

Dijets and Azimuthal Correlations

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HaQ February 21, 2006

Outline

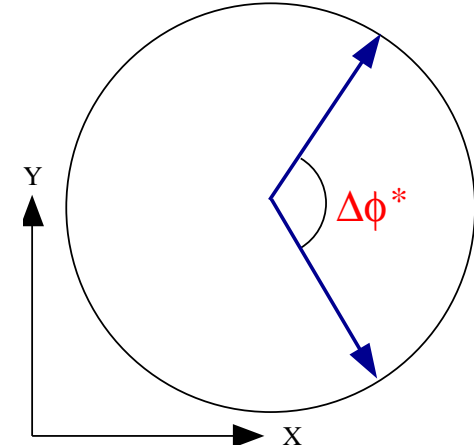
- Motivation and Selection
- Control Plots
- $\frac{d\sigma}{dQ^2 d\Delta\phi^*}$: P, S, C, systematic uncertainties
- $\frac{d\sigma}{dx_{B_j} d\Delta\phi^*}$: P, S, C, systematic uncertainties
- Summary

Motivation And Selection

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

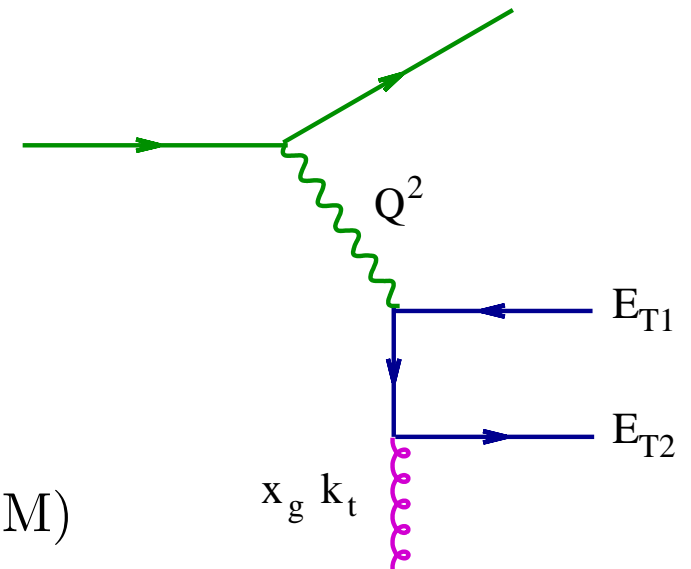
$$k_t^{*2} = E_{T1}^{*2} + E_{T2}^{*2} + 2|E_{T1}^*||E_{T2}^*|\cos\Delta\phi^*$$

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)



Motivation And Selection

| | 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 | |
| $156^\circ <$ | θ_e | $< 175^\circ$ | | | |
| $35 \text{ GeV} <$ | $E - p_z$ | $< 70 \text{ GeV}$ | | | |
| | $ z_{vtx} $ | $< 35 \text{ cm}$ | | | |
| | R_{clus} | $< 3.5 \text{ cm}$ | | | |
| | E_{had} | $< 0.5 \text{ GeV}$ | | | |
| | E_{veto} | $< 1.0 \text{ GeV}$ | | | |

Changes since last HaQ meeting: No x_{bj} cut, no calibration

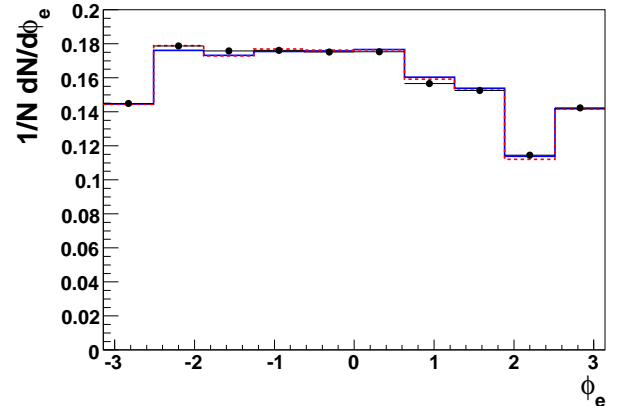
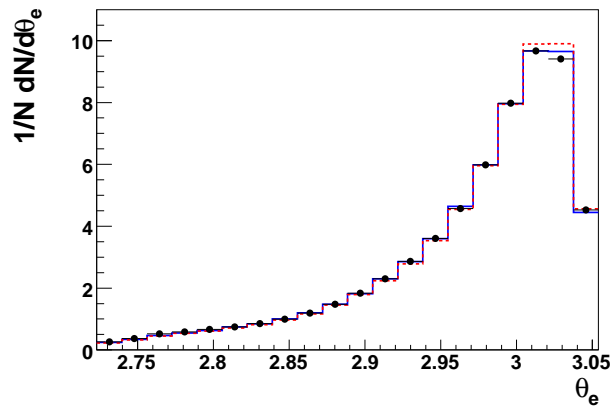
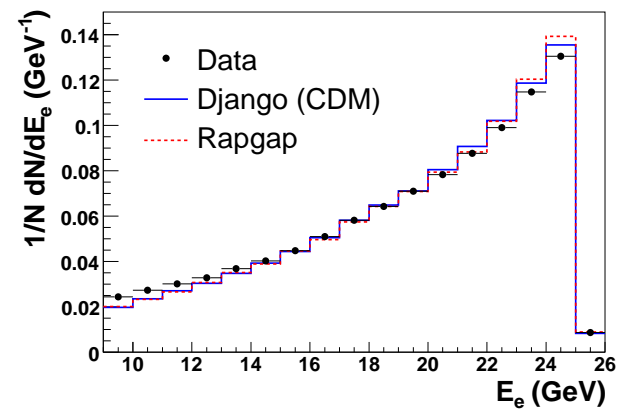
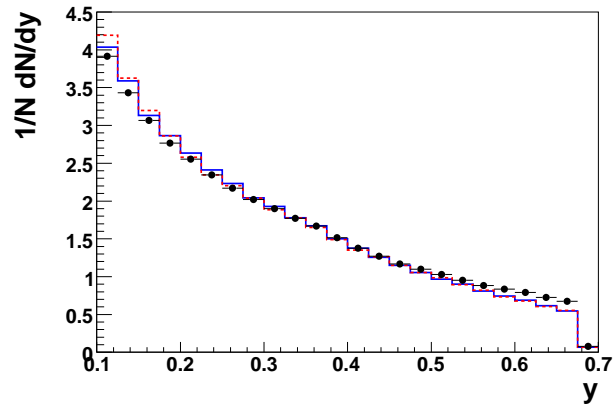
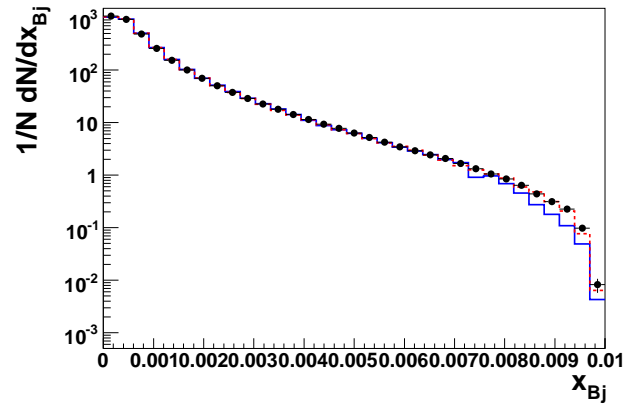
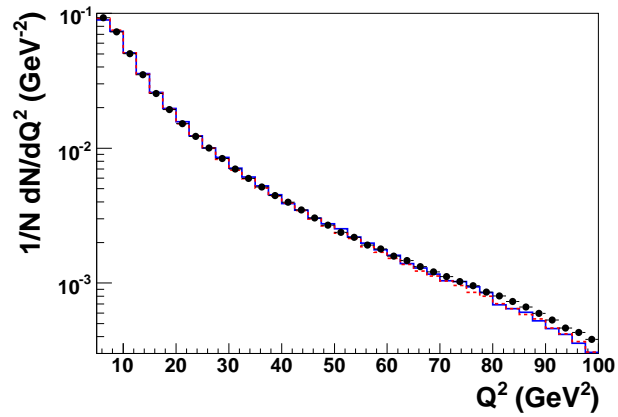
Motivation And Selection

Monte Carlo and Data Sets

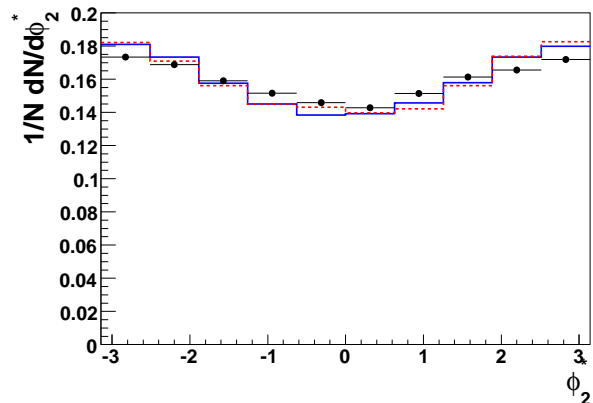
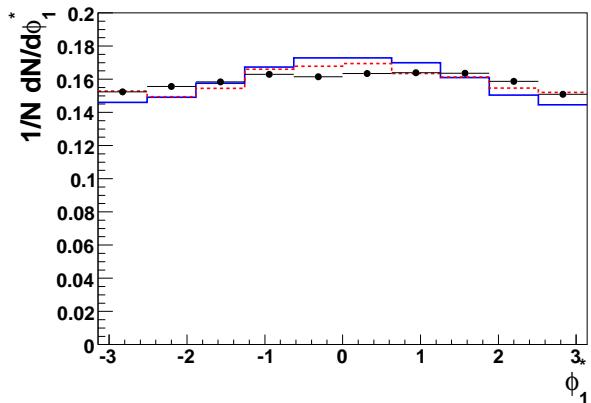
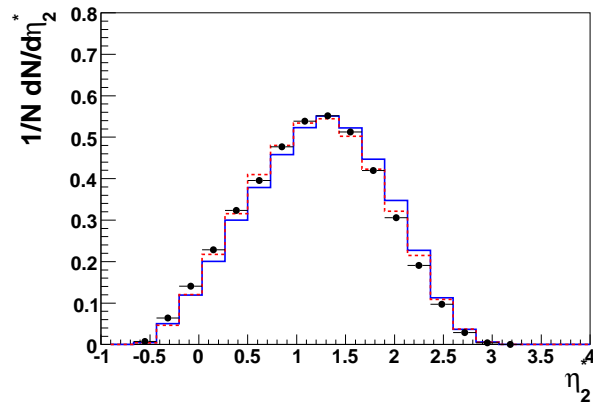
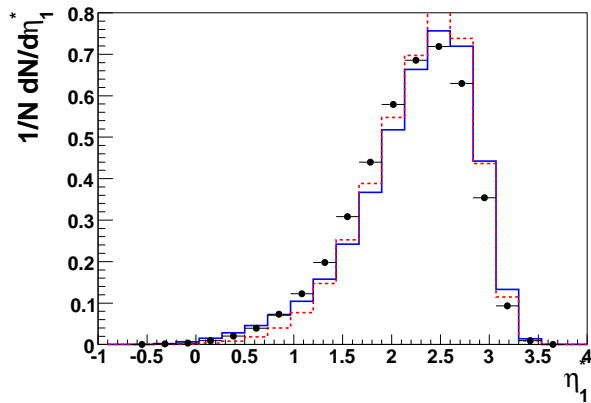
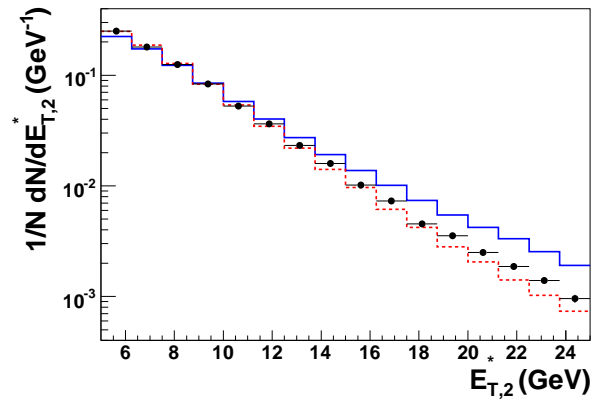
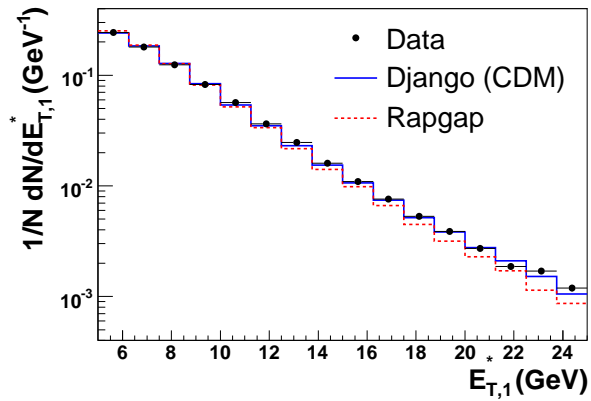
Using 1999/2000 e^+ , excluding shifted vertex runs.

| | Dijet events (w/o weights) | factor |
|-------------------|-------------------------------|--------|
| Data 99/00 e^+ | 88 000 | 1 |
| Rapgap 3.1 (Dir) | 566 000 | 6.4 |
| Djangoh 1.4 (CDM) | 482 000 | 5.5 |

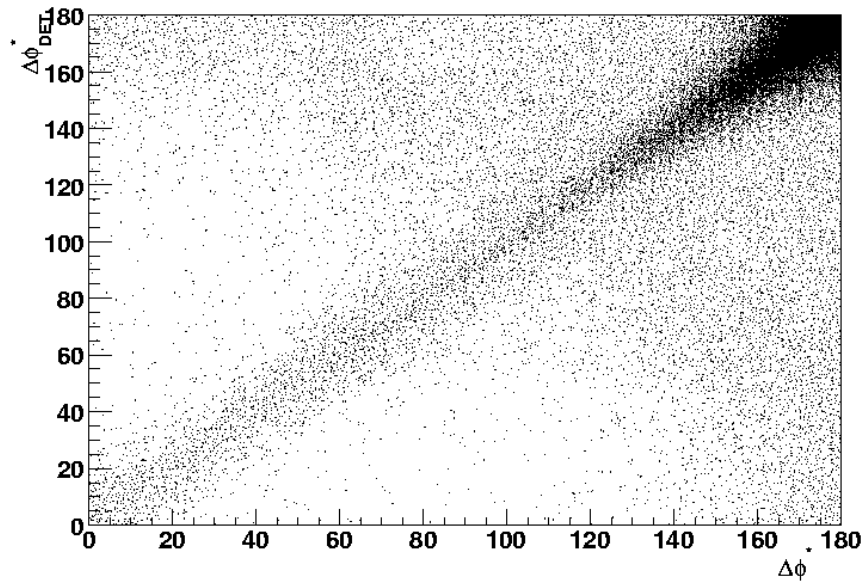
Control Plots DIS Sample



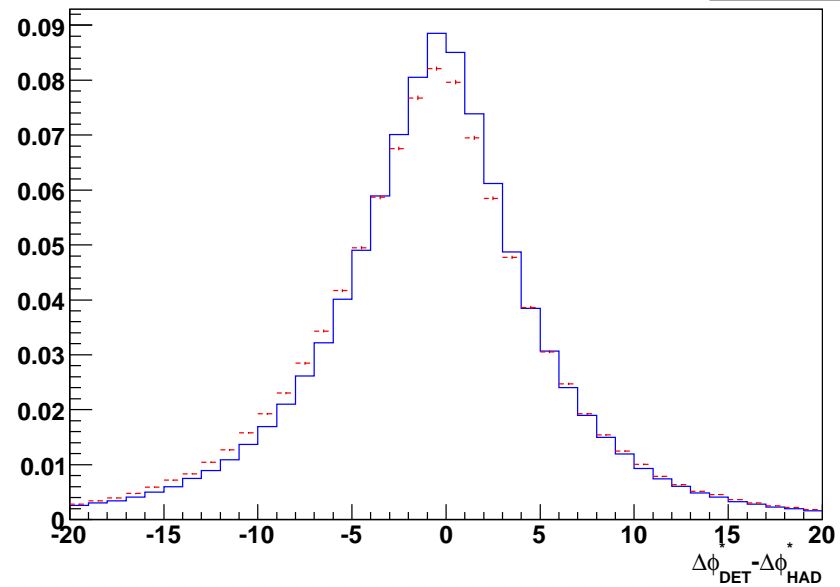
Control Plots Dijets



$\Delta\phi^*$ resolution

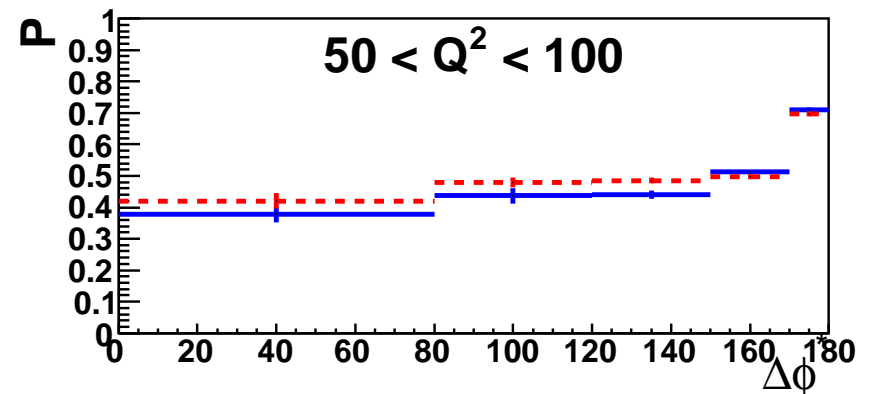
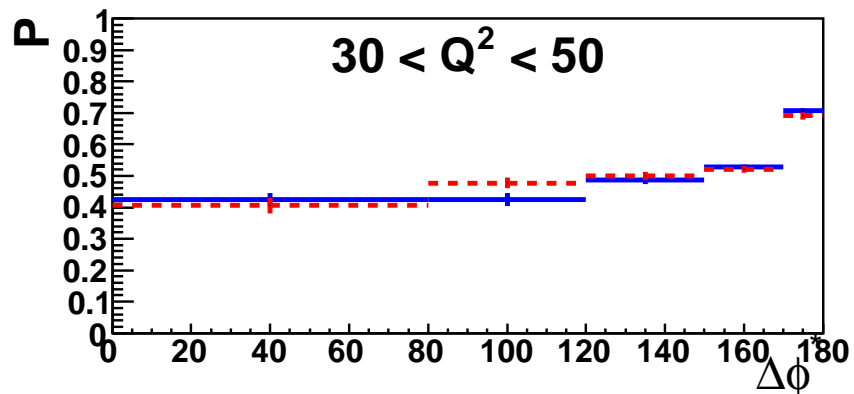
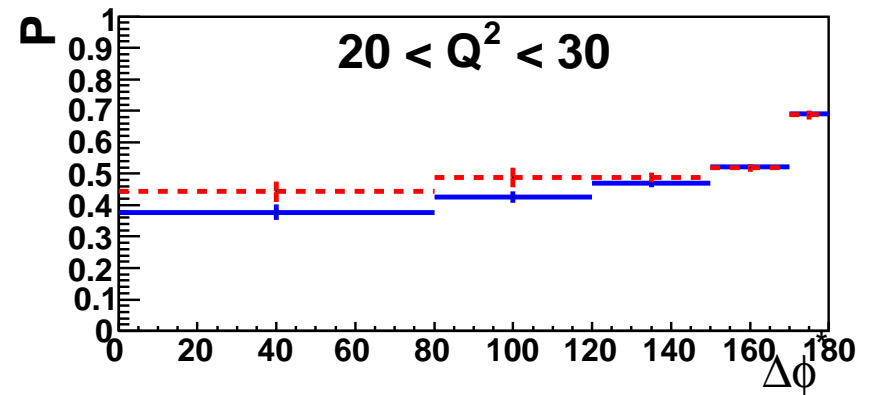
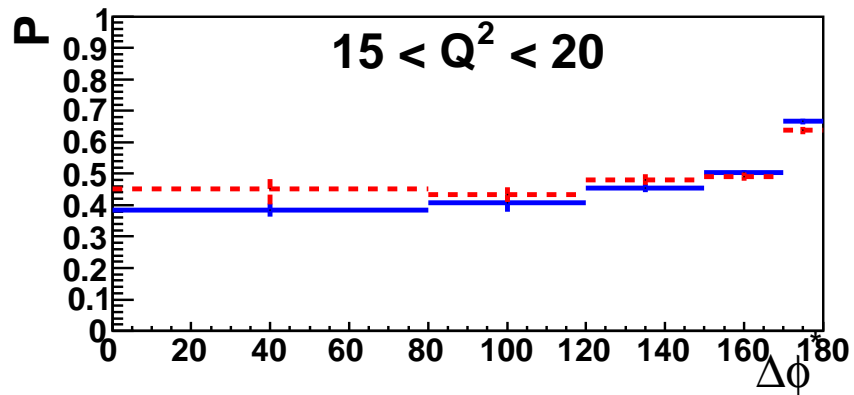
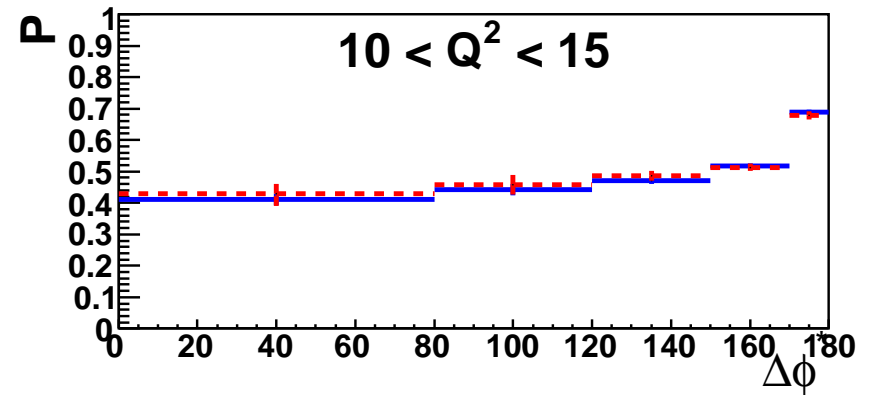
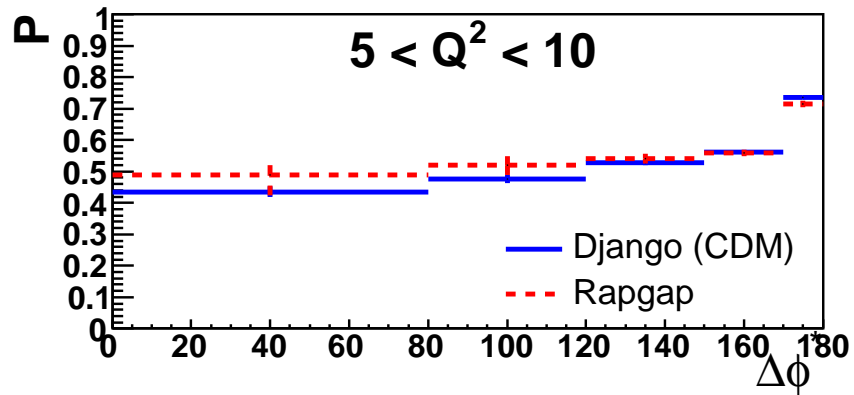


| | |
|------|--------|
| Mean | -0.666 |
| RMS | 6.052 |



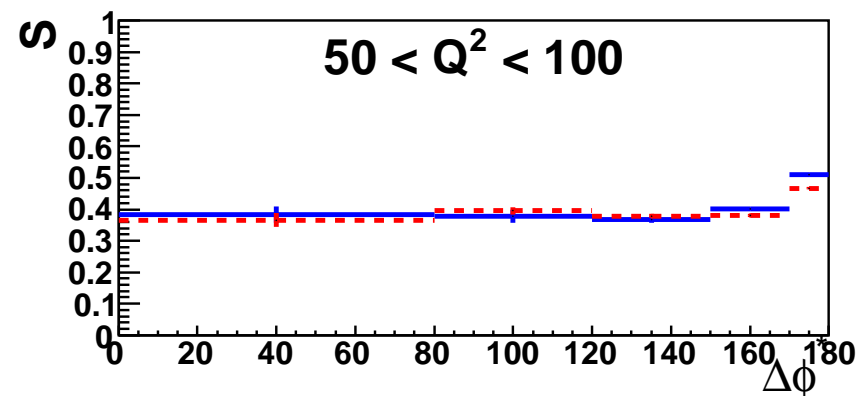
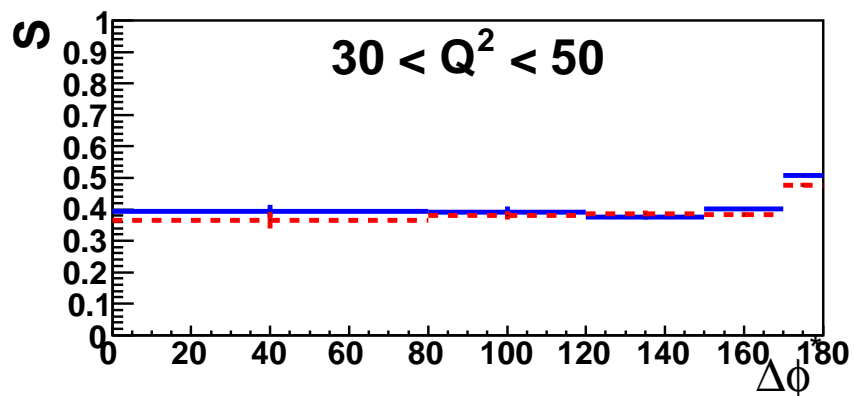
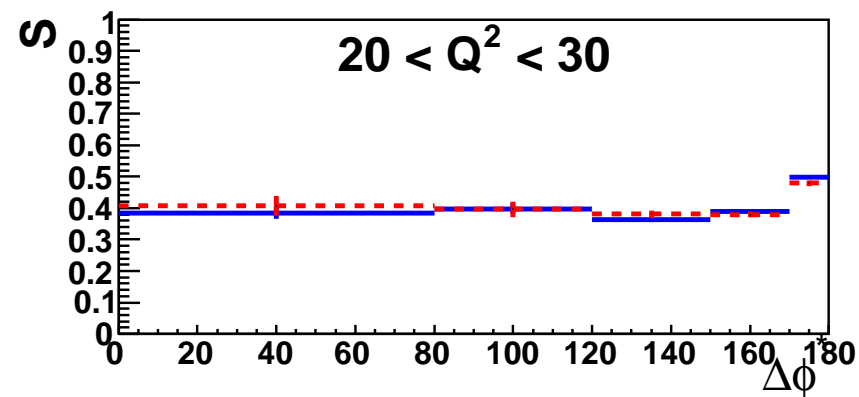
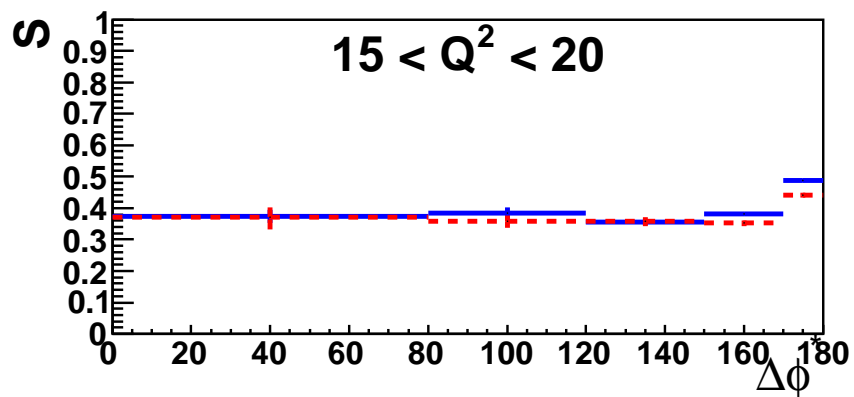
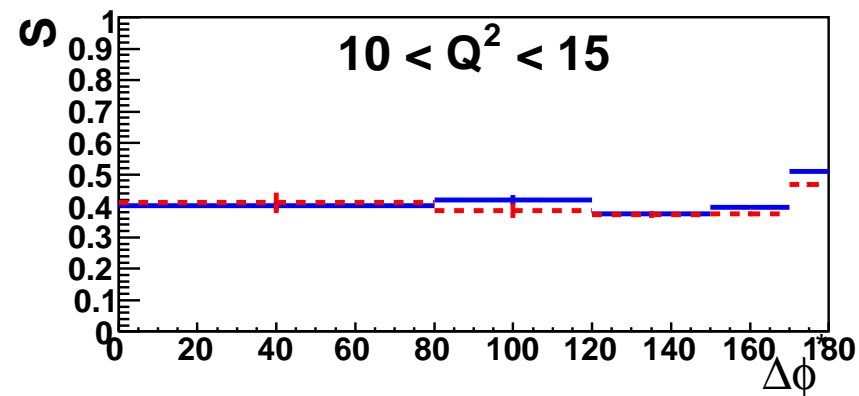
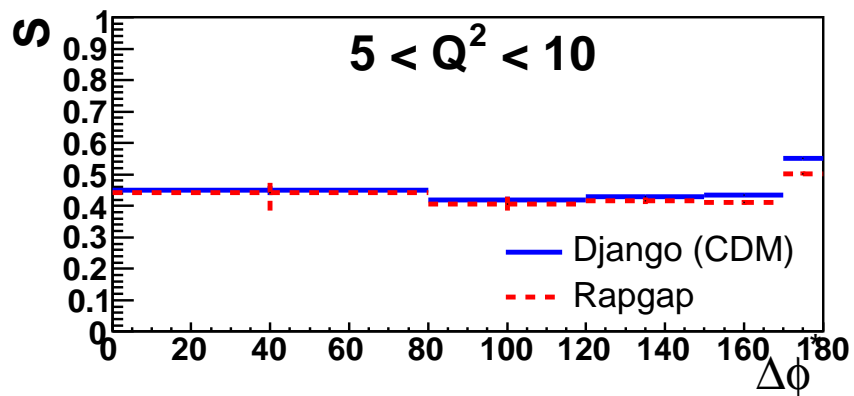
$d\sigma/dQ^2 d\Delta\phi^*$ Purity

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



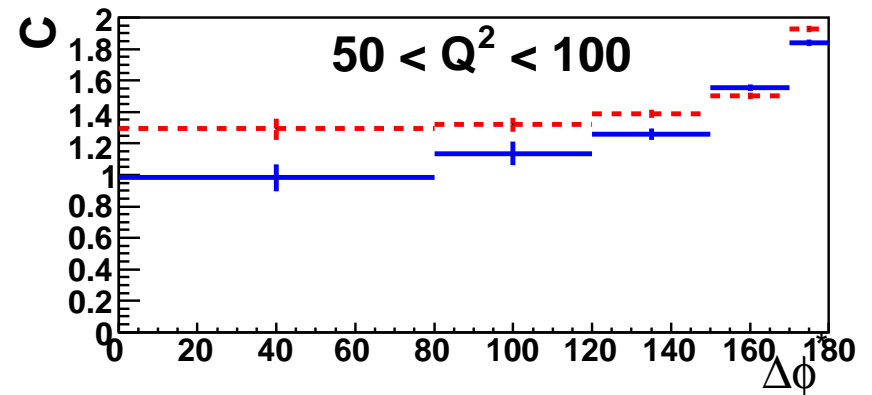
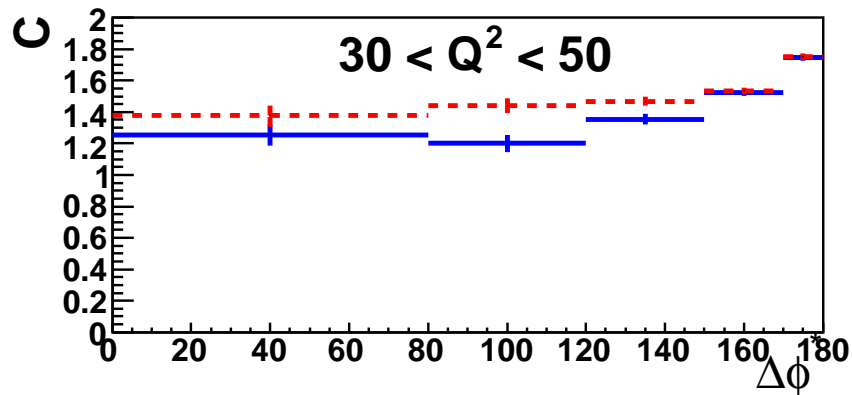
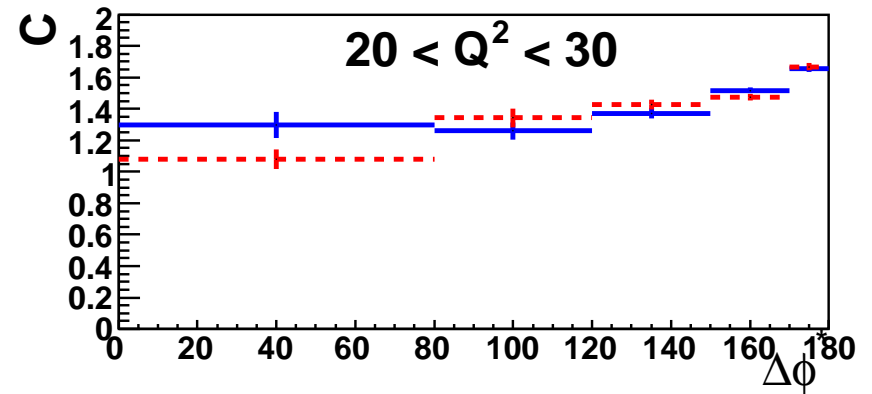
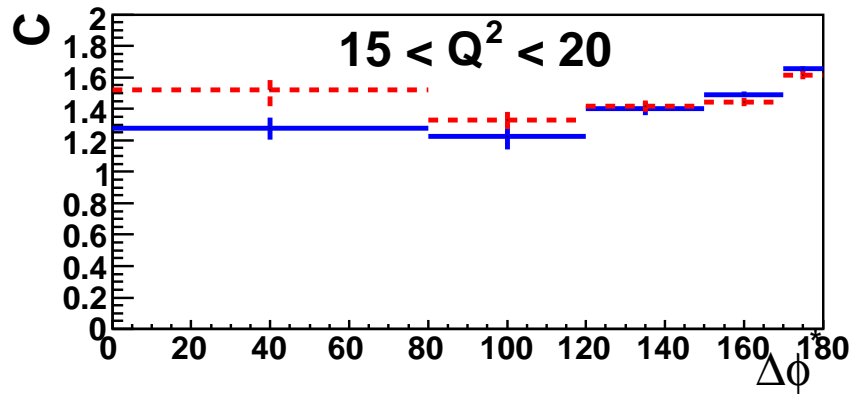
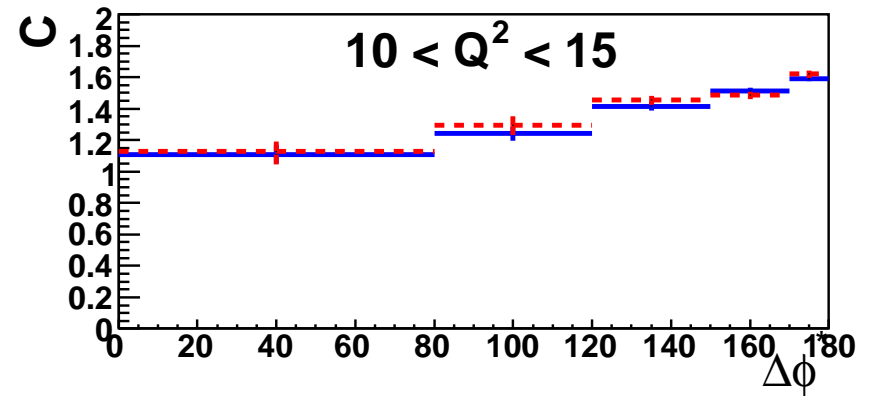
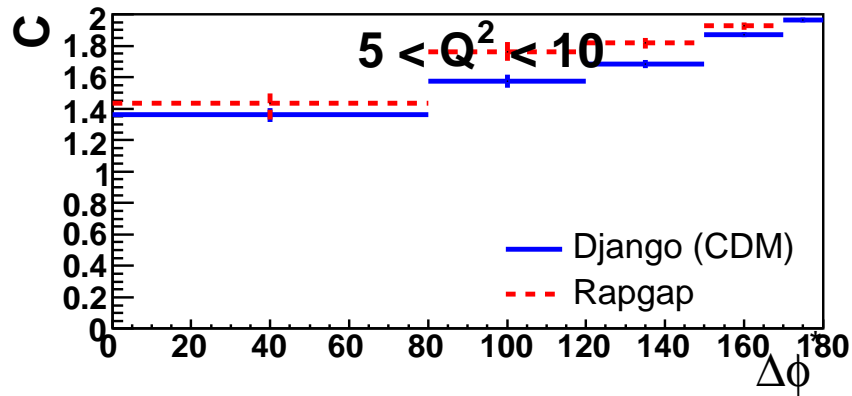
$d\sigma/dQ^2 d\Delta\phi^*$ Stability

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



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

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



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

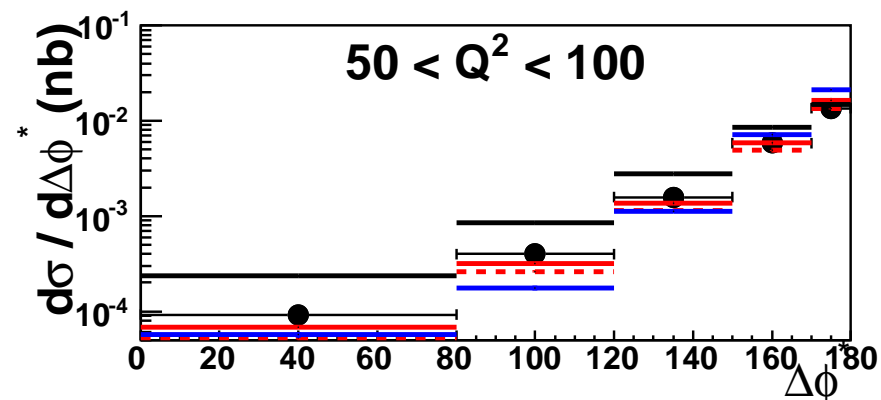
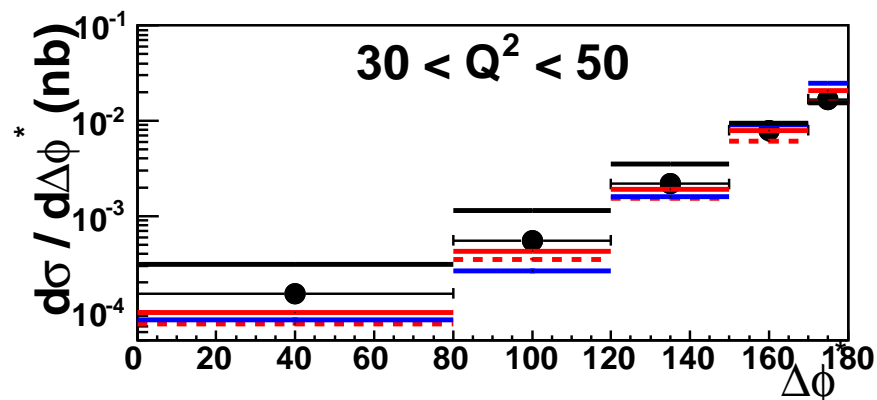
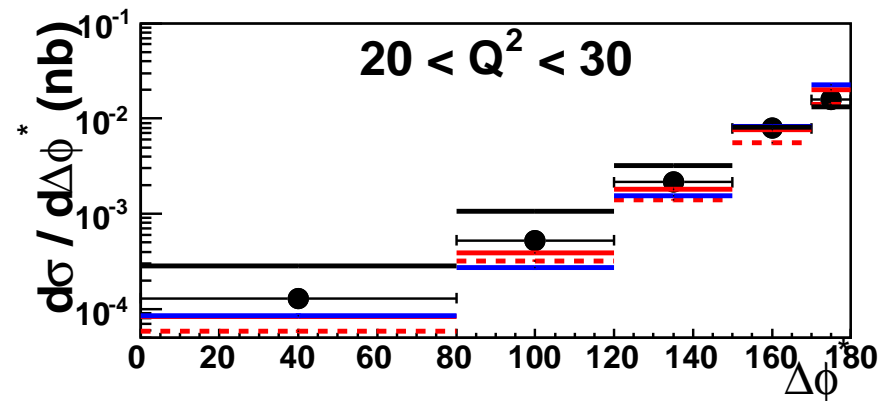
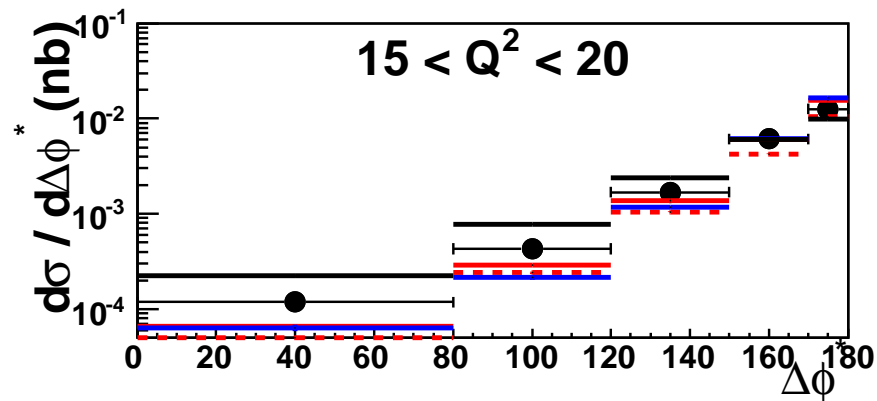
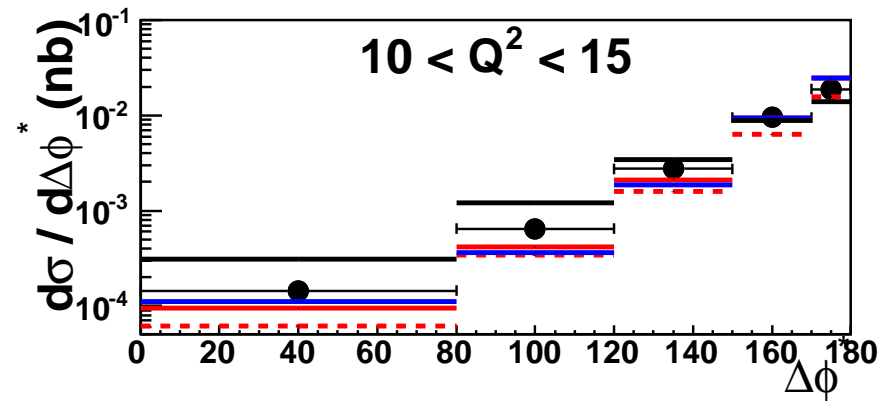
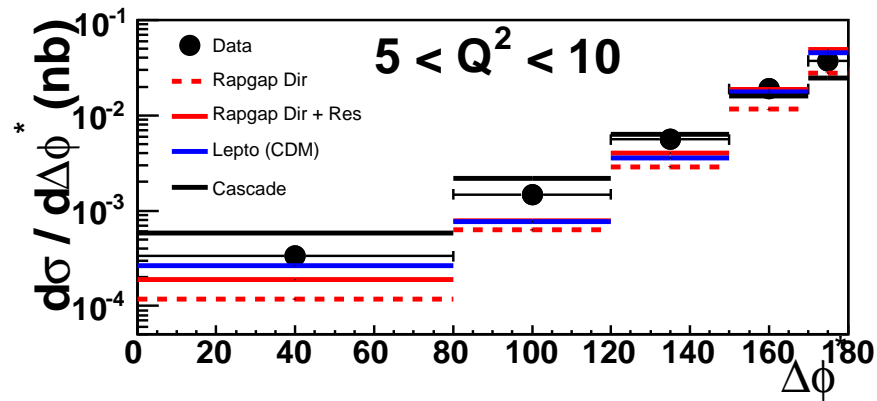
Systematic Uncertainties

Estimated using Rapgap

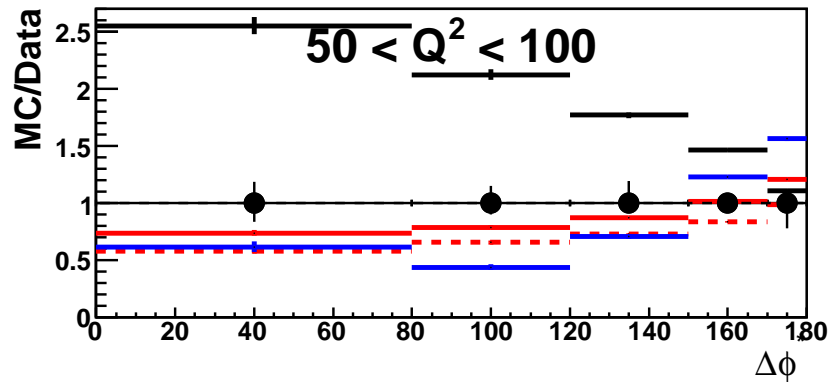
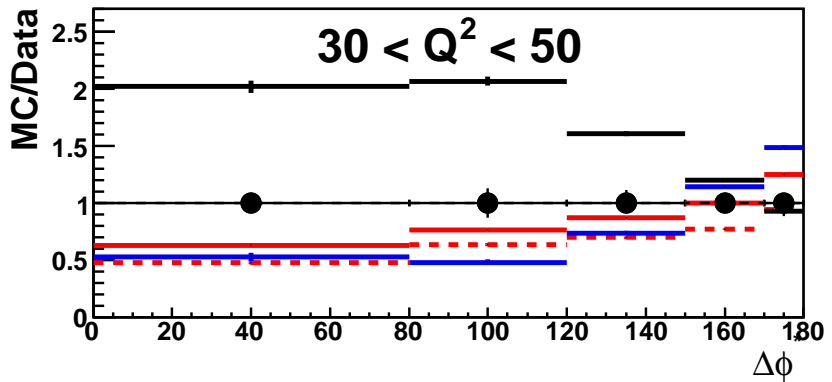
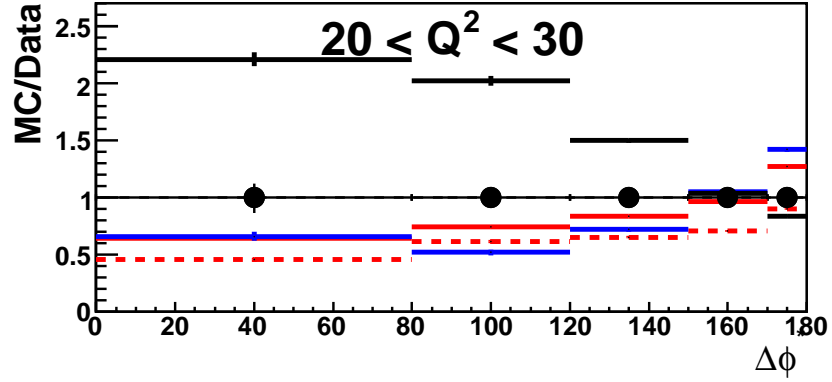
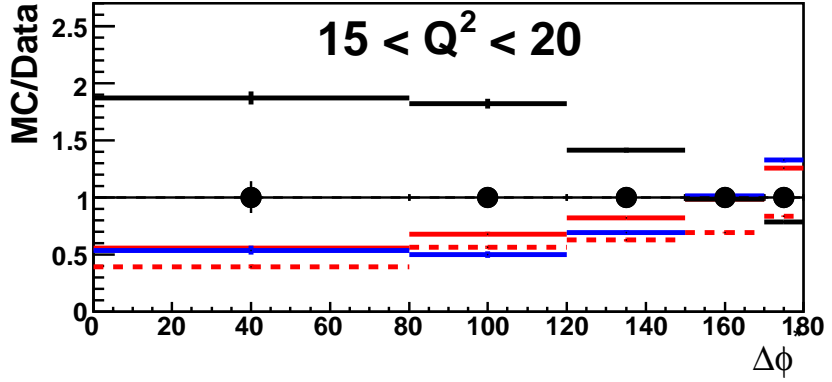
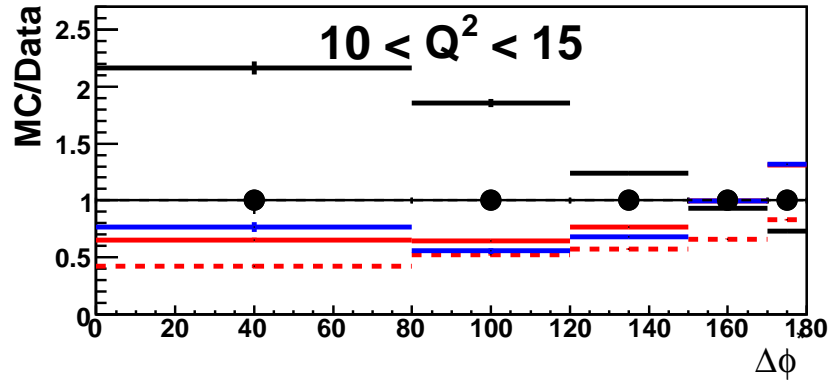
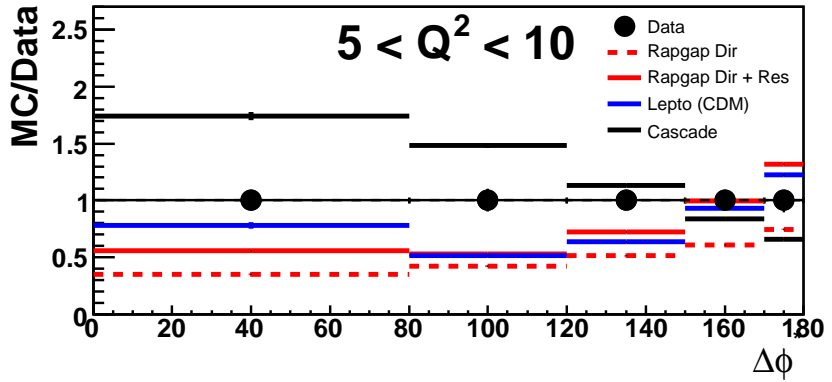
... except model dependence: $\frac{|C_{Rapgap} - C_{Django}|}{2}$

| Source | | Uncertainty |
|-------------------------------------|--------------|-------------|
| Electron Energy E'_e | $\pm 1\%$ | 0.1 - 2 % |
| Electron azimuthal angle θ_e | ± 1 mrad | 0.2 - 3 % |
| LAr Hadronic Energy | $\pm 4\%$ | } 1 - 20 % |
| SPACAL Hadronic Energy | $\pm 5\%$ | |
| Track Energy | $\pm 3\%$ | |
| Model dependence | | 0 - 15 % |

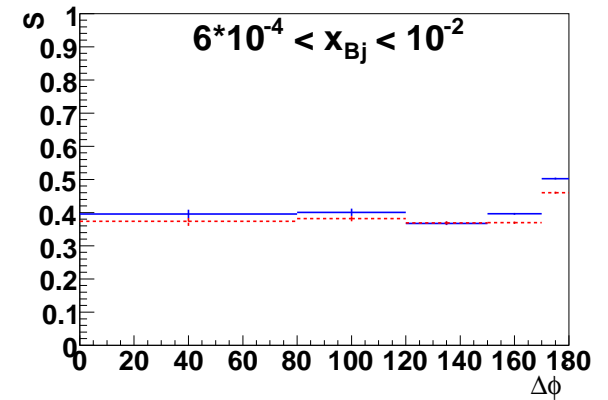
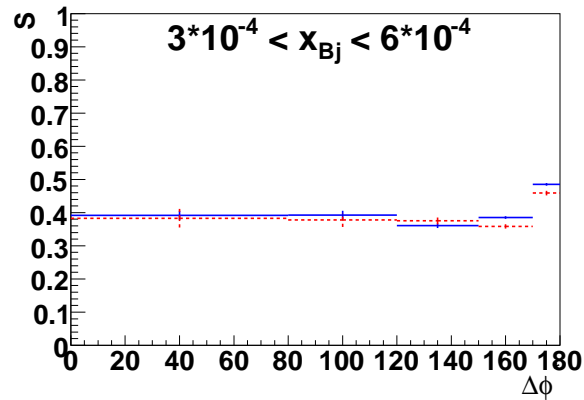
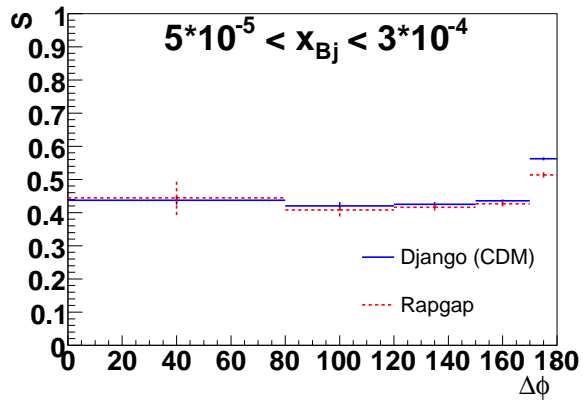
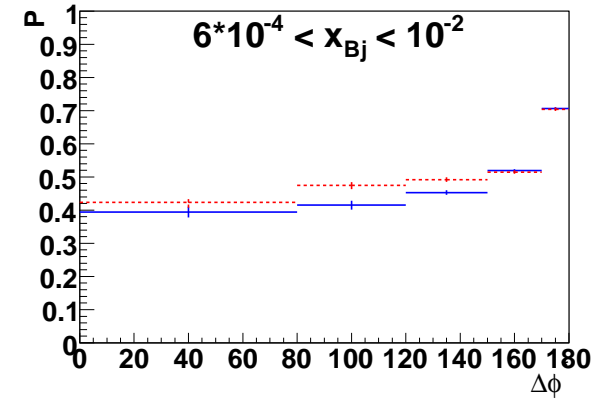
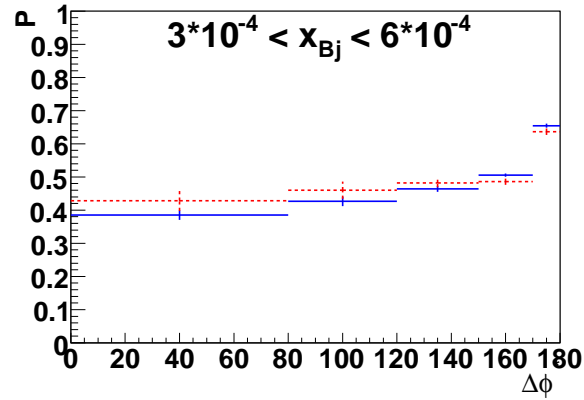
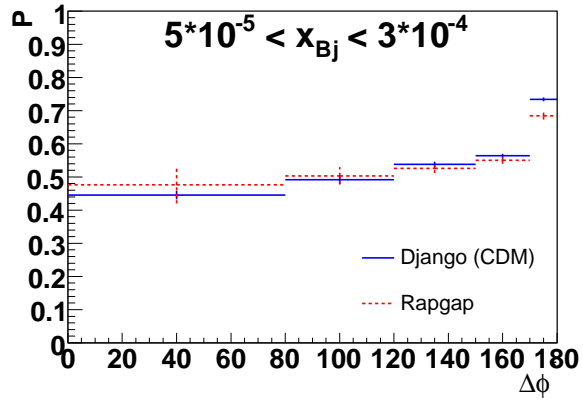
$$d\sigma / dQ^2 d\Delta\phi^*$$



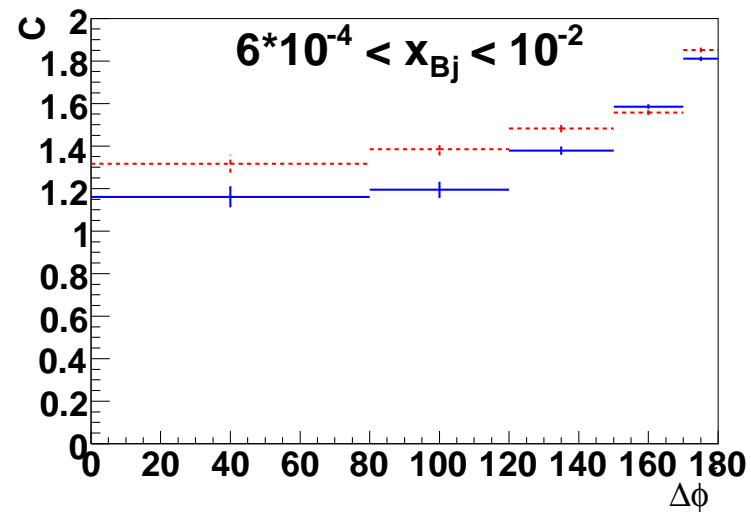
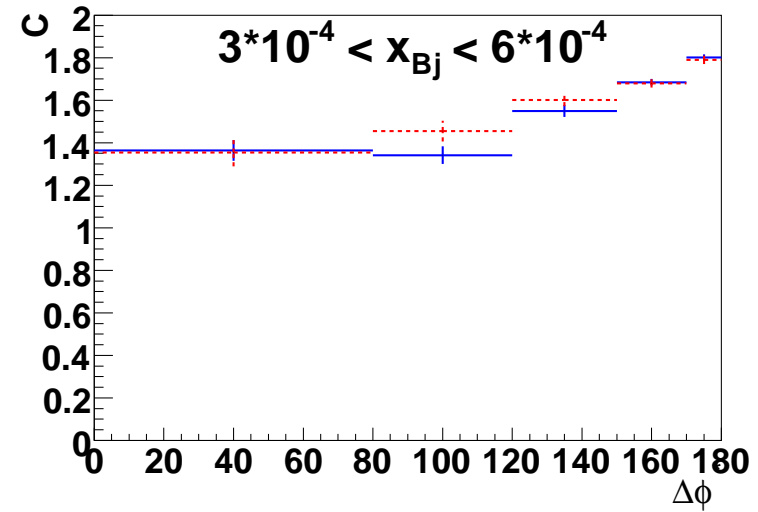
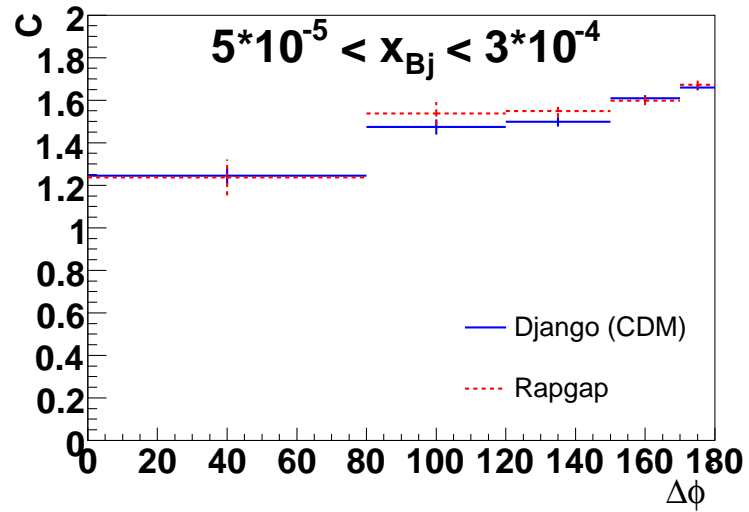
$d\sigma/dQ^2 d\Delta\phi^*$ Ratio



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



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



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

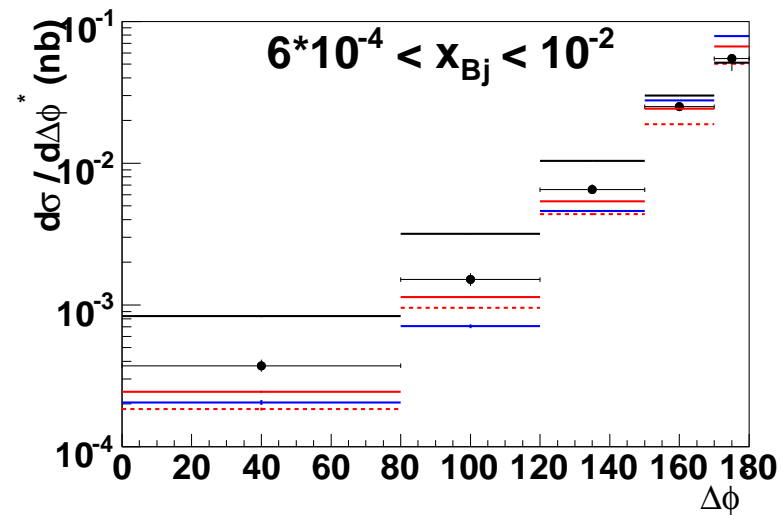
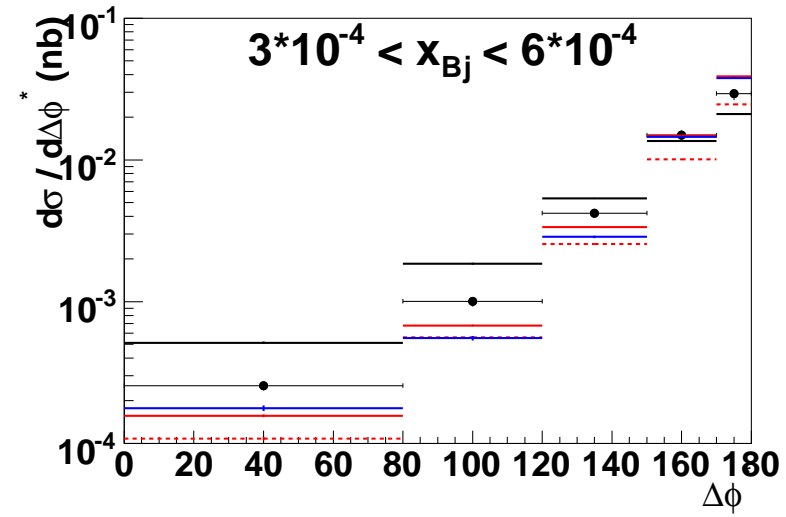
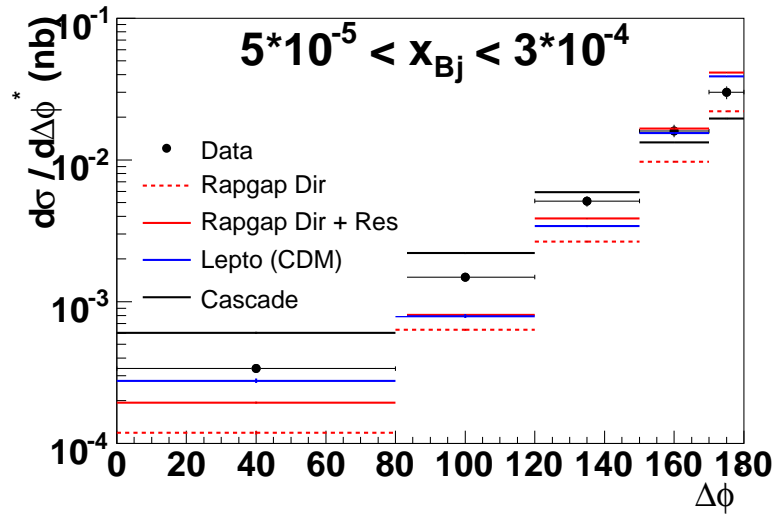
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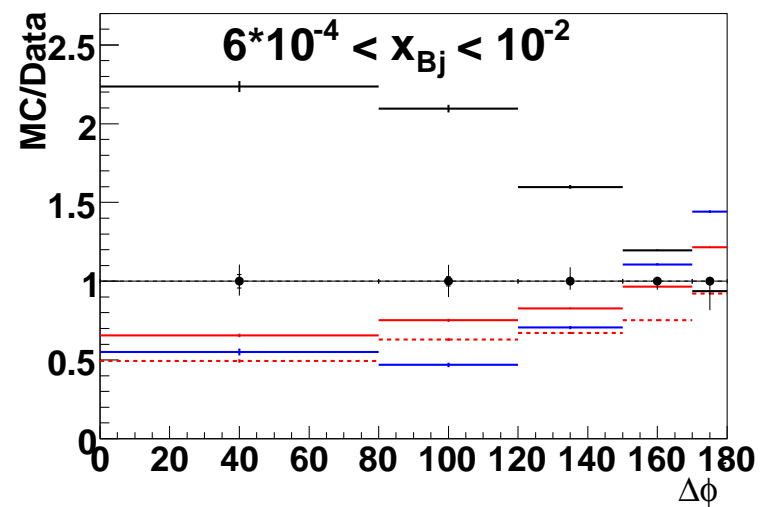
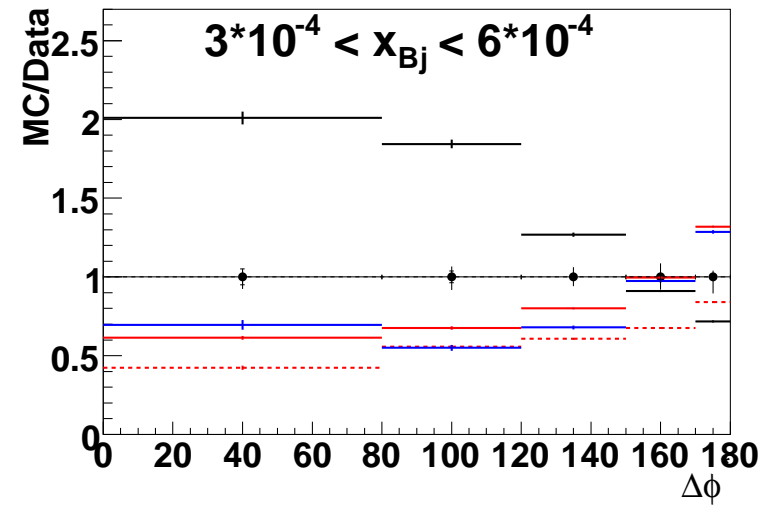
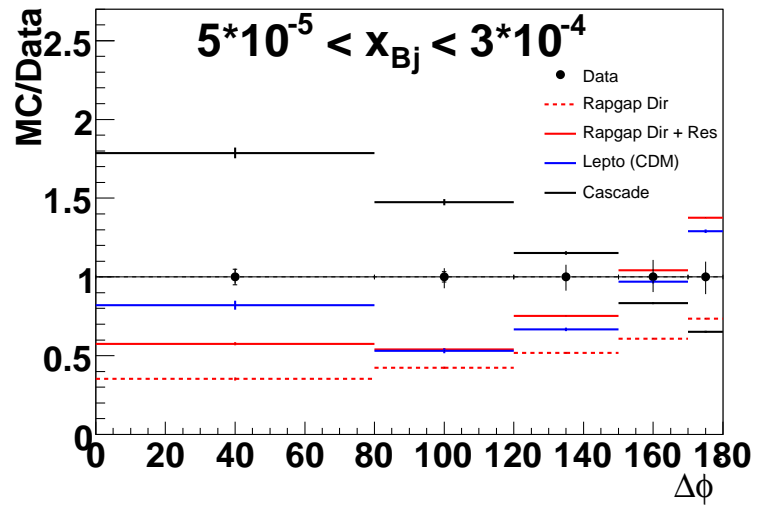
... except model dependence: $\frac{|C_{Rapgap} - C_{Django}|}{2}$

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| Electron azimuthal angle θ_e | ± 1 mrad | 0.2 - 2 % |
| LAr Hadronic Energy | $\pm 4\%$ | } 1 - 20 % |
| SPACAL Hadronic Energy | $\pm 5\%$ | |
| Track Energy | $\pm 3\%$ | |
| Model dependence | | 0 - 10 % |

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



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



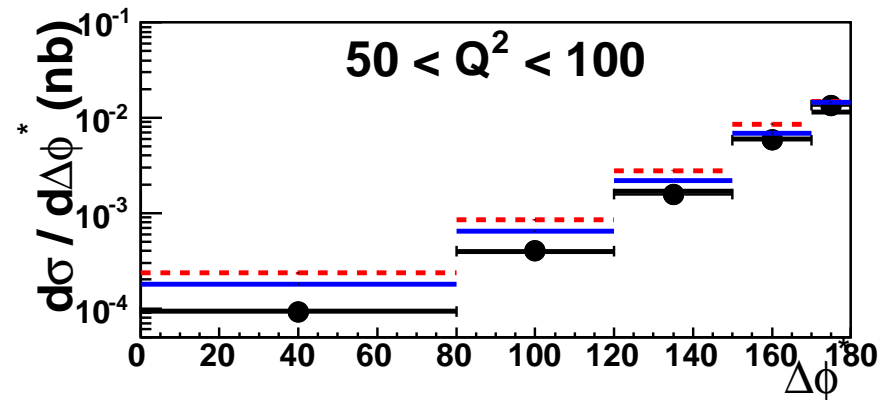
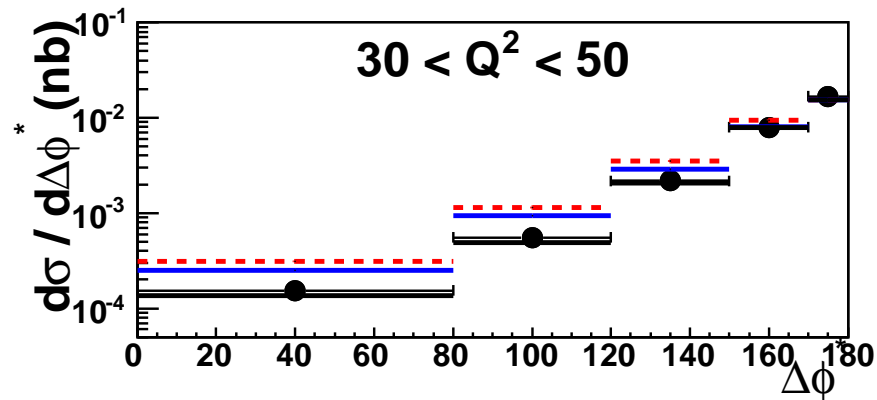
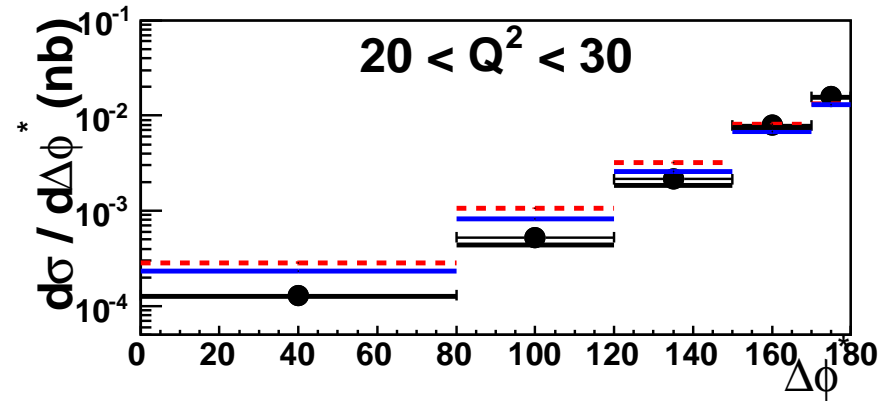
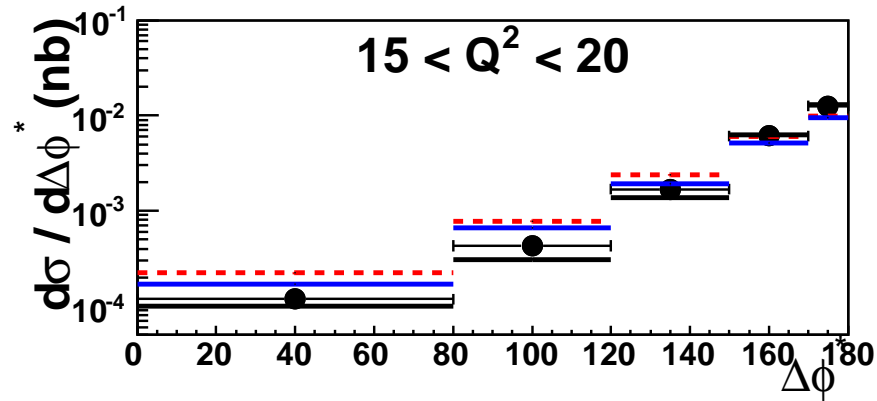
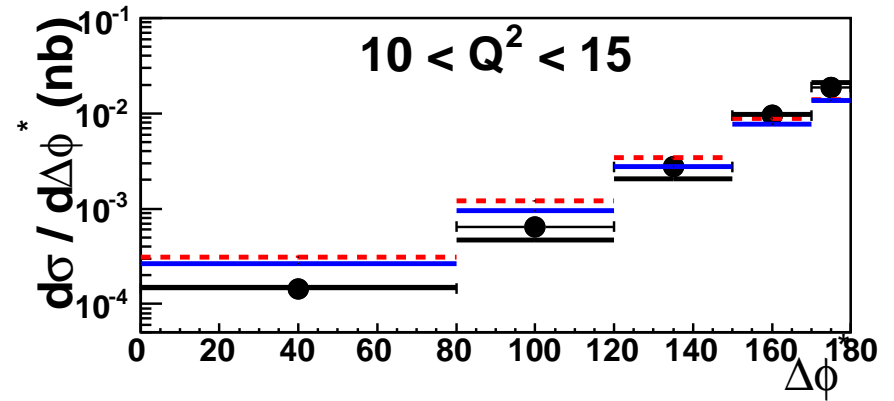
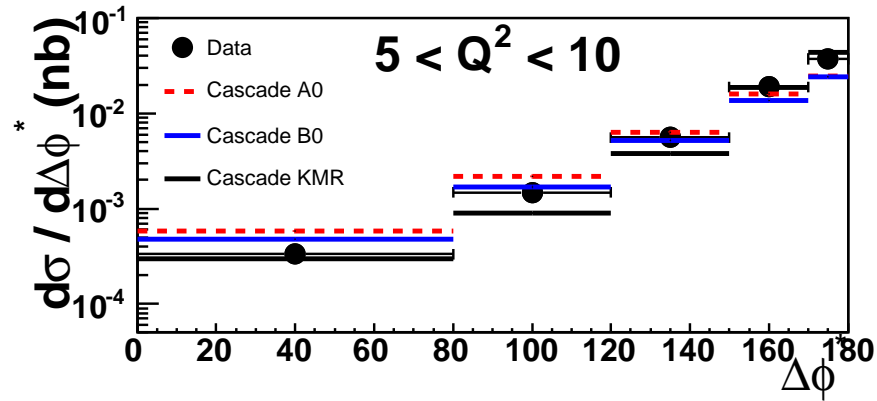
Summary

- 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 $\Delta\phi^* \sim 180^\circ$

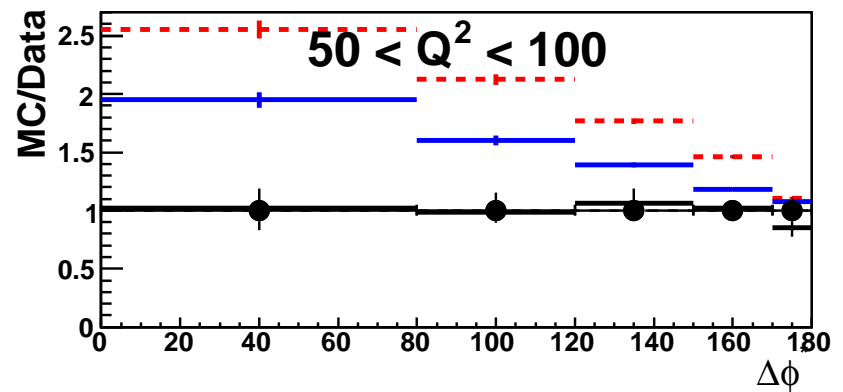
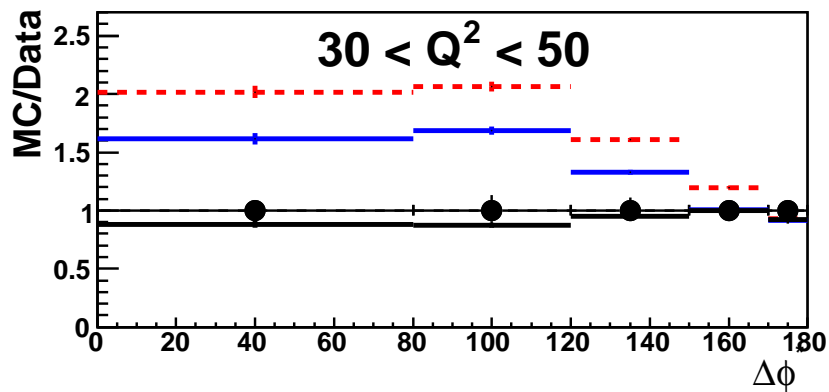
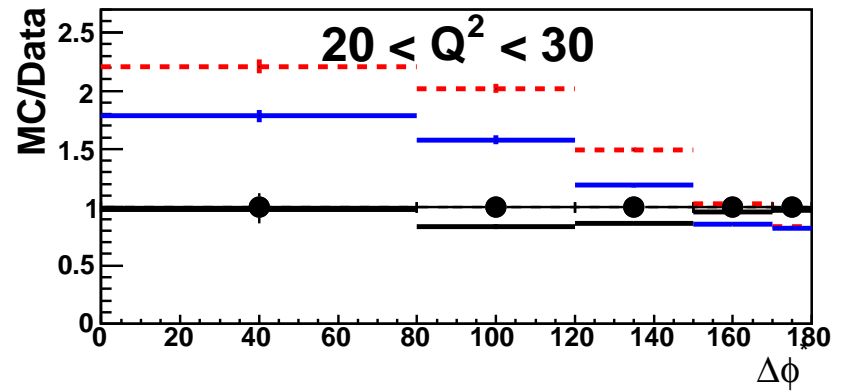
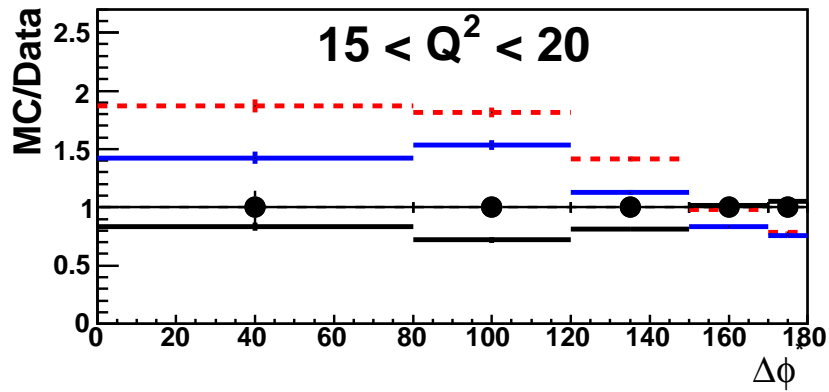
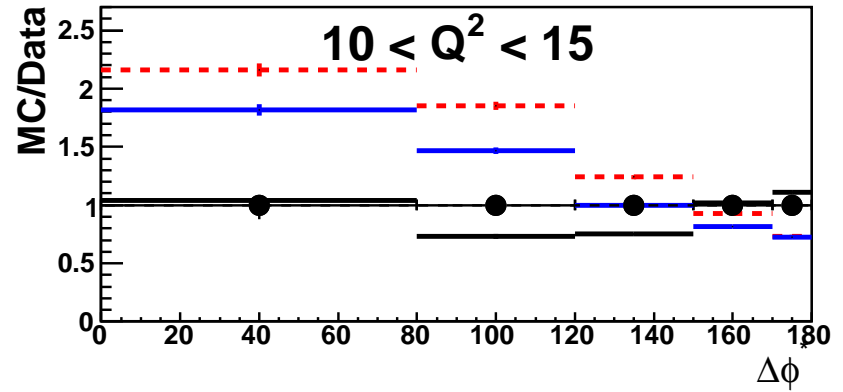
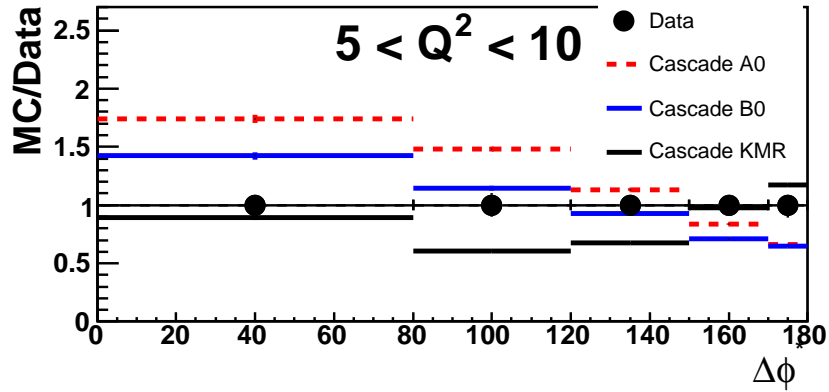
Next:

- NLO calculations on the way...
- More MC statistics for corrections
- Unfolding

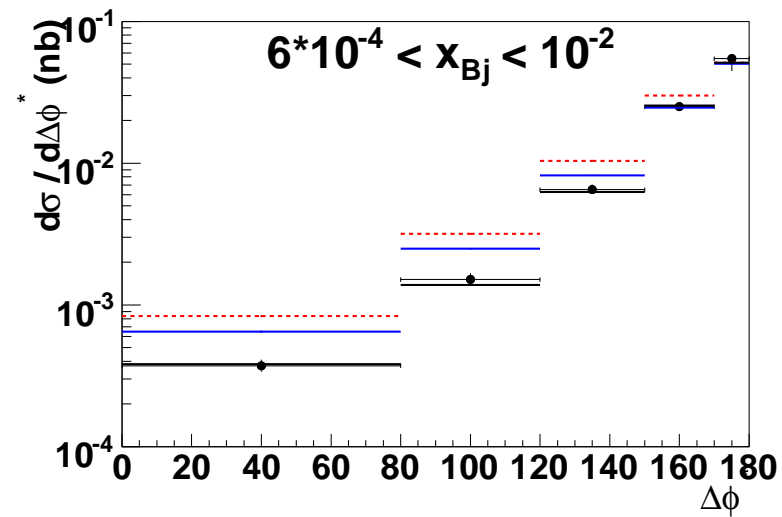
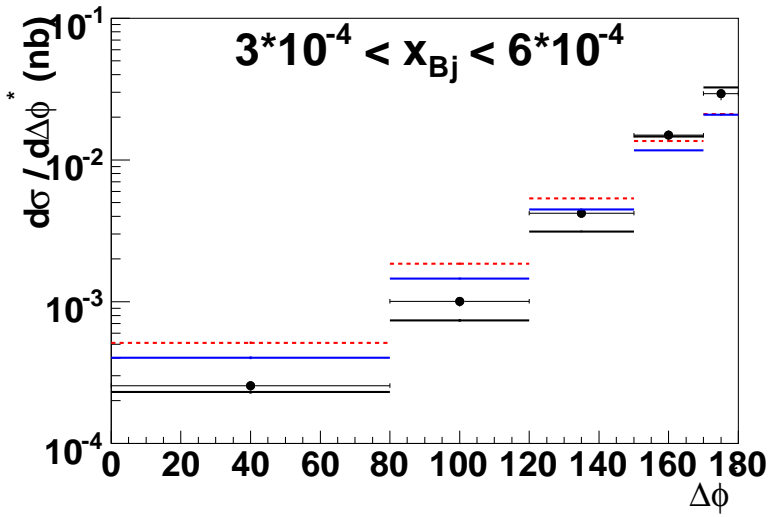
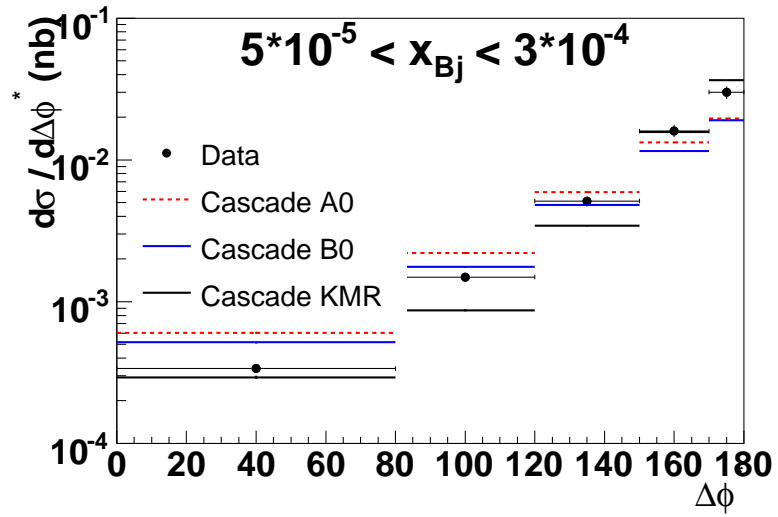
$$d\sigma / dQ^2 d\Delta\phi^*$$



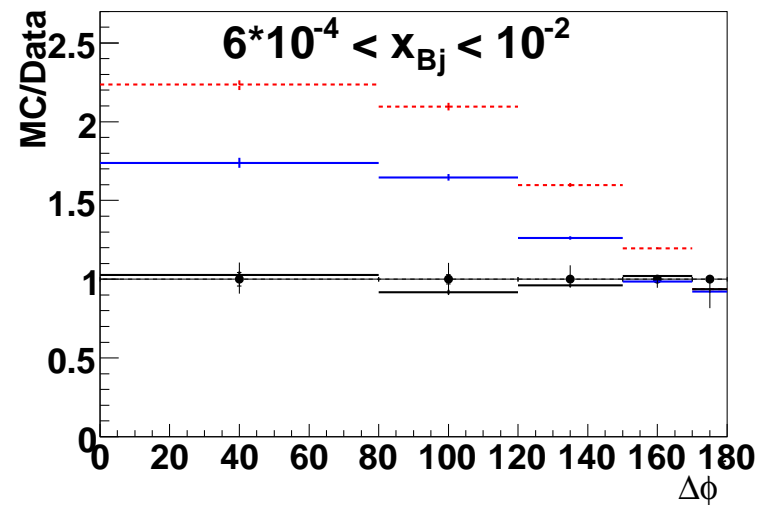
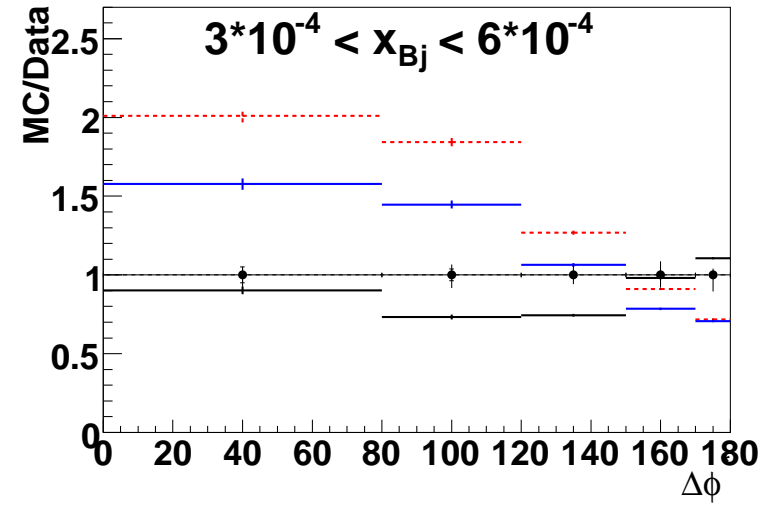
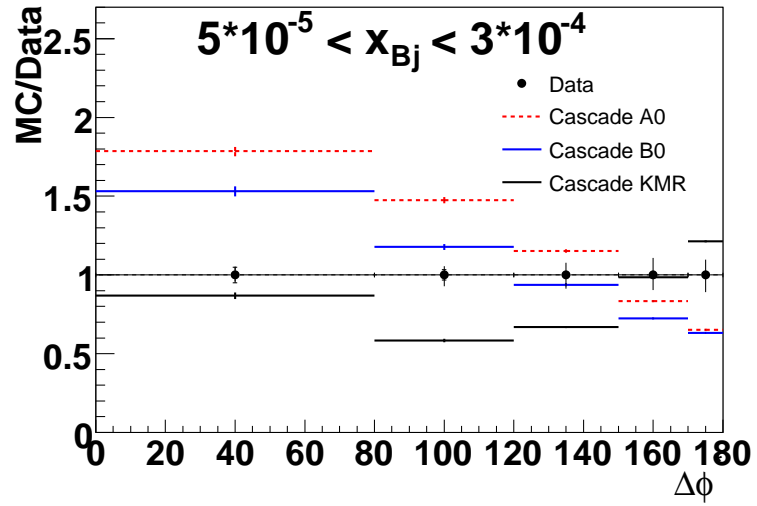
$d\sigma/dQ^2 d\Delta\phi^*$ Ratio



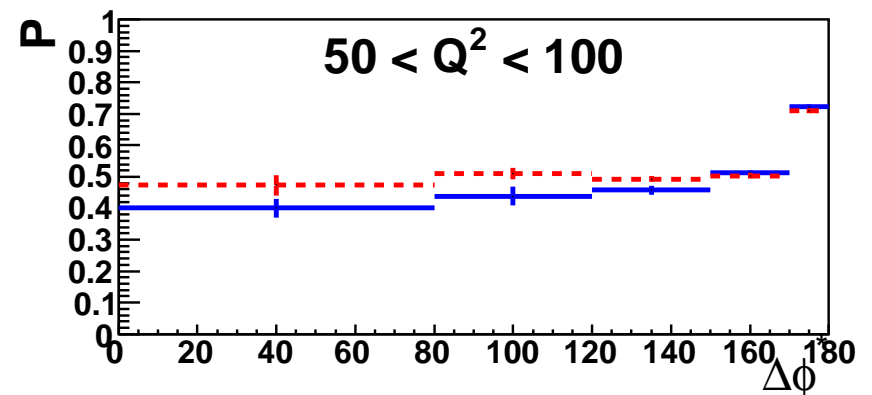
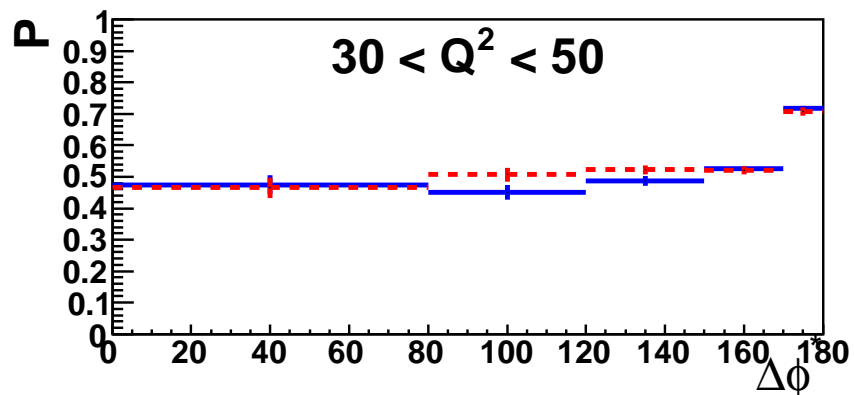
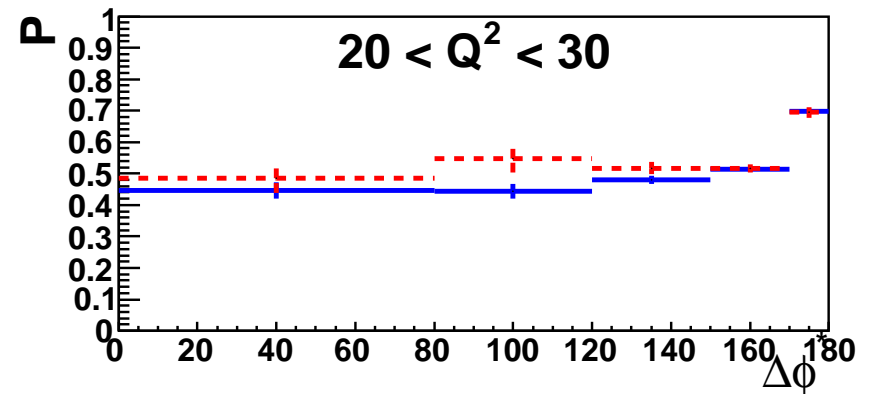
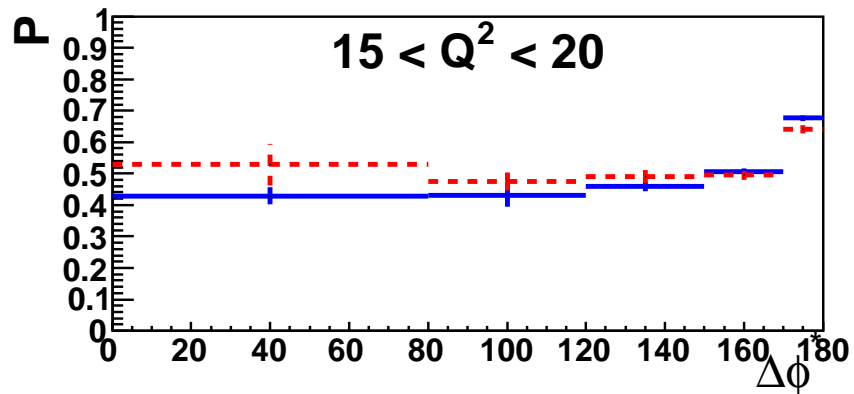
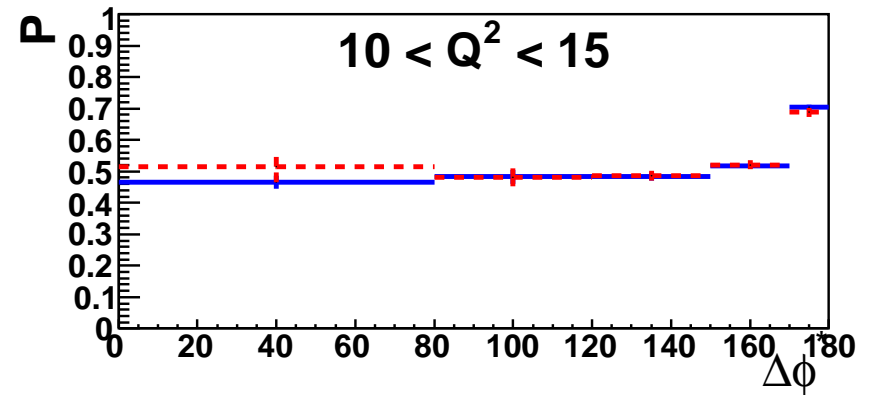
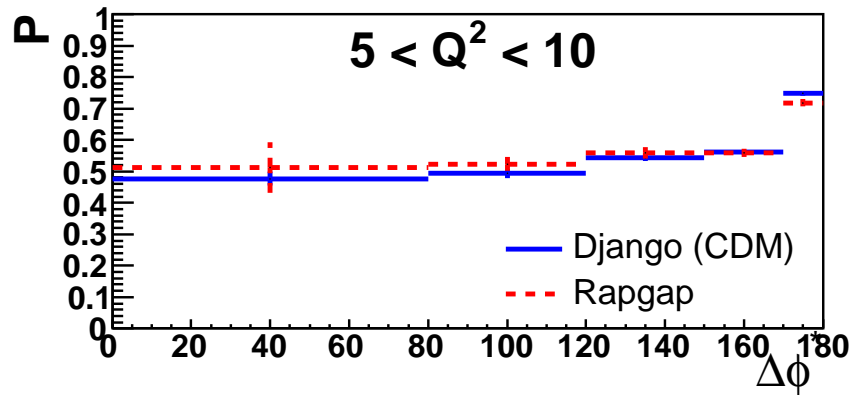
$$d\sigma / dx_{bj} d\Delta\phi^*$$



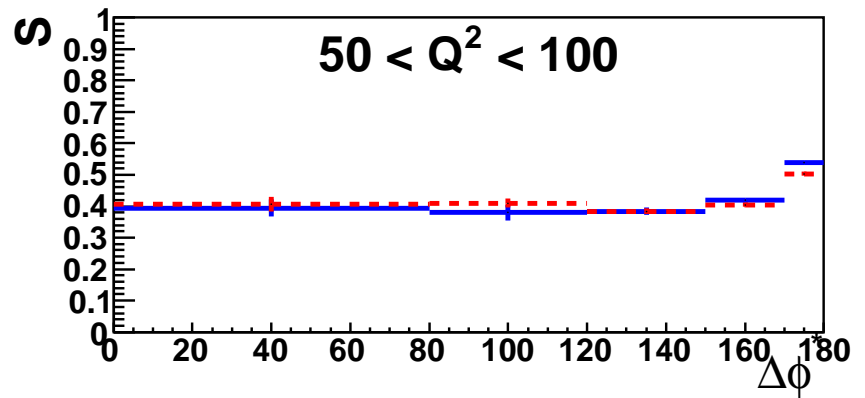
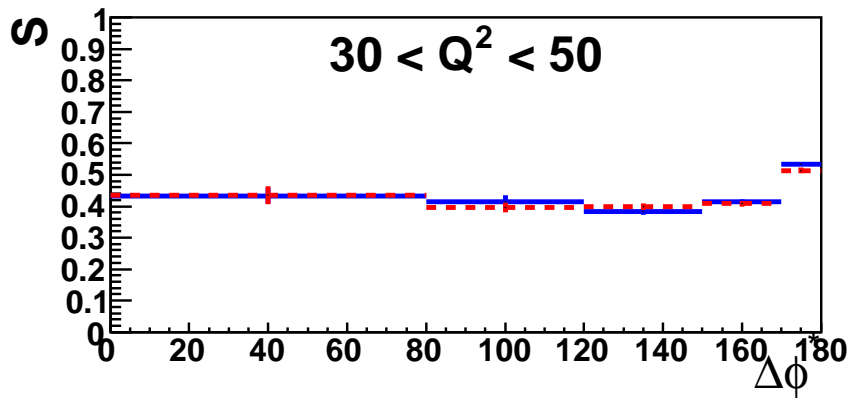
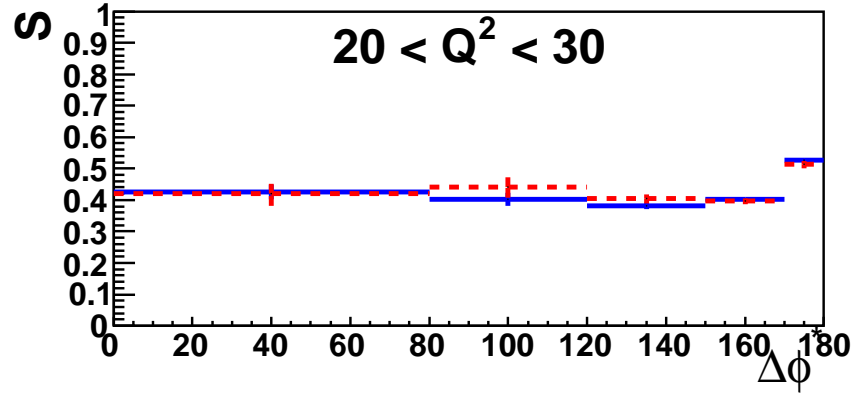
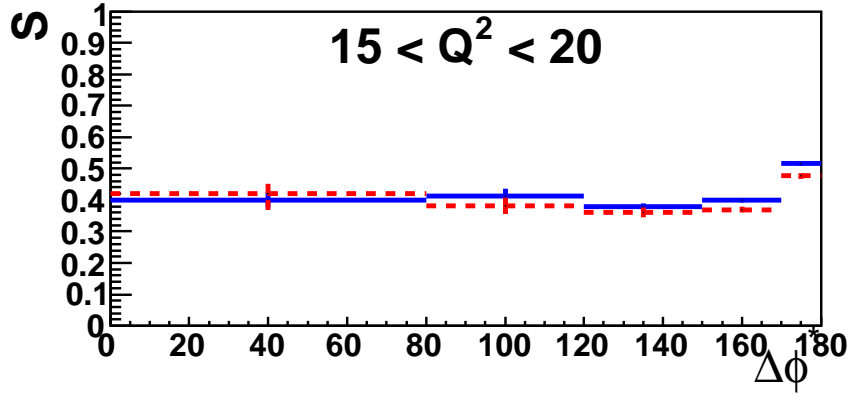
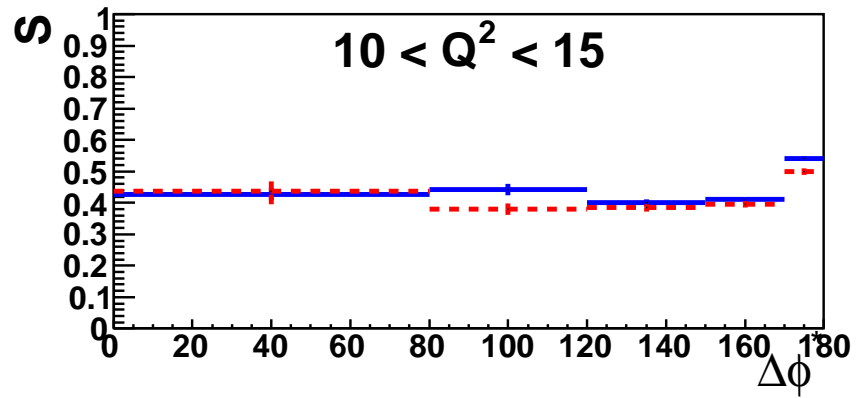
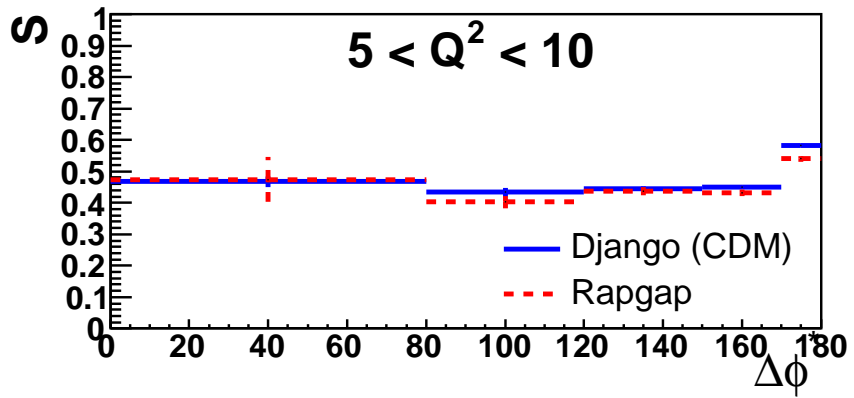
$d\sigma/dx_{bj}d\Delta\phi^*$ Ratio



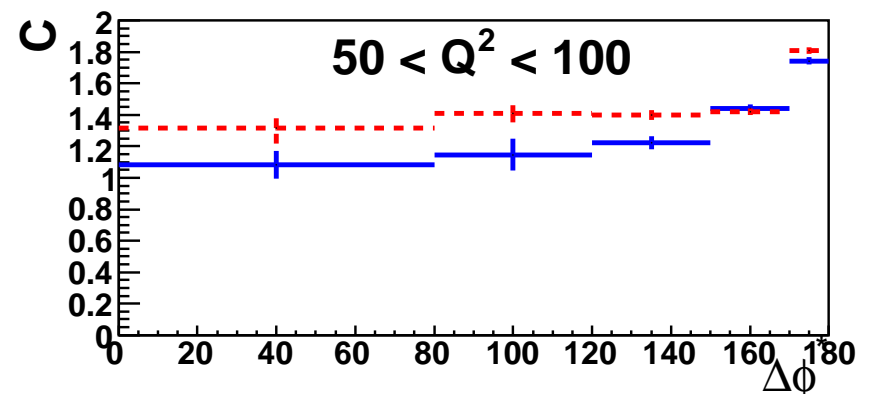
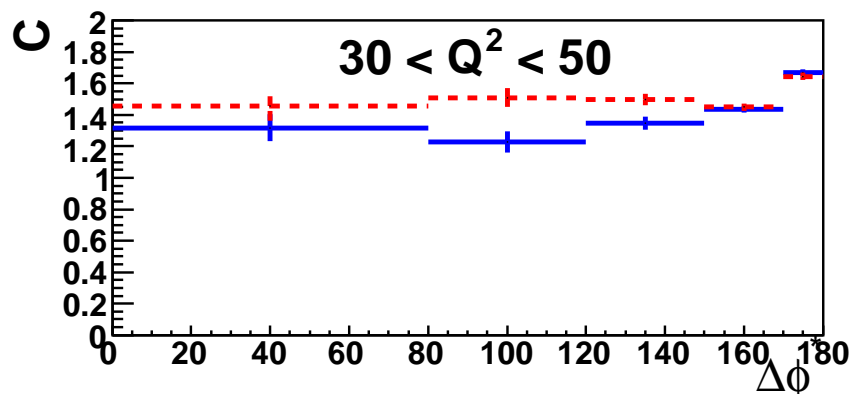
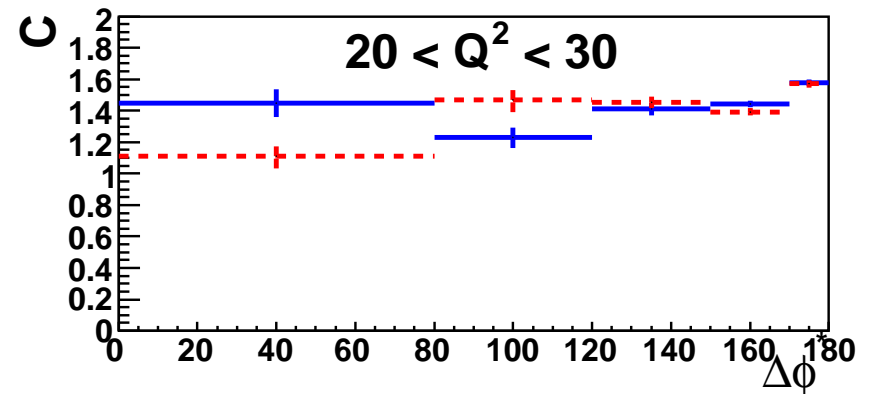
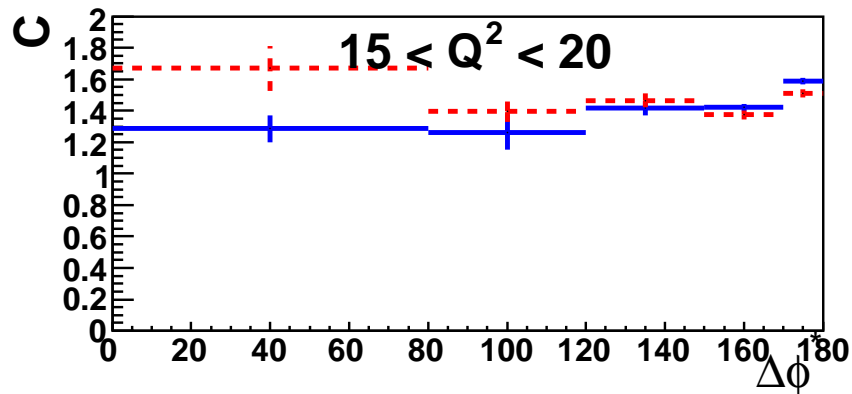
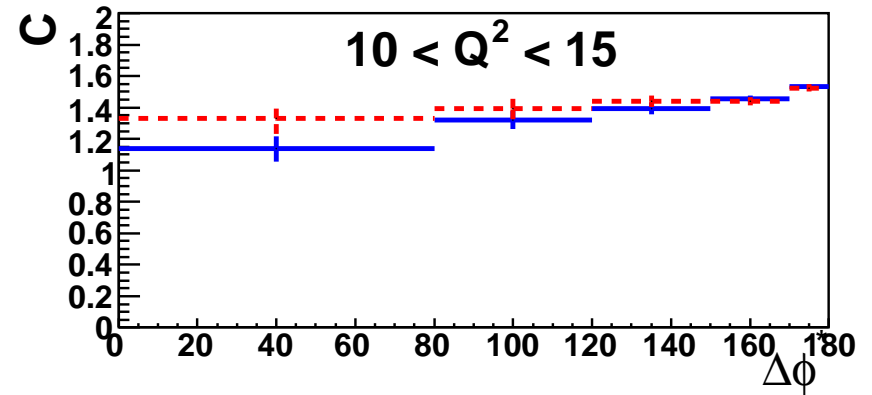
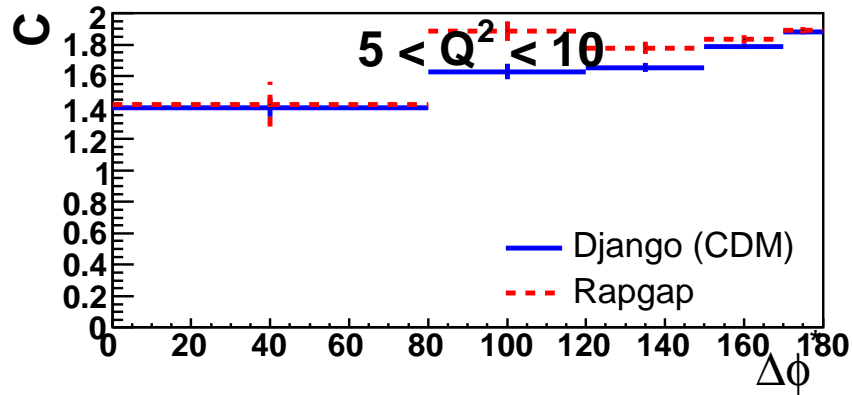
$d\sigma/dQ^2 d\Delta\phi^*$ Purity Asymmetric cuts



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



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



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

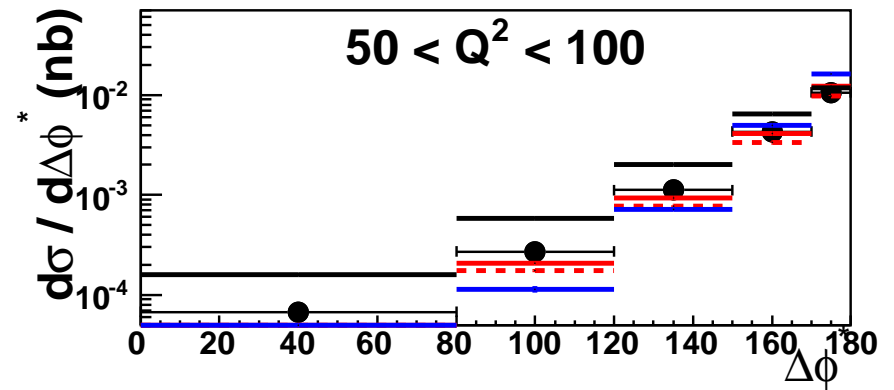
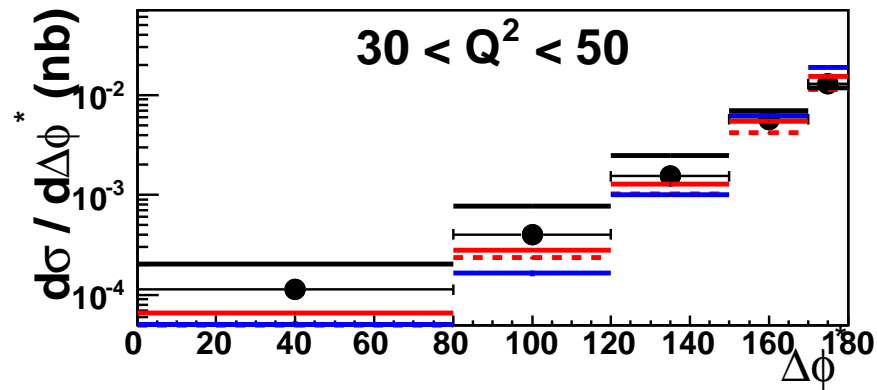
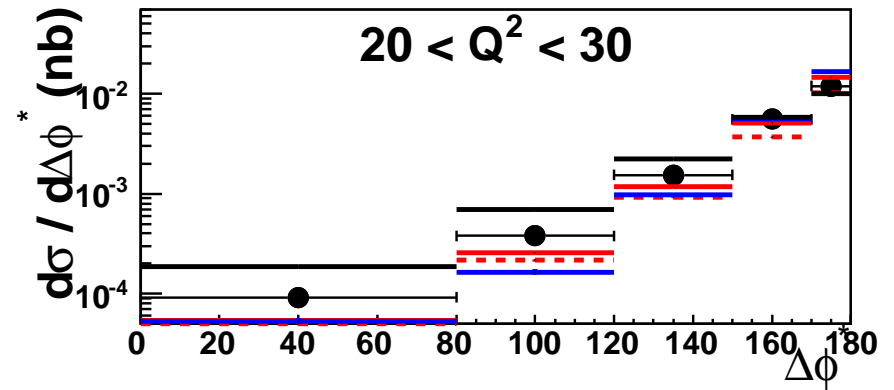
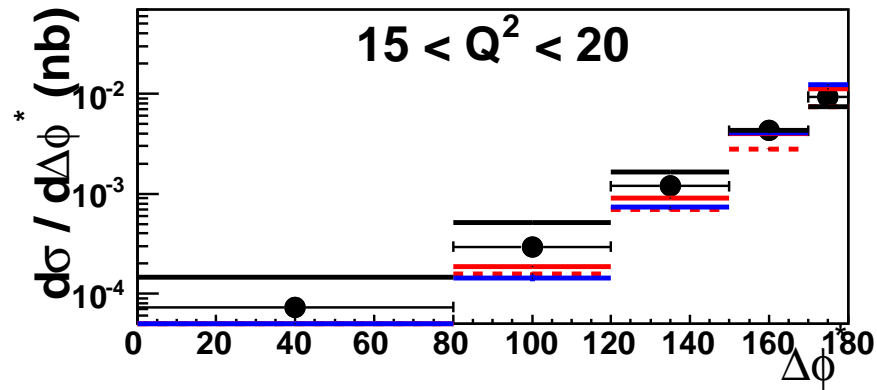
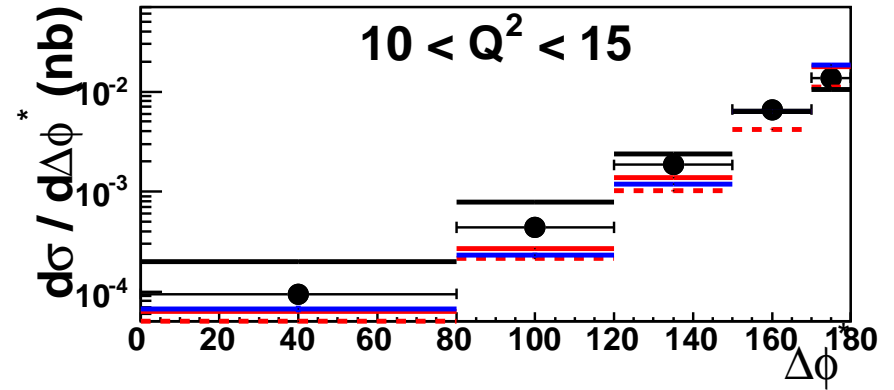
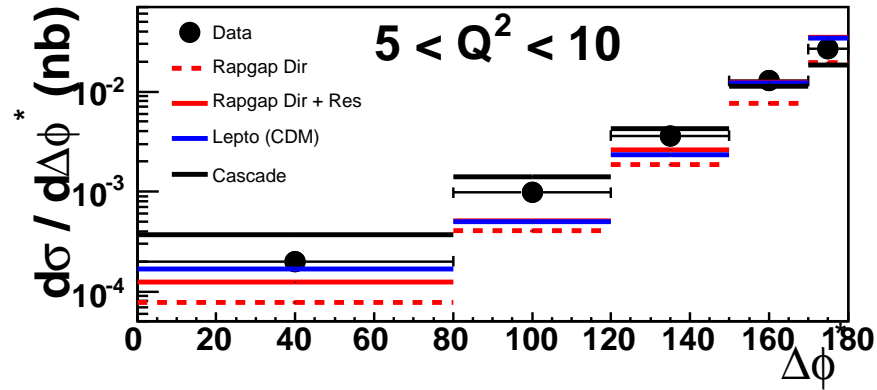
Systematic Uncertainties

Estimated using Rapgap

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

| Source | | Uncertainty |
|-------------------------------------|--------------|-------------|
| Electron Energy E'_e | $\pm 1\%$ | 0.1 - 1 % |
| Electron azimuthal angle θ_e | ± 1 mrad | 0.2 - 2 % |
| LAr Hadronic Energy | $\pm 4\%$ | } 1 - 20 % |
| SPACAL Hadronic Energy | $\pm 5\%$ | |
| Track Energy | $\pm 3\%$ | |
| Model dependence | | 0 - 5 % |

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



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

