

## HERA Events, Tevatron Jets, and the Uncertainty In Quarks At Large x

Introduction

**Enhancing Quarks In The  
HERA Kinematic Region**

Connection With Tevatron Jets

Conclusions/Future Prospects

## Two Very Different Questions

Is The Standard Model Uncertainty  
Due to Parton Distributions at  $x > 0.5$   
Larger Than 6%?

Can We “Fit The Data?”

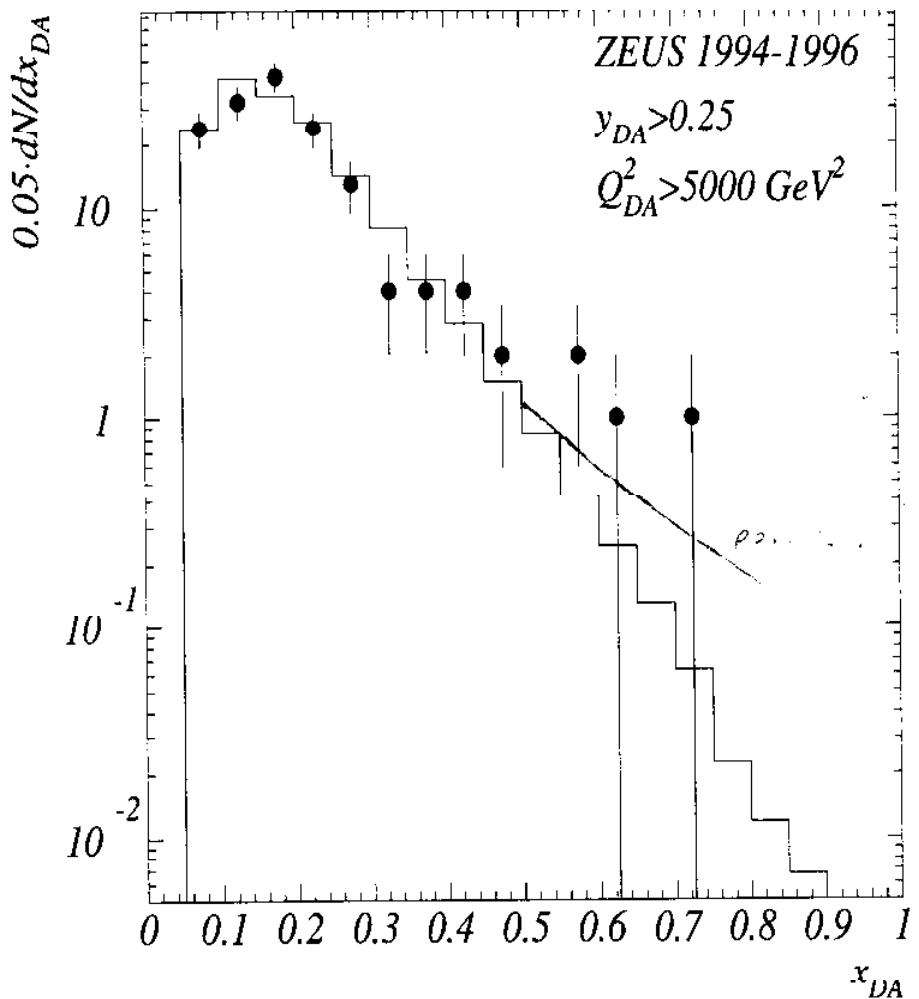
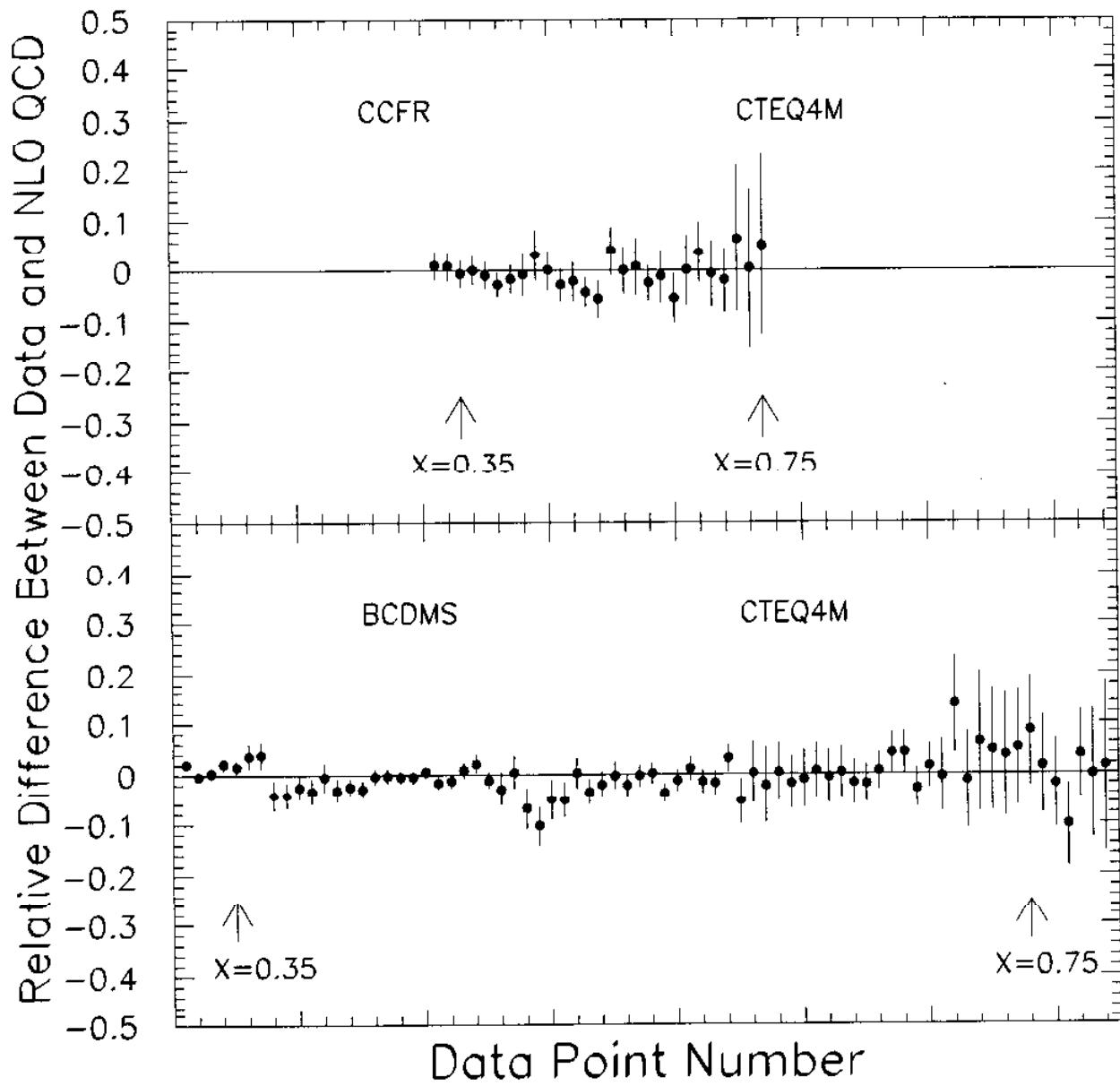
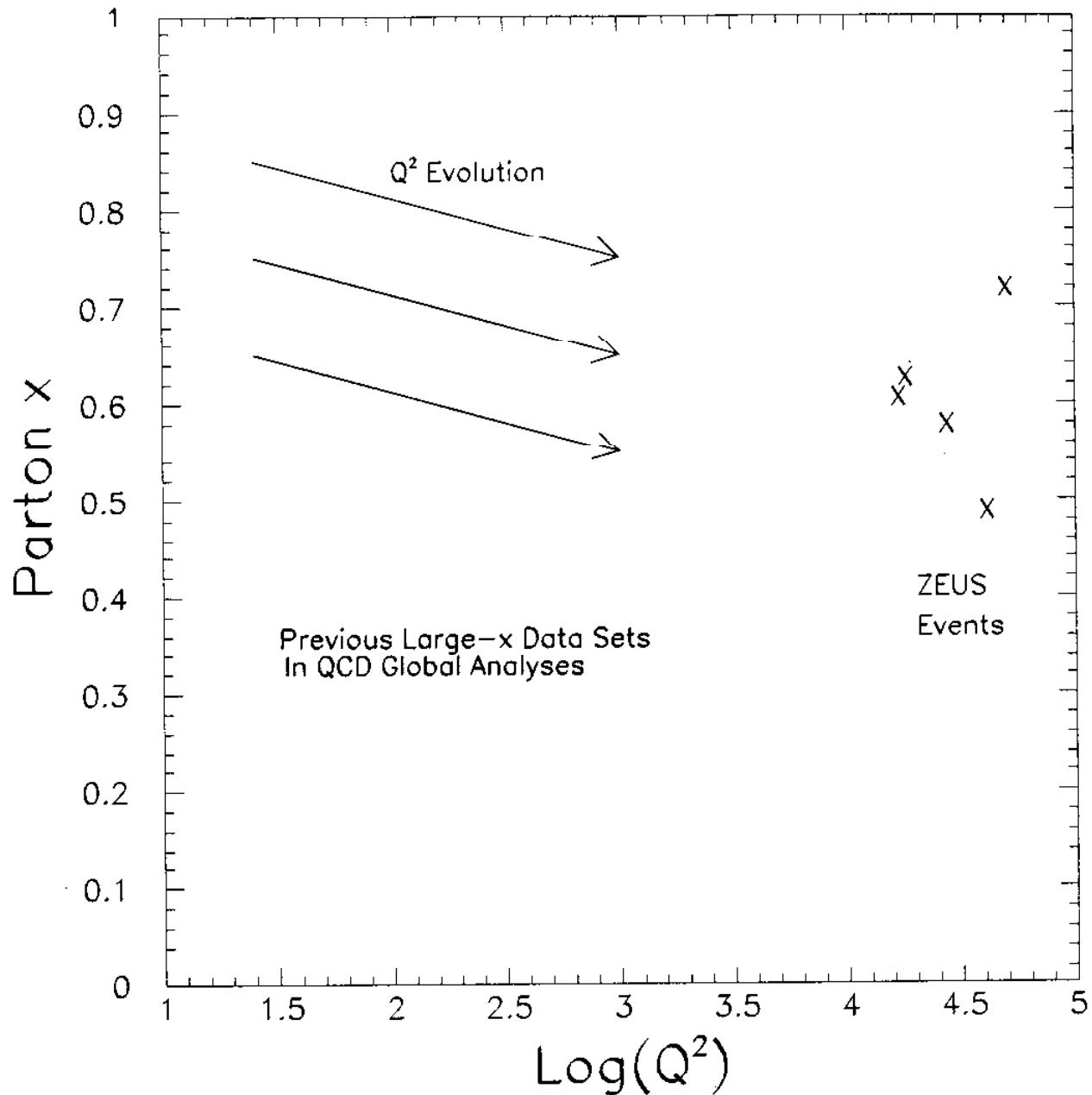


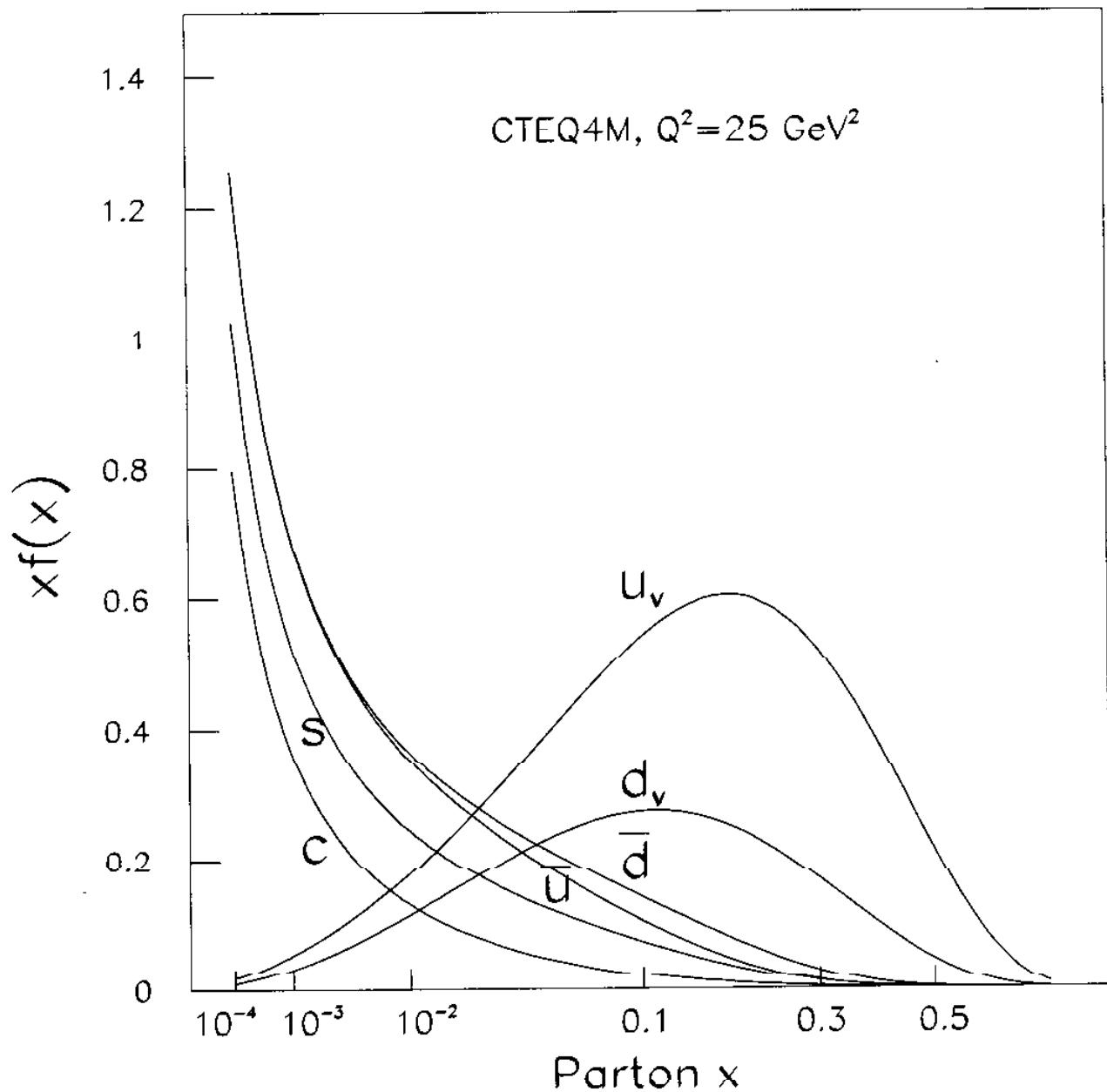
Figure 2: The  $x_{DA}$  distribution of the observed events with the cuts shown (full dots), compared to the Standard Model  $e^+p$  NC expectation (histogram). The error bars on the data points are obtained from the square root of the number of events in the bin.

## Comparison Of Fixed Target Data With Conventional Parton Distributions



## How Large- $x$ Quarks Can Evolve Into The HERA Kinematic Region





## Parameterization Exercise With u Valence

CTEQ Parameterization

$$A * x^B * (1 - x)^C * (1 + D x^E)$$

### Exercise:

Extreme Variations of All 5 Parameters

Constrain Lower x To Agree With CTEQ4M

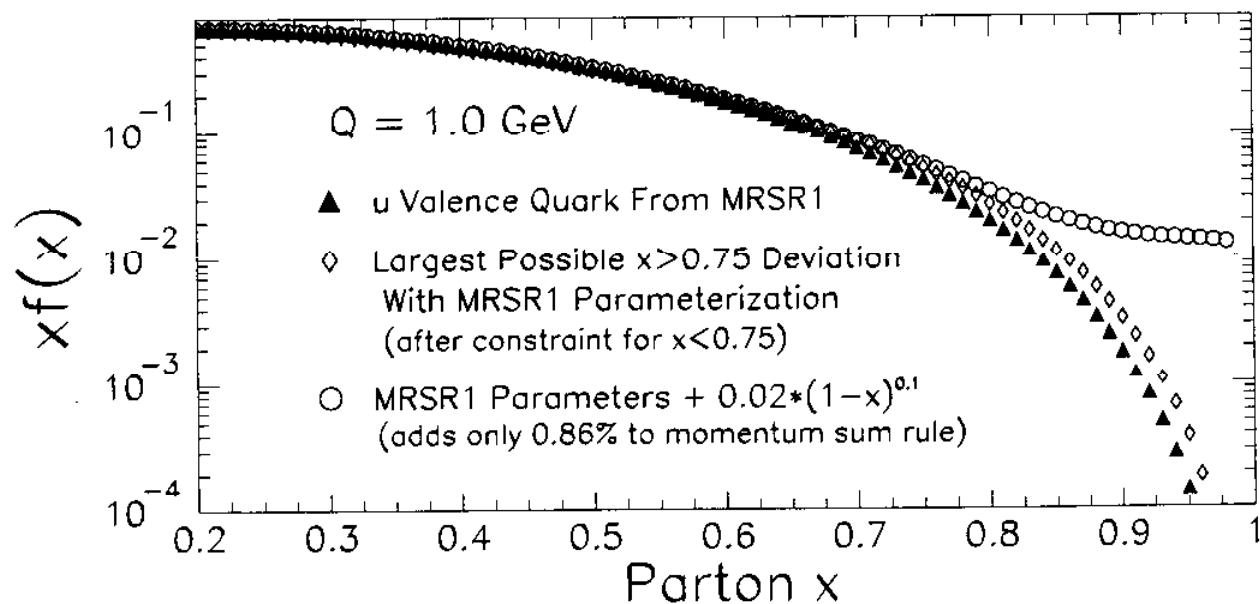
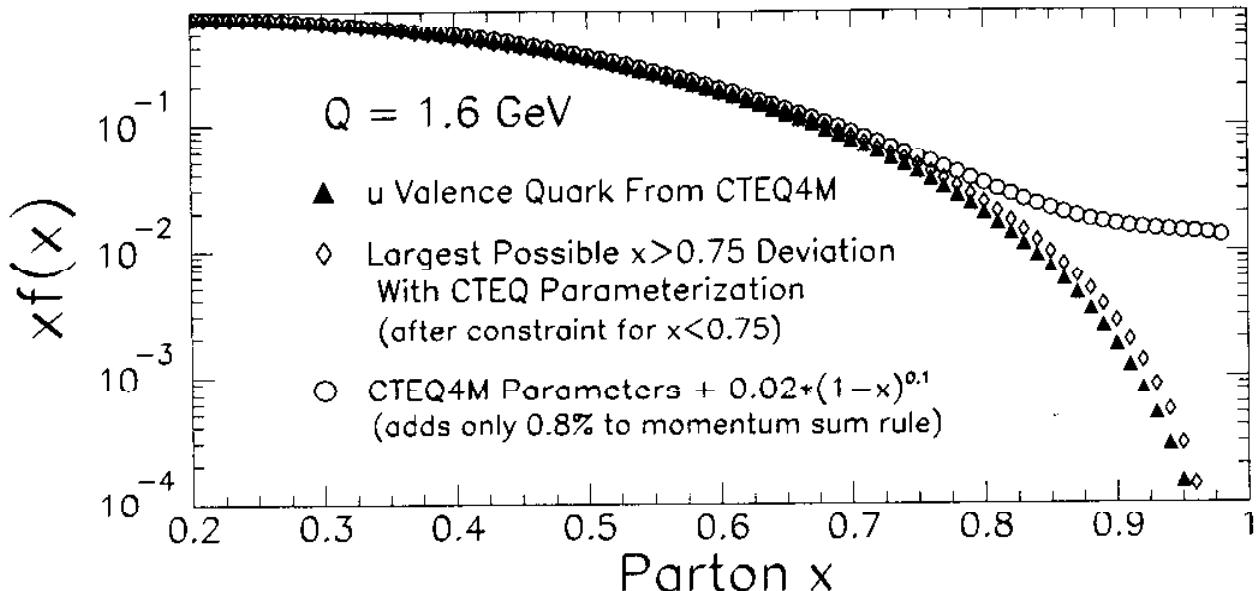
Constrain Sum Rules To Agree With CTEQ4M

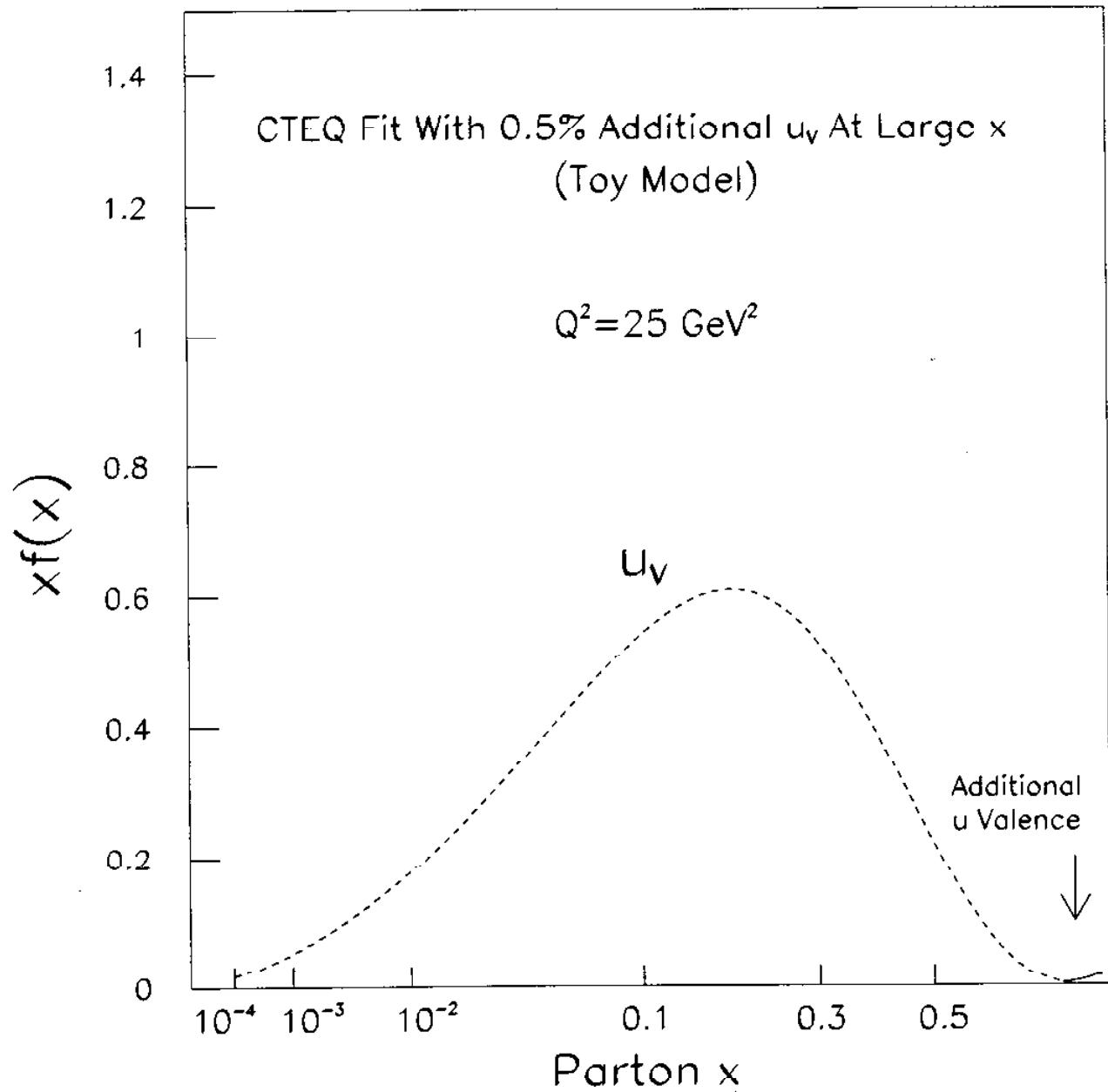
Find Most Extreme Large-x Deviation

Repeat With MRS Parameterization

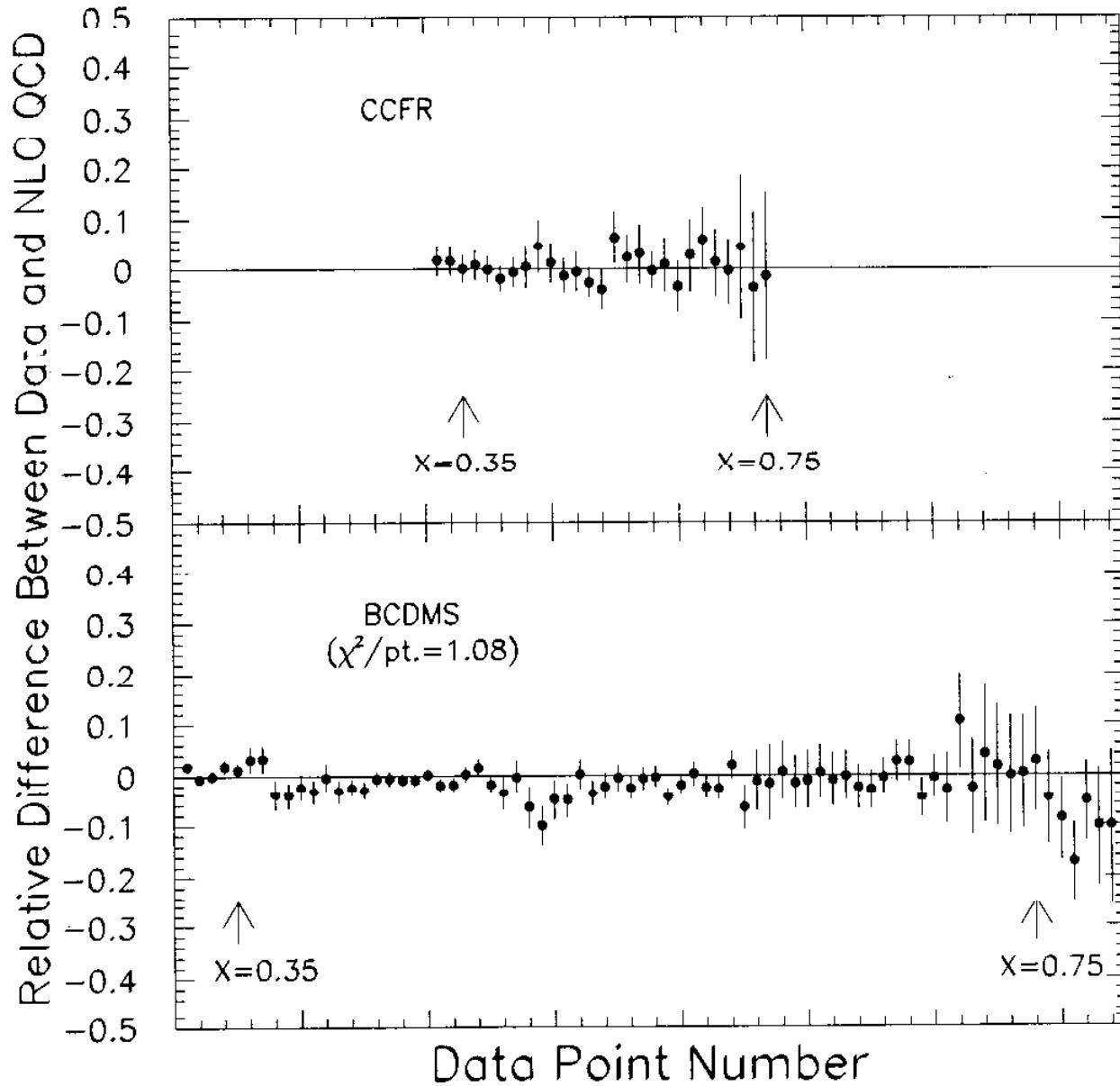
$$A * x^B * (1 - x)^C * (1 + D\sqrt{x} + E * x)$$

Showing That Common Parameterizations  
Are Not Very Flexible At Large  $x$

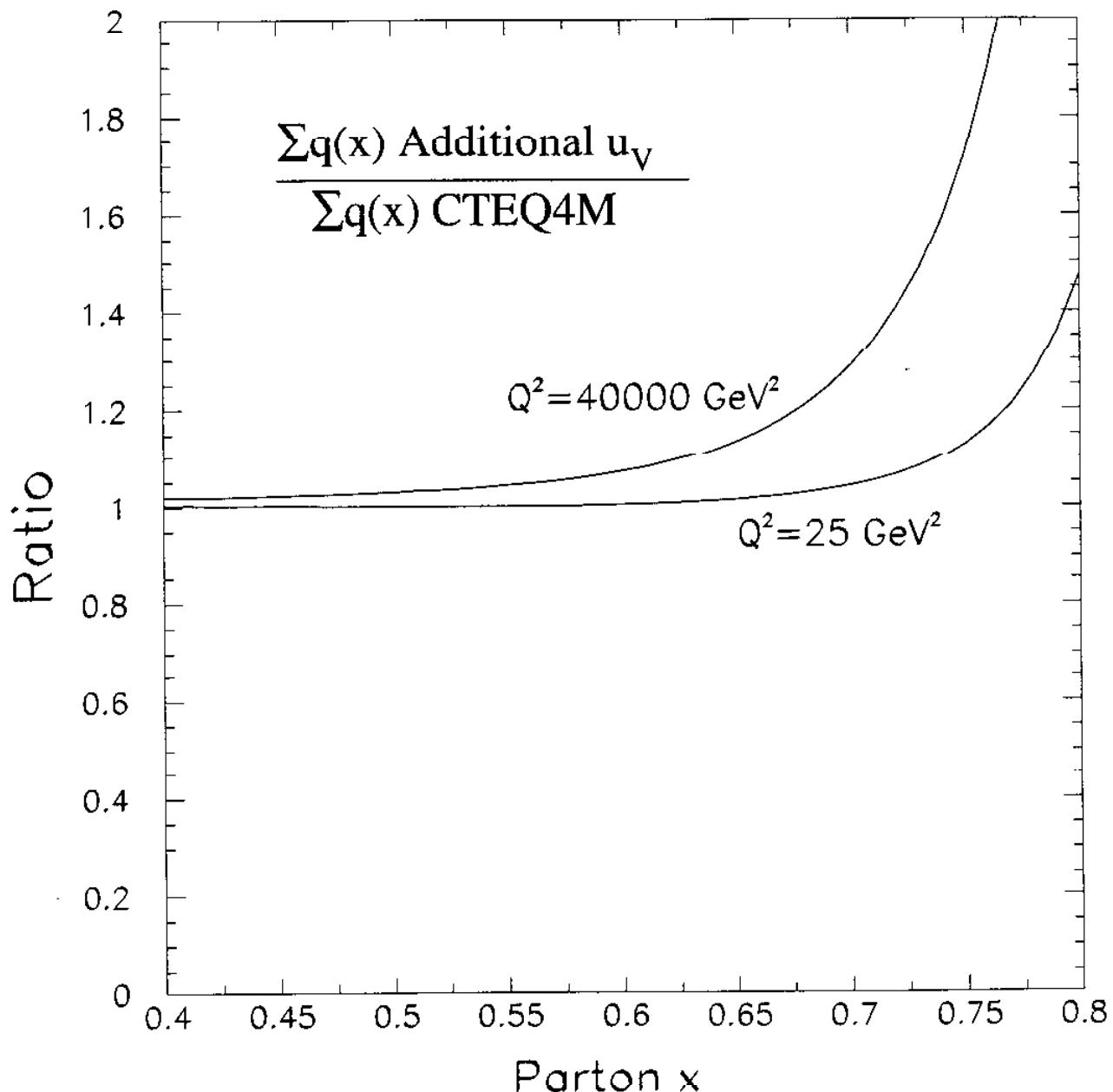




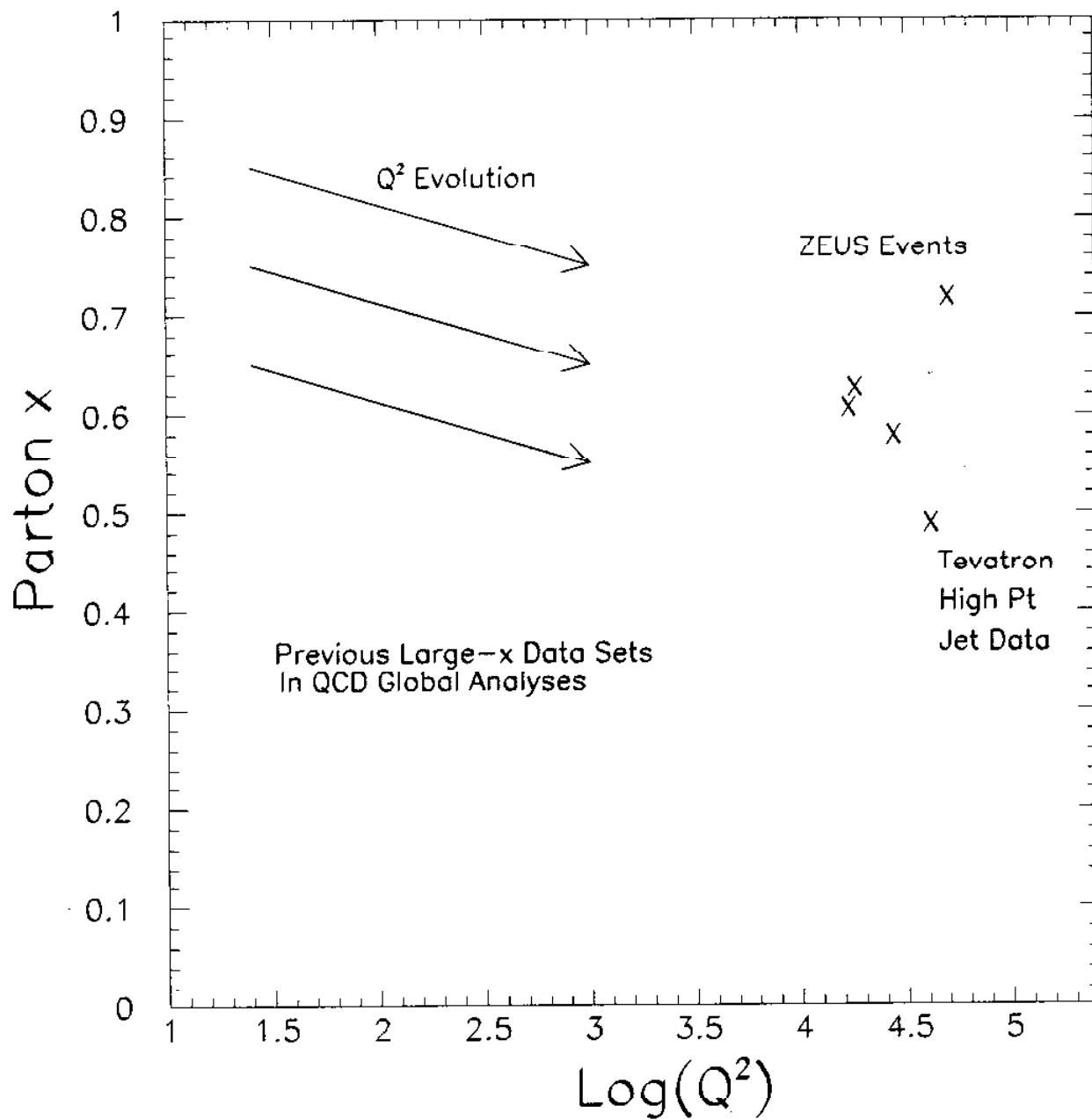
Comparison of Fixed Target Data With  
CTEQ Global Fit Including 0.5% Additional  $u_V$



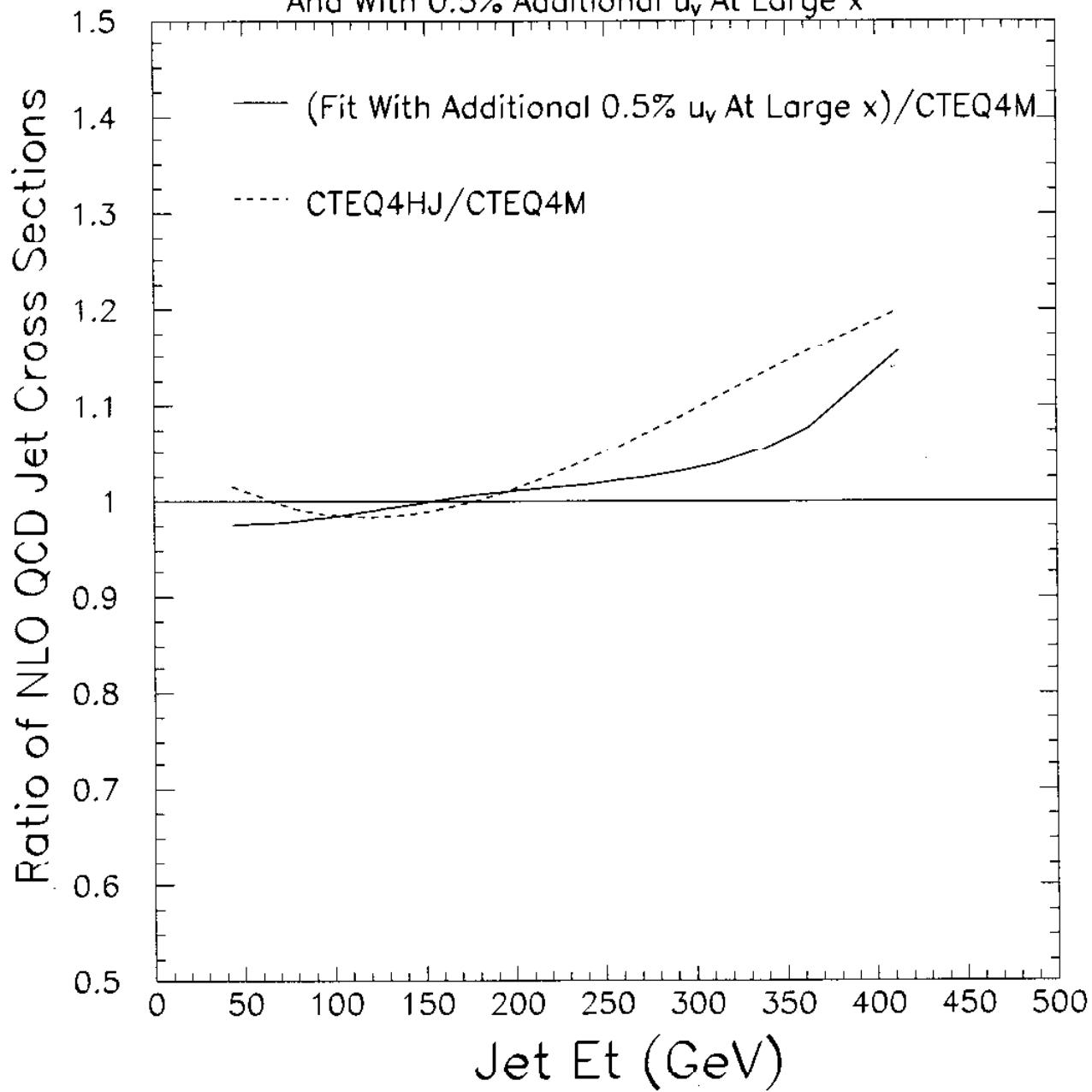
Comparison of Quarks From Conventional Analysis  
and From Fit Including 0.5% Additional  $u_V$



Tevatron High Pt Jet Data Would Be  
Affected By The Same Change In Quarks



Jet Cross Sections From Conventional Analysis,  
With Extra High- $x$  Gluons (CTEQ4HJ),  
And With 0.5% Additional  $u_V$  At Large  $x$

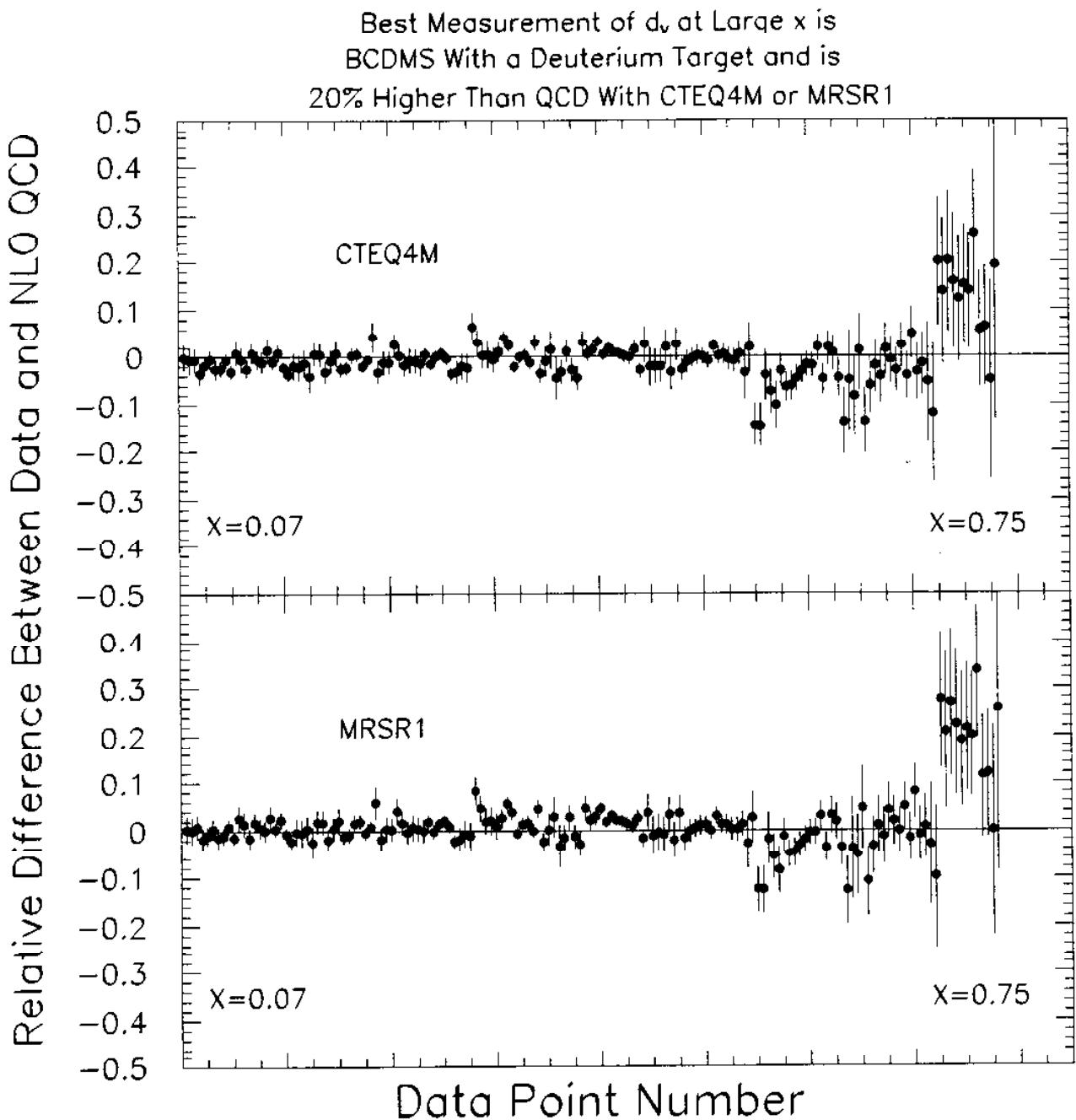


## Charge 1/3 vs Charge 2/3

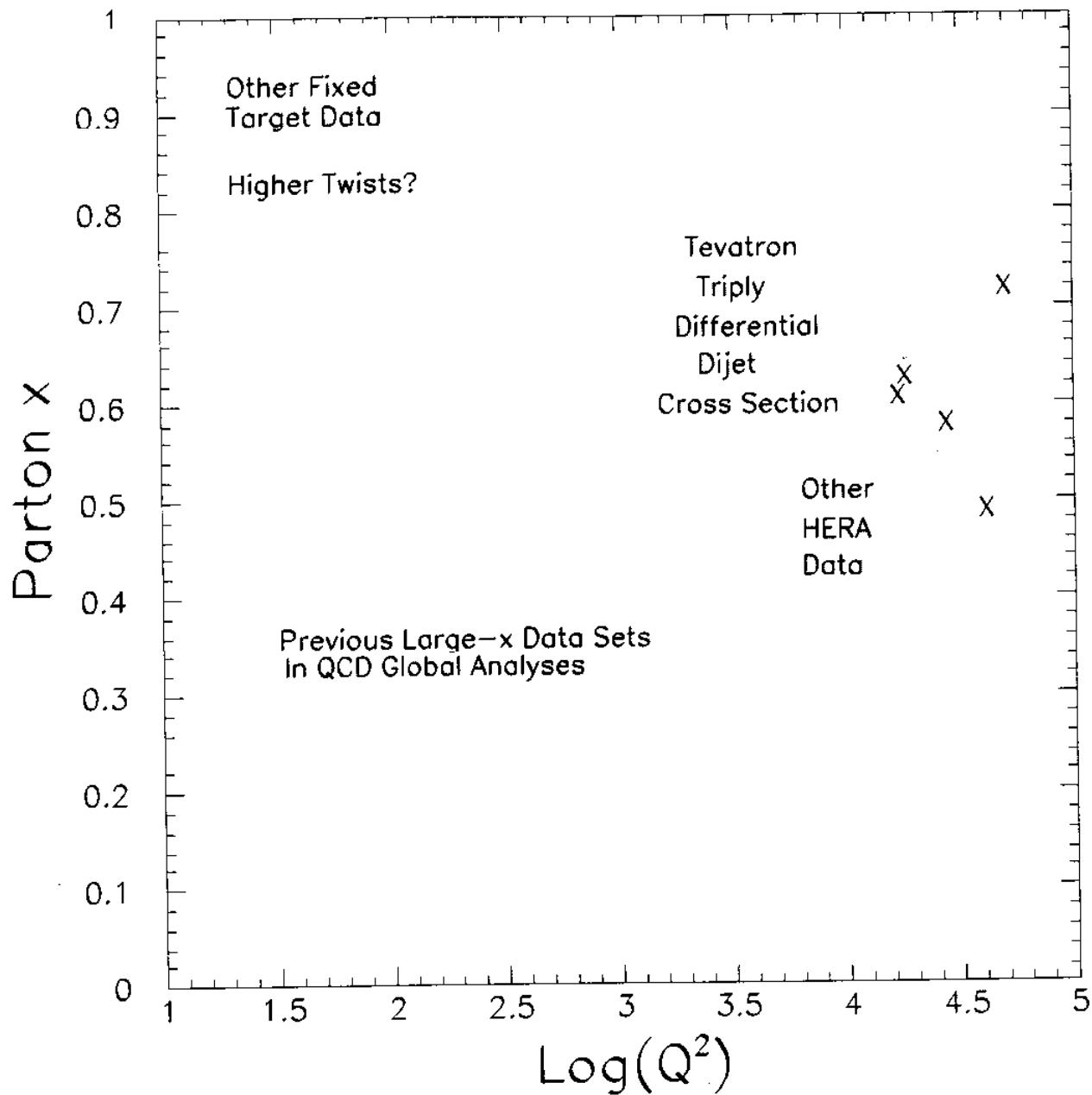
BCDMS On Hydrogen x4 Less Sensitive

HERA and Tevatron Similar Sensitivity

BCDMS on Deuterium Has An Excess  
Compared to CTEQ and MRS Already



## Other Relevant Data Sets That May Constrain The Large- $x$ Quarks



## Other Quark Uncertainties

$\bar{u}, \bar{d}$  Data Stop At  $x=0.65$

$s = \bar{s}$  Assumed

Shape of  $s$  Assumed =  $\bar{u} + \bar{d}$

Little Data Exists To Test This

Intrinsic Heavy Flavor Ignored  
(Replace Additional  $u_v$  With Charm)

## Conclusions/Future Prospects

If Excesses Persist and are "Smooth",  
QCD Effects Such As Parton Distributions  
Should Be Investigated

The Feed-down From Large  $x$  is  
One Possible QCD Scenario

Other Measurements Testing The  
Total Flux Of Quarks At Large  $x$   
Should Be Investigated