Photoproduction of isolated photons with a jet at HERA.

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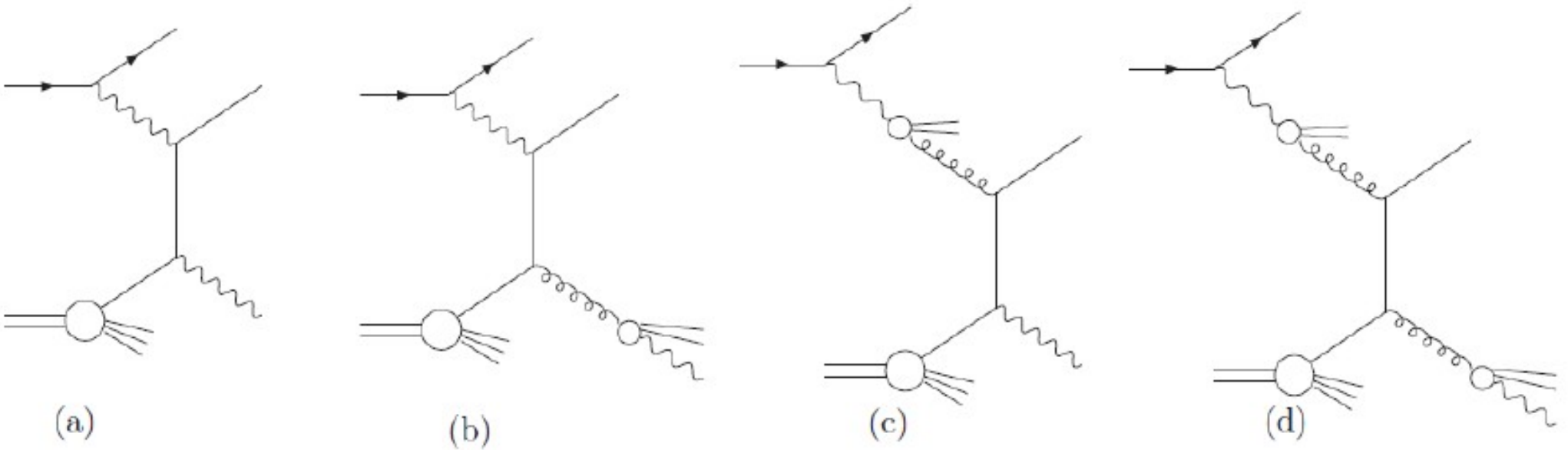
Introduction



A prompt photon is one that emerges directly from a perturbative QCD process. LO diagrams are illustrated above:
(a) direct, in which the entire incoming photon interacts,
(c) resolved, in which a parton from the photon interacts.

Higher order pQCD processes occur and also "fragmentation" processes (b, d).

Motivation

- Prompt (isolated, high p_T) photons are a useful tool to study and test QCD.

- Their measurements are more precise than hadronic jets.

- Prompt photons can be used to measure and constrain the pdfs of proton and photon.

- Looking at three new variables: x_p, $\Delta\Phi$ and $\eta^{\gamma} - \eta^{jet}$.
- Study of three regions of x_γ – longitudinal momentum transfer from photon, resolved- and direct-enhanced:

$$x_\gamma < 0.8 \text{ and } x_\gamma > 0.8$$

and to remove more of the remaining direct component:

$$x_\gamma < 0.7$$

Theory

FGH (Fontannaz, Guillet and Heinrich) - the LO and NLO diagrams and the box-diagram term are calculated explicitly. Fragmentation processes calculated in terms of fragmentation function.

LMZ (Lipatov, Malyshev and Zotov) - k_T-factorisation method makes use of unintegrated parton densities in the proton. Fragmentation terms are not included.

Analysis procedure

- Apply cleaning photoproduction cuts.
- Use Zufos as photon candidates.
- Find accompanying hadronic jet.
- Subtract the background using $\langle \delta Z \rangle$ quantity – it is broader for background than for signal. Perform a statistical subtraction. It is done for every bin of every measured variable.
- Calculate acceptance corrections, cross-sections.

Data Samples

Data: HERA II 04p, 04/05e, 06e, 06p, 07p (Common Ntuples v06d) 374 pb^{-1}

MC Signal: 04p, 05e, 06e, 06p, 07p (CN v06b PYTHIA) Direct, Resolved

MC Background: 04p, 04/05e, 06e, 06p, 07p (CN v06b PYTHIA - Heavy Flavour Group, Jet – Sebastian's + Filtered) Direct, Resolved

Cuts

Event Selection

Trigger HPP16 on

$0.2 < y_{JB} < 0.7$

$|$ Zvtx $|<40$ cm

$|$BCAL time$|<10$ ns

Cal $p_T<10$ GeV

No SINISTRA electron with Prob > 0.9 and Yel < 0.7

Prompt Photon Selection

Tufo[0] =31

$-0.7<\eta^{zufo}<0.9$

$6<E_T{}^{zufo}<15$ GeV

$E^{zufo}/E^{jet}>0.9$

ZufoEemc/ZufoEcal>0.9

track isolation in cone 0.2

$x_\gamma < 0.7$, $x_\gamma < 0.8$ or $x_\gamma > 0.8$

Jet Selection

$-1.5<\eta^{jet}<1.8$

$4<E_T{}^{jet}<35$ GeV

Truth level selection

$Q^2<1$ GeV^2

$0.2<y_{JB}<0.7$

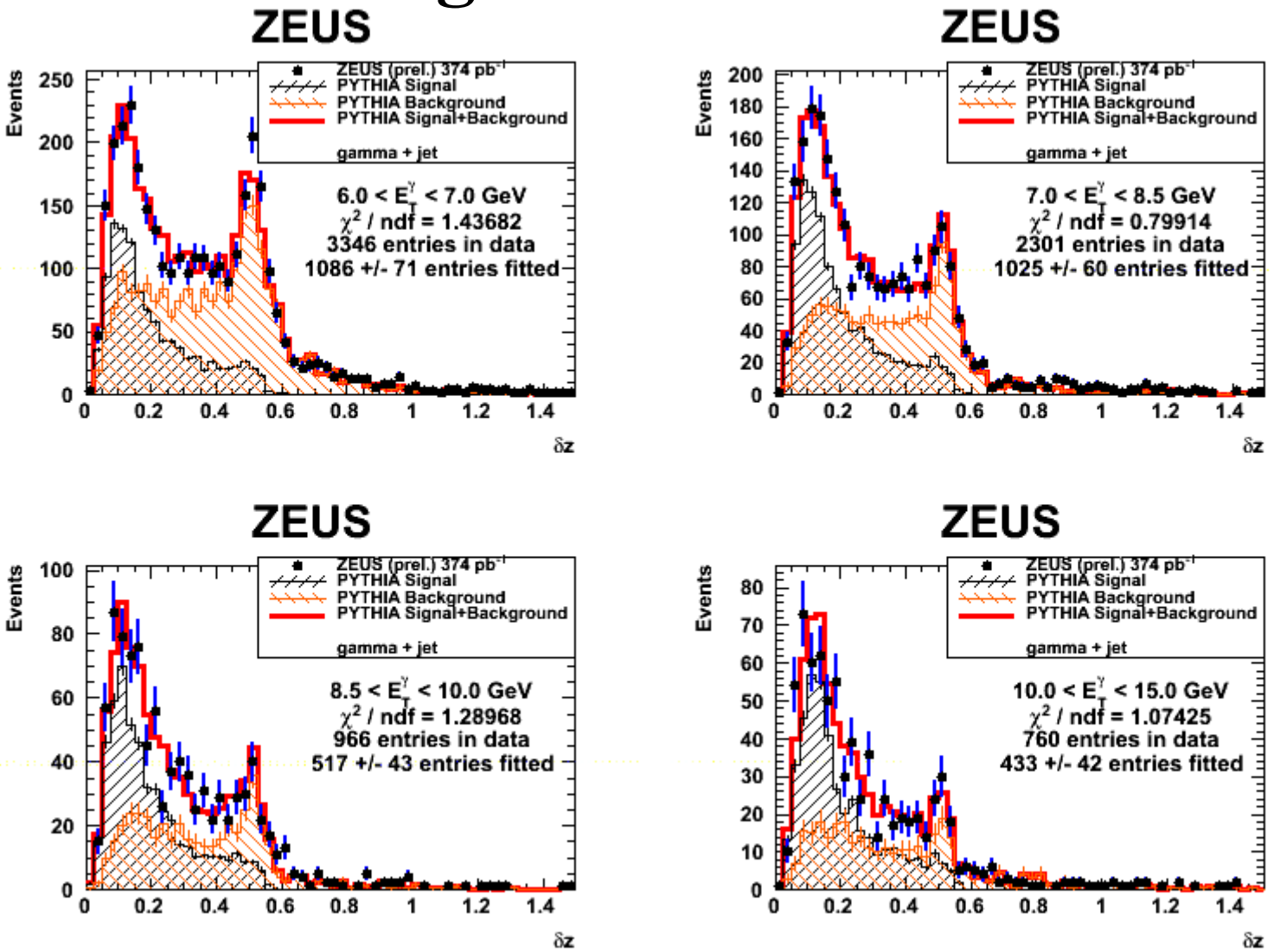
Particle type 29

$-0.7<\eta^{particle}<0.9$

$6<E_T{}^{particle}<15$ GeV

$E^{particle}/E^{jet}>0.9$

Signal extraction



<δZ> energy weighted mean width of the electromagnetic cluster in Z direction:

$$\langle \delta Z \rangle = \sum_i E_i |Z_i - Z_{\text{cluster}}| \; / (w_{\text{cell}} \sum_i E_i)$$

Distributions of <δZ> in bins of E_T^{γ} showing the fitted signal and background.

Components. Chi**2 per degree of freedom in bins of examined variables is typically 1.1.

A model of
50% PYTHIA Direct,
40% Resolved,
5% each of resolved and direct radiative ("fragmentation").

The radiative events are obtained from the background.
They are discarded from the background before it is
used in the fits.

A systematic uncertainty allows for uncertainties in this model.

However different x_γ regions have different ratio of direct and resolved. Current 50/40/5/5 is obtained from $0.0 < x_\gamma < 1.0$ fit of PYTHIA MC signal to signal extracted from data. This ratio is further modified using detector-level PYTHIA predictions, so it is multiplied on ratio of what PYTHIA predicts is in e.g. $0.0 < x_\gamma < 0.7$ to the number of events in $0.0 < x_\gamma < 1.0$. Thus subregion ratios are:

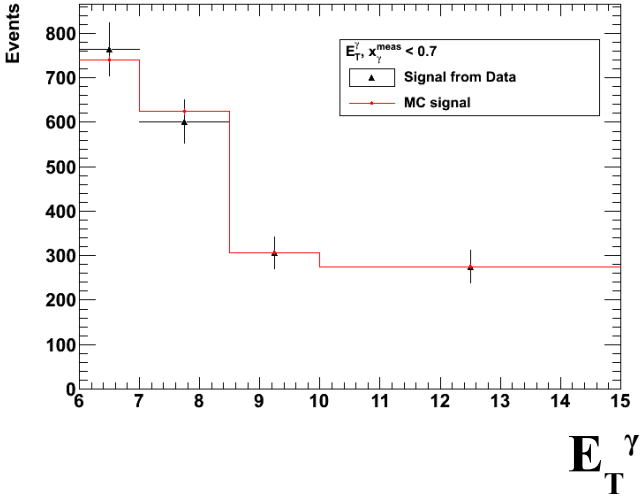
$0.0 < x_\gamma < 0.7$: 10/75/5/10

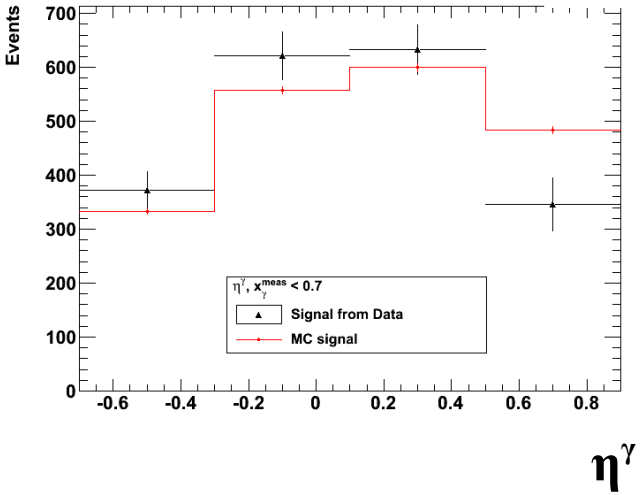
$0.0 < x_\gamma < 0.8$: 16/69/6/9

$0.8 < x_\gamma < 1.0$: 82/13/4/1

ΔΦ reweighting. x_γ < 0.7

Before reweighting





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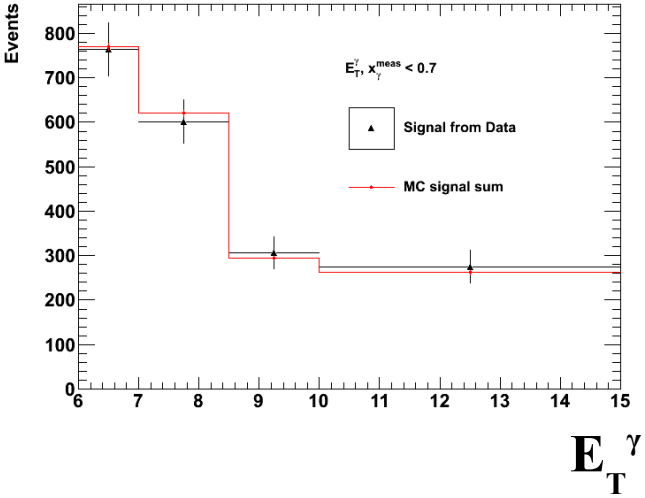
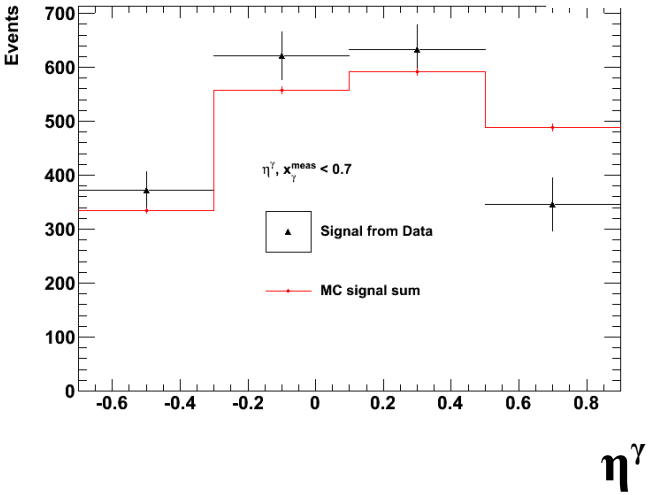
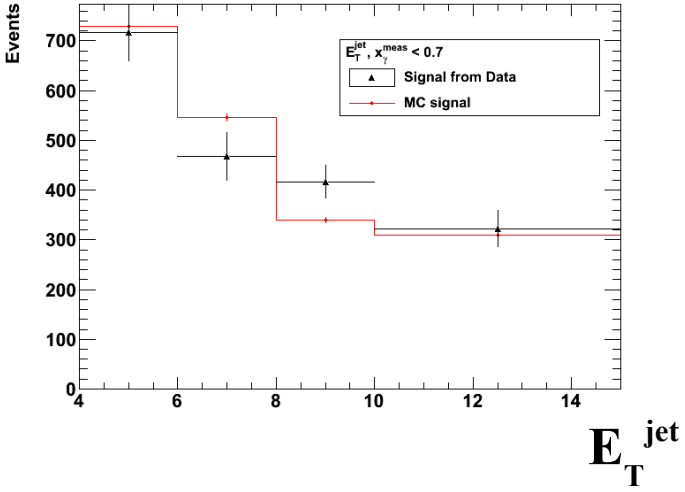


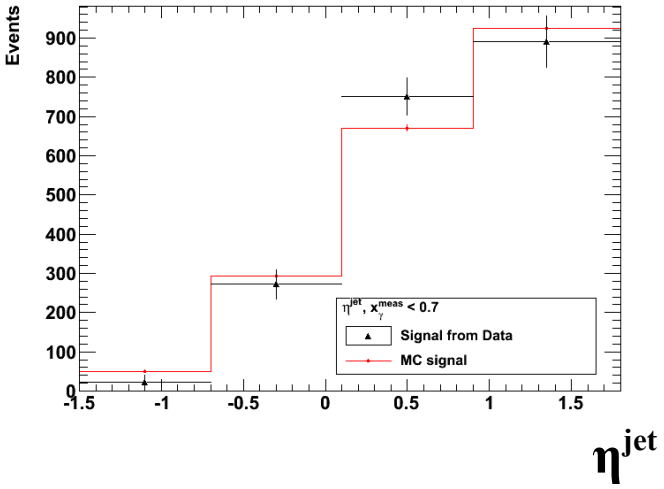


ΔΦ reweighted using function determined from seven bins:
weight = a*ΔΦ + b
No significant changes in distributions.

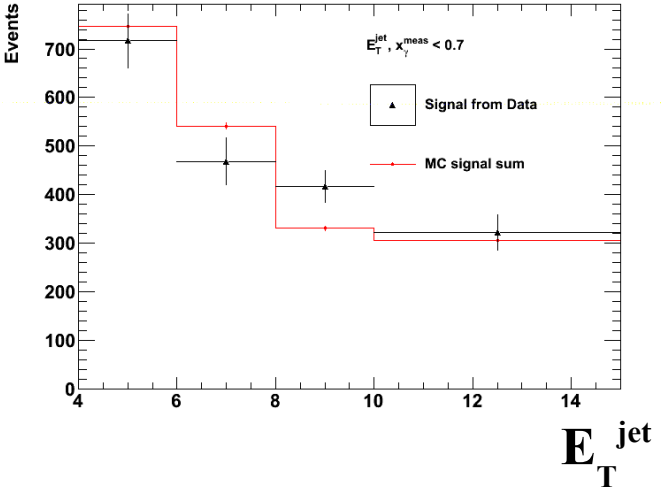
ΔΦ reweighting. $x_\gamma < 0.7$

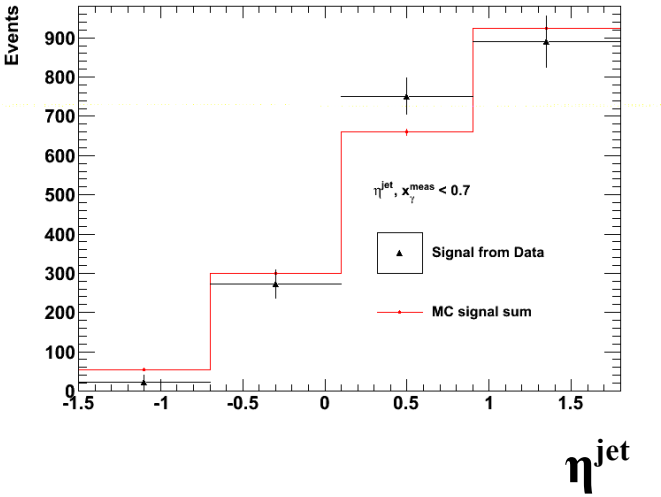
Before reweighting





After reweighting

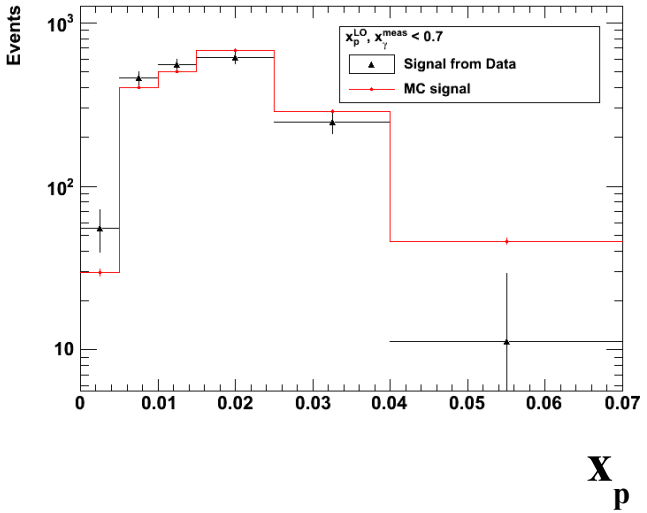




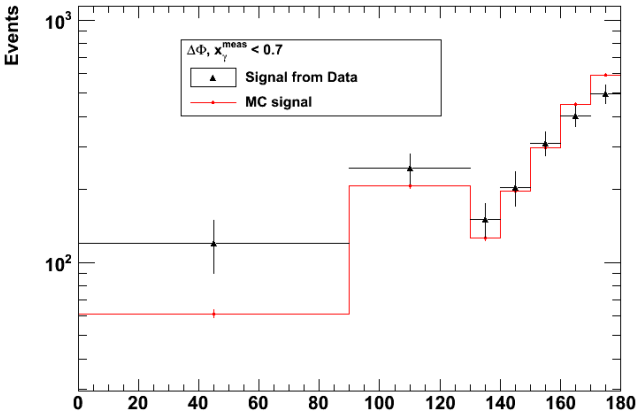
No significant changes in distributions.

ΔΦ reweighting. $x_\gamma < 0.7$

Before reweighting

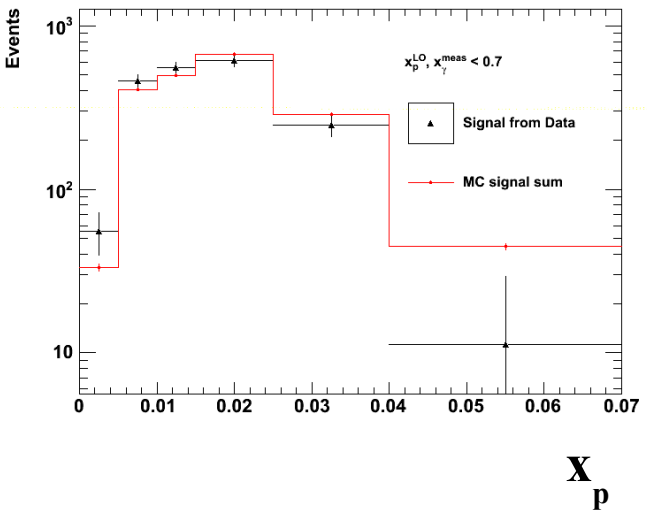


x_p

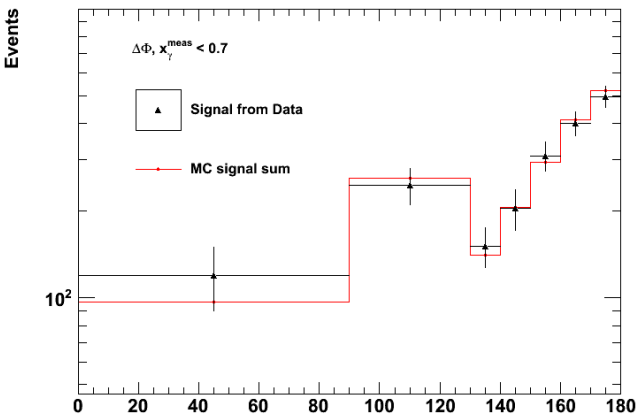


$\Delta\Phi$

After reweighting



x_p

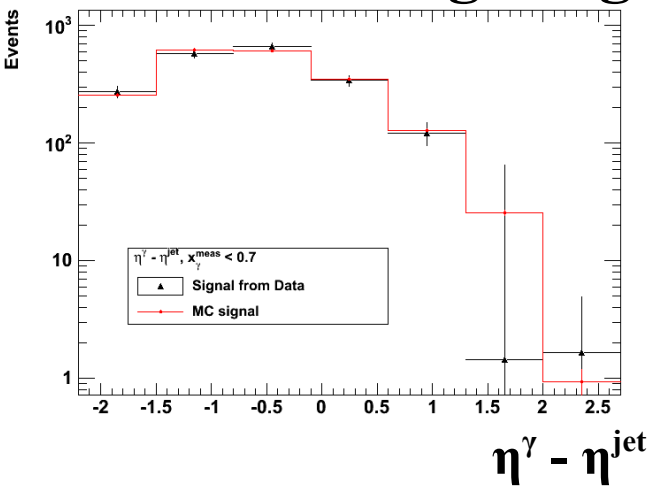


$\Delta\Phi$

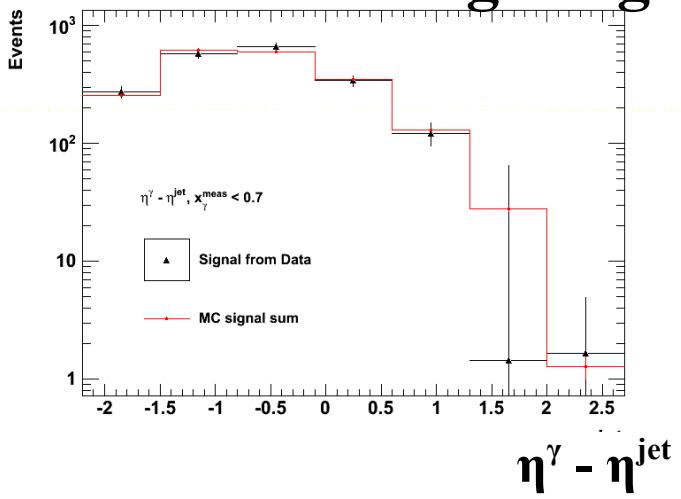
x_p does not show noticeable changes. ΔΦ improves.

ΔΦ reweighting. x_γ < 0.7

Before reweighting



After reweighting

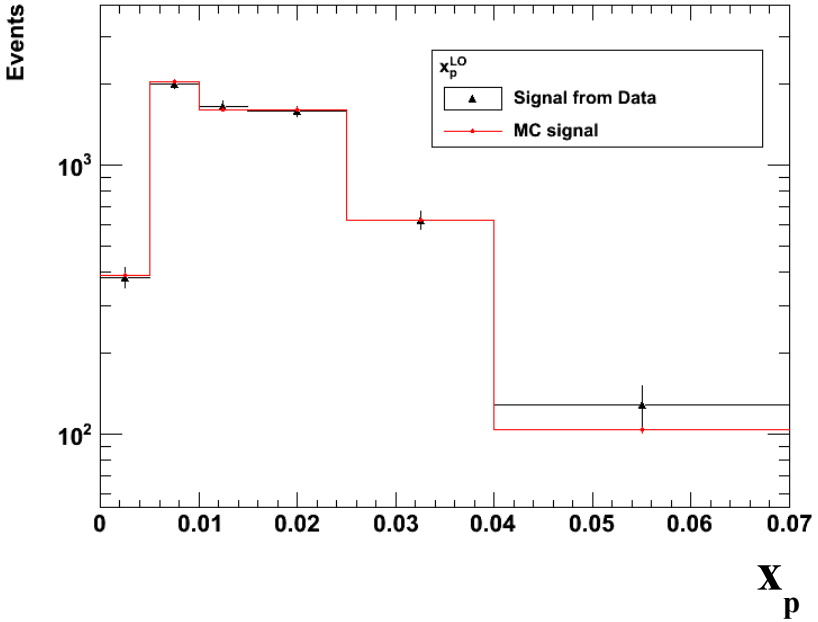


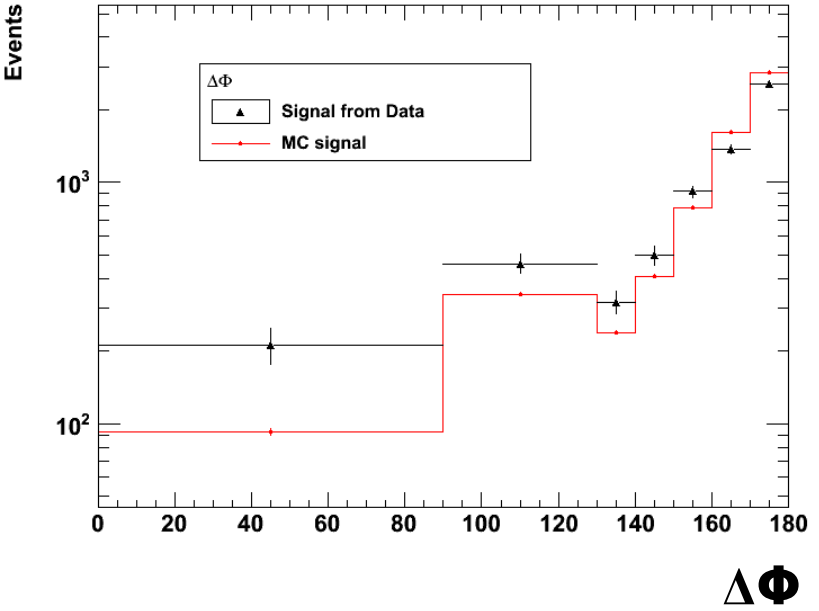
Typical change in numbers – E_T^γ

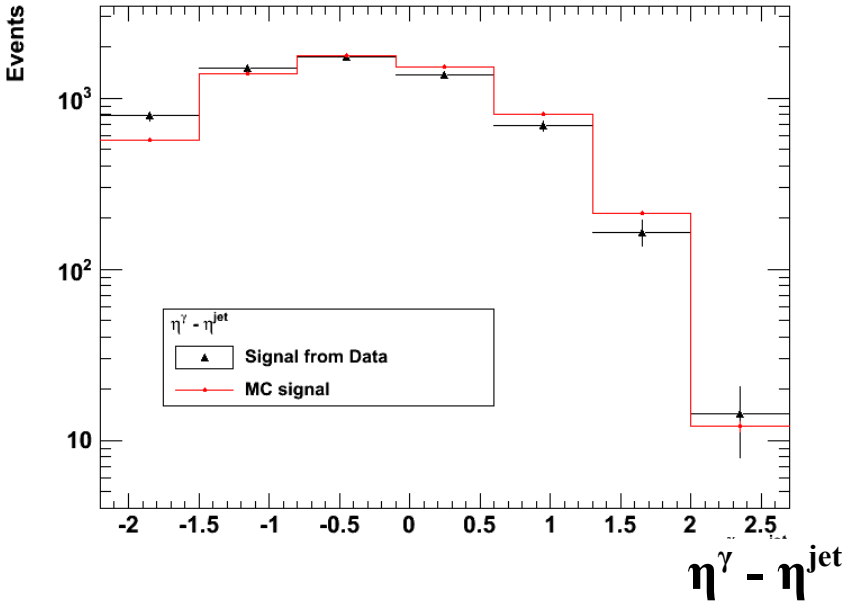
relative difference, Et-jet and eta-jet reweighted [%]	stat. error [%]	syst. error up [%]	syst. error down [%]
1.75495	8.88493	7.90227	19.87959
0.04484	9.43463	6.01201	21.46577
-0.89667	13.55742	9.99940	25.49549
-1.23823	15.57437	9.52430	27.96578

Reweighting ΔΦ gives small changes in control plots and cross-section numbers.

Control plots. All x_γ





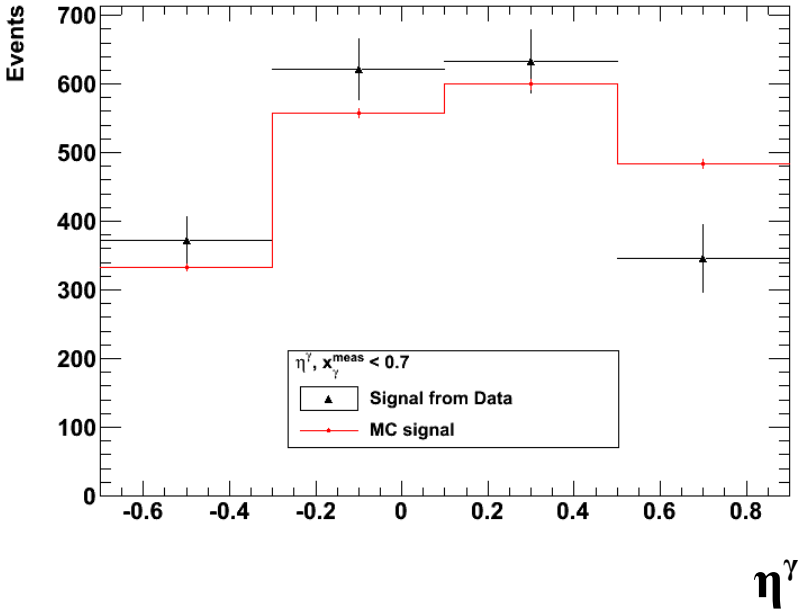


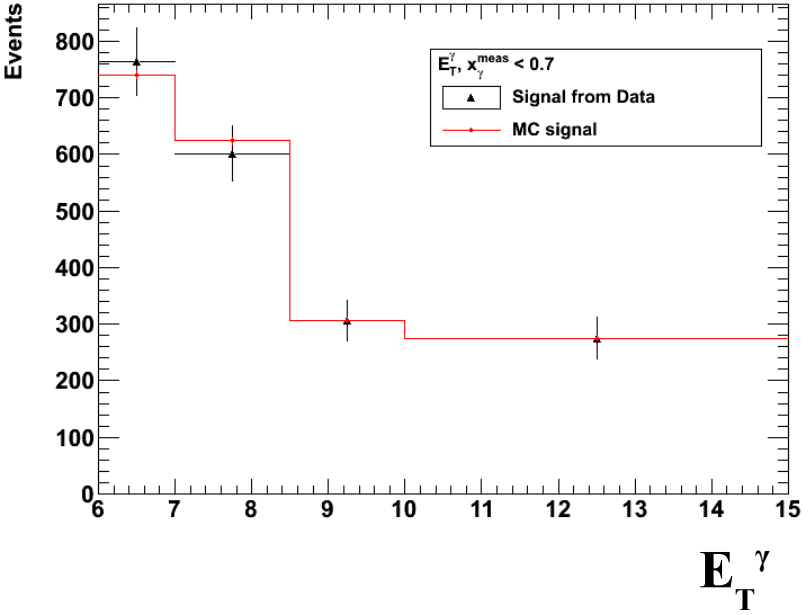
Signal from Data is signal extracted with deltaz fits.

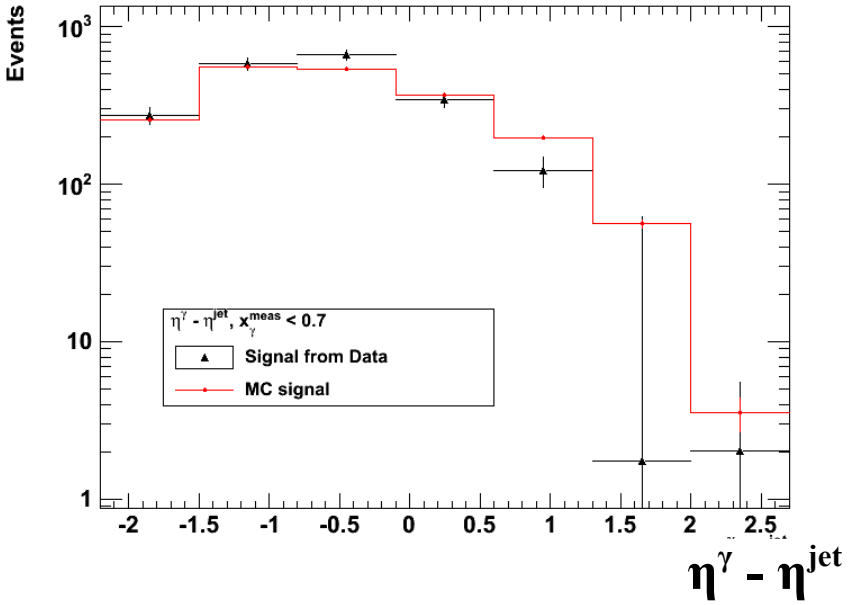
MC is normalized to signal from data.

Reasonable description of data by PYTHIA MC.

Control plots. $x_\gamma < 0.7$







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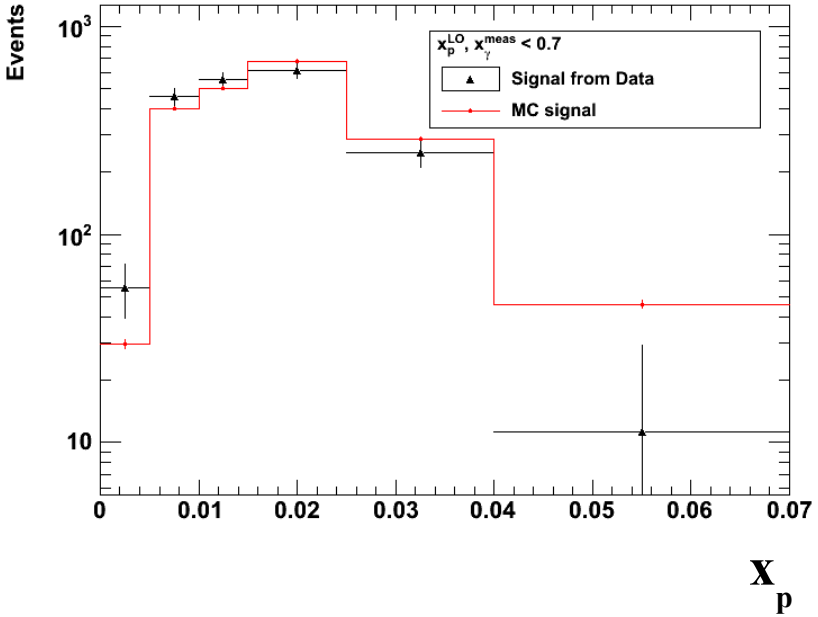
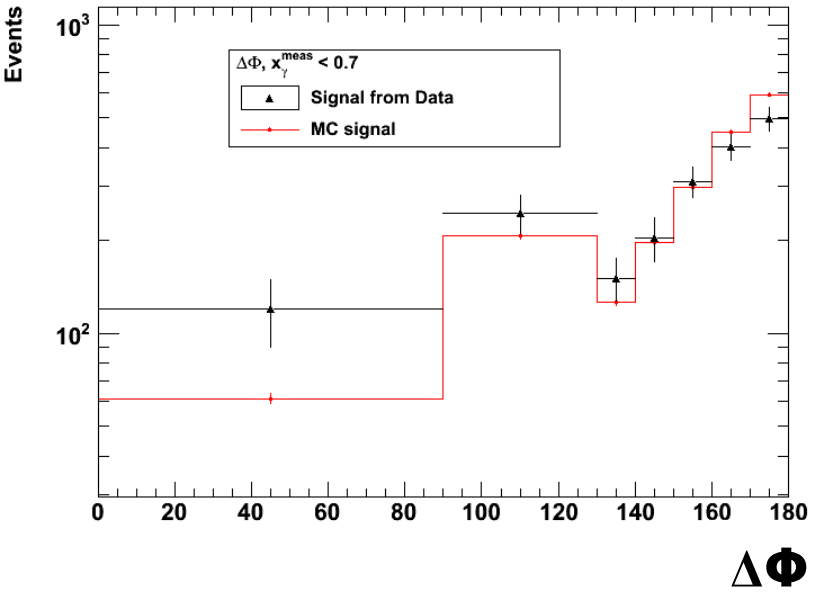
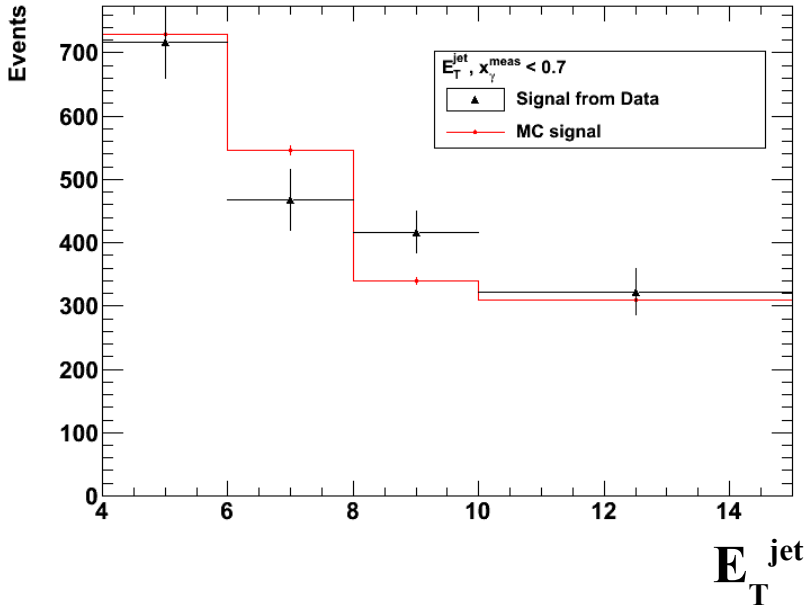
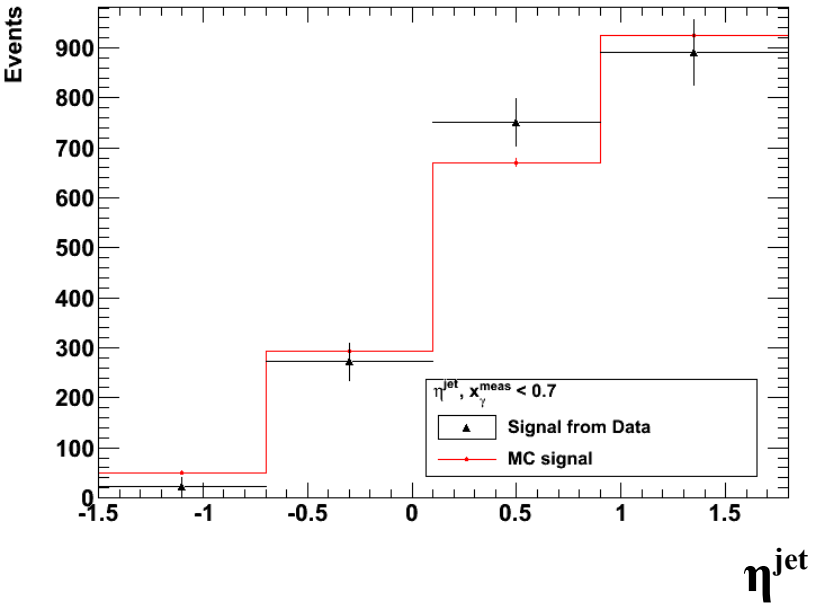


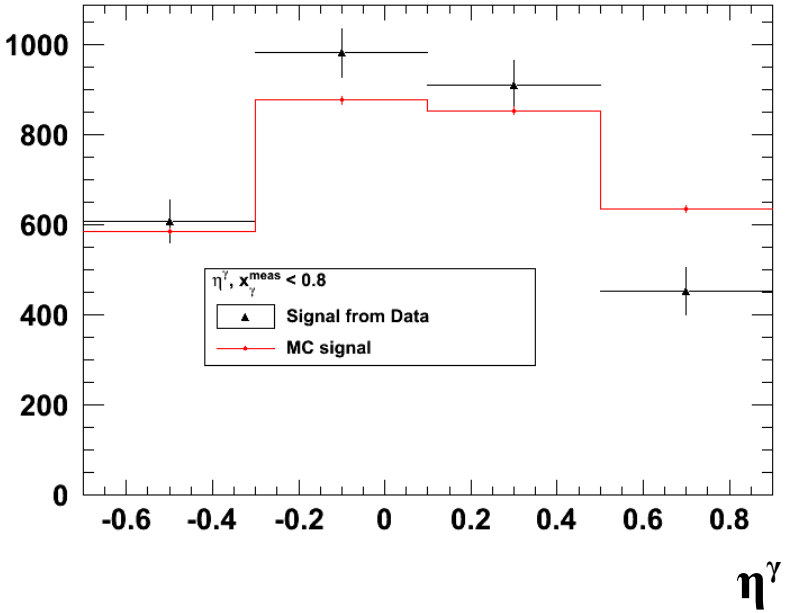


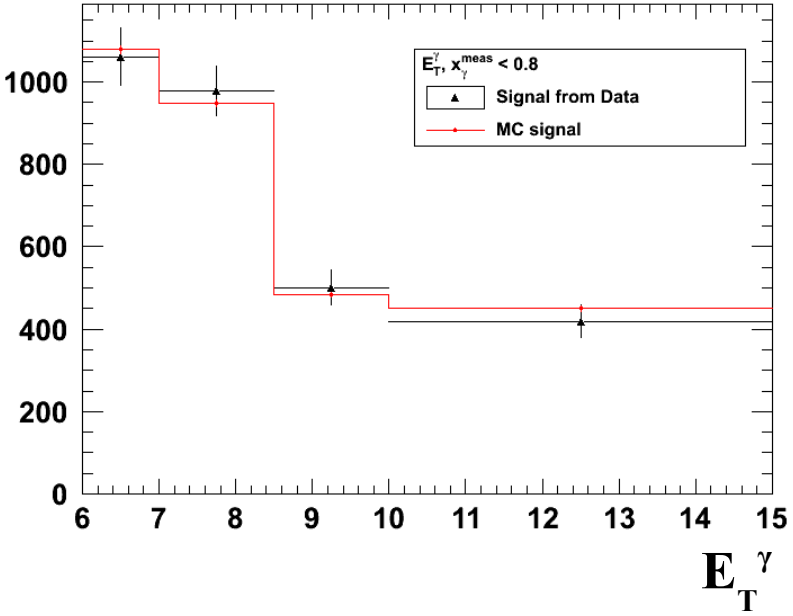


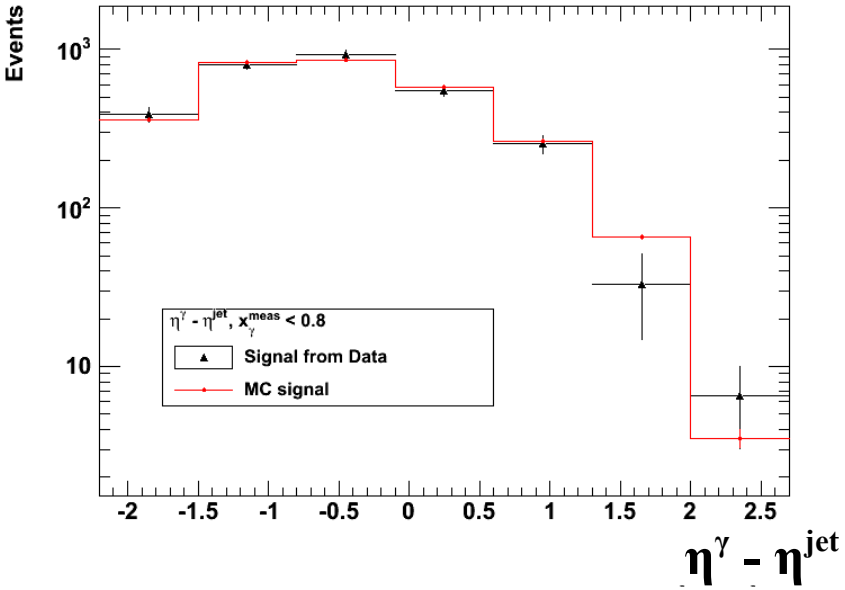


Reasonable description of data.

Control plots. $x_\gamma < 0.8$

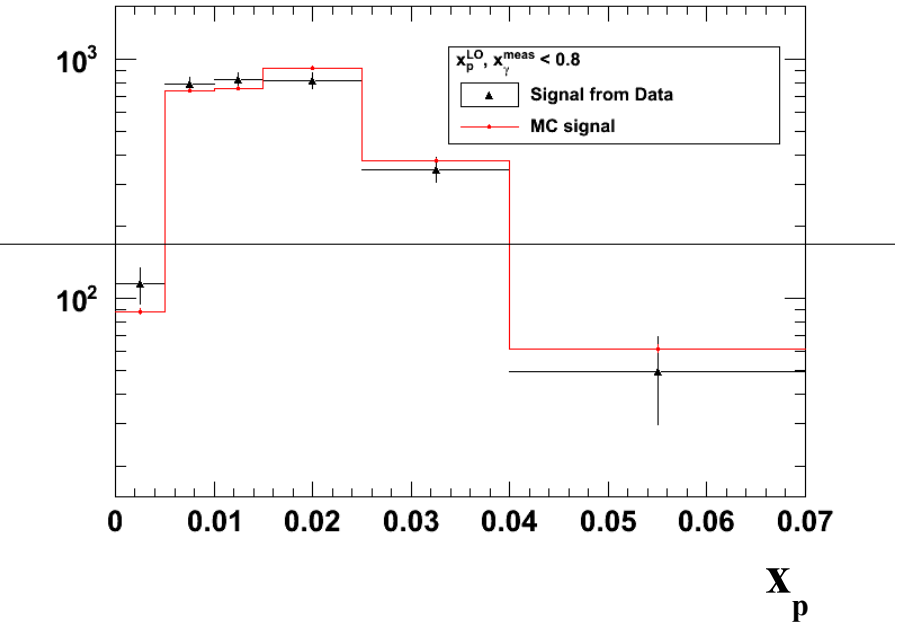


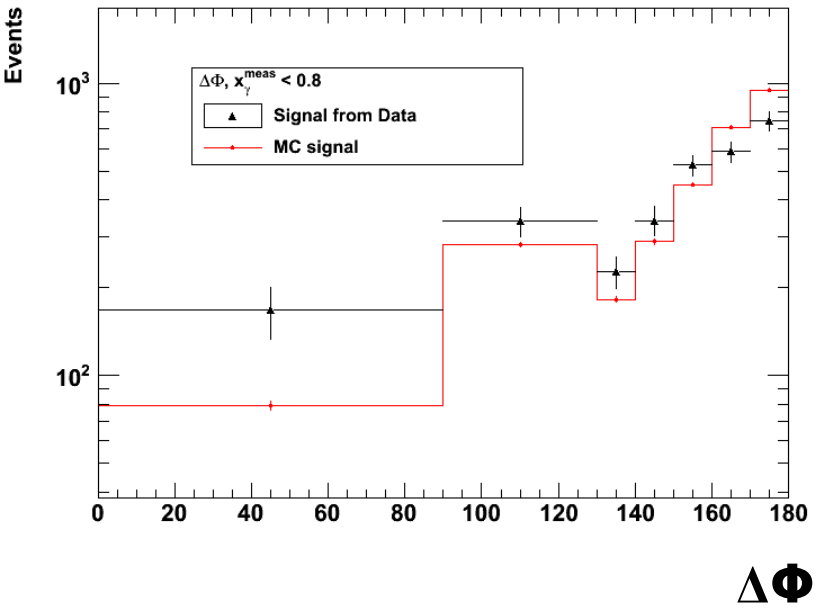


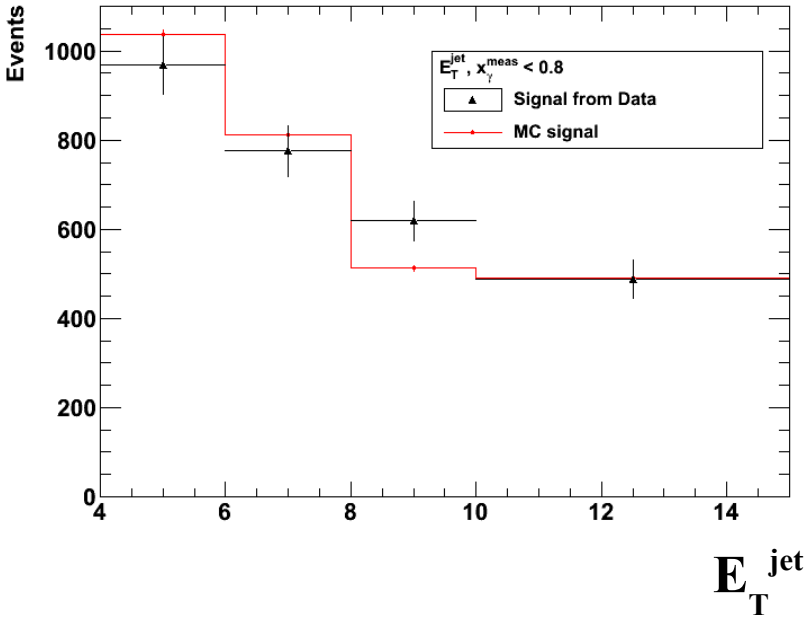


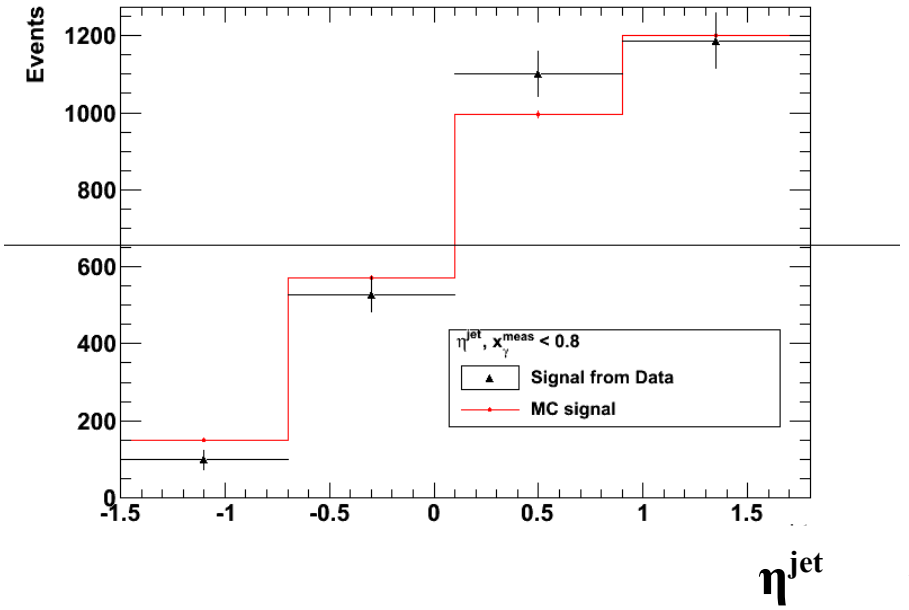
Reasonable description of data by PYTHIA MC.

Control plots. $x_\gamma < 0.8$



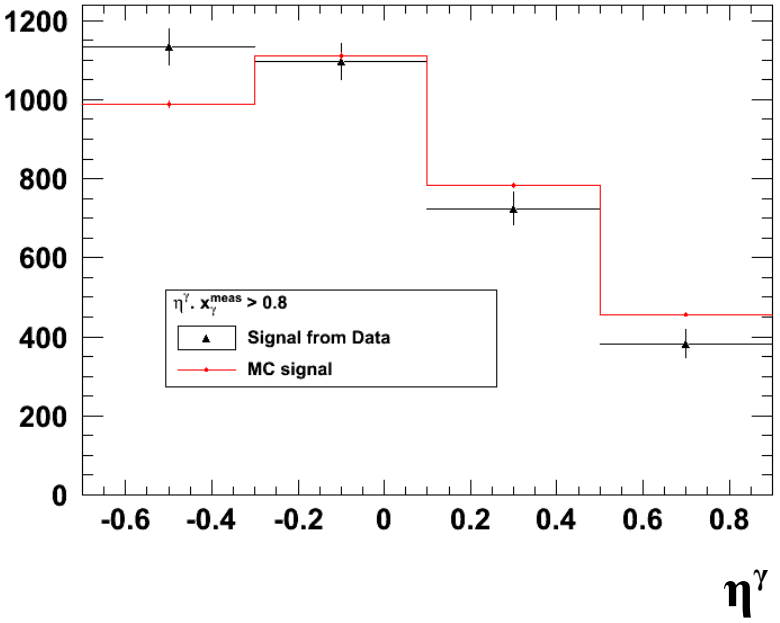


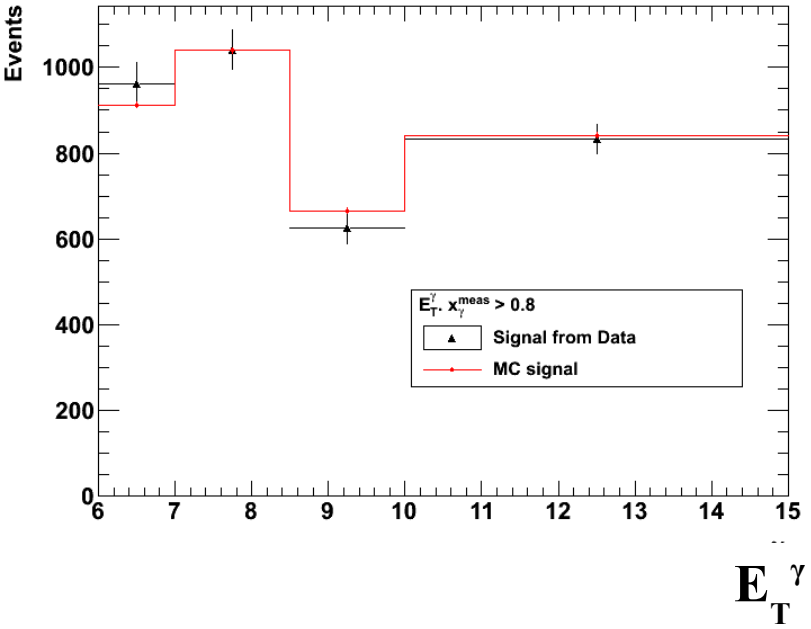


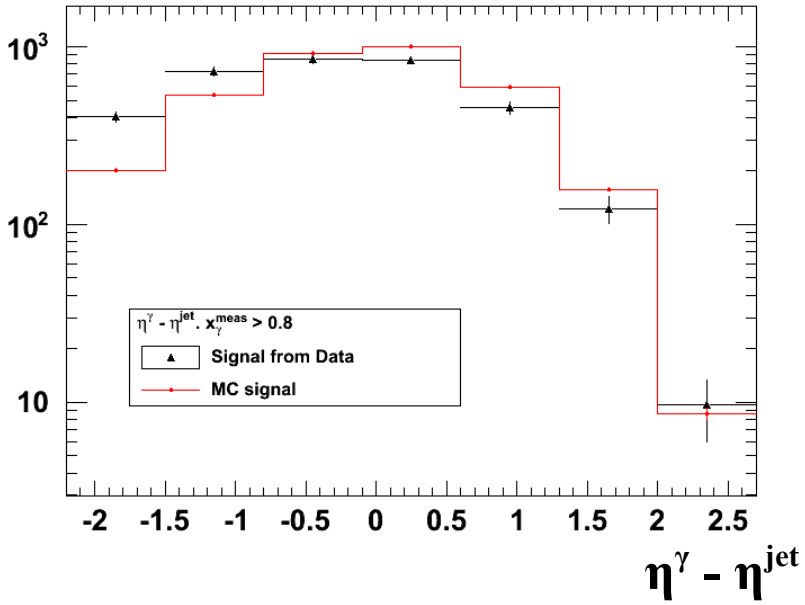


Reasonable description of data.

Control plots. $x_\gamma > 0.8$

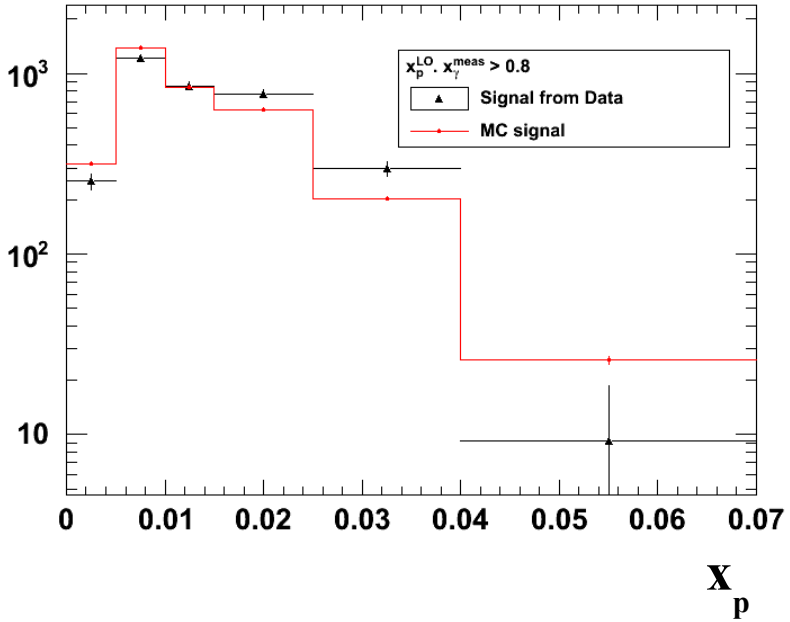


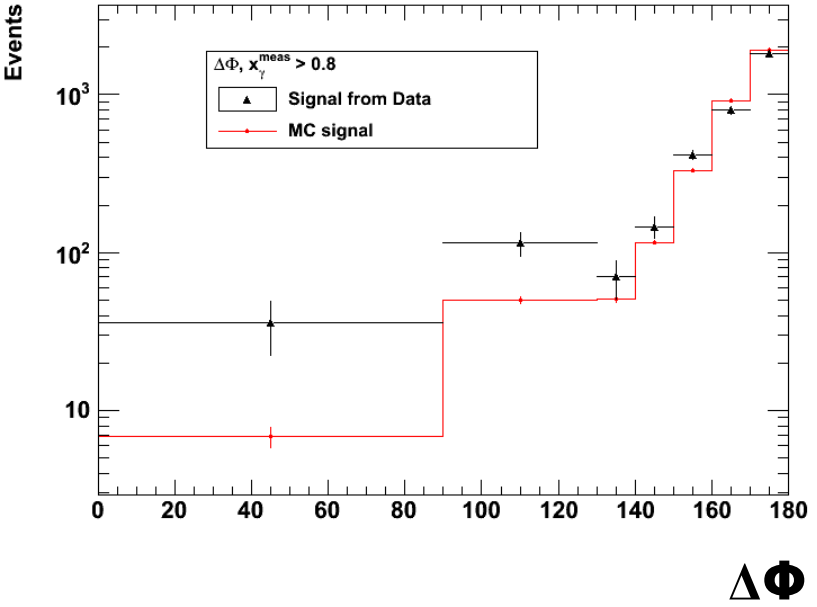


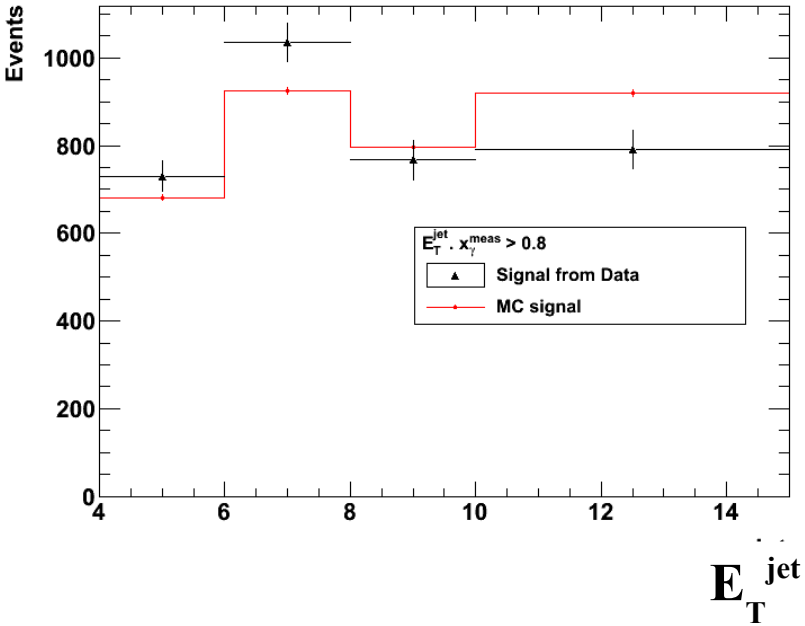


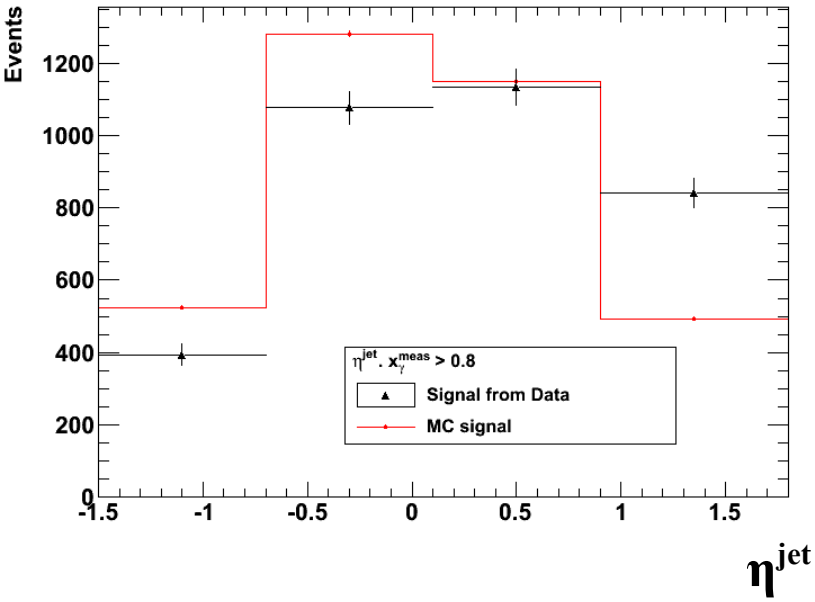
Reasonable description of data by PYTHIA MC.

Control plots. $x_\gamma > 0.8$



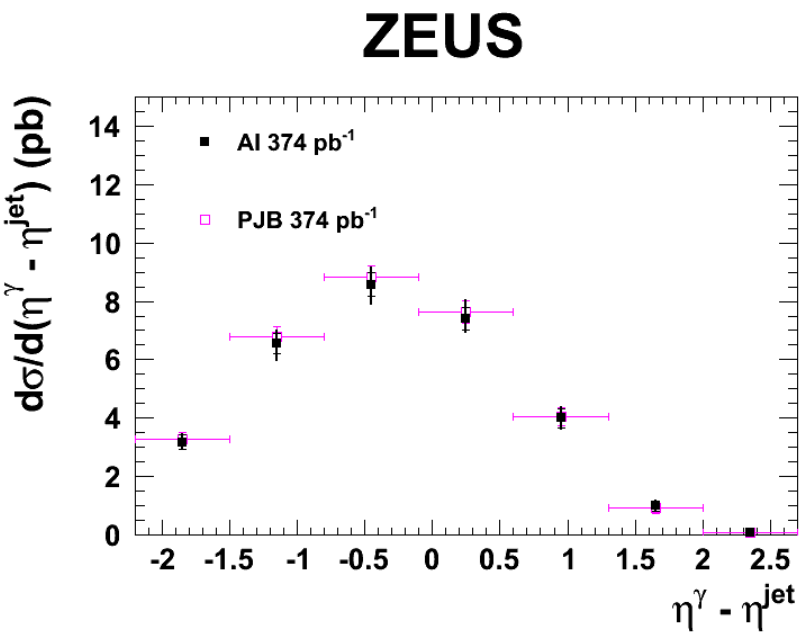


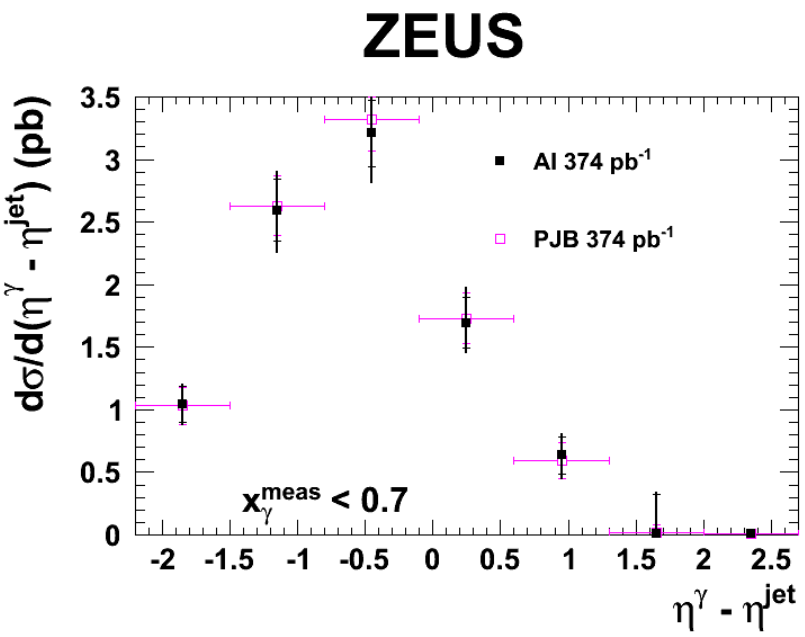


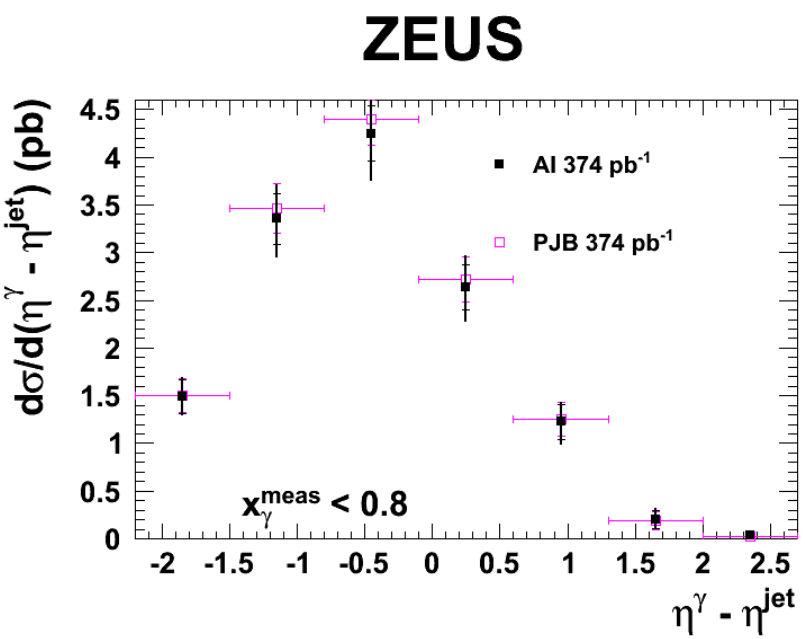


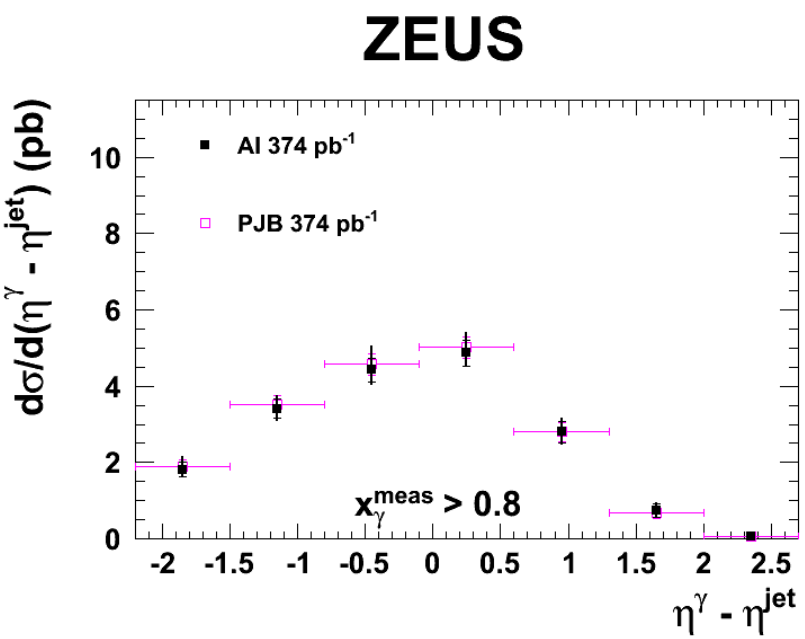
Reasonable description of data.

Comparison between analyses



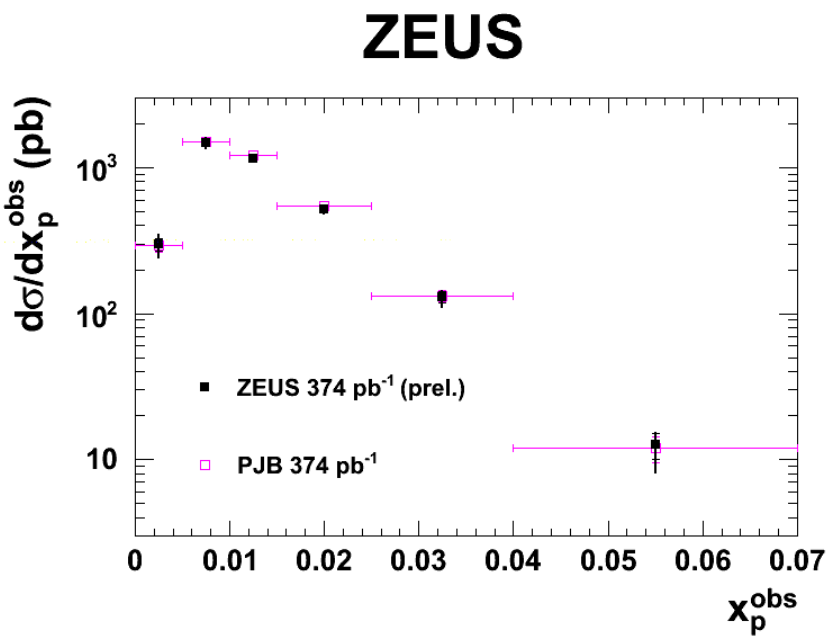


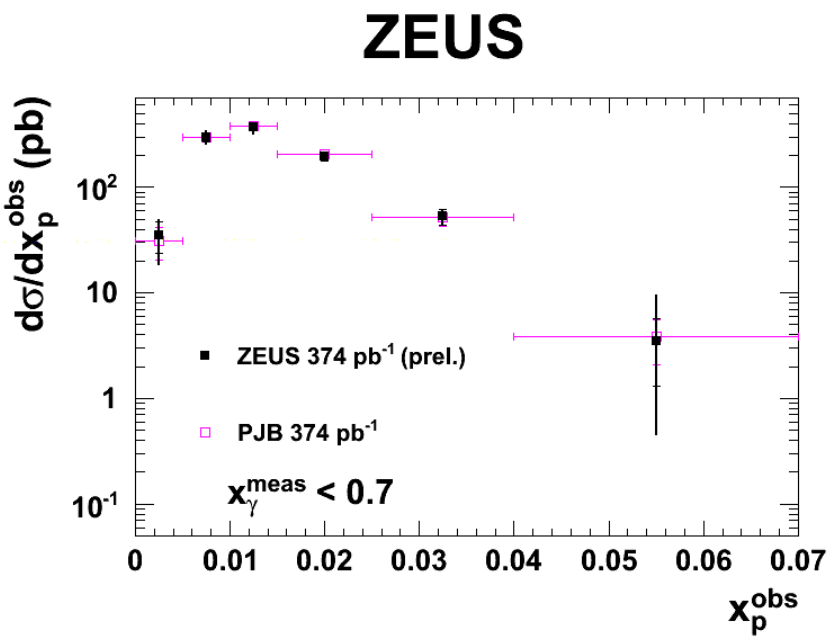


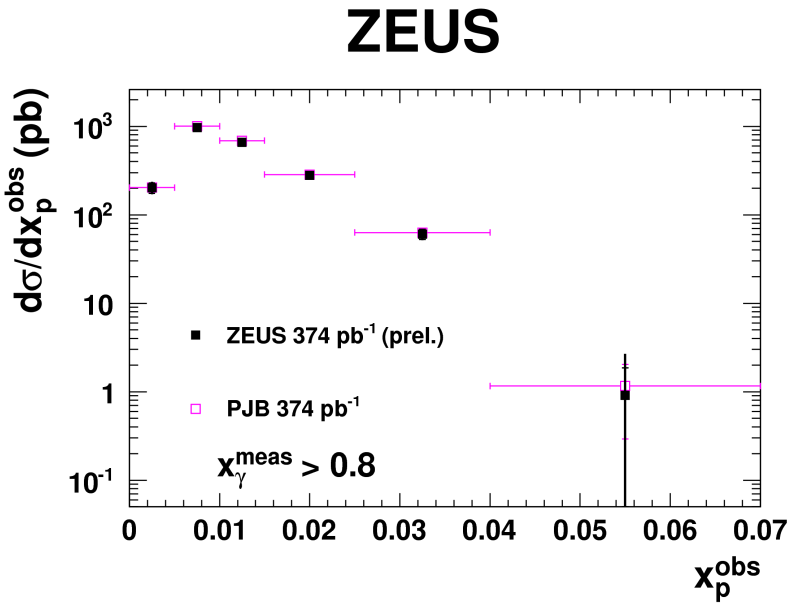


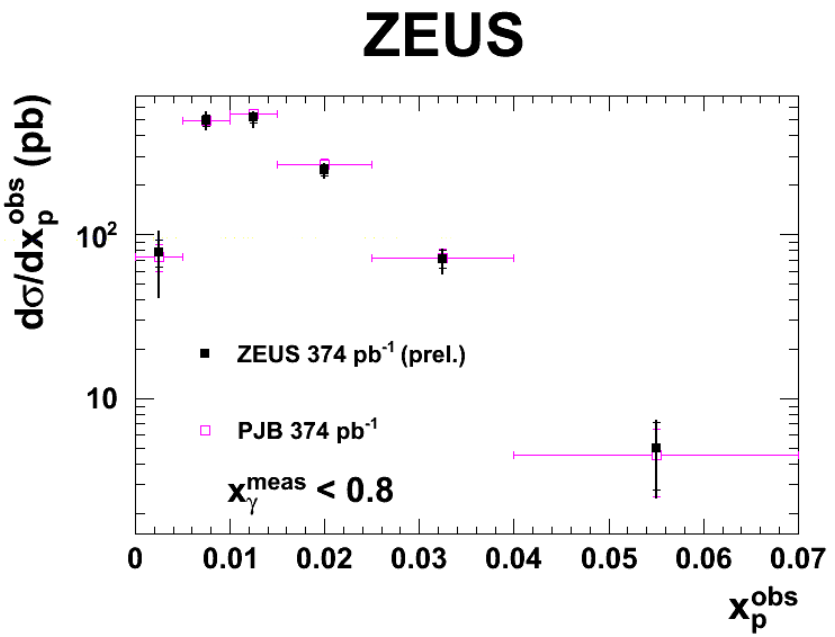
Good agreement between analyses.

Comparison between analyses









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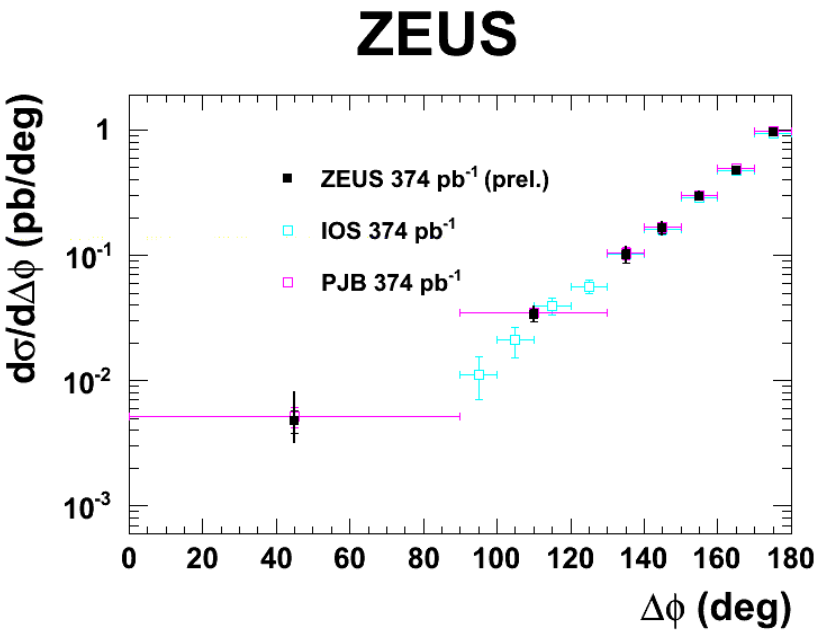
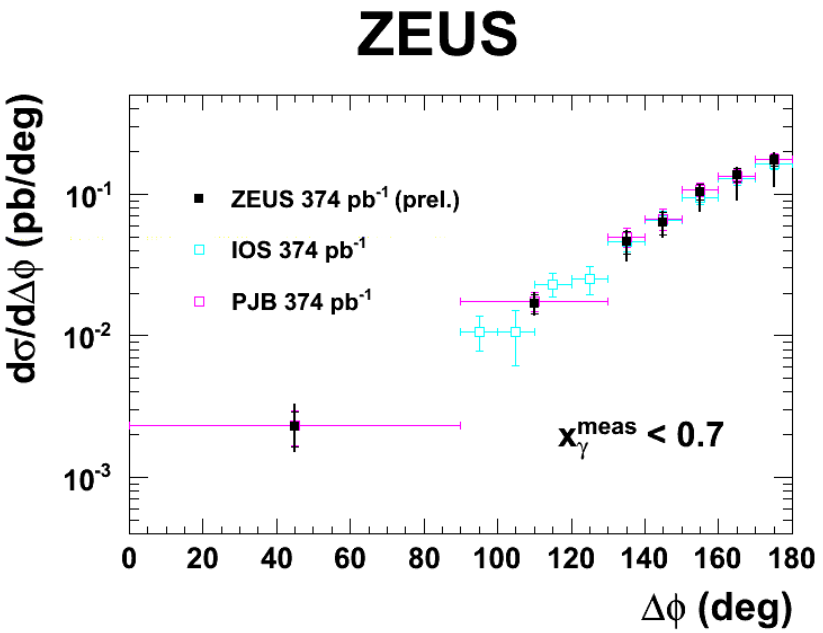
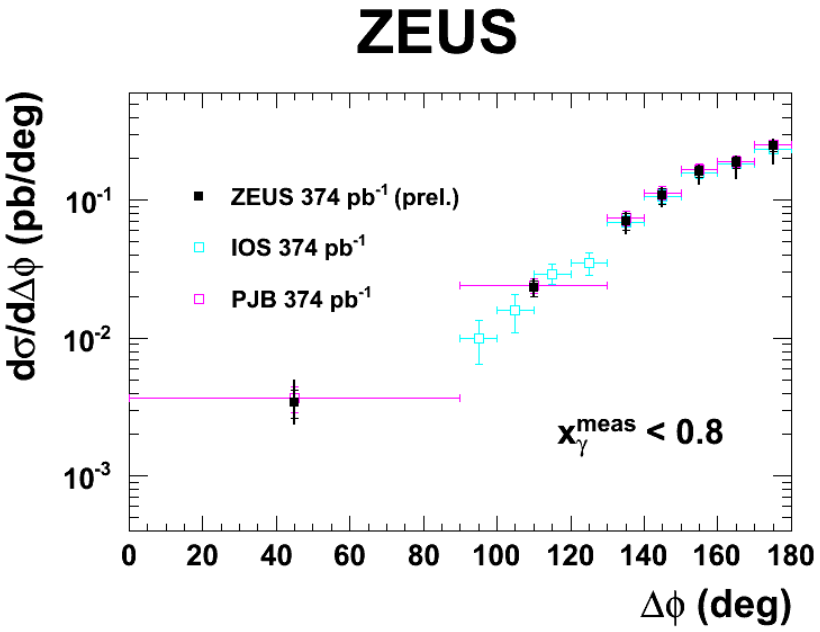
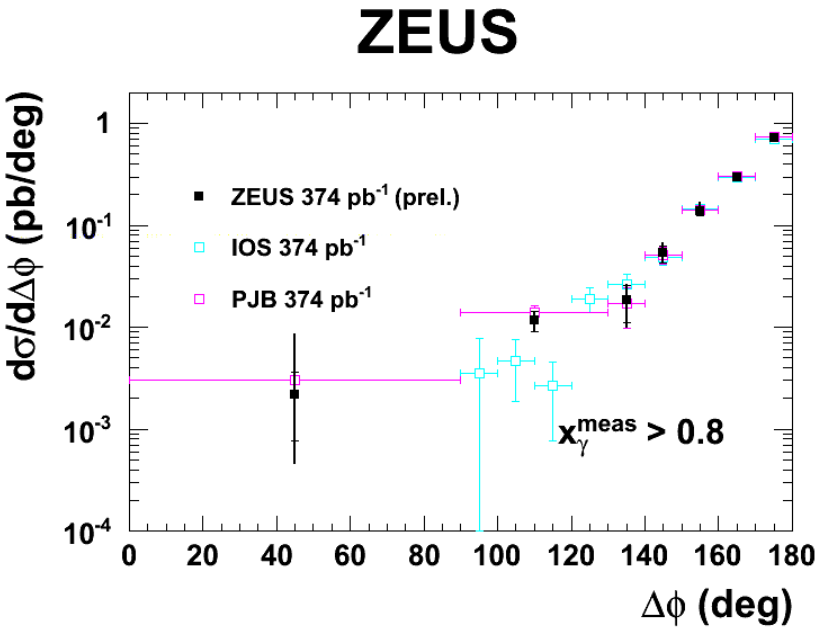
Comparison between analyses



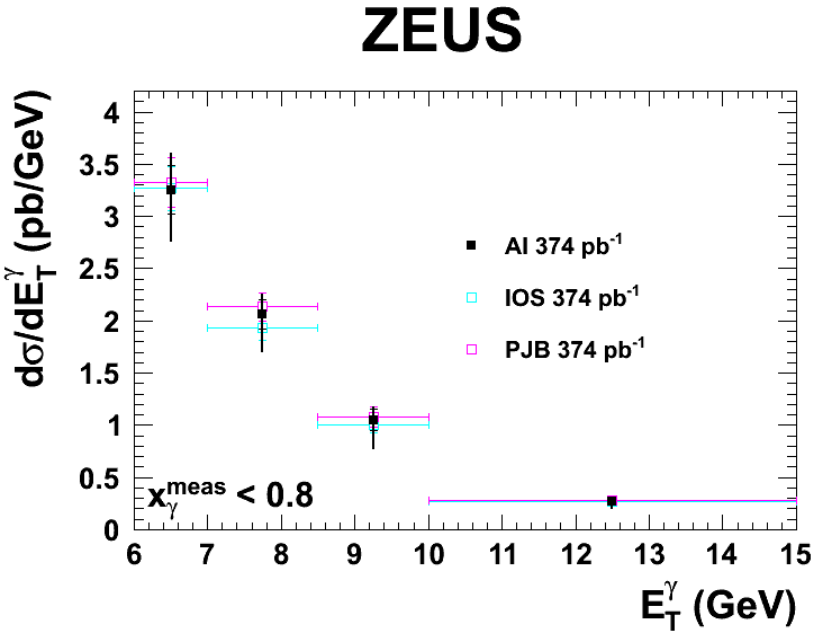


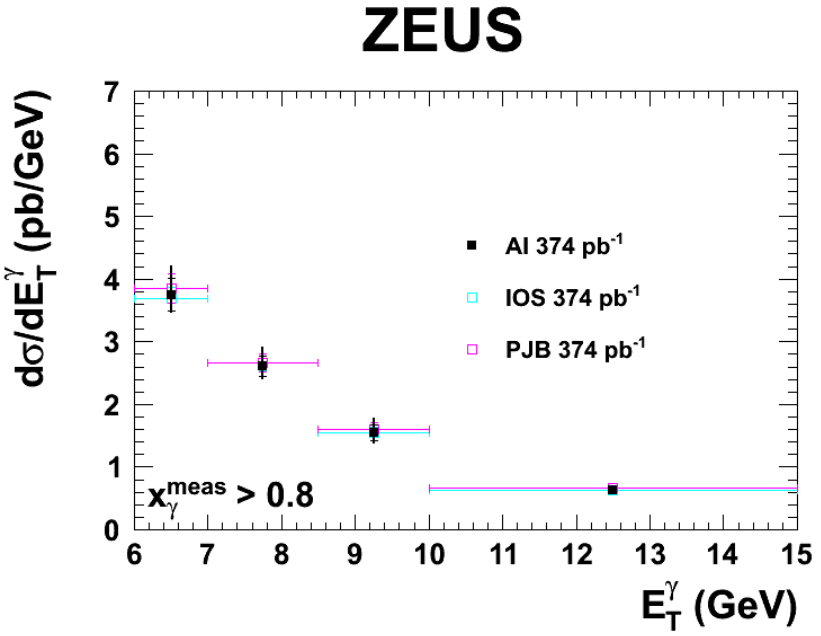


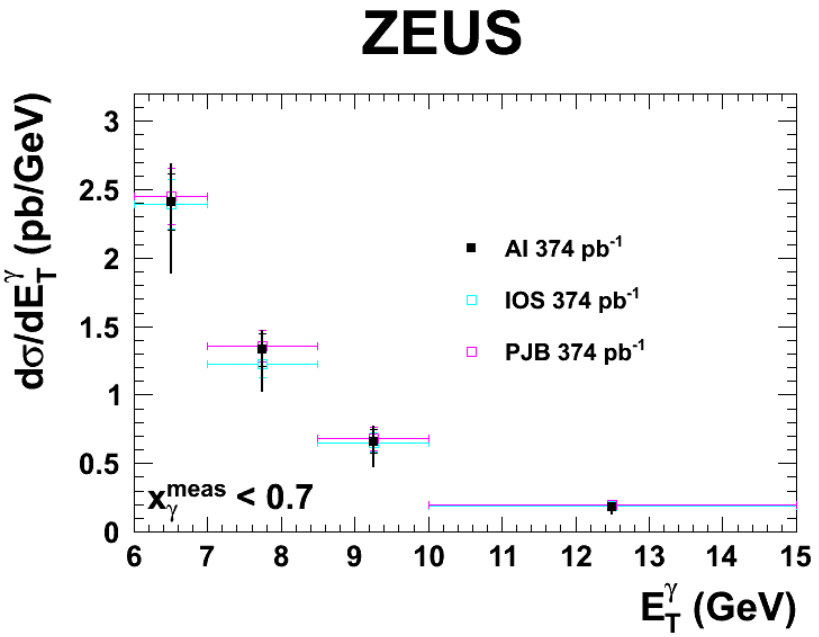


Good agreement between analyses.

Comparison between analyses

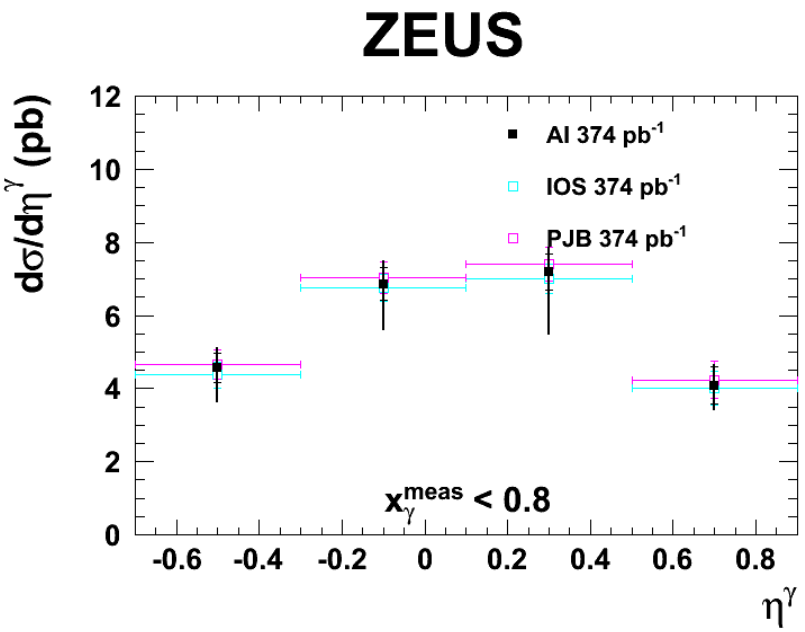


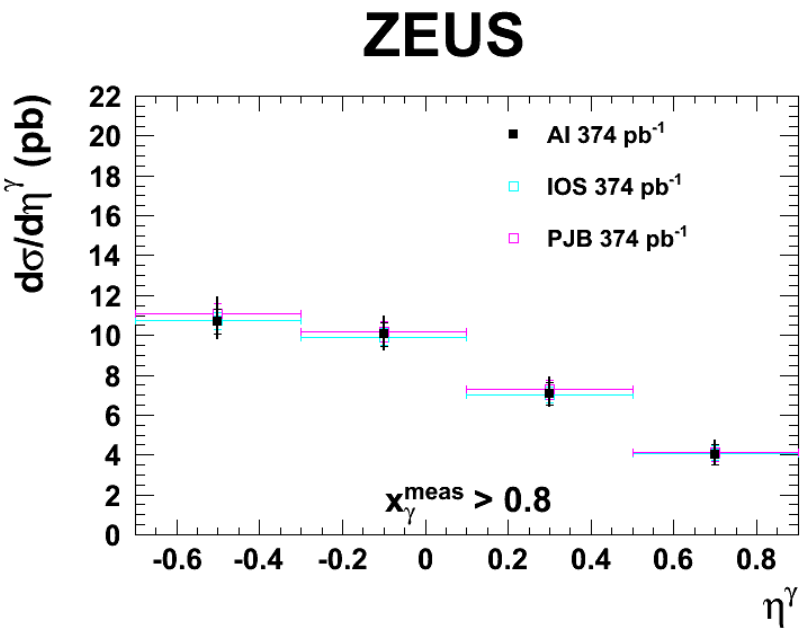


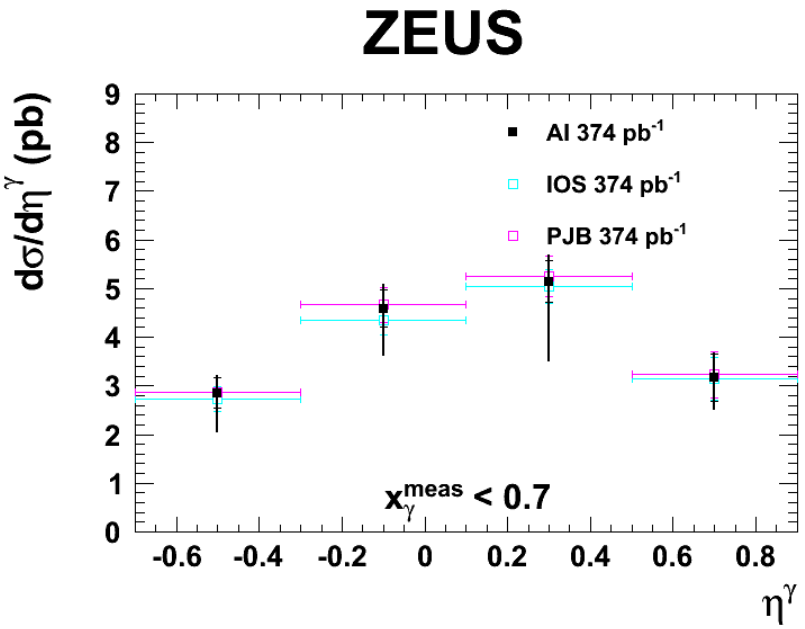


Reasonable agreement between analyses.

Comparison between analyses

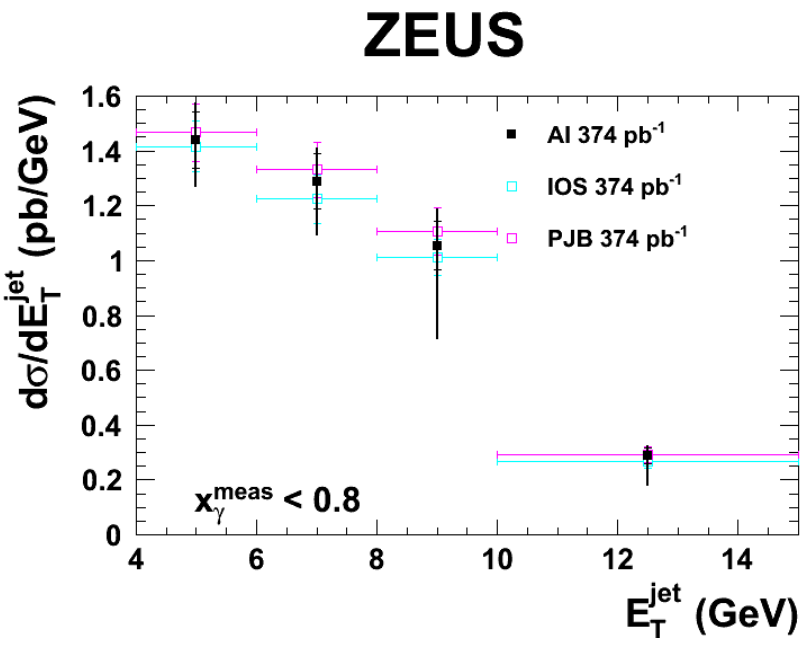


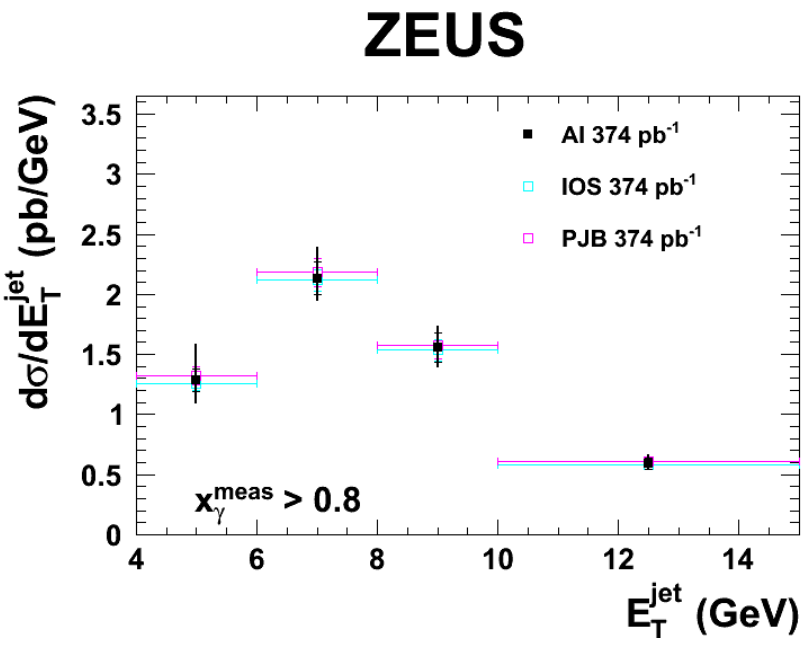


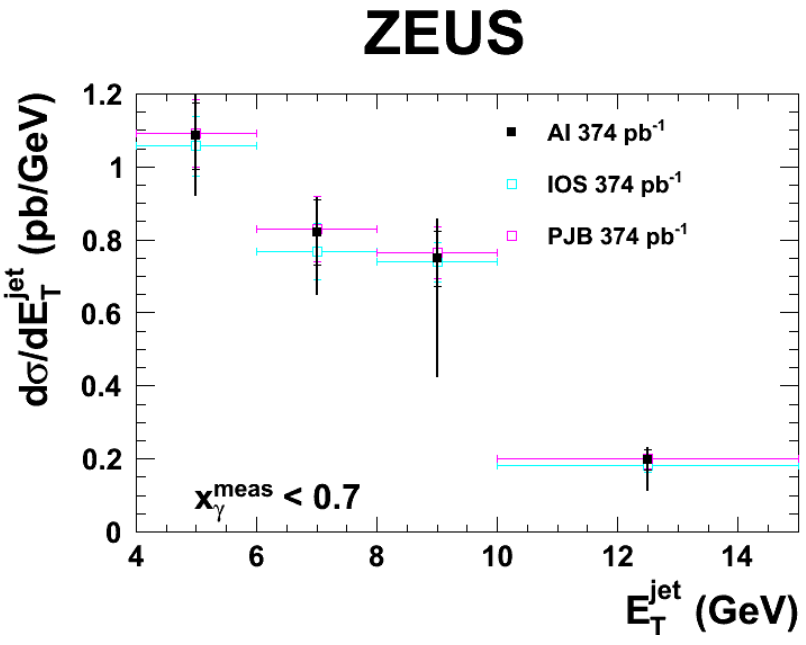


Reasonable agreement between analyses.

Comparison between analyses

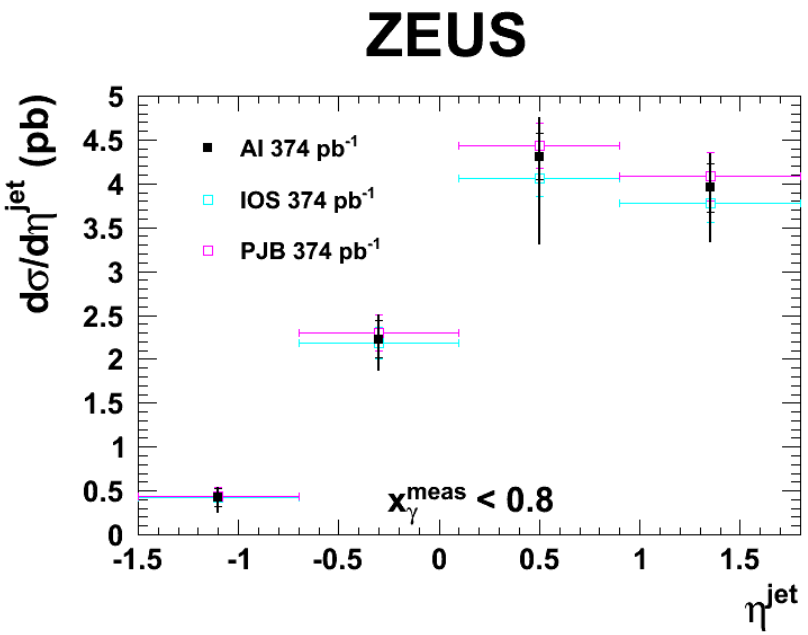


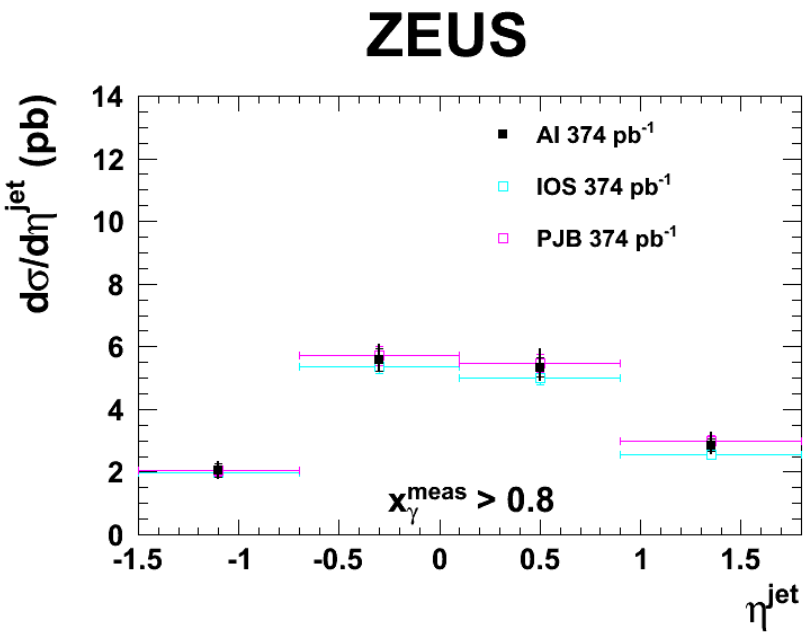


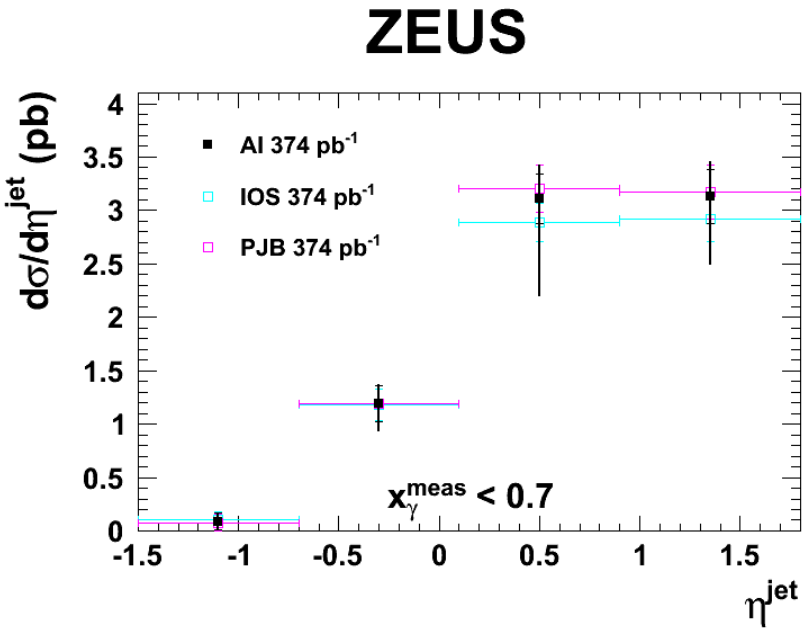


Reasonable agreement between analyses.

Comparison between analyses

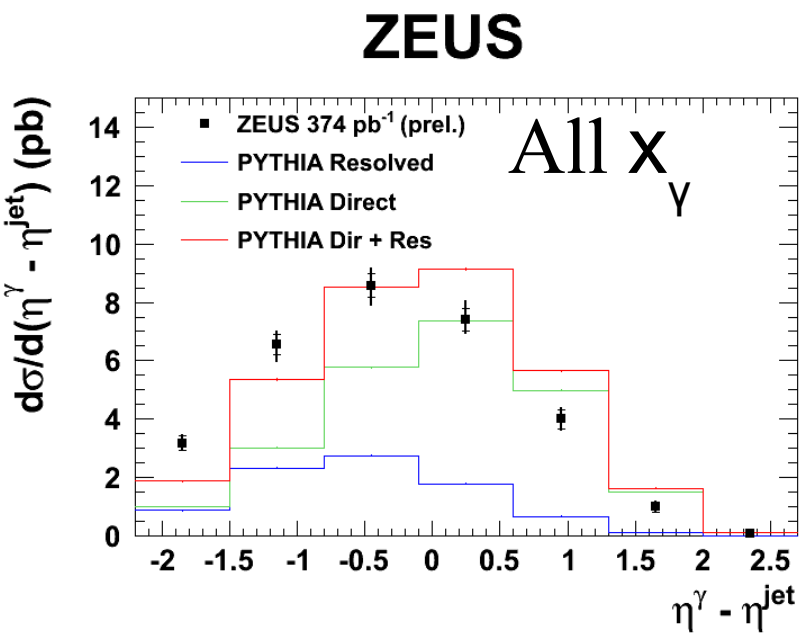


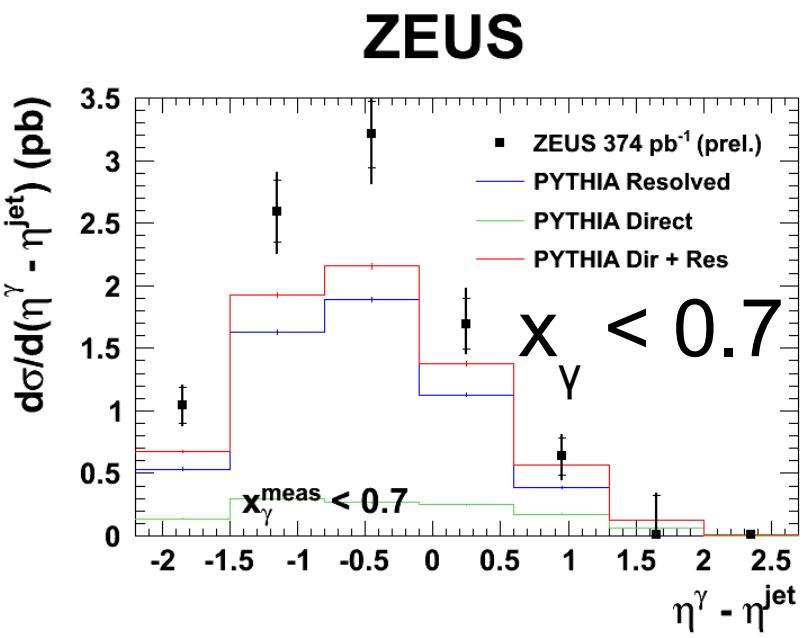


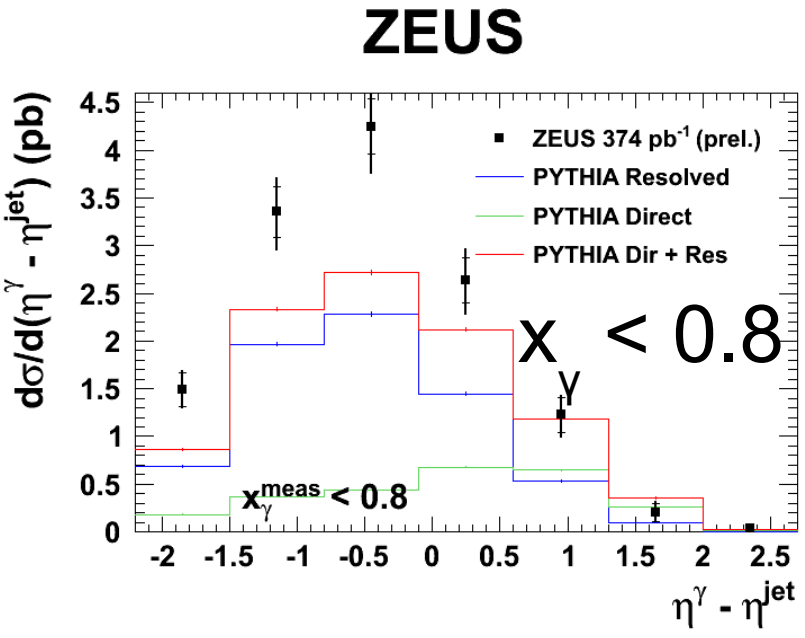


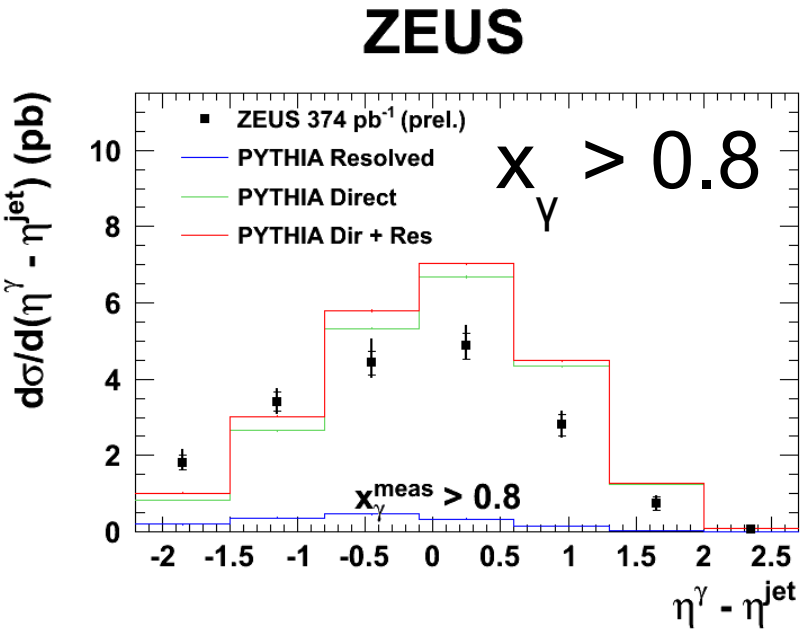
Reasonable agreement between analyses.

PYTHIA. Cross sections. η^{γ} - η^{jet}



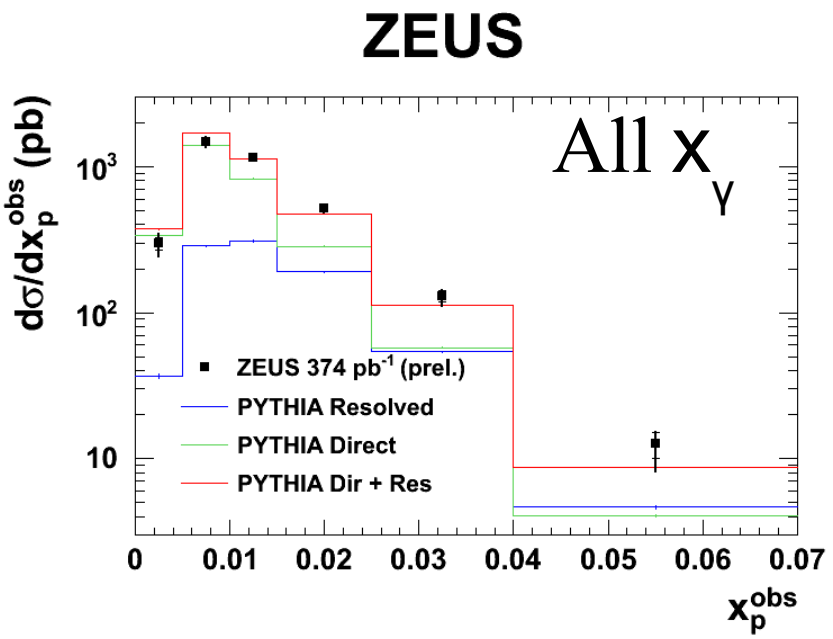


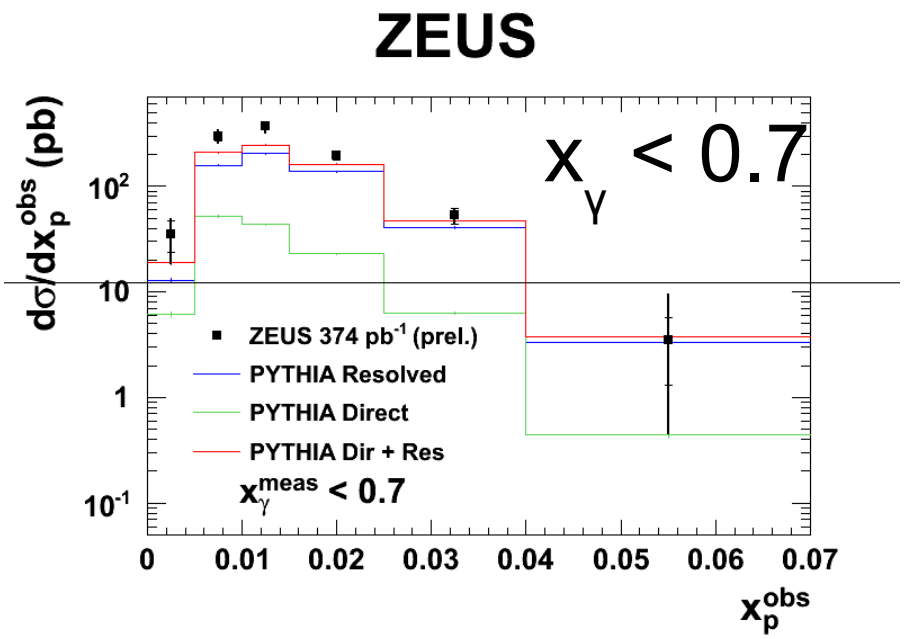


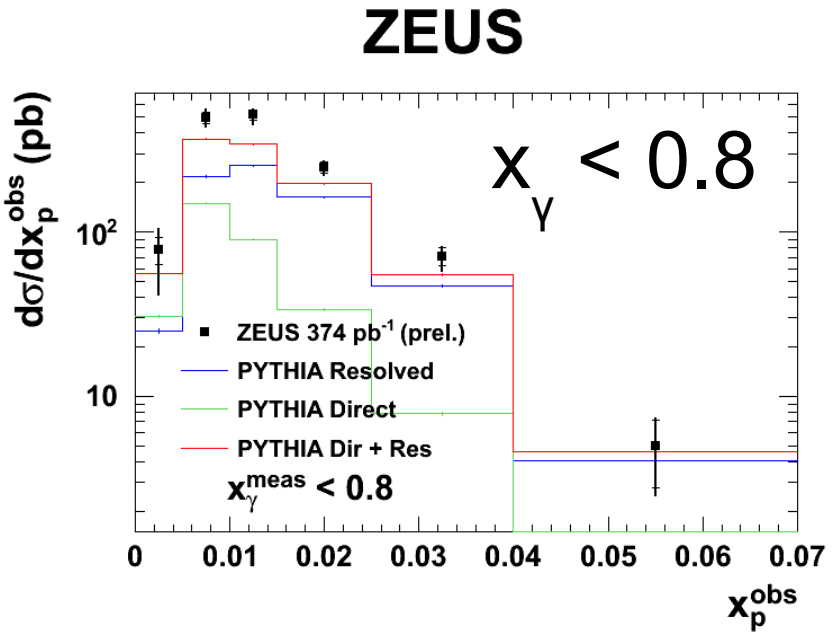


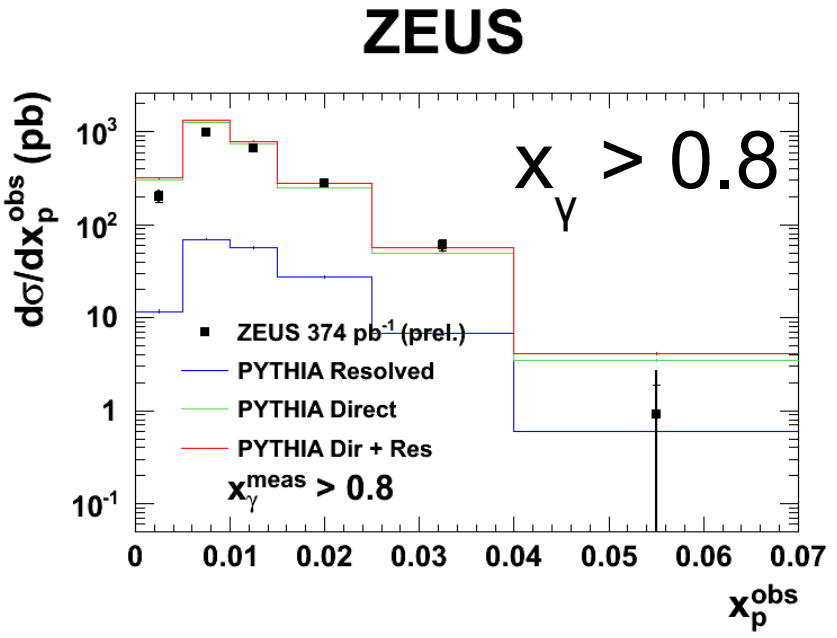
Scale factors (from the main analysis) for PYTHIA are obtained such as to approximately fit x_γ cross-section of data. PYTHIA gives wrong peak in all x_γ region, underestimates low x_γ.

PYTHIA. Cross sections. x_p



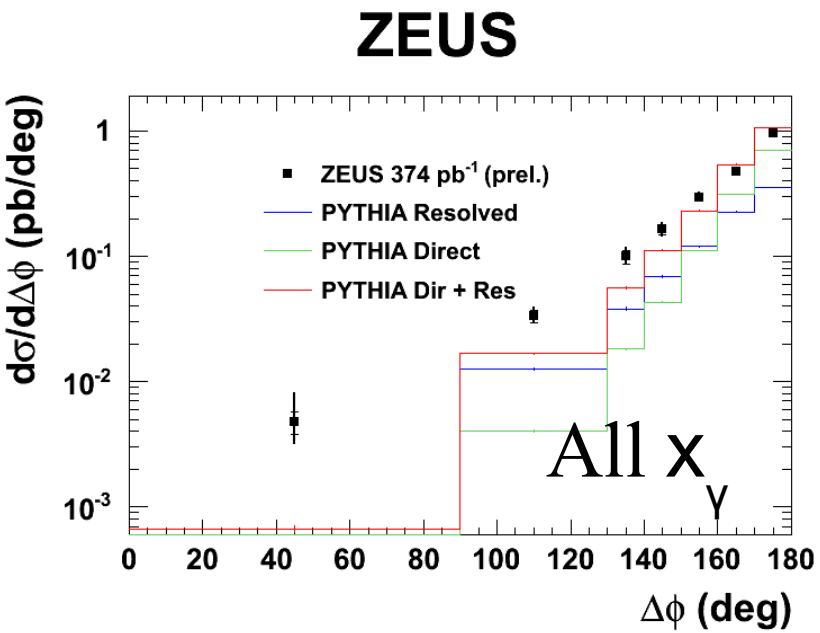


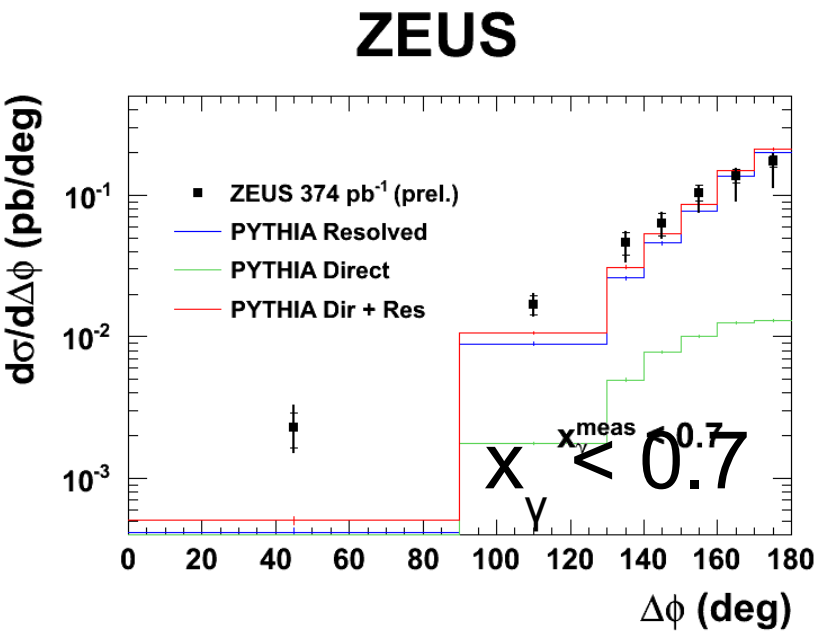


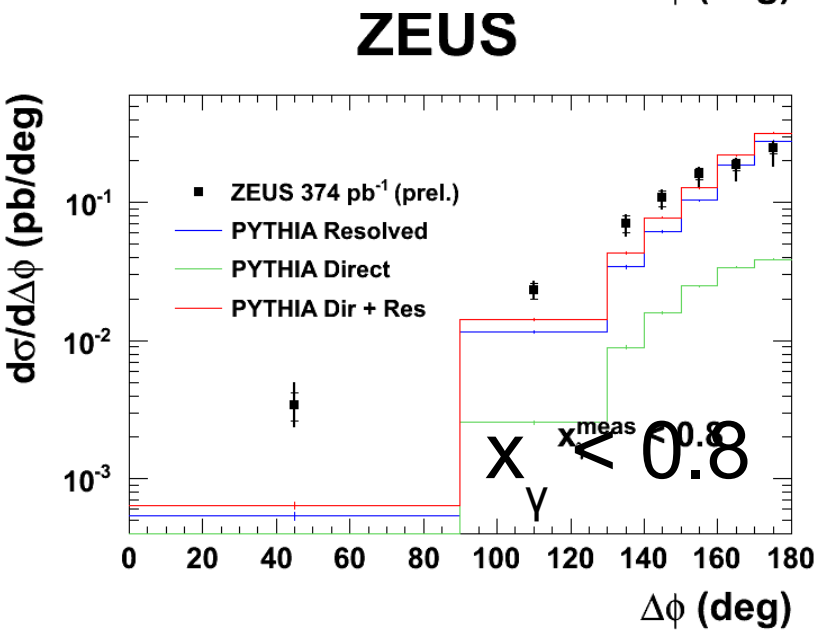


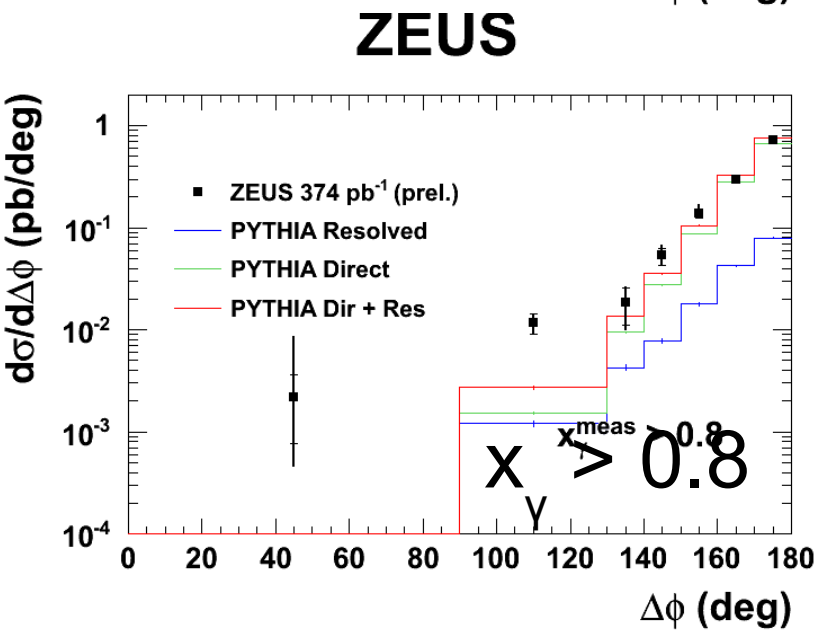
Reasonable description of data by theory. Low x_γ shows underestimation.

PYTHIA. Cross sections. ΔΦ



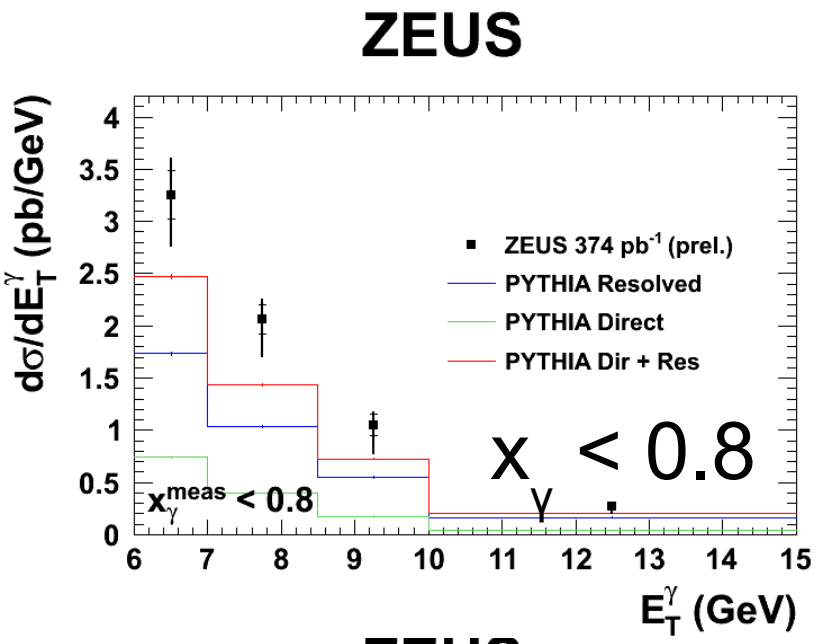


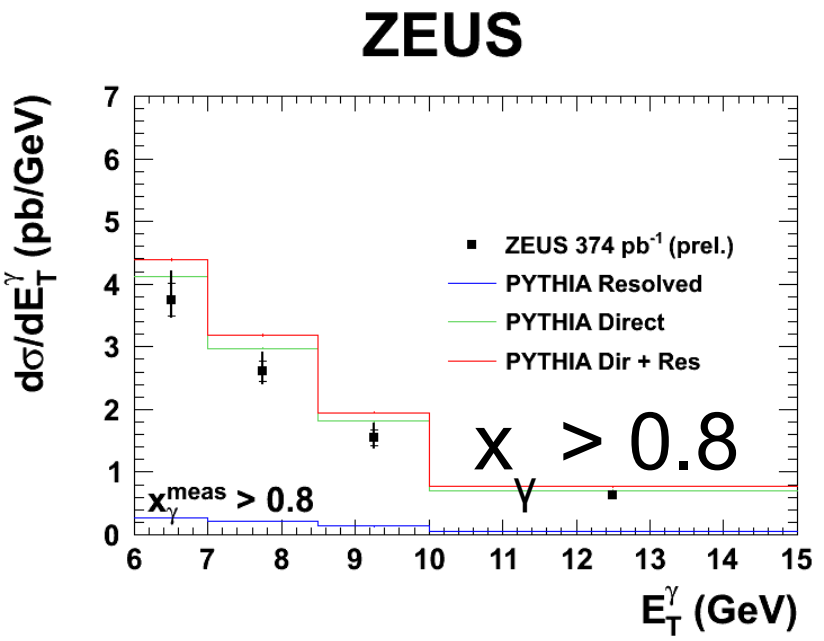


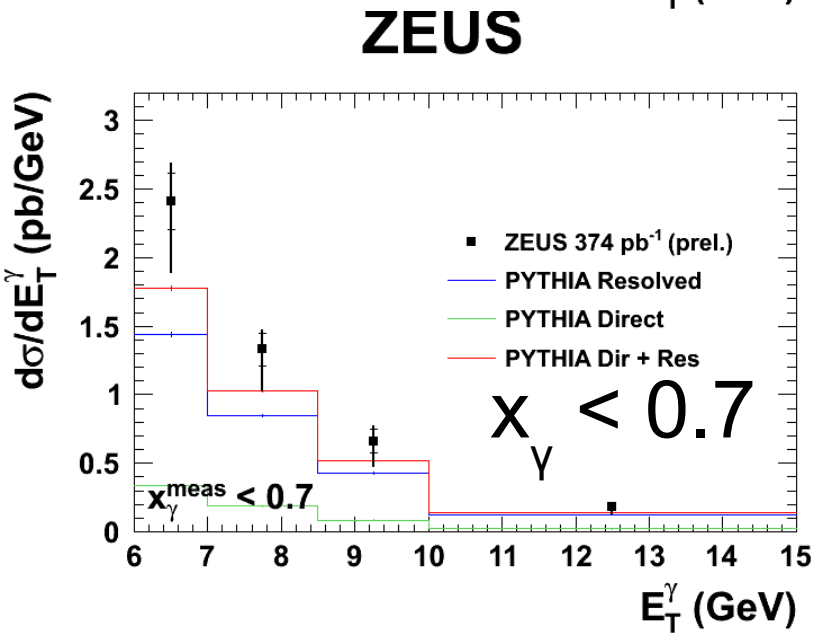


Reasonable description of data by theory. Low ΔΦ is underestimated.

PYTHIA. Cross sections. E_T^γ

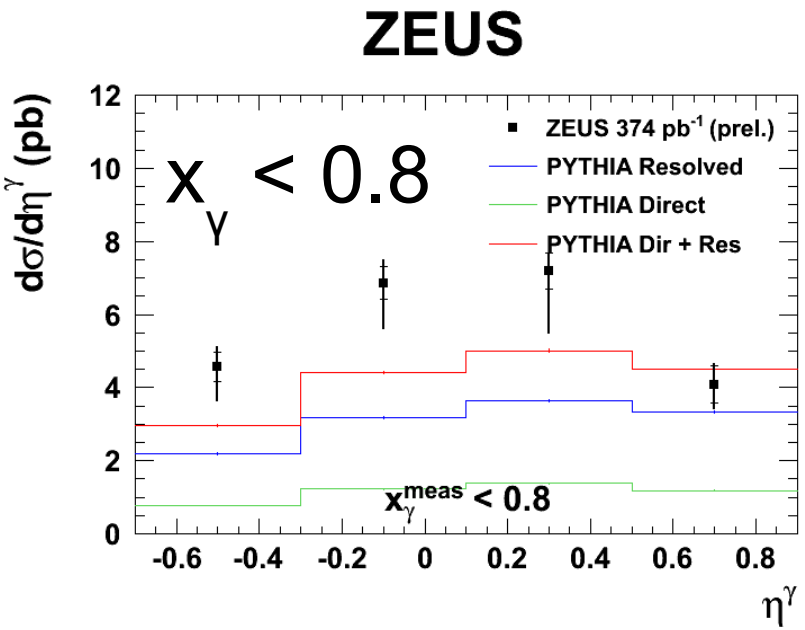


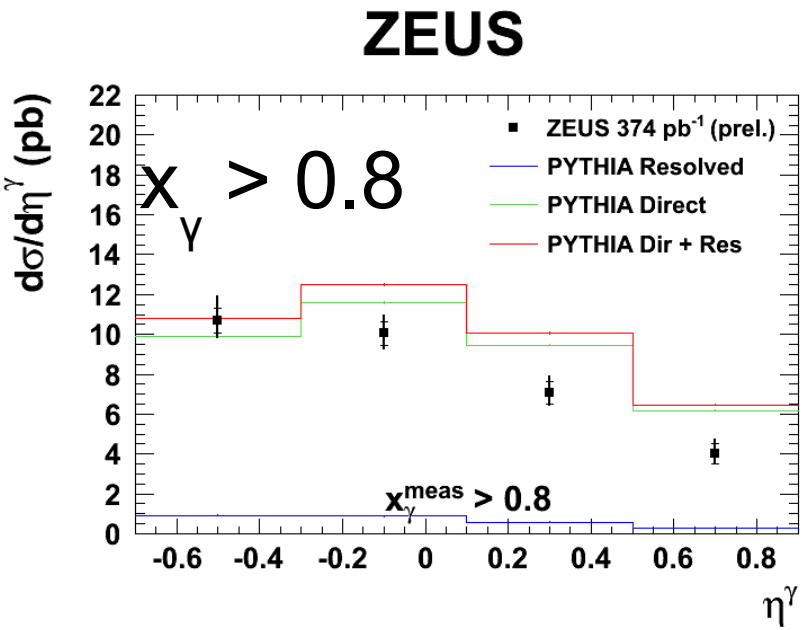


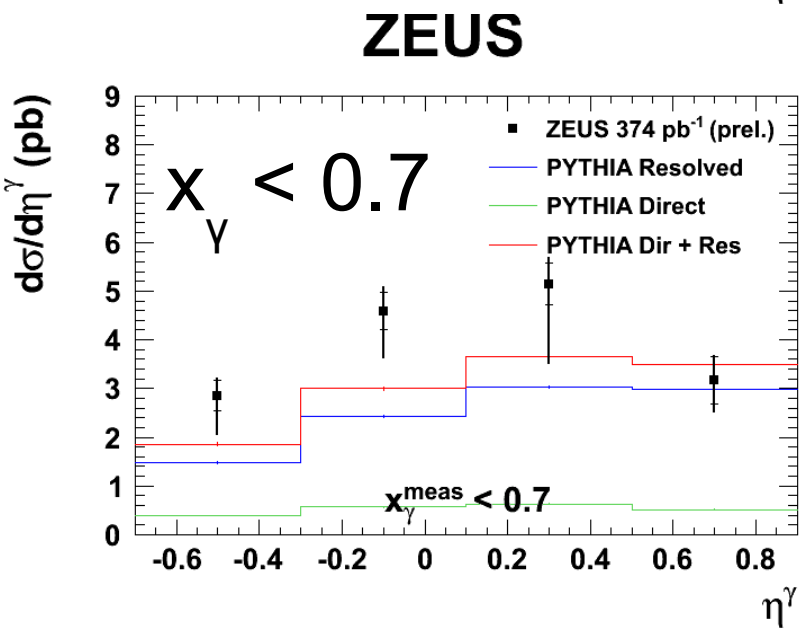


Reasonable description of data by MC. Low x_γ shows underestimation.

PYTHIA. Cross sections. η^{γ}

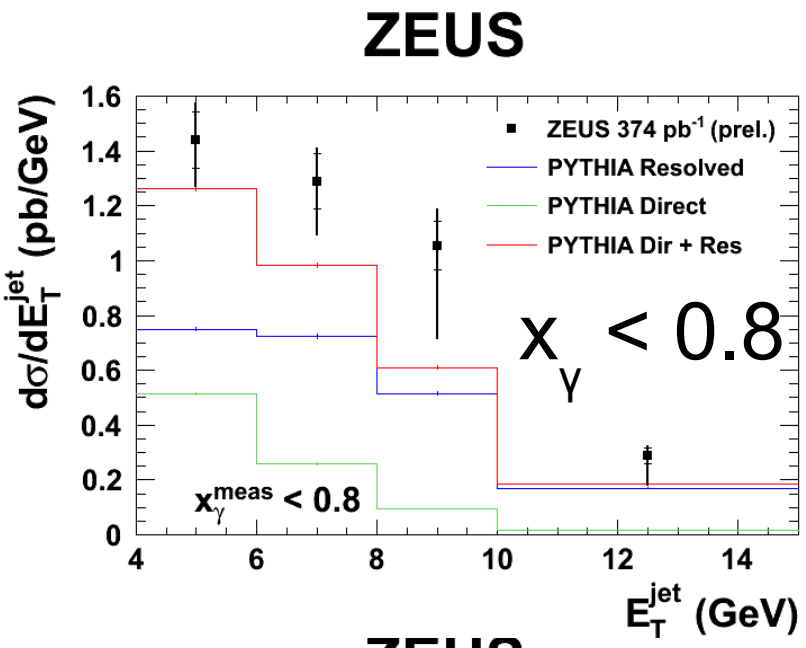


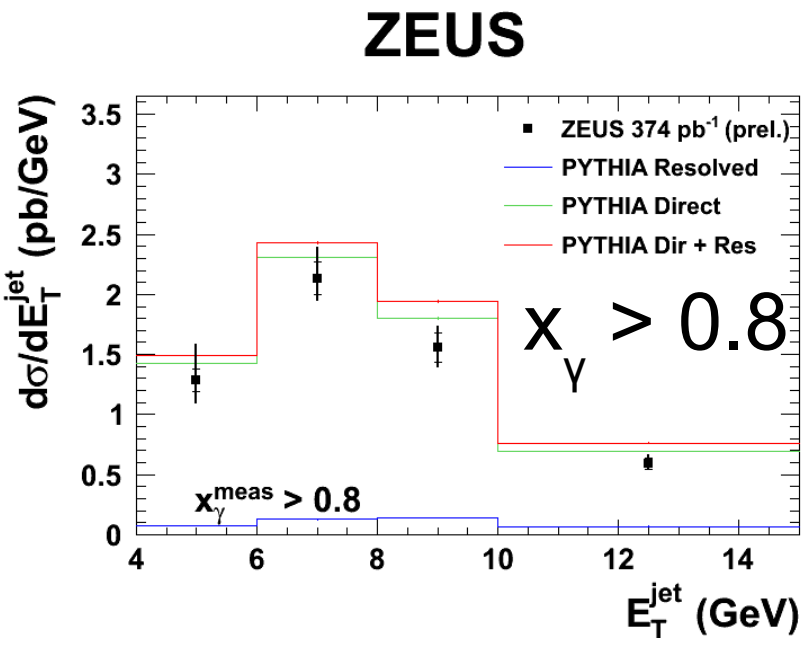


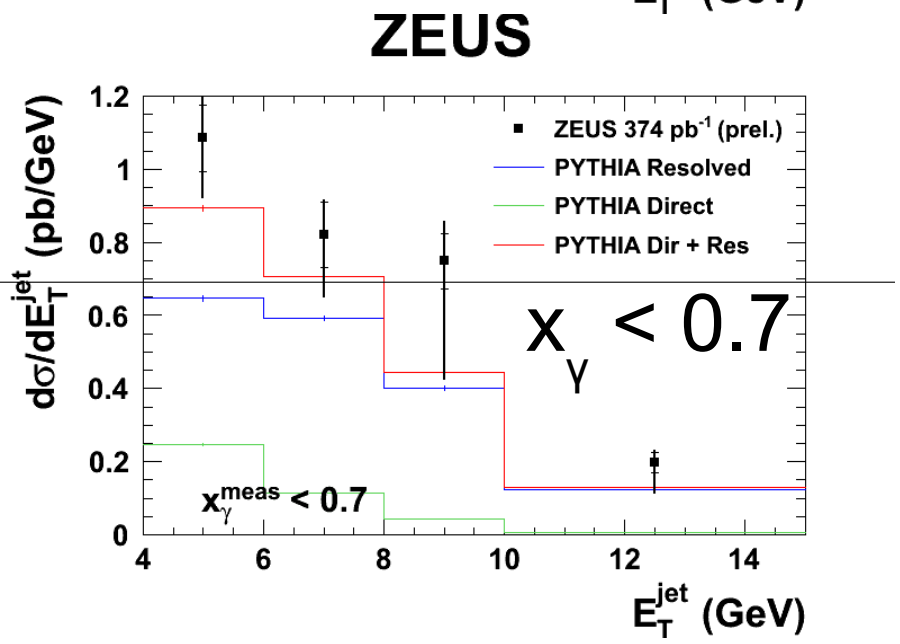


Reasonable description of data by MC. Low x_γ shows underestimation

PYTHIA. Cross sections. E_T^{jet}

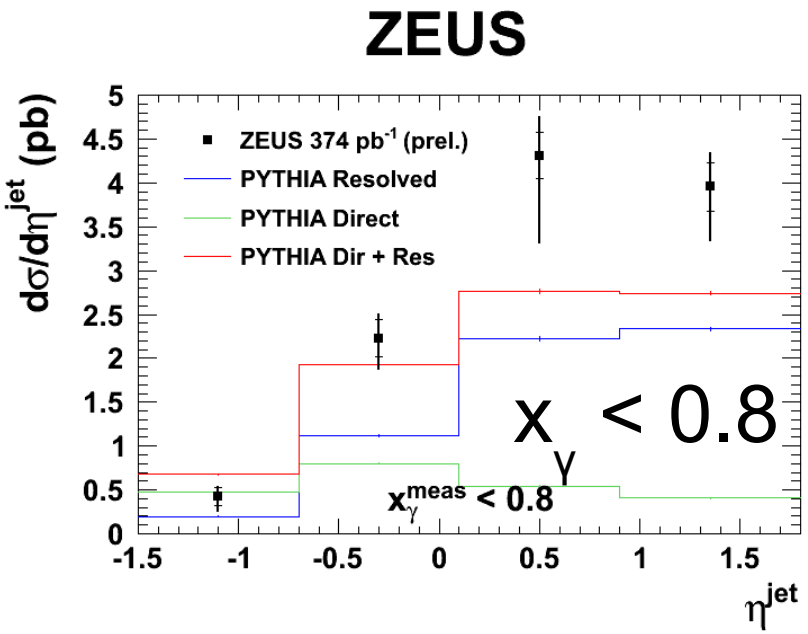


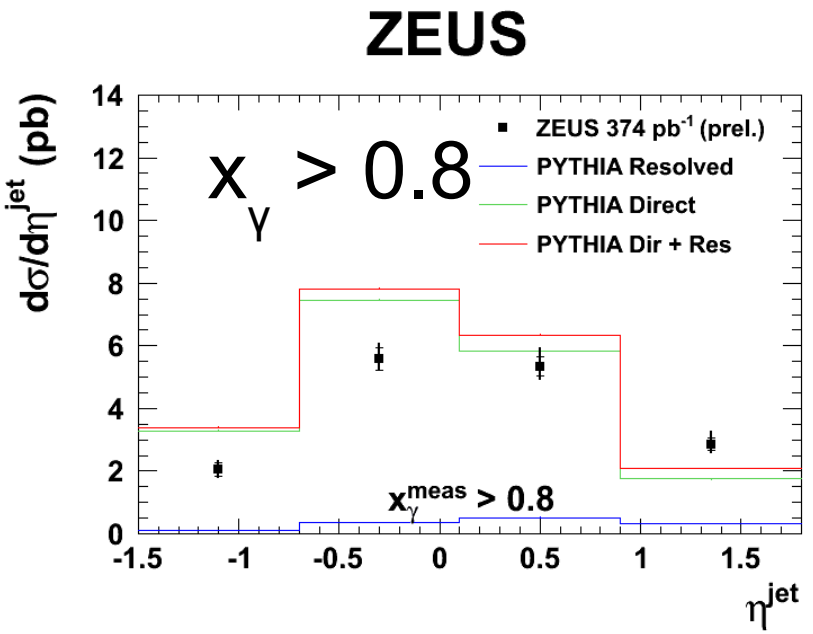


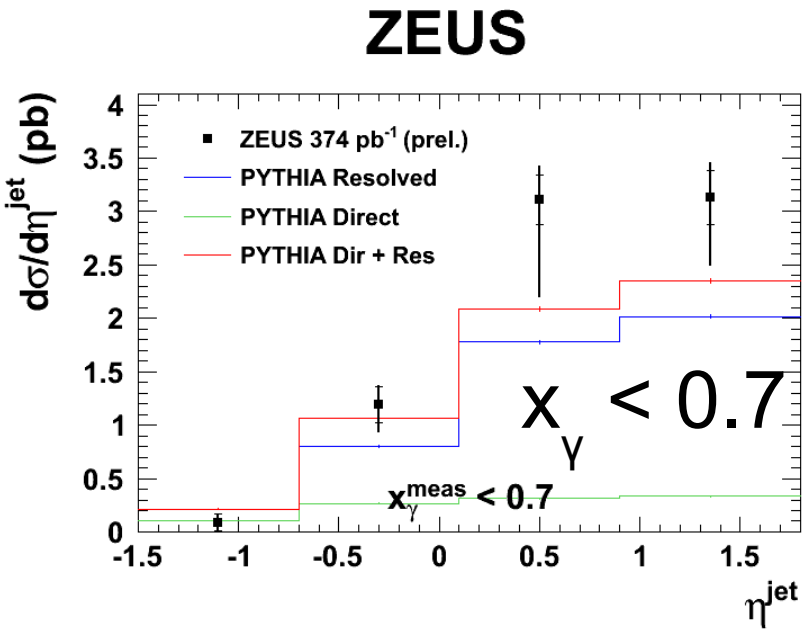


Reasonable description of data by MC.

PYTHIA. Cross sections. η^{jet}







Reasonable description of data by MC.

Corrections

No reweighting is applied.

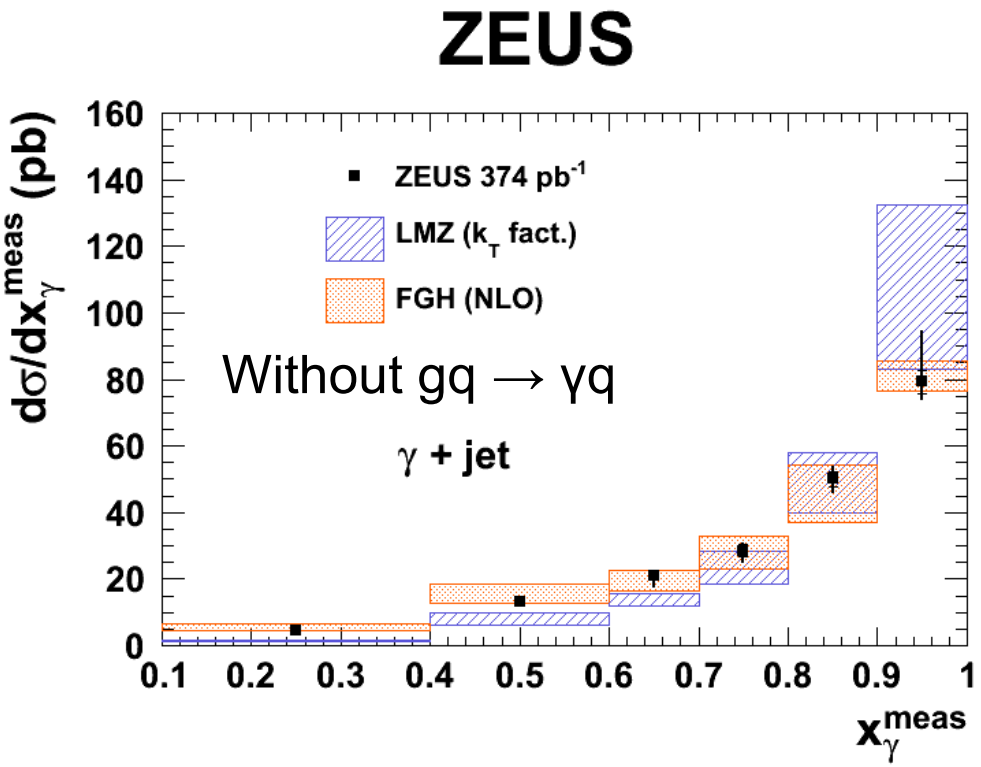
Hadronisation are applied to theory.

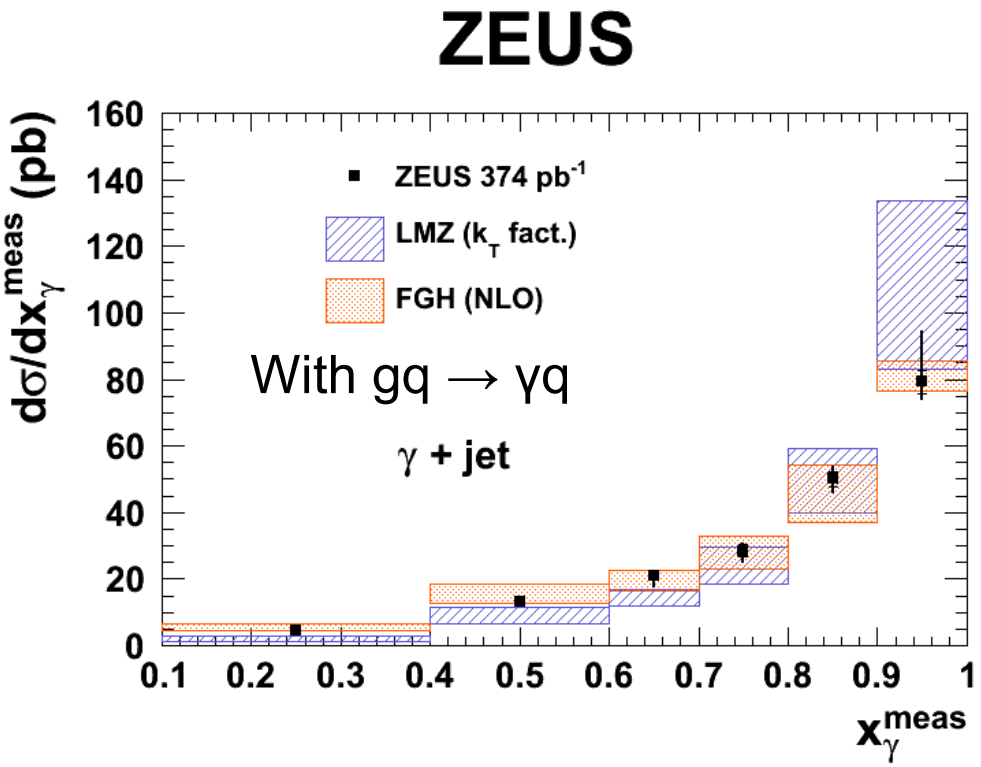
E-gamma is corrected by 1.1 factor as in the main analysis.

Energy scale variations are the same as in the main analysis: vary E-gamma by 2% and independently vary E-jet by sqrt(x**2 + 2**2), where x = 1.5, 2 or 4 depending on E-jet value and 2 comes from electron scale.

DIS contamination corrections are applied to data.

Update of LMZ theory





Published paper arXiv:1312.1539 has LMZ predictions where box diagram is included together with 2 → 3 subprocesses:

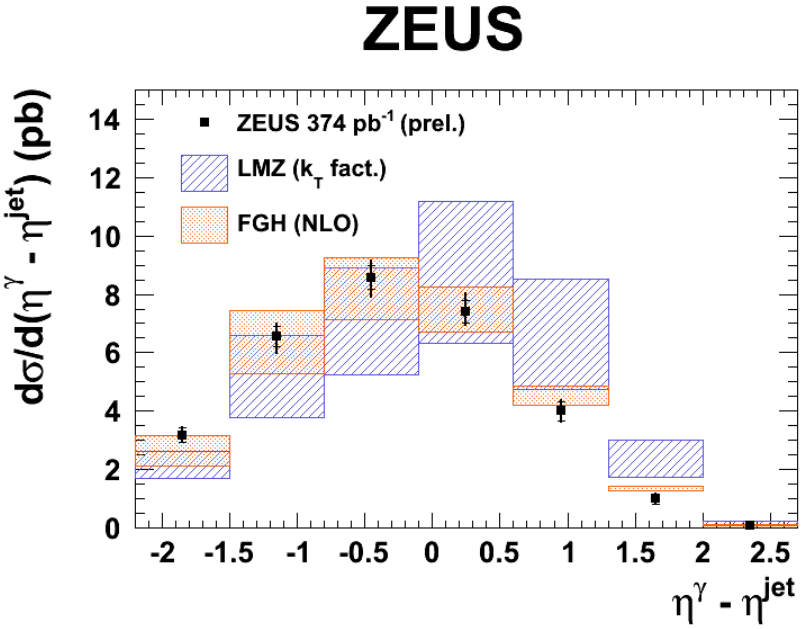
$\gamma(k_1) + q(k_2) \rightarrow \gamma(p_1) + g(p_2) + q(p_3)$

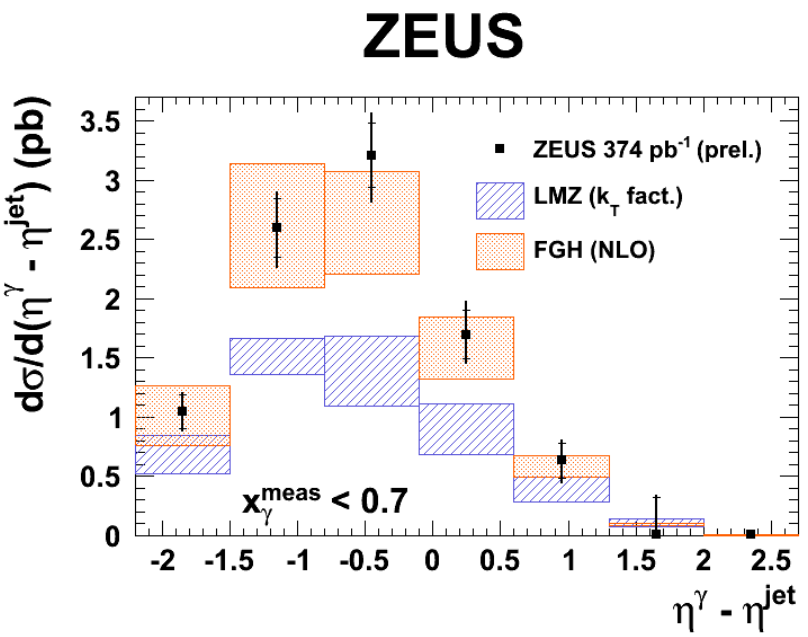
$\gamma(k_1) + g^*(k_2) \rightarrow \gamma(p_1) + q(p_2) + \mathrm{qbar}(p_3)$

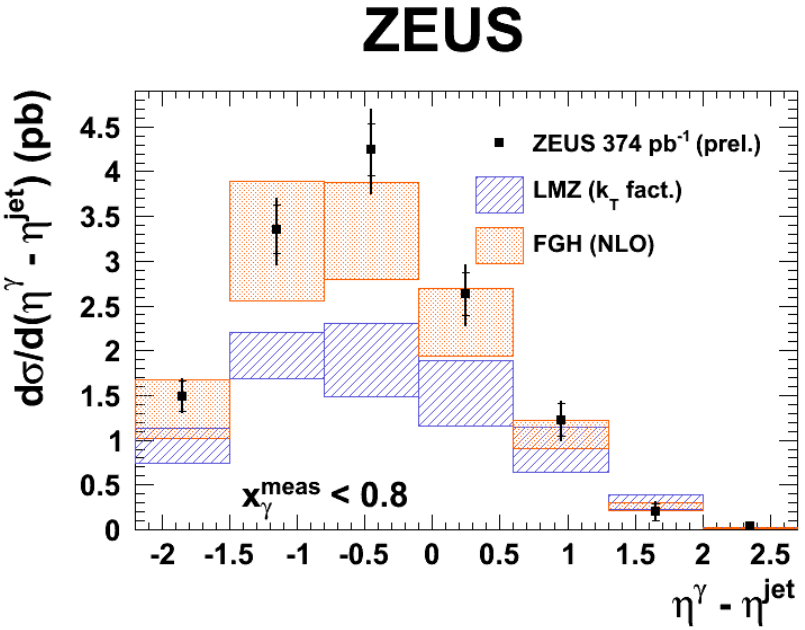
$\gamma(k_1) + g(k_2) \rightarrow \gamma(p_1) + g(p_2)$.

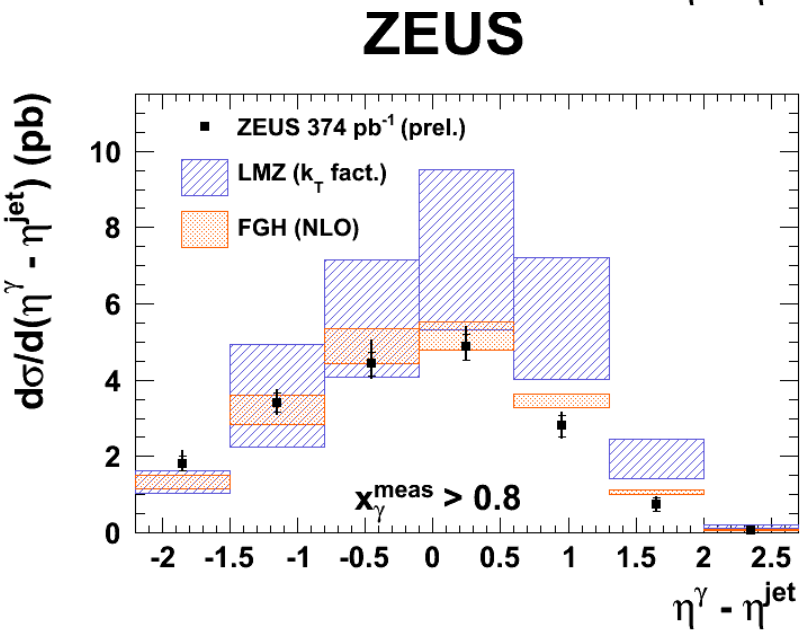
Now gq → γq process is also included.

Theory. Cross sections. η^{γ} - η^{jet}



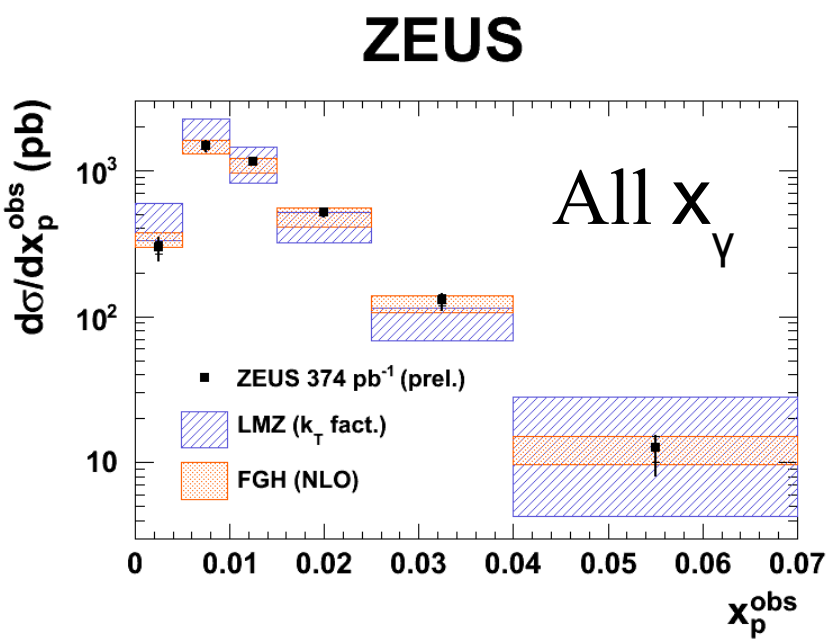


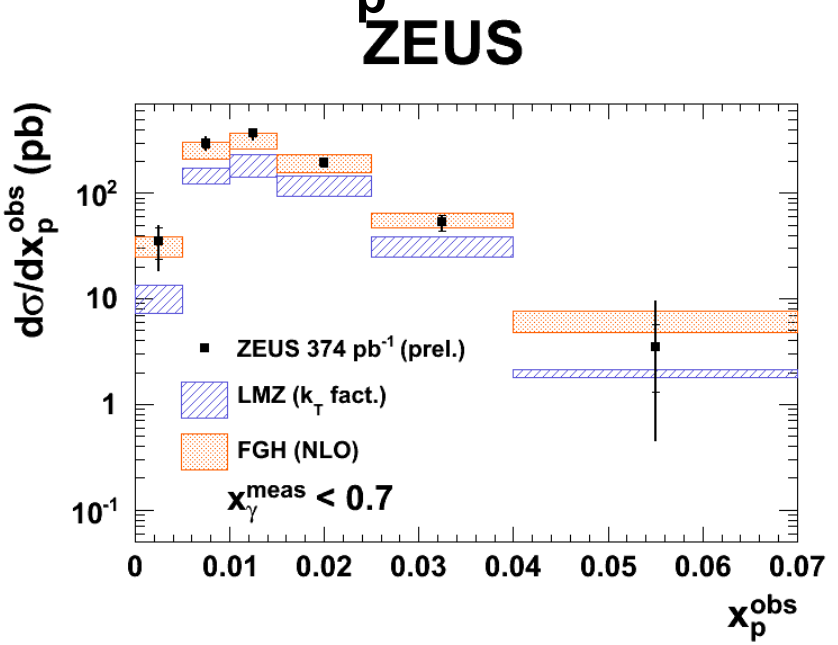


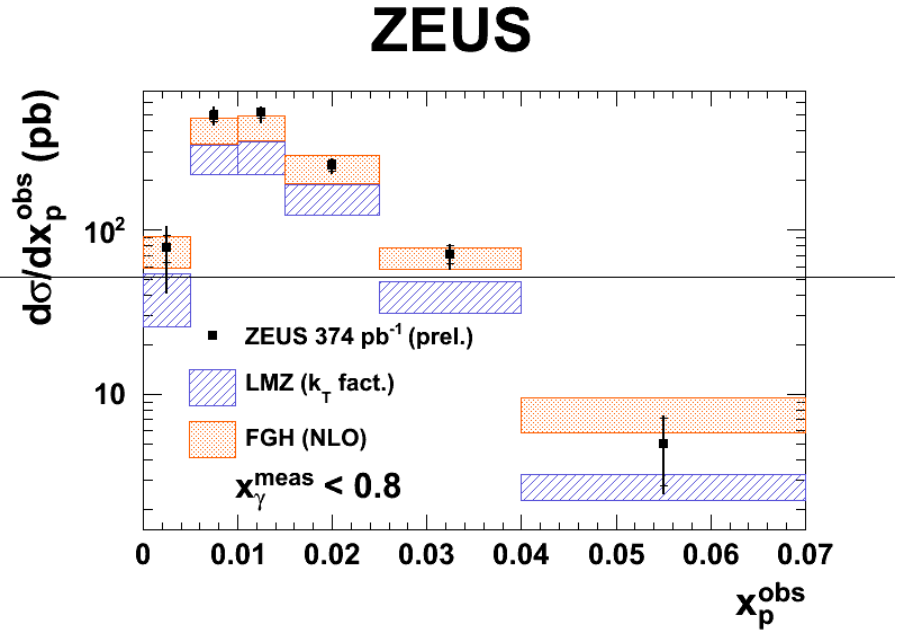


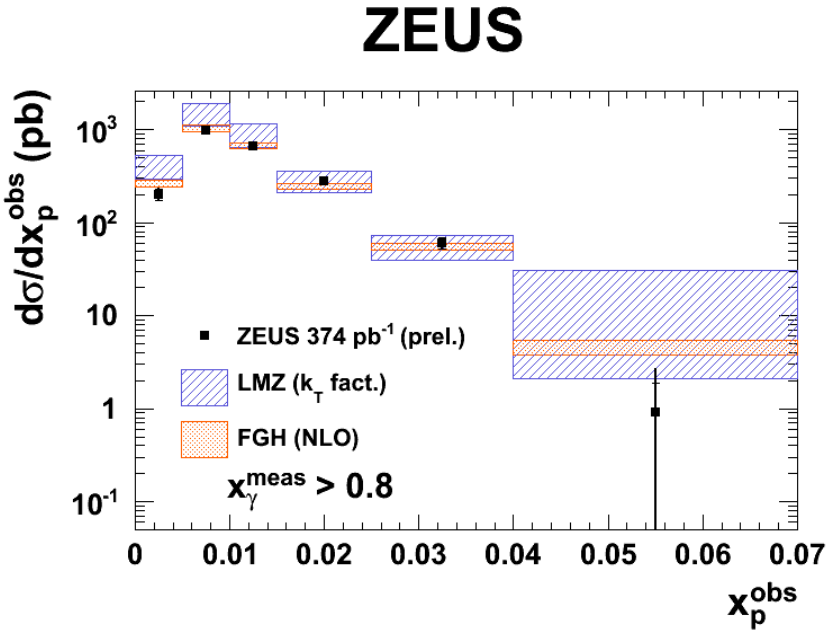
Reasonable description of data by theory. LMZ tends to underestimate low x_{γ} (more so x_{γ}<0.7, e.g. fifth bin) and overestimate high x_{γ} at high η^{γ} - η^{jet}.

Theory. Cross sections. x_p



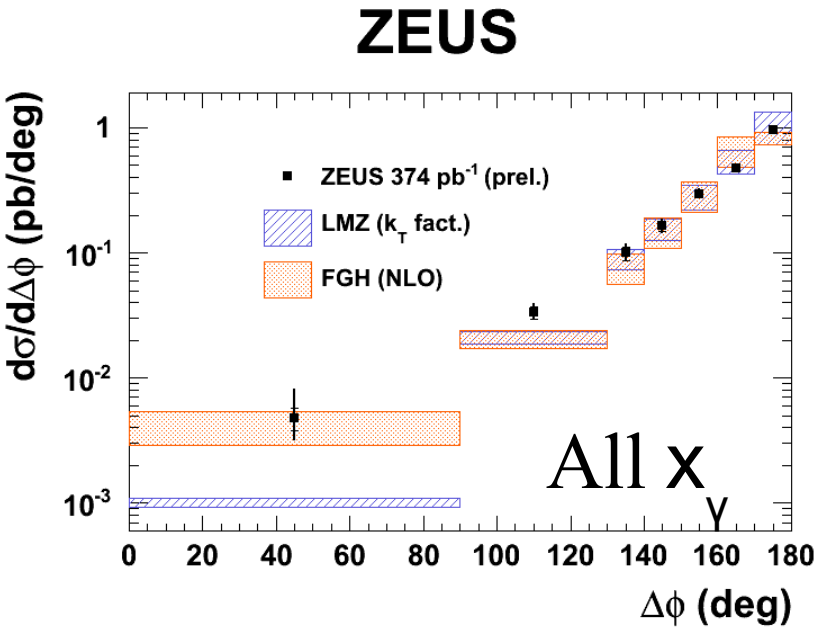


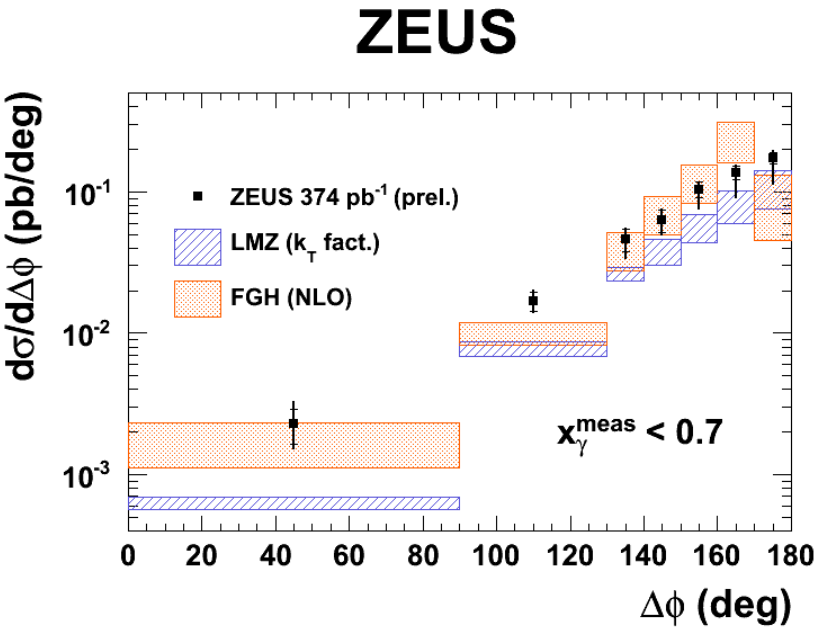


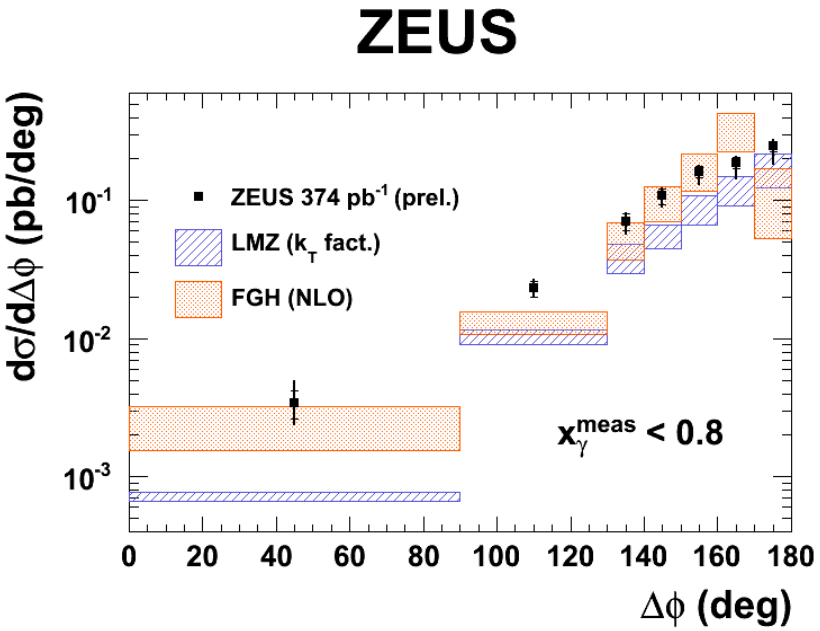


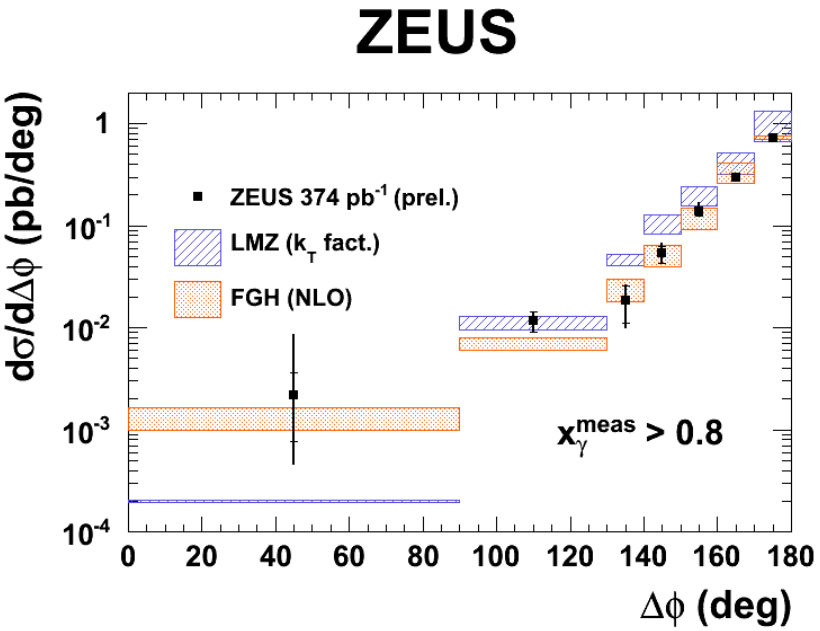
Reasonable description of data by theory. LMZ underestimates cross-section at small ΔΦ, in general tends to underestimate low x_γ. In x_γ<0.7 LMZ underestimates first bin, while it agrees within errors in x_γ<0.8.

Theory. Cross sections. ΔΦ



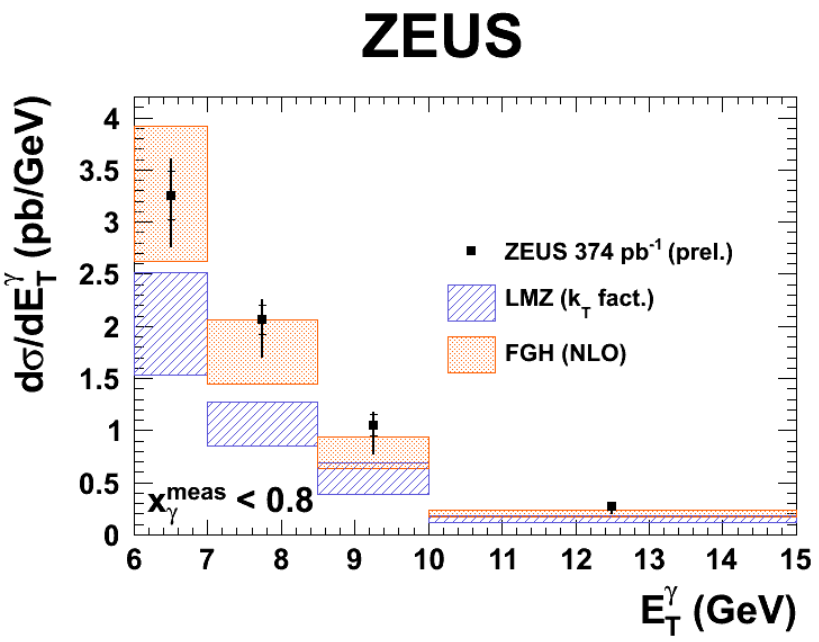


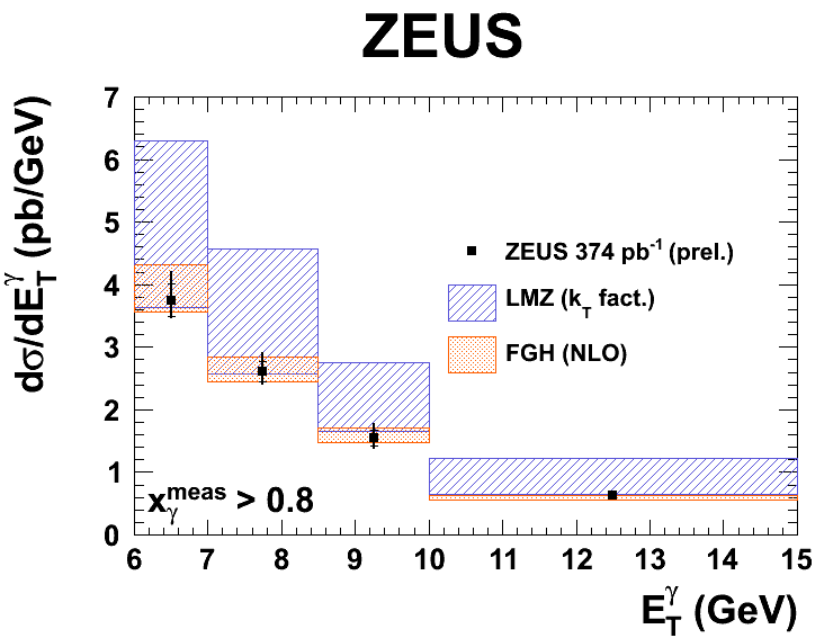


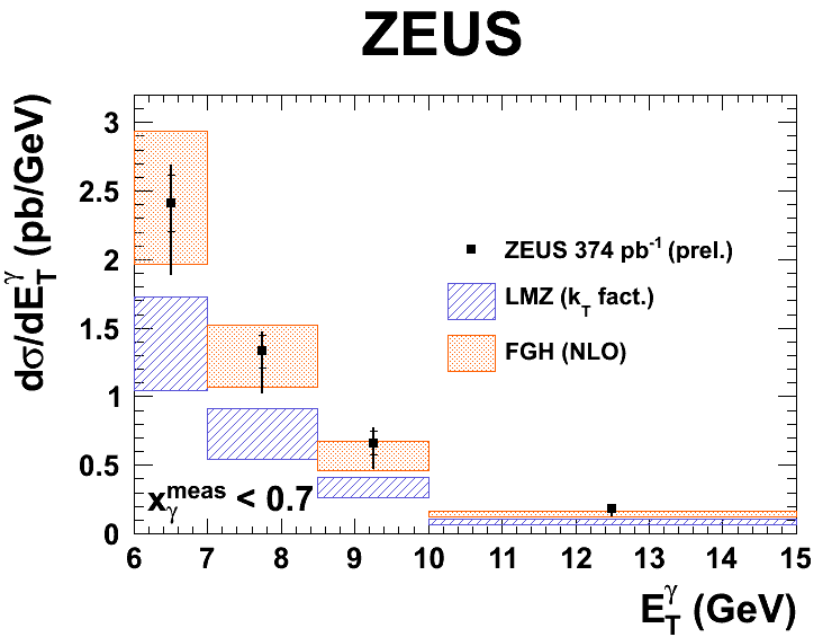


Reasonable description of data by theory. LMZ tends to underestimate low x_γ and overestimate high x_γ.

Theory. Cross sections. E_T^γ



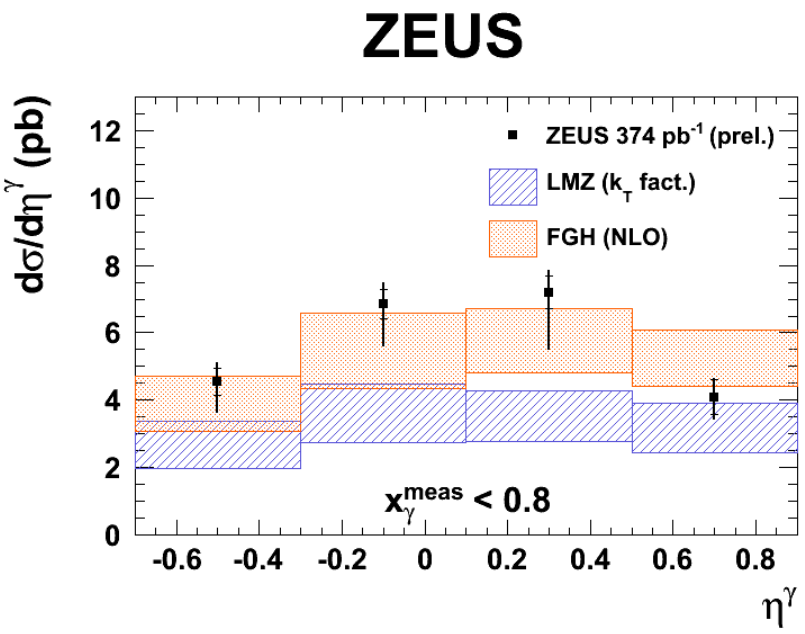


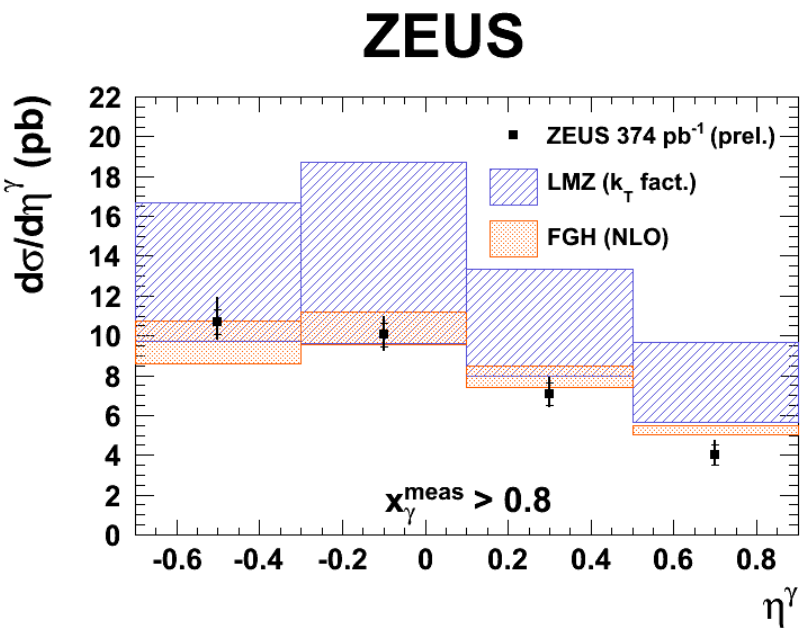


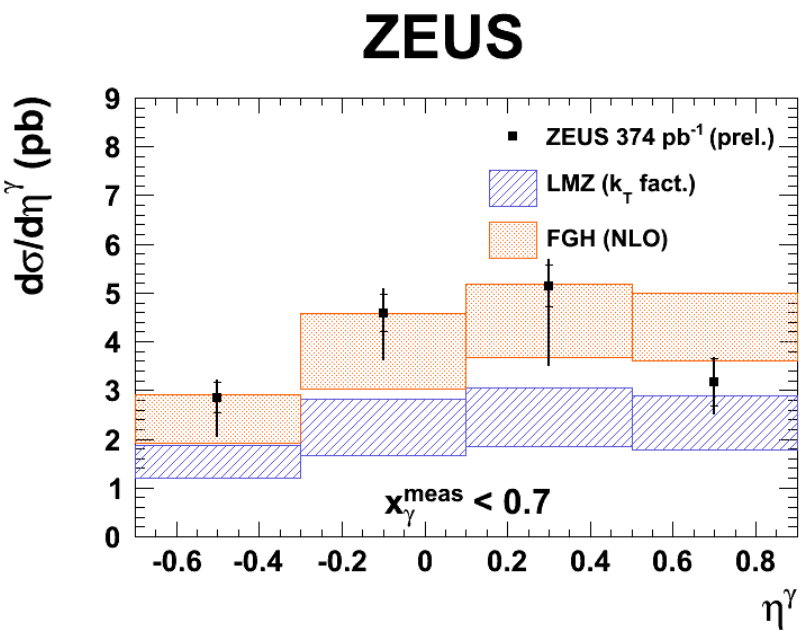
Reasonable shape description of data by theory.

LMZ tends to underestimate low x_γ region.

Theory. Cross sections. η^{γ}



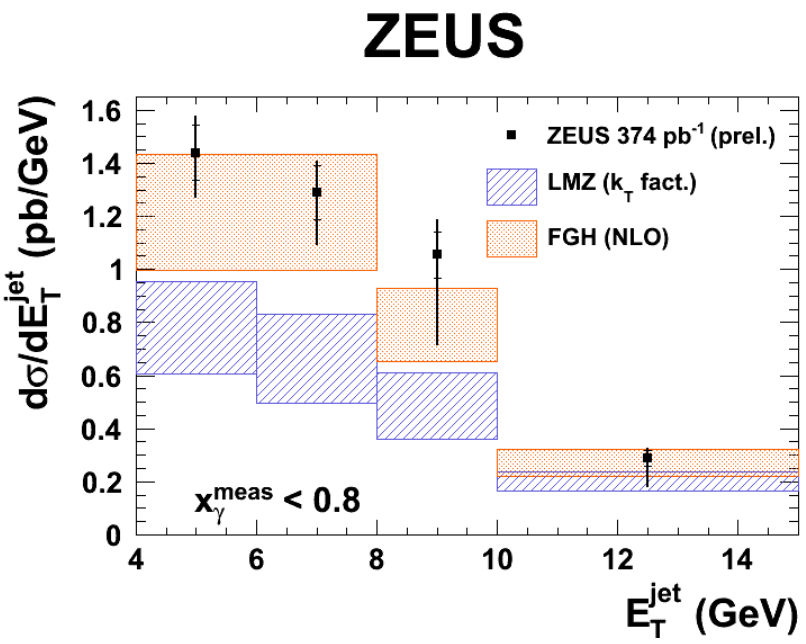


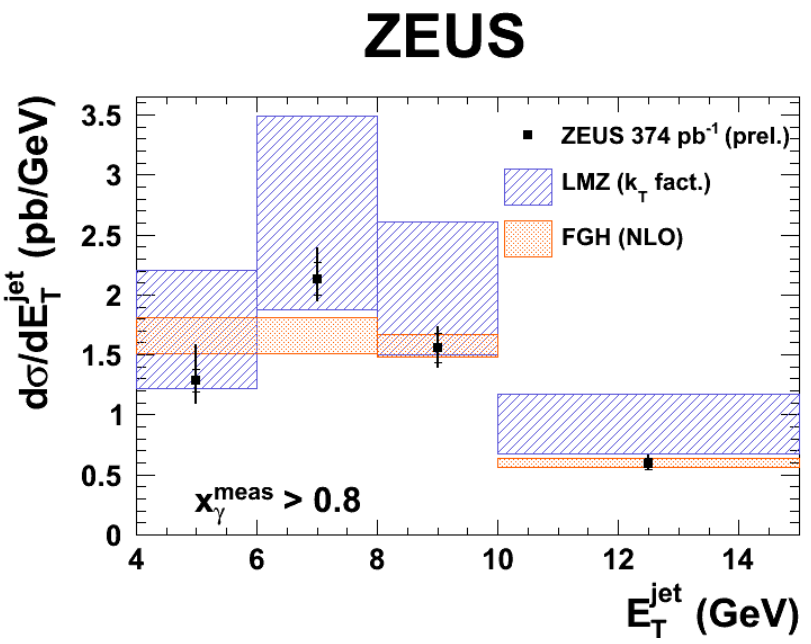


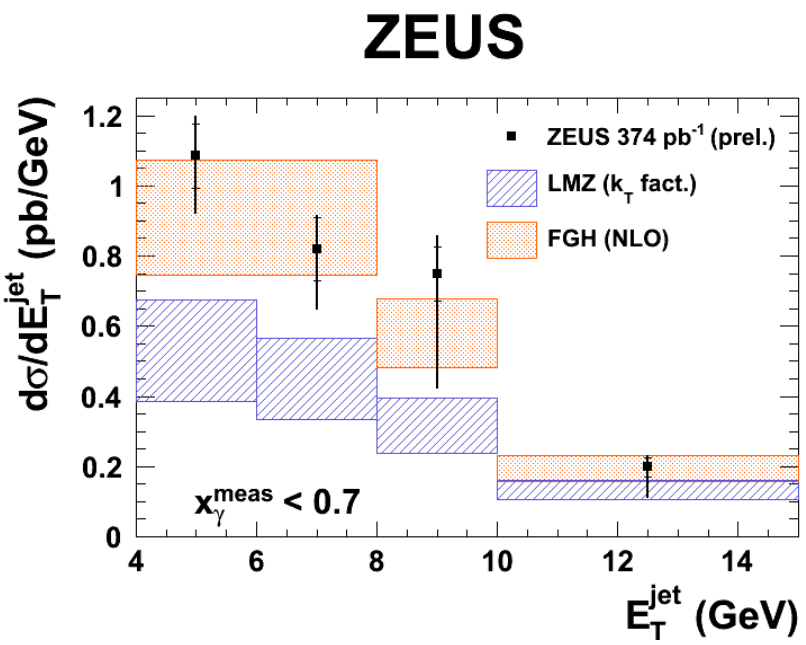
Reasonable shape description of data by theory.

LMZ tends to underestimate low x_{γ} region.

Theory. Cross sections. E_T^{jet}



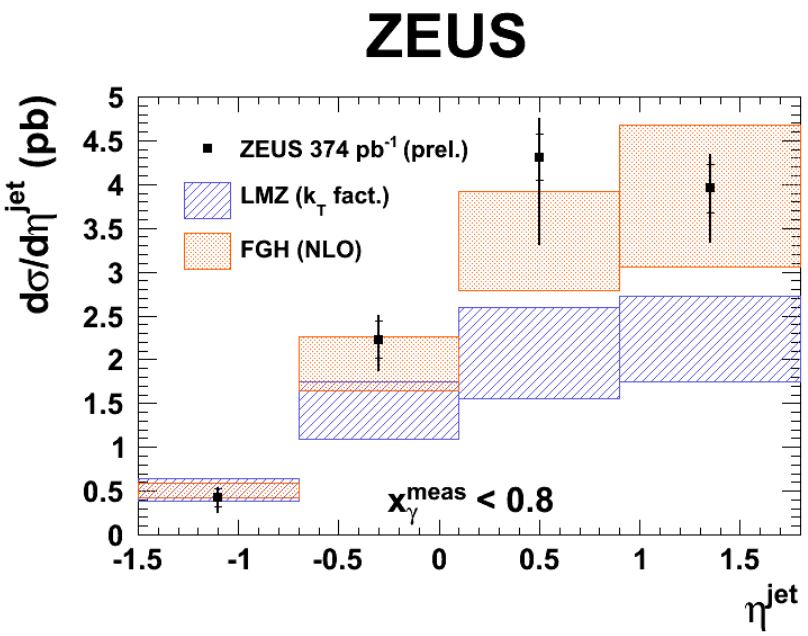


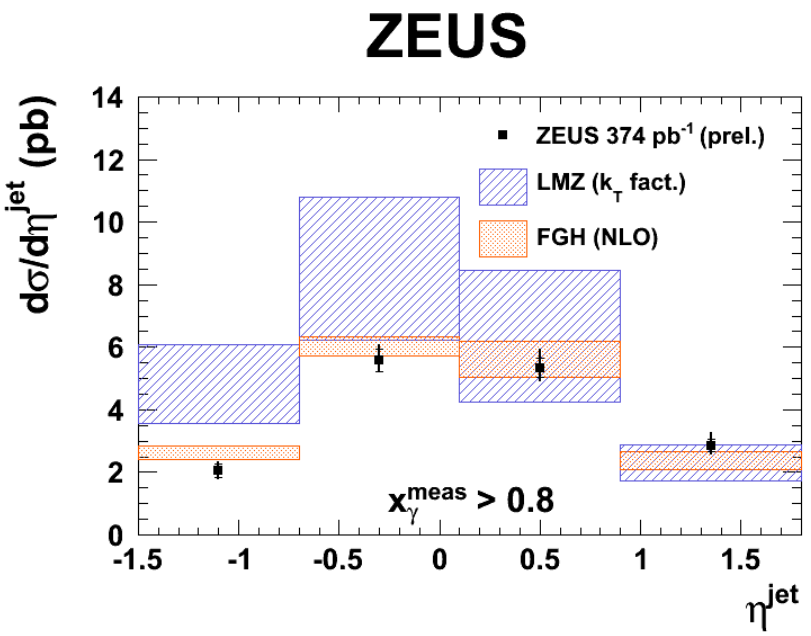


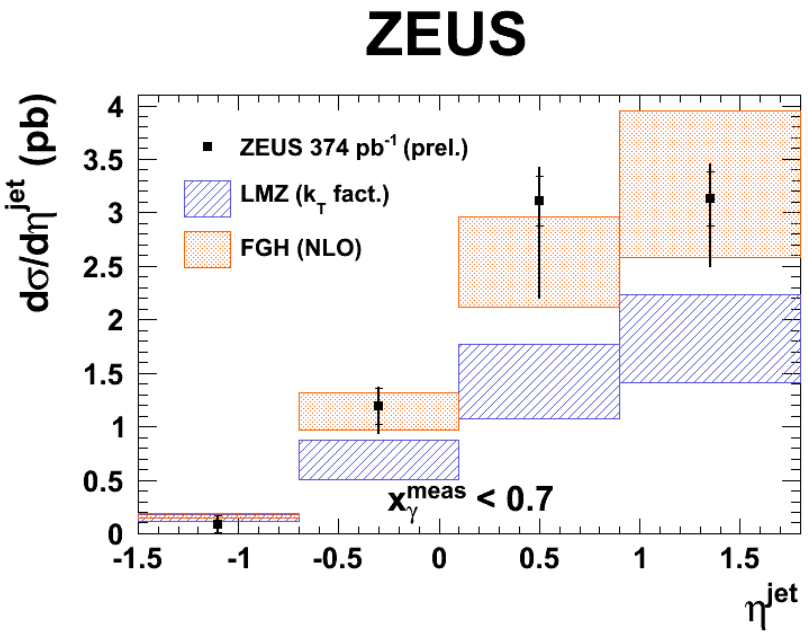
Reasonable shape description of data by theory.

LMZ tends to underestimate low x_γ region.

Theory. Cross sections. η^{jet}







Reasonable shape description of data by theory.

LMZ tends to underestimate low x_γ region and overestimate low η^{jet} at high x_γ.

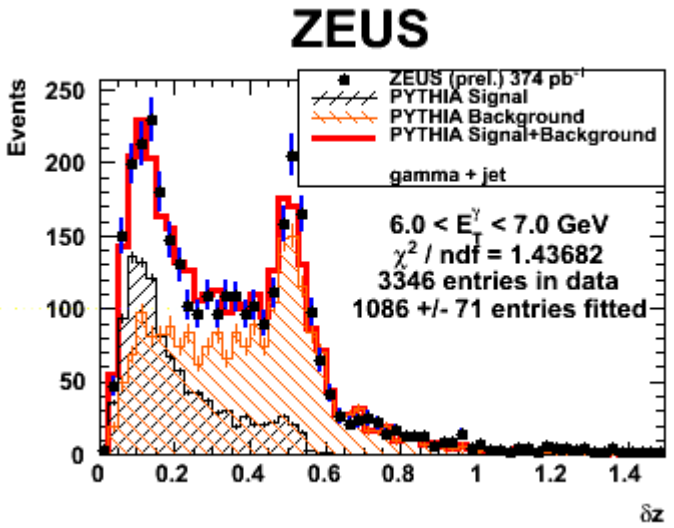
Conclusion

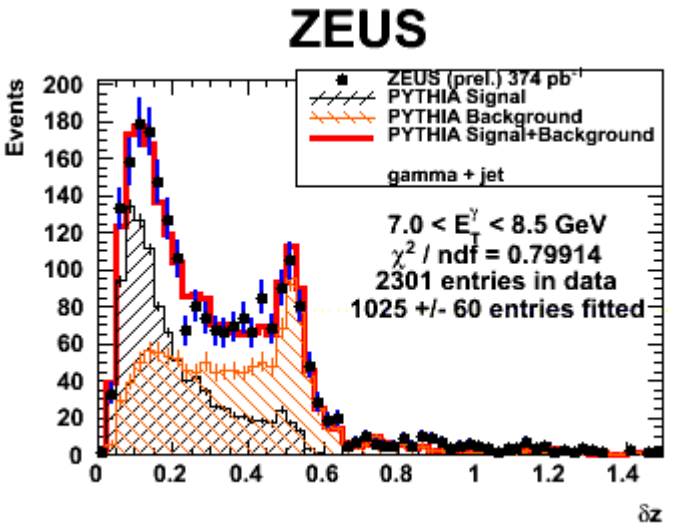
Complete set of photoproduction cross sections has been calculated for prompt photons with an accompanying jet.

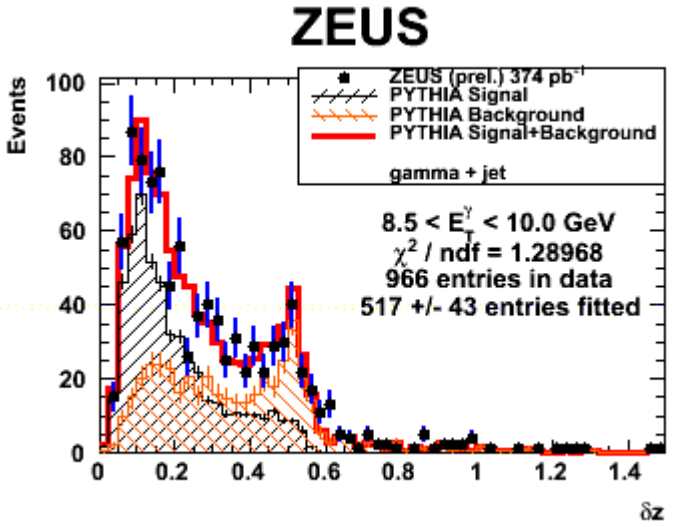
Reasonable description by theory is available.

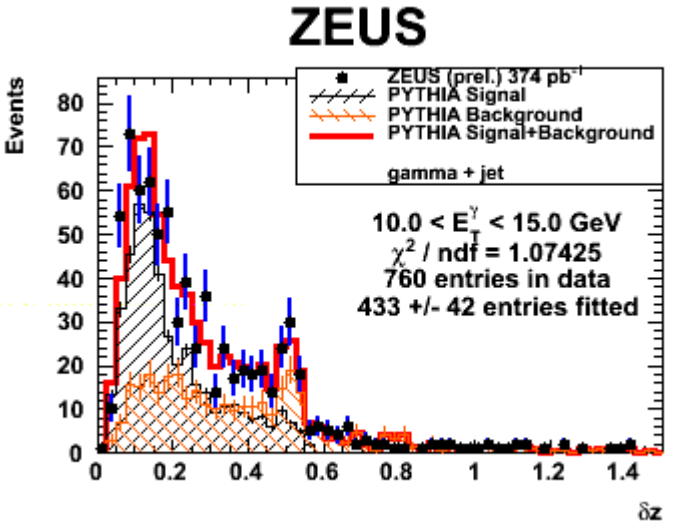
FGH reproduces well measured experimental distributions.

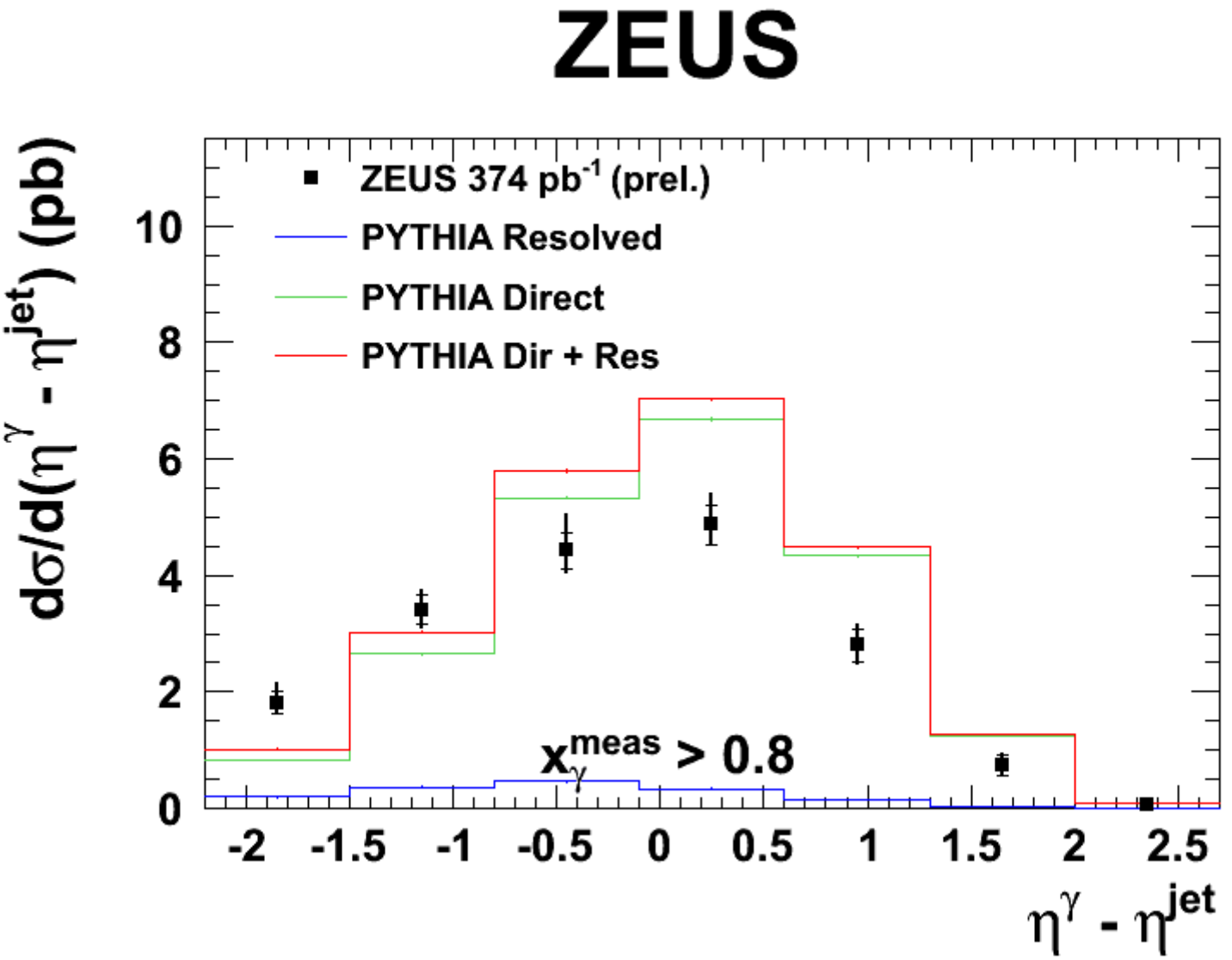
LMZ has a tendency to be too high at high x_γ^{meas}, but too low at low x_γ^{meas}, which is especially emphasized in $x_\gamma^{meas}<0.7$ region.

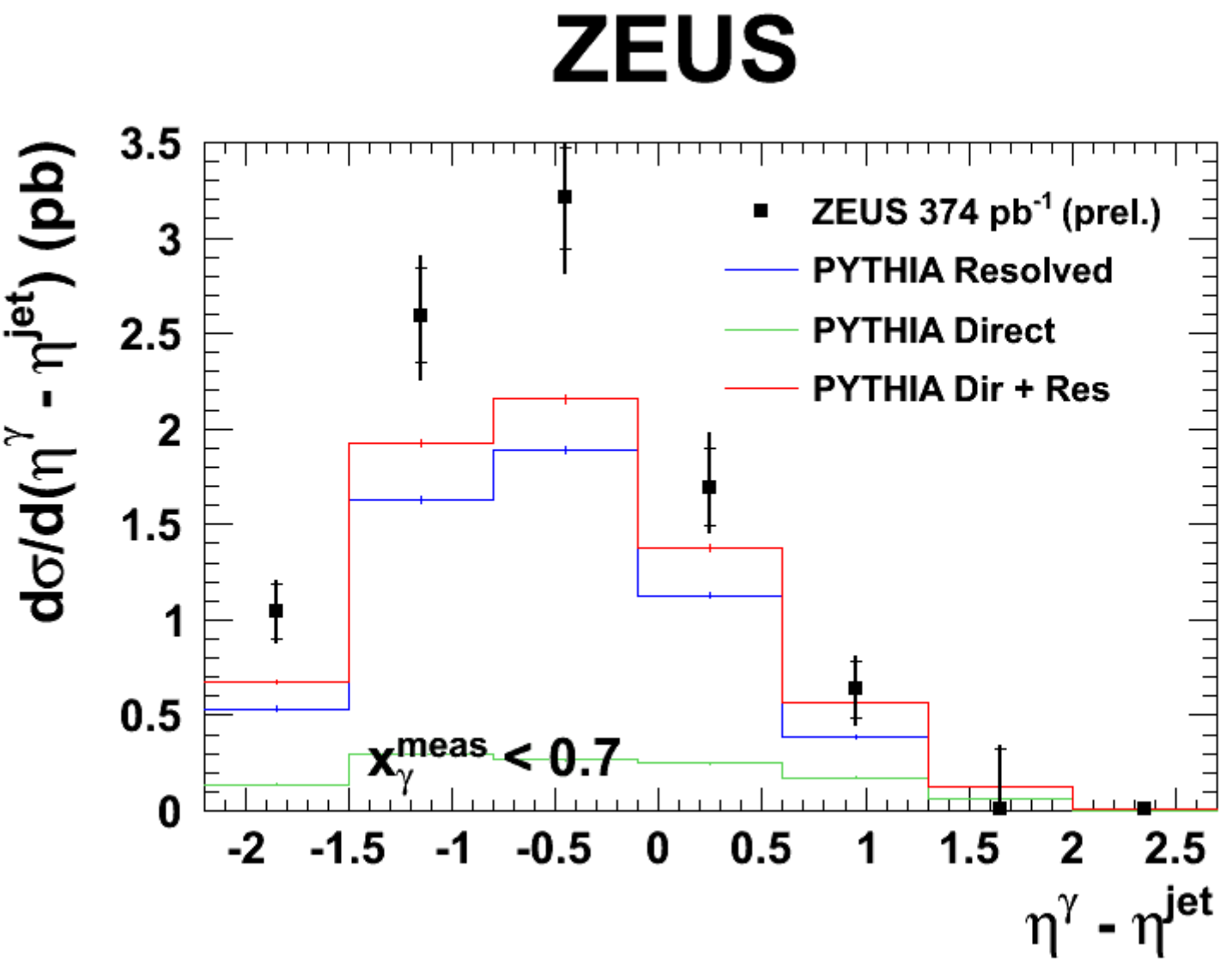

ZEUS
ZEUS (prel.) 374 pb^{-1}
PYTHIA Signal
PYTHIA Background
PYTHIA Signal+Background
gamma + jet
6.0 < E_T^γ < 7.0 GeV
χ^2 / ndf = 1.43682
3346 entries in data
1086 +/- 71 entries fitted
Events
δz

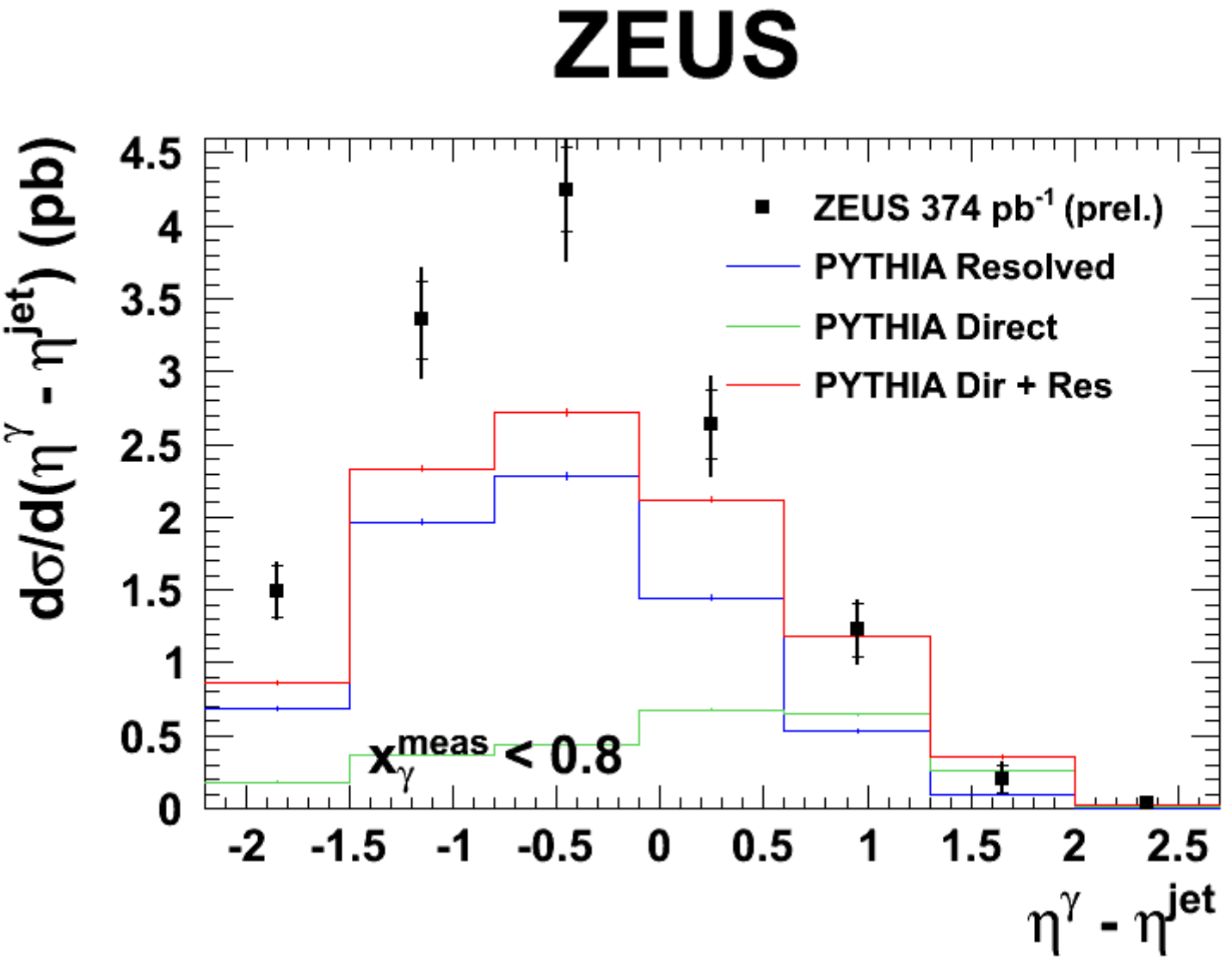

ZEUS
ZEUS (prel.) 374 pb^{-1}
PYTHIA Signal
PYTHIA Background
PYTHIA Signal+Background
gamma + jet
7.0 < E_T^γ < 8.5 GeV
χ^2 / ndf = 0.79914
2301 entries in data
1025 +/- 60 entries fitted
Events
δz

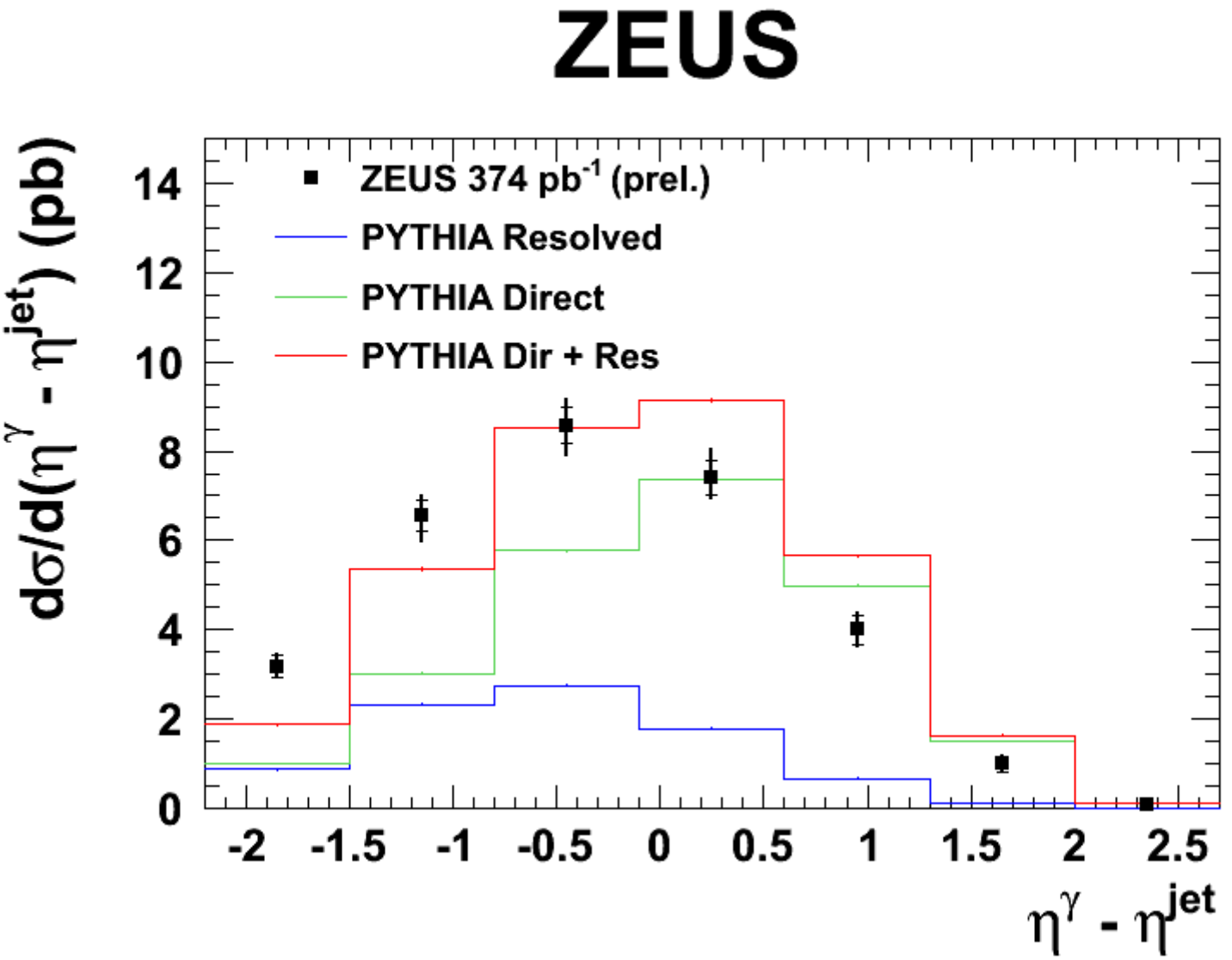

ZEUS
ZEUS (prel.) 374 pb^{-1}
PYTHIA Signal
PYTHIA Background
PYTHIA Signal+Background
gamma + jet
8.5 < E_T^γ < 10.0 GeV
χ^2 / ndf = 1.28968
966 entries in data
517 +/- 43 entries fitted
Events
δz

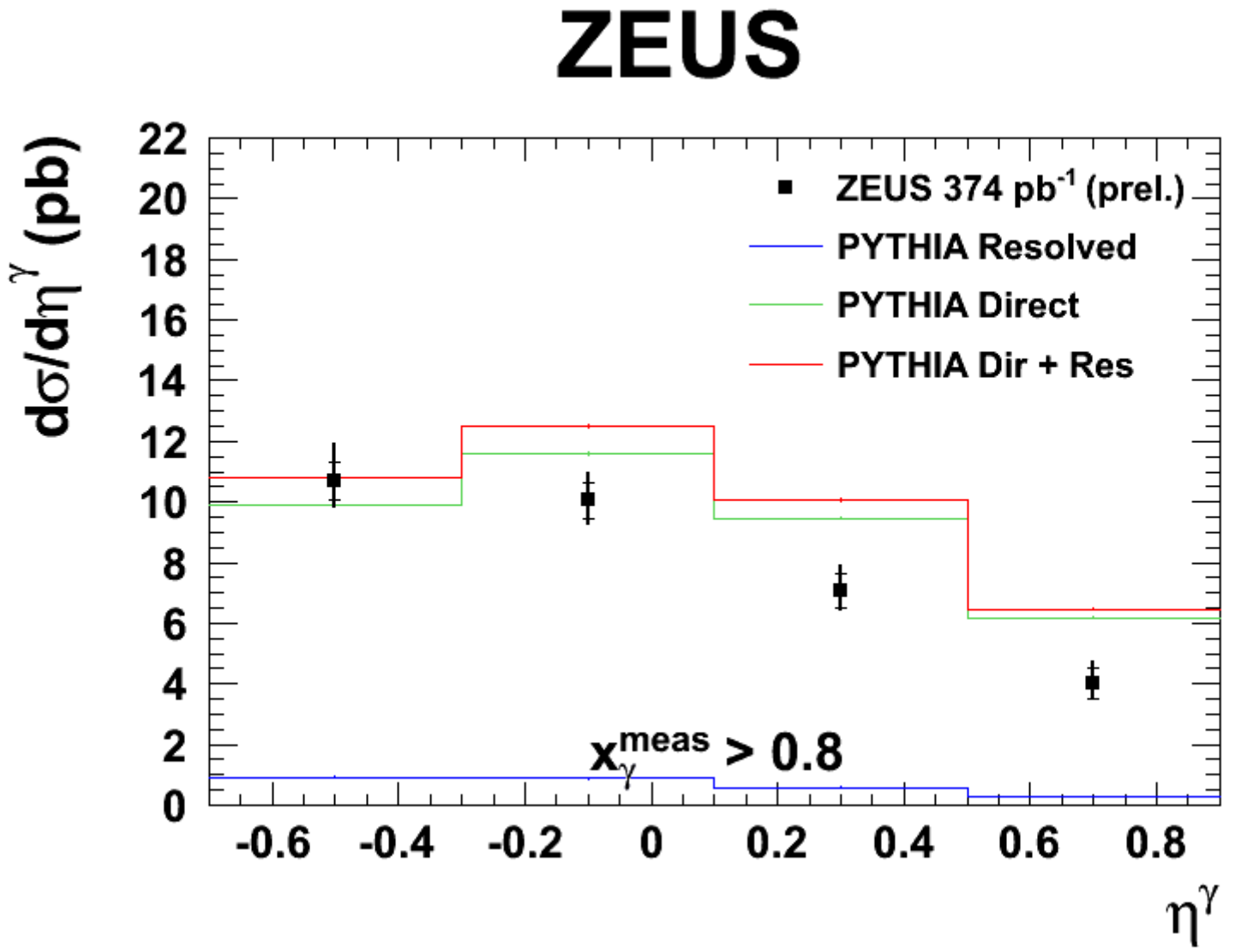

ZEUS
ZEUS (prel.) 374 pb^{-1}
PYTHIA Signal
PYTHIA Background
PYTHIA Signal+Background
gamma + jet
10.0 < E_T^γ < 15.0 GeV
χ^2 / ndf = 1.07425
760 entries in data
433 +/- 42 entries fitted
Events
δz

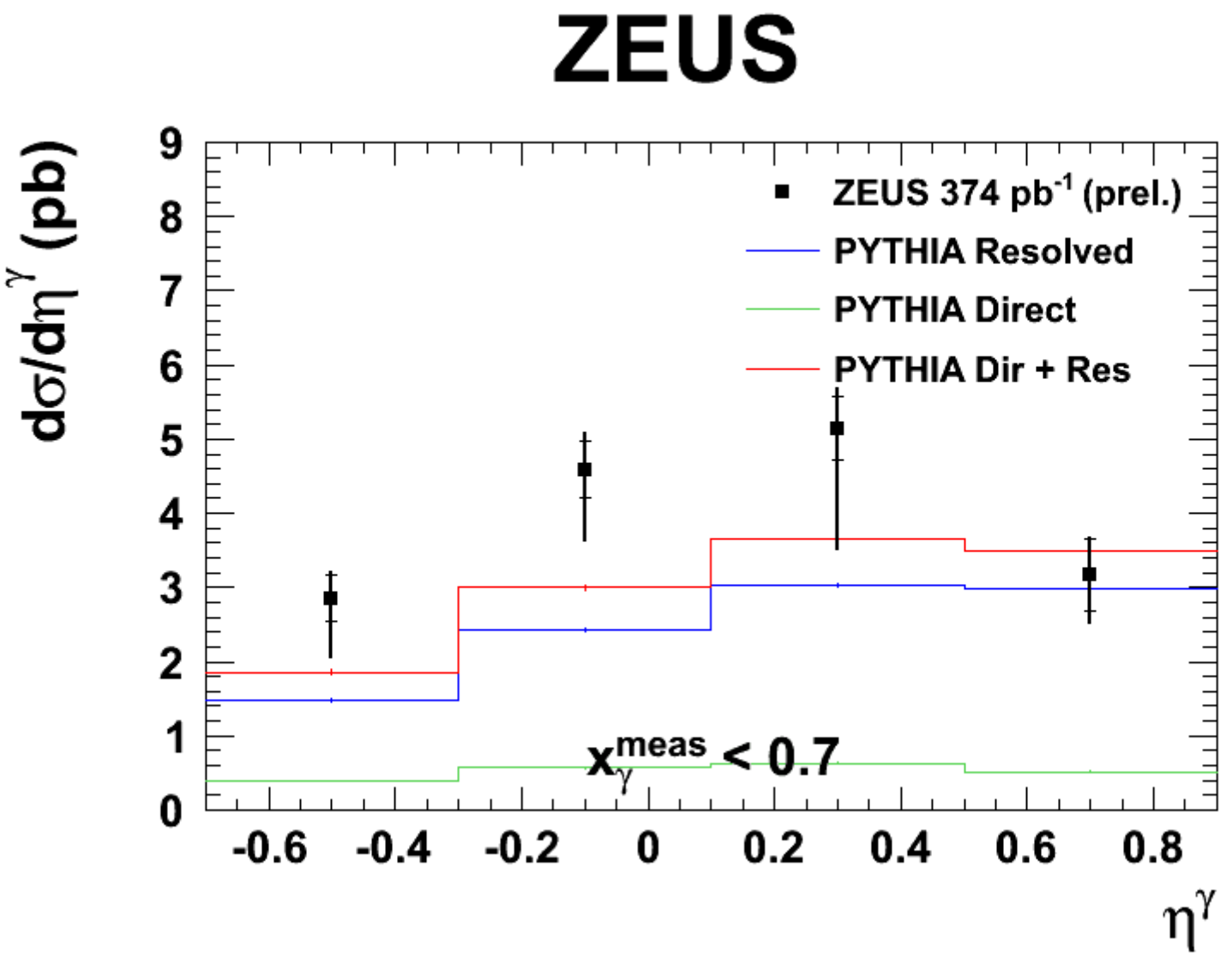

ZEUS
ZEUS 374 pb^{-1} (prel.)
PYTHIA Resolved
PYTHIA Direct
PYTHIA Dir + Res
$x_\gamma^{meas} > 0.8$
$d\sigma/d(\eta^\gamma - \eta^{jet})$ (pb)
$\eta^\gamma - \eta^{jet}$
0
2
4
6
8
10
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
2.5

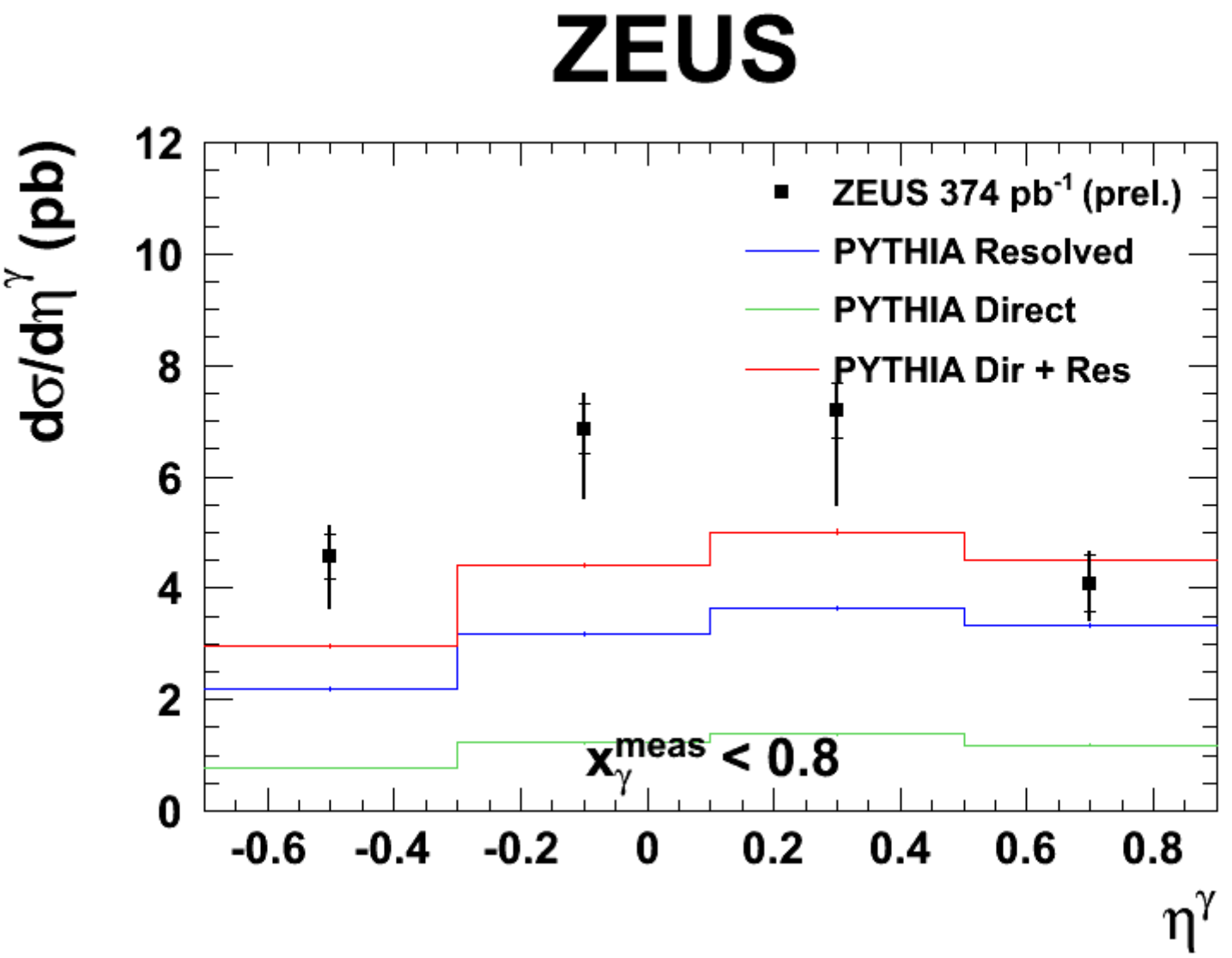

ZEUS
ZEUS 374 pb^{-1} (prel.)
PYTHIA Resolved
PYTHIA Direct
PYTHIA Dir + Res
$x_\gamma^{meas} < 0.7$
$d\sigma/d(\eta^\gamma - \eta^{jet})$ (pb)
$\eta^\gamma - \eta^{jet}$
3.5
3
2.5
2
1.5
1
0.5
0
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
2.5

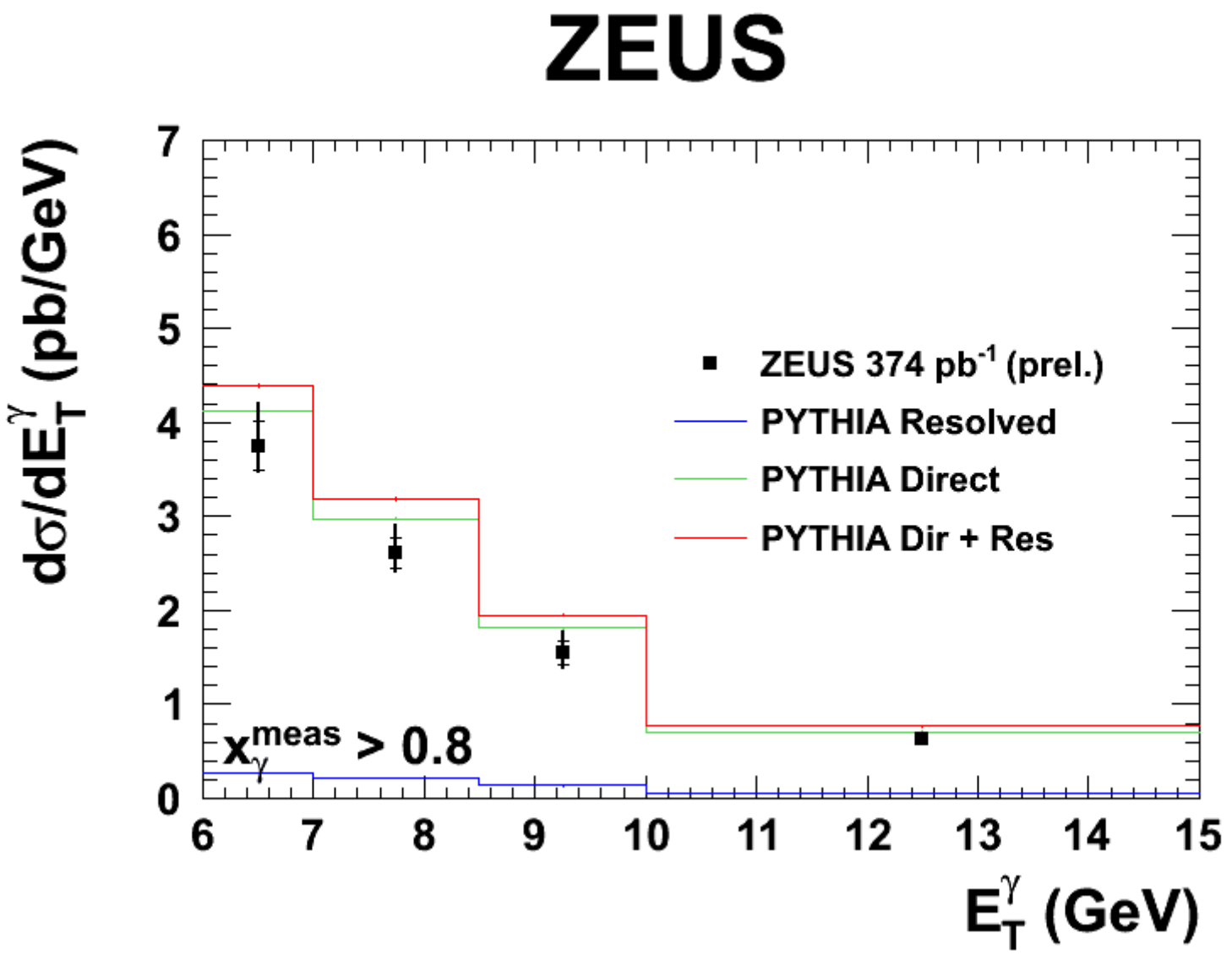

ZEUS
ZEUS 374 pb^{-1} (prel.)
PYTHIA Resolved
PYTHIA Direct
PYTHIA Dir + Res
$x_\gamma^{meas} < 0.8$
$d\sigma/d(\eta^\gamma - \eta^{jet})$ (pb)
$\eta^\gamma - \eta^{jet}$
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
2.5

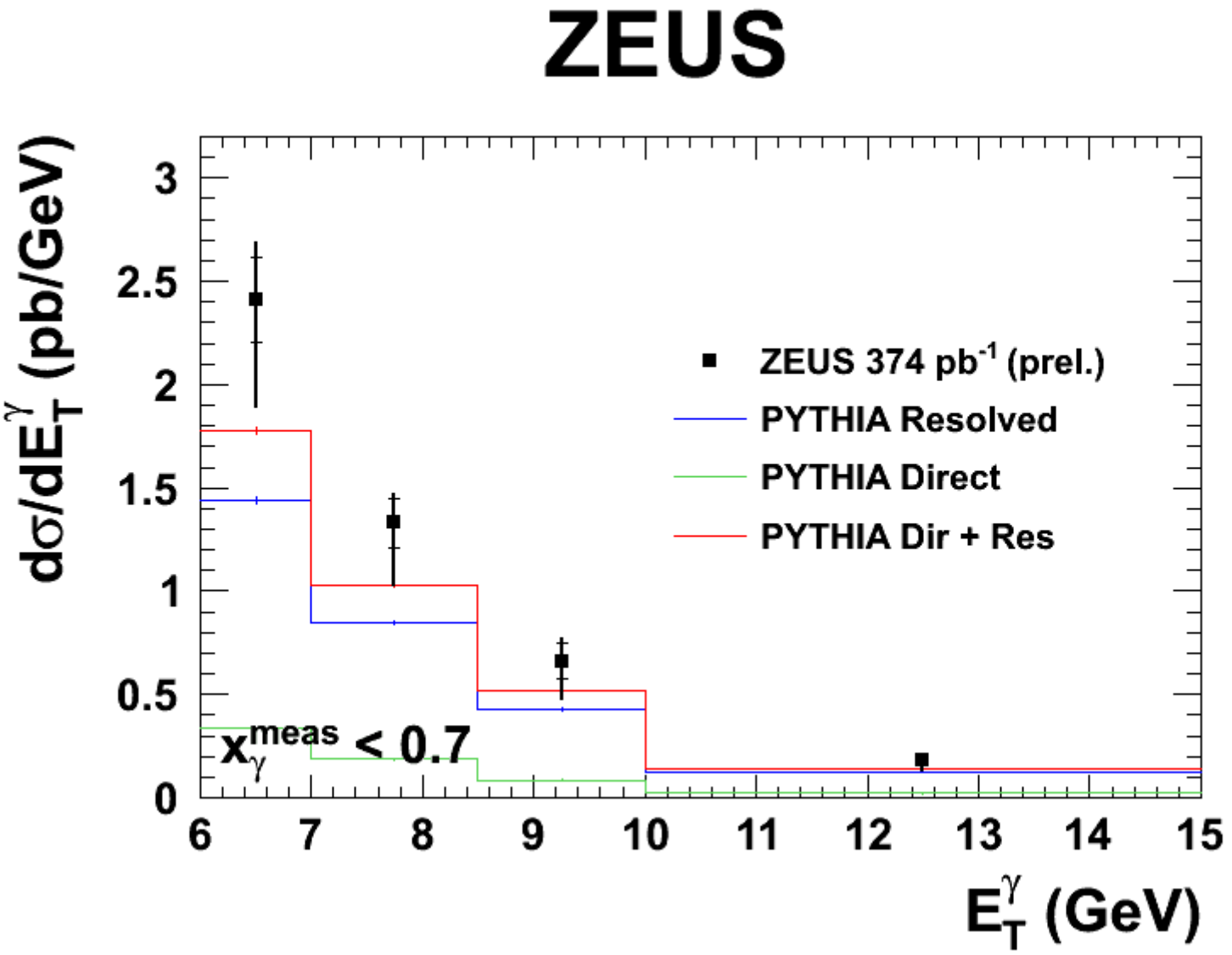

ZEUS
ZEUS 374 pb^{-1} (prel.)
PYTHIA Resolved
PYTHIA Direct
PYTHIA Dir + Res
$d\sigma/d(\eta^{\gamma} - \eta^{jet})$ (pb)
$\eta^{\gamma} - \eta^{jet}$
0
2
4
6
8
10
12
14
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
2.5

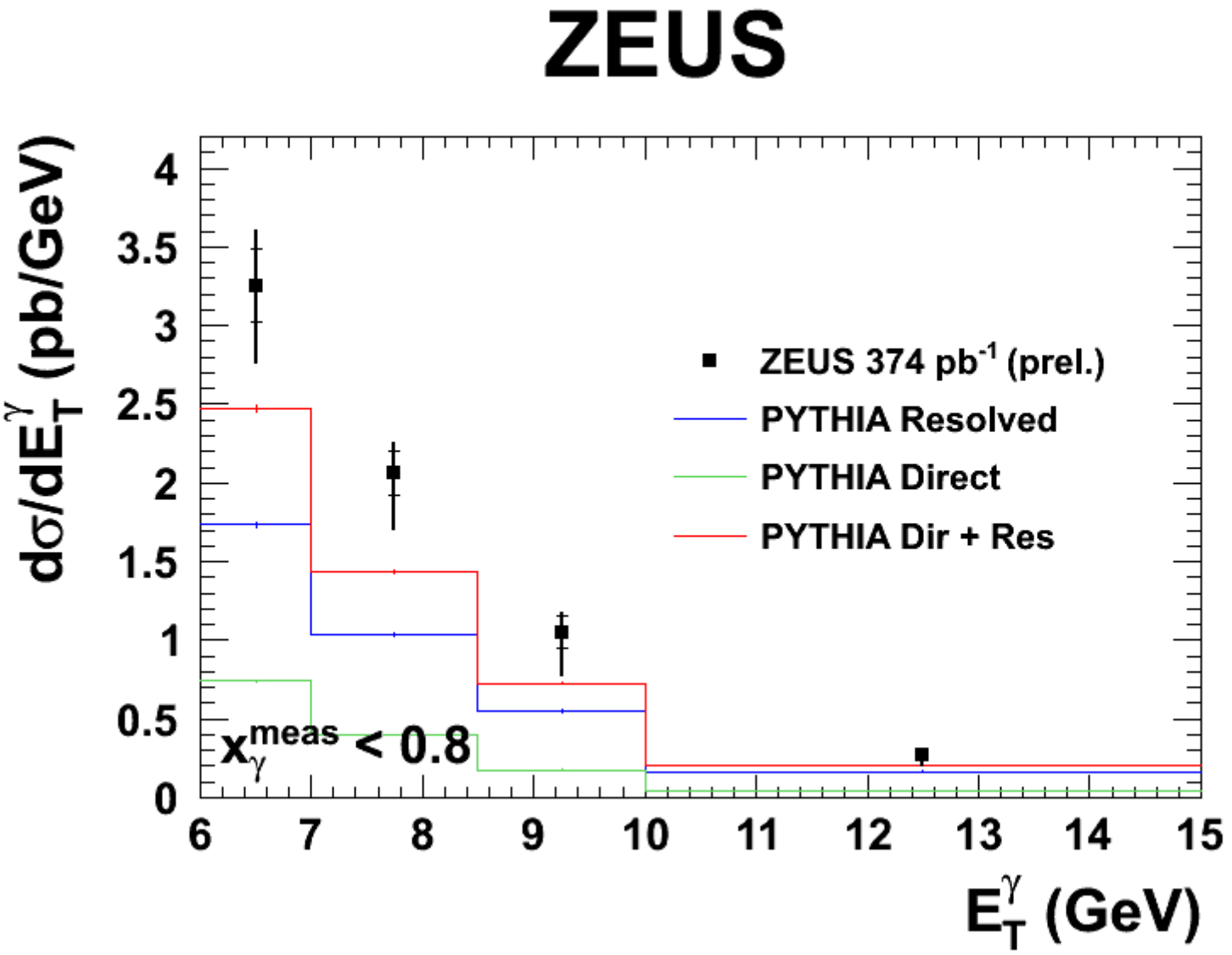

ZEUS
ZEUS 374 pb^{-1} (prel.)
PYTHIA Resolved
PYTHIA Direct
PYTHIA Dir + Res
$x_\gamma^{meas} > 0.8$
$d\sigma/d\eta^\gamma$ (pb)
η^γ
0
2
4
6
8
10
12
14
16
18
20
22
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8

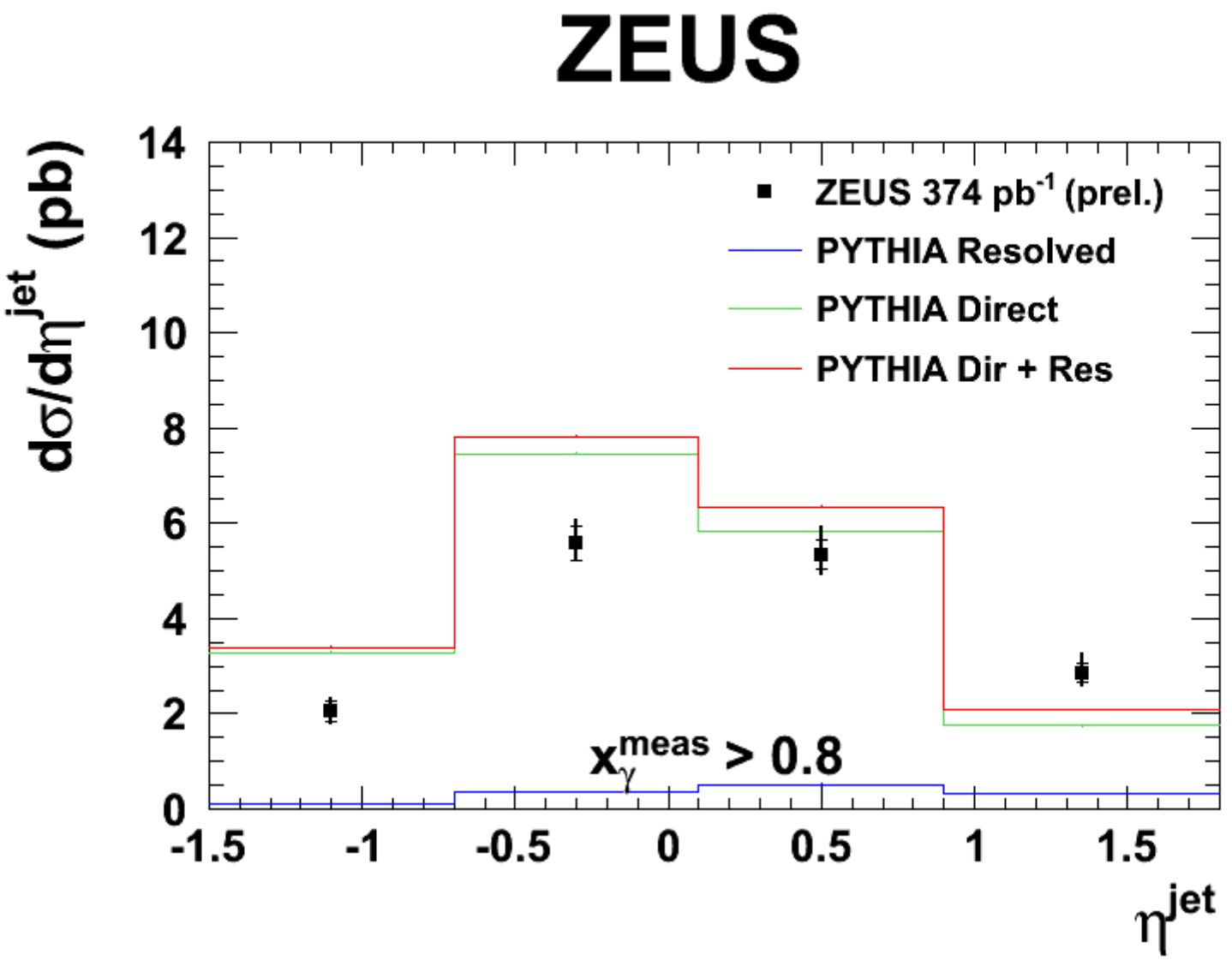

ZEUS
ZEUS 374 pb^{-1} (prel.)
PYTHIA Resolved
PYTHIA Direct
PYTHIA Dir + Res
$x_\gamma^{meas} < 0.7$
$d\sigma/d\eta^\gamma$ (pb)
η^γ
0
1
2
3
4
5
6
7
8
9
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8

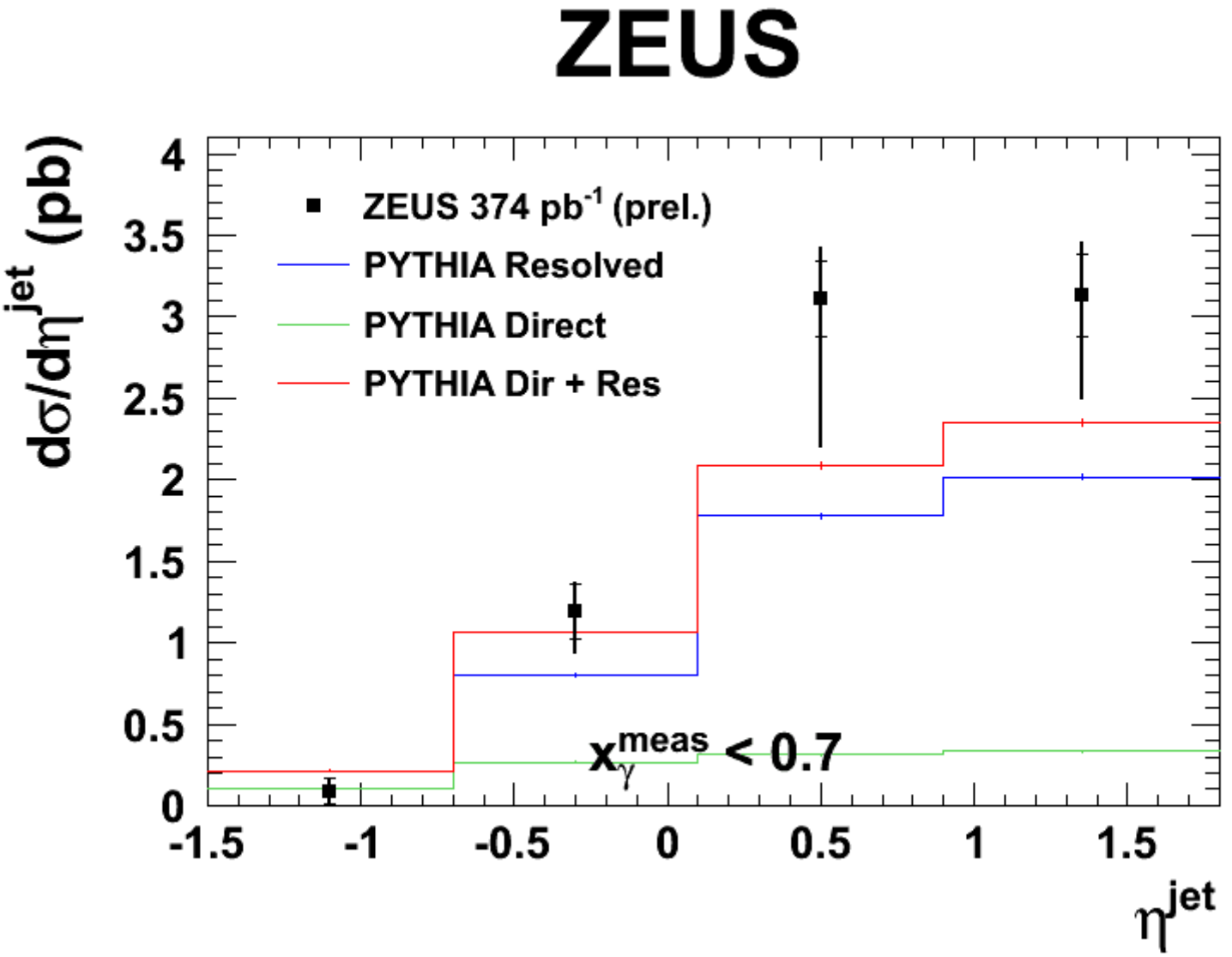

ZEUS
ZEUS 374 pb^{-1} (prel.)
PYTHIA Resolved
PYTHIA Direct
PYTHIA Dir + Res
$x_\gamma^{meas} < 0.8$
$d\sigma/d\eta^\gamma$ (pb)
η^γ
0
2
4
6
8
10
12
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8

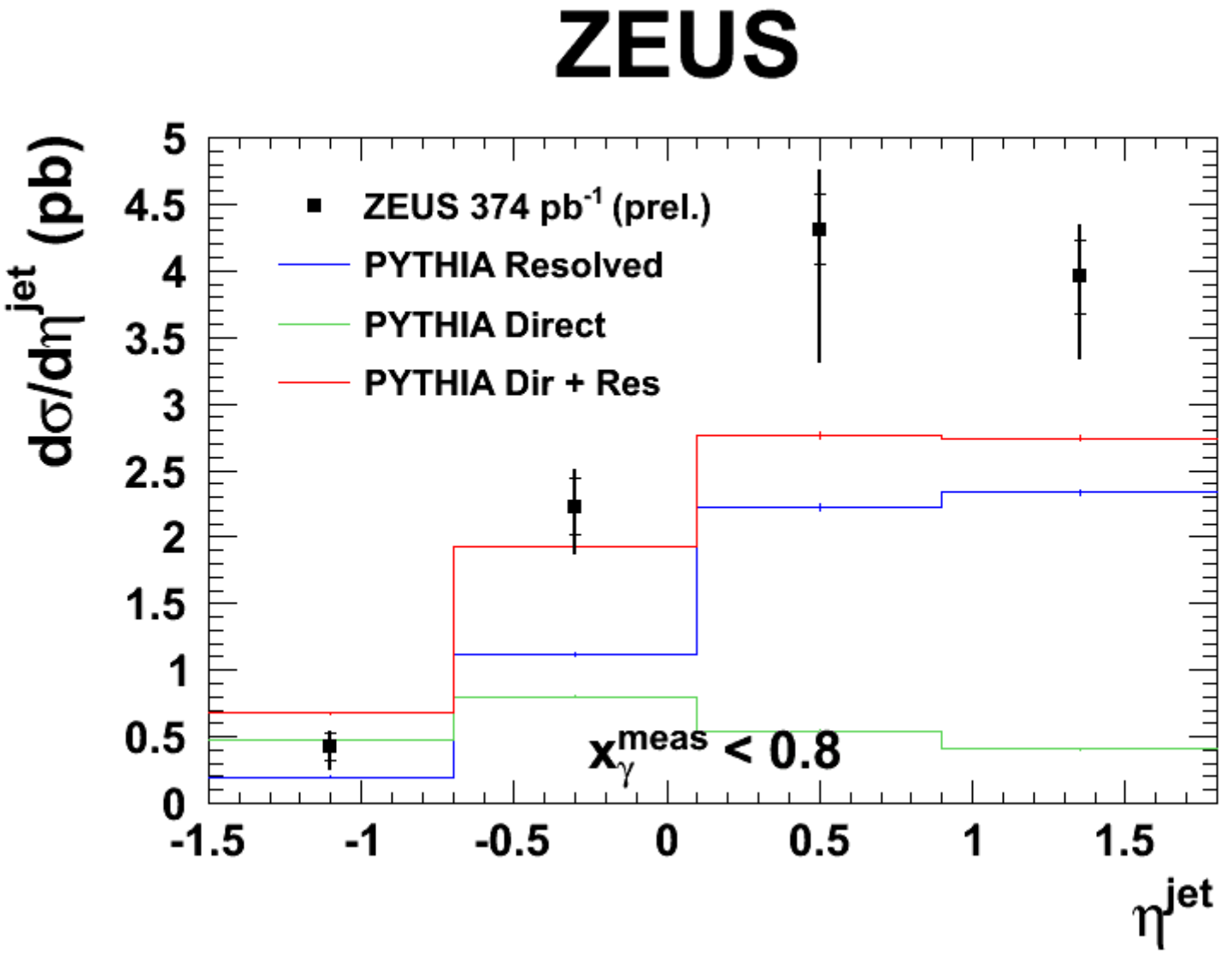

ZEUS
$d\sigma/dE_T^\gamma$ (pb/GeV)
ZEUS 374 pb^{-1} (prel.)
PYTHIA Resolved
PYTHIA Direct
PYTHIA Dir + Res
$x_\gamma^{meas} > 0.8$
E_T^γ (GeV)
0
1
2
3
4
5
6
7
6
7
8
9
10
11
12
13
14
15

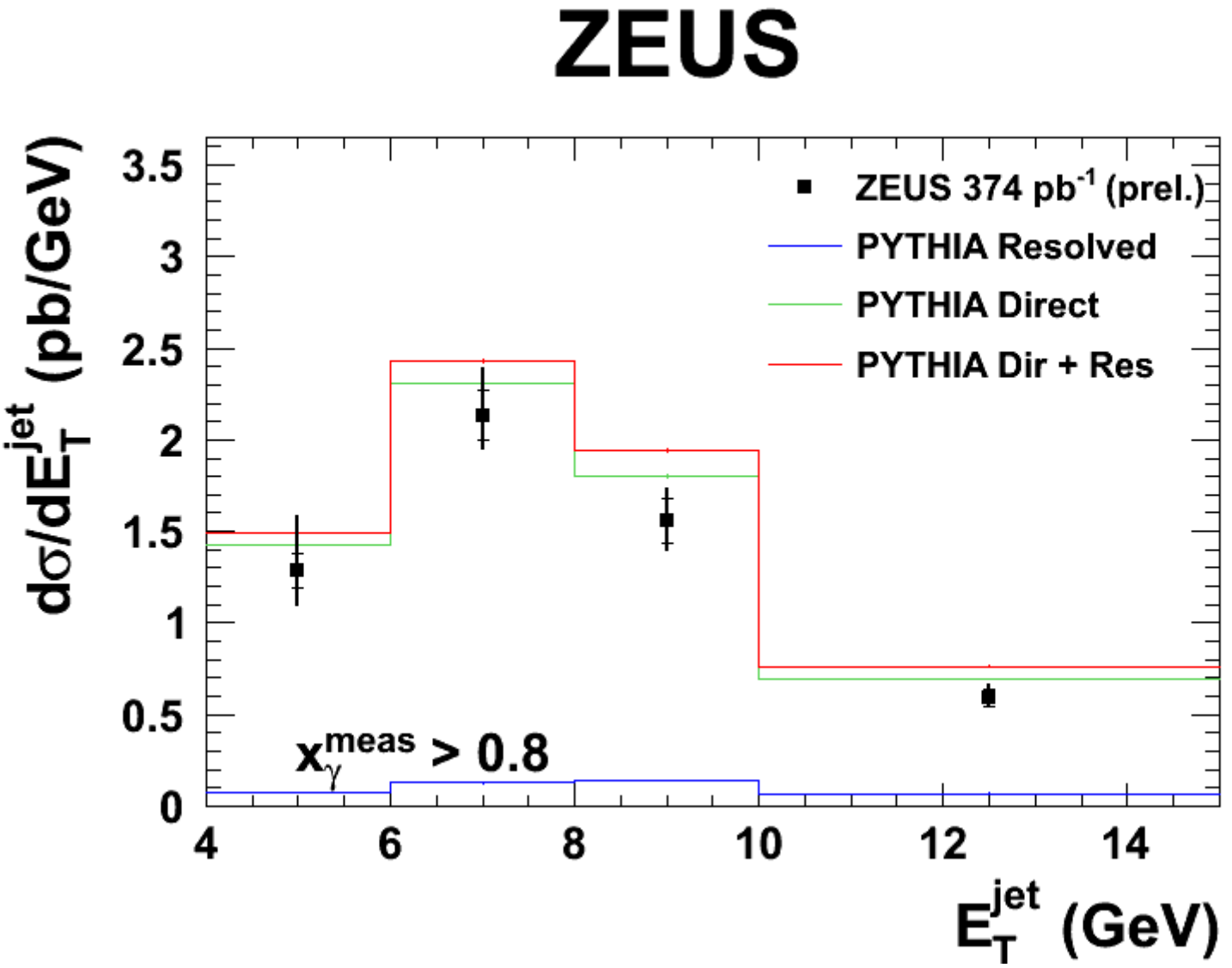

ZEUS
$d\sigma/dE_T^\gamma$ (pb/GeV)
3
2.5
2
1.5
1
0.5
0
6
7
8
9
10
11
12
13
14
15
E_T^γ (GeV)
ZEUS 374 pb^{-1} (prel.)
PYTHIA Resolved
PYTHIA Direct
PYTHIA Dir + Res
$x_\gamma^{meas} < 0.7$

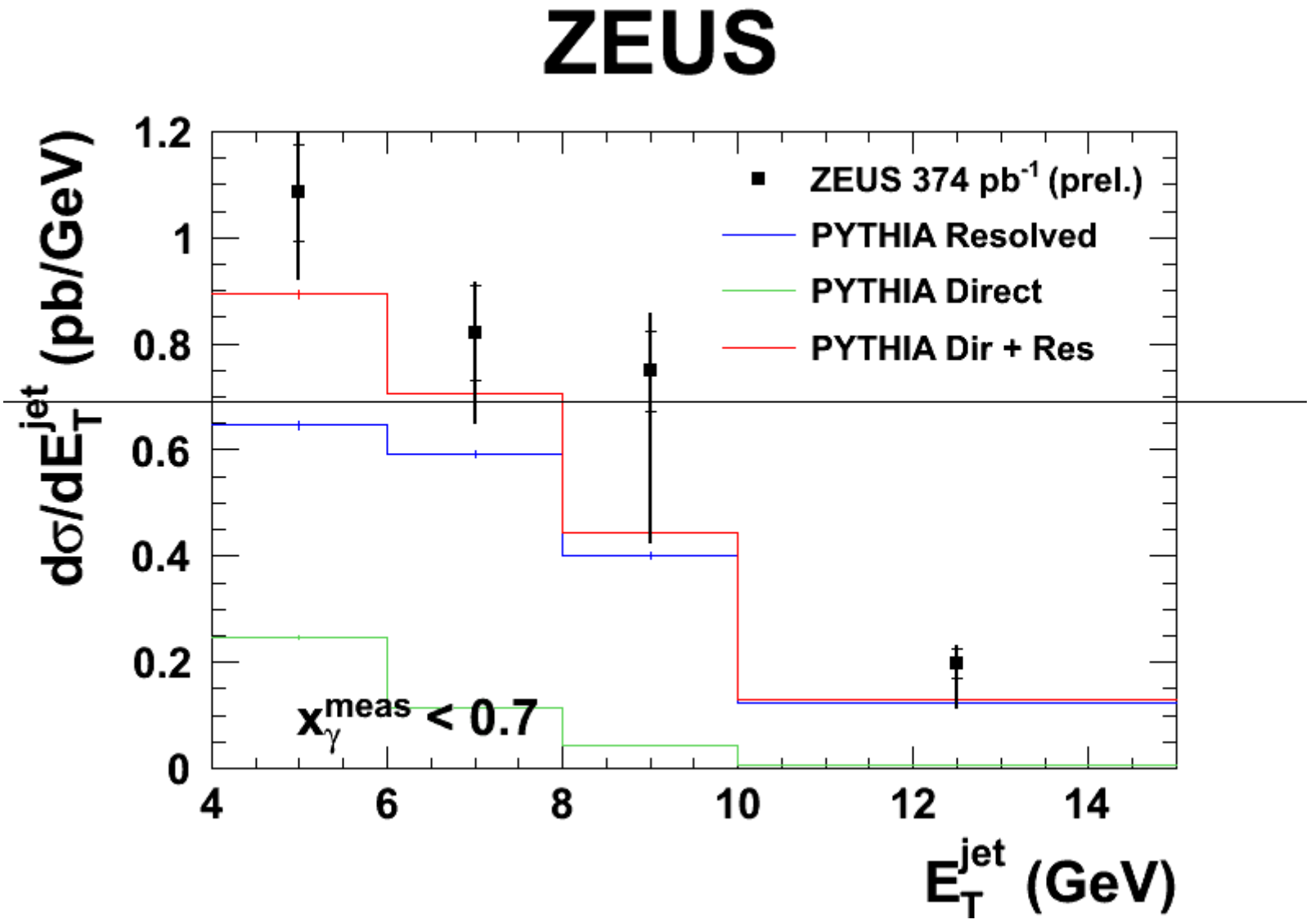

ZEUS
$d\sigma/dE_T^\gamma$ (pb/GeV)
E_T^γ (GeV)
ZEUS 374 pb^{-1} (prel.)
PYTHIA Resolved
PYTHIA Direct
PYTHIA Dir + Res
$x_\gamma^{meas} < 0.8$
0
0.5
1
1.5
2
2.5
3
3.5
4
6
7
8
9
10
11
12
13
14
15

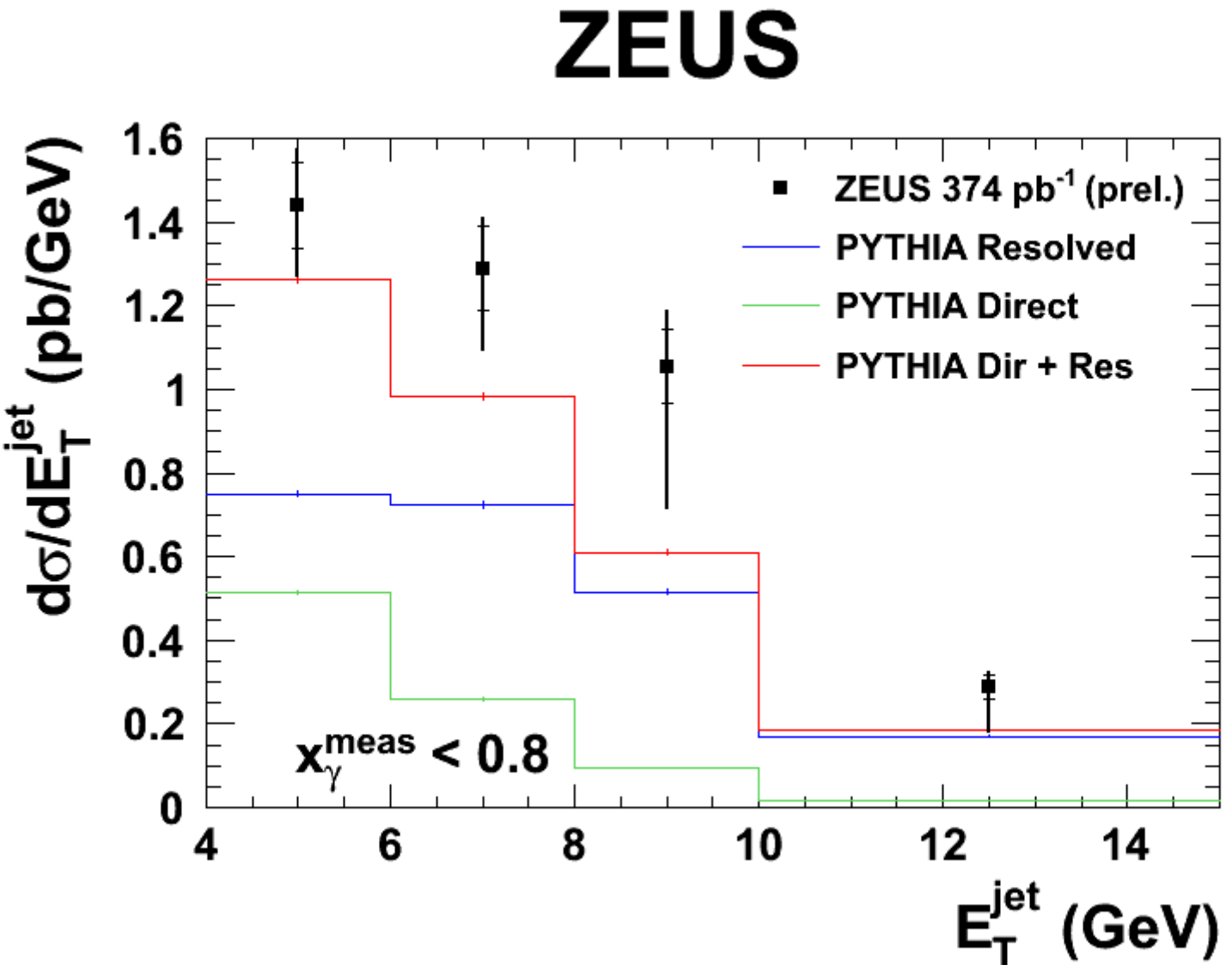

ZEUS
ZEUS 374 pb^{-1} (prel.)
PYTHIA Resolved
PYTHIA Direct
PYTHIA Dir + Res
$x_\gamma^{meas} > 0.8$
$d\sigma/d\eta^{jet}$ (pb)
η^{jet}
0
2
4
6
8
10
12
14
-1.5
-1
-0.5
0
0.5
1
1.5

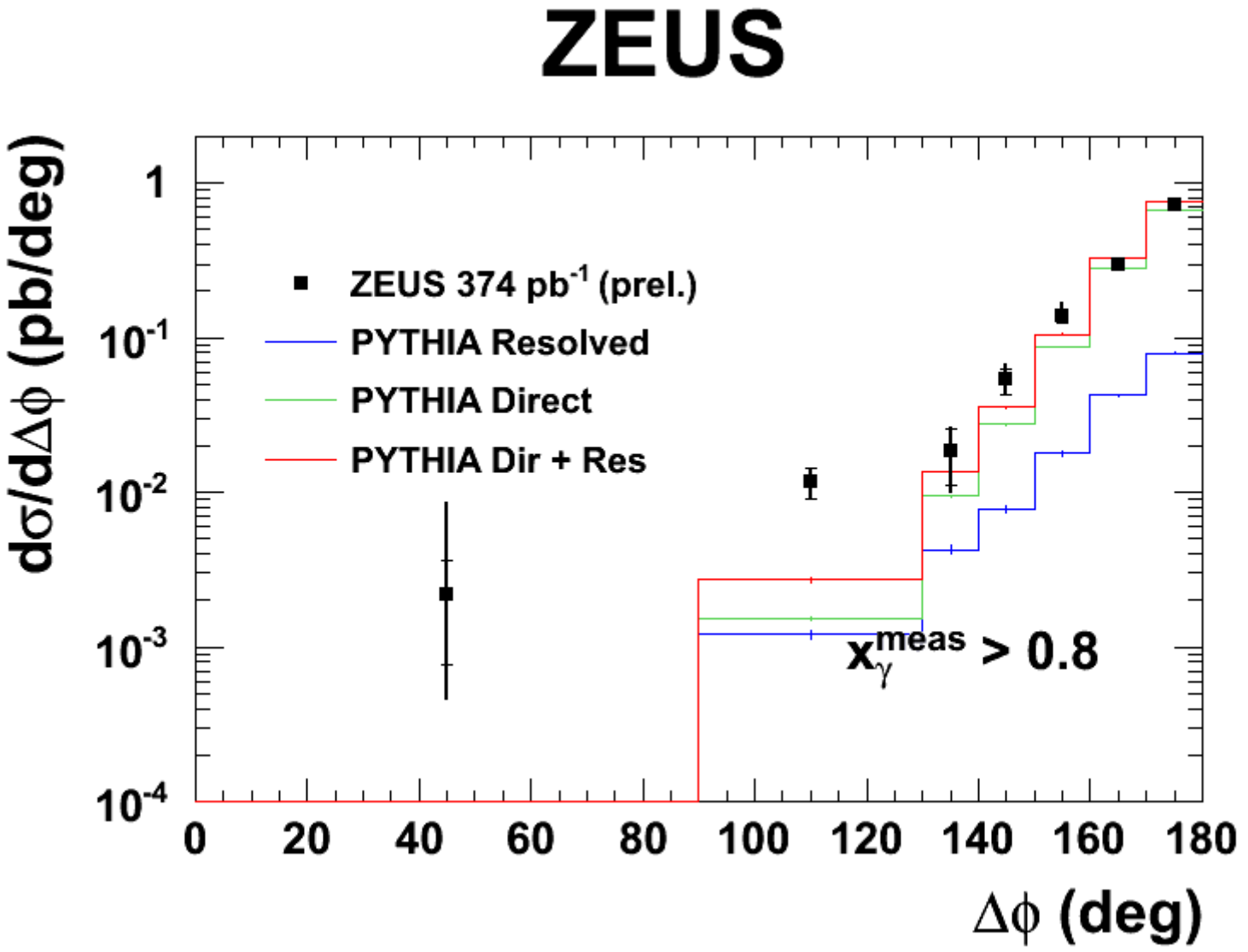

ZEUS
ZEUS 374 pb-1 (prel.)
PYTHIA Resolved
PYTHIA Direct
PYTHIA Dir + Res
dσ/dη^jet (pb)
x_γ^meas < 0.7
η^jet
4
3.5
3
2.5
2
1.5
1
0.5
0
-1.5
-1
-0.5
0
0.5
1
1.5

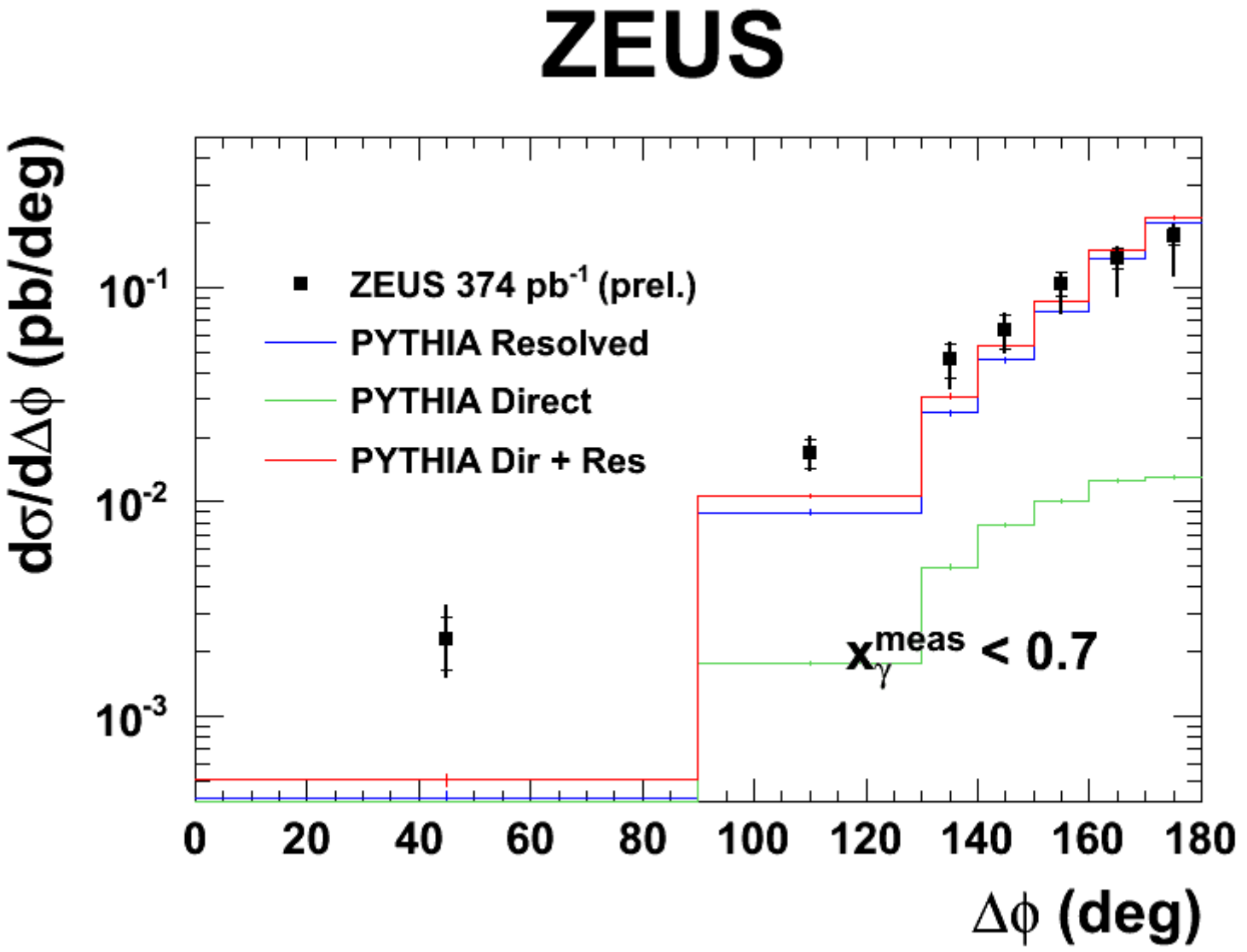

ZEUS
ZEUS 374 pb-1 (prel.)
PYTHIA Resolved
PYTHIA Direct
PYTHIA Dir + Res
dσ/dη^jet (pb)
x_γ^meas < 0.8
η^jet
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
-1.5
-1
-0.5
0
0.5
1
1.5

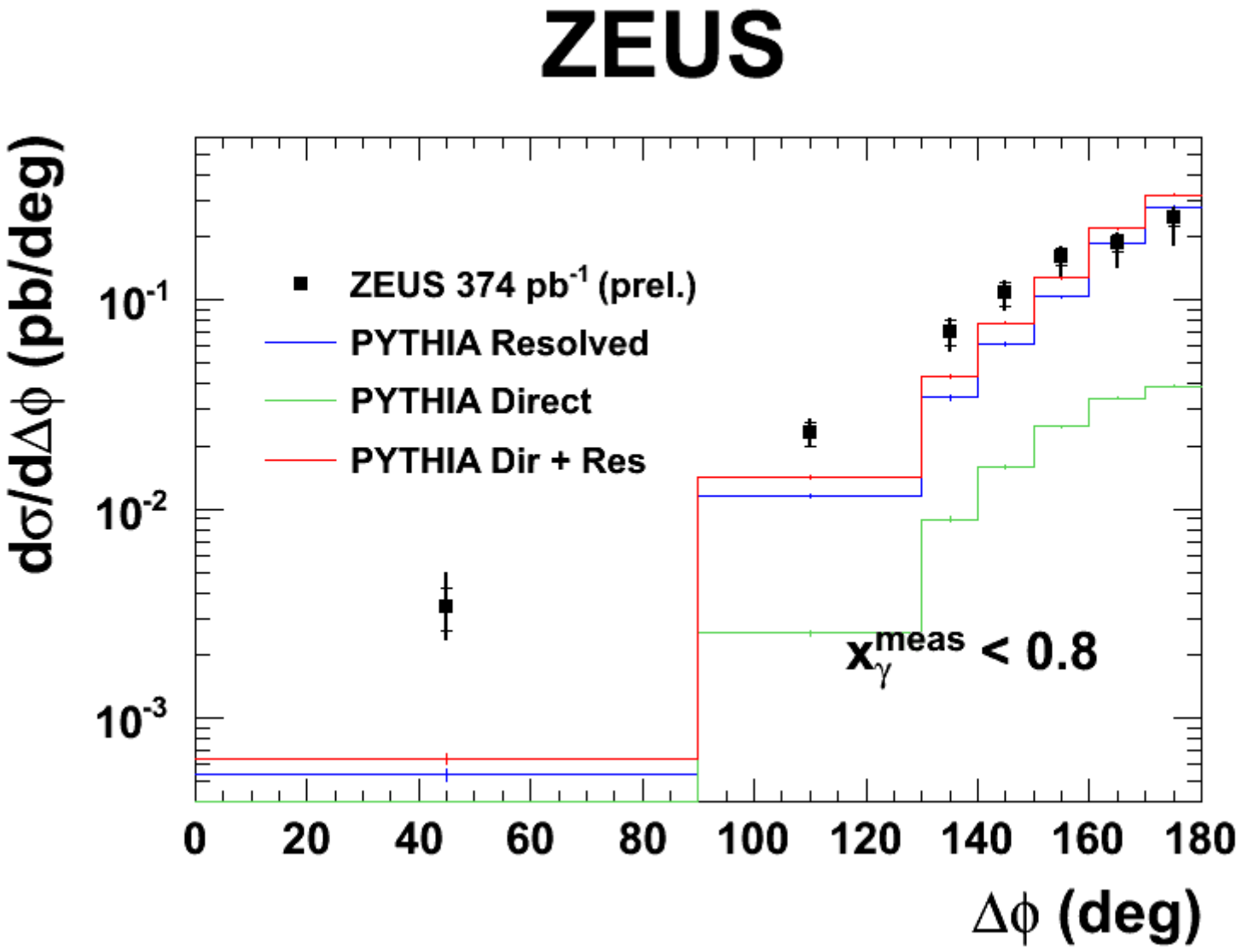

ZEUS
ZEUS 374 pb^{-1} (prel.)
PYTHIA Resolved
PYTHIA Direct
PYTHIA Dir + Res
$x_\gamma^{meas} > 0.8$
$d\sigma/dE_T^{jet}$ (pb/GeV)
E_T^{jet} (GeV)
0
0.5
1
1.5
2
2.5
3
3.5
4
6
8
10
12
14

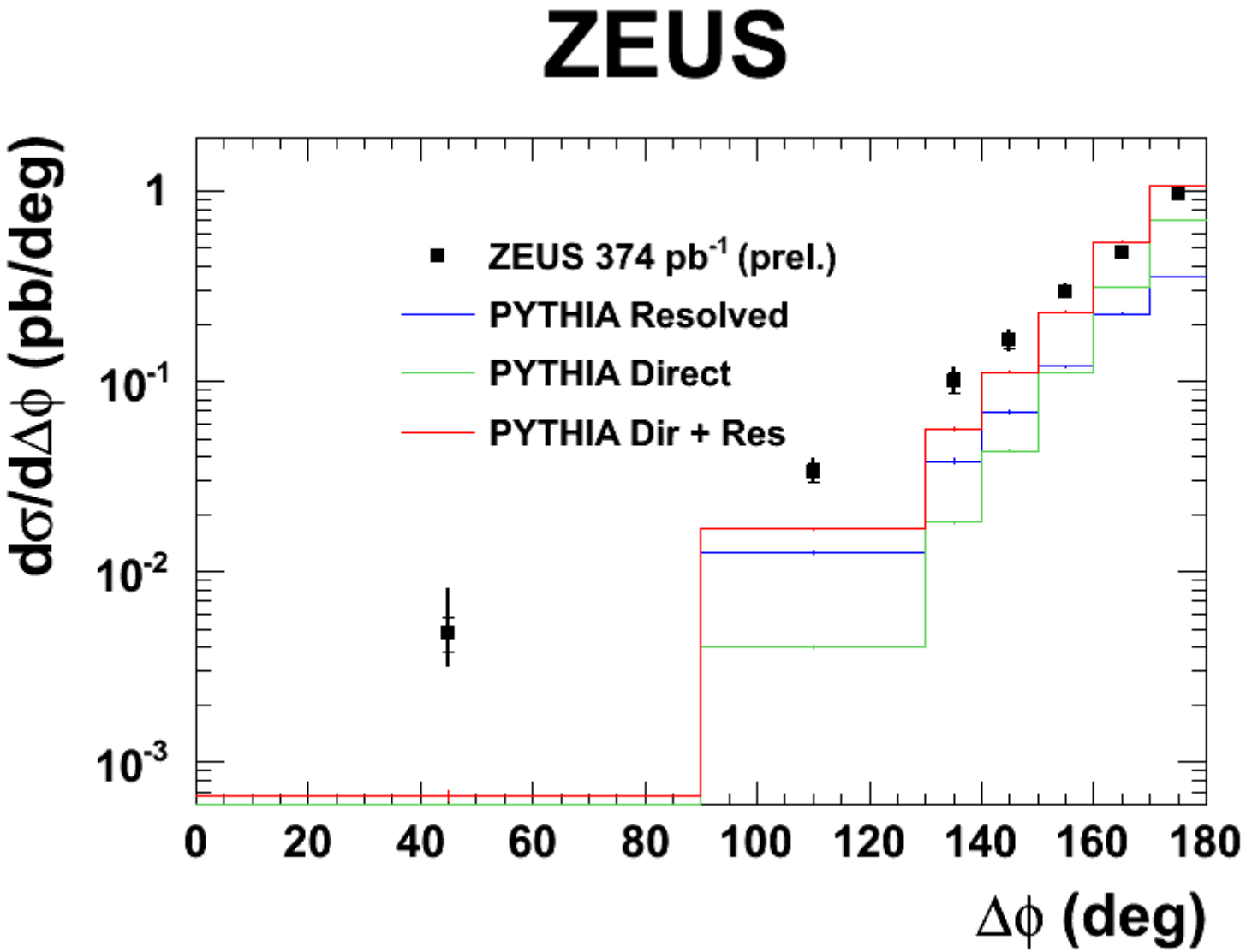

ZEUS
ZEUS 374 pb^{-1} (prel.)
PYTHIA Resolved
PYTHIA Direct
PYTHIA Dir + Res
$x_\gamma^{meas} < 0.7$
$d\sigma/dE_T^{jet}$ (pb/GeV)
E_T^{jet} (GeV)
1.2
1
0.8
0.6
0.4
0.2
0
4
6
8
10
12
14

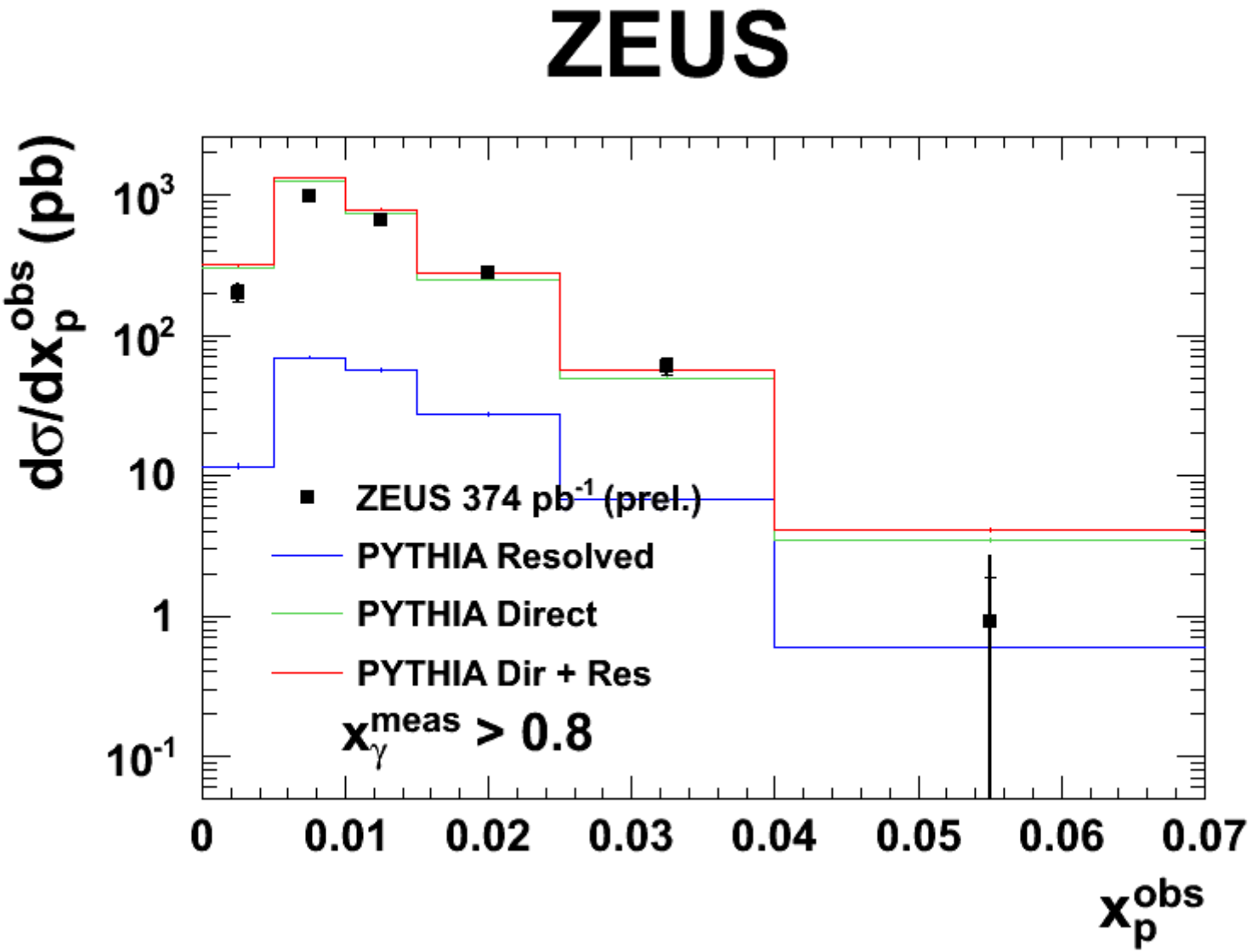

ZEUS
ZEUS 374 pb^{-1} (prel.)
PYTHIA Resolved
PYTHIA Direct
PYTHIA Dir + Res
$x_\gamma^{meas} < 0.8$
$d\sigma/dE_T^{jet}$ (pb/GeV)
E_T^{jet} (GeV)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
4
6
8
10
12
14

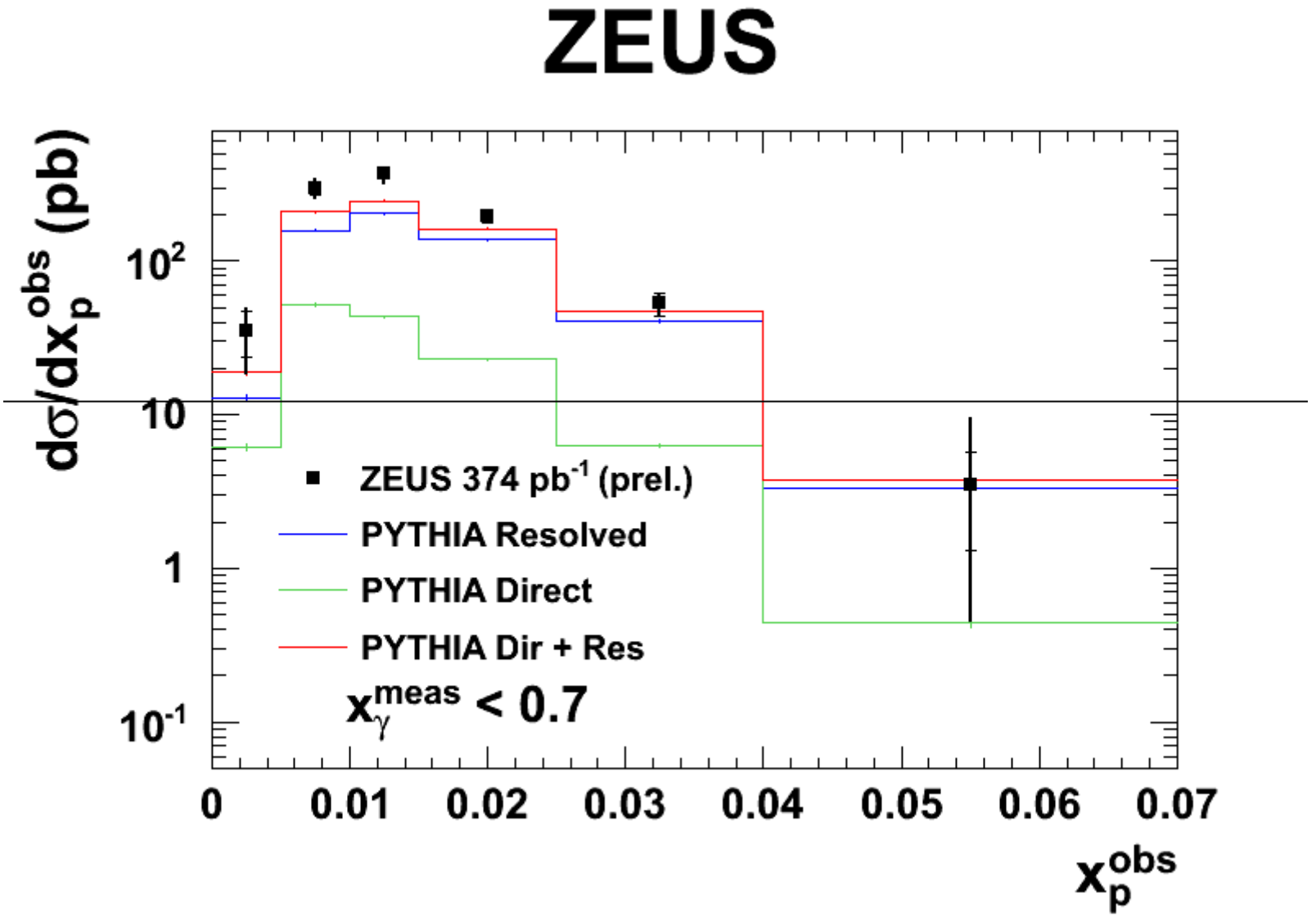

ZEUS
dσ/dΔφ (pb/deg)
1
10^-1
10^-2
10^-3
10^-4
ZEUS 374 pb^-1 (prel.)
PYTHIA Resolved
PYTHIA Direct
PYTHIA Dir + Res
x_γ^meas > 0.8
0
20
40
60
80
100
120
140
160
180
Δφ (deg)

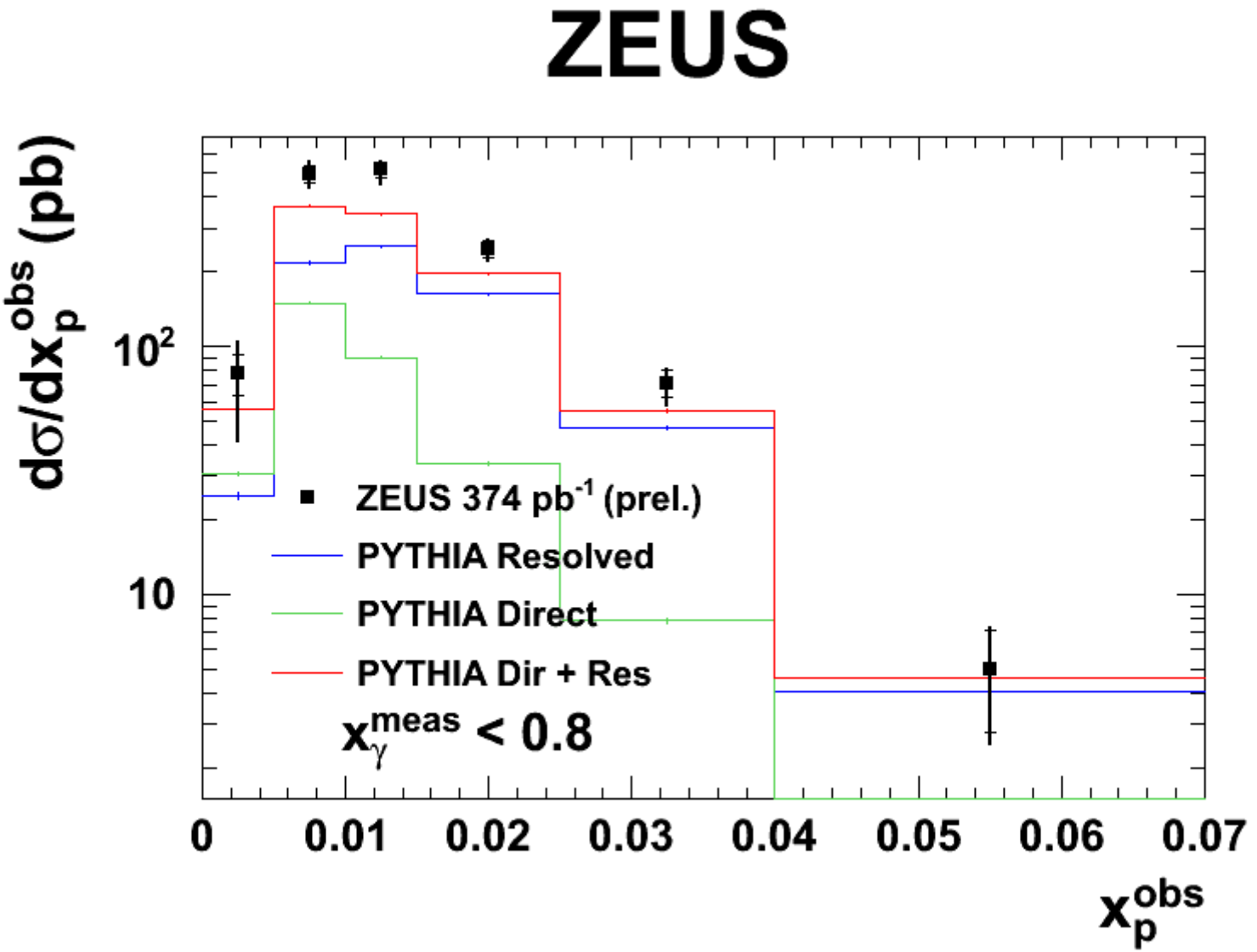

ZEUS
ZEUS 374 pb^{-1} (prel.)
PYTHIA Resolved
PYTHIA Direct
PYTHIA Dir + Res
$x_\gamma^{meas} < 0.7$
$d\sigma/d\Delta\phi$ (pb/deg)
10^{-1}
10^{-2}
10^{-3}
0
20
40
60
80
100
120
140
160
180
$\Delta\phi$ (deg)

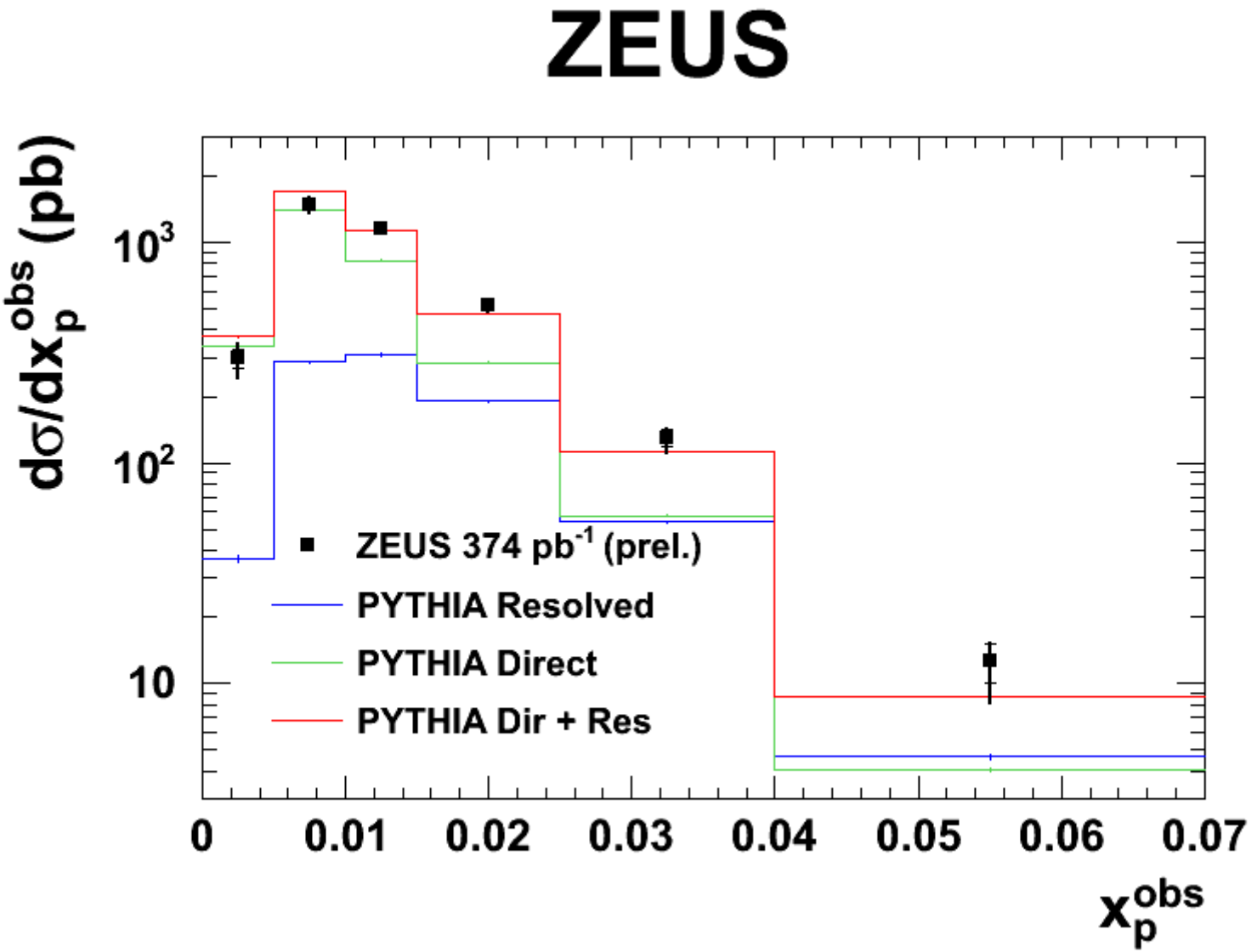

ZEUS
ZEUS 374 pb^{-1} (prel.)
PYTHIA Resolved
PYTHIA Direct
PYTHIA Dir + Res
$x_\gamma^{meas} < 0.8$
$d\sigma/d\Delta\phi$ (pb/deg)
10^{-1}
10^{-2}
10^{-3}
0
20
40
60
80
100
120
140
160
180
$\Delta\phi$ (deg)

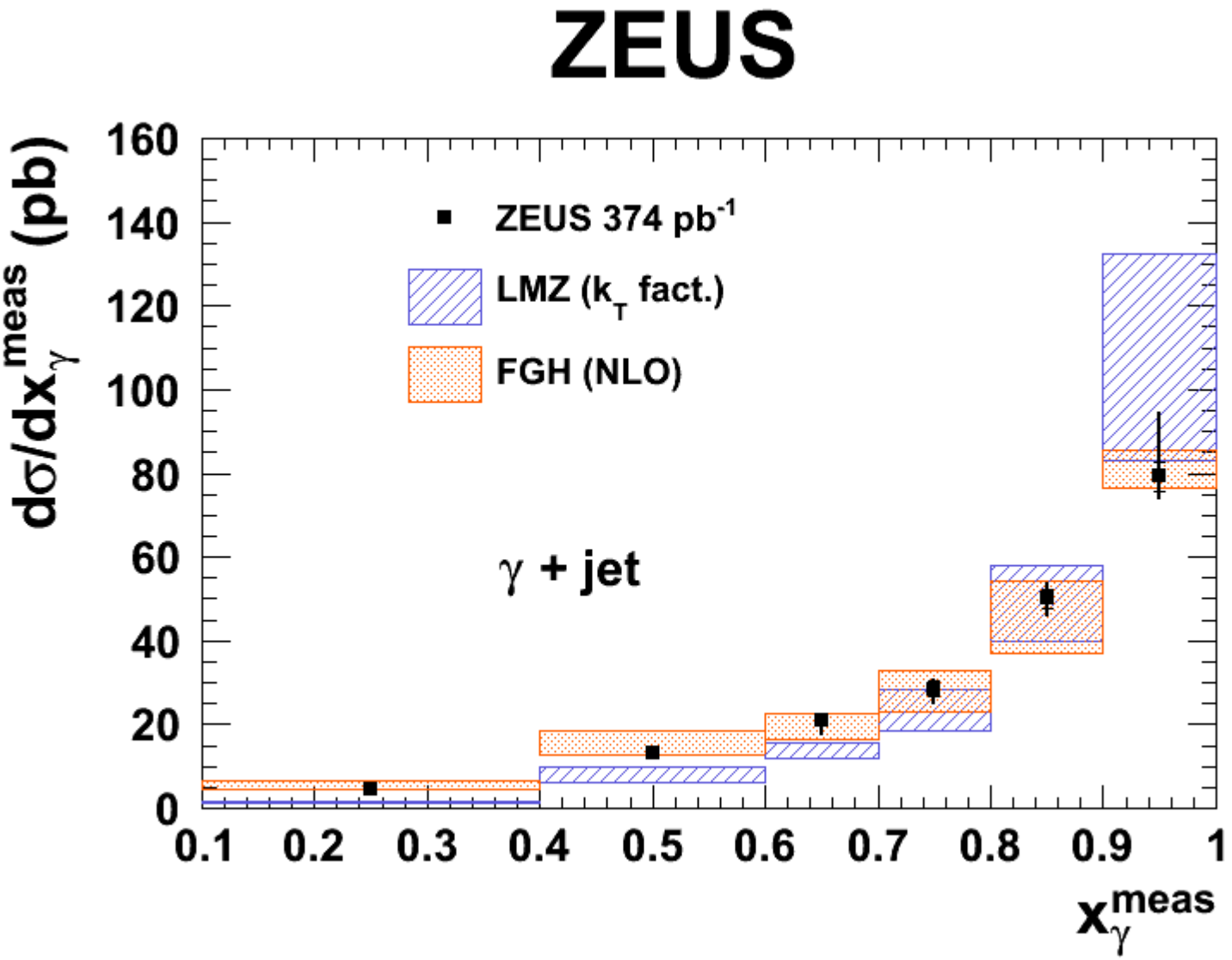

ZEUS
ZEUS 374 pb^{-1} (prel.)
PYTHIA Resolved
PYTHIA Direct
PYTHIA Dir + Res
dσ/dΔφ (pb/deg)
1
10^{-1}
10^{-2}
10^{-3}
0
20
40
60
80
100
120
140
160
180
Δφ (deg)

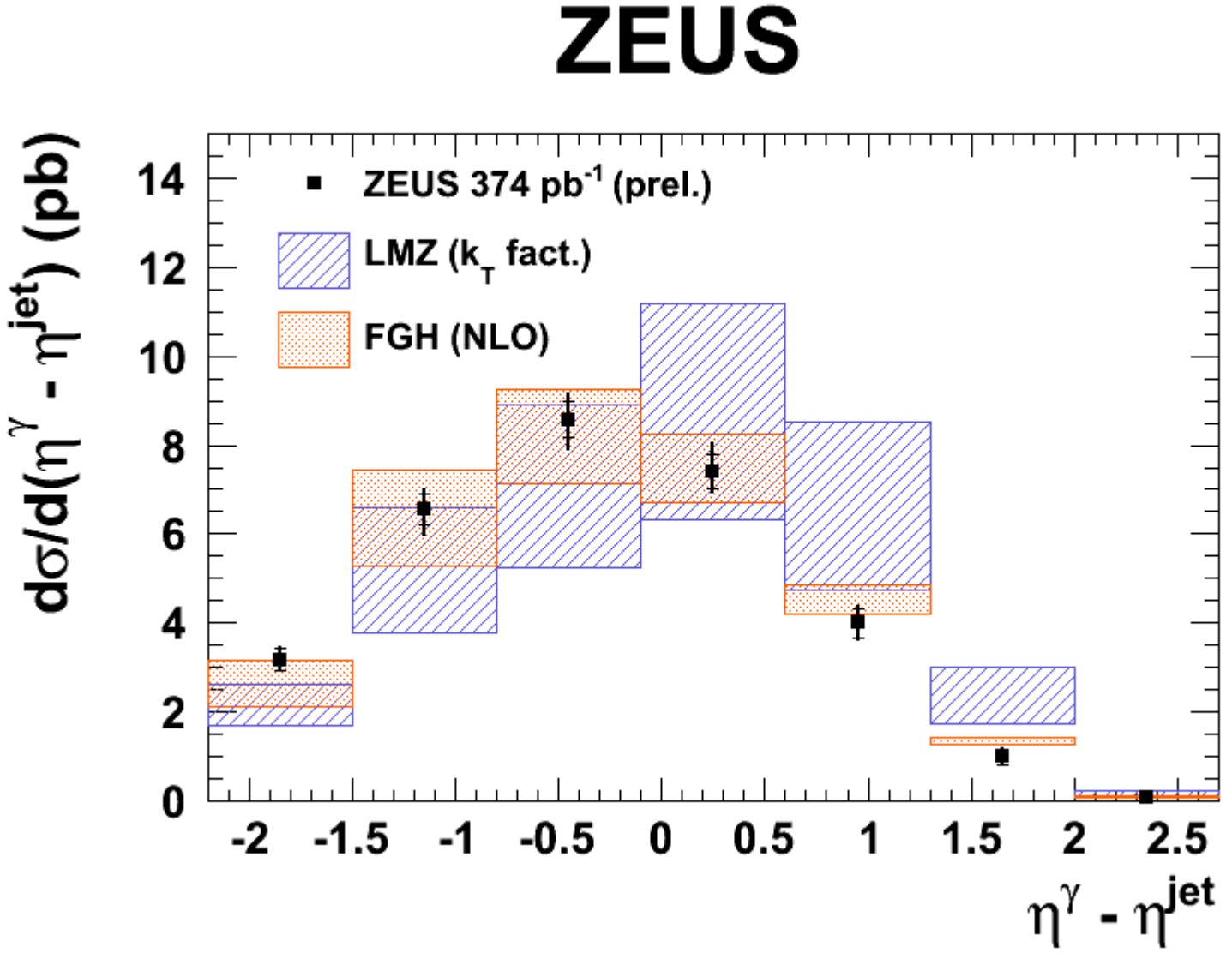

ZEUS
$d\sigma/dx_p^{obs}$ (pb)
10^3
10^2
10
1
10^{-1}
ZEUS 374 pb^{-1} (prel.)
PYTHIA Resolved
PYTHIA Direct
PYTHIA Dir + Res
$x_\gamma^{meas} > 0.8$
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
x_p^{obs}

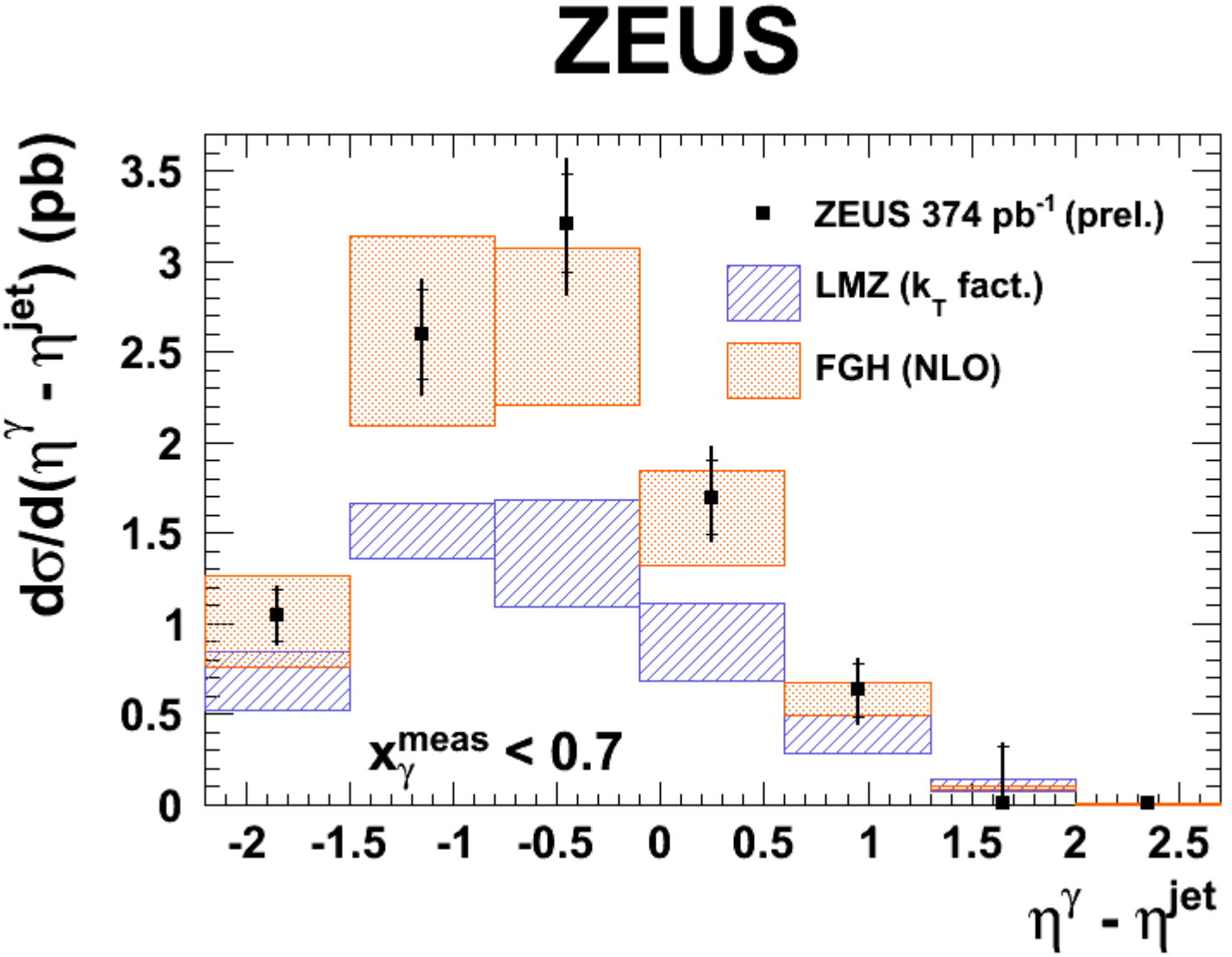

ZEUS
$d\sigma/dx_p^{obs}$ (pb)
10^2
10
1
10^{-1}
ZEUS 374 pb^{-1} (prel.)
PYTHIA Resolved
PYTHIA Direct
PYTHIA Dir + Res
$x_\gamma^{meas} < 0.7$
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
x_p^{obs}

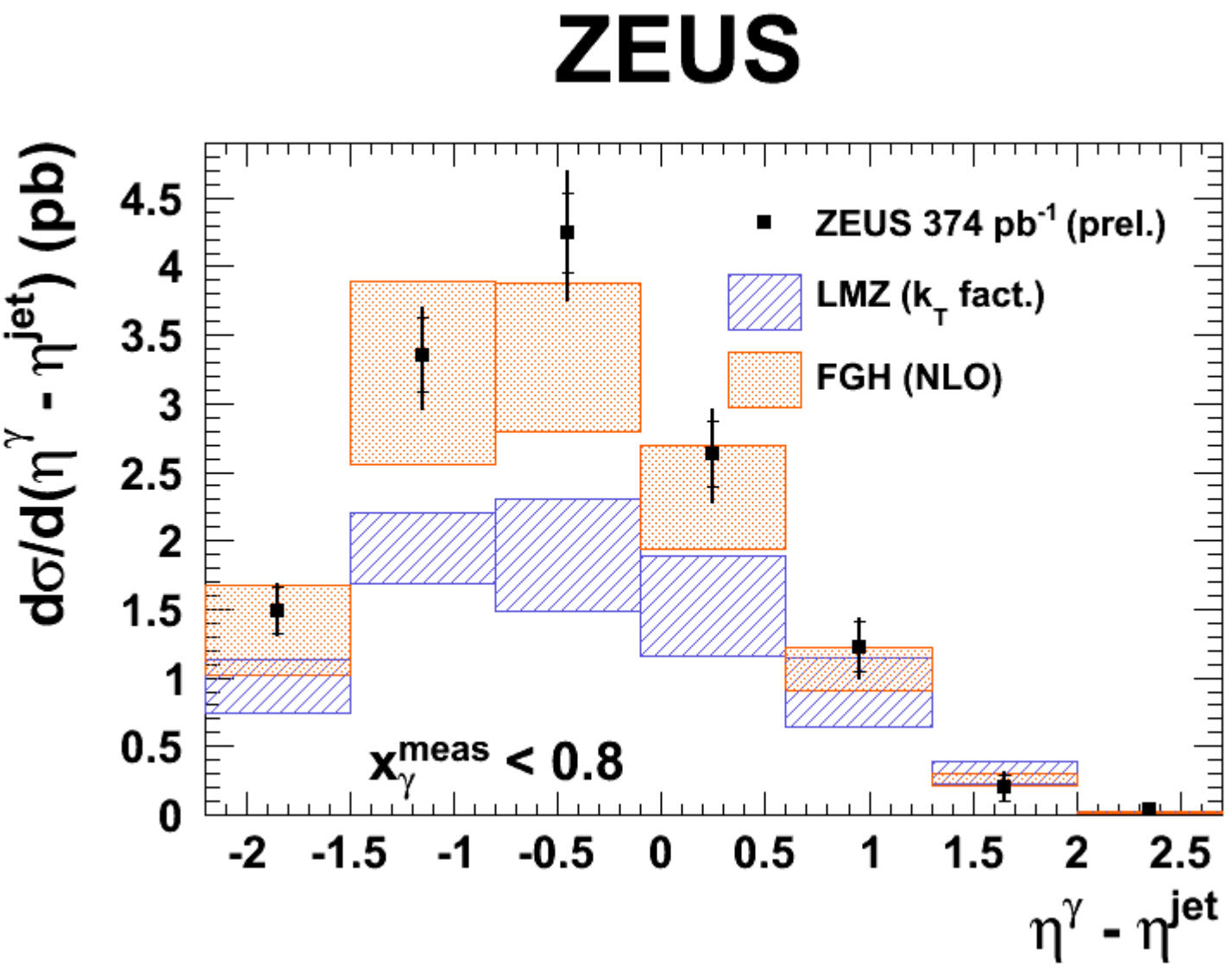

ZEUS
$d\sigma/dx_p^{obs}$ (pb)
10^2
10
ZEUS 374 pb^{-1} (prel.)
PYTHIA Resolved
PYTHIA Direct
PYTHIA Dir + Res
$x_\gamma^{meas} < 0.8$
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
x_p^{obs}

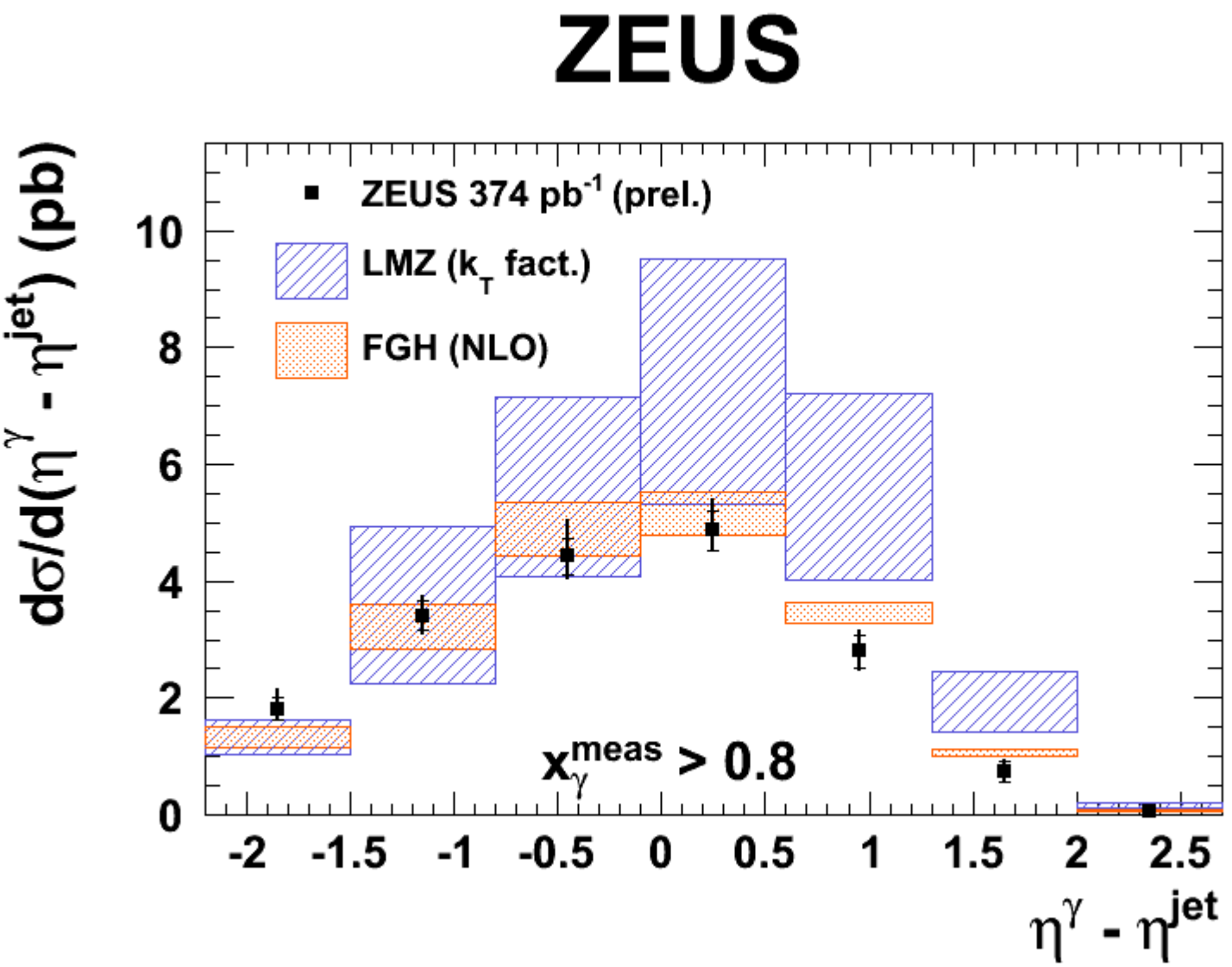

ZEUS
$d\sigma/dx_p^{obs}$ (pb)
10^3
10^2
10
ZEUS 374 pb^{-1} (prel.)
PYTHIA Resolved
PYTHIA Direct
PYTHIA Dir + Res
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
x_p^{obs}

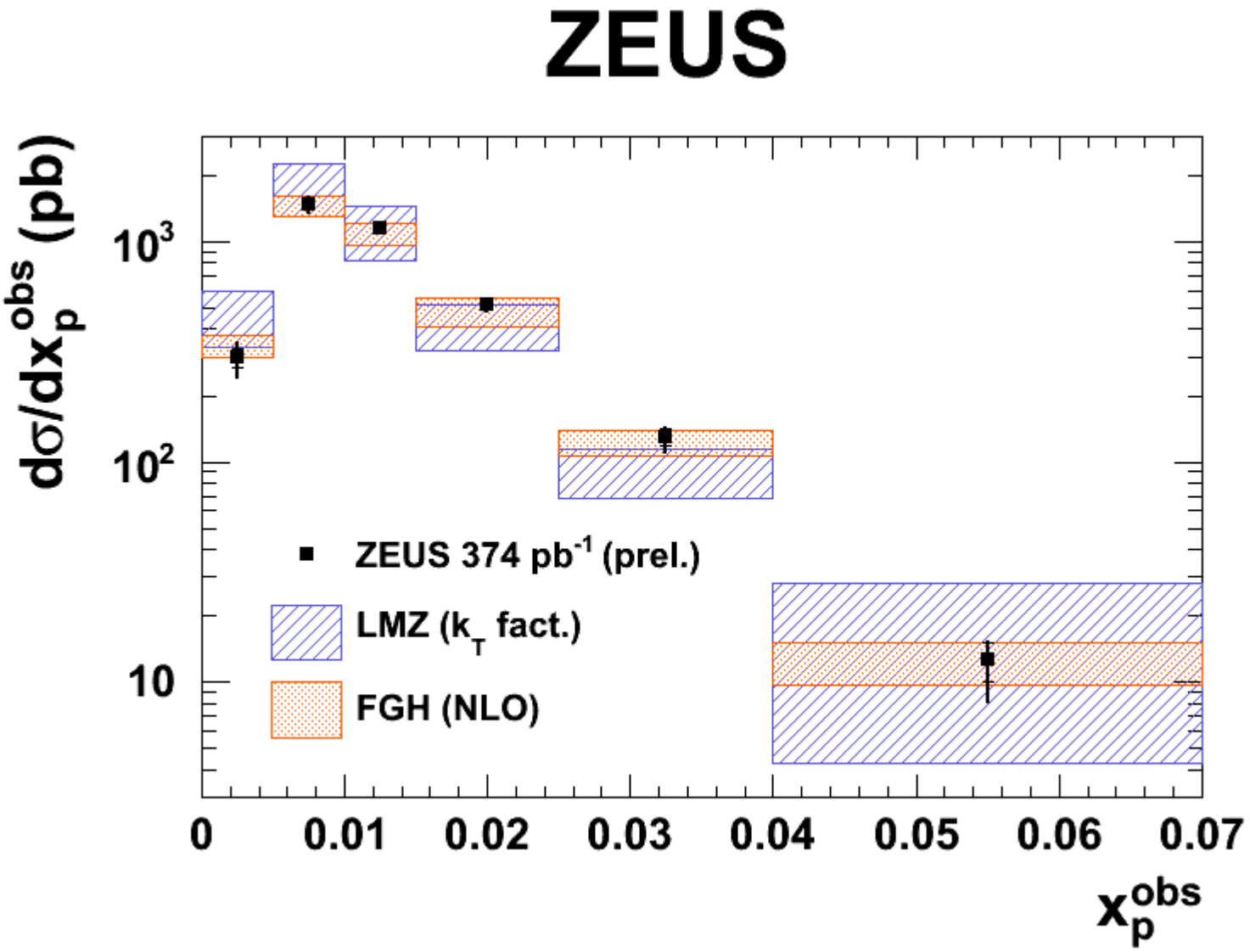

ZEUS
ZEUS 374 pb-1
LMZ (kT fact.)
FGH (NLO)
γ + jet
dσ/dxγmeas (pb)
xγmeas
0
20
40
60
80
100
120
140
160
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

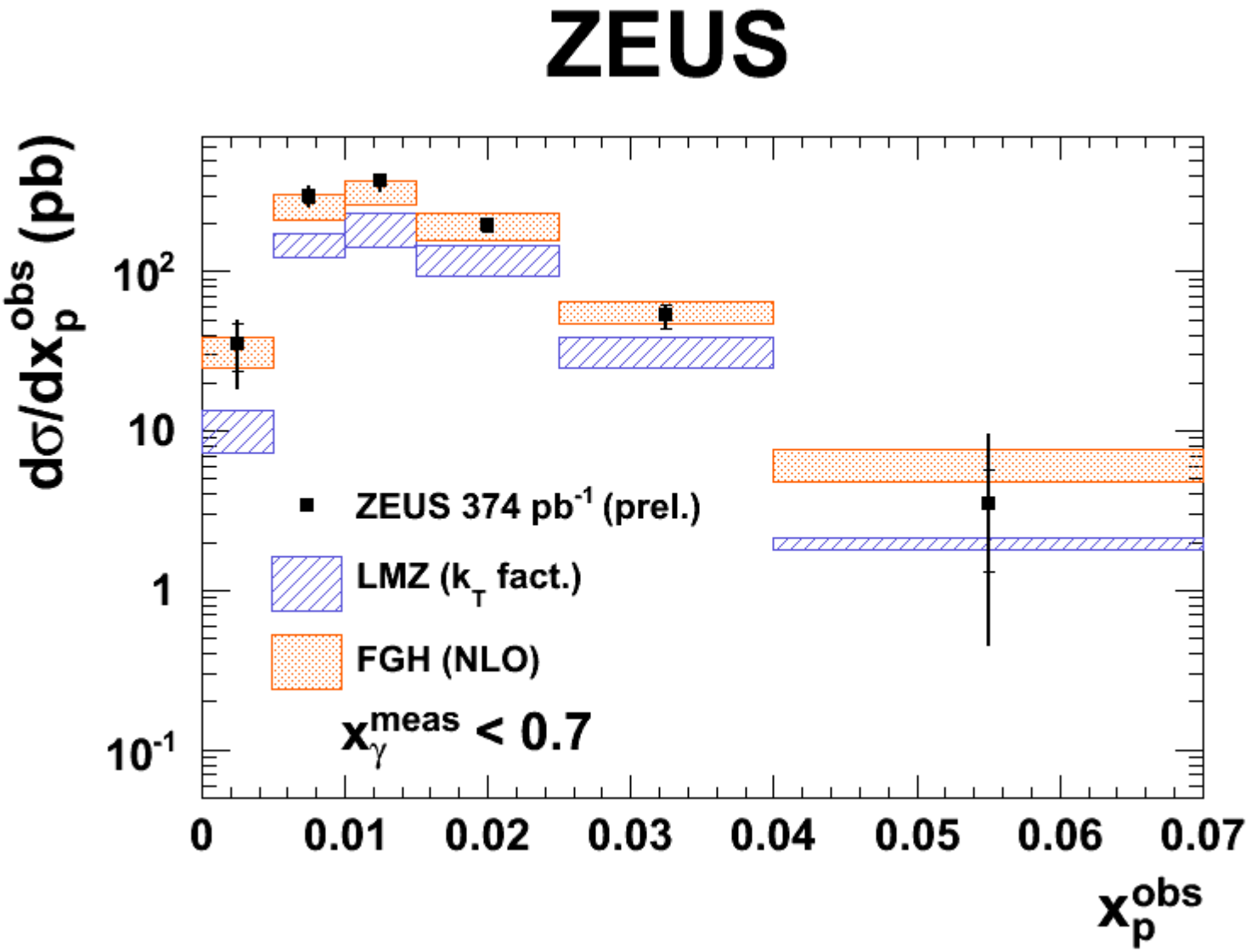

ZEUS
ZEUS 374 pb^{-1} (prel.)
LMZ (k_T fact.)
FGH (NLO)
$d\sigma/d(\eta^{\gamma} - \eta^{jet})$ (pb)
$\eta^{\gamma} - \eta^{jet}$
0
2
4
6
8
10
12
14
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
2.5

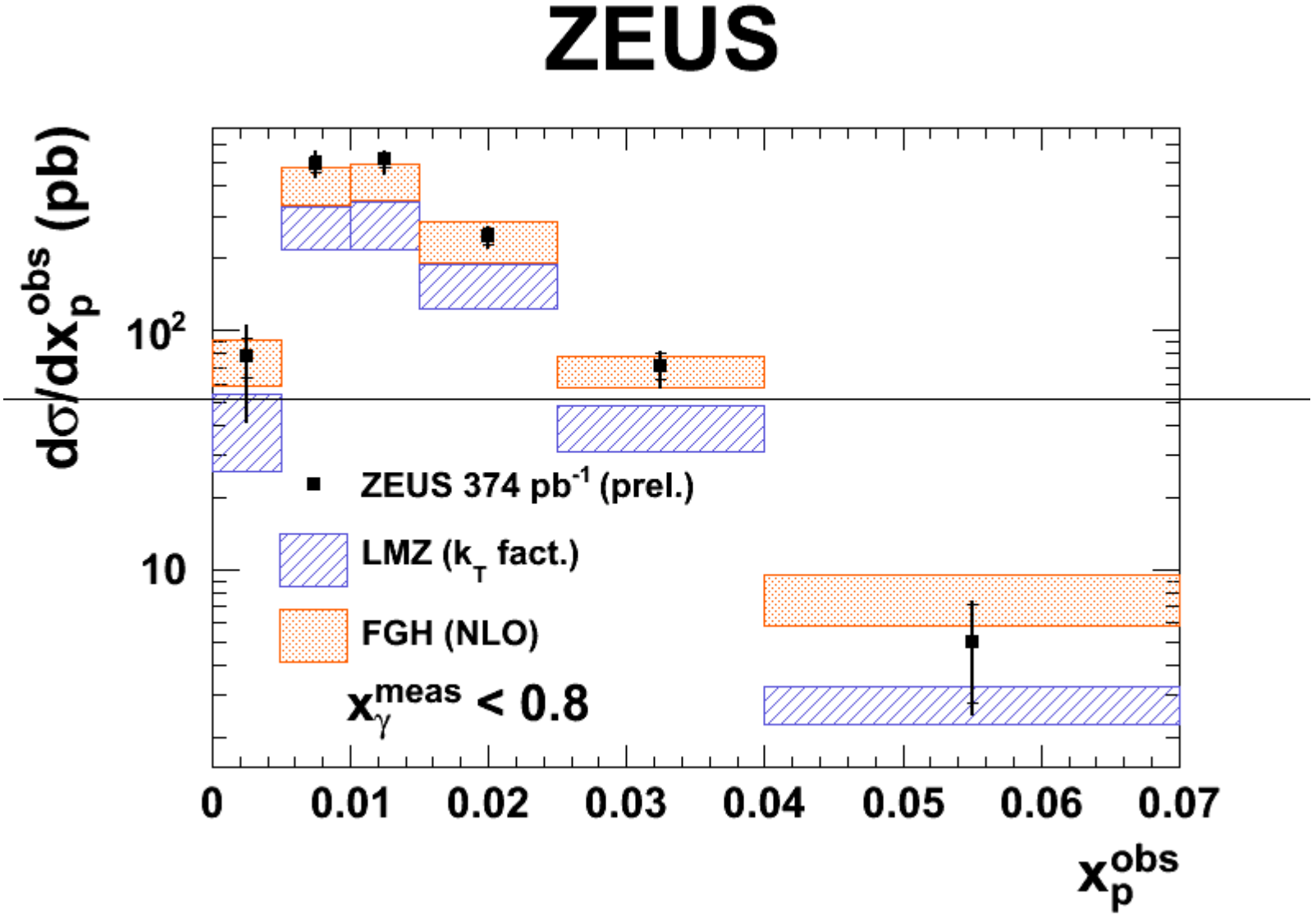

ZEUS
ZEUS 374 pb-1 (prel.)
LMZ (kT fact.)
FGH (NLO)
xγmeas < 0.7
dσ/d(ηγ - ηjet) (pb)
ηγ - ηjet
3.5
3
2.5
2
1.5
1
0.5
0
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
2.5

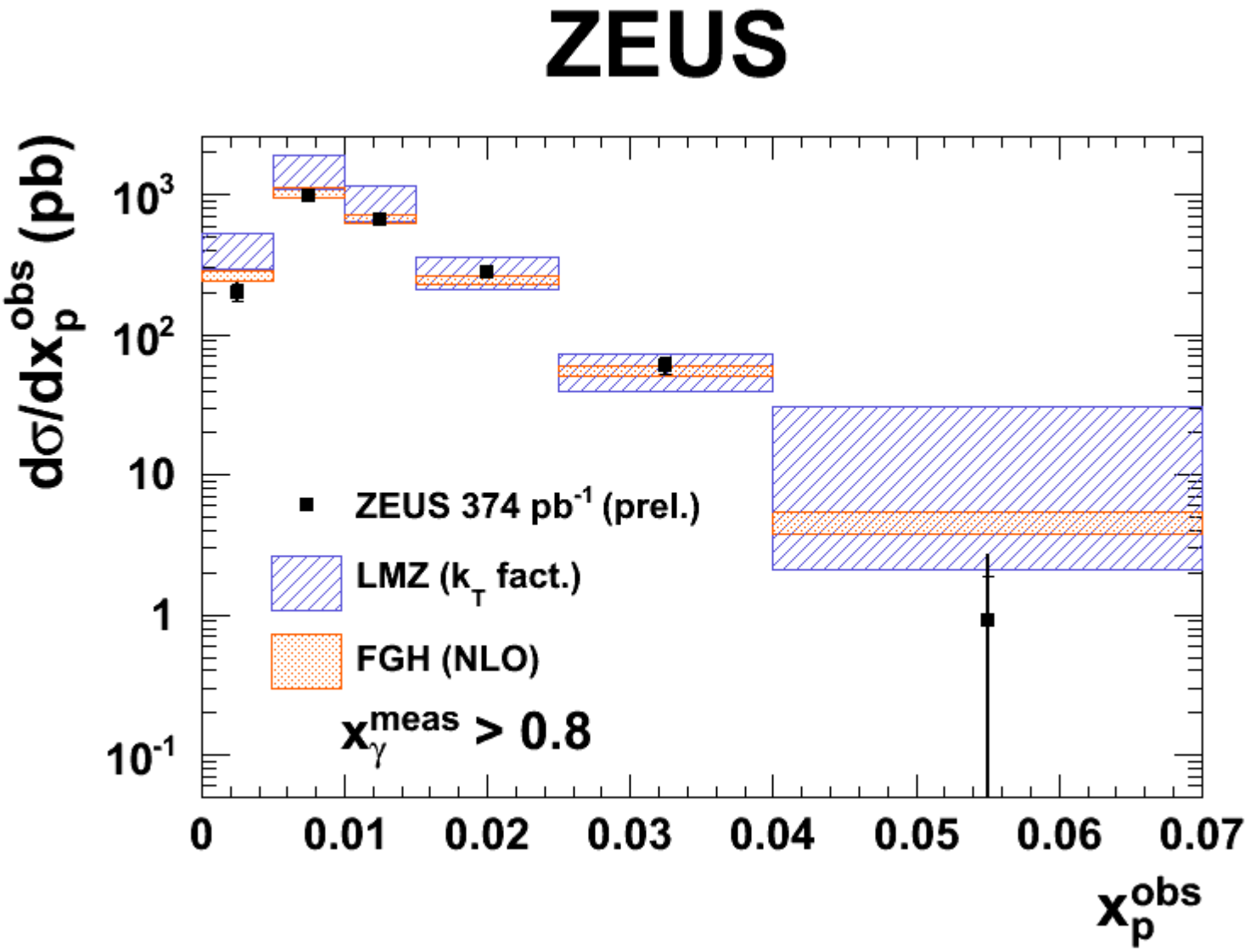

ZEUS
ZEUS 374 pb^{-1} (prel.)
LMZ (k_T fact.)
FGH (NLO)
$x_\gamma^{meas} < 0.8$
$d\sigma/d(\eta^\gamma - \eta^{jet})$ (pb)
$\eta^\gamma - \eta^{jet}$
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
2.5

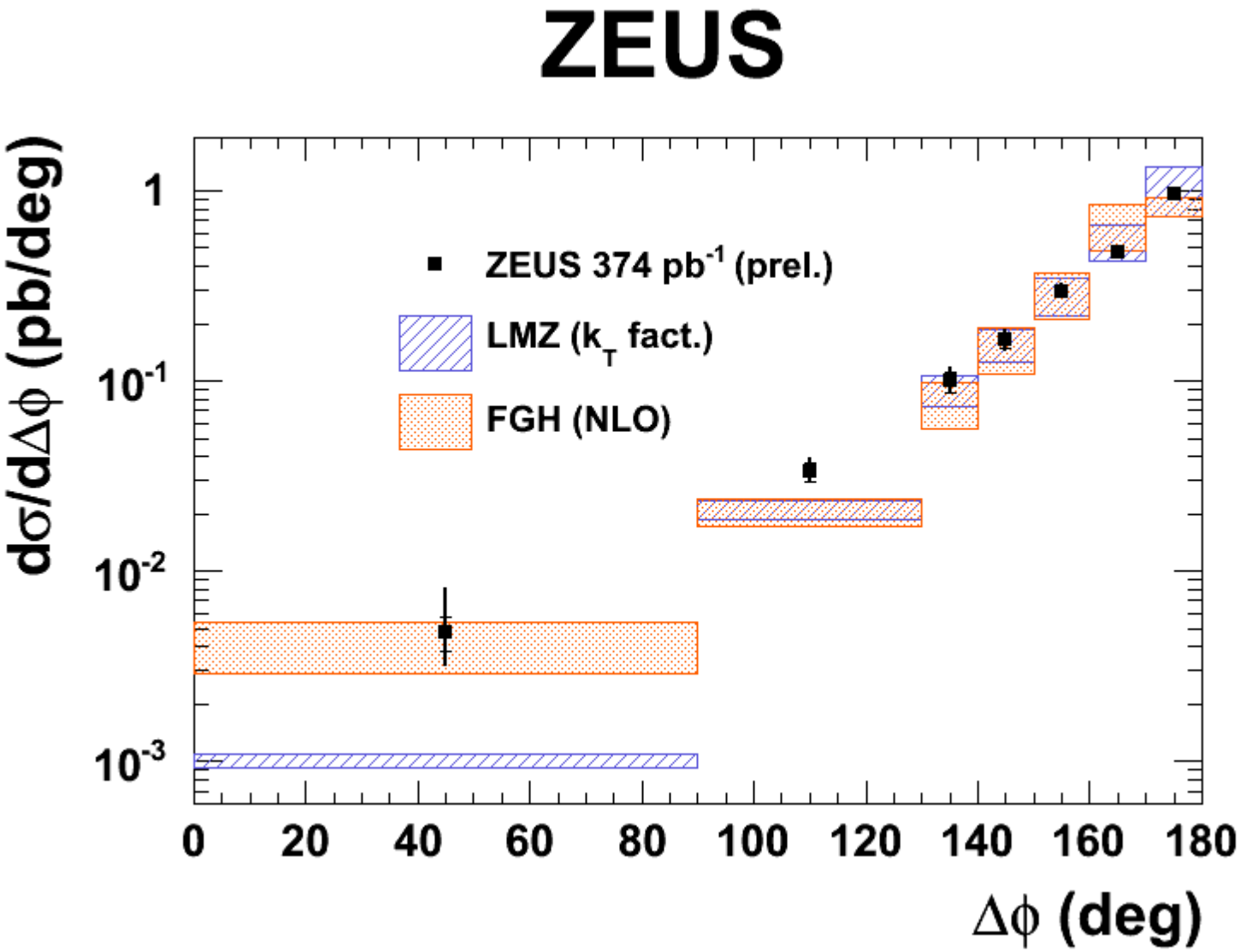

ZEUS
ZEUS 374 pb^{-1} (prel.)
LMZ (k_T fact.)
FGH (NLO)
$x_\gamma^{meas} > 0.8$
$d\sigma/d(\eta^\gamma - \eta^{jet})$ (pb)
$\eta^\gamma - \eta^{jet}$
0
2
4
6
8
10
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
2.5

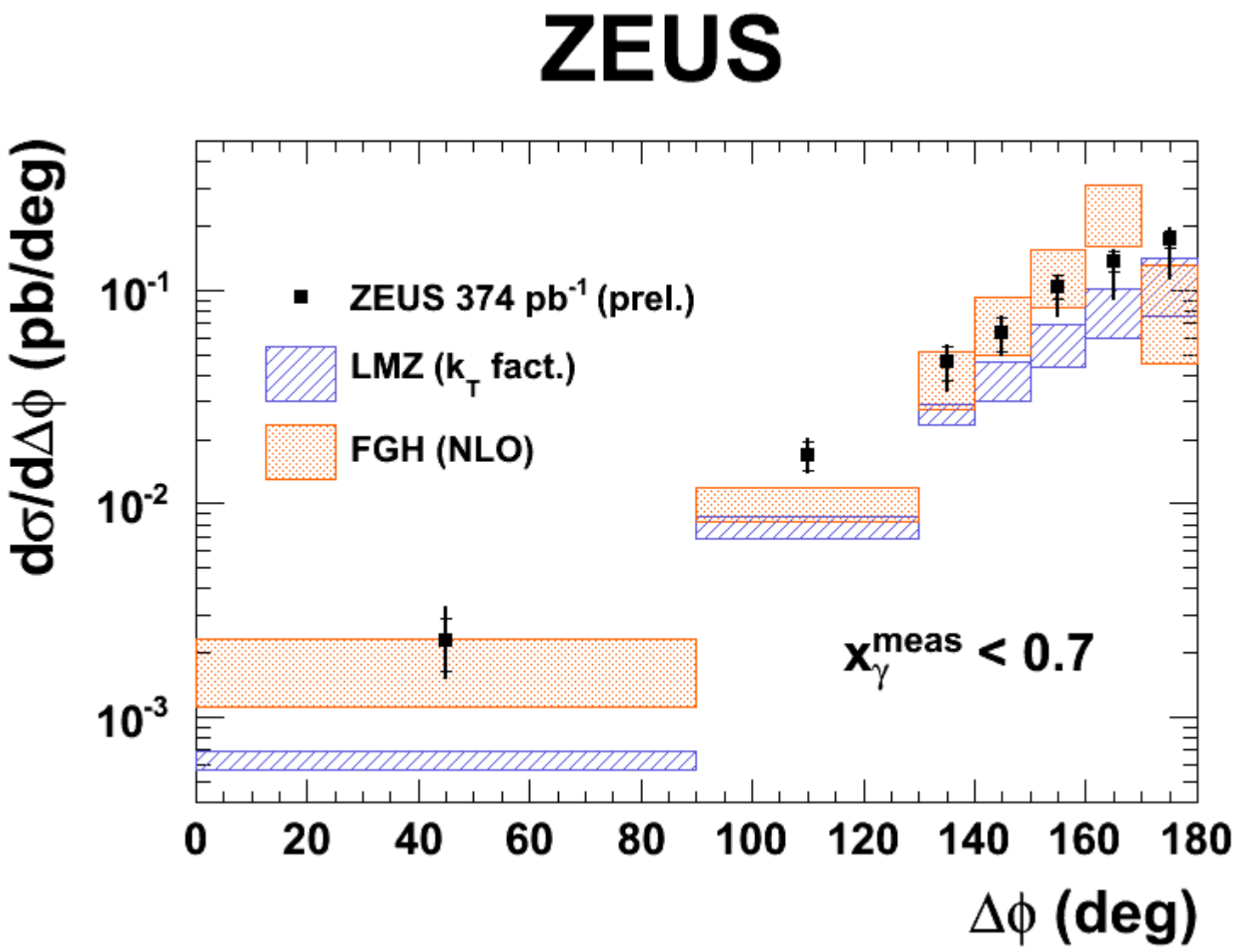

ZEUS
$d\sigma/dx_p^{obs}$ (pb)
10^3
10^2
10
ZEUS 374 pb^{-1} (prel.)
LMZ (k_T fact.)
FGH (NLO)
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
x_p^{obs}

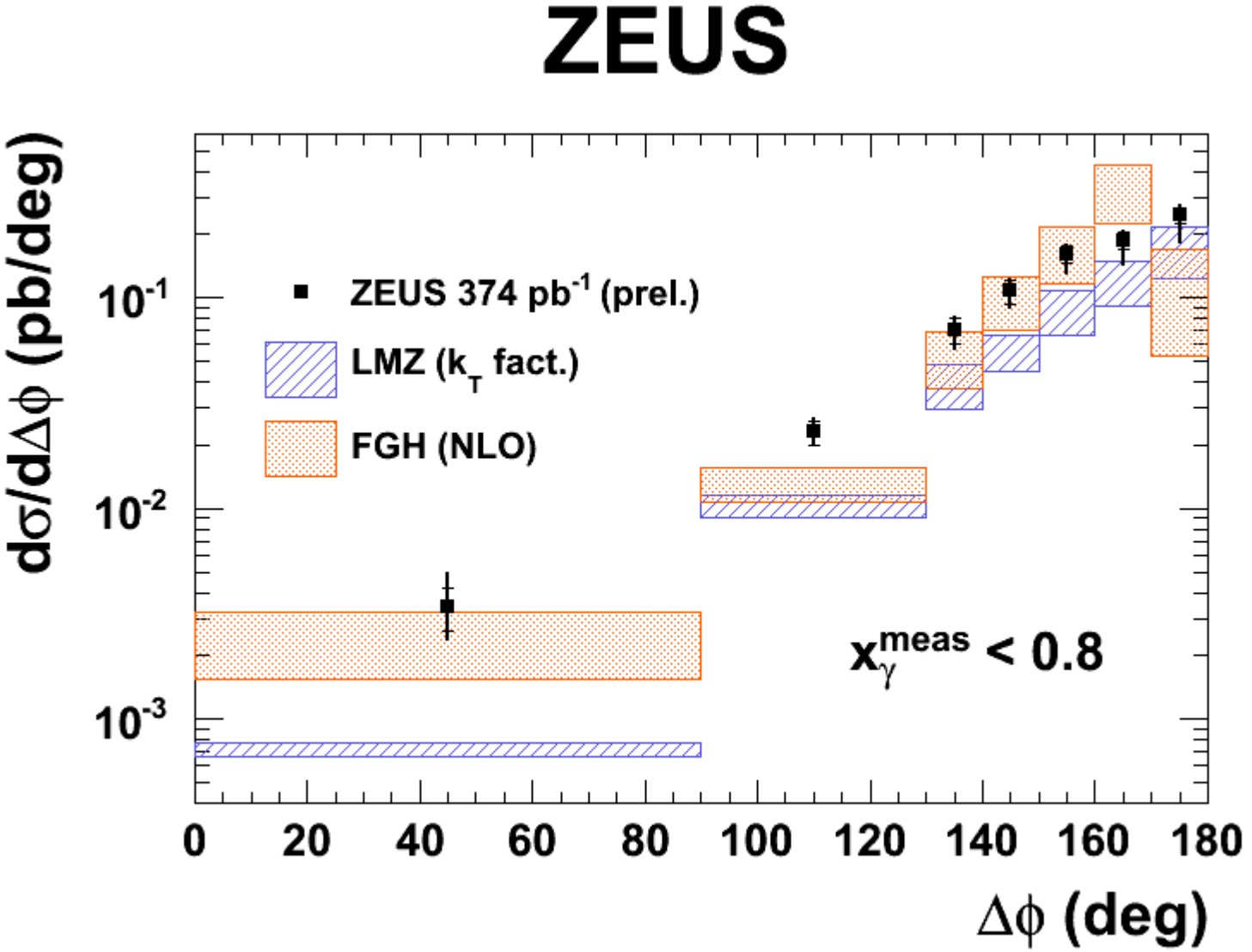

ZEUS
$d\sigma/dx_p^{obs}$ (pb)
10^2
10
1
10^{-1}
ZEUS 374 pb^{-1} (prel.)
LMZ (k_T fact.)
FGH (NLO)
$x_\gamma^{meas} < 0.7$
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
x_p^{obs}

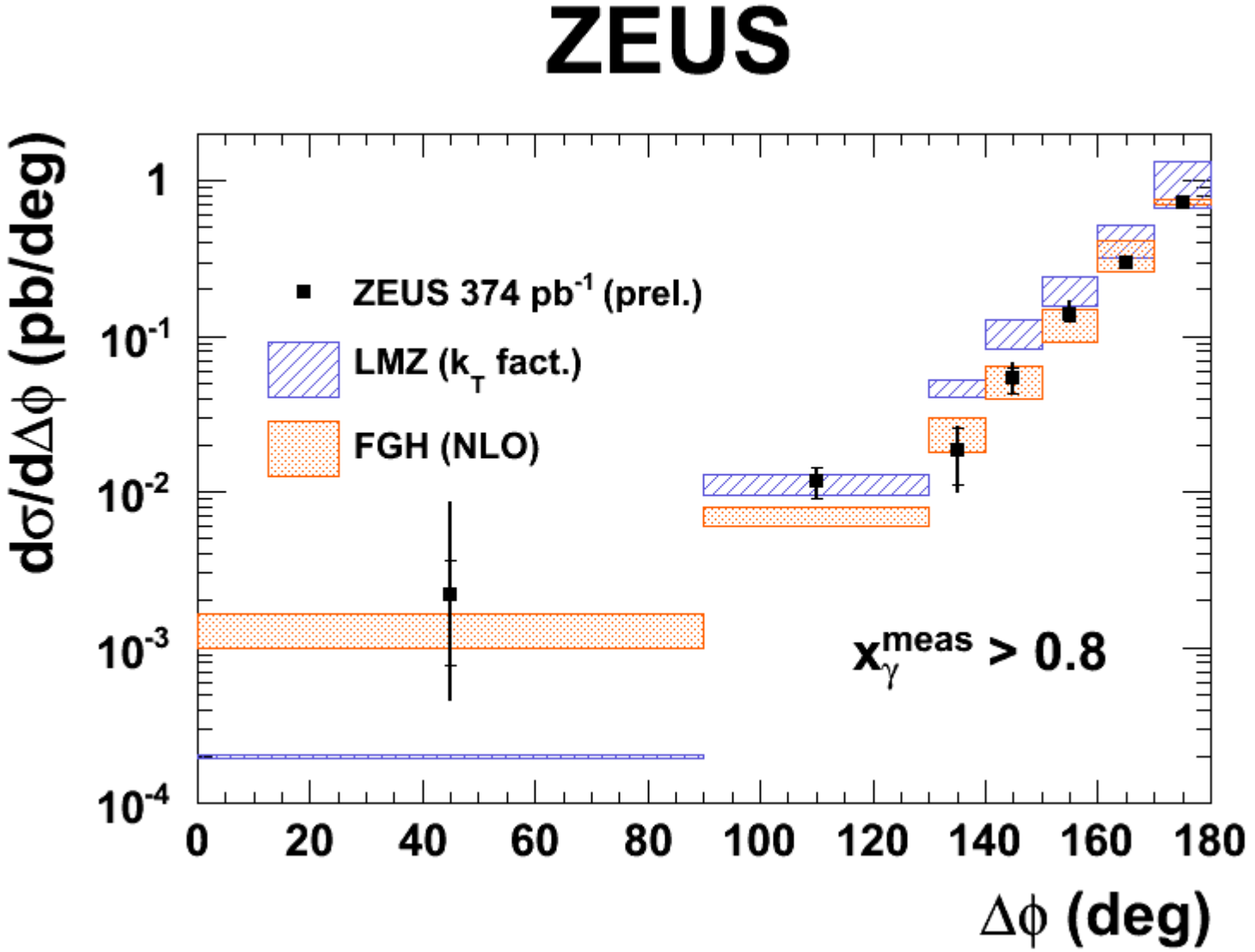

ZEUS
$d\sigma/dx_p^{obs}$ (pb)
10^2
10
ZEUS 374 pb^{-1} (prel.)
LMZ (k_T fact.)
FGH (NLO)
$x_\gamma^{meas} < 0.8$
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
x_p^{obs}

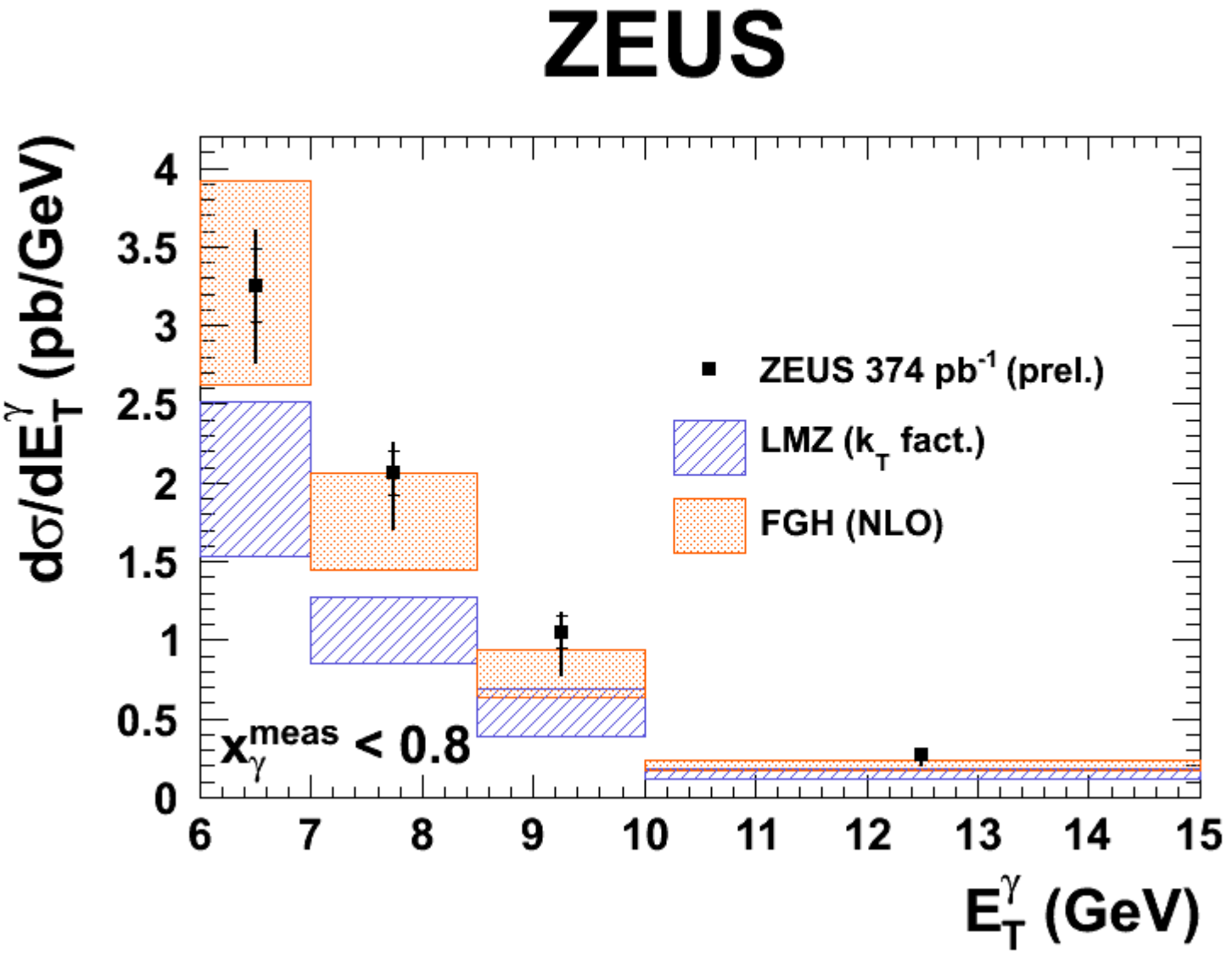

ZEUS
$d\sigma/dx_p^{obs}$ (pb)
10^3
10^2
10
1
10^{-1}
ZEUS 374 pb^{-1} (prel.)
LMZ (k_T fact.)
FGH (NLO)
$x_\gamma^{meas} > 0.8$
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
x_p^{obs}

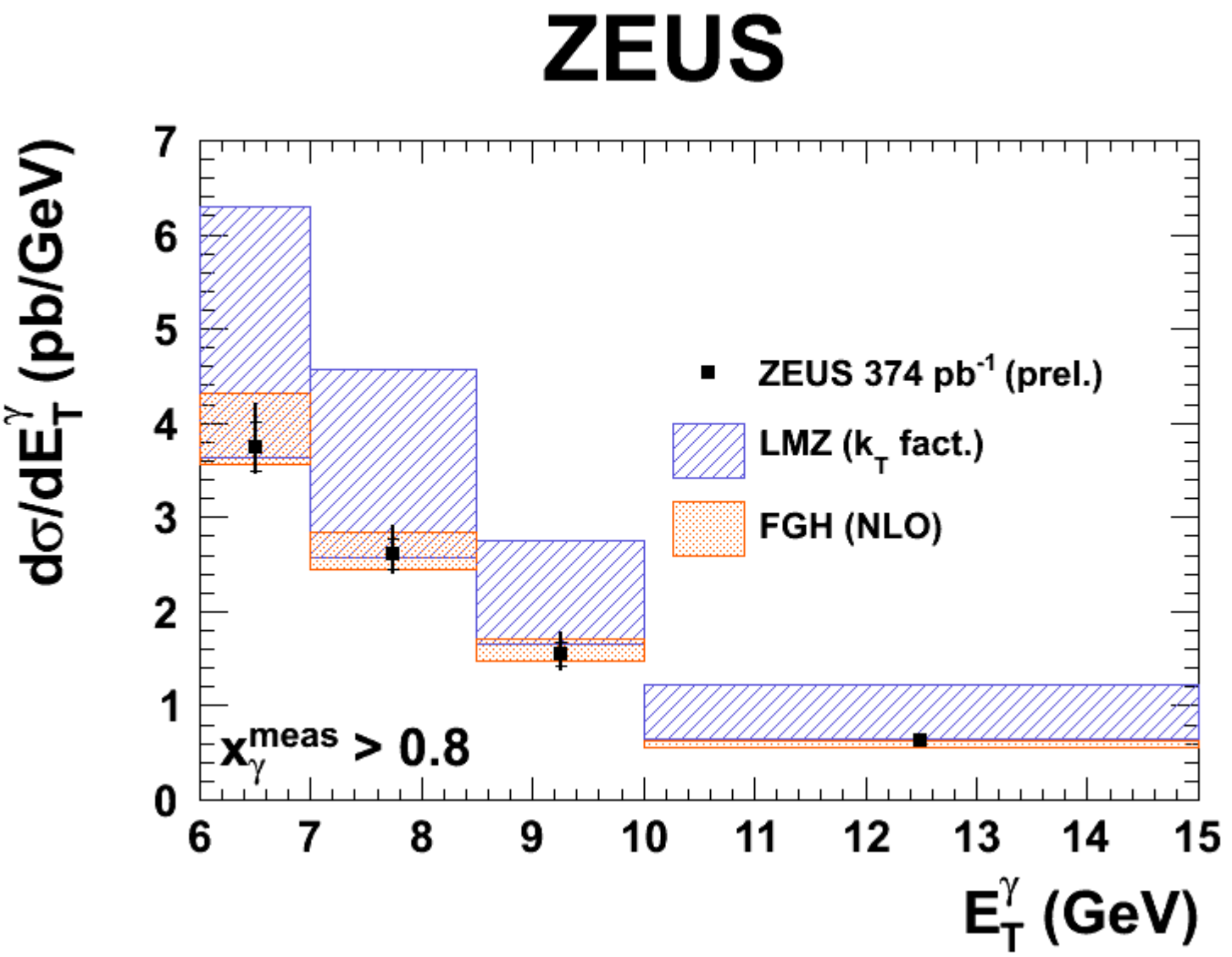

ZEUS
ZEUS 374 pb-1 (prel.)
LMZ (kT fact.)
FGH (NLO)
dσ/dΔφ (pb/deg)
1
10-1
10-2
10-3
0
20
40
60
80
100
120
140
160
180
Δφ (deg)

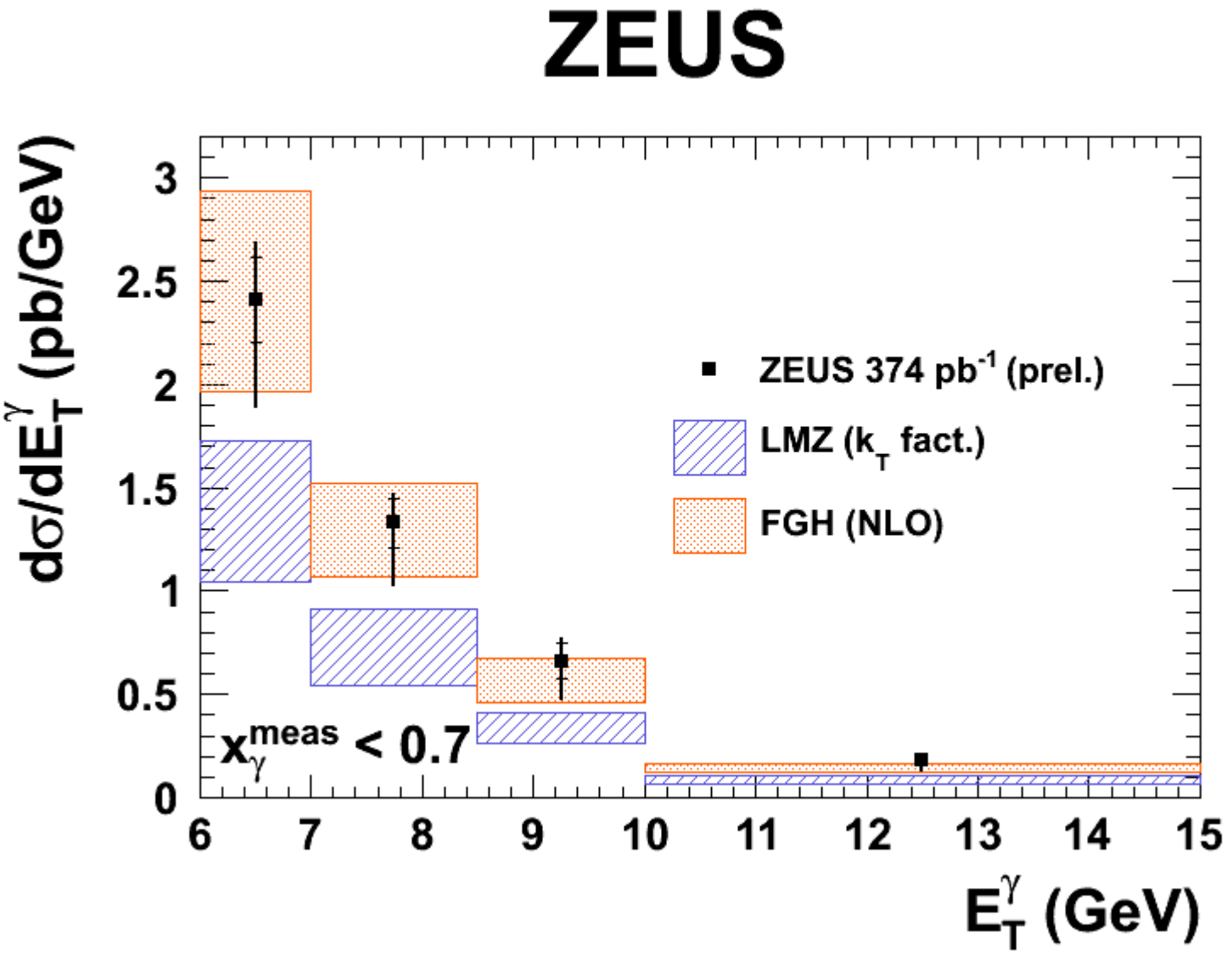

ZEUS
$d\sigma/d\Delta\phi$ (pb/deg)
10^{-1}
10^{-2}
10^{-3}
ZEUS 374 pb^{-1} (prel.)
LMZ (k_T fact.)
FGH (NLO)
$x_\gamma^{meas} < 0.7$
0
20
40
60
80
100
120
140
160
180
$\Delta\phi$ (deg)

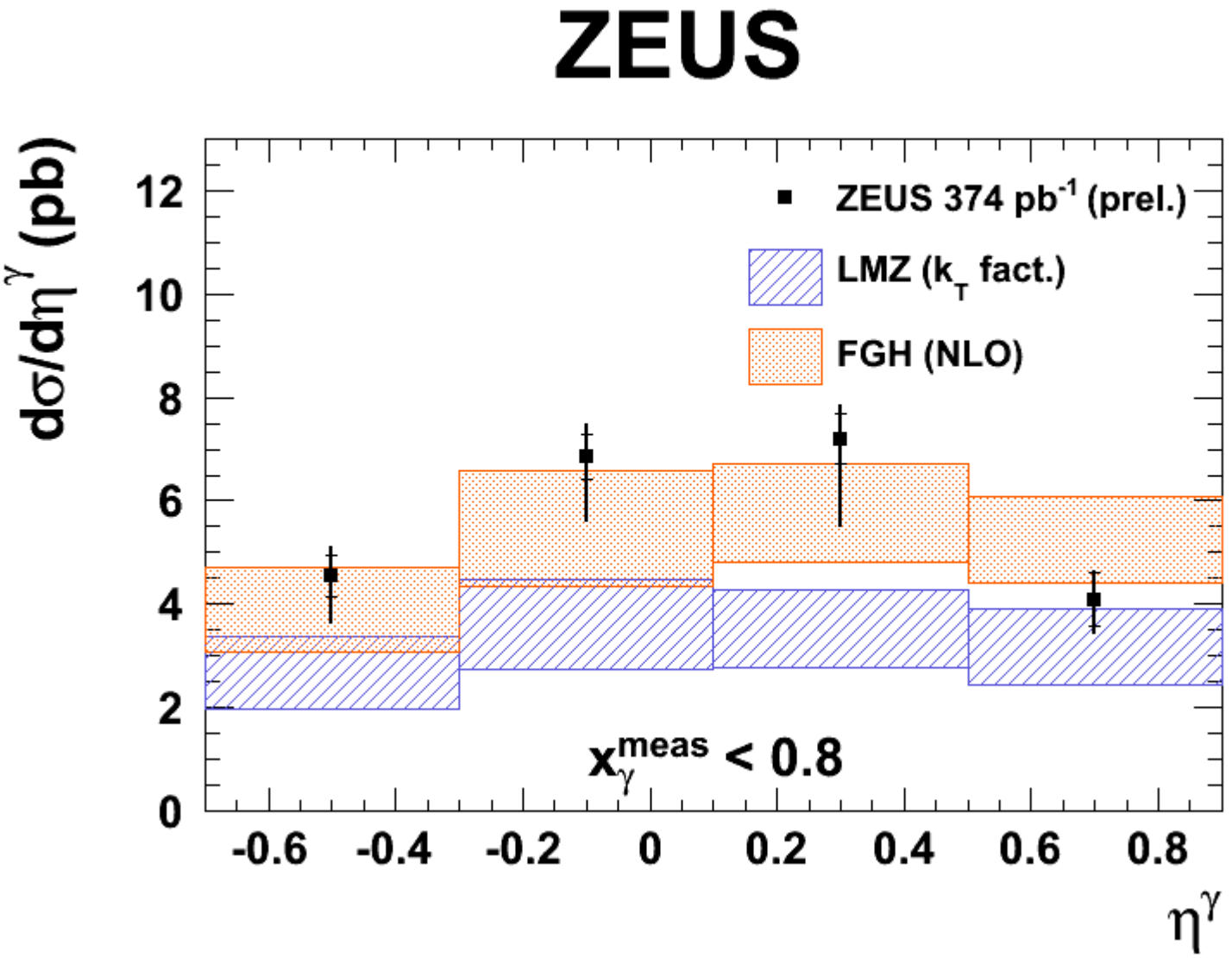

ZEUS
dσ/dΔφ (pb/deg)
10^-1
10^-2
10^-3
ZEUS 374 pb^-1 (prel.)
LMZ (k_T fact.)
FGH (NLO)
x_γ^meas < 0.8
0
20
40
60
80
100
120
140
160
180
Δφ (deg)

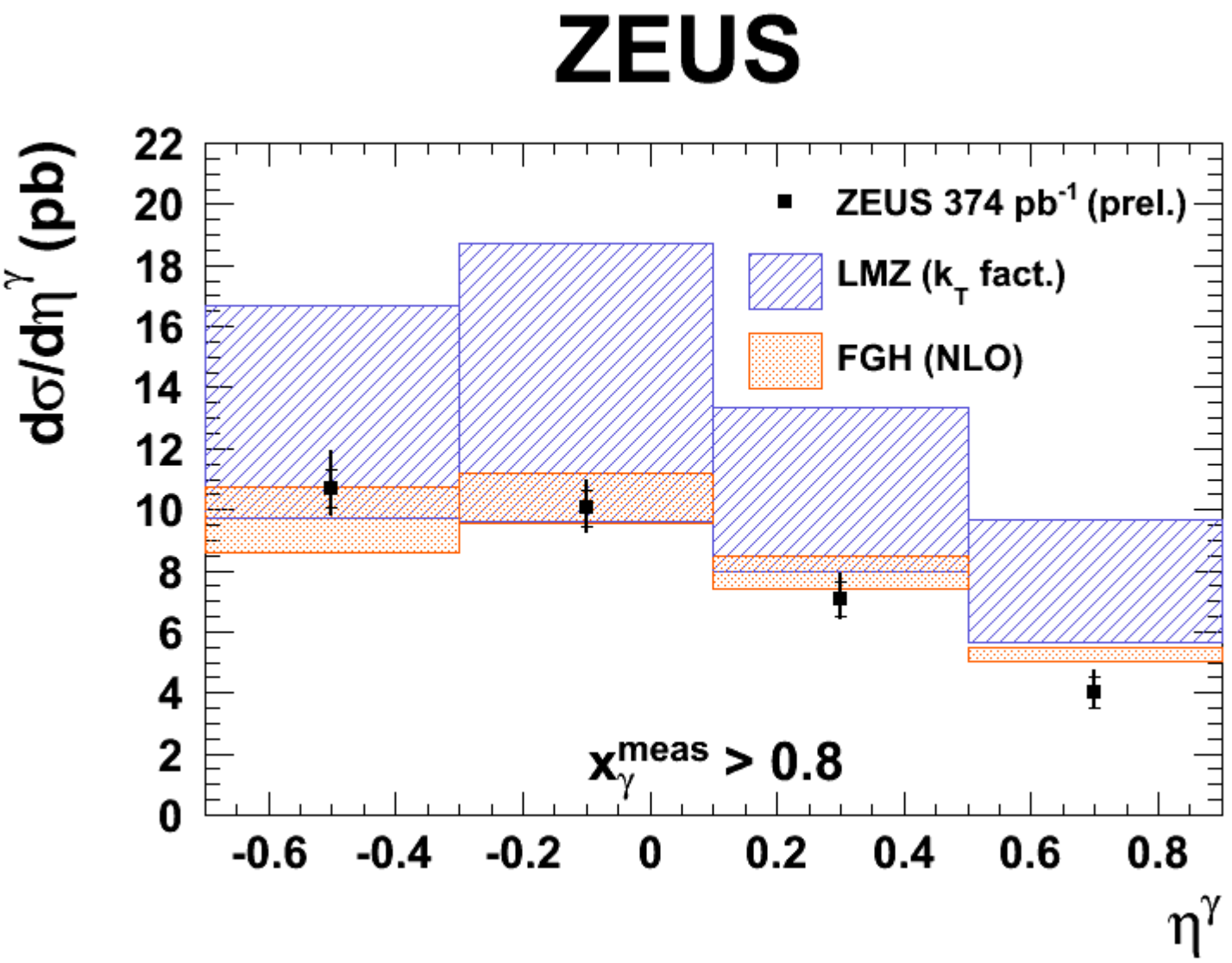

ZEUS
ZEUS 374 pb-1 (prel.)
LMZ (kT fact.)
FGH (NLO)
xγmeas > 0.8
dσ/dΔφ (pb/deg)
Δφ (deg)
1
10-1
10-2
10-3
10-4
0
20
40
60
80
100
120
140
160
180

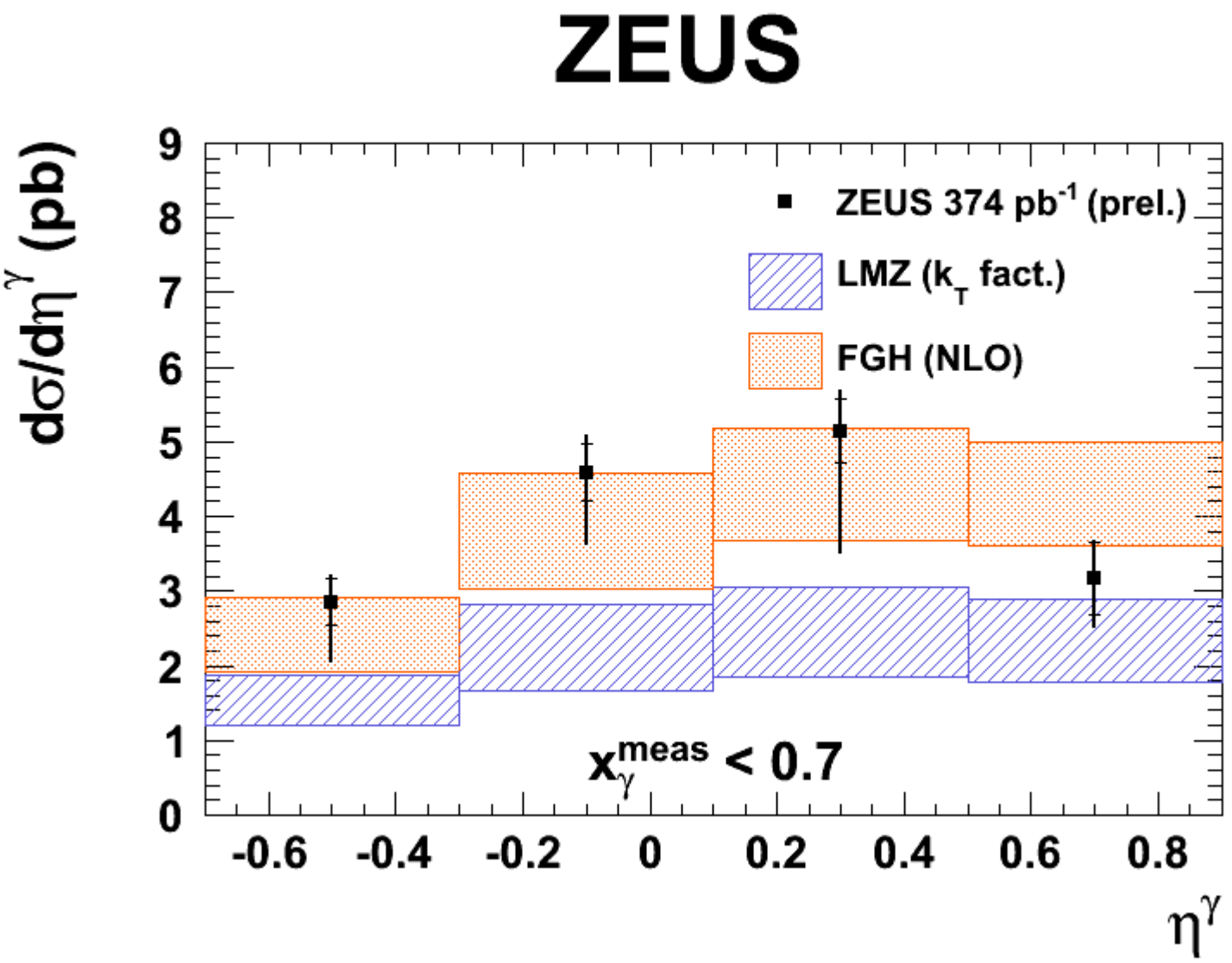

ZEUS
$d\sigma/dE_T^\gamma$ (pb/GeV)
4
3.5
3
2.5
2
1.5
1
0.5
0
6
7
8
9
10
11
12
13
14
15
E_T^γ (GeV)
ZEUS 374 pb^{-1} (prel.)
LMZ (k_T fact.)
FGH (NLO)
$x_\gamma^{meas} < 0.8$

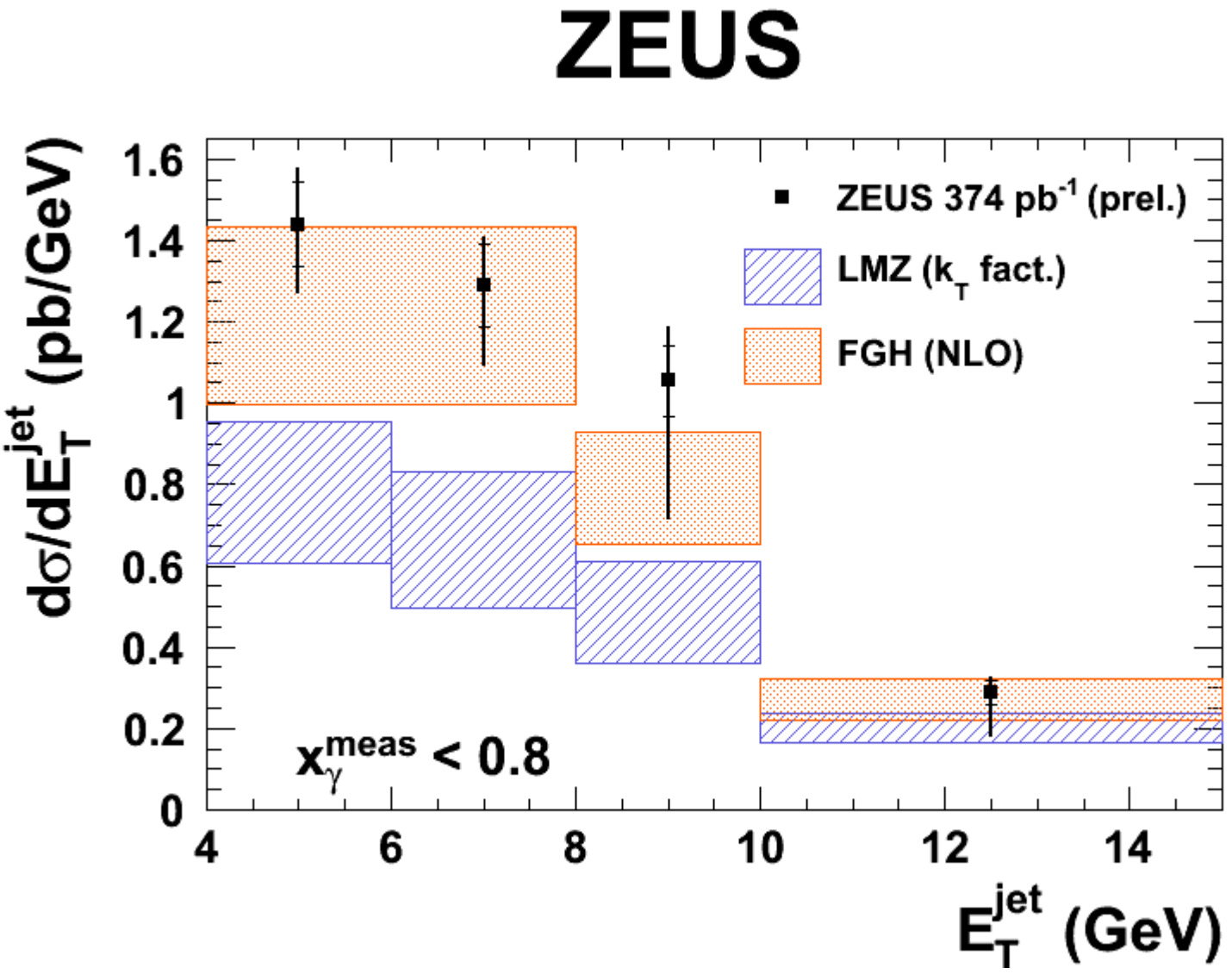

ZEUS
$d\sigma/dE_T^\gamma$ (pb/GeV)
E_T^γ (GeV)
ZEUS 374 pb^{-1} (prel.)
LMZ (k_T fact.)
FGH (NLO)
$x_\gamma^{meas} > 0.8$
0
1
2
3
4
5
6
7
6
7
8
9
10
11
12
13
14
15

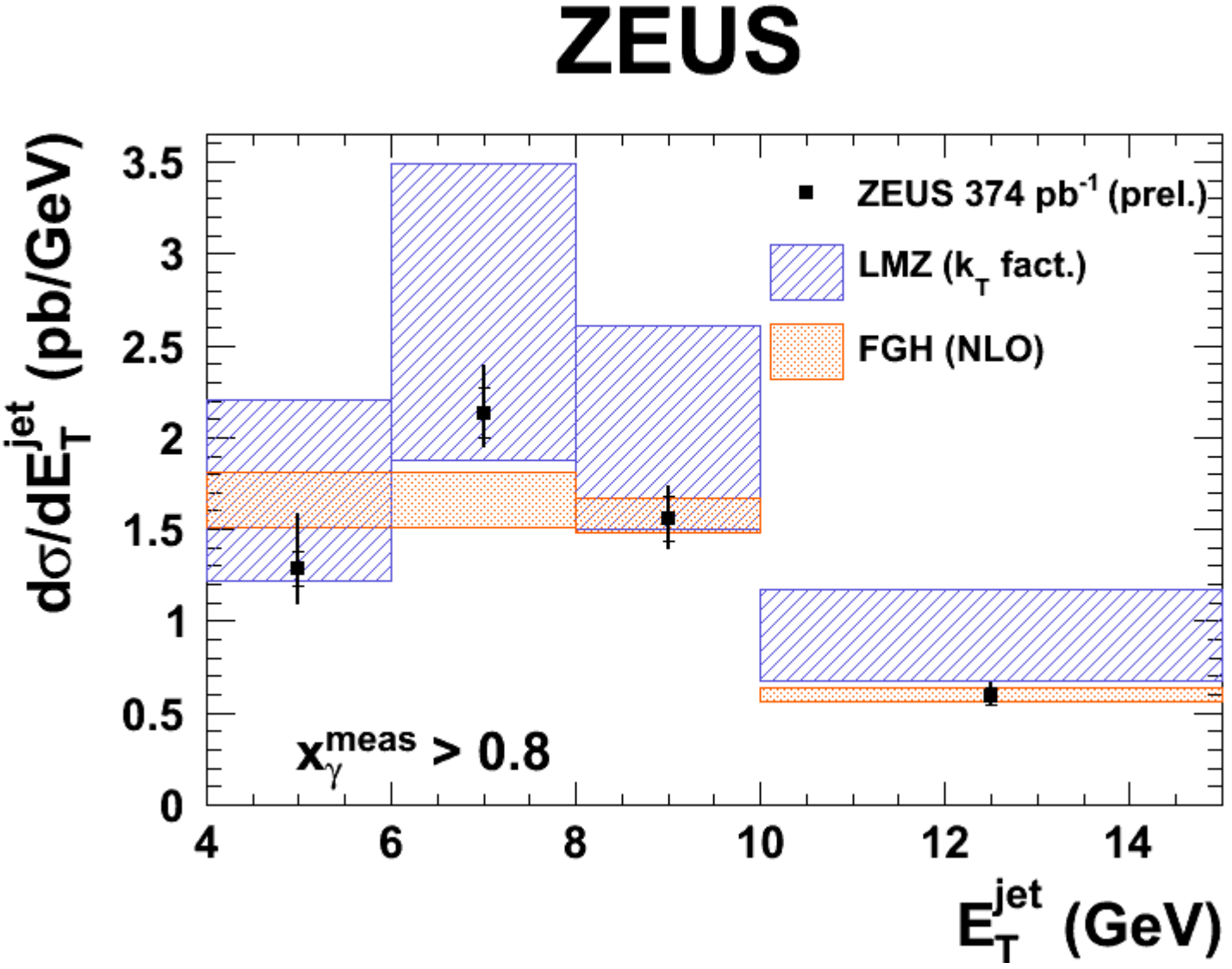

ZEUS
$d\sigma/dE_T^\gamma$ (pb/GeV)
3
2.5
2
1.5
1
0.5
0
6
7
8
9
10
11
12
13
14
15
E_T^γ (GeV)
ZEUS 374 pb^{-1} (prel.)
LMZ (k_T fact.)
FGH (NLO)
$x_\gamma^{meas} < 0.7$

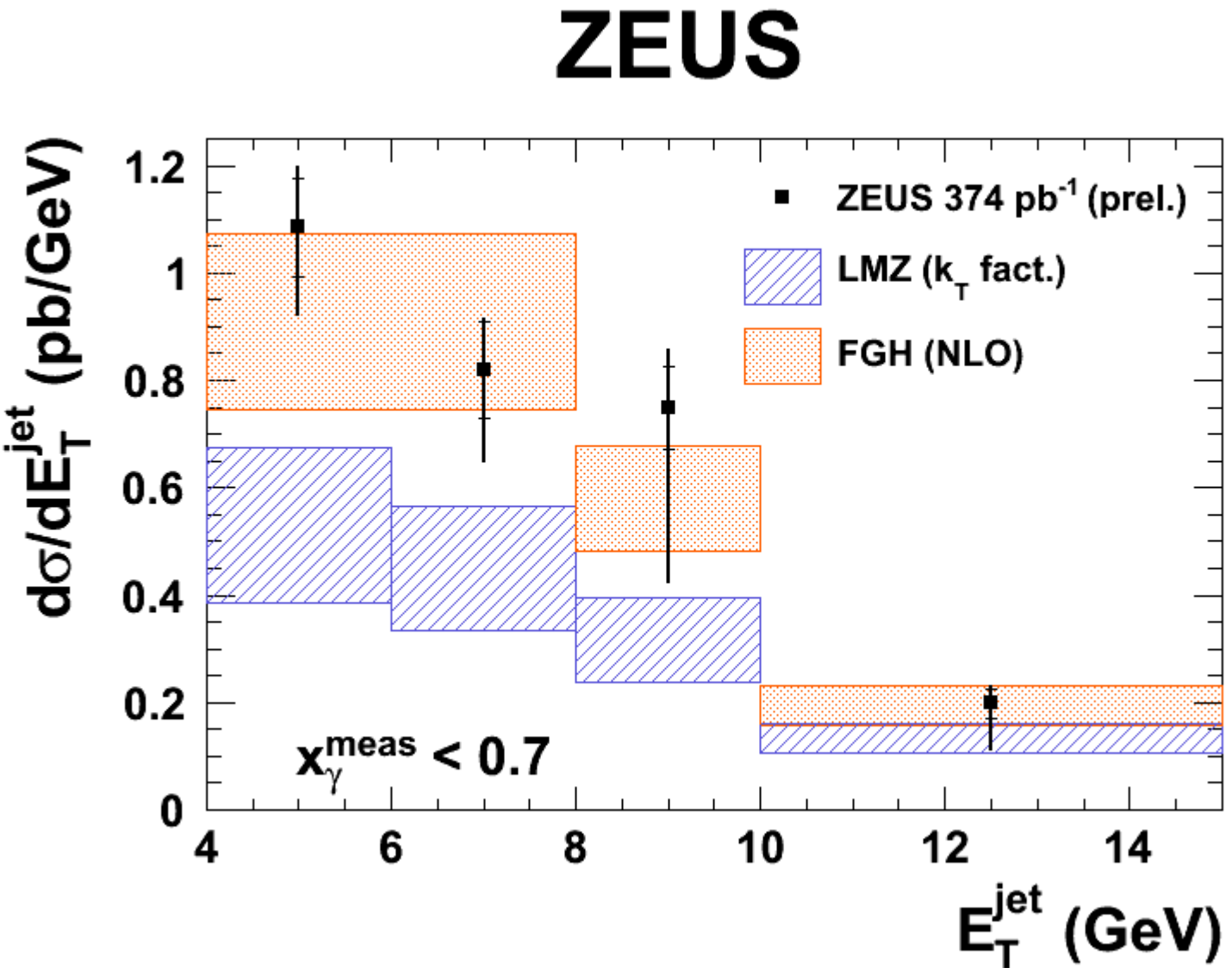

ZEUS
ZEUS 374 pb-1 (prel.)
LMZ (kT fact.)
FGH (NLO)
dσ/dηγ (pb)
xγmeas < 0.8
ηγ
0
2
4
6
8
10
12
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8

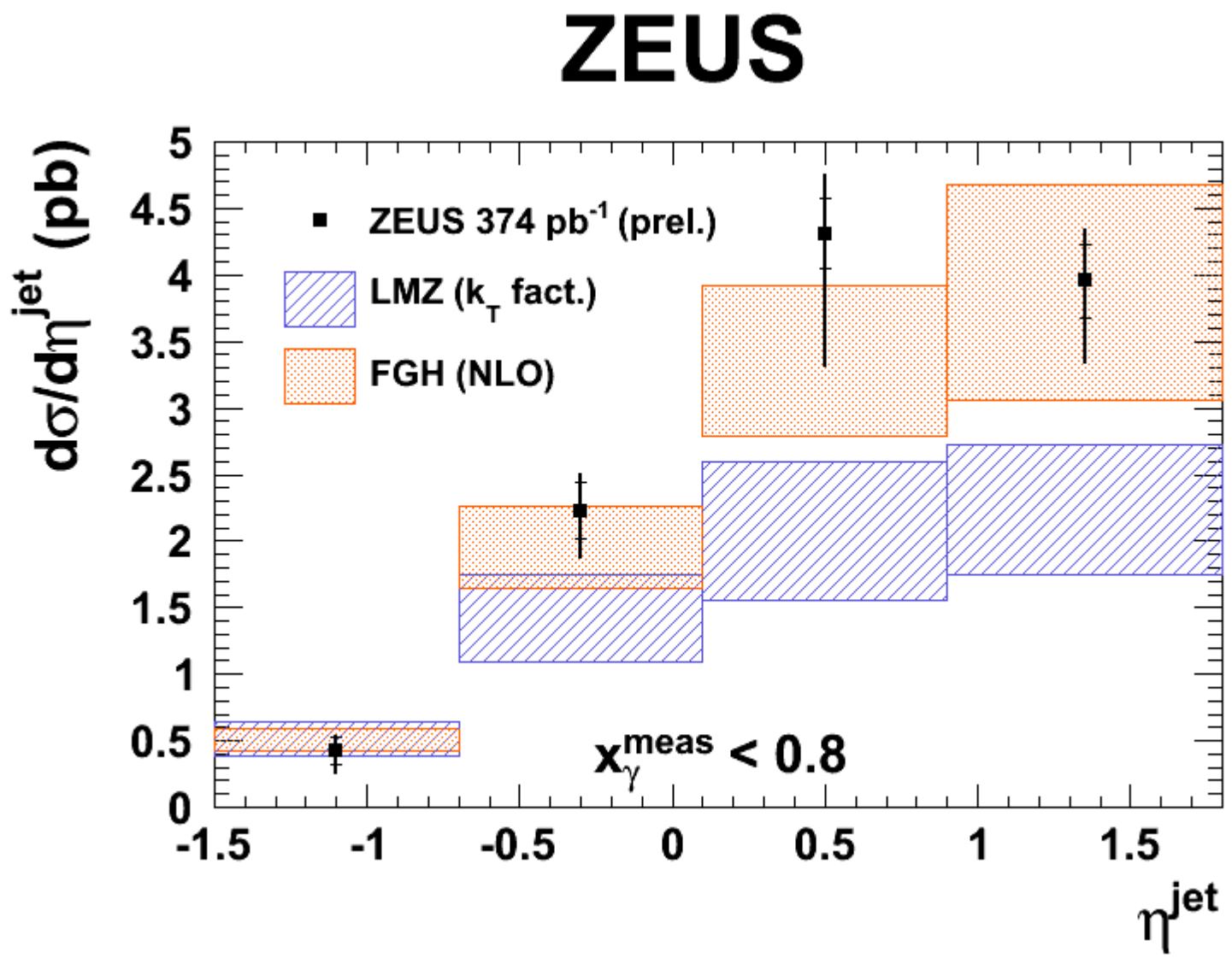

ZEUS
ZEUS 374 pb-1 (prel.)
LMZ (kT fact.)
FGH (NLO)
xγmeas > 0.8
dσ/dηγ (pb)
ηγ
22
20
18
16
14
12
10
8
6
4
2
0
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8

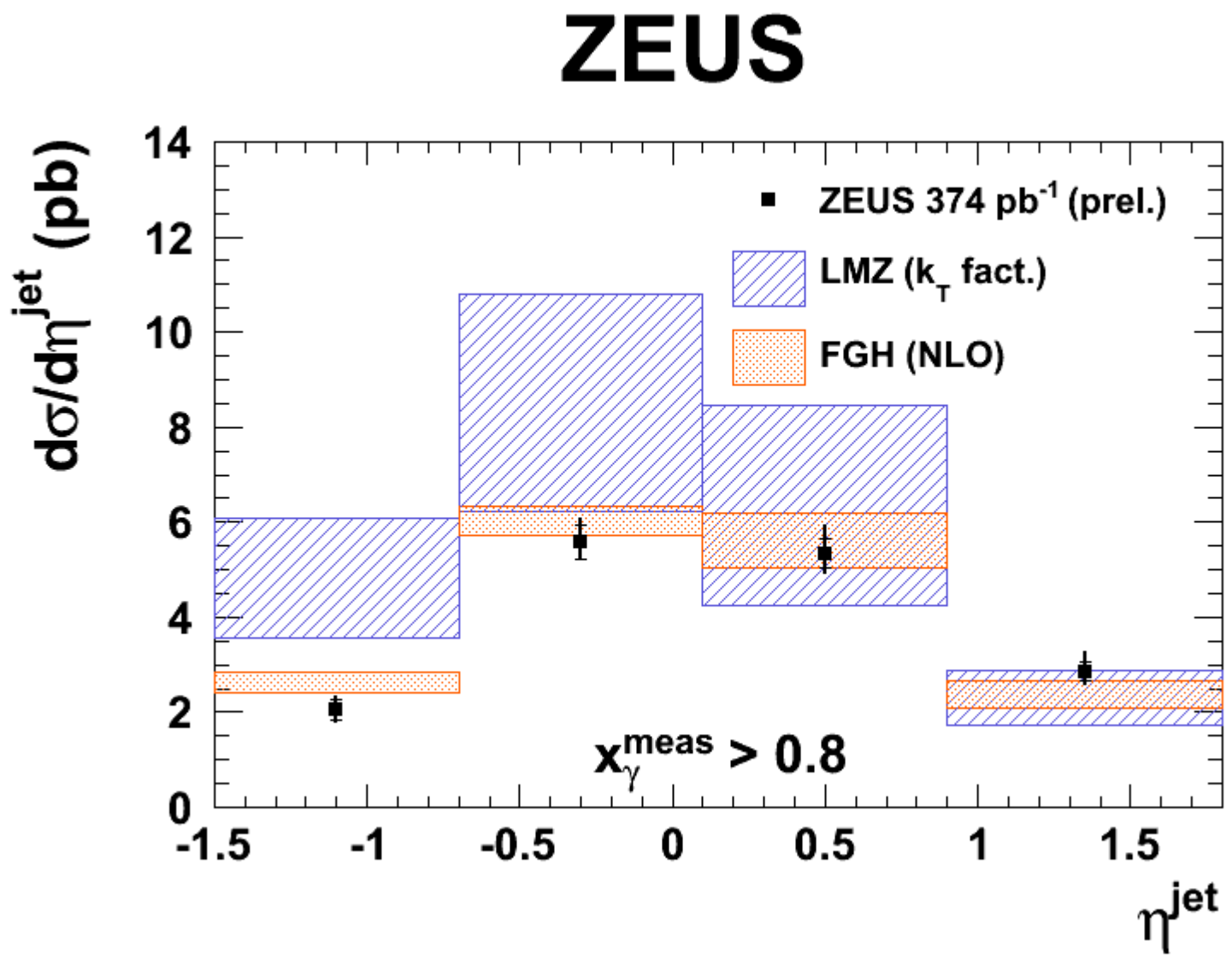

ZEUS
ZEUS 374 pb-1 (prel.)
LMZ (kT fact.)
FGH (NLO)
dσ/dηγ (pb)
xγmeas < 0.7
ηγ
0
1
2
3
4
5
6
7
8
9
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8

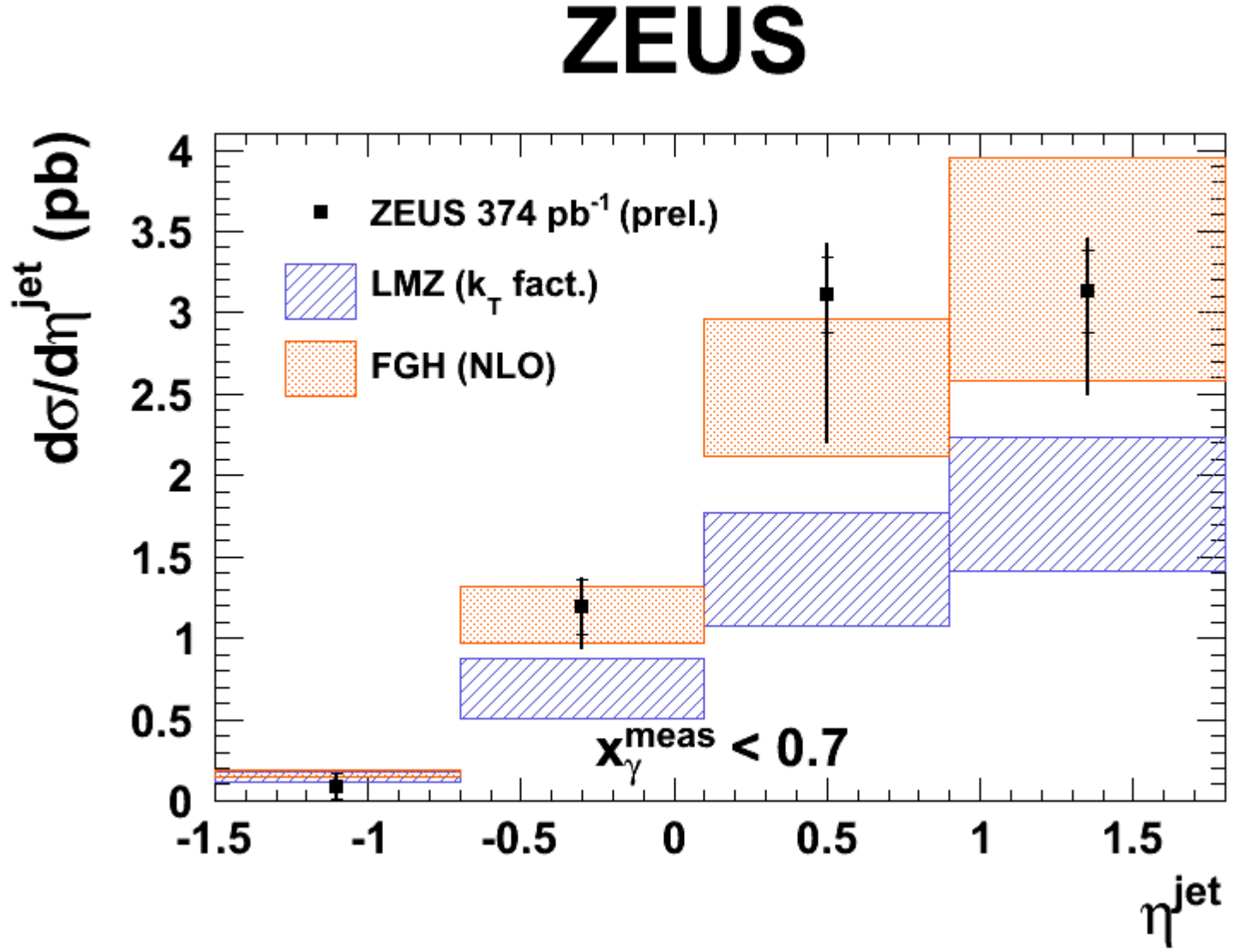

ZEUS
ZEUS 374 pb^{-1} (prel.)
LMZ (k_T fact.)
FGH (NLO)
$x_\gamma^{meas} < 0.8$
$d\sigma/dE_T^{jet}$ (pb/GeV)
E_T^{jet} (GeV)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
4
6
8
10
12
14


ZEUS
ZEUS 374 pb^{-1} (prel.)
LMZ (k_T fact.)
FGH (NLO)
$x_\gamma^{meas} > 0.8$
$d\sigma/dE_T^{jet}$ (pb/GeV)
E_T^{jet} (GeV)
0
0.5
1
1.5
2
2.5
3
3.5
4
6
8
10
12
14


ZEUS
ZEUS 374 pb^{-1} (prel.)
LMZ (k_T fact.)
FGH (NLO)
$x_\gamma^{meas} < 0.7$
$d\sigma/dE_T^{jet}$ (pb/GeV)
E_T^{jet} (GeV)
0
0.2
0.4
0.6
0.8
1
1.2
4
6
8
10
12
14


ZEUS
ZEUS 374 pb^{-1} (prel.)
LMZ (k_T fact.)
FGH (NLO)
$x_\gamma^{meas} < 0.8$
$d\sigma/d\eta^{jet}$ (pb)
η^{jet}
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
-1.5
-1
-0.5
0
0.5
1
1.5


ZEUS
ZEUS 374 pb^{-1} (prel.)
LMZ (k_T fact.)
FGH (NLO)
$x_\gamma^{meas} > 0.8$
$d\sigma/d\eta^{jet}$ (pb)
η^{jet}
14
12
10
8
6
4
2
0
-1.5
-1
-0.5
0
0.5
1
1.5


ZEUS
ZEUS 374 pb-1 (prel.)
LMZ (kT fact.)
FGH (NLO)
dσ/dηjet (pb)
ηjet
xγmeas < 0.7
4
3.5
3
2.5
2
1.5
1
0.5
0
-1.5
-1
-0.5
0
0.5
1
1.5

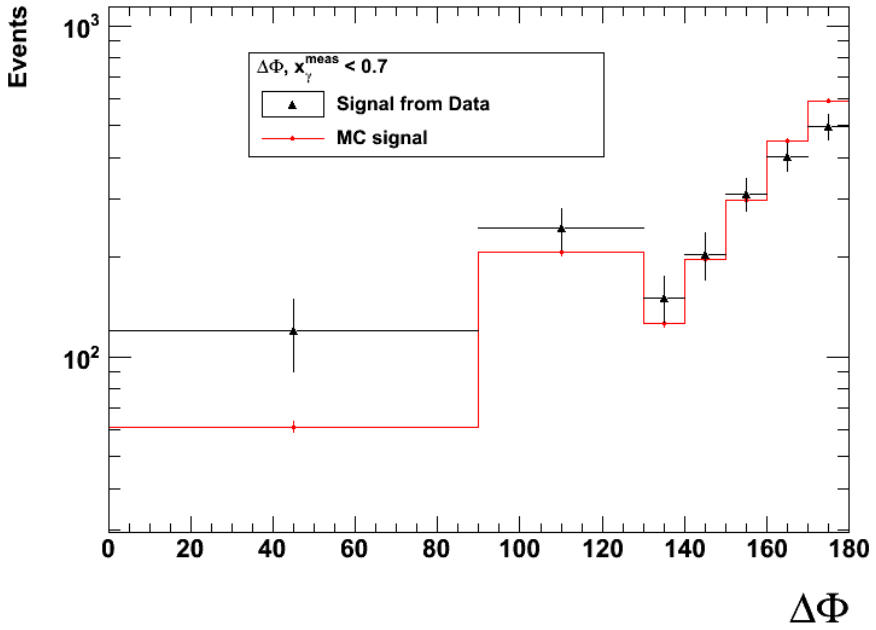
Backup slides

$\Delta\Phi$ study
Resolutions
Fits in bins
Acceptance, purity, efficiency
Systematics

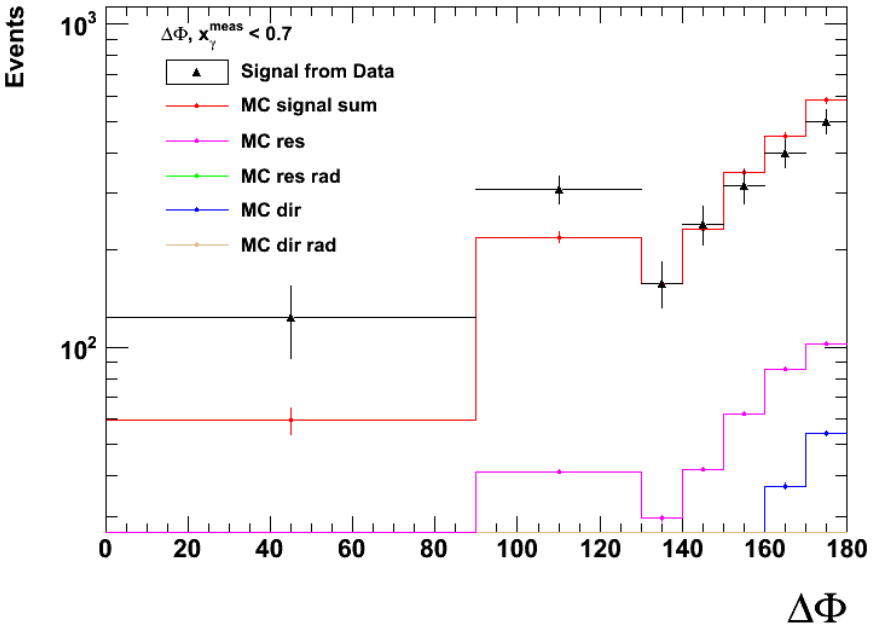
ΔΦ study

Comparison with HERWIG. No reweighting

PYTHIA



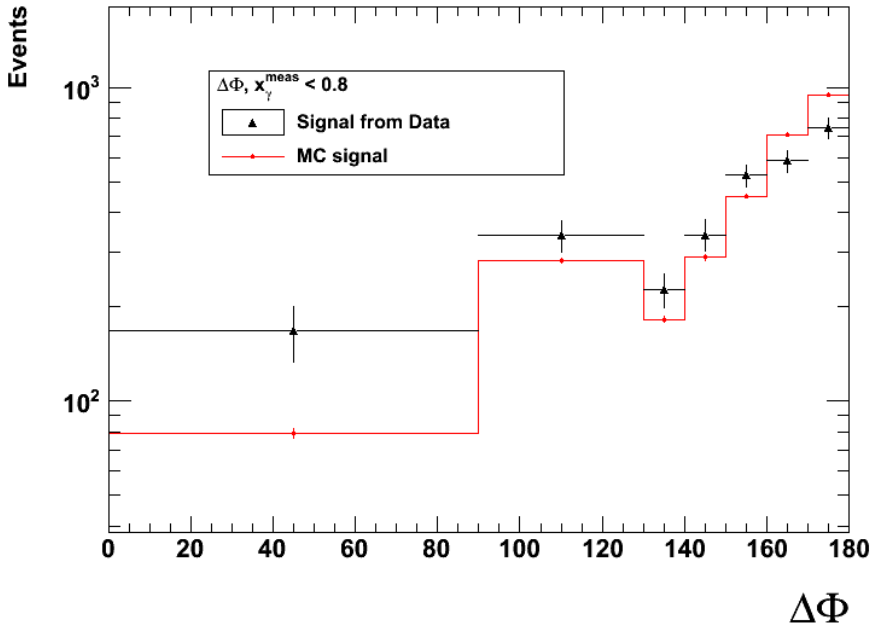
HERWIG



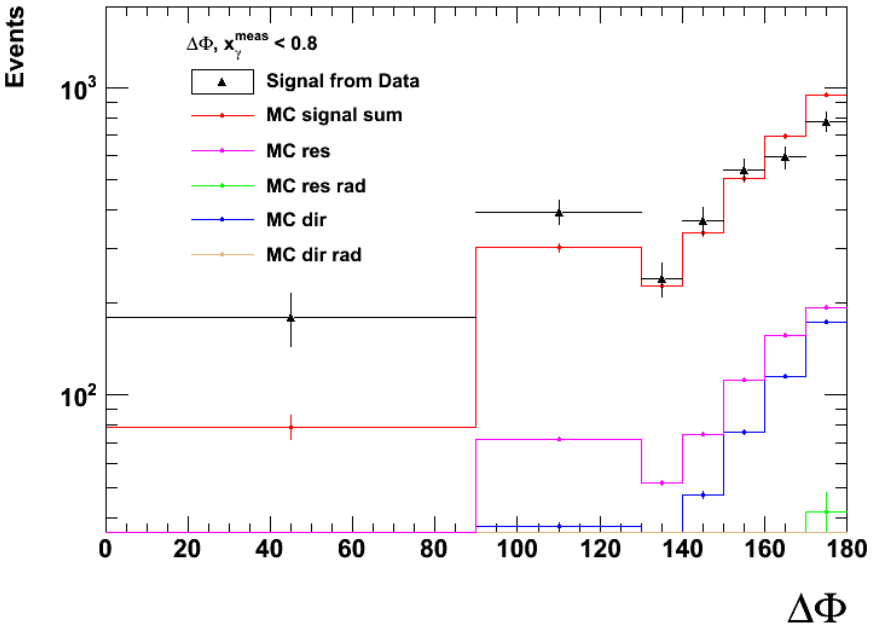
In some bins HERWIG fits better, in some worse. No significant improvement compared with when using PYTHIA.

Comparison with HERWIG. No reweighting

PYTHIA



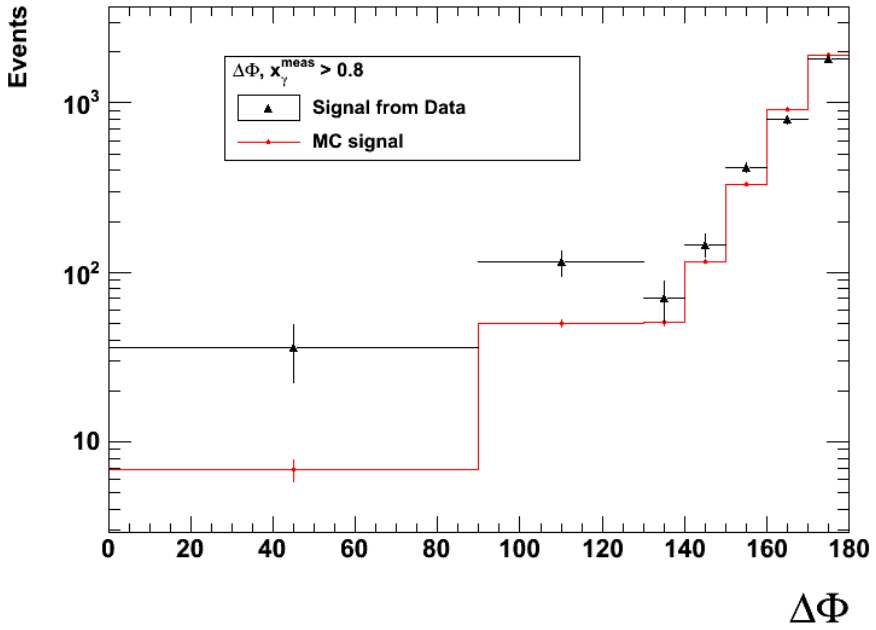
HERWIG



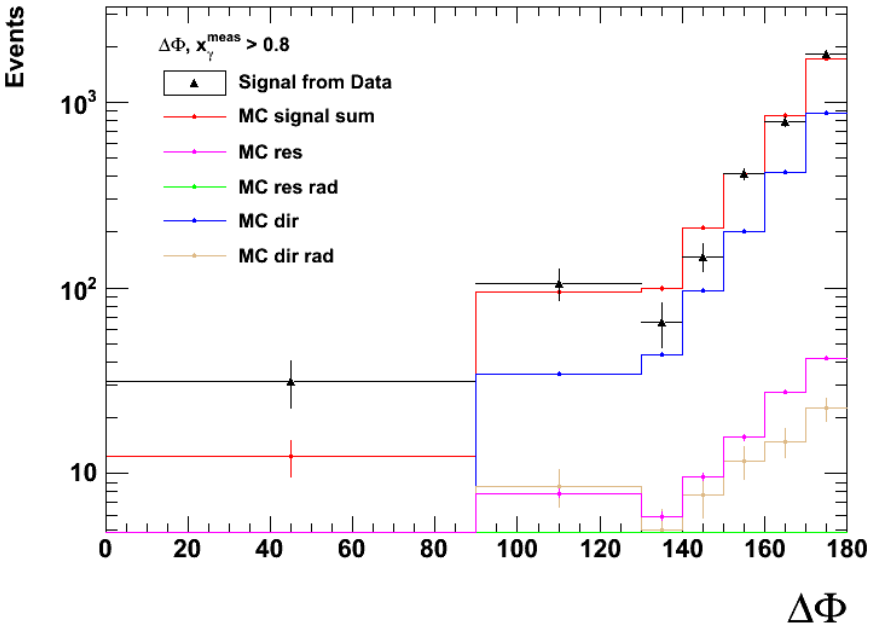
In some bins HERWIG fits better, in some worse. No significant improvement compared with when using PYTHIA.

Comparison with HERWIG. No reweighting

PYTHIA



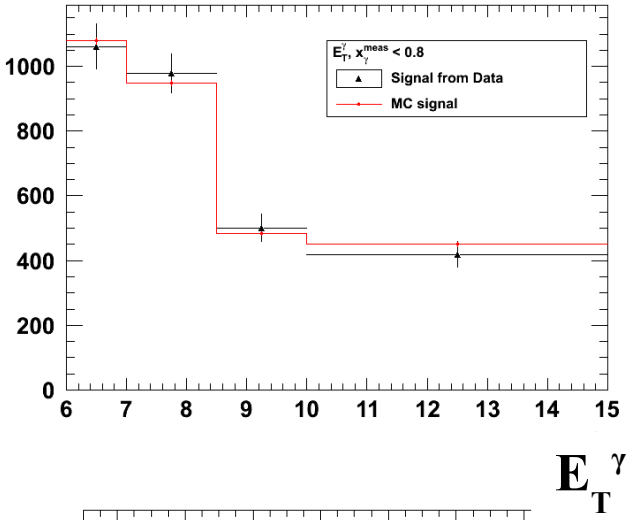
HERWIG



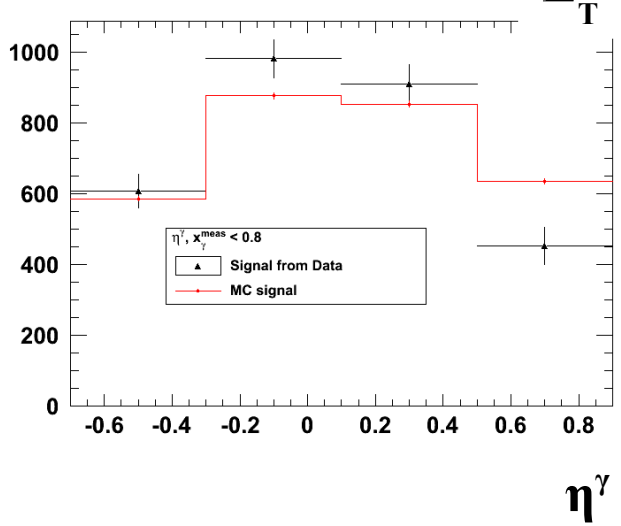
In some bins HERWIG fits better, in some worse. No significant improvement compared with when using PYTHIA.

ΔΦ reweighting. $x_\gamma < 0.8$

Before reweighting

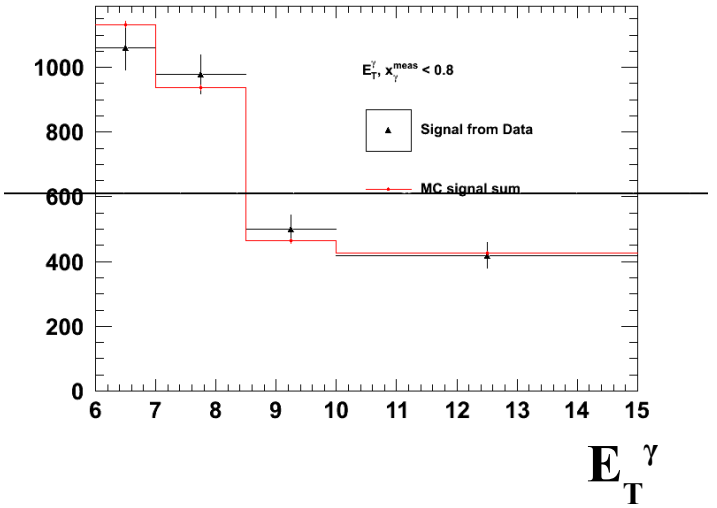


E_T^γ

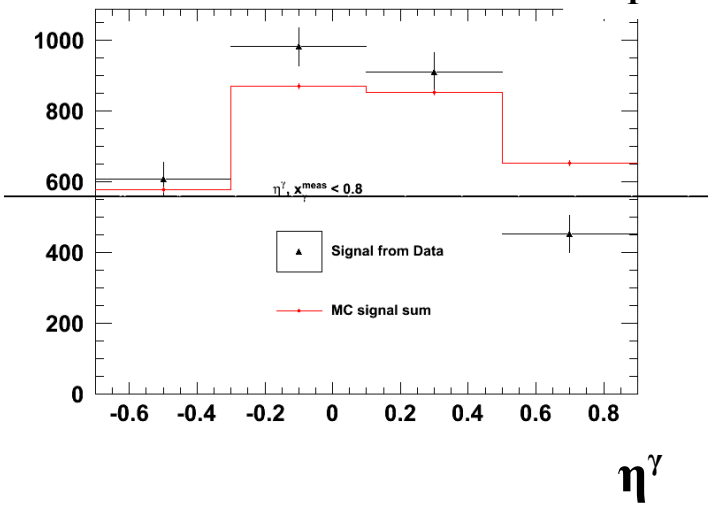


η^γ

After reweighting



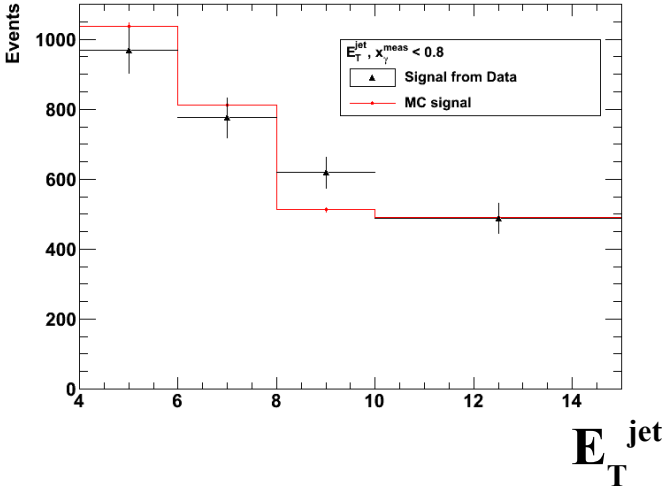
E_T^γ

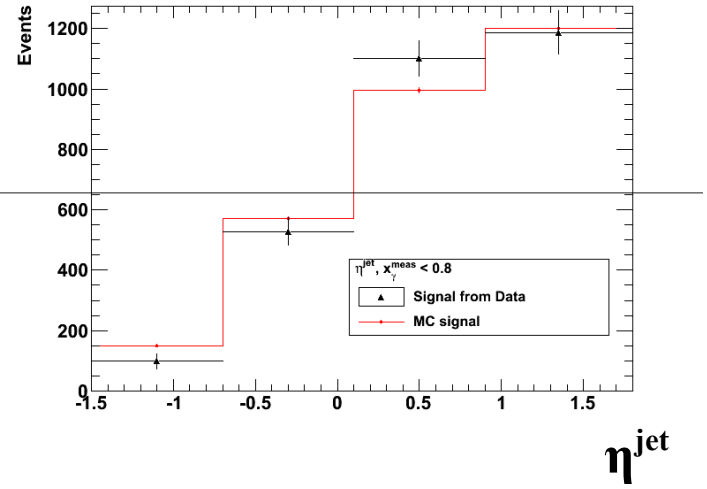


η^γ

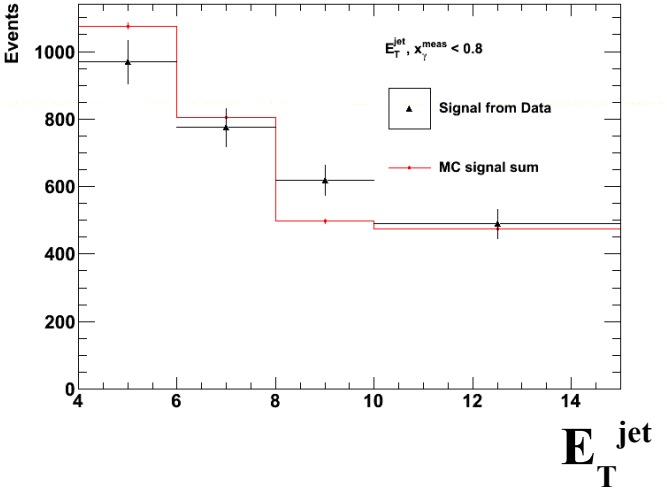
ΔΦ reweighting. $x_\gamma < 0.8$

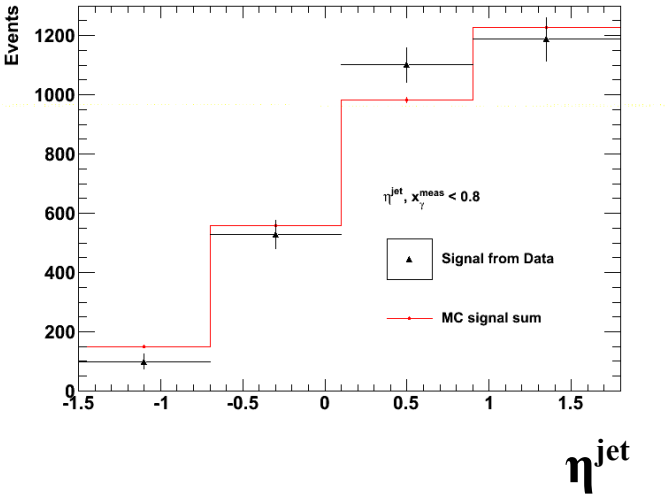
Before reweighting





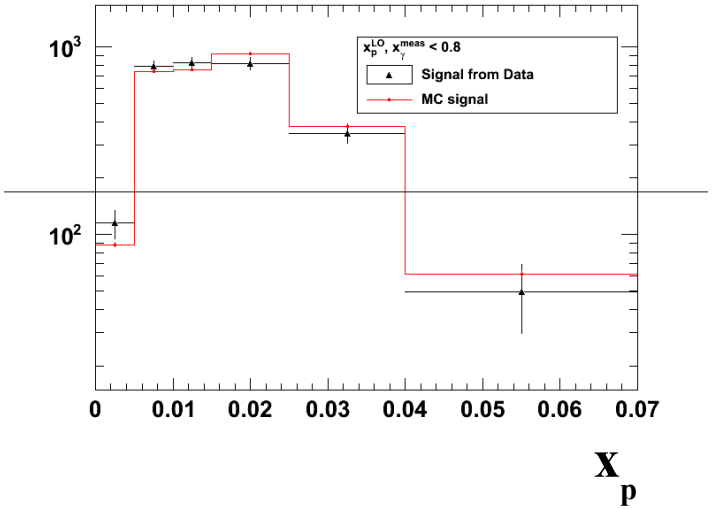
After reweighting



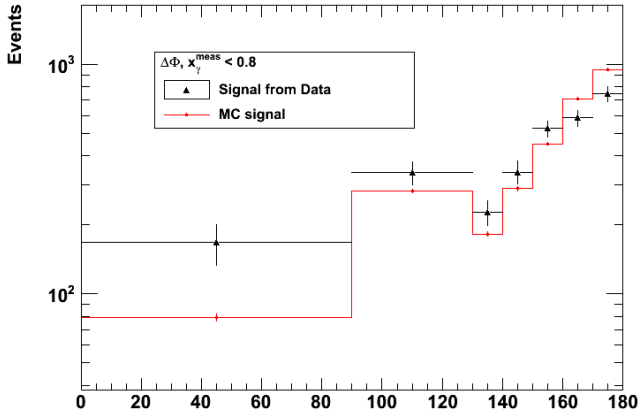


ΔΦ reweighting. x_γ < 0.8

Before reweighting

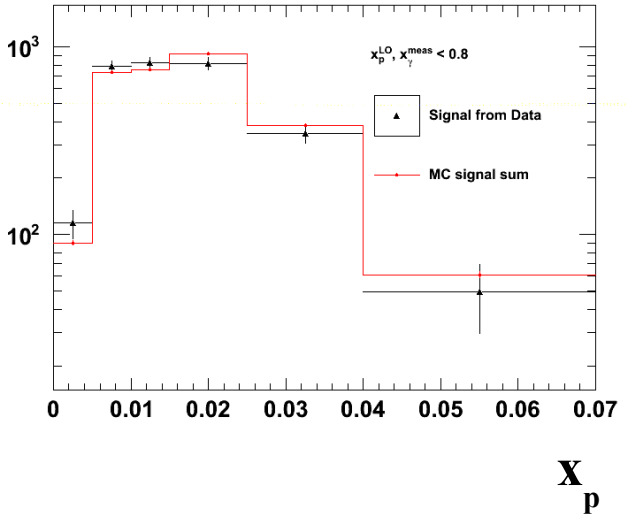


x_p

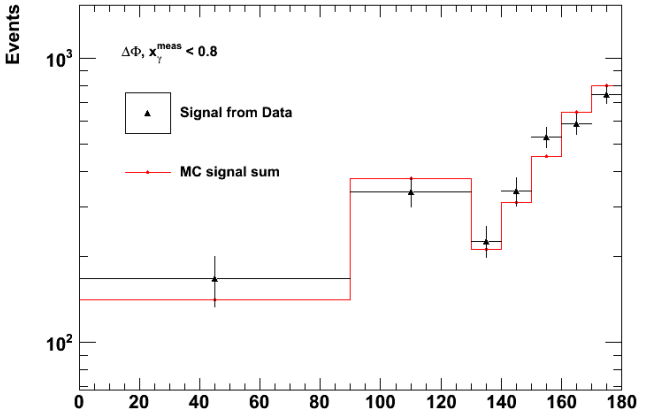


ΔΦ

After reweighting



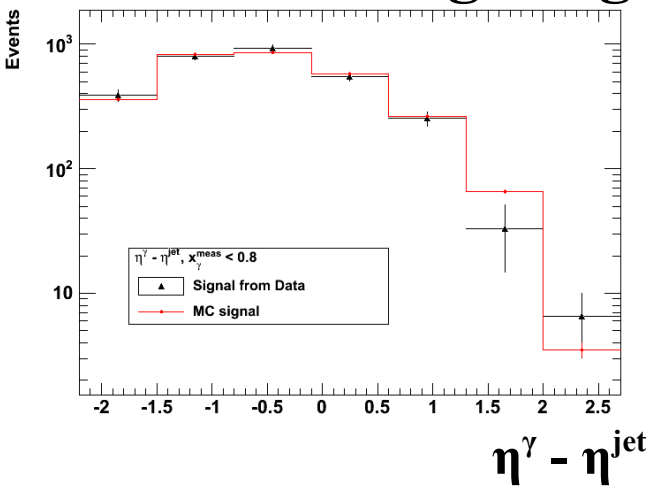
x_p



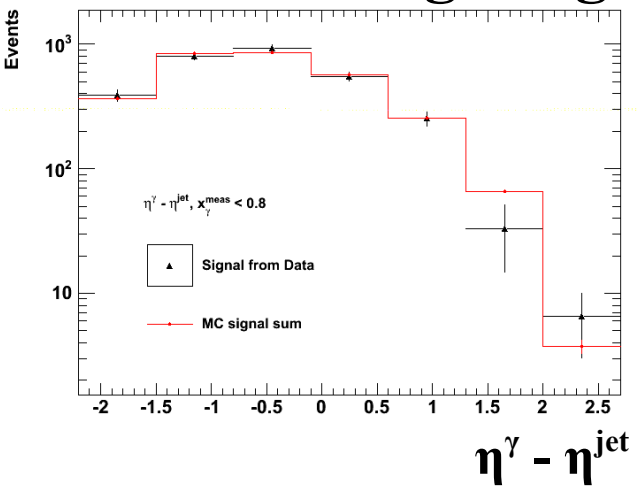
ΔΦ

ΔΦ reweighting. $x_\gamma < 0.8$

Before reweighting

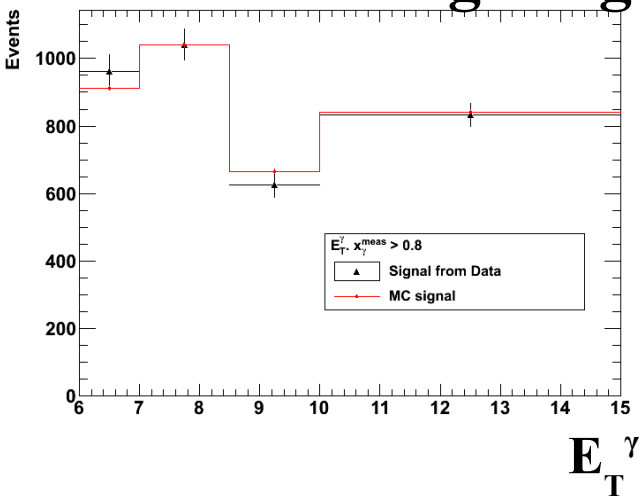


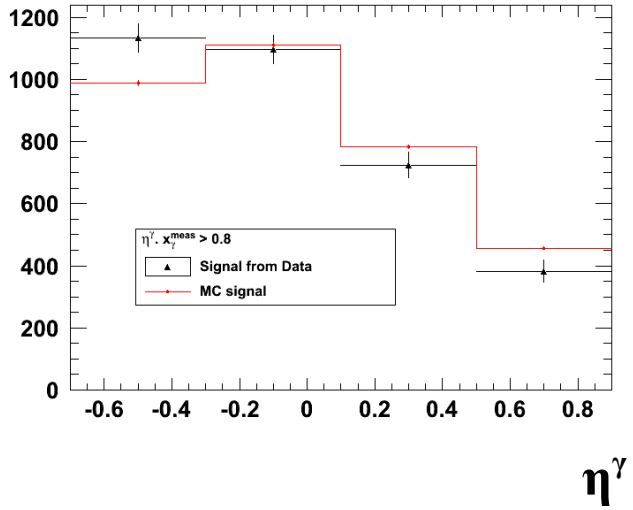
After reweighting



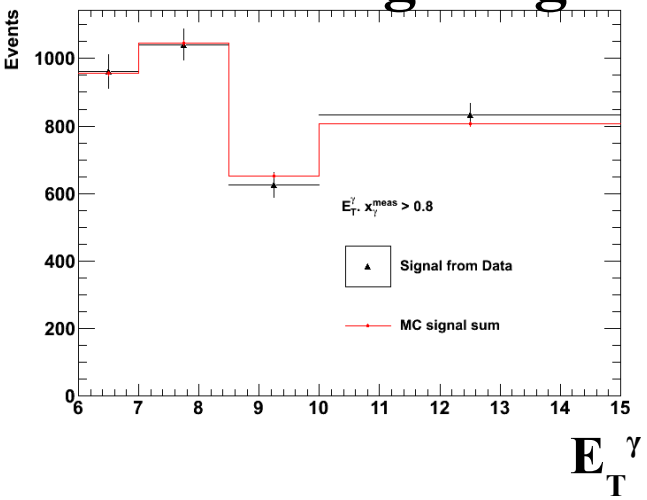
ΔΦ reweighting. x_γ > 0.8

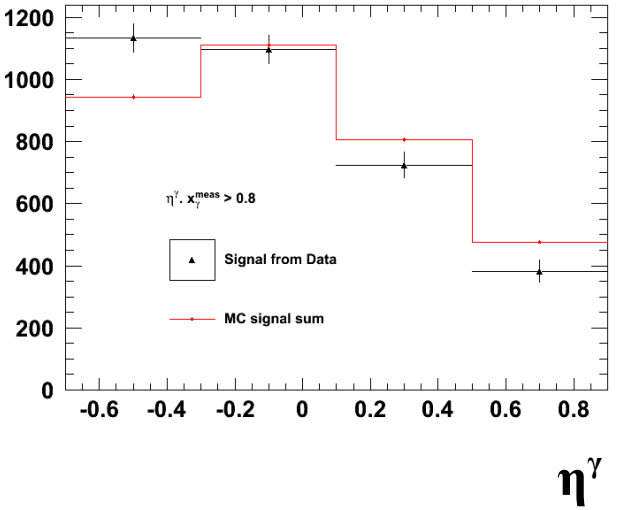
Before reweighting





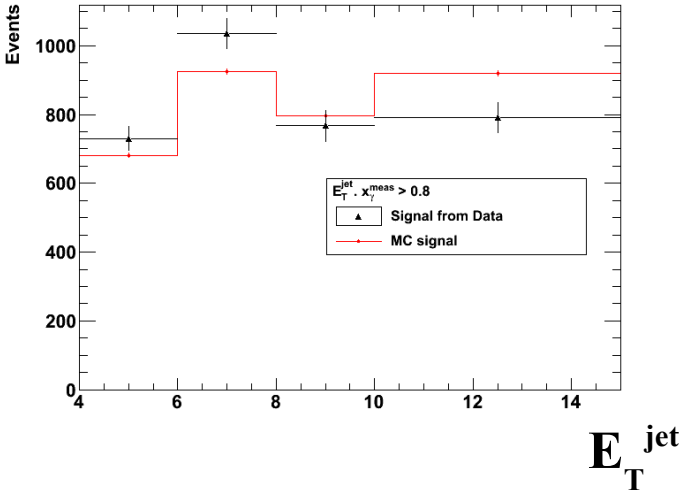
After reweighting

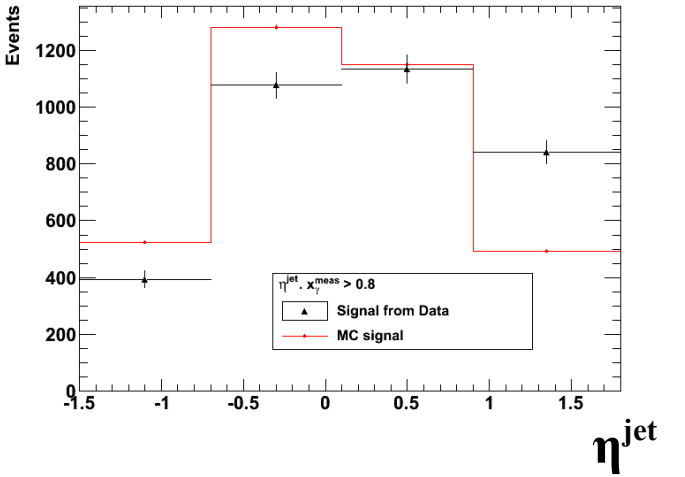




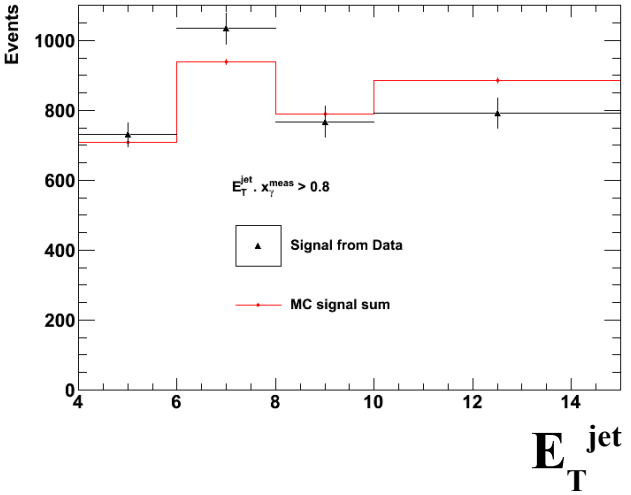
ΔΦ reweighting. x_γ > 0.8

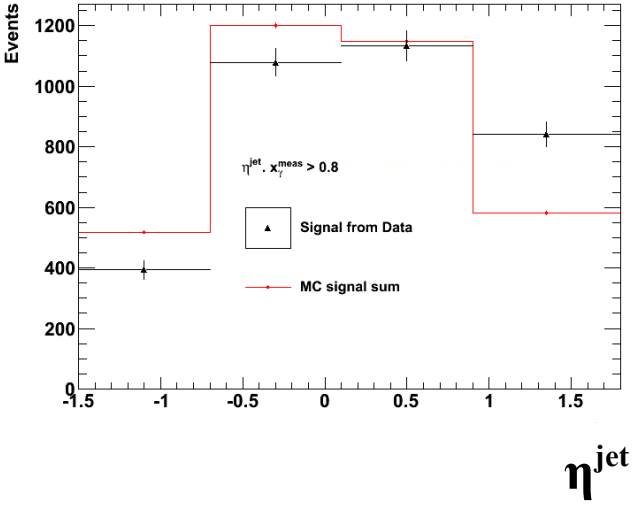
Before reweighting





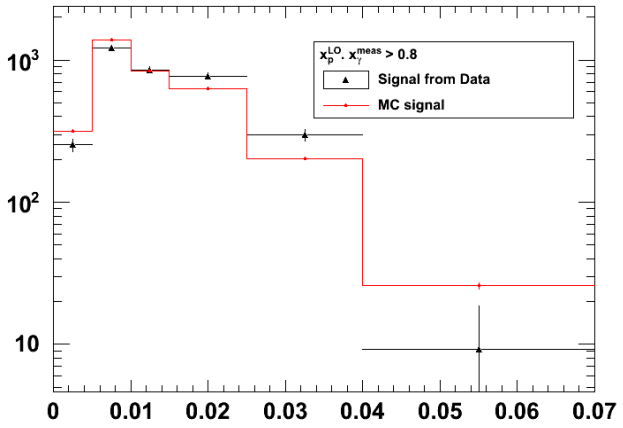
After reweighting



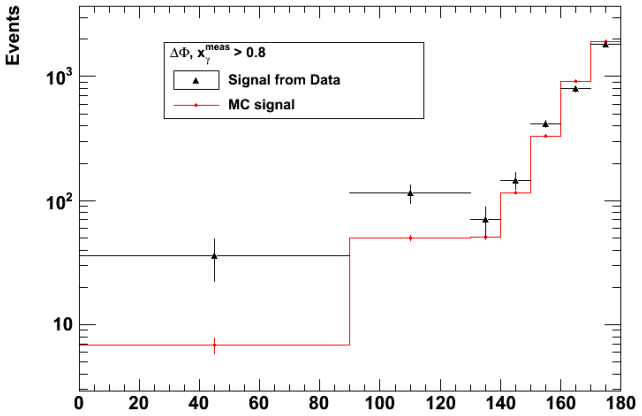


ΔΦ reweighting. $x_\gamma > 0.8$

Before reweighting

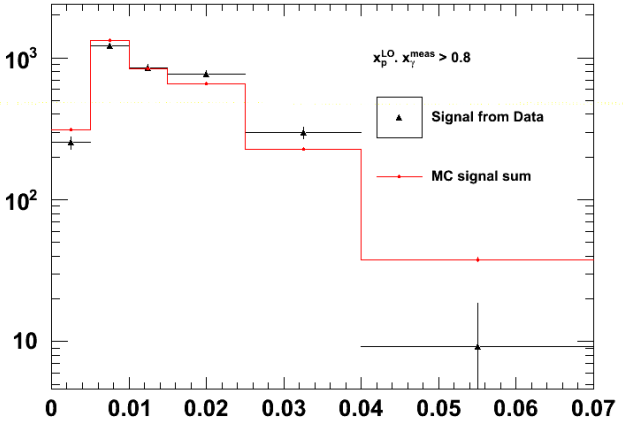


x_p

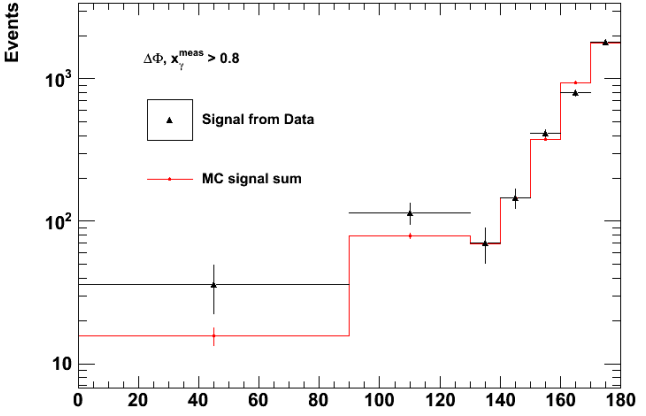


$\Delta\Phi$

After reweighting



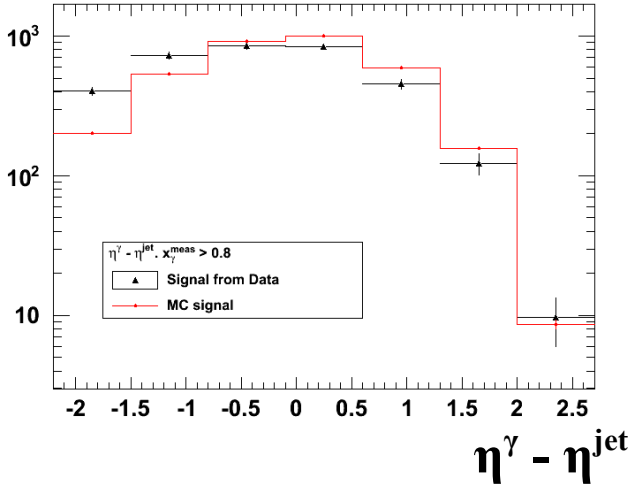
x_p



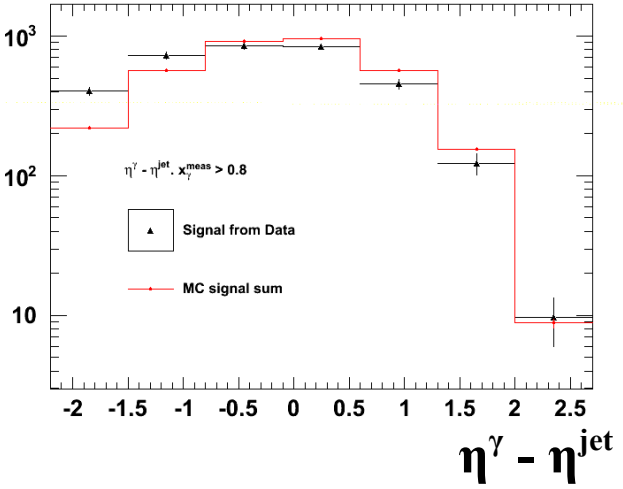
$\Delta\Phi$

ΔΦ reweighting. $x_\gamma > 0.8$

Before reweighting

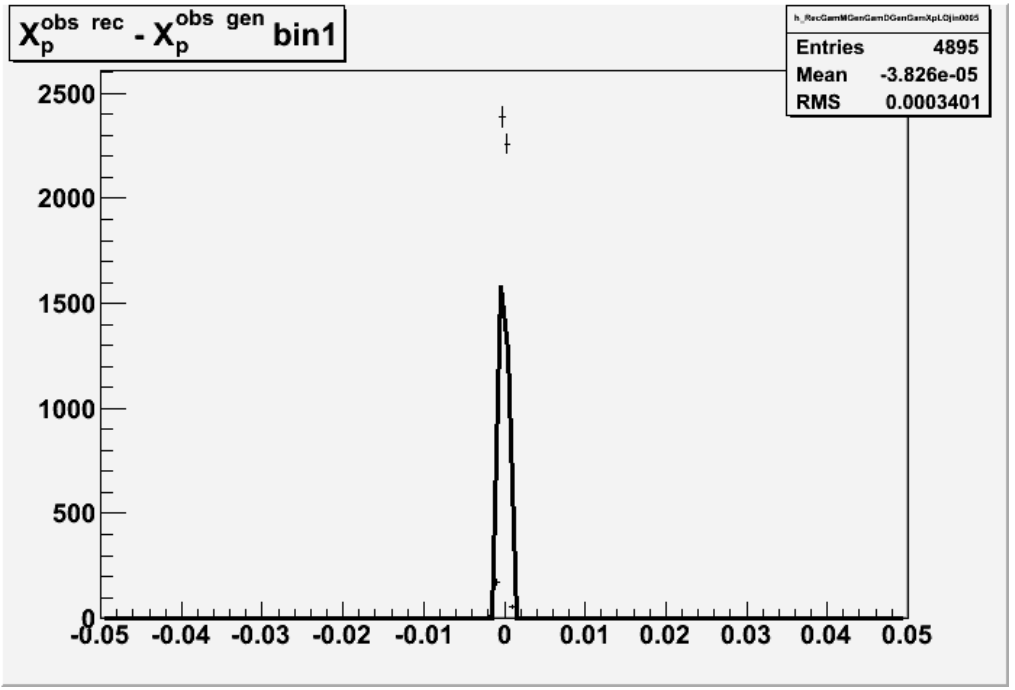


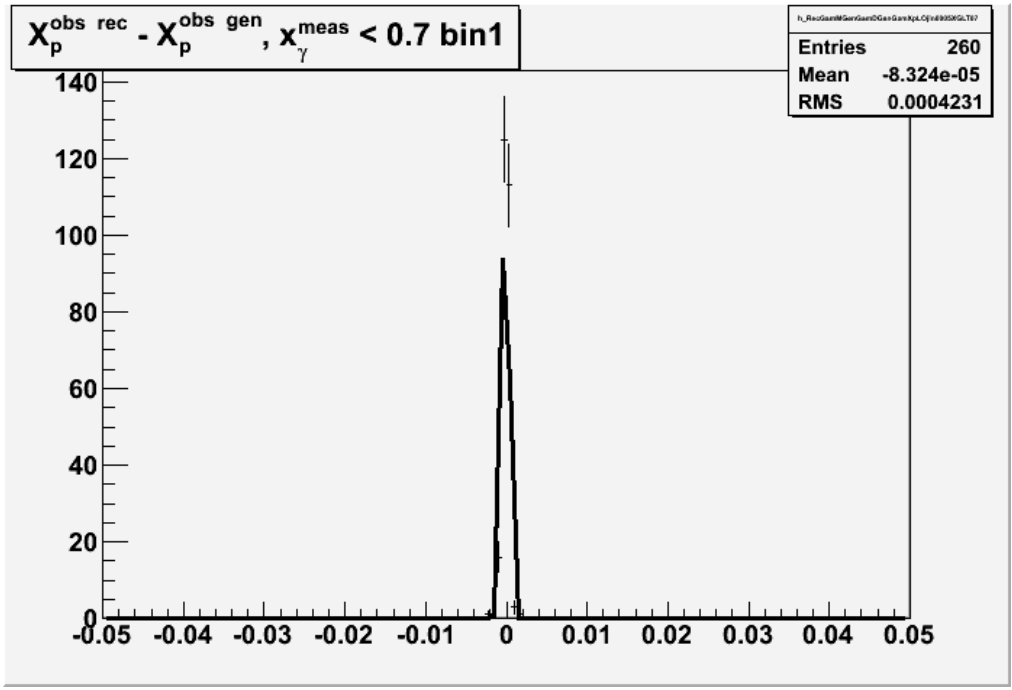
After reweighting



Resolutions

X_p^{obs} [0.000, 0.005]





Bin 1 all xgamma

EXT PARAMETER NO.	NAME	VALUE	ERROR	STEP SIZE	FIRST DERIVATIVE
1	Constant	3.42991e+03	6.48816e+01	1.66664e-01	8.66247e-07
2	Mean	-3.05014e-05	5.72072e-06	1.79417e-08	5.30990e+00
3	Sigma	3.77224e-04	4.44118e-06	9.29957e-06	7.23346e-03

Bin 1 xgamma<0.7

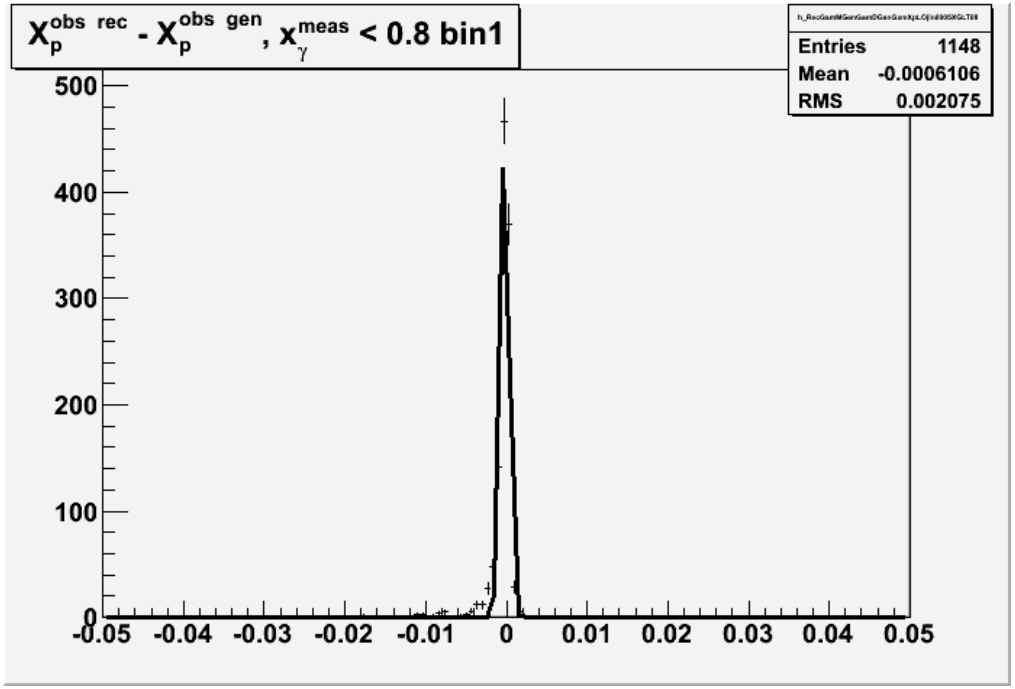
EXT PARAMETER NO.	NAME	VALUE	ERROR	STEP SIZE	FIRST DERIVATIVE
1	Constant	1.66720e+02	1.34388e+01	1.47131e-02	1.05662e-07
2	Mean	-6.78001e-05	2.94067e-05	3.53288e-08	5.97504e-02
3	Sigma	4.03659e-04	1.99591e-05	1.52039e-05	1.62969e-04

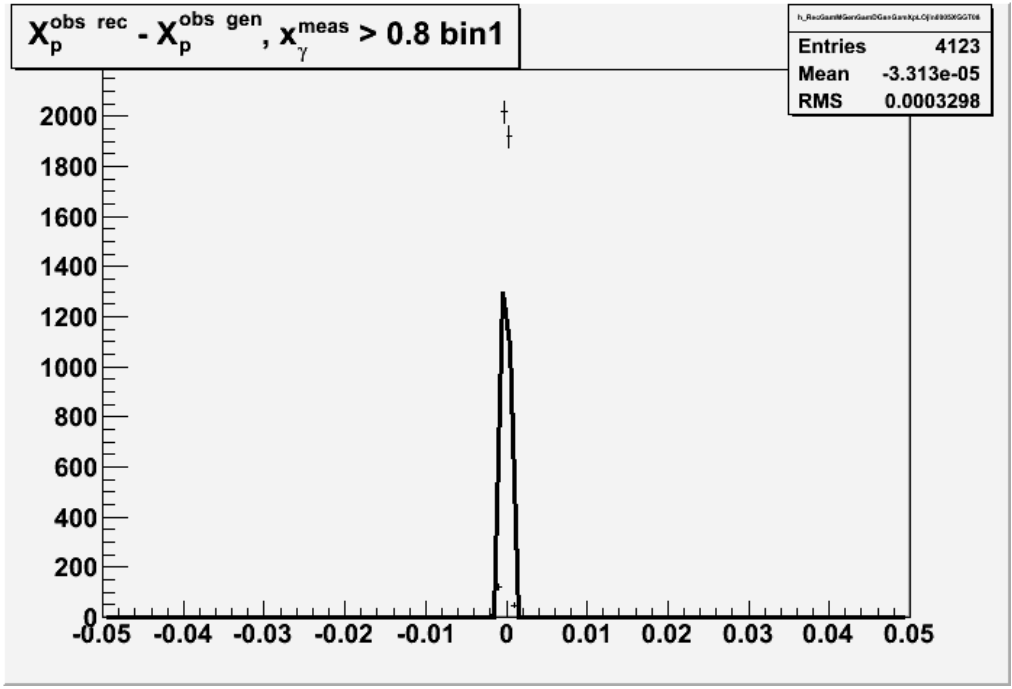
$$X_p \text{ resolution} = (X_p^{rec} - X_p^{gen})$$

Using combined direct and resolved sample

Sigma is smaller than half of the bin width 2.5e-3

X_p^{obs} [0.000, 0.005]





Bin 1 xgamma<0.8

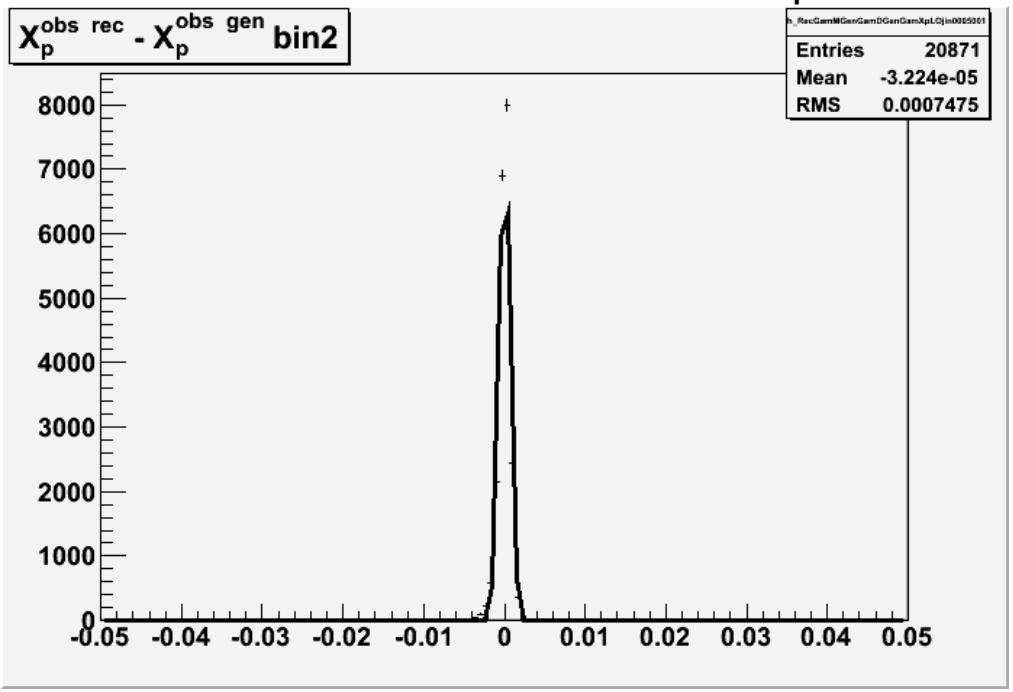
EXT PARAMETER NO.	NAME	VALUE	ERROR	STEP SIZE	FIRST DERIVATIVE
1	Constant	4.98818e+02	2.28923e+01	-1.14771e-03	-4.17710e-07
2	Mean	-6.42327e-05	1.70358e-05	-2.51085e-09	3.13151e-01
3	Sigma	4.02464e-04	1.15926e-05	3.28309e-07	-4.38162e-04

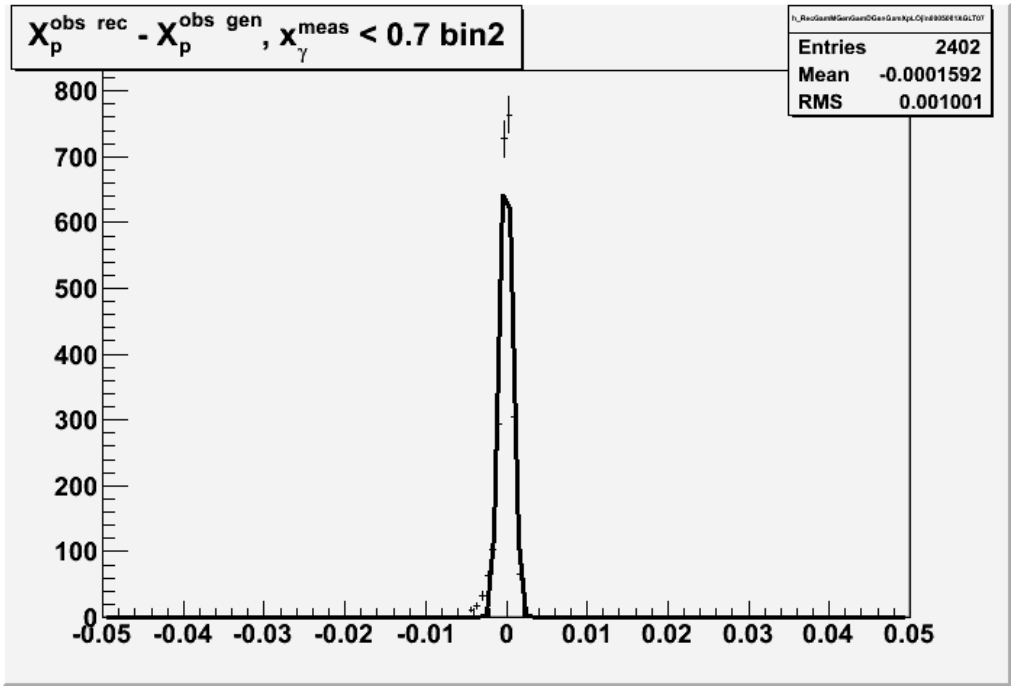
Bin 1 xgamma>0.8

EXT PARAMETER NO.	NAME	VALUE	ERROR	STEP SIZE	FIRST DERIVATIVE
1	Constant	2.93951e+03	6.08236e+01	1.23885e-01	3.97480e-07
2	Mean	-2.47133e-05	5.99279e-06	1.52900e-08	-1.20283e+01
3	Sigma	3.71934e-04	4.79097e-06	8.19702e-06	7.18874e-03

Sigma is smaller than half of the bin width 2.5e-3

X_p^{obs} [0.005, 0.01]





Bin 2 all xgamma

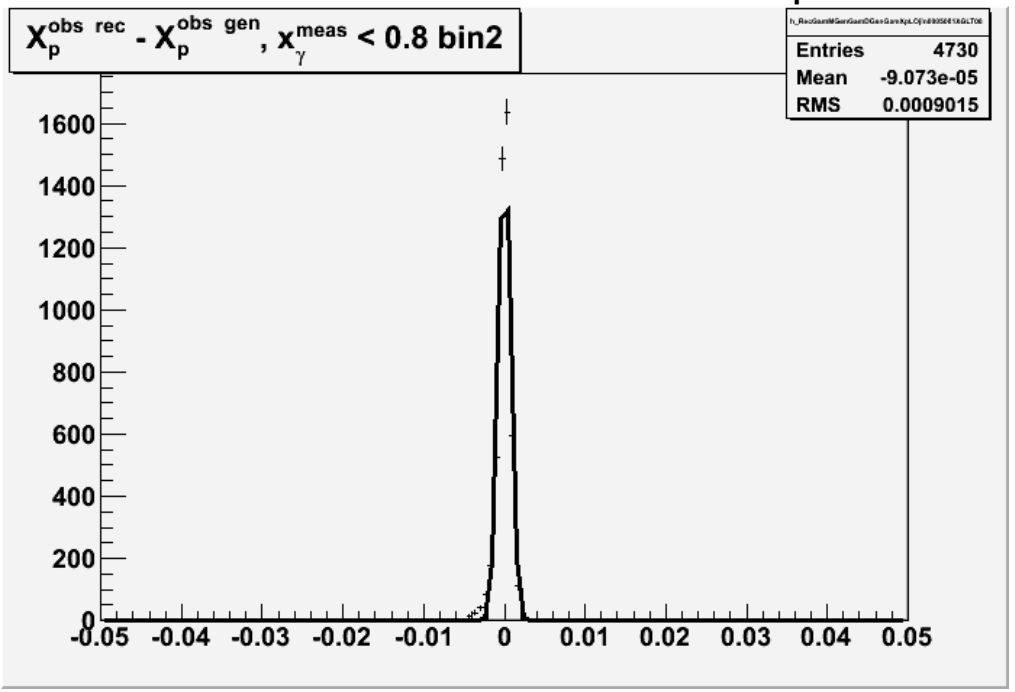
EXT NO.	PARAMETER NAME	VALUE	ERROR	STEP SIZE	FIRST DERIVATIVE
1	Constant	8.21382e+03	7.79816e+01	7.20418e-01	3.89603e-07
2	Mean	2.61928e-05	4.70030e-06	5.74257e-08	1.11578e+00
3	Sigma	6.54704e-04	4.17476e-06	1.77101e-05	-2.40027e-03

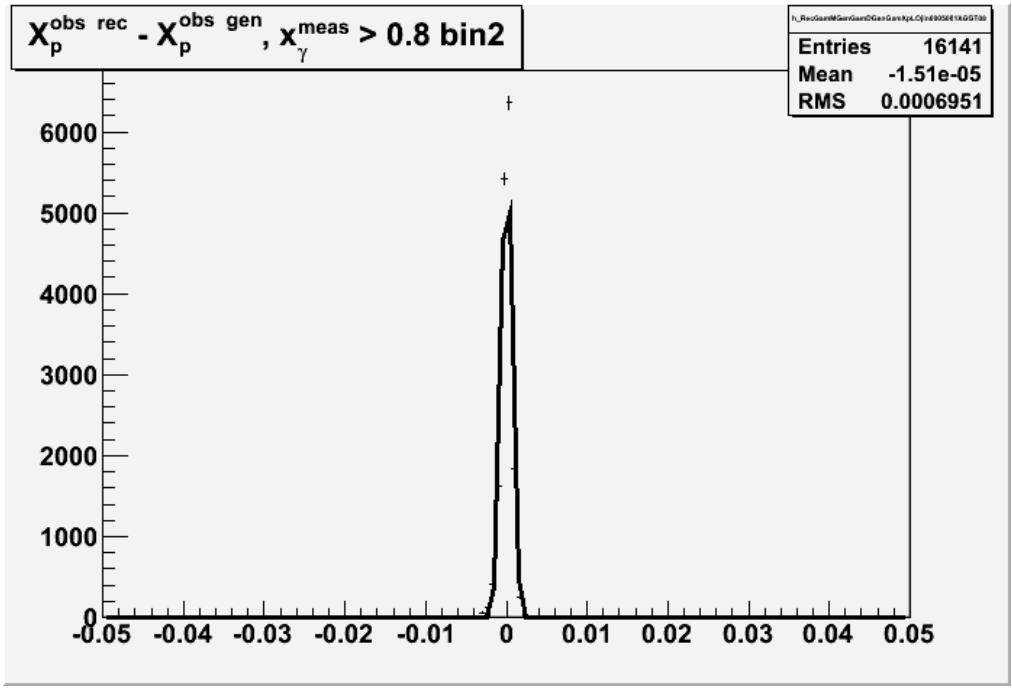
Bin 2 xgamma<0.7

EXT NO.	PARAMETER NAME	VALUE	ERROR	STEP SIZE	FIRST DERIVATIVE
1	Constant	7.76426e+02	2.22362e+01	-3.66209e-02	1.37097e-06
2	Mean	-2.08548e-05	1.69466e-05	9.02917e-09	4.70596e-01
3	Sigma	7.75178e-04	1.50999e-05	9.69806e-06	1.33518e-03

Sigma is smaller than half of the bin width 2.5e-3

X_p^{obs} [0.005, 0.01]





Bin 2 xgamma<0.8

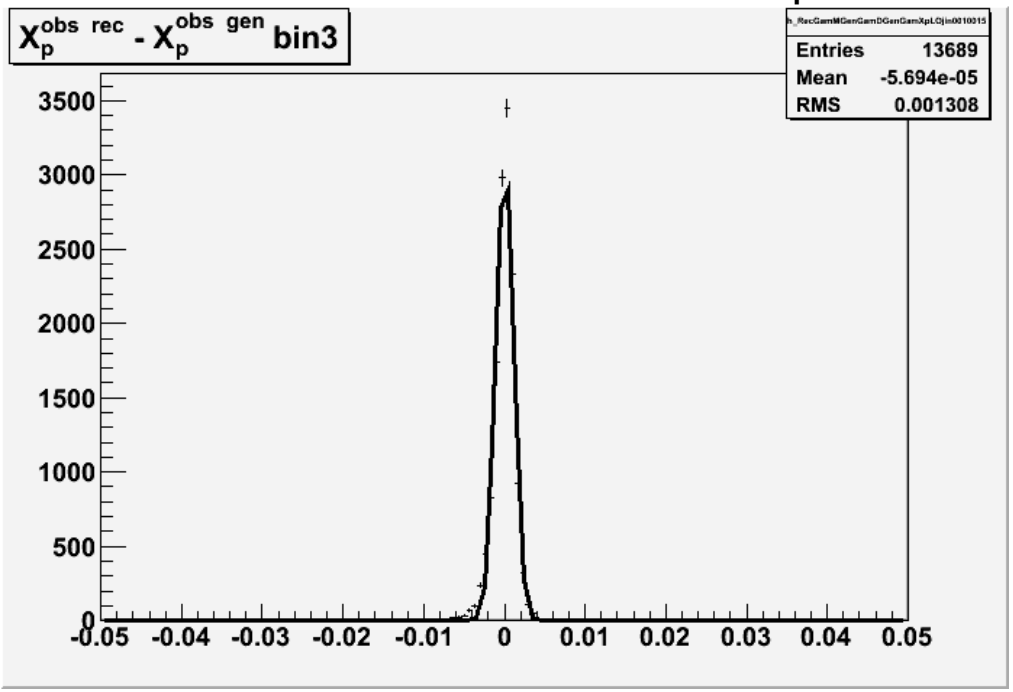
EXT PARAMETER NO.	NAME	VALUE	ERROR	STEP SIZE	FIRST DERIVATIVE
1	Constant	1.65954e+03	3.39637e+01	-7.25783e-03	1.23199e-07
2	Mean	1.10100e-05	1.10724e-05	-1.84226e-09	1.82110e-01
3	Sigma	7.22179e-04	1.01482e-05	3.84360e-07	-1.25495e-04

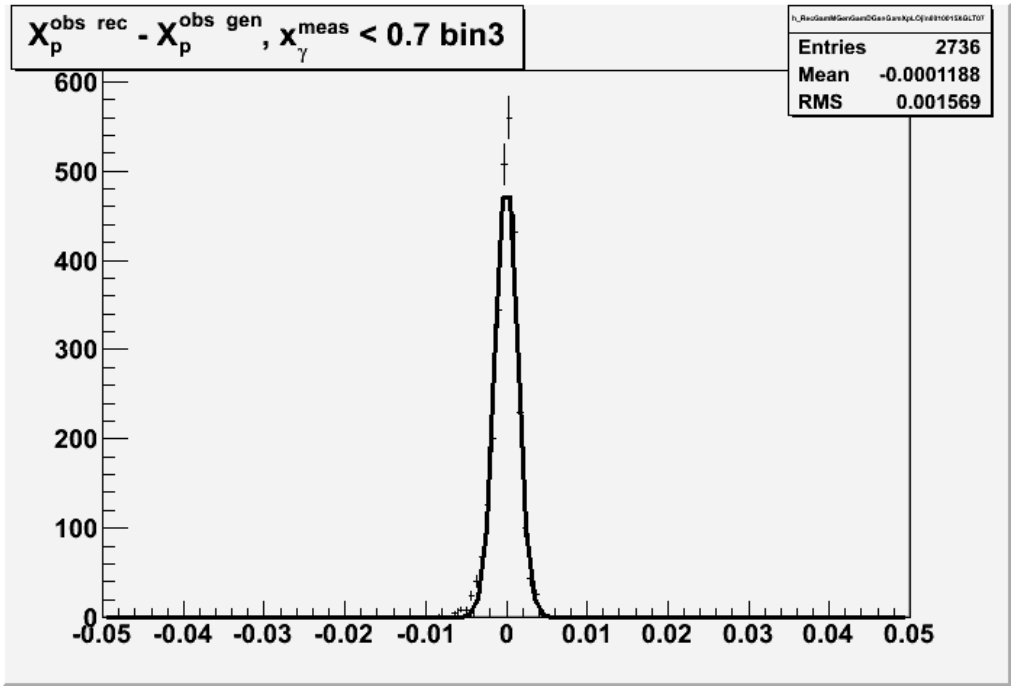
Bin 2 xgamma>0.8

EXT PARAMETER NO.	NAME	VALUE	ERROR	STEP SIZE	FIRST DERIVATIVE
1	Constant	6.56554e+03	7.01798e+01	5.20356e-01	7.47578e-08
2	Mean	2.94890e-05	5.18129e-06	5.04961e-08	-1.30750e-01
3	Sigma	6.37105e-04	4.53443e-06	1.62198e-05	-4.12401e-04

Sigma is smaller than half of the bin width 2.5e-3

X_p^{obs} [0.01, 0.015]





Bin 3 all xgamma

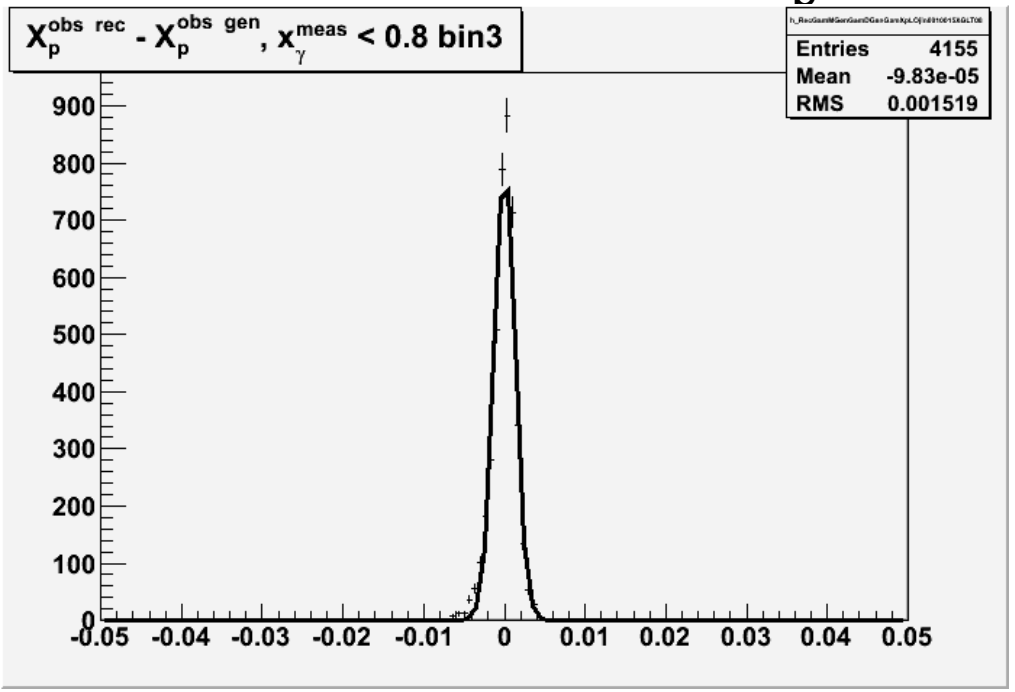
NO.	NAME	VALUE	ERROR	STEP SIZE	FIRST DERIVATIVE
1	Constant	3.14655e+03	3.84545e+01	3.25043e-01	2.21949e-06
2	Mean	4.93773e-05	1.01186e-05	1.14412e-07	1.09395e+00
3	Sigma	1.10758e-03	9.46374e-06	2.13245e-05	1.84520e-02

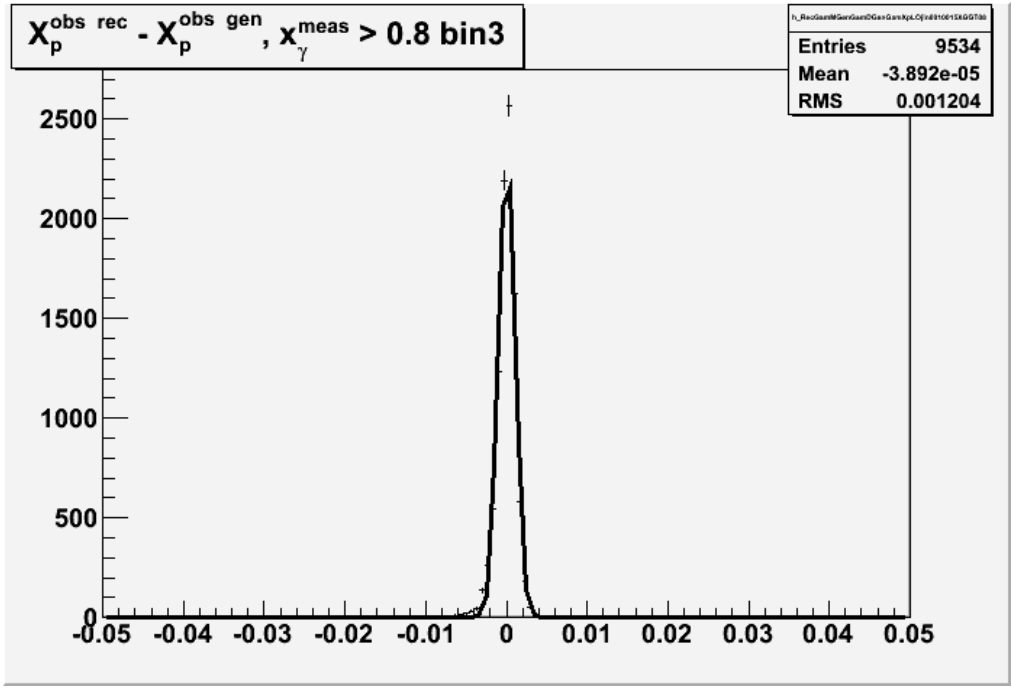
Bin 3 xgamma<0.7

NO.	NAME	VALUE	ERROR	STEP SIZE	FIRST DERIVATIVE
1	Constant	5.01690e+02	1.33971e+01	4.94146e-02	-1.18459e-06
2	Mean	-3.22348e-06	2.87615e-05	1.37392e-07	-1.78176e+00
3	Sigma	1.39432e-03	2.54537e-05	2.02975e-05	-2.34797e-03

Sigma is smaller than half of the bin width 2.5e-3

X_p^{obs} [0.01, 0.015]





Bin 3 xgamma<0.8

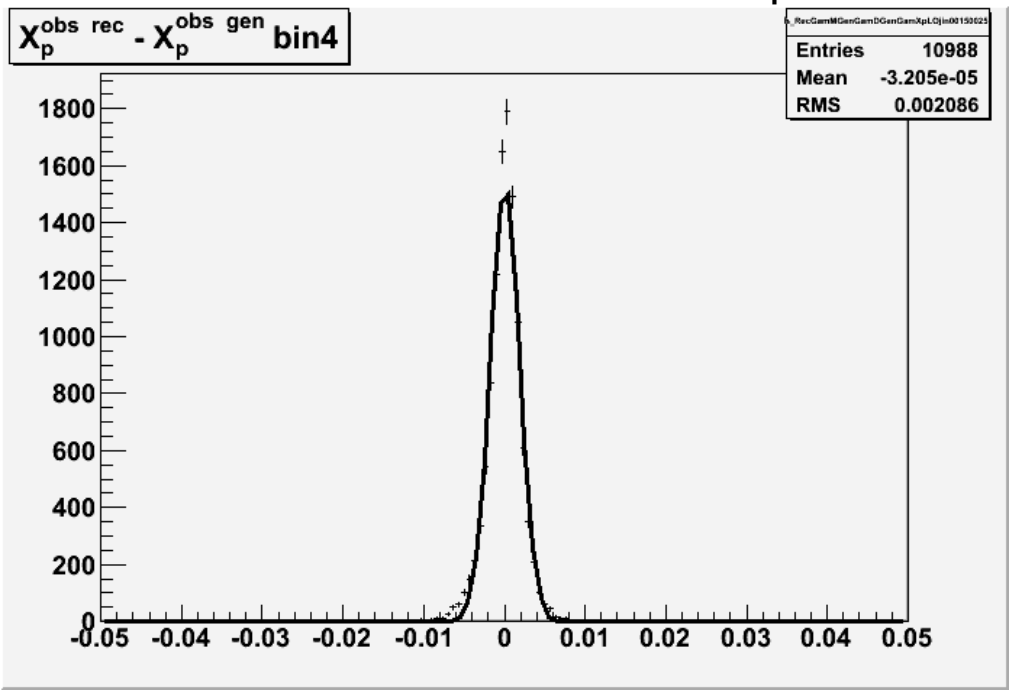
EXT PARAMETER NO.	NAME	VALUE	ERROR	STEP SIZE	FIRST DERIVATIVE
1	Constant	8.00274e+02	1.79648e+01	8.73962e-02	2.85000e-06
2	Mean	3.05518e-05	2.25305e-05	1.43684e-07	-2.11744e+00
3	Sigma	1.31543e-03	2.08543e-05	2.27425e-05	-1.76297e-02

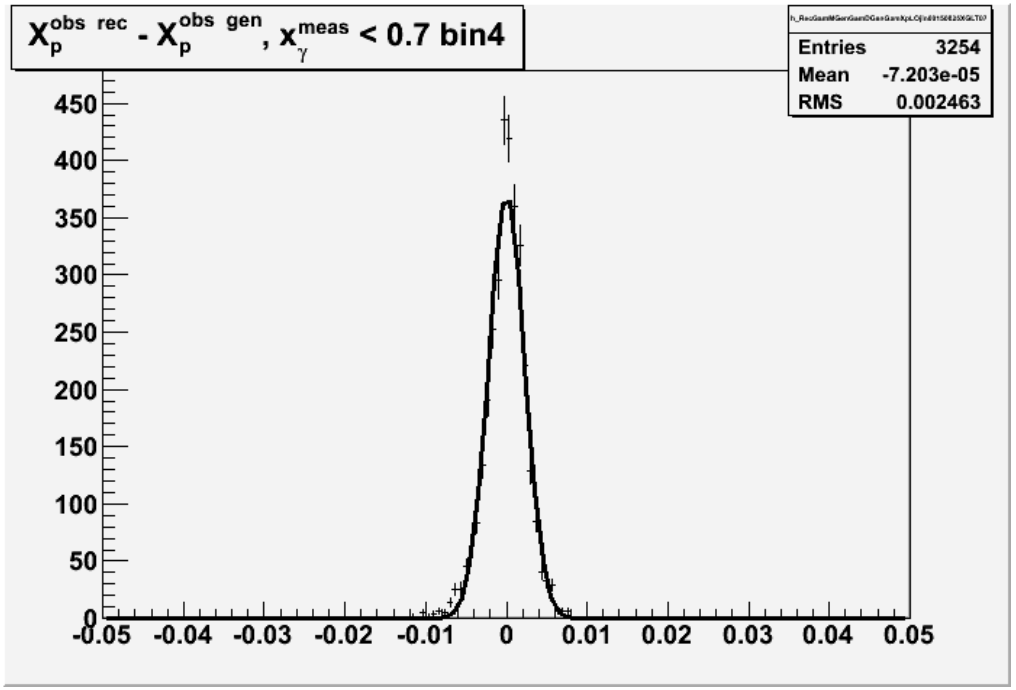
Bin 3 xgamma>0.8

EXT PARAMETER NO.	NAME	VALUE	ERROR	STEP SIZE	FIRST DERIVATIVE
1	Constant	2.36953e+03	3.39942e+01	2.26760e-01	4.94535e-07
2	Mean	4.89237e-05	1.11709e-05	9.86326e-08	1.19110e-01
3	Sigma	1.03064e-03	1.01439e-05	1.95317e-05	-2.68604e-03

Sigma is smaller than half of the bin width 2.5e-3

X_p^{obs} [0.015, 0.025]





Bin 4 all xgamma

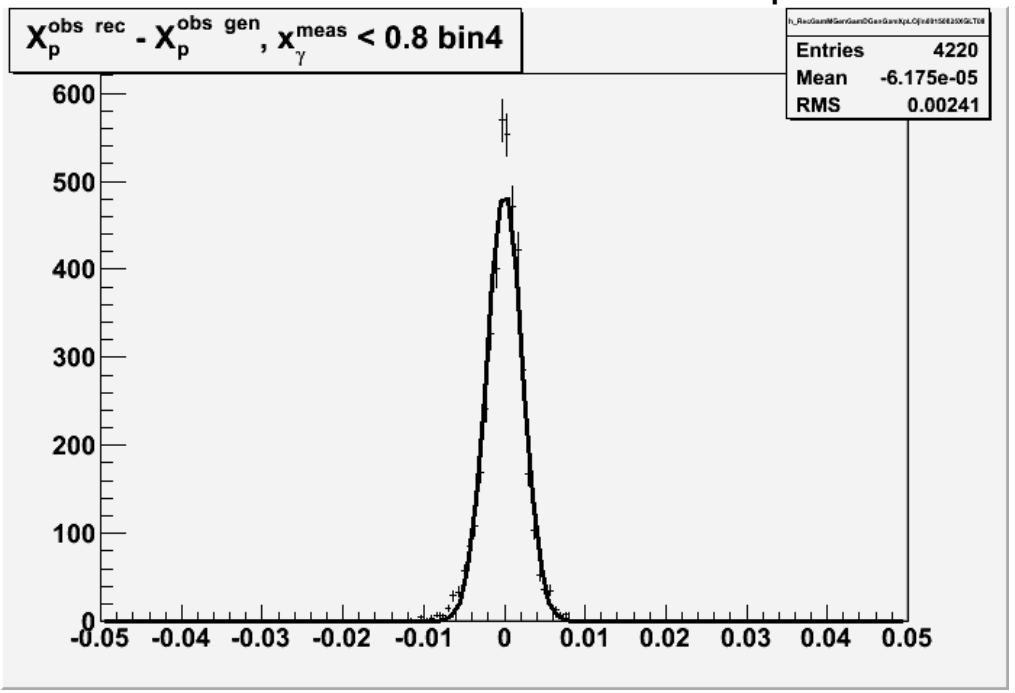
EXT PARAMETER NO.	NAME	VALUE	ERROR	STEP SIZE	FIRST DERIVATIVE
1	Constant	1.54098e+03	2.13405e+01	1.55571e-01	3.64472e-09
2	Mean	7.50015e-05	1.80382e-05	1.83637e-07	1.02389e-01
3	Sigma	1.81887e-03	1.79015e-05	2.19374e-05	1.49996e-04

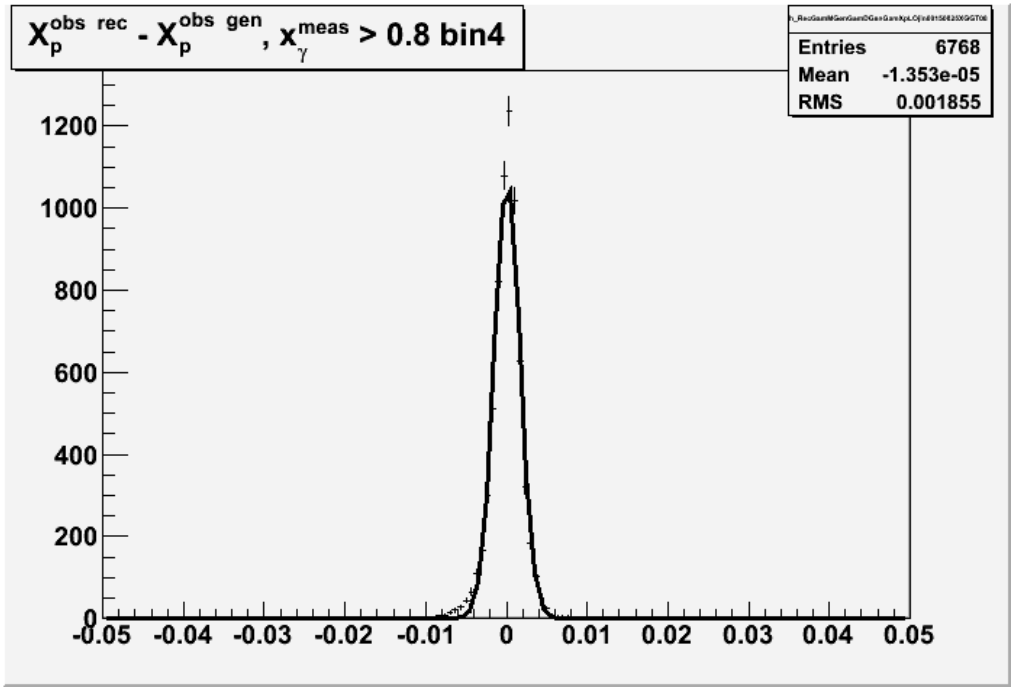
Bin 4 xgamma<0.7

EXT PARAMETER NO.	NAME	VALUE	ERROR	STEP SIZE	FIRST DERIVATIVE
1	Constant	3.72557e+02	9.23611e+00	3.58017e-02	-1.20559e-07
2	Mean	1.92889e-05	4.11250e-05	2.15192e-07	-1.76778e+00
3	Sigma	2.23736e-03	3.85156e-05	2.07718e-05	-1.62965e-02

Sigma is smaller than half of the bin width 5e-3

X_p^{obs} [0.015, 0.025]





Bin 4 xgamma<0.8

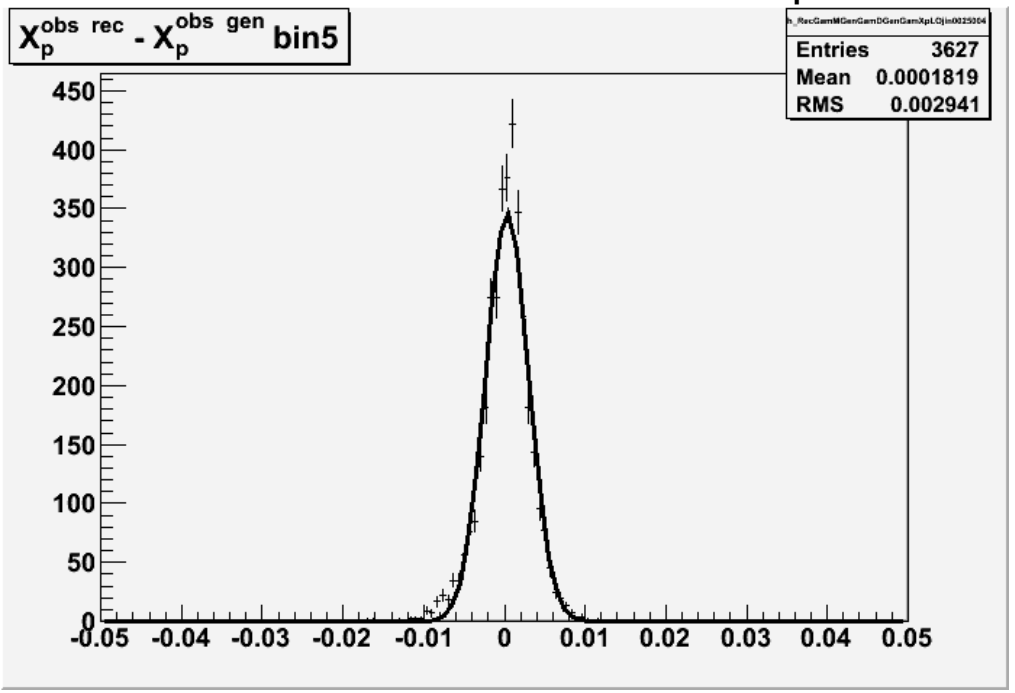
NO.	NAME	VALUE	ERROR	STEP SIZE	FIRST DERIVATIVE
1	Constant	4.91593e+02	1.07522e+01	4.59186e-02	2.17360e-07
2	Mean	1.68938e-05	3.55693e-05	2.05952e-07	-1.47014e+00
3	Sigma	2.20328e-03	3.36577e-05	2.03739e-05	-1.44726e-02

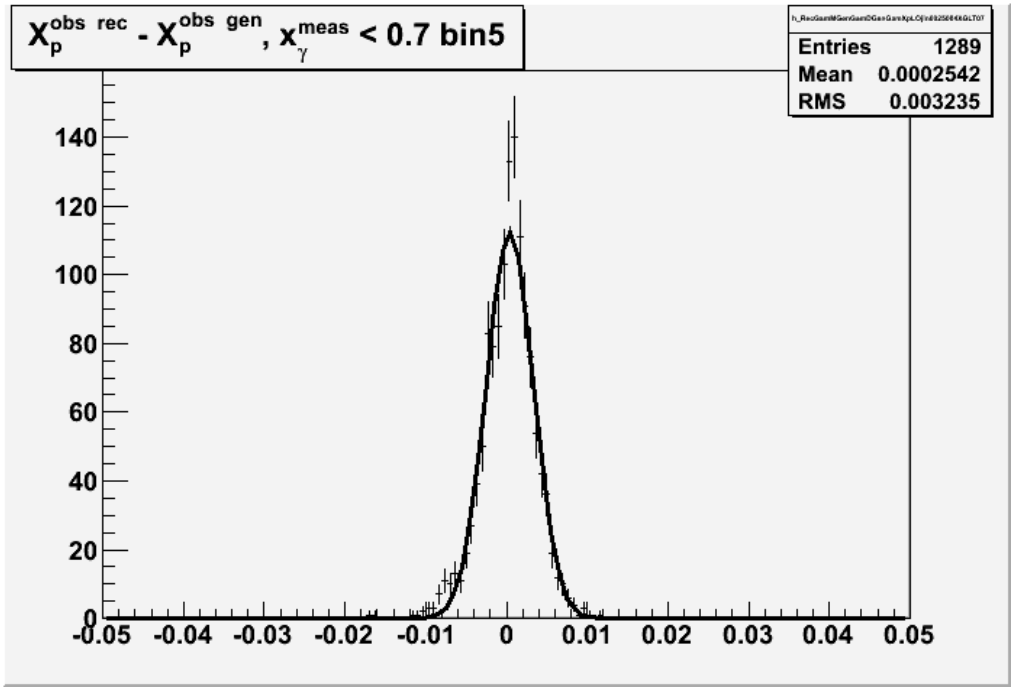
Bin 4 xgamma>0.8

NO.	NAME	VALUE	ERROR	STEP SIZE	FIRST DERIVATIVE
1	Constant	1.07600e+03	1.88279e+01	1.06018e-01	-2.38406e-08
2	Mean	8.71798e-05	2.01260e-05	1.58405e-07	2.82818e-02
3	Sigma	1.60767e-03	1.98442e-05	2.12385e-05	-1.94644e-04

Sigma is smaller than half of the bin width 5e-3

X_p^{obs} [0.025, 0.04]





Bin 5 all xgamma

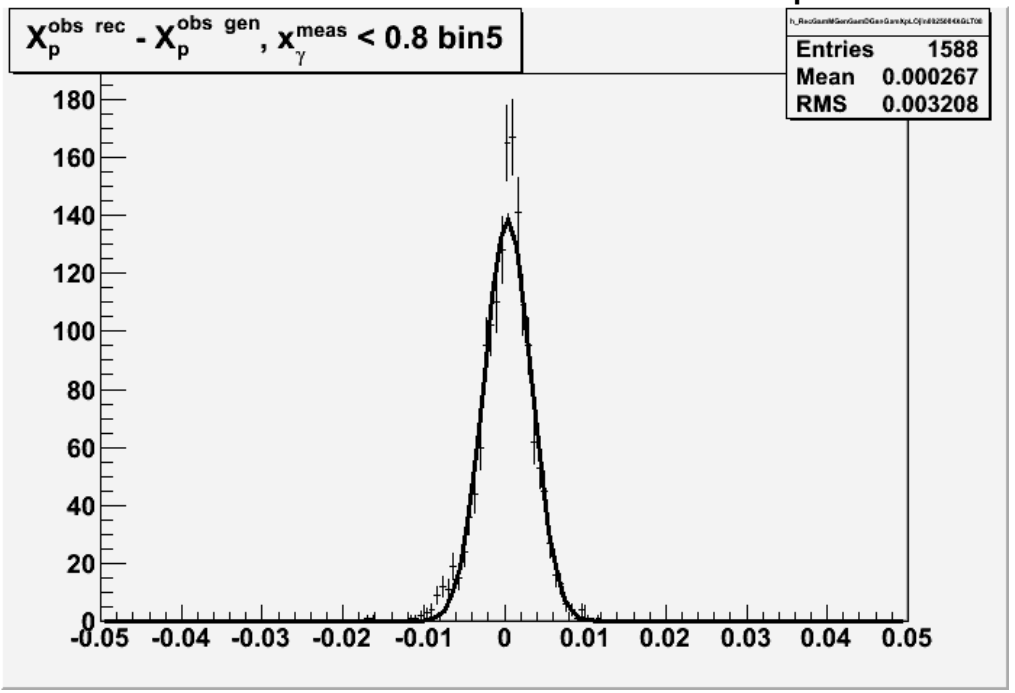
NO.	NAME	VALUE	ERROR	STEP SIZE	FIRST DERIVATIVE
1	Constant	3.46469e+02	8.12778e+00	3.36024e-02	1.36913e-07
2	Mean	3.31789e-04	4.60861e-05	2.59952e-07	-2.91644e-02
3	Sigma	2.67939e-03	4.35380e-05	2.10652e-05	-5.78447e-04

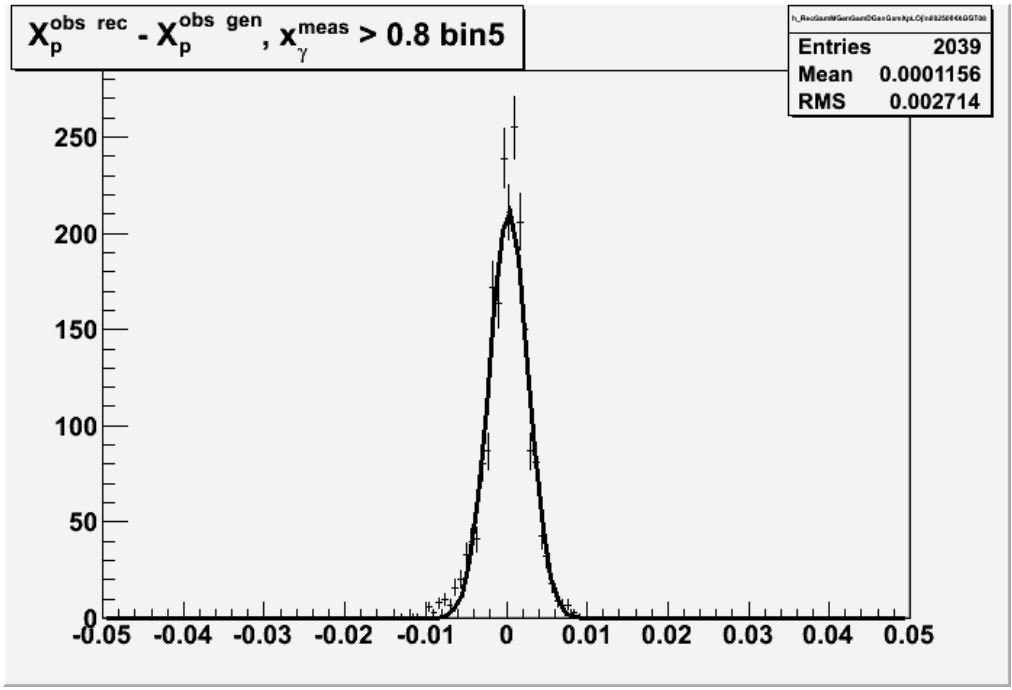
Bin 5 xgamma<0.7

NO.	NAME	VALUE	ERROR	STEP SIZE	FIRST DERIVATIVE
1	Constant	1.12190e+02	4.26518e+00	1.11093e-02	-1.60398e-06
2	Mean	4.15577e-04	8.50744e-05	2.91292e-07	-3.88660e-01
3	Sigma	2.93789e-03	7.43798e-05	2.06055e-05	-4.42537e-03

Sigma is smaller than half of the bin width 7.5e-3

X_p^{obs} [0.025, 0.04]





Bin 5 xgamma<0.8

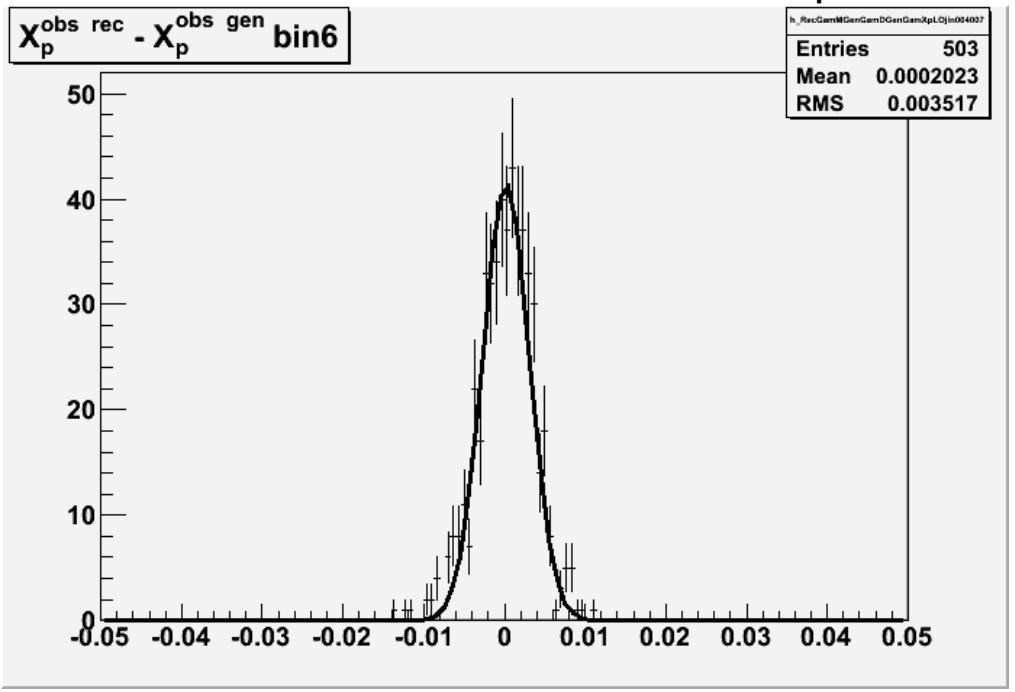
NO.	NAME	VALUE	ERROR	STEP SIZE	FIRST DERIVATIVE
1	Constant	1.38448e+02	4.70994e+00	1.30533e-02	1.92442e-06
2	Mean	4.09821e-04	7.70704e-05	2.77859e-07	1.46454e-01
3	Sigma	2.94334e-03	6.62563e-05	1.95437e-05	-1.11068e-03

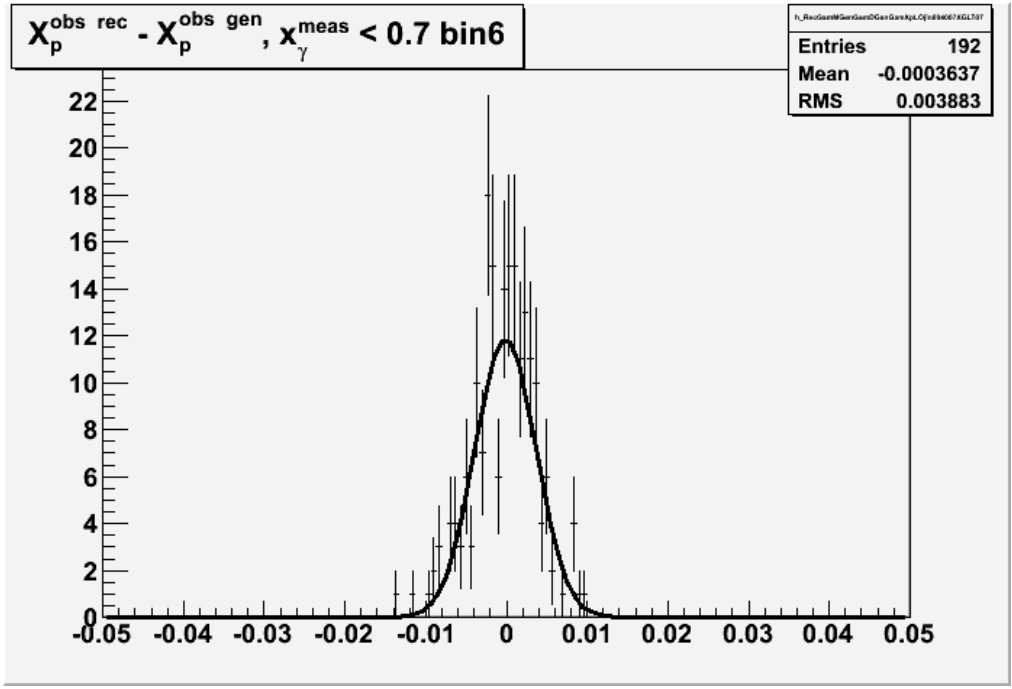
Bin 5 xgamma>0.8

NO.	NAME	VALUE	ERROR	STEP SIZE	FIRST DERIVATIVE
1	Constant	2.11890e+02	6.78594e+00	2.42163e-02	1.08848e-07
2	Mean	2.84730e-04	5.64270e-05	2.77684e-07	2.28183e-03
3	Sigma	2.42784e-03	5.48177e-05	2.49522e-05	-8.35136e-05

Sigma is smaller than half of the bin width 5e-3

X_p^{obs} [0.04, 0.07]





Bin 6 all xgamma

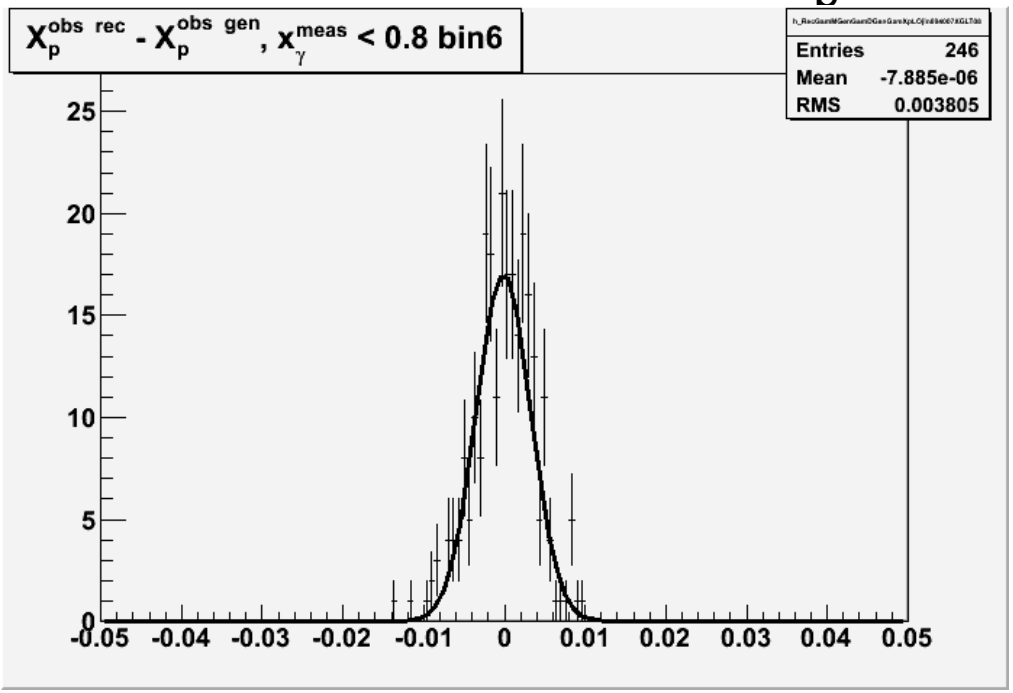
EXT PARAMETER NO.	NAME	VALUE	ERROR	STEP SIZE	FIRST DERIVATIVE
1	Constant	4.13827e+01	2.61888e+00	7.03529e-03	-1.03395e-05
2	Mean	1.93856e-04	1.53005e-04	4.97575e-07	2.21759e-01
3	Sigma	2.89694e-03	1.25114e-04	3.26503e-05	5.09021e-04

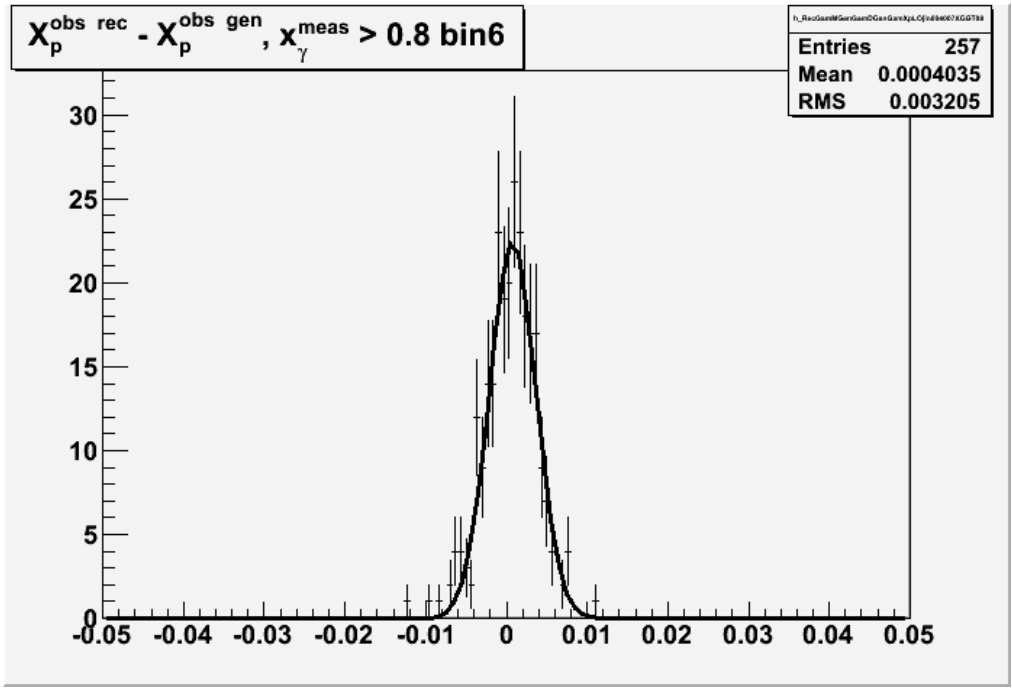
Bin 6 xgamma<0.7

EXT PARAMETER NO.	NAME	VALUE	ERROR	STEP SIZE	FIRST DERIVATIVE
1	Constant	1.18659e+01	1.37090e+00	2.56658e-03	-9.75237e-05
2	Mean	-1.16935e-04	3.40573e-04	8.84882e-07	-1.08033e-01
3	Sigma	3.77296e-03	3.71202e-04	5.90881e-05	-1.30371e-03

Sigma is smaller than half of the bin width 1.5e-2

X_p^{obs} [0.04, 0.07]





Bin 6 xgamma<0.8

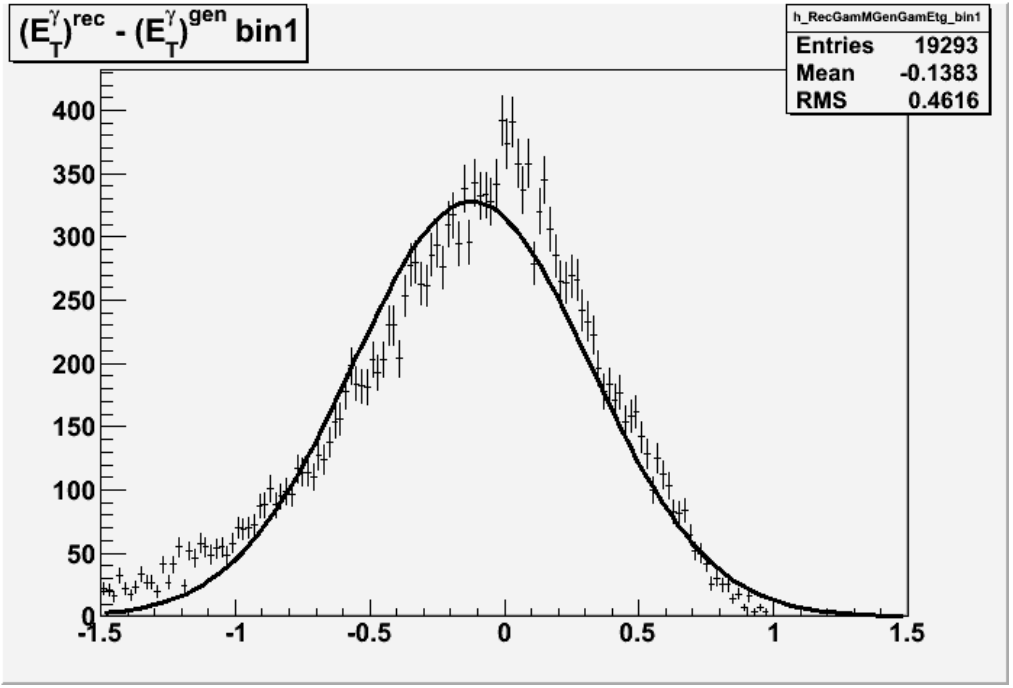
EXT PARAMETER NO.	NAME	VALUE	ERROR	STEP SIZE	FIRST DERIVATIVE
1	Constant	1.70520e+01	1.60947e+00	3.26665e-03	-2.39973e-08
2	Mean	-1.21900e-04	2.66288e-04	6.63059e-07	-1.27515e-03
3	Sigma	3.36944e-03	2.33193e-04	4.07981e-05	-3.64682e-05

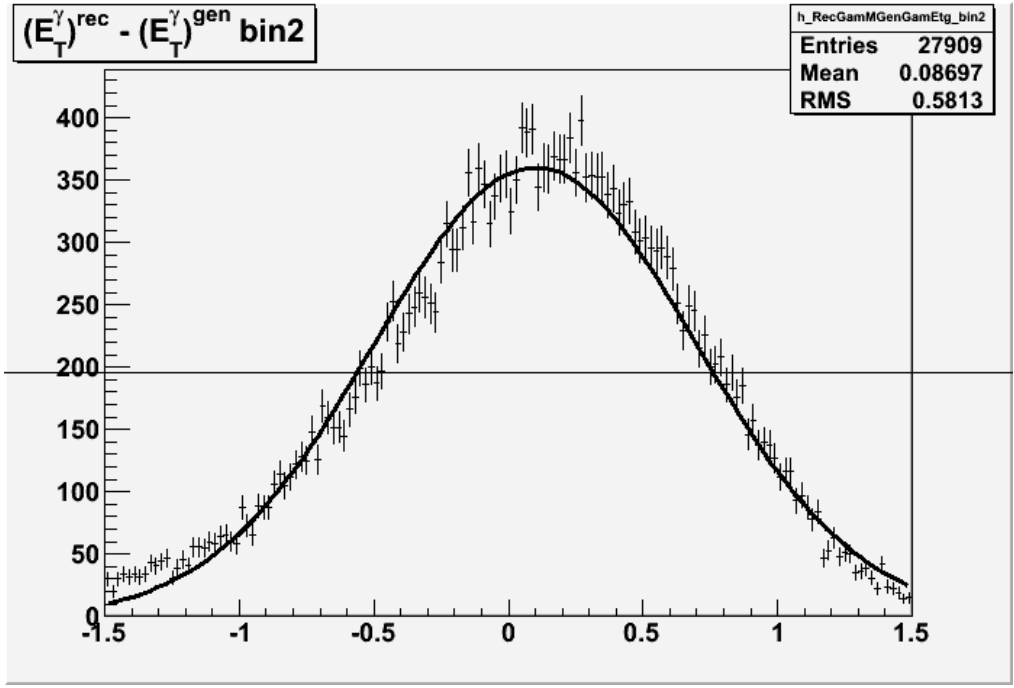
Bin 6 xgamma>0.8

EXT PARAMETER NO.	NAME	VALUE	ERROR	STEP SIZE	FIRST DERIVATIVE
1	Constant	2.23976e+01	1.96577e+00	3.19644e-03	-9.27844e-07
2	Mean	7.63388e-04	1.97529e-04	4.33119e-07	-3.73103e-03
3	Sigma	2.88539e-03	1.89081e-04	3.33978e-05	-3.20225e-04

Sigma is smaller than half of the bin width 1.5e-2

E_T^γ





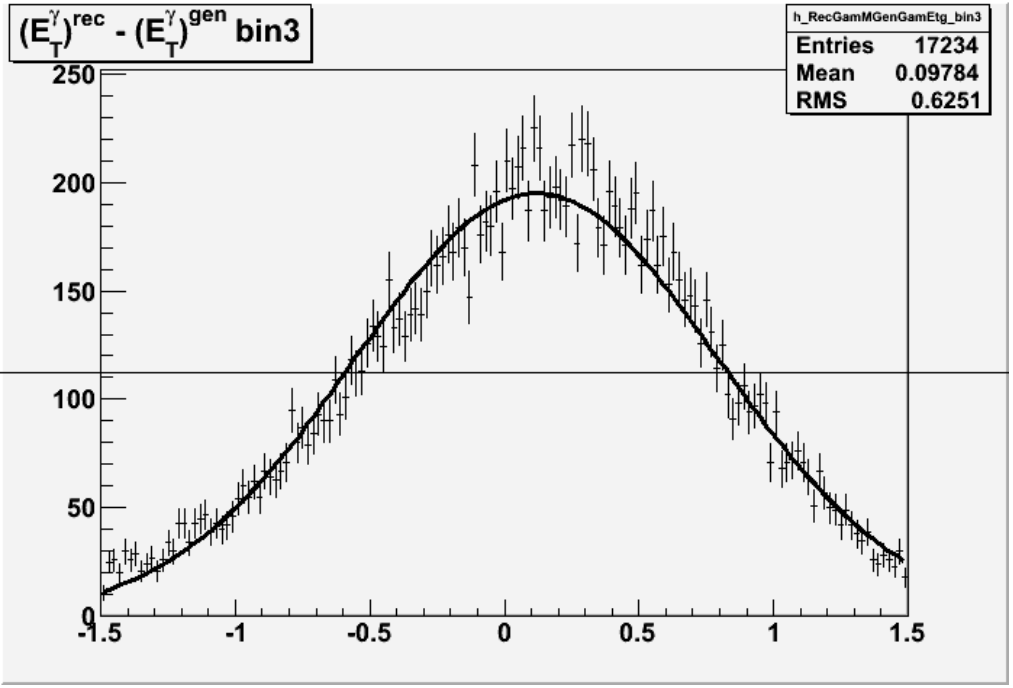
Et-gamma bin 1 6-7 GeV

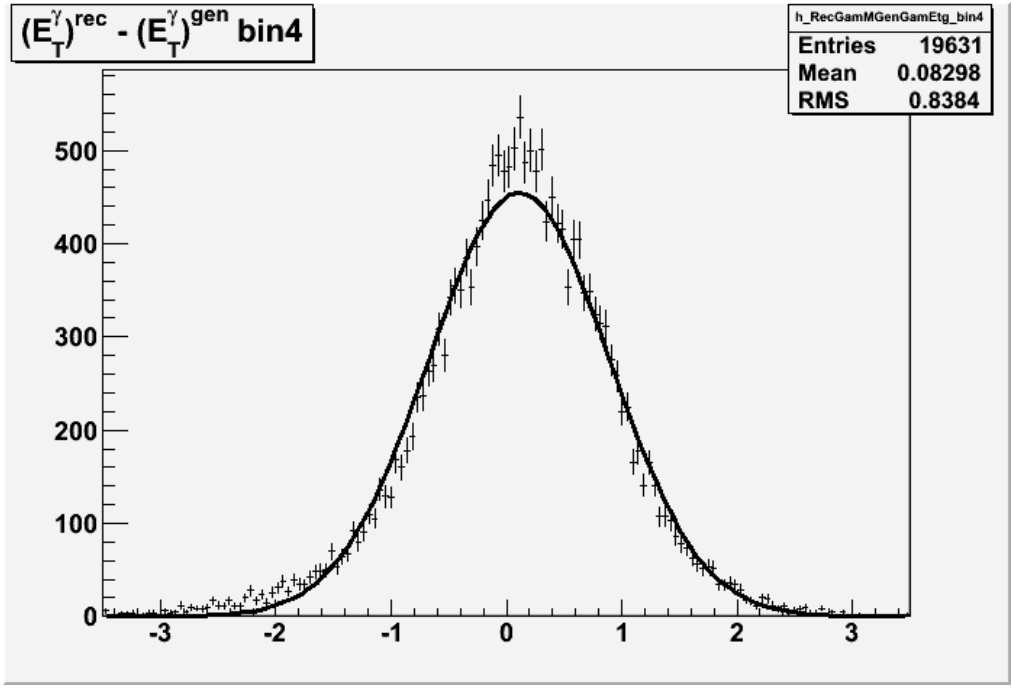
EXT PARAMETER NO.	NAME	VALUE	ERROR	STEP SIZE	FIRST DERIVATIVE
1	Constant	3.27702e+02	3.20542e+00	3.47882e-02	-7.01878e-08
2	Mean	-1.22138e-01	3.77843e-03	4.81933e-05	4.82123e-03
3	Sigma	4.41526e-01	2.92983e-03	2.19759e-05	4.17799e-03

Et-gamma bin 2 7-8.5 GeV

EXT PARAMETER NO.	NAME	VALUE	ERROR	STEP SIZE	FIRST DERIVATIVE
1	Constant	3.60049e+02	2.86062e+00	2.08193e-02	1.01728e-05
2	Mean	1.00122e-01	3.91316e-03	3.63748e-05	1.54568e-02
3	Sigma	5.99332e-01	3.33108e-03	1.36055e-05	3.99502e-02

E_T^γ





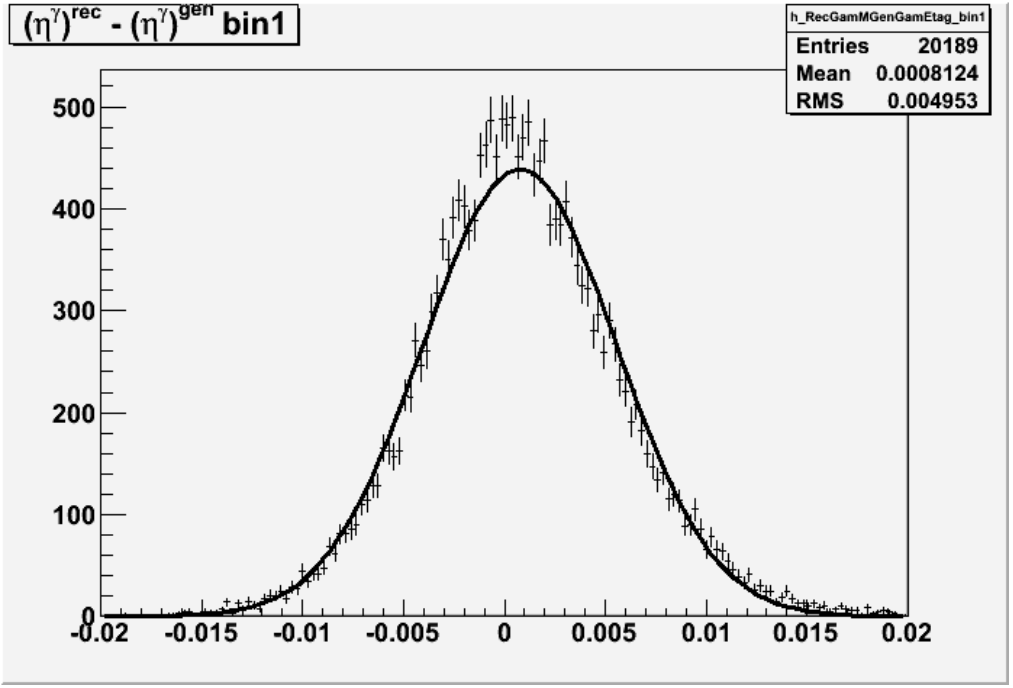
Et-gamma bin 3 8.5-10 GeV

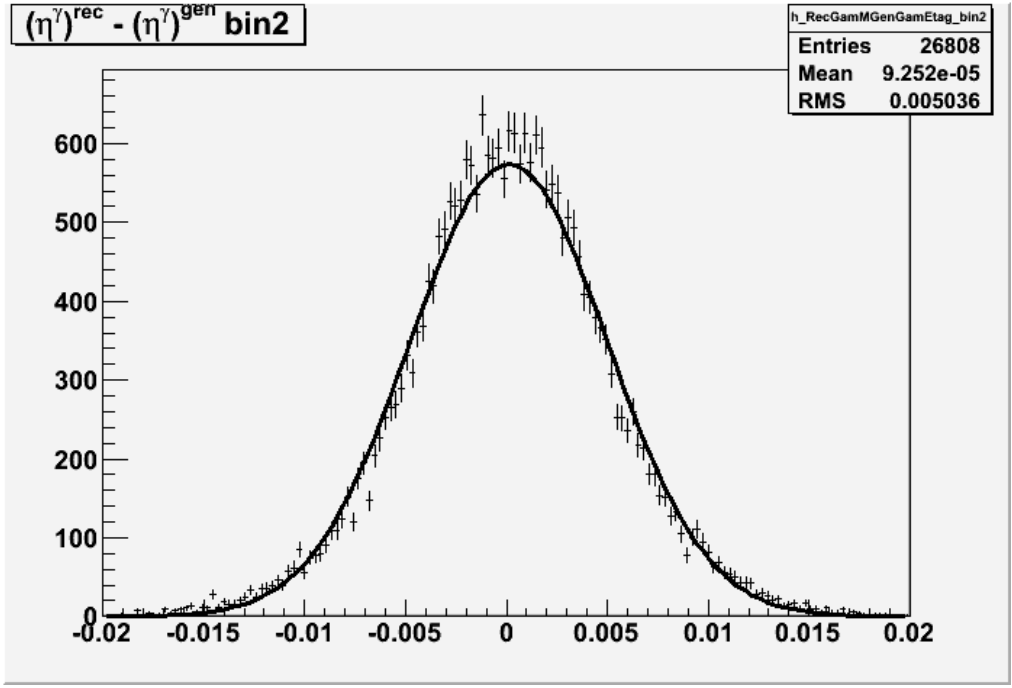
EXT PARAMETER NO.	NAME	VALUE	ERROR	STEP SIZE	FIRST DERIVATIVE
1	Constant	1.94830e+02	2.02391e+00	1.02555e-02	2.49426e-06
2	Mean	1.19608e-01	5.84831e-03	3.89967e-05	-8.17443e-03
3	Sigma	6.78153e-01	5.46140e-03	1.42415e-05	4.91577e-02

Et-gamma bin 4 10-15 GeV

EXT PARAMETER NO.	NAME	VALUE	ERROR	STEP SIZE	FIRST DERIVATIVE
1	Constant	4.54830e+02	4.40023e+00	3.46320e-02	5.52029e-08
2	Mean	1.10019e-01	5.71464e-03	5.96292e-05	-5.34553e-05
3	Sigma	7.82829e-01	5.03383e-03	1.61580e-05	-6.10192e-04

η^{γ}





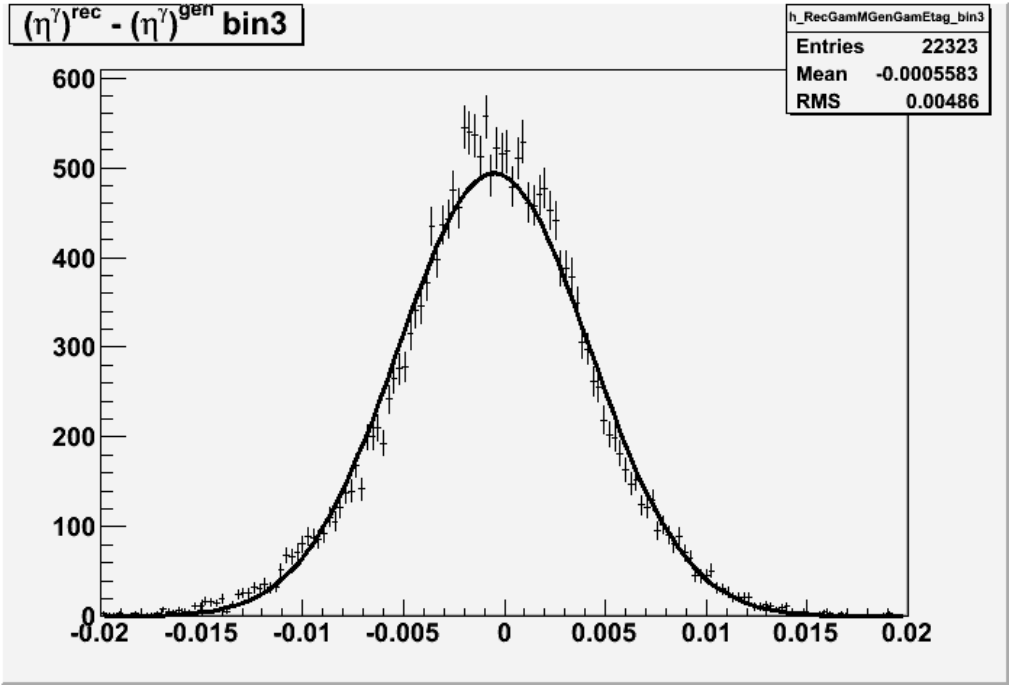
eta-gamma bin 1 -0.7 - -0.3

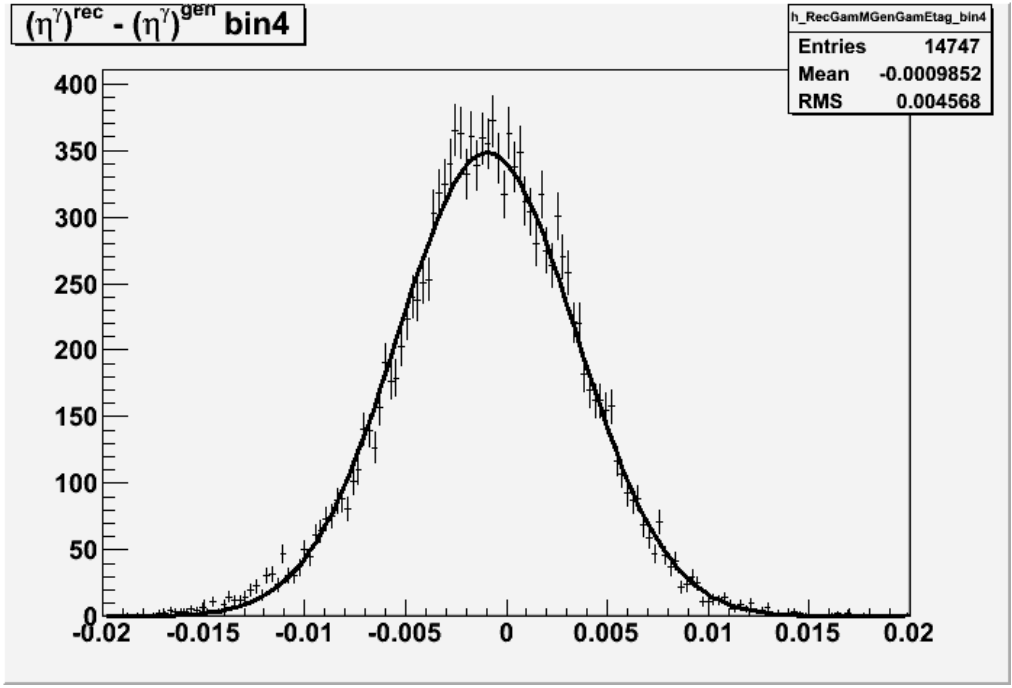
EXT PARAMETER NO.	NAME	VALUE	ERROR	STEP SIZE	FIRST DERIVATIVE
1	Constant	4.38918e+02	4.07804e+00	2.79365e-02	-2.48809e-06
2	Mean	7.57454e-04	3.46157e-05	3.05650e-07	-3.84218e-01
3	Sigma	4.79769e-03	2.87523e-05	1.33339e-05	-6.33114e-03

eta-gamma bin 2 -0.3 - 0.1

EXT PARAMETER NO.	NAME	VALUE	ERROR	STEP SIZE	FIRST DERIVATIVE
1	Constant	5.73582e+02	4.67629e+00	3.43706e-02	1.61663e-09
2	Mean	1.16785e-04	3.01218e-05	2.92970e-07	-1.54977e-03
3	Sigma	4.88681e-03	2.61145e-05	1.28751e-05	-4.84215e-04

η^{γ}





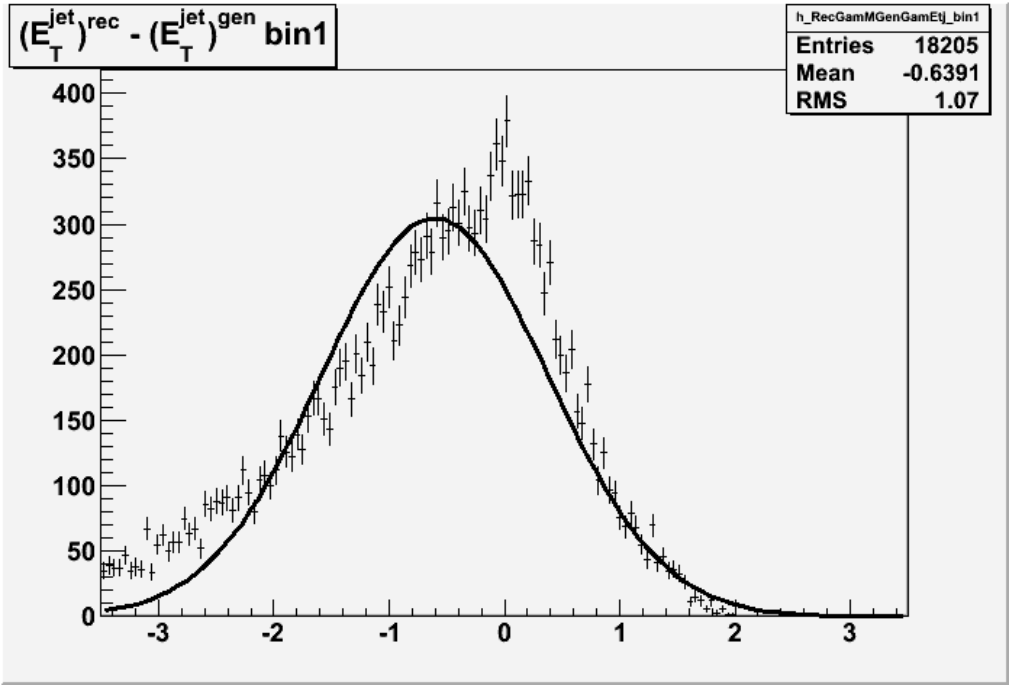
eta-gamma bin 3 0.1 - 0.5

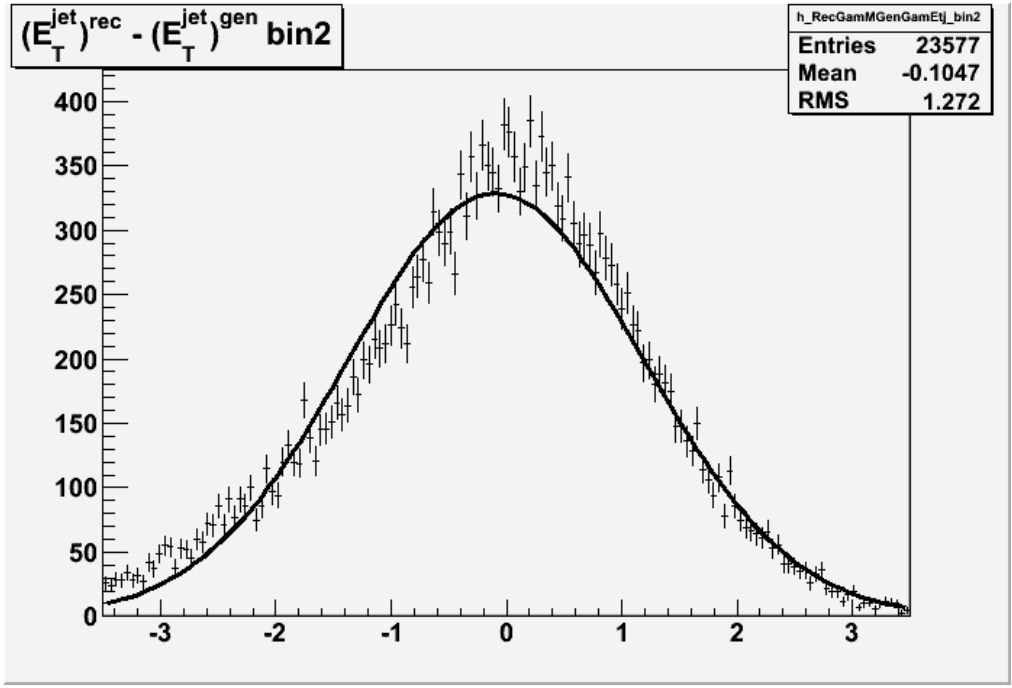
EXT PARAMETER NO.	NAME	VALUE	ERROR	STEP SIZE	FIRST DERIVATIVE
1	Constant	4.93811e+02	4.37249e+00	2.94379e-02	-3.35021e-09
2	Mean	-5.11674e-04	3.20137e-05	2.82094e-07	1.39417e-02
3	Sigma	4.72933e-03	2.71316e-05	1.26630e-05	-4.29873e-04

eta-gamma bin 4 0.5 - 0.9

EXT PARAMETER NO.	NAME	VALUE	ERROR	STEP SIZE	FIRST DERIVATIVE
1	Constant	3.48008e+02	3.69358e+00	2.01588e-02	5.32939e-09
2	Mean	-9.51076e-04	3.72973e-05	2.57850e-07	5.63752e-02
3	Sigma	4.44198e-03	2.95146e-05	1.18315e-05	-1.64368e-03

E_T^{jet}





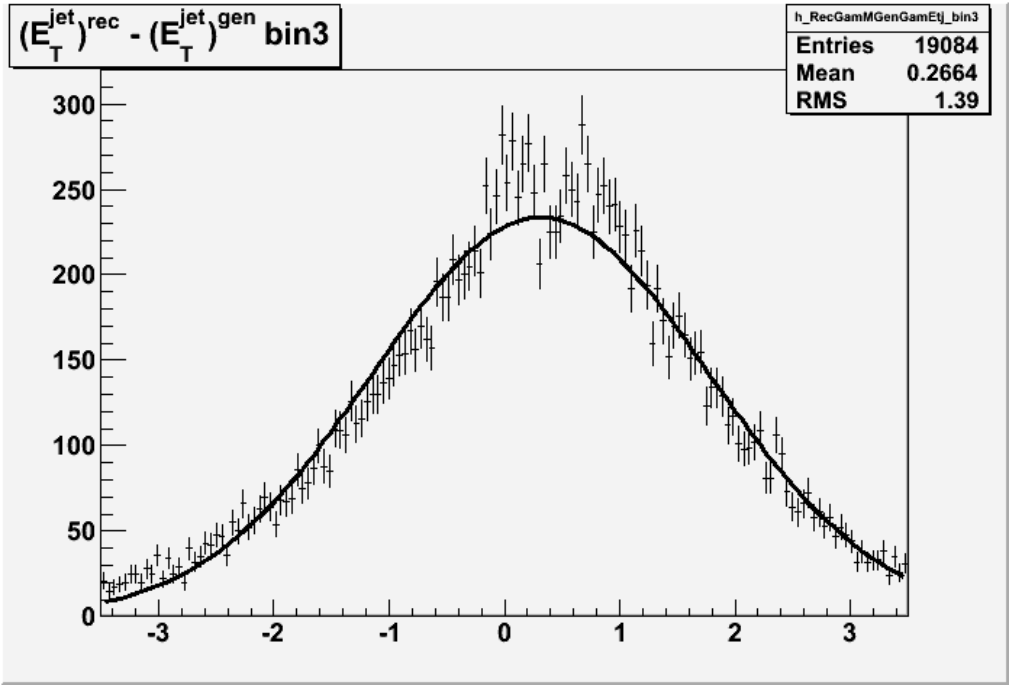
Et-jet bin 1 4-6 GeV

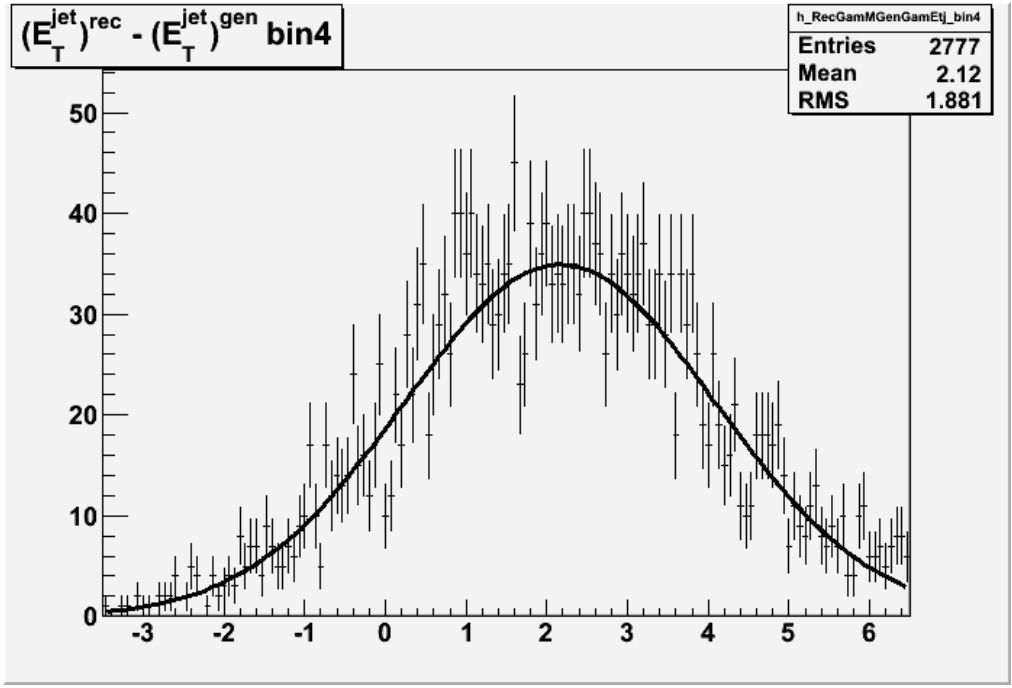
EXT PARAMETER NO.	NAME	VALUE	ERROR	STEP SIZE	FIRST DERIVATIVE
1	Constant	3.04385e+02	3.19077e+00	4.50033e-02	1.46444e-05
2	Mean	-6.04500e-01	1.04726e-02	1.48769e-04	4.77472e-03
3	Sigma	9.82548e-01	7.03803e-03	2.70514e-05	2.83814e-02

Et-jet bin 2 6-8 GeV

EXT PARAMETER NO.	NAME	VALUE	ERROR	STEP SIZE	FIRST DERIVATIVE
1	Constant	3.28564e+02	2.85321e+00	2.35626e-02	-6.09853e-07
2	Mean	-9.07747e-02	9.24810e-03	9.43752e-05	-4.99215e-04
3	Sigma	1.28065e+00	7.52477e-03	1.57251e-05	2.81820e-04

E_T^{jet}





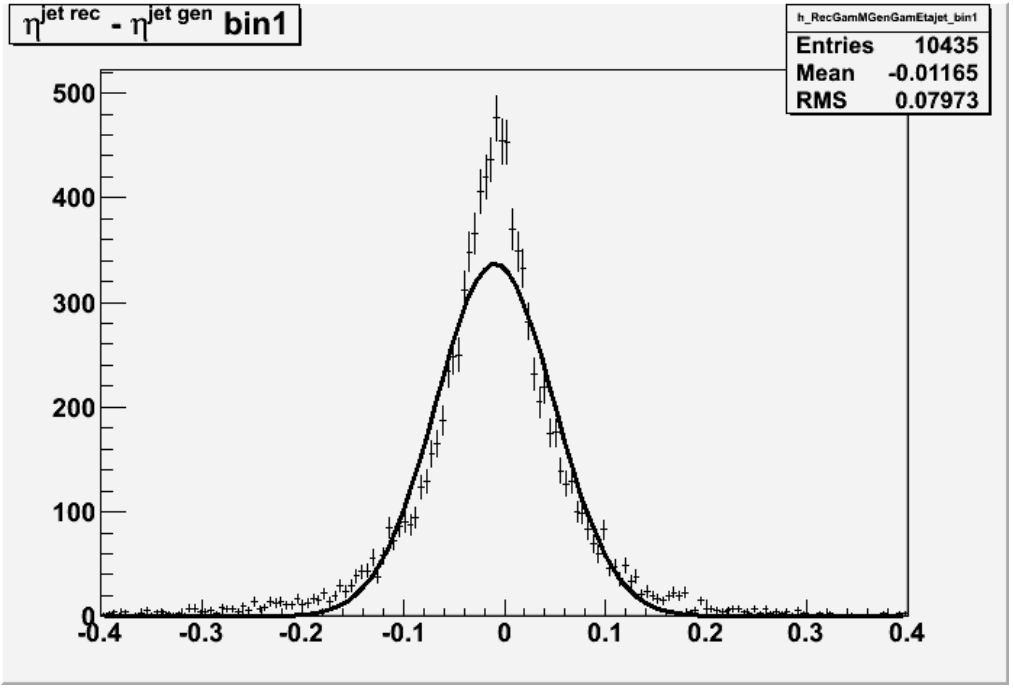
Et-jet bin 3 8-10 GeV

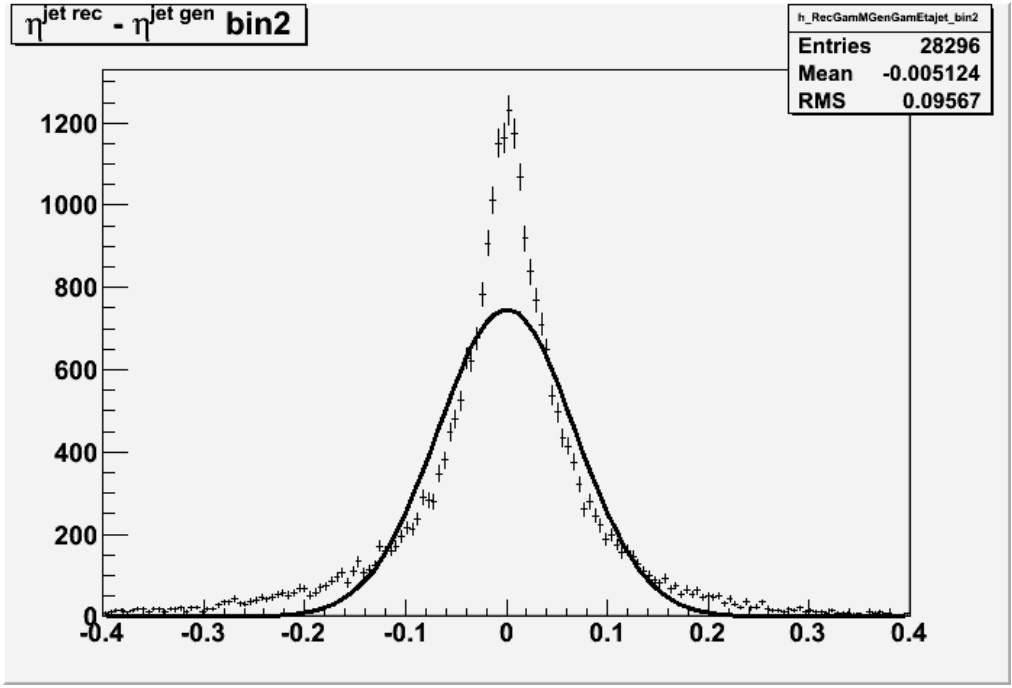
EXT PARAMETER NO.	NAME	VALUE	ERROR	STEP SIZE	FIRST DERIVATIVE
1	Constant	2.33311e+02	2.31854e+00	2.65851e-04	-3.05957e-06
2	Mean	3.15174e-01	1.15921e-02	-2.37934e-06	1.23656e-03
3	Sigma	1.46647e+00	1.10598e-02	-9.50434e-07	3.40900e-03

Et-jet bin 4 10-15 GeV

EXT PARAMETER NO.	NAME	VALUE	ERROR	STEP SIZE	FIRST DERIVATIVE
1	Constant	3.49136e+01	9.18027e-01	4.20176e-03	-6.22006e-07
2	Mean	2.16482e+00	4.14644e-02	2.45550e-04	-1.77093e-06
3	Sigma	1.93003e+00	3.68521e-02	2.92600e-05	-1.83937e-04

η^{jet}





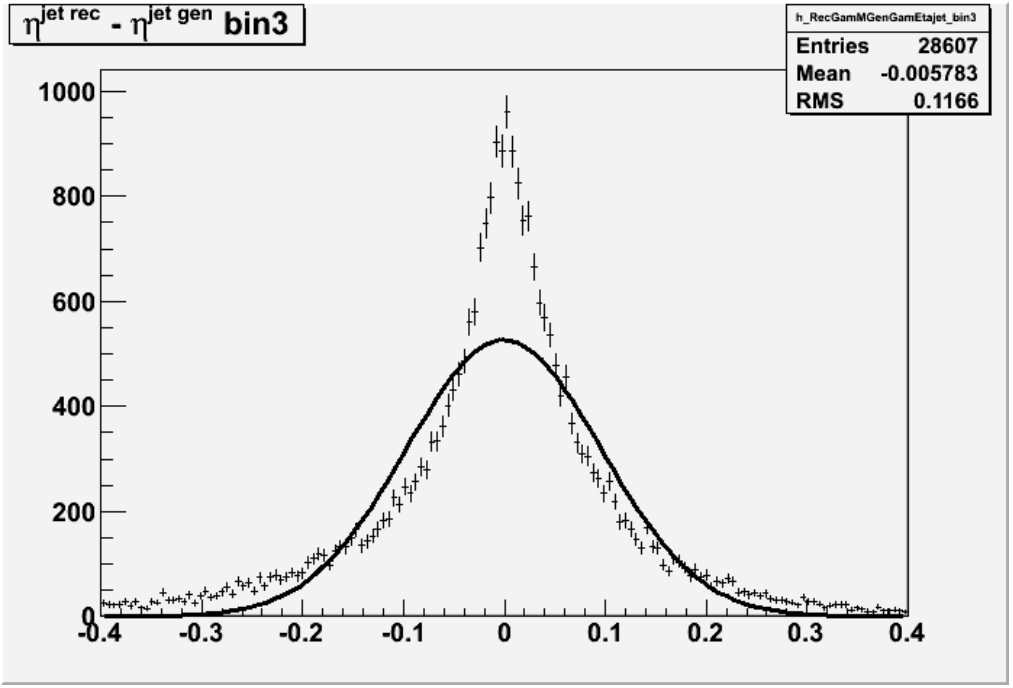
eta-jet bin 1 -1.5 - -0.7

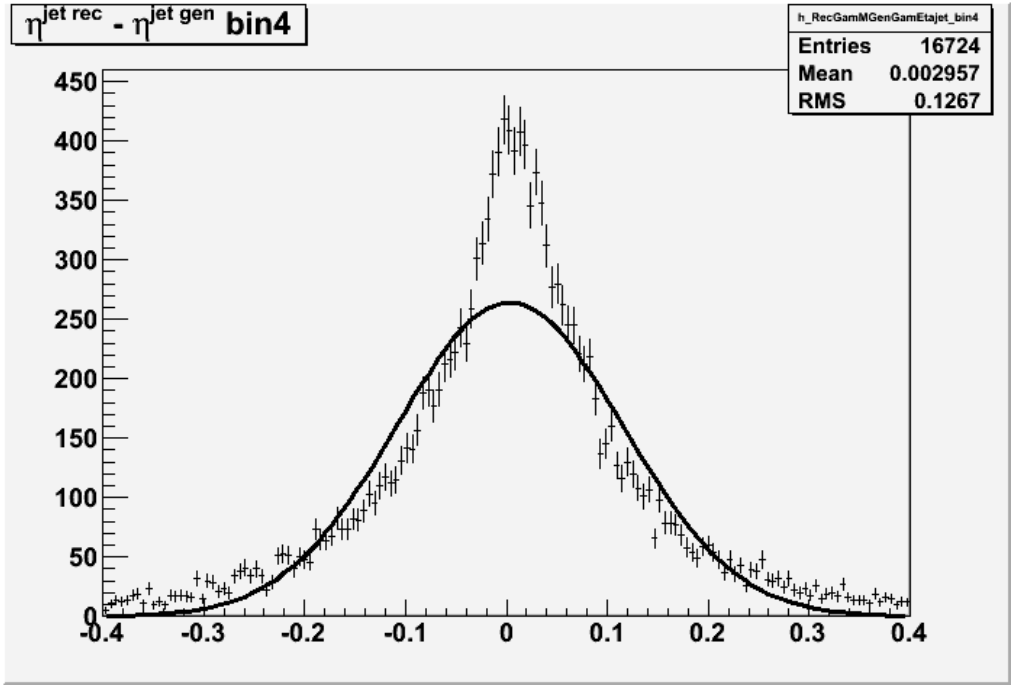
EXT PARAMETER NO.	NAME	VALUE	ERROR	STEP SIZE	FIRST DERIVATIVE
1	Constant	3.37007e+02	5.42331e+00	5.25134e-02	9.54943e-08
2	Mean	-9.37708e-03	6.07661e-04	9.10719e-06	-1.00334e-04
3	Sigma	5.84455e-02	7.17790e-04	3.34403e-05	-6.49342e-04

eta-jet bin 2 -0.7 - 0.1

EXT PARAMETER NO.	NAME	VALUE	ERROR	STEP SIZE	FIRST DERIVATIVE
1	Constant	7.47076e+02	8.54617e+00	1.44084e-01	-8.21194e-07
2	Mean	1.56216e-04	4.41915e-04	1.30773e-05	-4.61492e-03
3	Sigma	6.78048e-02	6.38872e-04	4.37908e-05	-1.11525e-02

η^{jet}



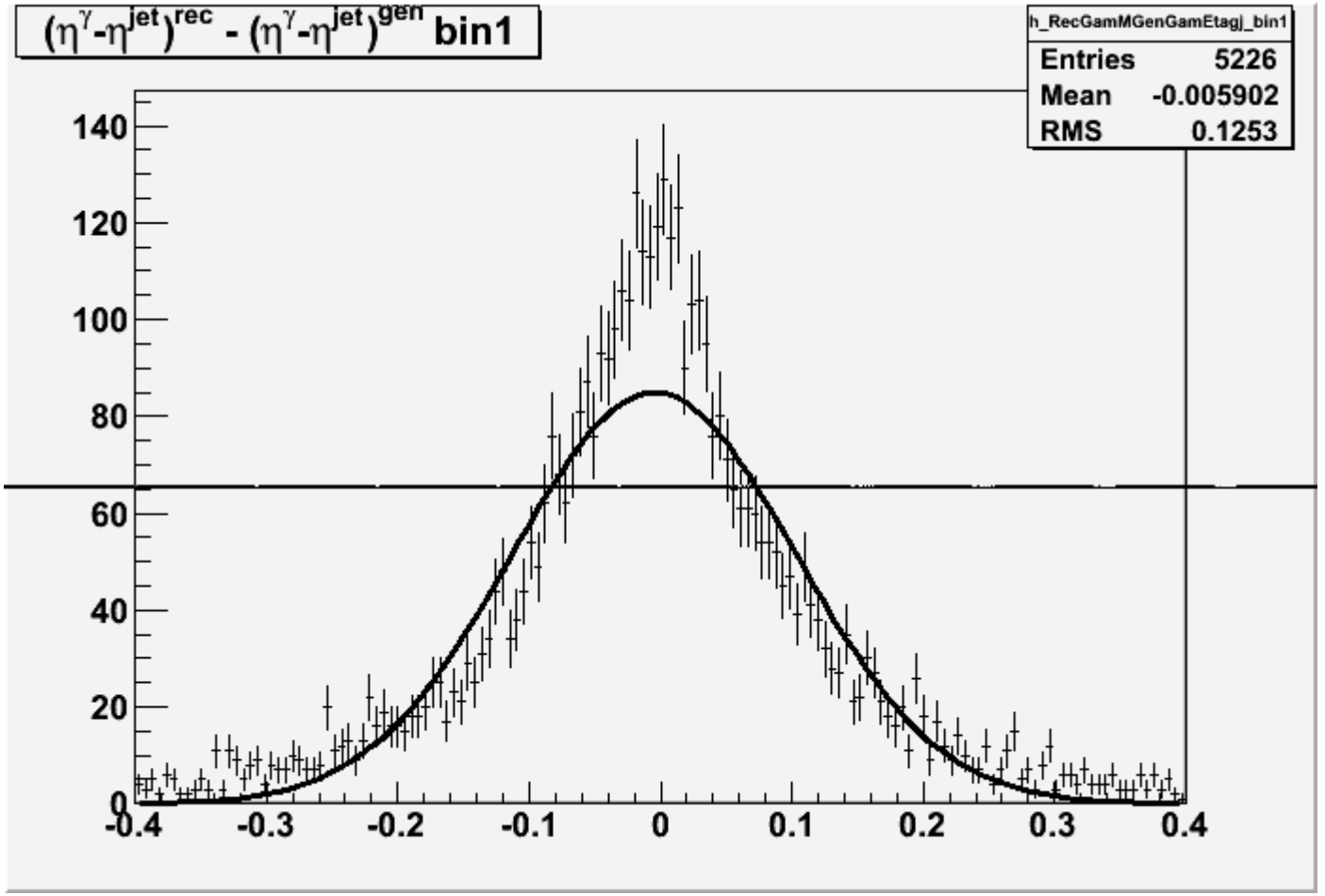


eta-jet bin 3 0.1 - 0.9

EXT PARAMETER NO.	NAME	VALUE	ERROR	STEP SIZE	FIRST DERIVATIVE
1	Constant	5.26778e+02	6.16052e+00	9.78760e-02	1.70495e-06
2	Mean	-6.78126e-04	6.37637e-04	1.79128e-05	-1.06764e-02
3	Sigma	9.63795e-02	9.38856e-04	4.61530e-05	-7.71493e-04

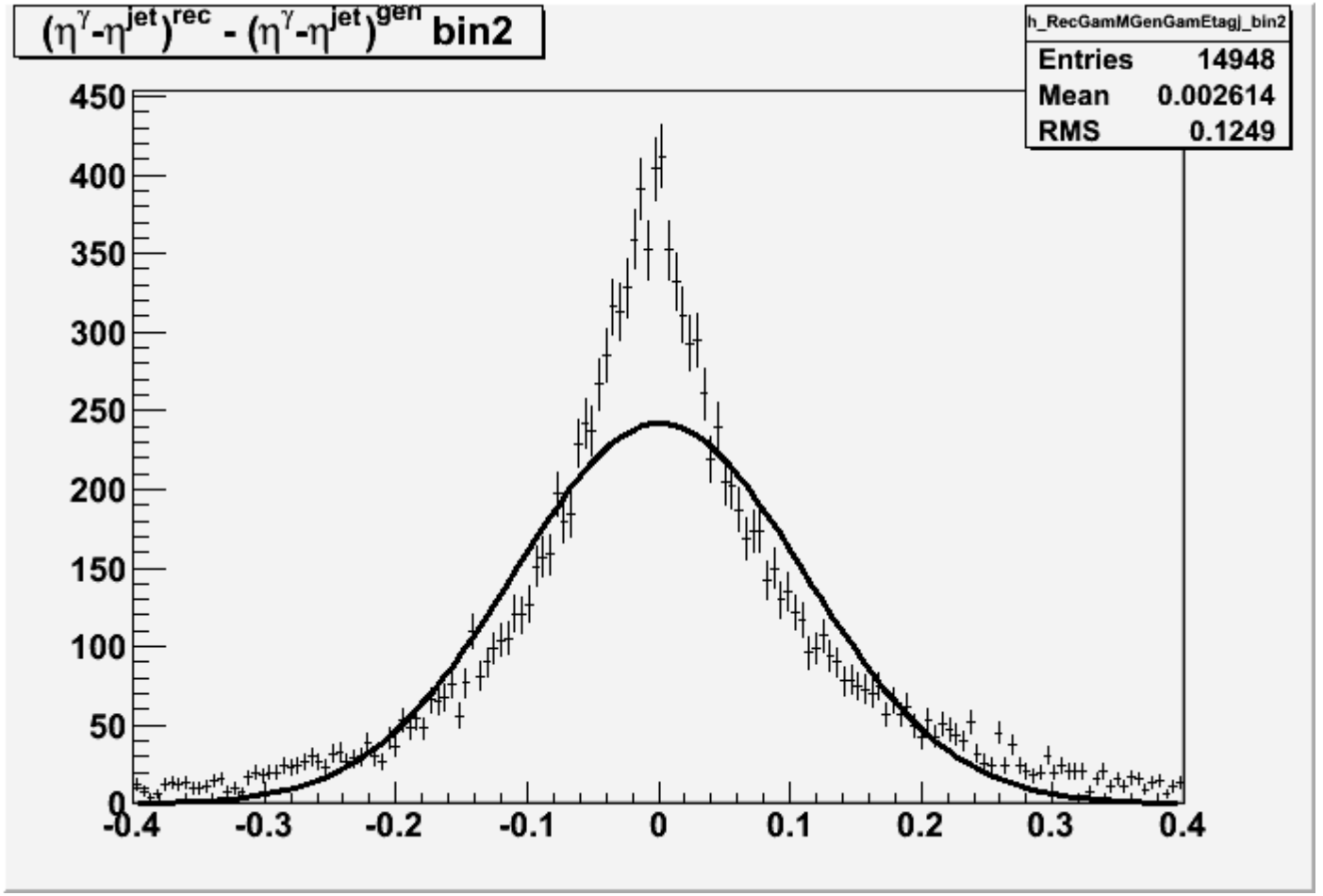
eta-jet bin 4 0.9 - 1.8

EXT PARAMETER NO.	NAME	VALUE	ERROR	STEP SIZE	FIRST DERIVATIVE
1	Constant	2.64294e+02	3.62951e+00	4.11459e-02	-3.02551e-08
2	Mean	3.34736e-03	9.54947e-04	1.74989e-05	-1.83859e-04
3	Sigma	1.12125e-01	1.21713e-03	3.82986e-05	-1.12778e-03



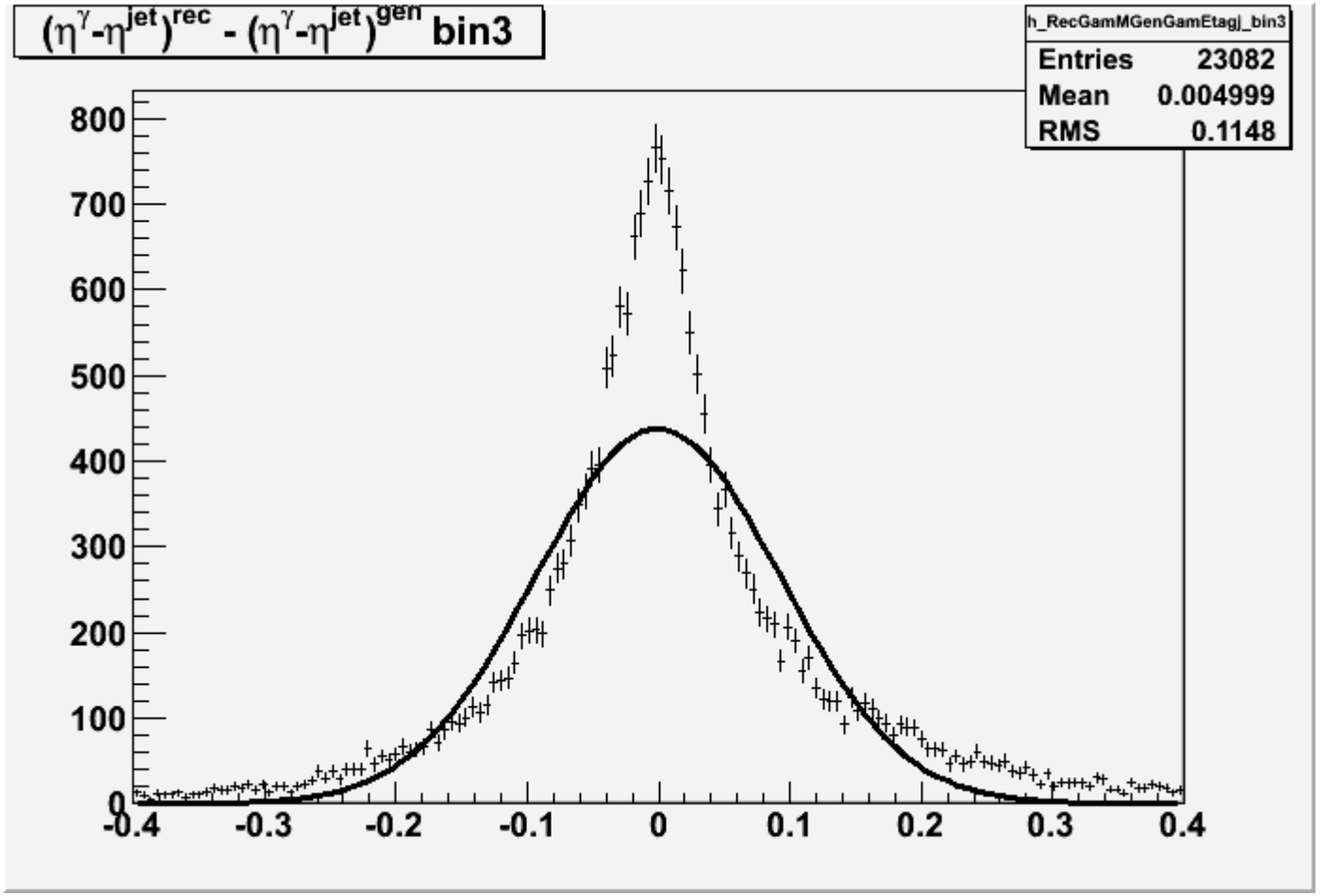
Etagj bin 1 -2.2 - -1.5

EXT PARAMETER NO.	NAME	VALUE	ERROR	STEP SIZE	FIRST DERIVATIVE
1	Constant	8.49221e+01	2.01954e+00	1.30907e-02	1.50704e-06
2	Mean	-4.86008e-03	1.65077e-03	1.66988e-05	9.58249e-04
3	Sigma	1.08156e-01	1.98173e-03	3.64756e-05	-4.20981e-04



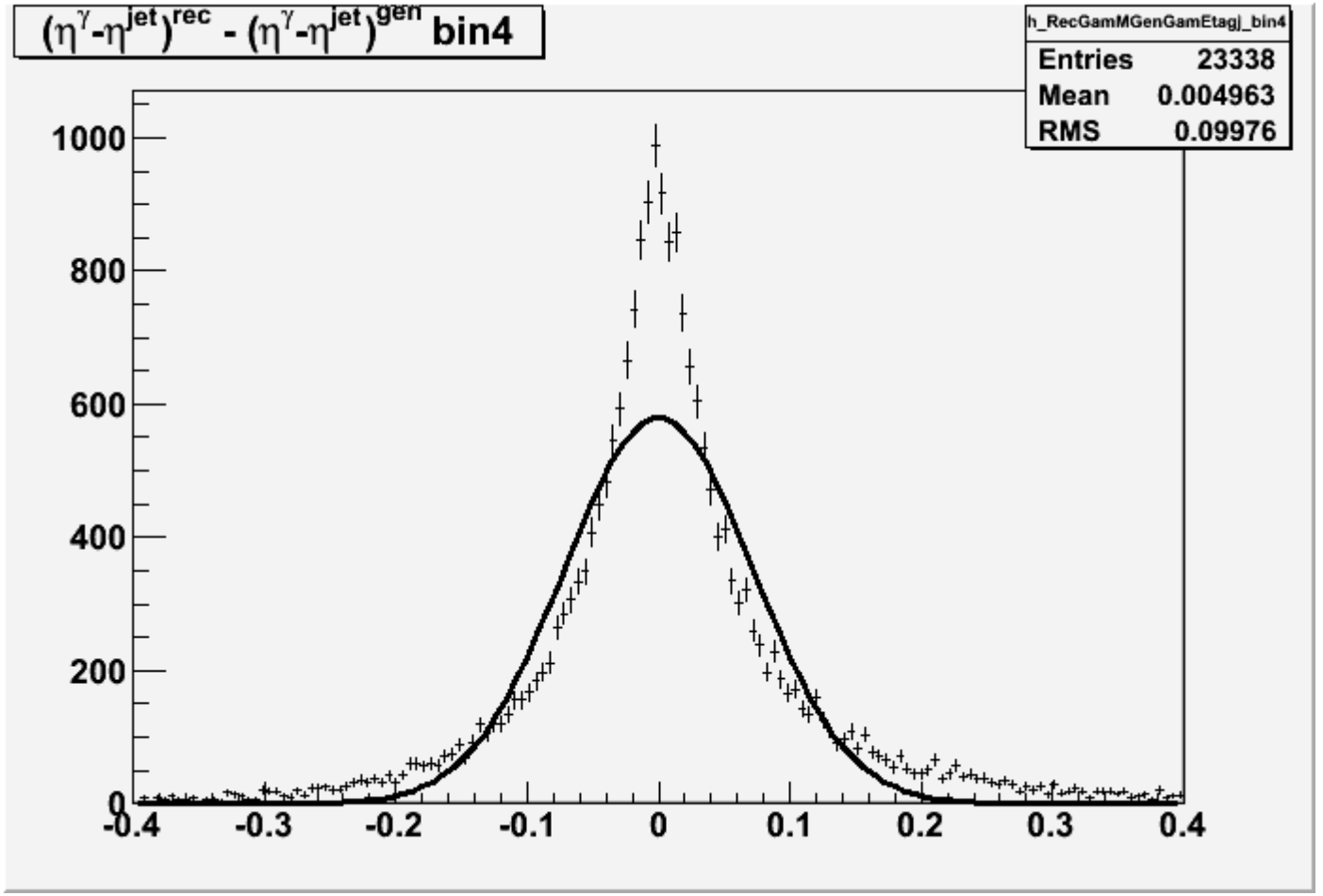
Etagj bin 2 -1.5 - -0.8

EXT PARAMETER NO.	NAME	VALUE	ERROR	STEP SIZE	FIRST DERIVATIVE
1	Constant	2.41795e+02	3.52997e+00	3.84856e-02	1.21391e-06
2	Mean	6.64909e-04	1.00204e-03	1.76394e-05	2.47990e-03
3	Sigma	1.10590e-01	1.28279e-03	3.92126e-05	-7.51846e-04



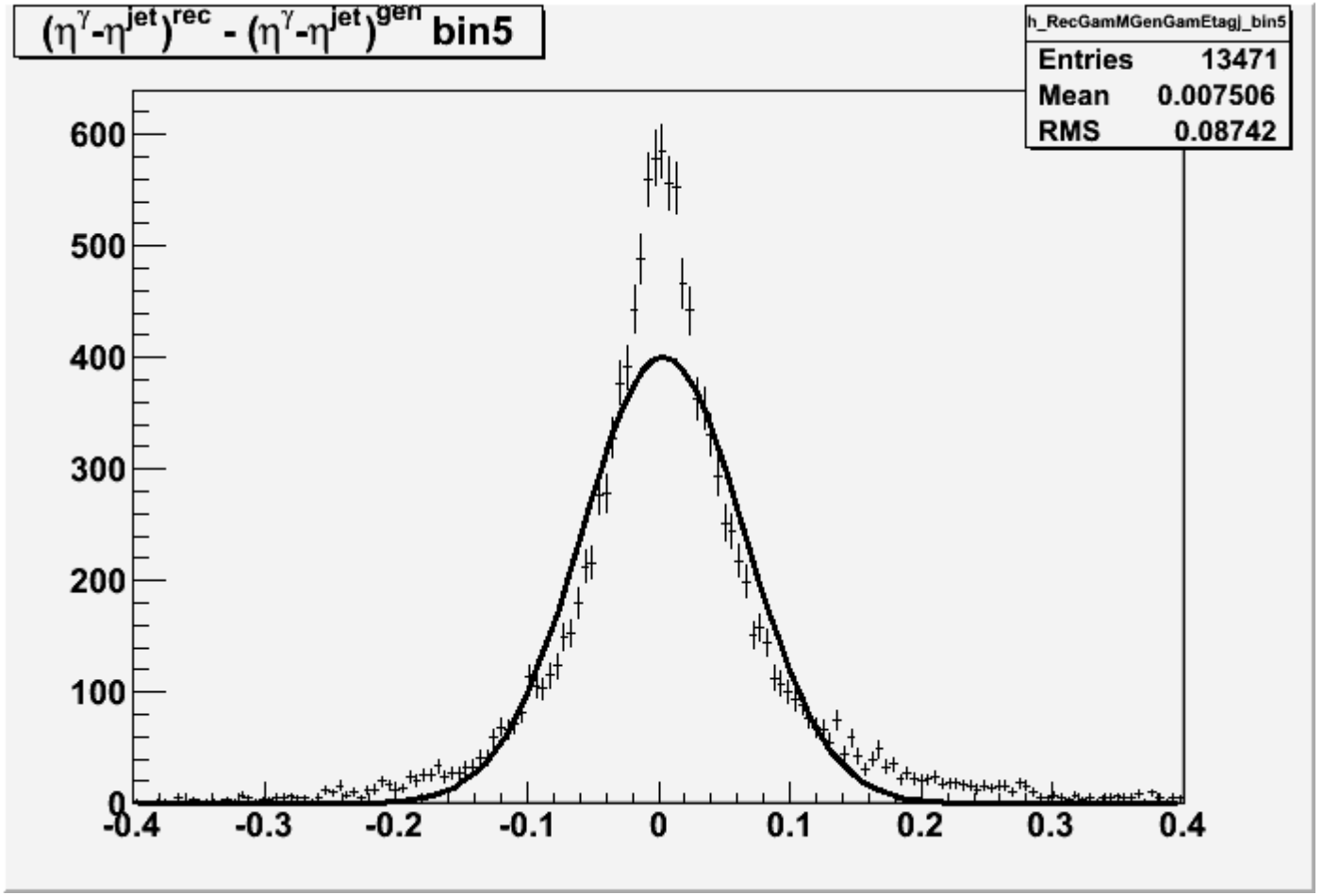
Etagj bin 3 -0.8 - -0.1

EXT PARAMETER NO.	NAME	VALUE	ERROR	STEP SIZE	FIRST DERIVATIVE
1	Constant	4.37937e+02	5.83834e+00	8.32580e-02	2.27838e-06
2	Mean	-4.51158e-04	6.88916e-04	1.77016e-05	1.85273e-02
3	Sigma	9.30955e-02	1.04293e-03	4.71217e-05	1.65675e-03



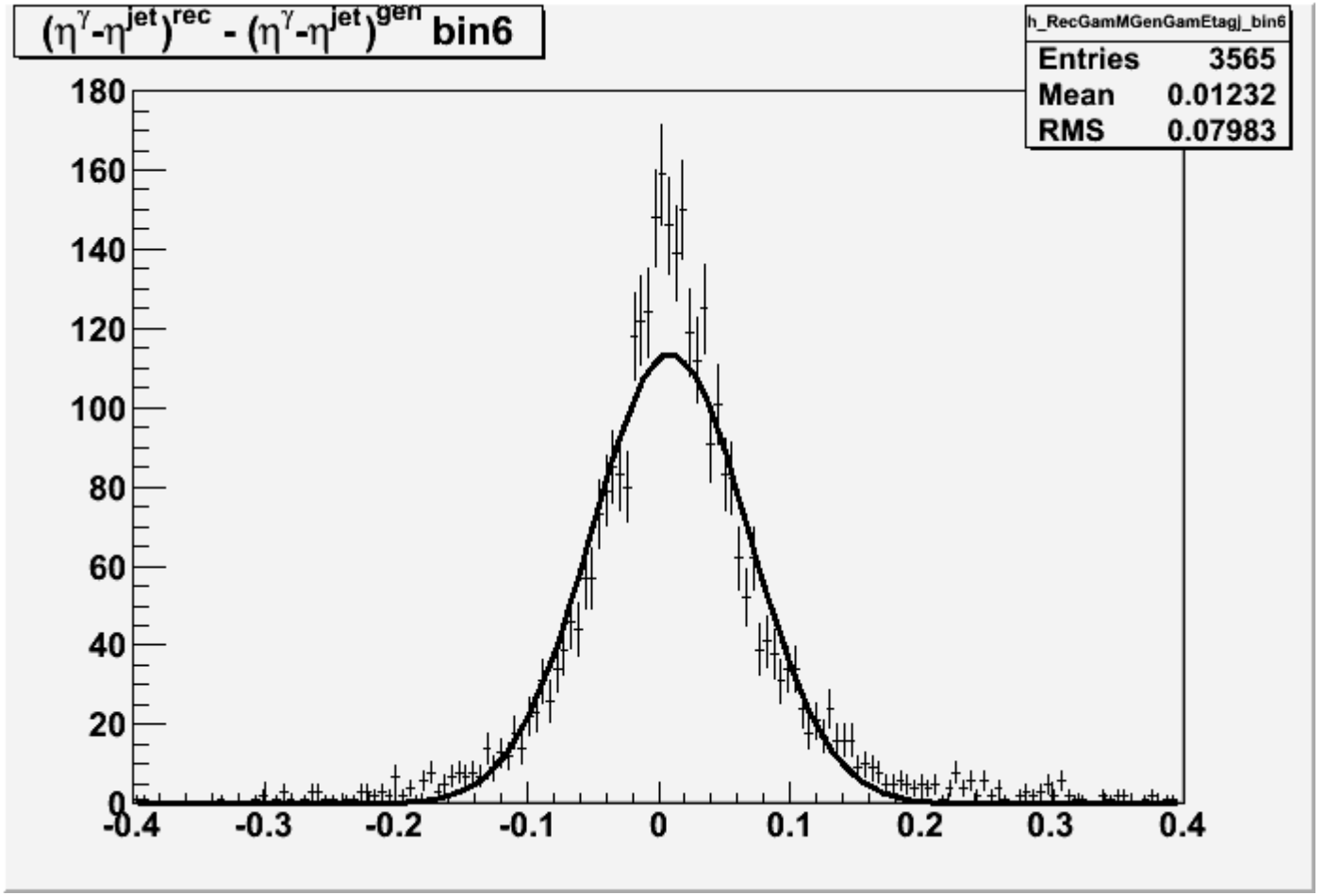
Etagj bin 4 -0.1 - 0.6

EXT PARAMETER NO.	NAME	VALUE	ERROR	STEP SIZE	FIRST DERIVATIVE
1	Constant	5.79960e+02	7.33584e+00	1.12130e-01	-4.73901e-07
2	Mean	4.33125e-05	5.14843e-04	1.38842e-05	1.16150e-03
3	Sigma	7.18110e-02	7.49049e-04	4.43598e-05	-5.49420e-03



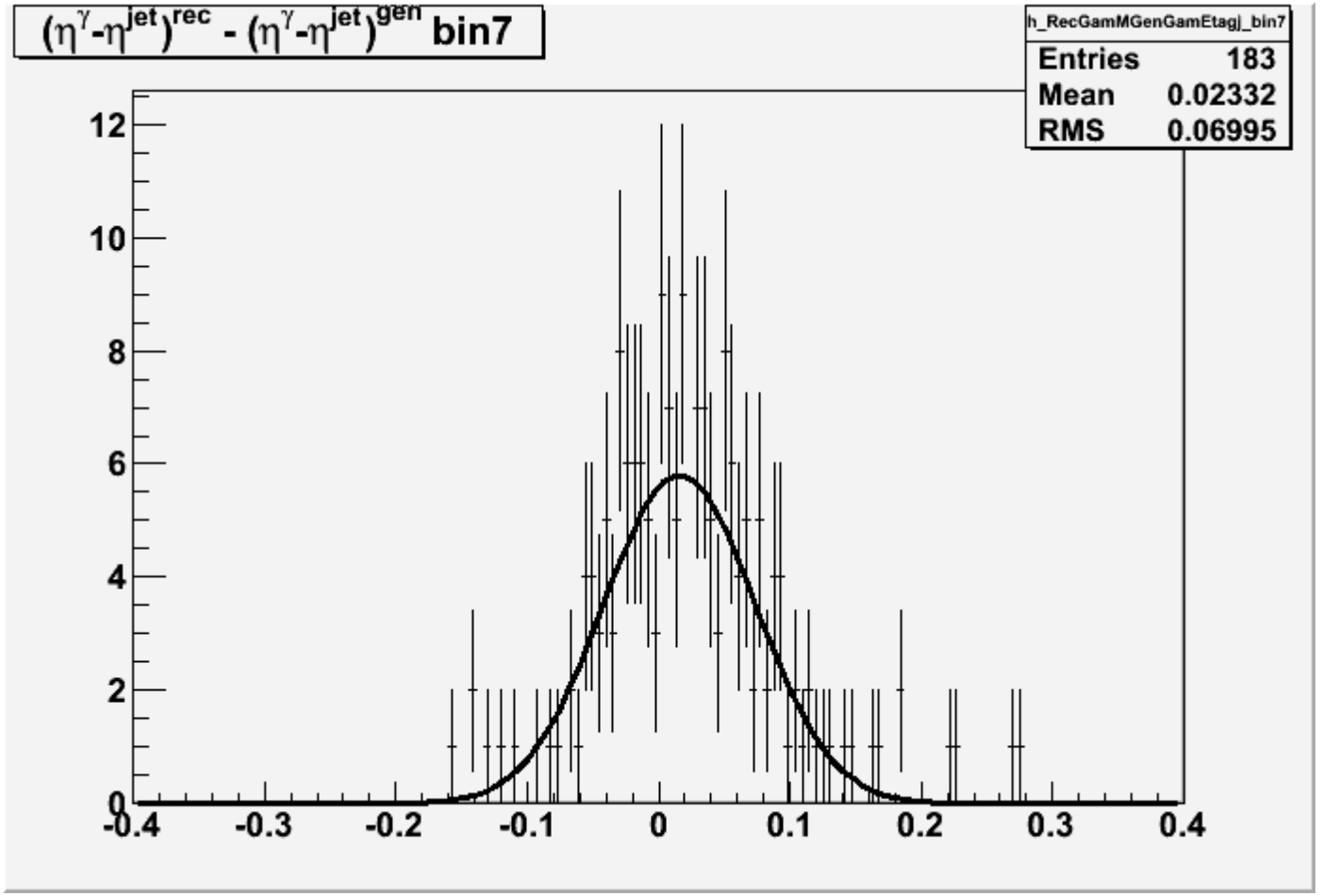
Etagj bin 5 0.6 - 1.3

EXT PARAMETER NO.	NAME	VALUE	ERROR	STEP SIZE	FIRST DERIVATIVE
1	Constant	4.01023e+02	6.03318e+00	6.92054e-02	8.12116e-07
2	Mean	3.52589e-03	5.74523e-04	1.06822e-05	7.15449e-04
3	Sigma	6.18994e-02	7.33709e-04	3.74906e-05	4.95875e-04



Etagj bin 6 1.3 - 2.0

EXT PARAMETER NO.	NAME	VALUE	ERROR	STEP SIZE	FIRST DERIVATIVE
1	Constant	1.13482e+02	2.99982e+00	1.69995e-02	-2.82929e-07
2	Mean	8.78328e-03	1.06312e-03	8.94403e-06	-3.44386e-04
3	Sigma	5.97034e-02	1.17076e-03	3.15288e-05	-4.17598e-04

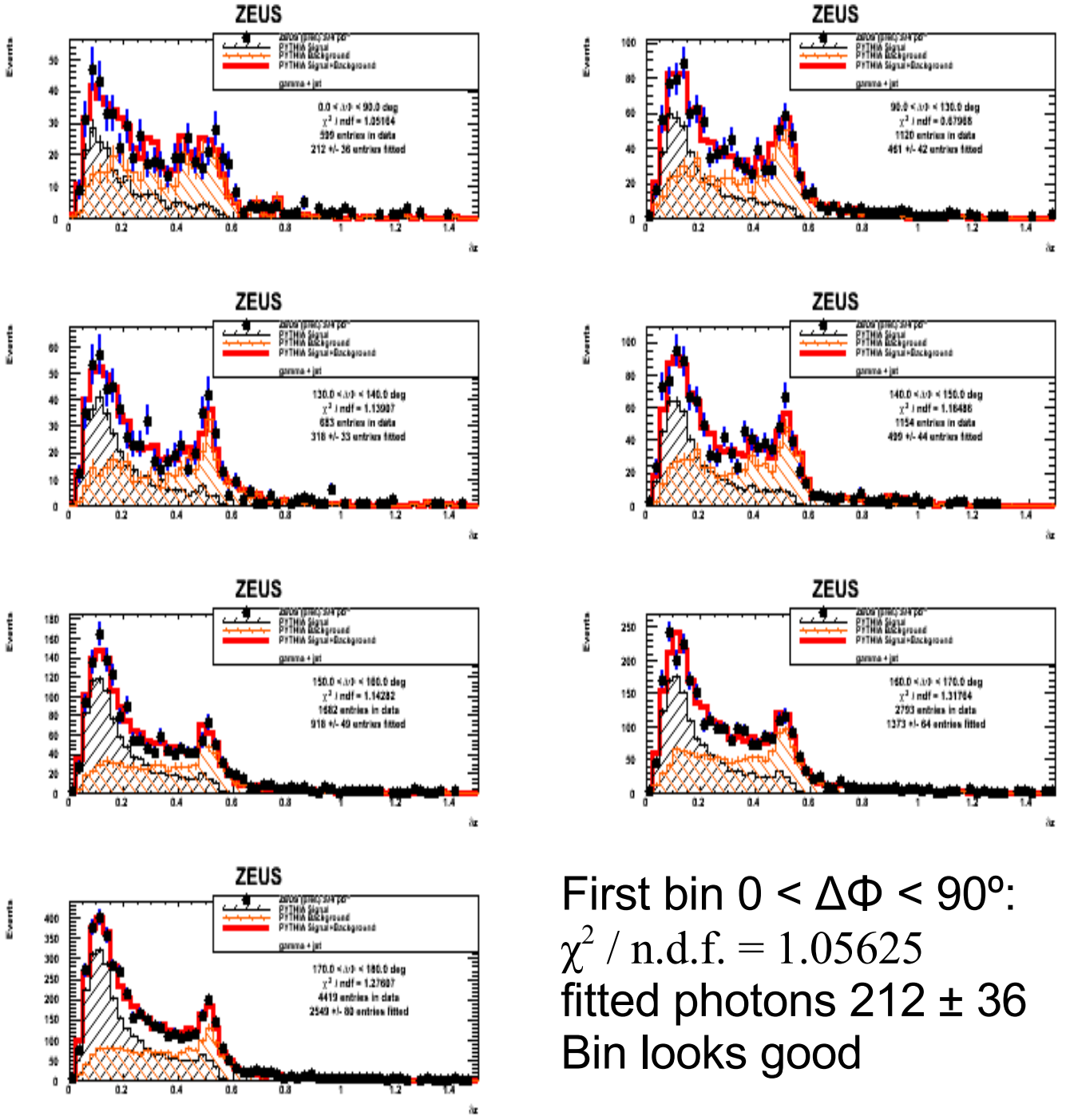


Etagj bin 7 2.0 - 2.7

EXT PARAMETER NO.	NAME	VALUE	ERROR	STEP SIZE	FIRST DERIVATIVE
1	Constant	5.80244e+00	7.06648e-01	1.34605e-03	-1.72641e-04
2	Mean	1.58550e-02	5.21723e-03	1.44991e-05	-1.13238e-02
3	Sigma	5.78610e-02	6.01639e-03	5.93949e-05	-7.85405e-04

Fits in bins

<δZ> Fits in ΔΦ bins. All x_γ



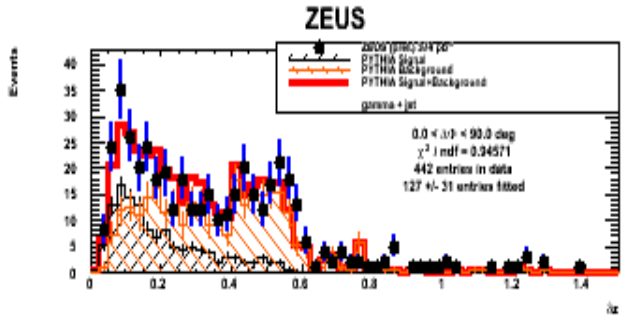
First bin 0 < ΔΦ < 90º:

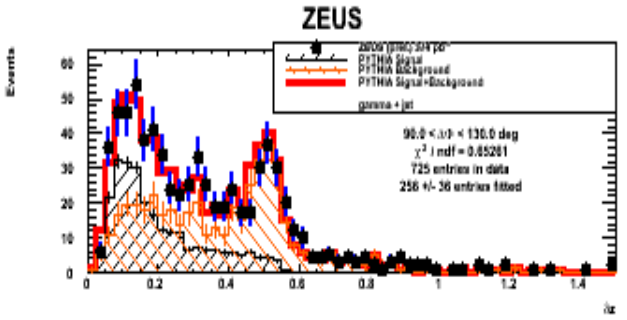
χ^2 / n.d.f. = 1.05625

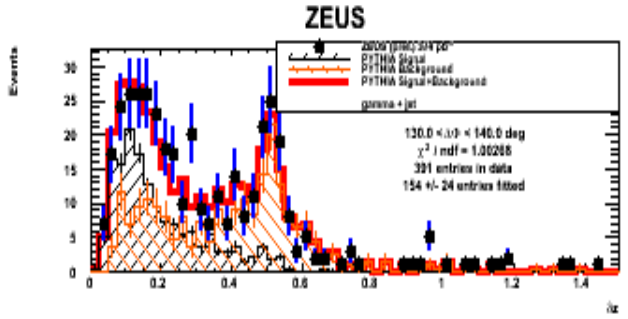
fitted photons 212 ± 36

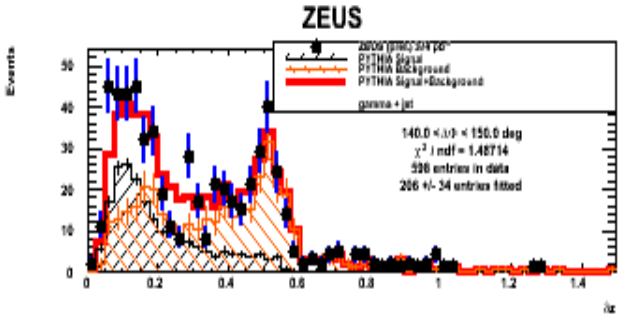
Bin looks good

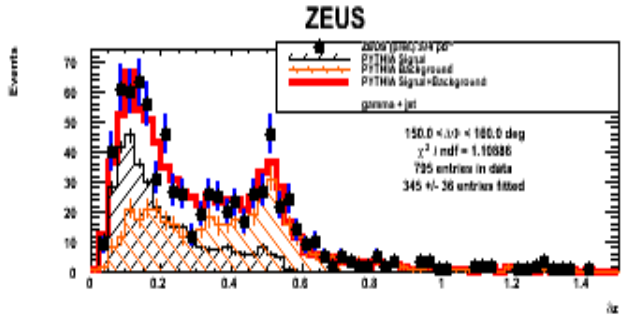
<δZ> Fits in ΔΦ bins. x_γ < 0.7

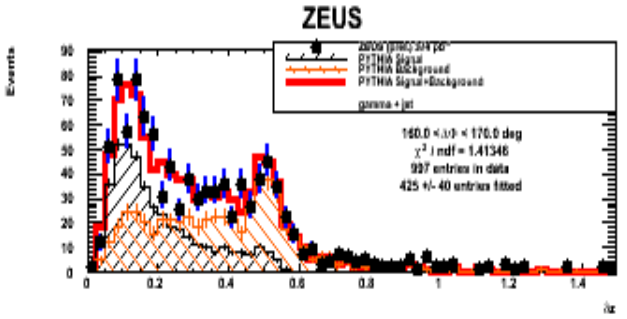


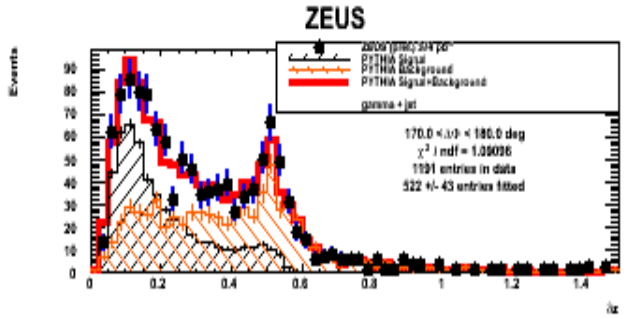












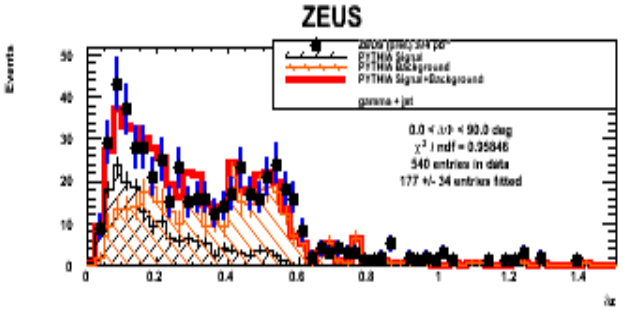
First bin 0 < ΔΦ < 90º:

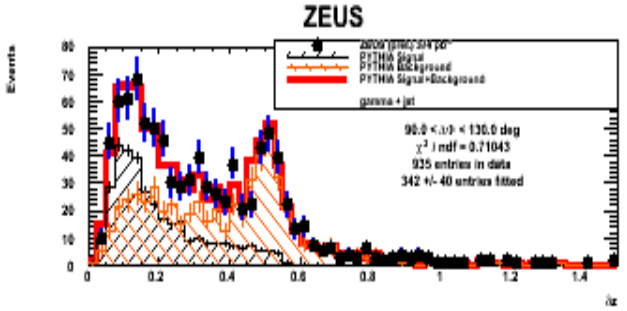
χ^2 / n.d.f. = 0.86857

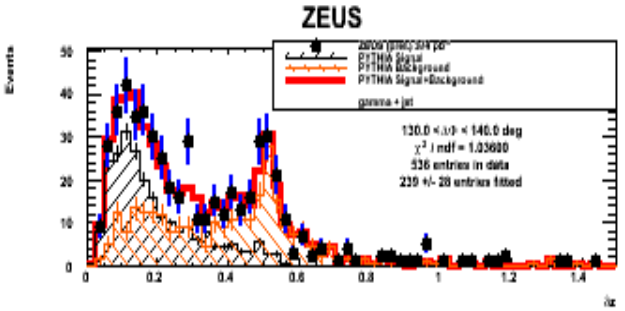
fitted photons 122 ± 29

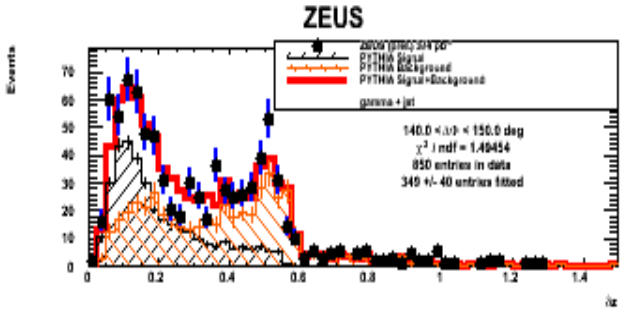
Bin looks good

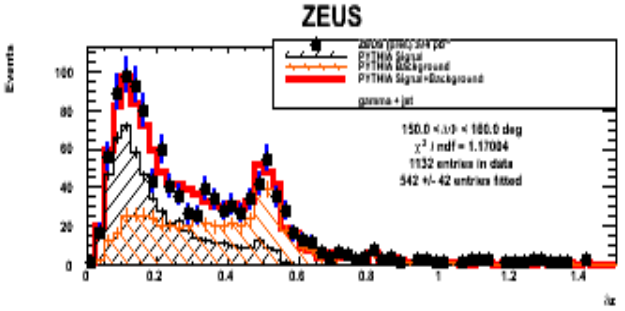
<δZ> Fits in ΔΦ bins. $x_\gamma < 0.8$

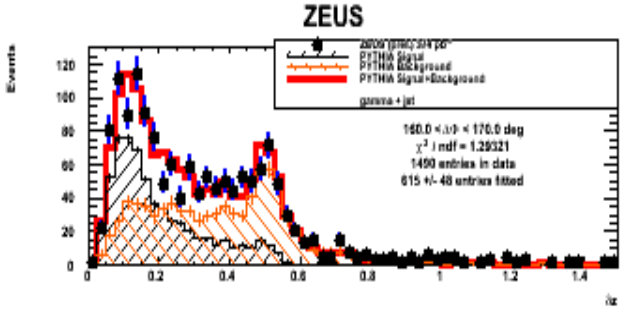


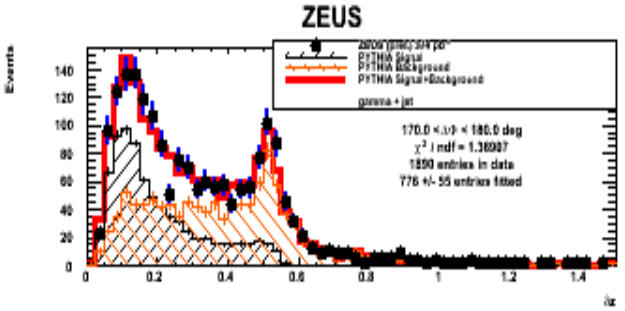












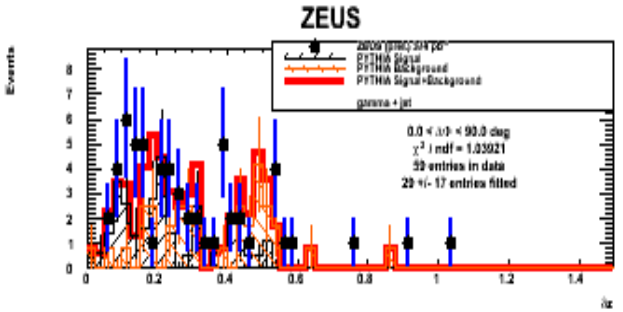
First bin $0 < \Delta\Phi < 90^\circ$:

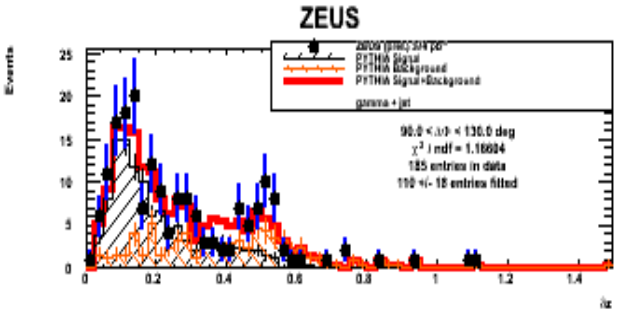
χ^2 / n.d.f. $= 0.94718$

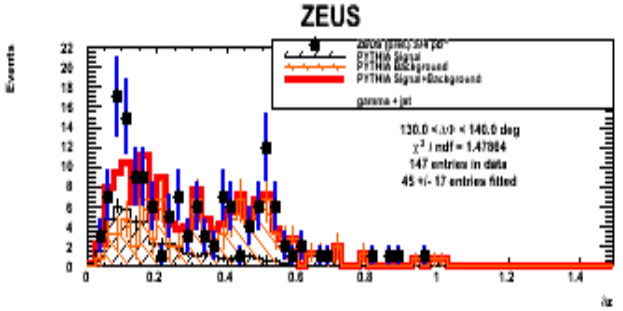
fitted photons 169 ± 34

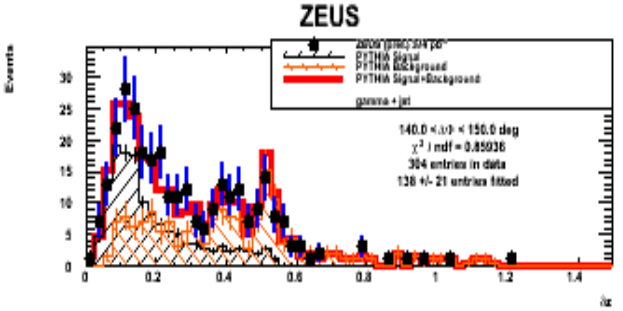
Bin looks good

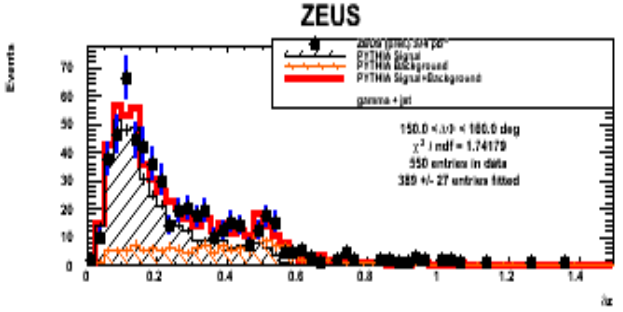
<δZ> Fits in ΔΦ bins. x_γ > 0.8

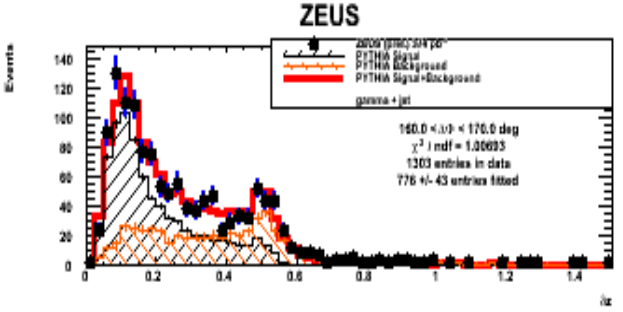


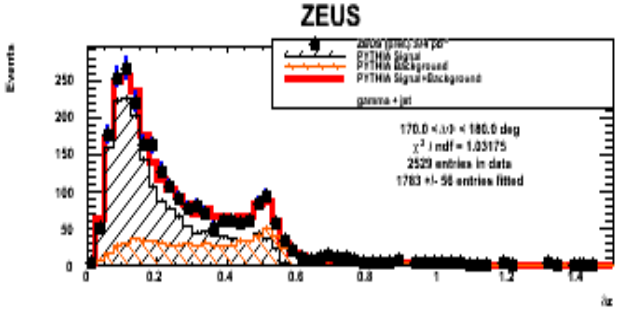












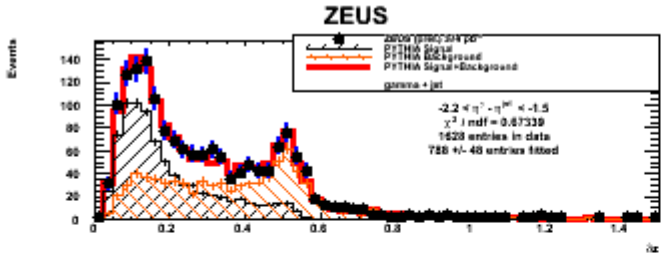
First bin 0 < ΔΦ < 90º:

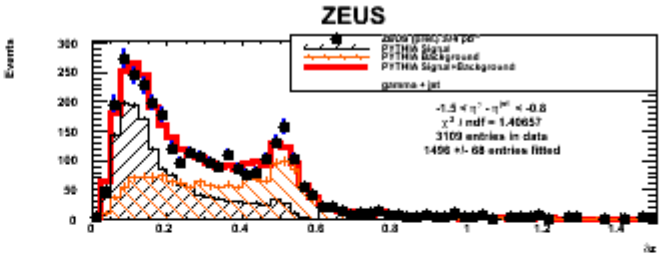
χ^2 / n.d.f. = 0.92611

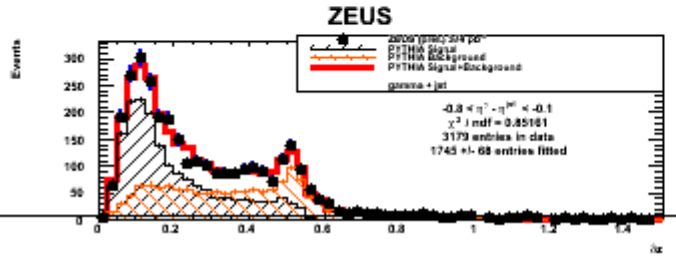
fitted photons 38 ± 13

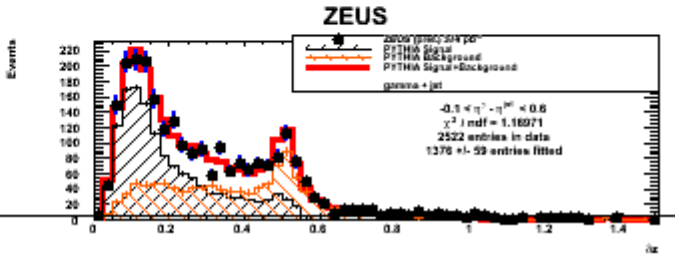
Small statistics

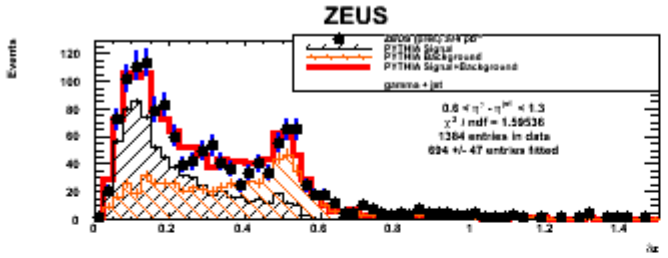
<δZ> Fits in η^{γ} - η^{jet} bins. All x_{γ}

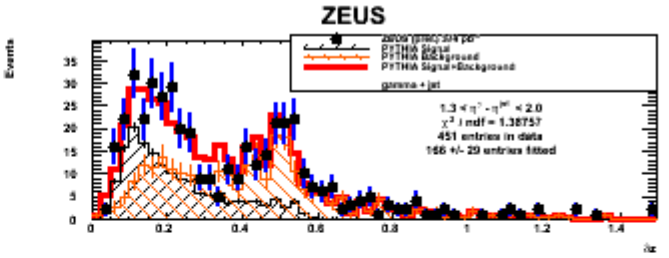


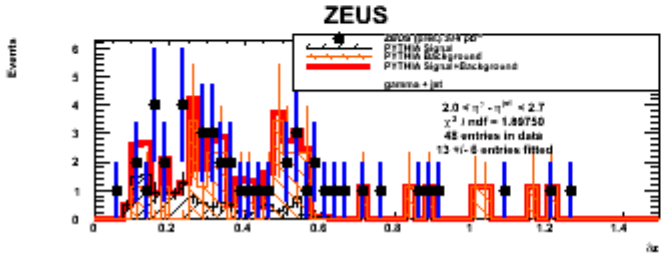




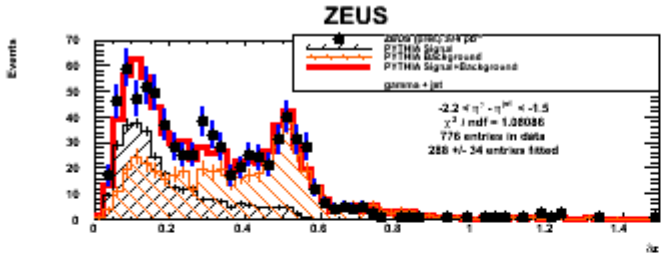


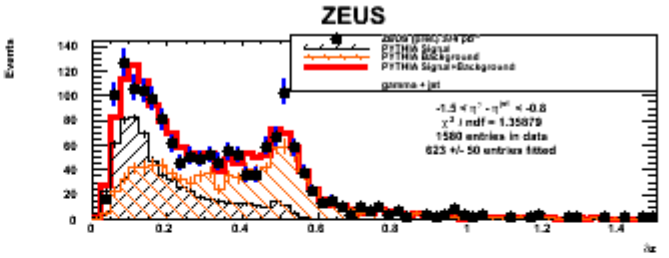


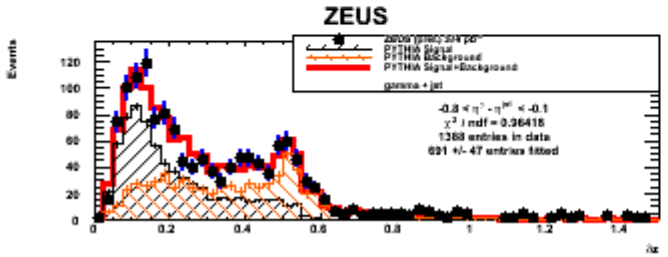


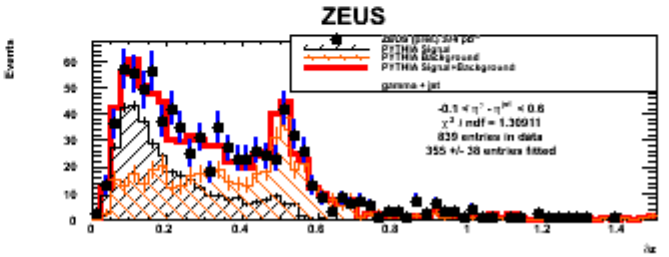


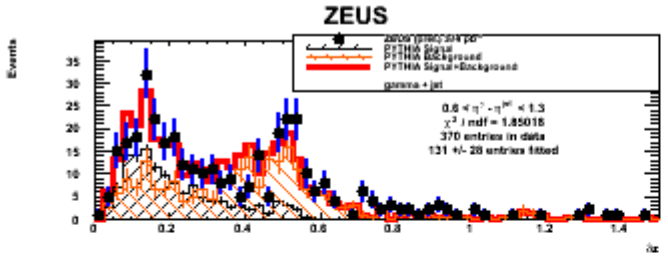
<δZ> Fits in η^{γ} - η^{jet} bins. $x_{\gamma} < 0.7$

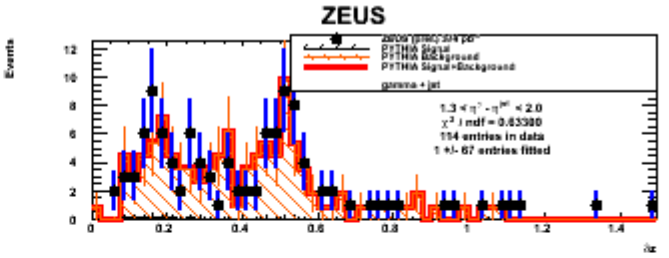


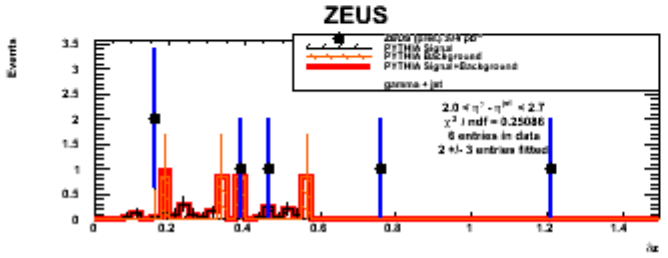




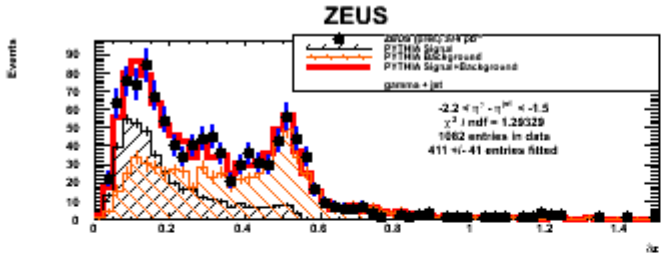


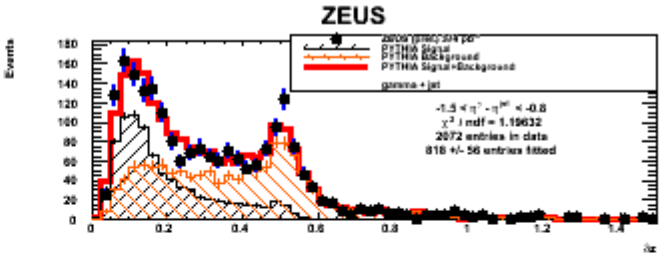


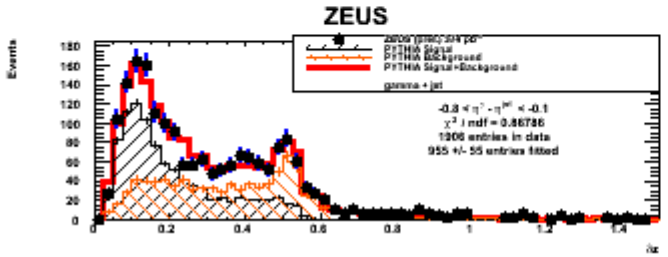


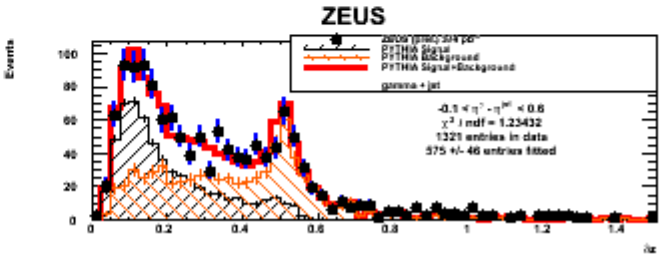


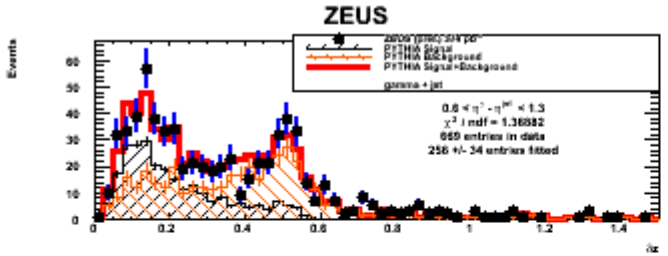
<δZ> Fits in η^{γ} - η^{jet} bins. $x_{\gamma} < 0.8$

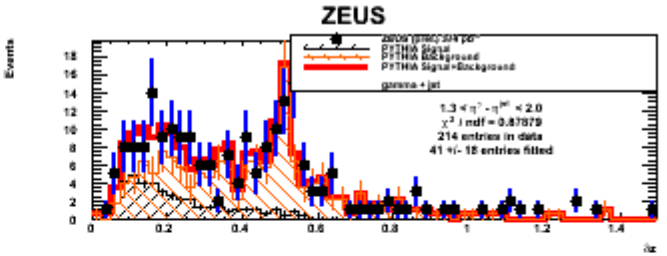


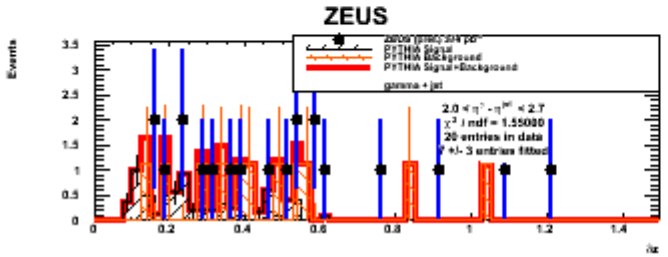




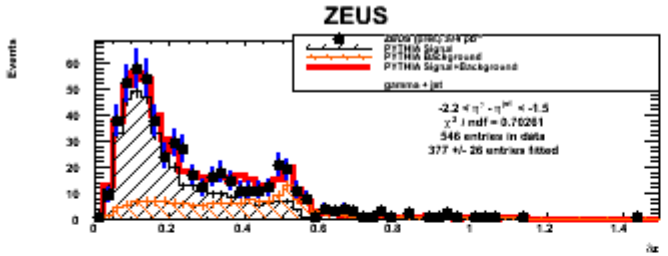


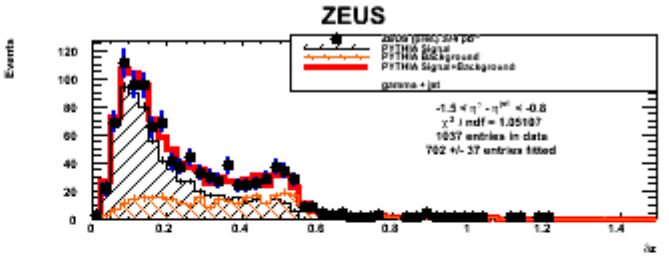


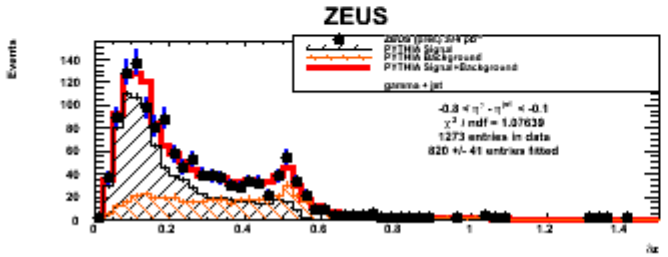


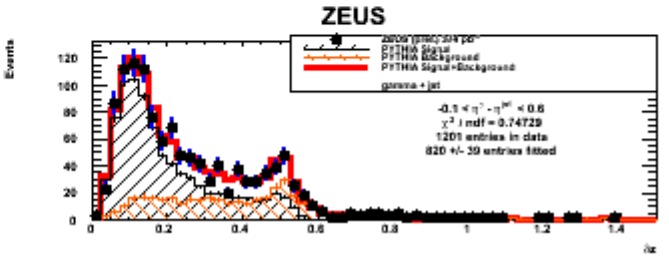


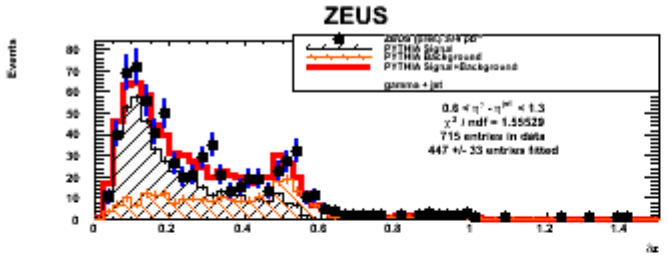
<δZ> Fits in η^{γ} - η^{jet} bins. $x_{\gamma} > 0.8$

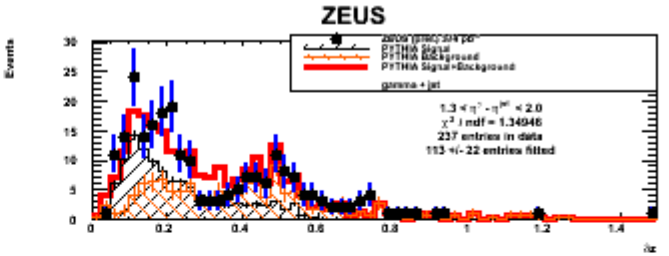


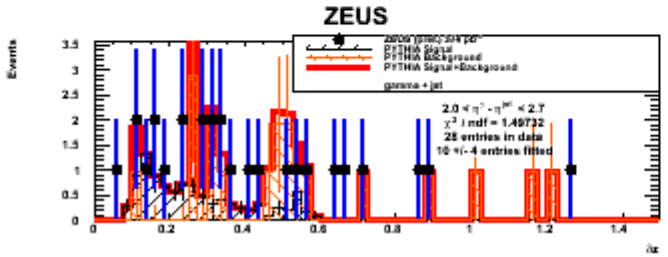




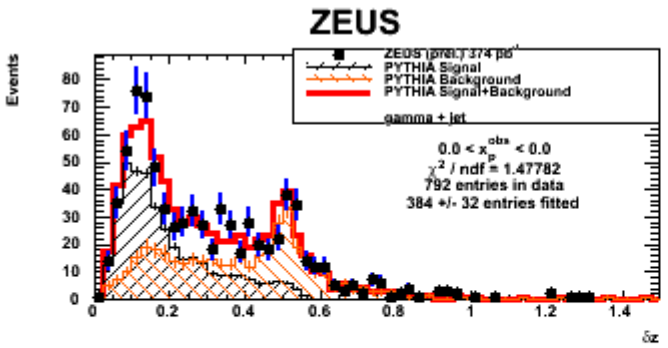


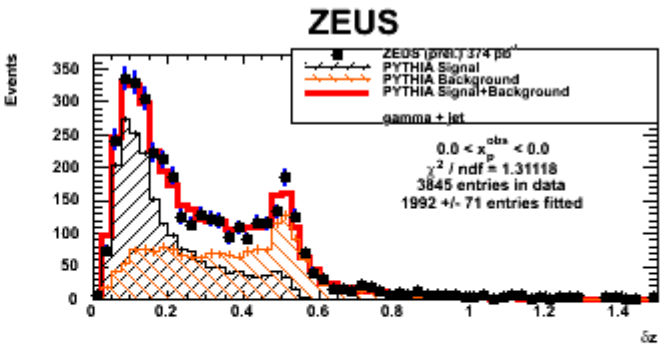


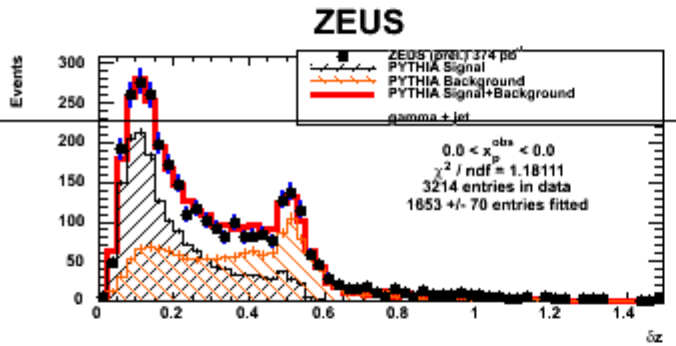


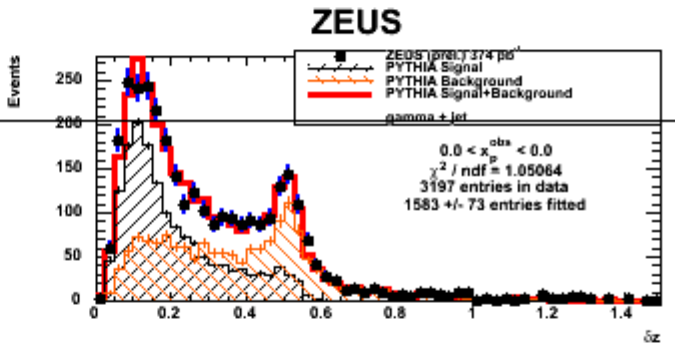


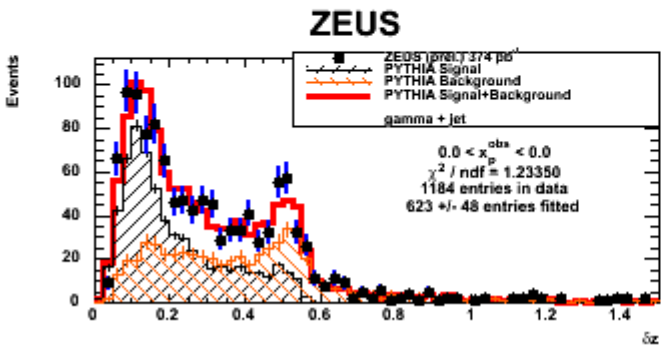
<δZ> Fits in x_p bins. All x_γ

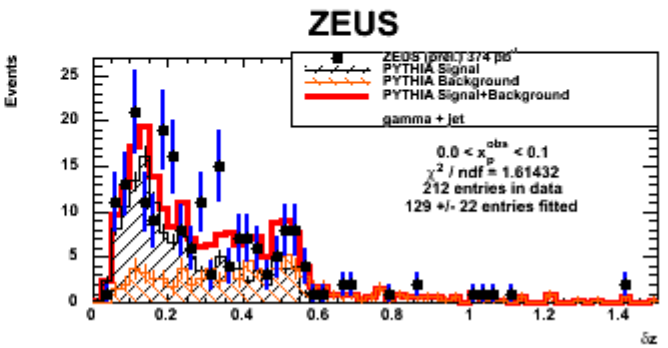




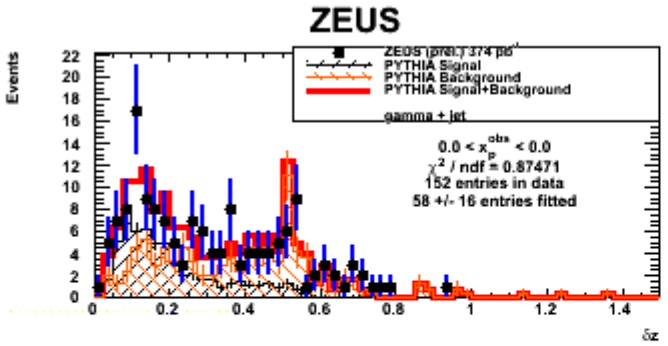


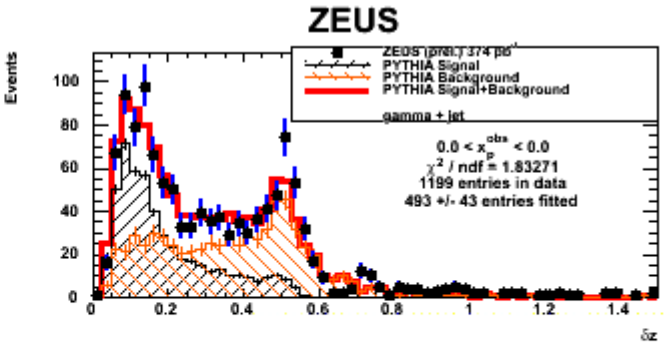


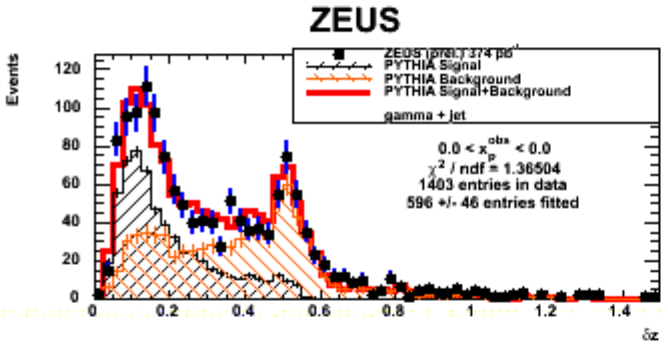


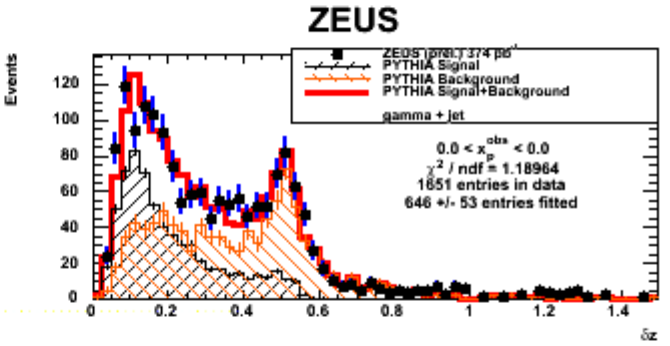


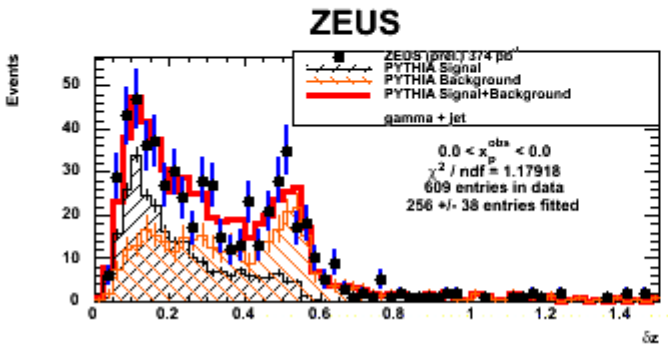
<δZ> Fits in x_p bins. x_γ < 0.7

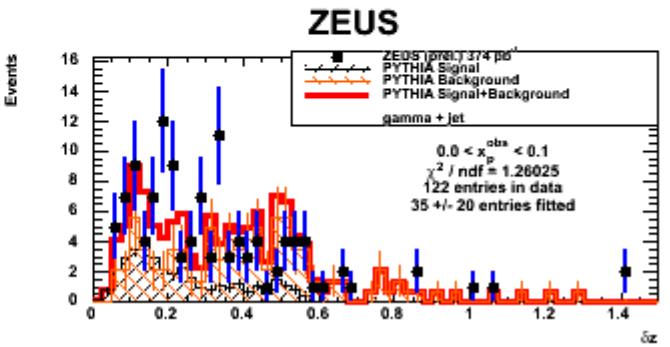




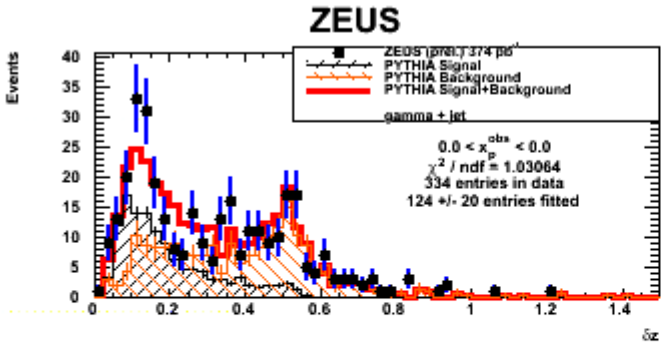


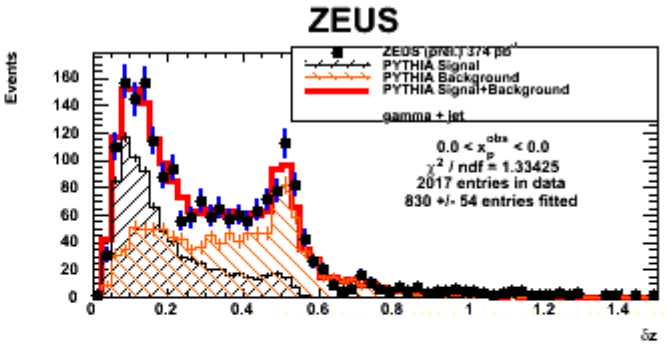


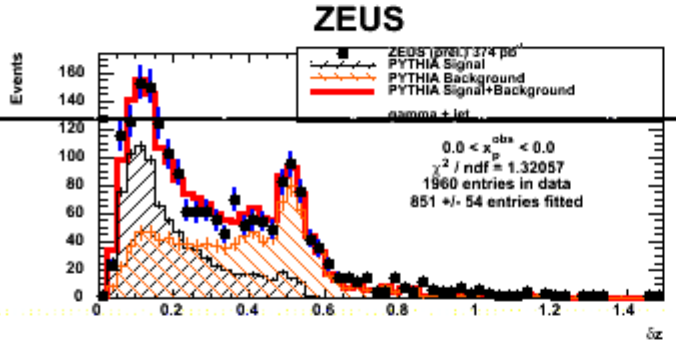


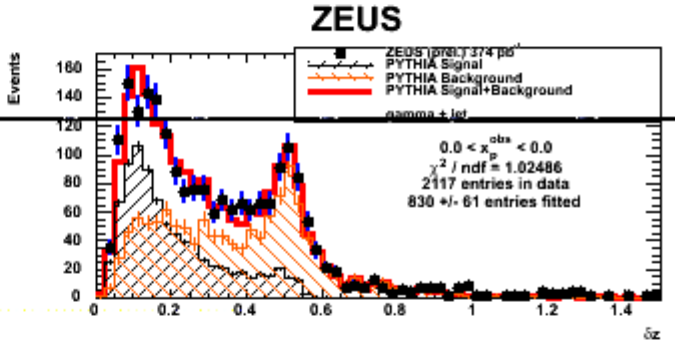


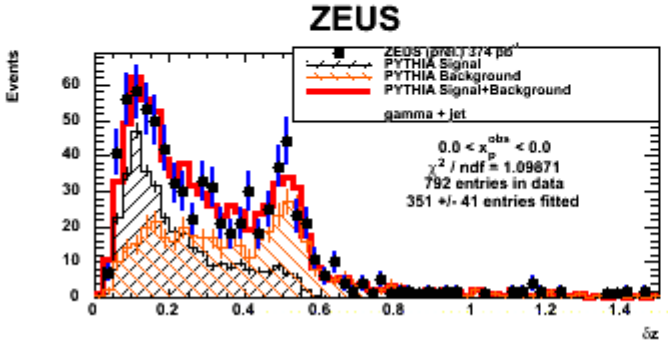
<δZ> Fits in x_p bins. x_γ < 0.8

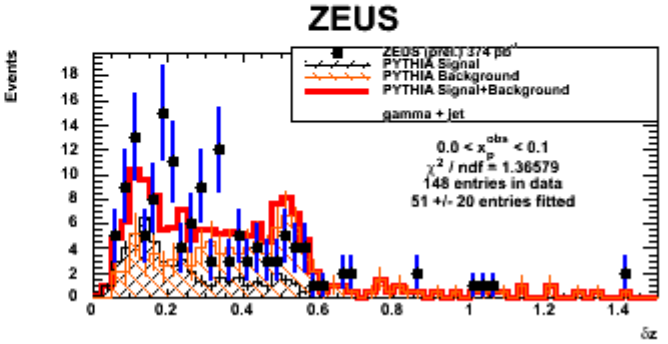




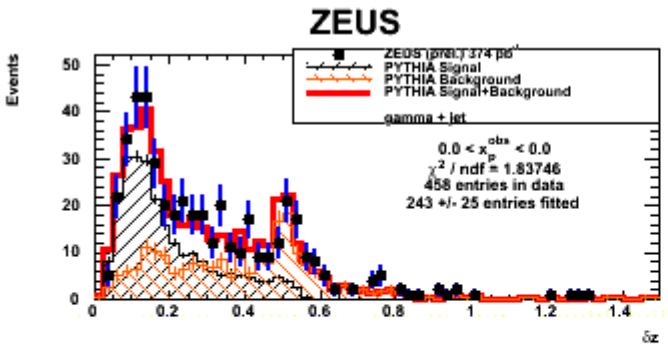


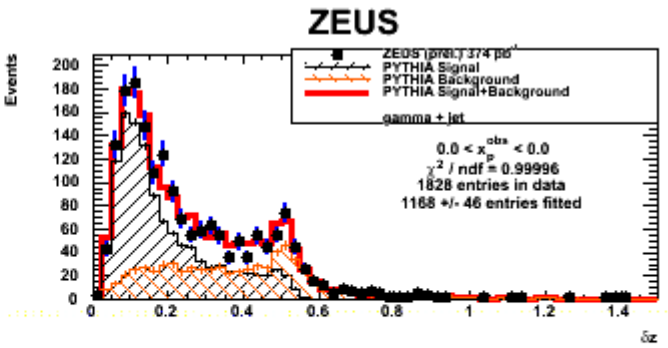


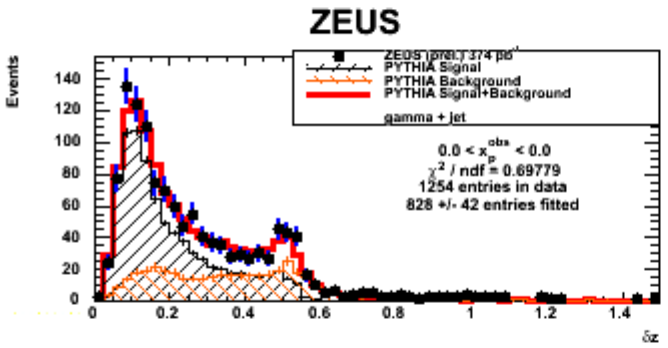


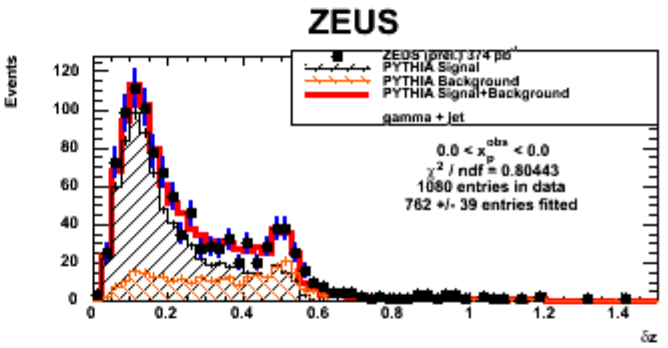


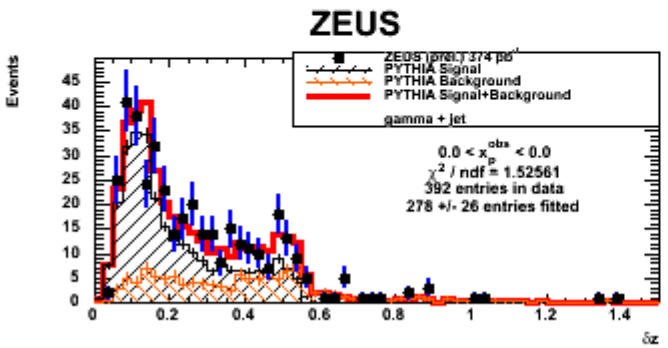
<δZ> Fits in x_p bins. x_γ > 0.8

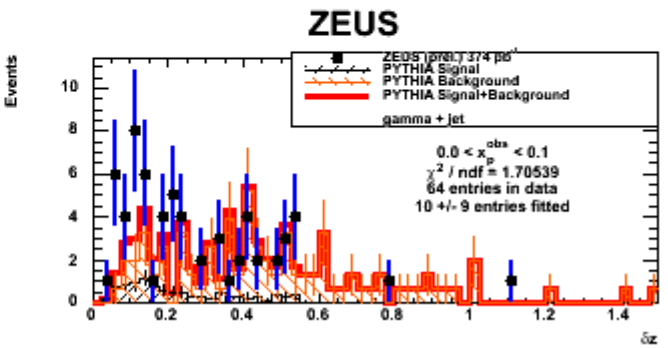




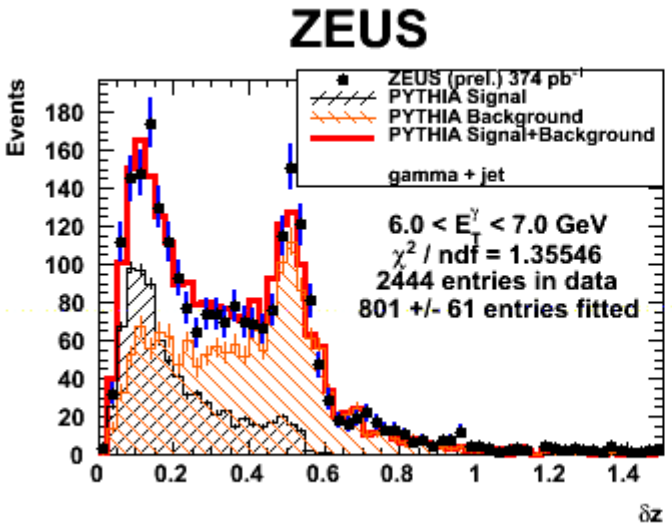


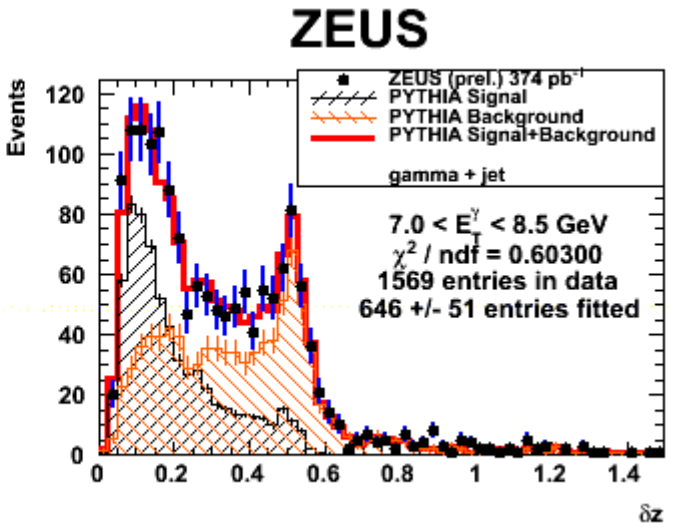


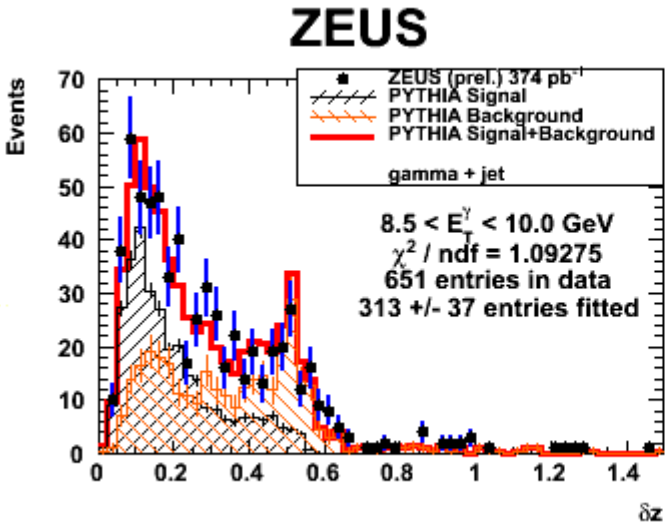


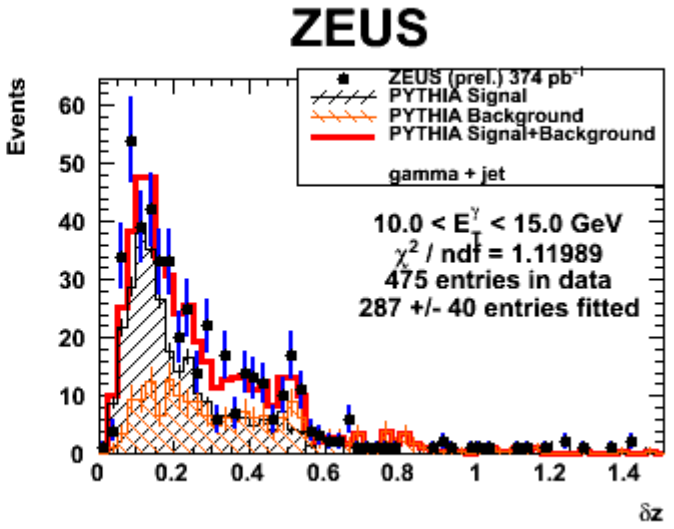


<δZ> Fits in E_T^γ bins. x_γ < 0.7

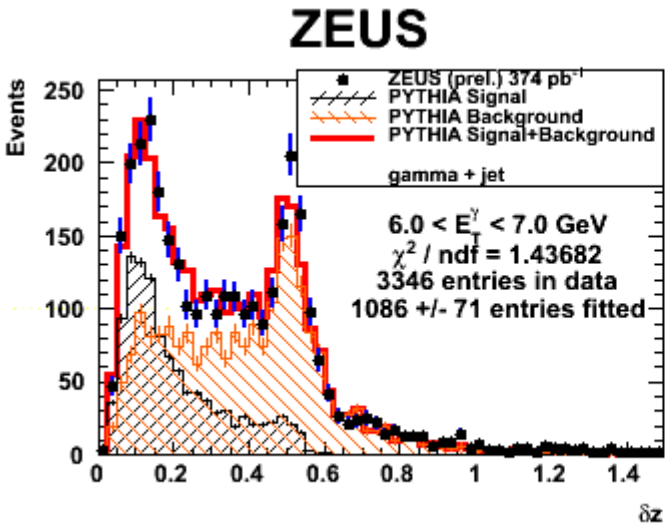


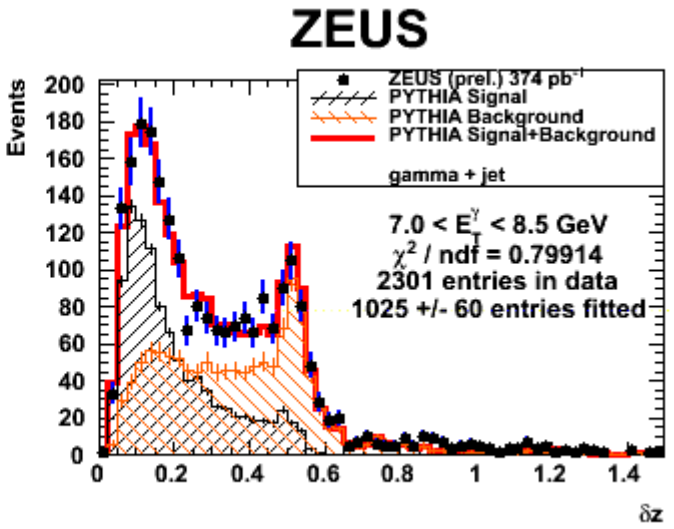


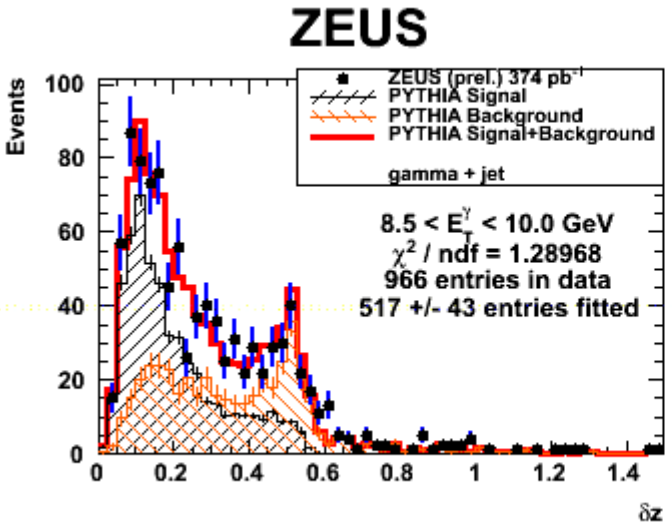


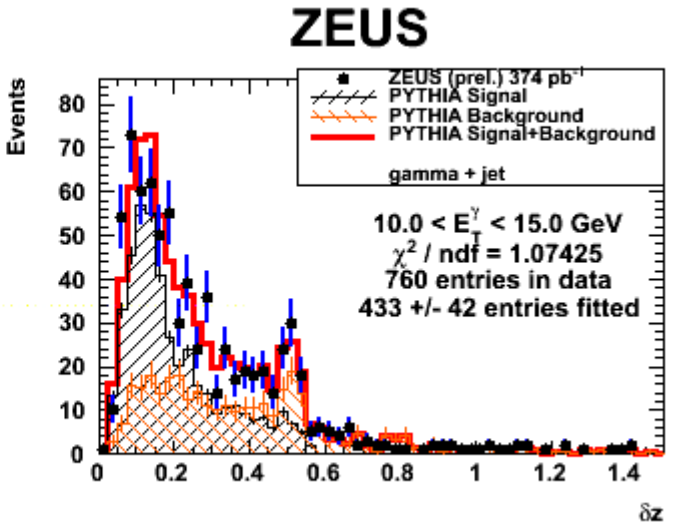


<δZ> Fits in E_T^γ bins. x_γ < 0.8

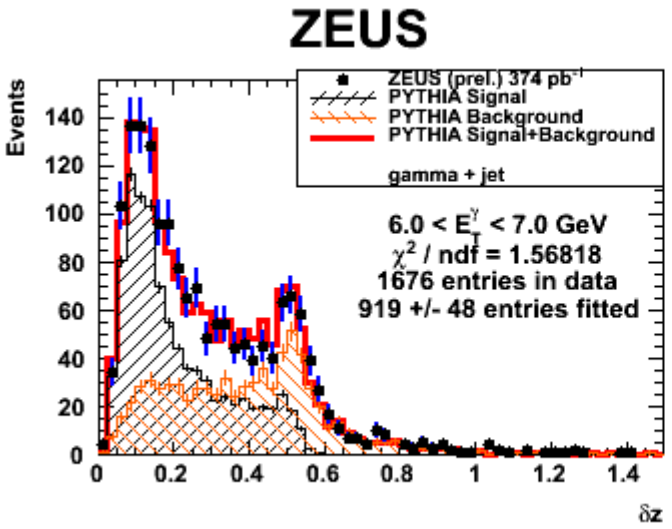


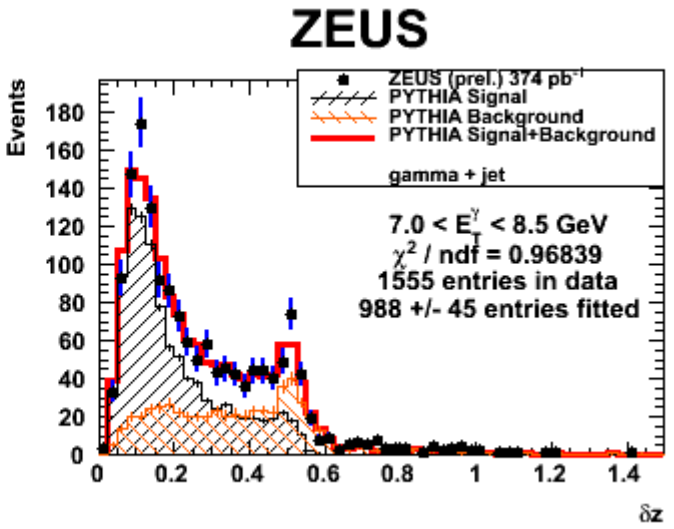


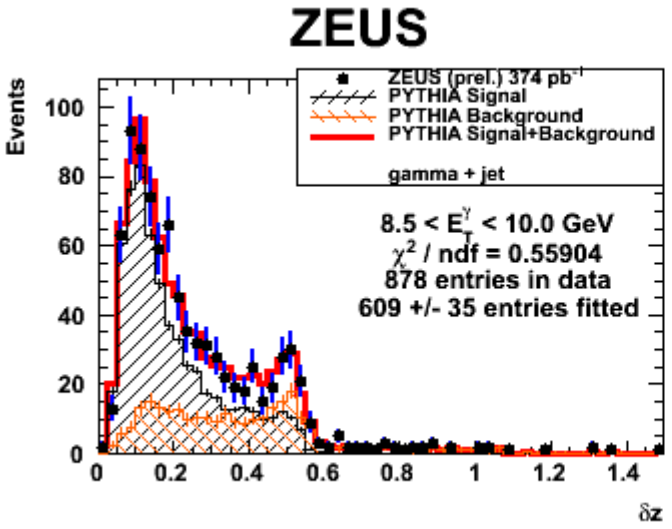


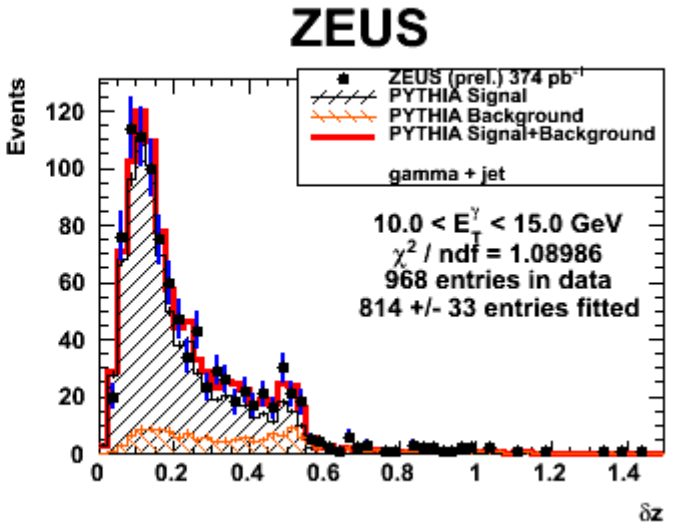


<δZ> Fits in E_T^γ bins. $x_\gamma > 0.8$

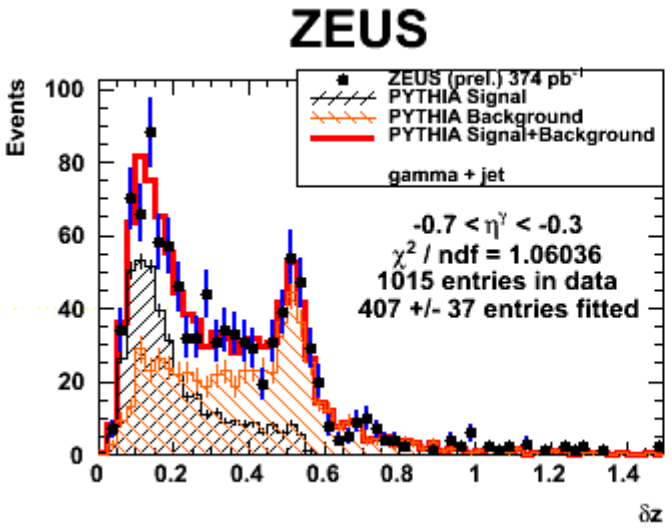


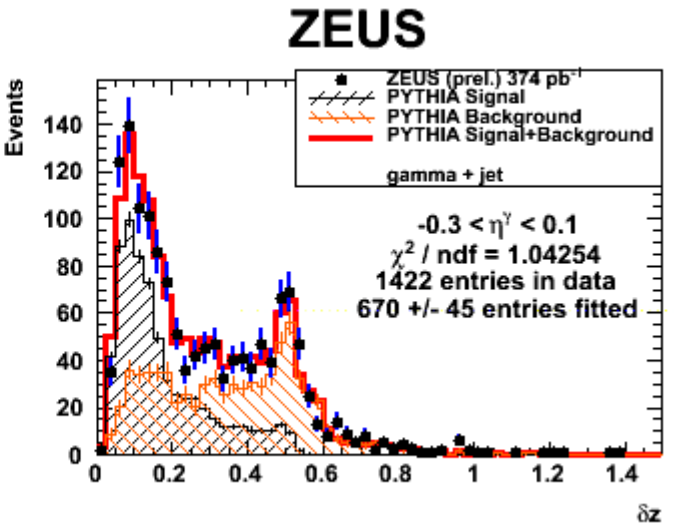


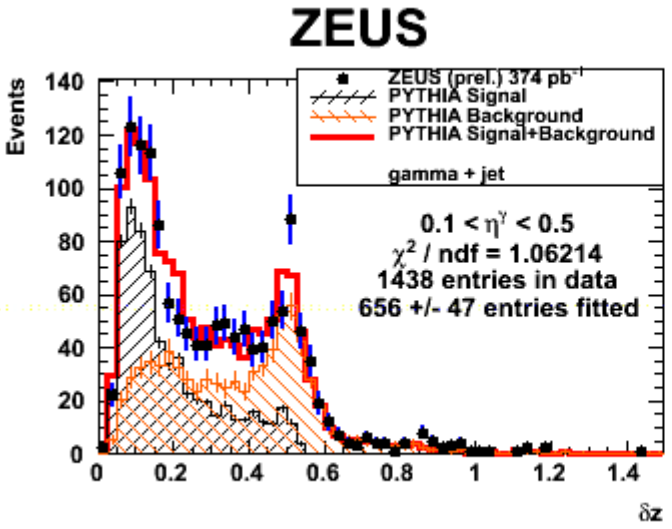


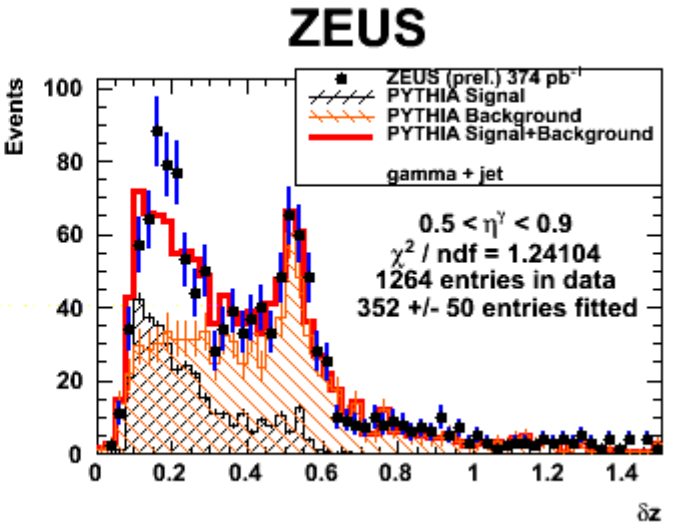


<δZ> Fits in η^{γ} bins. $x_{\gamma} < 0.7$

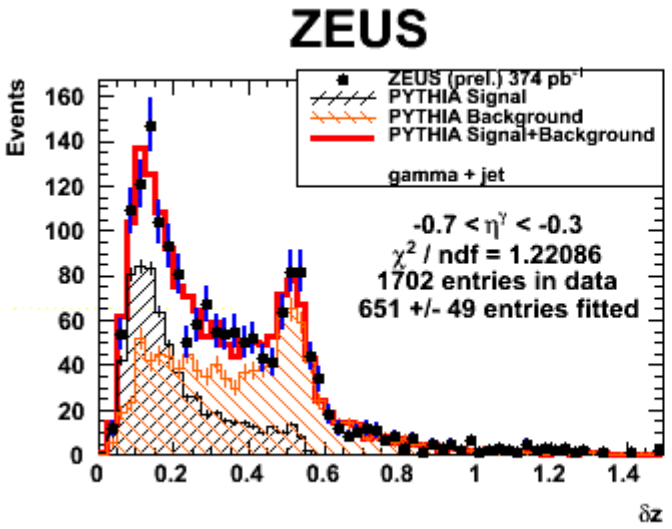


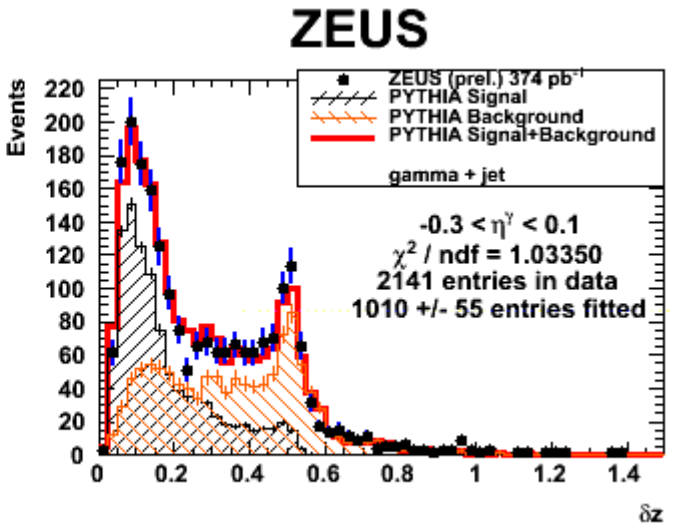


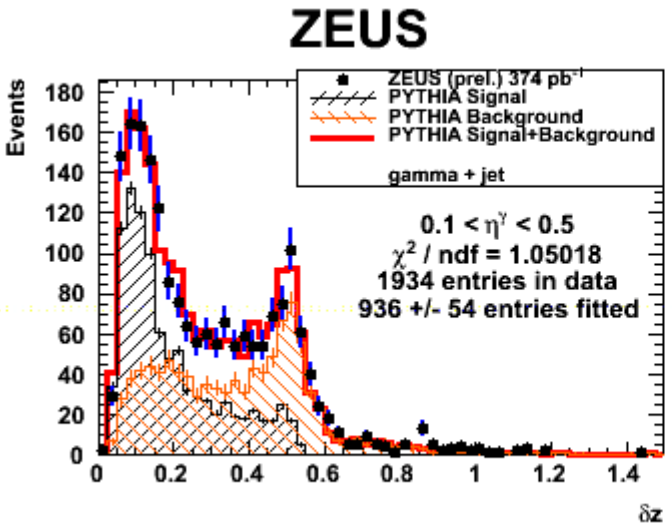


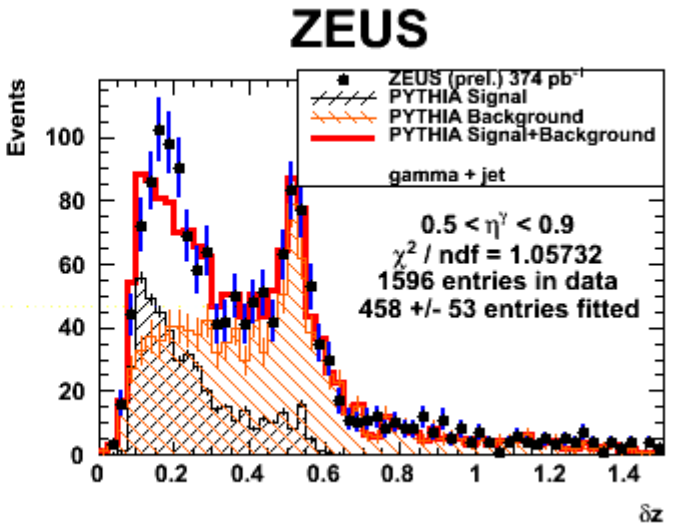


<δZ> Fits in η^{γ} bins. $x_{\gamma} < 0.8$

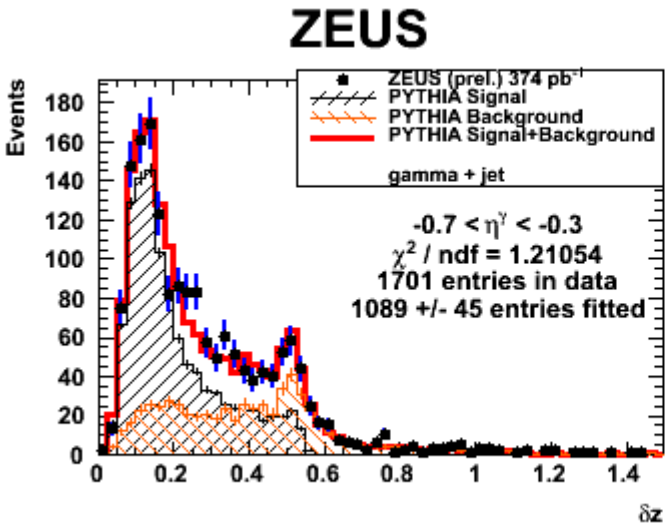


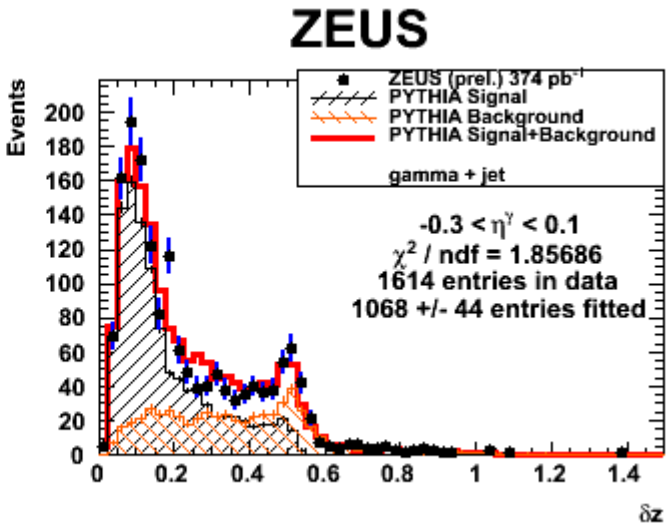


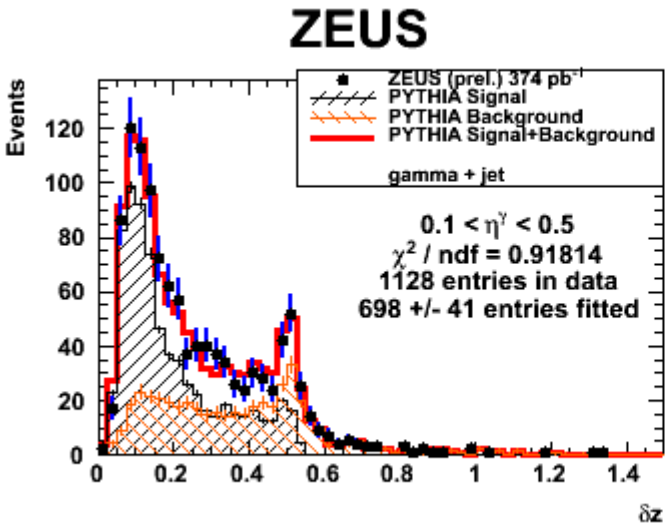


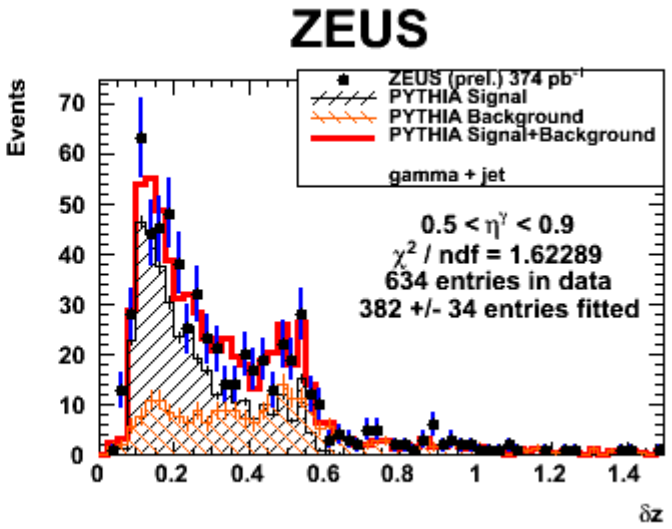


<δZ> Fits in η^{γ} bins. $x_{\gamma} > 0.8$

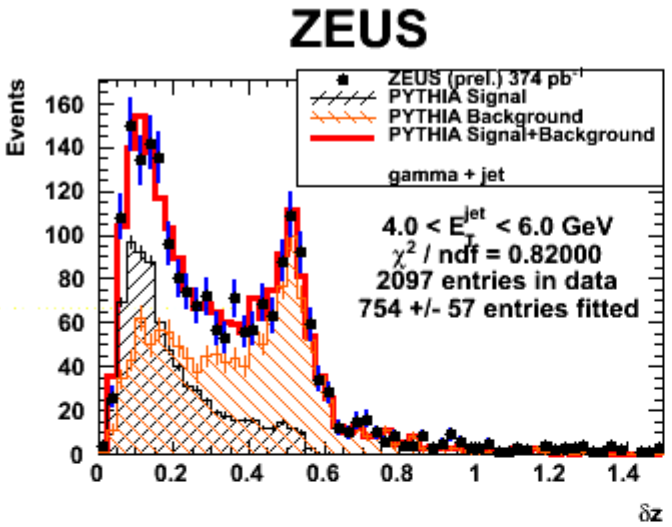


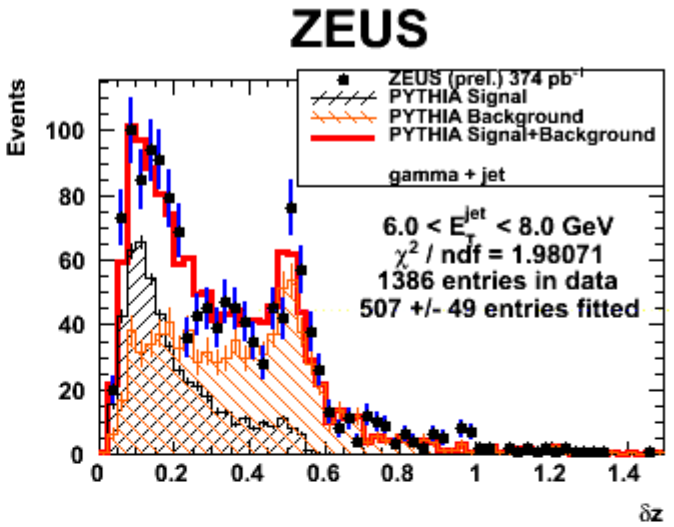


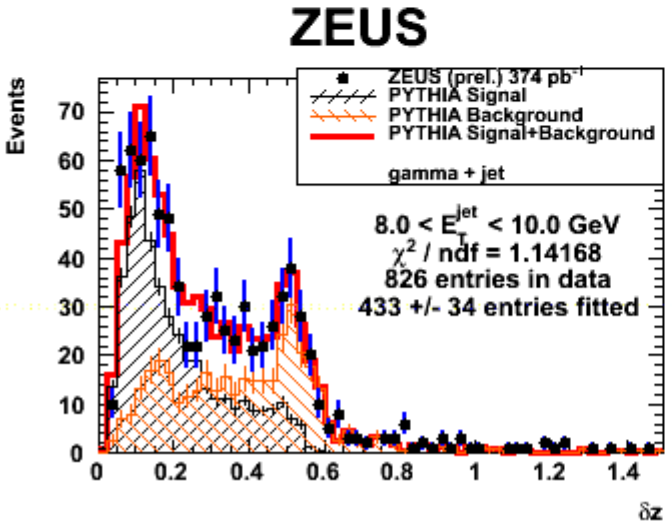


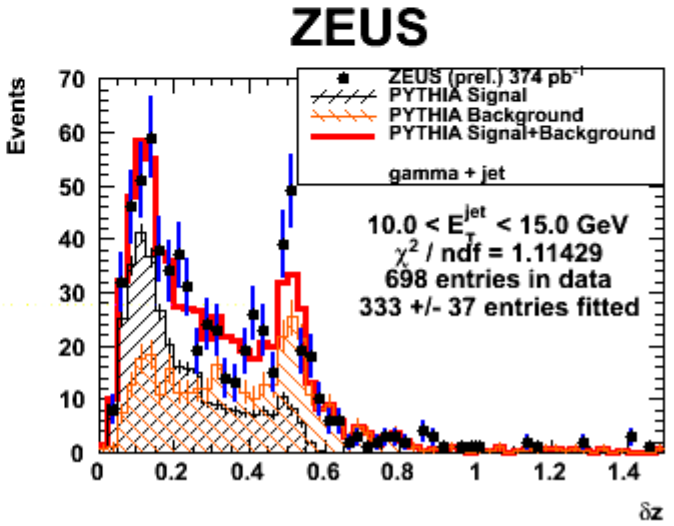


<δZ> Fits in E_T^{jet} bins. x_γ < 0.7

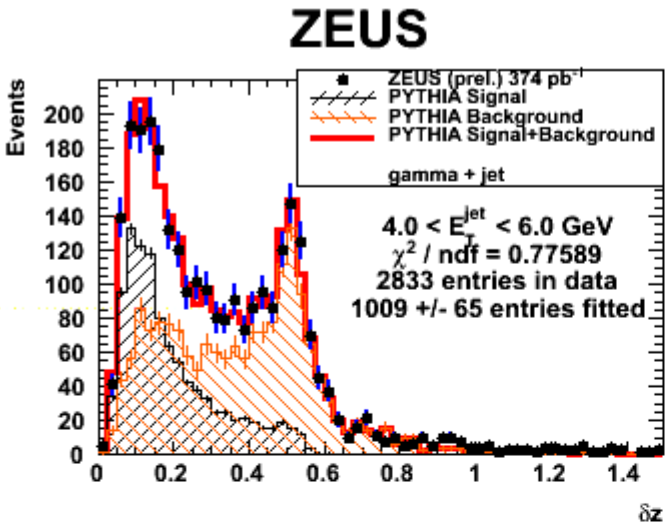


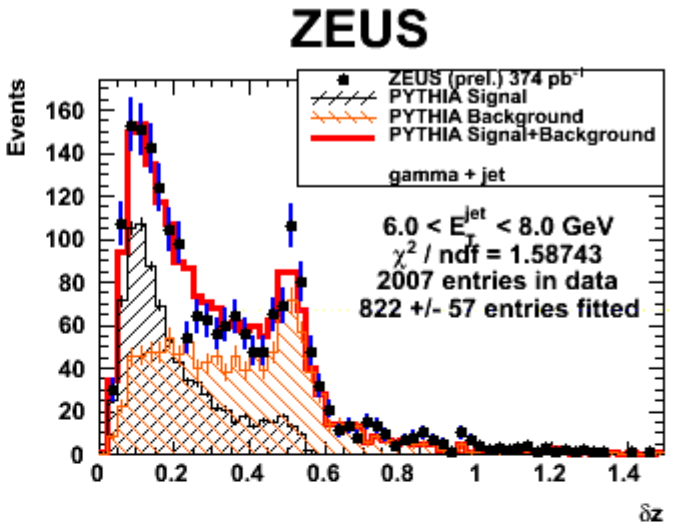


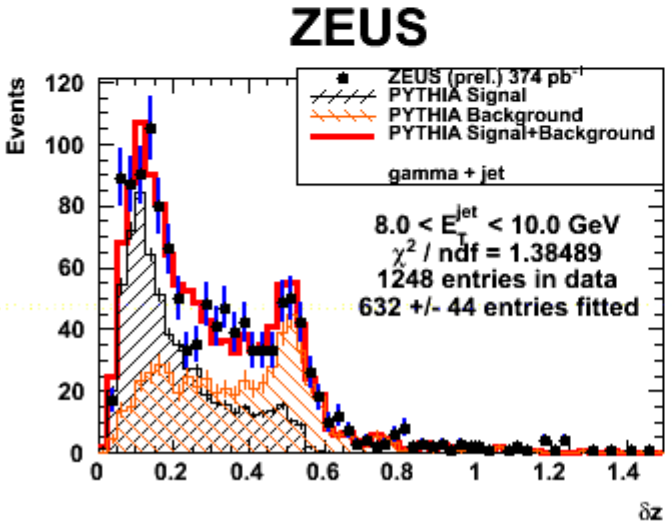


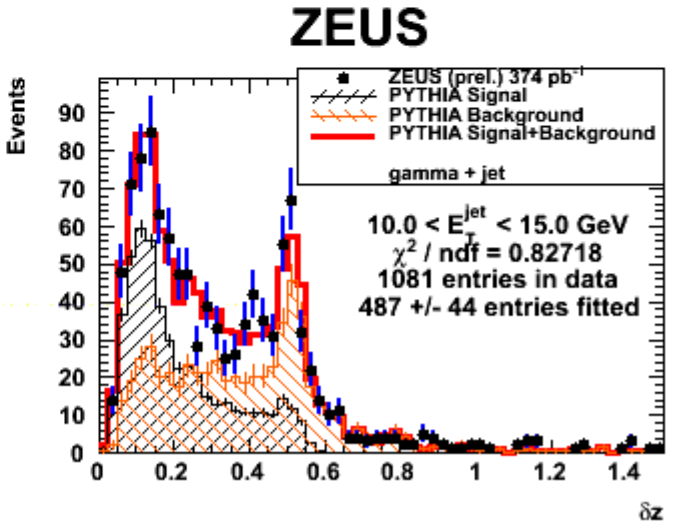


<δZ> Fits in E_T^{jet} bins. $x_\gamma < 0.8$

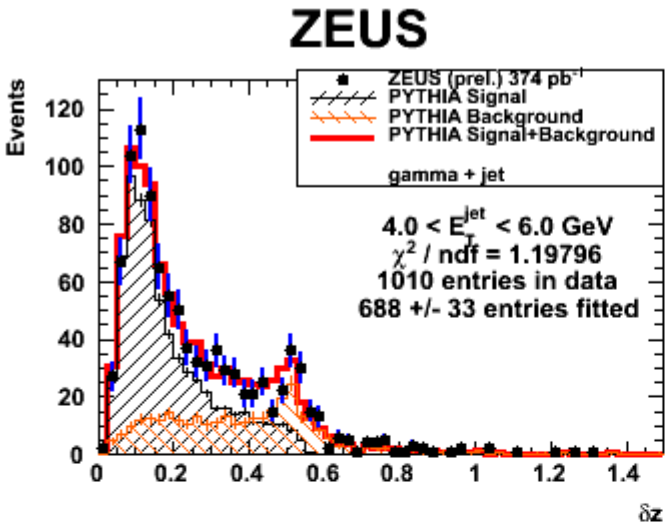


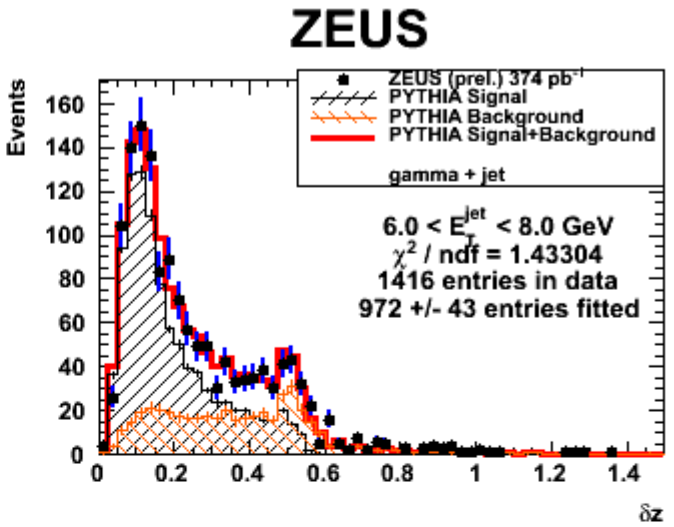


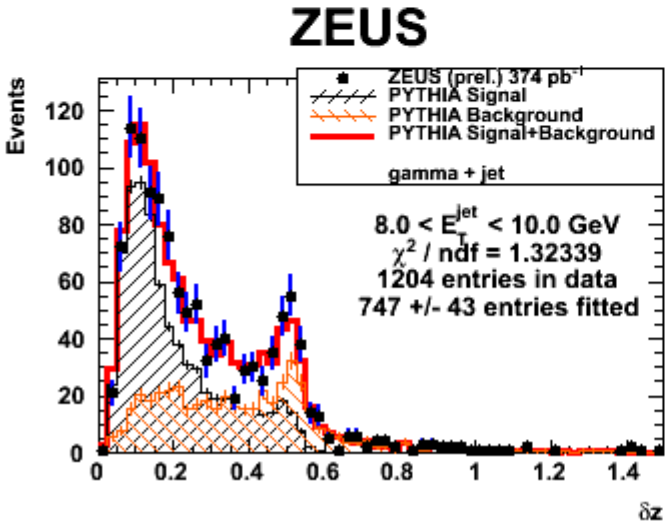


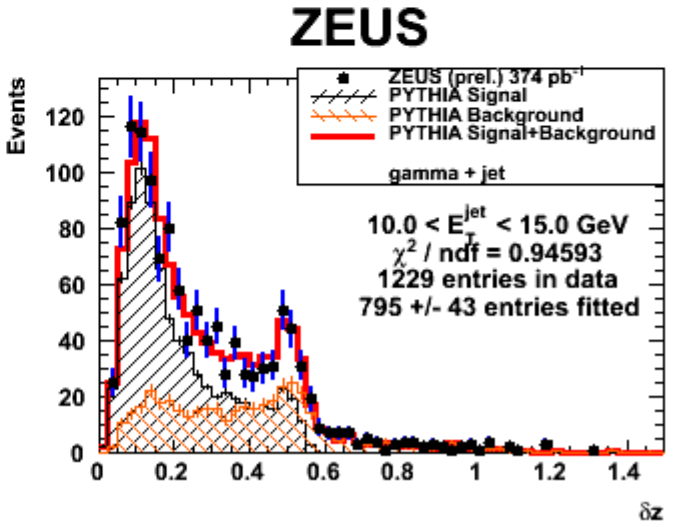


<δZ> Fits in E_T^{jet} bins. $x_\gamma > 0.8$

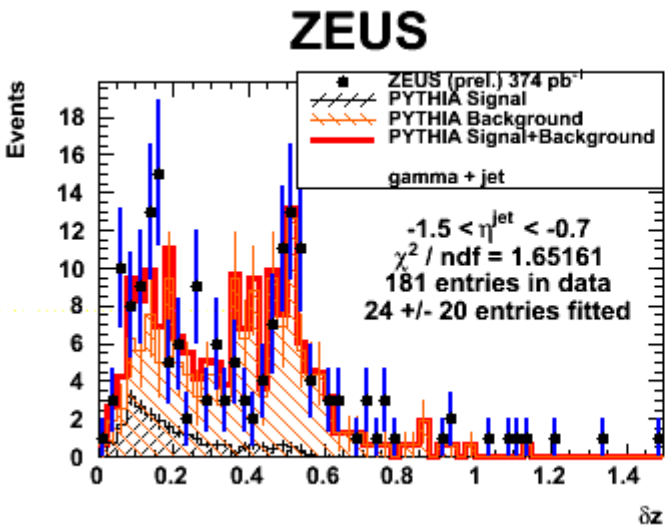


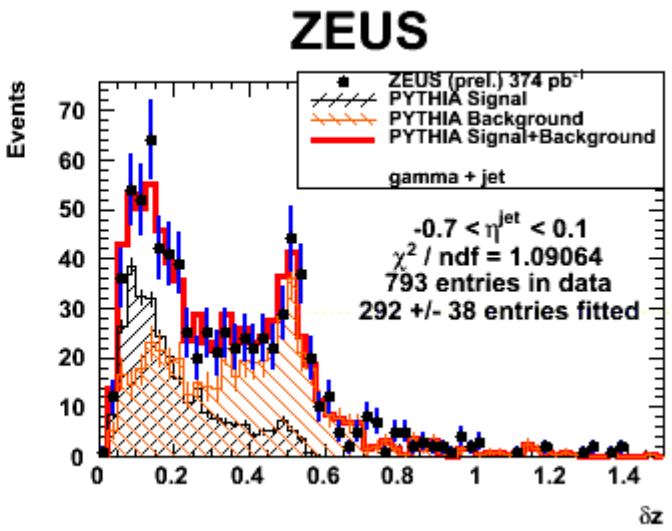


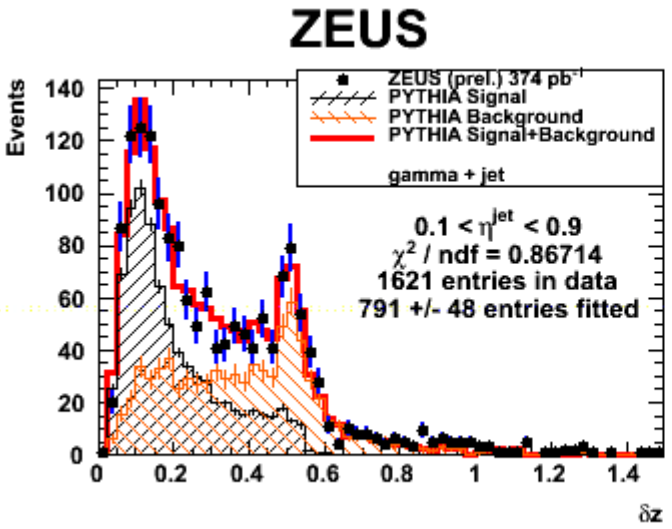


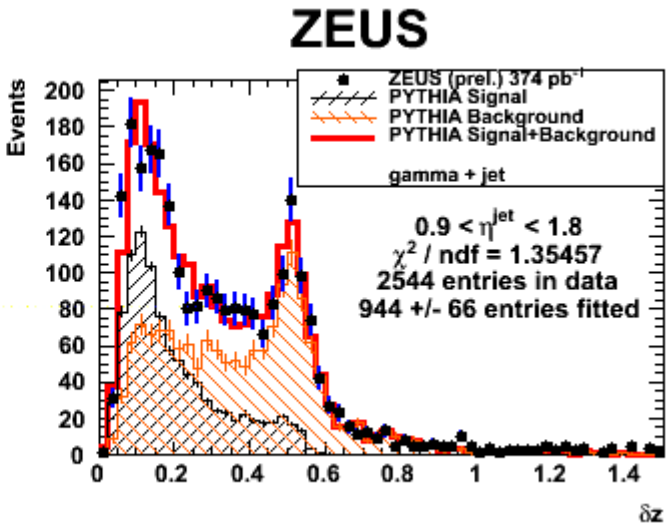


<δZ> Fits in η^{jet} bins. $x_\gamma < 0.7$









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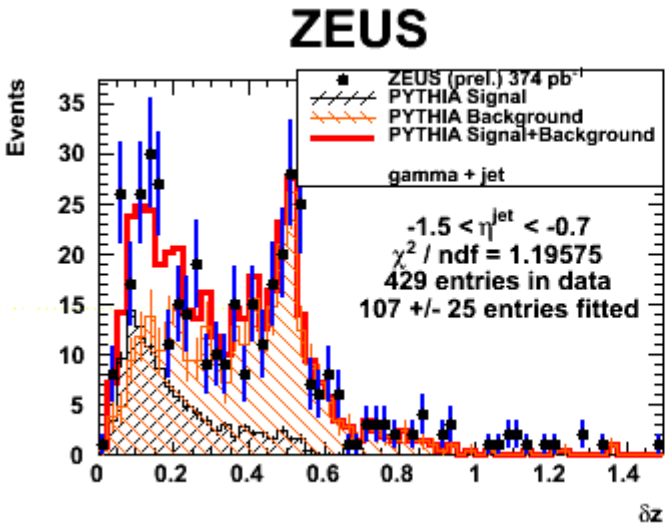
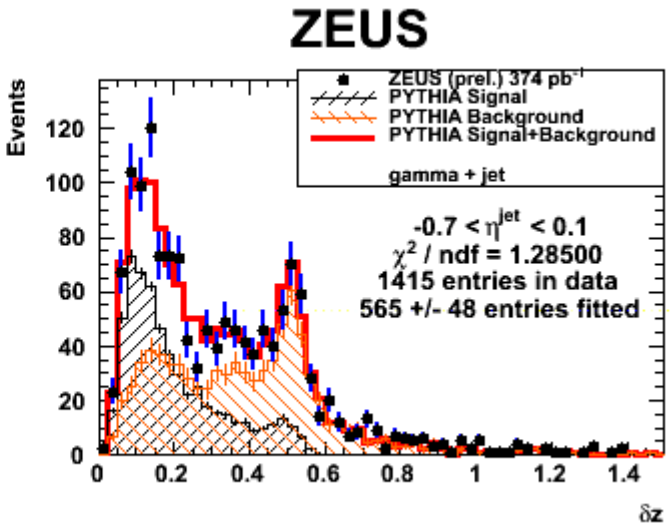
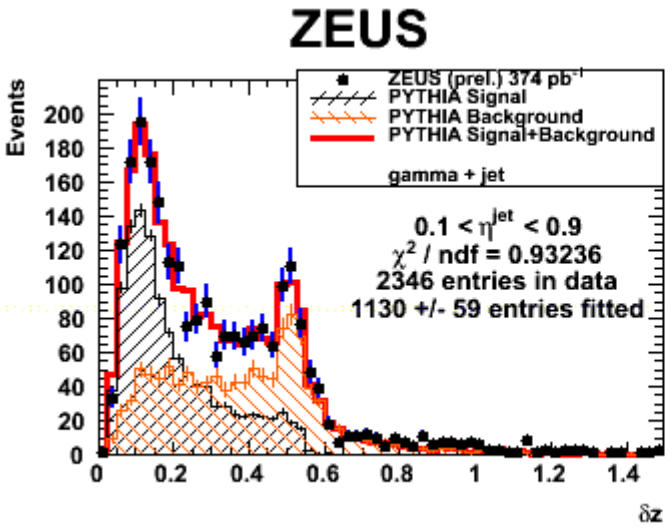
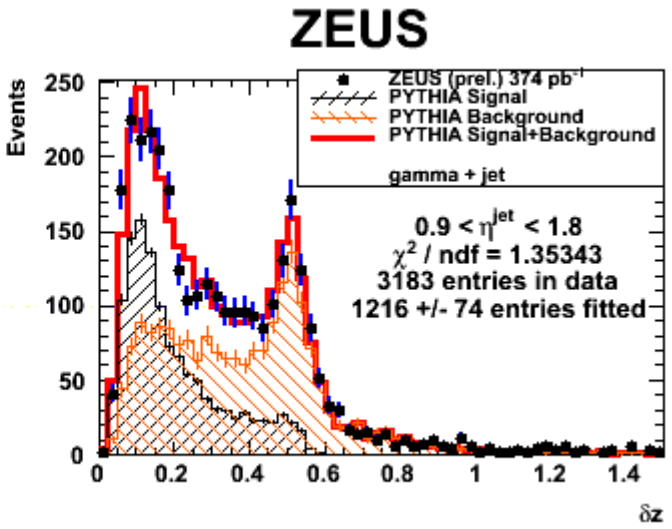
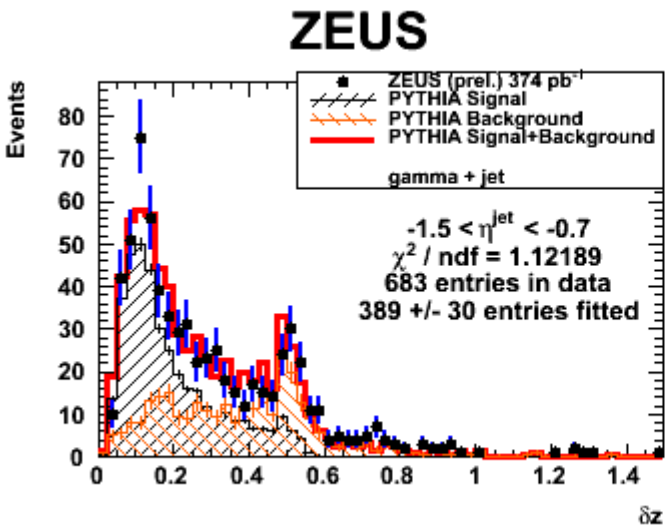


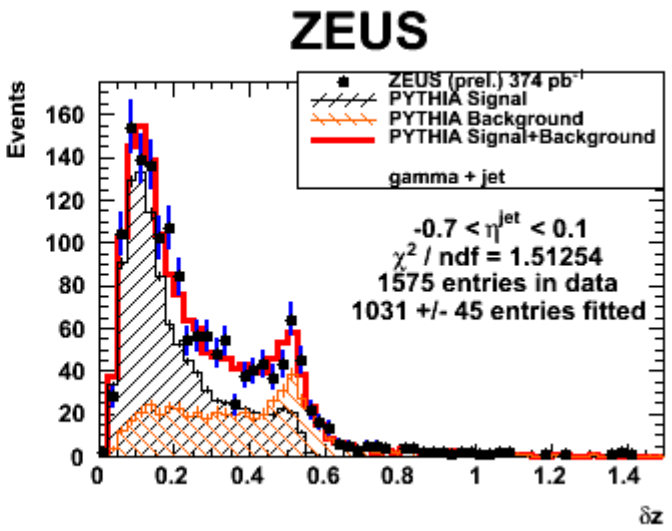


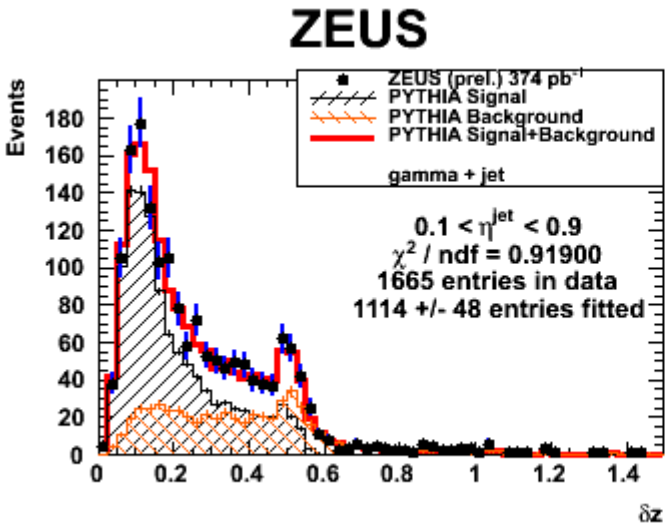


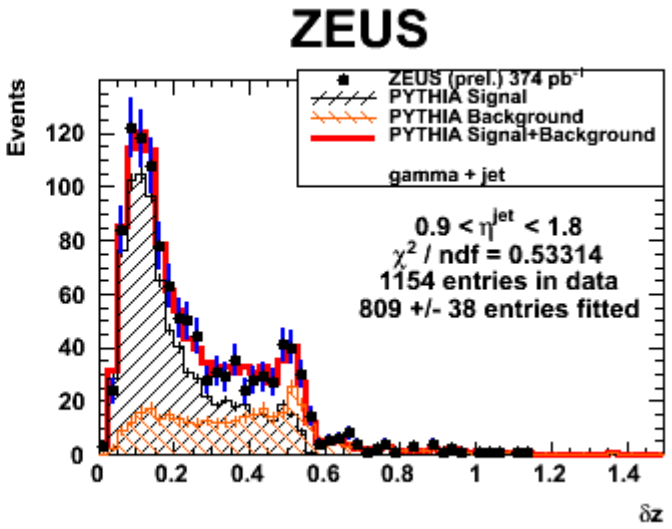


<δZ> Fits in η^{jet} bins. $x_\gamma > 0.8$

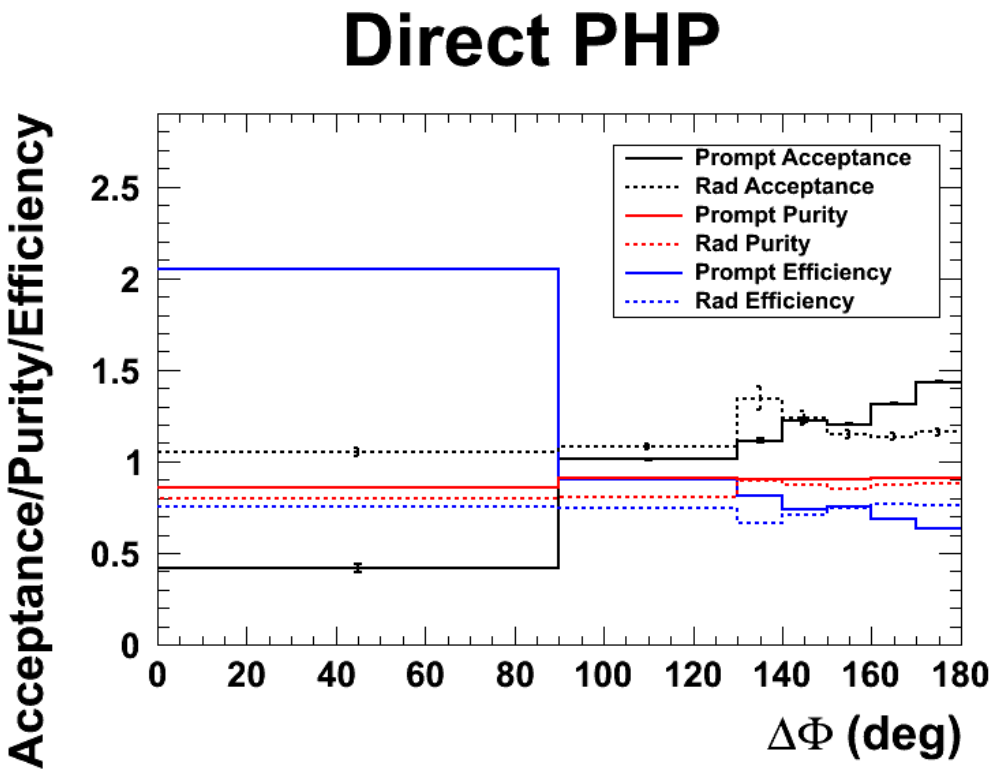


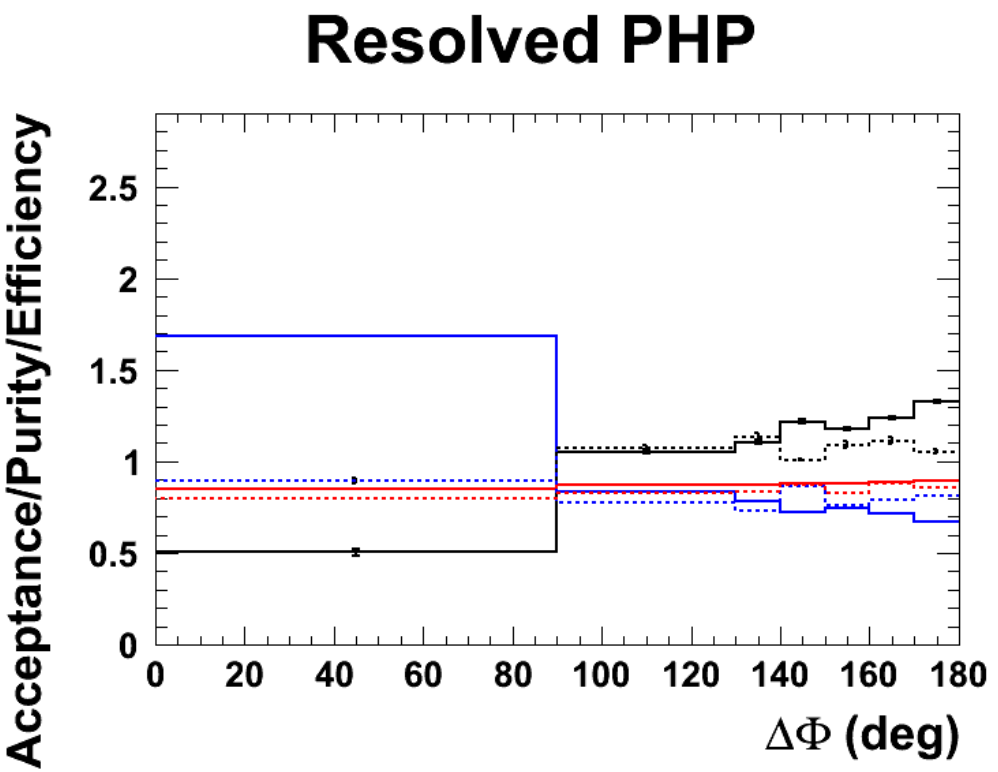


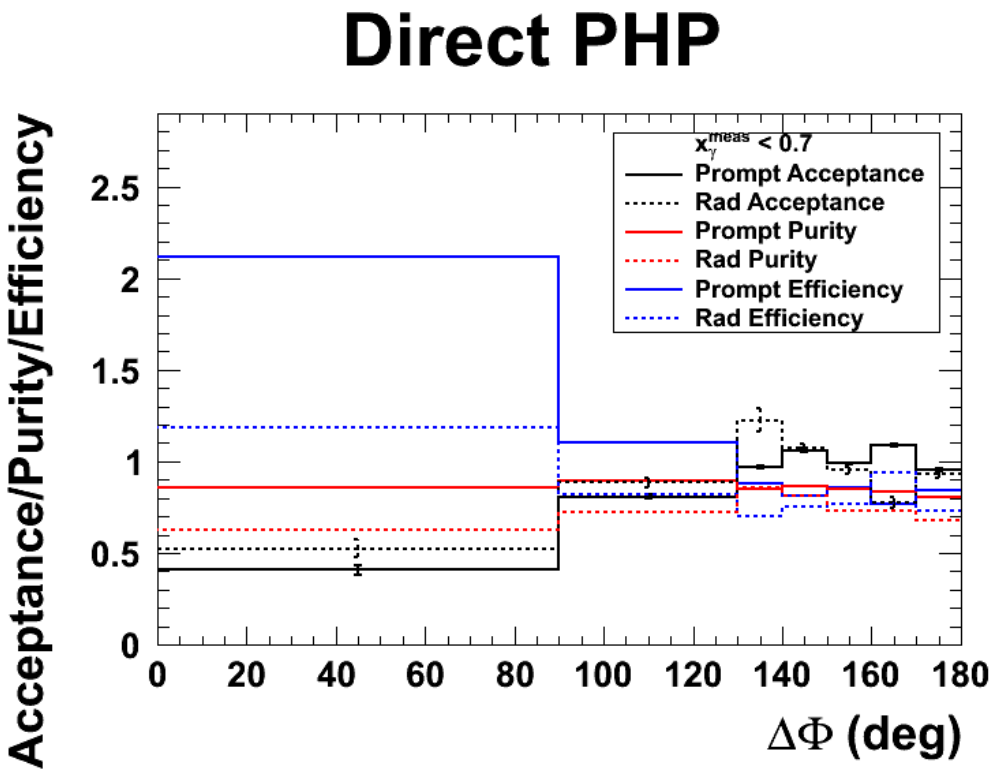


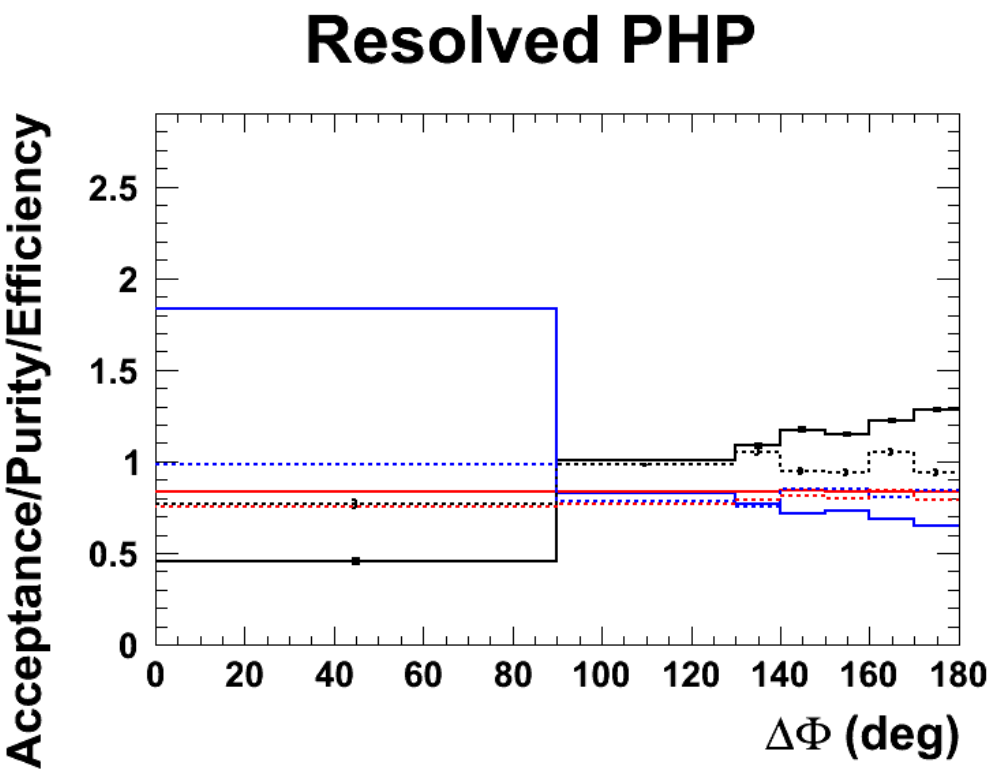


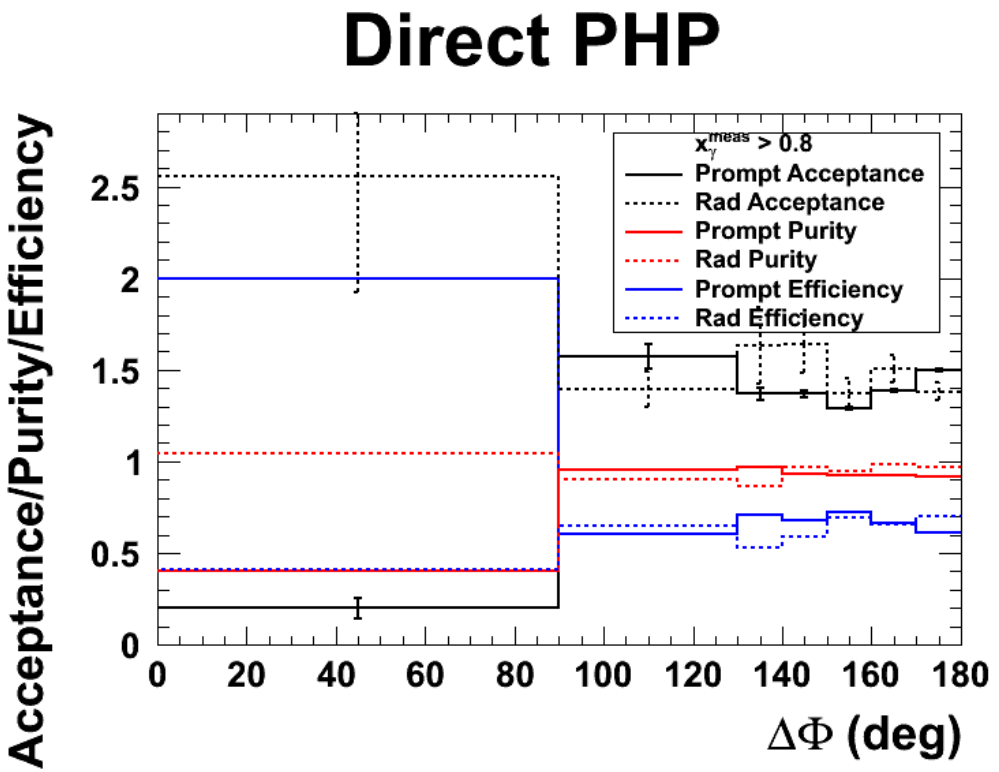
Acceptance, purity, efficiency

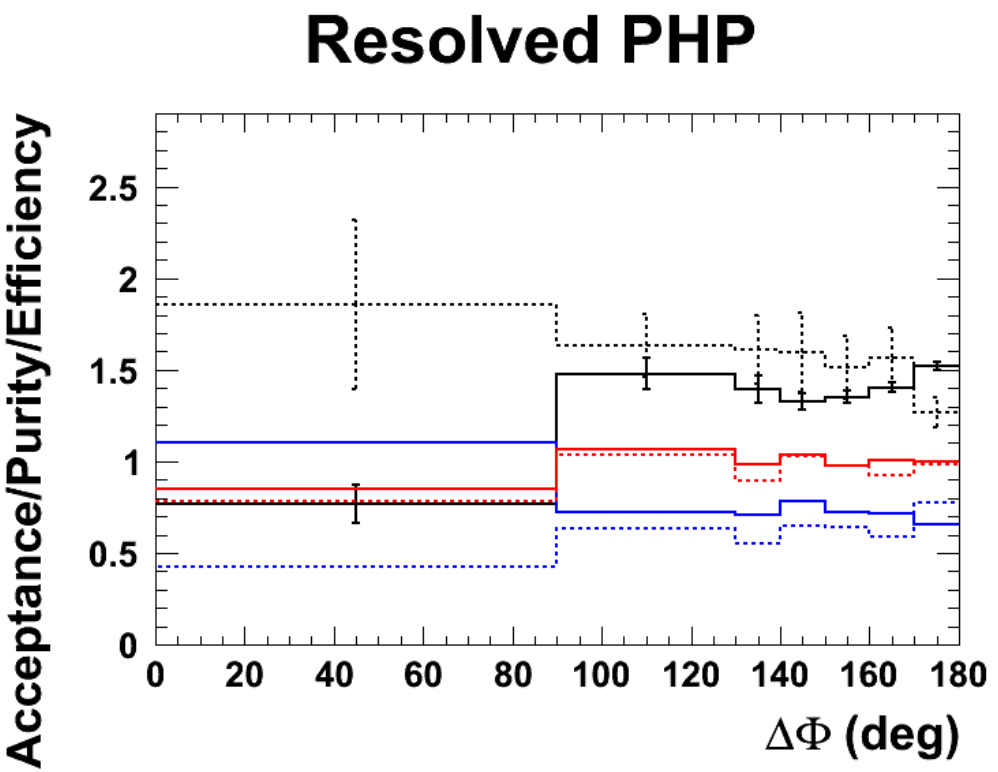

Direct PHP
Acceptance/Purity/Efficiency
Prompt Acceptance
Rad Acceptance
Prompt Purity
Rad Purity
Prompt Efficiency
Rad Efficiency
0
0.5
1
1.5
2
2.5
0
20
40
60
80
100
120
140
160
180
ΔΦ (deg)


Resolved PHP
Acceptance/Purity/Efficiency
0
0.5
1
1.5
2
2.5
0
20
40
60
80
100
120
140
160
180
ΔΦ (deg)

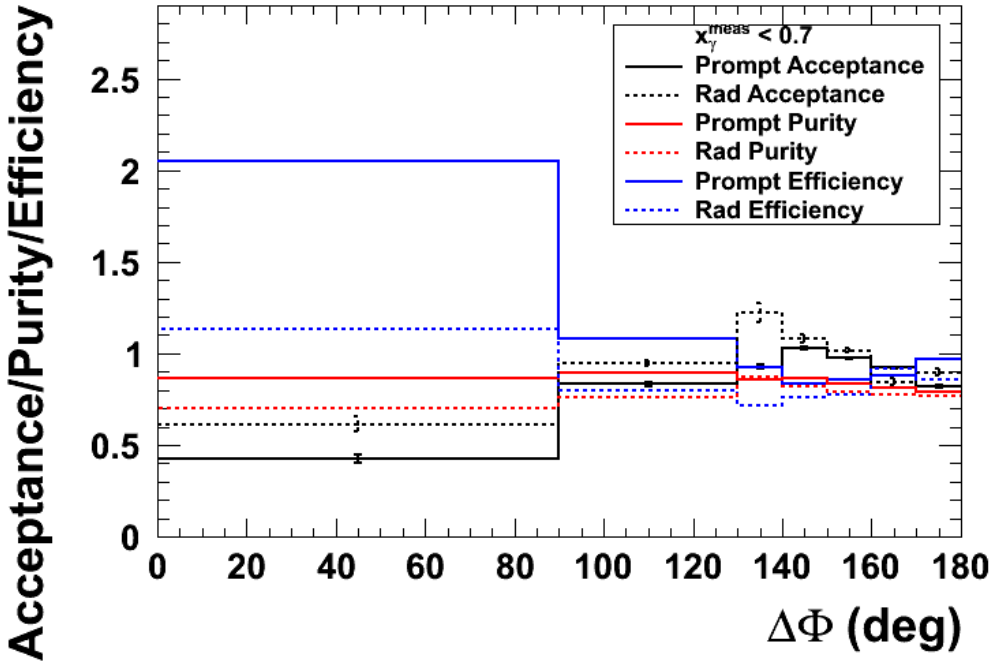

Direct PHP
$x_\gamma^{meas} < 0.7$
Prompt Acceptance
Rad Acceptance
Prompt Purity
Rad Purity
Prompt Efficiency
Rad Efficiency
Acceptance/Purity/Efficiency
ΔΦ (deg)


Resolved PHP
Acceptance/Purity/Efficiency
ΔΦ (deg)

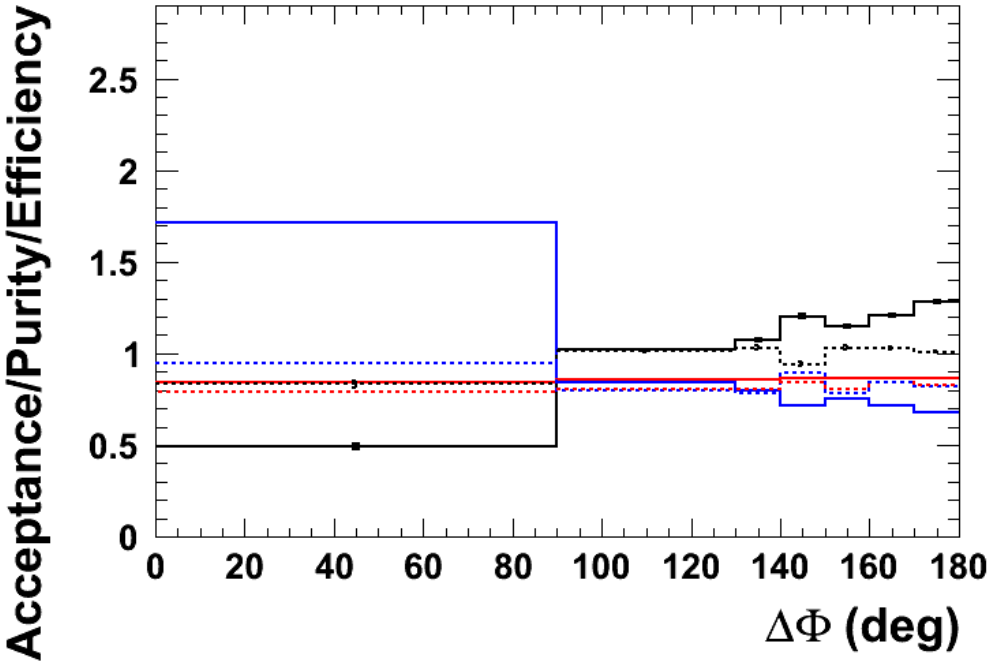

Direct PHP
$x_\gamma^{meas} > 0.8$
Prompt Acceptance
Rad Acceptance
Prompt Purity
Rad Purity
Prompt Efficiency
Rad Efficiency
Acceptance/Purity/Efficiency
ΔΦ (deg)


Resolved PHP
Acceptance/Purity/Efficiency
ΔΦ (deg)

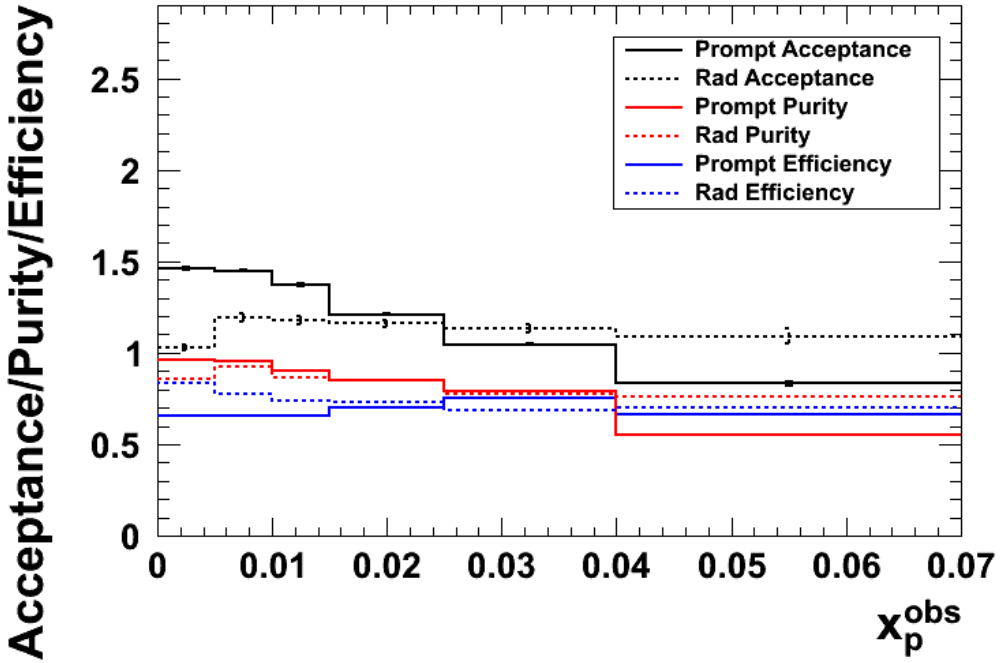
Direct PHP



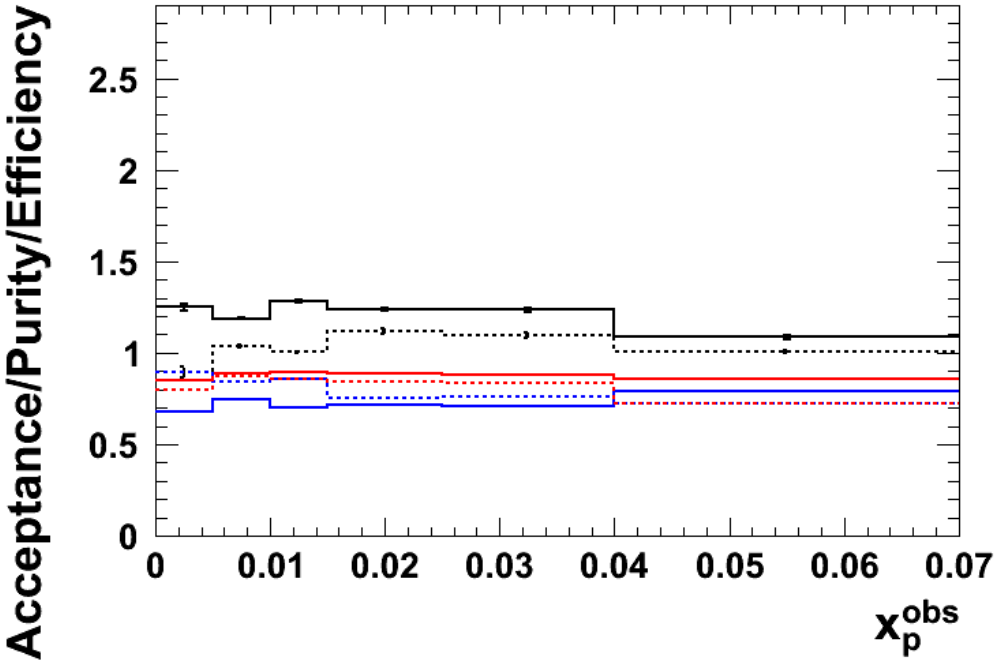
Resolved PHP



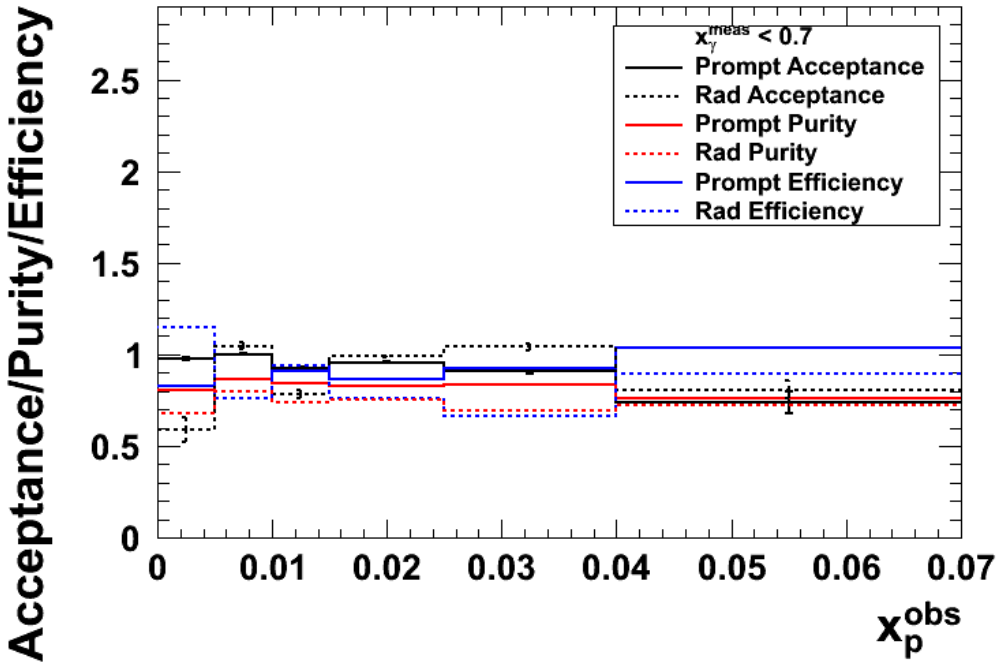
Direct PHP



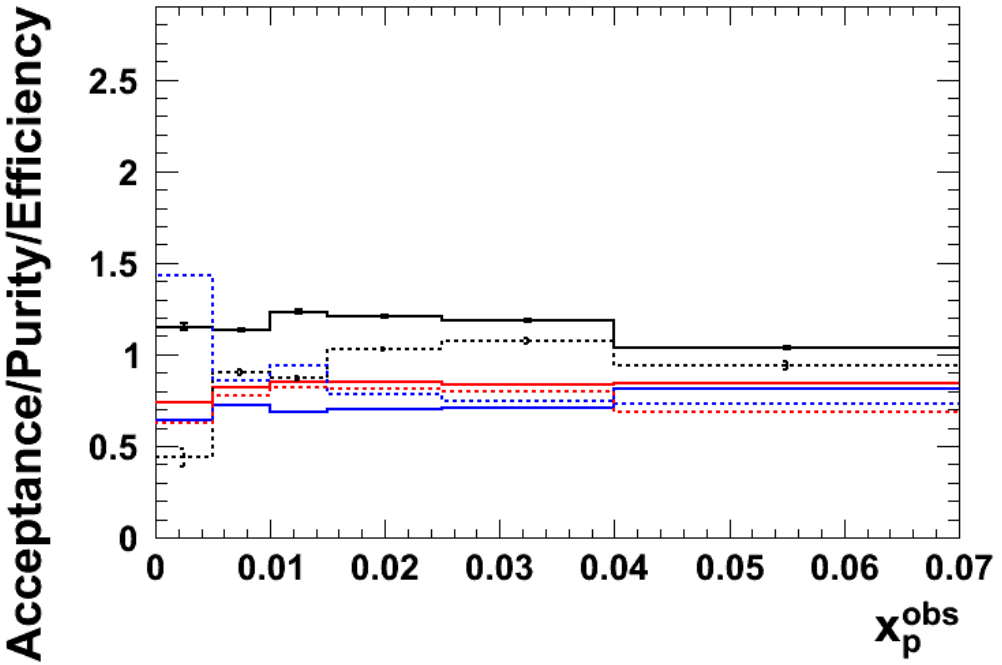
Resolved PHP



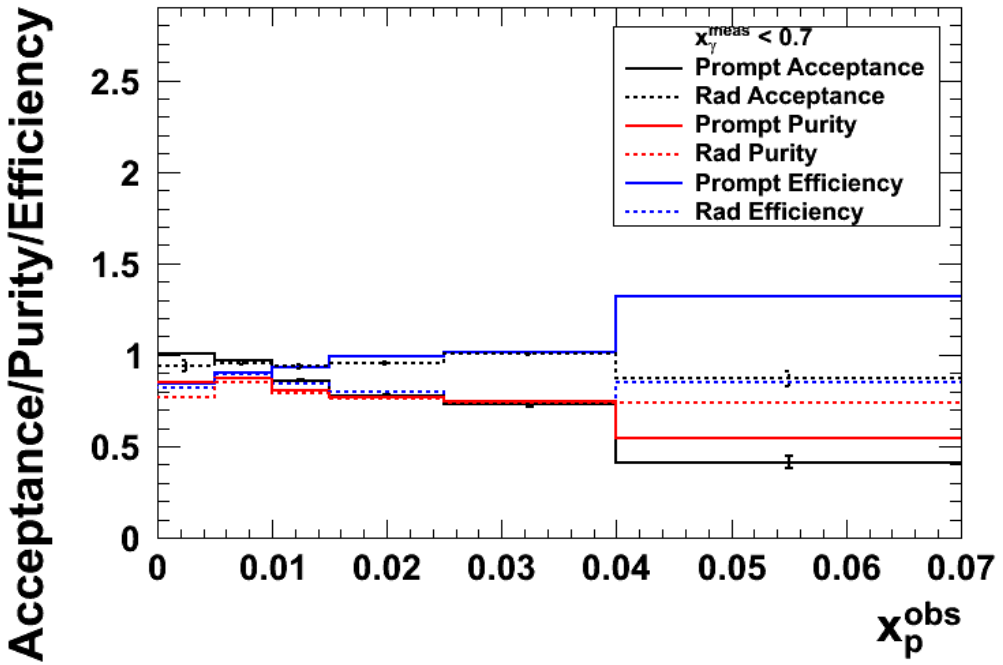
Direct PHP



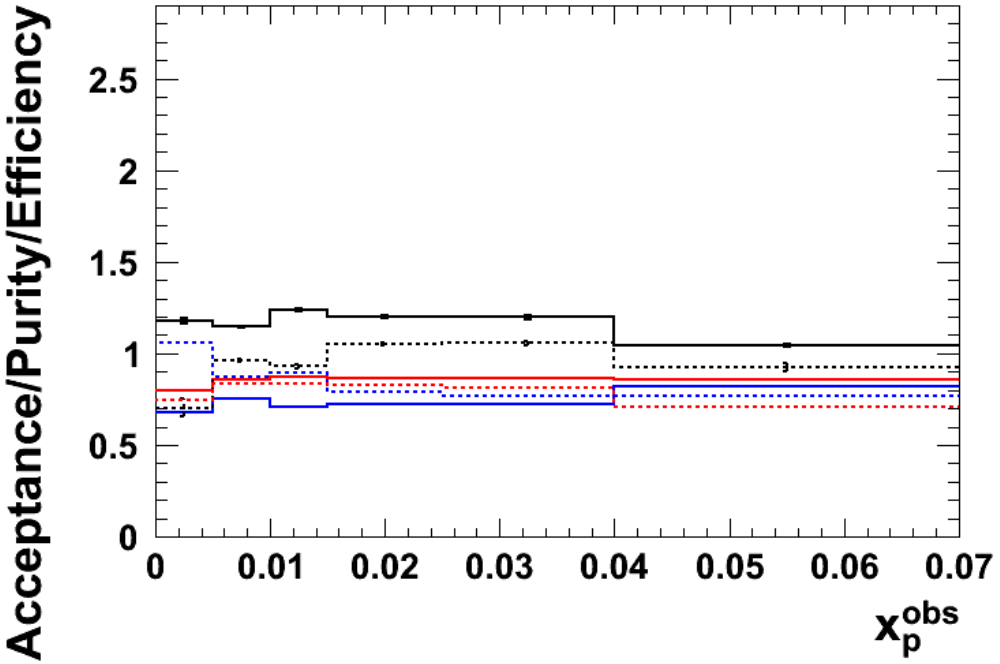
Resolved PHP



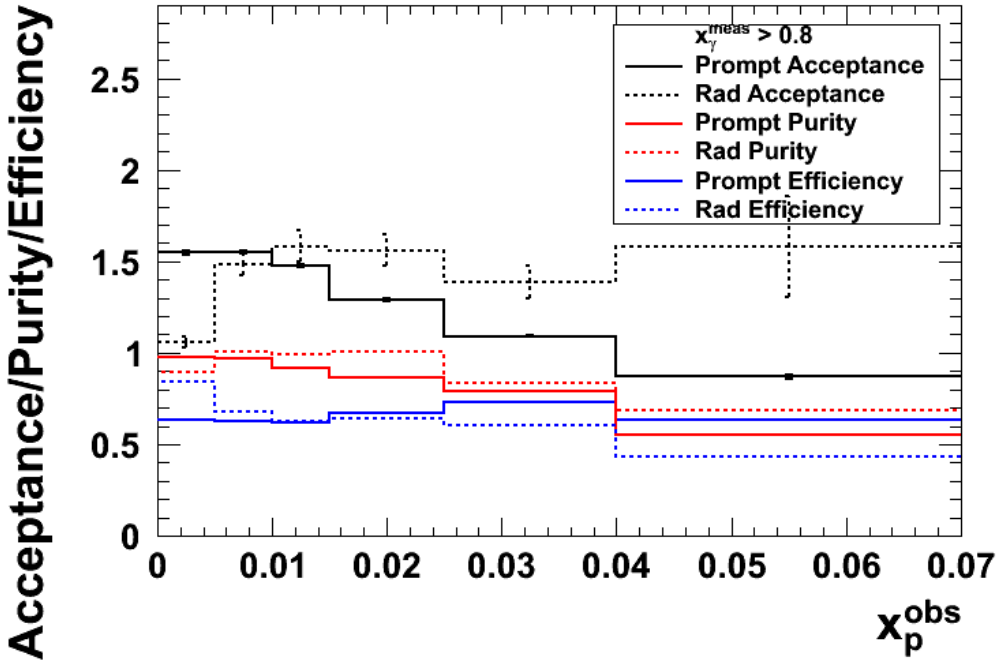
Direct PHP



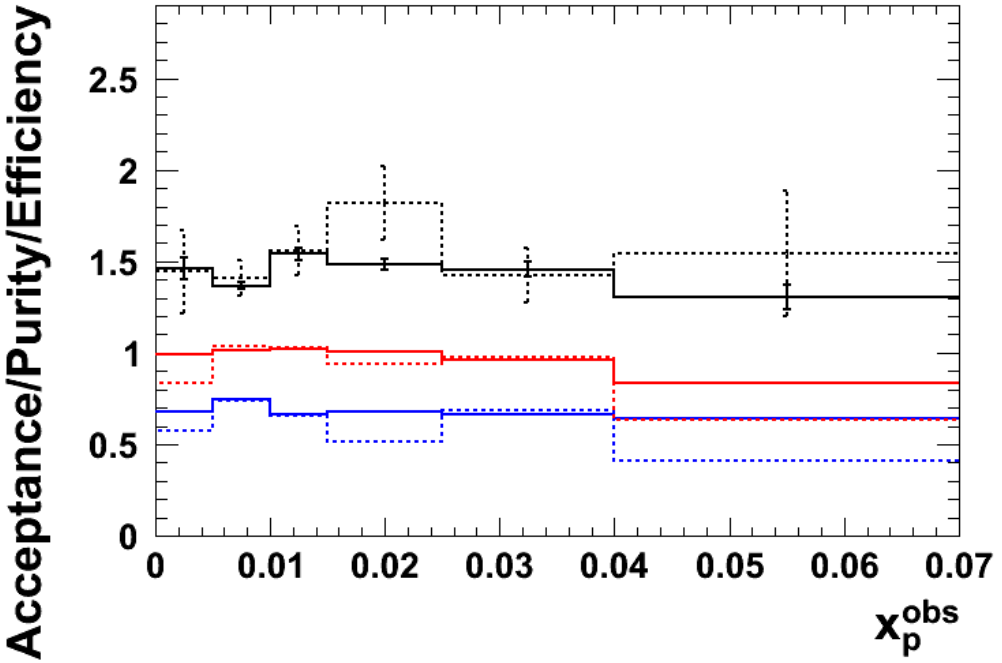
Resolved PHP



Direct PHP

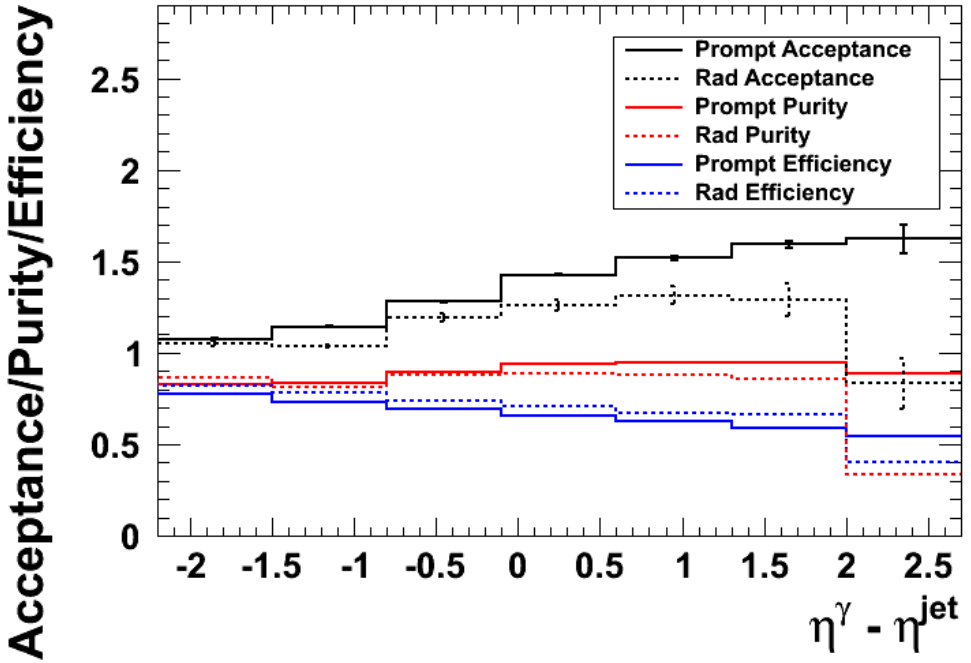


Resolved PHP

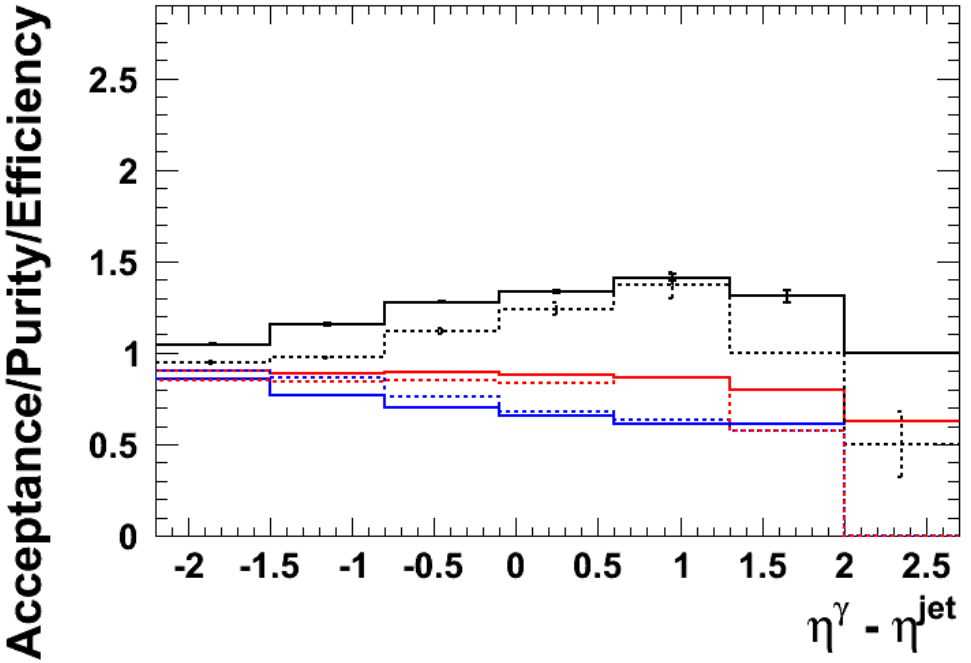


All x_γ

Direct PHP

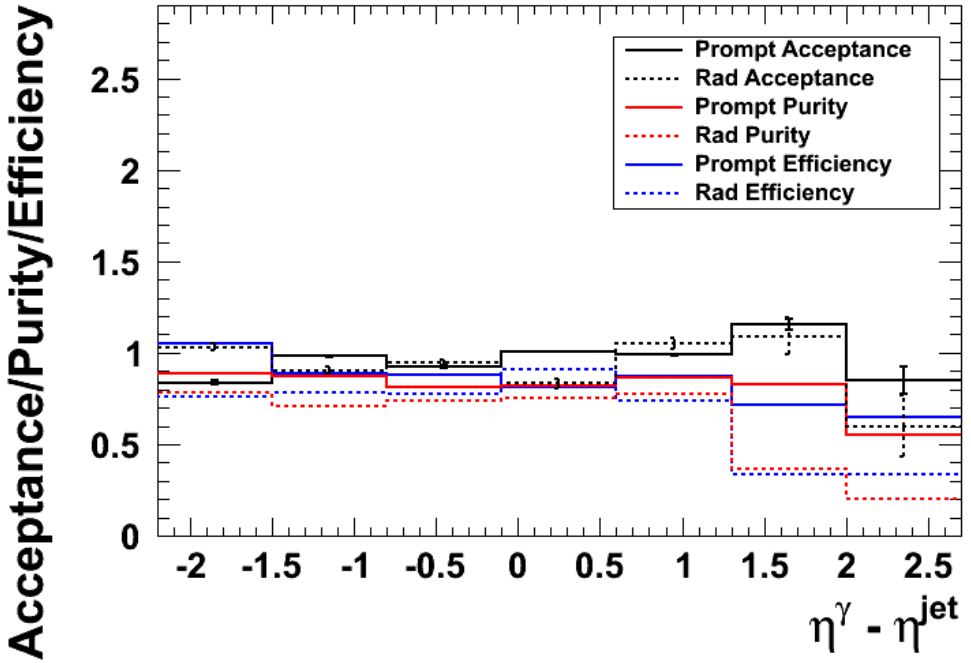


Resolved PHP

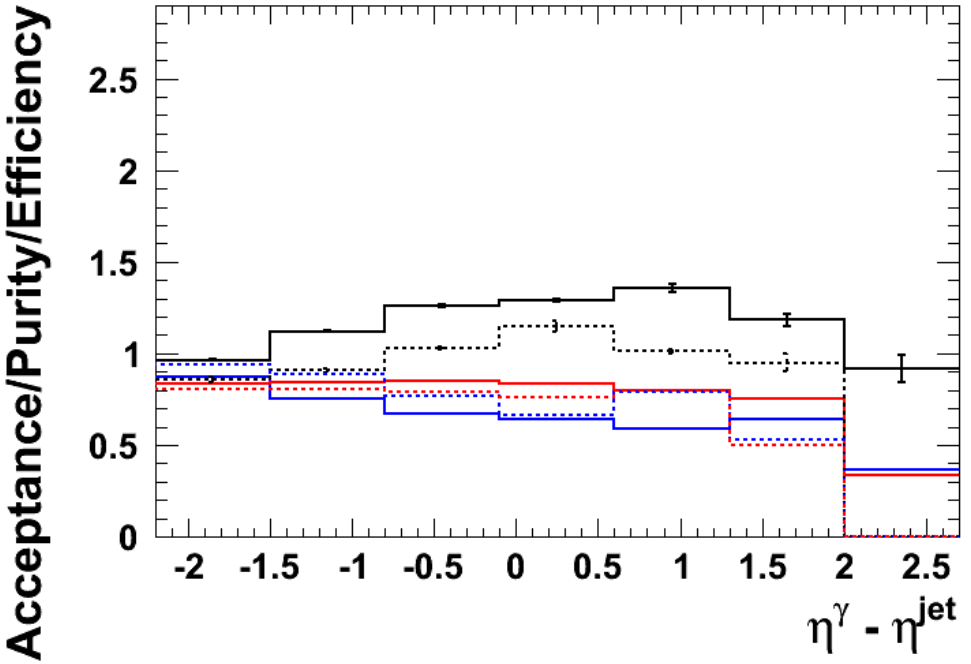


$x_\gamma < 0.7$

Direct PHP

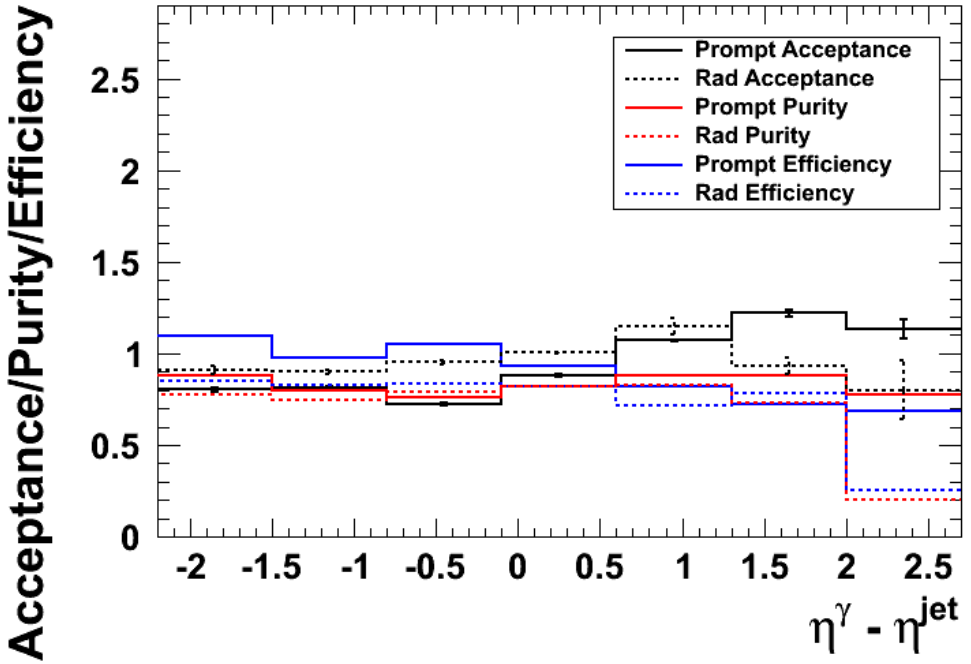


Resolved PHP

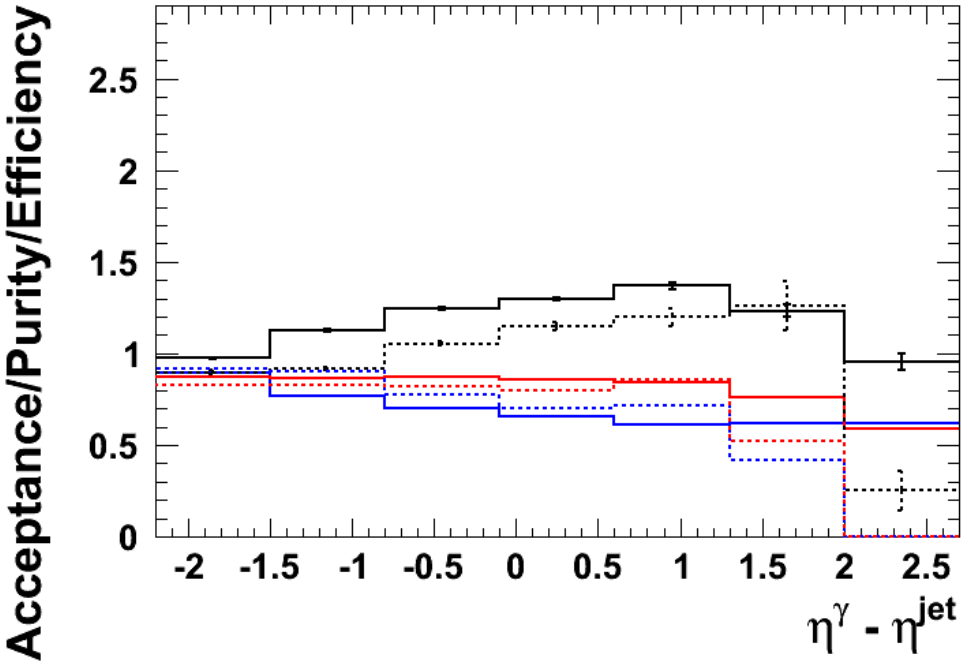


$x_\gamma < 0.8$

Direct PHP

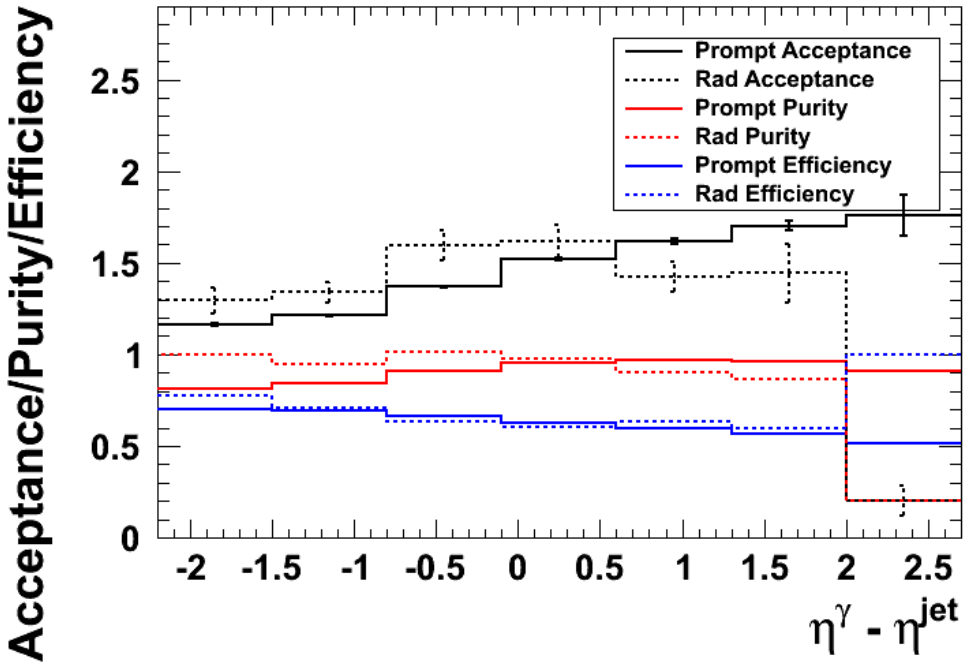


Resolved PHP

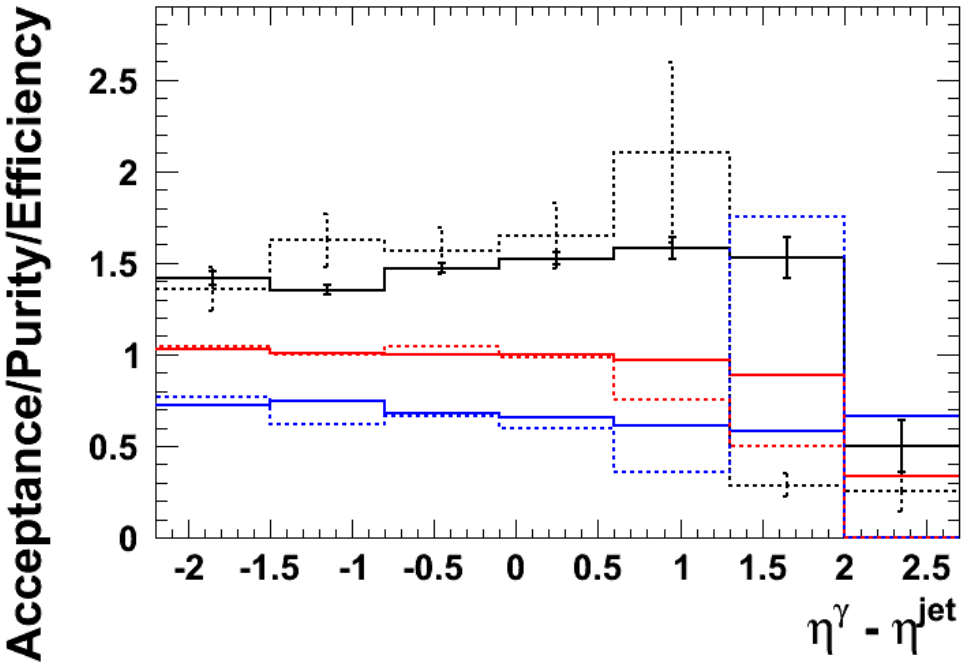


$x_\gamma > 0.8$

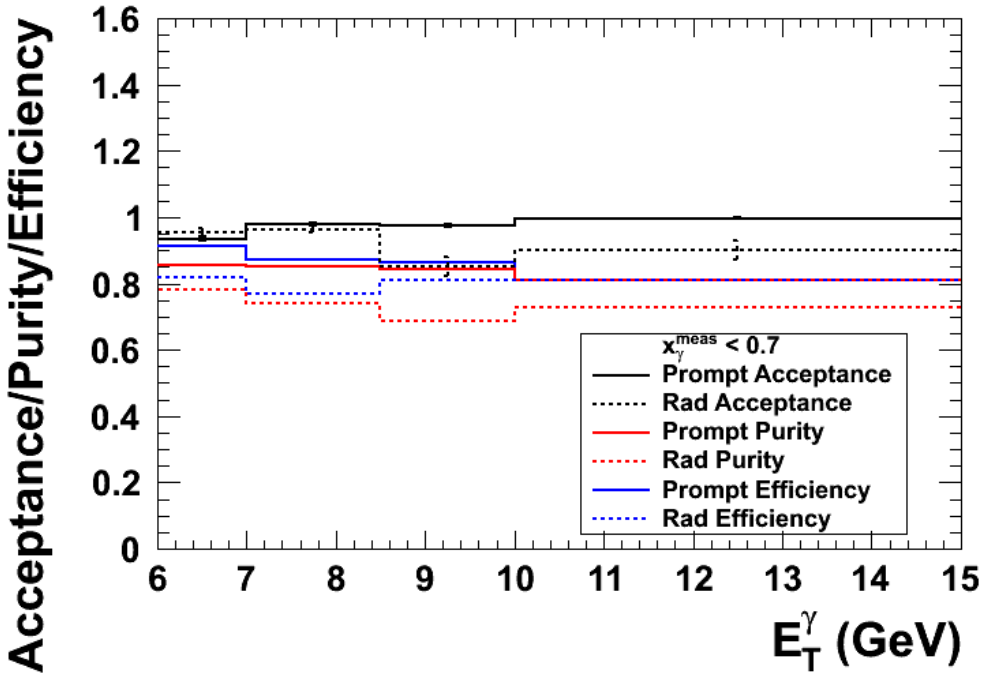
Direct PHP



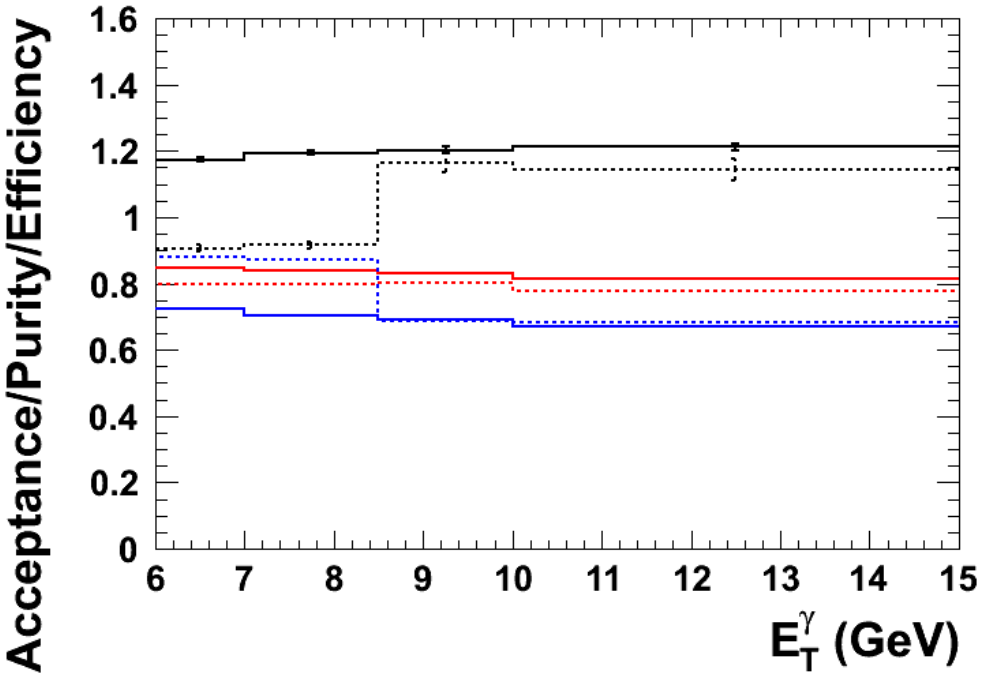
Resolved PHP



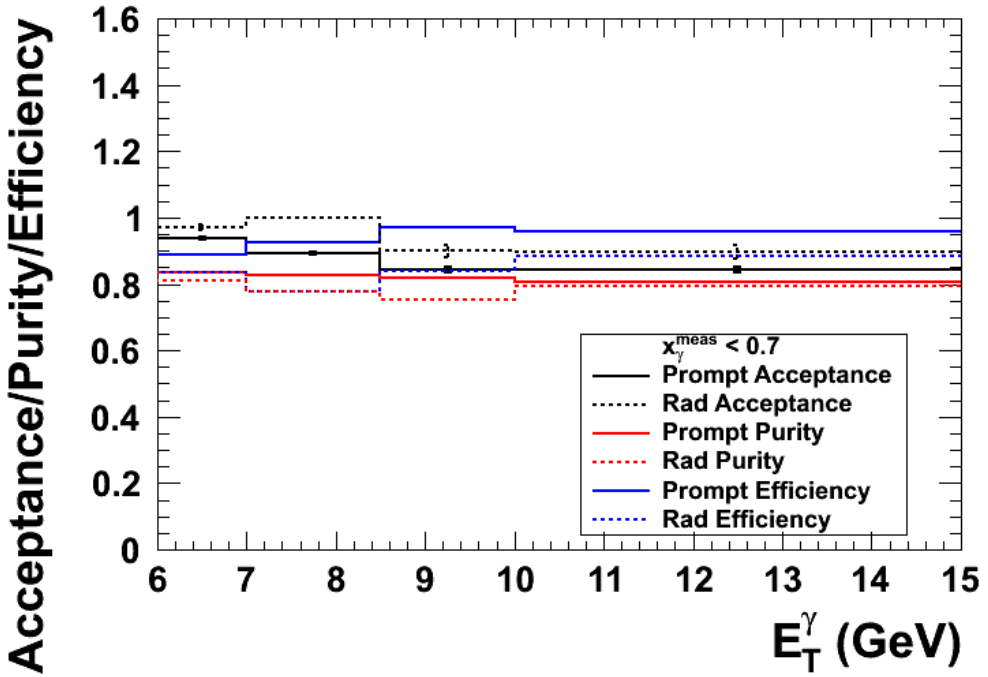
Direct PHP



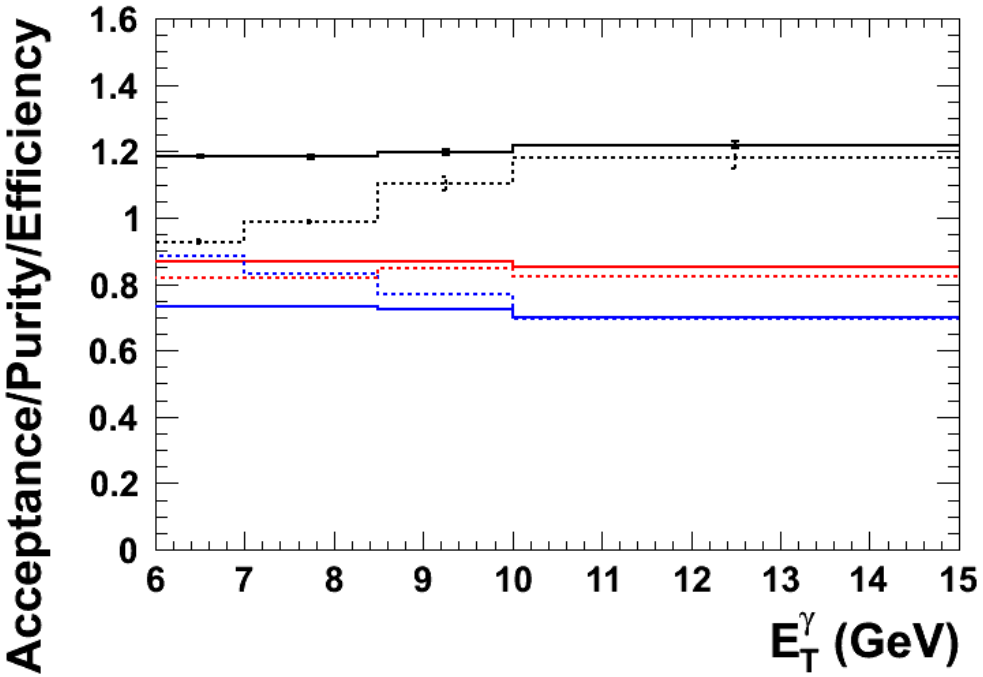
Resolved PHP



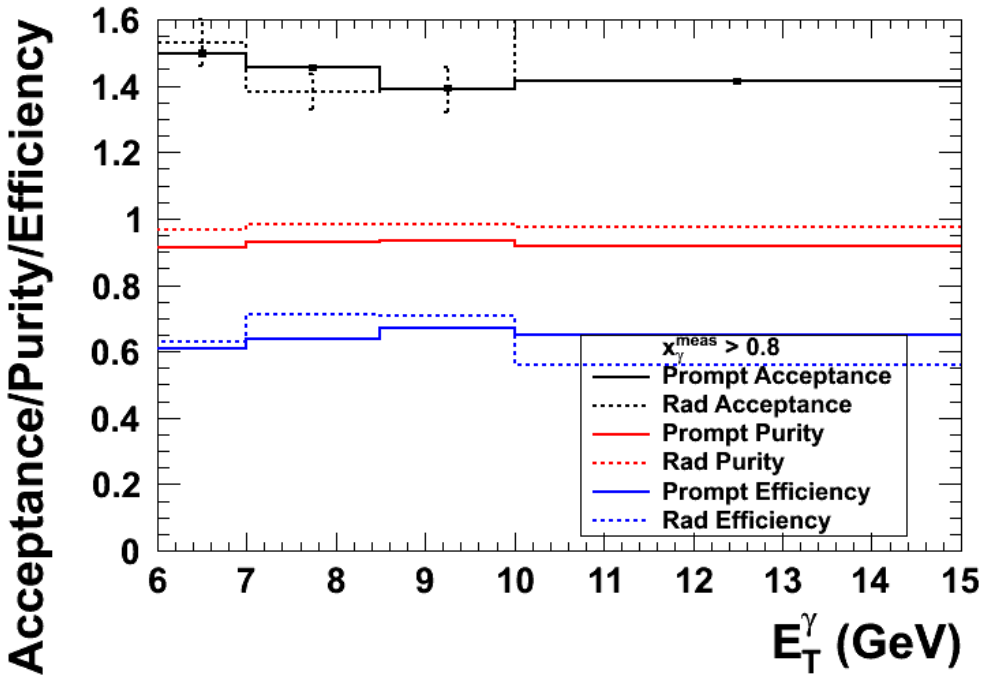
Direct PHP



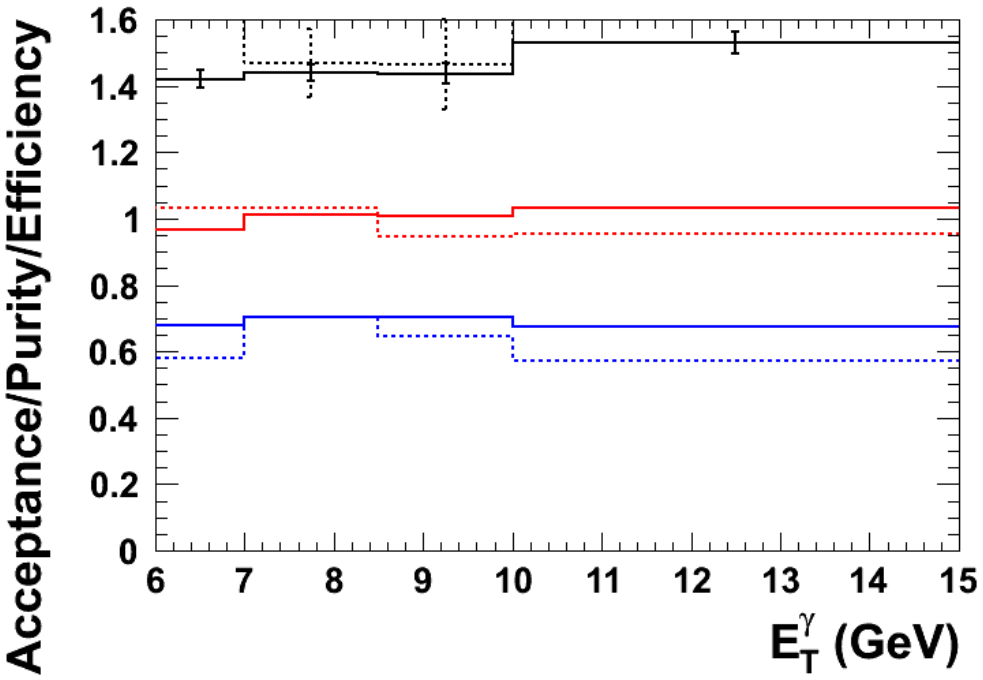
Resolved PHP



Direct PHP

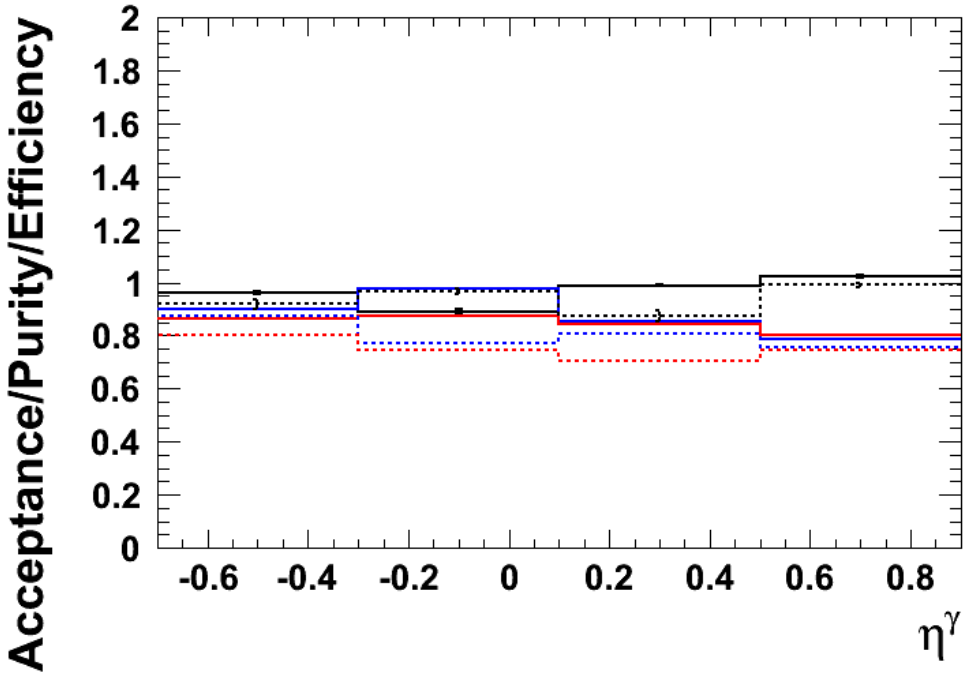


Resolved PHP

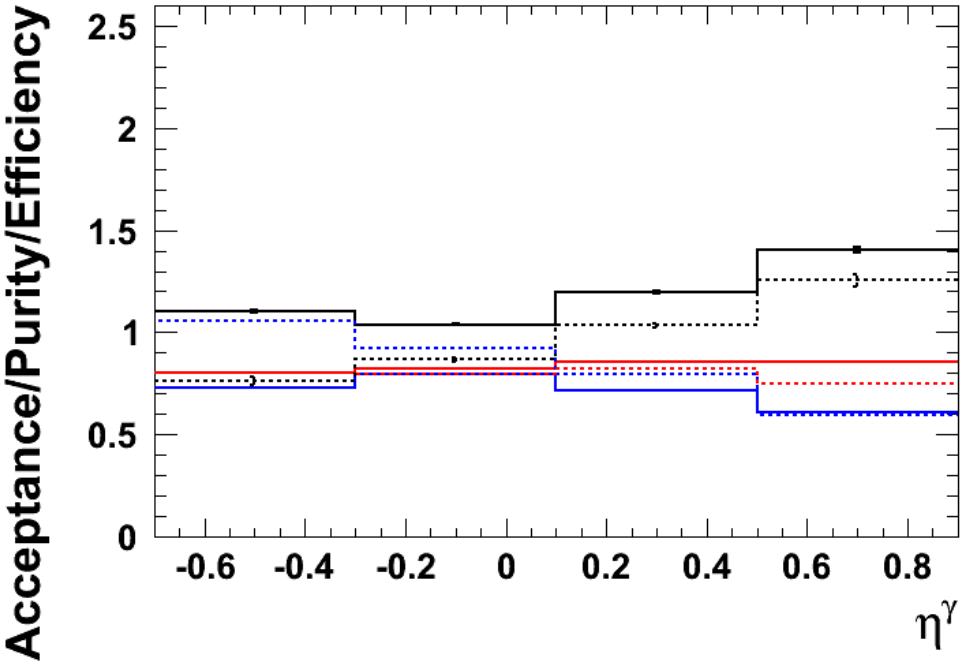


$x_\gamma < 0.7$

Direct PHP

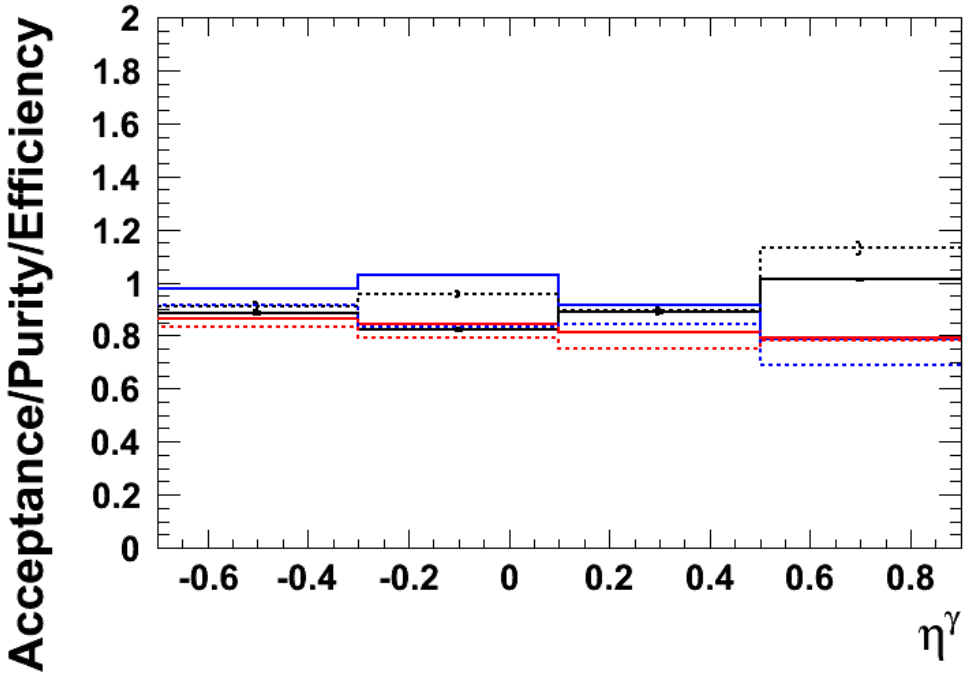


Resolved PHP

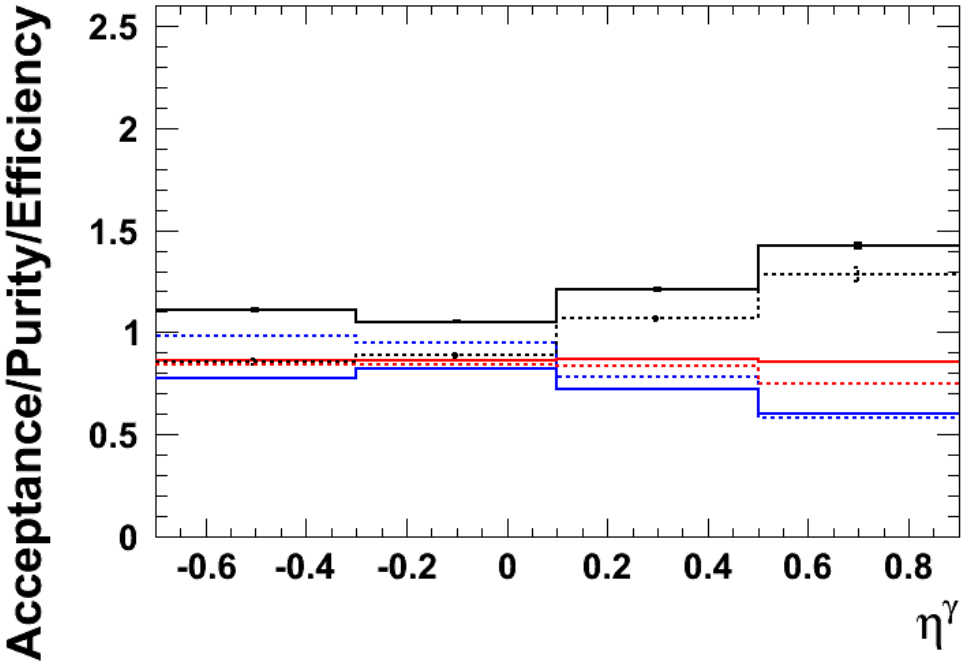


$x_\gamma < 0.8$

Direct PHP

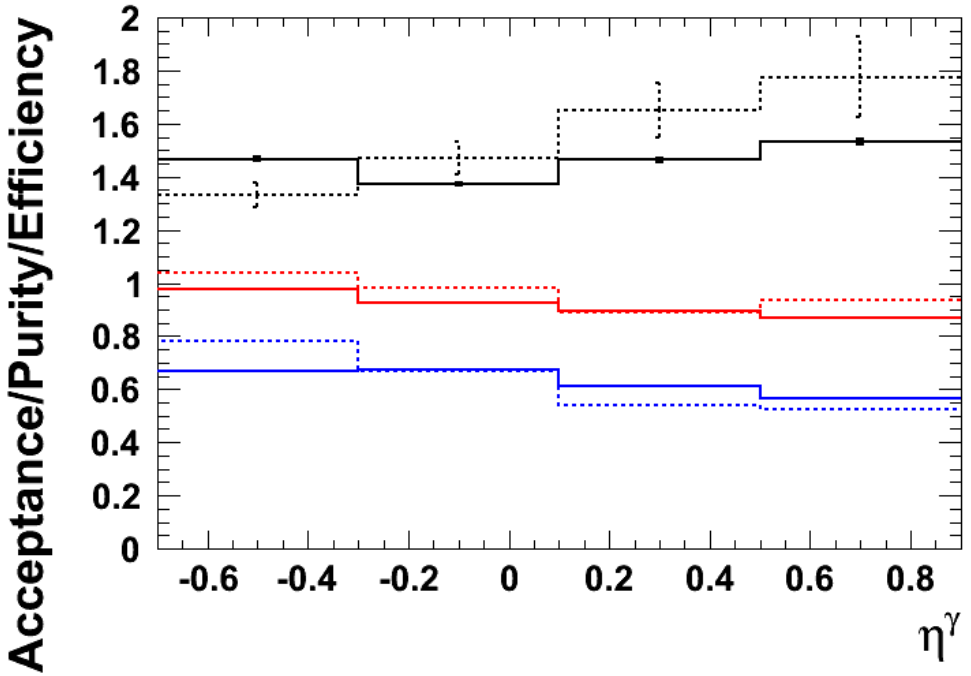


Resolved PHP

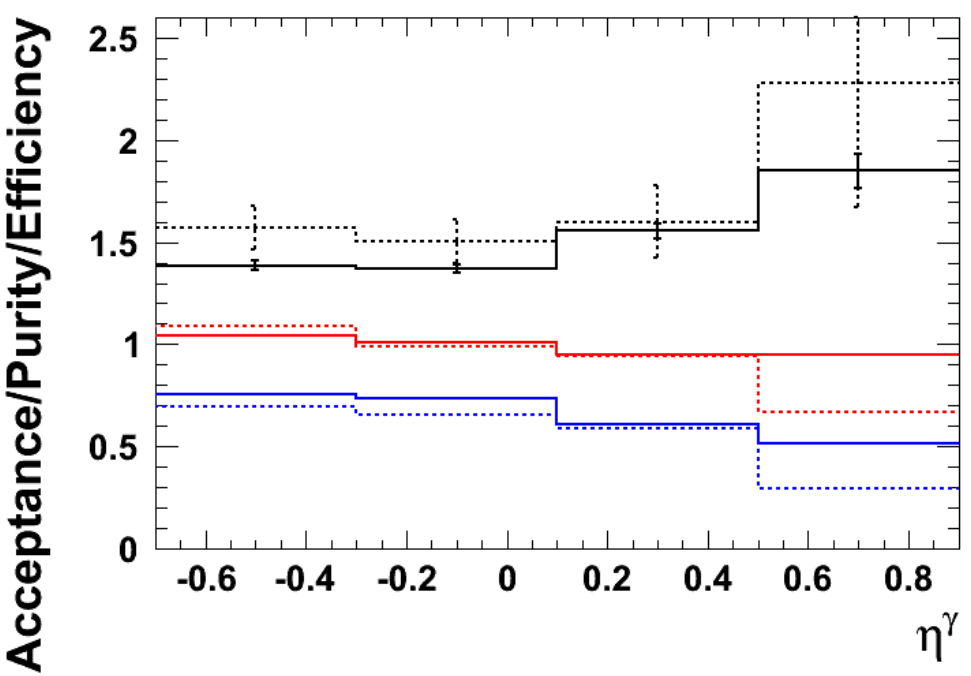


$x_\gamma > 0.8$

Direct PHP

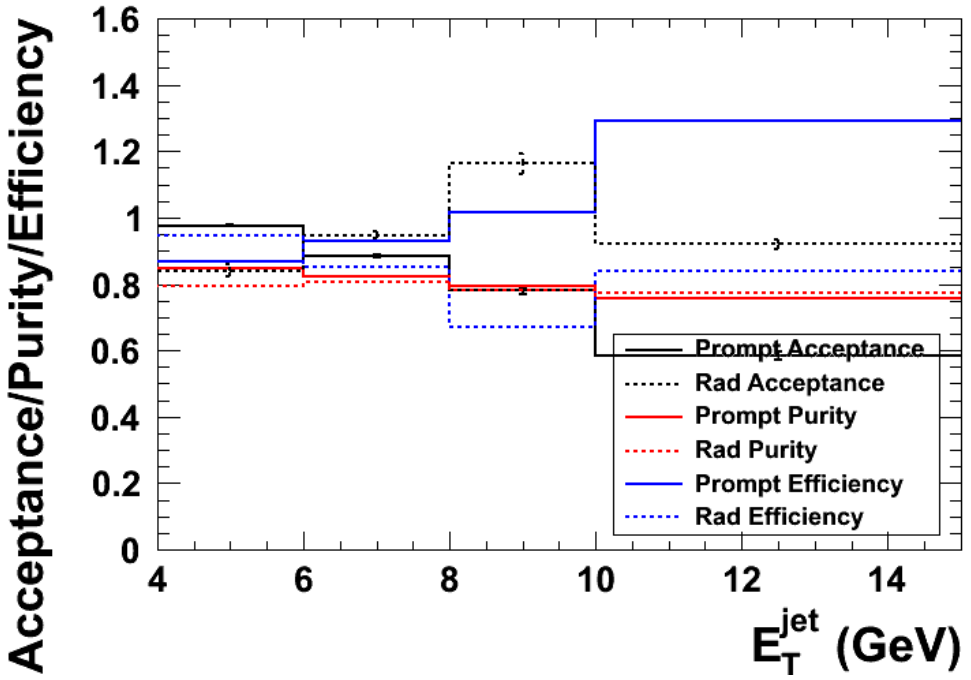


Resolved PHP

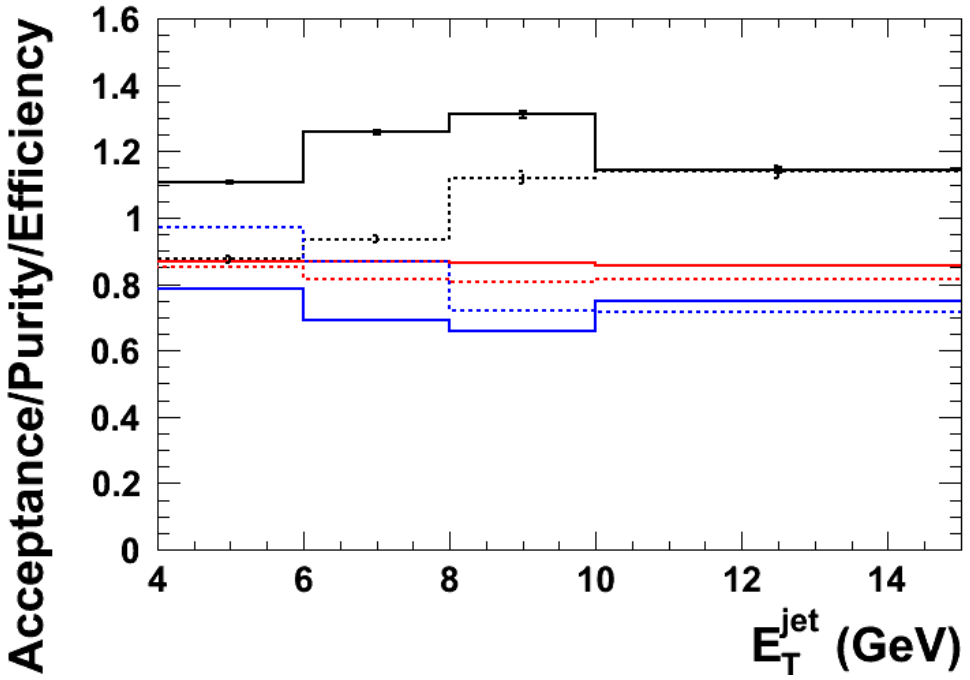


$x_y < 0.8$

Direct PHP

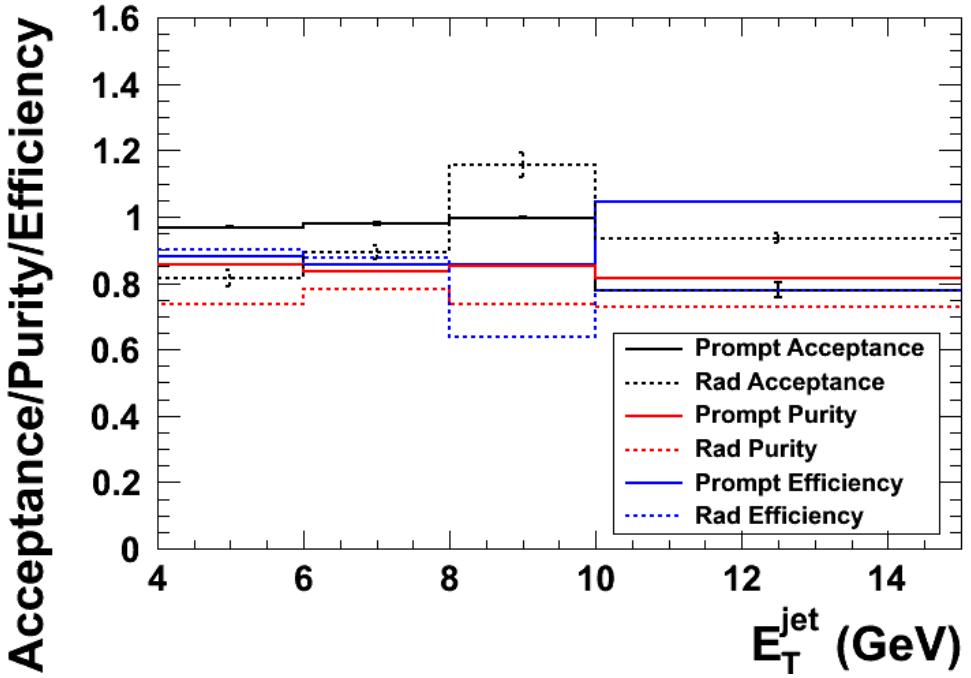


Resolved PHP

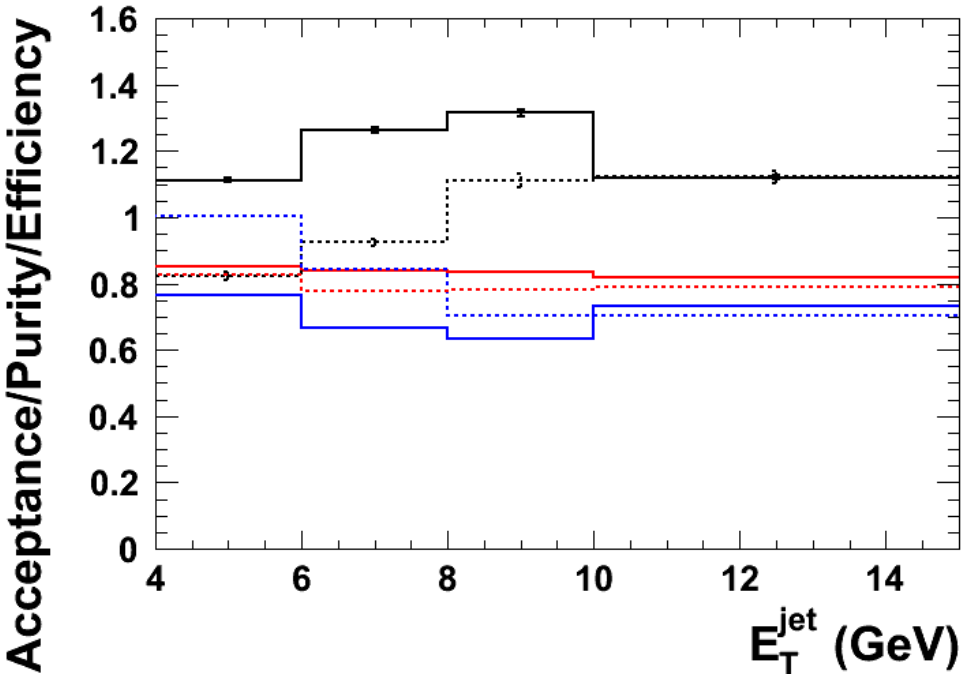


$x_\gamma < 0.7$

Direct PHP

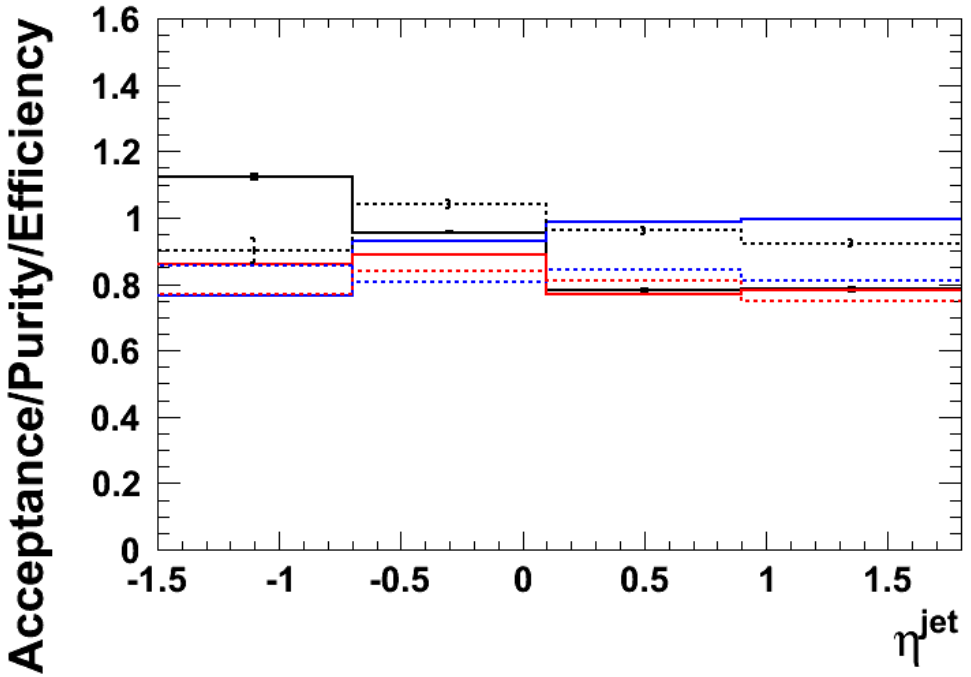


Resolved PHP

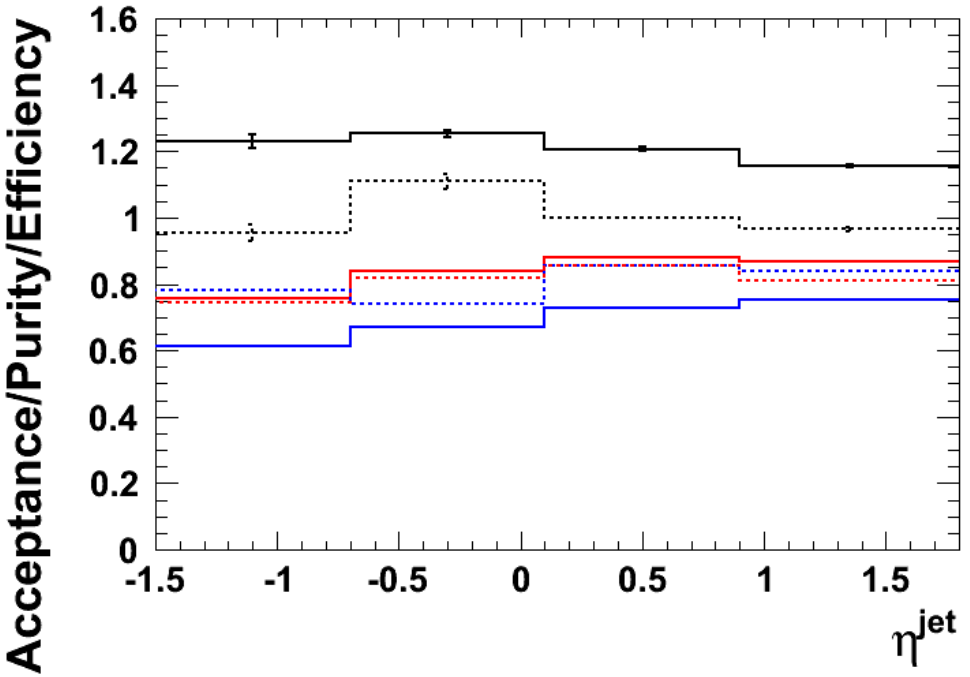


$x_\gamma < 0.8$

Direct PHP

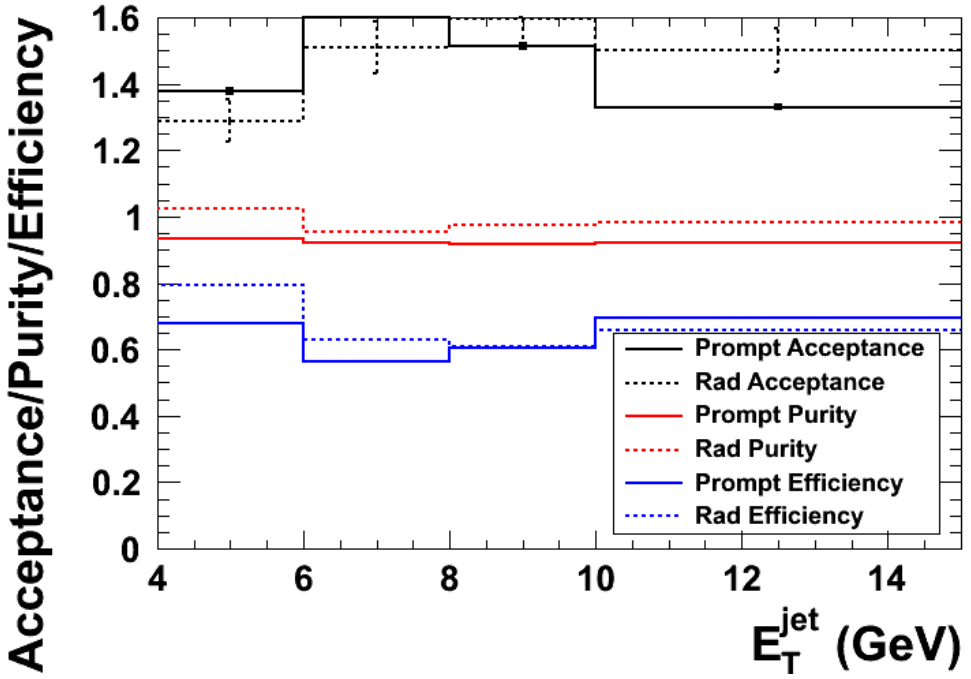


Resolved PHP

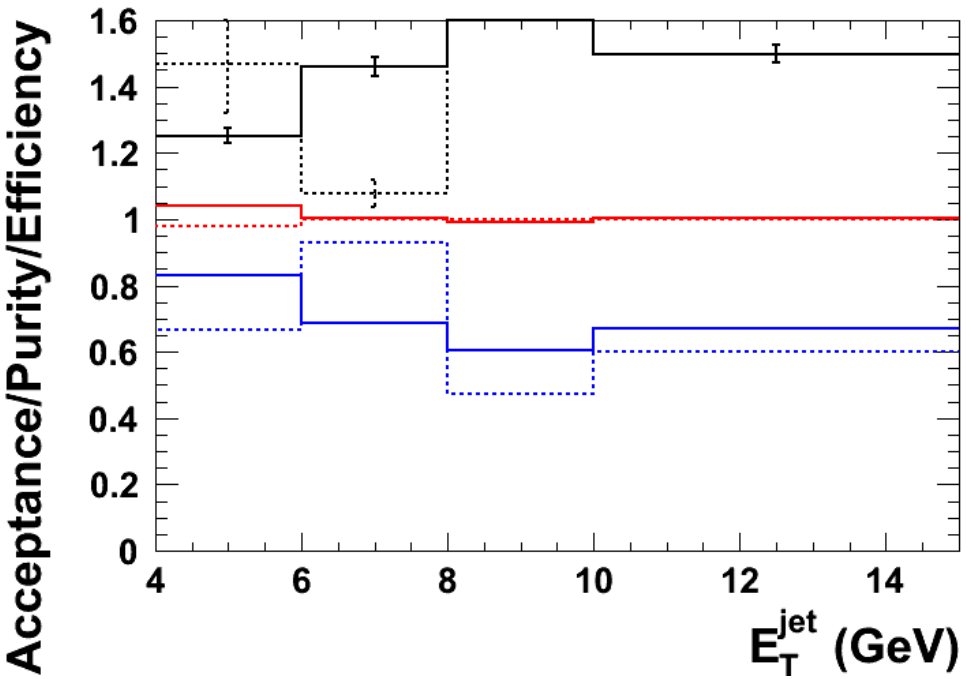


$x_\gamma > 0.8$

Direct PHP

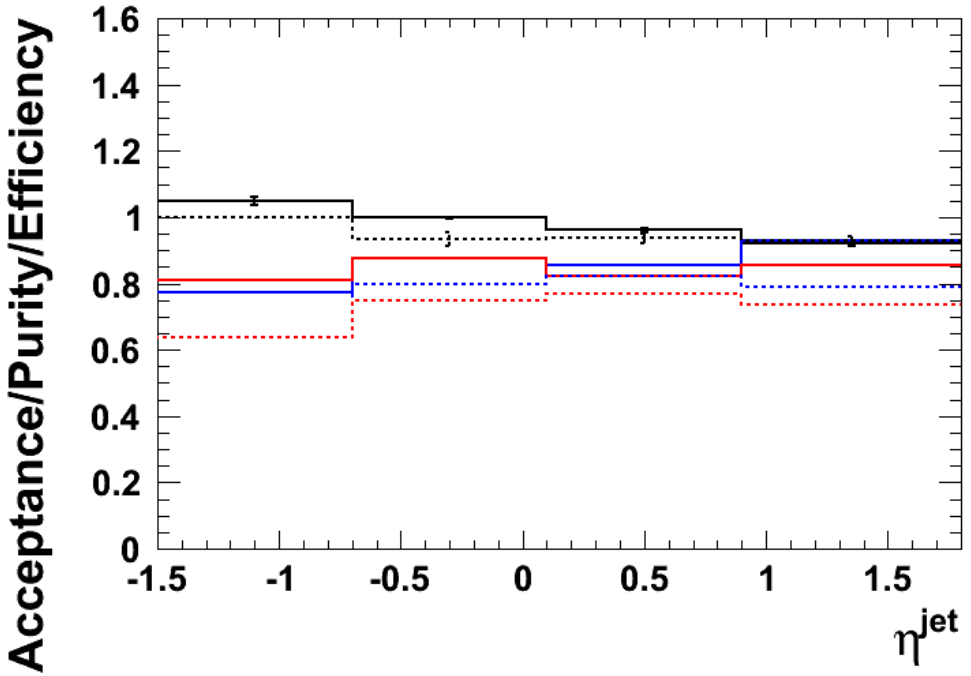


Resolved PHP

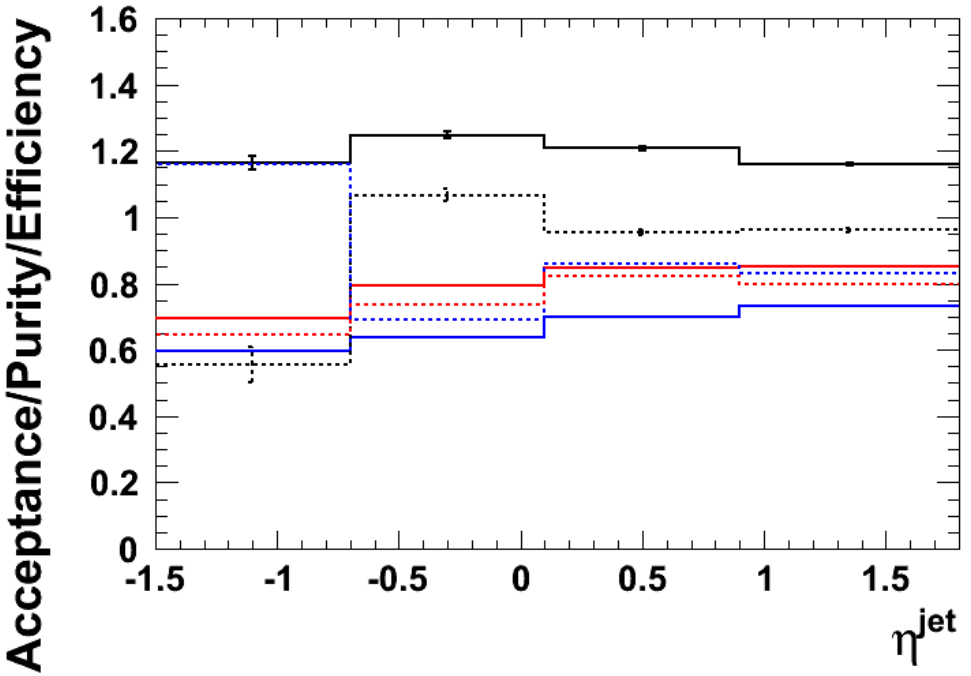


$x_\gamma < 0.7$

Direct PHP

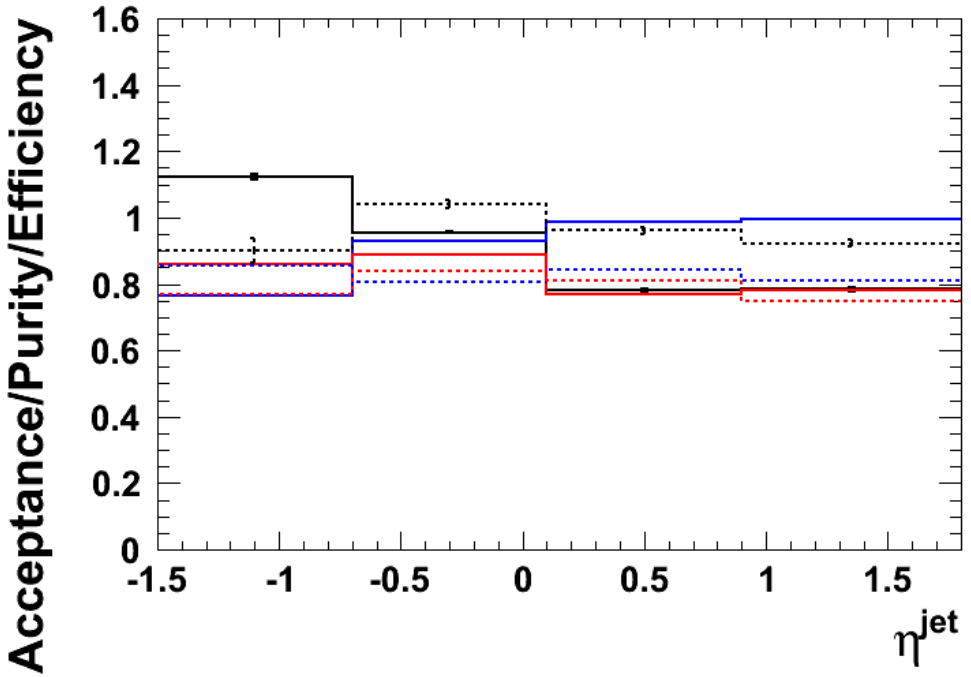


Resolved PHP

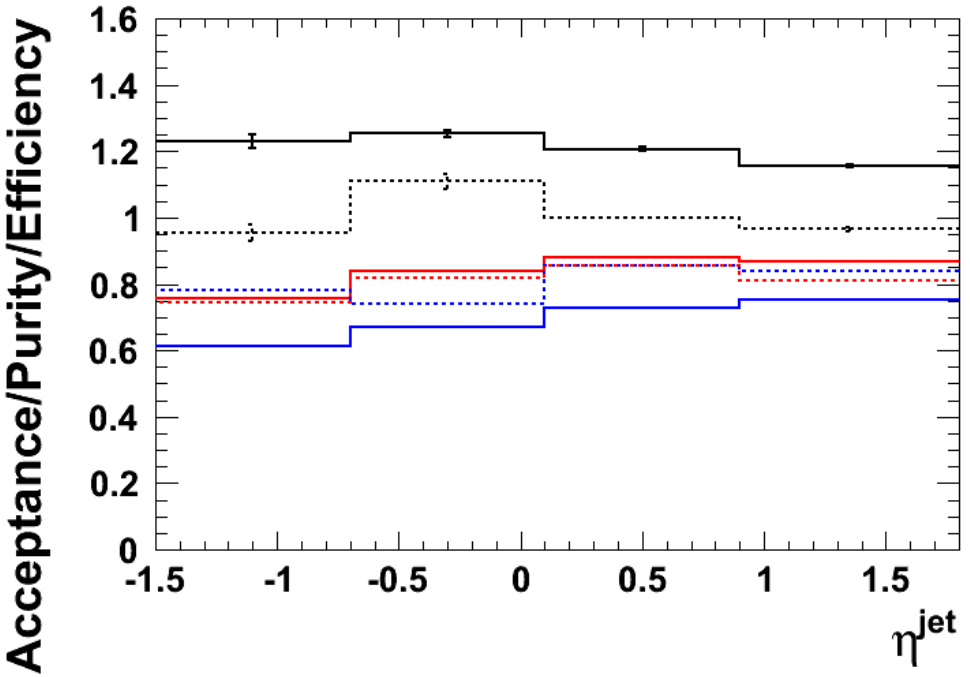


$x_\gamma < 0.8$

Direct PHP

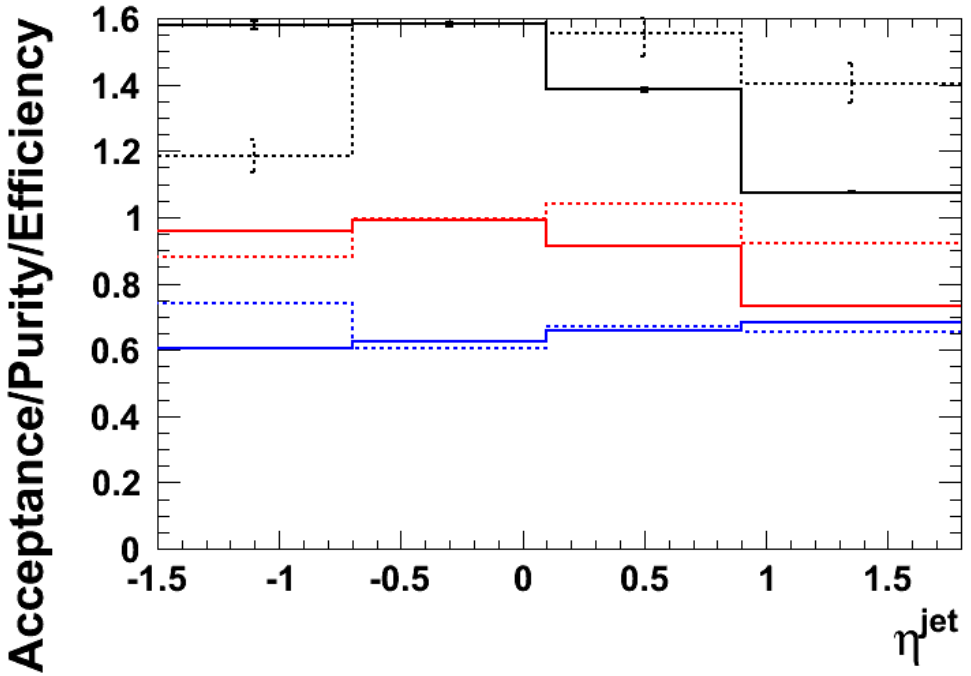


Resolved PHP

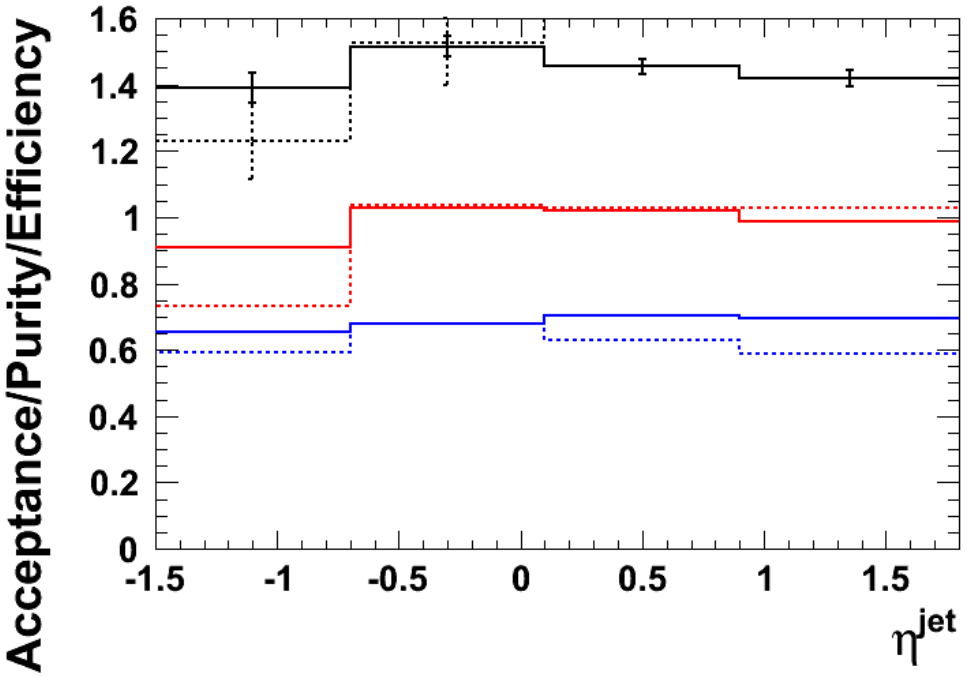


$x_\gamma > 0.8$

Direct PHP

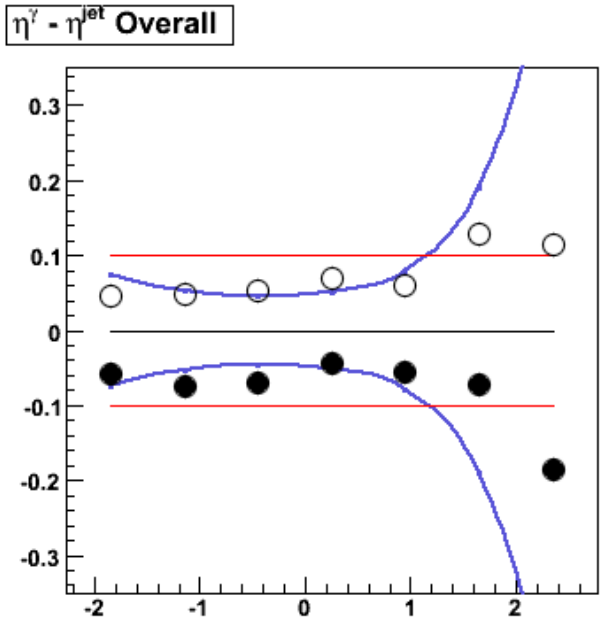


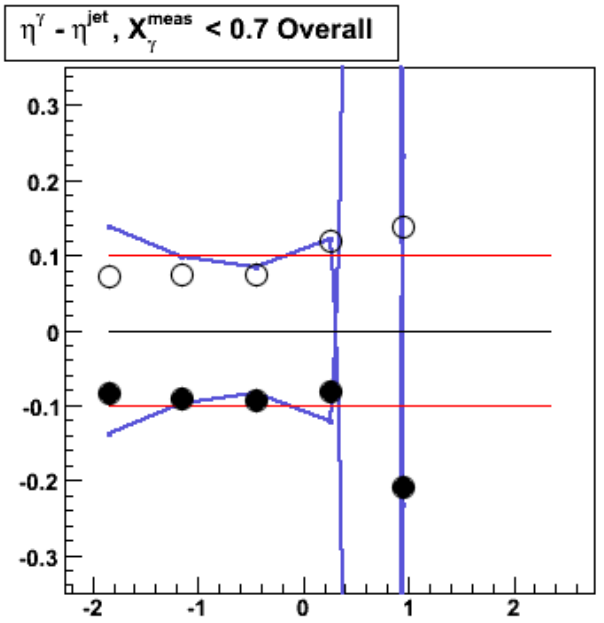
Resolved PHP

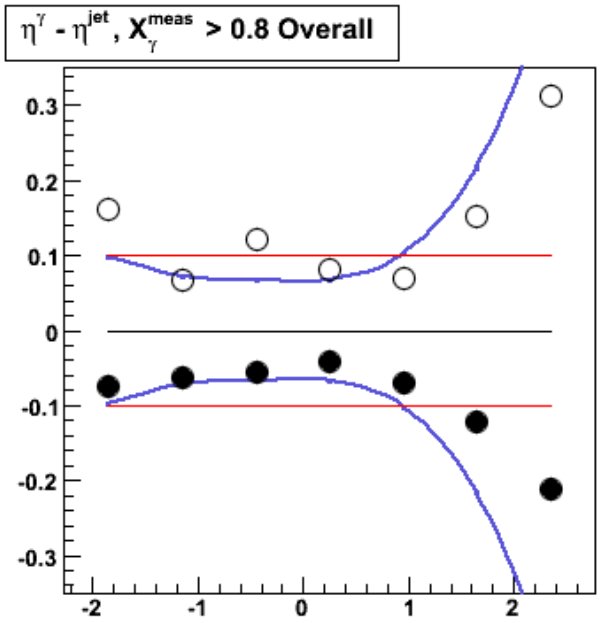


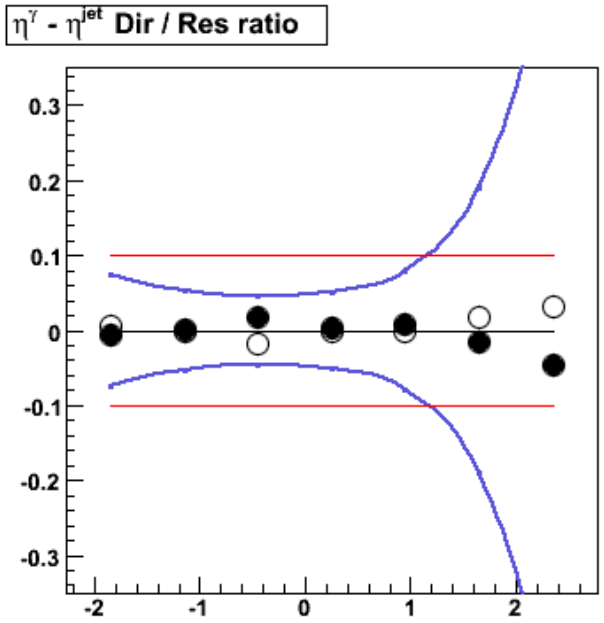
Systematic uncertainties

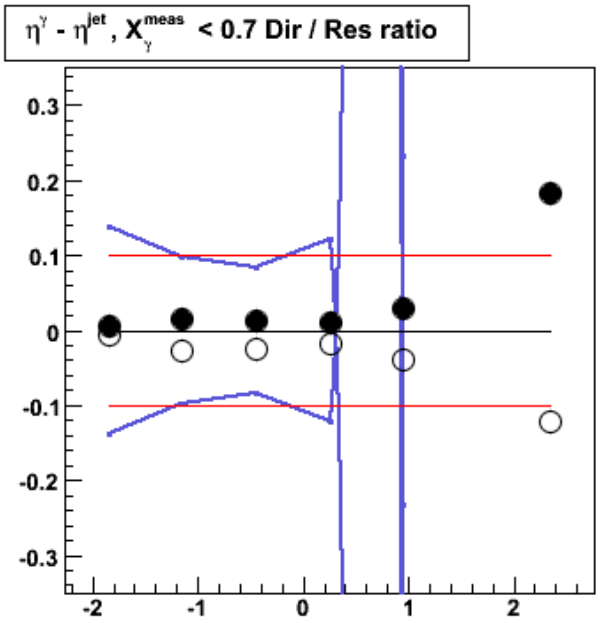
$x_Y < 0.7$, $x_Y > 0.8$

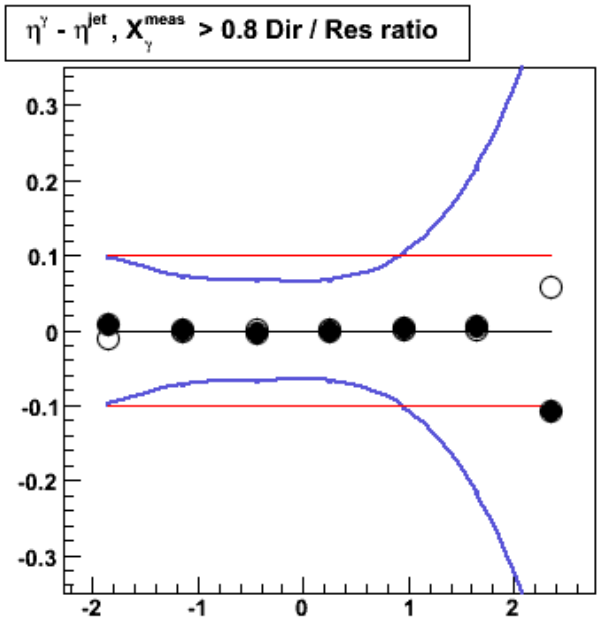

η^{γ} - η^{jet} Overall
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-2
-1
0
1
2

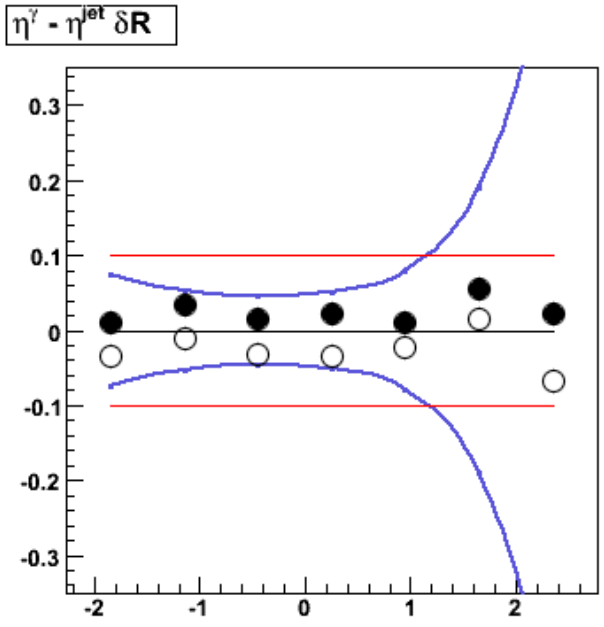

η^{γ} - η^{jet}, X_{γ}^{meas} < 0.7 Overall
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-2
-1
0
1
2

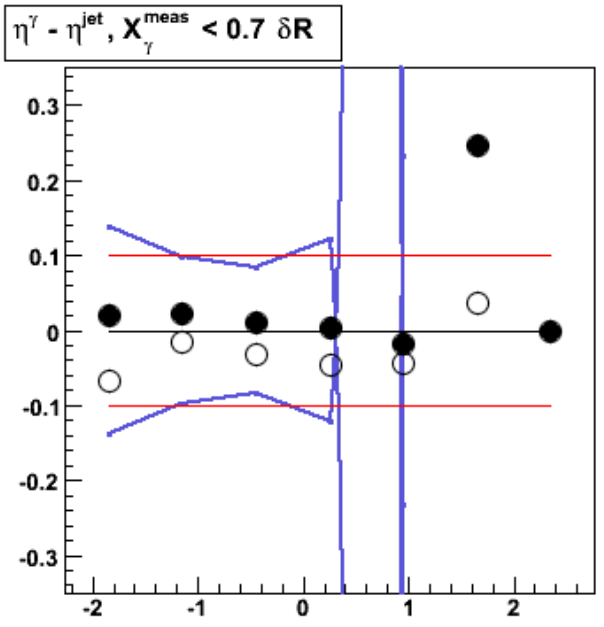

η^{γ} - η^{jet}, X_{γ}^{meas} > 0.8 Overall
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-2
-1
0
1
2

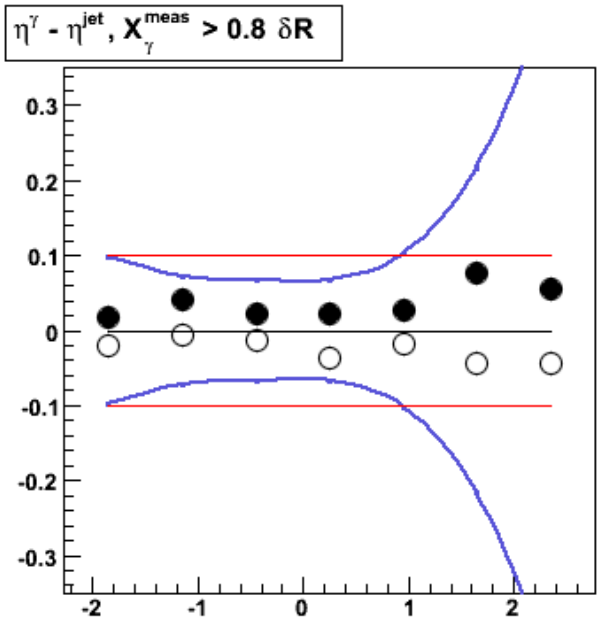

η^{γ} - η^{jet} Dir / Res ratio
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-2
-1
0
1
2

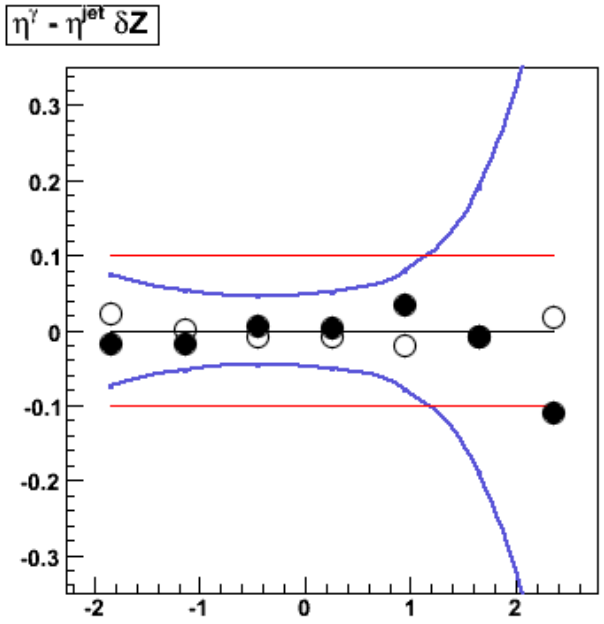

η^{γ} - η^{jet}, X_{γ}^{meas} < 0.7 Dir / Res ratio
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-2
-1
0
1
2

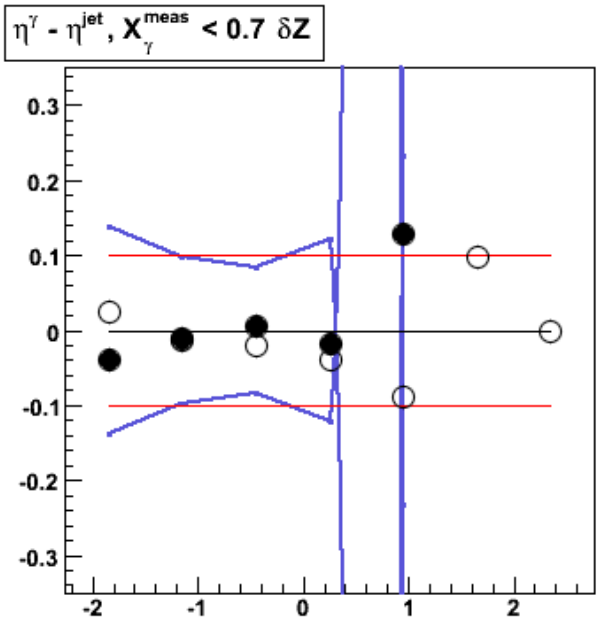

η^{γ} - η^{jet}, X_{γ}^{meas} > 0.8 Dir / Res ratio
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-2
-1
0
1
2

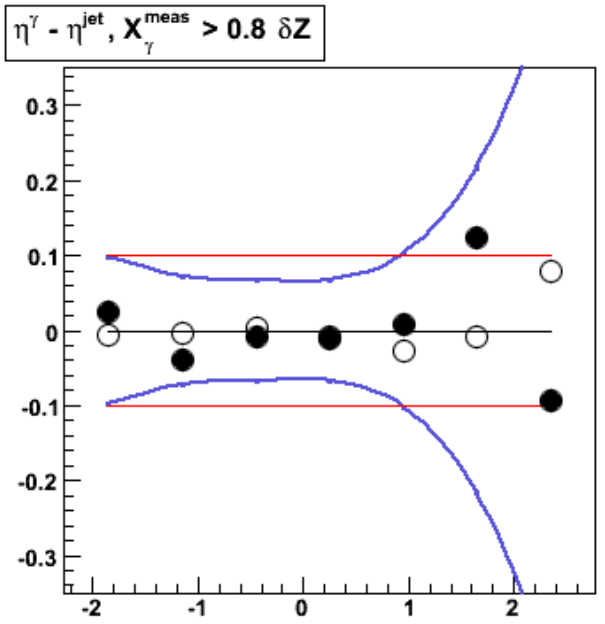

η^{γ} - η^{jet} δR
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-2
-1
0
1
2

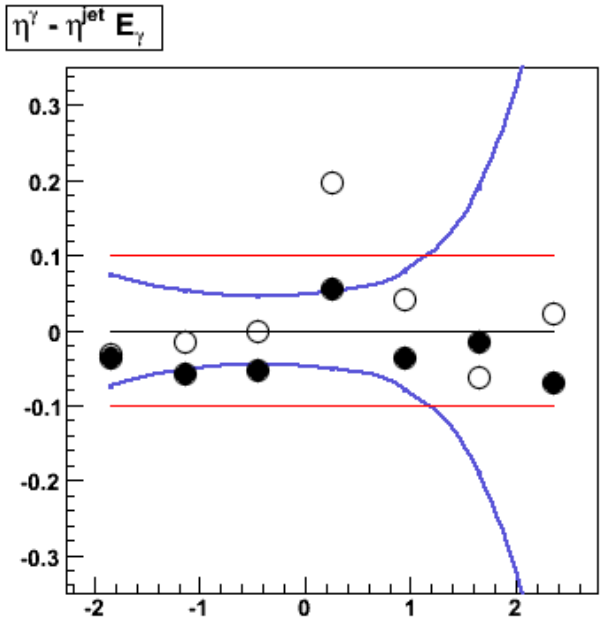

η^{γ} - η^{jet}, X_{γ}^{meas} < 0.7 δR
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-2
-1
0
1
2

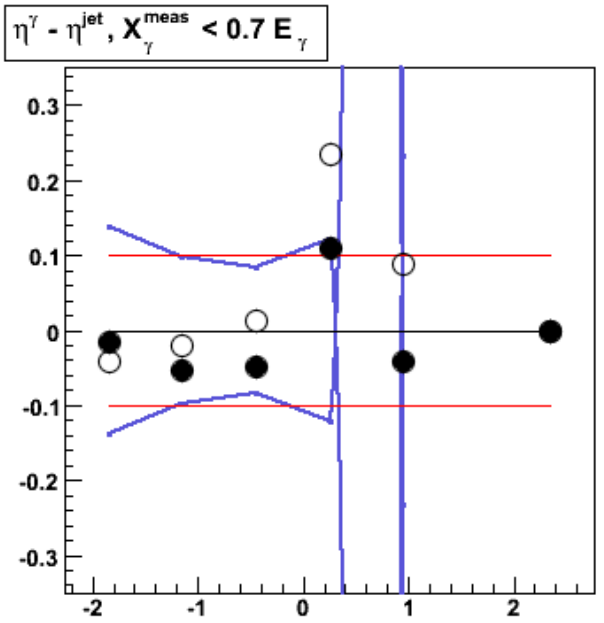

η^{γ} - η^{jet}, X_{γ}^{meas} > 0.8 δR
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-2
-1
0
1
2

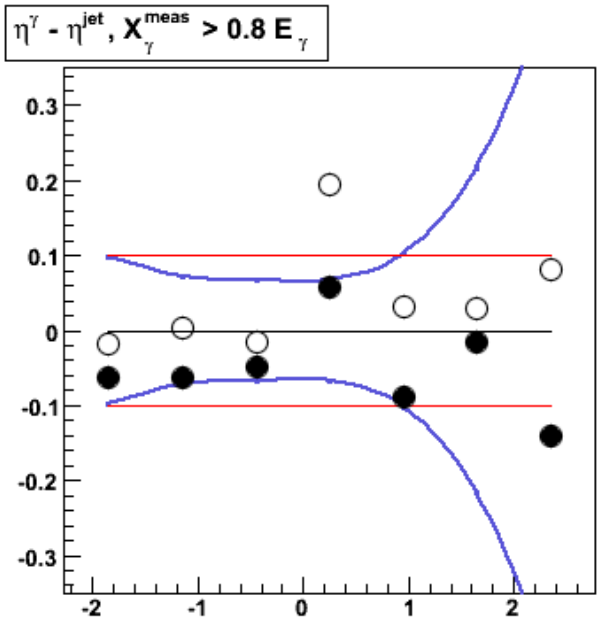

η^{γ} - η^{jet} δZ
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-2
-1
0
1
2

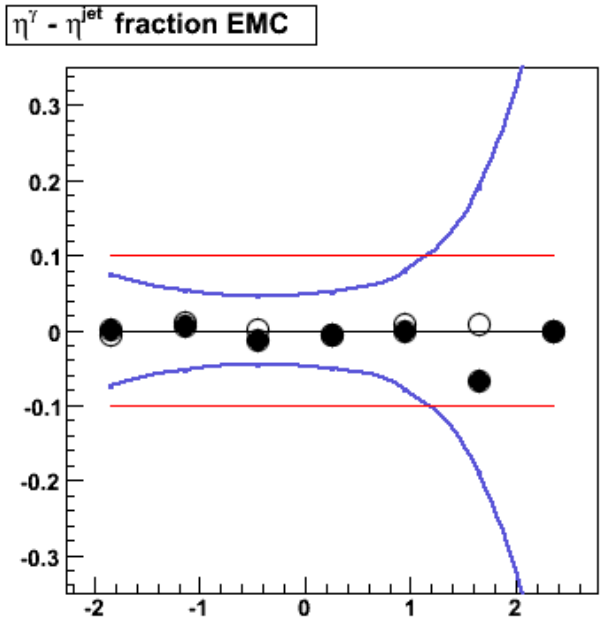

η^{γ} - η^{jet}, X_{γ}^{meas} < 0.7 δZ
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-2
-1
0
1
2

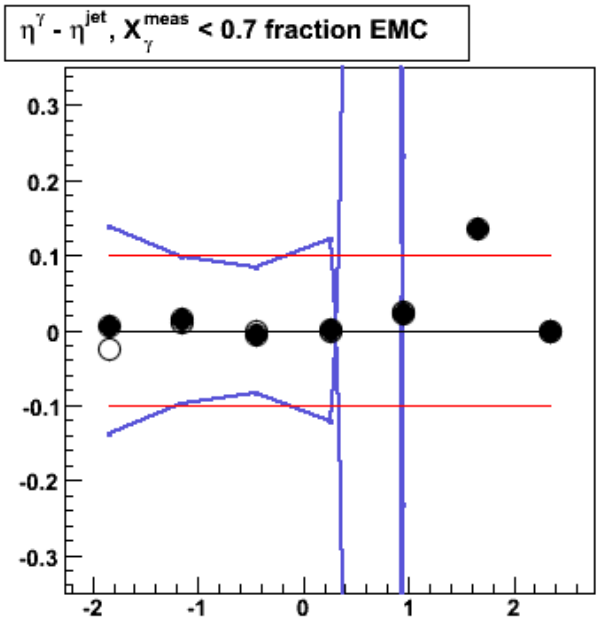

η^{γ} - η^{jet}, X_{γ}^{meas} > 0.8 δZ
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-2
-1
0
1
2

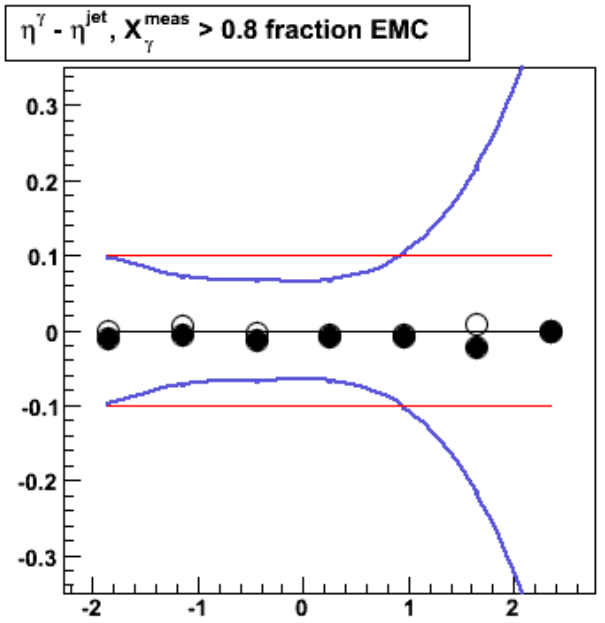

η^{γ} - η^{jet} E_{γ}
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-2
-1
0
1
2

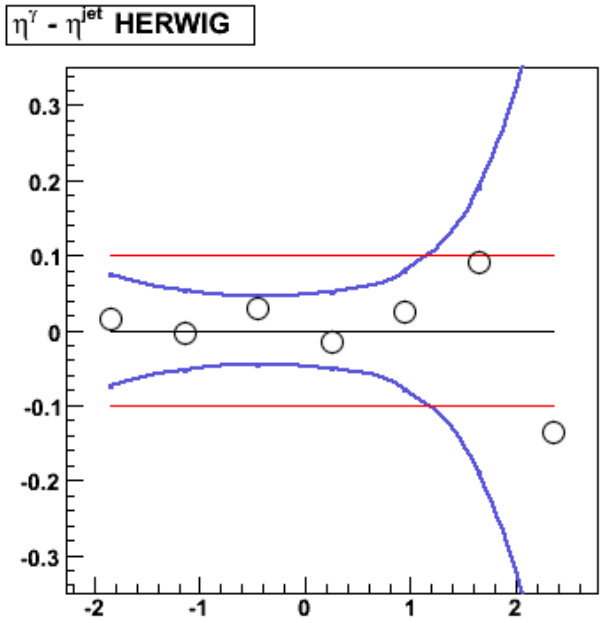

η^{γ} - η^{jet}, X_{γ}^{meas} < 0.7 E_{γ}
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-2
-1
0
1
2

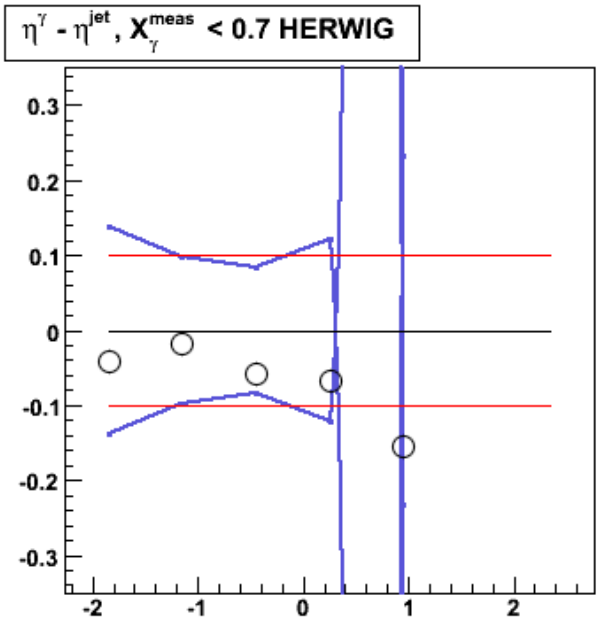

η^{γ} - η^{jet}, X_{γ}^{meas} > 0.8 E_{γ}
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-2
-1
0
1
2

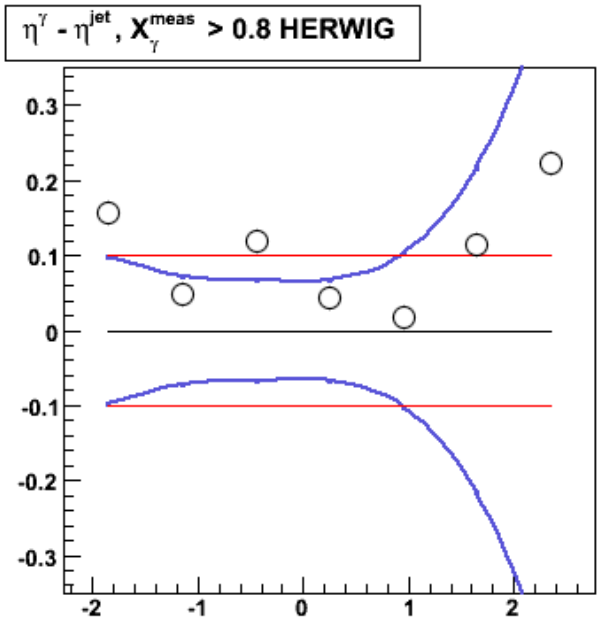

η^{γ} - η^{jet} fraction EMC
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-2
-1
0
1
2

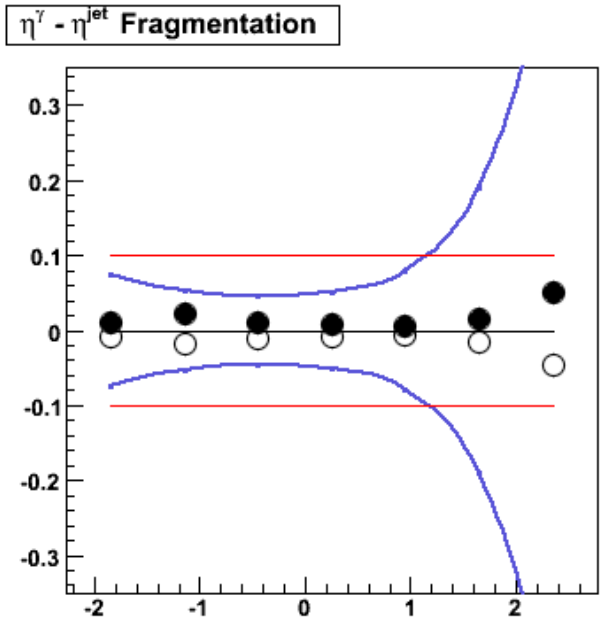

η^{γ} - η^{jet}, X_{γ}^{meas} < 0.7 fraction EMC
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-2
-1
0
1
2

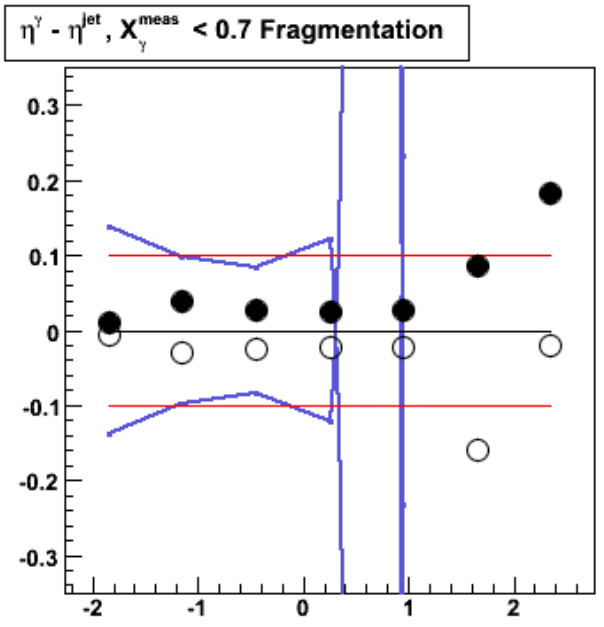

η^{γ} - η^{jet}, X_{γ}^{meas} > 0.8 fraction EMC
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-2
-1
0
1
2

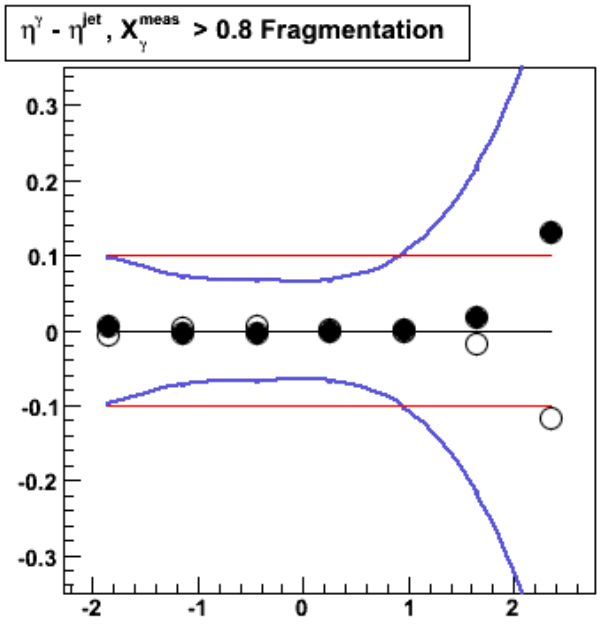

η^{γ} - η^{jet} HERWIG
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-2
-1
0
1
2

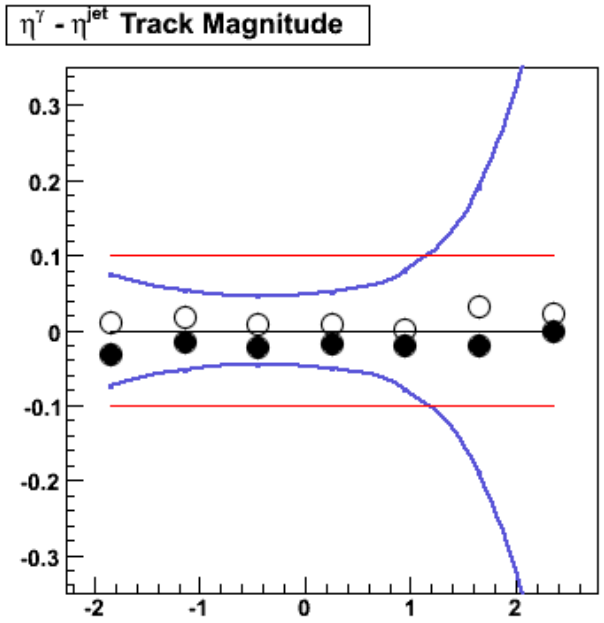

η^{γ} - η^{jet}, X_{γ}^{meas} < 0.7 HERWIG
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-2
-1
0
1
2

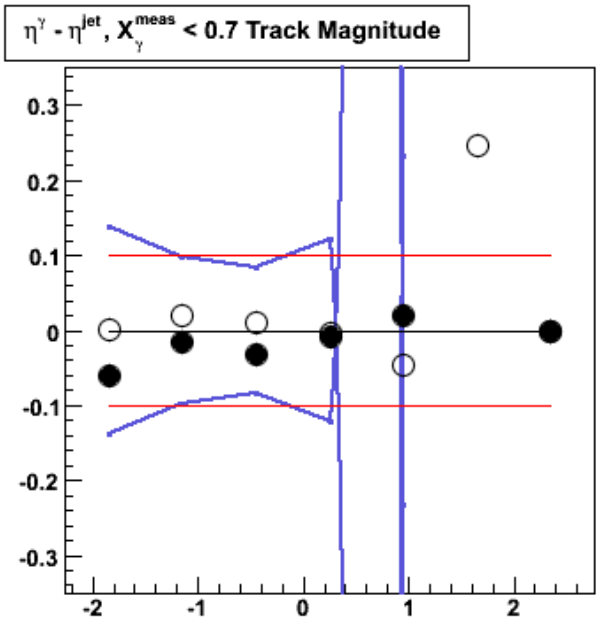

η^{γ} - η^{jet}, X_{γ}^{meas} > 0.8 HERWIG
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-2
-1
0
1
2

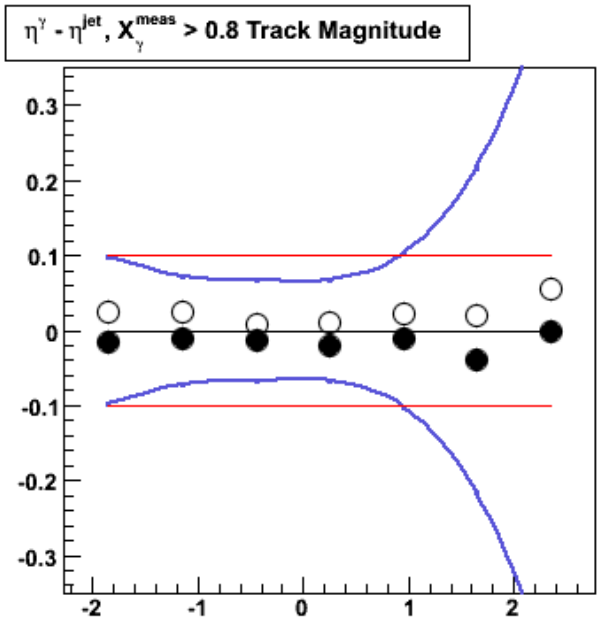

η^{γ} - η^{jet} Fragmentation
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-2
-1
0
1
2

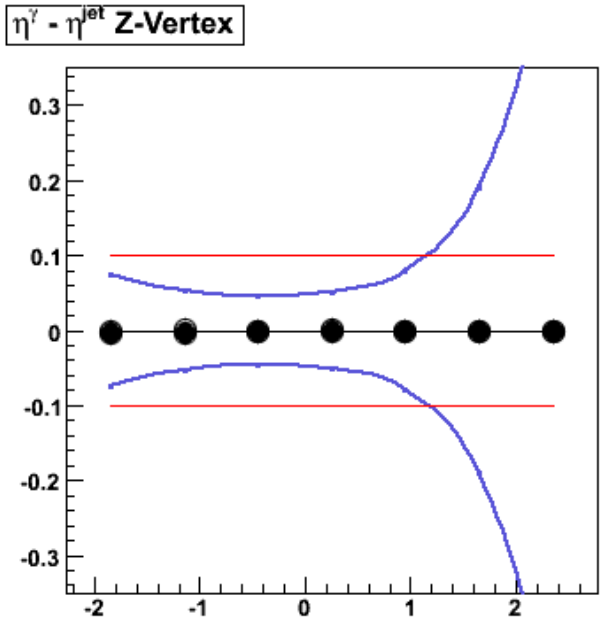

η^{γ} - η^{jet}, X_{γ}^{meas} < 0.7 Fragmentation
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-2
-1
0
1
2

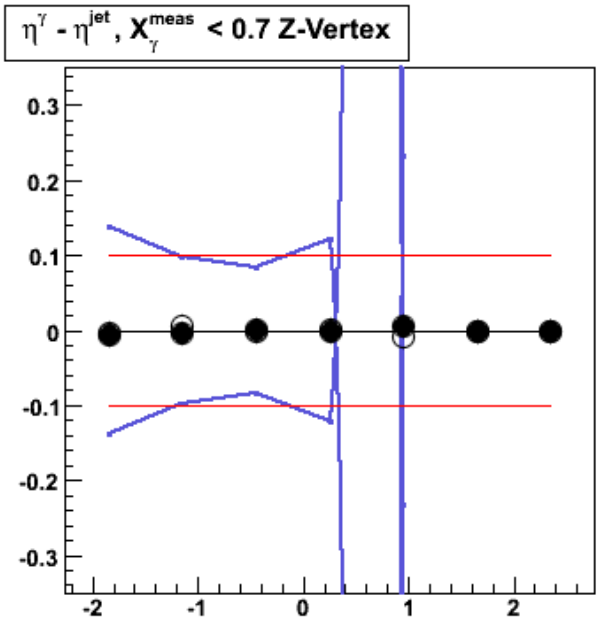

η^{γ} - η^{jet}, X_{γ}^{meas} > 0.8 Fragmentation
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-2
-1
0
1
2

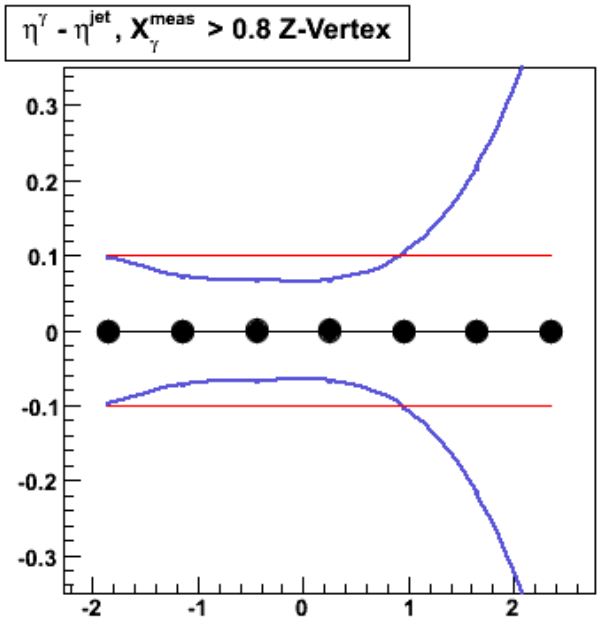

η^{γ} - η^{jet} Track Magnitude
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-2
-1
0
1
2

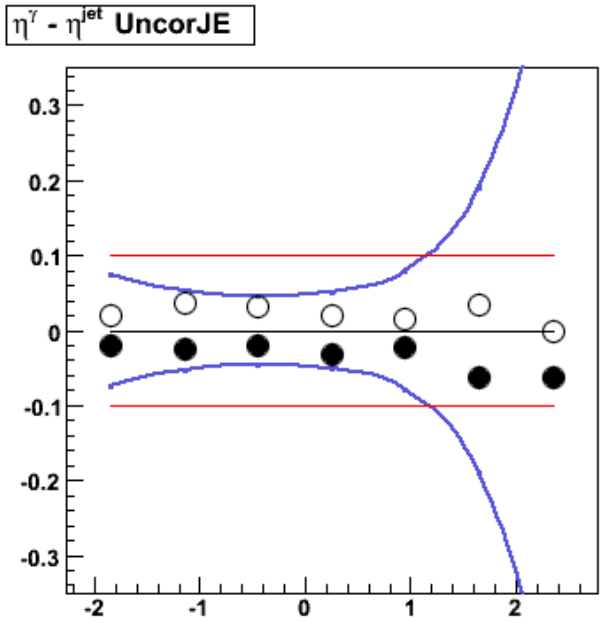

η^{γ} - η^{jet}, X_{γ}^{meas} < 0.7 Track Magnitude
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-2
-1
0
1
2

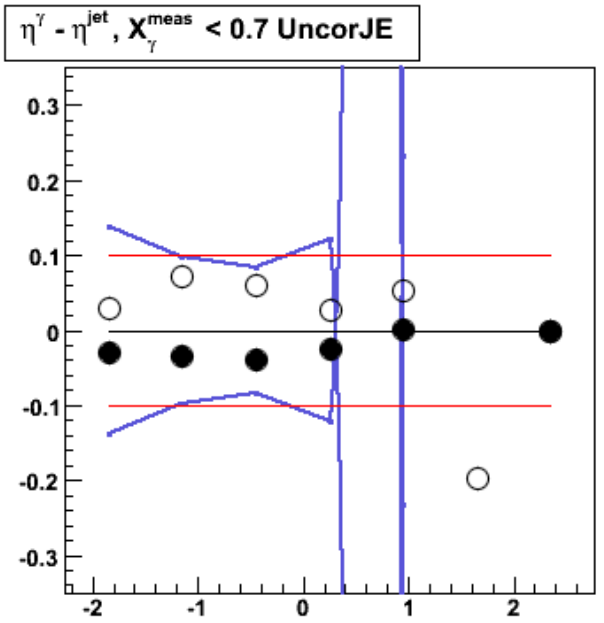

η^{γ} - η^{jet}, X_{γ}^{meas} > 0.8 Track Magnitude
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-2
-1
0
1
2

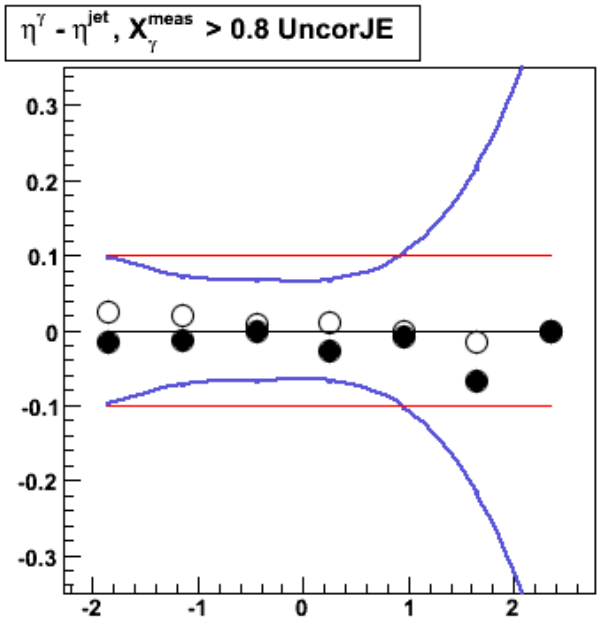

η^{γ} - η^{jet} Z-Vertex
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-2
-1
0
1
2


η^{γ} - η^{jet}, X_{γ}^{meas} < 0.7 Z-Vertex
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-2
-1
0
1
2


η^{γ} - η^{jet}, X_{γ}^{meas} > 0.8 Z-Vertex
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-2
-1
0
1
2







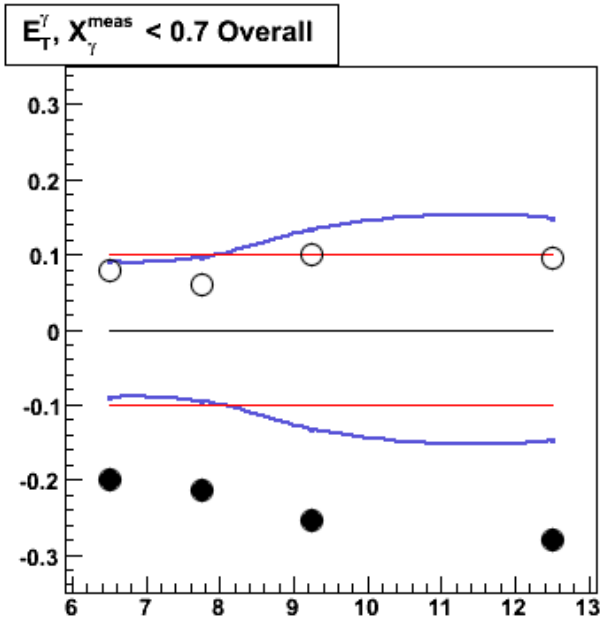
Standard cuts:

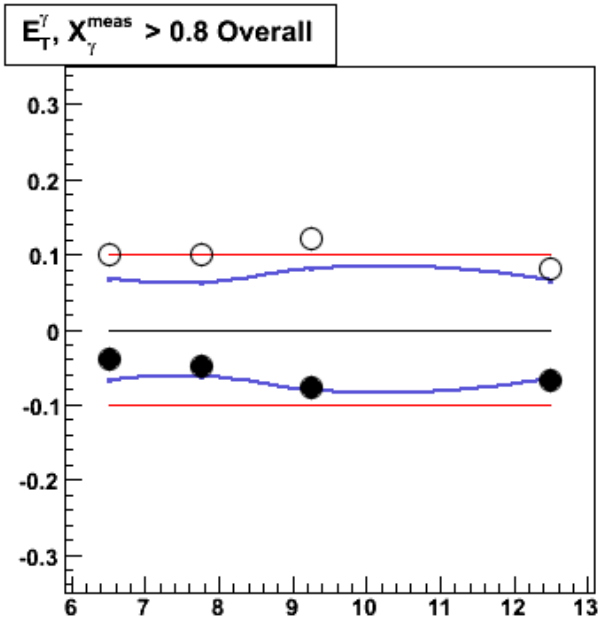
Vary jet energy independently from gamma energy:

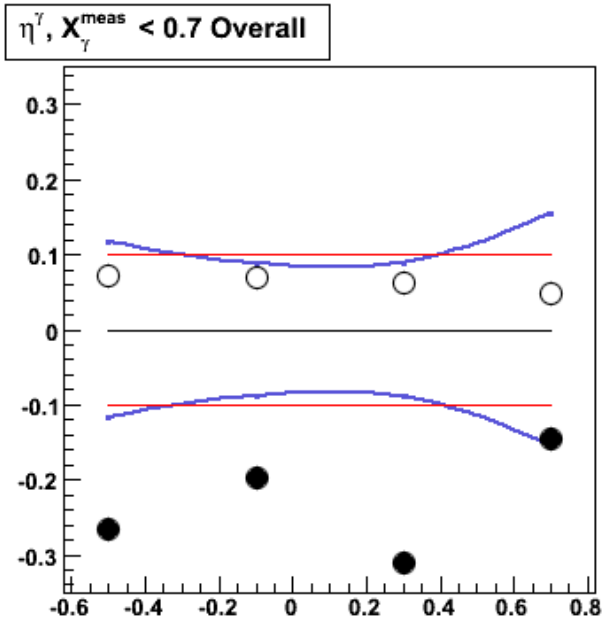
If JetEt ≤ 6 GeV by sqrt(4.*4. + 2.*2.))

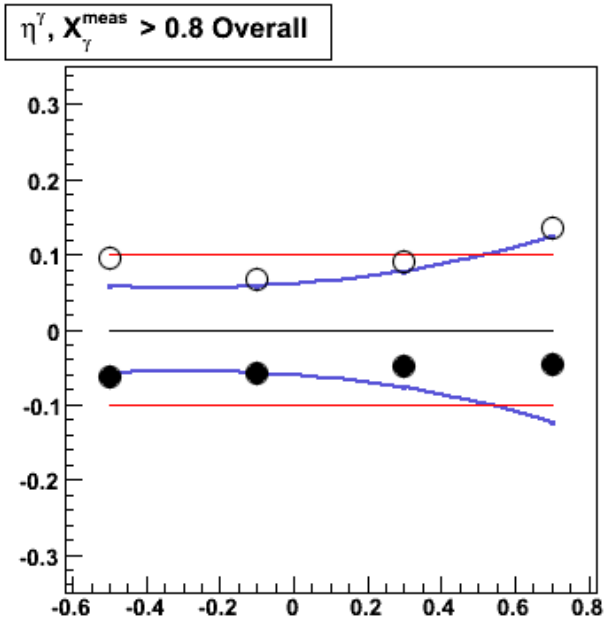
If 6 < JetEt ≤ 10 GeV by sqrt(2.*2. +2.*2.))

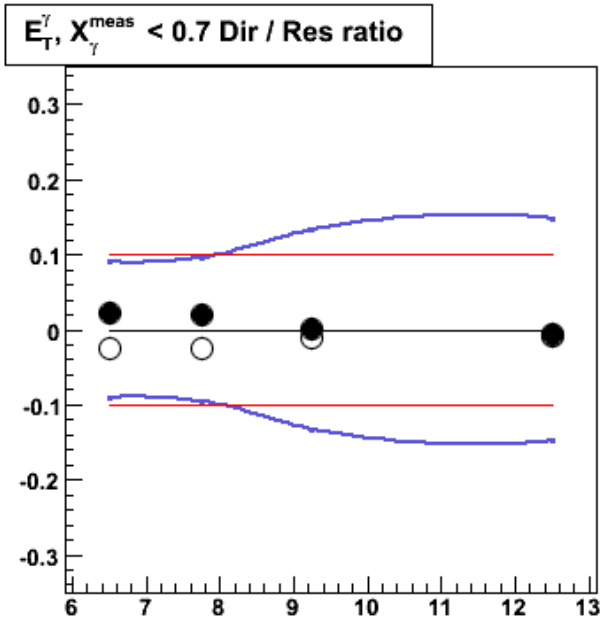
If JetEt > 10 GeV vary by sqrt(1.5*1.5 + 2.*2.))

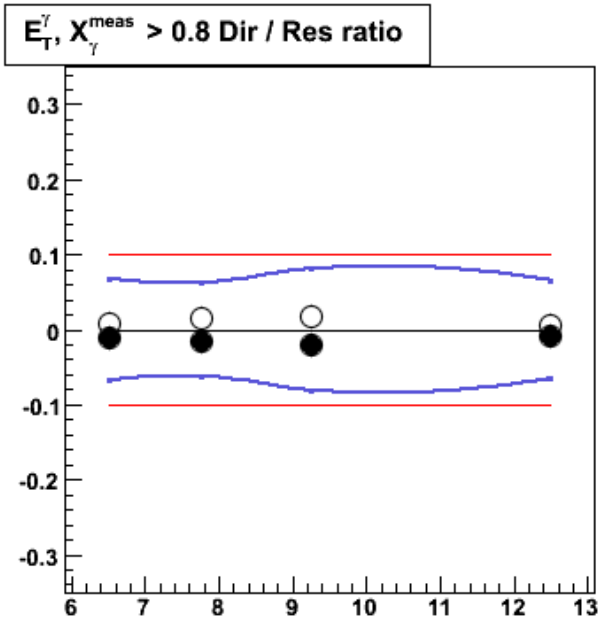

E_T^γ, X_γ^{meas} < 0.7 Overall
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
6
7
8
9
10
11
12
13

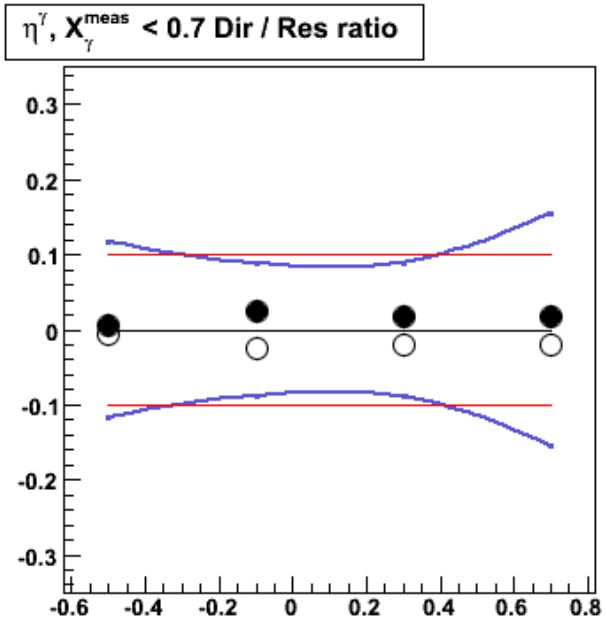

E_T^γ, X_γ^{meas} > 0.8 Overall
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
6
7
8
9
10
11
12
13

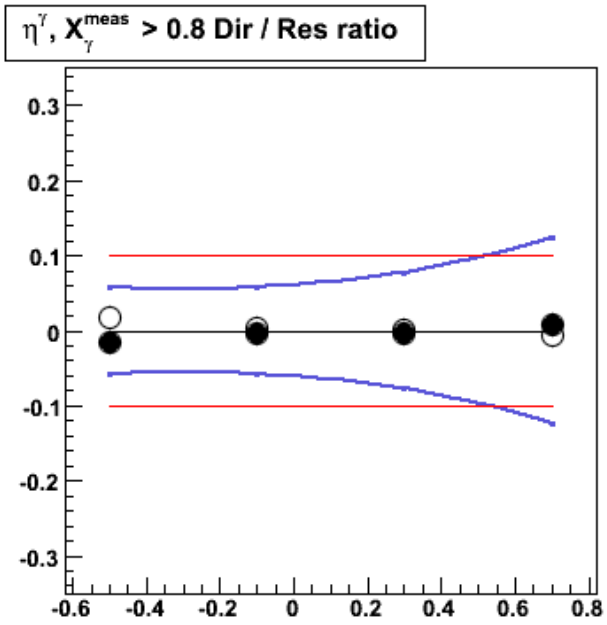

η^γ, X_γ^{meas} < 0.7 Overall
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8

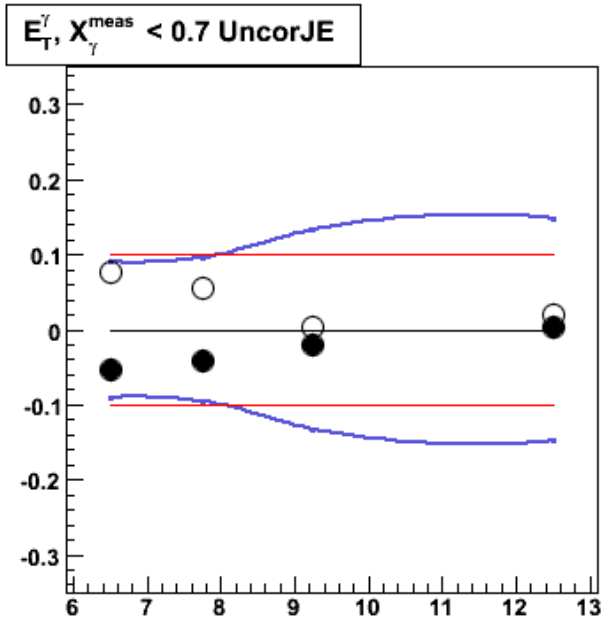

η^γ, X_γ^{meas} > 0.8 Overall
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8

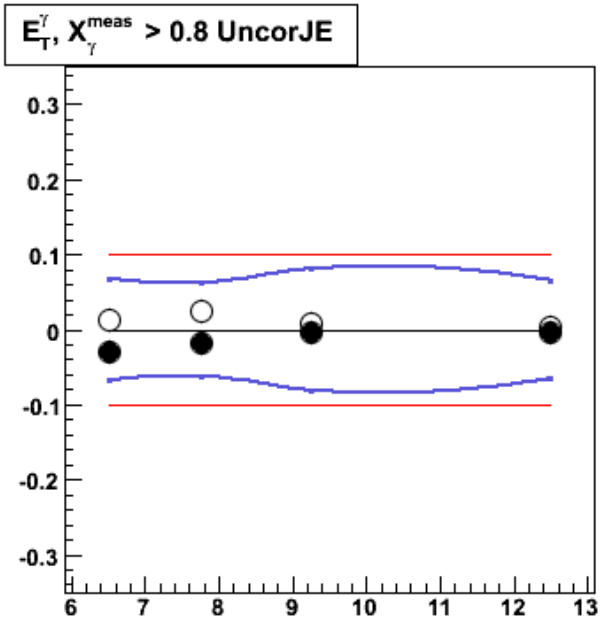

E_T^γ, X_γ^{meas} < 0.7 Dir / Res ratio
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
6
7
8
9
10
11
12
13

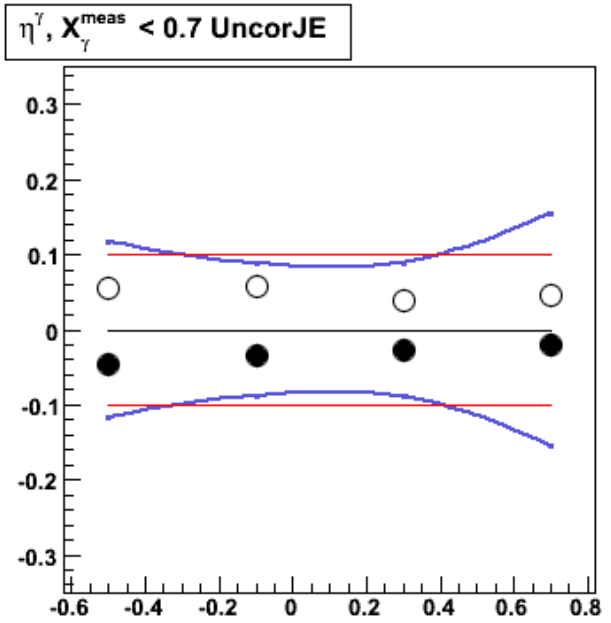

E_T^γ, X_γ^{meas} > 0.8 Dir / Res ratio
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
6
7
8
9
10
11
12
13

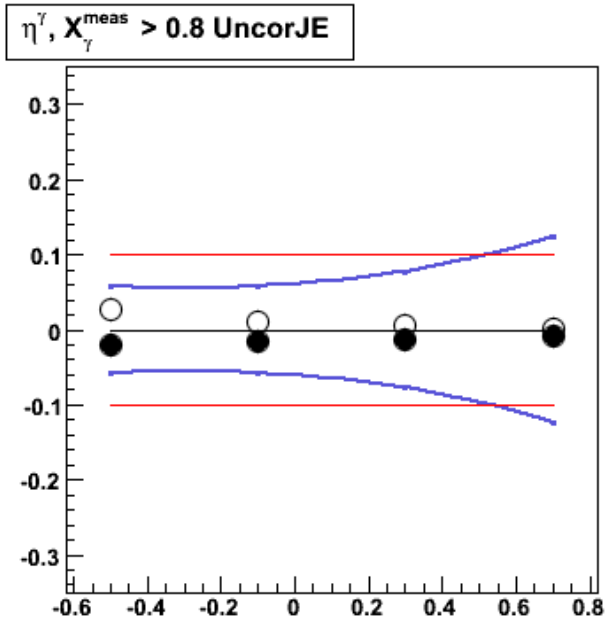

η^γ, X_γ^{meas} < 0.7 Dir / Res ratio
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8


η^γ, X_γ^{meas} > 0.8 Dir / Res ratio
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8









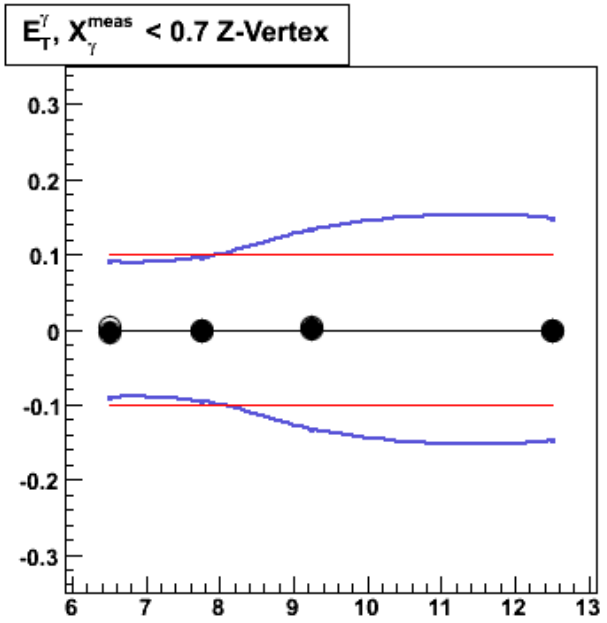
Standard cuts:

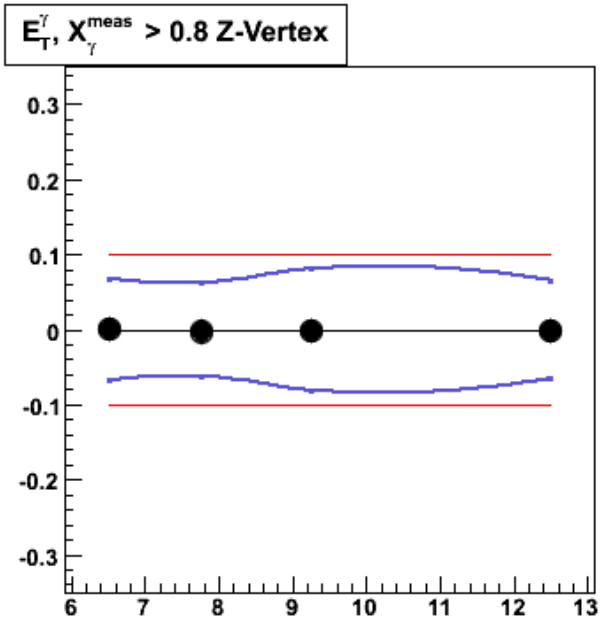
Vary jet energy independently from gamma energy:

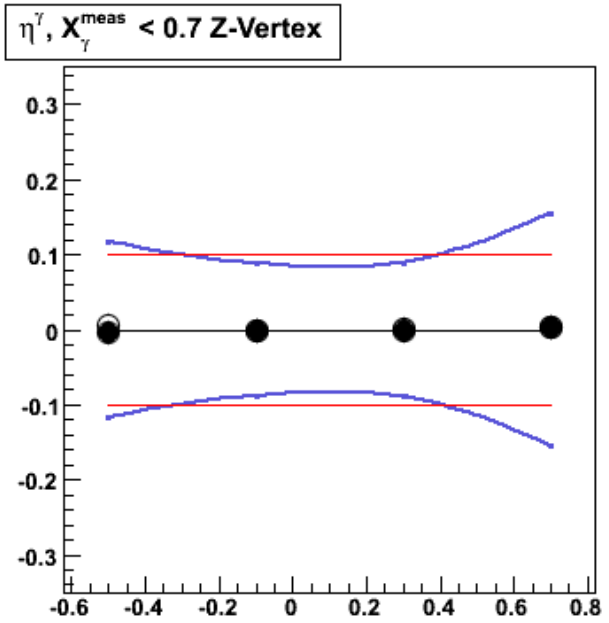
If JetEt ≤ 6 GeV by sqrt(4.*4. + 2.*2.))

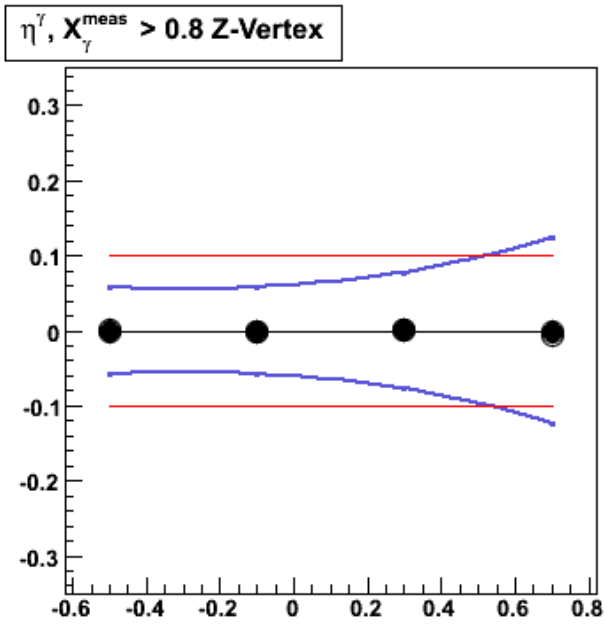
If 6 < JetEt ≤ 10 GeV by sqrt(2.*2. +2.*2.))

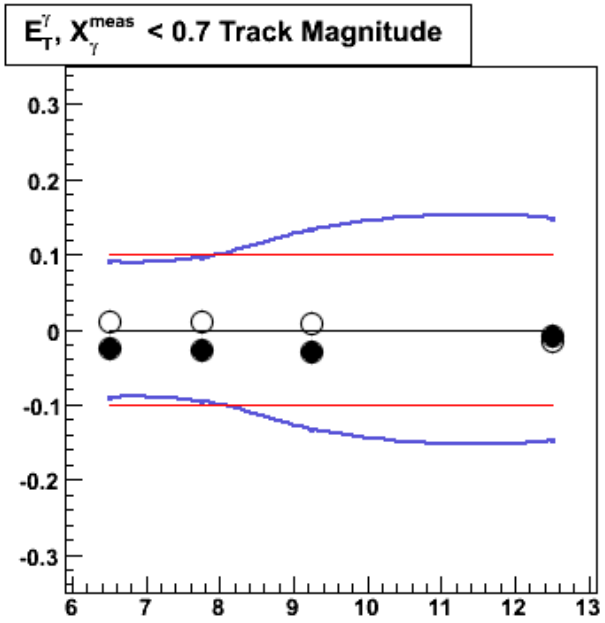
If JetEt > 10 GeV vary by sqrt(1.5*1.5 + 2.*2.))

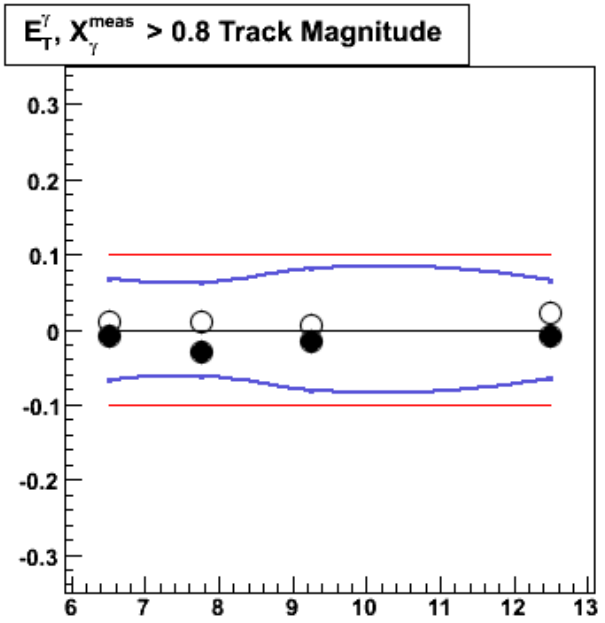

E_T^γ, X_γ^{meas} < 0.7 Z-Vertex
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
6
7
8
9
10
11
12
13

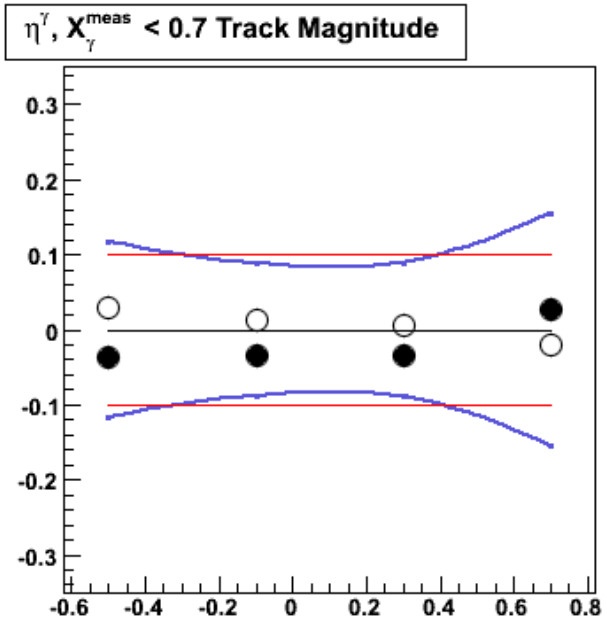

E_T^γ, X_γ^{meas} > 0.8 Z-Vertex
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
6
7
8
9
10
11
12
13

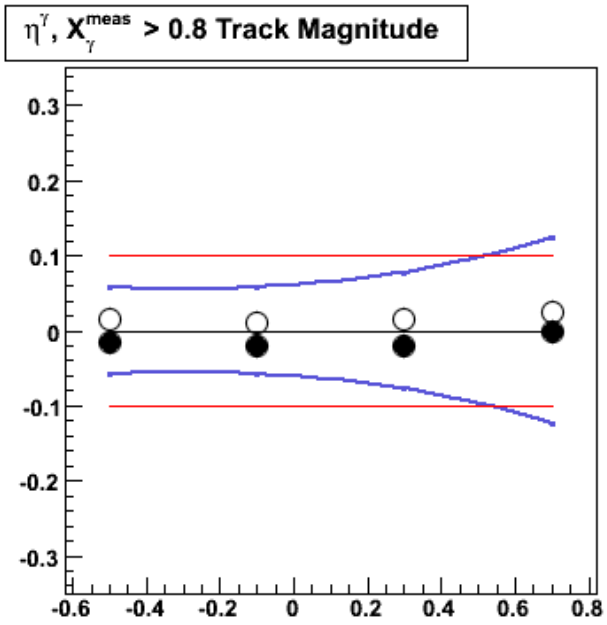

η^γ, X_γ^{meas} < 0.7 Z-Vertex
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8

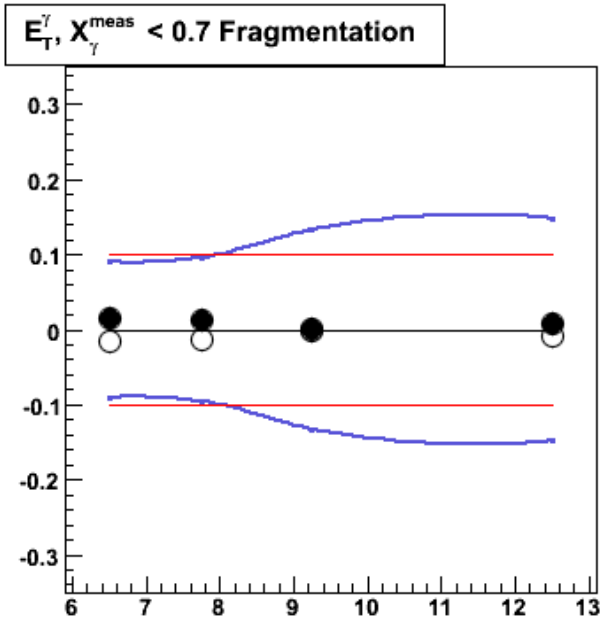

η^γ, X_γ^{meas} > 0.8 Z-Vertex
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8

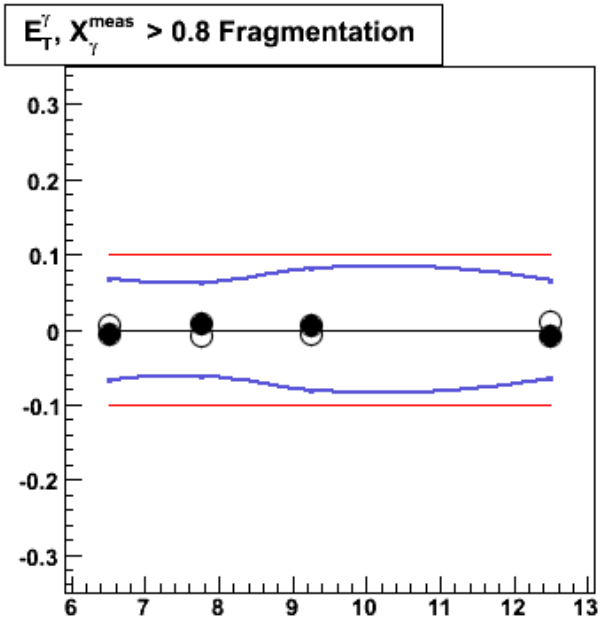

E_T^γ, X_γ^{meas} < 0.7 Track Magnitude
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
6
7
8
9
10
11
12
13

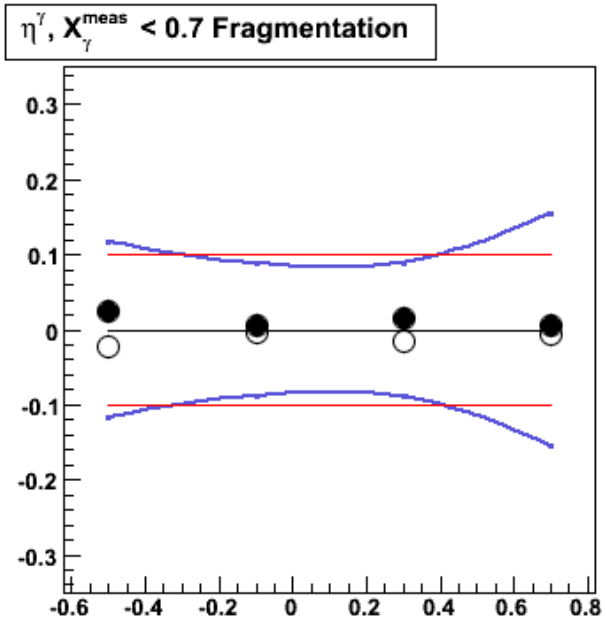

E_T^γ, X_γ^{meas} > 0.8 Track Magnitude
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
6
7
8
9
10
11
12
13

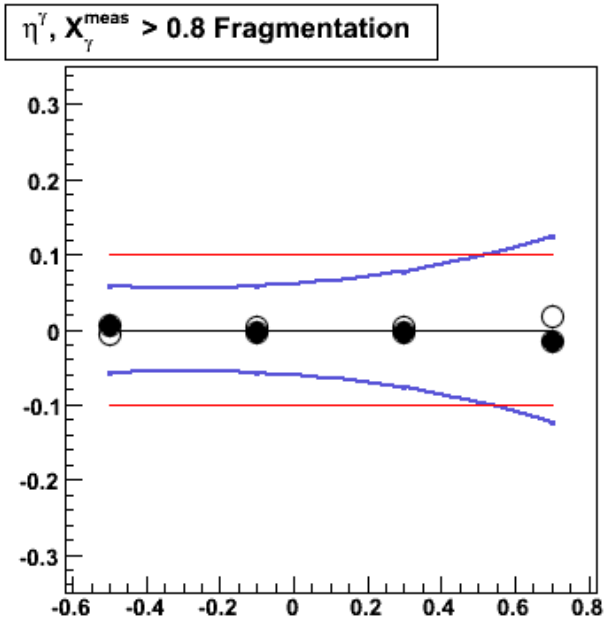

η^γ, X_γ^{meas} < 0.7 Track Magnitude
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8

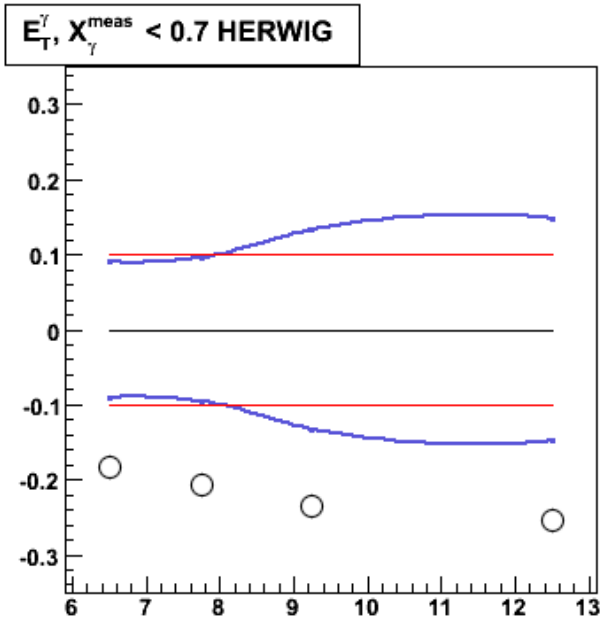

η^γ, X_γ^{meas} > 0.8 Track Magnitude
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8

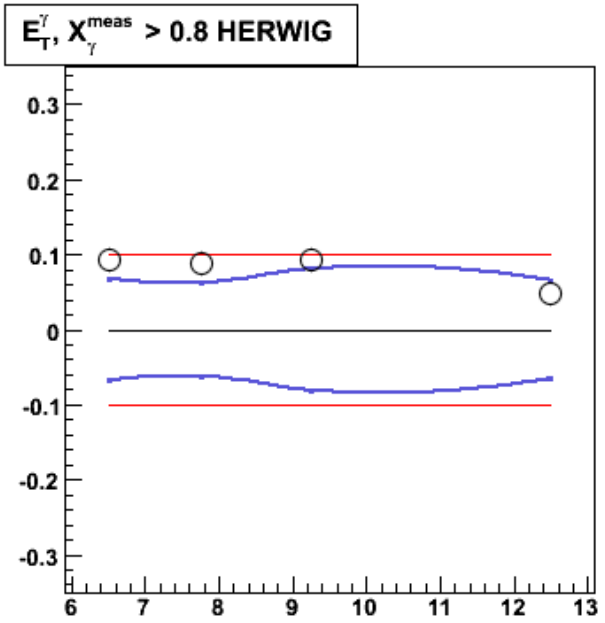

E_T^γ, X_γ^{meas} < 0.7 Fragmentation
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
6
7
8
9
10
11
12
13

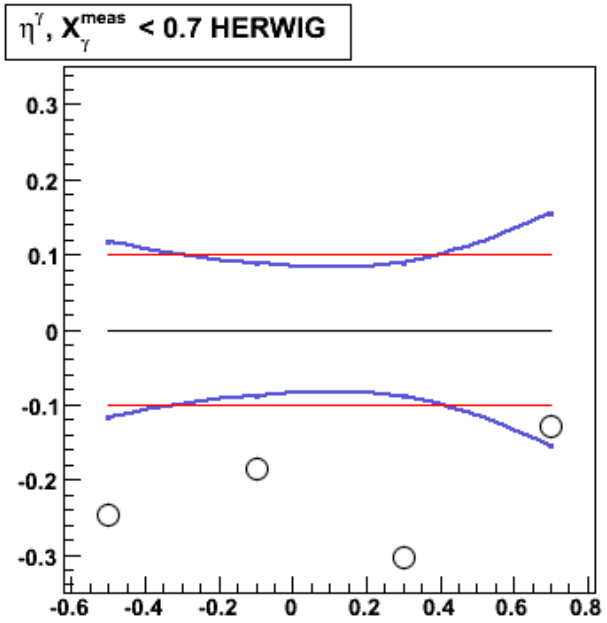

E_T^γ, X_γ^{meas} > 0.8 Fragmentation
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
6
7
8
9
10
11
12
13

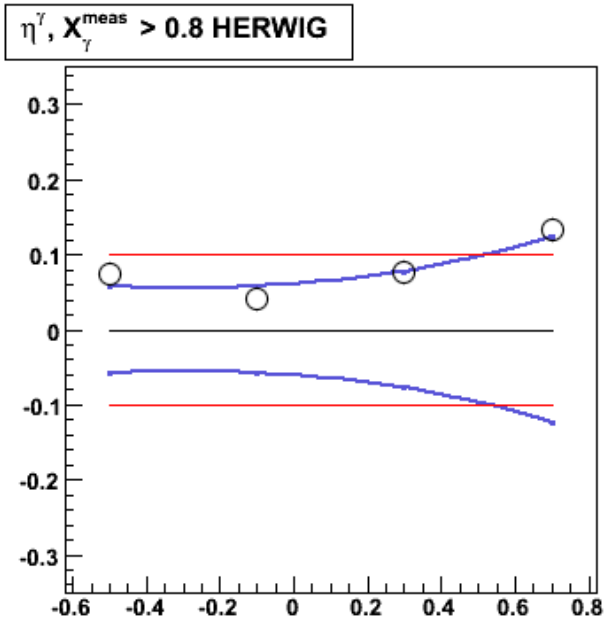

η^γ, X_γ^{meas} < 0.7 Fragmentation
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8

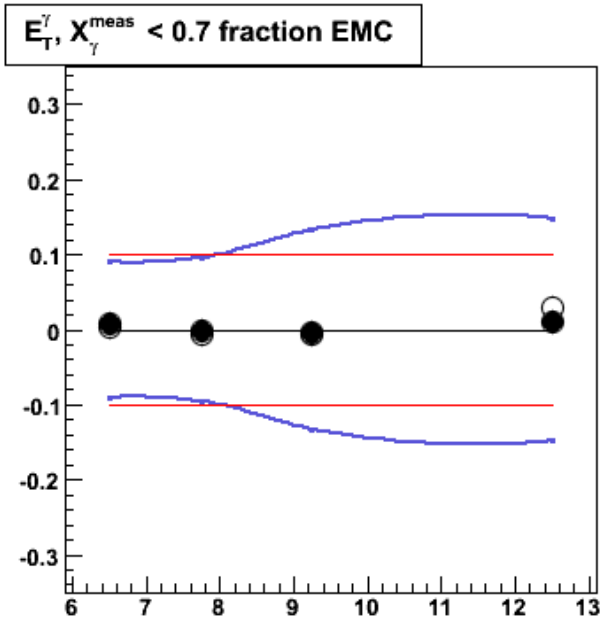

η^γ, X_γ^{meas} > 0.8 Fragmentation
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8

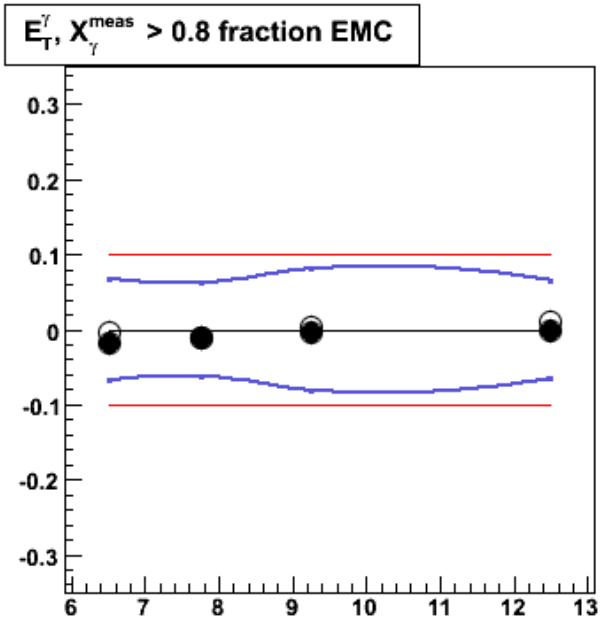

E_T^γ, X_γ^{meas} < 0.7 HERWIG
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
6
7
8
9
10
11
12
13

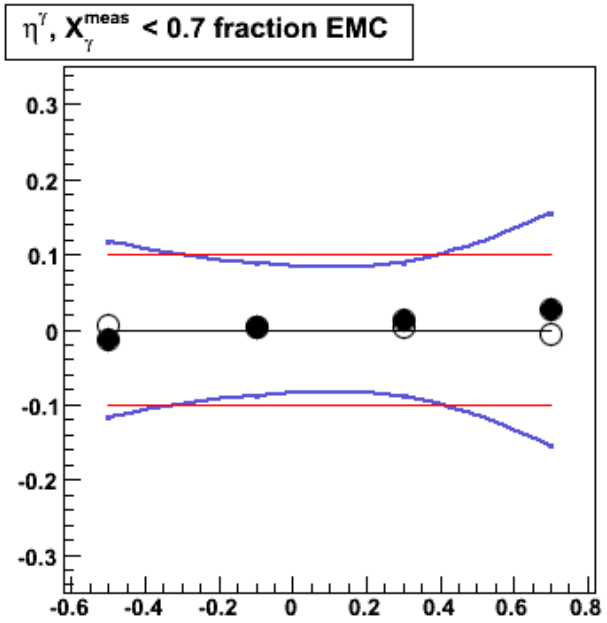

E_T^γ, X_γ^{meas} > 0.8 HERWIG
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
6
7
8
9
10
11
12
13

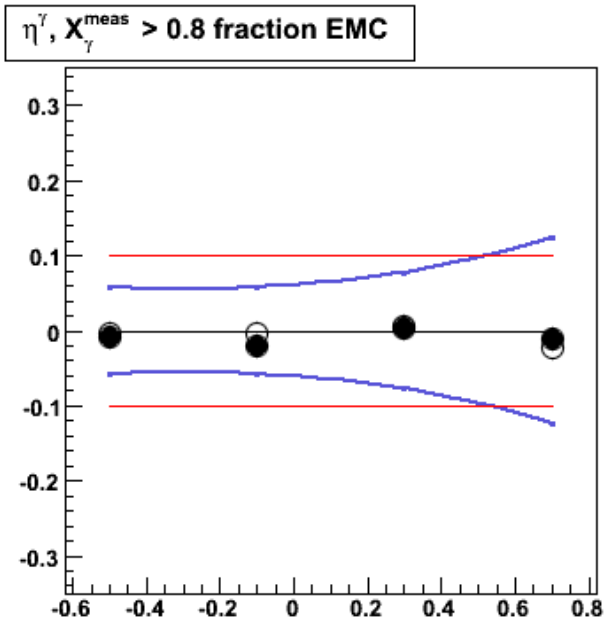

η^γ, X_γ^{meas} < 0.7 HERWIG
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8

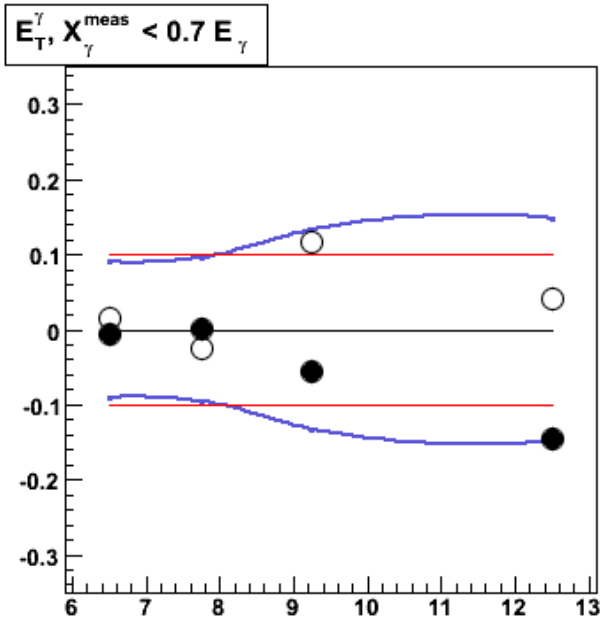

η^γ, X_γ^{meas} > 0.8 HERWIG
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8

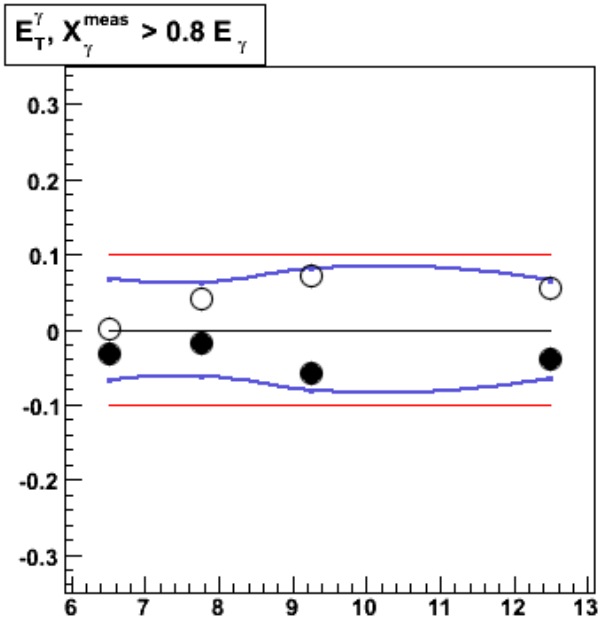

E_T^γ, X_γ^{meas} < 0.7 fraction EMC
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
6
7
8
9
10
11
12
13

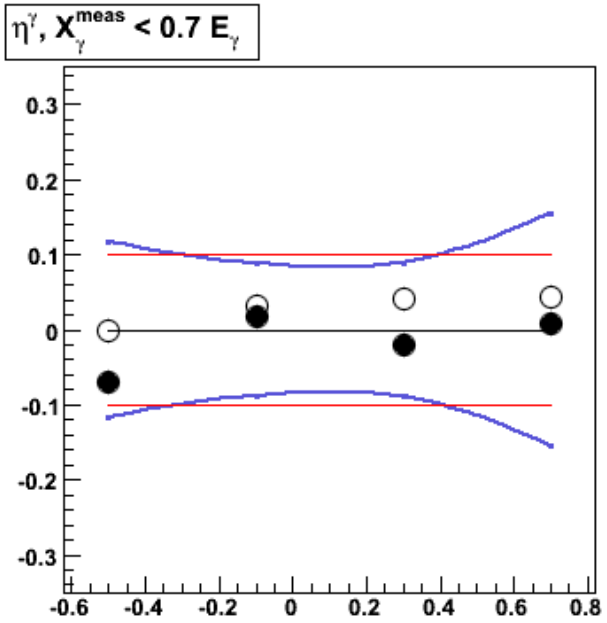

E_T^γ, X_γ^{meas} > 0.8 fraction EMC
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
6
7
8
9
10
11
12
13

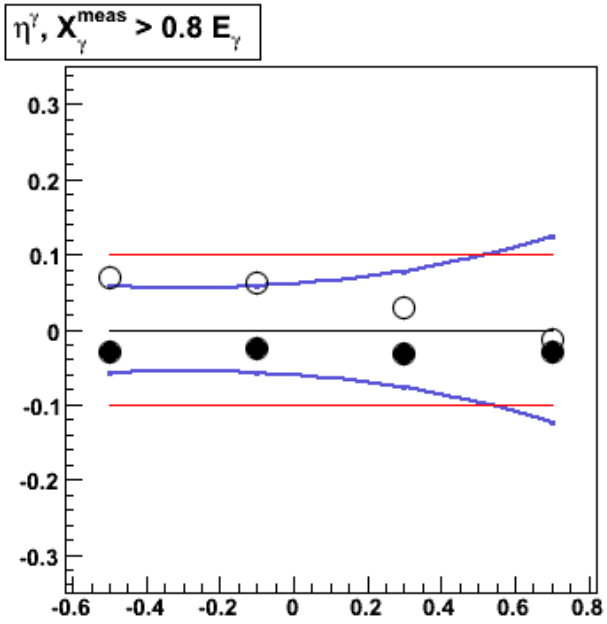

η^γ, X_γ^{meas} < 0.7 fraction EMC
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8

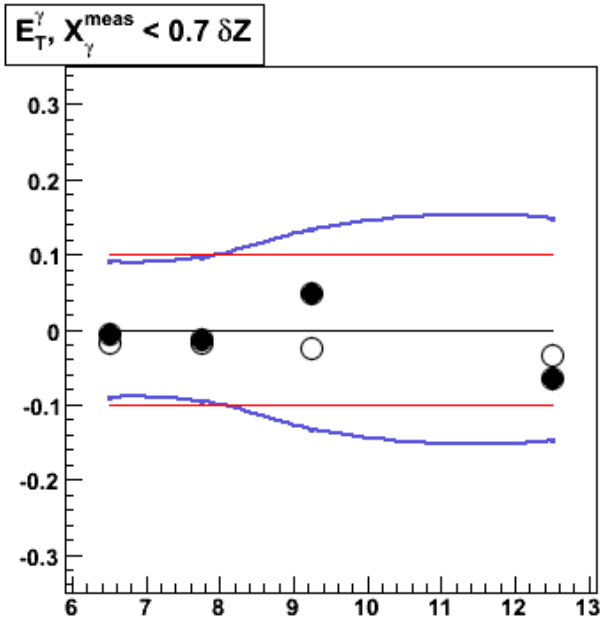

η^γ, X_γ^{meas} > 0.8 fraction EMC
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8

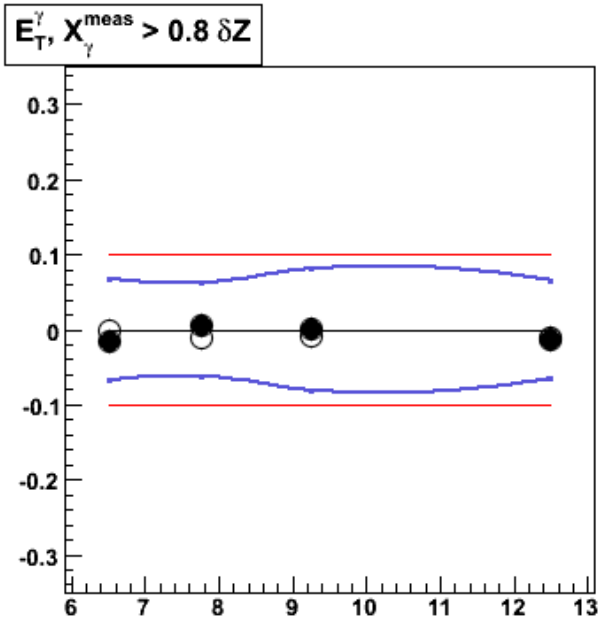

E_T^γ, X_γ^{meas} < 0.7 E_γ
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
6
7
8
9
10
11
12
13

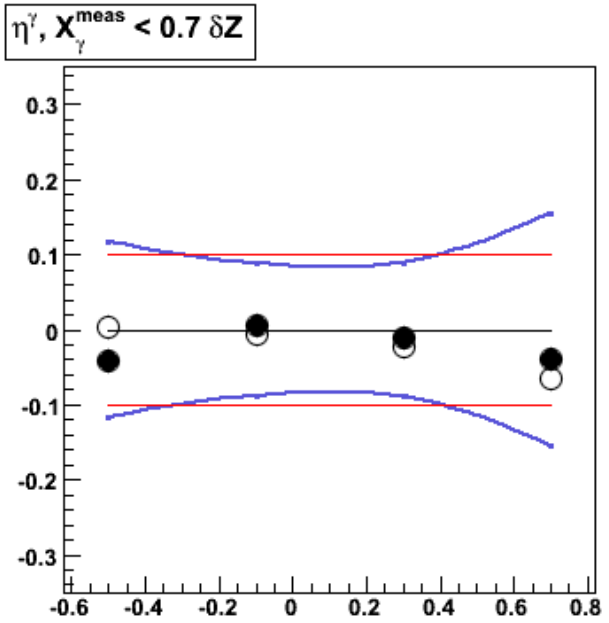

E_T^γ, X_γ^{meas} > 0.8 E_γ
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
6
7
8
9
10
11
12
13

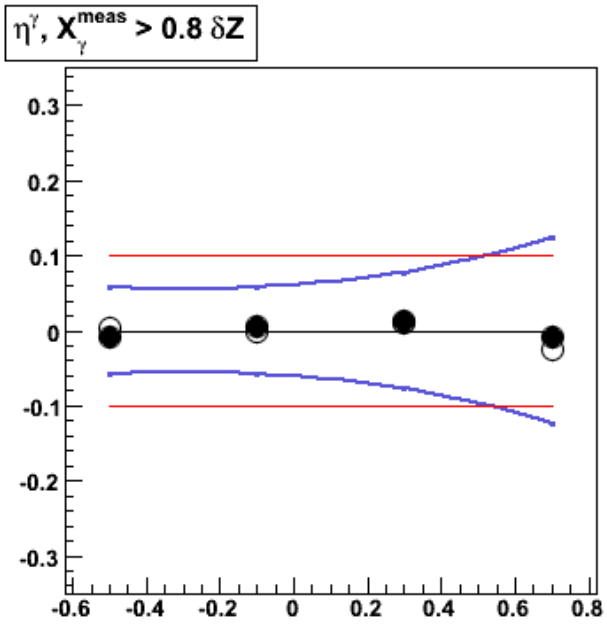

η^γ, X_γ^{meas} < 0.7 E_γ
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8

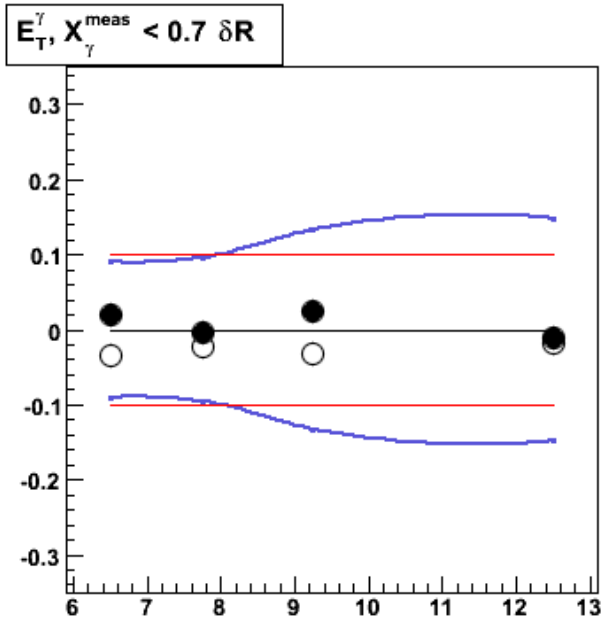

η^γ, X_γ^{meas} > 0.8 E_γ
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8

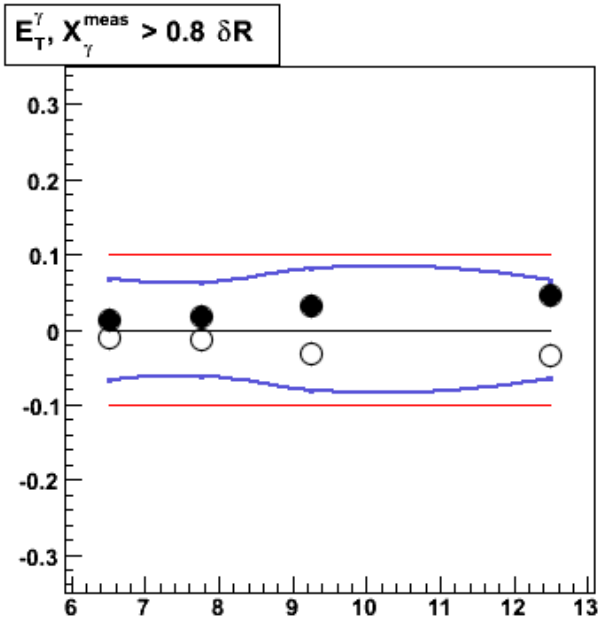

E_T^γ, X_γ^{meas} < 0.7 δZ
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
6
7
8
9
10
11
12
13

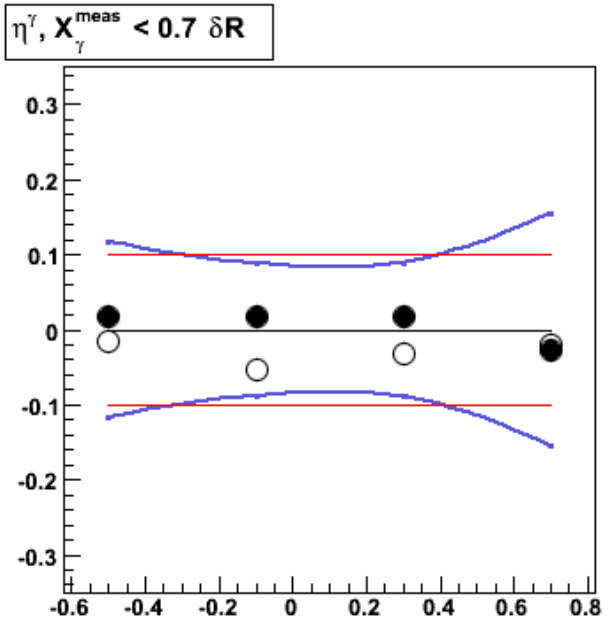

E_T^γ, X_γ^{meas} > 0.8 δZ
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
6
7
8
9
10
11
12
13

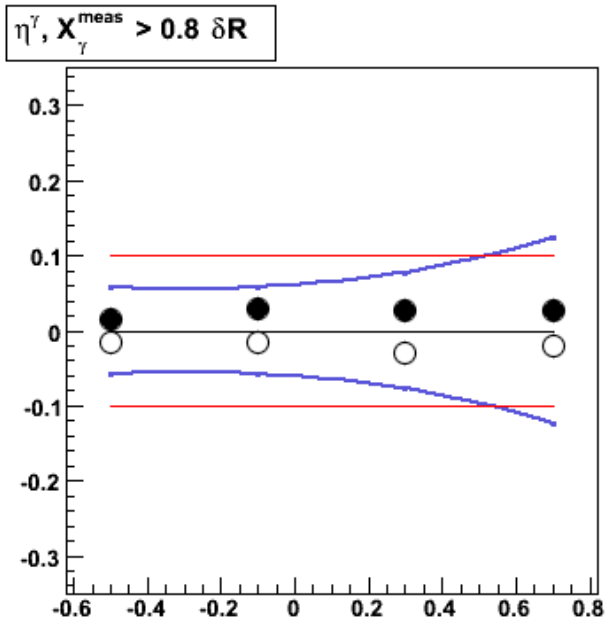

η^γ, X_γ^{meas} < 0.7 δZ
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8

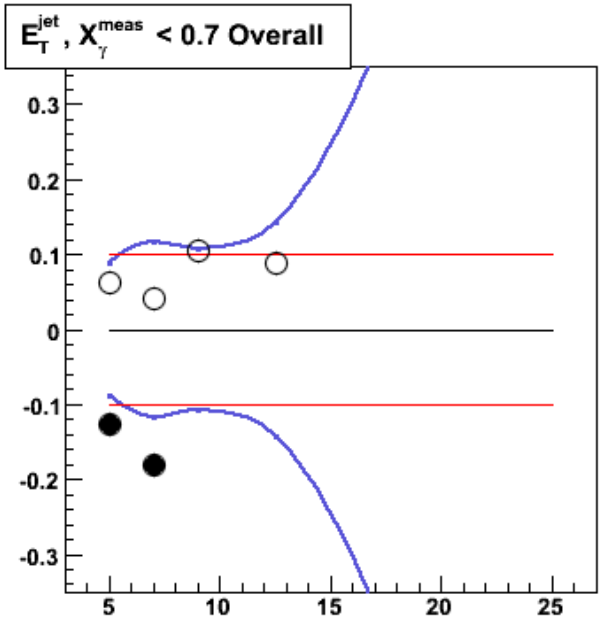

η^γ, X_γ^{meas} > 0.8 δZ
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8

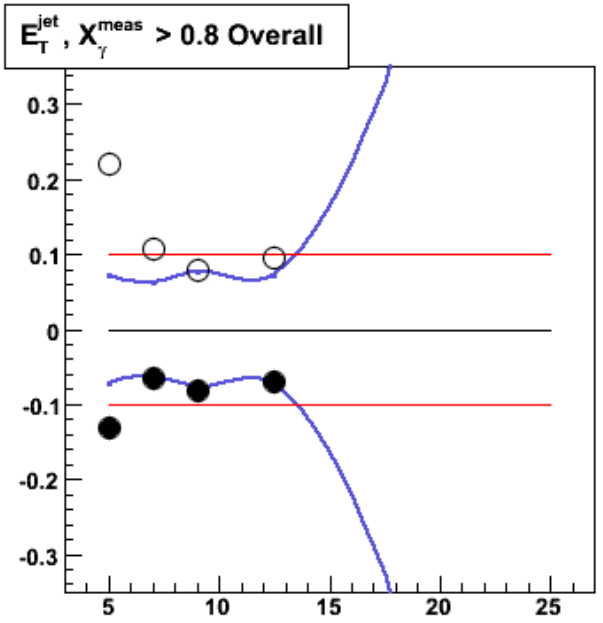

E_T^γ, X_γ^{meas} < 0.7 δR
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
6
7
8
9
10
11
12
13

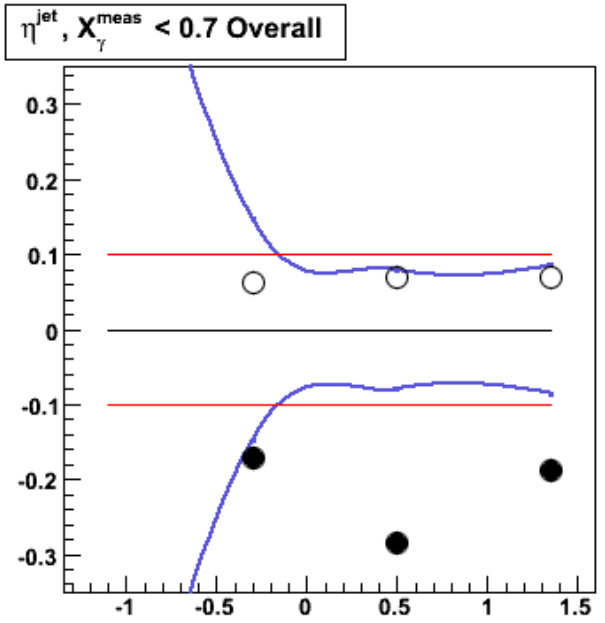

E_T^γ, X_γ^{meas} > 0.8 δR
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
6
7
8
9
10
11
12
13

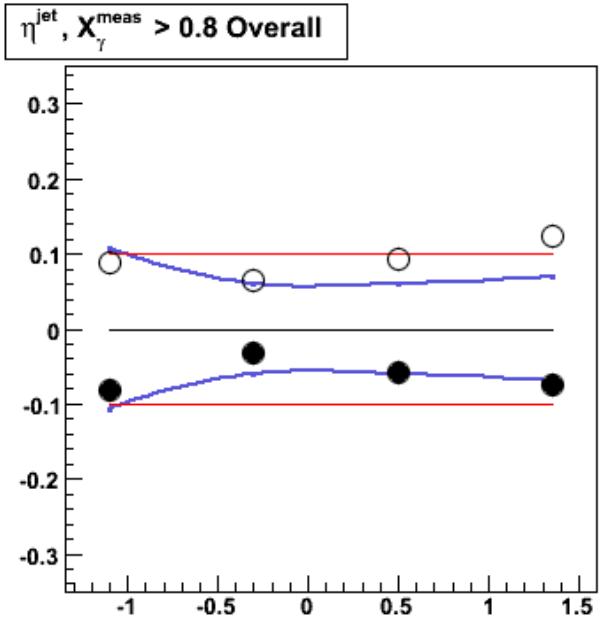

η^γ, X_γ^{meas} < 0.7 δR
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8

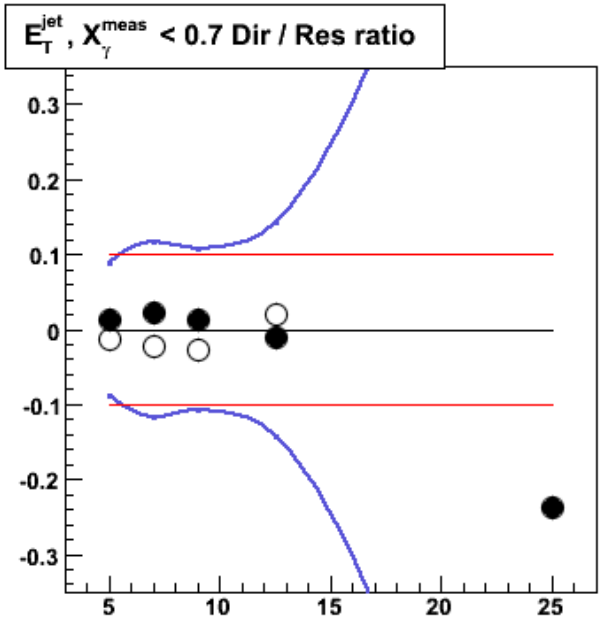

η^γ, X_γ^{meas} > 0.8 δR
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8

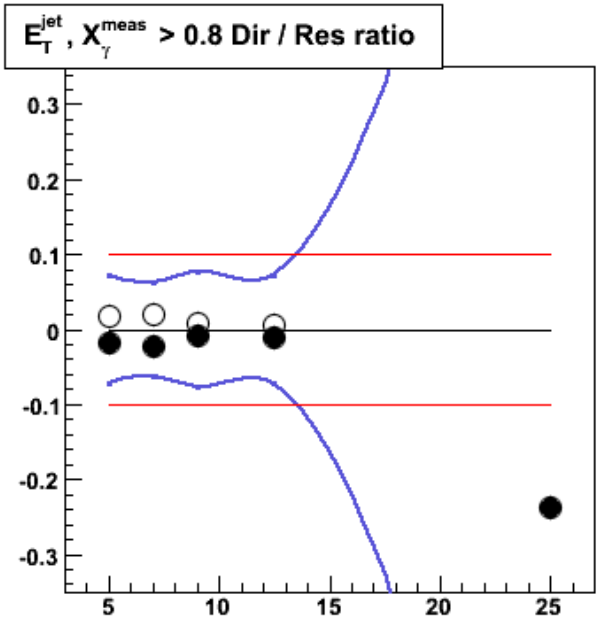

E_T^{jet}, X_γ^{meas} < 0.7 Overall
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
5
10
15
20
25

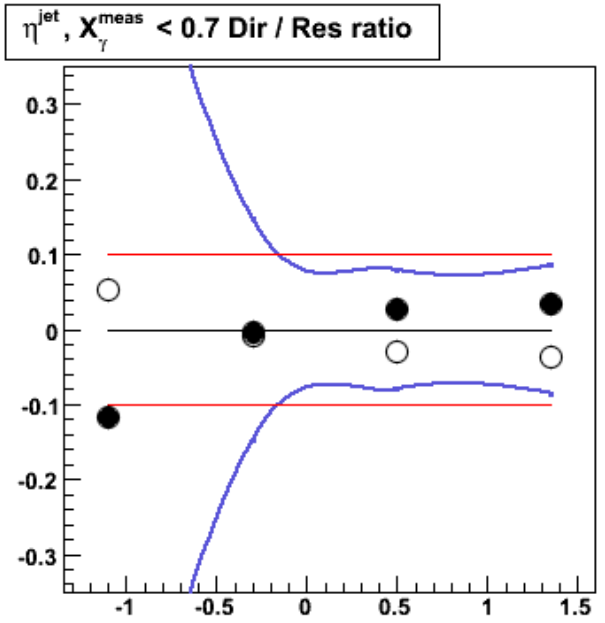

E_T^{jet}, X_γ^{meas} > 0.8 Overall
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
5
10
15
20
25

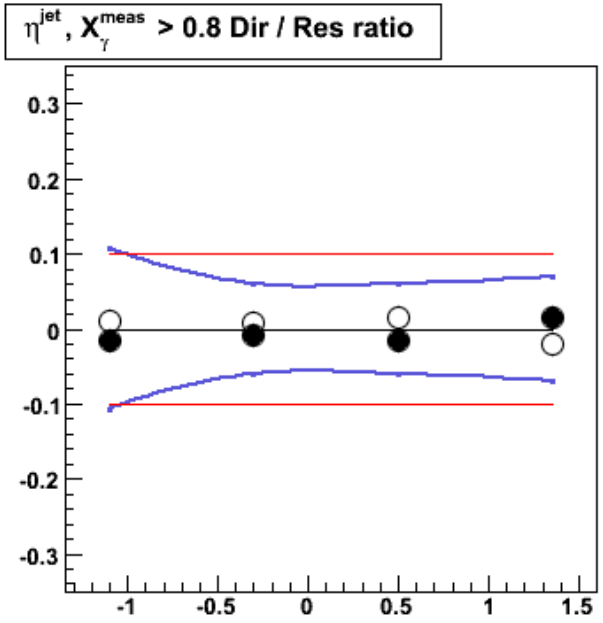

η^{jet}, X_γ^{meas} < 0.7 Overall
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-1
-0.5
0
0.5
1
1.5

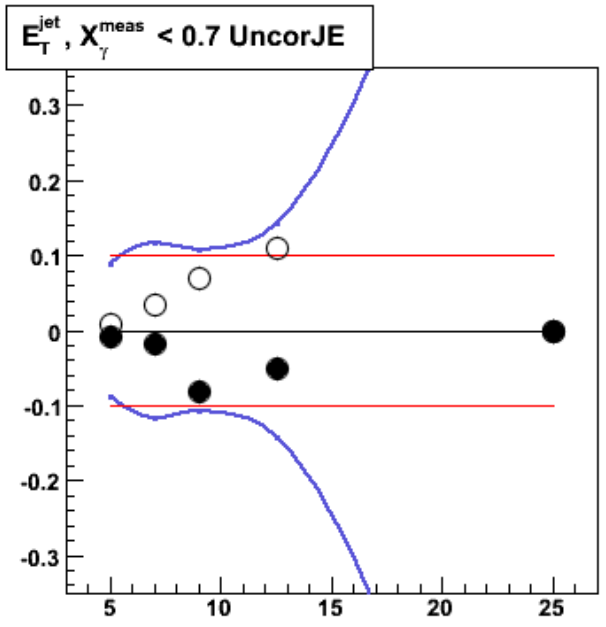

η^{jet}, X_γ^{meas} > 0.8 Overall
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-1
-0.5
0
0.5
1
1.5

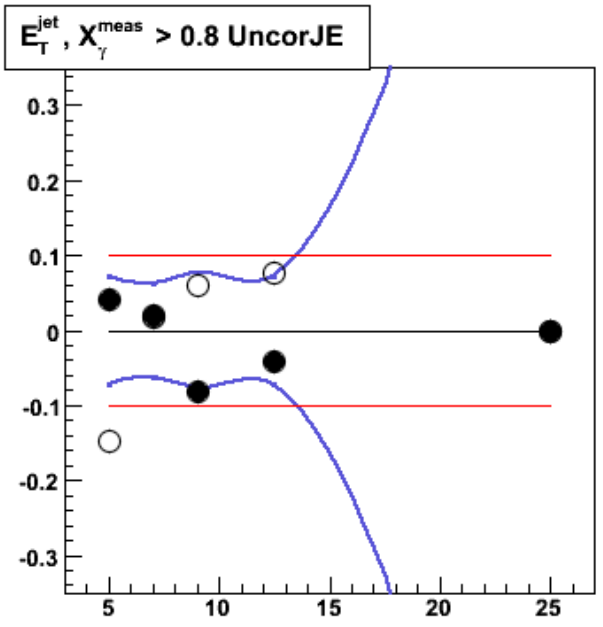

E_T^{jet}, X_γ^{meas} < 0.7 Dir / Res ratio
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
5
10
15
20
25

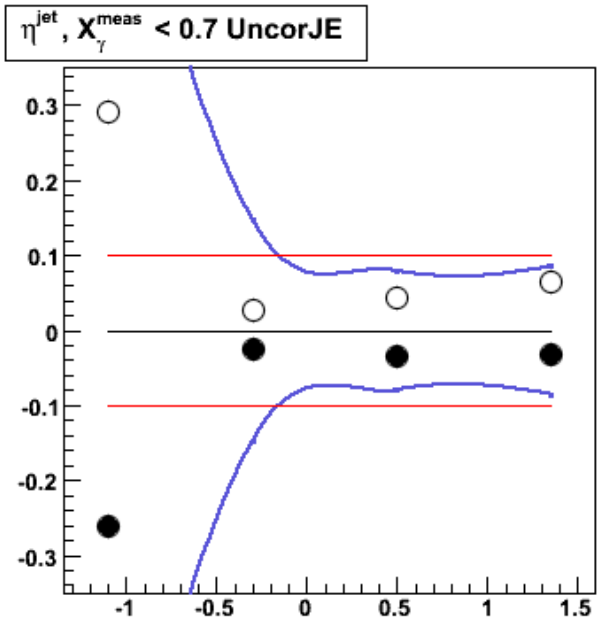

E_T^{jet}, X_γ^{meas} > 0.8 Dir / Res ratio
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
5
10
15
20
25

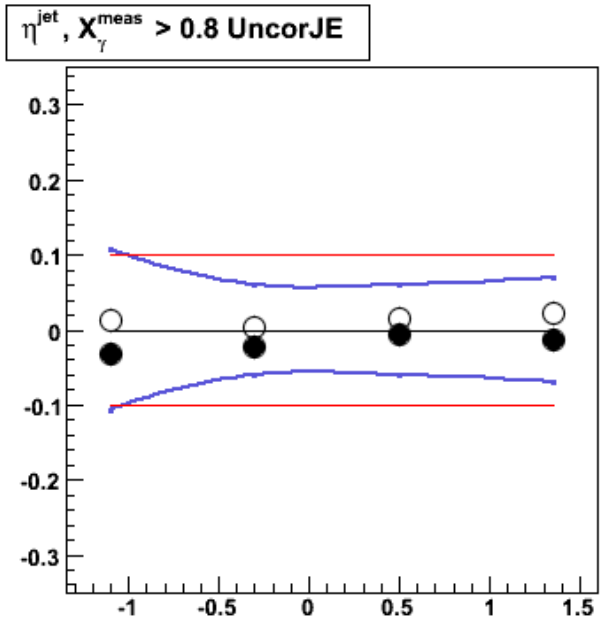

η^{jet}, X_γ^{meas} < 0.7 Dir / Res ratio
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-1
-0.5
0
0.5
1
1.5


η^{jet}, X_γ^{meas} > 0.8 Dir / Res ratio
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-1
-0.5
0
0.5
1
1.5









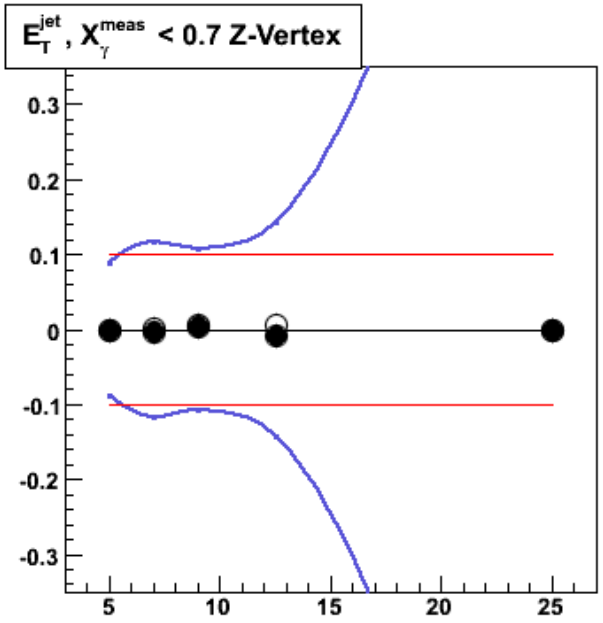
Standard cuts:

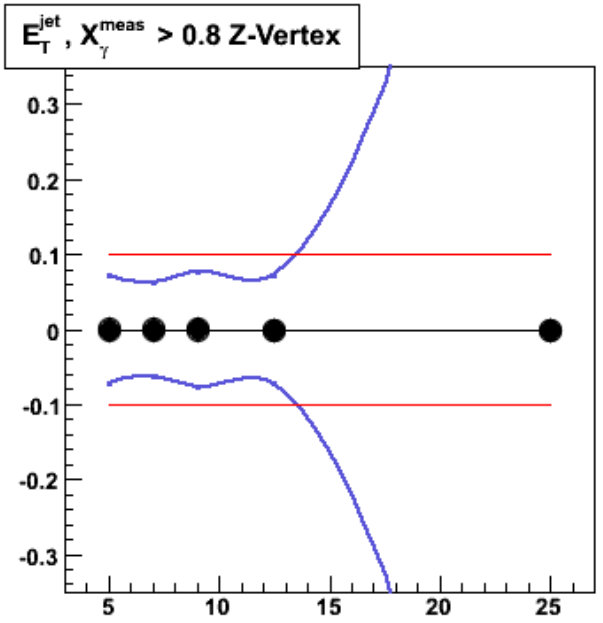
Vary jet energy independently from gamma energy:

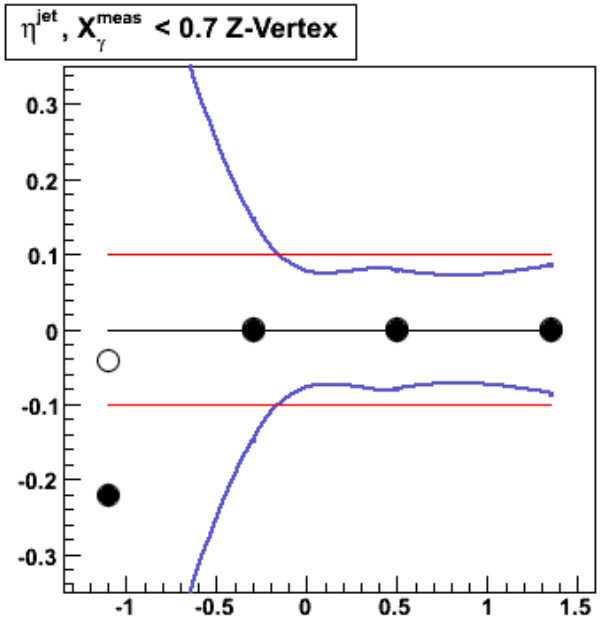
If JetEt ≤ 6 GeV by sqrt(4.*4. + 2.*2.))

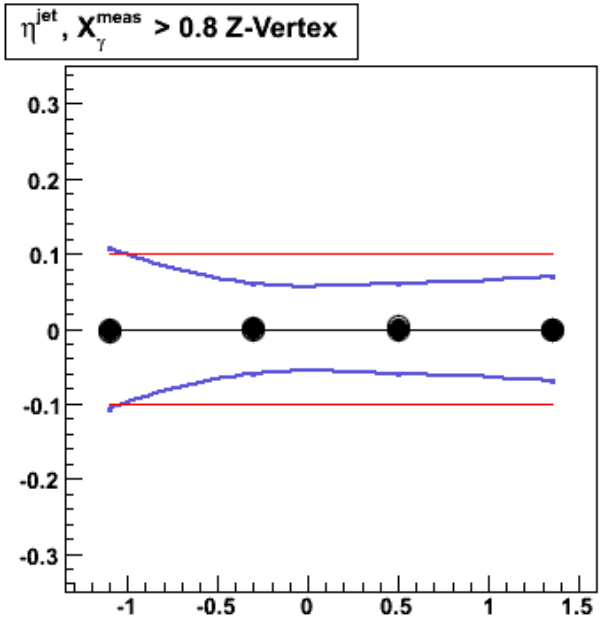
If 6 < JetEt ≤ 10 GeV by sqrt(2.*2. +2.*2.))

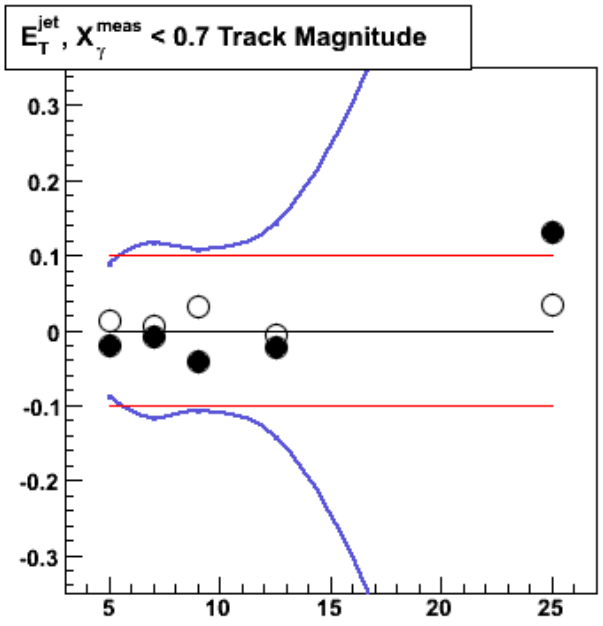
If JetEt > 10 GeV vary by sqrt(1.5*1.5 + 2.*2.))

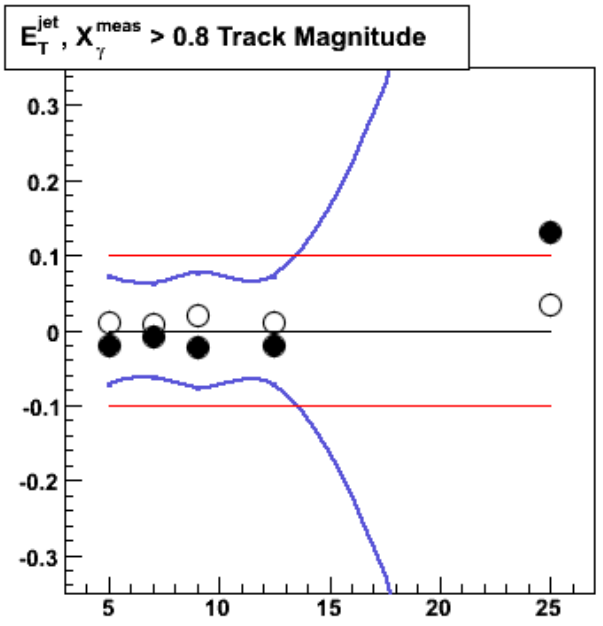

E_T^{jet}, X_γ^{meas} < 0.7 Z-Vertex
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
5
10
15
20
25

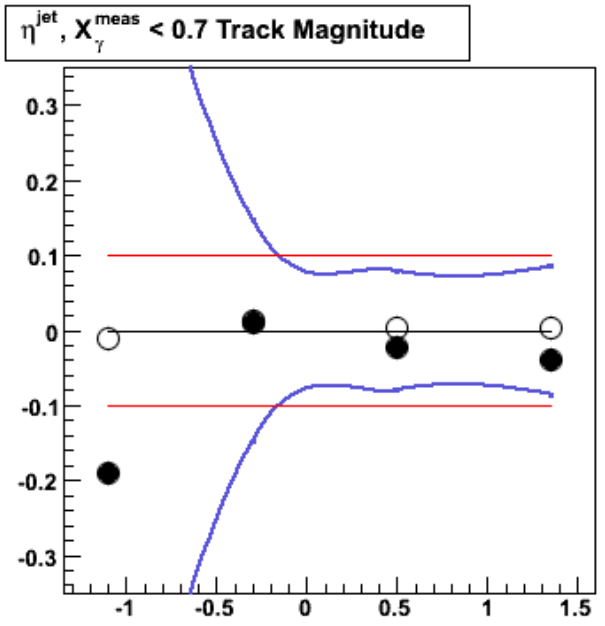

E_T^{jet}, X_γ^{meas} > 0.8 Z-Vertex
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
5
10
15
20
25

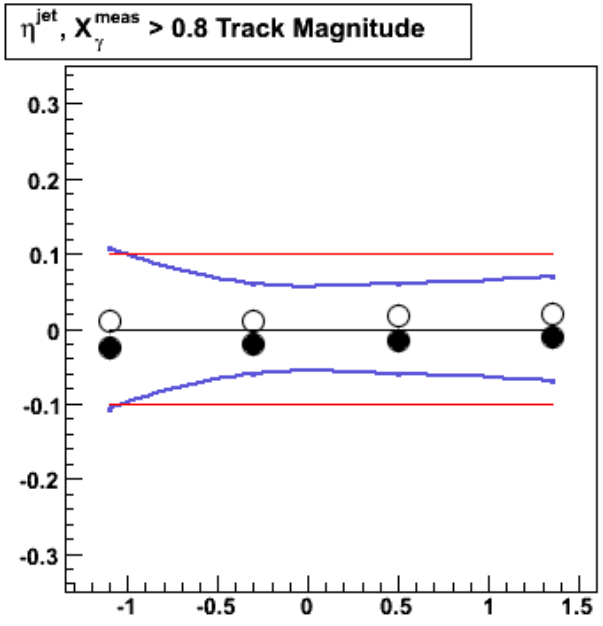

η^{jet}, X_γ^{meas} < 0.7 Z-Vertex
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-1
-0.5
0
0.5
1
1.5

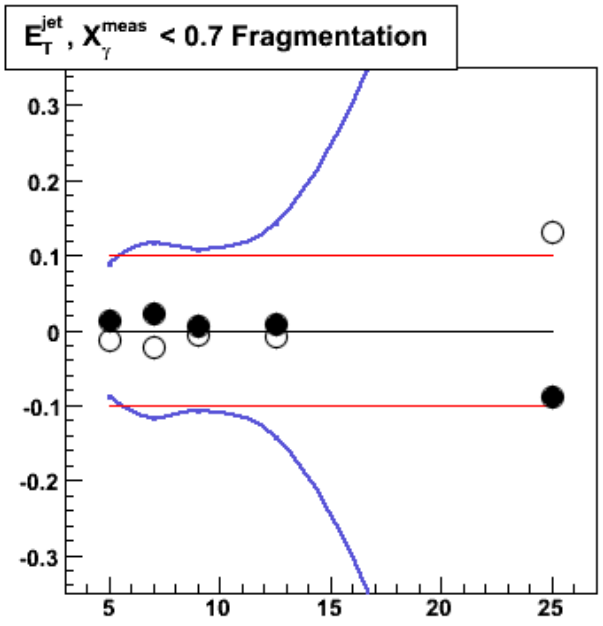

η^{jet}, X_γ^{meas} > 0.8 Z-Vertex
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-1
-0.5
0
0.5
1
1.5

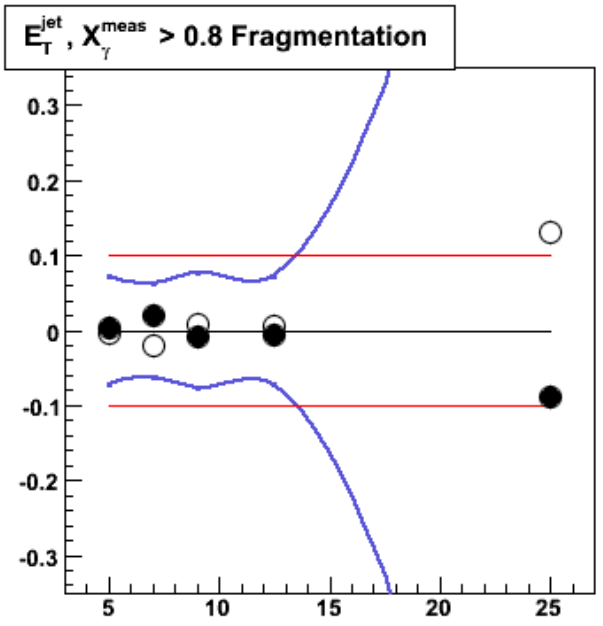

E_T^{jet}, X_γ^{meas} < 0.7 Track Magnitude
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
5
10
15
20
25

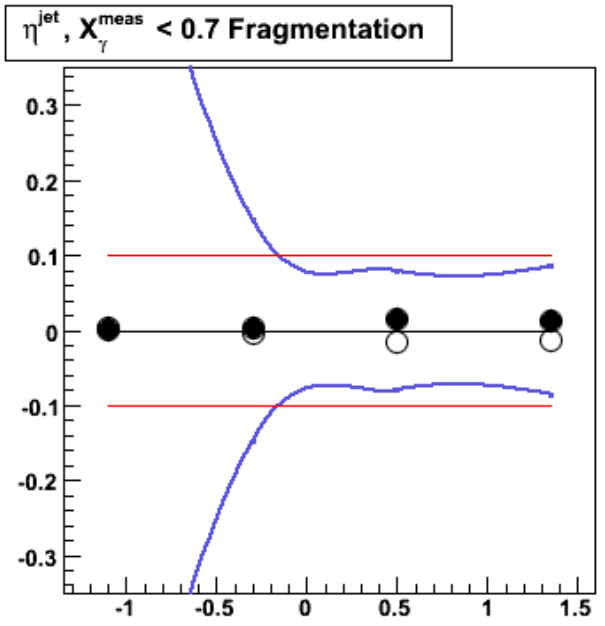

E_T^{jet}, X_γ^{meas} > 0.8 Track Magnitude
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
5
10
15
20
25

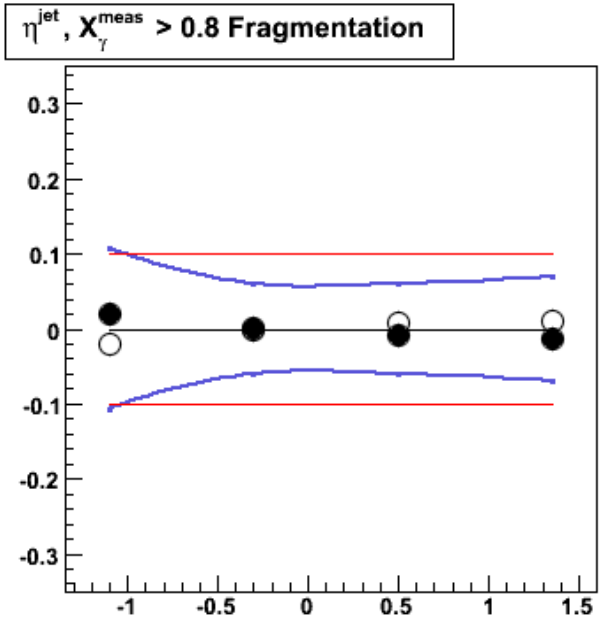

η^{jet}, X_γ^{meas} < 0.7 Track Magnitude
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-1
-0.5
0
0.5
1
1.5

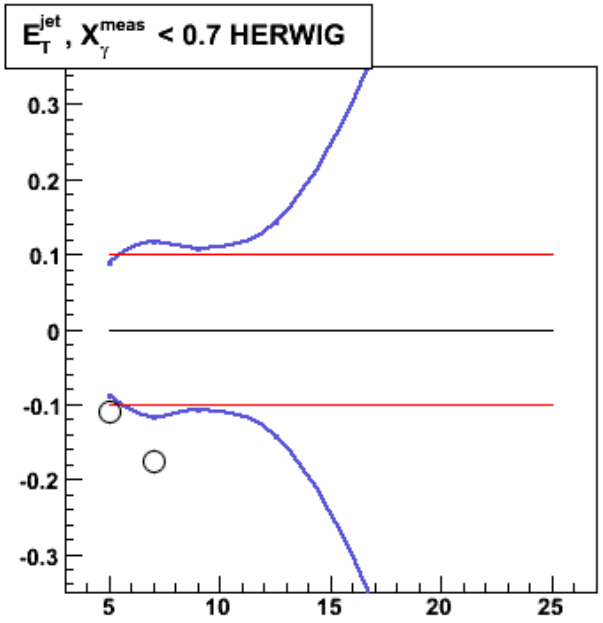

η^{jet}, X_γ^{meas} > 0.8 Track Magnitude
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-1
-0.5
0
0.5
1
1.5

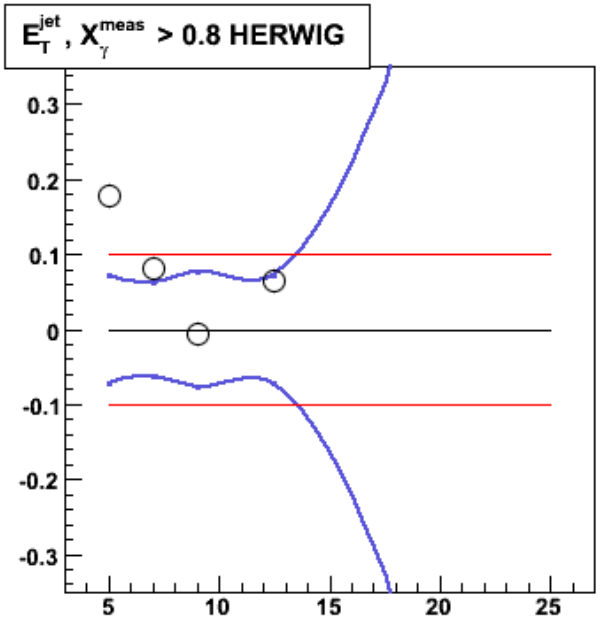

E_T^{jet}, X_γ^{meas} < 0.7 Fragmentation
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
5
10
15
20
25

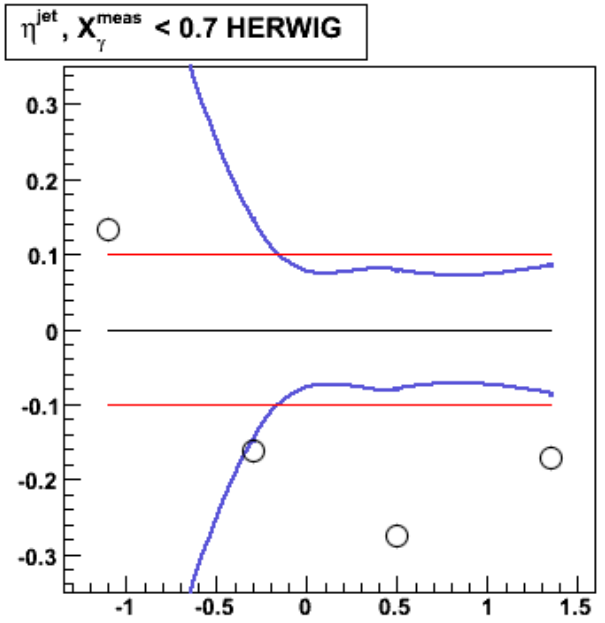

E_T^{jet}, X_γ^{meas} > 0.8 Fragmentation
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
5
10
15
20
25

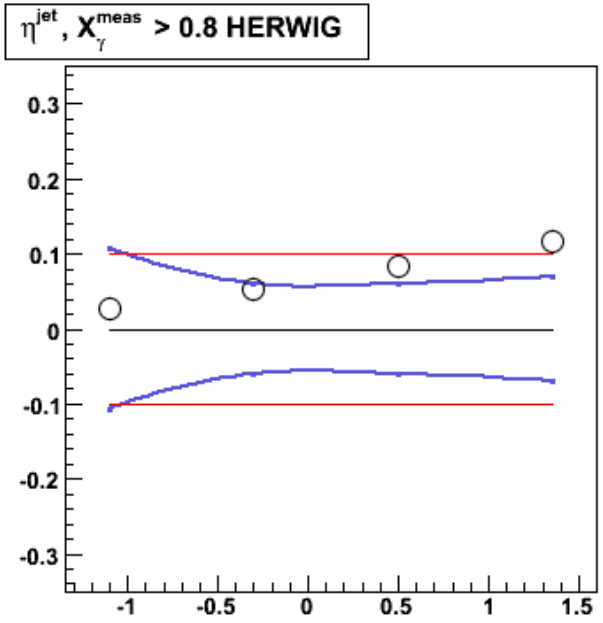

η^{jet}, X_γ^{meas} < 0.7 Fragmentation
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-1
-0.5
0
0.5
1
1.5

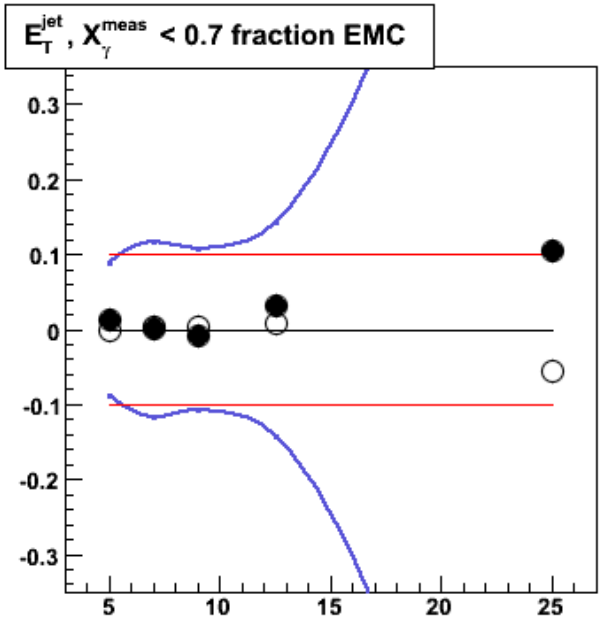

η^{jet}, X_γ^{meas} > 0.8 Fragmentation
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-1
-0.5
0
0.5
1
1.5

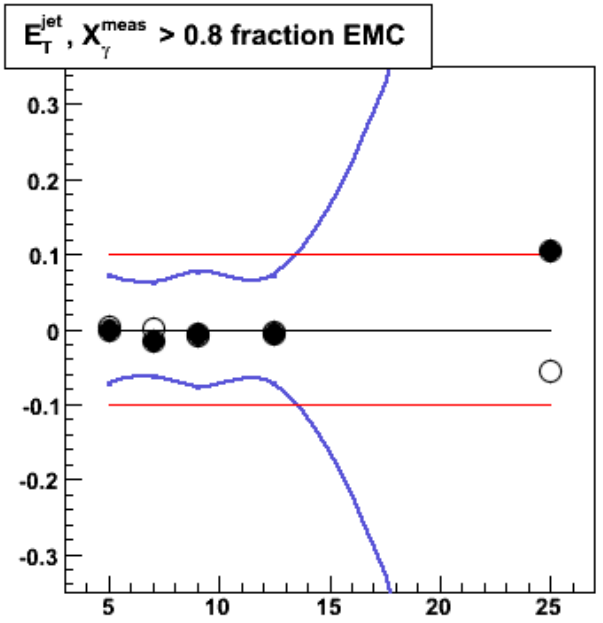

E_T^{jet}, X_γ^{meas} < 0.7 HERWIG
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
5
10
15
20
25

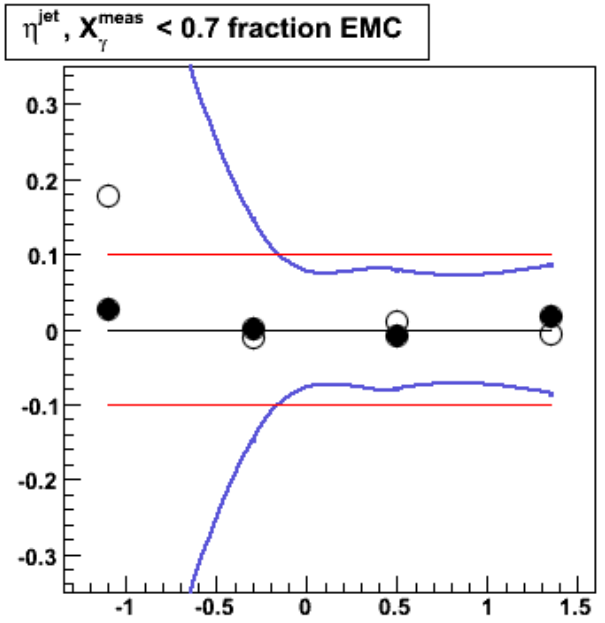

E_T^{jet}, X_γ^{meas} > 0.8 HERWIG
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
5
10
15
20
25

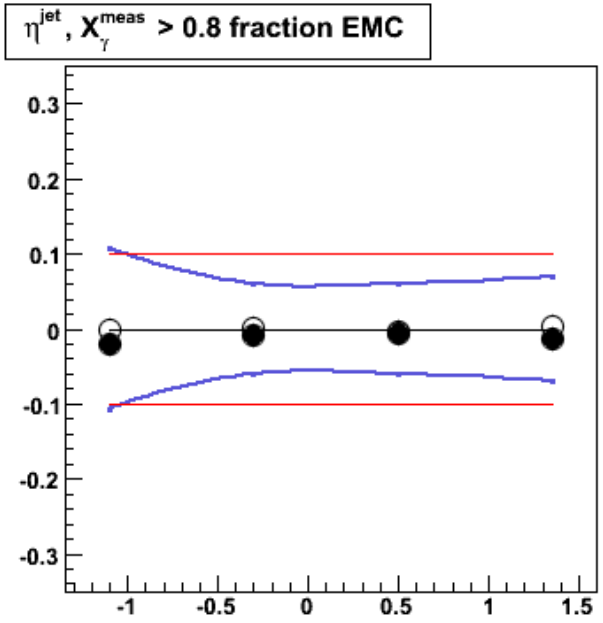

η^{jet}, X_γ^{meas} < 0.7 HERWIG
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-1
-0.5
0
0.5
1
1.5

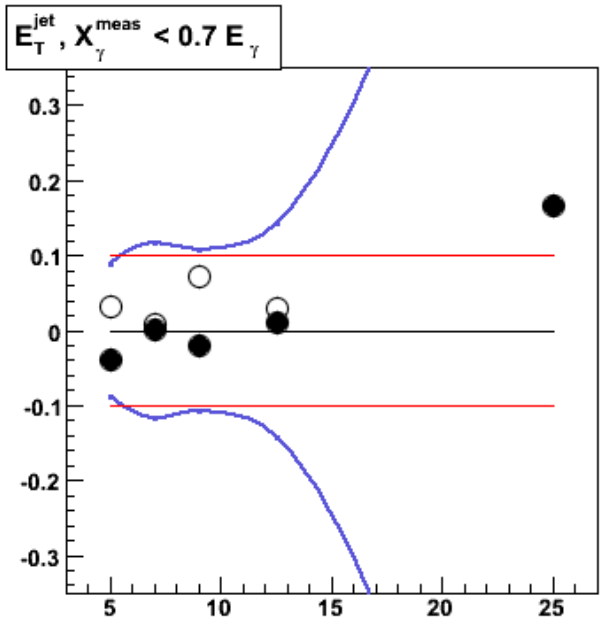

η^{jet}, X_γ^{meas} > 0.8 HERWIG
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-1
-0.5
0
0.5
1
1.5

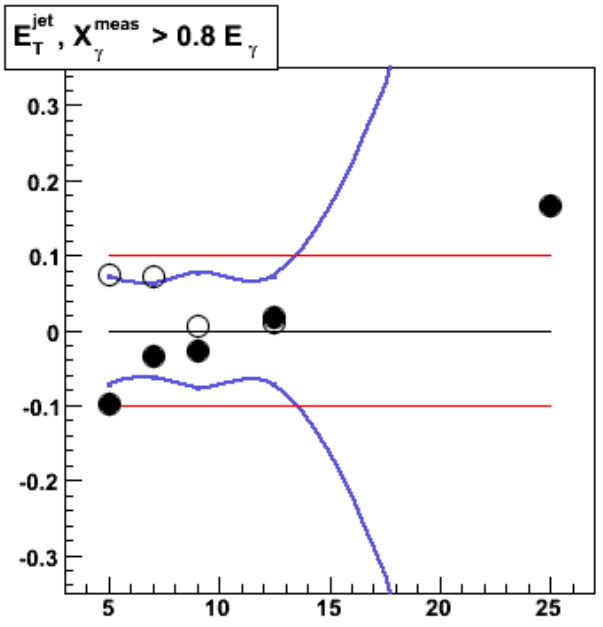

E_T^{jet}, X_γ^{meas} < 0.7 fraction EMC
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
5
10
15
20
25

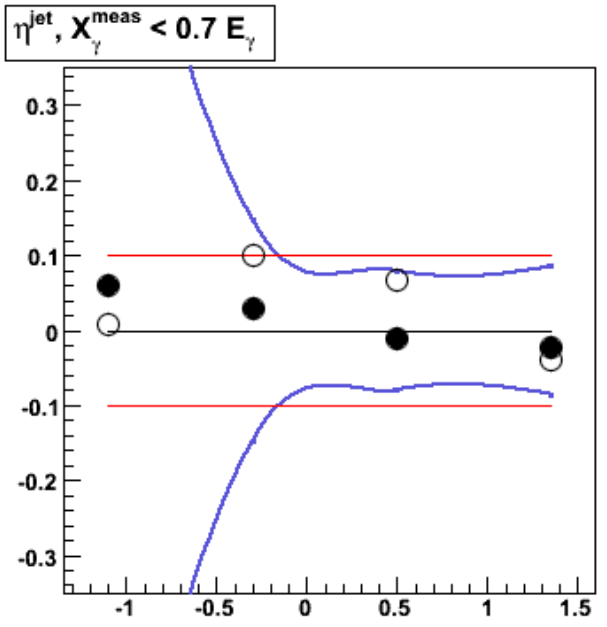

E_T^{jet}, X_γ^{meas} > 0.8 fraction EMC
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
5
10
15
20
25

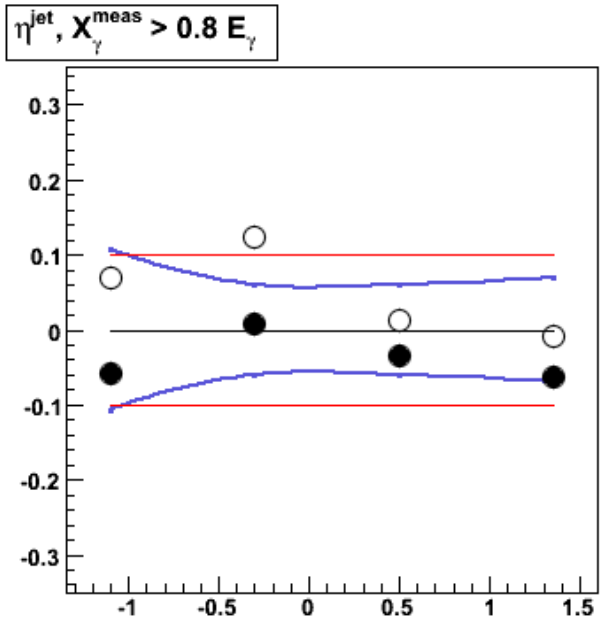

η^{jet}, X_γ^{meas} < 0.7 fraction EMC
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-1
-0.5
0
0.5
1
1.5

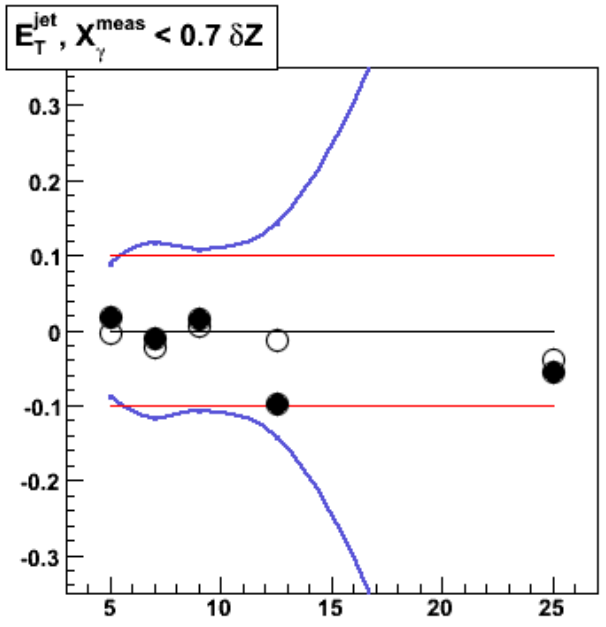

η^{jet}, X_γ^{meas} > 0.8 fraction EMC
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-1
-0.5
0
0.5
1
1.5

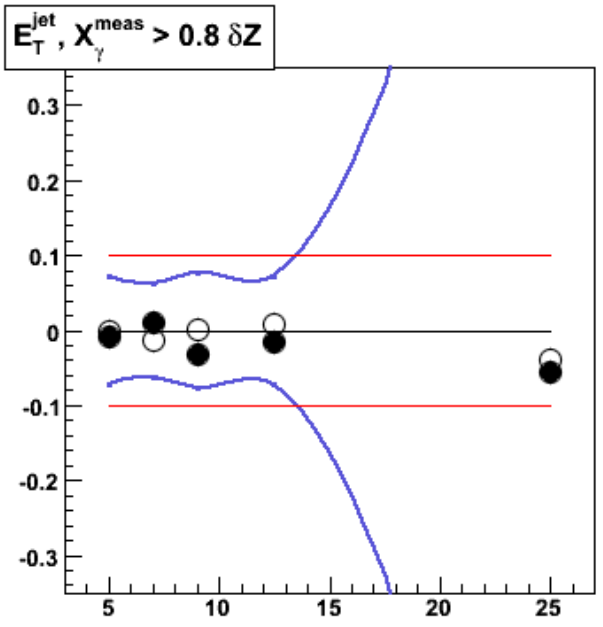

E_T^{jet}, X_γ^{meas} < 0.7 E_γ
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
5
10
15
20
25

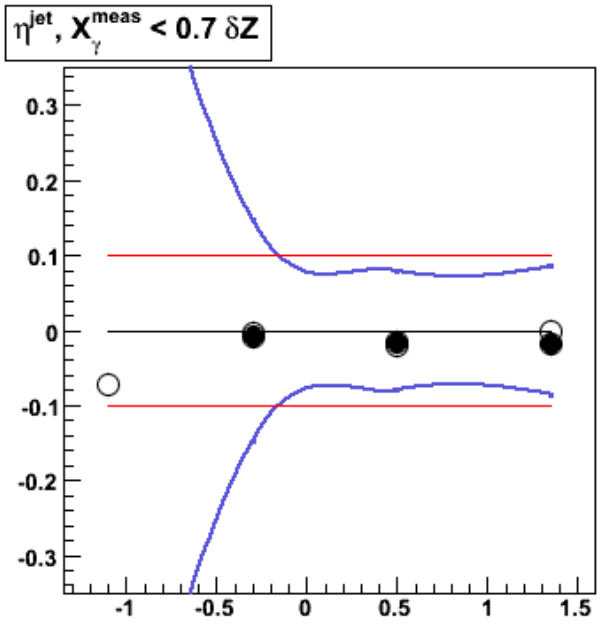

E_T^{jet}, X_γ^{meas} > 0.8 E_γ
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
5
10
15
20
25

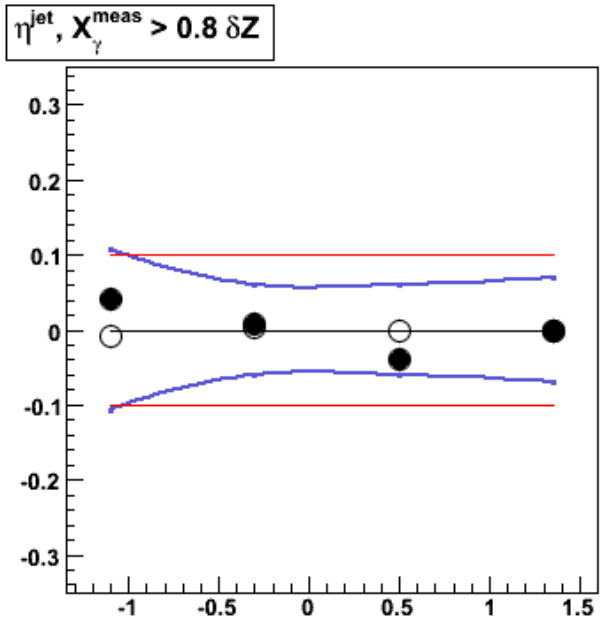

η^{jet}, X_γ^{meas} < 0.7 E_γ
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-1
-0.5
0
0.5
1
1.5

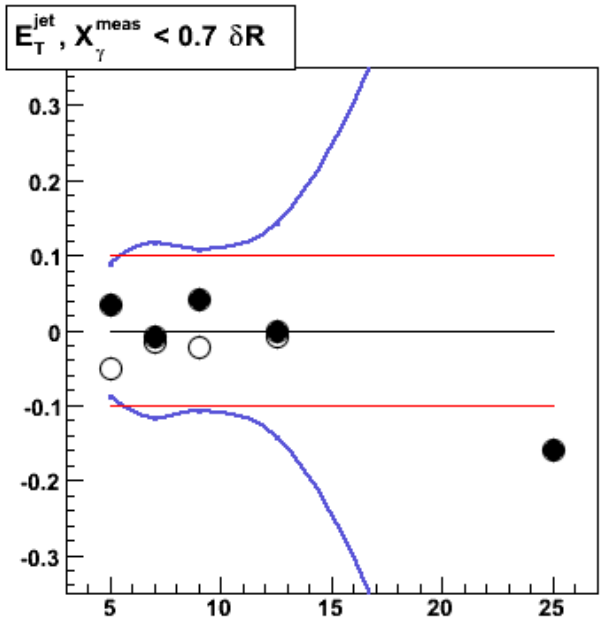

η^{jet}, X_γ^{meas} > 0.8 E_γ
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-1
-0.5
0
0.5
1
1.5

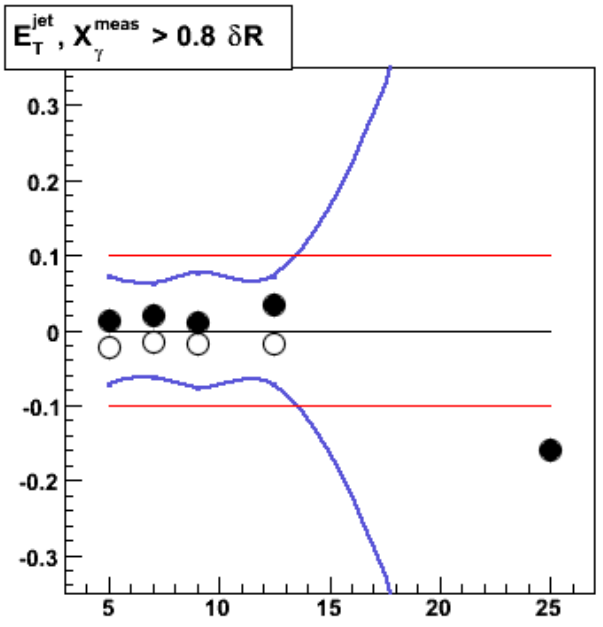

E_T^{jet}, X_γ^{meas} < 0.7 δZ
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
5
10
15
20
25

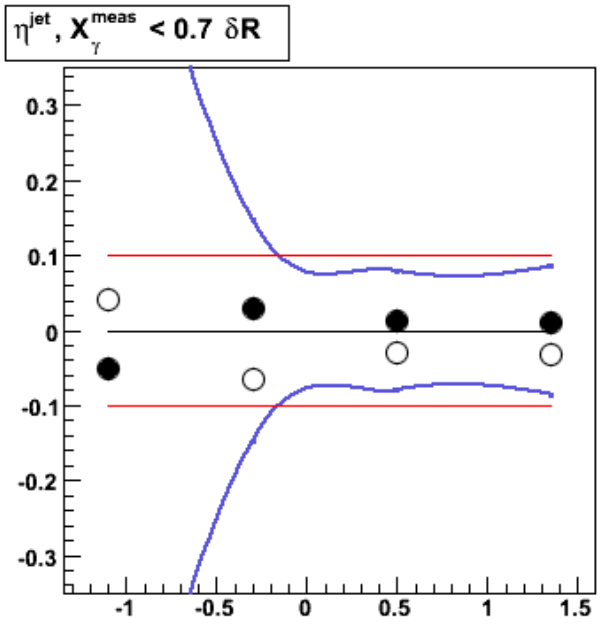

E_T^{jet}, X_γ^{meas} > 0.8 δZ
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
5
10
15
20
25

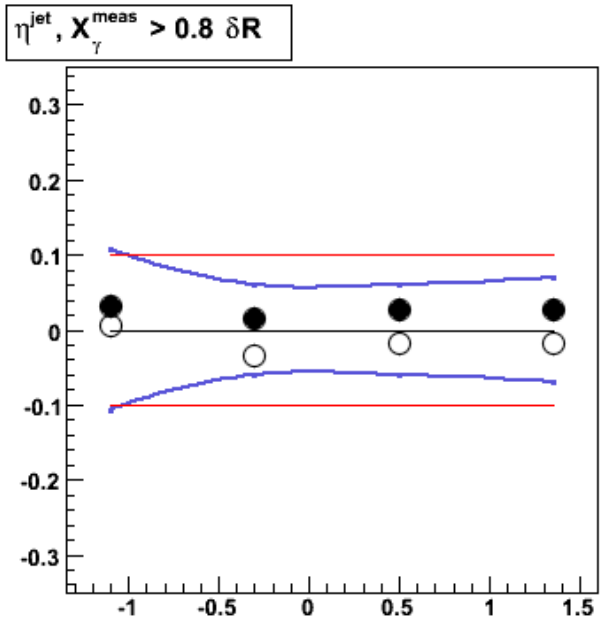

η^{jet}, X_γ^{meas} < 0.7 δZ
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-1
-0.5
0
0.5
1
1.5

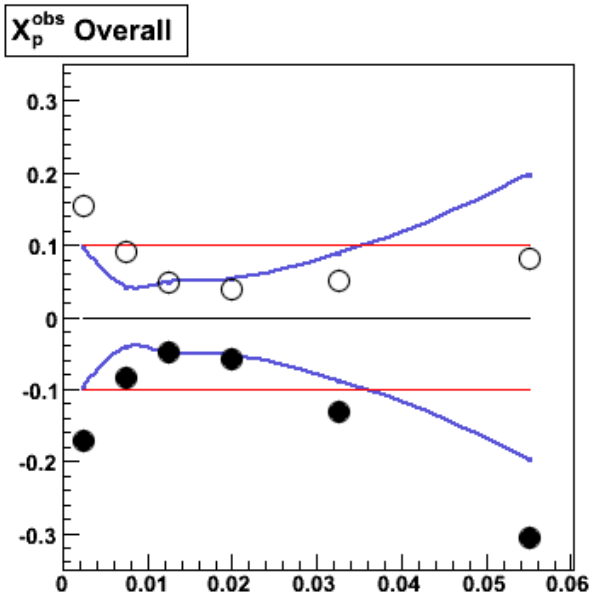

η^{jet}, X_γ^{meas} > 0.8 δZ
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-1
-0.5
0
0.5
1
1.5

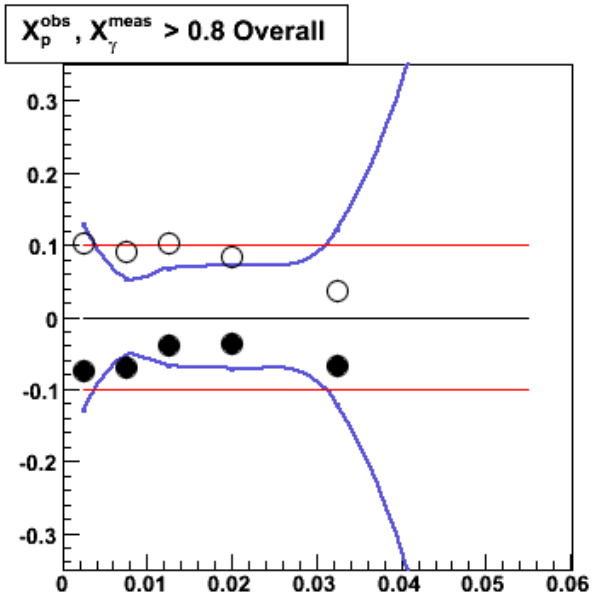

E_T^{jet}, X_γ^{meas} < 0.7 δR
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
5
10
15
20
25

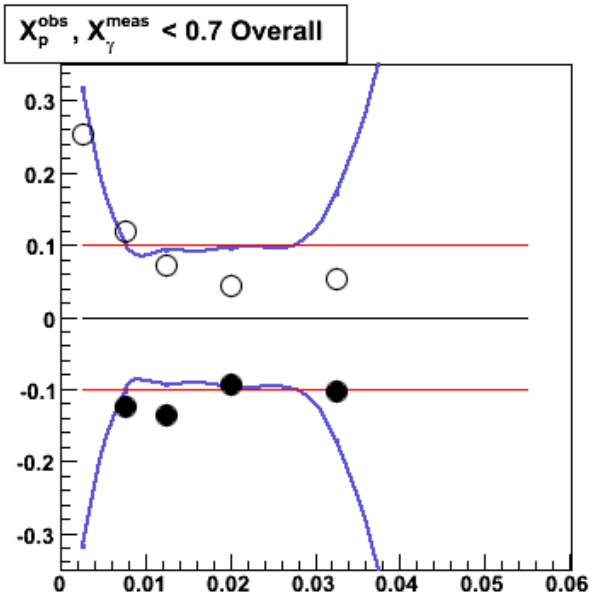

E_T^{jet}, X_γ^{meas} > 0.8 δR
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
5
10
15
20
25


η^{jet}, X_γ^{meas} < 0.7 δR
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-1
-0.5
0
0.5
1
1.5


η^{jet}, X_γ^{meas} > 0.8 δR
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-1
-0.5
0
0.5
1
1.5





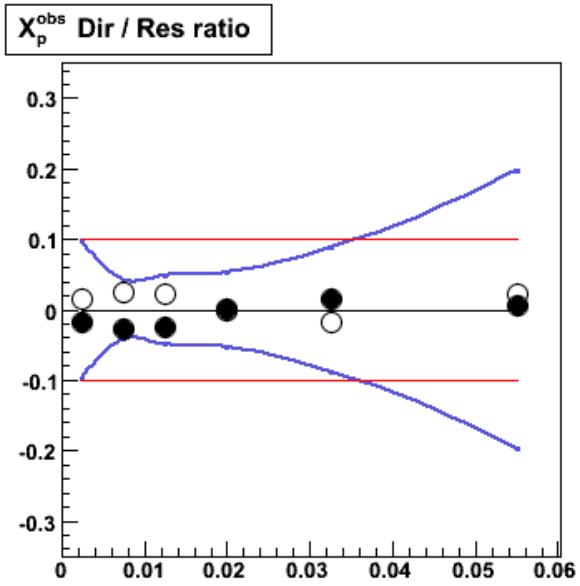


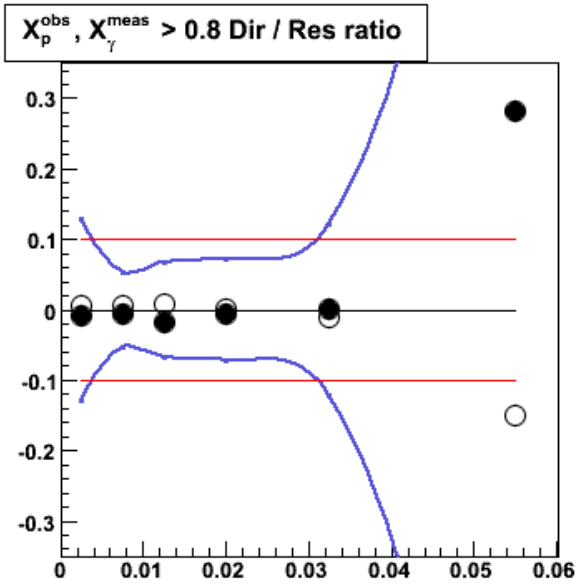
Rel.statistical uncertainties

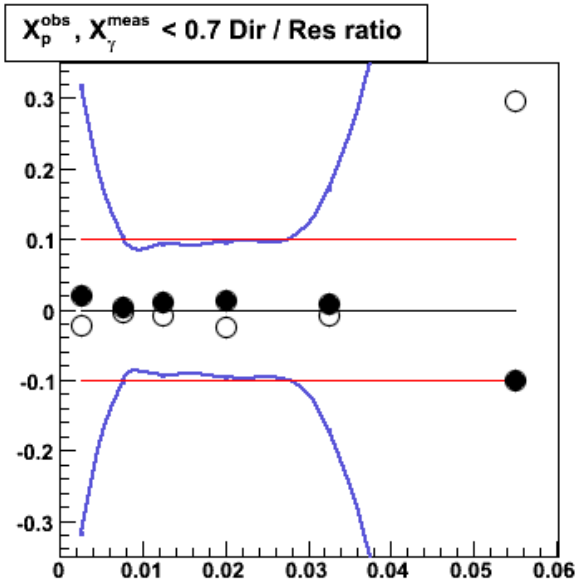
10% line

upper sum

lower sum





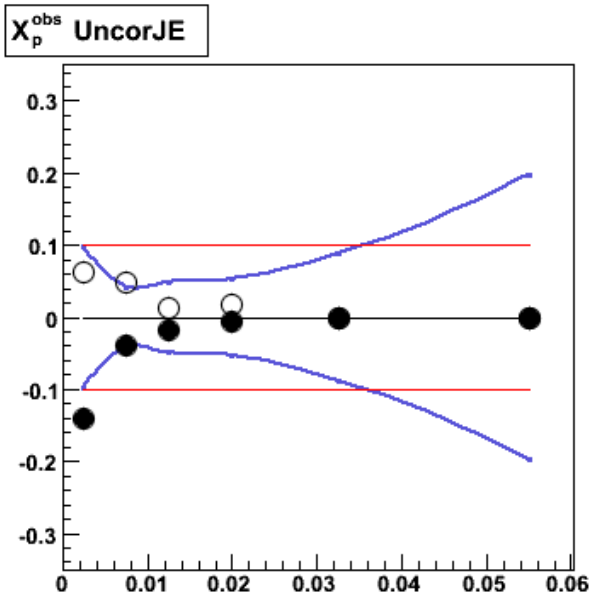


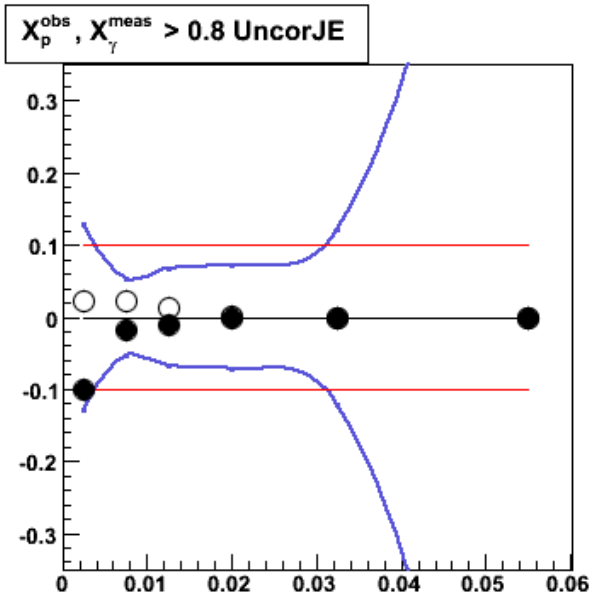
Rel.statistical uncertainties

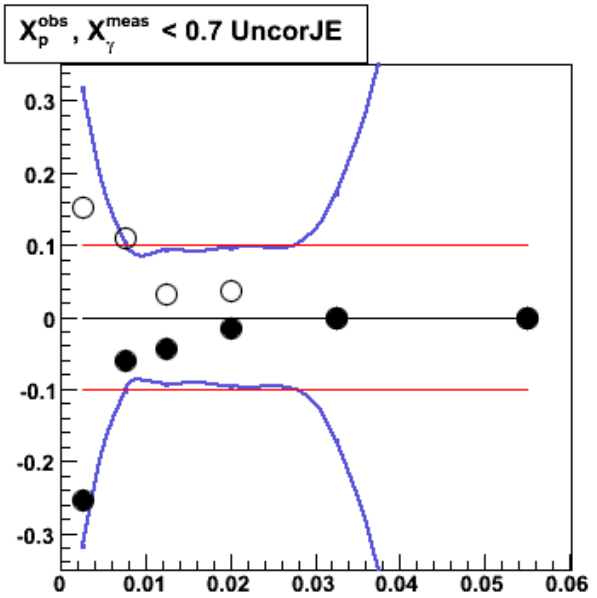
10% line

-15% resolved

+15% resolved





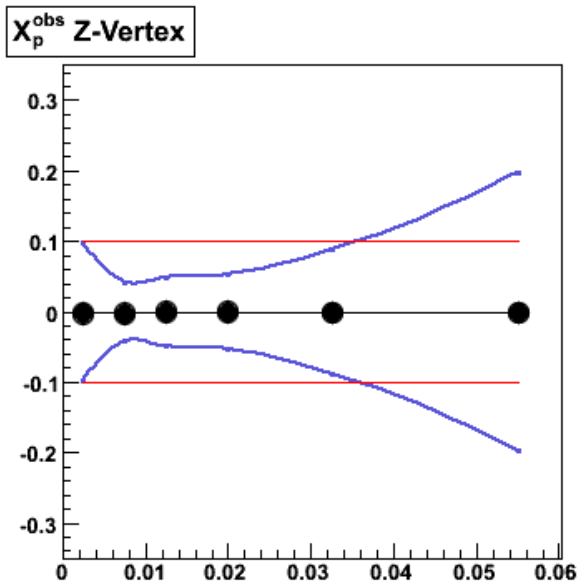


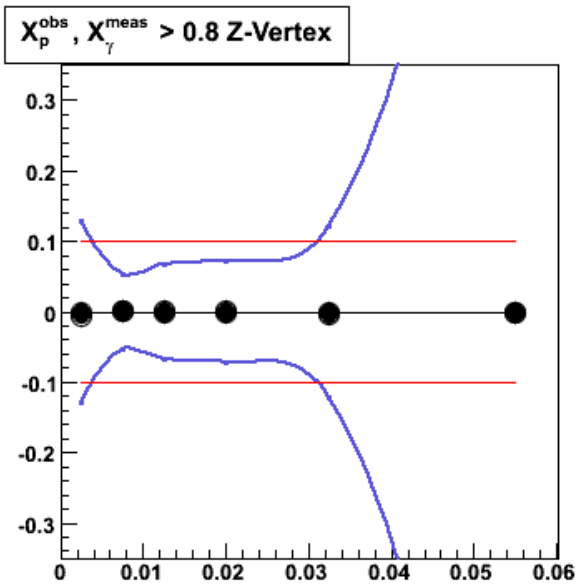
Rel.statistical uncertainties

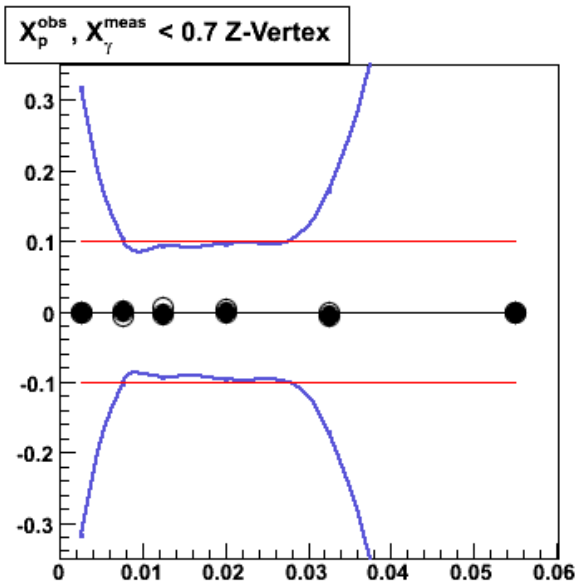
10% line

variation up

variation down





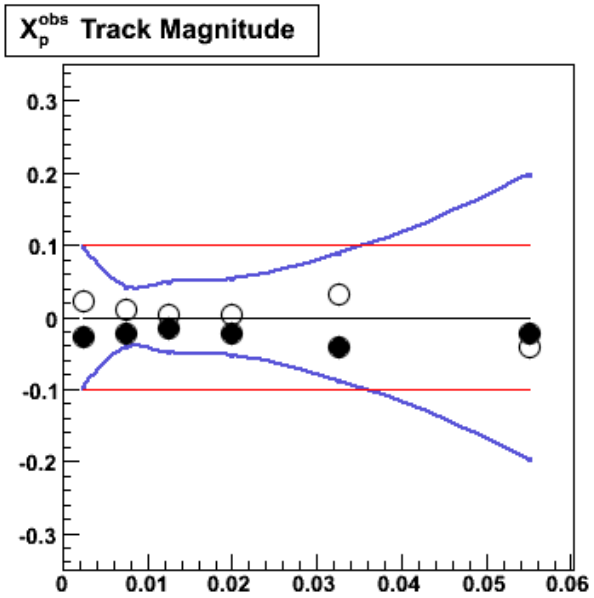


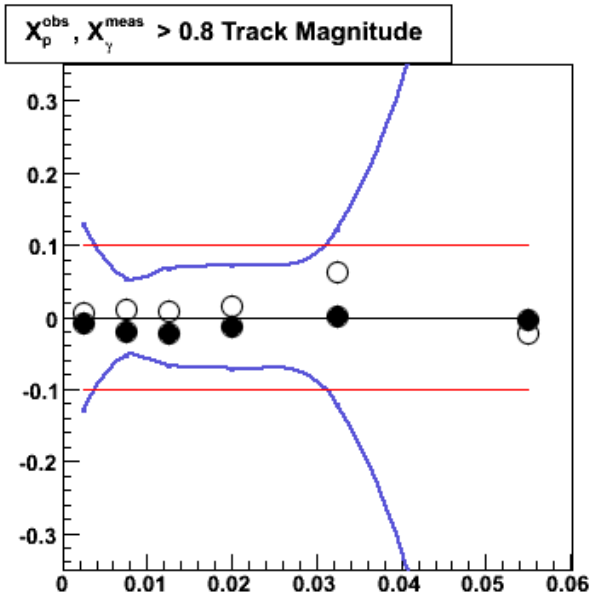
Rel.statistical uncertainties δZ

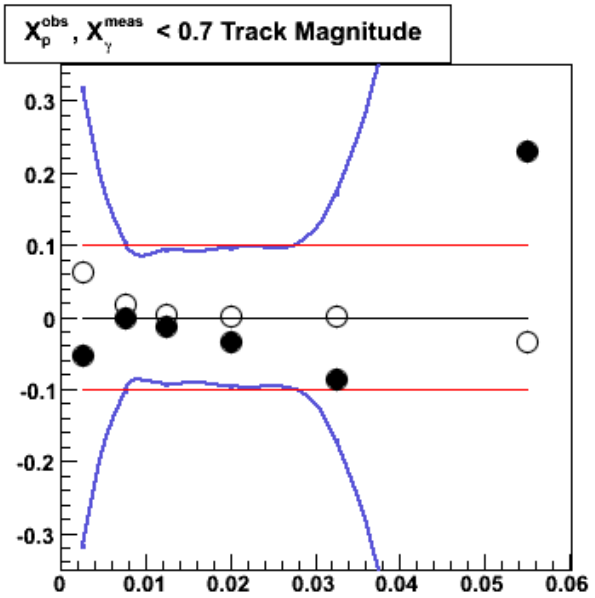
10% line

$|Z_{vertex}|<45$

$|Z_{vertex}|<35$





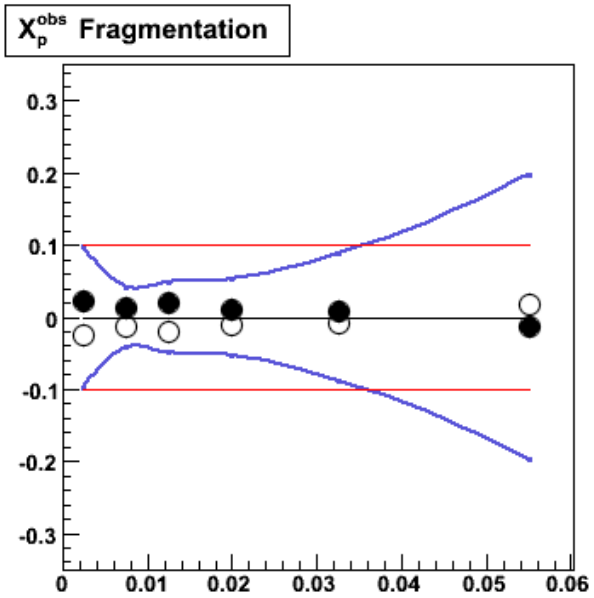


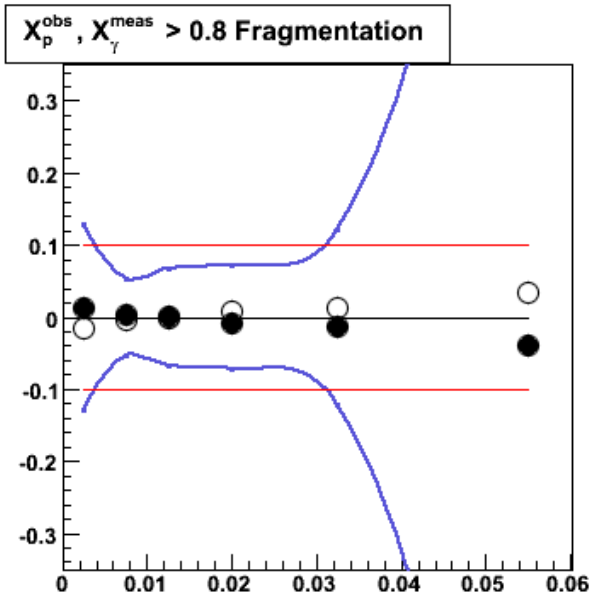
Rel.statistical uncertainties

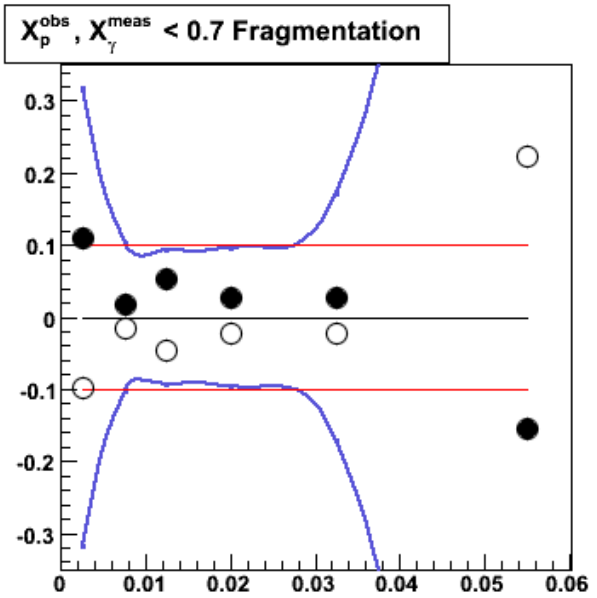
10% line

○ $p_{track} > 350\ MeV$

● $p_{track} > 150\ MeV$





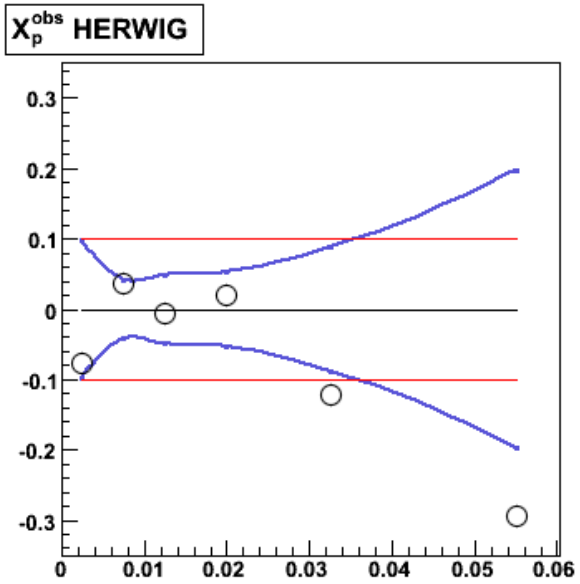


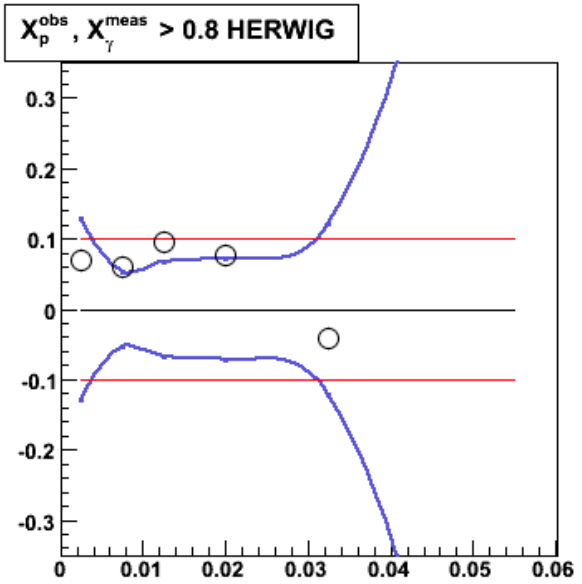
Rel.statistical uncertainties

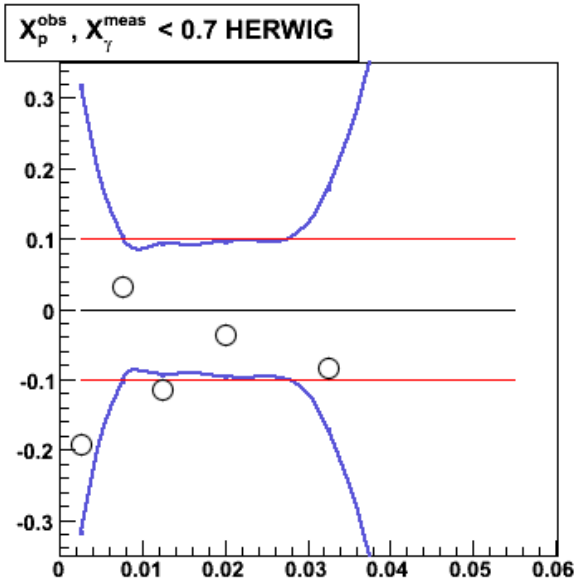
10% line

+5% Fragmentation

-5% Fragmentation



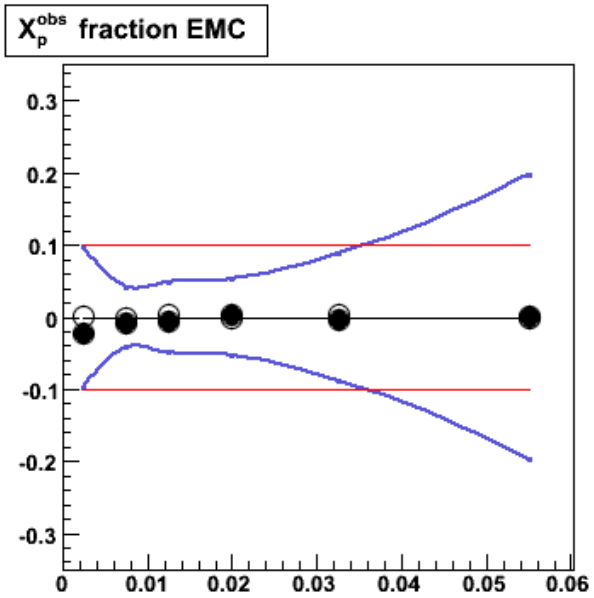


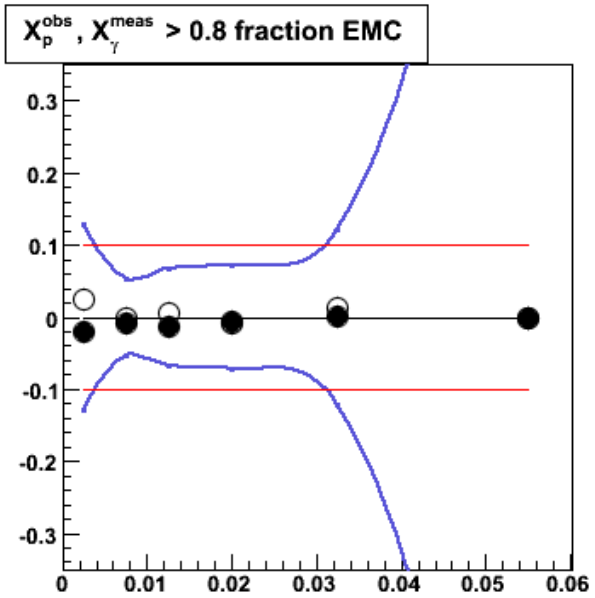


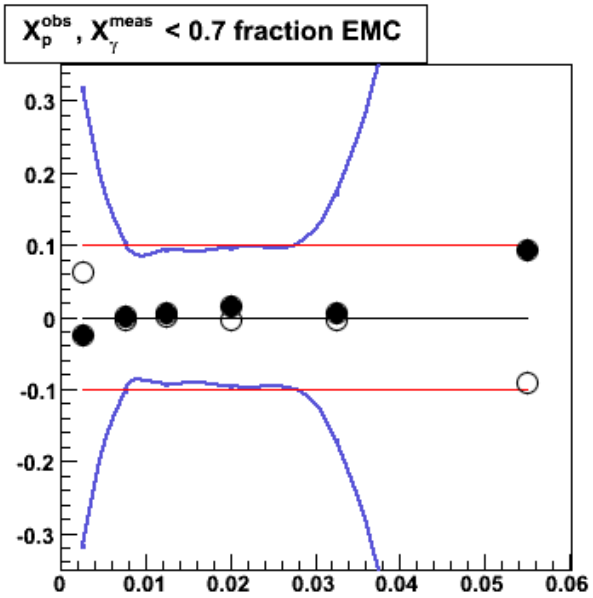
Rel.statistical uncertainties

10% line

HERWIG





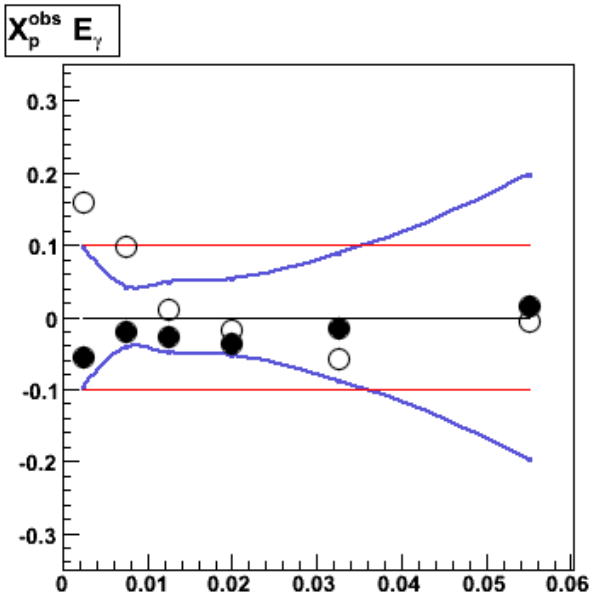


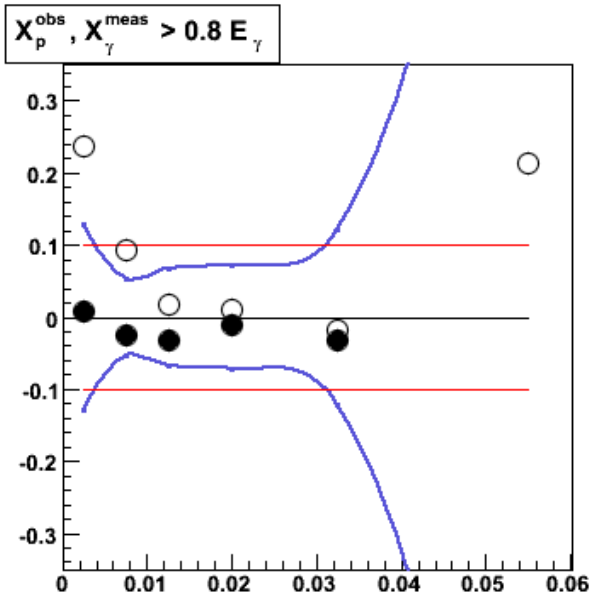
Rel.statistical uncertainties

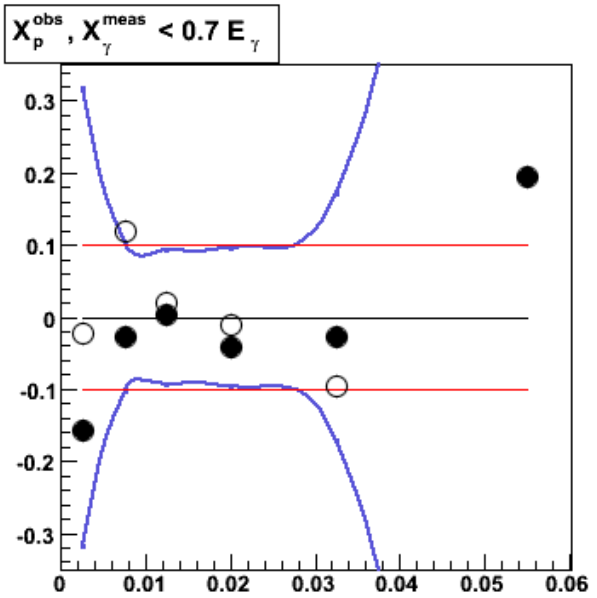
10% line

Fraction EMC +0.025

Fraction EMC -0.025





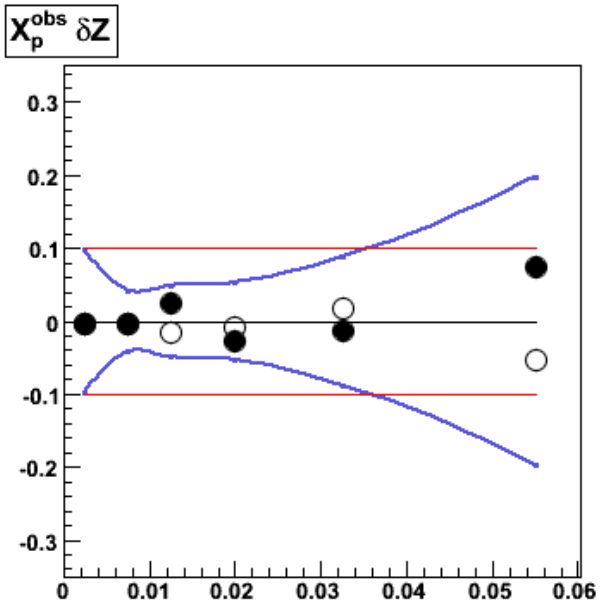


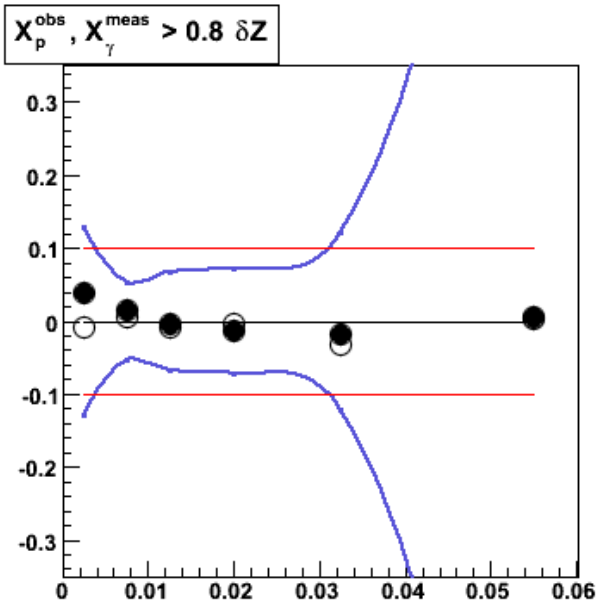
Rel.statistical uncertainties

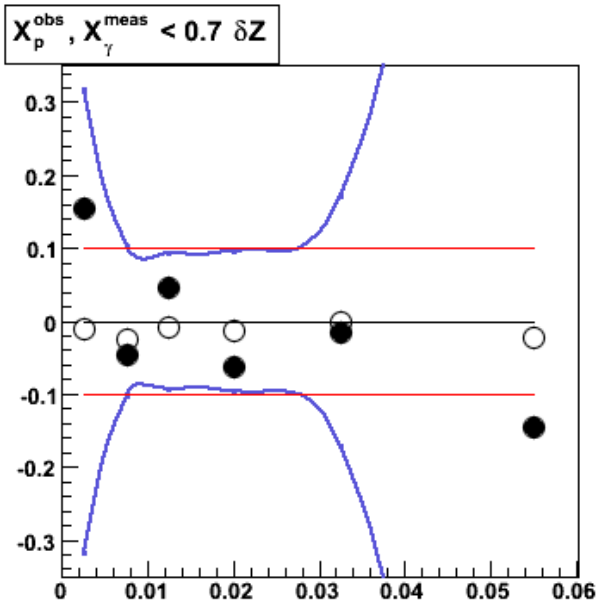
10% line

E_γ *+2%*

E_γ *-2%*





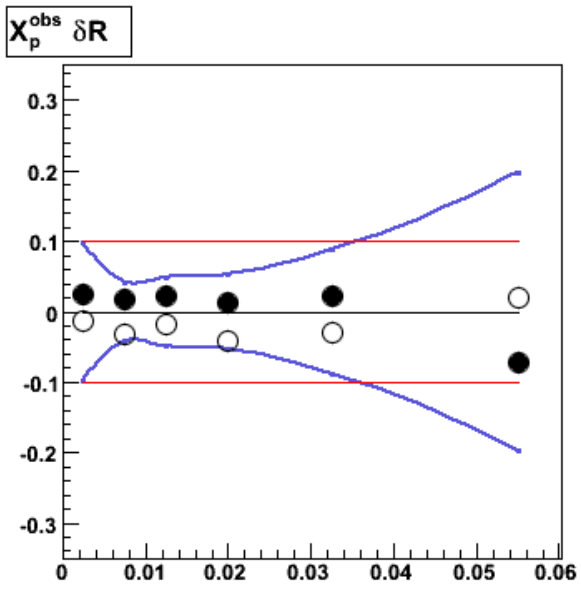


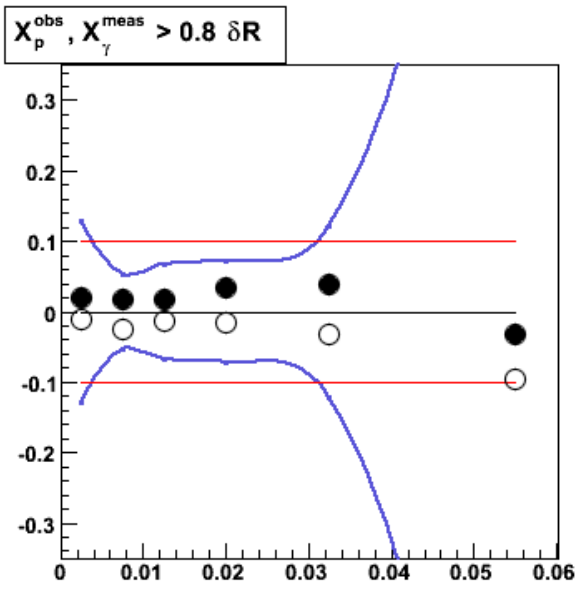
Rel.statistical uncertainties δZ

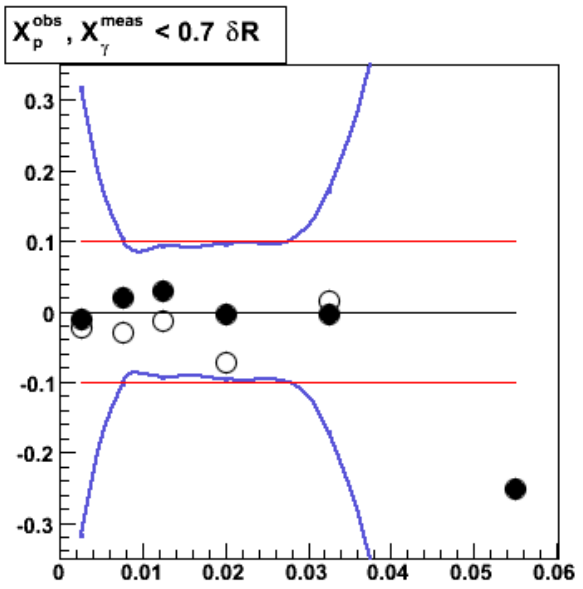
10% line

○ δZ *fit range 1.0*

● δZ *fit range 0.6*





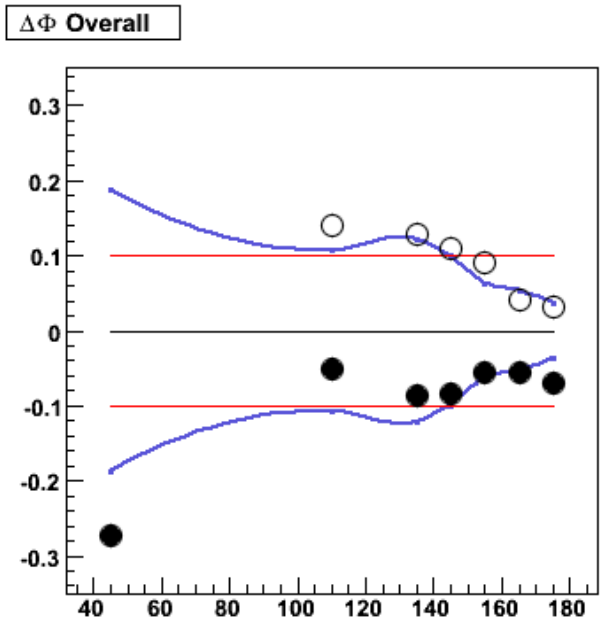


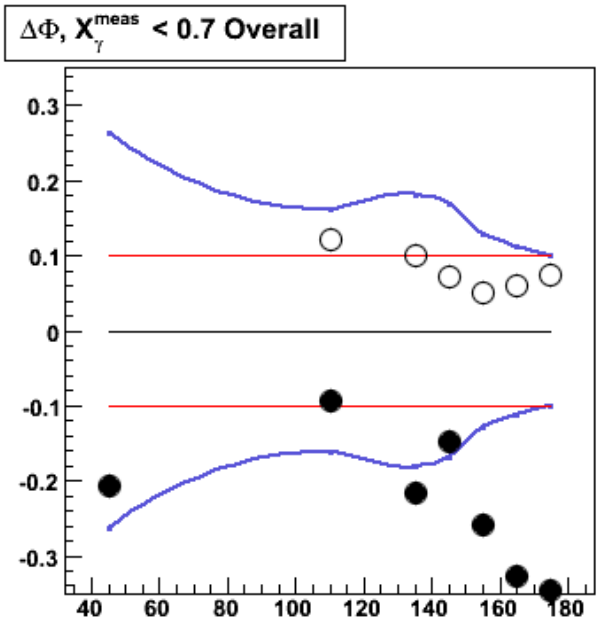
Rel.statistical uncertainties

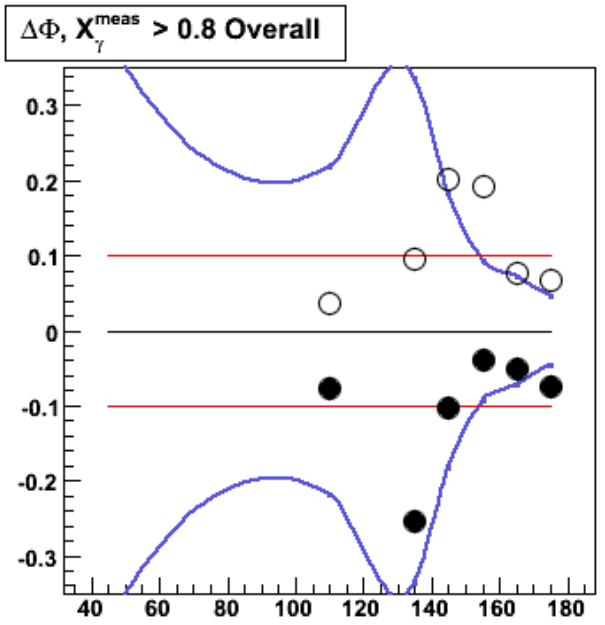
10% line

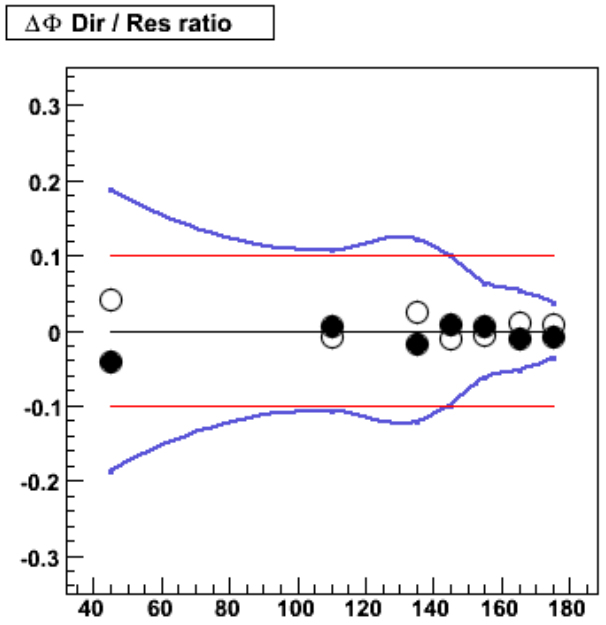
δR 0.3

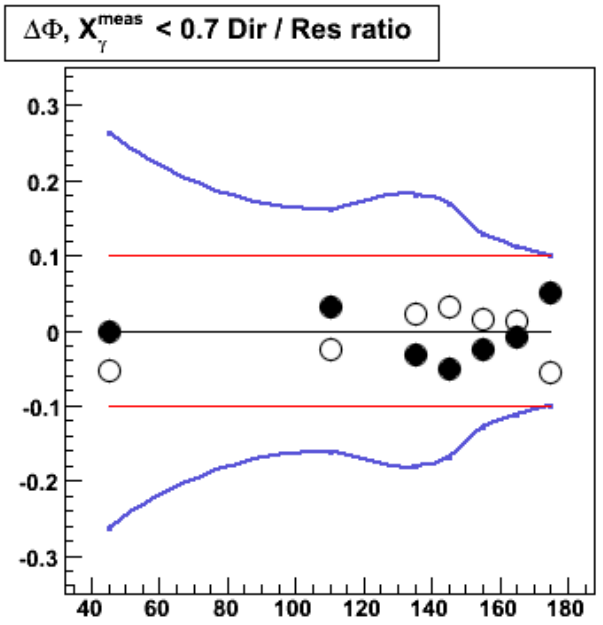
δR 0.1

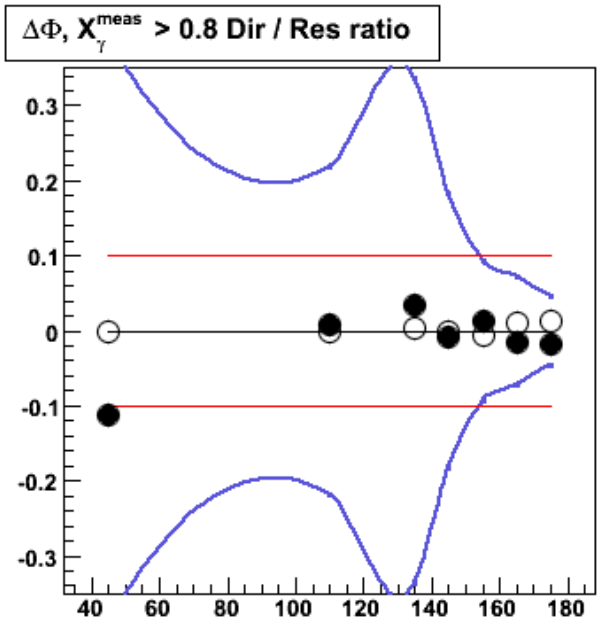

ΔΦ Overall
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180

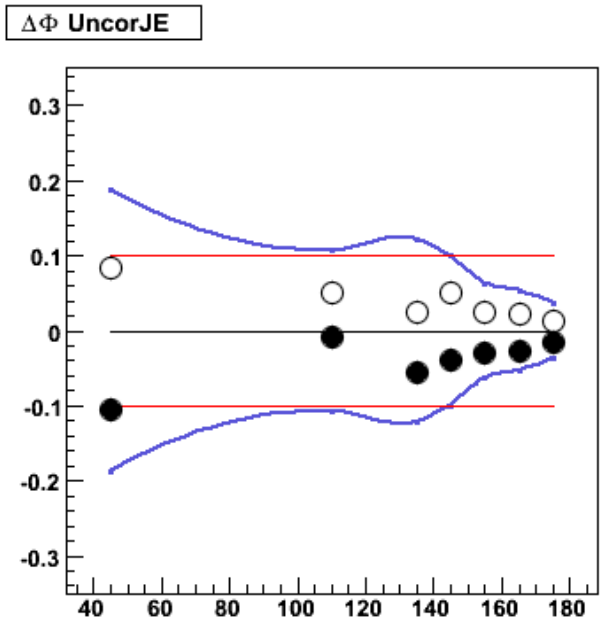

ΔΦ, X$_\gamma^{meas}$ < 0.7 Overall
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180

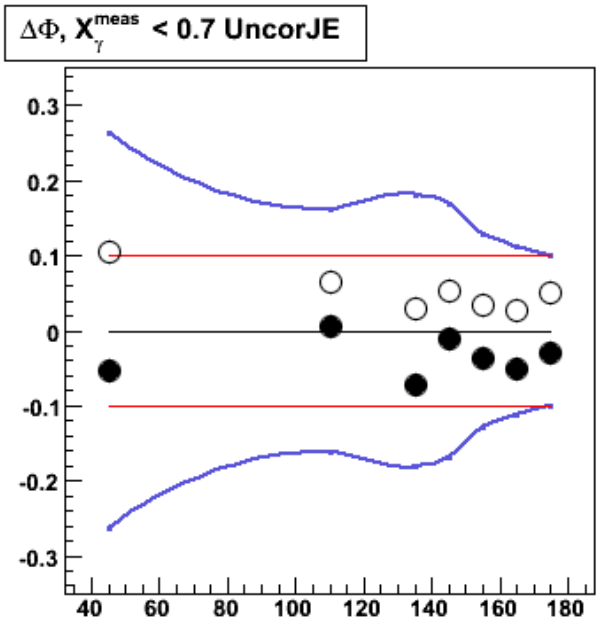

ΔΦ, X$_\gamma^{meas}$ > 0.8 Overall
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180

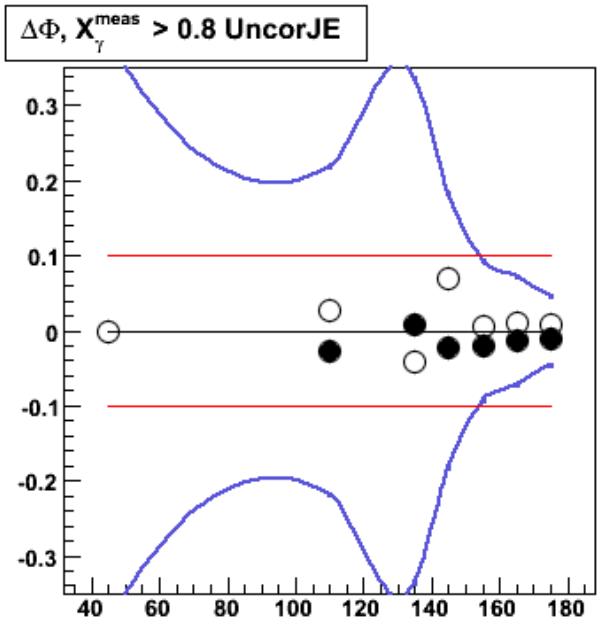

ΔΦ Dir / Res ratio
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180

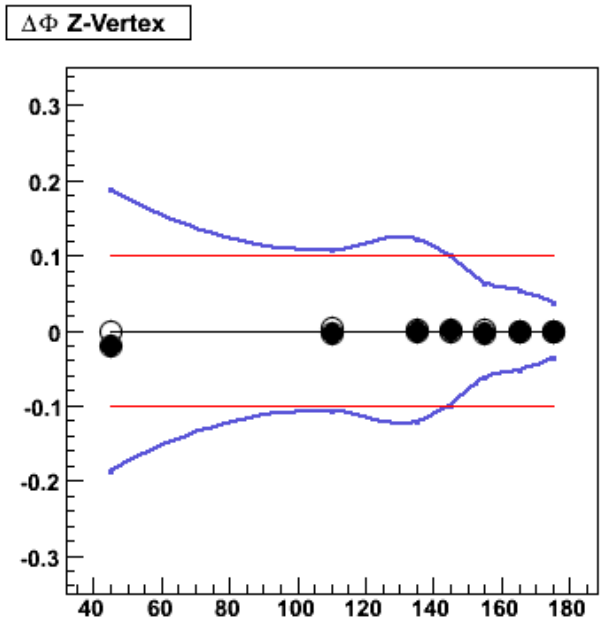

ΔΦ, X$_\gamma^{meas}$ < 0.7 Dir / Res ratio
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180

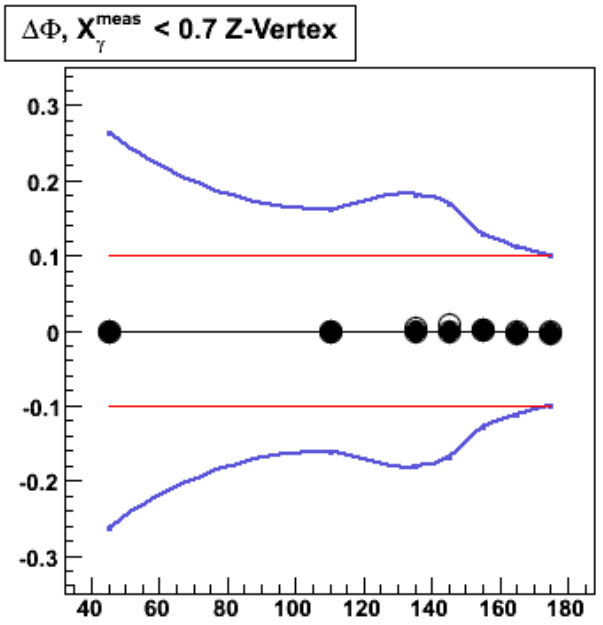

ΔΦ, X$_\gamma^{meas}$ > 0.8 Dir / Res ratio
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180

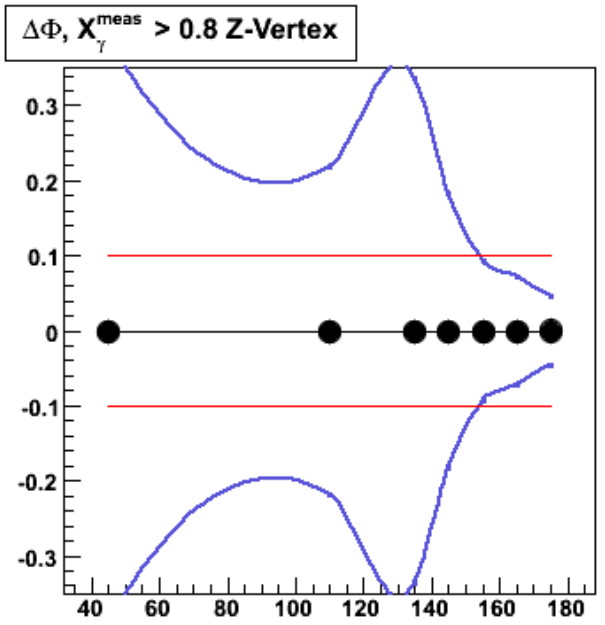

ΔΦ UncorJE
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180

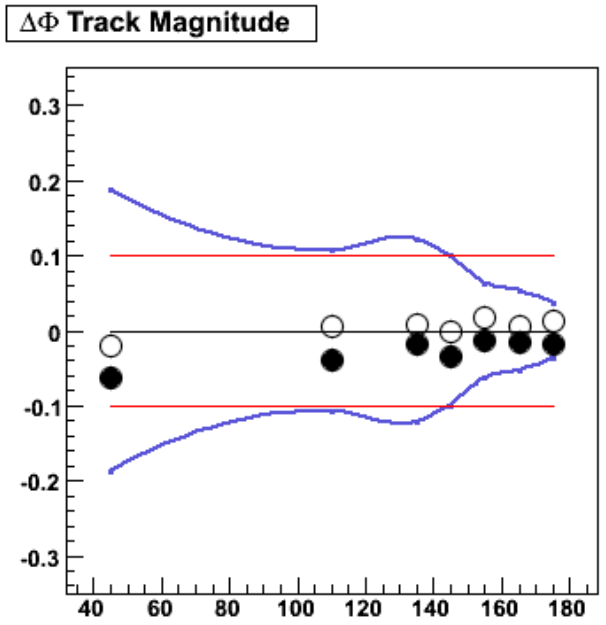

ΔΦ, X_γ^meas < 0.7 UncorJE
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180

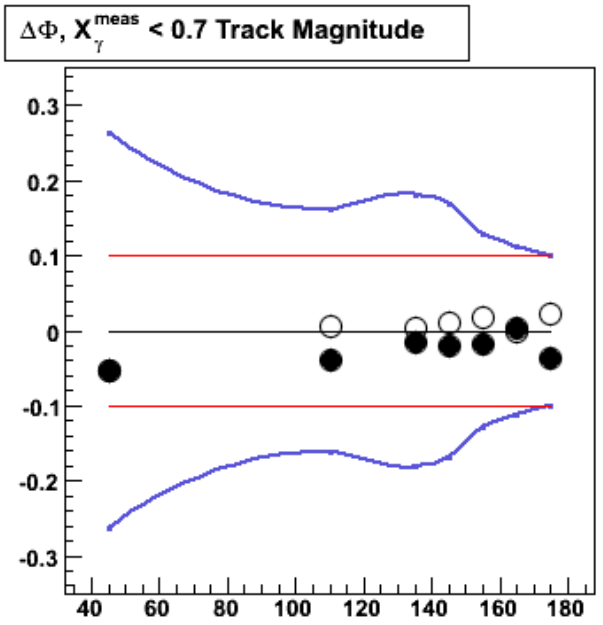

ΔΦ, X_γ^meas > 0.8 UncorJE
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180

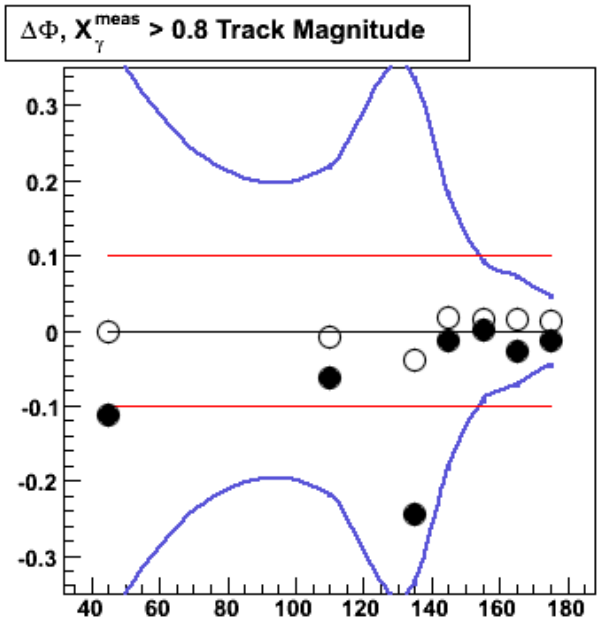

ΔΦ Z-Vertex
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180

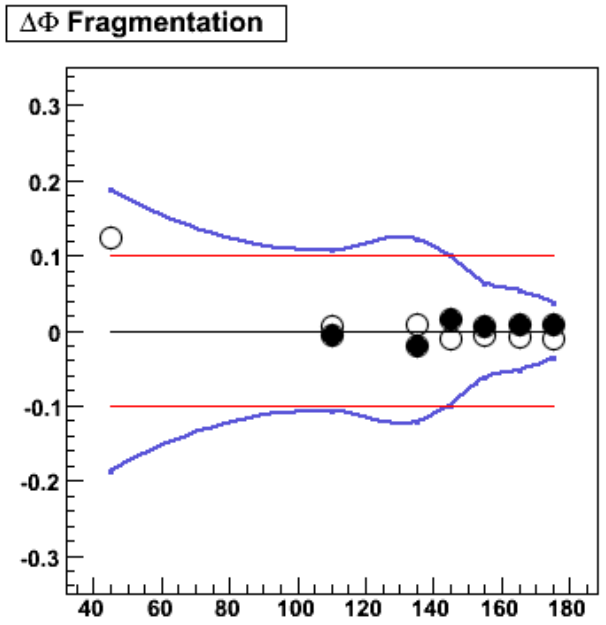

ΔΦ, X_γ^meas < 0.7 Z-Vertex
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180

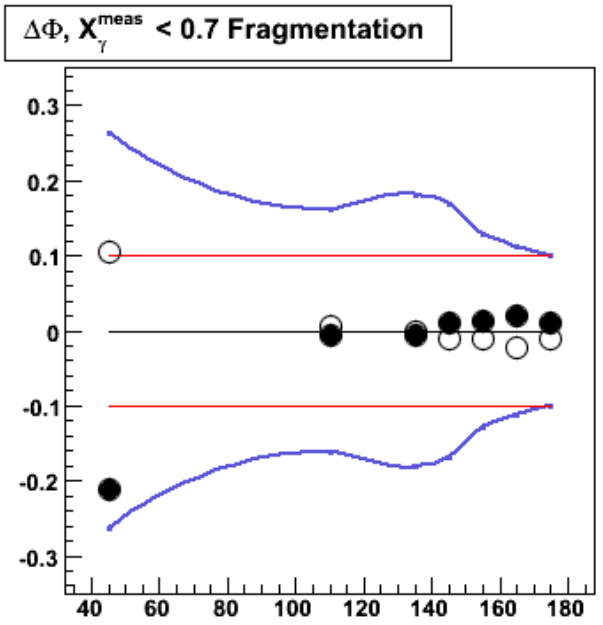

ΔΦ, X_γ^meas > 0.8 Z-Vertex
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180

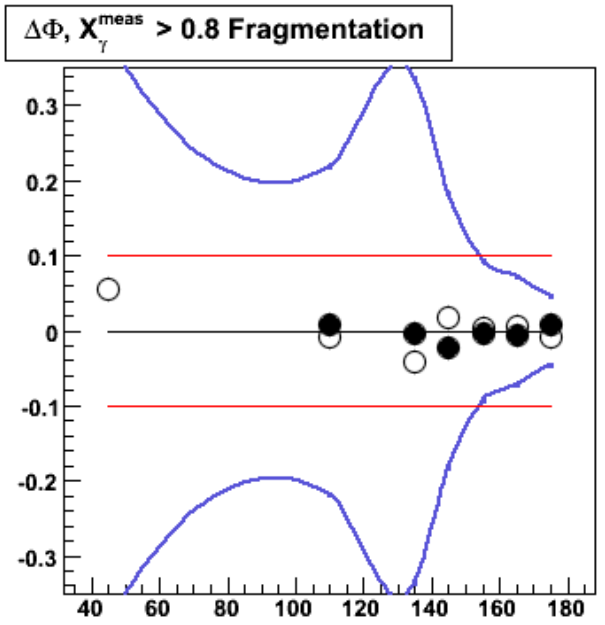

ΔΦ Track Magnitude
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180

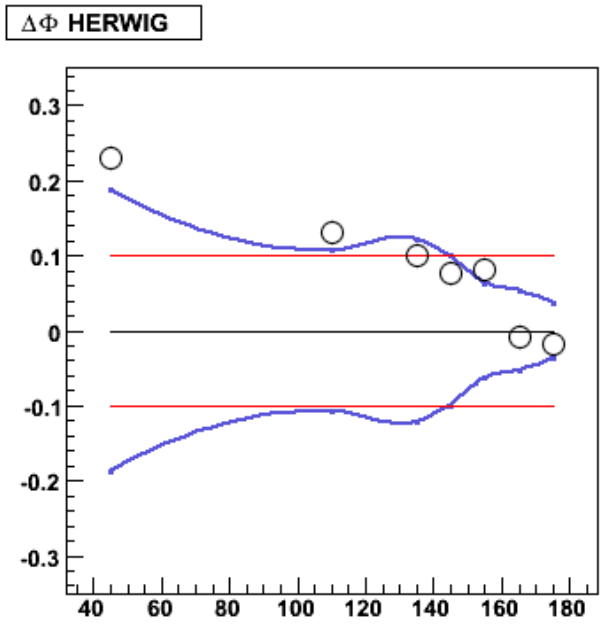

ΔΦ, X$_\gamma^{meas}$ < 0.7 Track Magnitude
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180

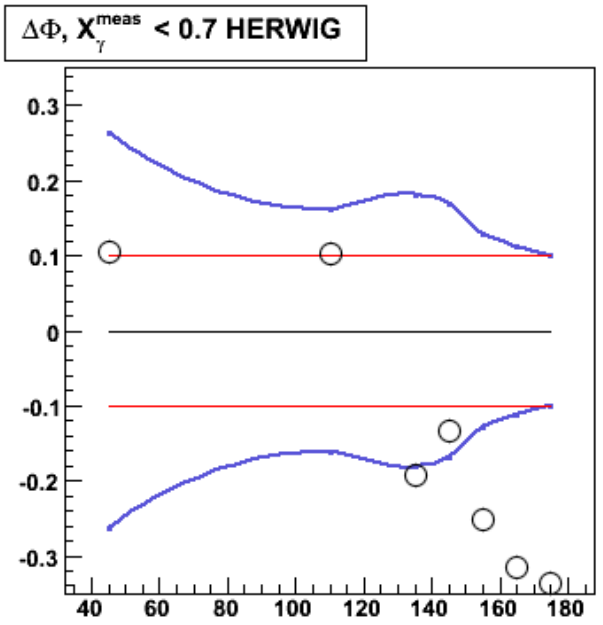

ΔΦ, X$_\gamma^{meas}$ > 0.8 Track Magnitude
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180

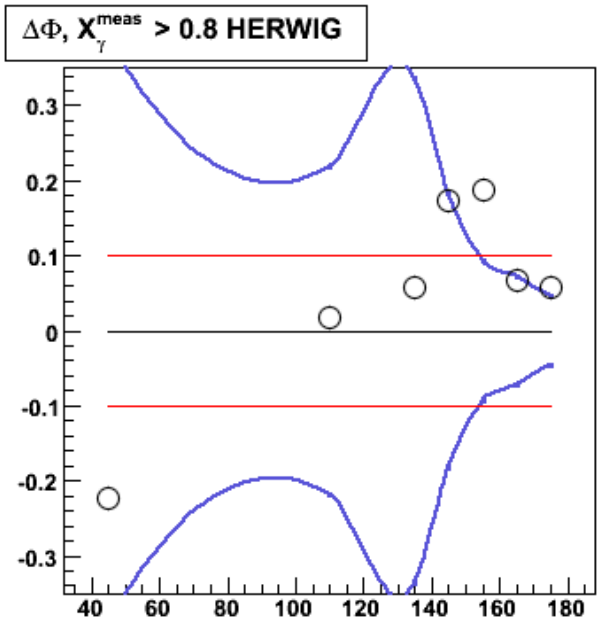

ΔΦ Fragmentation
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180

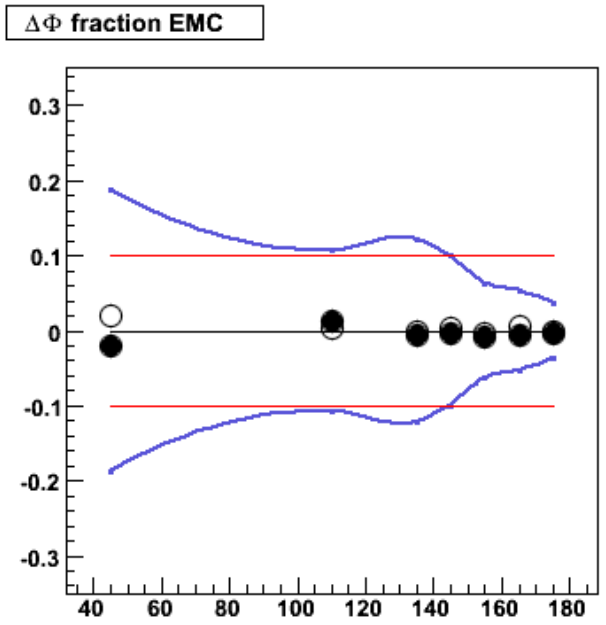

ΔΦ, X_γ^meas < 0.7 Fragmentation
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180

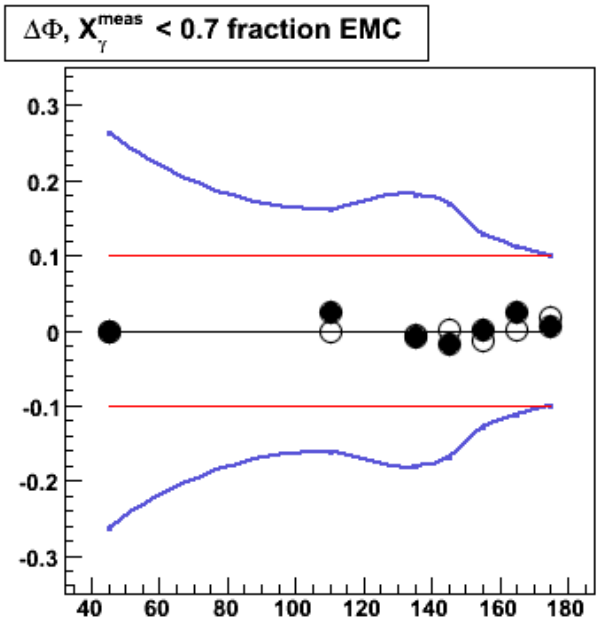

ΔΦ, X_γ^meas > 0.8 Fragmentation
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180

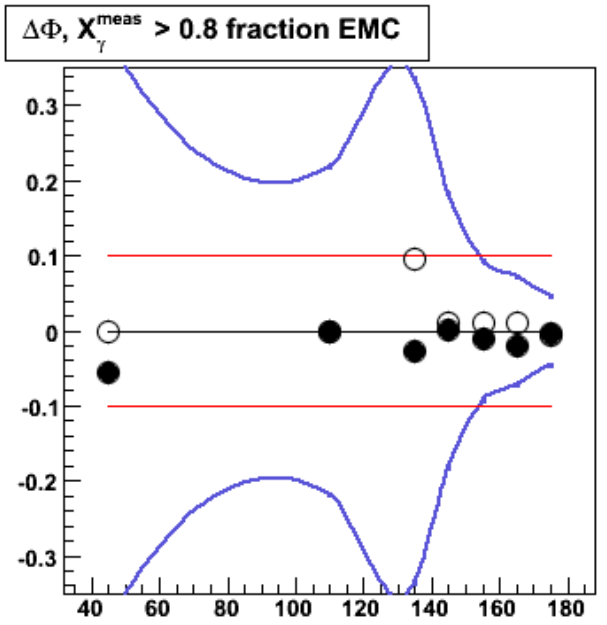

ΔΦ HERWIG
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180

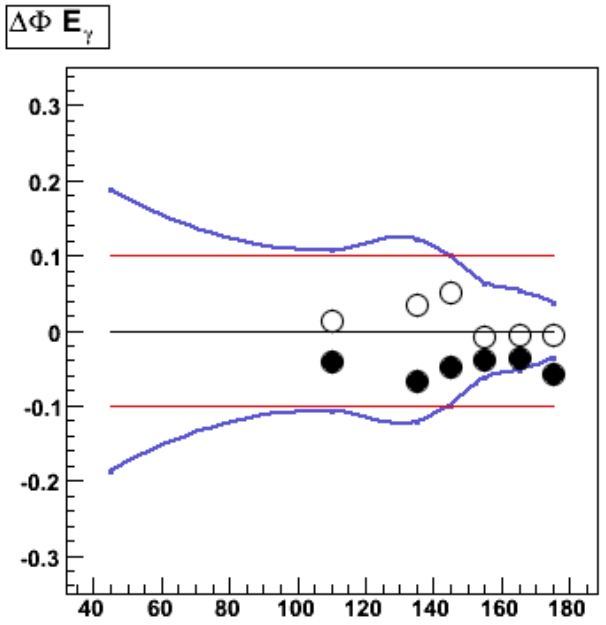

ΔΦ, X$_\gamma^{meas}$ < 0.7 HERWIG
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180

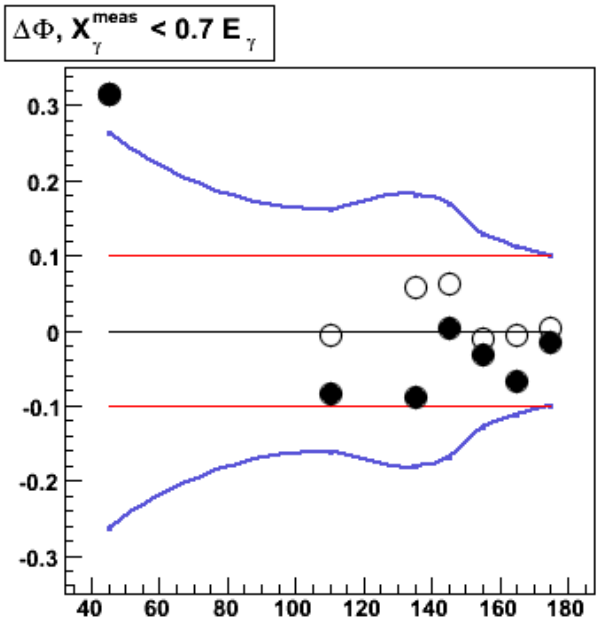

ΔΦ, X$_\gamma^{meas}$ > 0.8 HERWIG
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180

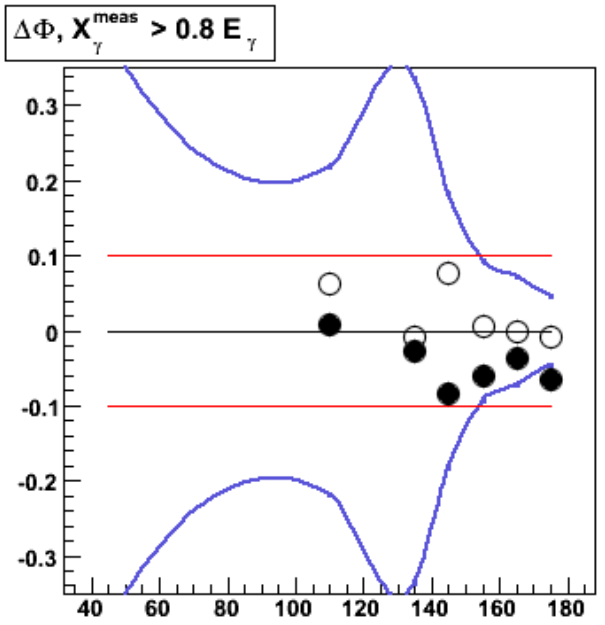

ΔΦ fraction EMC
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180

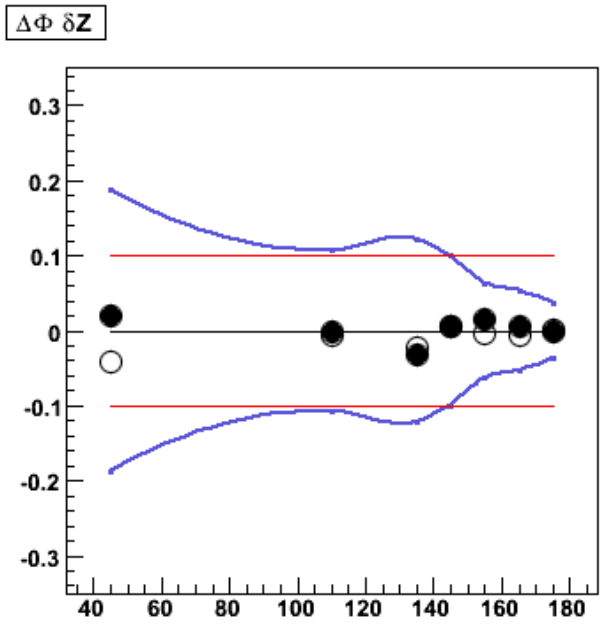

ΔΦ, X_γ^meas < 0.7 fraction EMC
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180

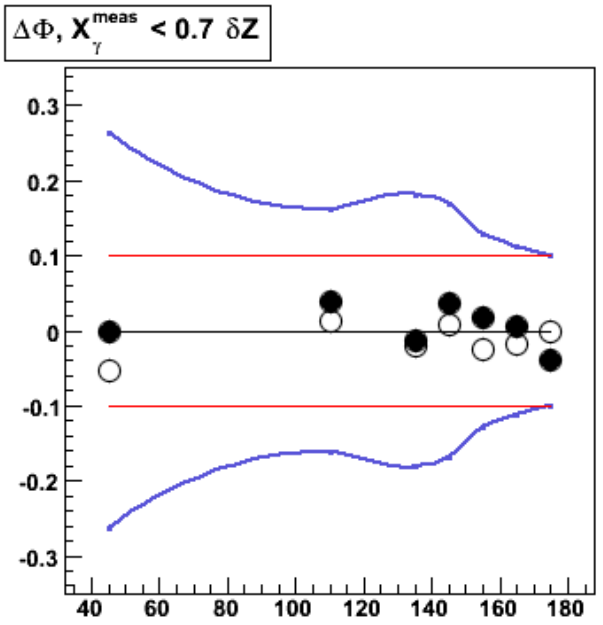

ΔΦ, X_γ^meas > 0.8 fraction EMC
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180

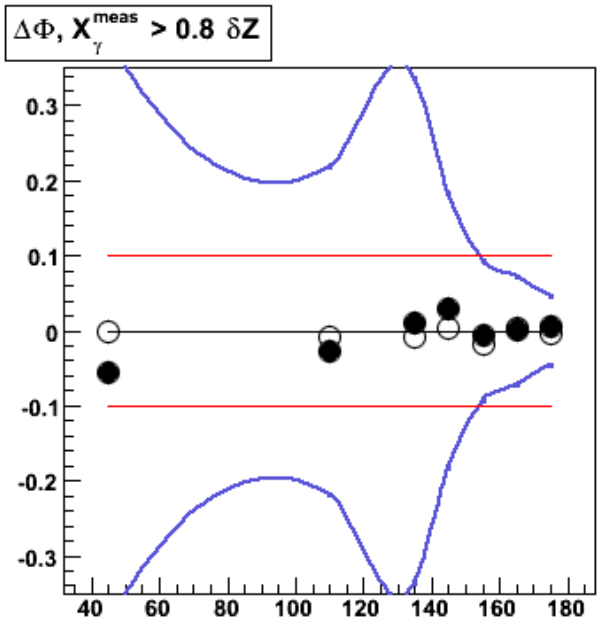

ΔΦ E_γ
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180

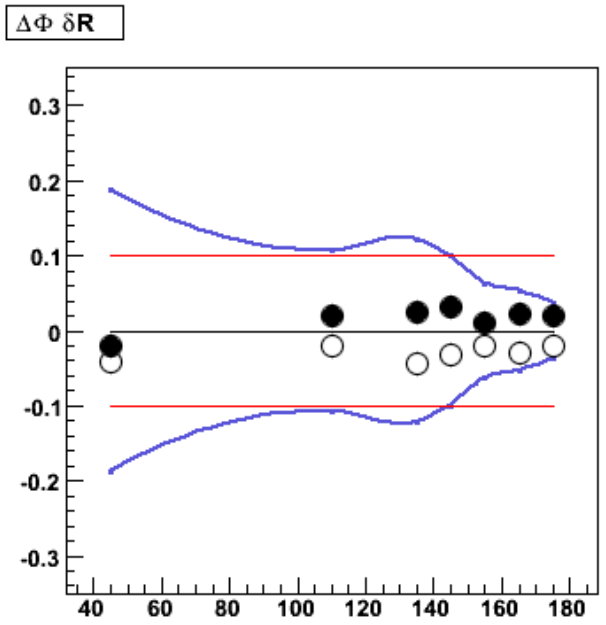

ΔΦ, X_γ^meas < 0.7 E_γ
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180

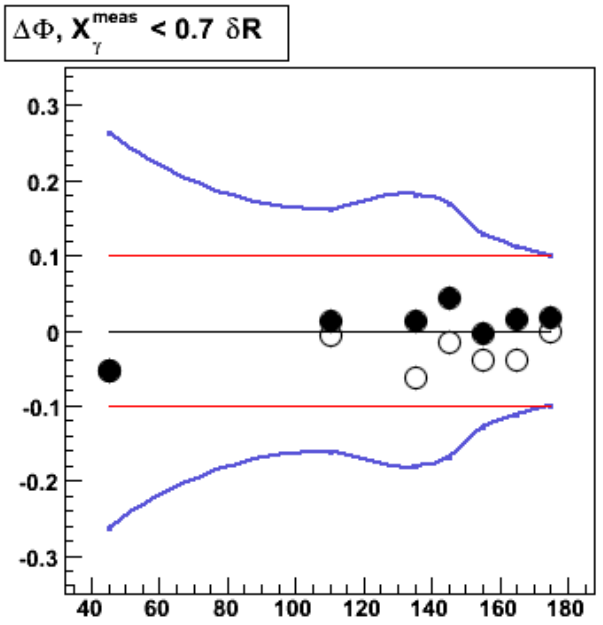

ΔΦ, X_γ^meas > 0.8 E_γ
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180

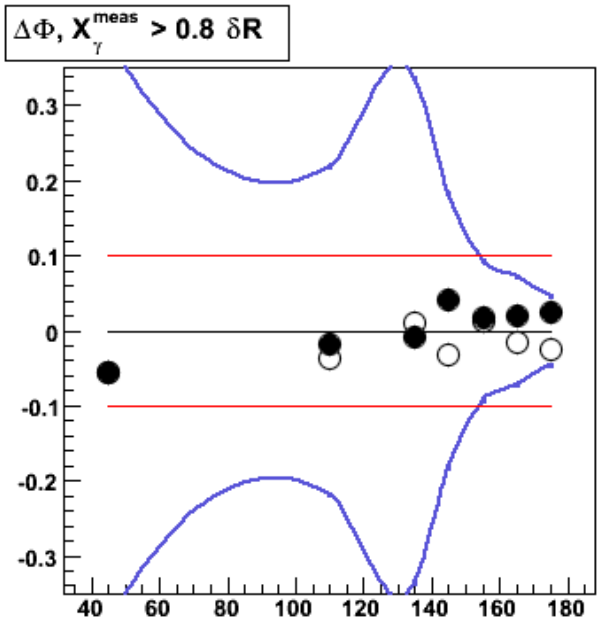

ΔΦ δZ
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180


ΔΦ, X_γ^{meas} < 0.7 δZ
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180


ΔΦ, X_γ^{meas} > 0.8 δZ
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180

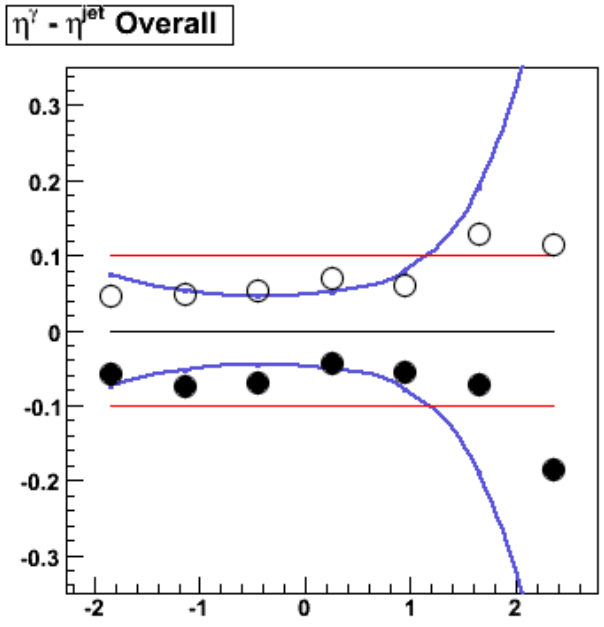

ΔΦ δR
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180

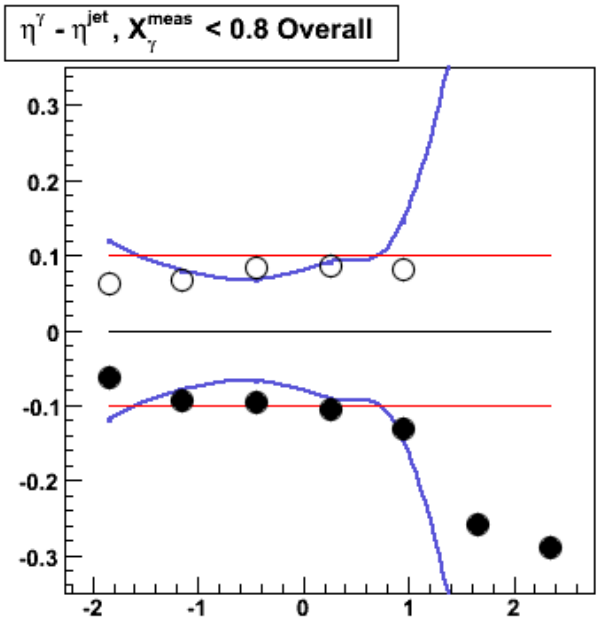

ΔΦ, X_γ^meas < 0.7 δR
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180

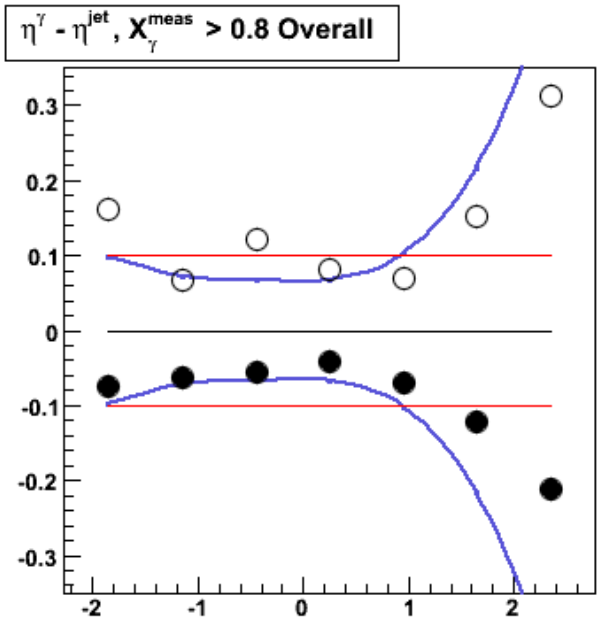

ΔΦ, X_γ^meas > 0.8 δR
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180

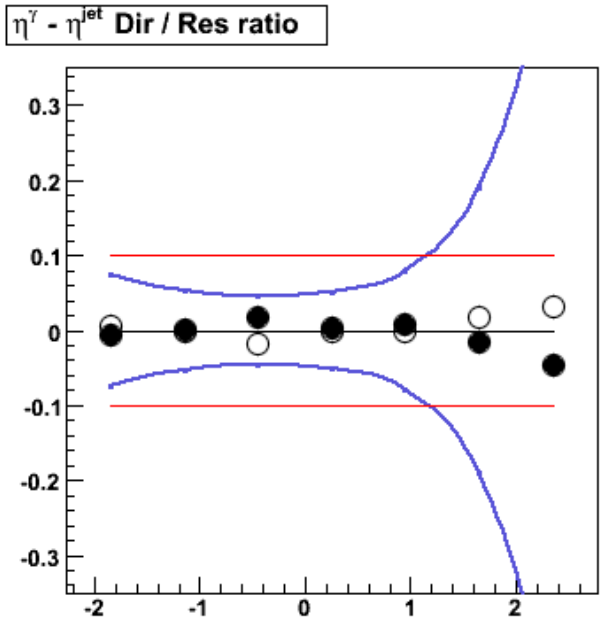
Systematic uncertainties

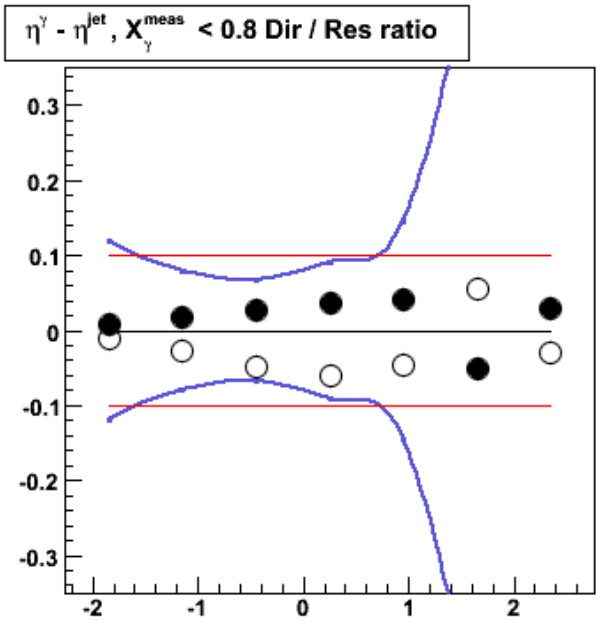
$x_Y < 0.8$, $x_Y > 0.8$

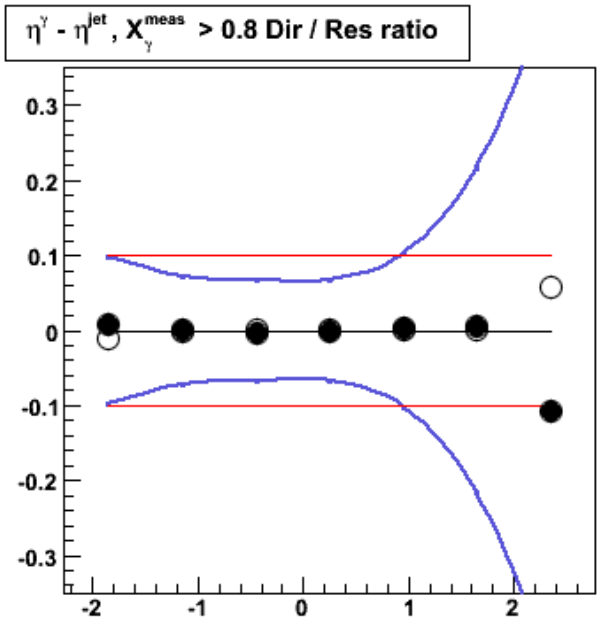

η^{γ} - η^{jet} Overall
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-2
-1
0
1
2

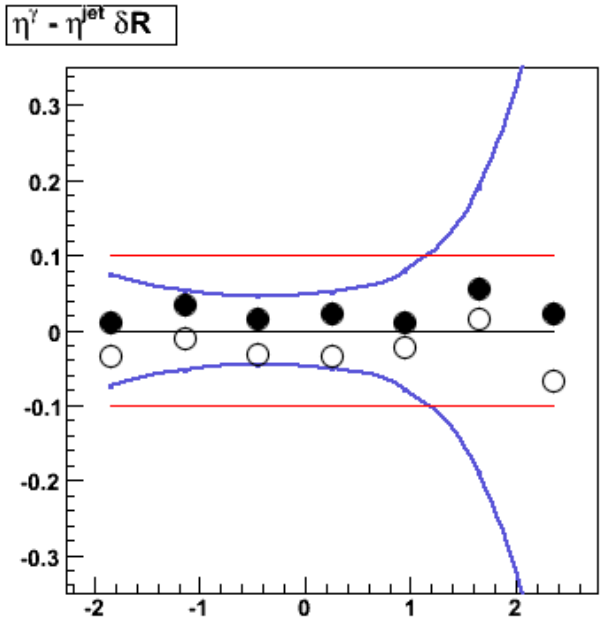

η^{γ} - η^{jet}, X_{γ}^{meas} < 0.8 Overall
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-2
-1
0
1
2

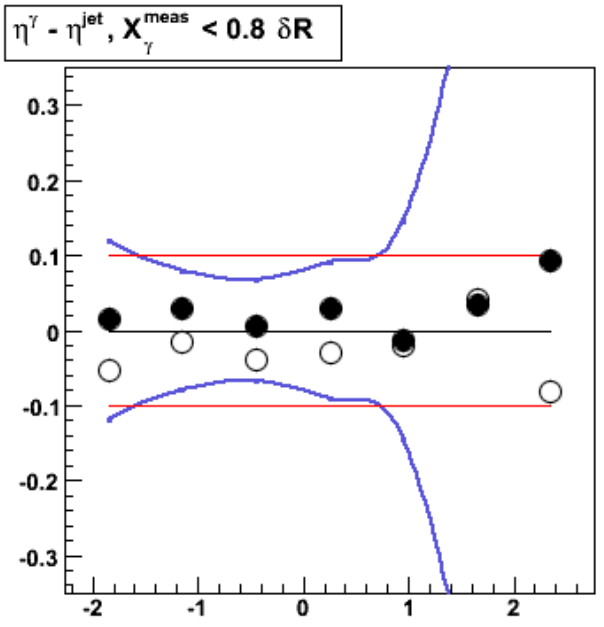

η^{γ} - η^{jet}, X_{γ}^{meas} > 0.8 Overall
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-2
-1
0
1
2

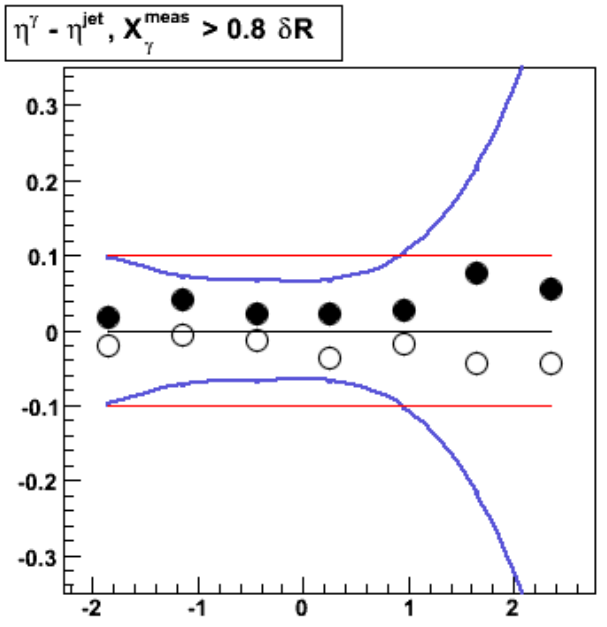

η^{γ} - η^{jet} Dir / Res ratio
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-2
-1
0
1
2

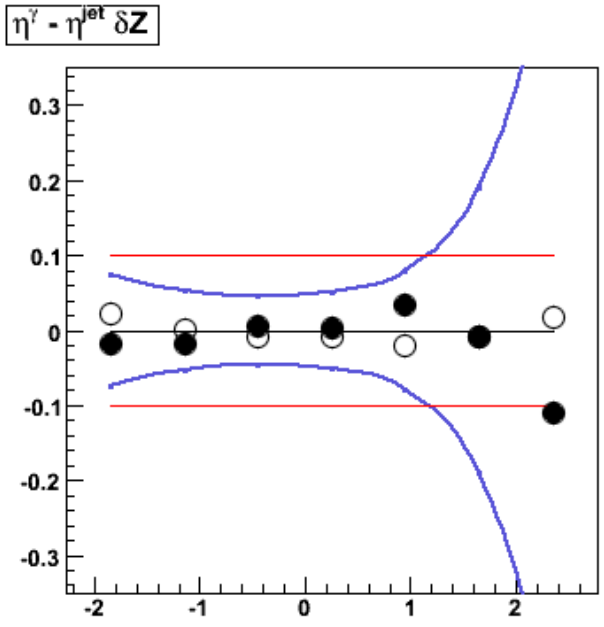

η^{γ} - η^{jet}, X_{γ}^{meas} < 0.8 Dir / Res ratio
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-2
-1
0
1
2

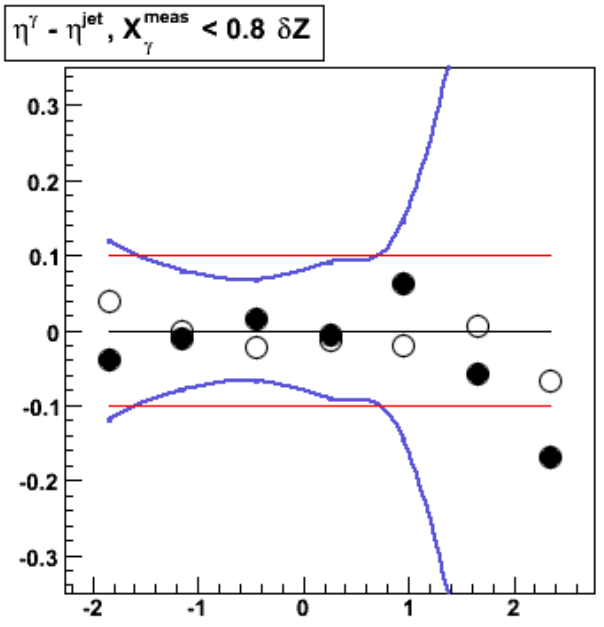

η^{γ} - η^{jet}, X_{γ}^{meas} > 0.8 Dir / Res ratio
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-2
-1
0
1
2

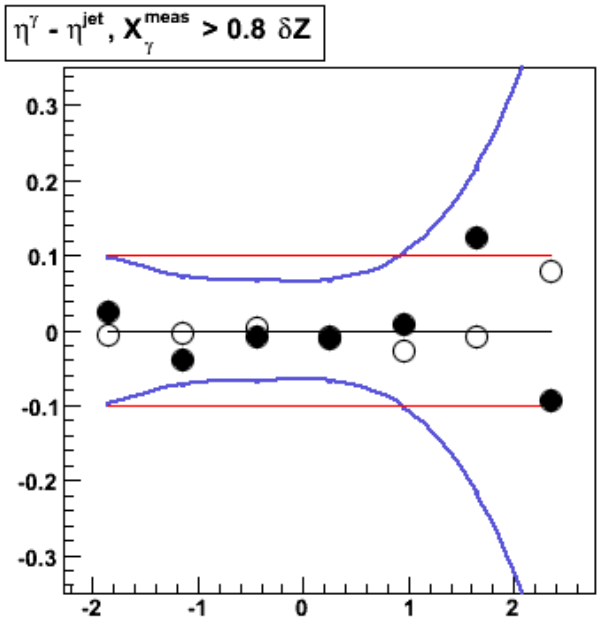

η^{γ} - η^{jet} δR
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-2
-1
0
1
2

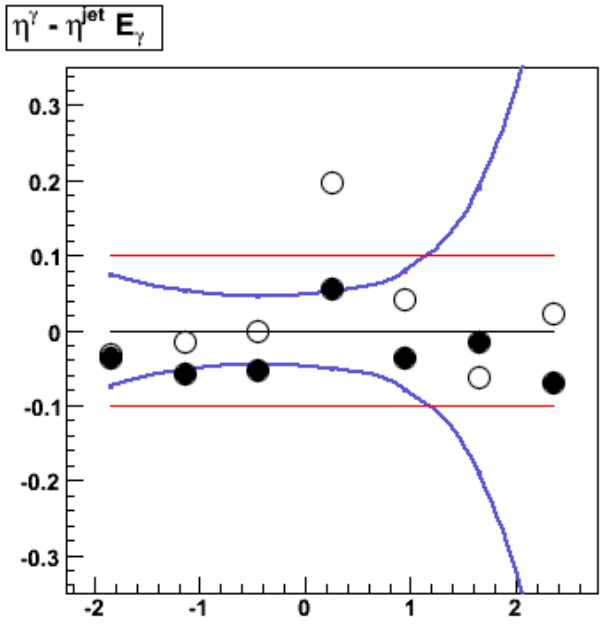

η^{γ} - η^{jet}, X_{γ}^{meas} < 0.8 δR
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-2
-1
0
1
2

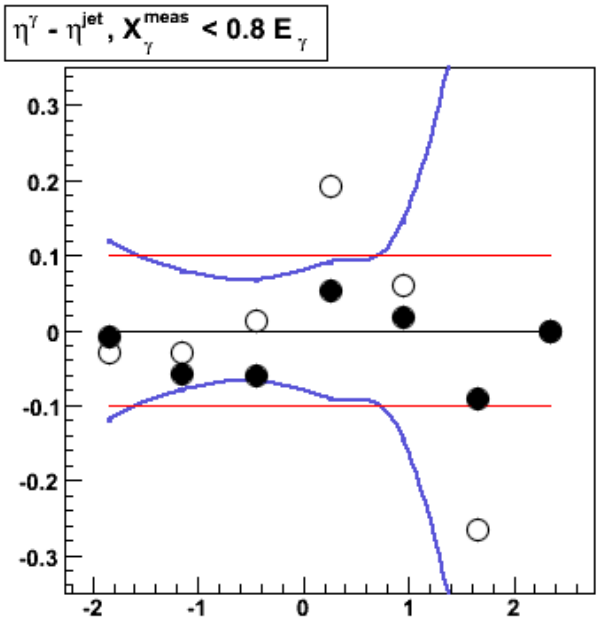

η^{γ} - η^{jet}, X_{γ}^{meas} > 0.8 δR
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-2
-1
0
1
2

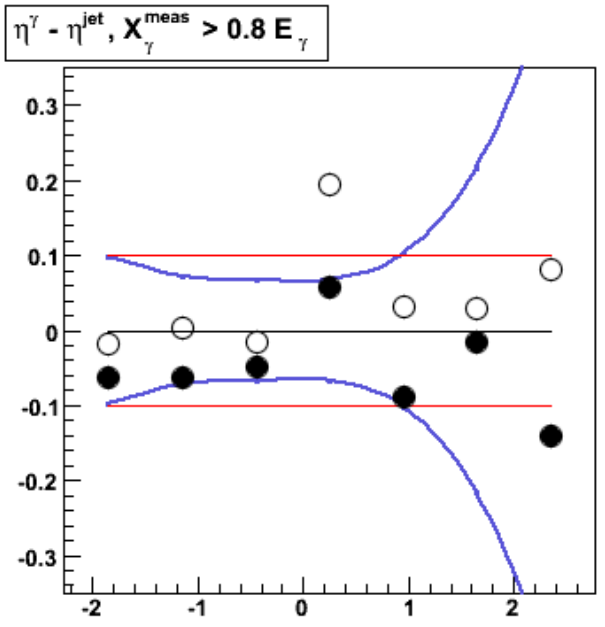

η^{γ} - η^{jet} δZ
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-2
-1
0
1
2

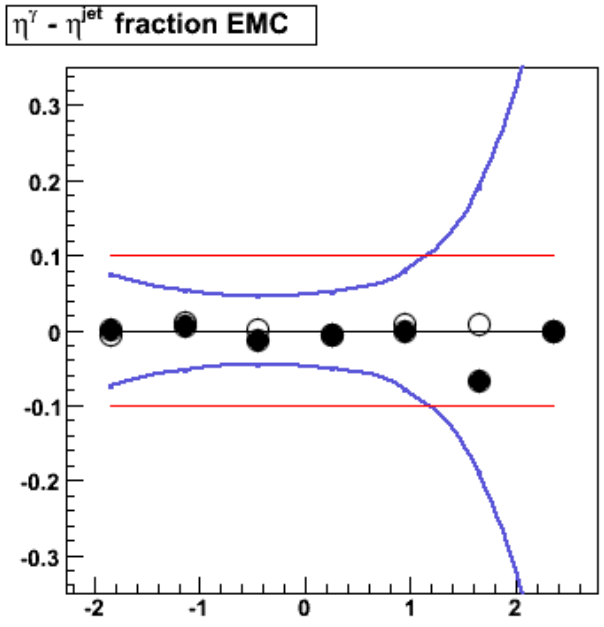

η^{γ} - η^{jet}, X_{γ}^{meas} < 0.8 δZ
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-2
-1
0
1
2

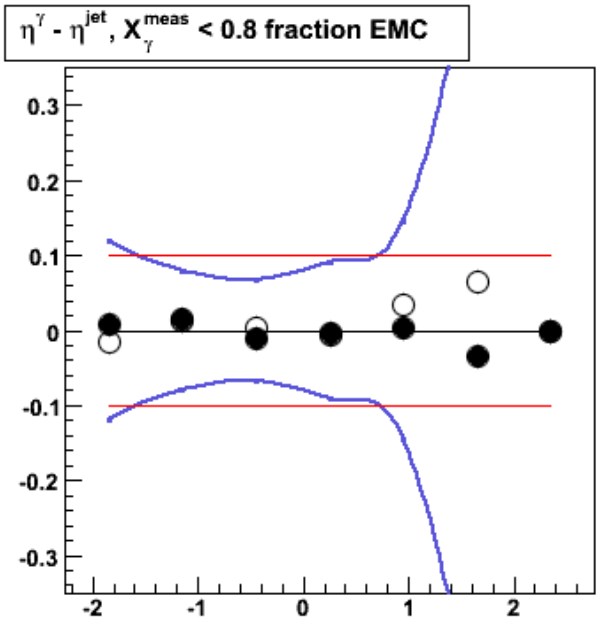

η^{γ} - η^{jet}, X_{γ}^{meas} > 0.8 δZ
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-2
-1
0
1
2

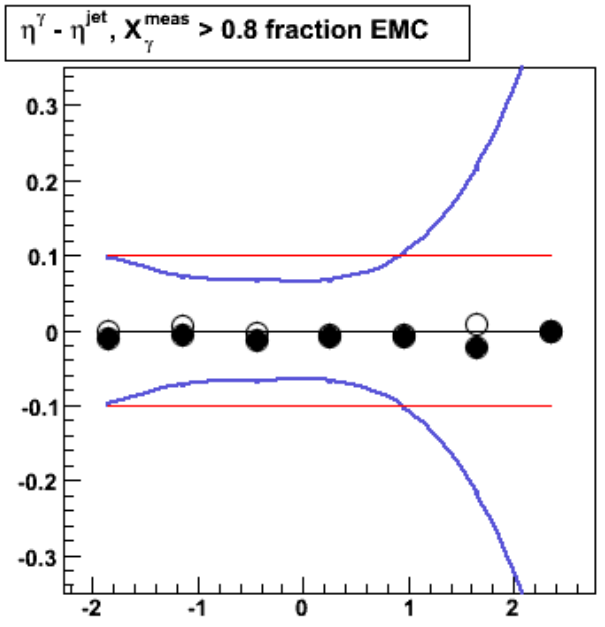

$\eta^{\gamma} - \eta^{jet}$ E_{γ}
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-2
-1
0
1
2

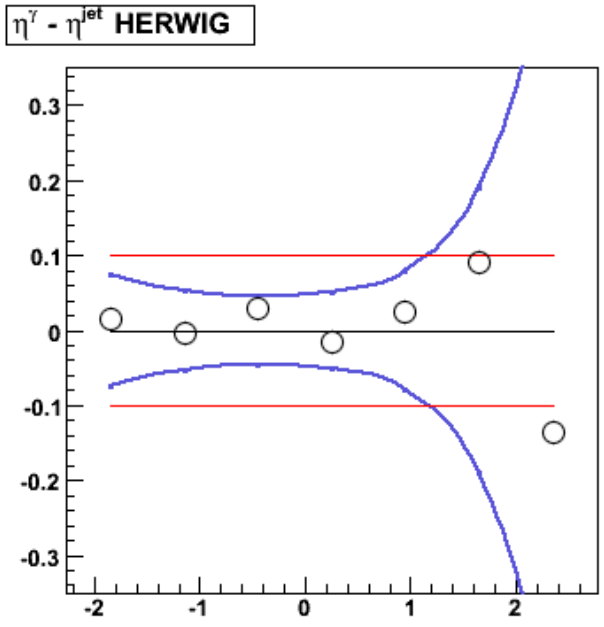

$\eta^{\gamma} - \eta^{jet}$, X_{γ}^{meas} < 0.8 E_{γ}
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-2
-1
0
1
2

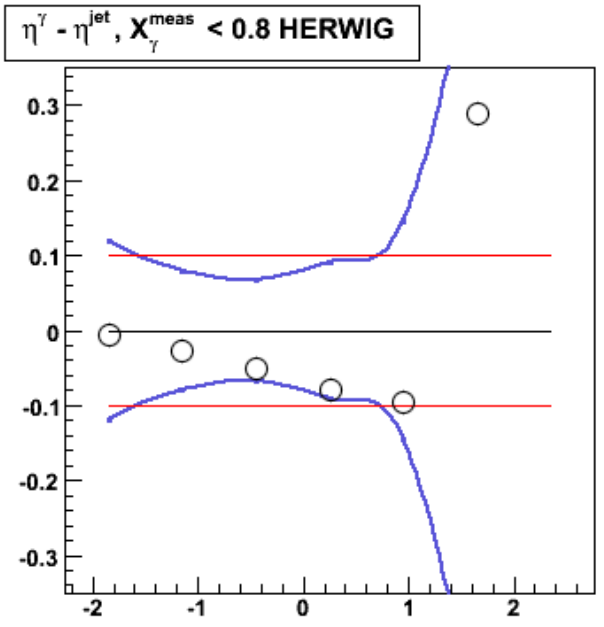

$\eta^{\gamma} - \eta^{jet}$, X_{γ}^{meas} > 0.8 E_{γ}
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-2
-1
0
1
2

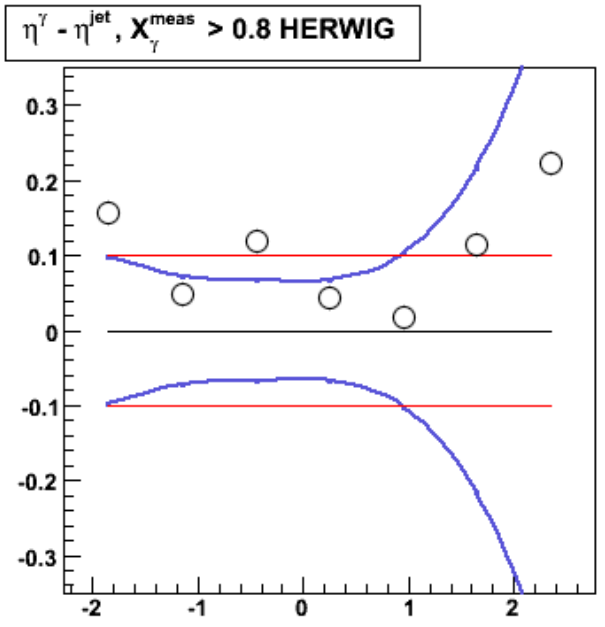

η^{γ} - η^{jet} fraction EMC
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-2
-1
0
1
2

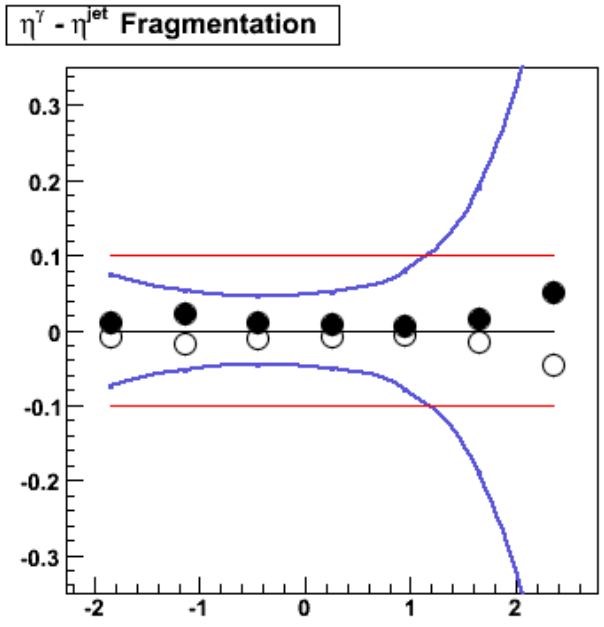

η^{γ} - η^{jet}, X_{γ}^{meas} < 0.8 fraction EMC
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-2
-1
0
1
2

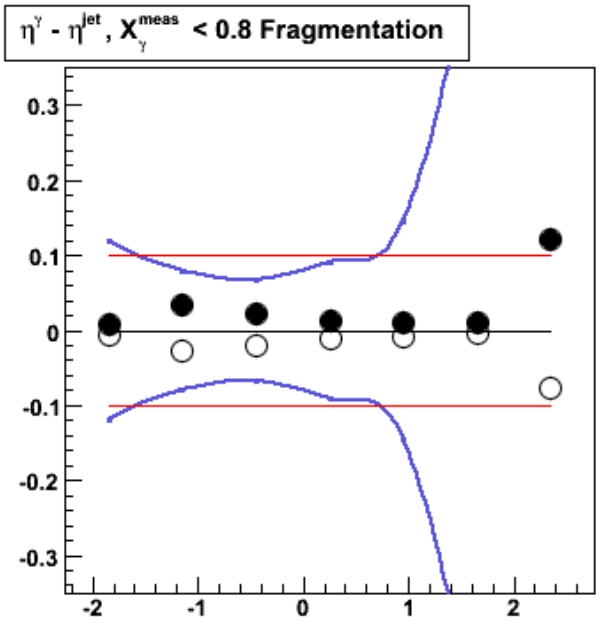

η^{γ} - η^{jet}, X_{γ}^{meas} > 0.8 fraction EMC
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-2
-1
0
1
2

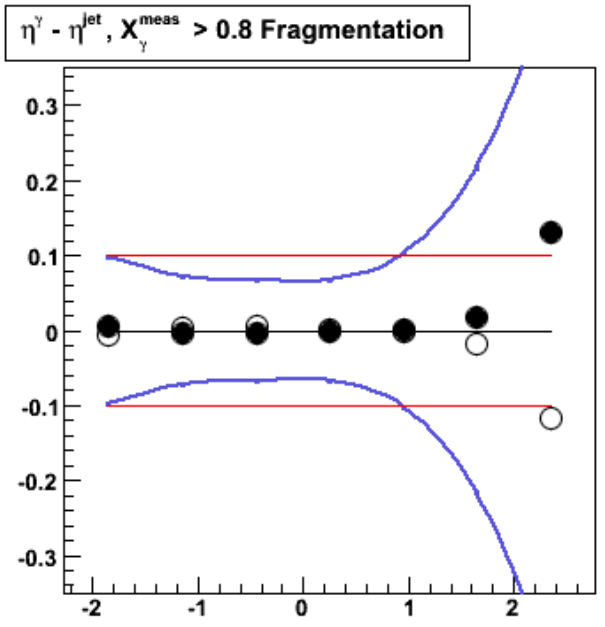

η^{γ} - η^{jet} HERWIG
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-2
-1
0
1
2

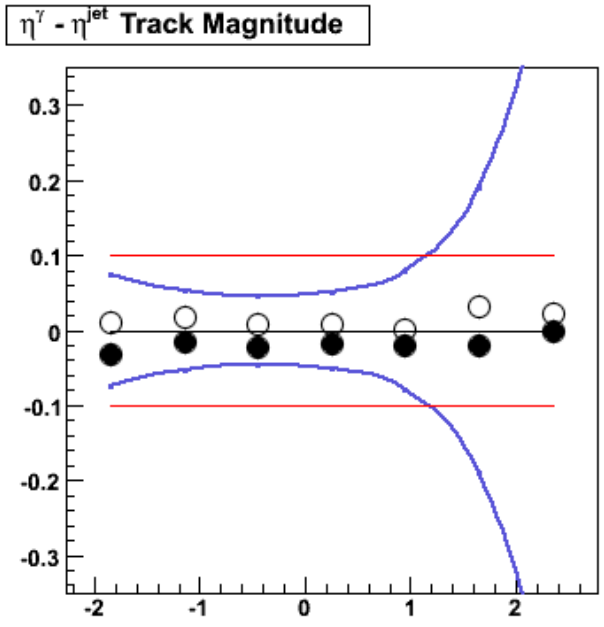

η^{γ} - η^{jet}, X_{γ}^{meas} < 0.8 HERWIG
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-2
-1
0
1
2

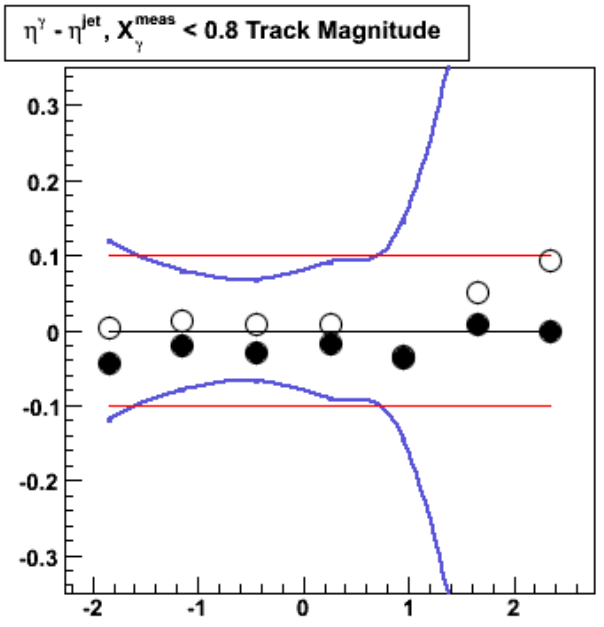

η^{γ} - η^{jet}, X_{γ}^{meas} > 0.8 HERWIG
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-2
-1
0
1
2

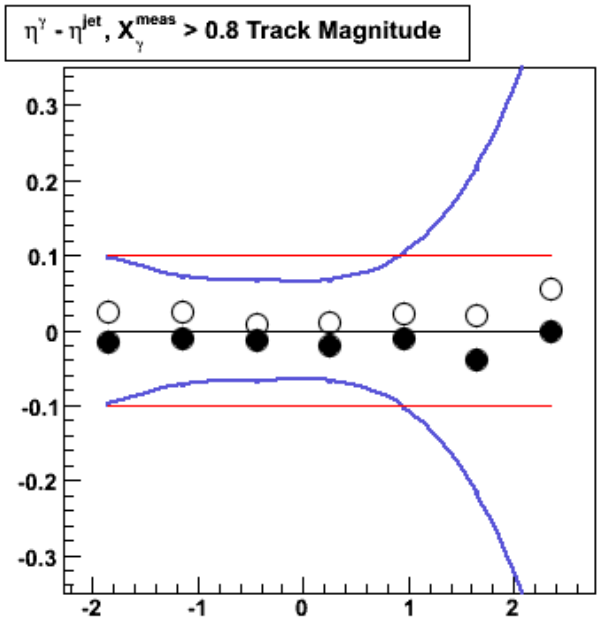

η^{γ} - η^{jet} Fragmentation
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-2
-1
0
1
2

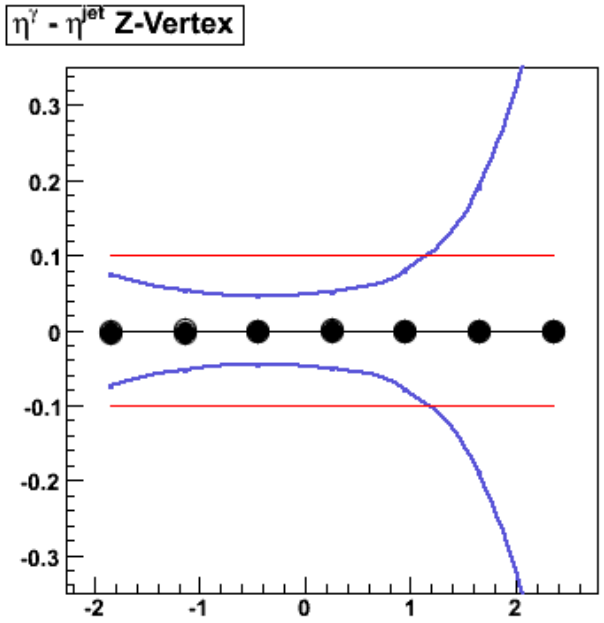

η^{γ} - η^{jet}, X_{γ}^{meas} < 0.8 Fragmentation
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-2
-1
0
1
2


η^{γ} - η^{jet}, X_{γ}^{meas} > 0.8 Fragmentation
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-2
-1
0
1
2


η^{γ} - η^{jet} Track Magnitude
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-2
-1
0
1
2


η^{γ} - η^{jet}, X_{γ}^{meas} < 0.8 Track Magnitude
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-2
-1
0
1
2


η^{γ} - η^{jet}, X_{γ}^{meas} > 0.8 Track Magnitude
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-2
-1
0
1
2


η^{γ} - η^{jet} Z-Vertex
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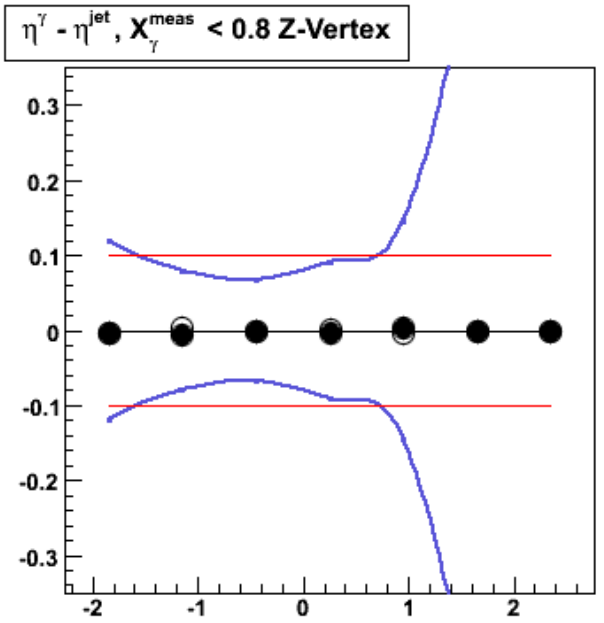
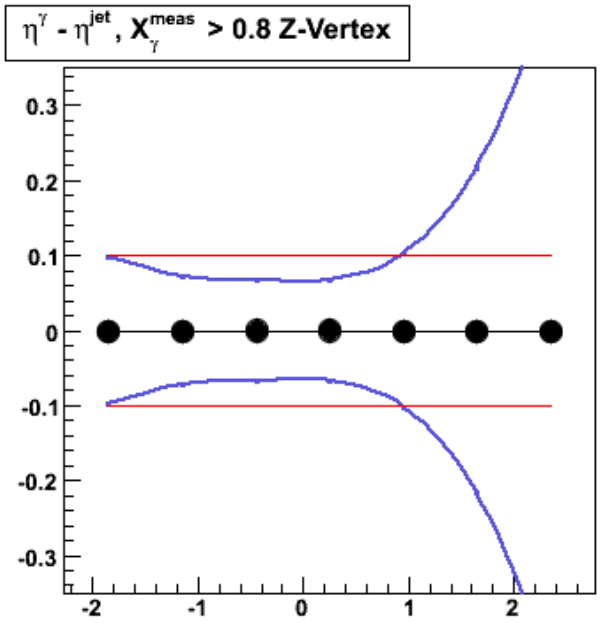
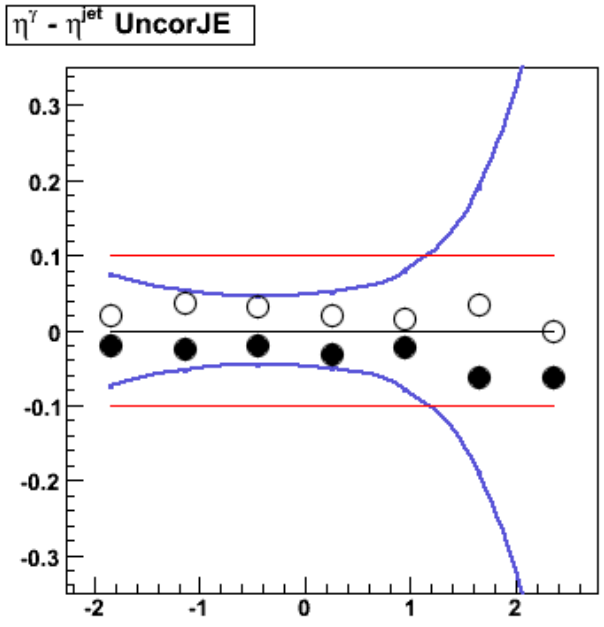
0.2
0.1
0
-0.1
-0.2
-0.3
-2
-1
0
1
2


η^{γ} - η^{jet}, X_{γ}^{meas} < 0.8 Z-Vertex
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-2
-1
0
1
2


η^{γ} - η^{jet}, X_{γ}^{meas} > 0.8 Z-Vertex
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-2
-1
0
1
2


η^{γ} - η^{jet} UncorJE
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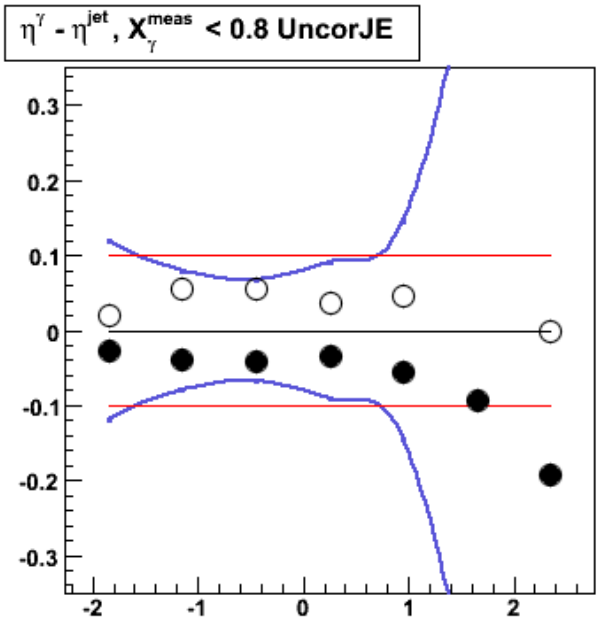
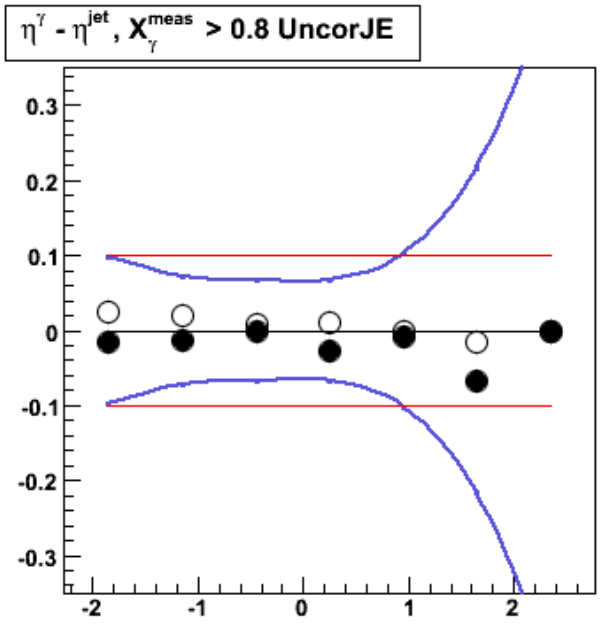
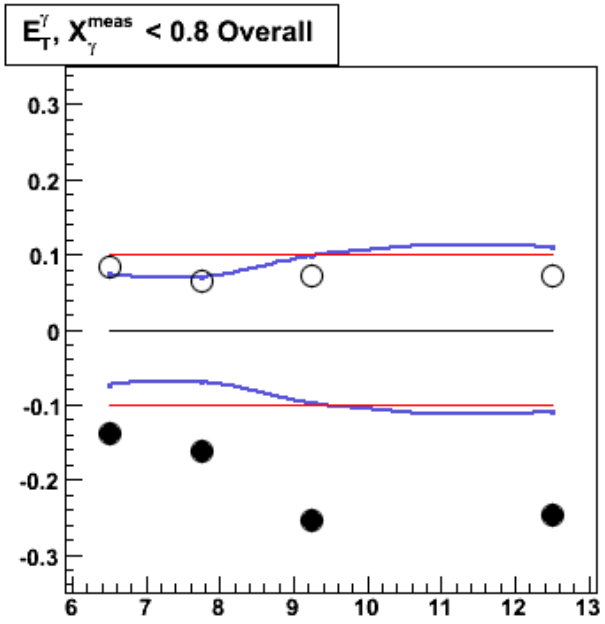
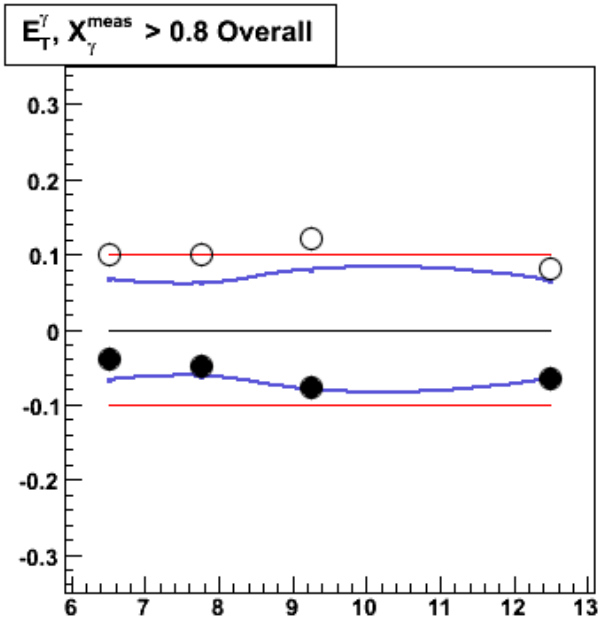
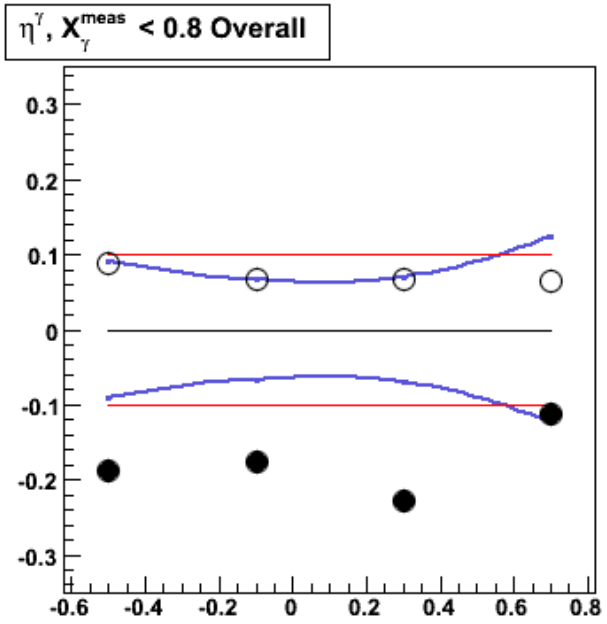
0.2
0.1
0
-0.1
-0.2
-0.3
-2
-1
0
1
2

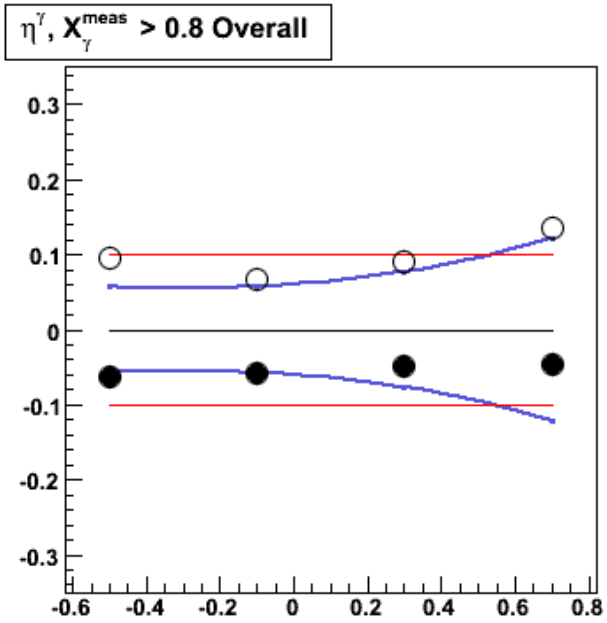

η^{γ} - η^{jet}, X_{γ}^{meas} < 0.8 UncorJE
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-2
-1
0
1
2

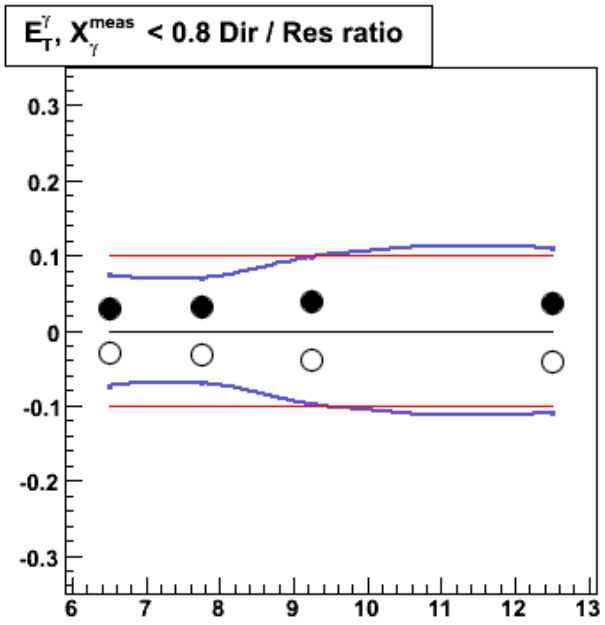

η^{γ} - η^{jet}, X_{γ}^{meas} > 0.8 UncorJE
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-2
-1
0
1
2

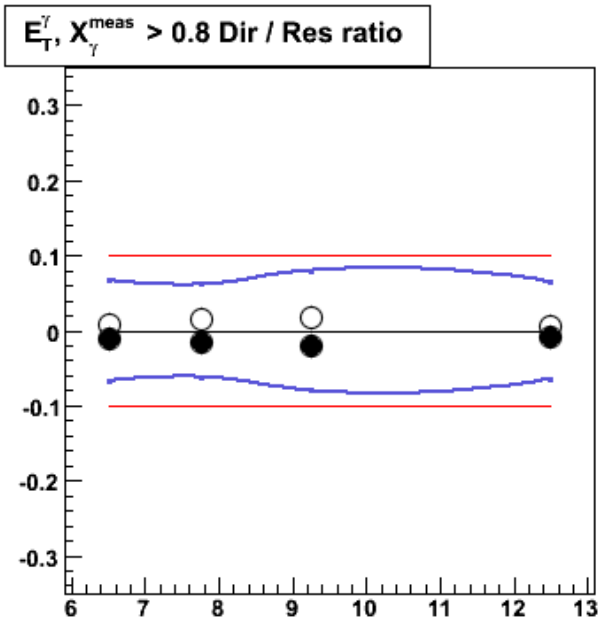

E_T^γ, X_γ^{meas} < 0.8 Overall
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
6
7
8
9
10
11
12
13

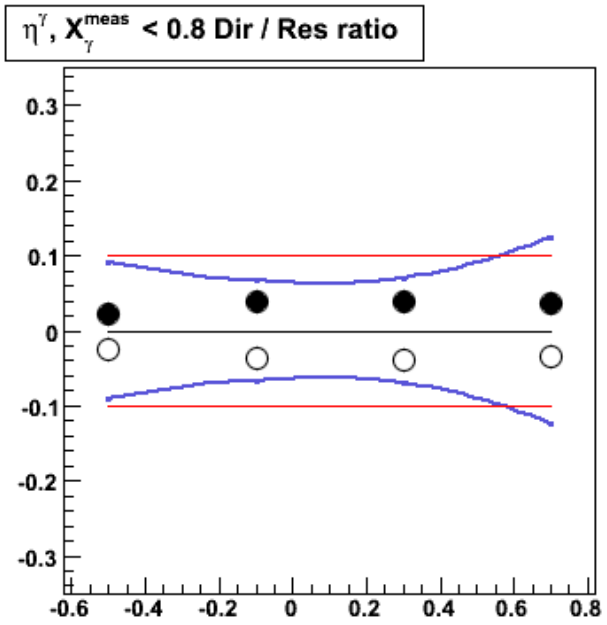

E_T^γ, X_γ^{meas} > 0.8 Overall
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
6
7
8
9
10
11
12
13

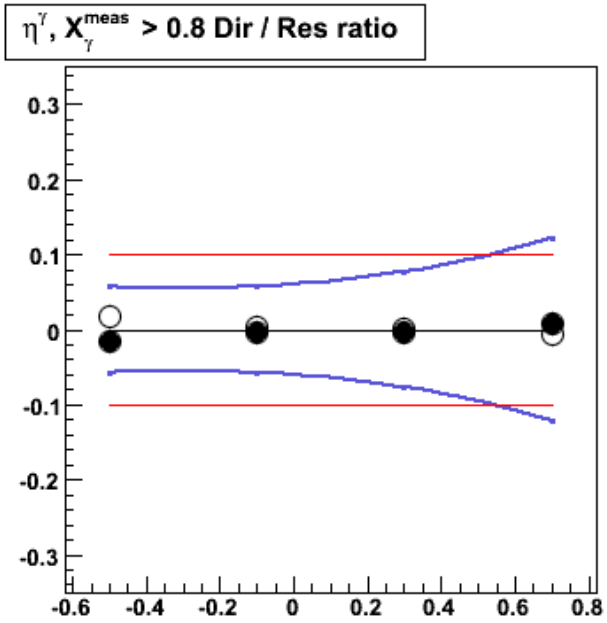

η^γ, X_γ^{meas} < 0.8 Overall
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8

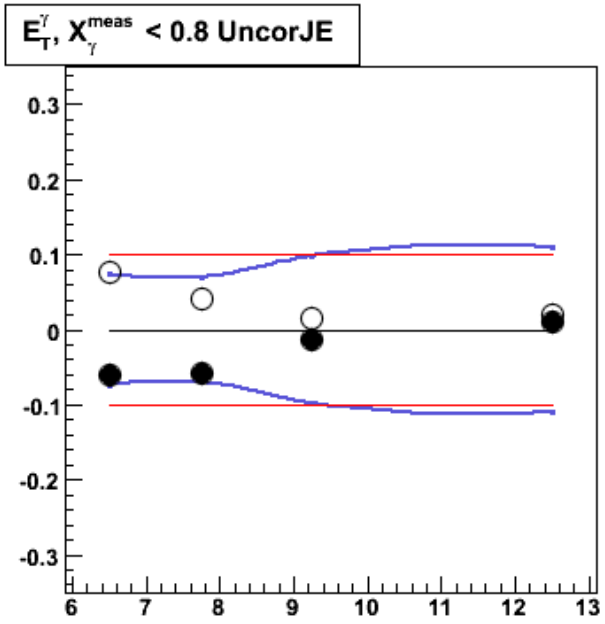

η^γ, X_γ^{meas} > 0.8 Overall
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8

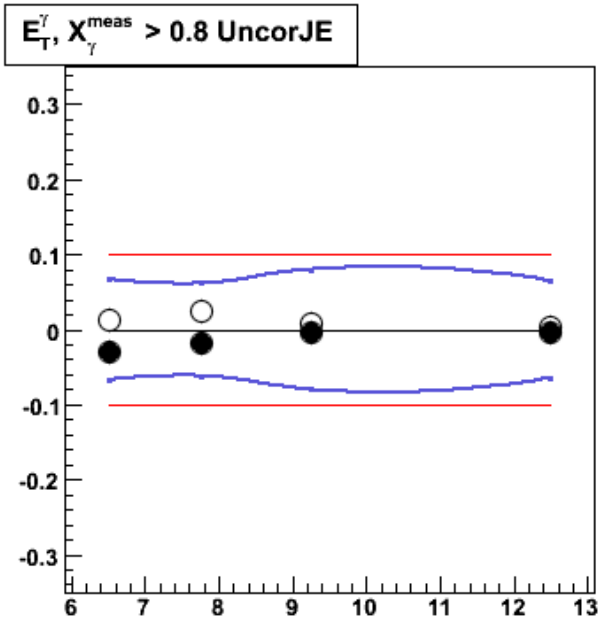

E_T^γ, X_γ^{meas} < 0.8 Dir / Res ratio
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
6
7
8
9
10
11
12
13


E_T^γ, X_γ^{meas} > 0.8 Dir / Res ratio
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
6
7
8
9
10
11
12
13


η^γ, X_γ^{meas} < 0.8 Dir / Res ratio
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8


η^γ, X_γ^{meas} > 0.8 Dir / Res ratio
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8


E_T^γ, X_γ^{meas} < 0.8 UncorJE
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
6
7
8
9
10
11
12
13


E_T^γ, X_γ^{meas} > 0.8 UncorJE
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
6
7
8
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10
11
12
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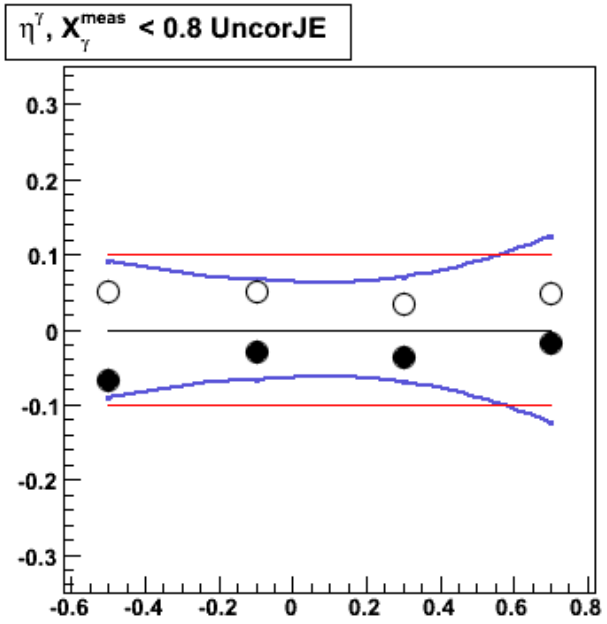
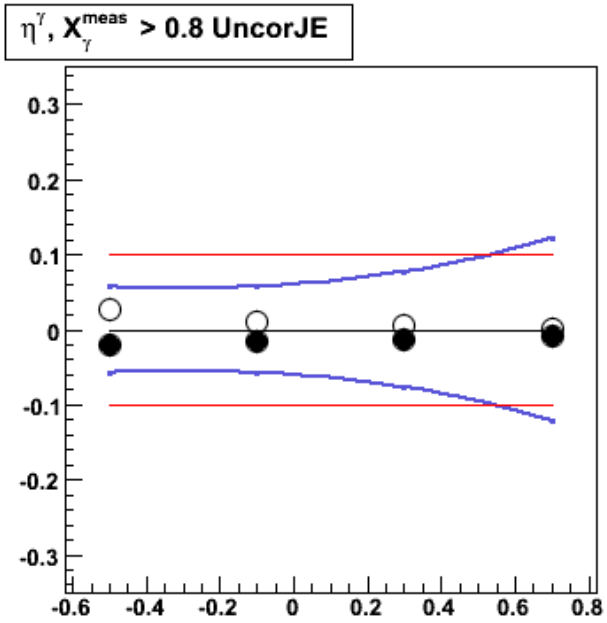
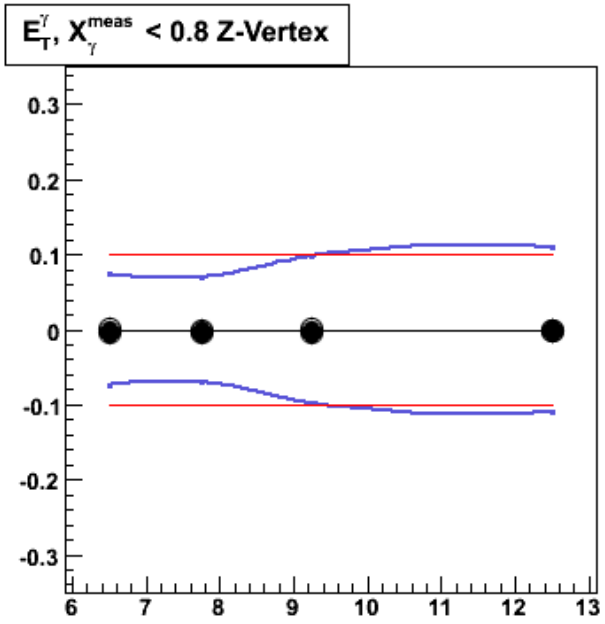
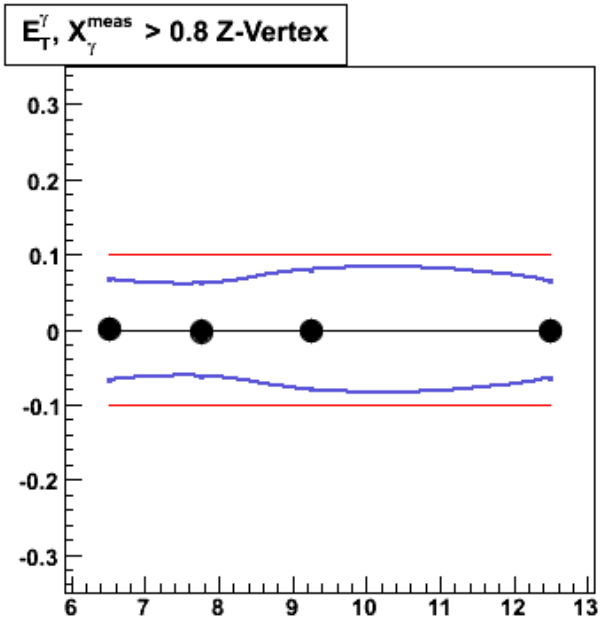

η^γ, X_γ^{meas} < 0.8 UncorJE
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8


η^γ, X_γ^{meas} > 0.8 UncorJE
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8


E_T^γ, X_γ^{meas} < 0.8 Z-Vertex
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
6
7
8
9
10
11
12
13


E_T^γ, X_γ^{meas} > 0.8 Z-Vertex
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
6
7
8
9
10
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12
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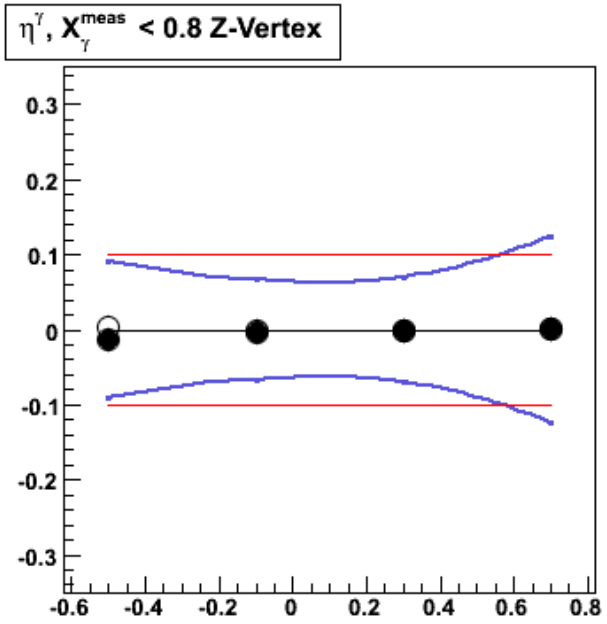
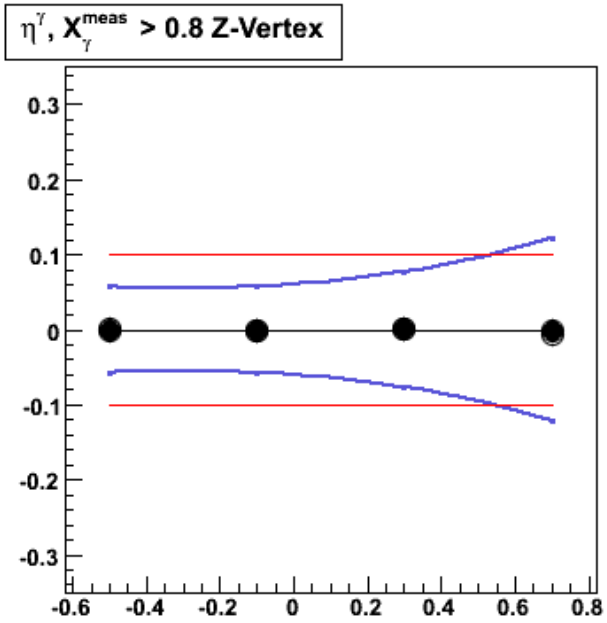
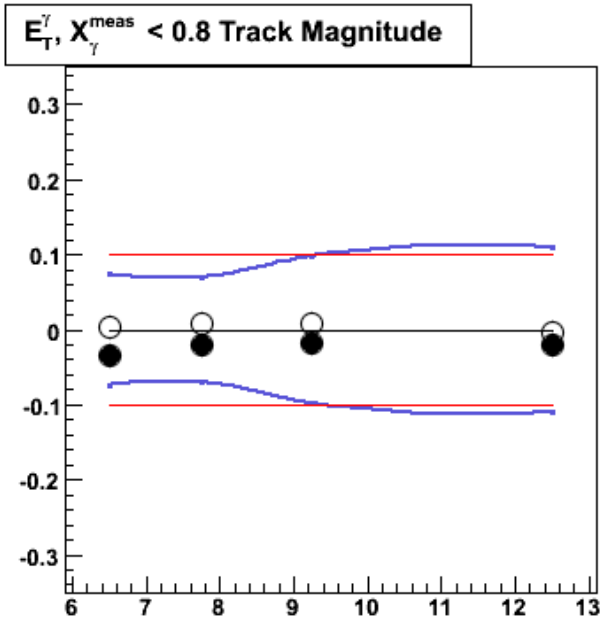

η^γ, X_γ^{meas} < 0.8 Z-Vertex
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8


η^γ, X_γ^{meas} > 0.8 Z-Vertex
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8


E_T^γ, X_γ^{meas} < 0.8 Track Magnitude
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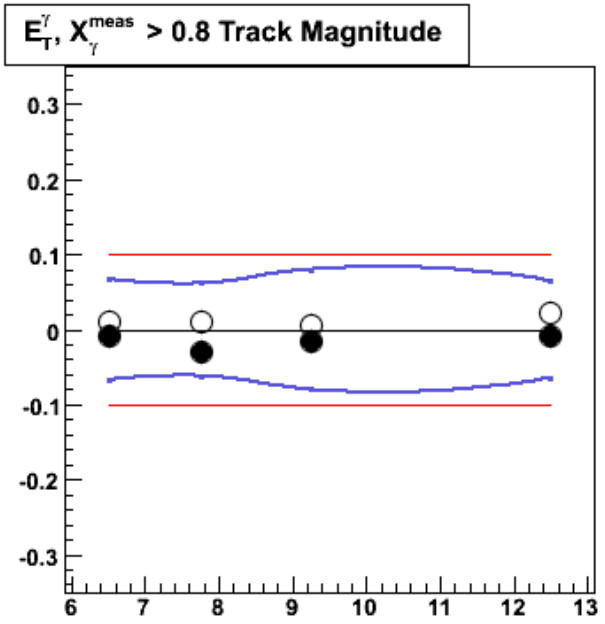
0.2
0.1
0
-0.1
-0.2
-0.3
6
7
8
9
10
11
12
13


E_T^γ, X_γ^{meas} > 0.8 Track Magnitude
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
6
7
8
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10
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12
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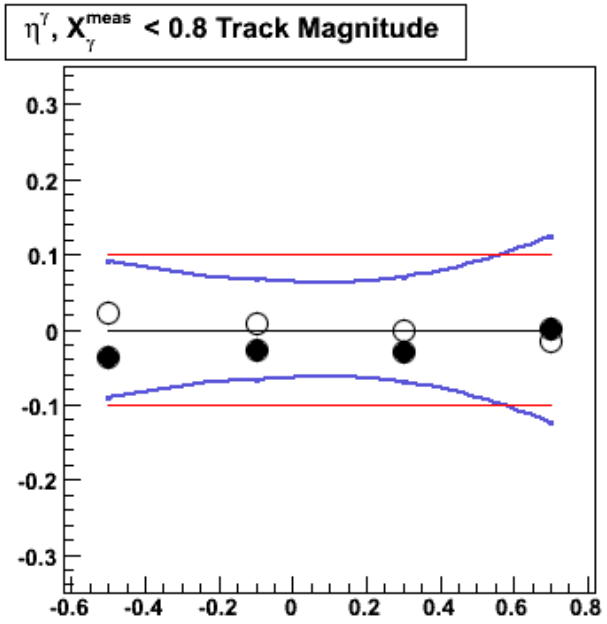
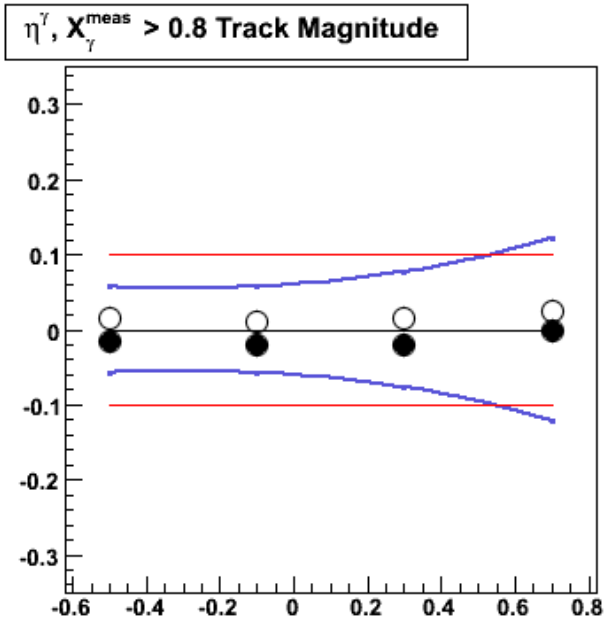
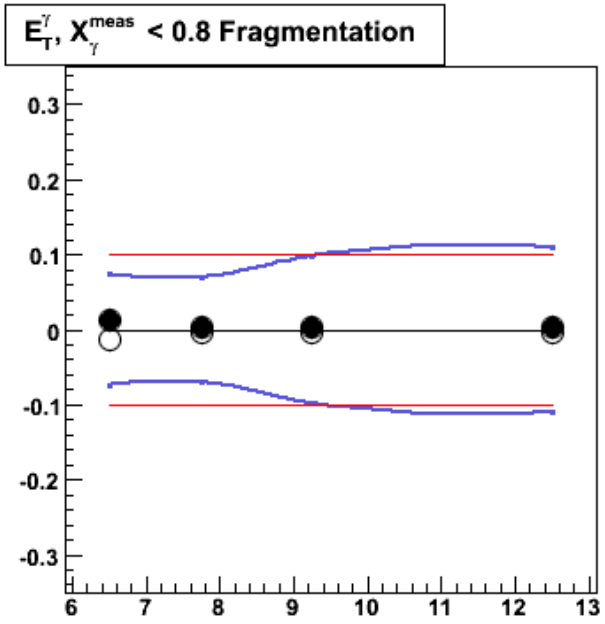

η^γ, X_γ^{meas} < 0.8 Track Magnitude
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8


η^γ, X_γ^{meas} > 0.8 Track Magnitude
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8


E_T^γ, X_γ^{meas} < 0.8 Fragmentation
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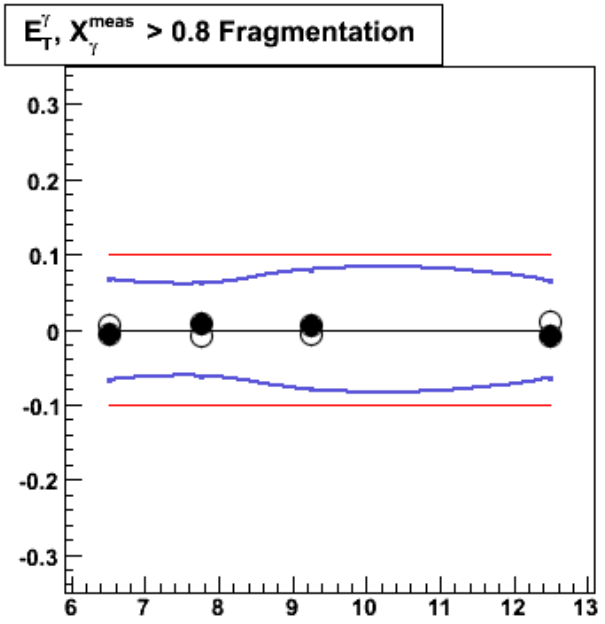
0.1
0
-0.1
-0.2
-0.3
6
7
8
9
10
11
12
13


E_T^γ, X_γ^{meas} > 0.8 Fragmentation
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
6
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10
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12
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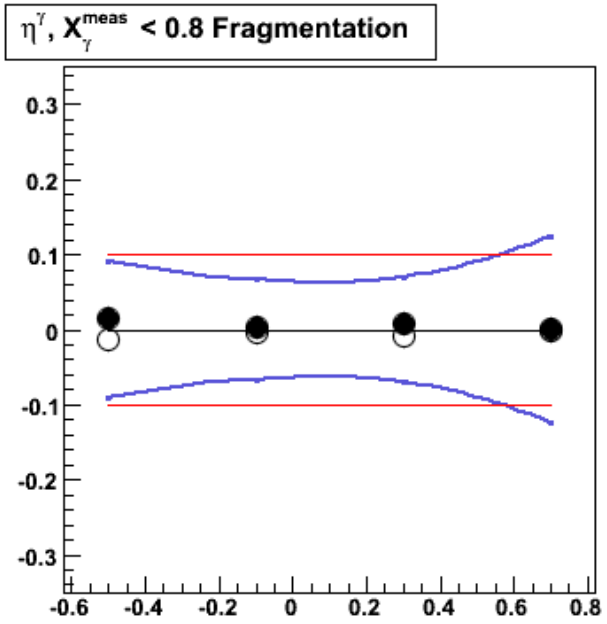
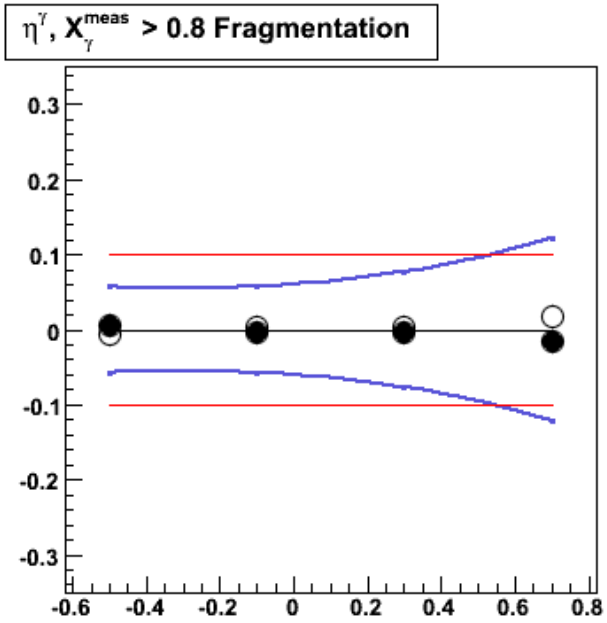
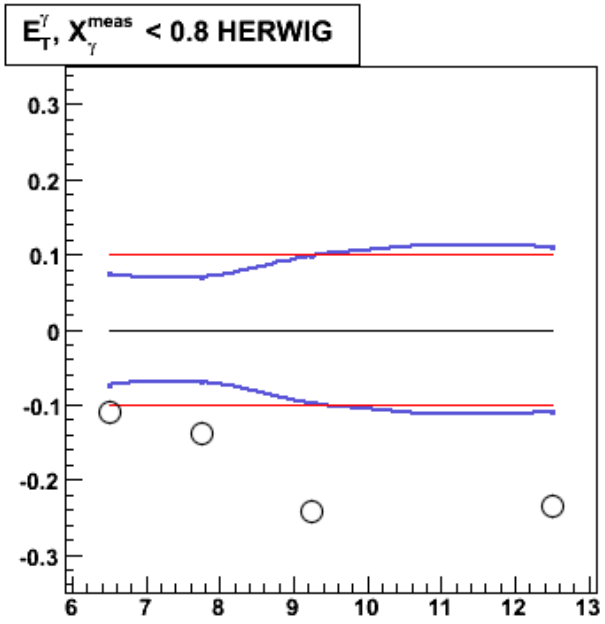

η^γ, X_γ^{meas} < 0.8 Fragmentation
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8


η^γ, X_γ^{meas} > 0.8 Fragmentation
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8


E_T^γ, X_γ^{meas} < 0.8 HERWIG
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0.1
0
-0.1
-0.2
-0.3
6
7
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12
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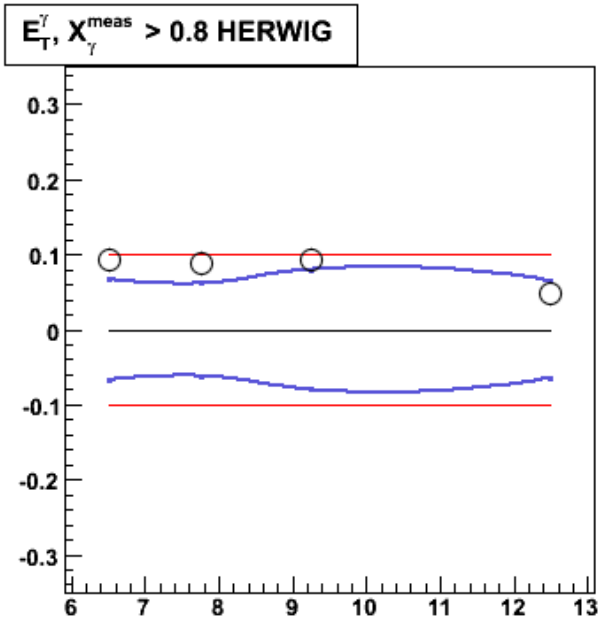
E_T^γ, X_γ^{meas} > 0.8 HERWIG
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
6
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12
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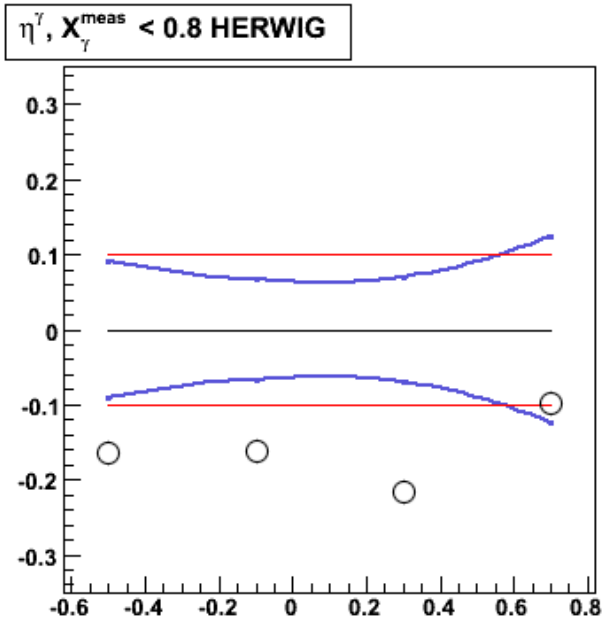
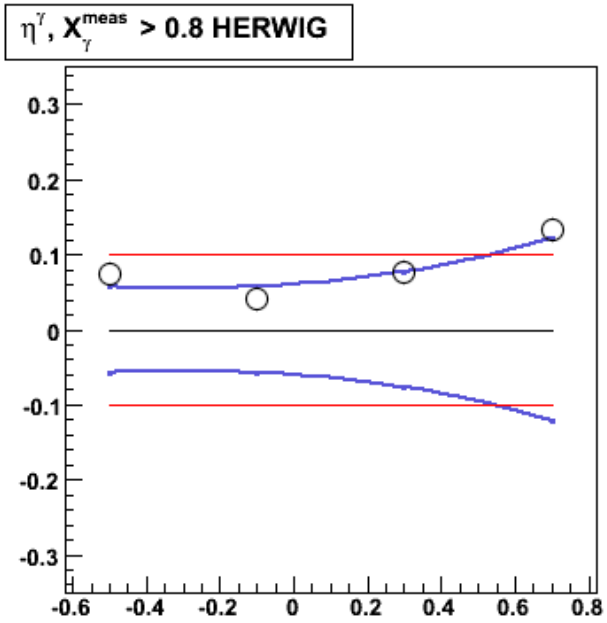
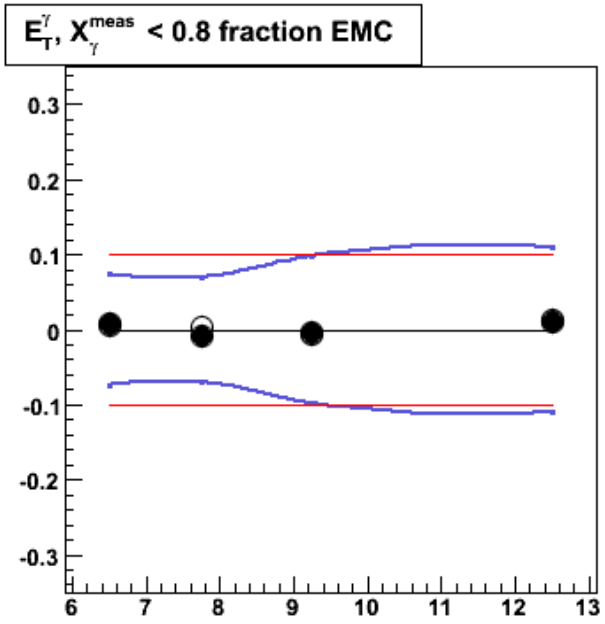

η^γ, X_γ^{meas} < 0.8 HERWIG
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8


η^γ, X_γ^{meas} > 0.8 HERWIG
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8


E_T^γ, X_γ^{meas} < 0.8 fraction EMC
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0.2
0.1
0
-0.1
-0.2
-0.3
6
7
8
9
10
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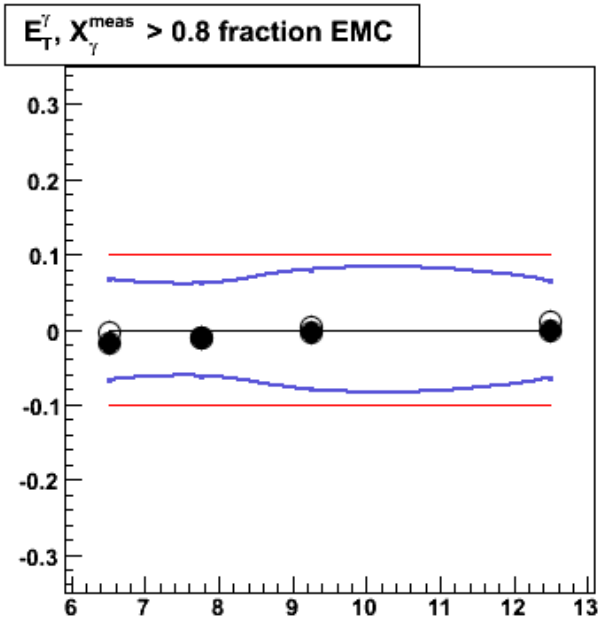
12
13


E_T^γ, X_γ^{meas} > 0.8 fraction EMC
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
6
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12
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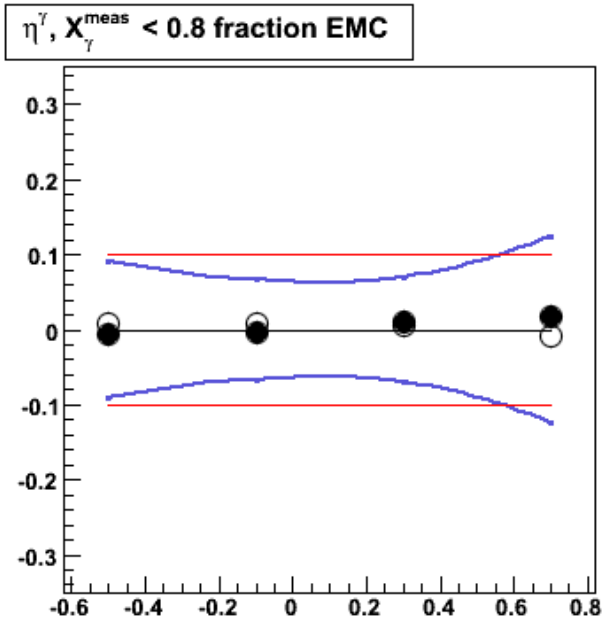
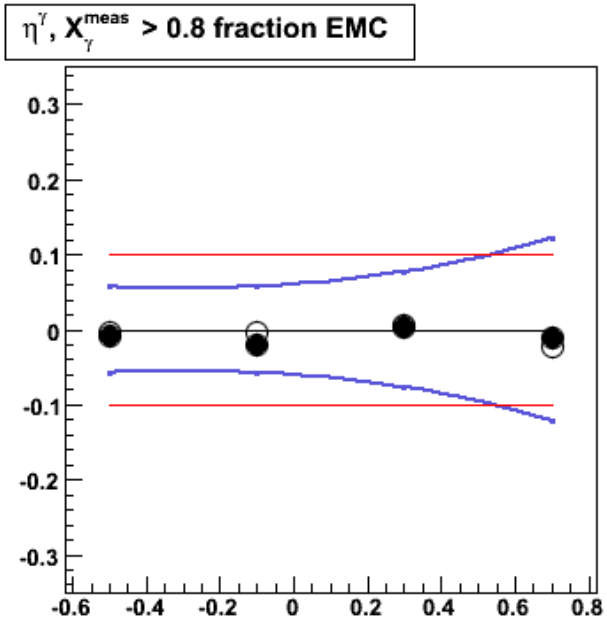
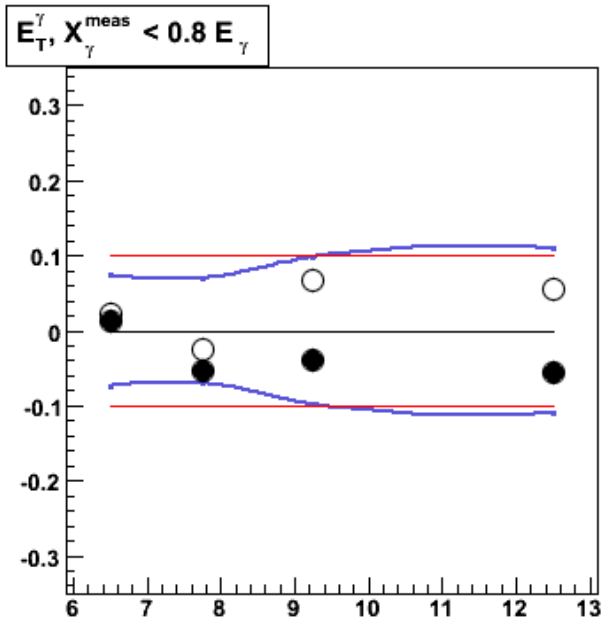
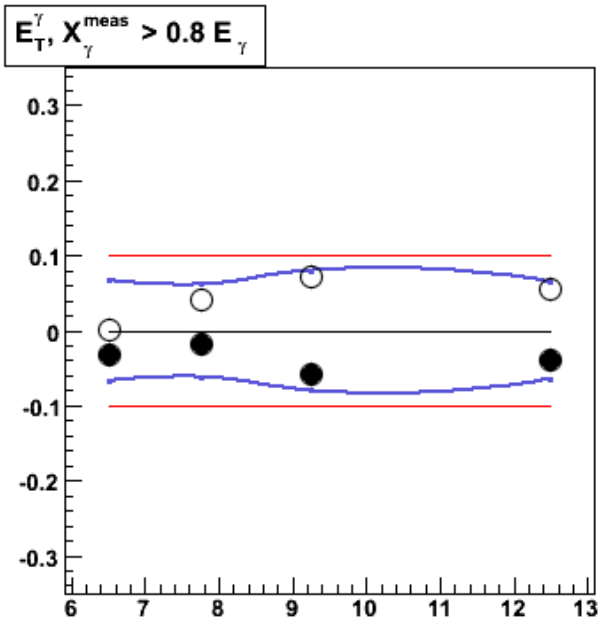
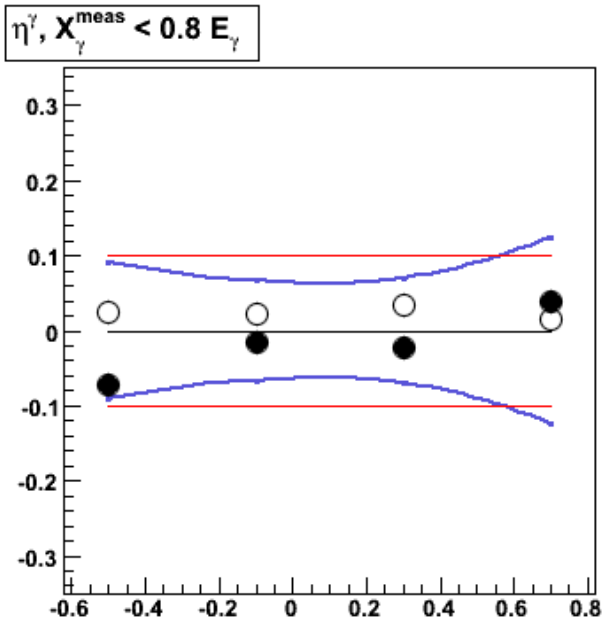
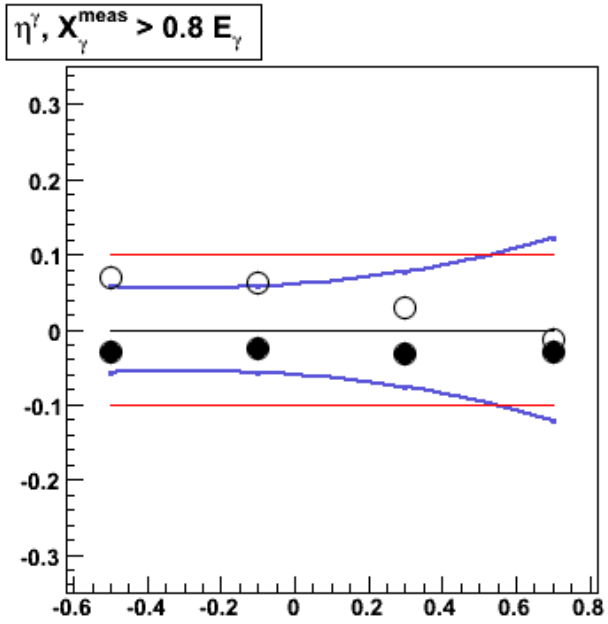

η^γ, X_γ^{meas} < 0.8 fraction EMC
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8

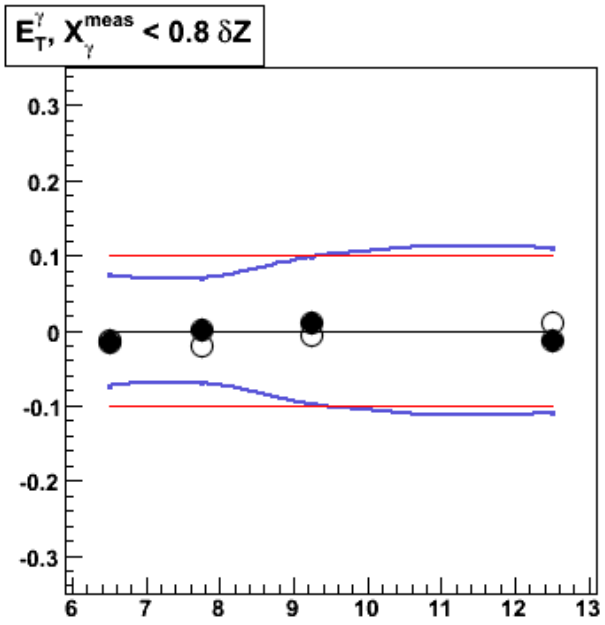

η^γ, X_γ^{meas} > 0.8 fraction EMC
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8


E_T^γ, X_γ^{meas} < 0.8 E_γ
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
6
7
8
9
10
11
12
13


E_T^γ, X_γ^{meas} > 0.8 E_γ
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
6
7
8
9
10
11
12
13


η^γ, X_γ^{meas} < 0.8 E_γ
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8


η^γ, X_γ^{meas} > 0.8 E_γ
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8


E_T^γ, X_γ^{meas} < 0.8 δZ
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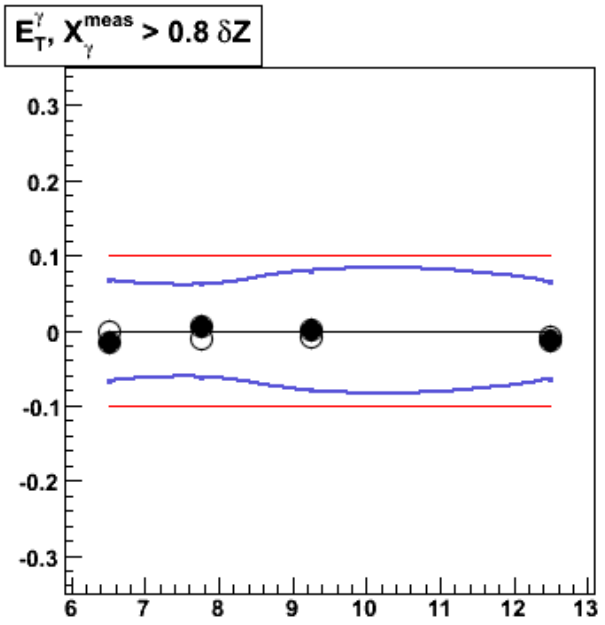
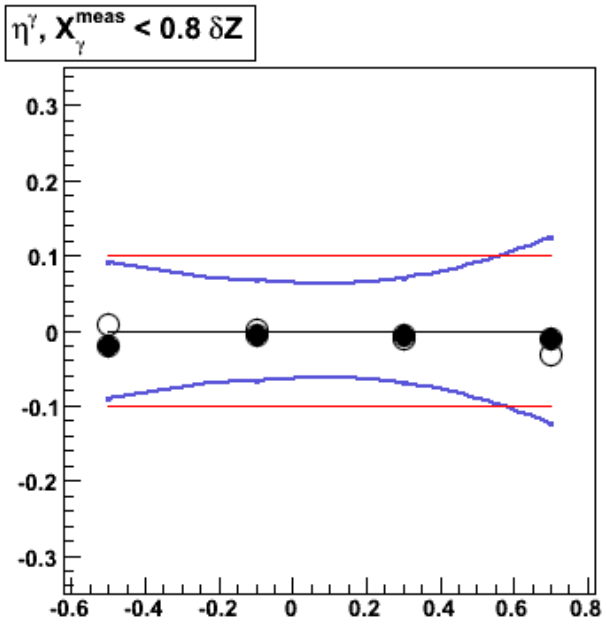
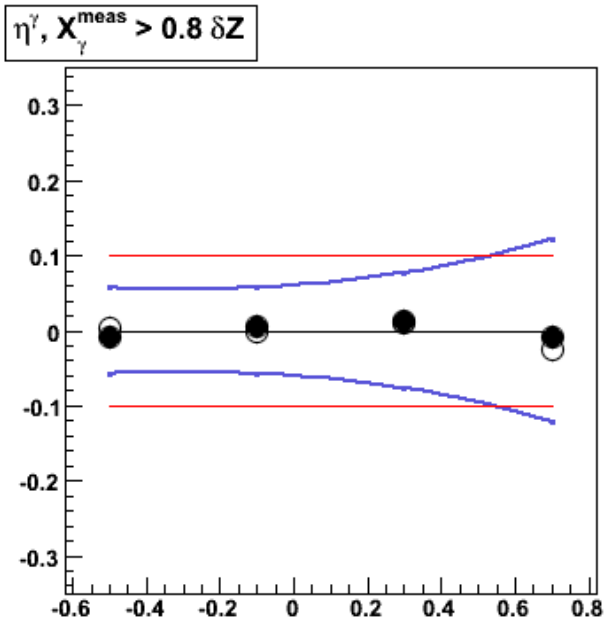
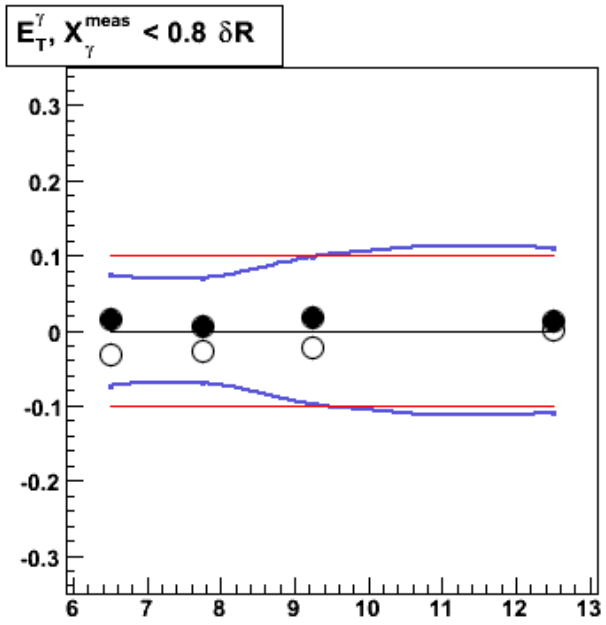
0.2
0.1
0
-0.1
-0.2
-0.3
6
7
8
9
10
11
12
13


E_T^γ, X_γ^{meas} > 0.8 δZ
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
6
7
8
9
10
11
12
13


η^γ, X_γ^{meas} < 0.8 δZ
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8


η^γ, X_γ^{meas} > 0.8 δZ
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8


E_T^γ, X_γ^{meas} < 0.8 δR
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0.2
0.1
0
-0.1
-0.2
-0.3
6
7
8
9
10
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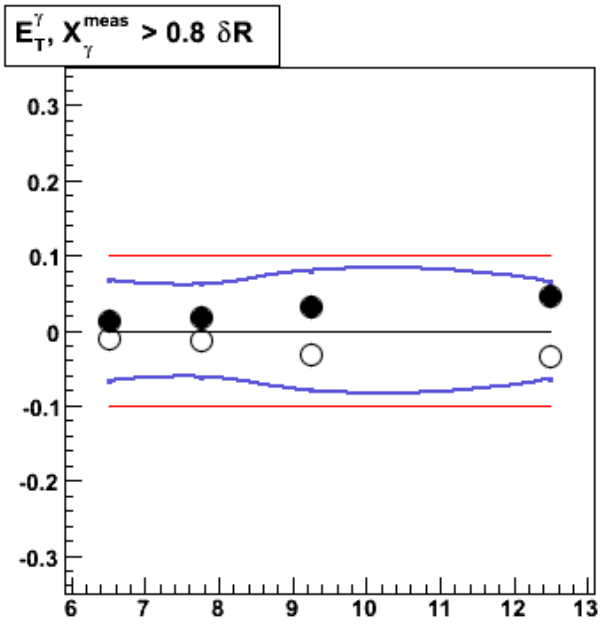
12
13


E_T^γ, X_γ^{meas} > 0.8 δR
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0.2
0.1
0
-0.1
-0.2
-0.3
6
7
8
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10
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12
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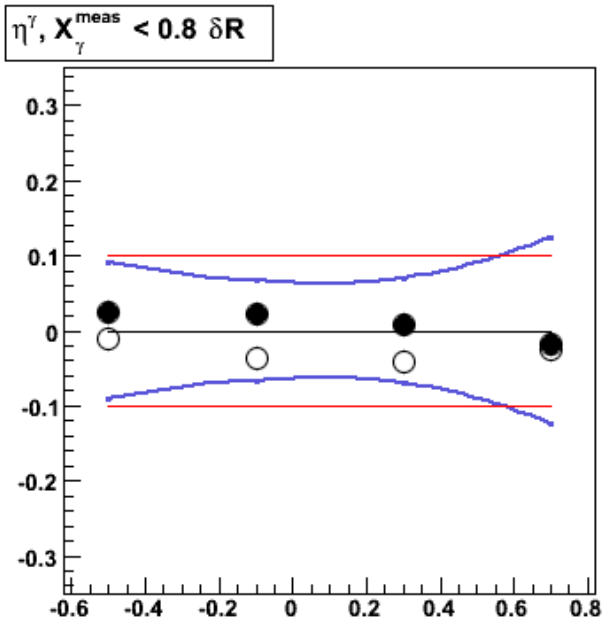
η^γ, X_γ^{meas} < 0.8 δR
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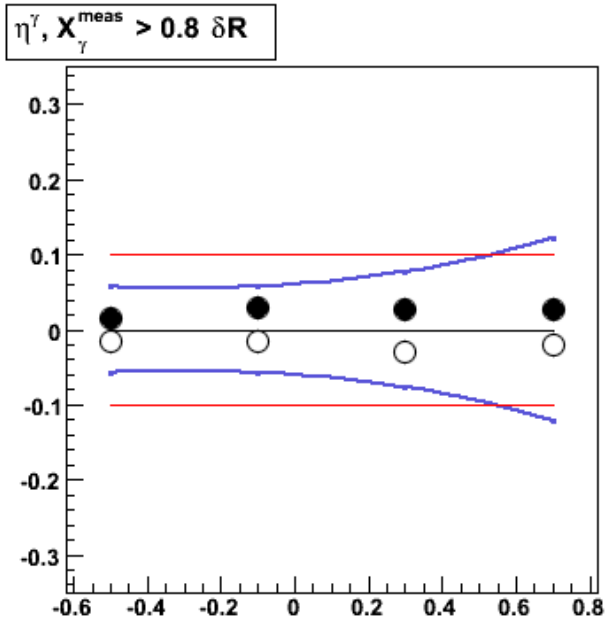
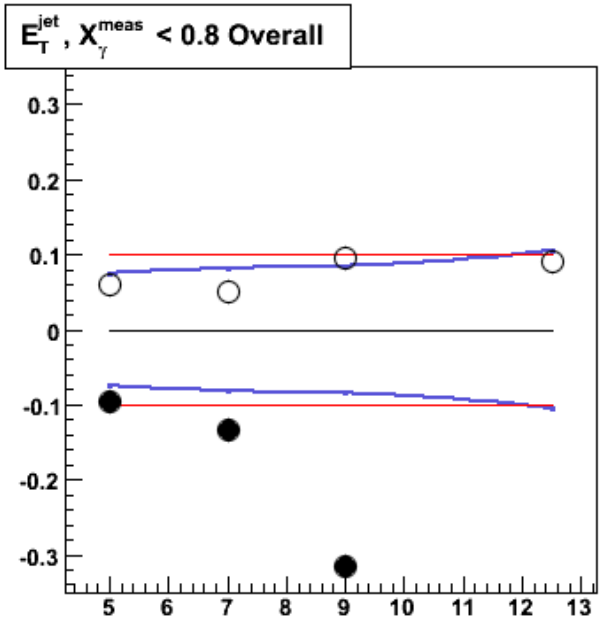
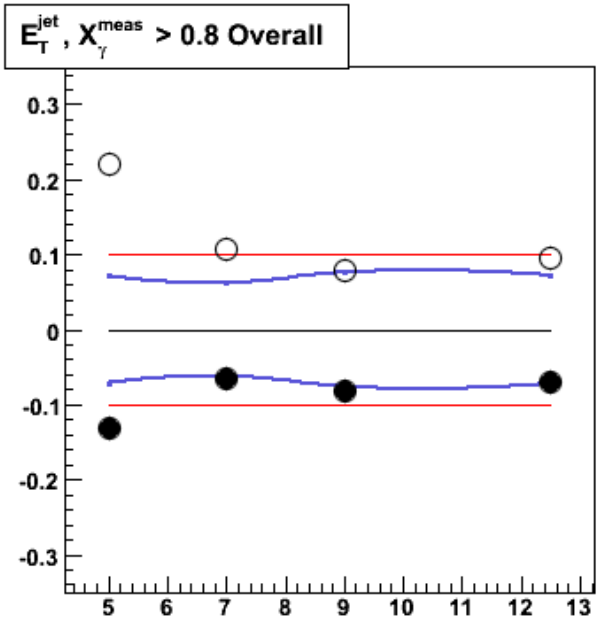
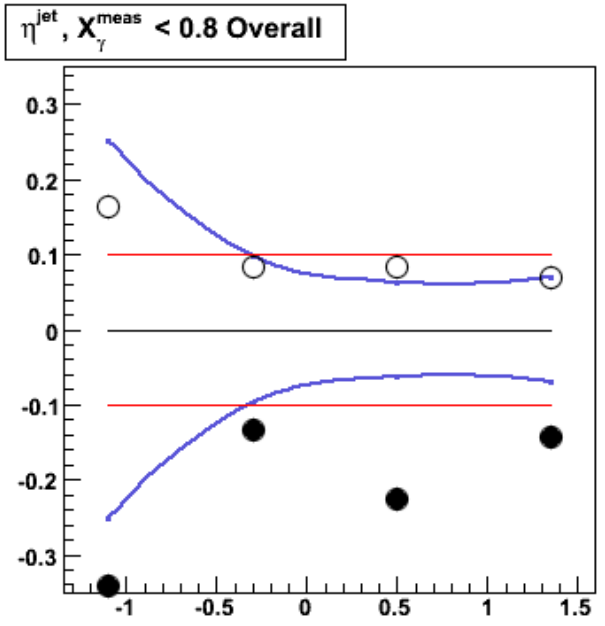
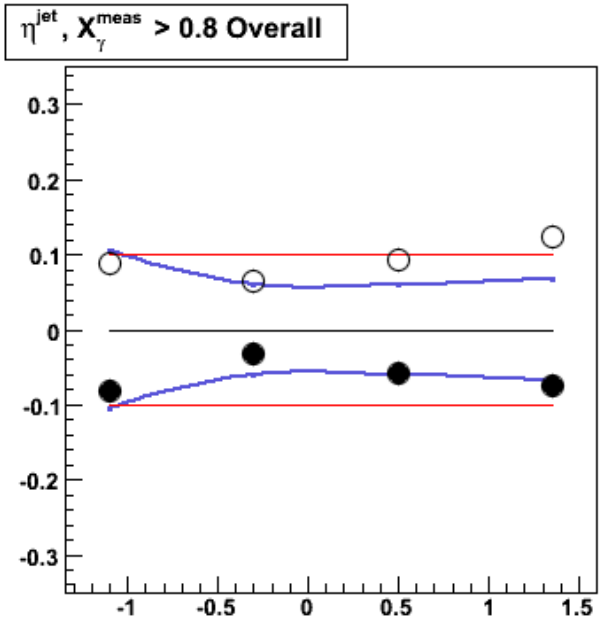
0.2
0.1
0
-0.1
-0.2
-0.3
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8

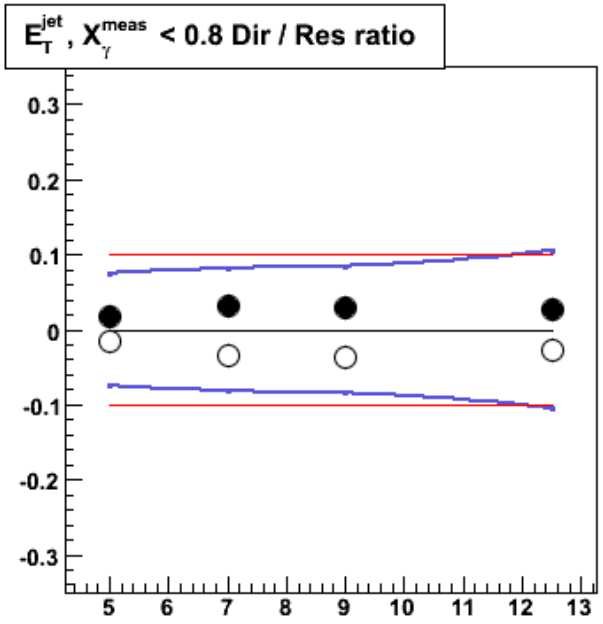

η^γ, X_γ^{meas} > 0.8 δR
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8

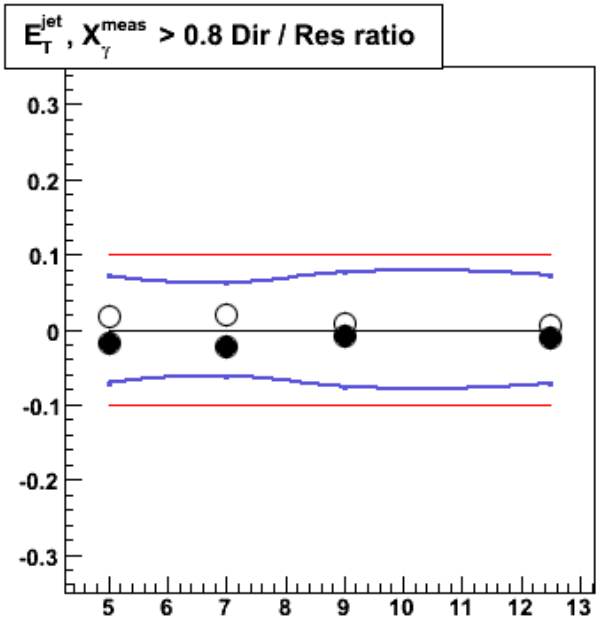

E_T^{jet}, X_γ^{meas} < 0.8 Overall
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
5 6 7 8 9 10 11 12 13

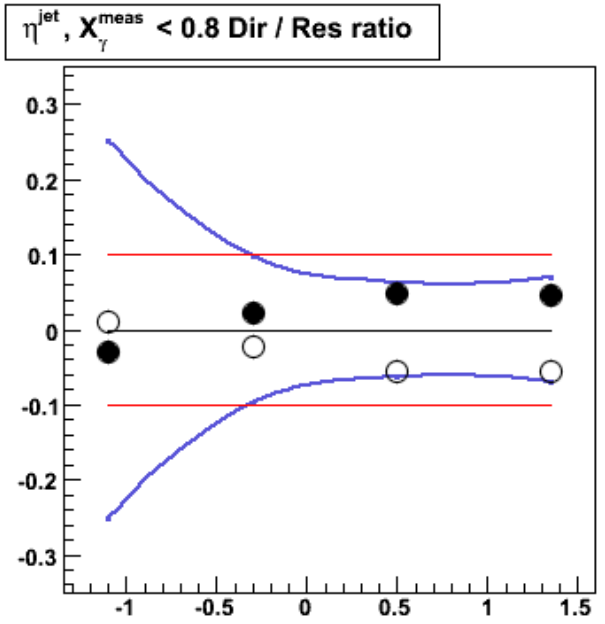

E_T^{jet}, X_γ^{meas} > 0.8 Overall
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
5 6 7 8 9 10 11 12 13

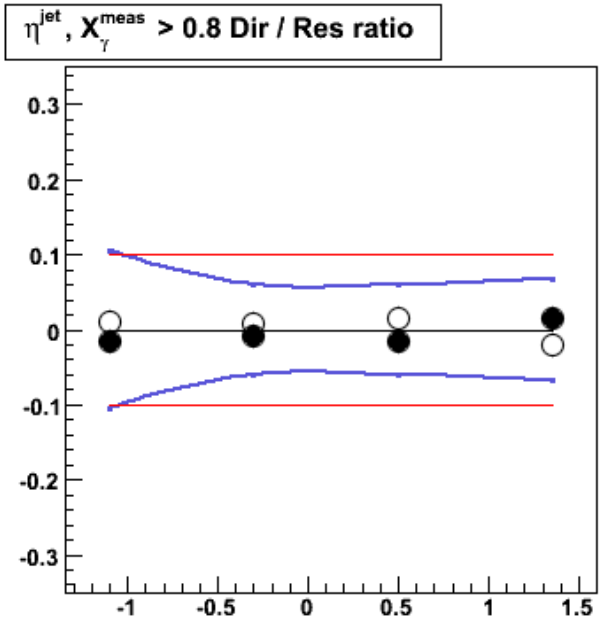

η^{jet}, X_γ^{meas} < 0.8 Overall
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-1 -0.5 0 0.5 1 1.5


η^{jet}, X_γ^{meas} > 0.8 Overall
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-1 -0.5 0 0.5 1 1.5


E_T^{jet}, X_γ^{meas} < 0.8 Dir / Res ratio
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
5 6 7 8 9 10 11 12 13


E_T^{jet}, X_γ^{meas} > 0.8 Dir / Res ratio
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
5 6 7 8 9 10 11 12 13


η^{jet}, X_γ^{meas} < 0.8 Dir / Res ratio
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-1 -0.5 0 0.5 1 1.5


η^{jet}, X_γ^{meas} > 0.8 Dir / Res ratio
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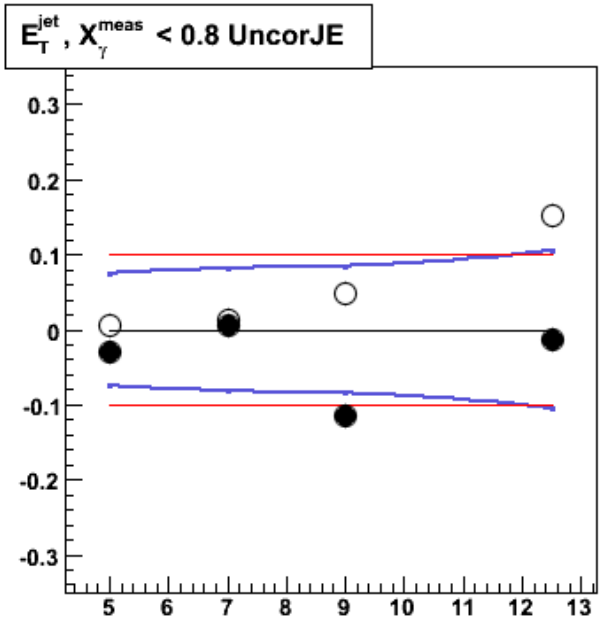
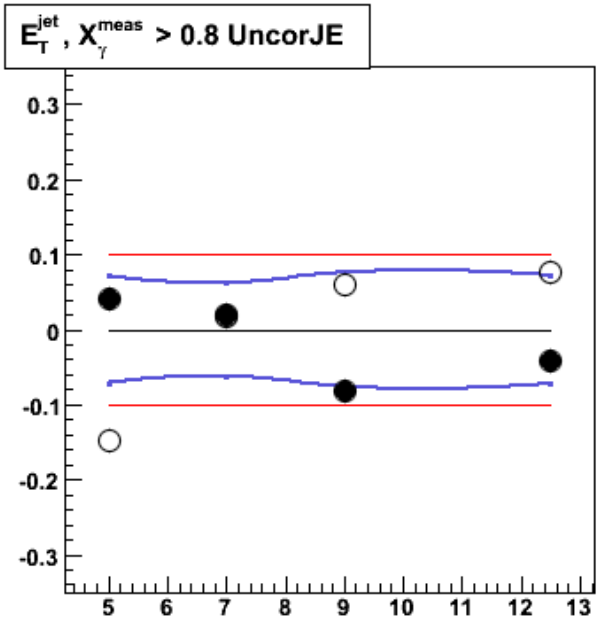
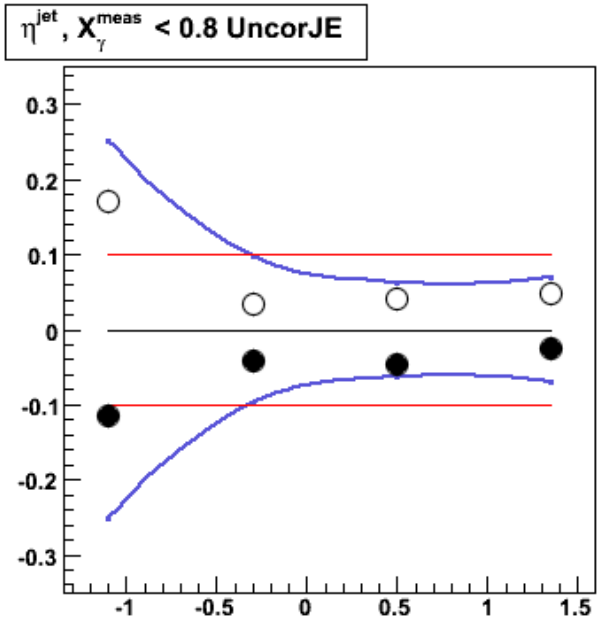
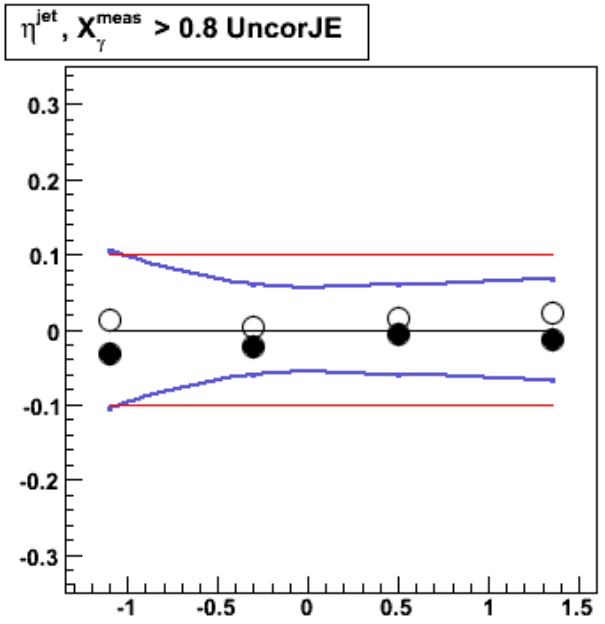
0.2
0.1
0
-0.1
-0.2
-0.3
-1 -0.5 0 0.5 1 1.5


E_T^{jet}, X_γ^{meas} < 0.8 UncorJE
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
5 6 7 8 9 10 11 12 13


E_T^{jet}, X_γ^{meas} > 0.8 UncorJE
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
5 6 7 8 9 10 11 12 13


η^{jet}, X_γ^{meas} < 0.8 UncorJE
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-1 -0.5 0 0.5 1 1.5


η^{jet}, X_γ^{meas} > 0.8 UncorJE
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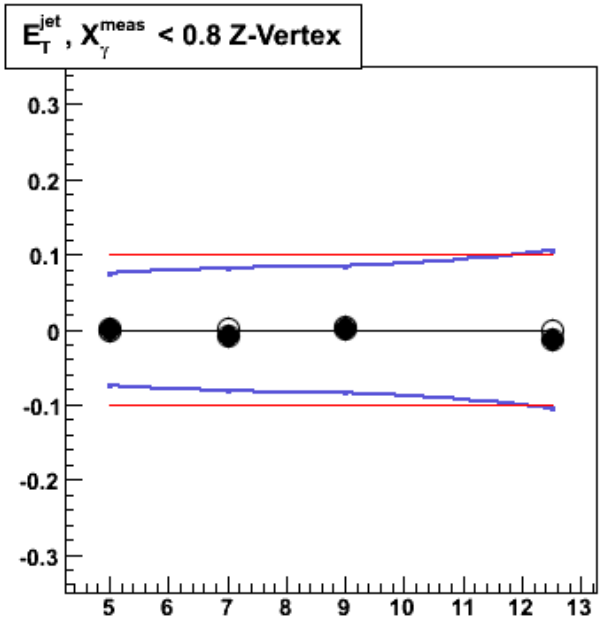
0.2
0.1
0
-0.1
-0.2
-0.3
-1 -0.5 0 0.5 1 1.5


E_T^{jet}, X_γ^{meas} < 0.8 Z-Vertex
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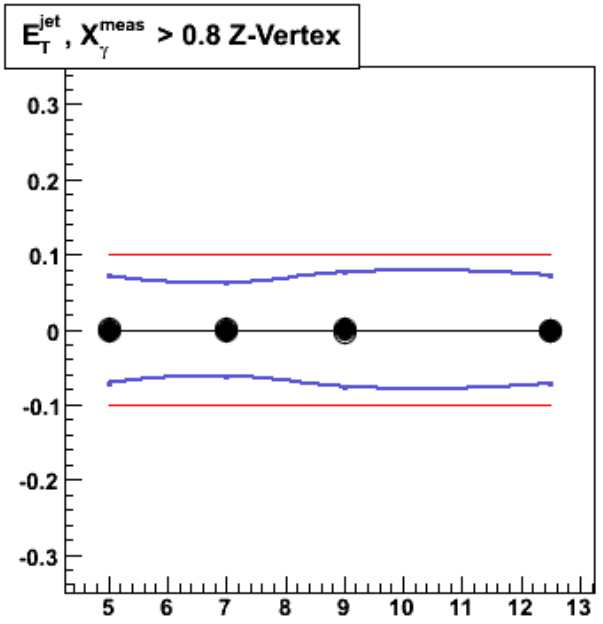
0.2
0.1
0
-0.1
-0.2
-0.3
5 6 7 8 9 10 11 12 13


E_T^{jet}, X_γ^{meas} > 0.8 Z-Vertex
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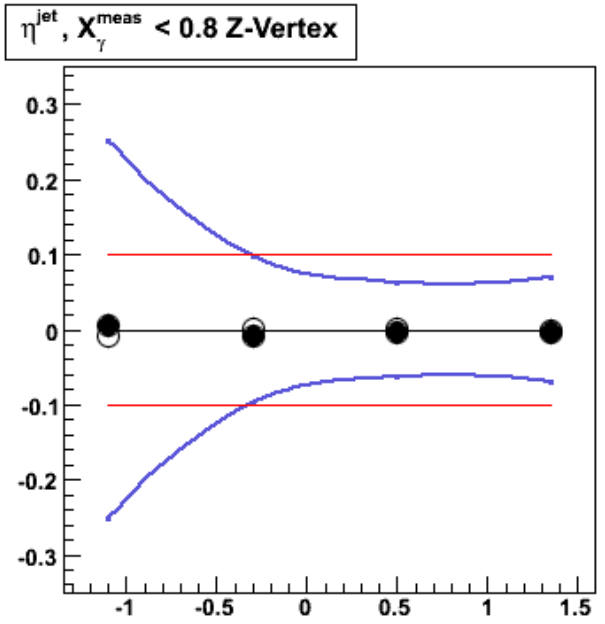
0.2
0.1
0
-0.1
-0.2
-0.3
5 6 7 8 9 10 11 12 13


η^{jet}, X_γ^{meas} < 0.8 Z-Vertex
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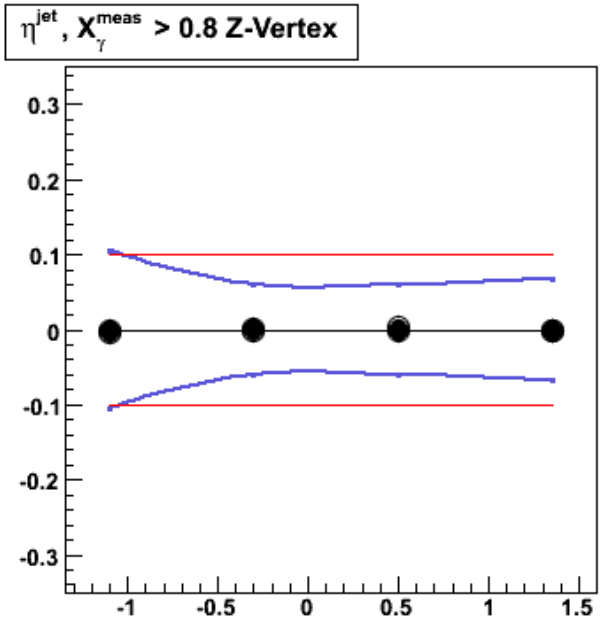
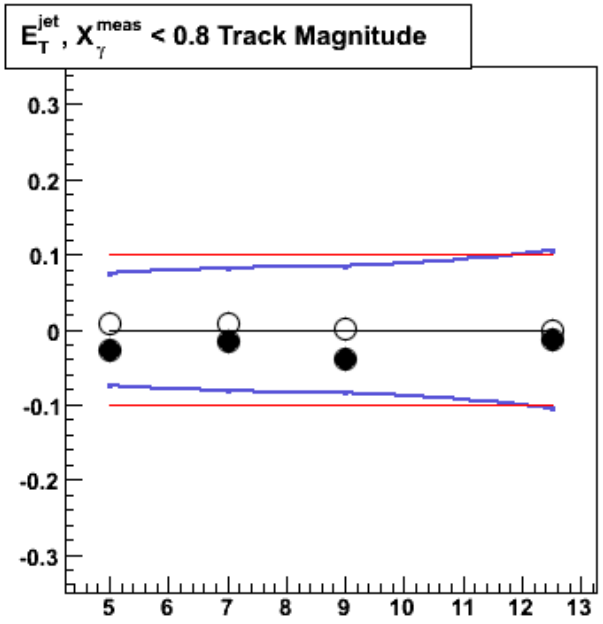
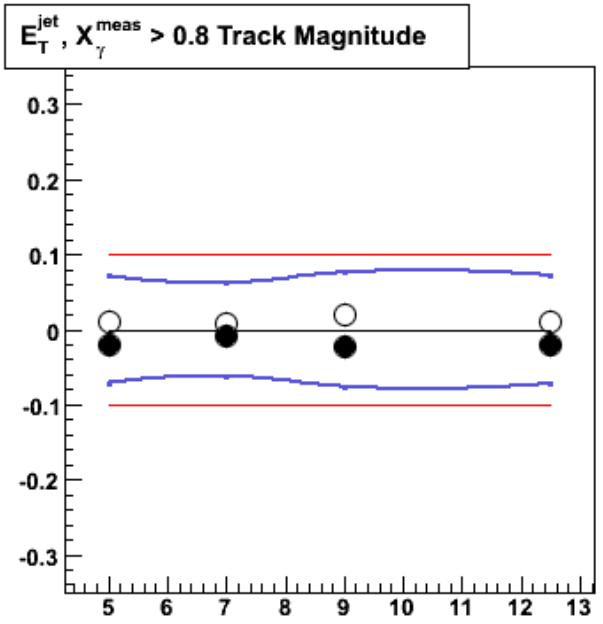
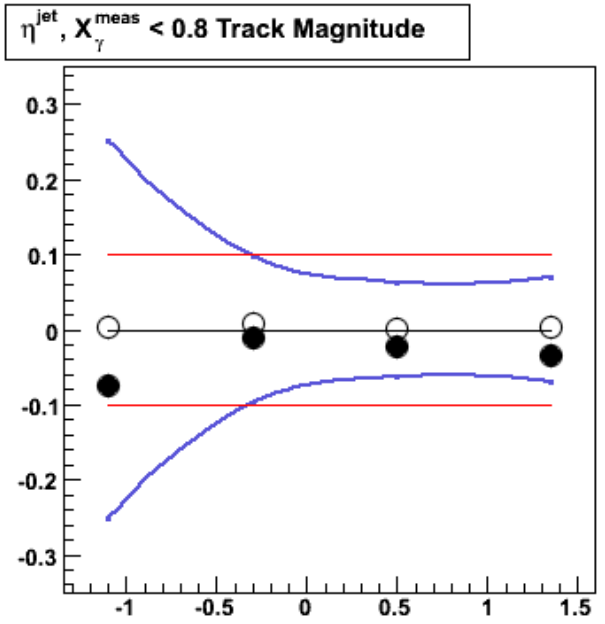
0.2
0.1
0
-0.1
-0.2
-0.3
-1 -0.5 0 0.5 1 1.5


η^{jet}, X_γ^{meas} > 0.8 Z-Vertex
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-1 -0.5 0 0.5 1 1.5


E_T^{jet}, X_γ^{meas} < 0.8 Track Magnitude
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
5 6 7 8 9 10 11 12 13


E_T^{jet}, X_γ^{meas} > 0.8 Track Magnitude
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
5 6 7 8 9 10 11 12 13


η^{jet}, X_γ^{meas} < 0.8 Track Magnitude
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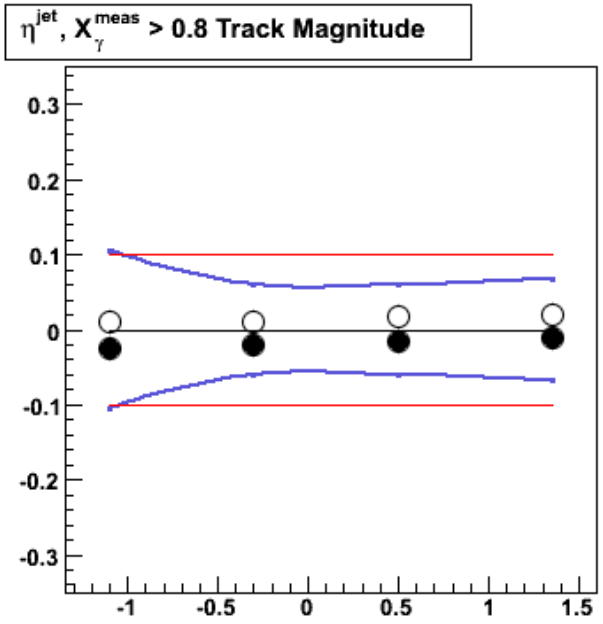
0.2
0.1
0
-0.1
-0.2
-0.3
-1 -0.5 0 0.5 1 1.5


η^{jet}, X_γ^{meas} > 0.8 Track Magnitude
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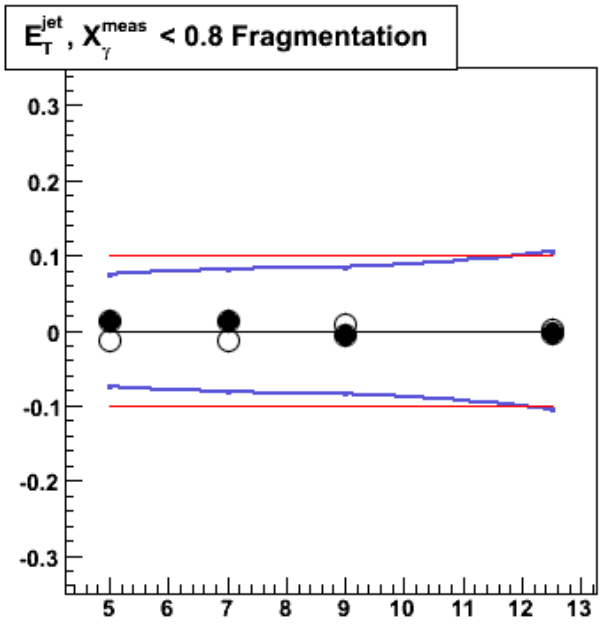
0.2
0.1
0
-0.1
-0.2
-0.3
-1 -0.5 0 0.5 1 1.5


E_T^{jet}, X_γ^{meas} < 0.8 Fragmentation
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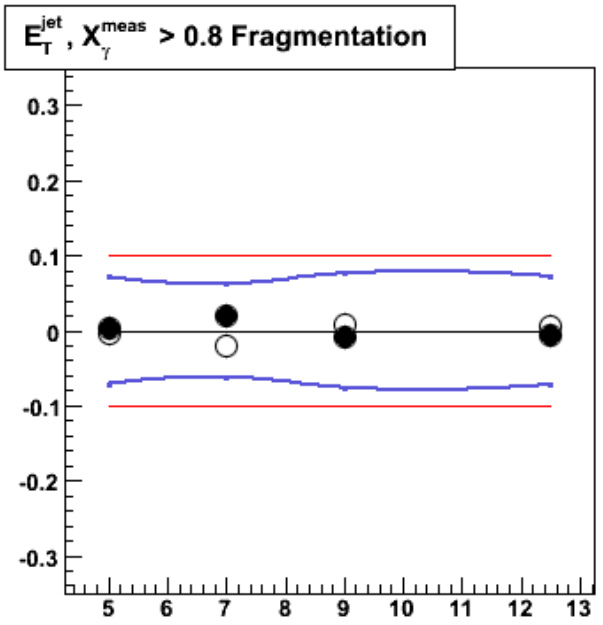
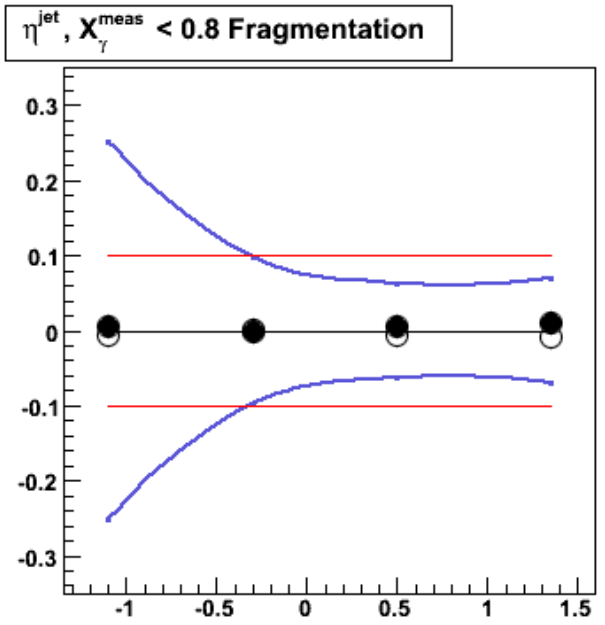
0.2
0.1
0
-0.1
-0.2
-0.3
5 6 7 8 9 10 11 12 13


E_T^{jet}, X_γ^{meas} > 0.8 Fragmentation
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
5 6 7 8 9 10 11 12 13


η^{jet}, X_γ^{meas} < 0.8 Fragmentation
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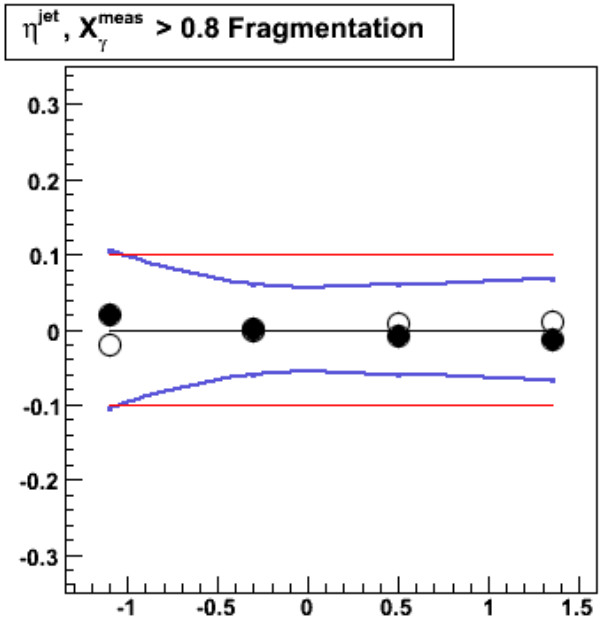
0.2
0.1
0
-0.1
-0.2
-0.3
-1 -0.5 0 0.5 1 1.5


η^{jet}, X_γ^{meas} > 0.8 Fragmentation
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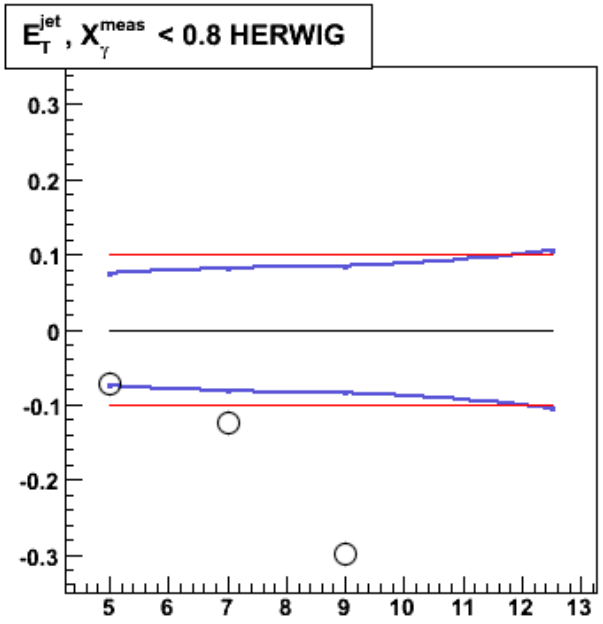
0.2
0.1
0
-0.1
-0.2
-0.3
-1 -0.5 0 0.5 1 1.5


E_T^{jet}, X_γ^{meas} < 0.8 HERWIG
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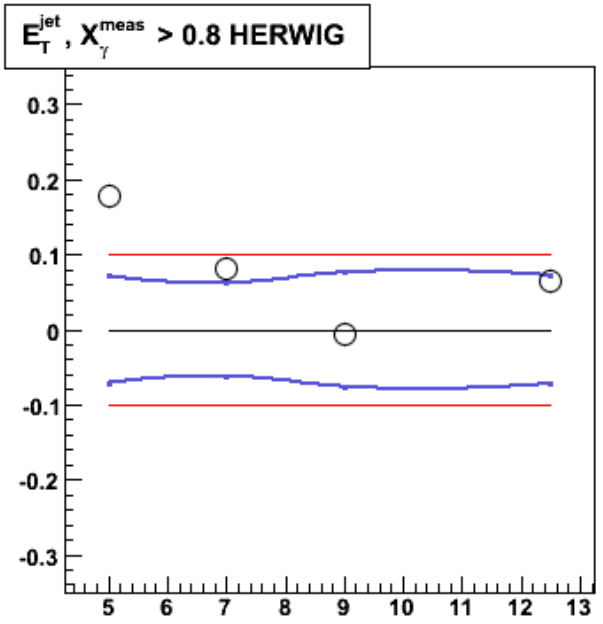
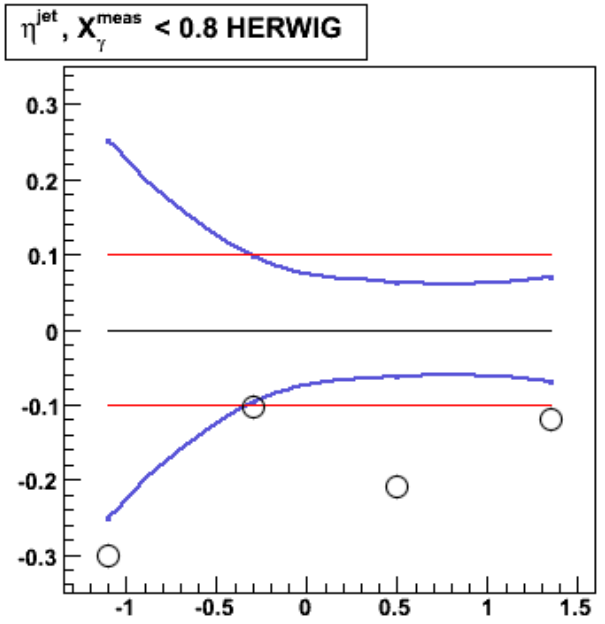
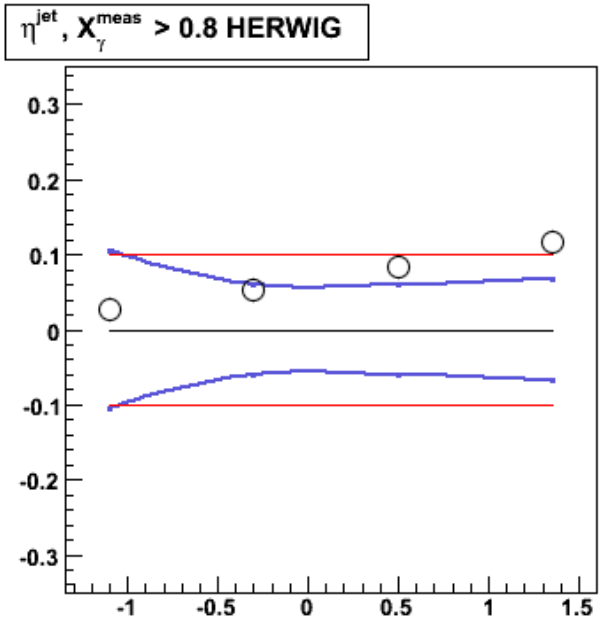
0.2
0.1
0
-0.1
-0.2
-0.3
5 6 7 8 9 10 11 12 13


E_T^{jet}, X_γ^{meas} > 0.8 HERWIG
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
5 6 7 8 9 10 11 12 13


η^{jet}, X_γ^{meas} < 0.8 HERWIG
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-1 -0.5 0 0.5 1 1.5


η^{jet}, X_γ^{meas} > 0.8 HERWIG
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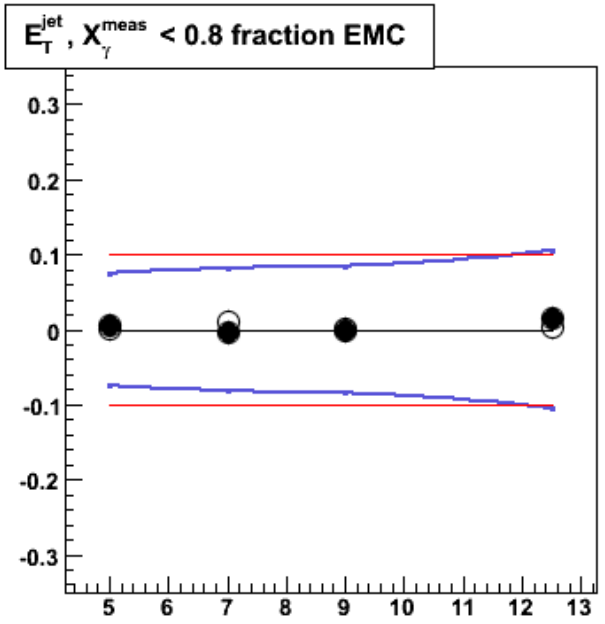
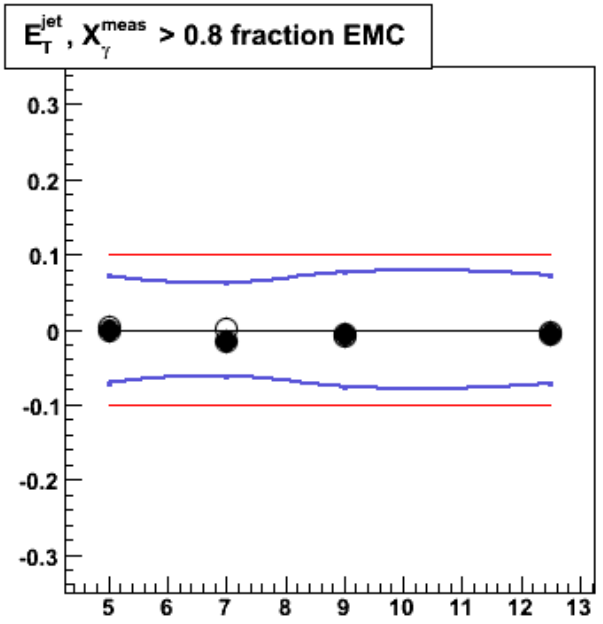
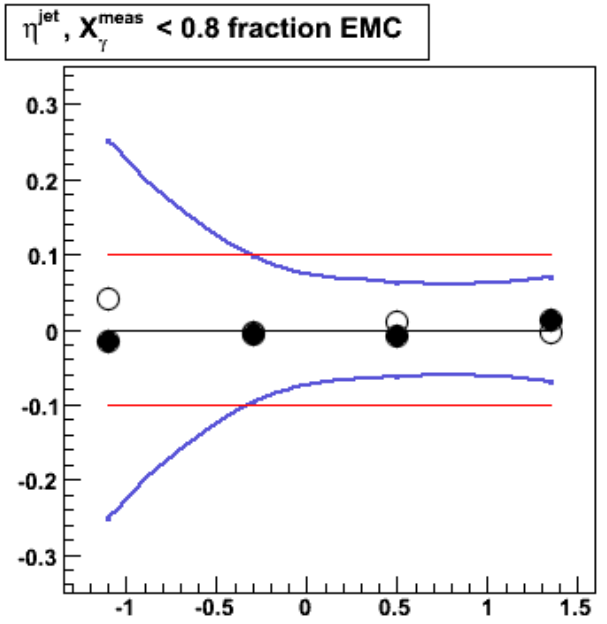
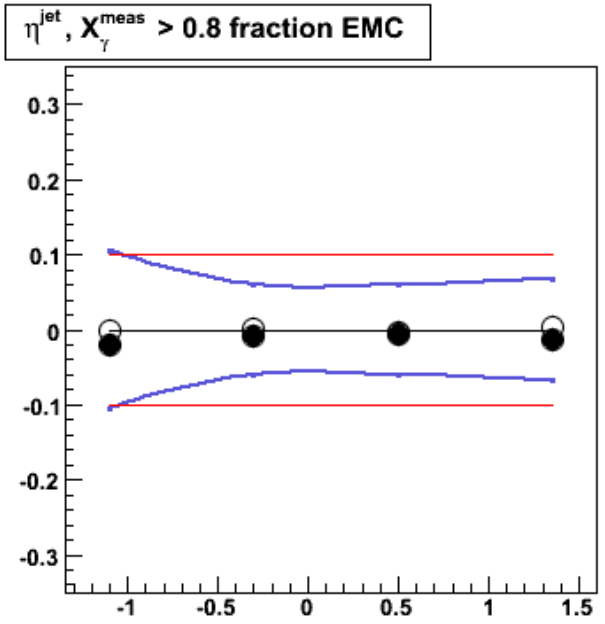
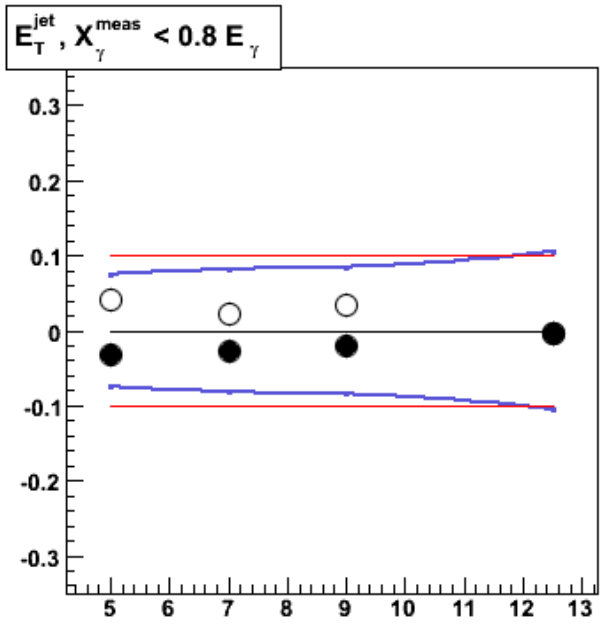
0.2
0.1
0
-0.1
-0.2
-0.3
-1 -0.5 0 0.5 1 1.5

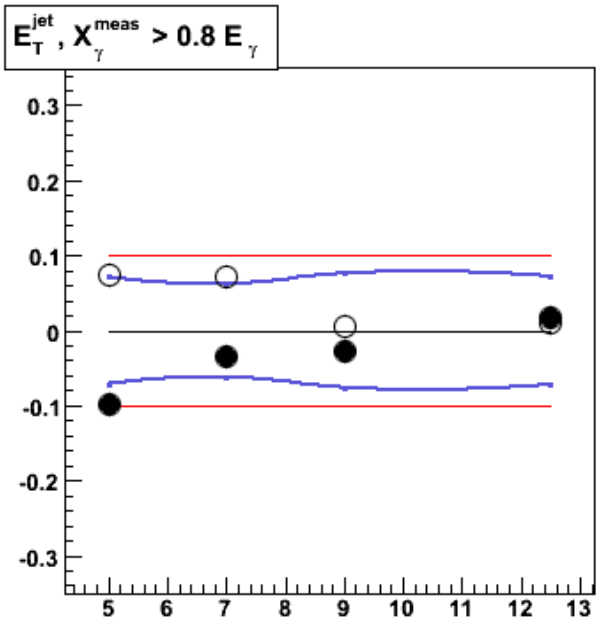

E_T^{jet}, X_γ^{meas} < 0.8 fraction EMC
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
5 6 7 8 9 10 11 12 13

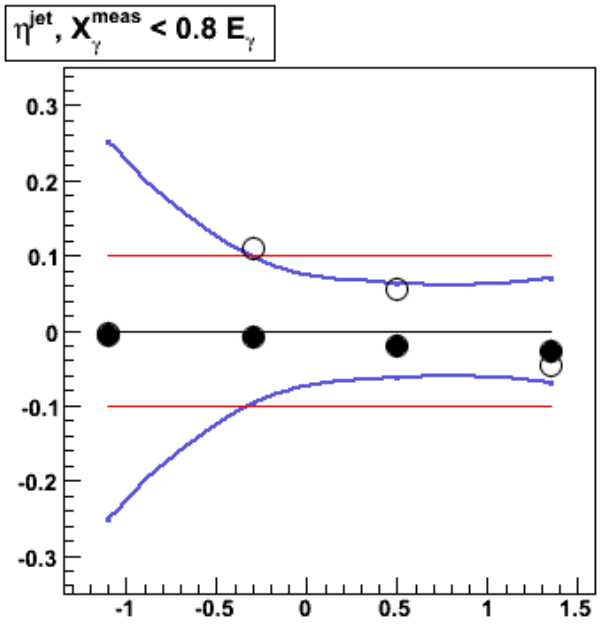

E_T^{jet}, X_γ^{meas} > 0.8 fraction EMC
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
5 6 7 8 9 10 11 12 13

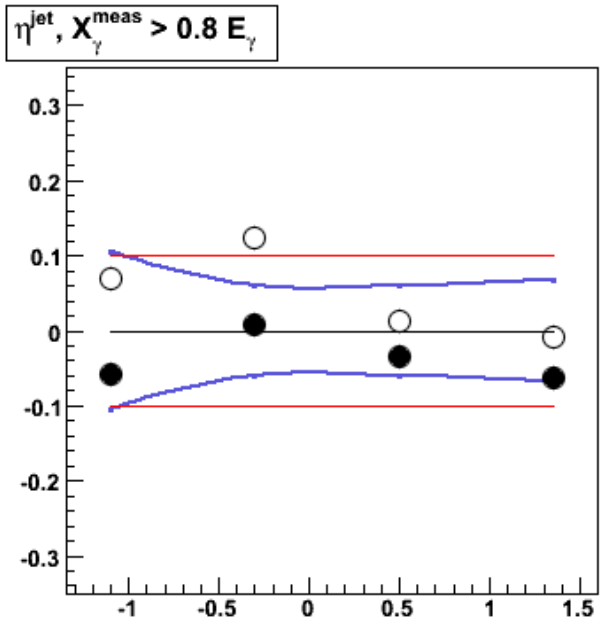

η^{jet}, X_γ^{meas} < 0.8 fraction EMC
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-1 -0.5 0 0.5 1 1.5

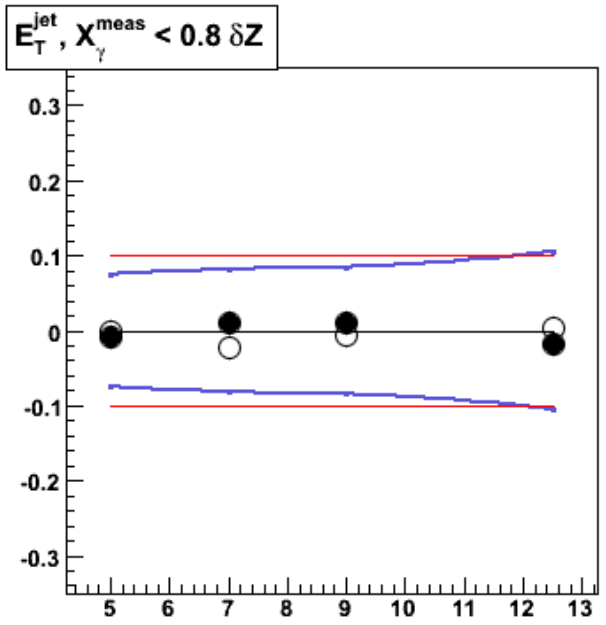

η^{jet}, X_γ^{meas} > 0.8 fraction EMC
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-1 -0.5 0 0.5 1 1.5

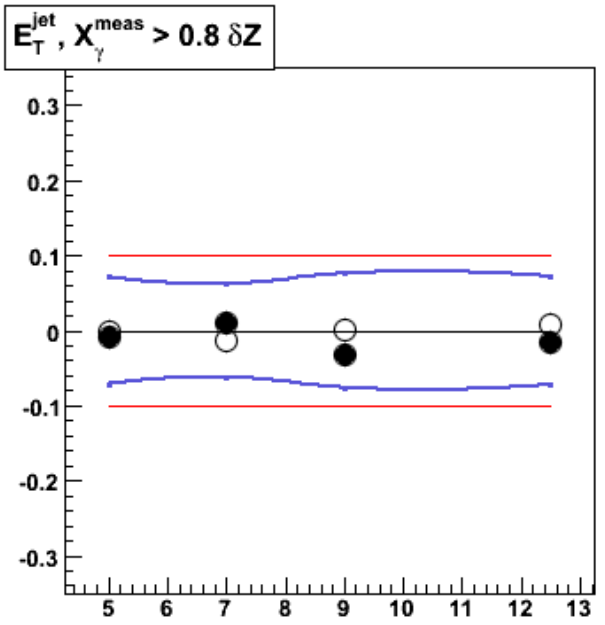

E_T^{jet}, X_γ^{meas} < 0.8 E_γ
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
5 6 7 8 9 10 11 12 13

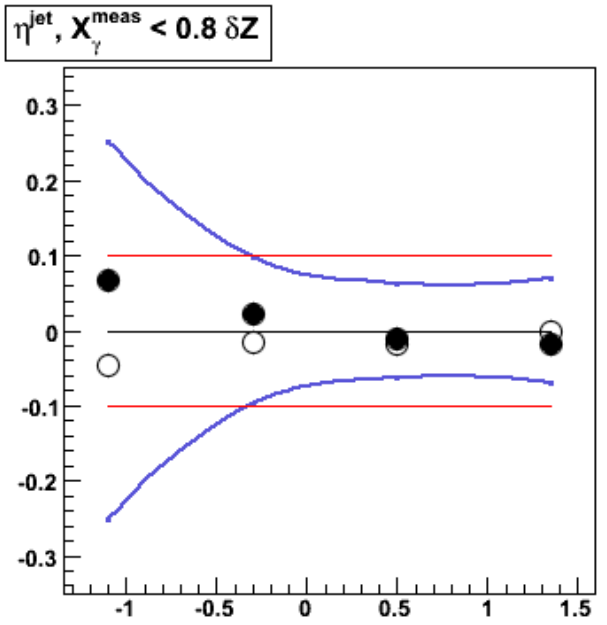

E_T^{jet}, X_γ^{meas} > 0.8 E_γ
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
5 6 7 8 9 10 11 12 13

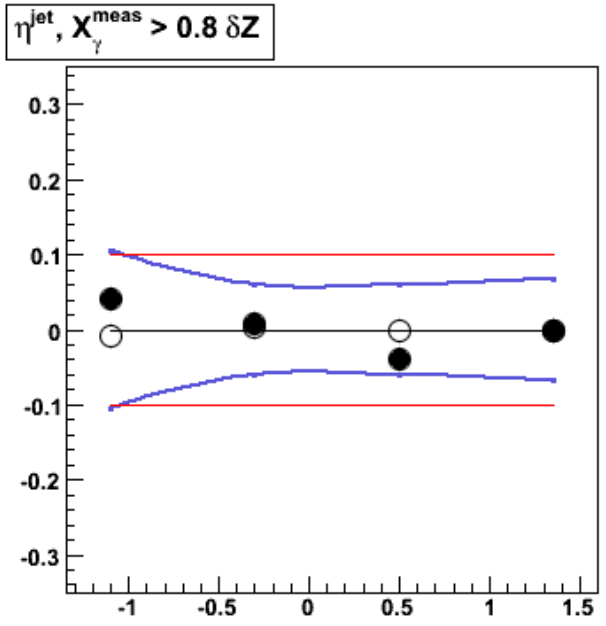

η^{jet}, X_γ^{meas} < 0.8 E_γ
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-1 -0.5 0 0.5 1 1.5

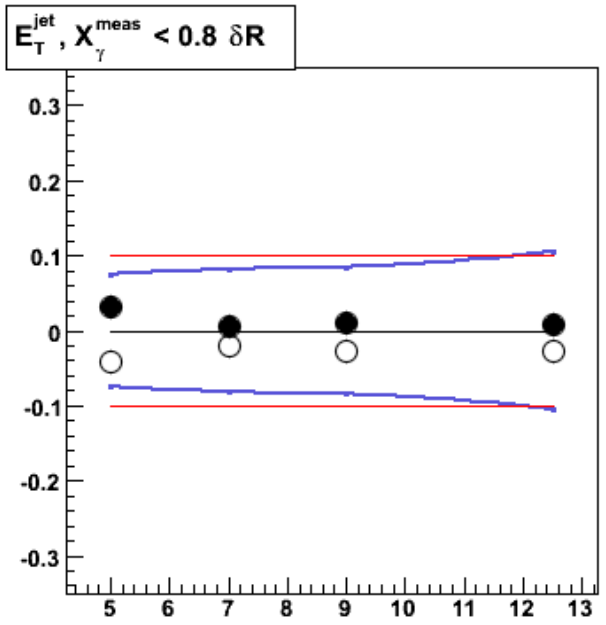

η^{jet}, X_γ^{meas} > 0.8 E_γ
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-1 -0.5 0 0.5 1 1.5


E_T^{jet}, X_γ^{meas} < 0.8 δZ
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
5 6 7 8 9 10 11 12 13


E_T^{jet}, X_γ^{meas} > 0.8 δZ
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
5 6 7 8 9 10 11 12 13


η^{jet}, X_γ^{meas} < 0.8 δZ
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-1 -0.5 0 0.5 1 1.5


η^{jet}, X_γ^{meas} > 0.8 δZ
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-1 -0.5 0 0.5 1 1.5


E_T^{jet}, X_γ^{meas} < 0.8 δR
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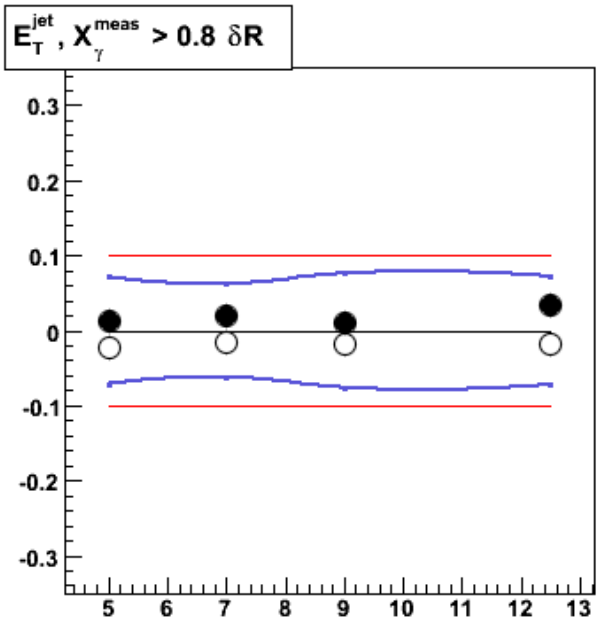
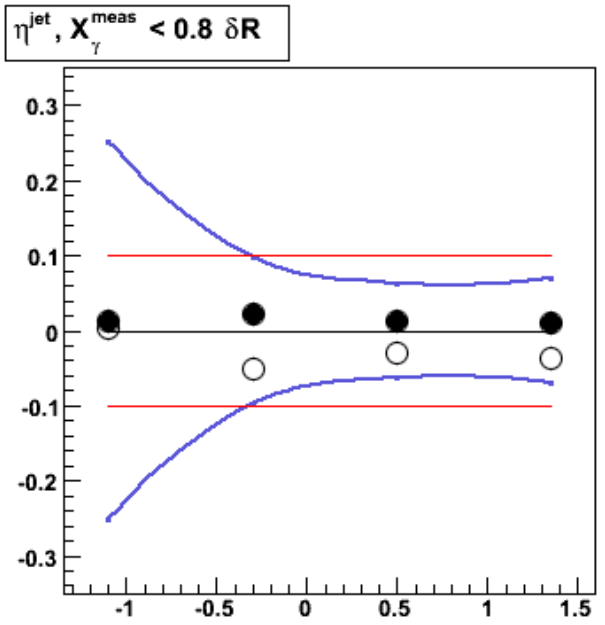
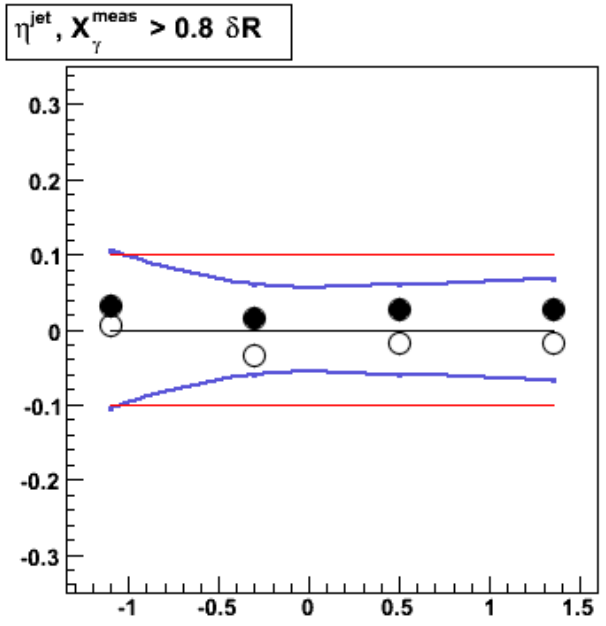
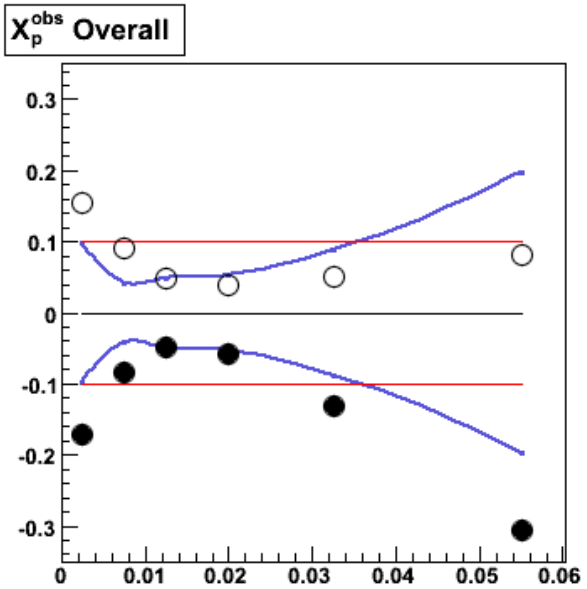
0.2
0.1
0
-0.1
-0.2
-0.3
5 6 7 8 9 10 11 12 13

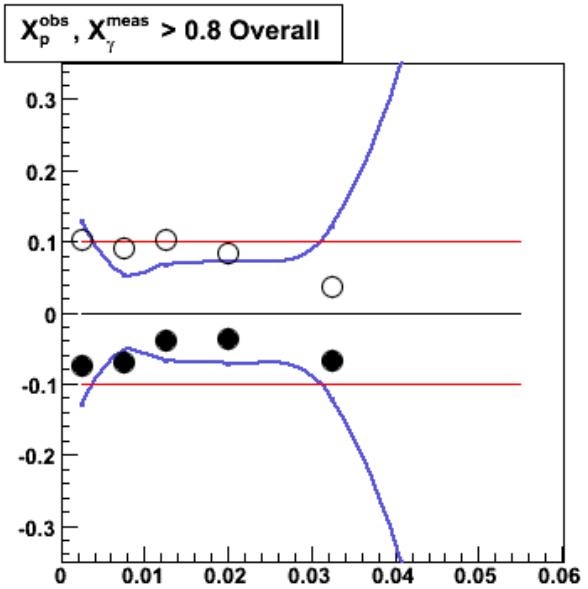

E_T^{jet}, X_γ^{meas} > 0.8 δR
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
5 6 7 8 9 10 11 12 13

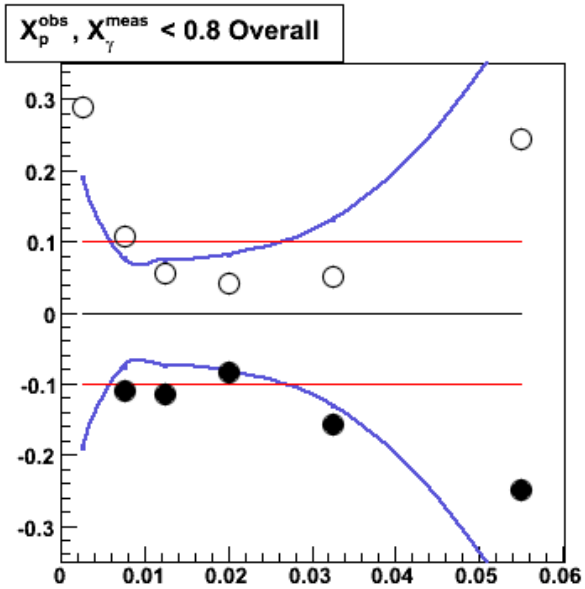

η^{jet}, X_γ^{meas} < 0.8 δR
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-1 -0.5 0 0.5 1 1.5


η^{jet}, X_γ^{meas} > 0.8 δR
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-1 -0.5 0 0.5 1 1.5

Overall Systematic uncertainties







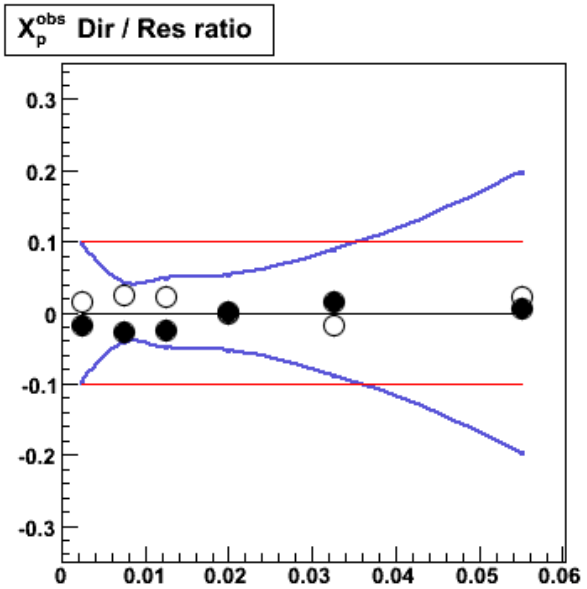
Rel.statistical uncertainties

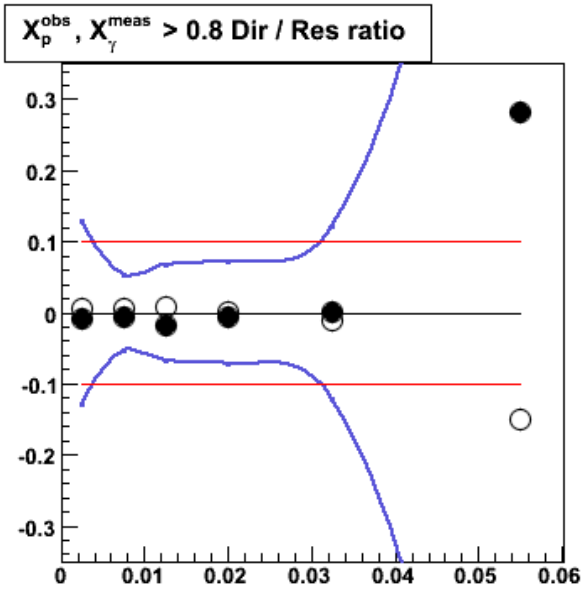
10% line

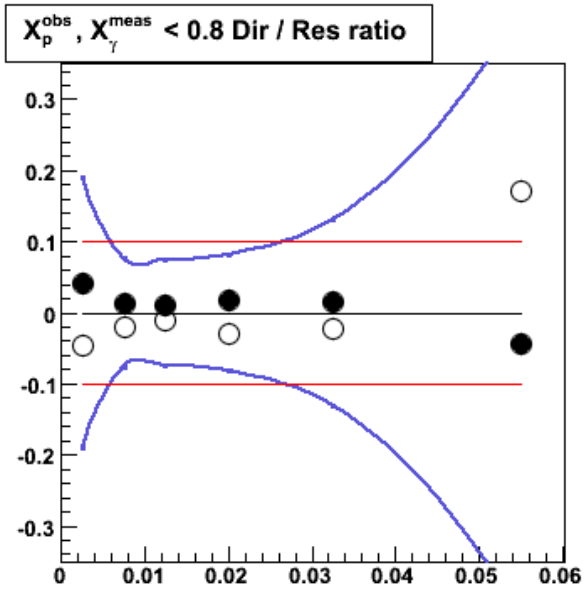
upper sum

lower sum

Systematic uncertainties: PYTHIA dir / res







Standard direct/ resolved ratio:
50% / 40%

Vary fraction of resolved by +-15%:

35% / 55%
65% / 25%

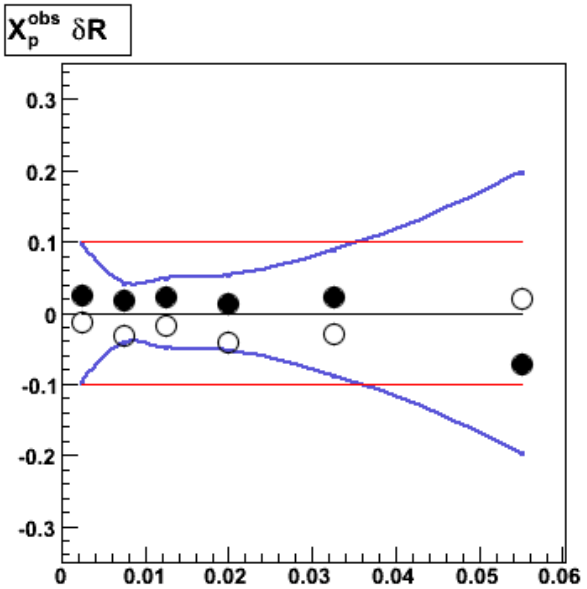
Rel.statistical uncertainties

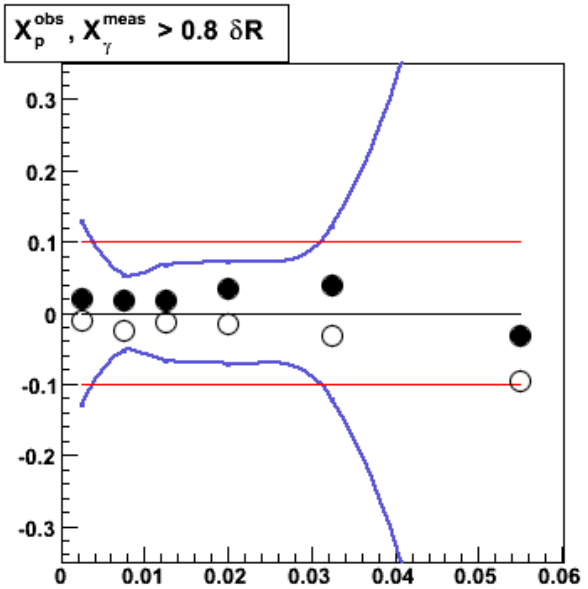
10% line

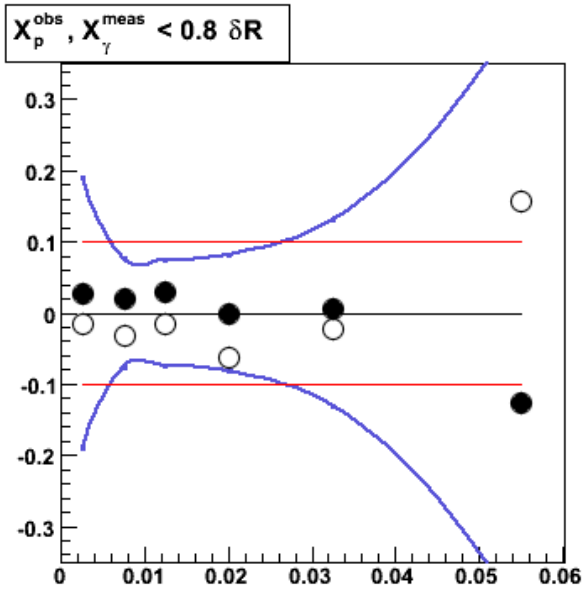
-15% resolved

+15% resolved

Systematic uncertainties: deltaR







Standard cut:

deltaR track isolation in cone 0.2

Vary cone radius by +-0.1

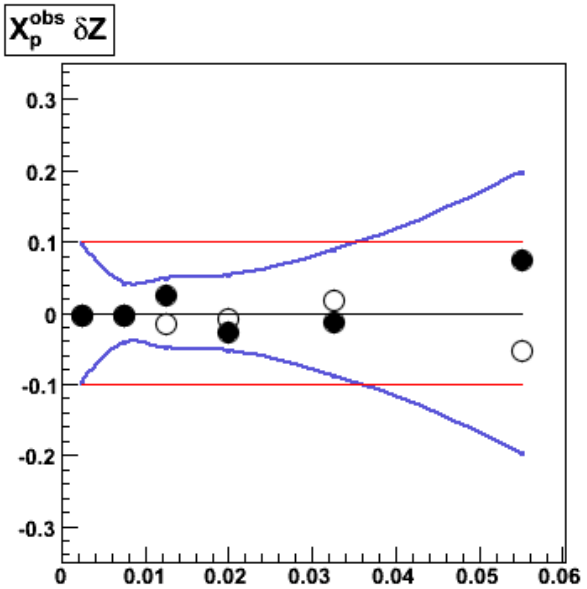
Rel.statistical uncertainties

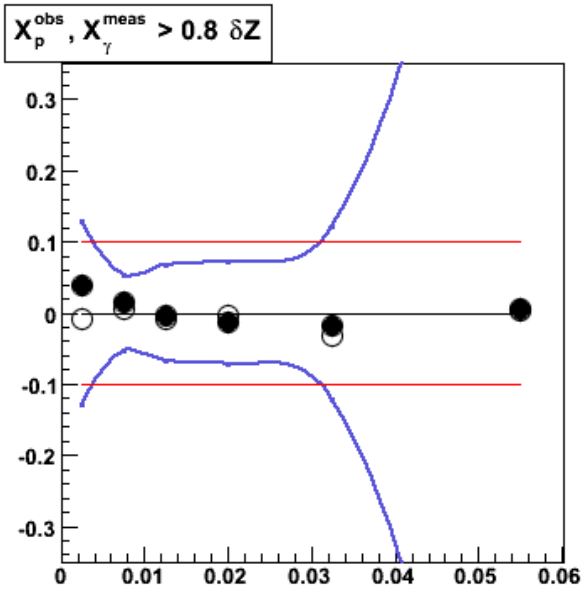
10% line

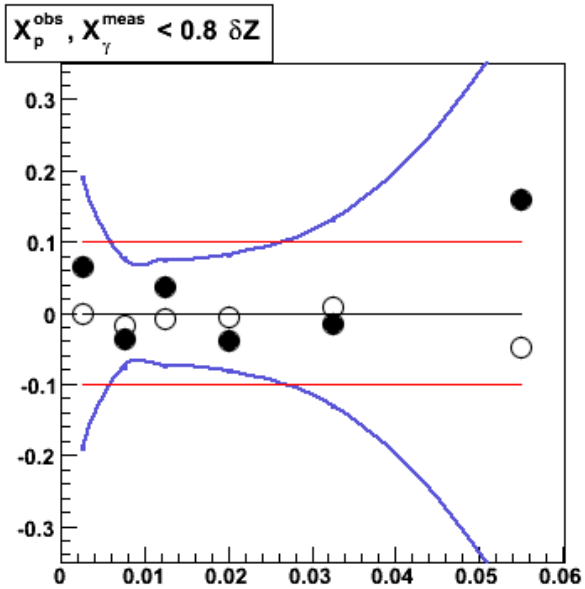
○ *δR 0.3*

● *δR 0.1*

Systematic uncertainties: deltaZ fit range







Standard range:

0.05 – 0.8

deltaZ upper limit variation between 0.6 and 1.0

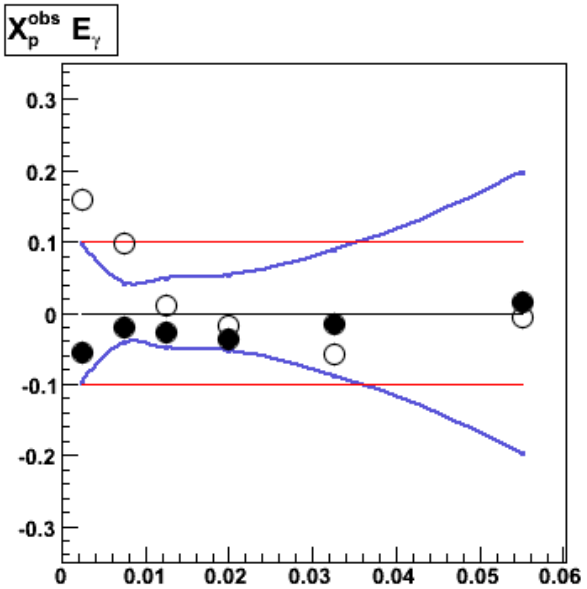
Rel.statistical uncertainties δZ

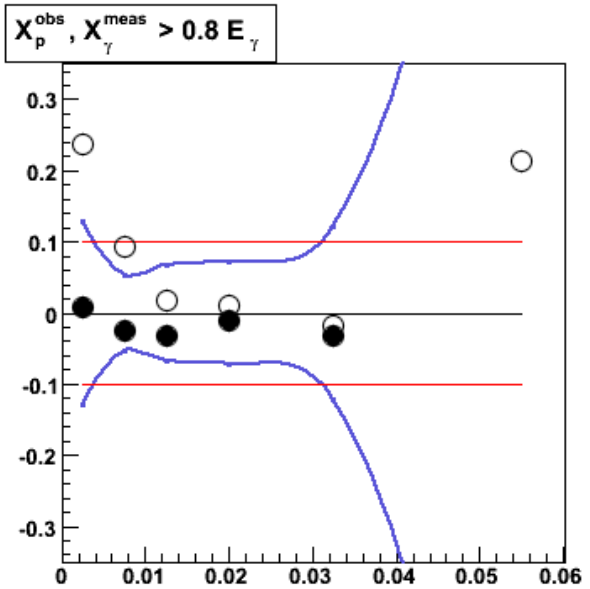
10% line

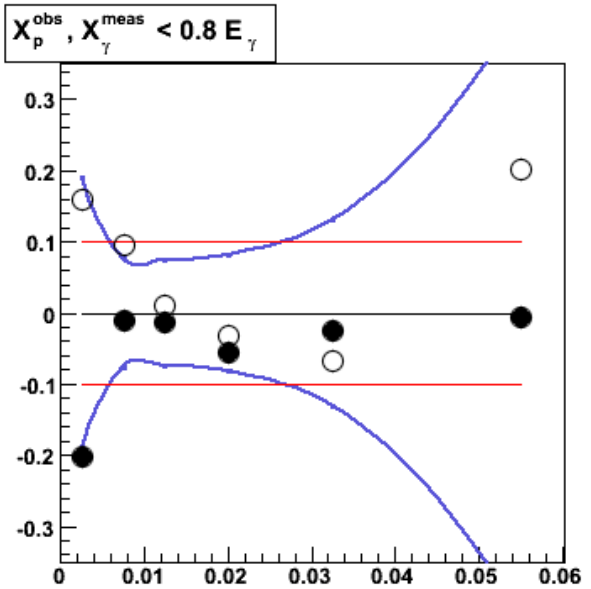
○ δZ *fit range 1.0*

● δZ *fit range 0.6*

Systematic uncertainties: E^{γ} variation







Standard cuts:

- $6 < E_T^{zufo} < 15$ GeV

Vary E^{γ} by +- 2%

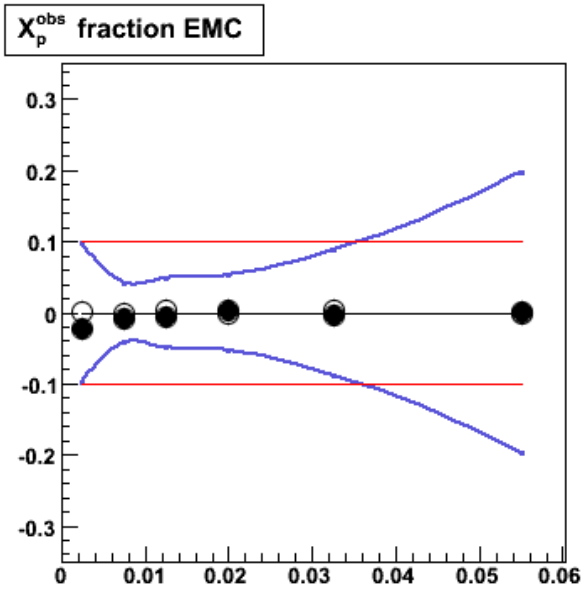
Rel.statistical uncertainties

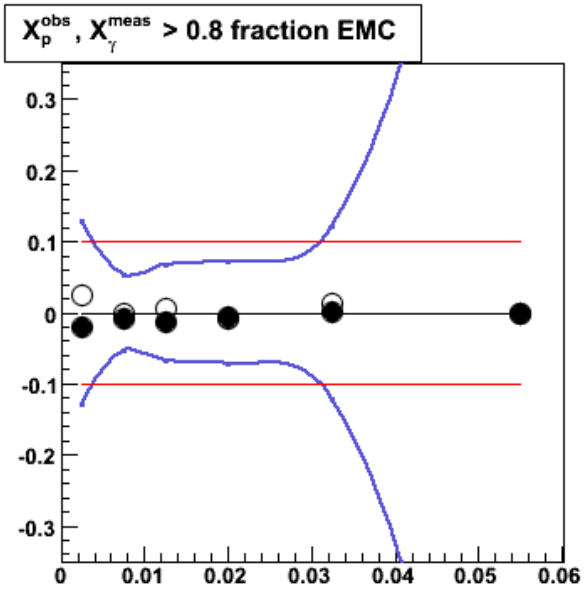
10% line

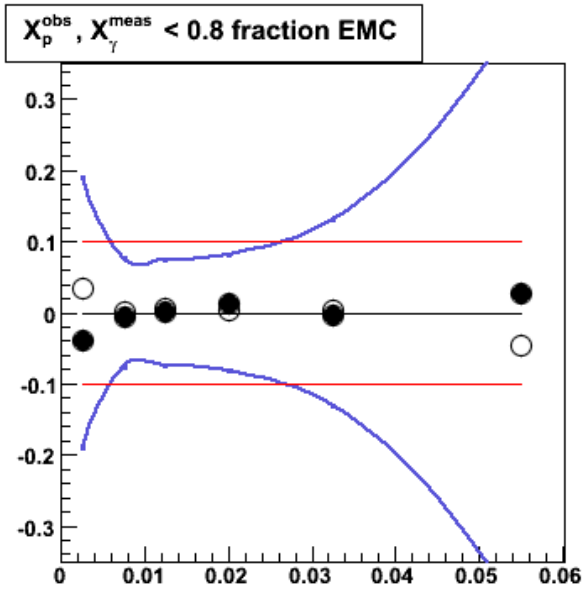
E_γ *+2%*

E_γ *-2%*

Systematic uncertainties: Fraction EMC







Standard cut:

- ZufoEemc/ZufoEcal>0.9

Vary the em fraction in the photon zufo by +-2.5%

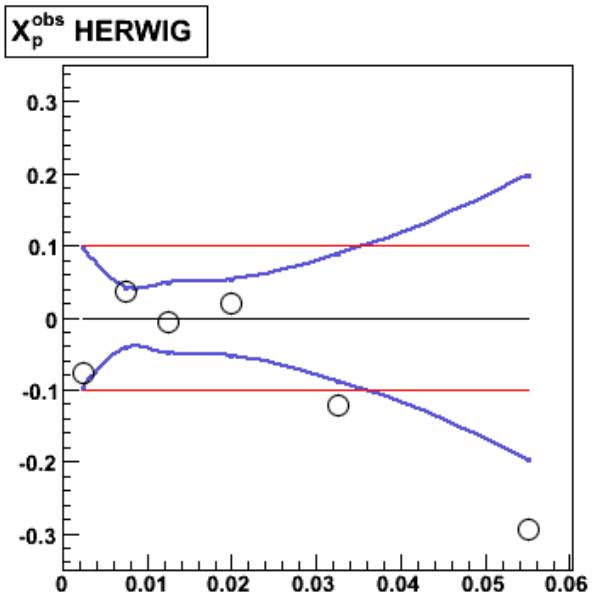
Rel.statistical uncertainties

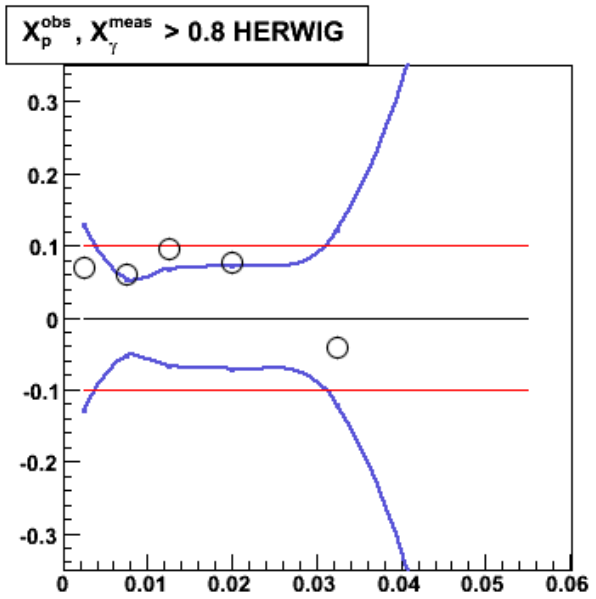
10% line

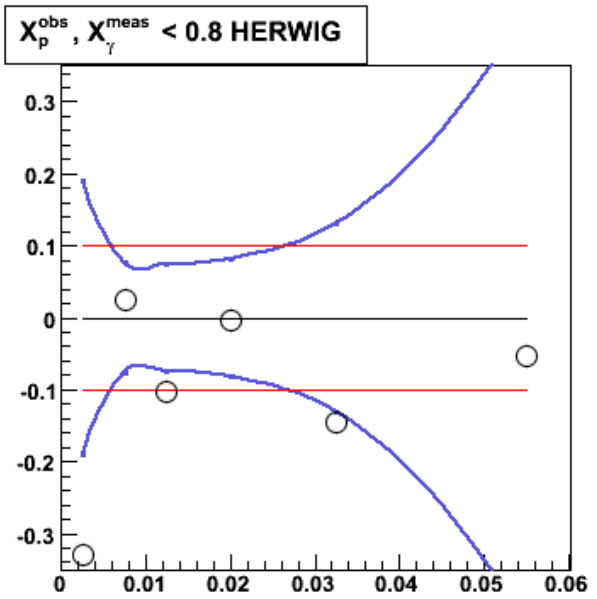
Fraction EMC +0.025

Fraction EMC -0.025

Systematic uncertainties: HERWIG







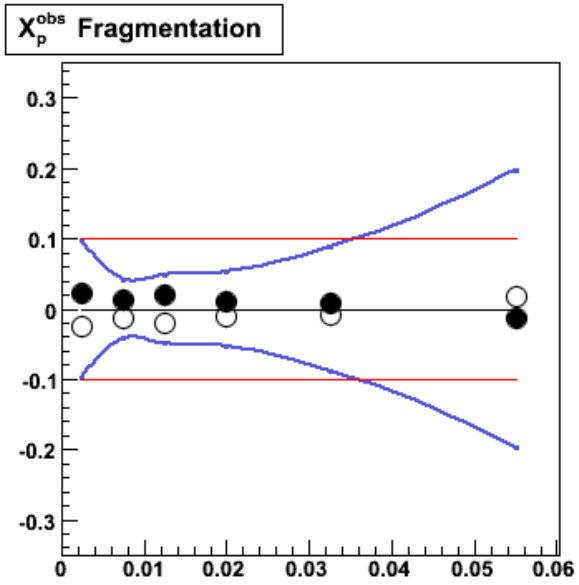
Use HERWIG signal and background instead of PYTHIA

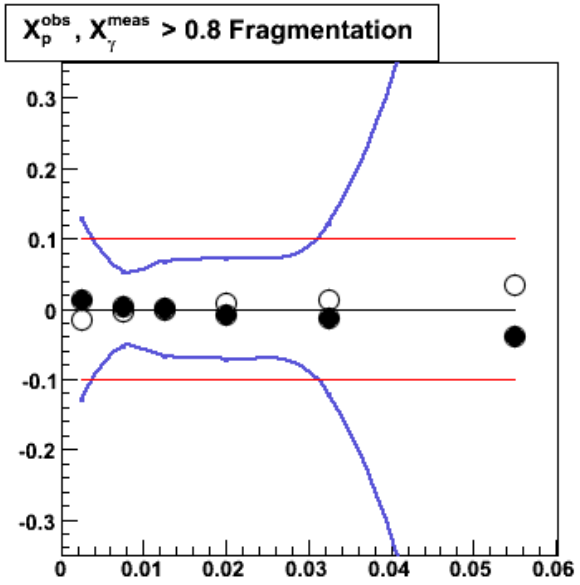
Rel.statistical uncertainties

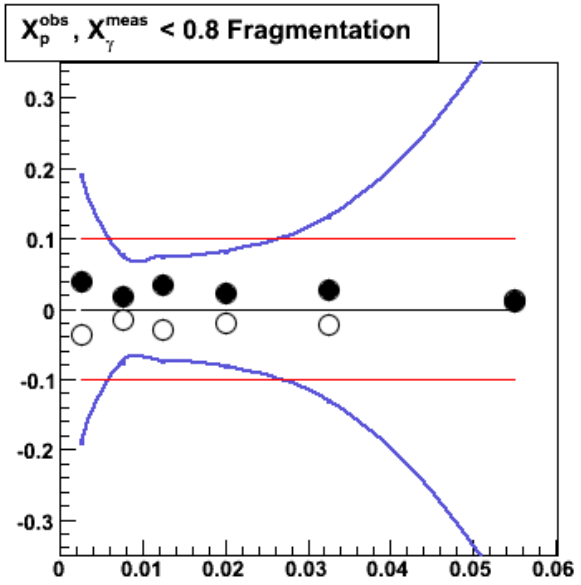
10% line

HERWIG

Systematic uncertainties: PYTHIA fragmentation







Standard value:

Rel.statistical uncertainties

10% line

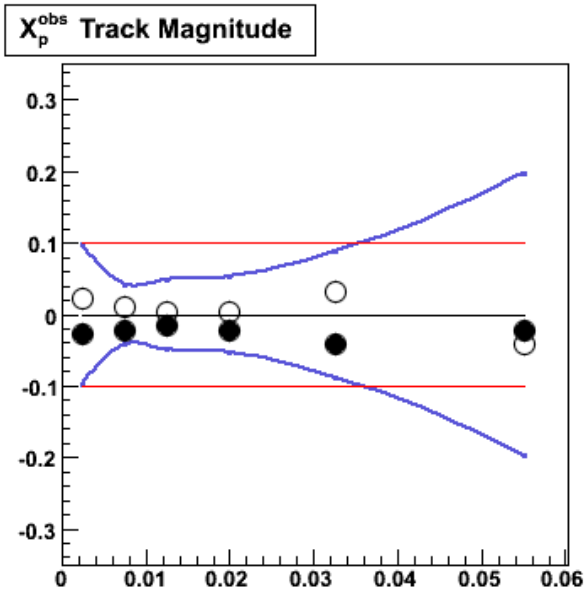
+5% Fragmentation

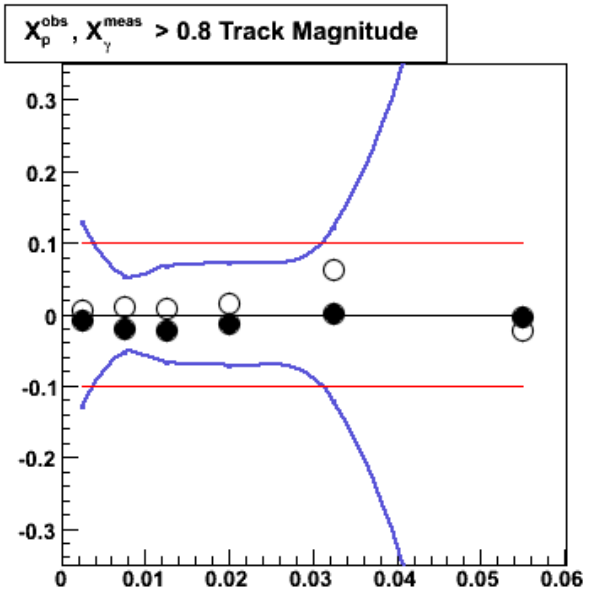
-5% Fragmentation

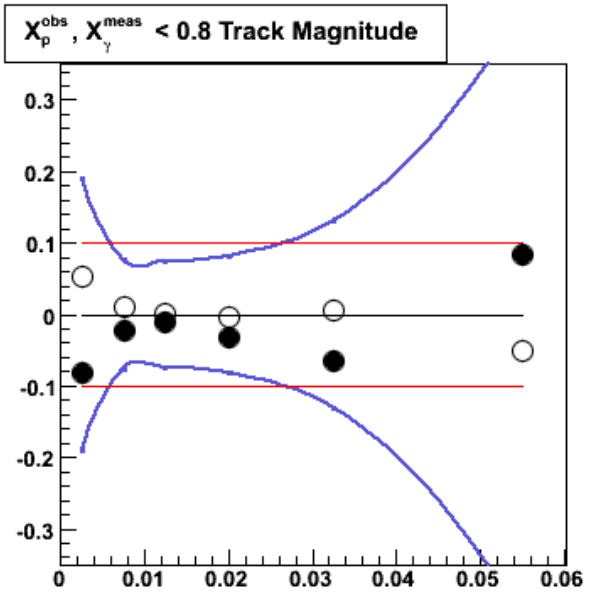
Vary fraction of fragmentation direct and resolved simultaneously by +-5%

• 10%

Systematic uncertainties: Track momentum







Standard cut:

•Track momentum>250 MeV

Vary track momentum by 100 MeV

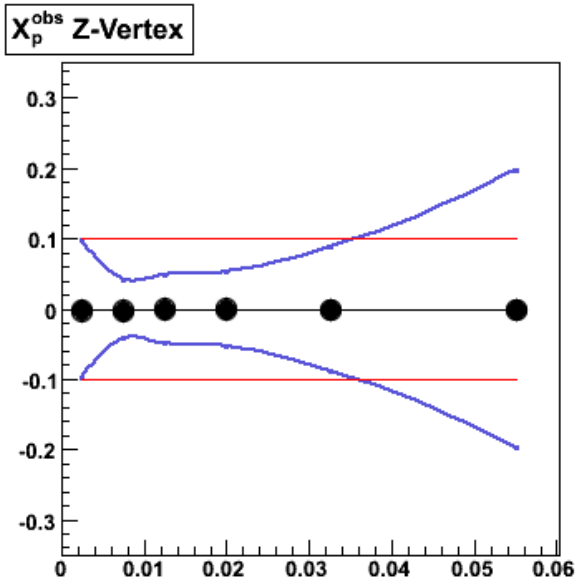
Rel.statistical uncertainties

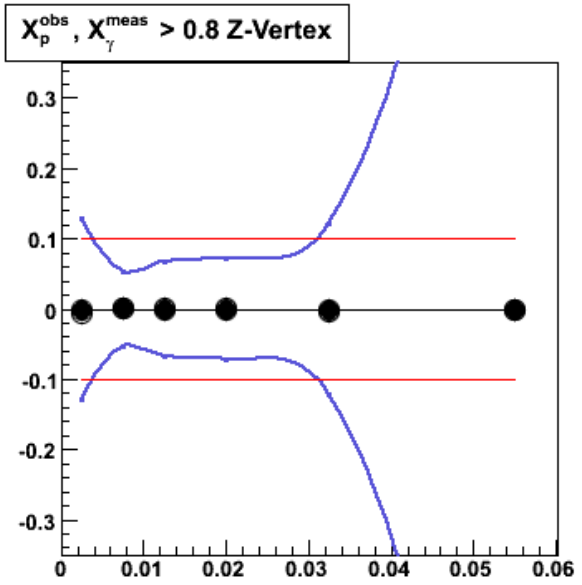
10% line

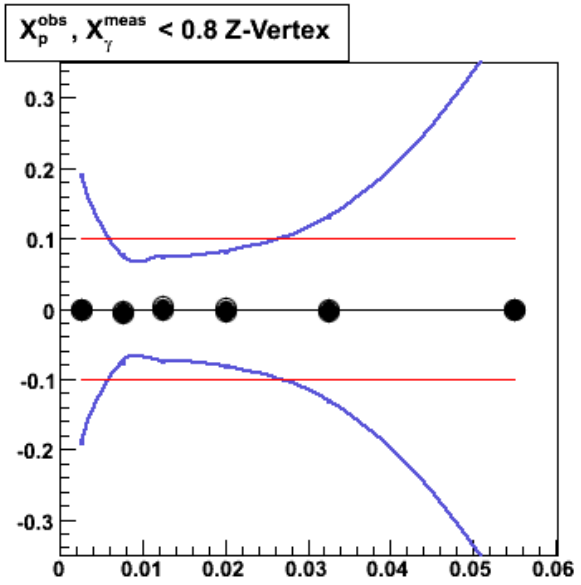
$p_{track} > 350$ *MeV*

$p_{track} > 150$ *MeV*

Systematic uncertainties: Zvtx







Standard cut:

- | Zvtx |<40 cm

Vary z-vertex cut by +-5 cm

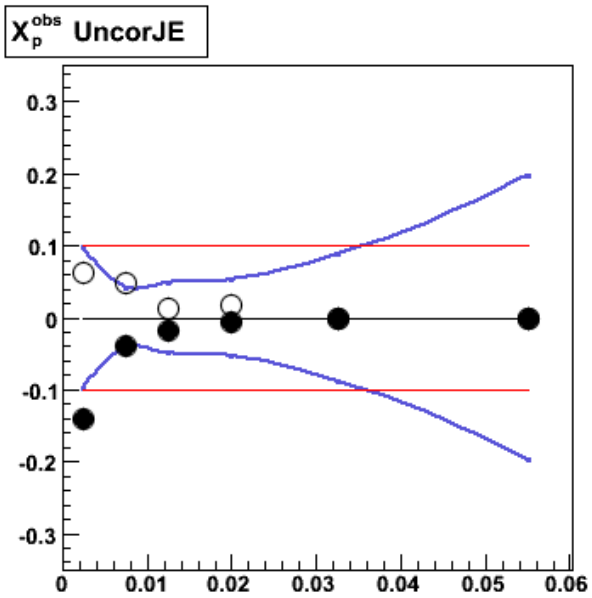
Rel.statistical uncertainties δZ

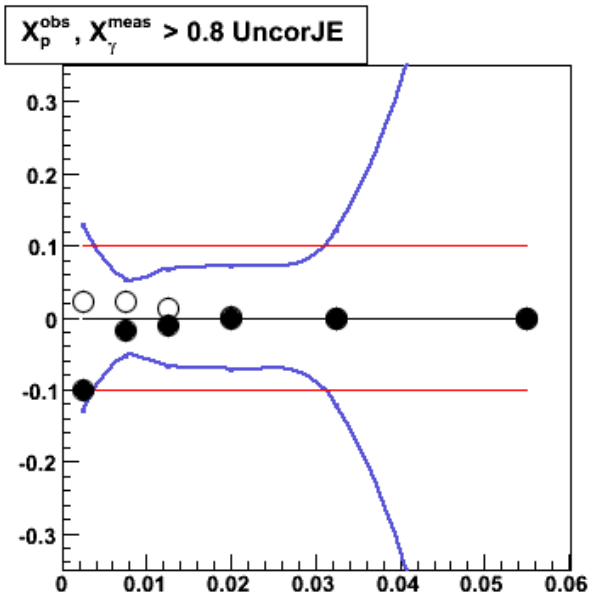
10% line

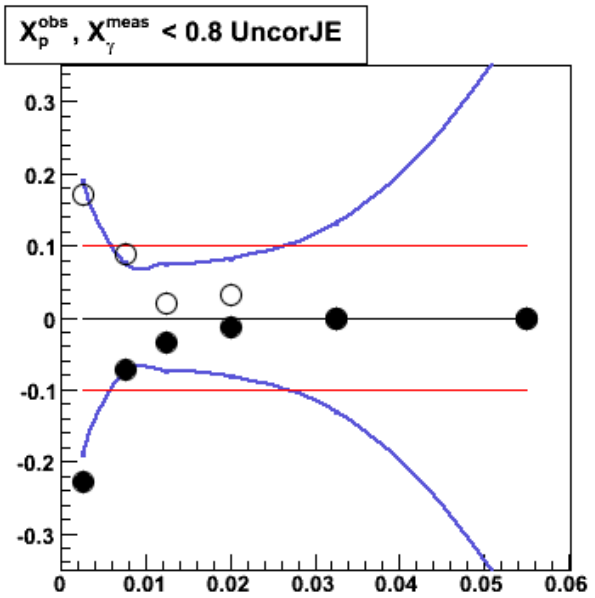
○ $|Z_{vertex}|<45$

● $|Z_{vertex}|<35$

Systematic uncertainties: E^{jet} variation







Standard cuts:

Vary jet energy independently from gamma energy:

If JetEt ≤ 6 GeV by sqrt(4.*4. + 2.*2.))

If 6 < JetEt ≤ 10 GeV by sqrt(2.*2. +2.*2.))

If JetEt > 10 GeV vary by sqrt(1.5*1.5 + 2.*2.))

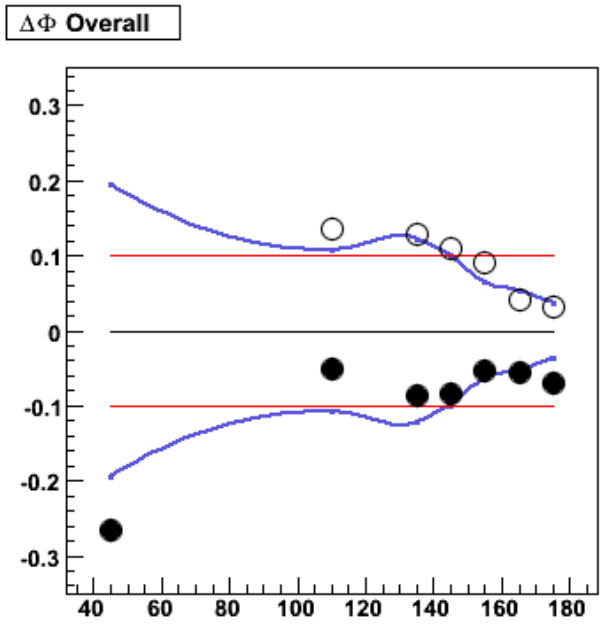
Rel.statistical uncertainties

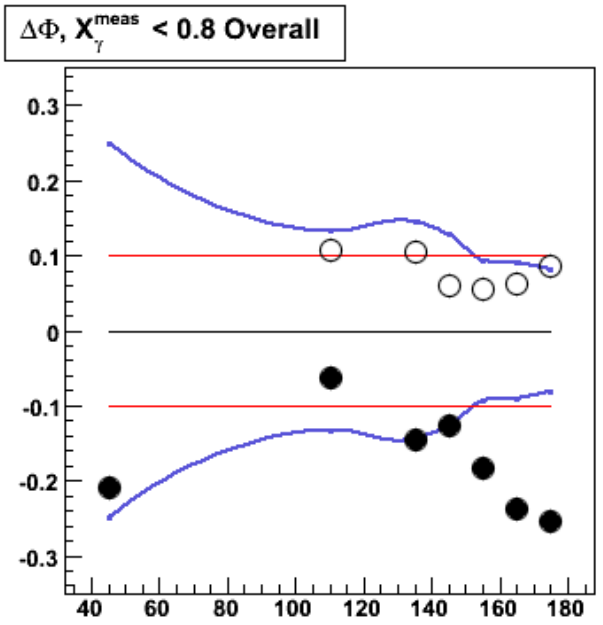
10% line

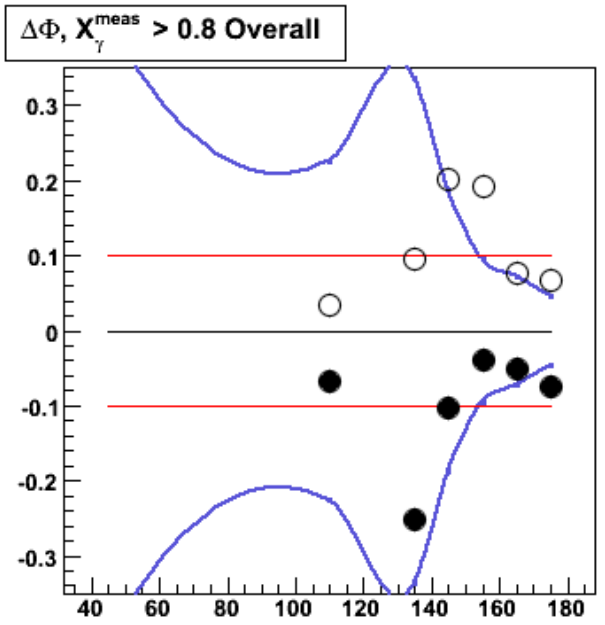
variation up

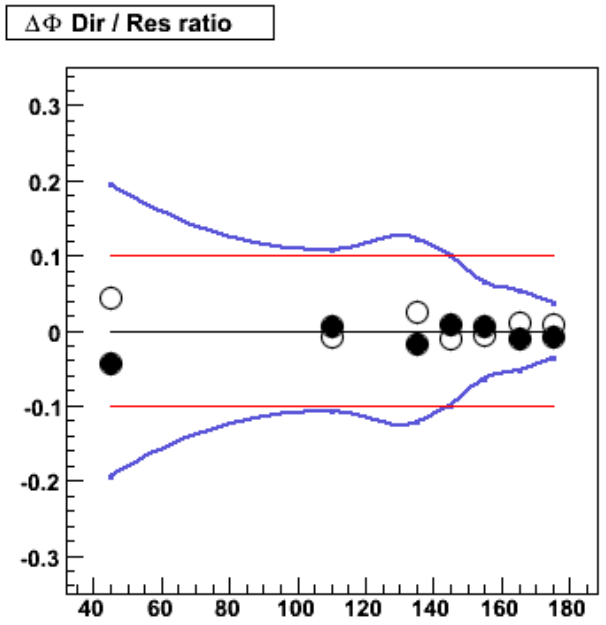
variation down

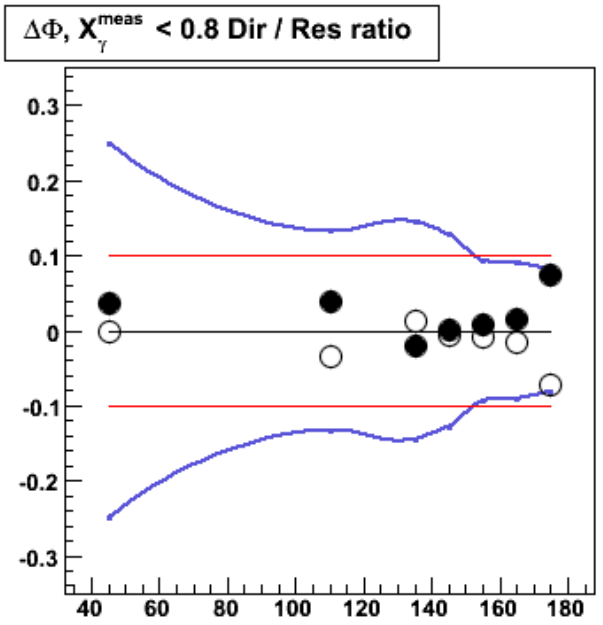
•$4<E_T^{jet}<35$ GeV

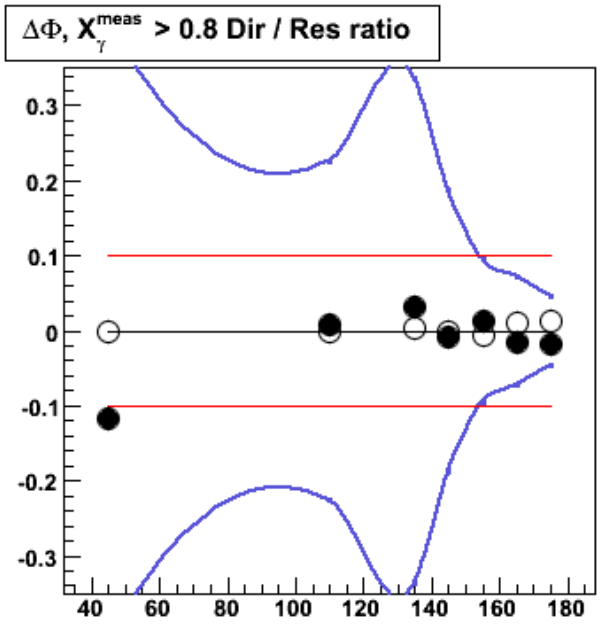

ΔΦ Overall
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180

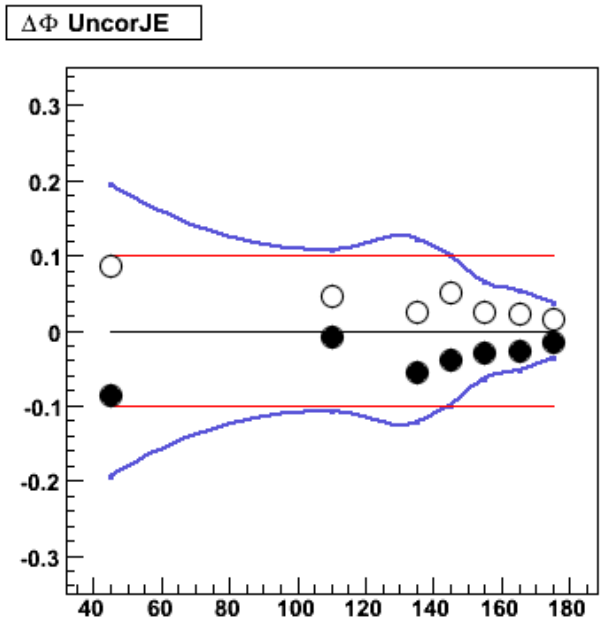

ΔΦ, X$_\gamma^{meas}$ < 0.8 Overall
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180

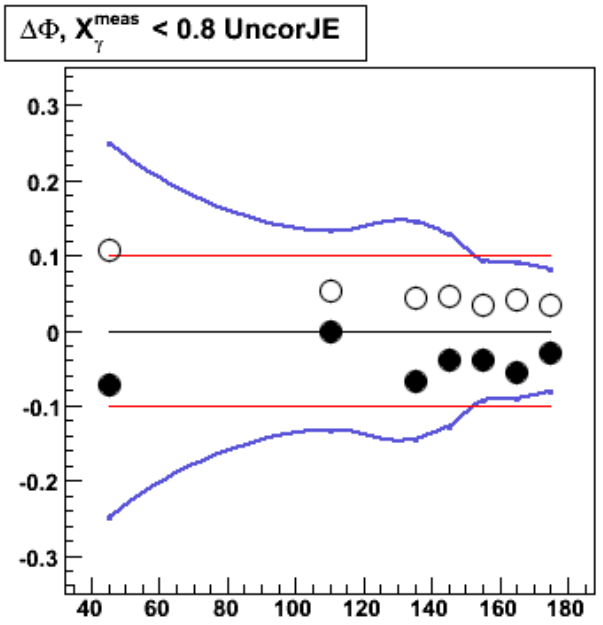

ΔΦ, X$_\gamma^{meas}$ > 0.8 Overall
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180

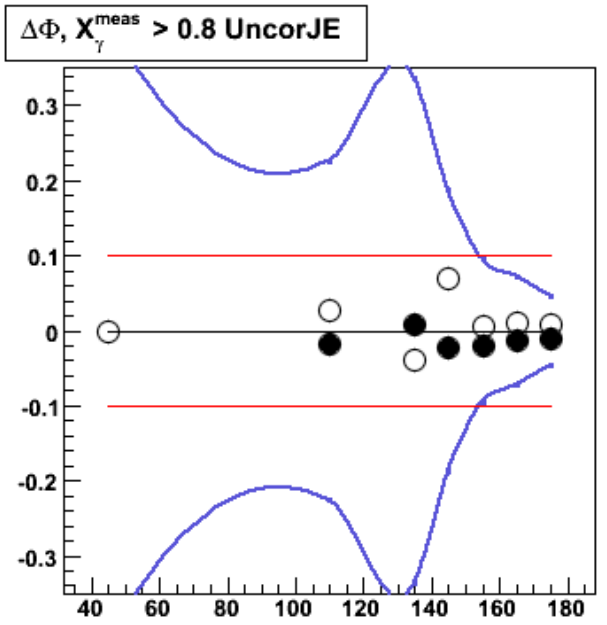

ΔΦ Dir / Res ratio
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180

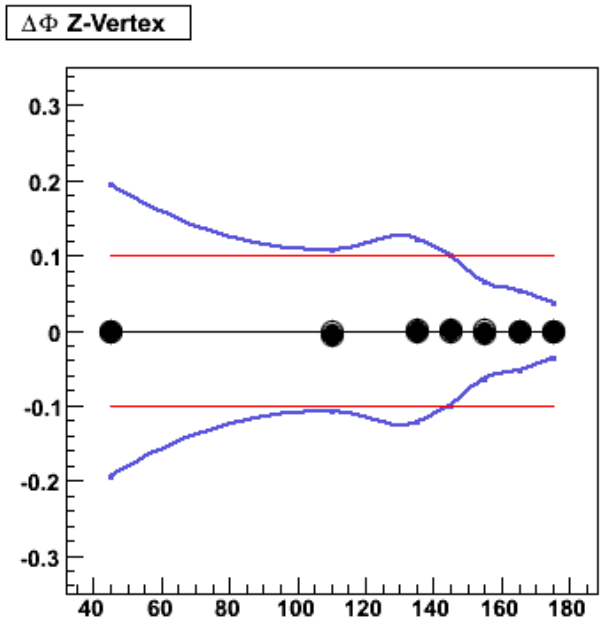

ΔΦ, X$_\gamma^{meas}$ < 0.8 Dir / Res ratio
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180

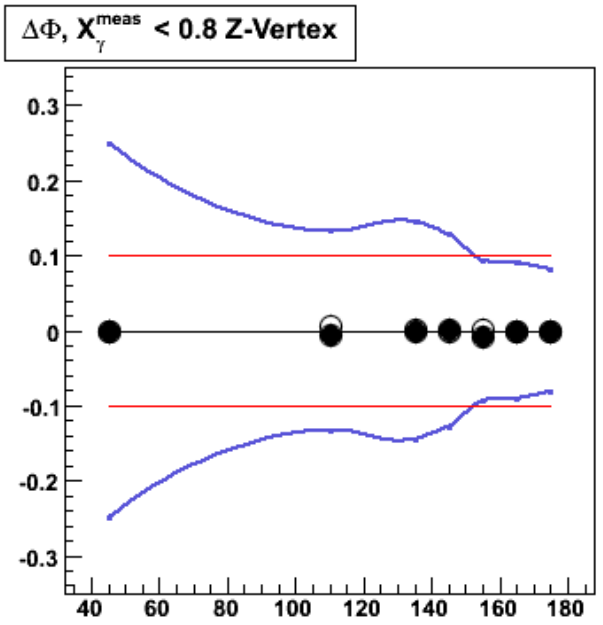

ΔΦ, X$_\gamma^{meas}$ > 0.8 Dir / Res ratio
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180

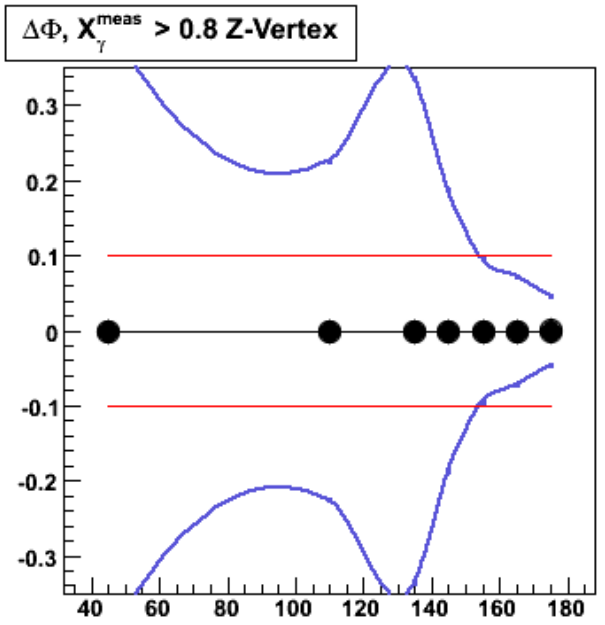

ΔΦ UncorJE
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180

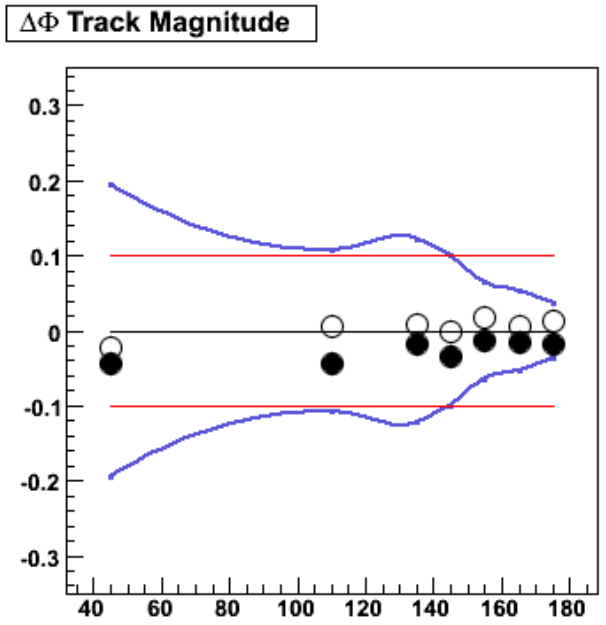

ΔΦ, X$_\gamma^{meas}$ < 0.8 UncorJE
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180

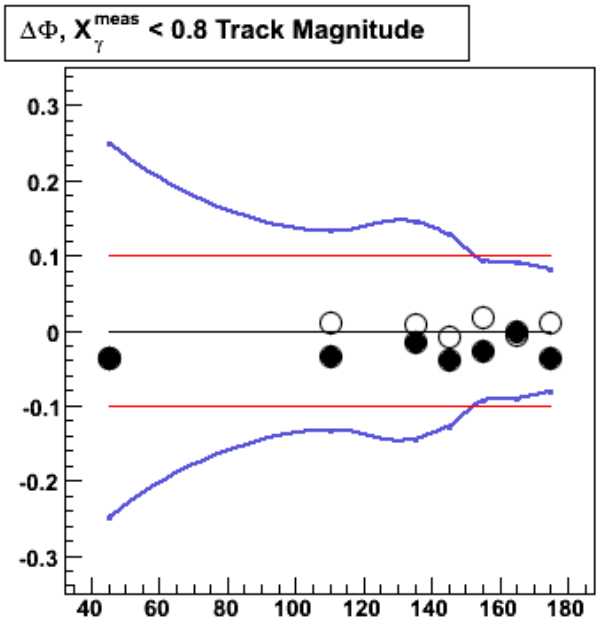

ΔΦ, X$_\gamma^{meas}$ > 0.8 UncorJE
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180

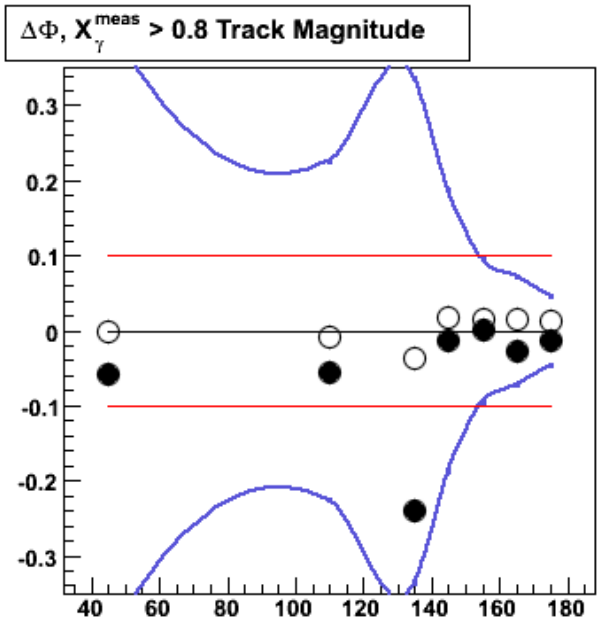

ΔΦ Z-Vertex
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180

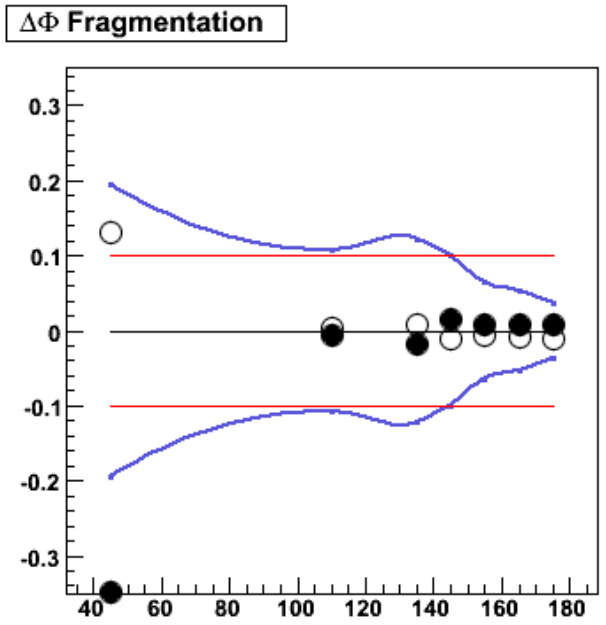

ΔΦ, X$_\gamma^{meas}$ < 0.8 Z-Vertex
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180

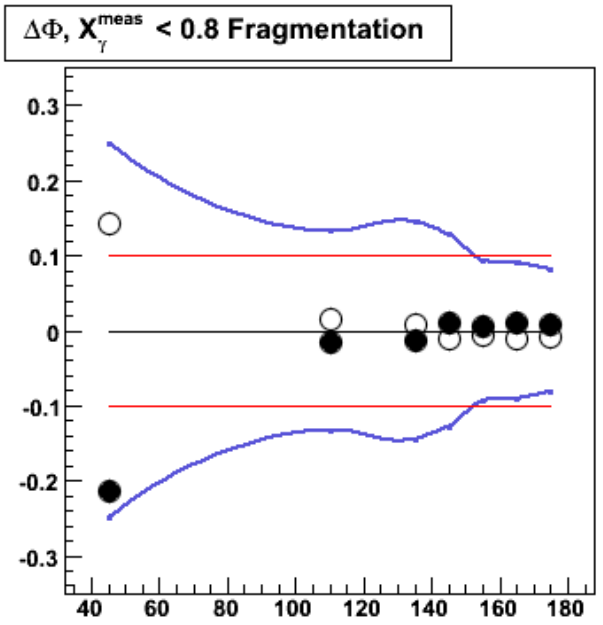

ΔΦ, X$_\gamma^{meas}$ > 0.8 Z-Vertex
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180

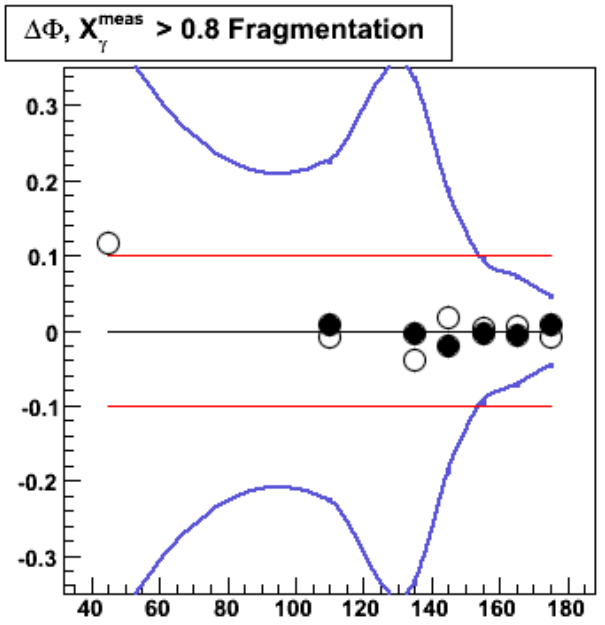

ΔΦ Track Magnitude
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180

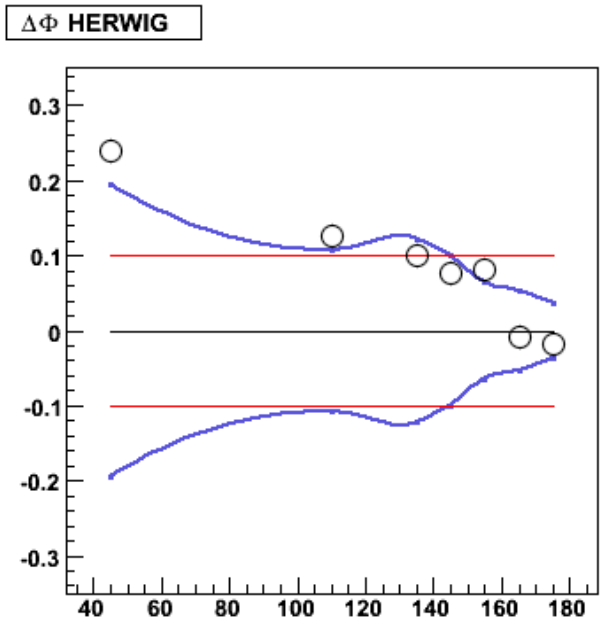

ΔΦ, X$_\gamma^{meas}$ < 0.8 Track Magnitude
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180

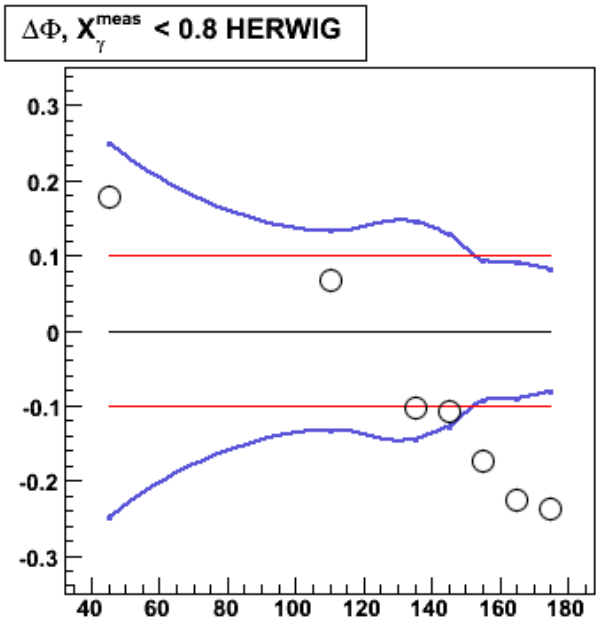

ΔΦ, X$_\gamma^{meas}$ > 0.8 Track Magnitude
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180

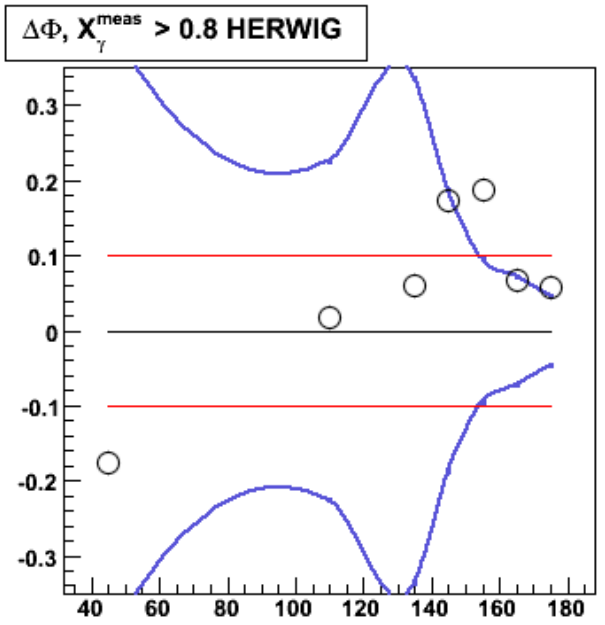

ΔΦ Fragmentation
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180

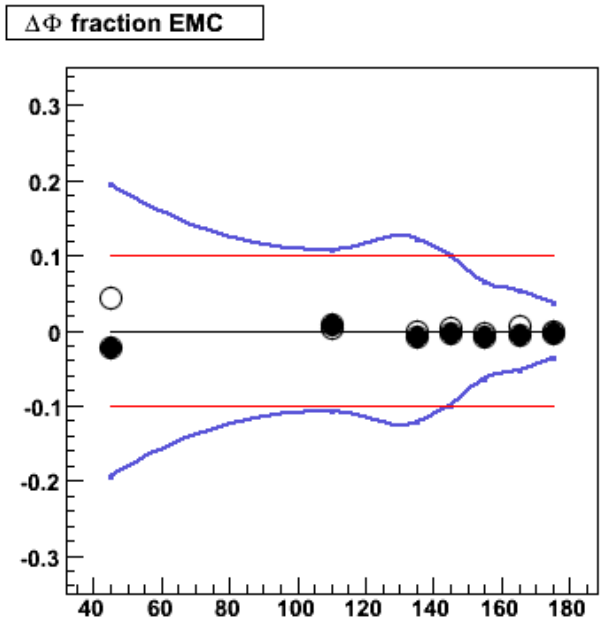

ΔΦ, X_γ^meas < 0.8 Fragmentation
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180

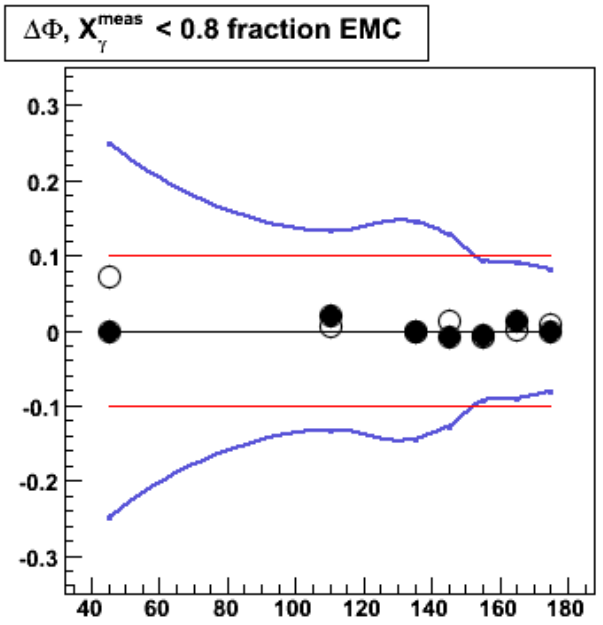

ΔΦ, X_γ^meas > 0.8 Fragmentation
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180

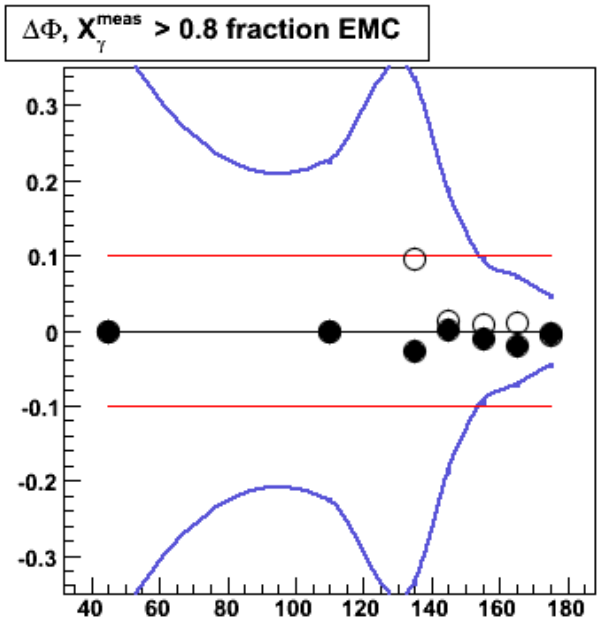

ΔΦ HERWIG
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180

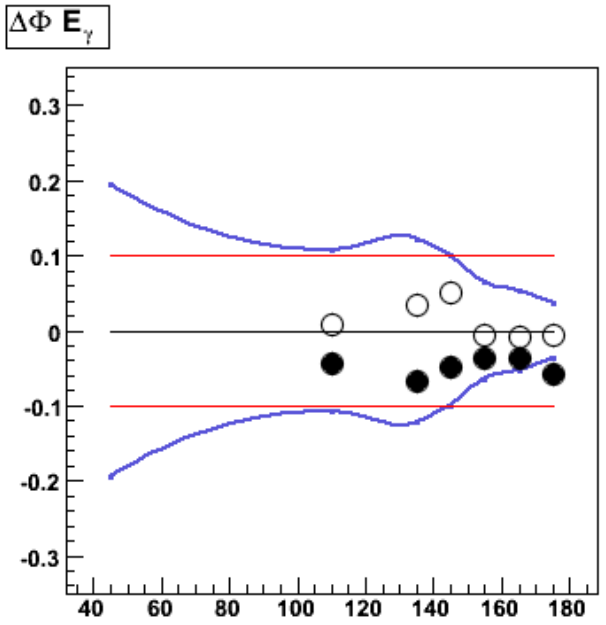

ΔΦ, X$_\gamma^{meas}$ < 0.8 HERWIG
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180

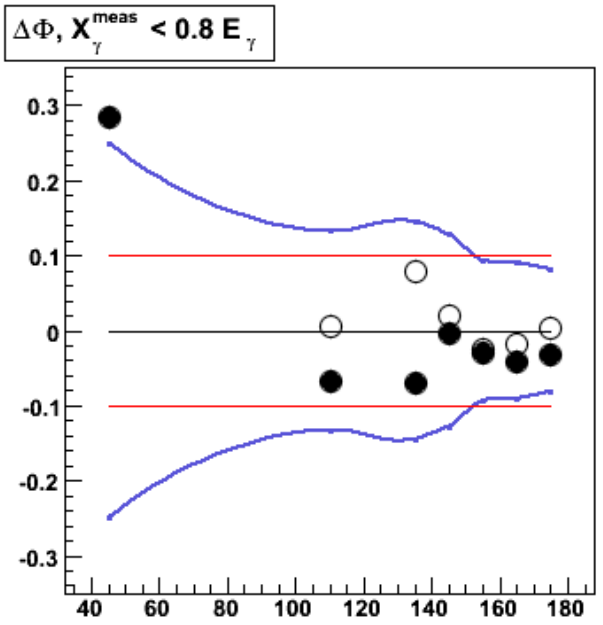

ΔΦ, X$_\gamma^{meas}$ > 0.8 HERWIG
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180

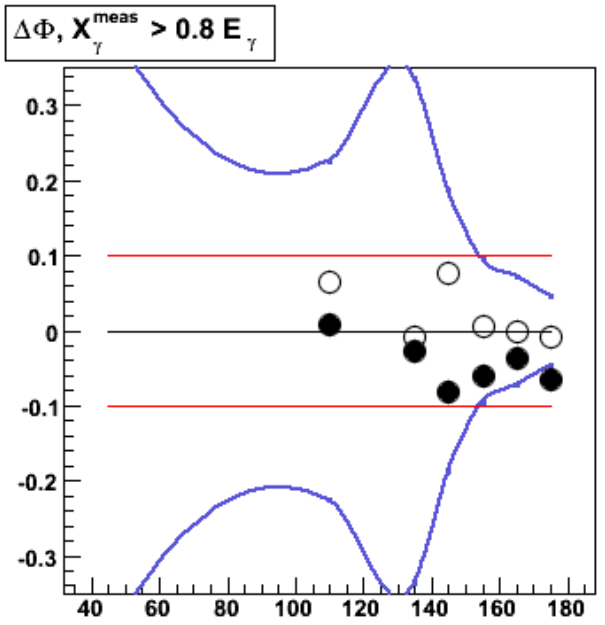

ΔΦ fraction EMC
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180

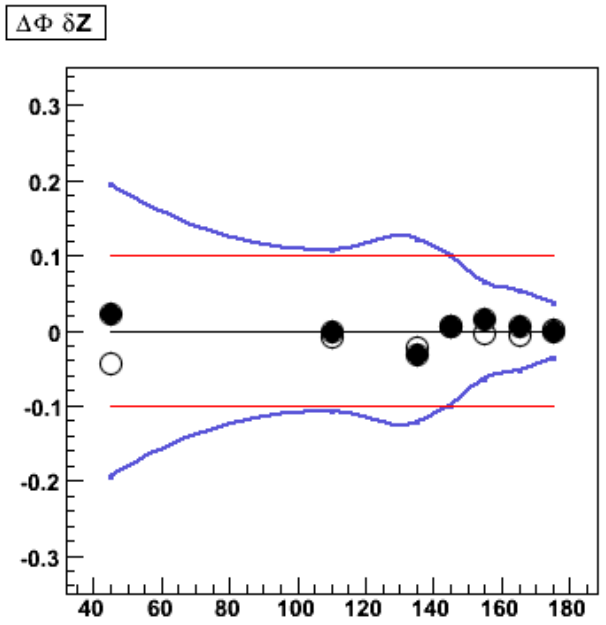

ΔΦ, X_γ^meas < 0.8 fraction EMC
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180

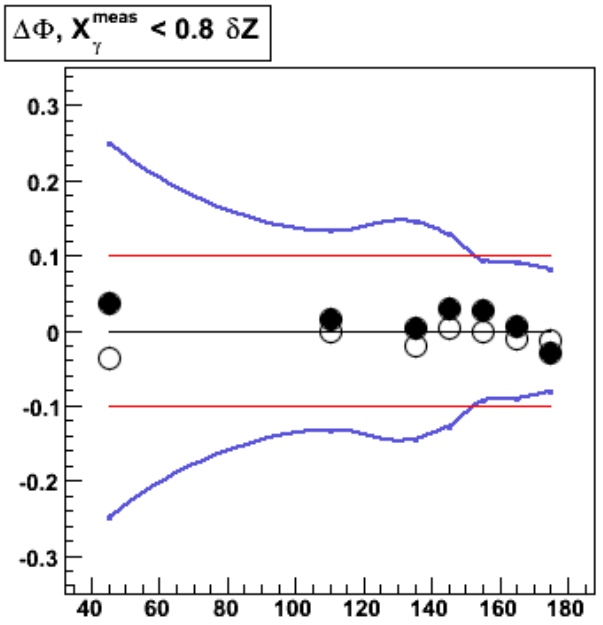

ΔΦ, X_γ^meas > 0.8 fraction EMC
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180

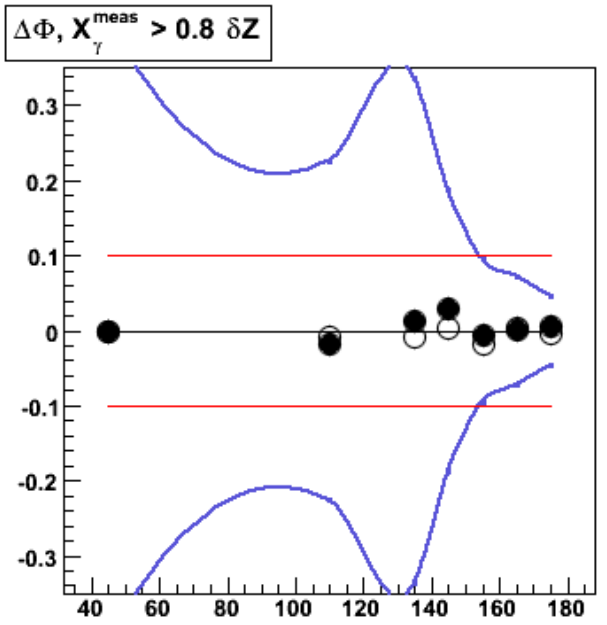

ΔΦ E_γ
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180

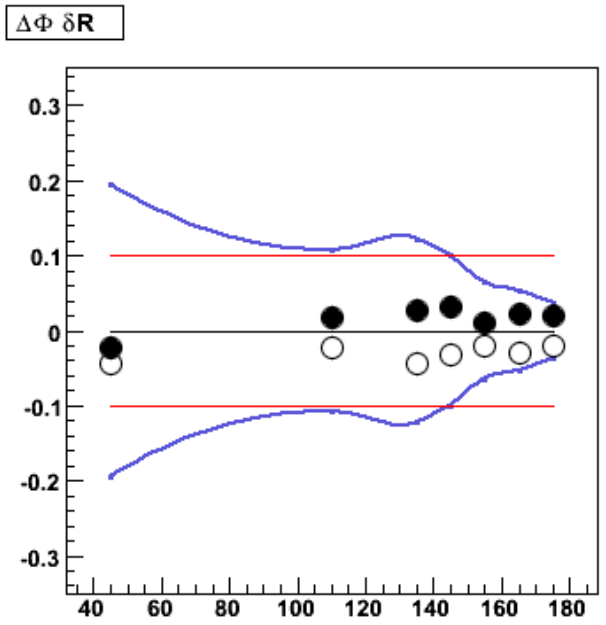

ΔΦ, X_γ^meas < 0.8 E_γ
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180

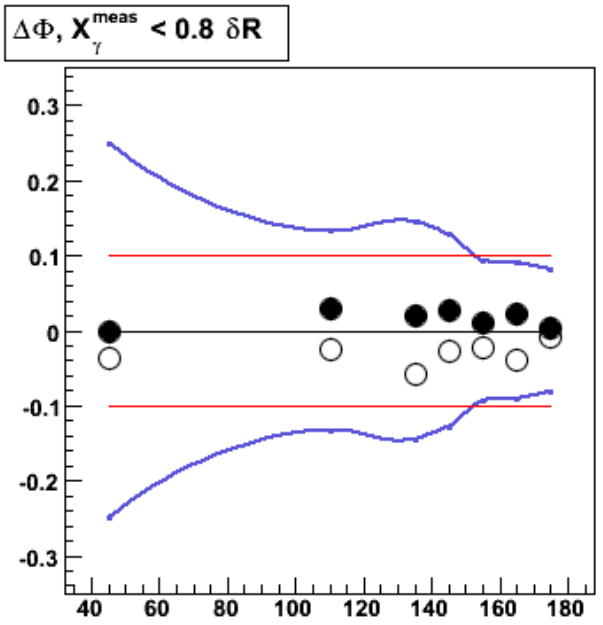

ΔΦ, X_γ^meas > 0.8 E_γ
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180

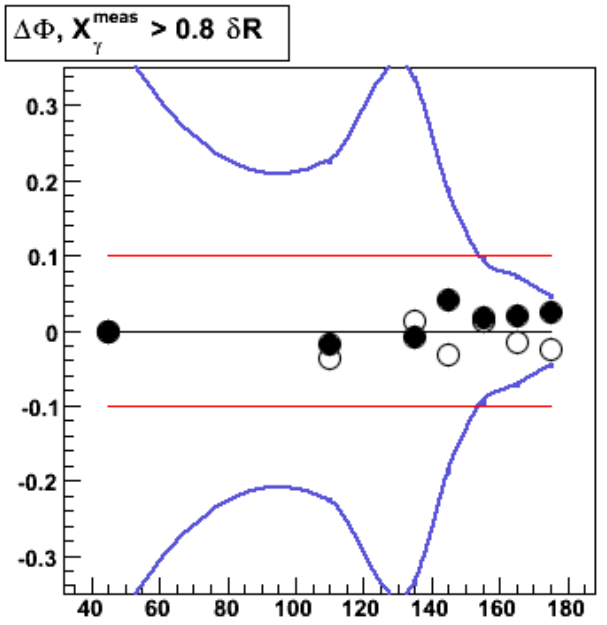

ΔΦ δZ
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180


ΔΦ, X_γ^{meas} < 0.8 δZ
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180


ΔΦ, X_γ^{meas} > 0.8 δZ
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180


ΔΦ δR
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180


ΔΦ, X_γ^meas < 0.8 δR
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180


ΔΦ, X_γ^meas > 0.8 δR
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
40
60
80
100
120
140
160
180