



# Summary of Inclusive Physics on EicC

EicC Inclusive Physics (and New Physics) Working Group:

Yong Du, Jun Gao, **Dexu Lin**, Dianyu Liu, Hongkai Liu,  
Xiaohui Liu, Teng Ma, Ye Tian, Bin Yan and Jinlong Zhang

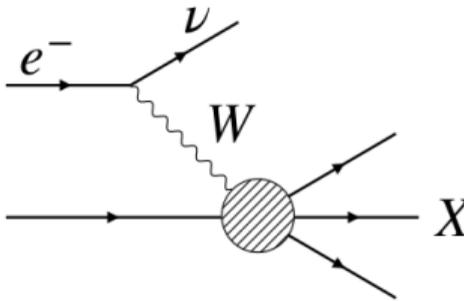
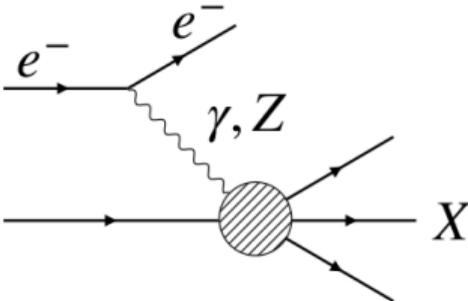
The 8<sup>th</sup> EicC CDR Workshop

Shandong University, Qingdao

Aug. 17 - Aug. 20, 2024

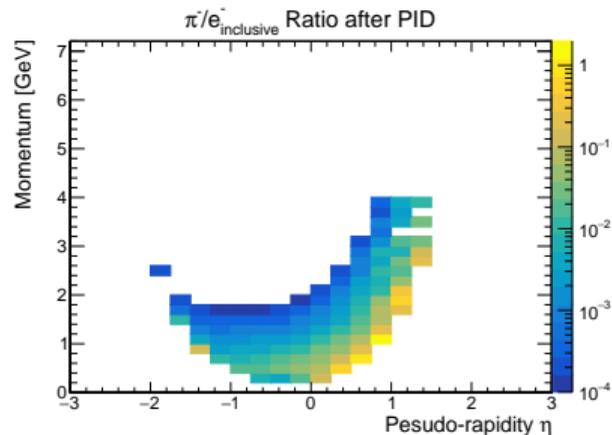
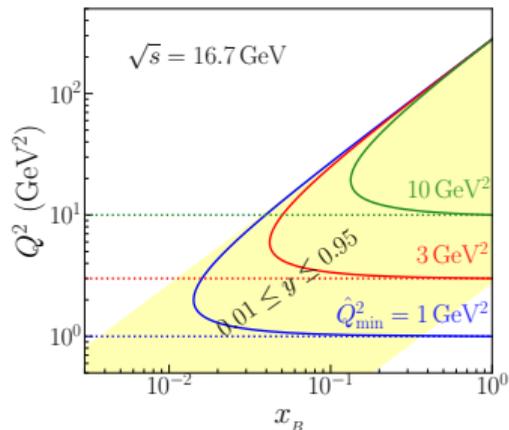
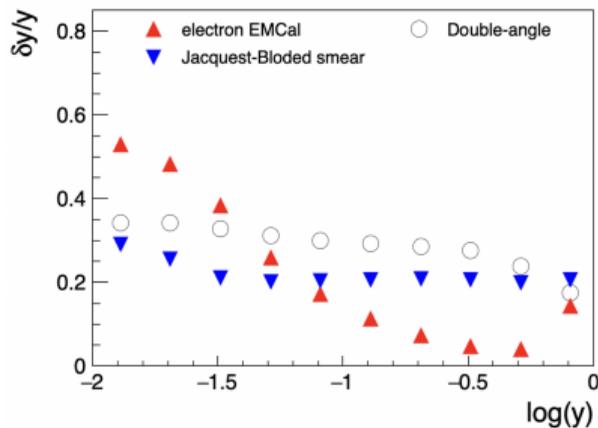
# Contents of Inclusive Physics for CDR

<b>1 EicC Physics</b>	<b>5</b>
1.1 Executive summary	5
1.2 Inclusive deep inelastic scattering	7
1.2.1 Inclusive DIS measurements	7
1.2.2 The impact on proton PDFs	12
1.2.3 The impact on nuclear PDFs	15
1.2.4 DIS with polarized beams and tagged DIS	18
1.2.5 Exploring new physics beyond the SM	20



# Inclusive Measurements at EicC

## Inclusive DIS: original; least requirement; 1D structure

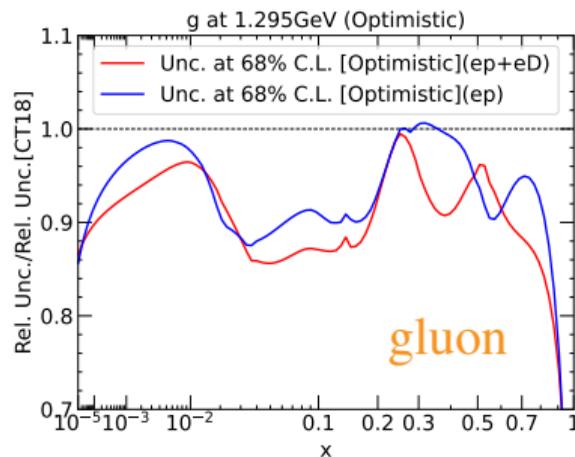
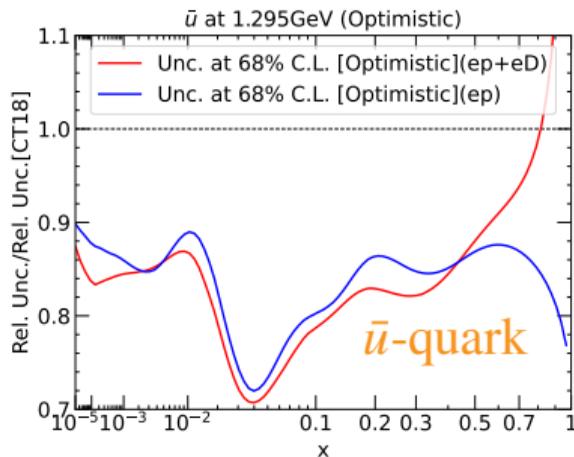
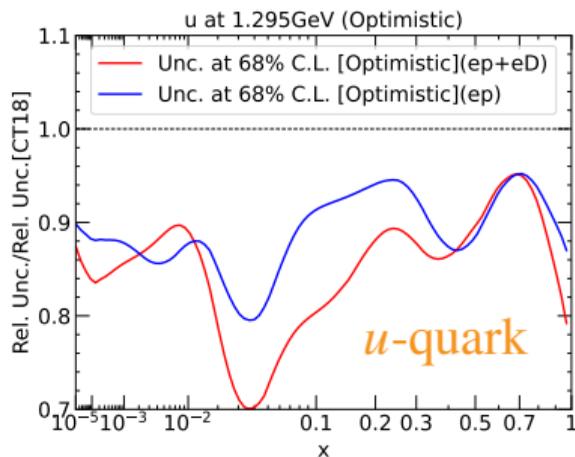


Kinematic reconstruction of the DIS variables ( $x$ ,  $Q^2$ ,  $y$ ) are essential for all physics

QED radiation modifies kinematics ( $Q^2$ ), correction needed

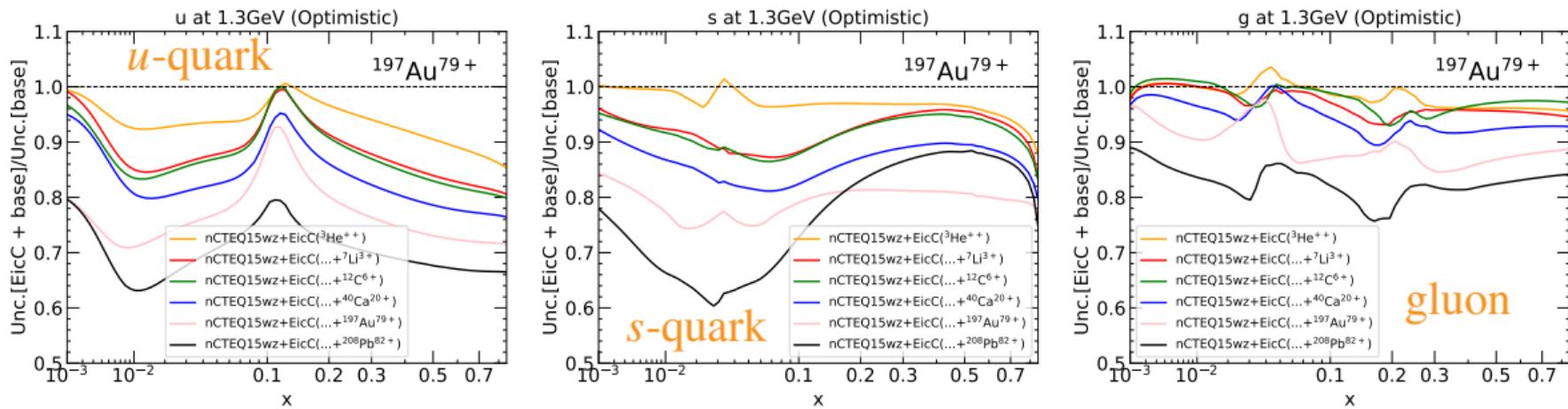
We only want the scattered electrons, but pions dilute.

# Impact on PDFs



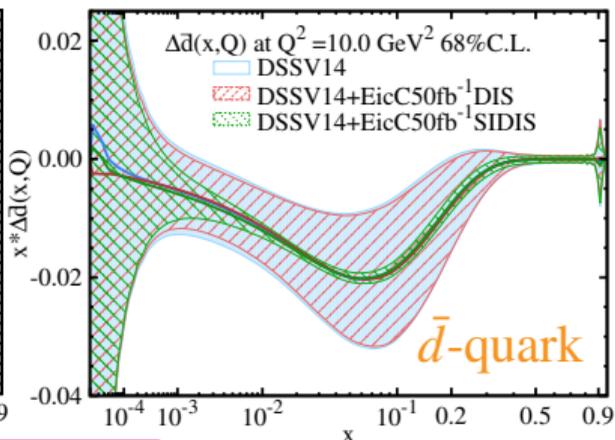
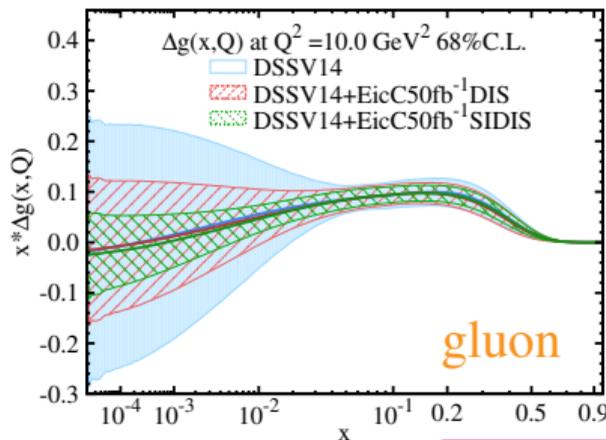
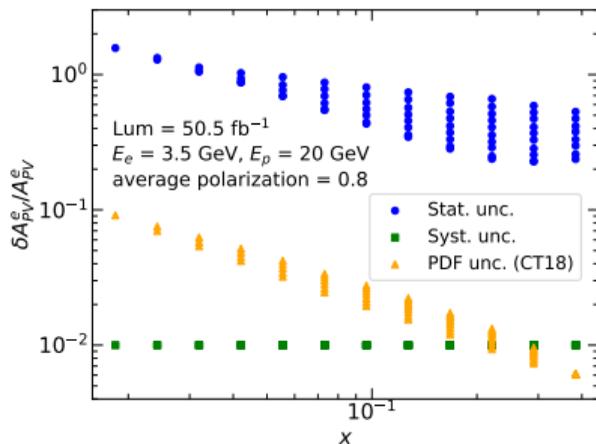
- Based on the CT18 NNLO baseline PDFs and the EicC pseudo-data,
- Results for  $Q = 1.295$  GeV, PDFs for other components also included in CDR draft,
- PDF uncertainties generally reduced by about 10% (15%), comparable to EIC studies,
- Depends on the assumption of systematic uncertainties.

# Impact on Nuclear PDFs (nPDFs)



- Based on the nCTEQ15WZ NLO baseline nPDFs and the EicC pseudo-data,
- Results for  $Q = 1.3$  GeV, PDFs for other components also included in CDR draft,
- Uncertainties of quark nPDFs reduced by about 20%,
- Depends on the assumption of systematic uncertainties.

# Single and Double Spin Asymmetry



JHEP 08 (2021) 034

- Single spin asymmetry:

$$A_{PV}^e = \frac{\sigma^R - \sigma^L}{\sigma^R + \sigma^L},$$

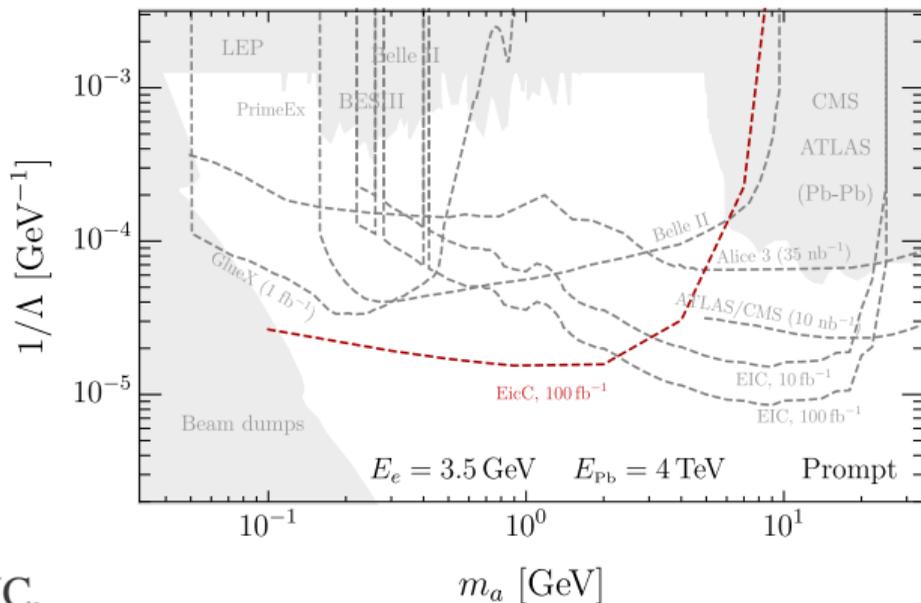
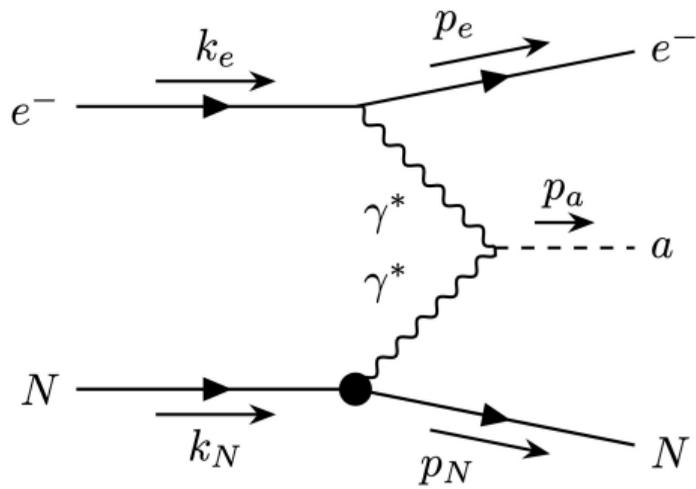
- Highly suppressed at EicC due to the low cms energy.

- Double spin asymmetry:

$$A_{LL} = \frac{d\sigma^{++} - d\sigma^{+-}}{d\sigma^{++} + d\sigma^{+-}} = \frac{1}{P_e P_p} \frac{N^{++} - N^{+-}}{N^{++} + N^{+-}},$$

- Inclusive DIS data place stringent constraints on the helicity distributions of certain flavors (e.g. gluons).

# Exploring EW/BSM Physics



- Developments recently focusing on EIC,
- BSM with heavy mediators are far less contaminated at EicC,
- Scenarios such as **axion-like particle (ALP)**, dark photon, light dark matter could be more interesting.

# Summary

- Inclusive deep inelastic measurements: base for high luminosity EicC,
- Draft in a good shape, and merged into the CDR,
- A few topics of BSM are discussed in the CDR.

