

Early Science Report  
Feedback by referees  
on Inclusive measurements

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**ePIC and EIC Physics Readiness Workshop**

UniCal – March, 17 2026

# Introduction

- A few slides to convey our impressions on the ESR (Inclusive measurements part).
- A detailed written report with our main comments and suggestions is almost ready and will be sent to PC (and will be attached to the agenda)
- A huge thank to the Editing Team and all the ESR's contributors for their efforts to provide a good starting draft.

# Structure Functions vs Reduced Cross Sections

- Structure Functions ( $F_2$ ,  $F_L$ ) appear prominently in the present draft
- Whether you present your results in terms of SFs or reduced cross sections is, in part, a matter of taste:

$$\sigma_{r,\text{NC}}^- = \frac{d^2\sigma_{\text{NC}}^{e^-p}}{dx dQ^2} \cdot \frac{Q^4 x}{2\pi\alpha^2 Y_+} = F_2 - \frac{y^2}{Y_+} F_L$$

- In the ESR the message should be clear however that the reduced cross sections are the observables we (experimentalists) measure and care about.

# Structure Function $F_3$

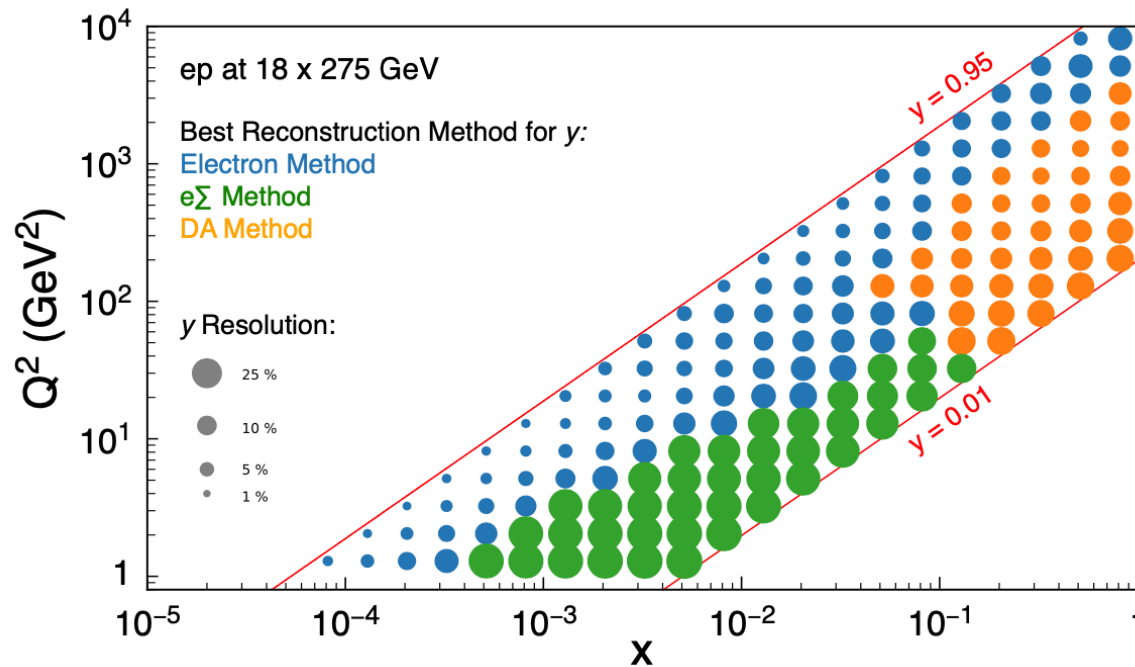
- $F_3$  is conspicuously mentioned in the intro paragraph from L143, but is then not discussed again, beyond appearing in the reduced cross section formula in the appendix. Best not to mention it at all, or to explicitly note in that intro paragraph that the early-science focus is on  $F_2$  and  $F_L$ .

$$\sigma_{r,\text{NC}}^{\pm} = \frac{d^2\sigma_{\text{NC}}^{e^{\pm}p}}{dx dQ^2} \cdot \frac{Q^4 x}{2\pi\alpha^2 Y_+} = F_2 \mp \frac{Y_-}{Y_+} x F_3 - \frac{y^2}{Y_+} F_L$$

$$\text{with } Y_{\pm} = 1 \pm (1 - y)^2$$

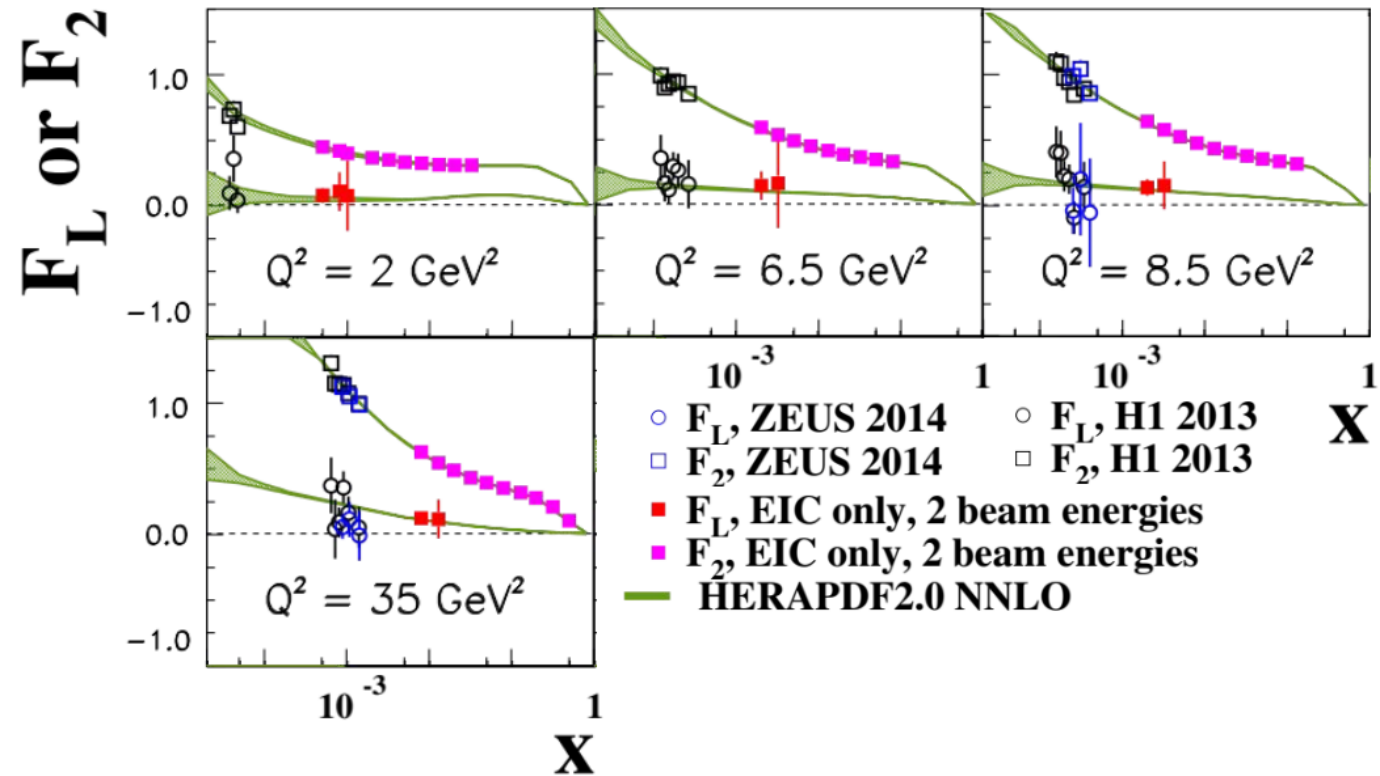
# $x, Q^2, y$ Reconstruction Methods

In Section A.2 (at L.478-507) the different reconstruction methods are described in detail. It would help to include a figure giving a graphical overview of the different resolutions in the  $x$ - $Q^2$  plane.



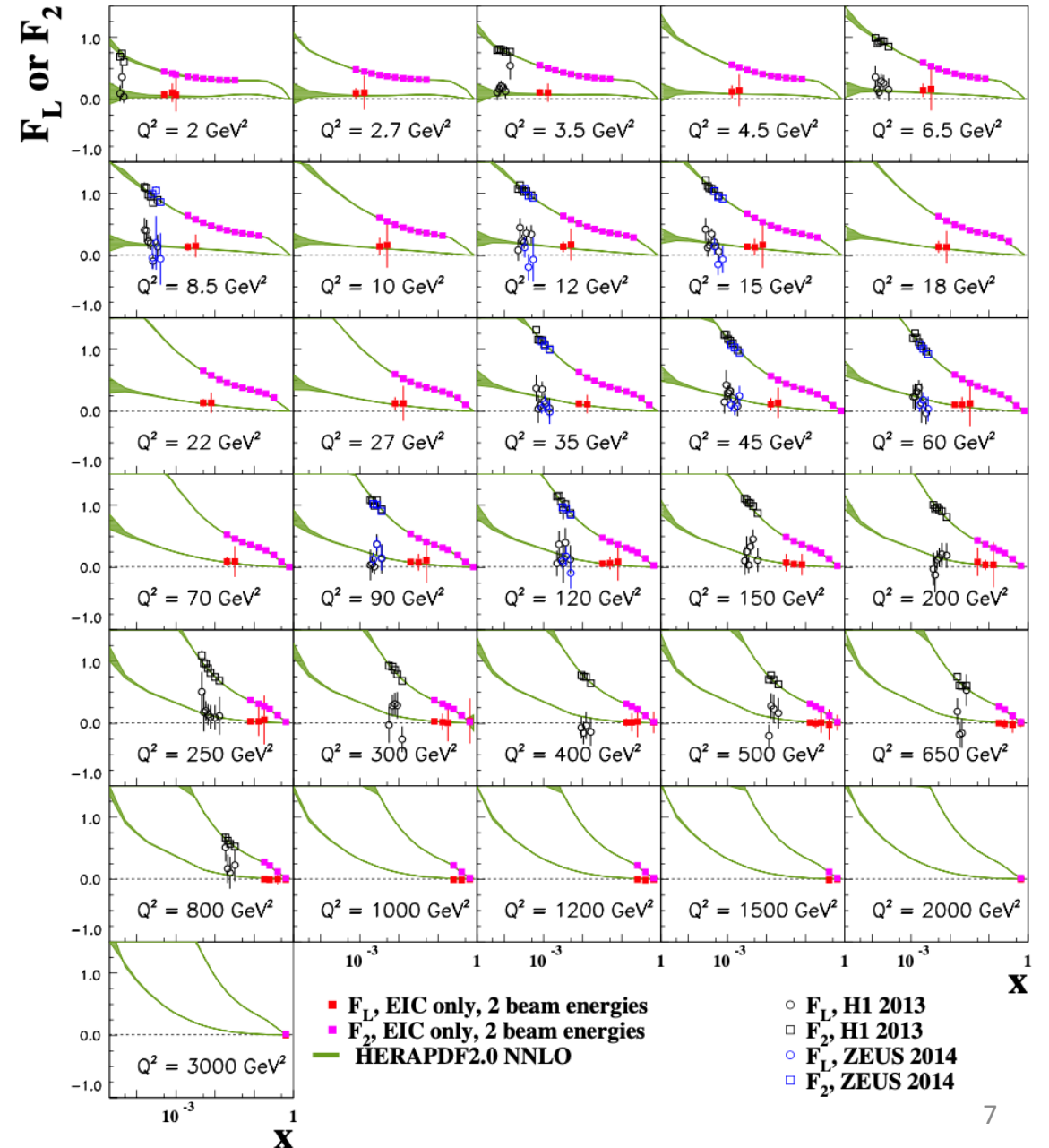
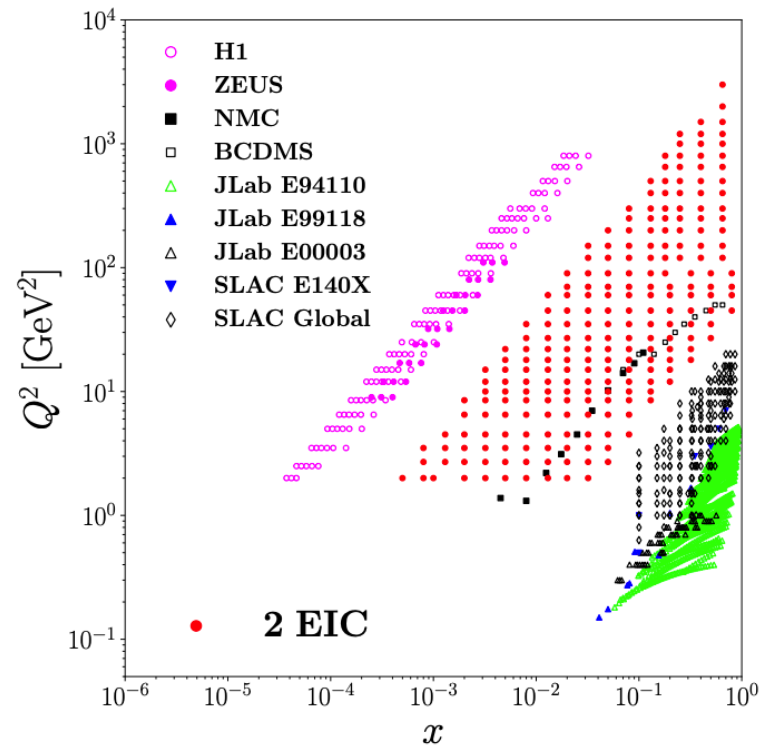
# Structure Functions $F_2$ and $F_L$

- Section 2
- Only four  $Q^2$  bins are shown
- Improve readability but gives a rather incomplete picture

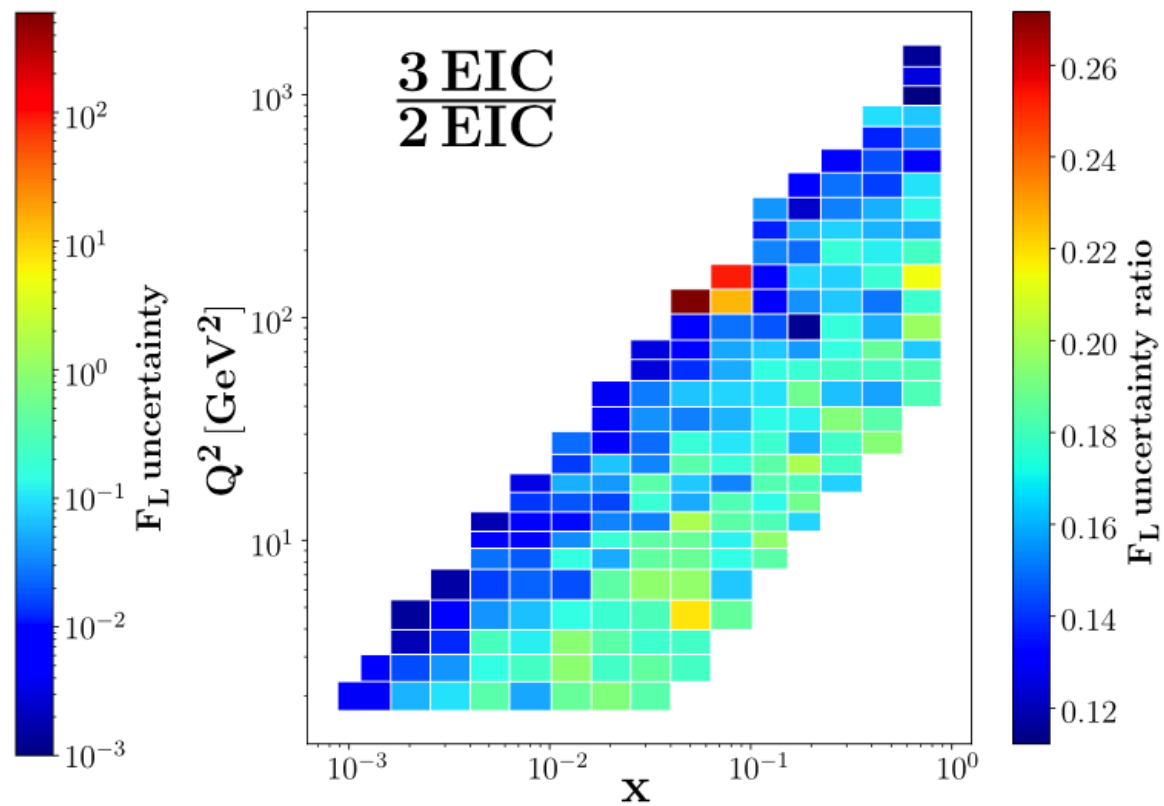
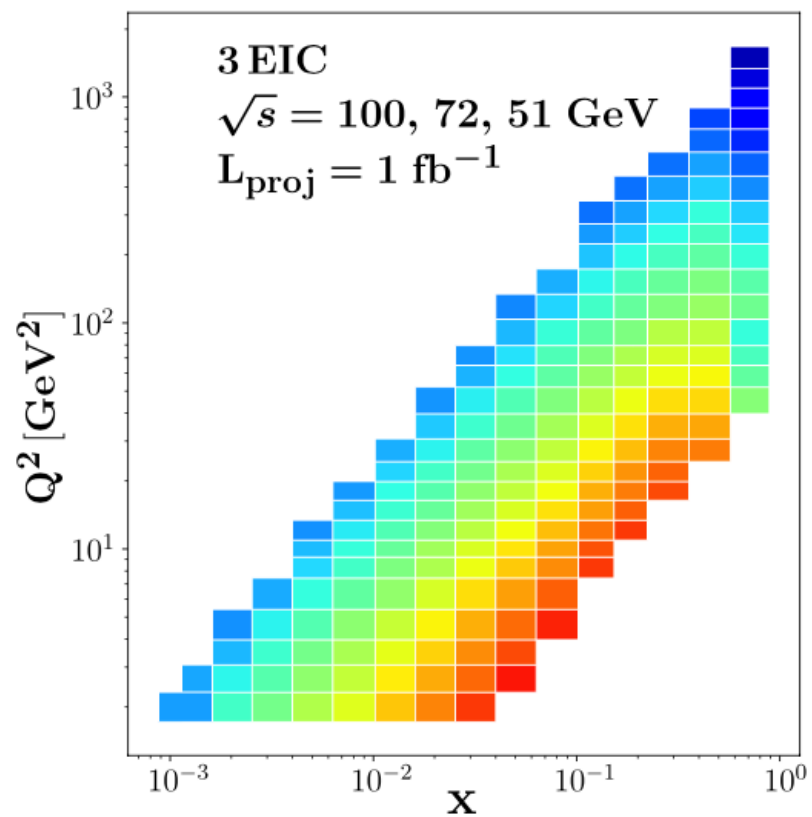


# Structure Functions $F_2$ and $F_L$

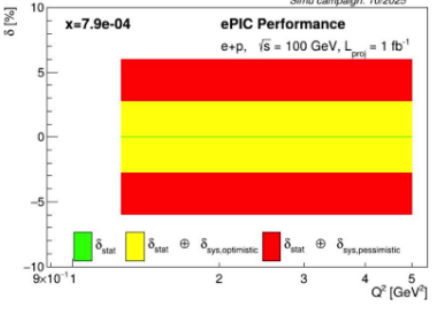
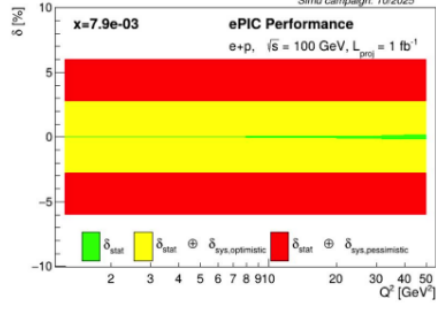
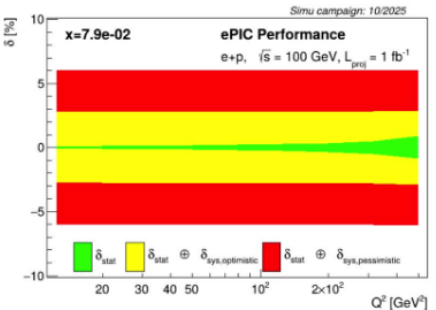
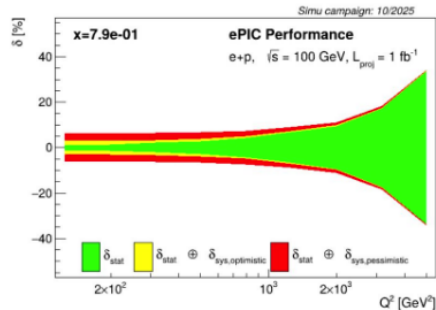
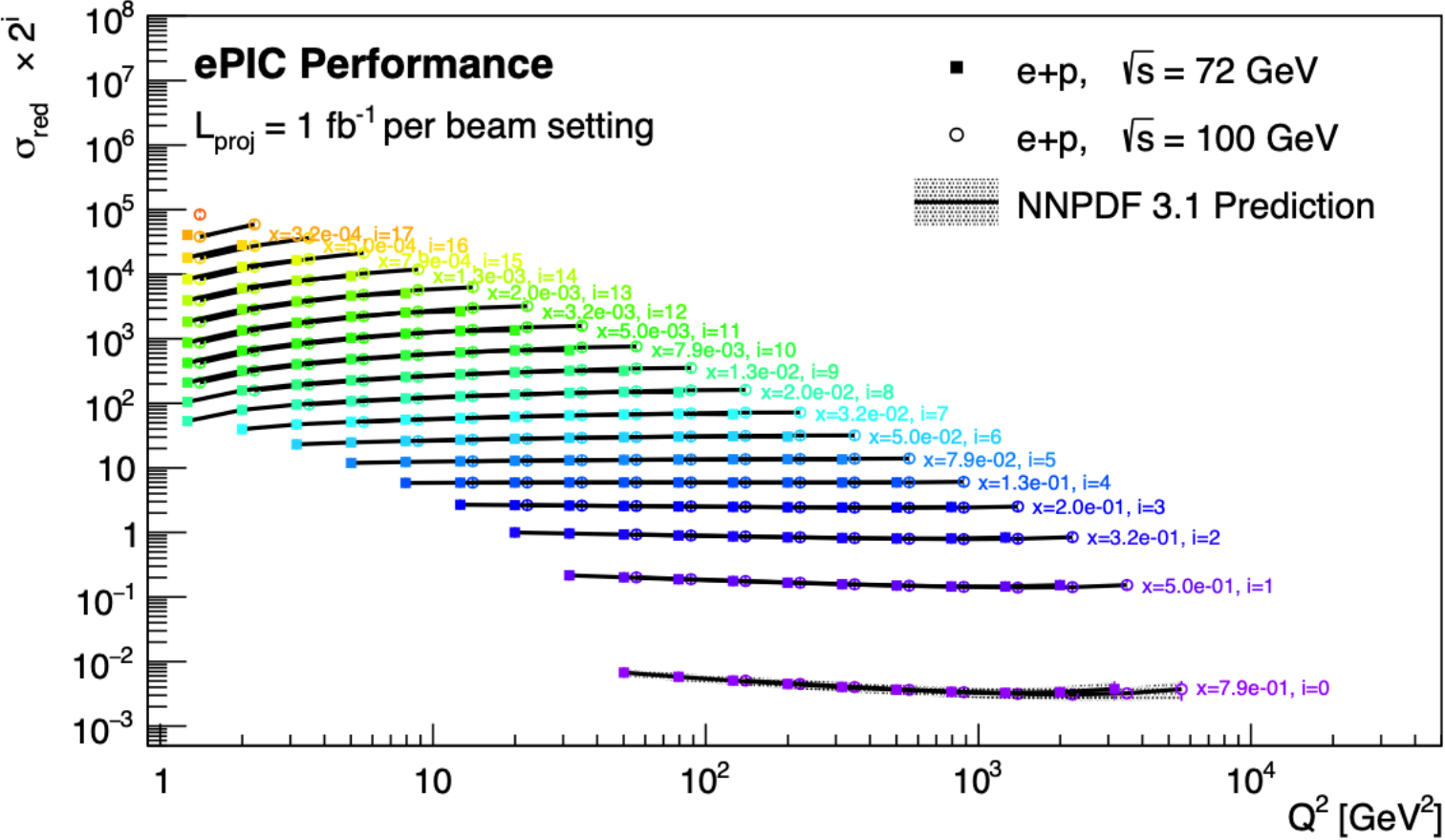
- Better if jointly presented with a phase-space plot showing complementarity with HERA and Fixed-target  $F_L$  measurements.



# Uncertainty on $F_L$

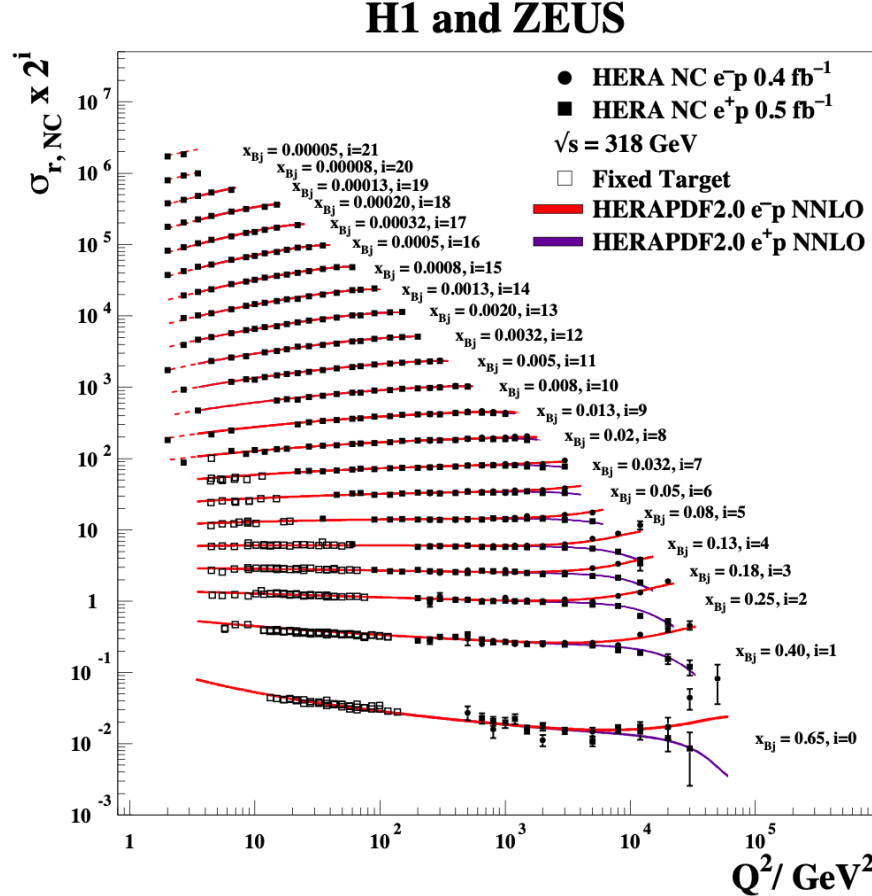
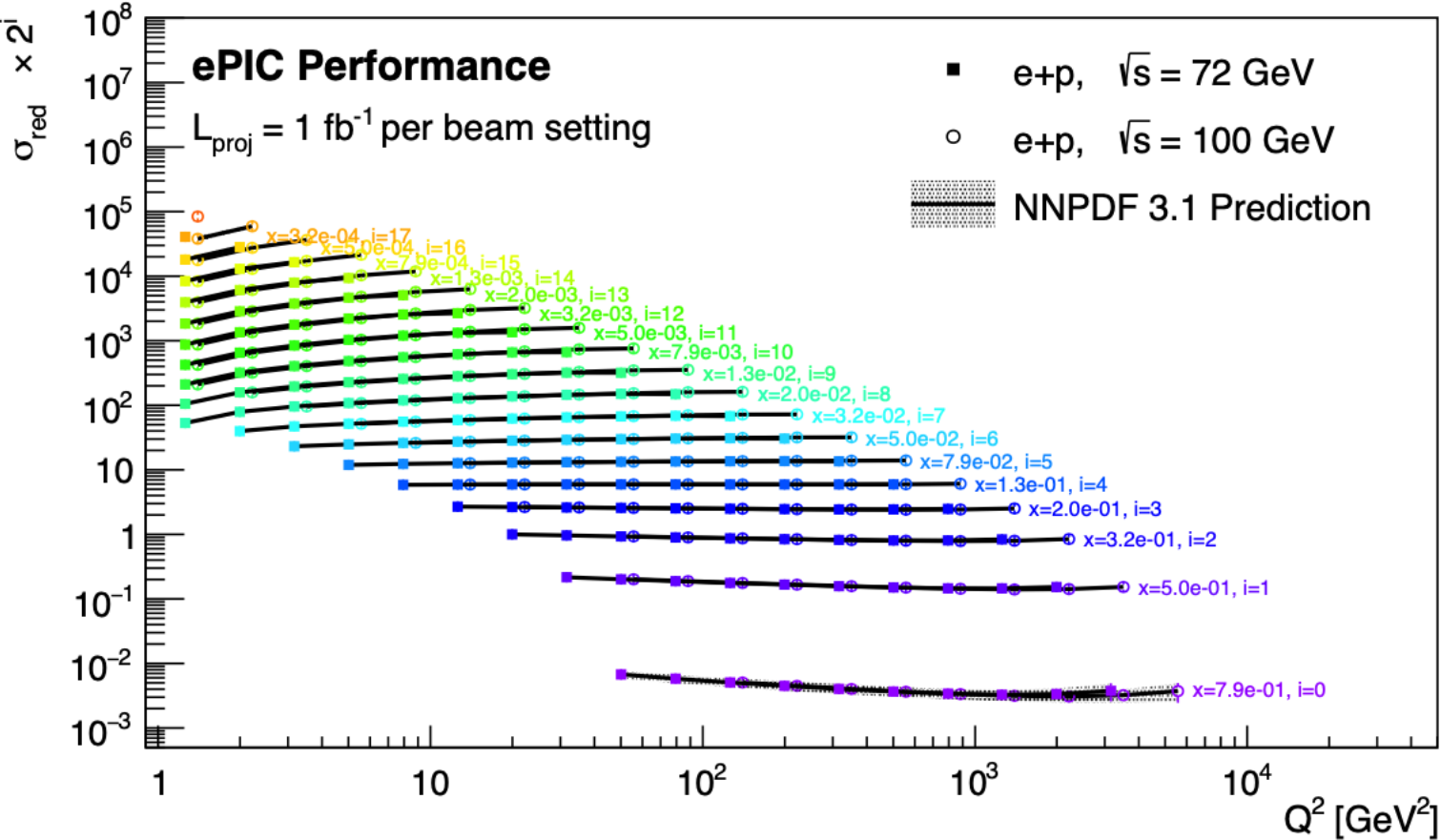


# Reduced Cross Sections



- In appendix A. Consider the possibility to use it in the main body of the document?
- Need to improve readability.

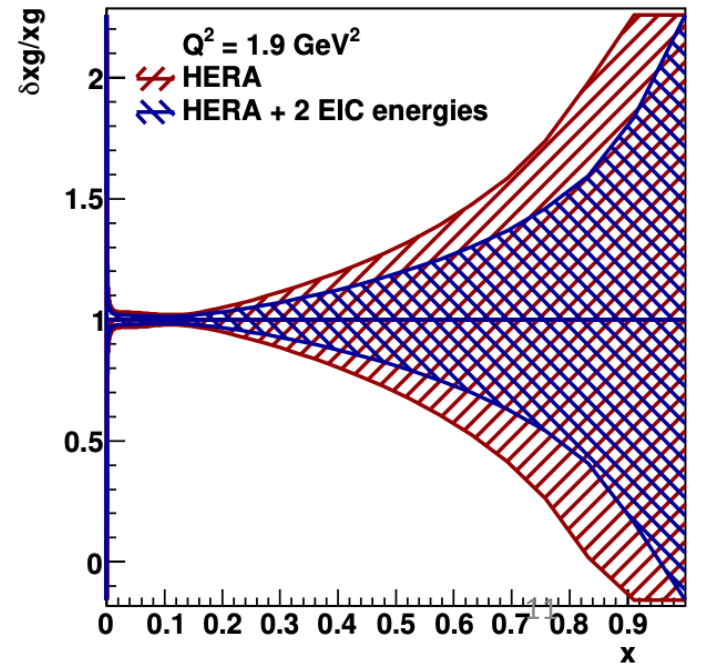
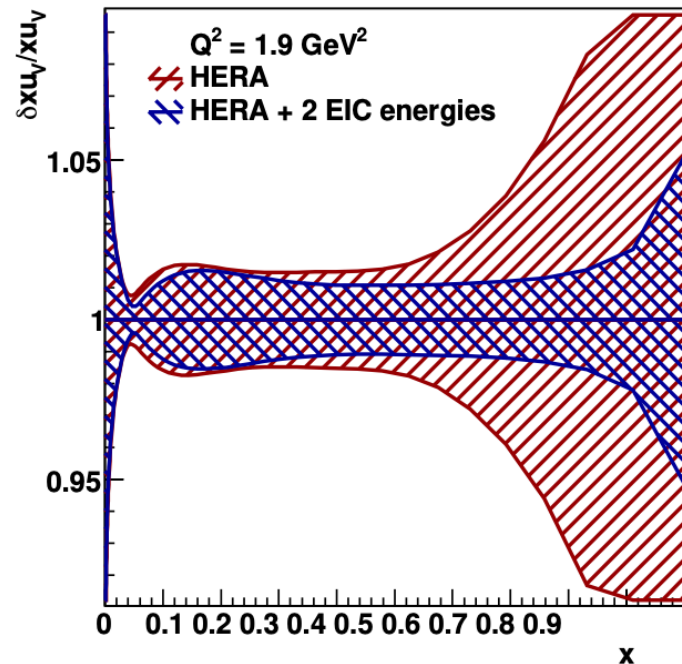
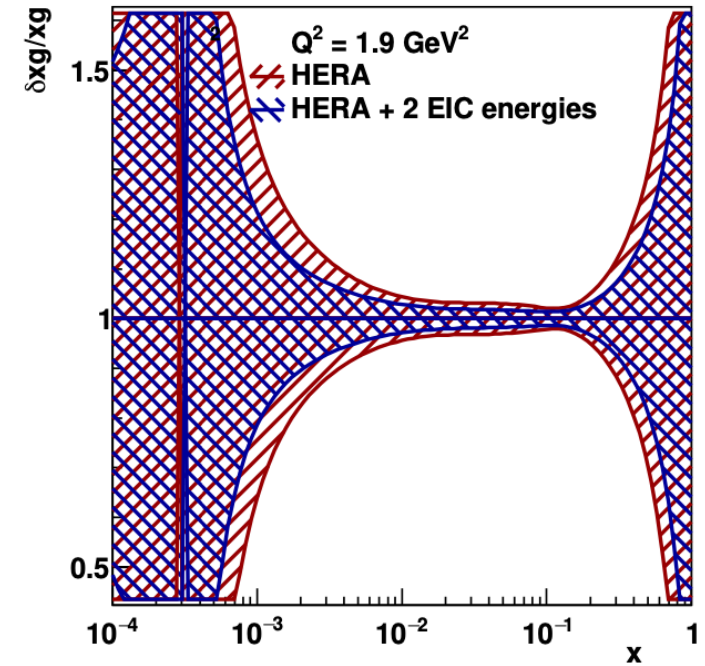
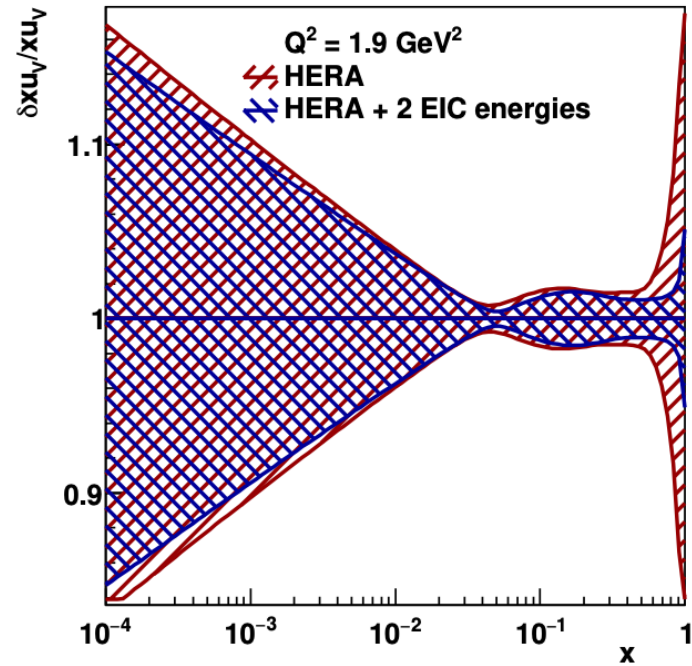
# Reduced Cross Sections



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- Need to improve readability.

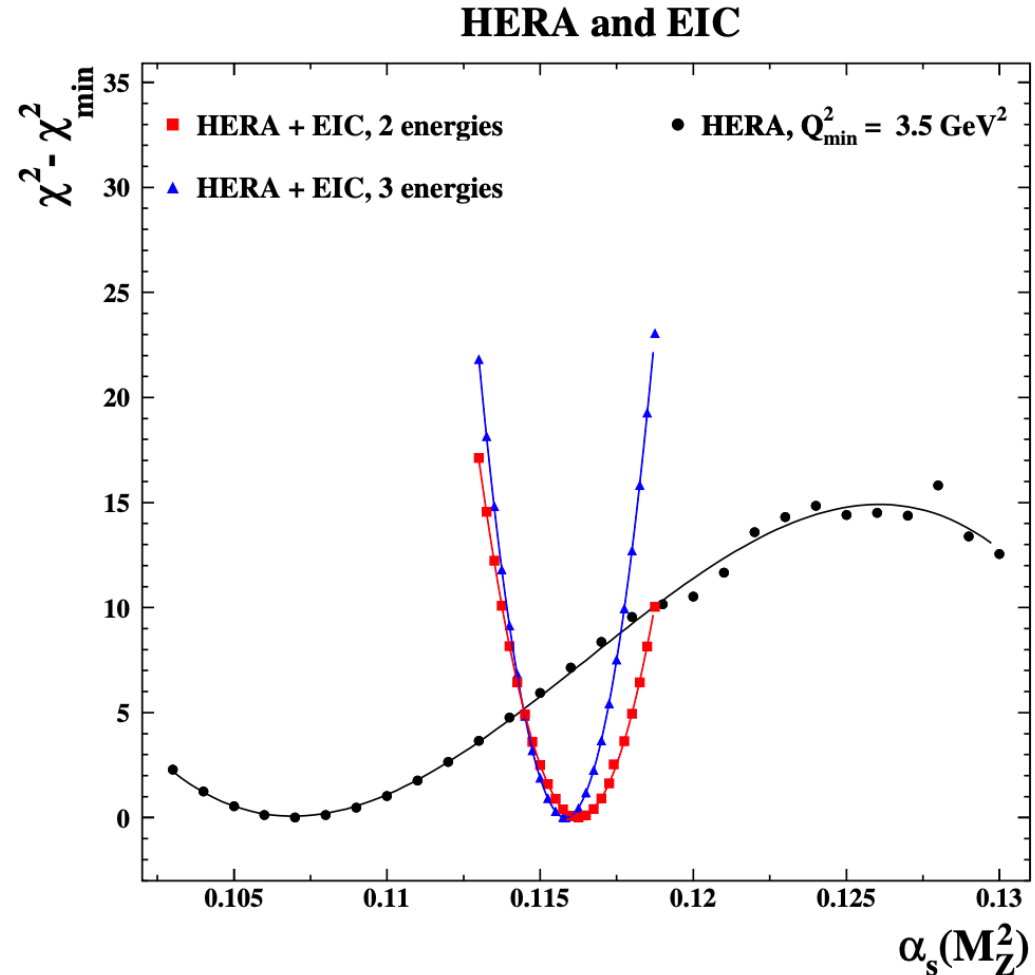
# ePIC PDFs

- Present discussion of PDFs very brief and generic
- Comparison to HERA only PDFs
- Comparison to global PDFs sets (NNPDF4.0, MSHT20, CT25)?
- What about aN<sup>3</sup>LO fits?



# ePIC PDFs

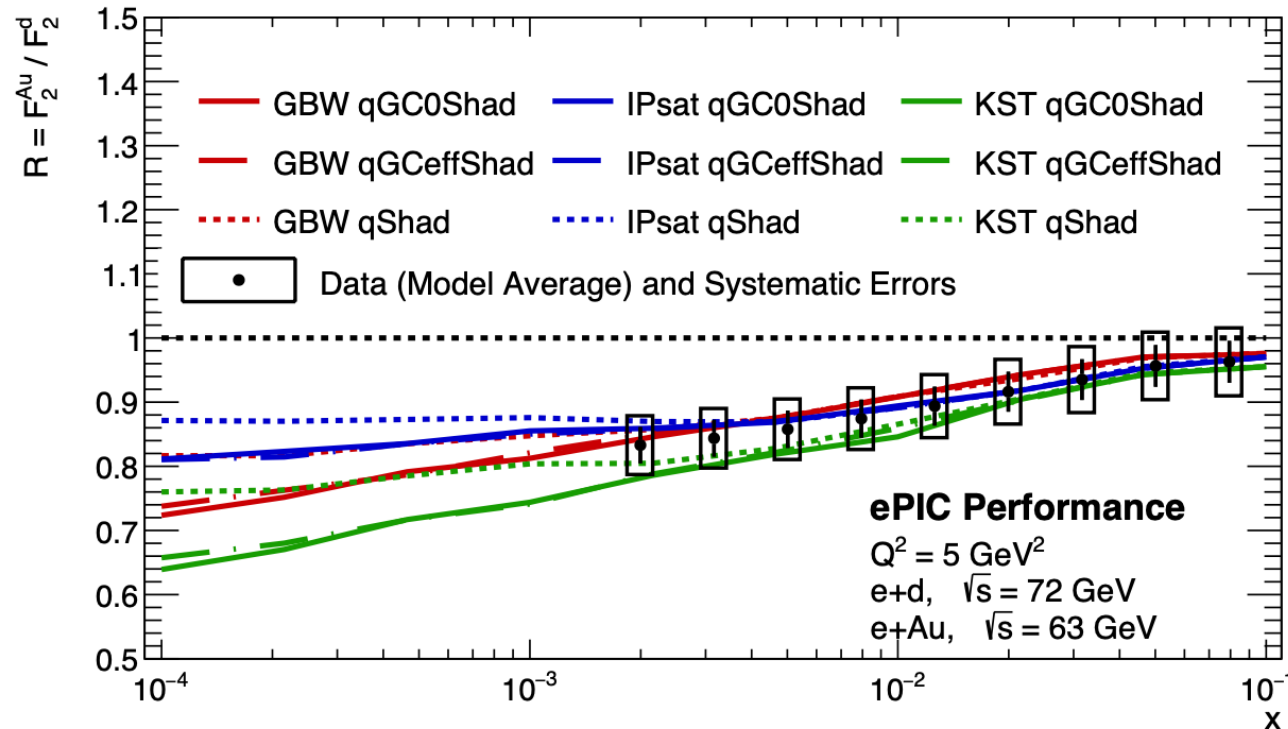
- Present discussion of PDFs very brief and generic
- Comparison to HERA only PDFs
- Comparison to global PDFs sets (NNPDF4.0, MSHT20, CT25)?
- What about aN<sup>3</sup>LO fits?
- ...and simultaneous determination of  $\alpha_s(M_Z)$ ?



$$\alpha_s(M_Z^2) = 0.1162 \pm 0.0008 \text{ (exp)}$$

# F<sub>2</sub> Ratios in e + Au collisions and nPDFs

Nuclear effects on structure functions quantified using ratios:



$$R(x, Q^2) \equiv \frac{F_2^A(x, Q^2)}{A F_2^n(x, Q^2)}$$

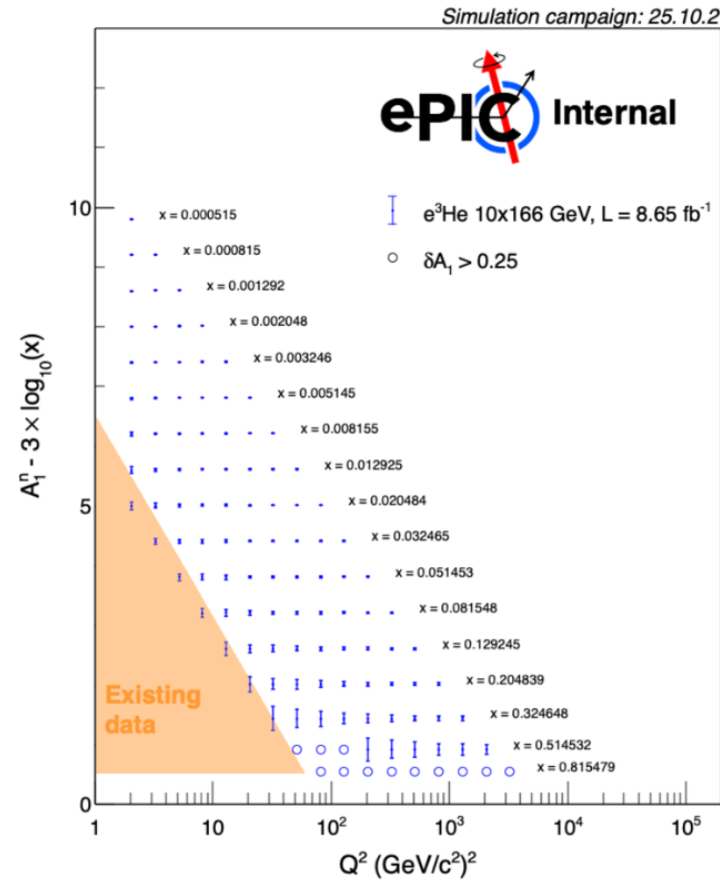
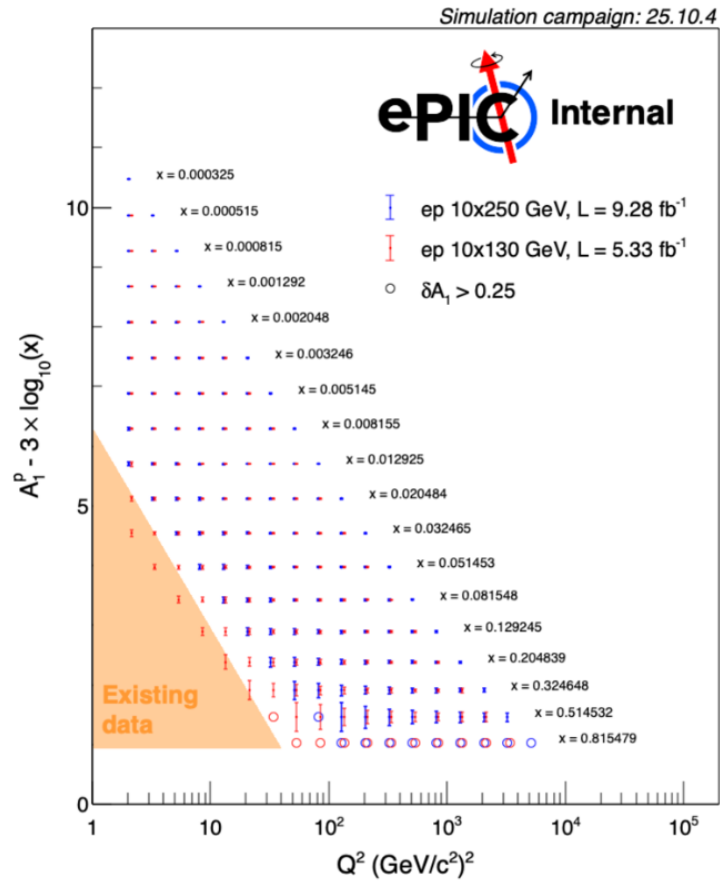
$$R_L(x, Q^2) = \frac{F_L^A(x, Q^2)}{A F_L^n(x, Q^2)}$$

Do not like those ratios... ;)

We would very much prefer reduced cross-sections and nPDF extracted from DGLAP fits.

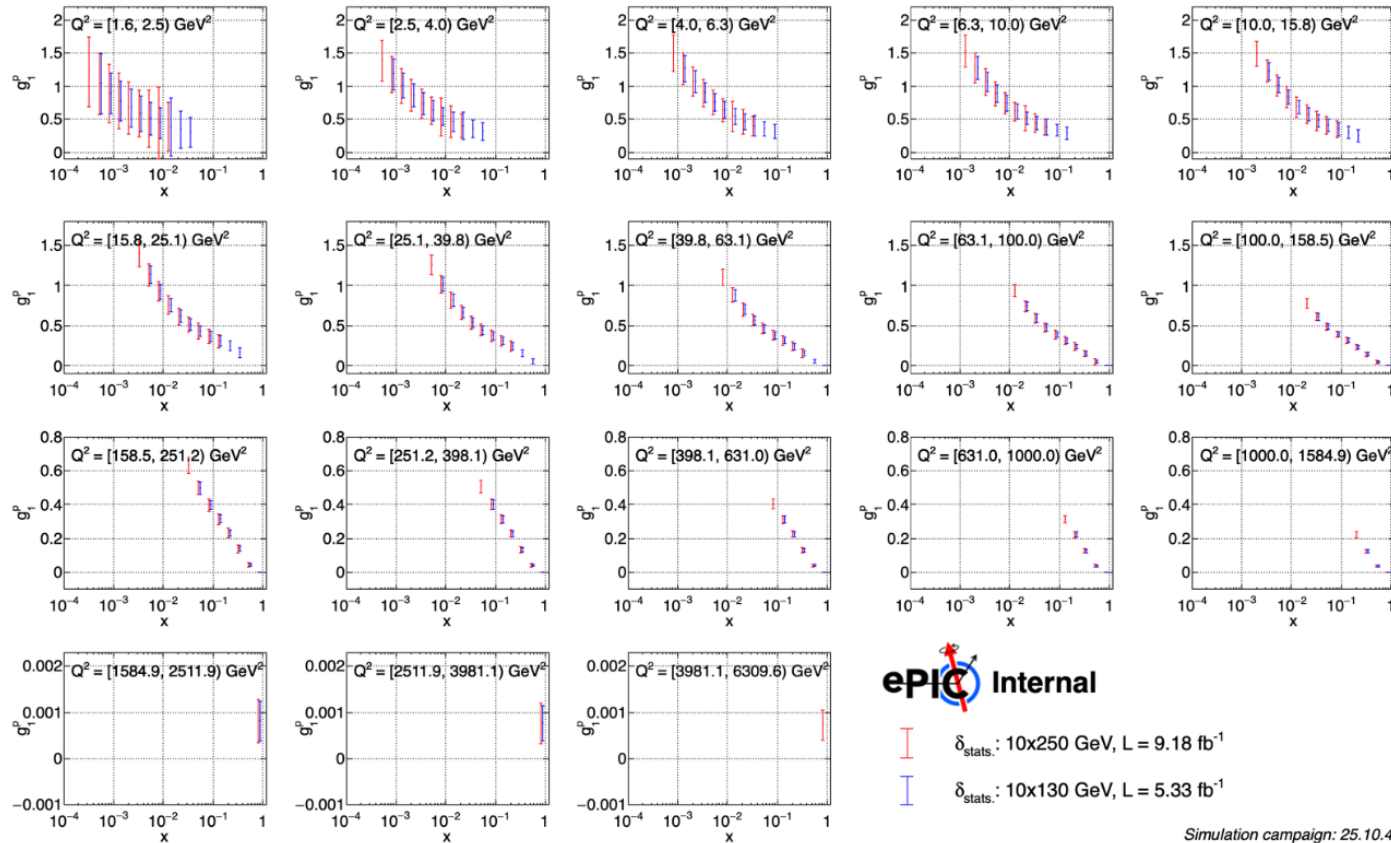
Should nPDFs be moved from the semi-inclusive to the inclusive part?

# Double spin asymmetries: $A_1^{(n,p)}$



Nicely show the ePIC potential; give more detail w.r.t. existing data?

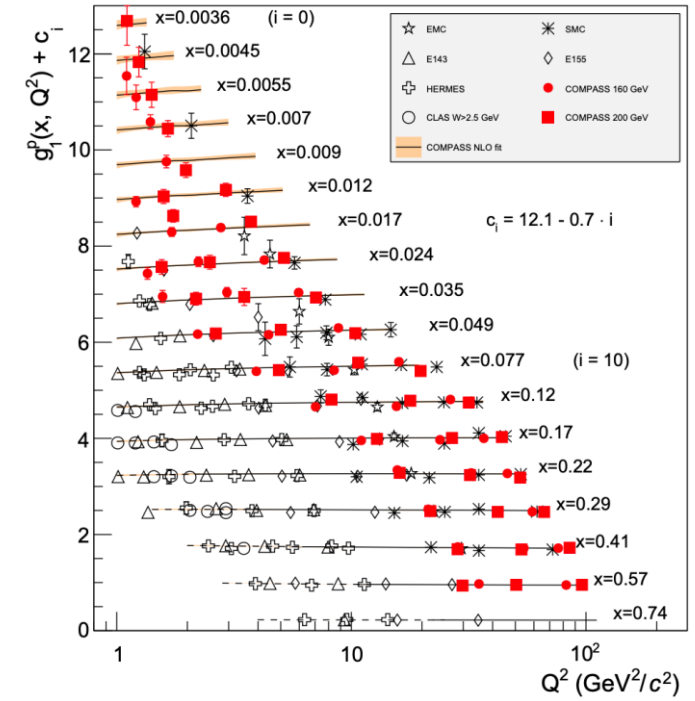
# Structure function $g_1^p$



**ePIC Internal**

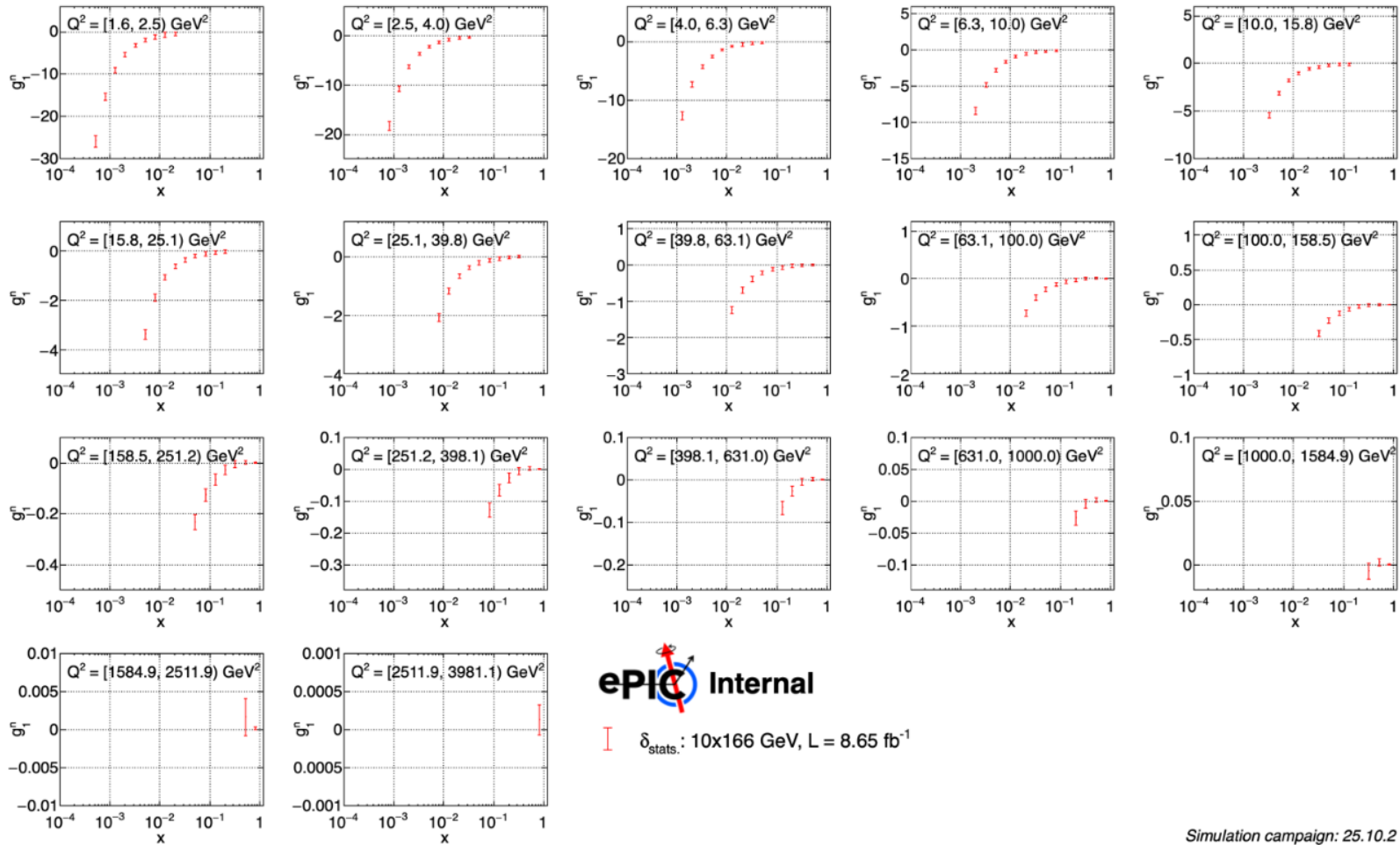
|  $\delta_{\text{stats.}} : 10 \times 250 \text{ GeV}, L = 9.18 \text{ fb}^{-1}$   
|  $\delta_{\text{stats.}} : 10 \times 130 \text{ GeV}, L = 5.33 \text{ fb}^{-1}$

Simulation campaign: 25.10.4



Consider a possible layout?

# Structure functions $g_1^n$



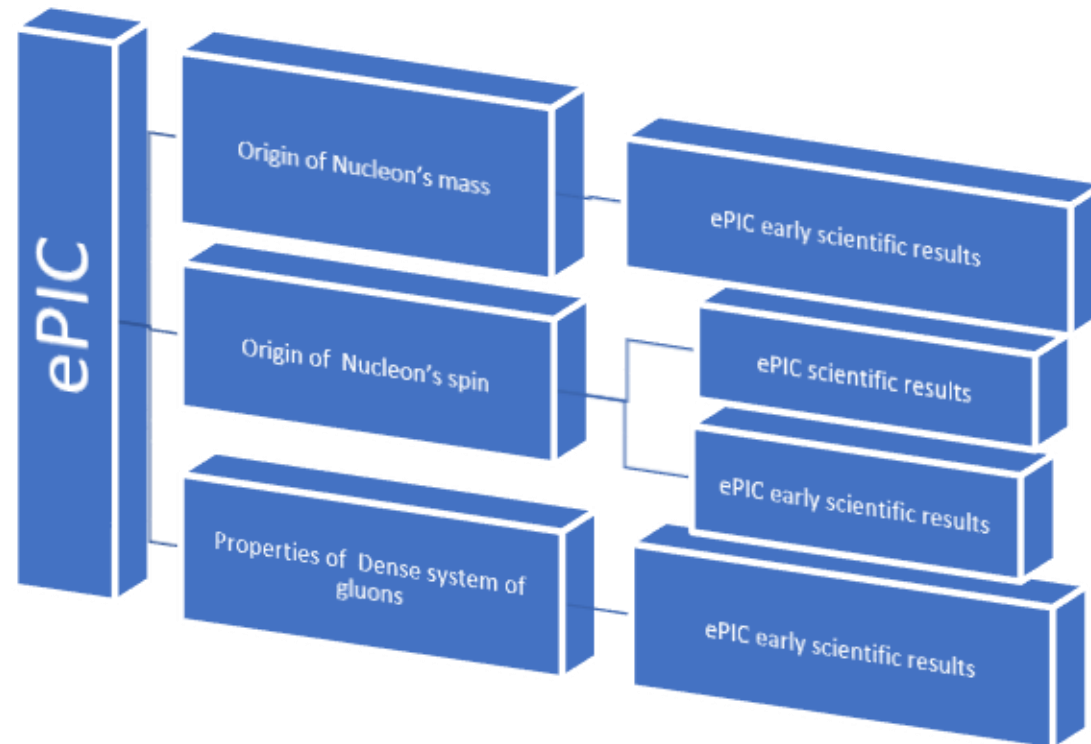
Simulation campaign: 25.10.2

# Discussion

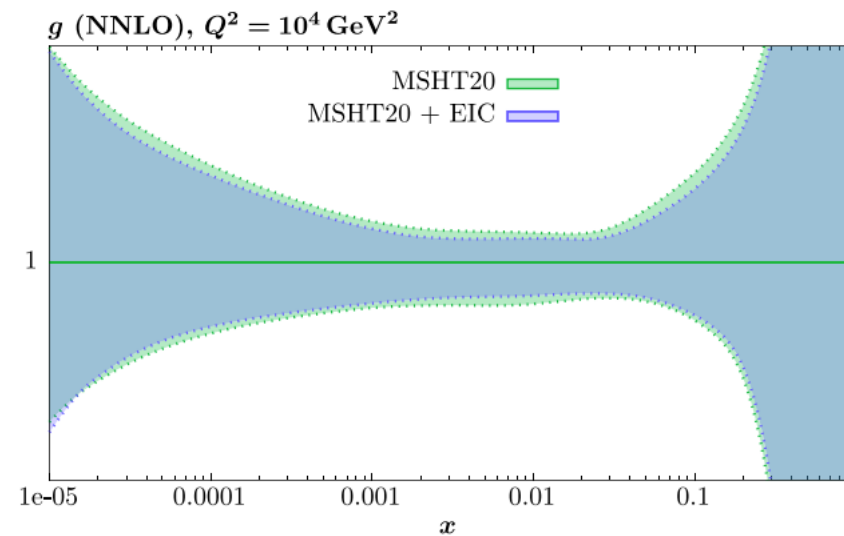
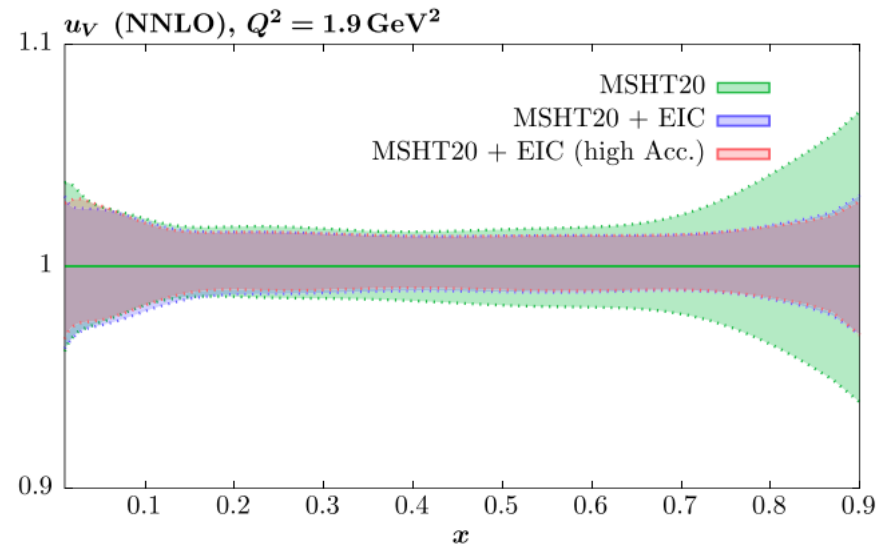
# Back-up

# NAS Pillars and ePIC early scientific results

Include, most probably in section 2, a figure (e.g. in the form of a flow chart) that graphically displays the connection between the “NAS science pillars” and the ePIC early scientific results. A table may also work just fine.



# PDFs with EIC pseudo-data



# Additional (general) comments

The document in general and the part on inclusive measurements in particular lacks detailed references. This makes sometimes it difficult to understand the connection between the various results.

MC Generators are described in detail in appendix C (Exclusive and diffractive measurements) (Section C.2) but not at all in the other appendices. Whatever is the level of detail that you want to give to MC generators we feel it should be rather uniform across the entire document.