Status of Jet Corrections in Run II

Lina Galtieri, for the Jet correction group

- Provide Jet Corrections along the lines of Run I
- Di−Jet group: improve jet resolution

Jet Corrections Step 1:

- Check the calorimeter E−scale (with calor., electron, muon groups)
  - Use electrons, muons, gam−jet balance
- Test Run I JTC96X corrections and determine their uncertainties
- Determine the relative central−plug response
- Tune simulation to reproduce test−beam data and low P_T pion data

Jet Corrections Step 2 (reduce uncertainties)

- Determine underlying event
- Tune jet fragmentation (charged tracks in jets) in Monte Carlo to reproduce tracks in jets.
- Determine absolute jet corrections using the Monte Carlo.
- Complete the new Run II corrections: JTC02X (?).

CEM Energy Scale

Use M(Z) to check E−scale.

- Use tower−to−tower gain corrections (Eva Halkiadakes)

$M(Z) = 91.26 \pm 0.26$ GeV

$\sigma(Z) = 3.52 \pm 0.21$ GeV

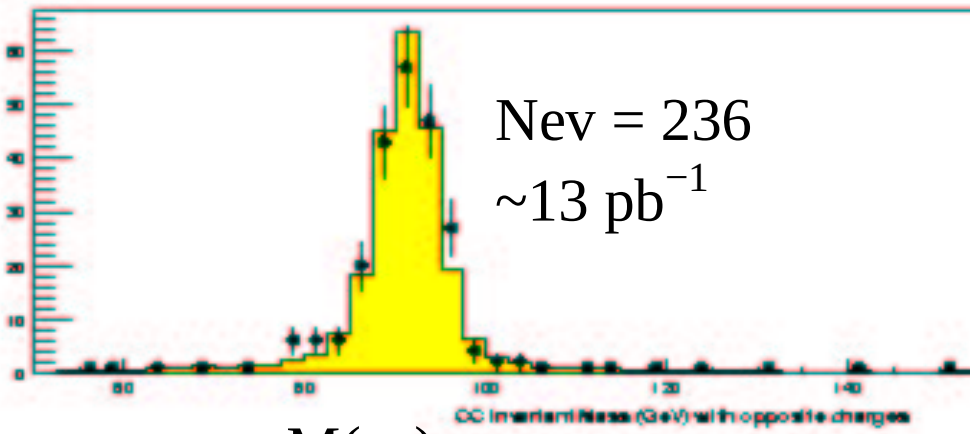
- Simulation shifted by 2.8% and smeared by 2% to get agreement with the data

- After tower−tower correction

  $E/P = 1.035$ $\sigma(E/P) = 5.7\%$

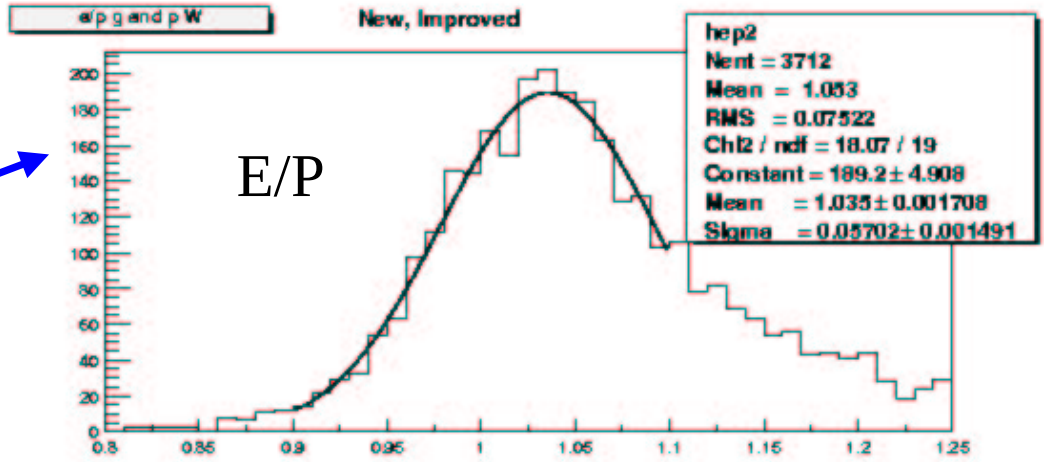
- Need to check with MC with correct amount of material

$Z \rightarrow e^+e^-$ central electrons



M(ee)

YKKim + ETF group



E/P

Larry Nodulman +ETF group

PEM Energy Scale

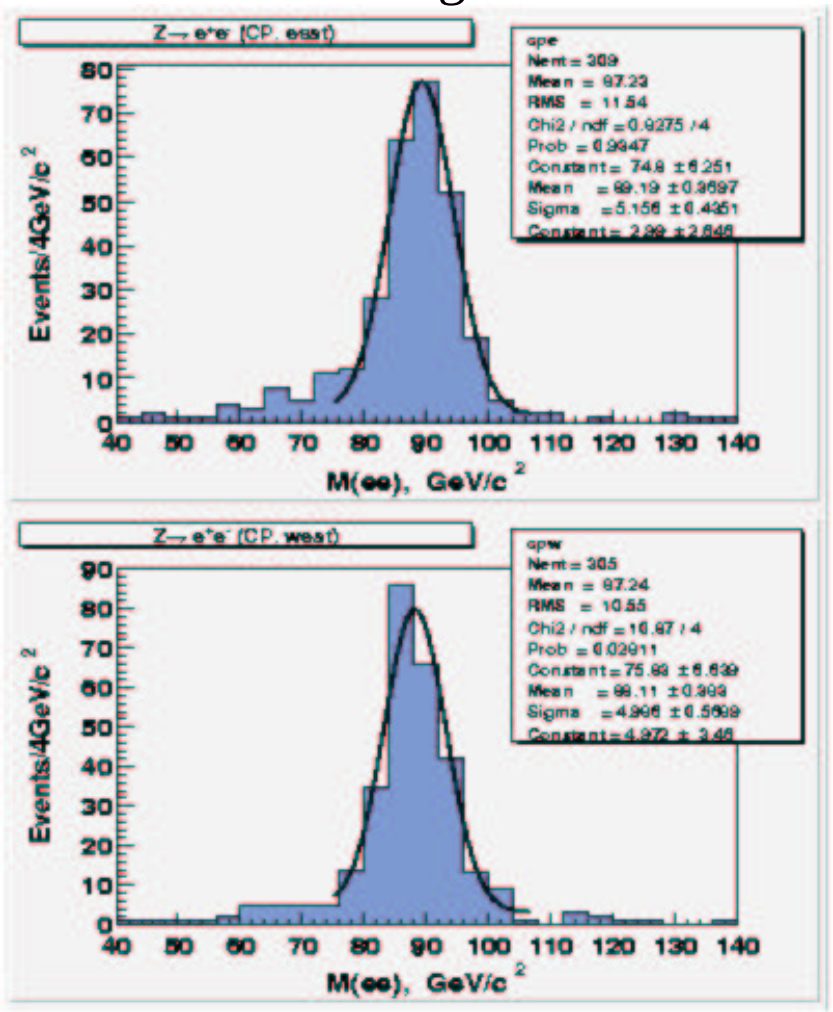
Use Z−> e+e−: one e into Central, other in Plug

- Corrections needed:
  - ➔Tower−tower corrections in central to improve resolution (not done yet)
  - ➔PEM face corrections (resolution)
  - ➔PPT corrections (resolution)
- Z mass depends upon the cluster algorithm used.
- Using: 3x3 clustering + PPT :

	M(Z)	σ(Z)
EAST	89.19 ± 0.37	5.16 ± 0.44
WEST	88.11 ± 0.38	4.99 ± 0.57

- EAST E−scale is 4.0% low
- WEST E−scale is 6.4% low

Central−Plug Electrons



Jedong Lee +ETF

CHA and WHA Energy Scale

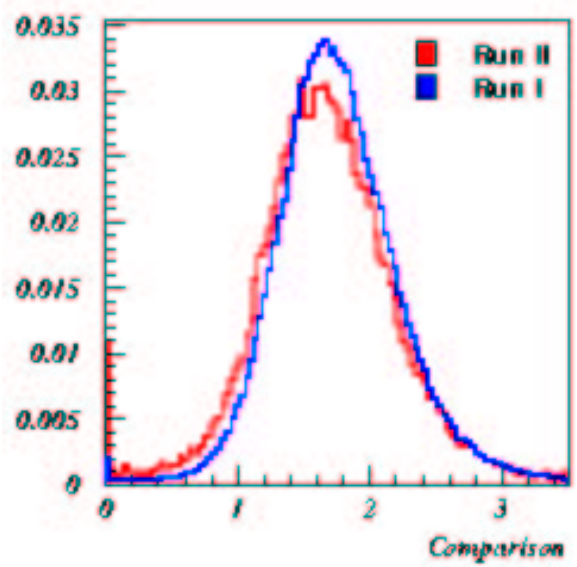
- MIP peak in CHA obtained using muons from J/ψ
  - Using cuts very similar to run I, compare CHA E−scale

$(MIP)_{II}/(MIP)_{Ib} = (0.96 \pm 0.5)\%$

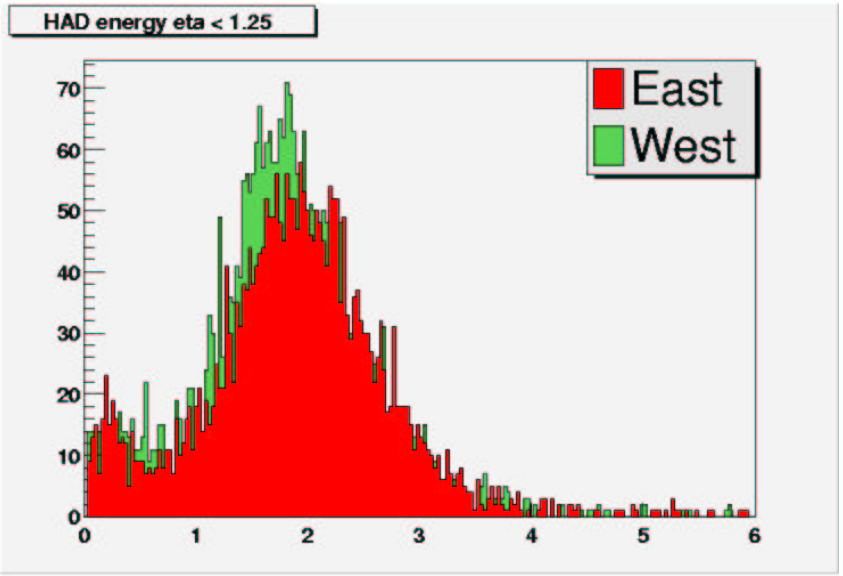
  - More muons needed to evaluate tower− tower calibration

- First IMU trigger test used to look at muon response in WHA (η=1.0−1.2)
  - Find East−West plug asymmetry
  - More data needed to understand background and peak position
  - A few PHA muons collected

CHA muons, Robyn Madrak



WALL muons, Dan Cyr



E−scale from γ−jet balance

We can learn three things from γ−jet balance:

- Central E−scale, by comparing with run I
- The relative central−plug E−scale
- What is the E−uncertainty if we use the old JTC96X corrections

$$f_b = (P_T^{Jet} - P_T^{\gamma})/P_T^{\gamma}$$

- E_T (γ) > 25 GeV

  Run Ib $f_b = -0.2036 \pm 0.0016$

  Run II $f_b = -0.2341 \pm 0.0046$

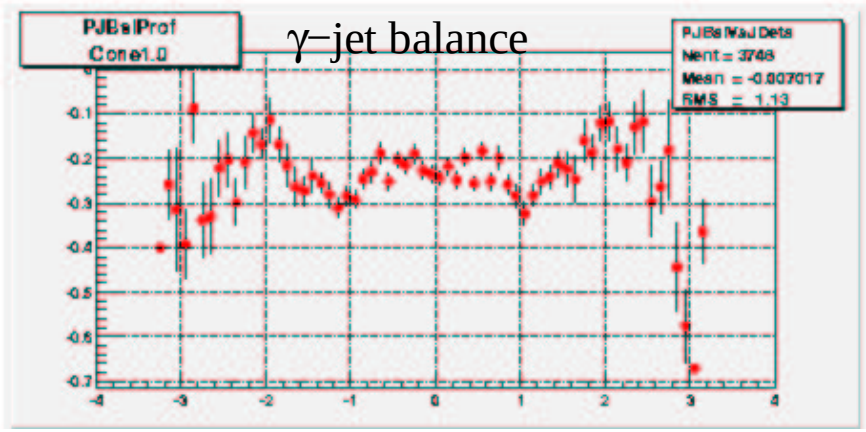
  $\Delta P_T / P_T = (-3.1 \pm 0.5)\%$

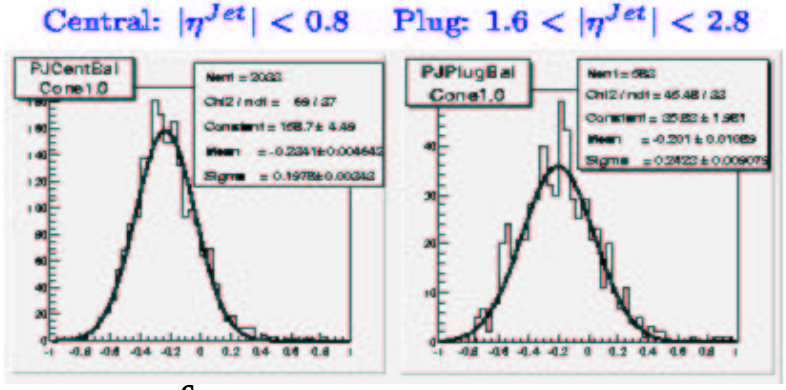
Run II jet E−scale off by ~3% in central

- Plug−central response:

  $(+3.3 \pm 1.1)\%$

  (bug not fixed here, see later)

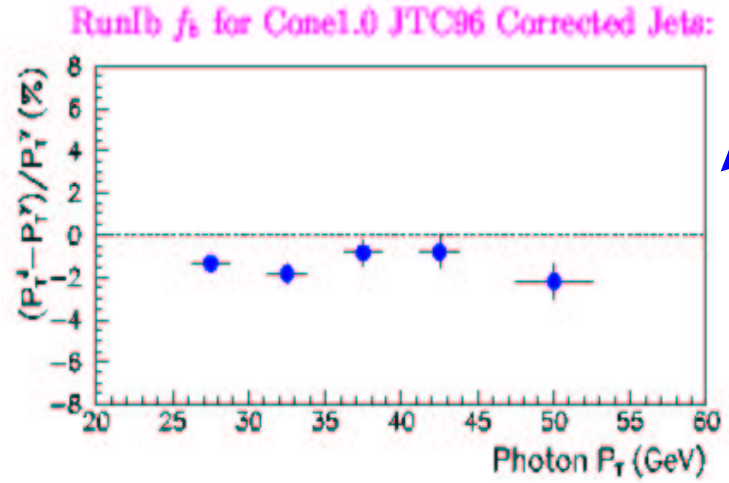




Giuseppe Latino

Can we use Run I corrections?

Try to apply Run I corrections, JTC96X , to central jets in Run II.



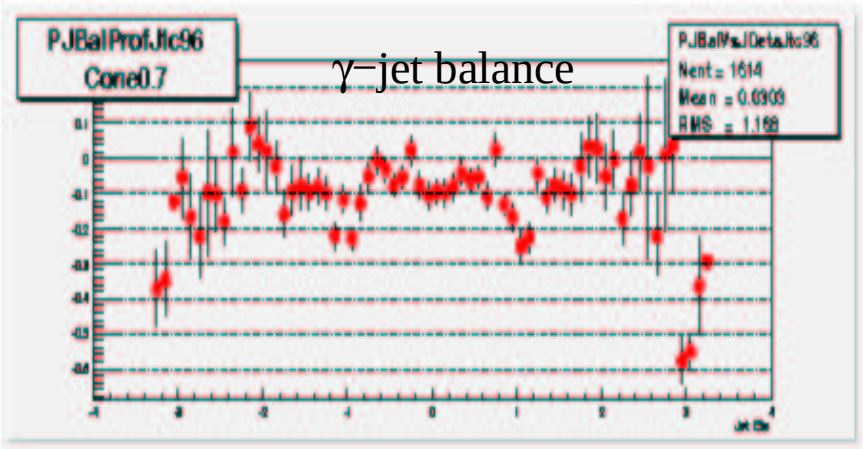
Run Ib:

γ−jet balance as a function of $P_{T(}\gamma)$.

- After corrections obtained a balance to within 1−2%
- K_T kick effect?

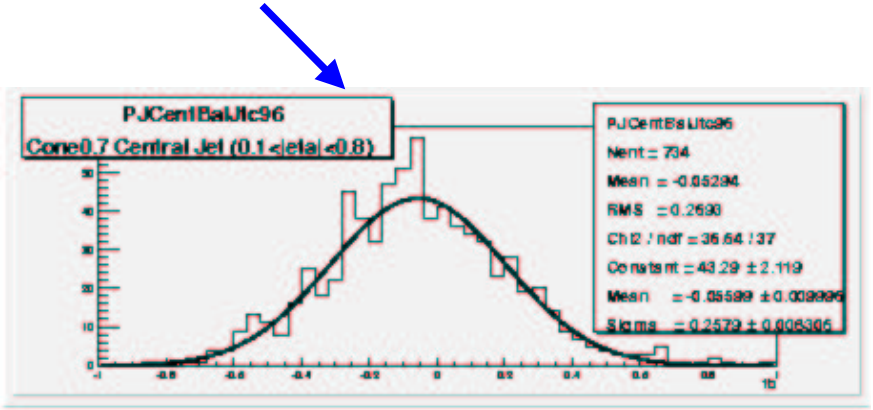
Run II:

Run II γ−jet balance after JTC96X correction



Jet η

Unbalance of −5.9% in central



f_b

Giuseppe Latino

Summary of Jet E_T Scale in CDFII

Calorimeter E−scale

CEM : absolute scale checked with Z→e+e−

Results show E−scale OK within 2−3%.

CHA : scale checked with MIP peak from J/ψ muons

Run II scale 4% low with respect to run I

WHA: First observation of MIP peak from muons!

PEM : absolute scale checked with Z→e+e−, one e in the central

Need many corrections: face , tower−tower, PPR.

Scale off up to 10% depending on cluster algorithm used.

Observe EAST−WEST plug difference of 2−3%

PHA: calibration from test beam. Need plug muons

Jet E−scale: γ−jet balance, using JTC96X corrections, seems to be ~6% off for central jets.

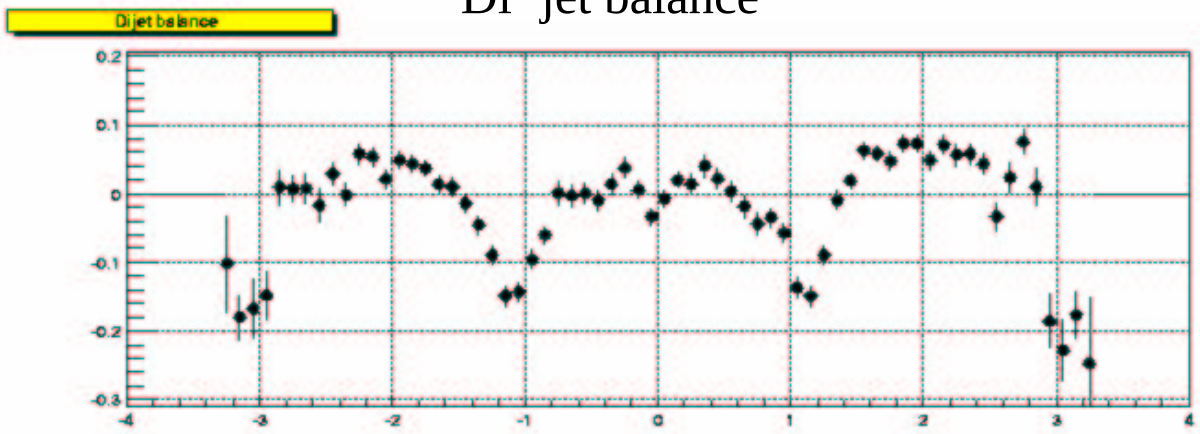
(bug not fixed here, see later. Effect expected to be small in central)

Plug response relative to central

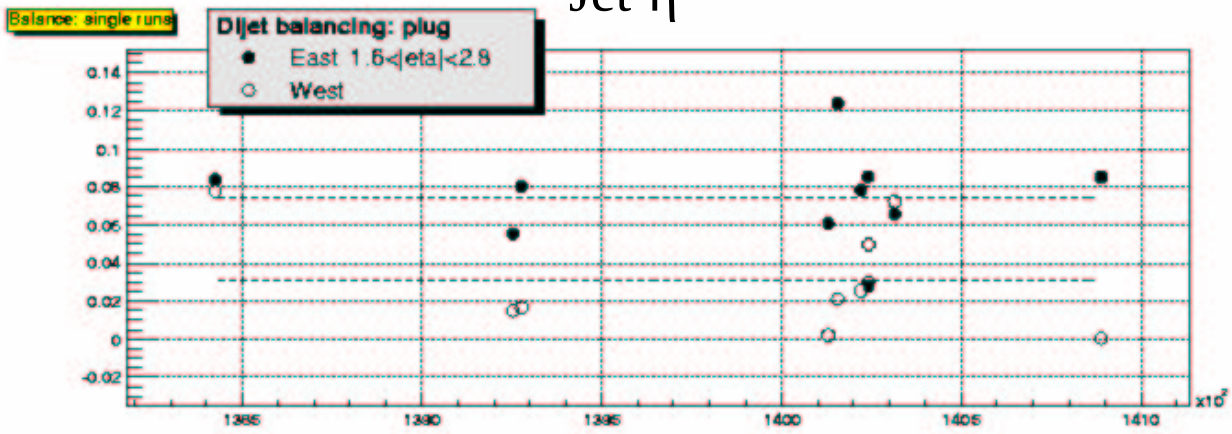
Bhatti, Flanagan, Harris, Currat and others

For the plug we evaluate a correction relative to the central calorimeter by doing jet−jet balance . One jet is always in the central calorimeter.

Di−jet balance



Jet η



Run Number

- Cracks in detector clearly visible
- F_b = (3.1±0.4)%West
- F_b = (5.4± 0.4)% East

(bug fixed in these plots)

Balance for East and West Plugs as a function of run number.

East Plug response is systematically higher than for the West Plug

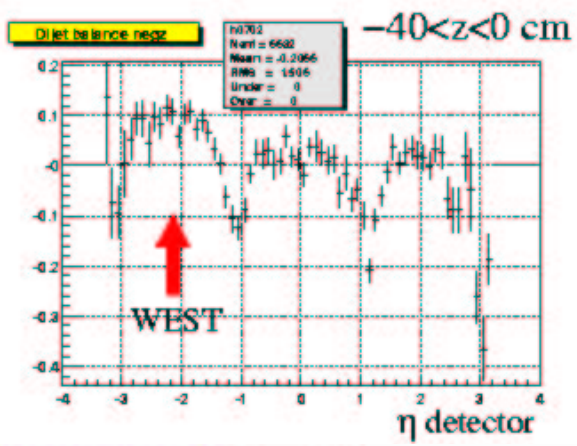
East−West Plug Response

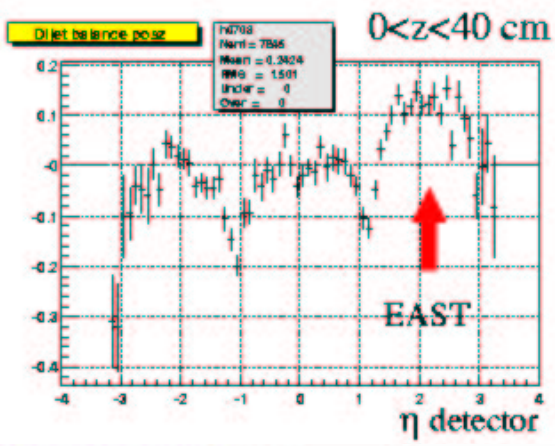
Investigating the 3%difference in East−West Plug response (Currat).

Found a bug in Cal `PhysicsTowers` calculation

Problem with Tower E_T calculation: erroneous π offset in θ calculation

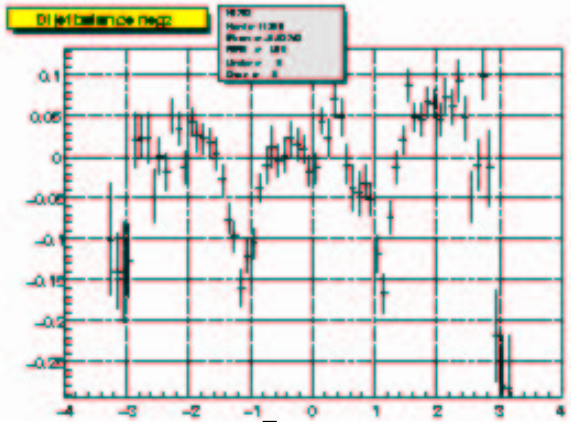
$z_v < 0$

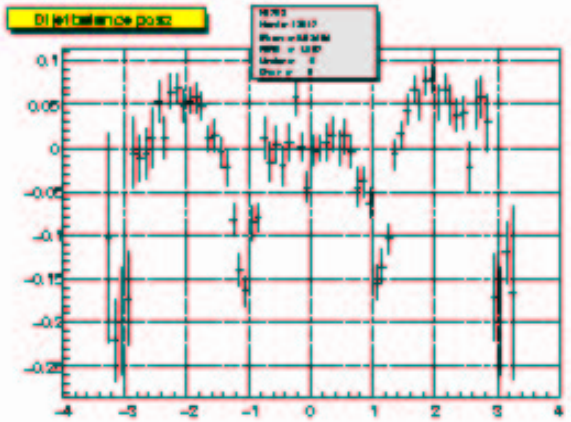




$z_v > 0$

Before the fix.
η dependence is wrong



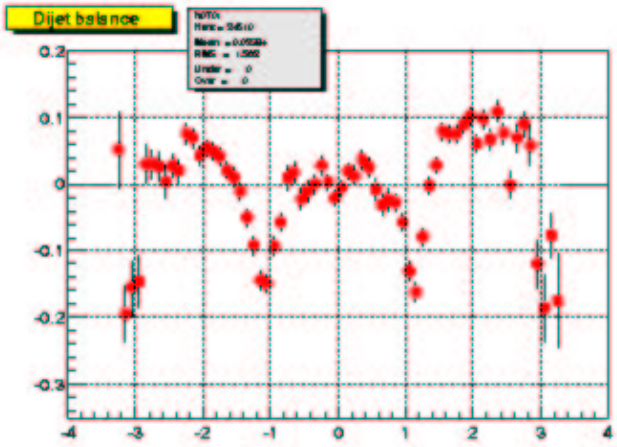


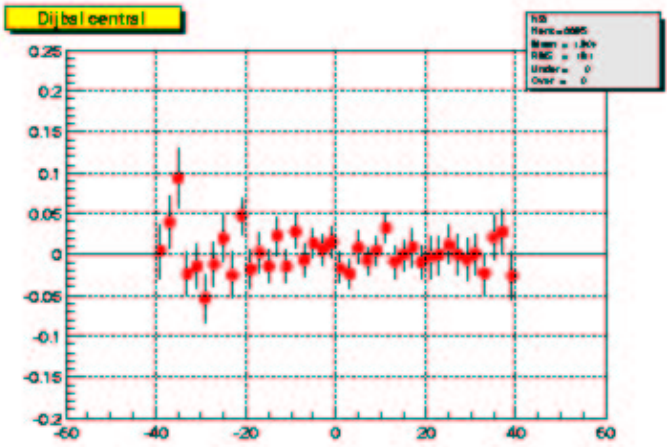
After the fix.
η dependence is correct.The 3% difference persists

East−West Plug Response

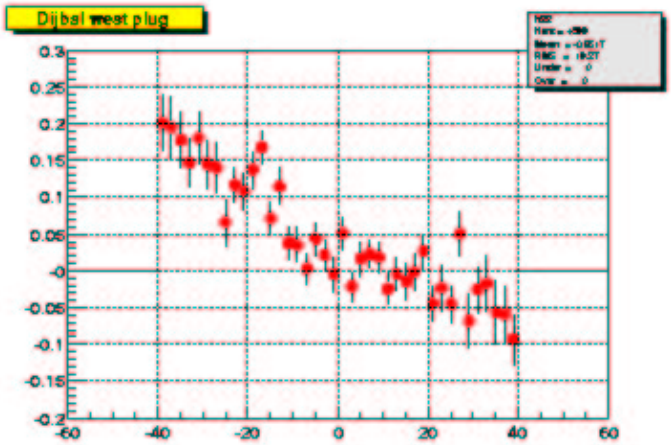
More on Cal. `PhysicsTowers` bug (Currat , Latino and others).

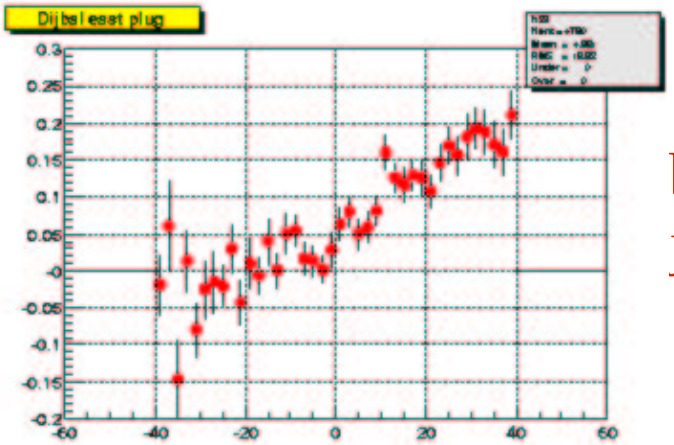
Look at z vertex dependence of di−jet balance in East and West Plug





balance in central jets OK





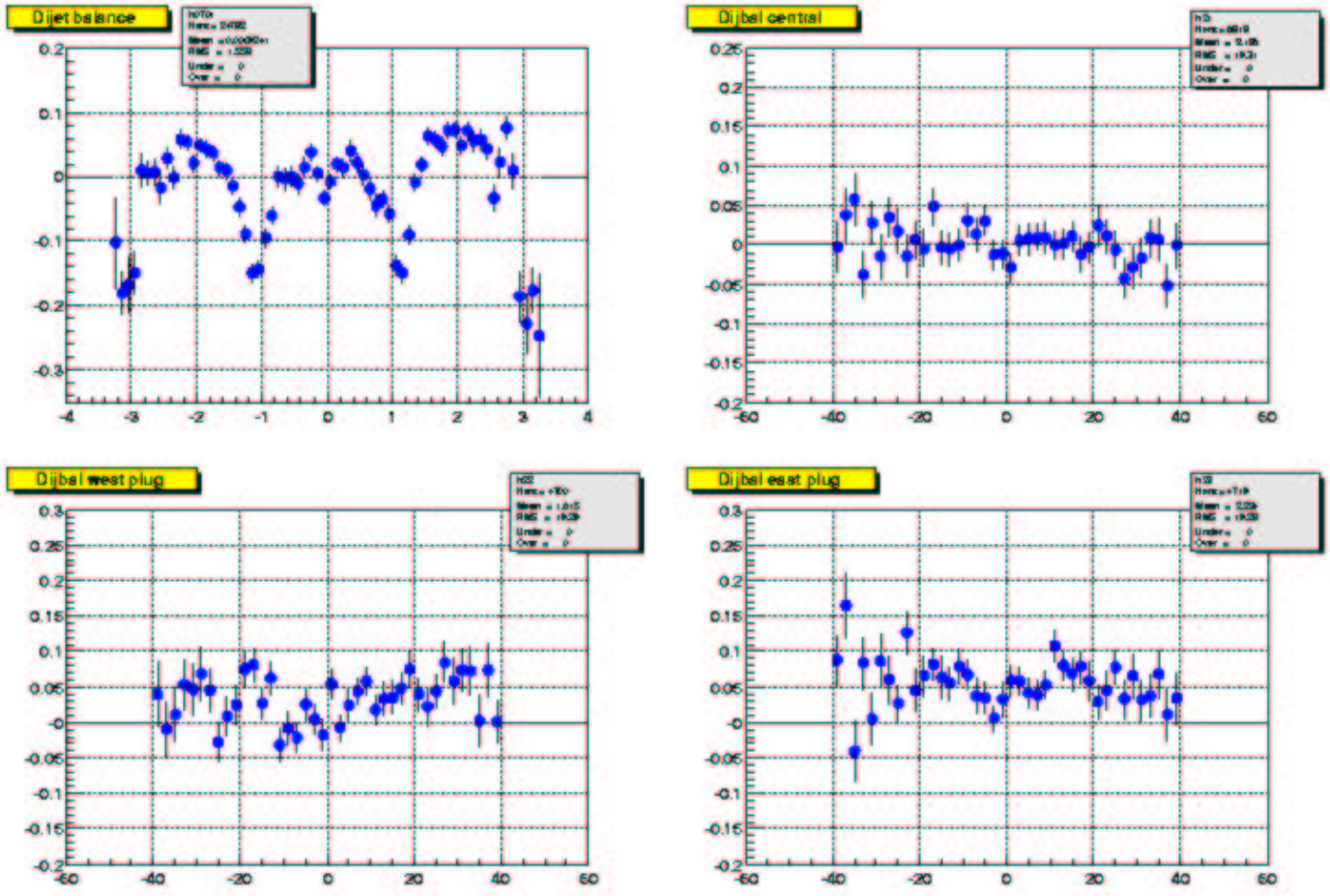
balance in plug jets wrong

vertex z (cm)

vertex z (cm)

East−West Plug Response

After the bug fix: dependence on vertex z is now correct (Currat)



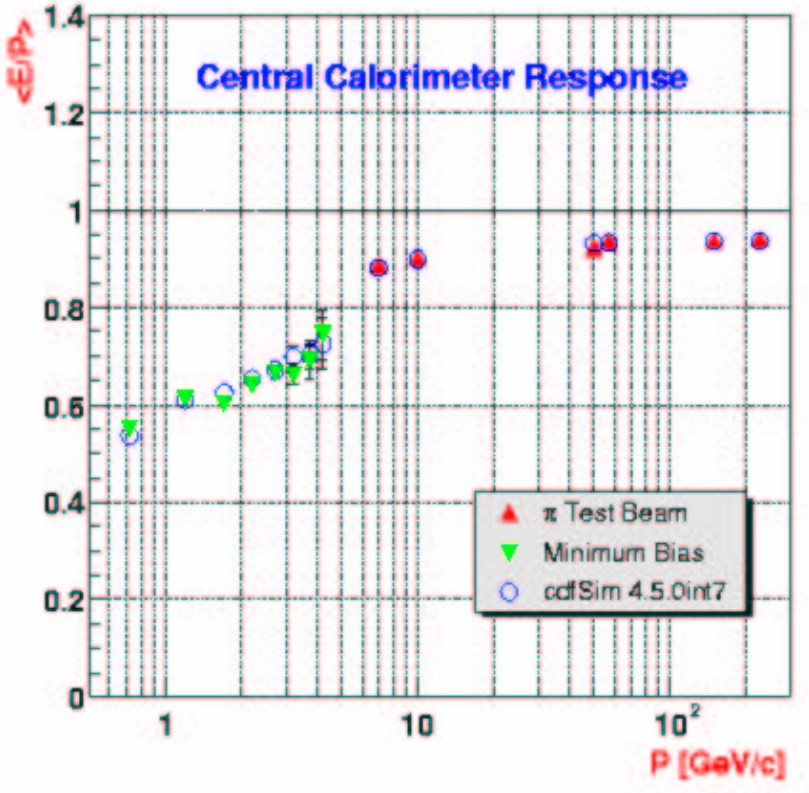
vertex z (cm)

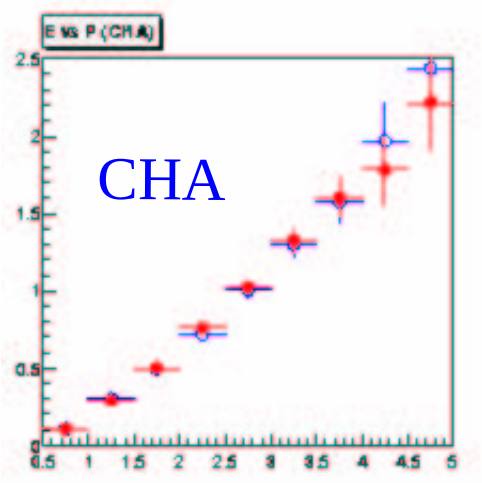
vertex z (cm)

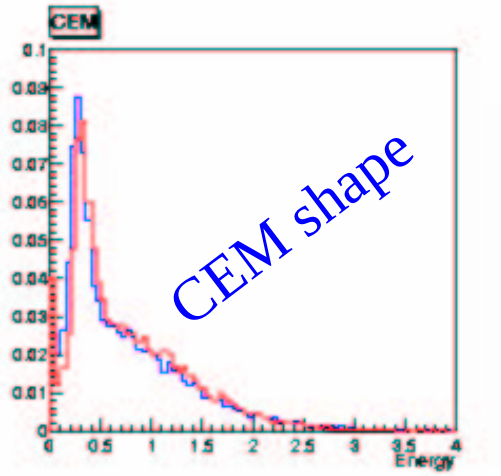
Low P_T pion response tuning in central

Soon Yung Jun

- Uses test beam data above 8 GeV (see CDF−5886)
- Uses minbias events in Run II below 5 GeV, see Demers et al. CDF−5874
- Fits CEM and CHA separately
- All distributions agree very well
- Region between 4 and 10 GeV will have data from track trigger (Mel)







- V4.5.0int7 has the new tuning.
- After the bug fix, jets should be OK in Monte Carlo

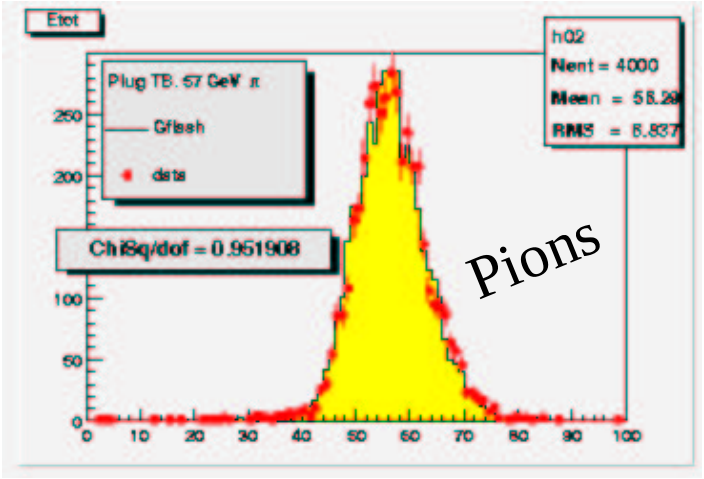
Plug Calorimeter Simulation

Charles Currat (CDF−5886), Henri Bachacou, Erik Brubaker (CDF−5834)

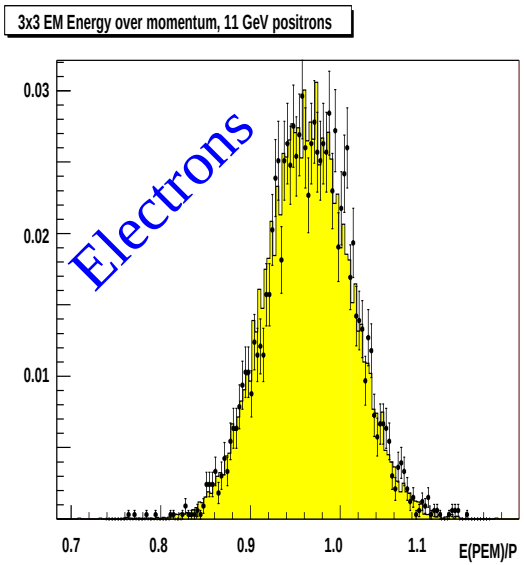
Tuning GFLASH calorimeter simulation – PEM and PHA calorimeters

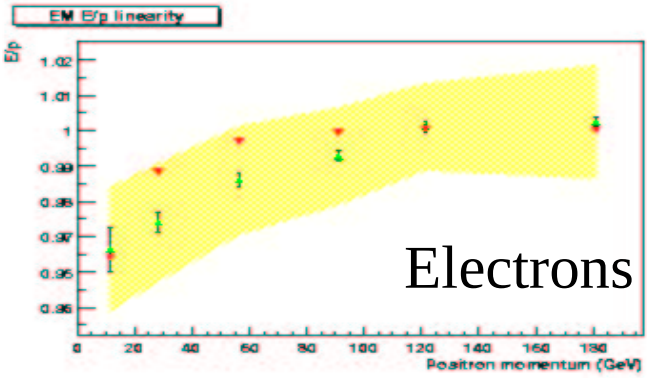
- e.g. electrons and $\pi^{\pm}$ responses : simulation−vs−test beam results

Very good agreement in 8−250 GeV range

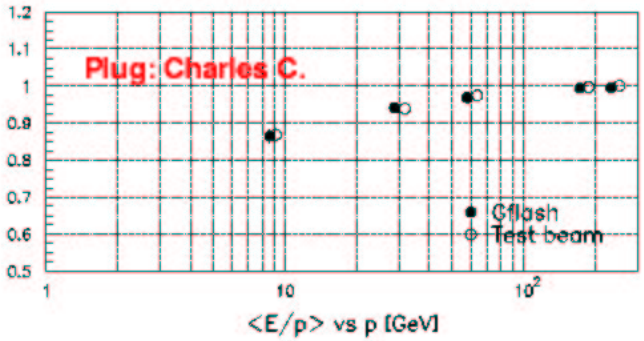


For pions the EM and the HAD distributions are tuned separately





Pions



Other Group activities

No time to discuss:

- Studies of systematics in gam−jet balance (K_T kick) (Jeremy Lys)
- First look at jets with tuned GFLASH (Jeremy Lys)
- Studies of Jet corrections for jets obtained with the K_T algorithm (Castro, Dorigo, Frigo and Padova group)
- Di−Jet studies: first look at underlying event. It agrees with run I results (Mario Martinez−Perez)

Summary

- Particle response:
  - CEM electrons E−scale OK within ~3%
  - CHA muon MIP peak is shifted by about 4%
  - PEM electrons need more work. E−scale low by 4−10%
  - WHA and PHA could benefit from muon triggers

- Gam−Jet balance
  - Central E−scale within 3% from run I
  - Could use Run I correction in central (~6% shift but need to look again)

BUG FOUND IN CAL. `PhysicsTowers`

- Relative plug−central corrections from Di−jet balance: wait for further checks of bug fix.

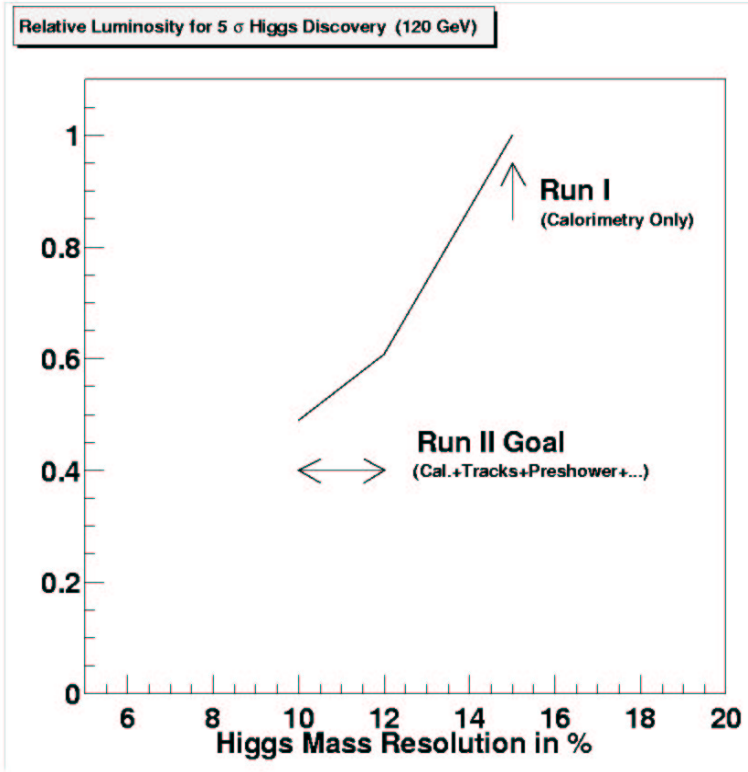
- Calorimeter simulation tuning proceeding very well.

Dijet Group: Jet Resolution studies

Steve Kuhlmann for the dijet group

Meets 9am off−week Thursdays

Goal is to use all detector information such as tracking and shower max to improve jet resolutions.



Dijet Group: Jet Resolution studies

Steve Kuhlmann for the dijet group

Work continues on several fronts:

Testing a Root module running off Run II Photon+Central Jet Data Stntuples

Once ready (summer?), could be converted to other ntuple formats easily if CalData, Tracks, CES and CPR clusters are available.

Once both Central and Plug/ISL algorithms are final (years?), an AC++ module will be available to run in Production

NEED someone to start developing algorithm for PLUG/ISL, this will be the critical path for a general purpose module...