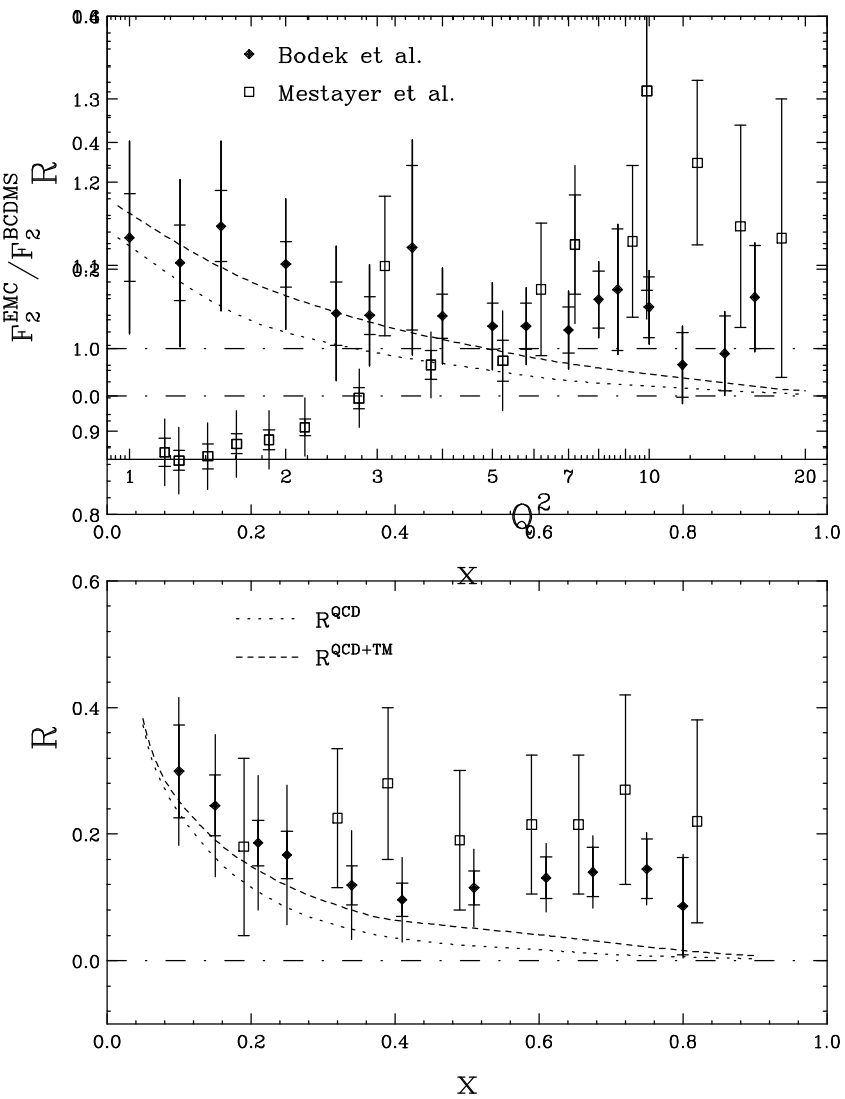
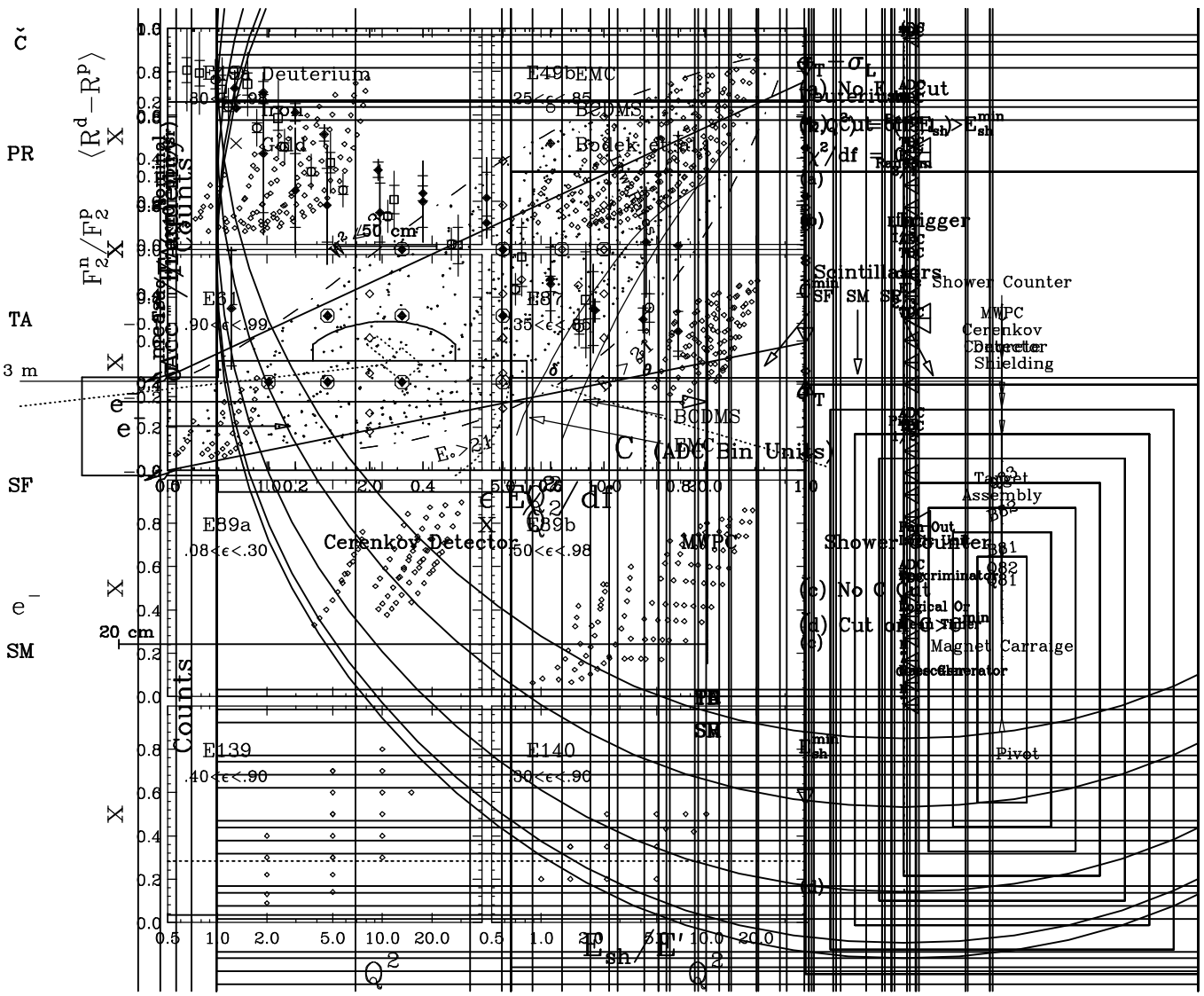
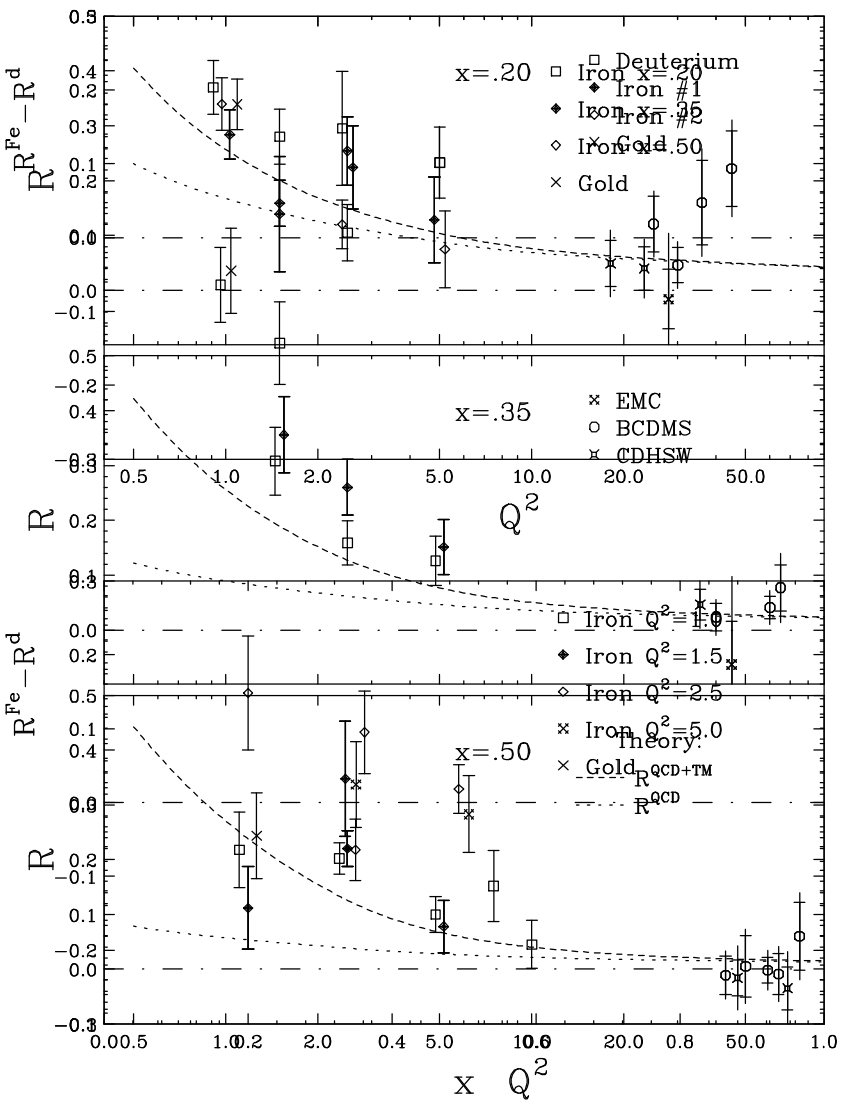
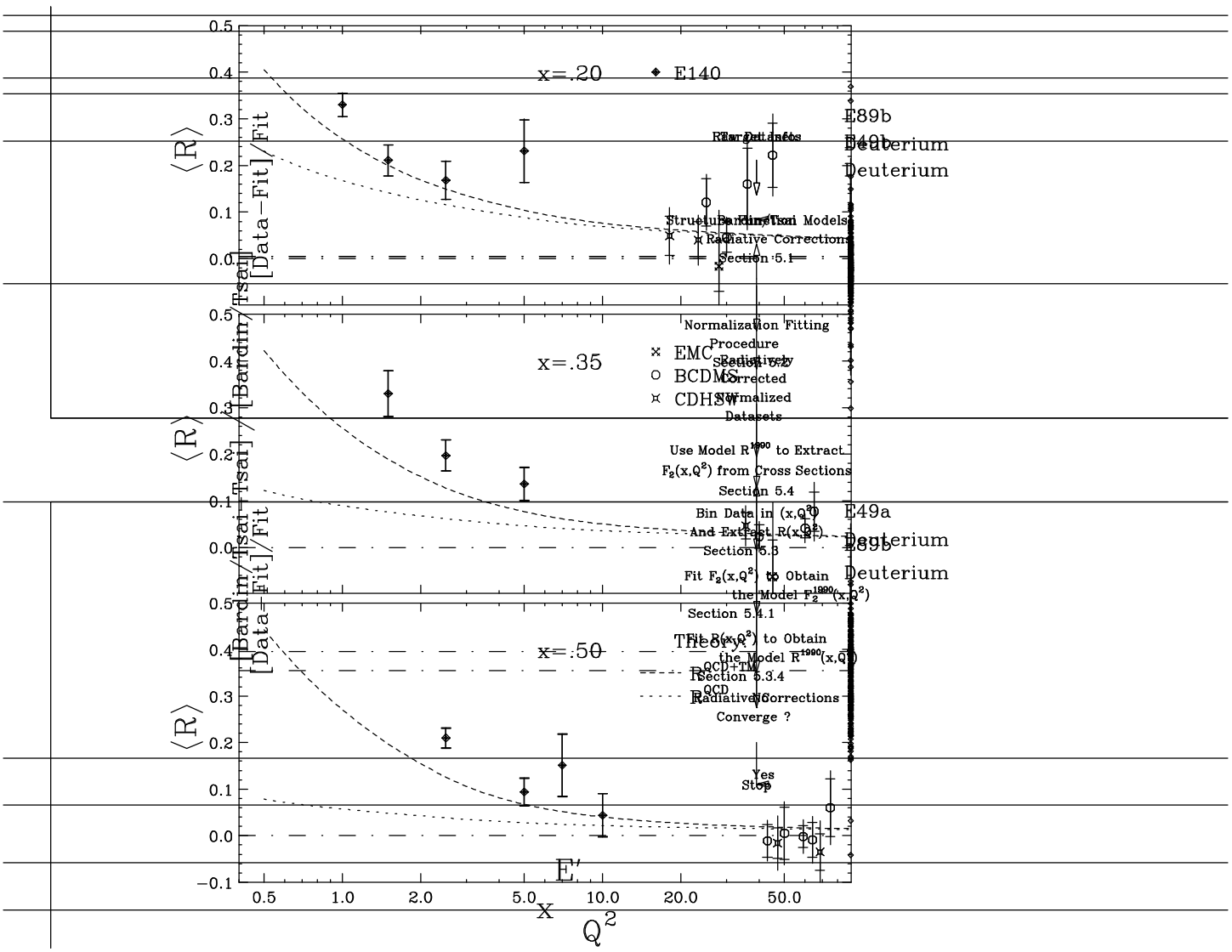
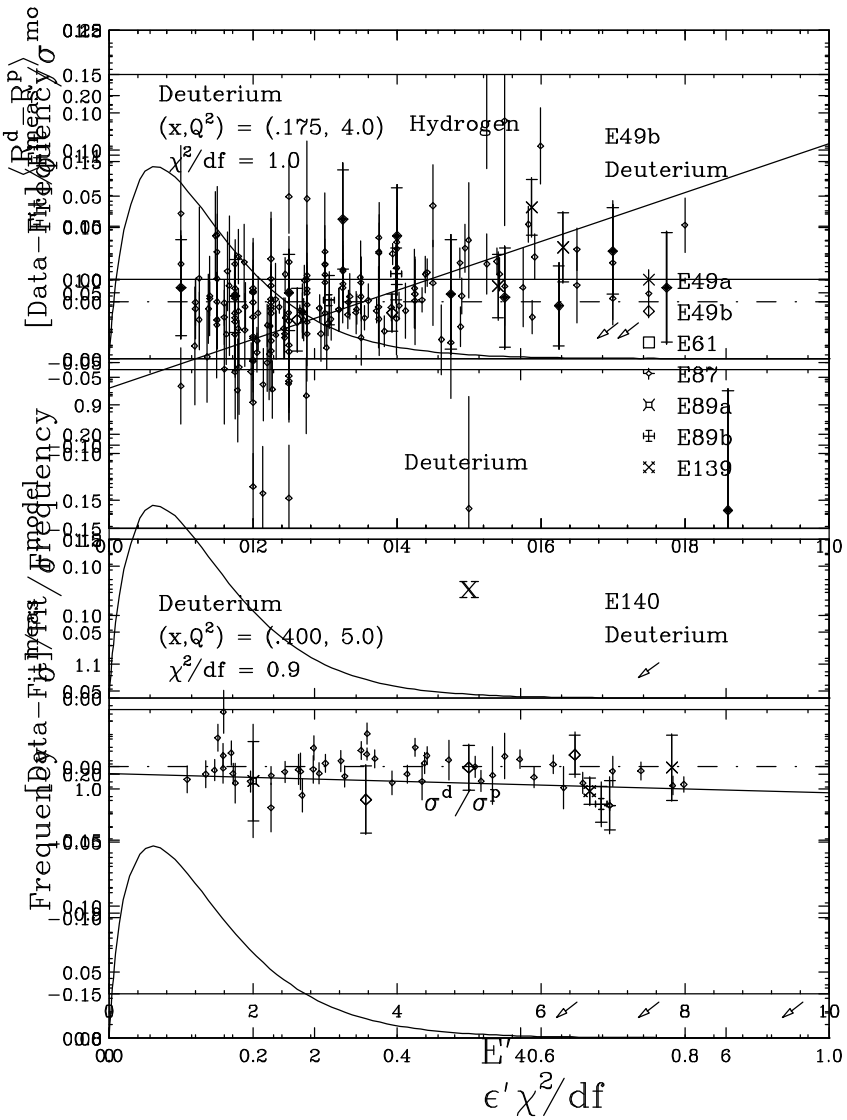

Bodek et al.
Mestayer et al.
F_2^{EMC}/F_2^{BCDMS}
R
Q^2
X
R^{QCD}
R^{QCD+TM}
R
X

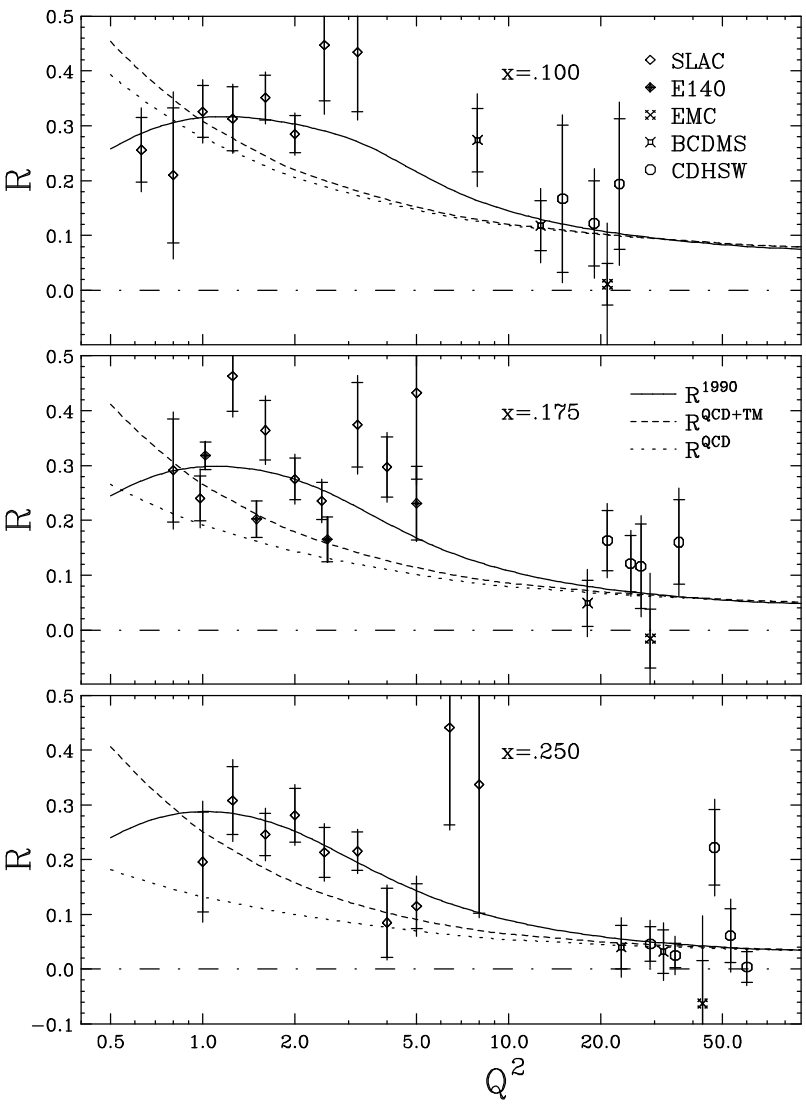


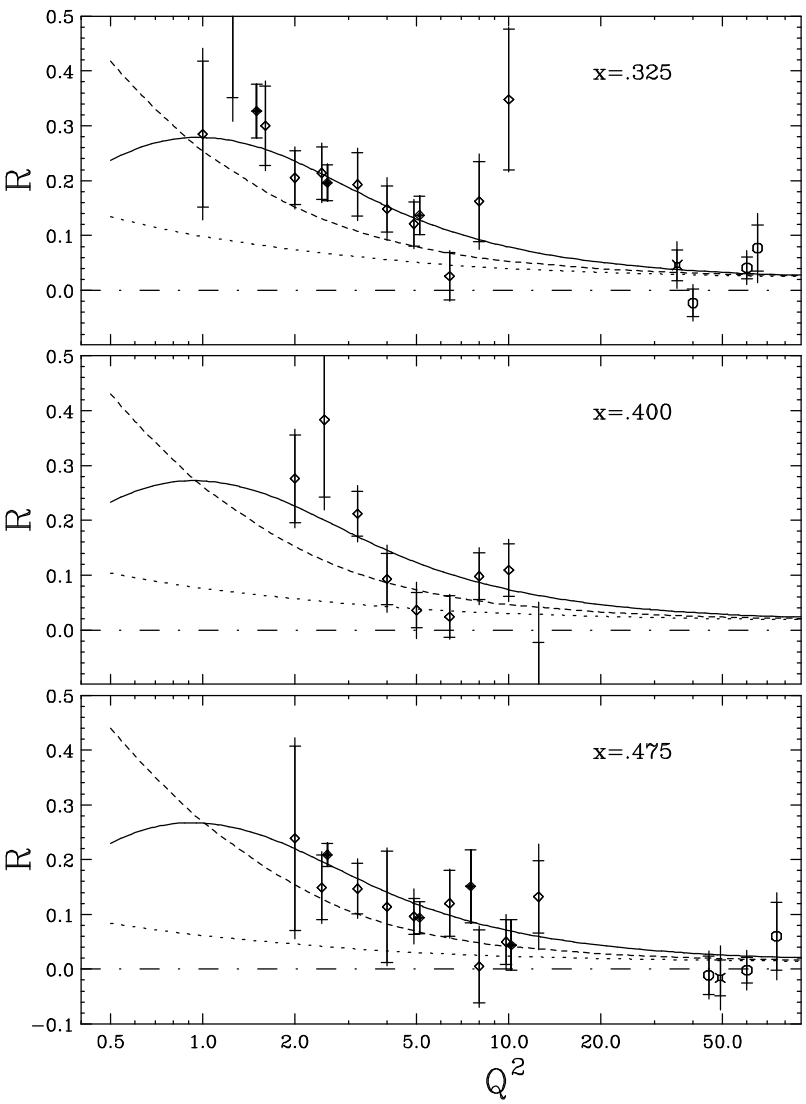
Č
PR
TA
SF
SM
3 m
20 cm
Counts
E49a Deuterium
E49b EMC
BCDMS
Bodek et al.
Iron
Gold
50 cm
E61
E87
E89a
E89b
Cerenkov Detector
MWPC
E139
E140
Scintillators
Shower Counter
Magnet Carraige
Pivot
Target Assembly
Shielding
Cerenkov Detector
Shower Counter
Trigger

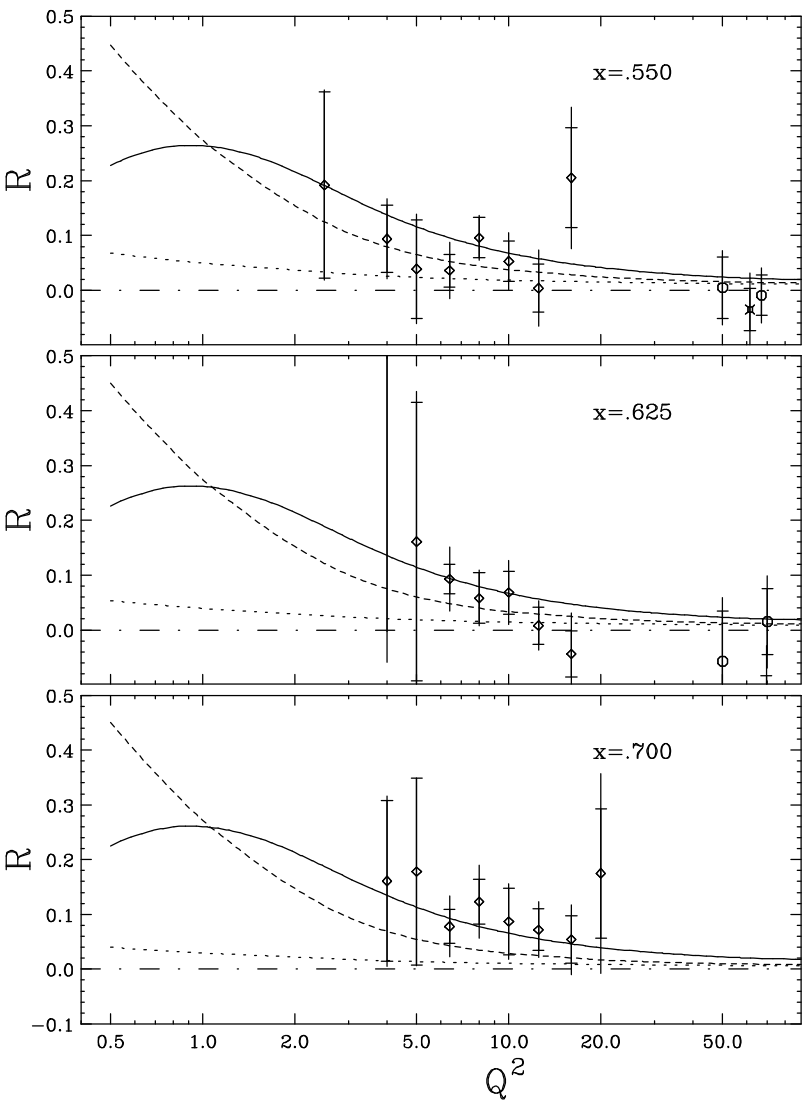

x=.20
Deuterium
Iron x=.20
Iron #1
Iron x=.35
Iron #2
Iron x=.50
Gold
x=.35
EMC
BCDMS
CDHSW
Iron Q²=1.0
Iron Q²=1.5
Iron Q²=2.5
Iron Q²=5.0
x=.50
Gold
Theory:
R^QCD+TM
R^QCD
R^Fe − R^d
R
Q²
x Q²

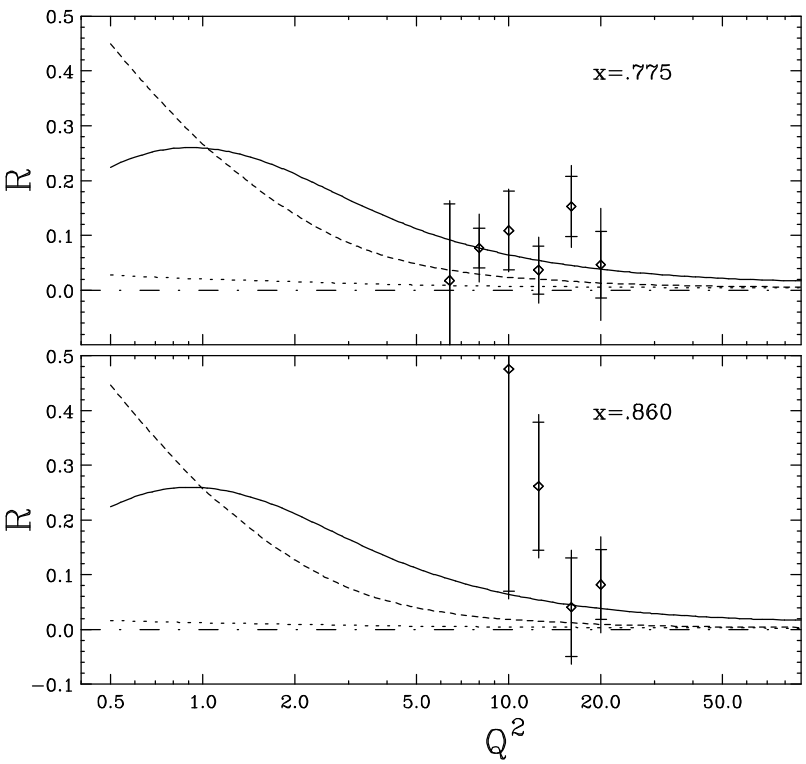

x=.20
E140
E89b
E49b
Deuterium
Deuterium
Structure Function Models
Radiative Corrections
Section 5.1
x=.35
EMC
BCDMS
CDHSW
Normalization Fitting
Procedure
Section 5.2
Corrected
Normalized
Datasets
Use Model R^{1990} to Extract
$F_2(x,Q^2)$ from Cross Sections
Section 5.4
Bin Data in (x,Q^2)
And Extract $R(x,Q^2)$
Section 5.3
Fit $F_2(x,Q^2)$ to Obtain
the Model $F_2^{1990}(x,Q^2)$
Section 5.4.1
Fit $R(x,Q^2)$ to Obtain
the Model $R^{1990}(x,Q^2)$
Section 5.3.4
Converge ?
Yes
Stop
E49a
E89b
Deuterium
Deuterium
x=.50
Theory
QCD+TM
QCD
Radiative Corrections
$\langle R \rangle$
[Bardin/Tsai]/[Data−Fit]
E′
x
Q^2
0.5
1.0
2.0
5.0
10.0
20.0
50.0
−0.1
0.0
0.1
0.2
0.3
0.4
0.5

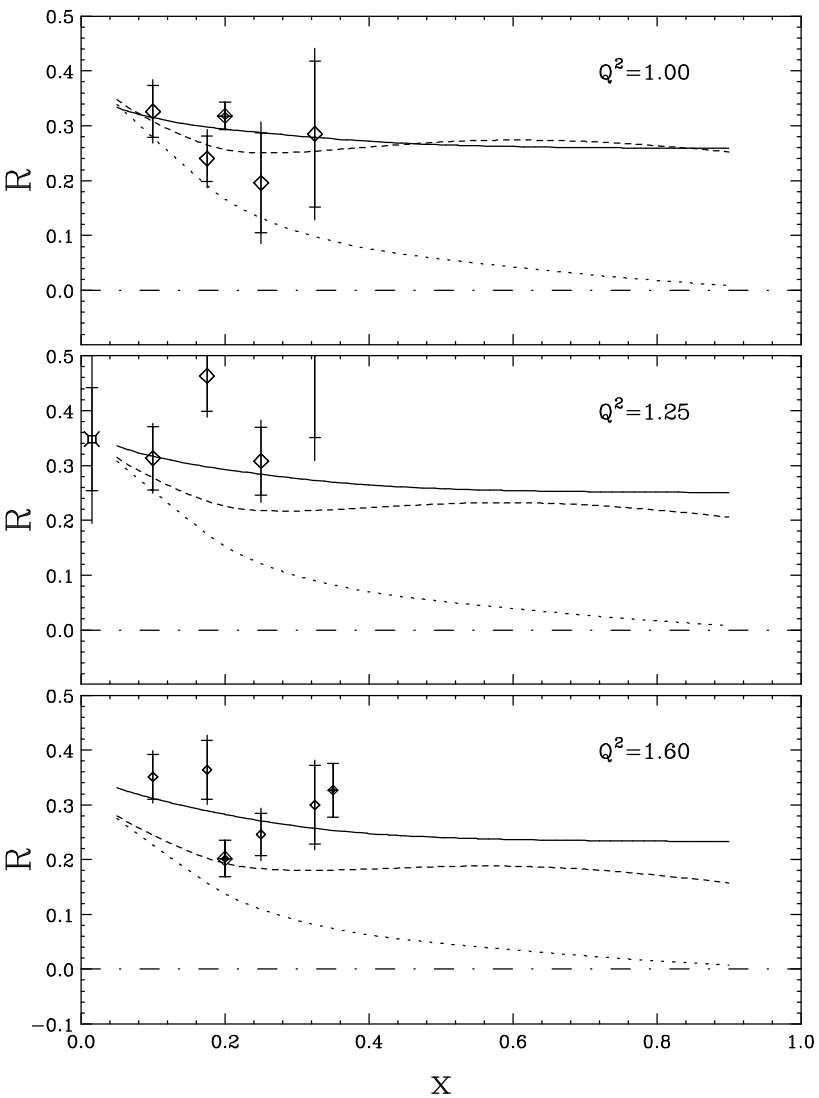

Deuterium
(x,Q²) = (.175, 4.0)
χ²/df = 1.0
Hydrogen
E49b
Deuterium
E49a
E49b
E61
E87
E89a
E89b
E139
Deuterium
X
Deuterium
(x,Q²) = (.400, 5.0)
χ²/df = 0.9
E140
Deuterium
σ^d / σ^p
E′
ε′χ²/df

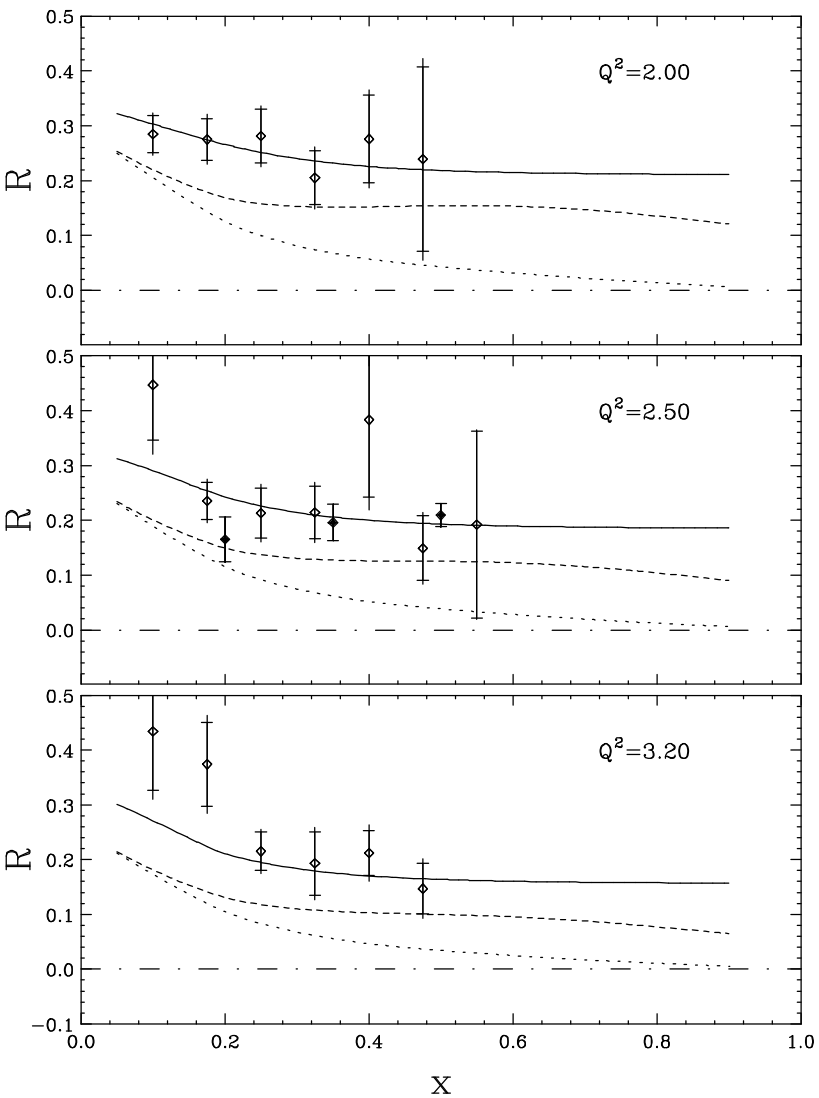

x=.100
x=.175
x=.250
SLAC
E140
EMC
BCDMS
CDHSW
R^{1990}
R^{QCD+TM}
R^{QCD}
R
Q^2
0.5
1.0
2.0
5.0
10.0
20.0
50.0
−0.1
0.0
0.1
0.2
0.3
0.4
0.5

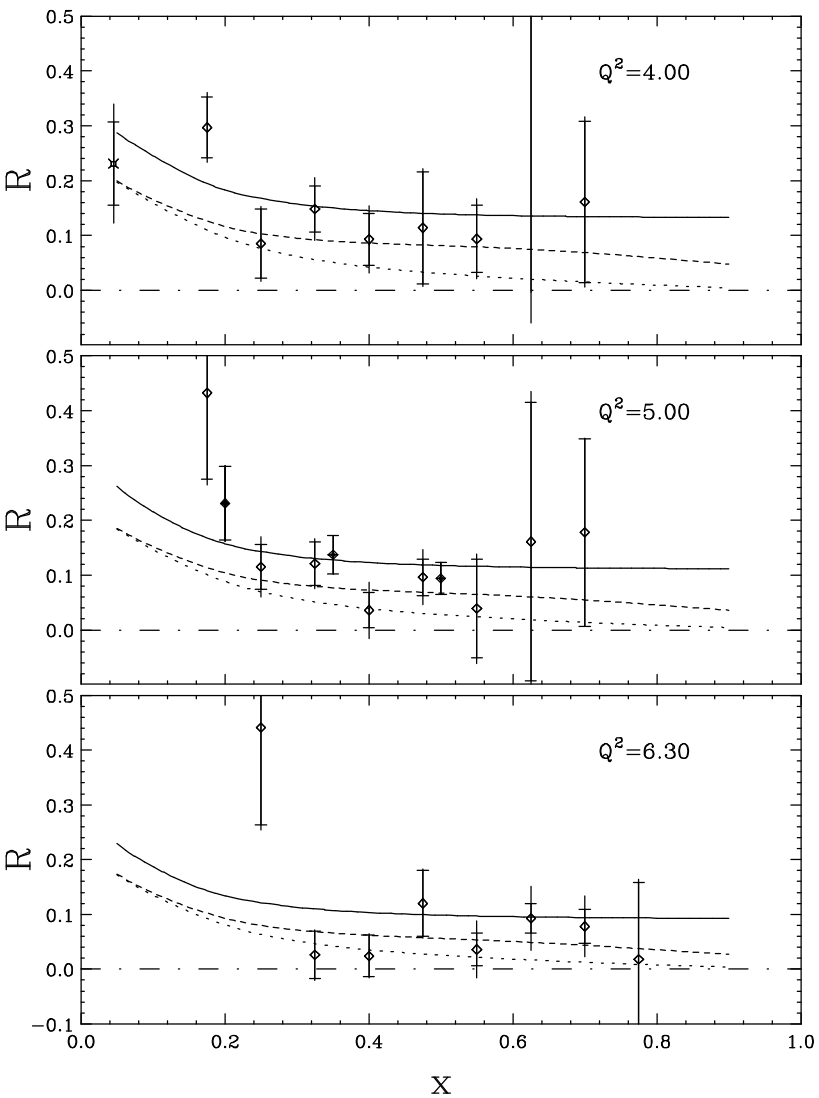

x=.325
x=.400
x=.475
R
Q^2
0.5
0.4
0.3
0.2
0.1
0.0
−0.1
0.5
1.0
2.0
5.0
10.0
20.0
50.0

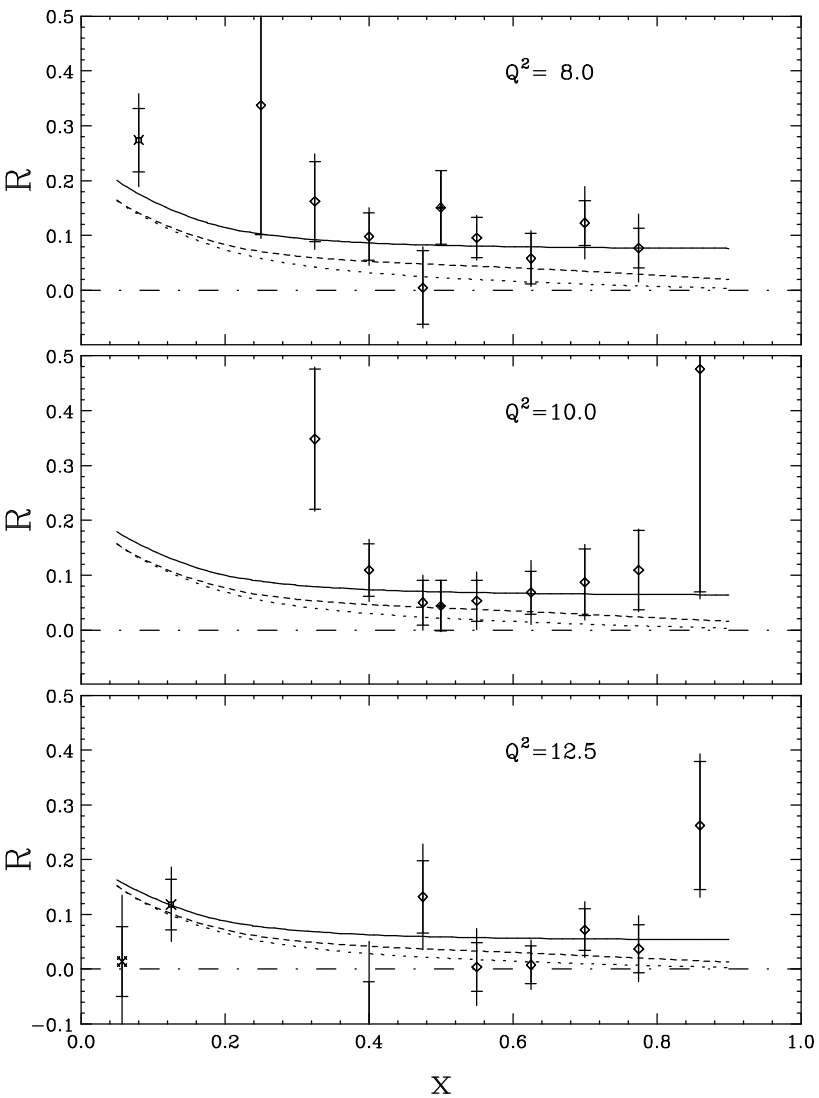

x=.550
x=.625
x=.700
R
R
R
0.5
0.4
0.3
0.2
0.1
0.0
−0.1
0.5
1.0
2.0
5.0
10.0
20.0
50.0
Q^2

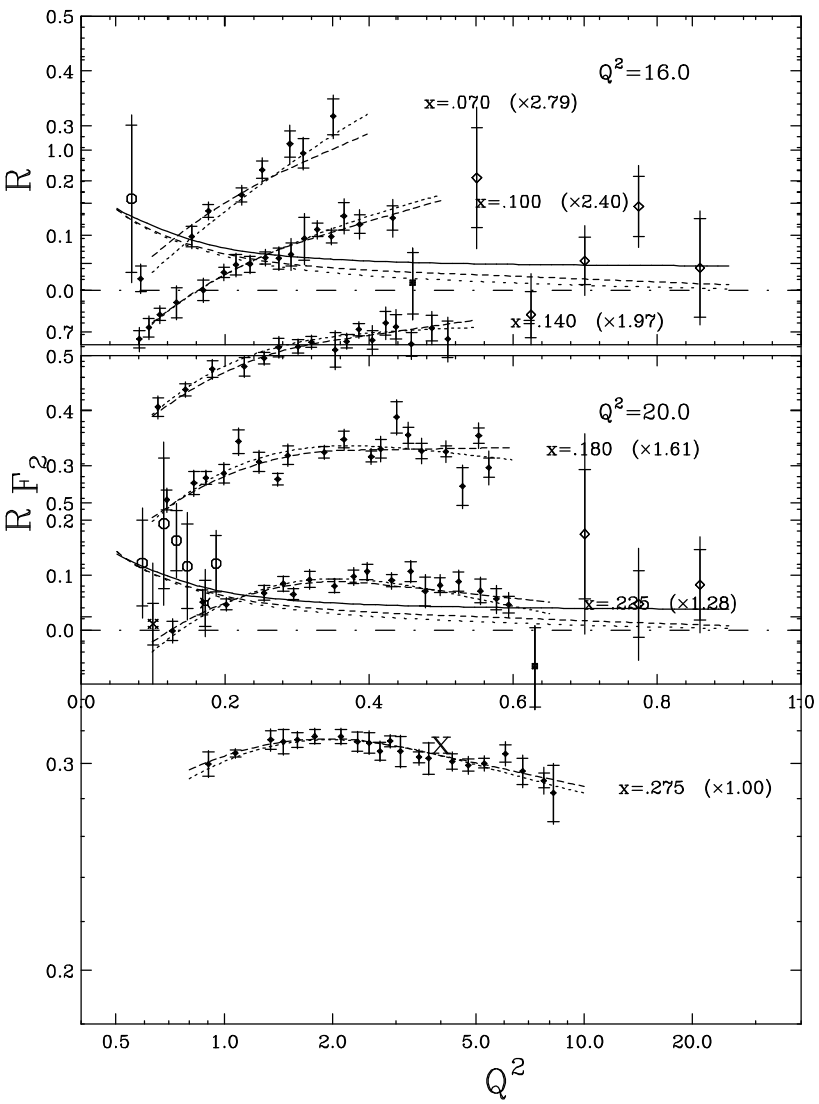

x=.775
x=.860
R
R
0.5
0.4
0.3
0.2
0.1
0.0
−0.1
0.5
1.0
2.0
5.0
10.0
20.0
50.0
Q^2

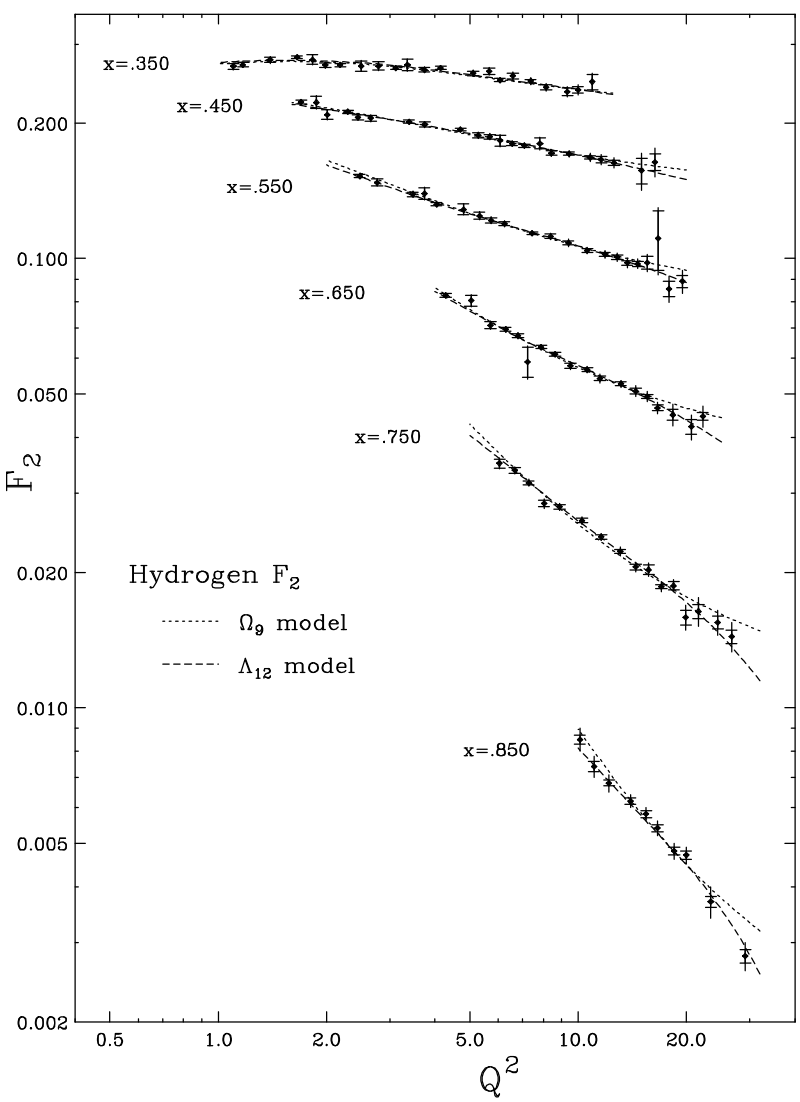

Q^2=1.00
Q^2=1.25
Q^2=1.60
R
X
0.5
0.4
0.3
0.2
0.1
0.0
−0.1
0.0
0.2
0.4
0.6
0.8
1.0

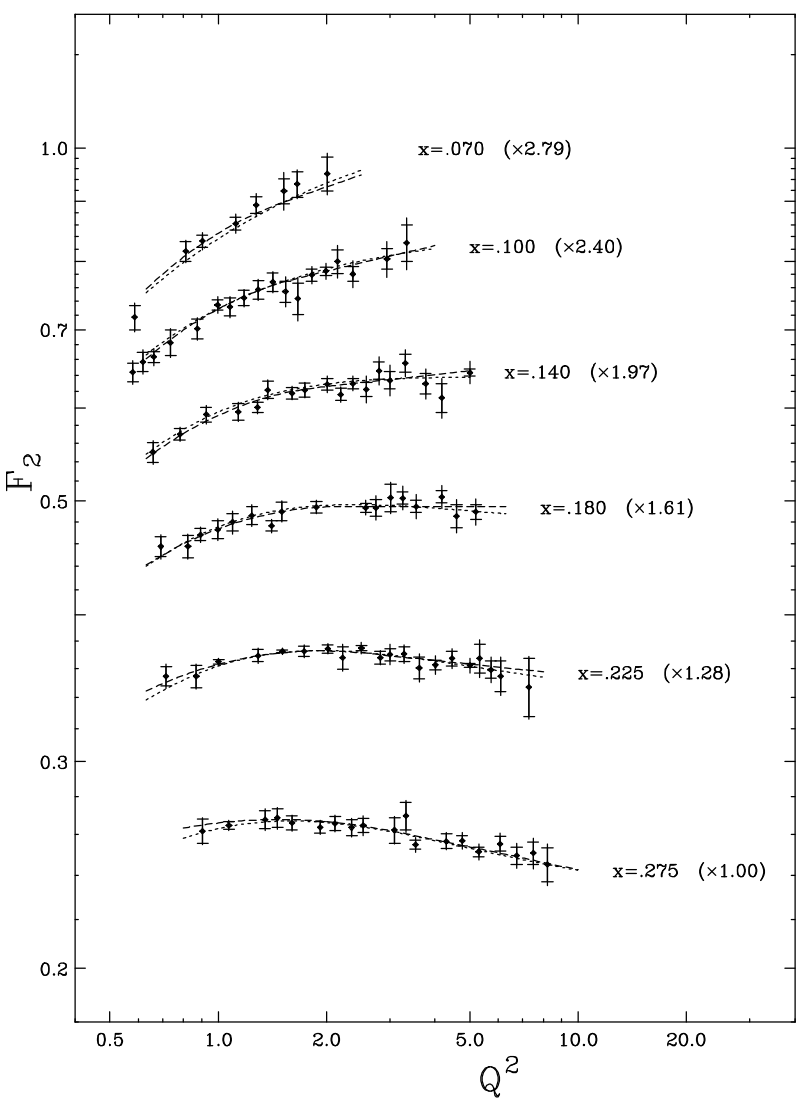

Q^2=2.00
Q^2=2.50
Q^2=3.20
R
X
0.5
0.4
0.3
0.2
0.1
0.0
−0.1
0.0
0.2
0.4
0.6
0.8
1.0

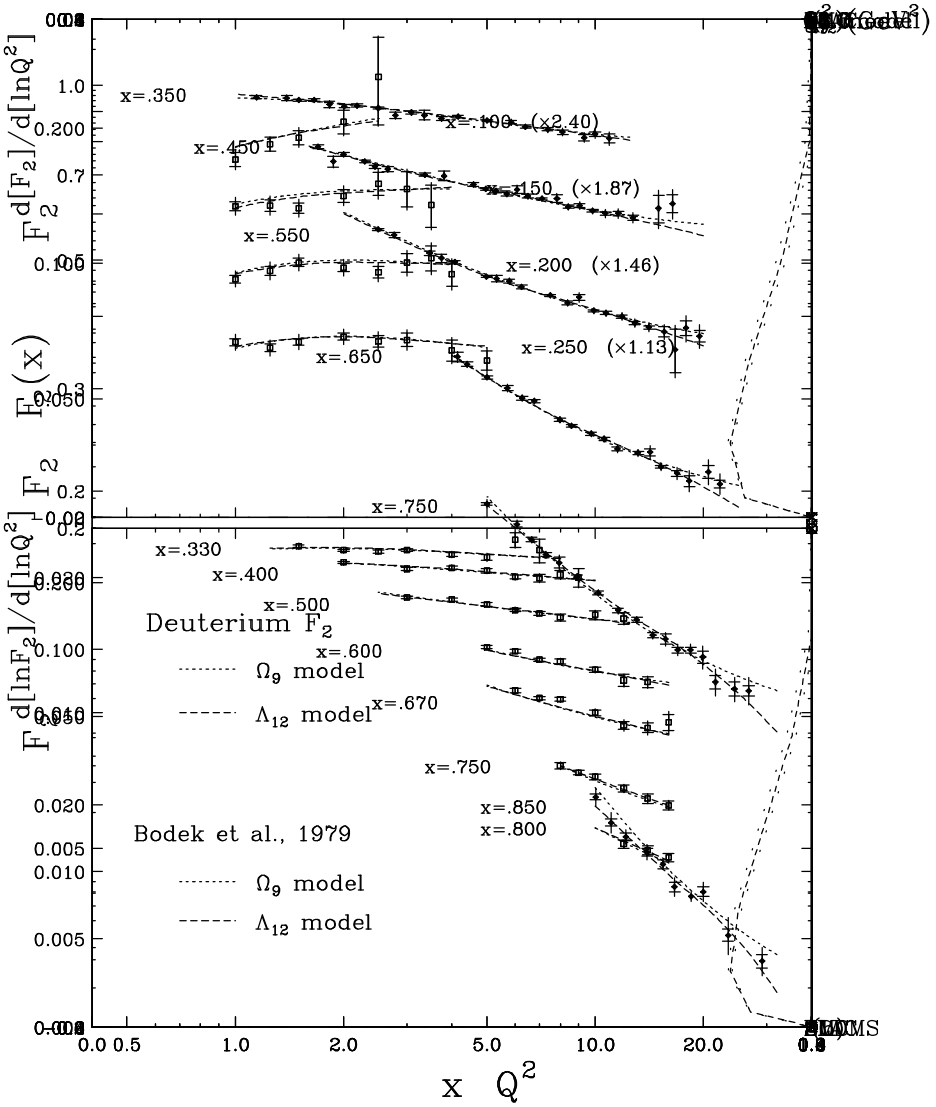

Q^2=4.00
Q^2=5.00
Q^2=6.30
R
X
0.5
0.4
0.3
0.2
0.1
0.0
−0.1
0.0
0.2
0.4
0.6
0.8
1.0

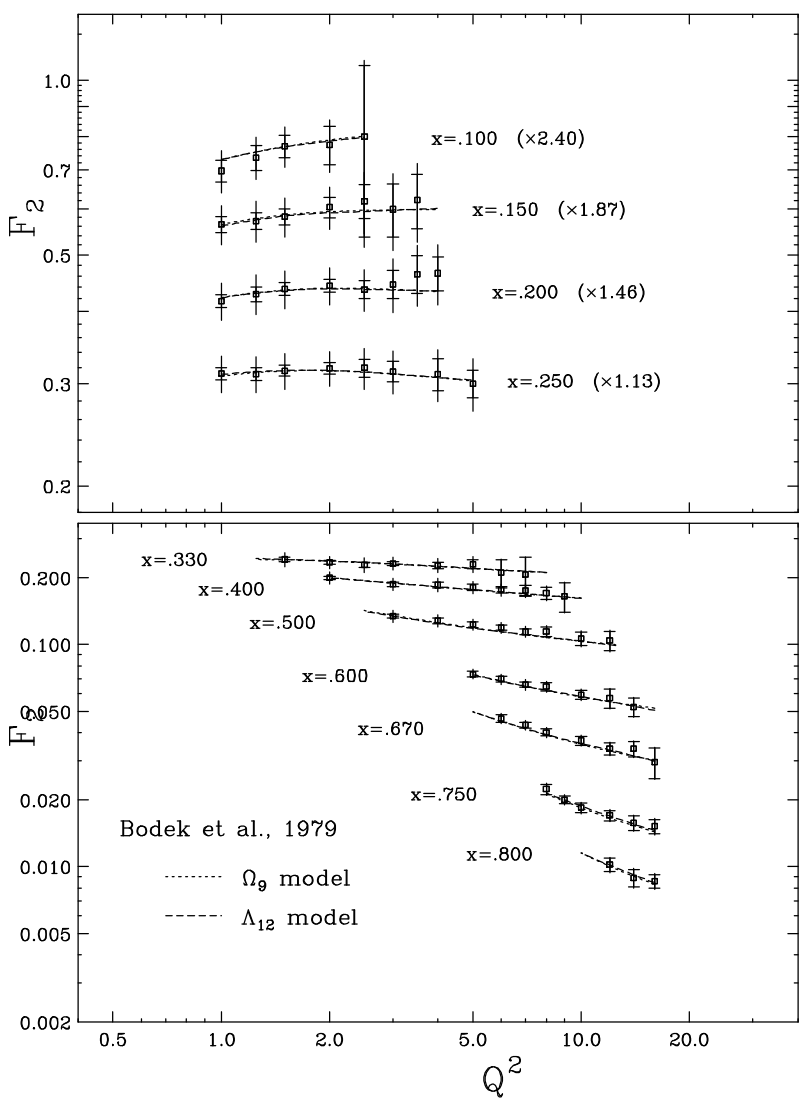

Q^2= 8.0
Q^2=10.0
Q^2=12.5
R
X
0.5
0.4
0.3
0.2
0.1
0.0
−0.1
0.0
0.2
0.4
0.6
0.8
1.0

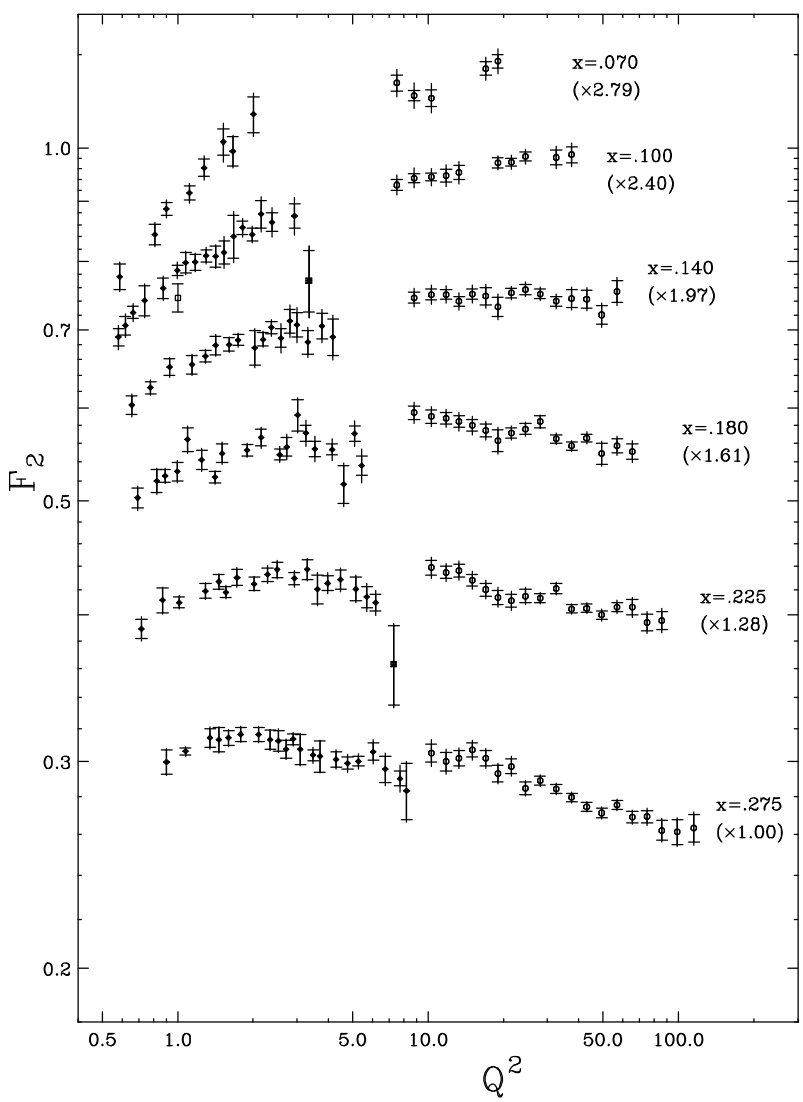

R
Q^2=16.0
x=.070 (×2.79)
x=.100 (×2.40)
x=.140 (×1.97)
$R F_2$
Q^2=20.0
x=.180 (×1.61)
x=.225 (×1.28)
x=.275 (×1.00)
X
Q^2

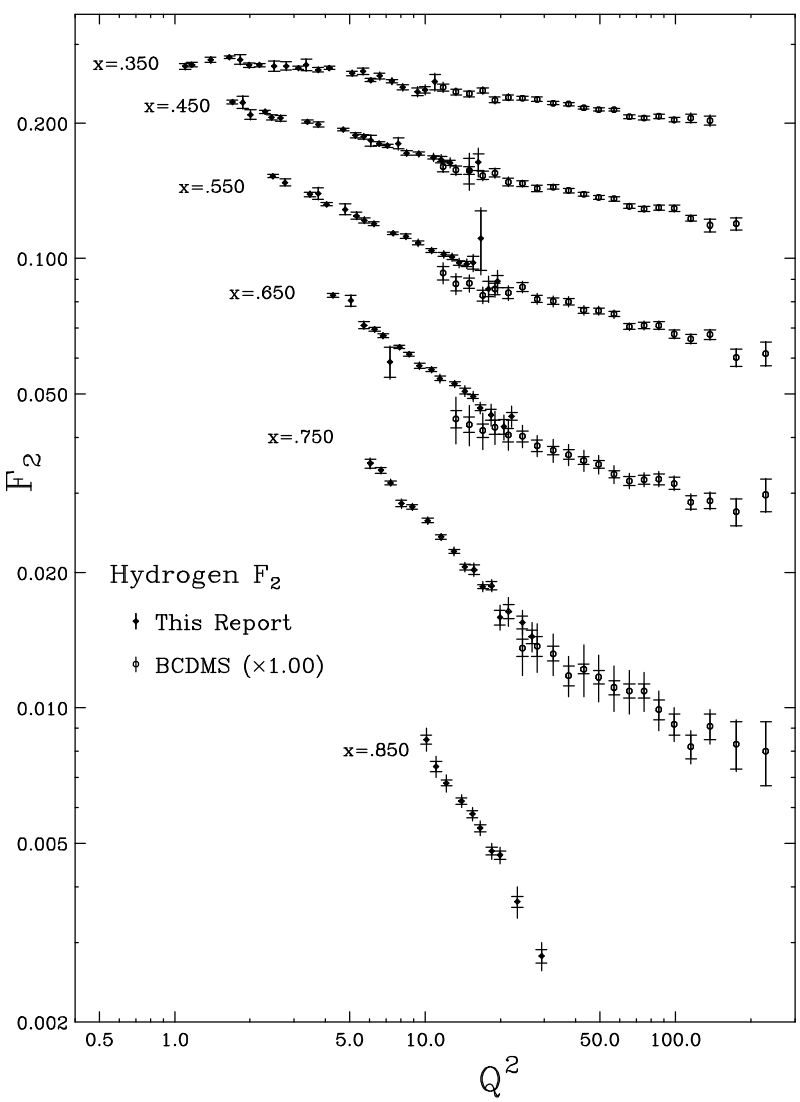

x=.350
x=.450
x=.550
x=.650
x=.750
x=.850
Hydrogen F_2
Ω_9 model
Λ_{12} model
F_2
Q^2
0.200
0.100
0.050
0.020
0.010
0.005
0.002
0.5
1.0
2.0
5.0
10.0
20.0

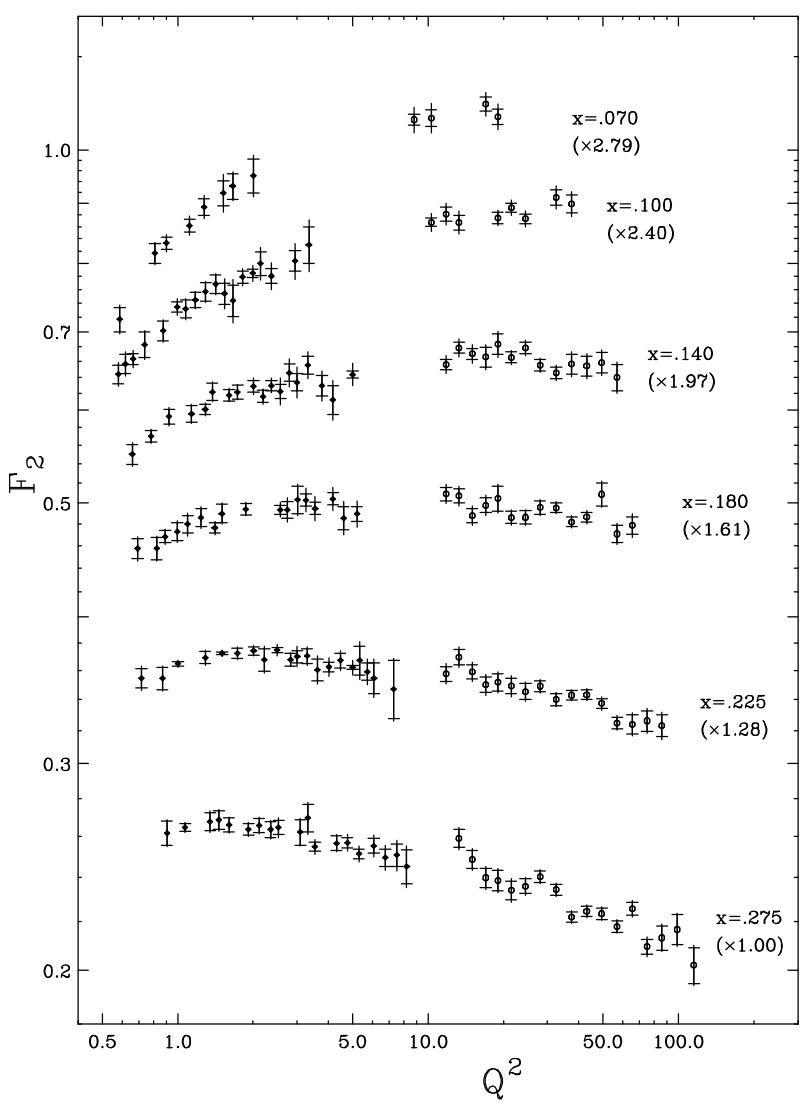

x=.070 (×2.79)
x=.100 (×2.40)
x=.140 (×1.97)
x=.180 (×1.61)
x=.225 (×1.28)
x=.275 (×1.00)
F2
Q2
1.0
0.7
0.5
0.3
0.2
0.5
1.0
2.0
5.0
10.0
20.0

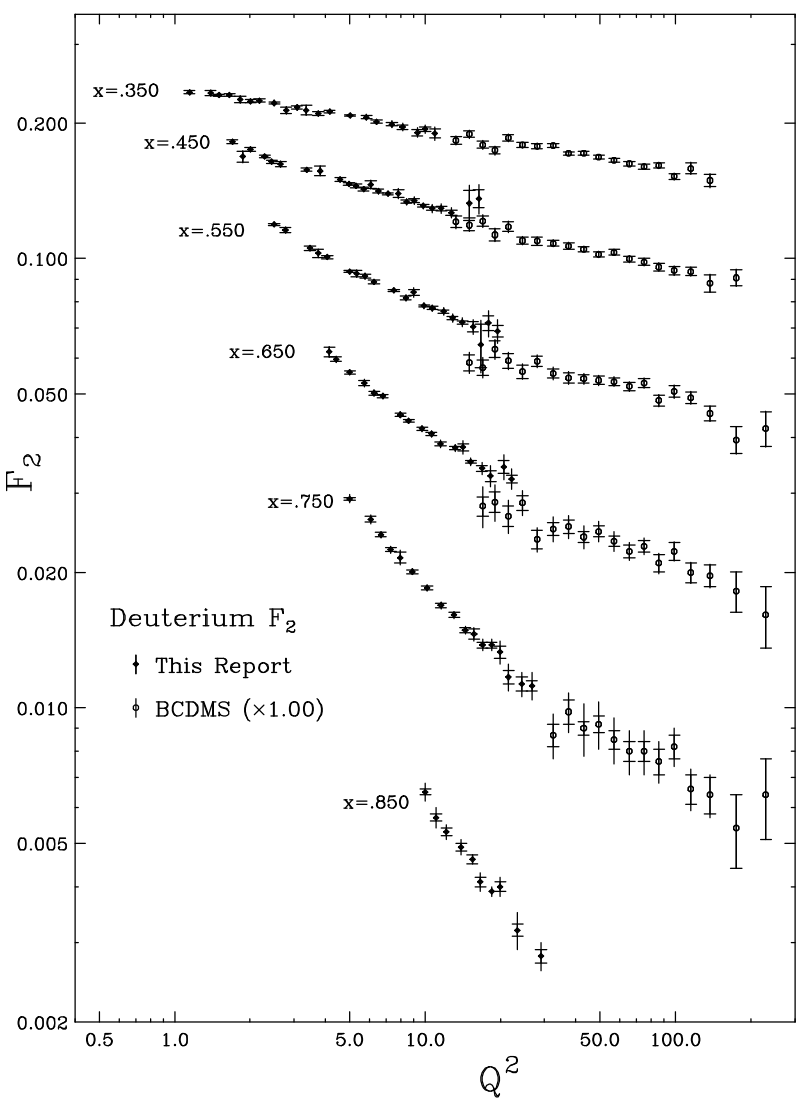

x=.350
x=.100 (×2.40)
x=.450
x=.150 (×1.87)
x=.550
x=.200 (×1.46)
x=.650
x=.250 (×1.13)
x=.750
x=.330
x=.400
x=.500
Deuterium F_2
Ω_9 model
Λ_{12} model
x=.600
x=.670
x=.750
x=.850
x=.800
Bodek et al., 1979
Ω_9 model
Λ_{12} model
F_2
$F_2(x)$
$F_2 \frac{d[\ln F_2]}{d[\ln Q^2]}$
$\frac{d[F_2]}{d[\ln Q^2]}$
0.0 0.5 1.0 2.0 5.0 10.0 20.0
x Q^2

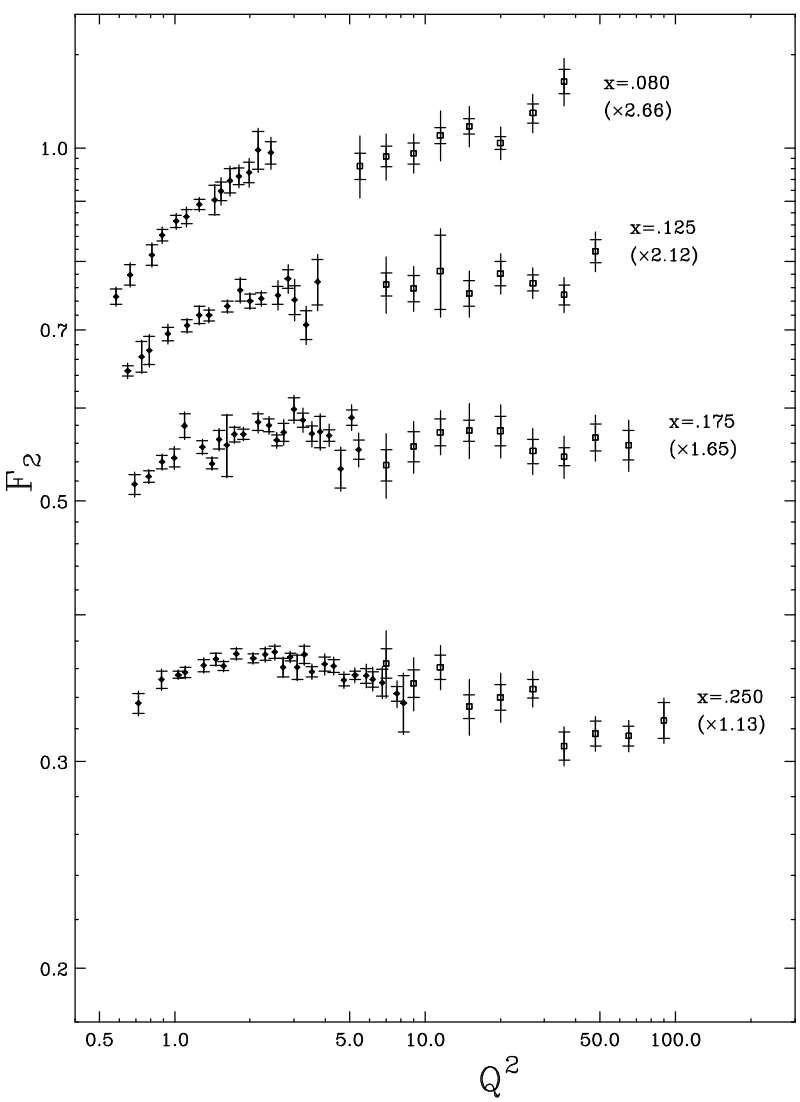

1.0
0.7
0.5
0.3
0.2
F_2
x=.100 (×2.40)
x=.150 (×1.87)
x=.200 (×1.46)
x=.250 (×1.13)
0.200
0.100
0.050
0.020
0.010
0.005
0.002
x=.330
x=.400
x=.500
x=.600
x=.670
x=.750
x=.800
Bodek et al., 1979
Ω_9 model
Λ_{12} model
0.5
1.0
2.0
5.0
10.0
20.0
Q^2

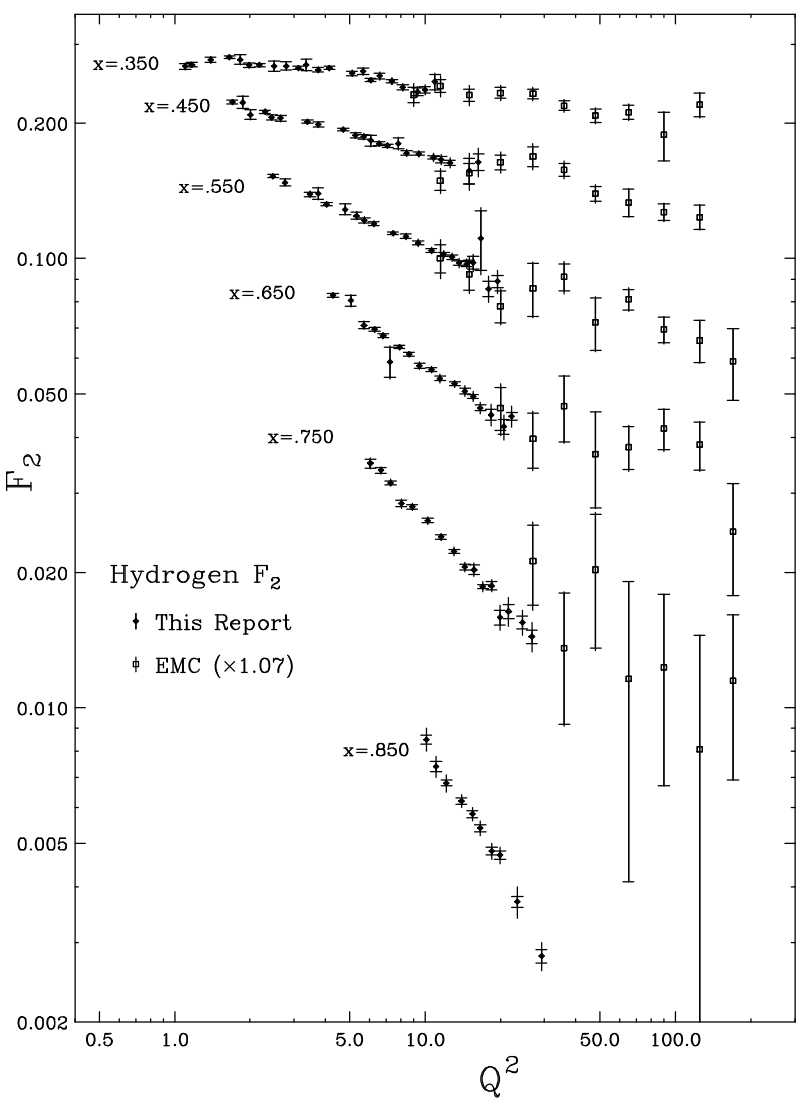

x=.070
(×2.79)
x=.100
(×2.40)
x=.140
(×1.97)
x=.180
(×1.61)
x=.225
(×1.28)
x=.275
(×1.00)
F_2
Q^2
1.0
0.7
0.5
0.3
0.2
0.5
1.0
5.0
10.0
50.0
100.0

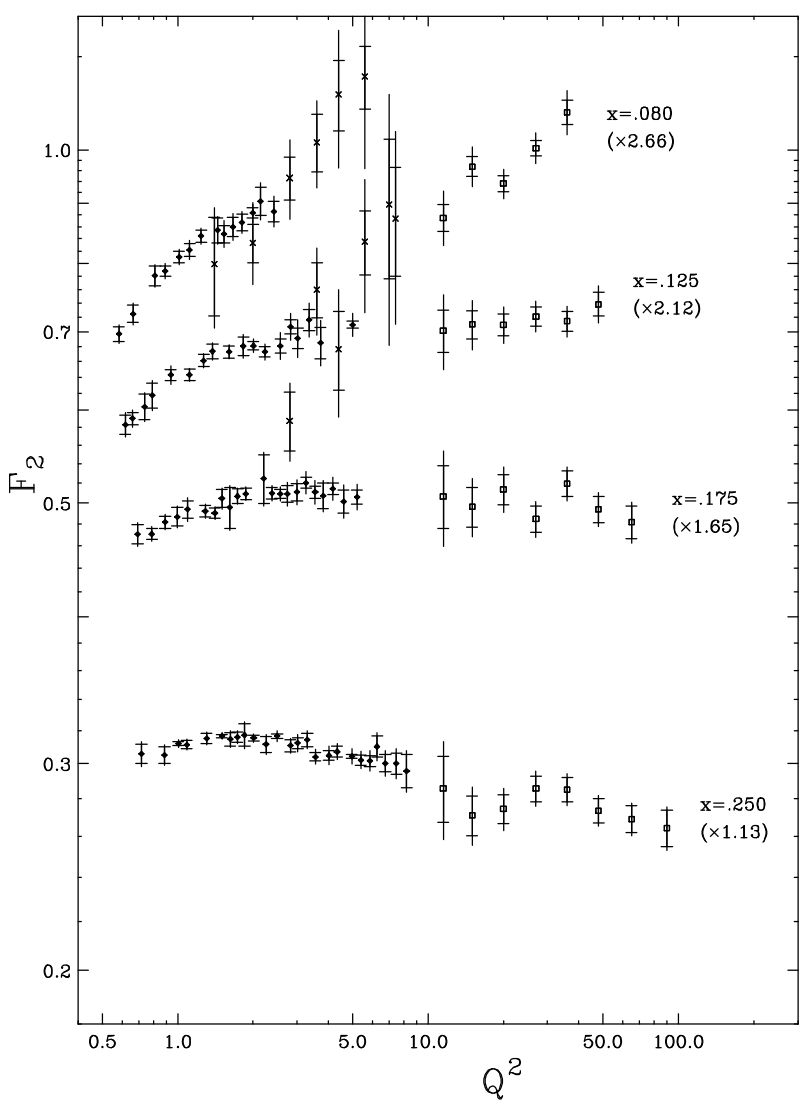

x=.350
x=.450
x=.550
x=.650
x=.750
x=.850
Hydrogen F_2
This Report
BCDMS (×1.00)
F_2
Q^2
0.200
0.100
0.050
0.020
0.010
0.005
0.002
0.5
1.0
5.0
10.0
50.0
100.0

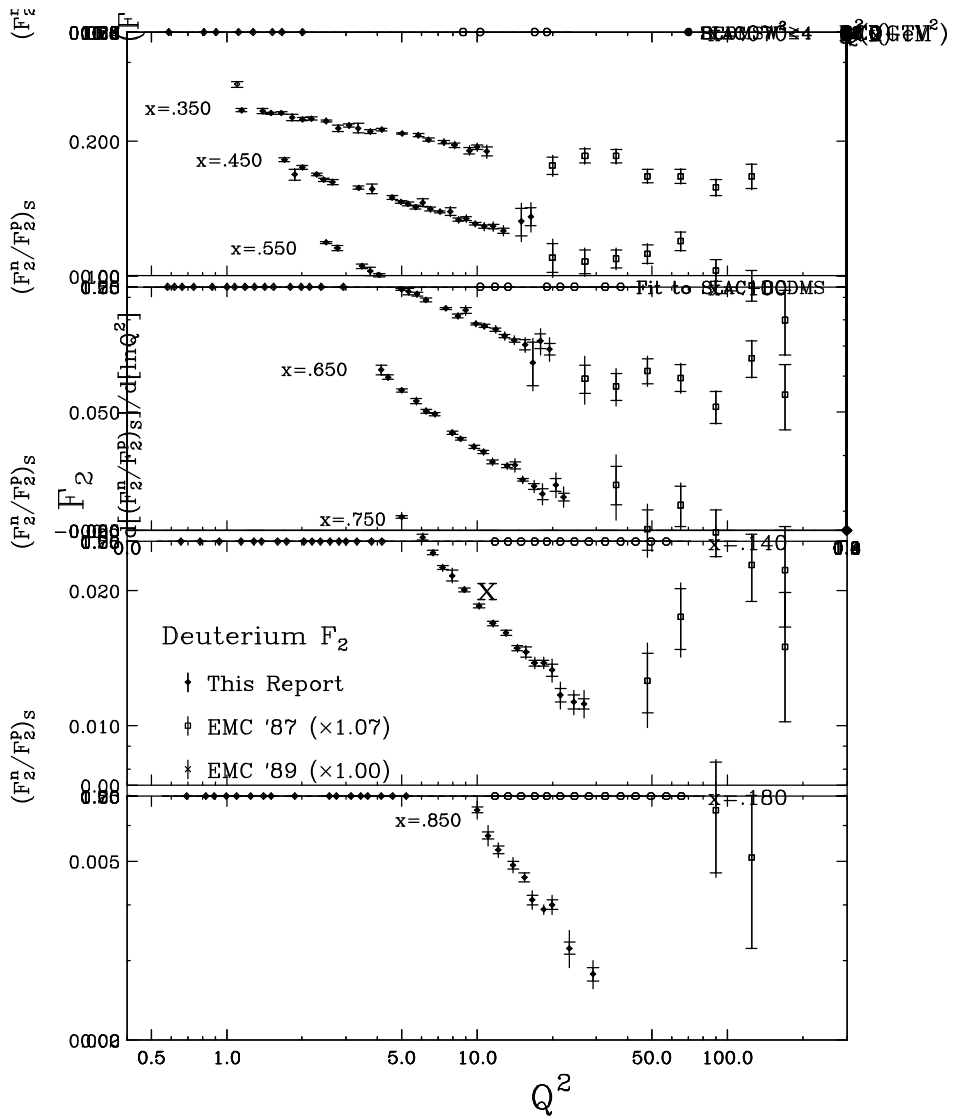

x=.070
(×2.79)
x=.100
(×2.40)
x=.140
(×1.97)
x=.180
(×1.61)
x=.225
(×1.28)
x=.275
(×1.00)
1.0
0.7
0.5
0.3
0.2
F_2
0.5
1.0
5.0
10.0
50.0
100.0
Q^2

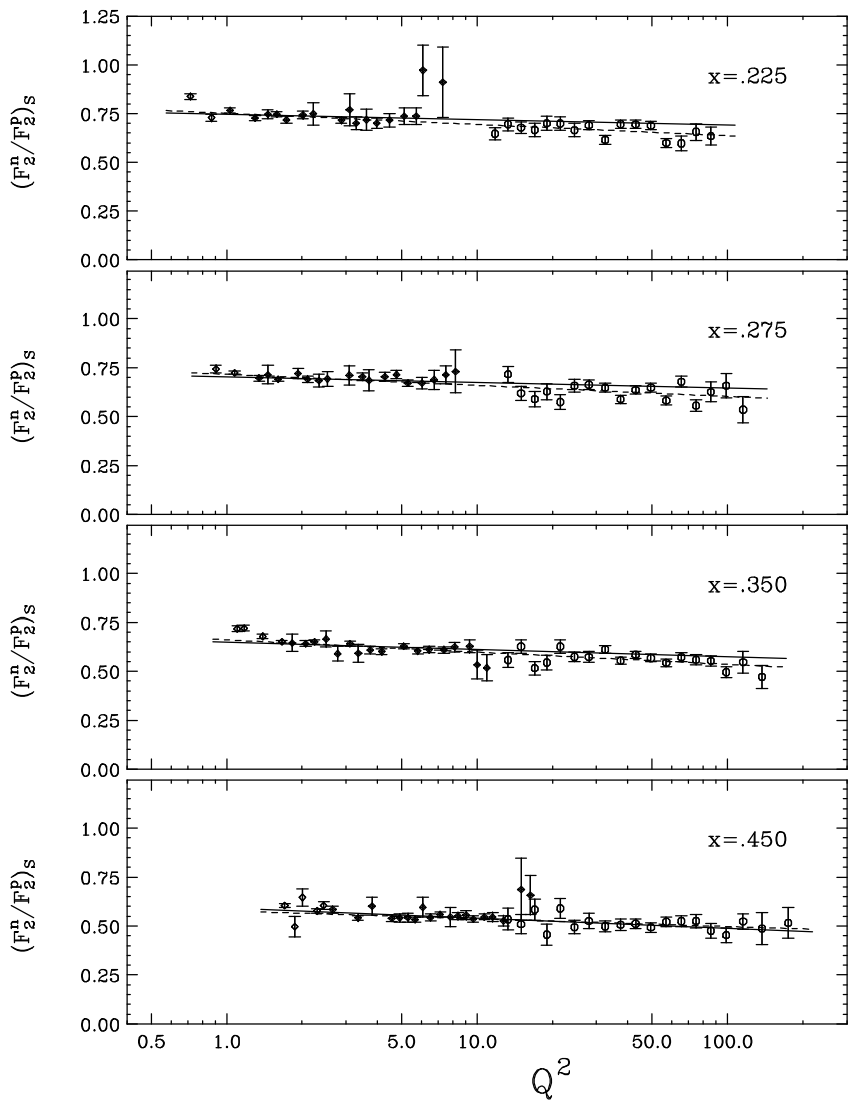

x=.350
x=.450
x=.550
x=.650
x=.750
x=.850
Deuterium F_2
This Report
BCDMS (×1.00)
F_2
Q^2
0.200
0.100
0.050
0.020
0.010
0.005
0.002
0.5
1.0
5.0
10.0
50.0
100.0

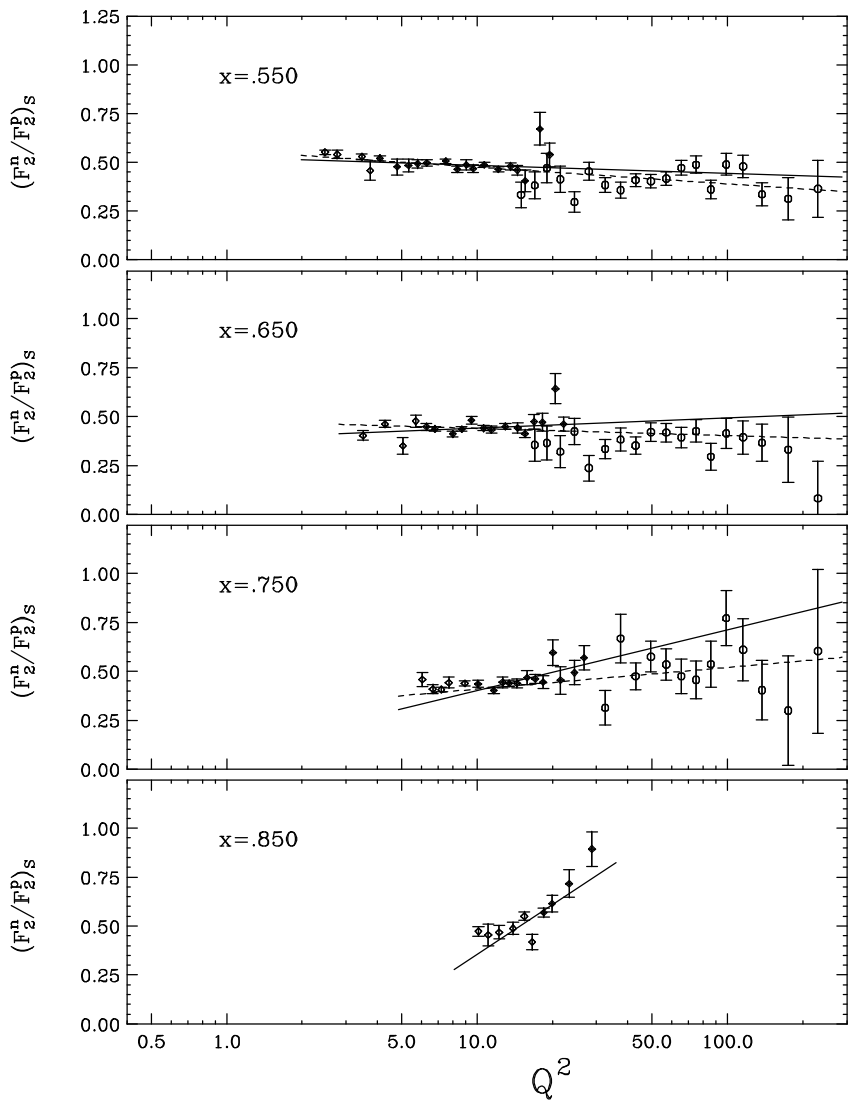

x=.080
(×2.66)
x=.125
(×2.12)
x=.175
(×1.65)
x=.250
(×1.13)
F_2
Q^2
1.0
0.7
0.5
0.3
0.2
0.5
1.0
5.0
10.0
50.0
100.0

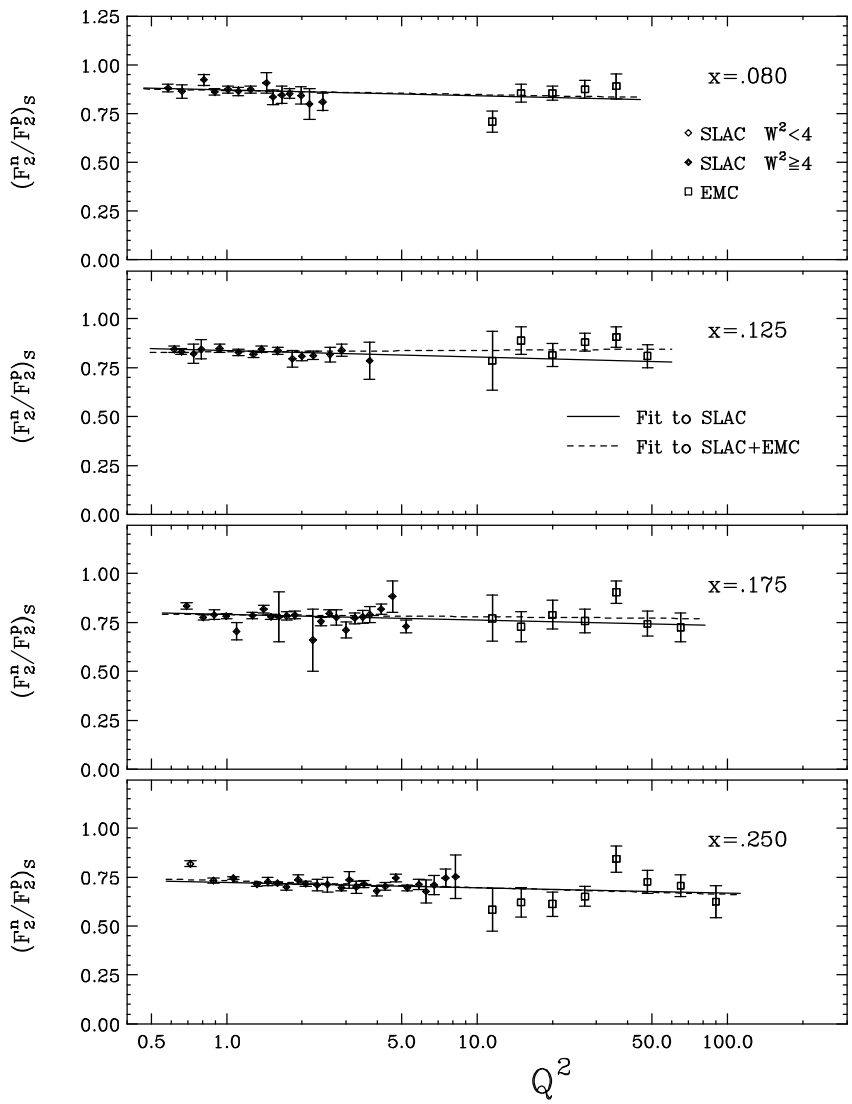

x=.350
x=.450
x=.550
x=.650
x=.750
x=.850
Hydrogen F_2
This Report
EMC (×1.07)
F_2
Q^2
0.200
0.100
0.050
0.020
0.010
0.005
0.002
0.5
1.0
5.0
10.0
50.0
100.0

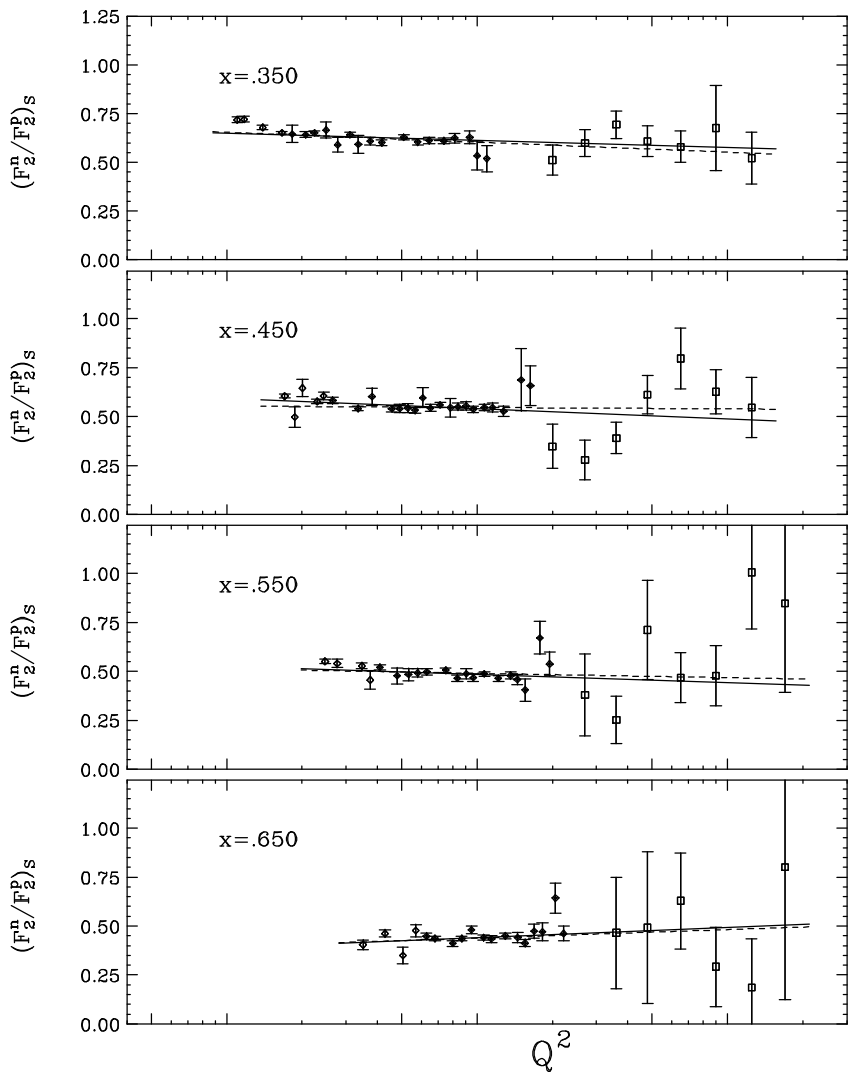

x=.080
(×2.66)
x=.125
(×2.12)
x=.175
(×1.65)
x=.250
(×1.13)
F_2
Q^2
1.0
0.7
0.5
0.3
0.2
0.5
1.0
5.0
10.0
50.0
100.0

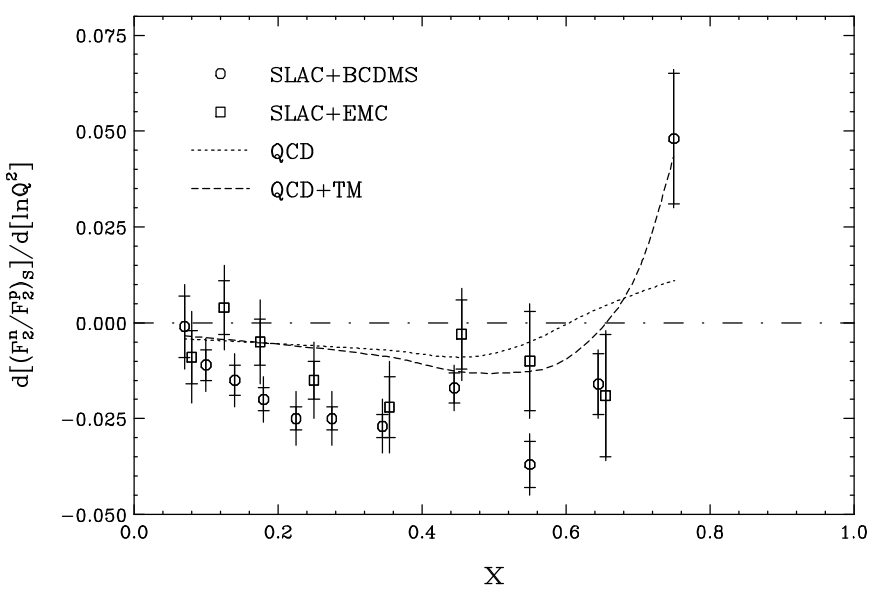

x=.350
x=.450
x=.550
x=.650
x=.750
x=.140
x=.180
x=.850
Deuterium F_2
This Report
EMC '87 (×1.07)
EMC '89 (×1.00)
F_2
$d[(F_2^n/F_2^p)_S]/d[\ln Q^2]$
$(F_2^n/F_2^p)_S$
Q^2
0.5
1.0
5.0
10.0
50.0
100.0
0.200
0.100
0.050
0.020
0.010
0.005

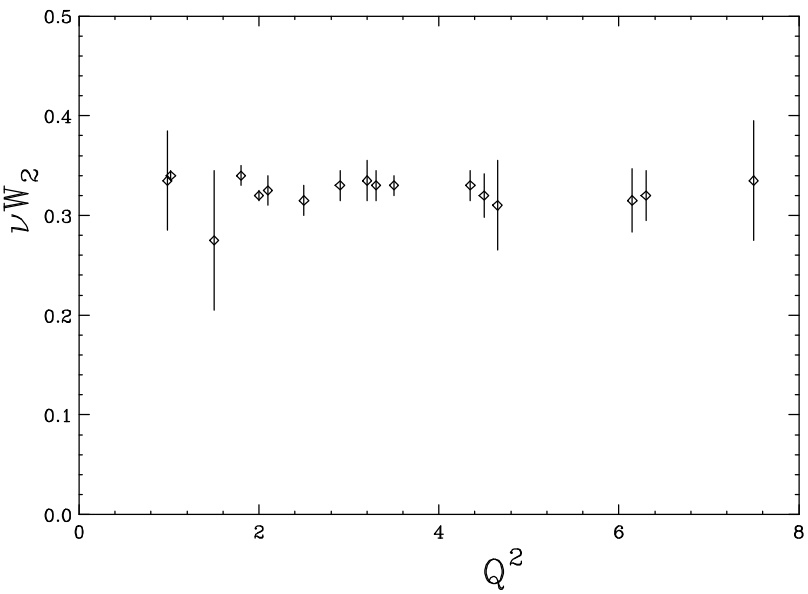

x=.225
x=.275
x=.350
x=.450
$(F_2^n/F_2^p)_S$
1.25
1.00
0.75
0.50
0.25
0.00
0.5
1.0
5.0
10.0
50.0
100.0
Q^2

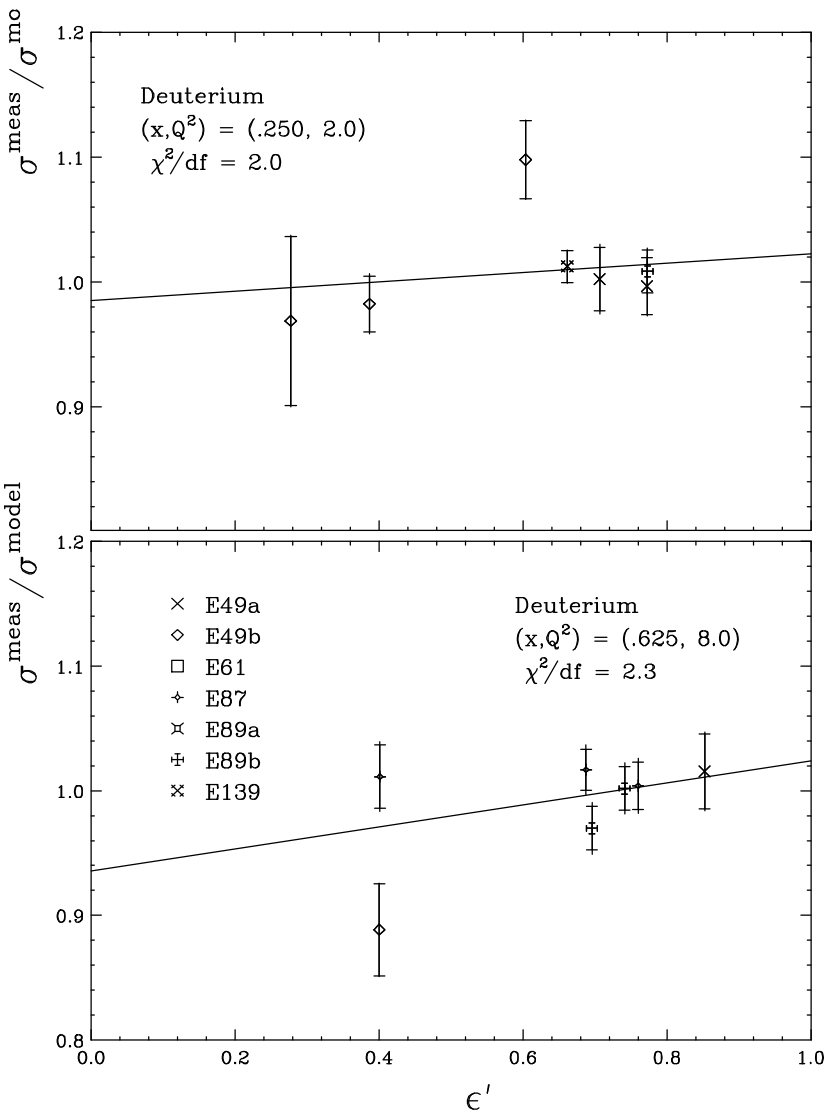

x=.550
x=.650
x=.750
x=.850
$(F_2^n/F_2^p)_S$
1.25
1.00
0.75
0.50
0.25
0.00
0.5
1.0
5.0
10.0
50.0
100.0
Q^2

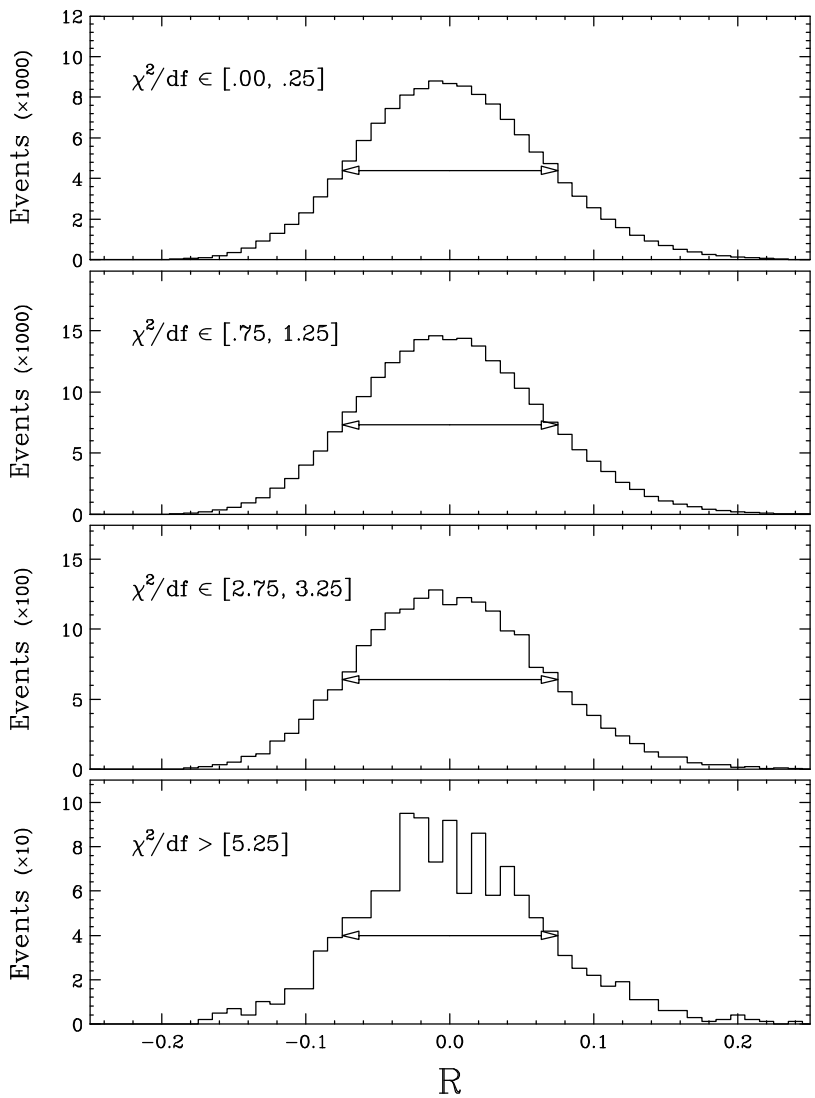

x=.080
SLAC W²<4
SLAC W²≥4
EMC
x=.125
Fit to SLAC
Fit to SLAC+EMC
x=.175
x=.250
(F₂ⁿ/F₂ᵖ)s
Q²
0.00
0.25
0.50
0.75
1.00
1.25
0.5
1.0
5.0
10.0
50.0
100.0

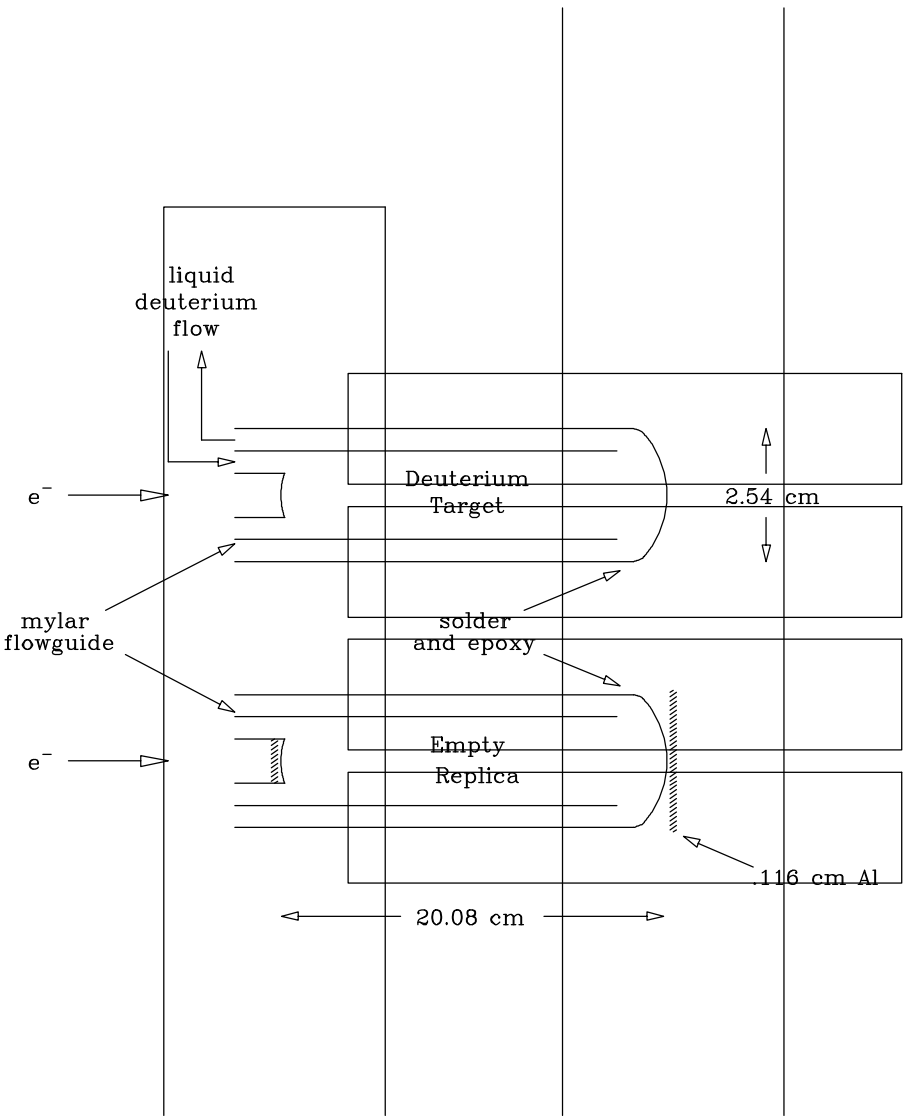

x=.350
x=.450
x=.550
x=.650
$(F_2^n/F_2^p)_S$
Q^2
0.00
0.25
0.50
0.75
1.00
1.25


SLAC+BCDMS
SLAC+EMC
QCD
QCD+TM
0.075
0.050
0.025
0.000
−0.025
−0.050
0.0
0.2
0.4
0.6
0.8
1.0
X
d[(F2n/F2p)s]/d[lnQ2]


0.5
0.4
0.3
0.2
0.1
0.0
νW_2
0
2
4
6
8
Q^2


Deuterium
(x,Q²) = (.250, 2.0)
χ²/df = 2.0
Deuterium
(x,Q²) = (.625, 8.0)
χ²/df = 2.3
E49a
E49b
E61
E87
E89a
E89b
E139
σ^meas / σ^mo
σ^meas / σ^model
ε′
1.2
1.1
1.0
0.9
0.8
0.0
0.2
0.4
0.6
0.8
1.0


Events (×1000)
χ²/df ∈ [.00, .25]
Events (×1000)
χ²/df ∈ [.75, 1.25]
Events (×100)
χ²/df ∈ [2.75, 3.25]
Events (×10)
χ²/df > [5.25]
R


liquid
deuterium
flow
e⁻
Deuterium
Target
2.54 cm
mylar
flowguide
solder
and epoxy
e⁻
Empty
Replica
.116 cm Al
20.08 cm