

New developments in QCD analysis of F2D

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Plan

Note: for clarity of the presentation we focus the discussion of 'QCD analysis' to 'QCD fits' (with NLO DGLAP evolution equations) and then to diffractive PDFs (DPDFs)

- ** QCD fits on F2D and diffractive PDFs (DPDFs):
Discussion of the DPDFs w.r.t. Data sets (F2D)
Results of the fits on all ZEUS versus all H1 data
FLD predictions
Discussion of the uncertainties...
- ** Applications to Tevatron and perspectives @ LHC

Data sets: inclusive diffraction

Pre-2008 data samples (published):

1. H1 LRG ($M_y < 1.6 \text{ GeV}$)
2. H1 FPS ($M_y = M_p$)
3. ZEUS FPC-I ($M_y < 2.3 \text{ GeV}$)
4. ZEUS LPS ($M_y = M_p$)
5. ZEUS FPC-II ($M_y < 2.3 \text{ GeV}$)

Post-2008 (published):

6. ZEUS-LRG new ($M_y < 2.3 \text{ GeV}$) (arXiv:0812.2003)
7. ZEUS-LPS new ($M_y = M_p$) (arXiv:0812.2003)

Preliminary:

8. H1-LRG new 99-04 ($M_y < 1.6 \text{ GeV}$) (preliminary)

-- THEN: QCD fits of (part of) these data sets

Method already explained by Marta Rupsa (previous talk)

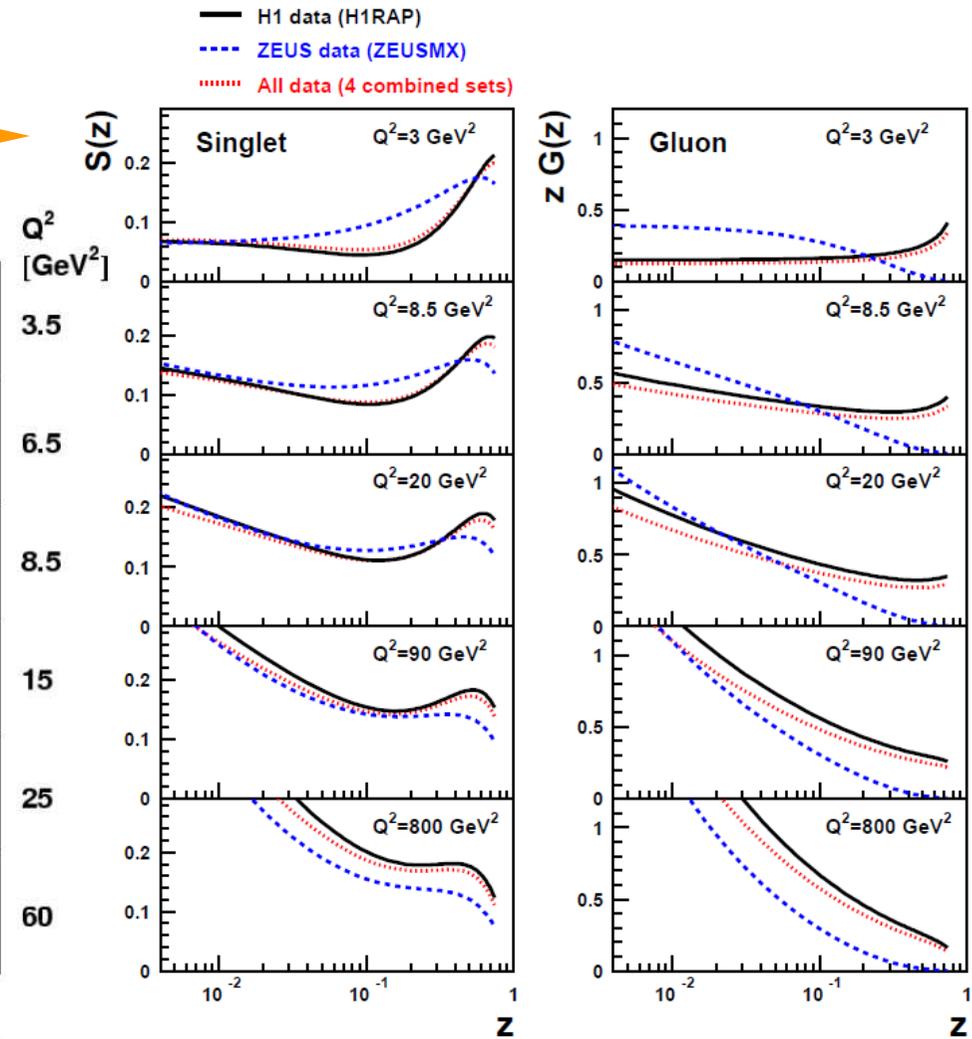
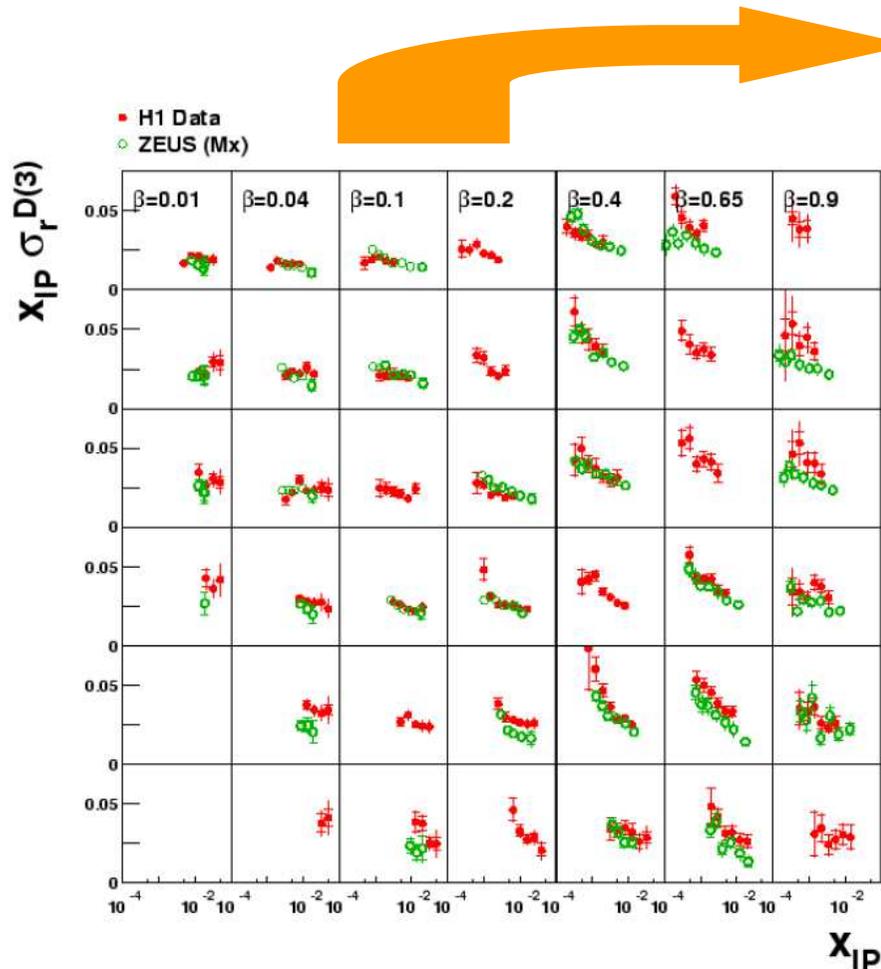
-- DPDFs of this talk based on:

C. Royon, L. S. et al. Nucl.Phys.B781:1-31,2007; Nucl.Phys.B746:15-28,2006

Fits on H1 (LRG) and ZEUS (Mx)

ZEUS Mx and H1 LRG DPDFs are found to be quite different // differences in data (below)

C. Royon, L. S. et al. Nucl.Phys.B781:1-31,2007

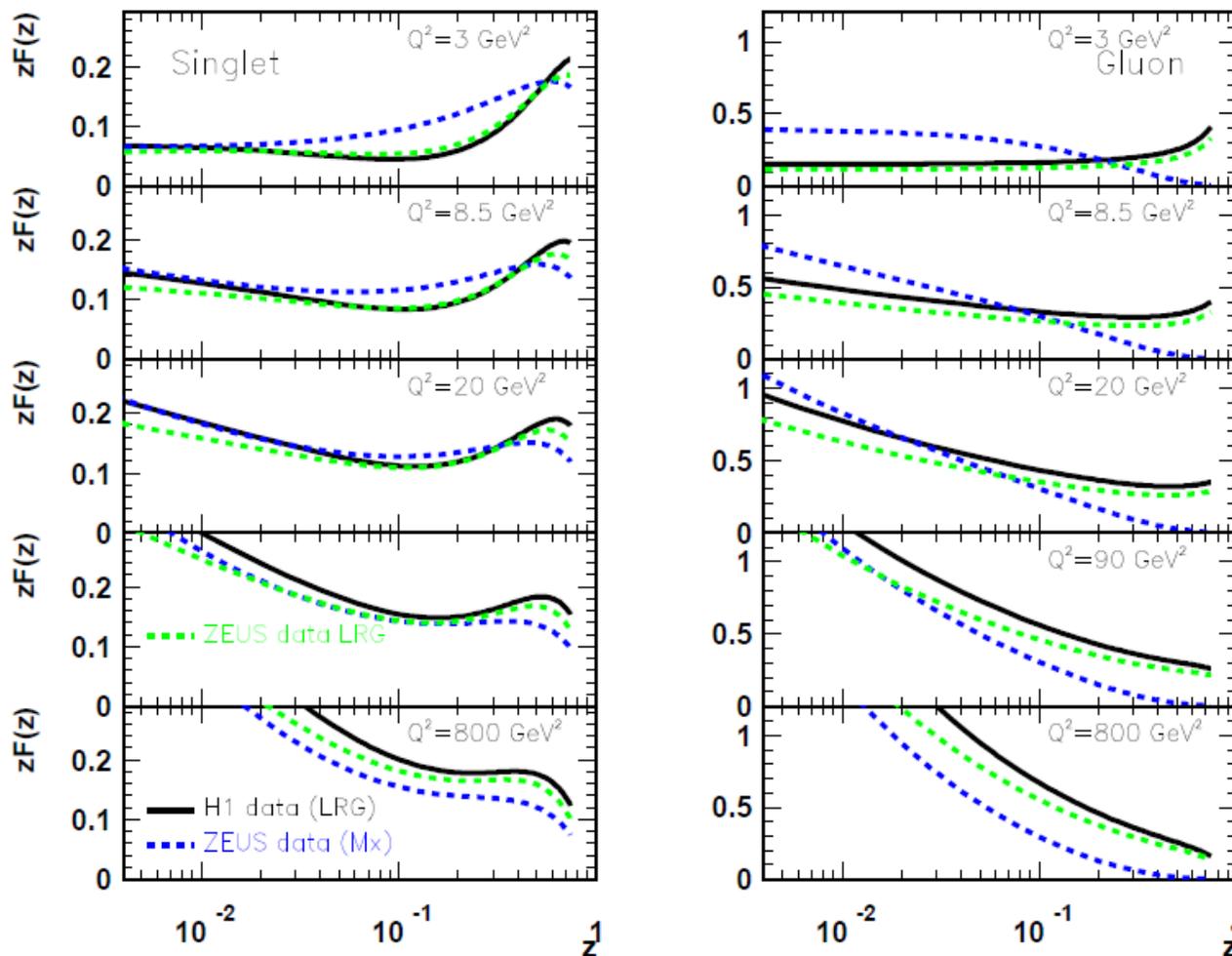


Update with last ZEUS LRG data

QCD Fit result is found to be very close to H1 LRG...

Normalisation of $\sim 10\%$ difference between H1/ZEUS derived from the fit

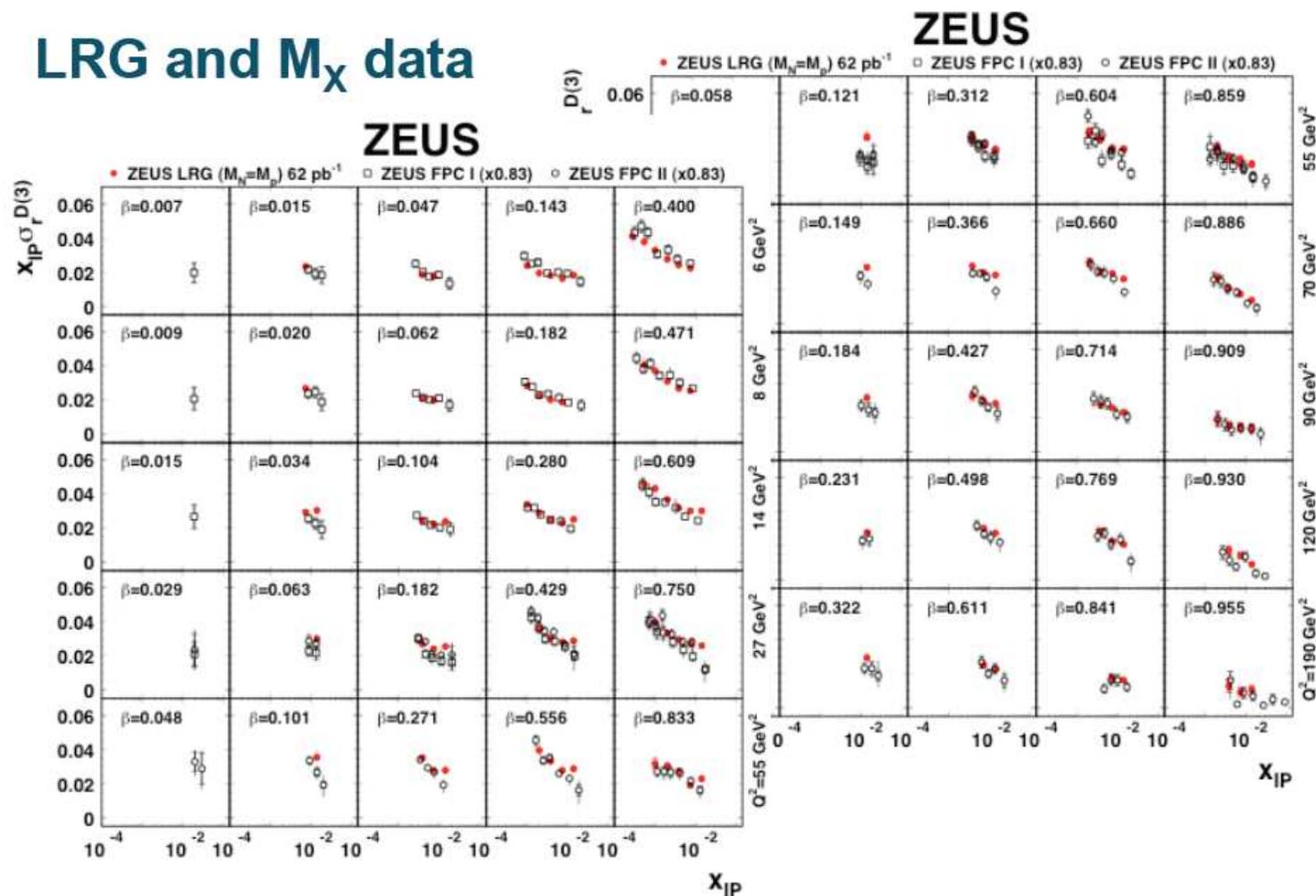
ZEUS Mx and **ZEUS LRG** DPDFs are found to be quite different!



&
DPDFs
ZEUS LRG
close to
H1 LRG

Are ZEUS LRG and ZEUS Mx so different?

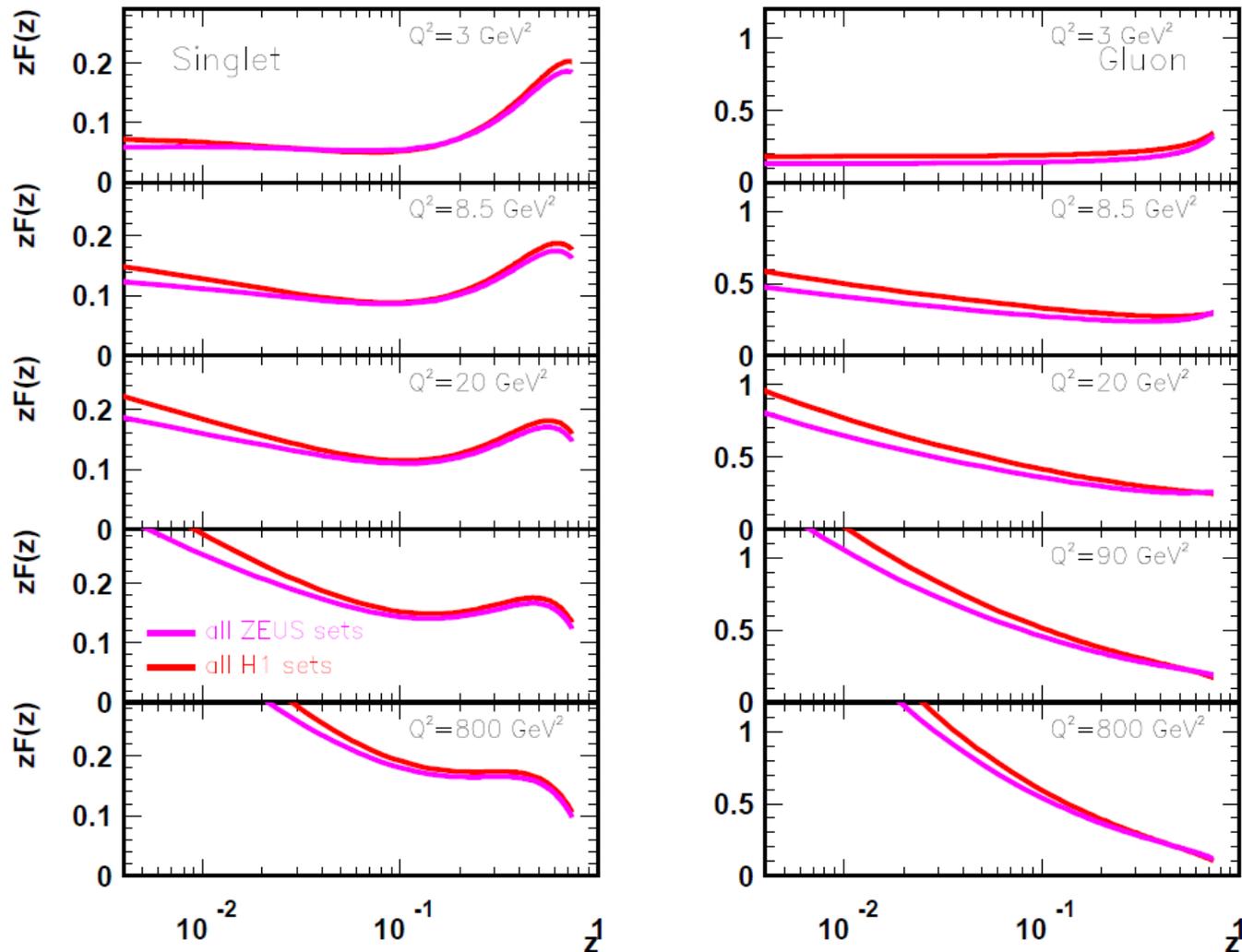
ZEUS LRG and Mx cross sections are quite close for most bins...
 => High sensitivity of the QCD fit technique... (too high?!)



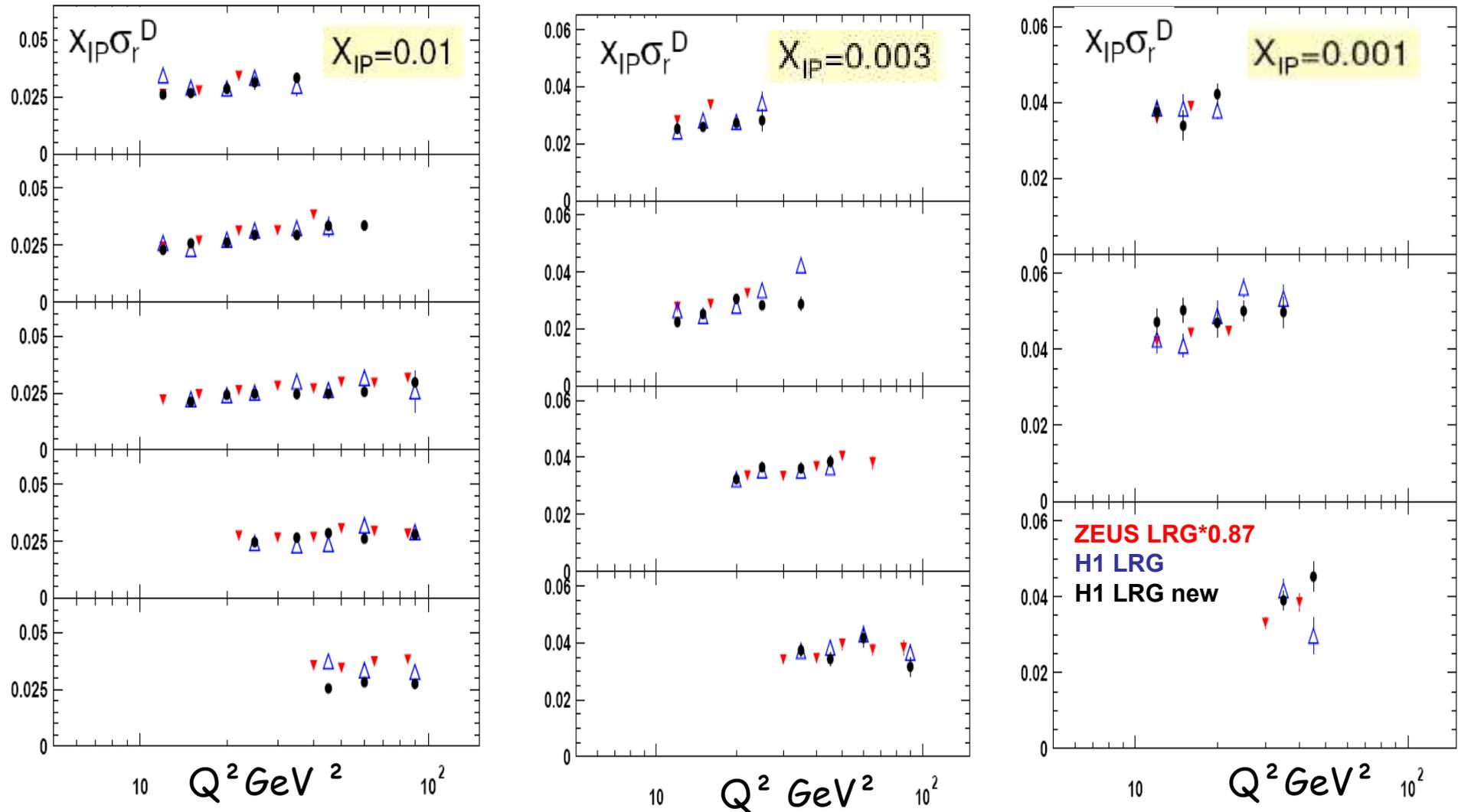
Summary: H1 versus ZEUS DPDFs (last data)

Perfectly compatible with errors...

$\delta = 5\%-10\%$ for zS and $10\%-25\%$ for zG [25% for zG at large z]



Note: H1preliminary versus other data sets



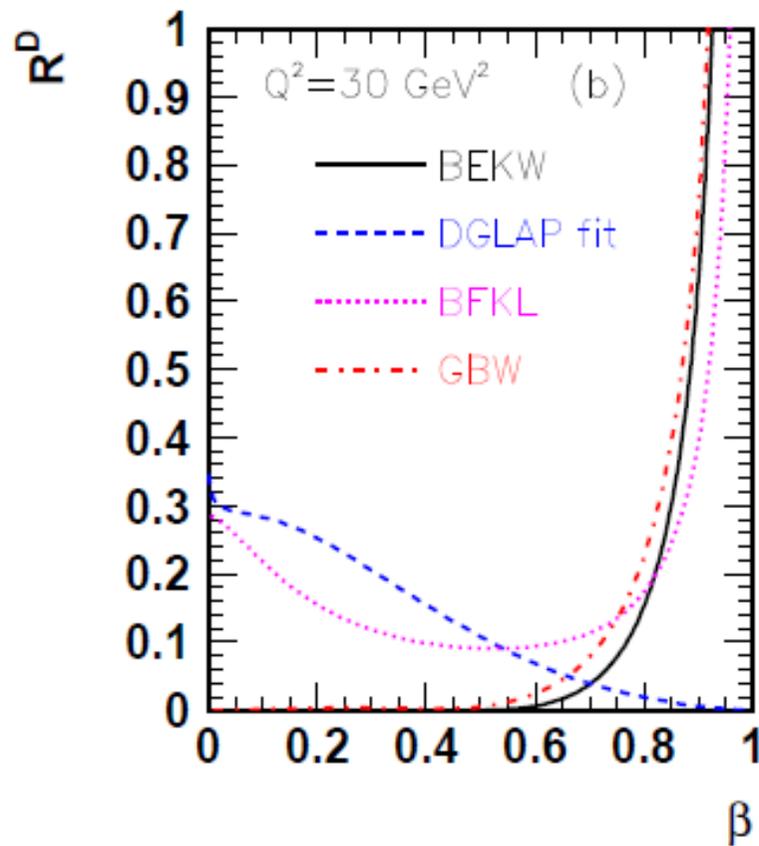
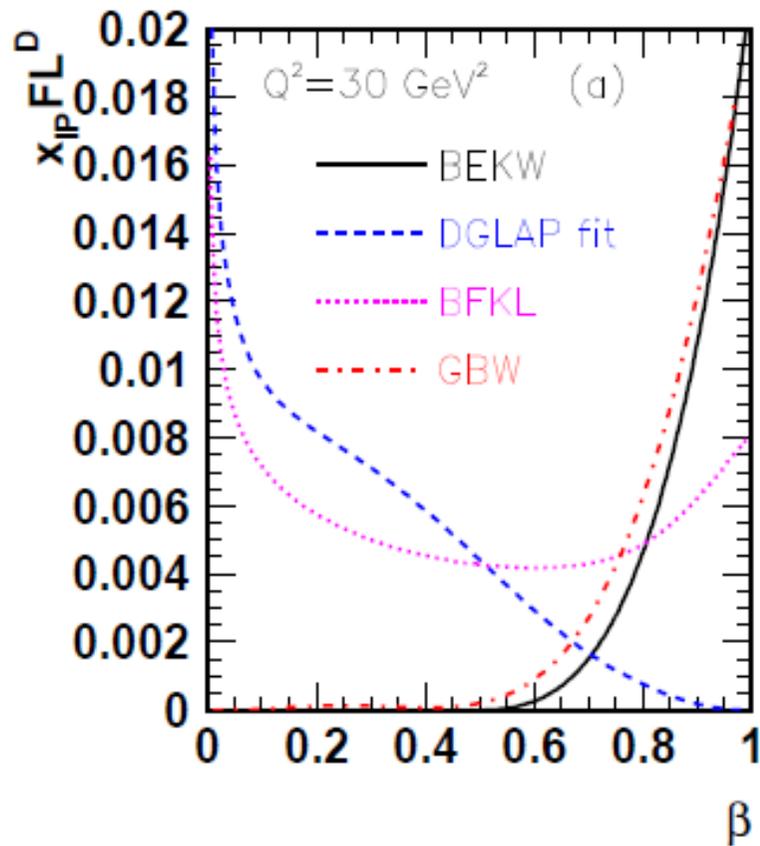
good agreement of all data sets... (with H1/ZEUS ~ 0.9 -global-)
 \Rightarrow Will provide high precision (high constraints) on DPDFs!

FL^D and $R^D = FL^D / (F2^D - FL^D)$

For $x_{IP} = 10^{-3}$

--- Result of the Global QCD fit to F2D data

Oter curves: dipole-like models...



Uncertainty on the gluon @ large z

Method developed in:

C. Royon, L. S. et al. Nucl.Phys.B781:1-31,2007

If we shift the high z behaviour of the
Gluon density by $zG \rightarrow zG * (1-z)^{\Delta v}$

THEN: Δv is (approx.) conserved during the QCD evolution

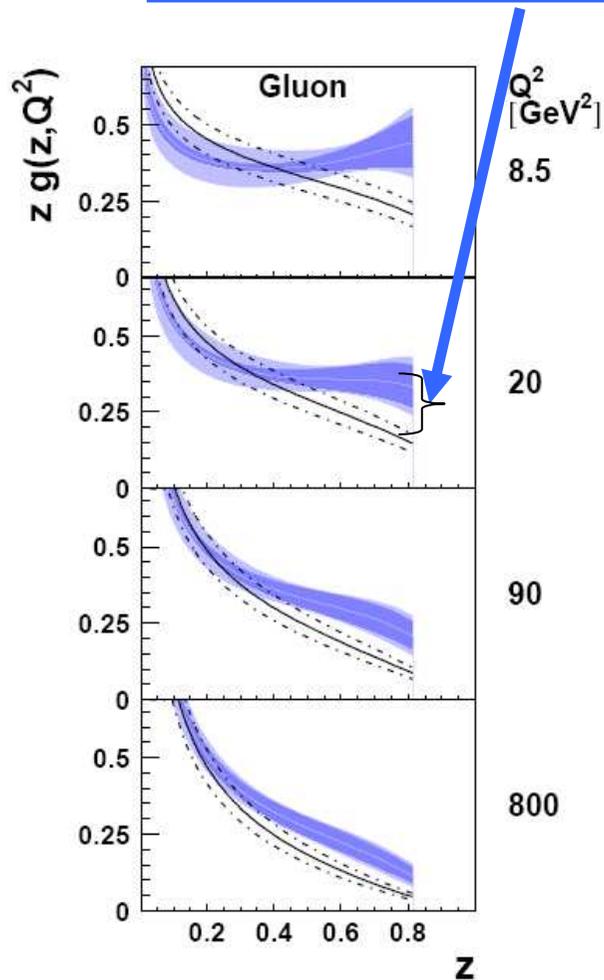
Efficient method to quantify the large z uncertainty

Including experimental and param. (functionnal) aspects...

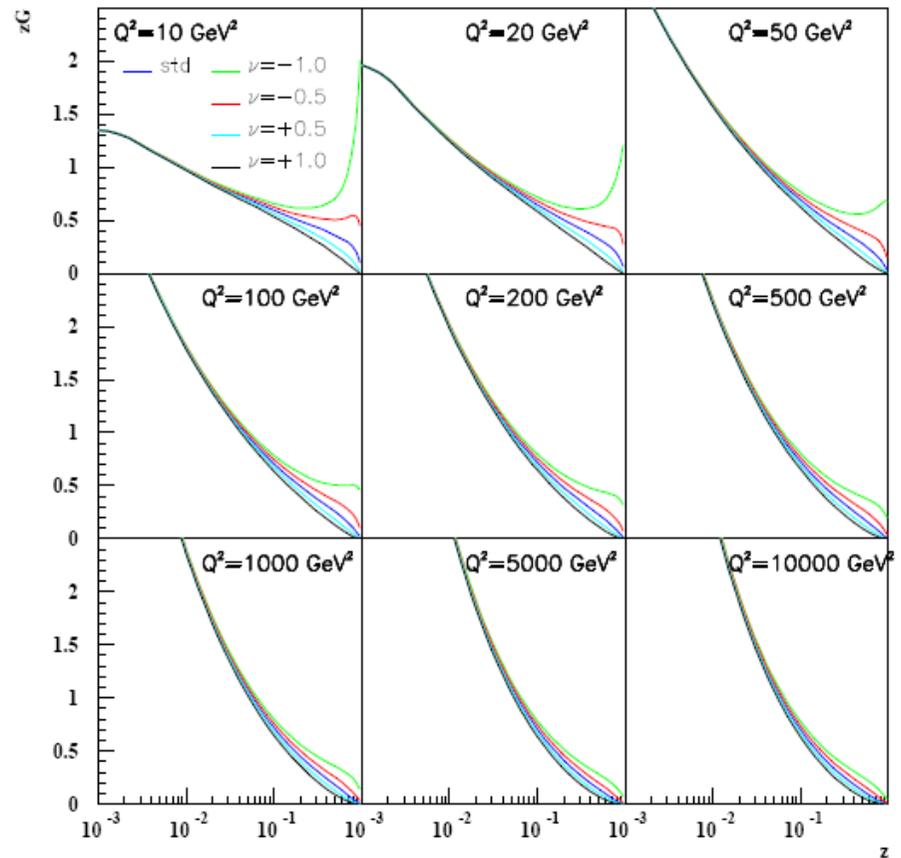
Check the impact of this error on Tevatron/LHC observables
(following of the talk)

Uncertainty on the gluon @ large z

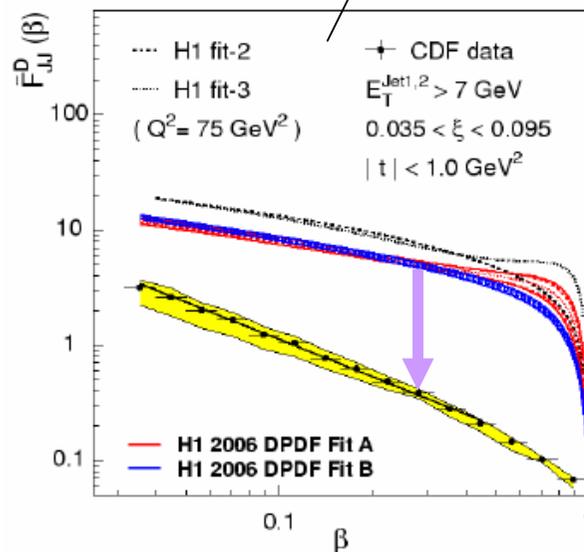
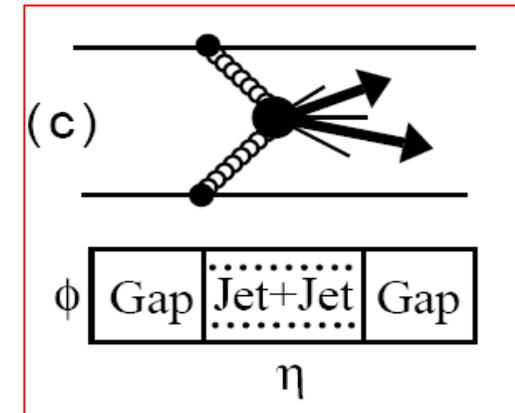
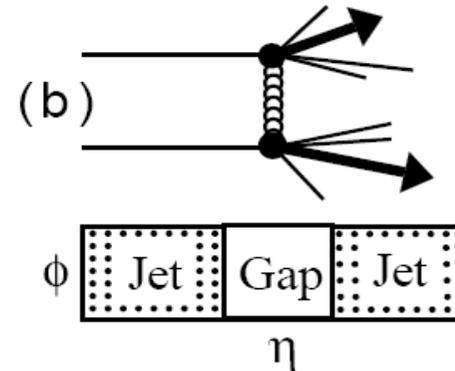
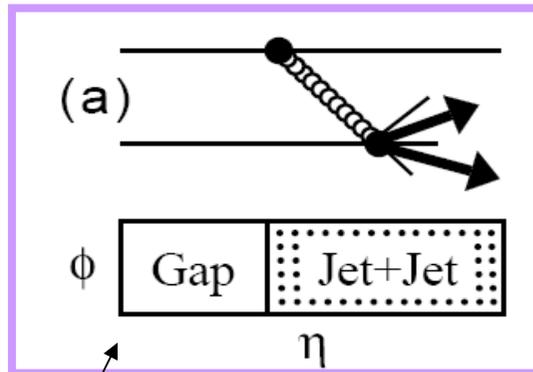
From a fit to H1/ZEUS data
 $\nu = 0.0 \pm 0.5$



Gluon density
 With 1 and 2 'sigmas' variations



Moving to Tevatron : a brief reminder



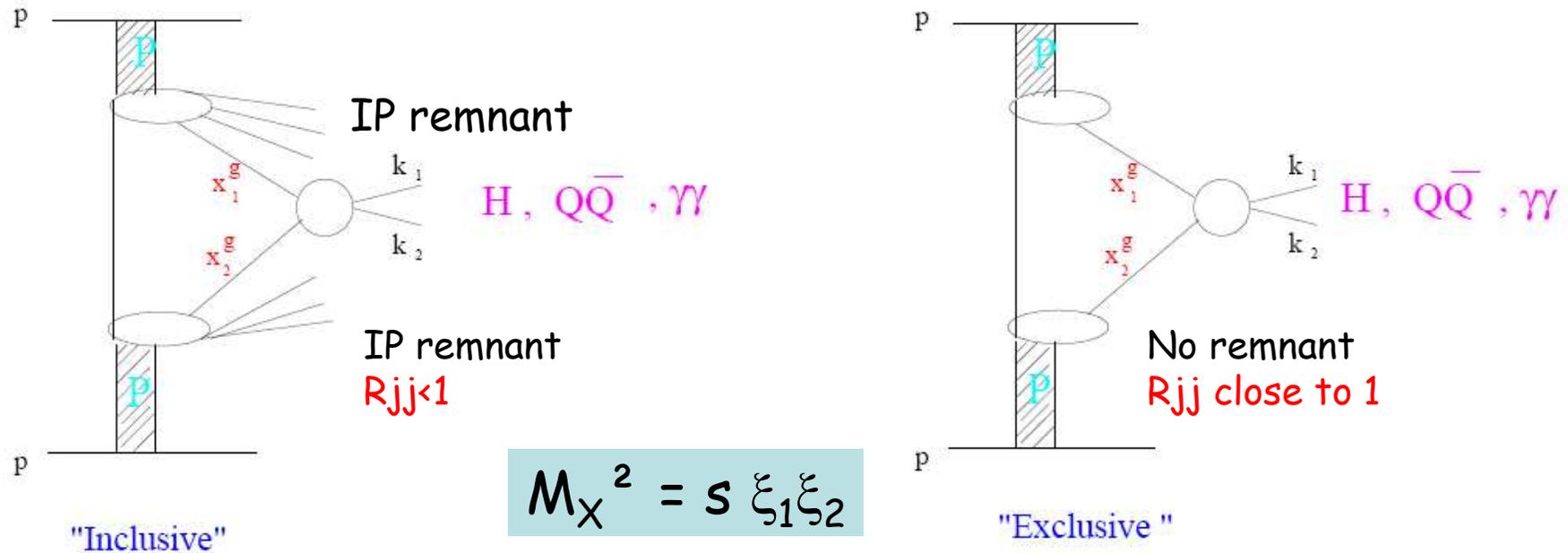
- (a) Single Diffraction
- (b) Large Angle Diffraction
- (c) Double Diffraction

QCD factorisation breaking

$$\bar{F}_{JJ}^D(\beta) = \frac{1}{\xi_{\max} - \xi_{\min}} \int_{\xi_{\min}}^{\xi_{\max}} d\xi \left[\beta g^D(\xi, \beta, Q^2) + \frac{4}{9} \beta \Sigma^D(\xi, \beta, Q^2) \right]$$

We focus on double diffraction [Double Pomeron Exchange -case (c)-] and the impact of the gluon density uncertainty on predictions for this process
Hypothesis : we can use the dPDFs extracted @ HERA [at the end the calculations is multiply by the « constant » survival gap probability]

Interest of DPE : Production of heavy states



● Pb : Does Double Pomeron Exchange (DPE) exists in the exclusive mode ?

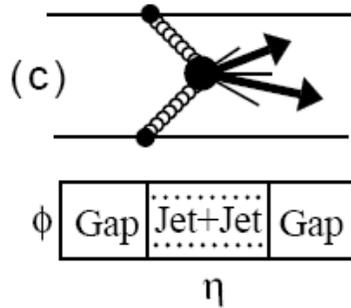
● We can check if excl. evts exist @ TeV ?!
 (if not covered by DPDF error)

Measurement of the Dijet Mass Fraction @ TeV
 See also talk of Olda Kepka

$$R_{jj} = \frac{M_{jj}}{M_X}$$

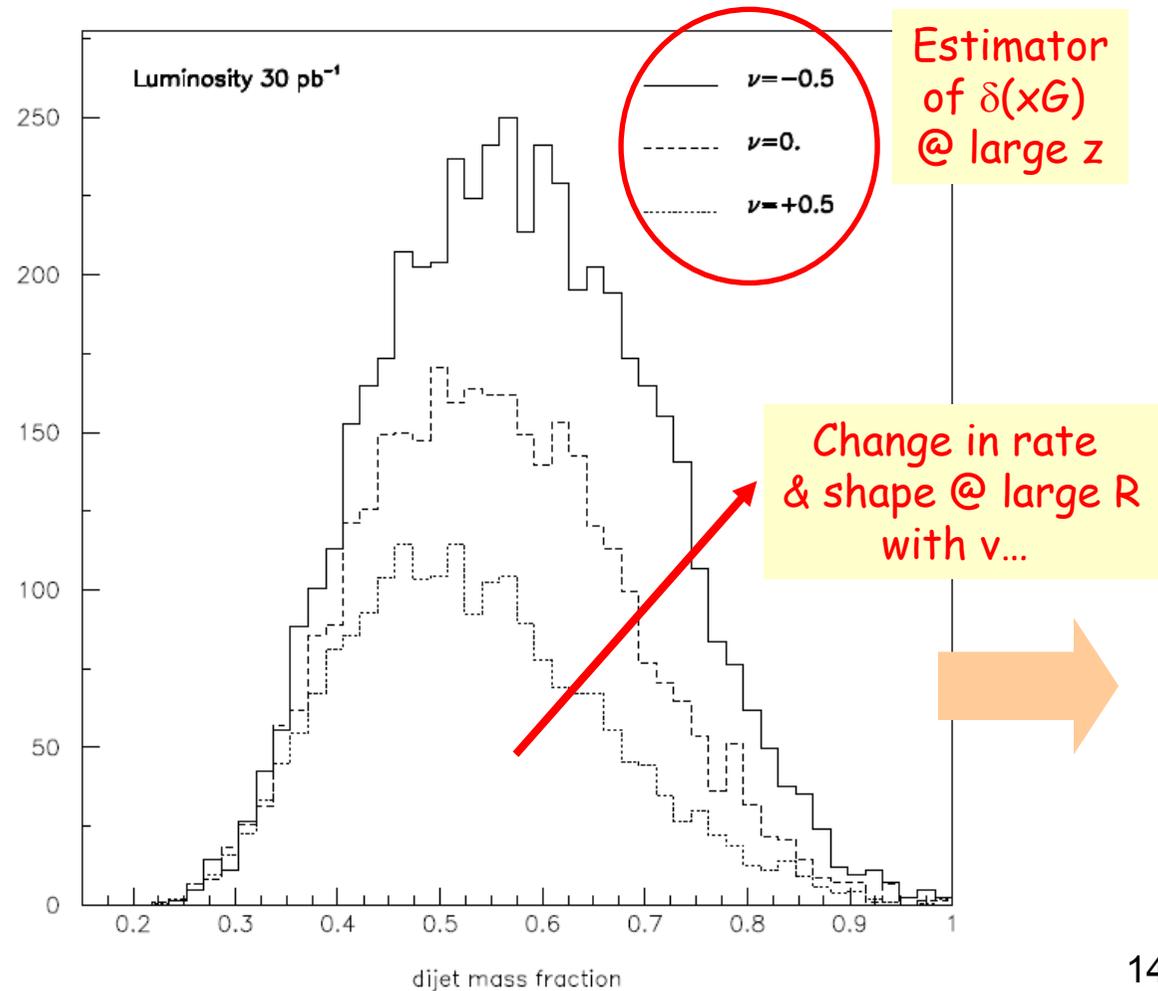
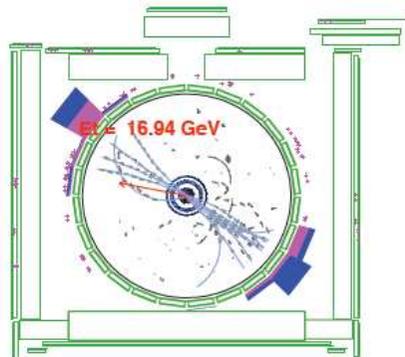
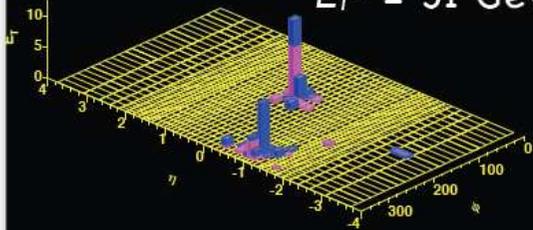
Gluon density and dijet mass fraction

Possible measurement of the dijet mass fraction at the Tevatron sensitive to gluon density



CDF Run II Preliminary

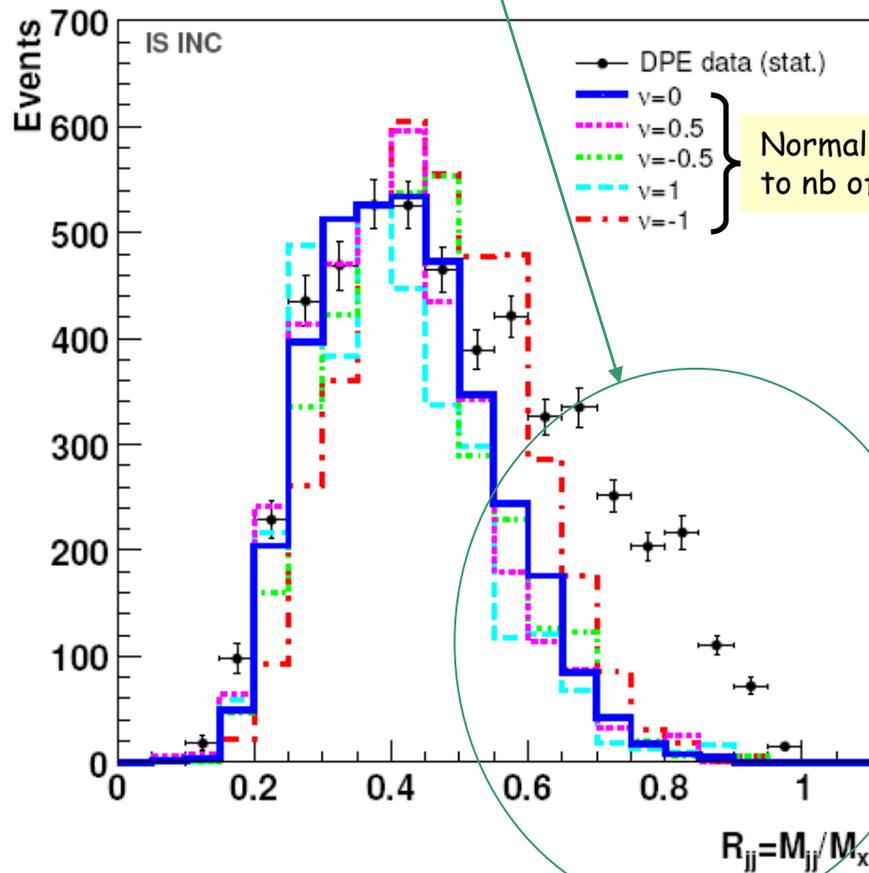
$R_{jj} = 0.96$ $E_T^1 = 33$ GeV
 $E_T^2 = 31$ GeV



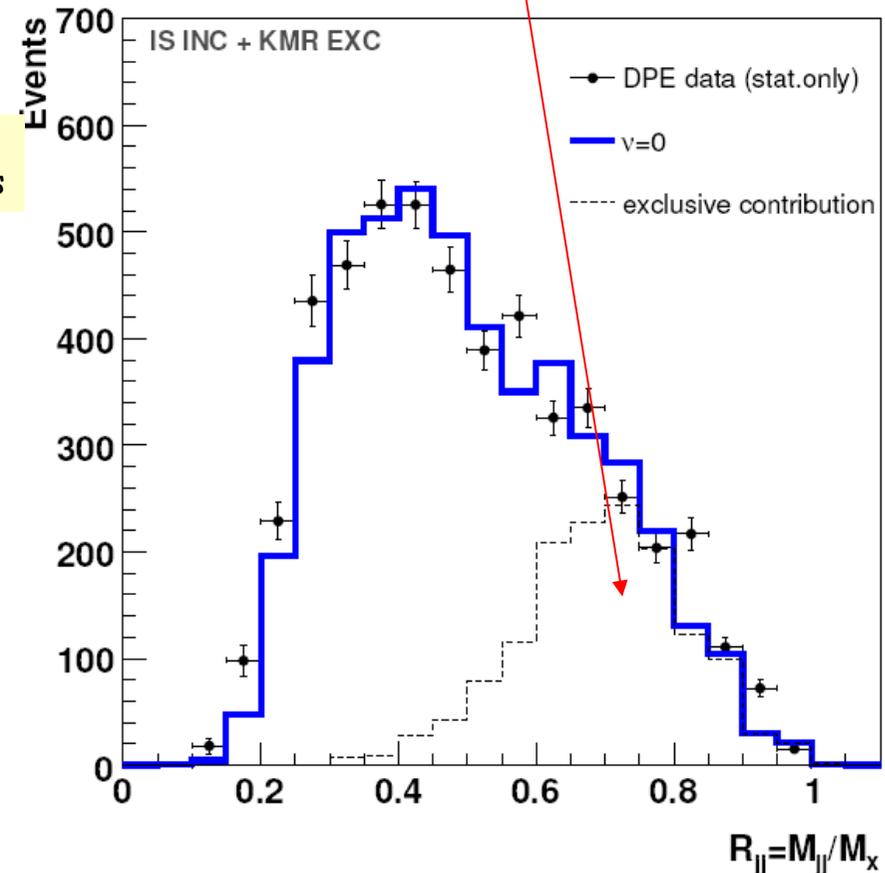
Dijet mass fraction : measurement & predictions

Effect of the gluon uncertainty on the shape :
It does not cover the large R.

**predictions
with exclusive production**



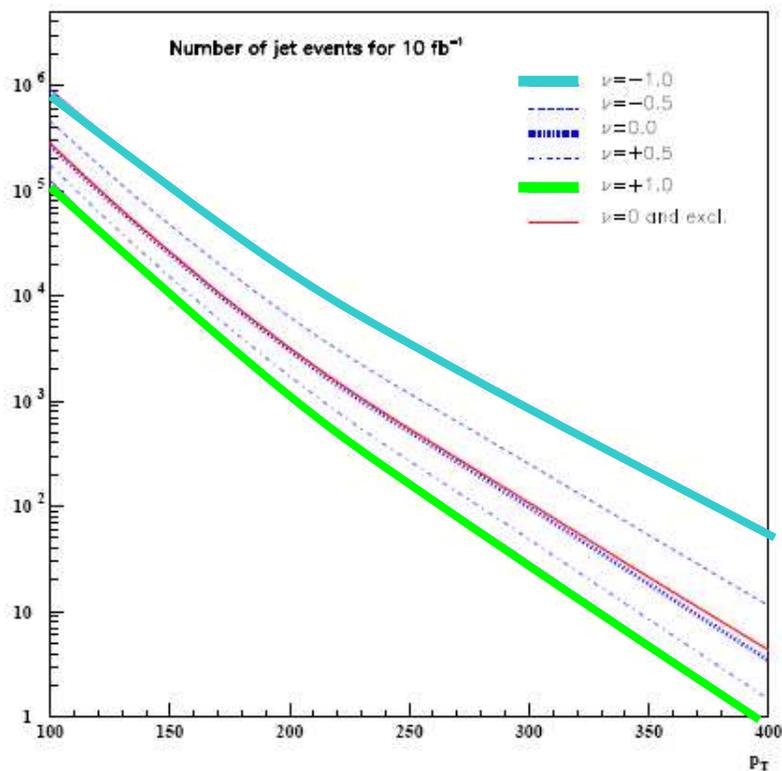
pT (jets) > 10 GeV



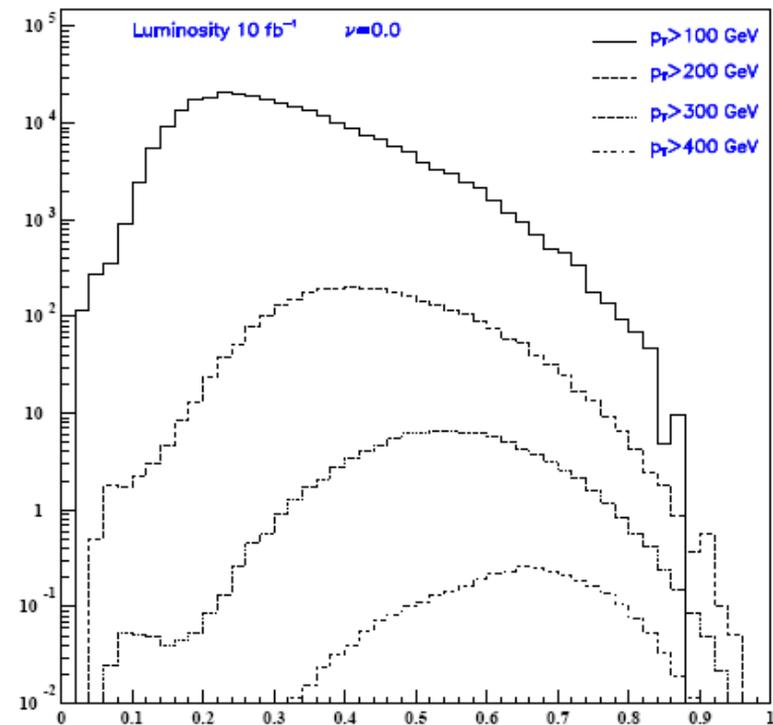
Check the impact on the Gluon @ large z

DPE rate of events @ LHC (simul)

Rate of DPE evenents @ LHC as a function of the transverse momentum (min) of the 2 leading jets => **impact of the gluon density (at large z)...**



Rate of events ($p_{T_{\min}}$)



Dijet mass fraction

R_{jj}

Outlook

- Many data sets on F2D (LRG or LPS/FPS)
=> Precise determination of DPDFs
Once the normalisation difference between data sets H1/ZEUS is treated as free parameters and corrected globally (10%).
Is it correct?
Work needed at the data level to understand this 10%
- DPDFs can be used in other contexts:
Exclusive dijet events at the Tevatron(/LHC) with/without
« Remnants »... Large impact of the large z gluon density!
But not sufficient to describe the large R_{ij} tail...
factorisation breaking taking into account as a constant factor
=> Perspectives for LHC (see specific talks @ this workshop)