Analysis of double spin asymmetry A_{LL}

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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

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- Weighting of events at parton level at NLO:

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

  - $\Lambda=\pm1$: 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

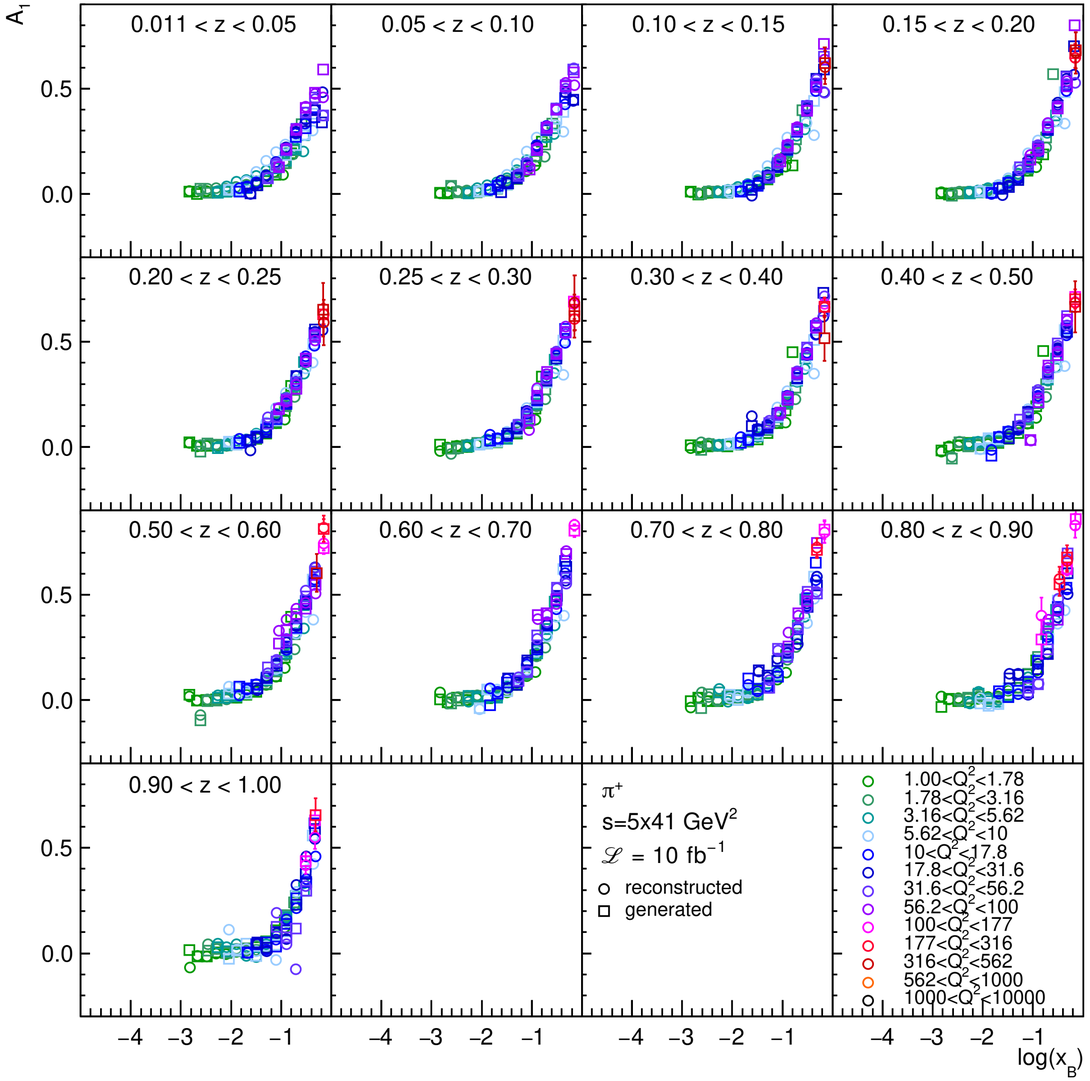
Analysis of longitudinal double-spin asymmetry

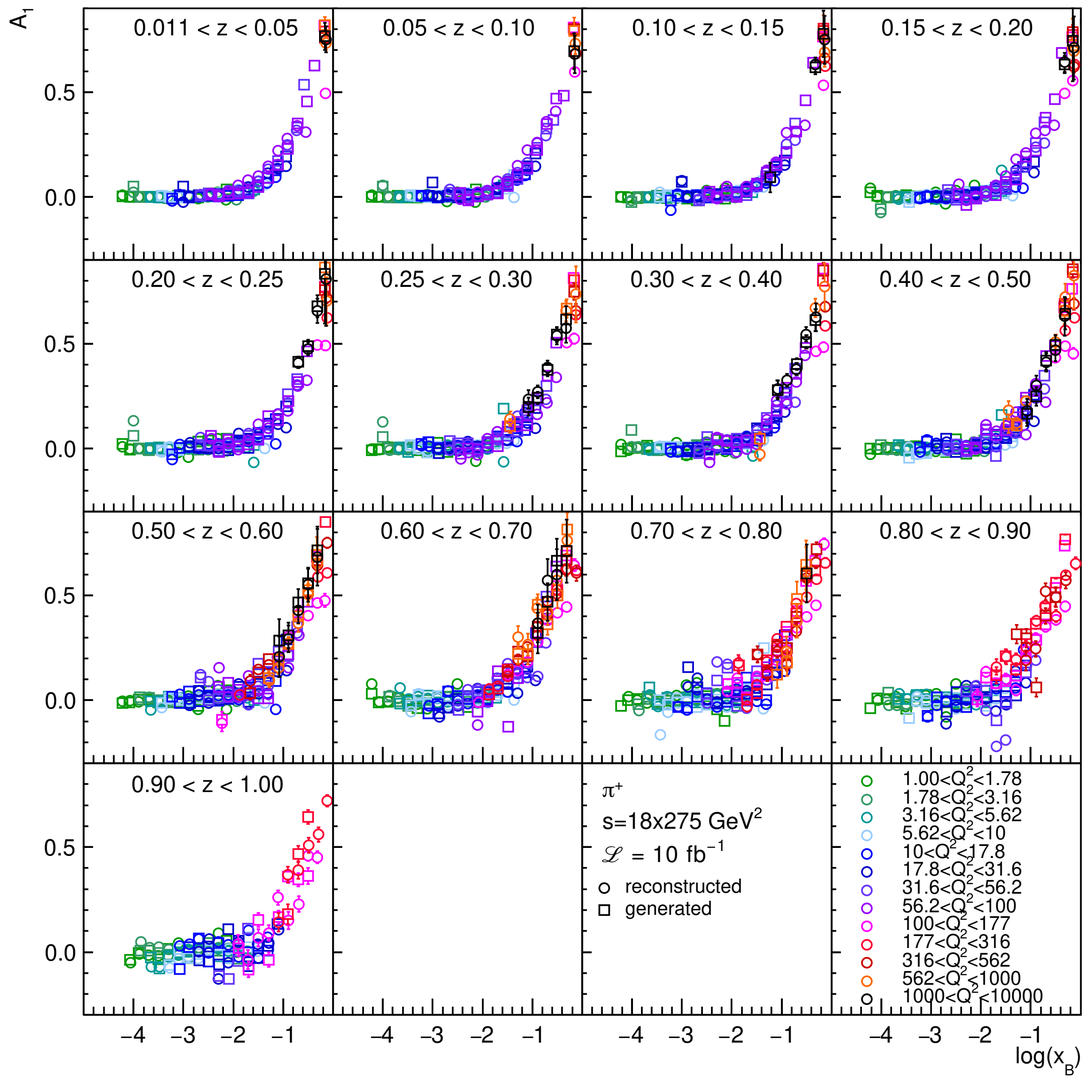
$$A_{\parallel}^{h}(x_B, Q^2, z) = \frac{1}{P_e\, P_p} \frac{\overrightarrow{\overrightarrow{N^h}} - \overleftarrow{\overleftarrow{N^h}}}{\overrightarrow{\overrightarrow{L}} \quad \overleftarrow{\overleftarrow{L}}}(x_B, Q^2, z)$$

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

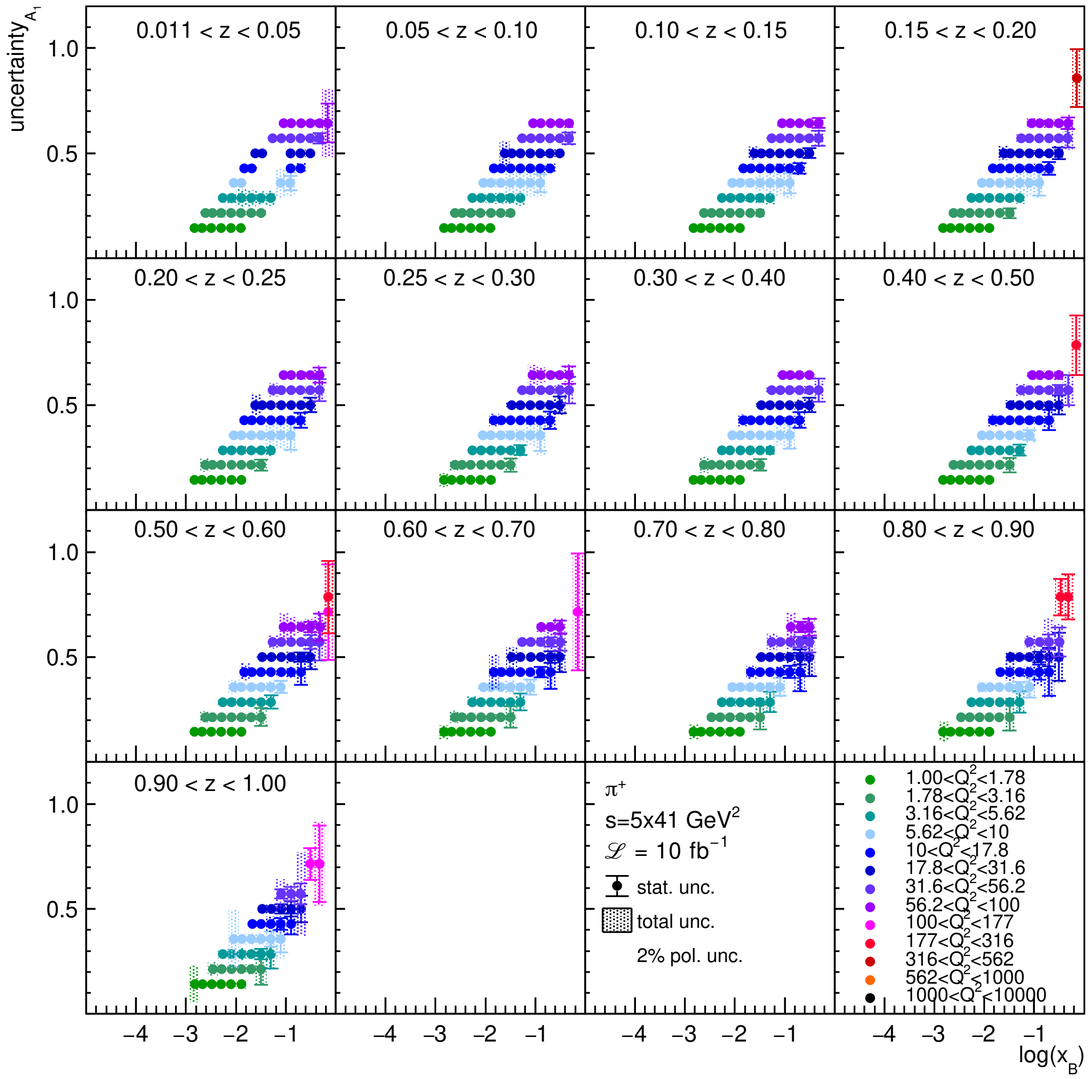
- Assume constant e and p beam polarisations of 70% with with 2% uncertainty
- A_1 → access to convolution of helicity distributions and FFs

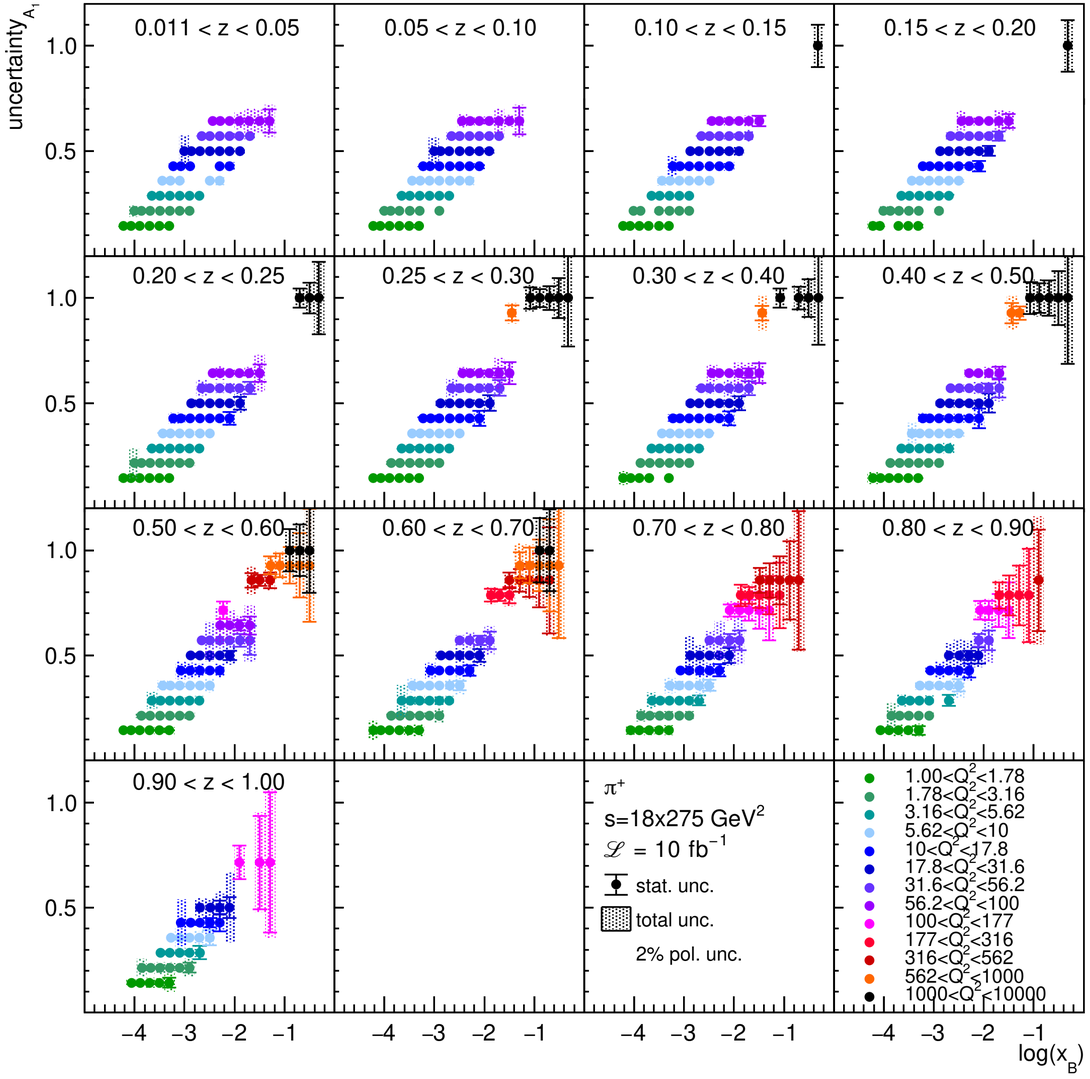
Generated and reconstructed A_1 (D(y)=1)



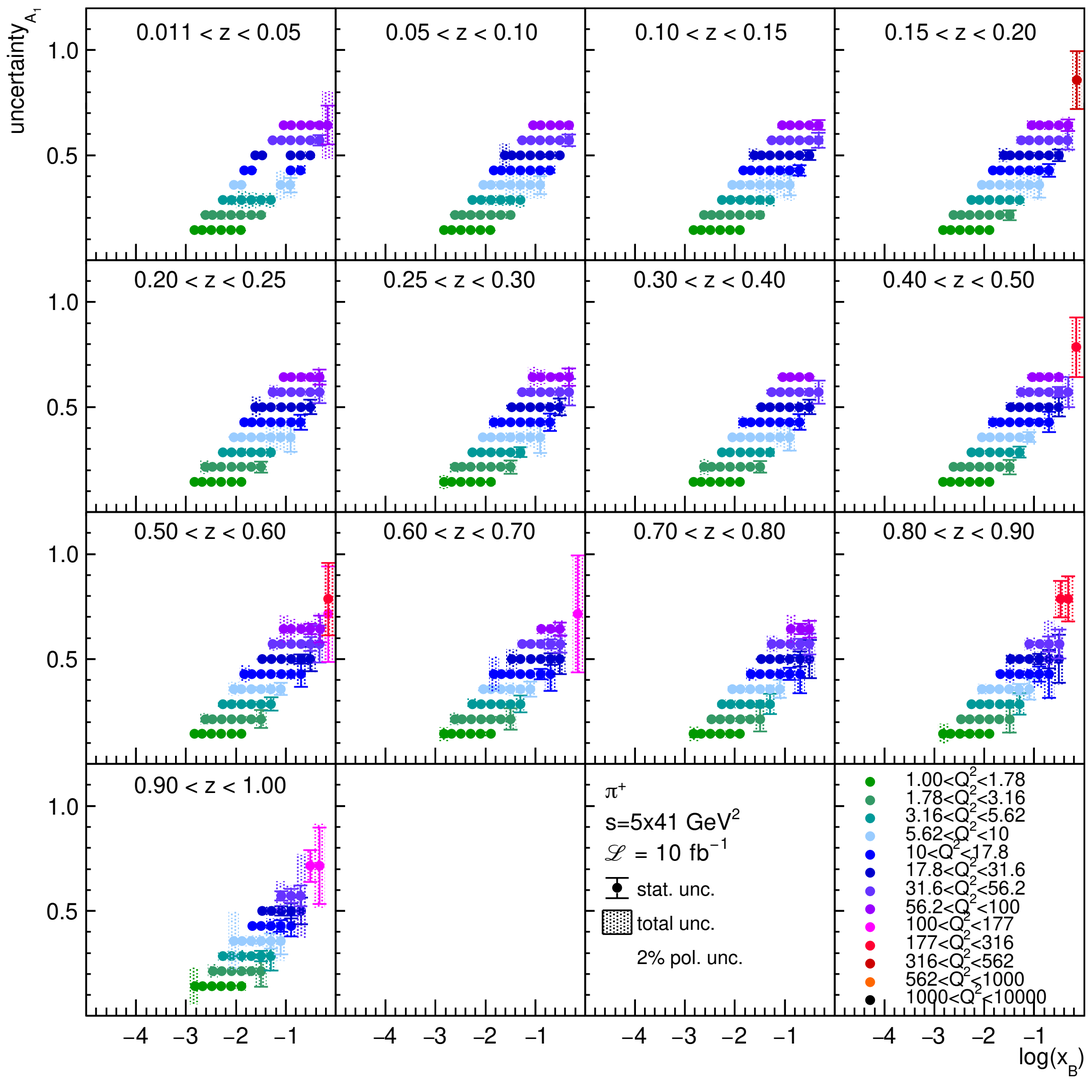


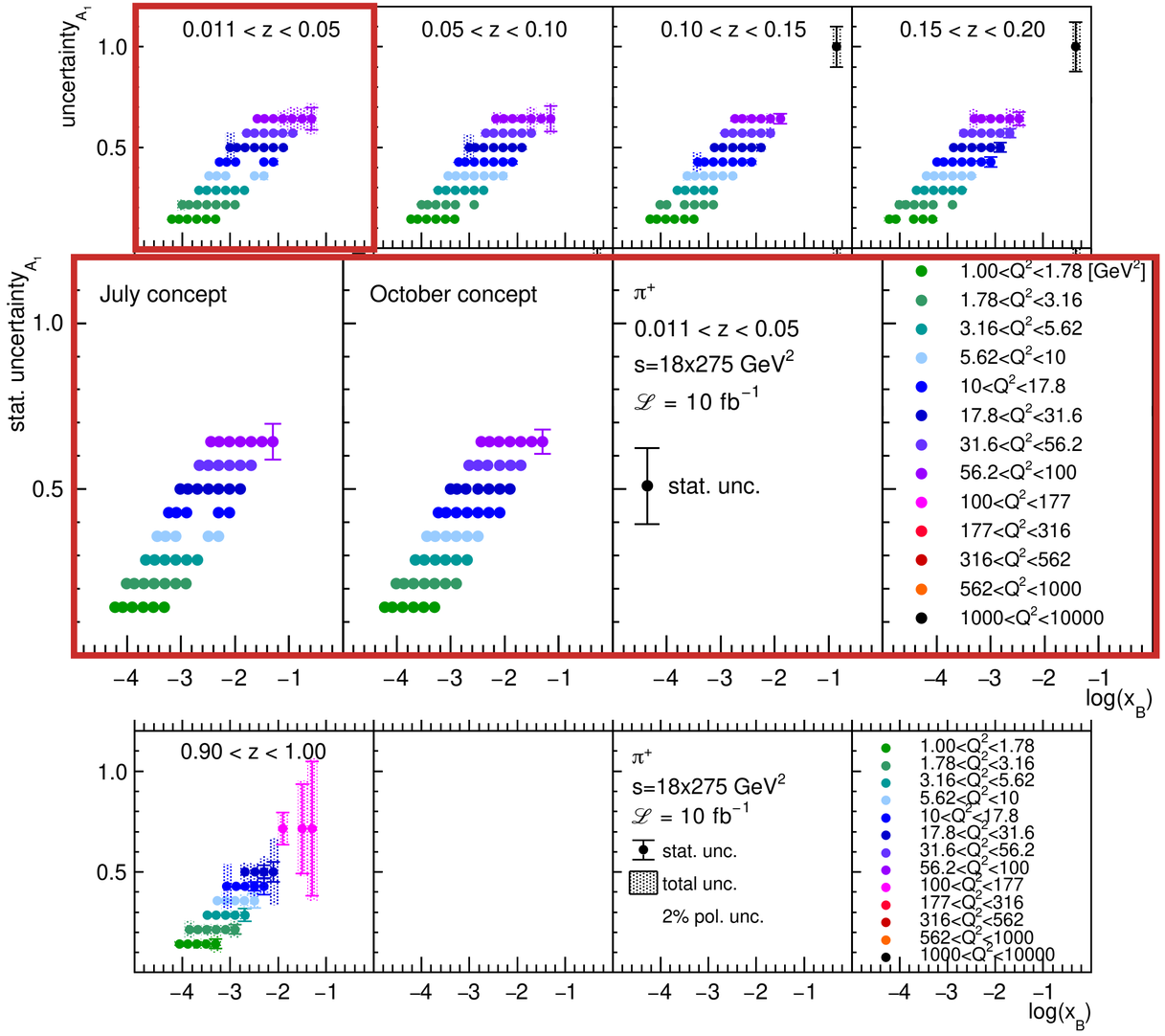
Systematic uncertainties



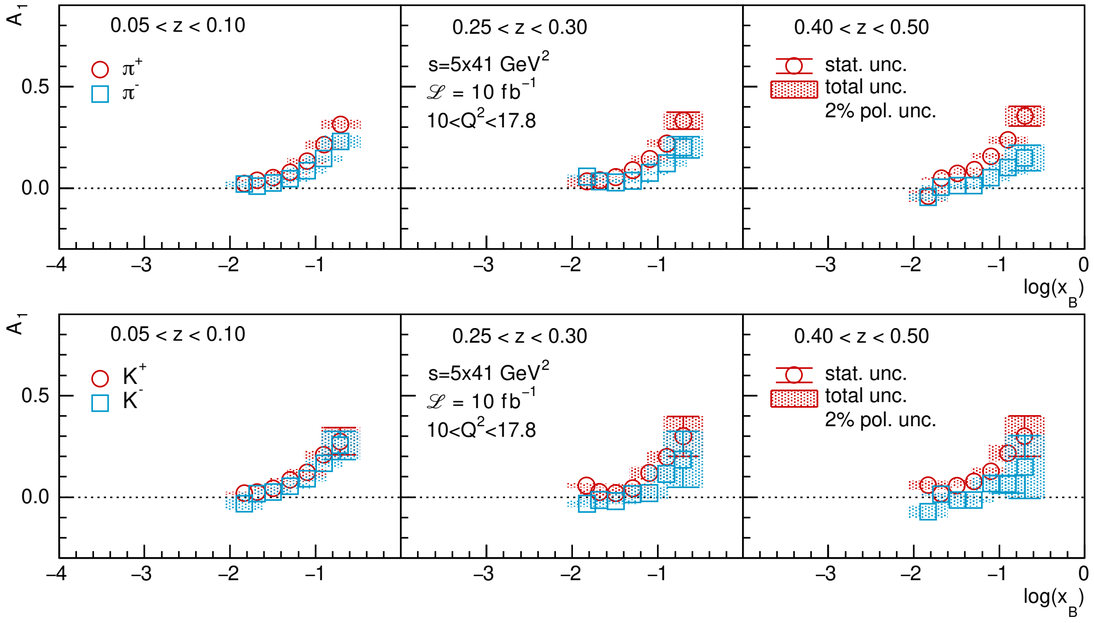


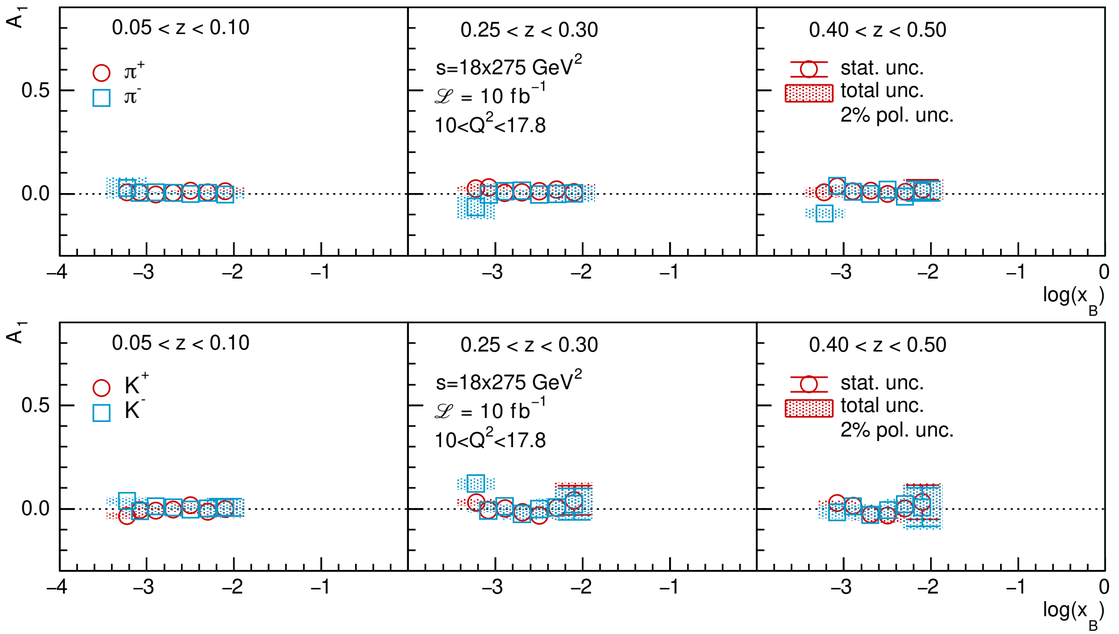
Systematic uncertainties





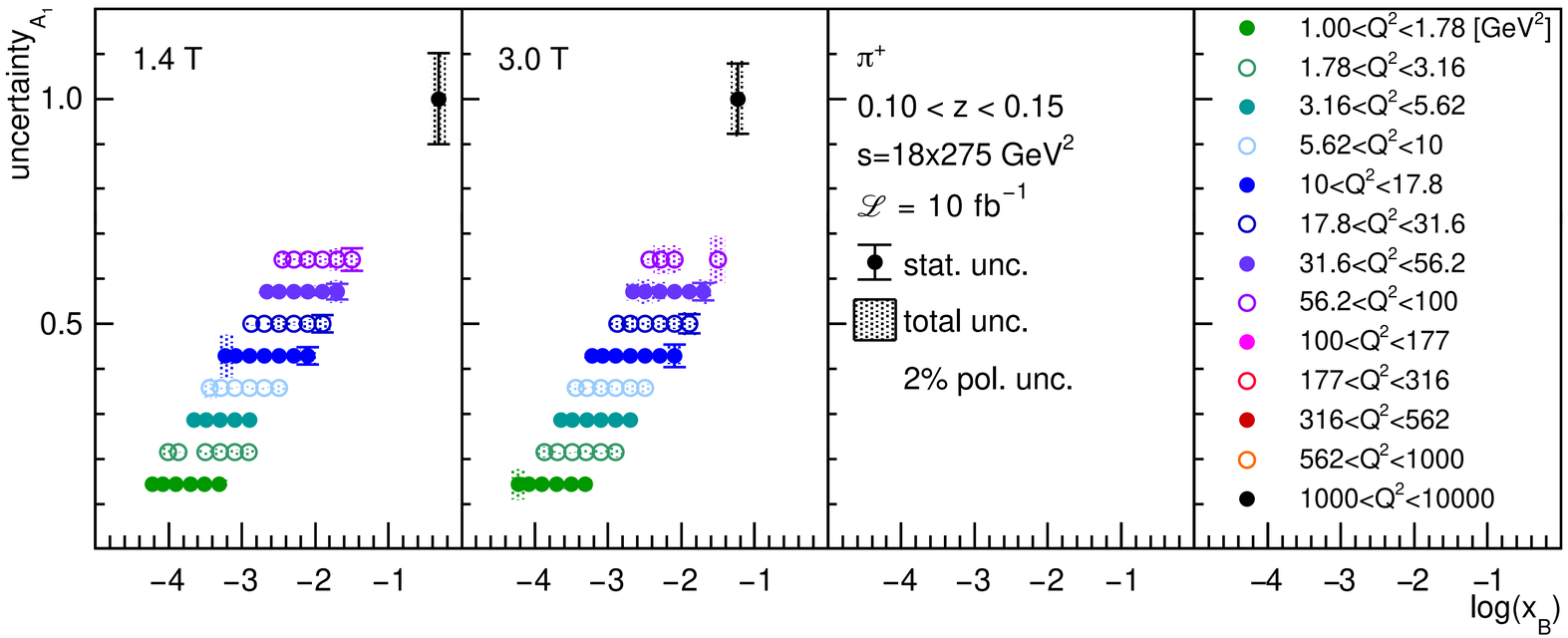
Asymmetries





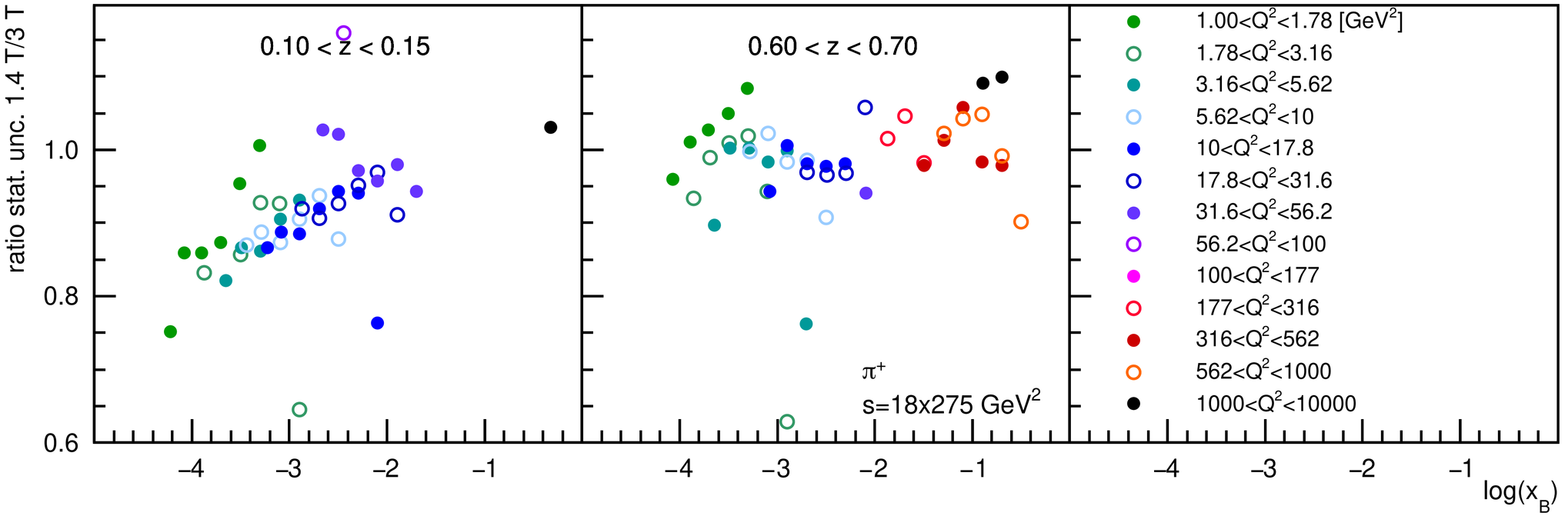
Influence of the magnetic field

- Kinematic coverage



Influence of the magnetic field

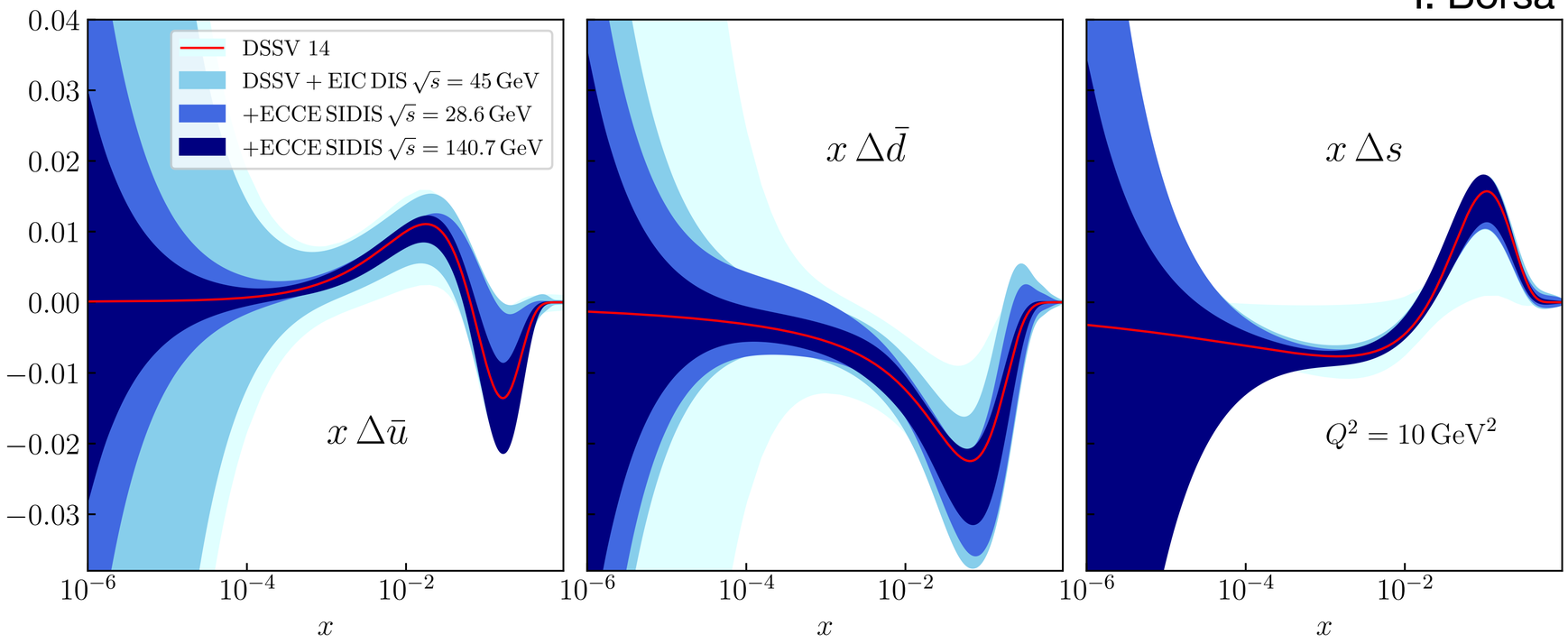
- Statistical uncertainty



Impact plots

Based on reweighing technique.

I. Borsa



Summary and conclusion for ECCE studies

- Proposed EIC detector appropriate for study of SIDIS and extraction of A_1 with broad kinematic coverage and good precision

- Lower magnetic field brings some advantage at low x_B but 1.4 T or 3.0 T both appropriate