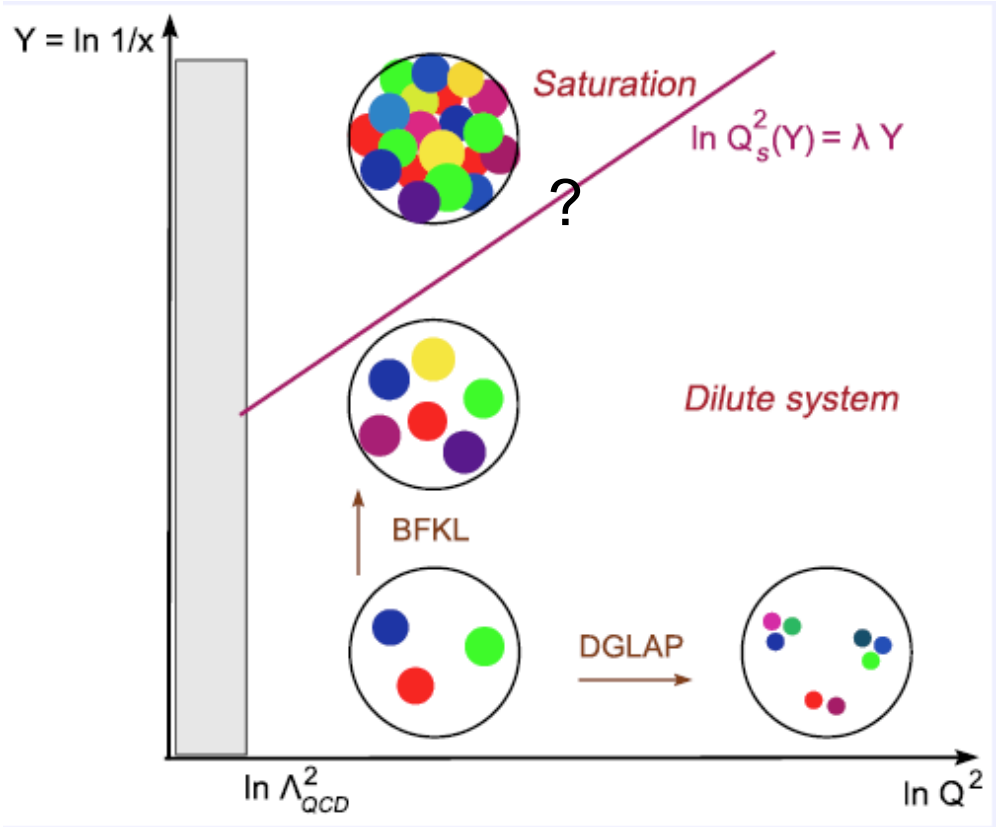
1st ECFA-CERN LHeC Workshop
Divonne-les-Bains, September 1st-3rd 2008

Working Group on Physics at High Parton Densities (ep and eA)

Conveners: N. Armesto, B. Cole, P. Newman and A. Stasto

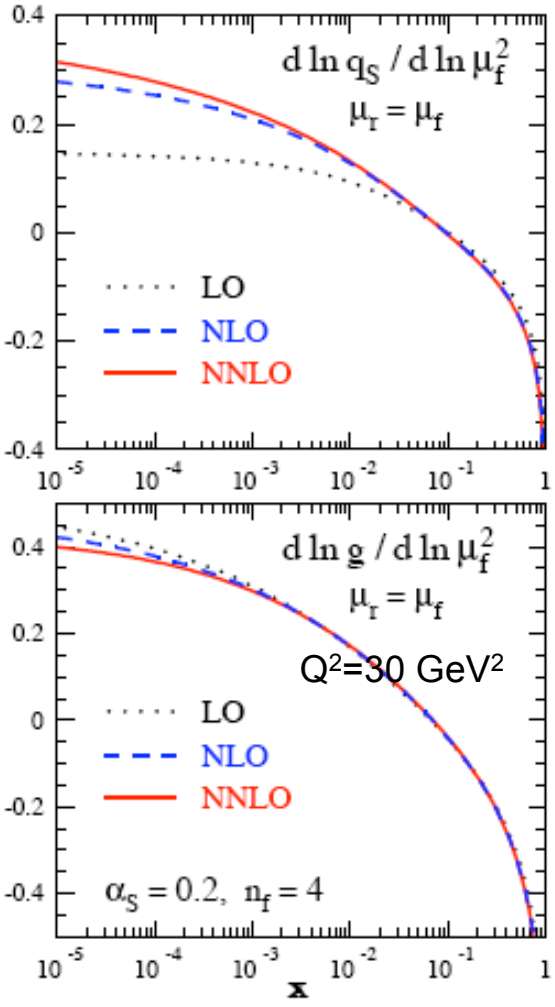
Motivation: the QCD diagram



- Many aspects of QCD remain to be understood.
- With decreasing x, the linear regime must break down; the question is: where?
- This problem is of fundamental interest: QCD at high energies, unitarity in a QFT.

Altarelli, Brodsky, Bartels, Sabio-Vera

F_2, F_L: alternatives for low x

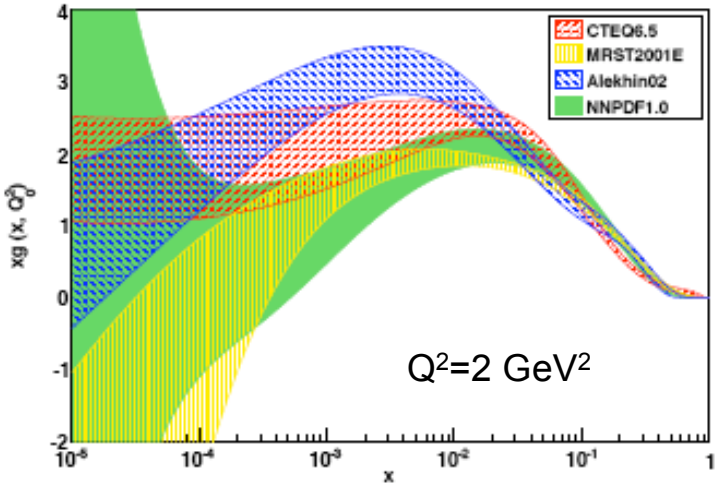


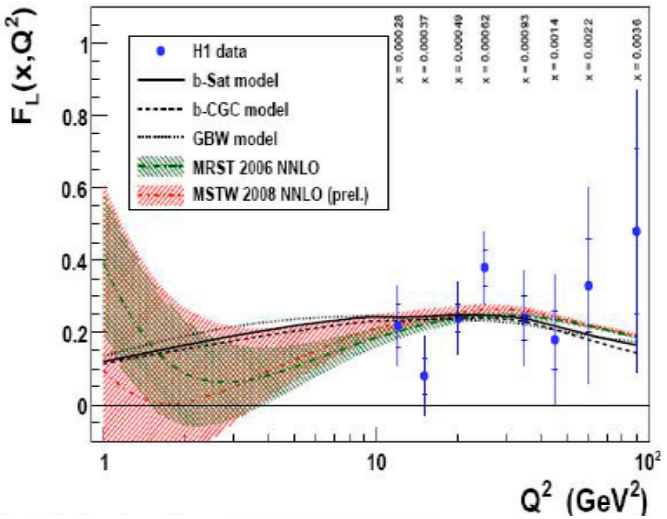
1) NLO (Rojo)

2) Higher orders (Vogt)

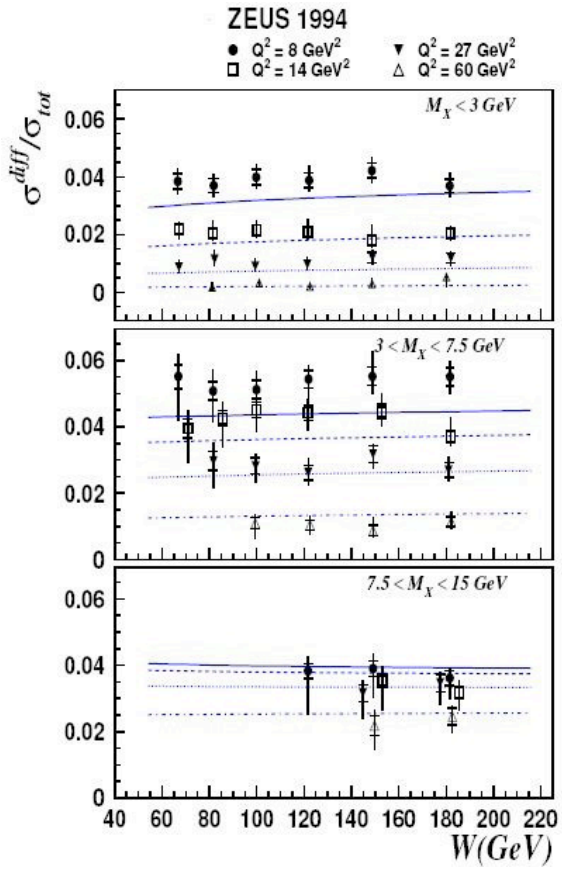
3) Resummation (Altarelli)

4) Saturation (Bartels, Kowalski)

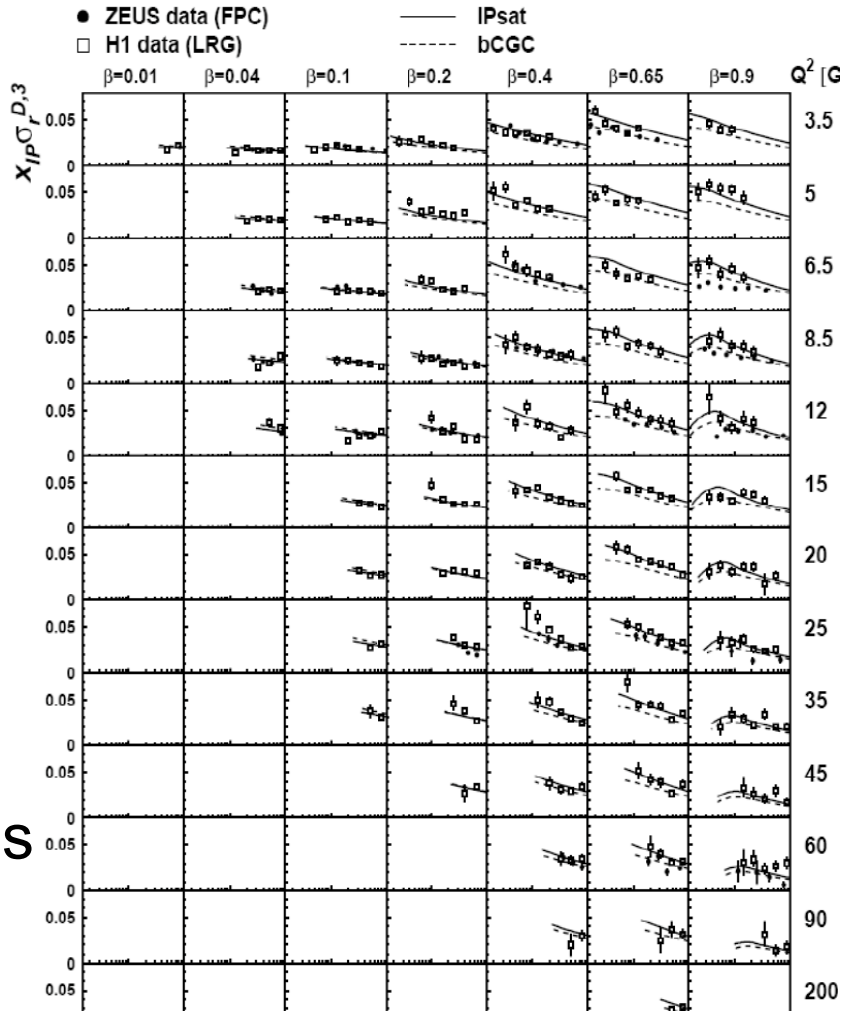




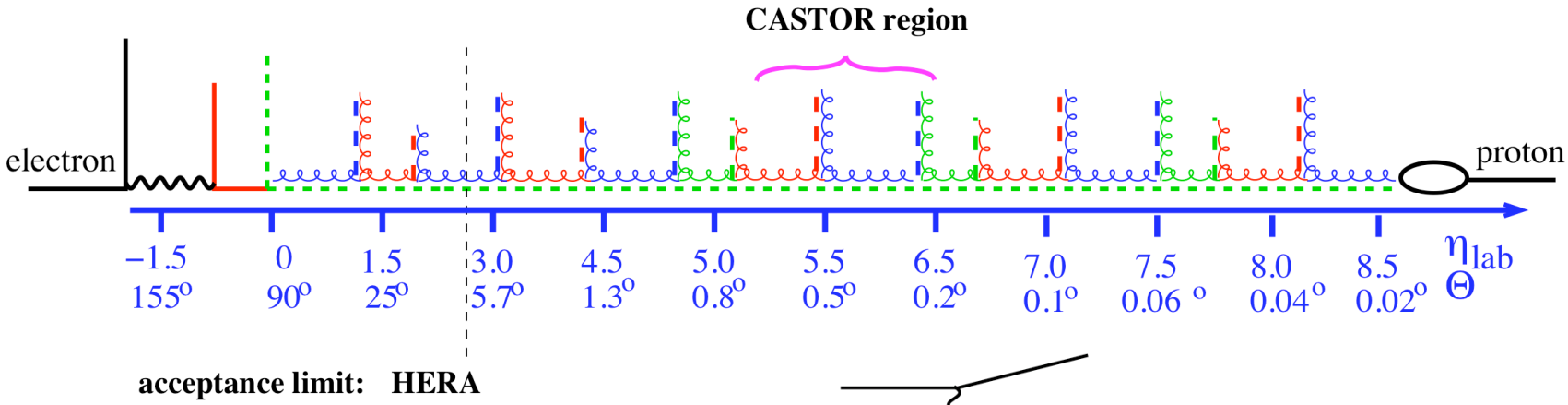
Diffraction



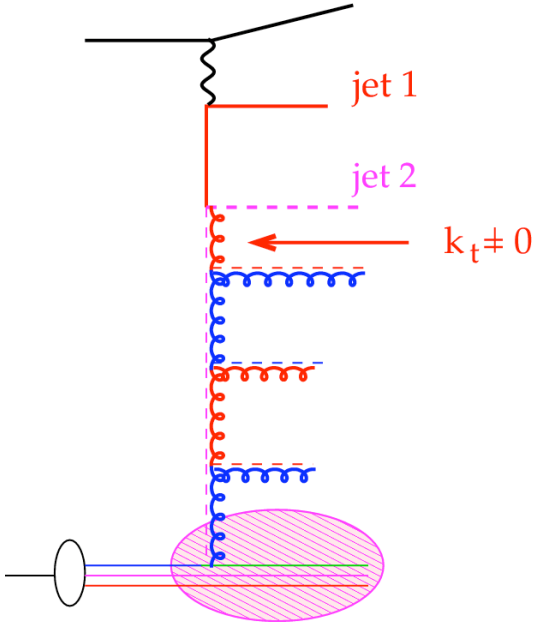
Saturation (dipole) models provide a link with F_2, which must be checked at smaller x/larger W^2 (Kowalski, Bartels): requires forward p-ID.

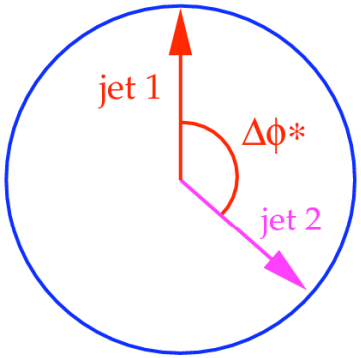


Forward jets and dijets



Measuring jets of similar E_T widely separated in rapidity maximizes the sensitivity to new (non-DGLAP) dynamics like BFKL, saturation (Jung, Kutak): requires large rapidity coverage.

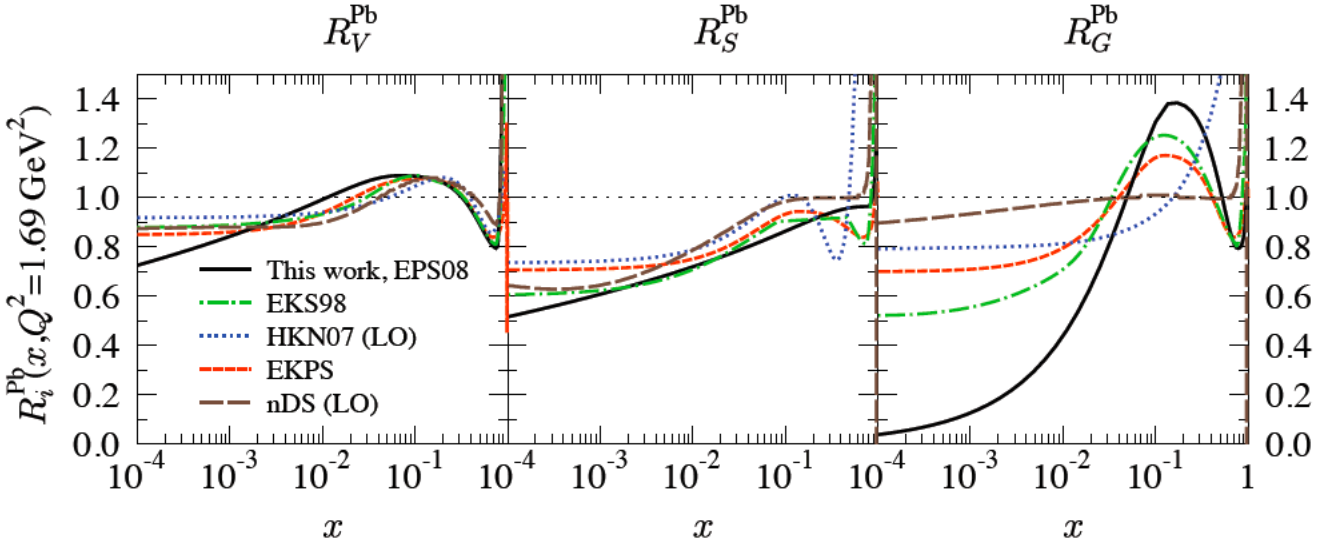


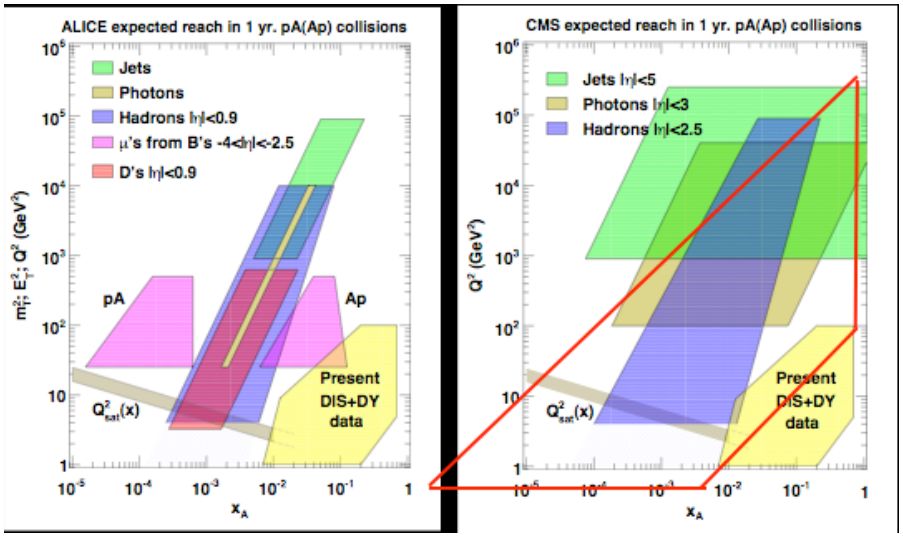


eA

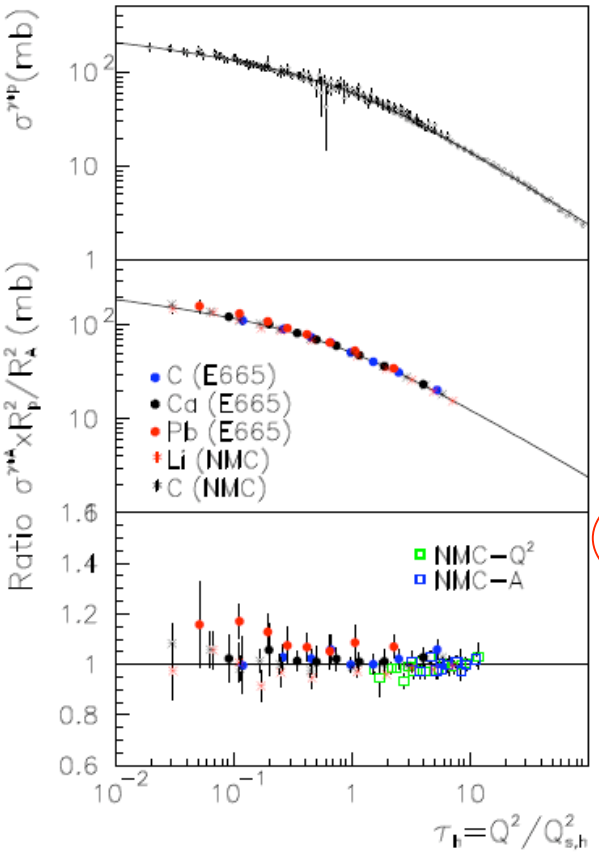
Npdf´s DGLAP analysis largely uncertain for small x and Q^2: analogous to going to pp at the LHC without HERA.

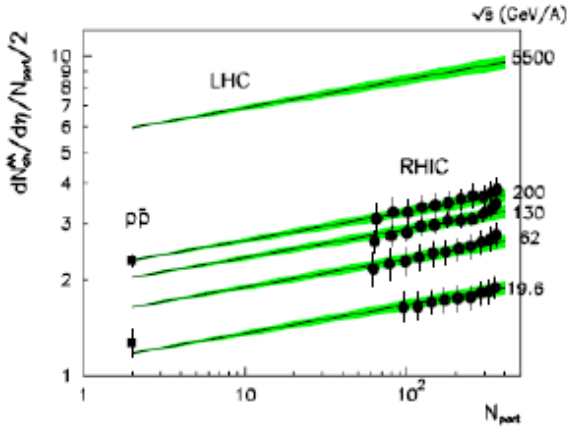
This uncertainty will be difficult to solve with pA@LHC (d'Enterria, Campanelli, Arleo). CC and HQ (Behnke) are required to reduce the uncertainties in the sea and gluon.

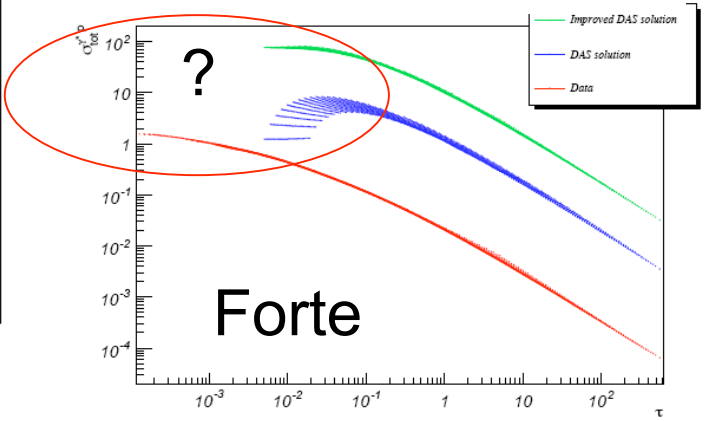




Geometric scaling







Geometric scaling in ep and eA can be related with particle production in AB: 1st day observable at the LHC.

$Q_{sA}^2 \sim A^{1/3} Q_{sp}^2$: nuclear enhancement.

Need of small Q^2 to access small vaues of the scaling variable.