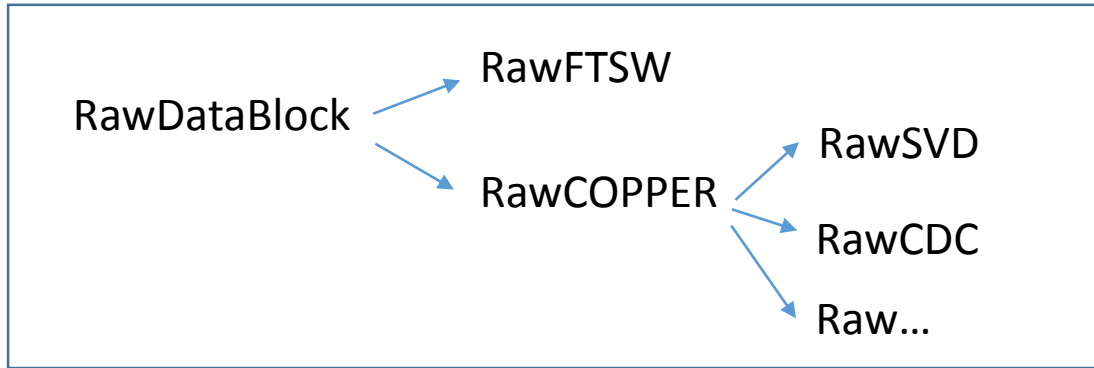


RawCOPPER data format

Oct. 21, 2013 (svn rev.7133)

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1, RawDataBlock object (to handle Raw data from COPPER board)

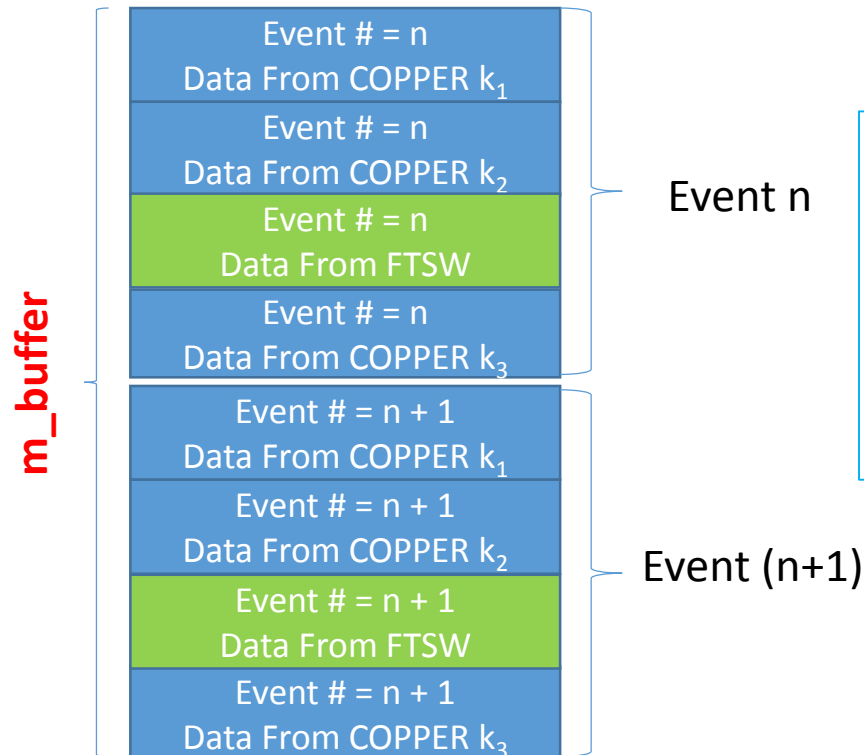


Source code :

<https://belle2.cc.kek.jp/svn/trunk/software/daq/dataobjects/include>
<https://belle2.cc.kek.jp/svn/trunk/software/daq/dataobjects/src>

```
RawDataBlock{  
    methods to access data;  
    int m_num_nodes; // # of nodes  
    int m_num_events; // # of events  
  
    int* m_buffer; -> buffer for data  
}
```

Example of data structure



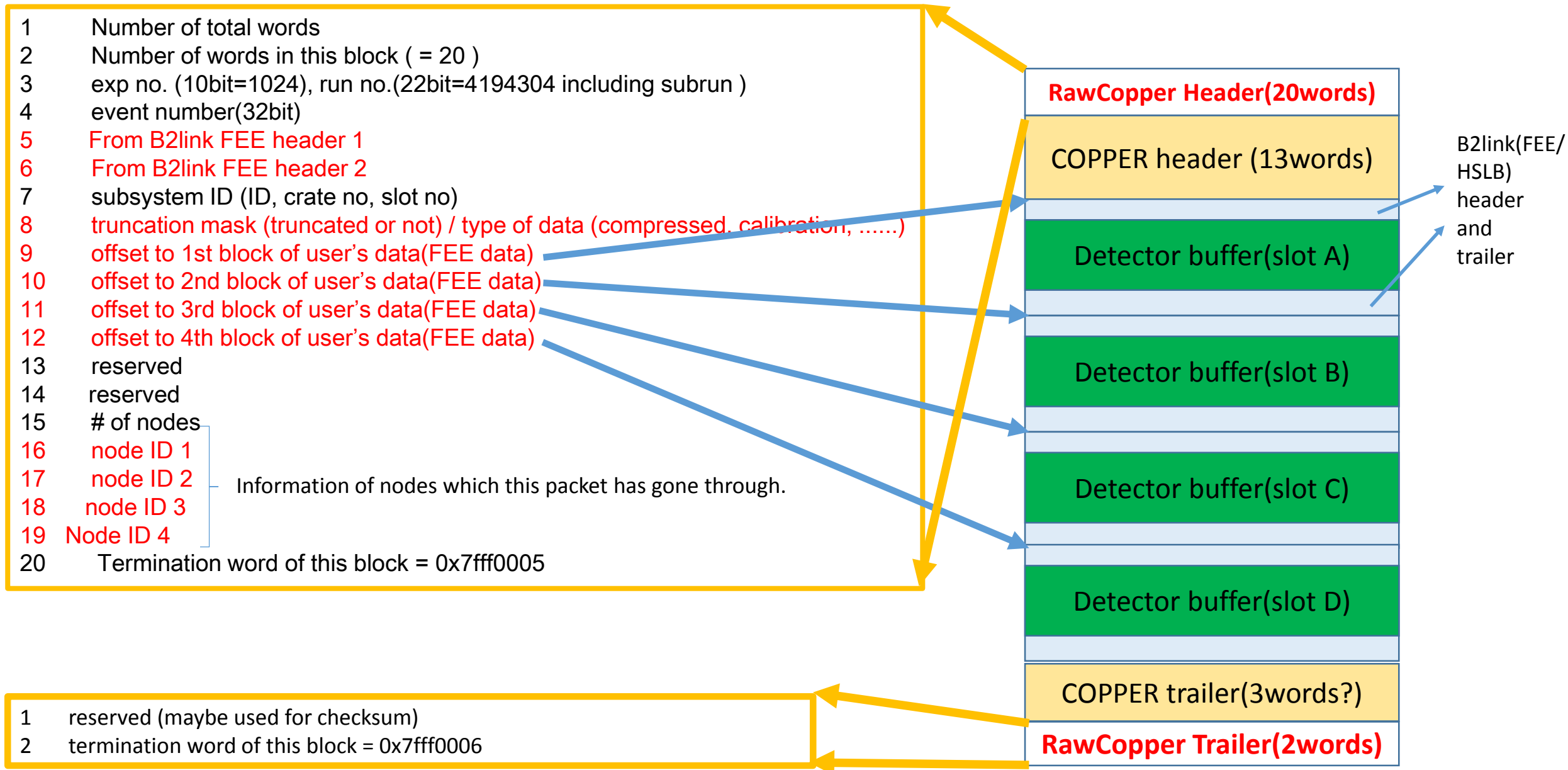
In this example,
 $M_num_nodes = 4$
 $M_num_events = 2$.

of data blocks = $4 * 2 = 8$

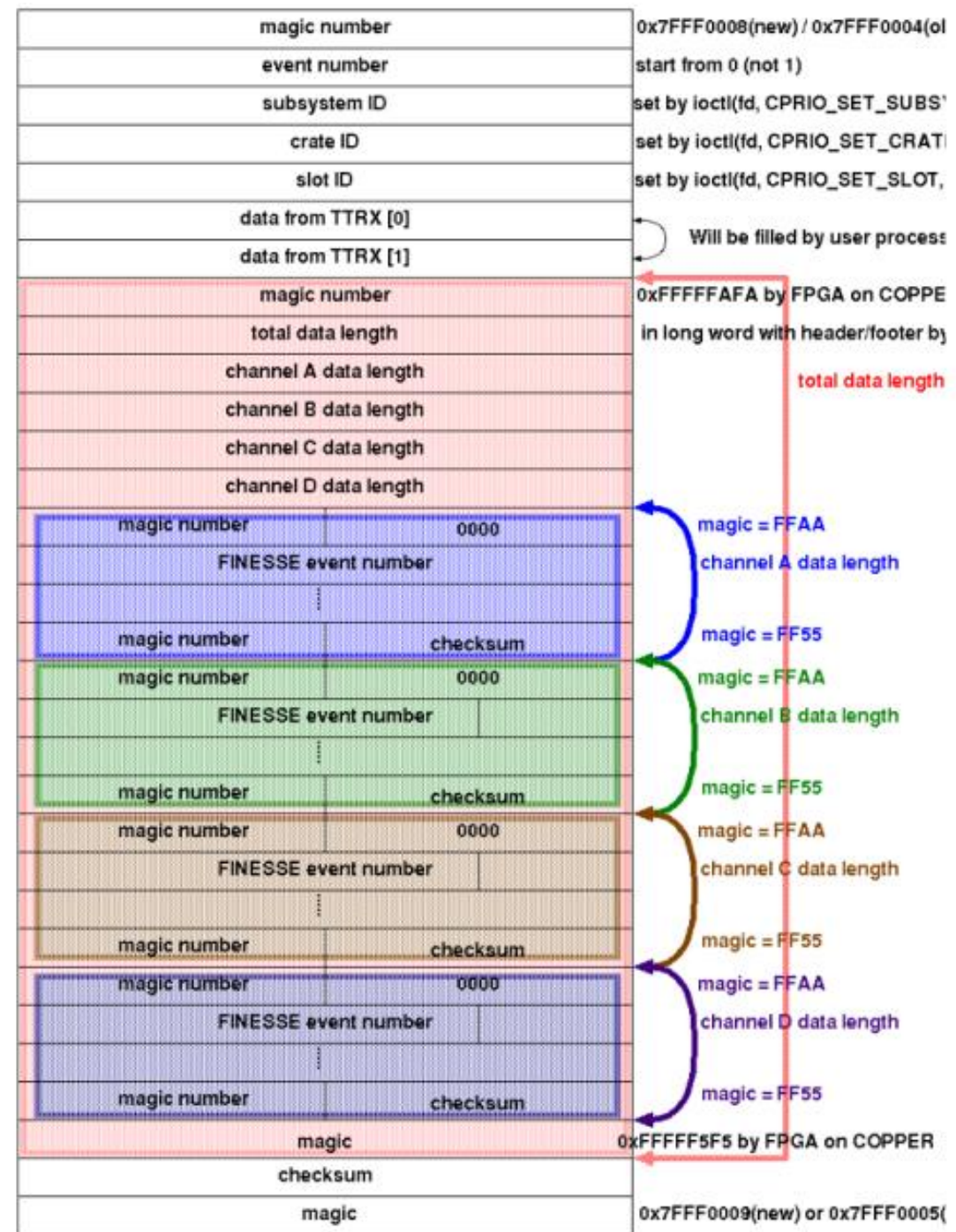
Overview of RawCOPPER format (one data block from a COPPER board)

- RawCOPPER header
 - COPPER header
 - B2link HSLB header (slot A FINNESSE)
 - B2link FEE header(slot A FINNESSE)
 - Data contents(Detector buffer) (slot A FINNESSE)
 - B2link FEE trailer (slot A FINNESSE)
 - B2link HSLB trailer (slot A FINNESSE)
 - B2link HSLB header (slot B FINNESSE)
 - B2link FEE header(slot B FINNESSE)
 - Data contents(Detector buffer) (slot B FINNESSE)
 - B2link FEE trailer (slot B FINNESSE)
 - B2link HSLB trailer (slot B FINNESSE)
 - B2link HSLB header (slot C FINNESSE)
 - B2link FEE header(slot C FINNESSE)
 - Data contents(Detector buffer) (slot C FINNESSE)
 - B2link FEE trailer (slot C FINNESSE)
 - B2link HSLB trailer (slot C FINNESSE)
 - B2link HSLB header (slot D FINNESSE)
 - B2link FEE header(slot D FINNESSE)
 - Data contents(Detector buffer) (slot D FINNESSE)
 - B2link FEE trailer (slot D FINNESSE)
 - B2link HSLB trailer (slot D FINNESSE)
 - COPPER trailer
- RawCOPPER trailer

2, “RawCOPPER header” and trailer format : 2013/8/26 (Not yet confirmed)



3, COPPER header and trailer from Belle document



4, B2link FEE header/Trailer, B2link HSLB header/Trailer (tentative)



1: 0xffaa****

1: ftsw_data[0];

2: ftsw_data[1];

3: (exp_number << 22) | (run_number << 0);

4: b2l_time;

ftsw_data[0] bit [31] (1-bit) --- always 0

ftsw_data[0] bit [30:4] (27-bit) --- ctime (127 MHz counter)

ftsw_data[0] bit [3:0] (4-bit) --- trigger type

ftsw_data[1] bit [31:16] (16-bit) --- utime (lower 16 bit of unix time)

ftsw_data[1] bit [15:0] (16-bit) --- event tag (start from 0)

1: ftsw_data[1] (copy)

1: 0xff55****

5, Example : how to get information of RawCOPPER header

You can get event # info from RawCOPPER object like this;

```
for ( int i = 0; i < raw_copper.GetNumEntries(); i++) {  
//      Get Event number  
    unsigned int event_no = raw_copper.GetEveNo( i );  
//      Get RawCOPPER data block  
    int* buf = raw_copper.GetBuffer( i );  
//      See contents of a data block (from RawCOPPER header to RawCOPPER trailer)  
    for( int j = 0; j < raw_copper.GetBlockNwords(); j++ ){  
        printf(“%d¥n”, buf[ j ] );    }  
//      Get Detector Buffer (raw data from detector electronics)  
    int* buf_slot_a = raw_copper.Get1stDetectorBuffer( i );  
    int* buf_slot_b = raw_copper.Get2ndDetectorBuffer( i );  
    int* buf_slot_c = raw_copper.Get3rdDetectorBuffer( i );  
    int* buf_slot_d = raw_copper.Get4thDetectorBuffer( i );  
//      See contents of raw data from detector  
    for( int j = 0; j < raw_copper.Get1stDetectorNwords( i ); j++ ){  
        printf(“%d¥n”, buf[ j ] );    }  
    for( int j = 0; j < raw_copper.Get2ndDetectorNwords( i ); j++ ){  
        printf(“%d¥n”, buf[ j ] );    }  
    .....  
}
```

Test program to read RawCOPPER(RawCDC) data

1, Get dummy data file (data from two CDC FEE boards connected to FINESSE A and C.)
login.cc.kek.jp : ~yamadas/rawdata/[root_output_RawCDC_rev7133.root](#)

2, See contents of the data

```
% cd ${BELLE2_LOCAL_DIR}/daq/; svn update
```

```
% cd ${BELLE2_LOCAL_DIR}/daq/rawdata/examples/
```

```
% basf2 ReadStoreTemplate.py -i ./root\_output\_RawCDC\_rev7133.root | less
```

```
[INFO] Steering file: ReadStoreTemplate.py
```

```
>>> basf2 Python environment set
```

```
>>> Framework object created: fw
```



```
==== DataBlock(RawCDC) : Block # 0 : Event # 0 : node ID 0x00000000 : block size 224 bytes
```

```
== Detector Buffer(FINESSE A)
```

```
0x0094c13a 0x91000001
```

```
== Detector Buffer(FINESSE C)
```

```
0x0094c13a 0x91000001
```

```
==== DataBlock(RawCDC) : Block # 1 : Event # 1 : node ID 0x00000000 : block size 224 bytes
```

```
== Detector Buffer(FINESSE A)
```

```
0x0094c23f 0xf1000001
```

```
== Detector Buffer(FINESSE C)
```

```
0x0094c23f 0xf1000001
```

```
==== DataBlock(RawCDC) : Block # 2 : Event # 2 : node ID 0x00000000 : block size 224 bytes
```

```
== Detector Buffer(FINESSE A)
```

```
0x0094c30d 0x69000001
```

```
== Detector Buffer(FINESSE C)
```

```
0x0094c30d 0x69000001
```

```
....
```

In this data,

Detector buffer contains only 2words(=8bytes)
per/FINESSE/event.

Note that block # is a number used by DAQ software
for handling data and not related with **Event #**.