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Dijet rates in DIS

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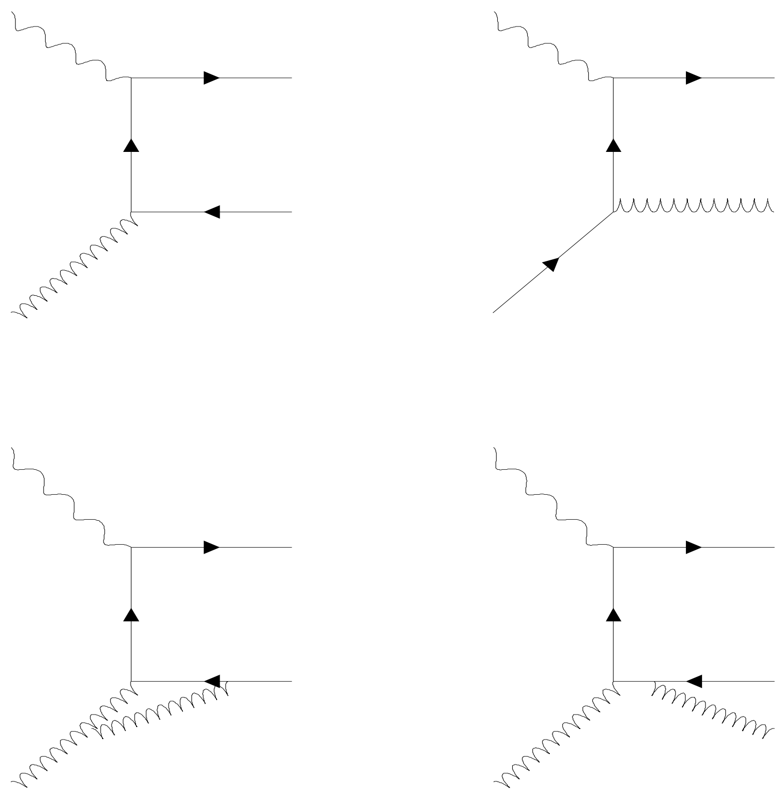
1. Introduction and motivation

Inclusive dijet production in DIS:



Measurement of dijet production at (low) x_B, Q^2 is highly non trivial test of perturbative QCD $\leftrightarrow$relevant scale ?

Observable:

$$R_2 = \frac{\sigma_{2jet}}{\sigma_{DIS}}$$

Convenient observable in Jet physics

...dependent on

- **x_B for fixed Q^2**
  - $W^2 \approx \frac{Q^2}{x_B} \Rightarrow$ phase space for large transverse energies increases
- **E_t of jets**
  - large E_t as sign for hard QCD process

Measurement will be compared to NLO calculations (DISENT, JETVIP)

Data set and cuts

H1 data 1996/97:

$$\mathbf{L} \approx 22\,\mathbf{pb}^{-1}$$

DIS event selection:

$E_e^{'} > 9\,\mathbf{GeV}$, $y_e > 0.1$, $156^o < \theta_e < 175^o$

$\Rightarrow$ **phase space of analysis:**

$5 < Q^2 < 100\,\mathbf{GeV}^2$ **and** $10^{-4} < x_B < 10^{-2}$

Jet selection:

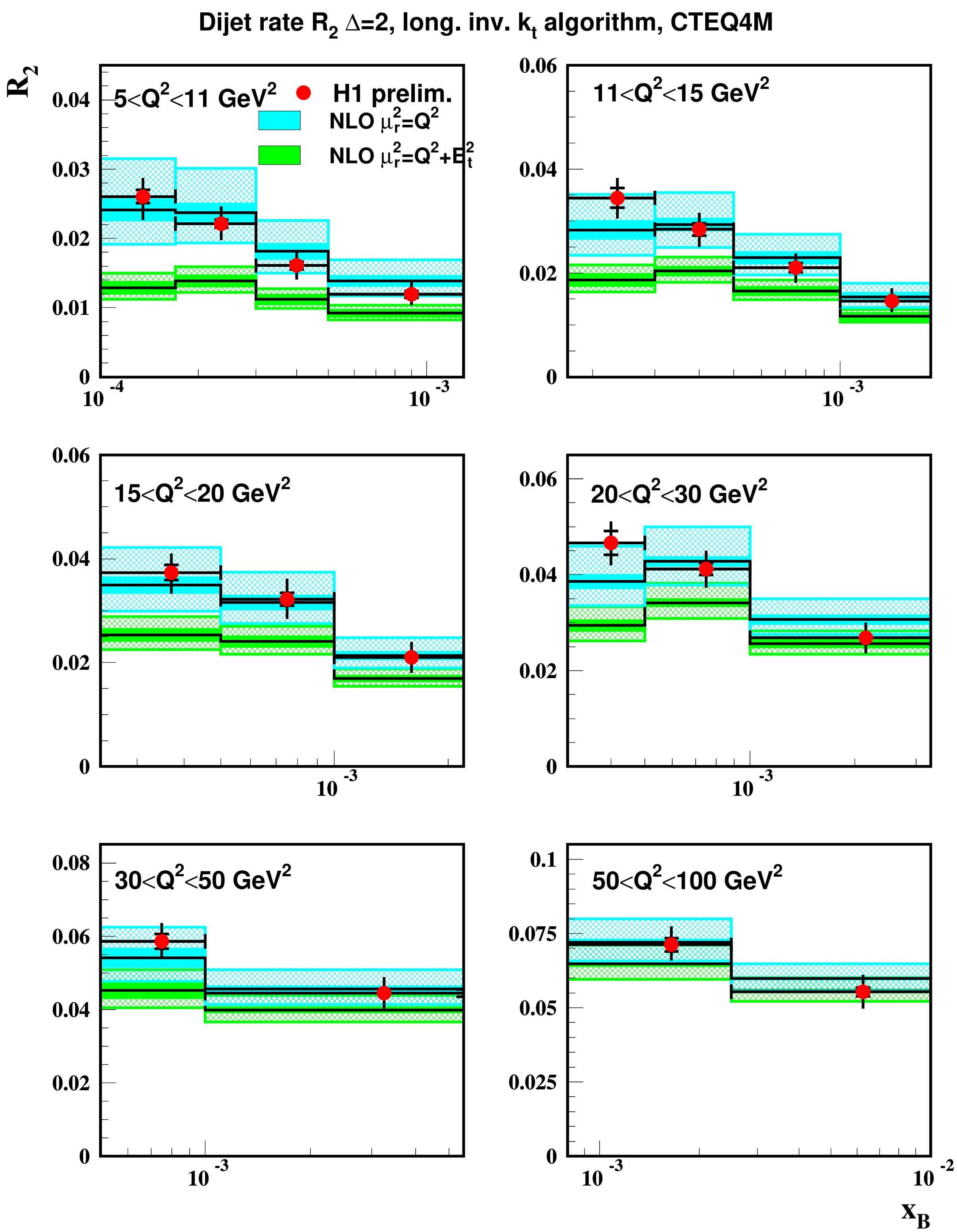
long. invariant k_t algorithm à la Ellis Soper in hadronic CMS frame

$E_{t,jet} > 5\,\mathbf{GeV}$ **with** $E_{t,jet1} > (5 + \triangle)\,\mathbf{GeV}$, $\triangle = 2$

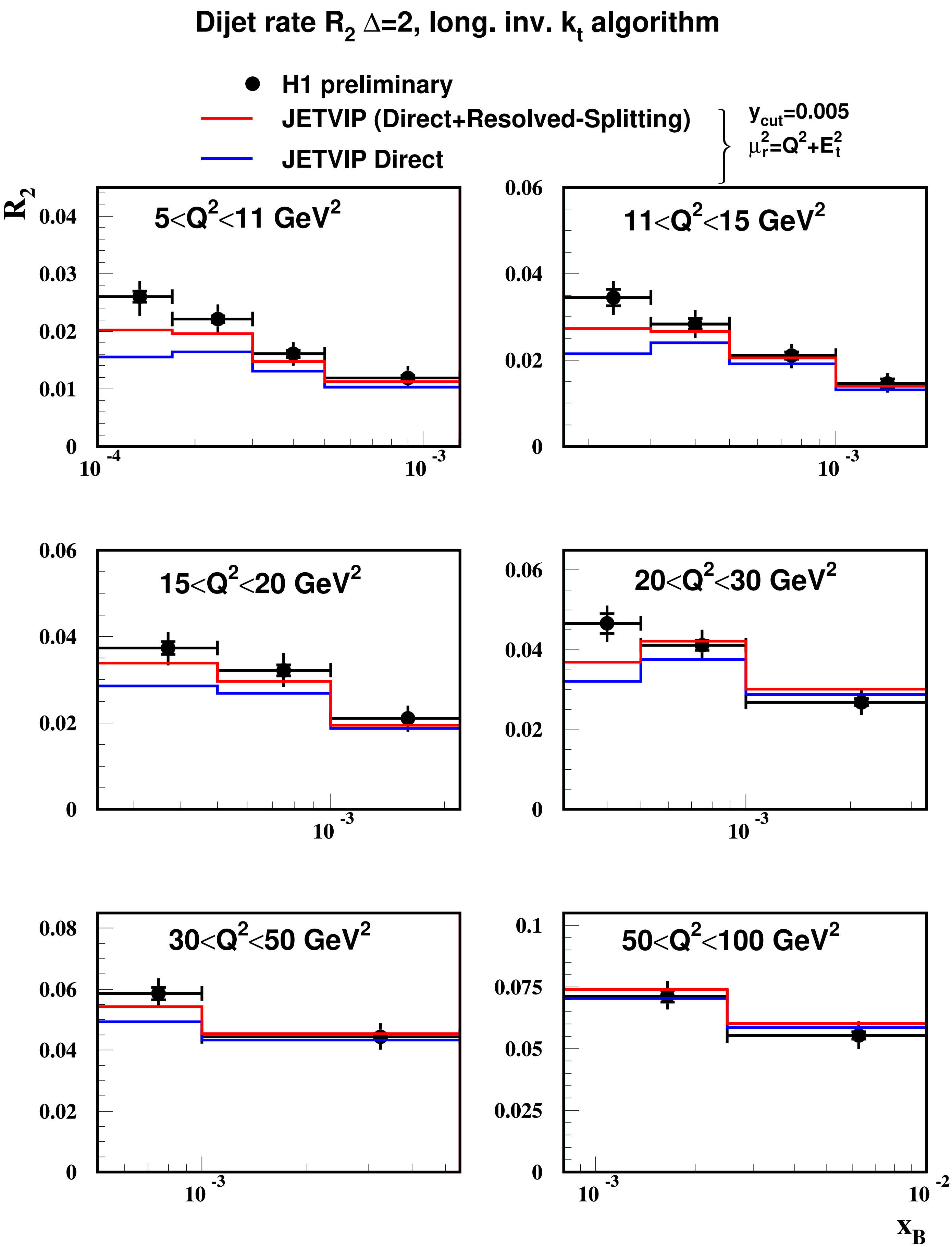
($\rightarrow$ more on $\triangle$ later)

$N_{jet} \geq 2$ **in** $-1 < \eta_{lab} < 2.5$

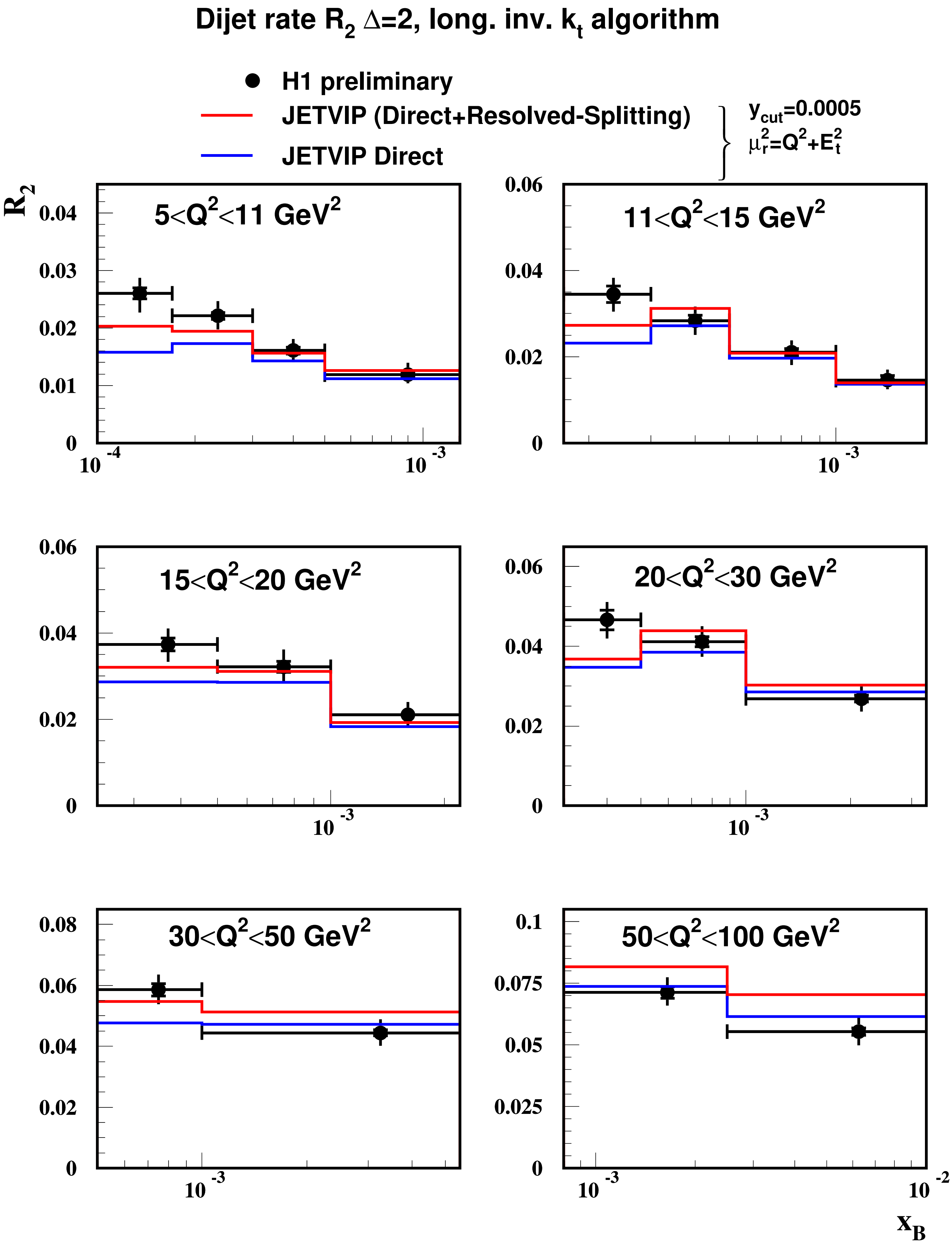
Results



Dijet rate R_2 Δ=2, long. inv. k_t algorithm, CTEQ4M
R_2
$5<Q^2<11$ GeV^2
H1 prelim.
NLO $\mu_r^2=Q^2$
NLO $\mu_r^2=Q^2+E_t^2$
$11<Q^2<15$ GeV^2
$15<Q^2<20$ GeV^2
$20<Q^2<30$ GeV^2
$30<Q^2<50$ GeV^2
$50<Q^2<100$ GeV^2
x_B



Dijet rate R_2 Δ=2, long. inv. k_t algorithm
H1 preliminary
JETVIP (Direct+Resolved-Splitting)
JETVIP Direct
y_{cut}=0.005
$\mu_r^2=Q^2+E_t^2$
R_2
$5<Q^2<11$ GeV^2
$11<Q^2<15$ GeV^2
$15<Q^2<20$ GeV^2
$20<Q^2<30$ GeV^2
$30<Q^2<50$ GeV^2
$50<Q^2<100$ GeV^2
x_B



Dijet rate R_2 Δ=2, long. inv. k_t algorithm
H1 preliminary
JETVIP (Direct+Resolved-Splitting)
JETVIP Direct
y_{cut}=0.0005
$\mu_r^2=Q^2+E_t^2$
R_2
$5<Q^2<11$ GeV^2
$11<Q^2<15$ GeV^2
$15<Q^2<20$ GeV^2
$20<Q^2<30$ GeV^2
$30<Q^2<50$ GeV^2
$50<Q^2<100$ GeV^2
x_B

Study of E_t dependence

R_2 is studied as a function of Δ

$$E_{t,jet1} > (E_{t,cut} + \Delta), \Delta \geq 0$$

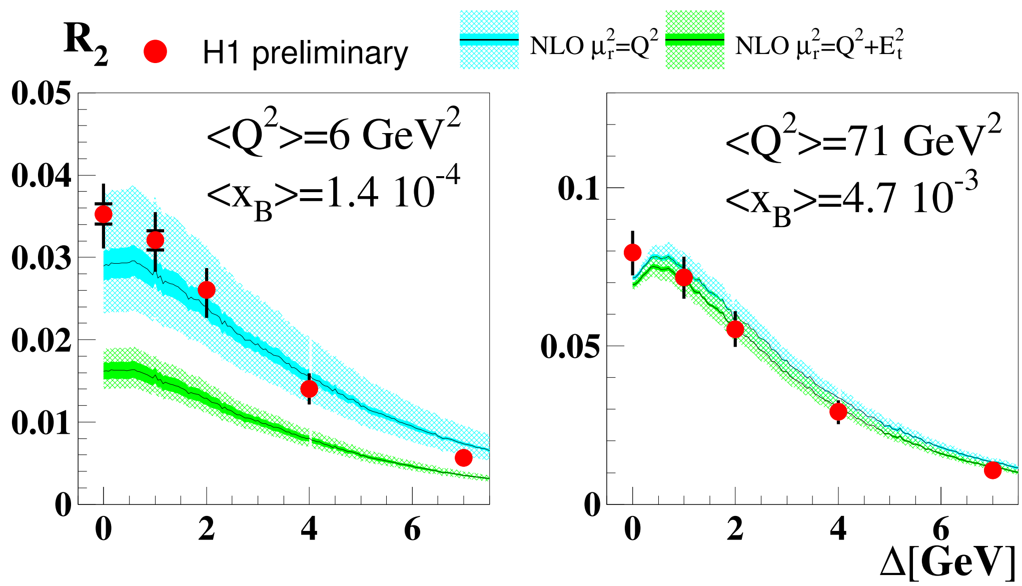
$$E_{t,,jet2} > E_{t,cut}$$

- With increasing Δ the phase space for 3-body contributions to NLO dijet cross section is increased to cancel virtual (negative) 2-body contributions($\rightarrow$ next foil)

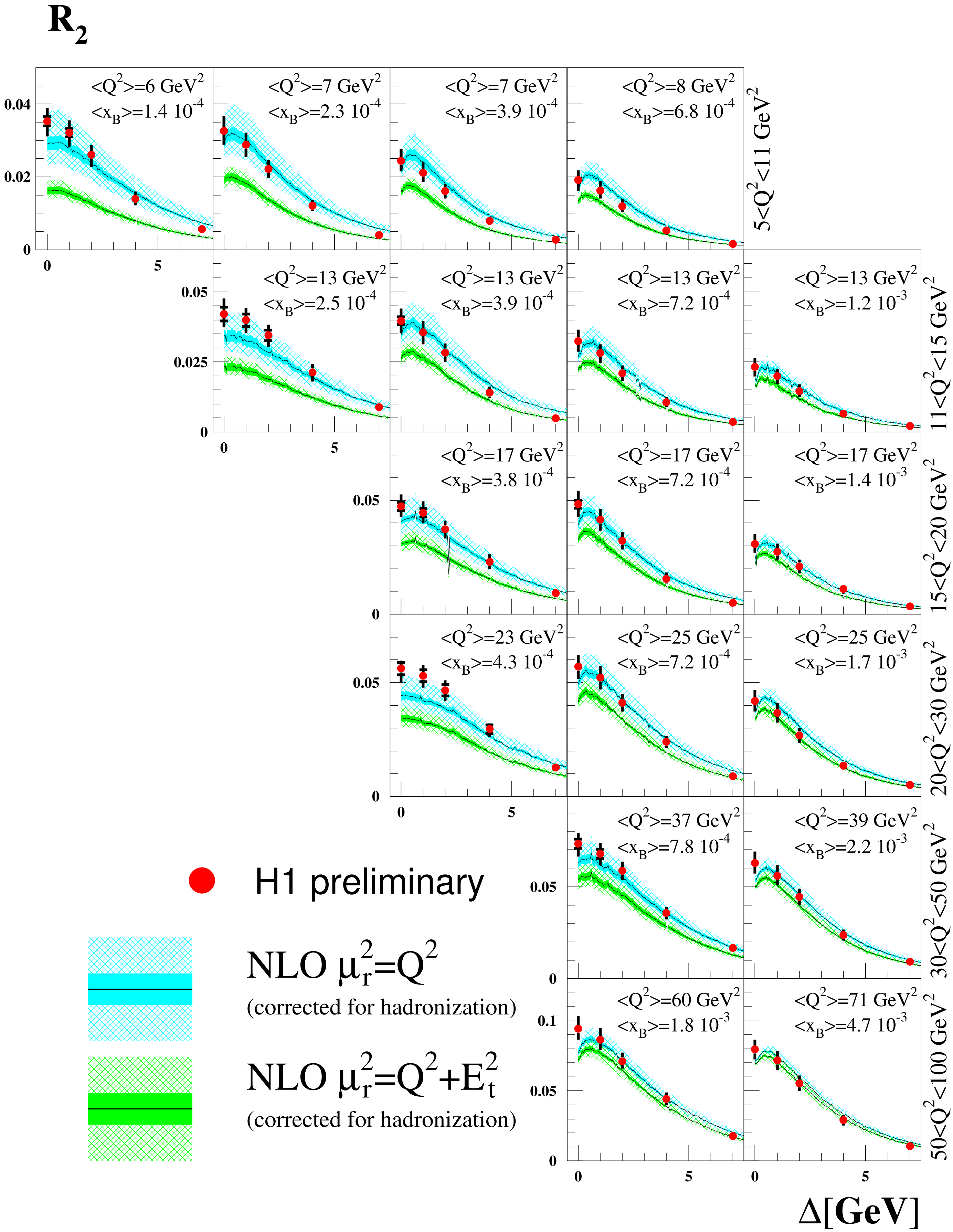
R_2 as function of Δ, $R_2(x_B, Q^2, E_t) \rightarrow R_2(x_B, Q^2, \Delta)$

First measurement of this kind !

example for low x_B, Q^2 and large x_B, Q^2



- **Data increase with decreasing Δ**
- **NLO describes data for large x_B, Q^2 for both scales, at low x_B, Q^2 only $\mu_r^2 = Q^2$ describes data**
- **NLO calculation show turnover for $\Delta < 1$!**



R2
<Q2>=6 GeV2 <xB>=1.4 10-4
<Q2>=7 GeV2 <xB>=2.3 10-4
<Q2>=7 GeV2 <xB>=3.9 10-4
<Q2>=8 GeV2 <xB>=6.8 10-4
5<Q2<11 GeV2
<Q2>=13 GeV2 <xB>=2.5 10-4
<Q2>=13 GeV2 <xB>=3.9 10-4
<Q2>=13 GeV2 <xB>=7.2 10-4
<Q2>=13 GeV2 <xB>=1.2 10-3
11<Q2<15 GeV2
<Q2>=17 GeV2 <xB>=3.8 10-4
<Q2>=17 GeV2 <xB>=7.2 10-4
<Q2>=17 GeV2 <xB>=1.4 10-3
15<Q2<20 GeV2
<Q2>=23 GeV2 <xB>=4.3 10-4
<Q2>=25 GeV2 <xB>=7.2 10-4
<Q2>=25 GeV2 <xB>=1.7 10-3
20<Q2<30 GeV2
<Q2>=37 GeV2 <xB>=7.8 10-4
<Q2>=39 GeV2 <xB>=2.2 10-3
30<Q2<50 GeV2
<Q2>=60 GeV2 <xB>=1.8 10-3
<Q2>=71 GeV2 <xB>=4.7 10-3
50<Q2<100 GeV2
H1 preliminary
NLO μr2=Q2
(corrected for hadronization)
NLO μr2=Q2+Et2
(corrected for hadronization)
Δ[GeV]

Conclusion

- Detailed measurement of R_2 at low x_B and Q^2 presented

- NLO calculations describe the data for $\mu_r^2 = Q^2$ in entire phase space

- NLO calculations describe the data at large x_B, Q^2 for $\mu_r^2 = Q^2 + E_t^2$
  - Room for additional contributions at low x_B (resolved γ^*, different parton dynamics ?)

- First detailed measurement of dijet production as function of NLO threshold parameter Δ
  - Measurement suited to improve QCD predictions for $\Delta \to 0$