A Feedback on the DHCAL test beams read-out data: a closer look at the data format

Outline

- Context, setup and terminology
- A few statistics
- Some problems noticed
- Some other verifications made
- Other studies yet to be made

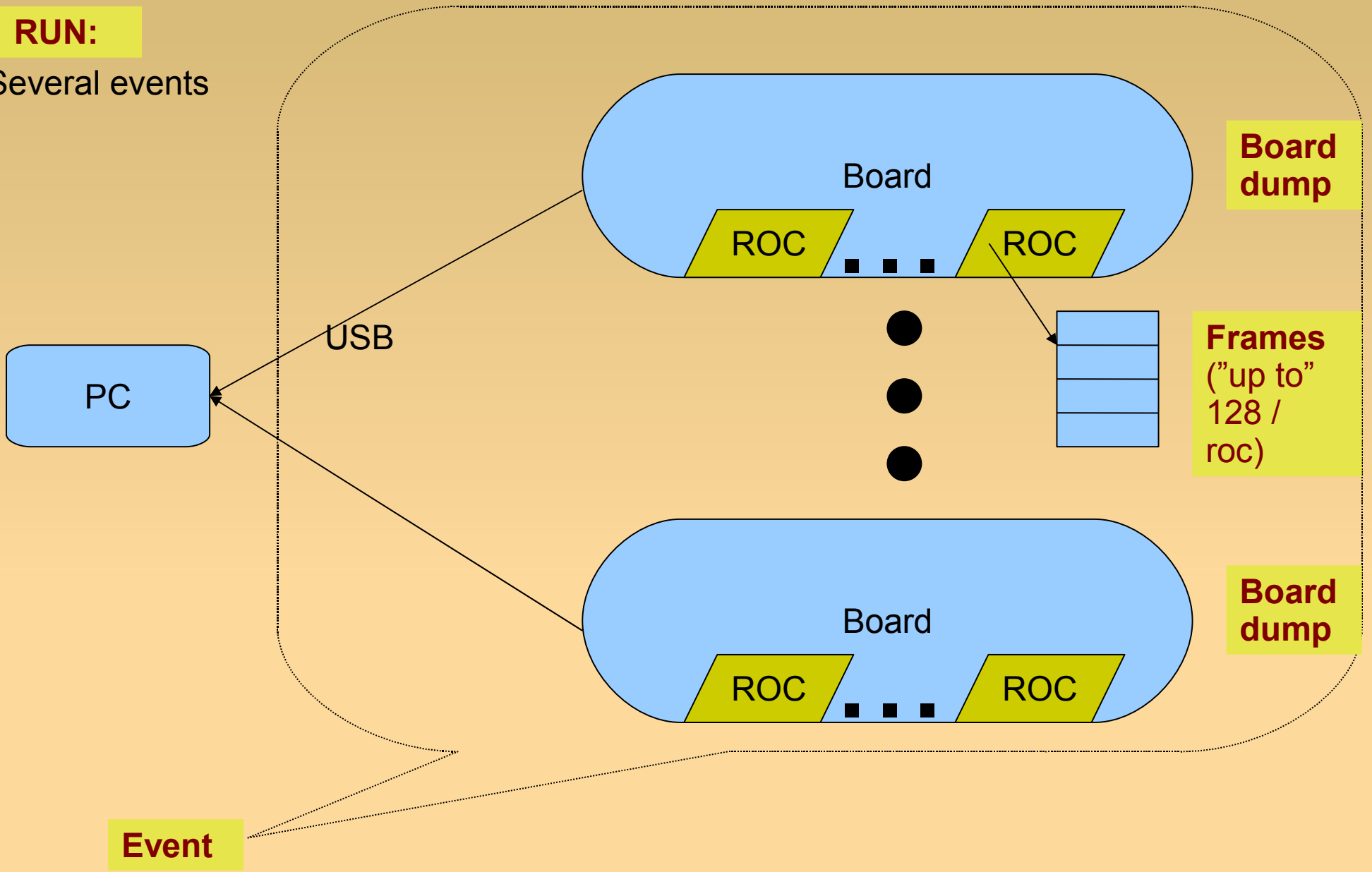
Context, Setup and terminology

- Context: trying to understand the features, needs and possible weaknesses of available data dumps
  - Looked at 2 DHCAL CERN testbeam data sets (multi-threaded Labview DAQ): based on HardRoc v1

Setup and terminology

1 RUN:

Several events



A few statistics

- July/Aug '08: 304 runs, in these stats: last 274 runs
- Nov '08: 87 runs, in these stats: last 84 runs
- Board dumps: 1757249 (July), 421457 (Nov)
- *Valid* events: 281030 & 79848
  - Ignored boards causing event ID collisions (see later)
- Avge data frames/ROC: 34.07 & 27.4

Some problems noticed

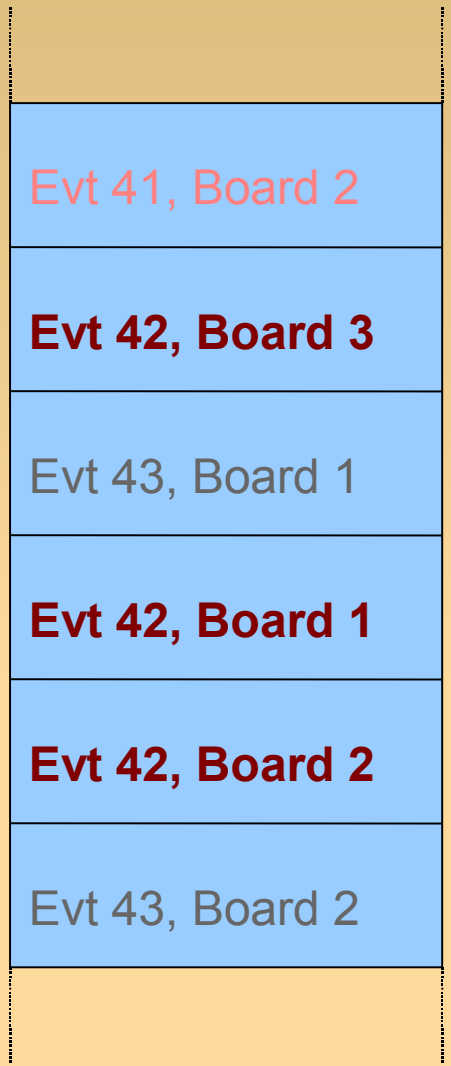
- Chips sending more than 128 frames ?!
  - Happens for a very few ROCs (0.05% & 0.03%)
  - Not always on the same ROCs
  - The additional ”garbage” (frames > 128) is always an exact (binary level) duplication of the frames 2, 3, ...
- No other kind of ”internal” exact self-similarity (eg. within frames <= 128)
- → This seems to mean: autosimilarity <=> more than 128 frames
- Hardware or software problem ?

Some problems noticed

- Event counter inconsistencies
  - For each run, event counter stored in the board dumps expected to increase from 0 to... up to 2^{24}-1 and back from 0, ...
  - But... resets to 0 *before* reaching 2^{24}-1
    - Happens on 43% & 21% of the runs
    - In all these stats: we ignore the board dumps concerned by event id collision
  - Some missing event ID intervals (5.55% & 0.23%)
  - In July (0.03%): Event ID (TrigCount) might be inconsistent with other related event ids (ExtrTrigInAcq/ExtTrigOutAcq)
- Hardware or software problem ?

Some problems noticed

- Event locality within data files



Example with 3 boards / event:
Evt 42 is defined within 4 board dumps => *distance* is 4

July: distance *generally* <= 6
Nov: distance *generally* <= 7

But *max* observed distance > 20 or 40, 100, ...

Some problems noticed

- Less/more data frames than expected
  - Data frames can be truncated (see later)
  - But sometimes (0.03% & 0.007% of board dumps) data frames end before or after expected, even without truncation
- Hardware or software problem ?

Some other verifications made

- Expected: data frame timestamp counter monotically increasing, and saturating
  - Happens on 4% & 2.5% of all ROC dumps
- Also verified:
  - (Almost) No self-similarity of the timestamp counter in data frames for any given ROC data dump
  - Timestamp counter in ROC data frames never stalls

Some other verifications made

- Data frames truncated (expected)
  - A field (NbOfData) holds the size of the recorded data for a board
  - However: whole data is contained in a fixed size buffer (esp. When ROC dumps > 128 frames)
  - → Data can be truncated if larger
    - → Happens for 0.03% of the board dumps

Conclusion, other studies yet to be made

- Redundancy, meta-data helps !
- Recheck all my figures !
  - Ask us for the raw material, scripts, logs and stats
- Arbitrate between hardware/software problems
  - Most problems could be arbitrated/solved with meta-data (end of event dump, etc.) generated by the DIF. Need to think about a read-out format. Generic for Hard/SPI/SKIROC if possible
  - Could allow on-line LCIO file generation with clean built events
- Check for self-similarity of data frame bitmaps
- ...

One proposed read-out format