8th November 2002

Where to Calculate Calibration Constants

C .N .P .Gee
Rutherford Appleton Laboratory

Calibration Run Structure

- **Assume joint calibration runs with LAr and Tilecal, with…**
  - one calorimeter at a time, with two common triggers.
  - probably following the same general structure as existing LAr runs, with nested loops, e.g. …

Loop over tower builder/receiver settings (cells enabled, delays)
| Loop over Patterns (which cells fire)
| | Loop over Amplitudes
| | | Loop over (e.g. 100) Triggers
| | | | Process data from 1 trigger

Trigger Frequency.

- **The obvious place to do the calibration calculations is at the event builder**
  - with access to built events containing all Calorimeter & Trigger data.
- **For detailed calibration runs where access to event-by-event calorimeter data is essential (e.g. laser pulsing), this is the only option. If it takes a long time, ATLAS will have to wait.**
  - Cf. LAr needs 10 minutes to calibrate, with events at 10kHz.
- **However, the ROS can probably pass < 1kHz of events to event builder**
  - c.f. 1kHz level-2 acceptance rate
  - the bandwidth of the readout and ROS is about to be reduced (deferrals).
  - The events (from calorimeter and from L1Calo) are big since many calo channels fire – probably even lower event transmission frequency.

How much CPU is needed?

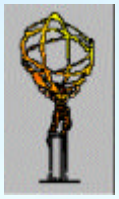
- **The calibration input from L1Calo is the digitised pulse shape from PPr, read out via PPRod.**
- **If the energy equivalent of each analogue calibration pulse is known, it is not necessary to analyse calorimeter data for every event.**
- **I wrote a short C program to measure time to process PPRod data only:**
  - running on a 1GHz CPU (no addressing/error handling) :
  - Unpacking & histogramming PPr data: 16 x 57μs/event = 1 kHz.
  - Finding the pulse centre timing: 16 x 140μs/event = 450 Hz.
- **Probably slower in real life - faster CPU, but including address decoding & error handling for each channel.**
  - there are lots of CPUs in the event builder, BUT results for each pulse height or pulse timing need to be collected in one place.

How fast could we run?

- **Running at 10kHz with 8 parallel streams, LAr calibration takes 10 minutes for 300k triggers per stream.**
- **We will probably need fewer calibration points for most runs – need to specify.**
- **Question: How do we run faster than the ROS – e.g. at 10 kHz LAr pulser rate?**
- **Answer: like LAr, don't send events to ROS.**
  - Instead, process data locally on PPRod, using a CPU(/DSP/FPGA) daughter board. One on each PPRod, so 16 times faster than 1 CPU!! Just like LAr.
  - Each CPU computes averages over (e.g.) 100 events in the innermost loop.
  - Details to be worked out. Will need access to CPU daughter from VME, and some hardware handshake signals via PPRod front panel to trigger generator.

- **To continue work with calorimeters, need to know that there is no objection in principle to this.**

End



The End