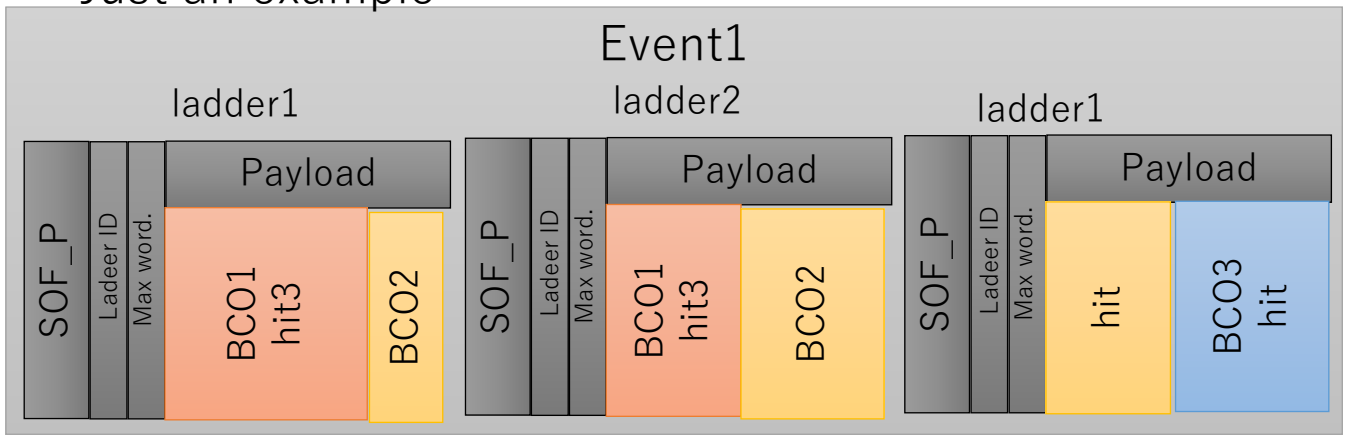
```
0  Evt:2 68 68 0
    0  0x      44  :
    1  0x   20bb9  :
    2  0x      6e  :
    3  0x       0  :
    4  0xf06fcaf0  :   packet header : len, lad=7 6
    5  0xcd9b6431  :  hitdata  :
    6  0x82610000  :  hitdata  :
    7  0xef7f00f6  :  hitdata  :
    8  0xef7f00f6  :  hitdata  :
    9  0xef7f00f4  :  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
```

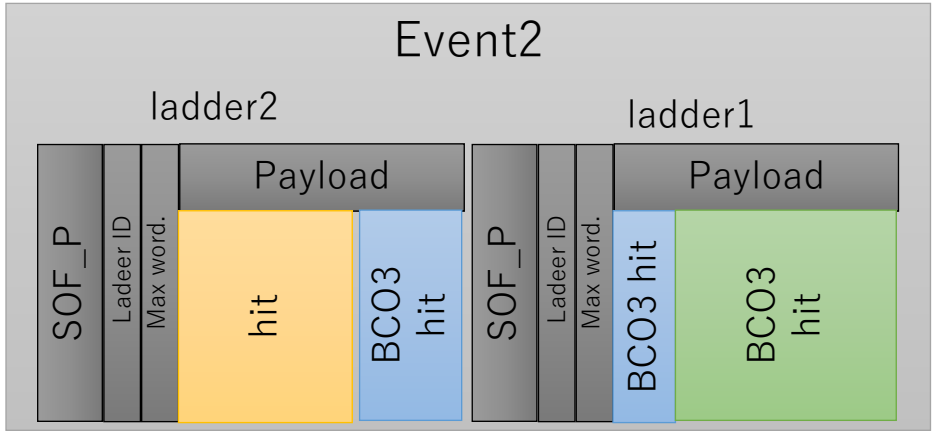
```
    data is NULL
0  Evt:8 68 68 0
    0  0x      44  :
    1  0x   20bb9  :
    2  0x      6e  :
    3  0x       0  :
   20  0xf06fcaf0  :   packet header : len, lad=7 6
   21  0xef7600ed  :  hitdata  :
   22  0xcafeff80  :  hitdata  :
   23  0xad57cade  :  hitdata  : -- hit header
   24  0xf36d8a84  :  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.

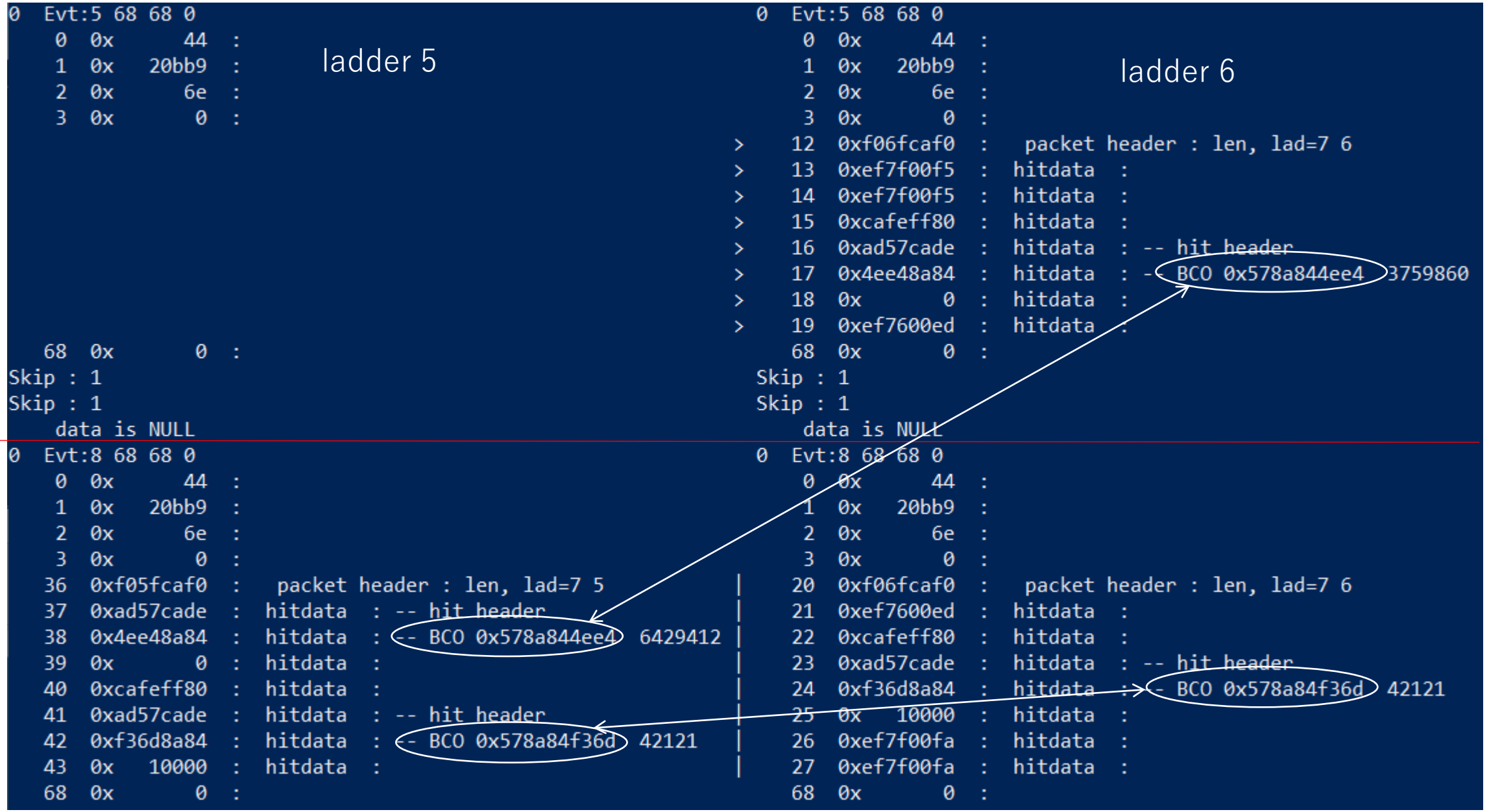
Just an example



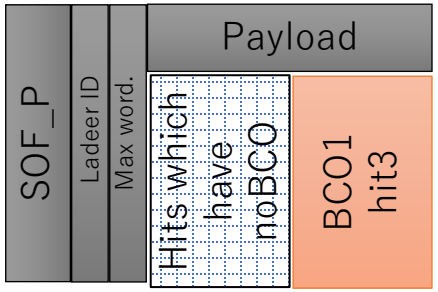


- Each ladder is filled up with the hit data which sometimes don't belong to the same event.

Raw data for ladder 5 and 6



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  :
   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

Hits with missing BCO info

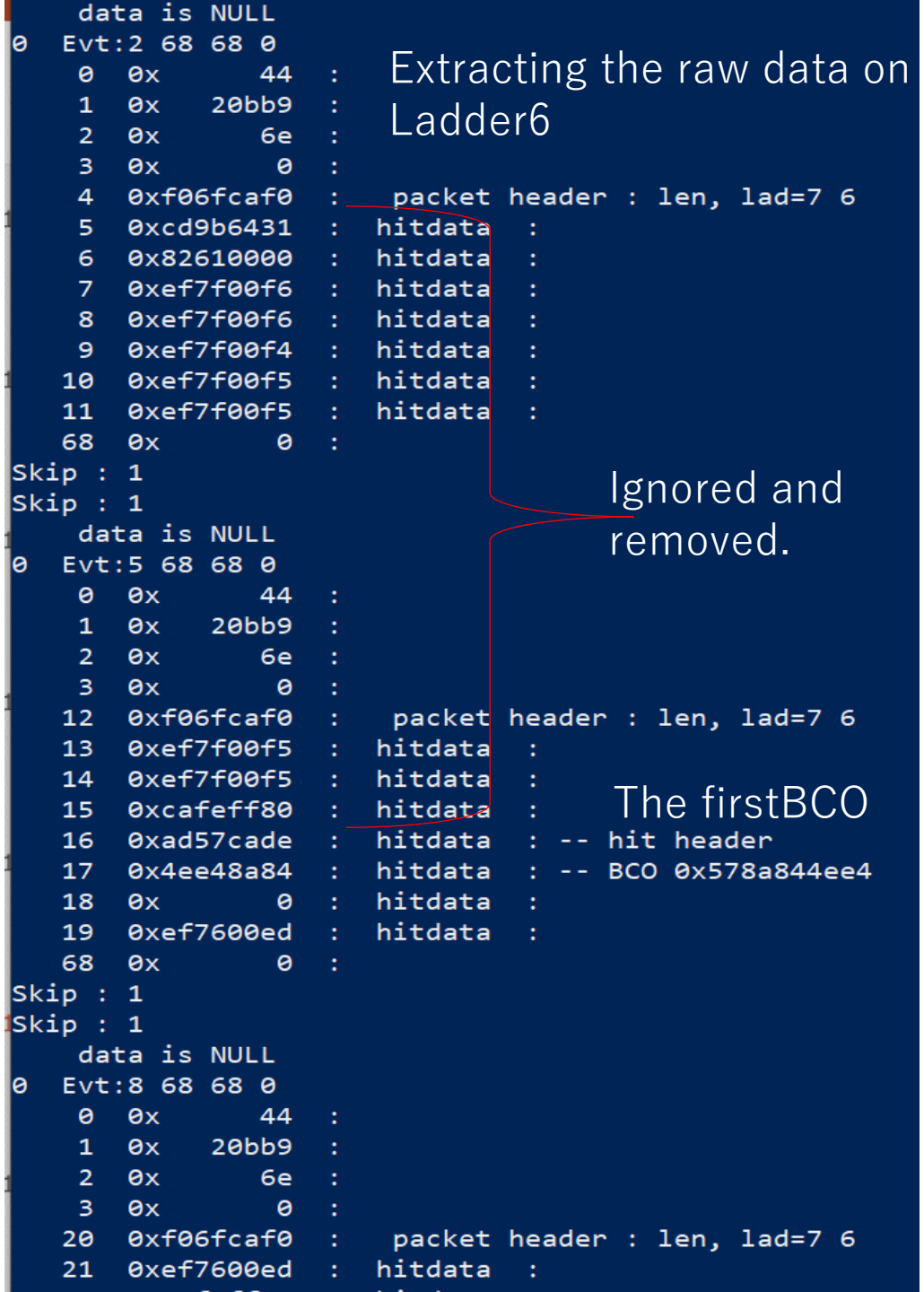
The firstBCO

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.



Event count and footer words?

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