Decorrelation of Dijets at Low x and Q^2

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Outline

⇒ Motivation

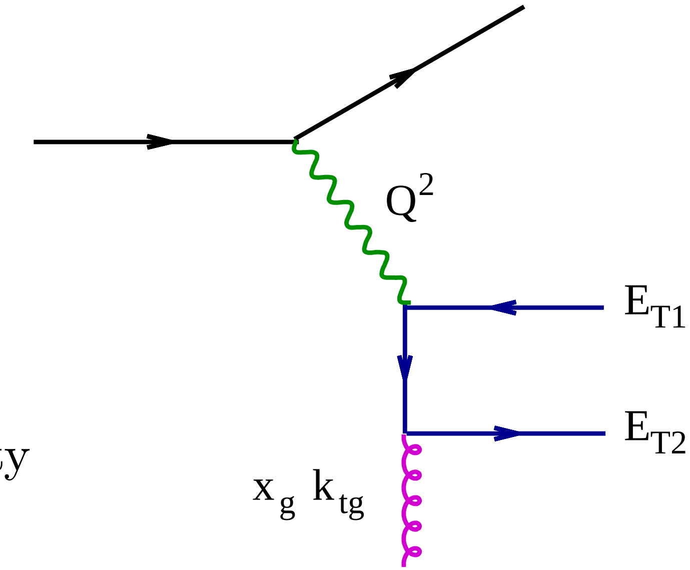
⇒ Selection

⇒ MC Models and NLO Calculations

⇒ Results

⇒ Summary & Conclusions

Motivation



DGLAP: Gluon collinear with proton in LO

$\Rightarrow$ Jets back-to-back in HCM

Higher order QCD radiation

$\Rightarrow k_{tg} \neq 0$ and $\Delta\phi^* < 180^\circ$

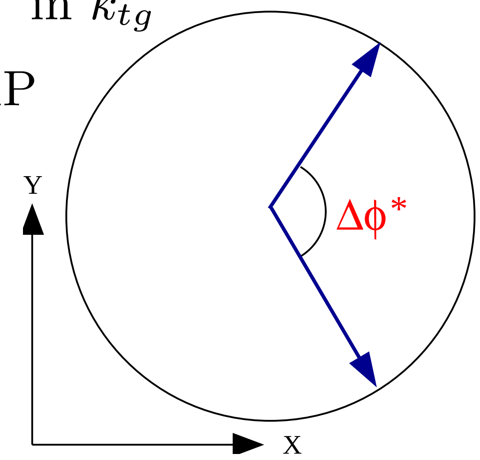
Gluon propagators ordered in virtuality

$\Rightarrow k_{tg}$ ordered

Small-x: New dynamics (BFKL, CCFM): 'random walk' in k_{tg}

$\Rightarrow$ Broader $\Delta\phi^*$ spectrum compared to DGLAP

uPDF $\Rightarrow \Delta\phi^* < 180^\circ$ already in LO



Azimuthal Decorrelations:

$\Rightarrow$ Sensitive to different parton dynamics

$\Rightarrow$ Sensitive to unintegrated gluon density

Selection

Using 1999/2000 e^+p H1 data, $\mathcal{L} \simeq 64$ pb^{-1}

Higher luminosity and better resolution than previous measurement
(Eur.Phys.J.C33:477-493,2004)

DIS Selection

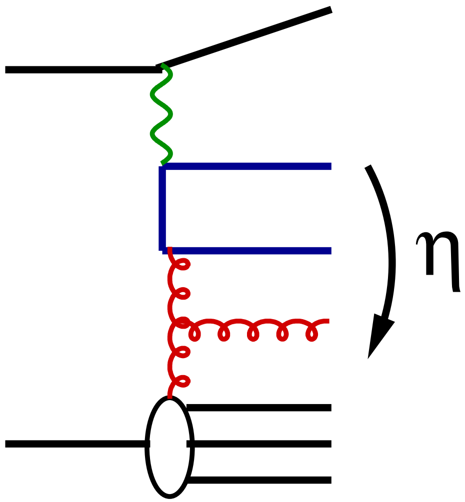
$$5 \text{ GeV}^2 < Q^2 < 100 \text{ GeV}^2$$
$$0.1 < y < 0.7$$

Dijet Selection

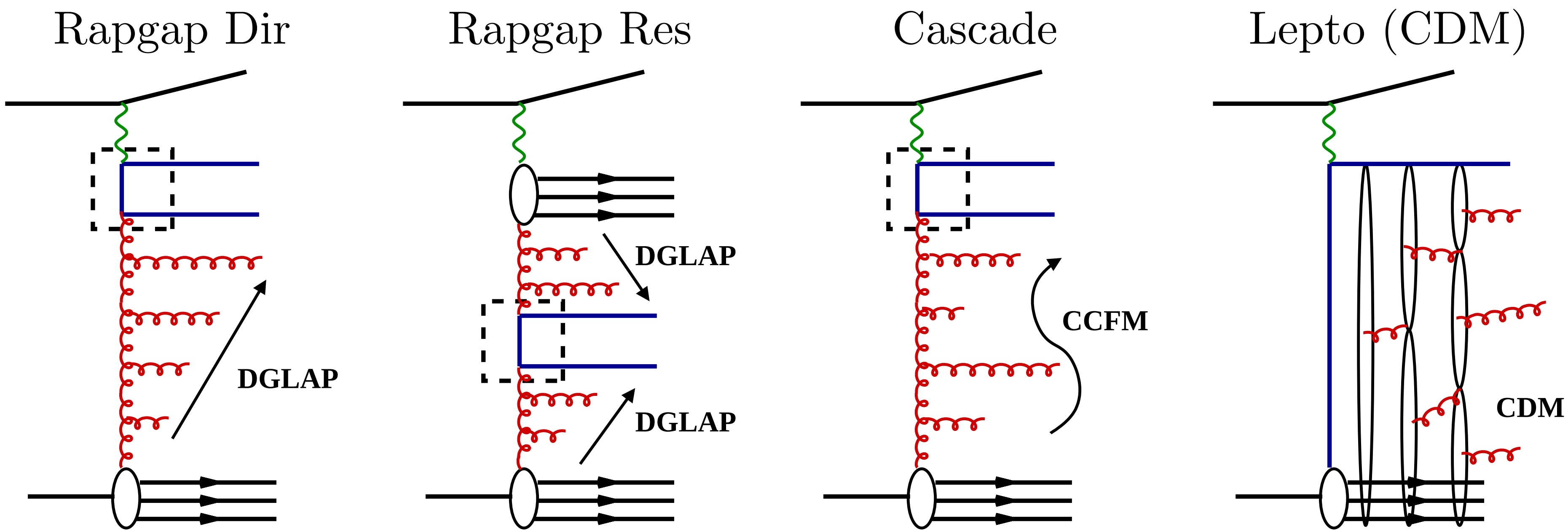
$$-1 < \eta_j < 2.5 \quad \text{(LAB)}$$
$$5 \text{ GeV} < E^*_{\perp j} \quad \text{(HCM)}$$

Incl. k_T-algorithm

The two jets closest in η
to the scattered electron
is chosen as dijet system



MC Models and NLO Calculations

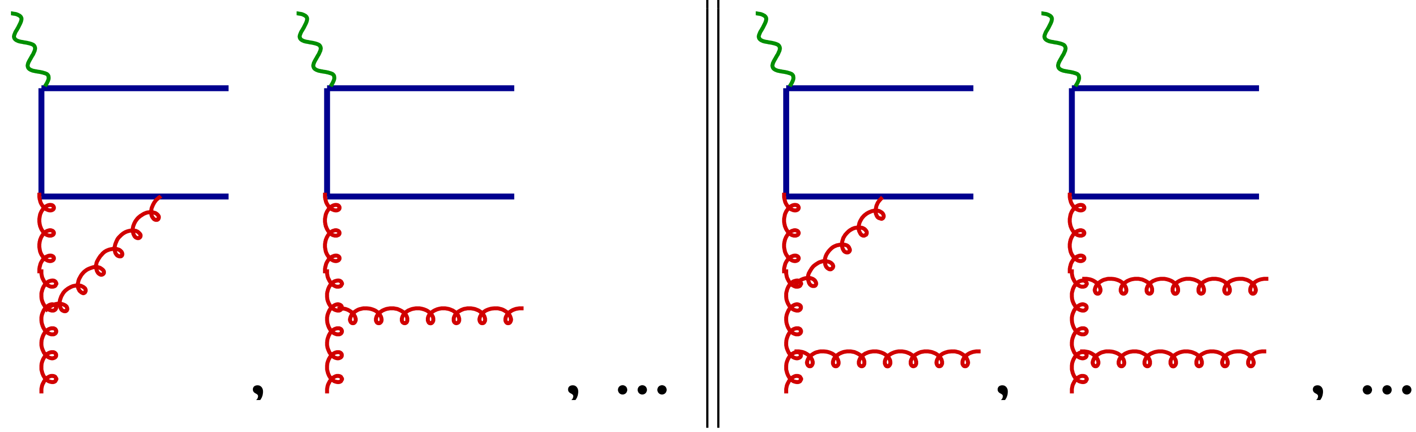


Rapgap (Dir) and Django (CDM) are used for corrections to hadron level

MC Models and NLO Calculations

NLO calculations using NLOJET++

NLO 2-jet || NLO 3-jet



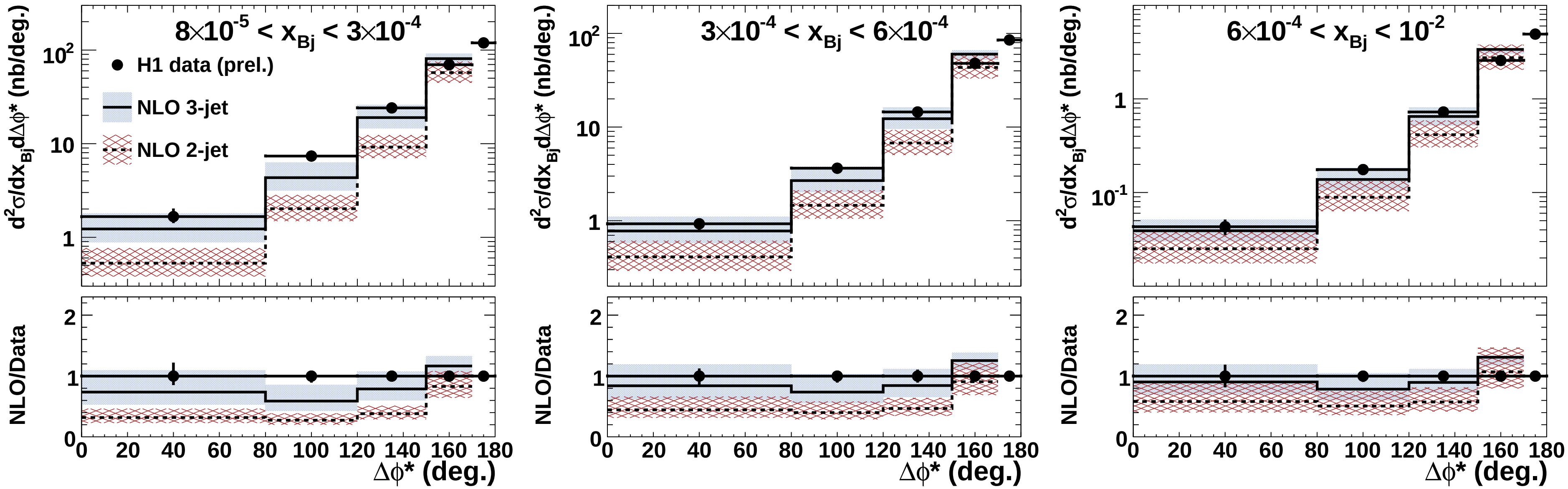
Scales: $\mu_r = \mu_f = \left(\frac{E_{T1}+E_{T2}}{2}\right)$

Scale Uncertainty: $\frac{1}{2}\mu_{r,f} < \mu_{r,f} < 2\mu_{r,f}$ changing both scales simultaneously

PDF: CTEQ6M

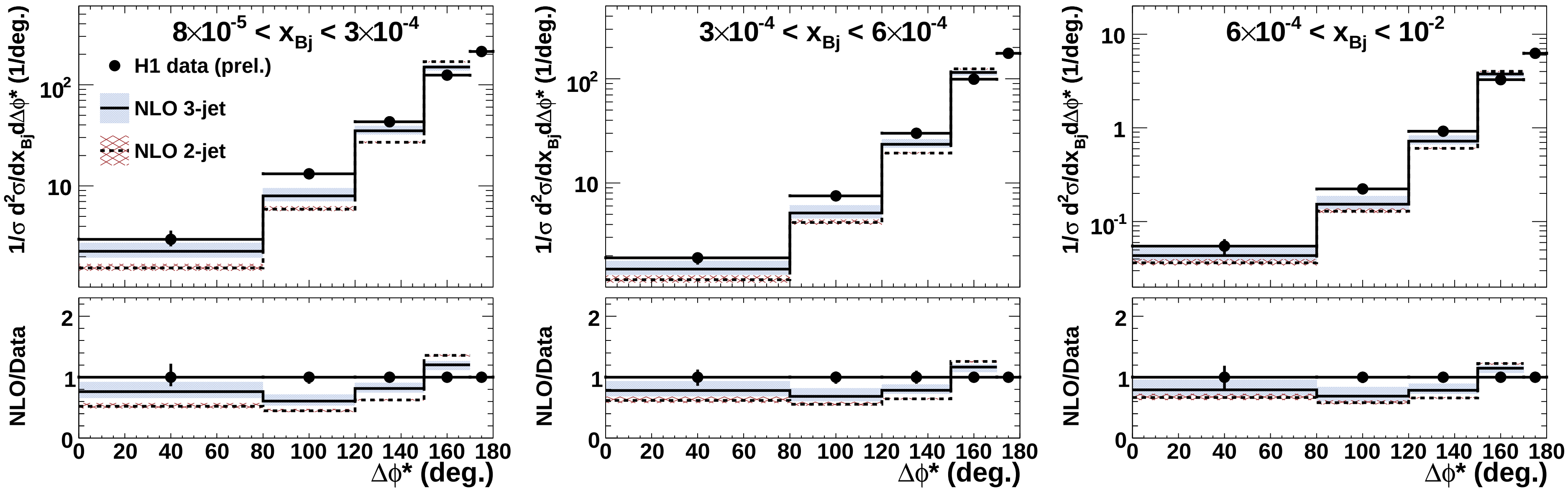
Hadronization corrections using Cascade

$\frac{d^2\sigma}{dx_{bj}\, d\Delta\phi^*}$ Data and NLOJET



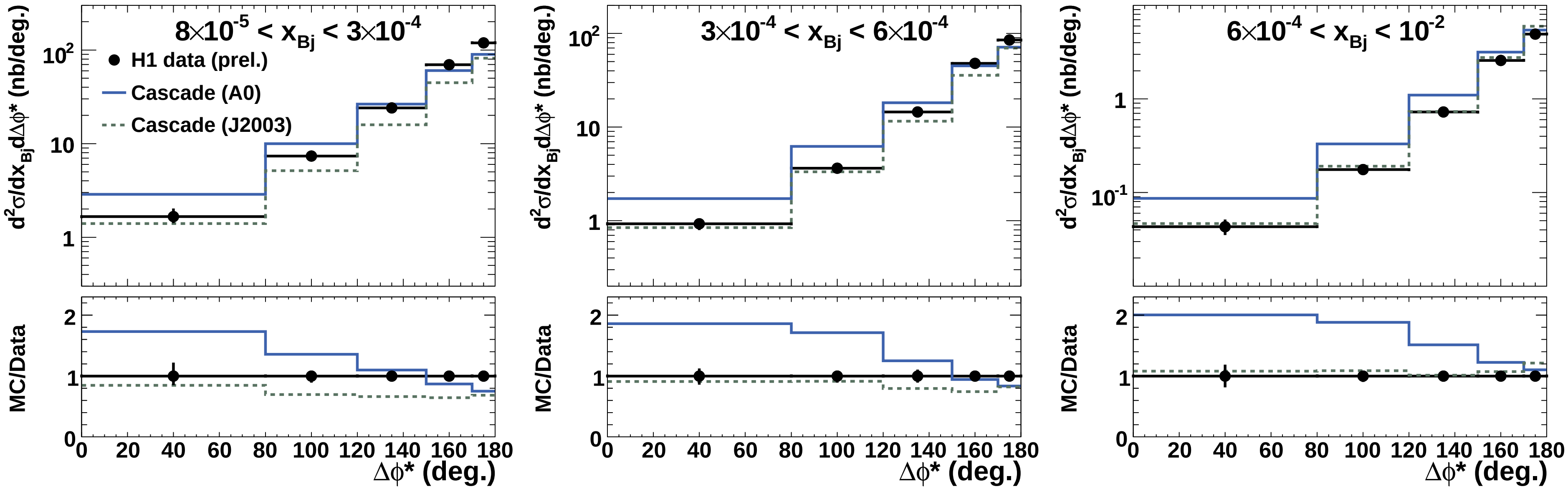
- Infrared sensitivity $\Rightarrow$ No NLO predictions for $\Delta\phi^* \sim 180^\circ$
- One parton radiation not enough (NLO 2-jet $\sim$ effectively LO)
- Two parton radiation better (NLO 3-jet $\sim$ effectively NLO)
  Systematically low for $\Delta\phi^* < 150^\circ$ but large scale uncertainties ($\sim$20 - 50%)

$\frac{1}{\sigma}\frac{d^2\sigma}{dx_{bj}\,d\Delta\phi^*}$ Data and NLOJET



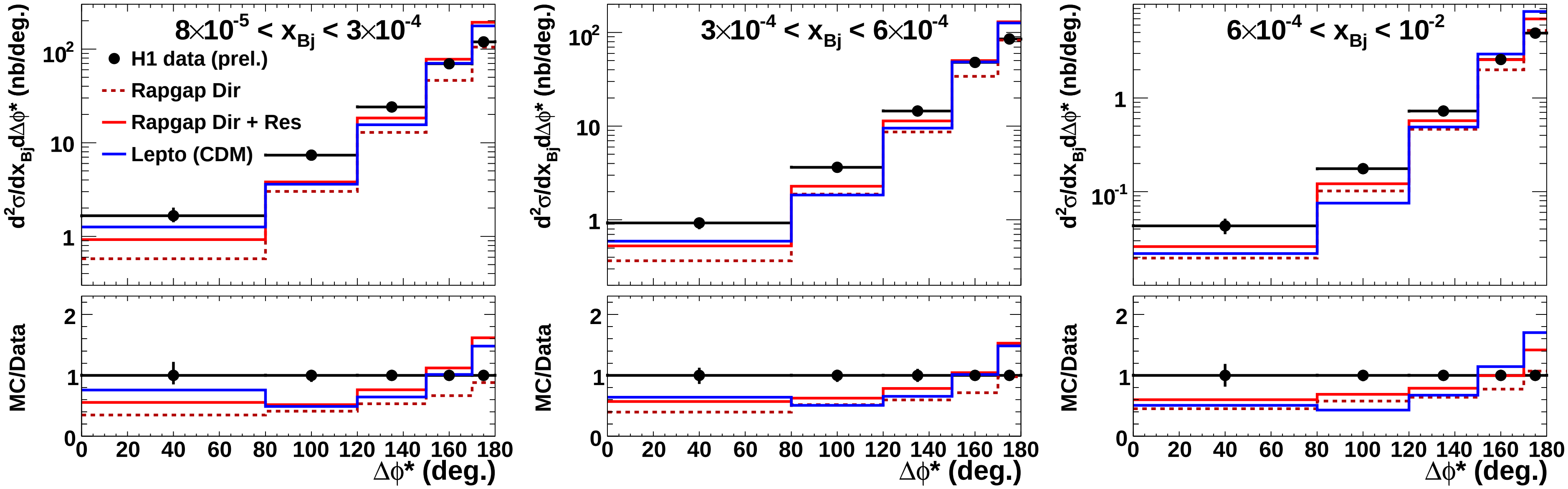
- Normalize to visible cross section in each x_{Bj} bin ($0° < \Delta\phi < 170°$)
  $\Rightarrow$ Cancellation of scale uncertainties (now $\leq 20\%$)
- NLO 3-jet not in agreement with data

$\frac{d^2\sigma}{dx_{bj}\,d\Delta\phi^*}$ Data and Cascade



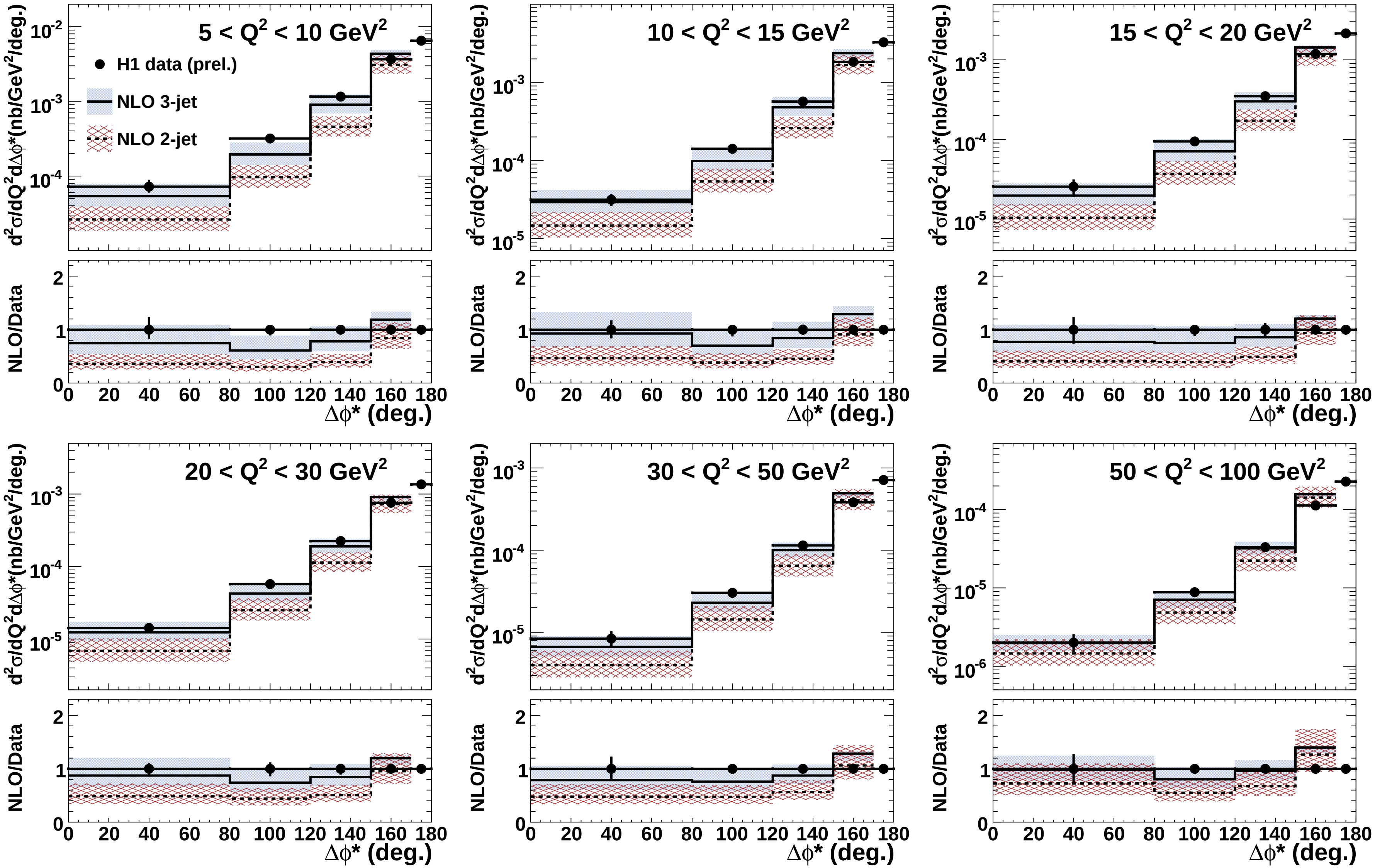
- Sensitivity to unintegrated gluon density
- Cascade (J2003) describes data resonably well except in lowest x_{Bj} bin
- Cascade (A0) fails in all x_{Bj} bins.
  A0 has too hard k_t-spectrum

$\frac{d^2\sigma}{dx_{bj}d\Delta\phi^*}$ Data, Rapgap and Lepto(CDM)



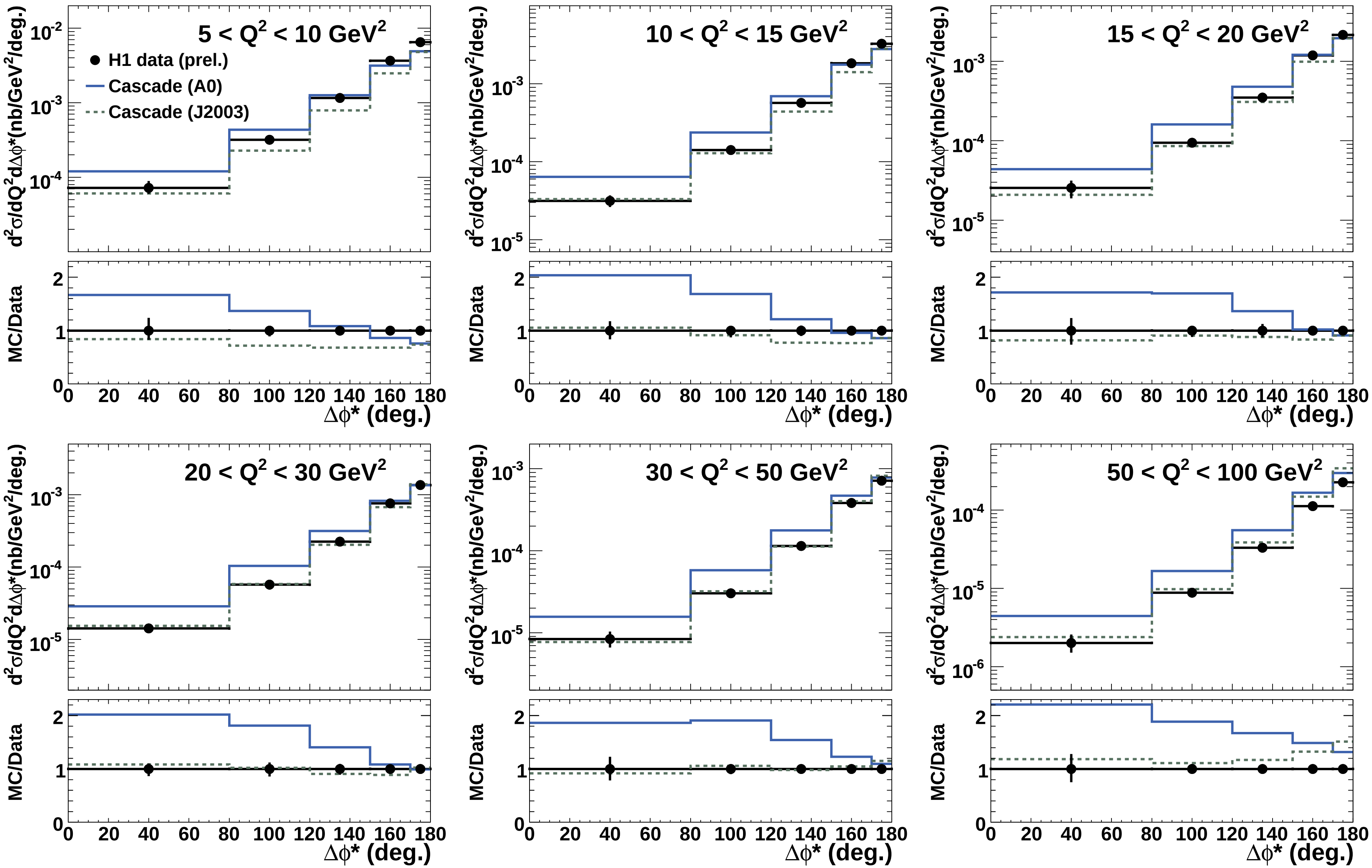
- Rapgap Dir has right amount of back-to-back jets
- Both Rapgap Dir+Res and Lepto(CDM) predict too many back-to-back jets and too few dijets with small $\Delta\phi^*$
- Rapgap Dir+Res better at high x_{Bj}
- Lepto(CDM) better at low x_{Bj}

$\frac{d^2\sigma}{dQ^2 d\Delta\phi^*}$ Data and NLOJET



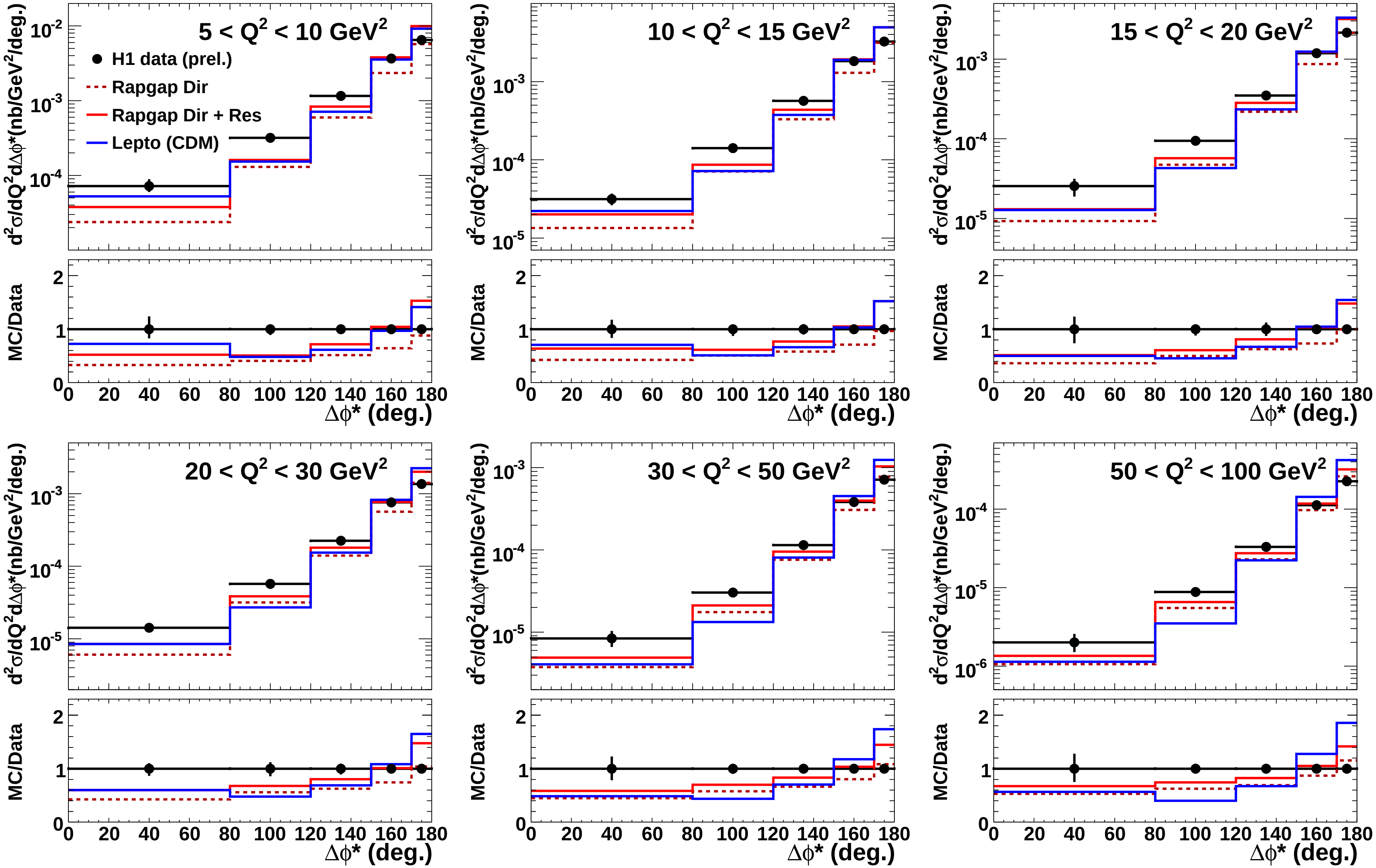
NLO 3-jet systematically low for $\Delta\phi^* < 150^\circ$, but describes data within large scale uncertainties

$\frac{d^2\sigma}{dQ^2 d\Delta\phi^*}$ Data and Cascade



Cascade with J2003 provides good description of data

$\frac{d^2\sigma}{dQ^2 d\Delta\phi^*}$ Data, Rapgap and Lepto(CDM)



All models fail to describe shape of the data

Summary & Conclusions

- Azimuthal decorrelations in dijet events measured in bins of Q^2 and in bins of x_{Bj}
- One parton radiation (NLO 2-jet) not enough to describe data
- Two parton radiation (NLO 3-jet) systematically low for $\Delta\phi^* < 150^\circ$, but within large scale uncertainties in agreement with data
- Normalise to visible cross section
  $\Rightarrow$ Data not within scale uncertainties of NLO 3-jet
- Data show sensitivity to the unintegrated gluon density, they prefer J2003 compared to A0
- Rapgap Dir, Rapgap Dir+Res and Lepto(CDM) fail to describe the data