

# Discussion session on non-linear effects

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DESY

- GLR approach (integrated pdfs)
- BK equation (un-integrated pdfs, and beyond ...)
- connection of GLR and BK equation

# GLR approach (integrated pdfs)

- GLR approach: critical review – is it still ok to use it ?
  - NLO splitting fcts in GLR approach
  - sensitivity to the radius  $R$
- how does it influence  $F_2$  and  $F_2^c$  ?
  - saturation, but gluon density is larger ...

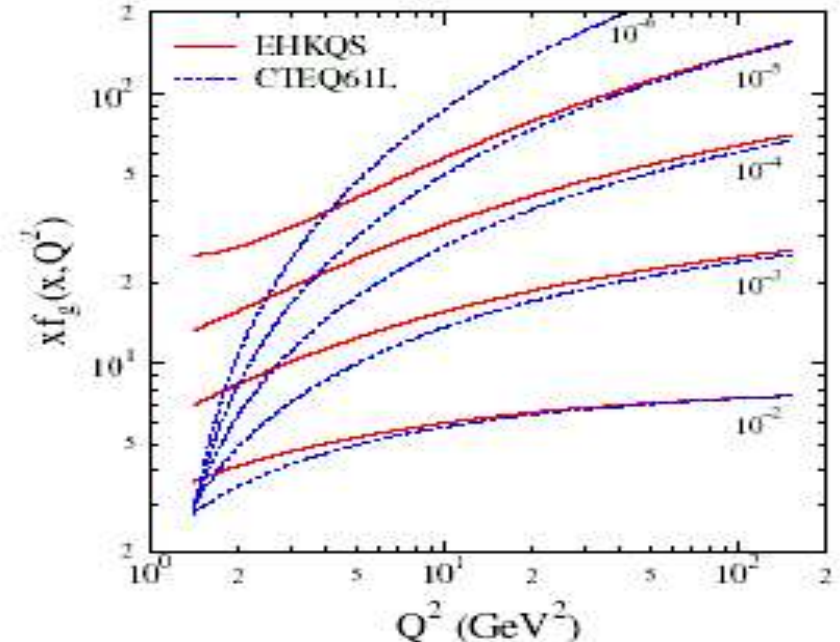
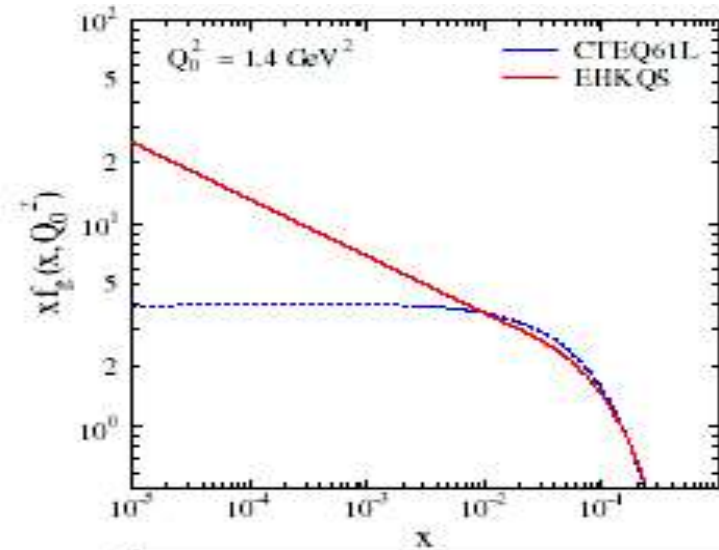
# Non – linear effects (GLR) at HERA ?

- use H1 F2 data
- fit with DGLAP + GLR

K. Eskola, H. Honkanen, V. Kolhinen, L. Qiu, C.Salgado  
 NPB 660 (2003) 211

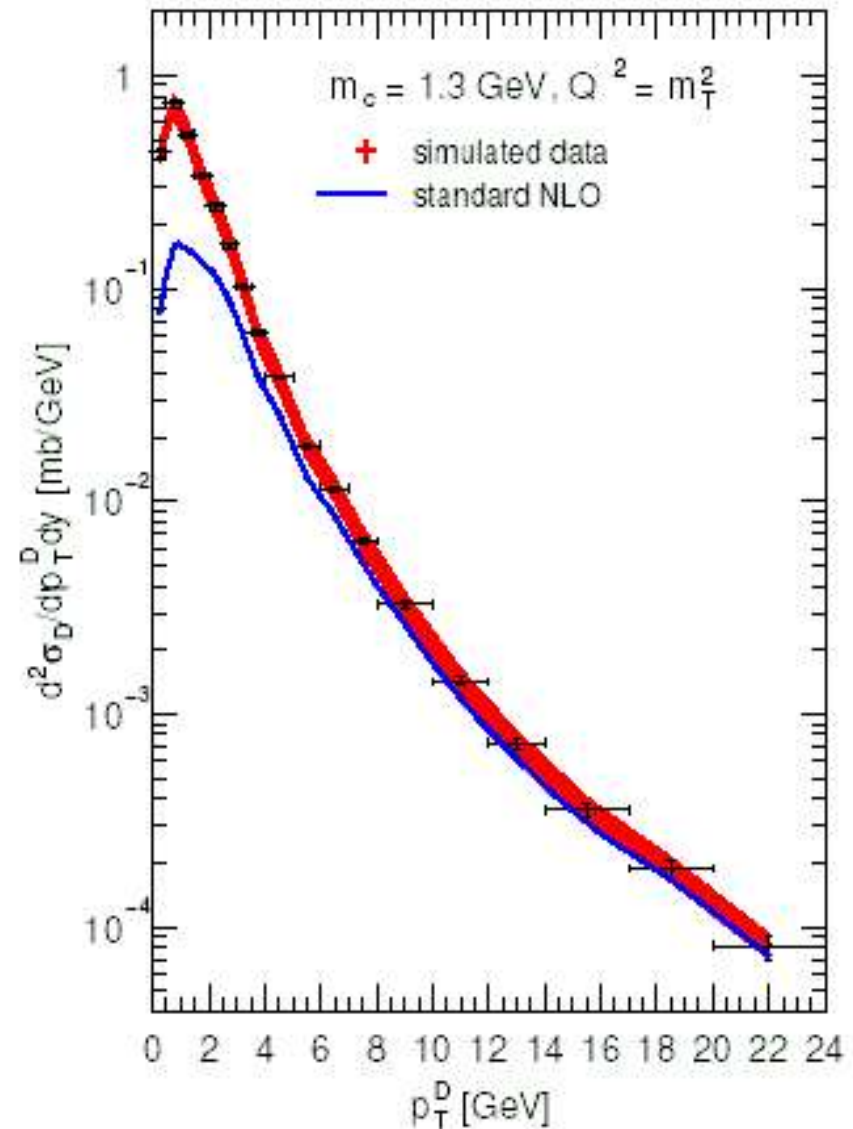
$$\frac{dxg}{d\log Q^2} \sim \frac{dxg}{d\log Q^2} \Big|_{DGLAP} - \frac{1}{R^2} K \otimes [xg]^2$$

- stay in pert region  $Q^2 > 2 \text{ GeV}^2$
- obtain better fit to F2
- obtain different gluon
- extrapolate to LHC



# Non – linear effects (GLR) at LHC

- Non – linear effects at LHC
- D0 in central rapidity range, measurable with ALICE  
(A. Dainese et al, hep-ph/0403098)
- measurable also at HERA ?



# BK equation

- BK equation (un-integrated pdfs)
  - how is BK related to unintegrated pdfs ?
  - higher twist terms ?
  - effect of initial conditions
  - using saturation model as initial condition
- what about CCFM (angular ordering) in BK
- sensitivity to the radius  $R$
- howto treat small  $kt$  region
- howto compare: linear and non-linear evolution, others ????

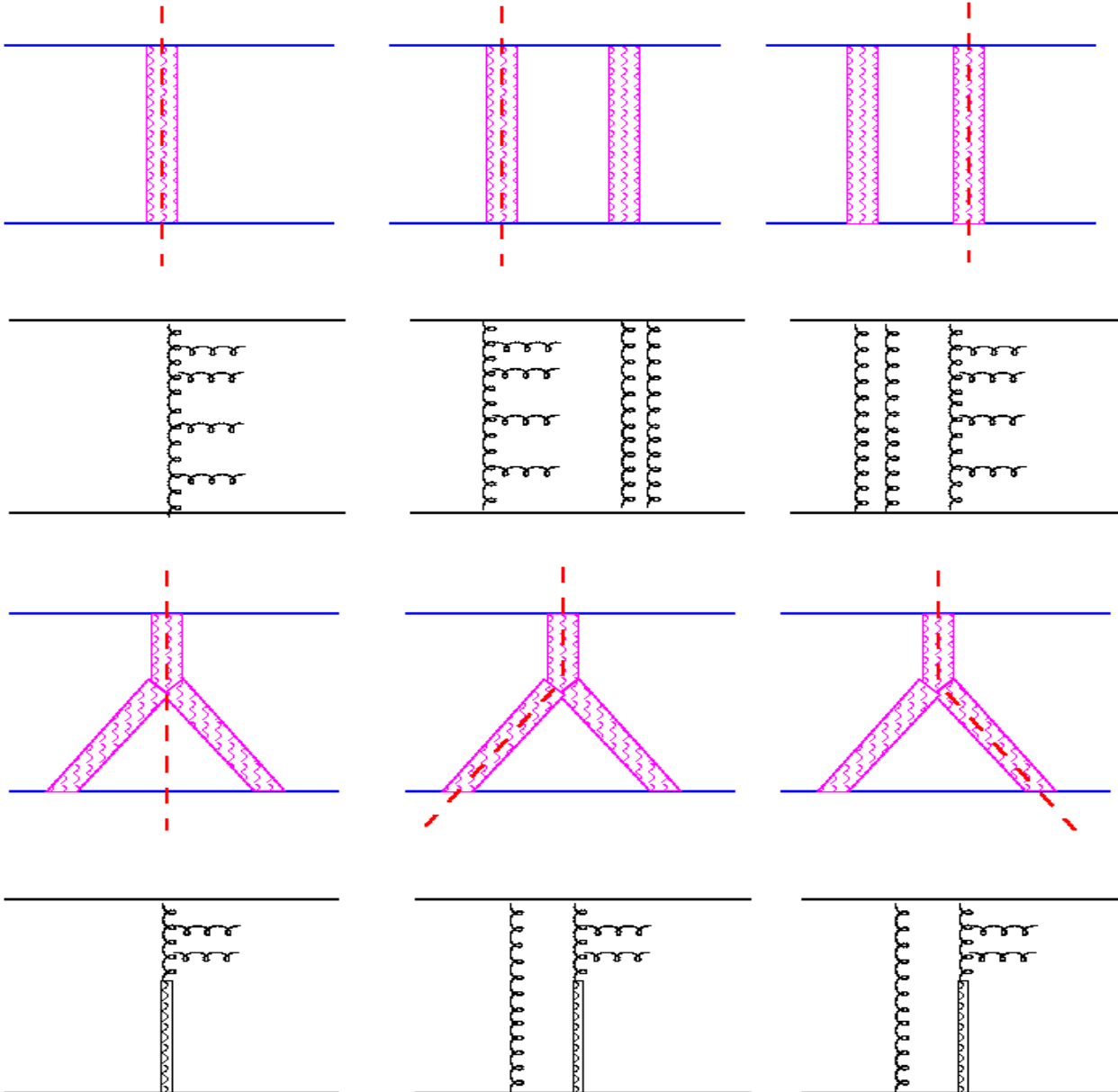
# GLR vrs BK

- Get consistent picture from GLR and BK
- similar effects or going in different directions ?
- where is which approach best suited – where ?
- can both be combined ( small and large kt regions ? )

# Prospects for experiments at HERA

- What are relevant observables at HERA:
  - need small  $x$ , and small  $kt$  processes
  - effects from non-linear terms at HERA: final states, charm,  $J/\psi$  ?
  - what about diffraction ?

# AGK, non-linear terms and diffraction



**How are AGK cutting rules related to saturation/non-linear effects and to suppression of jet cross-section in diffraction?**

Connect to:

- multiple scatterings
- saturation
- who can tell the weight factor
- what about double gaps



# Prospects for experiments

- What are interesting observables at LHC:
  - charm production (D-meson ala ALICE)
  - bottom production (bbar pair production)
    - pt of bbar -pair
    - phi correlation
    - muon pair correlation
- How to see multiple hard scatterings ?

# Goals

- proof that non – linear effects are important at LHC
  - show difference in x-sections
- estimate uncertainties of extrapolations ....
  - where are these effects important ?
  - where do we see kt effects
- where do we see/expect deviations from single parton hard scattering
- where are multiple interactions relevant
- what are the consequences for LHC physics:
  - Higgs ?
  - $b\bar{b}$  ?
  - W/Z production ?