PDF's at Large-x

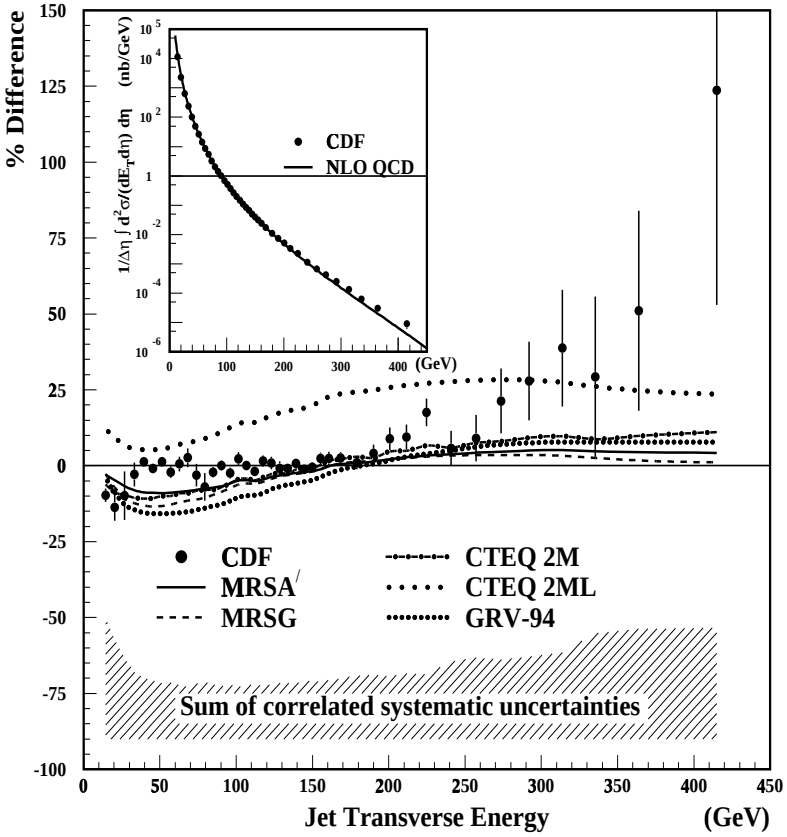
What we don't know can hurt us

Fred Olness

SMU

DIS'2000
24-30 April 200

Why do I care about Hi-x?



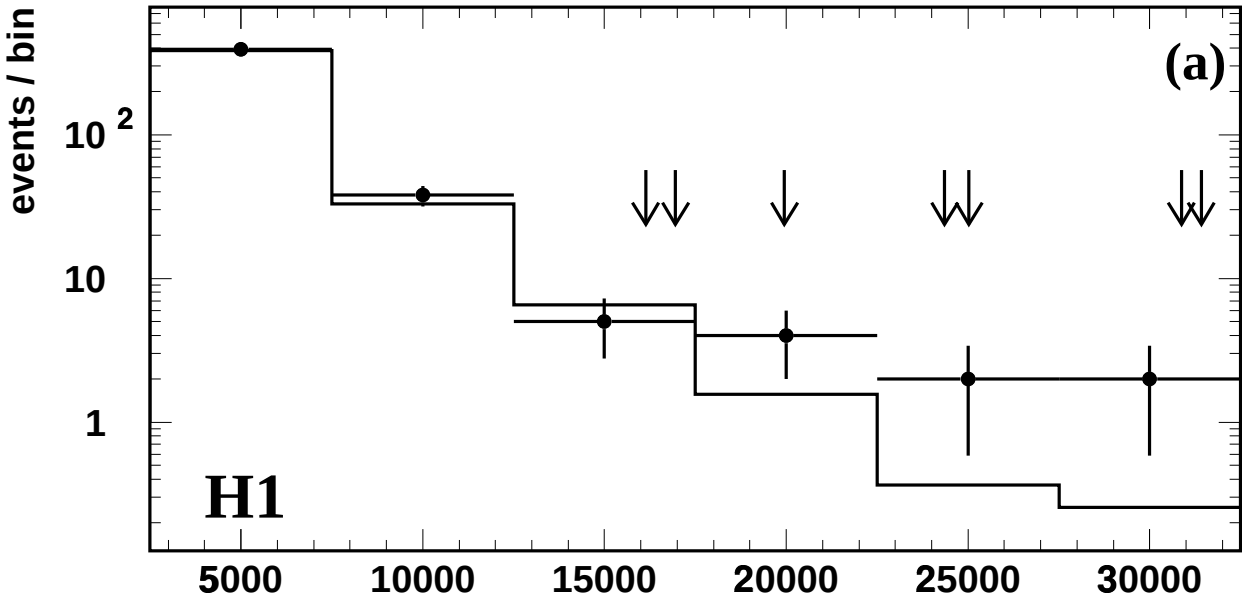
1996: Excess High E_T Jets at Tevatron

Is this a sign of compositeness?

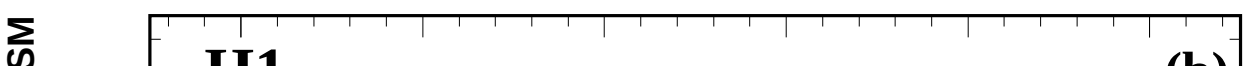
CDF Collaboration
PRL 77, 438 (1996)

1997: Excess DIS events at large $\{x,Q^2\}$

Is this a sign of leptoquarks?



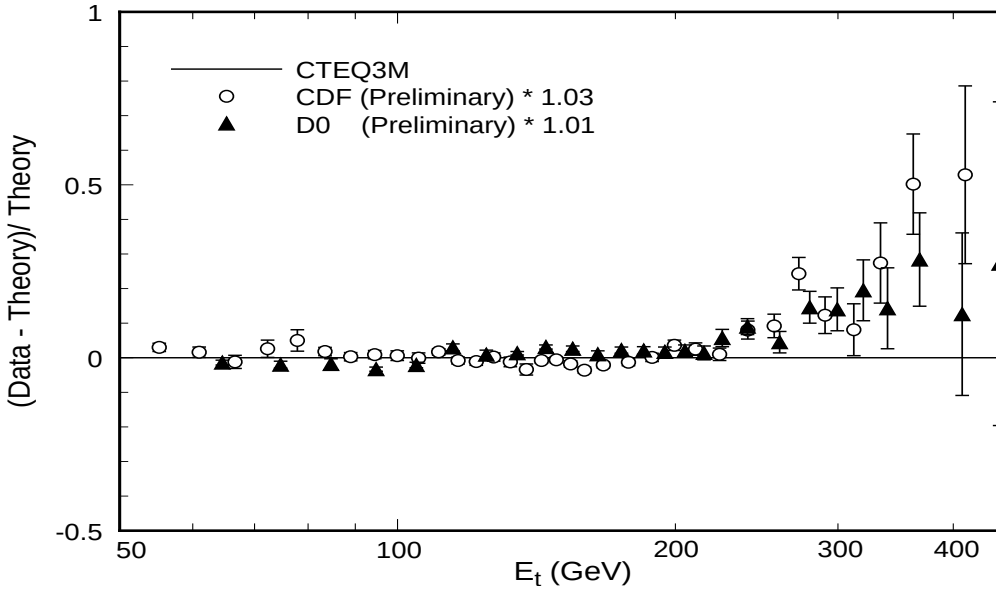
H1 Collaboration, ZPC74, 191 (1997)
ZEUS Collaboration, ZPC74, 207 (1997)



The Problem: Excess at Hi E_T

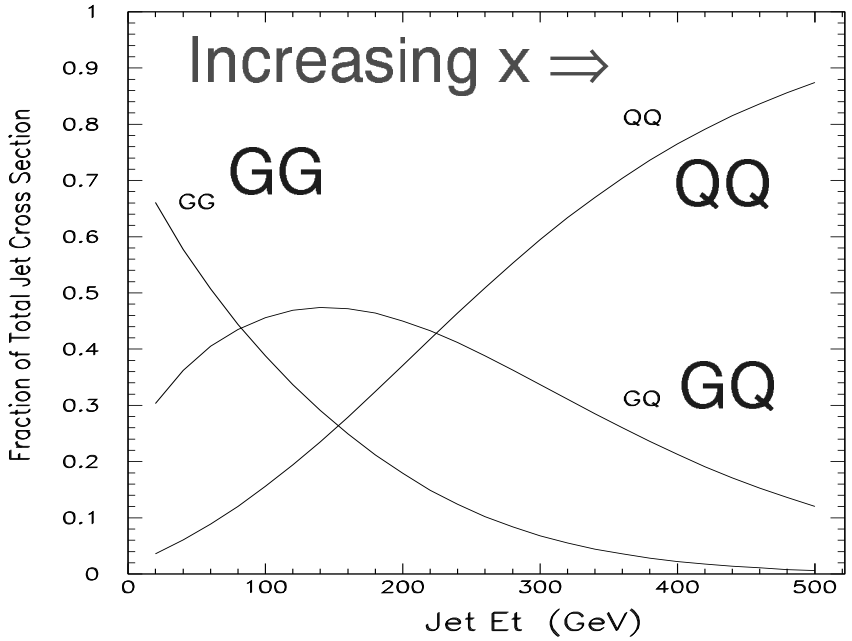
$P + \bar{P} \Rightarrow$ Jet

Compare Data to Theory



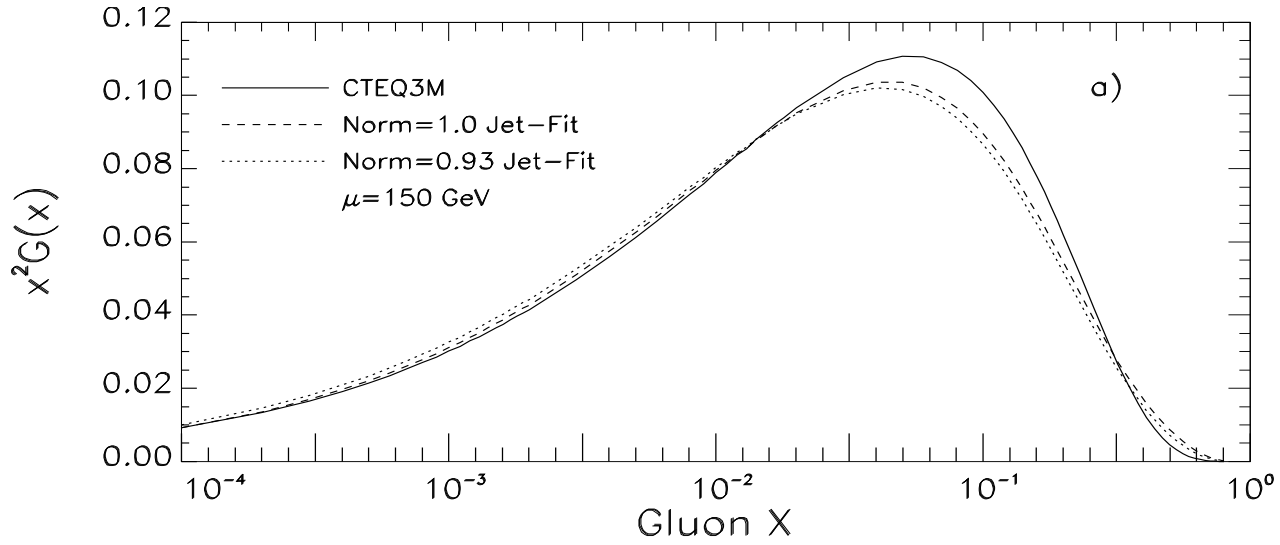
et al.,

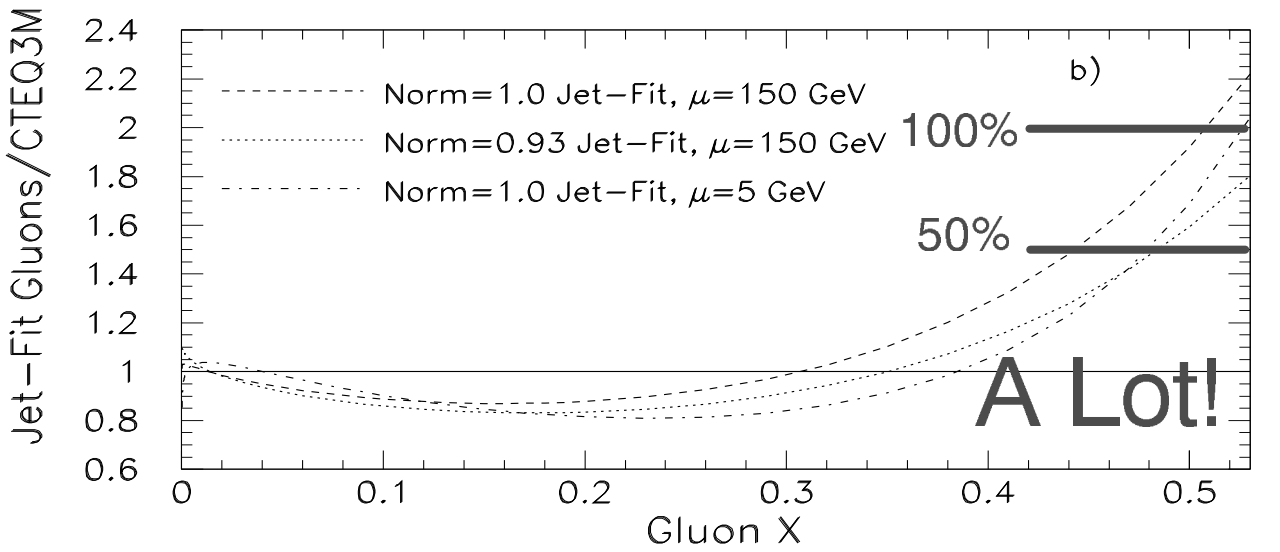
Fraction of total jet cross section

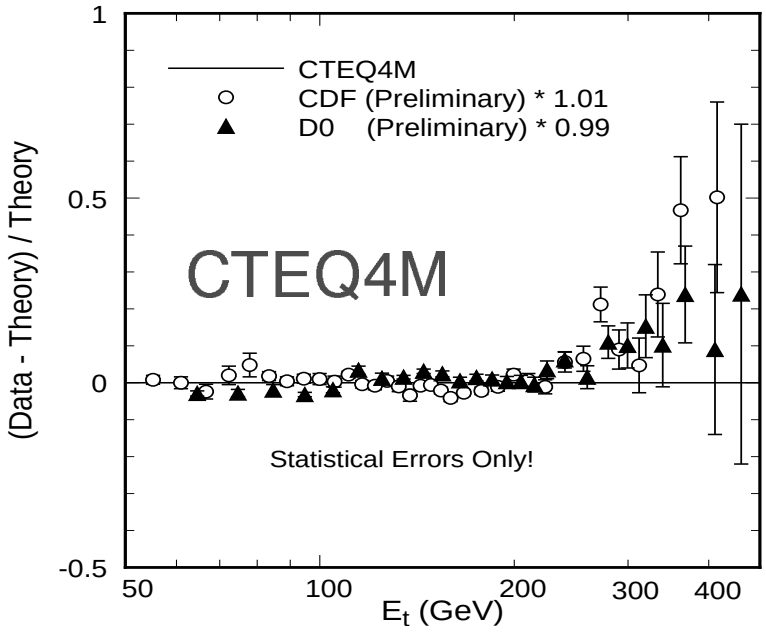


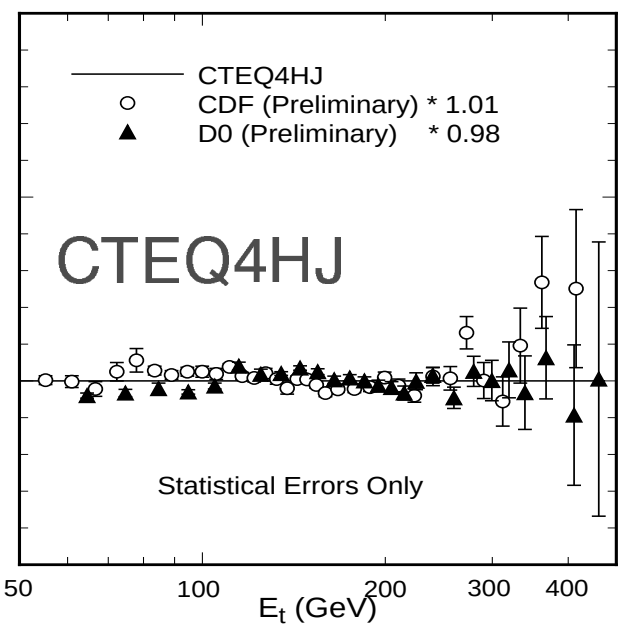
H.L. Lai., et al., Phys.Rev.D55:1280-1296,1997
J. Huston, et al., Phys.Rev.Lett.77:444-447,1996

The Solution: Pump up the Gluons

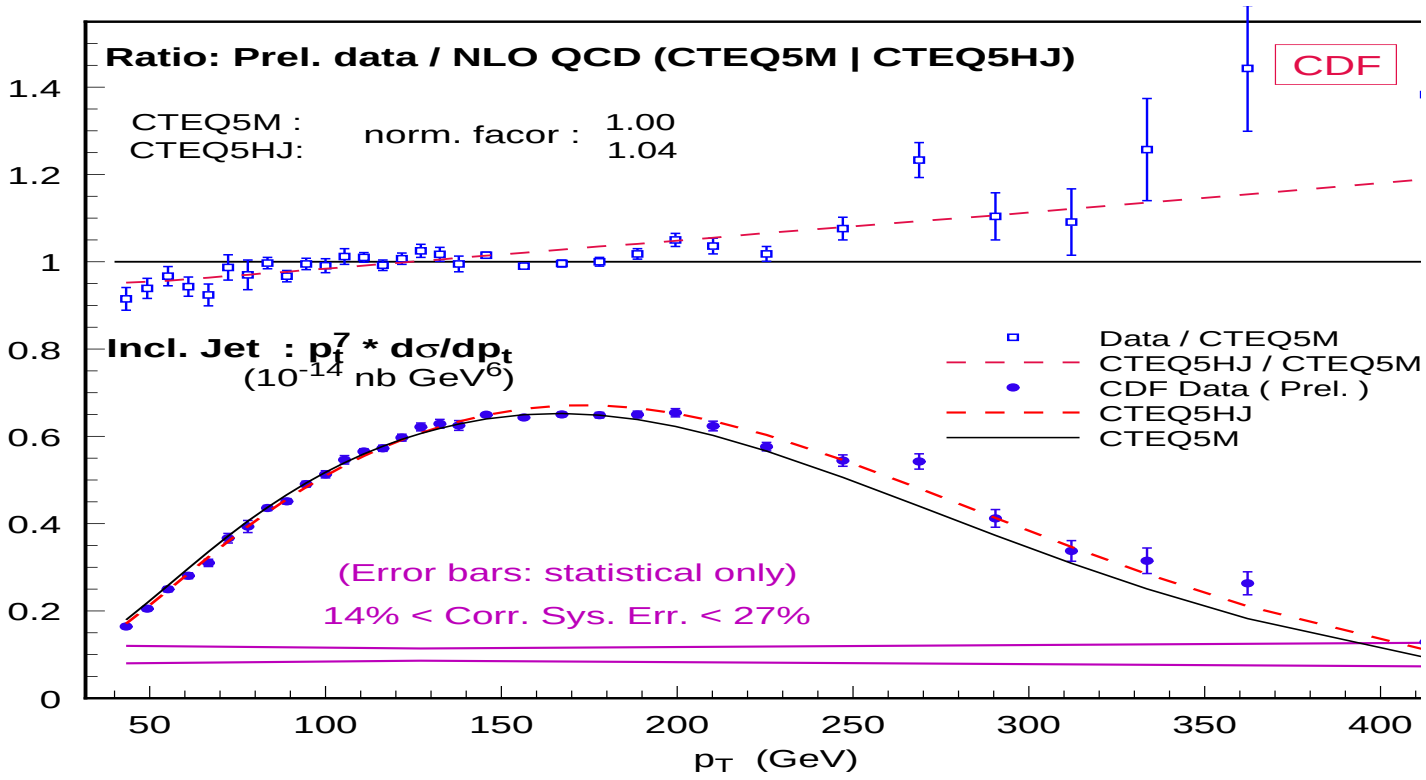


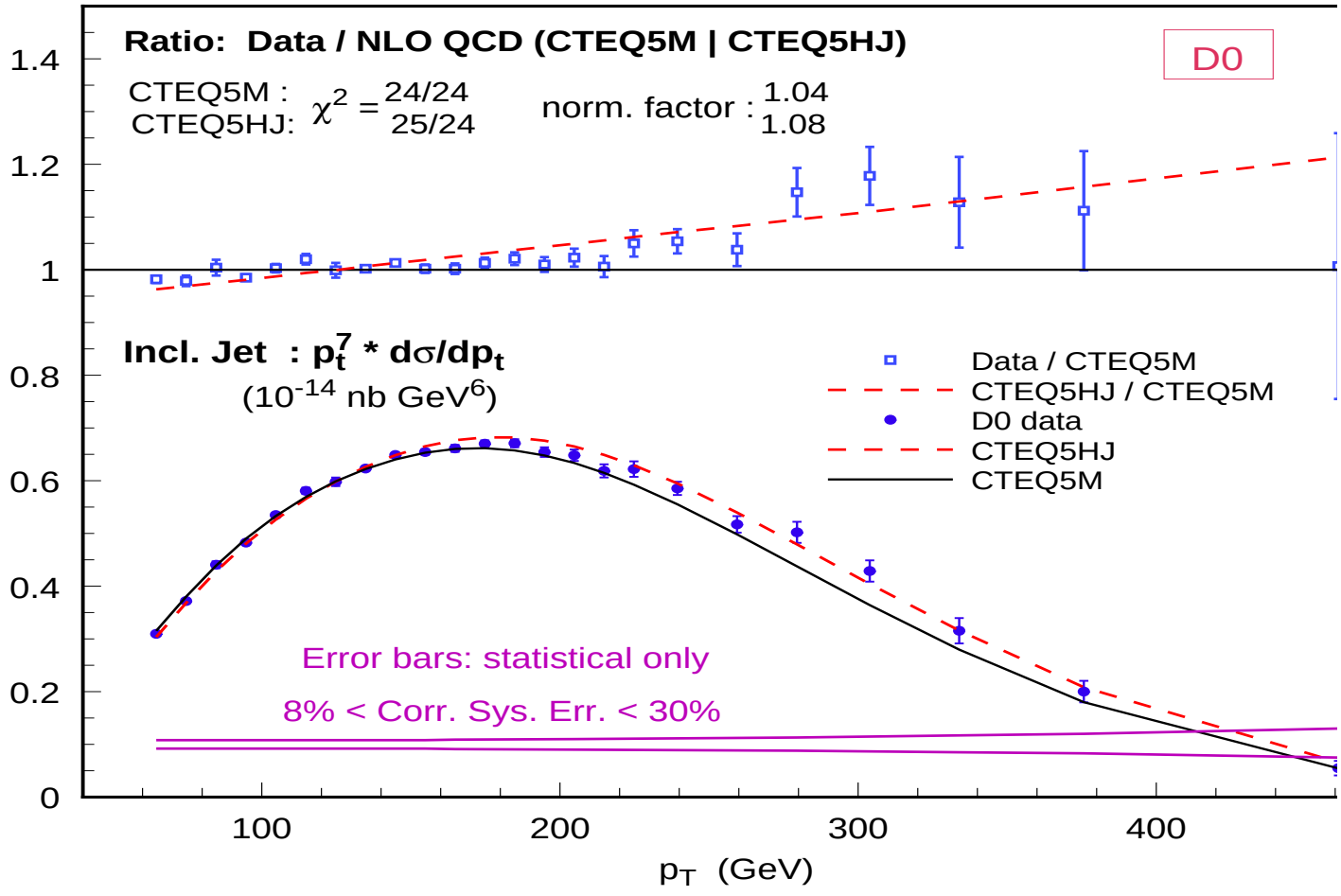






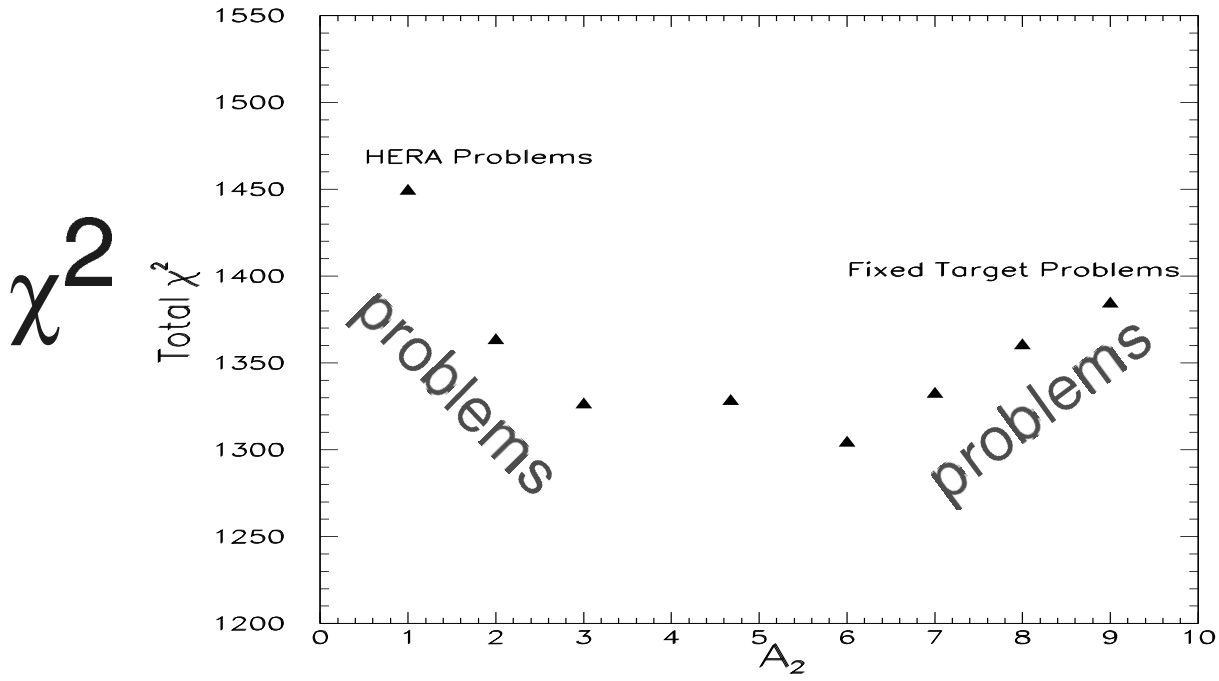
Tevatron Jet Cross Section

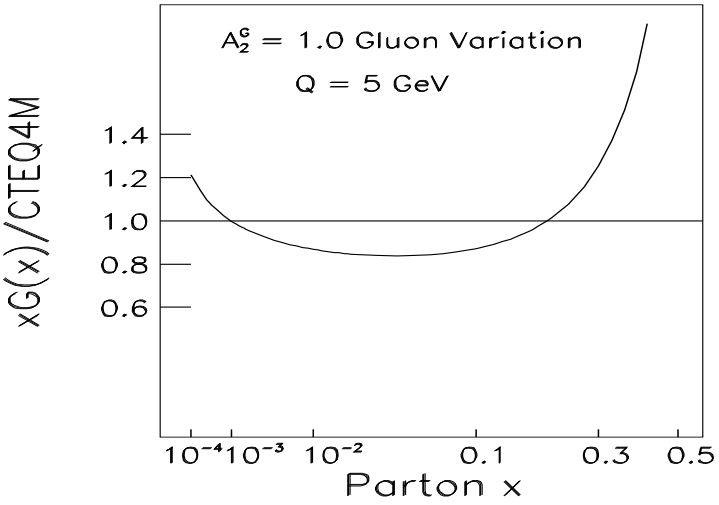


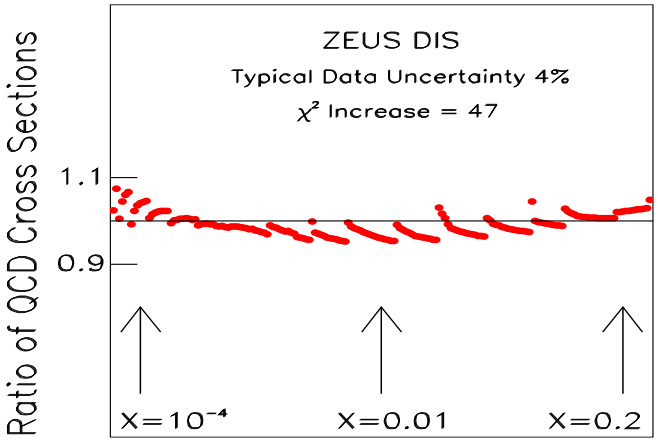


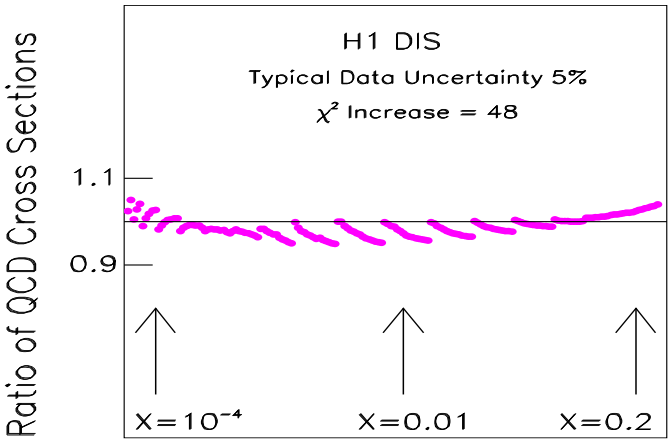
How far can we push the Gluons???

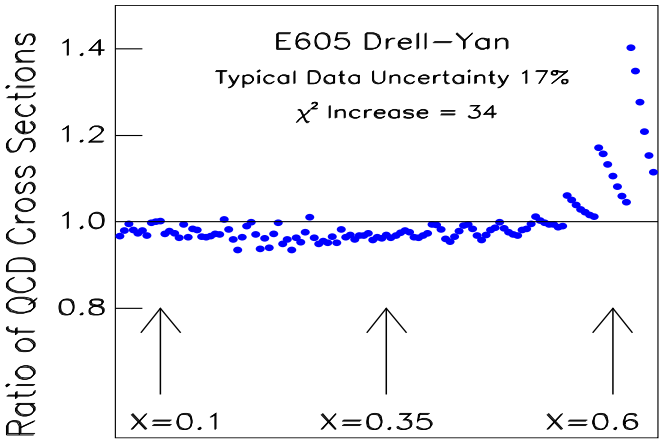
Scan parameter space; examine χ^2





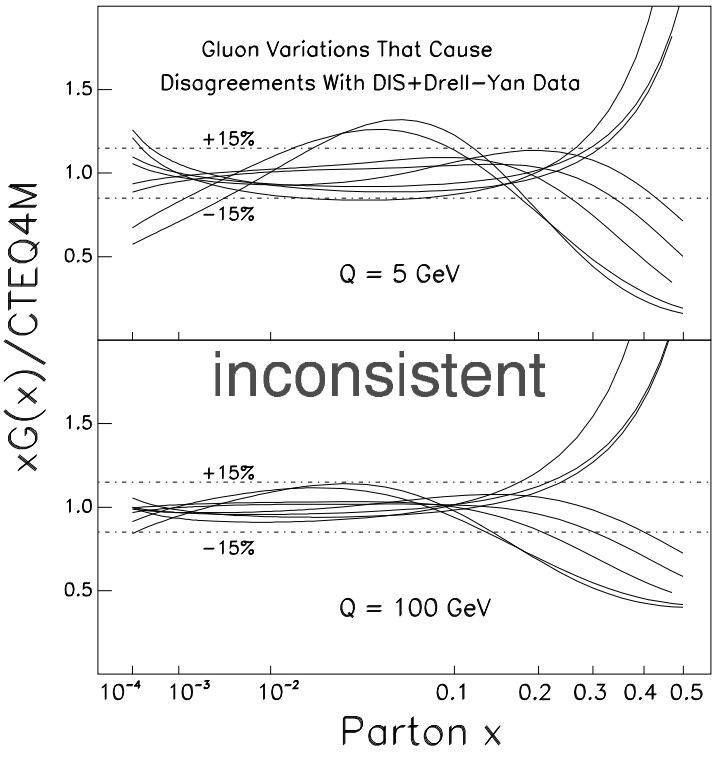


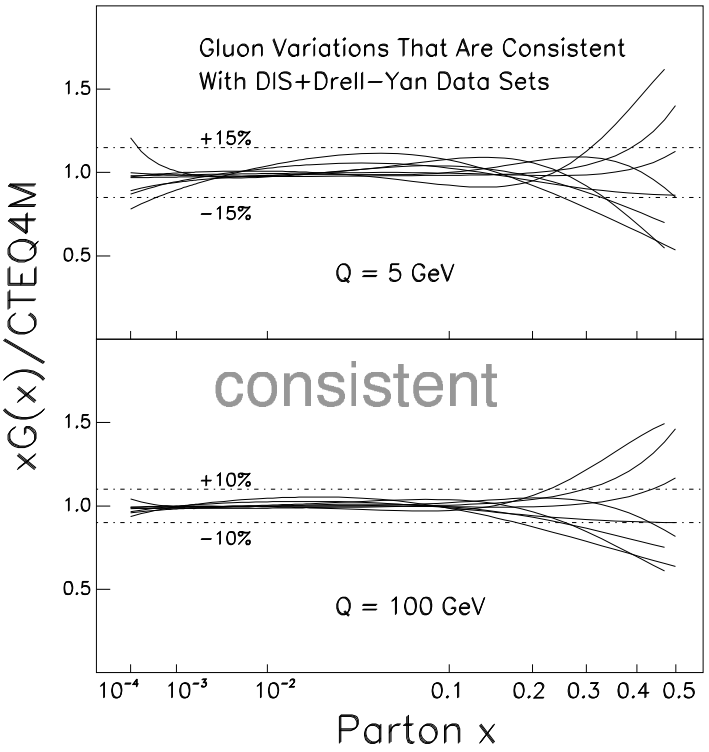




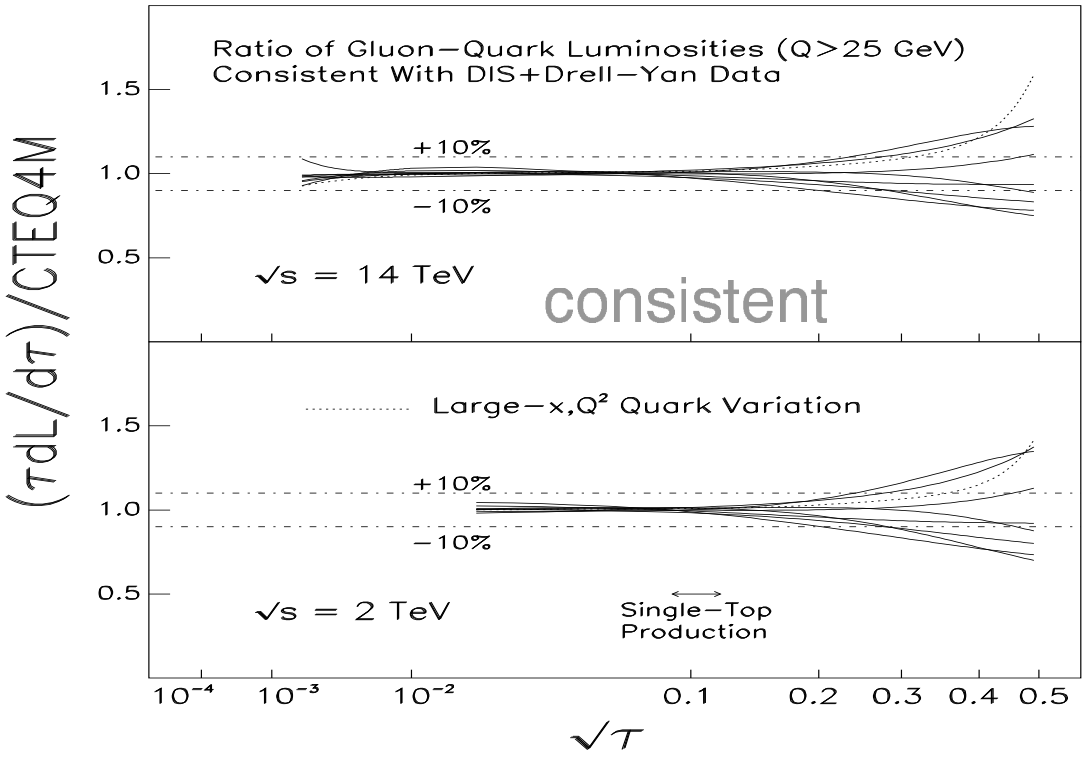
How far can we push the Gluons???

Variation of Gluon PDF vs. X



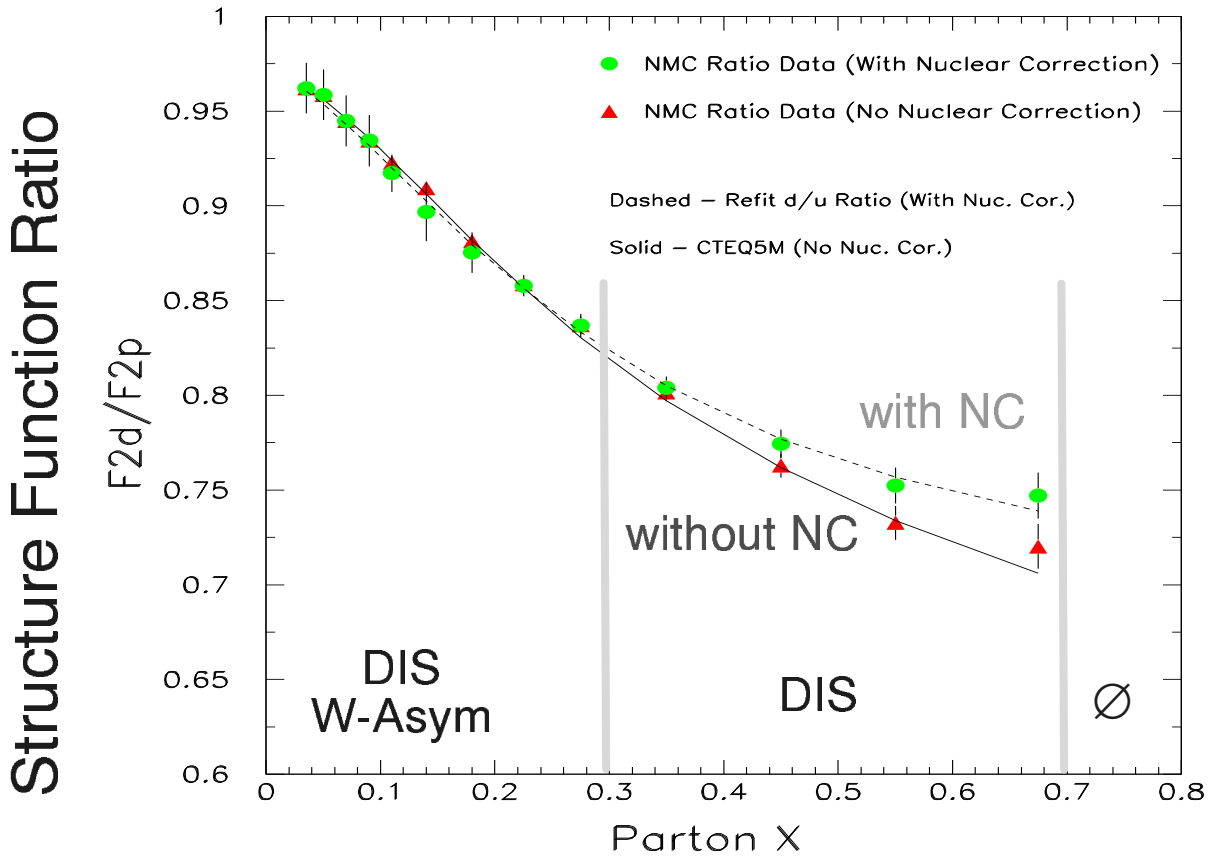


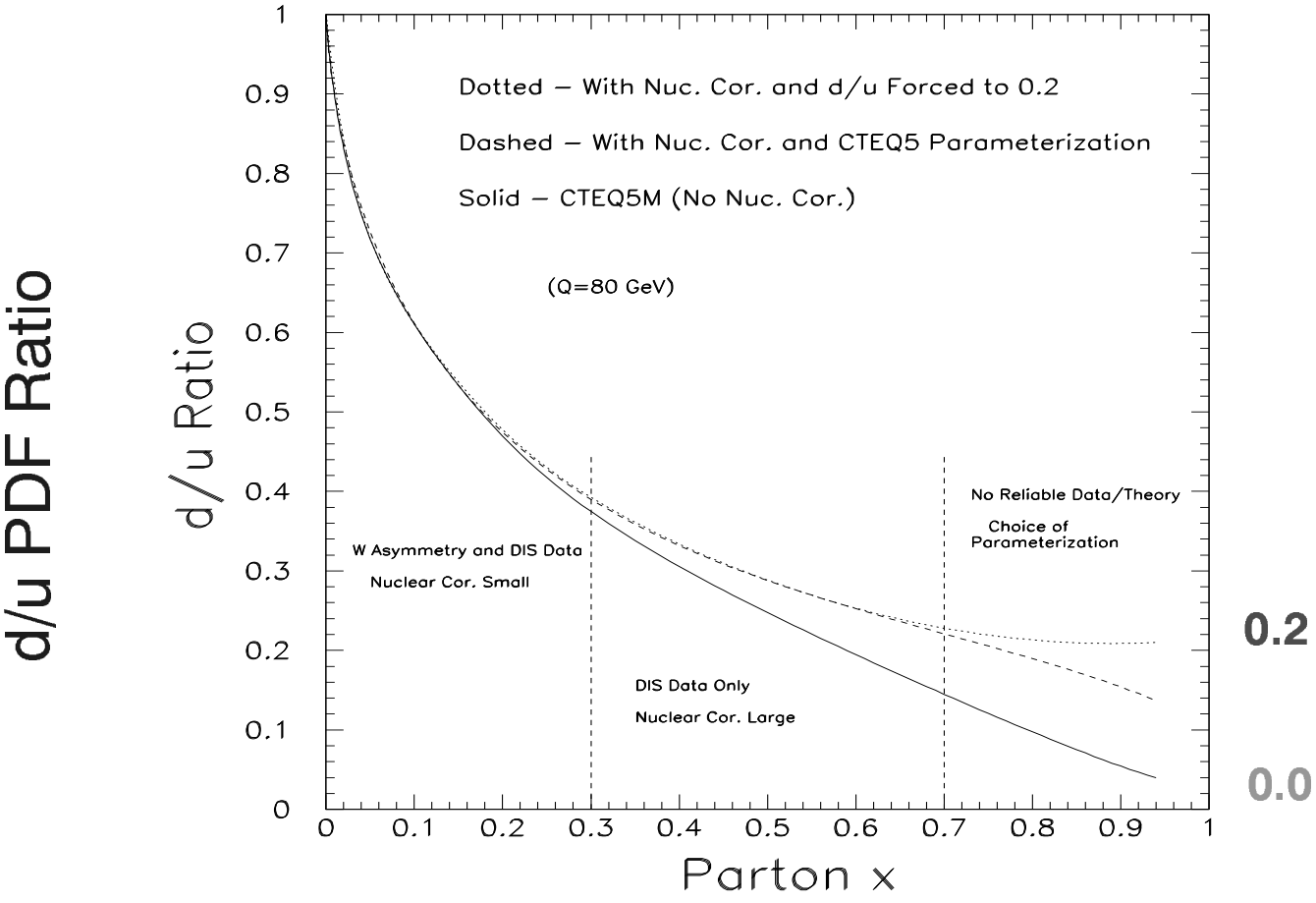
Variation of Gluon Luminosity vs. τ



J. Huston, et al., Phys.Rev.D58:114034,1998

Nuclear Corrections: Are they needed at Hi X?

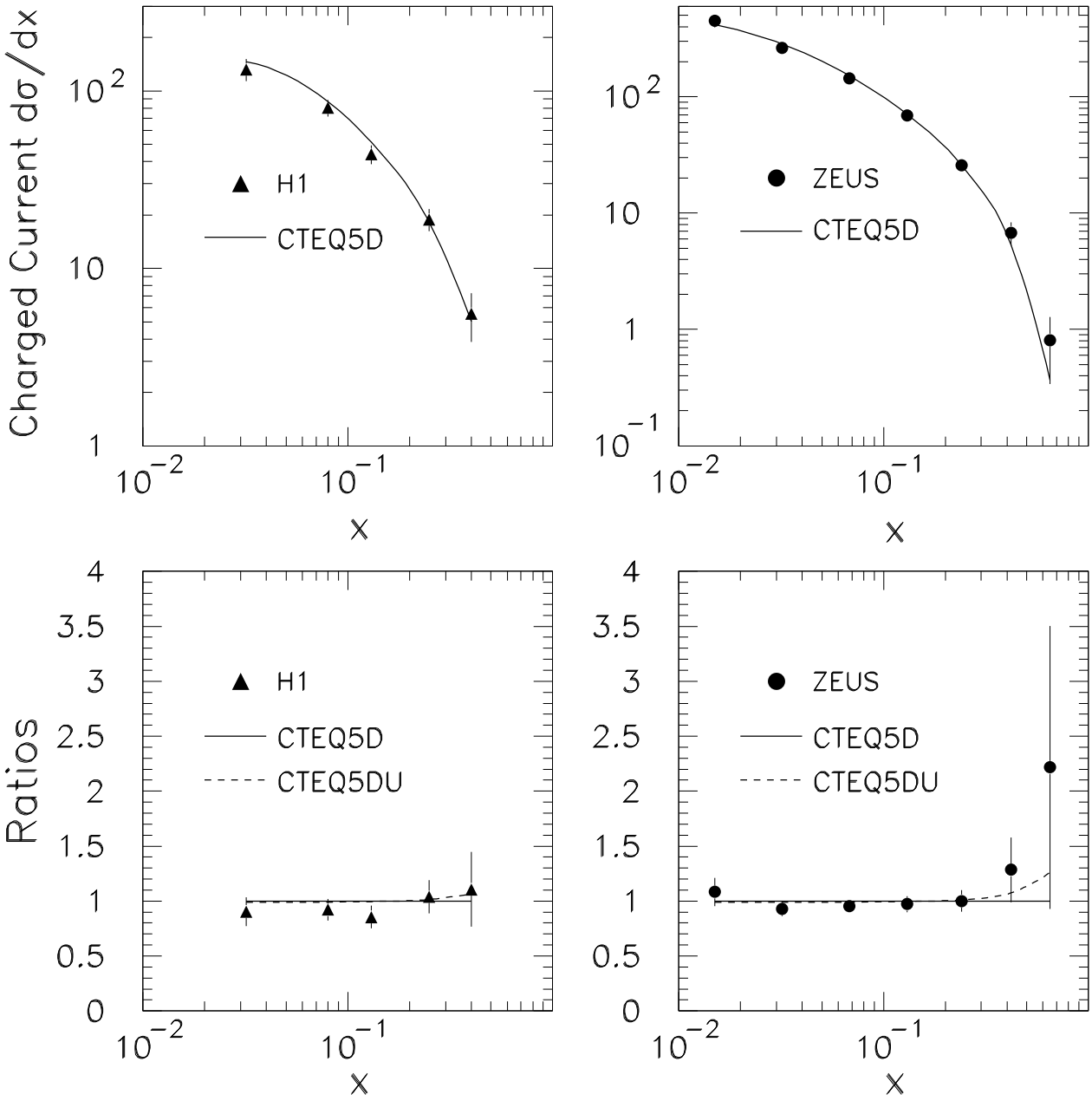




Nuclear Corrections: Can HERA Help?

Compare to HERA with/without Nuclear Corrections

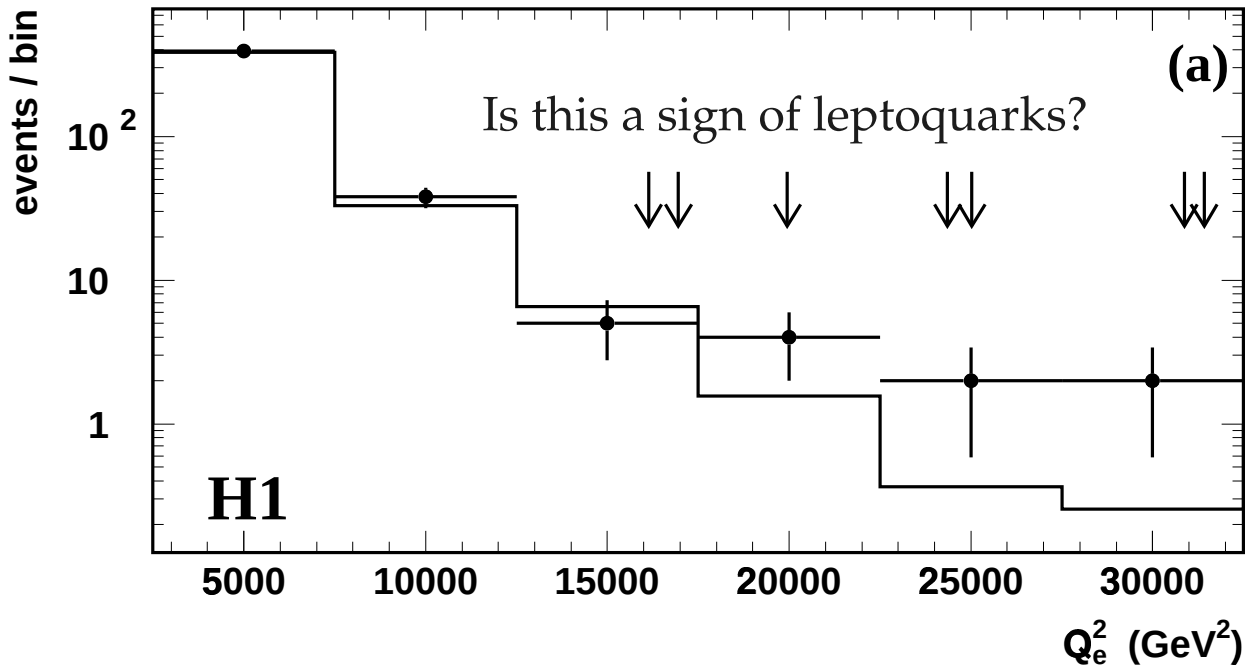
HERA Charged Current Data, Hi Q

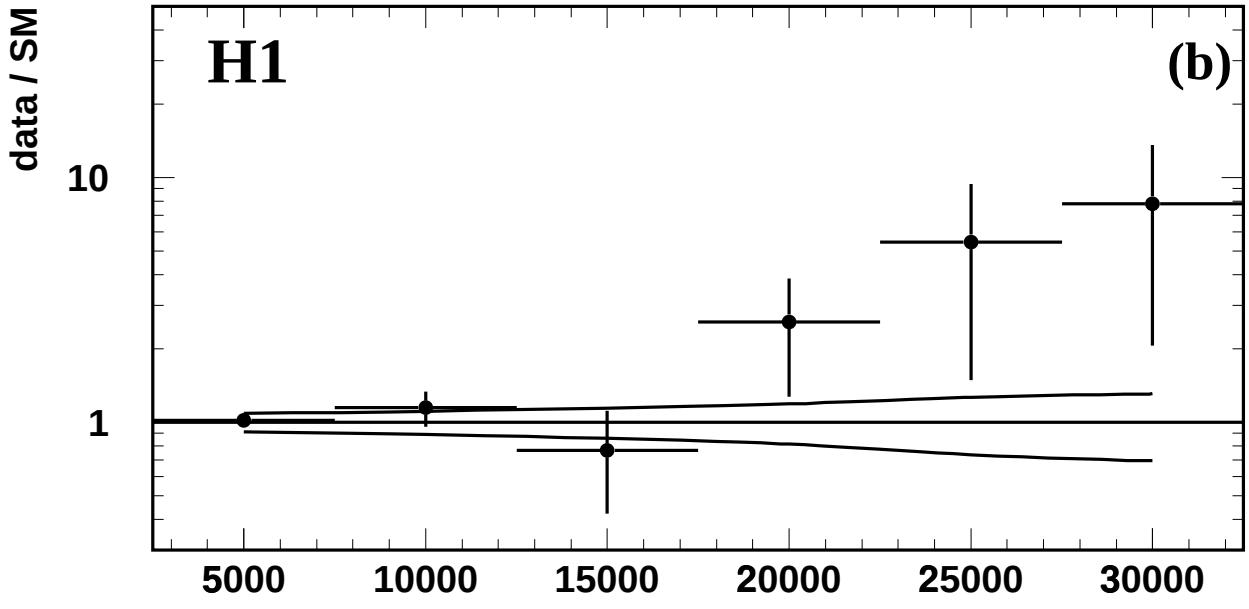


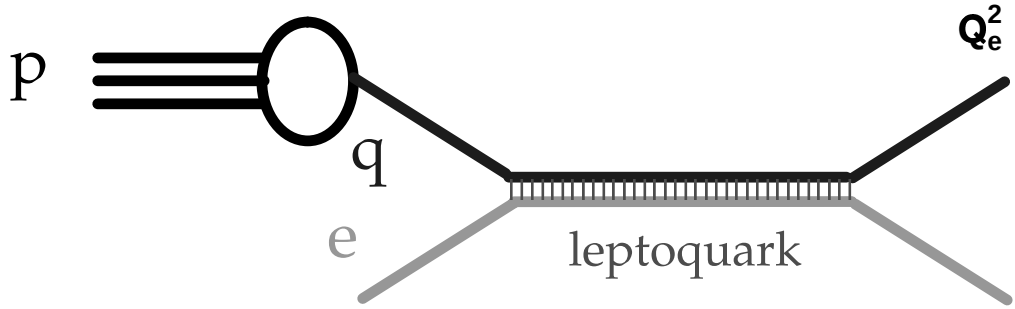
Data extend to x=0.7
Curves split about x=0.7

S. Kuhlmann, et al., Phys.Lett.B476:291-296,2000

Excess DIS events at Large {x,Q} (1997)

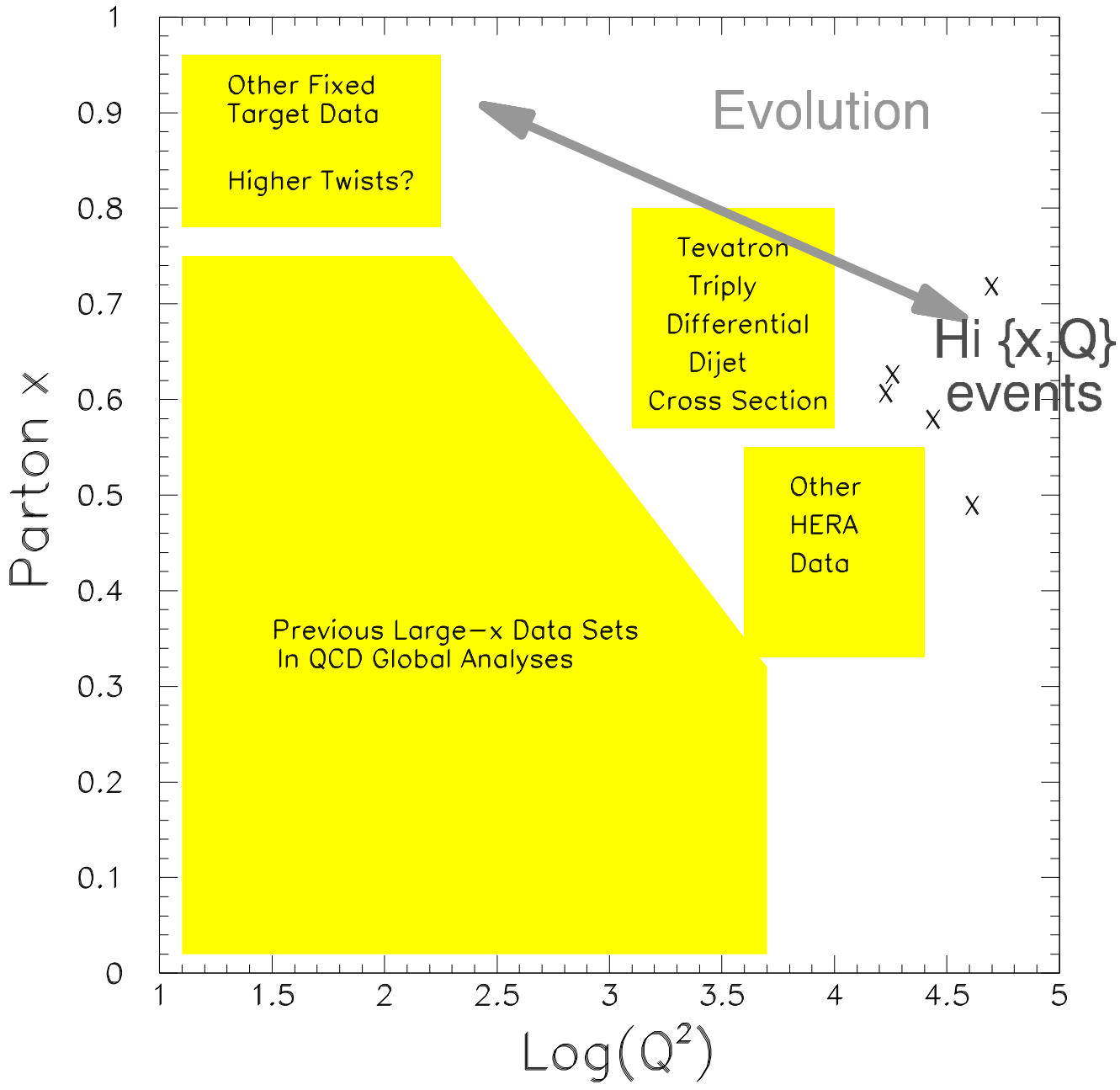






H1 Collaboration, ZPC74, 191 (1997)
ZEUS Collaboration, ZPC74, 207 (1997)

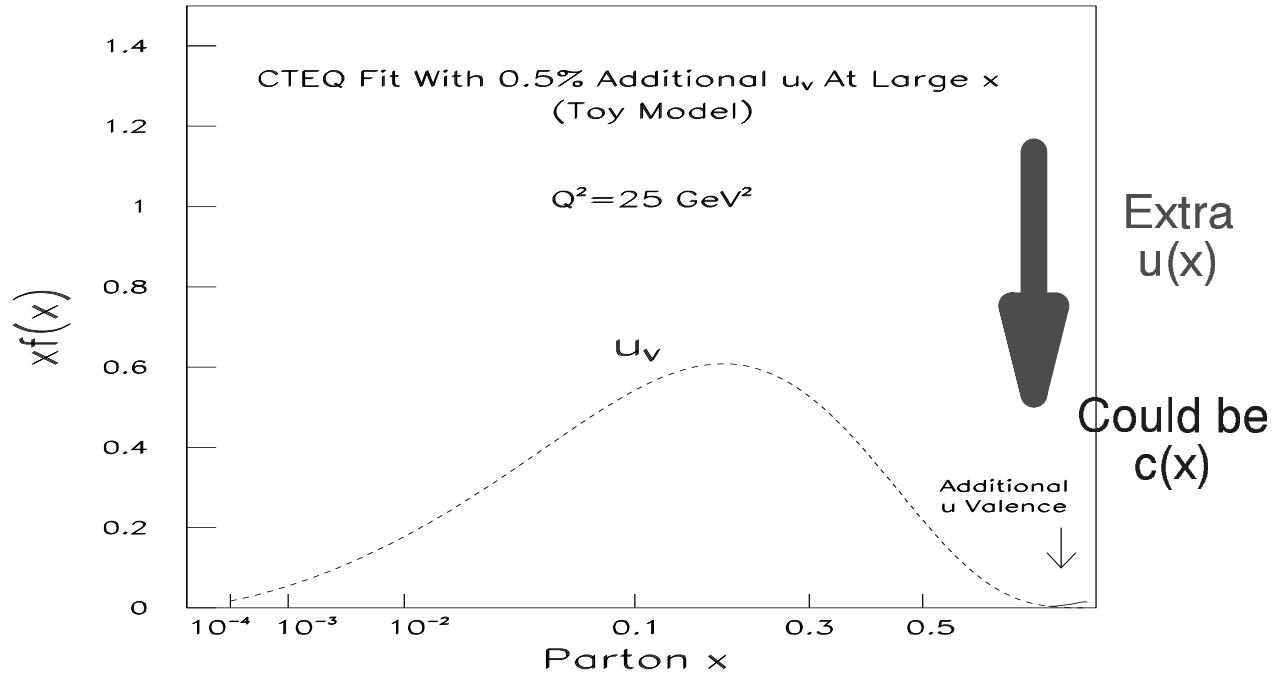
Where do the Excess HERA Events Lie?

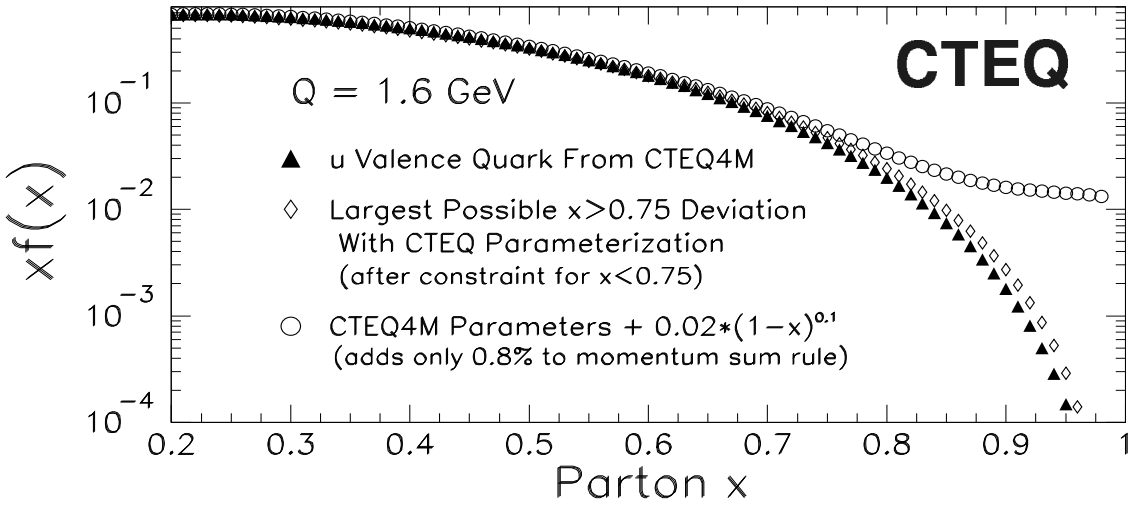


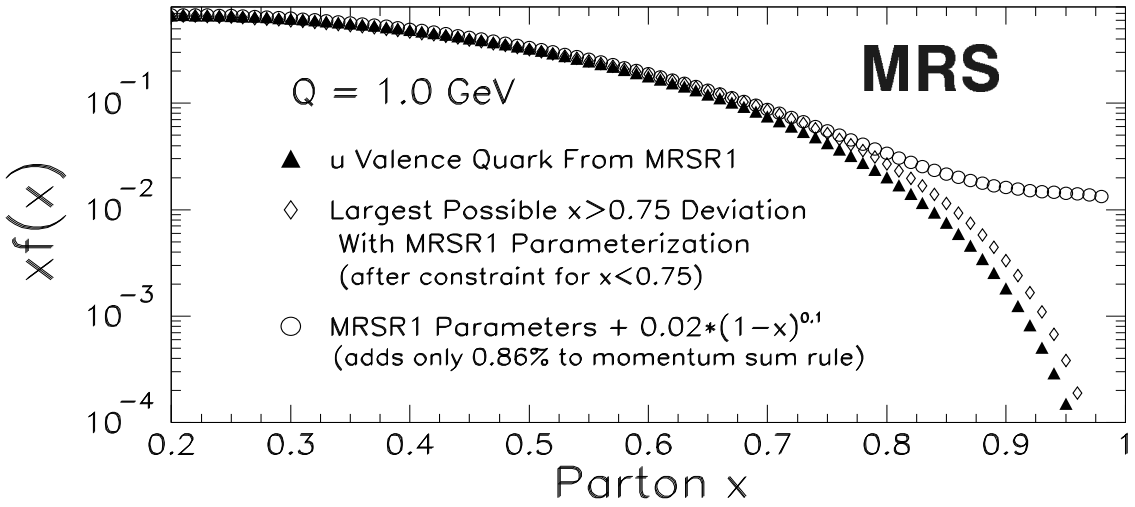
* No direct overlap with other data
* No indirect overlap with fit data

S. Kuhlmann, et al., Phys.Lett.B476:291-296,2000

How Restrictive are PDF Parameterizations?

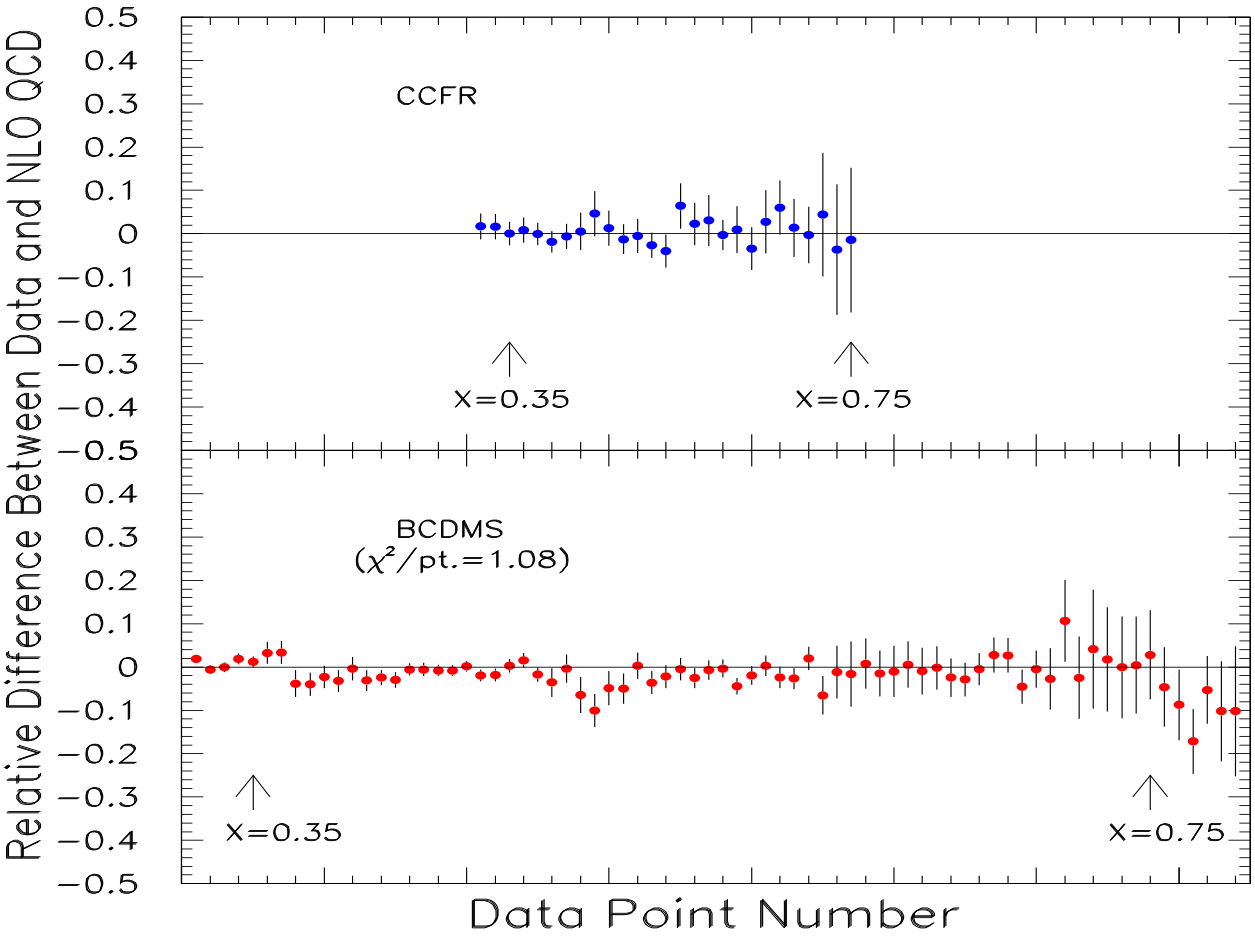






S. Kuhlmann, et al., Phys.Lett.B476:291-296,2000

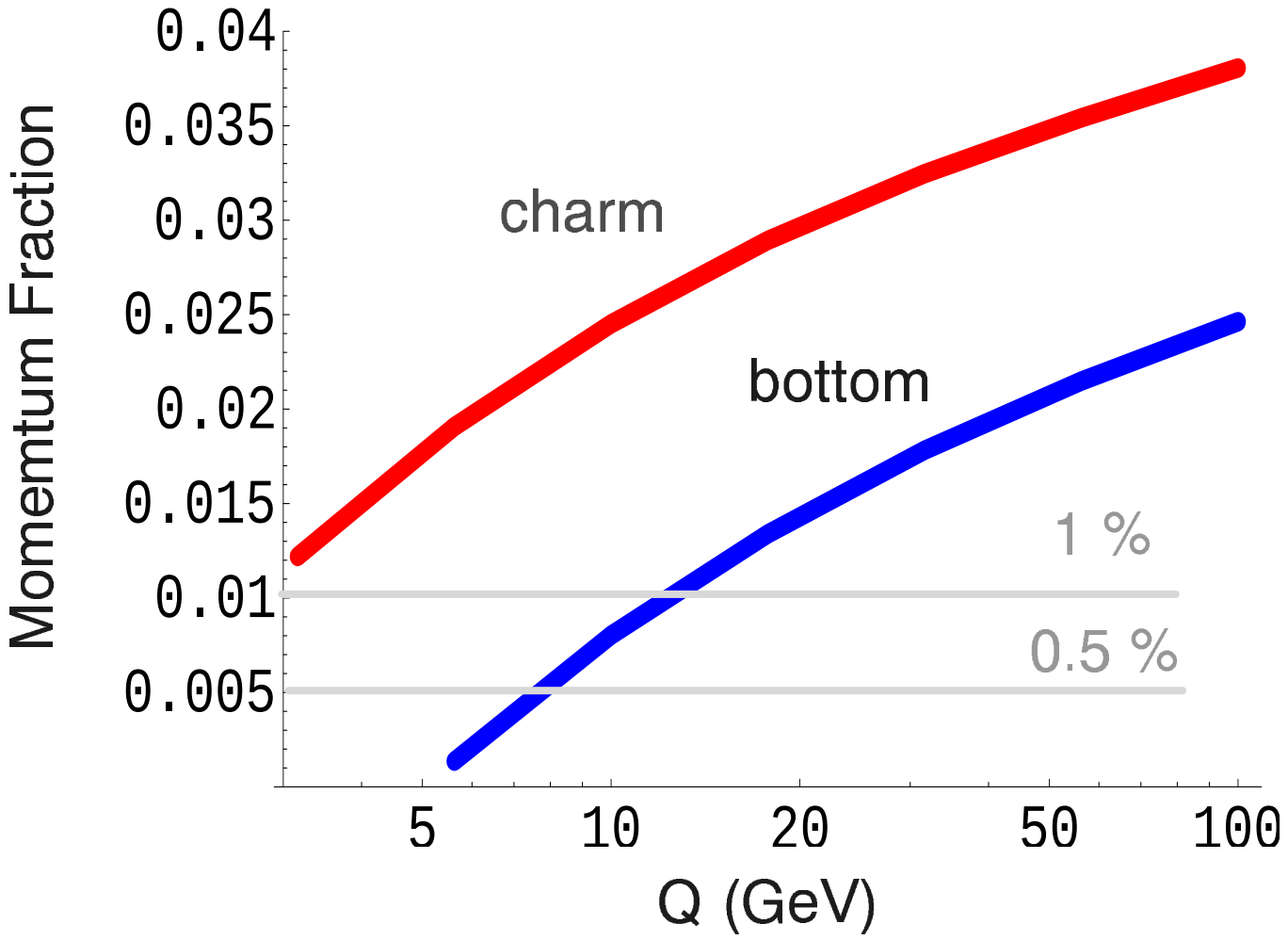
Can we add U(x) at Hi X ?



* Fit includes extra 0.5% u-quark
* No problem with DIS data

S. Kuhlmann, et al., Phys.Lett.B476:291-296,2000

How much "Intrinsic" Charm & Bottom?

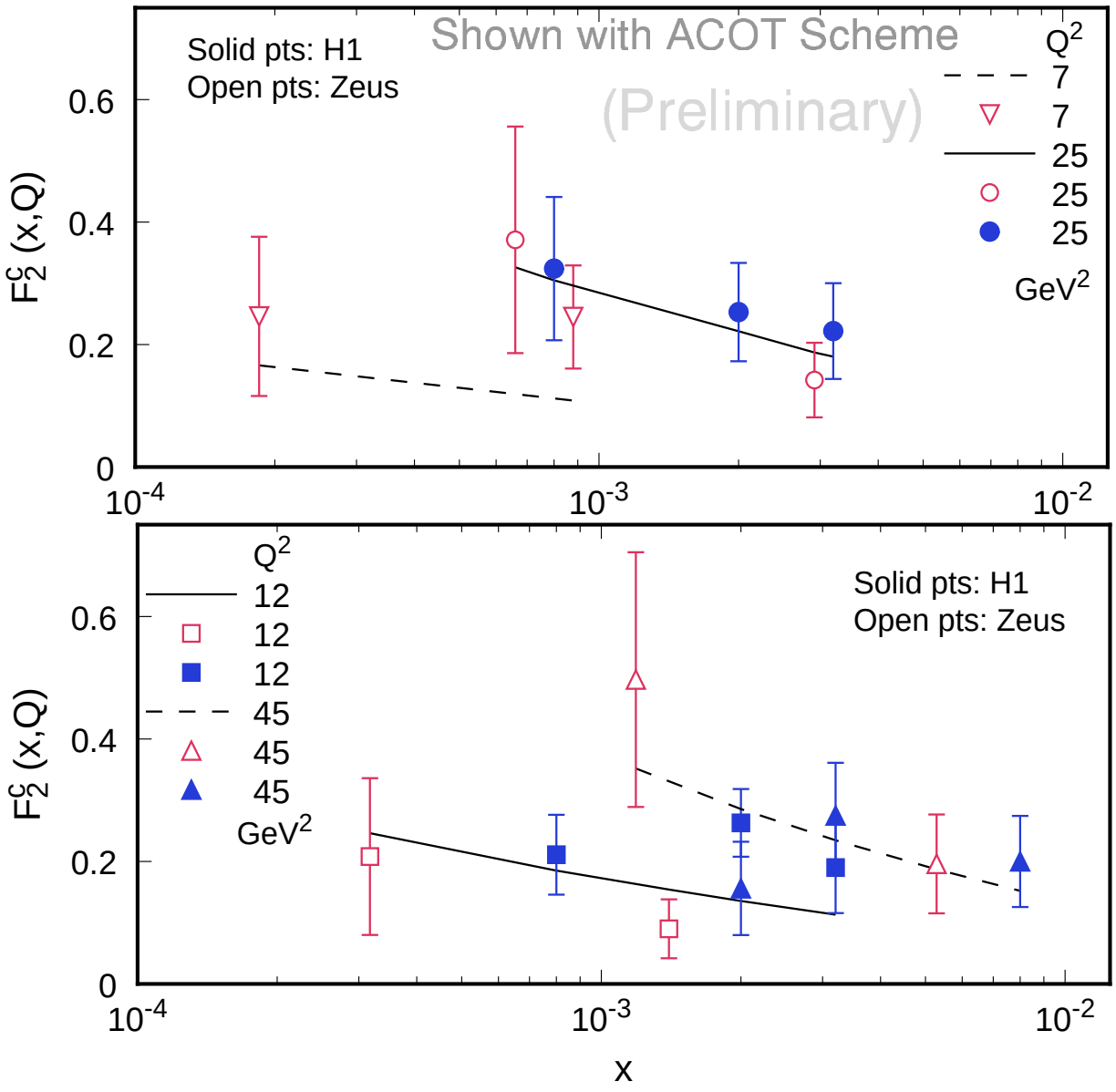


Intrinsic Charm

* HSV analysis of EMC $\Rightarrow$ 0.86±0.60%
* 0.1% could be measurable at HERA

(HSV) Harris, Smith, Vogt , Nucl.Phys.B461:181-196,1996
Ingelman, Jonsson, Nyberg, Phys.Rev.D47:4872-4882,1993
Vogt, Brodsky , Phys.Lett.B349:569-575,1995

HERA F2-Charm

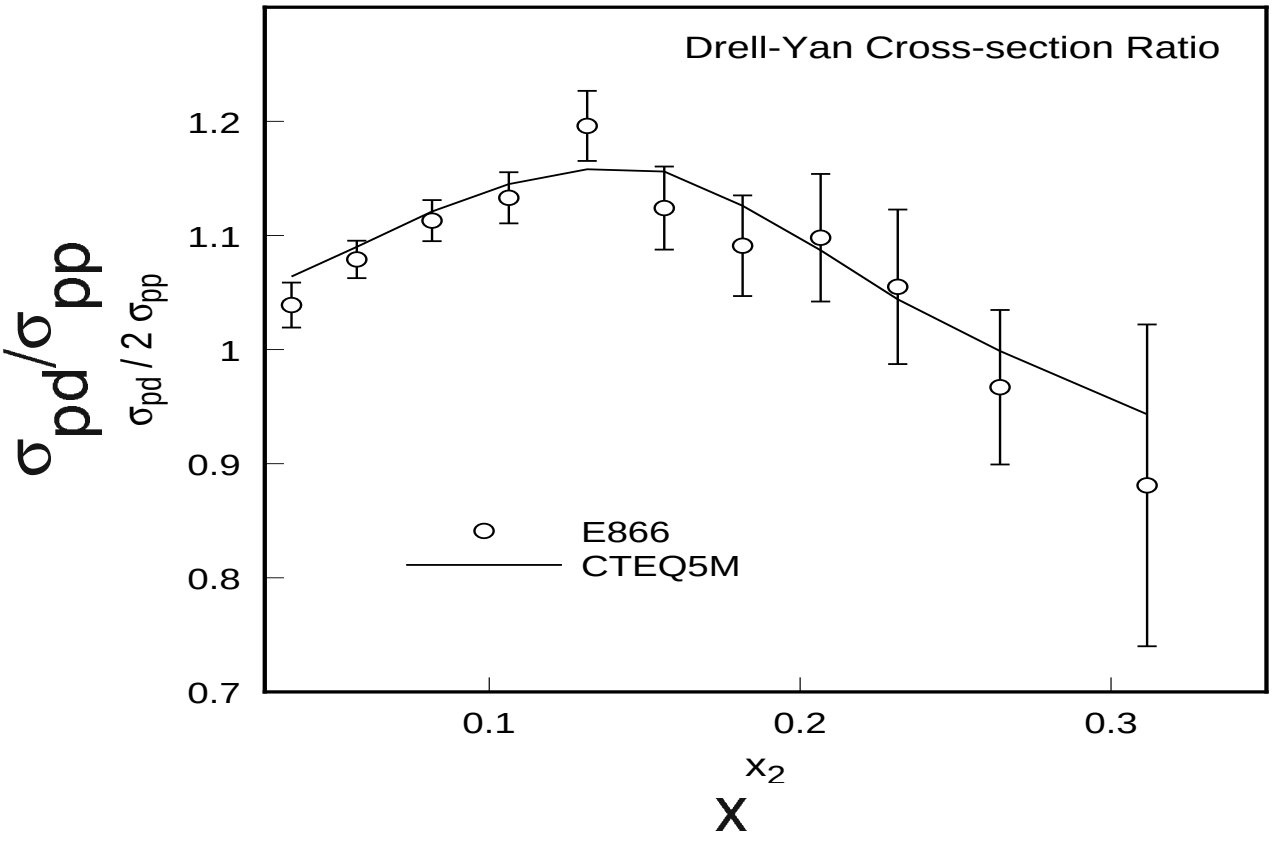


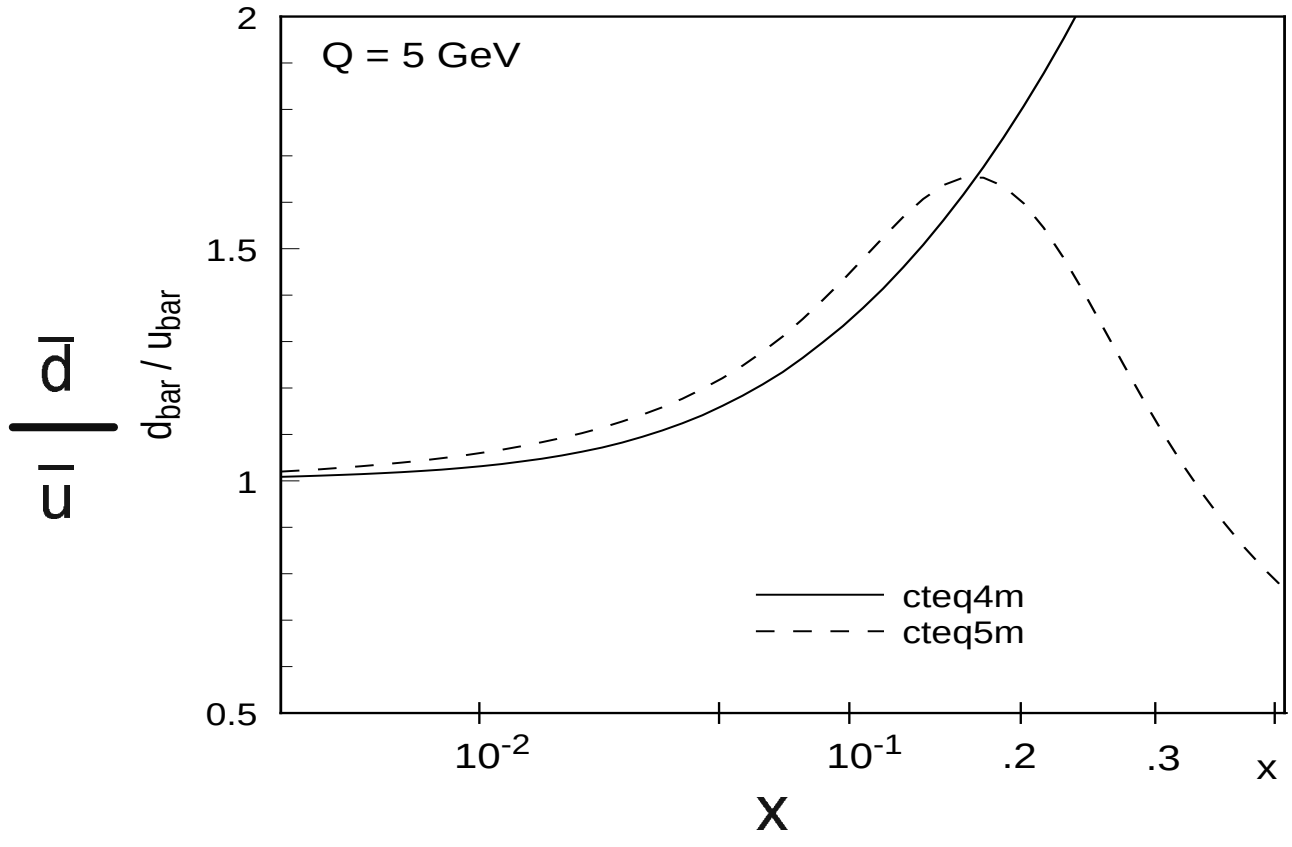
* F_C^2 up to 30% of F^2
* Must be aware of schemes

* Good agreement here
* What about b-quark???

H1 Collaboration, Z. Phys. C72, 593 (1996).
ZEUS Collaboration, Eur.Phys.J.C12:35-52,2000
Amundson, Schmidt, Tung, Wang;

Drell-Yan & effect on d/u

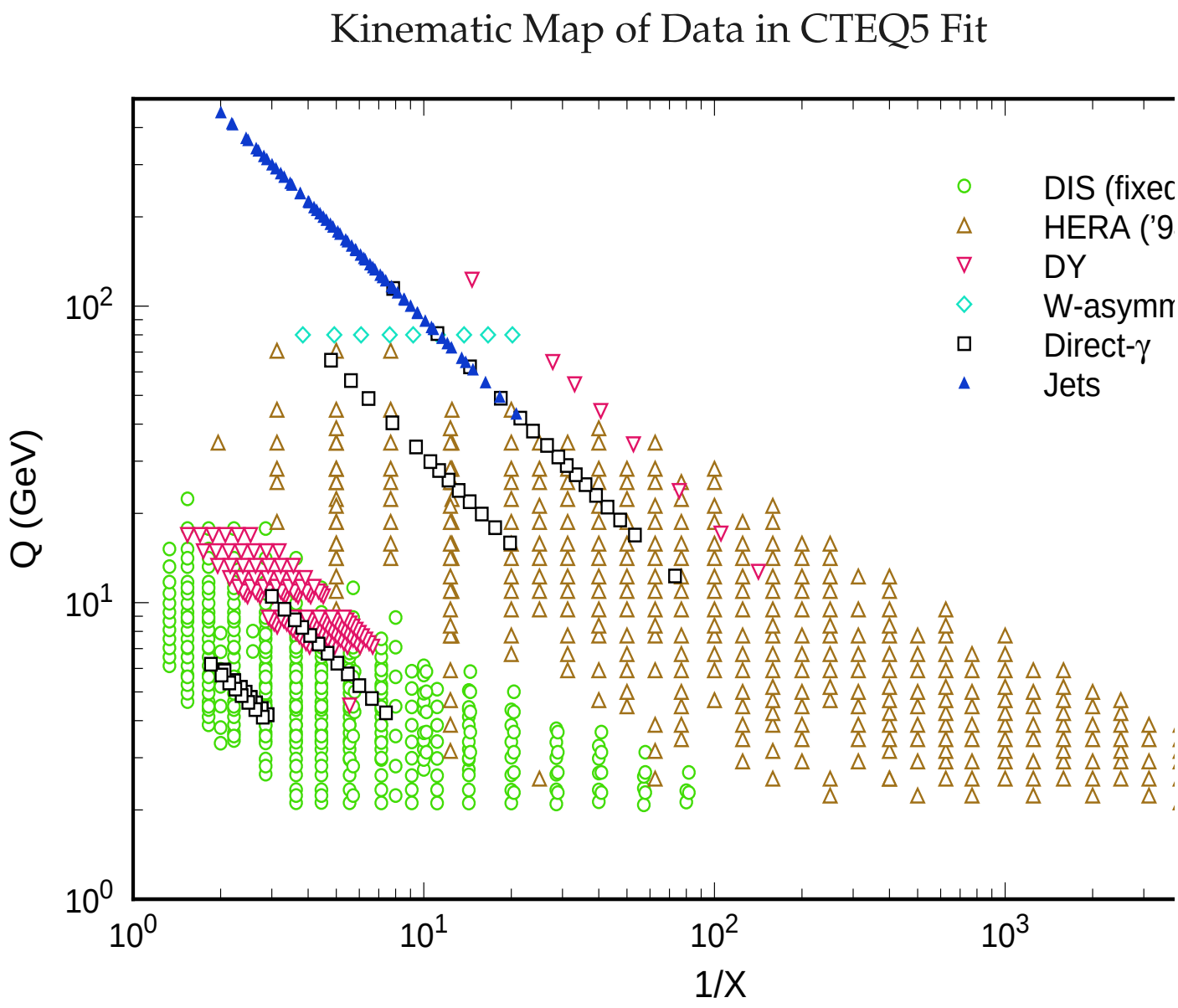




Global Fitting: The Present

- DIS
  - Published analysis: NMC + CCFR
  - Extended results: H1 + ZEUS
- W-Asym
  - Extended CDF results constrain d/u
- Jets
  - Updated CDF + DØ results
- Direct γ
  - Updated CDF + DØ results
  - E706: Data ~2-3x theory... need resummation of K_T
- Drell-Yan
  - NA51 data: x=0.18
  - E866 data: $x \in [0.03,0.35]$
- Heavy Quarks
  - F2C from HERA
  - Run I at Tevatron

Global Fitting: The Future



- Improved Stats at Hi x
- Issues of Higher Twist
- Nuclear Corrections
- Resummation of: 1/x, (1-x), K_T, ...
- ...