PDF4MC
status report for PDF4LHC

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PDF4MC approach

Can a PDF obtained by a MC fit and what is the influence of parton showers to a fit?

- parametrized PDFs @ starting Q_0^2 evolved in LHAPDF for MC generator, e.g.

$$xf(x,Q_0^2) = N\,\frac{1}{x^{\lambda}}(1-x)^{\eta}\,P(x,i)$$

- MC generator makes predictions for e.g. x-section, F_2
- fit these MC predictions to data by changing parameters of starting PDFs
- including parton showers

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parameters to be fitted

- MC generator makes predictions for e.g. x-section, F_2
- fit these MC predictions to data by changing parameters of starting PDFs
- including parton showers

PDF4MC approach

- use of *RAPGAP* and *PYTHIA* running at 10^6 events to produce MC predictions

- fit these MC predictions to 104 experimental data points of dataset:
  EPJC 21 (2001) 33 (hep-ex/0012053H1-93)
  (measurement of inclusive DIS x-section at $\sqrt{s}$=300.9 GeV)

- kinematic range

$$3\ 10^{-5} \leq x \leq 0.2$$

$$5\ \text{GeV}^2 \leq Q^2 \leq 150\ \text{GeV}^2$$

PDF4MC approach

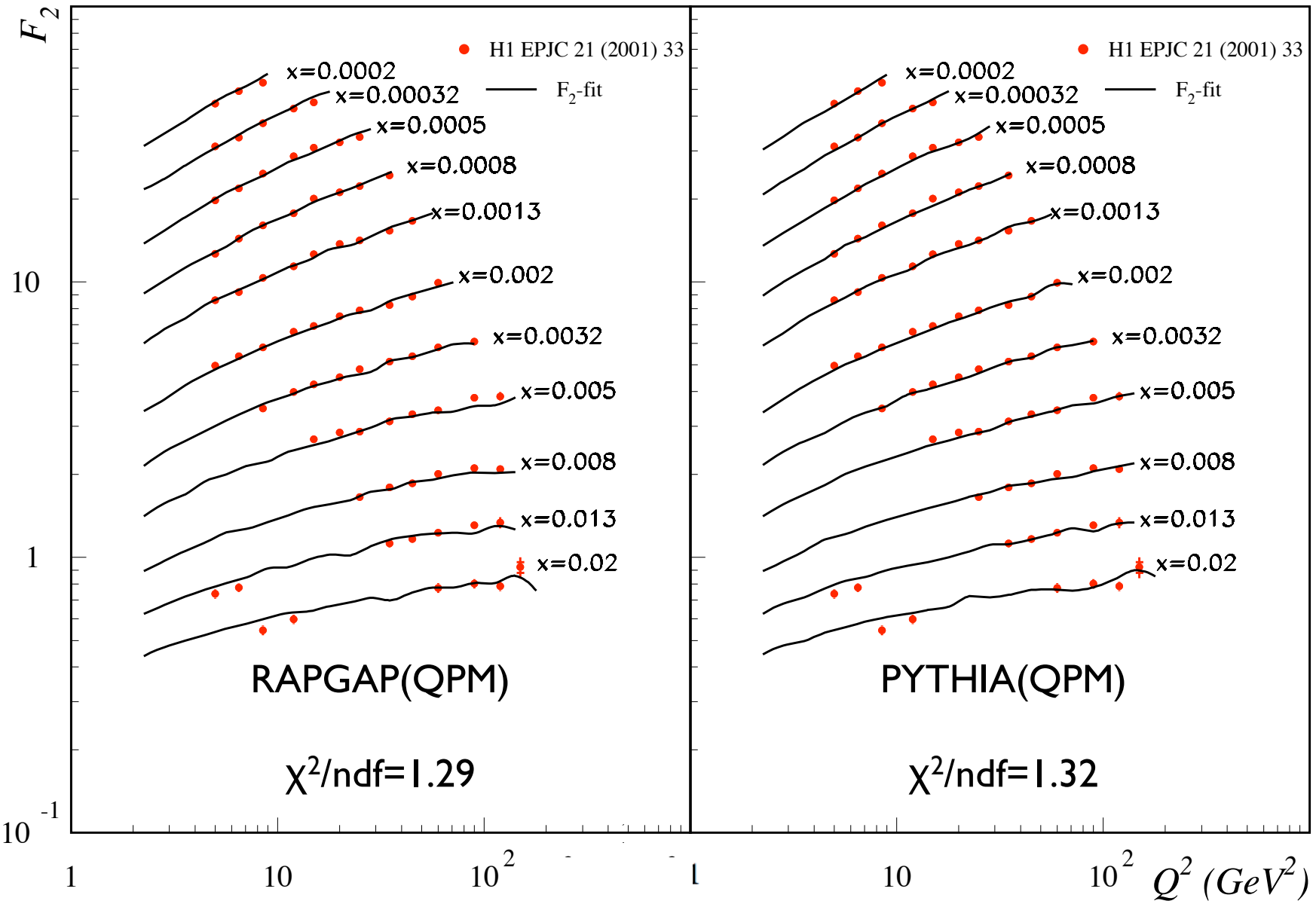
- fitting of gluon and seaquark-densityfunctions
  (weak sensitivity to valencequark-densityfunctions)

- in both cases the cteq-logpade parametrization is used:

$$xf(Q_0^2, x) = P_1 x^{P_2} (1-x)^{P_3} e^{xP_4} (1 + e^{P_5} x)^{P_6}$$

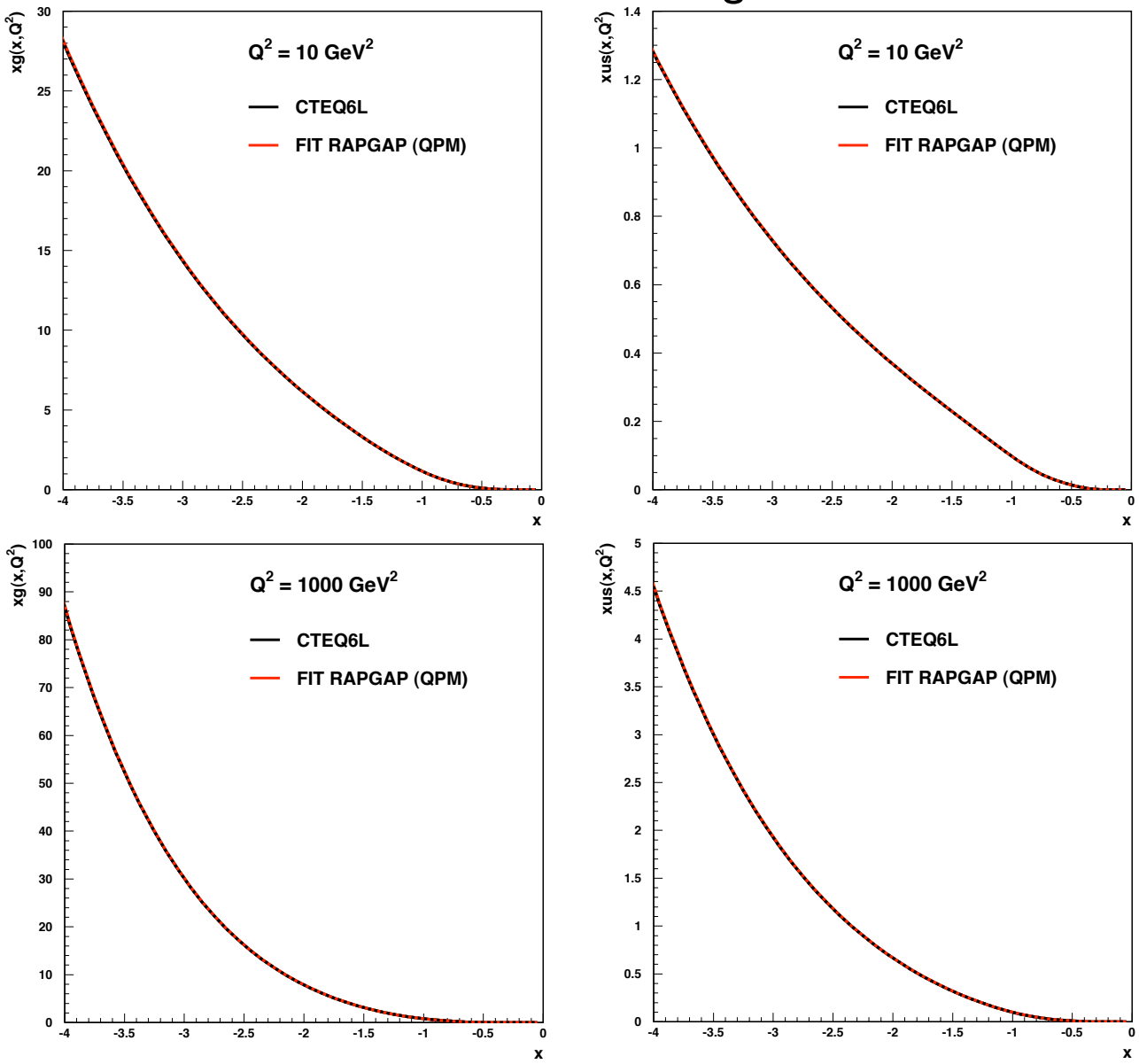
- fitting of 12 parameters

Results


F_2
H1 EPJC 21 (2001) 33
F_2-fit
x=0.0002
x=0.00032
x=0.0005
x=0.0008
x=0.0013
x=0.002
x=0.0032
x=0.005
x=0.008
x=0.013
x=0.02
RAPGAP(QPM)
χ^2/ndf=1.29
PYTHIA(QPM)
χ^2/ndf=1.32
Q^2 (GeV^2)

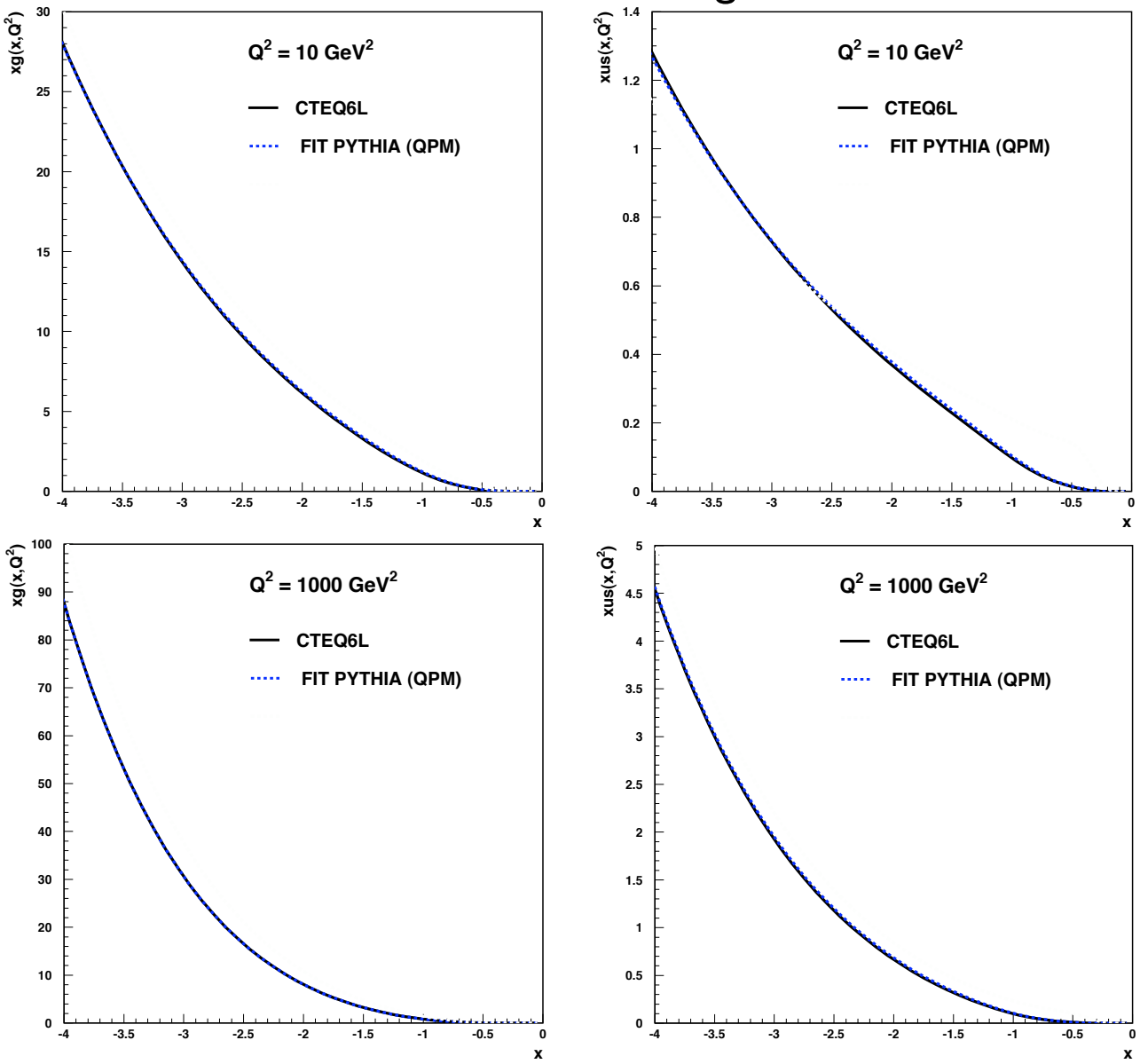
Results

fit of *RAPGAP* running in QPM



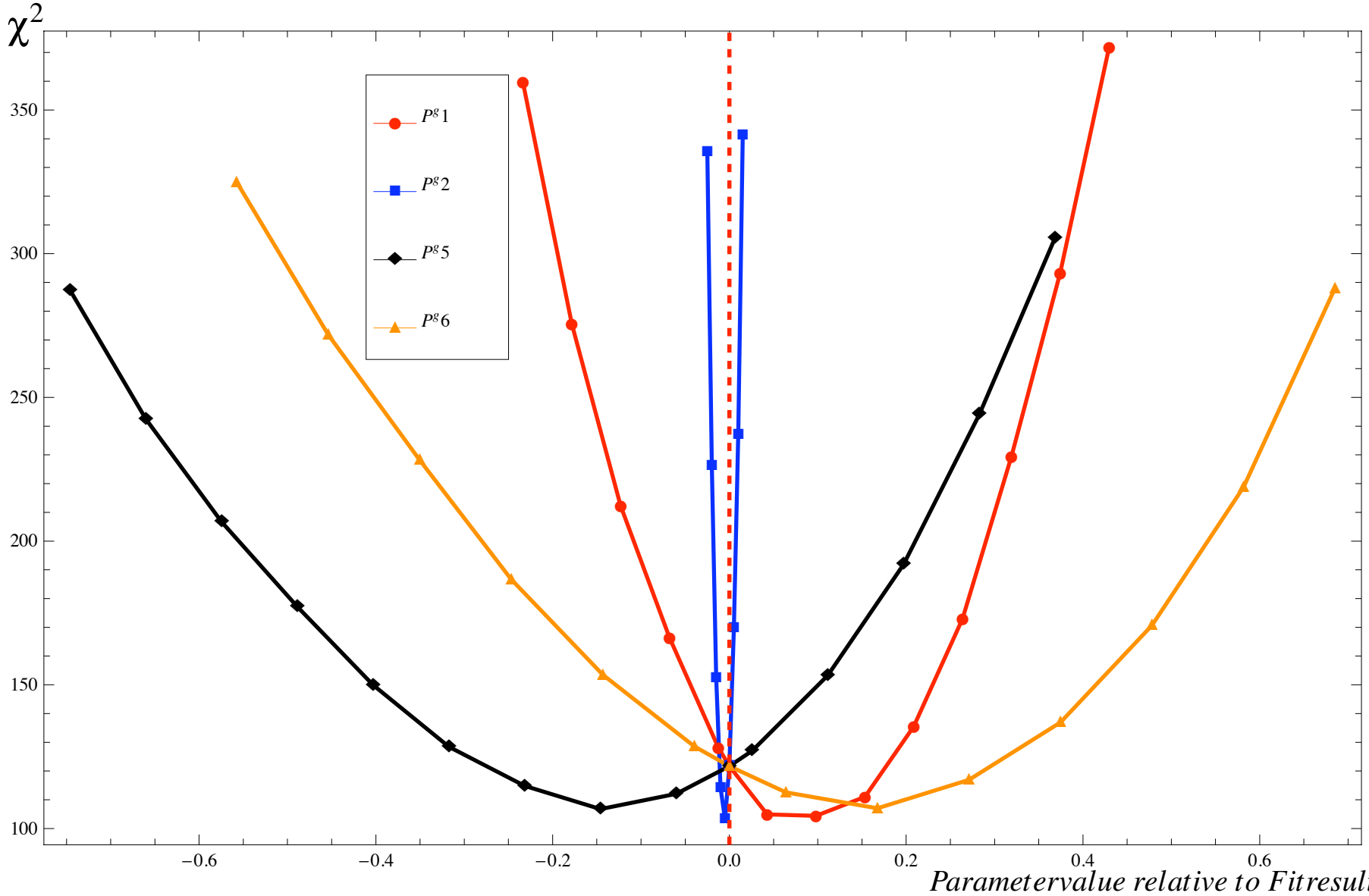
Results

fit of *PYTHIA* running in QPM



Results

scans of gluondensity parameters (*PYTHIA, QPM*)



Results

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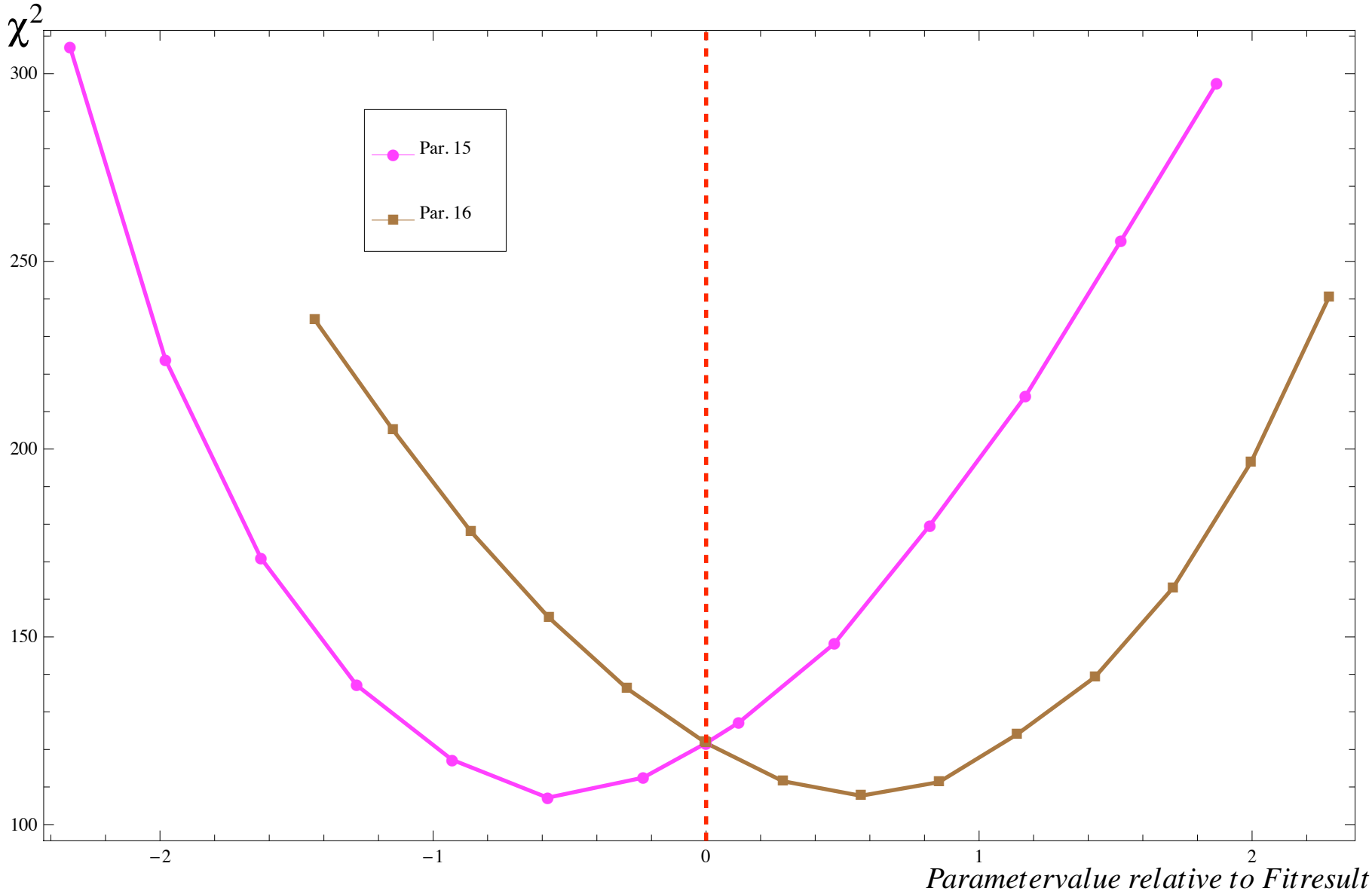
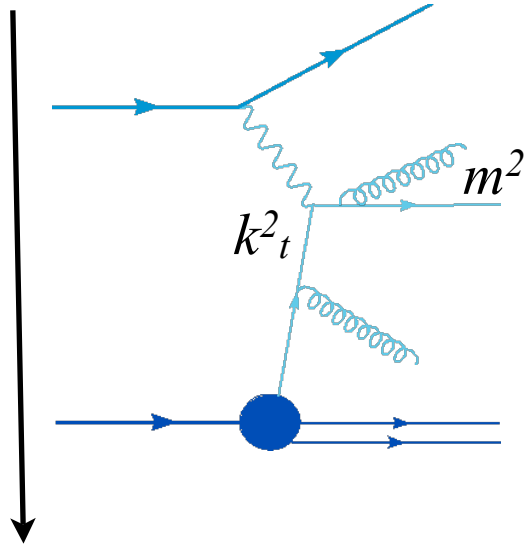


PDF4MC approach

- *RAPGAP* and *PYTHIA* yield consistent results in QPM

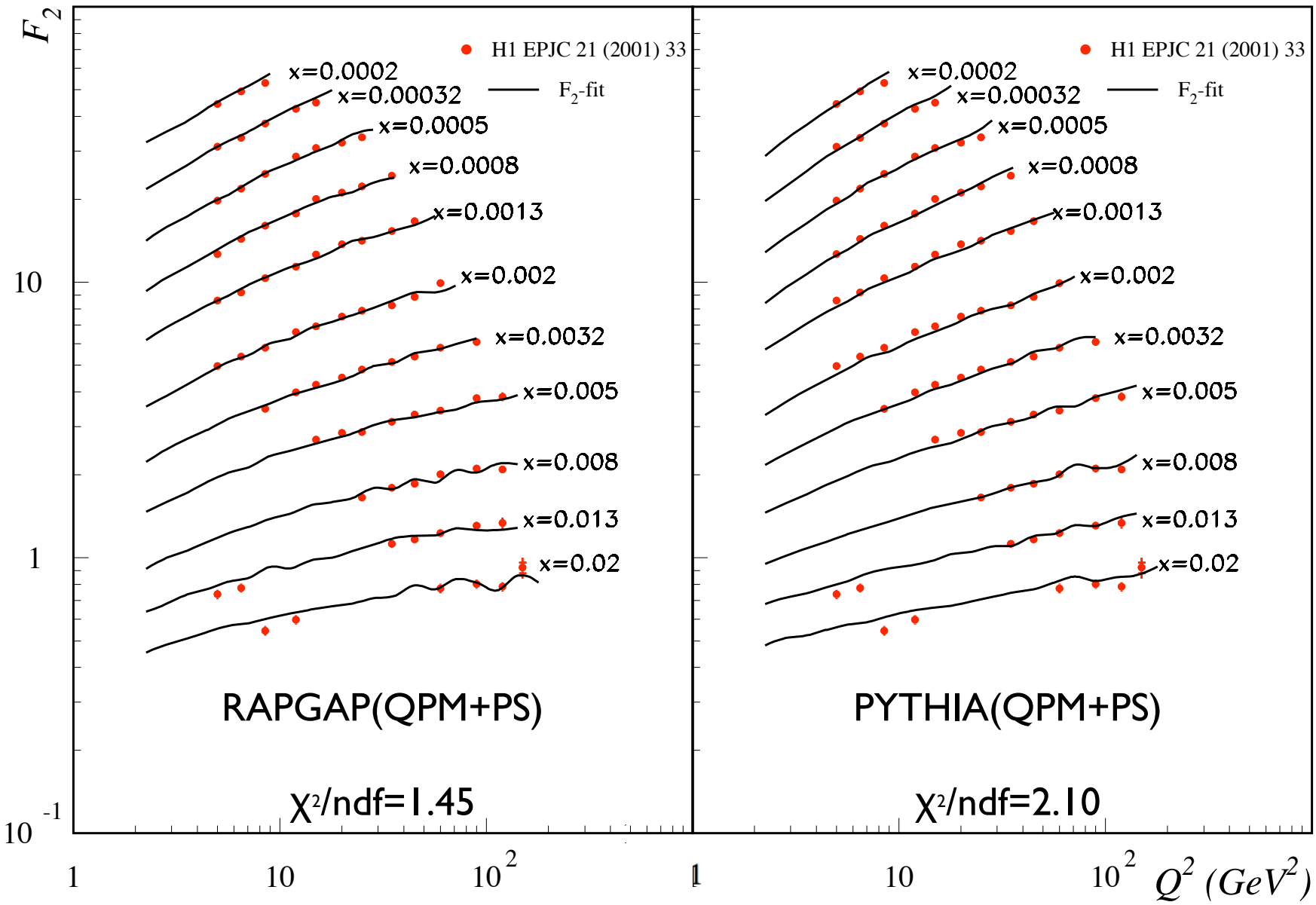
$$x = \frac{Q^2}{ys}$$



- What happens if parton showers are included?

$$x = \frac{Q^2 - k^2 + m^2}{ys}$$

Results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H1 EPJC 21 (2001) 33
F_2-fit
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x=0.00032
x=0.0005
x=0.0008
x=0.0013
x=0.002
x=0.0032
x=0.005
x=0.008
x=0.013
x=0.02
RAPGAP(QPM+PS)
χ^2/ndf=1.45
PYTHIA(QPM+PS)
χ^2/ndf=2.10
Q^2 (GeV^2)

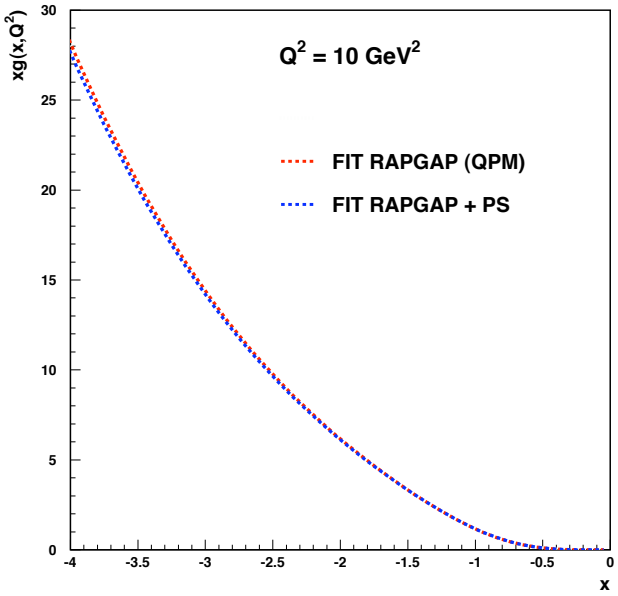
Results

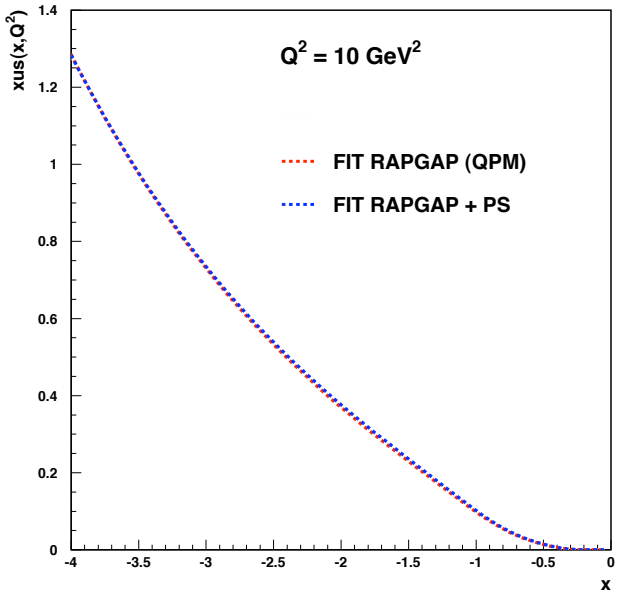
Q^2-ordered, initial and final state parton shower

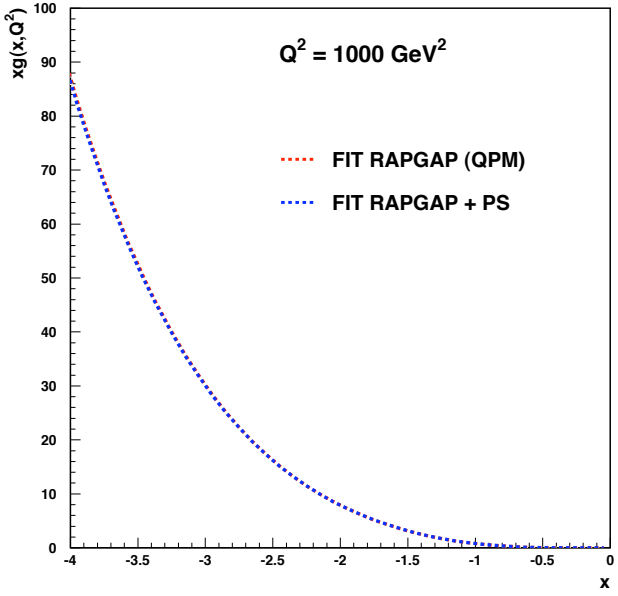
RAPGAP yields Q^2 and x independent of parton shower s.f.

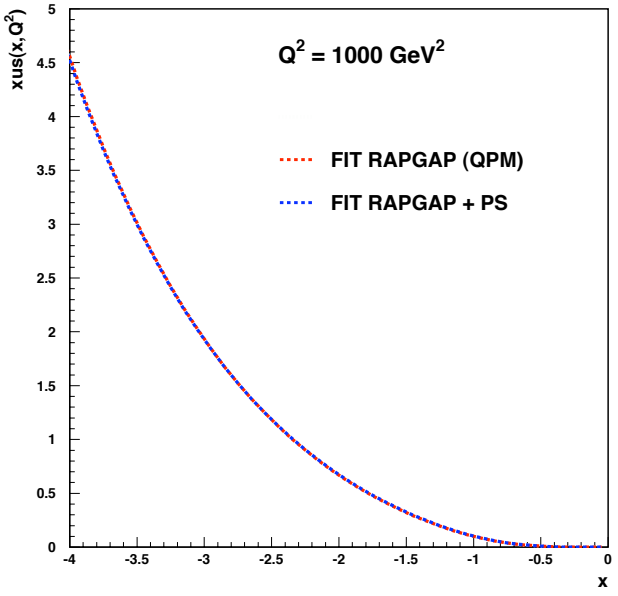
QCD Effects On The Event Structure In Leptoproduction

M. Bengtsson, T. Sjostrand
(Lund U., Dept. Theor. Phys.) ,
G. Ingelman (DESY) .
DESY 87/097, LU TP-87-11, Aug 1987.
28pp.
Published in Nucl.Phys.B301:554,1988.



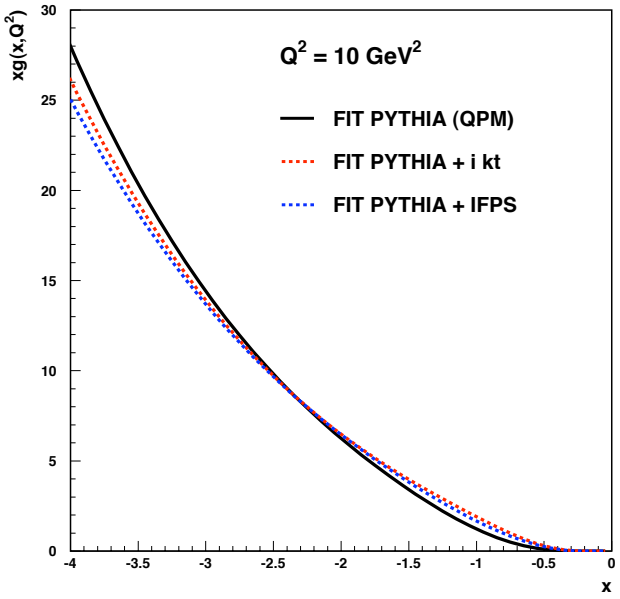


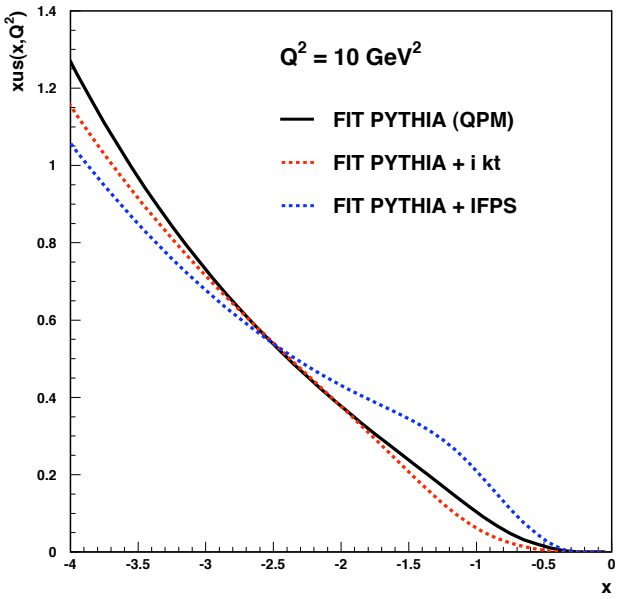


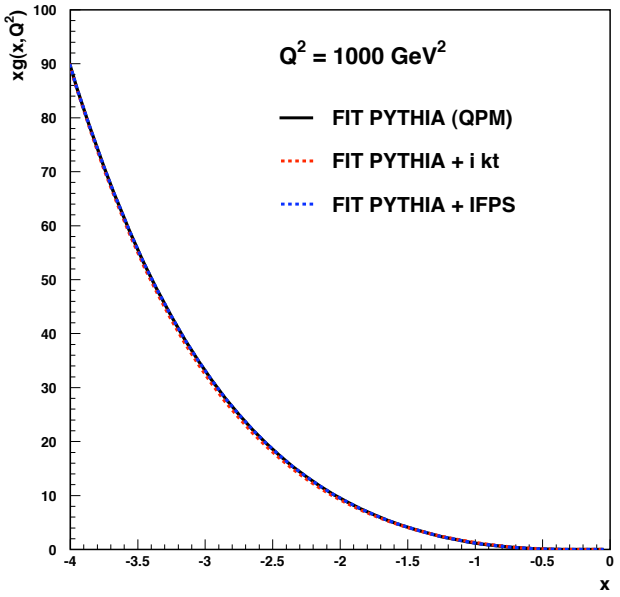


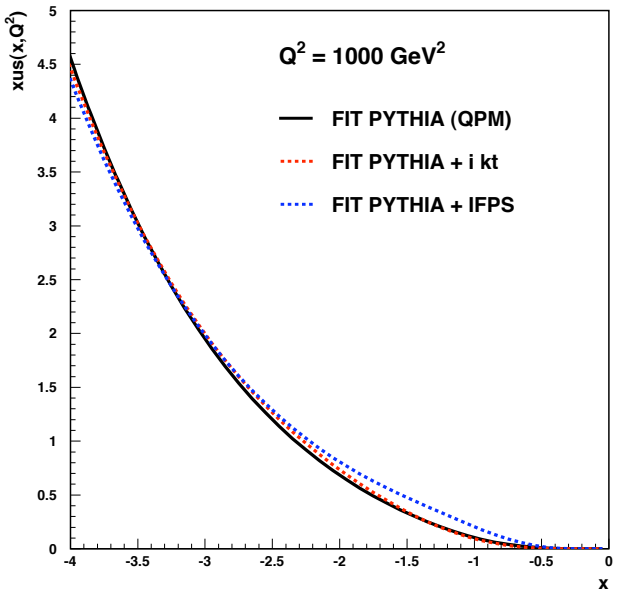
Results

Q^2-ordered, initial and final state parton shower









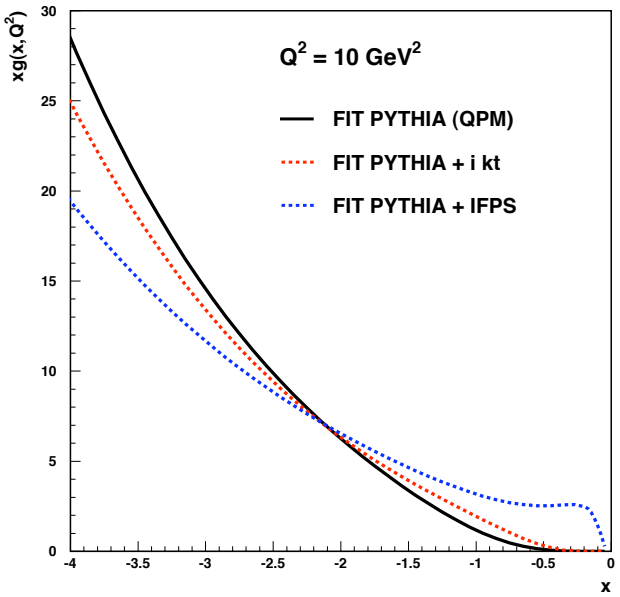
QPM: χ^2/ndf=1.32

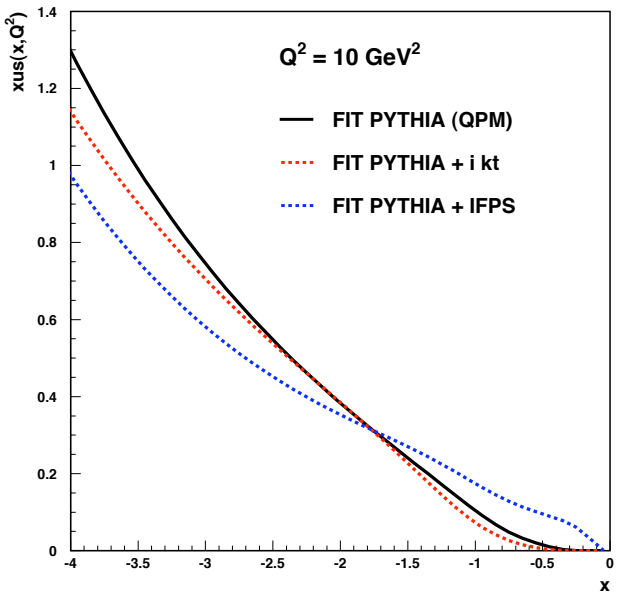
int. k_t: χ^2/ndf=1.13

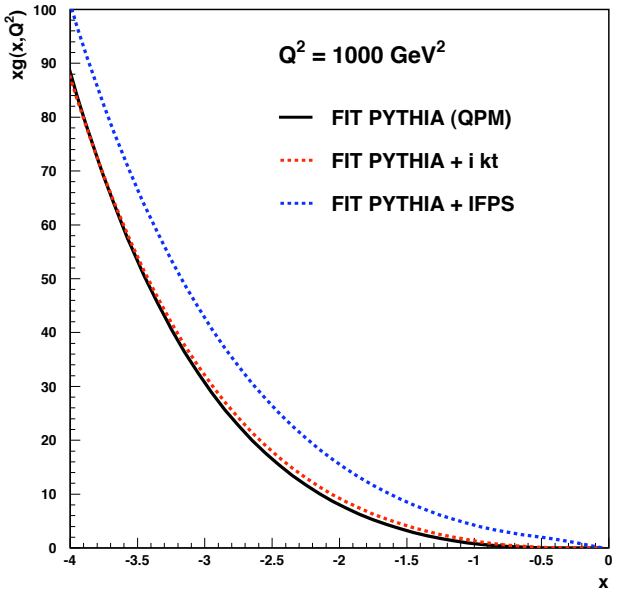
IF PS: χ^2/ndf=2.10

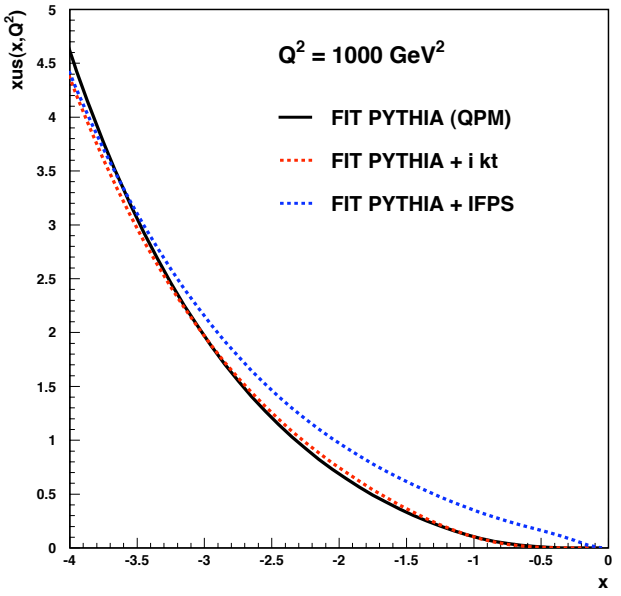
Results

p_t-ordered, initial and final state parton shower









QPM: $\chi^2/ndf=1.17$

int. k_t: $\chi^2/ndf=1.16$

IF PS: $\chi^2/ndf=4.30$

Results

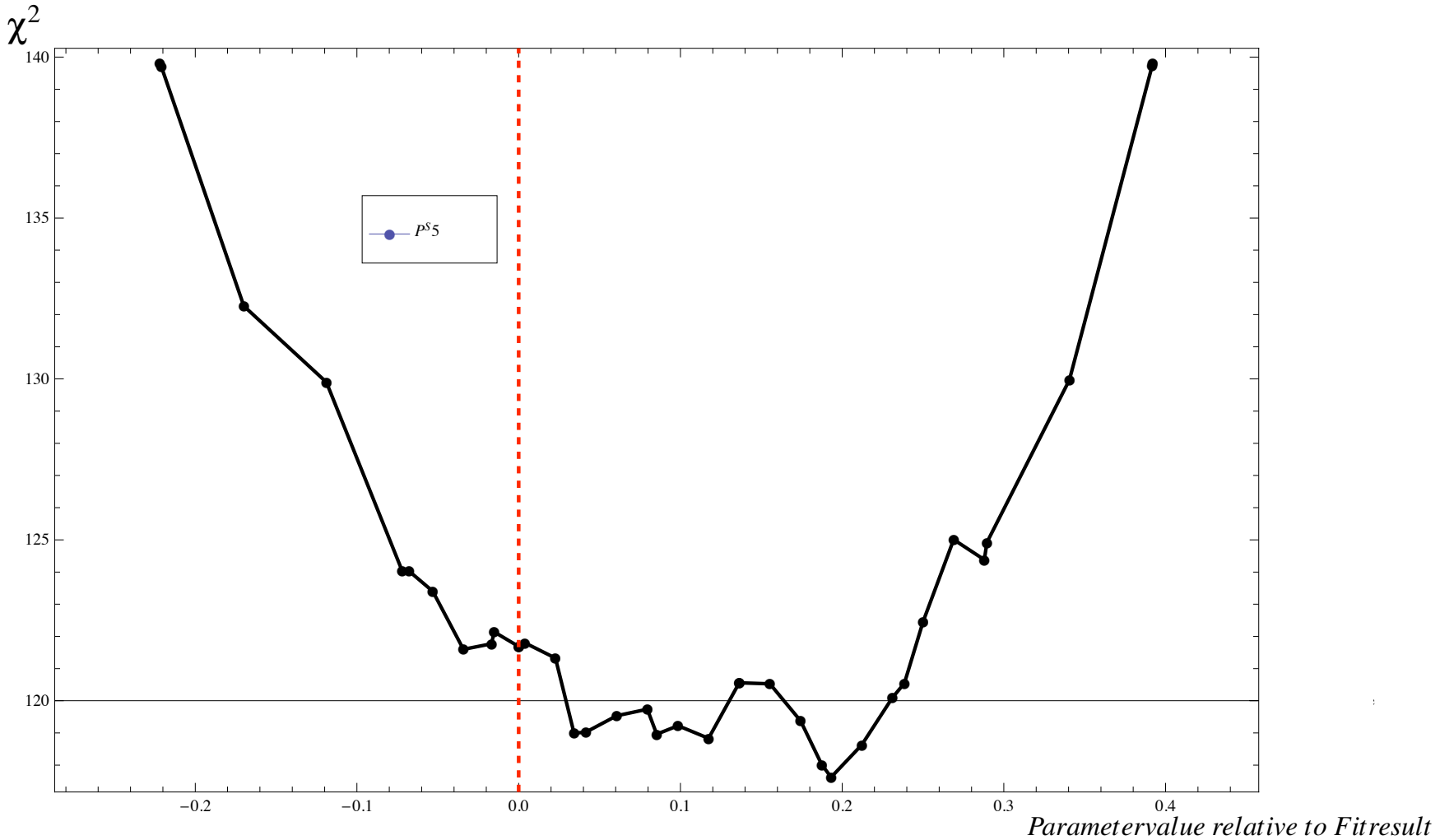
scan of seaquarkdensity parameter P_5, ($PYTHIA$, QPM)

$$xf(Q_0^2, x) = P_1 x^{P_2} (1-x)^{P_3} e^{xP_4} (1 + e^{P_5} x)^{P_6}$$

Results

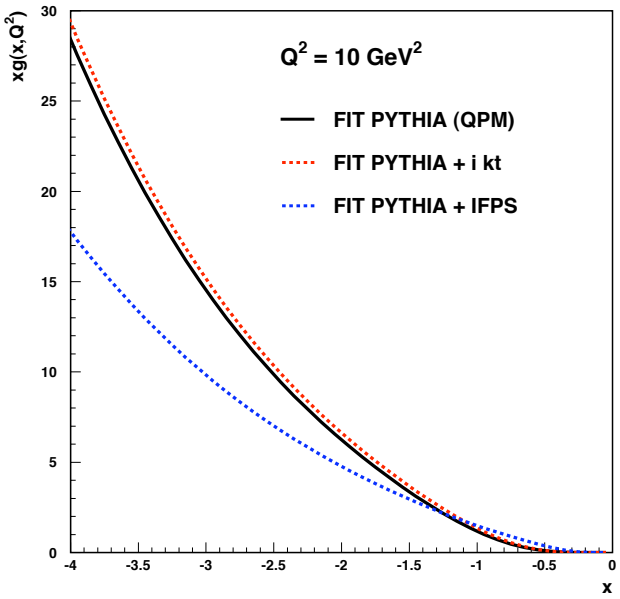
scan of seaquarkdensity parameter P_5, (*PYTHIA, QPM*)

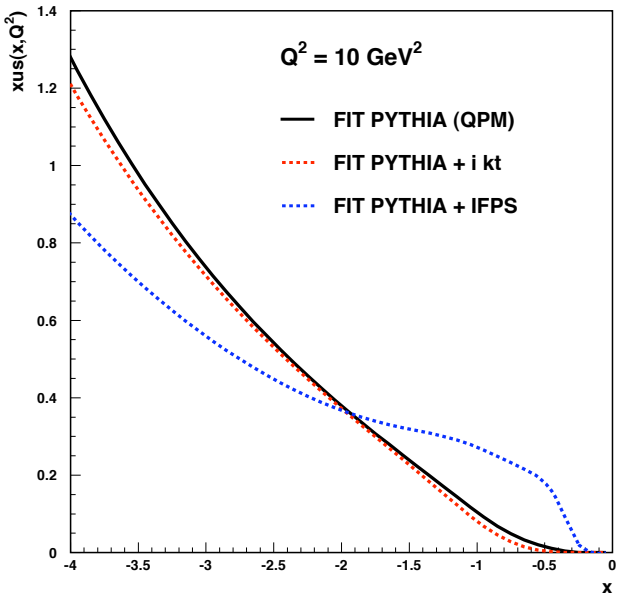
$$xf(Q_0^2,x) = P_1 x^{P_2}(1-x)^{P_3} e^{xP_4}(1+e^{P_5}x)^{P_6}$$

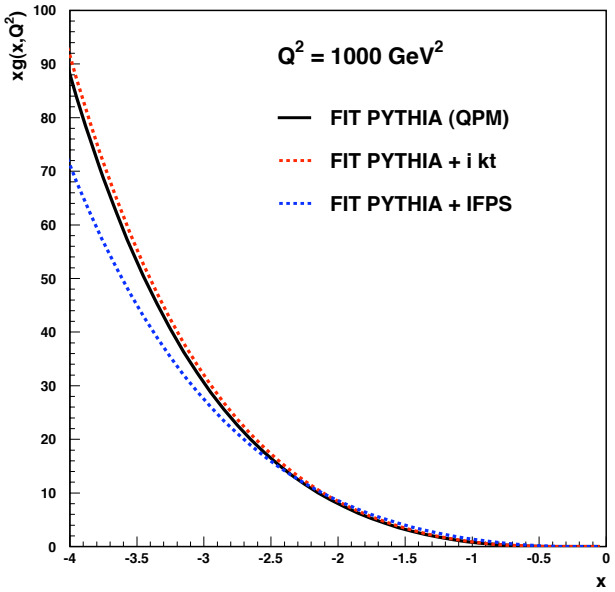


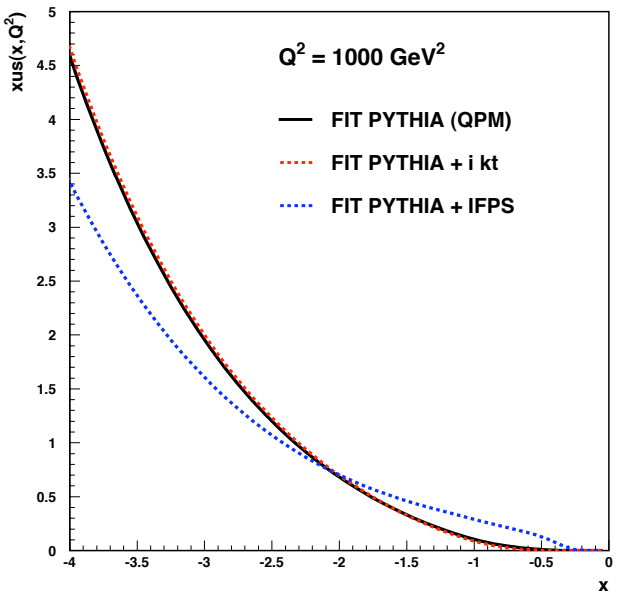
Results

p_t-ordered, initial and final state parton shower, P_5 fixed









QPM: $\chi^2/ndf=1.13$

int. k_t: $\chi^2/ndf=1.40$

IF PS: $\chi^2/ndf=1.81$

Summary

- fitting of *RAPGAP* and *PYTHIA* QPM-predicitons to inclusive DIS data leads to a PDF-parametrization consistent with CTEQ6L
- including parton showers in the *RAPGAP*-fit does not change the result

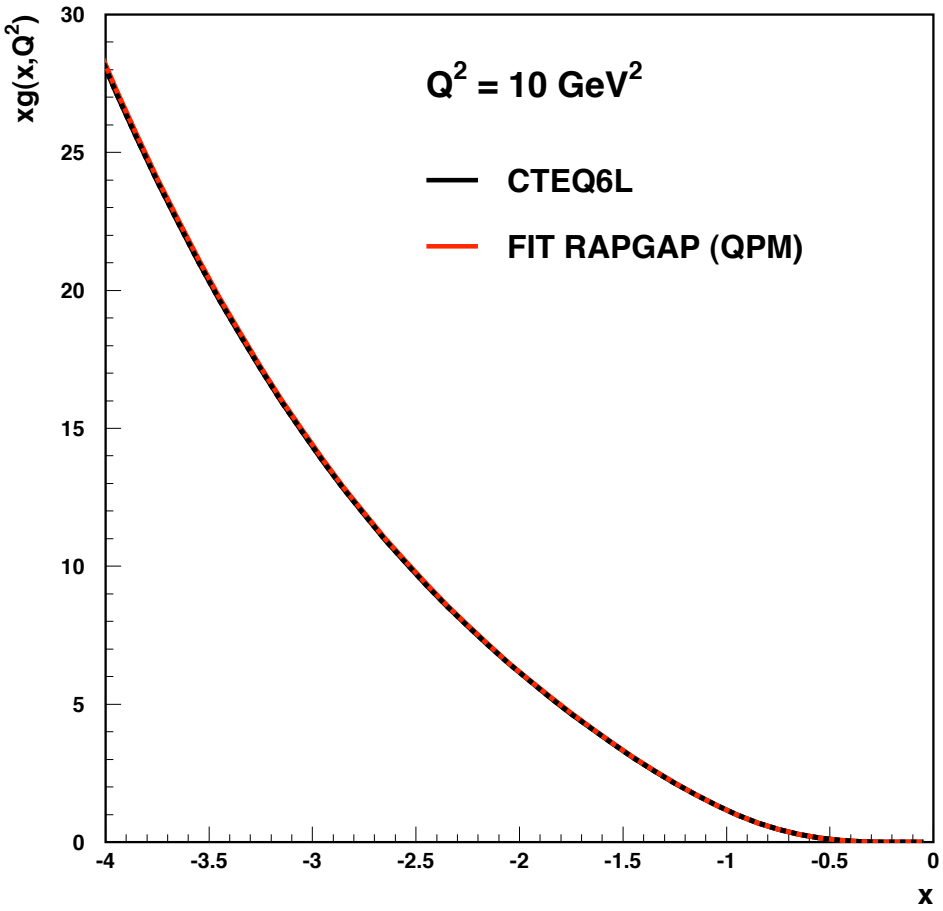
  → shows that Q^2 and x in *RAPGAP* are indeed independent of parton showers
- including parton showers in the *PYTHIA*-fit leads to changes in PDFs
- different results for different ordering (Q^2 and p_t) of parton showers in *PYTHIA*

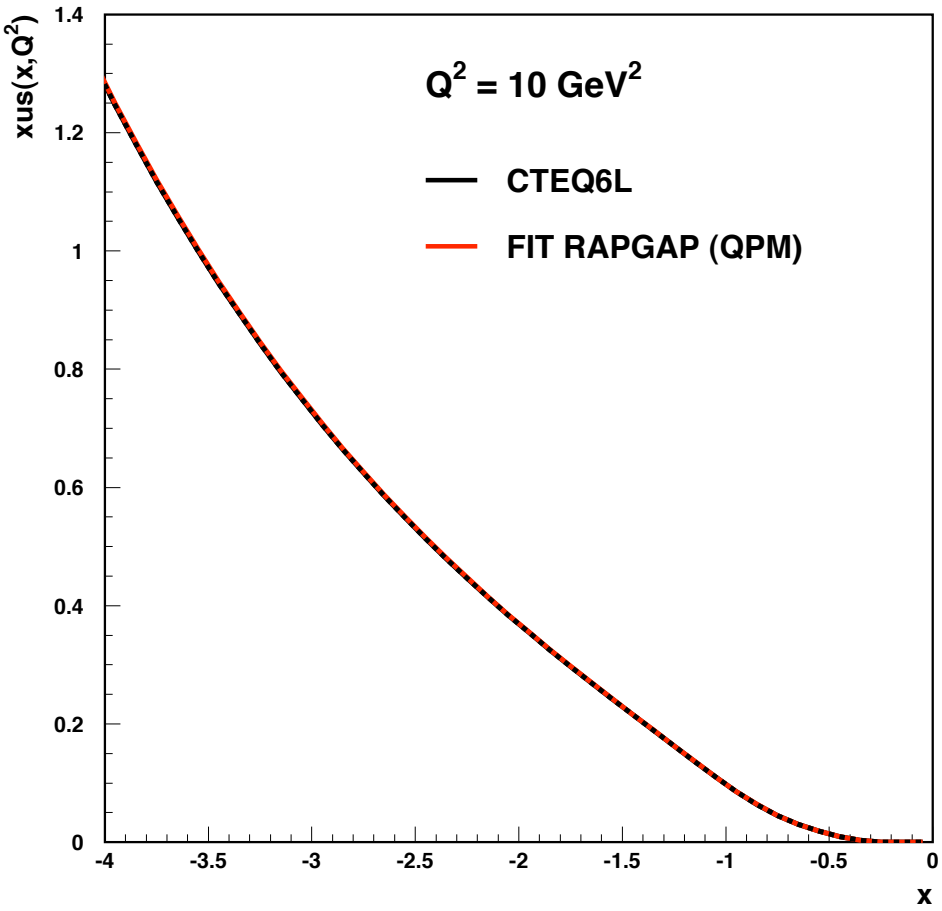
Outlook

- including more datapoints, e.g. combined datasets of H1 and ZEUS, in the analysis
- first release of PDF-set in summer 2009 !

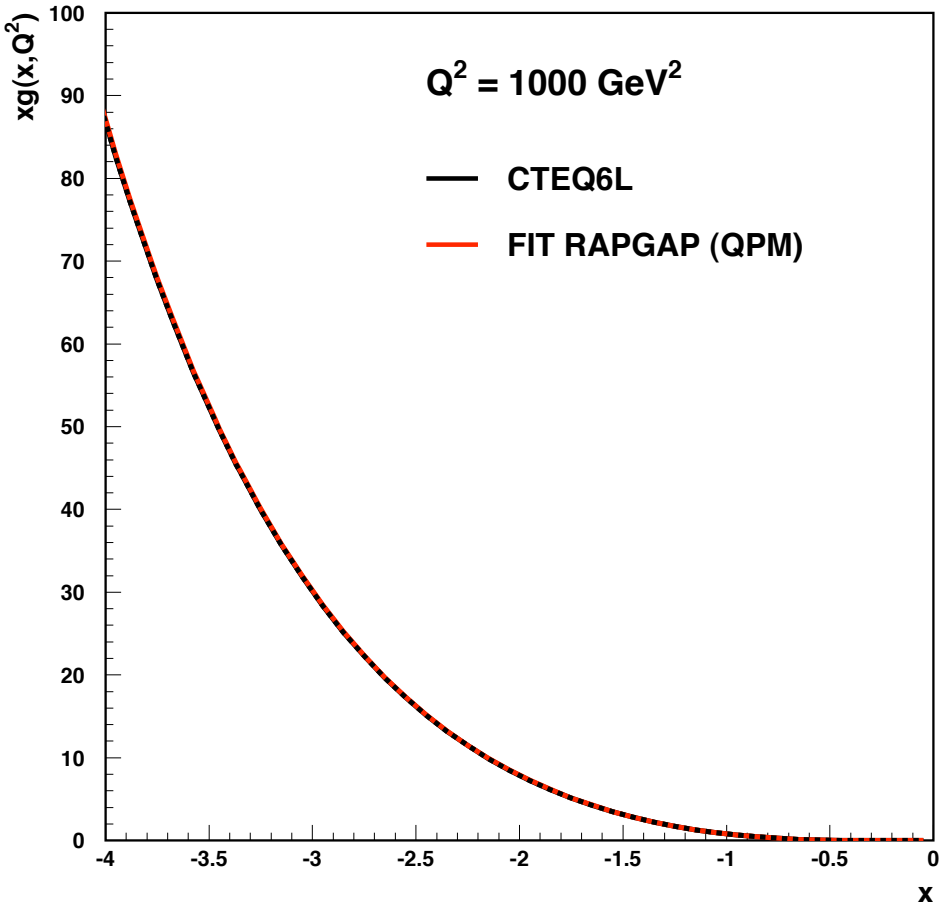
Thank you for your attention

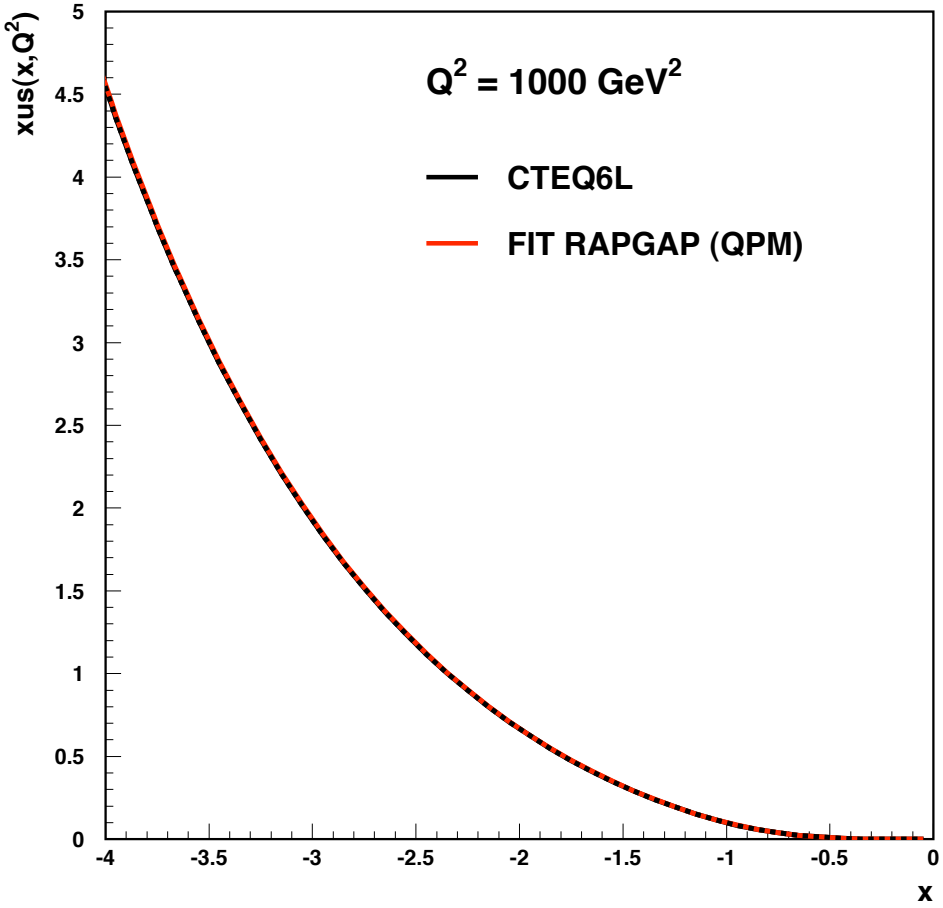
Results


xg(x,Q²)
Q² = 10 GeV²
CTEQ6L
FIT RAPGAP (QPM)
x

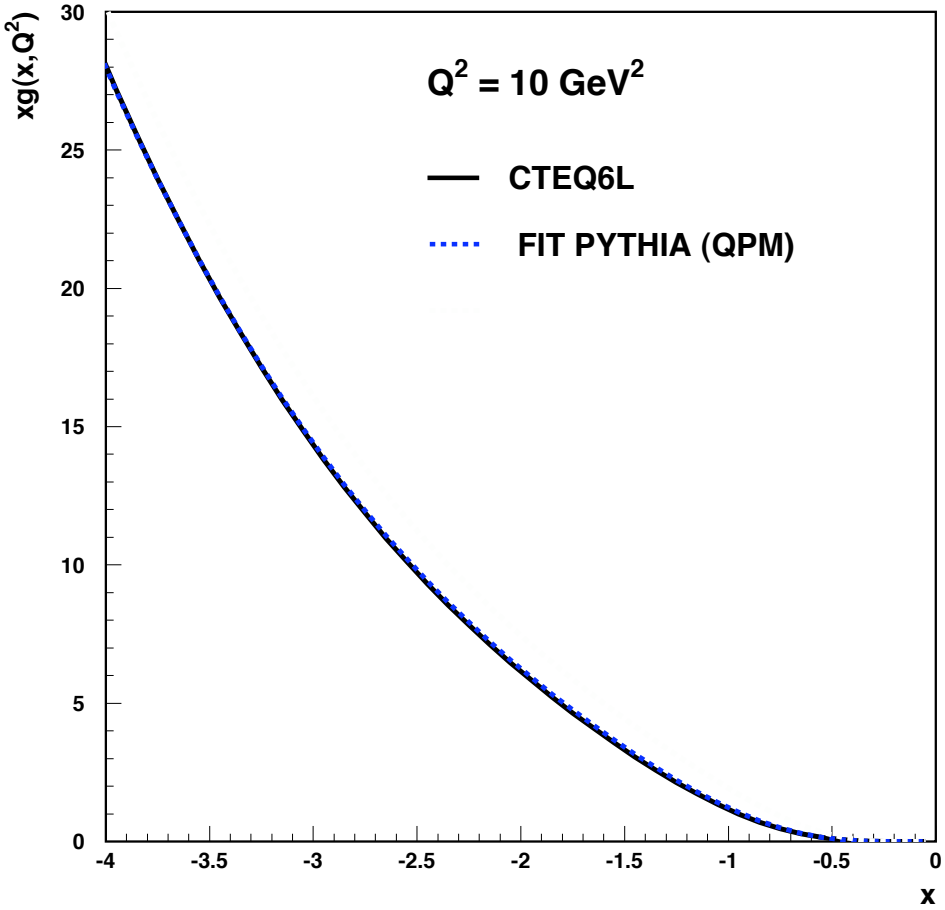

xus(x,Q²)
Q² = 10 GeV²
CTEQ6L
FIT RAPGAP (QPM)
x

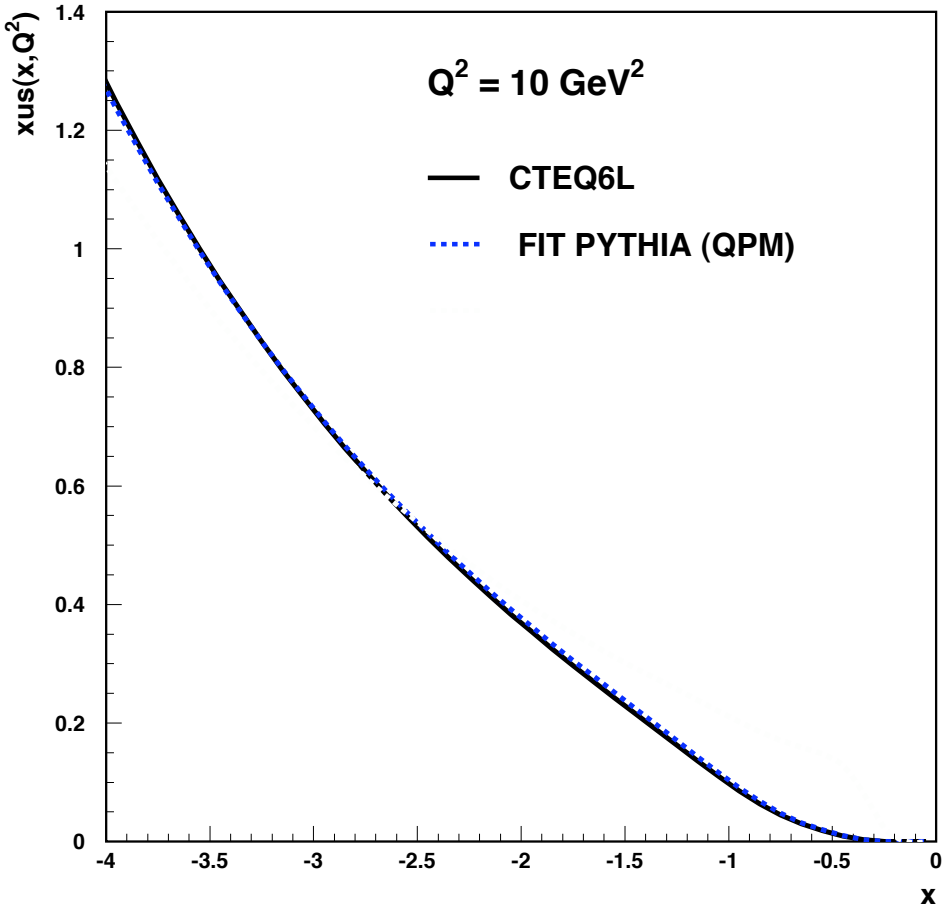
Results


xg(x,Q²)
Q² = 1000 GeV²
CTEQ6L
FIT RAPGAP (QPM)
x

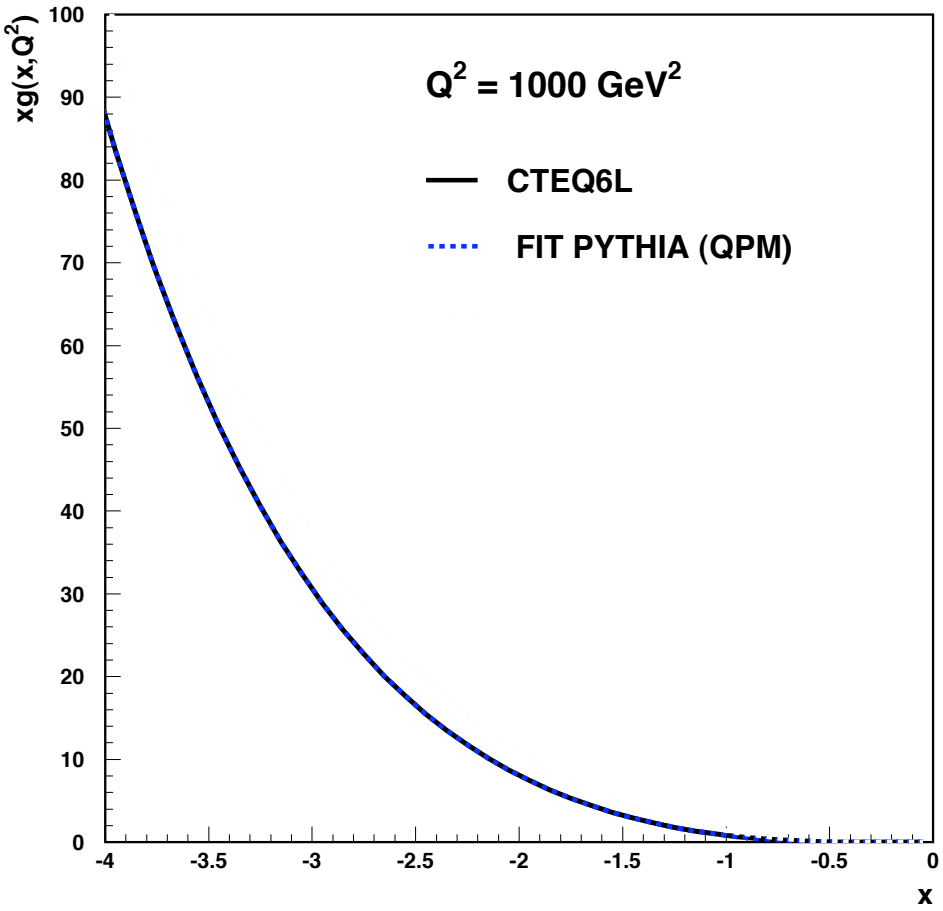

xus(x,Q²)
Q² = 1000 GeV²
CTEQ6L
FIT RAPGAP (QPM)
x

Results


xg(x,Q²)
Q² = 10 GeV²
CTEQ6L
FIT PYTHIA (QPM)
x


xus(x,Q²)
Q² = 10 GeV²
CTEQ6L
FIT PYTHIA (QPM)
x

Results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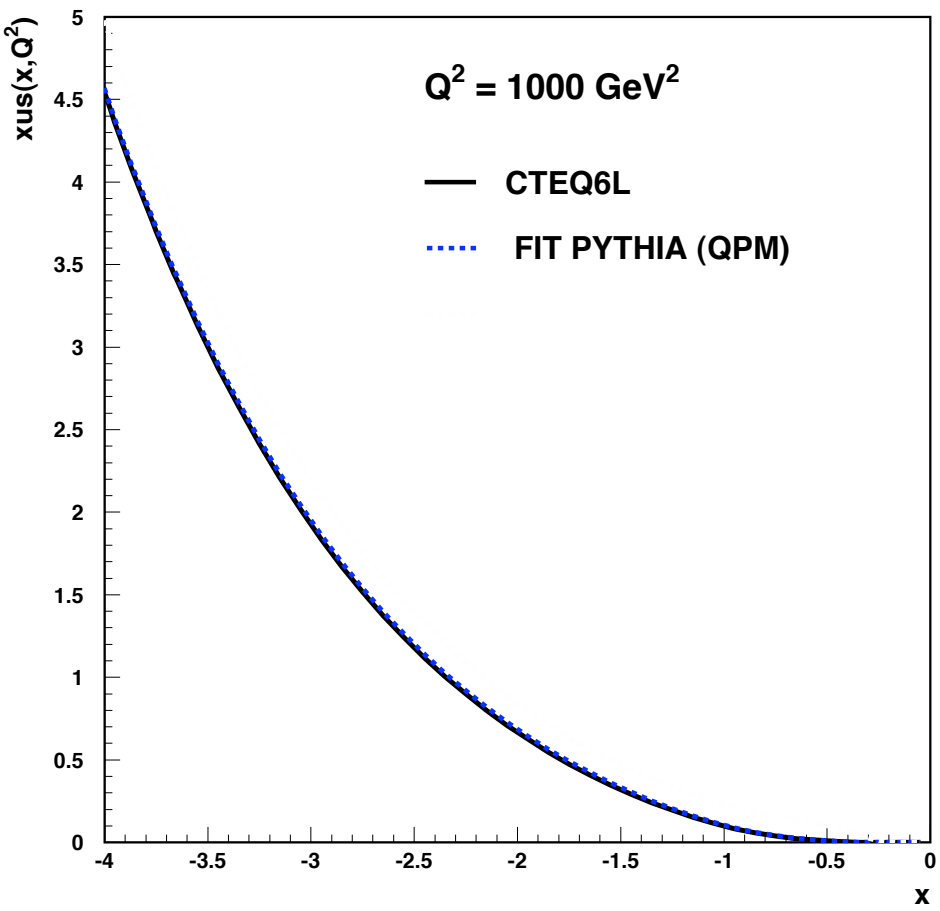
xus(x,Q²)
Q² = 1000 GeV²
CTEQ6L
FIT PYTHIA (QPM)
x

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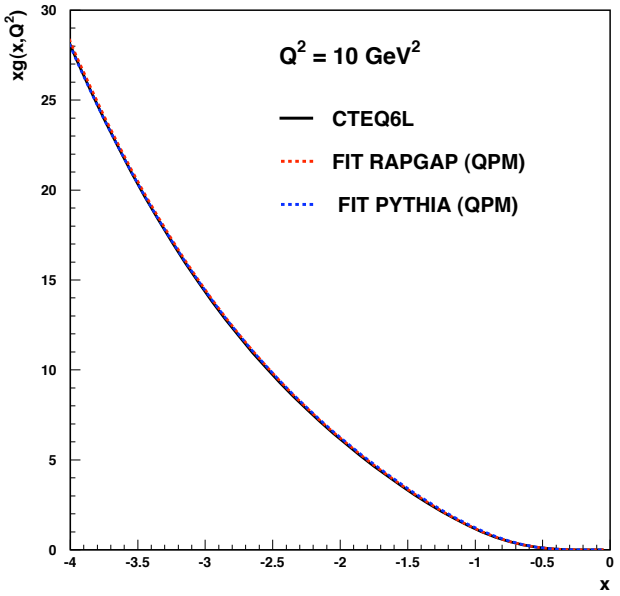
xg(x,Q²)
Q² = 10 GeV²
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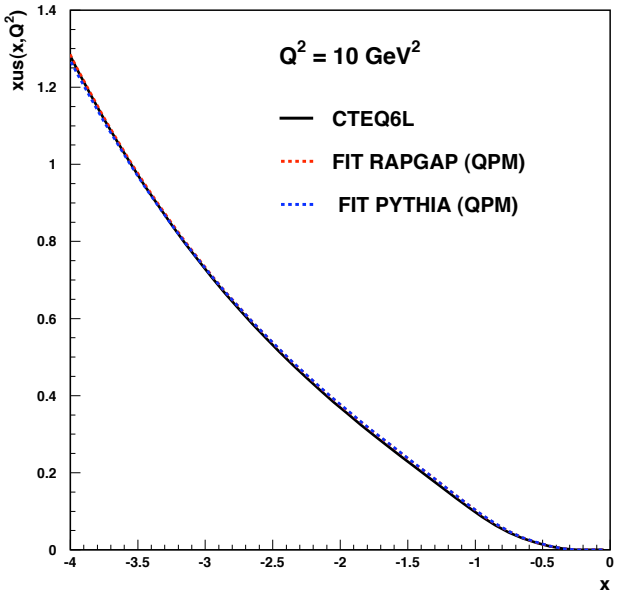
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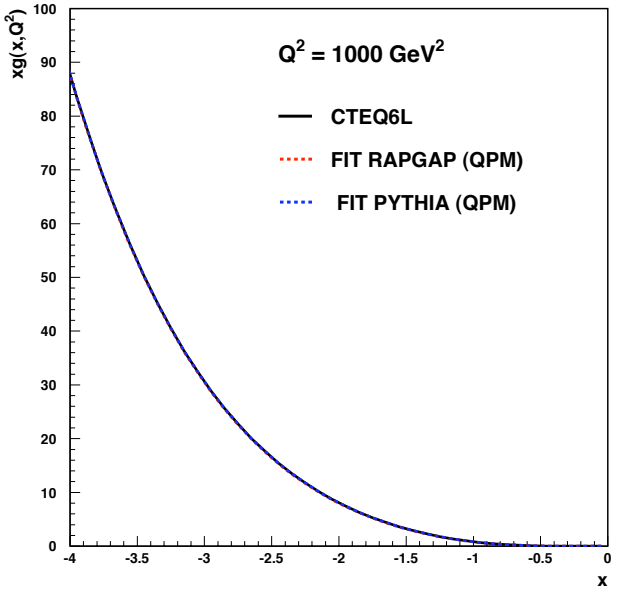
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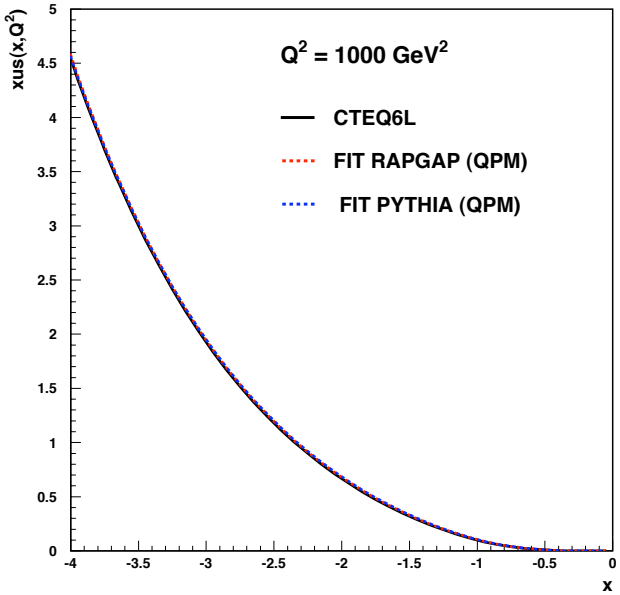
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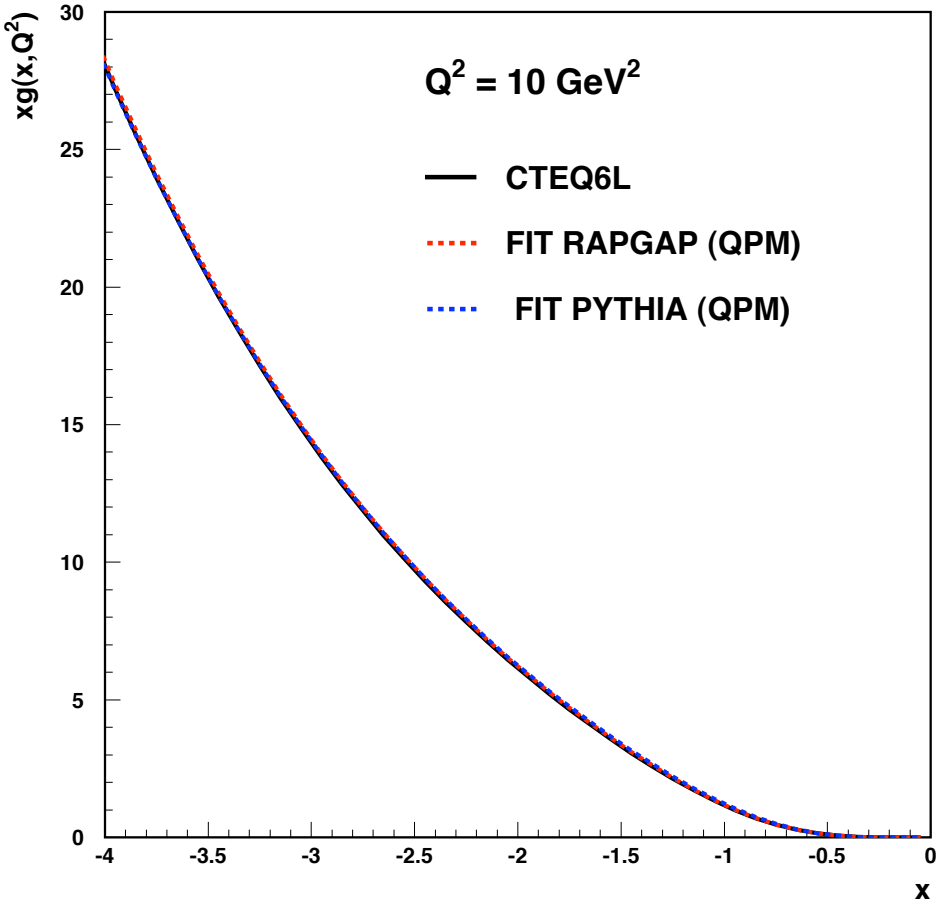
CTEQ6L
FIT RAPGAP (QPM)
FIT PYTHIA (QPM)
x

Results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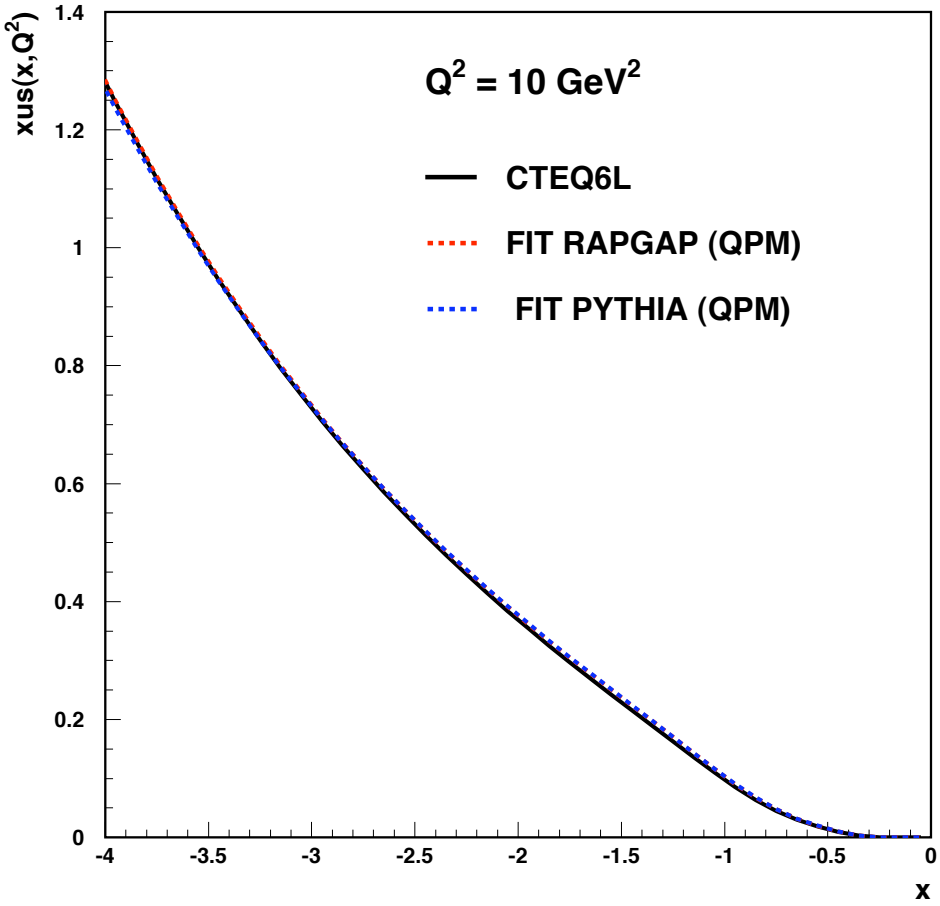
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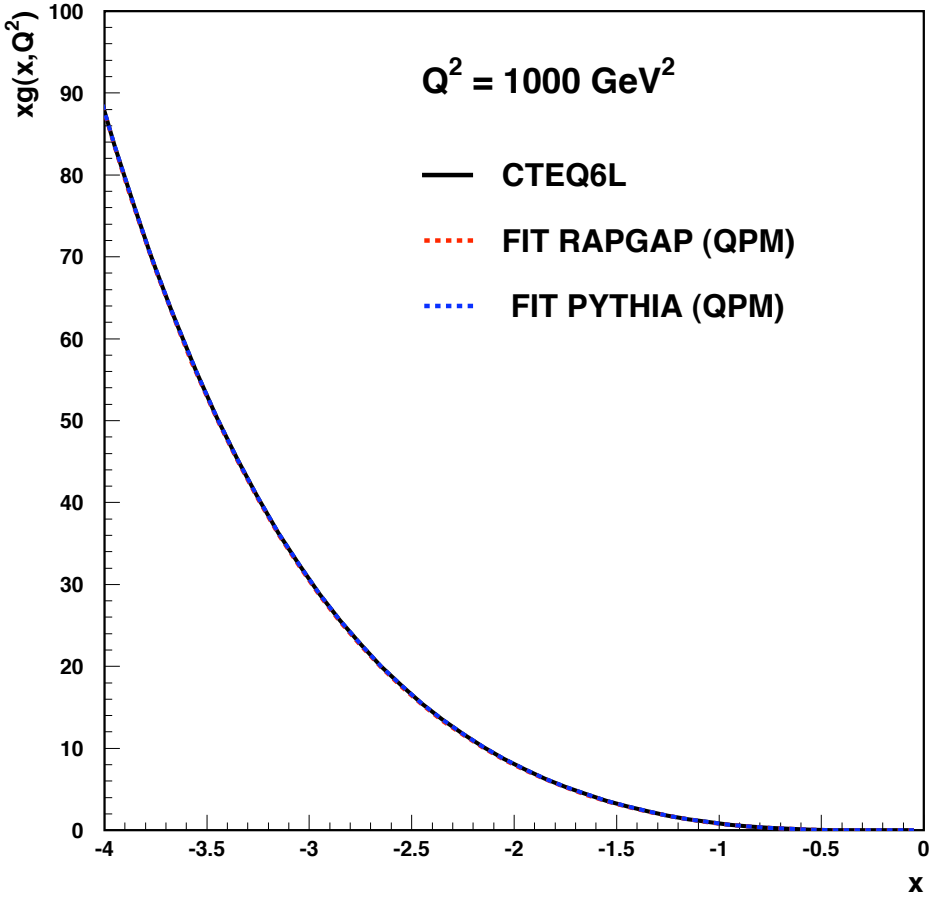
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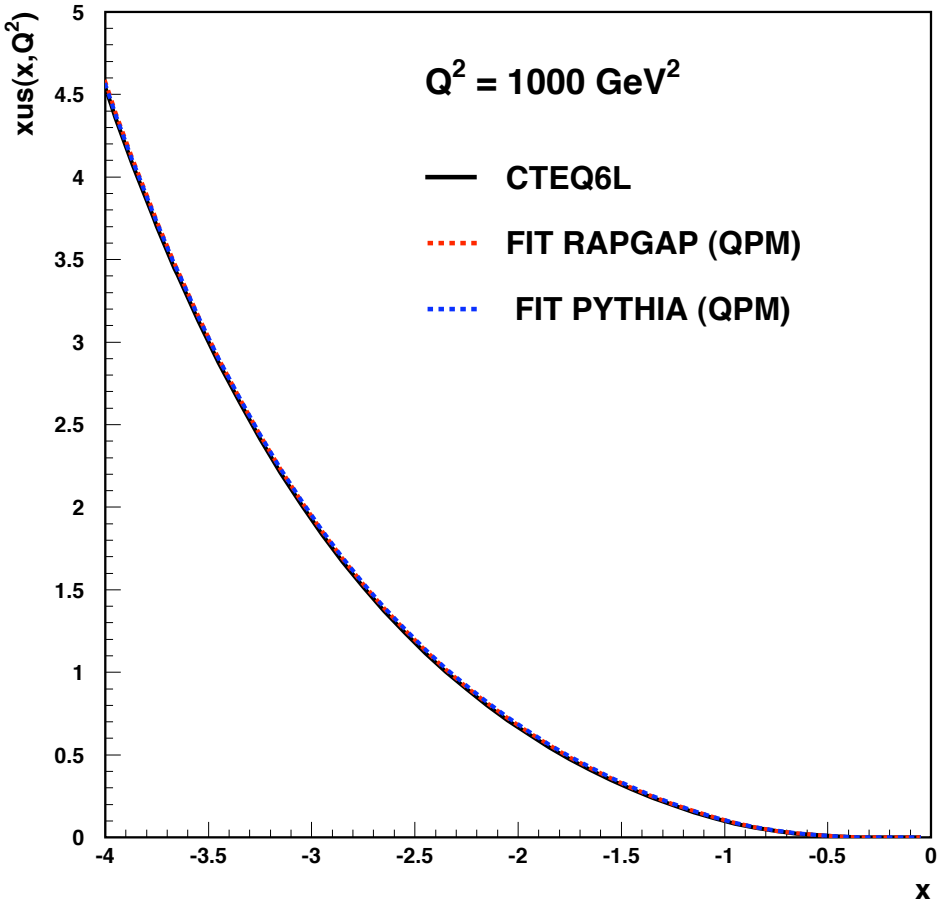
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FIT RAPGAP (QPM)
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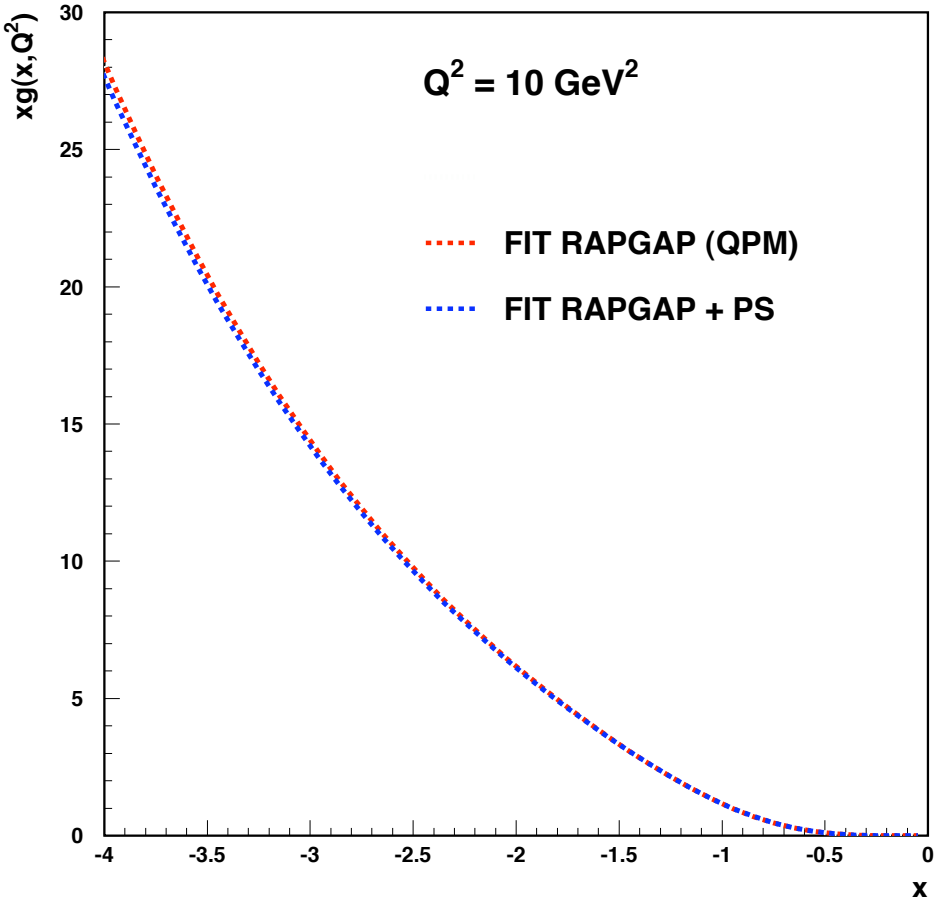
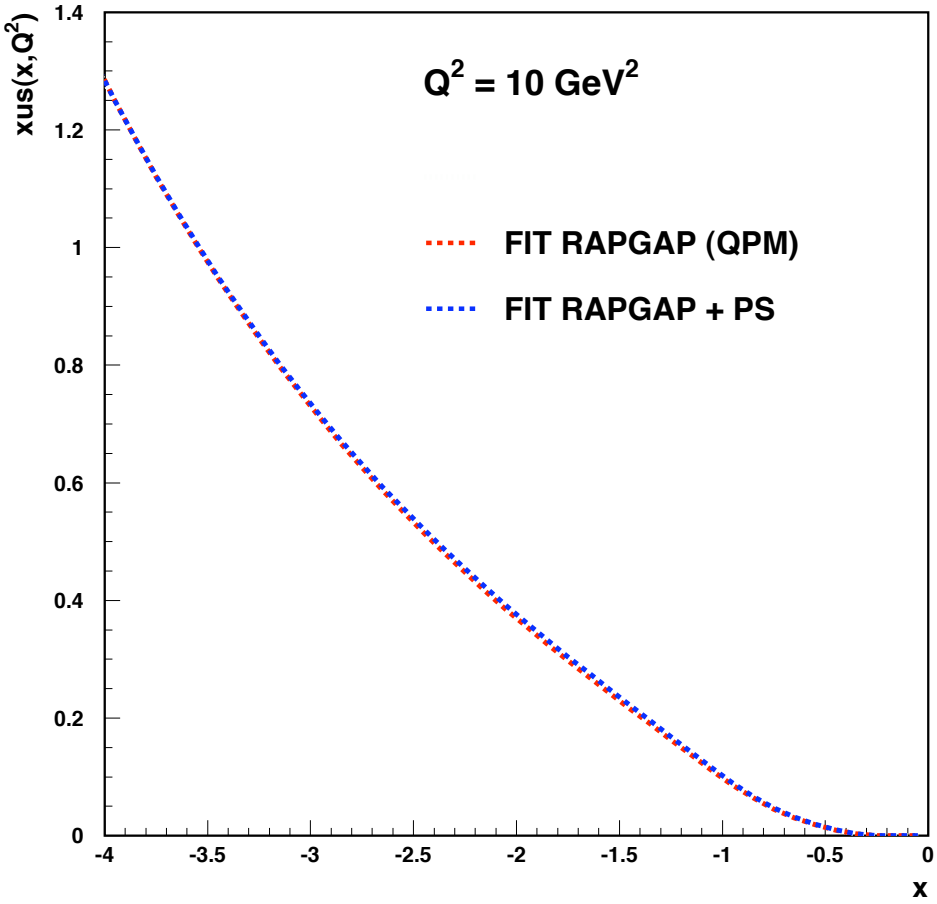

xg(x,Q²)
Q² = 10 GeV²
FIT RAPGAP (QPM)
FIT RAPGAP + PS
x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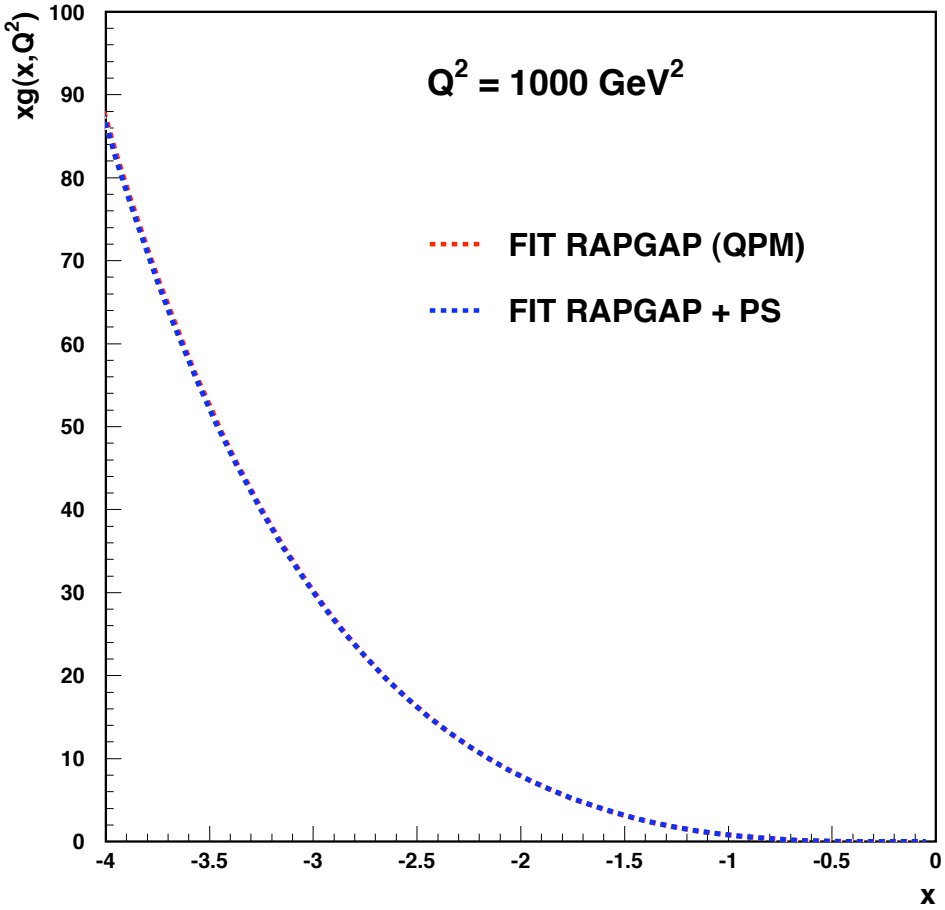
FIT RAPGAP (QPM)
FIT RAPGAP + PS
x

Results


xg(x,Q²)
Q² = 1000 GeV²
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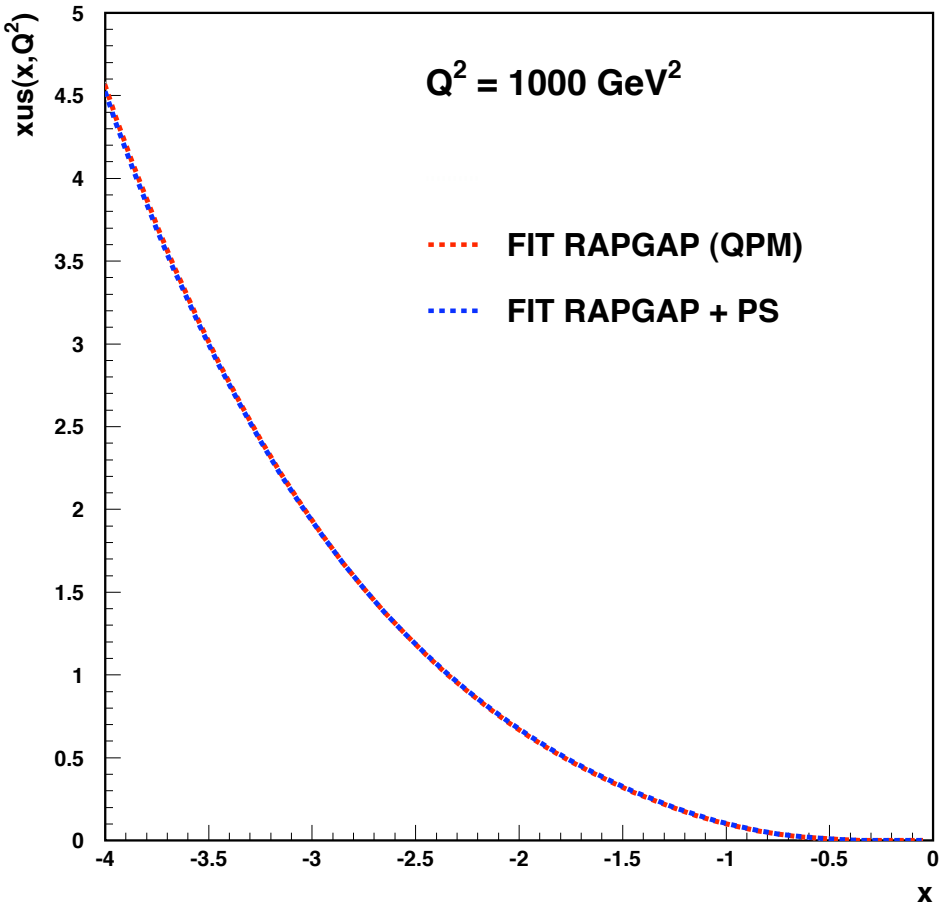
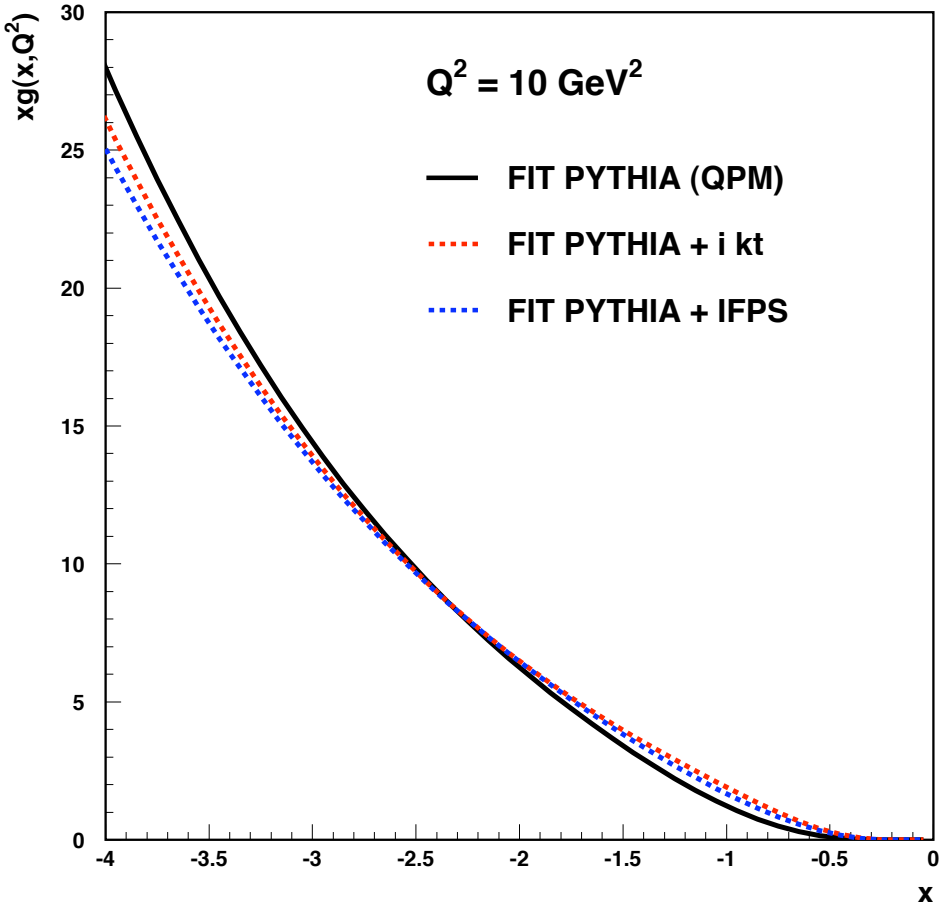
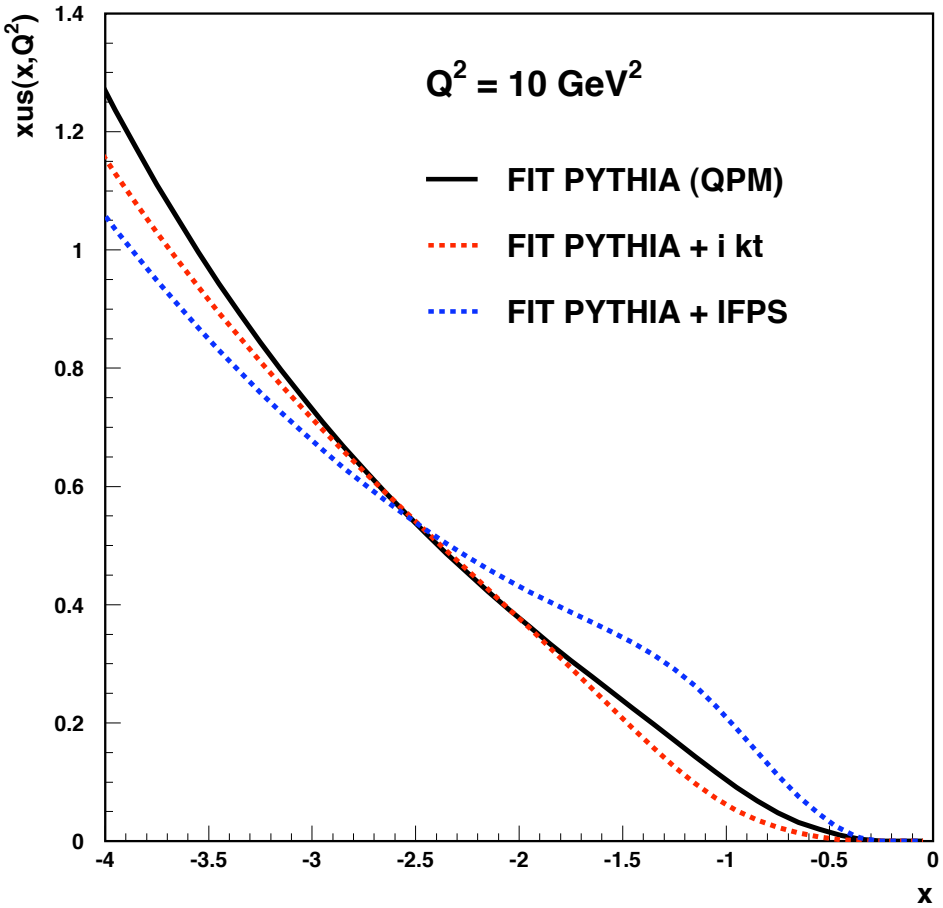
FIT RAPGAP + PS
x


xus(x,Q²)
Q² = 1000 GeV²
FIT RAPGAP (QPM)
FIT RAPGAP + PS
x

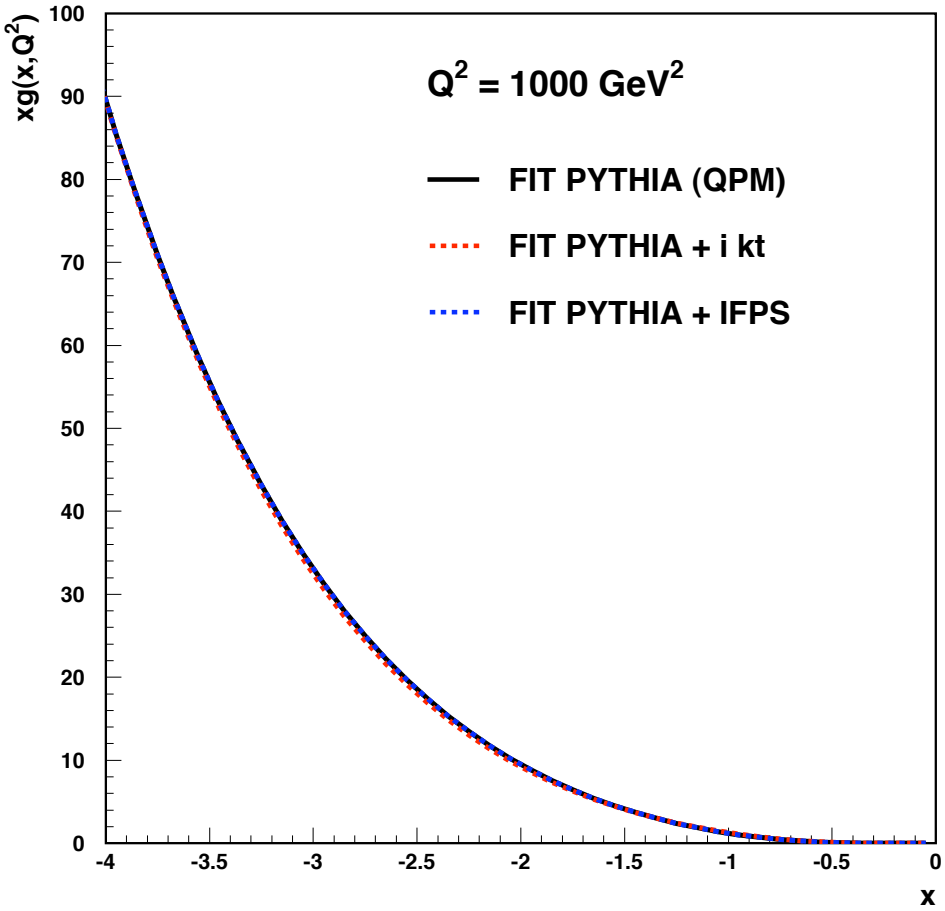
Results

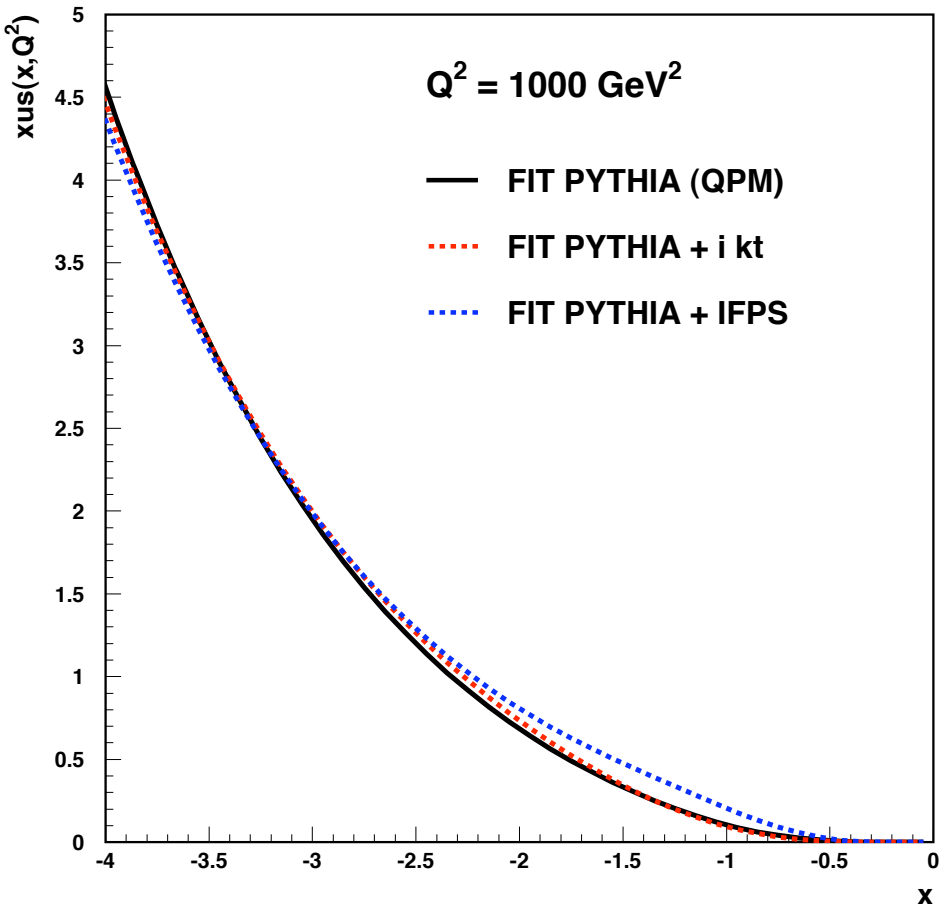




Q^2-ordered, initial and final state parton shower

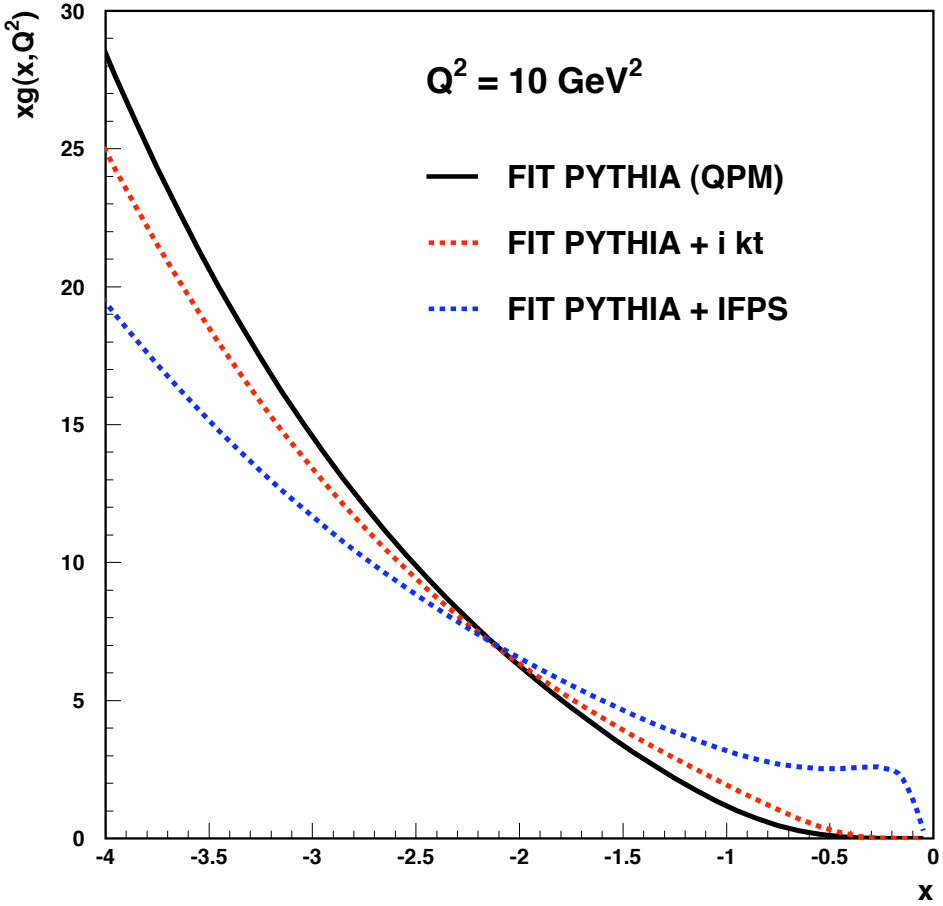
Results

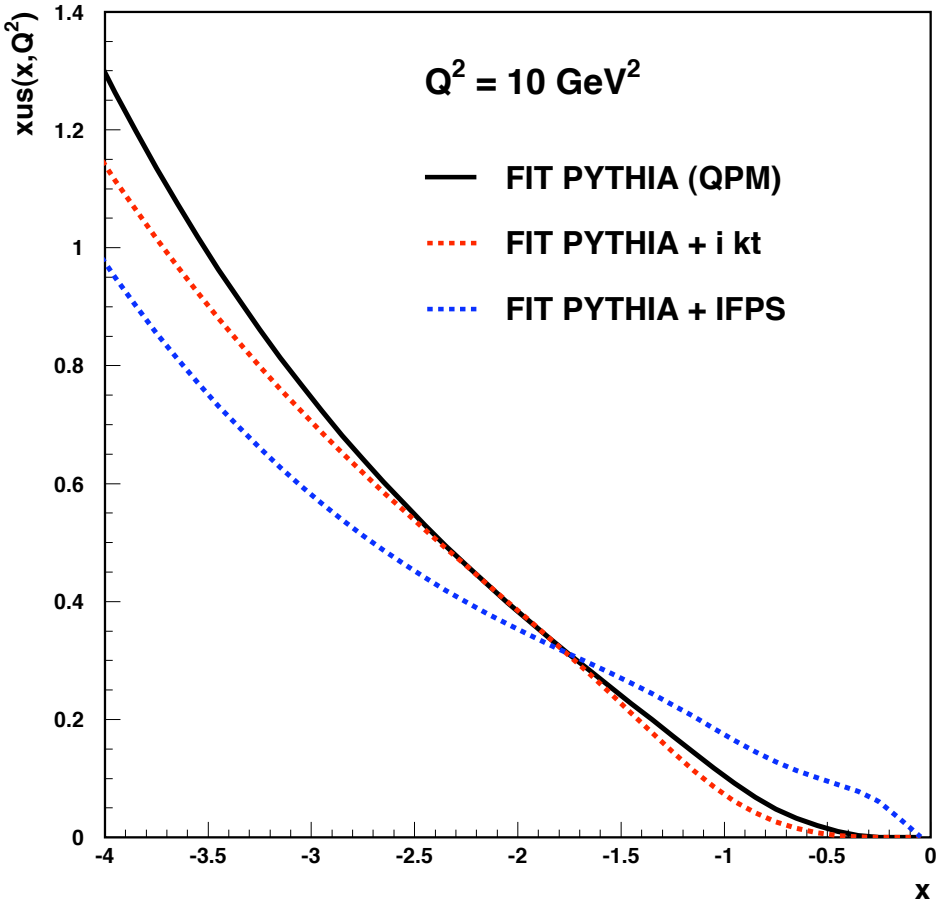




Q^2-ordered, initial and final state parton shower

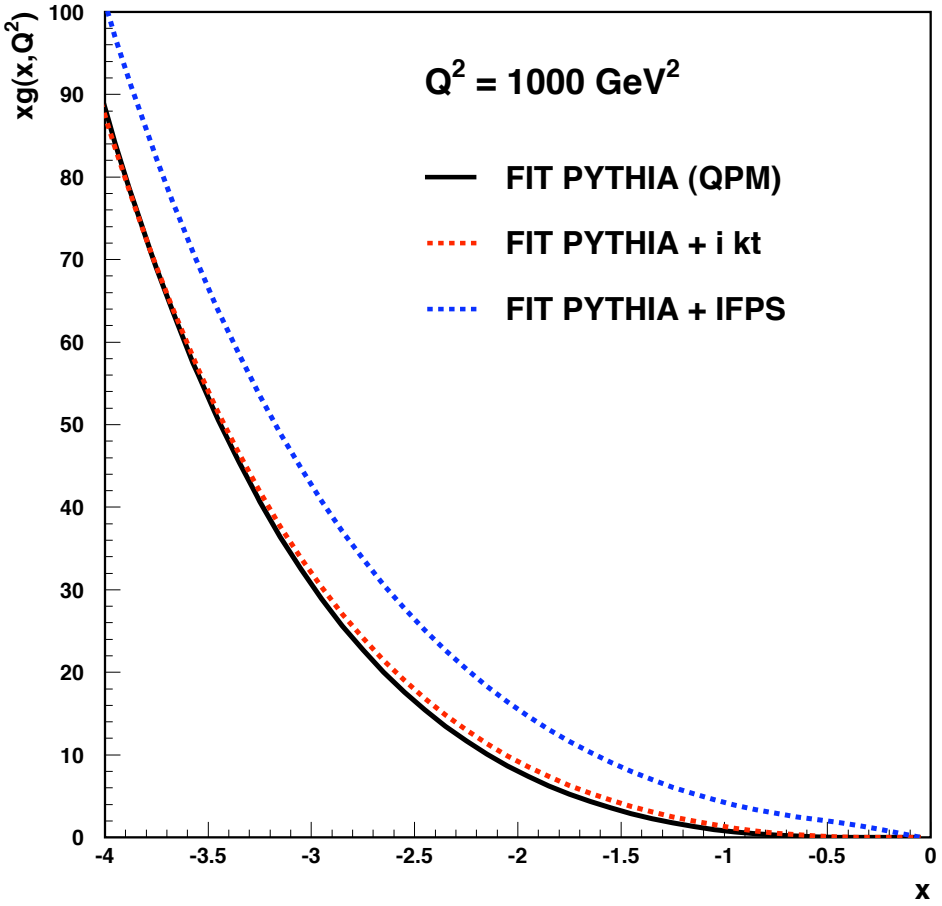
Results

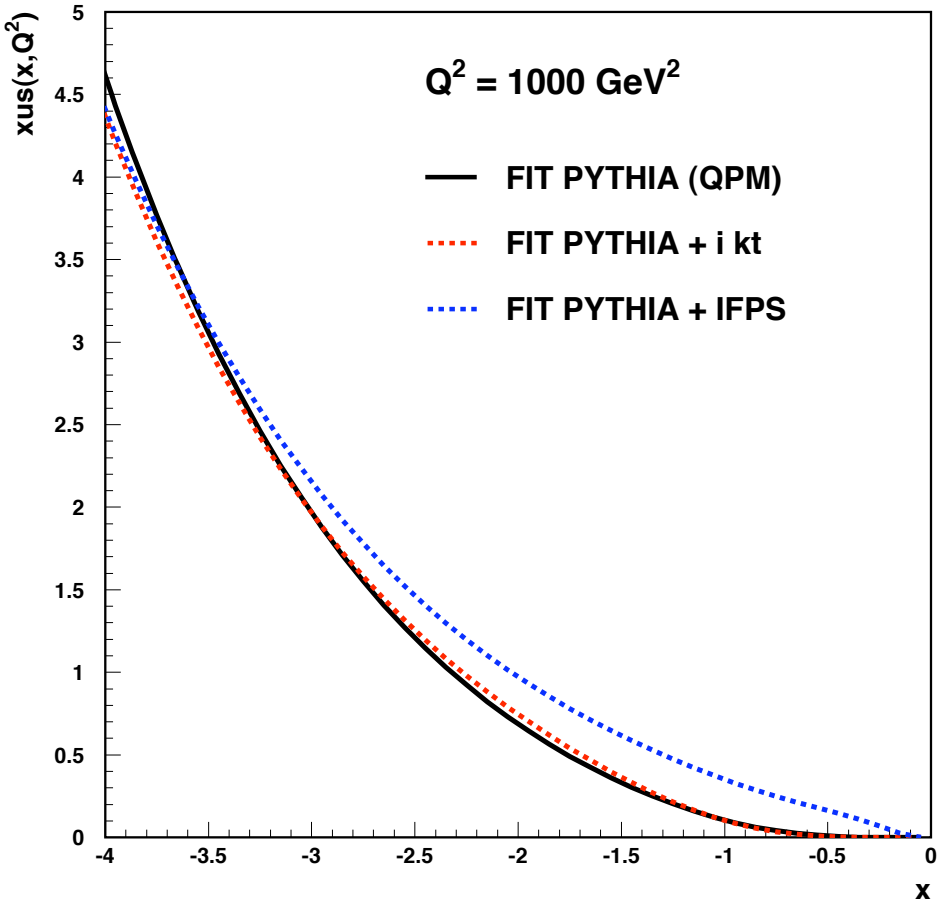




p_t-ordered, initial and final state parton shower

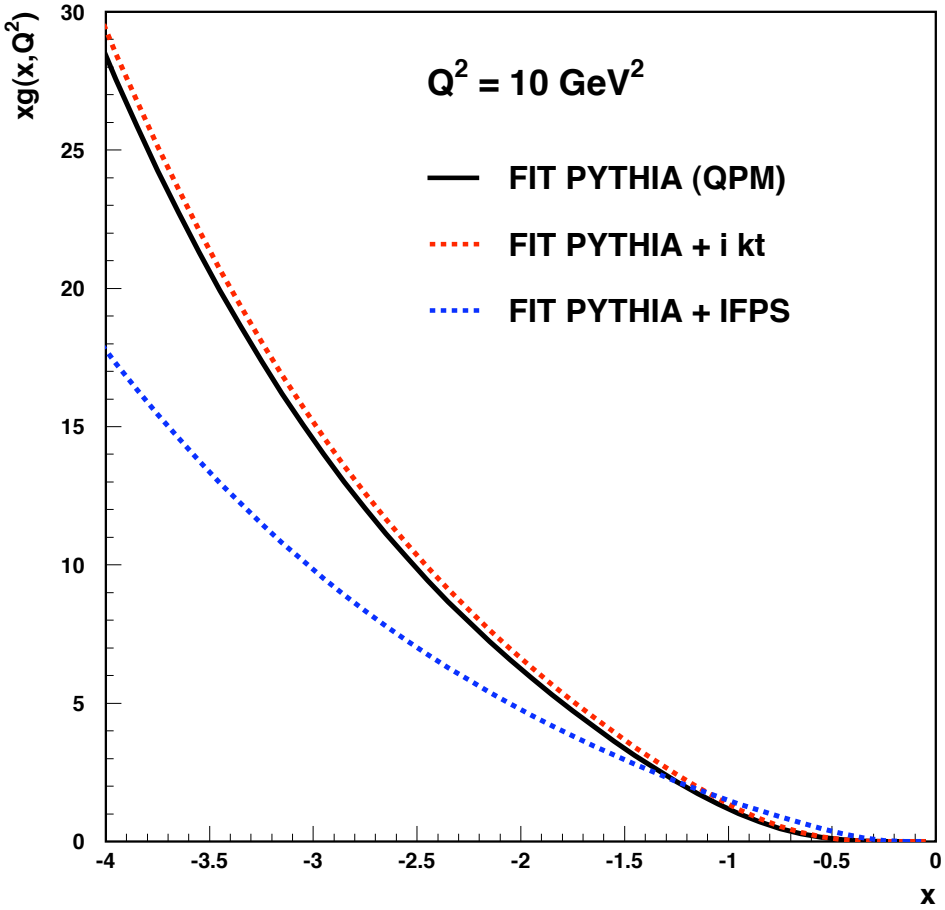
Results

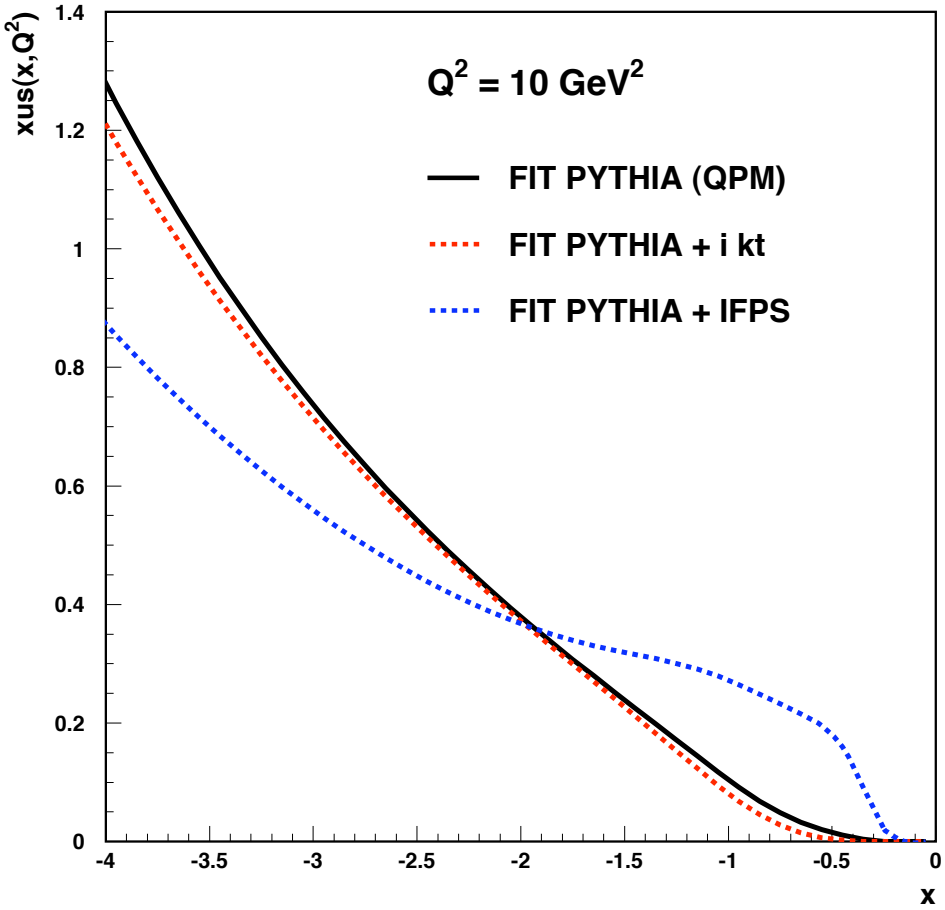




p_t-ordered, initial and final state parton shower

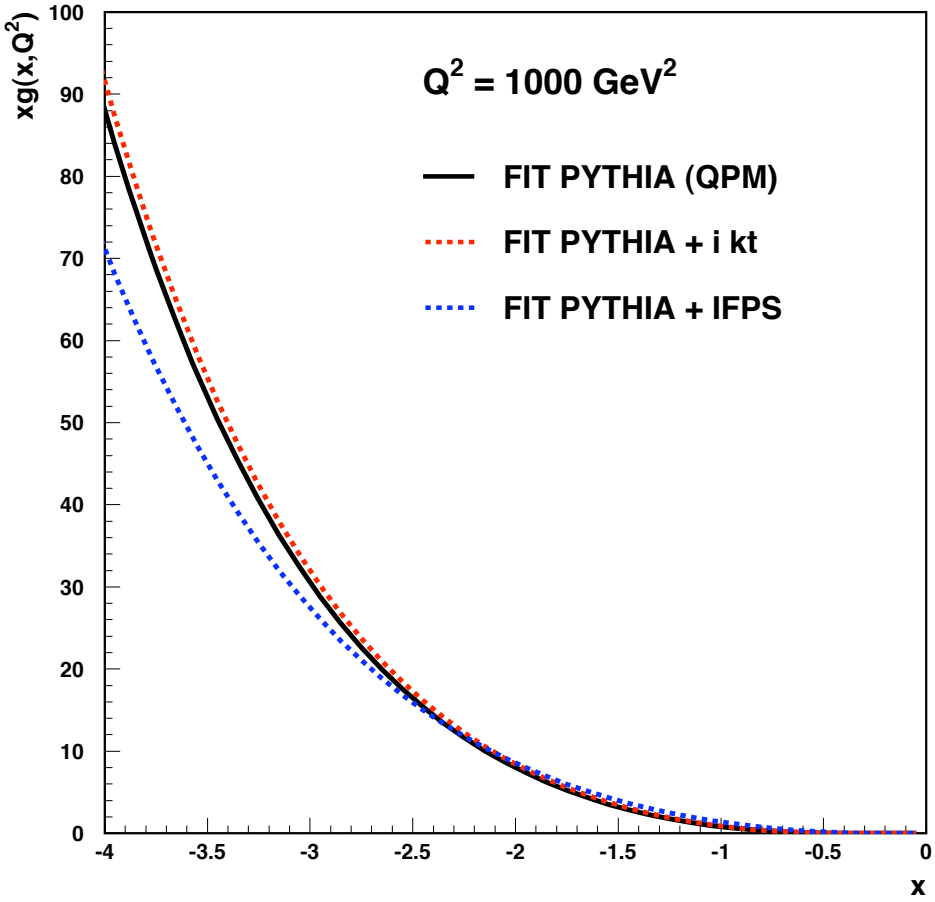
Results

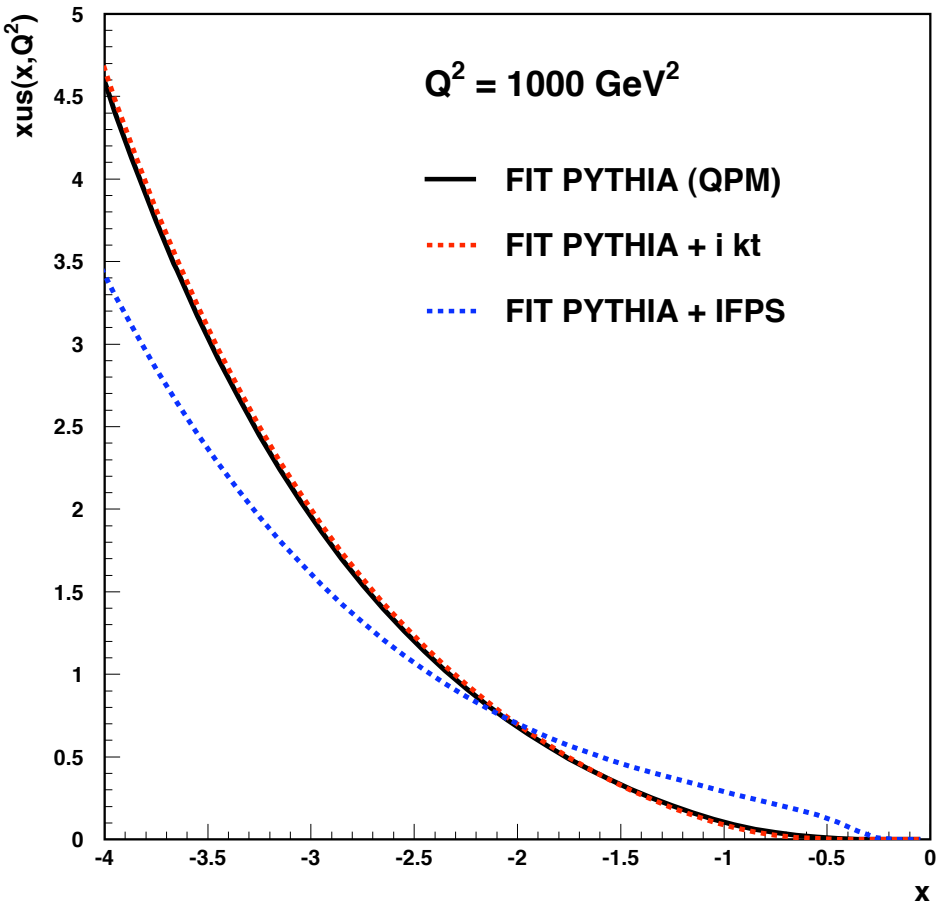




p_t-ordered, initial and final state parton shower, P_5 fixed

Results





p_t-ordered, initial and final state parton shower, P_5 fixed