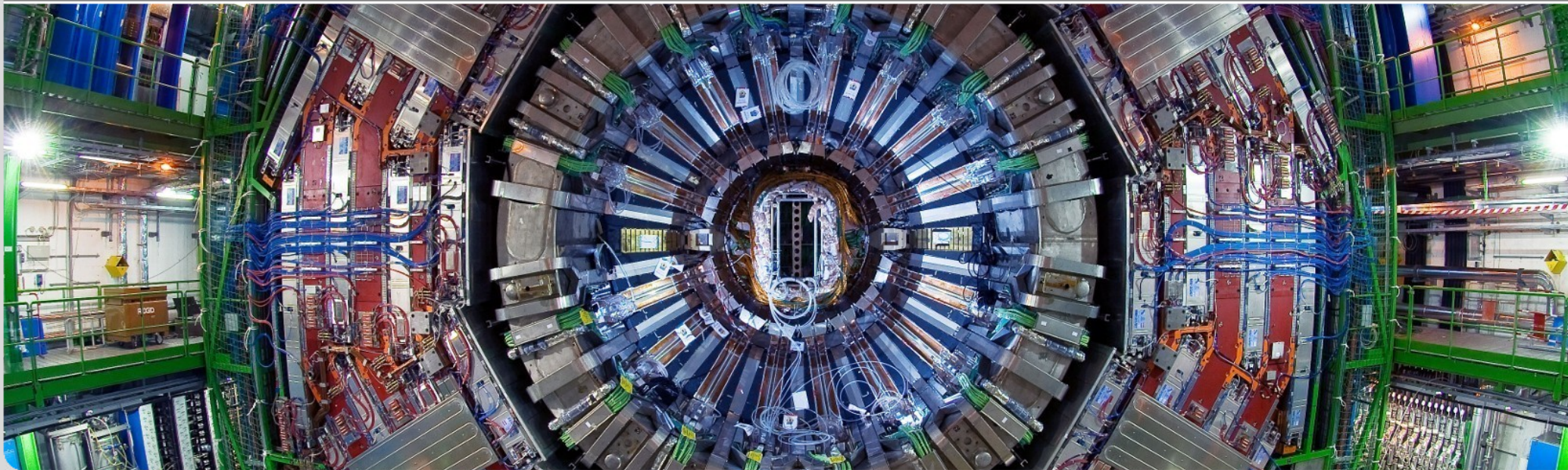




Sensitivity of PDF and α_s to CMS Inclusive Jets 2010

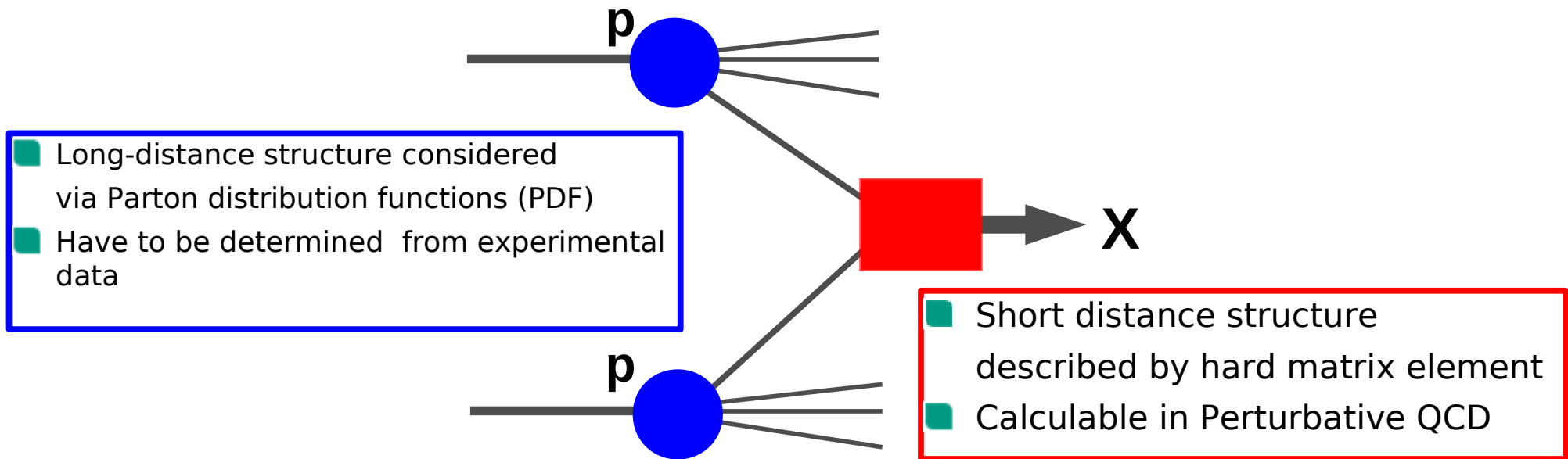
Günther Quast, Klaus Rabbertz, Georg Sieber

Institut für Experimentelle Kernphysik (IEKP)



Motivation

- Cross Section can be factorized in a long and short distance term



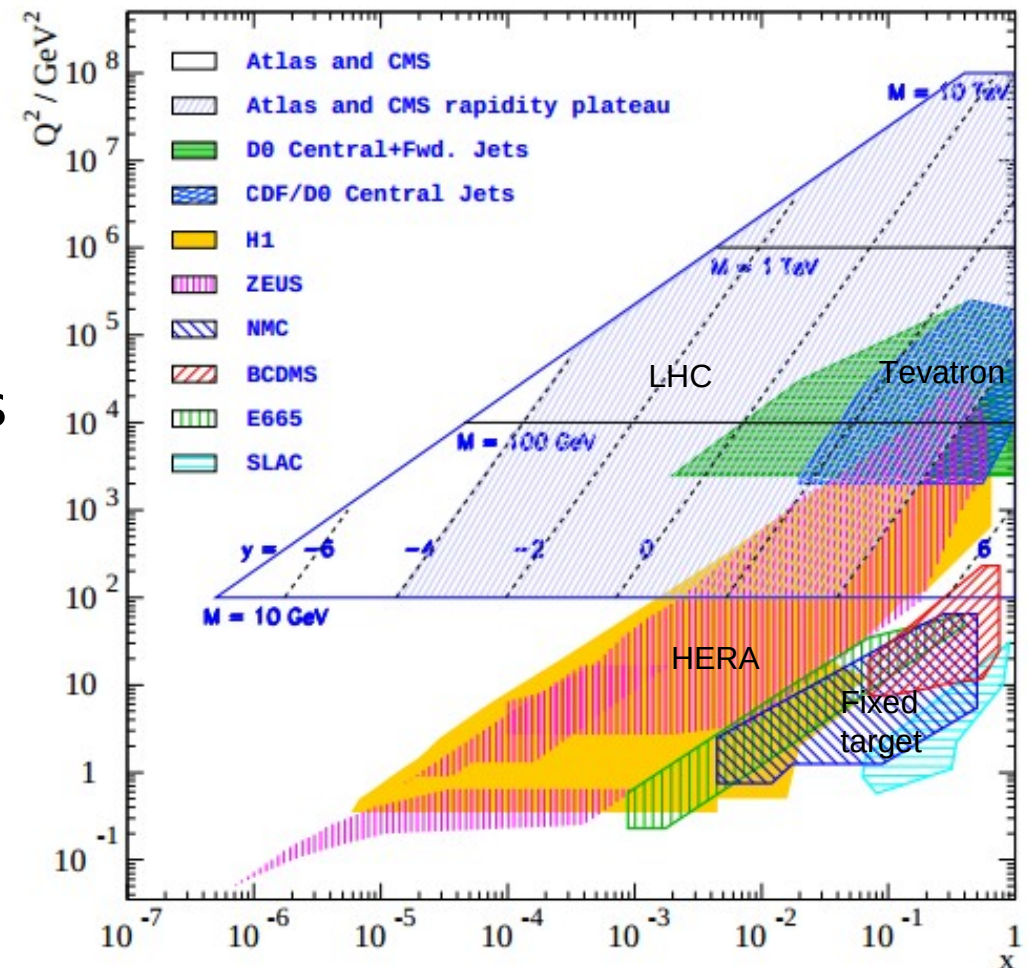
$$\sigma_X = \sum_{a,b} \int_0^1 dx_1 dx_2 f_a(x_1, \mu_F^2) f_b(x_2, \mu_F^2) \times \hat{\sigma}_{ab \rightarrow X}(x_1, x_2, \alpha_s(\mu_R^2), \frac{Q^2}{\mu_R^2}, \frac{Q^2}{\mu_F^2})$$

- Precision of PDFs essential!

Kinematic plane



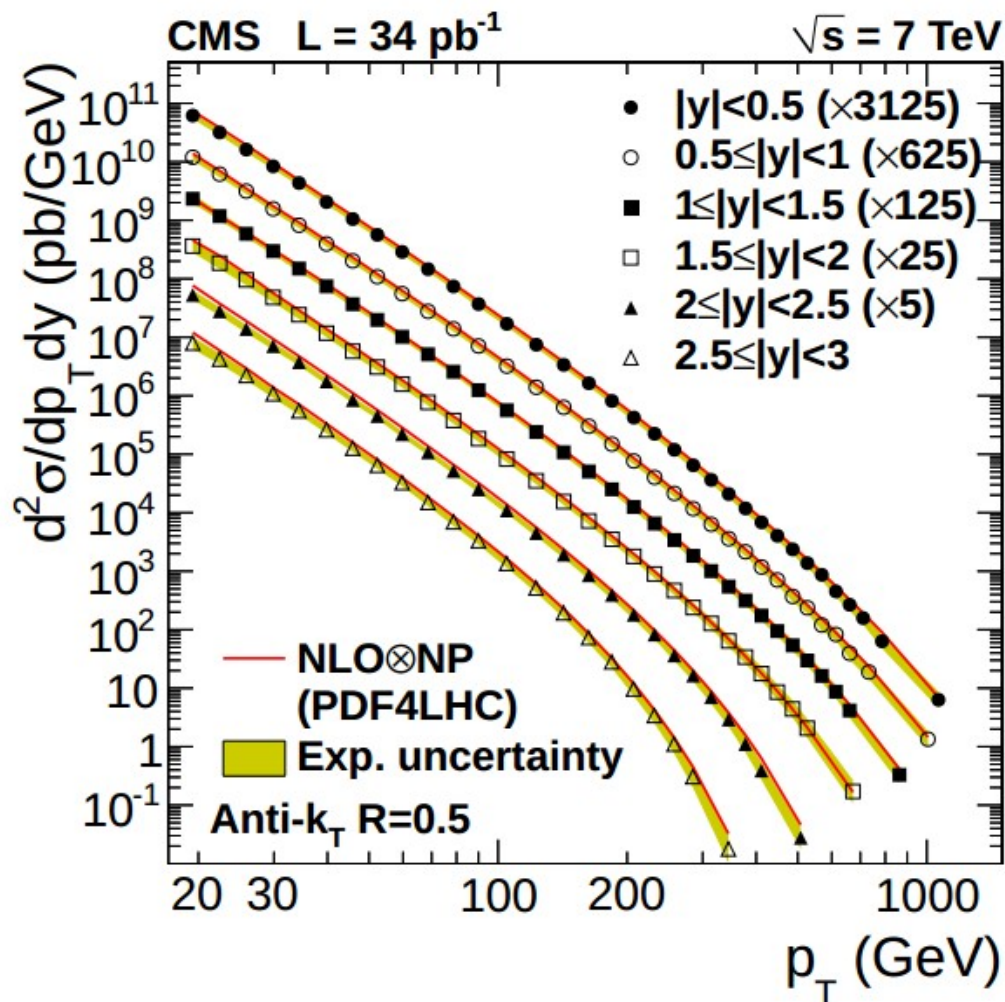
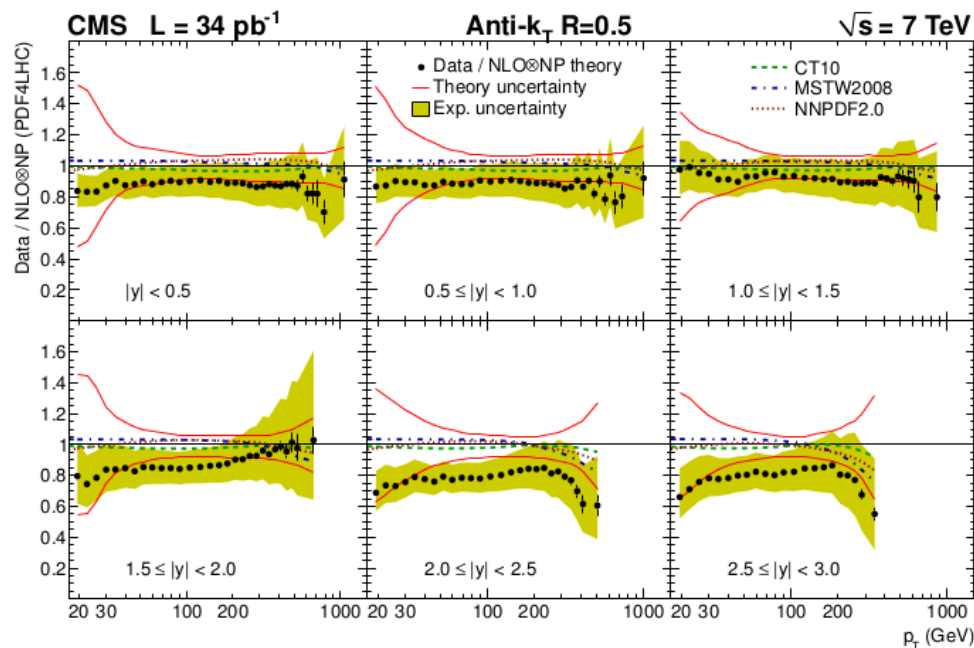
- Accessible phase space regions by experiments
- HERA DIS data span wide range in x and Q^2
→ default input for all PDFs
- LHC data can provide constraints in high- x region and probe QCD at high scales



CMS Inclusive Jet Cross Section 2010

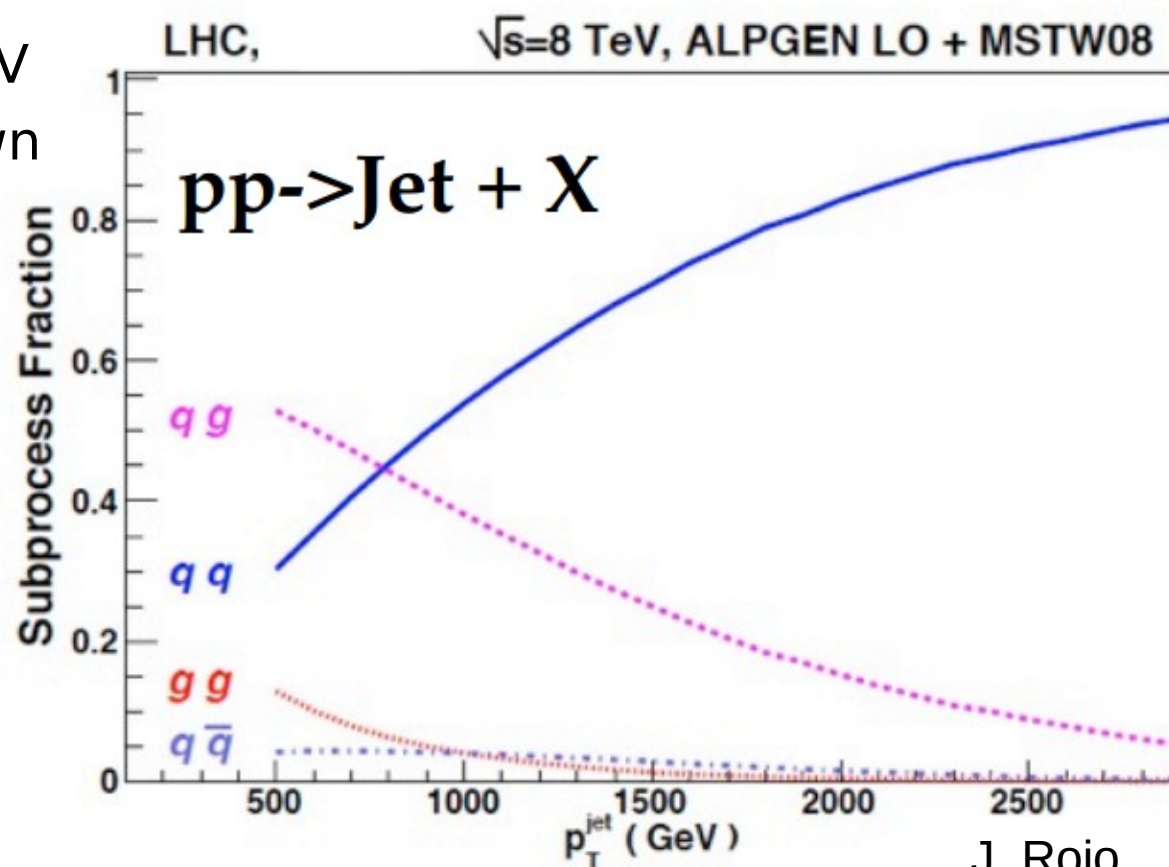


- Center of mass energy 7 TeV
- $18 < p_{T, \text{JET}} < 1200 \text{ GeV}$
- $L_{\text{int}} = 34 \text{ pb}^{-1}$
- Public on HEPData
- Phys. Rev. Lett. 107 132001



Subprocesses in Jet Production

- **qg and gg processes**
 - dominant below 800 GeV
 - Sensitive to gluon PDF
- **qq processes**
 - prevail above 800 GeV
 - Sensitive to up/down quark PDFs
- **q $\bar{q}$ processes**
 - Suppressed
 - No sensitivity to antiquark PDFs



HERAFitter framework

- Set of fitting tools for determination of PDFs

- Fit procedure:

- 1) Parametrize quark and gluon distributions at starting scale Q_0
- 2) e.g: $xf_i(x, Q_0^2) = A_i x^{B_i} (1-x)^{C_i}$
- 3) Solve evolution equation to obtain PDF at any scale

- 4) Fit PDF parameters to your data

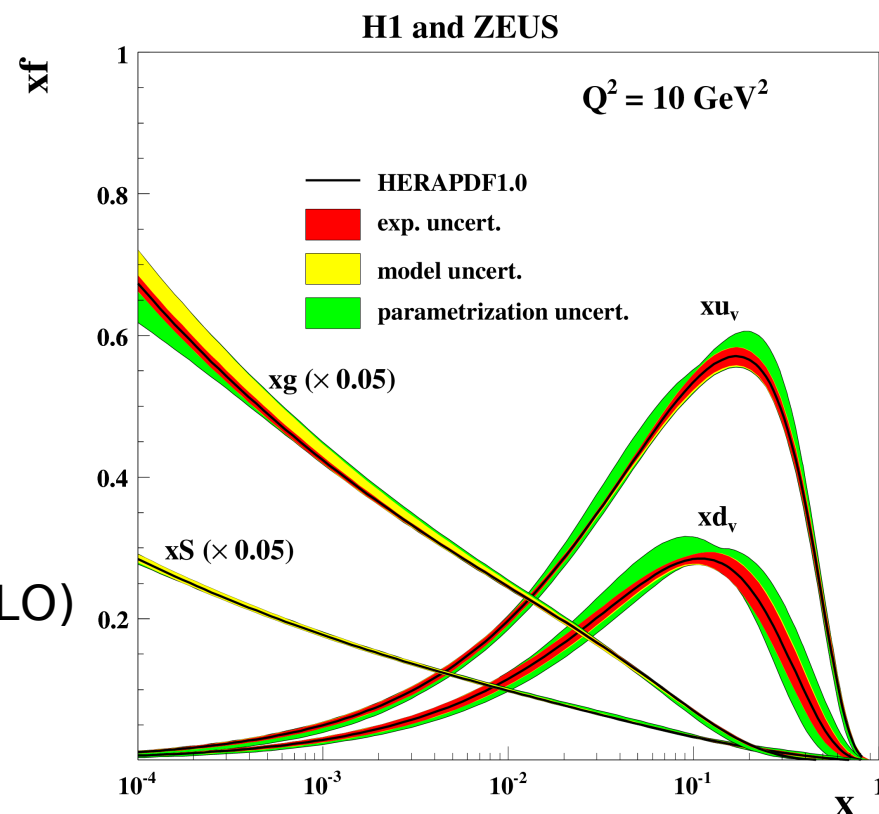
- 5) Estimate uncertainties of the fit

- “Out of the box” HERAFitter produces the HERAPDF1.0

- Fit settings:

- Only HERA I DIS data

- Evolution in next-to-leading order (NLO)



JHEP 1001:109,2010.

PDF uncertainties

■ Experimental

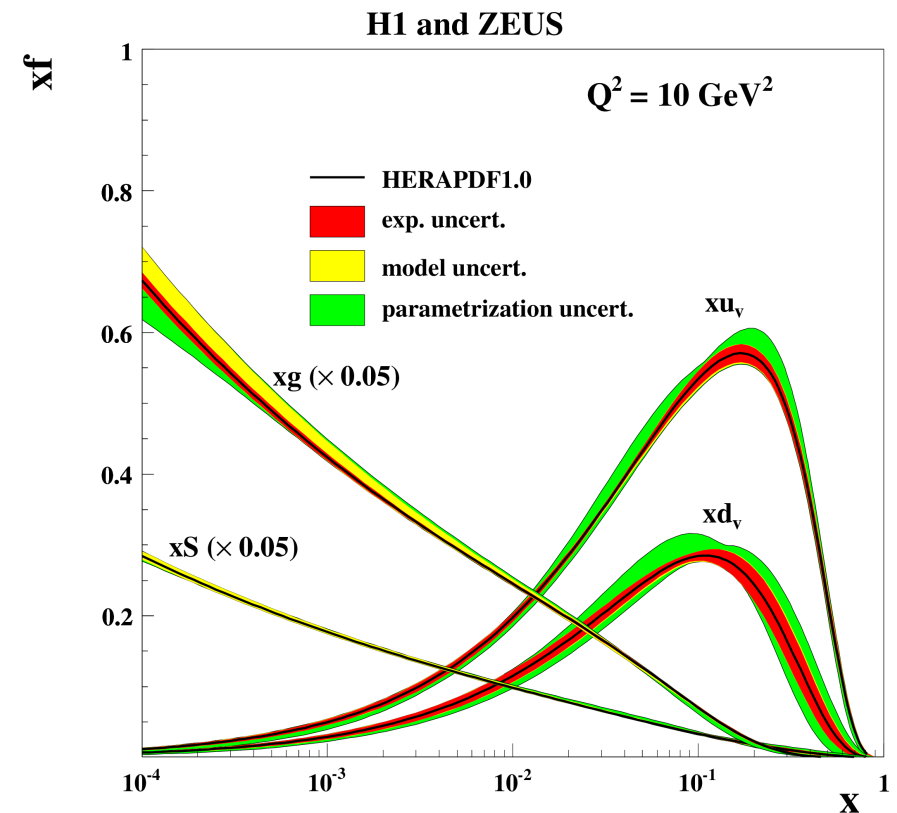
- Propagated data uncertainties

■ Model

- Vary input assumptions
 - heavy quark masses
 - strangeness fraction

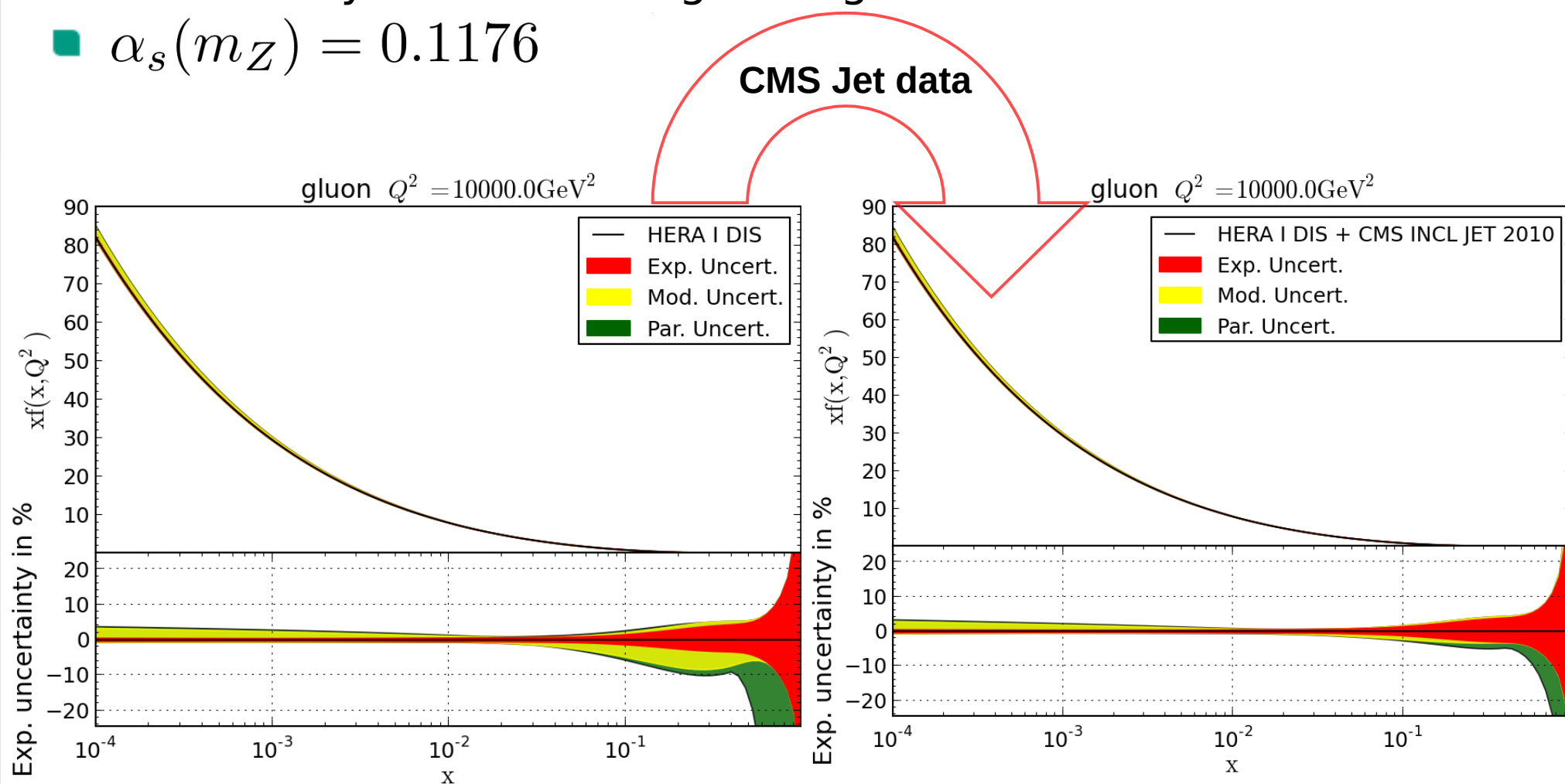
■ Parametrisation

- Vary input parametrisation and check influence on PDF



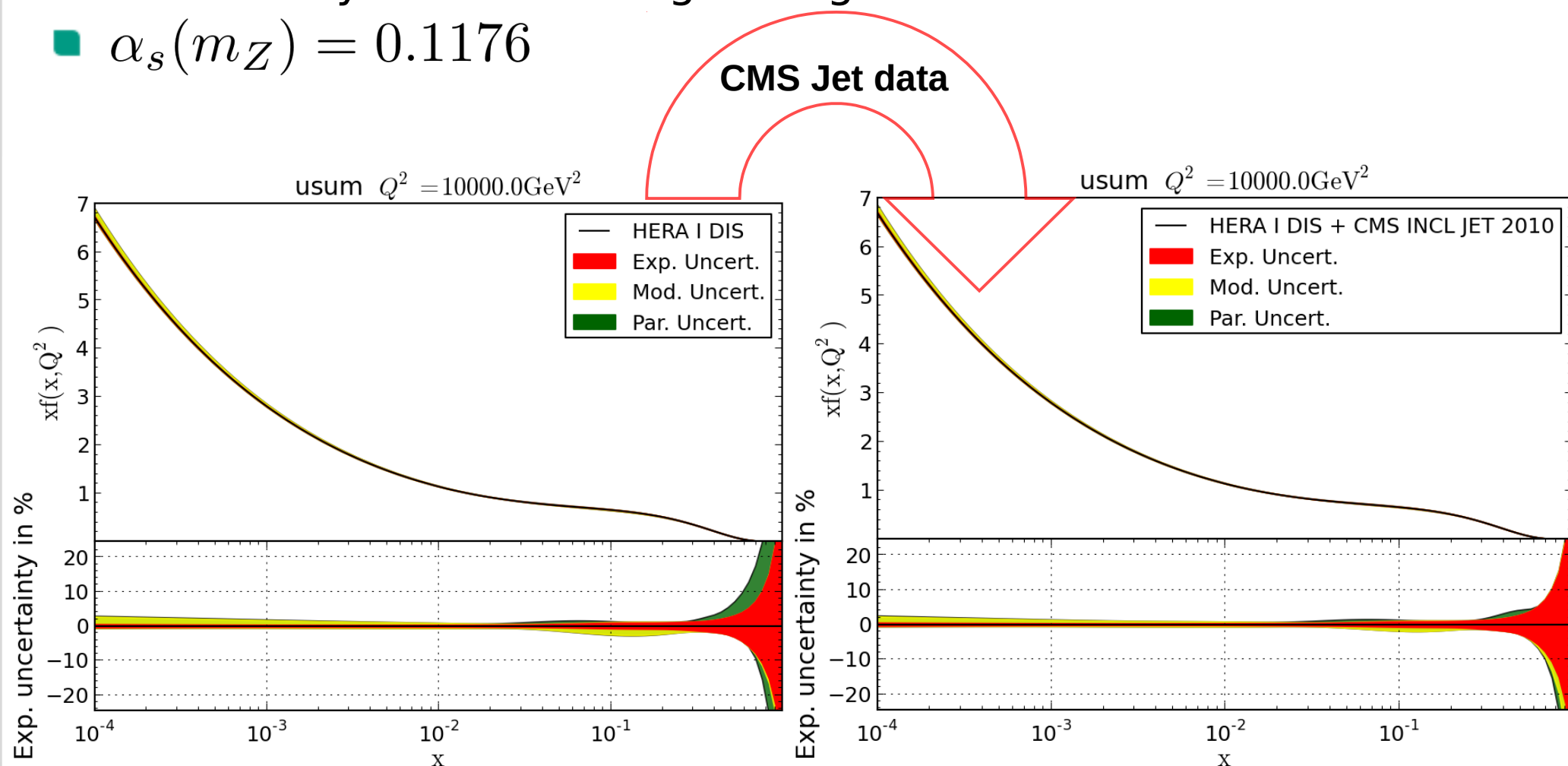
Fits with CMS Inclusive Jets 2010

- **Gluon PDF**
- Uncertainty reduced in high- x region
- $\alpha_s(m_Z) = 0.1176$



Fits with CMS Inclusive Jets 2010

- **Up Quark PDF**
- Uncertainty reduced in high- x region
- $\alpha_s(m_Z) = 0.1176$



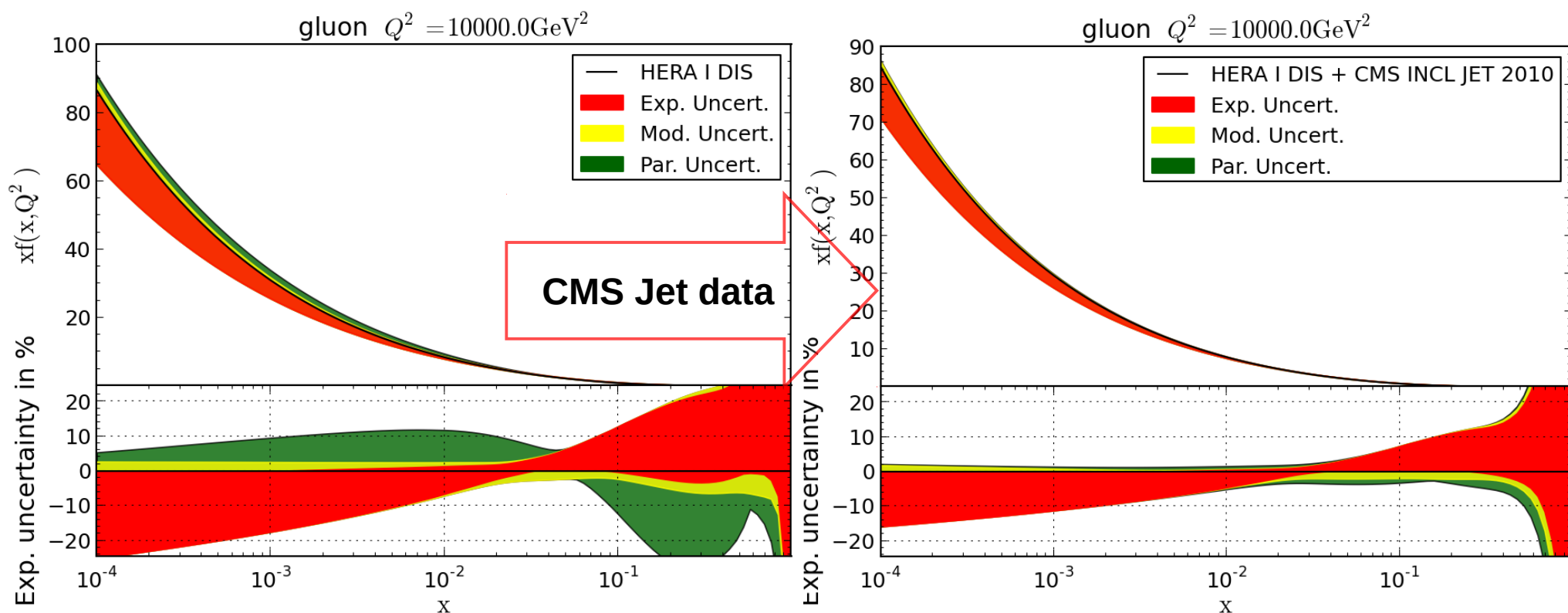
Fits with CMS Inclusive Jets 2010

■ Gluon PDF

■ $\alpha_s(m_Z)$ free parameter in fit

→ Uncertainty on α_s absorbed in experimental uncertainty

→ Jet data decorrelates gluon PDF and α_s





Summary

- HERAFitter is a versatile software tool which allows to estimate the influence of new data on PDFs
- Study with CMS Inclusive Jets 2010 and HERA I DIS data
 - Sensitive to quark and gluon PDF
 - Inclusive jets reduce uncertainty in high- x region
 - Jet data decorrelates the gluon PDF and α_s
- CMS Inclusive Jets 2011 data will be published soon
 - ~150 times more data
 - full study and separation of systematic uncertainties
 - interesting input for further PDF studies