
Past (and future?) L3 electron triggering

James T. Linnemann
Michigan State University
Paris Workshop
March 12, 1999

What from L2? (central)

- ▶ Central: matched L1 Cal TT, CFT/SMT, PS
 - Cal: 1X2 TT cluster
 - Isolation in Cal (physics, not ID)
 - perhaps, isolation in tracks
- ▶ improvements in L3:
 - Cal spatial resolution (EM3 = .05x.05; TT = .2x.2)
 - redo matches
 - Cal energy resolution (L1 noisy, poor calibration)
 - E/p: better info
 - Possibly, Zv correction

L2 electrons (Forward)

- ▶ No CFT track, no SMT
- ▶ 2-layer FPS match with Cal TT
- ▶ Improvements in L3:
 - Cal as for central
 - disk tracking
 - track and EM3 match
 - E/p?

Photons

▶ L2:

- CPS u-v match with Cal TT “e”
- FPS match with Cal TT “e”

▶ L3:

- Cal improvements as for e
 - redo PS match
- try tracking again?
 - First time in disks?

L3 in Run I, Run II

- ▶ Input rate up 5X
 - 250 msec nominal budget to 50 msec nominal
- ▶ Processors probably > 20X faster
- ▶ net effect is > X4 in available cycles
 - modulo I/O, overheads
- ▶ Run I em algorithm:
 - < 10msec per first call
 - tightly coded

Run I strategy (McKinley Thesis)

- ▶ Seeds from L1 em Cal TT mask
 - Run II: fully matched in “all” detectors
 - need not start in calorimeter
 - but calorimeter is crudest in L1/L2
- ▶ local cal unpacking at TT granularity
 - 3x3 TT around L1 seed
 - run-independent calibration constant
 - unpack directly into nominal Et for speed
 - used Et not E in analyses; slight bias resulted
 - correction for vertex done AFTER analysis

Parameters of e/ tool (Run I)

- ▶ # electrons required
- ▶ Et min (EC, CC separately)
- ▶ Track match options
 - Y/N, cen, fwd, veto, veto_cen, veto_fwd
 - , in requirement
- ▶ shape cut selection:
 - e, , and these with _long, _trans, _ignore, _tight
 - turn on part or all of shape cuts
 - in the end, no distinction between e, in cal
- ▶ Isolation Y/N (physics, not ID)
 - cone_ R, cone_fraction_max

L3 Em Cal Algorithm (successive cuts)

- ▶ Et cut
 - peak Em3 cell, shower centroid, .3 X .3 EM+FH1
 - Zvtx correction (L0, centroid)
 - leakage correction
- ▶ Longitudinal Shape
- ▶ Transverse Shape
- ▶ track match if required
- ▶ isolation if required

Longitudinal Cuts

- ▶ $FH1/EM < \text{cut}$
- ▶ $\text{min} < EM3/EM < \text{max}$
 - loose: (.1, .9) mainly for noise rejection
- ▶ $EM4/EM < \text{min}$

- ▶ EM1, EM2 fractions not used: E scale offsets

Transverse variables

- ▶ EM3 grid around peak EM3 cell
 - CC: $r_5 - r_3$ (E-weighted r from peak) ($5 \times 5 - 3 \times 3$)
 - EC: $E_{5 \times 5} / E_{3 \times 3}$ ($E_{7 \times 7} / E_{5 \times 5}$ for $\text{leta}=31,32$)
- ▶ More cuts if `_TIGHT`:
 - $r_5 < \text{max}$ (constant value)
 - $\text{min} < E_{4 \times 4} / E_{2 \times 2} < \text{max}$ (CC only)
- ▶ These are all symmetric about peak
 - **more** 2-gamma rejection: (Pershkin, Para):
 - $e_3 / e_2 < \text{cut}$ (2nd, 3rd highest neighbors of peak)
 - (**not used** either online or offline?) (but: run II has PS)

Tuning

- ▶ The cuts are “simple”, but all the work was in tuning them on test beam data
 - real data was not exactly same as test beam
 - thus, set rather conservatively (“99% efficient”)
 - deciding which possible variables to actually use
- ▶ only Plate MC (too slow, late) came close to fitting real data
- ▶ tuning was a **LOT** of work, 3-5 people for months (had to be ready BEFORE run)
- ▶ Almost all cuts depended on
 - E (4 ranges X EC,CC), | | (7 ranges)

Tracking (Dan Claes)

- ▶ Actually, only hit counting in r-phi view
 - aided by $B=0$, straight line
- ▶ central and forward performed
- ▶ used with trepidation (not in at the start)
- ▶ lots of work on fast unpacking
 - still much slower than cal
 - Fine if run only after considerable rejection

Isolation Cone

Cone/Core - $1 < \text{cut}$

- ▶ Sum over all layers except ICD/MG
- ▶ Core: .3x.3 about peak
- ▶ Cone: cells within $R > .3$ of tower with peak

- ▶ The allowed range cuts were tuned for individual scripts by the interested group:
 - a **PHYSICS** cut, not an ID cut

Bit of History

- ▶ Not well integrated with offline:
 - “code structure = organization chart”
 - L2 got started first!
 - Offline not suitable for timing (space?) constraints
 - crippled by lack of accurate MC
 - result: needed effort on comparison with offline
 - an independent cross check is best spin on this
 - ESUM was a blessing and a curse:
 - too crude a selection algorithm for which duplicate
 - but EM3 detailed recording much harder to handle

Speed (and consequences)

- ▶ Lots of work tuning unpacking code
 - only “good enough” calib; fast memory of history
 - X30 faster on rewrite
- ▶ Remember local unpacking
 - dominated time; cut variables much faster
- ▶ Choose order of cuts so most rejection fastest
 - Track matches after other rejection attained
- ▶ Errors in seldom-used options (too flexible?)
 - people get sick of checking things

L3 e/ Handles

- ▶ Localized, incremental, unpacking
- ▶ Probably Calorimeter biggest change wrt L2
 - energy calibration better
 - shower shape (how much better after PS?)
 - what are handles for e/ separation? Needed?
 - PS cluster shape?
- ▶ no disk tracking done in L2
- ▶ SMT in r-phi only
- ▶ $Z_v = 0$, or try to measure?