Diffractive dissociation in photoproduction at HERA

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H1 Collaboration

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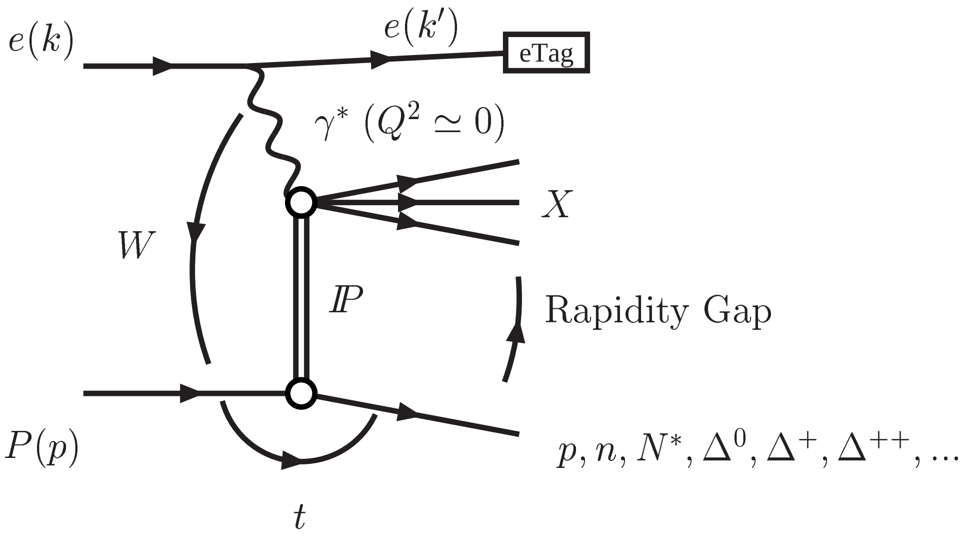
- New Rapidity Gap measurement
- Leading Proton measurement
- Effective intercept extraction
- First attempt Triple Regge fit

Preliminary Rapidity Gap data



- 1997 MB data corresponding lumi of $\simeq 2\ pb^{-1}$
- Selection based on

  Large Rapidity Gap in the event

  No activity in FWD and $\eta_{max} < 3.2$

  $\Rightarrow 4 \leq \Delta\eta$ (Rapidity Gap)

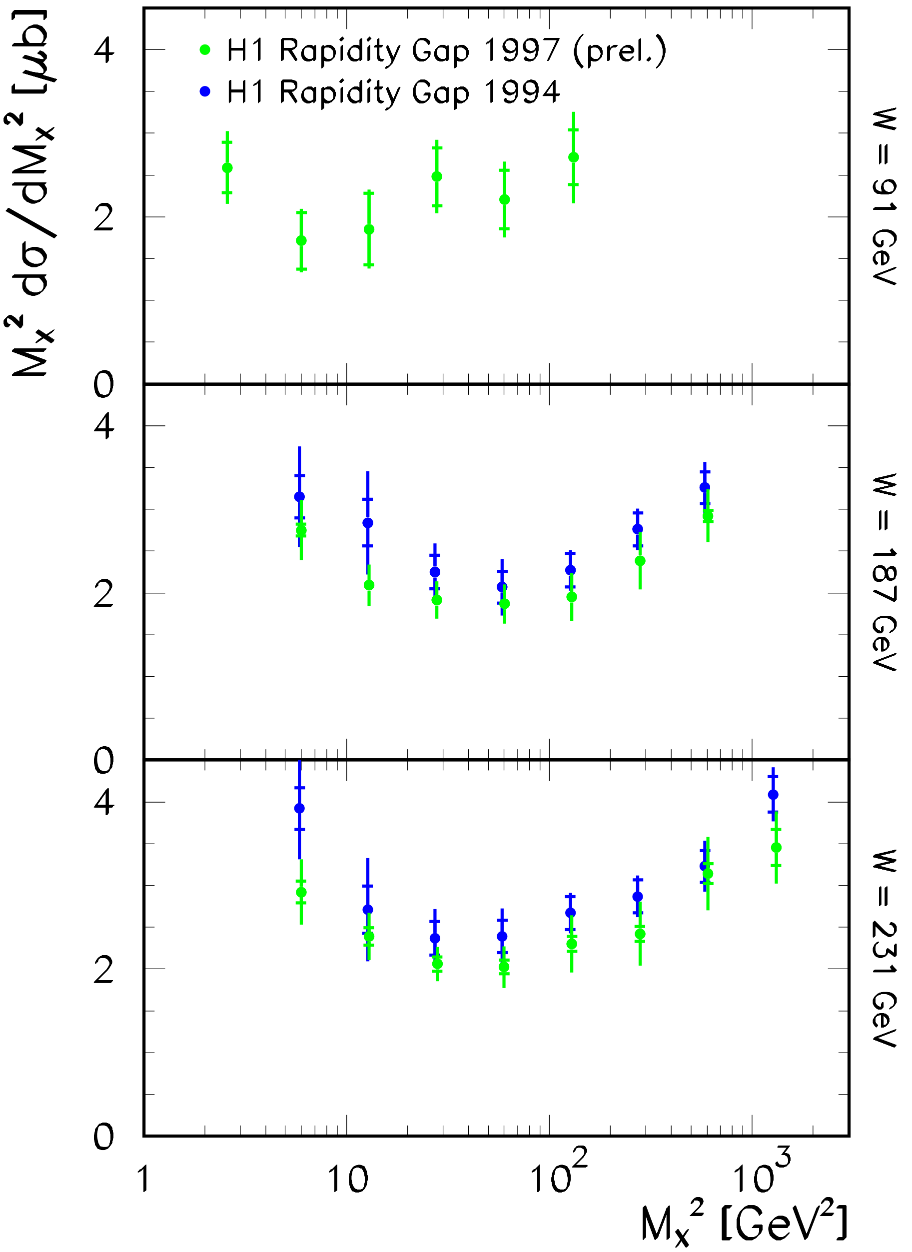
Kinematical domain:

- $Q^2 = 0$ GeV^2
- $\langle W_{\gamma p} \rangle = 231,\ 187,\ 91$ GeV
- $\mid t \mid < 1$ GeV^2
- $M_Y < 1.6$ GeV

Cross Section: $M_X^2 \frac{d\sigma(\gamma p \to XY)}{dM_X^2}$

$$1.58 \leq M_X^2 \leq 1860 \text{ GeV}^2$$

Cross section comparison '94 -'97

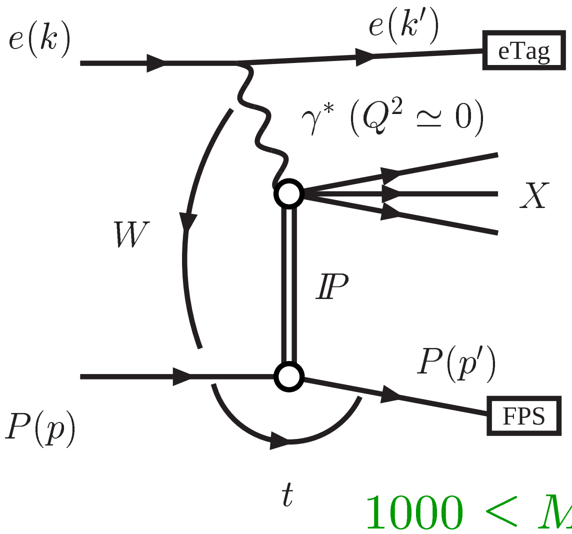


$\Leftarrow$ New

$$\frac{d\sigma}{dM_X^2} \propto 1/M_X^2$$

- Improved statistics (factor of 10)
- Extended W range (W=91 GeV)
- Still Large Systematic uncertainty (Phoj-Pyth)

Leading Proton Cross Section



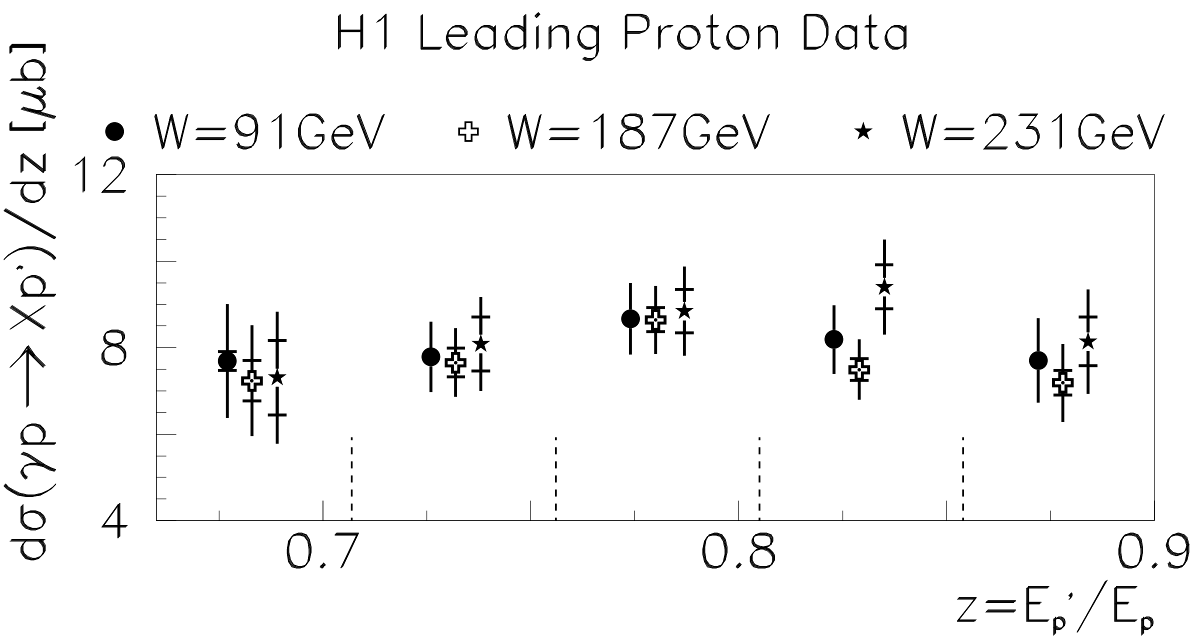
<u>Kinematical domain:</u>

- $Q^2 = 0\ \mathrm{GeV}^2$
- $\langle W \rangle = 231,\ 187,\ 91\ \mathrm{GeV}$
- $P_T < 0.2\ \mathrm{GeV}$
- $0.68 < z = \frac{E'_p}{E_p} < 0.88$

$$1000 \leq M_X^2 = W^2\ (1 - z) \leq 17\,000\ \mathrm{GeV}^2$$

$$\frac{d\sigma(\gamma p \to X p)}{dz}$$

(Nucl.Phys. **B619** (2001) 3-21)



$$\frac{d\sigma}{dz} \sim \text{indep. of } W,\ z \Rightarrow M_X^2\ \frac{d\sigma}{dM_X^2} \sim M_X^2\ @\ \text{fixed } W$$

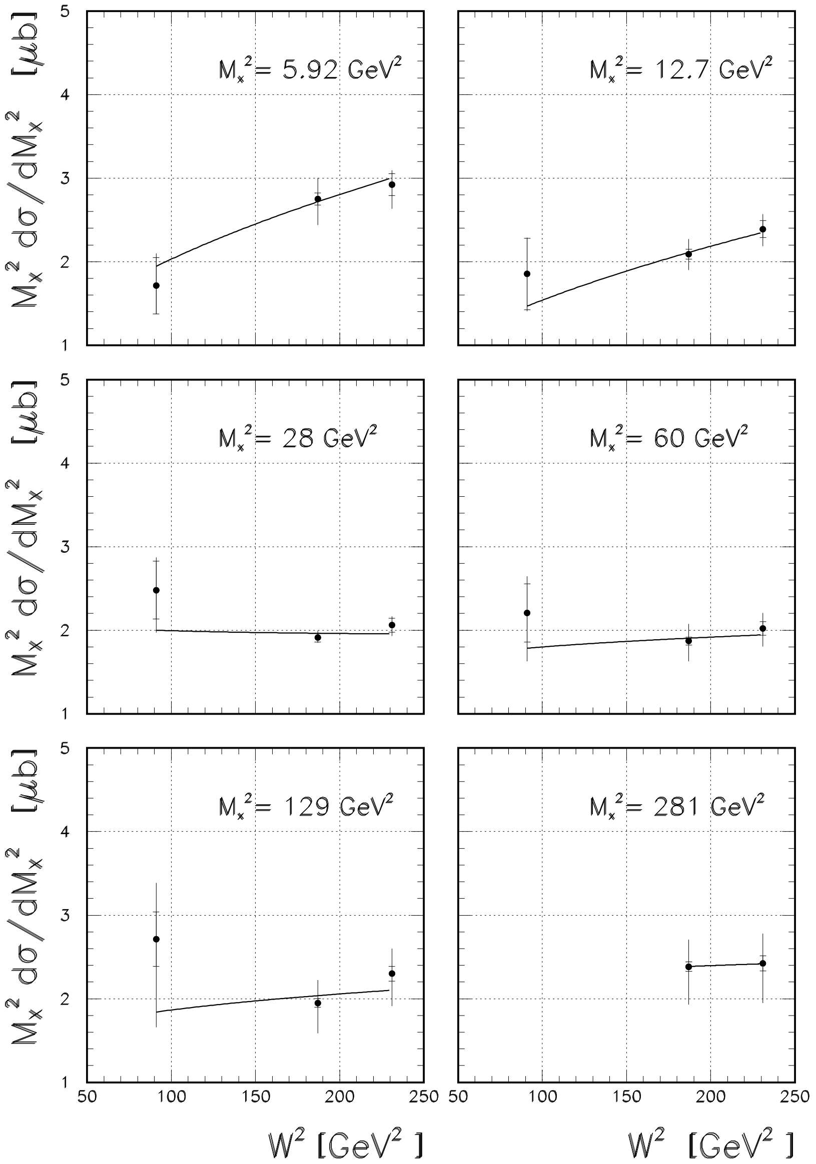
Determination of $\alpha_{eff}(0)$ on RG

$$\frac{d\sigma}{dM_X^2} \propto \left(W^2\right)^{2\alpha_{eff}(0)-2} \; \frac{e^{-B|t_{min}|}-e^{-B}}{B} \qquad \text{(Fixed } M_X^2\text{)}$$

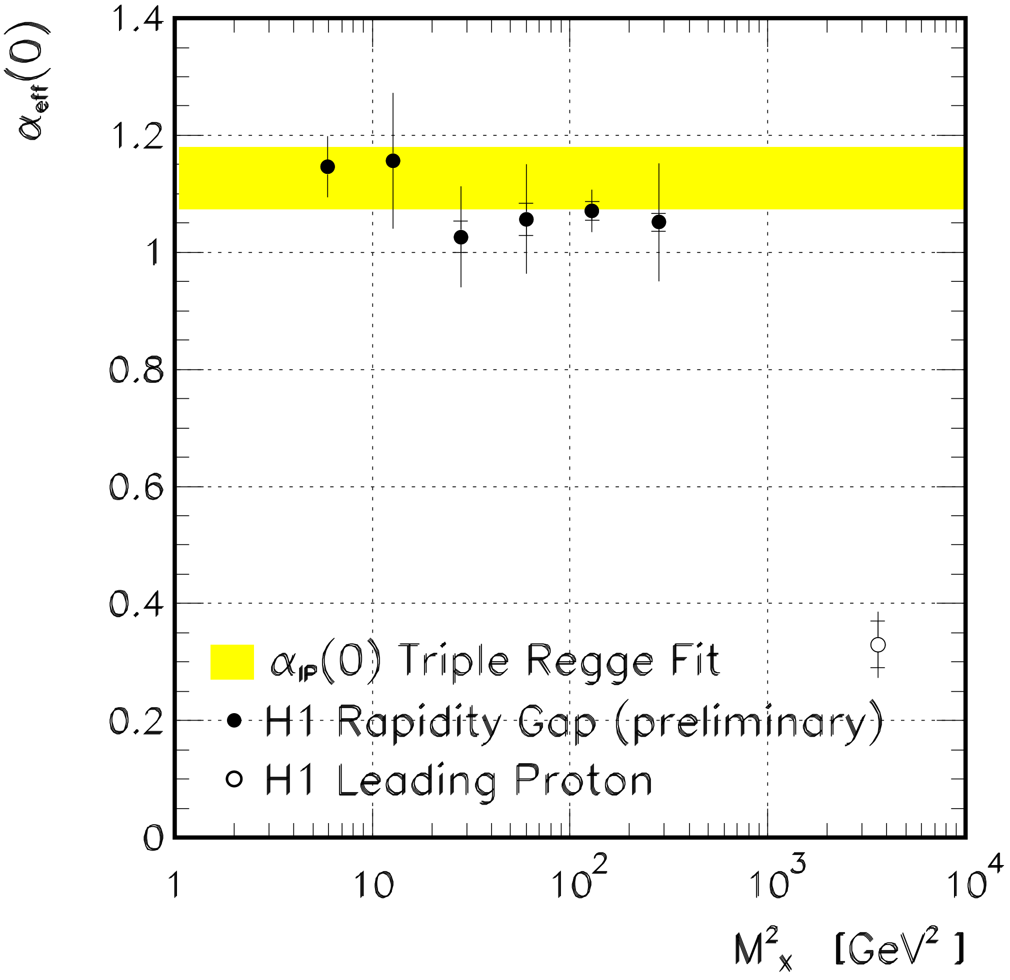
$$\text{with } B = b_0 + 2\,\alpha'\,ln(W^2/M_X^2)$$

$$b_0 = 4.6 \pm 0.6 \text{ GeV}^{-2} \qquad \alpha' = 0.26 \pm 0.02 \text{ GeV}^{-2}$$

• H1 Rapidity Gap (preliminary)

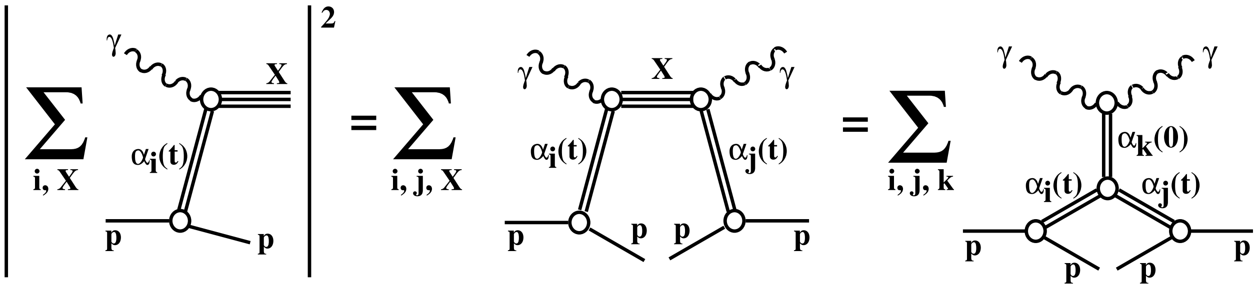


Effective intercept: $\alpha_{eff}(0)$ from W dep. at fixed M_X^2



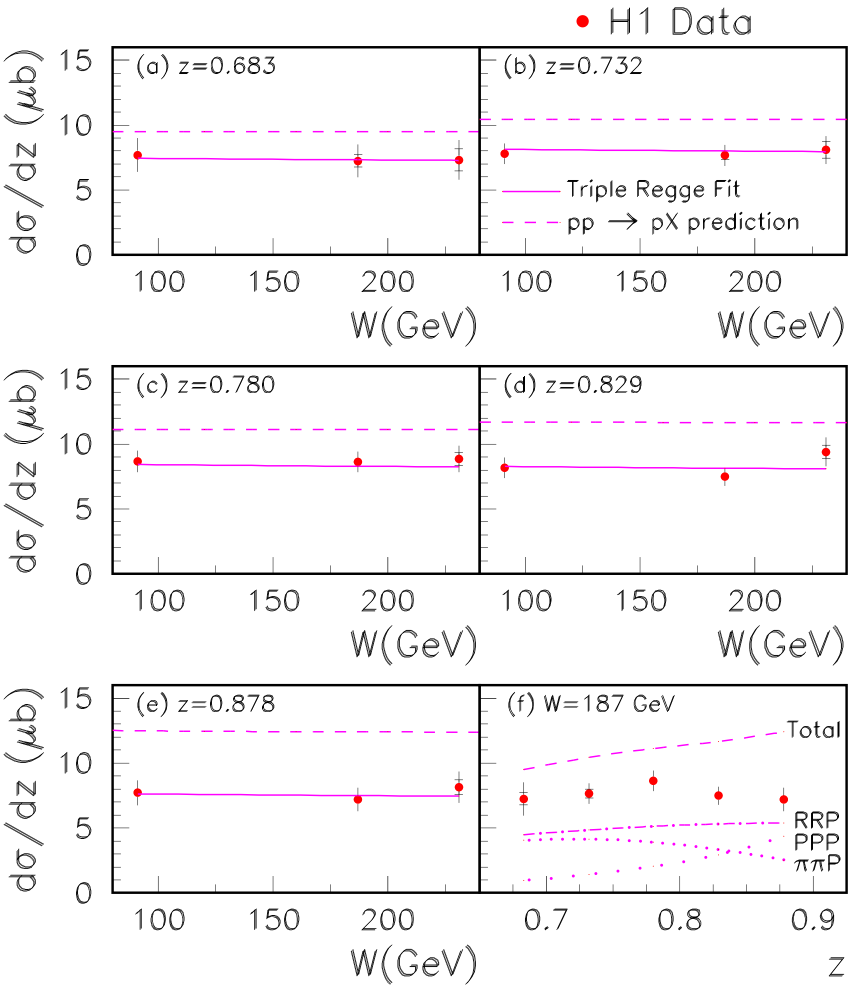
- Rapidity Gap data, $I\!P$ dominated
- Leading Proton data, π and $I\!R$ dominated
  $(\alpha_\pi(0) = 0$ and $\alpha_{I\!R}(0) = 0.5)$

Triple Regge formalism



$$\frac{d^2\sigma}{dM_X^2\,dt} = \frac{s_0}{W^4}\sum_{i,j,k} G_{ijk}(t)\left(\frac{W^2}{M_X^2}\right)^{\alpha_i(t)+\alpha_j(t)}\left(\frac{M_X^2}{s_0}\right)^{\alpha_k(0)}$$

$$\frac{d\sigma}{dz} = W^2\frac{d\sigma}{dM_X^2} \propto \frac{e^{Bt_{min}}-e^{Bt_{max}}}{B}\,(W^2)^{2\alpha_i(0)-1}\,(M_X^2)^{\alpha_k(0)-2\alpha_i(0)}$$



Results

$\alpha_i(0)$=0.33±0.04±0.04

$\alpha_k(0)$=0.99±0.01±0.05

b_0=3.6±0.7±1.4 GeV^{-2}

⇒ Predictions based on *pp* fair agreement (50%)

Triple Regge fit on $\gamma p \to Xp/Y$

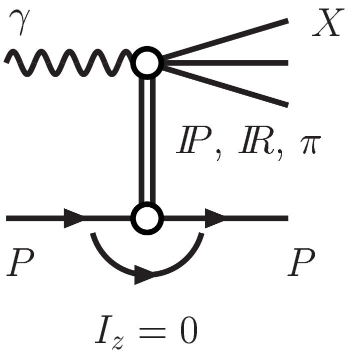
$\Rightarrow$ 6 Couplings $G_{ijk}(0)$, $\alpha_{I\!P}(0)$ are fitted

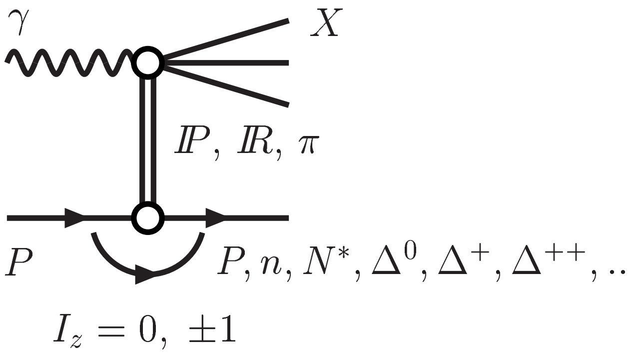
- Remaining parameters fixed to:

Quantity		value			
$\alpha_{I\!R}(0)$	=	0.55	$\pm$	0.10	
$\alpha'_{I\!P}$	=	0.26	$\pm$	0.02	GeV^{-2}
$\alpha'_{I\!R}$	=	0.90	$\pm$	0.10	GeV^{-2}
$b_{pI\!P}$	=	2.3	$\pm$	0.3	GeV^{-2}
$b_{pI\!R}$	=	1.0	$\pm$	1.0	GeV^{-2}
b_{ijk}	=	0.0	$\pm$	1.0	GeV^{-2}

Fit Assumptions:

- No Interferenc
- $I\!P$, $I\!R$ and π exchanges considered
- Additional isospin exchanges in RG wrt LP



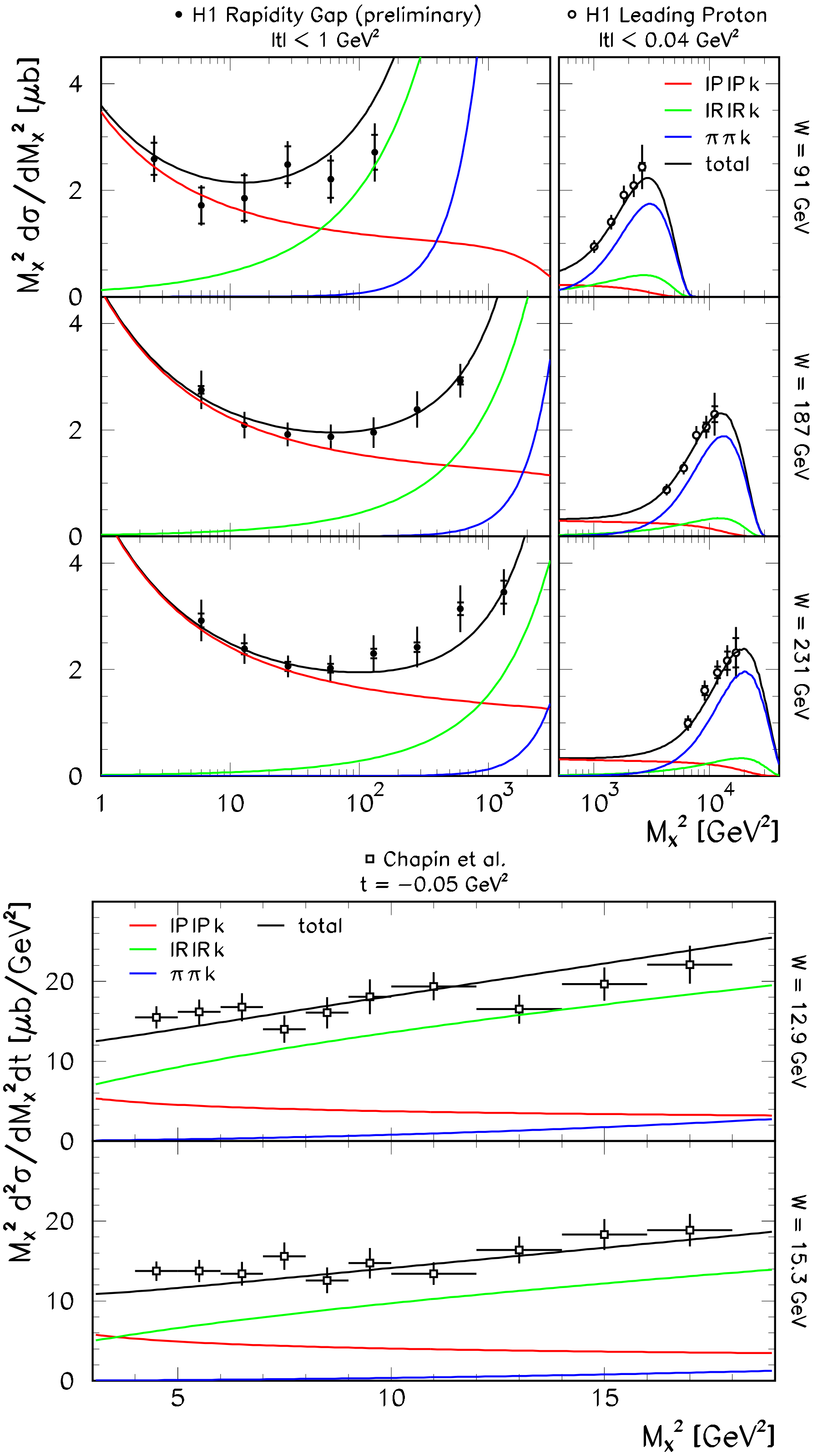


Leading Proton data:
No isospin exchanged

Rapidity Gap data:
Isospin exchanged

- For π exchange $\to$ Factor of 3 = RG/LP
- For $I\!R$ exchange $\to$ New Fit para $\mathcal{R}$ = RG/LP
  For $p \to (p,\ n)$: $\mathcal{R}$ expected < 3
  when proton resonances like Δ's $\to \mathcal{R} > 3$

Triple Regge Fit on RG, LP and Fixed Target



Rapidity Gap:

dominated by $I\!P$

high M_X^2 $I\!R$ contr.

Leading Proton:

dominated by π

Fixed Target:

dominated by $I\!R$

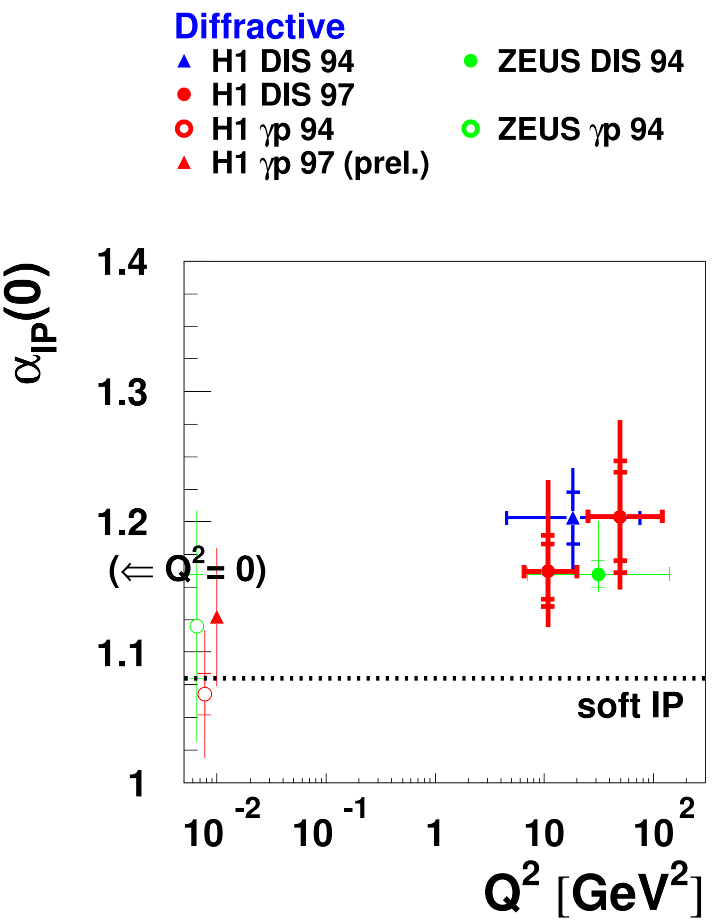
$\mathcal{R}$=11.4±0.2±6.8 !

$\alpha_{I\!P}(0)$ stable!!

$\Updownarrow$

$$\alpha_{I\!P}(0) = 1.127 \pm 0.004(\mathrm{stat}) \pm 0.025(\mathrm{syst}) \pm 0.046(\mathrm{mod})$$

$\alpha_{I\!P}(0)$ comparison for diffractive dissociation



Present $\alpha_{I\!P}(0)$ combined with previous extractions

$\Rightarrow$ Agreement with previous $Q^2 = 0$ extractions

$\Rightarrow$ Indication for rise in function of Q^2

Conclusions

- New Cross Section presented of Rapidity Gap events
  $\Rightarrow$ additional $\langle W \rangle = 91$ GeV measurement

$\alpha_{eff}(0)$ and Triple Regge fit showed:

$\Rightarrow$ RG data (low M_X^2), $I\!\!P$ dominated

$\Rightarrow$ LP data (high M_X^2), $\pi / I\!\!R$ dominated

Triple Regge fit:

$\Rightarrow$ Stable Extraction of $\alpha_{I\!\!P}$:

$$\alpha_{I\!\!P} = 1.127 \pm 0.004 \pm 0.025 \pm 0.046$$