CAT Meeting
CERN
24-May-2006

Status of SM CAT Activities

Cristobal Padilla (CERN)

Outline:

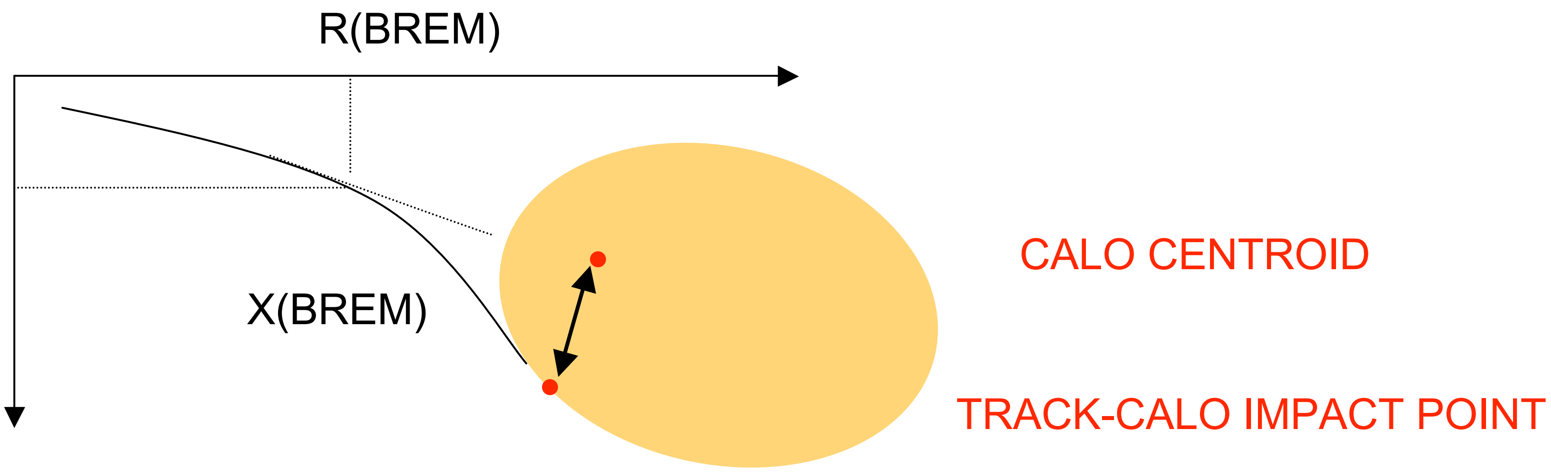
1. Plans for Bremsstrahlung recovery
2. New variable for offline electron selection
3. Trigger efficiencies using $Z \rightarrow e^+e^-$ events
4. Things not covered
    - Magnetic field studies for ID reconstruction
    - MC generator differences
    - Tau trigger optimization for Z and W
    - Luminosity measurement studies

Plans for Bremsstrahlung Recovery Algorithm

Anne-Catherine

Bremsstrahlung signature :

- Track with large number of outliers after the point of Brem
- Kink in radius curvature

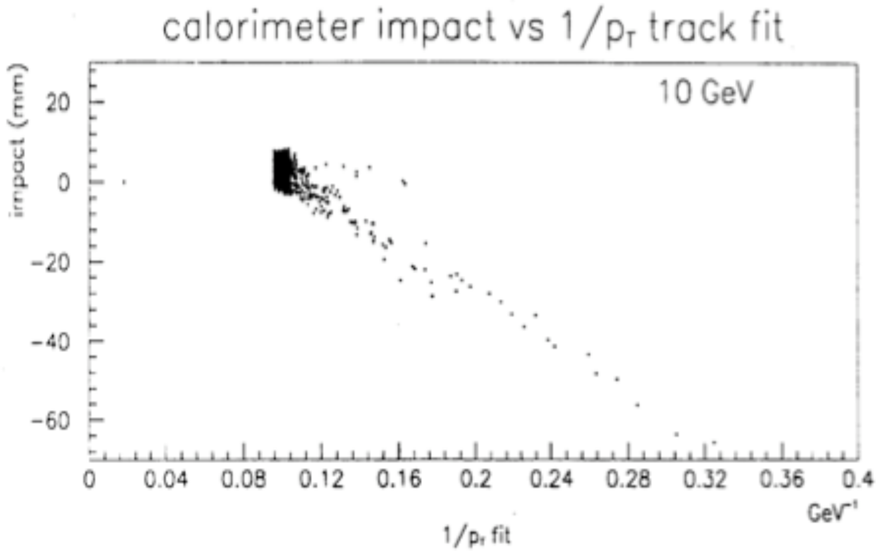


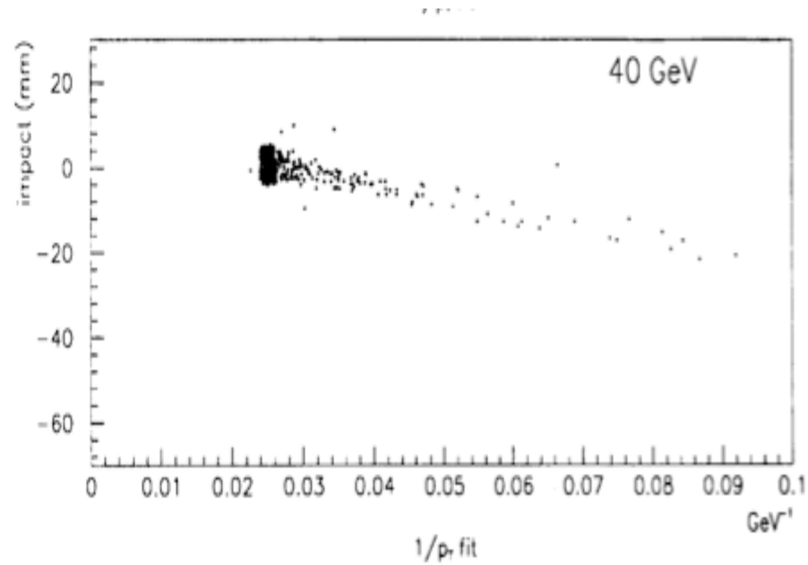
- B field fans out the bremsstrahlung energy in the r-phi direction
- But Calorimeter cluster centroid position to large extend unaffected by Bremsstrahlung

Plans for Bremsstrahlung Recovery Algorithm

Follow ideas from : “ASCOT/EAGLE INDET-NO-015” september 92 & Pavel Nevski

“Electron identification using energy momentum matching in the ASCOT/EAGLE Inner detector”





- Exploit correlation of track calorimeter impact point - calorimeter centroid vs 1/pT
  - The energy lost in Bremsstrahlung is correlated with xbrem
- Bremsstrahlung fit with 7 parameters : 5 Helix parameters + 2 for the Bremsstrahlung position (X,R)
- Try several (X,R) positions, modify 1/pT (according to the plot above) compute new φ, minimize $\chi 2$
- Bremsstrahlung more likely to occur at a tracking layer (regions of highest density)

Status and Plans

- Code developed with offline release 11.5.0
- Tests still to be done before being included in an official offline release
- Future plans for Bremsstrahlung studies
  - Implement a similar method in the EF (Tetiana)
  - Study how to recover the efficiency lost by this effect at LVL2

Electron Identification and Jet Rejection

Victor

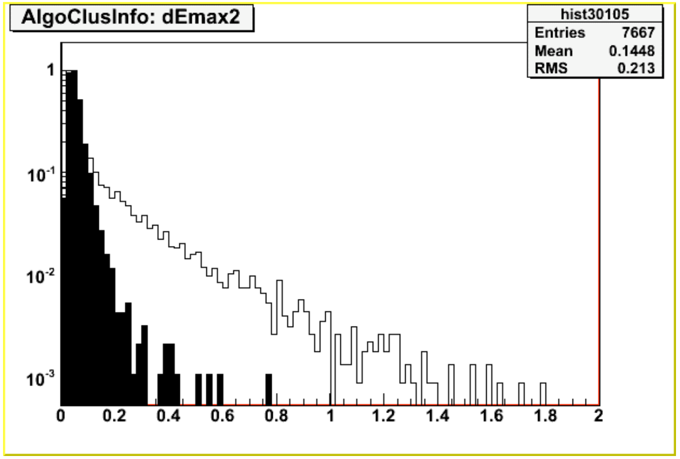
- With release 11.0.41:

Apply "new cuts" (normalized to the maximum cell energy in the first EM sampling) to compare their efficiency with "old" one for:

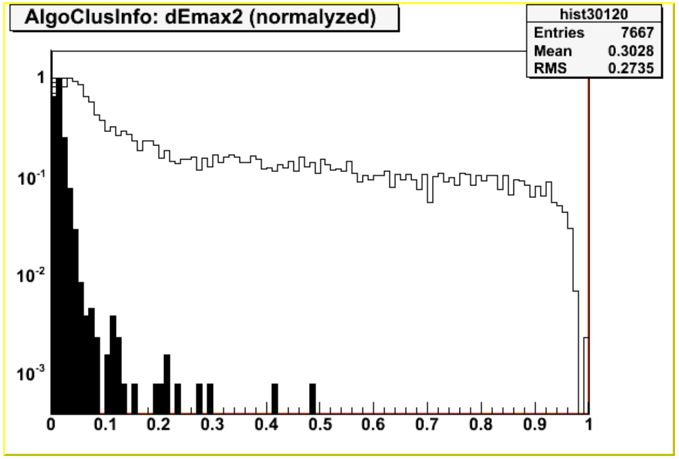
  - electrons Et = 25 GeV
  - electrons Et = 10 GeV
  - jets (JF17)

Effect of Normalized cuts

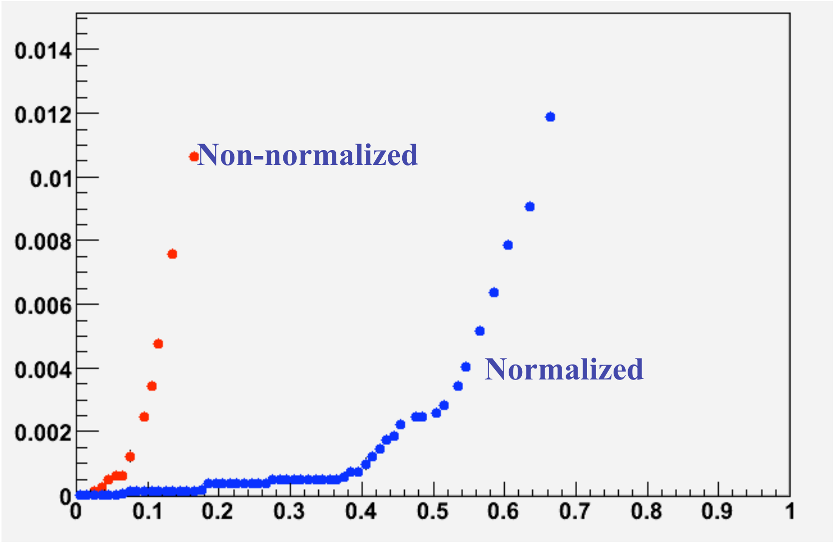
$\Delta E_{max2} = E_{max2}/(1+9x10^{-3}E_t)$, where E_{max2}- second maximum in the cluster in the 1st sampling



$\Delta E_{max2}/E_{max}$, where E_{max}- maximum in the cluster in the 1st sampling



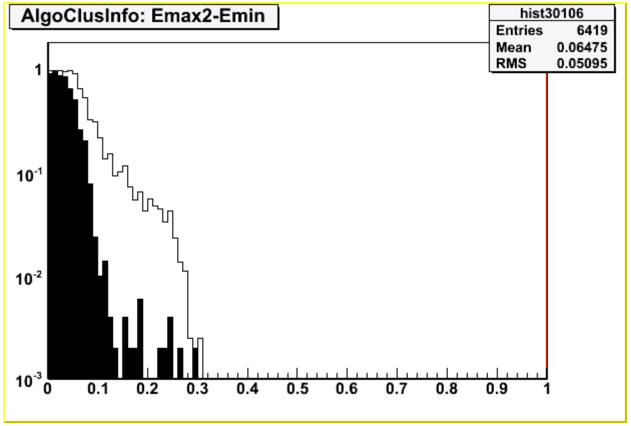
dEmax2 (Rej electrons vs. Rej Jets)



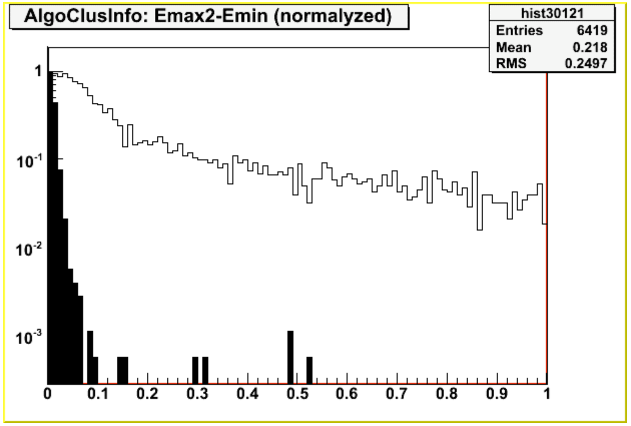
For an electron rejection of 0.3%. the normalized variable rejects 50% of the jets (compared to 10% of the jets rejected if the non-normalized variable is used)

Effect of Normalized variables

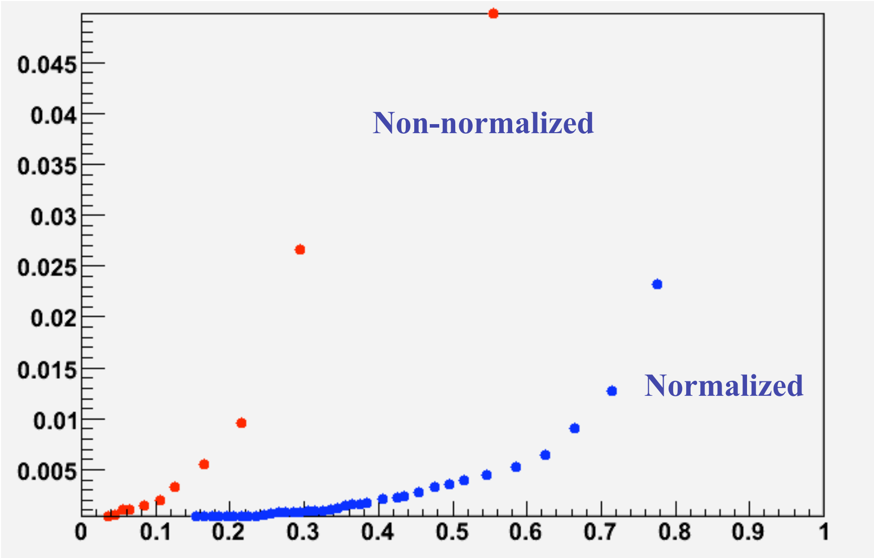
$\Delta E = E_{max2}, - E_{min}$ where E_{max2}- second maximum in the cluster in the 1st sampling, E_{min} – energy of the strip with minimum between 1st and 2nd maxima



Normalized for $\Delta E / E_{max}$



dE (Rej electrons vs. Rej Jets)



For an electron efficiency of 99%, the normalized variable rejects more than three times more jets

Electron Identification and Jet Rejection

When release 12.0.0 will ready

- Efficiency of electron identification and jet rejection as function of h
- For jets separate
  - isolated electrons (W,Z,t)
  - Non-isolated electrons (b,c,π^0)
  - And others (conversion)
- And look at efficiency of their identification

- …..And try to apply the same method at LVL2 (where we have our larger efficiency drop today with respect to offline)

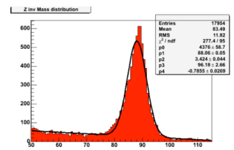
Trigger Efficiencies using $Z \rightarrow e^+e^-$ events

Method to determine electron trigger efficiencies with real data using a Z-> ee sample

a) Run the HLT trigger chain and store events offline. Determine the number of Z by a fitting procedure (after reconstruction).

SINGLE TRIGGER : e25i

Trigger → offline →



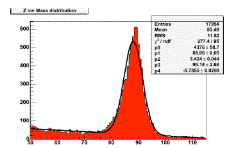
-Diagnostic sample-

⇒ N_1^Z events

b) Tag (online) the events for which we have 2 or more clusters satisfying the e25i cuts

DOUBLE TAG: 2e25i

Trigger → offline →



-Tagged sample-

⇒ N_2^Z events

$$N_1^z = \varepsilon_z^{rec}\left(2\varepsilon_e^{trig} - {\varepsilon_e^{trig}}^2\right)N_0^z + B_1$$

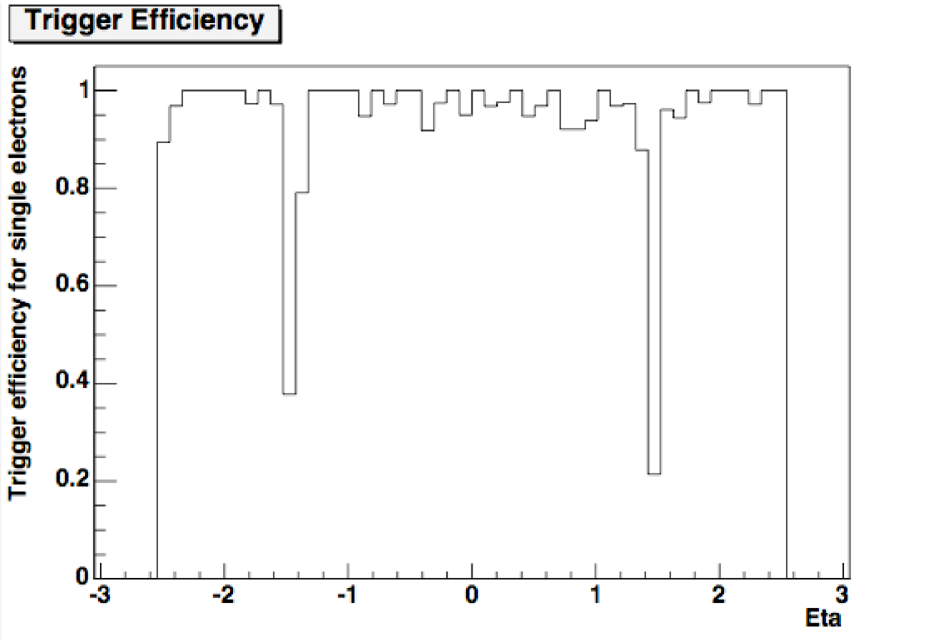
$$N_2^z = \varepsilon_z^{rec}{\varepsilon_e^{trig}}^2 N_0^z + B_2$$

$$\varepsilon^{trig} = \frac{2\,(N_2^z - B_2)}{(N_2^z - B_2) + (N_1^z - B_1)}$$

Trigger Efficiencies using Z→e^+e^- events

Teresa

- Study performed with offline release 11.0.5 using CSC data on ESD



Trigger efficiency of single electrons with E_T = 25 GeV

- The LVL2 trigger efficiencies computed with both methods are
  - Single electron: 94.2±0.6% (96.3±0.5% for is_em=0 electrons)
  - Using Z→e+e^- method: 93.4±0.6 (96.8±0.5 for is_em=0 electrons)
    - Small differences being investigated
    - Somehow surprised that efficiencies have improved so much with respect to Rome data