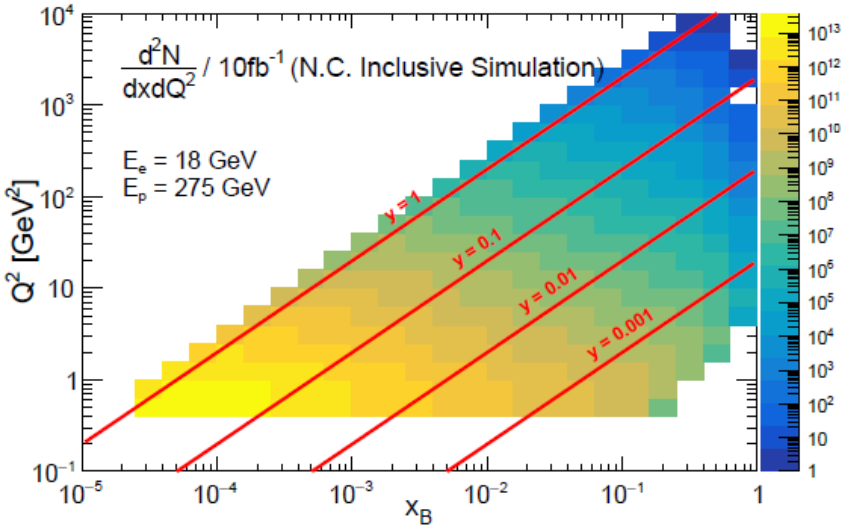
Requirements from the Inclusive Reactions Group

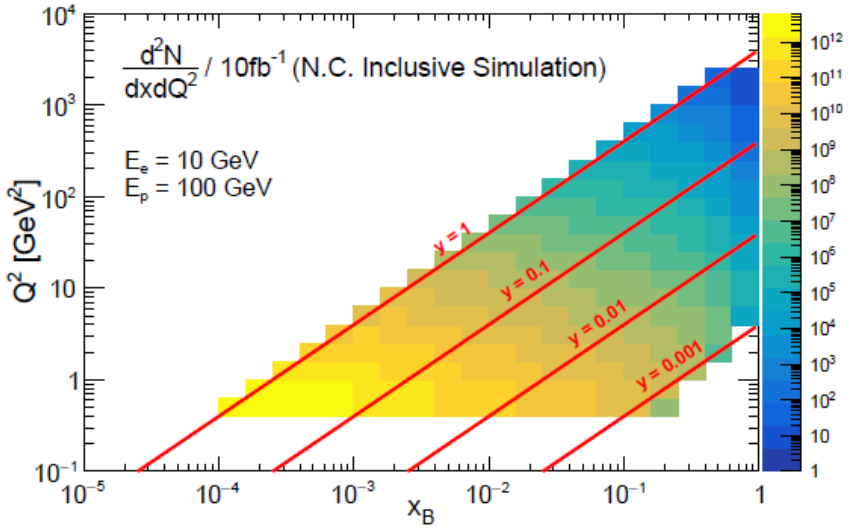
Renee Fatemi, Nobuo Sato and Barak Schmookler

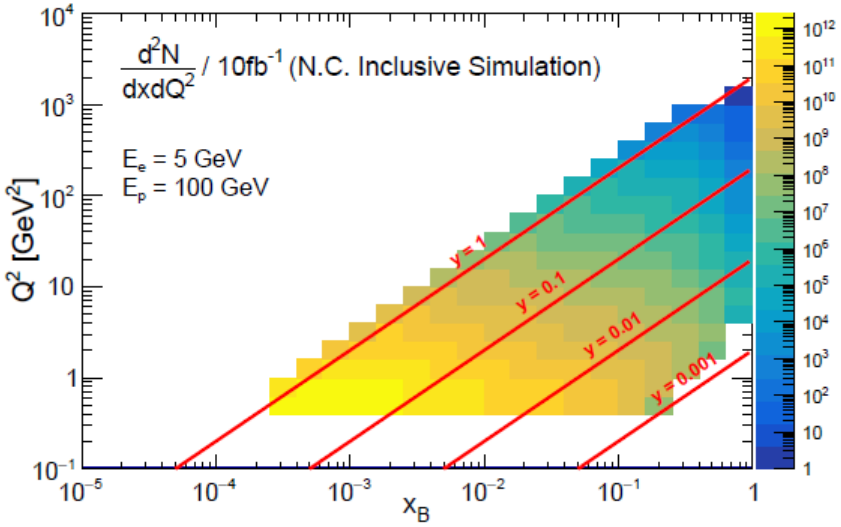
Contributions from the Inclusive Group

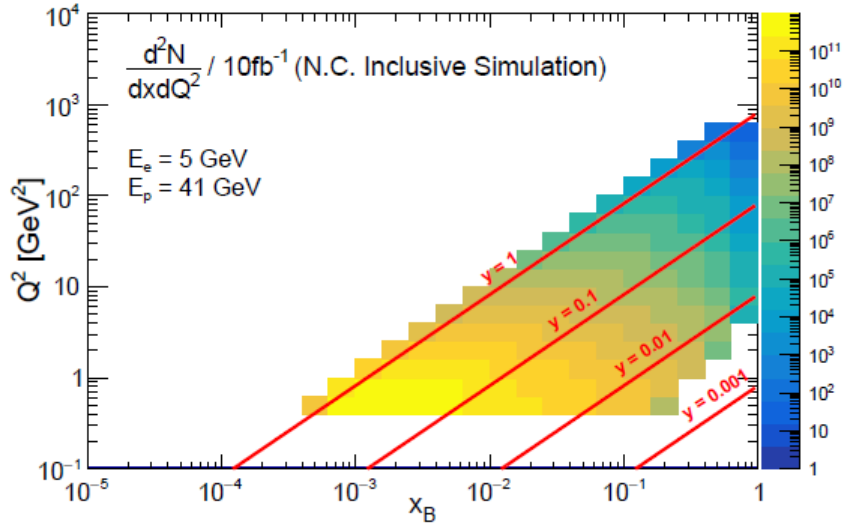
Detector requirements from the Inclusive Group

N.C. Kinematic Phase Space and Yields

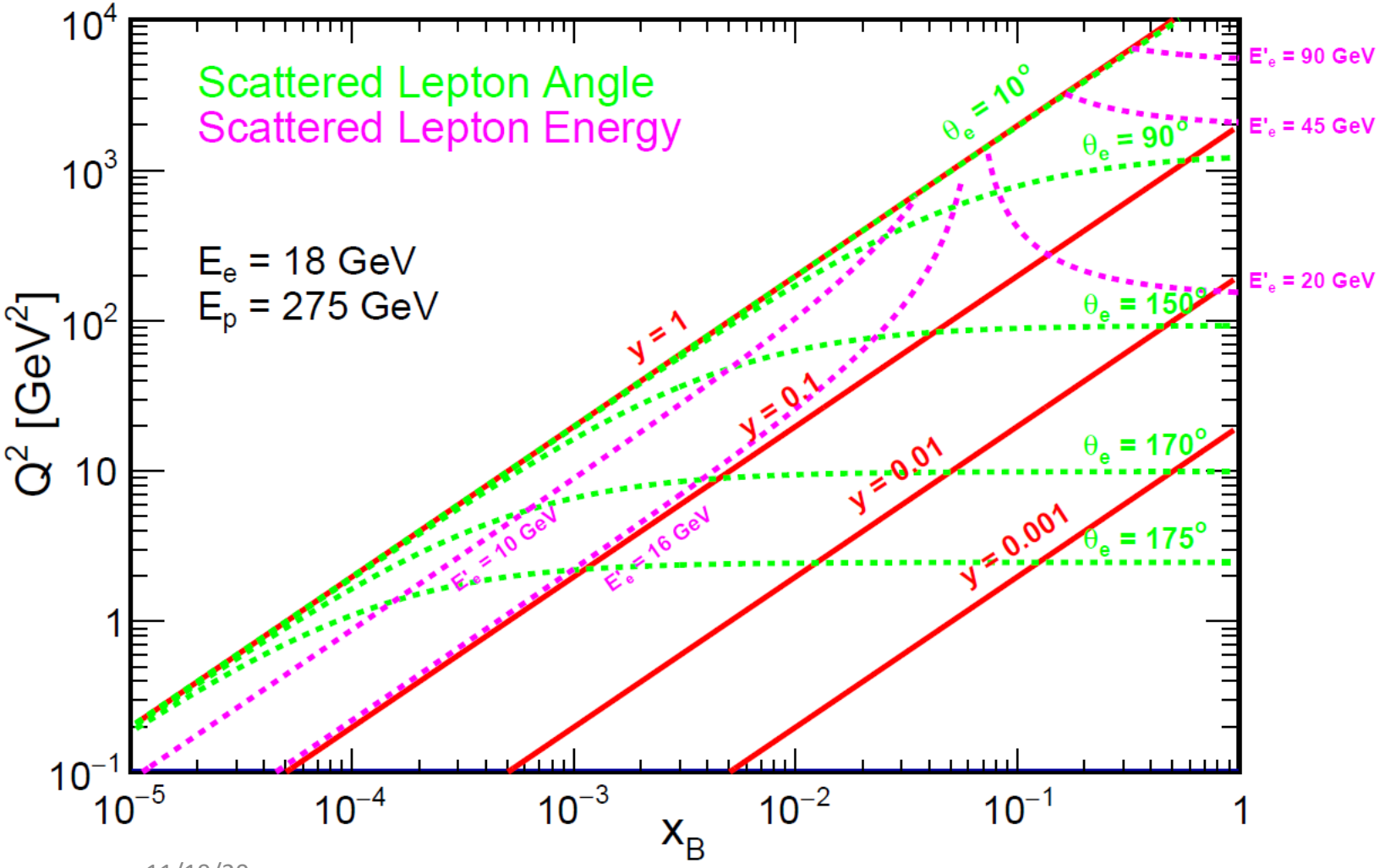








Scattered Electron Kinematics

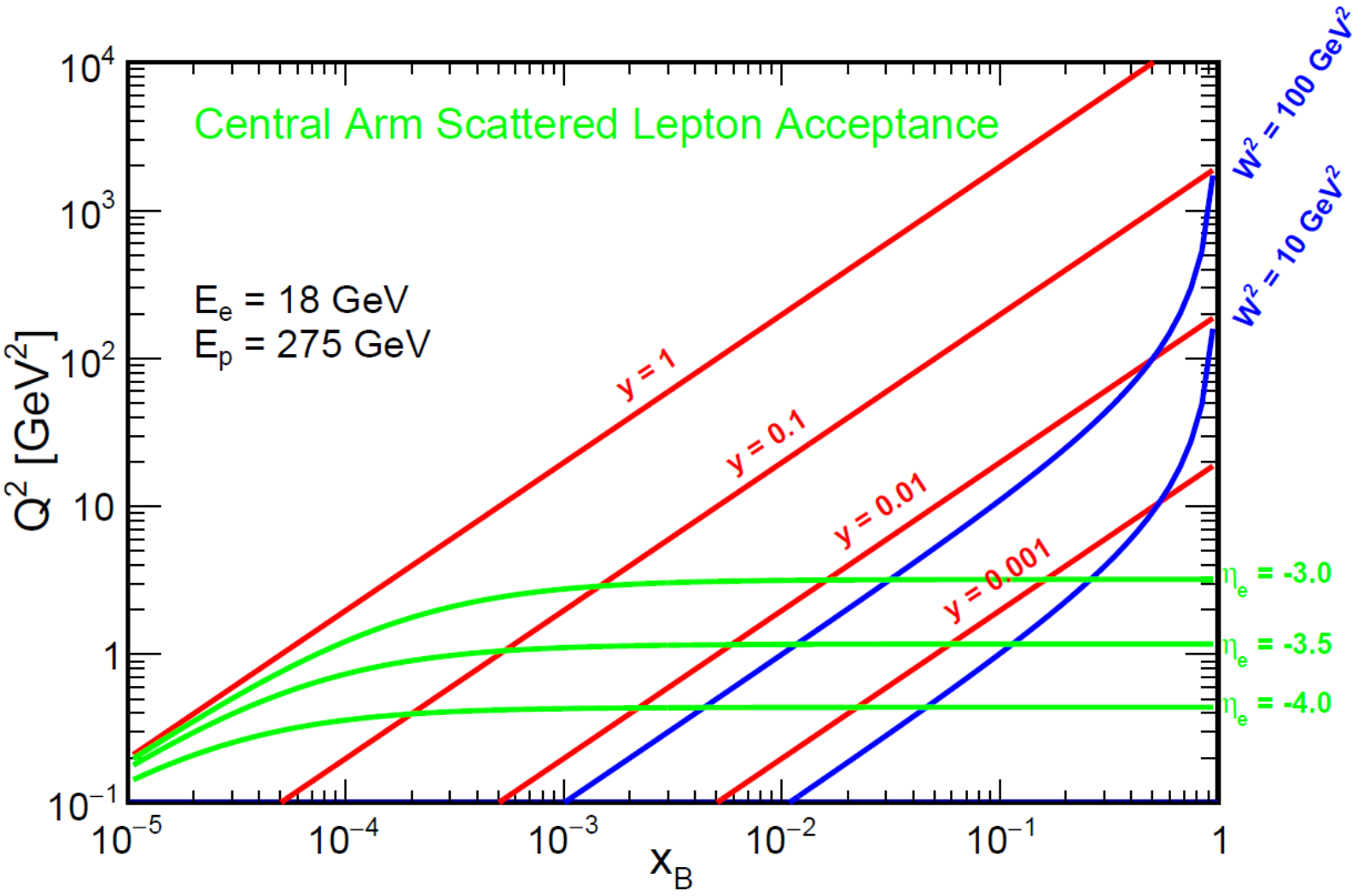


$$Q^2 = 4EE' \cos^2(\theta_p^{e'}/2)$$

$$y = 1 - \frac{E'(1-\cos\theta_p^{e'})}{2E}$$

$$x = \frac{Q^2}{sy}$$

Scattered Electron Kinematics

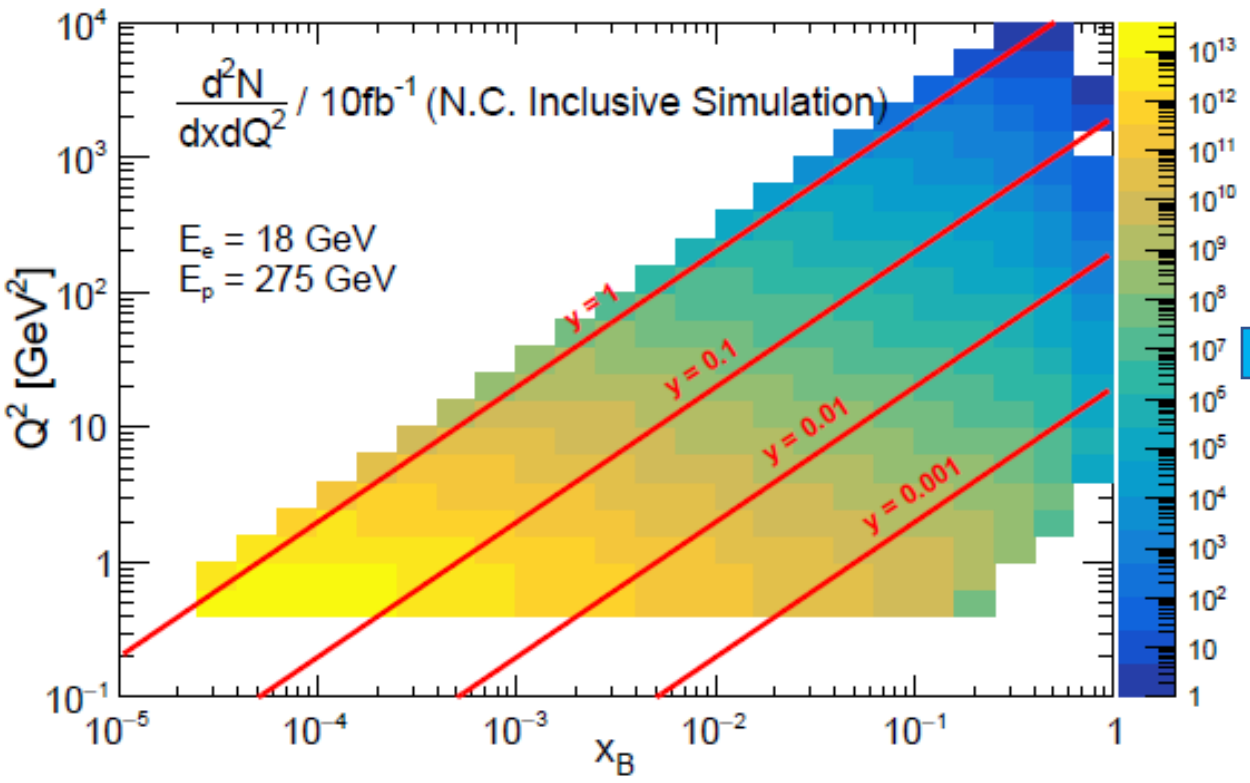


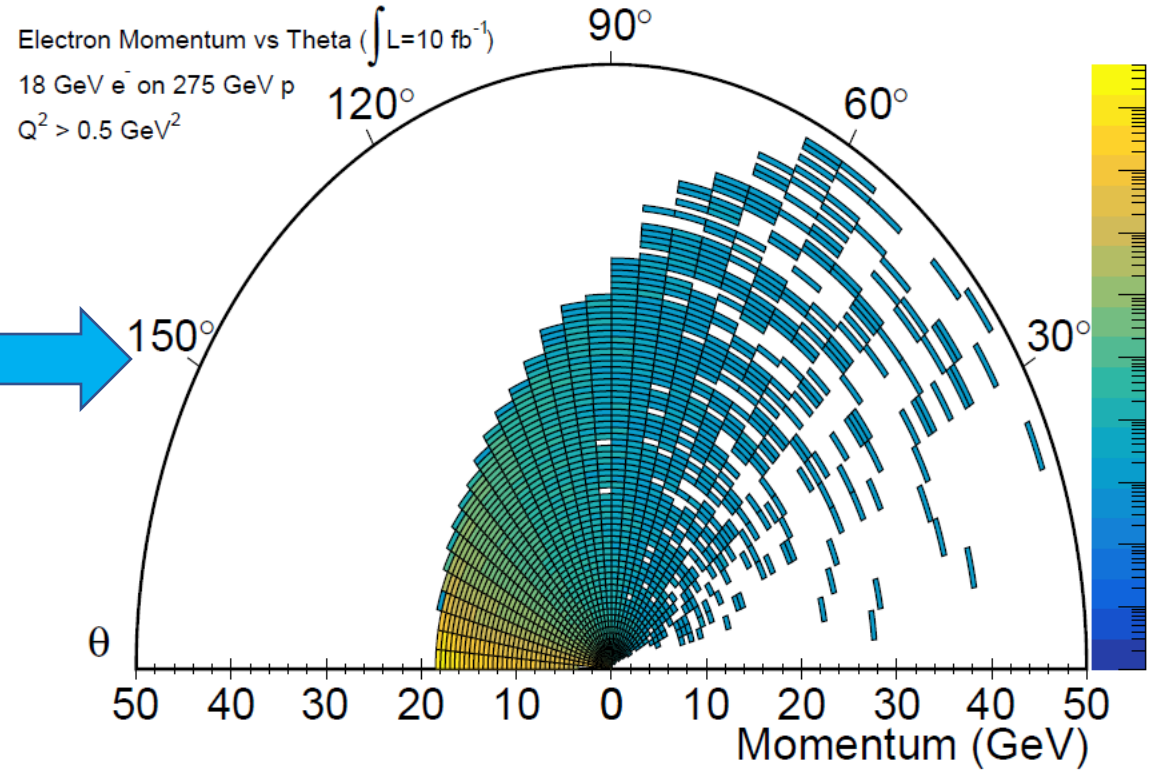
$$Q^2 = 4EE' \cos^2(\theta_p^{e'}/2)$$

$$y = 1 - \frac{E'(1-\cos\theta_p^{e'})}{2E}$$

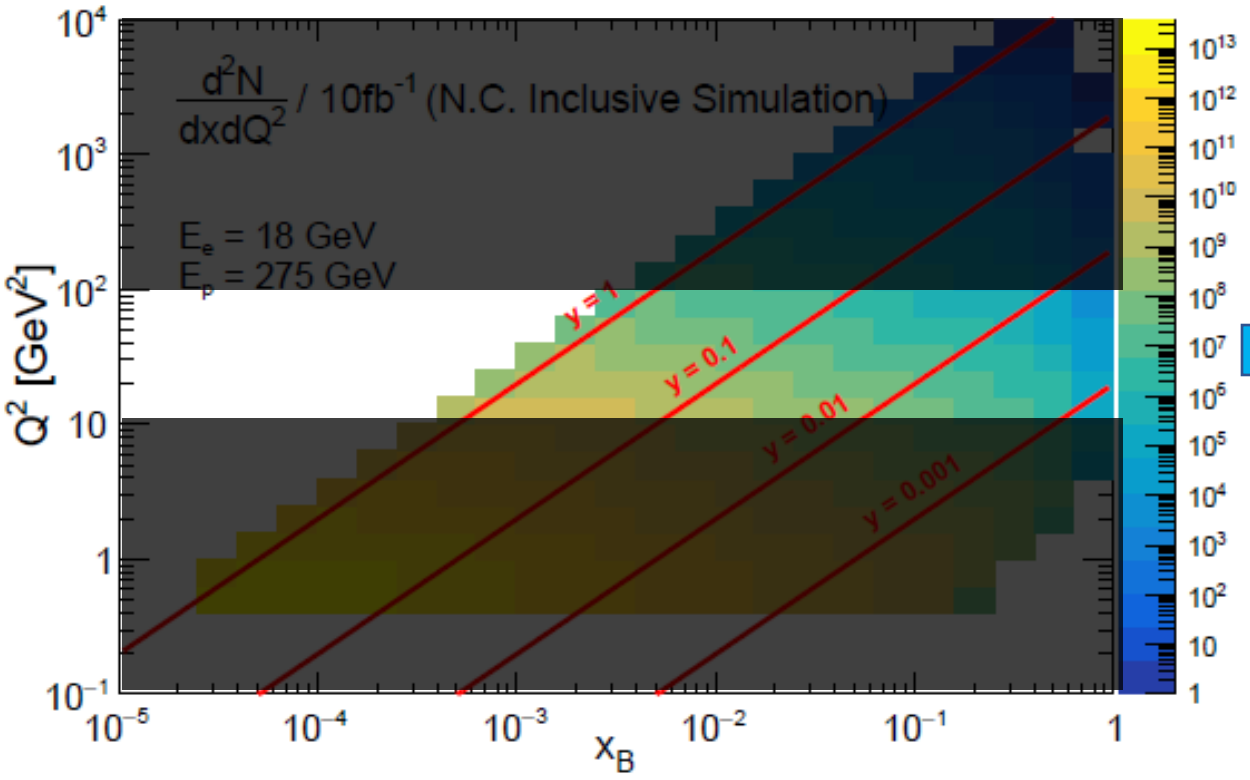
$$x = \frac{Q^2}{sy}$$

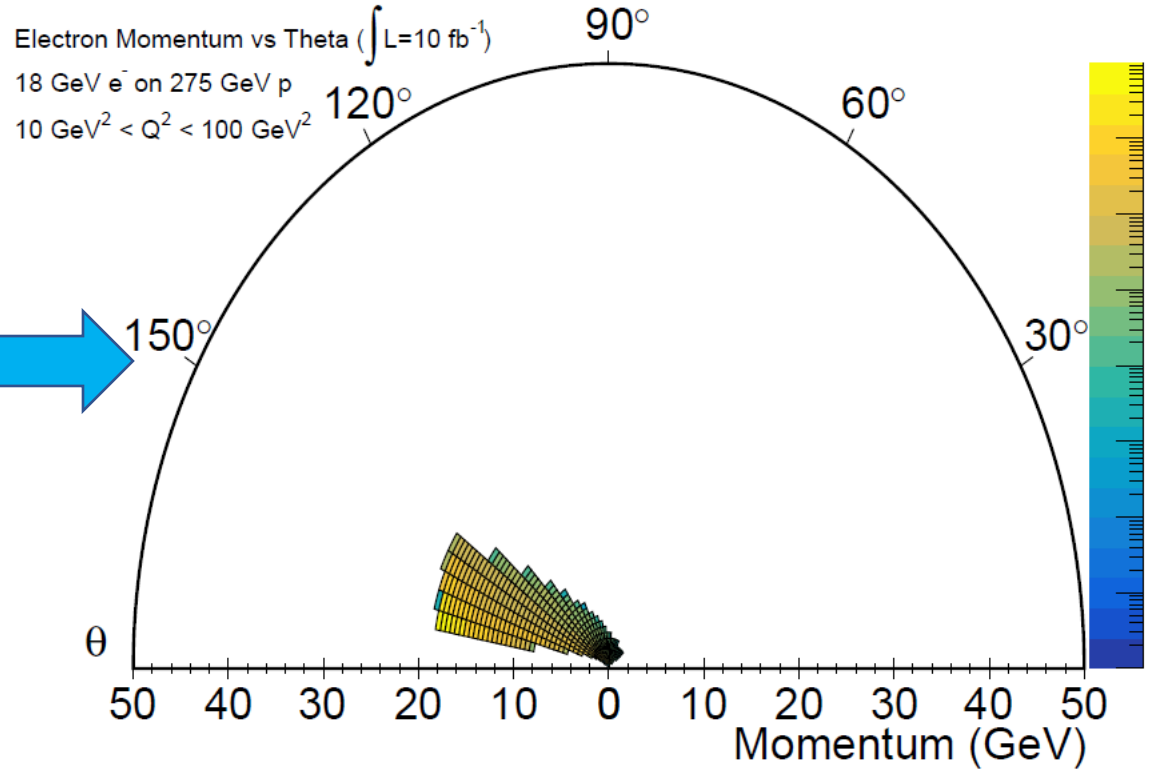
Scattered Electron Kinematics and Yields



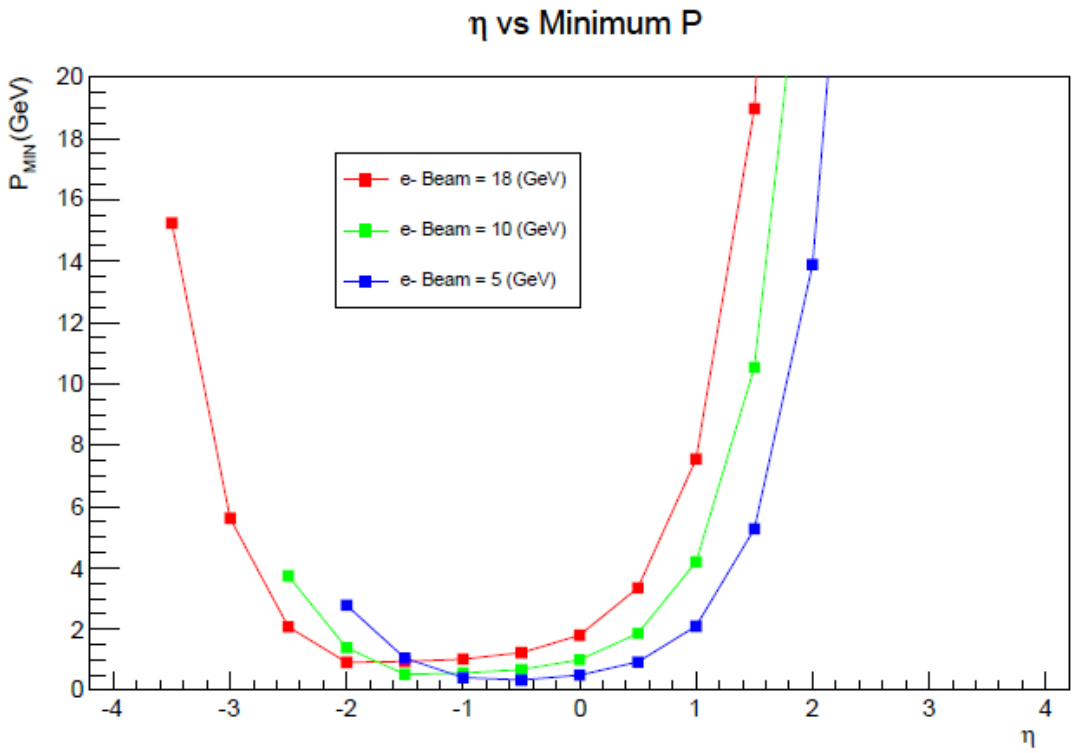


Scattered Electron Kinematics and Yields





Electron Momentum Acceptance



$Q^2 > 1$ GeV^2 and $y < 0.95$ constraints applied

$E^{e^-}_{beam}$ (GeV)	η bin	$p^{e^-}_{min}$ (GeV)
18	(-3.5,-2)	0.9
18	(-2,-1)	0.9
18	(-1, 0)	1.0
18	(0, 1)	1.8
10	(-3.5,-2)	1.4
10	(-2,-1)	0.5
10	(-1, 0)	0.6
10	(0, 1)	1.0
5	(-3.5,-2)	2.8
5	(-2,-1)	0.4
5	(-1, 0)	0.3
5	(0, 1)	0.5

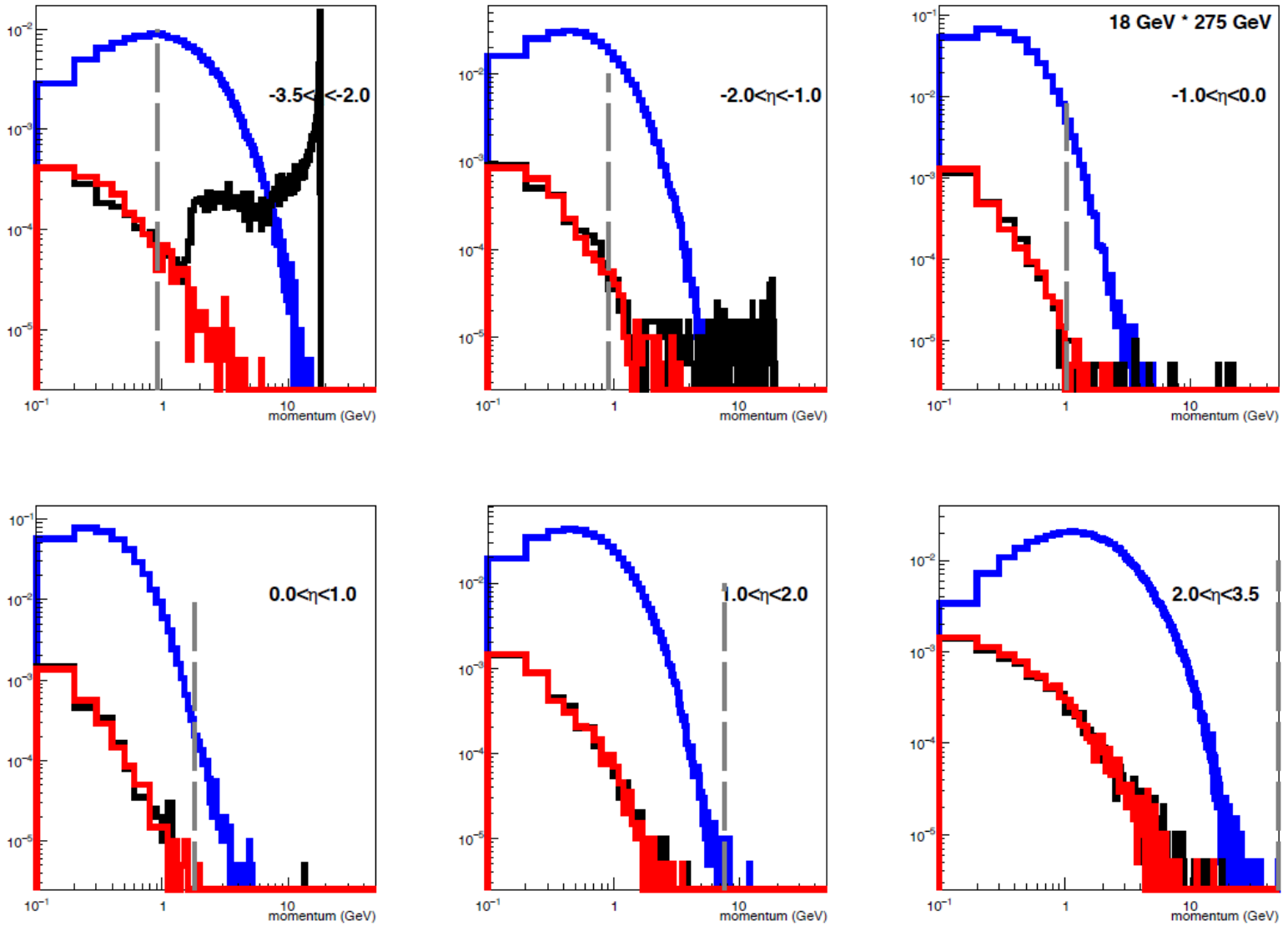
Scattered Electron Background

18x275 GeV

Electrons

Pions

Positrons



Estimated π/e Ratios

$E^{e^-}_{beam}$ (GeV)	η bin	$p^{e^-}_{min}$ (GeV)	Max π^-/e^-	final π^-/e^- ratio
18	(-3.5,-2)	0.9	200	0.02
18	(-2,-1)	0.9	800	0.08
18	(-1, 0)	1.0	1000	0.1
18	(0, 1)	1.8	100	0.01
10	(-3.5,-2)	1.4	10	0.001
10	(-2,-1)	0.5	400	0.04
10	(-1, 0)	0.6	800	0.08
10	(0, 1)	1.0	1000	0.1
5	(-3.5,-2)	2.8	0.1	0.00001
5	(-2,-1)	0.4	100	0.01
5	(-1, 0)	0.3	500	0.05
5	(0, 1)	0.5	1000	0.1

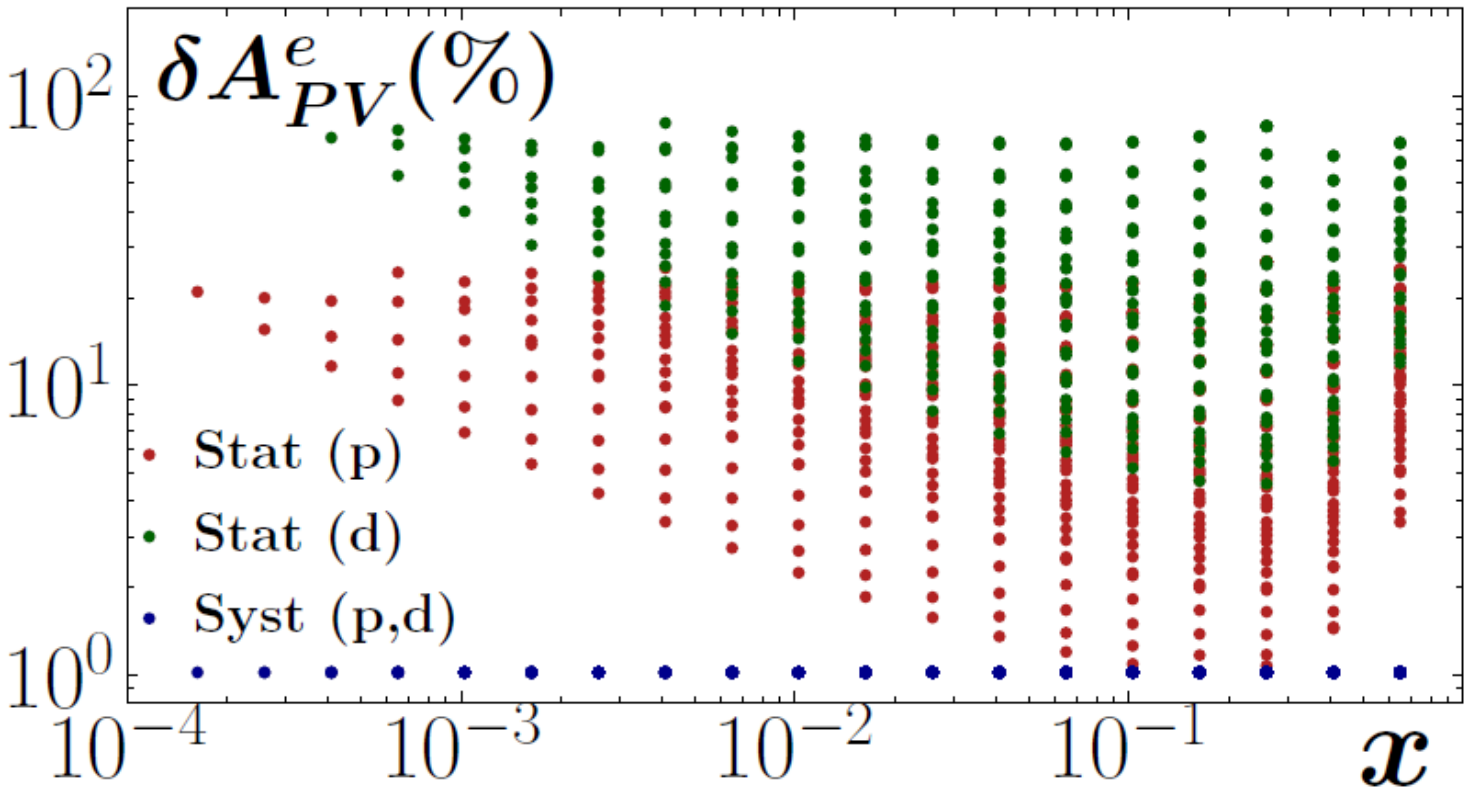
Pion contamination

1) Inflates statistical errors because it is typically treated as a dilution

2) Incurs ~1% systematic error

Tightest constraints come from electron parity violating asymmetries A_{PV}^{e-}

Requirement on final π/e Contamination



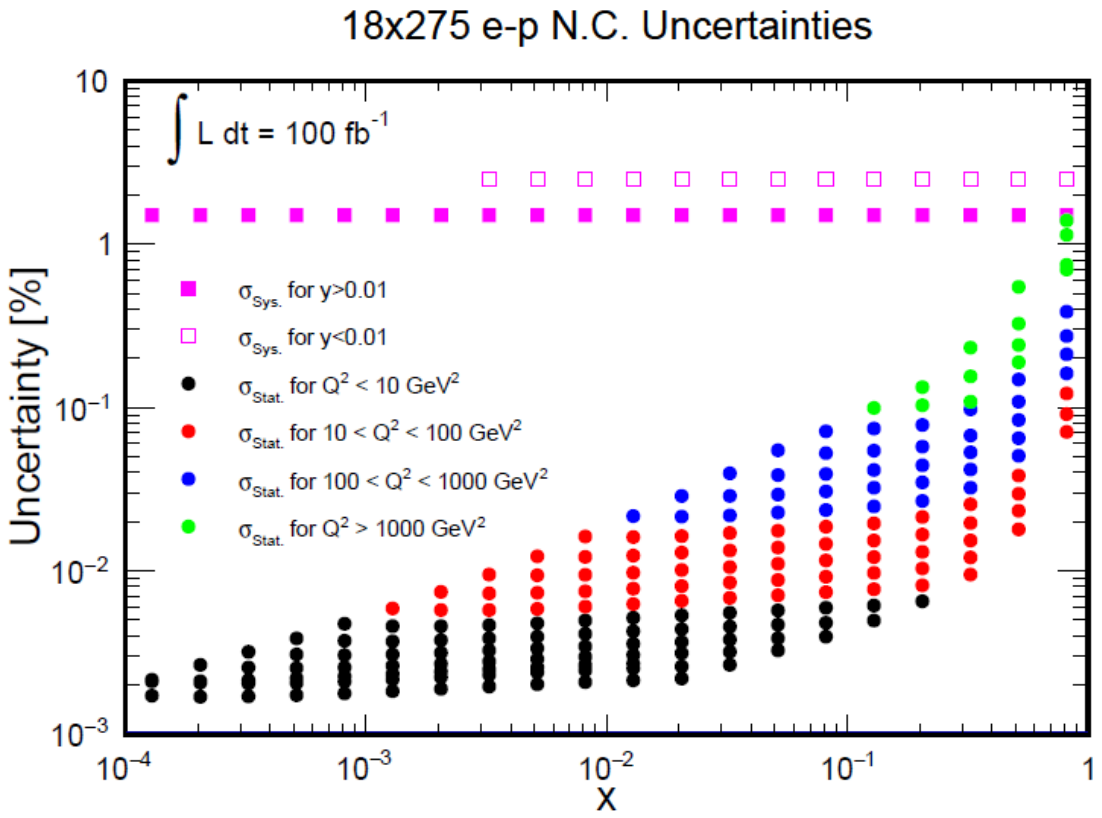
1) Limit pion contamination systematic error to be ~10% of statistical error.

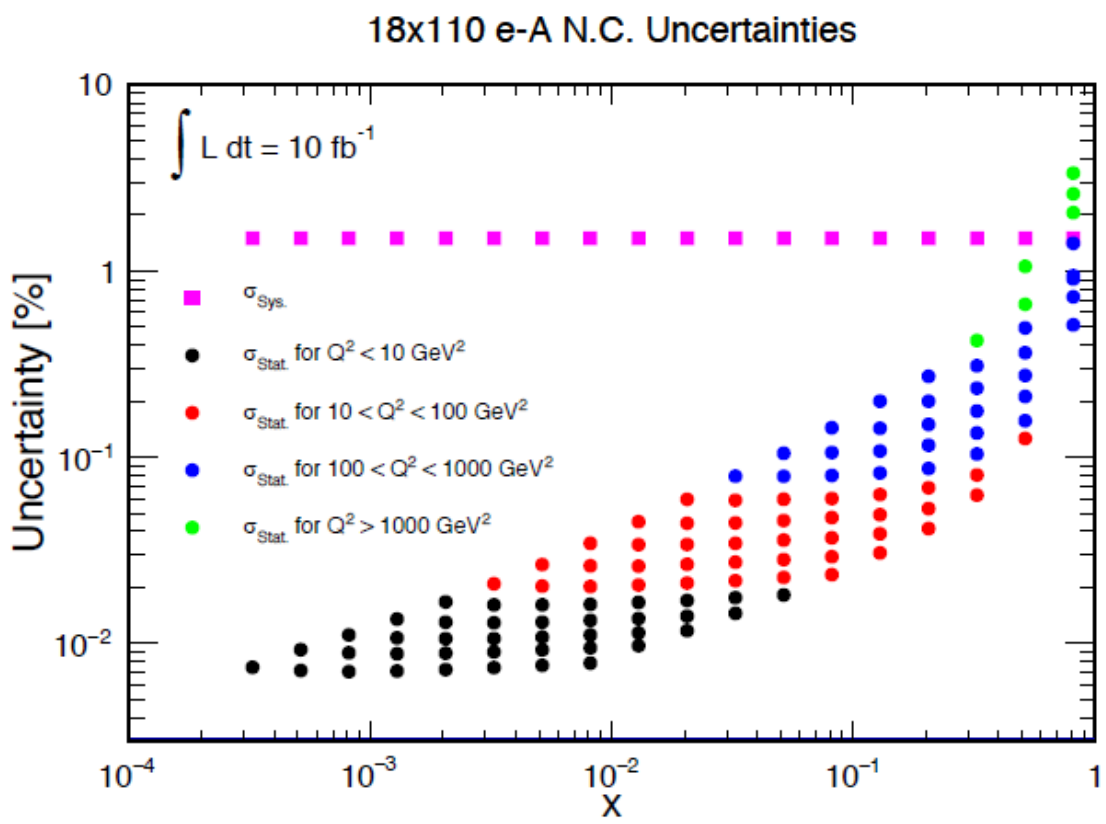
2) Translates into a requirement of pi/e = 1×10^{-3}

3) This requirement is never met in the central region ($-2 < \eta < 1$)

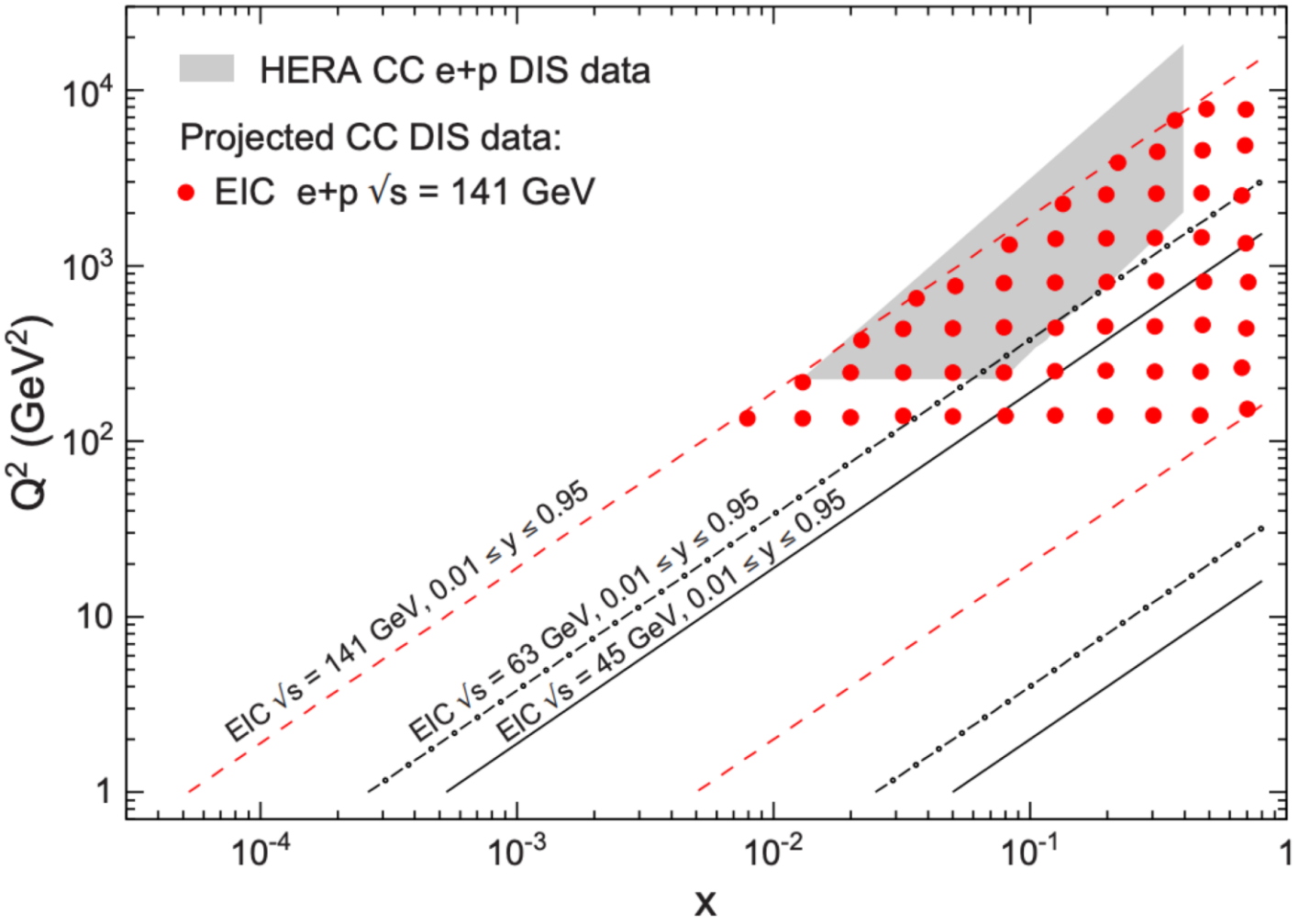
4) Room for improvement with implementation of PID algorithms.

Estimated uncertainties for N.C. Cross sections





C.C. Phase Space and Reconstruction

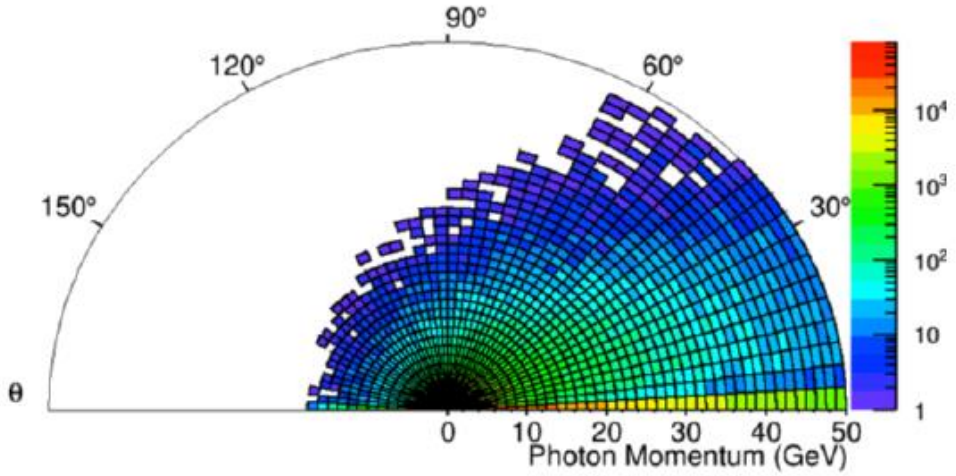


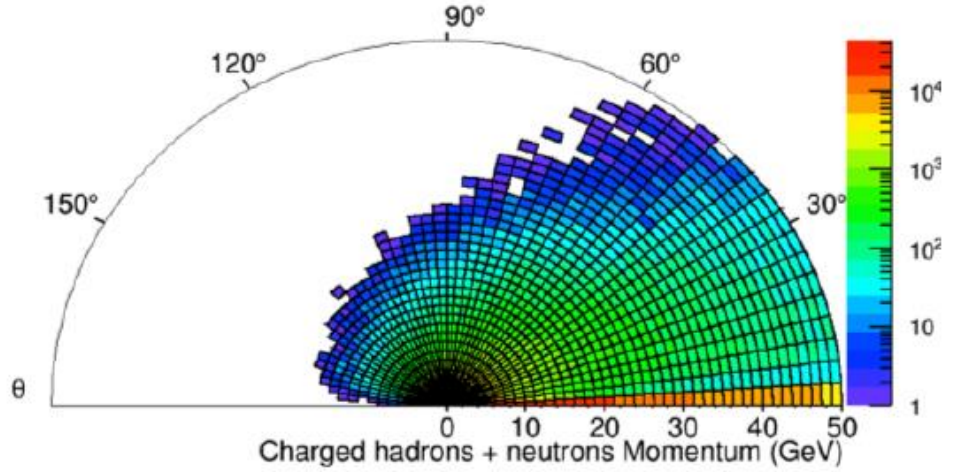
$$Q^2_{JB} = \frac{p_T^2}{1 - y_{JB}}$$

$$y_{JB} = \frac{(E - p^z)}{2E}$$

$$x_{JB} = \frac{Q^2_{JB}}{s y_{JB}}$$

Hadronic Reconstruction



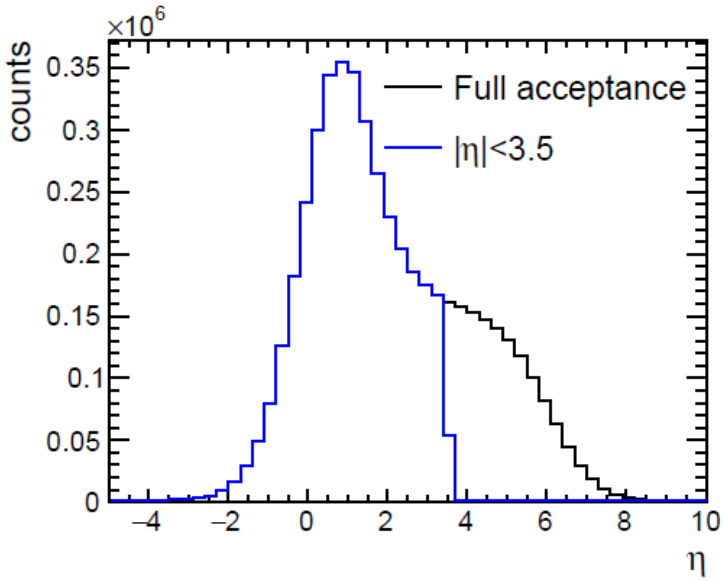


$$Q^2_{JB} = \frac{p_T^2}{1 - y_{JB}} \qquad p_T^2 = (\sum_h P_h^x)^2 + (\sum_h P_h^y)^2$$

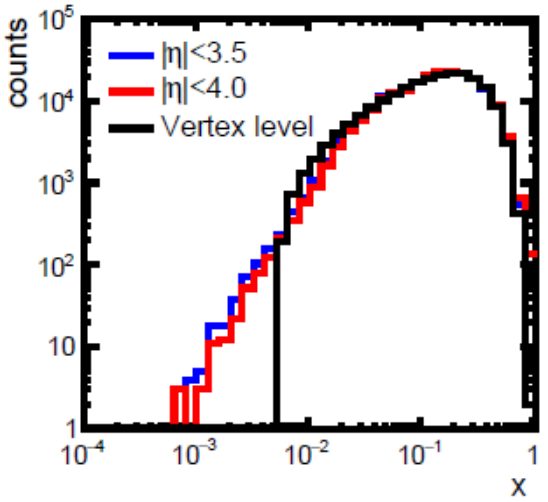
$$y_{JB} = \frac{(E - p^z)}{2E} \qquad (E - p^z) = \sum_h (E_h - p_h^z)$$

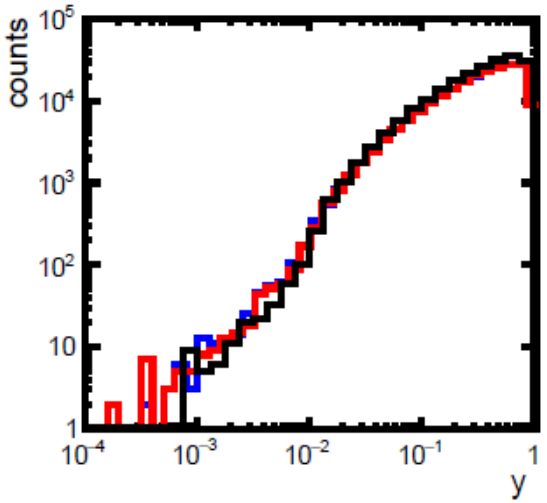
$$x_{JB} = \frac{Q^2_{JB}}{s y_{JB}}$$

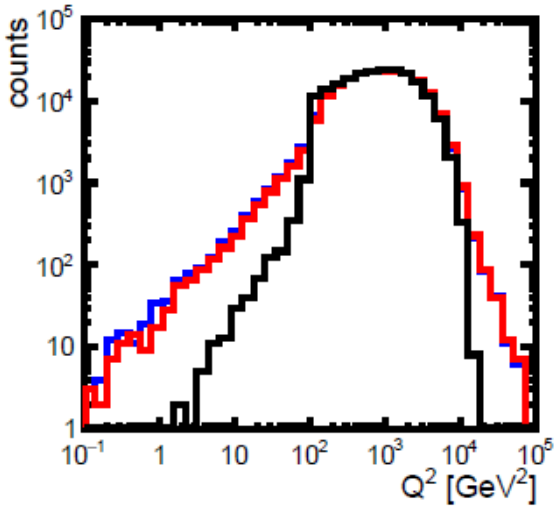
Hadronic Reconstruction



Angular distribution of hadrons and photons show that J.B. reconstruction is affected by central detector forward acceptance.







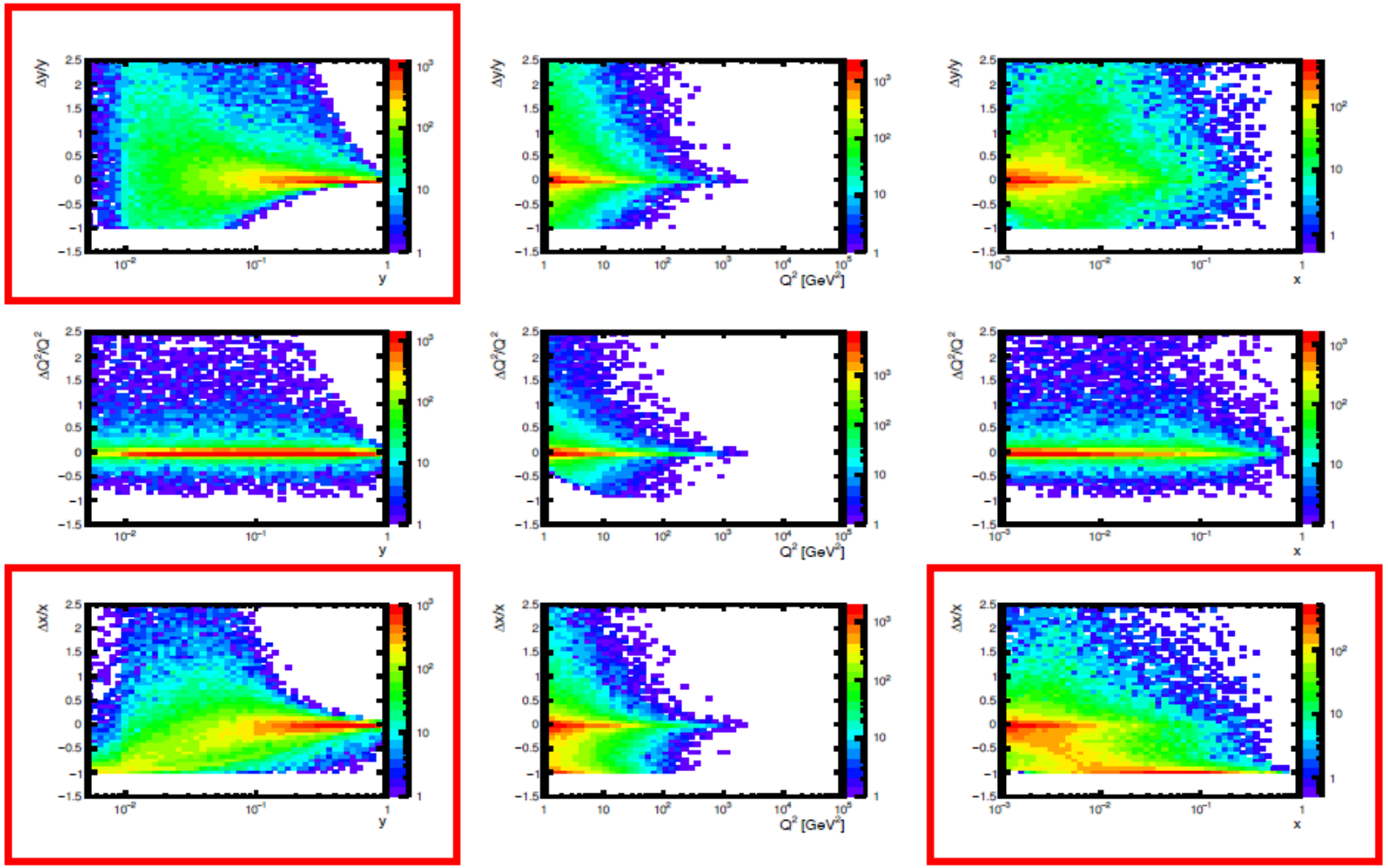
But increasing acceptance to η = +4 seems to have minimal impact on the kinematic reconstruction resolutions

J.B. reconstruction requires inelasticity > 0.01 cut

Δx/x and Δy/y diverge as y → 0

Δx/x develops systematic offset at x ~10^{-2} .

Caused by large positive fluctuations in y that then suppress x.



J.B. reconstruction requires inelasticity > 0.01 cut

Δx/x and Δy/y diverge as $y \rightarrow 0$

Δx/x develops systematic offset at x ~10^{-2} .

Caused by large positive fluctuations in y that then suppress x.

Removed by y > 0.01 cut