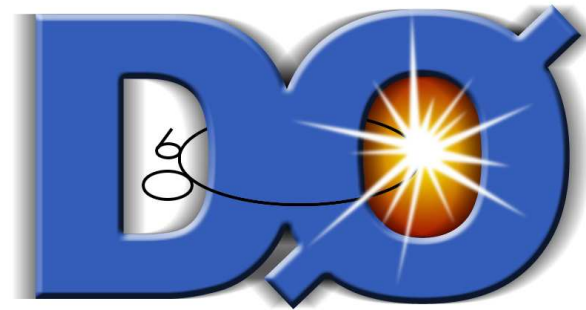

Latest Jet Results from the Tevatron (at $\sqrt{s}=1.96$ TeV)

Duncan Brown

U.Va, Fermilab

On Behalf of the CDF and DØ Collaborations



Moriond Conference on QCD and High Energy
Interactions

La Thuile, March 12th 2008

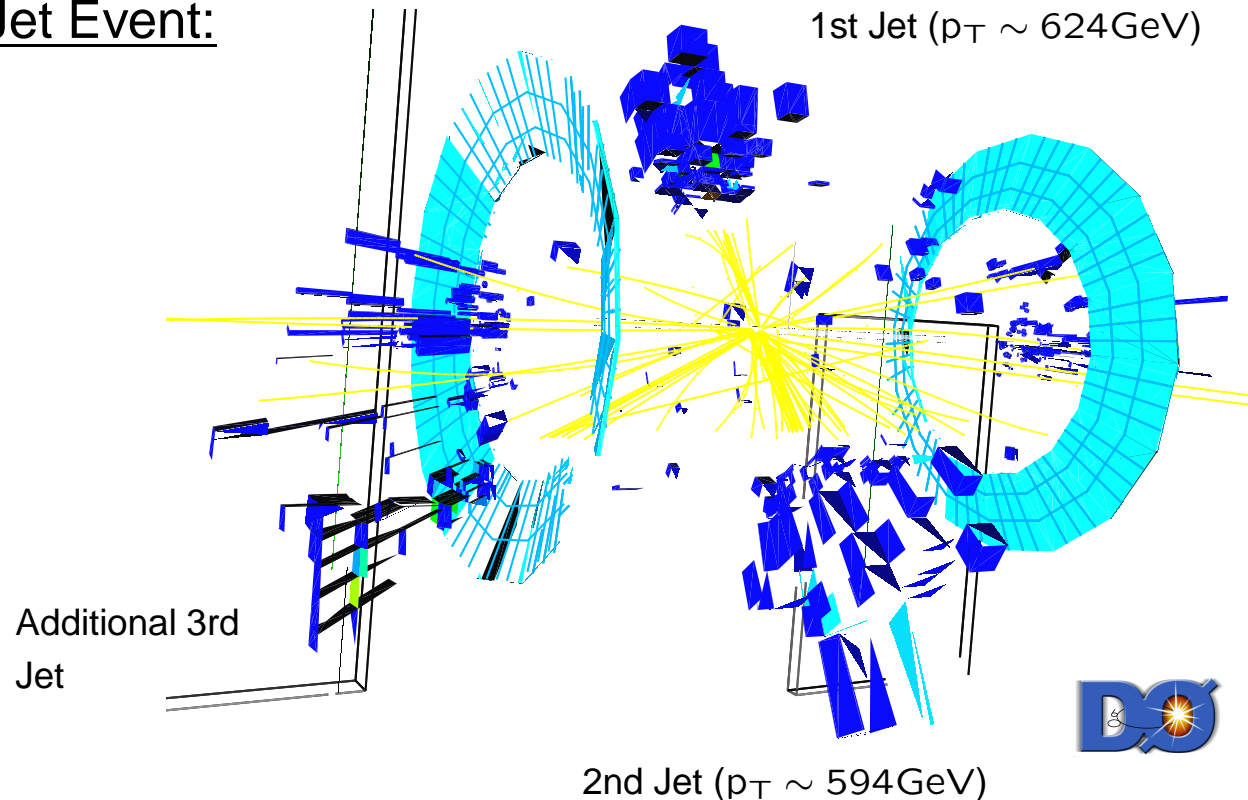
Jet Events at the Tevatron

Tevatron Run II:

$$p \longrightarrow \sqrt{s} = 1.96 \text{ TeV} \longleftarrow \bar{p}$$

($E = 980 \text{ GeV}$) ($E = 980 \text{ GeV}$)

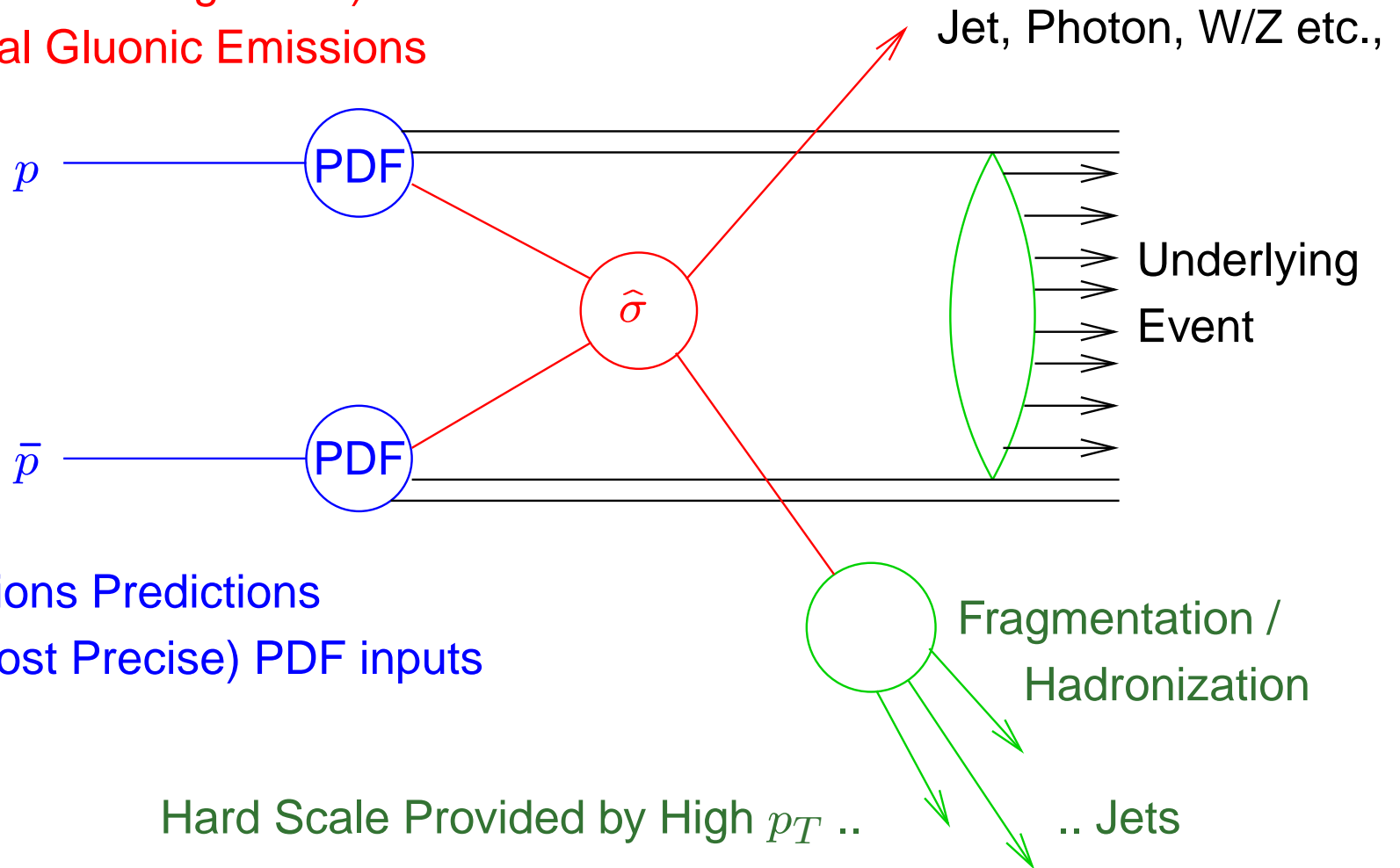
Three-Jet Event:



- Increased \sqrt{s} (and Luminosity) \Rightarrow Extended Kinematic Reach
- \Rightarrow Simultaneously Measure Inclusive (and more Exclusive) Jet Production

Jet Production in pQCD

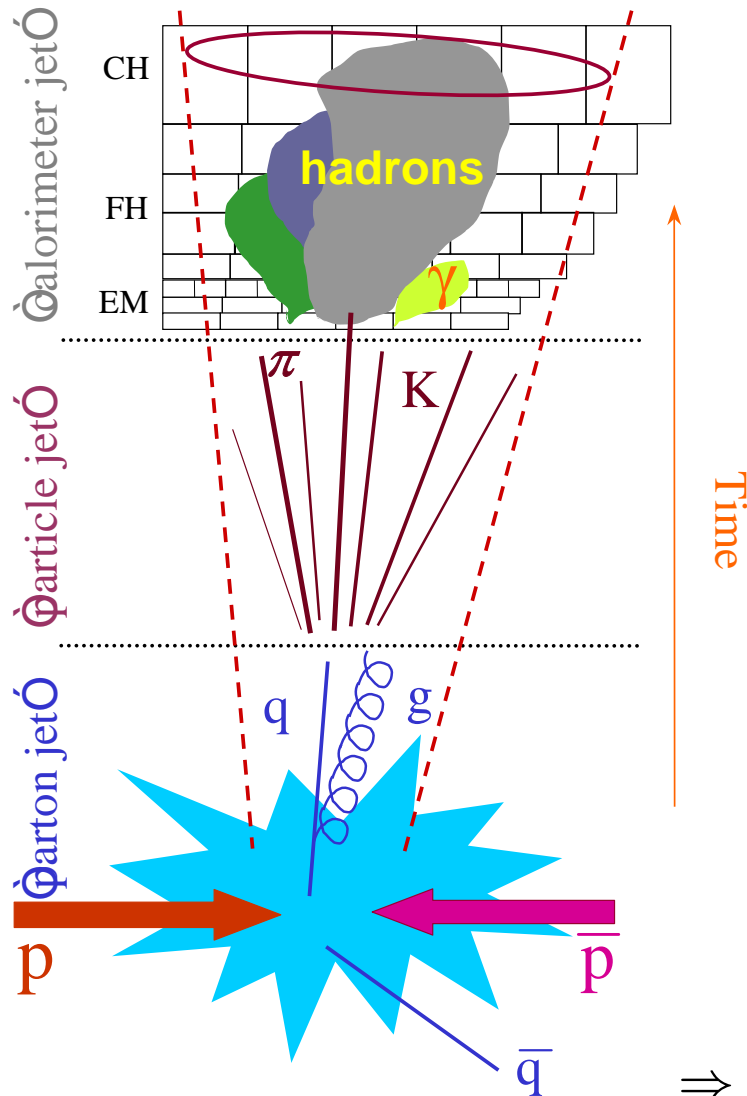
- Jet Formation via QCD Hard Scattering Subprocesses
- NLO (Next-to-Leading Order) Contributions
⇒ Additional Gluonic Emissions



- Cross Sections Predictions
Require (Most Precise) PDF inputs

Jet Measurements at the Tevatron

- Jets Defined via Jet Algorithms



DØ Run II / CDF Midpoint Cone

Iterative Procedure: Cone of Radius

$$\mathcal{R} = \sqrt{(\Delta y)^2 + (\Delta \phi)^2}$$

Split / Merge Jets Using Midpoints

Jet Energy Scale

$$E_{ptcl} = \frac{E_{cal} - \text{Offset}}{(F_{\eta} \cdot R) \cdot S} \cdot k_{bias}$$

Offset: Energy not associated to hard scatter

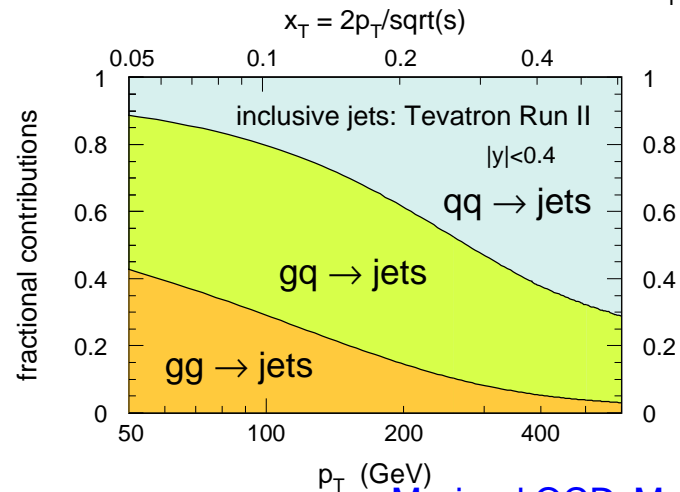
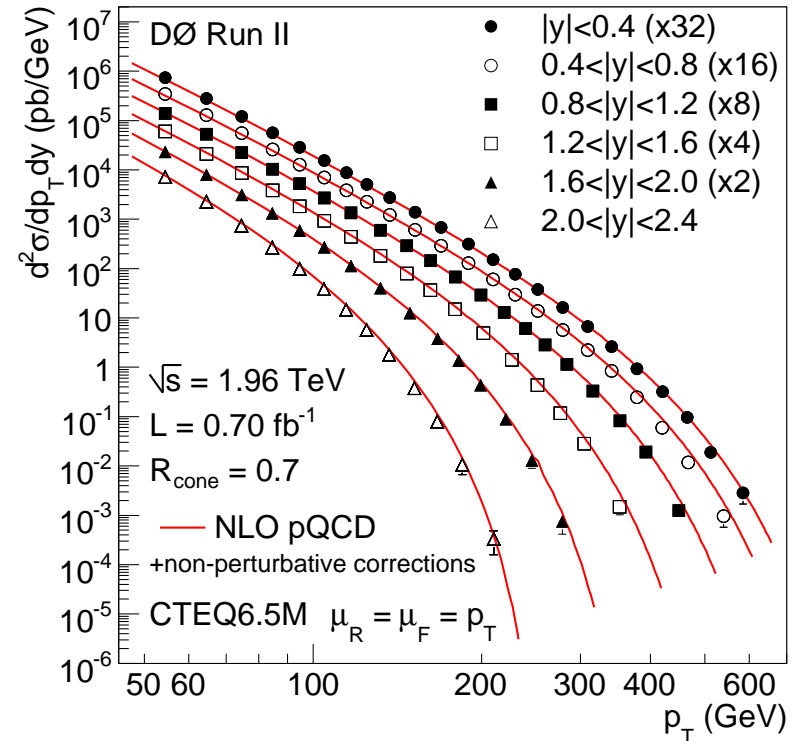
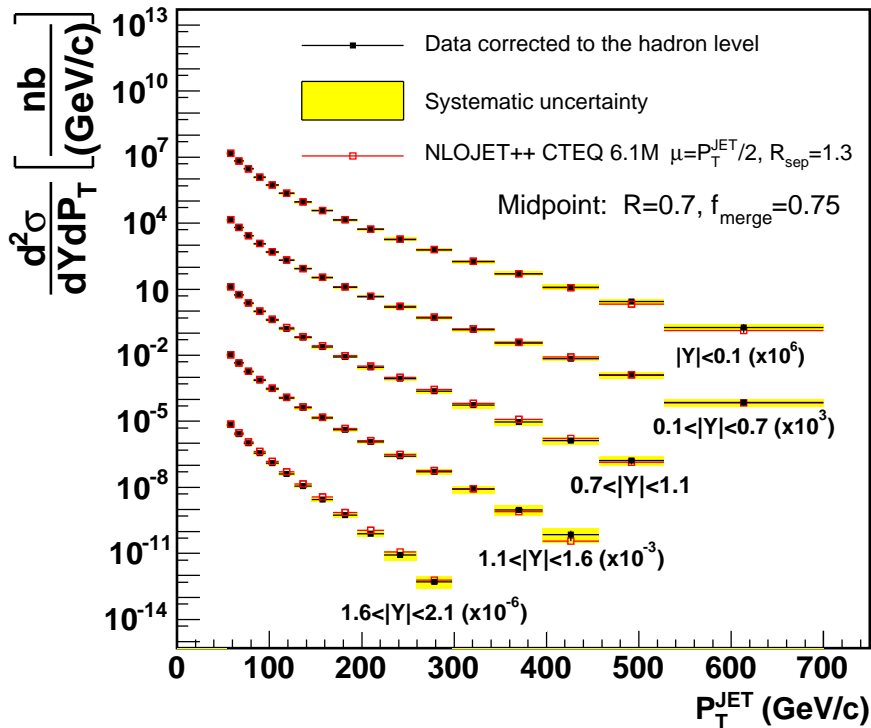
Response: Deposited Particle Energy Fraction

Showering: Energy Flow In/Out of Jet

⇒ Compare Data and Theory at the Hadron Level

Inclusive Jet Production

CDF Run II Preliminary ($L=1.13 \text{ fb}^{-1}$)

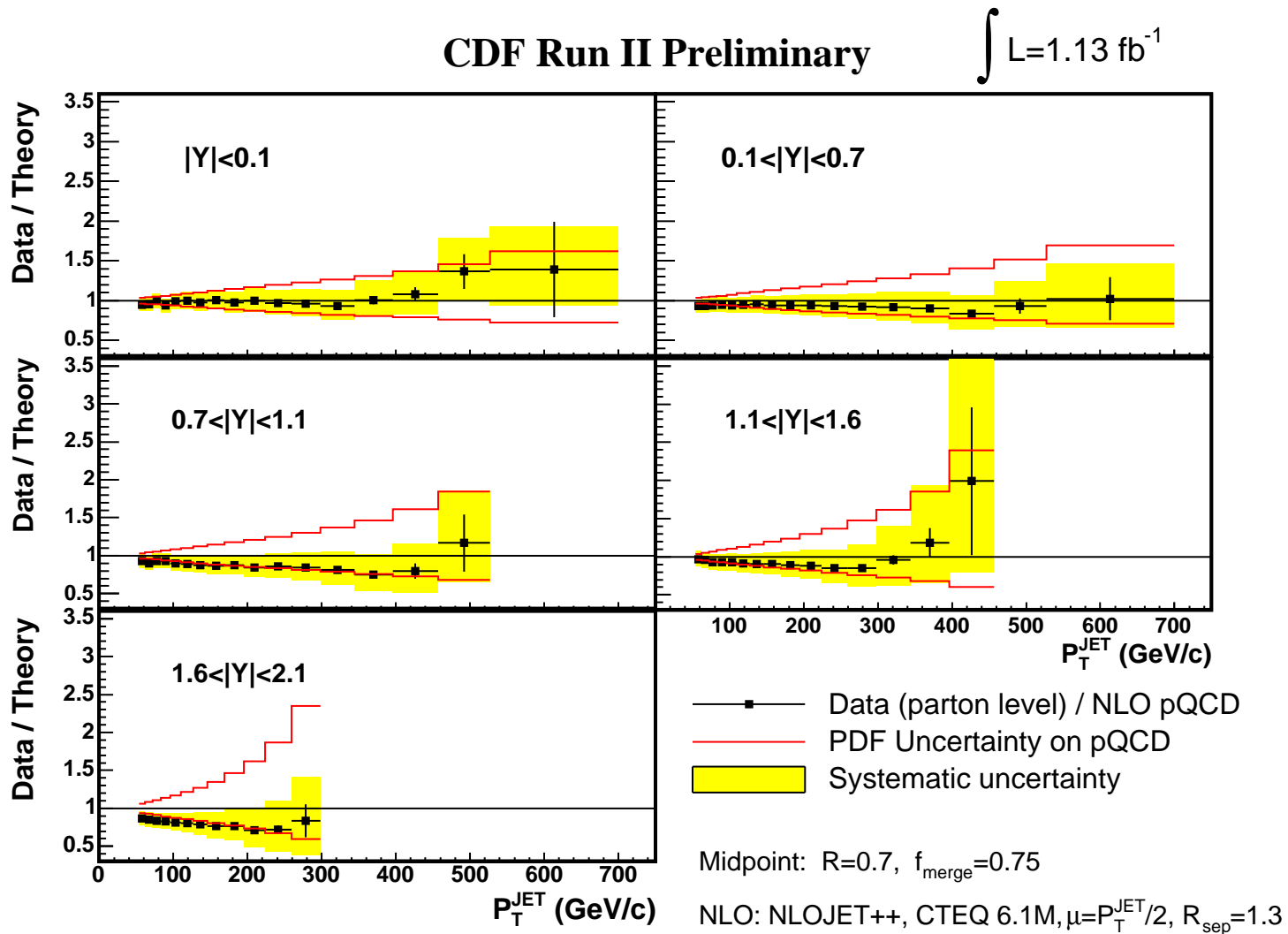


NLO Predictions Give Good Description of the Data

Probe of Gluon PDF Contribution at Large Jet p_T

Inclusive Jet Production

Detailed Comparisons: Data and Theory Compatible within Uncertainties

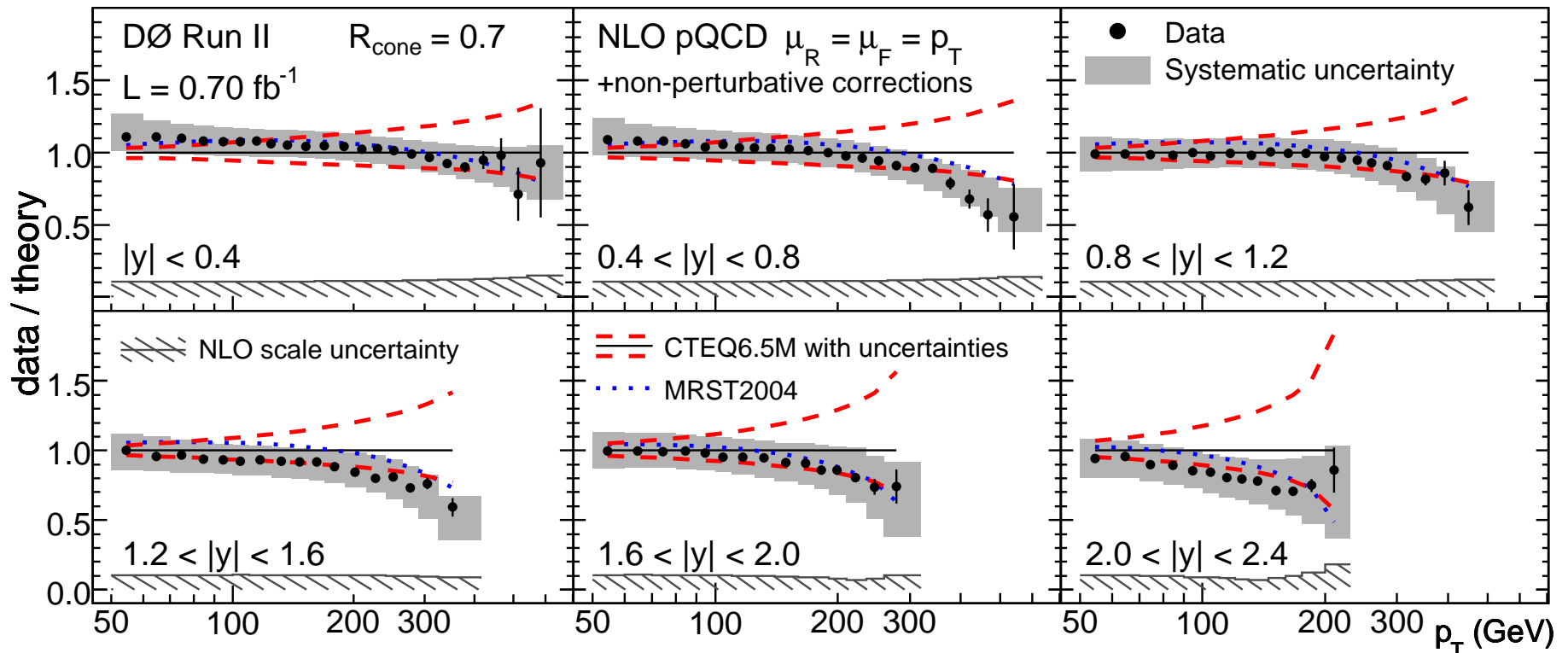


⇒ Data Favour Lower Edge of CTEQ 6.1 PDF Range

Inclusive Jet Production

Data Favour Lower Edge of CTEQ 6.5 PDF Region (at Large Jet p_T)

Shape Well Described by MRST2004



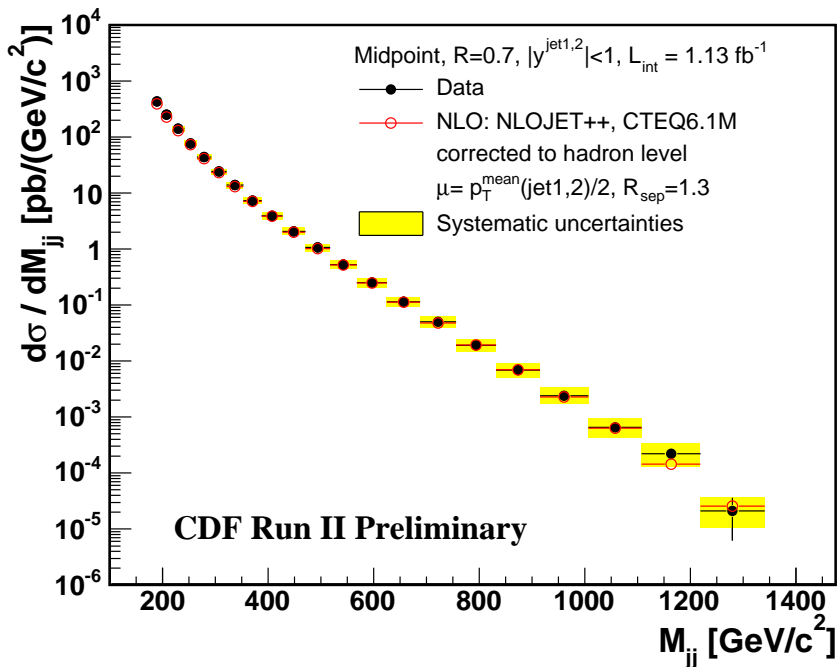
Significantly Reduced Experimental Systematic
Uncertainties

⇒ DØ Data (and Uncertainty Correlations) Available for PDF Fits

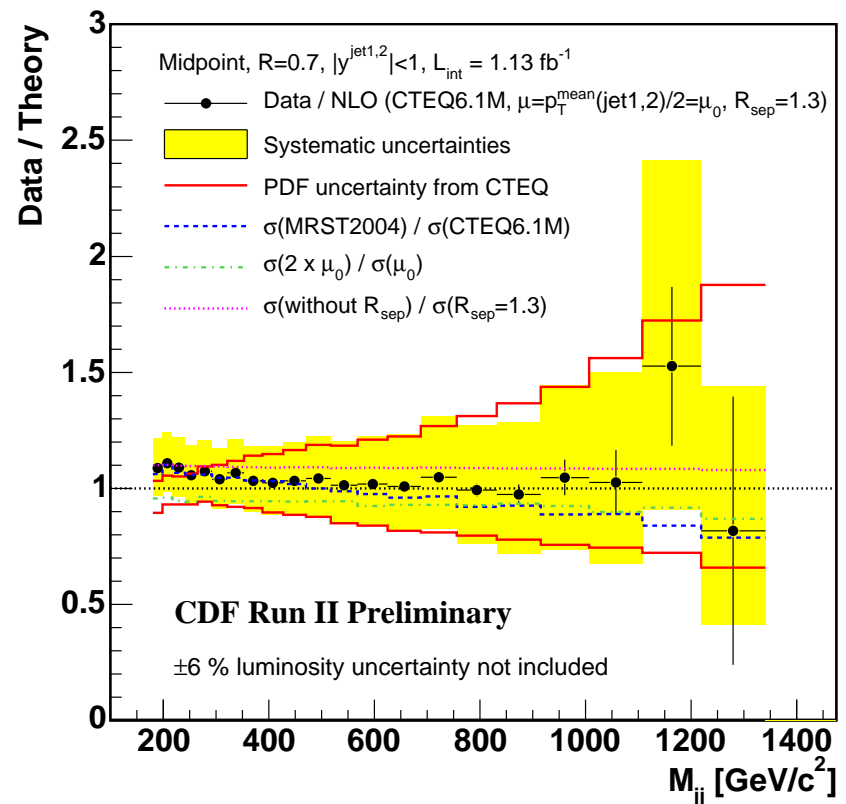
(see: <http://arxiv.org/abs/0802.2400>)

Exclusive Jet Production: Dijet Mass

Central Dijet Production : Implications for New Physics



NLO QCD Predictions Describe Data



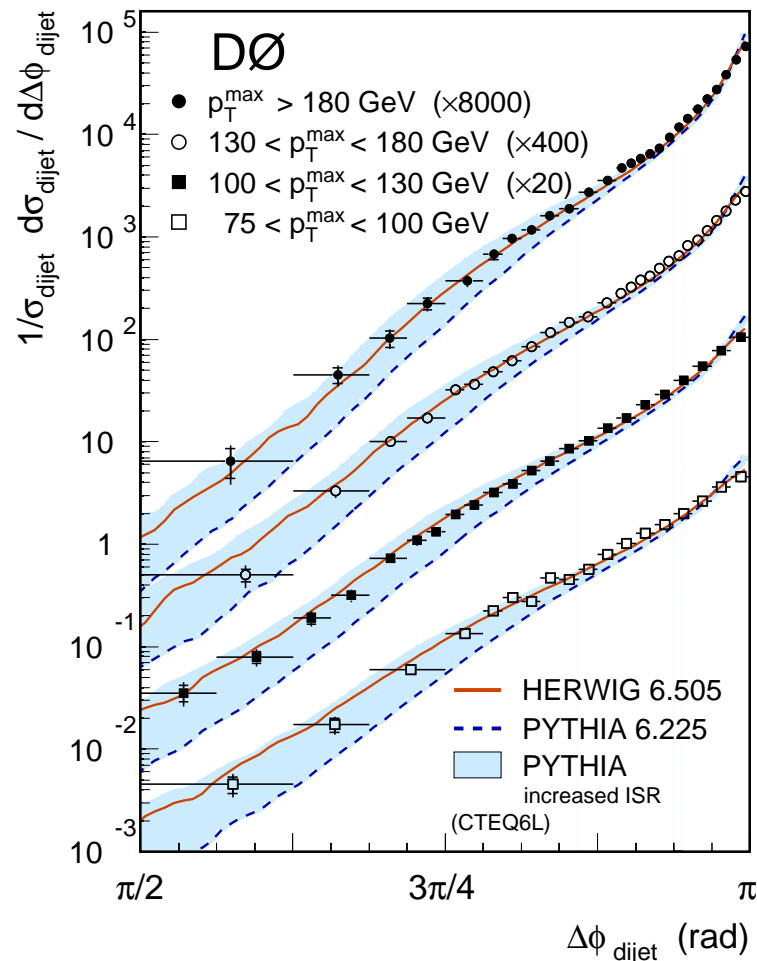
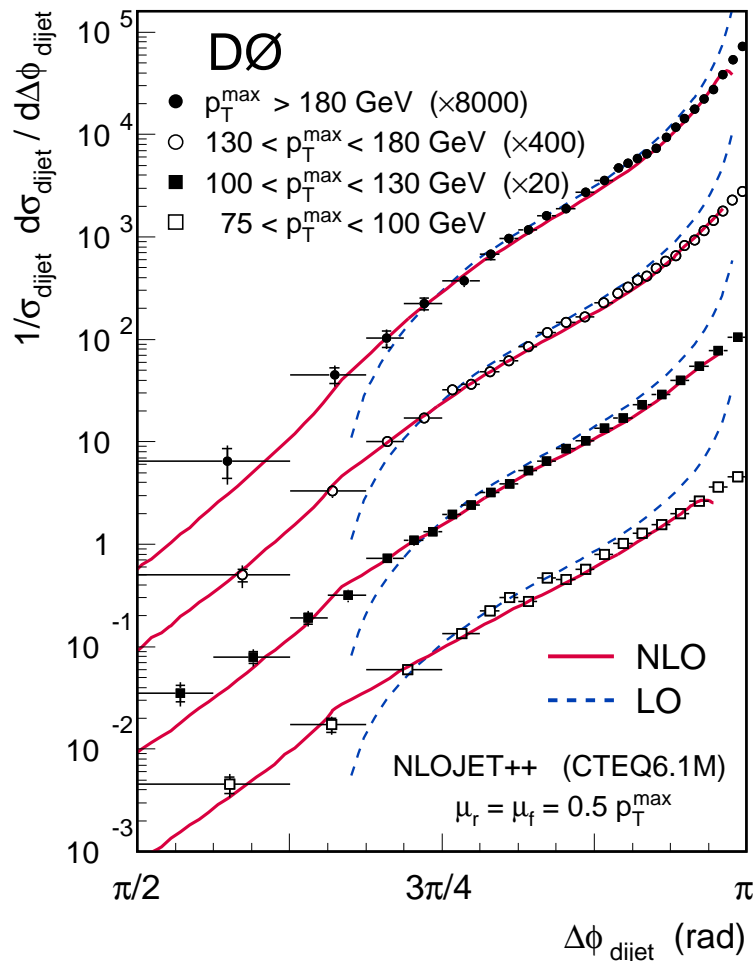
⇒ Limits Set for Excited Quark, Massive Gluon and Z'/W' Scenarios

(see: http://www-cdf.fnal.gov/physics/exotic/r2a/20080214.mjj_resonance_1b/)

Exclusive Jet Production: Dijet Angular Distributions

Probe Transition from Soft Radiation to Additional Jet Production

Additional Jet Production \Rightarrow Strong Dijet Azimuthal Decorrelations



NLO pQCD Describes Data

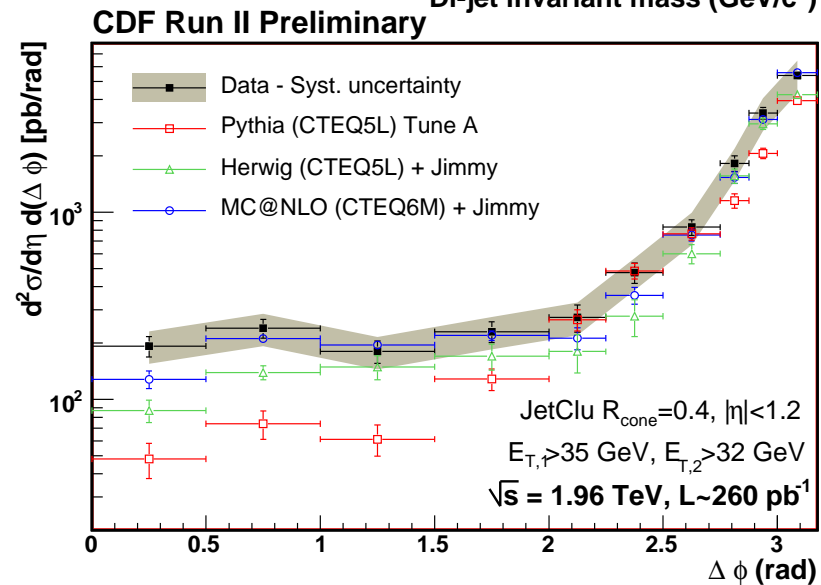
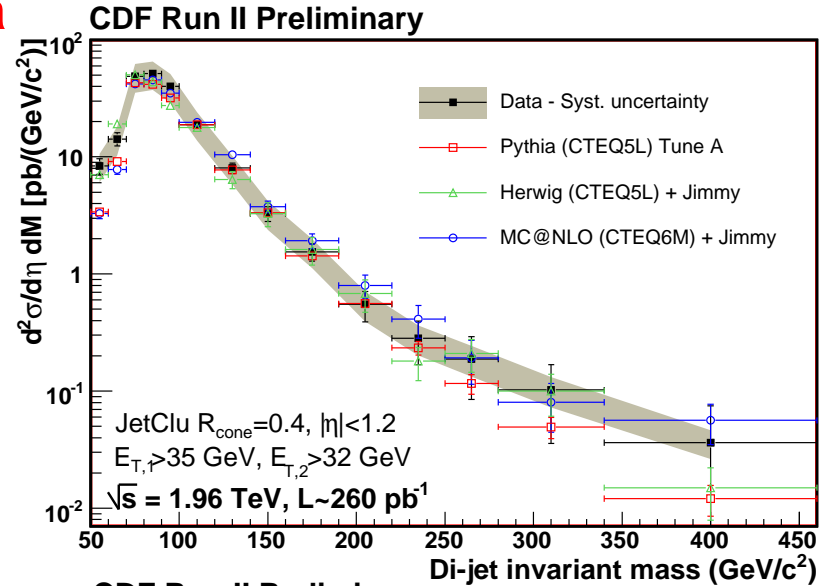
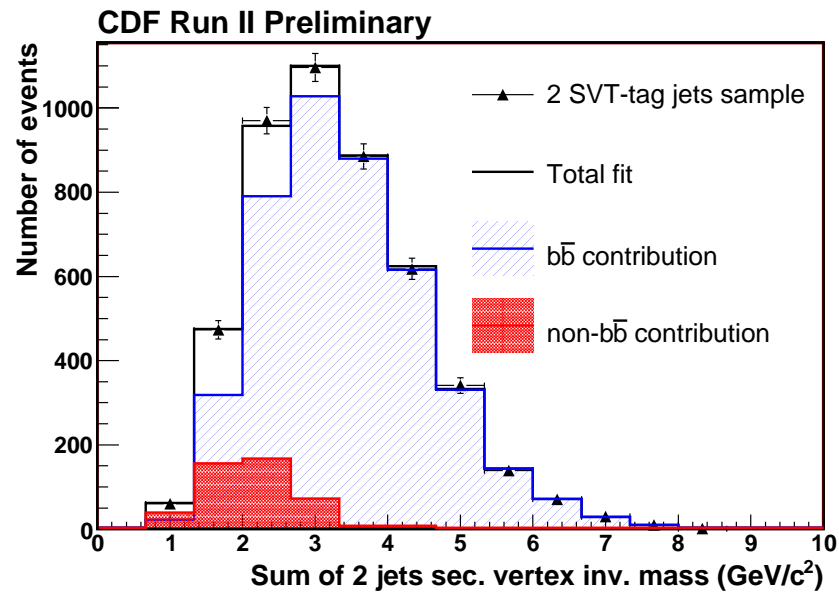
\Rightarrow Test / Tune MC Generators

$b\bar{b}$ Dijet Production (using SVT)

Dedicated Silicon Vertex Trigger Data

Displaced Vertex ($> 120 \mu\text{m}$)
used to Tag b-Jets

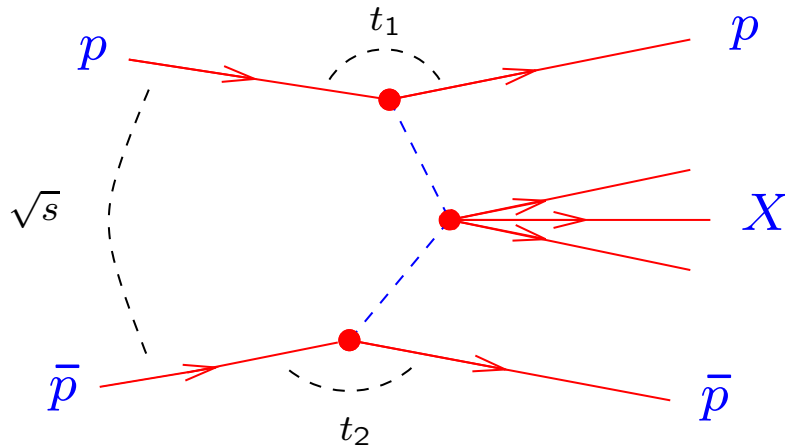
Fit Mass Templates to Extract
Heavy Flavor Contribution



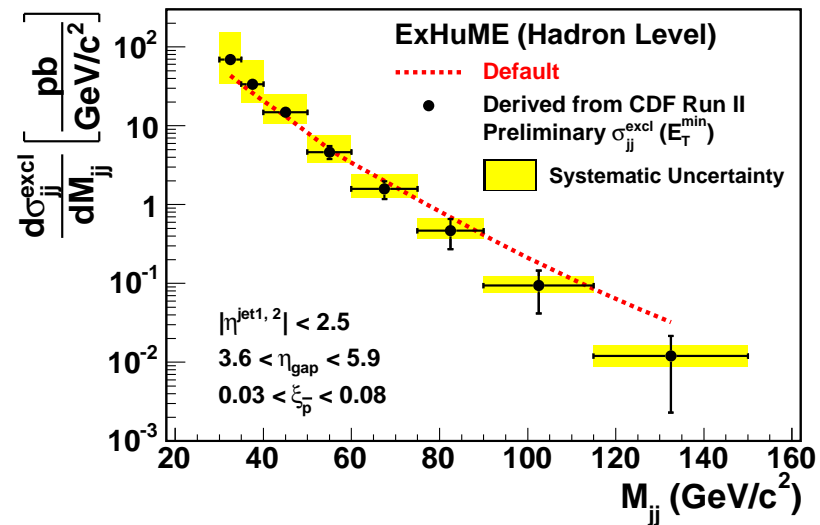
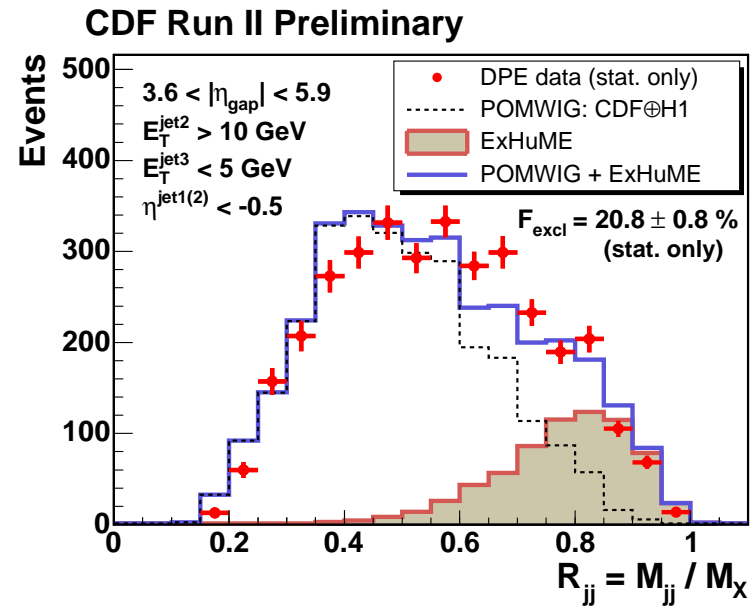
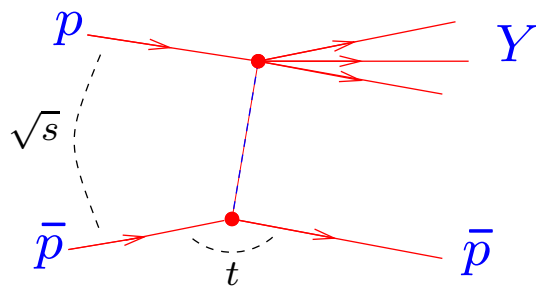
⇒ Higher Order Contributions / Multiple Interactions Important

Exclusive Diffractive Dijet Production

Measure Ratio $R_{JJ} = M_{JJ}/M_X$



Single Diffraction BKGD
(MC POMWIG)



⇒ Calibrating (Higgs Production) Predictions for the LHC

Summary and Outlook

- New Level of Jet Experimental Precision

- ⇒ Jet Measurements Constraining Inputs to pQCD Predictions

- ⇒ Implications for New Physics Searches

Run II Increase in Statistics

- ⇒ Higher Precision Tests over a Large Kinematic Region