W Charge Asymmetry

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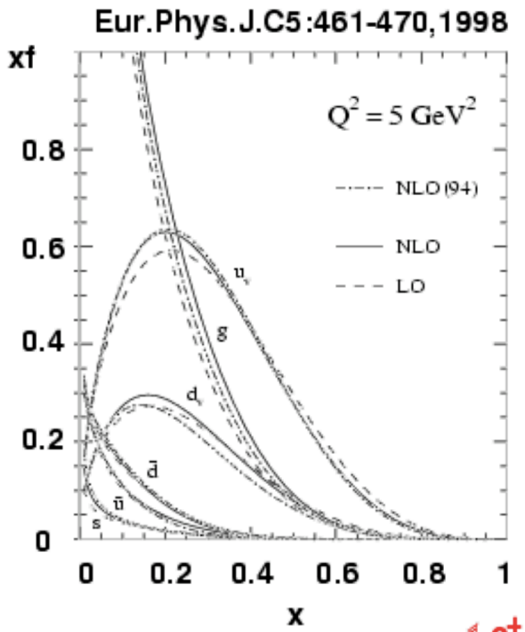
UCSB

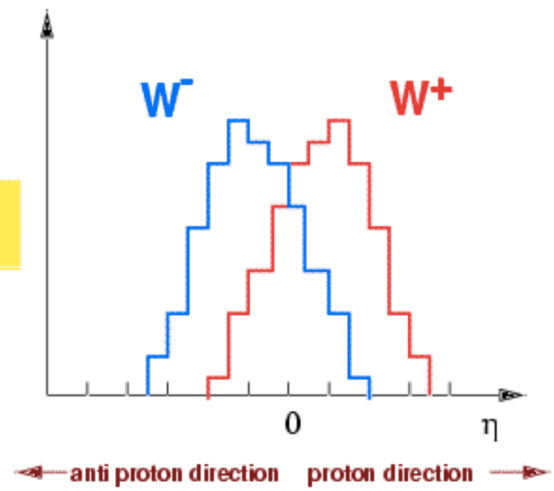
- CDF-Note 6282, Measurement of the W->e nu Charge Asymmetry
- CDF-Note 6108, Alignment of the Plug Calorimeter
- CDF-Note 6412, QCD Background of Plug W's

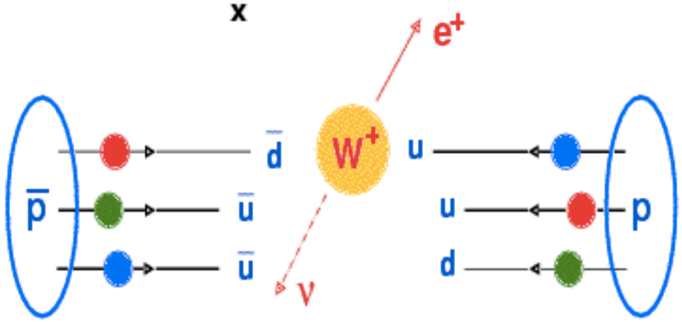
W Charge Asymmetry



u higher momentum

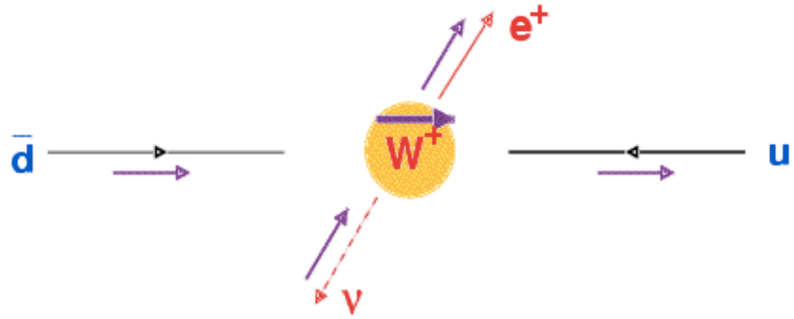
$u_V : d_V = 2 : 1$



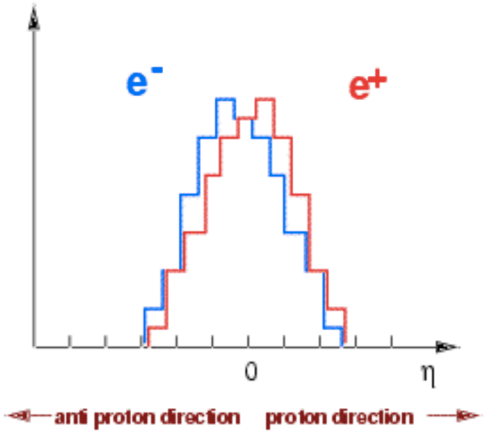


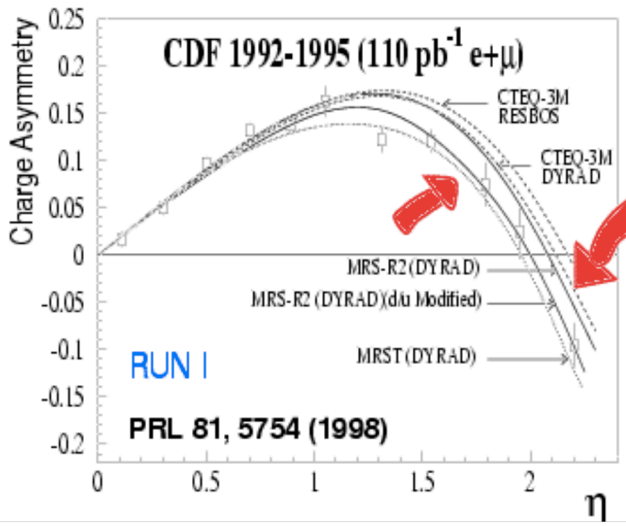
W^+ boosted in p direction
W^- boosted in $\bar{p}$ direction

W Charge Asymmetry



$$A_l(\eta) = \frac{d\sigma(e^+)/d\eta - d\sigma(e^-)/d\eta}{d\sigma(e^+)/d\eta + d\sigma(e^-)/d\eta} \simeq \frac{d(x)}{u(x)}$$





most sensitive

Lepton and Charge ID up to high $|\eta|$

Essentials for W Charge Asymmetry

Plug electron identification with Phoenix SiTracking

- Plug and Silicon
- Charge determination

Charge ID

Charge determination critical.

Charge misidentifation fq=wrong/total dilutes the asymmetry.

Correct for it

$$A_{true} = A_{meas}/(1-2fq)$$

So, make fq small and measure it.

MC predicts fq ~ 1%.

But MC has no residual mis-alignments, etc-->

We must measure fq in data.

Measured fq(eta) with Z->e+ e-

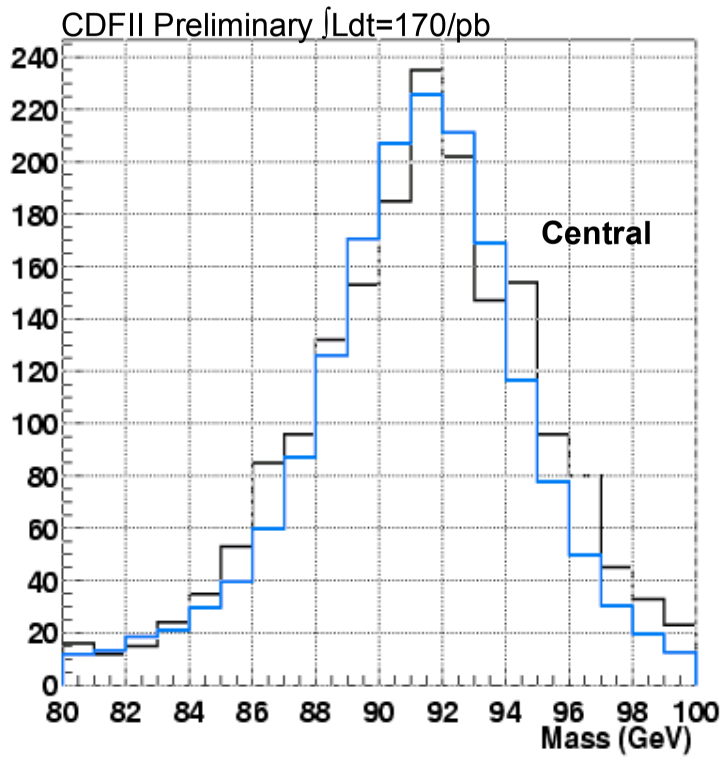
Z Event Selection

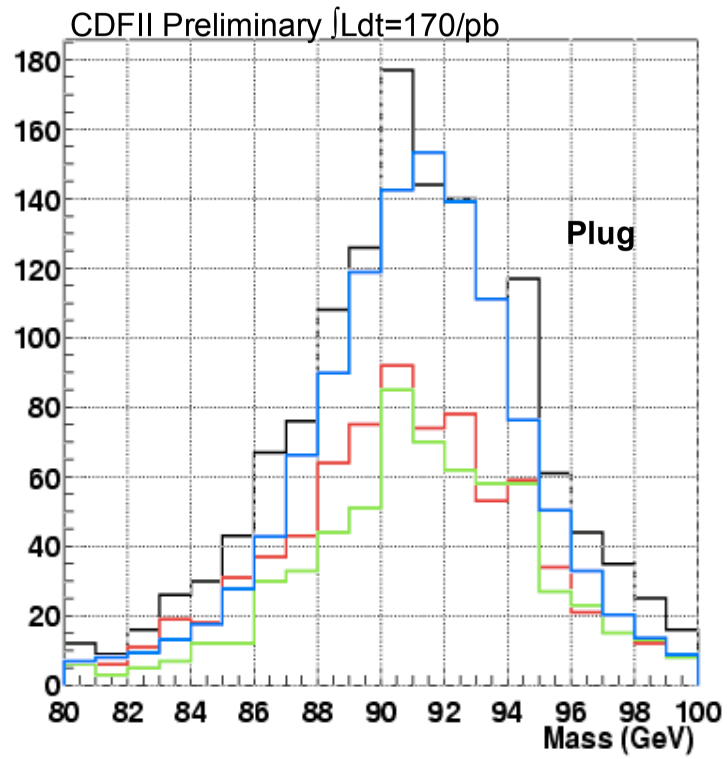
- Baseline electron selection with COT or Phoenix Track and Et>25GeV.
- Phoenix Track selection optimized for small fq
  - # SiRPhiHits >= 4
  - Chi2 < 8
  - Delta Chi2 > 0.5
  - Pull < 0.4

$$\frac{(\text{Chi2_Seed/dof for track with lesser Chi2_total/dof})}{(\text{Chi2_Seed/dof for track with greater Chi2/dof})}$$

- 80 < M_{ee}<100 GeV and compare central Qtag

M_{ee} Distribution



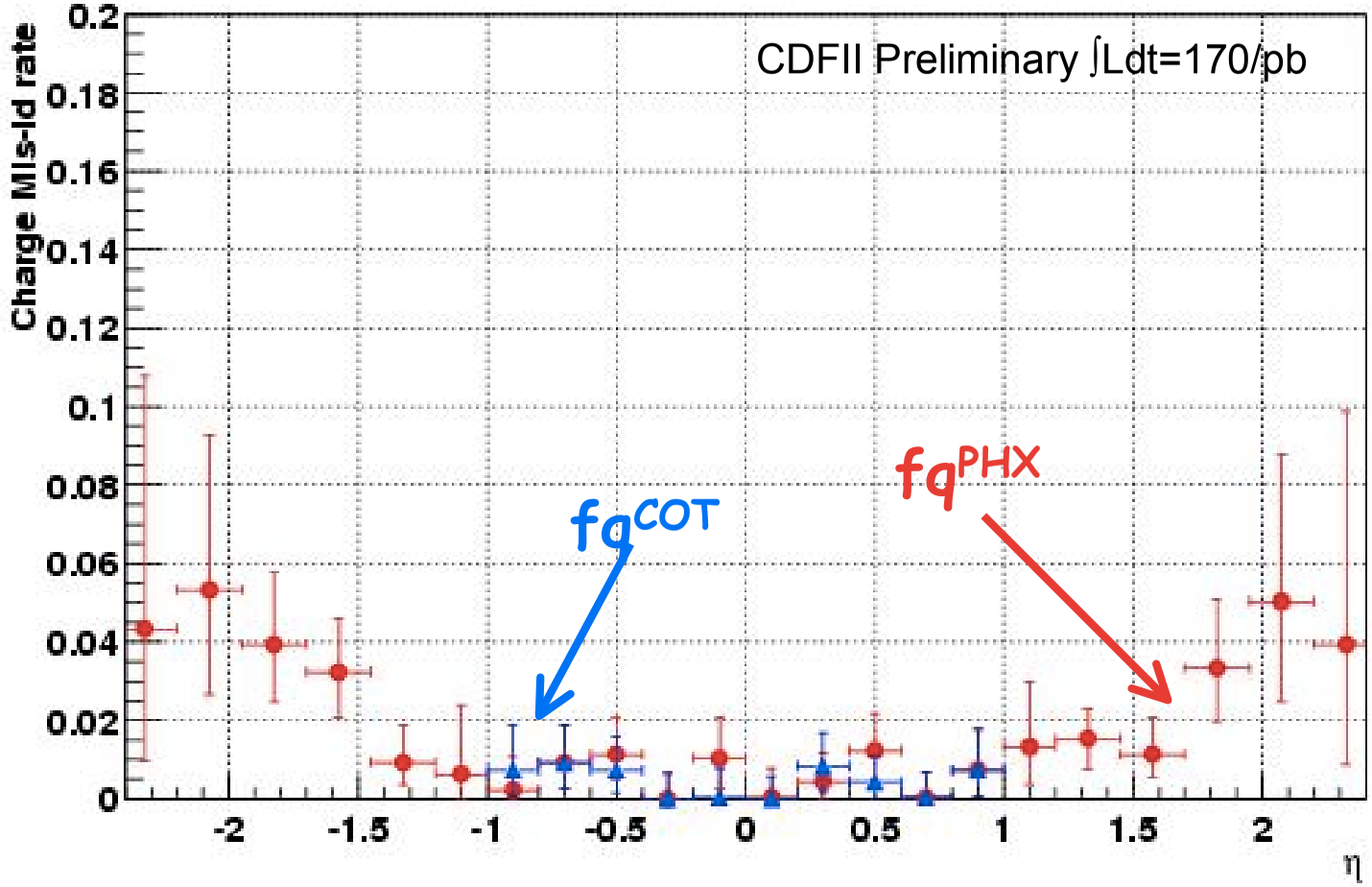


Data (west, east)

Corrected energy scale in MC

MC

Charge Mis-ID Rate



Errors calculated with Bayesian prescription; CDF5894

W Event Selection

Baseline electron selection w/ PHX track.

E_T>25 GeV

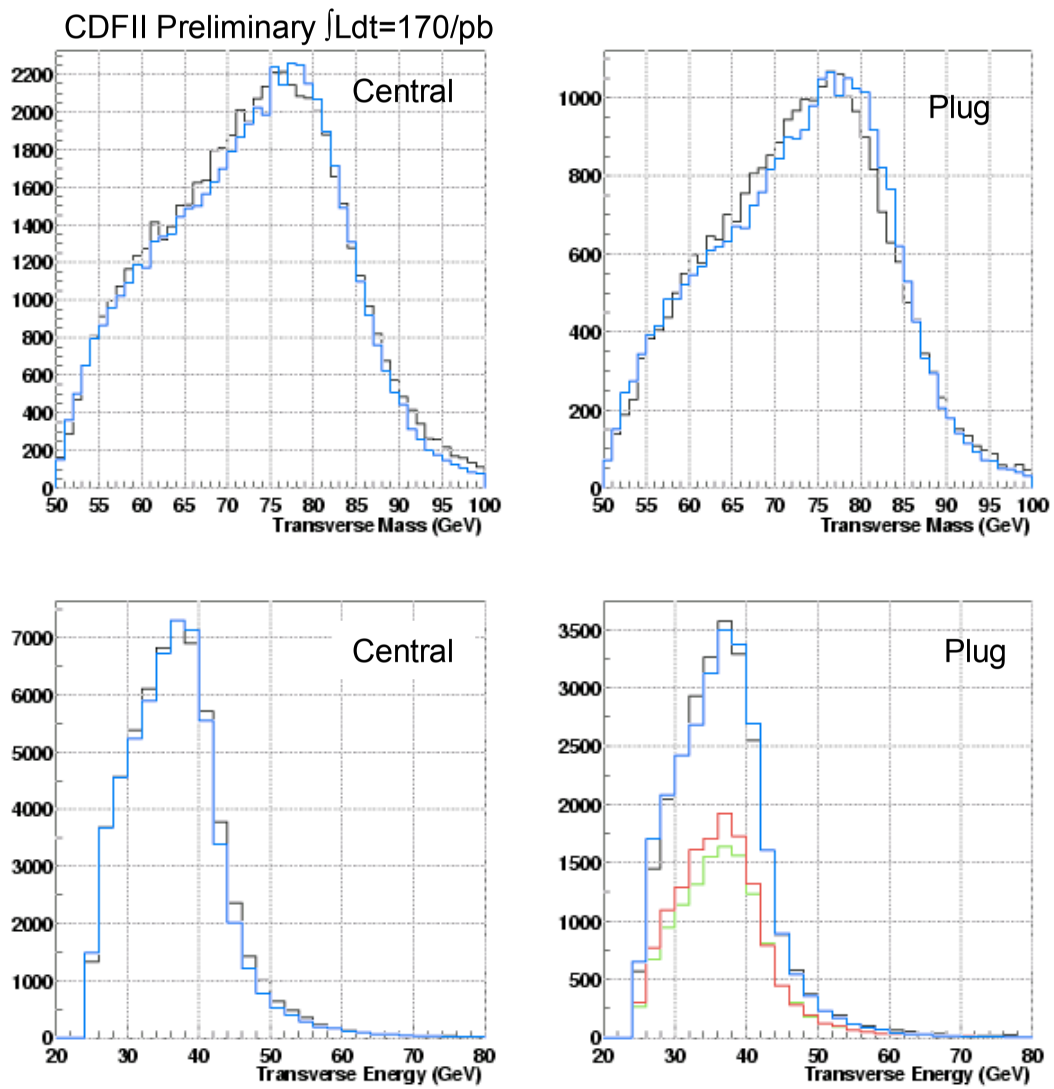
Missing E_T > 25 GeV

50 < M_T < 100 GeV/c^2

No other EMO with E_T>25 GeV

to suppress QCD and DY

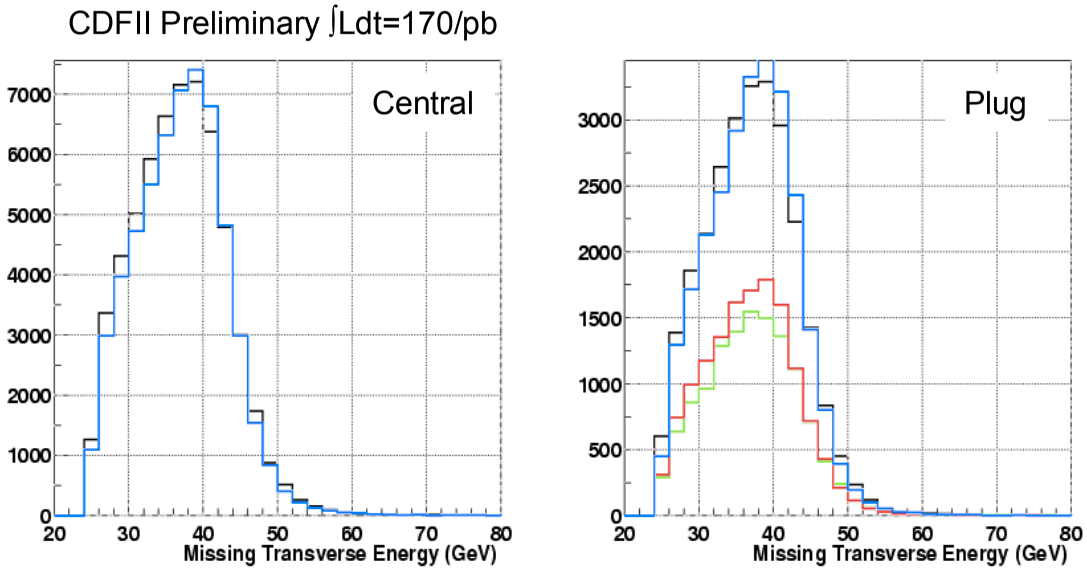
Kinematic Distributions: M_T and E_T



Data (west, east)

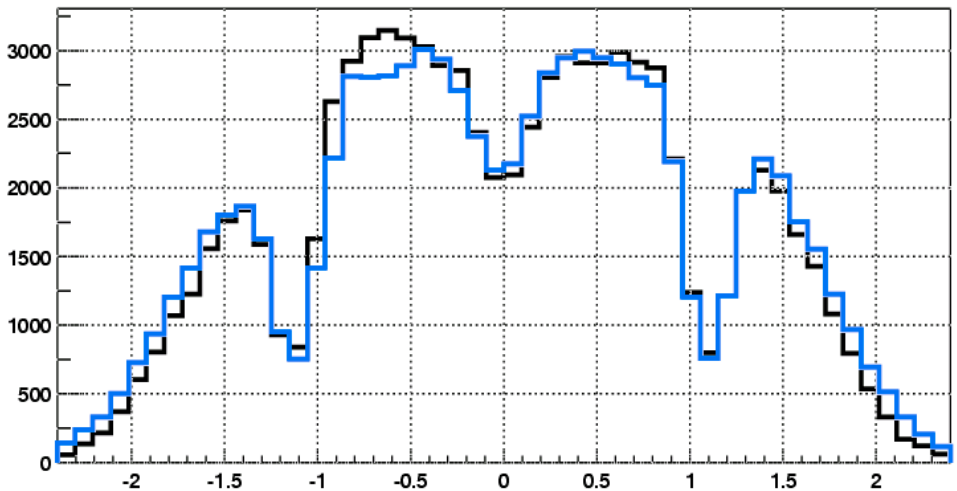
MC

Kinematic Distributions: ME_T and

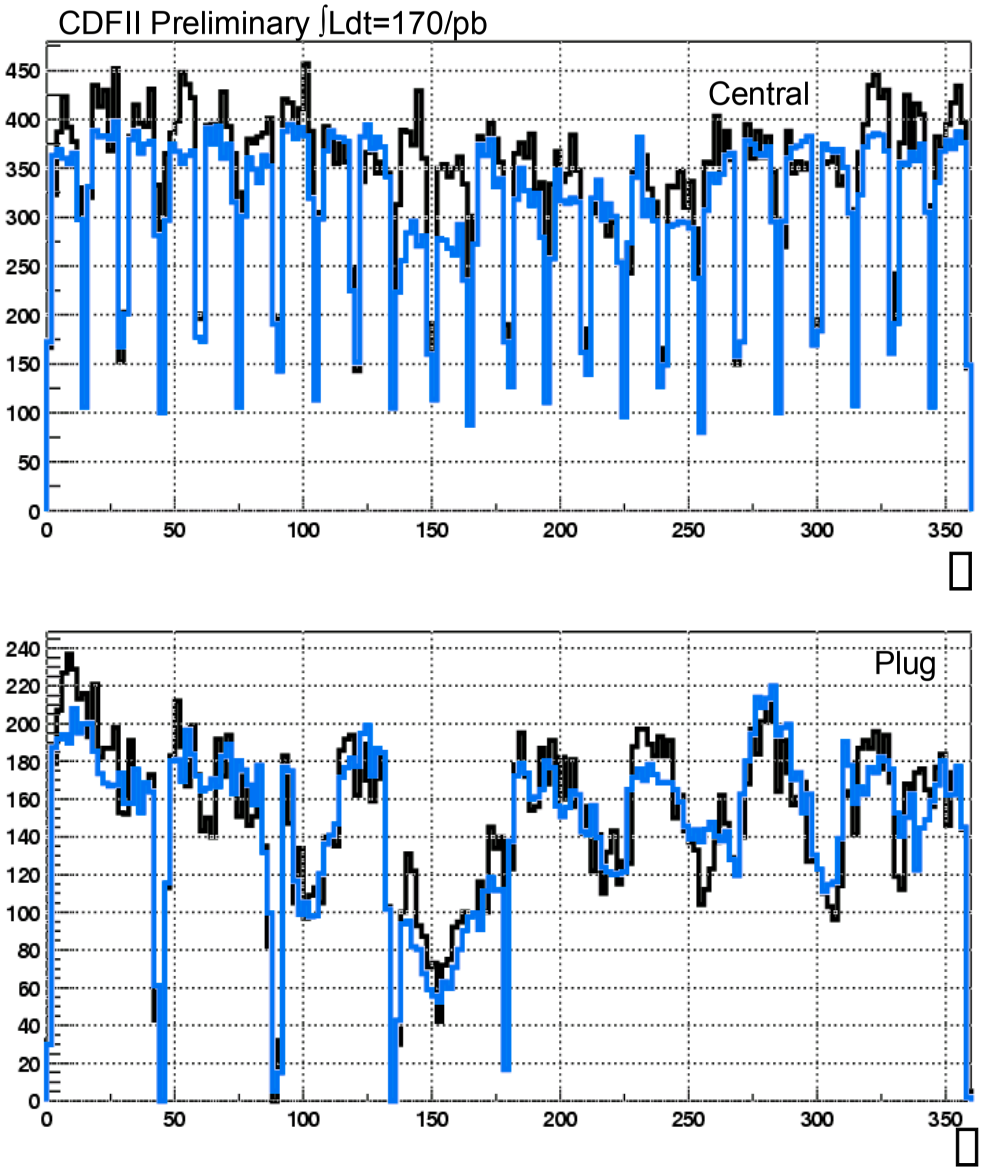


Data (west, east)

MC



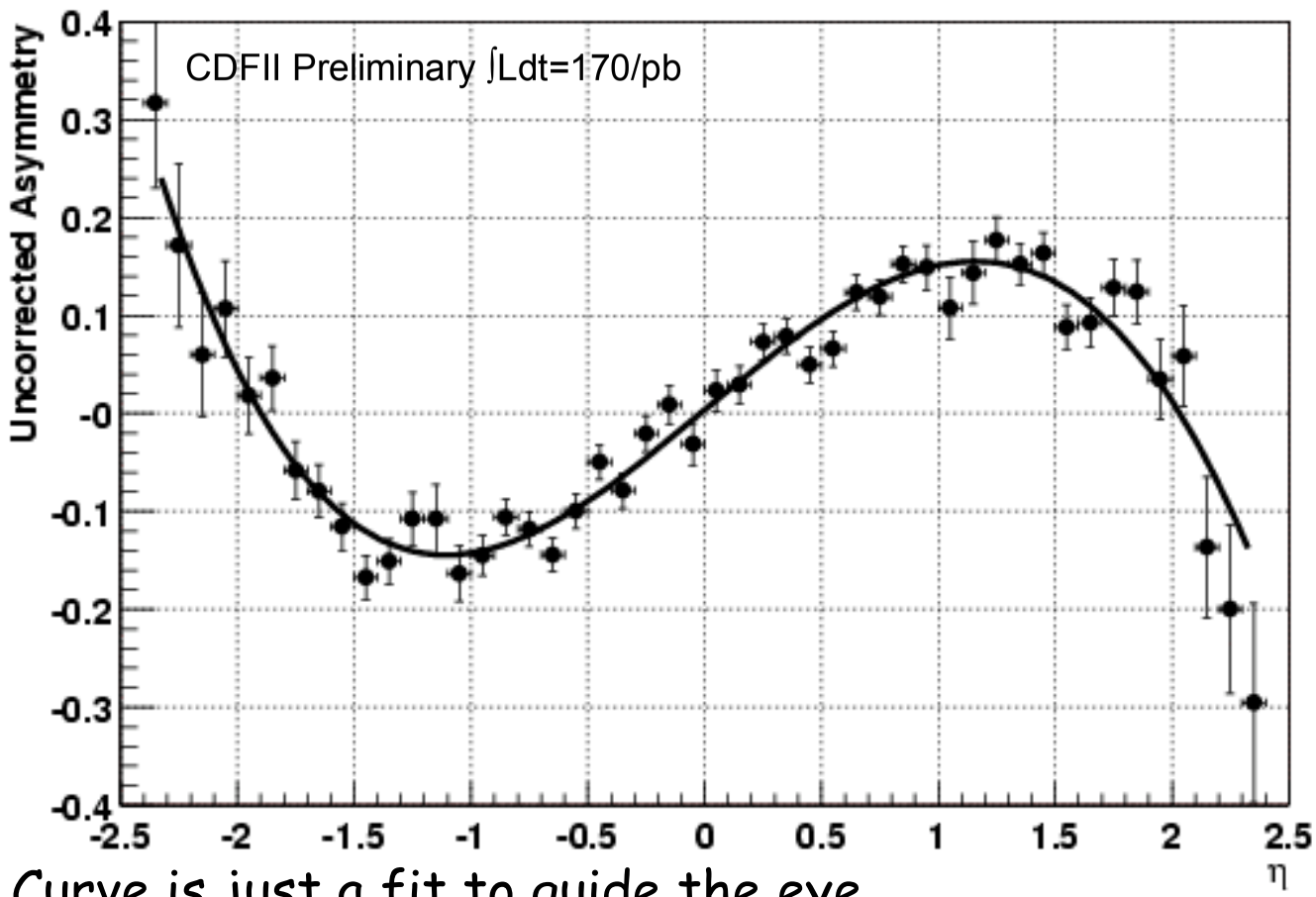
Kinematic Distributions:



Data

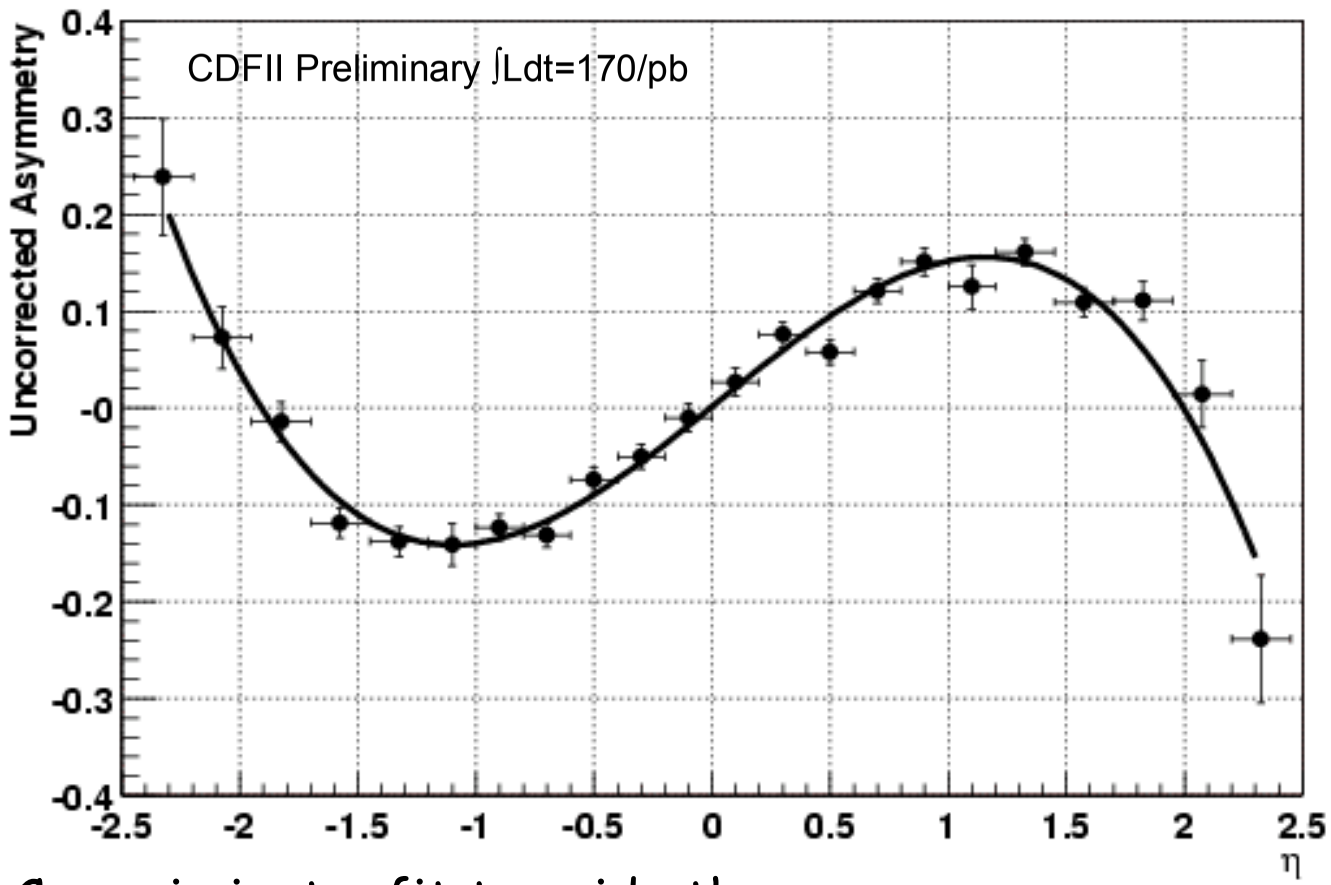
MC

Raw Asymmetry



Curve is just a fit to guide the eye.

Raw Asymmetry



Curve is just a fit to guide the eye.

Background

We correct the asymmetry for backgrounds from:

- W → τν → e (trippled statistic)

  Asymmetric, measured from MC

- Z → e^+e^-

  Asymmetric, measured from MC

- QCD

  Symmetric, measured from data CDF 6412.

  Use Iso vs MET.

QCD Background systematic

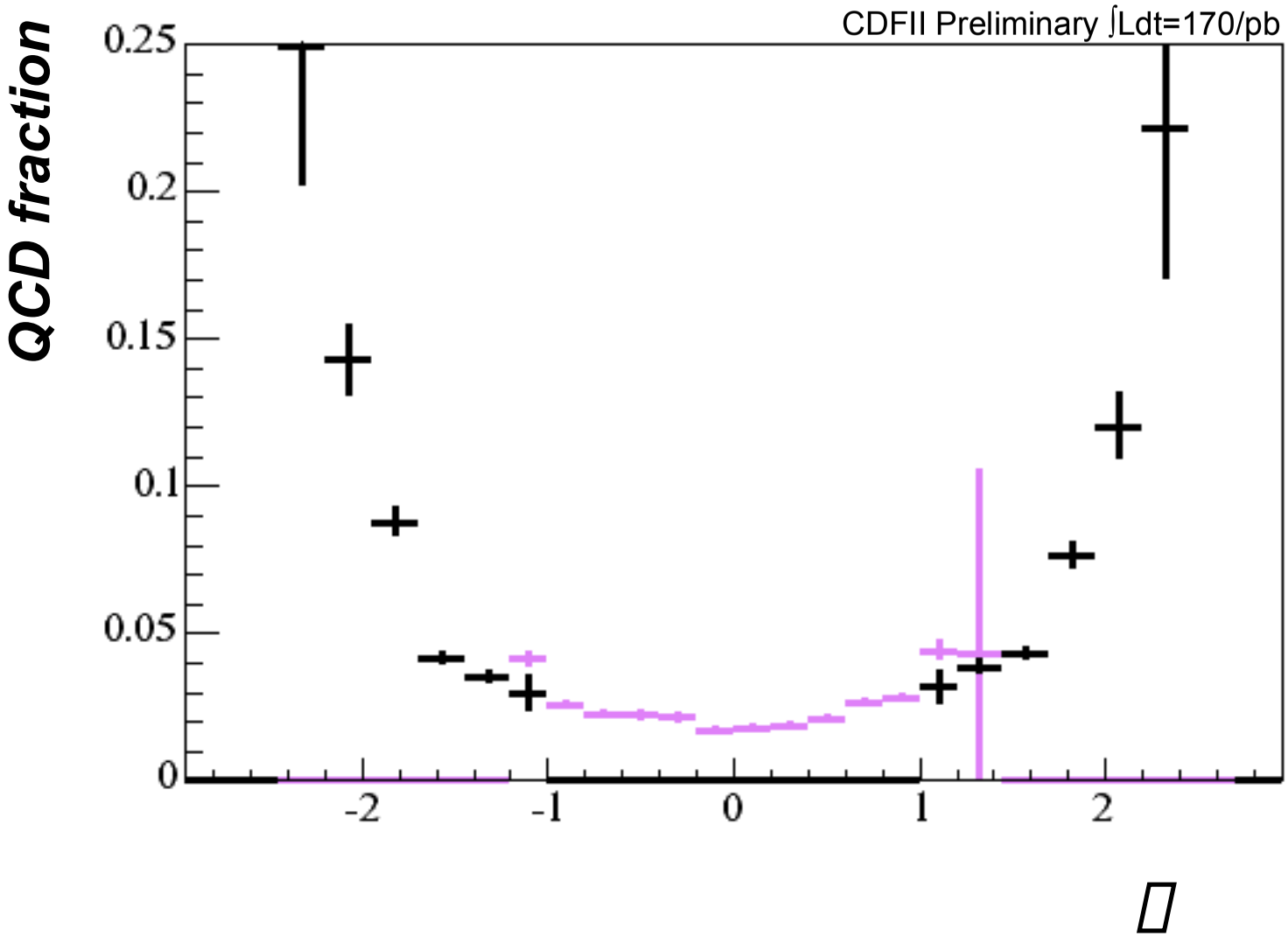
Check assumption of non-correlation

 small systematic, as long as we don't use the

PEM 3x3 2 or 5x9 cuts (they are correlated with Iso)

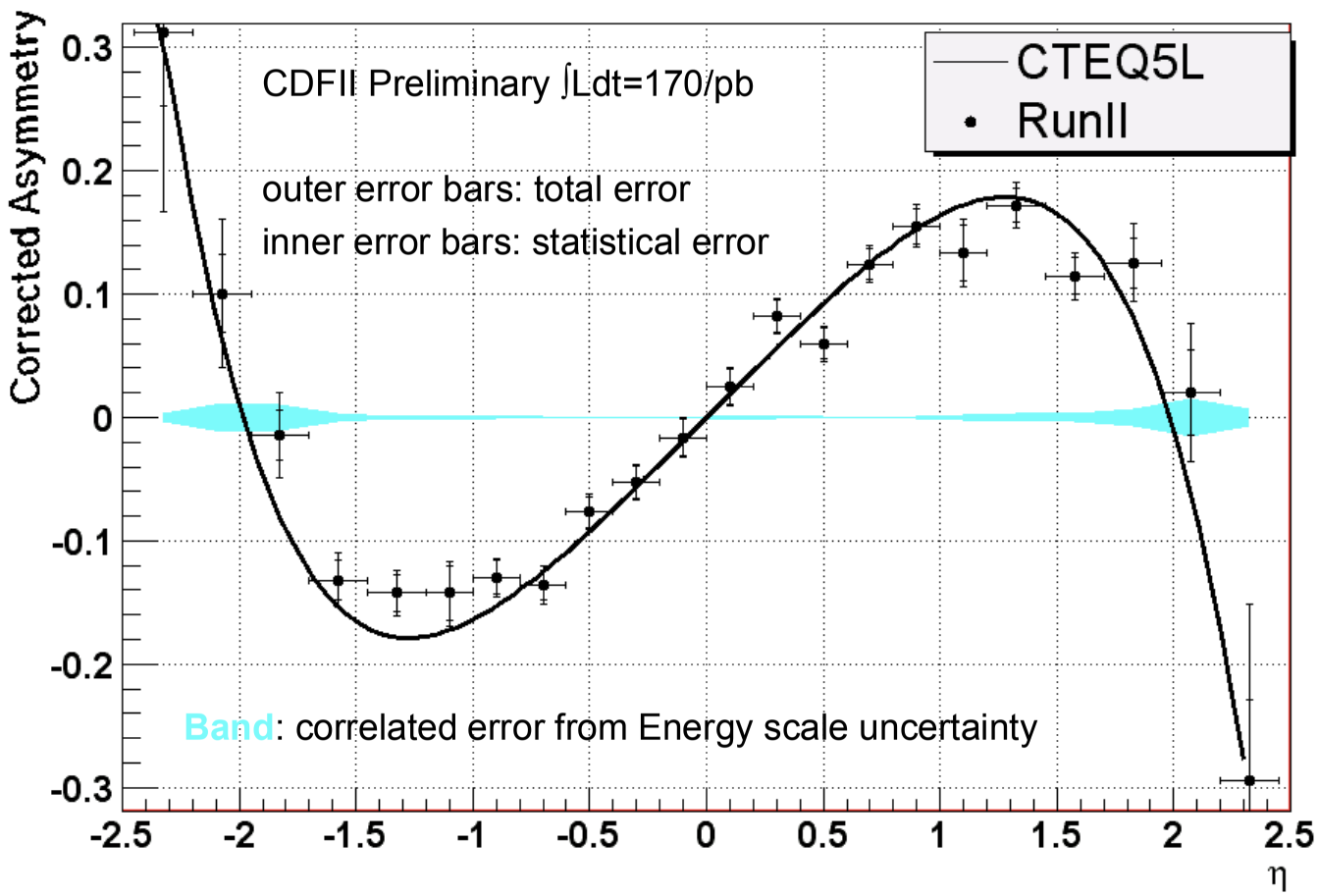
 upper limit by about a factor of 2.

QCD Background

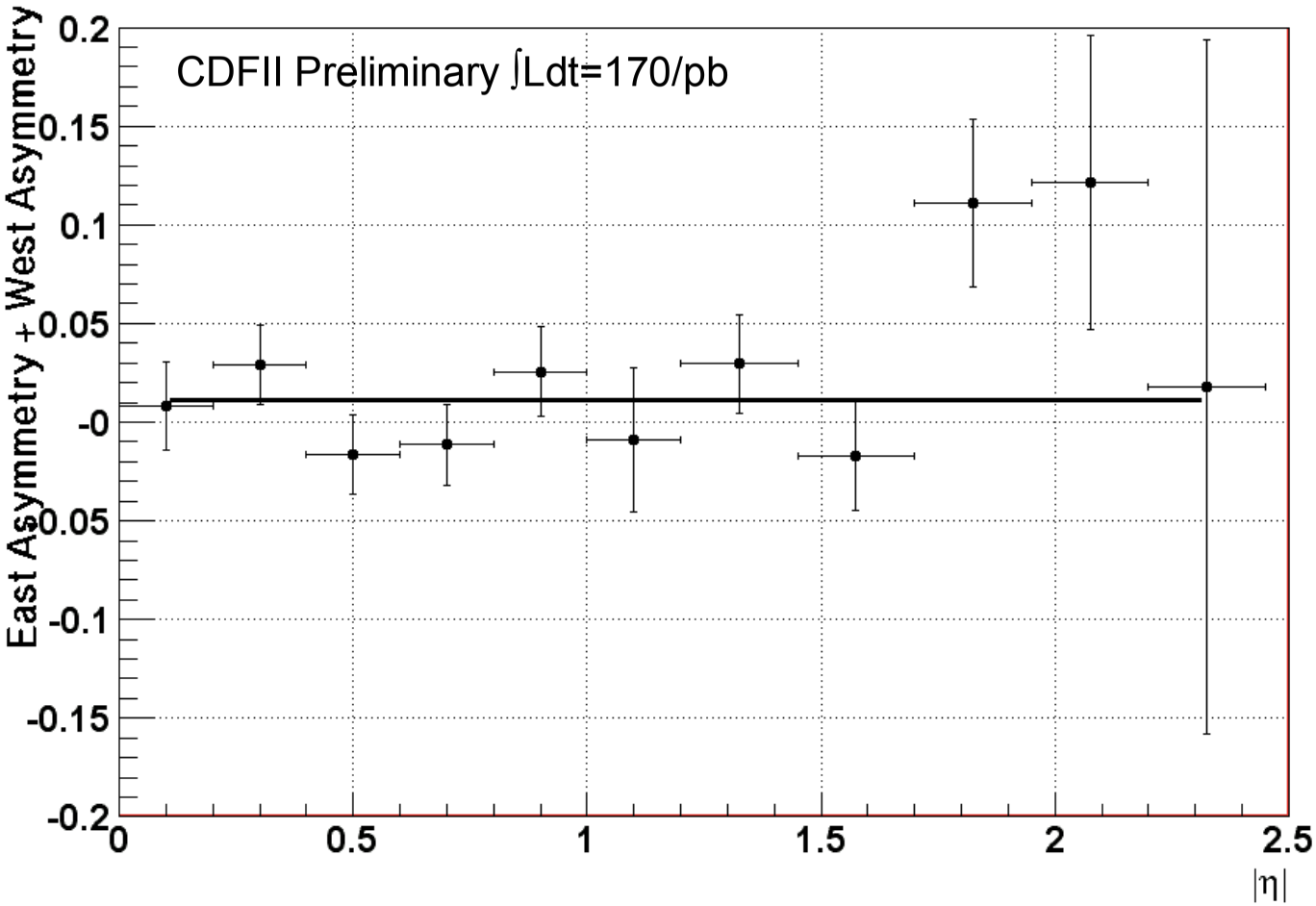


We use 0.5 ± 0.25. Becomes significant for η >1.8

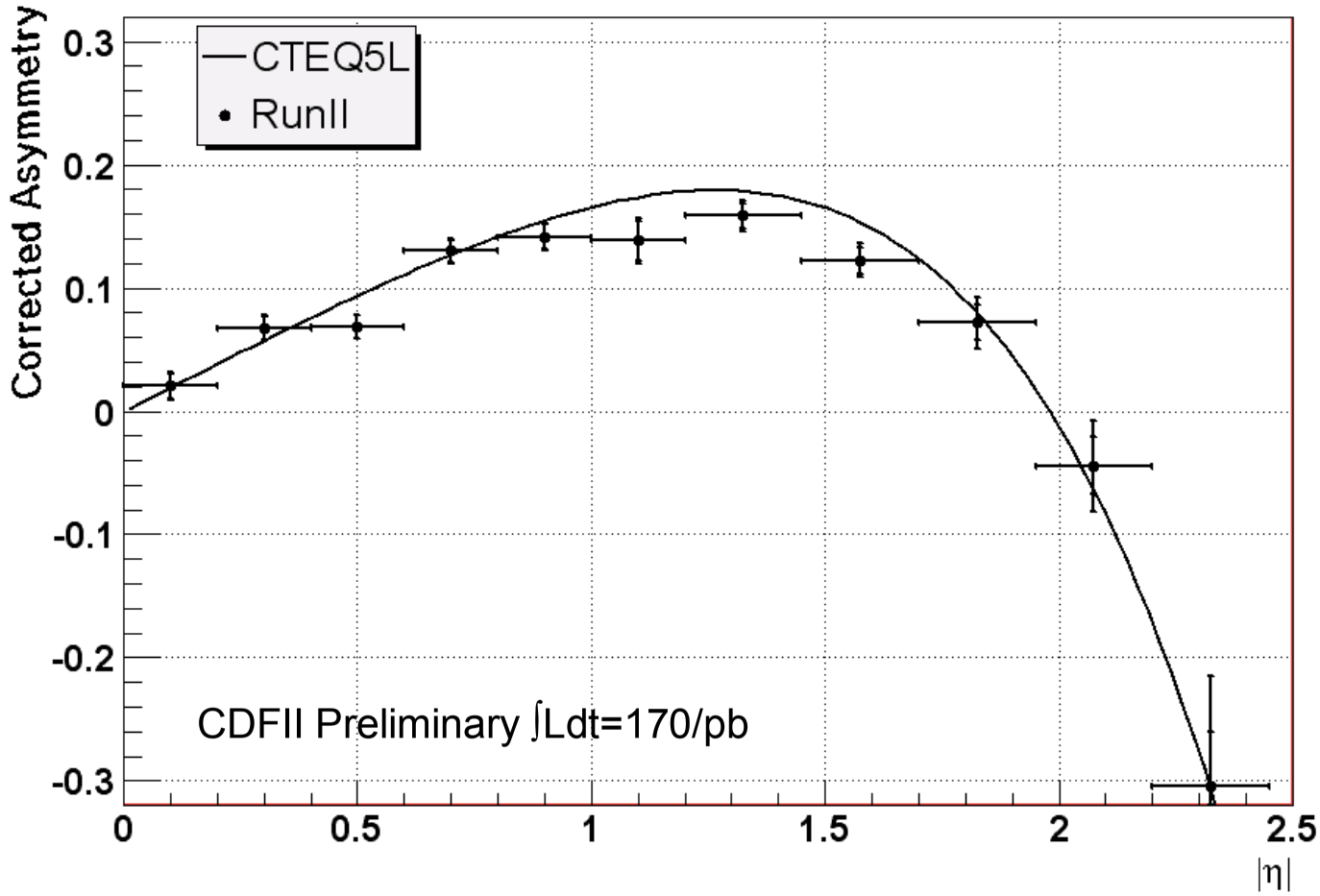
Corrected Asymmetry



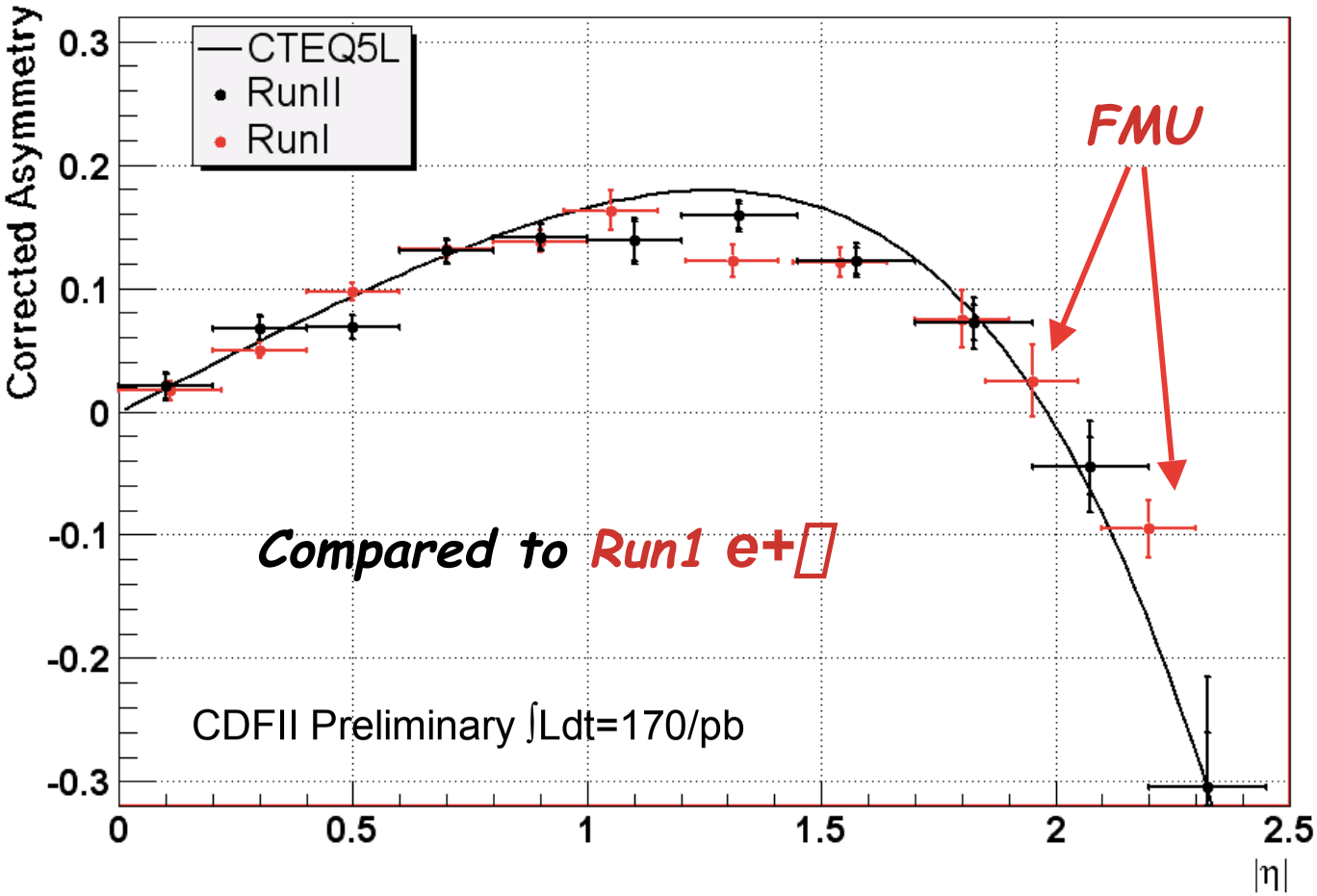
CP Check


CDFII Preliminary ∫Ldt=170/pb
East Asymmetry + West Asymmetry
0.2
0.15
0.1
0.05
-0
-0.05
-0.1
-0.15
-0.2
0
0.5
1
1.5
2
2.5
|η|

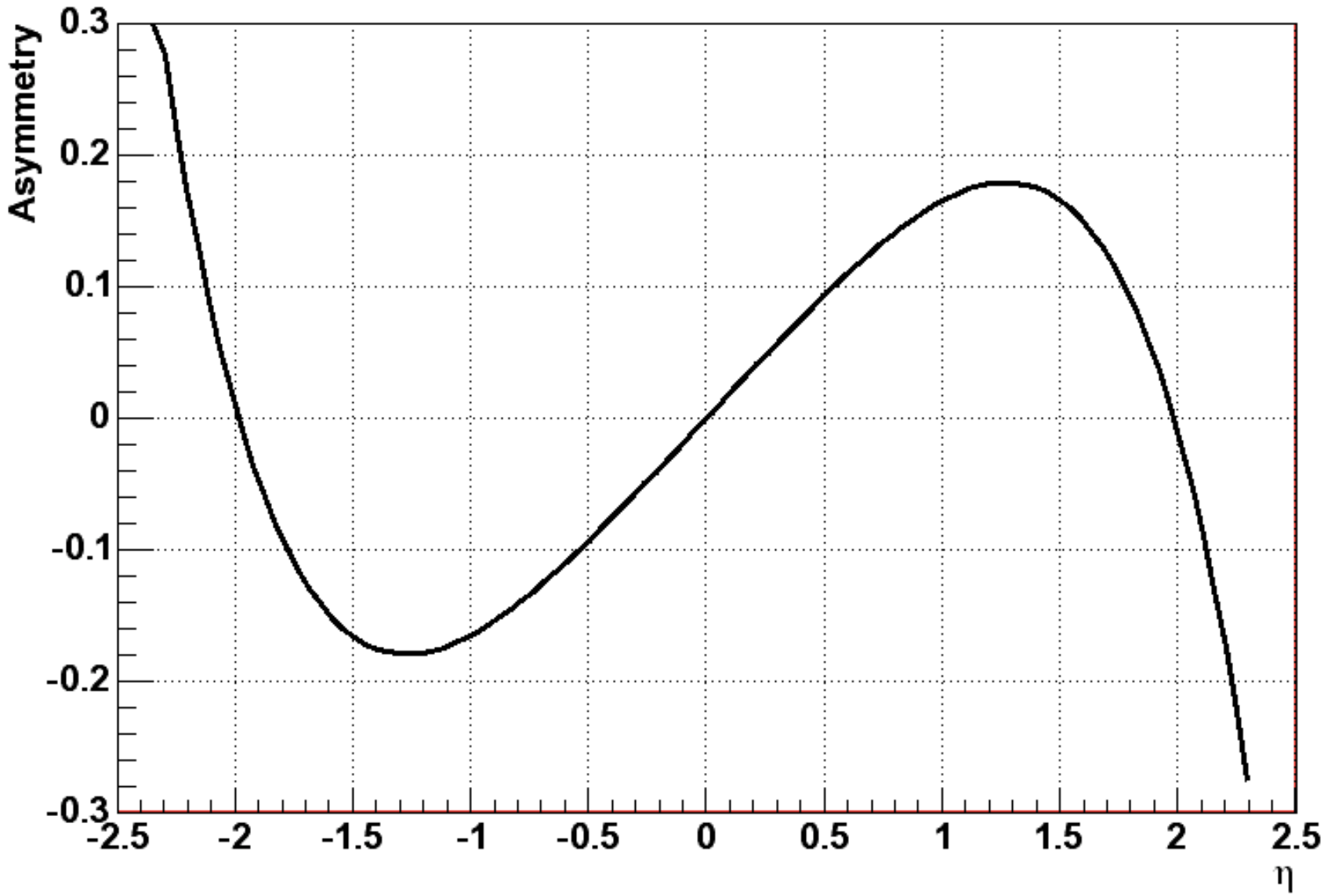
A(|□|)


Corrected Asymmetry
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
CTEQ5L
RunII
CDFII Preliminary ∫Ldt=170/pb
0
0.5
1
1.5
2
2.5
|η|

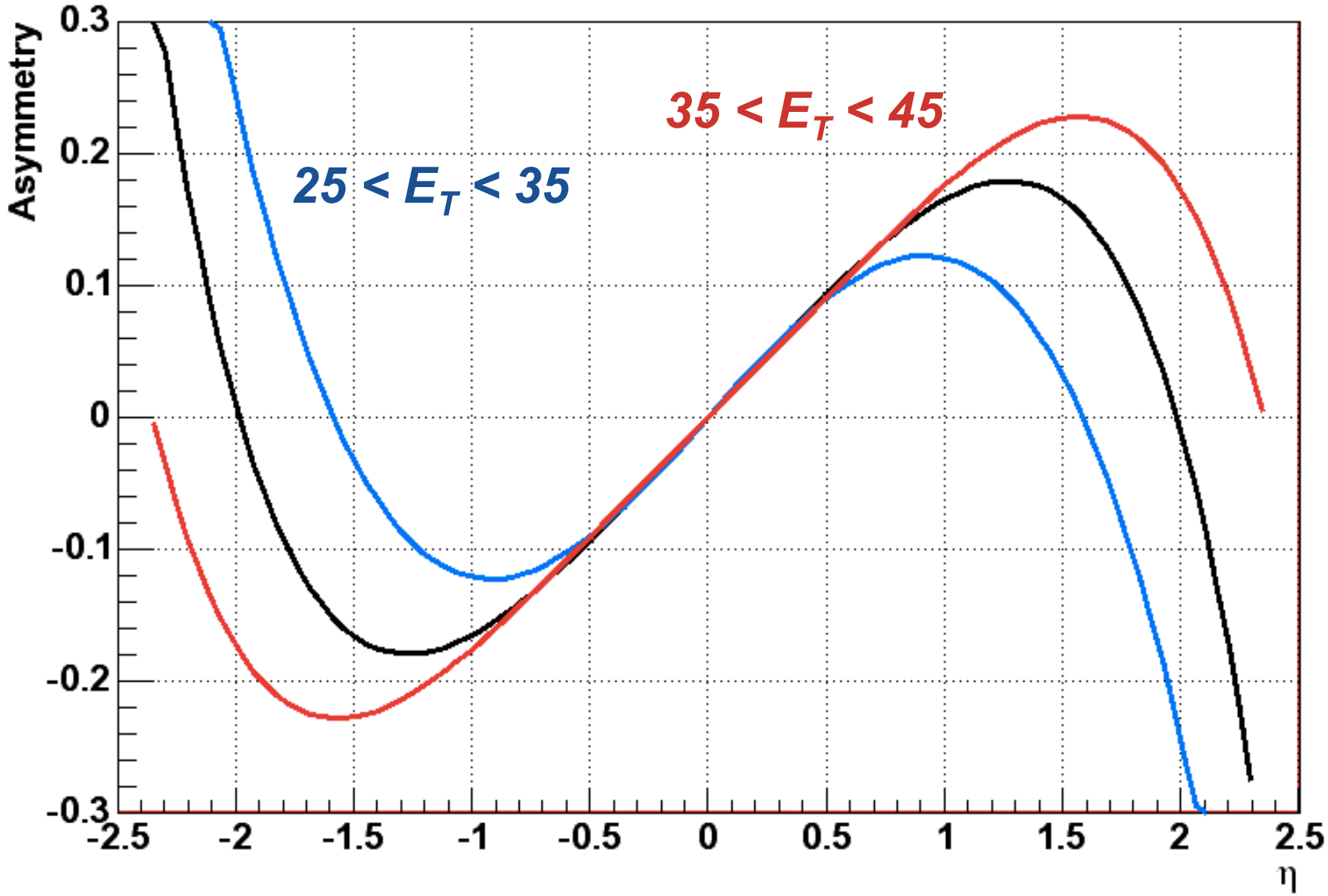
A(|□|)


Corrected Asymmetry
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
CTEQ5L
RunII
RunI
FMU
Compared to Run1 e+□
CDFII Preliminary ∫Ldt=170/pb
0
0.5
1
1.5
2
2.5
|η|

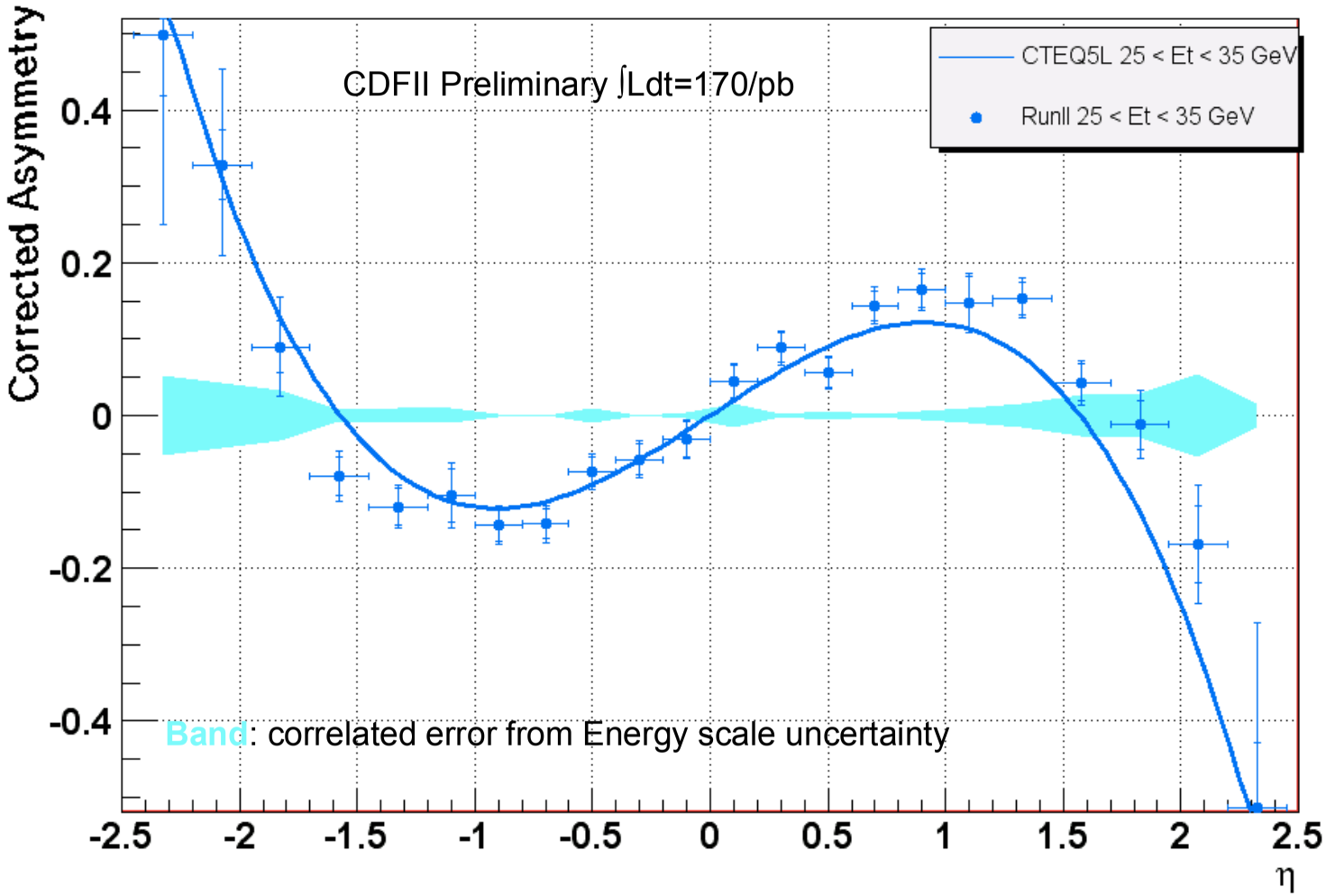
Getting more sensitivity to A_W



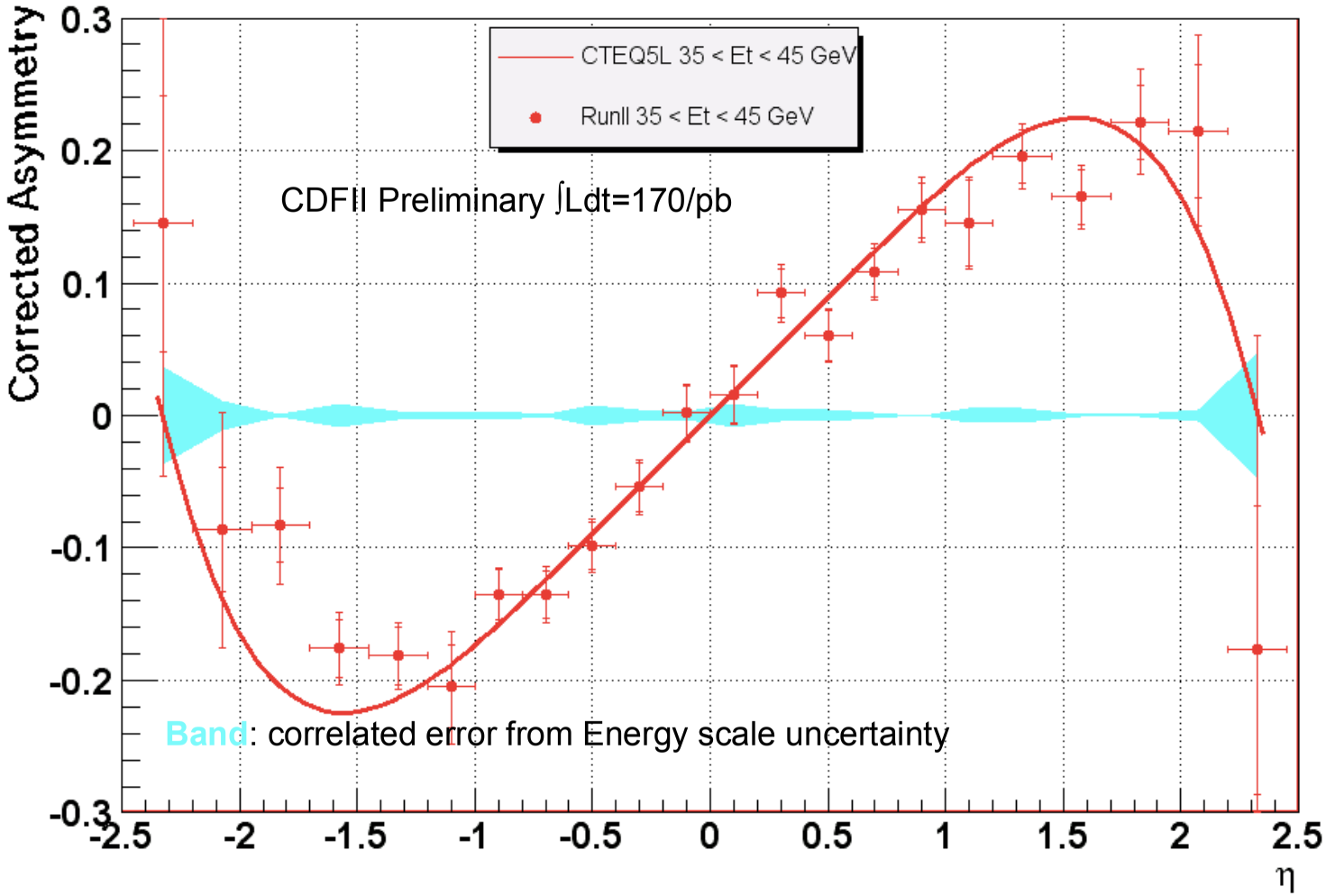
Getting more sensitivity to A_W



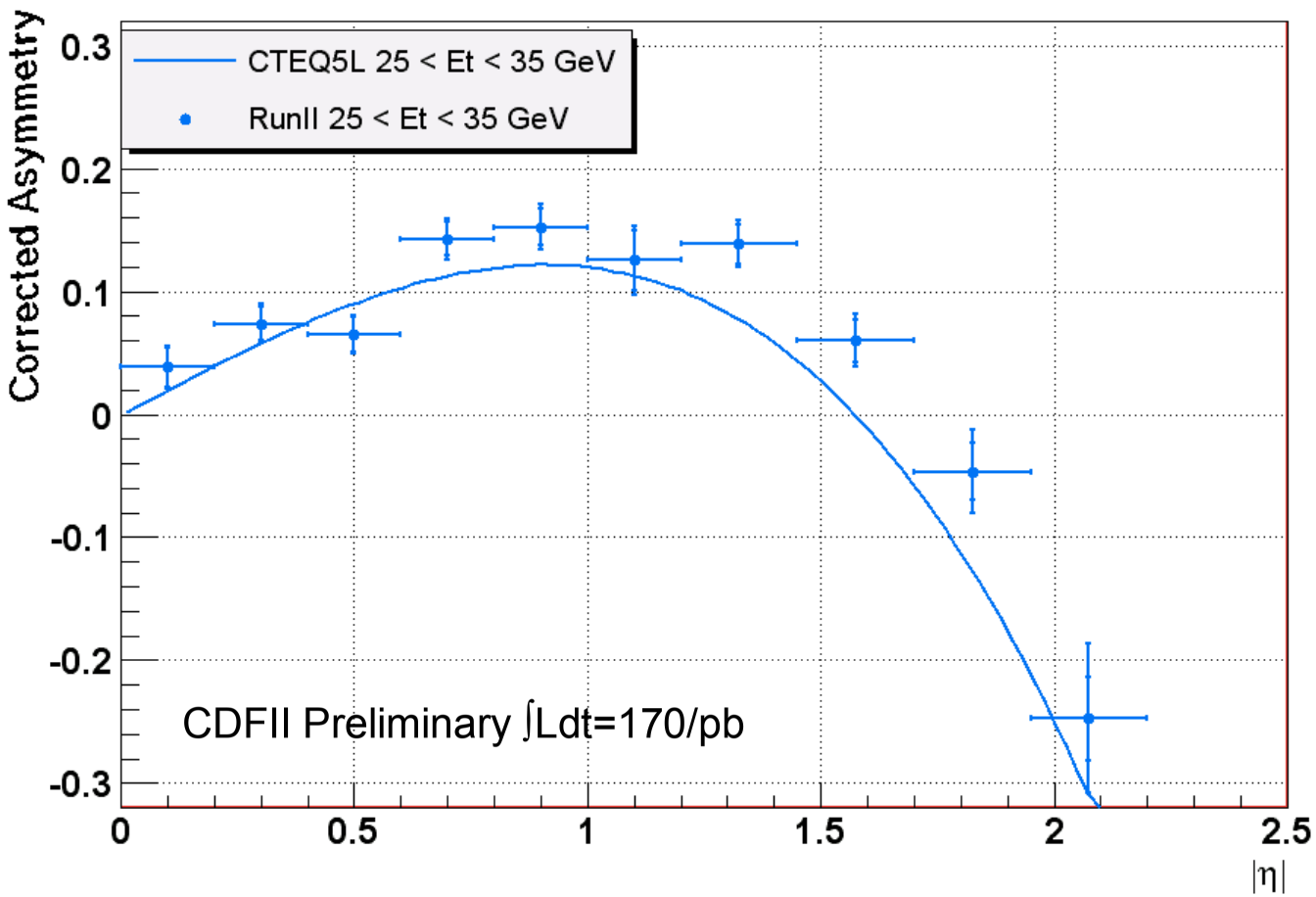
A_W for 25 < Et < 35 GeV



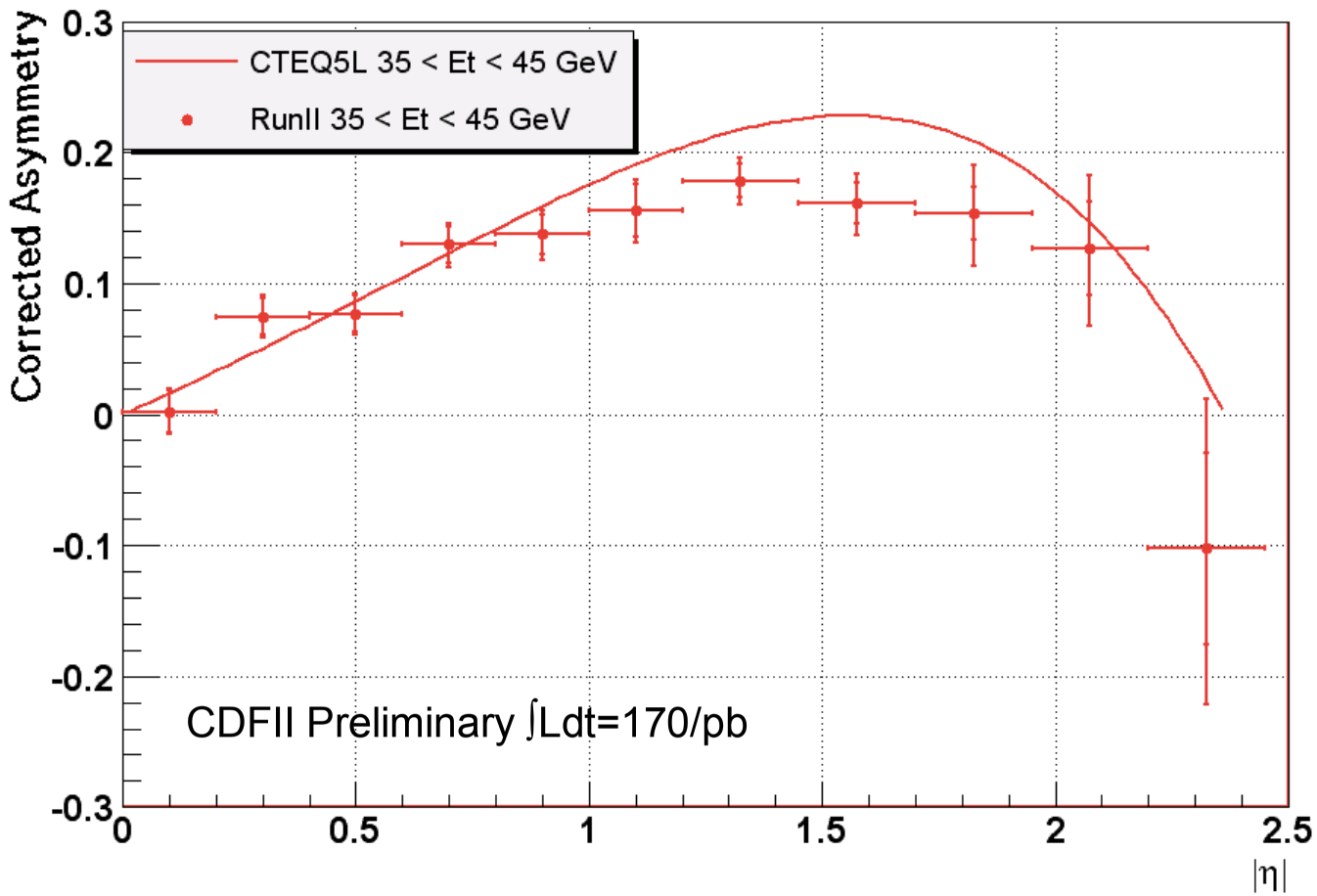
A_W for 35 < Et < 45 GeV



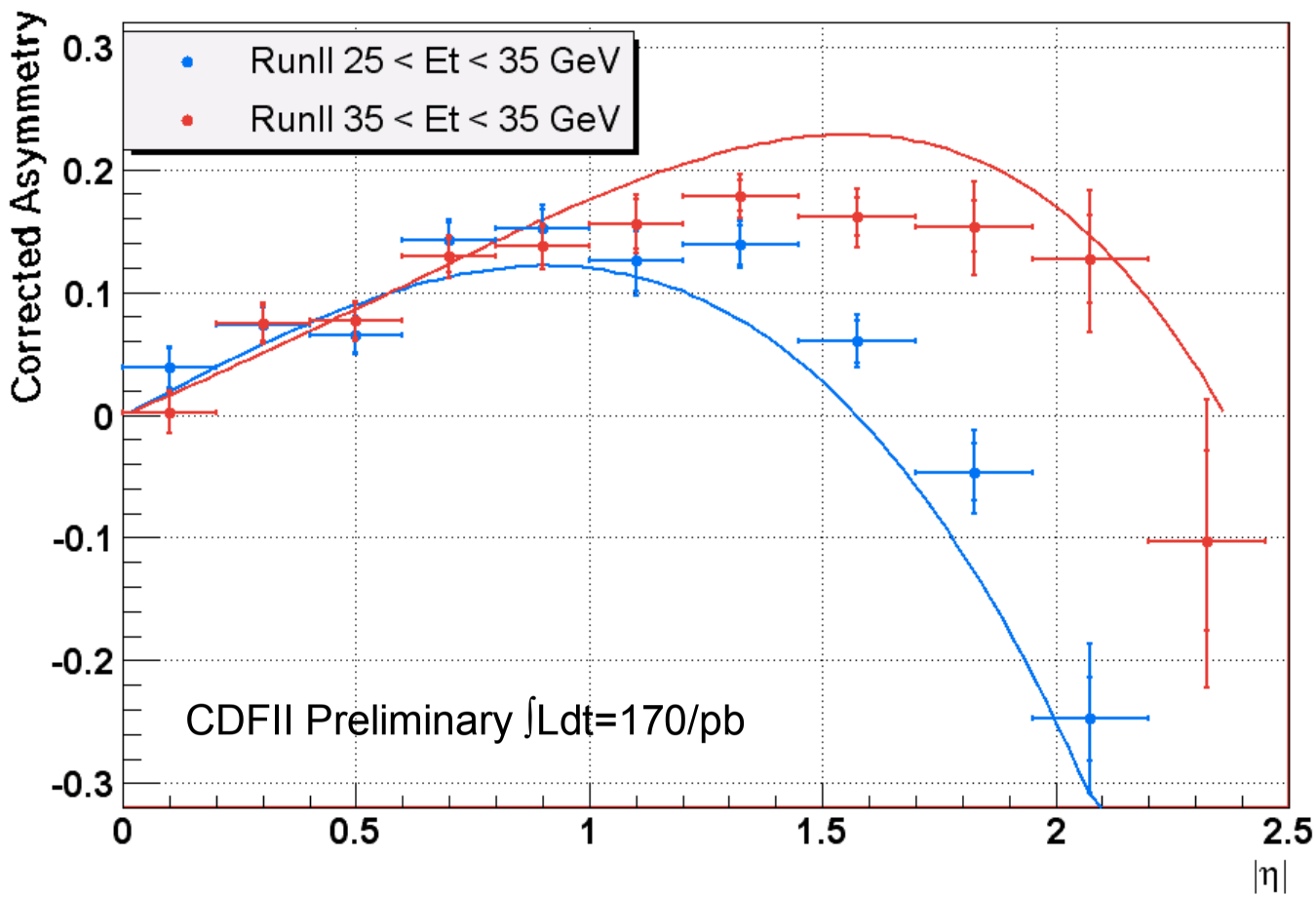
$A_W(\eta)$ with $25 < E_T < 35$ GeV



$A_W(\eta)$ with $35 < E_T < 45$ GeV

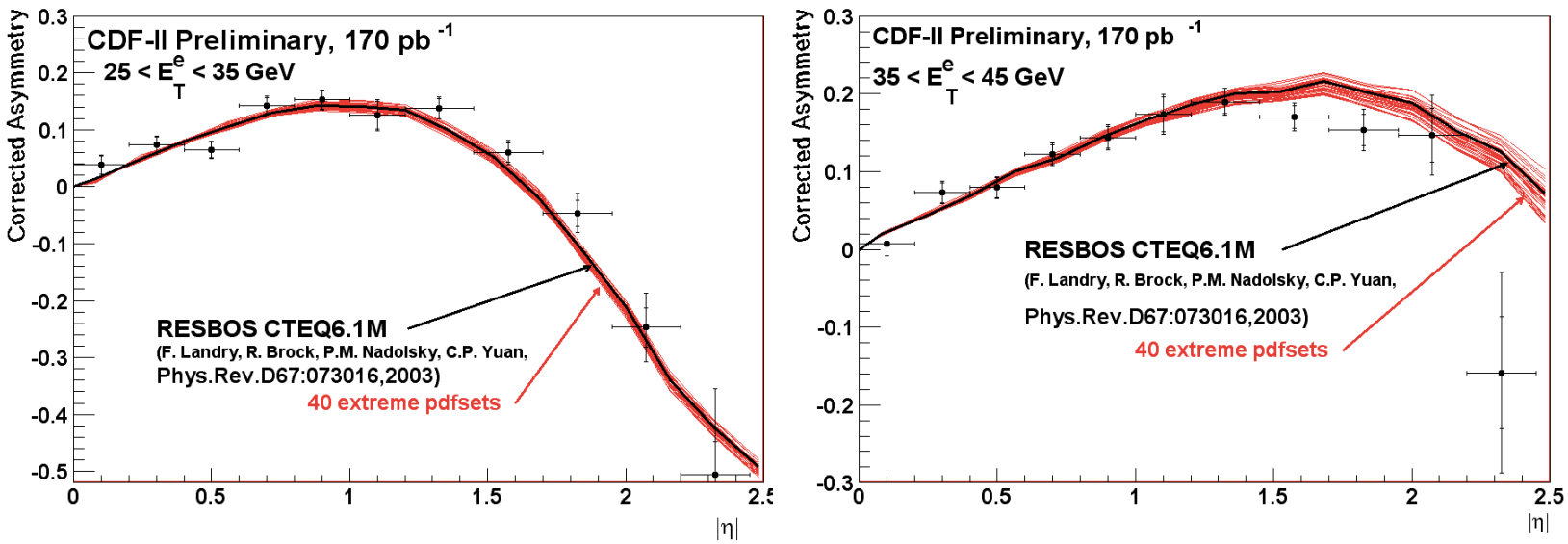


$A_W(\eta)$ for different E_T ranges



Conclusion

- We measured the W Charge Asymmetry
- Provides new PDF constraints



Joey Huston, CTEQ6.1 (ResBos NLO,NLL)

Higher Pt prediction indicates that data has more pdf discrimination