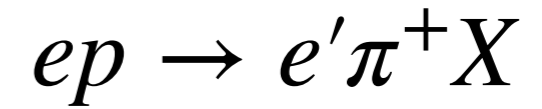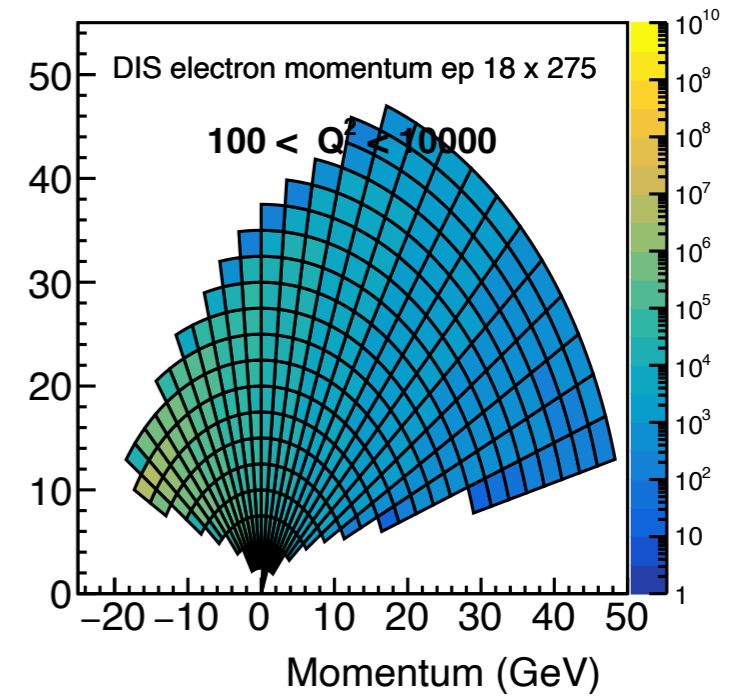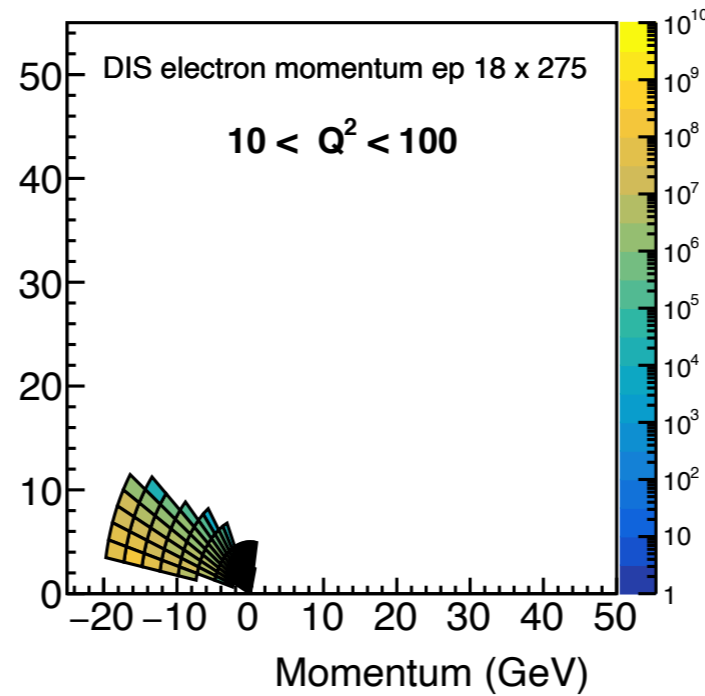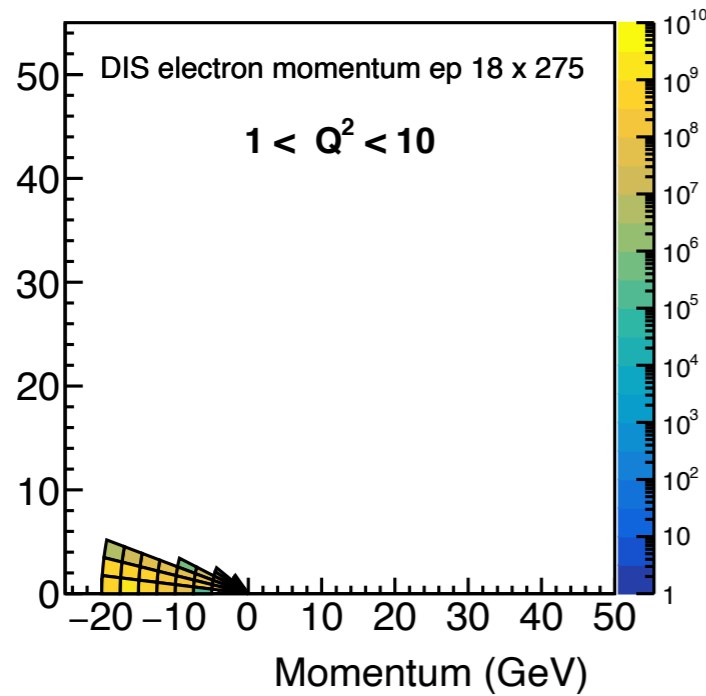# PWG requirements: Semi-Inclusive WG

Ralf Seidl (RIKEN), Justin Stevens (William & Mary), Alexey Vladimirov (Regensburg), Anselm Vossen (Duke), Bowen Xiao (Central Normal University)
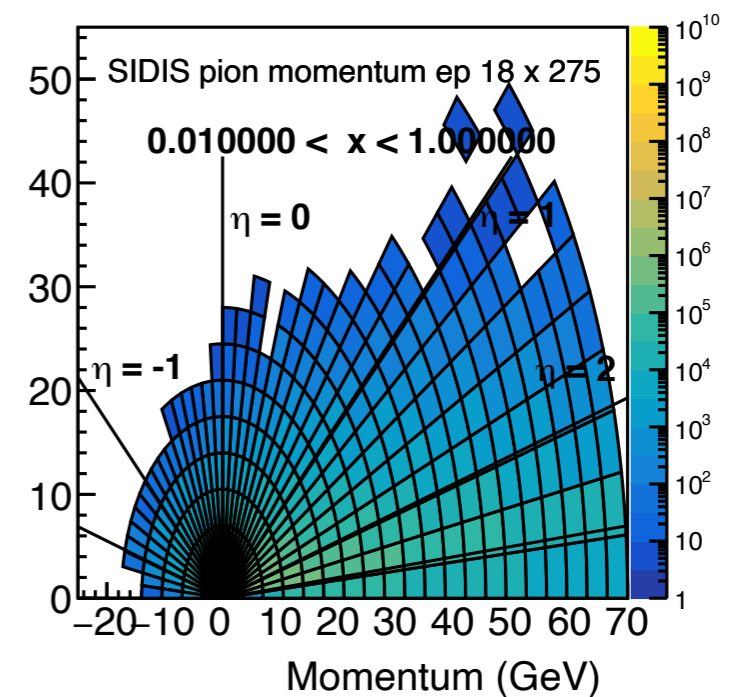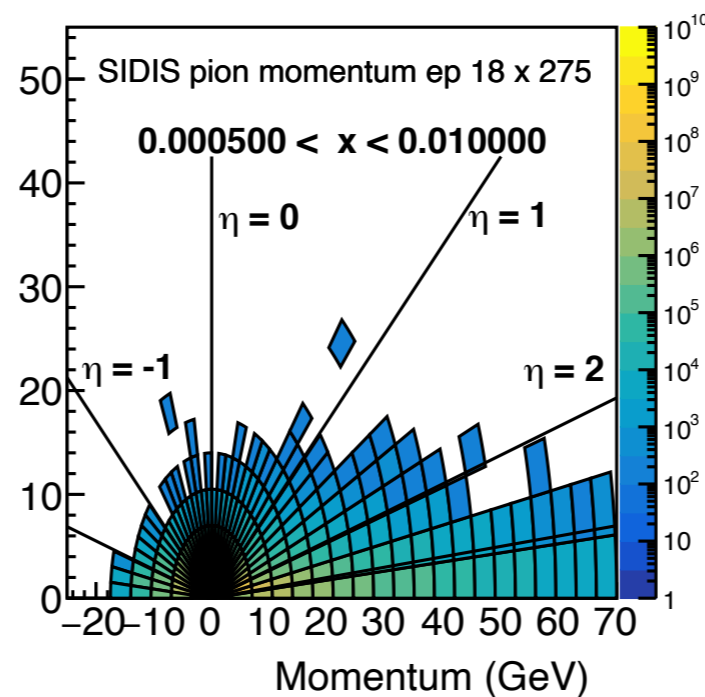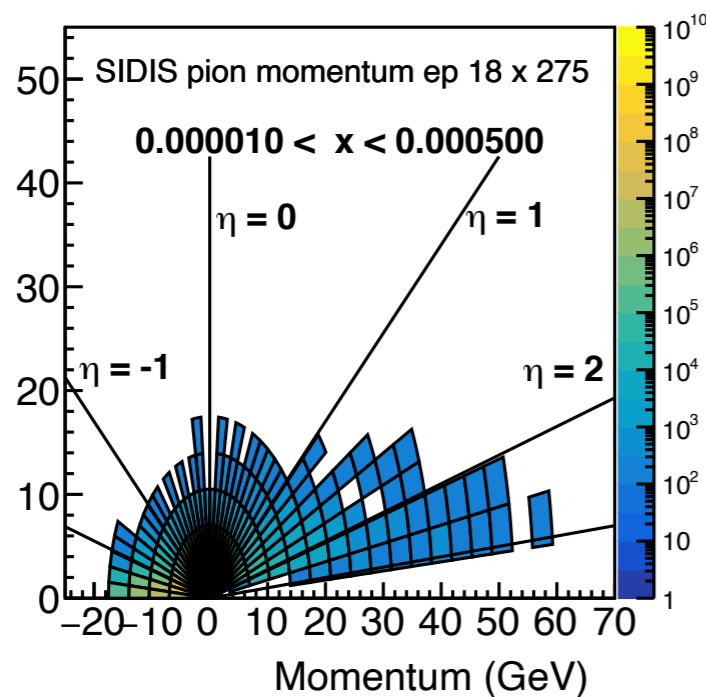
SIDIS kinematics

$$ep \rightarrow e'\pi^+X$$

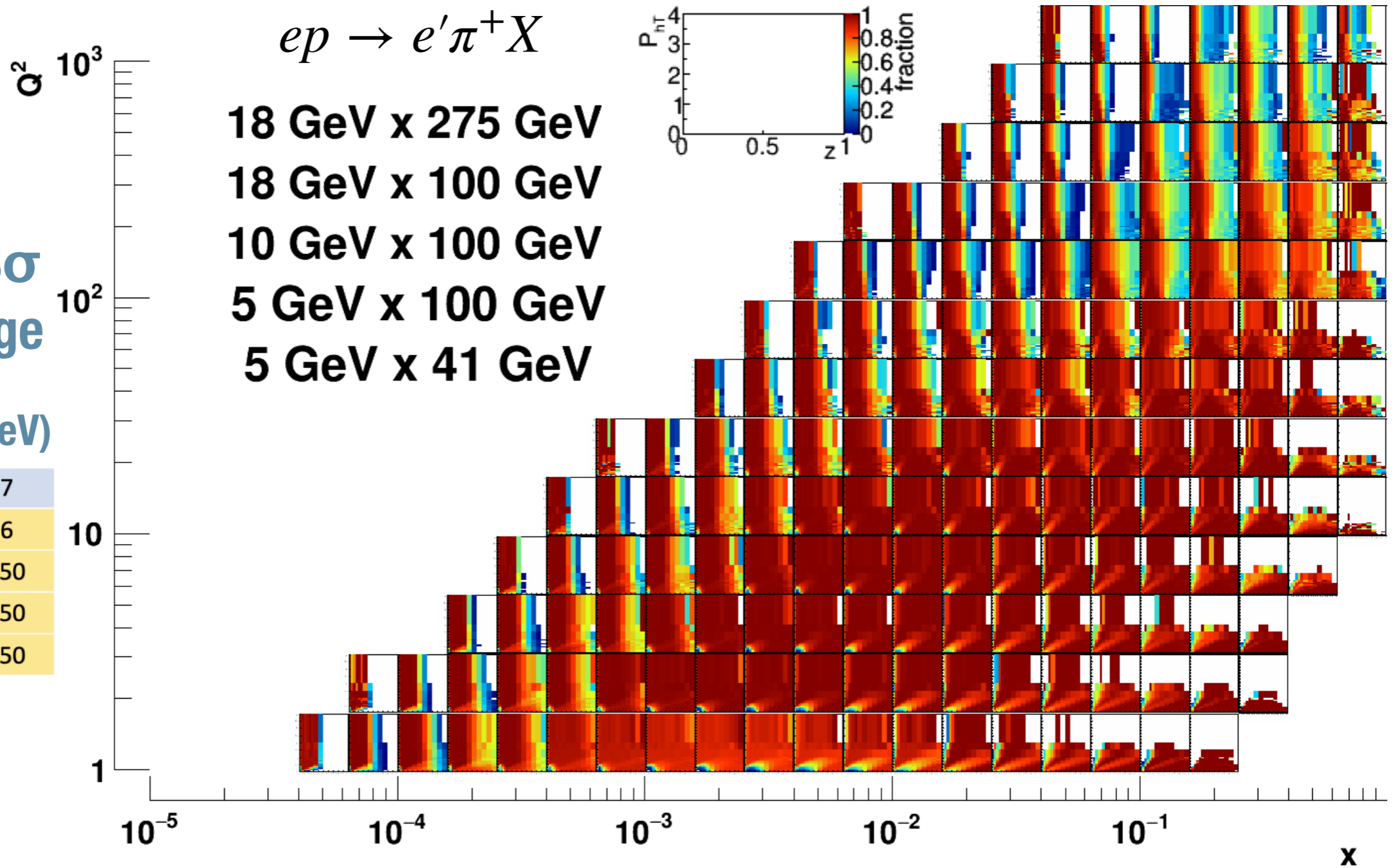## Electron Kinematics

Hadron Kinematics

Hadron PID impacts on TMDs

$$ep \rightarrow e'\pi^+ X$$

18 GeV x 275 GeV

18 GeV x 100 GeV

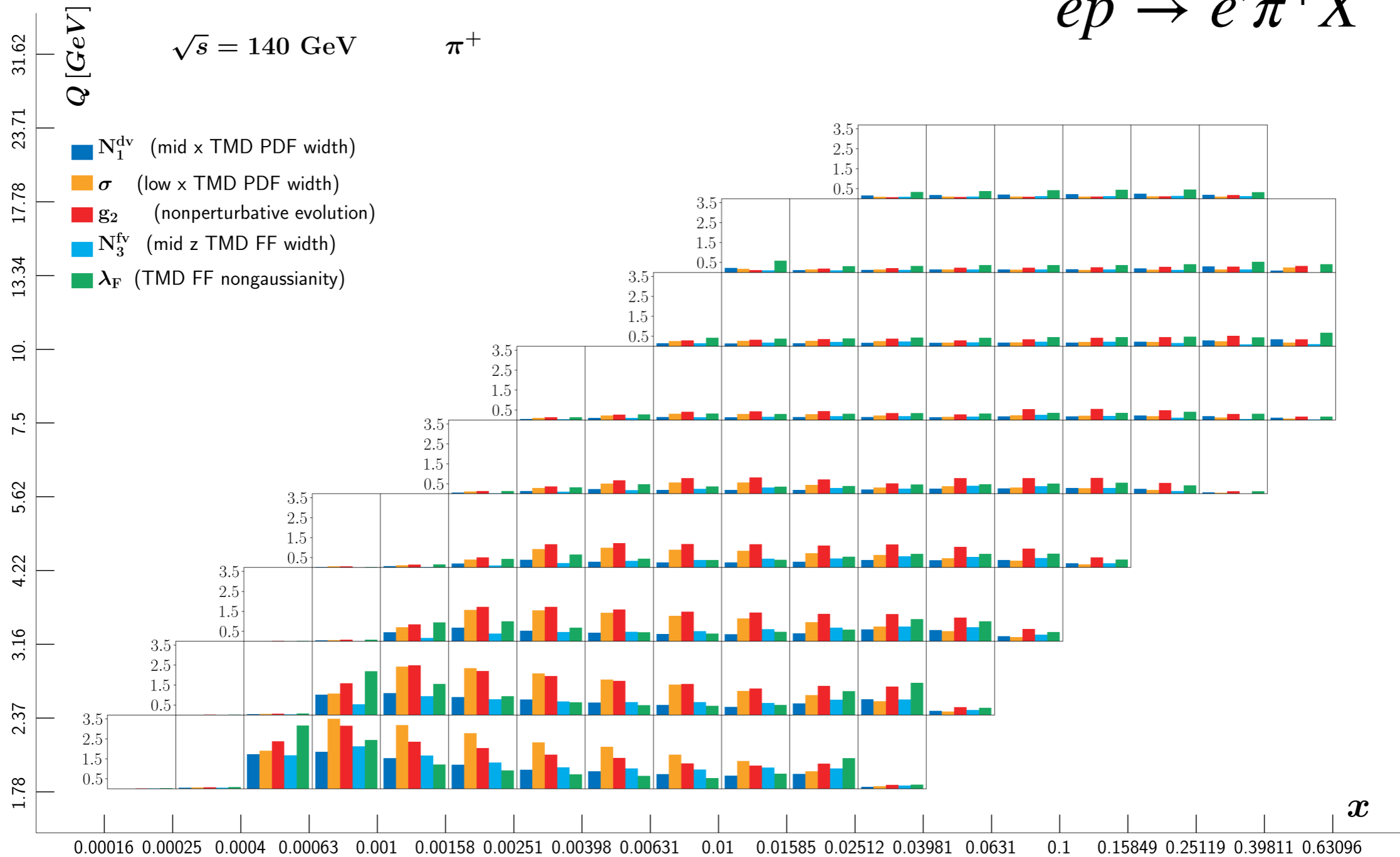10 GeV x 100 GeV

5 GeV x 100 GeV

5 GeV x 41 GeV

Assumed 3σ PID coverage

η	p (GeV)
-3.5 - -1.0	0.2 - 7
-1.0 - 1.0	0.2 - 6
1.0 - 2.0	0.2 − 50
2.0 - 3.0	0.5 − 50
3.0 - 3.5	0.5 − 50

* High-z/p_T limited in some cases by barrel PID p < 6 GeV

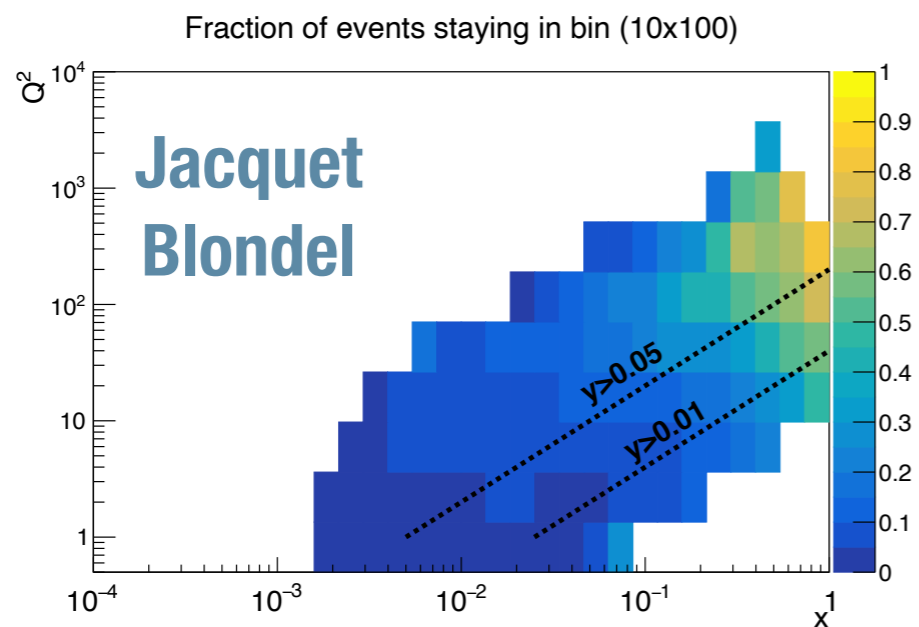* Impact at intermediate x-Q^2 compensated by different beam energies, when using existing models for TMD extraction

Hadron PID impacts on TMDs

$$ep \rightarrow e'\pi^+ X$$

$\sqrt{s} = 140$ GeV $\qquad \pi^+$

- N_1^{dv} (mid x TMD PDF width)
- σ (low x TMD PDF width)
- g_2 (nonperturbative evolution)
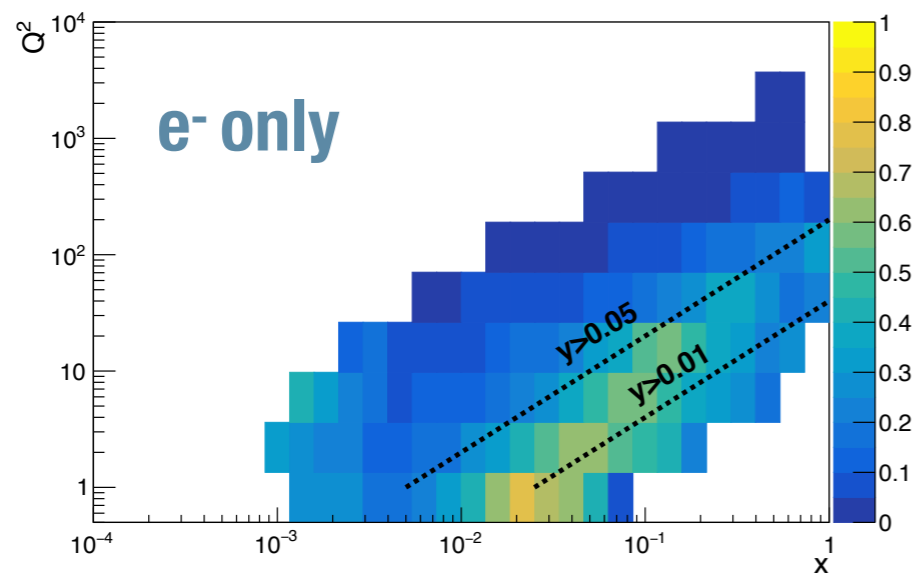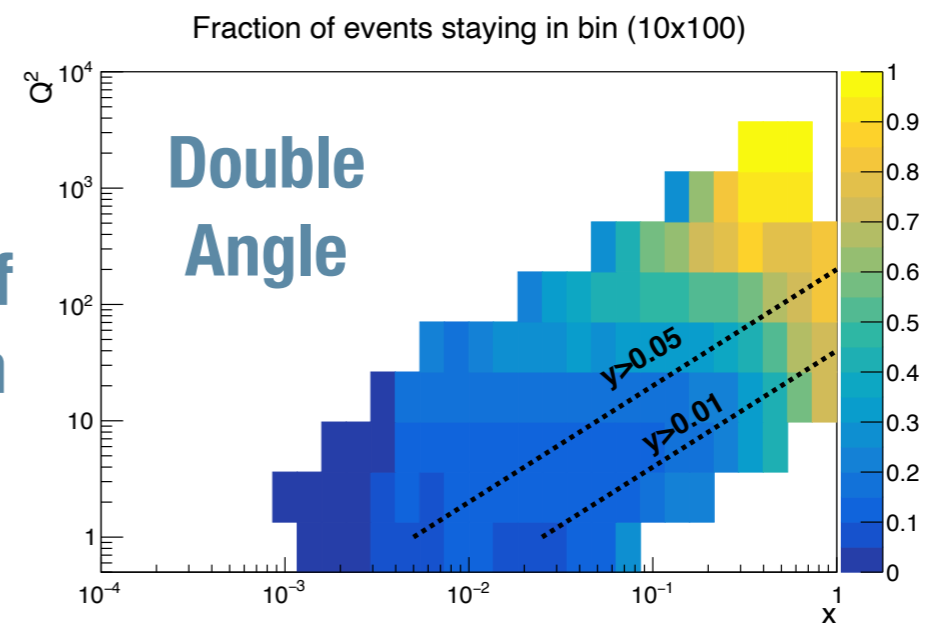- N_3^{fv} (mid z TMD FF width)
- λ_F (TMD FF nongaussianity)

✳ Impact studies by multiple groups: identify which regions are critical for PDF, FF and evolution parameters

Hadronic final state requirements
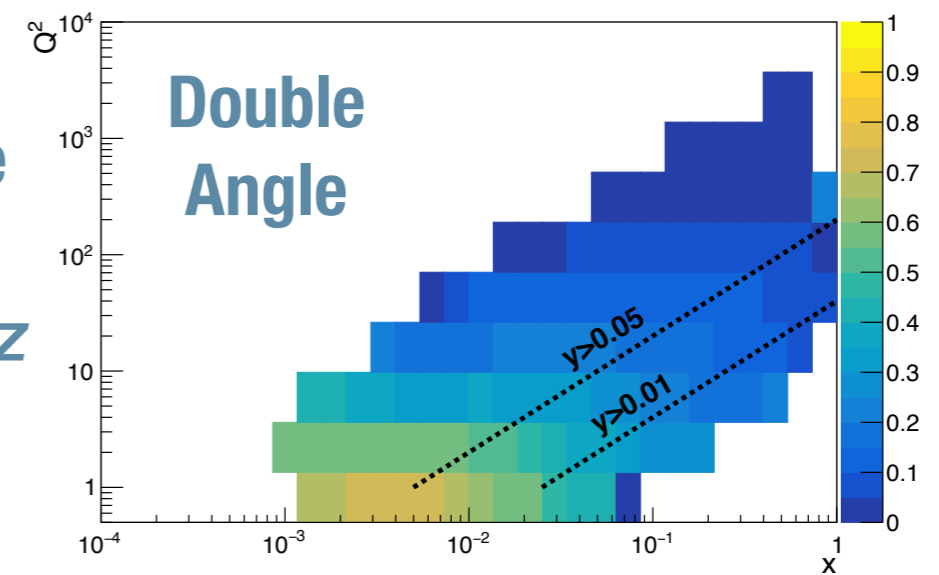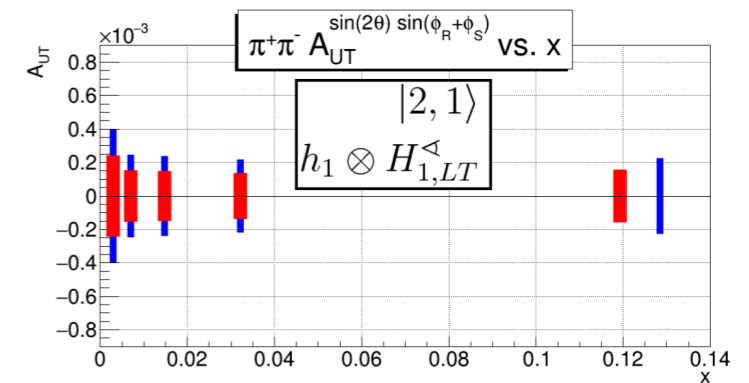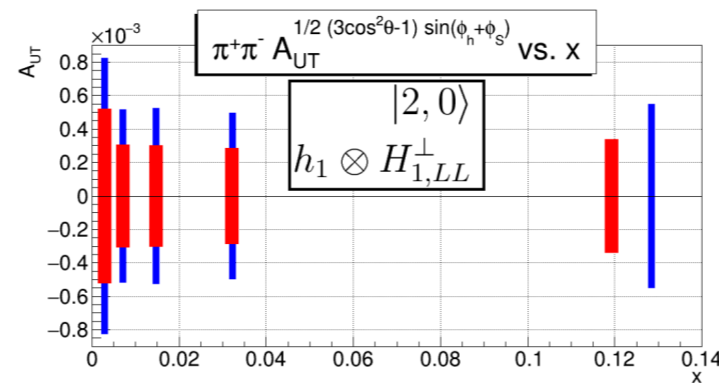

Fraction of events staying in bin (10x100)

Jacquet Blondel

Double Angle
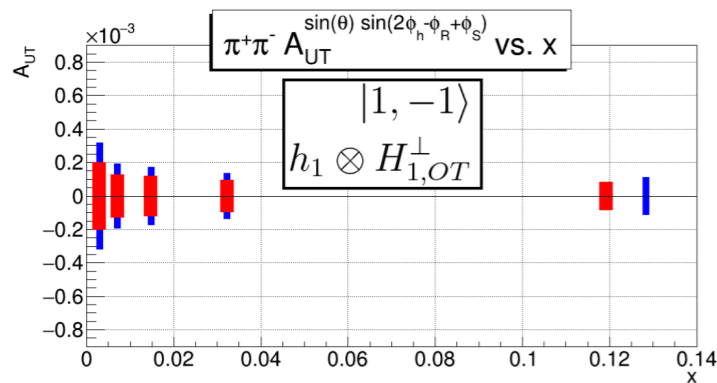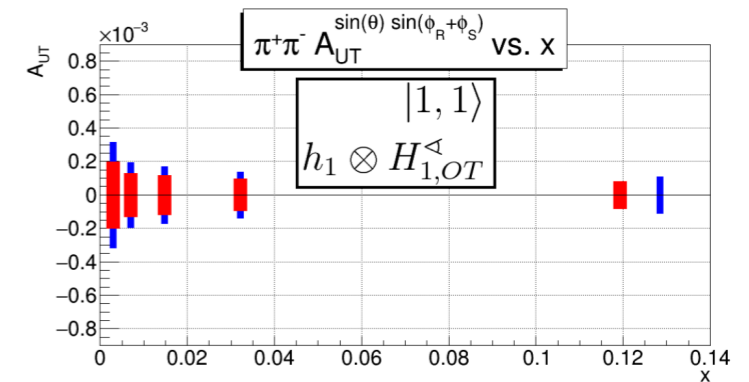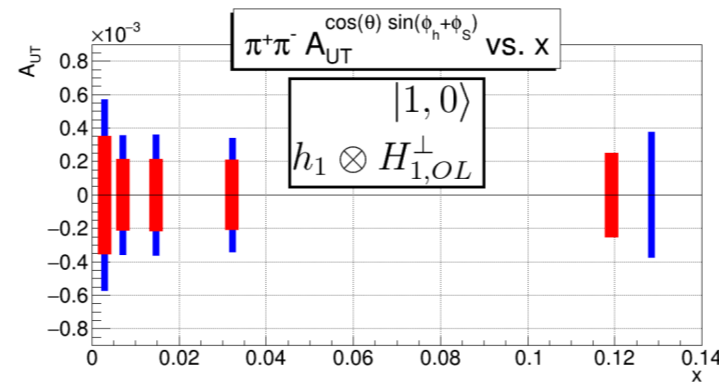
Purity of x-Q² bin

e⁻ only

Double Angle

Relative error in hadron z

✳ Similar requirements as inclusive group on coverage for hadronic final state |η| < 3.5
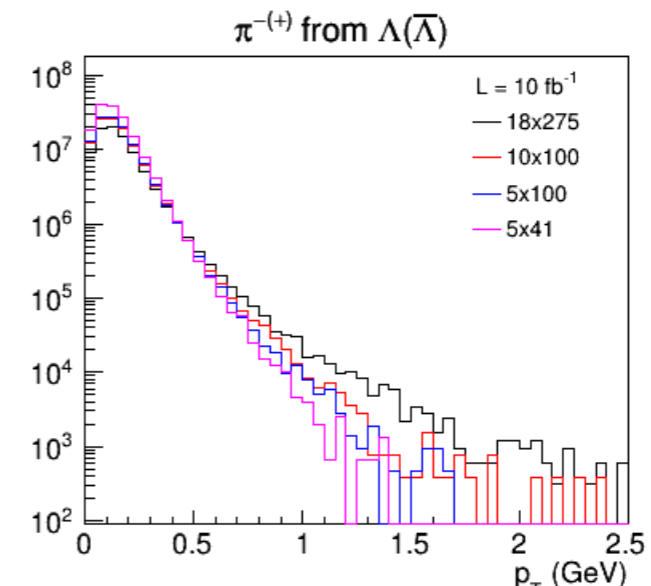
Di-hadron detector requirements
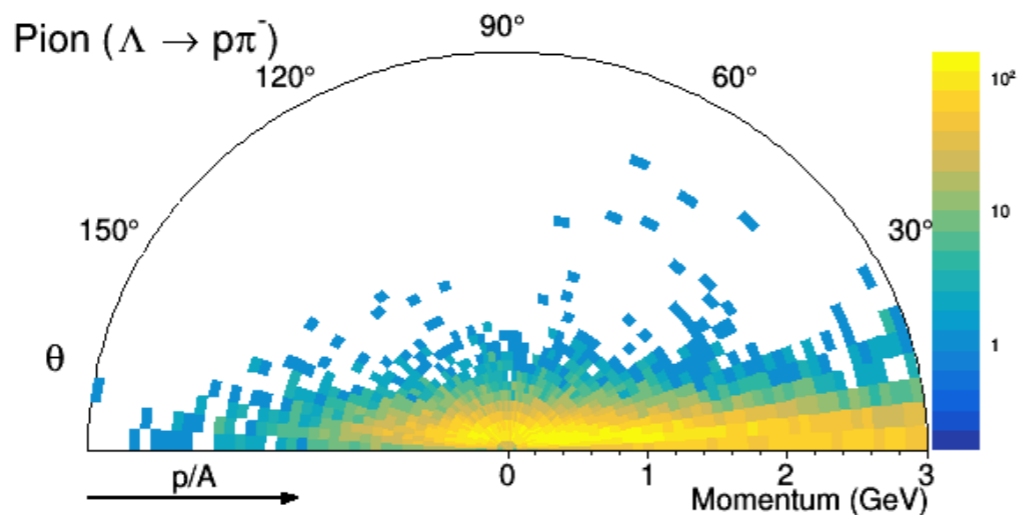
$$ep \rightarrow e'\pi^+\pi^- X$$
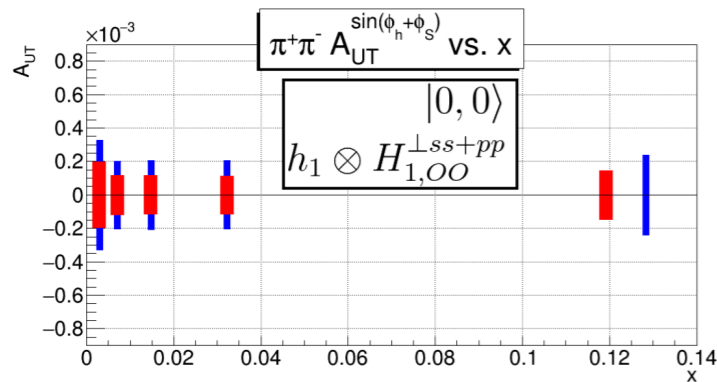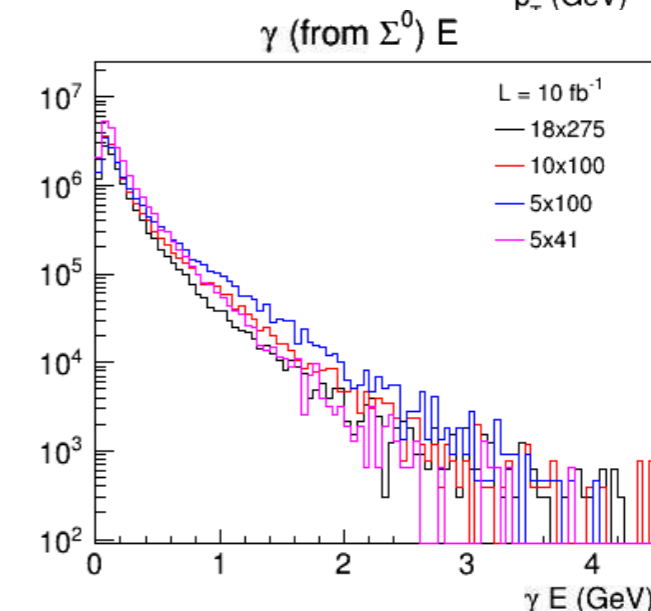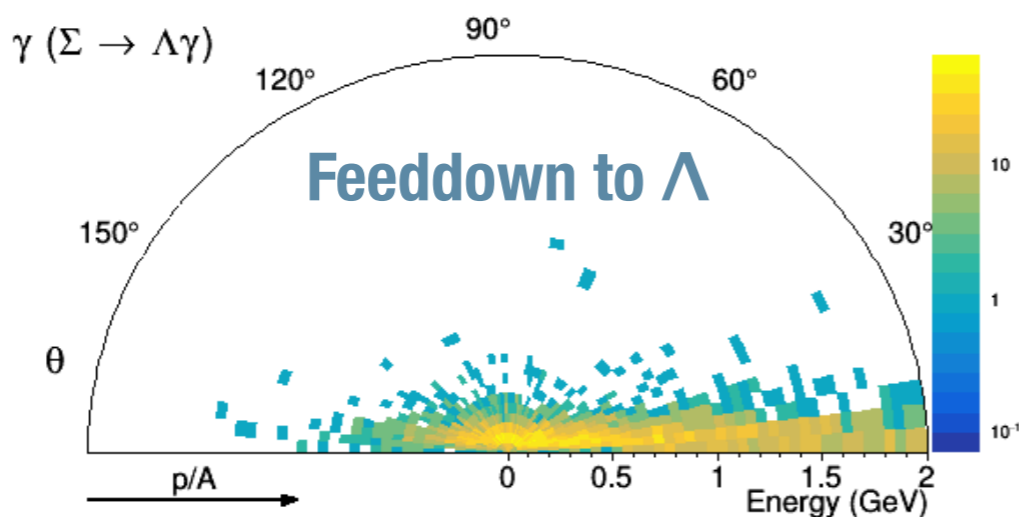

* ✳ Track minimum p_T: 100 MeV and 300 MeV does not significantly impact projected uncertainties

* ✳ PID similar to single hadrons: primarily in central barrel where 3σ π/K separation provides 95% purity for all ππ, πK, and KK di-hadron pairs

Λ detector requirements

$$ep \rightarrow e'\Lambda X$$

18x275 GeV

* Minimum $p_T^{\pi+}$ of 100 MeV needed for efficient Λ detection

* Σ feeddown rejection requires detection of $E_\gamma > 200$ MeV for η < 3 and $E_\gamma > 400$ MeV for η > 3
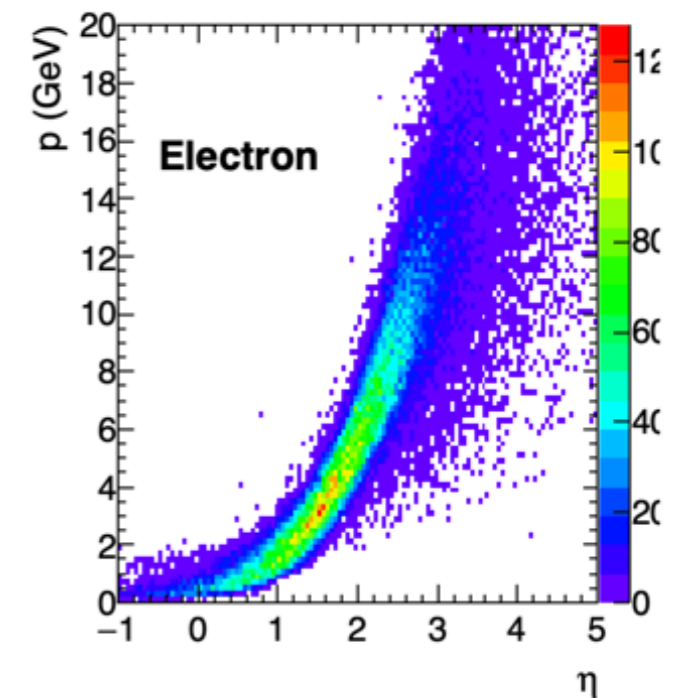
Spectroscopy e/π requirements

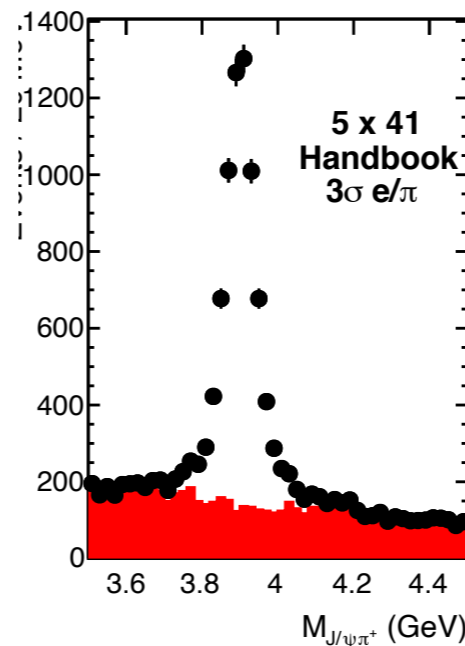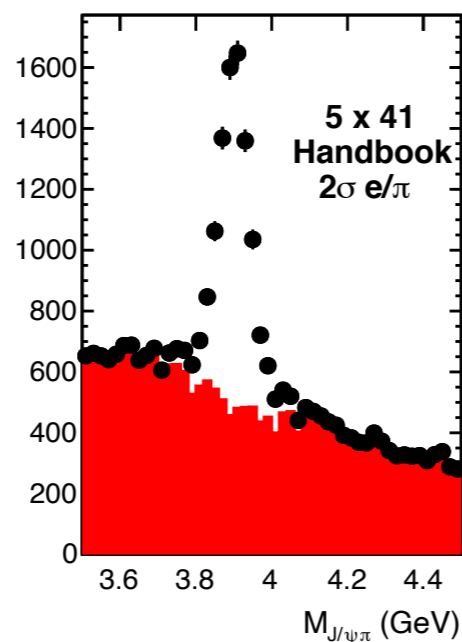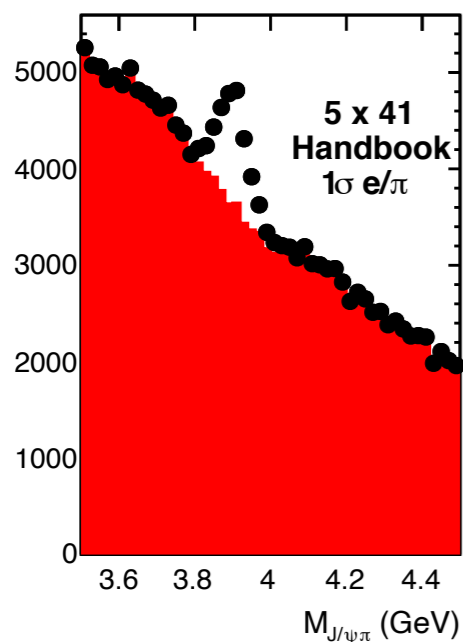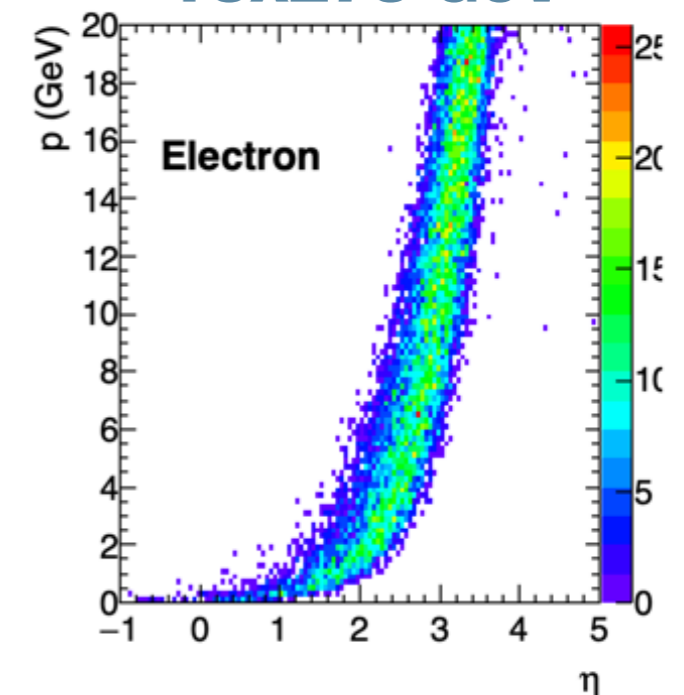$$\gamma p \rightarrow Z_c^+ n, \quad Z_c^+ \rightarrow J/\psi \pi^+$$

$$J/\psi \rightarrow e^+ e^-$$

✳ Direct photoproduction of charged charmonium Z_c and other exotics

✳ Central detector η < 3.5 coverage → larger acceptance at lower energies

✳ e/π separation for η > 1 required to achieve desired purity

5x41 GeV

18x275 GeV

5 x 41
Handbook
1σ e/π

5 x 41
Handbook
2σ e/π

5 x 41
Handbook
3σ e/π

Summary

* Many impact studies performed for SIDIS and di-hadron with smeared simulations using existing detector matrix

    * Helicity PDFs, TMDs, FFs, Transversity, etc.

* PID requirements driven by single and di-hadron SIDIS (π/K/p) and spectroscopy (e/π)

* Requirements on low momentum track and photon thresholds driven by Λ reconstruction

* More details provided in YR draft Section 8.2

* Thanks to all who contributed to the SIDIS WG effort!