

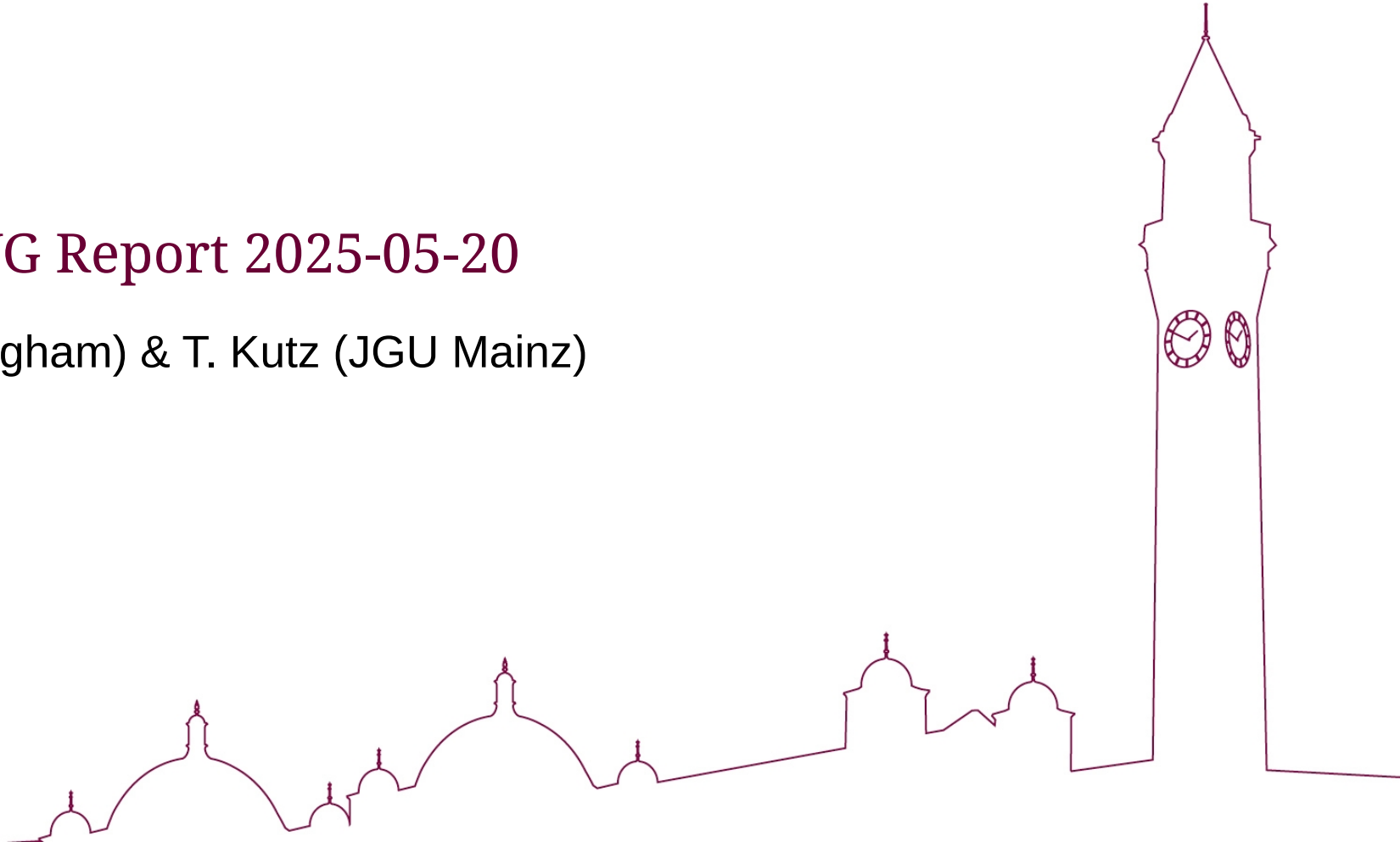


UNIVERSITY OF  
BIRMINGHAM

SCHOOL OF  
PHYSICS AND  
ASTRONOMY

# Inclusive PWG Report 2025-05-20

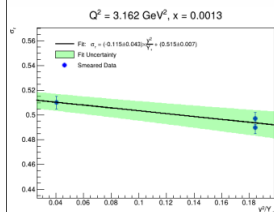
S. Maple (Birmingham) & T. Kutz (JGU Mainz)



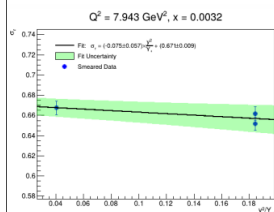
# Since Last update in Analysis Coordination meeting

## Evaluated EIC-only $F_L$ extraction with Early Science configs (Rosenbluth method)

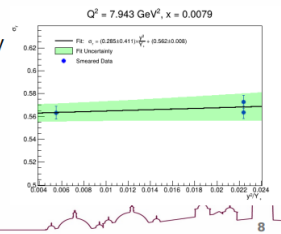
### Optimistic scenario (1% errors everywhere)



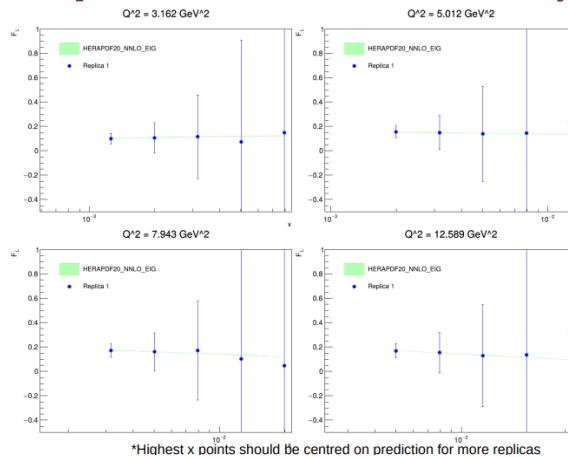
- Only 3 points and 2 c.o.m. energies
- Left point intersected, right hand points split roughly down middle
- Only  $\sim 0.14$  range in  $y^2/Y_+ \rightarrow$  lower c.o.m. energies needed to fill this out



- With these settings it's fairly common to get a positive gradient i.e. negative  $F_L$  (note tiny range on x axis)



### Optimistic scenario (1% errors everywhere)



- Repeat smearing procedure over 1000 replicas
- Central point is mean value reconstructed for  $F_L$
- Error bars are standard deviation of reconstructed values
- With 3 points / 2 energies we get a couple of meaningful points per  $Q^2$  range

- A couple of good points at low-x, but most impact will likely come when Early Science data included in global fits

### Inclusive PWG meeting

Tuesday 15 Apr 2025, 16:00 → 17:00 Europe/London

Description Zoom link: <https://mit.zoom.us/j/92661341001>

16:00 → 16:20 FL studies

Speaker: Stephen Maple (University of Birmingham)

FL\_update.pdf

16:20 → 16:40 Electron finder

Speaker: Tyler Kutz (MIT)

Basic electron finder...

16:40 → 17:00 Impact studies with early science runs

Speakers: Peter Risse (staff@smu.edu;member@smu.edu;employee@smu.edu), Shujie Li (Lawrence Berkeley National Laboratory)

CJ\_impact\_study\_pr...

EIC\_early\_science\_p...

# Since Last update in Analysis Coordination meeting

## Common electron finder library demonstrated

### Current detector-based electron ID

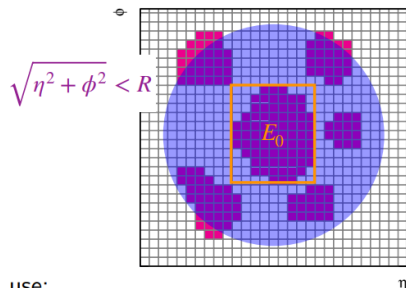
`edm4eic::ReconstructedParticleCollection ElectronID::FindScatteredElectron()`

- Loop over all reconstructed particles, and apply cuts on:

- Require negative tracks
- $0.9 < E/p < 1.2$
- Isolated cluster

$$R = 0.4$$

$$E_0 / \Sigma E_R < 0.9$$



- If  $> 1$  particles in collection, can use:

`edm4eic::ReconstructedParticle`

`SelectHighestPT(edm4eic::ReconstructedParticleCollection)`

- Available in snippets for people to start using in their analyses

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CJ\_impact\_study\_pr...

EIC\_early\_science\_p...

### How to use it?

<https://github.com/eic/snippets/tree/main/ElectronID>

Name	Last commit message	Last commit date
..		
ElectronID.cc	Added ElectronID class with inclusive skimmer exa...	2 minutes ago
ElectronID.hh	Added ElectronID class with inclusive skimmer exa...	2 minutes ago
InclusiveSkim.C	Added ElectronID class with inclusive skimmer exa...	2 minutes ago
InclusiveSkim.h	Added ElectronID class with inclusive skimmer exa...	2 minutes ago

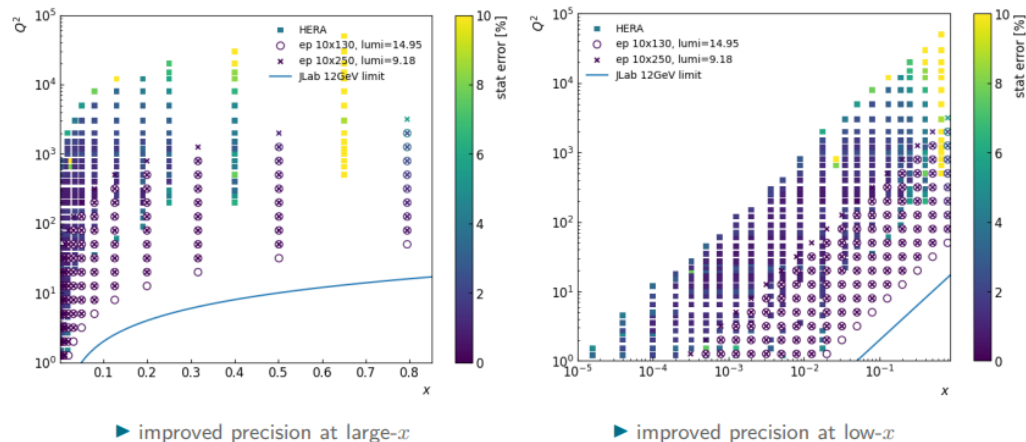
Use example: data skimmer for inclusive analysis

- Input: EICrecon ROOT file
- Output: ROOT file with kinematic variables calculated using MC and reconstructed electron

# Since Last update in Analysis Coordination meeting

## CJ impact studies using early science ep/eD

### eP runs: kinematics & statistics



- Shown at Early Science workshop

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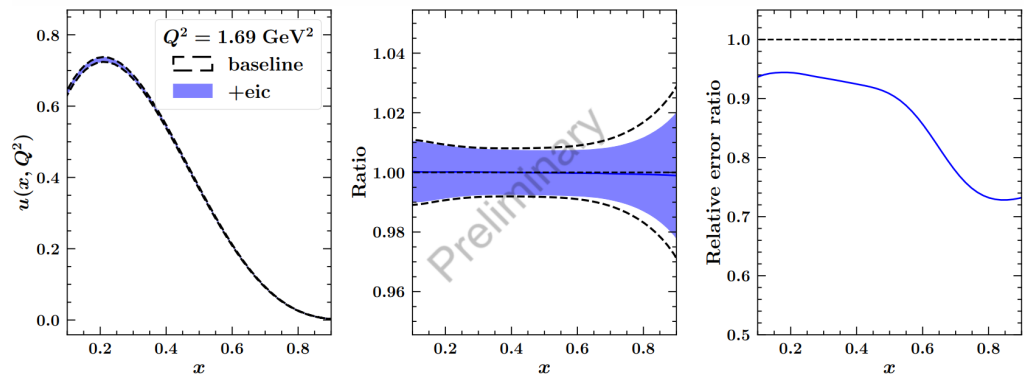
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CJ\_impact\_study\_pr...

EIC\_early\_science\_p...



# Next meeting today at 11am EST

## Inclusive PWG meeting

Tuesday 20 May 2025, 16:00 → 17:00 Europe/London

Description Zoom link: <https://mit.zoom.us/j/92661341001>

16:00 → 16:20 **Update on eID and A1n**

Speaker: Win Lin (Stony Brook University)

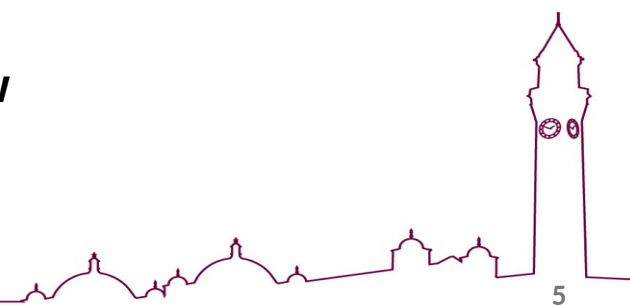
20m

16:20 → 16:40 **Update and discussion on studies for pTDR**

Speakers: Stephen Maple (University of Birmingham), Tyler Kutz (MIT)

20m

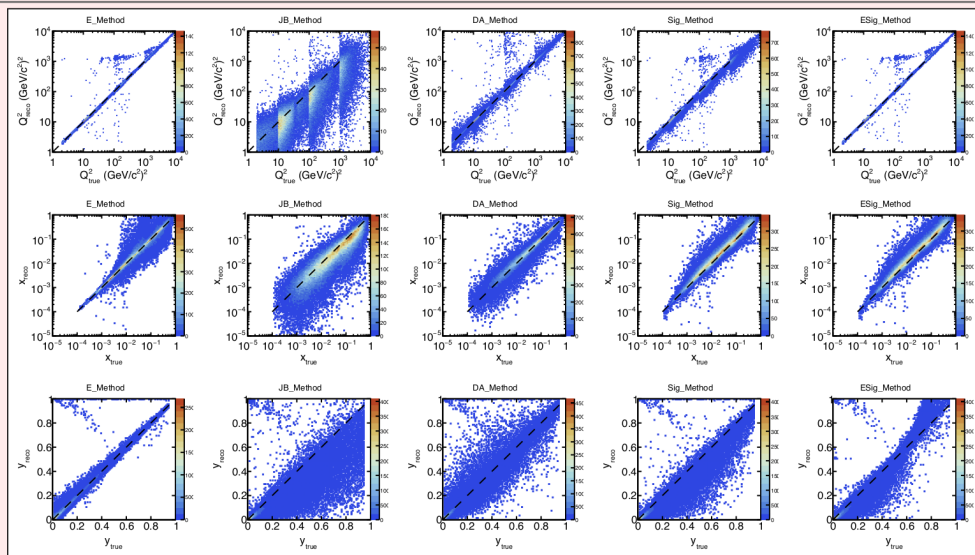
- Work to be shown properly later today: but here's a preview



# Next meeting today at 11am EST

- Validating electron finder (from snippets)
- Inclusive  $A_1^n$  comparison

e recon. (det. Based ID) - with dE/E cut



$A_1^n$  from  $e^3\text{He}$  DIS:

$$A_1(x, Q^2) \equiv \frac{\sigma_{1/2} - \sigma_{3/2}}{\sigma_{1/2} + \sigma_{3/2}} = \frac{A_{\parallel}}{D(1 + \eta\xi)} - \frac{\eta A_{\perp}}{d(1 + \eta\xi)}$$

$$\mathcal{L} = 8.65 \text{ fb}^{-1}, P_e = P_n = 70\%$$

Data split evenly between  $A_{\parallel}$  and  $A_{\perp}$

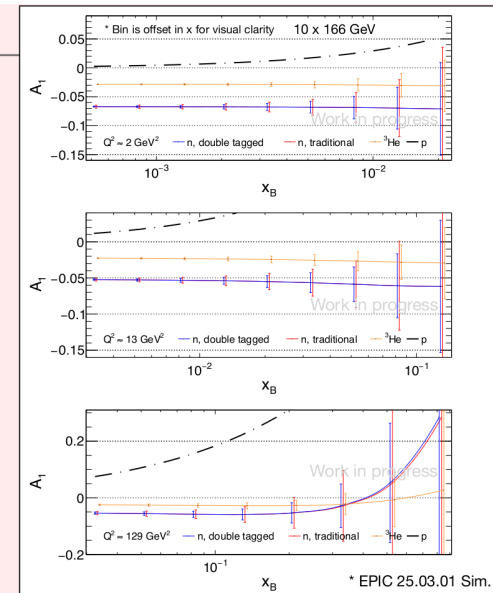
$$\delta A_{\parallel, \perp} = \frac{1}{\sqrt{N} P_e P_N}$$

$$A_1^{^3\text{He}} = P_n \frac{F_2^n}{F_2^{^3\text{He}}} A_1^n + 2P_p \frac{F_2^p}{F_2^{^3\text{He}}} A_1^p$$

Bin  $A_1^n$  calculated from: [Doi: 10.2172/824895](https://doi.org/10.2172/824895)

$F_2^{^3\text{He}} = F_2^D + F_2^p$ , all  $F_2$ 's are taken from [JAM22](#)

Correction not yet applied

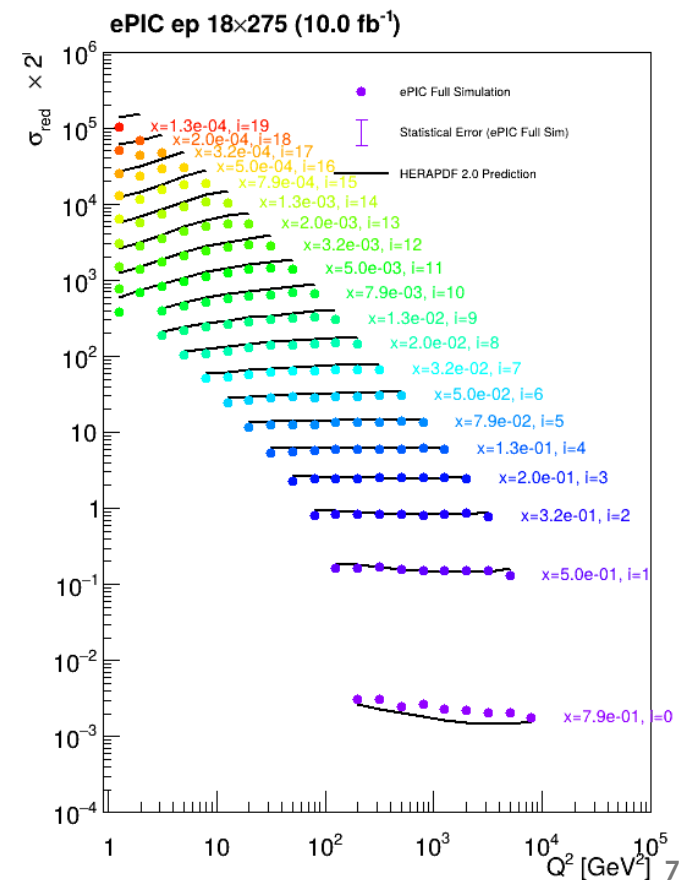
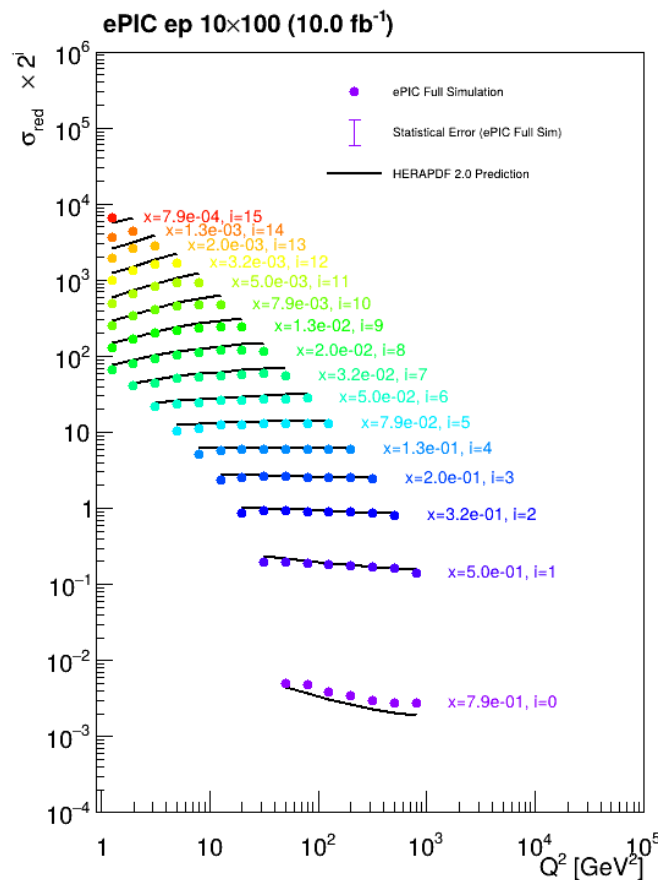
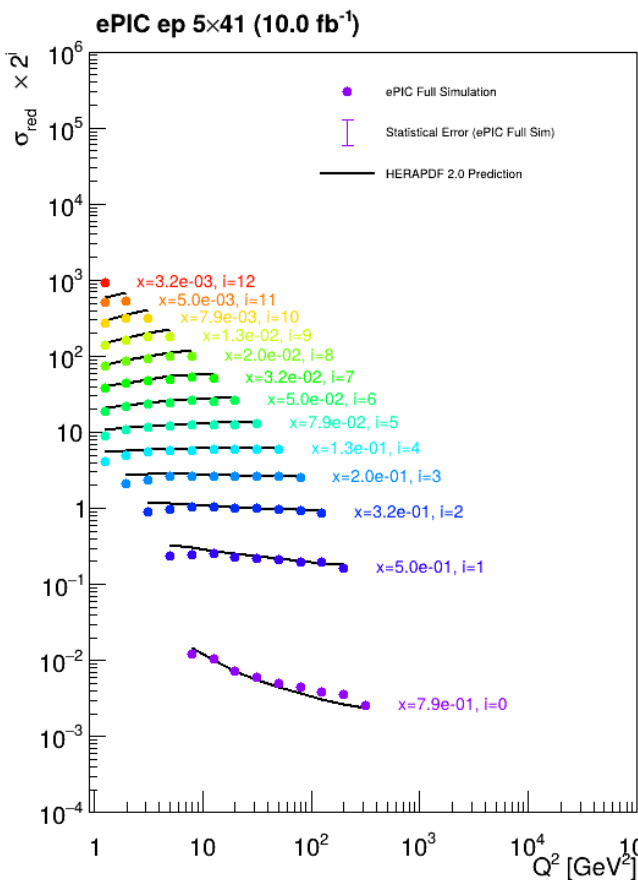


Work by W. Lin (SBU)

# Next meeting today at 11am EST

\*Stat error smaller  
than points

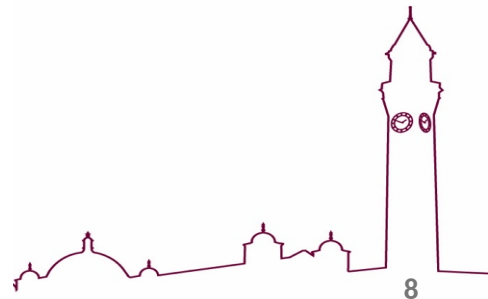
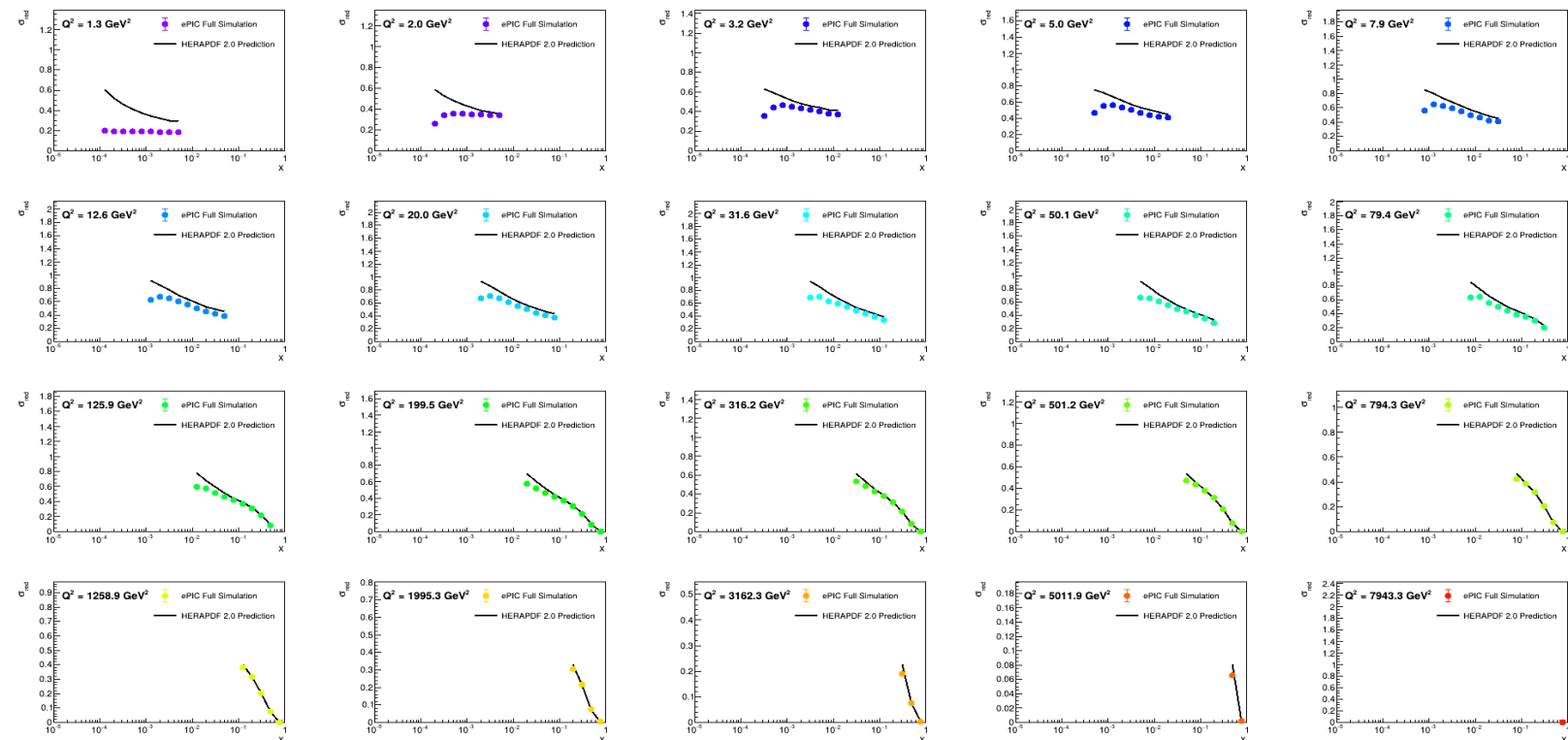
## Reduced cross section plots (25.04.0 pythia8 campaign files)



# Next meeting today at 11am EST

- Strange behaviour at low- $x$  → validate with different generator

18x275 ep  $\sigma_{\text{red}}$  vs  $x$  (25.04.0 pythia8 campaign files)

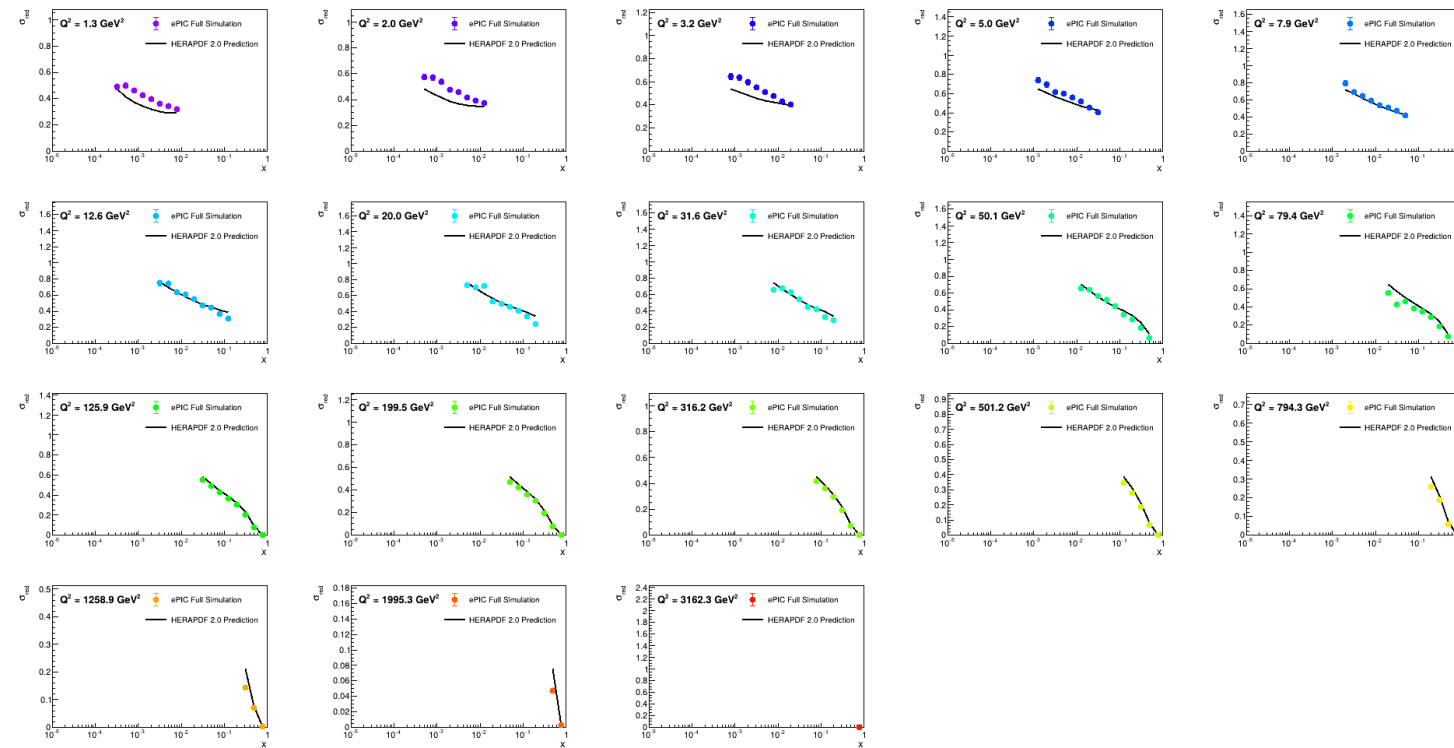




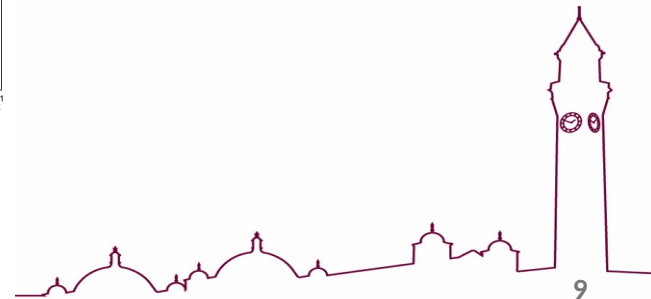
# Next meeting today at 11am EST

- Much better agreement → Pythia6 files underestimate where Pythia8 overestimates

10x250 ep  $\sigma_{\text{red}}$  vs  $x$  (25.04.0, pythia6 w/ CTEQ61)



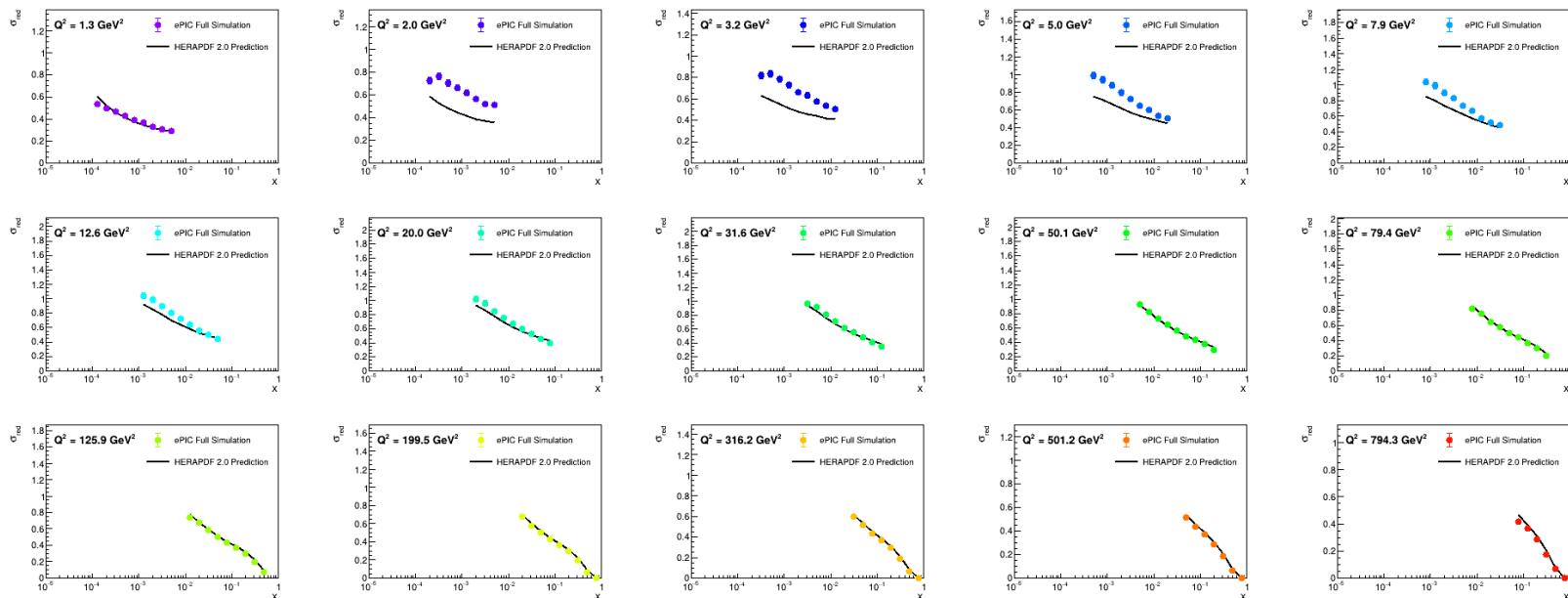
Note different  
c.o.m. energy



# Next meeting today at 11am EST

- Pythia6: HERAPDF1.5 overestimates at low  $Q^2$  more than CTEQ61

18x275 ep  $\sigma_{\text{red}}$  vs  $x$  (25.04.0, pythia6 w/ HERAPDF1.5)



# Ongoing work

- Validation/development of eID
- Studies of systematics (from e.g. radiative corrections, guesses at misalignment, etc.)

