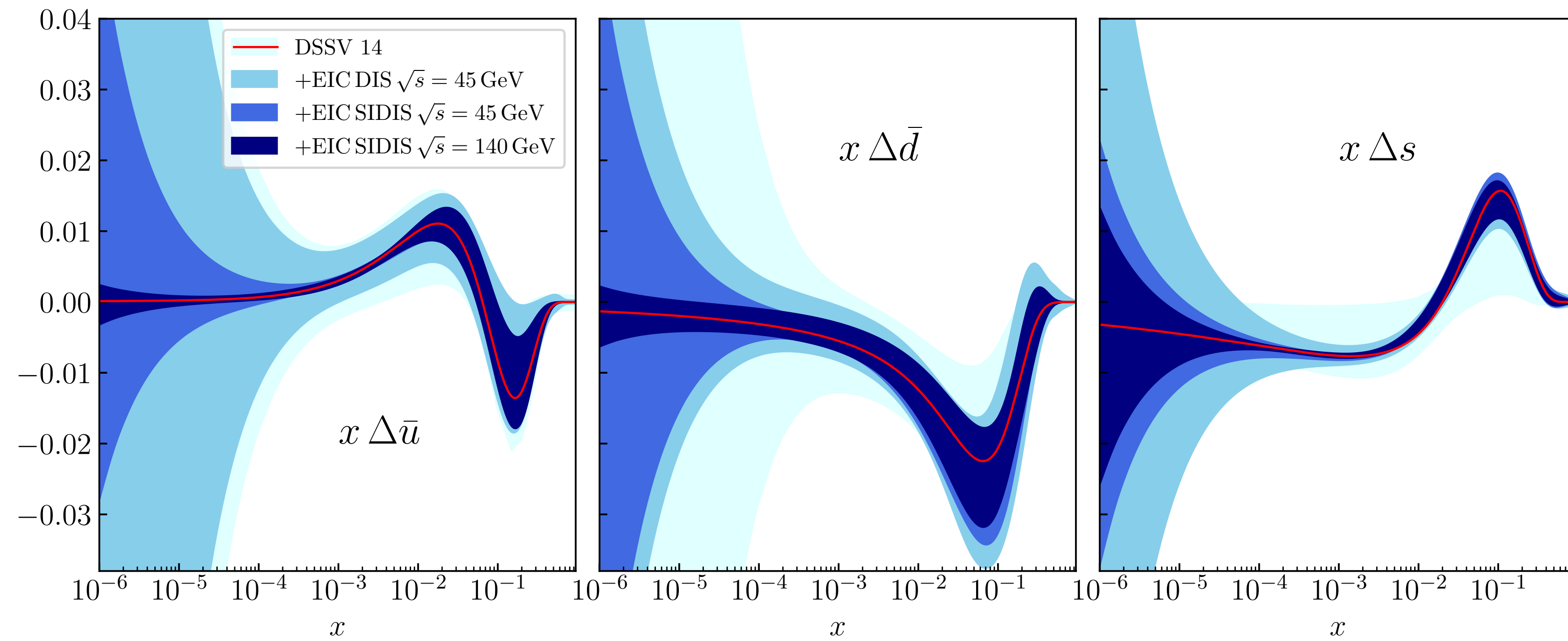# Longitudinal double-spin asymmetries in SIDIS

Ignacio Borsa, Universidad de Buenos Aires (theory)

Charlotte Van Hulse, UAH

Motivation

- Determination of helicity distribution of sea quarks.

- From yellow report:

Analysis of longitudinal double-spin asymmetry

- SIDIS data generated with PYTHIA-6 : 5x41 GeV^2 and 18x275 GeV^2

- Full reconstruction through GEANT simulation (ECCE July concept)

- DIS cuts: Q^2>1 GeV^2; 0.01<y<0.95 and W^2>10 GeV^2

Analysis of longitudinal double-spin asymmetry

- SIDIS data generated with PYTHIA-6 : 5x41 GeV^2 and 18x275 GeV^2

- Full reconstruction through GEANT simulation (ECCE July concept)

- DIS cuts: Q^2>1 GeV^2; 0.01<y<0.95 and W^2>10 GeV^2

- Weighting of events at parton level at NLO:

$$1 + \Lambda D(y) \frac{\Delta \otimes D^{q,g \to h}}{F^h_{UU}}$$

- $\Lambda=\pm 1$: relative beam helicity orientation

- Δ: DSSV14 helicity distributions

- $D^{q,g \to h}$ DSS14 pion and kaon fragmentation function

- Unpolarised F$^h_{UU}$: NNPDF30_nlo_as_0118 and DSS14 FFs

- Weighting only for pythia processes: 99, 131-136

- For ratio of longitudinal and transverse γ* cross section in D(y): Phys. Lett. B, 452:194–200, 1999

- D(y) set to 1 for evaluation of systematics
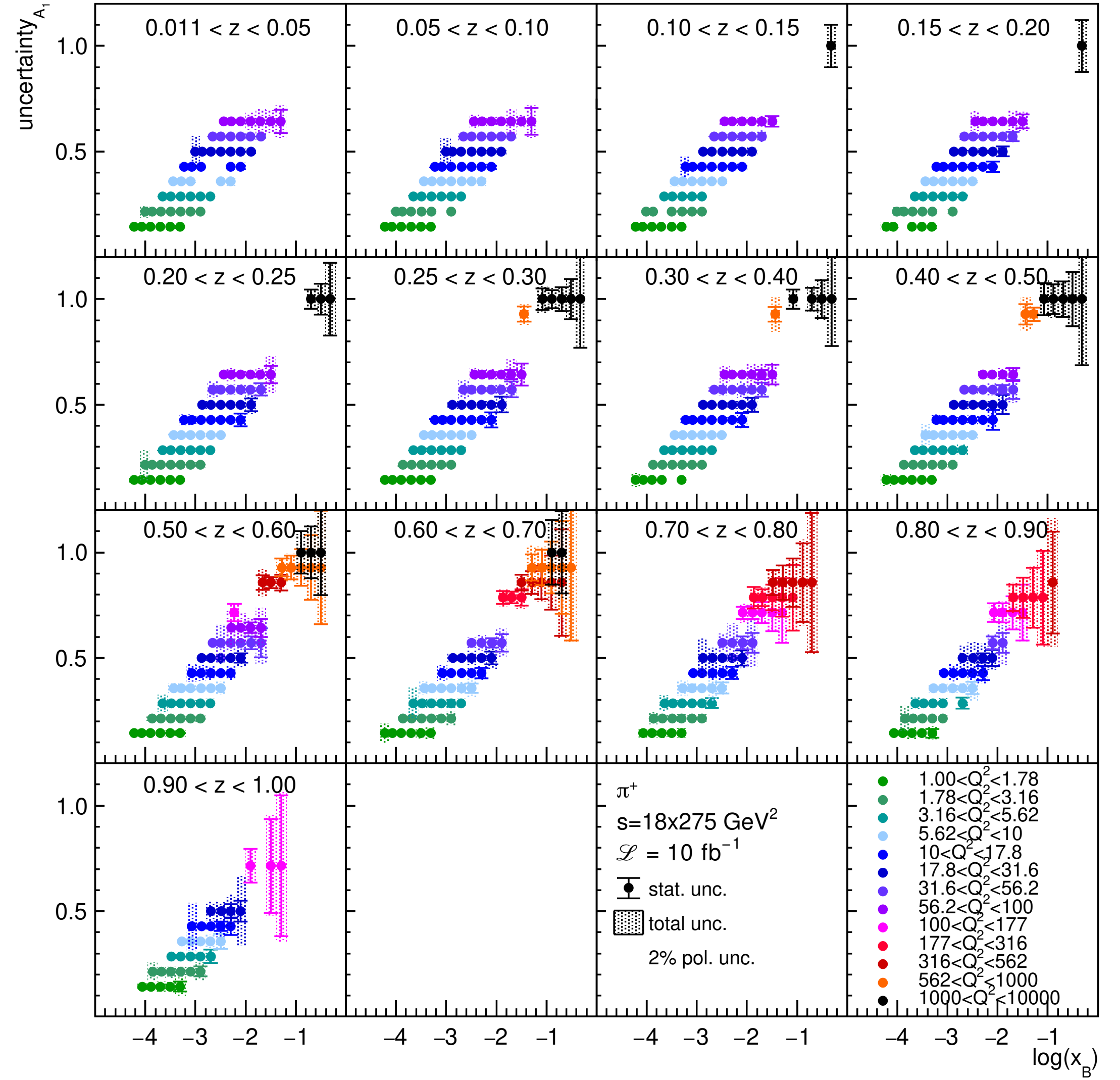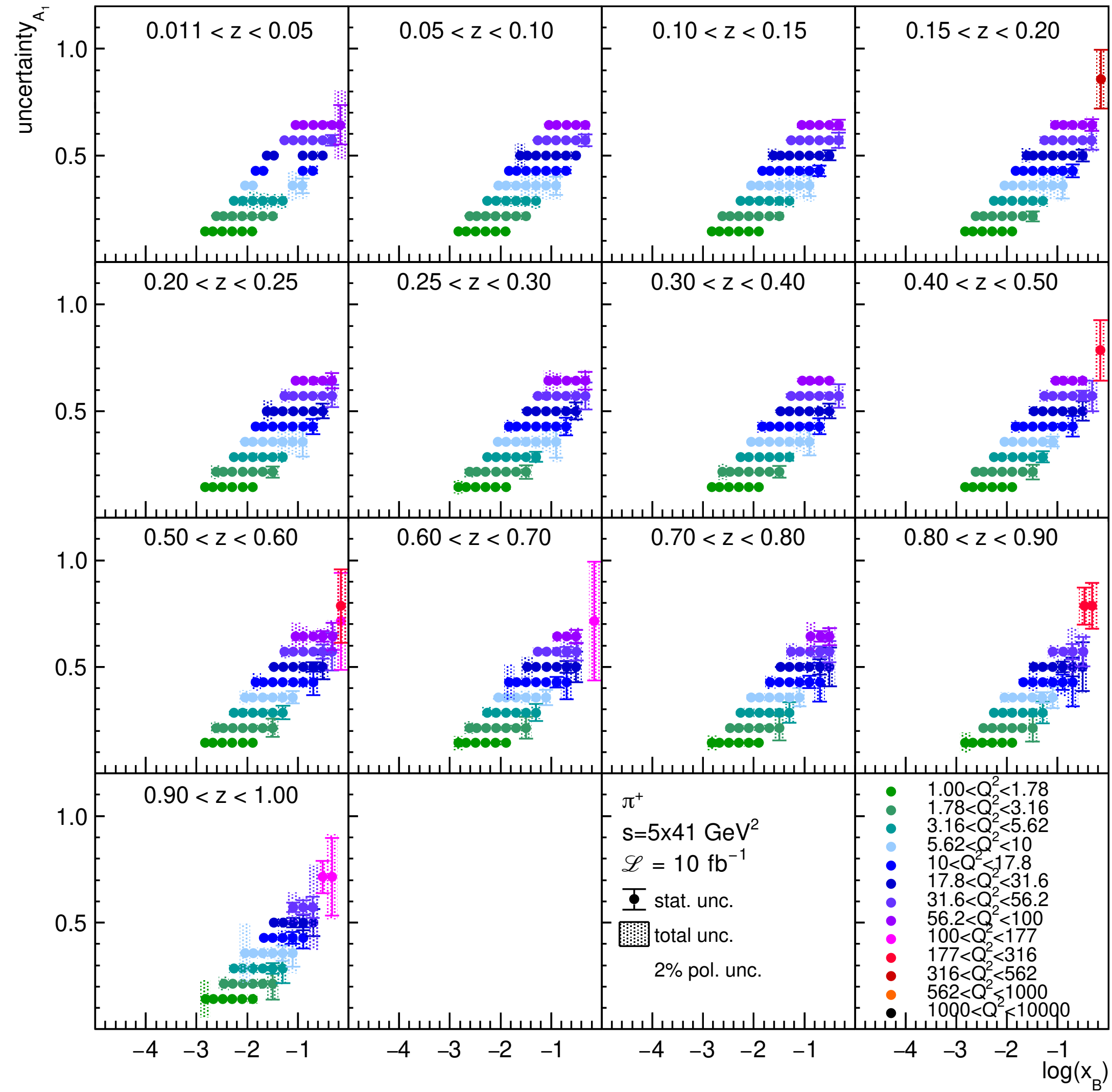
Analysis of longitudinal double-spin asymmetry

$$A_\parallel^h(x_B, Q^2, z) \;=\; \frac{1}{P_e\, P_p}\, \frac{\dfrac{N_{\overrightarrow{\Rightarrow}\,L}^{\overrightarrow{h}}}{} - \dfrac{N_{\overleftarrow{\Rightarrow}\,L}^{\overleftarrow{h}}}{}}{\dfrac{N_{\overrightarrow{\Rightarrow}\,L}^{\overrightarrow{h}}}{} + \dfrac{N_{\overleftarrow{\Rightarrow}\,L}^{\overleftarrow{h}}}{}}(x_B, Q^2, z)$$

$$=\; D(y)\, A_1^h(x_B, Q^2, z),$$

- Assume constant e and p beam polarisations of 70% with with 2% uncertainty

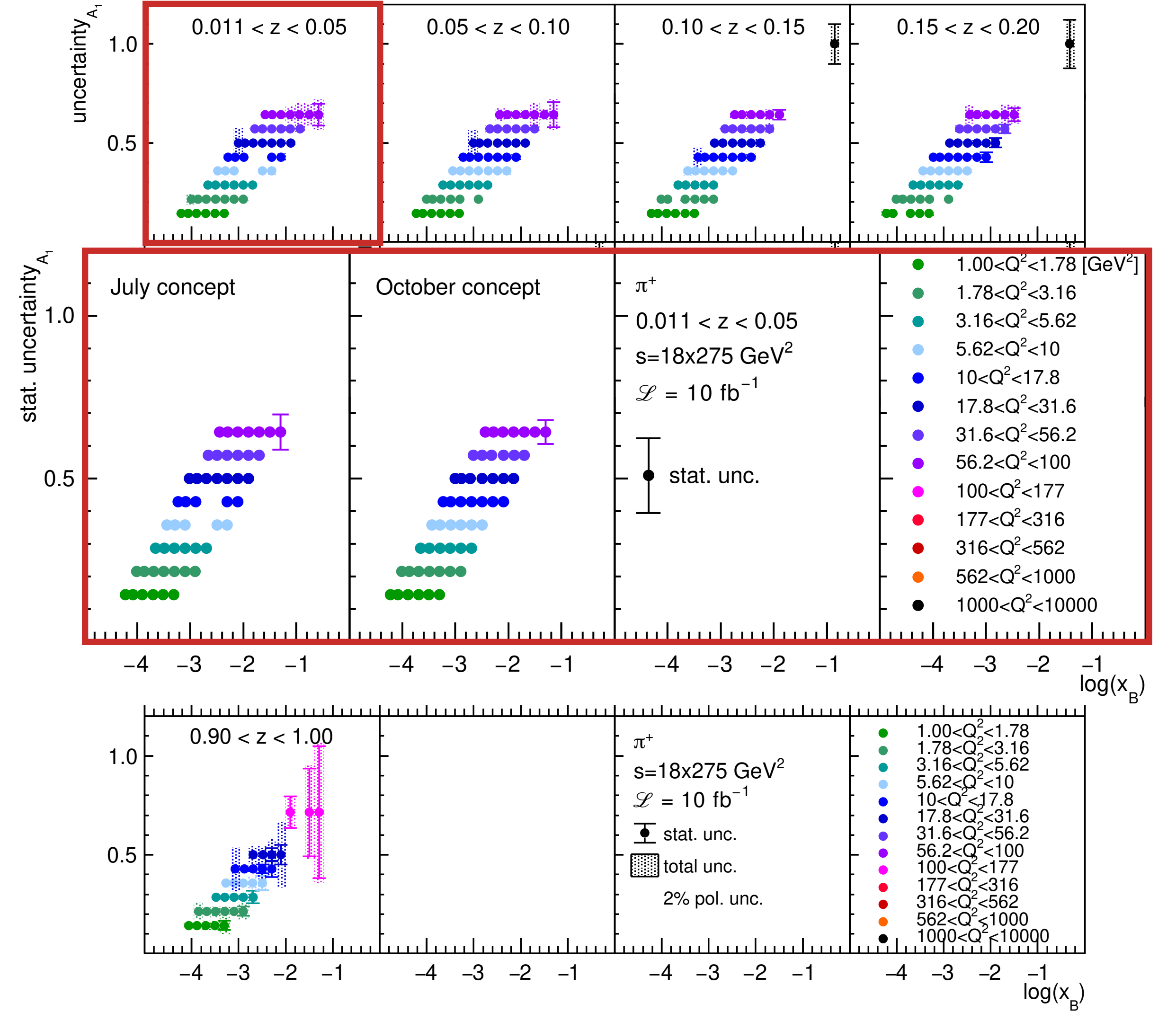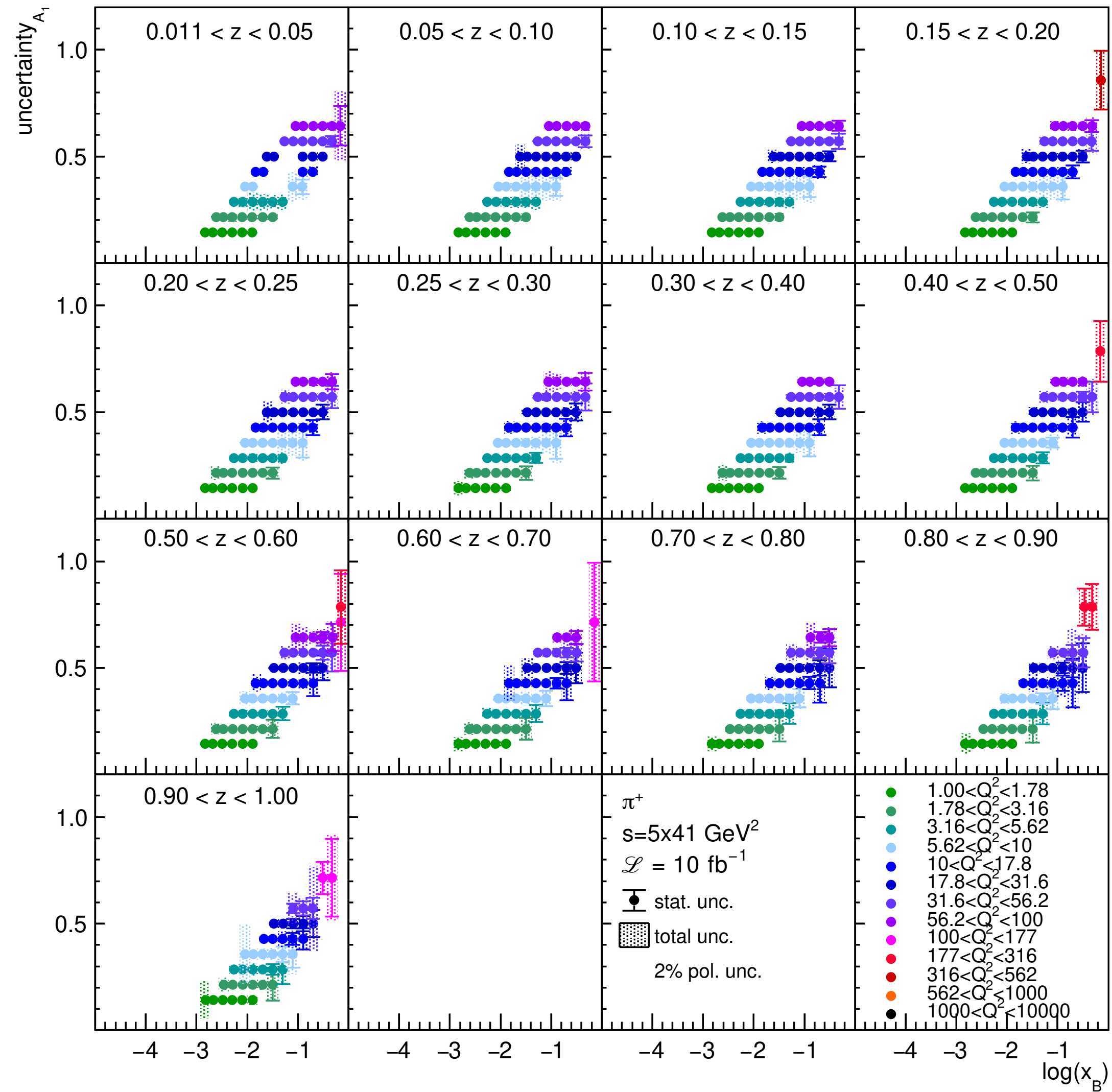- $A_1 \rightarrow$ access to convolution of helicity distributions and FFs
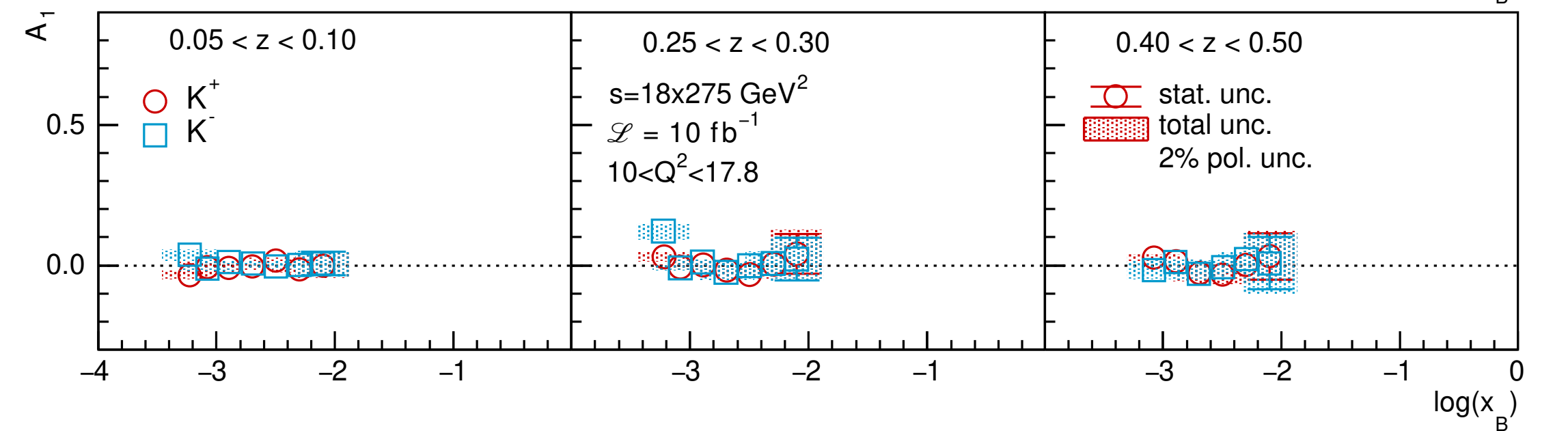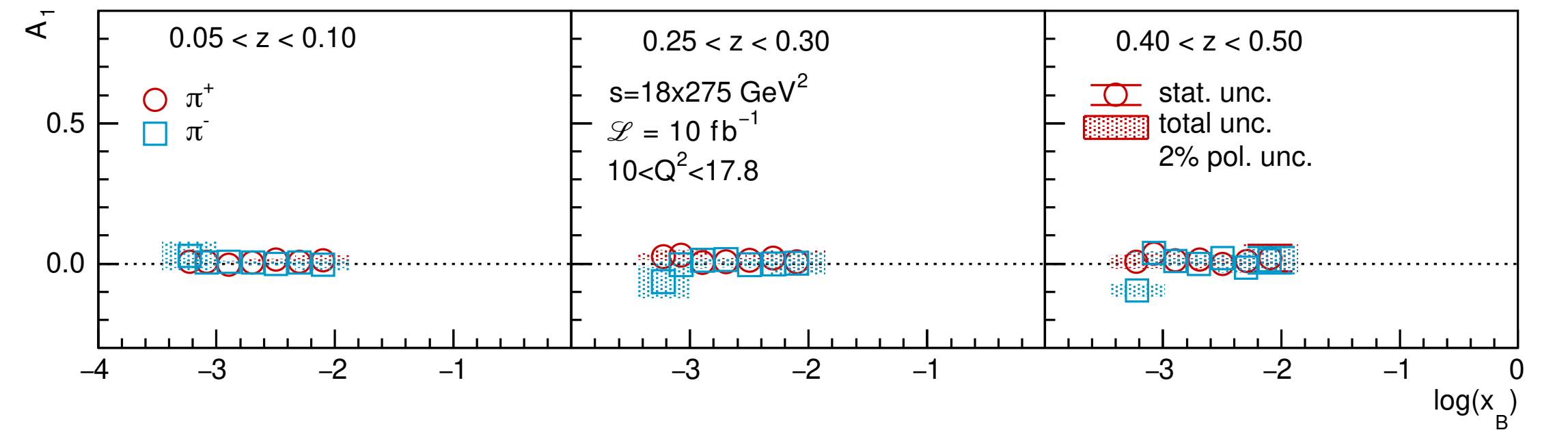
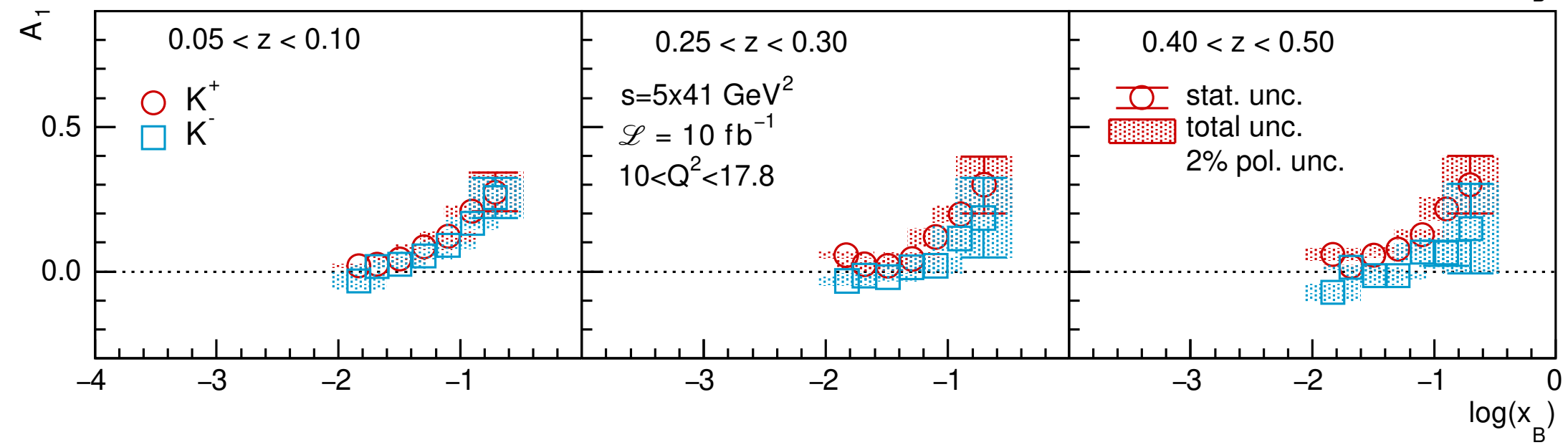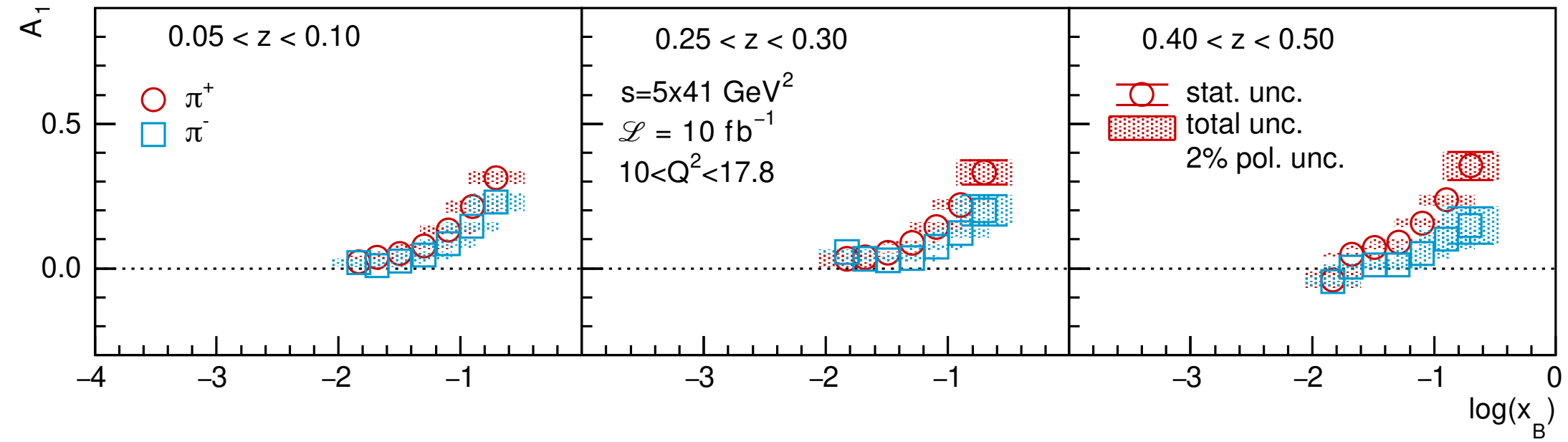# Generated and reconstructed A₁ (D(y)=1)
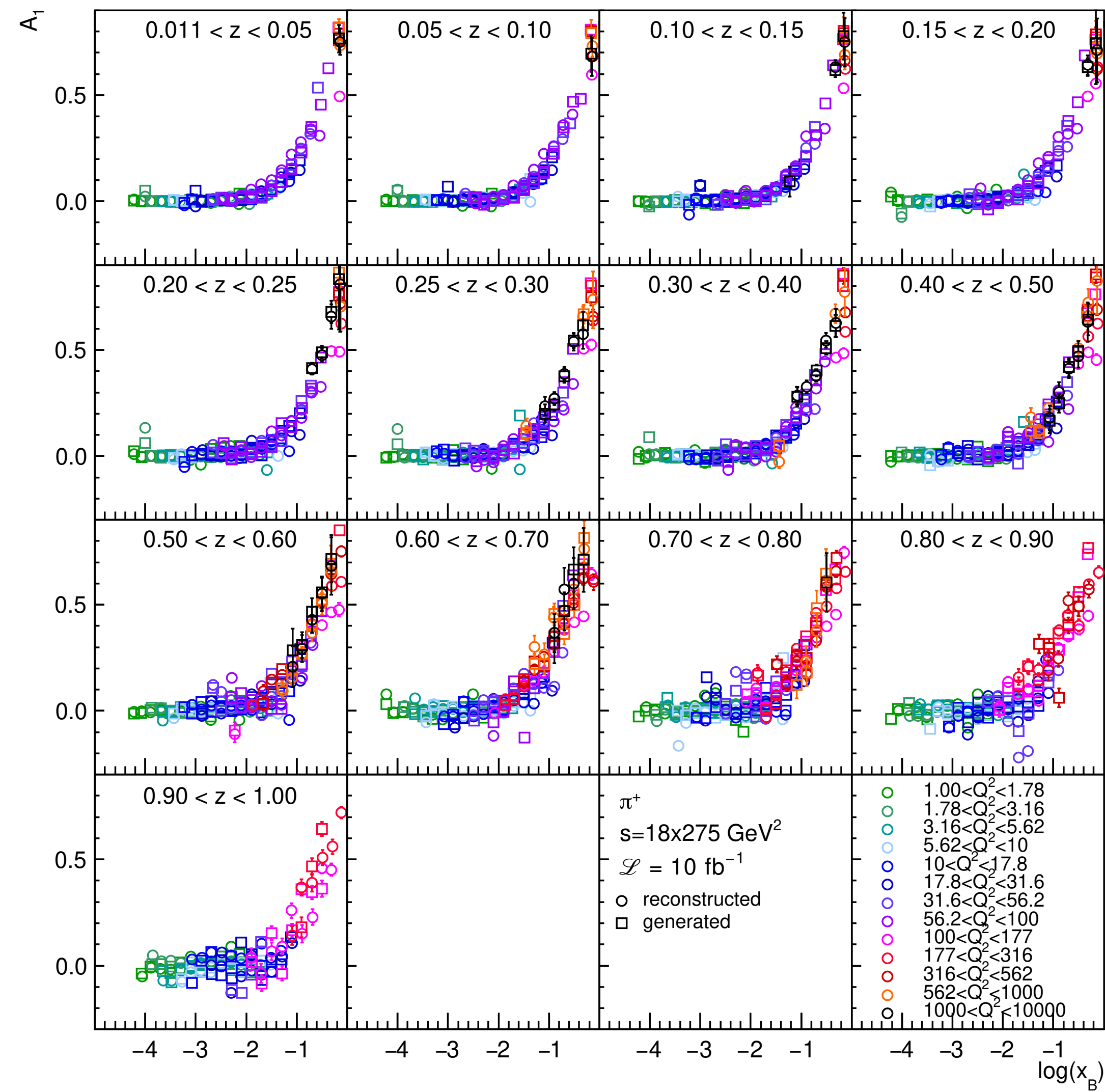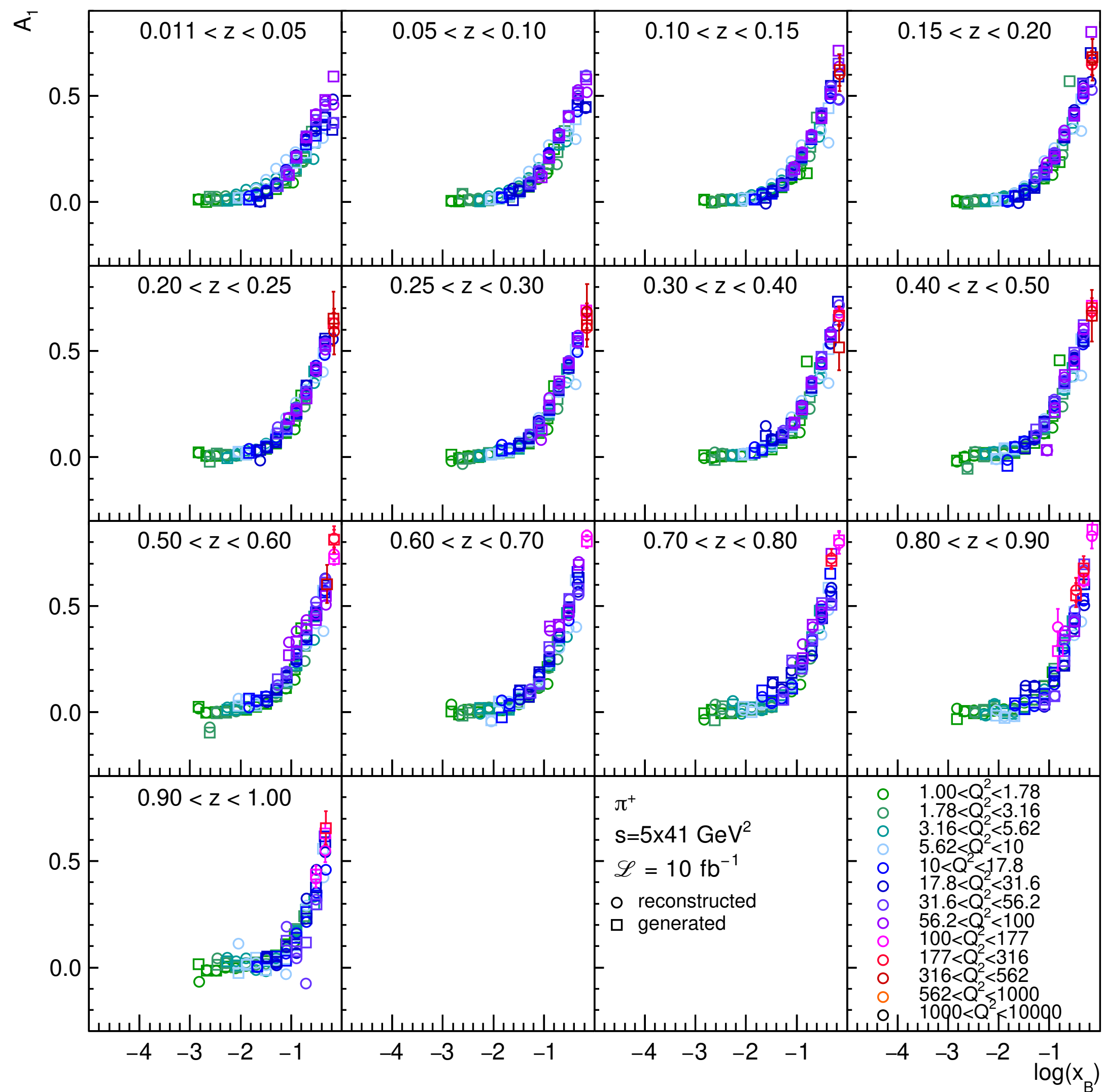
Systematic uncertainties
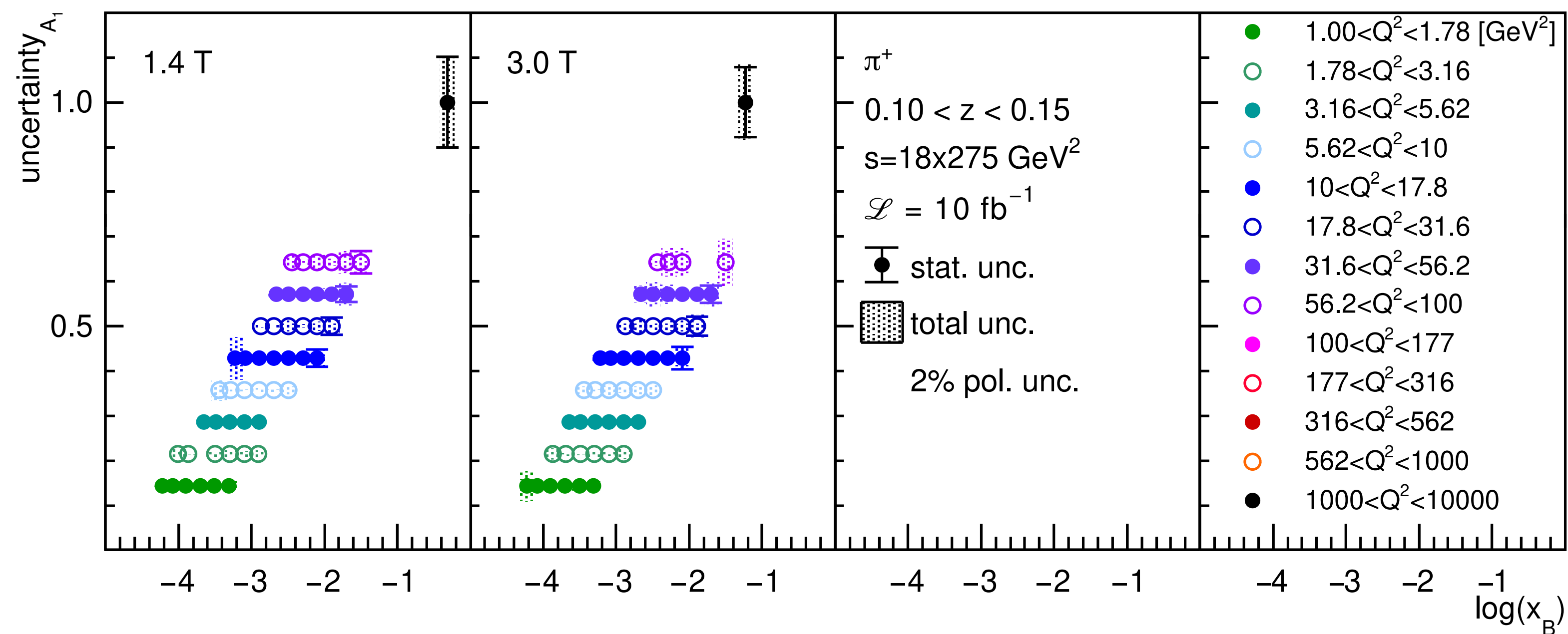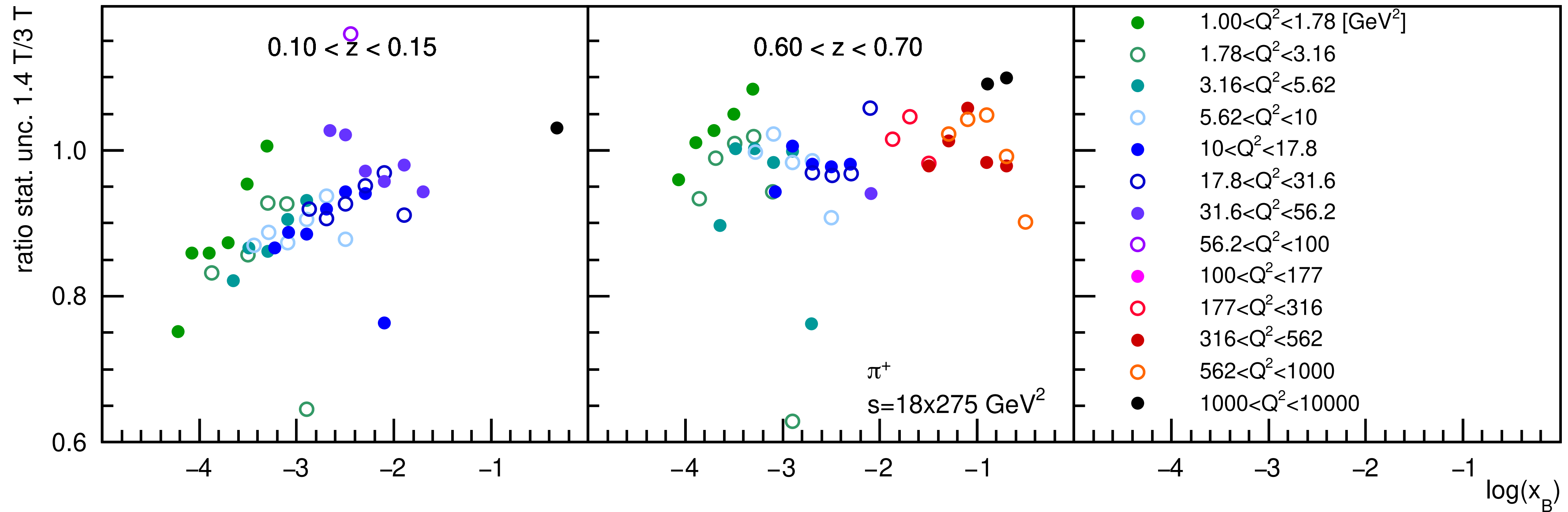
Systematic uncertair

Asymmetries

Influence of the magnetic field
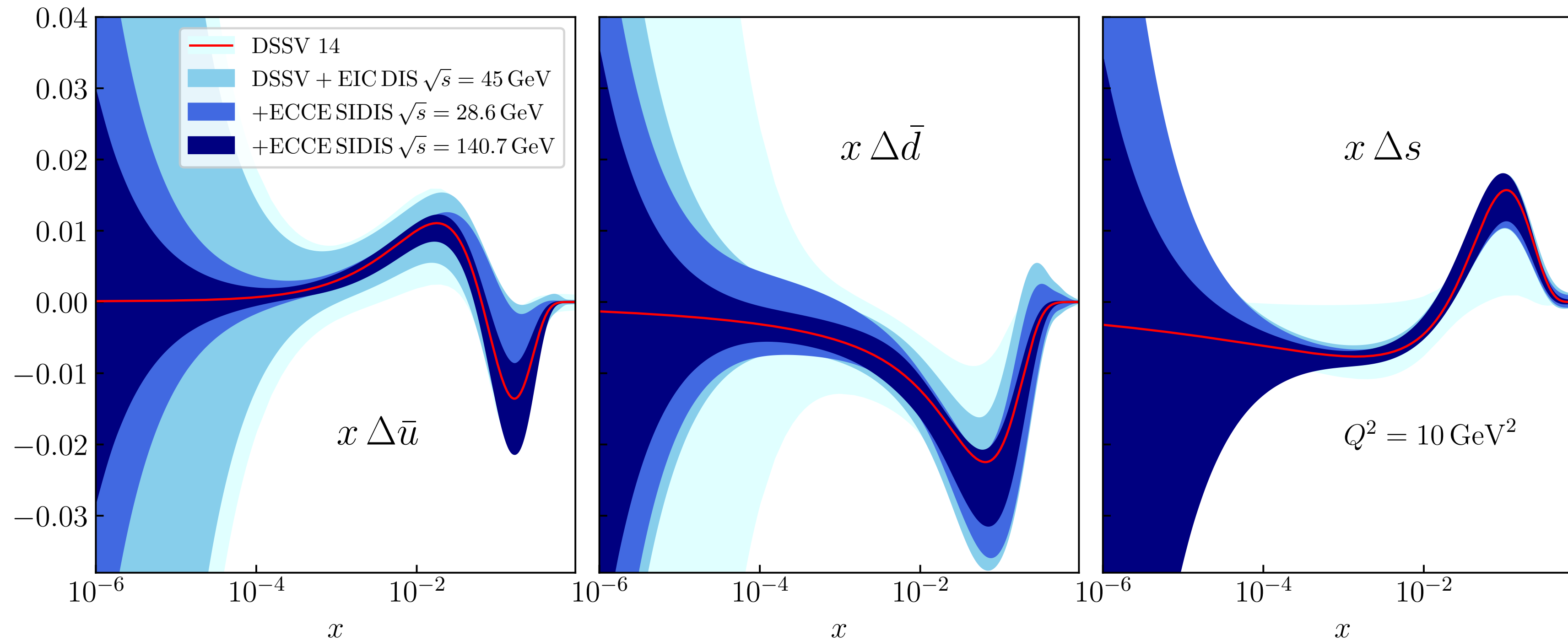
- Kinematic coverage

Influence of the magnetic field

- Statistical uncertainty

Impact plots

Based on reweighing technique.

Need to be added to paper, with clear explanation of procedure.
For example, for highest COM E: cut of x>10⁻⁴ applied, because
otherwise the data set is too restrictive and reweighing procedure cannot
be applied but rather global fit is needed. So the uncertainties are a conservative
estimate.

Summary and conclusion

- Paper covers experimental extraction of A_1 asymmetry and impact plots.

- Need to understand impact plots and complete section discussing impact plots.

- Need to add legend to plots as "ECCE" and references to tables and figures according to prescription.

- ECCE author list needs to be updated.

- Can theorist be added by hand, informing management?