Inclusive reactions update

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ECCE Bi-weekly Meeting
September 27, 2021

Summary of goals

Reconstruction studies

- Resolution of reconstruction methods vs. kinematics

Neutral-current studies for (p, D, 3He) × (5×41, 10×100, 18×275):

- Inclusive NC cross section
- Inclusive NC structure functions: F_2, F_L
- Double-spin (LL) asymmetries: A_1^p, $A_1^{^3He}$ (can then extract A_1^n)
- Double-spin (LT) asymmetry: $A_{LT}^p \propto g_T^p$

Charged-current studies for (p, D, 3He) × (5×41, 18×275):

- Inclusive CC cross section (and/or structure functions, time permitting)
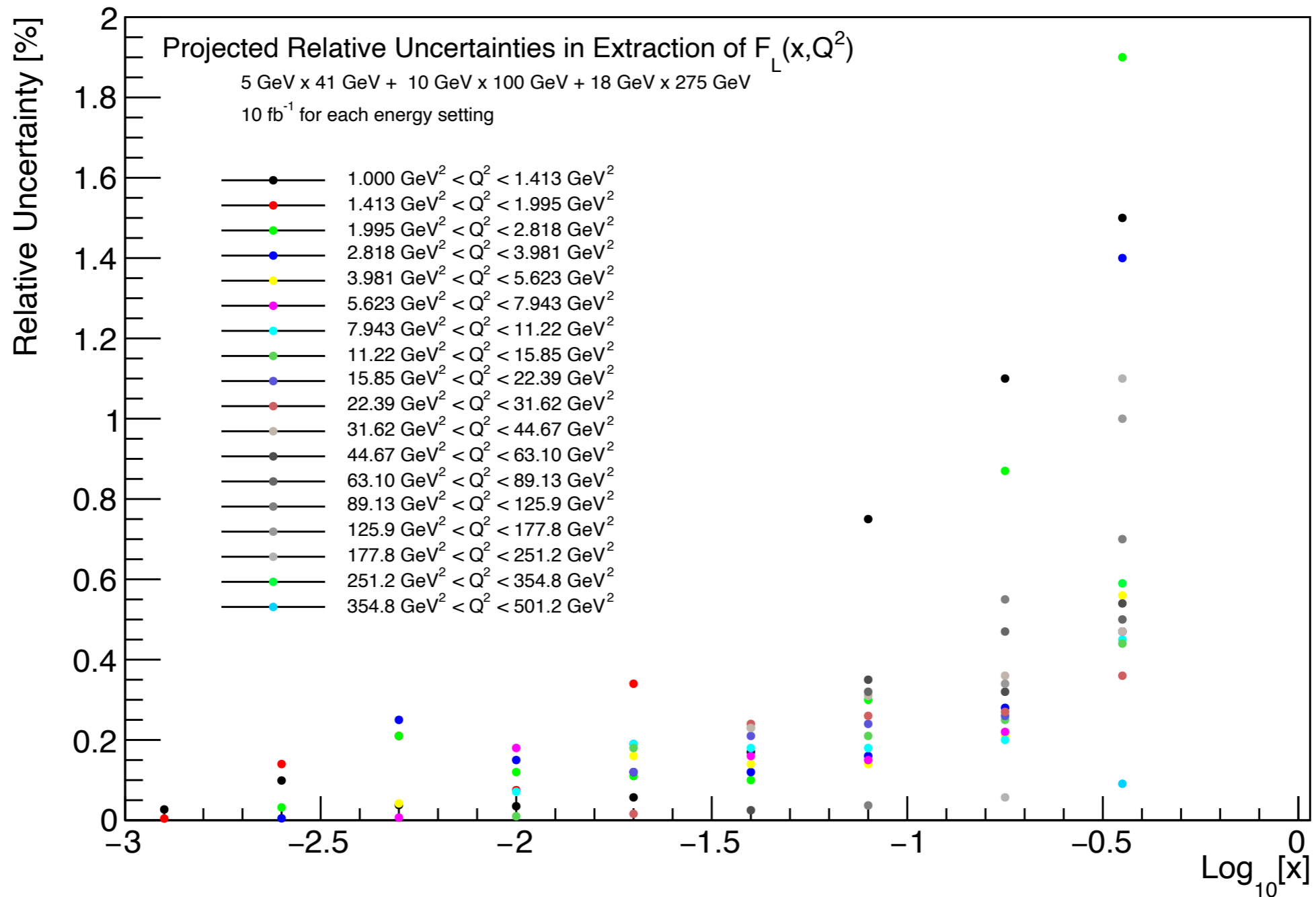
Reconstruction studies

prop.3.3
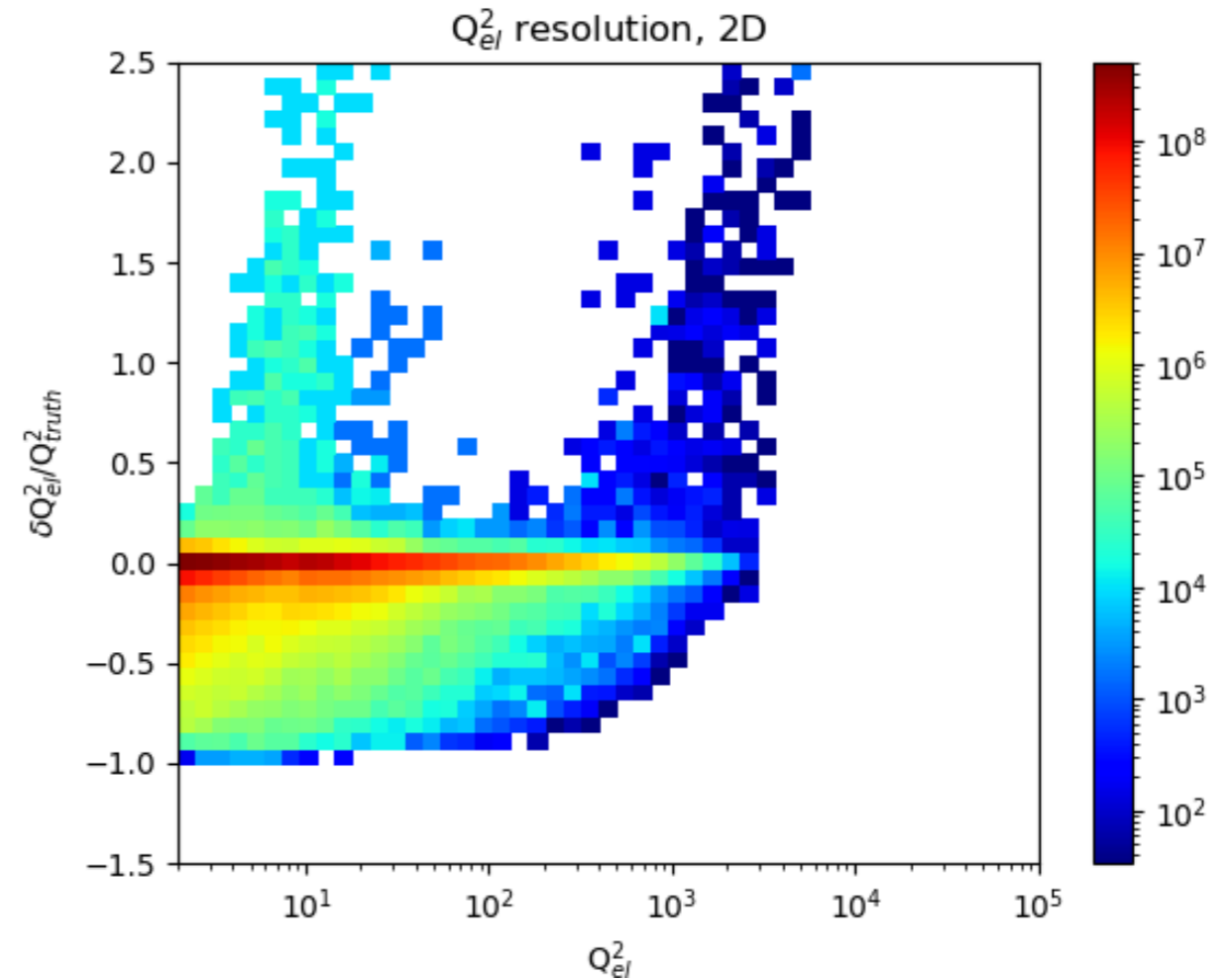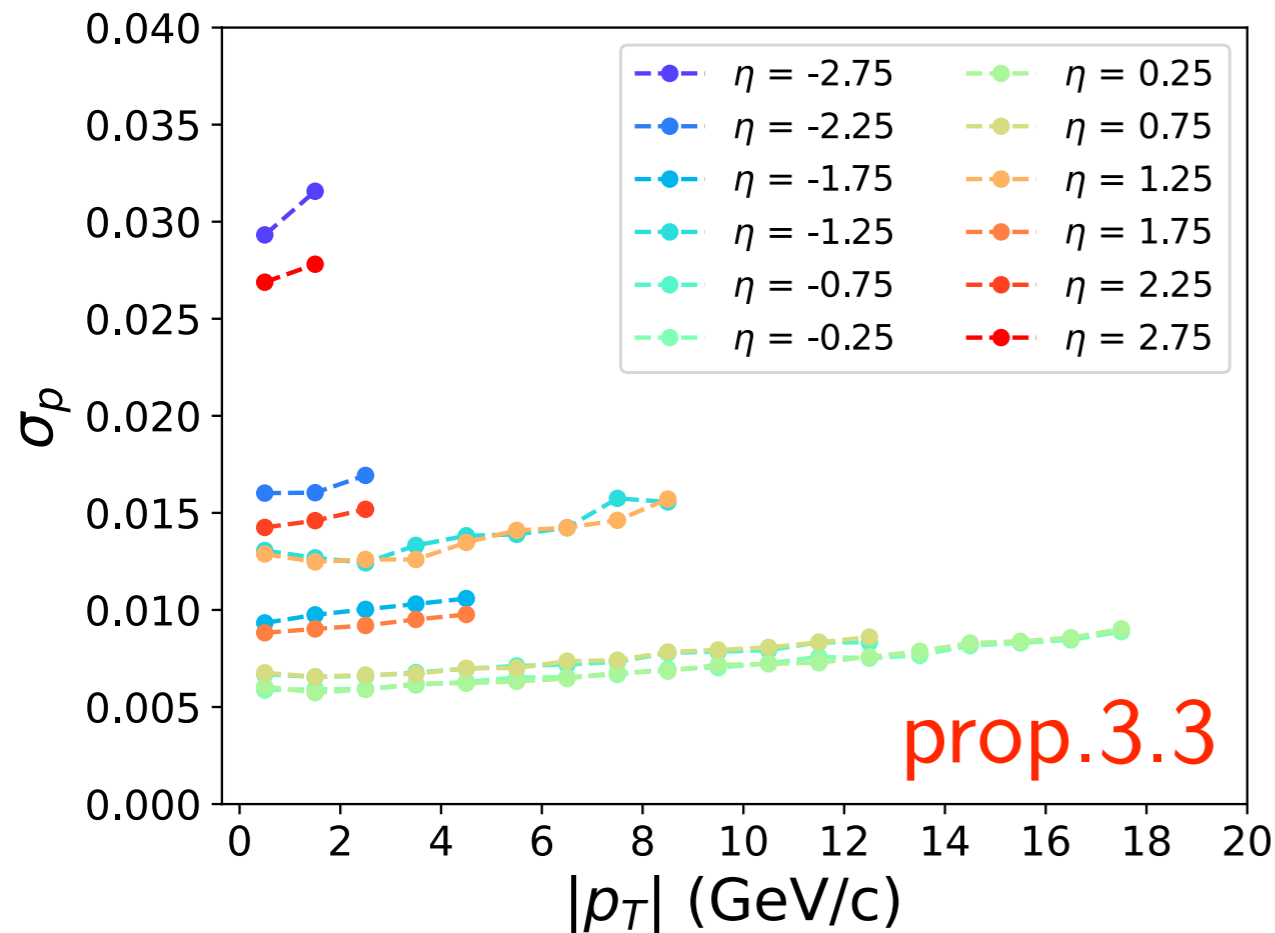
- Evaluate detector performance and determine final binning
- Provides resolution for fast-smearing for EW
- Currently looking at lepton reconstruction only
  - Developed reconstruction analysis module for fun4all
- Presently working on hadronic reconstruction (JB, DA, etc.) with results from second campaign

Inclusive neutral-current cross sections
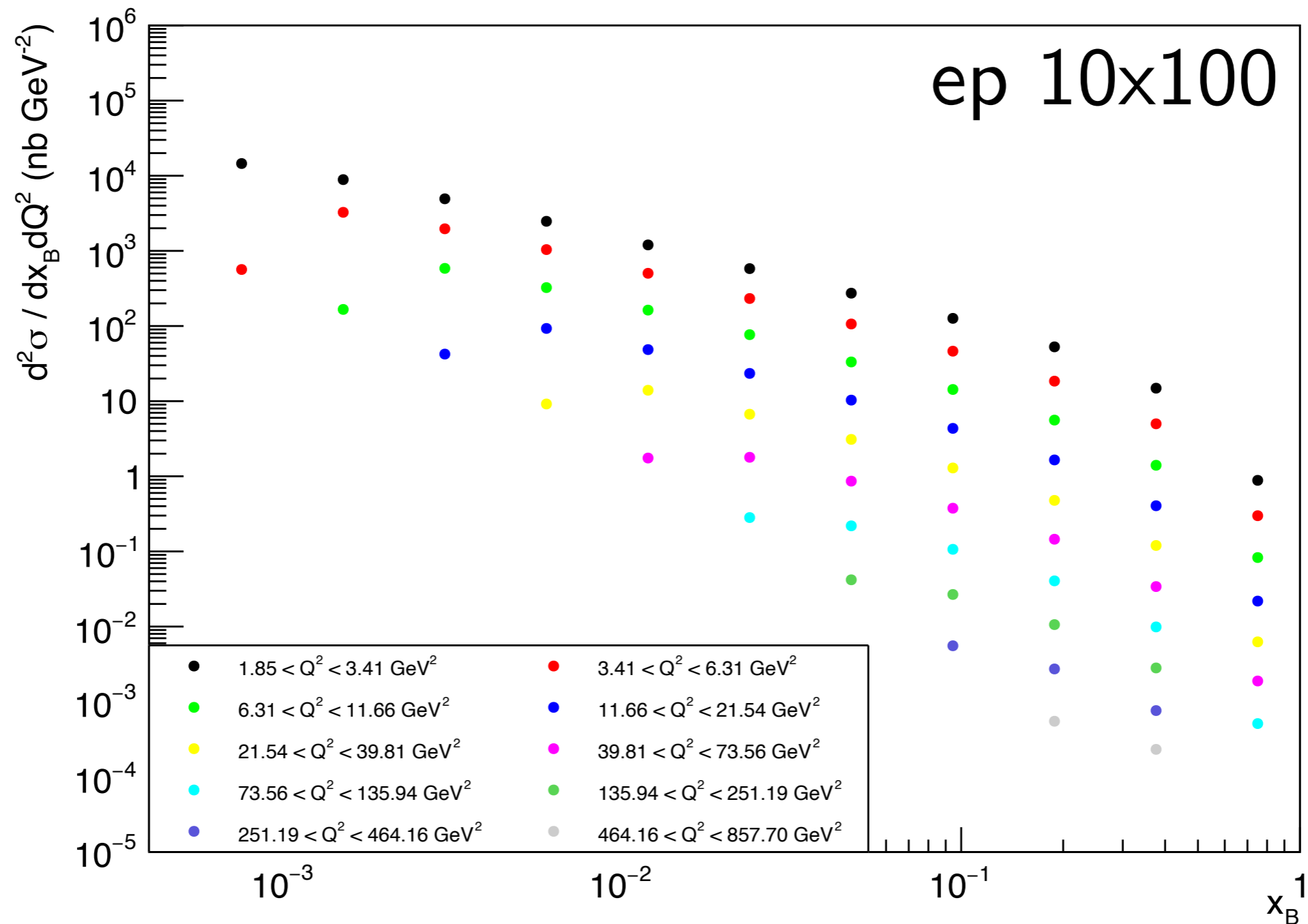
- Simultaneous extraction of F_2, F_L (assuming $F_3 = 0$)
- Use three beam energies: 5x41, 10x100, 18x275

Inclusive neutral-current structure functions

Projected Relative Uncertainties in Extraction of $F_L(x,Q^2)$

5 GeV x 41 GeV + 10 GeV x 100 GeV + 18 GeV x 275 GeV

10 fb^{-1} for each energy setting

Legend:
- $1.000 \text{ GeV}^2 < Q^2 < 1.413 \text{ GeV}^2$
- $1.413 \text{ GeV}^2 < Q^2 < 1.995 \text{ GeV}^2$
- $1.995 \text{ GeV}^2 < Q^2 < 2.818 \text{ GeV}^2$
- $2.818 \text{ GeV}^2 < Q^2 < 3.981 \text{ GeV}^2$
- $3.981 \text{ GeV}^2 < Q^2 < 5.623 \text{ GeV}^2$
- $5.623 \text{ GeV}^2 < Q^2 < 7.943 \text{ GeV}^2$
- $7.943 \text{ GeV}^2 < Q^2 < 11.22 \text{ GeV}^2$
- $11.22 \text{ GeV}^2 < Q^2 < 15.85 \text{ GeV}^2$
- $15.85 \text{ GeV}^2 < Q^2 < 22.39 \text{ GeV}^2$
- $22.39 \text{ GeV}^2 < Q^2 < 31.62 \text{ GeV}^2$
- $31.62 \text{ GeV}^2 < Q^2 < 44.67 \text{ GeV}^2$
- $44.67 \text{ GeV}^2 < Q^2 < 63.10 \text{ GeV}^2$
- $63.10 \text{ GeV}^2 < Q^2 < 89.13 \text{ GeV}^2$
- $89.13 \text{ GeV}^2 < Q^2 < 125.9 \text{ GeV}^2$
- $125.9 \text{ GeV}^2 < Q^2 < 177.8 \text{ GeV}^2$
- $177.8 \text{ GeV}^2 < Q^2 < 251.2 \text{ GeV}^2$
- $251.2 \text{ GeV}^2 < Q^2 < 354.8 \text{ GeV}^2$
- $354.8 \text{ GeV}^2 < Q^2 < 501.2 \text{ GeV}^2$

Y-axis: Relative Uncertainty [%]

X-axis: $\text{Log}_{10}[x]$

- Simultaneous extraction of F_2, F_L (assuming $F_3 = 0$)
- Use three beam energies: 5x41, 10x100, 18x275

Double-spin asymmetries A_{LL}
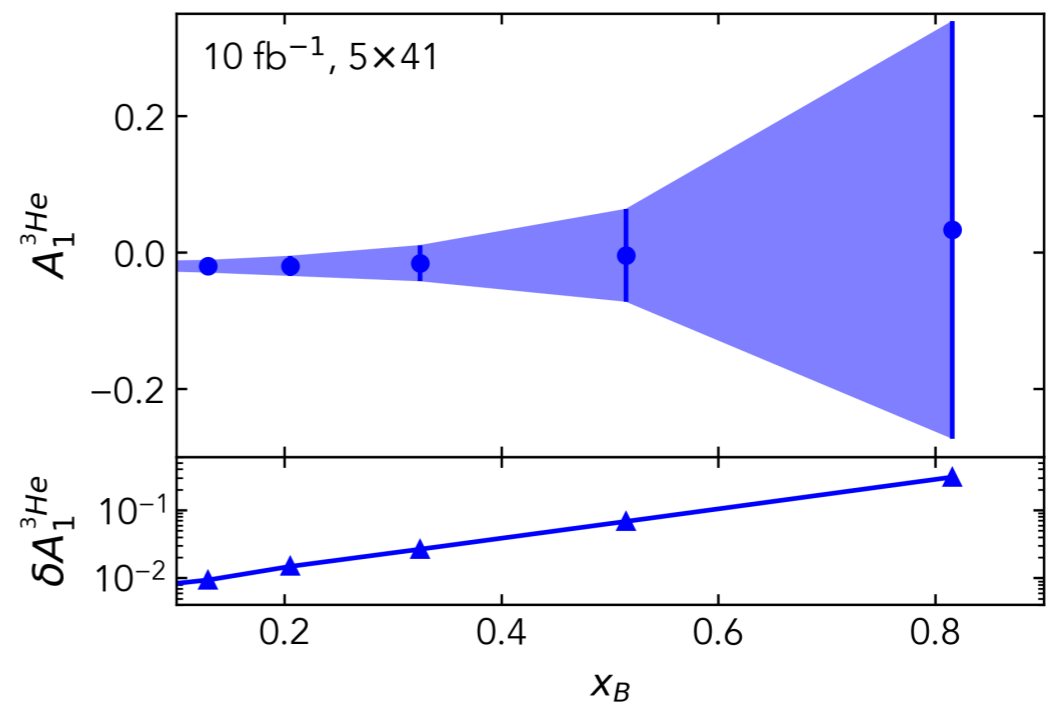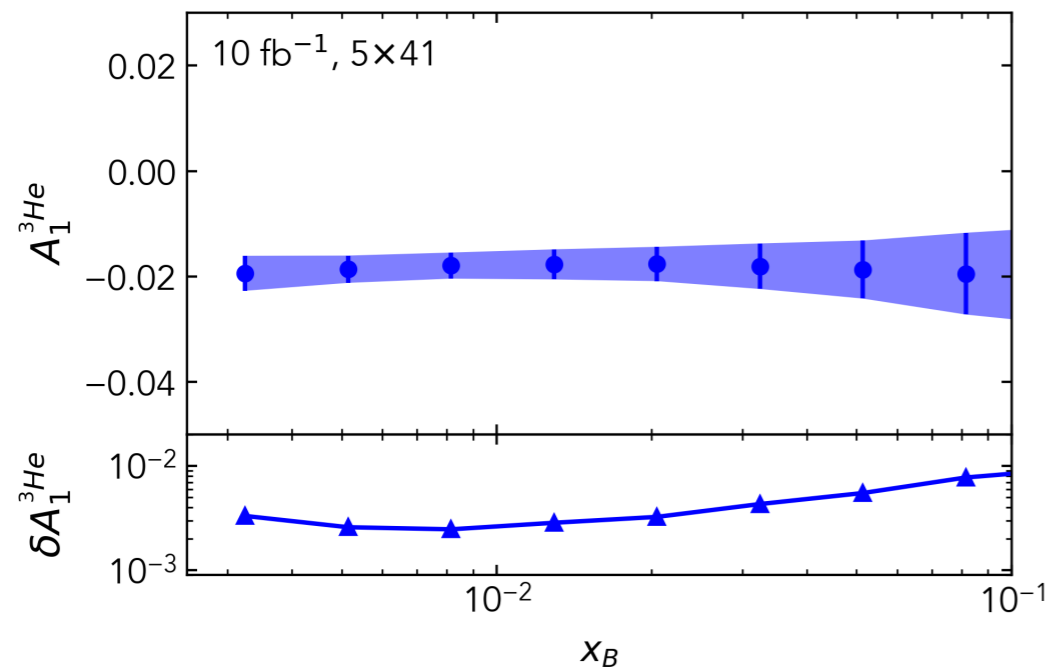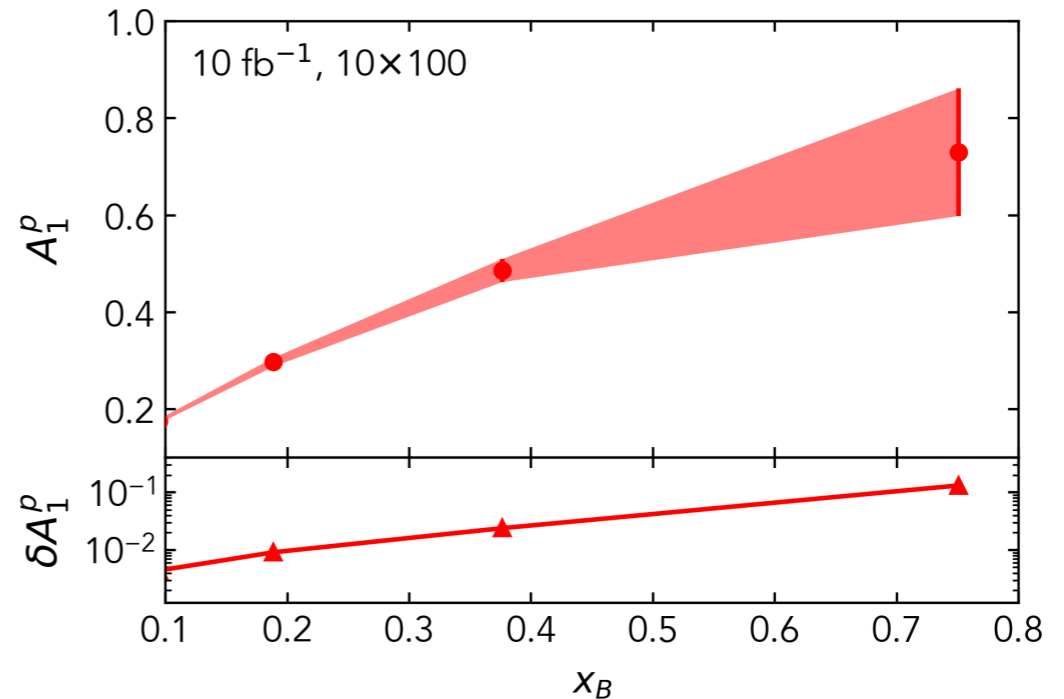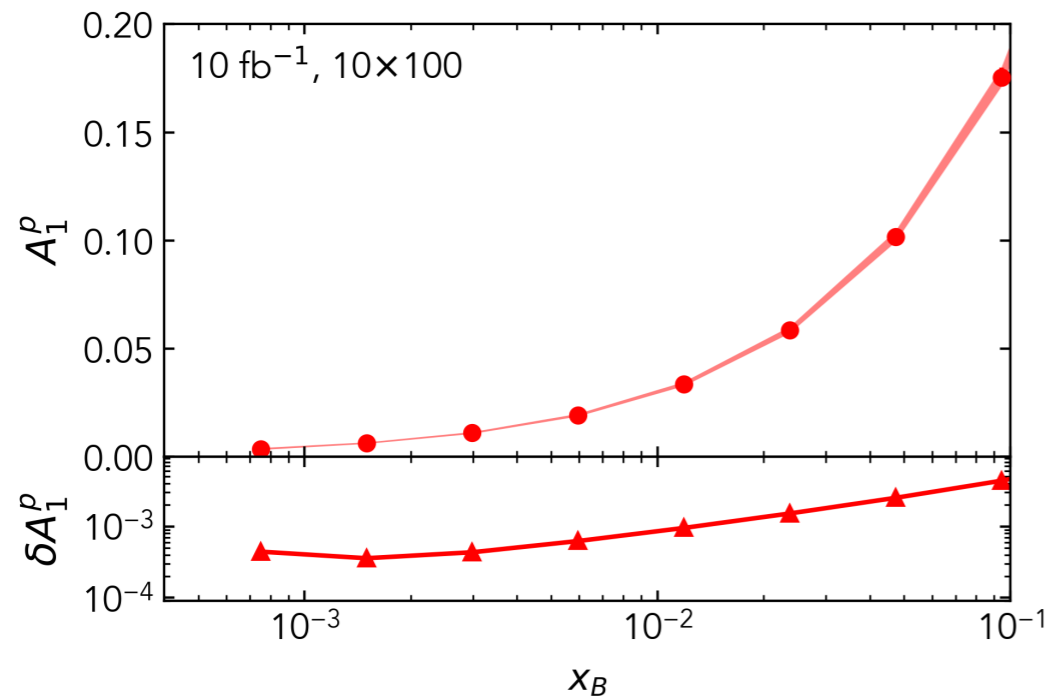
- Currently working on extracting A_1^n from proton, helium-3

Double-spin asymmetry A_{LT}^p

- Projected statistical uncertainties the same as A_{LL}

- Possible difference in systematic uncertainties due to transverse vs. longitudinal polarization of proton beam

- Need model of A_{LT}^p (or g_T^p) for central value

Top to-do items

- Hadronic reconstruction study

    - CC cross sections

    - Improved resolution for NC cross sections

- Evaluate systematics

- Finalize E/p cut for ePID

- Model for F_L and A_{LT}^p (or g_T^p)

- Implement plotting macro

- Impact studies

    - Can handle unpolarized PDF impact (Claire)

    - Need theorists for polarized PDF impact

Summary

- Developed framework for many observables...can simply update as results are improved/finalized

- Have some key to-dos to get final plots