W Production cross section with plug electrons (1.1<|η|<2.8)

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CDF note 6535

Why ?

CDF measured W production cross section using e and μ in central region

- Well known quantity
  - ⇨ Excellent to test silicon standalone tracking capability
    - → Measure efficiencies on data, check MC
- Measurement interesting *per se* (unexplored rapidity region) and
  - ⇨ Path to other interesting physics processes (associated production, decays involving Ws etc)

How

We measure the W production cross section looking for

- Electron in the forward region
  - Em clusters in *Plug*
  - MET
  - Clusters are matched to a 3D track *independently* reconstructed by the tracking system (i.e. no use of calorimetric info)
    - → Due to the η region this means using mostly silicon (SVXII, ISL) with or without COT
    - → This is very close to what is done in the central region

Data samples

We use the plug electron dataset collected in the first preshutdown period (March 2002-January 2003), equivalent to about 64 pb^{-1}

- Require MET_PEM trigger fired
  - Require working plug and silicon ("Good silicon Run"
- Reconstructed using 4.11.1

In order to measure efficiencies (trigger, ID etc)

- $Z \rightarrow ee$ (Central plug)
- JETXX (XX=20,50,70)

Ingredients

The recipe for cross section is always the same:

- $(N_{cand}-N_{back})/(\varepsilon \times L)$
  - $\varepsilon=\varepsilon_{sele} \times \varepsilon_{trigger}$

Measure efficiencies and background mostly using data

Requirements

- calorimetric
  - EM clusters in plug region ($1.1<|\eta|<2.8$) with large E_T
  - Cluster to be consistent with being an electron *and* isolated (ID)
  - Large MET
- tracking
  - Require a match with a track extrapolated to the PES
  - Require track to have $0.5<E/p<2$

Selection

Trigger
- MET_PEM fired

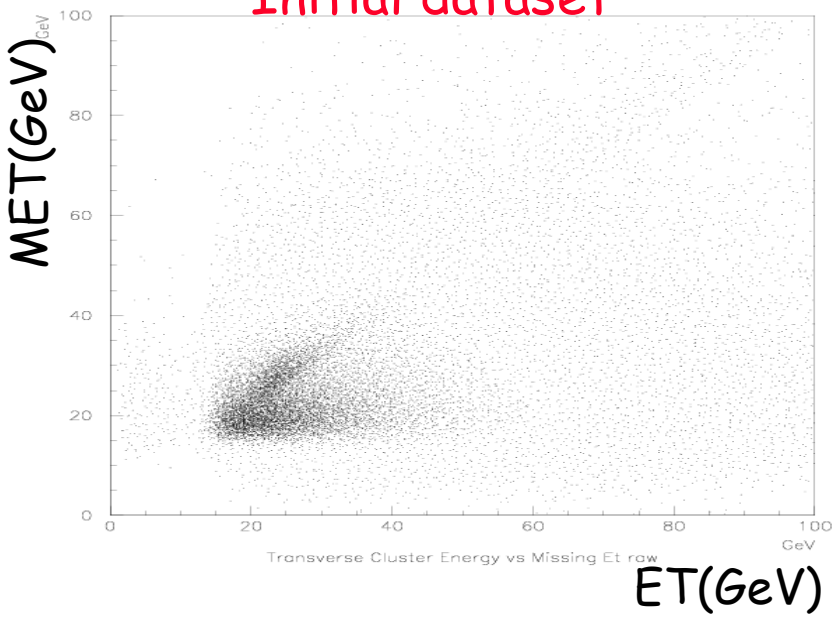
Primary vertex
- |PVZ|<60 cm

Electron
- E_T>20 GeV
- 1.1<|η|<2.8
- Electron ID
  - Had/Em <0.05
  - Relative Isolation<0.1

MET> 20 GeV

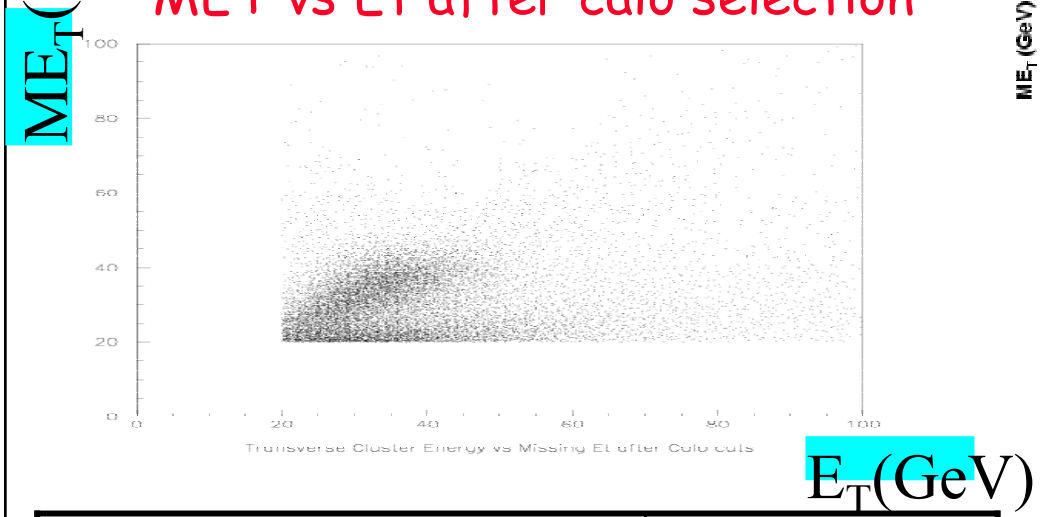
Require a track(P_T>1 GeV/c) to match:
- |ΔX|<3cm ,|ΔY|<3 cm
  - Δ indicates (PES-extrapolated track)
- 0.5< E/p < 2

Initial dataset

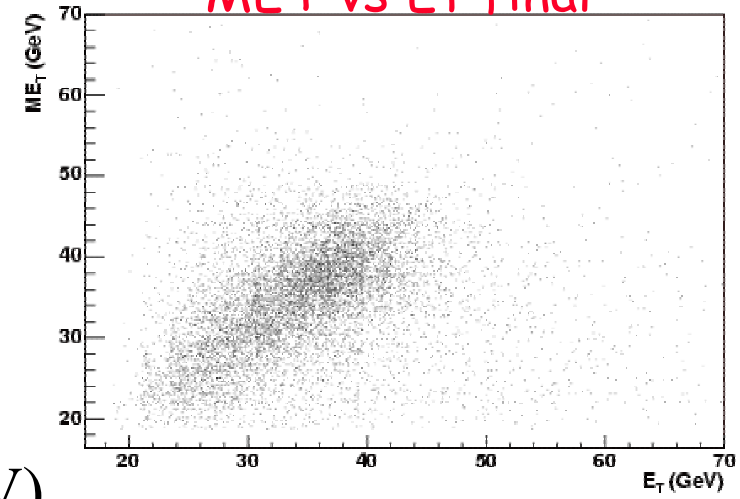


Selection Summary

MET vs Et after calo selection



MET vs Et final



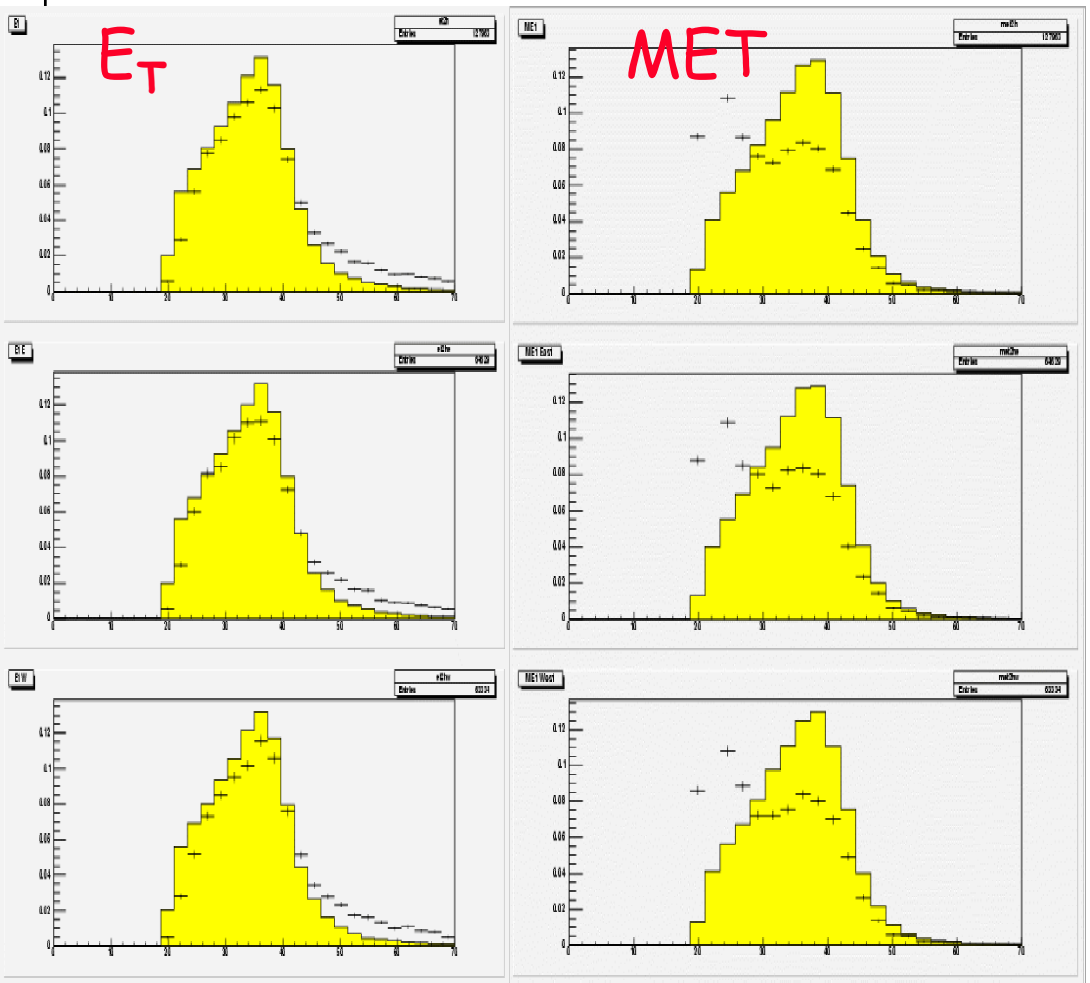
10461 events

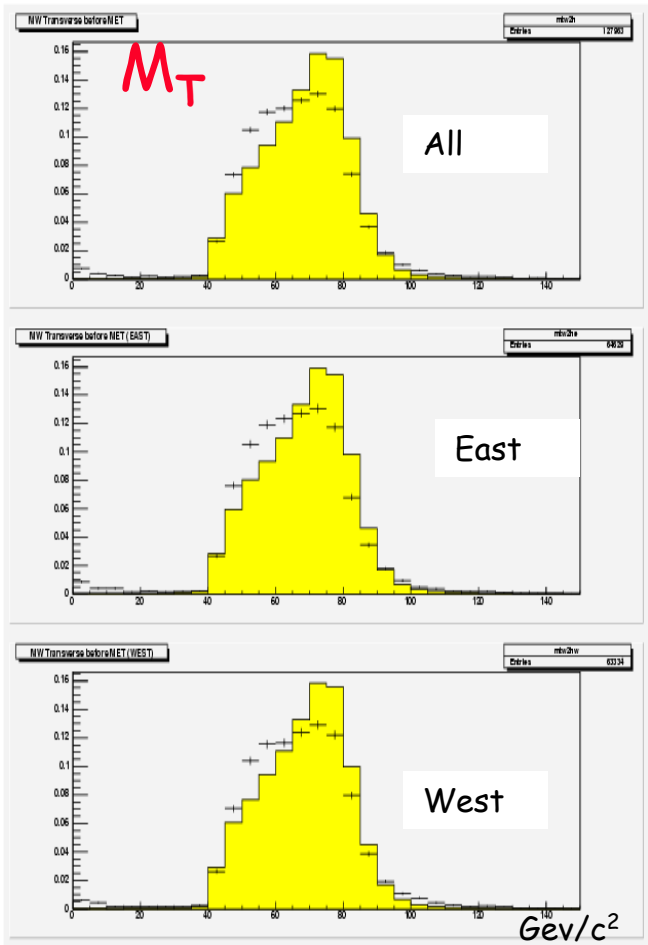
Requirement	# events
Trigger	1.1×10^6
Calo selection	90265
PES match	18181
Final sample	10461

Residual background from:

- QCD
- $Z \rightarrow ee$
- $W \rightarrow \tau\nu$

W->enu Distributions after calorimetric cuts

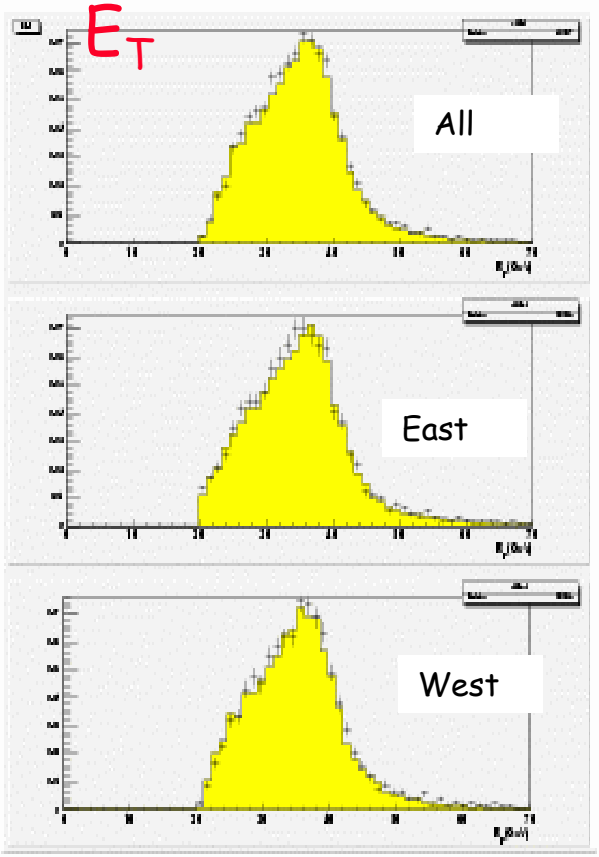


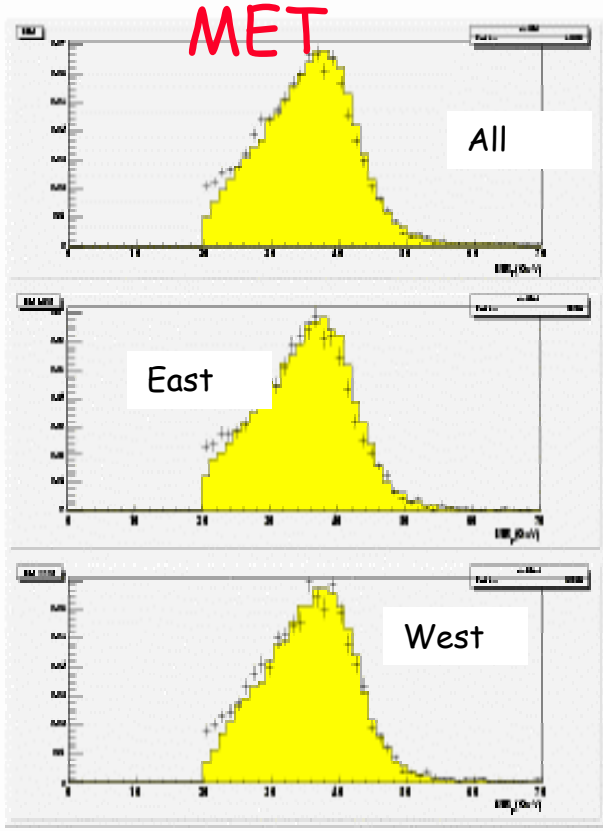


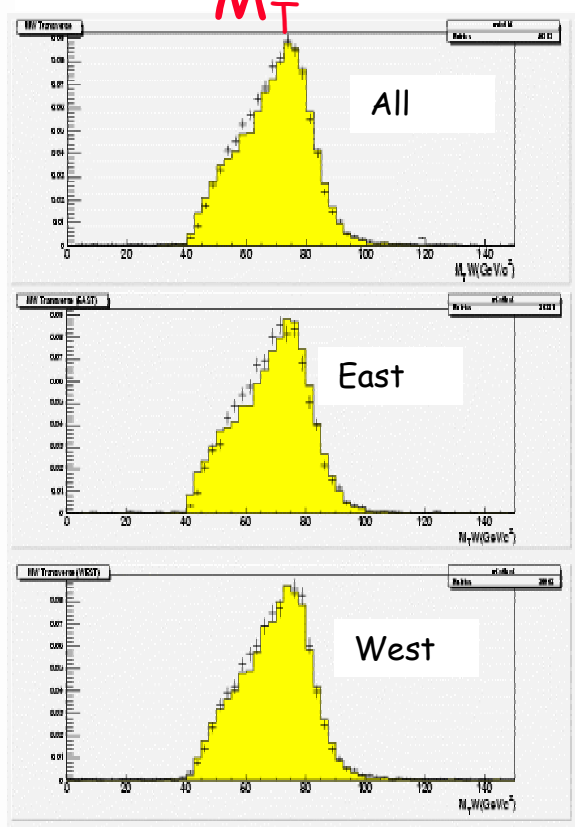
Large Background contamination. Use tracks to clean

After track selection

After track matching and E/p cut sample is clean:





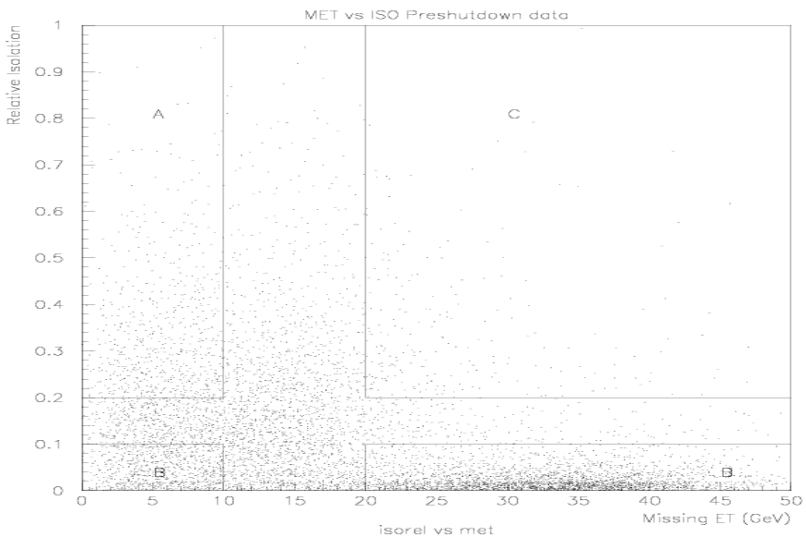


Top: All, Middle: East, Bottom: West

Background

QCD background is calculated using the MET vs ISO method.

- Corrections for $W\rightarrow\tau\nu$, $W\rightarrow e\nu$, $Z\rightarrow ee$ contributing to the different regions are applied.



$W\rightarrow\tau\nu$ and $Z\rightarrow ee$ background are estimated using MC and normalized to candidates

- Final result for the three contributions is (statistical uncertainty only):

  ⇨ $N(QCD)=495 \pm 62$

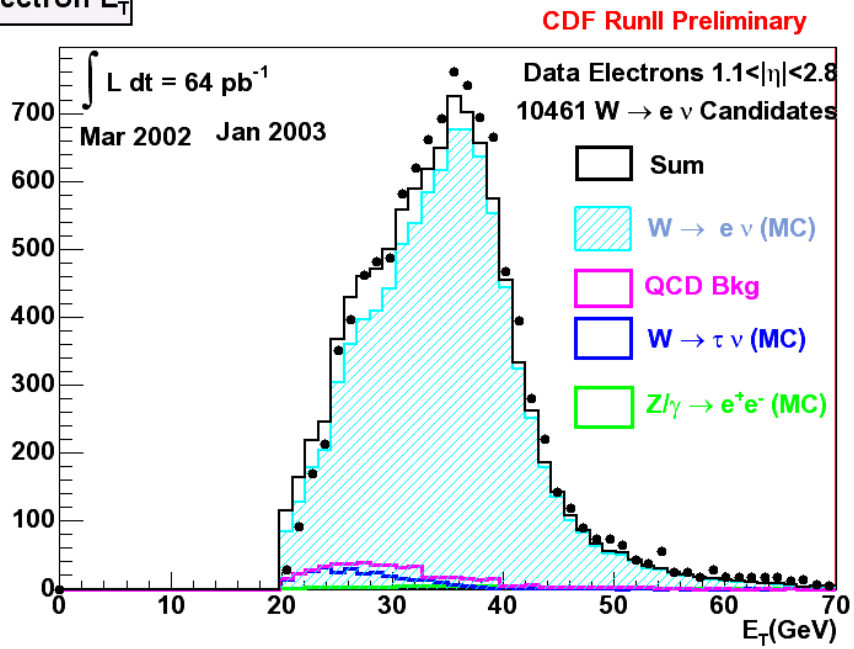
  ⇨ $N(Z)=87\pm13$

  ⇨ $N(W\rightarrow\tau\nu)=324\pm23$

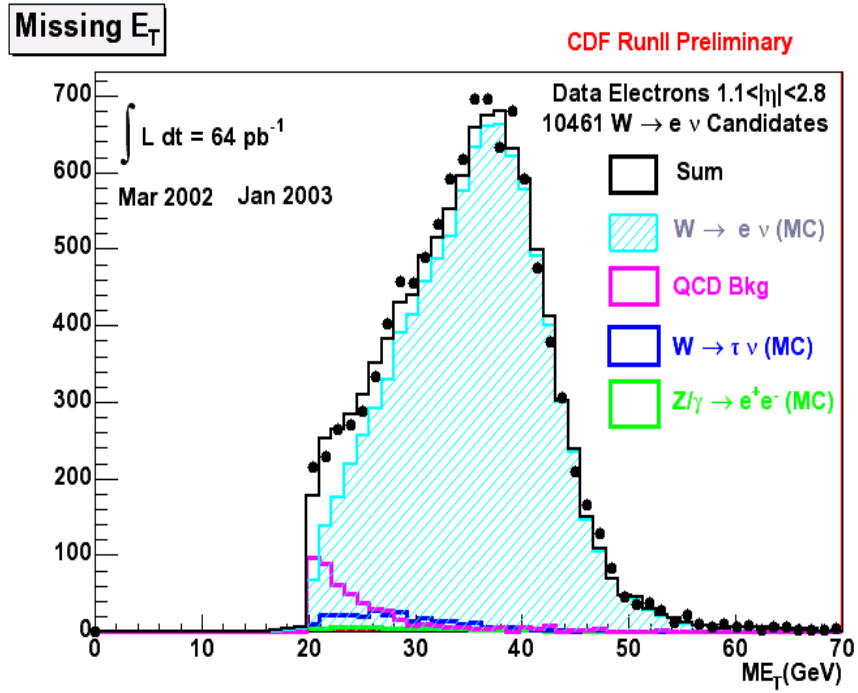
A few plots...

Kinematic Distributions

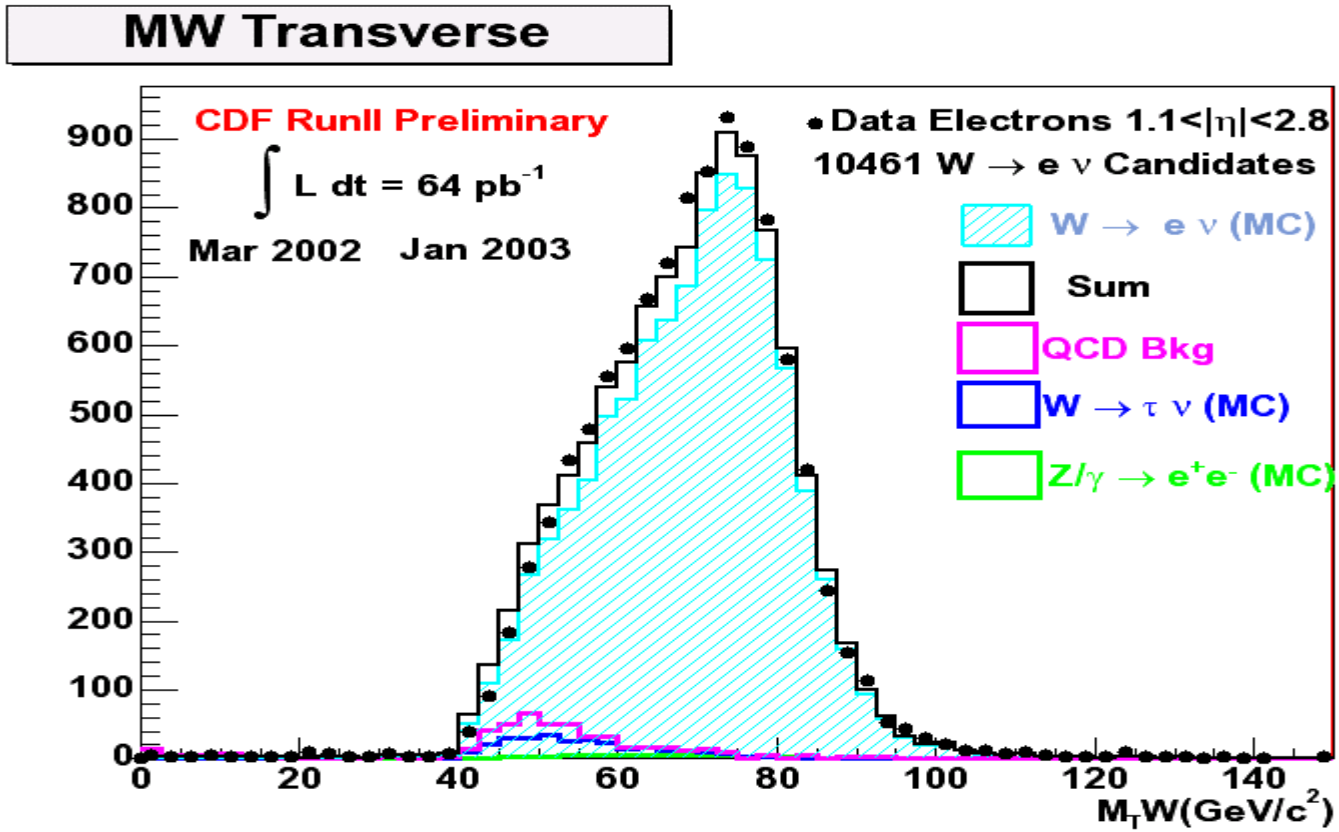
Electron E_T



Missing E_T



Transverse Mass



Acceptances and efficiencies

$\varepsilon = \varepsilon_{kin} \times \varepsilon_{id} \times \varepsilon_{pvz} \times \varepsilon_{track} \times \varepsilon_{E/p} \times \varepsilon_{trg}$

Geometrical and kinematical acceptance

⇨ ET>20 GeV, 1.1<|η|<2.8, MET>20

→ Computed using MC

Electron ID efficiency

⇨ Had/EM<0.05, Isorel<0.1

→ Measured using $Z \rightarrow ee$ (CP)

Track Matching

⇨ $\Delta X, \Delta Y < 3$ cm

→ Measured using plug leg of $Z \rightarrow ee$ (CP) events

E/p requirement

⇨ 0.5<E/p<2

→ Measured using plug leg of $Z \rightarrow ee$ (CP) events

PVZ efficiency

⇨ |Z|<60 cm

→ Measured $Z \rightarrow ee$ (CP), after removal of central leg

Trigger efficiency

⇨ MET_PEM fired

→ Measured using backup trigger

In red the ones measured using data

Kinematical Acceptance

Measured using EWK MC sample wewk09e processed using V4.9.1/4.11.1

- A = (0.3112±0.07)

Systematics:

- Et Scale
- Et Smearing
- W Pt tuning
- U Recoil
- Extra Material
- PDF

Systematics summary

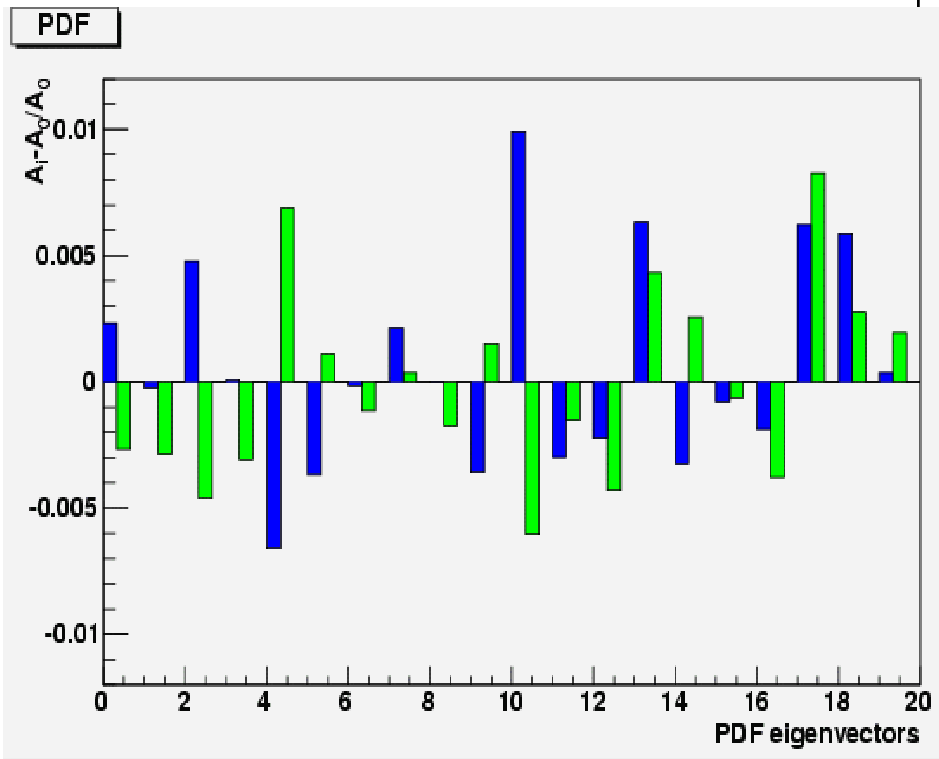
Source	Δ Acc/Acc (%)
Et scale	0.35
Et smer	0.16
Extra material	0.90
Pt tuning	0.06
U recoil	0.35
PDF	+1.71-1.37
Total	+2.00-1.72

Some systematics (material, PDF)

Extra material, use standard EWK MC dataset

- Change central (+-1.5% X_0 of Cu)
  - ⇨ Negligible
- Change by +/-1/6 X_0 Fe in plug (0.84, 0.90)%, take the biggest

1.5 M events generated for each PDF error eigenvalue, formula agreed within the Ewk..



Z→ee, CP data sample

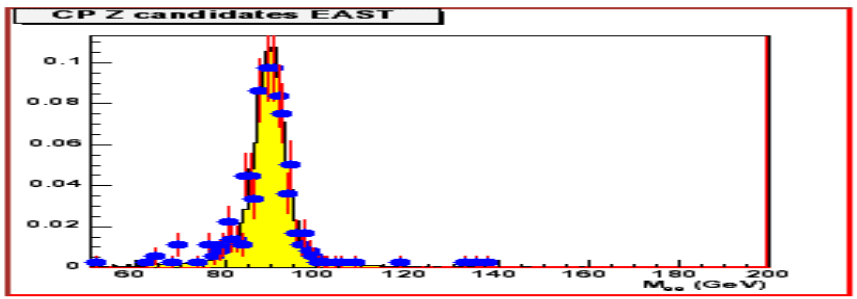
Central leg (tight)

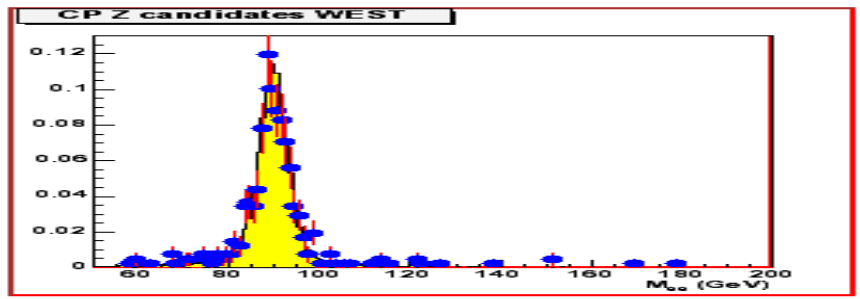
Plug leg:

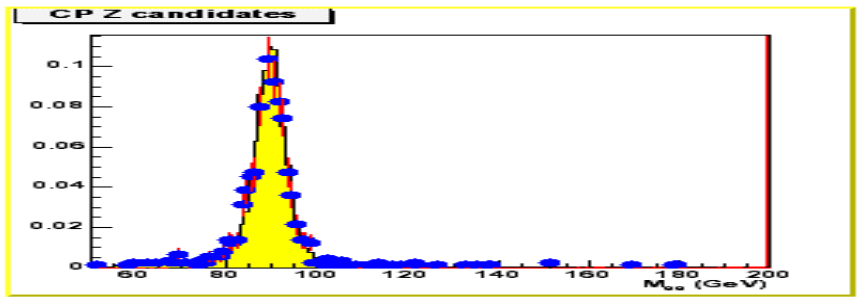
- |PVZ|<60
- ET>20, 1.1<|η|<2.8
- Had/Em<0.125
- 80<Mee<100

Used to measure

- ε ID efficiency
  - ⇨0.961±0.0037±0.022
- track matching efficiency
  - ⇨ΔX, ΔY
- E/p





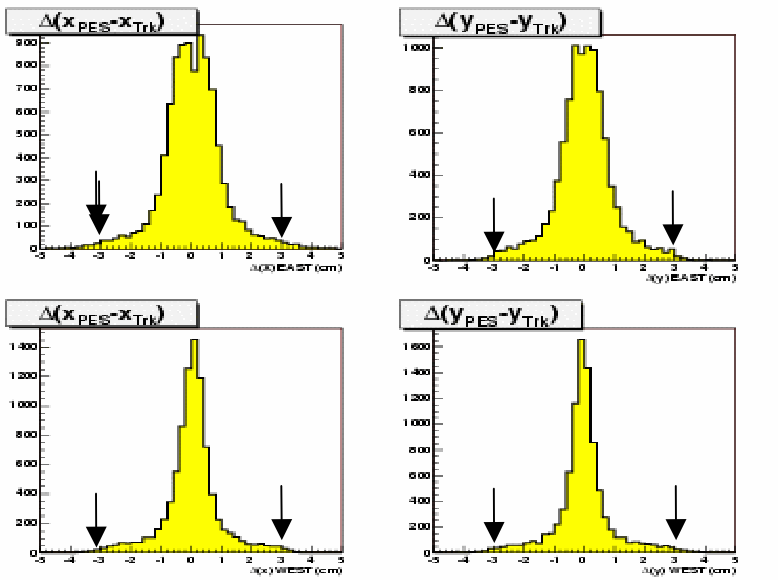


Track matching

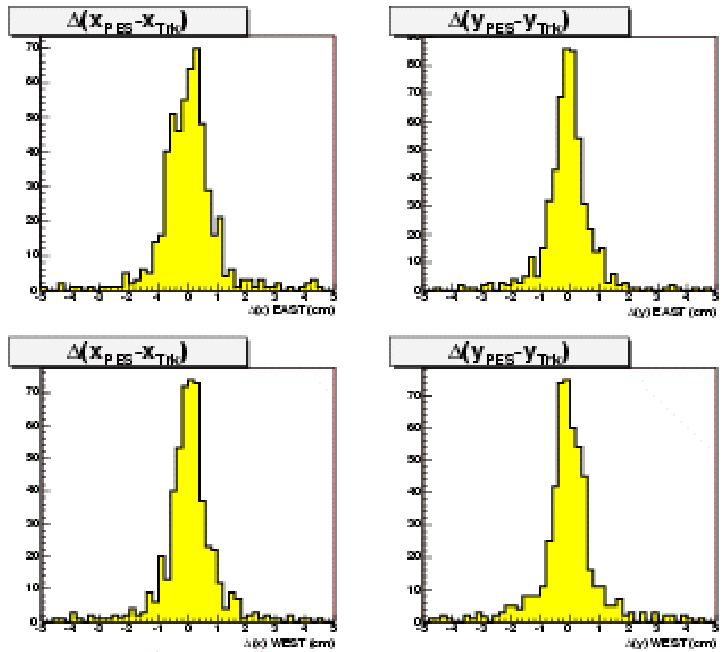
3D track found by tracking algorithm is extrapolated to PES location:

Correction for PES misalignment is applied, however (small) residual misalignment… checked that no effect on candidates

PES Matching



W candidates



Plug leg of Z CP

Tracking efficiency

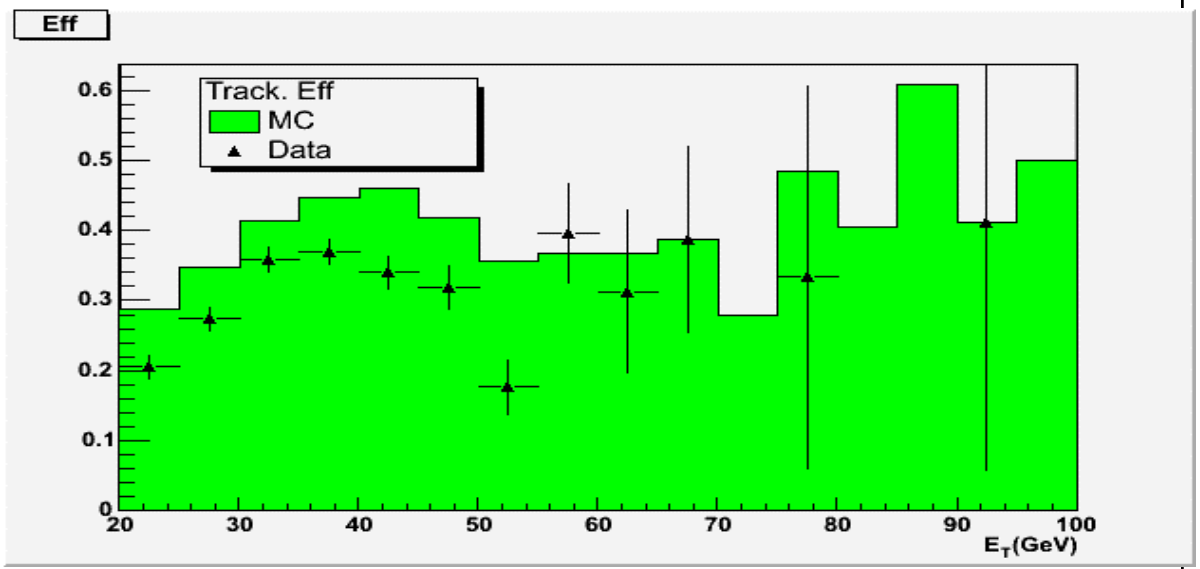
We do not want to rely on MC for $\varepsilon_{tracking}$

- Use $Z \rightarrow ee$ sample, measure how many plug e are matched ($\Delta X, \Delta Y < 3$ cm) by a track and define
- $\varepsilon_{tracking}(W_{data}) = \varepsilon_{tracking}(Z_{data}) \times \{\varepsilon_{tracking}(W_{MC}) / \varepsilon_{tracking}(Z_{MC})\}$

$Z \rightarrow ee$ (CP):

Data:

$\varepsilon_{tracking}(Z_{data}) = 0.32$

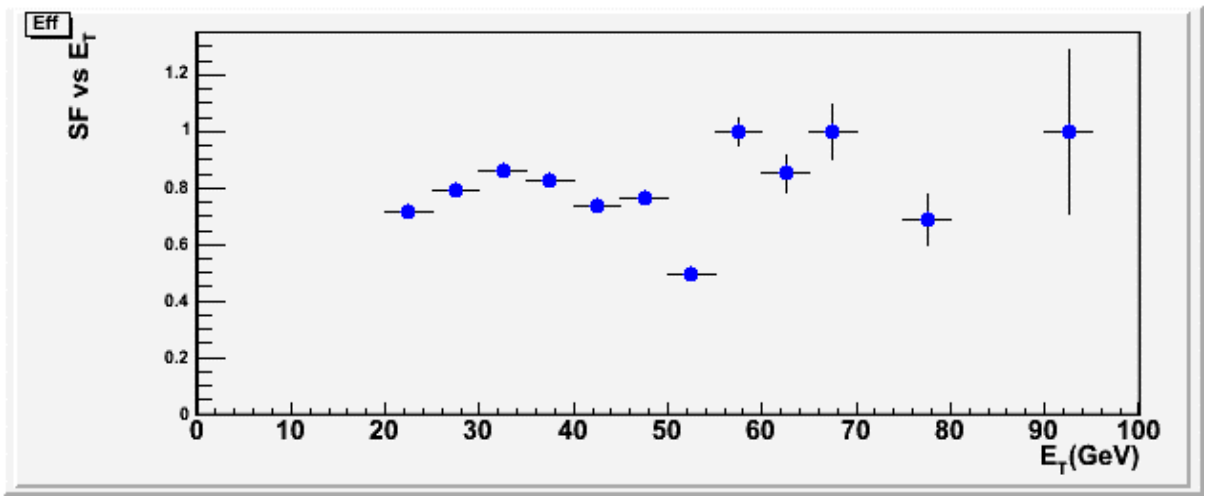


$$\varepsilon_{tracking}(W_{data}) = 0.322 \pm 0.009(stat)$$

Scale Factor (SF)

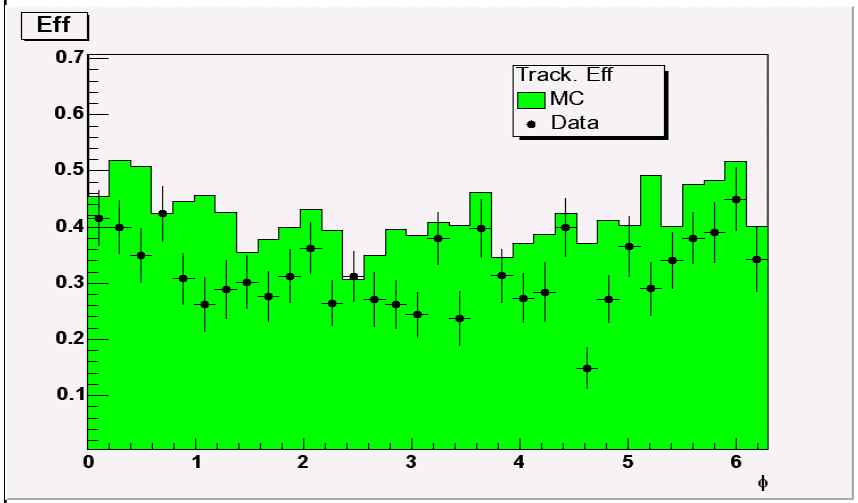
We might also define $\varepsilon_{tracking}$ as:

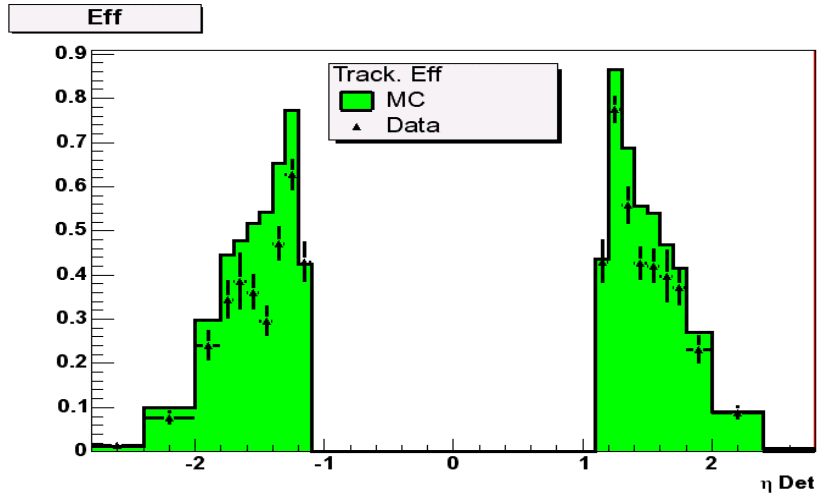
- $\varepsilon_{tracking} = \varepsilon_{tracking}(W_{MC}) \times$ SF where SF:
  - SF = $\varepsilon_{tracking}(Z_{data}) \times \varepsilon_{tracking}(Z_{MC})$
  - Sys obtained by assuming SF flat or taken as a function of η, φ and E_T. Biggest effect due to E_T, taken as syst.



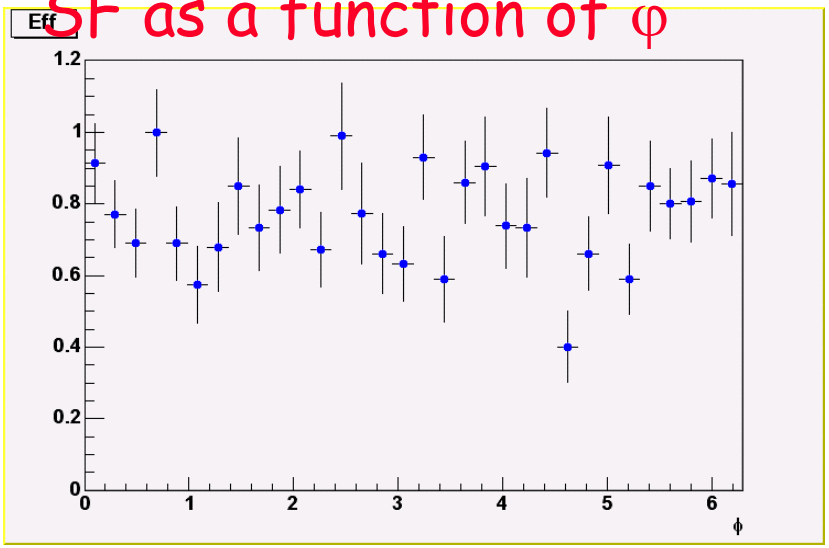
$\varepsilon_{tracking} = 0.322 \pm 0.009(stat) \pm 0.006(syst)$

SF and Tracking

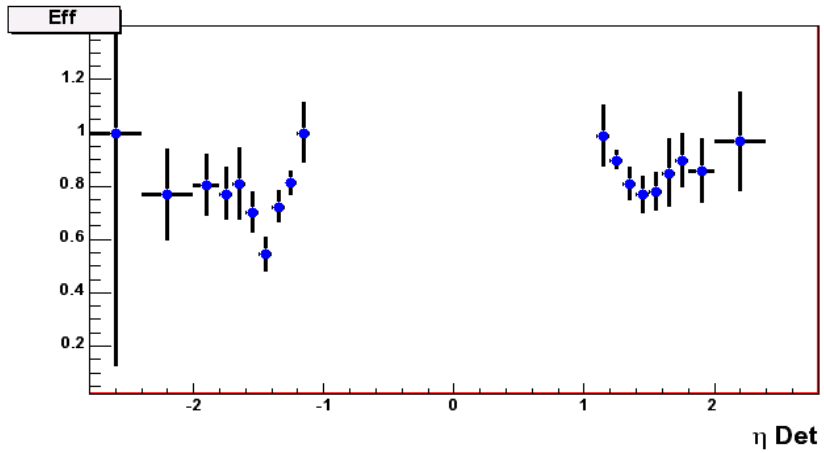




SF as a function of φ

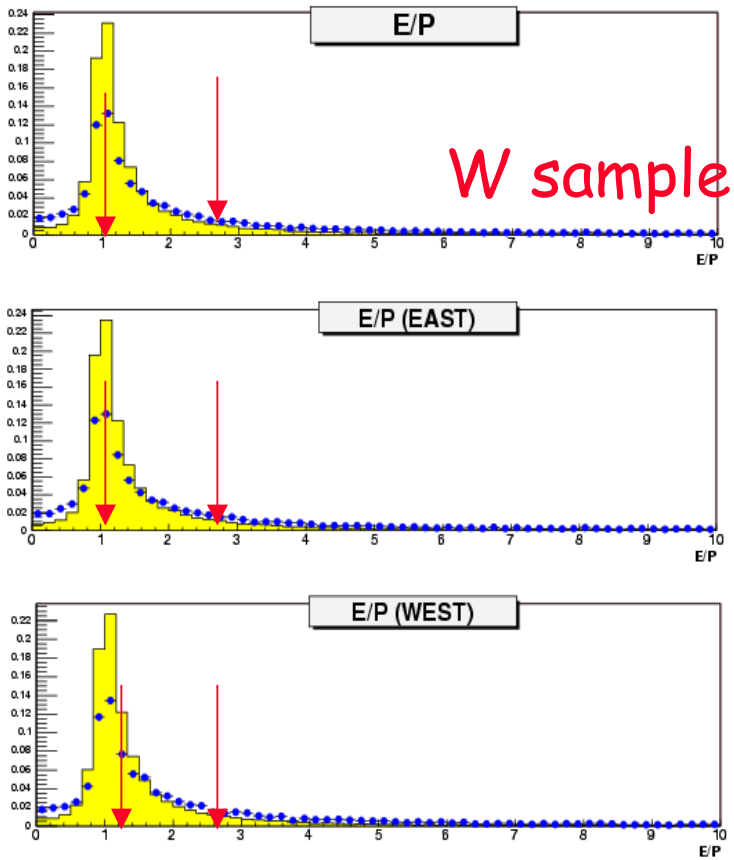


SF as a function of η

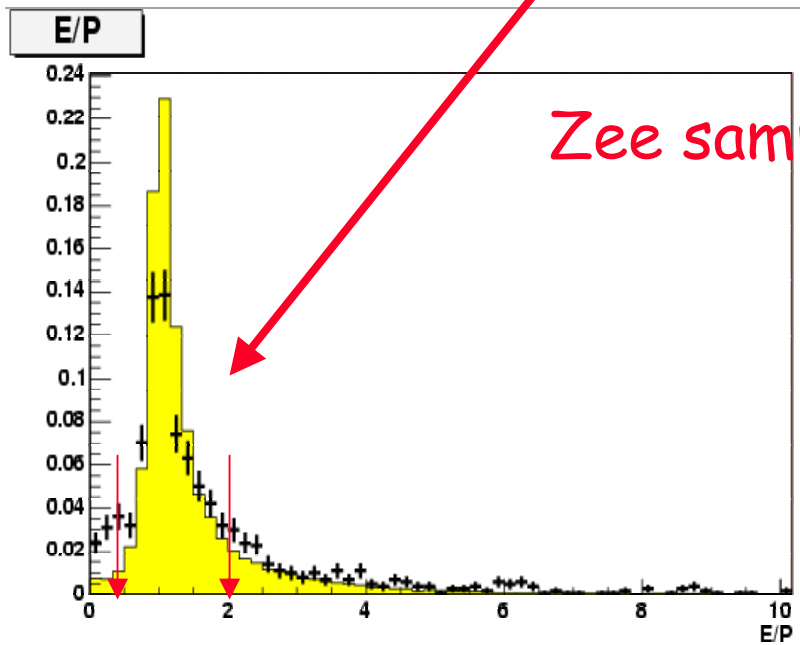


E/p requirement

We apply a cut to E/p : 0.5<E/p<2



As MC does not model the distribution well, we measure the efficiency on Z→ee sample



$\varepsilon = 0.639 \pm 0.015(stat) \pm 0.01(syst)$

PVZ efficiency

Primary vertex finding efficiency is measured using $Z \rightarrow ee$ (CP) events.

- Events are selected and then the central leg is stripped away
  - ⇨ Sample is reprocessed (now it looks W-plug-like…)
  - ⇨ Efficiency is defined as:

$$\frac{\text{(\# events w/o central leg with } |PVZ| < 60 \text{ cm)}}{\text{(\# events w central leg and central trk } |Z_0| < 60)}$$

$\varepsilon = 0.9207 \pm 0.0051 \pm 0.0035$

Trigger efficiencies

Trigger MET_PEM:

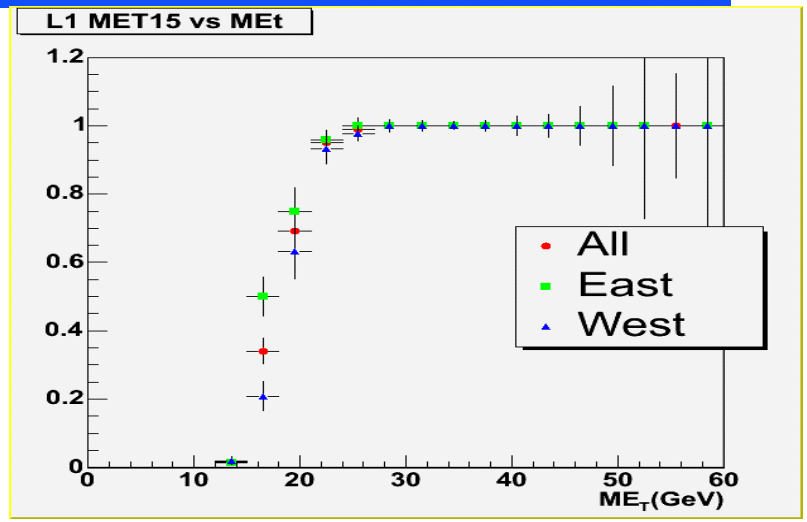
- L1_EM8_MET15
  - ⇨L2_PEM20_MET15
    - →L3_PEM20_MET15

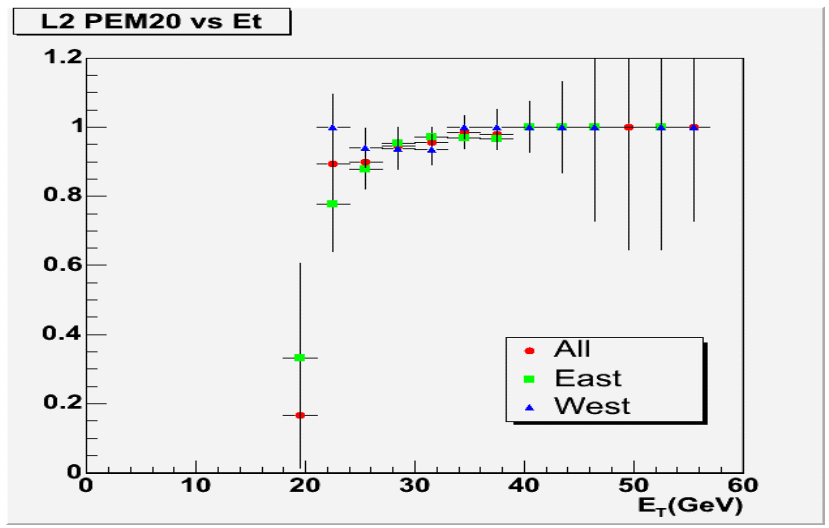
Using backup triggers we find an overall:

$\varepsilon_{trig}=0.958\pm0.012$

We checked with JET20, JET50, JET70 (agreement)

- Side effect: we measured the trigger ε also in the other data taking periods..





Cross Section

N.candidate events	10461	
N.background QCD events	495 ± 62 (stat)	± 247 (sys)
N.background Z events	87 ± 13 (stat)	
N.background $W \to \tau\nu$ events	324 ± 23 (stat)	
Lumin.(pb^{-1})	64	± 4.3 (sys)
ϵ	0.052 ± 0.002 (stat)	± 0.002 (sys)

	Value		Syst.error
ϵ_{Kin}	0.3112 ± 0.0007		0.0058
$\epsilon_{Pvz,Kin}$			0.0035
ϵ_{PVZ}	0.92 ± 0.005		
ϵ_{ID}	0.961 ± 0.004		0.022
ϵ_{trig}	0.958 ± 0.011		
$\epsilon_{E/p}$	0.64 ± 0.015		0.001
ϵ		0.170 ± 0.005	0.005
$\epsilon_{tracking}$		0.322 ± 0.009	0.006
ϵ_{Lum}		0.951 ± 0.001	0.005
Overall ϵ		0.052 ± 0.002	0.002

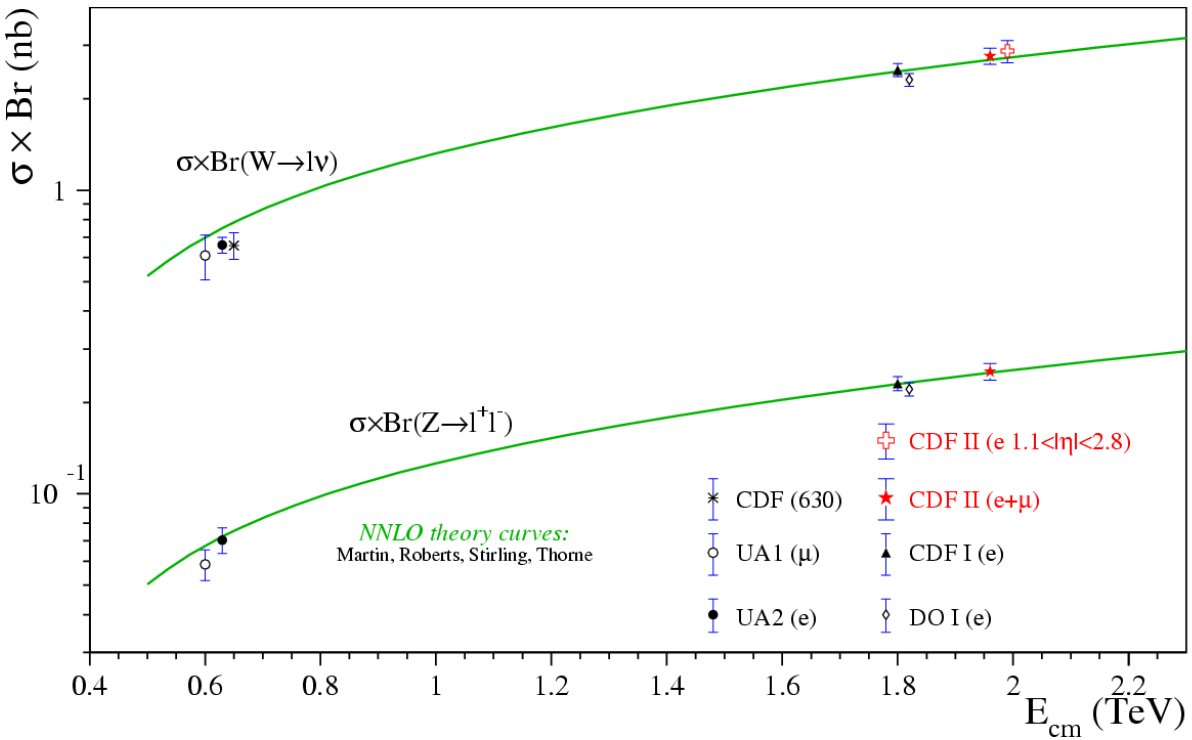
σ =2.874±0.034(stat)±0.167(syst)±0.172(lum) nb

Conclusion

Added one point to a 20 years old history…more to come

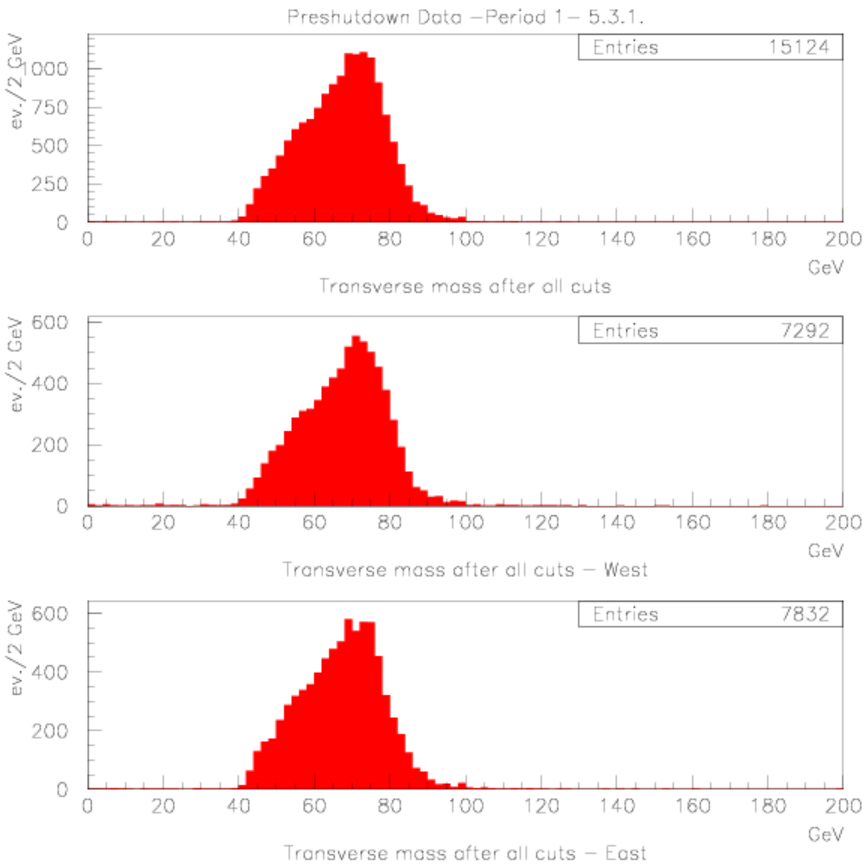
Work in progress:

- 5.3.1: increase tracking efficiency, increase in candidates…

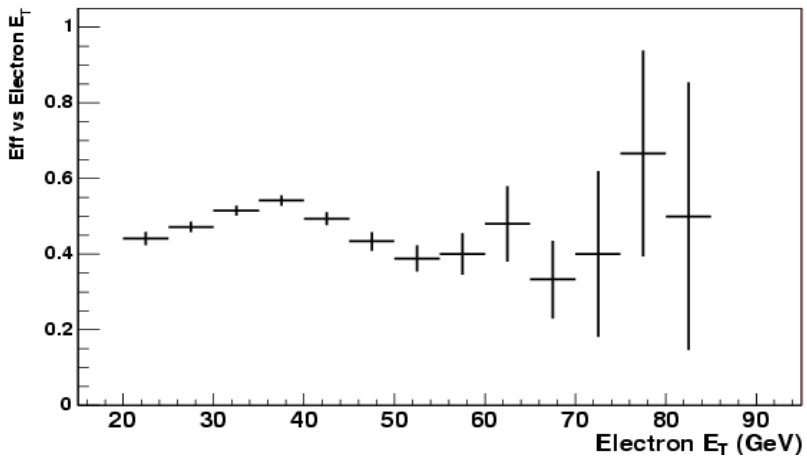


5.3.1…Very preliminary

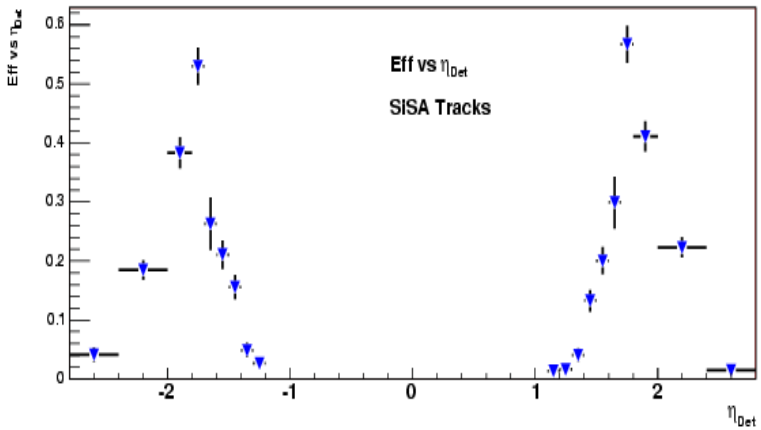
Candidates… (plug e)

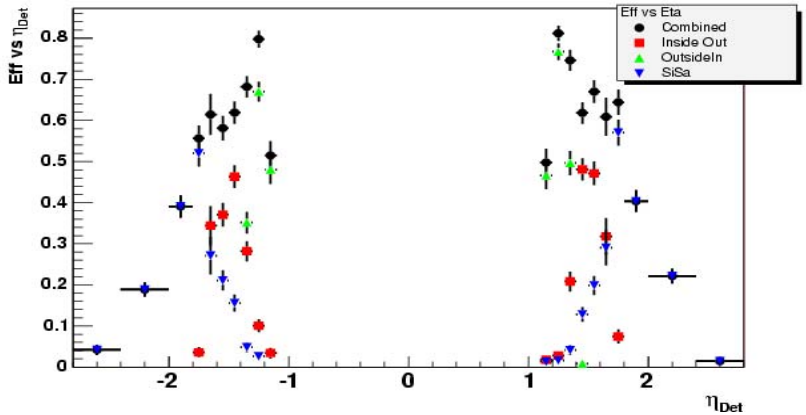


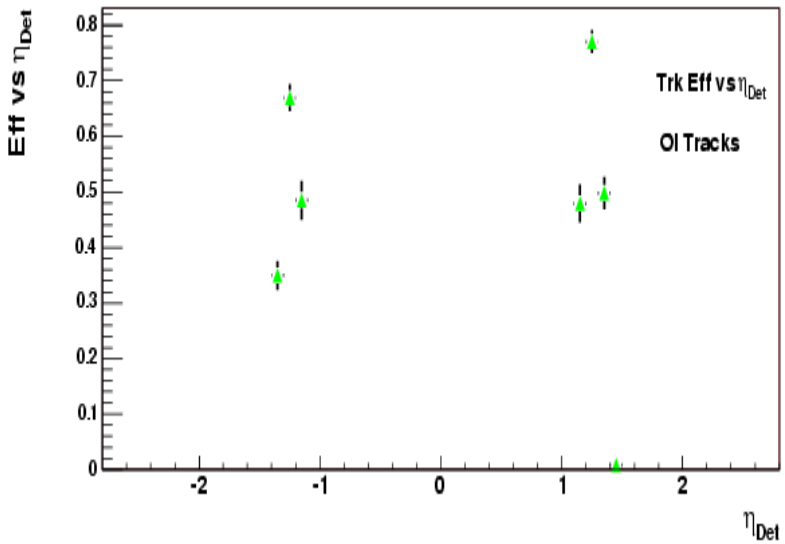
Tracking efficiency in $Z \rightarrow ee$ (CP): 0.48±0.01

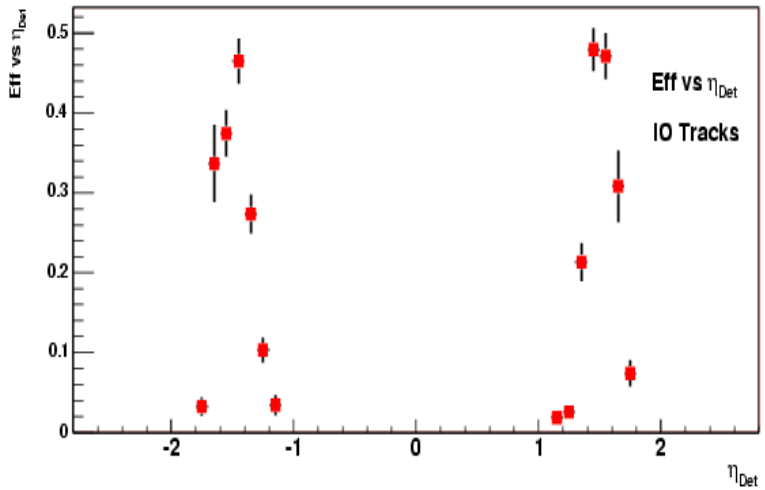


η dependence of tracking eff.

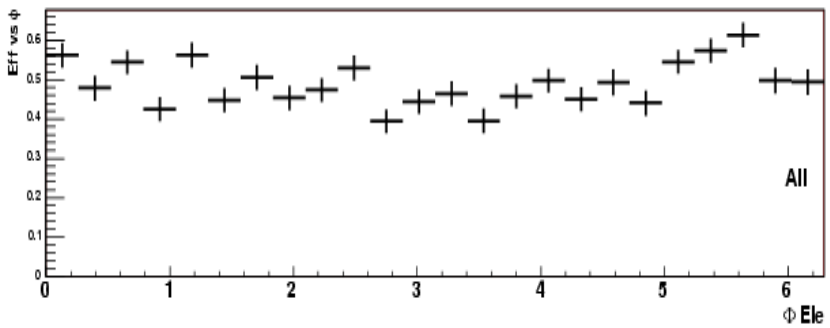


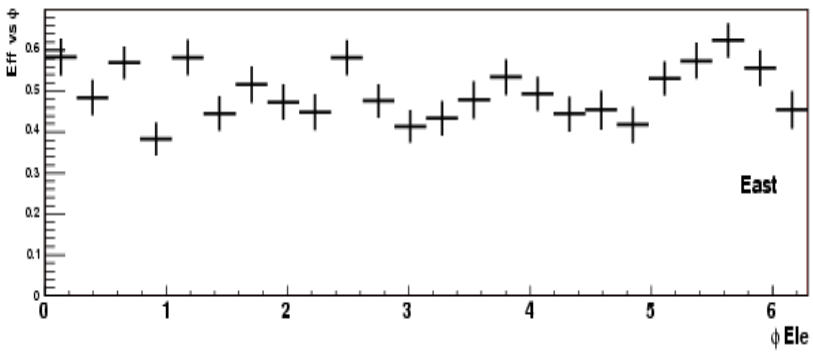


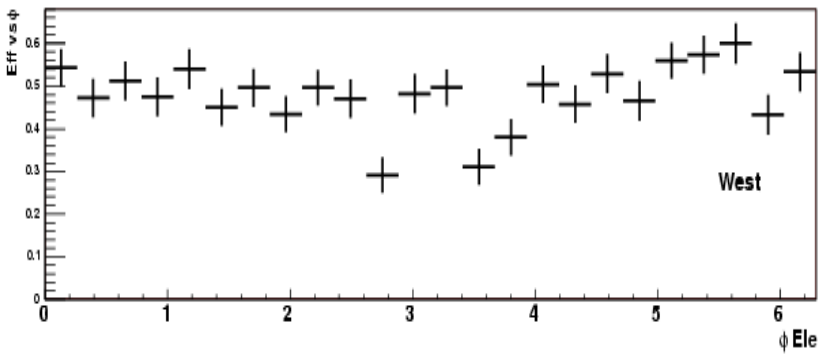


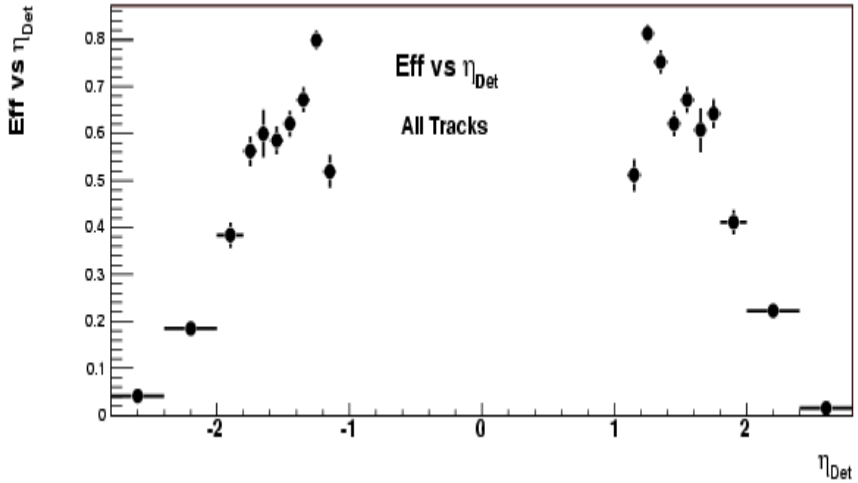


φ and η dependence





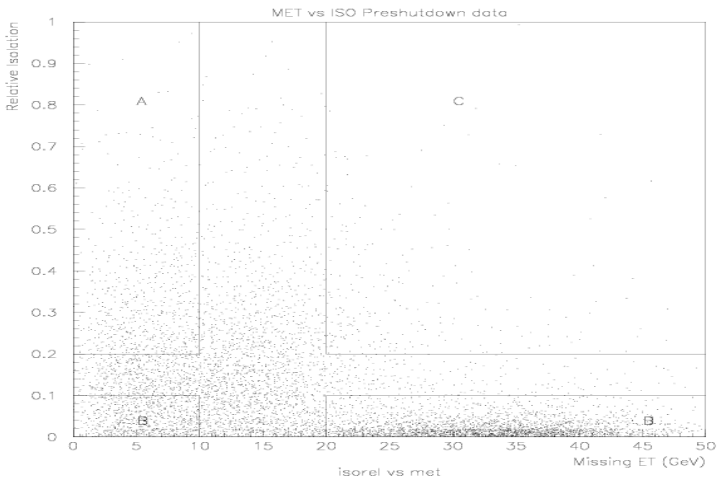




BACKUP

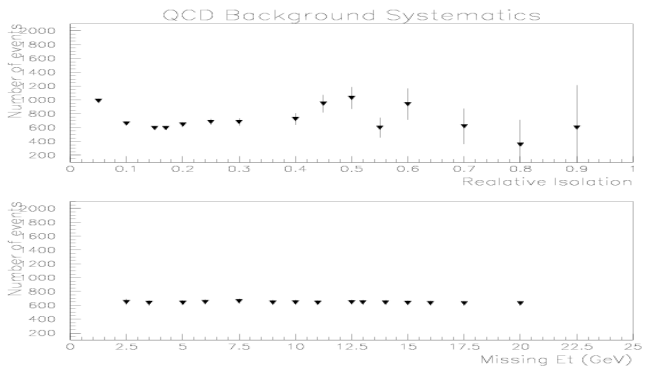
Background

QCD background is calculated using the MET vs ISO method:

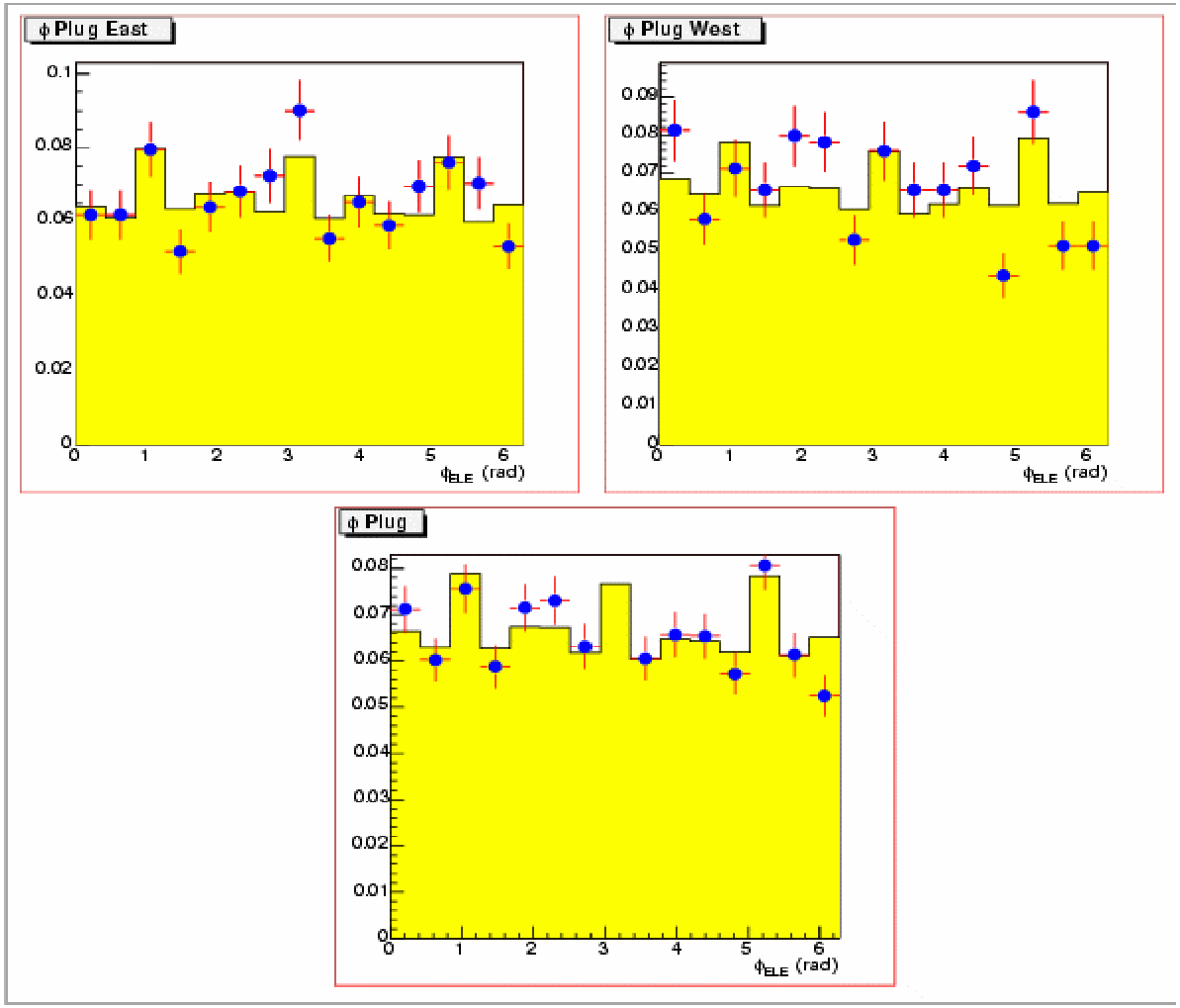


Corrections for $W \to \tau\nu$, $W \to e\nu$, $Z \to ee$ to the different regions are applied.

- Final background :
  - ⇨ N(QCD)=495 ± 62
  - ⇨ N(Z)=87±13
  - ⇨ N(W→τν)=324±23



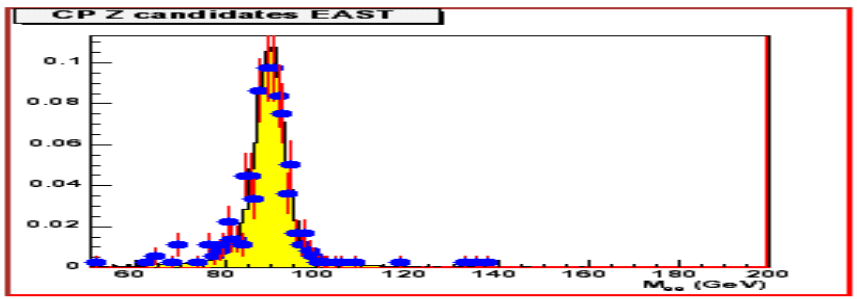
Z->ee CP sample

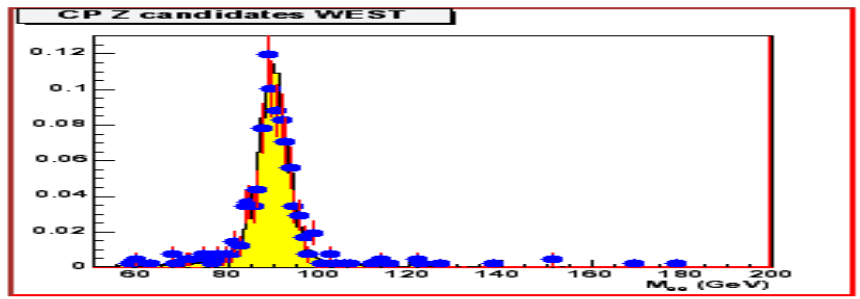


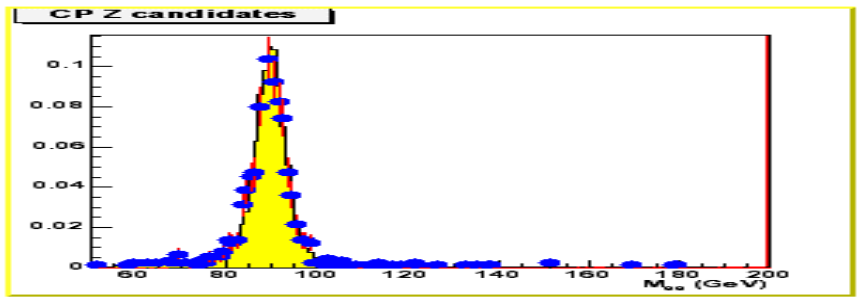
Z→ee (CP) sample

A sample of Zee is selected

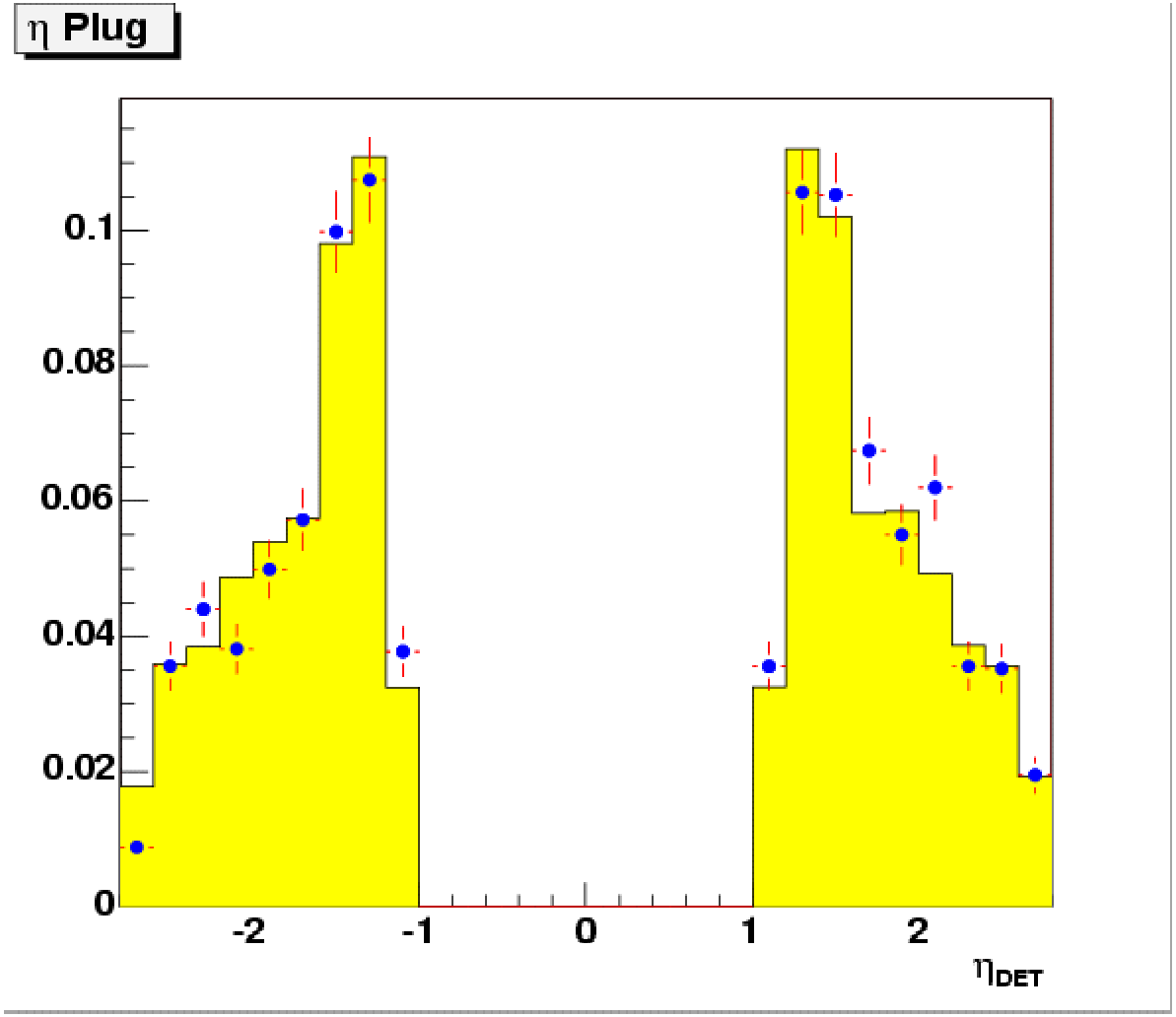
- Central leg (tight)
- Plug leg
  - |PVZ|<60
  - ET>20, 1.1<|h|<2.8
  - Had/Em<0.125
  - 80<Mee<100



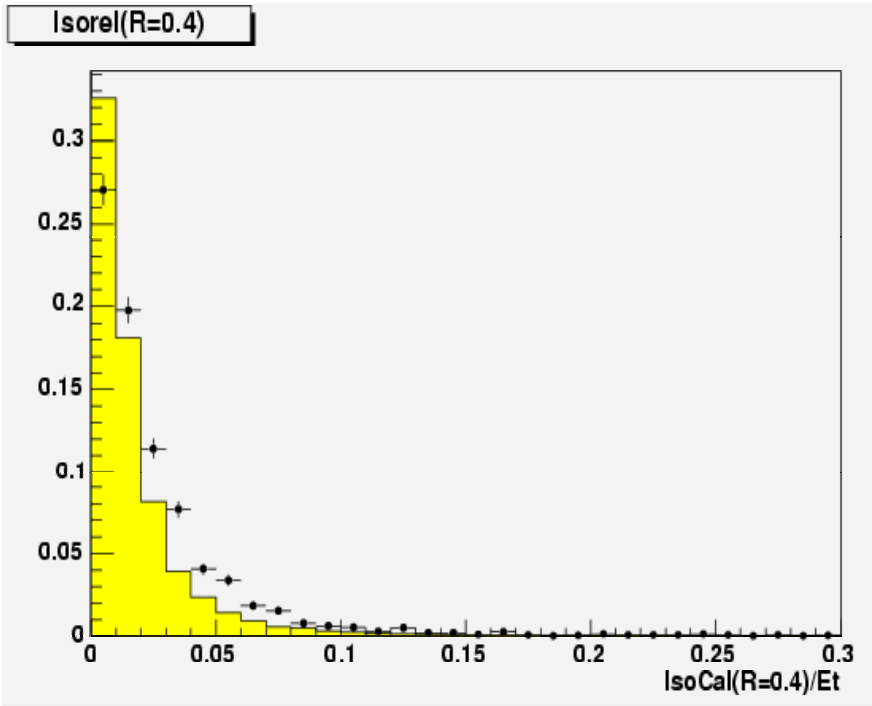


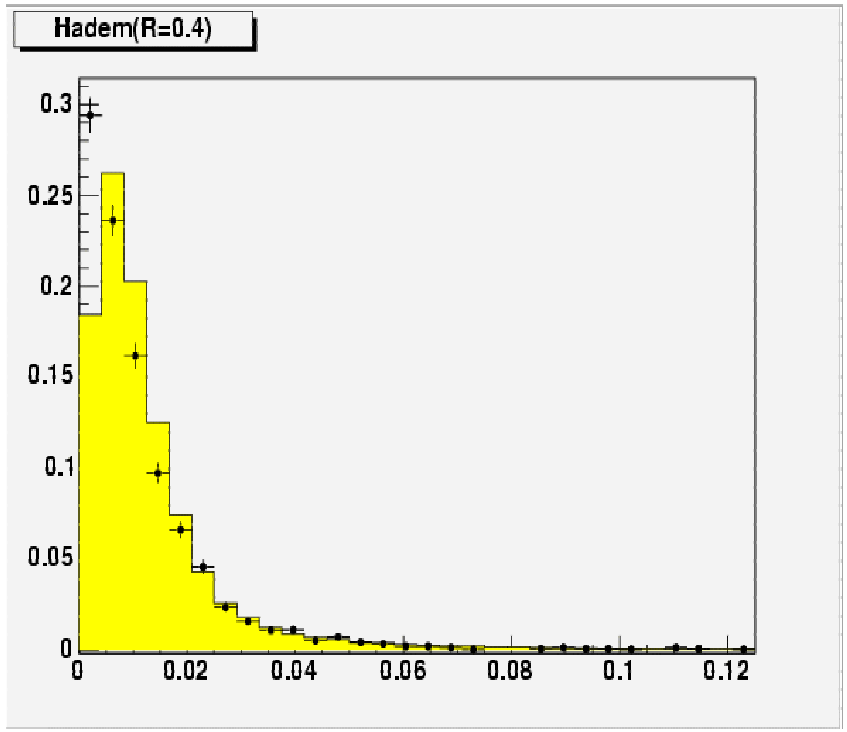


Z->ee CP sample



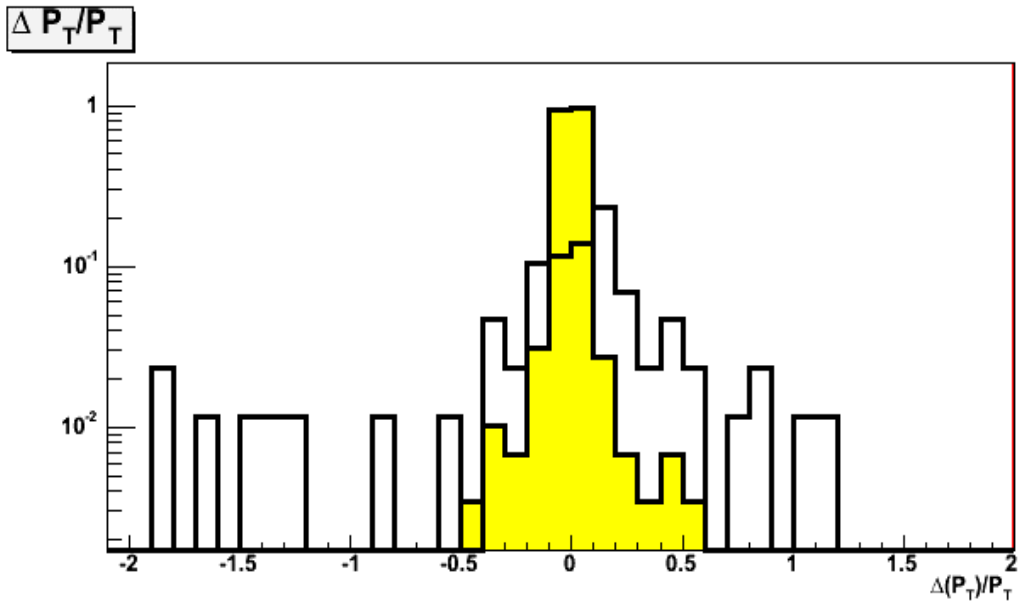
ID cuts


Isorel(R=0.4)
0.3
0.25
0.2
0.15
0.1
0.05
0
0
0.05
0.1
0.15
0.2
0.25
0.3
IsoCal(R=0.4)/Et


Hadem(R=0.4)
0.3
0.25
0.2
0.15
0.1
0.05
0
0
0.02
0.04
0.06
0.08
0.1
0.12

E/p selection

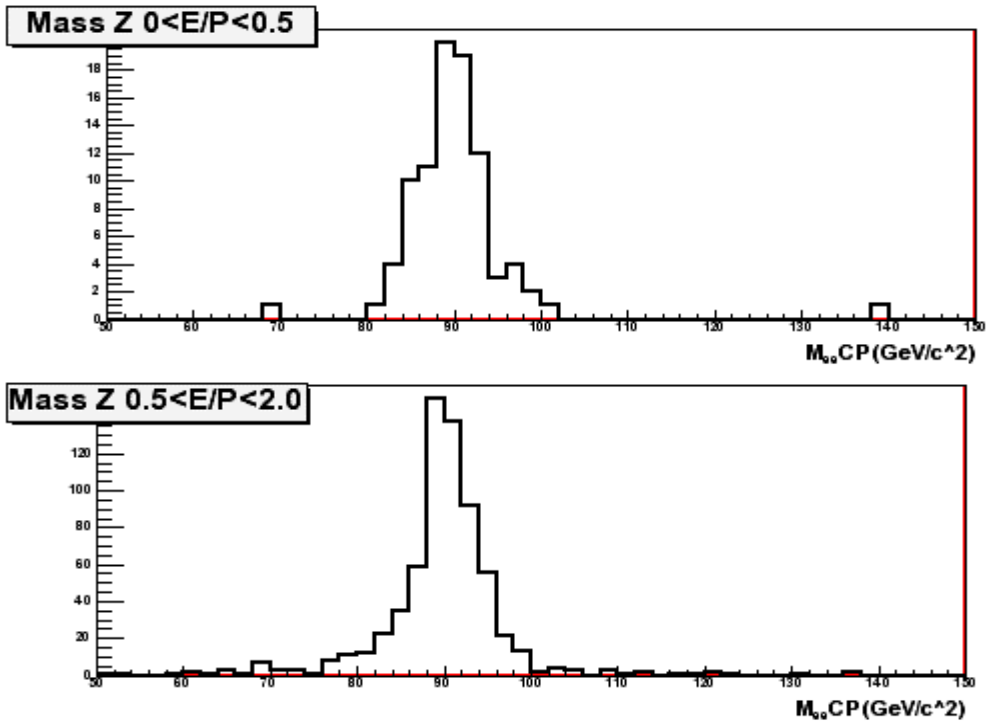
Delta P_T/P_T: Relative error on P_T larger for tracks in $0<E/P<0.5$ region (white histo) than for those in $0.5<E/P<2$ (yellow histo). W->enu sample



Tracks in the $0<E/p<0.5$ region have very high P_T. This is caused in part by high P_T tracks uncertainty We will exclude those tracks

E/p Study- Z->eeCP

Invariant mass Mee divided in E/P regions:
0<E/p<0.5
0.5<E/p<2



E/p selection

Background contamination is calculated with Fake Rate method (G. Veramendi and A. Robson A_{FB} and Z→ee CP Xsec)

$$\text{Eff E/P} = \frac{\text{Num evts with } 0.5<E/P<2.0\text{-Bkg (Z->ee CP sample)}}{\text{Num events with trk match-Bkg (Z->ee CP sample)}}$$

After Trk Match	All	East	Bkg East	West	Bkg West
	932	510	1.2 +/-1	423	1.0 +/-1
After 0.5<E/P<2.0	596	325	~0 +/-1	271	~0 +/-1

Et scale and smearing

ΔAcceptance = (Default - ($\pm 3\sigma$))

δ =(ΔAcceptance /Acceptance) (%)

Scaling 2.5%

Smearing 2.7%

Description	-3	A	A/A (%)	+3	ΔA	A/A (%)
Et Scaling	1.90%	0.0011	0.35	3.10%	0.0010	0.32
Et Smearing	1.60%	0.0005	0.16	3.80%	0.0005	0.16

Total scaling	0.35
Total smearing	0.16

$MAX(\delta_{+3\sigma}, \delta_{-3\sigma})$

Pt tuning in Pythia

As in W→enu central:

- $d\sigma/dp_T$ of ee pairs in $66<M_{ee}<116$ tuned by four Pythia parameters
- Comparison with CDF Run I data

$$\Delta\text{Acceptance} = (\text{Default} - (\pm 3\sigma))$$

$$\delta = (\Delta\text{Acceptance} / \text{Acceptance})\ (\%)$$

Parameter	$MAX(\delta_{+3\sigma},\delta_{-3\sigma})$
Par 62	.01
Par 64	.04
Par 91	.04
Par 93	.00
Total	0.057

Extra Material

ΔAcceptance = (Default - ($\pm 3\sigma$))

δ =(ΔAcceptance /Acceptance) (%)

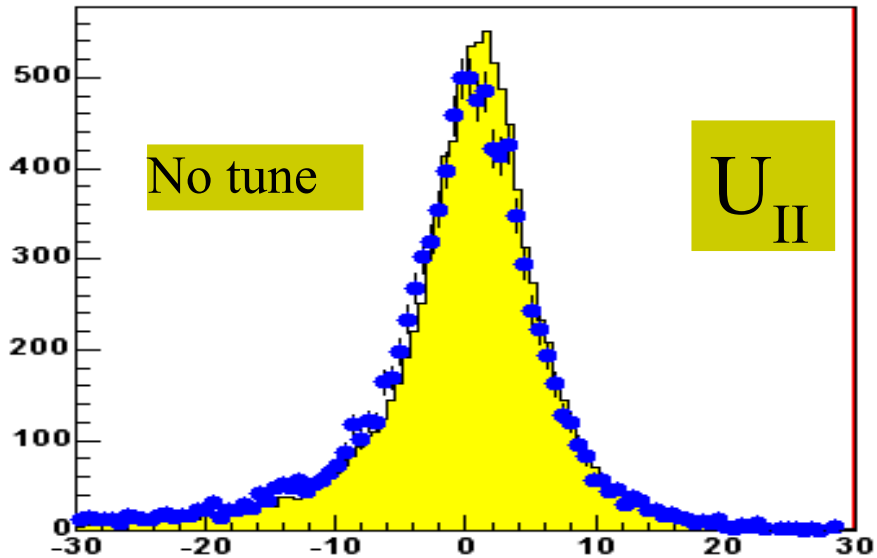
MC dataset	Description	ΔAcceptance	(%)
Wewk4e	Extra -1.5% Xo Cu in central	0.00003	-
Wewk3e	Extra +1.5% Xo Cu in central	0.00002	-
Total	MAX($\delta_{+\lambda}$,$\delta_{-\lambda}$)		-

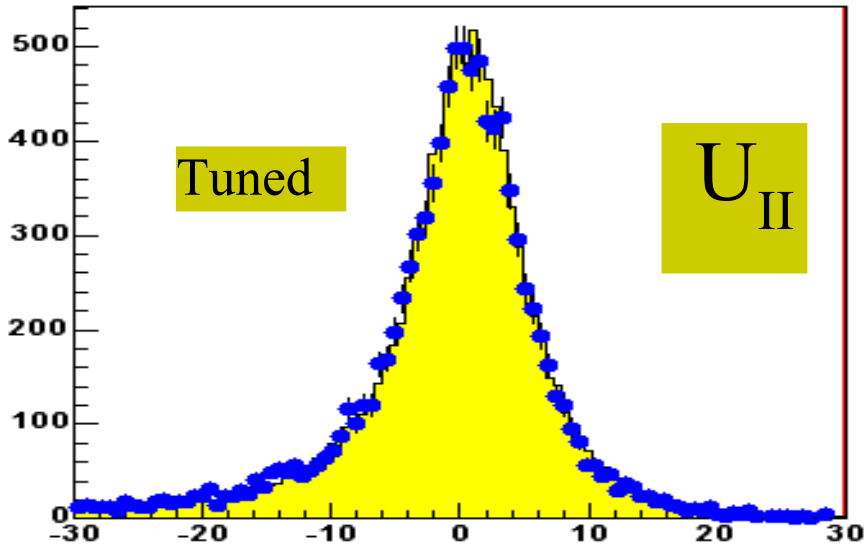
Negligible contribution from Central extra material

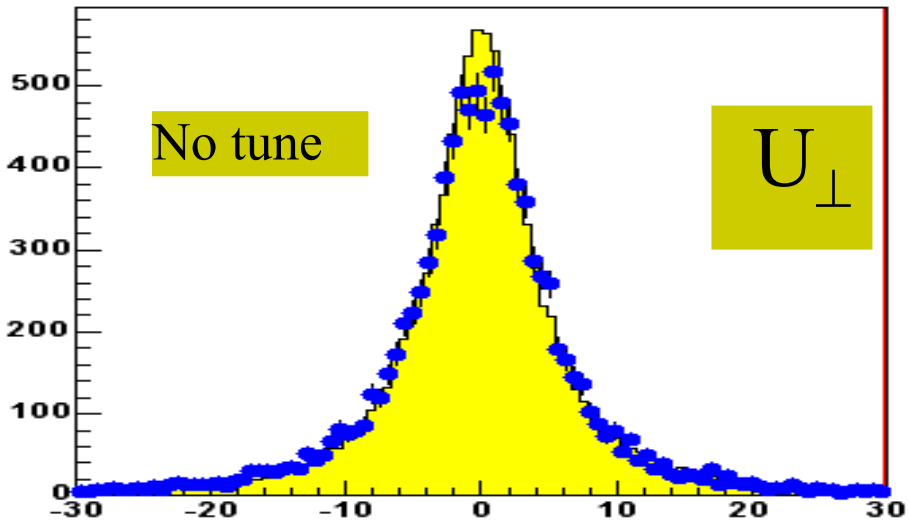
MC dataset	Description	ΔAcceptance	δ(%)
Wewk6e	Extra -1/6 Xo Fe in plug	0.0028	0.90
Wewkae	Extra +1/6 Xo Fe in plug	0.0026	0.84
Total	MAX($\delta_{+3\sigma}$,$\delta_{-3\sigma}$)		0.90

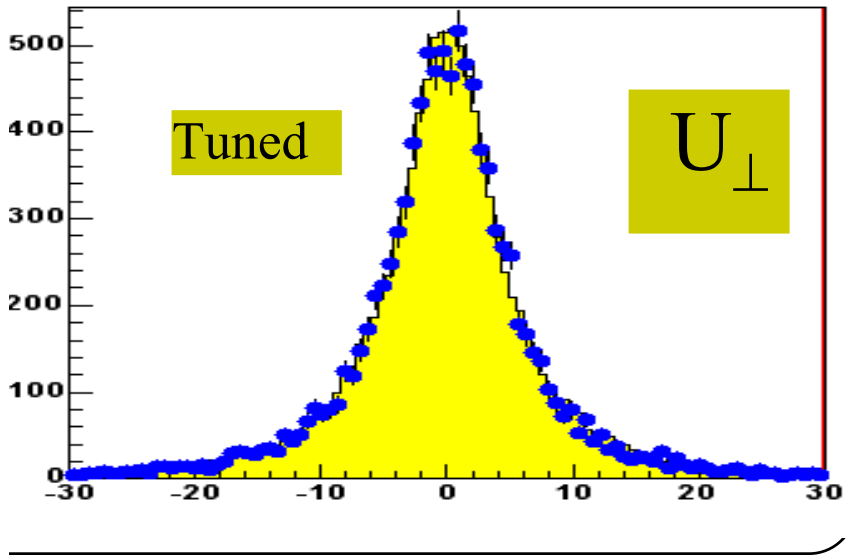
Systematics for extra material

Recoil energy Perp & Par









Recoil energy

$\vec{U} = -(\not{\vec{E}}_T + \vec{E}_T) \longrightarrow U_\perp \& U_{II} \longrightarrow$

$U'_{II} = K_{II}(U_{II} + C_{II})$

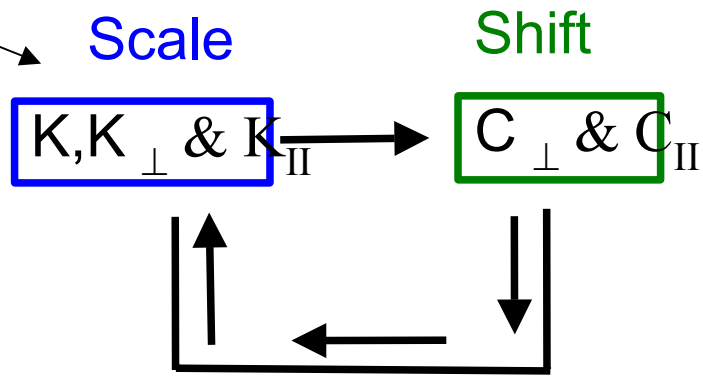
$U'_\perp = K_\perp(U_\perp + C_\gamma)$

$U' = K * \mathrm{sqrt}(U^2_\perp + U^2_{II})$

Parallel and perpendicular difined with respect of lepton direction

- Data and MC for different values of parameters were compared using χ^2 distributions

- Value of parameter for χ^2_{min} used to recalculate Met and acceptance
- Appropriate values of parameters of 3σ shift in χ^2 used for systematics study

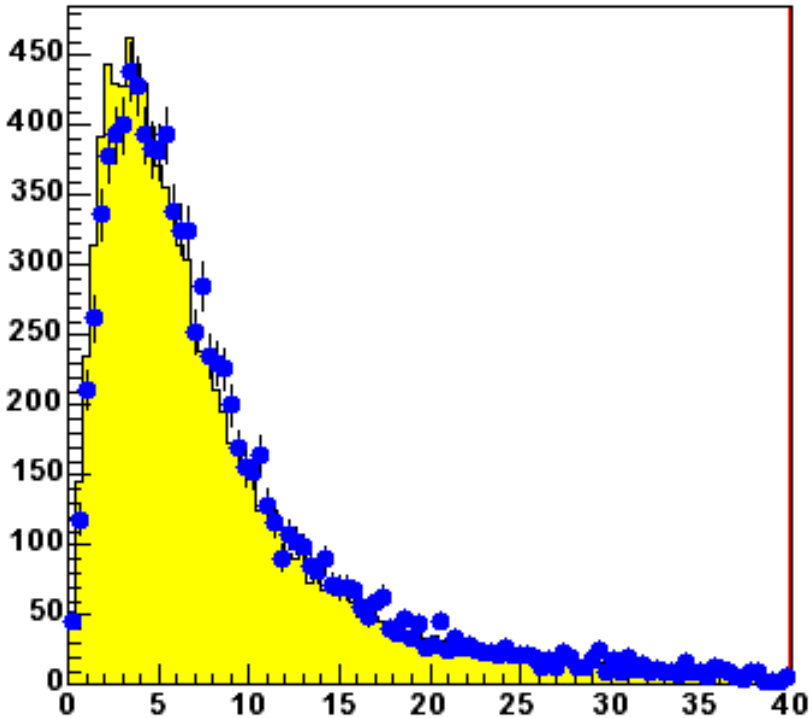


Evaluated in iteration

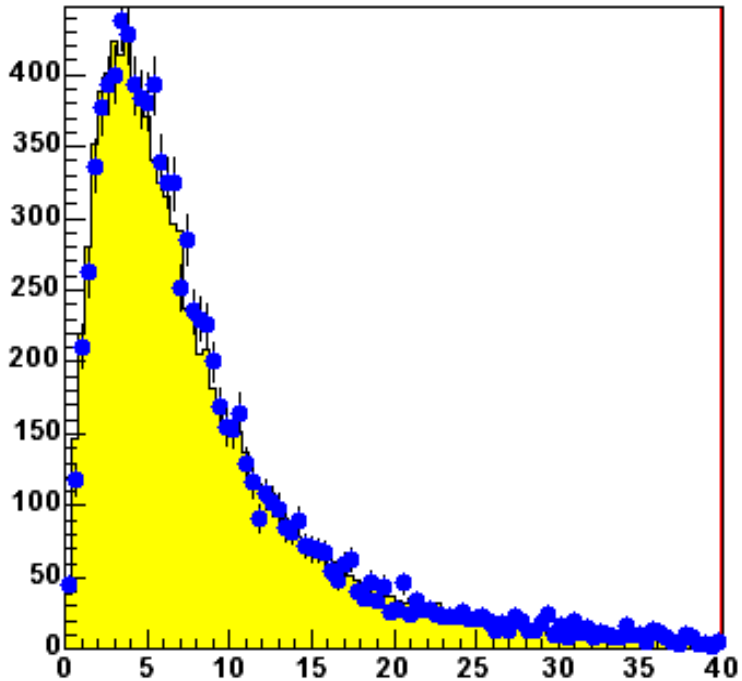
19

Recoil Energy: $\vec{U} = -(\not{\vec{E}}_T + \vec{E}_T)$

Before tuning



After tuning…



U is decomposed into its // and ⊥ (to l direction). Then it is shifted and scaled.

Systematics is computed by changing shift and scale

Recoil energy table

$$U'_{II} = K_{II}(U_{II} + C_{II})$$

$$U'_{\perp} = K_{\perp}(U_{\perp} + C_{\perp})$$

	K_{II}	$K_{\perp}$	K	C_{II}	$C_{\perp}$
n.d.f.	200	200	200	200	200
Fit value	1.097	1.104	1.069	-0.465	0.006
Δvalue	0.034	0.037	0.027	0.153	0.151
$\Delta A_{+3\sigma}$(%) ($\Delta A/A$)	-	-	0.18	0.29	0.004
$\Delta A_{-3\sigma}$(%) ($\Delta A/A$)	-	-	0.17	0.3	0.005
Total $\Delta A/A$ (%)	0.35				

Total = sqrt($0.18^2+0.3^2+0.005^2$)

Tracks

Scale Factor: Systematics

We define SF_0 as the average Scale Factor

Then we study what happens assuming that SF is a function of η or E_T

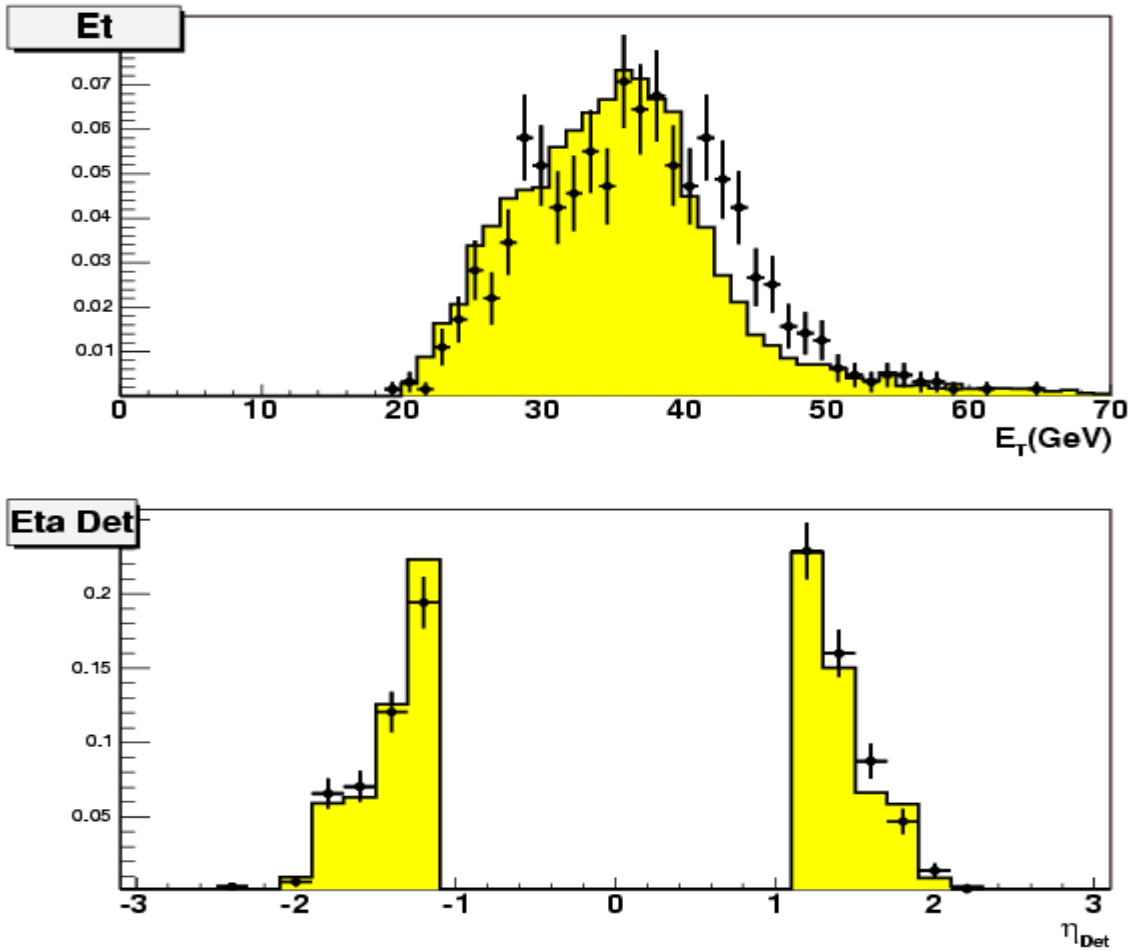
- We compute the difference between the number of events obtained using the average SF and the number of events obtained using SF function of η or E_T (Δ_{ET} and Δ_η)

$$\Delta_{E_T} = \left(\int \left(\frac{\frac{dN}{dE_T}}{SF(E_T)} \right) dE_T \right) - \left(\frac{\int \frac{dN}{dE_T} dE_T}{(SF_0)} \right)$$

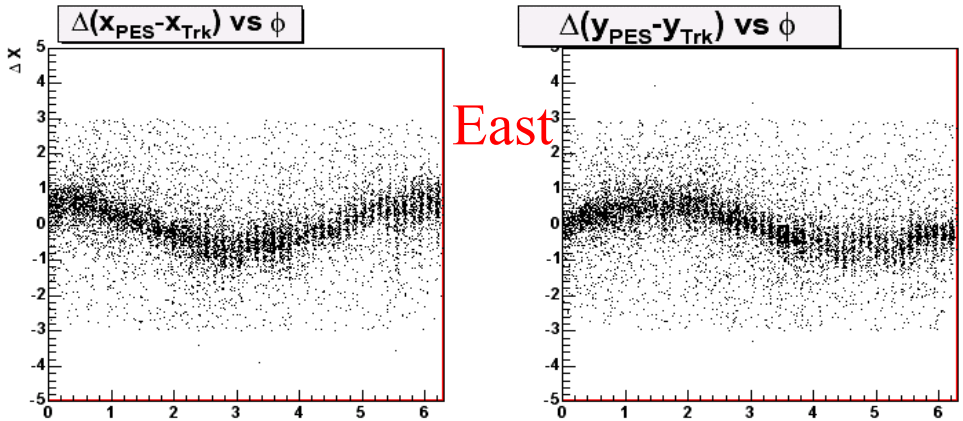
$$\Delta_{\eta} = \left(\int \left(\frac{\frac{dN}{d\eta}}{SF(\eta)} \right) d\eta \right) - \left(\frac{\int \frac{dN}{d\eta} d\eta}{(SF_0)} \right)$$

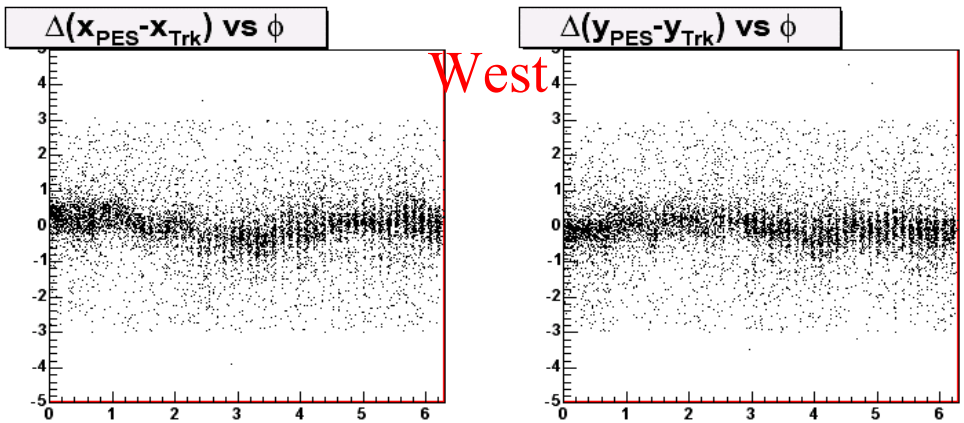
- We take the biggest of the two (Δ_{ET} and Δ_η) divided by the number of events obtained using a flat SF as the (fractional) systematic uncertainty due to the use of an average SF instead of a SF as a function of η or E_T

Scale Factor:W vs Z

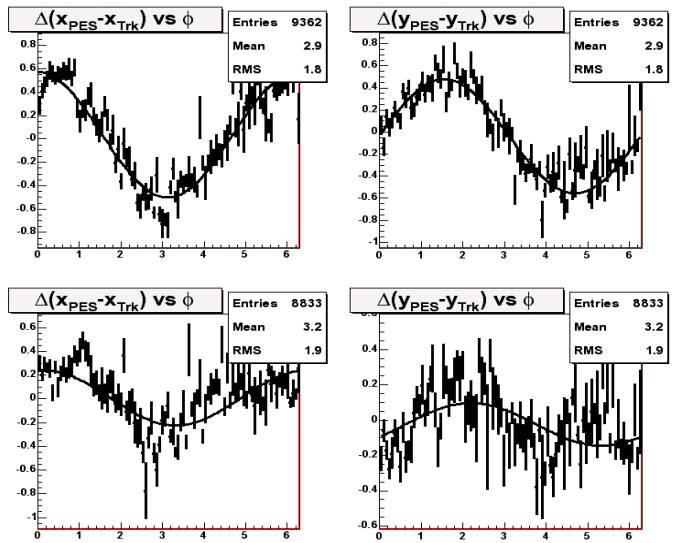


Track Matching- Wenu



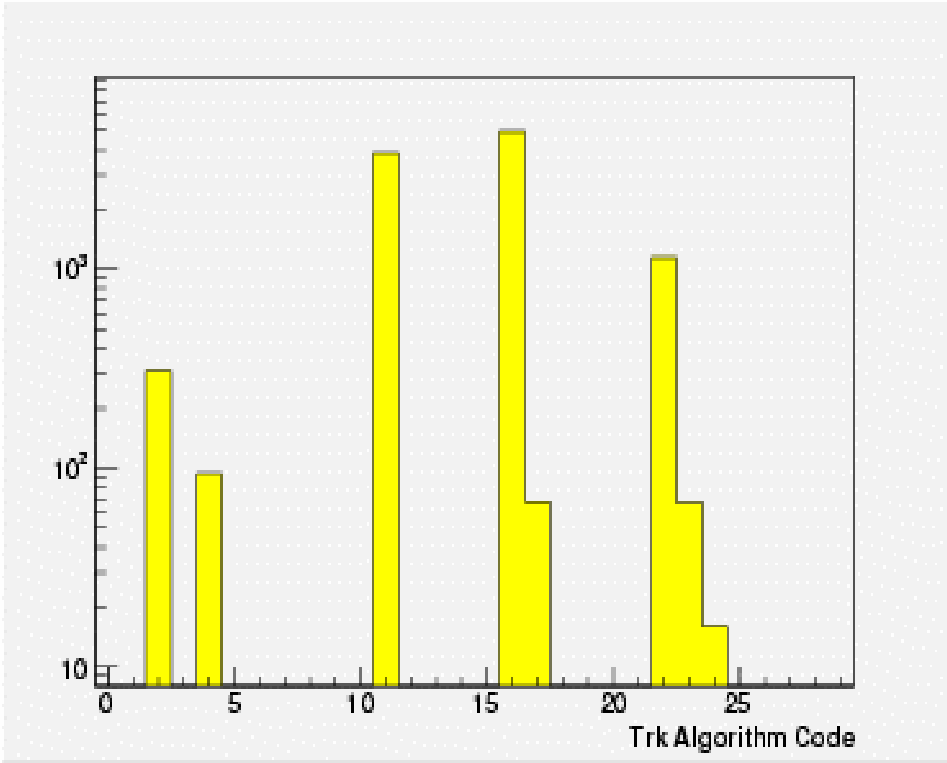


Plug East Misalignement of ~0.7cm
Marginal impact since PES doesn't seed any track.
Just matching with 3cm window



Residual misalignment

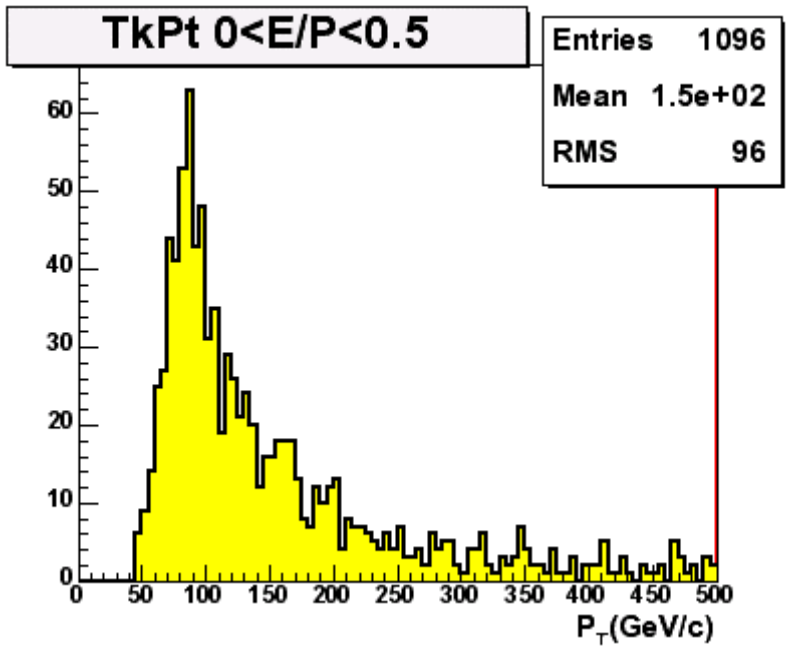
Track Matching

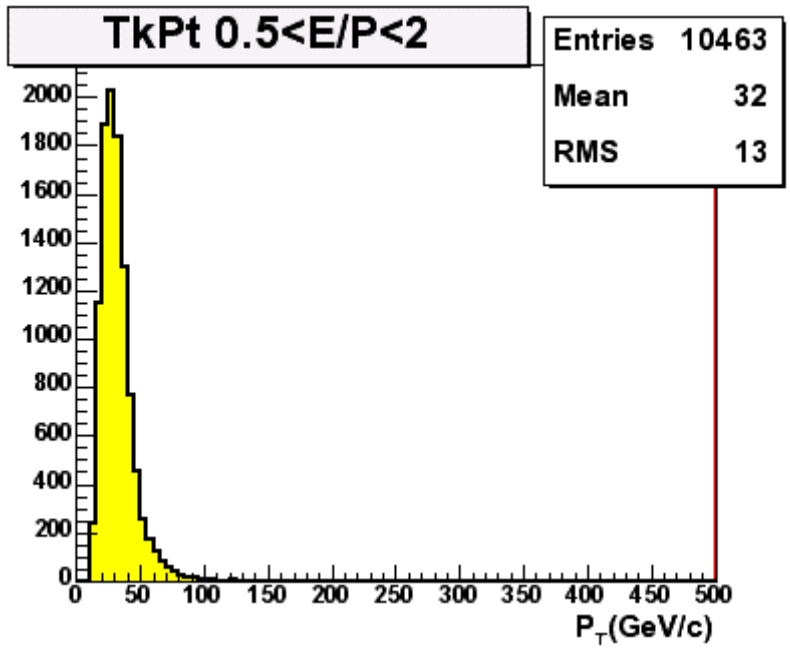


Tracks found by the different tracking algorithms

E/P Study- W->eν

Tracks from W->enu sample

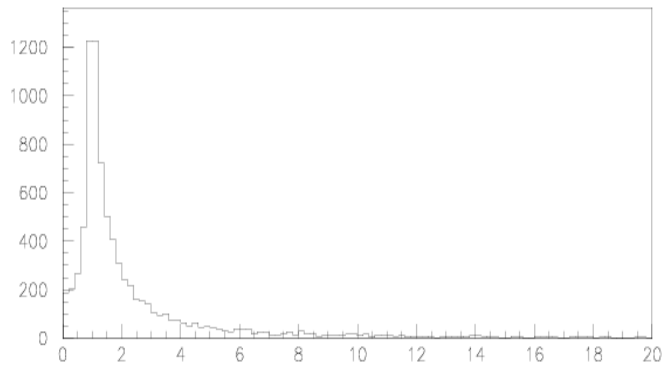


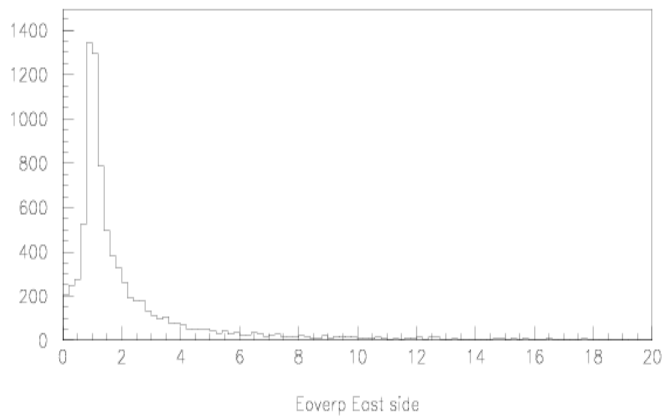


Region in 0<E/P< 0.5 coming from very High Pt tracks

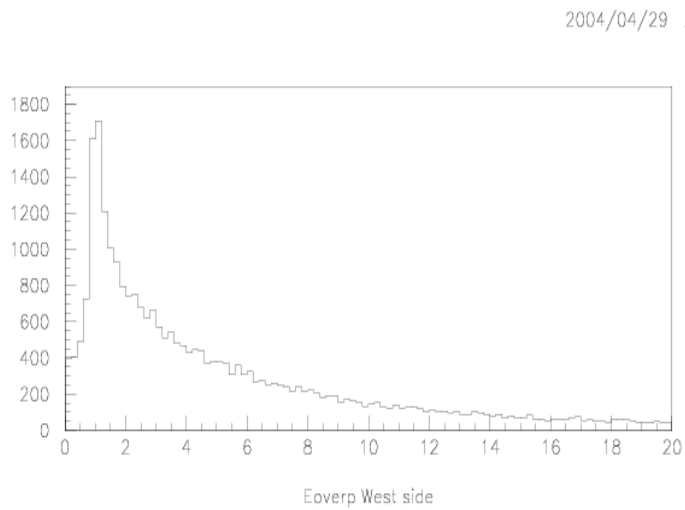
E/p: signal and back..

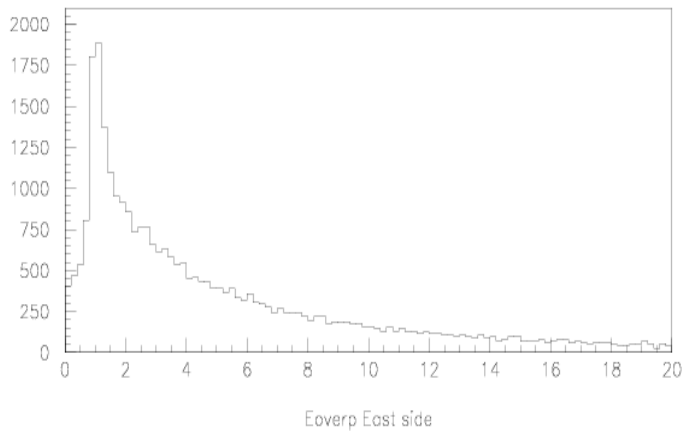
Signal sample





QCD enriched:





Silicon Coverage

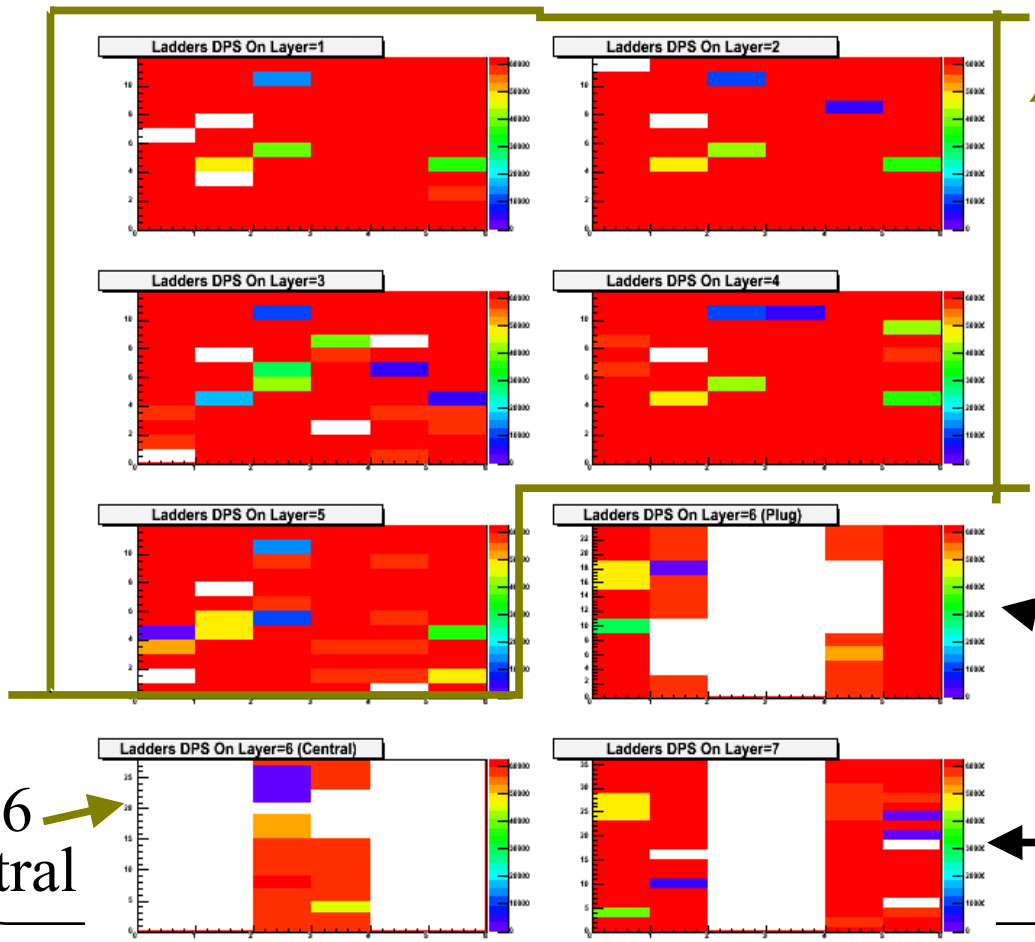
Q: plot phi vs Z distributions for each layer to confirm that the eta dependence of the scale factor is determined by the differences between the real and the simulated acceptances

- Look at DAQ status for all Si Ladders in our sample
- Compare to realistic MC (Run 151435)
- Study each individual layer
- Produce a Summary plot

Silicon Coverage: Data

Plot integrated luminosity (nb) for each (half)ladder tagged as "DPS On". We plot PhiWedge vs Half Barrel. Each (half)ladder is weighted with the integrated luminosity the ladder was in DpsOn

Data



SVX

"Offline Numerology" is used
Half-Barrel x-axis
Half-Barrel 0-1: West
Half Barrel 2-3: Central
Half Barrel 4-5: East

ISL 6 Forward

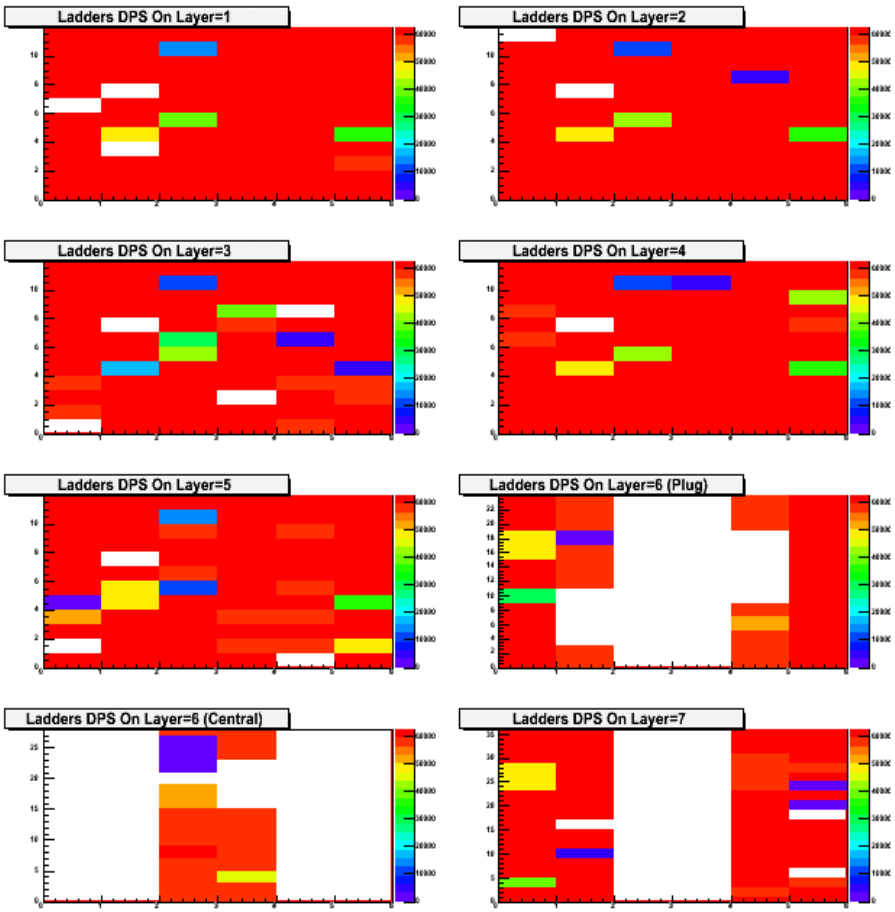
ISL 6 Central

ISL 7

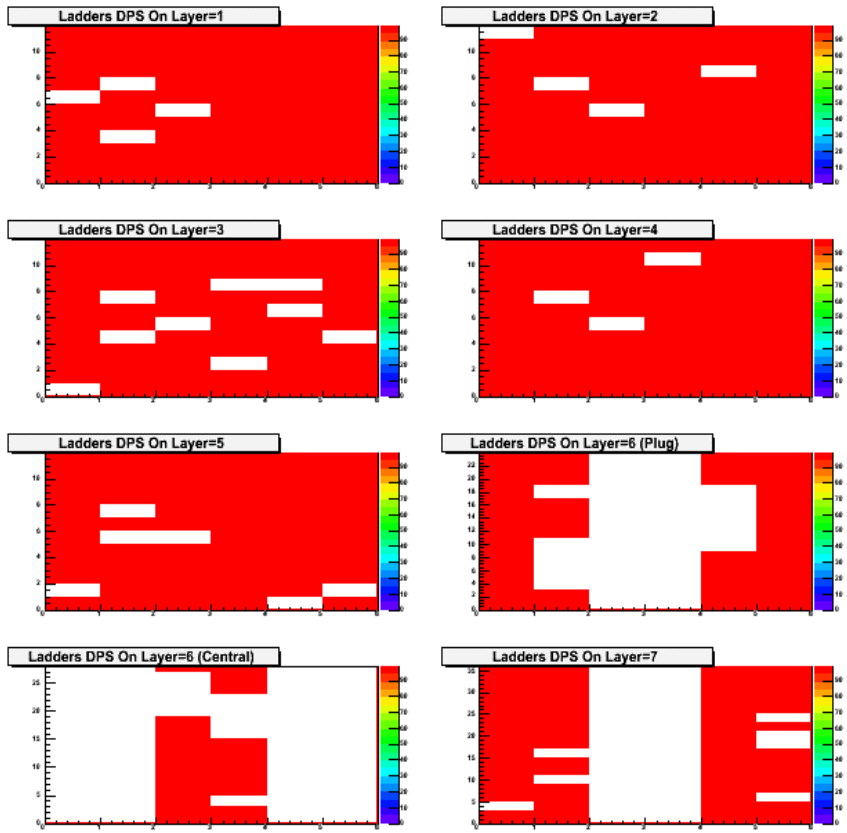
Silicon Coverage: Data and MC

Data and MC to ease comparison

Data

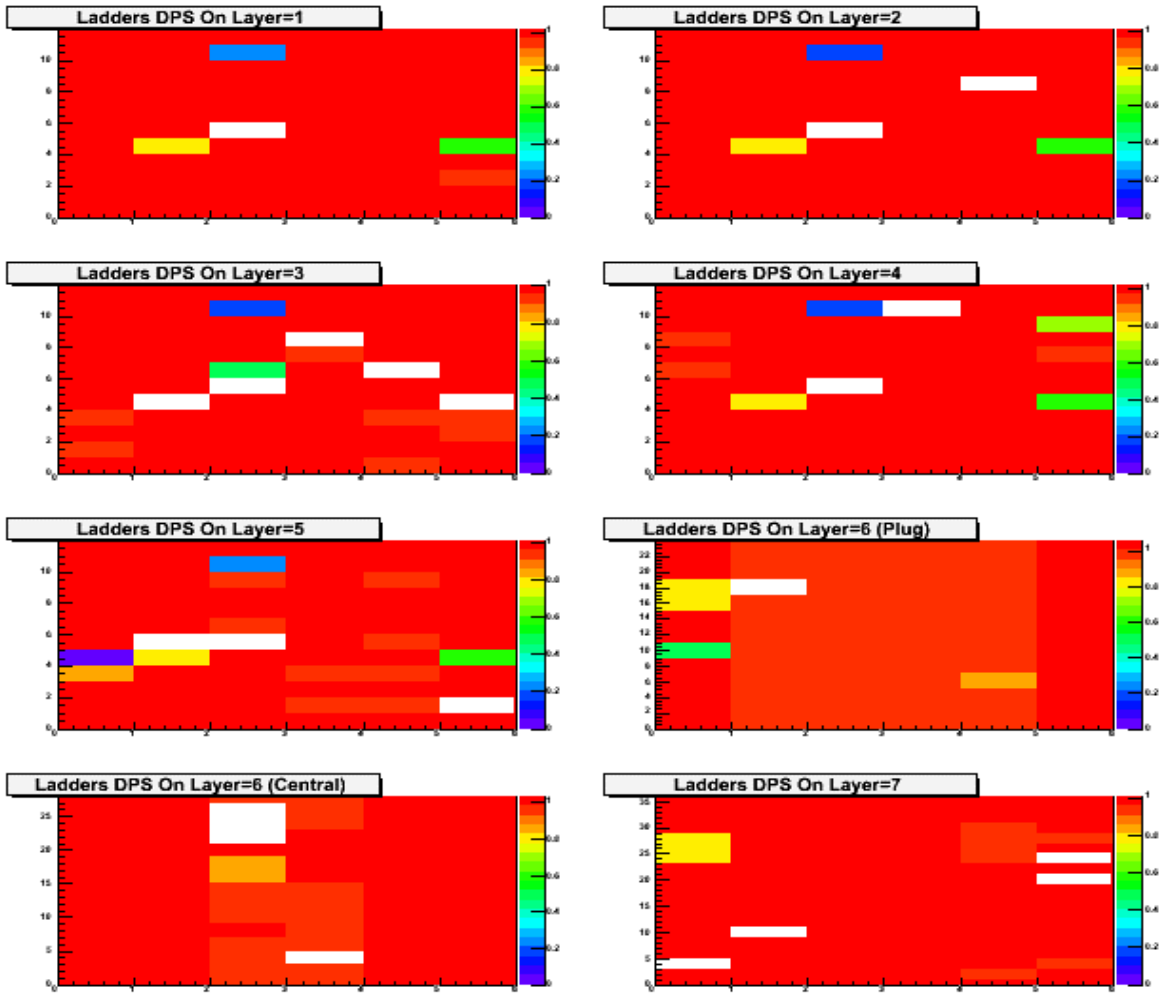


MC: Run 151435



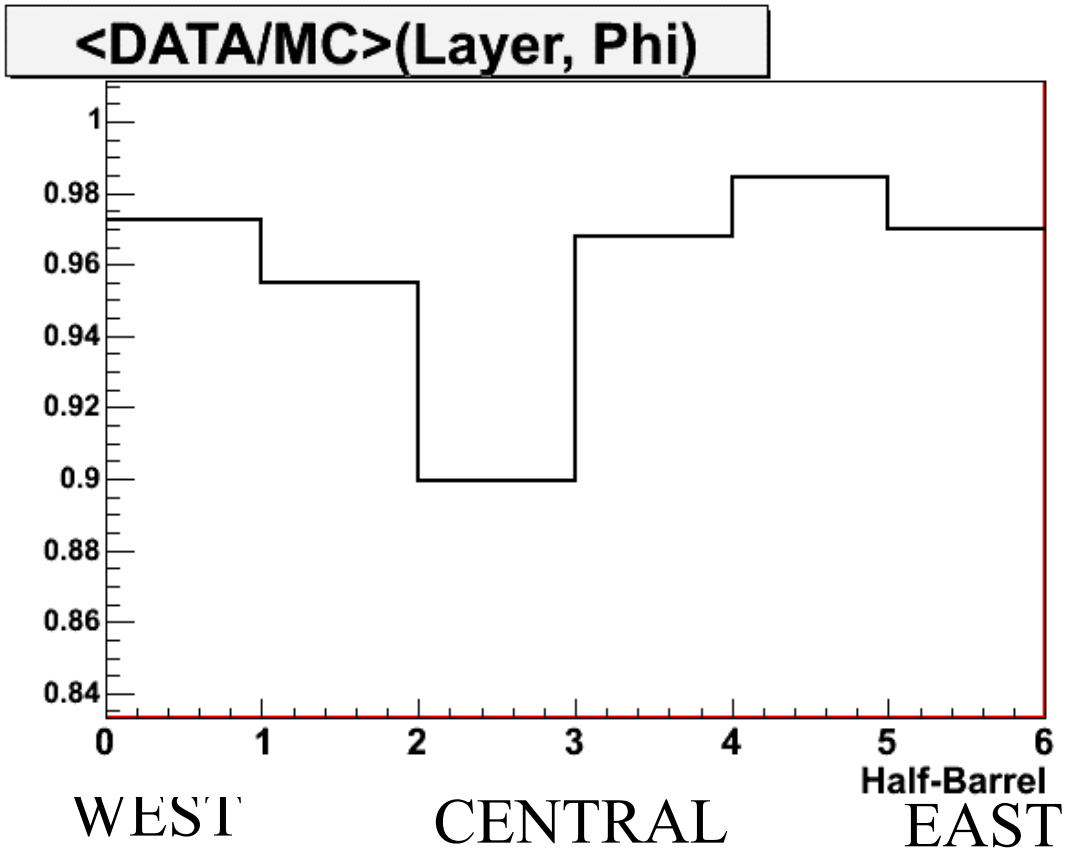
Silicon Coverage(2) Data/MC

DATA/MC after Data and MC independently normalized.



Silicon Coverage:Summary Plot

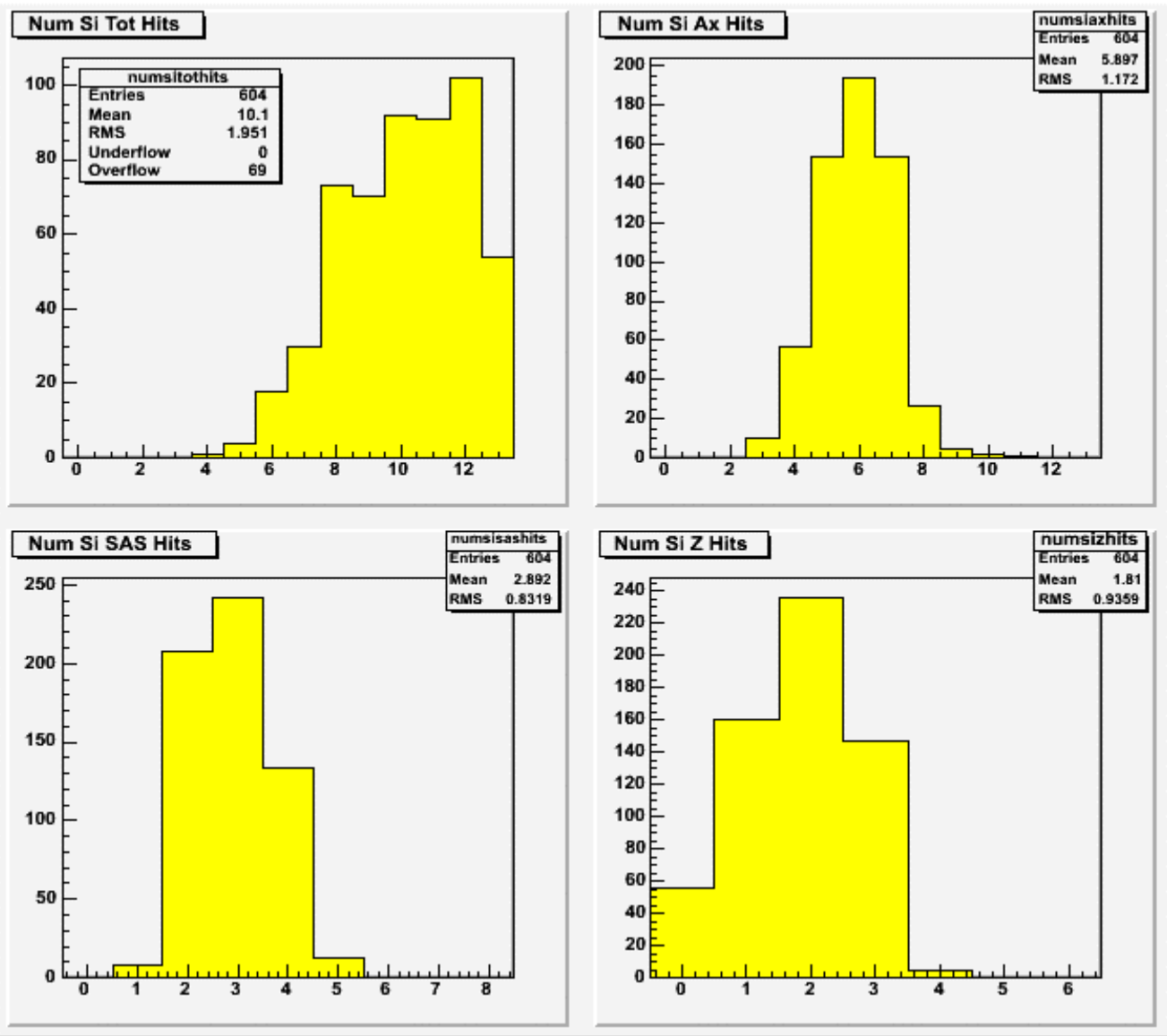
Summing over Phi wedges all layers



If agreement between data and MC this histo would have been flat.

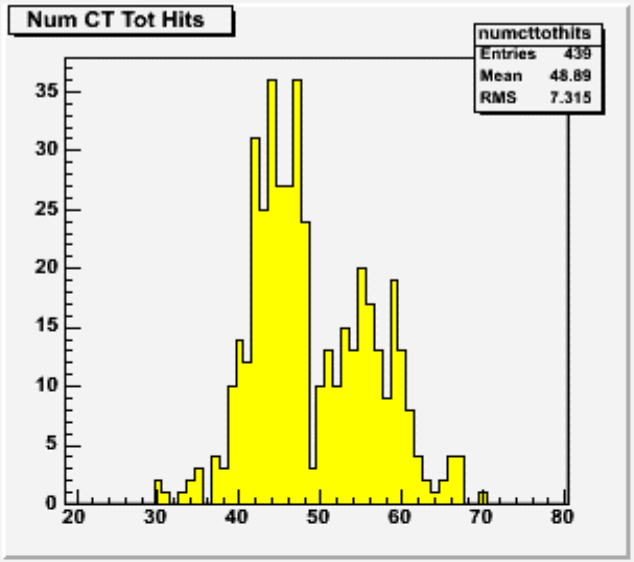
Data and MC: Difference between West and East

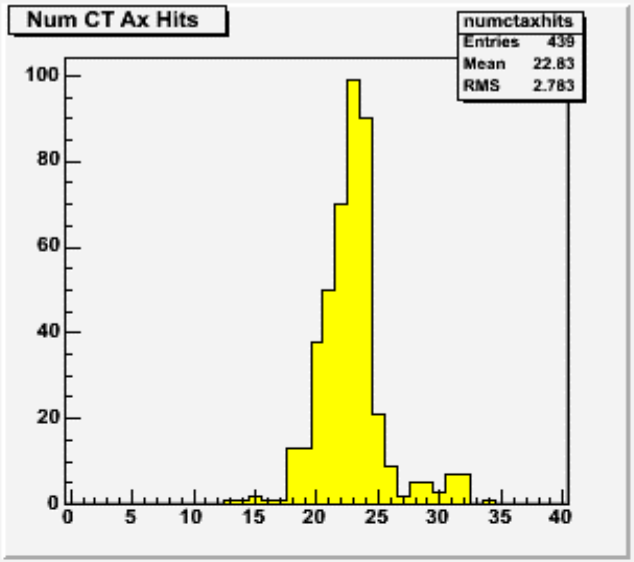
Track Quality (SiSA)

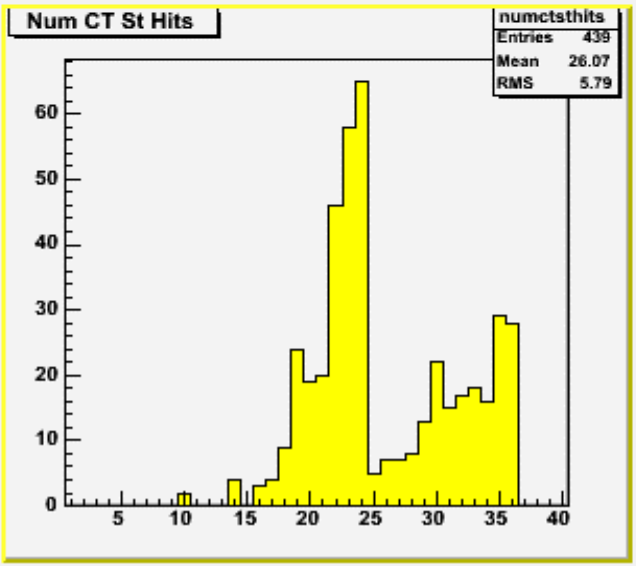


Silicon Hits for SiSA tracks

Track Quality(COT Hits)



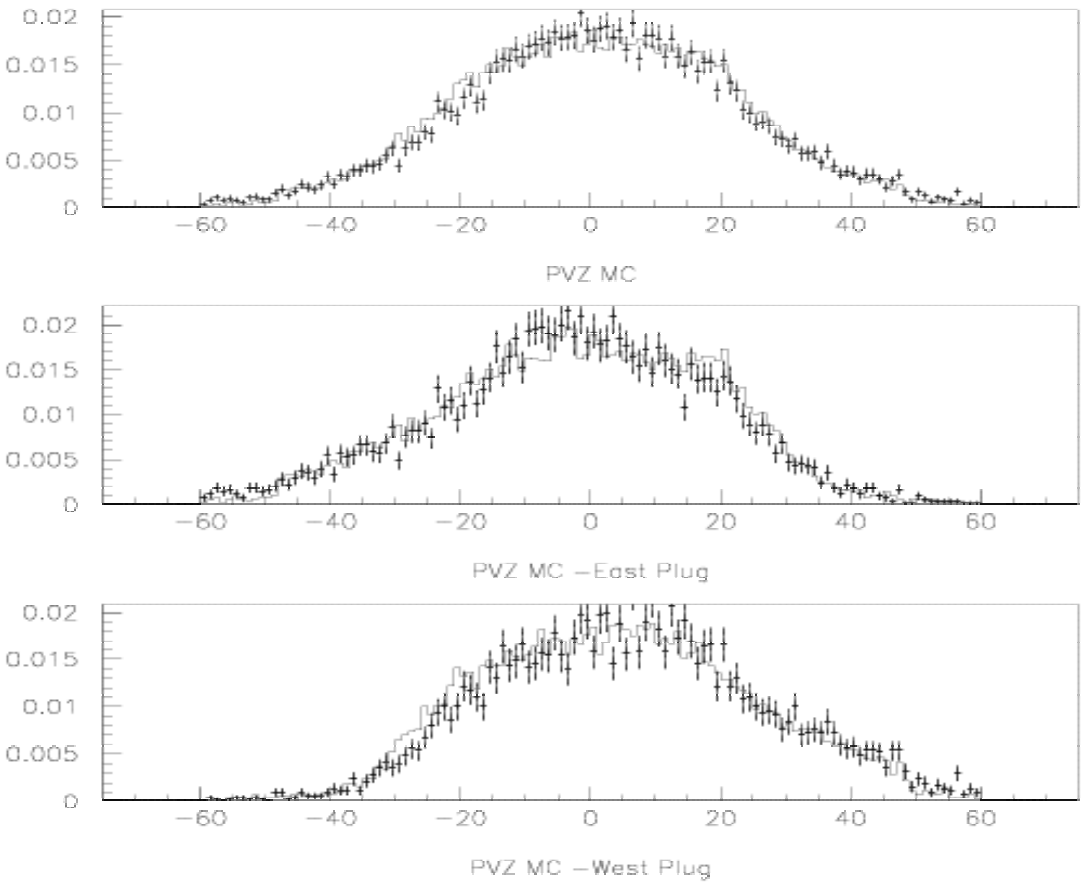




COT Hits for tracks NE SiSA

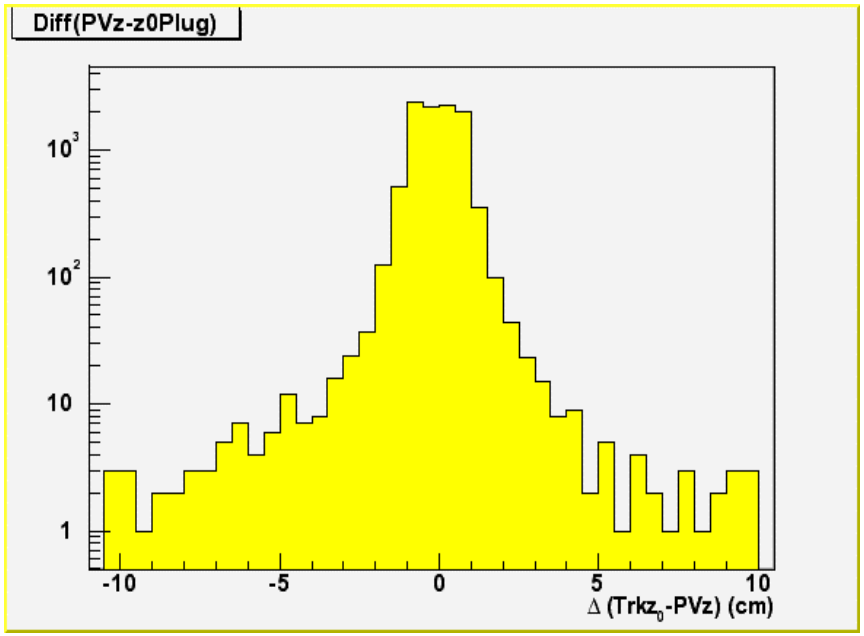
PVZ Distributions

After all cuts



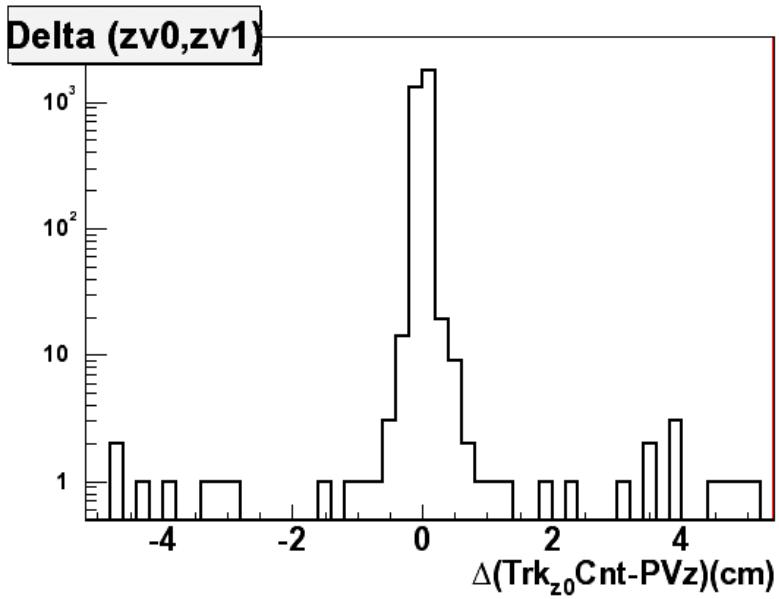
PV Vertex and Trkz0

On W→νe candidates (after E/P cut)



Difference between Trkz0 of plug track – Pvz from ZvertexColl

On Z→ee CP Candidates with stripped central track



Difference between Trkz0 of central electron and PV from Zvertex Coll in Z→ee CP sample with stripped central track

TRIGGER

Trigger Efficiencies

Preshut	Tot	East	West
L1_MET15	99.6+/-0.2	100+/-0.2	99.1+/-0.4
L3_MET15	99.9+/-0.1	100+/-0.2	99.8+/-0.3
L1_&_L3_MET15	99.5+/-0.3	100+/-0.2	99.6+/-0.2
L1_MET15 x L3_MET15	99.5+/-0.3	100+/-0.2	99.6+/-0.2
L2_PEM20	96.3+/-1.1	95.1+/-1.4	97.8+/-1.5
Overall	95.8+/-1.2	95.1+/-1.8	96.8+/-1.5

Systematics obtained after shifting Et Eele by +/-1-sigma (+/-3.1,3.6%) +/-1.0%

Systematics obtained relaxing the E/P cut:

+/-1.8%

To be conservative we take as systematics the largest uncertainty

We also checked on different sample (JET20) our results and it agrees well within the (large) statistical error.

Eff Trigger (%) =95.8+/-1.2 (stat) +/- 1.8 (syst)

Trigger Efficiencies

Preshut	Tot	East	West
L1_MET15	99.6+/-0.2	100+/-0.2	99.1+/-0.4
L3_MET15	99.9+/-0.1	100+/-0.2	99.8+/-0.3
L1_&_L3_MET15	99.5+/-0.3	100+/-0.2	99.6+/-0.2
L1_MET15 x L3_MET15	99.5+/-0.3	100+/-0.2	99.6+/-0.2
L2_PEM20	96.3+/-1.1	95.1+/-1.4	97.8+/-1.5
Overall	95.8+/-1.2	95.1+/-1.8	96.8+/-1.5

Systematics obtained after shifting Et Eele by +/-1-sigma (+/-3.1,3.6%) +/-1.0%

Systematics obtained relaxing the E/P cut:

+/-1.8%

To be conservative we take as systematics the largest uncertainty

We also checked on different sample (JET20) our results and it agrees well within the (large) statistical error.

Eff Trigger (%) =95.8+/-1.2 (stat) +/- 1.8 (syst)

Trigger Efficiencies

Preshut	Tot	East	West
L1_MET15	99.6+/-0.2	100+/-0.2	99.1+/-0.4
L3_MET15	99.9+/-0.1	100+/-0.2	99.8+/-0.3
L1_&_L3_MET15	99.5+/-0.3	100+/-0.2	99.6+/-0.2
L1_MET15 x L3_MET15	99.5+/-0.3	100+/-0.2	99.6+/-0.2
L2_PEM20	96.3+/-1.1	95.1+/-1.4	97.8+/-1.5
Overall	95.8+/-1.2	95.1+/-1.8	96.8+/-1.5

Systematics obtained after shifting Et elec by ±1 σ
(±3.1, ±3.6%) +/-1.0%
Systematics obtained relaxing the E/P cut: ±1.8%
To be conservative we take as systematics the largest variation

We also checked on different sample (JET20) our results and it agrees well within the (large) statistical error.

Eff Trigger (%) =95.8+/-1.2 (stat) +/- 1.8 (syst)

MET_PEM Trigger: Method

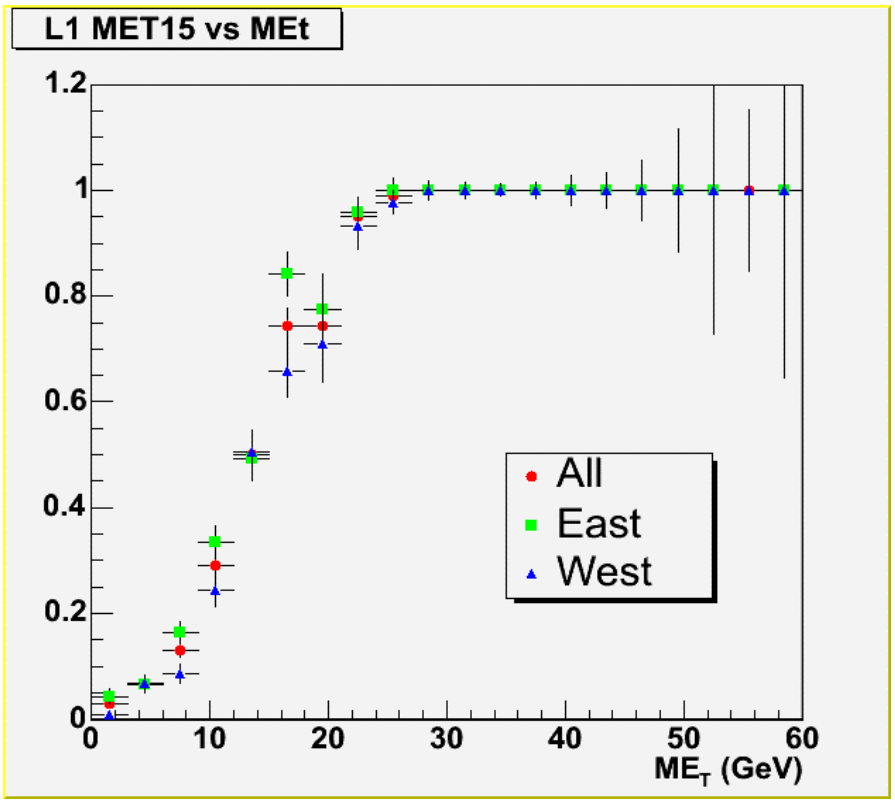
Three periods:
Preshutdown Data (Mar2002-Jan2003)
Post 1 (Feb 2003-May2003) → PhyTab 1_04_*
Post 2 (20 May 2003-Sept 2003) → Phy_Tab 1_05_*

Turn-On Curves fitted by 2 different curves:

- 1/(1+exp(-beta(x-alpha)))
- 1-p0 exp(-p1 x)

Will consider x as Raw (offline) variables (MET and Et)

Trigger Plots: L1 MET15



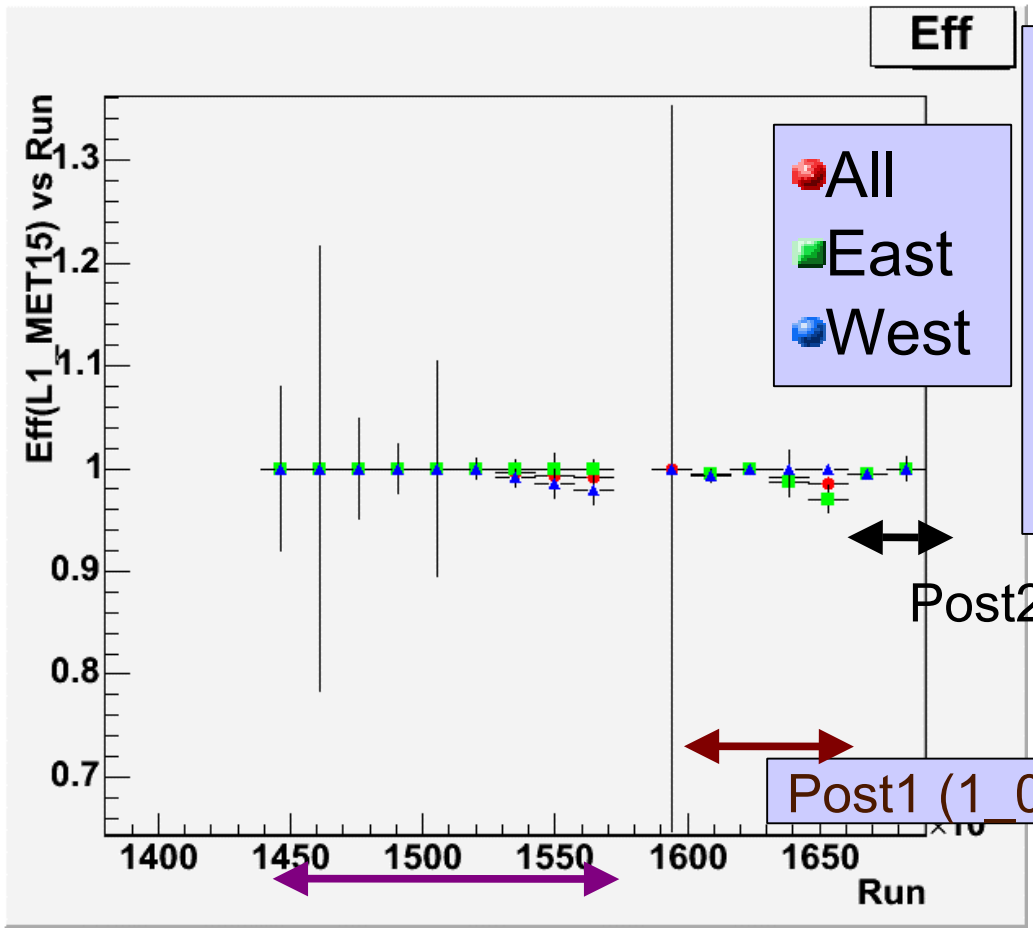
	Alpha	Beta
L1_MET	13.39 +/-0.20	.313+/-.017
L1_MET(EAST)	12.74 +/-0.27	.314+/-.017
L1_MET(WEST)	14.11+/-0.32	.322+/-.020

	P0	P1
L1_MET	1.282 +/-0.011	.0968 +/-.0012
L1_MET(EAST)	1.263 +/-0.016	.0915 +/-.0019
L1_MET(WEST)	1.190 +/-0.010	.0803 +/-.0016

Preshutdown period

Eff	Tot	EAST	WEST
L1_MET15	99.6+/-0.2	100+/-0.2	99.1+/-0.4

L1 MET15 vs Run



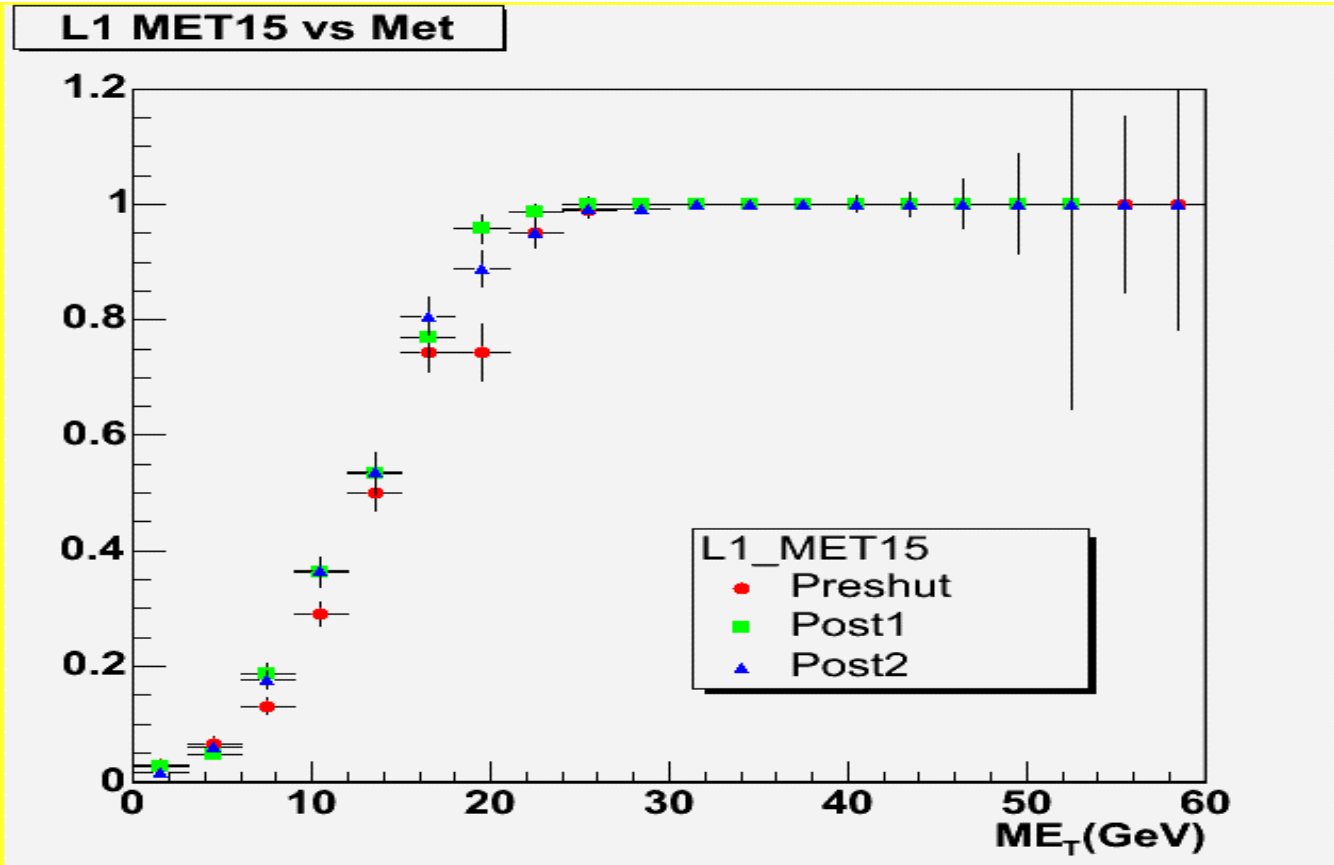
Trigger Eff:
Different behaviour in
Pre-Post1 run periods

- West lower for Pre
- East lower for Post1 (1_04)
- East = West for Post2 (1_05)

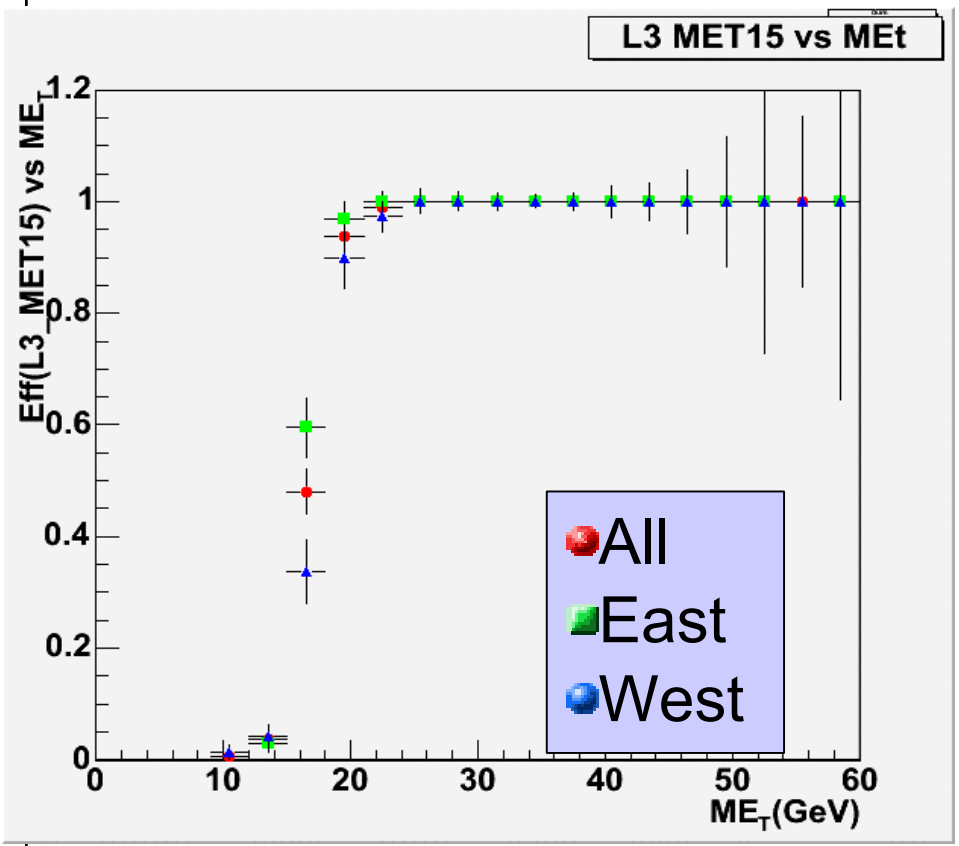
Preshutdown

L1 MET15

Trigger Eff for the three periods.



L3 MET15



	Alpha	Beta
L1_MET	16.63 +/-0.16	1.00+/-0.10
L1_MET(EAST)	16.21 +/-0.17	1.24+/-0.19
L1_MET(WEST)	17.22+/-0.25	0.85+/-0.12

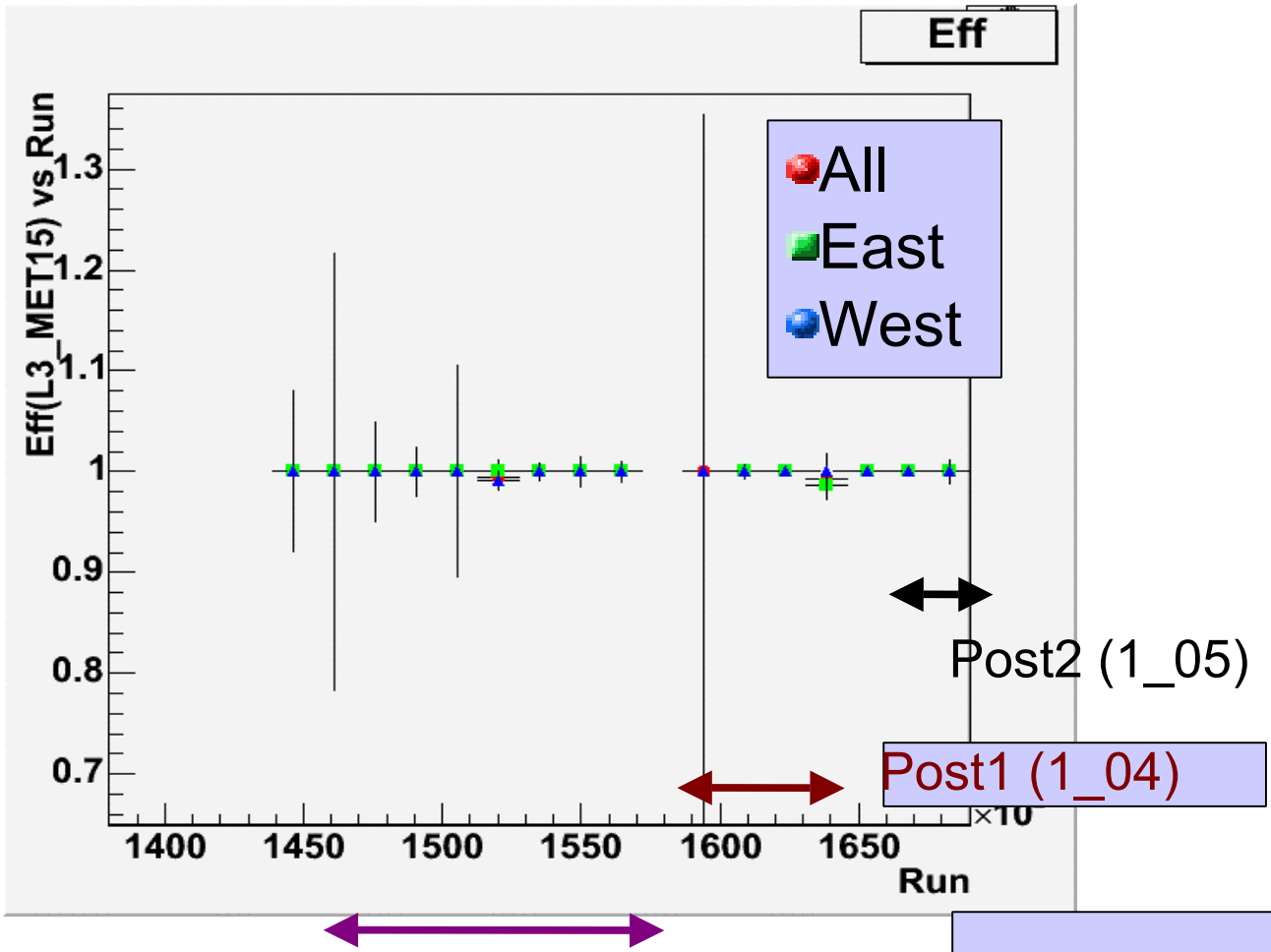
	P0	P1
L1_MET	6.3 +/-0.2	.173 +/-.003
L1_MET(EAST)	?290 +/-142?	.42 +/-.04
L1_MET(WEST)	5.28 +/-0.26	.153 +/-.004

Steeper curve than L1_MET15

Preshutdown period

Eff	Tot	EAST	WEST
L1_MET15	99.9+/-0.1	100+/-0.2	99.8+/-0.3

L3 MET15 vs Run



Post2 (1_05)

Post1 (1_04)

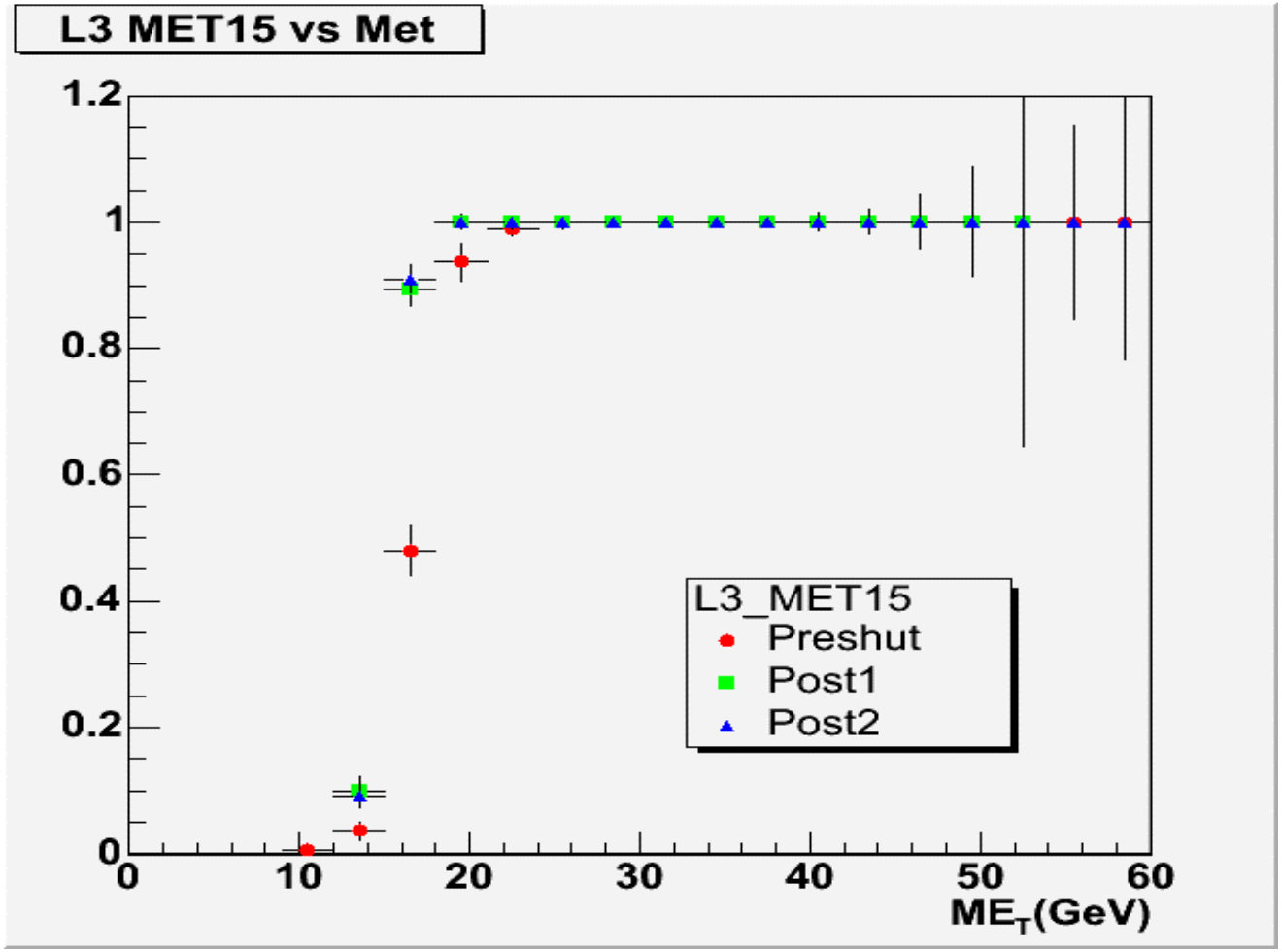
Preshutdown

Trigger Eff:

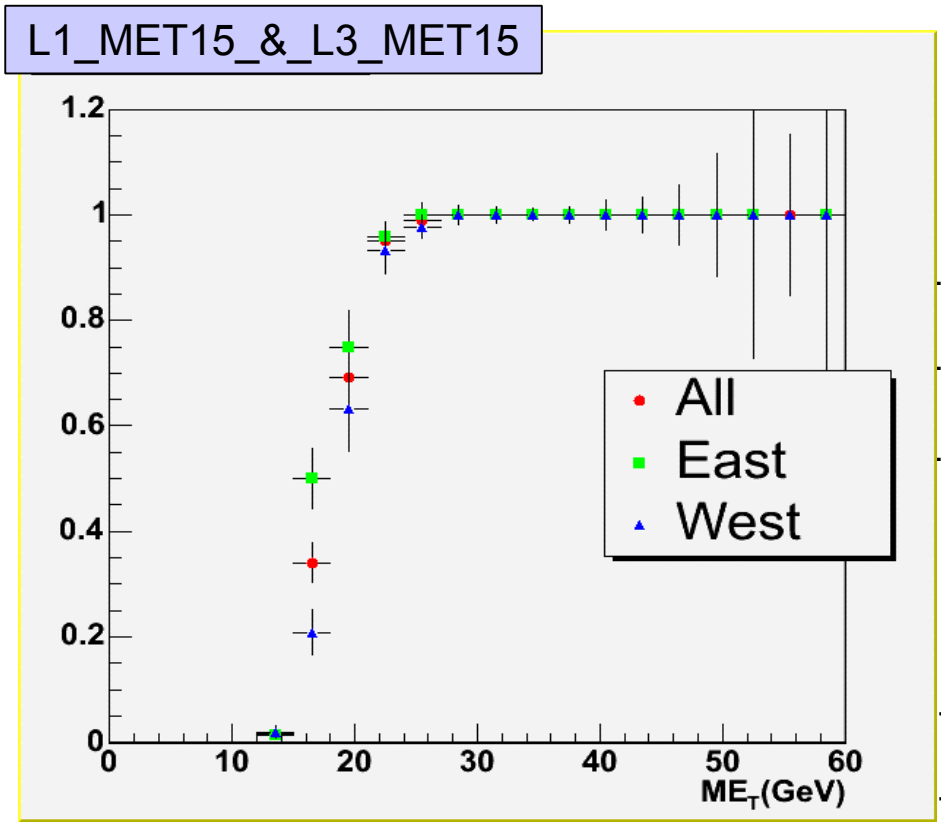
- Smaller run dependence than L1_MET15

L3 MET15 All

Trigger Eff for the three periods.



L1_MET15_&_L3 MET15



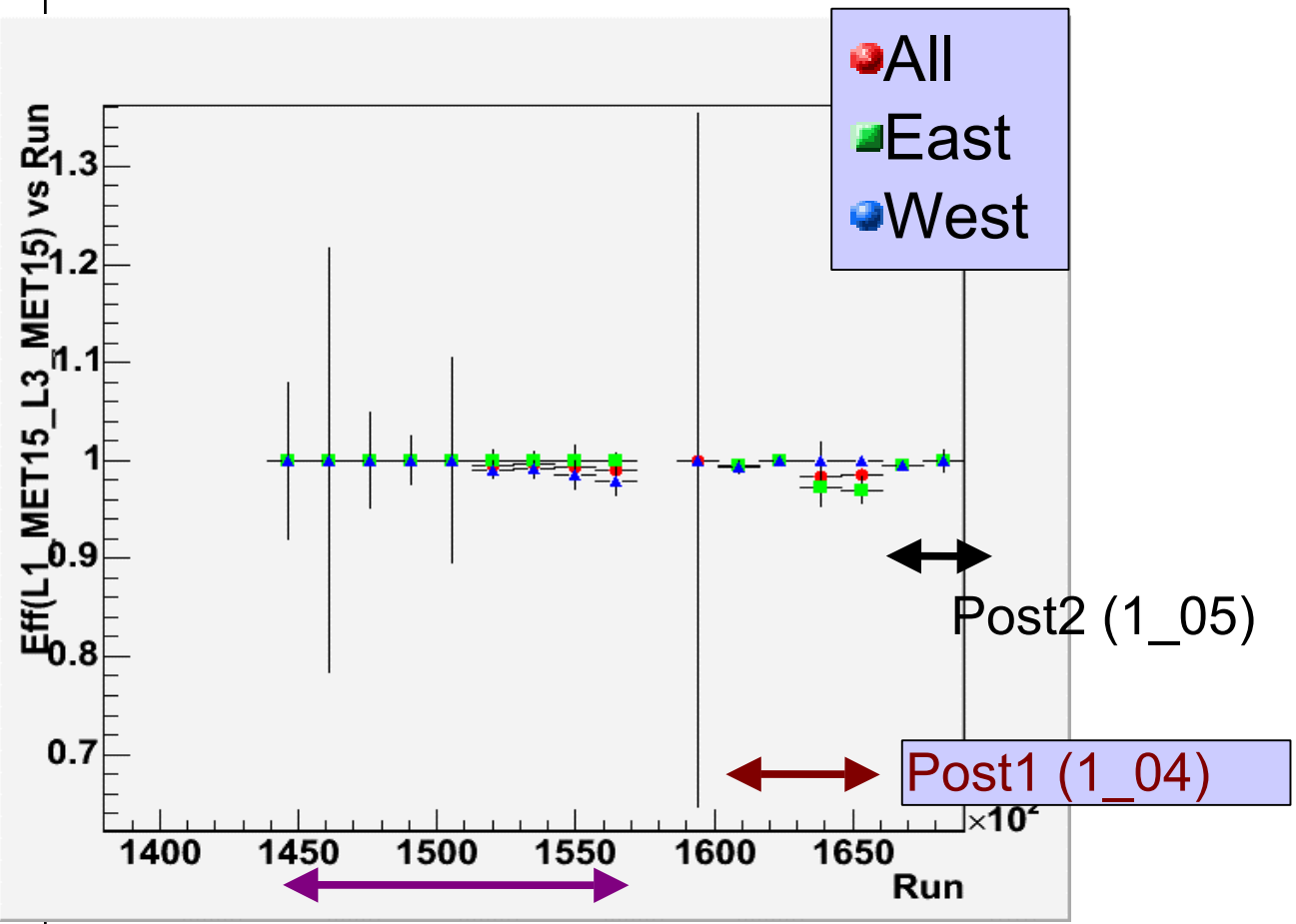
	Alpha	Beta
.1_MET	17.97 +/-0.25	0.768+/-0.06
.1_MET(EAST)	16.61 +/-0.24	1.24+/-0.22
.1_MET(WEST)	17.22+/-0.25	0.696+/-0.075

	P0	P1
_MET	35.8 +/-5.1	.27+/-.01
_MET(EAST)	52 +/-16	.29 +/-.02
L1_MET(WEST)	18.2 +/-2.6	.22 +/-.01

Preshutdown period

Eff	Tot	EAST	WEST
L1_MET15	99.5+/-0.3	100+/-0.2	99.6+/-0.2

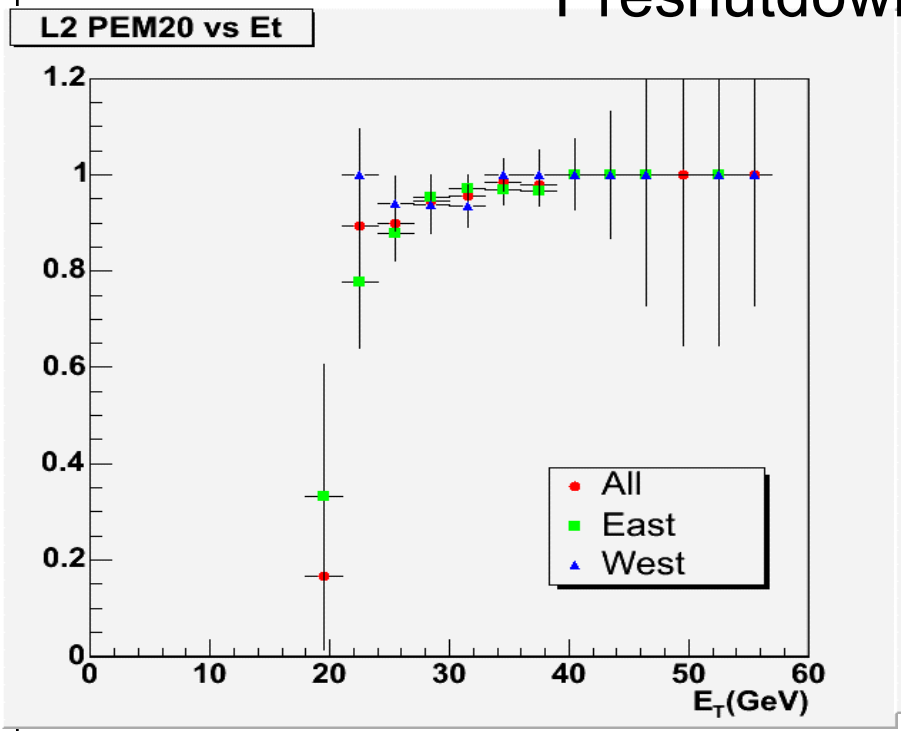
L3 MET15_&_L1_MET15 vs Run

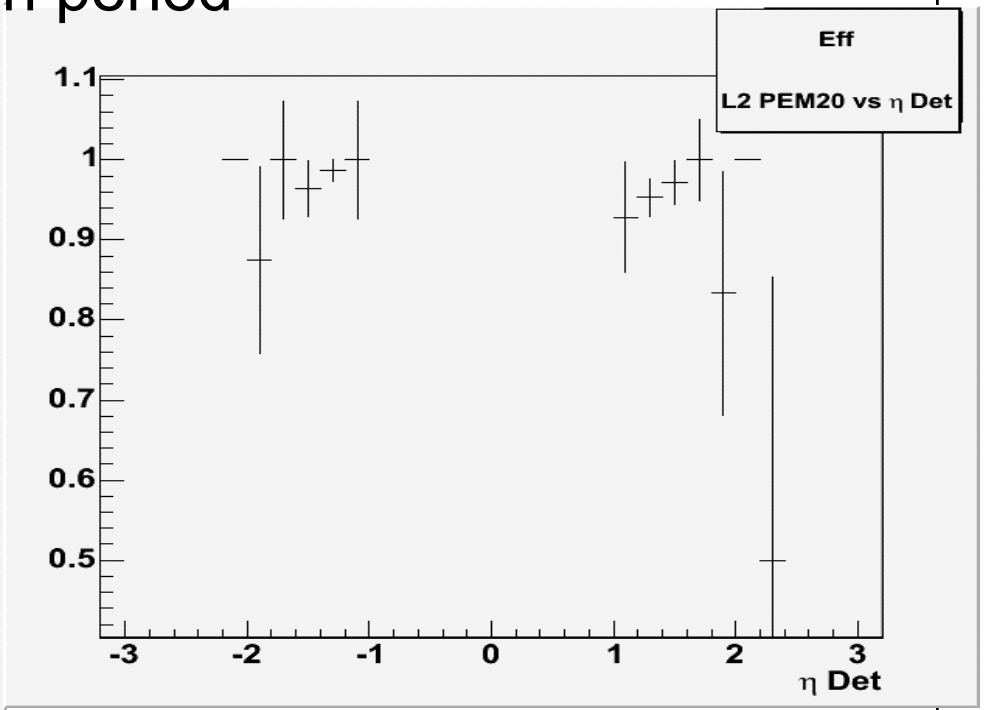


Preshutdown

Trigger Plots: L2_PEM20

Preshutdown period

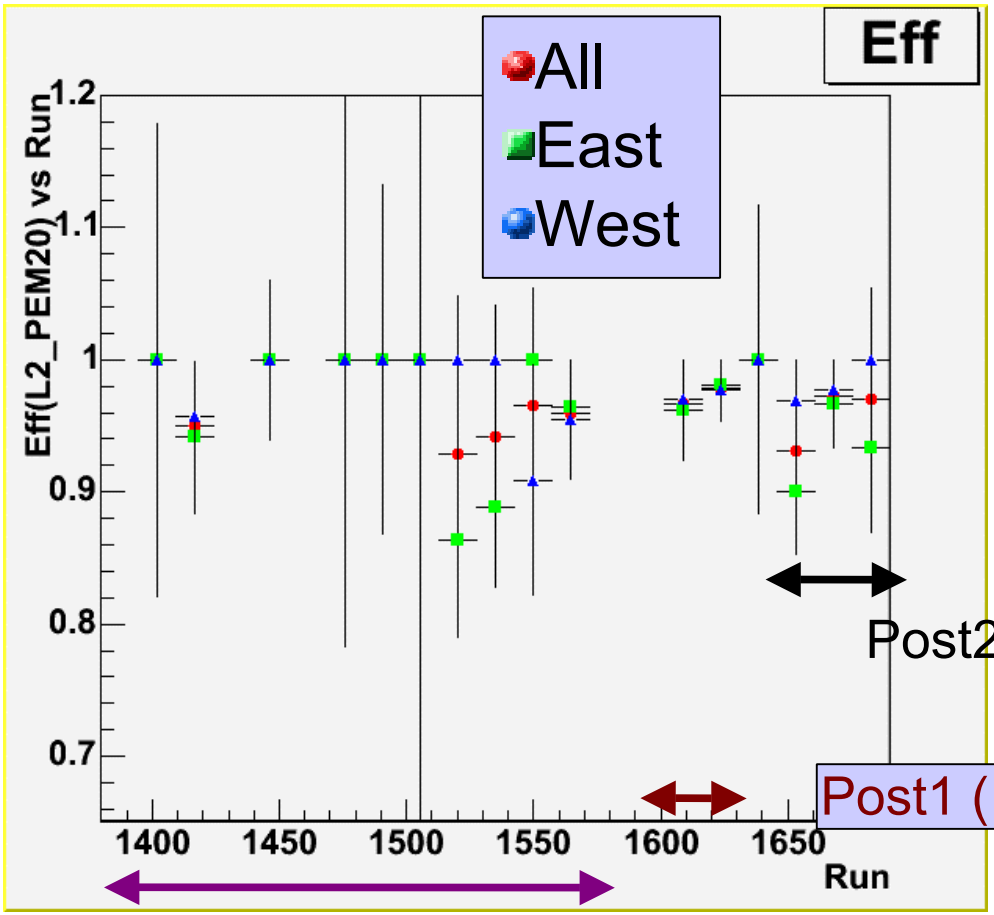




	Alpha	Beta
L2_PEM20	17.97 +/-0.25	20.7+/-0.54
L2_PEM(EAST)	16.61 +/-0.24	18.9+/-2.9
L2_PEM(WEST)	5.9+/-40	0.10+/-0.1

Eff	Tot	EAST	WEST
L2_PEM20	96.3+/-1.1	95.1+/-1.4	97.8+/-1.5

L2_PEM20 vs Run



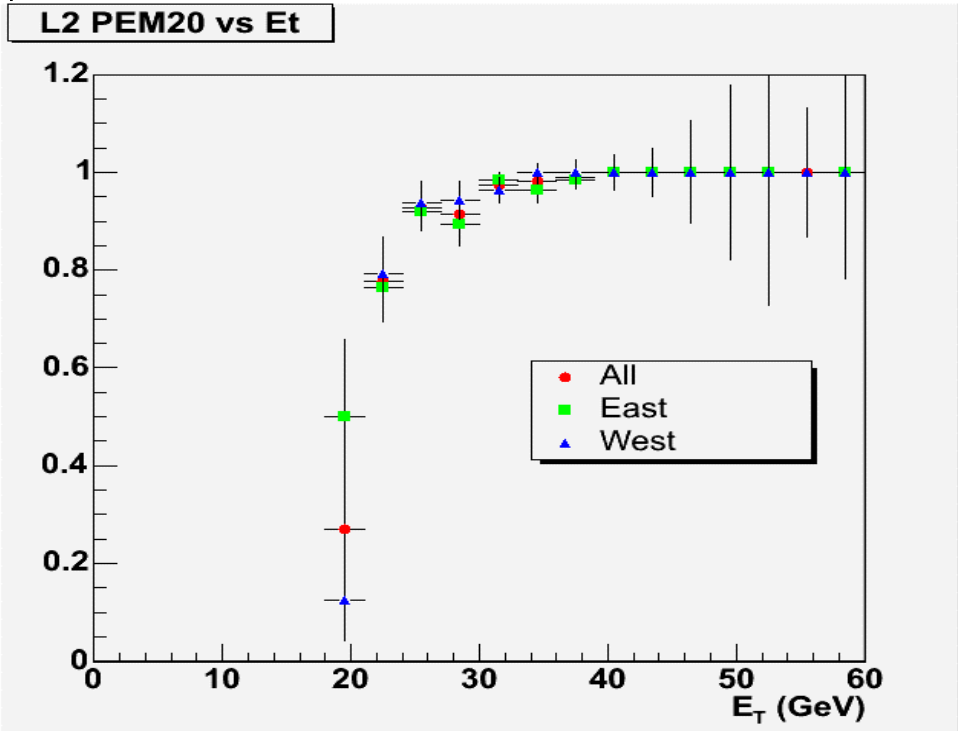
Post2 (1_05)

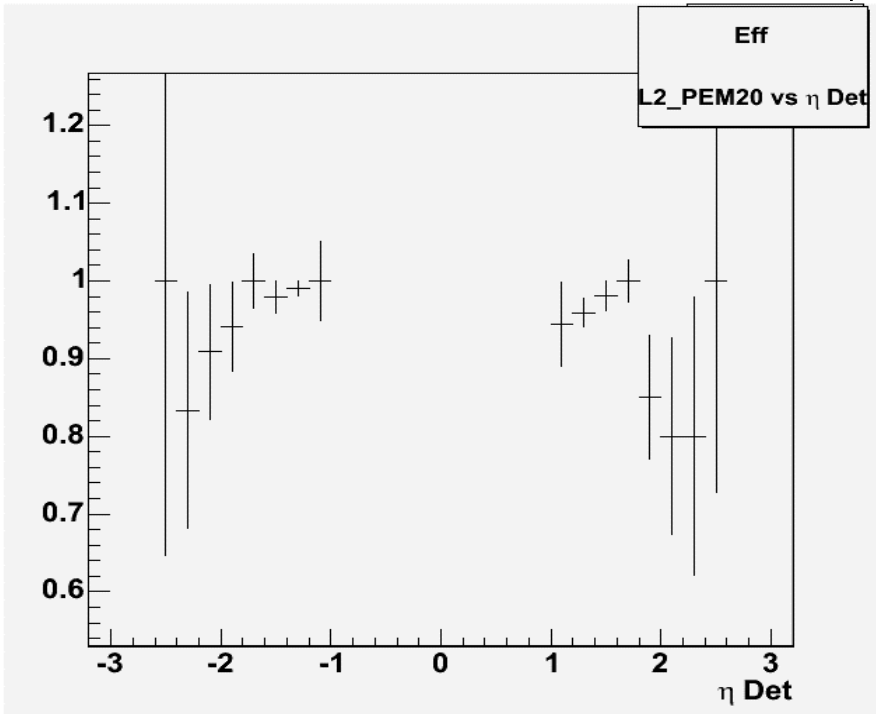
Post1 (1_04)

Preshutdown

Trigger Plots: L2_PEM20 (No E/p)

Preshutdown period



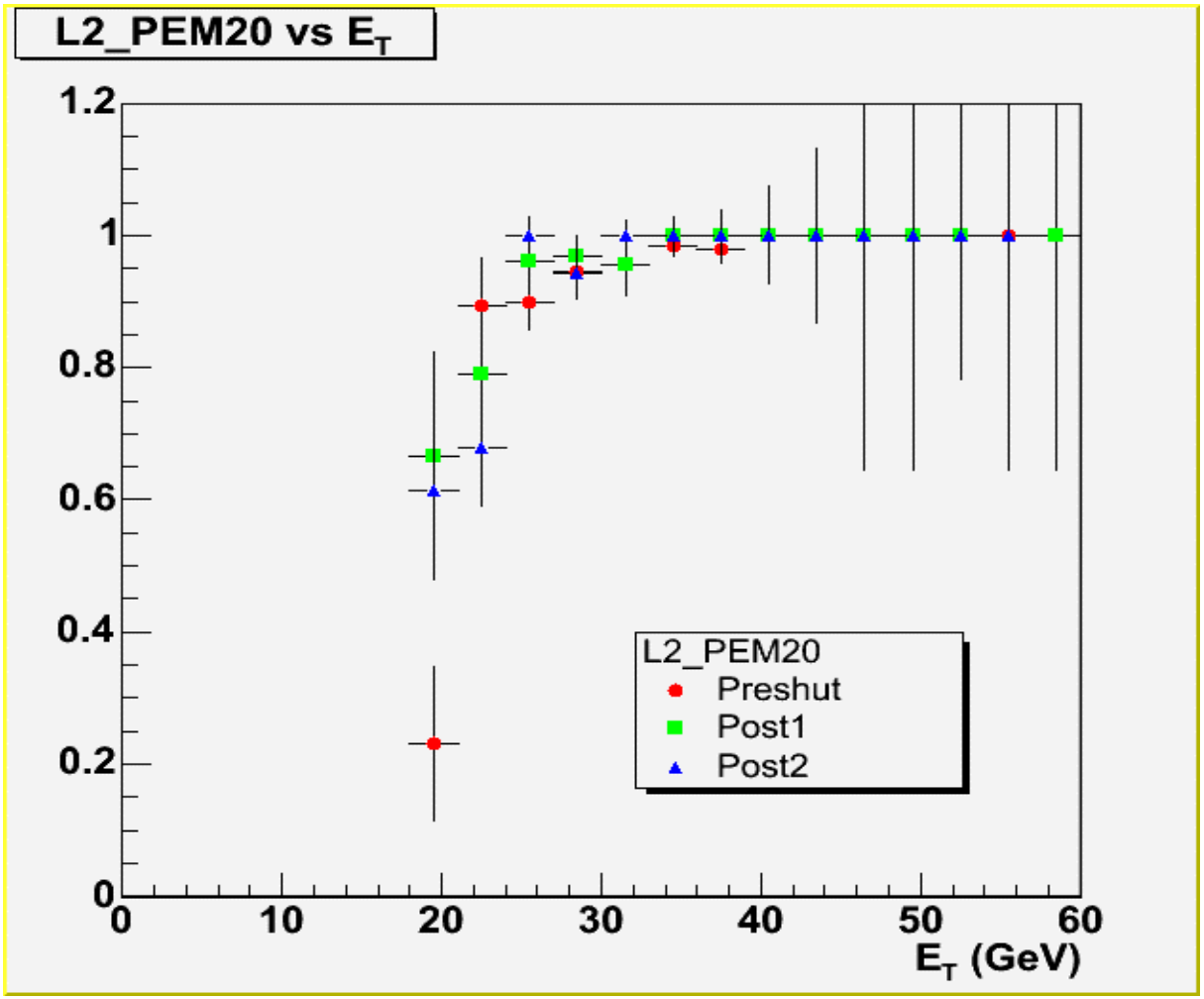


	Alpha	Beta
L2_PEM20	20.44 +/-0.61	0.45+/-0.12
L2_PEM(EAST)	18.3 +/-1.8	0.287+/-0.74
L2_PEM(WEST)	21.3+/-0.4	0.97+/-0.30

	E/P	NO E/P
All	96.3	96.4
East	95.1	95.1
West	97.8	97.9

Trigger Plots: L2 PEM20 All

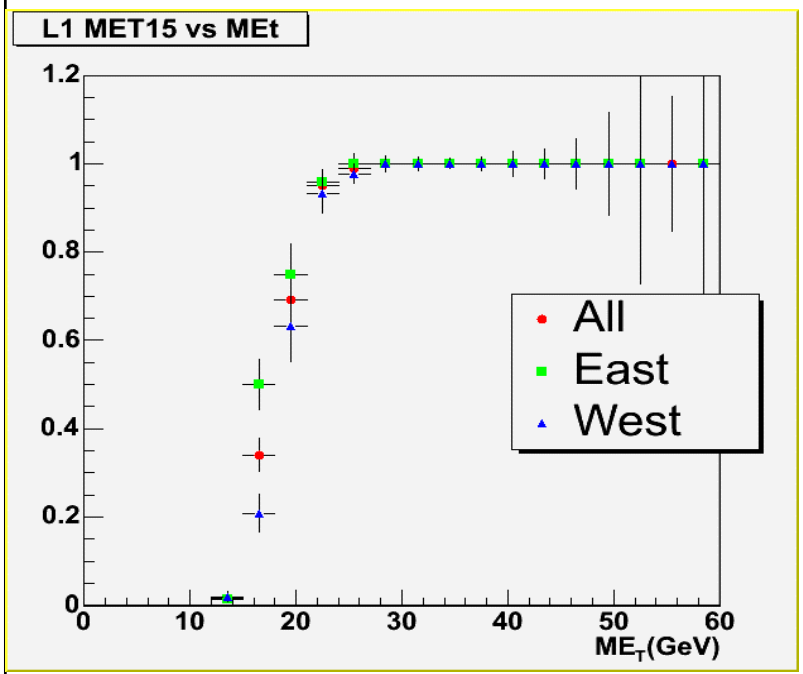
L2_PEM20 for the three run periods

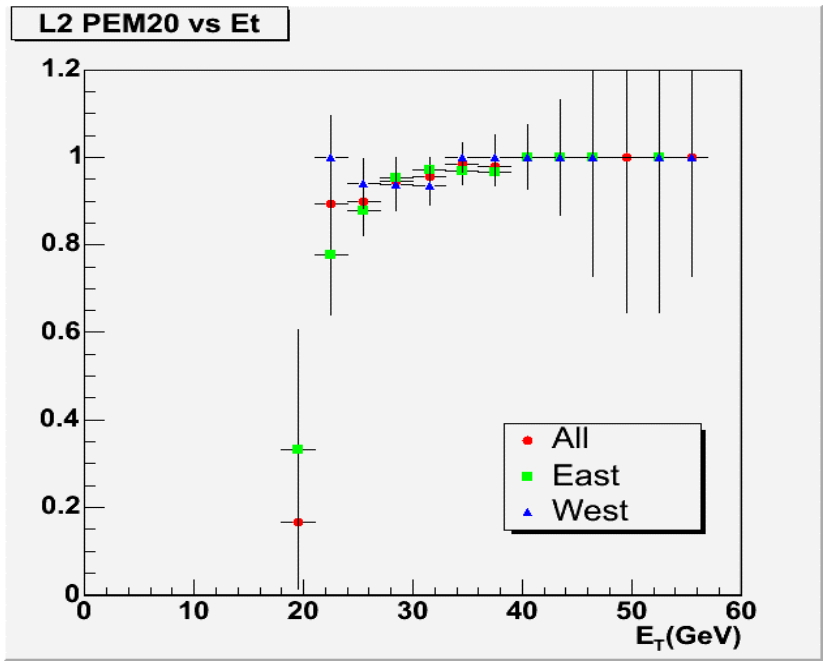


Trigger

Trigger efficiencies evaluated from data (backup triggers)

MET_PEM	PEM20_MET15	PEM20_L1_EM8_MET15	EM8_MET15





JET20 and L3_PEM20

Performed the same exercise on independent sample:
JET20(only preshutdown)
Can evaluate overall MET_PEM efficiency

$$\text{Eff(MET\_PEM)} = \frac{\text{MET\_PEM}}{\text{JET20 and offline selection}}$$

	Total	EAST	WEST
$\text{Eff(MET\_PEM)}_{\text{JET20}}$	84.2+/-9.4	90+/13	78+/-16

Evaluated L3_PEM20 from Z->ee (CP)
All events fired PLUG_ELECTRON_20 trigger bit
→Eff(L3_PEM20)=100%

Trigger Efficiencies

Preshut	Tot	East	West
L1_MET15	99.6+/-0.2	100+/-0.2	99.1+/-0.4
L3_MET15	99.9+/-0.1	100+/-0.2	99.8+/-0.3
L1_&_L3_MET15	99.5+/-0.3	100+/-0.2	99.6+/-0.2
L1_MET15 x L3_MET15	99.5+/-0.3	100+/-0.2	99.6+/-0.2
L2_PEM20	96.3+/-1.1	95.1+/-1.4	97.8+/-1.5
Overall	95.8+/-1.2	95.1+/-1.8	96.8+/-1.5
L1_MET15	99.7+/-0.2	99.8+/-0.3	99.7+/-0.4
L3_MET15	100+/-0.1	100+/-0.2	100+/-0.3
L1_&_L3_MET15	99.7+/-0.2	99.8+/-0.3	99.7+/-0.4
L1_MET15 x L3_MET15	99.7+/-0.2	99.8+/-0.3	99.7+/-0.4
L2_PEM20	97.4+/-1.4	97.4+/-2.1	97.4+/-2.1
Overall	97.2+/-1.4	97.2+/-2.2	97.1+/-2.2
L1_MET15	99.2+/-0.3	98.6+/-0.6	99.8+/-0.3
L3_MET15	99.9+/-0.1	99.8+/-0.3	99.8+/-0.3
L1_&_L3_MET15	99.1+/-0.3	98.4+/-0.6	99.8+/-0.3
L1_MET15 x L3_MET15	99.1+/-0.3	98.4+/-0.6	99.8+/-0.3
L2_PEM20	96.1+/-1.4	93.5+/-2.6	98.2+/-1.5
Overall	95.2+/-1.5	92.1+/-2.7	98.0+/-1.6

PreShut

Post1

Post2