Dijets and Azimuthal Correlations

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HaQ Meeting 21, 2006

Outline

→ Motivation

→ Selection and Control Plots

→ $\frac{d\sigma}{dQ^2 d\Delta\phi^*}$: P, S, C, Systematic Uncertainties

→ $\frac{d\sigma}{dx_{Bj} d\Delta\phi^*}$: P, S, C, Systematic Uncertainties

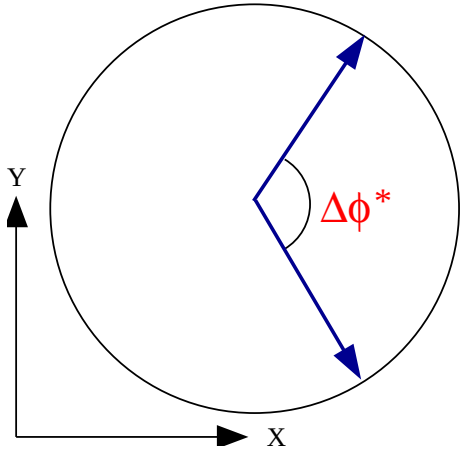
→ Summary

Motivation

- Azimuthal correlations: $\frac{d\sigma}{dQ^2 \Delta\phi^*}$, $\frac{d\sigma}{dx_{Bj} d\Delta\phi^*}$

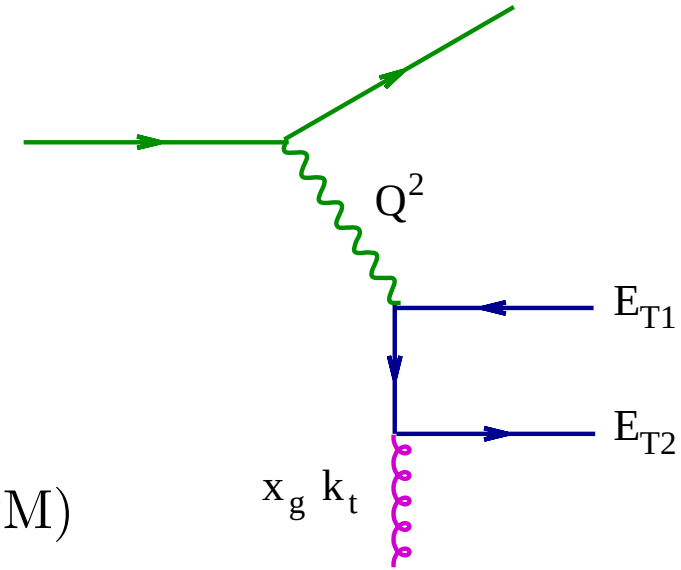
  $k_t^{*2} = E_{T1}^{*2} + E_{T2}^{*2} + 2|E_{T1}^*||E_{T2}^*| cos\Delta\phi^*$

  Sensitive to unintegrated gluon density.



- DGLAP: Back-to-back jets in LO

  $\Rightarrow \Delta\phi^* < 180^\circ$ from higher order QCD



- Small x: non-ordering in k_t

  $\Rightarrow \Delta\phi^* < 180^\circ$ already in LO (e.g. BFKL, CCFM)

Selection and Control Plots

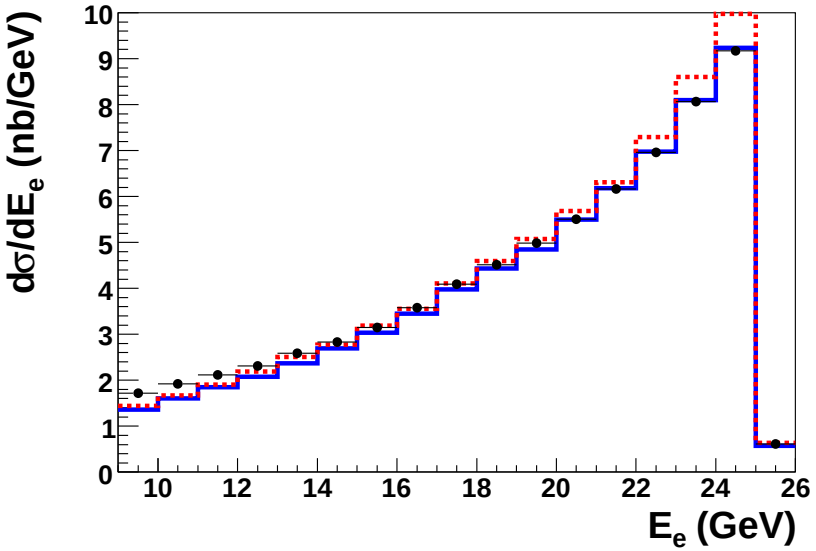
Using 1999/2000 e^+, excluding shifted vertex runs.

DIS Cuts			Dijet Cuts		
$5\ \text{GeV}^2 <$	Q^2	$< 100\ \text{GeV}^2$	$-1 <$	η_j	< 2.5
$0.1 <$	y	< 0.7	$5\ \text{GeV} <$	$E^*_{\perp j1,2}$	
$9\ \text{GeV} <$	E_e			Sort in η : $\eta_1 < \eta_2$	
$156^\circ <$	θ_e	$< 175^\circ$			
$35\ \text{GeV} <$	$E - p_z$	$< 70\ \text{GeV}$			
	$\lvert z_{vtx} \rvert$	$< 35\ \text{cm}$			
	R_{clus}	$< 4\ \text{cm}$			
	E_{had}	$< 0.5\ \text{GeV}$			
	E_{veto}	$< 1.0\ \text{GeV}$			
	Trigger	S0 OR S61			

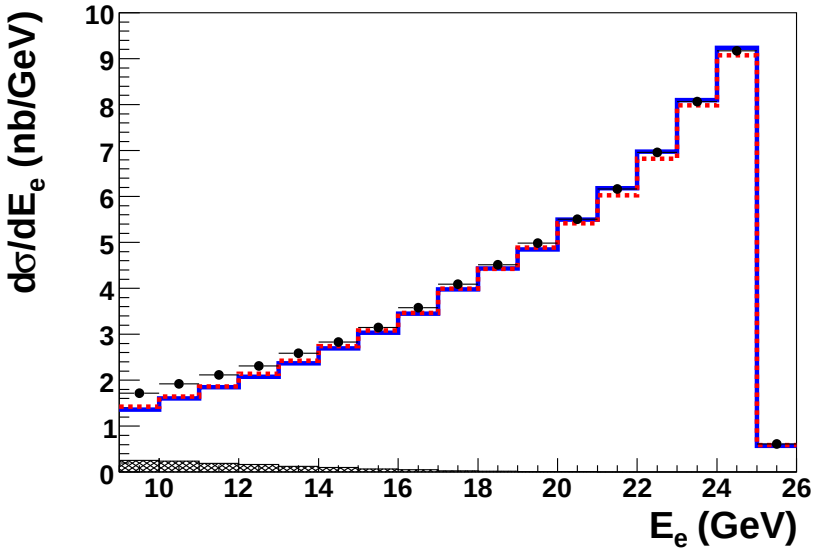
Electron Calibration for Rapgap

Apply 2.8.18 Calibration for Rapgap
(Django already calibrated)

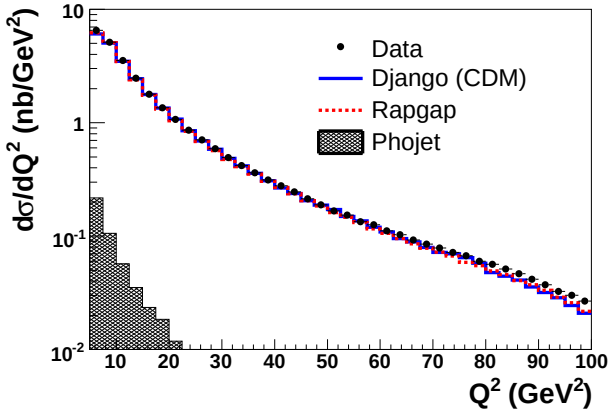
2.8.15 Original

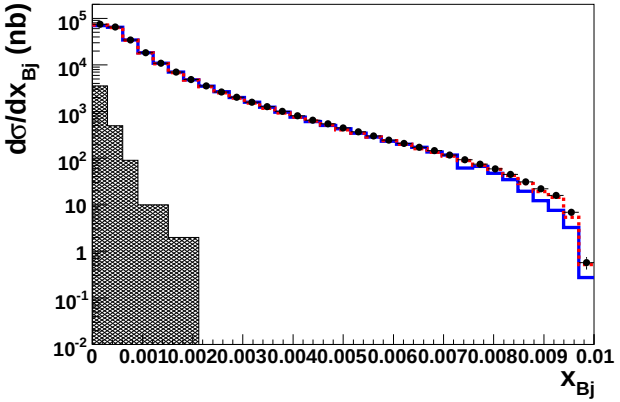


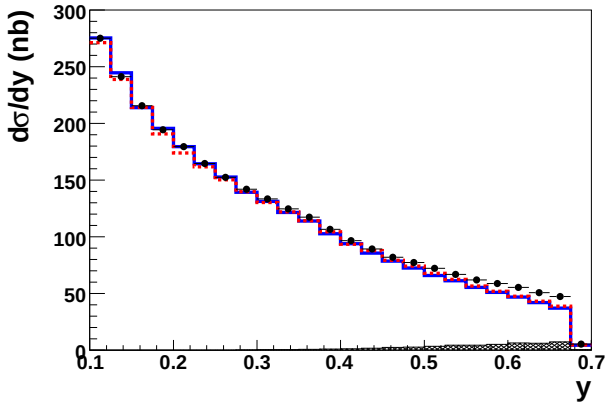
2.8.15 with Elec Calib

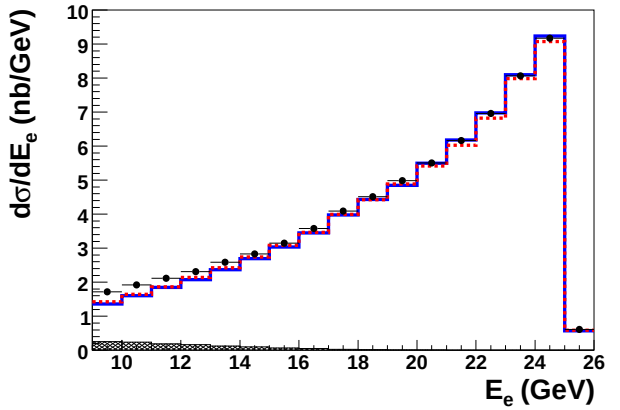


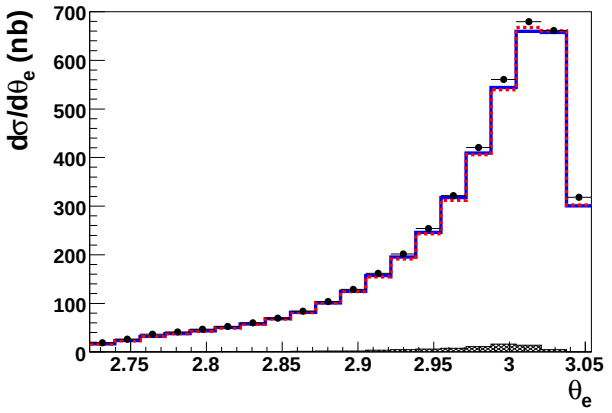
Control Plots DIS Sample

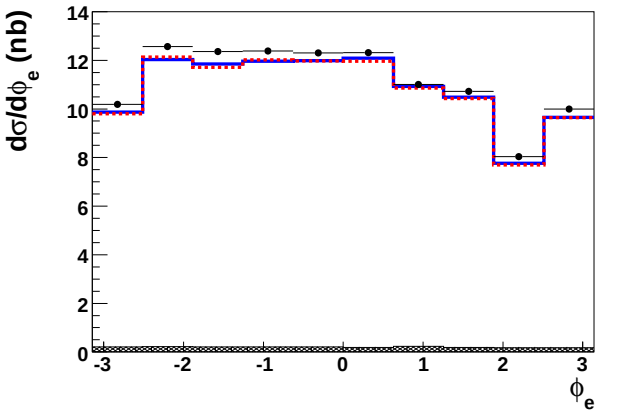




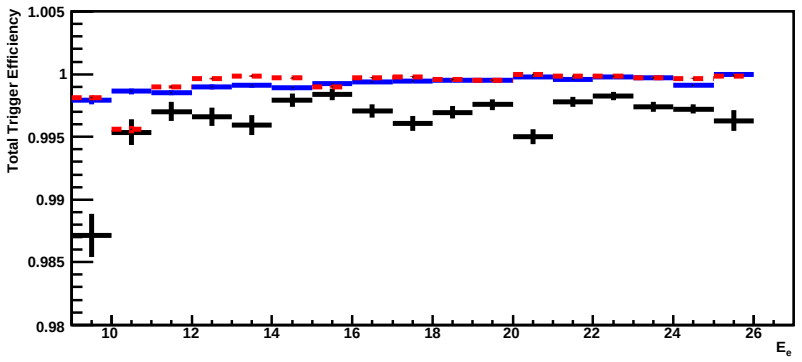


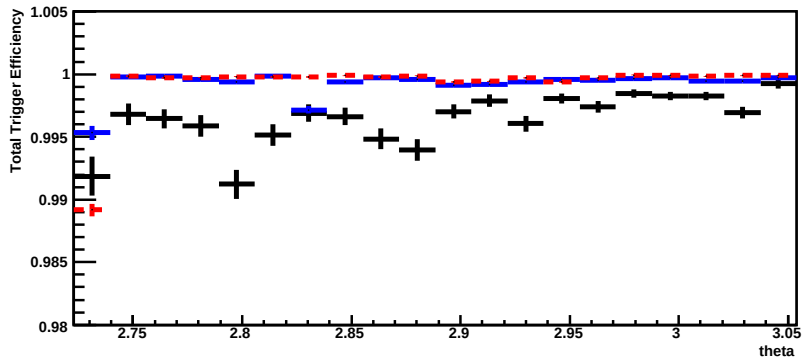


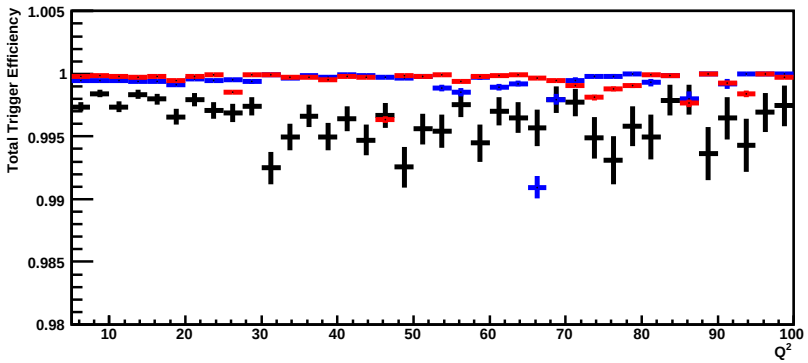


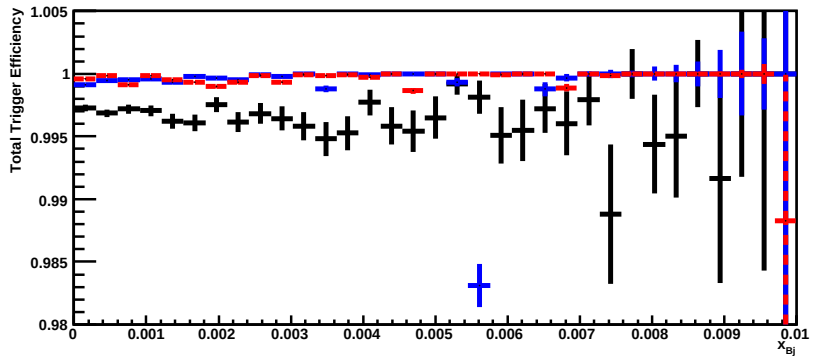


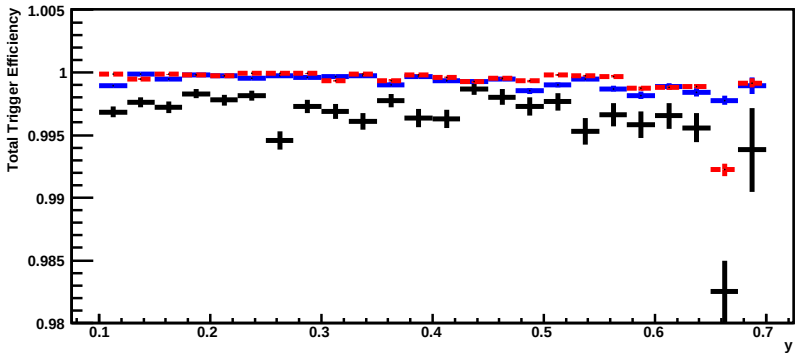
Trigger Efficiency (S0 OR S61) DIS



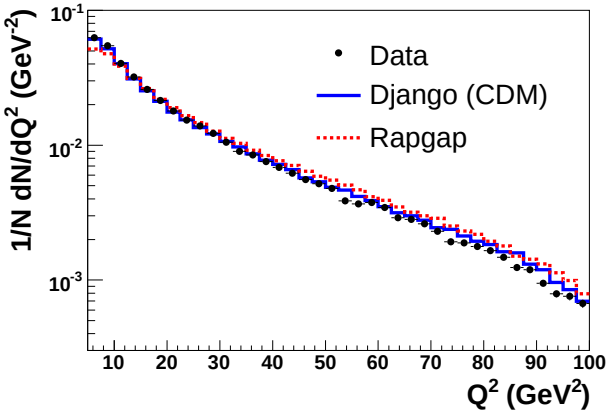


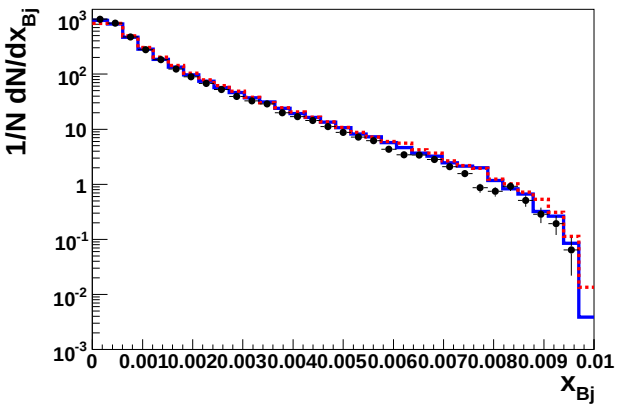


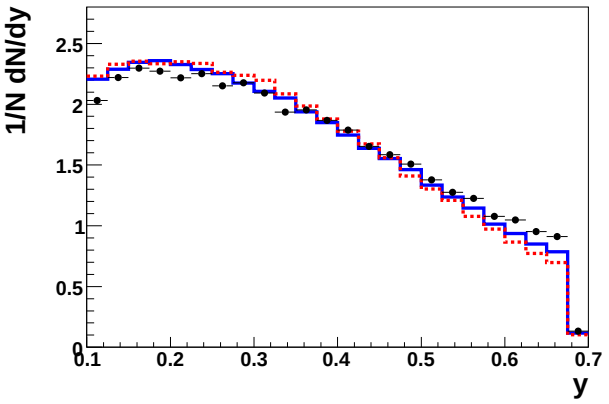


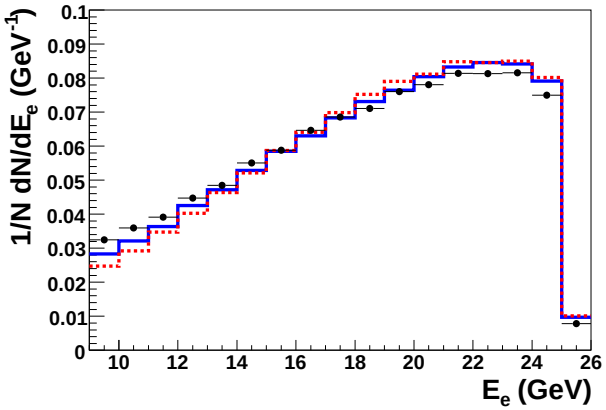


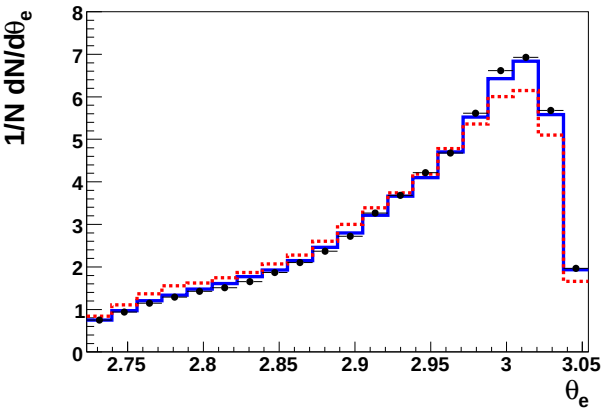
Control Plots Dijet Sample

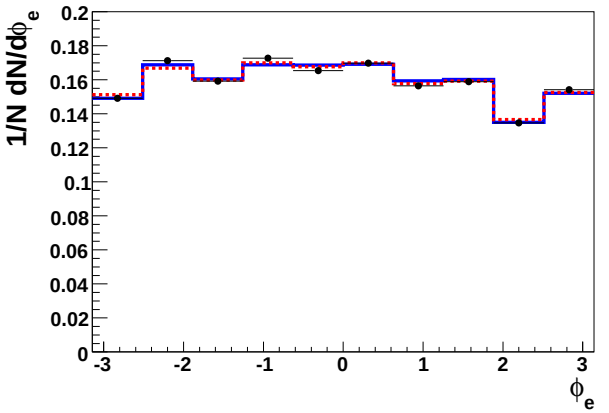




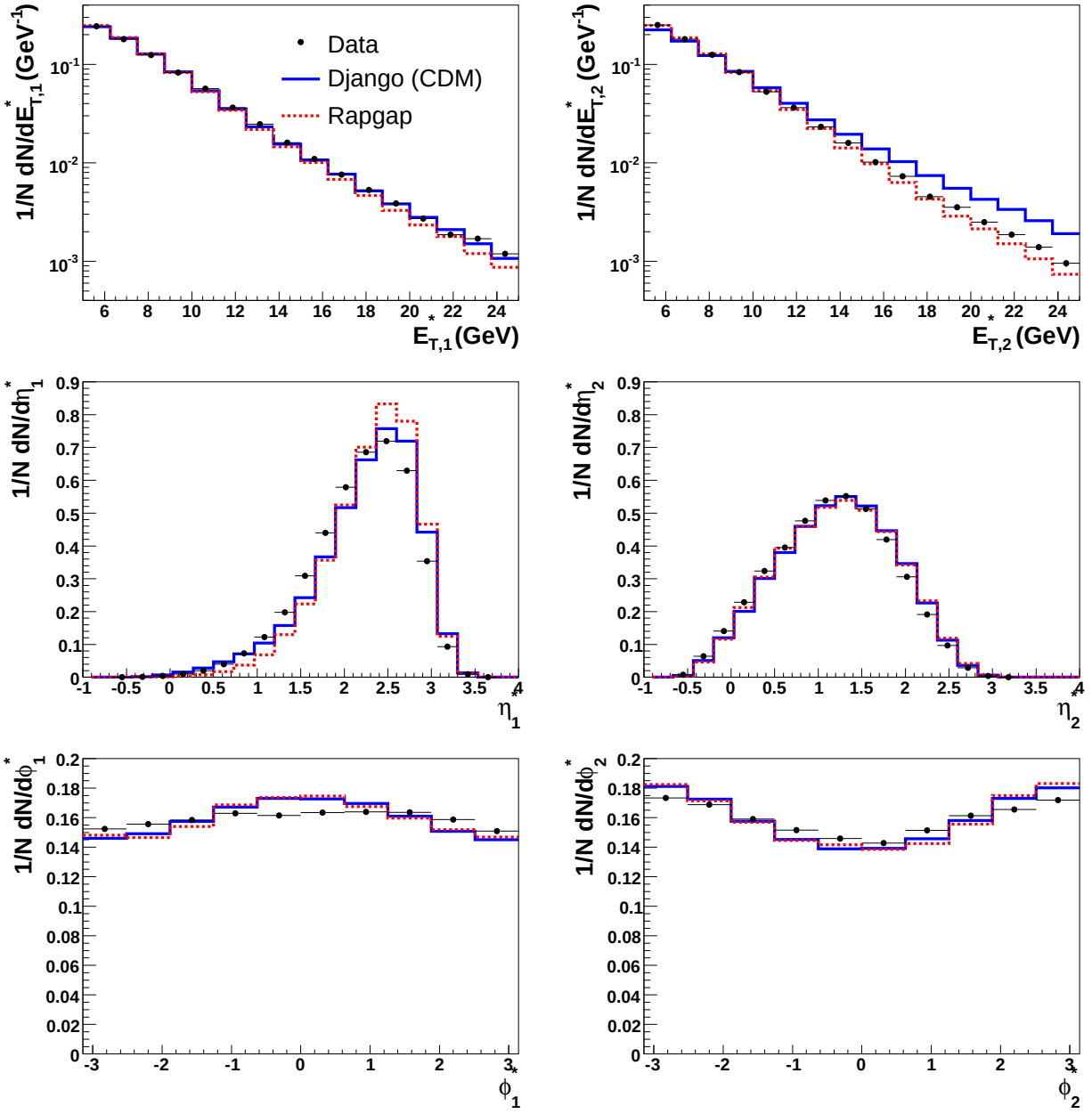






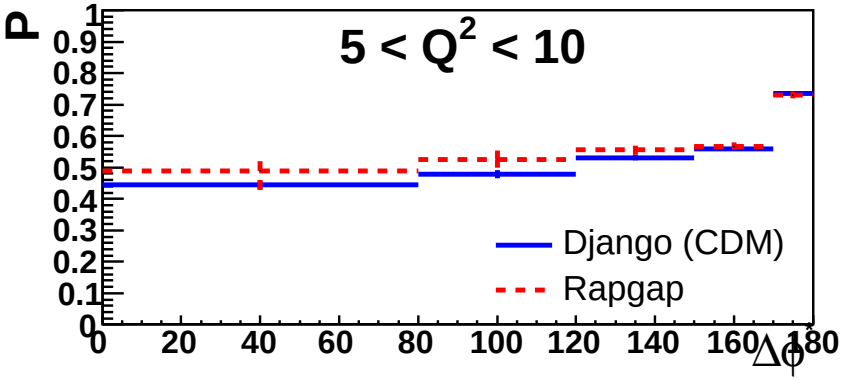


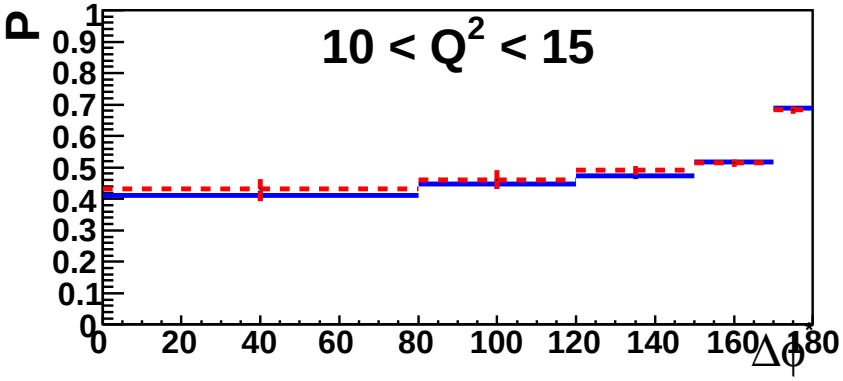
Control Plots Dijets

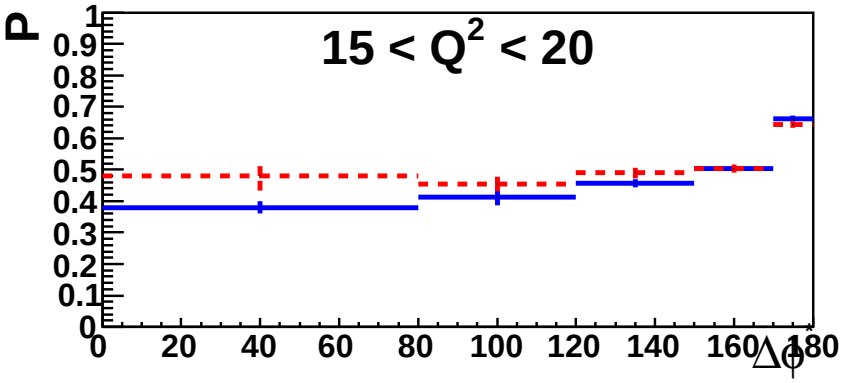


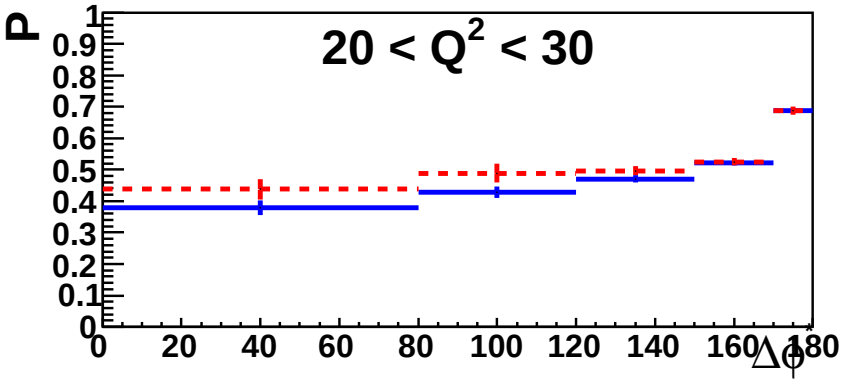
$d\sigma/dQ^2 d\Delta\phi^*$ Purity

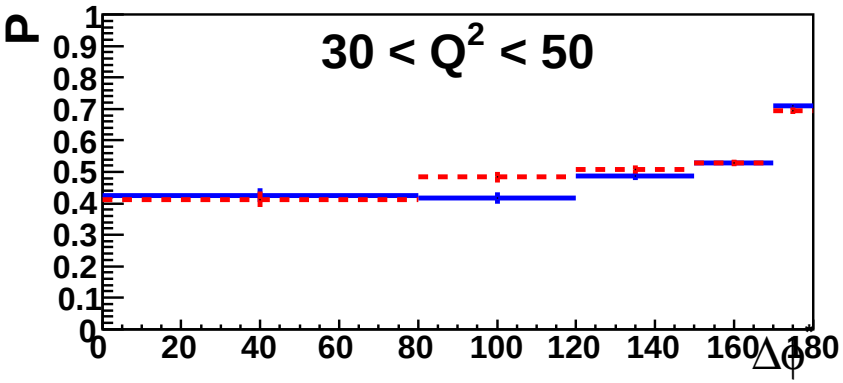
$$P = \frac{N_{DET\&\&HAD}}{N_{DET}}$$

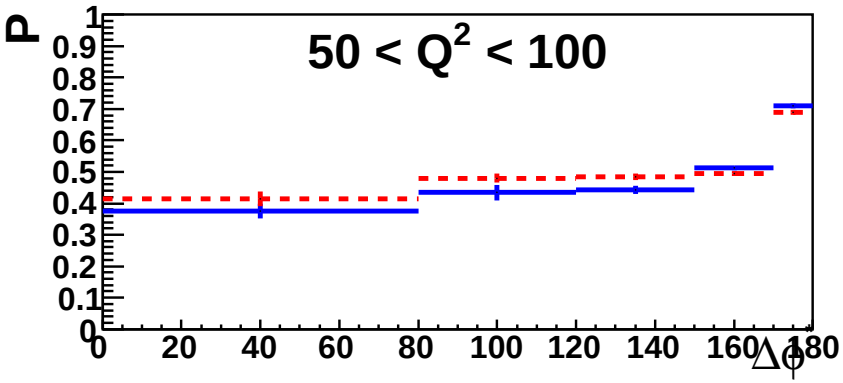






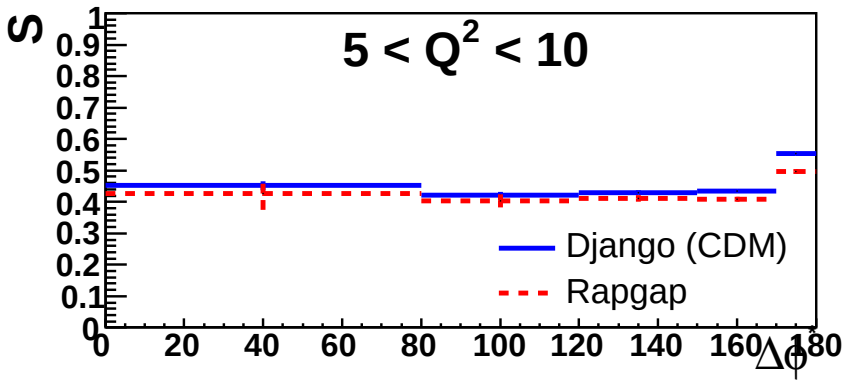


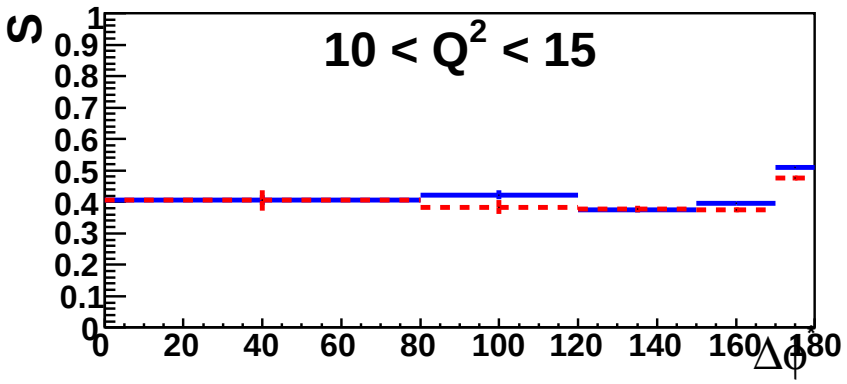


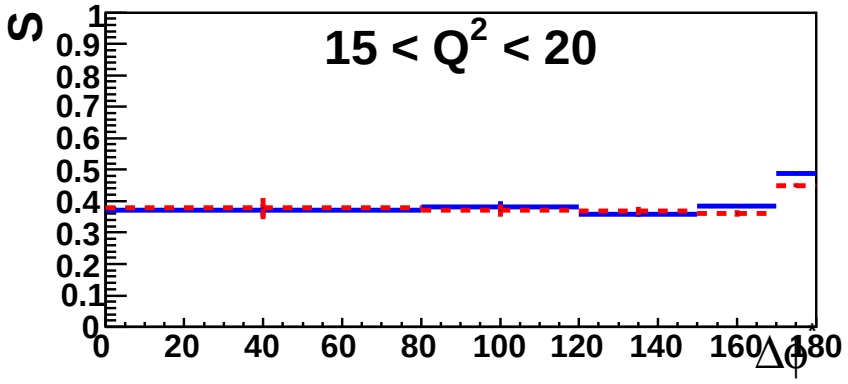


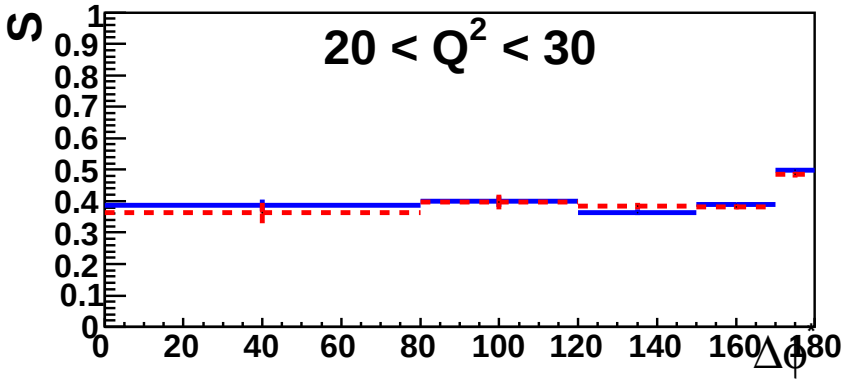
$d\sigma/dQ^2 d\Delta\phi^*$ Stability

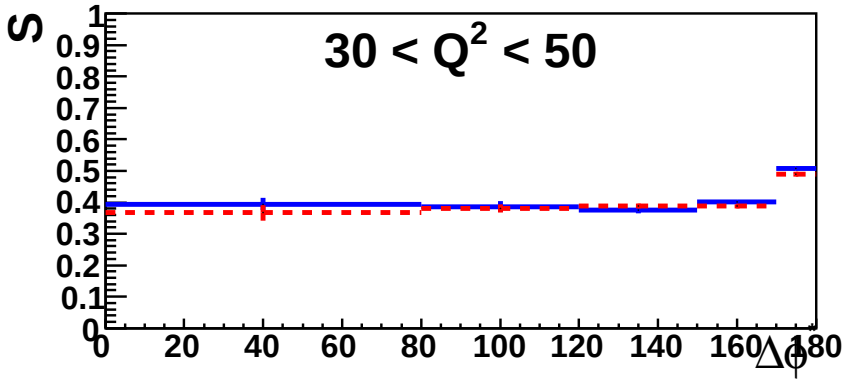
$$S = \frac{N_{DET\&\&HAD}}{N_{HAD}}$$

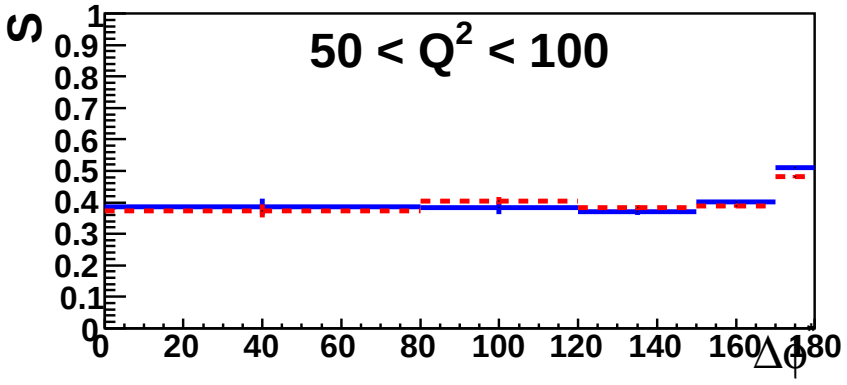




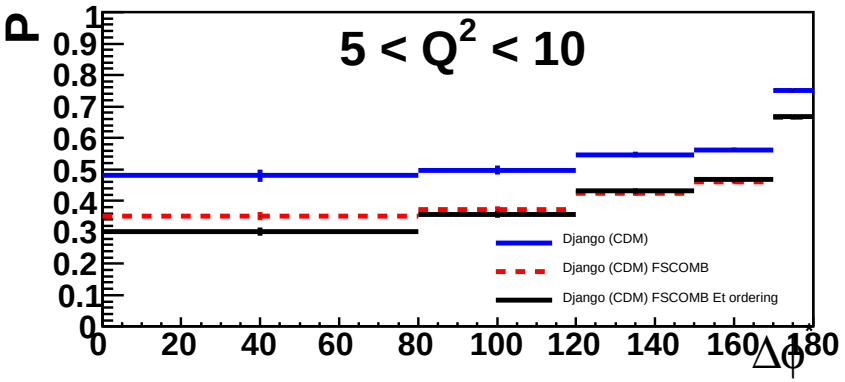


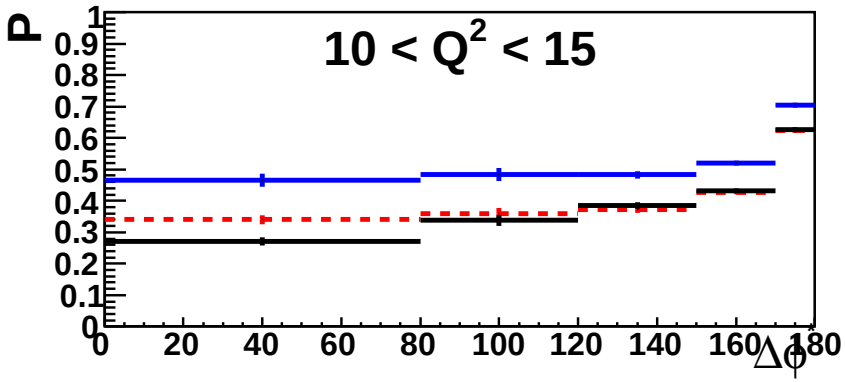


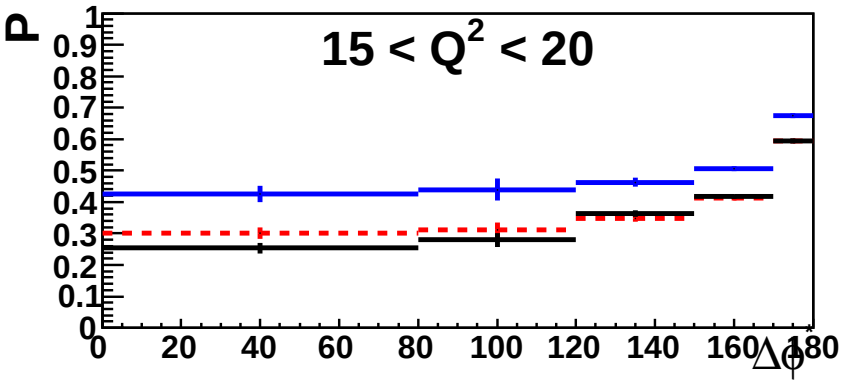


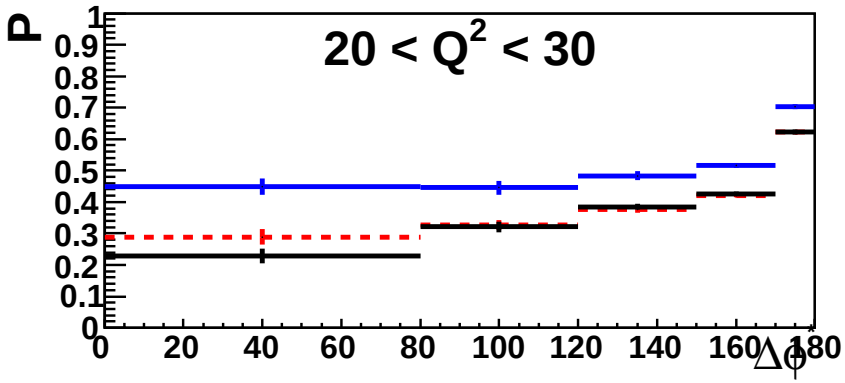


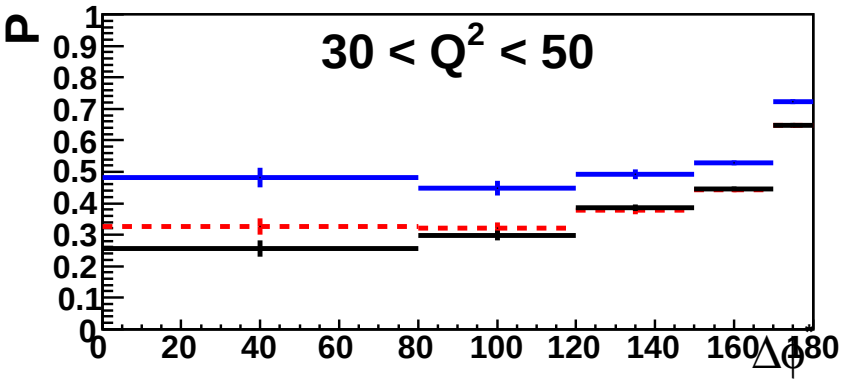
Hadroo2 Vs Fscomb. Romans cuts.

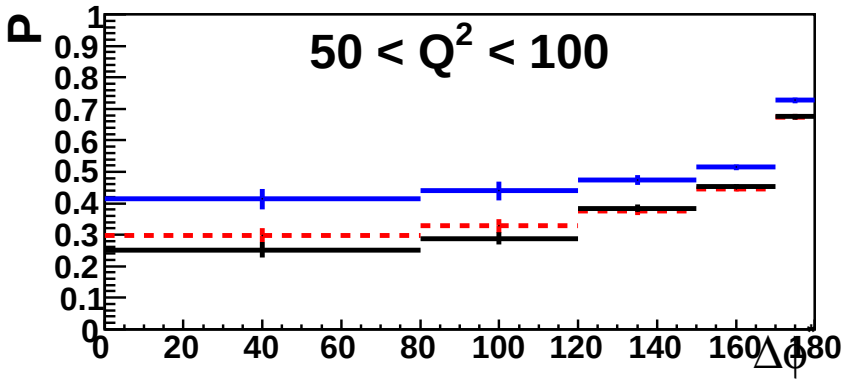












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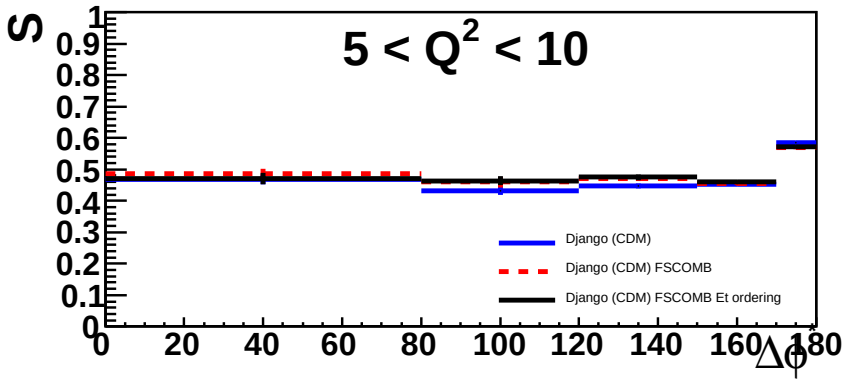
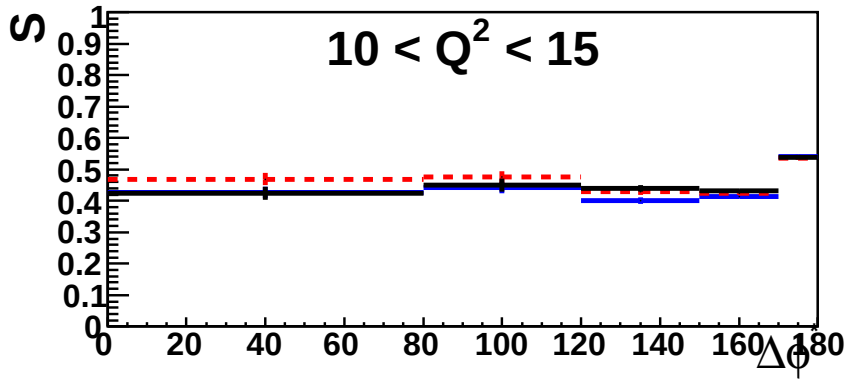
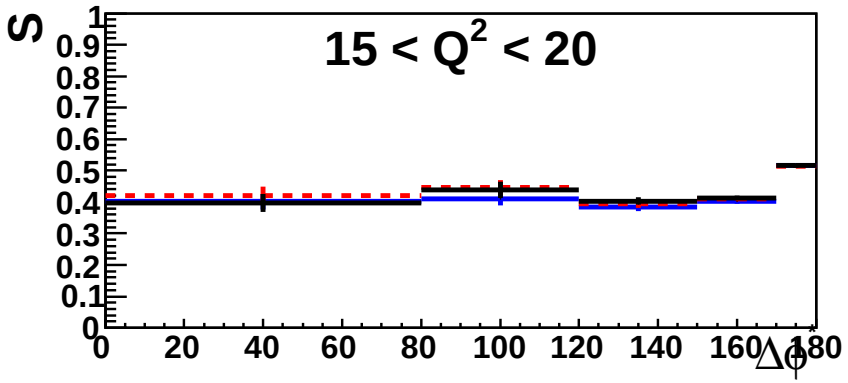
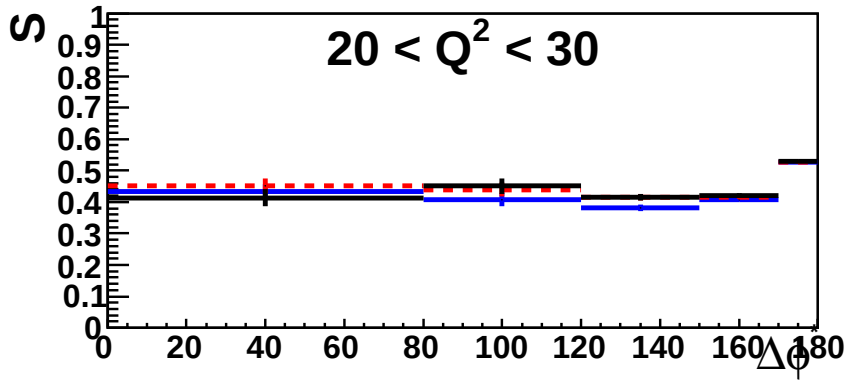
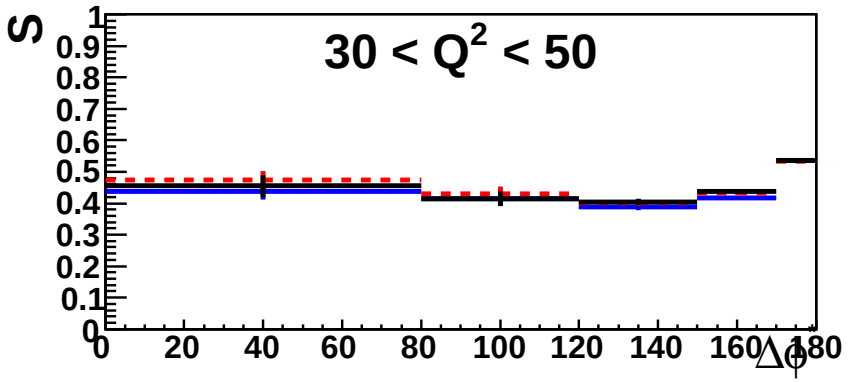
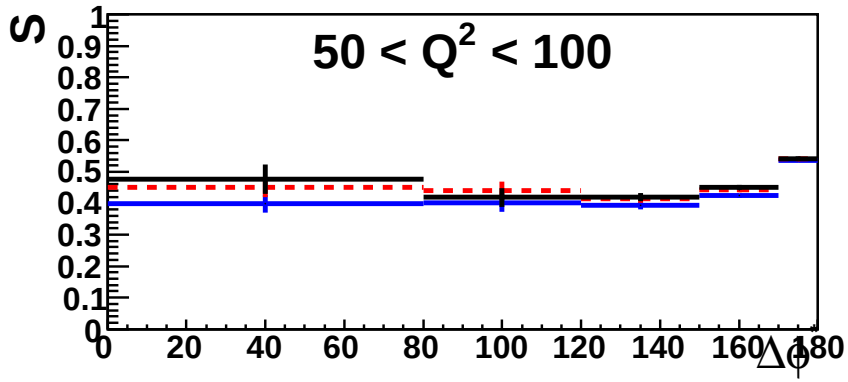






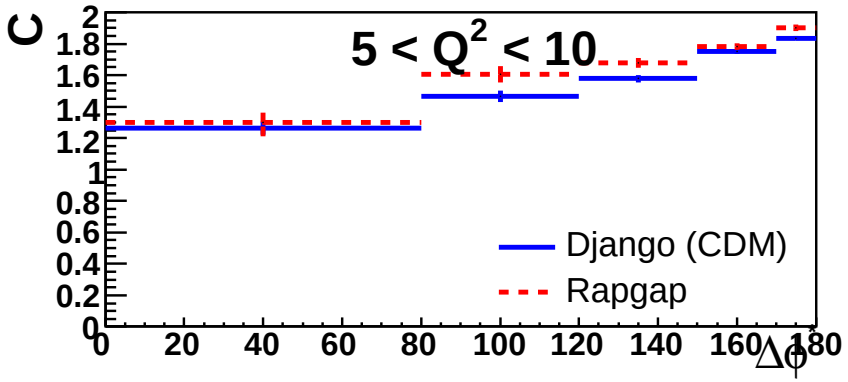


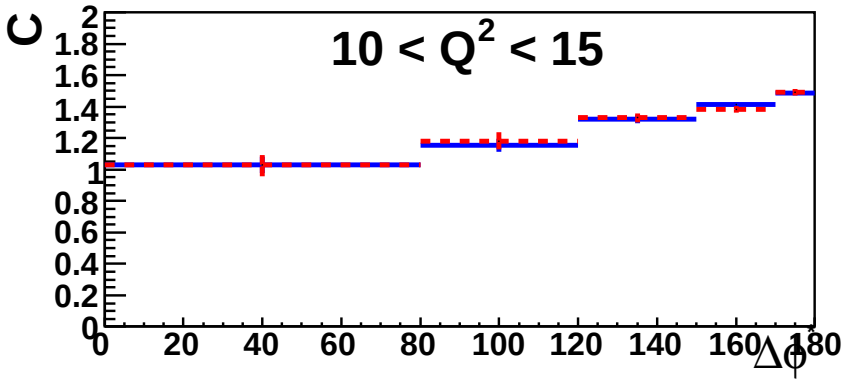


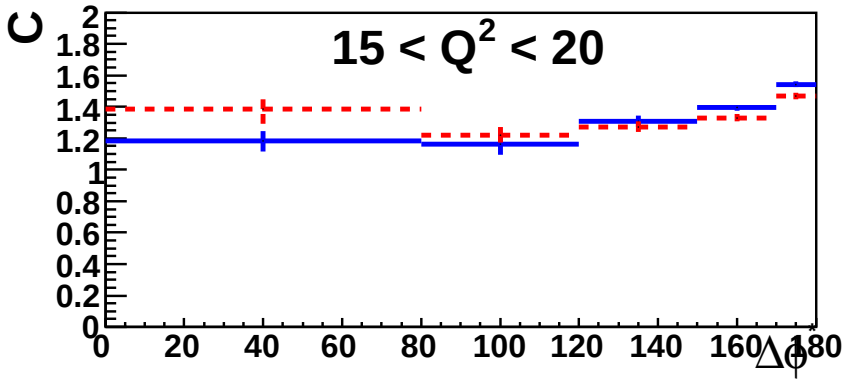


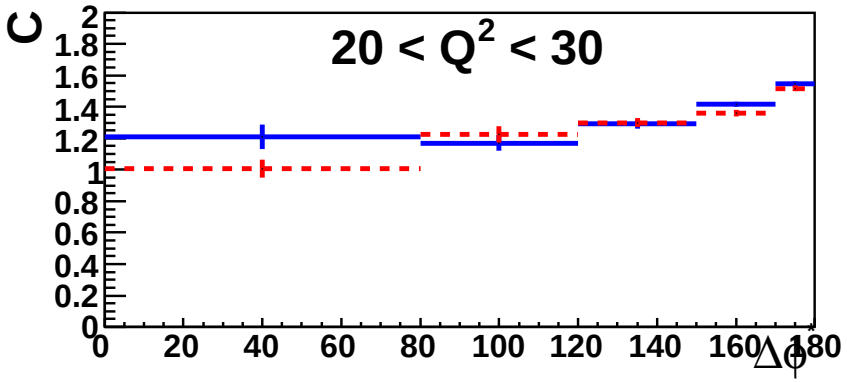
$d\sigma/dQ^2 d\Delta\phi^*$ Corrections

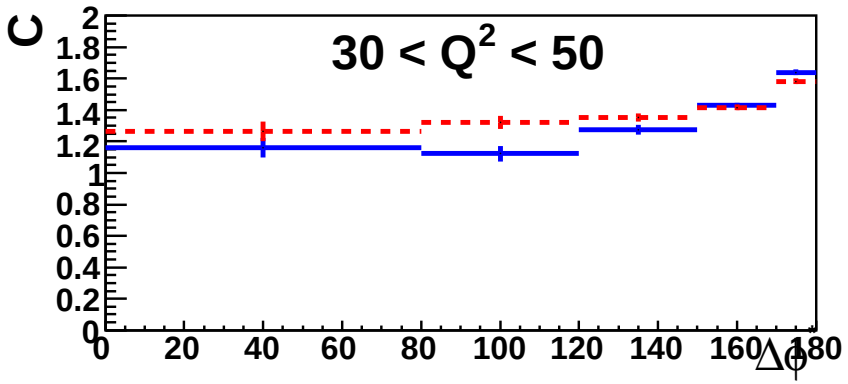
$$C = \frac{N_{HAD,NONRAD}}{N_{DET}}$$

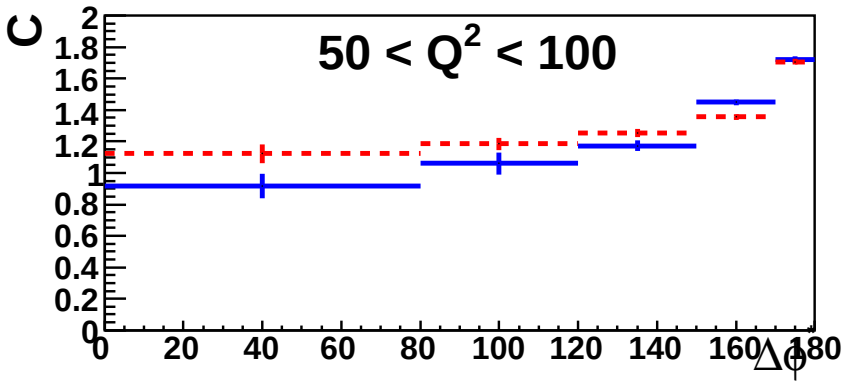




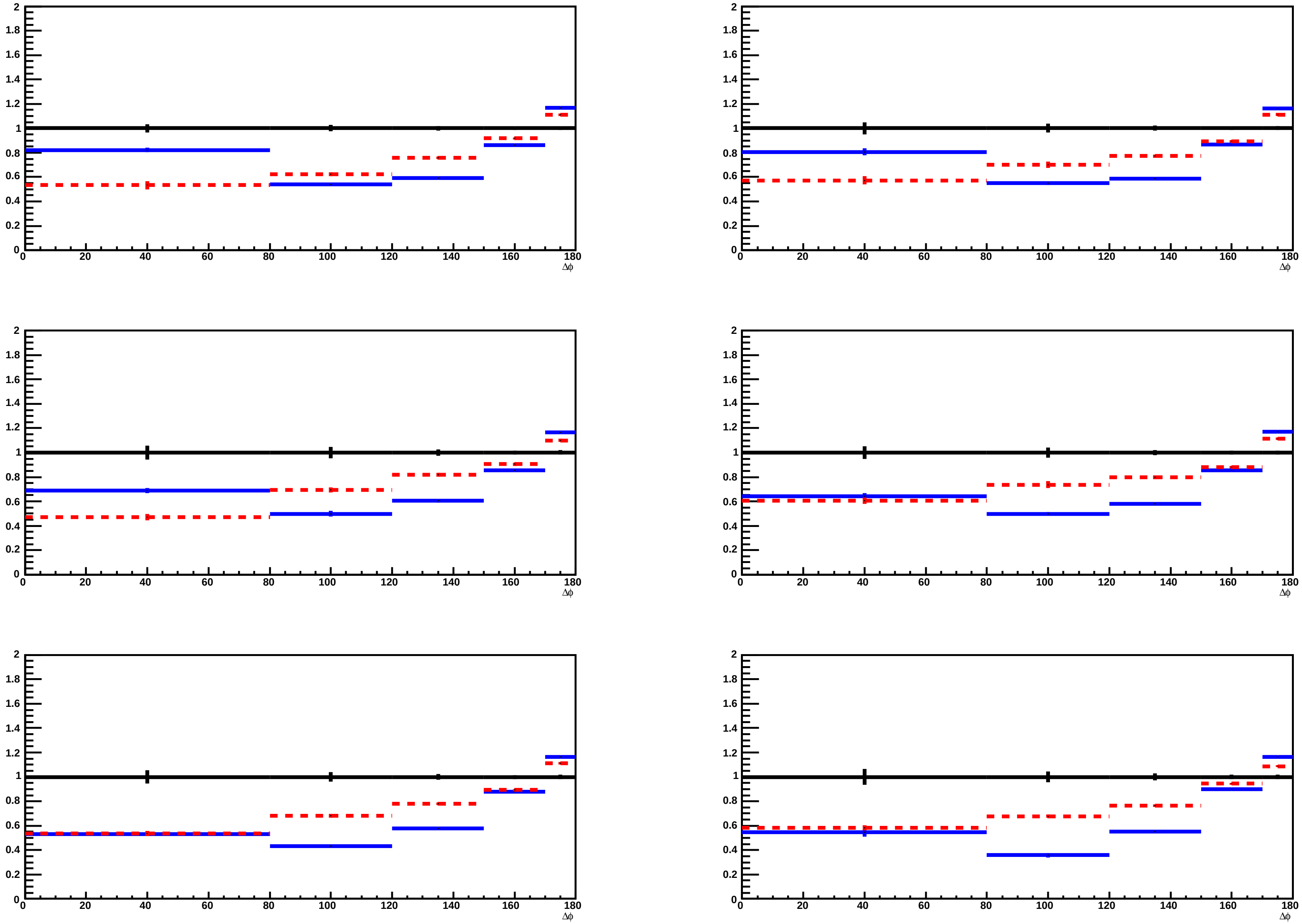








MC/Data, Detector Level: Need Reweighting



$d\sigma/dQ^2 d\Delta\phi^*$

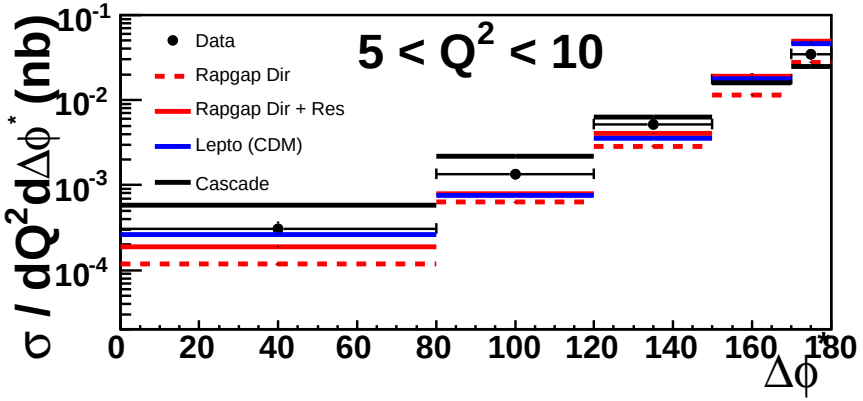
Systematic Uncertainties

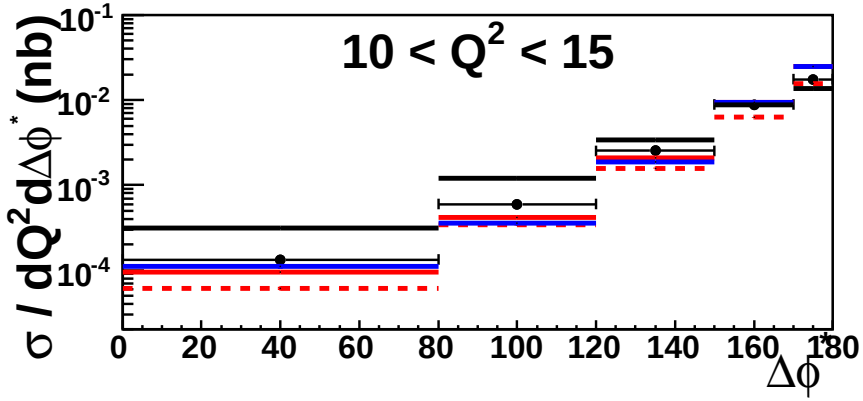
Estimated using Rapgap

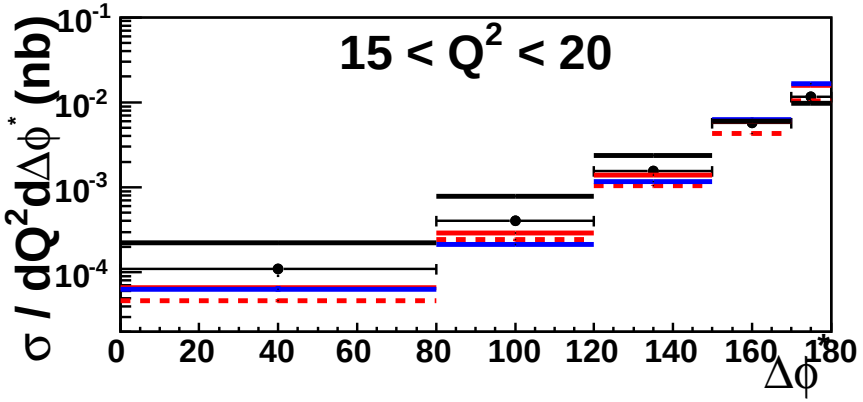
... except model dependence: $\frac{|C_{Rapgap} - C_{Django}|}{2}$

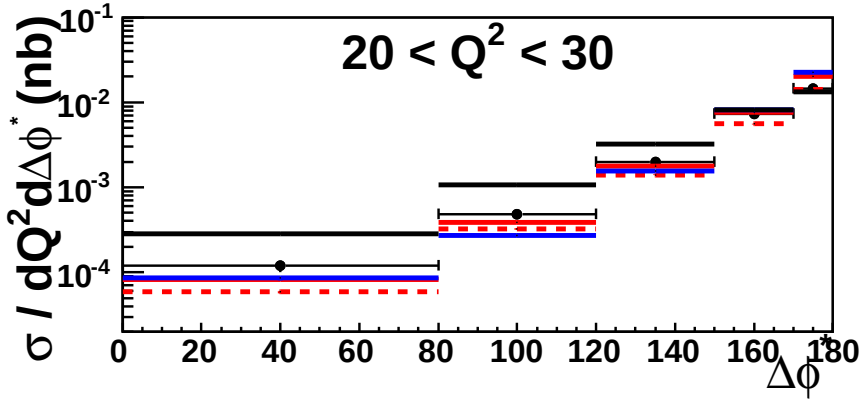
Source		Typical Uncertainty
Electron Energy	$\pm$ 1%	0.5 - 1.7 %
Electron Polar Angle θ_e	$\pm$ 1 mrad	0.3 - 0.9 %
LAr Hadronic Energy	$\pm$ 4%	5 - 10 %
Track Momentum	$\pm$ 3%	$\approx$ 0
Luminosity	$\pm$ 1.5%	1.5 %
Photoproduction		$\approx$ 0
Model Dependence		2 - 10 %

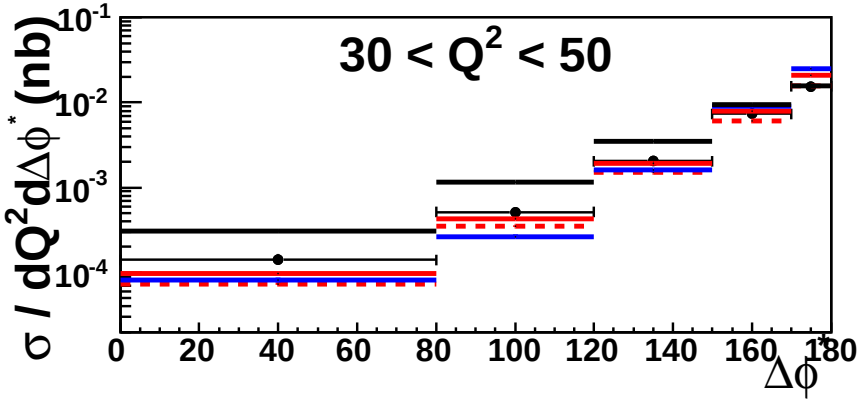
$d\sigma/dQ^2 d\Delta\phi^*$

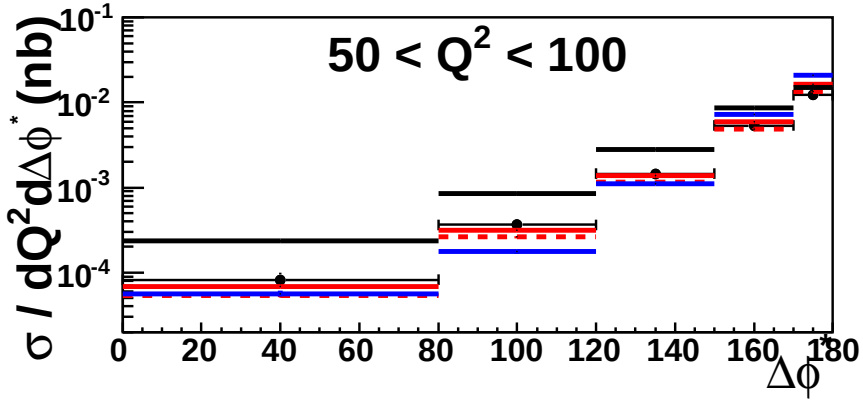




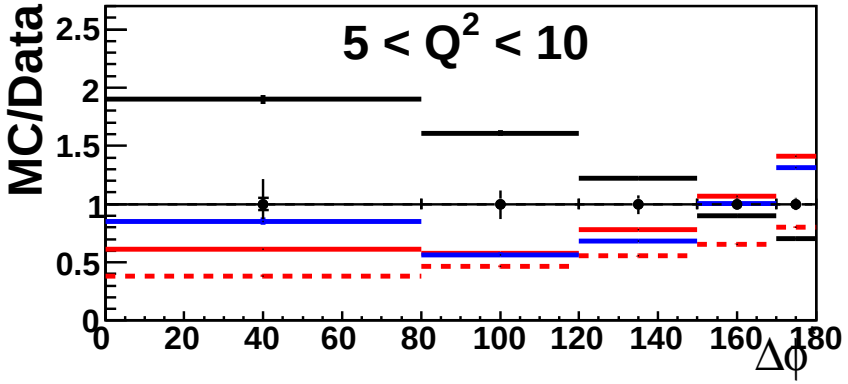


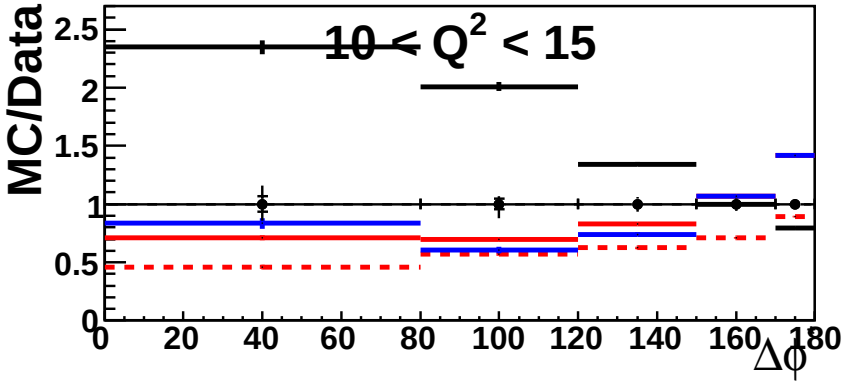


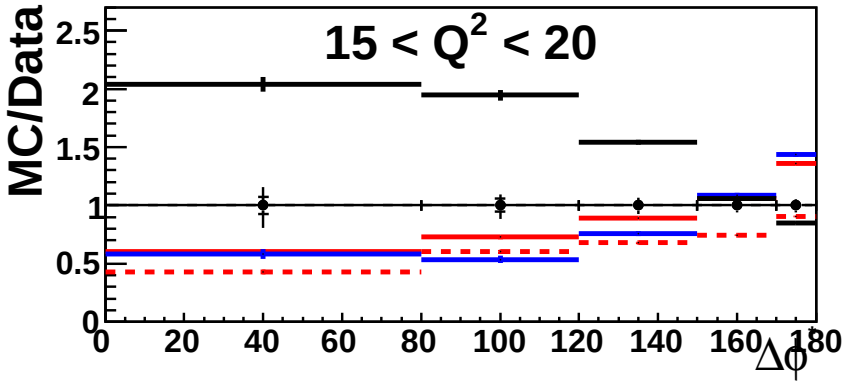


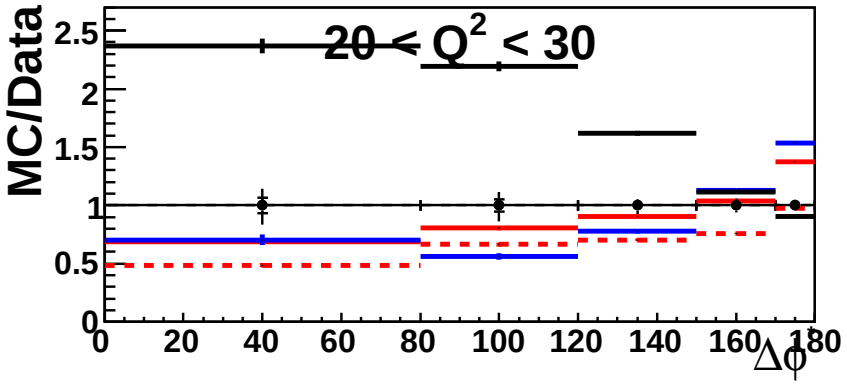


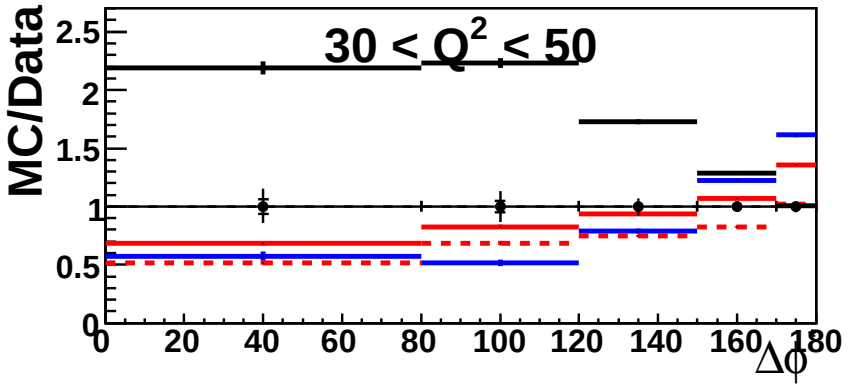
$d\sigma/dQ^2 d\Delta\phi^*$ Ratio

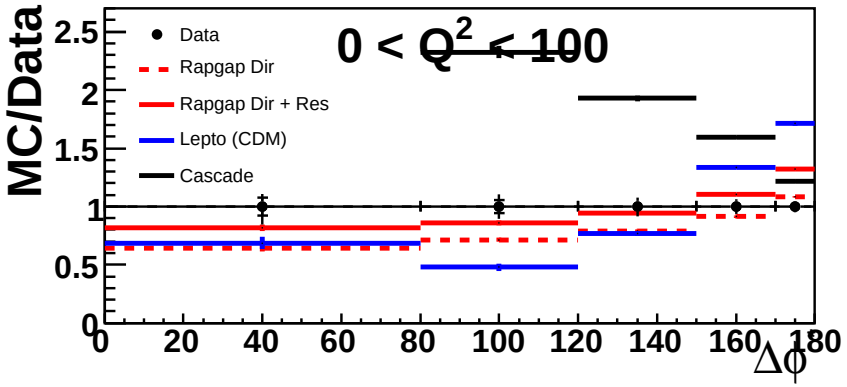




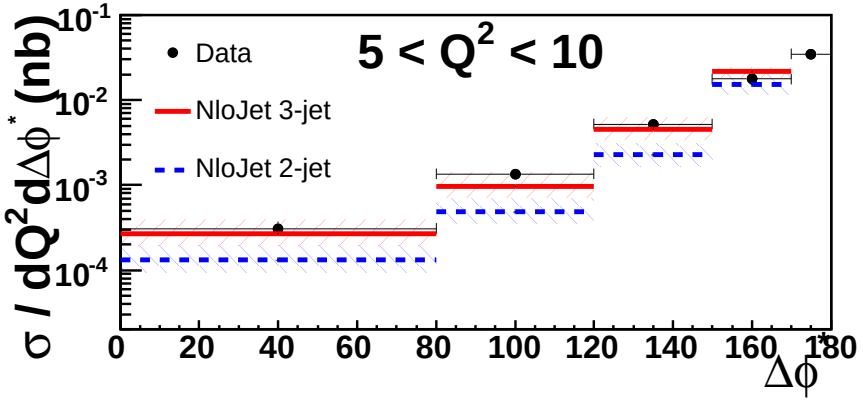


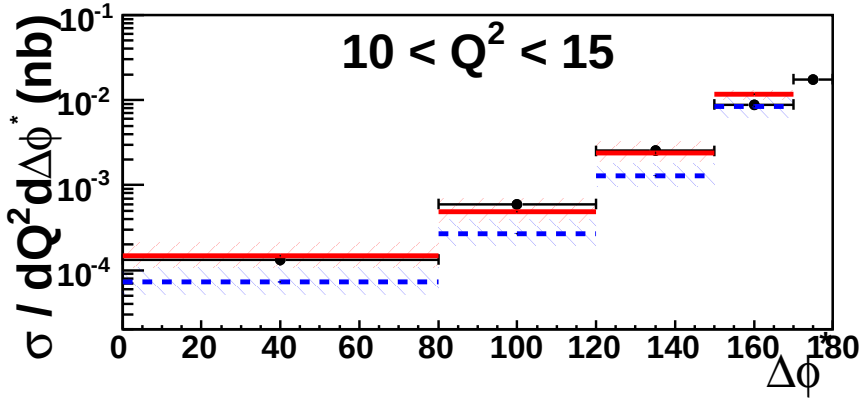


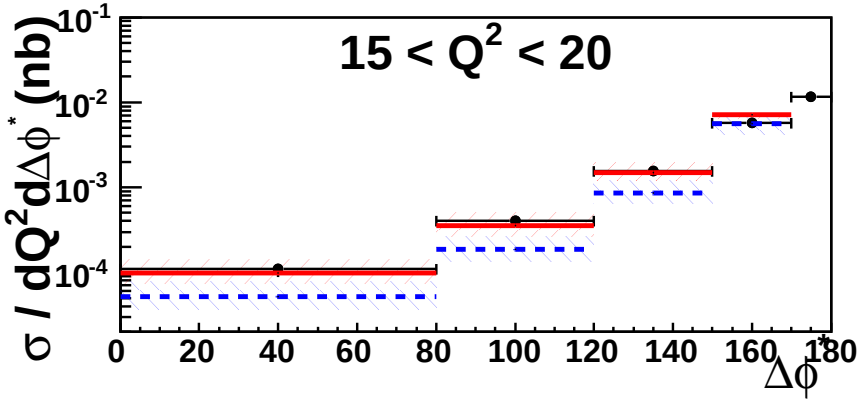


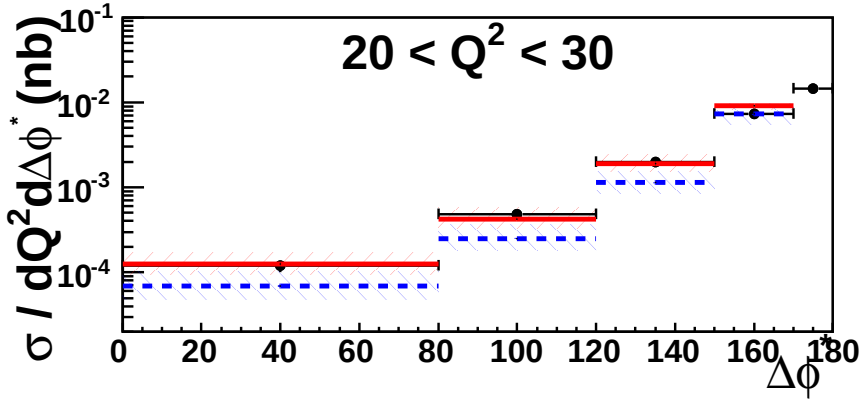


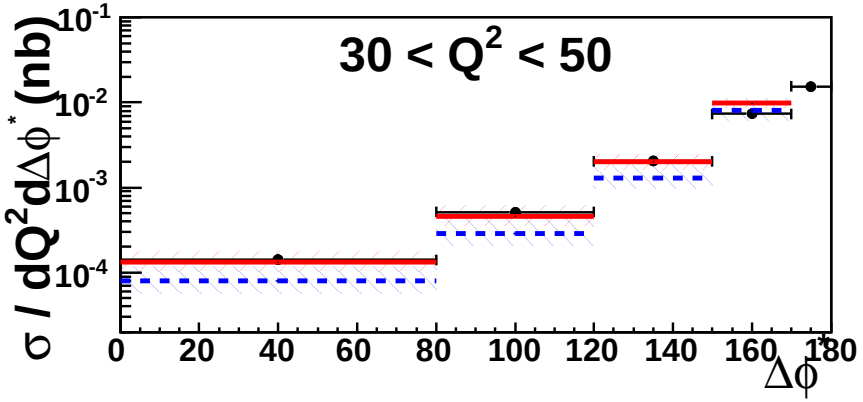
$d\sigma / dQ^2 d\Delta\phi^*$

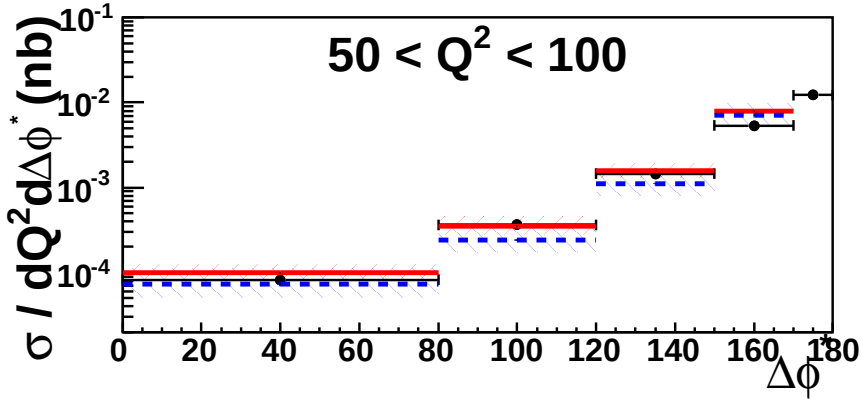




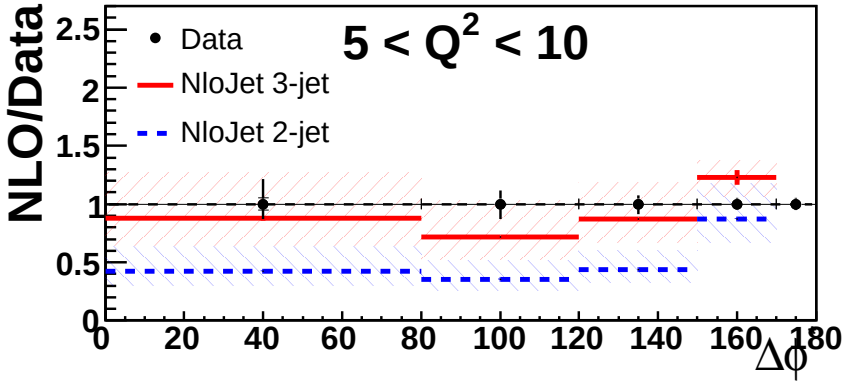


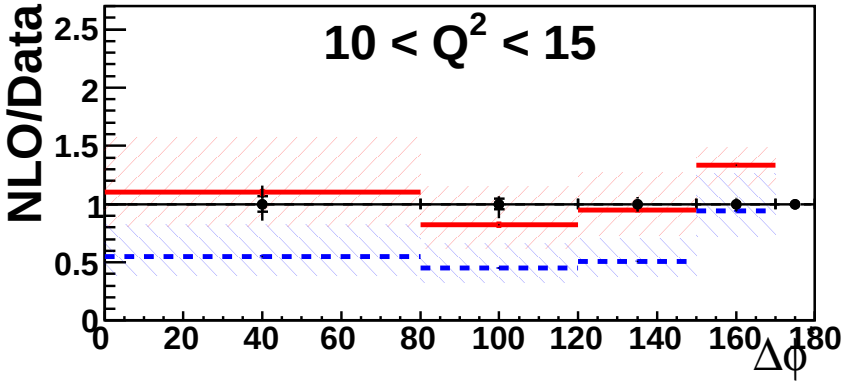


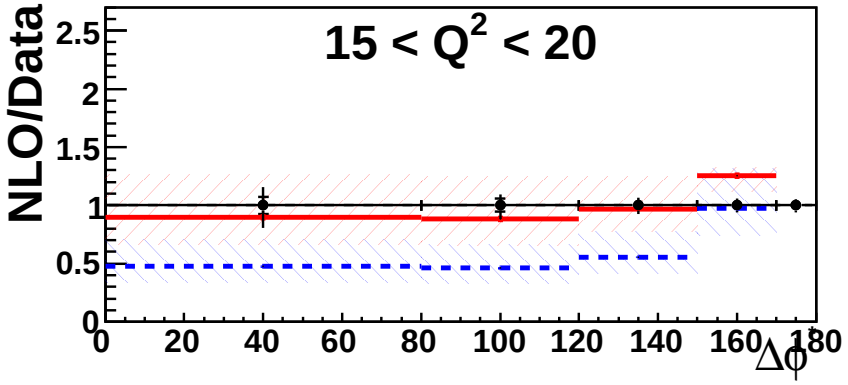


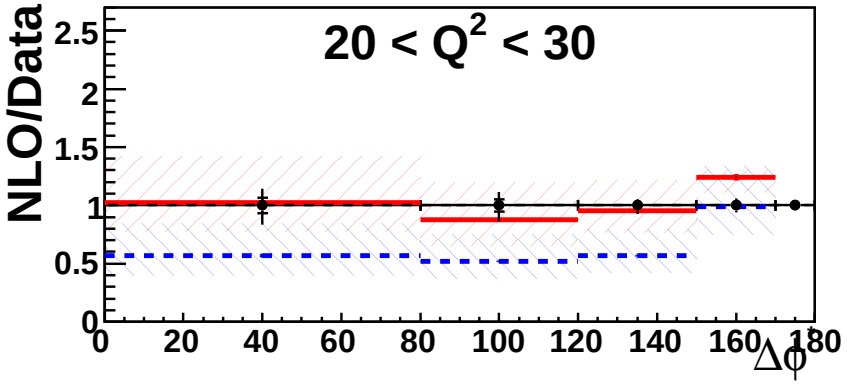


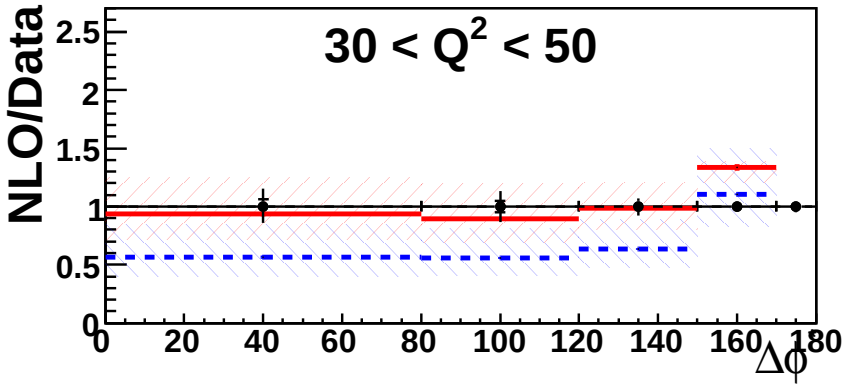
$d\sigma/dQ^2 d\Delta\phi^*$ Ratio

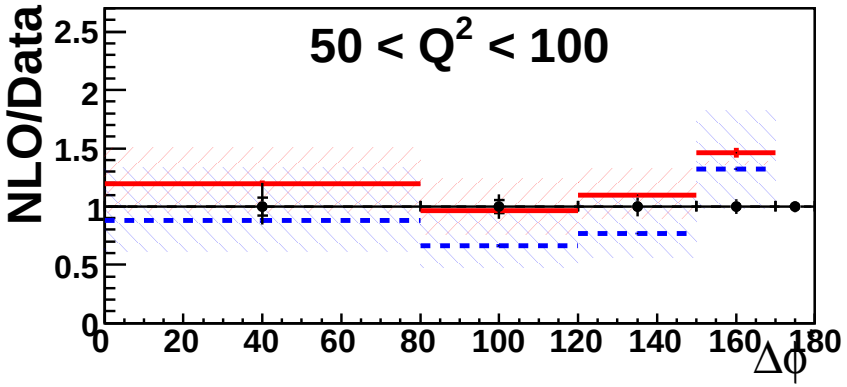




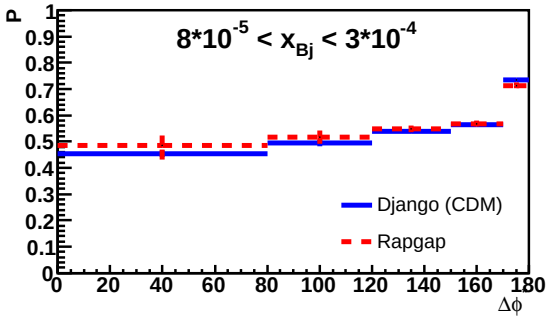


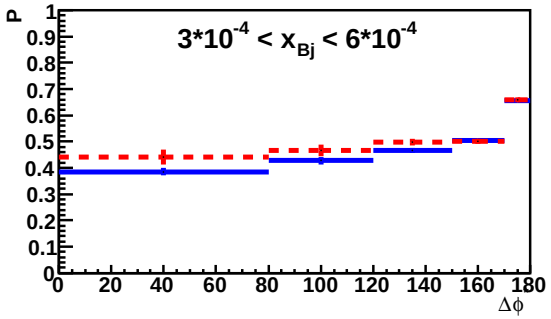


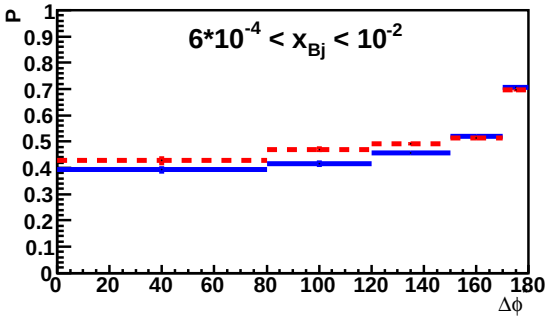


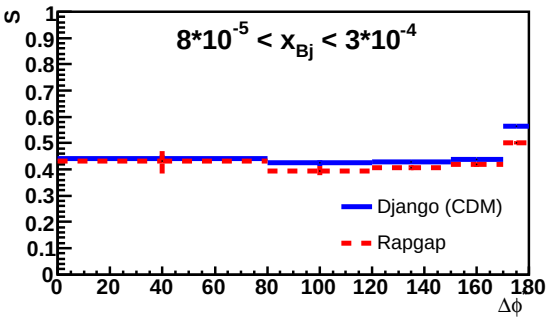


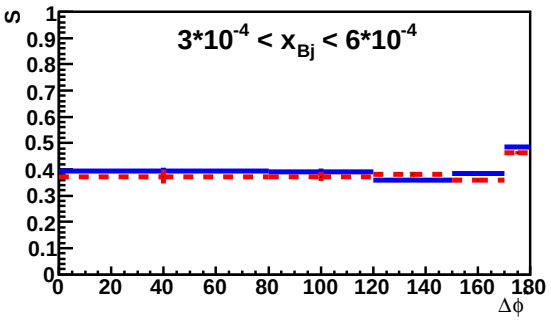
$d\sigma/dx_{bj}d\Delta\phi^*$ Purity and Stability

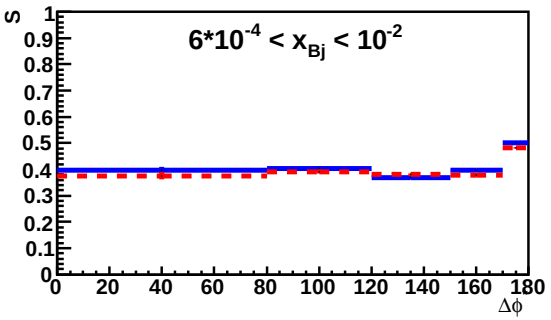


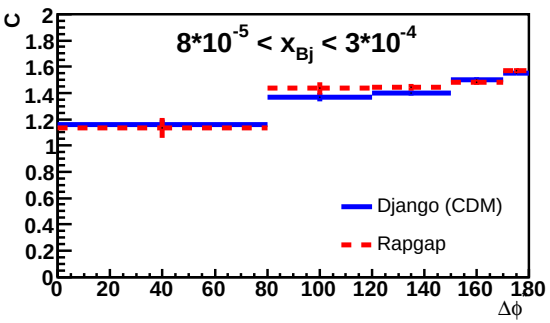


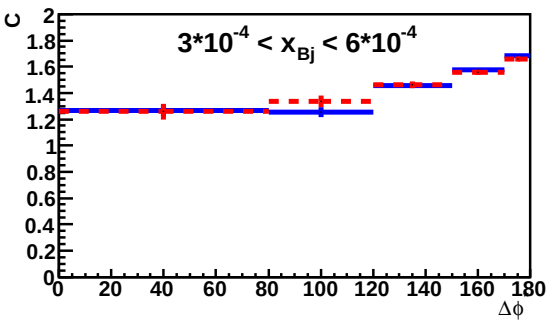


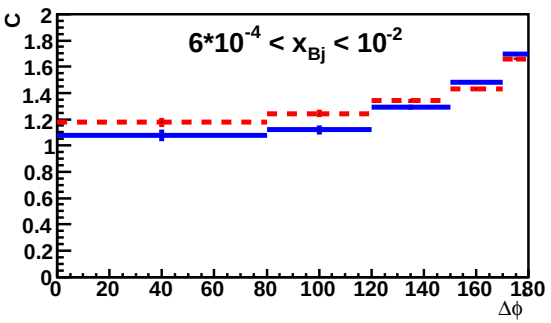












$d\sigma/dx_{bj}d\Delta\phi^*$

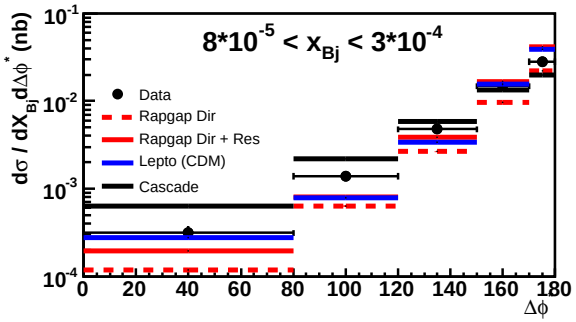
Systematic Uncertainties

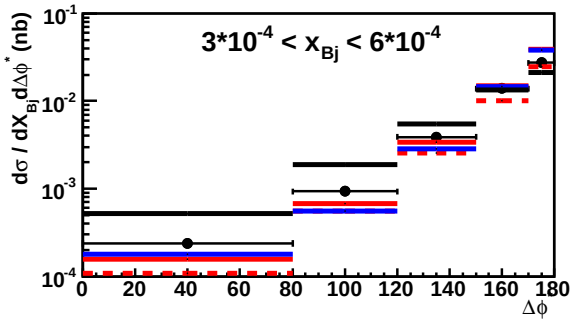
Estimated using Rapgap

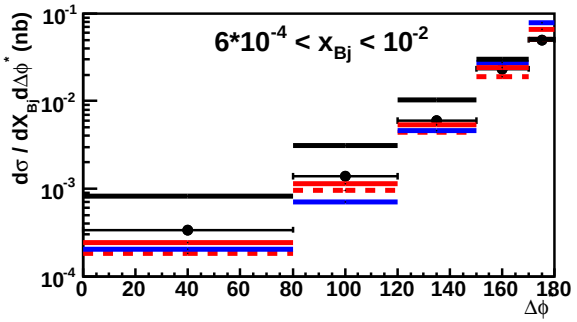
... except model dependence: $\frac{|C_{Rapgap} - C_{Django}|}{2}$

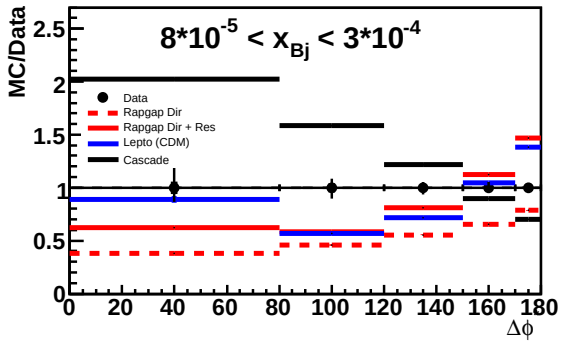
Source		Typical Uncertainty
Electron Energy	$\pm$ 1%	0.5 - 1.7 %
Electron Polar Angle θ_e	$\pm$ 1 mrad	0.3 - 0.9 %
LAr Hadronic Energy	$\pm$ 4%	5 - 10 %
Track Momentum	$\pm$ 3%	$\approx$ 0
Luminosity	$\pm$ 1.5%	1.5 %
Photoproduction		$\approx$ 0
Model Dependence		2 - 10 %

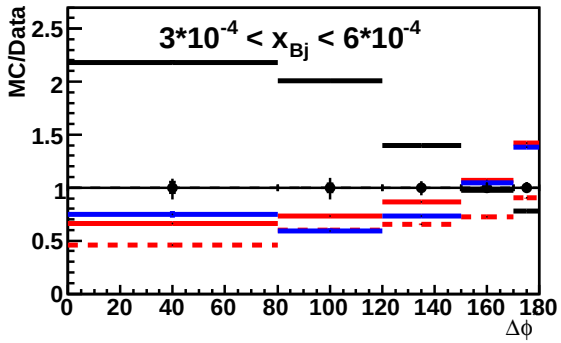
$d\sigma/dx_{bj}d\Delta\phi^*$

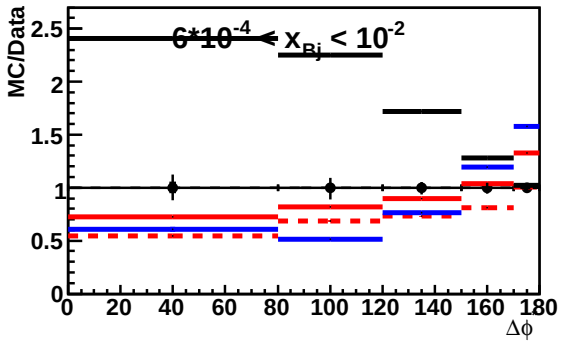




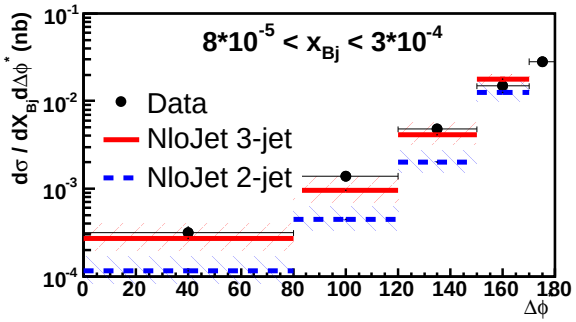


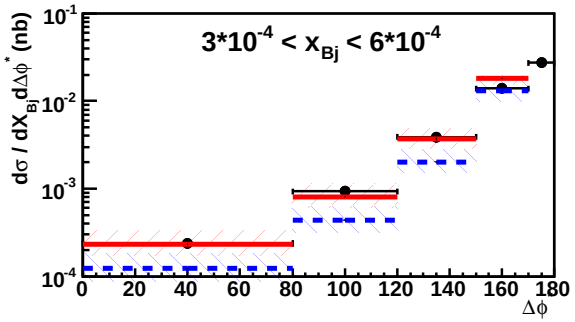


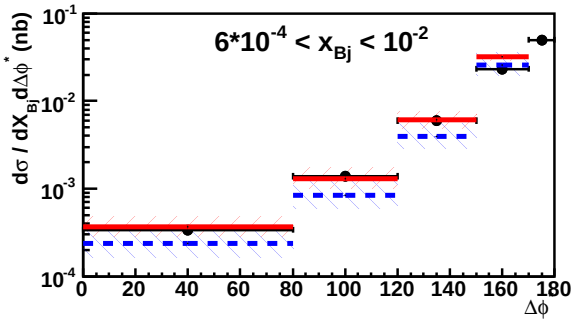


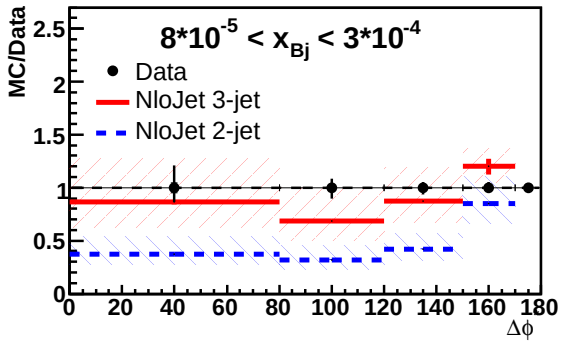


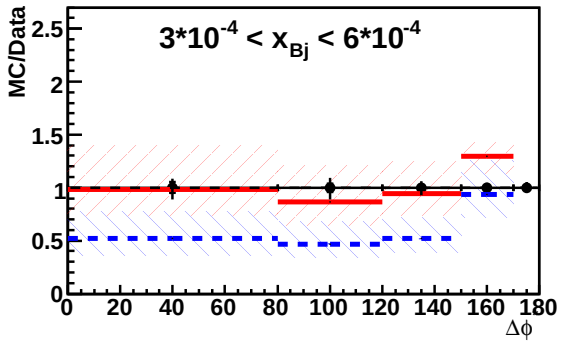
$d\sigma/dx_{bj}d\Delta\phi^*$

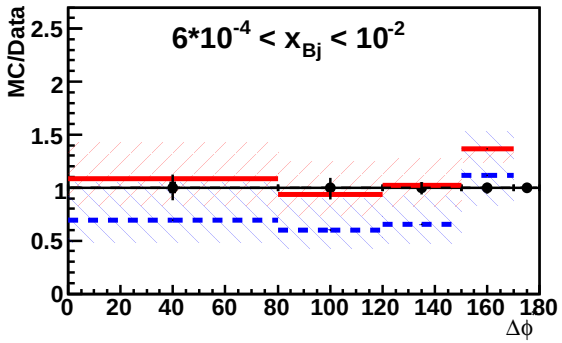










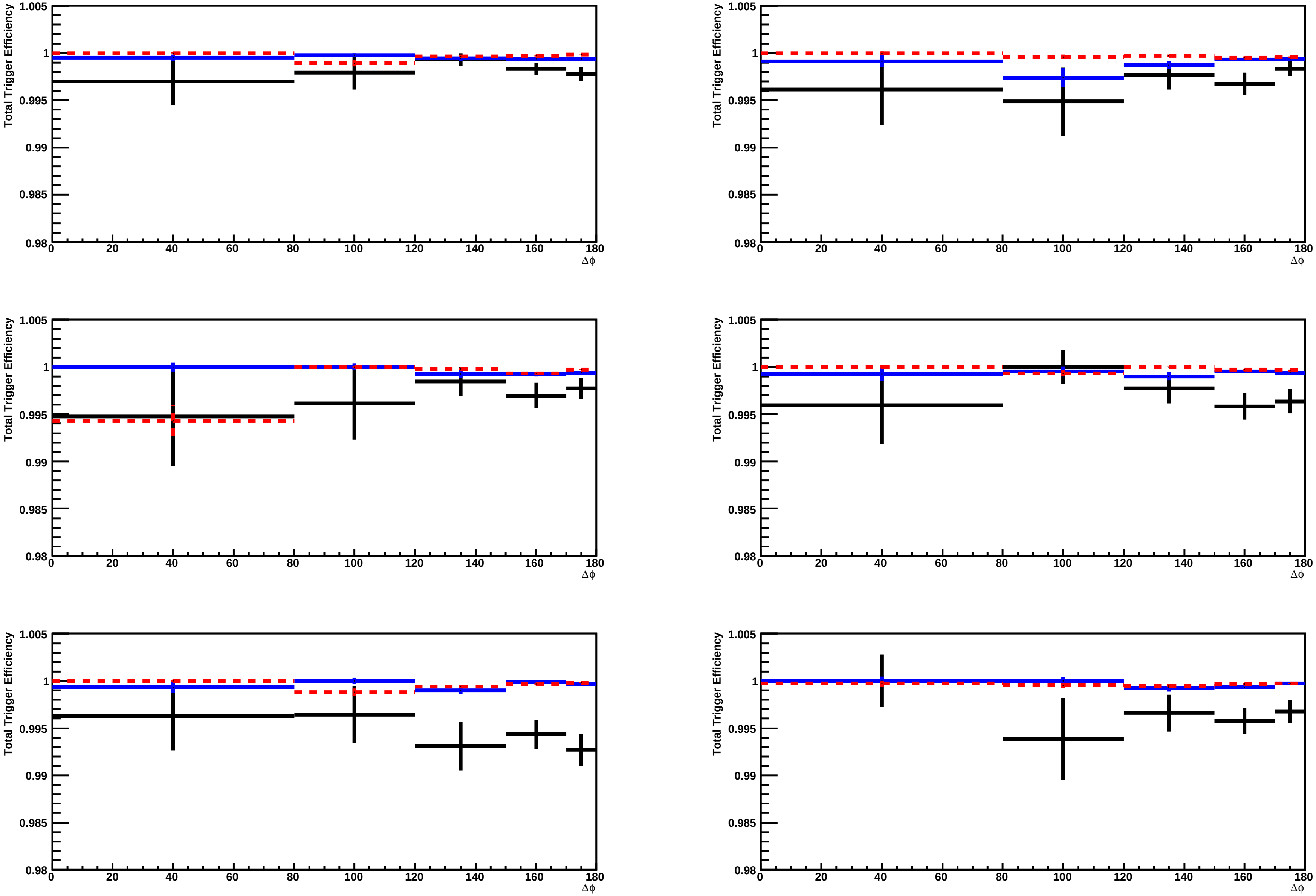


Summary

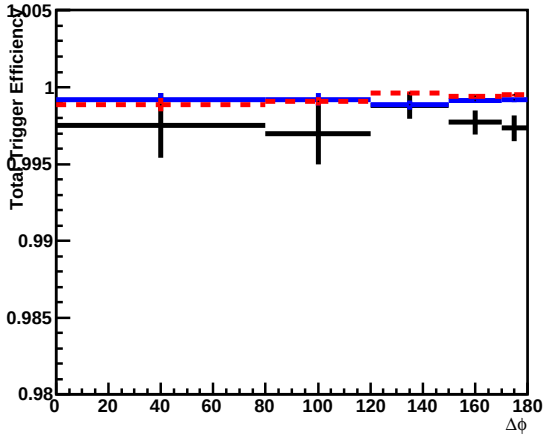
- Azimuthal correlations measured in bins of Q^2 and in bins of x_{Bj}
- Rapgap (Dir+Res) and Lepto(CDM) undershoots the data at small $\Delta\phi^*$ and overshoots at $\Delta\phi^* \sim 180^\circ$
- Cascade overshoot the data at small $\Delta\phi^*$ and undershoot at $\Delta\phi^* \sim 180^\circ$
- NLO 2-jet undershoot data except at high Q^2 and high x
- NLO 3-jet describes the data everywhere
- Aiming for preliminary to DIS06

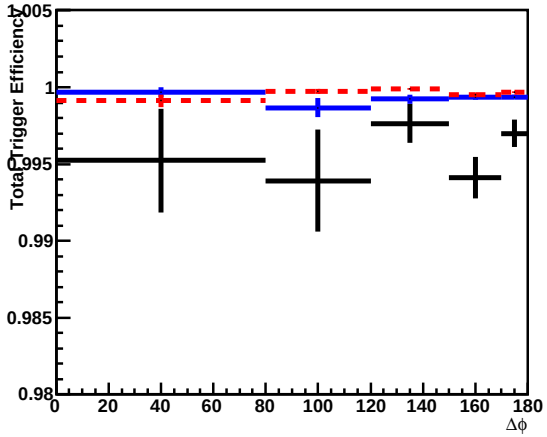
- To be done:
- Reweighting
- Control plots in analysis bins
- Cross check Romans S-distributions

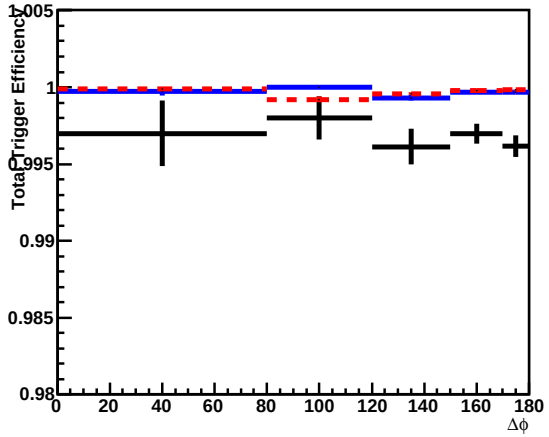
Trigger Efficiency (S0 OR S61) in Q^2 bins



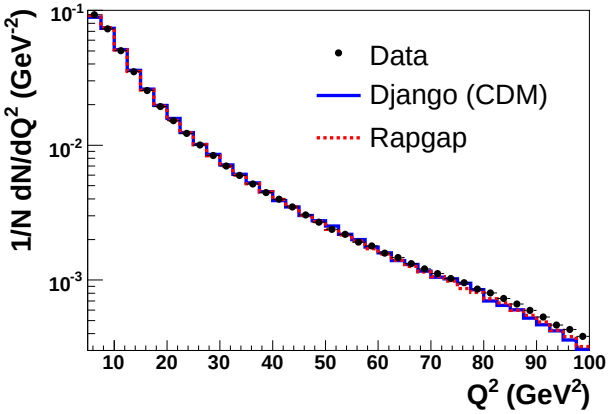
Trigger Efficiency (S0 OR S61) in x_{Bj} bins

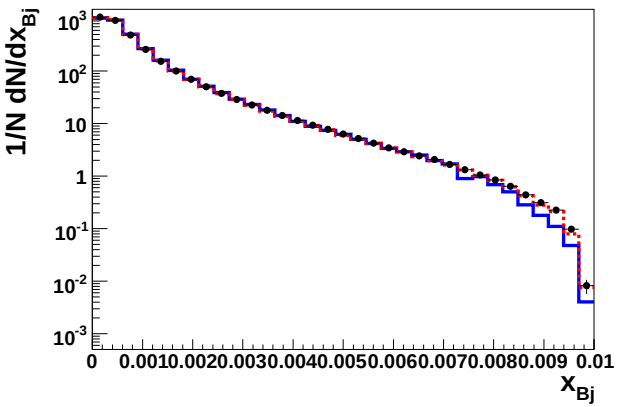


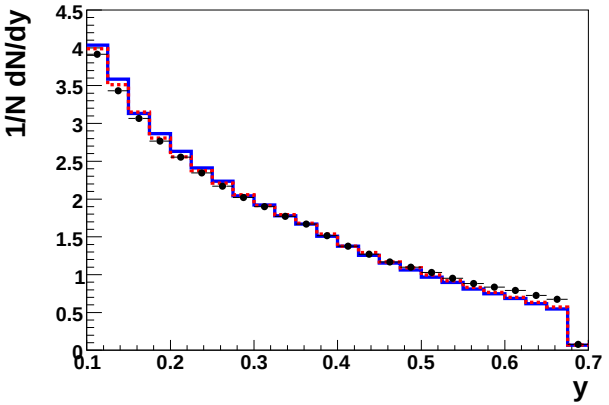


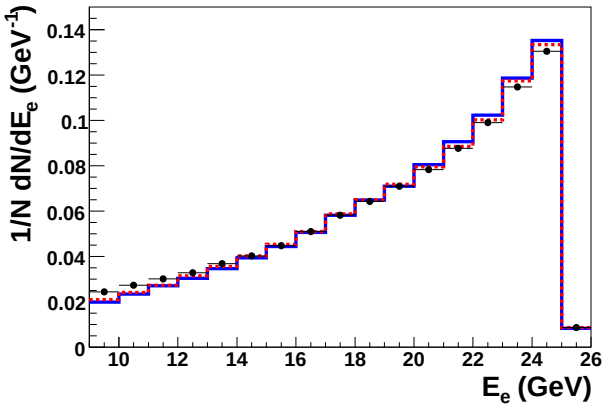


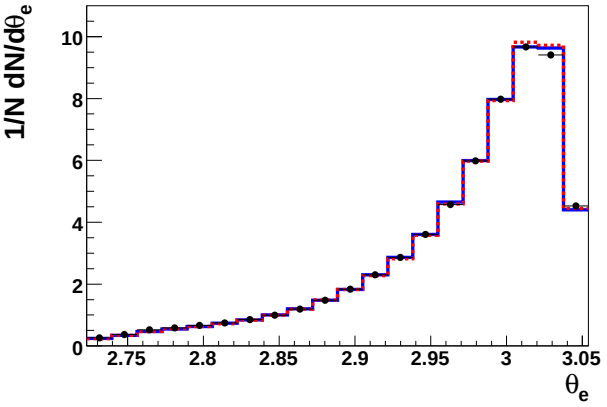
Control Plots DIS Sample

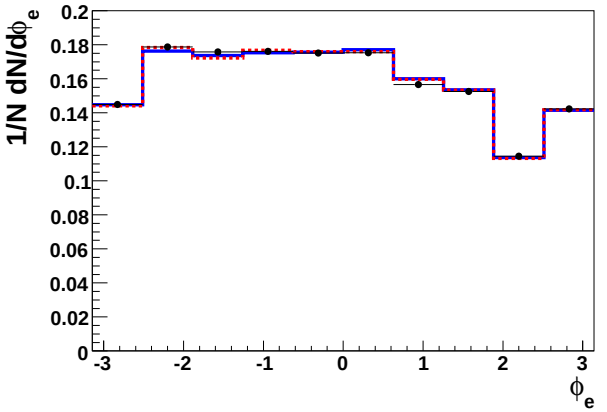




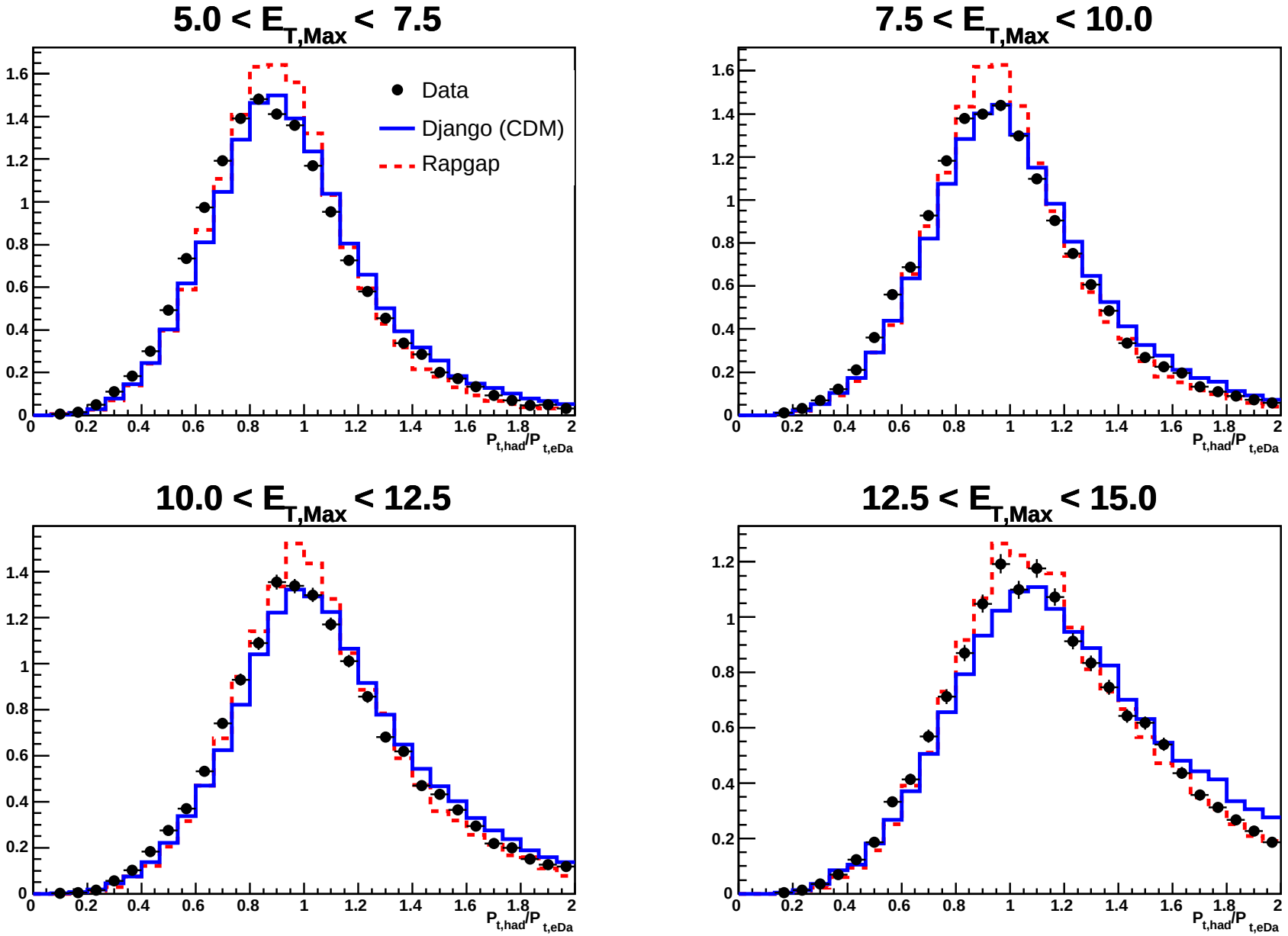




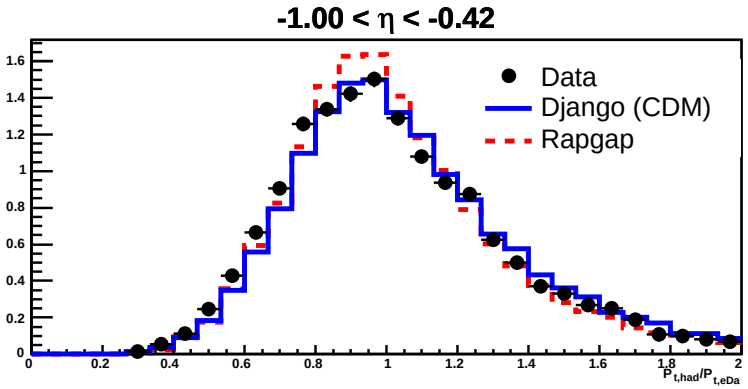


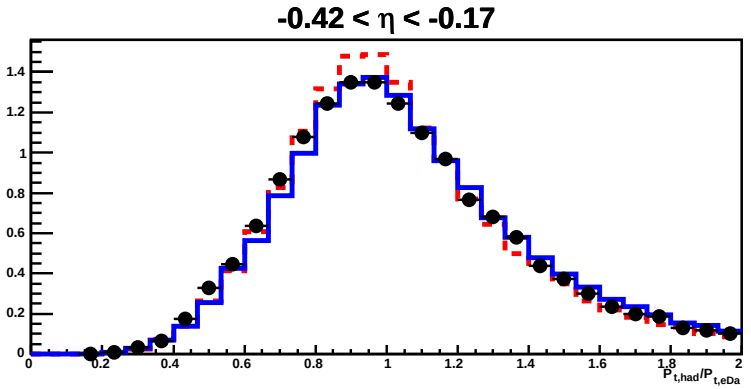


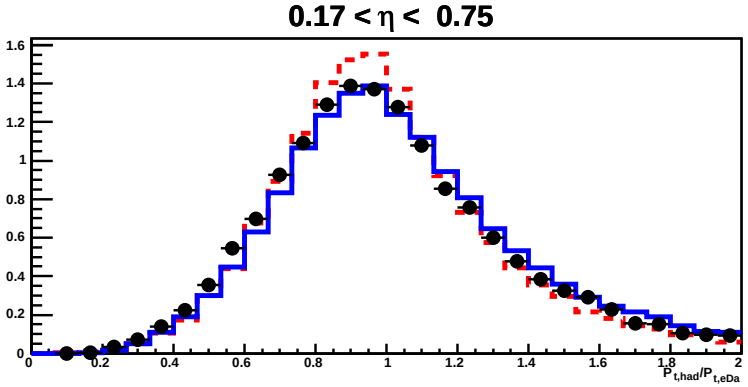
Pt Balance

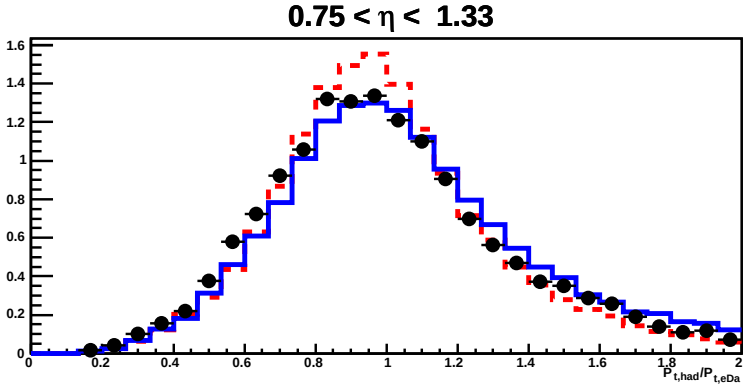

5.0 < E_T,Max < 7.5
7.5 < E_T,Max < 10.0
10.0 < E_T,Max < 12.5
12.5 < E_T,Max < 15.0
Data
Django (CDM)
Rapgap
P_t,had/P_t,eDa

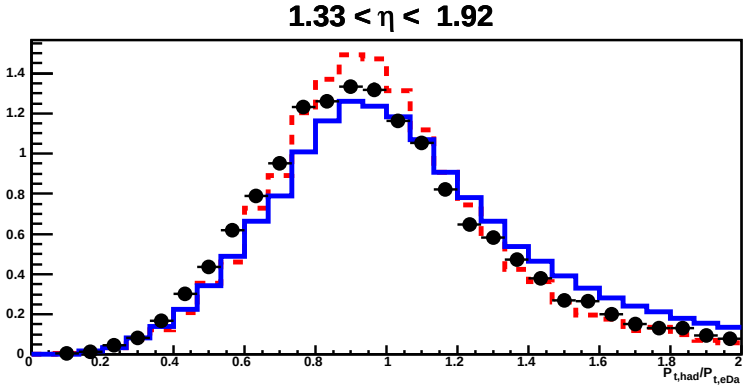
Pt Balance

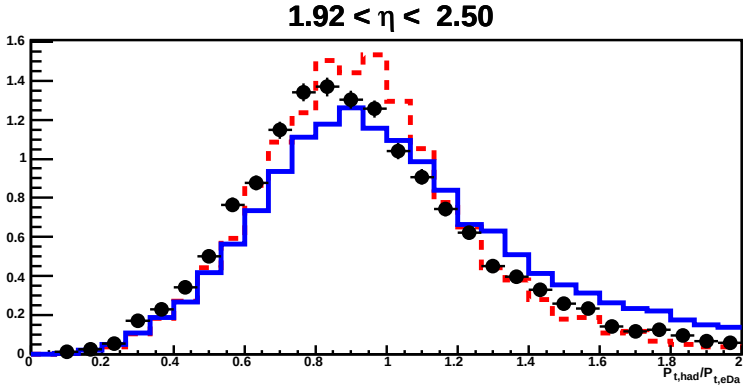

-1.00 < η < -0.42
Data
Django (CDM)
Rapgap
P_t,had/P_t,eDa


-0.42 < η < -0.17
P_t,had/P_t,eDa

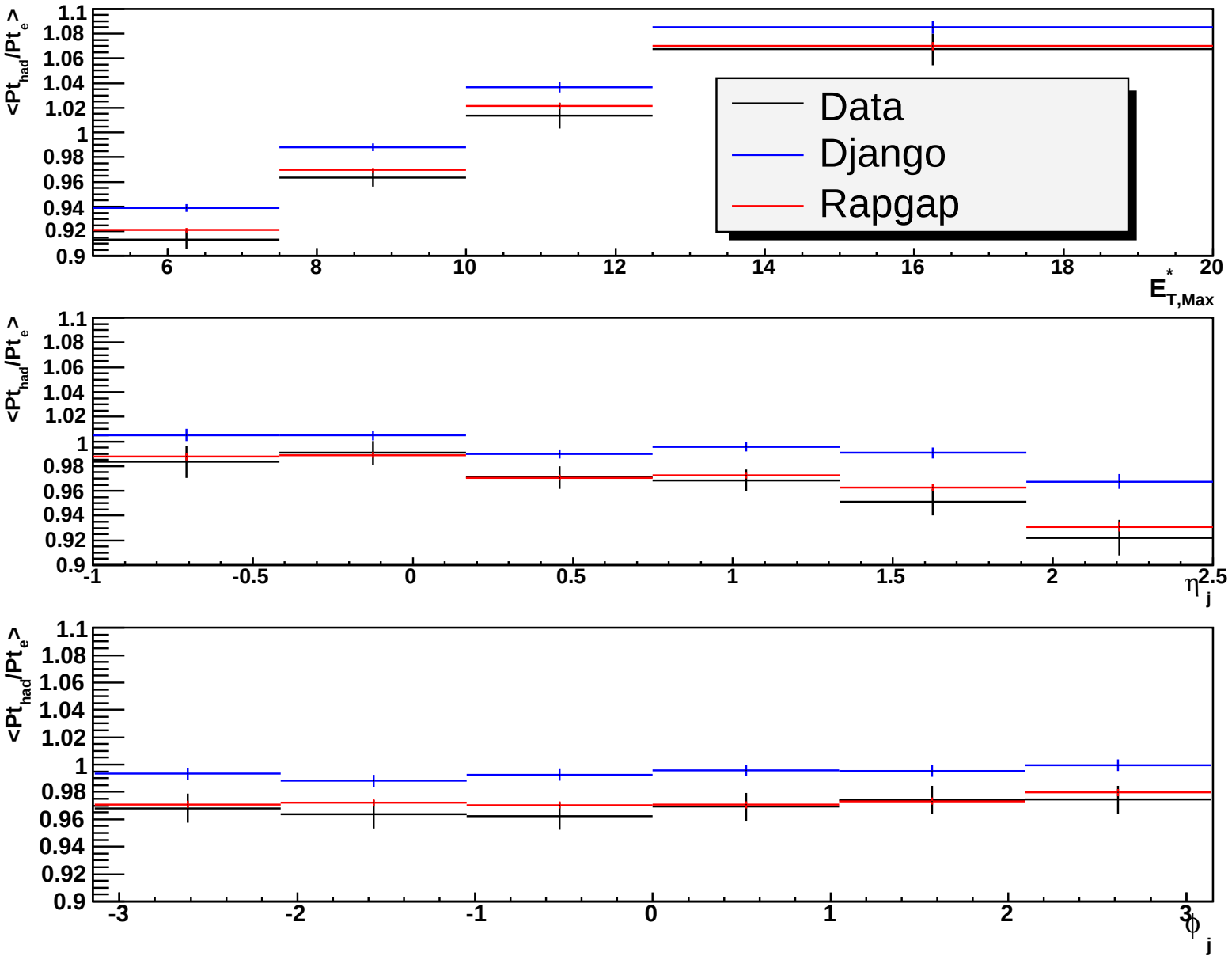

0.17 < η < 0.75
P_t,had/P_t,eDa


0.75 < η < 1.33
P_t,had/P_t,eDa

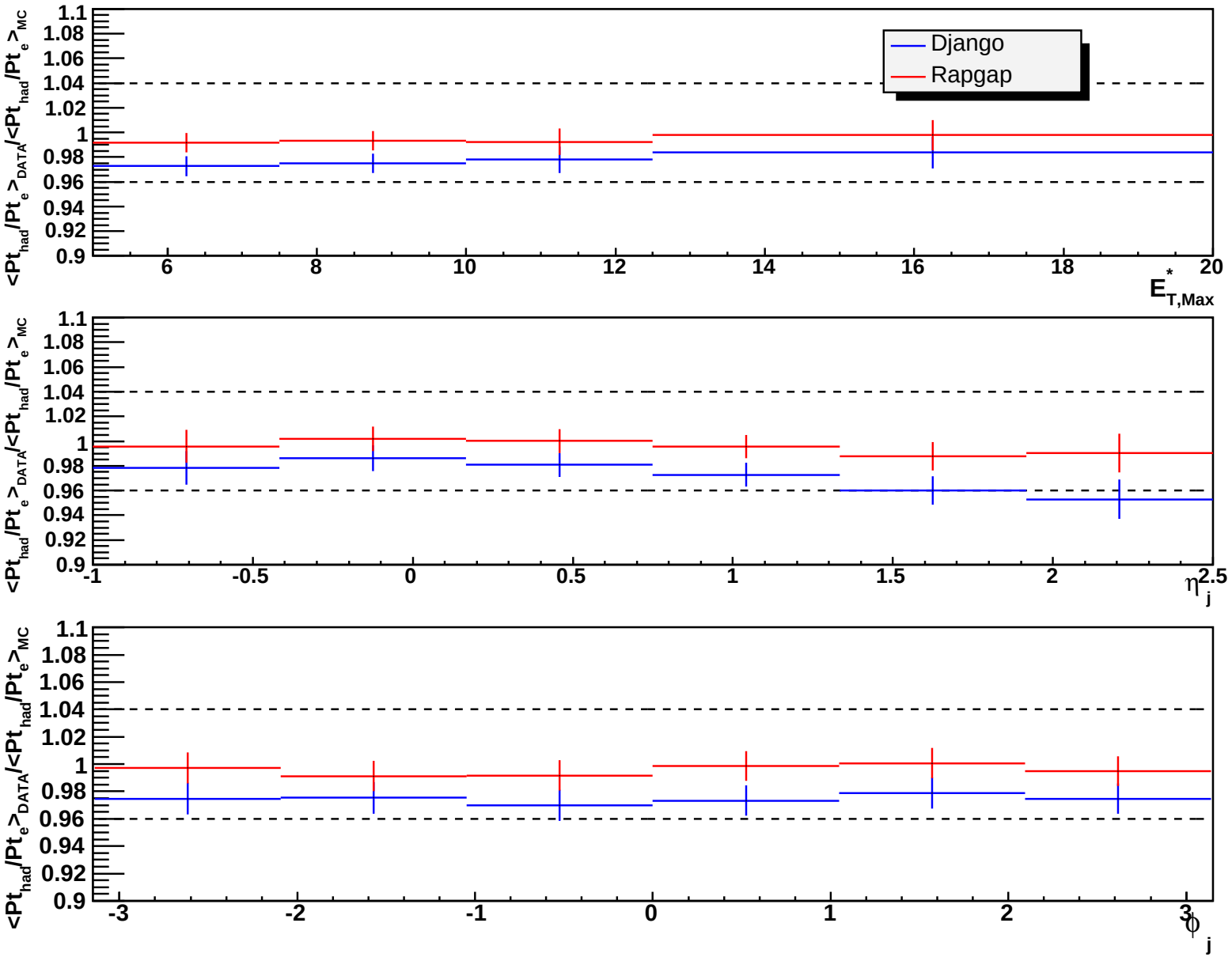

1.33 < η < 1.92
P_t,had/P_t,eDa


1.92 < η < 2.50
P_t,had/P_t,eDa

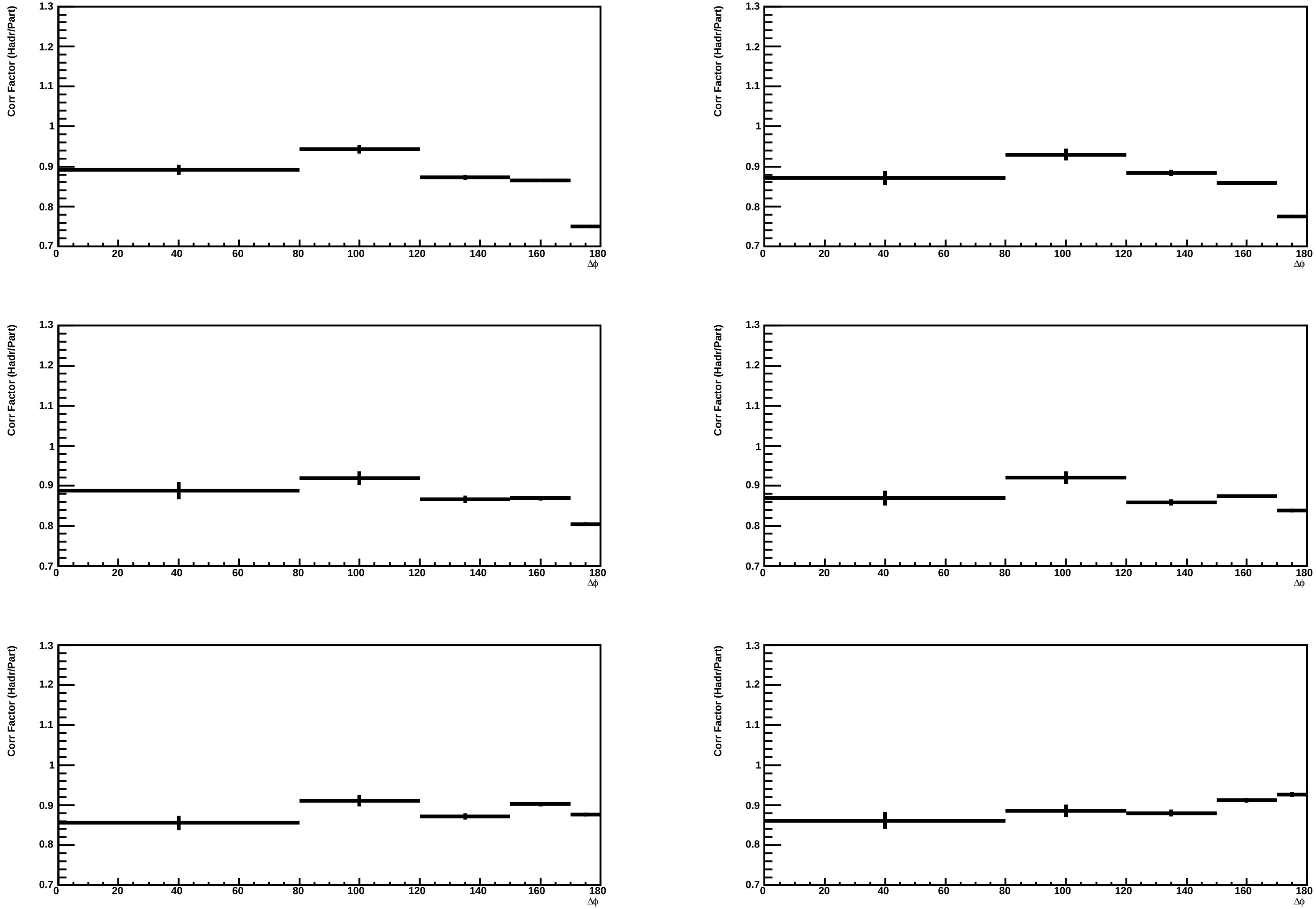
Pt Balance Mean Values



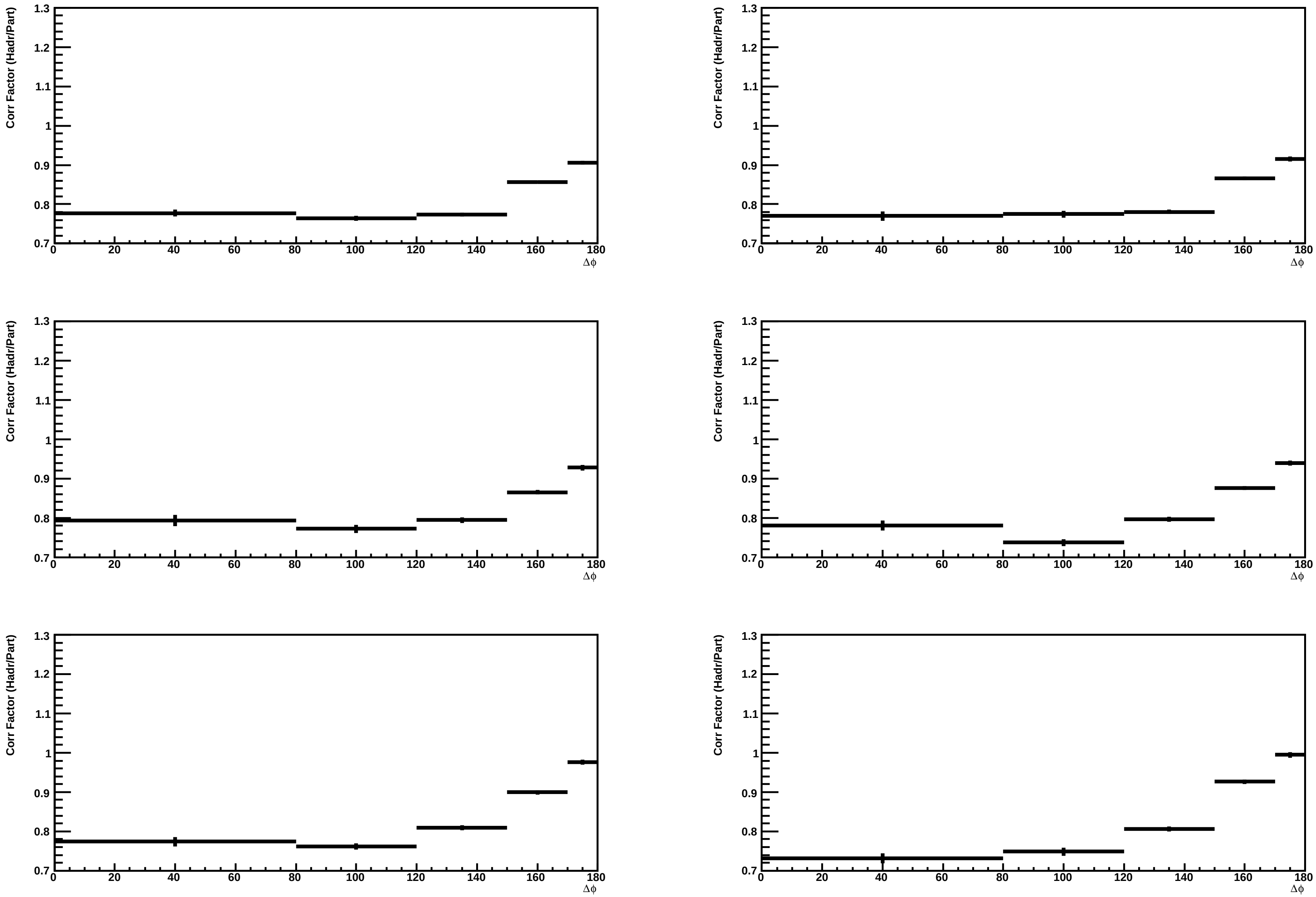
Pt Balance Double Ratio



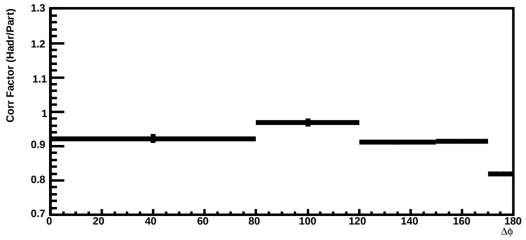
NLO 2-jet Corrections (Cascade KMR)

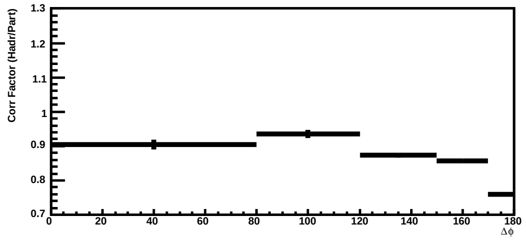


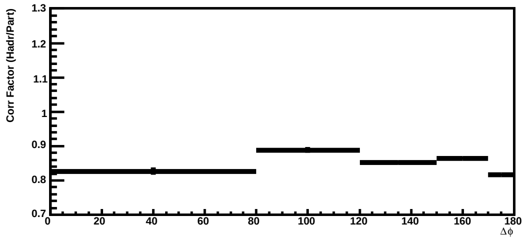
NLO 3-jet Corrections (Cascade A0)



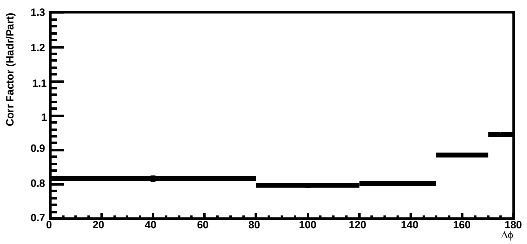
NLO 2-jet Corrections (Cascade KMR)

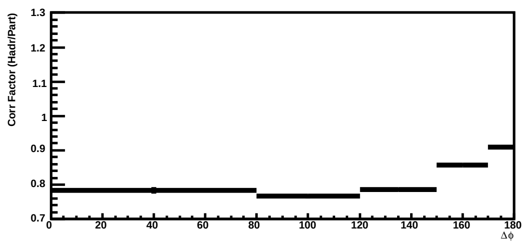


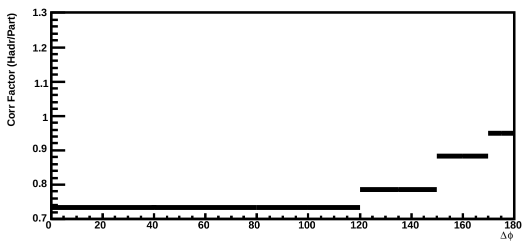




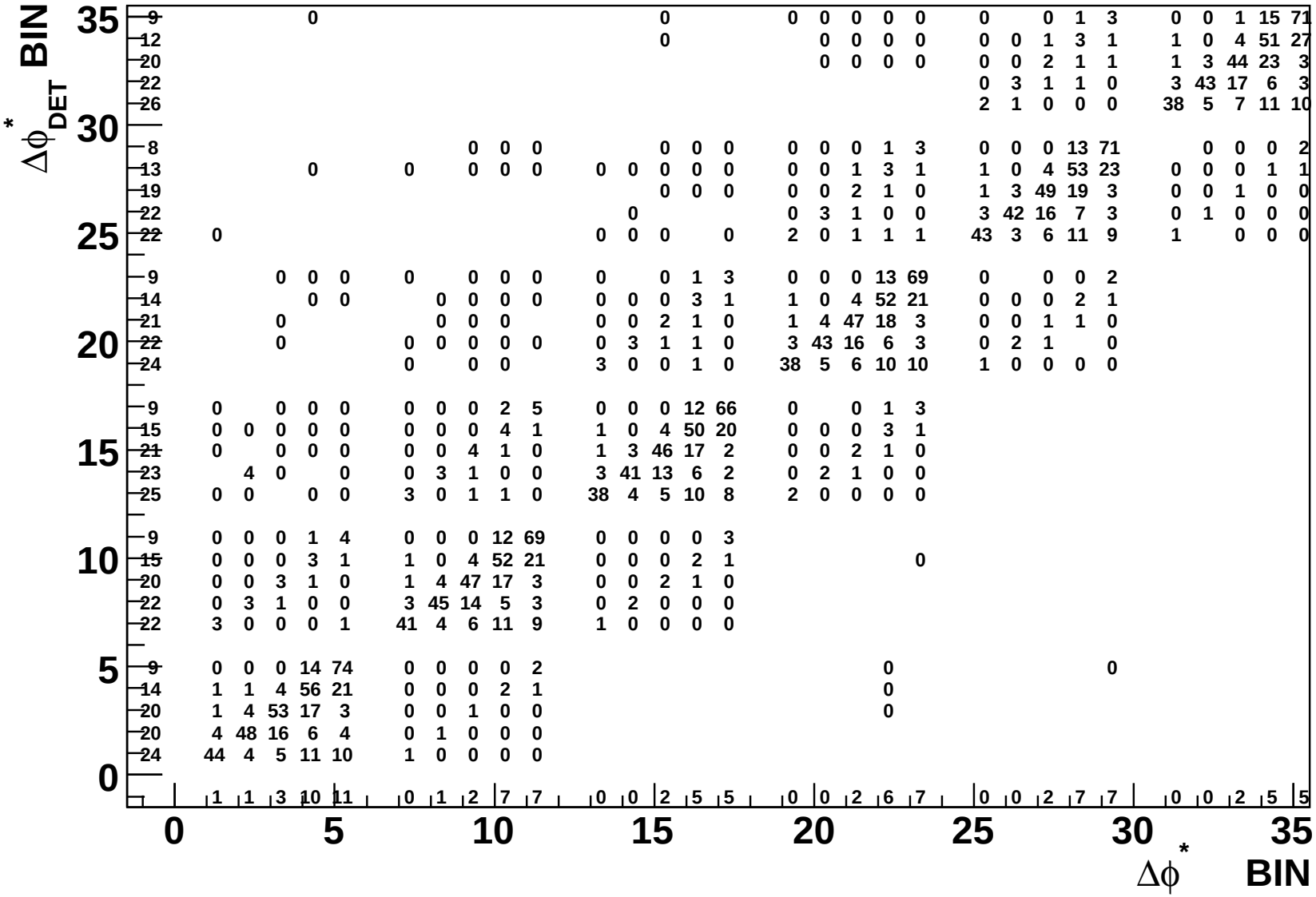
NLO 3-jet Corrections (Cascade A0)



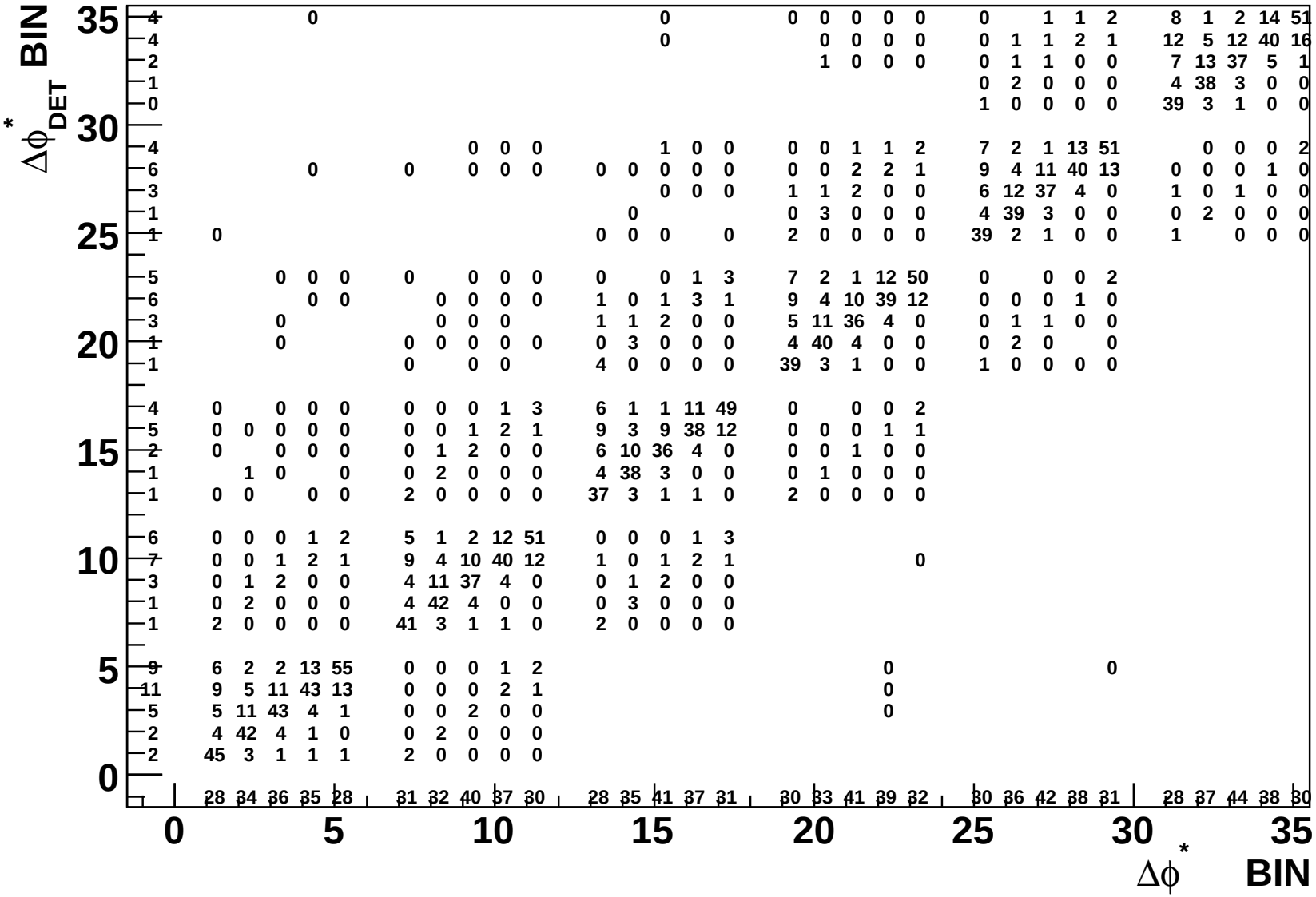




DPhi Migrations (Symm. Cuts., Diagonal = Purity)



DPhi Migrations (Symm. Cuts., Diagonal = Stability)



Something wrong with Spacal Hadronic Energy Scale...