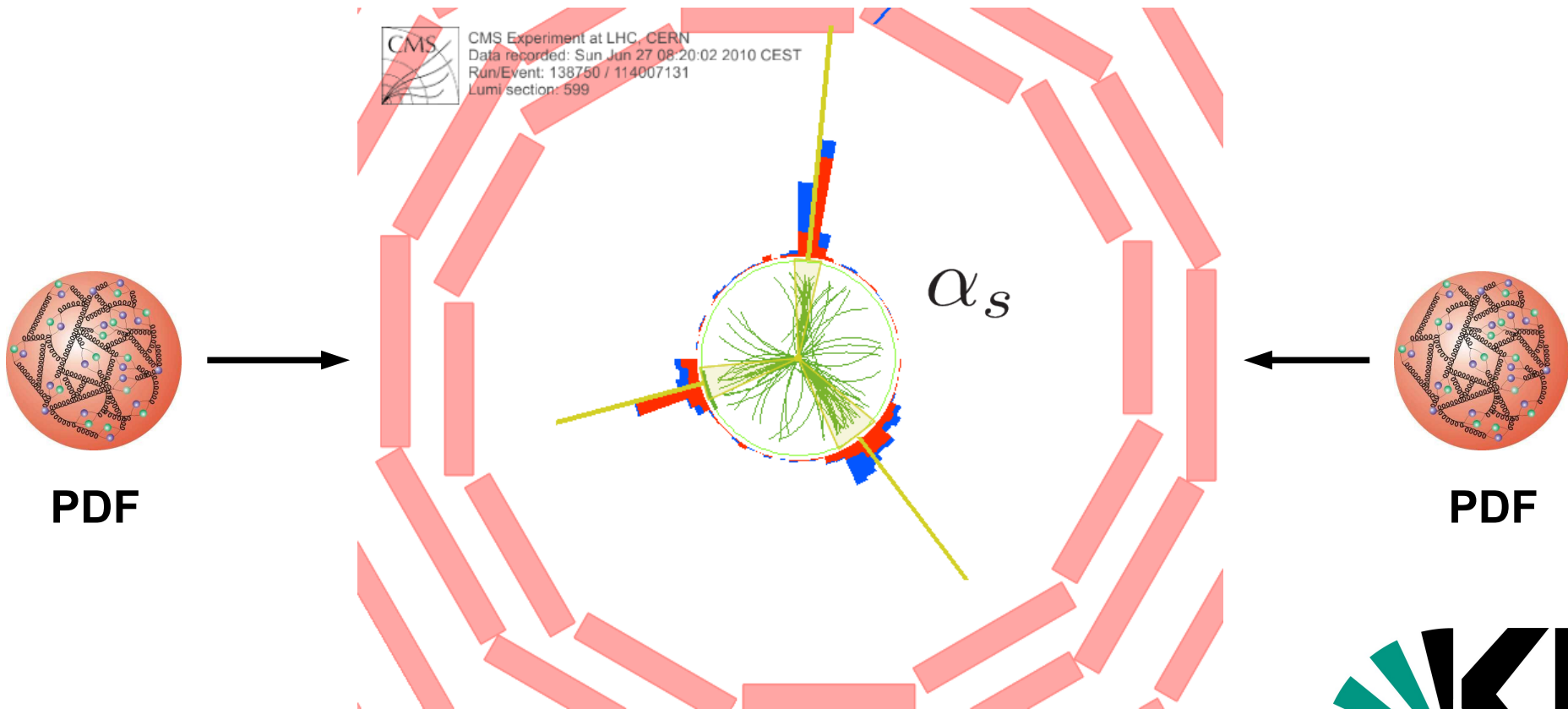


Proton Structure Analysis

Jet Production and Impact on PDFs (after HERA)



Klaus Rabbertz, KIT



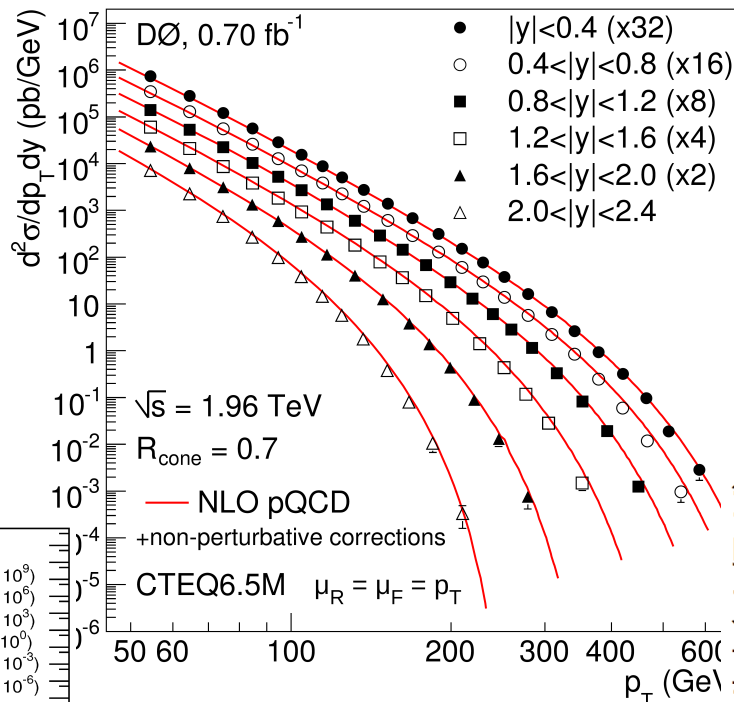
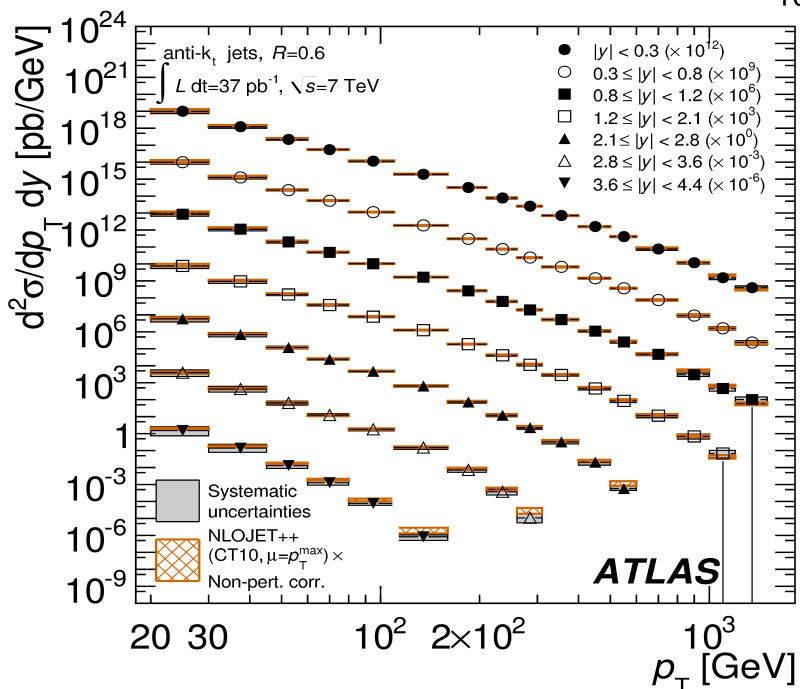
Inclusive Jets

Already now:

Precise measurements

- up to rapidities of about 5
- over 2 orders of magnitude in jet p_T
- over 10 orders of magnitude in jet cross section!

anti-kT, R=0.6

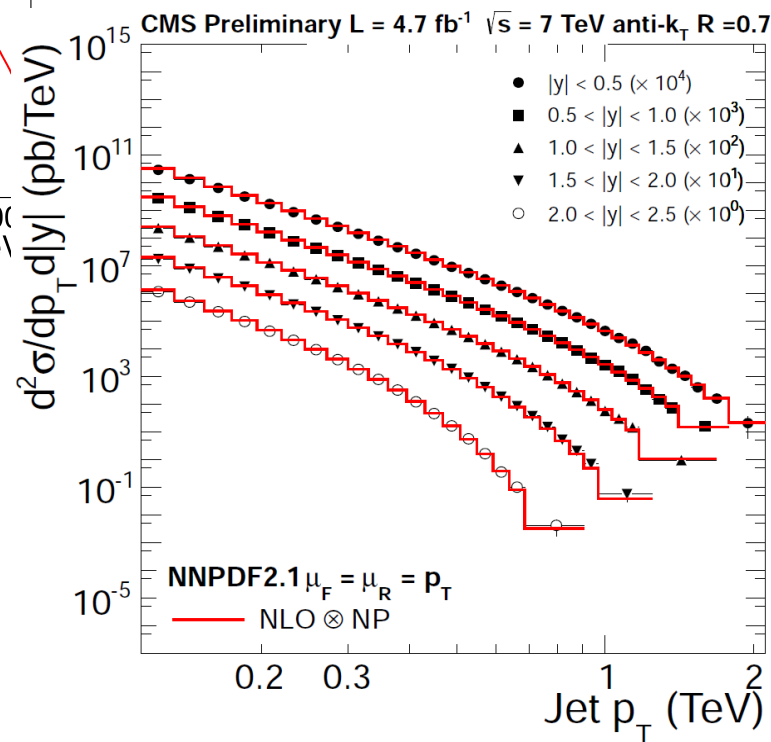


MidpointCone, R=0.7

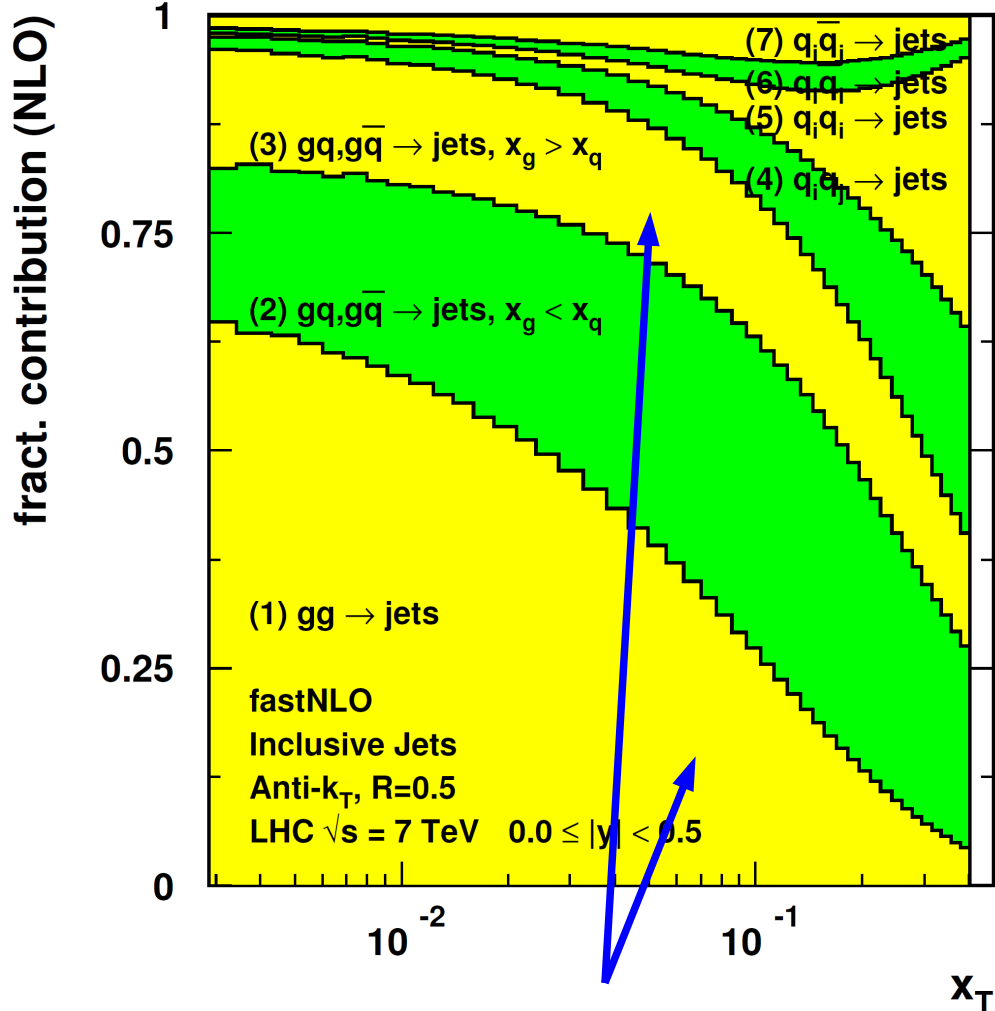
ATLAS, arXiv:1112.6297
 CMS-PAS-QCD-11-004
 D0, arXiv:1110.3771

$$\frac{d^2 \sigma}{dp_T dy} \propto \alpha_s^2 \cdot f(x_1) \cdot f(x_2)$$

anti-kT, R=0.7



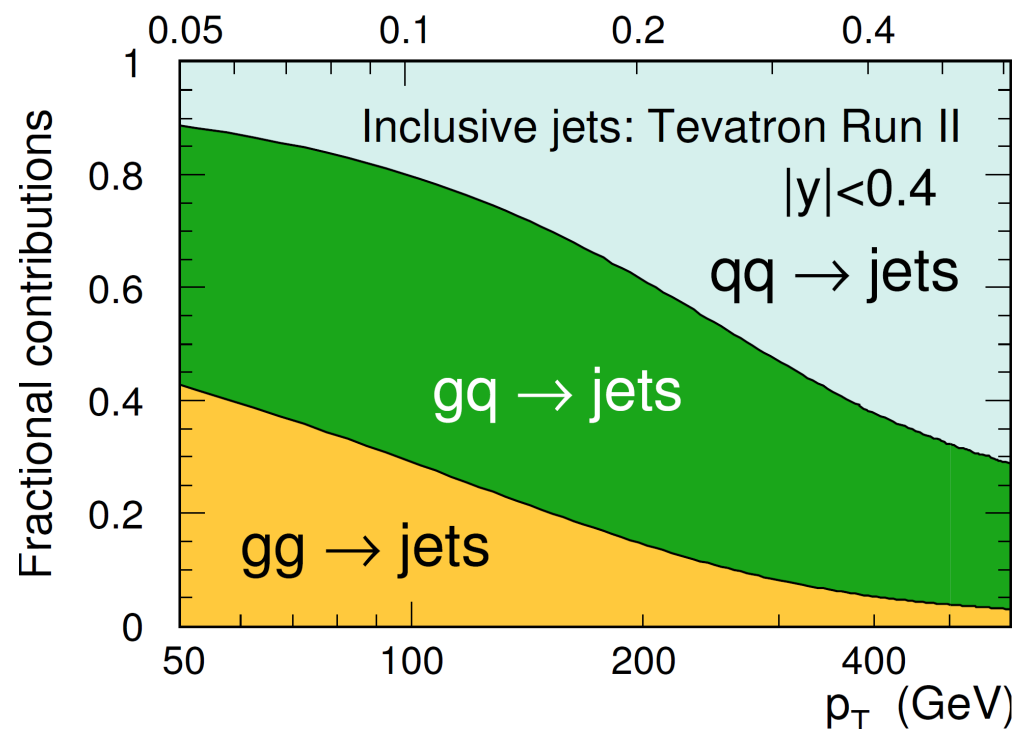
Process Decomposition



LHC

Tevatron

$$x_T = 2p_T/\sqrt{s}$$

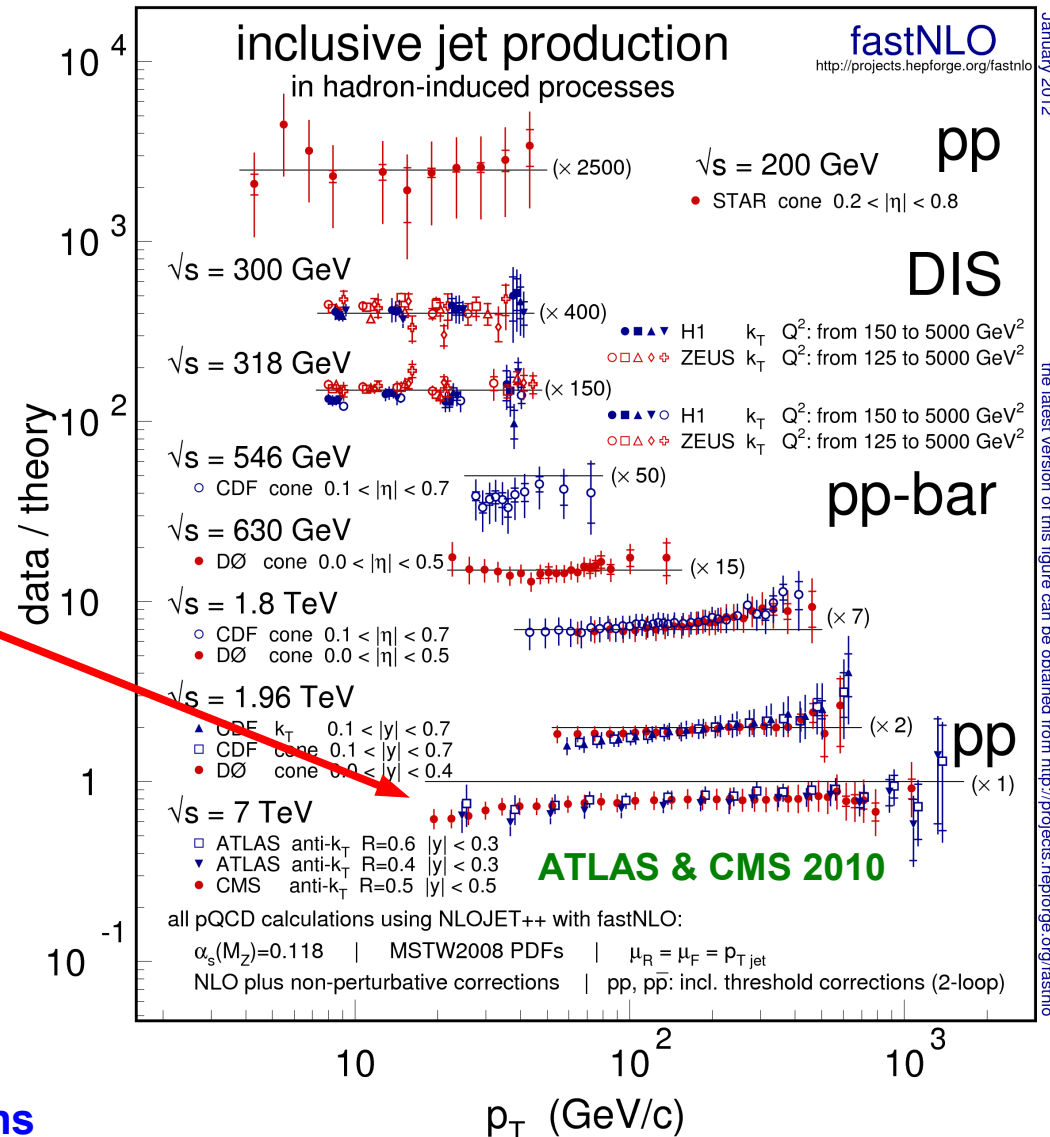


Access gluon at high x

But fraction decreasing vs. highest p_T (or x_T) ...

Global Jet Comparison

- Comparison of jet data from
 - STAR at RHIC
 - H1 and ZEUS at HERA
 - CDF and D0 at Tevatron
 - ATLAS and CMS at LHC
 not yet included in PDF fits

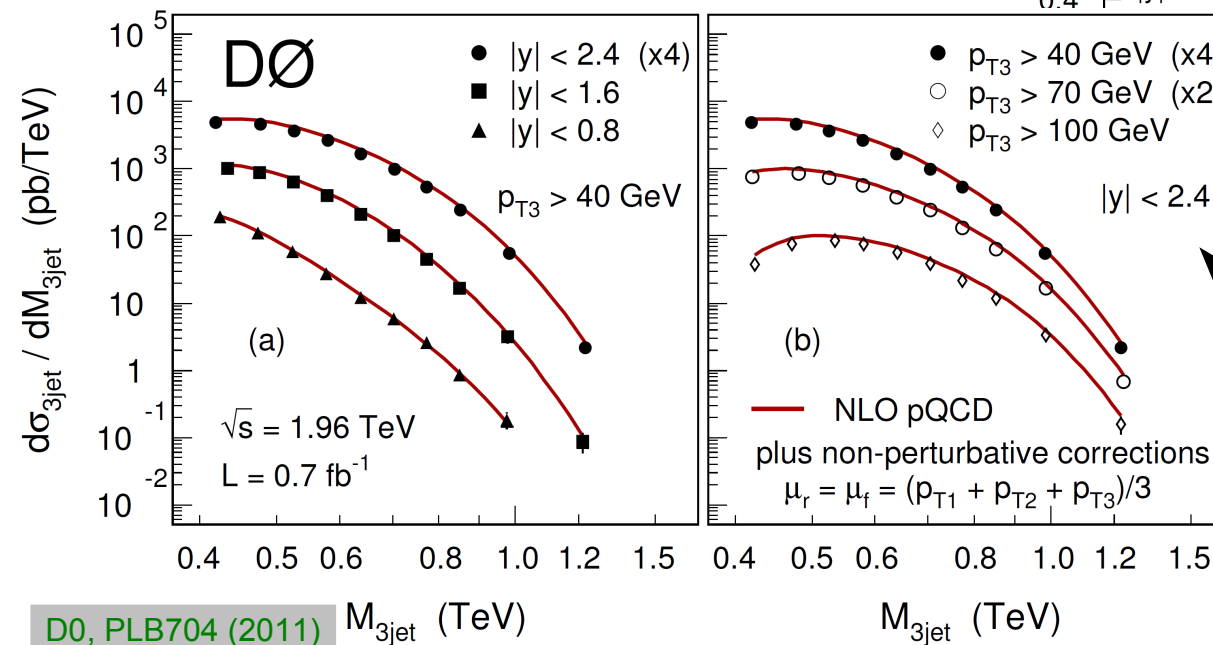
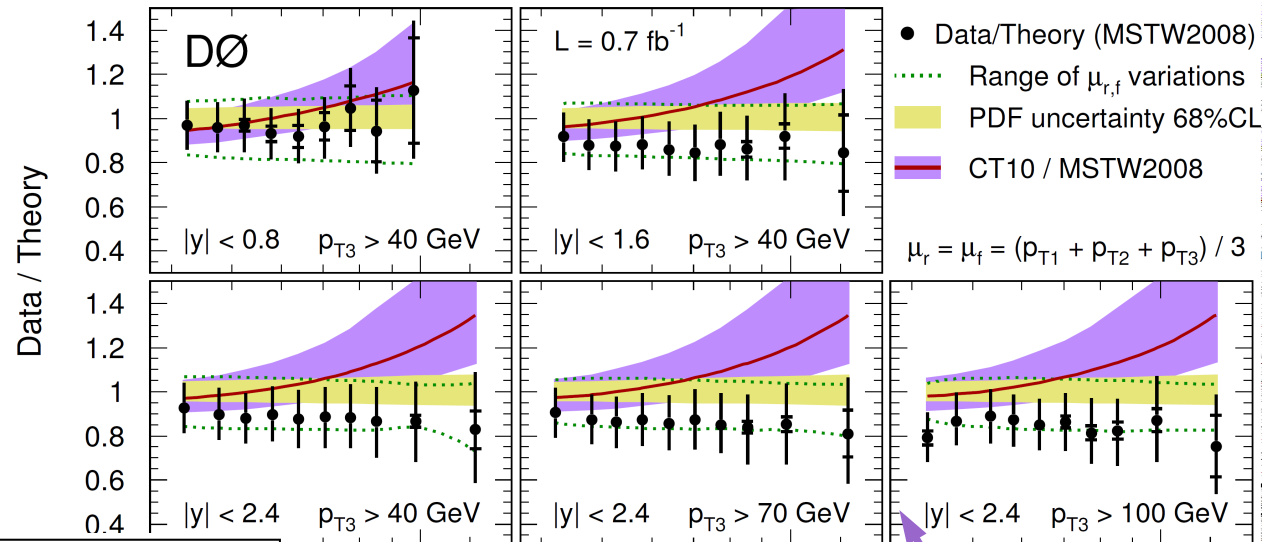


MSTW2008 NLO PDFs
(N)NLO ⊗ NP Corrections
Incl. Jets with threshold corrections

fastNLO, to be uploaded, arXiv:1109.1310v2, 2012

3-Jet Mass - not from LHC yet

- ➔ Sensitive to α_s beyond 2→2 process
- ➔ Known at NLO (NLOJet++)
- ➔ Sensitive to PDFs
- ➔ Involves additional “scale” $p_{T,3}$



Most PDFs work ok, CT10 is off
D0 investigated 3 different
lower pT thresholds $p_{T,3}$ and
3 max. rap. y

$$\frac{d\sigma_{3jet}}{dM_{3jet}} \propto \alpha_s^3$$

D0, PLB704 (2011) M_{3jet} (TeV)



Post HERA Aera

- **Many beautiful jet results:**
 - ➔ **Final ones to come from HERA**
 - ➔ **Last data from Tevatron to be analyzed**
 - ➔ **New measurements from ATLAS and CMS**
- **QCD at hadron colliders is becoming PRECISION PHYSICS**
- **Primary goal: Continue work to get the best PDFs including existing jet measurements and also future ideas for observables for our predictions**
- **Only then we can put the most stringent limits ... or find something new**
- **The work we foresee here is closely connected to the fastNLO project supported at a best effort level by the involved people (see Markus' talk for future potential)**



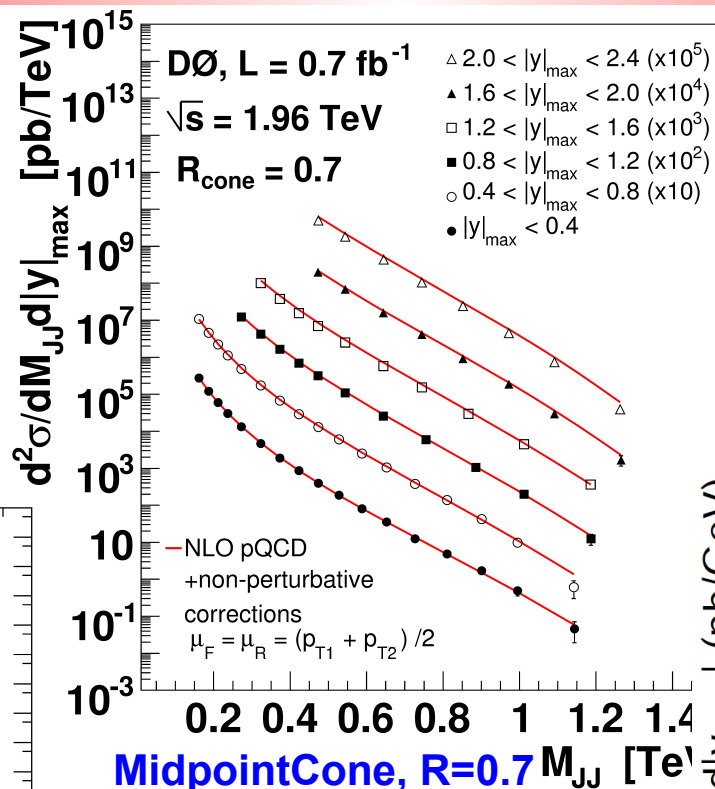
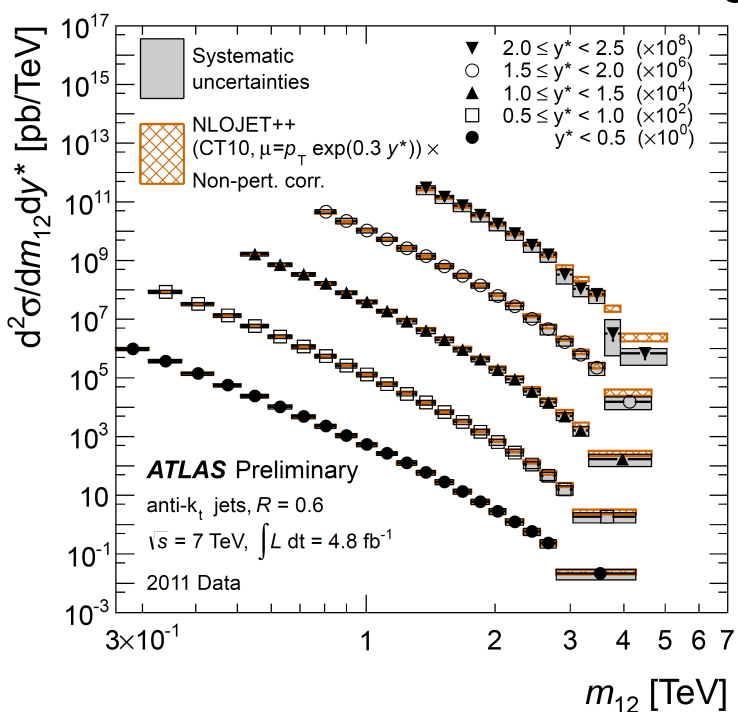
Backup Slides

Dijet Mass

**Again:
Precise measurements**

- up to rapidities of about 5
- up to dijet masses of 5 TeV
- over 8 orders of magnitude in jet cross section!

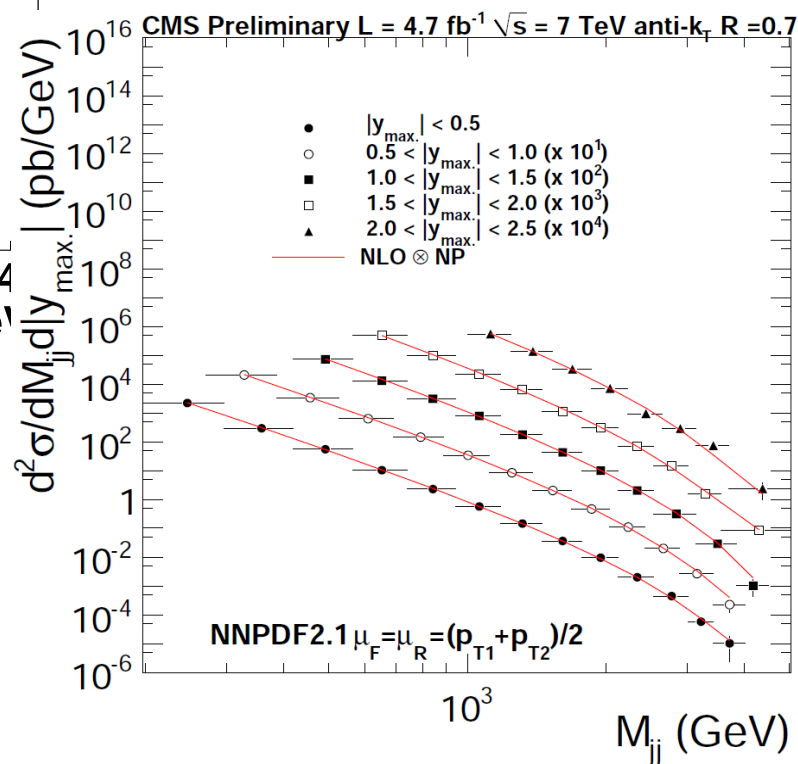
anti-kT, R=0.6



ATLAS-CONF-2012-021
CMS-QCD-PAS-11-004
D0, PLB693 (2010)

$$\frac{d^2 \sigma}{dM_{JJ} d|y_{max}|} \propto \alpha_s^2$$

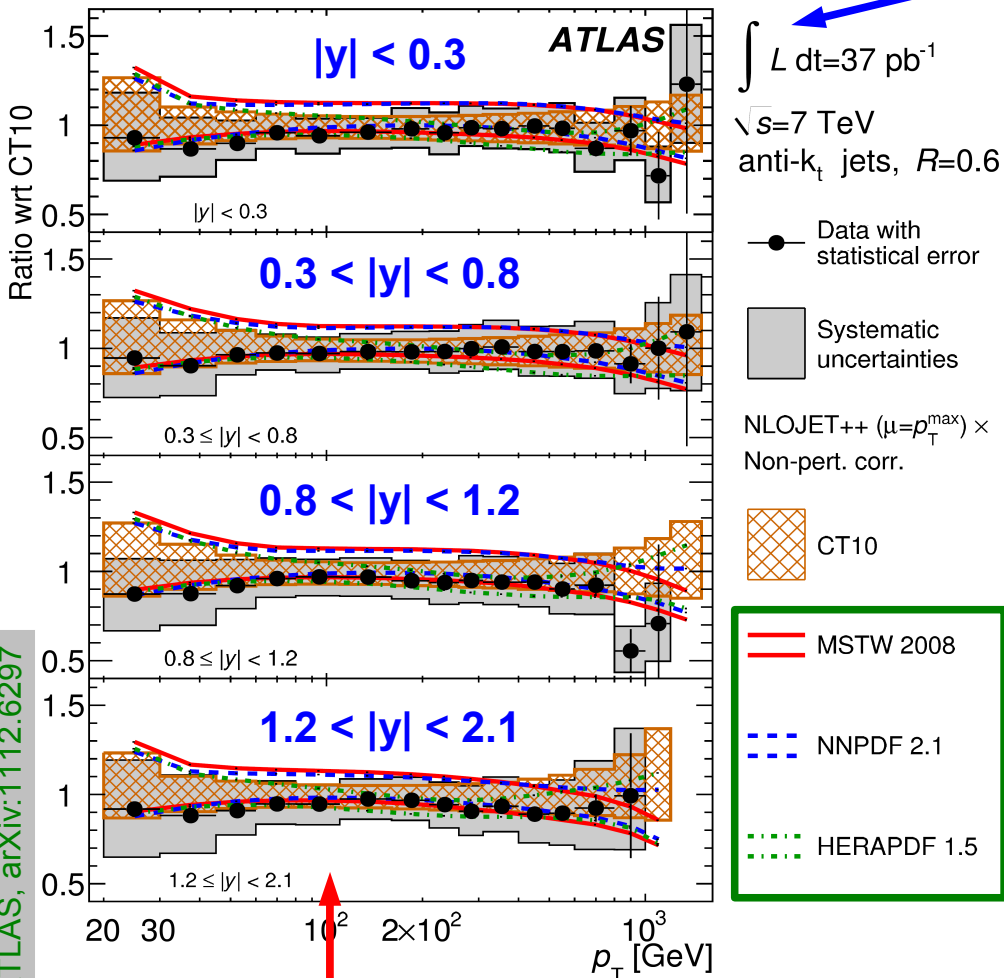
anti-kT, R=0.7



Detailed Comparison to PDFs

Compatibility with QCD so far using diverse PDFs

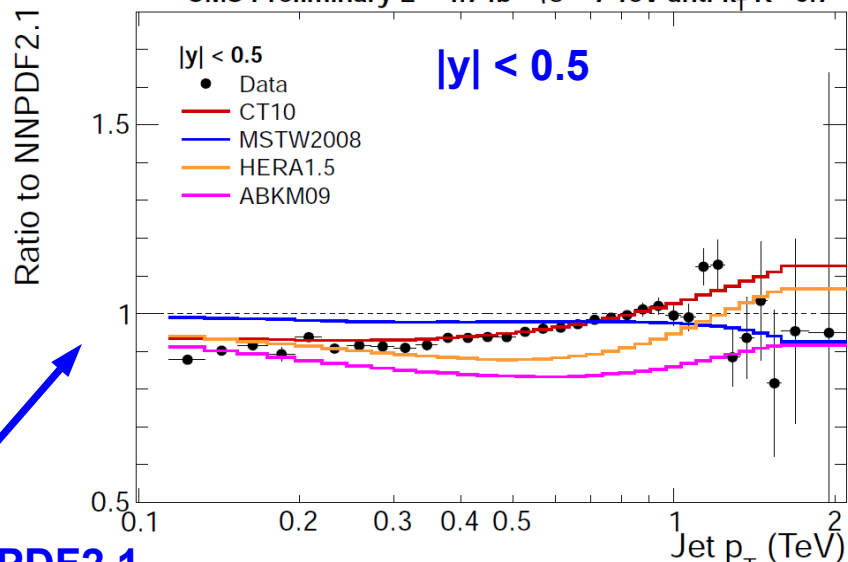
R=0.6



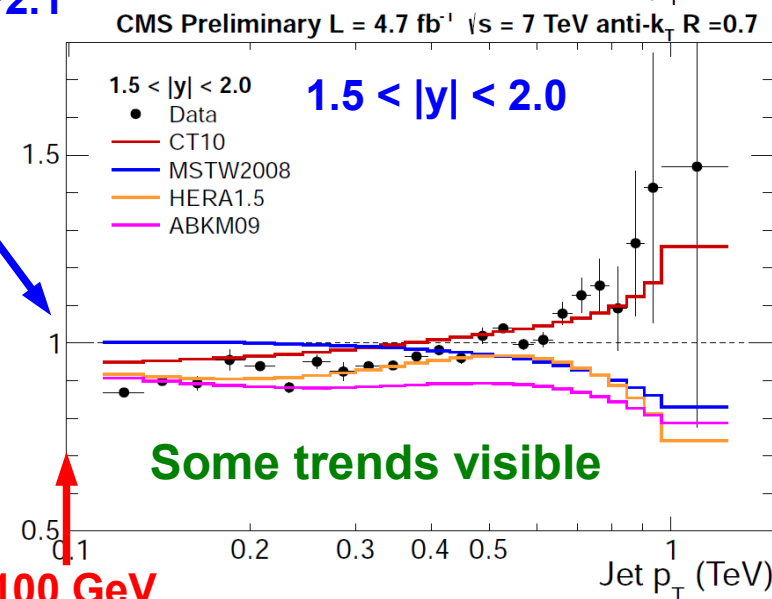
100 GeV

Ratio to CT10

Ratio to NNPDF2.1

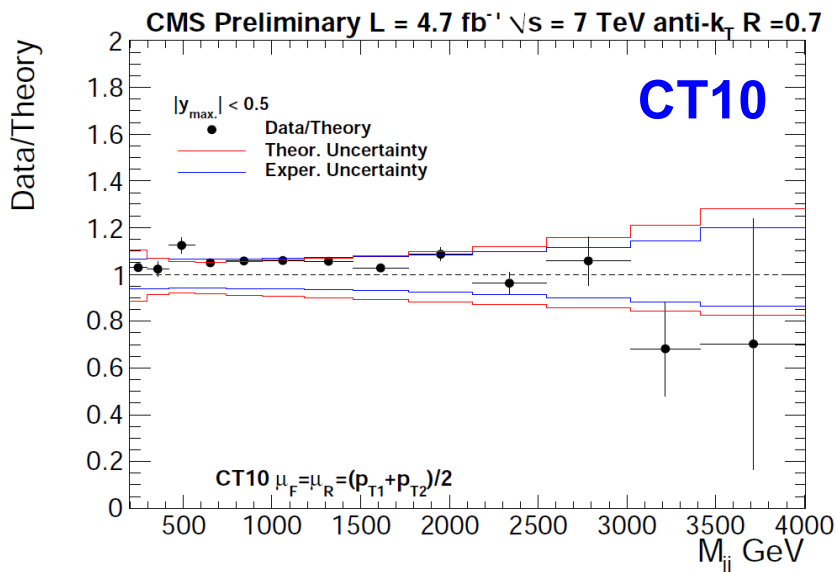


Ratio to NNPDF2.1

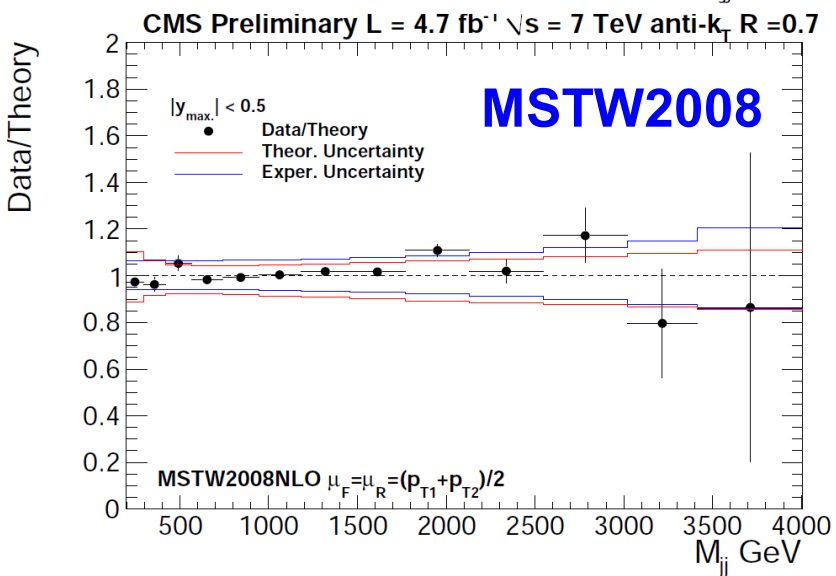
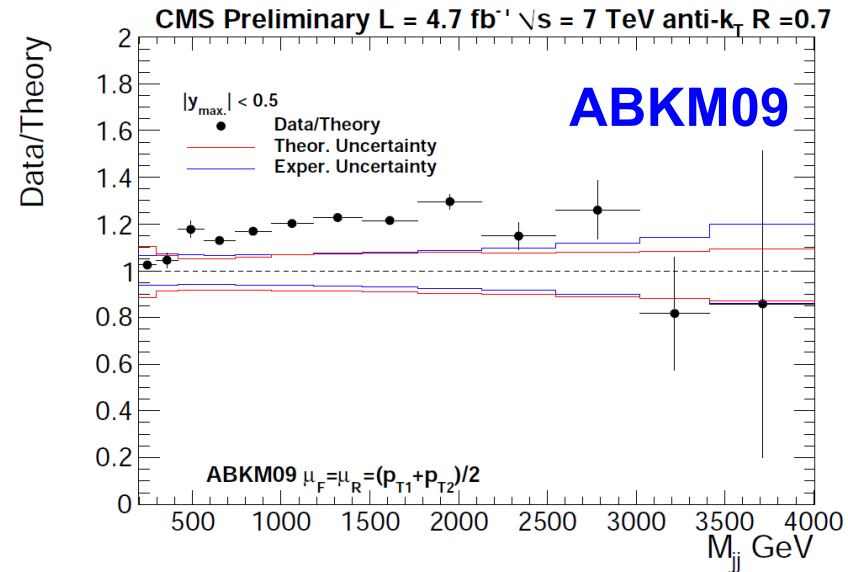


100 GeV

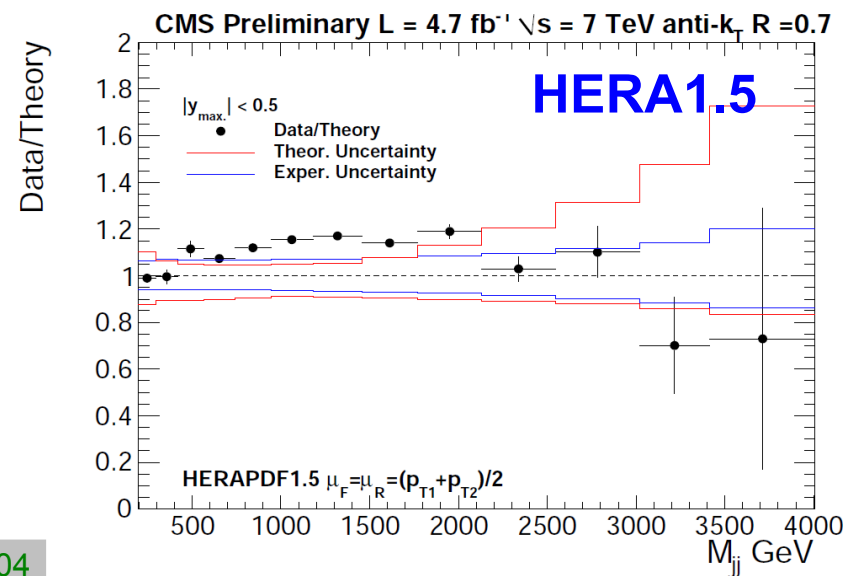
Comparison at $|y_{max}| < 0.5$



Dijet Mass
 $|y_{max}| < 0.5$



Dijet Mass
 $|y_{max}| < 0.5$



CMS-PAS-QCD-11-004