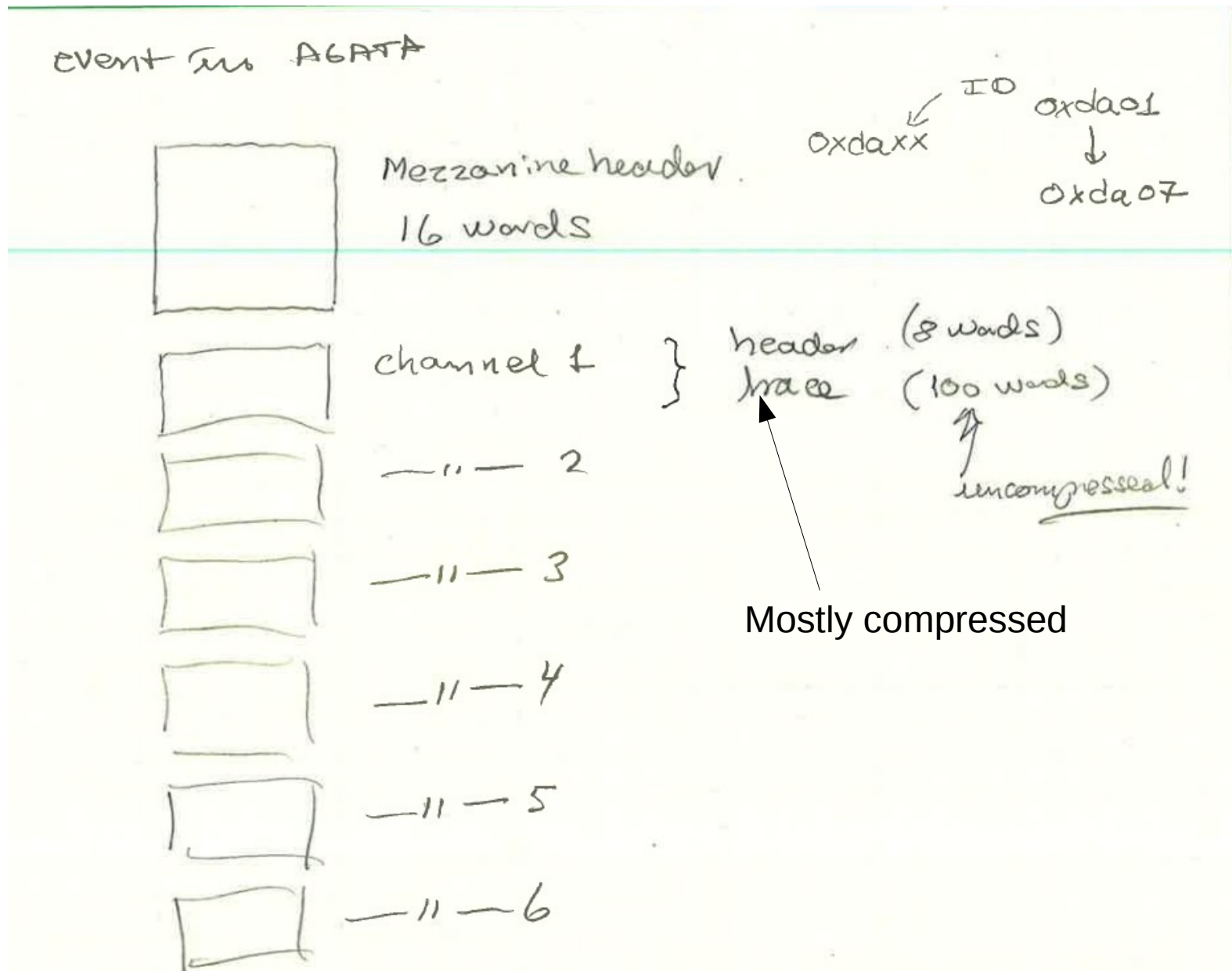# Translating AGATA mezzanine data to GRETINA mode 3 data format

Torben Lauritsen, ANL
Amel Korichi, CSNSM

AGATA mezzanine card data readout:

- 7 mezzanine cards with 6 channels each
- First card used for CC, with two gains (ignore rest)
- Next 6 cards used for the 36 segments

Format is in principle simple
but documentation is so so

event in AGATA

IO

Mezzanine header.   0xdaxx   ↙   0xda01
16 words   ↓
                                    0xda07

channel 1 } header (8 words)
              trace (100 words)
                      ↑
    —"— 2   uncompressed!

    —"— 3

                  Mostly compressed

    —"— 4

    —"— 5

    —"— 6

Headers are easier to read compared to GRETINA (all 16 bit words)

Mezzanine header

0	Mezzanine ID = 0xda?n
1	Event number (2 words)
2	
3	Timestamp (3)
4	
5	
6	Number of samples in trace
7…15	Spare (used by long traces id=0xda5n)

Channel ID

Channel header

|		
0	Channel ID	
1	Energy low	(ignored ?)
2	Energy high	
3	Channel status	
4… 7	Spare	

No byte swapping necessary

BUT, the trace that follows each channel header is <u>compressed</u> (factor ~0.35)

(Thanks to Jeremie and Olivier for an uncompression routine)

The readout order

In AGATA, the segments are read out from the front to the back

In GRETINA the data is read out by first reading the front
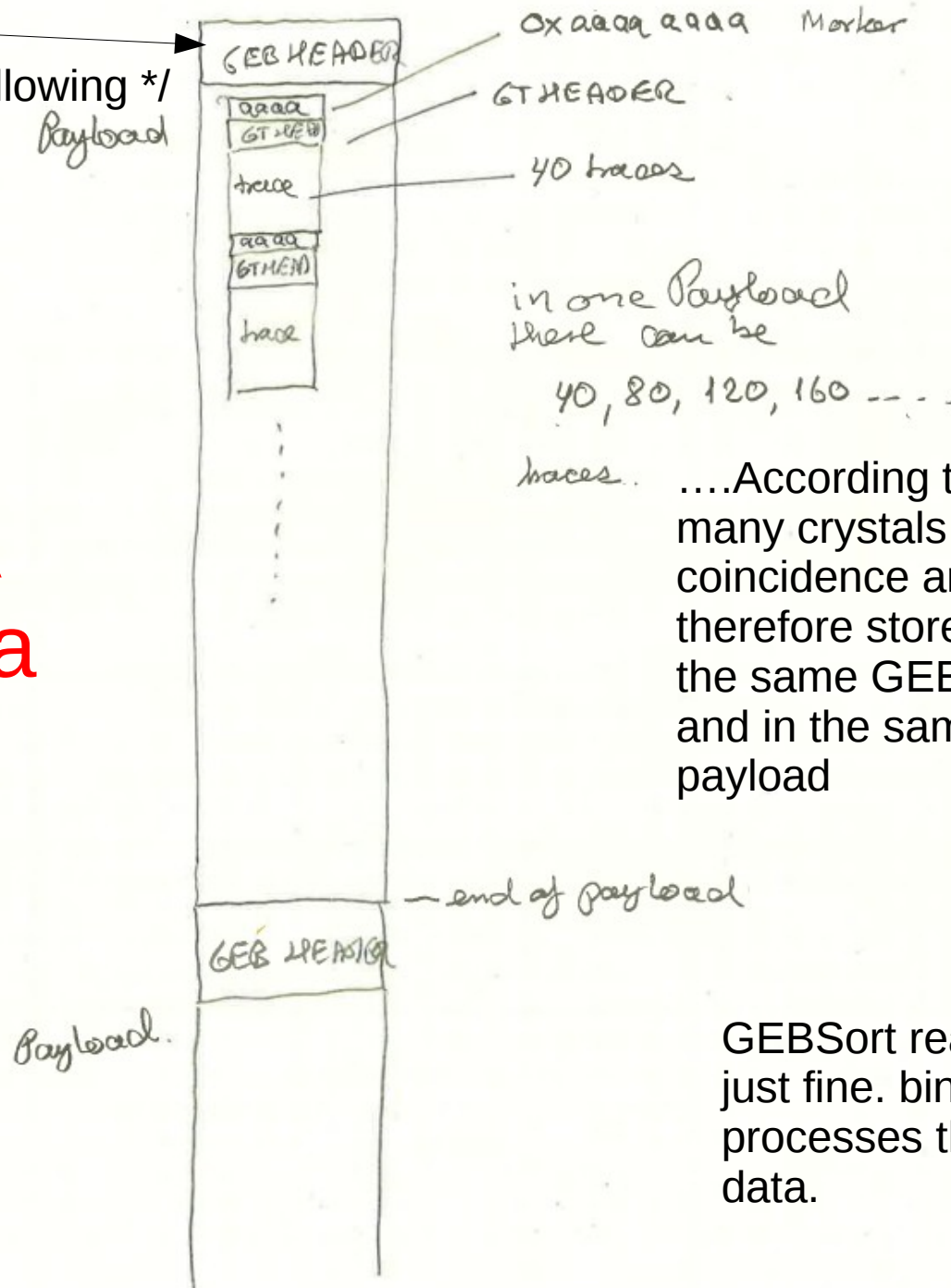segments, then go to the next layer and so on
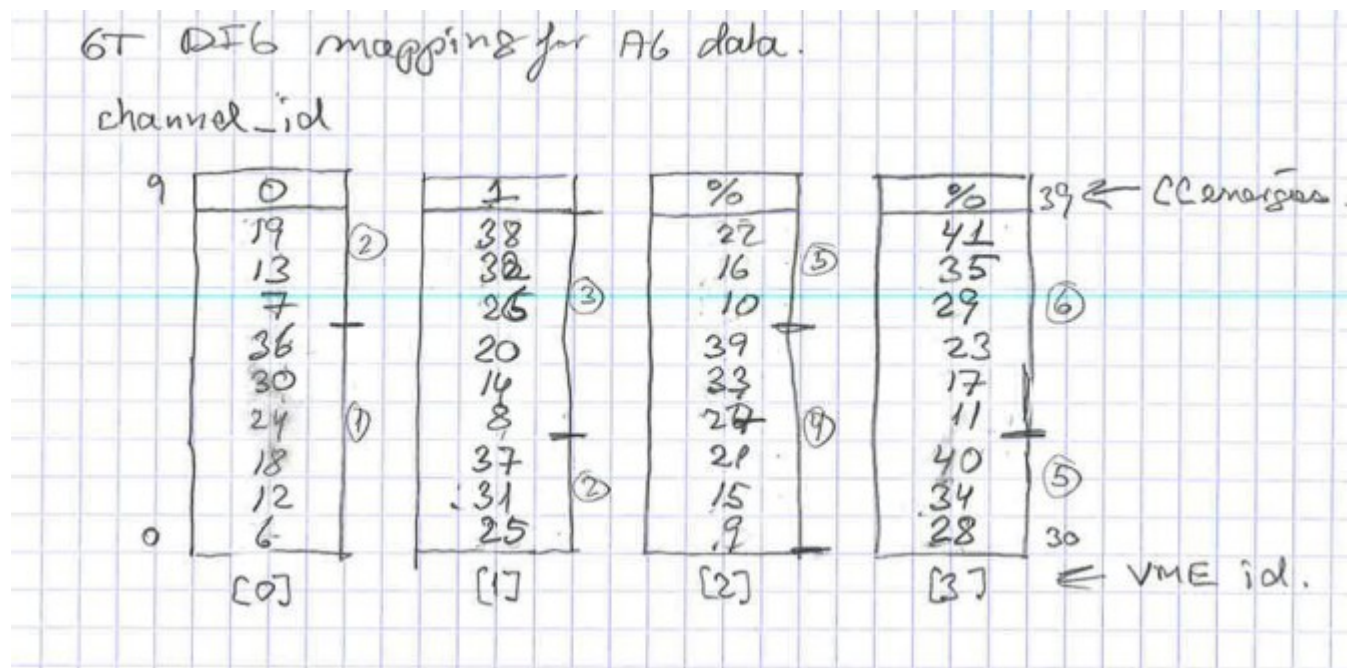
Mapping of AG
segment
channels into
the four GT
digitizers

O There is also a difference in clock and anti-clock
wise readout convention – which I was not aware
about before further checks (Erbert S.), so Heather
is taking care of that for now.
O Which one is the first segment?

overall structure :

struct gebData {
  int type; /* type of data following */
  int length;
  long long timestamp;
};

GEB HEADER

Payload

0x aaaa aaaa   Marker

GT HEADER

40 traces

in one Payload
there can be

40, 80, 120, 160 .....

traces.

The GRETINA mode3 data format

….According to how many crystals are in coincidence and therefore stored under the same GEB header and in the same payload

end of payload

GEB HEADER

Payload.

GEBSort reads the data just fine. bin_mode3.c processes the mode3 data.

# GT Event header, my numbering indicated

Official doc here

My hdr numbering

In 32 bit words

ĪNA GEB HEADER TYPES - GRETINA   http://gretina.lbl.gov/tools-etc/gebheaders

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15	16 17 18 19 20 21 22 23 24 25 26 27	?
Board ID	0 1 Packet Length (header included)	6A
LED/external timestamp bits 0-15*	2 3 LED/external timestamp bits 16-31	
LED/external timestamp bits 32-48*	4 5 Energy bits 0 -15	
Energy bits 16-24 X X T S E C R	6 7 CFD timestamp bits 0-15	
CFD timestamp bits 16-31	8 9 CFD timestamp bits 32-47	
CFD point 1 bits 0-15	10 11 CFD point 1 bits 16-31	
CFD point 2 bits 0-15	12 13 CFD point 2 bits 16-31	
Raw data point 0 (sign extended)	Raw data point 1 (sign extended)	
Raw data point 2 (sign extended)	Raw data point 3 (sign extended)	
...	...	
...	...	
...	...	

The energy is a 24-bit 2's complement signed integer, and must be converted to a 32-bit signed integer before use. The detector ID is a compound word consisting of 4 bit-fields as follows:

← Bits.

<5-bit detector #><2-bit crystal #><2-bit VME slot #><4-bit channel #>
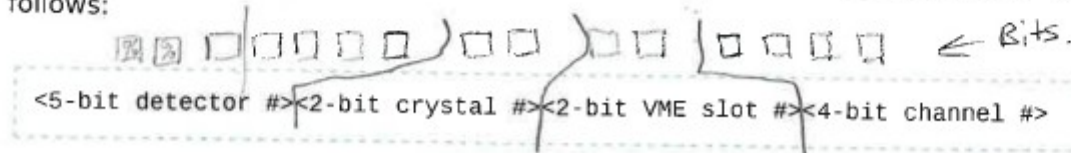
A sample code to unpack this data is included in the GEBHeaders.pdf file.
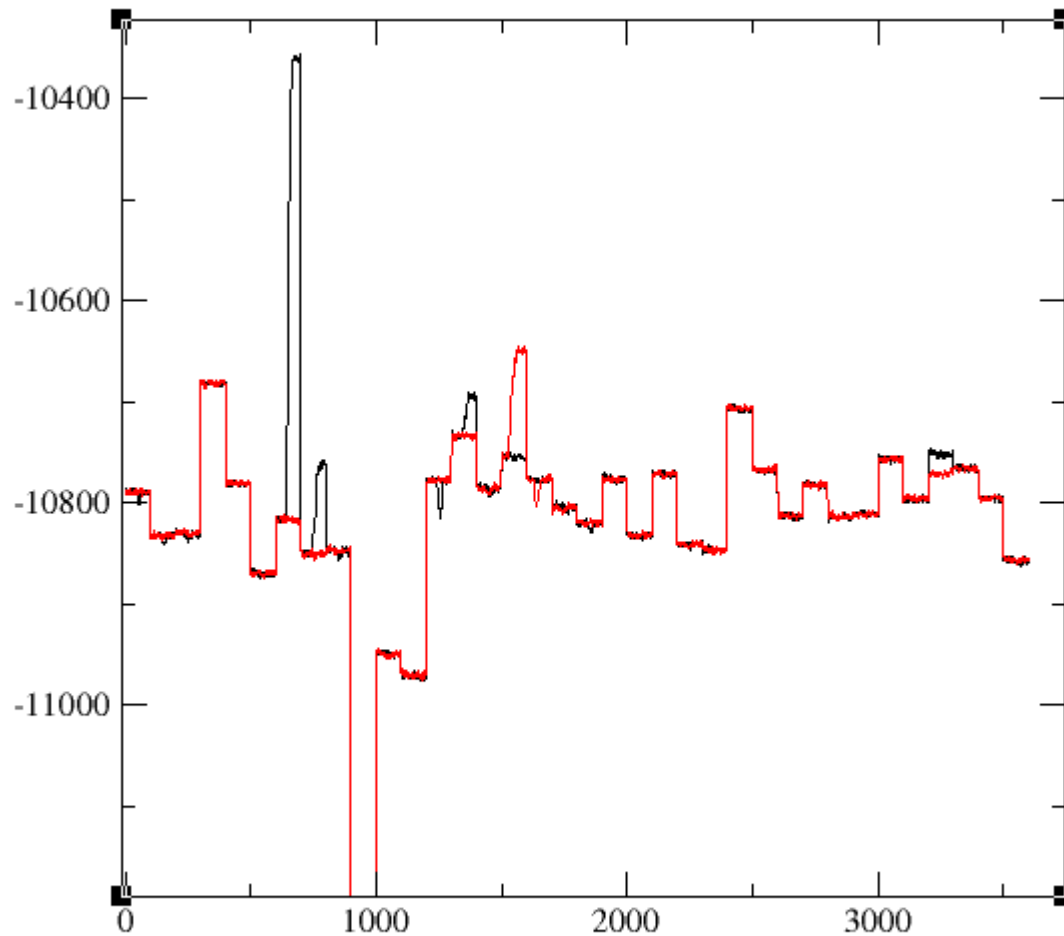
...

- The boad ID is a bit complicated

- The energies are written in a signed 24 bit two's complement format, Yikes!!!

- In GT the data is written in little endian, so we have to byte-swap all the AGATA translated data in the payload before we write it out. (Not the geb-header though.)

Overlay of first two traces seen.
Shows both net and induced charges

AG data is read out in order as opposed to GT segment trace data

Before gain and offset corrections!

Tue Jan 16 10:24:50 2018

Conclusions

- First had to learn to read GRETINA mode3 data

- It is a bit of work to translate the AGATA data.

- But, we can do it!

- To make sure we have the segment labeling translated correctly, maybe make a Compton scattering mapping of the array:

- *Look for events where two segments have energies that sum up to 1333 for a 60Co source. Such events will predominantly be for segments next to one another whether in the same crystal or neighboring crystals.*

Heather next....