CALIBRATION AND COMBINED TESTS WITH CALORIMETERS

Thomas Trefzger

Thomas.Trefzger@uni-mainz.de

University of Mainz, Germany

Overview

- L1 Calo Trigger people involved (so far):
  Norman, Murrough, Thomas
- Tilecal people:
  Rupert Leitner, Bob Stanek
- Liquid Argon people:
  Pascal Perrodo, Isabel Wingerter

First meetings end of may at CERN to start discussions on the procedure for calibrating L1 with calorimeters:
How the existing tools will be used, controlled, synchronised between the calorimeters and ourselves.

Our requirements

- GRANULARITY: Pulse each trigger tower separately. Effectively pulse each component cell forming a trigger tower. This may be done either by the calibration system itself or by disabling inputs to the trigger tower sums.
- ENERGY: Receive pulses with a range of different energies both within our dynamic range (0–255 GeV) and beyond it (to study generated pulses).
- TIMING: The timing of the calibration pulses must be the same timing - within a tolerance (about 1 ns) - of real particles.
- SYNCHRONOUS: Simultaneously pulse different areas of the calorimeter (which may be in different TTC partitions). E.g. to see signals summed across the barrel/endcap transition, etc.

Tilecal - calibration tools

1. Mobile caesium source
   - equalize the response of all cells by adjusting the PMT HV
2. Laser system
   - tracks the response of the PMTs on any desired time scale
   - the laser has a variable attenuation using a filter wheel
   - PMT gain will be measured to a relative precision of 0.5% by measuring the laser light intensity pulse by pulse
   - maximum rate 100 Hz
3. Charge injection
   - typically 30-50.000 events in 120 secs. 255 1 GeV steps, maximum charge 800 pC corresponding 800 GeV

Tilecal - calibration procedures

- Up to now they have no detailed overall calibration procedure (how to use Central Trigger Processor, how to specify settings, sequence of steps, etc)
- They will probably do one dedicated calibration run per day during ATLAS operation
- We can use the charge injection method to calibrate our system. Dynamic range and number of steps are sufficient
- They are happy to seek a common solution (based around run control, etc) with us.

Liquid Argon - calibration tools

1. Precision charge injection system:
   - Pulser rate : 10 kHz, 300 k Triggers required (100 different amplitudes $\times$ 10 DAC settings $\times$ 5 delays $\times$ 20 patterns $\times$ 3 gains)
2. Calibration is controlled by a dedicated calibration board (7 sectors pulsed in parallel)
   - A Local Trigger Processor (LTP) is used to generate the triggers.
   - Their RODs generate BUSY at the end of each burst of pulses. This is used to control the sequence of operations in the calibration run.
3. First studies with a TTC, calibration board and ROC are underway.

Liquid Argon - calibration procedures

- The Liquid Argon calibrates in stand-alone mode.
  Free from central DAQ.
- More work is required on both sides to establish a procedure for doing calibrations together with L1.
  - It seems hard to use their system without a hardware handshake
  - It seems essential to control the timing using the CTP for a joint calibration run.

Next steps

- We agreed with both calorimeters to prepare a document to specify the calibration procedures.
- Norman has made an outline and passed to me to fill in.
- Part of L1 content copied from early calibration note from Murrough.
- First draft will be sent to Murrough, Norman and calorimeter contact people.

2

Contents

Common runs with both calorimeters

After the slice test we aim to have a integration test with both calorimeters, Level 1, TTC, DAQ, calibration system (Autumn 2004). Such a test cannot be later because there is no SPS running in the year 2005 ! What we should try to do in such a test is the following:

- Run L1 Calorimeter and L1 Muon together into the Central Trigger Processor, measure the latencies, etc.
- Confirm that the detectors can read out correct data from L1
- Send ROIs through ROIboards to L2 and slice data to ROS
- Manage threshold via common trigger menu, runs from central run control, combined databases, etc.
- Test calibration procedures with calorimeters and check results
- Exercise timing-in procedure between ATLAS subsystems