YR Integration Meeting

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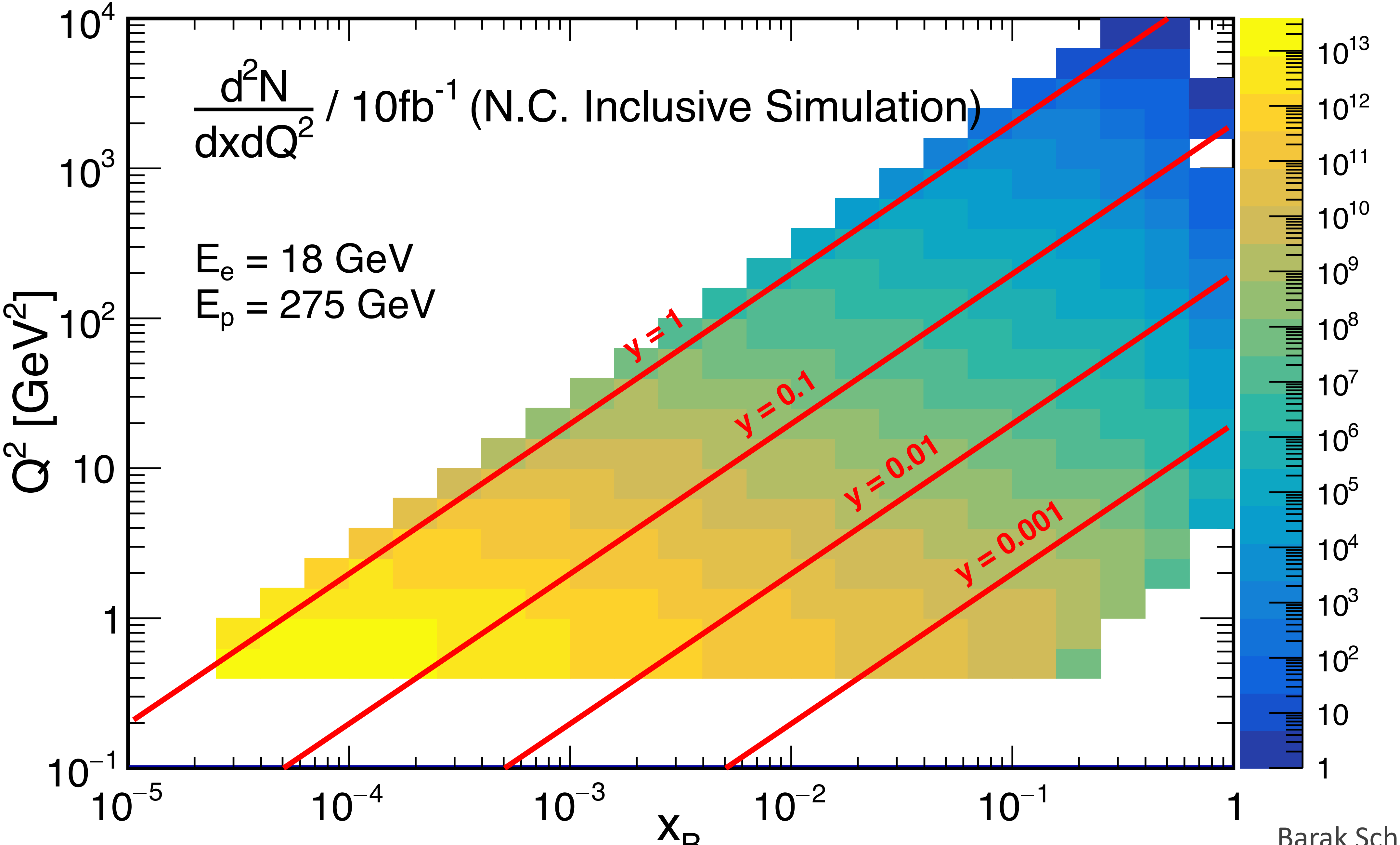
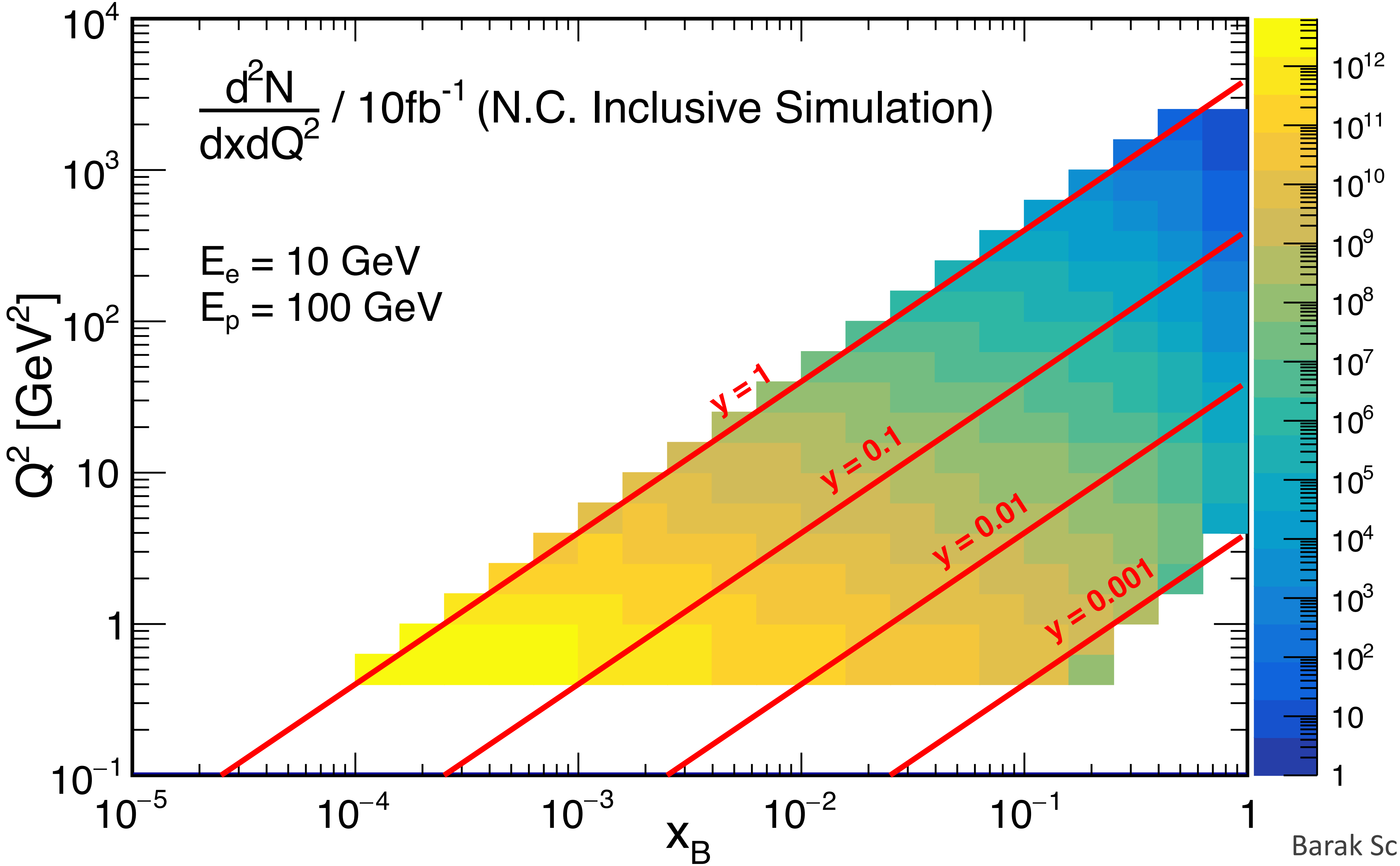
QUESTION Can you briefly summarize your planned physics program in terms of processes of interest and (where applicable) basic kinematic ranges in (x,Q2) or other relevant variables.

Measurement	Physics Topic/goal
inclusive $A_{\|\|}$ / $A_{\perp}$ for proton, deuterium, ^{3}He	Gluon & Quark Helicity $\Delta g(x,Q^2)$, Δu^+, Δd^+
Inclusive electron and p/d A_{PV} for p/d	Strange Pol and Unpolarized $\Delta s^+(x,Q^2)$, $s^+(x,Q^2)$
$\boldsymbol{\sigma}_{red}(x,Q^2)$, $\boldsymbol{\sigma}^{c/b}_{red}(x,Q^2)$ $\rightarrow$ F_2, F_L, $F_2^{c/b}$ for p,d	Proton PDFs $q(x,Q^2)$, $g(x, Q^2)$
$\boldsymbol{\sigma}_{red}(x,Q^2)$, $\boldsymbol{\sigma}^{c/b}_{red}(x,Q^2)$ $\rightarrow$ F_2, F_L, $F_2^{c/b}$ for A	Nuclear PDFs $q(x,Q^2)$, $g(x, Q^2)$
$\boldsymbol{\sigma}_{red}(x,Q^2)$, $\boldsymbol{\sigma}^{c/b}_{red}(x,Q^2)$ $\rightarrow$ F_2, F_L, $F_2^{c/b}$ for p, A	Non-linear QCD dynamics
EW inclusive electron A_{PV} for deuterium	BSM & Precision EW ($\sin^2\boldsymbol{\theta}_W$)
$\frac{d\sigma^{NC}}{dxdyd\phi}$ Triply differential NC X-sec	Lorentz and CPT Violating Effects



Barak Schmookler



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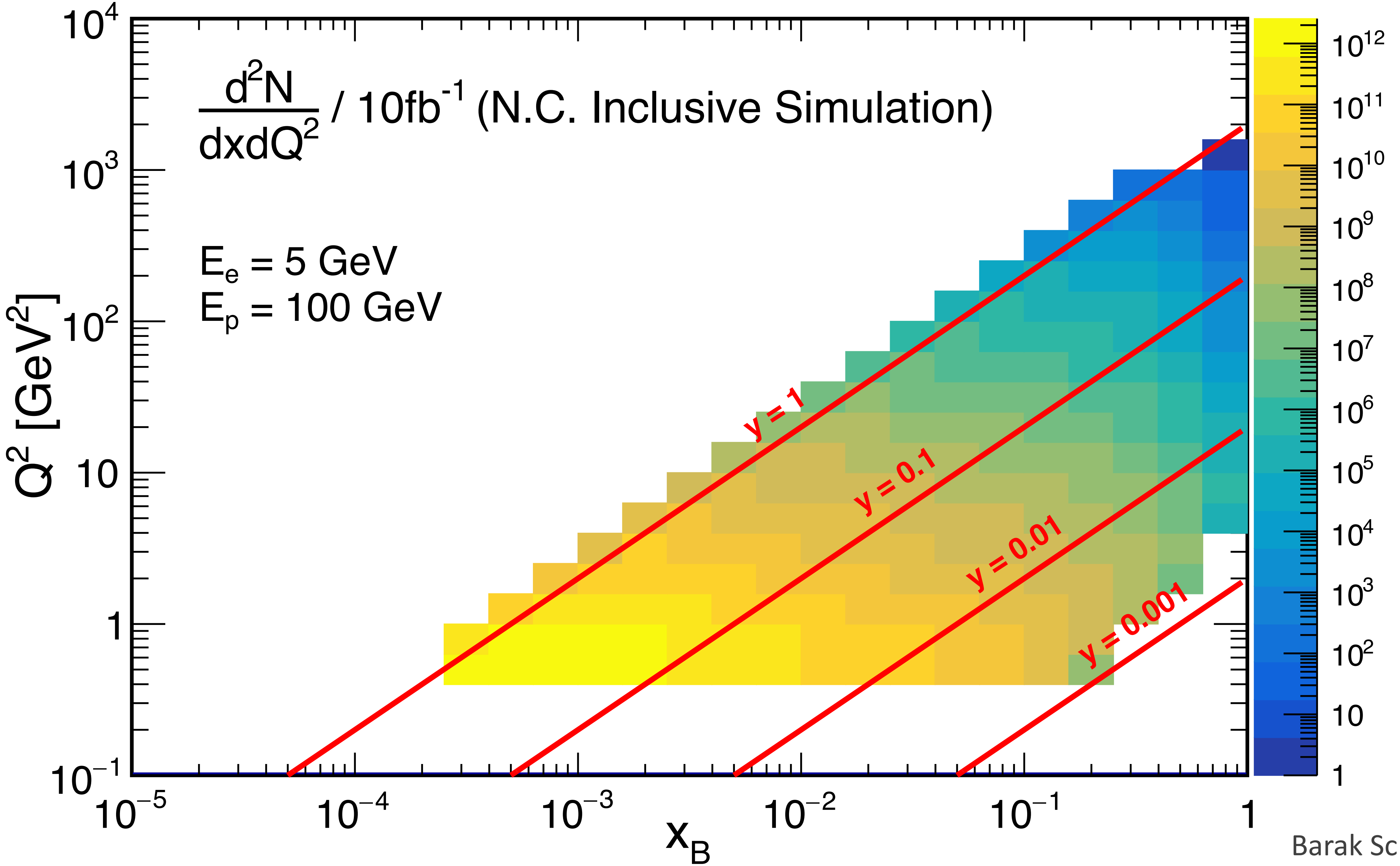

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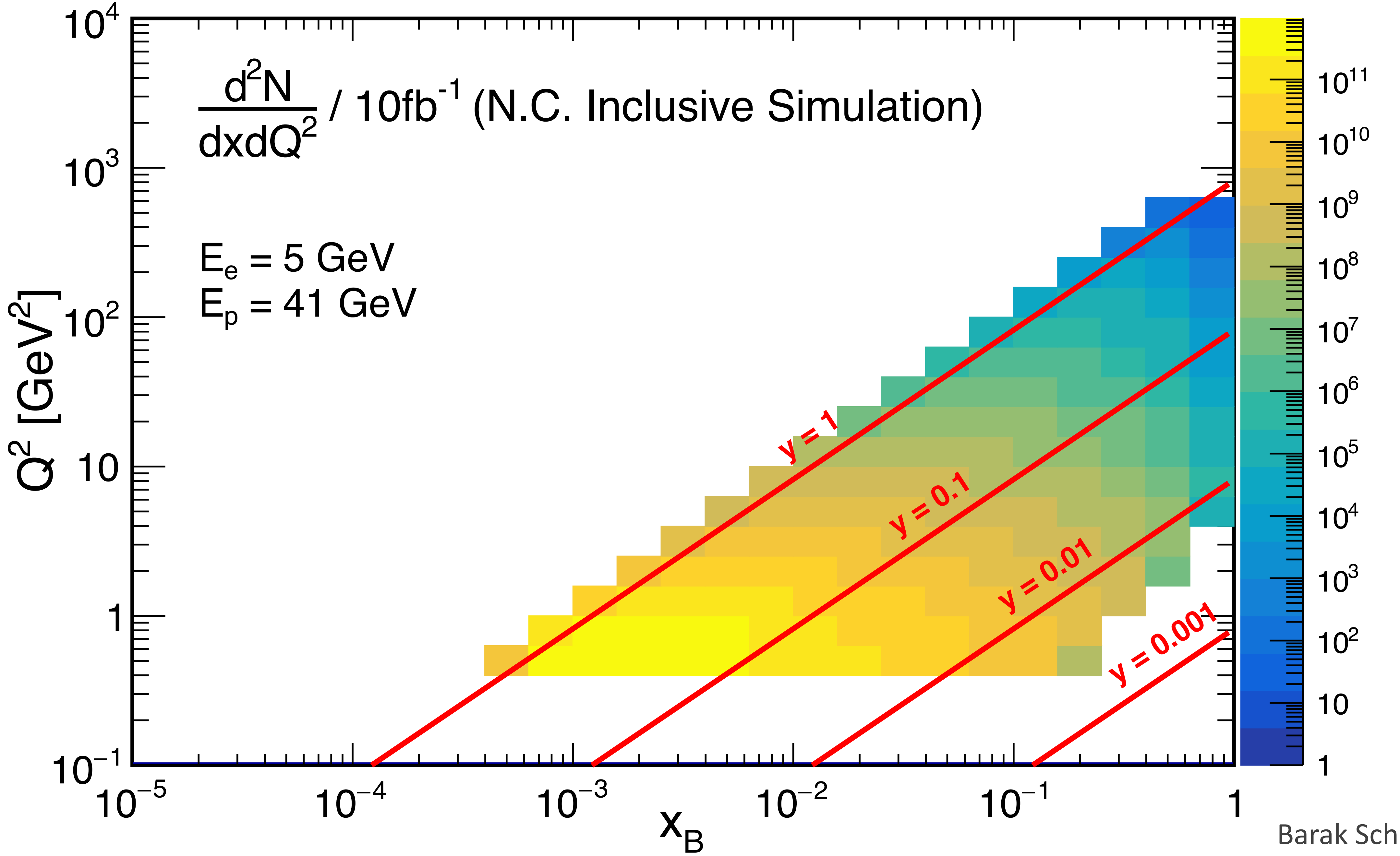

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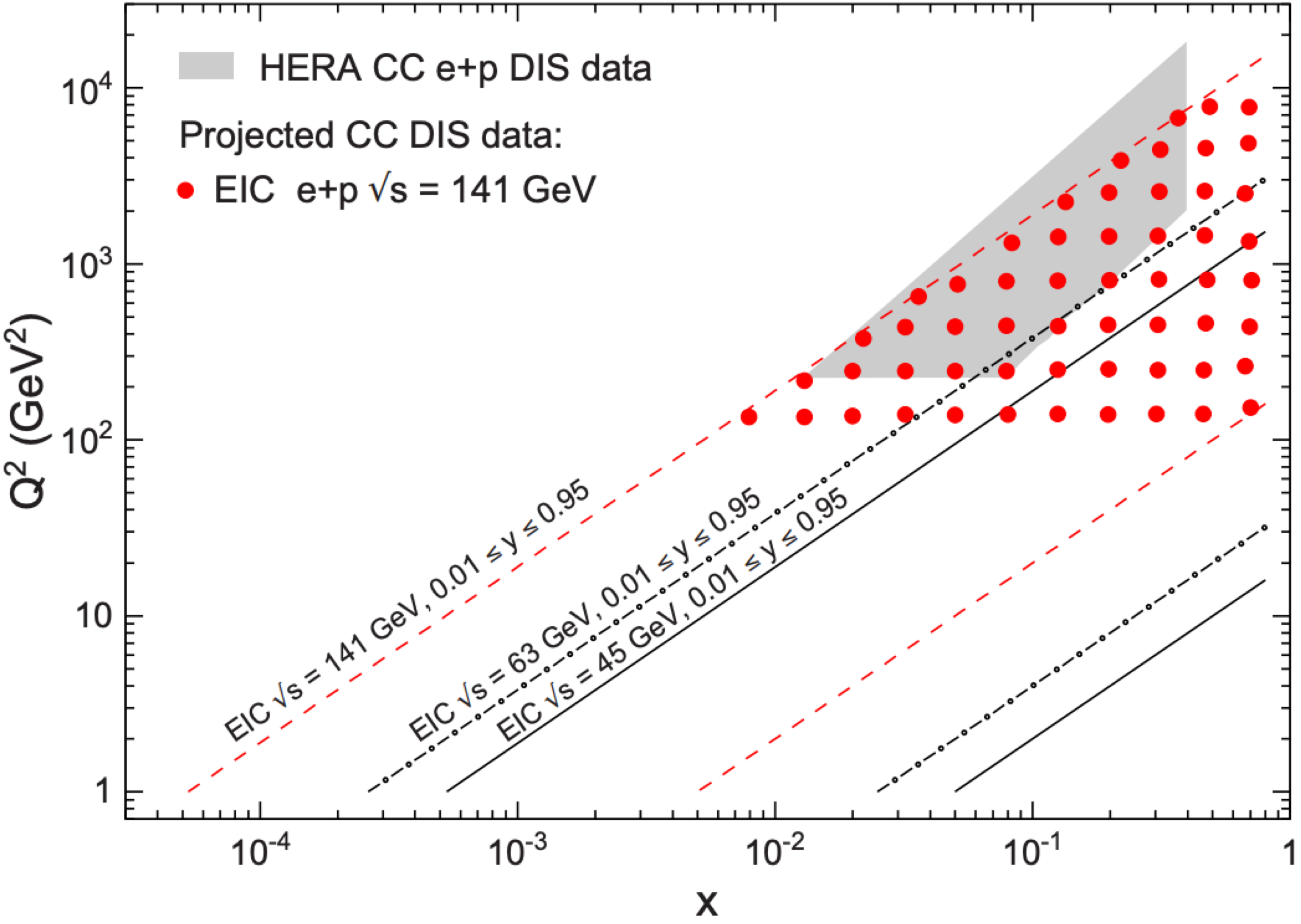


Xiaoxuan Chu

QUESTIONS

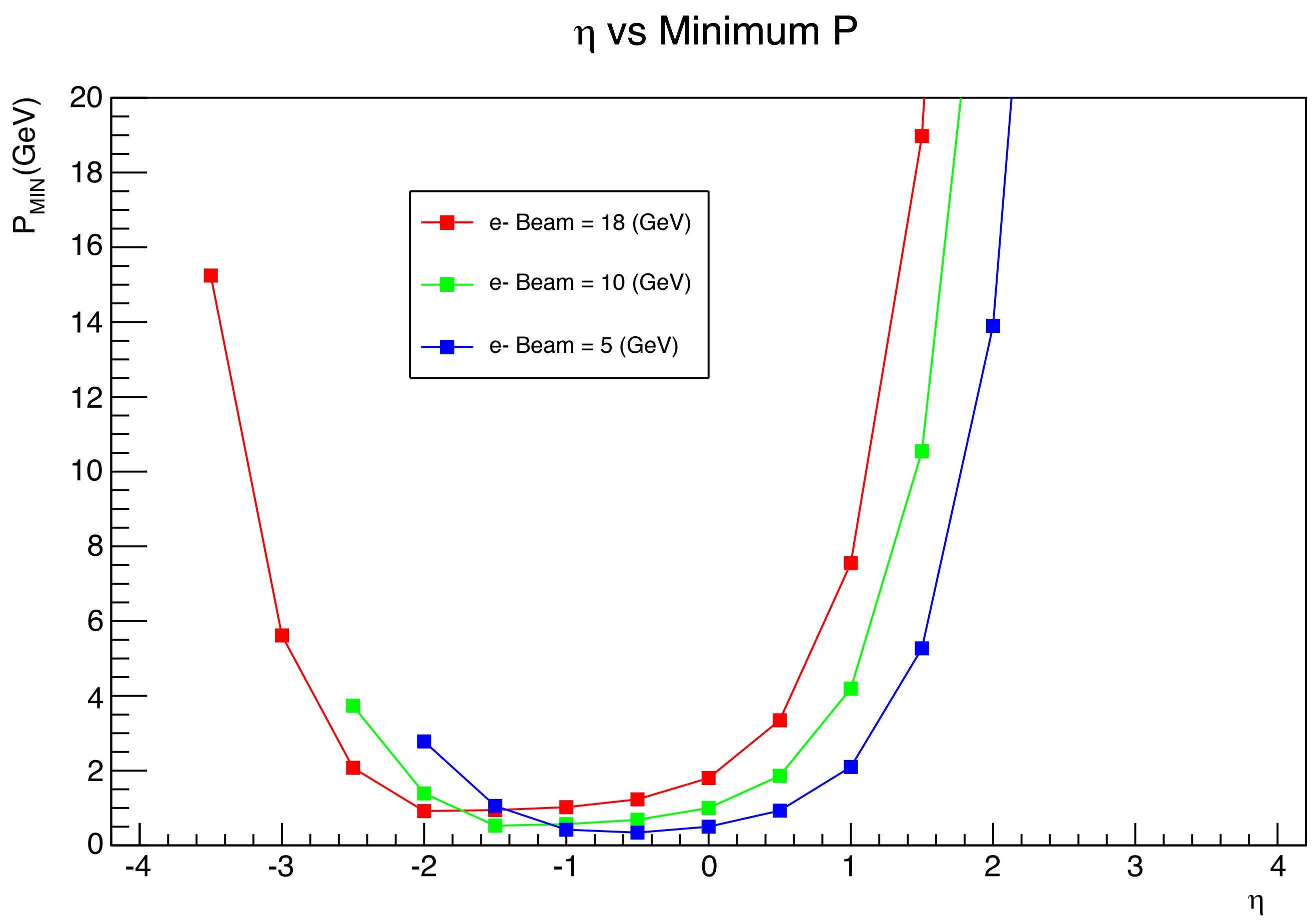
- What is the absolute best detector performance you would like to see and what is the detector performance you anticipate your physics not be possible anymore?

- Which basic detector-level measurements (eg track pT/eta, scattered electron, forward neutron/proton observables, overall HFS, displaced vertices, dE/dx ...) are most essential to realise your physics aims? Can you already say what sort of measurement (acceptance) ranges and resolutions / performance you need?

- For charged particles, how important is low momentum acceptance versus high momentum resolution (this informs the optimal choice of magnetic field). What is the sensitivity to the magnitude of the magnetic field?

ANSWERS: All tied in some way to electron PID. Will discuss in 7 slides.

Minimum e^- Momentum



$E^{e^-}_{beam}$ (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

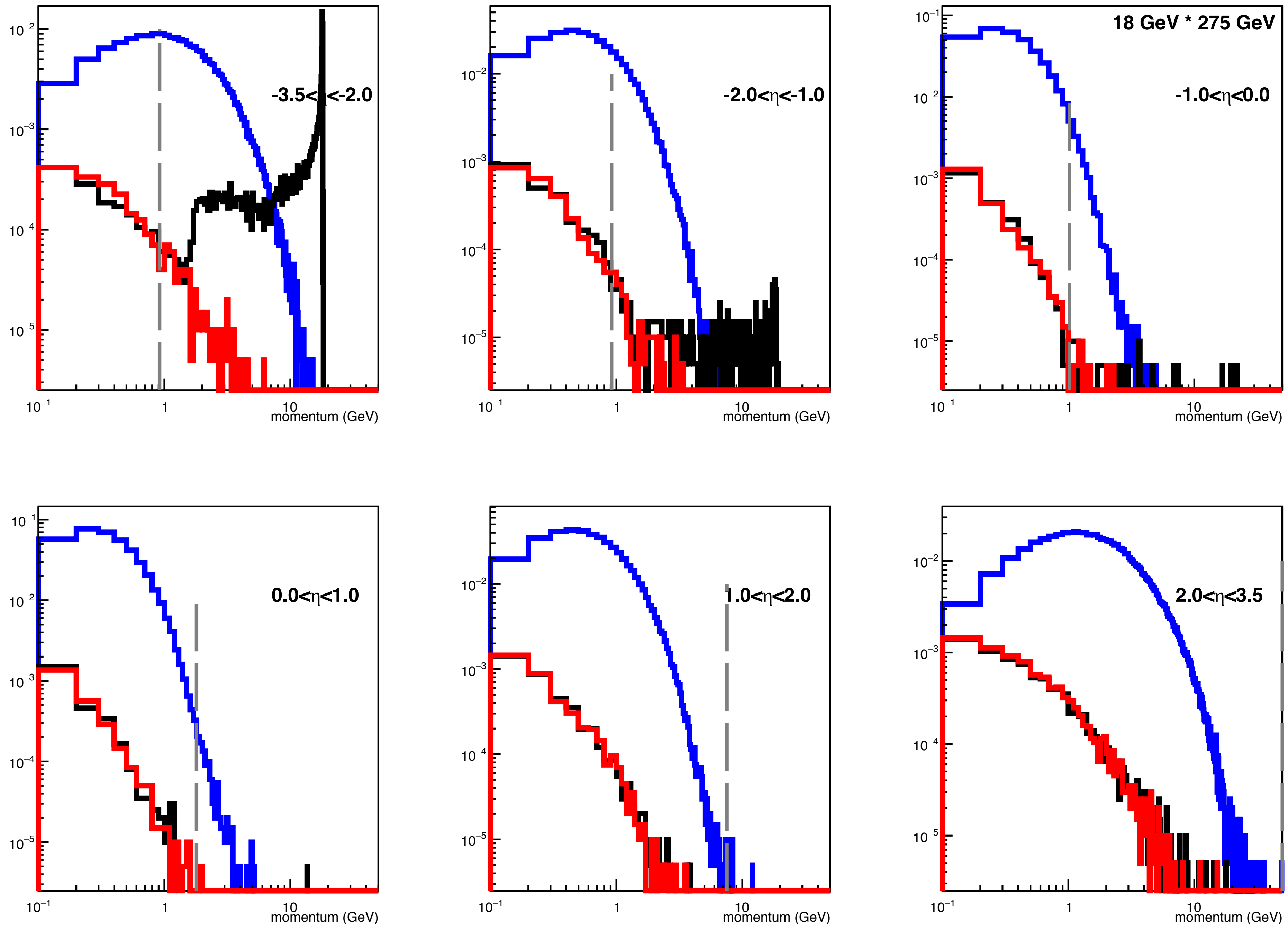
$Q^2 > 1$ and $y < 0.95$ constraints applied. No magnetic field.

18x275 GeV

Electrons

Pions

Positrons



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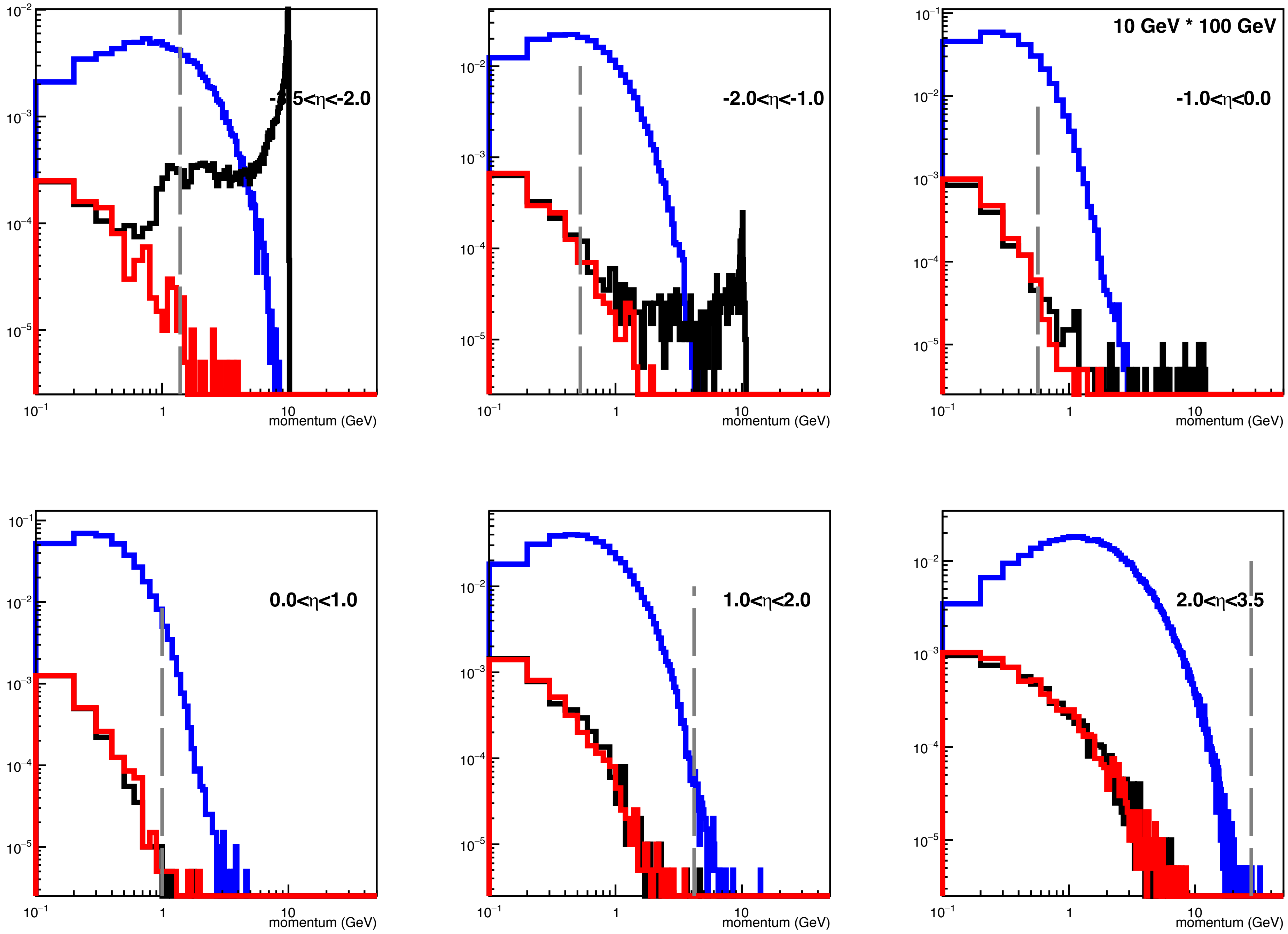
10x100 GeV

Electrons

Pions

Positrons



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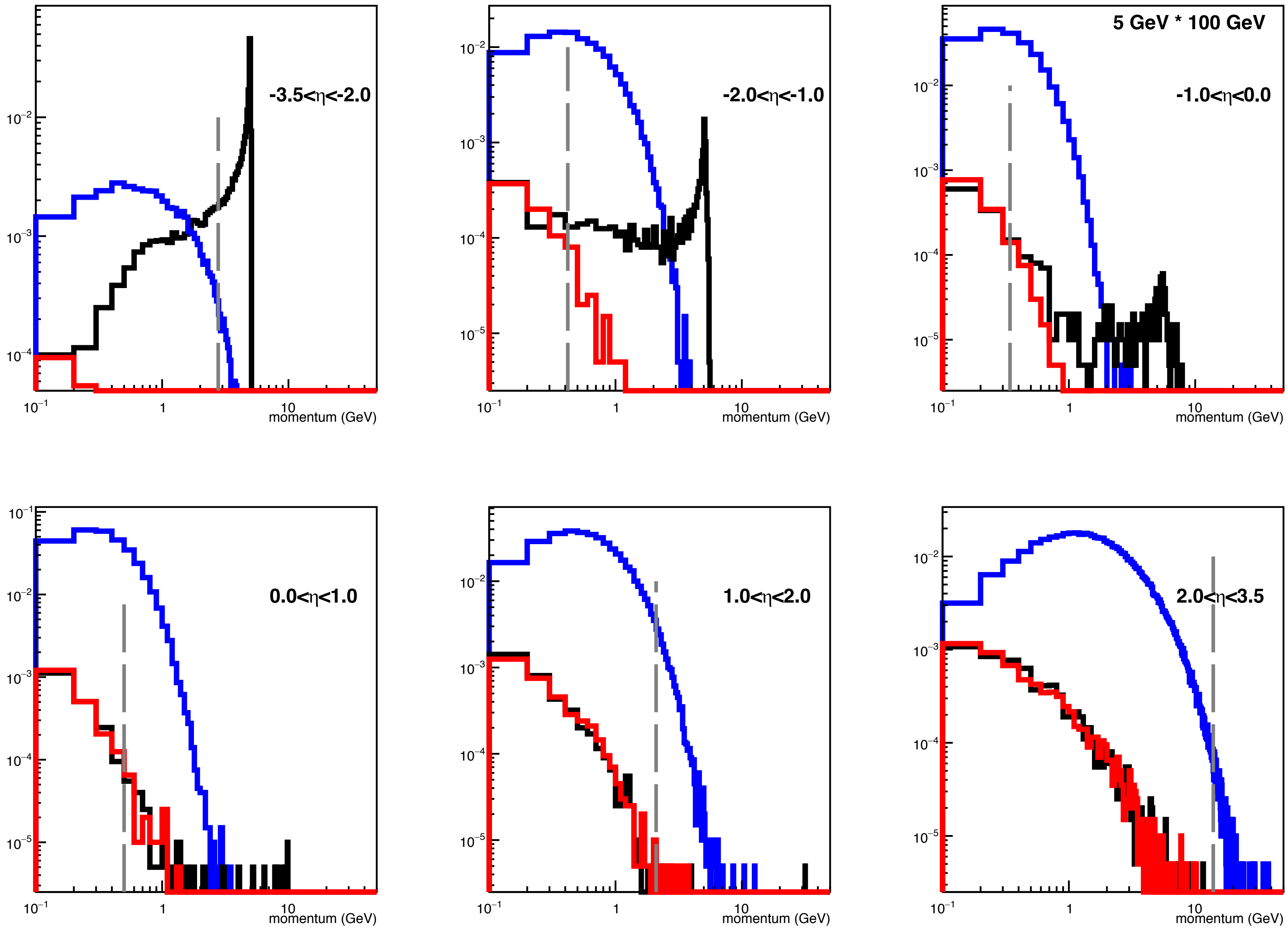
5x100 GeV

Electrons

Pions

Positrons



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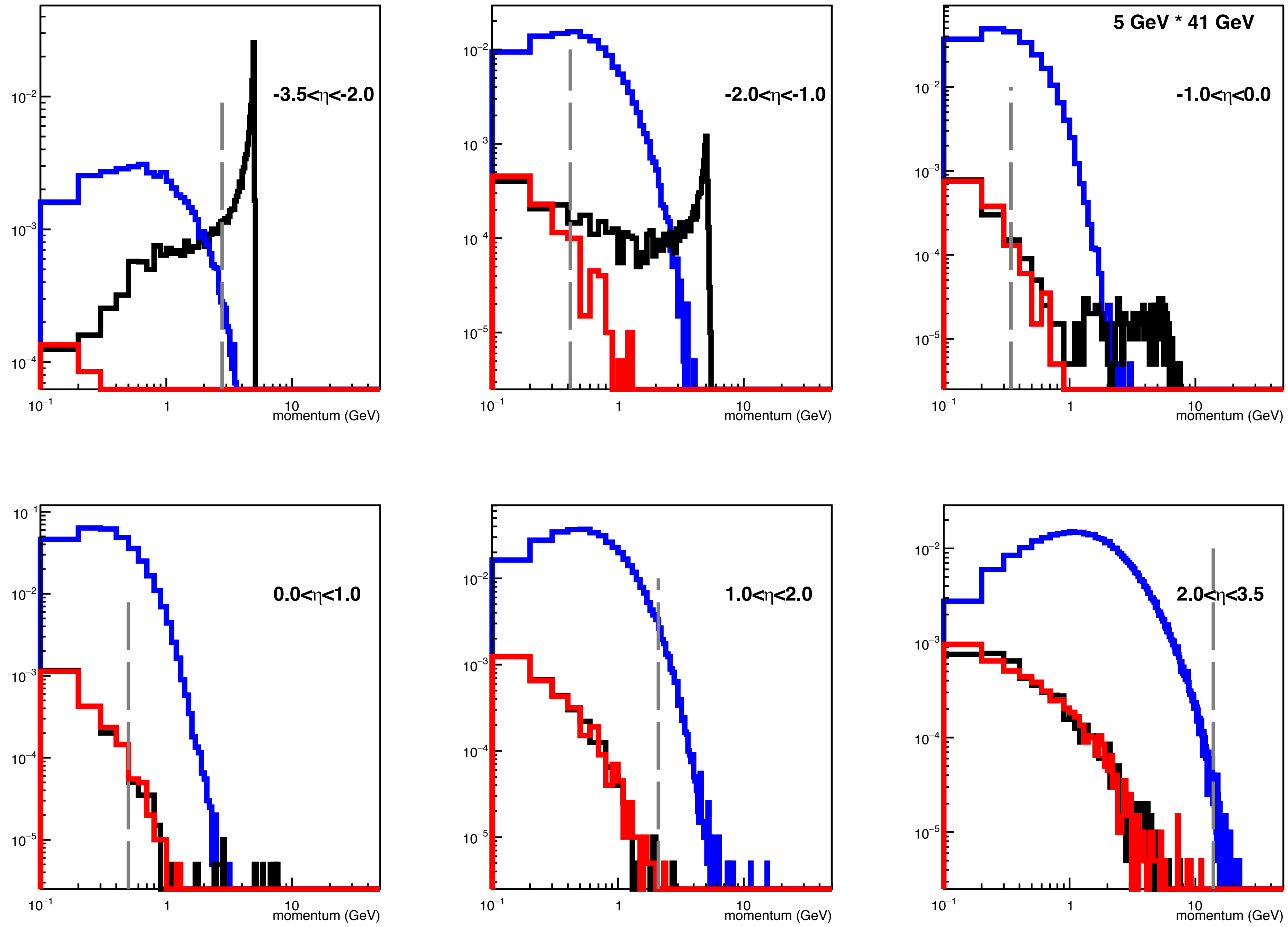
5x41 GeV

Electrons

Pions

Positrons



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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

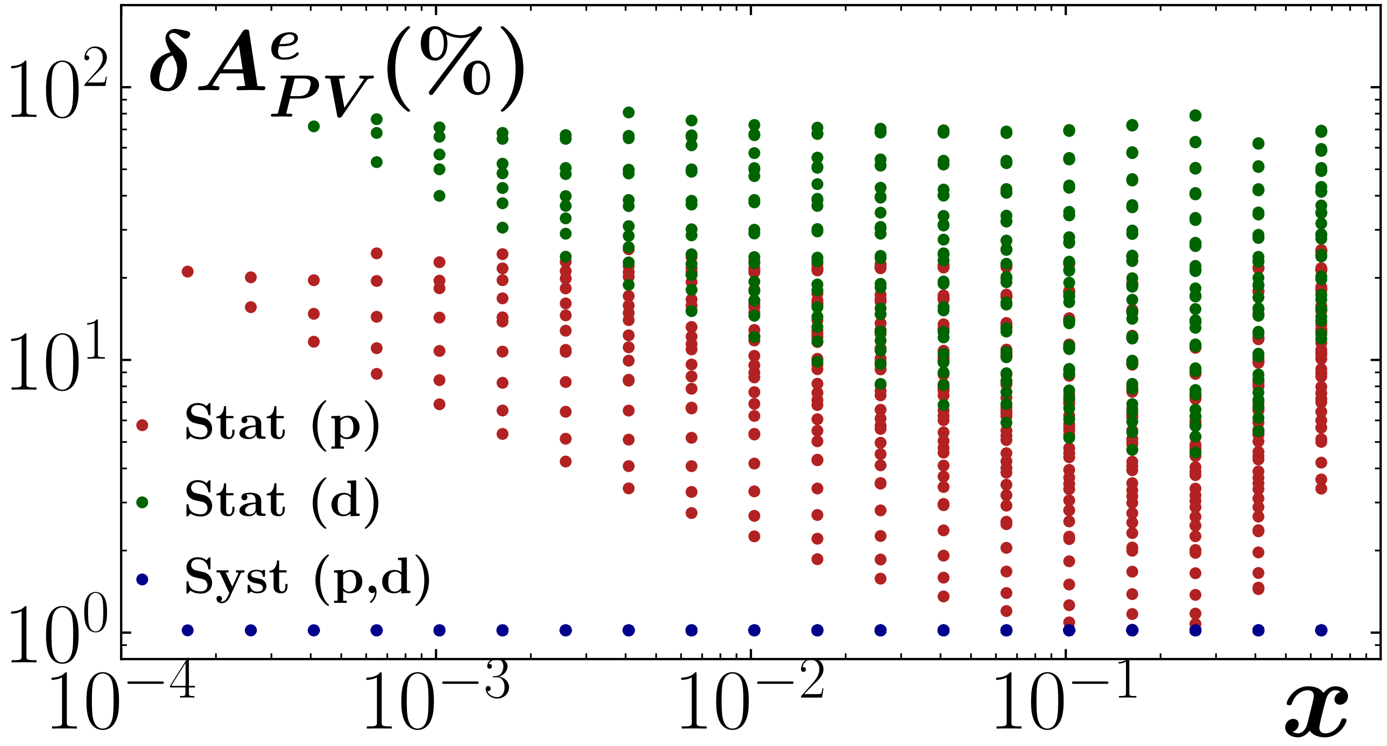
Pion contamination

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-}

% Errors from 10 fb^{-1}

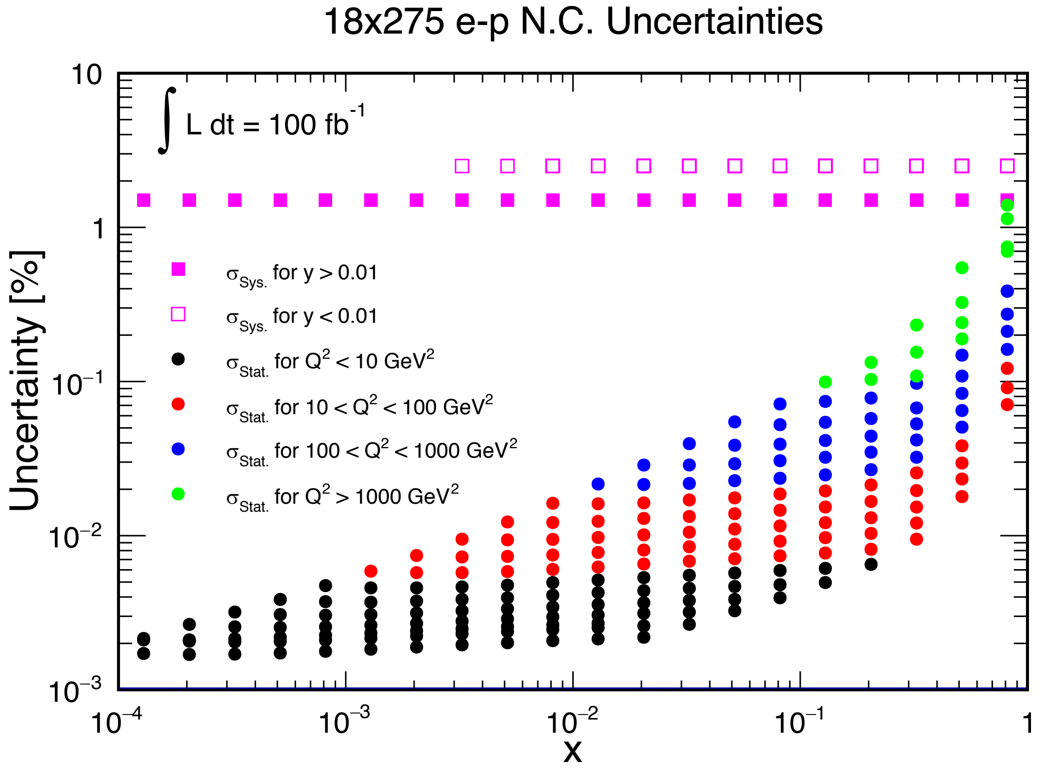


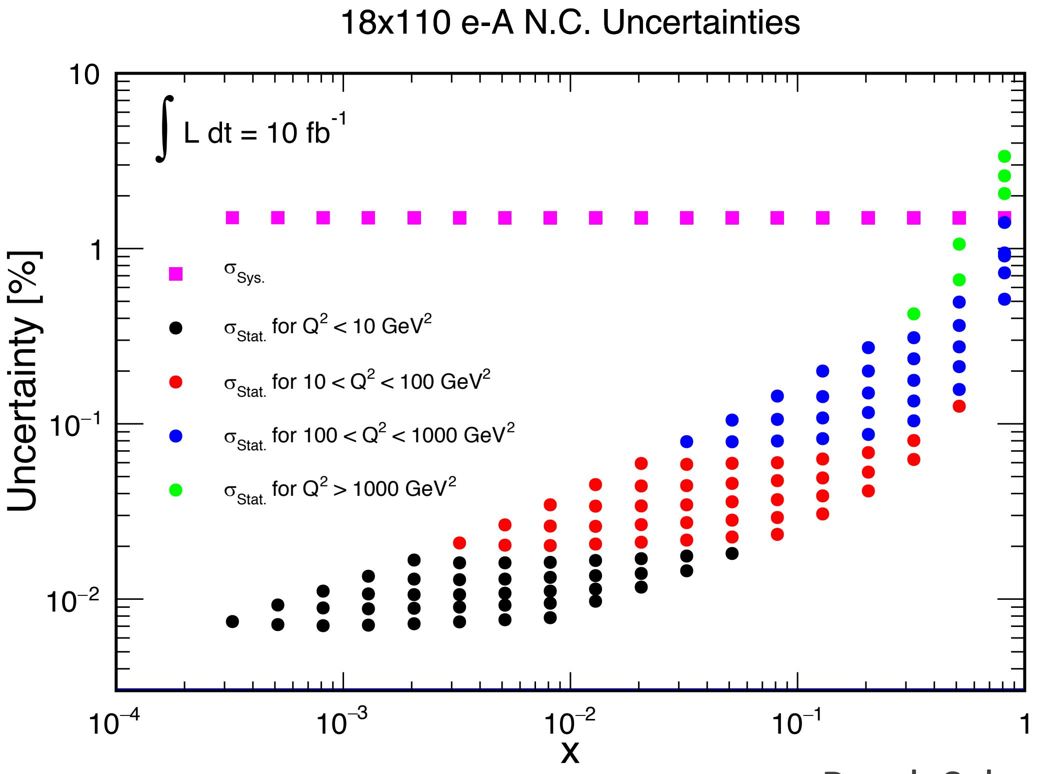
1) Limit pion contamination systematic error to be ~10% of statistical error.
2) Translates into a requirement of pi/e = 1×10^{-3}
3) This requirement is never met in the central region ($-2 < \eta < 1$)
4) Room for improvement with implementation of PID algorithms.

Chris Cocuzza

QUESTIONS How important is integrated luminosity? For the anticipated integrated luminosities, will your observable be systematic or statistics-limited? If you expect to be systematically limited, which systematic source (or sources) are the most important?

ANSWERS : NC Xsec are systematics limited at all √s values. Uncorrelated errors were 1.5-2.3% and were dominated by errors on radiative corrections and detector effects. An additional 2% was added for y<0.01 since they rely on hadronic reconstruction methods. Correlated systematic errors were set at 2.5-4.3% and was dominated by detector effects, no luminosity errors.

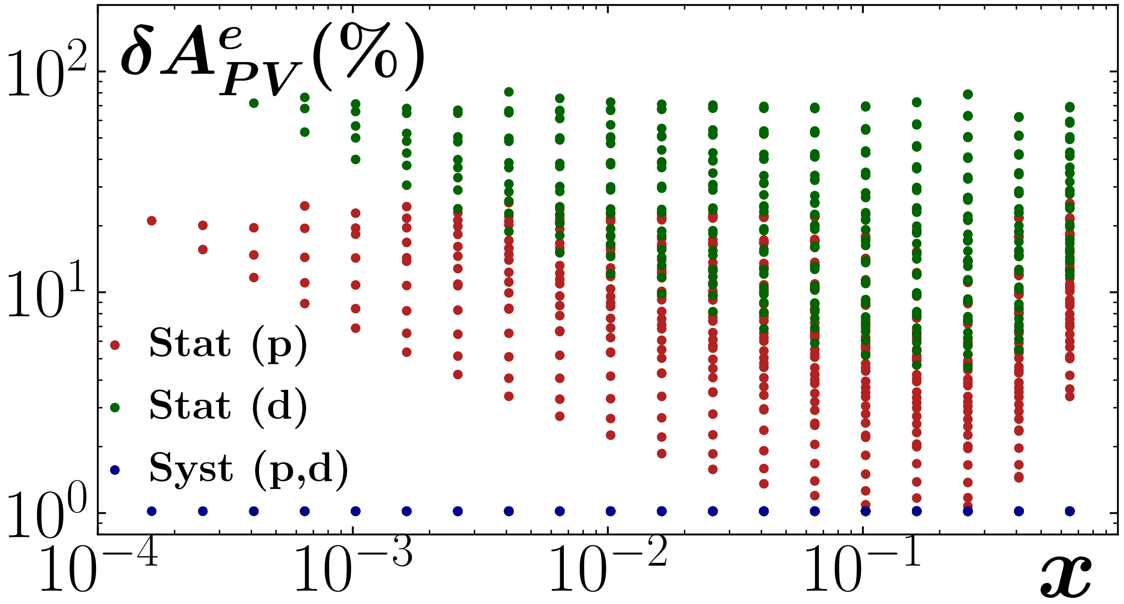




Barak Schmookler

QUESTIONS How important is integrated luminosity? For the anticipated integrated luminosities, will your observable be systematic or statistics-limited? If you expect to be systematically limited, which systematic source (or sources) are the most important?

How important is polarisation to your physics programme (quantify if possible, in terms of polarisation level and systematic precision requirements)? If applicable, discuss lepton and hadron polarization separately.



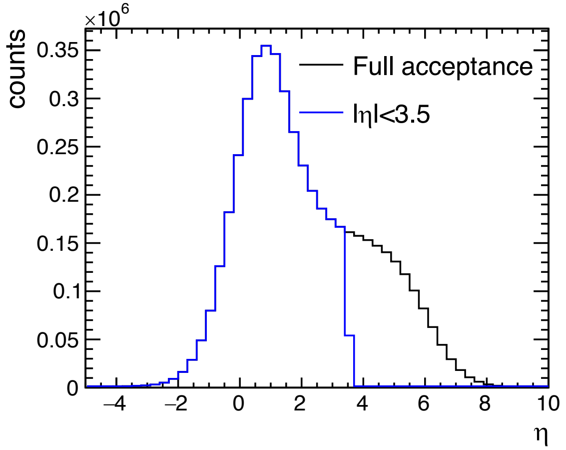
ANSWERS : Asymmetries are statistics and not systematics limited, so total integrated luminosity is important. Polarization feeds directly into statistical errors so maximizing polarization is critical. The systematic on the polarization enters as a normalization error so not as critical.

Chris Cocuzza

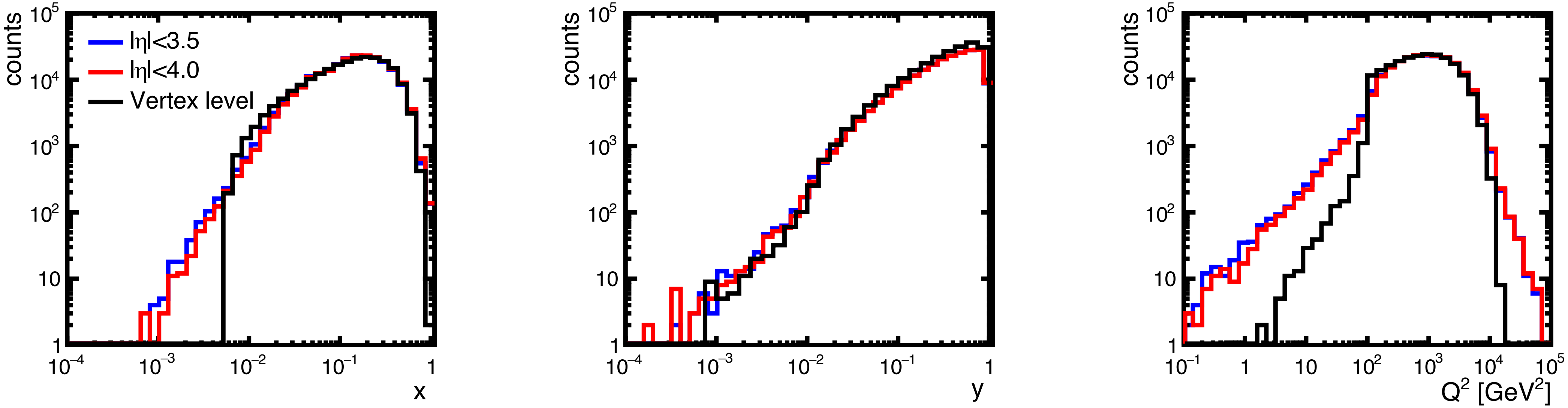
QUESTIONS

How important is the Interaction Region design for your physics observable and do you have criteria that might impact the design? For example, would you be impacted by reduced forward acceptance for neutrons, protons, photons?

Is the large rapidity acceptance (|eta| 3-4) critical for your physics? Any problems if the focusing quadrupoles would be inside the detector volume.



ANSWER JB reconstruction would be affected if IR encroached on η < 3.5. Expanding out to η = 4 is not critical for x, y and Q^2 reconstruction.



Xiaoxuan Chu

QUESTIONS

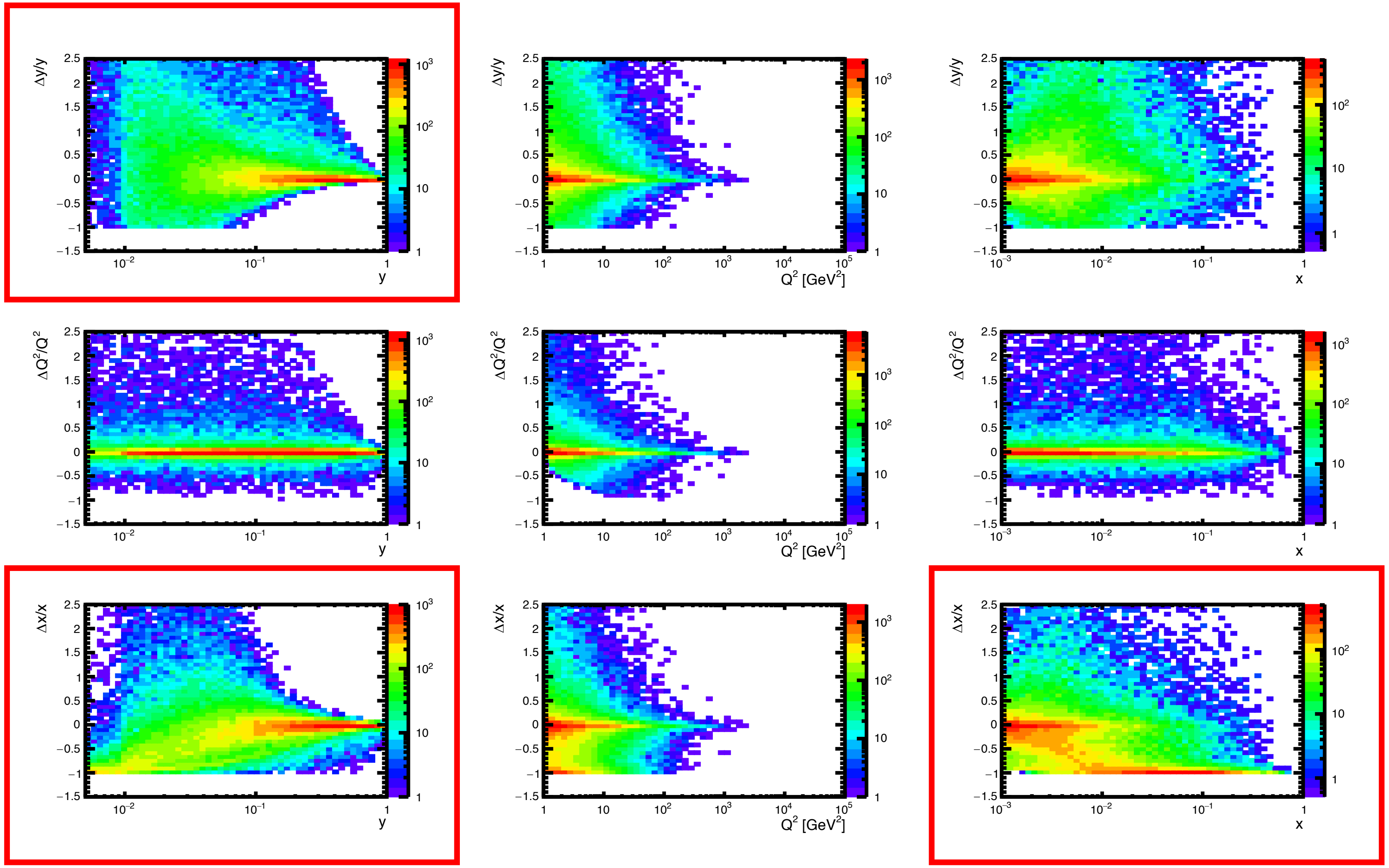
What is the sensitivity of your physics to the lower y-cut and the depolarization factor?

ANSWER JB reconstruction requires inelasticity > 0.01 cut.

$\Delta x/x$ and $\Delta y/y$ diverge as $y \to 0$

$\Delta x/x$ develops systematic offset at $x \sim 10^{-2}$.

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



Xiaoxuan Chu

QUESTIONS

What is the sensitivity of your physics to the lower y-cut and the depolarization factor?

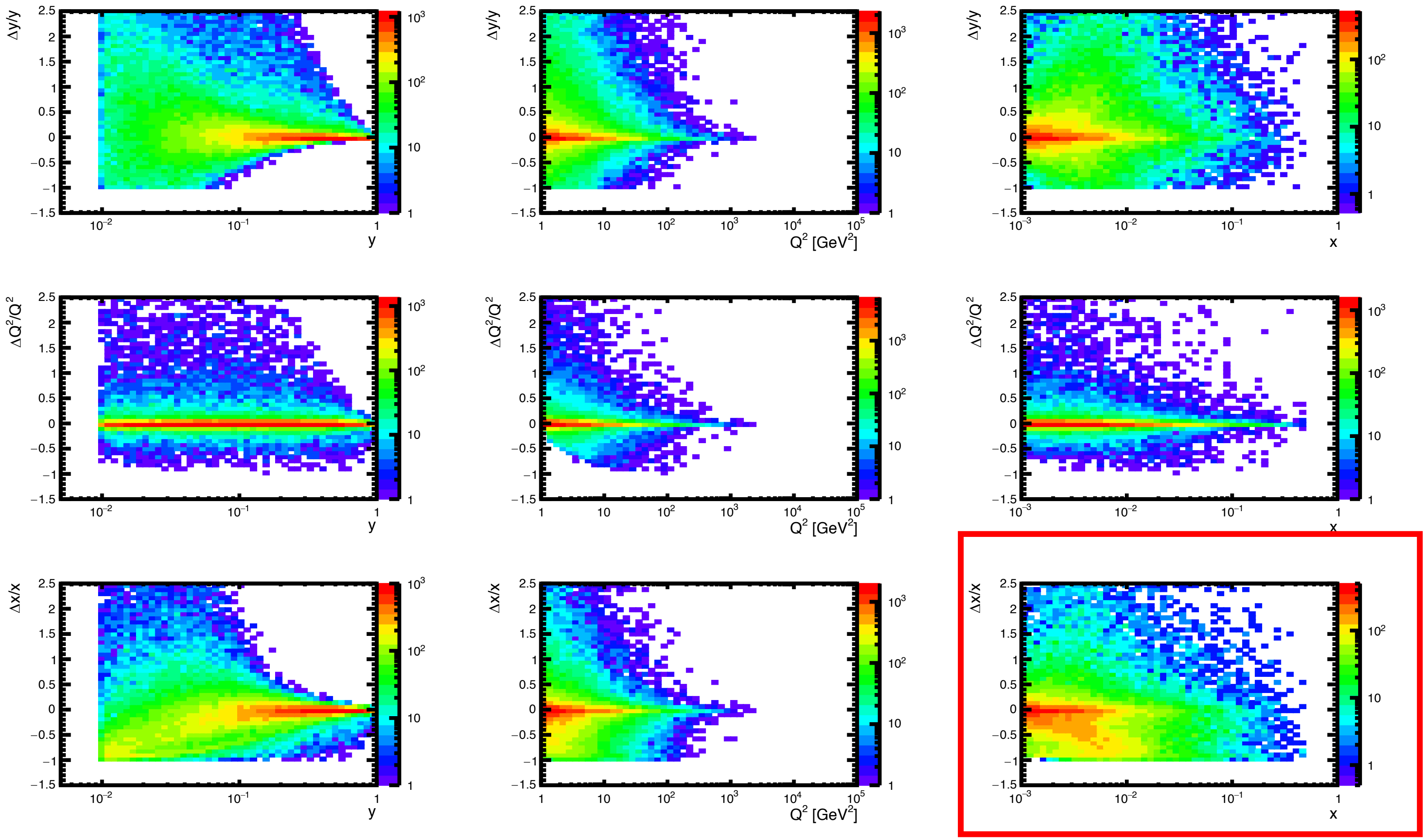
ANSWER JB reconstruction requires inelasticity > 0.01 cut.

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.

Removed by y > 0.01 cut



Xiaoxuan Chu

QUESTIONS

Which physics processes have contradictory requirements not possible to consolidate in one detector.
What physics processes need a dedicated detector / cannot be fulfilled by a general- purpose detector.

ANSWER In general, the proposed large acceptance detector is suitable for the vast majority of the inclusive channels, which typically require $Q^2 > 1$ cuts. A notable exception is inclusive photon-production which would require a far forward $Q^2 = 0$ tagger. The inclusive group did not study this channel but expects the requirements to be very similar to those discussed in the vector meson photo-production channel.