DIFFRACTIVE DI-JET PRODUCTION IN H1

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DIS 97

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OBSERVATION OF HIGH p_T JETS

IN DIFFRACTION

($p\bar{p}$: UA8 ; γp, $\gamma^* p$: ZEUS, H1)

→ POMERON (EXCHANGE) DESCRIPTION IN TERMS OF PARTONS
(LOW - NUSSINOV ; INGELMAN - SCHLEIN)

⊕ HARD SCALE (HIGH p_T) → QUANTITATIVE (QCD) INSIGHT IN THE POMERON STRUCTURE

BUT POMERON ≠ PARTICLE !

→ FACTORISATION OF $\mathbb{P}$ FLUX IN p

⊗ HARD PROCESS ??

(e.g. LARGE β ; COUNTER EXAMPLES IN JET PROD.)

[NIKOLAEV - ZAKHAROV; DONNACHIE - LANDSHOFF
COLLINS - FRANKFURT - STRIKMAN; BERERA - SOPER; BARTELS et al. ...]

- NON FACTORISABLE JET PRODUCTION, HT / LT.
- FACTORISATION PROPERTIES DIFFER FOR JETS IN γ PROD. / DIS

→ TEST { POMERON STRUCTURE PARAMETERIS.
CONSEQUENCES OF FACTORISATION H/F.

→ IN PHOTO PRODUCTION

→ IN DIS

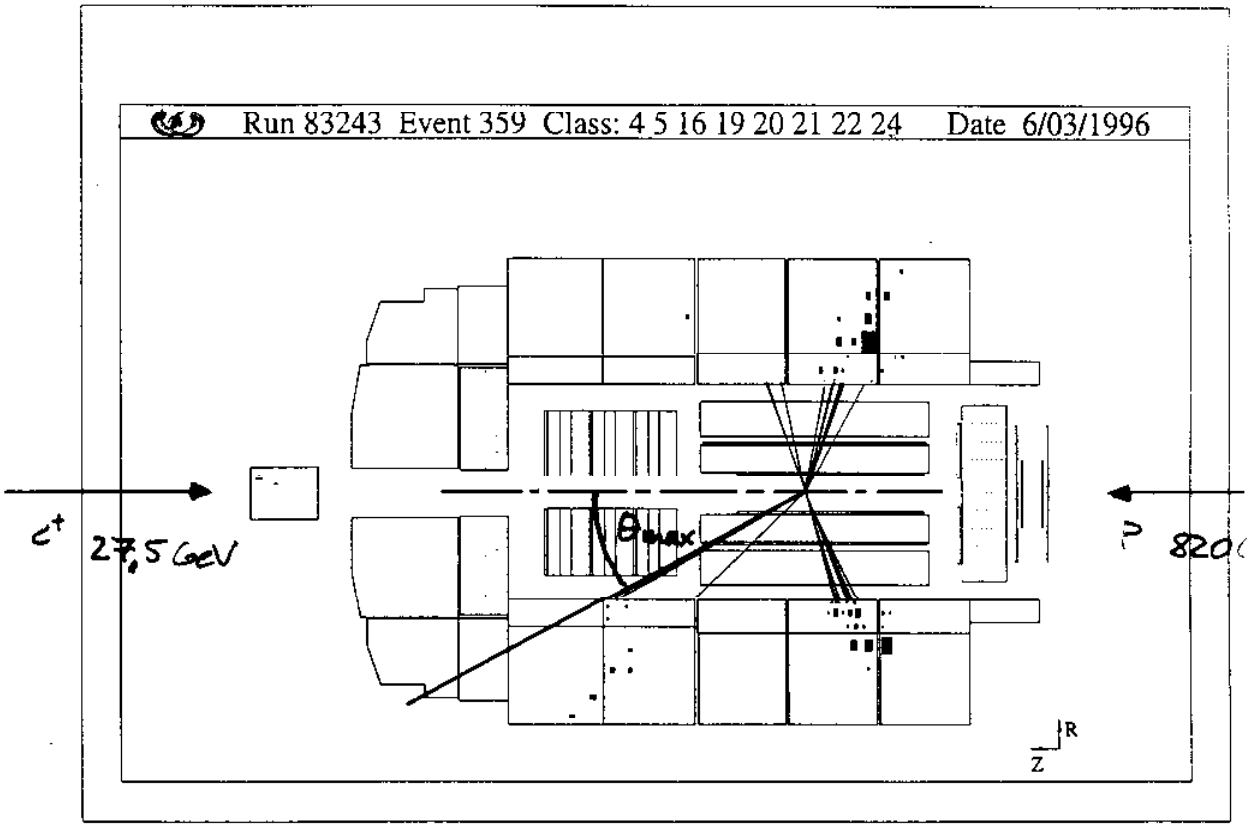
→ COMPARE DIJET PRODUCTION WITH PREDICTIONS BASED ON POMERON STRUCTURE OBTAINED IN INCLUSIVE DIFFRACTIVE SCATTERING + DGLAP EVOLUTION

γ PRODUCTION
2 JETS

FMD $M_Y < 1.6$ GeV

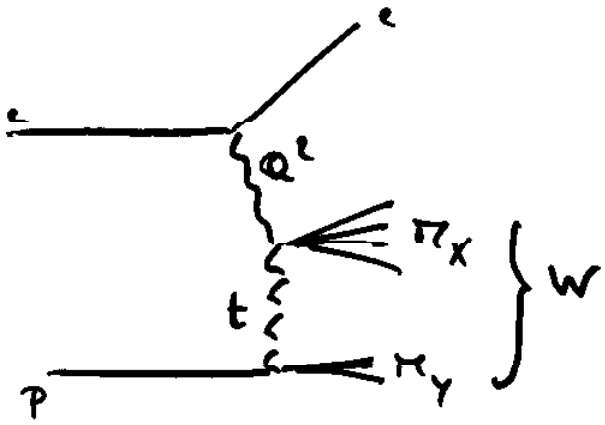
1. Motivation

(Re-)Discovery of events with a large rapidity gap at HERA:



quantify size of the gap by $\eta_{\max} := -\ln \tan \frac{\theta_{\max}}{2}$

KINEMATICS - EVENT SELECTION



$y = q \cdot p / e \cdot p$

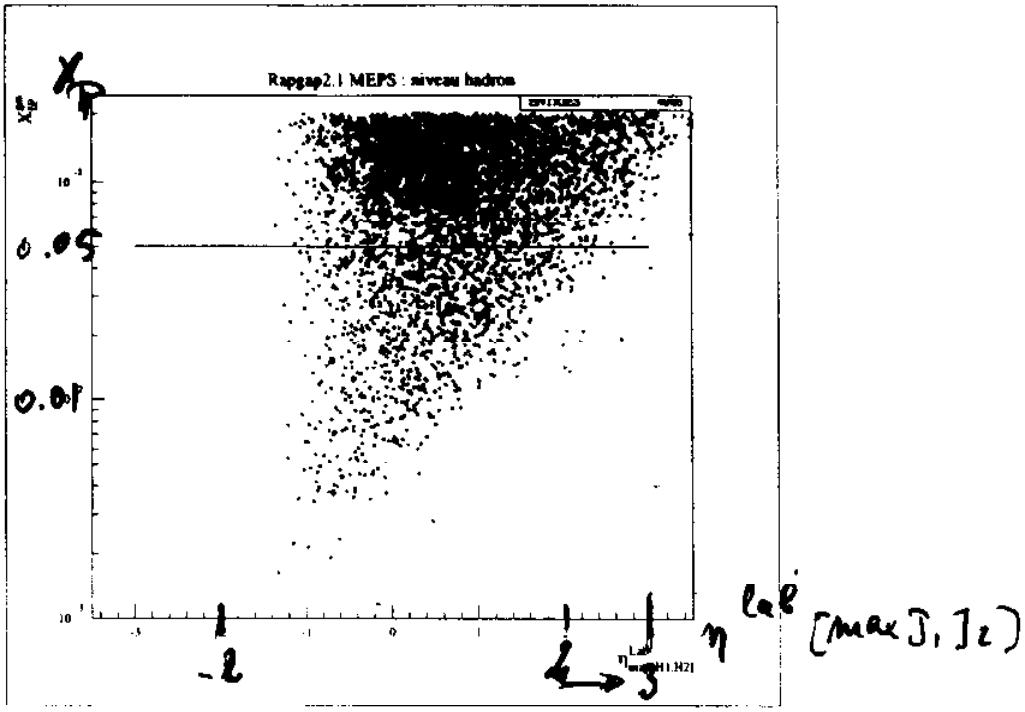
$M_X^2 = (\Sigma p_h)^2$

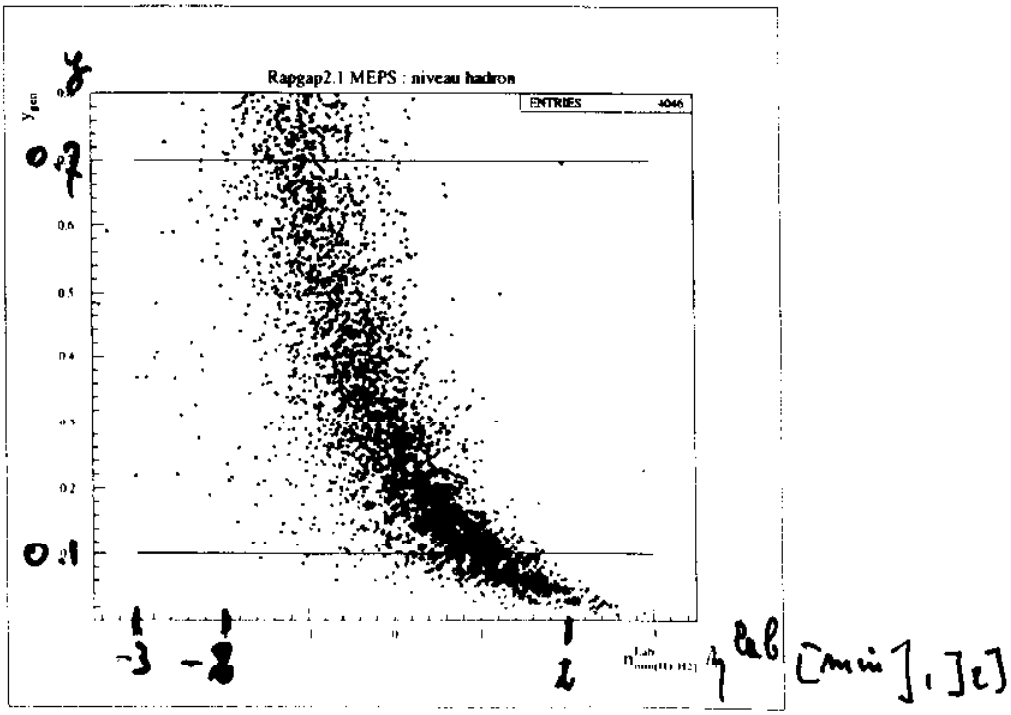
$$x_{\mathbb{P}} = \frac{Q^2 + M_X^2}{Q^2 + W^2}$$

PHOTOPRODUCTION	DIS
• $2.2\ pb^{-1}$	$20\ pb^{-1}$
$\gamma\mathbb{P} \simeq$ lab. + boost(β)	$\gamma^*\mathbb{P}$ frame
• $Q^2 < 0.01\ GeV^2$, $0.25 < y < 0.7$ } e-tag	$7.5 < Q^2 < 80\ GeV^2$, $0.1 < y < 0.7$ } acc. → 1
• $x_{\mathbb{P}} < 0.05$	
• cone, $\Delta R = 1$, $p_T^* > 5$ GeV	
$-1 < \eta_{jet} < 2$	
→ 400 DIJETS	78 DIJETS
• $\xi_{\mathbb{P}} = \frac{\Sigma(E+p_z)_{JJ}}{\Sigma(E+p_z)_h}$	$\xi_{\mathbb{P}} = \frac{Q^2 + M_{JJ}^2}{Q^2 + M_X^2}$
$x_\gamma = \frac{\Sigma(E-p_z)_{JJ}}{\Sigma(E-p_z)_h}$	
• PYTHIA	RAPGAP

CROSSSECTIONS TO THE HADRON LEVEL

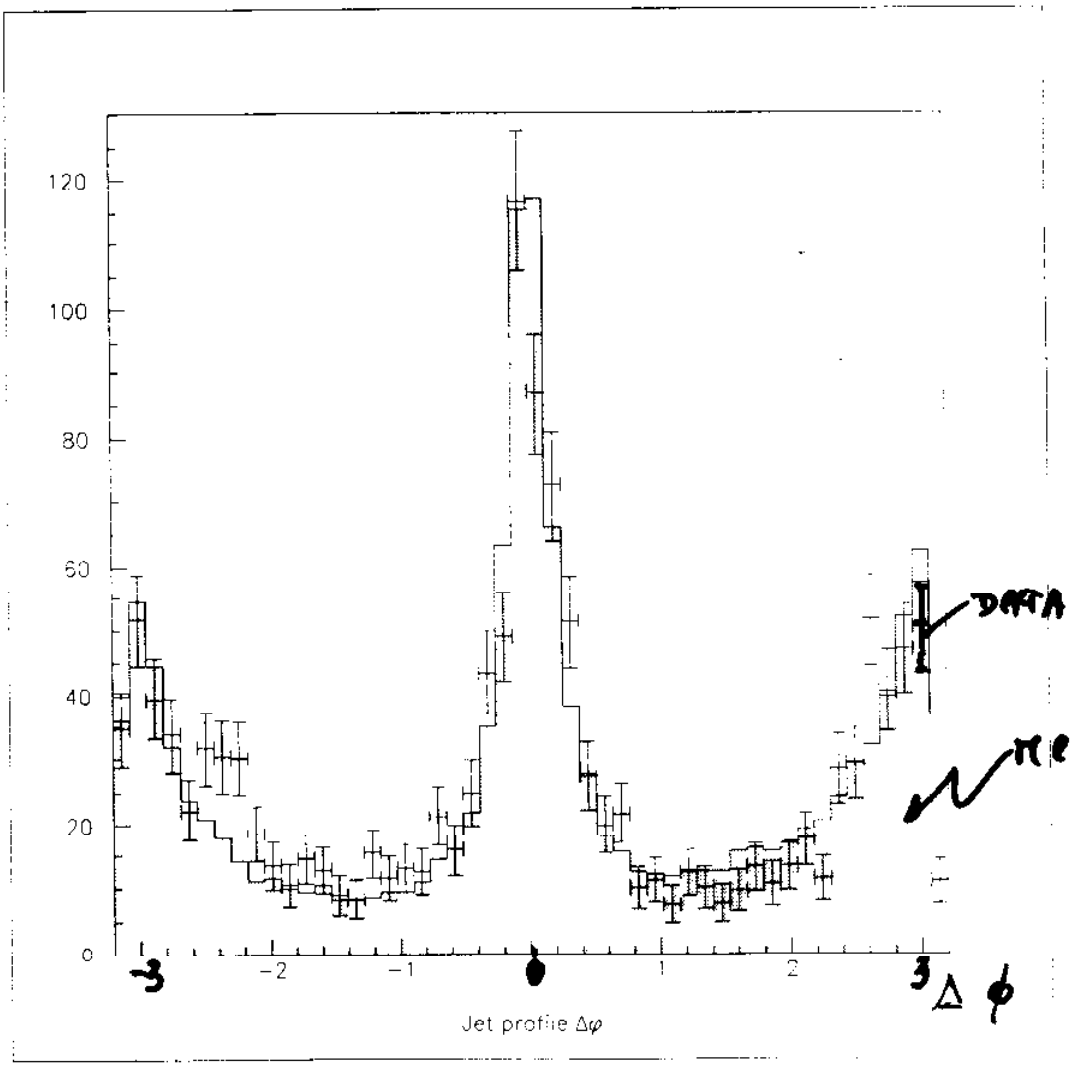
DIS MC.


Rapgap2.1 MEPS : niveau hadron
x_p
0.05
0.01
-2
2
3
η^{lab} [max J, J2]

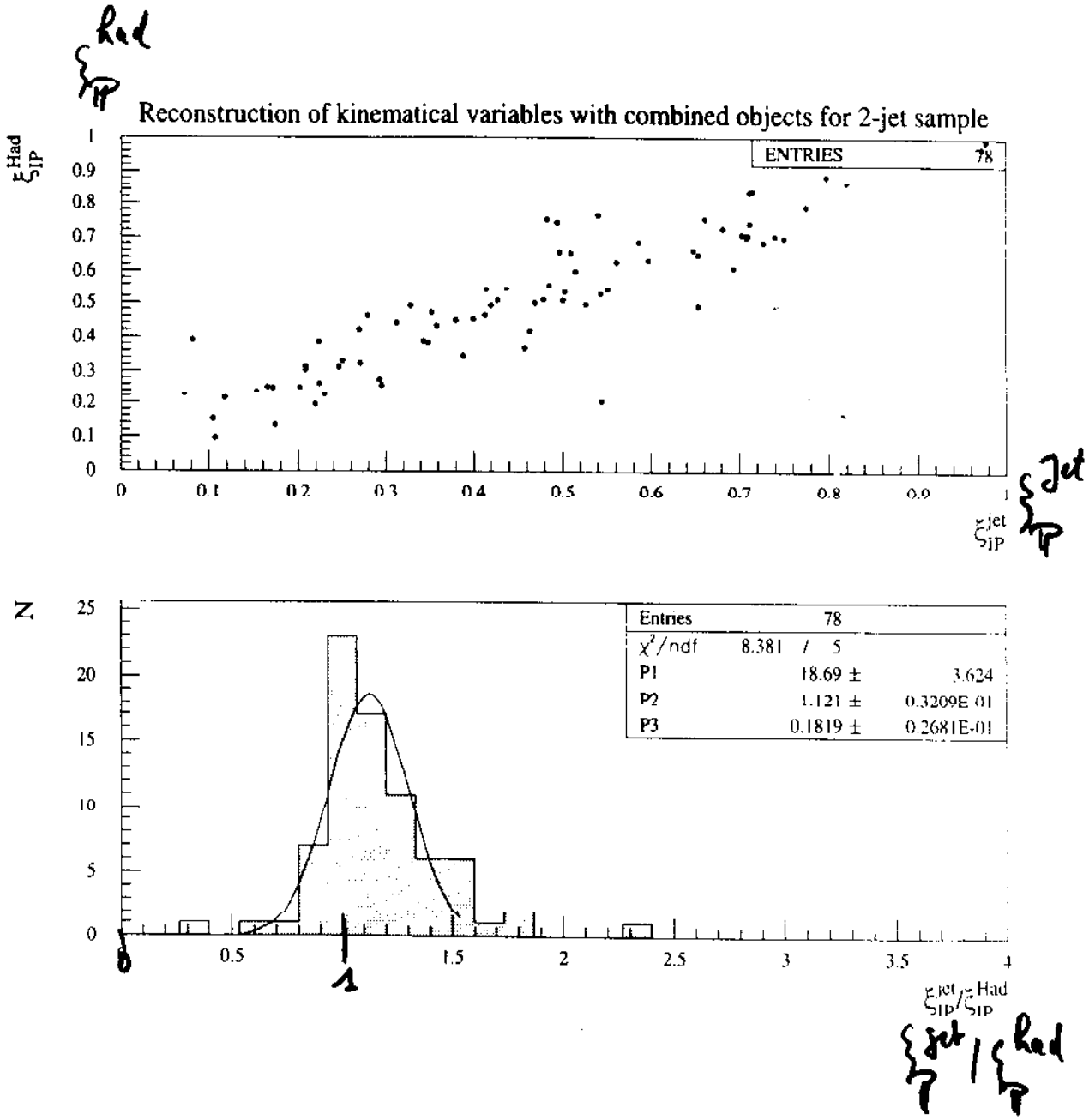

Rapgap2.1 MEPS : niveau hadron
ENTRIES 4046
y
0.7
0.1
-3
-2
2
η^{lab} [min J, J2]

Jet Profiles

DIS - 1 JET



DIS - 2 JETS


Reconstruction of kinematical variables with combined objects for 2-jet sample
ENTRIES 78
ξ_{IP}^{Had}
ξ_{IP}^{jet}
ξ_{IP}^{Had}
ξ_{IP}^{Jet}
N
Entries 78
χ^2/ndf 8.381 / 5
P1 18.69 ± 3.624
P2 1.121 ± 0.3209E-01
P3 0.1819 ± 0.2681E-01
$\xi_{IP}^{jet}/\xi_{IP}^{Had}$
$\xi_{IP}^{Jet}/\xi_{IP}^{Had}$
1

MONTE CARLO'S

PEMPYT RAPGAP

FACTORISATION ALA INGELMAN-SCHLEIN:

$$d\sigma(ep \to epX) \propto f_{\mathbb{P}/p}(x_{\mathbb{P}}) \cdot d\sigma(e\mathbb{P} \to eX)$$

γ STRUCTURE FUNCTION
RESOLVED + DIRECT
$(x_\gamma \sim 1)$

$\mathbb{P}$ STRUCTURE FUNCTION

- NON QCD EVOLVED PARAM.

SOFT GLUONS	$6(1-z)^5$
HARD GLUONS	$6z(1-z)$
HARD QUARKS	$\frac{6}{4}z(1-z)$

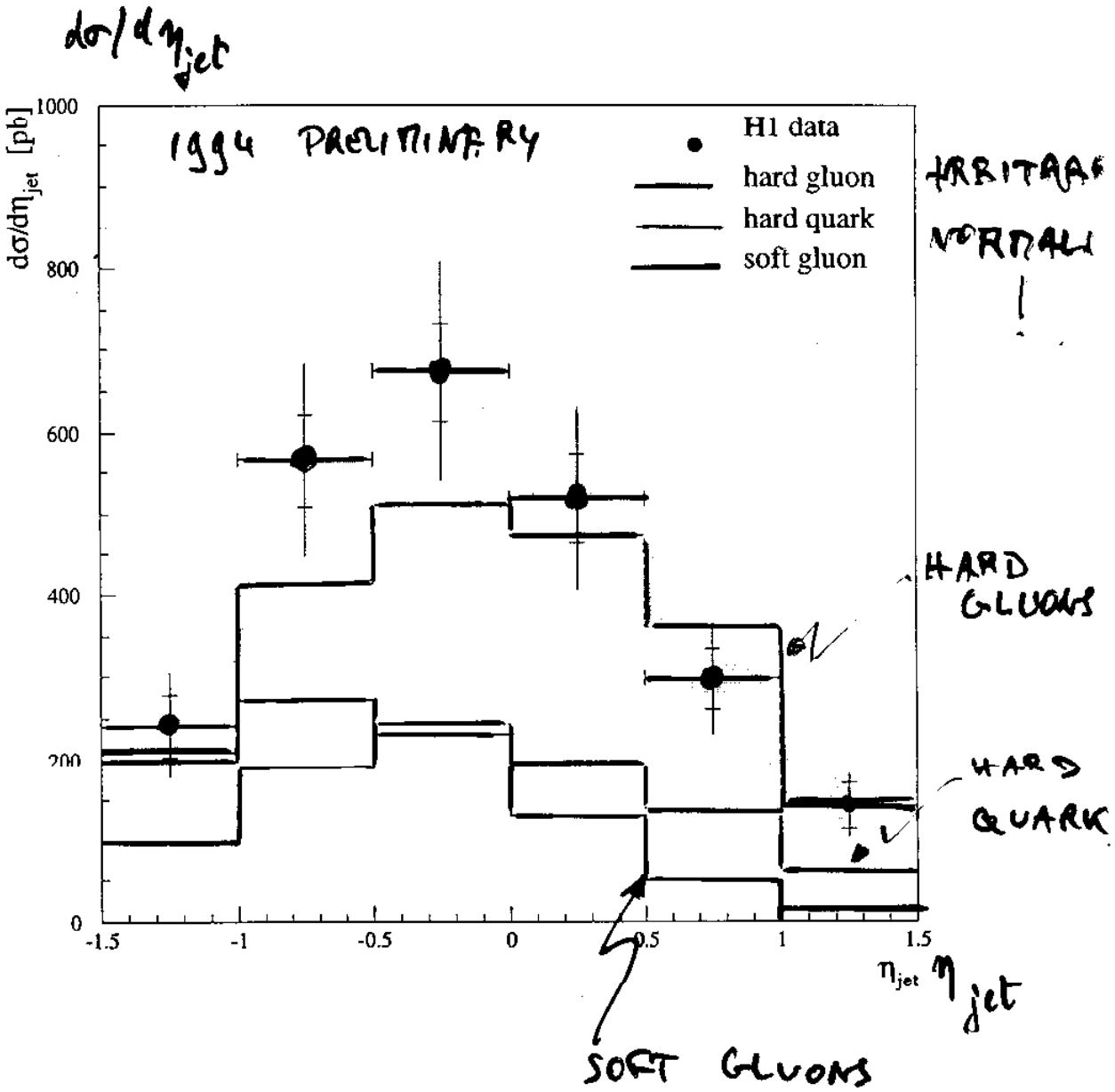
- → "QCD FIT" PARAM.
  POMERON + REGGEON + INTERF
  $\mathbb{R}$: cf π
  $\mathbb{P}$: DGLAP EVOLUTION

2 REMARKS!

- CUTS FOR 2 JETS ⇒ $\mathbb{P} \gg \mathbb{R}$
- SCALE = $p_T^2 \sim 50$ GeV^2 in PHOTOPROD

$d\sigma/d\eta^*$ in comparison to POMPYT predictions (no DGLAP evolution)

PHOTOPRODUCTION



Pomeron + Meson Phenomenological Fit

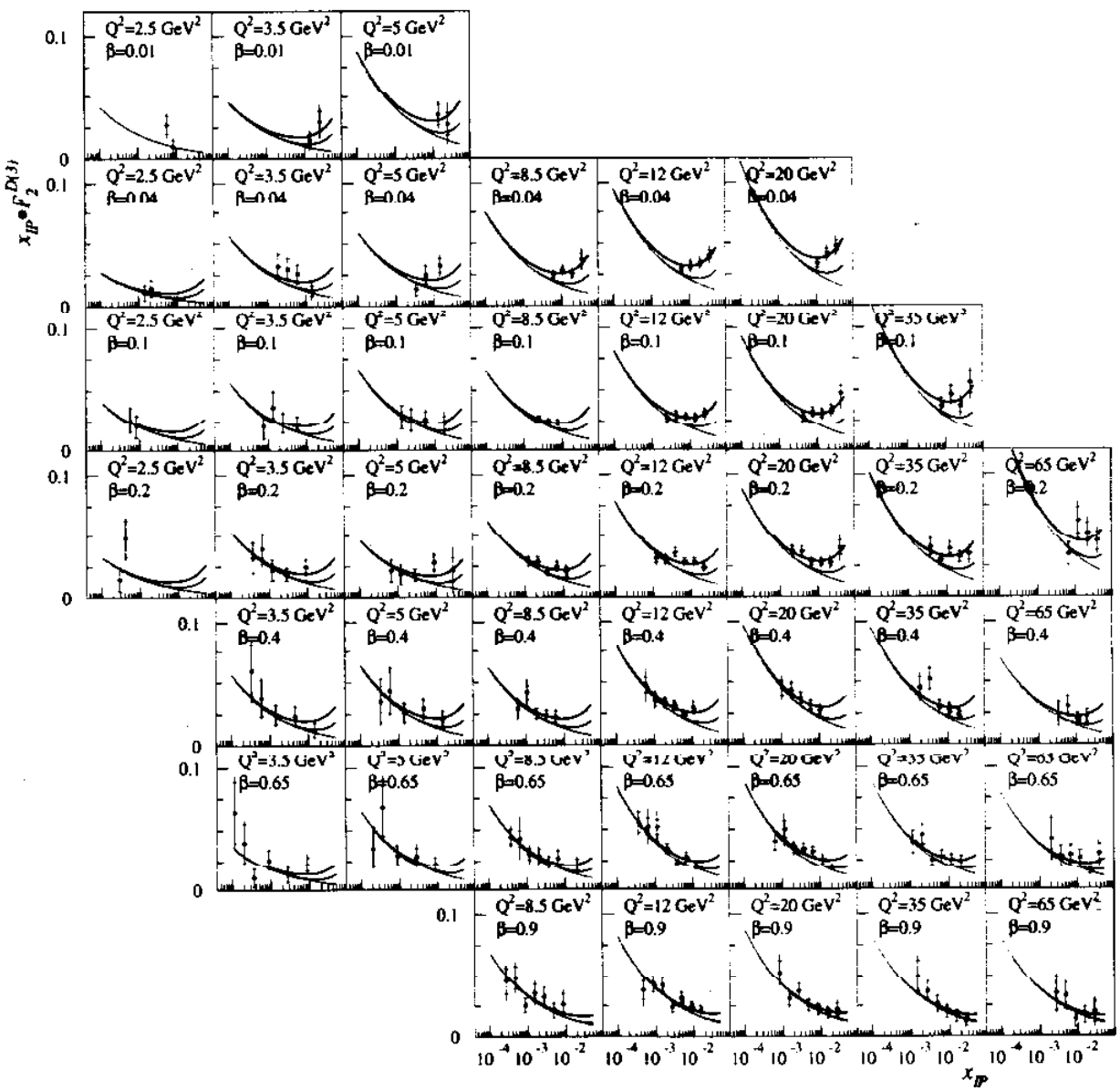
Phenomenological fit including meson and pomeron components:

$$F_2^{D(3)} = F_2^{\mathbb{P}}(\beta, Q^2) \cdot x_{\mathbb{P}}^{-n_1} + C_M \cdot F_2^M(\beta, Q^2) \cdot x_{\mathbb{P}}^{-n_2}$$

+ interference with phase angle of 45°

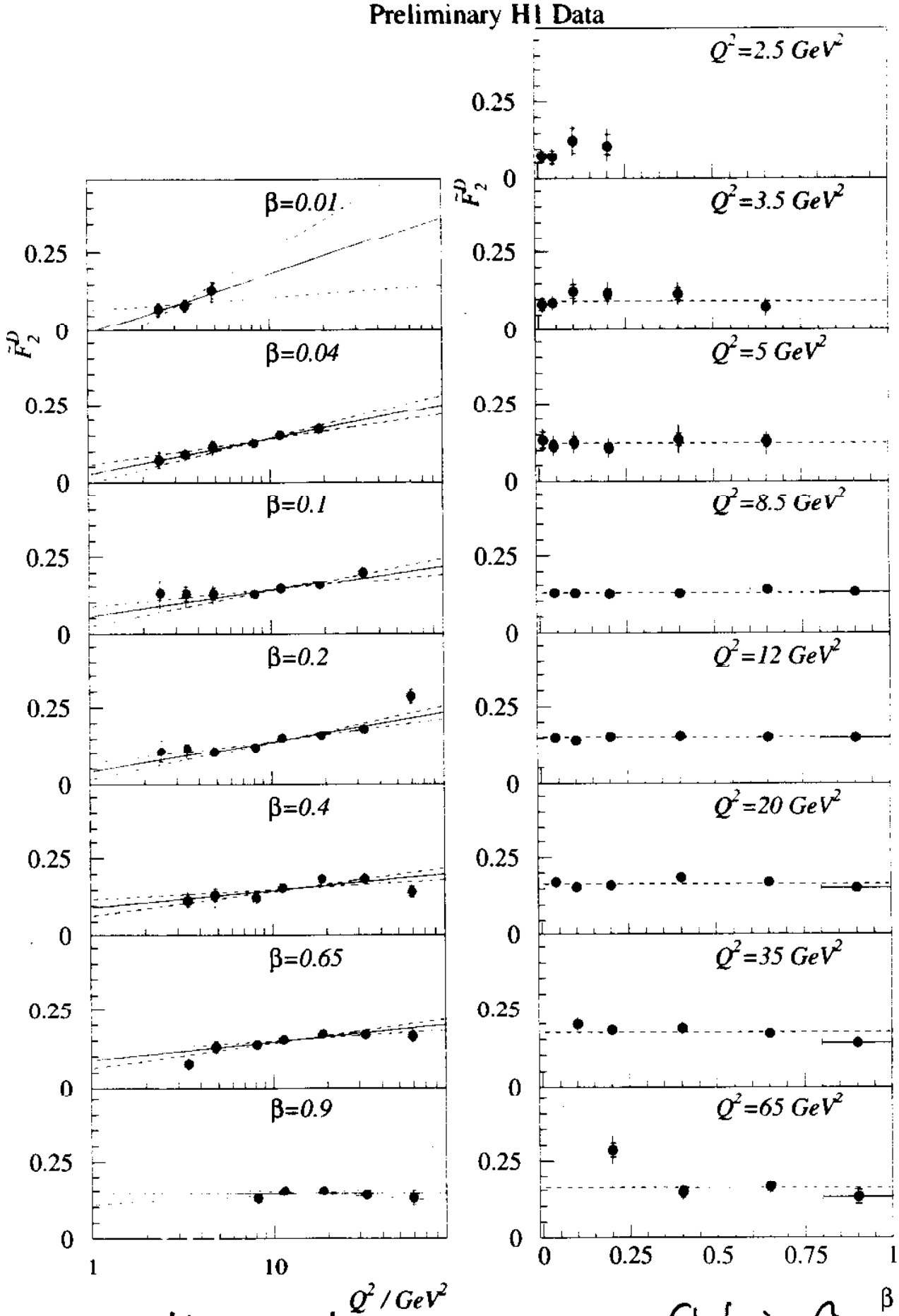
Fit $F_2^{\mathbb{P}}(\beta, Q^2)$, C_M, n_1 and n_2 assuming $F_2^M = F_2^{\pi}$ (GRV)

H1 Preliminary 1994



$n_1 = 1.29 \pm 0.03$ $\qquad \chi^2/ndf = 170/156$

$n_2 = 0.3 \pm 0.3$

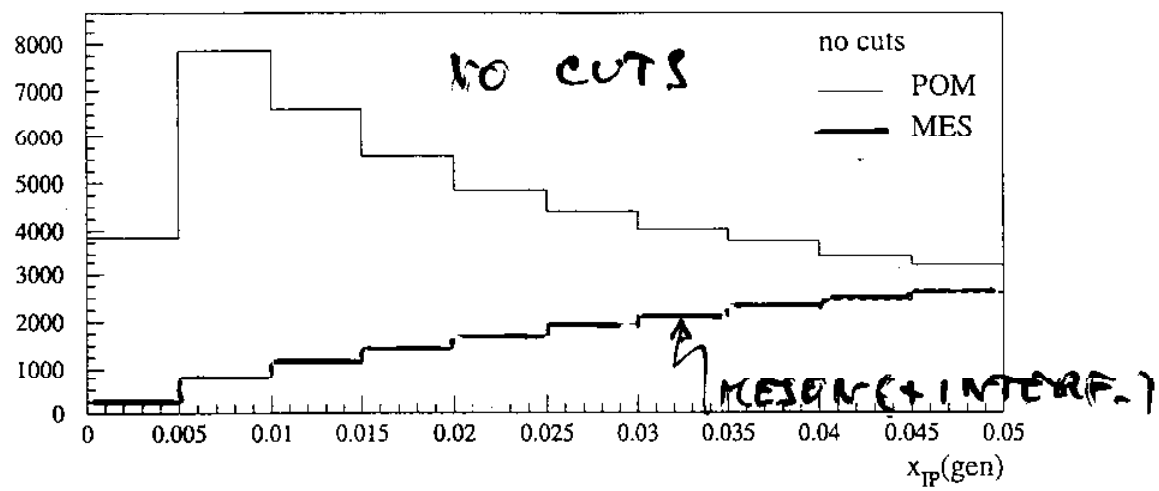


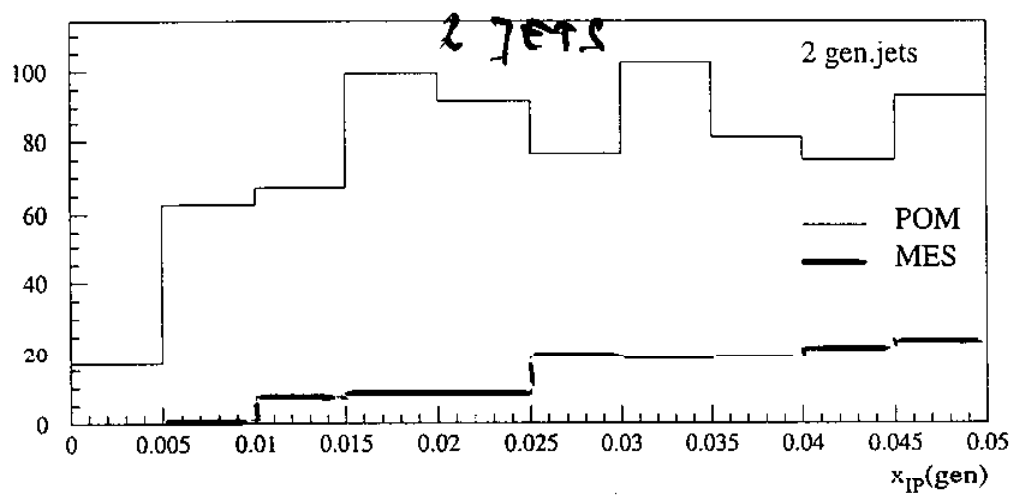
scaling violations

~ flat in β

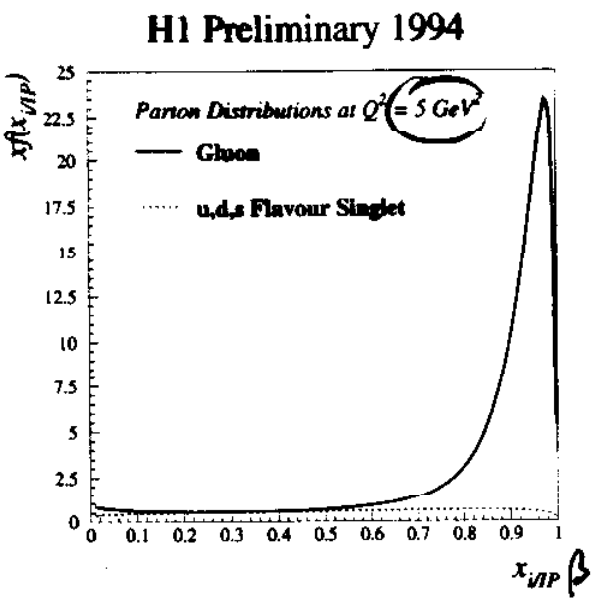
Distribution of $x_{\mathbb{P}}$ for the pomeron and meson component of the fit

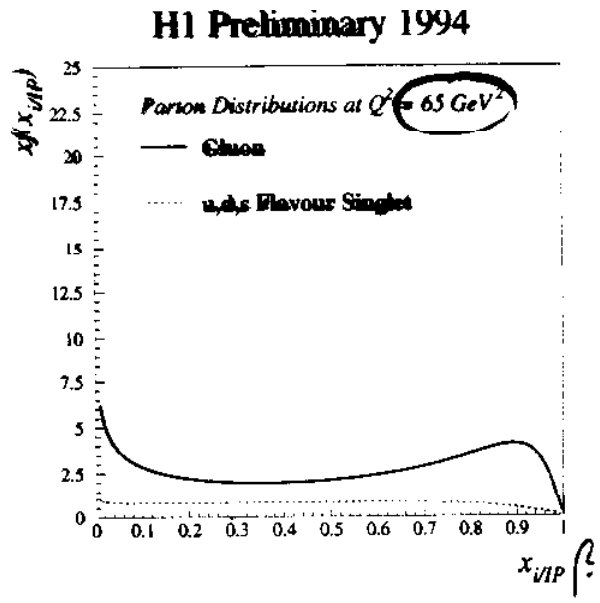
PHOTOPRODUCTION

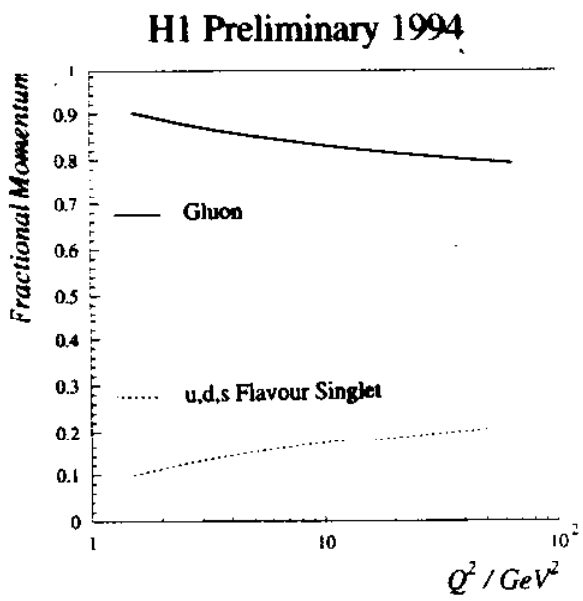




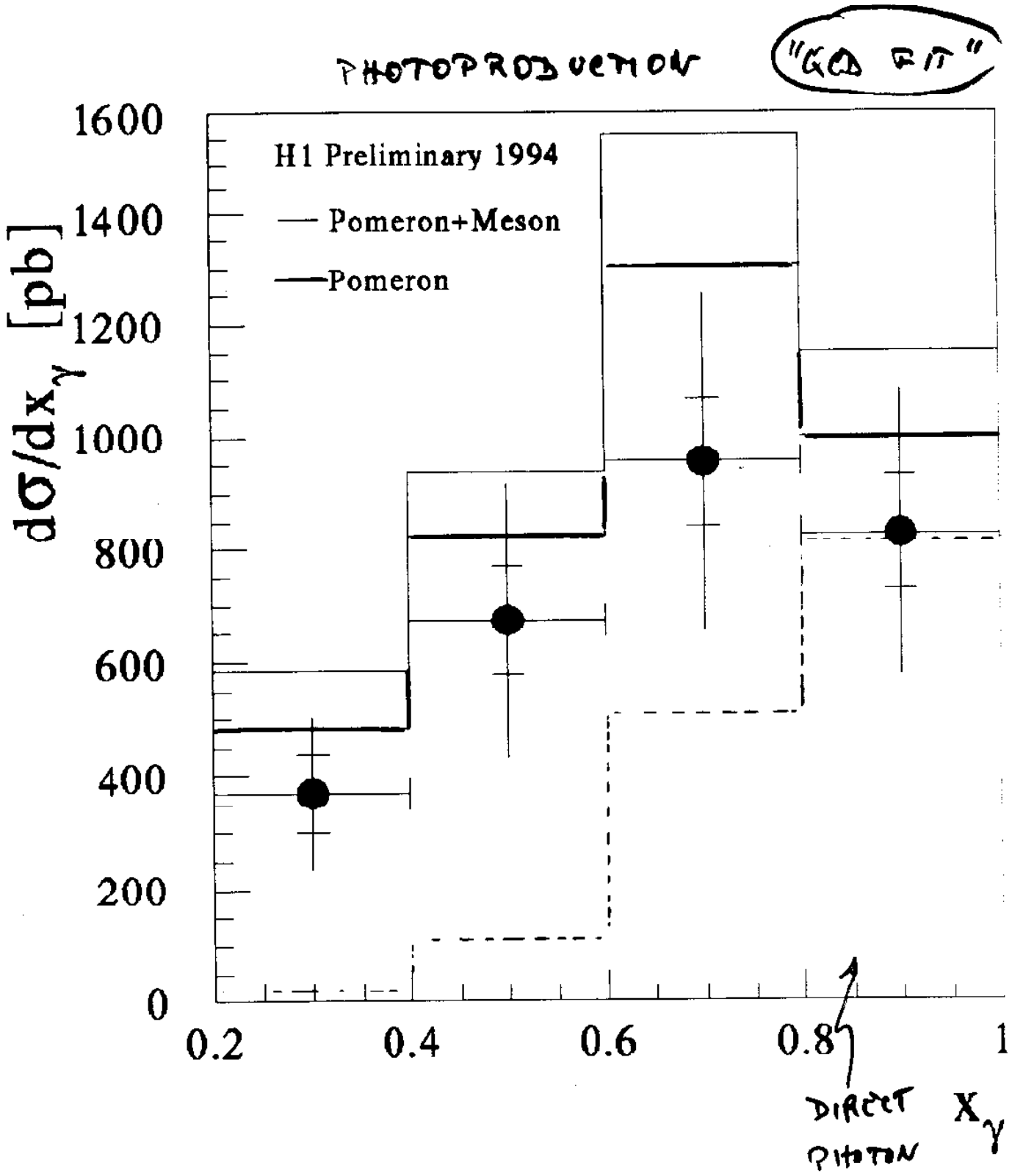
Parton Distribution Functions





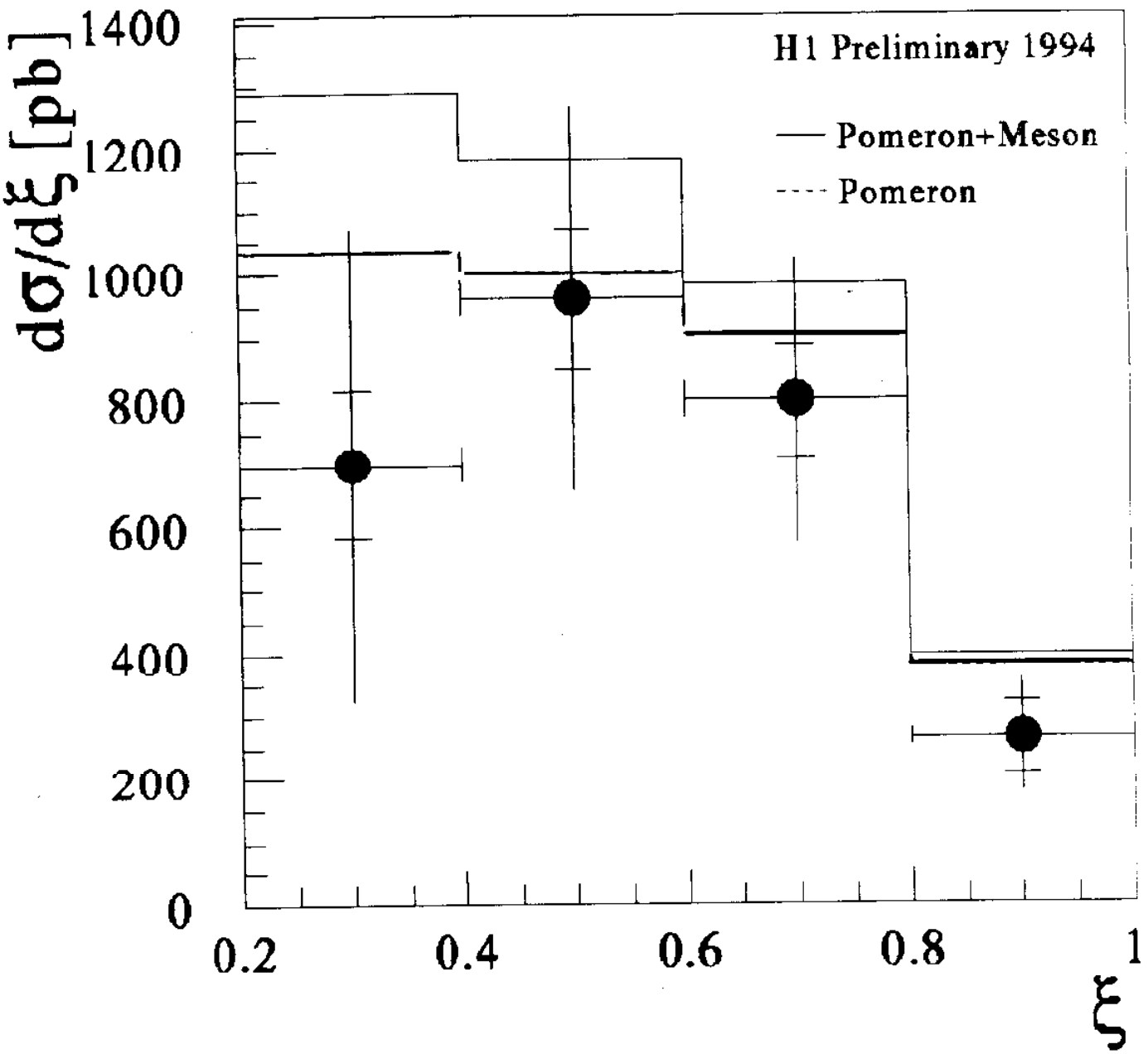


- "Leading" gluon behaviour at $Q^2 \sim Q_0^2$
- Gluon distribution rapidly evolved by DGLAP
- Significant fraction of total momentum carried by gluons

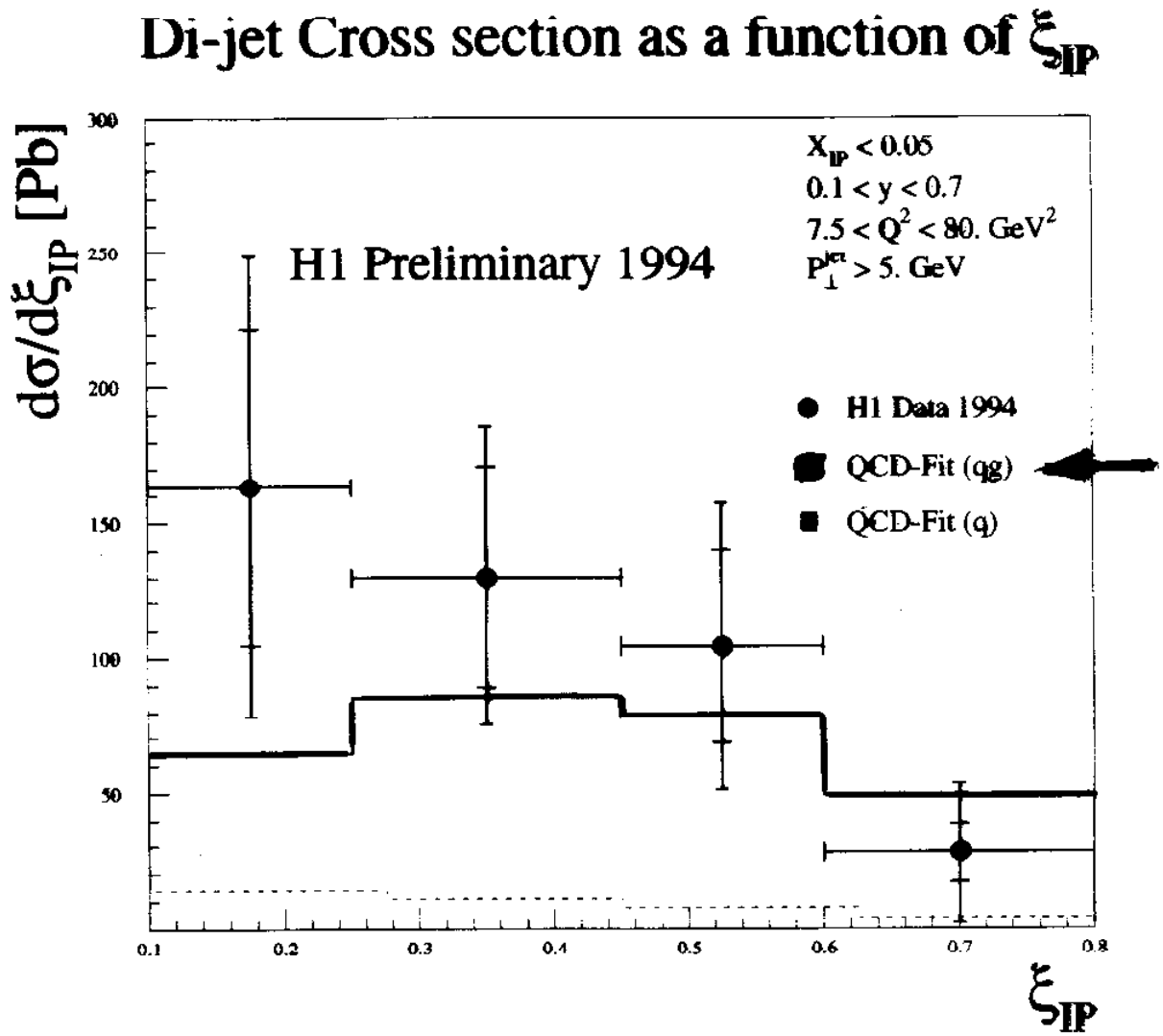

PHOTOPRODUCTION
"GRV FIT"
H1 Preliminary 1994
Pomeron+Meson
Pomeron
$d\sigma/dx_\gamma$ [pb]
1600
1400
1200
1000
800
600
400
200
0
0.2
0.4
0.6
0.8
1
X_γ
DIRECT PHOTON

"QCD FIT"

PHOTOPRODUCTION

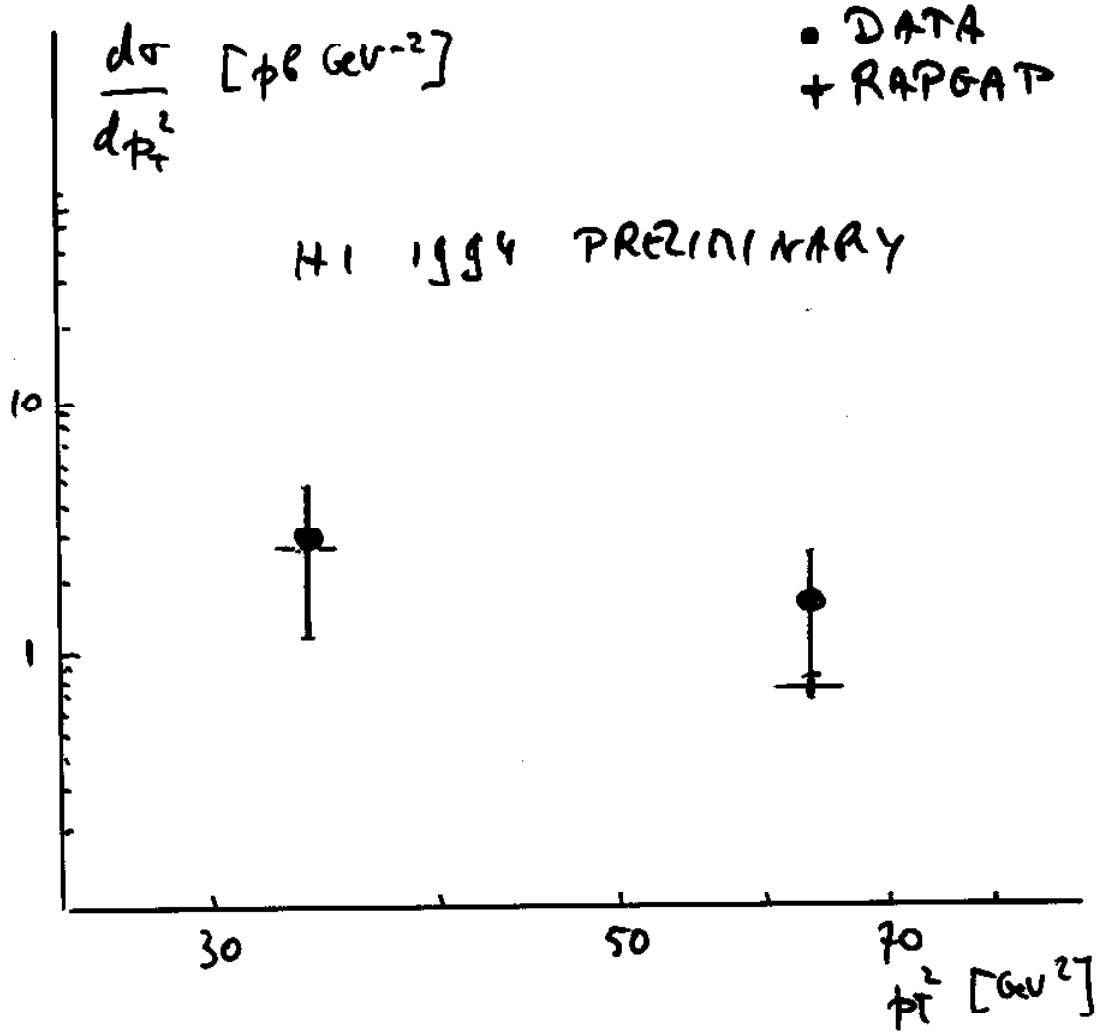


Di–jet Production in Diffractive DIS



- Di–jet cross section needs gluon rich structure
- Hard parton distribution required

DIS


$\frac{d\sigma}{dp_T^2}$ [pb GeV^{-2}]
• DATA
+ RAPGAP
H1 1994 PRELIMINARY
10
1
30
50
70
p_T^2 [GeV^2]

CONCLUSIONS

- 1994 DATA → 400 DIJETS IN γ PROD
  78 DIJETS IN DIS
  ($p_T^* > 5$ GeV)

- HARD PARTON DISTRIBUTION IN $\mathbb{P}$
  FAVOURED

- * GIVEN - LIMITED STATISTICS
  - SCALE UNCERTAINTY *

→ "REASONABLE" DESCRIPTION OF

- SHAPE - x_γ → γ PROD
  - $\xi_{\mathbb{P}}$ γ PROD, DIS
  - p_t^2 DIS

- NORMALISATION

  WITH $\mathbb{P}$'s PDF FROM
  INCLUSIVE ($F_{LD}^{(3)}$) DIFFRACTION
  + DGLAP EVOLUTION