SDHCAL and LCIO::RawCalorimeterHit

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Use of LCIO

Raw data

- First version of SDHCAL Raw Data was data buffers stored in LCIO GenericObject containing only integers.
- Conversion of this objet into RawCalorimeterHit has been done in second step.
- Most recent test beam data are stored with LCIO RawCalorimeterHit format.

SDHACL raw data details

- Each prtotype readout is a LCEvent
- The event contains one collection of RawCalorimeterHit with collection parameters.

Collection of RawCalorimeterHit

- The collection parameters contains various clock counter values that are computed at the Detector Interface Board (DIF) board.
- The largest counter is 48 bits.
- One DIF reads 1/3 m^2 of a SDHCAL GRPC detector (3072 channels). One detector has 3 DIF s and the full prototype has 50 detectors, so 150 DIFs.
- Each DIF is identified by a number.
- For each readout, hits in the full prototype are stored in RawCalorimeterHit.
  - CellID0 contains information on channel number and DIF number.
  - CellID1 has been optionnaly used to store a time that is now stored in the collection parameter.
  - Amplitude is used to stored the SDHCAL threshold (2 bits) + sometimes one extra bits to flag hits as potential particle interaction candidate.
  - TimeStamp is used to store the hit time.

Reconstruction

- A clustering in time is done using the RawCalorimeterHit timeStamp.
- Time-clustered hits are stored under a new LCIO file with one event per time cluster and as collections of CalorimeterHit.
- Calorimeter hit time is computed using the RawCalorimeterHit timestamp and the time inforrmation stored in the raw data collection.

SDHCAL future data

- Future evolution of SDHCAL hardware is to reach fine time precision.
- On electronics, it is usually done using coarse time counter and fine time counter.
- One 32 bits time stamp is likely to be not sufficient.
- We can reuse CellID1 to store extra time.
- We might have more than one kind of time information like Time Crossing Thresholds and Time Over Threshold.

SDHCAL request

SDHCAL RawCalorimeterHit evolution needs

- Keep the future RawCalorimeterHit the availability to read old RawCalorimeterHit. This can be done by using bit-flags in collection (see LCIO.h file).
- For future, having the possibilities to store more timestamps par RawCalorimeterHit.

Suggestion

Use the bit flag word to tag old/new format and a collection parameter to describe the RawCalorimeterHit contents for new RawCalorimeterHit.