Irfu
Institut de recherche
sur les lois fondamentales
de l'Univers

(Pedestrian) discussion on Meson PDFs

Future measurements of meson PDFs at CERN

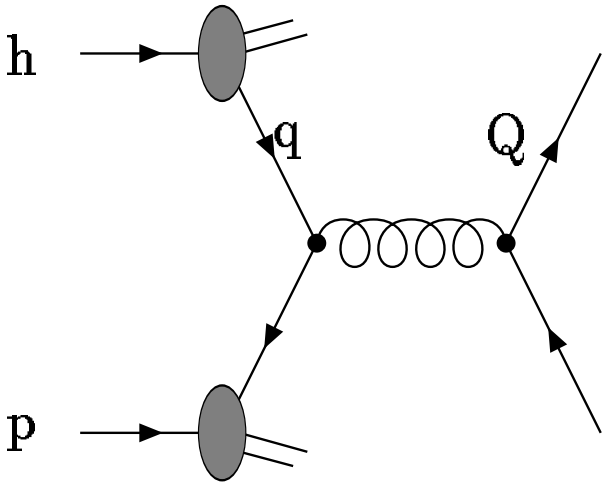
- Drell-Yan data – mainly sensitive to quark PDFs
  - Can be used to extract the valence PDF the sea PDFs
  - Electromagnetic process – cross sections are low

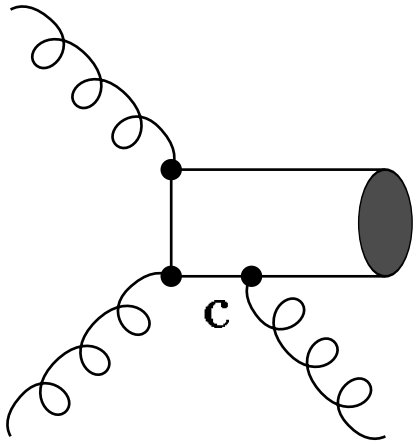
- J/psi data – sensitive to both quark and gluon PDFs
  - A big advantage – cross sections are large (strong interaction process) : factor of 30 - 40 !
  - Interpretation ?

What is needed for a reliable interpretation of the J/psi data ?

Gluon PDF – Method-3 : from J/ψ production

- Main processes contributing to J/ψ





$q\bar{q}$	gg

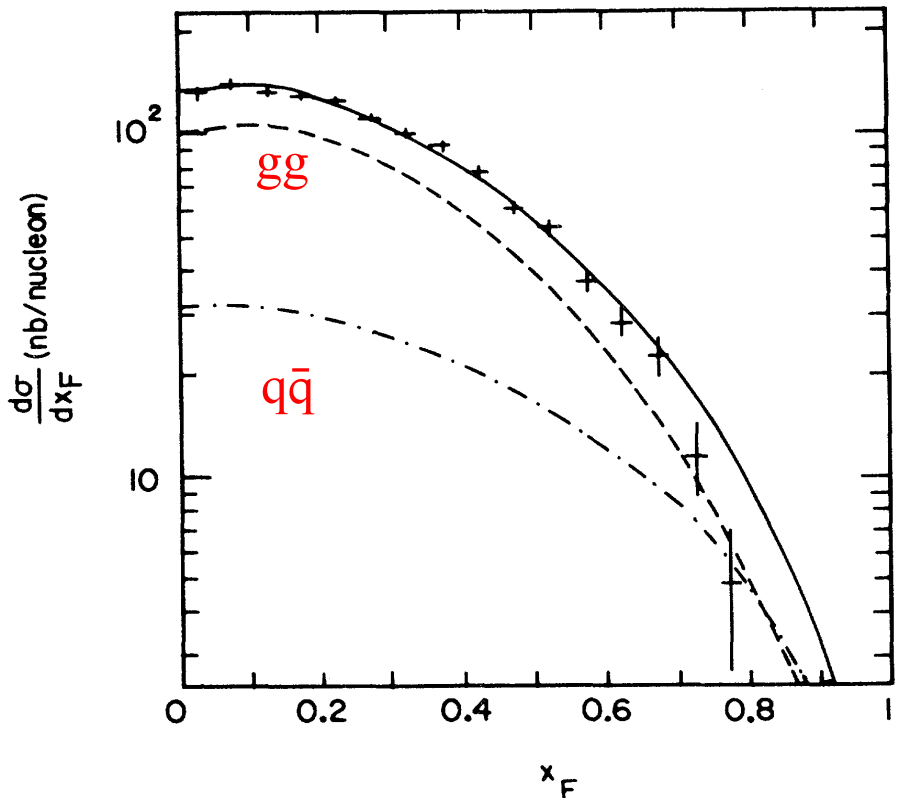
$q\bar{q}$ annihilation

gg fusion

Gluon PDF extraction – examples

- E537: 125 GeV/c: W target

Akerlof et al., PRD48, 5067 (1993)



How well can we extract the gluon distribution ?
What is the relative fraction of qq and gg components?

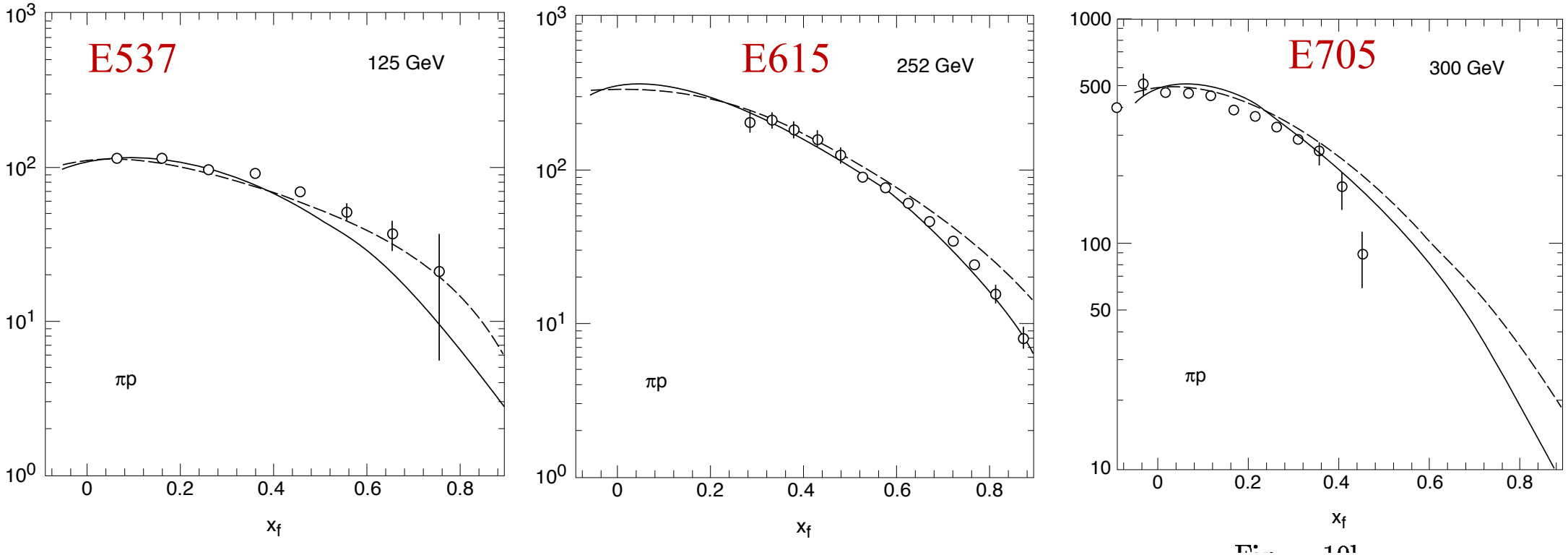
Models for J/psi production

- Color Evaporation Model

- NRQCD (factorization)

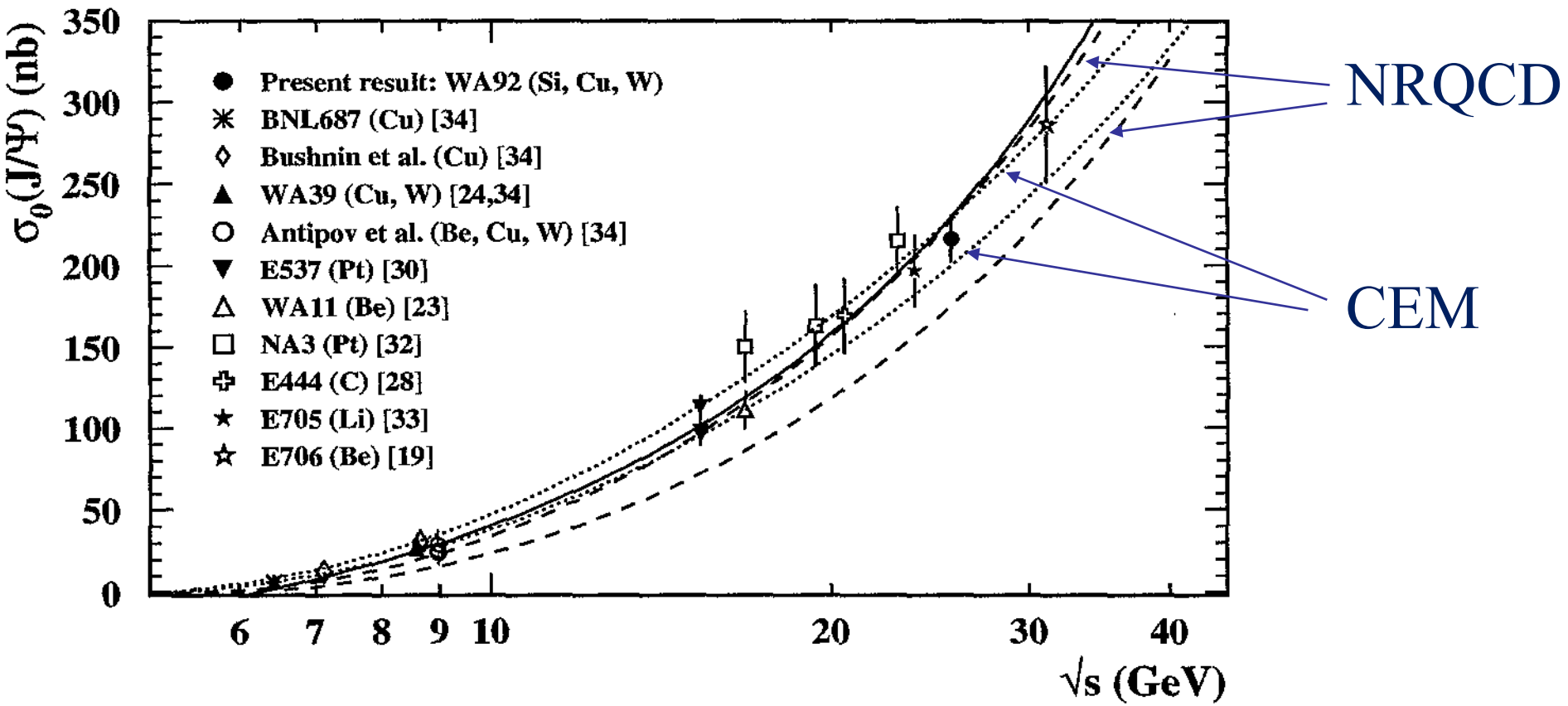
CEM calculations vs π-induced J/psi cross sections

Gavai et al., Int.J.Mod.Phys .A10, 3043 (1995)



J/psi production : summary of π-induced data

Beatrice Collaboration / Nuclear Physics B 557 (1999) 3–21



Dependence on the: factorization scale μ and charm mass M

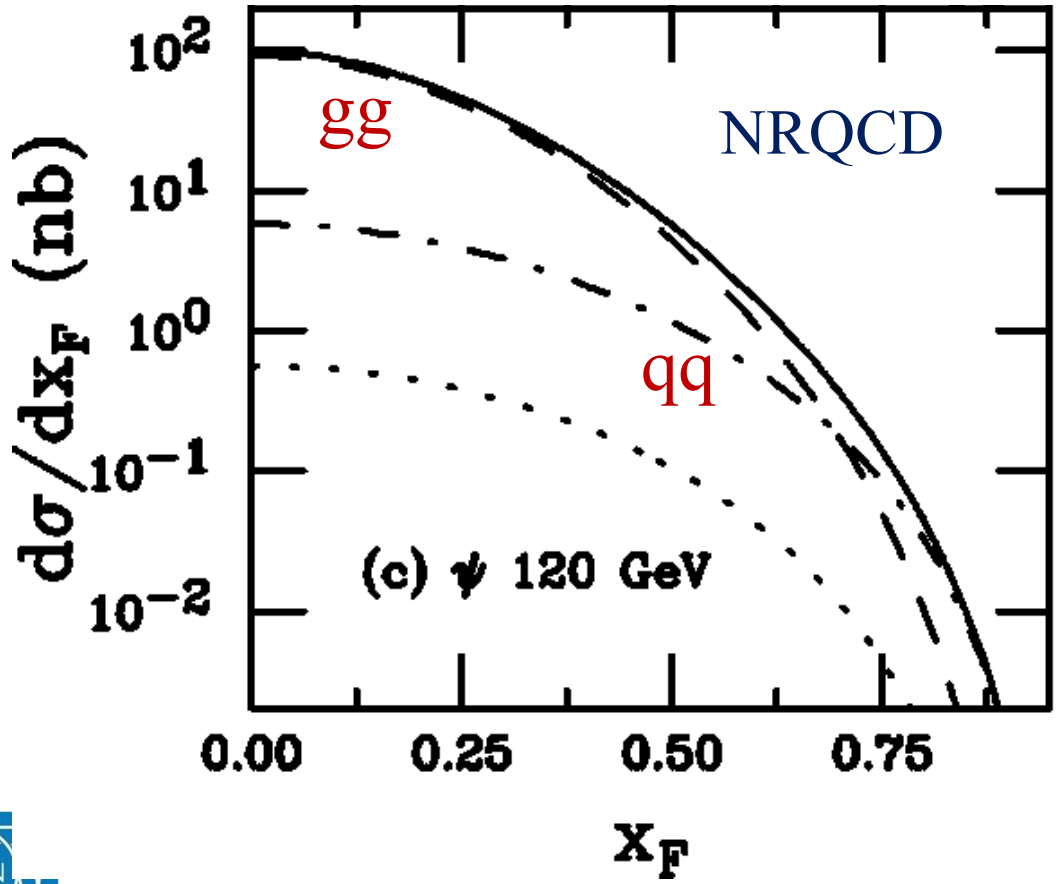
Models form J/psi production – x dependence

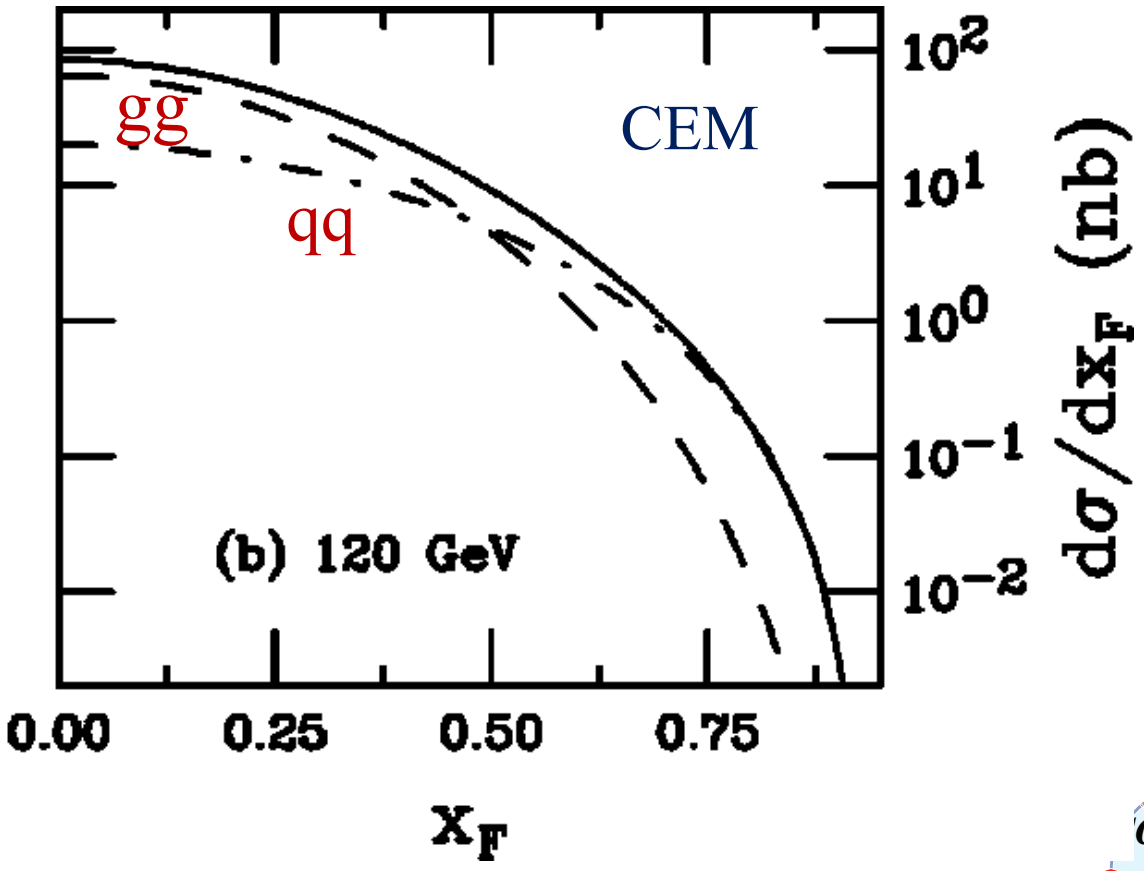
- CEM (Color Evaporation Model)
- NRQCD (factorization approach)

PHYSICAL REVIEW C, VOLUME 61, 035203

x_F dependence of ψ and Drell-Yan production

R. Vogt





Example : use of kaon beam for J/psi production

- K− on a proton target $K^-(\bar{u}s) + p(uud) \sim \bar{u}_K u_p + g_K g_p$
- K+ on a proton target $K^+(u\bar{s}) + p(uud) \sim$ -- $+ g_K g_p$

No valence quark term

The difference $K^- - K^+$ contains the valence-valence term only (within corrections)

- Results could be used to:
  - Determine the kaon g(x) and u(x) distributions ?
  - Improve the J/psi production models at FT energies ?

Example : use of antiproton beam for J/psi production

- K− on a proton target $p^-(\bar{u}\bar{u}\bar{d}) + p(uud) \sim \bar{u}_p u_p + \bar{d}_p d_p + g_p g_p$
- K+ on a proton target $p^+(uud) + p(uud) \sim$ -- $+ g_p g_p$

No valence quark term

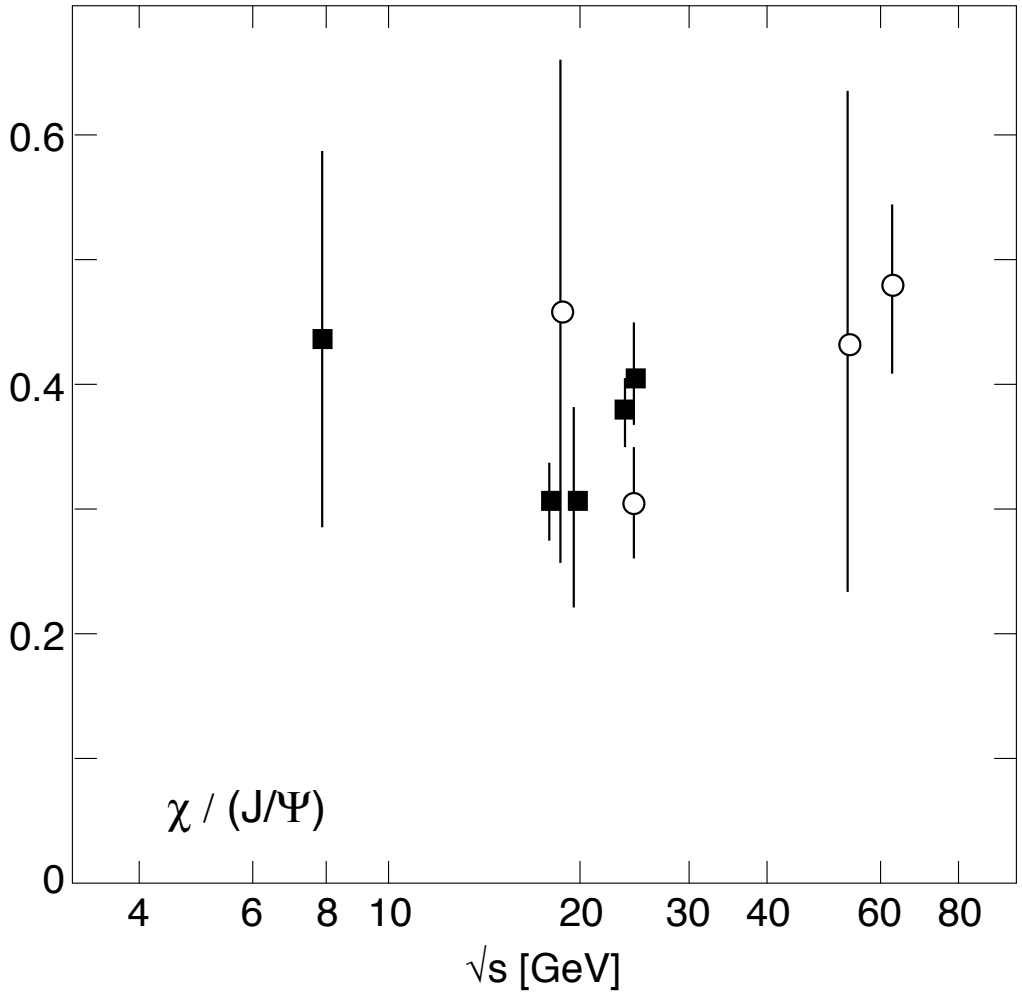
The difference $p^- - p^+$ contains the valence-valence term only (within corrections)

- Results could be used to:
  - Proton quark and gluon distributions are known.
  - Check the subtraction procedure ?

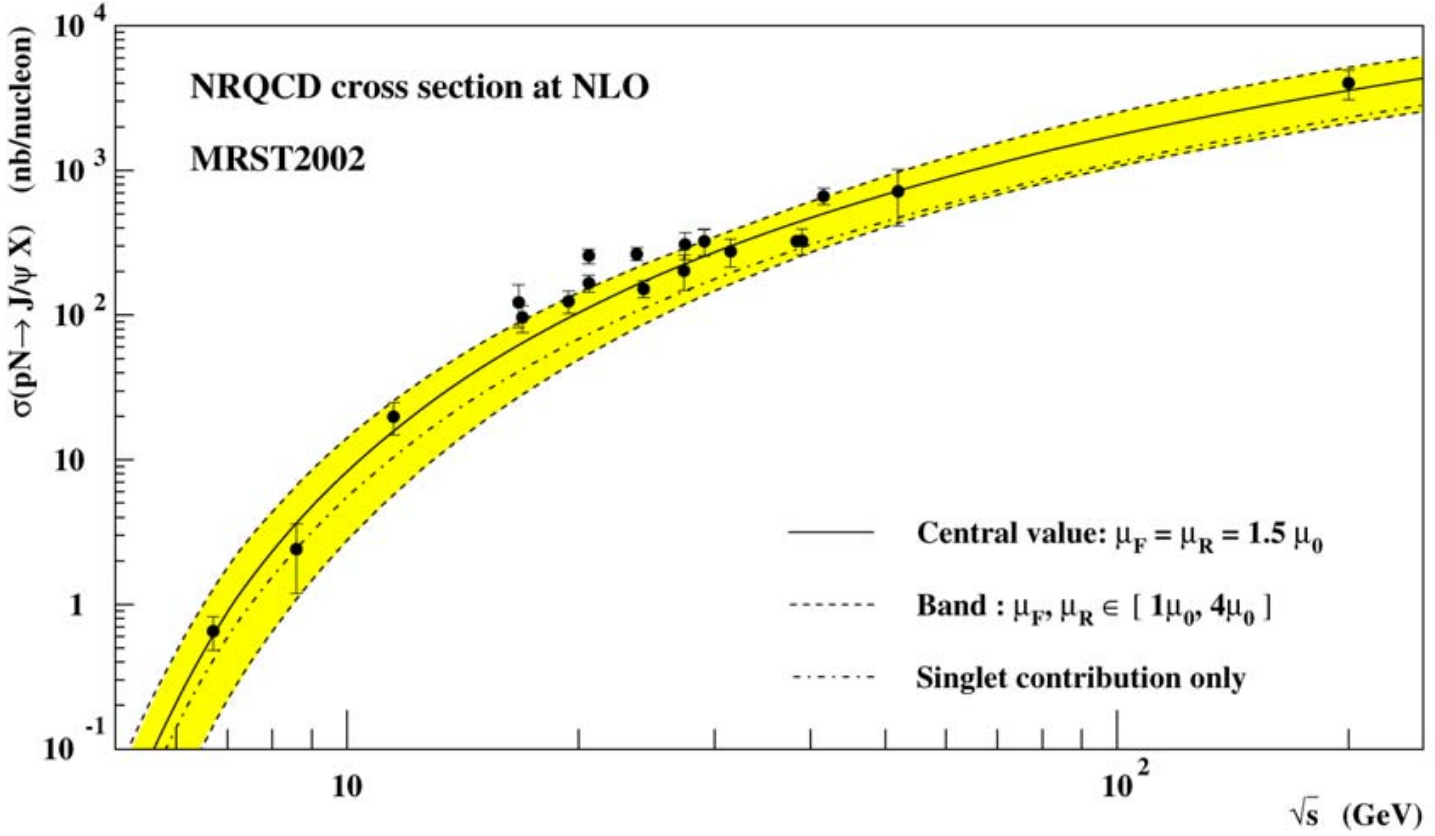
Feed-down contribution to J/psi

- From Gavai et al.,

Gavai et al., Int.J.Mod.Phys .A10, 3043 (1995)



Analysis of


NRQCD cross section at NLO
MRST2002
Central value: $\mu_F = \mu_R = 1.5\,\mu_0$
Band : $\mu_F, \mu_R \in [\,1\mu_0, 4\mu_0\,]$
Singlet contribution only
$\sigma(pN \to J/\psi\, X)$ (nb/nucleon)
$\sqrt{s}$ (GeV)
10^4
10^3
10^2
10
1
10^{-1}
10
10^2