

# Early Science Report Inclusive Appendix Status

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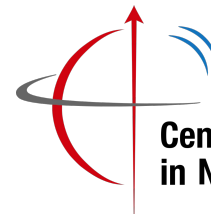
ePIC and EIC Physics Readiness Workshop, 03/17/2026



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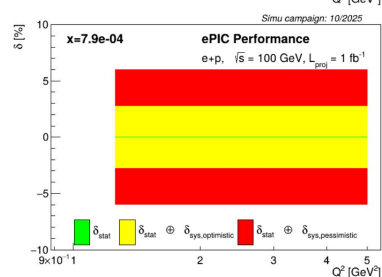
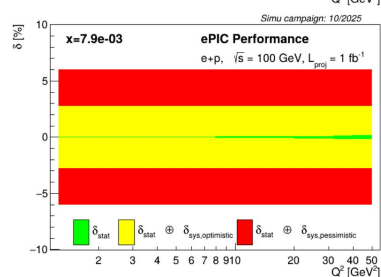
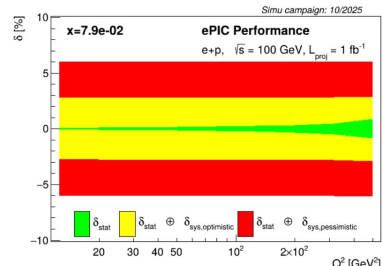
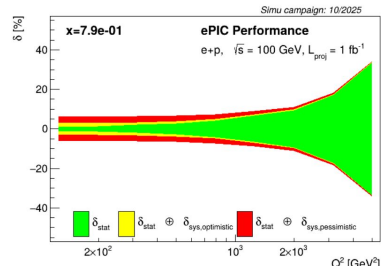
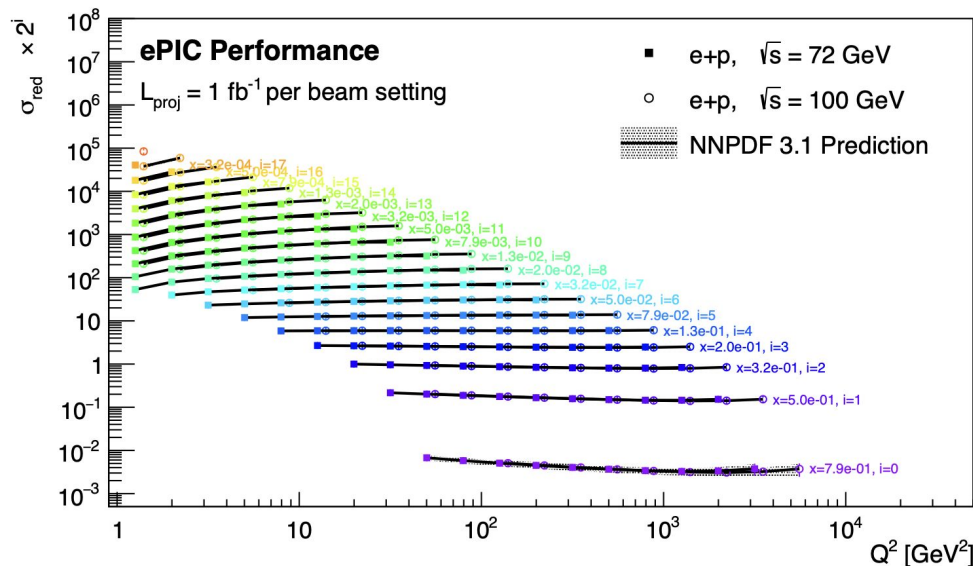


Center for Frontiers  
in Nuclear Science

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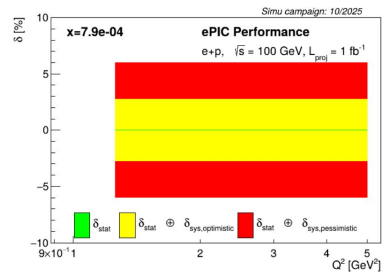
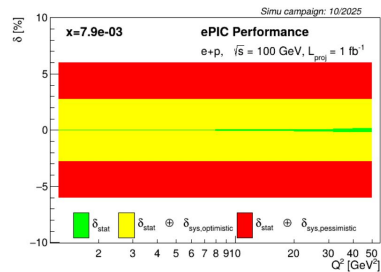
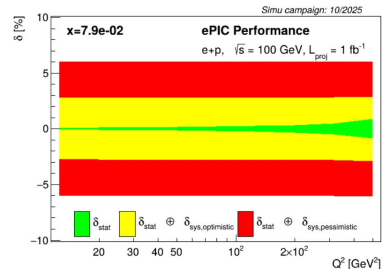
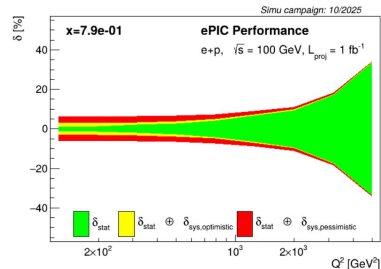
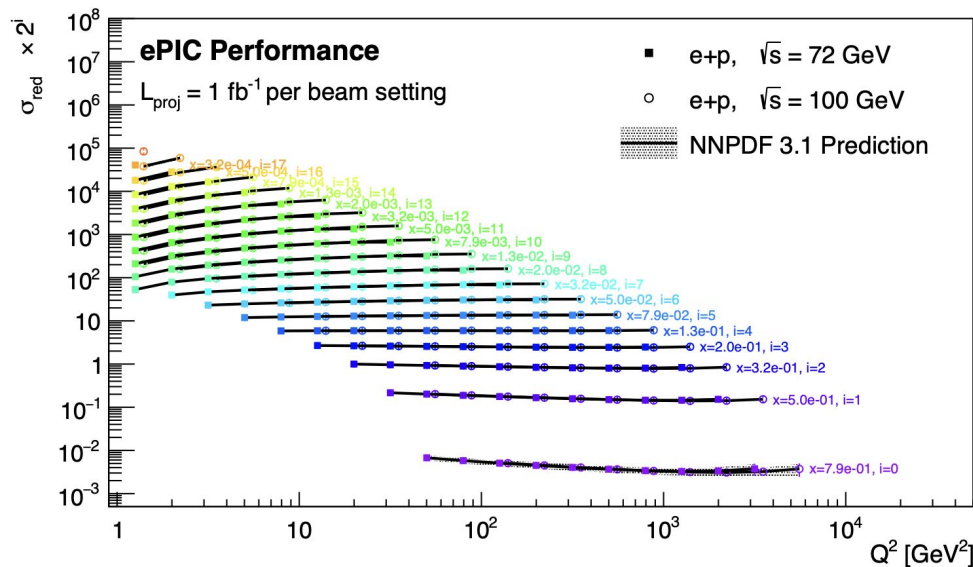
- All plots will be updated when 26.03 simulation campaign finish running
- Additional topics? Impact on nPDFs if possible, others?
- Background discussion?
- Add some plots to A.1 and A.2? E.g. benchmarks plots for eID, kinematic resolutions
- Possibility of group paper similar to exclusive PWG's?

# A3. NC Reduced Cross Sections



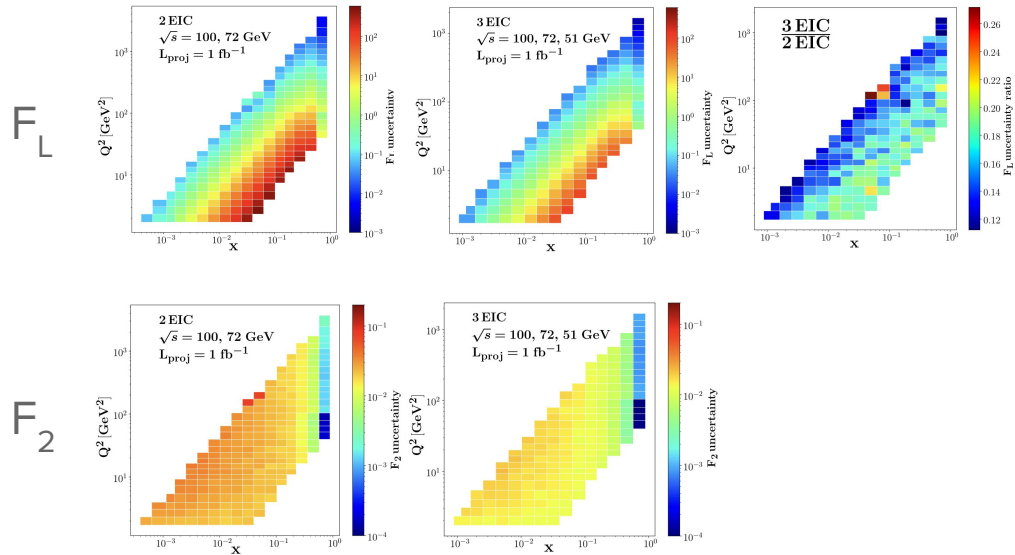
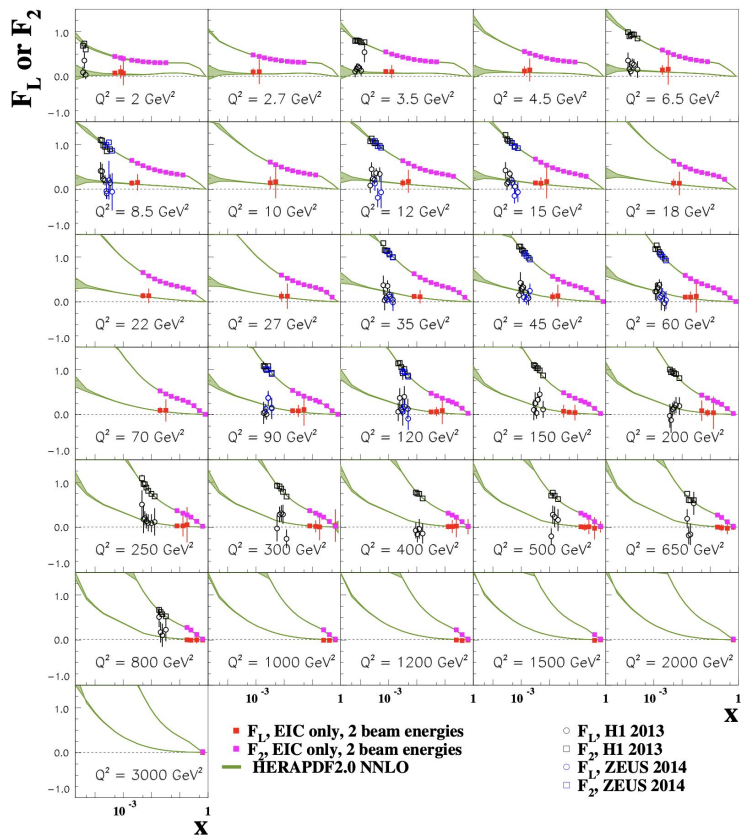
- Goal is to give indication of how many (e-p)  $\sigma_{\text{red}}$  measurements, over what region in  $x$ - $Q^2$ , and with what precision
  - Input for other studies in the appendix
  - Is it worth having kinematic resolution plot to motivate  $x$ - $Q^2$  binning? (Similarly to what is in preTDR)
- Set up systematics estimates as range, clarify that we take midpoint for further studies, and that statistical uncertainties should be negligible for lower  $Q^2$  (and  $x$ ) values
  - Values inspired by YR studies - possible to update?

# A3. NC Reduced Cross Sections



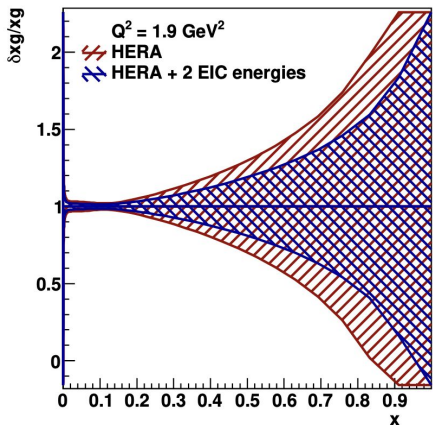
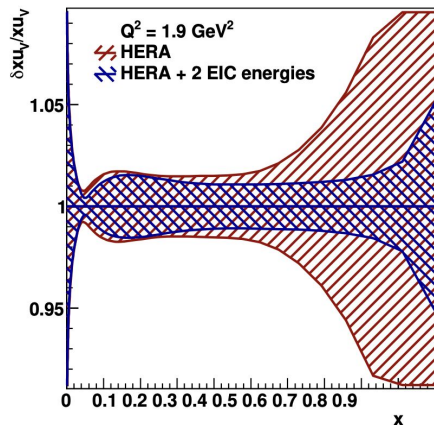
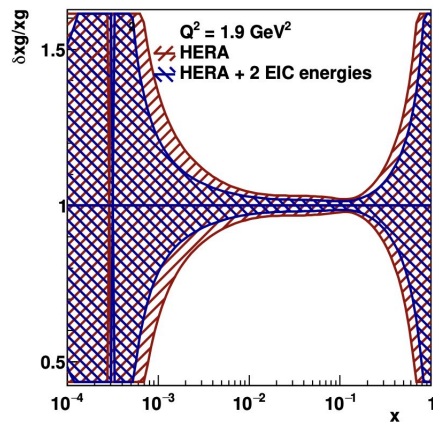
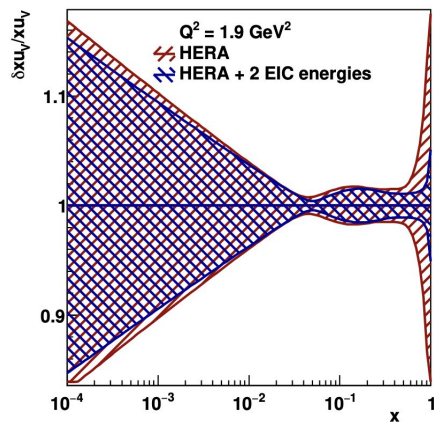
- Plots in good place - currently showing pessimistic (red band on RHS) uncertainties for points on LHS  
 -> update LHS with March campaign for statistical uncertainties and systematics to 1.9%/3.4% uncertainties from midpoint of estimates (won't make visual difference since errors are small)
- Update RHS plot with statistical uncertainties from March campaign

# A4. Proton $F_2$ and $F_L$



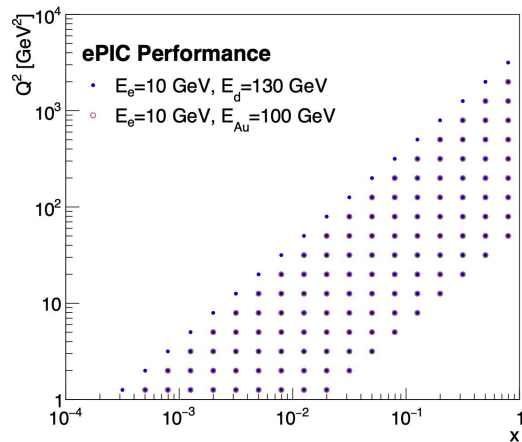
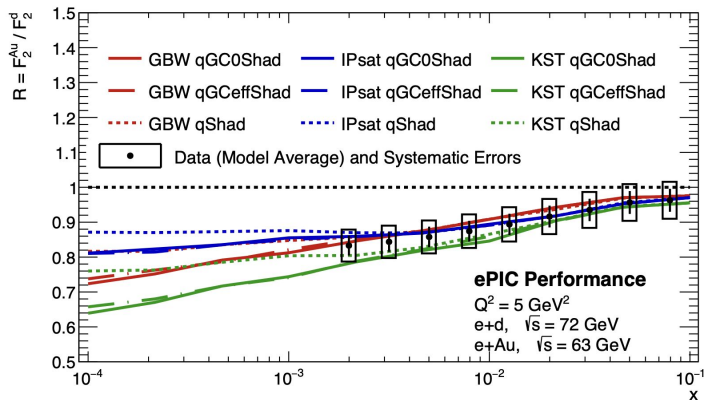
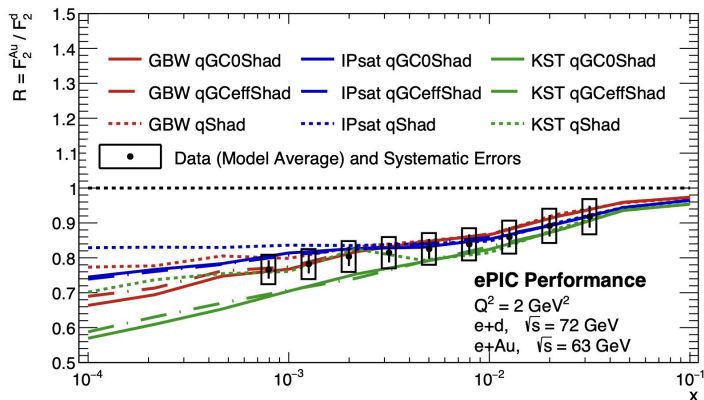
- Cross-section grids used as inputs to study extraction of structure functions
- LHS shows  $F_2/F_L$  and uncertainties from **model independent** extraction (2-beams)
- Compare to 3-beams - strong case for  $F_L$  (5-8x improvement in uncertainties)
- Not using “ePIC style” - RHS in python, no official macro? Workaround possible

# A5. Proton PDFs



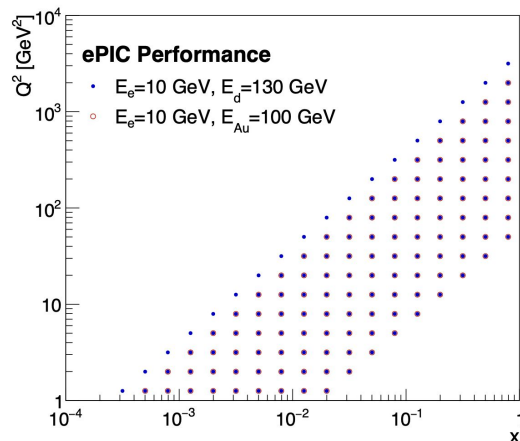
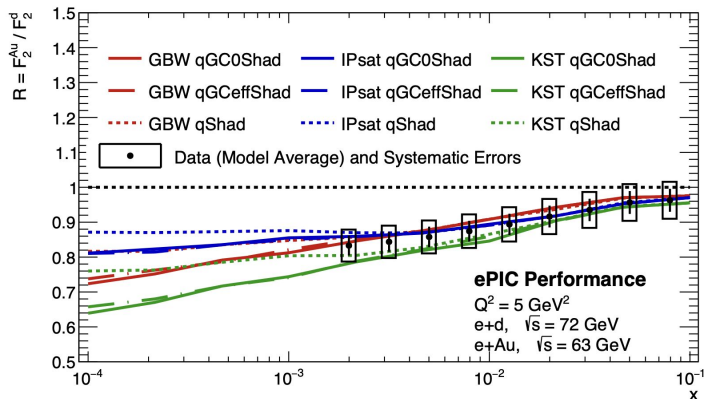
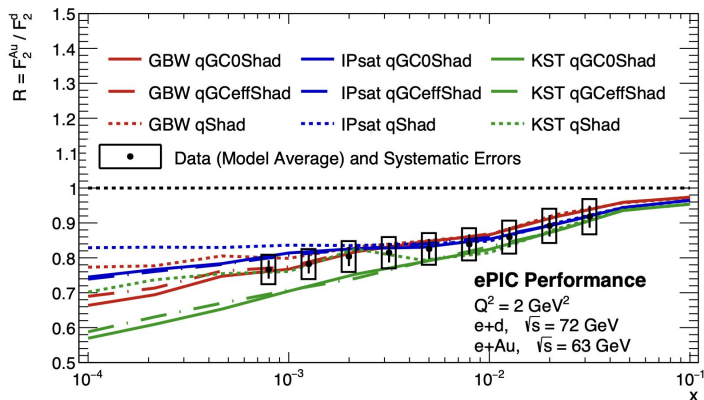
- Same cross-section grids used as inputs to fits
- Proton PDF impact (HERAPDF2.0) from 2 EIC early science beam configs
  - $U_v$  and  $g$  distributions are only ones to show significant impact
  - More impact at large- $x$
- Have equivalent plot for 3 beams - removed from appendix (minimal difference between configs)
- Problem with axis on  $U_v$  linear from conversion -> fixed now in overleaf, but not for version as of March 6th

# A6. $F_2$ ratio in e+Au collisions



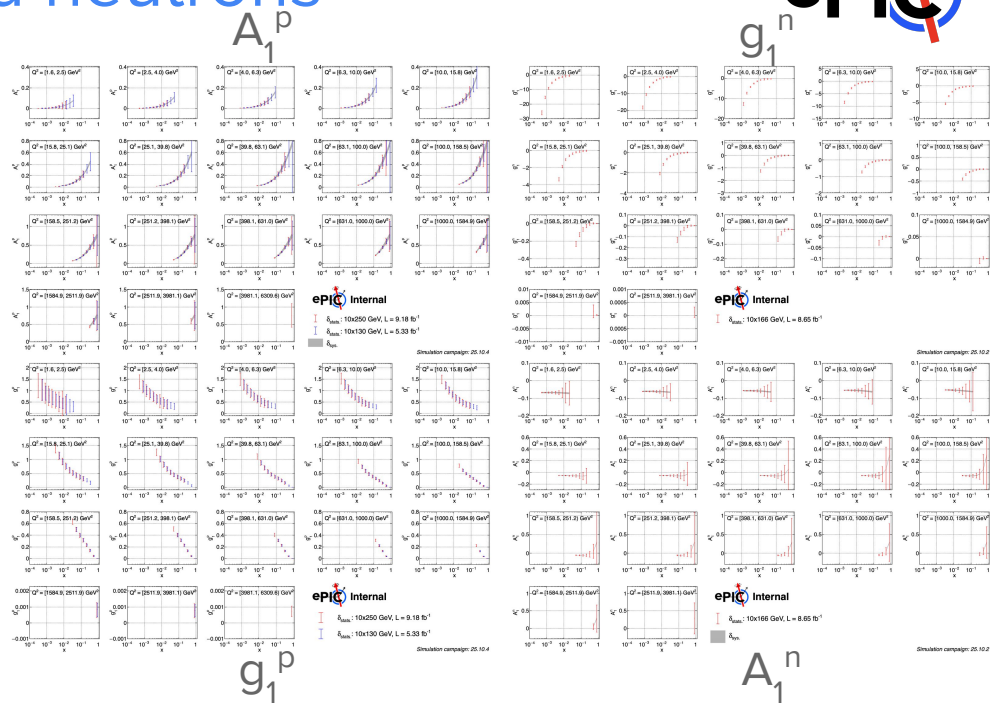
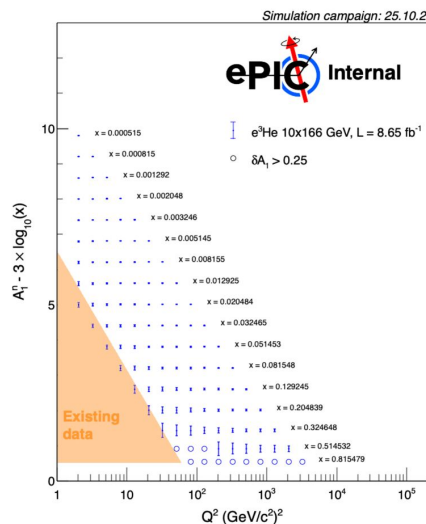
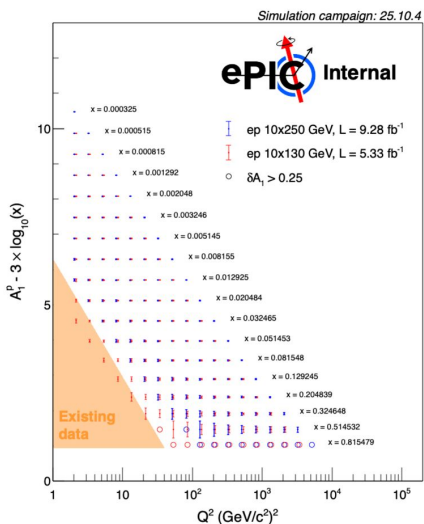
- Initial studies of  $F_2$  ratio in Au at 2  $Q^2$  values (more available)
  - Would like similar plot for Ru/Cu, but don't currently have model predictions for these (TODO: e.g. R vs A)
- Statistical uncertainties omitted as showing points for lower x and  $Q^2$
- Optimistic and pessimistic estimates for systematics
  - In optimistic use 1.5% normalisation uncertainty uncorrelated between beam configs, in pessimistic use 3.4%

# A6. $F_2$ ratio in e+Au collisions



- This is our only projection for (unpolarised) e-A
- We could pursue other, impactful, projections by working with groups beyond inclusive WG:
  - Create/pass eA pseudodata to PDF fitting groups for nPDF impact studies
  - Work with EDT WG towards  $\sigma_{\text{red}}^D / \sigma_{\text{red}}$  ratio in ep/eA

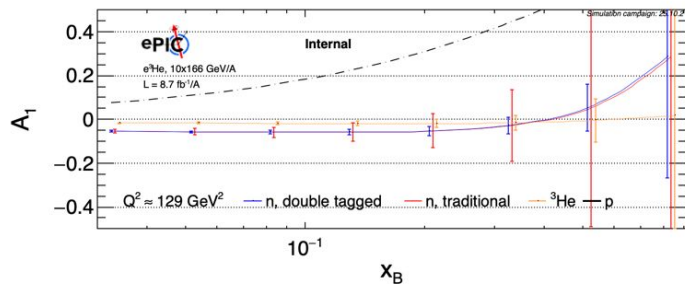
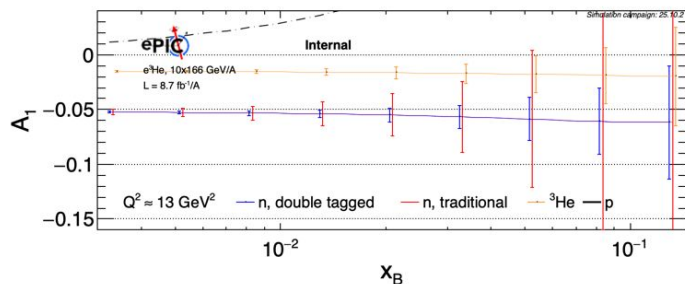
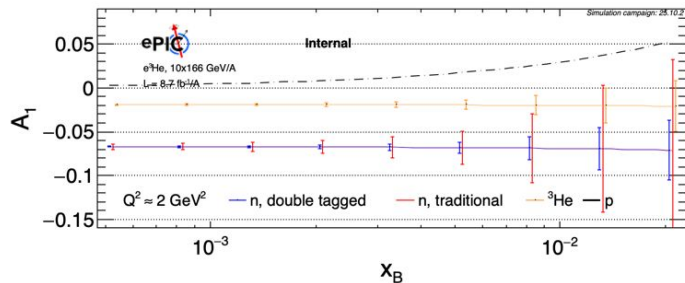
# A7. $A_1$ and $g_1$ for protons and neutrons



- Demonstrate what is possible for  $A_1$  extractions during early science
- Systematic and statistical uncertainties compared on RHS stamp plots -> statistical uncertainty dominates



# C.5.3. He3 with double spectator tagging



## Dominant background

background	DIS & physics ( $Q^2 > 1 \text{ GeV}^2$ )	Machine
DVCS	3% for DIS and < 1% from $\pi^0$	
DV $\pi^0$ P	0% low $t$ and 60-100% for high $t$	
DEMP	0.012% for DIS	
DVMP	<40% but can be removed by mass fits	
eAu $\phi$	~1% incoherent	
eHe3	Photoproduction (not studied here)	

## Dominant systematics

	Dominant systematics source	Estimates
DVCS	BH interference?	
DV $\pi^0$ P	cluster merging	
DEMP	Scale uncertainty	12%
DVMP	Background estimation and efficiency	
eAu $\phi$	Incoherent background and unfolding	
eHe3	Far-forward mistagging rate?	

Uncertainty in pion contamination and beam polarization?

# Summary



- Appendices for inclusive physics studies have made a good start (from Inclusive WG's perspective).
  - Plots to be updated with March campaign.
  - Text to be polished.
- Would like to add some discussions on backgrounds, **and hopefully new studies** (time permitting).

Thank you! :)