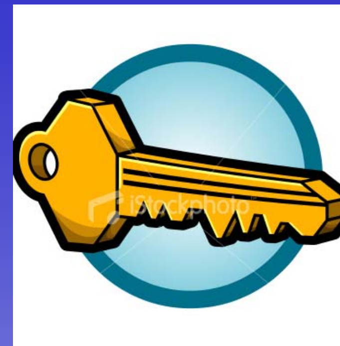
The  to

Diffraction, saturation, and pp cross-sections at the LHC and beyond

Konstantin Goulianos
The Rockefeller University
http://physics.rockefeller.edu/dino/myhtml/conference.html

A topical conference on elementary particles, astrophysics, and cosmology

CONTENTS

Why study soft physics?

Two reasons: one fundamental / one practical.

- *fundamental*

σ_T

↕ **optical theorem**

Im $f_{el}(t=0)$

↕ **dispersion relations**

Re $f_{el}(t=0)$

measure σ_T & ρ-value at LHC:

violation of dispersion relations →
sign for new physics

Bourrely, C., Khuri, N.N., Martin, A.,Soffer, J., Wu, T.T

Diffraction

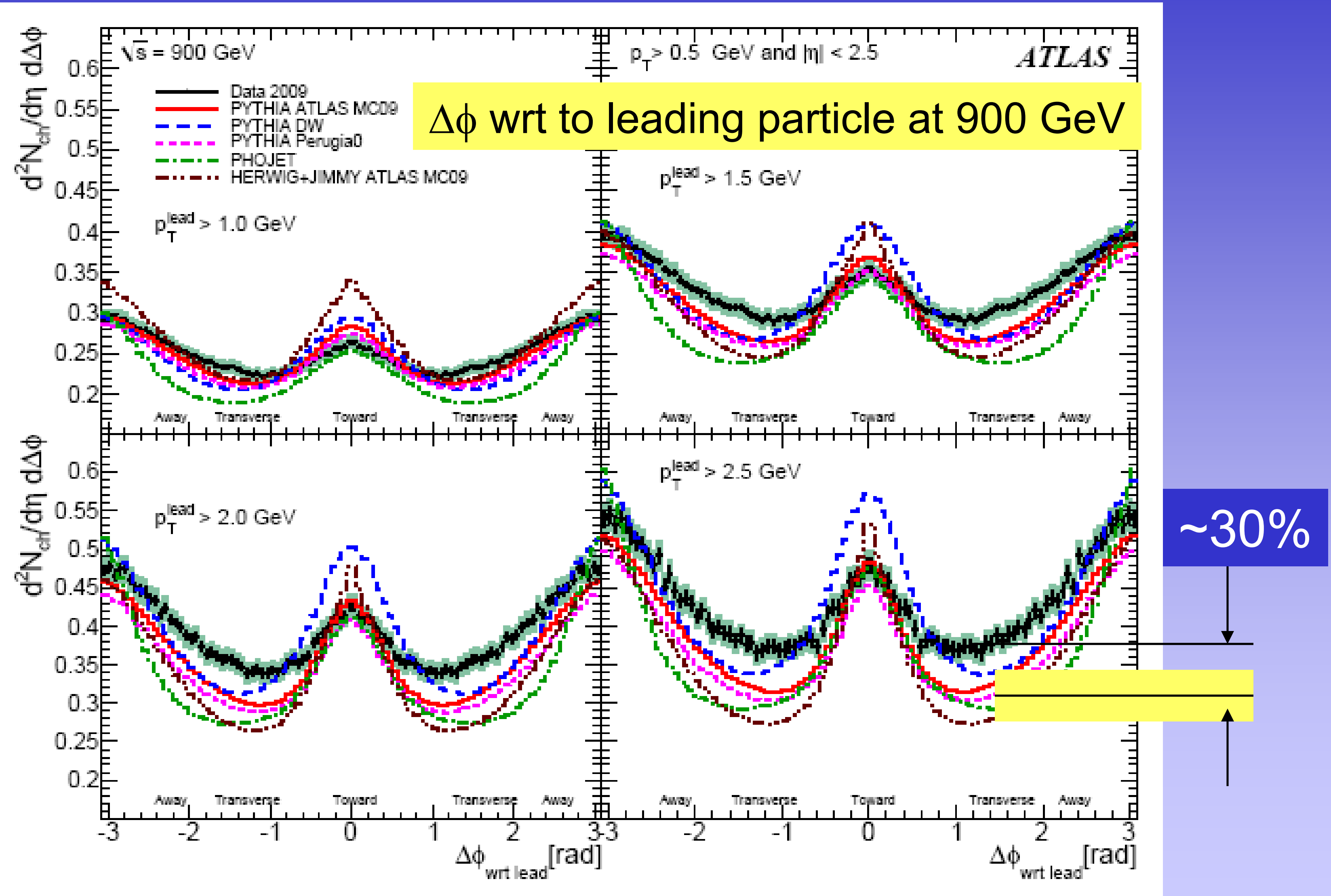
- **saturation → σ_T**
- **dark energy???**

- *practical*: underlying event, triggers, calibrations

All MCs based on pre-LHC data are inadequate
→ need to build robust soft physics MC simulations

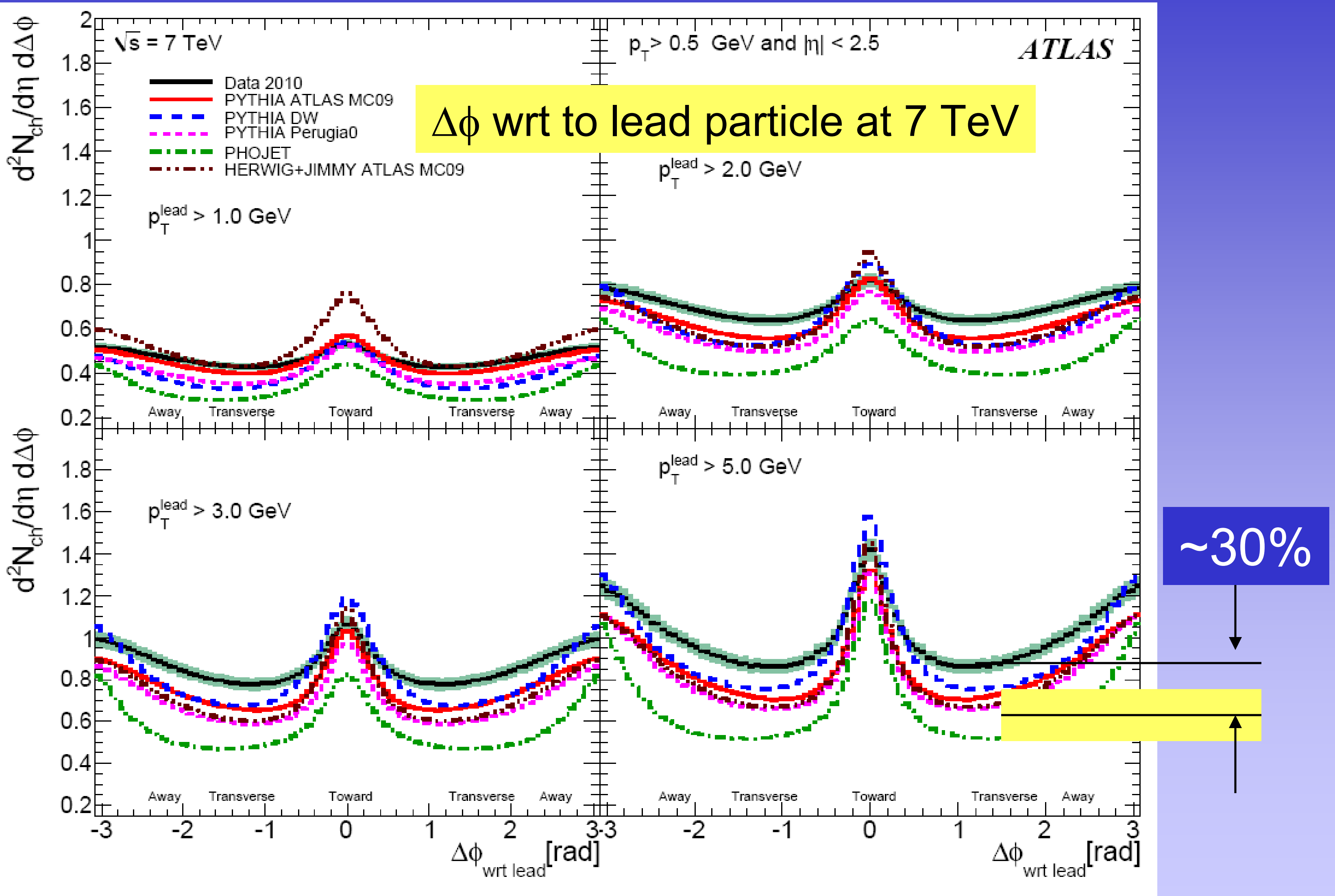
ATLAS: UE data vs MC at 900 GeV

http://www.citeulike.org/user/qitek/article/8363551



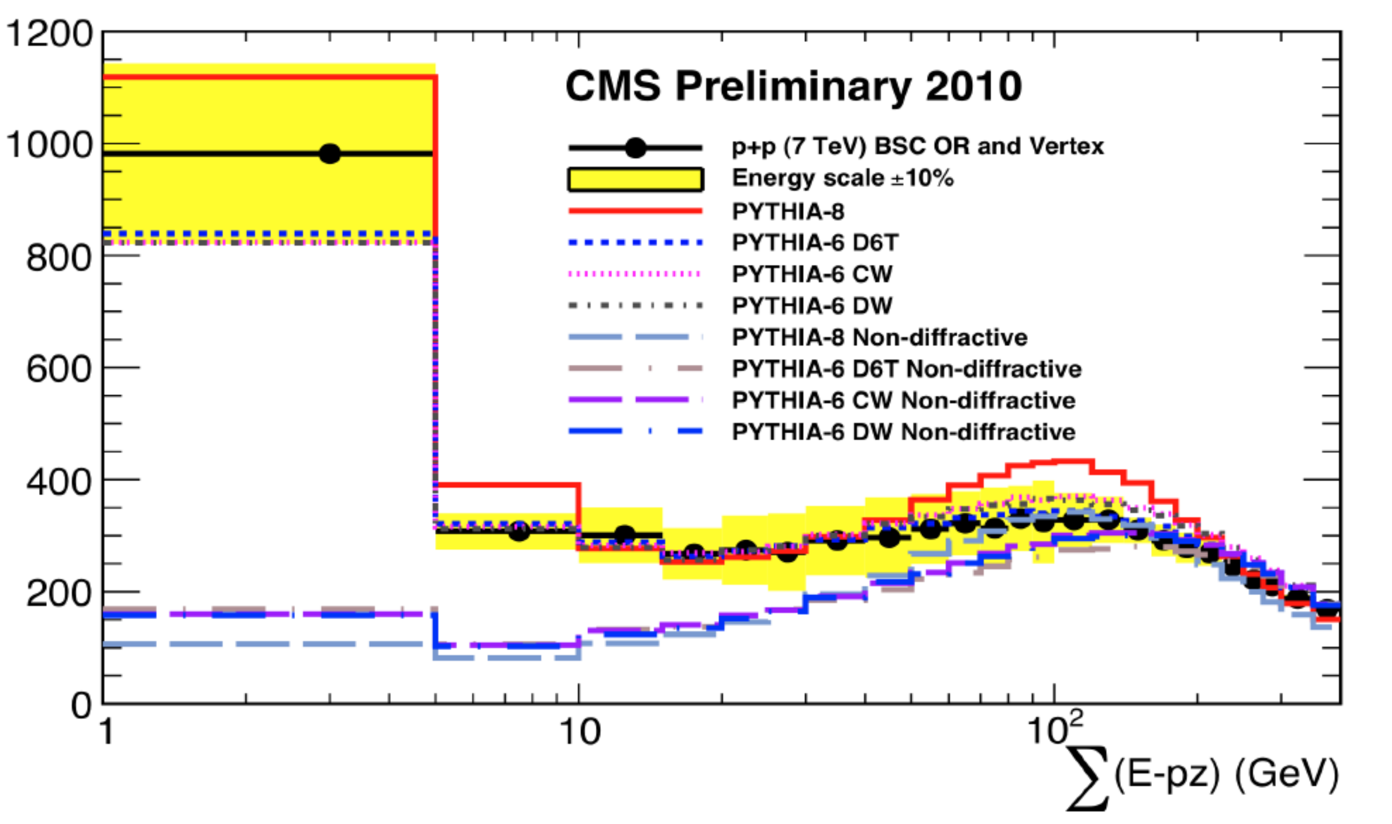
ATLAS: UE data vs MC at 7 TeV

http://www.citeulike.org/user/qitek/article/8363551



CMS: observation of Diffraction at 7 TeV

Pre-approved on 11/11/2012

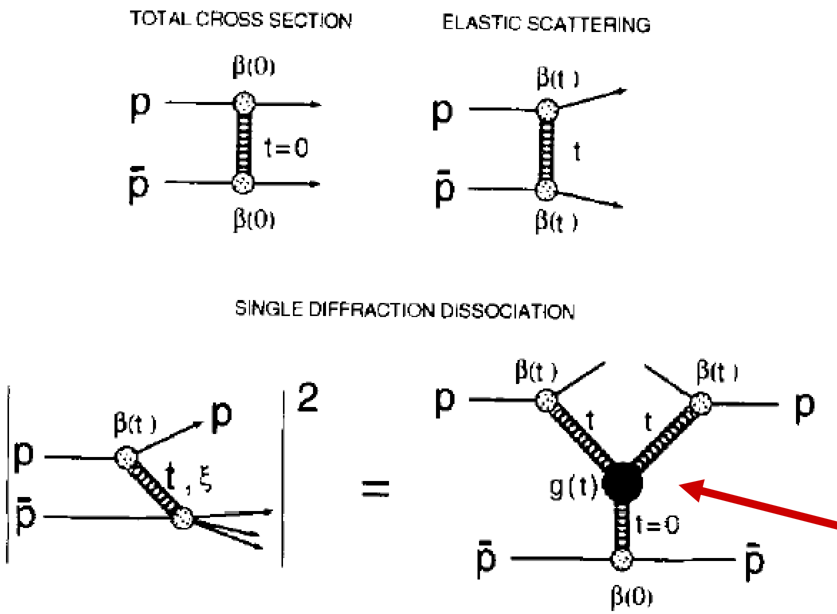


13: CMS inclusive single diffraction observation: data vs. MC.

An example of a beautiful data analysis and of MC inadequacies

Regge theory – values of s_o & g?

KG-1995: PLB 358, 379 (1995)



$$\sigma_T = \beta_1(0)\beta_2(0)\left(\frac{s}{s_0}\right)^{\alpha(0)-1} = \sigma_0^{p\bar{p}}\left(\frac{s}{s_0}\right)^{\epsilon} \quad (1)$$

$$\frac{d\sigma_{\text{el}}}{dt} = \frac{\beta_1^2(t)\beta_2^2(t)}{16\pi}\left(\frac{s}{s_0}\right)^{2[\alpha(t)-1]}$$

$$= \frac{\sigma_T^2}{16\pi}\left(\frac{s}{s_0}\right)^{2\alpha' t} F^4(t) \approx \frac{\sigma_T^2}{16\pi} e^{b_{\text{el}}(s)t} \quad (2)$$

$$F^4(t) \approx e^{b_{0,el}t} \quad \Rightarrow \quad b_{\text{el}}(s) = b_{0,el} + 2\alpha' \ln\left(\frac{s}{s_0}\right) \quad (3)$$

$$\frac{d^2\sigma_{\text{sd}}}{dt\,d\xi} = \frac{\beta_1^2(t)}{16\pi}\,\xi^{1-2\alpha(t)}\left[\beta_2(0)\,g(t)\left(\frac{s'}{s'_0}\right)^{\alpha(0)-1}\right]$$

$$= f_{\mathcal{P}/p}(\xi,t)\;\sigma_T^{\mathcal{P}\bar{p}}(s',t) \quad (4)$$

Parameters:

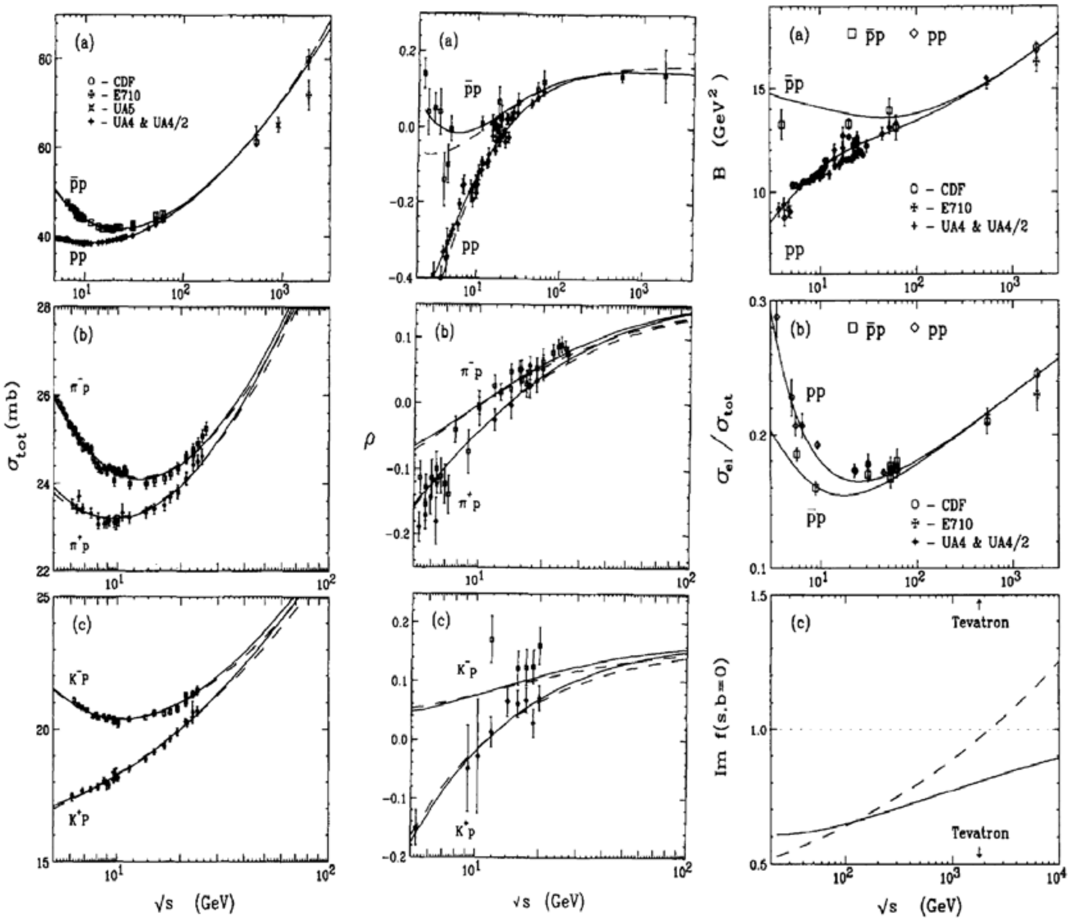
- s_0, s_0' and g(t)
- set s_0' = s_0 (universal IP)
- g(t) ➔ g(0) ≡ g_{PPP} →KG-1995
- determine s_0 and g_{PPP} – how?

Global fit to p±p, π±, K±p x-sections

CMG-1996
PLB 389, 176 (1996)

A new determination of the soft pomeron intercept

R.J.M. Covolan[1], J. Montanha[2], K. Goulianos[3]



Regge theory eikonalized

❑ INPUT

$$\alpha_{f/a} = 0.68 + 0.82\,t$$

$$\alpha_{\omega/\rho} = 0.46 + 0.92\,t$$

$$\alpha'_{\mathbb{P}} = 0.25\ \mathrm{GeV}^{-2}$$

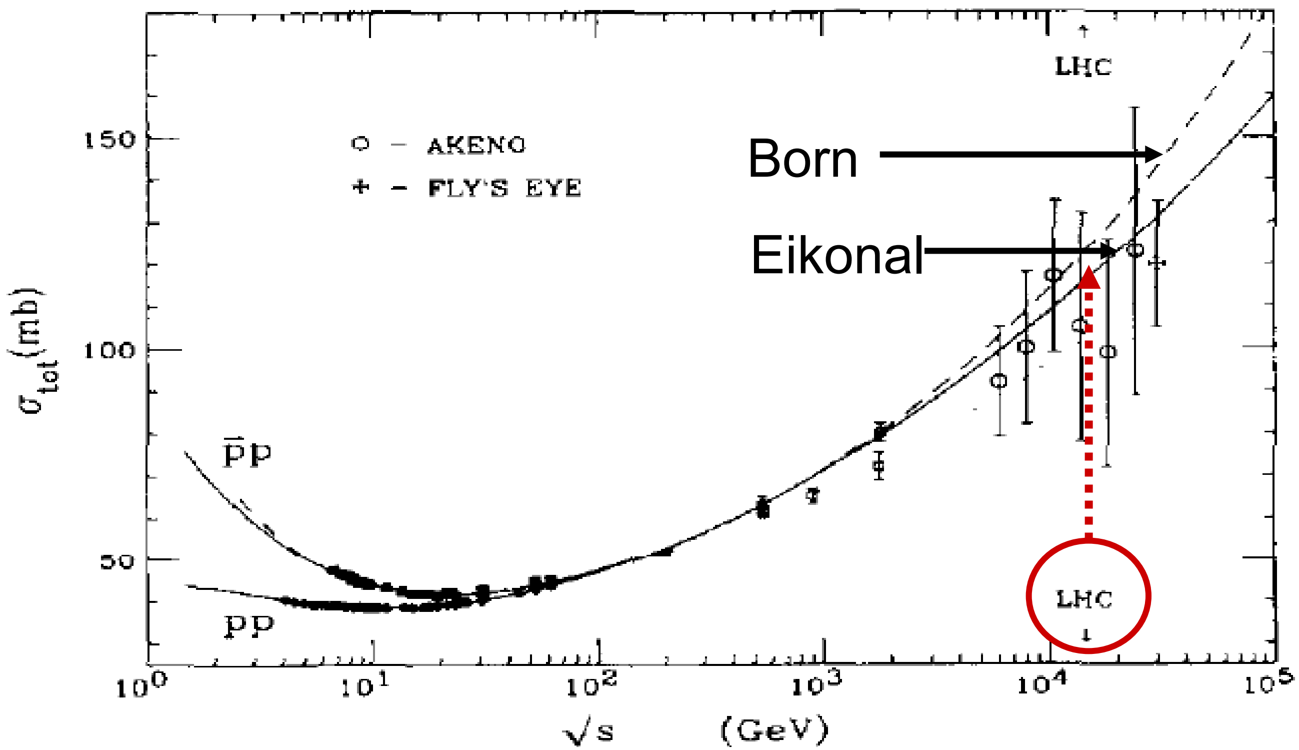
❑ RESULTS

$$\alpha^{\mathrm{Born}}_{0,\mathbb{P}} = 1.104 \pm 0.002\,, \quad \alpha^{\mathrm{Eik}}_{0,\mathbb{P}} = 1.122 \pm 0.002$$

$$\sigma^{p^\pm p}_{\mathrm{tot}} = 16.79\, s^{0.104} + 60.81\, s^{-0.32} \mp 31.68\, s^{-0.54}$$

negligible

σ^T at LHC from CMG global fit



- σ @ LHC √s=14 TeV: 122 ± 5 mb Born, 114 ± 5 mb eikonal

  ➔ error estimated from the error in ε given in CMG-96

Compare with **SUPERBALL** σ(14 TeV) = 109 ± 6 mb

caveat: s_o=1 GeV^2 was used in global fit!

but Peter Landshoff says…

How well can we predict the total cross section at the LHC?

Authors: P V Landshoff

(Submitted on 3 Nov 2008) arXiv:0811.0260v1 [hep-ph]

Abstract: Independently of any theory, the possibility that the large value of the Tevatron cross section claimed by CDF is correct suggests that the total cross section at the LHC may be large. Because of the experimental and theoretical uncertainities, the best prediction is 125 ± 35 mb.

The problem is → Unitarity!

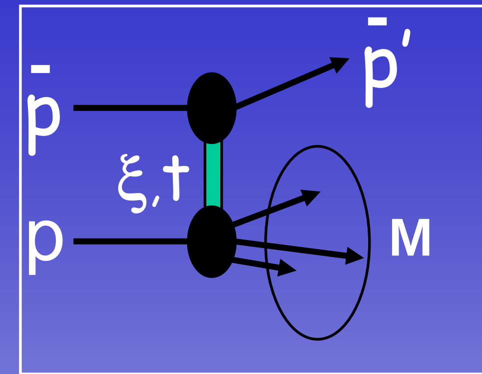
$$\left(\frac{d\sigma_{el}}{dt}\right)_{t=0} \sim \left(\frac{s}{s_o}\right)^{2\epsilon}, \quad \sigma_t \sim \left(\frac{s}{s_o}\right)^{\epsilon}, \quad \sigma_{sd} \sim \left(\frac{s}{s_o}\right)^{2\epsilon}$$

- ❑ $d\sigma/dt$ σ_{sd} grows faster than σ_t as s increases
  → unitarity violation at high s

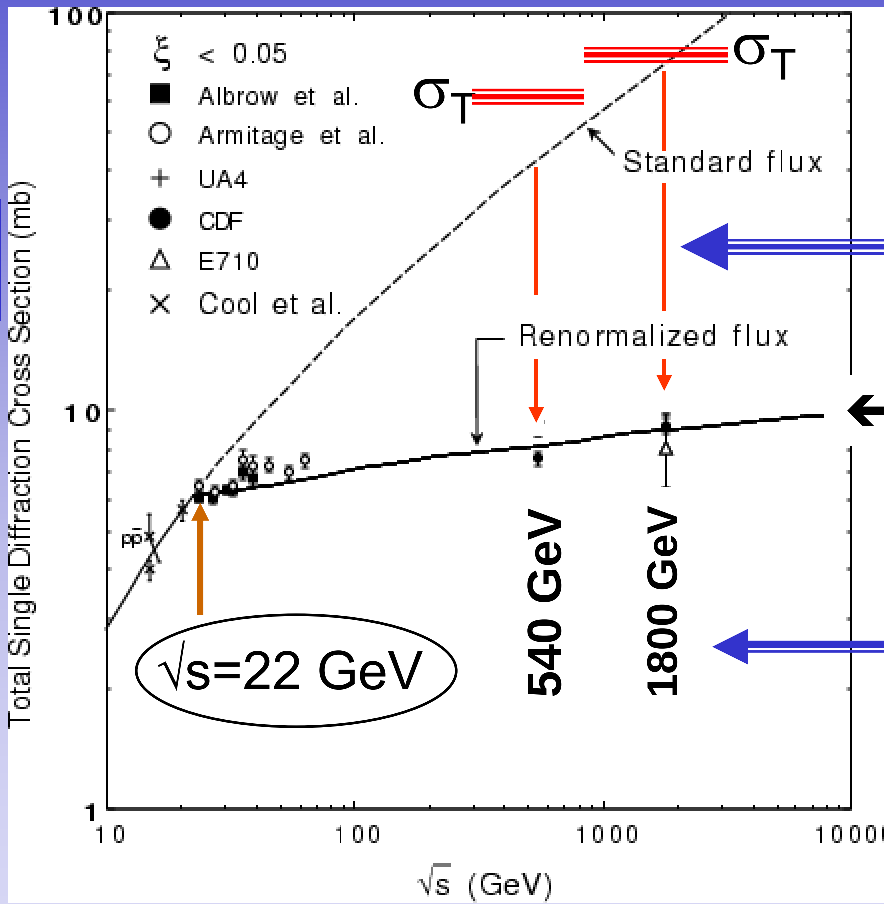
(similarly for partial x-sections in impact parameter space)

- ❑ the unitarity limit is already reached at $\sqrt{s} \sim 2$ TeV

σ^T_{SD} vs σ_T (pp & $\bar{p}$p)



σ^T_{SD} mb



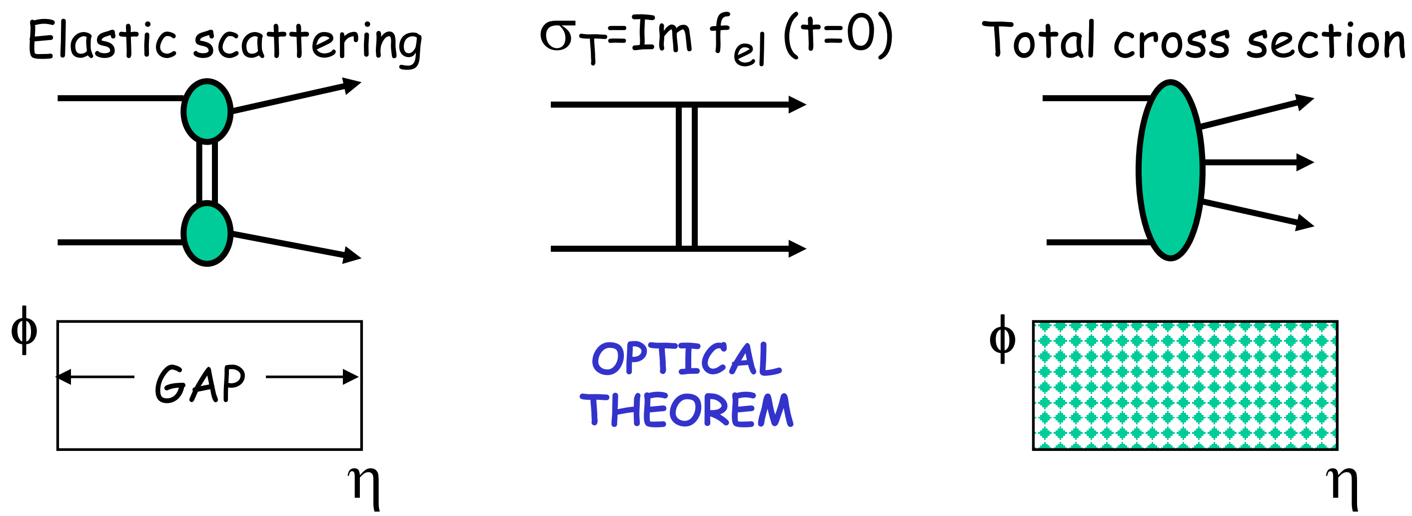
Factor of ~8 (~5) suppression at $\sqrt{s}$ = 1800 (540) GeV

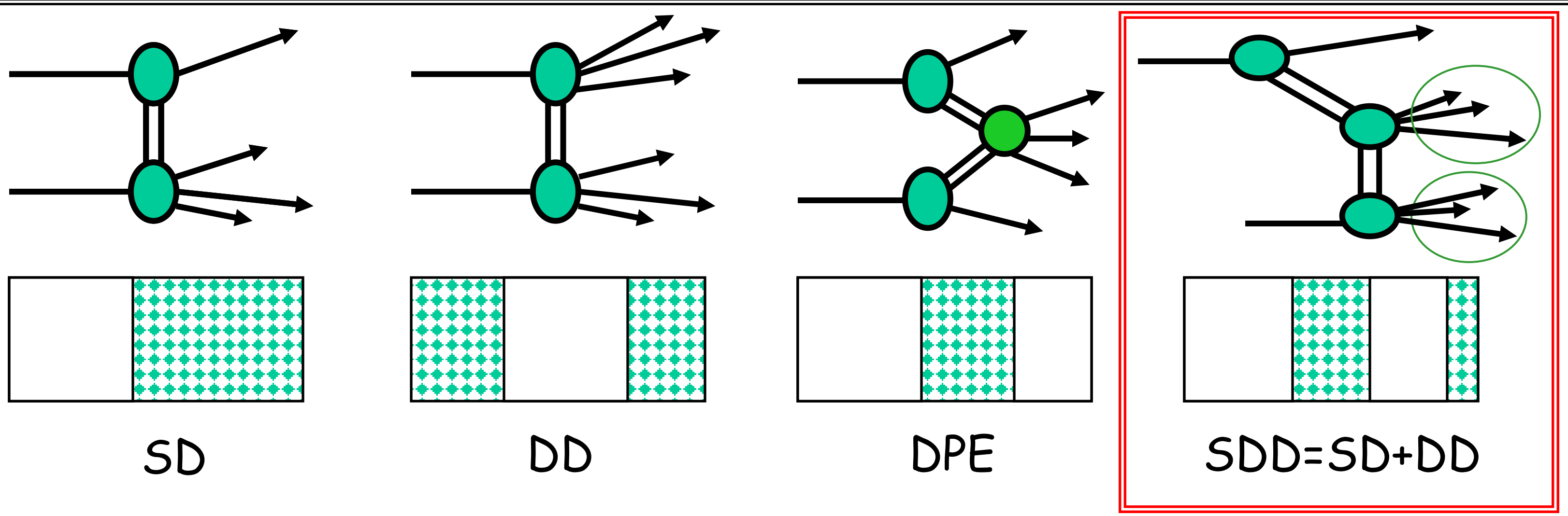
← **RENORMALIZATION MODEL**

KG, PLB 358, 379 (1995)

CDF Run I results

Diffractive pp/p̄p Processes





p-p Interactions

Non-diffractive:

Color-exchange

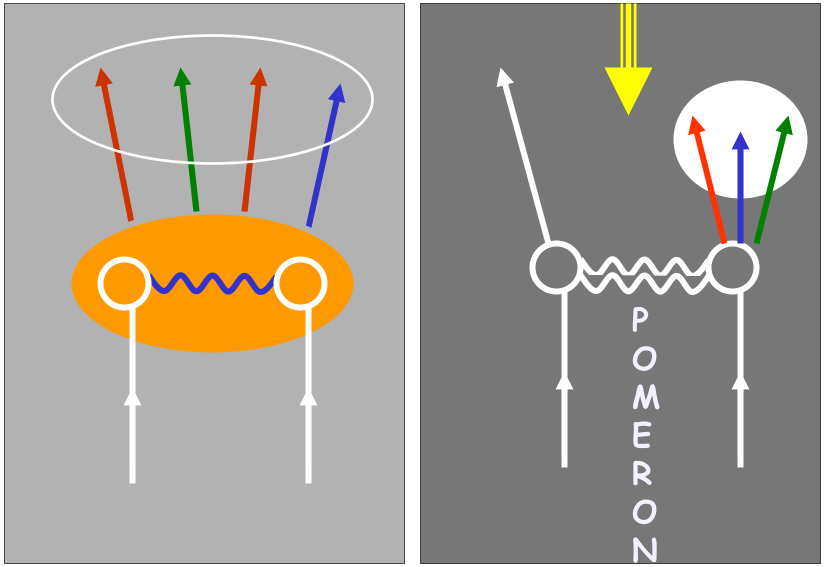
Diffractive:

Colorless exchange with vacuum quantum numbers

rapidity gap

Incident hadrons acquire color and break apart

CONFINEMENT



Incident hadrons retain their quantum numbers remaining colorless

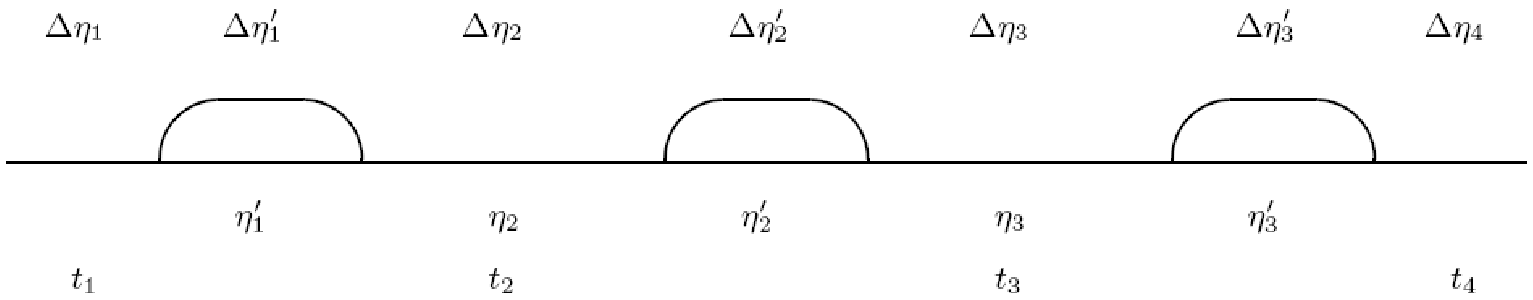
pseudo-DECONFINEMENT

Goal: understand the QCD nature of the diffractive exchange

Basic and combined ("nested") diffractive processes

acronym	basic diffractive processes
$\mathbf{SD}_{\bar{p}}$	$\bar{p}p \to \bar{p} + \text{gap} + [p \to X_p],$
$\mathbf{SD}_{p}$	$\bar{p}p \to [\bar{p} \to X_{\bar{p}}] + \text{gap} + p,$
DD	$\bar{p}p \to [\bar{p} \to X_{\bar{p}}] + \text{gap} + [p \to X_p],$
DPE	$\bar{p}p \to \bar{p} + \text{gap} + X_c + \text{gap} + p,$
	2-gap combinations of SD and DD
$\mathbf{SDD}_{\bar{p}}$	$\bar{p}p \to \bar{p} + \text{gap} + X_c + \text{gap} + [p \to X_p],$
$\mathbf{SDD}_{p}$	$\bar{p}p \to [\bar{p} \to X_{\bar{p}}]\text{gap} + X_c + \text{gap} + p.$

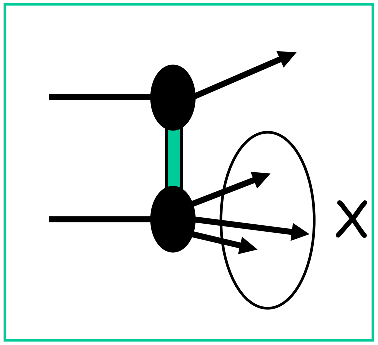
multi-gap "nested" process

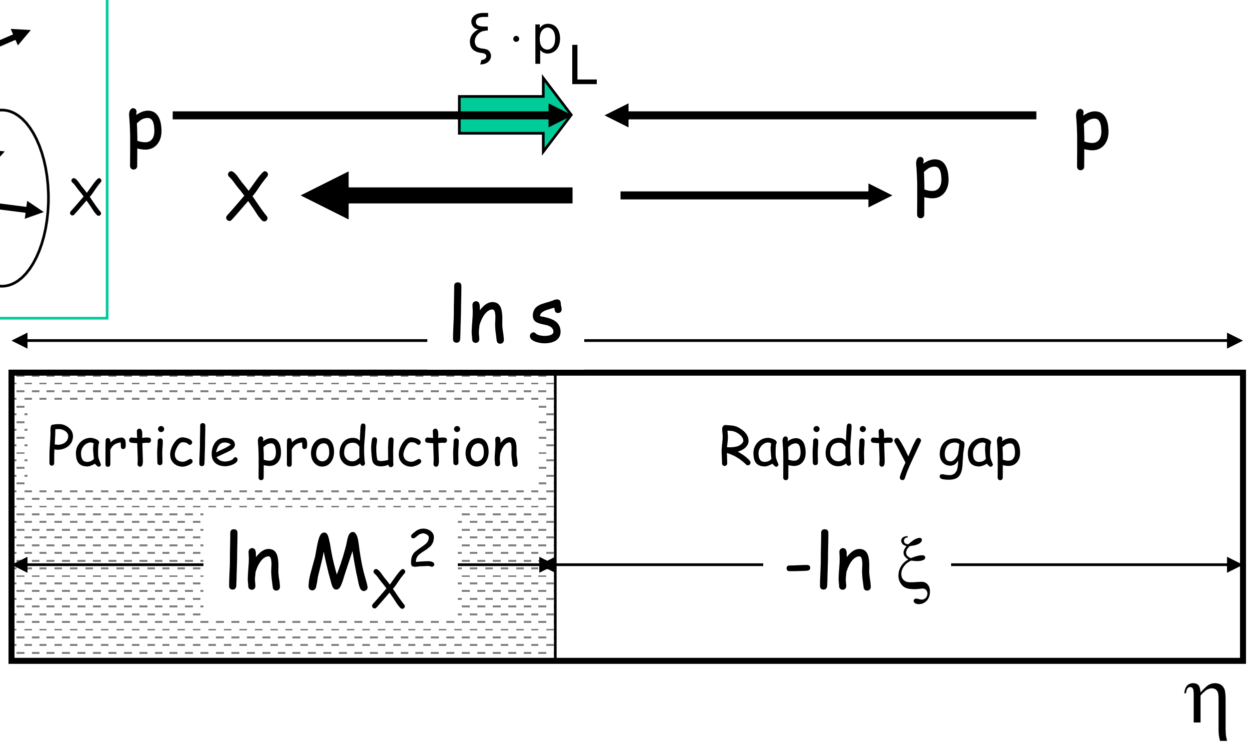


Renormalization
→ the key to diffraction in QCD

Diffractive gaps

definition: gaps not exponentially suppressed



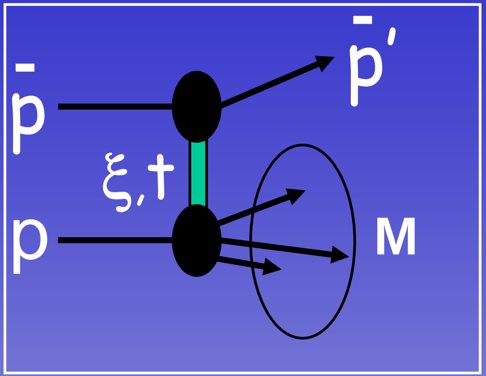


No radiation ⇒

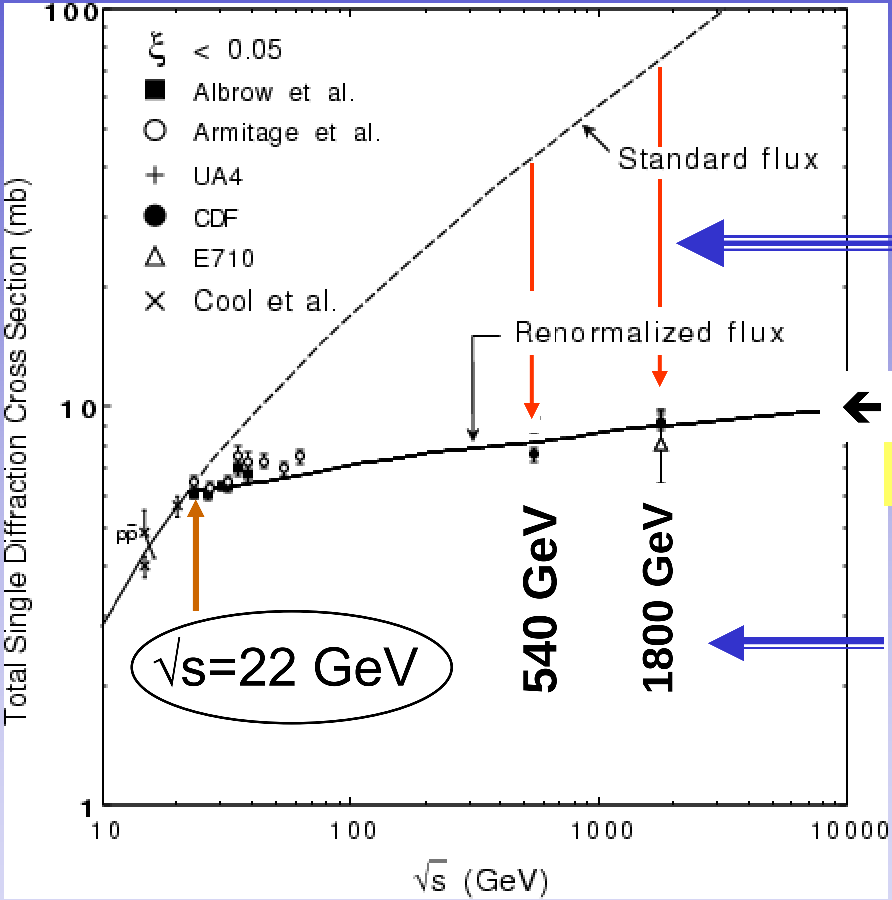
$$\left(\frac{d\sigma}{d\Delta\eta}\right)_{t=0} \approx \text{constant} \Rightarrow \frac{d\sigma}{dM^2} \sim \frac{1}{M^2} \Rightarrow \frac{d\sigma}{d\xi} \sim \frac{1}{\xi}$$

σ^T_{SD} ($\bar{p}p$ & pp) - data

➔ suppressed relative to Regge for √s>22 GeV



σ^T_{SD} mb



Factor of ~8 (~5) suppression at √s = 1800 (540) GeV

← RENORMALIZATION MODEL

KG, PLB 358, 379 (1995)

CDF Run I results

M^2 distribution: data

➔ $d\sigma/dM^2|_{t=-0.05}$ ~ independent of s over 6 orders of magnitude!

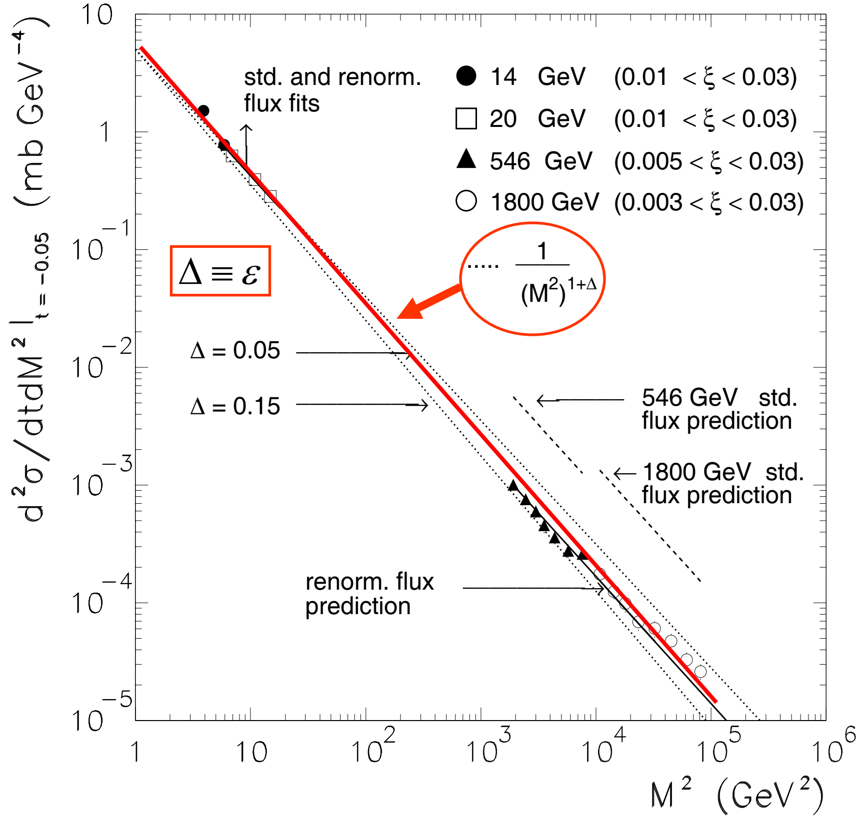
KG&JM, PRD 59 (1999) 114017

Regge → data

$$\frac{d\sigma}{dM^2} \propto \frac{s^{2\varepsilon} \rightarrow 1}{(M^2)^{1+\varepsilon}}$$

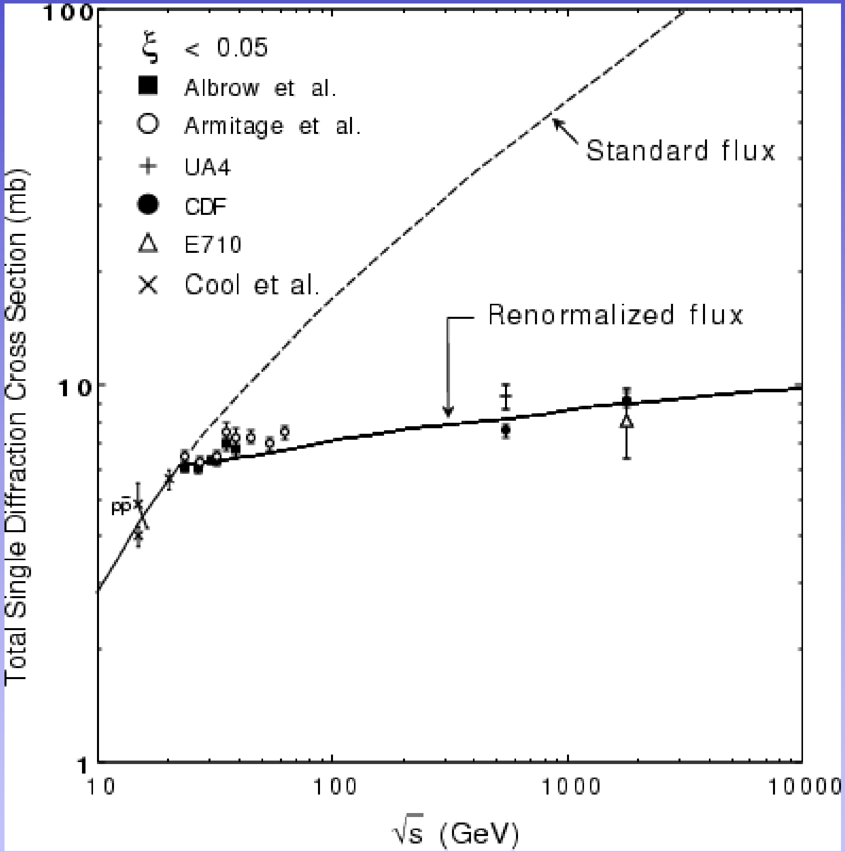
Independent of S over 6 orders of magnitude in M^2

➔ M^2 scaling



➔ factorization breaks down to ensure M^2 scaling

Saturation at low Q^2 and small-x



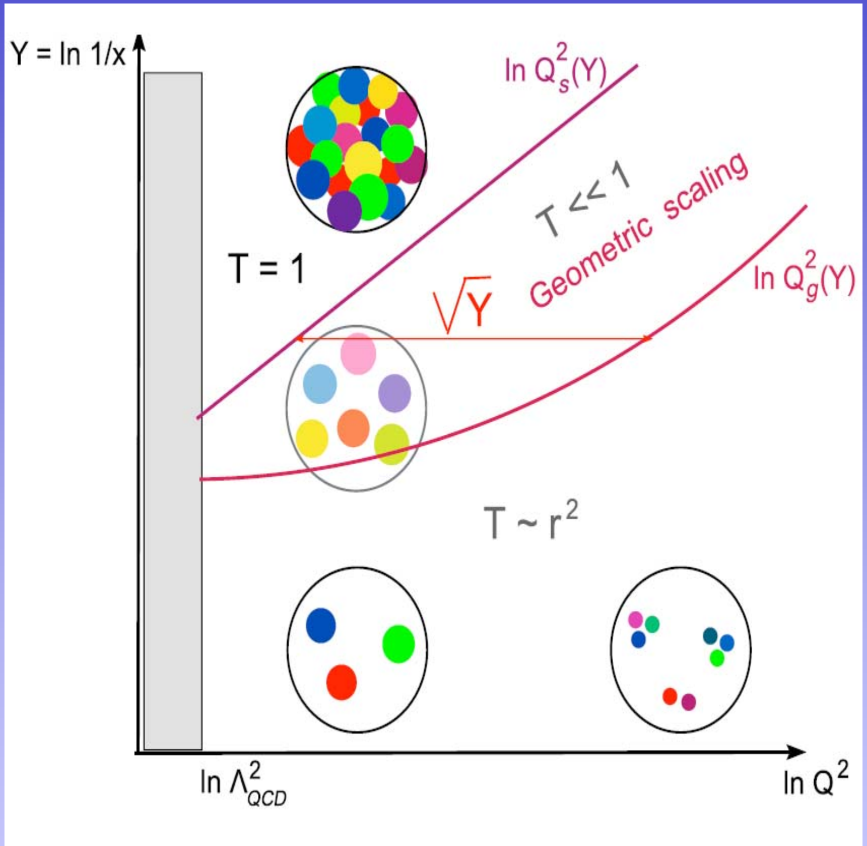
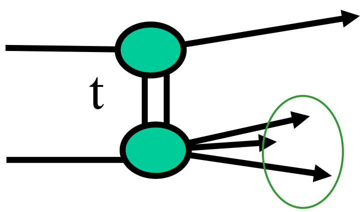


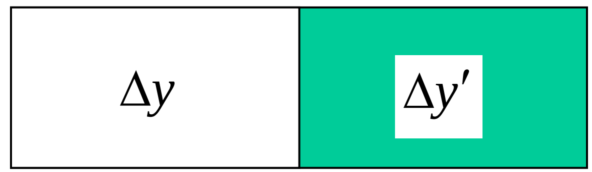
figure from a talk by Edmond Iancu

Single diffraction renormalized – (1)

CORFU-2001: hep-ph/0203141

EDS 2009: http://arxiv.org/PS_cache/arxiv/pdf/1002/1002.3527v1.pdf





2 independent variables: $t, \Delta y$

color factor

$$\kappa = \frac{g_{IP-IP-IP}(t)}{\beta_{IP-p-p}(0)} \approx 0.17$$

$$\frac{d^2\sigma}{dt\,d\Delta y} = \underbrace{C\cdot F_p^2(t)\cdot\left\{e^{(\varepsilon+\alpha' t)\Delta y}\right\}^2}_{\text{gap probability}} \cdot \kappa \cdot \underbrace{\left\{\sigma_o\, e^{\varepsilon\,\Delta y'}\right\}}_{\text{sub-energy x-section}}$$

Gap probability ➔ (re)normalize to unity

Single diffraction renormalized – (2)

color factor

$$\kappa = \frac{g_{IP-IP-IP}(t)}{\beta_{IP-p-p}(0)} \approx 0.17$$

Experimentally:

KG&JM, PRD 59 (114017) 1999

$$\kappa = \frac{g_{IP-IP-IP}}{\beta_{IP-p}} = 0.17 \pm 0.02, \quad \varepsilon = 0.104$$

QCD: $\kappa = f_g \times \frac{1}{N_c^2 - 1} + f_q \times \frac{1}{N_c} \xrightarrow{Q^2=1} \approx 0.75 \times \frac{1}{8} + 0.25 \times \frac{1}{3} = 0.18$

Single diffraction renormalized - (3)

$$\frac{d^2\sigma_{sd}(s,M^2,t)}{dM^2dt} = \left[\frac{\sigma_\circ}{16\pi}\sigma_\circ^{I\!Pp}\right] \frac{s^{2\epsilon}}{N(s,s_o)} \frac{e^{bt}}{(M^2)^{1+\epsilon}}$$

$$b = b_0 + 2\alpha' \ln\frac{s}{M^2} \qquad s_o^{\rm CMG} = (3.7\pm1.5)\ {\rm GeV}^2$$

$$N(s,s_o) \equiv \int_{\xi_{\rm min}}^{\xi_{\rm max}} d\xi \int_{t=0}^{-\infty} dt\, f_{I\!P/p}(\xi,t) \overset{s\to\infty}{\rightarrow} \sim s_o^\epsilon \frac{s^{2\epsilon}}{\ln s}$$

$$\frac{d^2\sigma_{sd}(s,M^2,t)}{dM^2dt} \overset{s\to\infty}{\rightarrow} \sim \ln s\, \frac{e^{bt}}{(M^2)^{1+\epsilon}}$$

$$\sigma_{sd} \xrightarrow{s\to\infty} \sim \frac{\ln s}{b\to\ln s} \Rightarrow const$$

set to unity
➔ determine s_o

Single diffraction renormalized – (4)

$$\frac{d^2\sigma}{dt\,d\Delta y} = N_{gap}\cdot\underbrace{C\cdot F_p^2(t)\cdot\left\{e^{(\varepsilon+\alpha' t)\Delta y}\right\}^2}_{P_{gap}(\Delta y,t)}\cdot\kappa\cdot\left\{\sigma_o\, e^{\varepsilon\,\Delta y'}\right\}$$

$$N_{gap}^{-1}(s) = \int_{\Delta y,t} P_{gap}(\Delta y,t)\, d\Delta y\, dt \xrightarrow{s\to\infty} C'\cdot\frac{s^{2\varepsilon}}{\ln s}$$

$$\frac{d^2\sigma}{dt\,d\Delta y} = C''\left[e^{\varepsilon(\Delta y-\ln s)}\cdot\ln s\right]e^{(b_0+2\alpha'\Delta y)t}$$

grows slower than s^{ε}

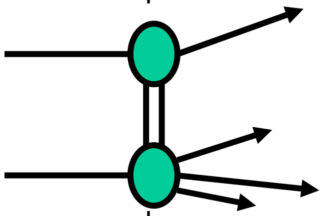
→ Pumplin bound obeyed at all impact parameters

Scale s_o and triple-pom coupling

Pomeron flux: interpret as gap probability

➔set to unity: determines g_{PPP} and s_0

KG, PLB 358 (1995) 379



s_o^{ε}

$$\frac{d^2\sigma_{SD}}{dt\,d\xi} = f_{IP/p}(t,\xi)\cdot\sigma_{IP-\bar{p}}(s\xi)$$

$s_o^{-\varepsilon/2}\cdot g_{PPP}(t)$

Pomeron-proton x-section

- ❑ Two free parameters: s_o and g_{PPP}
- ❑ Obtain product $g_{PPP}\bullet s_o^{\varepsilon/2}$ from σ_{SD}
- ❑ Renormalized Pomeron flux determines s_o
- ❑ Get unique solution for g_{PPP}

g_{PPP}=0.69 mb$^{-1/2}$=1.1 GeV $^{-1}$ $\qquad$ S_o=3.7±1.5 GeV^2

Saturation glueball?

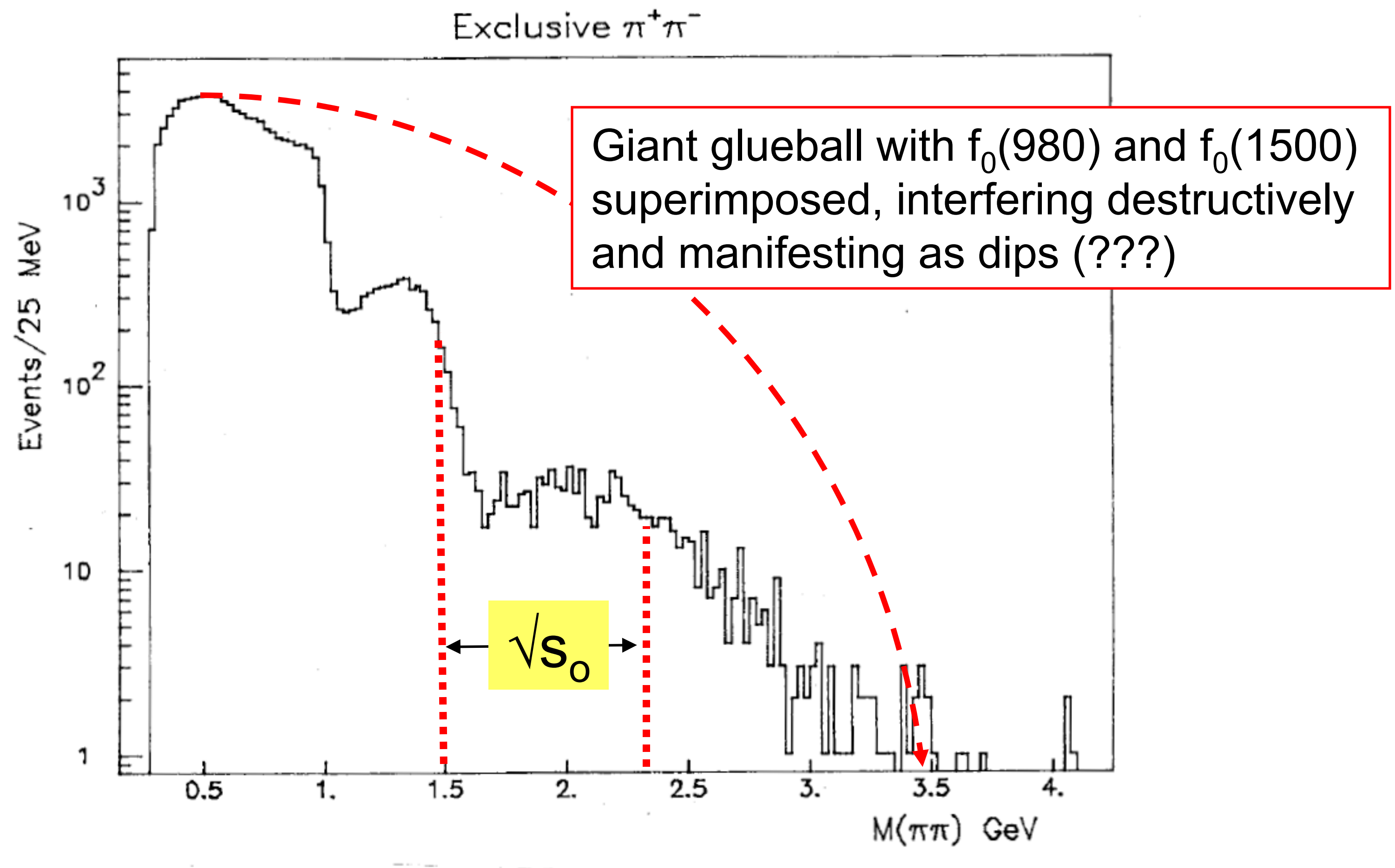
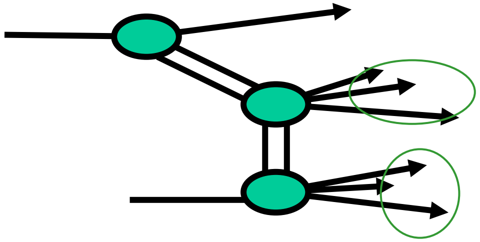
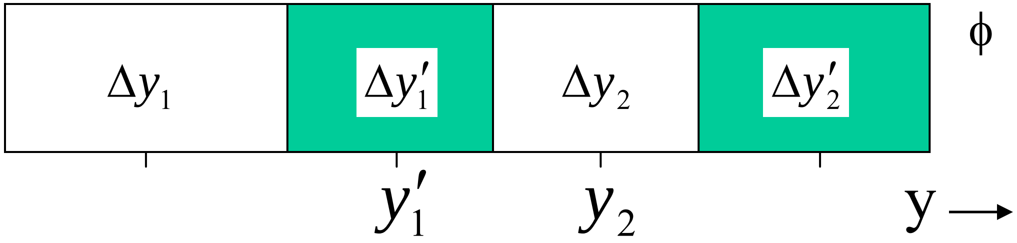


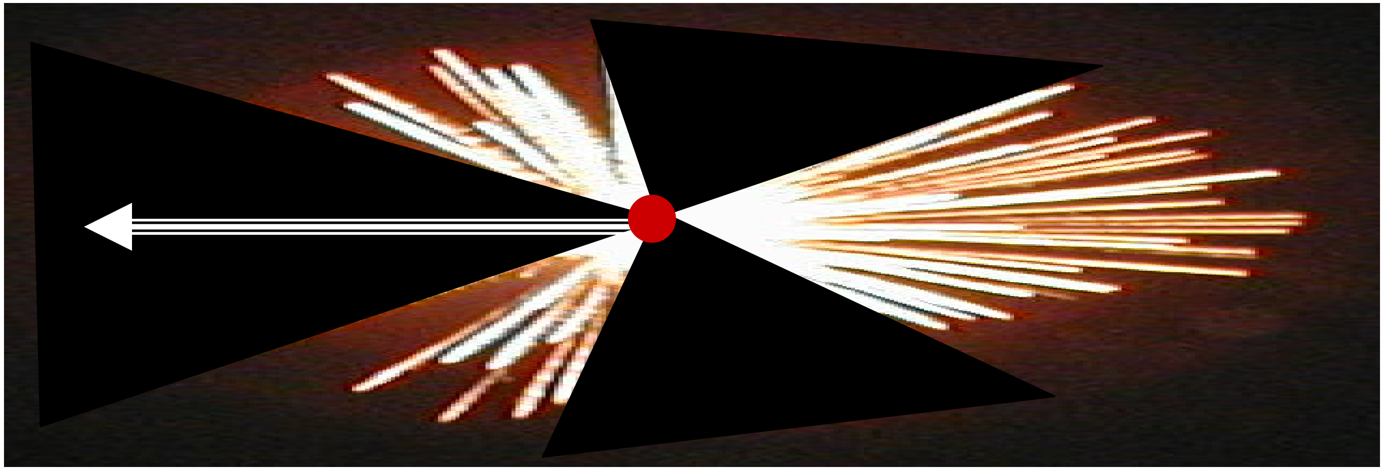
Figure 8: $M_{\pi^+\pi^-}$ spectrum in *DIPE* at the ISR (Axial Field Spectrometer, R807 [97, 98]). Figure from Ref. [98]. **See M.G.Albrow, T.D. Goughlin, J.R. Forshaw, hep-ph>arXiv:1006.1289**

Multigap diffraction

KG, hep-ph/0203141

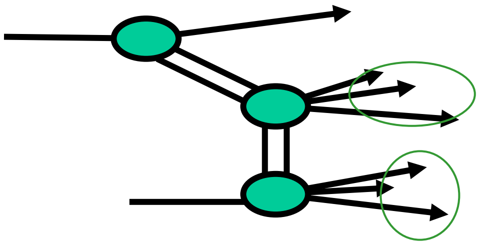


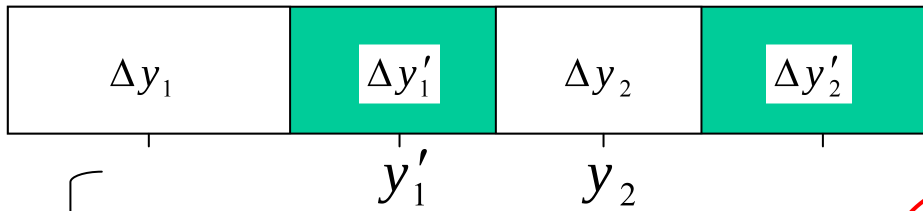




Rapidity Gaps in Fireworks

Multigap cross sections





5 independent variables { y_1', y_2, t_1, $\Delta y = \Delta y_1 + \Delta y_2$, t_2 }

color factor

$$\frac{d^5\sigma}{\prod_{i=1-5} dV_i} = C\times F_p^2(t_1)\prod_{\text{i=1-2}}\left\{e^{(\varepsilon+\alpha' t_i)\Delta y_i}\right\}^2 \times \kappa^2\left\{\sigma_o\, e^{\varepsilon(\Delta y_1'+\Delta y_2')}\right\}$$

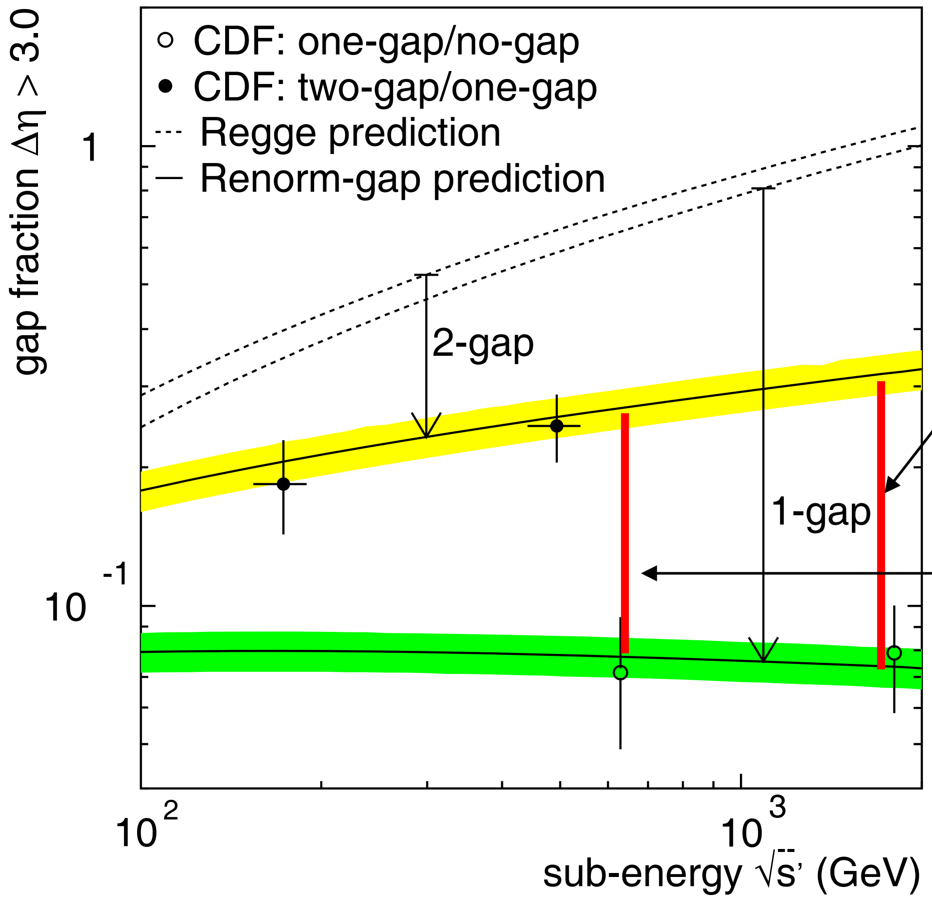
Gap probability

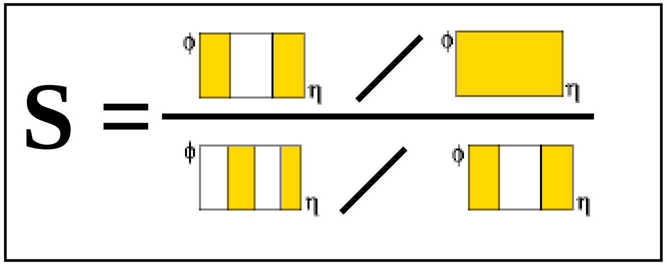
$$\int_{\Delta y,t} \sim s^{2\varepsilon} / \ln s$$

Sub-energy cross section (for regions with particles)

Same suppression as for single gap!

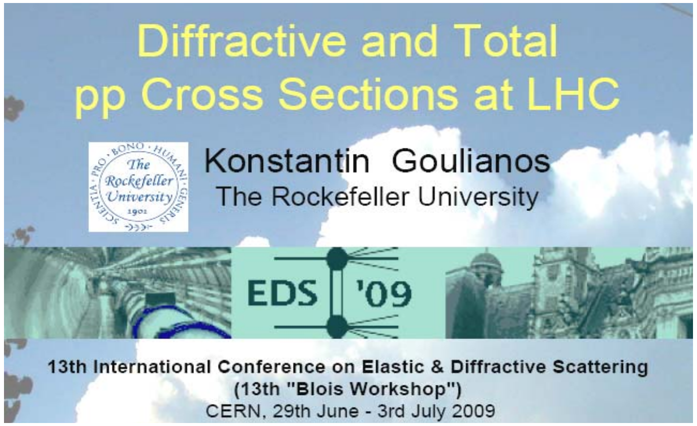
Gap survival probability



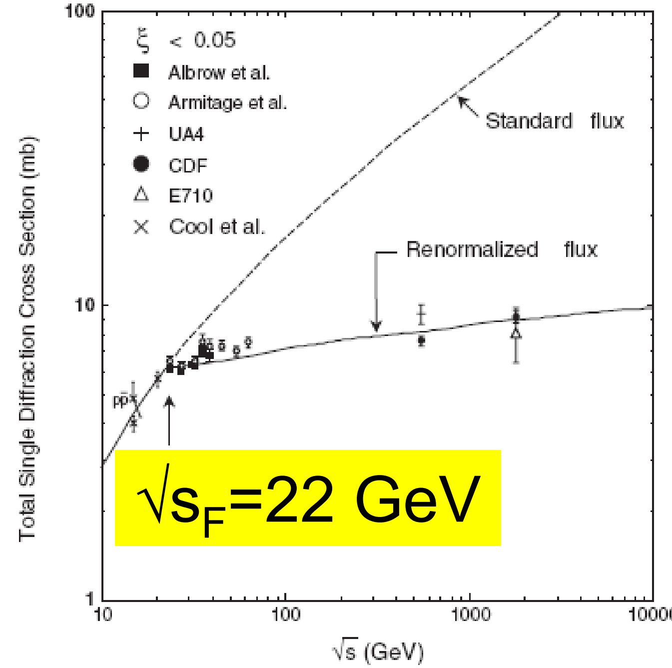


$$S^{1-gap/0-gap}_{2-gap/1-gap}(1800\ GeV) \approx 0.23$$

$$S^{1-gap/0-gap}_{2-gap/1-gap}(630\ GeV) \approx 0.29$$



http://arxiv.org/abs/1002.3527



- Use the Froissart formula as a *saturated* cross section

$$\sigma_t(s > s_F) = \sigma_t(s_F) + \frac{\pi}{m^2} \cdot \ln^2 \frac{s}{s_F}$$

- This formula should be valid above the *knee* in σ_{sd} vs. $\sqrt{s}$ at $\sqrt{s_F} = 22$ GeV (Fig. 1) and therefore valid at $\sqrt{s} = 1800$ GeV.

- Use $m^2 = s_o$ in the Froissart formula multiplied by $1/0.389$ to convert it to mb^{-1}.

- Note that contributions from Reggeon exchanges at $\sqrt{s} = 1800$ GeV are negligible, as can be verified from the global fit of Ref. [7].

- Obtain the total cross section at the LHC:

$$\sigma_t^{\text{LHC}} = \sigma_t^{\text{CDF}} + \frac{\pi}{s_o} \cdot \left(\ln^2 \frac{s^{\text{LHC}}}{s_F} - \ln^2 \frac{s^{\text{CDF}}}{s_F} \right)$$

SUPERBALL MODEL

98 ± 8 mb at 7 TeV
109 ±12 mb at 14 TeV

σ^{SD} and ratio of α'/ε

PHYSICAL REVIEW D **80**, 111901(R) (2009)

Pomeron intercept and slope: A QCD connection

Konstantin Goulianos

$$\frac{d^2\sigma_{sd}(s,M^2,t)}{dM^2dt} = \left[\frac{\sigma_\circ}{16\pi}\sigma_\circ^{\mathbb{P}p}\right]\frac{s^{2\epsilon}}{N(s)}\frac{1}{(M^2)^{1+\epsilon}}e^{bt}$$

$$\stackrel{s\to\infty}{\Longrightarrow}\left[2\alpha' e^{(\epsilon b_0)/\alpha'}\sigma_\circ^{\mathbb{P}p}\right]\frac{\ln s^{2\epsilon}}{(M^2)^{1+\epsilon}}e^{bt}$$

$$\sigma_{pp/\bar{p}p}^{\rm tot} = \sigma_\circ \cdot e^{\epsilon\Delta\eta}.$$

$$\sigma_{sd}^{\infty} = 2\sigma_\circ^{\mathbb{P}p}\exp\left[\frac{\epsilon b_\circ}{2\alpha'}\right] = \sigma_\circ^{pp}$$

$$\sigma_\circ^{\mathbb{P}p} = \beta_{\mathbb{P}pp}(0)\cdot g(t) = \kappa\sigma_\circ^{pp}$$

$$\kappa = \frac{f_g^\infty}{N_c^2-1} + \frac{f_q^\infty}{N_c}$$

$$b_\circ = R_p^2/2 = 1/(2m_\pi^2).$$

$$r = \frac{\alpha'}{\epsilon} = -[16m_\pi^2\ln(2\kappa)]^{-1}$$

$$r_{\rm pheno} = 3.2 \pm 0.4\ ({\rm GeV}/c)^{-2}$$

$$r_{\rm exp} = 0.25\ ({\rm GeV}/c)^{-2}/0.08 = 3.13\ ({\rm GeV}/c)^{-2}$$

Monte Carlo Strategy for the LHC

MONTE CARLO STRATEGY

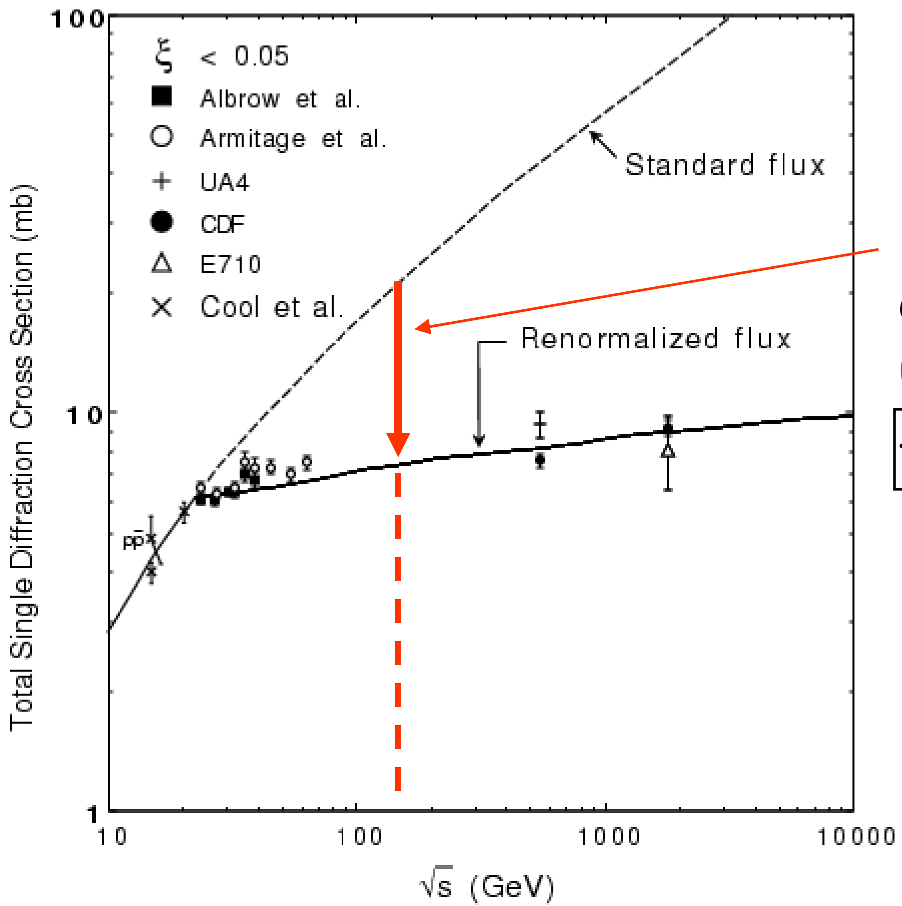
- ❑ σ^T → from SUPERBALL model
- ❑ optical theorem → Im $f_{el}(t=0)$
- ❑ dispersion relations → Re $f_{el}(t=0)$
- ❑ differential σ^{SD} → from RENORM
- ❑ use *nested* pp final states for pp collisions at the *IP-p* sub-energy √s'

σ_T
↕ optical theorem
Im $f_{el}(t=0)$
↕ dispersion relations
Re $f_{el}(t=0)$

Strategy similar to that employed in the MBR (Minimum Bias Rockefeller) MC used in CDF based on multiplicities from:
K. Goulianos, Phys. Lett. B 193 (1987) 151 pp
"A new statistical description of hardonic and e^+e^- multiplicity distributions "

Dijets in γp at HERA from RENORM

K. Goulianos, POS (DIFF2006) 055 (p. 8)



Factor of ~3 suppression expected at W~200 GeV
(just as in pp collisions)

for both direct and resolved components

Dark Energy

Non-diffractive interactions

Rapidity gaps are formed by multiplicity fluctuations:

$$P(\Delta y) = e^{-\rho \Delta y}, \quad \rho = \frac{dN_{particles}}{dy}$$

P(Δy) is exponentially suppressed

Diffractive interactions

Rapidity gaps at t=0 grow with Δy:

$$\Delta y \approx -\ln \xi = \ln s - \ln M^2$$

$$P(\Delta y)\big|_{t=0} \sim e^{2\varepsilon \Delta y}$$

2ε: negative particle density!

⇓

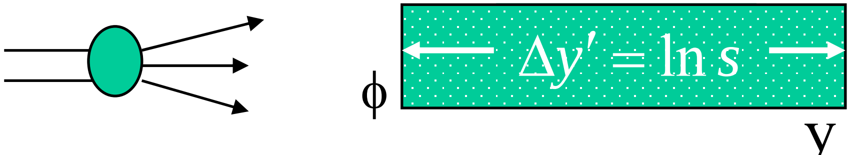
Gravitational repulsion?

SUMMARY

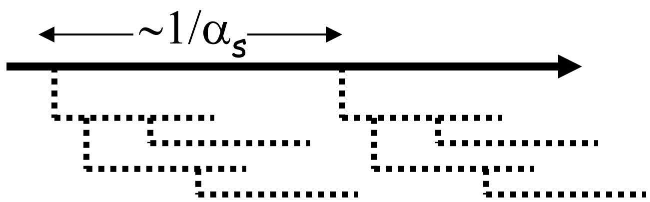
- ❑ Introduction
- ❑ Diffractive cross sections
- ❑ The total cross section
- ❑ Ratio of pomeron intercept to slope
- ❑ Monte Carlo strategy for the LHC
- ❑ Dark energy (?)

BACKUP

RISING X-SECTIONS IN PARTON MODEL



$$\sigma_T(s) = \sigma_o\, e^{\varepsilon \Delta y'} = \sigma_o\, s^{\varepsilon}$$



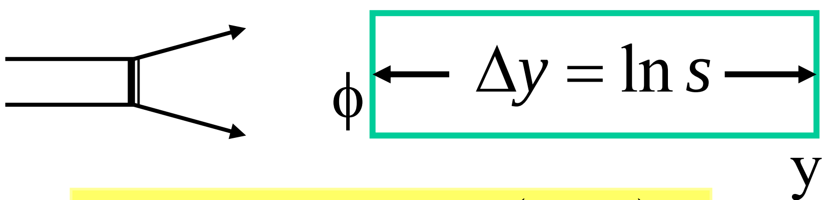
Emission spacing controlled by α-strong

➔ σ_T : power law rise with energy

(see E. Levin, An Introduction to Pomerons,Preprint DESY 98-120)

α' reflects the size of the emitted cluster,

which is controlled by $1/\alpha_s$ and thereby is related to ε

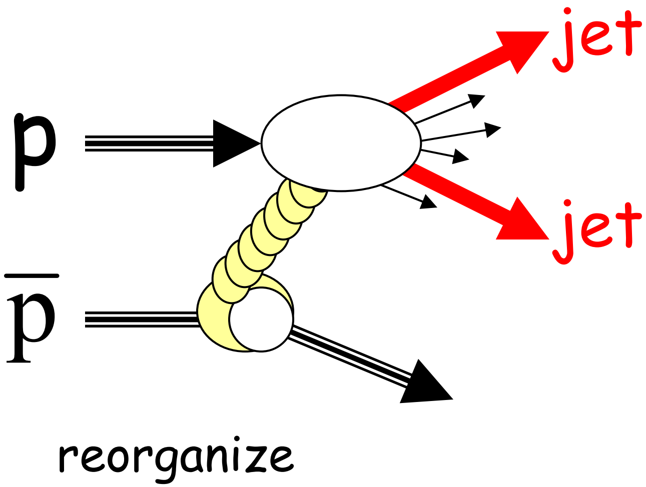


$$\mathrm{Im}\ f_{el}(s,t) \propto e^{(\varepsilon + \alpha' t)\Delta y}$$

← assume linear t-dependence

Forward elastic scattering amplitude

Diffractive dijets @ Tevatron



$$F^D(\xi, x, Q^2) \propto \frac{1}{\xi^{1+2\varepsilon}} \cdot F(x/\xi, Q^2)$$

$F^D_{JJ}(\xi,\beta,Q^2)$ @ Tevatron

$$F^D(\xi,\beta,Q^2) = \mathrm{N}_{\text{renorm}}\frac{1}{\xi^{1+2\varepsilon}}\cdot\frac{C(Q^2)}{(x/\xi)^{\lambda(Q^2)}} = \frac{2\varepsilon}{(\beta s)^{2\varepsilon}}\cdot\frac{1}{\xi^{1+2\varepsilon}}\cdot\frac{C(Q^2)}{\beta^{\lambda(Q^2)}}$$

$$\mathrm{N}^{-1}_{\text{renorm}} = \int_{\xi_{\min}}^{1}\frac{d\xi}{\xi^{1+2\varepsilon}} \xrightarrow{\xi_{\min}=\frac{x_{\min}}{\beta}\approx\frac{1}{\beta s}} \frac{(\beta s)^{2\varepsilon}}{2\varepsilon}$$

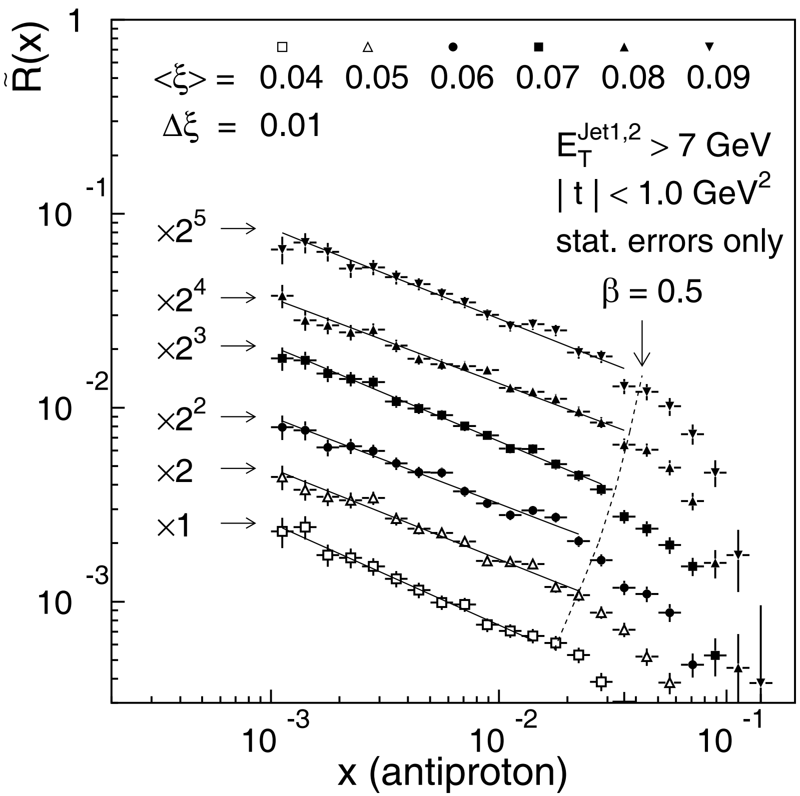
$$\text{RENORM} \quad \Rightarrow \quad \mathrm{R}^{SD}_{ND}(x) = \frac{2\varepsilon}{s^{2\varepsilon}}\frac{1}{\xi^{1-\lambda(Q^2)}}\cdot x^{-(2\varepsilon)}$$

$$\varepsilon_g = 0.2 \rightarrow x^{-0.4}$$

SD/ND dijet ratio vs. x_{Bj}@ CDF

$$R(x) = \frac{F_{jj}^{SD}(x)}{F_{jj}^{ND}(x)}$$

CDF Run I



0.035 < ξ < 0.095

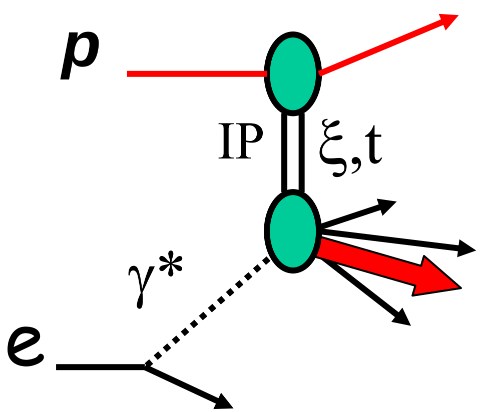
Flat ξ dependence for β < 0.5

$$R(x) = x^{-0.45}$$

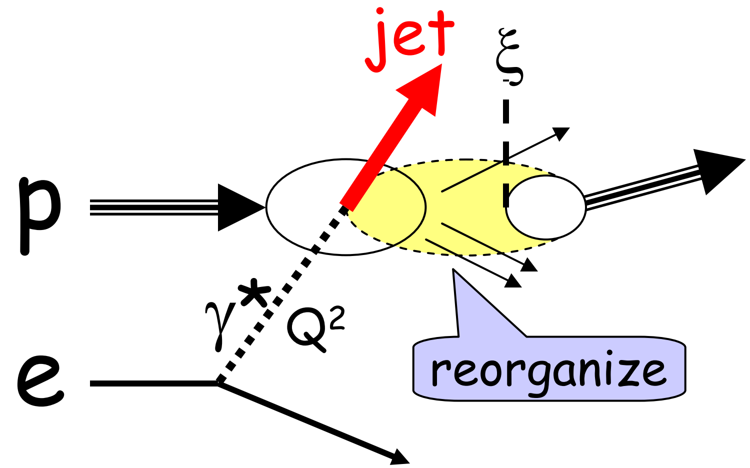
Diffractive DIS @ HERA

J. Collins: factorization holds (but under what conditions?)

Pomeron exchange



Color reorganization

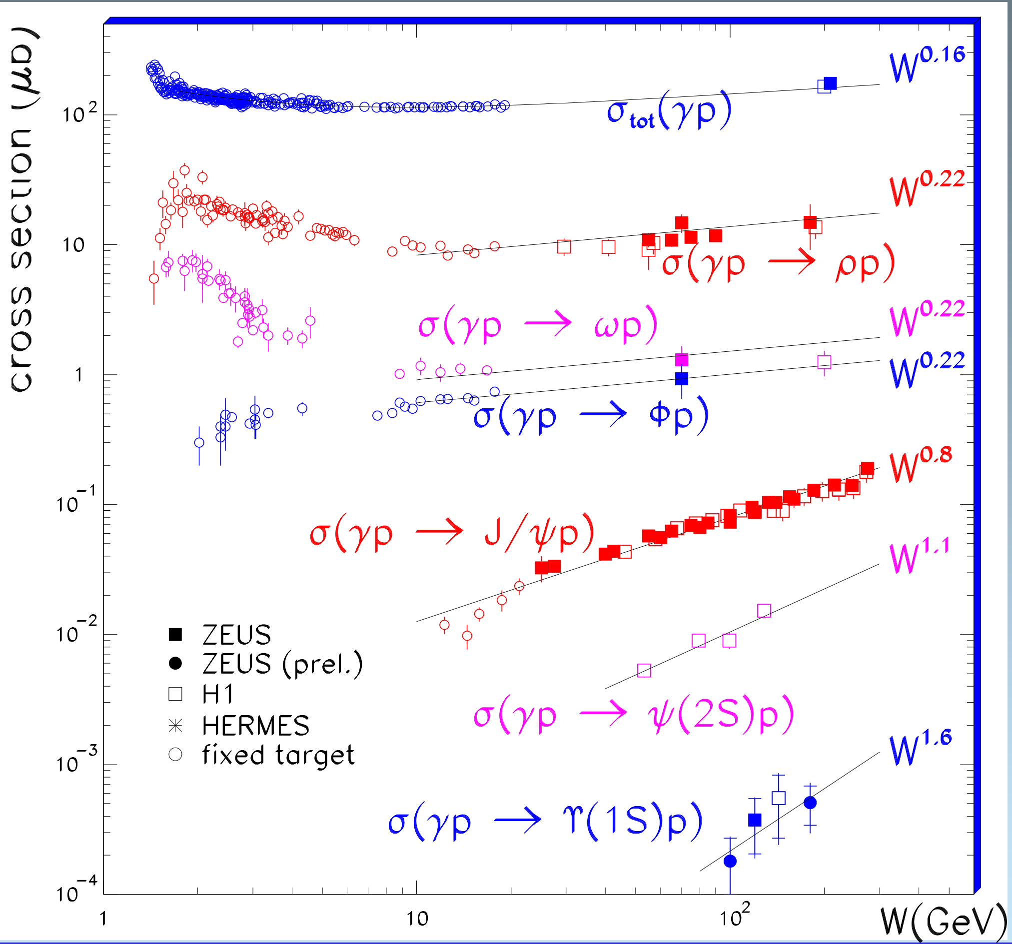


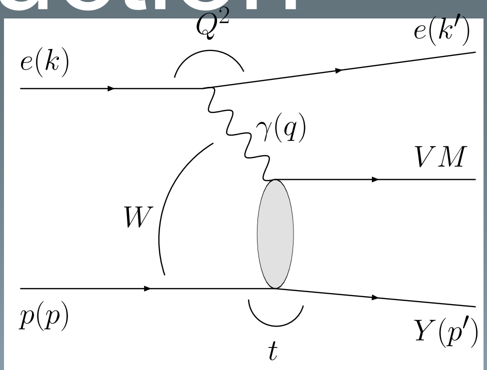
$$F_2^{D(3)}(\xi, x, Q^2) \propto \frac{1}{\xi^{1+\varepsilon}} \cdot F_2(x, Q^2)$$

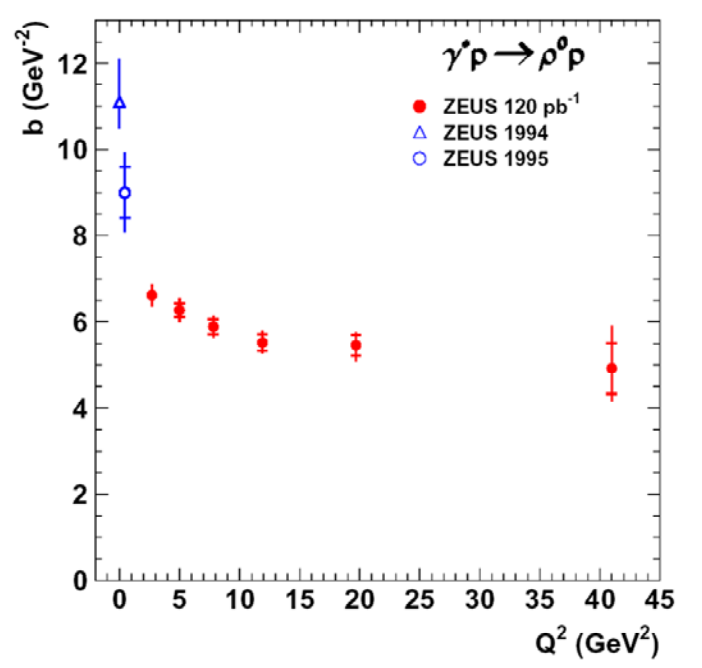
Results favor color reorganization

Vector meson production

(Pierre Marage, HERA-LHC 2008)

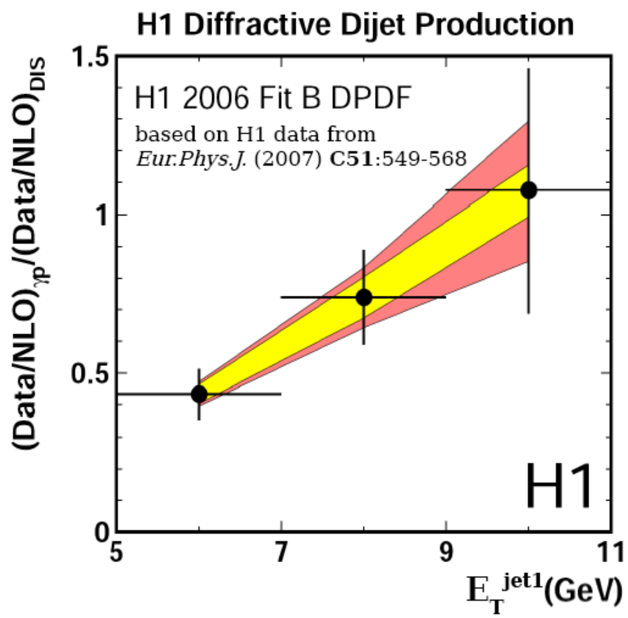




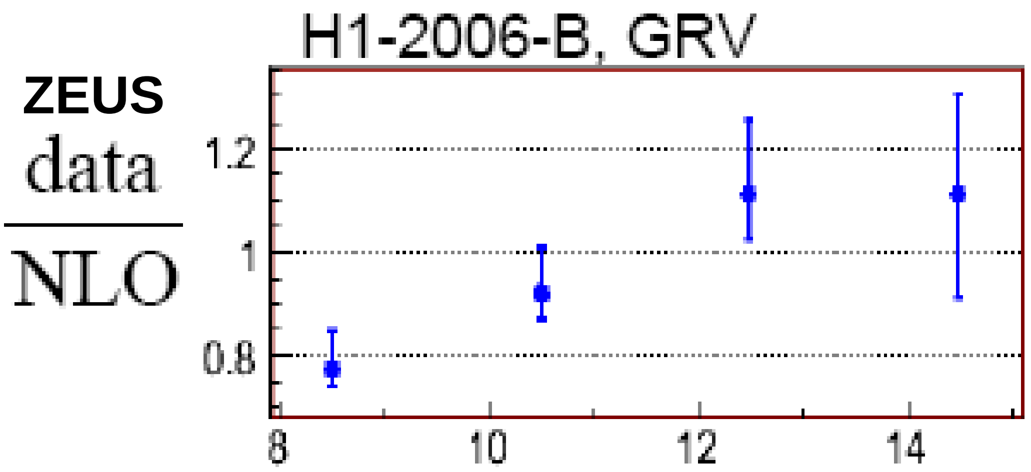


- *left* - why different σ vs. W slopes? ➔ more room for particles
- *right* - why smaller b-slope in γ*p? ➔ same reason

Dijets in γp at HERA - 2008

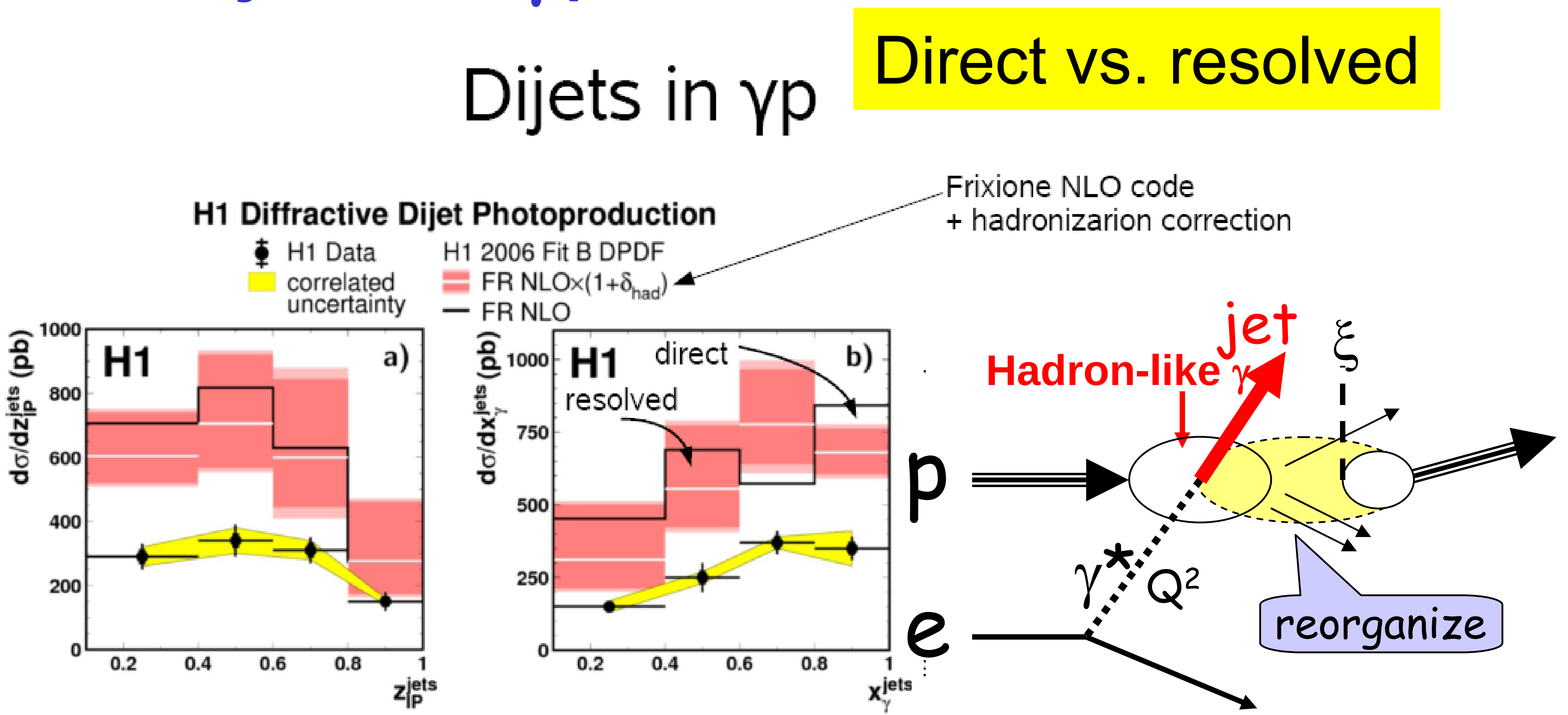


DIS 2008 talk by W. Slomiński,

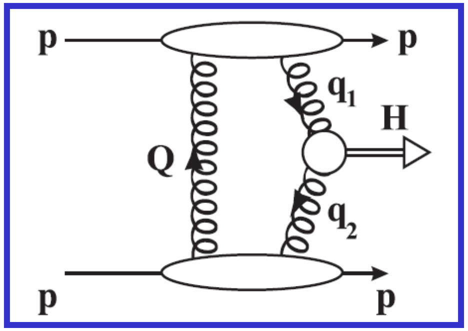


- ❑ 20-50 % apparent rise when E_T^{jet} 5→10 GeV
- ➔ due to suppression at low E_T^{jet} !!!

Dijets in γp at HERA – 2007



- the reorganization diagram predicts:
  - ➔ suppression at low Z_{IP}^{jets}, since larger $\Delta\eta$ is available for particles
  - ➔ same suppression for direct and resolved processes



EXCLUSIVE HIGGS PRODUCTION

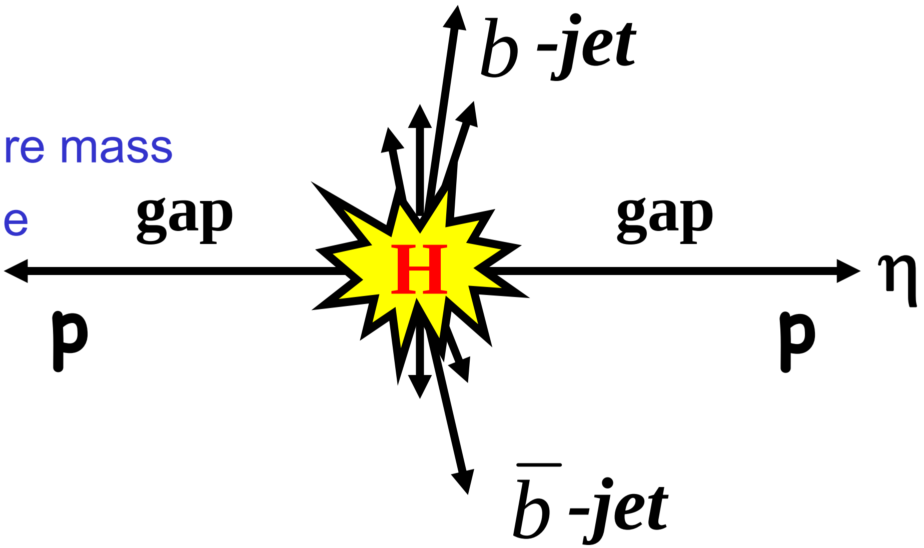
see, e.g., http://arxiv.org/abs/0806.0302

- ❑ detect protons in roman pots
  in coincidence with b-bbar
- ❑ use missing mass technique to measure mass
- ➔ Low QCD bgd from Jz=0 selection rule

basically determine spin of H

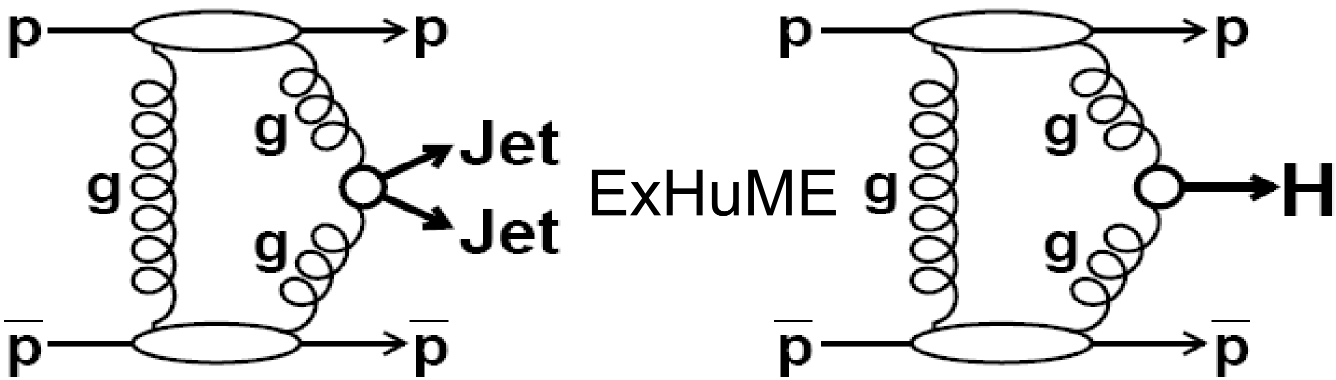
$$M_H^2 = (p + \bar{p} - p' - \bar{p}')^2$$

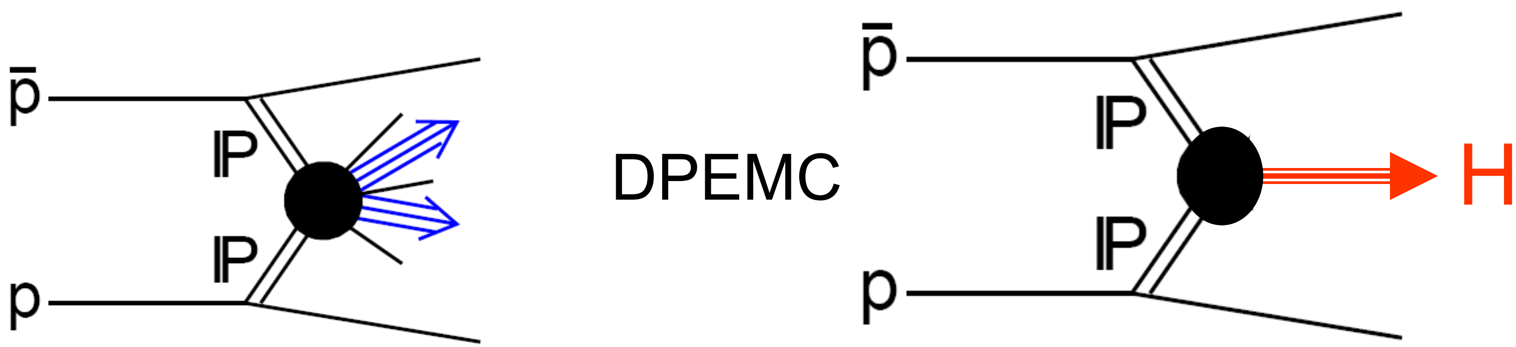
psec timing ➔ ΔM~(1-2) GeV



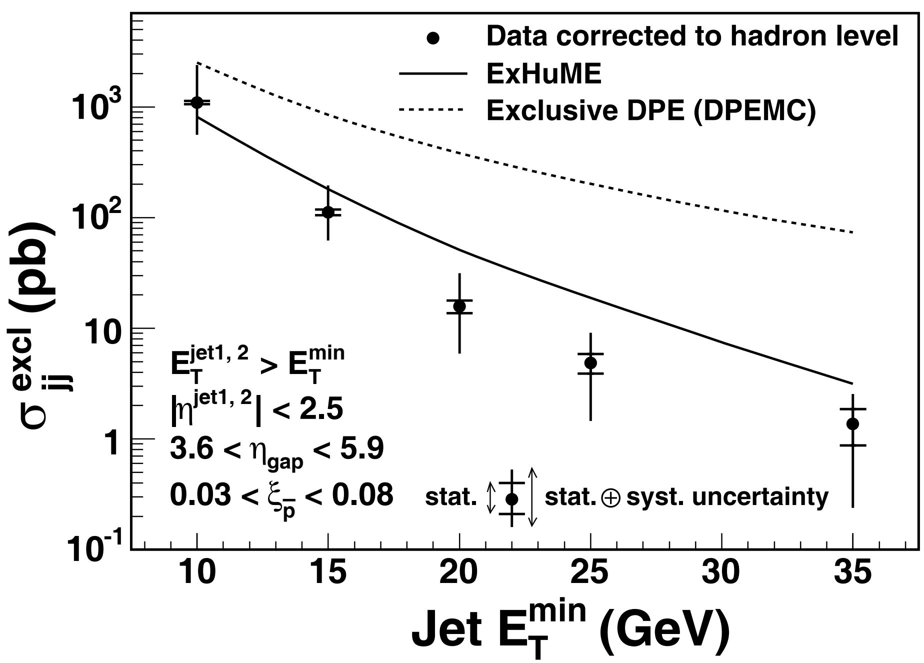
Exclusive Dijet and Higgs Production

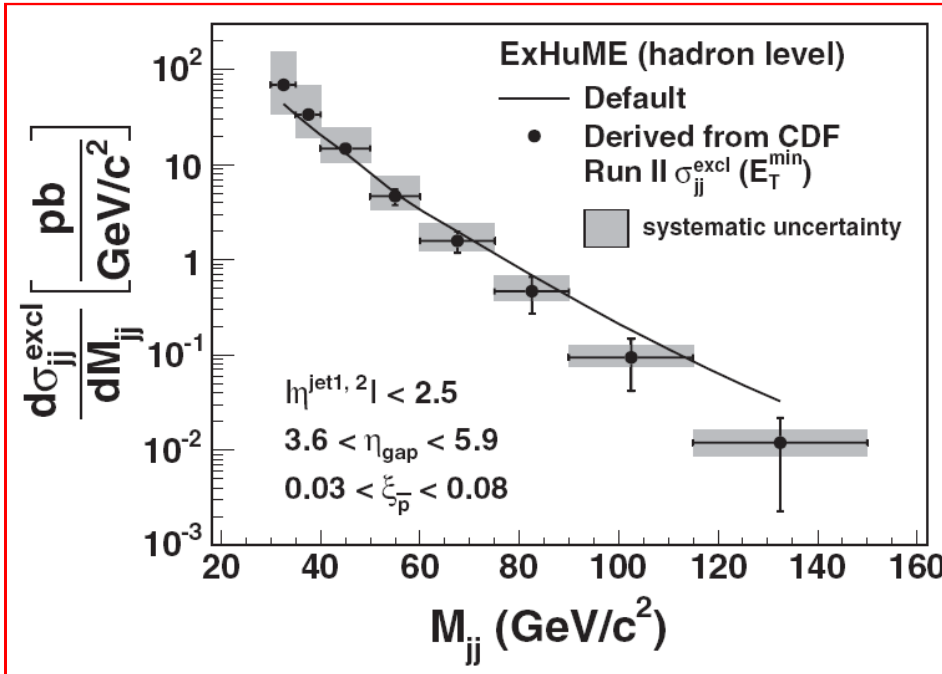
Phys. Rev. D 77, 052004





Exclusive Dijet x-section vs MC





left: the data favor ExHuME (updated DPEMC agrees now with data)
right: points derived from CDF excl. di-jet x-sections using ExHuME
➔ predictions for Higgs production should be within factor of 2

The end