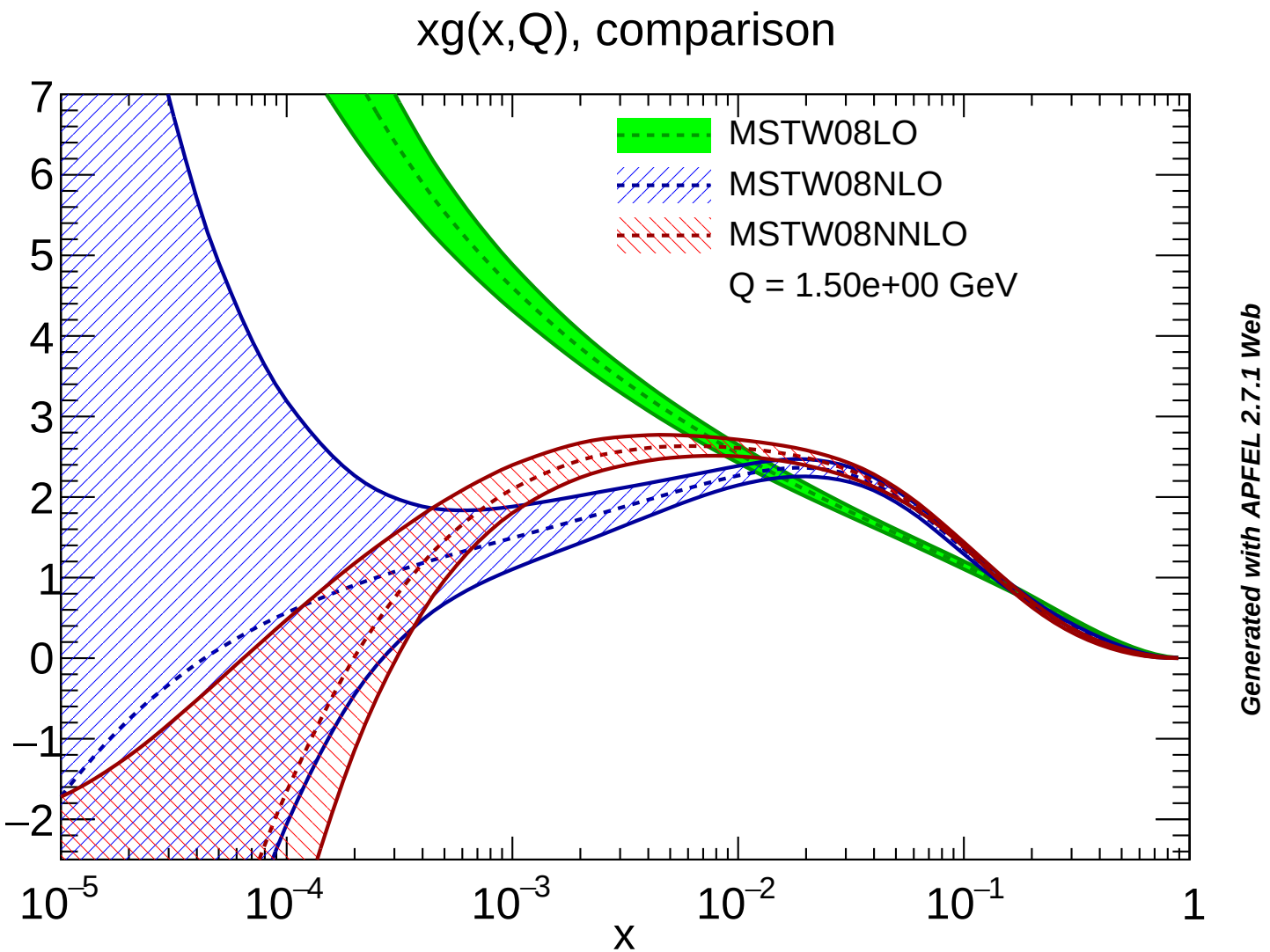
Round table discussion I: Fragmentation and non-universality. How to fit PDFs and FFs?

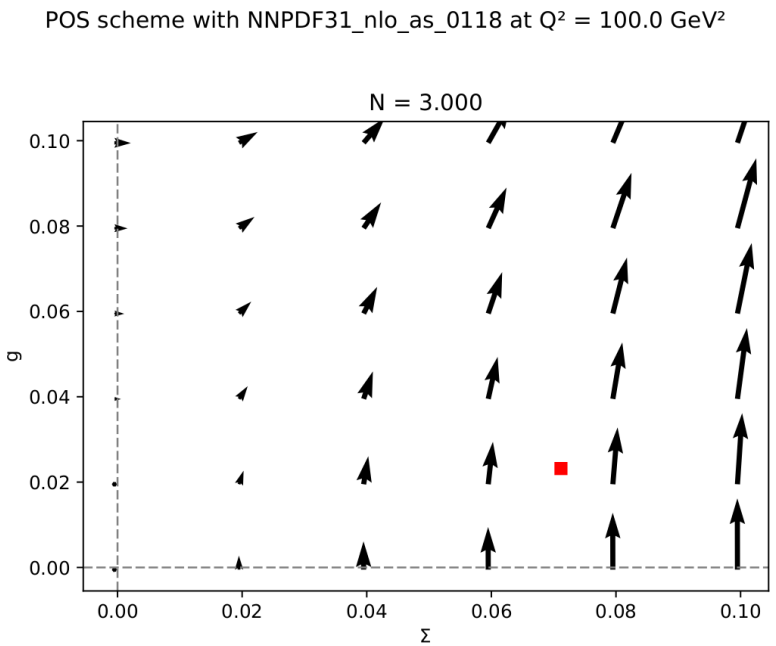
Quarkonia As Tools 2022

Aussois, 9-15 Jan 2022

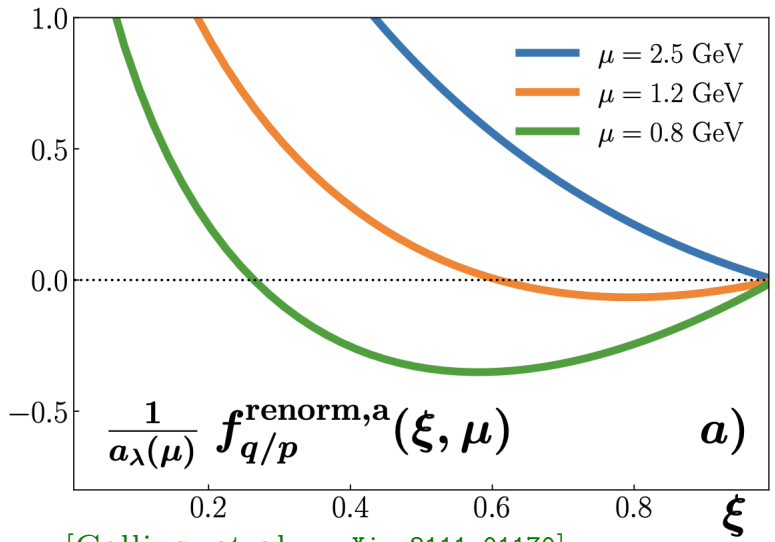
Positivity of PDFs



Positivity of PDFs

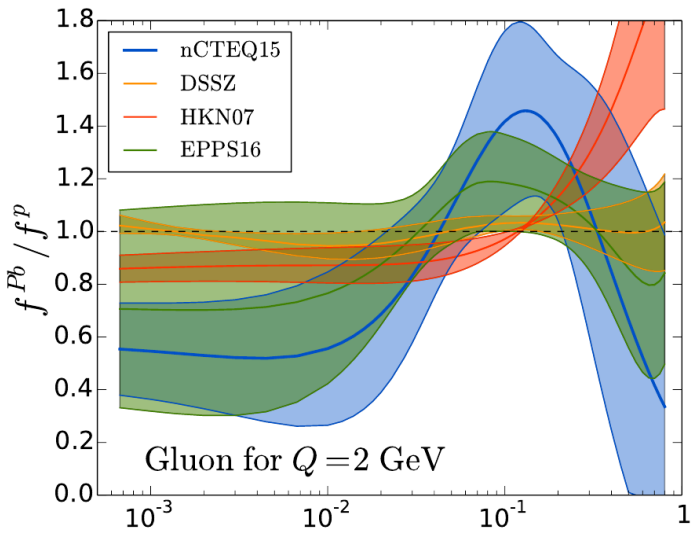


[JHEP 11 (2020) 129, arXiv:2006.073077]

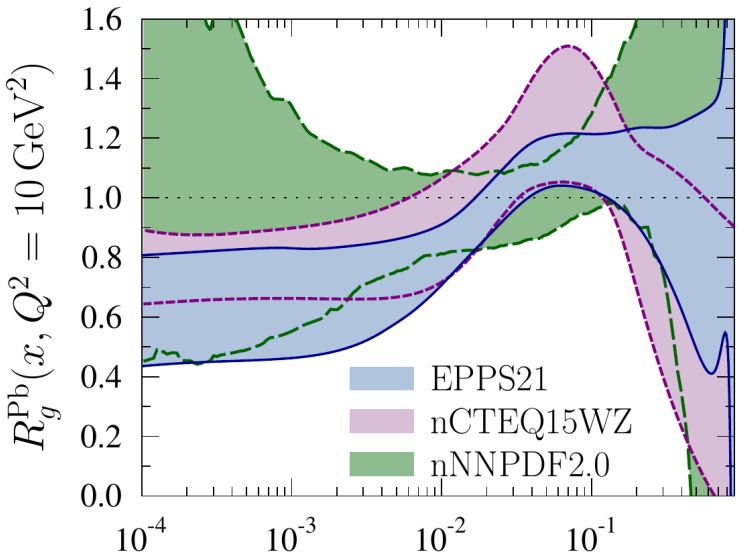


[Collins, et al., arXiv:2111.01170]

Constraints on nPDFs: nuclear gluon



[Phys.Rept. 911 (2021) 1, arXiv:1807.00603]

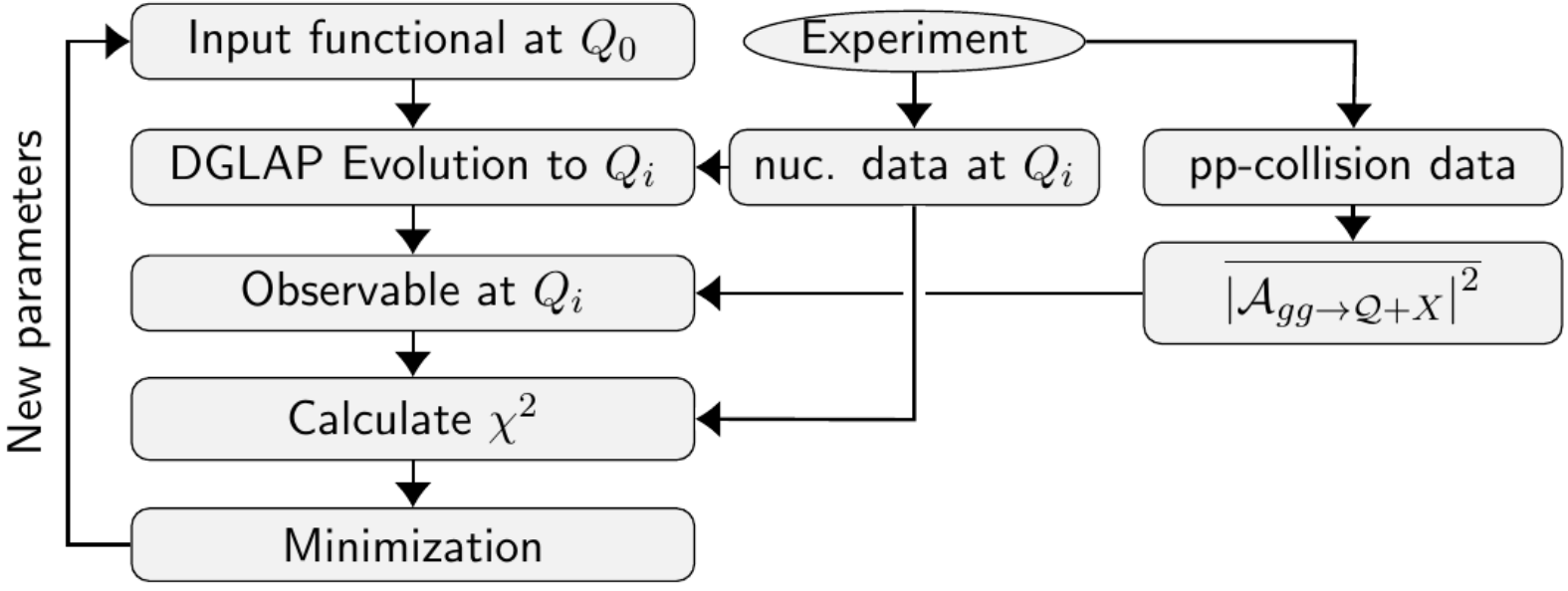


[Eskola, et al., arXiv:2112.12462]

Constraints on nPDFs: nuclear gluon

Data-driven Approach

$$\sigma(AB \to \mathcal{Q} + X) = \int \mathrm{d}x_1 \, \mathrm{d}x_2 f_{1,g}(x_1) \, f_{2,g}(x_2) \, \frac{1}{2\hat{s}} \overline{|\mathcal{A}_{gg\to Q} + X|^2} \mathrm{dLIPS}$$

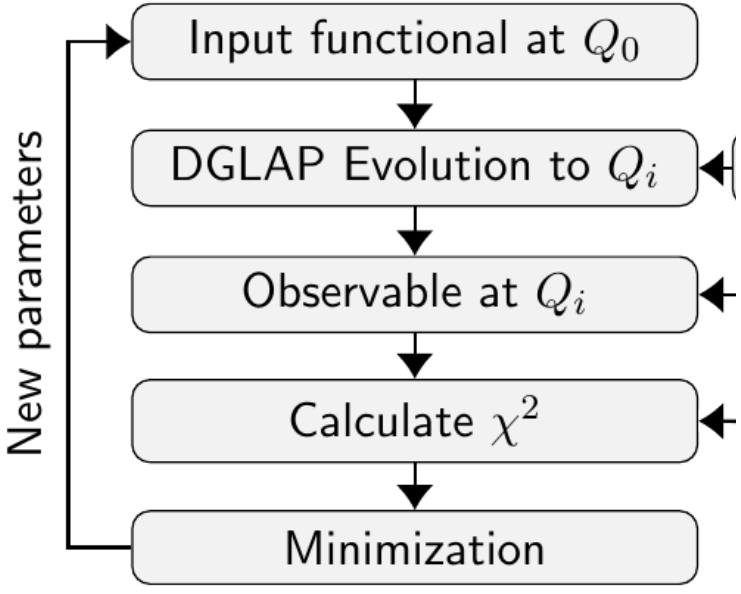


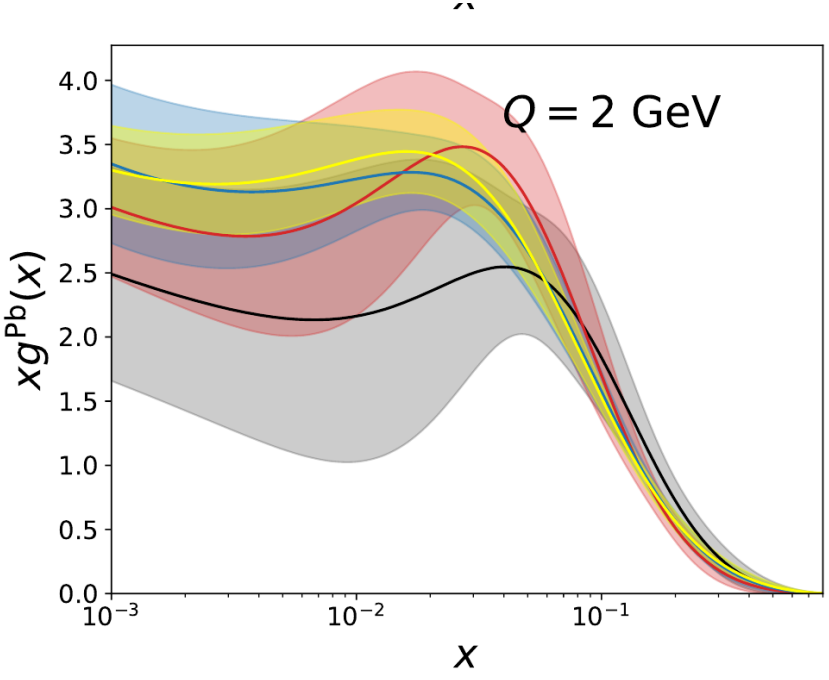
$$\overline{|\mathcal{A}_{gg\to Q+X}|^2} = \begin{cases} \frac{\lambda^2 \kappa \hat{s}}{M_{\mathcal{Q}}^2} \exp\left(-\kappa \frac{p_T^2}{M_Q^2}\right) & \text{if } p_T \leq \langle p_T \rangle \\ \frac{\lambda^2 \kappa \hat{s}}{M_{\mathcal{Q}}^2} \exp\left(-\kappa \frac{\langle p_T \rangle^2}{M_Q^2}\right) \left(1 + \frac{\kappa}{n} \frac{p_T^2 - \langle p_T \rangle^2}{M_Q^2}\right)^{-n} & \text{if } p_T > \langle p_T \rangle \end{cases}$$

Constraints on nPDFs: nuclear gluon

Data-driven Approach

$$\sigma(AB \to \mathcal{Q} + X) = \int \mathrm{d}x_1 \, \mathrm{d}x_2 f_{1,g}(x_1) \, f_{2,g}(x_2) \, \frac{1}{2\hat{s}} \overline{|\mathcal{A}_{gg\to Q} + X|^2} \mathrm{dLIPS}$$





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Exclusive production what about photon flux (WW) vs. photon PDFs like LUX?

$$xf_{\gamma/p}(x,\mu^2) = \frac{1}{2\pi\alpha(\mu^2)}\int_x^1 \frac{dz}{z}\left\{\int_{\frac{x^2m_p^2}{1-z}}^{\frac{\mu^2}{1-z}} \frac{dQ^2}{Q^2}\alpha^2(Q^2)\right.$$
$$\left[\left(zp_{\gamma q}(z) + \frac{2x^2m_p^2}{Q^2}\right)F_2(x/z,Q^2) - z^2F_L\left(\frac{x}{z},Q^2\right)\right]$$
$$\left. - \alpha^2(\mu^2)z^2F_2\left(\frac{x}{z},\mu^2\right)\right\}, \quad (6)$$

[PRL 117 (2016) 24, 242002, arXiv:1607.04266]

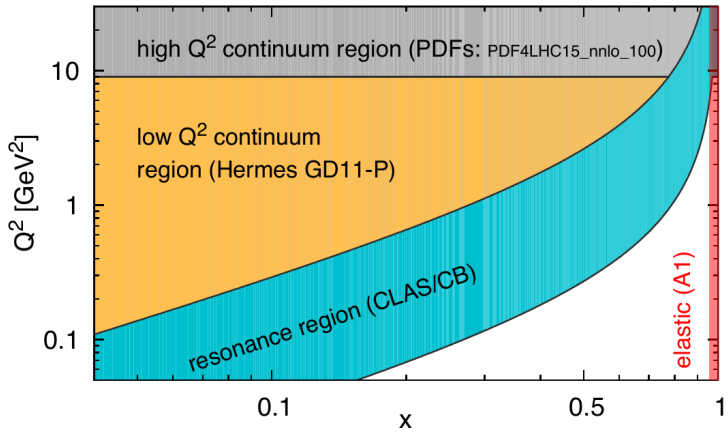


FIG. 1. Our breakup of the (x, Q^2) plane and the data for $F_2(x, Q^2)$ and $F_L(x, Q^2)$ we use in each region. The white region is inaccessible at leading order in QED.

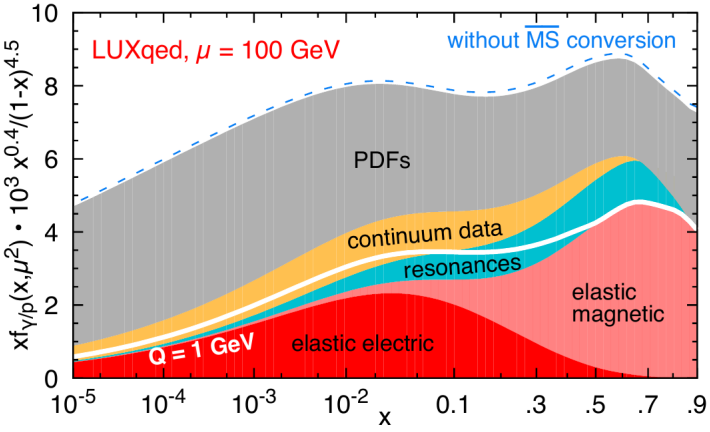
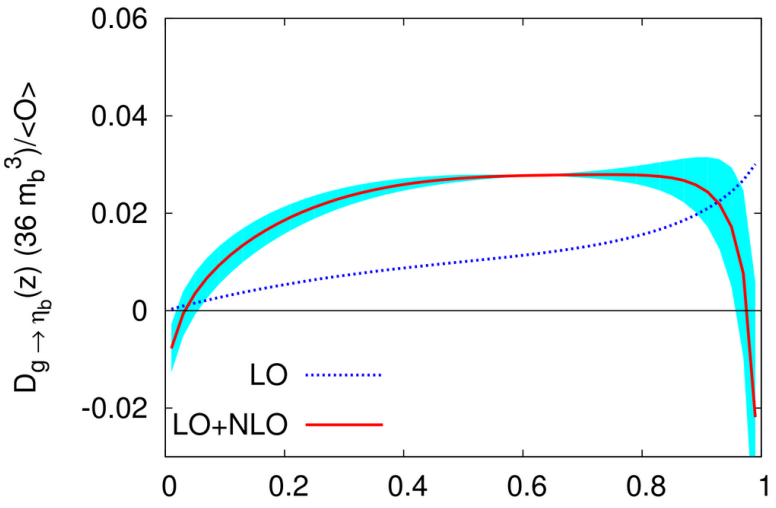
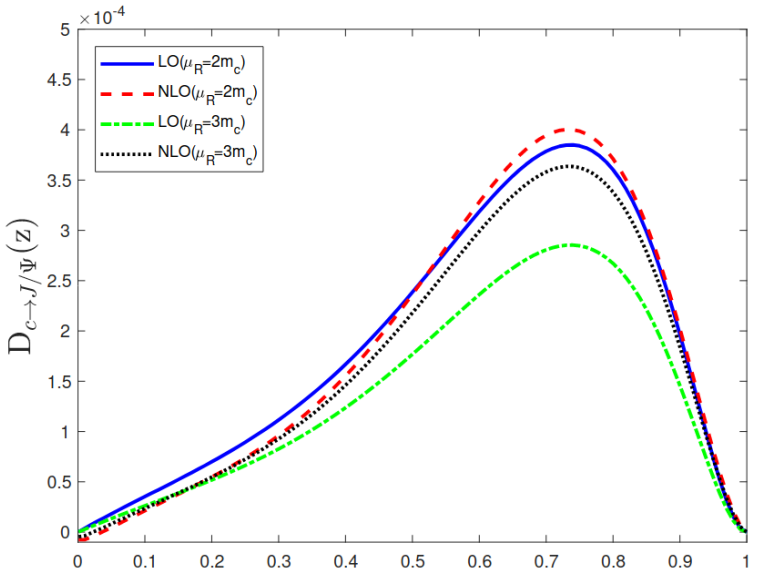


FIG. 2. Contributions to the photon PDF at $\mu = 100$ GeV, multiplied by $10^3 x^{0.4}/(1-x)^{4.5}$, from the various components discussed in the text. The white line is the sum of the inelastic contribution from $Q^2 < 1\,(\text{GeV})^2$ in Eq. (6) and the full elastic

Quarkonia FFs computations

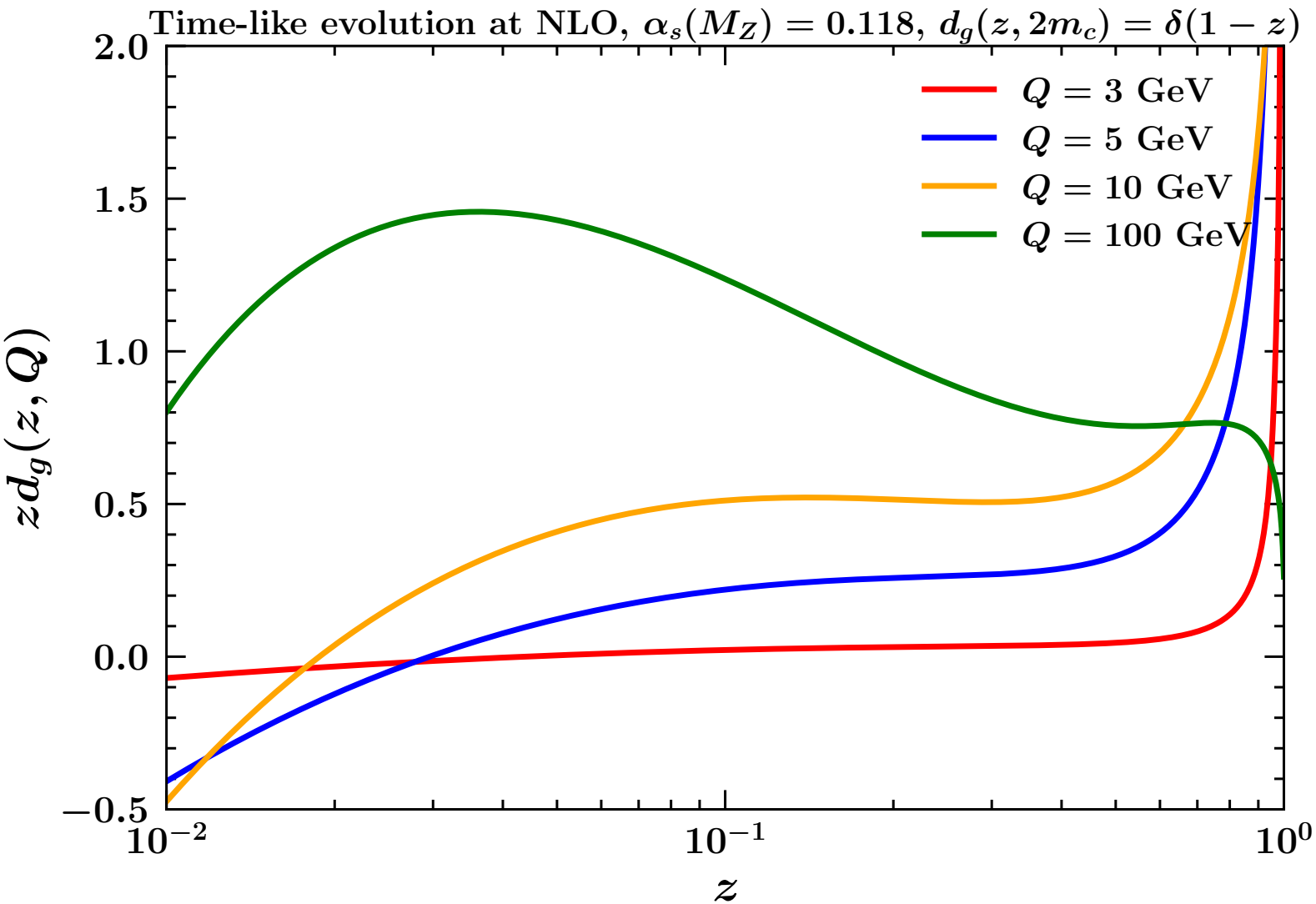


[JHEP 04 (2015) 121, arXiv:1412.3834]



[PRD 103, 074004 (2021), arXiv:2101.01527]

Evolution of FFs from delta function



FFs for hadrons [PRD 104 (2021) 9, 094005, arXiv:2105.09873]