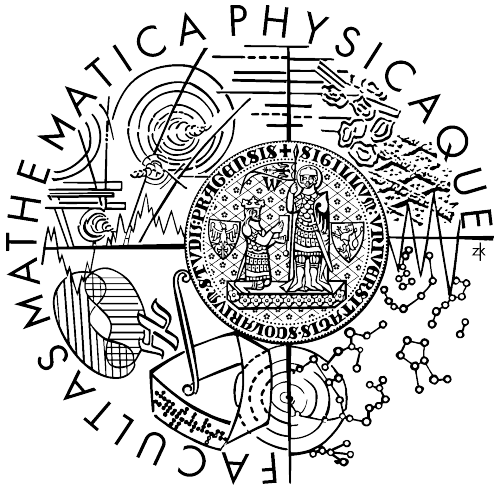
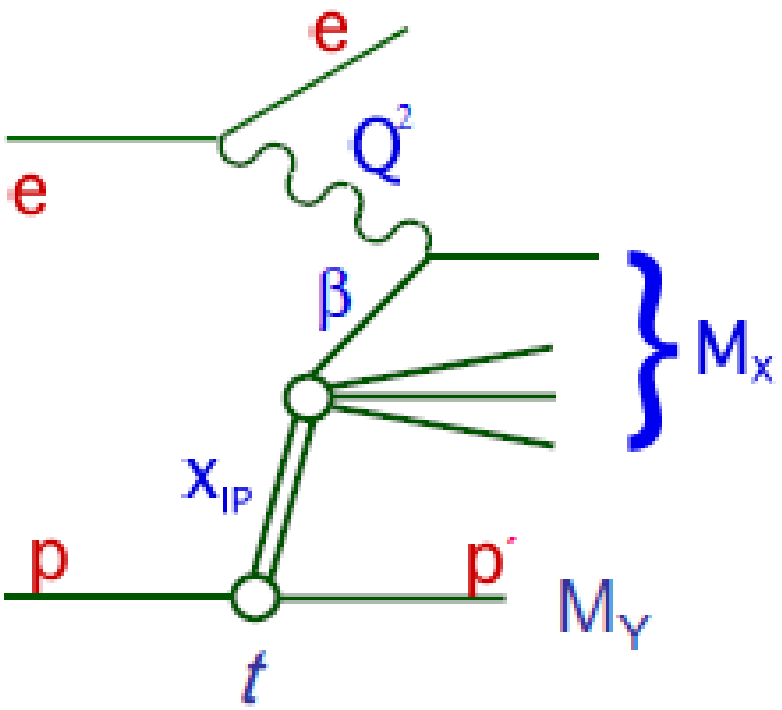
Diffractive Jets at H1

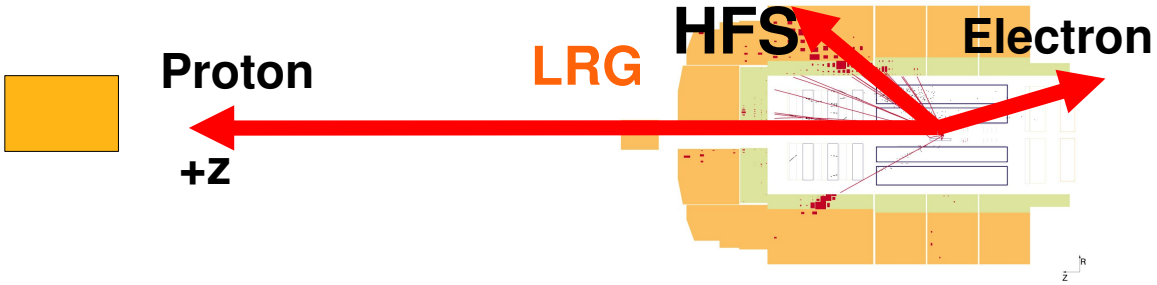


Richard Polifka
Charles University in Prague
On behalf of the
H1 Collaboration

21.04.2010
DIS 2010, Firenze

Diffractive measurements





Experimental techniques:

LRG method

+ high statistics

-- proton dissociative background

-- not possible to measure the hadronic final state in the forward direction

Proton Tagging

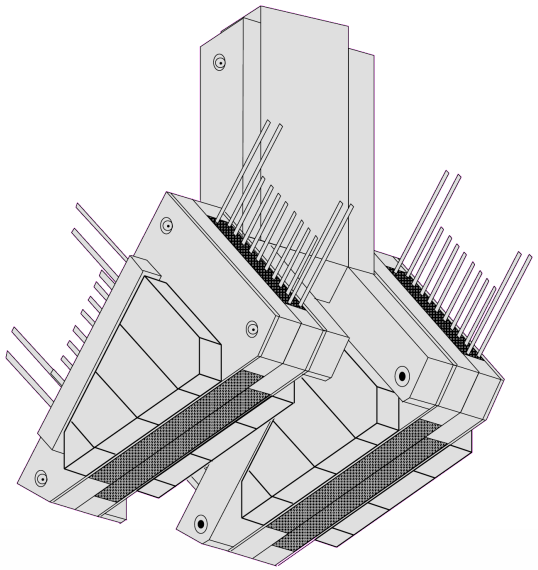
+ direct and accurate measurement of diffractive variables

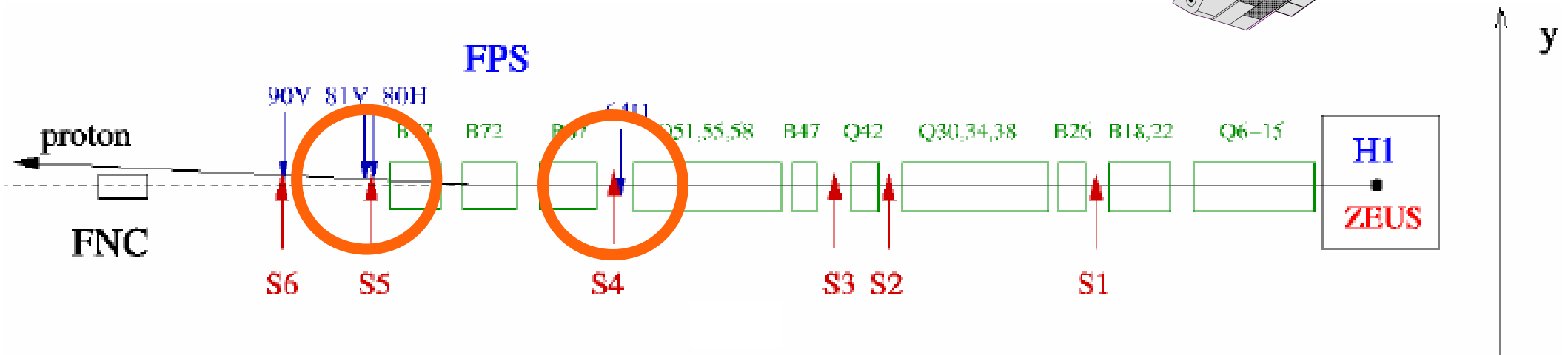
+ free of proton dissociation background

-- small acceptance → low statistics

FPS at H1

- Forward Proton Spectrometer:
  - 61m and 80m stations, each station able to measure x and y position twice, 2 station allow to measure the angle of the scattered proton
  - Scintilating fibres with PMT
  - Acceptance:
    - Proton Energy: 820 to 920 GeV
    - Proton Px: -0.63 to -0.27 GeV
    - Proton Py: - 0.8 to 0.8 GeV
    - $x_{IP} = 1 - Ep'/Ep$ up to 0.1





Kinematical variables in diffractive DIS

$$Q^2 = (k - k')^2,\ y = pq / pk$$

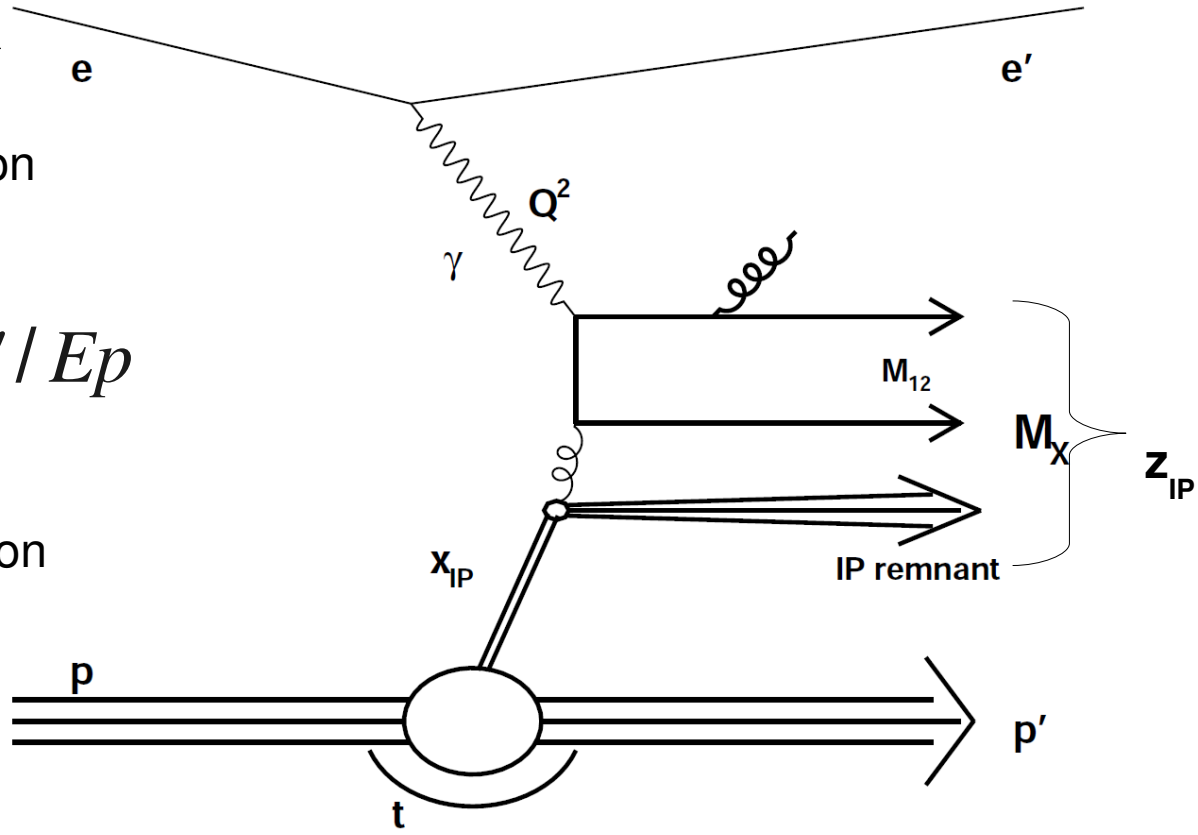
Reconstructed from scattered electron and hadronic final state

$$t = (p - p')^2,\ x_{IP} = 1 - Ep'/Ep$$

Reconstructed from direct measurement of the scattered proton

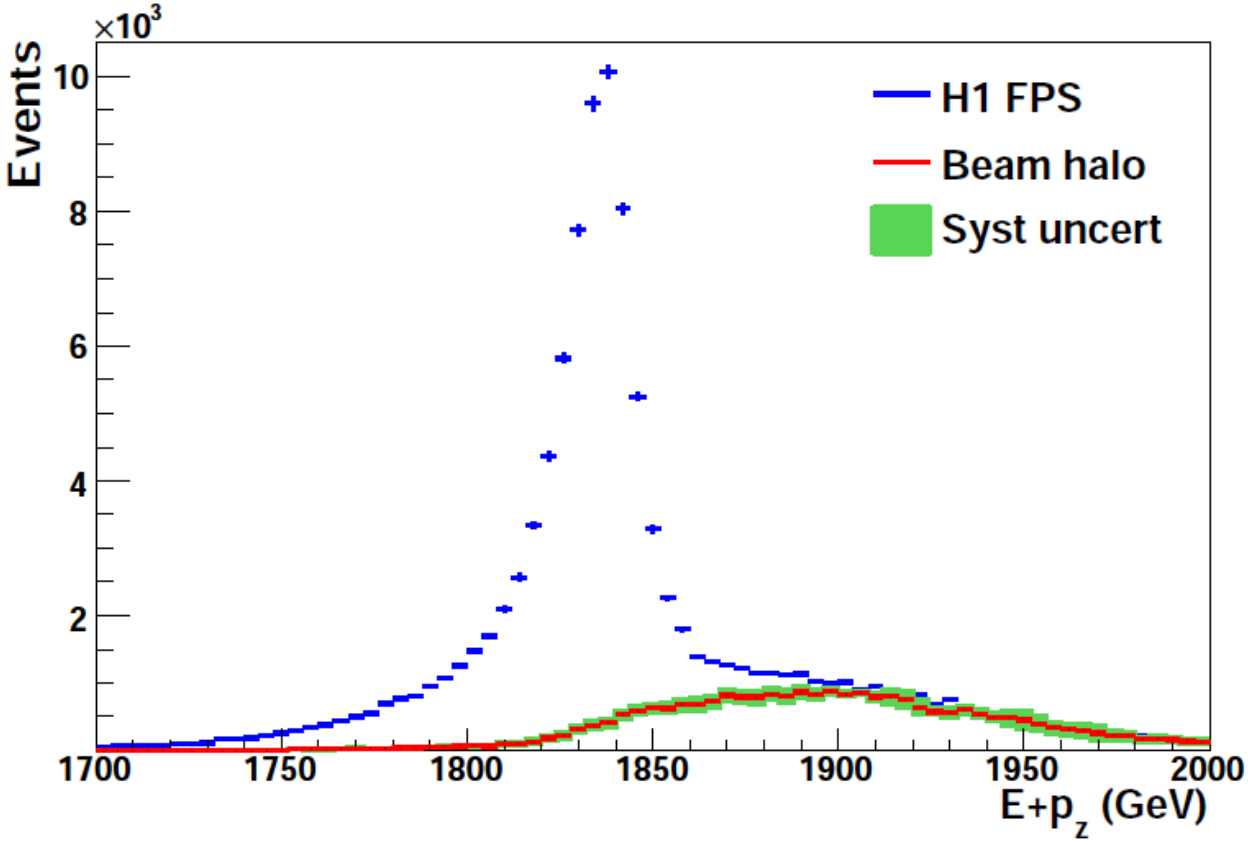
$$z_{IP} = (Q^2 + M_{12}^2)/(x_{IP}\, y\, s)$$

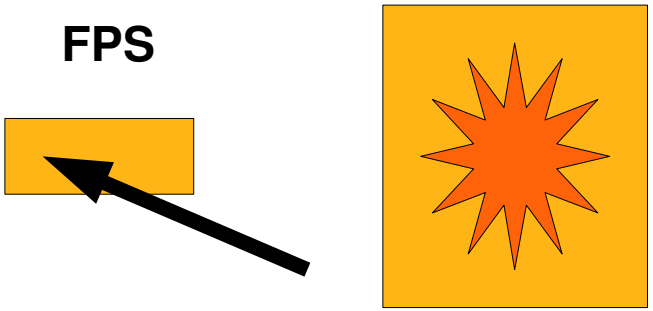
Fraction of mass of the hadronic final state that is contained in the dijet system



Selection

- Data collected during whole HERA-II period with $L_{int} = 156\ pb^{-1}$
- Tagged proton selection requires a good understanding of background in FPS due to coincidence of beam halo protons and event in the central detector





Selection

- Central dijet selection:
  - Kt Algorithm applied in the hadronic centre-of-mass system
  - Selected: 450 events

$0.05 < y < 0.7$

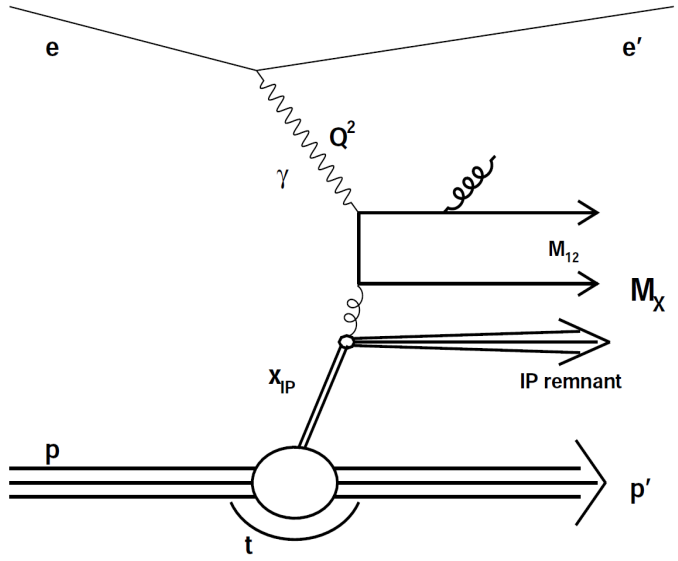
$4 < Q^2 < 110\ \mathrm{GeV}^2$,

$x_{IP} < 0.1$

$p_{T1}^* > 5\ \mathrm{GeV}$

$p_{T2}^* > 4\ \mathrm{GeV}$

$-1 < \eta < 2.5$



Cross section measurement

NLOJET++ using H1 2006 DPDF Fit B

- IP and IR contribution
- scale $\mu = Q^2 + p^{*2}_{T1}$
- Hadronization uncertainties ~8%

Detector

- RapGap and NLO corrected by 1.23 due to **proton dissociation background missing** in FPS analysis

RapGap with DPDF 2006 Fit B

Stable hadrons

Data
RapGap
NLO

Comparison to previous analysis

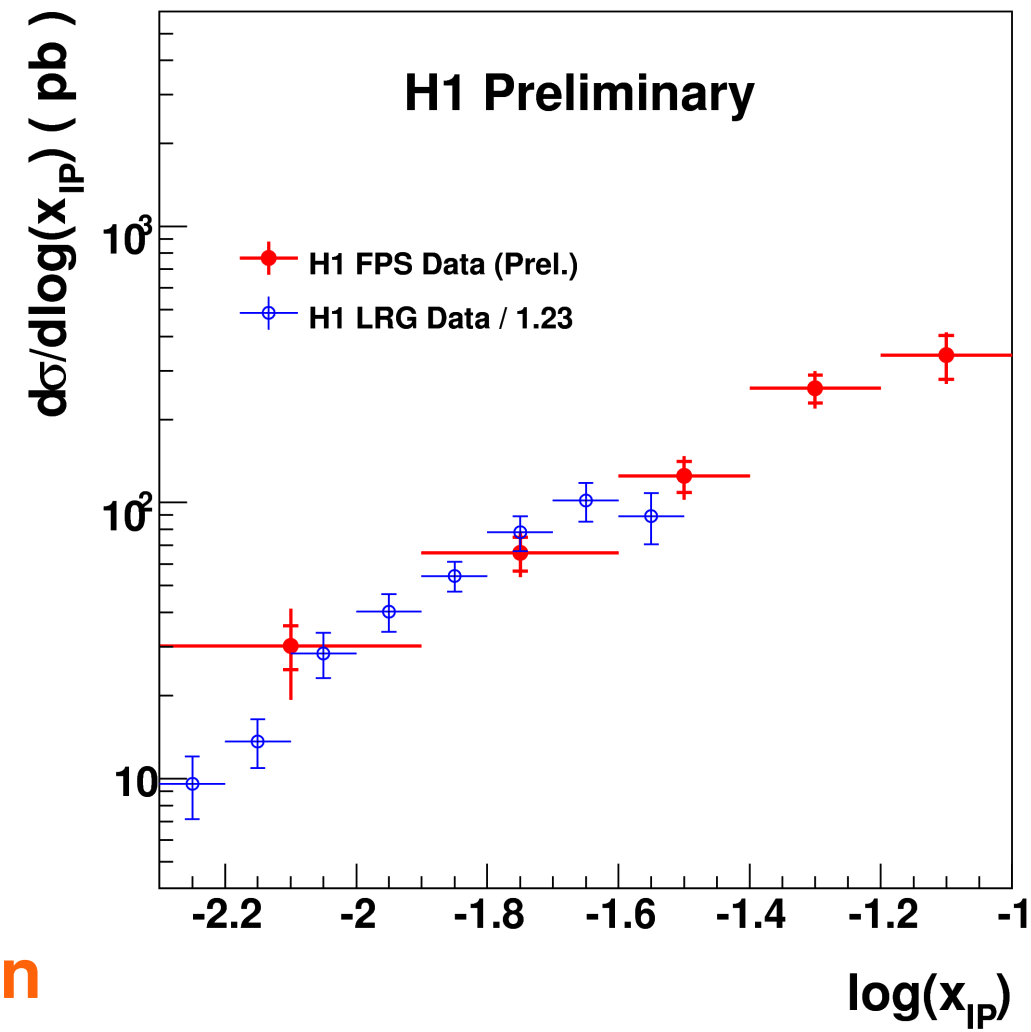
- Diffractive DIS dijet analysis with LRG (JHEP 0710:042)
- Published data scaled by 1.23 (proton dissociation background)

$4 < Q^2 < 80\ \mathrm{GeV}^2$

$0.1 < y < 0.7$

$p_{T1}^* > 5.5\ \mathrm{GeV}$

$p_{T2}^* > 4\ \mathrm{GeV}$



- **Very good consistency**
- **Phase space extension in x_{IP} by factor of 3**

x_{IP} dependence

- Total uncorrelated error ~13%
- Total normalisation uncertainty approximately 5% (not presented)
- R = Theory/Data
- NLO error:
  - Scale variations $2\mu, \mu/2 \oplus$ hadronization uncertainties

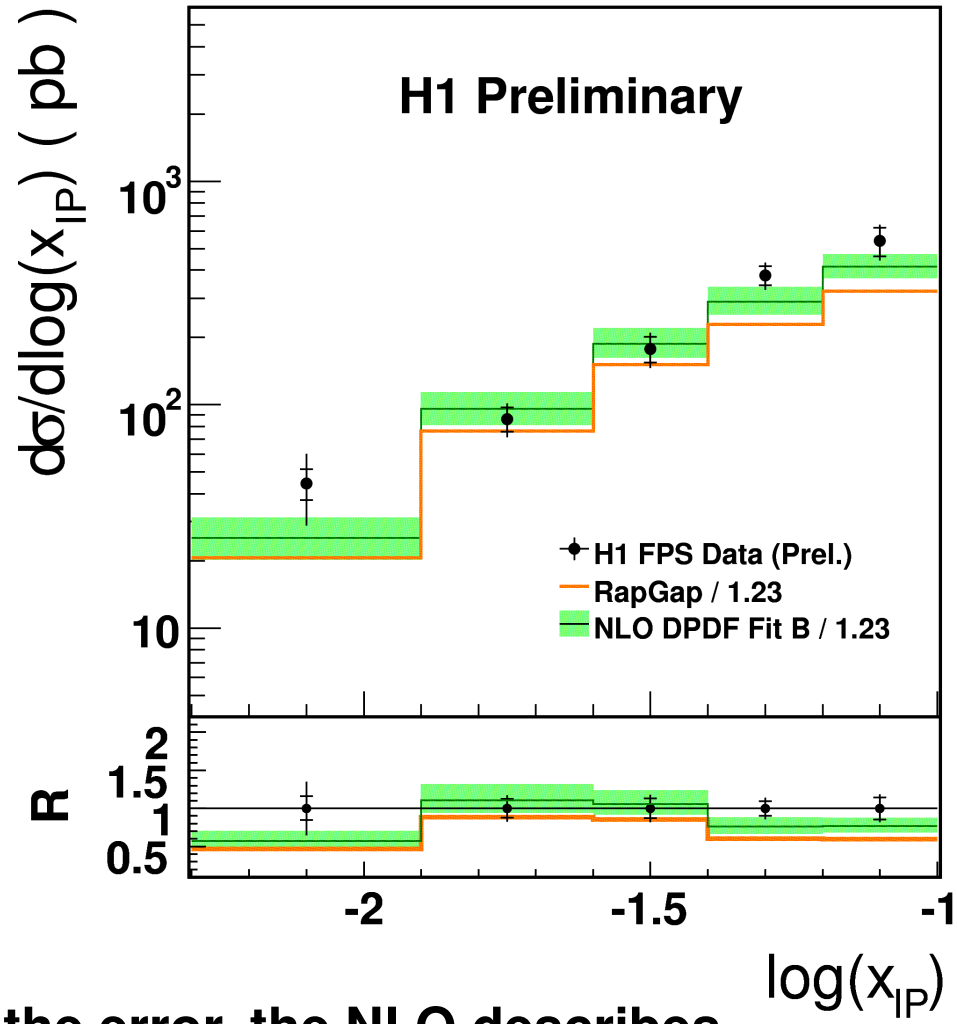
$4 < Q^2 < 110$ GeV^2

$0.05 < y < 0.7$

$X_{IP} < 0.1$

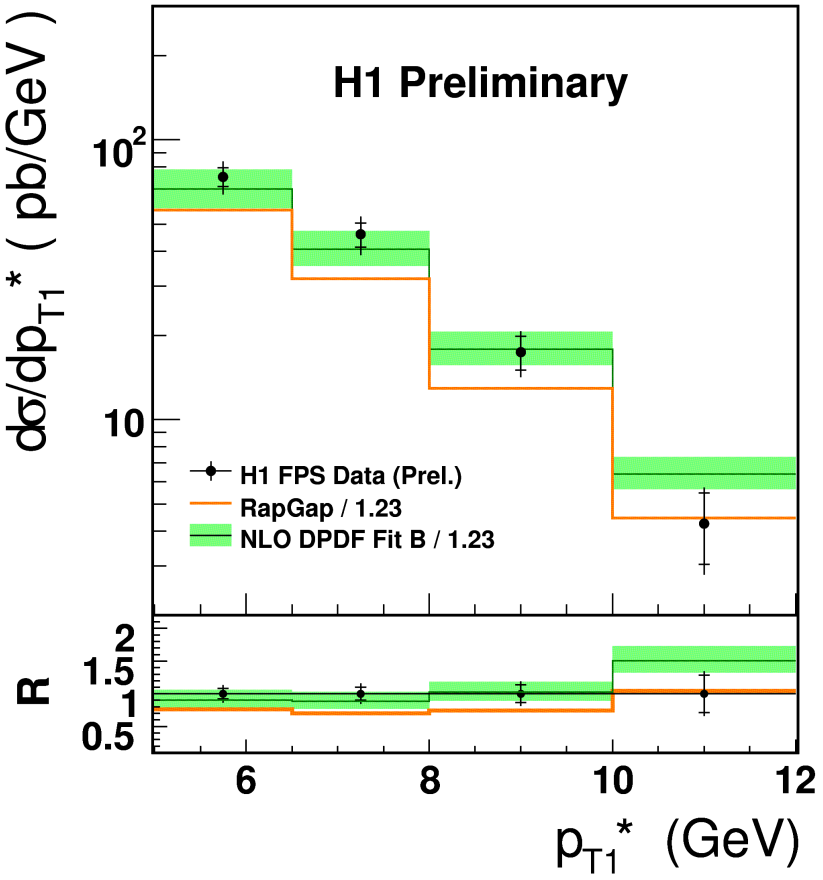
$p_{T1}^* > 5$ GeV

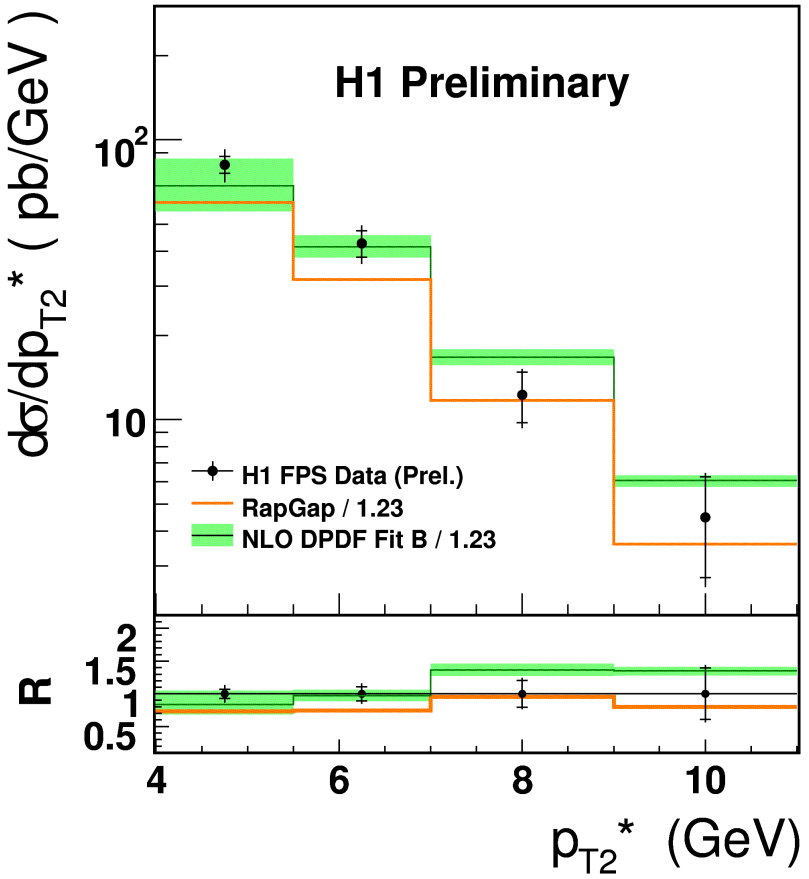
$p_{T2}^* > 4$ GeV



- **Within the error, the NLO describes the data well**
- **RapGap describes the shape but it's off in normalisation**

Jet Transverse Momenta

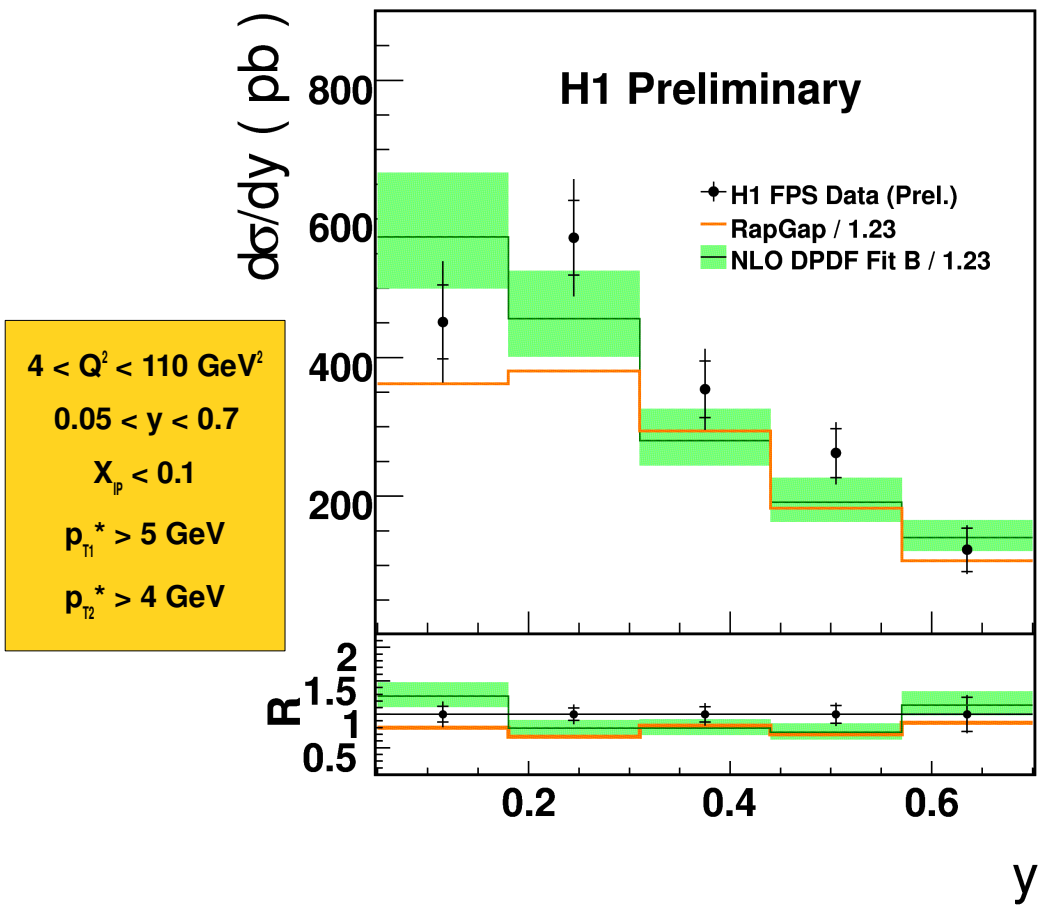




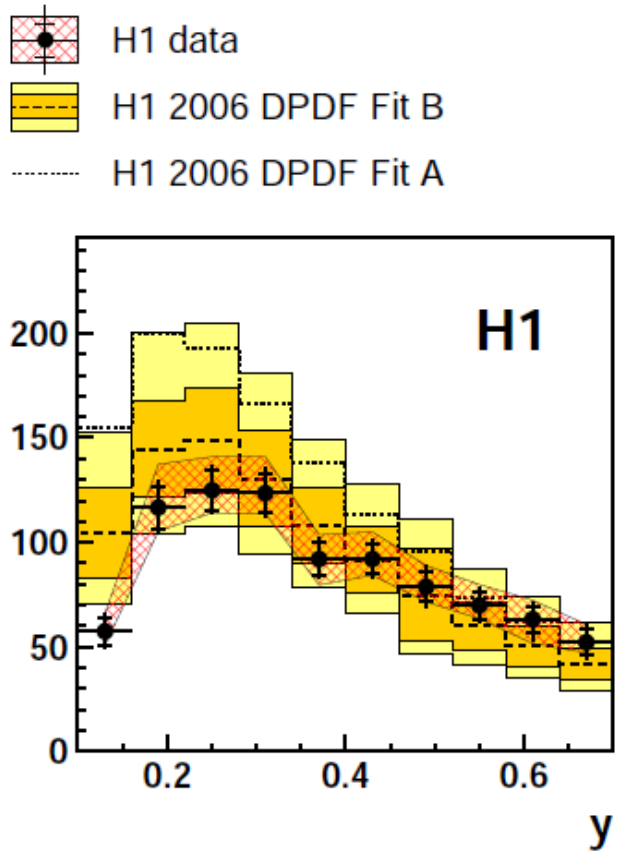
- **Transverse momenta of the leading and next-to-leading jet are well described by the NLO predictions**
- **RapGap off in normalisation**

y dependence

JHEP 0710:042



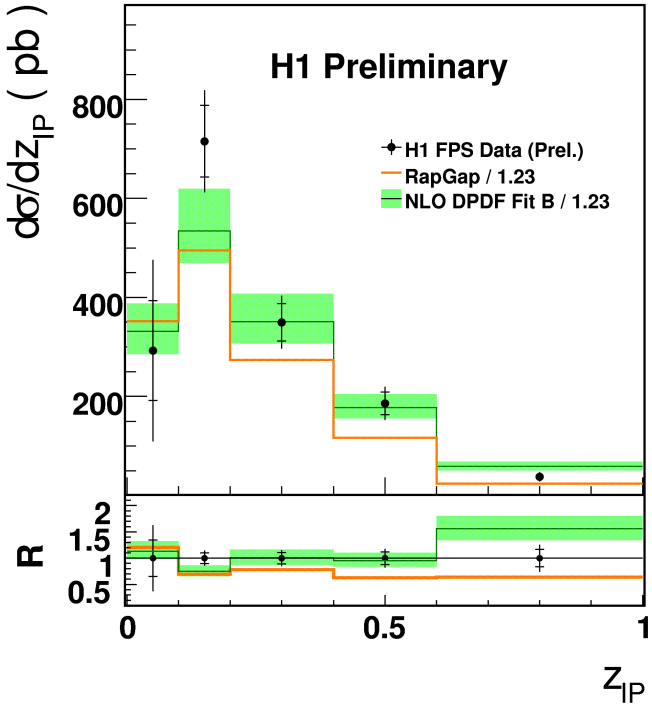
$4 < Q^2 < 110$ GeV^2
$0.05 < y < 0.7$
$X_{IP} < 0.1$
$p_{T1}^* > 5$ GeV
$p_{T2}^* > 4$ GeV

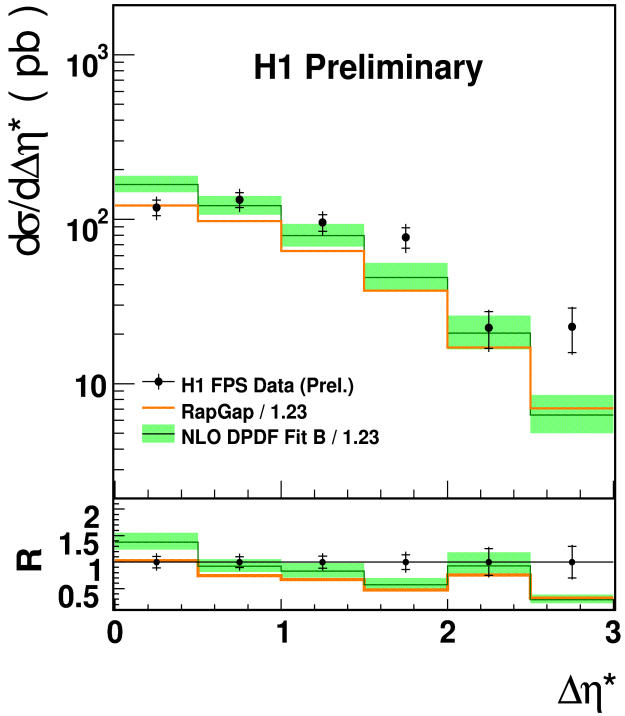


$4 < Q^2 < 80$ GeV^2
$0.1 < y < 0.7$
$X_{IP} < 0.03$
$p_{T1}^* > 5.5$ GeV
$p_{T2}^* > 4$ GeV

- **NLO gives a good description of the data within the errors**
- **Deviations at low *y* expected due to the absence of soft pomeron remnant in the NLO prediction**
- **RapGap agrees in shape better but is off in normalisation**

z_{IP} and $\Delta\eta^*$





- **NLO roughly agrees with the data within the errors**
- **Deviations expected due to the absence of soft pomeron remnant in the NLO**

- **Highest bin in $\Delta\eta^*$ shows a significant deviation, extension to the topology of 1 central and 1 forward jet may be interesting**

summary

- Central jets with FPS measured
- HERA II period 20x higher statistics → first tagged proton dijet measurement in ep ever
- Consistency with previous analyses proven after substraction of proton dissociation background
- DPDFs tested in new kinematical region up to $x_{IP} < 0.1$
- Within errors NLO describes the data, RapGap is off in normalisation