Past (and future?) L3 electron triggering

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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 < cut
- min < EM3/ EM < max
  - loose: (.1, .9) mainly for noise rejection
- EM4/ EM < min

- EM1, EM2 fractions not used: E scale offsets

Transverse variables

- EM3 grid around peak EM3 cell
  - CC: r5 - r3 (E-weighted r from peak) (5x5 - 3x3)
  - EC: E5x5/E3x3 (E7x7/E5x5 for Ieta=31,32)
- More cuts if _TIGHT:
  - r5 < max (constant value)
  - min < E4x4/E2x2 < max (CC only)
- These are all symmetric about peak
  - more 2-gamma rejection: (Pershkin, Para):
  - e3/e2 < 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 < 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
- Zv = 0, or try to measure?