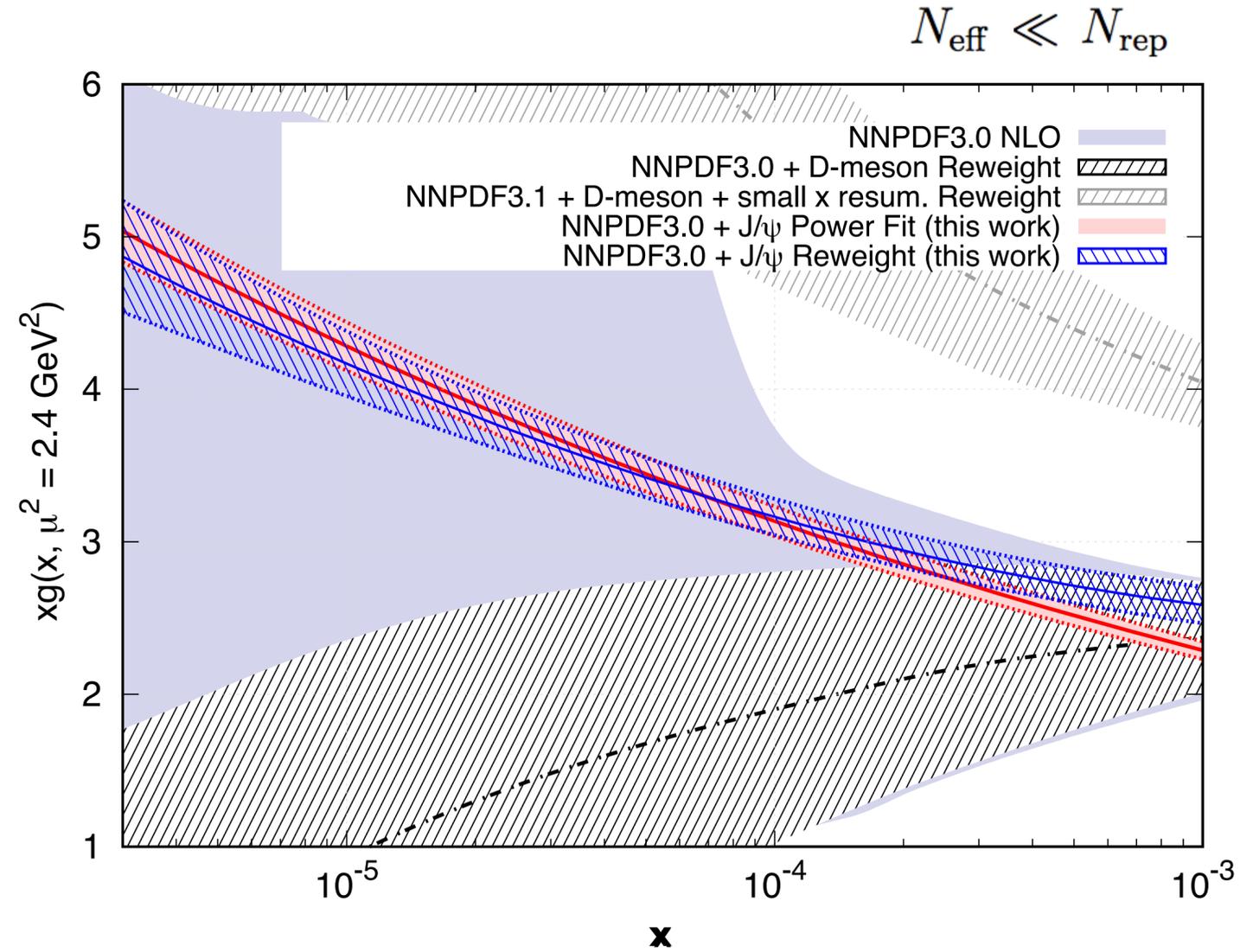
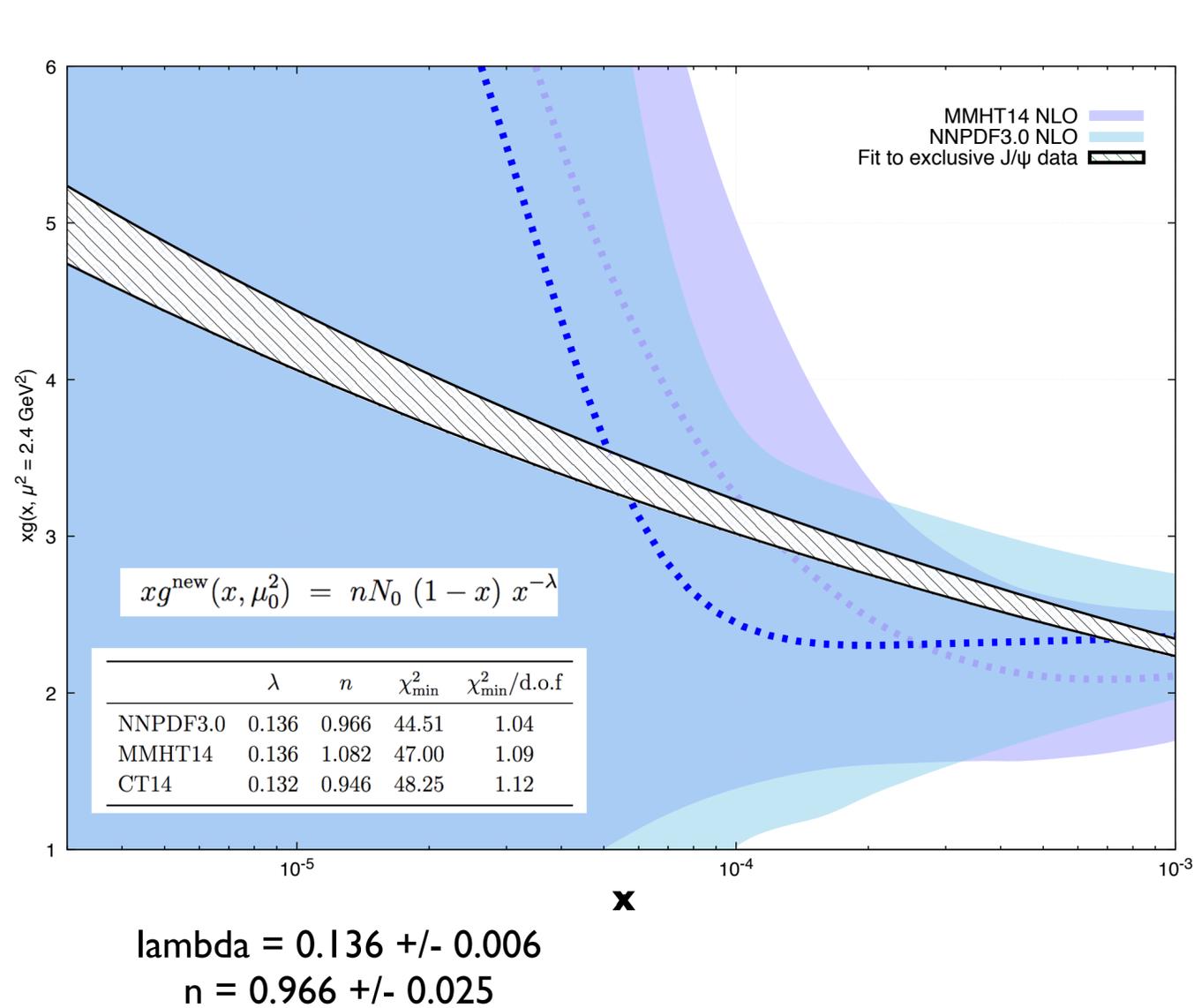


Tension between different extractions of gluon PDFs at NLO

Framework: Tamed collinear factorisation + GPD (Shuvaev) + NRQCD for CEP of J/psi



Constraints from inclusive D meson production data

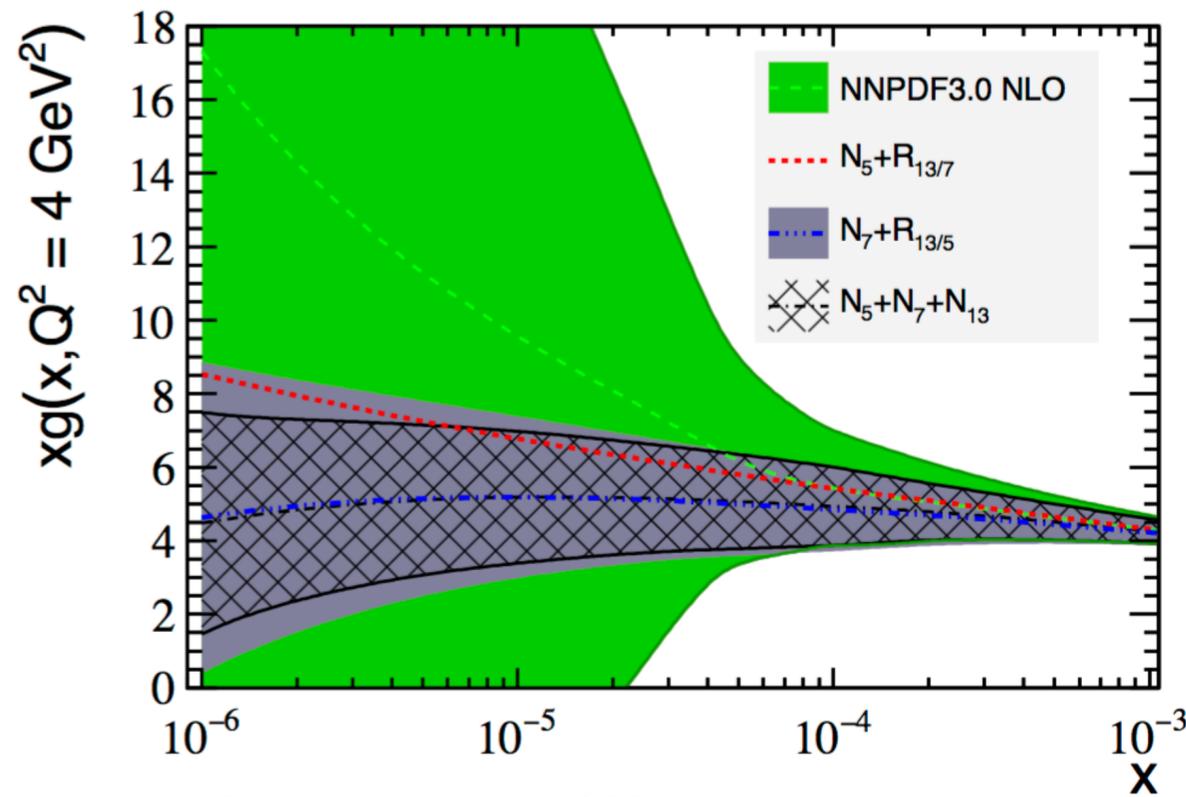
Idea: Construct ratios of observables in y and p_T bins to combat various uncertainties

$$N_X^{ij} = \frac{d^2\sigma(X \text{ TeV})}{dy_i^D d(p_T^D)_j} \bigg/ \frac{d^2\sigma(X \text{ TeV})}{dy_{\text{ref}}^D d(p_T^D)_j}$$

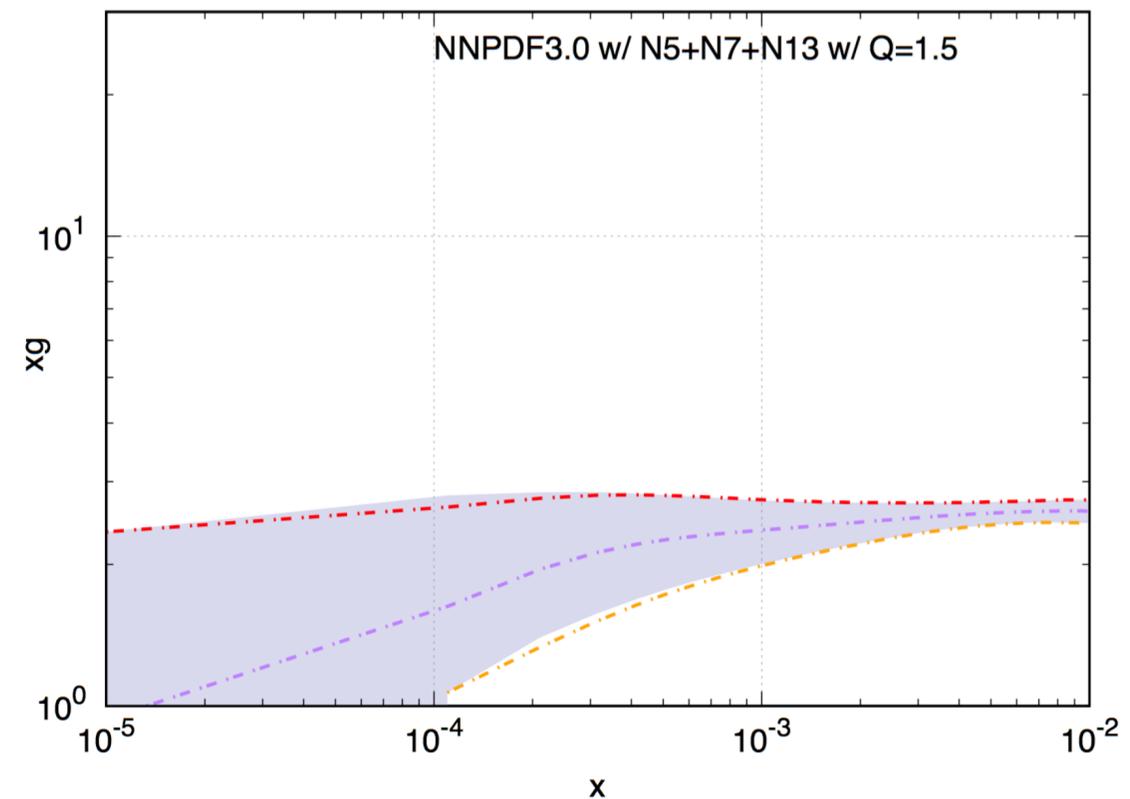
$$R_{13/X}^{ij} = \frac{d^2\sigma(13 \text{ TeV})}{dy_i^D d(p_T^D)_j} \bigg/ \frac{d^2\sigma(X \text{ TeV})}{dy_i^D d(p_T^D)_j}$$



find decreasing gluon at the lowest x accessible



Plot from 1610.09373



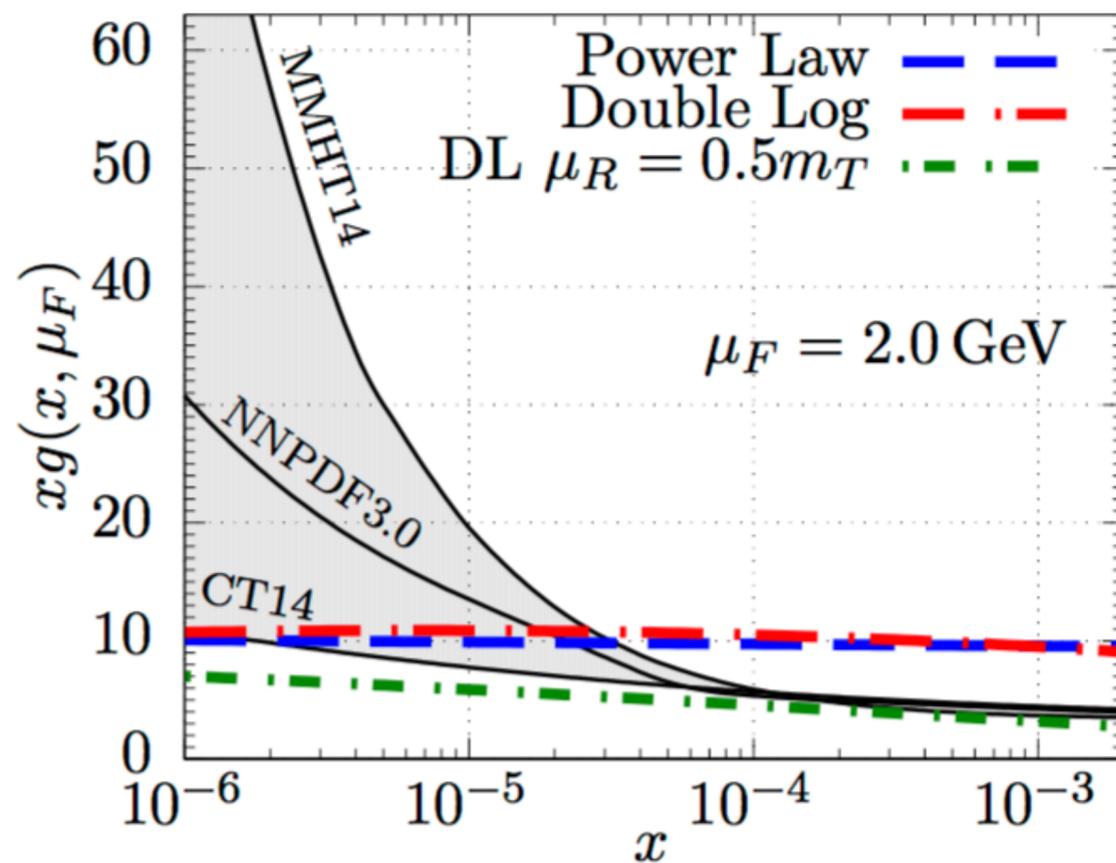
We need a much harder gluon at low x to describe the exclusive J/psi LHCb data.

What's the reconciliation?

Indications of **inconsistencies** in the inclusive D experimental measurement

$$xg(x) = N \left(\frac{x}{x_0} \right)^{-\lambda}$$

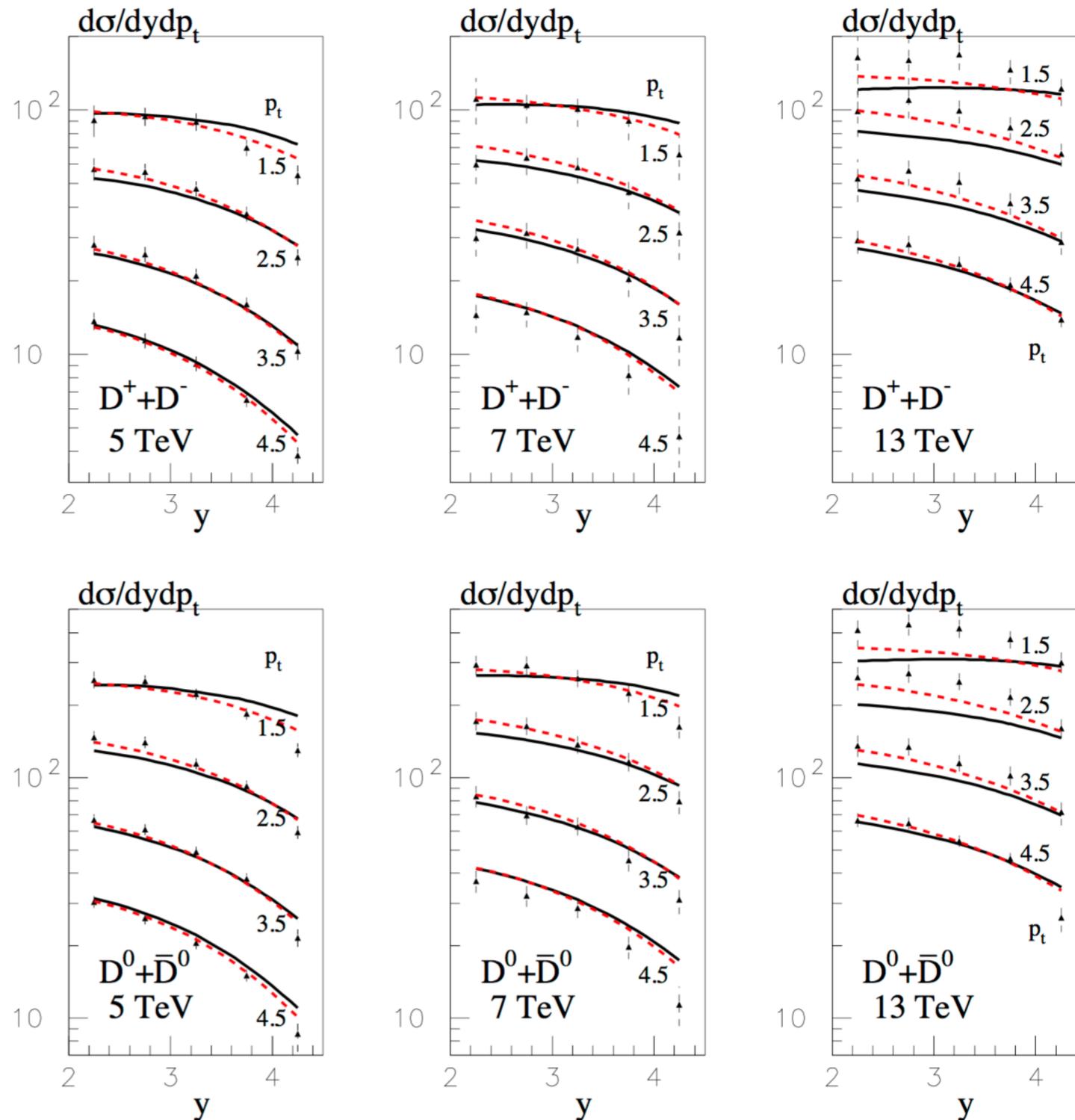
$$xg(x, \mu^2) = N^{\text{DL}} \left(\frac{x}{x_0} \right)^{-a} \left(\frac{\mu^2}{Q_0^2} \right)^b \exp \left[\sqrt{16(N_c/\beta_0) \ln(1/x) \ln(G)} \right]$$



Plot from 1712.06834

Framework:
 FONLL for open charm production at NLO
 +
 Hep-ph/0510032 c-> D fragmentation functions

Rapidity and energy dependence of open charm cross section



Plot from I712.06834

- Need *slower* increasing gluon with decreasing x to describe rapidity dependence
- Need *faster* increasing gluon with decreasing x to describe energy dependence

$$y \sim \ln(1/x) !!$$

dash

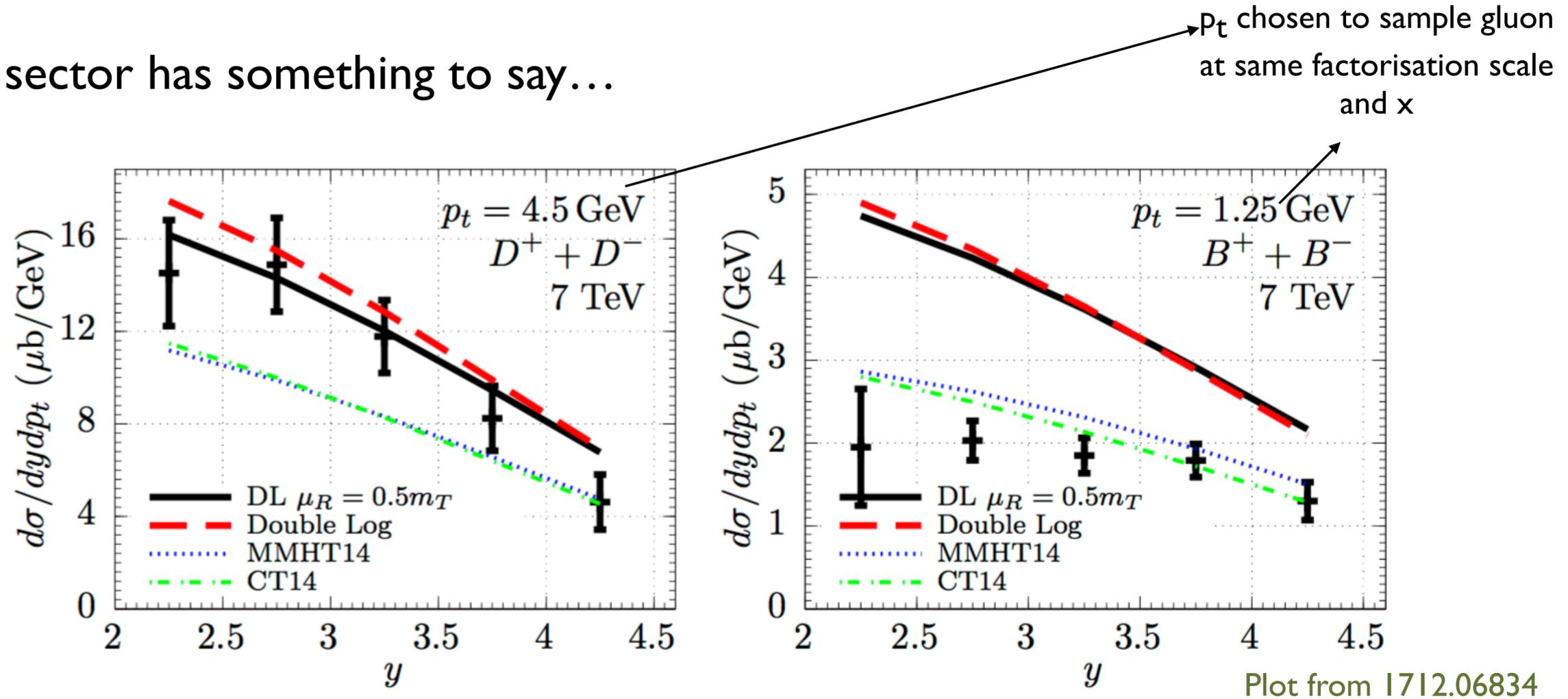
$Q_0=1 \text{ GeV}$ and $\mu_F = \mu_R = 0.85m_T$

solid

$\mu_f = \mu_R = 0.5m_T$ and $Q_0=0.5 \text{ GeV}$

Open beauty results

B sector has something to say...



Gluon found through fit to D meson data fails to describe the B meson distribution

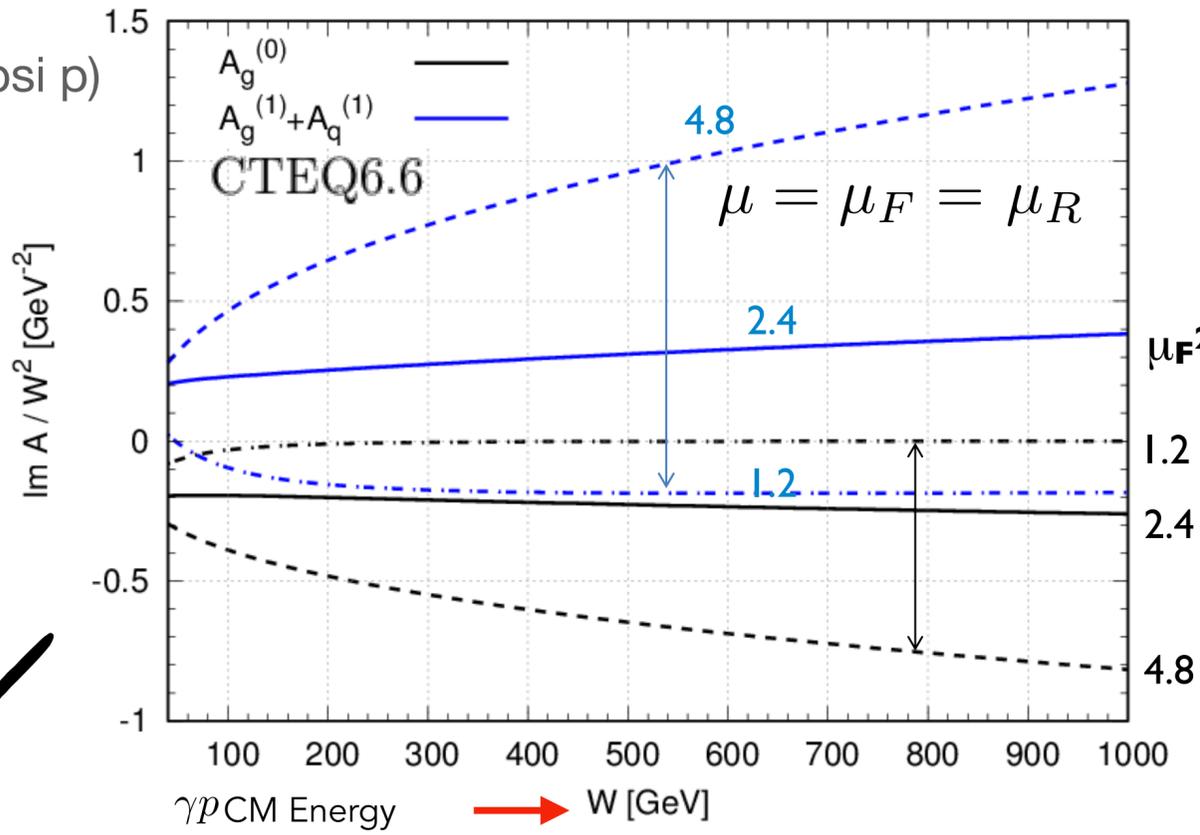
(Some) Possibilities

- Discrepancy at low p_t indicative of additional effects in $c \rightarrow D$ fragmentation functions?
- Light quark cloud from pp initial state contributes to formation of D meson with the open charm, may be interesting to see the dependence of D meson production in events with different multiplicities (?)
- Inconsistency in experimental measurement viz. previous slides (analysis of 1712.06834 is AFTER corrected data from LHCb rapidity efficiency problems in certain rapidity interval)
- For CEP of J/psi, use **NLO** matrix element + **NLO** GPD + **LO** NRQCD
 - LO NRQCD is OK as first relativistic correction (3g Fock state to maintain the gauge invariance) shown to be small
 - In any case, in hep-ph/9611207 the relativistic corrections are shown to change the normalisation only and not the energy dependence

Backups

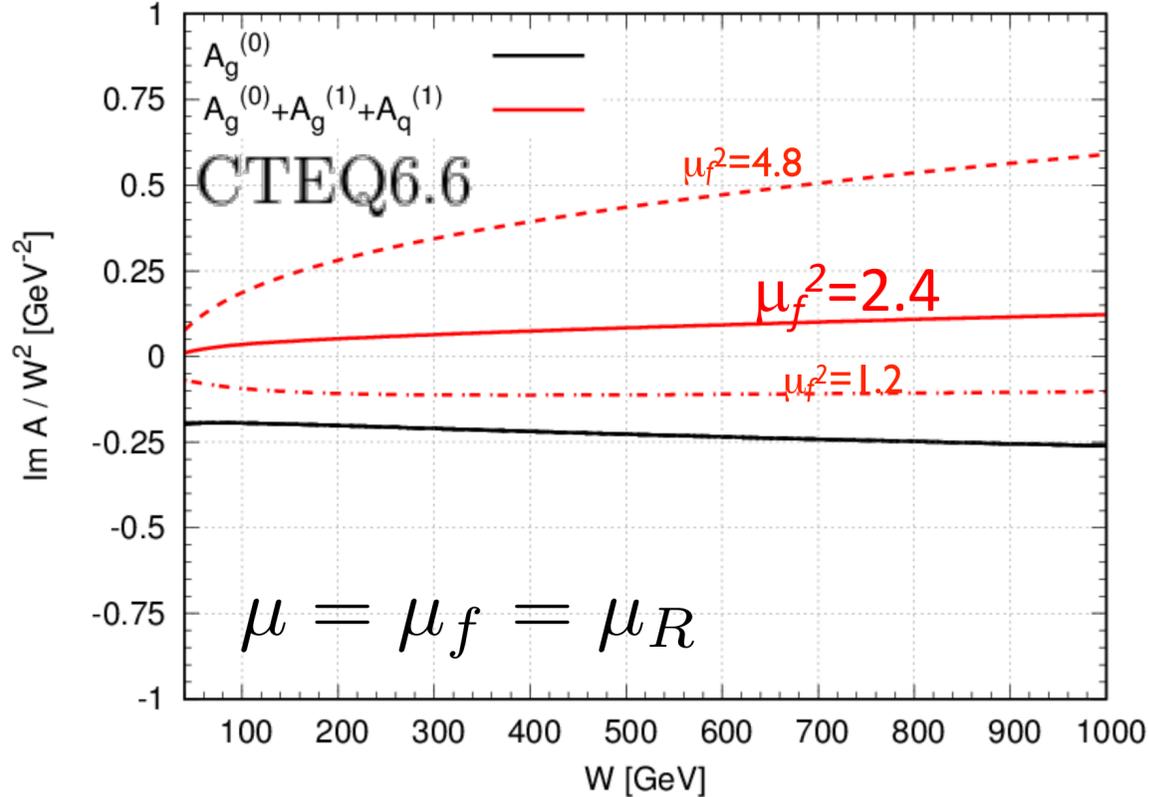
Exclusive J/psi photoproduction ($\gamma p \rightarrow J/\psi p$)

Conventional approach:



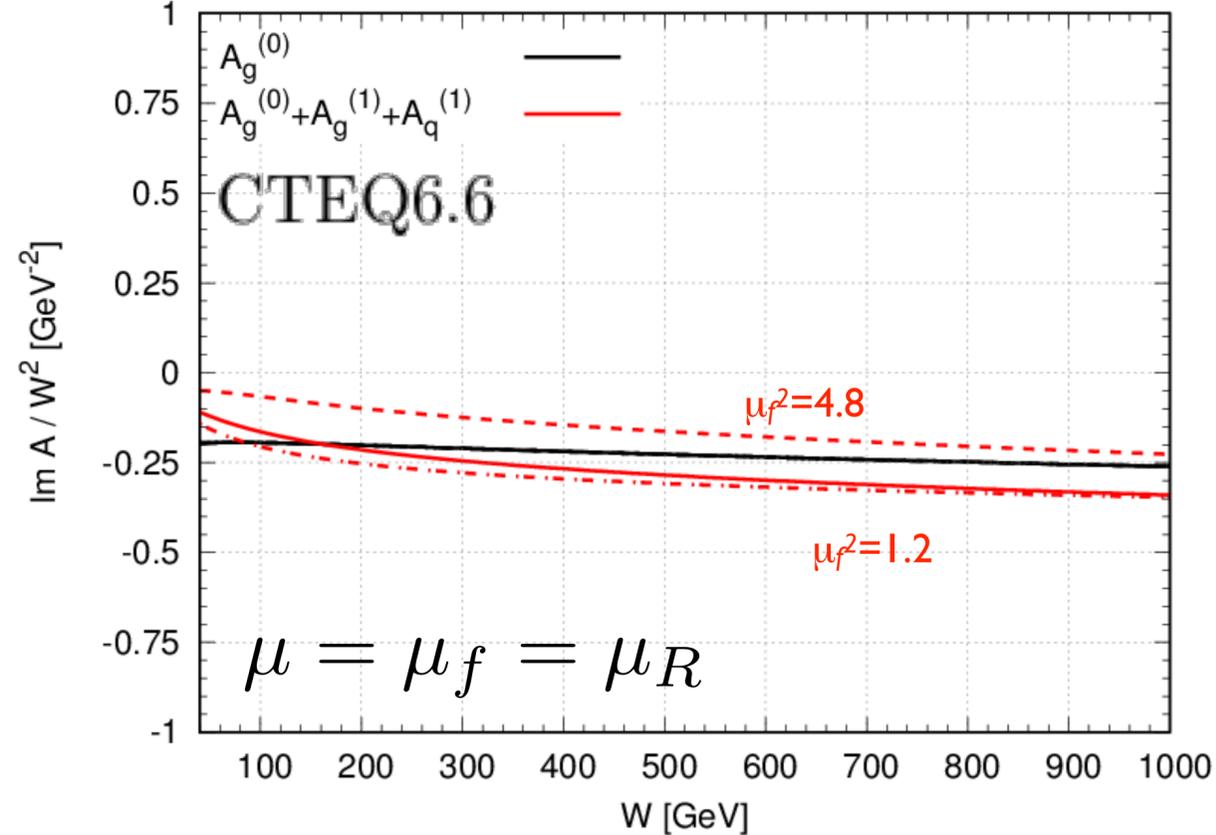
DL resummation (c.f. Maxim discussion on Monday):

Fix: $\mu_F^2 = 2.4 \text{ GeV}^2$



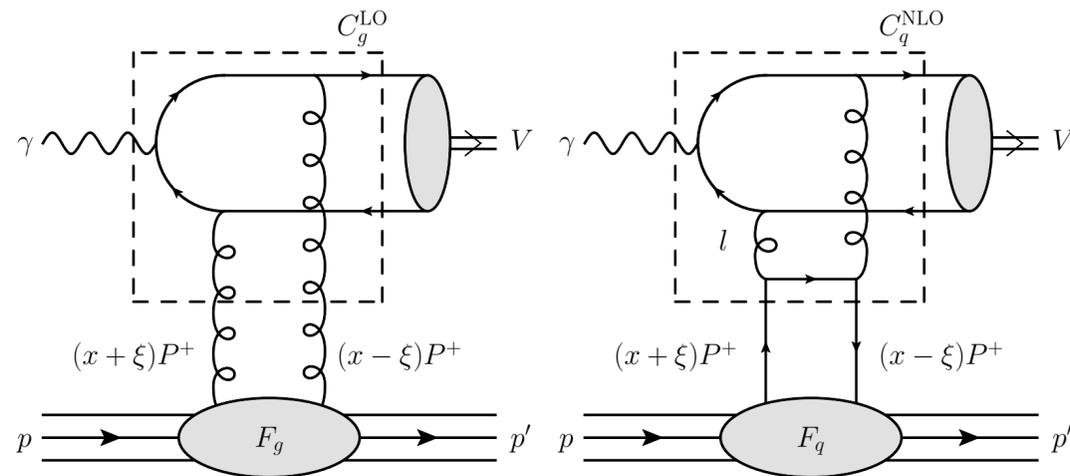
Low kt cut to avoid (crucial) double counting

Fix: $\mu_F^2 = 2.4 \text{ GeV}^2$



Stability of prediction III

'Q0' cut 1610.02272



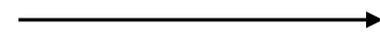
Subtract DGLAP contribution

NLO ($|\ell^2| < Q_0^2$)

from known NLO MSbar coefficient function
to avoid a double count with input GPD at
 Q_0 .

Typically power suppressed, but sizeable here

$$\mathcal{O}(Q_0^2/M_{J/\psi}^2)$$



Fix: $\mu_F^2 = 2.4 \text{ GeV}^2$

