L1/L2 Calorimeter Trigger

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- Sampling weight determination
- BLS board components
- CTFE boards
- Triggering
- Readout
- Debugging
- Calibration
- Schedule

Sampling Weight Determination

- goals (in order of importance)
  - useful L1 CC trigger
  - final, complete, calibrated L1 Cal ASAP after that
  - best L1 electron efficiency and energy
  - optimize L2 E_T resolution
    - improve over Run 1 L1
  - best L2 jet efficiency, scale, and uniformity

Coarse Hadronic Sampling Issues

- CH not in tower sums due to noise considerations
  - current FH weights not tuned to account for this
    - leaves towers ~10–15% lower than raw offline
- very little FH in center of ICR
  - low jet response relative to CC/EC
  - poor jet resolution and efficiency
- possible approach
  - re–optimize FH values to compensate

Inter–Cryostat Region

- covered by massless gaps and ICD
  - not in Run 1 trigger tower sums
    - further worsens ICR jet response (50%–60% of CC), resolution and efficiency
      - very slow trigger turn–ons
      - 'lost' jets
      - very poor L1/L2 E_T resolution
  - now on 'high η' BLS boards for use at Level 2
- priorities
  - best ϕ granularity for L2 ET
  - for L2 ICR jets:
    - ieta most needed: 1.1–1.2
    - very useful: 0.9–1.0,1.3–1.4
    - unimportant: 0.8

ICR Hardware Configuration

- 2 EM and 2 HAD towers can be instrumented
  - one each for ietas 18 and 20
  - available for L2 decisions
  - possible break–down:

TT ieta	type	cell ietas	cell layers added
’18’	EM	9,11	CCMG+ECMG
"	HAD	12,13,14	ICD+
		13	ECMG
’20’	EM	8	CCMG+ECMG
"	HAD	10,12	CCMG+ECMG

Notes:

- trigger ’slices’ with some irregular η granularity
- all ICR cells included, minimal mixture of ICD/MG

Approach

- hold EM weights constant for best L1 e/γ's
- tune FH+MG+ICD thru detector
  - best single charged pion resolution and linearity
    - pick relatively low energy of 20 GeV (a nod to jets)
  - provides some help for jets and $\not{E}_T$ @ L1
  - delays main benefit till L2
- trigger reference sets
  - lower TT thresholds in ICR by 50% @ L1
  - tighten @ L2
- Early L1 Cal Trigger
  - CC
    - newly optimized EM sampling weights
    - FH values from Run 1 at first, then re−optim.
  - EC non−CH re−optimized

Trigger Drivers and Summers

- First, mostly–CC set (up to |eta| = 1.5)
  - all drivers here and CC installed
  - trigger summers
    - ~4000 tested
    - all of CC South and 3/4 of CC North installed
    - more than 10% EM tested bad –– being repaired
      - should be ready by 2–week shutdown
- 'EC' set
  - drivers in hand
  - trigger summers for |eta| < 3.2 ordered (new vendor)
    - should arrive early next week
- resistor values for high–eta/MG/ICD being determined
  - summers are being labelled

CTFE Boards

- Run 1 boards modified
  - use Run 1 fixed resistor Terminator_Attenuation networks
  - or Run II variable gain Term_Attn circuit board mezzanine cards
- modifications done at SiDet
- 60% of 320 boards finished
  - enough with Run 1 resistor networks to cover CC
  - rest left at SiDet for installation of Run II daughter cards
    - one part missing before send orders

Triggering

- using mix of old/new hardware
- have measured trigger pick–off timing w/respect to beam crossing
- TCC software can handle simple triggers (eg. 1 EM > 5 GeV)
- successfully triggered a few CC towers
  - used pulser signal
  - approx. in time with beam
  - TT eta +4...–4 (ie. |eta| <0.8)
  - need collisions for confirmation
- timing 'close' –– need triple digit. to nail down
- final timing of trigger required after receiver boards arrive

Readout to L2 and L3

- full readout needs
  - some FPGA code
  - installation of a lot of equipment
  - make old Run 1 equipment work again
  - should be working by mid to late May
- readout over monitoring path
  - should happen this week
  - will be out–of–time with beam
    - would take ~1 week to do this

L1 Calorimeter Debugging

- L1CalExamine
  - exists in CVS, release held back by caladdress problems
    - need also to implement Run 2 cell−TT map
  - unpacks trigsimmed version of crate 16
    - data format not well−established for data until readout working
  - histograms and ntuple for debugging
  - can work from TCC−based readback
- utilize pulsers
  - did correct towers fire?
  - Run 2 pulser mapping implemented into caladdress

Calibration

- also use L1CalExamine
- pulsers
  - did tower fire at 'correct' value?
- comparison of TT to precision readout
  - overall normalization issues
  - phi and eta uniformity
  - parametrize trigsim

Schedule

- at present
  - CC BLS's 3/4 instrumented
  - CTFE boards installed for simple single tower triggers
- near–term (ie. next month)
  - implement EC summers/drivers as come in
  - utilize TCC–based readback for CC debugging
- longer term (>~ 1 month)
  - install far forward/ICR hardware
  - implement full readout
  - debug and calibrate
  - implement new summers where needed
  - implement fancy tiles, etc.