

Diffractive Final States

CMS workshop



LUND
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1) Can final states in diffractive excitation be calculated from basic principles?

2) Are gap events the analogy to diffraction in optics, *i.e.* the shadow of absorption to inelastic states?

Basis for the Regge approach and the Good–Walker formalism

Alternative: Form of inel. events with gaps: Colour recon. or $\mathbb{P} \sim$ hadron

Regge theory \Rightarrow inclusive cross sections, but not final states

Most present MCs: POMPYT, RAPGAP, PYTHIA8, based on the Ingelman–Schlein model:

$p - \mathbb{P}$ coll. with distributions $f_{\mathbb{P},p}(x_{\mathbb{P}})$ and $f_{q/g,\mathbb{P}}(\beta)$ tuned to data

Lund Dipole Cascade model: MC DIPSY

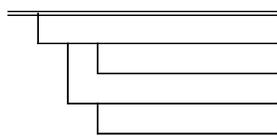
Based on pert. BFKL evolution and saturation,
including essential non-leading effects

Dipoles account for increased screening at small x
Soft gluons suppressed below $Q_s(x) \Rightarrow$ pert. QCD OK (?)

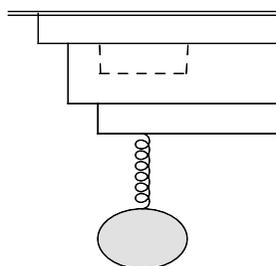
Reproduces incl. and excl. non-diffractive reactions in DIS and pp -coll.

Diff. exc. à la Good–Walker:

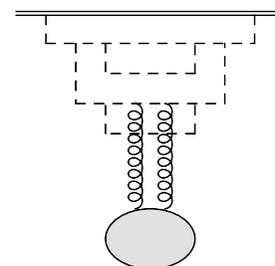
Diff. eigenstates = parton cascades (à la Miettinen-Pumplin)



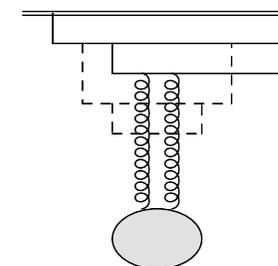
Virtual cascade
a



Inelastic int.
b



Elastic scatt.
c



Diffractive ex.
d

Reproduces incl. diffraction with no new parameter

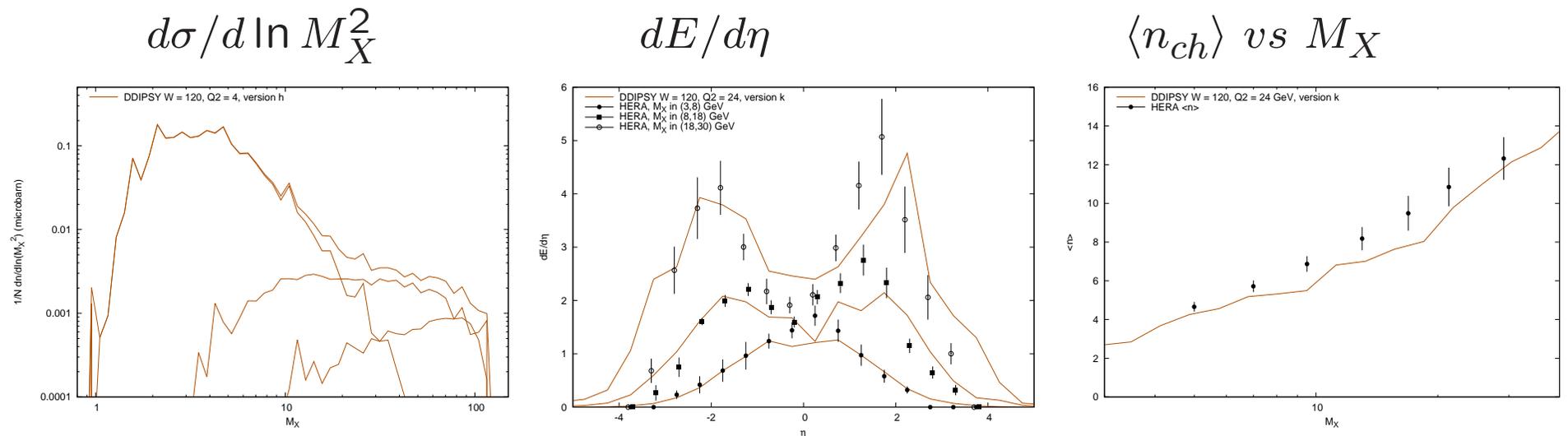
Diffractive final states

diffr. eigenstate $|\Psi\rangle = U |\Phi_i\rangle$; $U = \text{evol. op.}$, $|\Phi_i\rangle = \text{mass eigenstate}$

$$\langle \Phi_f | T | \Phi_i \rangle = \langle \Phi_f | U^\dagger T U | \Phi_i \rangle = \sum_l \langle \Phi_f | \Psi_l \rangle T_l \langle \Psi_l | \Phi_i \rangle$$

The amplitude contains interference between many terms,
but possible to generate by generalization of the DIPSY MC

Preliminary results for DIS ($W = 120 \text{ GeV}$, $Q^2 = 4 \text{ GeV}^2$)



Diffractive excitation of **protons** soon to come