

# Analysis Coordination Meeting



12 / 10 / 2024

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**Wiki of the SIDIS PWG:** <https://wiki.bnl.gov/EPIC/index.php?title=SIDIS>

**PWG meetings:** Tuesday 2.30 pm (~ every 2 weeks)  
- last meeting: 12/03/2024  
- next meeting: 12/17/2024  
- first meeting in 2025: January 7th or 14th

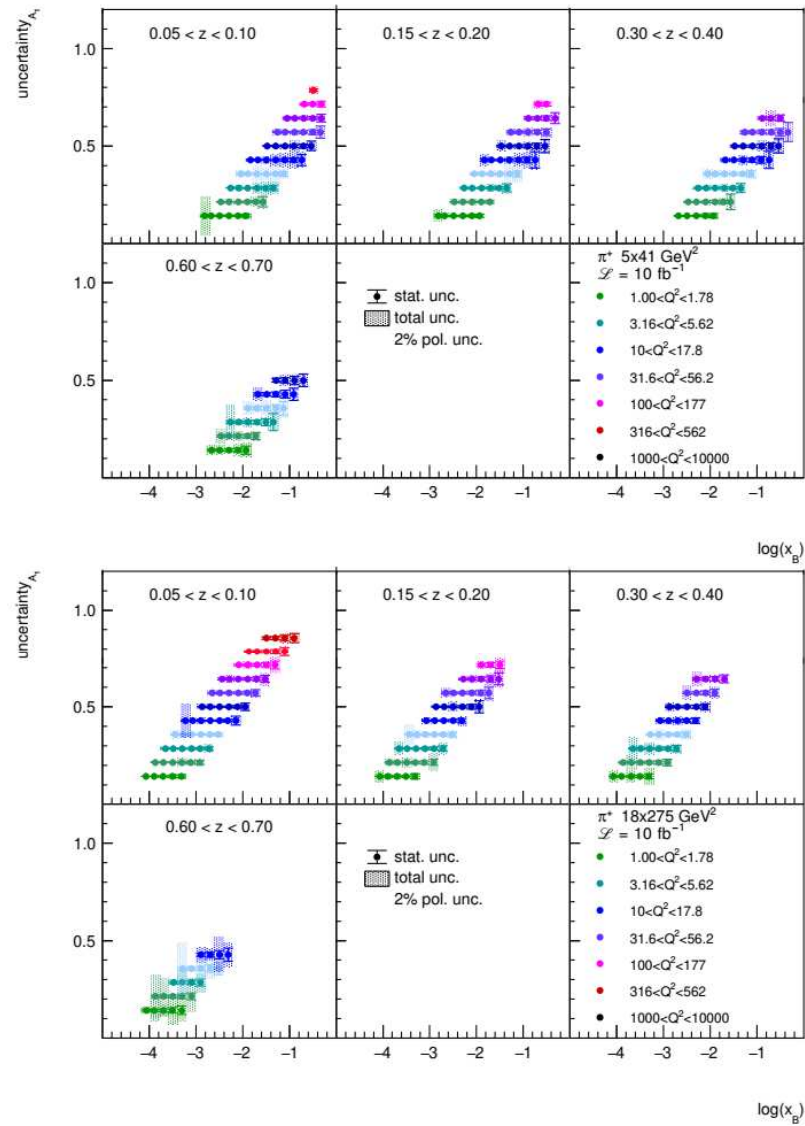


# SIDIS Working Group

## Updates of the pre-TDR :

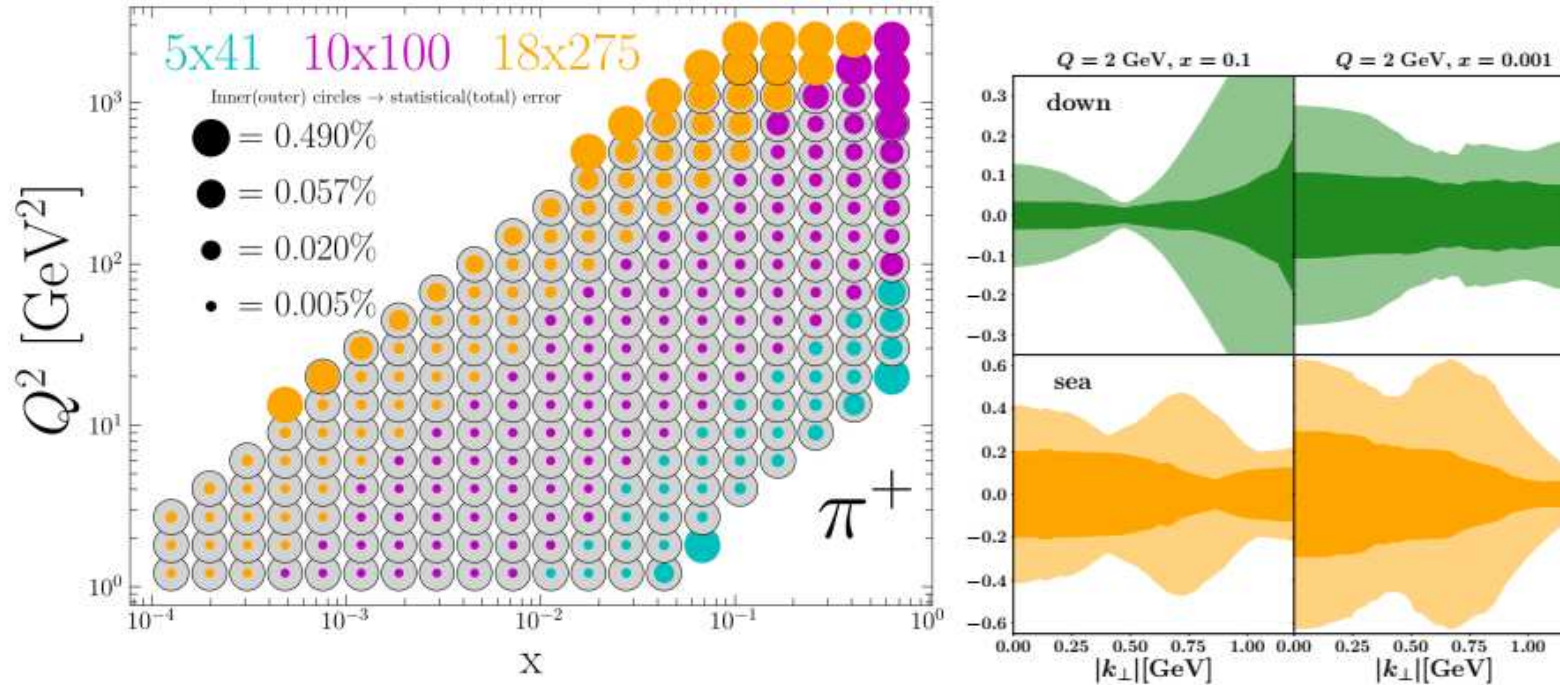
- Introductory text about TMDs was included
  - Discussion on detector requirements for SIDIS measurements was added
  - Final plot on  $A_{UT}$  (Ralf) was added
  - Introduction, description and final plot on  $A_{LL}$  (Charlotte) was added
  - Paragraph on the reconstruction of SIDIS variables was added
- ➔ We have now included everything we planned to add from the SIDIS WG

## 2.4.2 Origin of Nucleon Spin

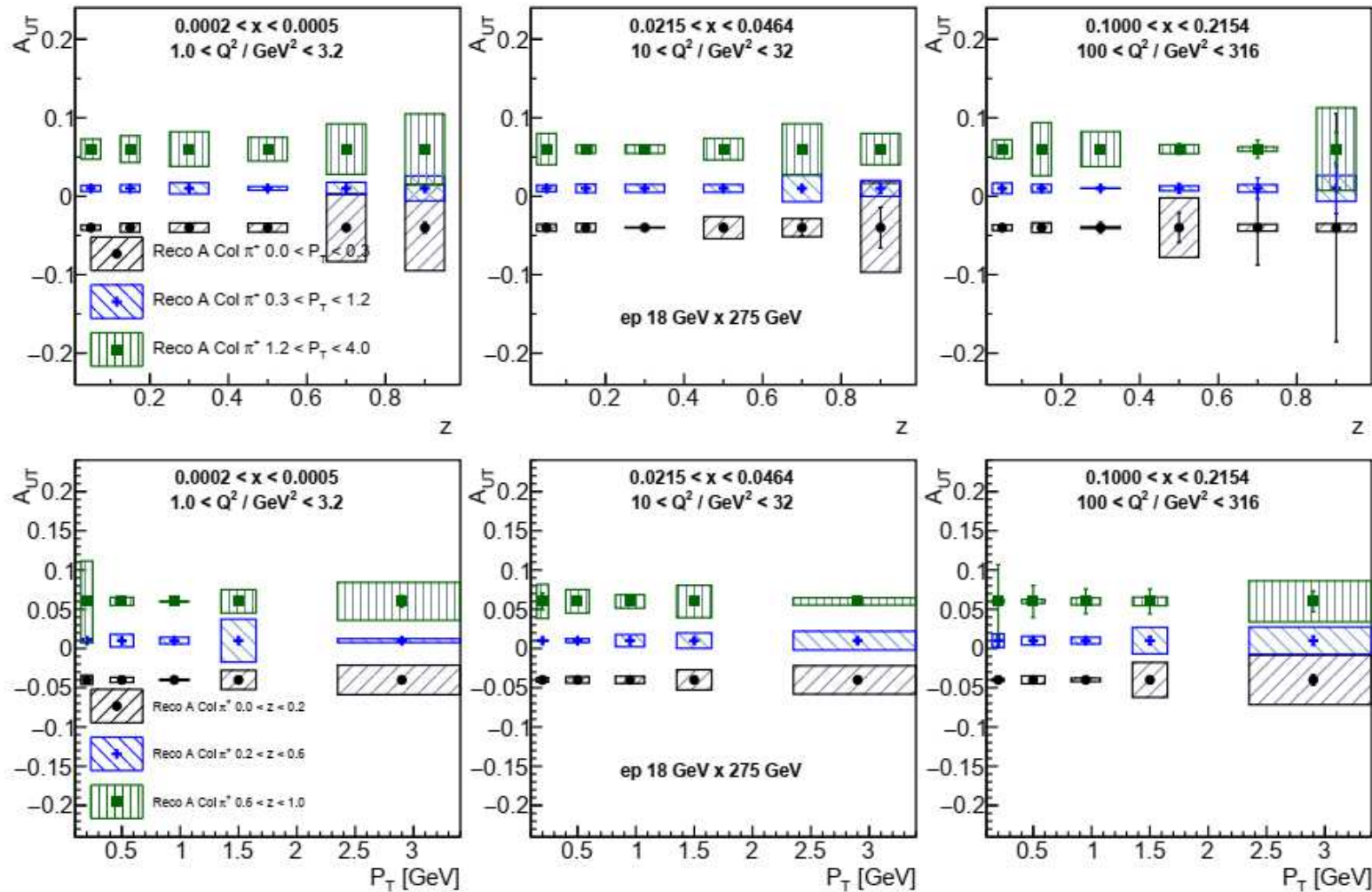


**Figure 2.7:** Statistical (error bars) and total (error bands) uncertainty for each selected bins in  $x_B$  and  $Q^2$  and for selected ranges in  $z$ , for positive-pion  $A_1$  asymmetries at  $5 \times 41 \text{ GeV}^2$  (top two rows) and  $18 \times 275 \text{ GeV}^2$  (bottom two rows). An additional global scale uncertainty of 2% accounts for the uncertainty in the beam polarizations, as indicated in the figure. The central value on the vertical axis of the data points has no meaning.

## 2.4.3.1 Imaging in Momentum Space



**Figure 2.8:** Left: Expected statistical and total uncertainty of un-polarized TMD PDFs for  $\pi^+$  in the  $Q^2 - x_B$  plane. The inner (colored) circle shows the statistical uncertainty, while the outer circle provides the total uncertainty for each  $Q^2 - x_B$  bin. The color shows the beam energy configuration which provides the highest statistics in a specific bin. Right panel: Expected uncertainties of valence down (green) and sea quark (orange) TMD PDFs at  $x = 0.1$  (left) and  $x = 0.001$  (right) as obtained based on the MAP24 [1] global TMD fit. The lighter shaded regions show the uncertainties based on existing data while the darker shaded regions show the expected uncertainties after including ePIC data.



**Figure 2.9:** Top: Expected uncertainties in three example  $x$ - $Q^2$  bins for the Collins asymmetries for positive pions as a function of the momentum fraction  $z$  and in three bins of hadron transverse momentum relative to the virtual photon direction assuming a luminosity of  $10 \text{ fb}^{-1}$ . Bottom, the same but as a function of the hadron transverse momentum in bins of  $z$ .



# SIDIS Working Group

## EIC Early Science

Year 1: 10 GeV electrons on 115 GeV/u heavy ion beams (Ru or Cu)

Year 2: 10 GeV electrons on 130 GeV/u Deuterium

Year 3: 10 GeV electrons on 130 GeV transversely polarized protons  
+ Last weeks switch to longitudinal proton polarization

- Limited luminosity → No fully differential measurements

**Discussion on input and projections was started and is ongoing!**



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## → Perspective for year 1:

- Nuclear PDFs and nuclear FFs are poorly known in the EIC kinematic domain
  - Even with very low statistics, 1D (nPDF)/2D(nFF) studies would be useful first results

→ **Scale projections on eA from yellow report**

## → Perspective for year 2:

- Proton and neutron PDFs and FFs can be studied, improvement on strange and d quark PDFs (based on deuterium target)?
- early unpol. TMD measurements (first look at TMD evolution?)

## → Perspective for year 3:

- SIDIS structure functions with target polarization (depending on luminosity): early look at  $A_{UT}$  asymmetries
- Early  $A_{LL}$  asymmetries?