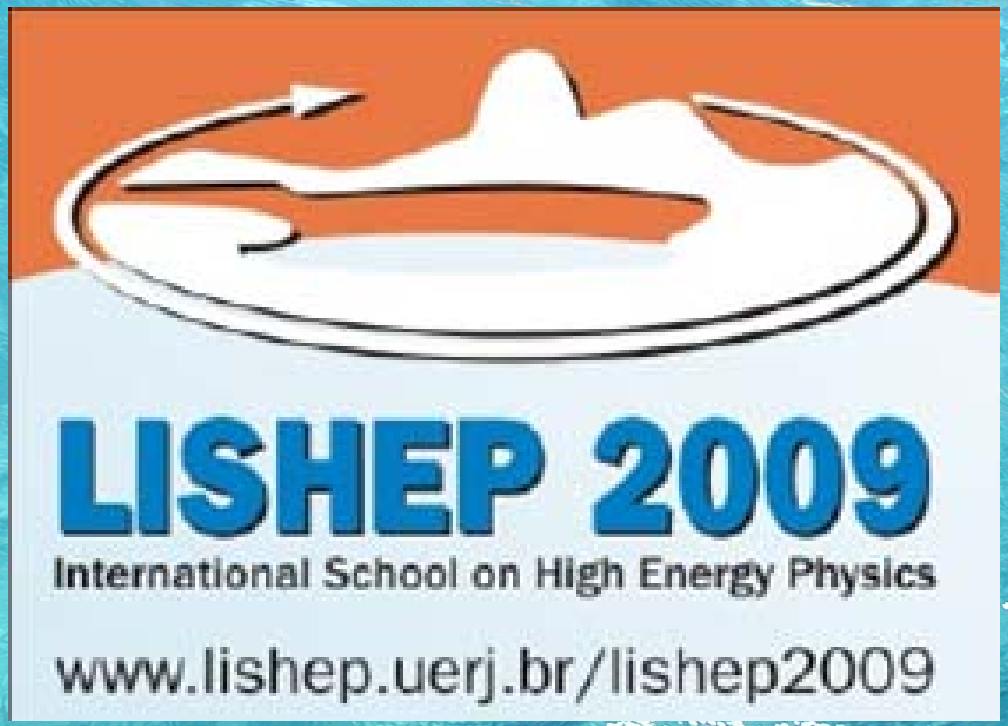
# Factorization Breaking in Diffraction

## ➔ pp, $\gamma$p and $\gamma^*$p ➔

Konstantin Goulianos
The Rockefeller University



# Contents

- pp and $\bar{p}p$ results
- $\gamma p$ and $\gamma^* p$ results
- discussion

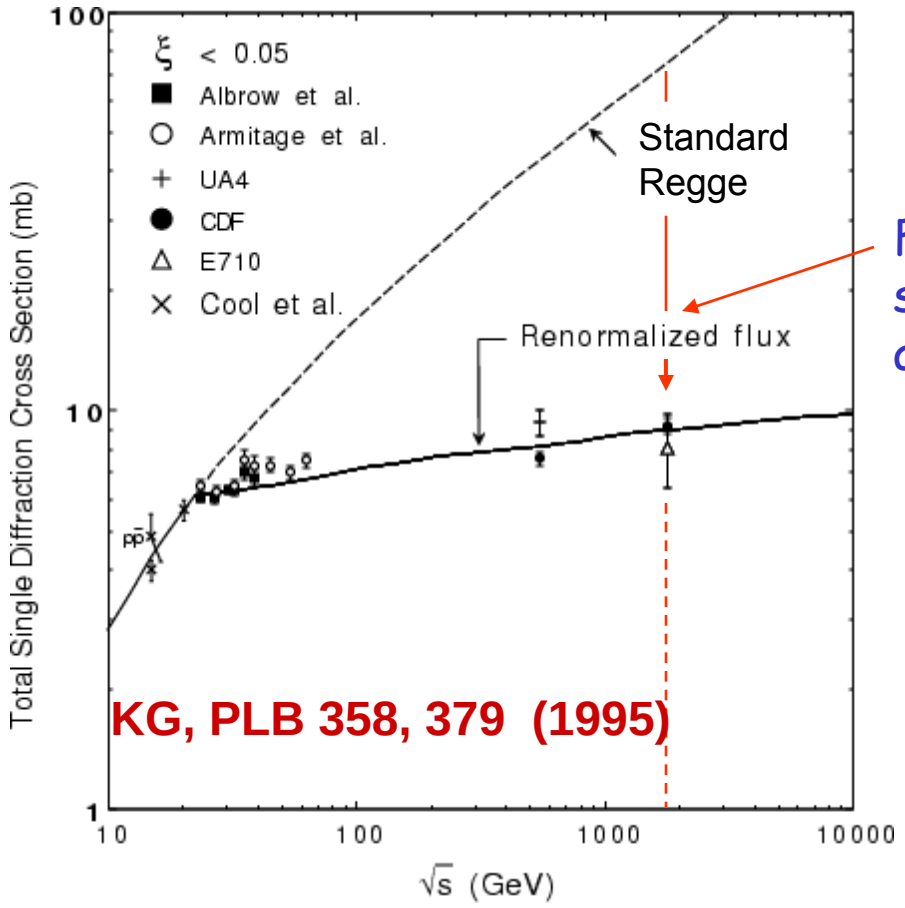


# pp and $\bar{p}p$ results



# $\sigma^{T}_{SD}$ (pp & $\bar{p}p$) - Soft Diffraction

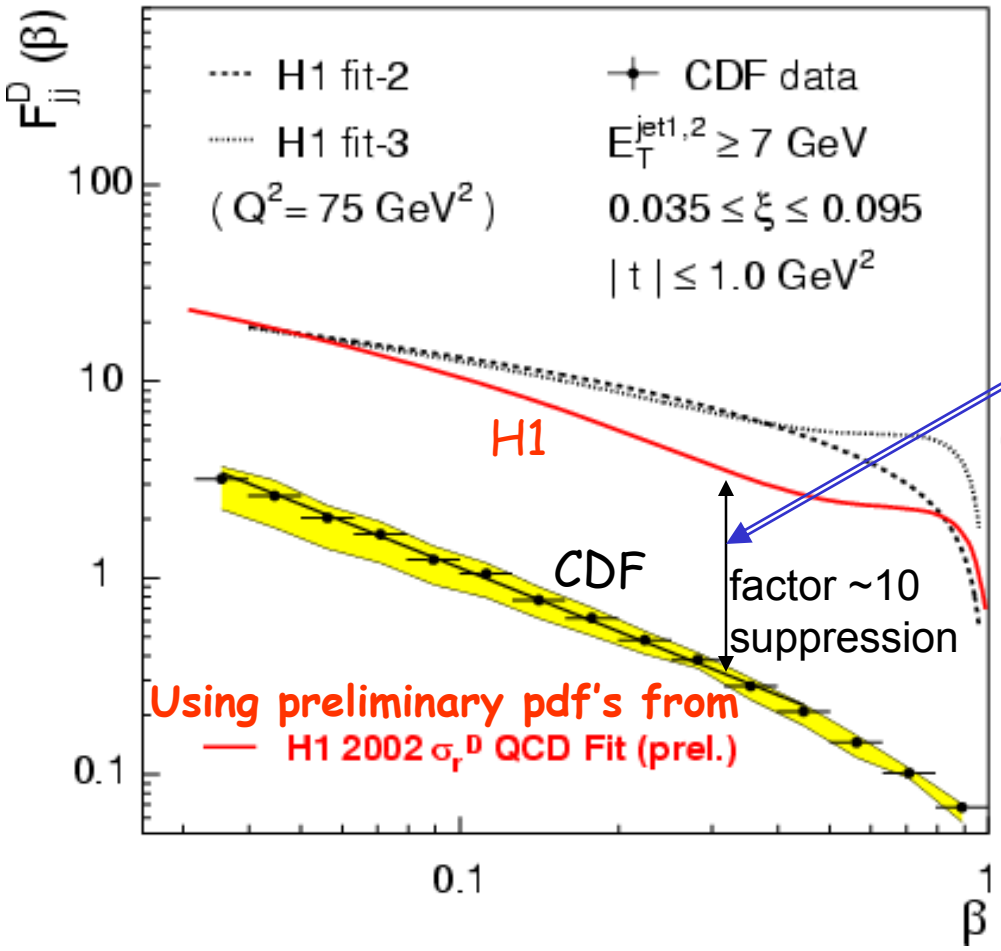
Suppression relative to prediction from Regge factorization




Factor of ~10 (~5) suppression observed at $\sqrt{s}$ = 1800 (540) GeV

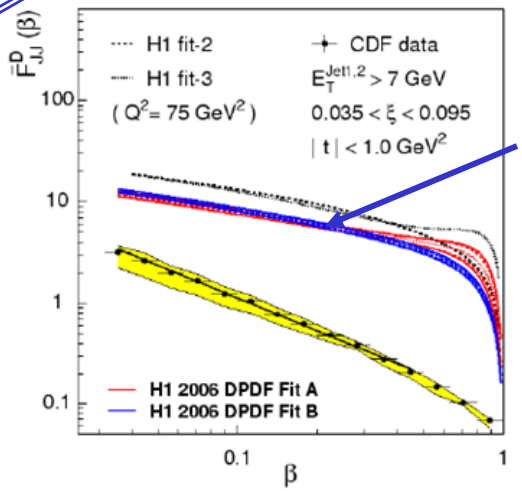
# Diffractive Structure Function

$\bar{p}p$ vs. $\gamma^*p$ - Breakdown of QCD factorization




$$\bar{p}p \rightarrow \bar{p} + \text{dijet} + X$$

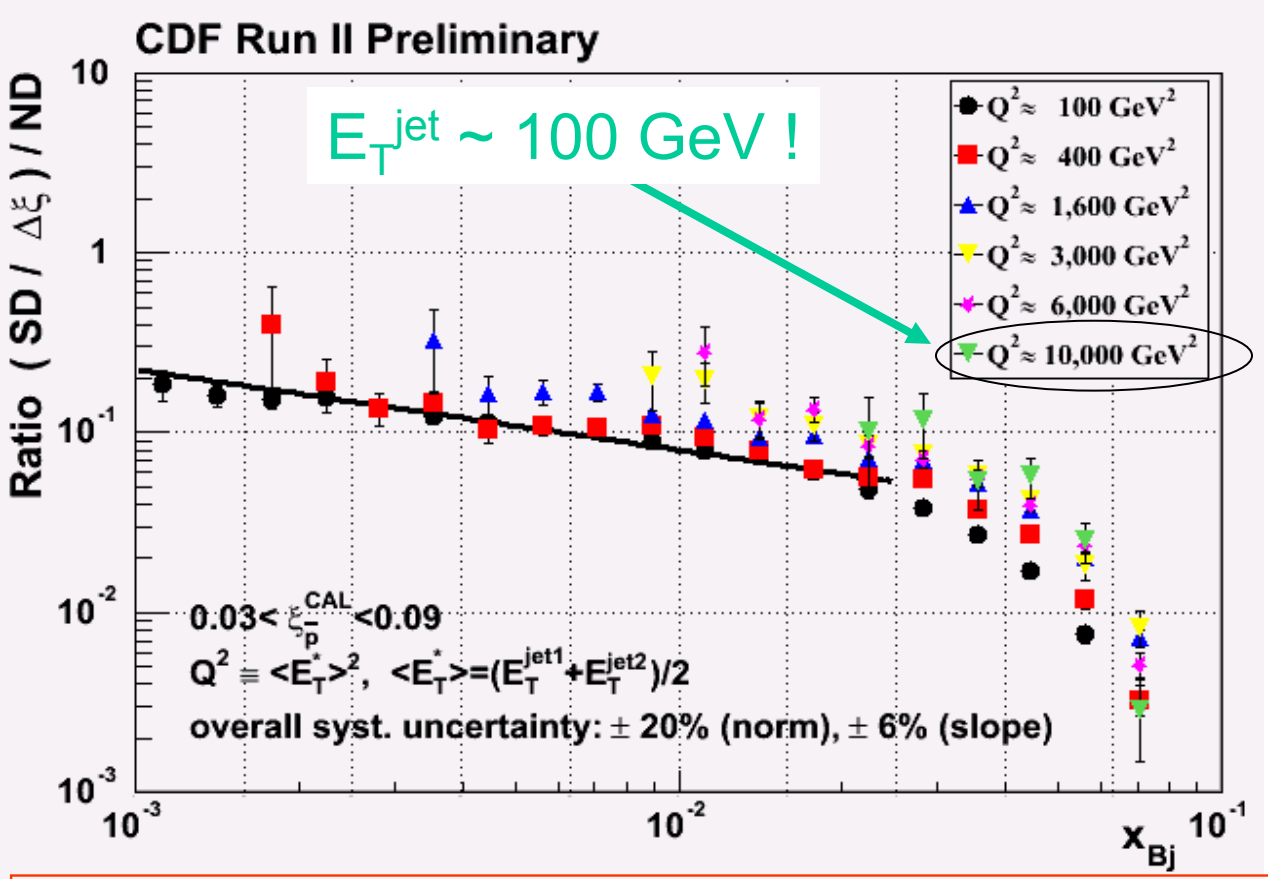
same suppression
as in soft diffraction




**H1 2006 fits: more flat!**

momentum fraction of parton in Pomeron

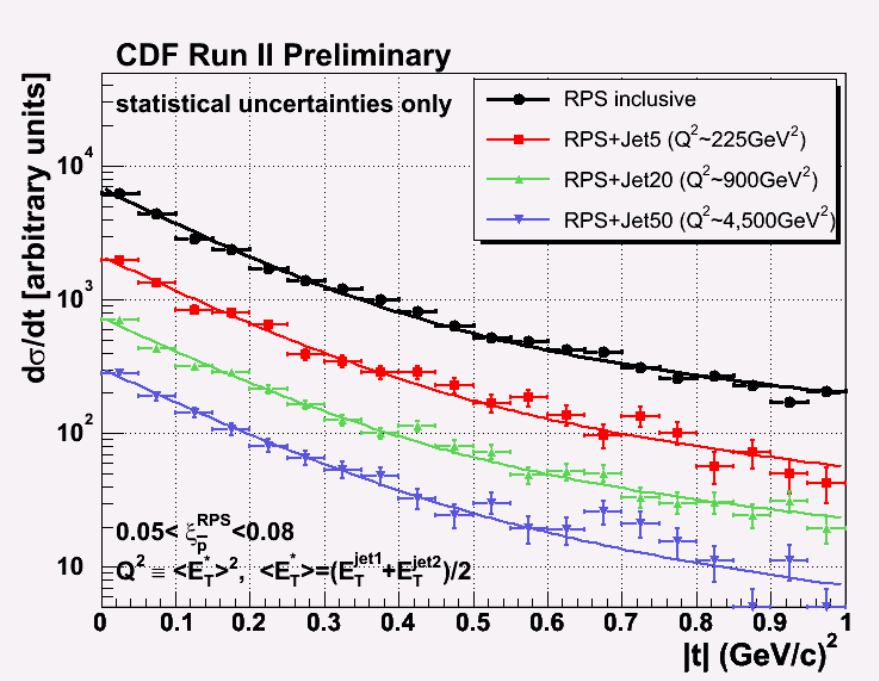
# Diffractive Structure Function: $x_{Bj}$ and $Q^2$ dependence

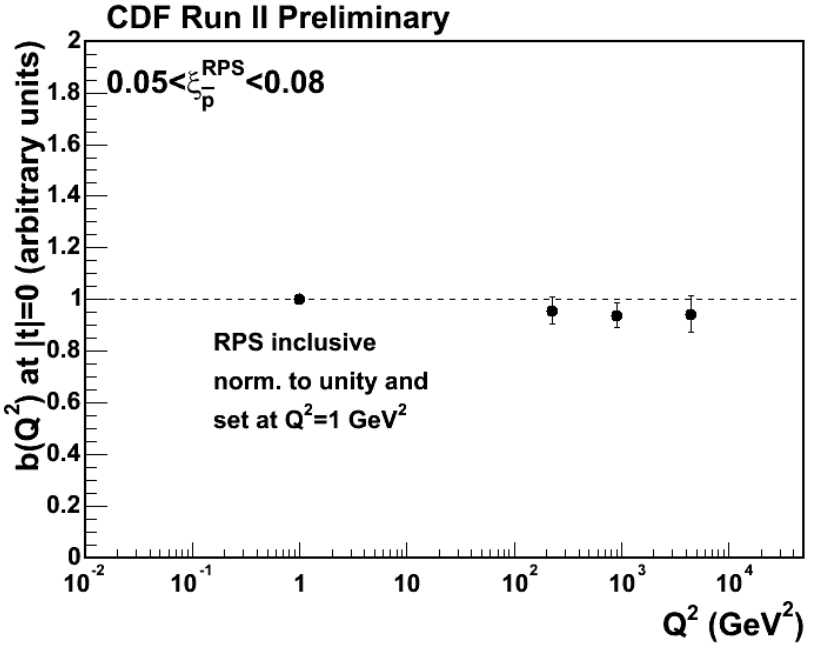



Small $Q^2$ dependence in region $100 < Q^2 < 10{,}000$ GeV$^2$

⇨ Pomeron evolves as the proton!

# Diffractive Structure Function:
## t- dependence




Fit dσ/dt to a double exponential:

$$F = 0.9 \cdot e^{b_1 \cdot t} + 0.1 \cdot e^{b_2 \cdot t}$$

- No diffraction dips
- No Q2 dependence in slope from inclusive to $Q^2 \sim 10^4$ GeV$^2$

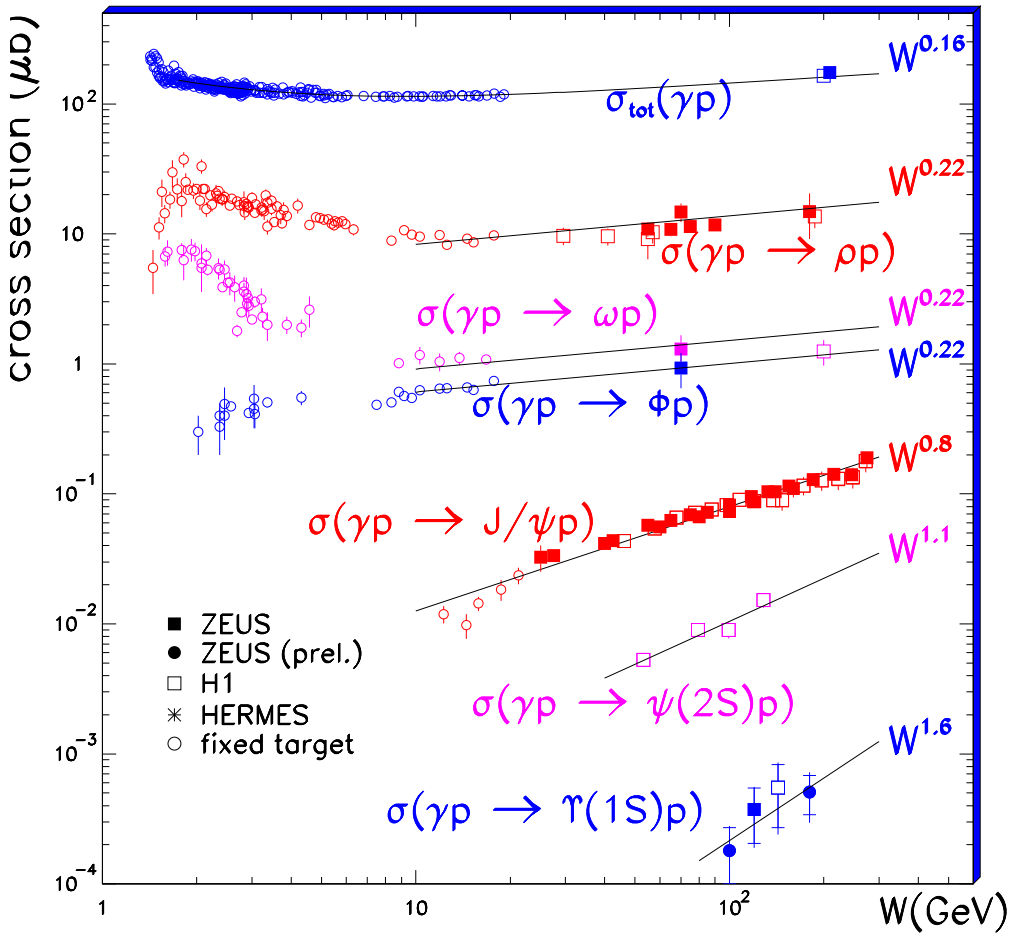
- Same slope over entire region of $0 < Q^2 < 4{,}500$ GeV$^2$ across soft and hard diffraction!

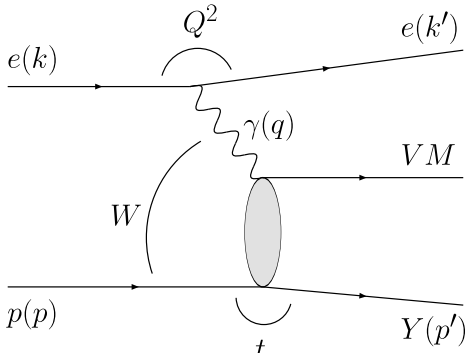
# $\gamma p$ and $\gamma^* p$

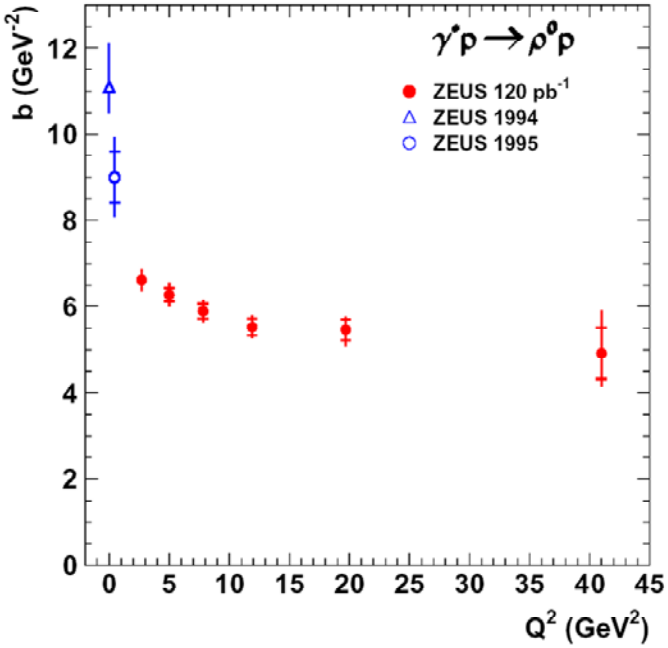


# Vector meson production

(Pierre Marage, HERA-LHC 2008)



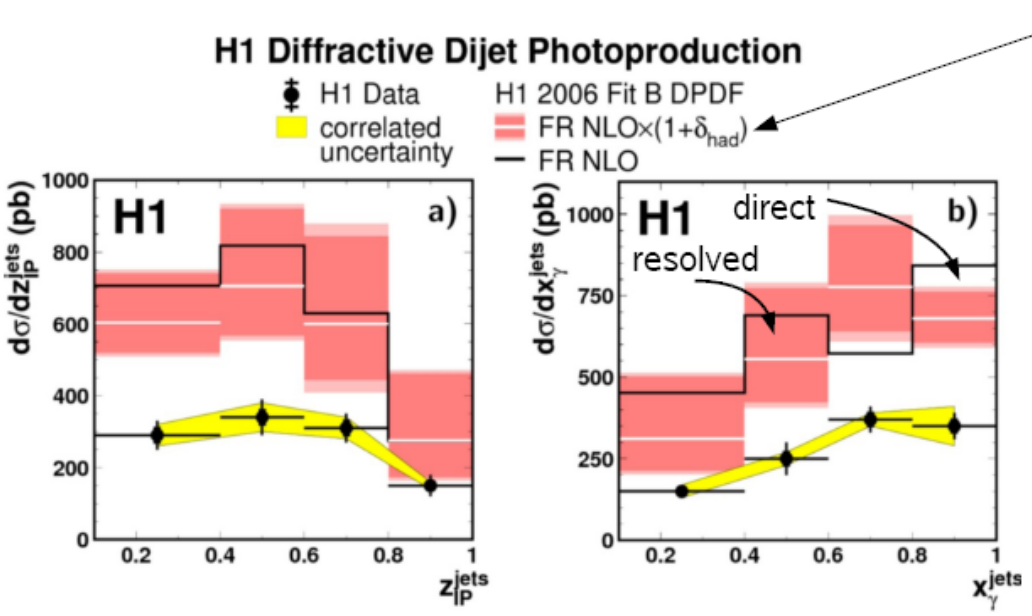




- *left* -suppression of 20-50 % at high W
- *right* -suppression of low |t| events at high $Q^2$ →smaller slope!

# Dijets in γp at HERA - 2007

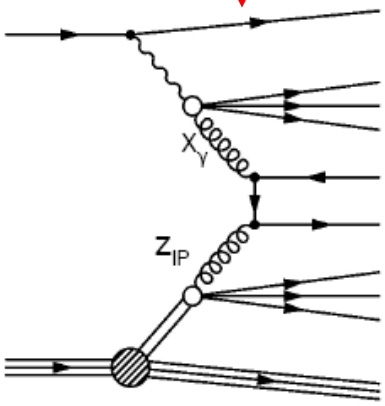
[slide from summary of the HERA/LHC Workshop of March 14, 2007]

## Dijets in γp




Frixione NLO code
+ hadronizarion correction

**Hadron-like γ**



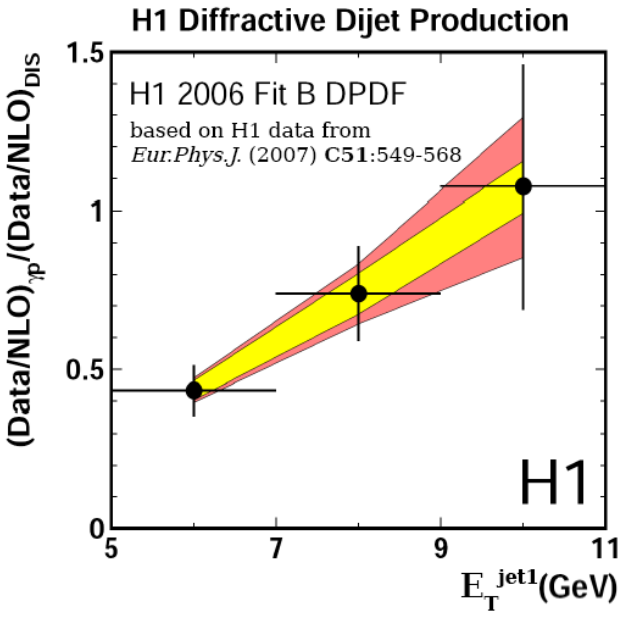

- large violation of naive factorization observed
- factorization breaking occurs in direct and resolved processes

**QCD factorisation not OK**

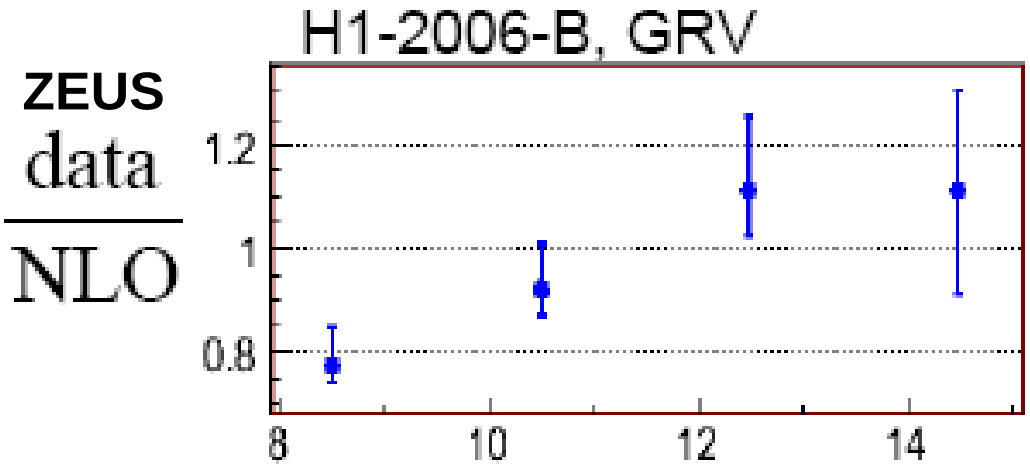
**Unexpected, not understood**

Matthias Mozer, HERA-LHC 2007 12

# Dijets in γp at HERA - 2008




DIS 2008 talk by W. Slomiński,




- suppression of 20-50 % observed at low ET
- expected in renormalization model

# DISCUSSION




thank you