

ECCE Physics Benchmarks Team Bi-weekly Meeting Report

October 24th, 2021

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Physics plots for proposal

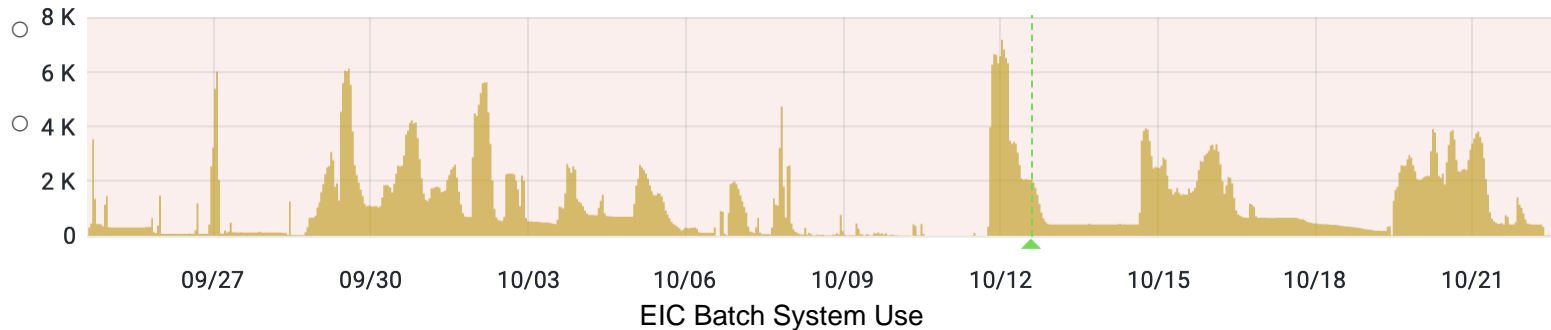
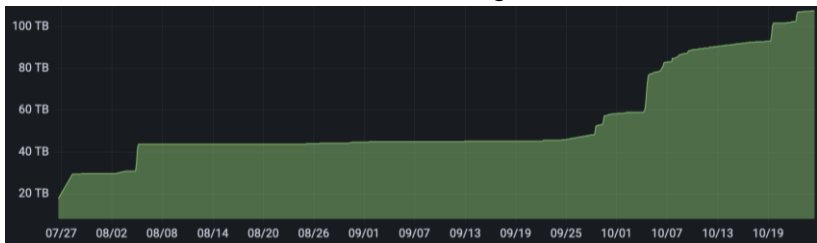
Plot	NAS topic	Additional NAS topic	Person in charge	WG		
xB, Q2 resolution vs. x, Q2 for different reconstruction methods	Detector performance		Claire	Inclusive		1) Tomographic Imaging of Quarks and Gluons
Inclusive NC e+P cross section vs. xB, for bins of Q2	7		Tyler	Inclusive		2) Heavy-quarkonia exclusive production at threshold
Inclusive NC e+D cross section vs. xB, for bins of Q2	7		Tyler	Inclusive		3) 3D imaging in Momentum Space
Inclusive NC e+He3 cross section vs. xB, for bins of Q2	7		Tyler	Inclusive		4) Gluon spin and orbital motion
Proton structure functions F2, FL, xF3 vs. xB	7		Sonny, Tyler, Claire	Inclusive		5) Transverse motion in polarized nucleons
Deuterium structure functions F2, FL, xF3 vs. xB	7		Sonny, Tyler, Claire	Inclusive		6) Propagation of energetic quarks through matter
Helium-3 structure functions F2, FL, xF3 vs. xB	7		Sonny, Tyler, Claire	Inclusive		7) Properties of Nuclei in QCD
Proton double-spin asymmetry ALL vs. xB	4	7	Jackson, Tyler, Claire	Inclusive		8) Diffraction
Helium-3 double-spin asymmetry ALL vs. xB	4	7	Jackson, Tyler, Claire	Inclusive		
Proton double-spin asymmetry ALT vs. xB	4	7	Needs assignment	Inclusive		
Constraints on unpolarized PDFs vs. xB : IMPACT	7		Claire, Eimear	Inclusive		
A1p, A1He3, A1n vs. xB (A1n extracted from A1p, A1He3) : IMPACT	4	7	Jackson	Inclusive		
Constraints on polarized PDFs vs. xB : IMPACT	4	7	Needs assignment	Inclusive		
Mean Delta z/z values in bins of x and Q2 for the scattered lepton kinematic reconstruction method	Detector performance		Ralf, Charlotte	SIDIS		
A_UT Sivers sin(phi_h - phi_S) or Collins sin(phi_h + phi_S) asymmetry moments for pi+ and pi- vs z	3	5	Ralf	SIDIS		
Up and down quark Sivers functions as a function of k_T in several bins of x (YR Fig 7.53)	3	5	Ralf	SIDIS		
A_LL double helicity asymmetries for pi+/- and K+/- as a function of x in bins of Q2 and z	4		Charlotte	SIDIS		
Expected impact of the EIC on the anti-up, anti-down and strange quark helicities (YR Fig 7.19)	4		Charlotte	SIDIS		
Nuclear modification factor (ReA) of J/psi vs momentum fraction (z)	6		Xinli Li and Wangmei Zha	Jets & HF		
Projected uncertainties for the nuclear modification factor (ReA) of open heavy flavor vs. momentum fraction (z)	6		Xuan Li	Jets & HF		
Jet energy scale and resolution vs jet energy	Detector performance		Tristan Protzman and Rosi Reed	Jets & HF		
Jet ReA vs jet pT	6		Raymond Ehlers	Jets & HF		
Dihadron azimuthal angle correlation: delta phi distribution	1		Nathan Grau	Jets & HF		
Jet eta vs. jet z for primary particle jet, reconstructed track jet and reconstructed track+cluster jet	3		John Lajole	Jets & HF		
Reconstructed track+cluster jet q_perp vs. z	3		John Lajole	Jets & HF		
Distribution of jet charge for u-quark and d-quark jets	3		John Lajole	Jets & HF		
DVCS (ep) cross section vs t, Q2 and xB	1		Igor	Exclusive		
Detector acceptance and efficiency for DVCS (ep) vs rapidity	Detector performance		Igor	Exclusive		
DVCS (He4) cross section vs t, Q2 and xB	1	7	Gary	Exclusive		
Detector acceptance and efficiency for DVCS (He4) vs rapidity	Detector performance		Gary	Exclusive		
Exclusive J/Psi cross section vs t, Q2 and xB	1	4	Nathaly, Stuart	Exclusive		
Detector acceptance and efficiency for DVCS (J/Psi) vs rapidity	Detector performance		Nathaly, Stuart	Exclusive		
Exclusive phi (eA) cross section (or asymmetries) vs t	1	8	Justin	Exclusive		
Detector acceptance and efficiency for DVCS (for exclusive phi) vs rapidity	Detector performance		Justin	Exclusive		
TCS cross section (or asymmetries) vs t, Q2 and xB	1		Kayleigh	Exclusive		
Detector acceptance and efficiency for DVCS (for TCS) vs rapidity	Detector performance		Kayleigh	Exclusive		
Pion form factor vs Q2	1		S. Kay, G. Huber	Diffraction & Tagging		
Pion structure function vs x	1		R. Trotta	Diffraction & Tagging		
A1n through e-He3 vs x: 5x41 GeV/u	7		D. Nguyen, J. Pybus	Diffraction & Tagging		
eA diffraction: d sigma/dt vs t	8		M. Baker, P. Steinberg	Diffraction & Tagging		
Electroweak mixing angle vs. Q2 (ep and eD)	N/A		Xiaochao	Electroweak & BSM		
Reconstructed Tau lepton decay length vs. truth decay length	Vertex tracking detector performance		Jinlong Zhang	Electroweak & BSM	TBC	
An impact plot for tau searching (Receiver Operating Characteristic curve)	N/A		Jinlong Zhang	Electroweak & BSM	TBC	

Discussions started among PWG conveners and Godparents to choose the best set of plots to feature in the proposal

Simulation WG

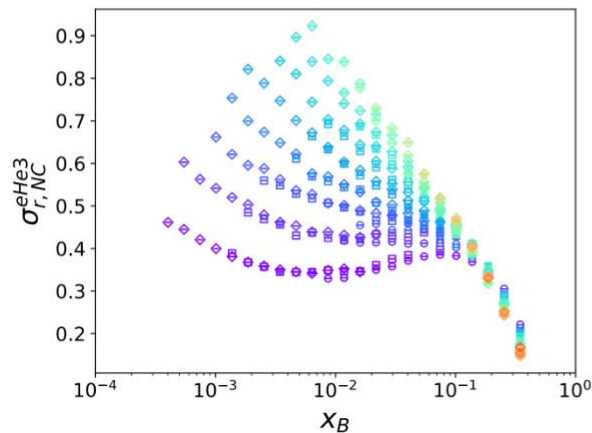
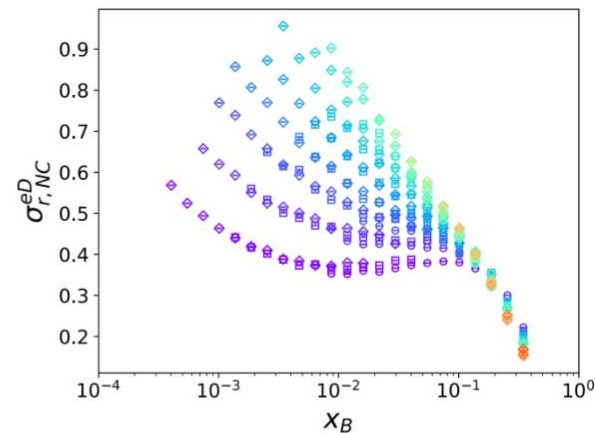
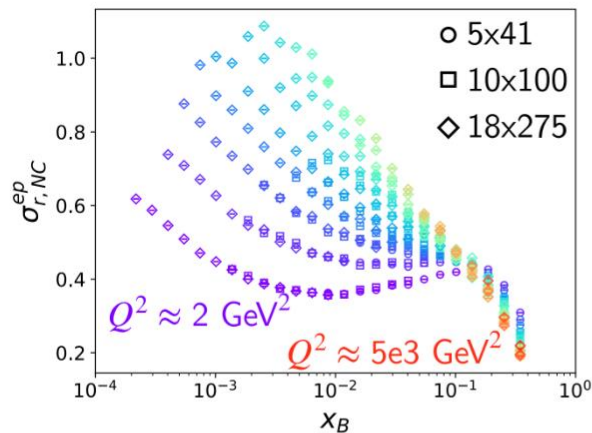
- Second simulation campaign is complete
 - Includes all re-runs and re-processing
 - [See production table for locations of all samples](#)
- [Third campaign](#) will be underway soon
 - Waiting for two more subsystem updates
 - Will update detector positions after final decision on layout

ECCE S3 Storage



Inclusive reactions WG

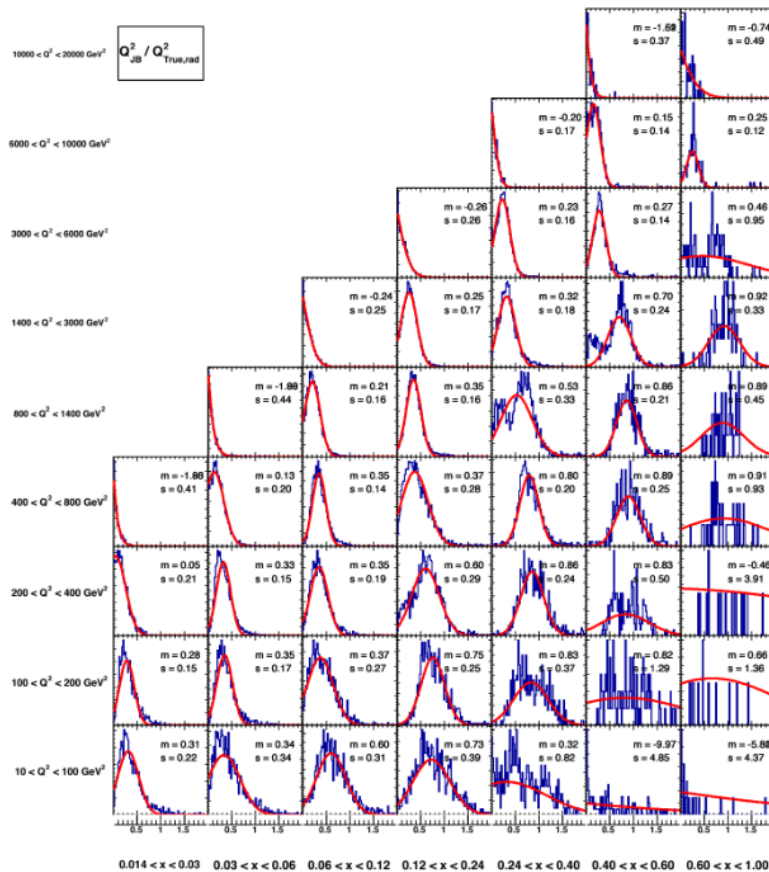
Inclusive NC cross sections



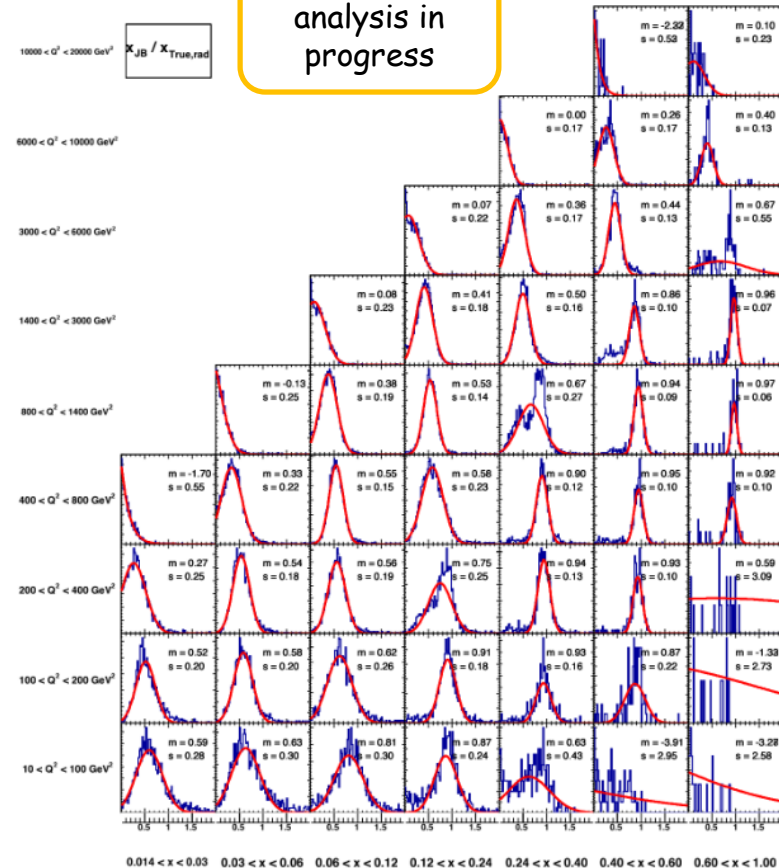
- Updating structure function extractions (existing used fast smearing cross sections)
- ECCE-style plot for note

Inclusive reactions WG

Inclusive CC: Q^2 and x_B resolution



Cross section analysis in progress

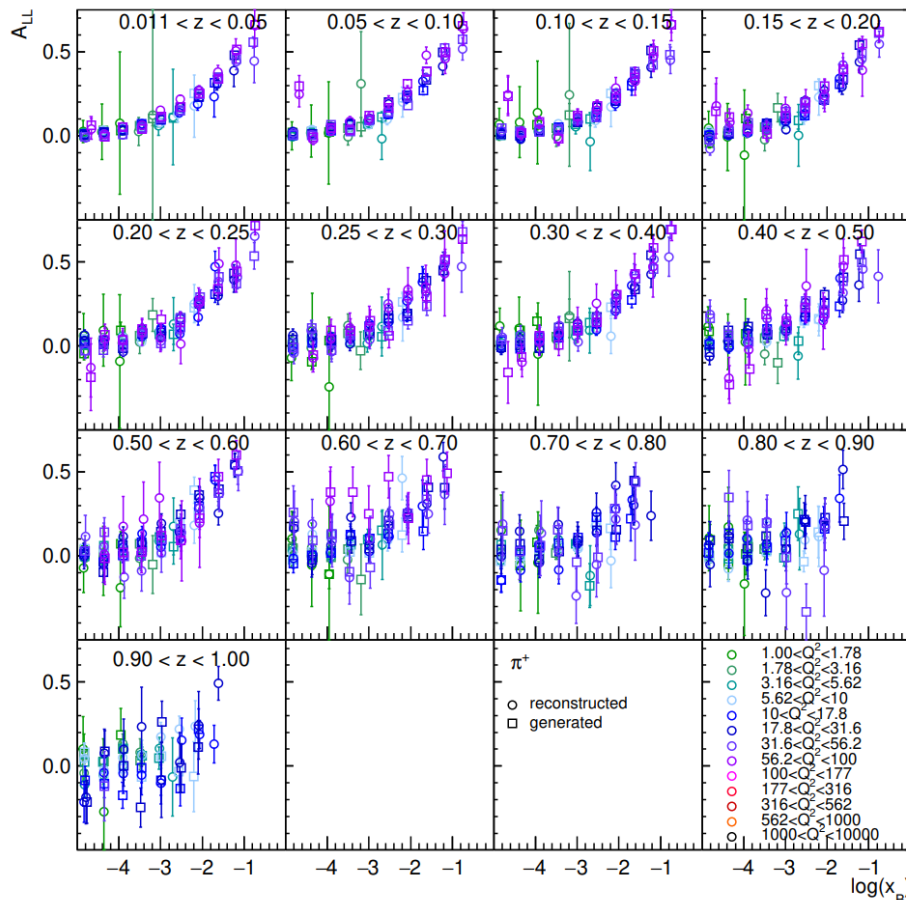


Semi-inclusive reactions WG

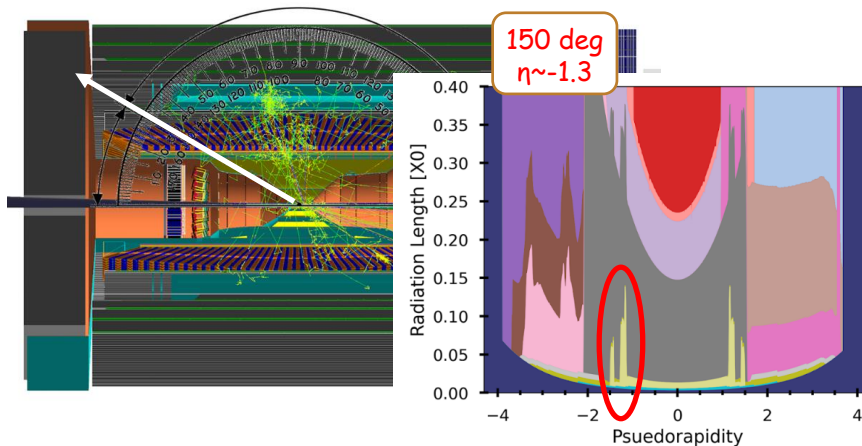
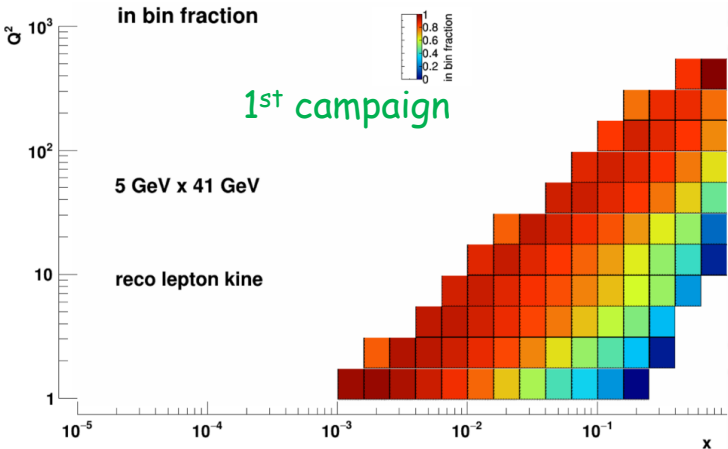
- A_{LL} asymmetry on proton for π^+
- 50% stat of the low Q^2 18x100 sample
- Uncertainties need to be scaled to 10fb^{-1}

Full statistics results and other beam energy settings will be sent to theorists for evaluation of impact in helicity PDFs

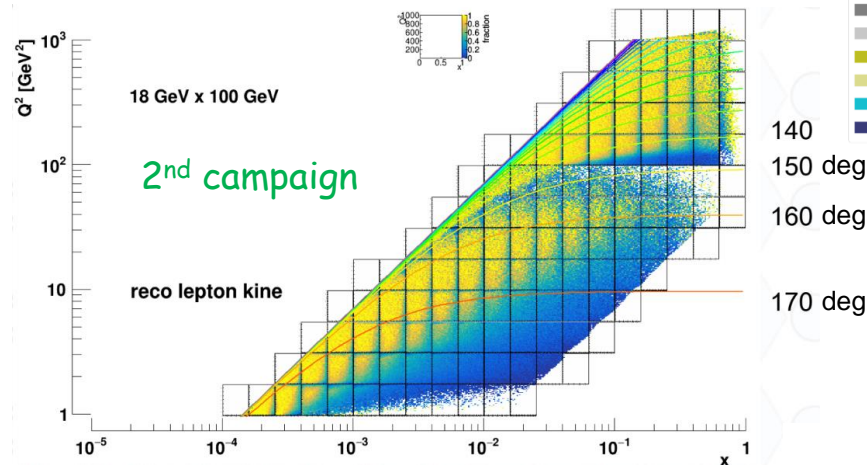
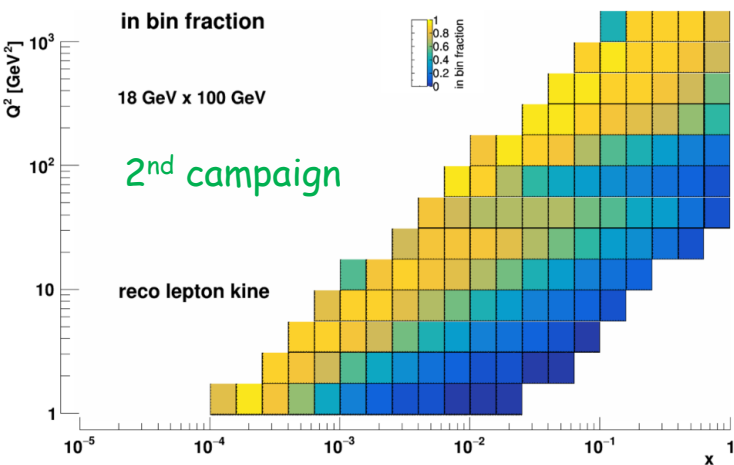
Analysis notes being updated with 2nd campaign data



SIDIS WG: lepton reconstruction inefficiency



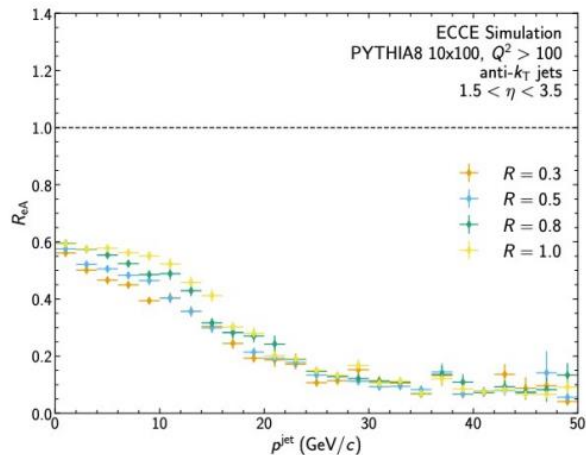
- ECCE Simulation
prop.4, July-2021 concept
- Forward LHCaI
 - Forward EMCaI
 - Backward HCaI
 - Barrel HCaI
 - SC Magnet
 - BCaI Support
 - BCaI
 - Inner det. spt./service
 - Backward EMCaI
 - Barrel LGAD
 - Backward LGAD
 - Forward LGAD
 - Dual RICH
 - mRICH AeroGel
 - DIRC
 - Forward/backward GEMs
 - Forward/backward silicon
 - Barrel muRwELL
 - Barrel silicon
 - Au-coated beam chamber



Jets & HF WG

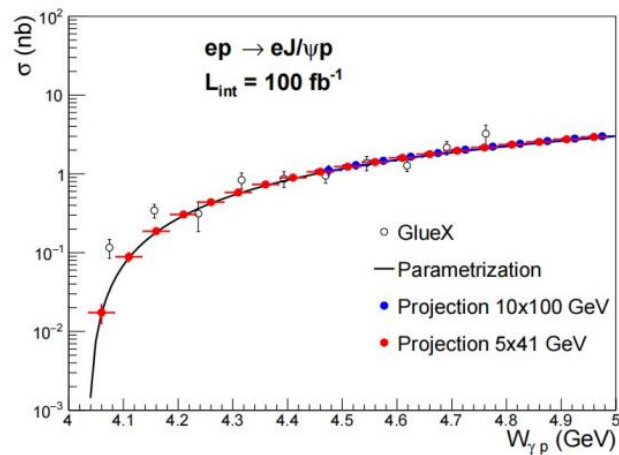
- Most analyses almost finished
- 5 analysis notes in progress

Charged Jet R_{eA}

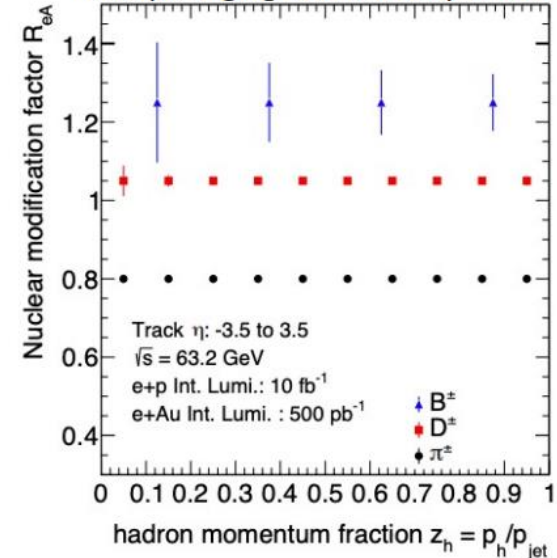


Equivalent of Fig. 7.71 of YR

J/ψ photo production at threshold

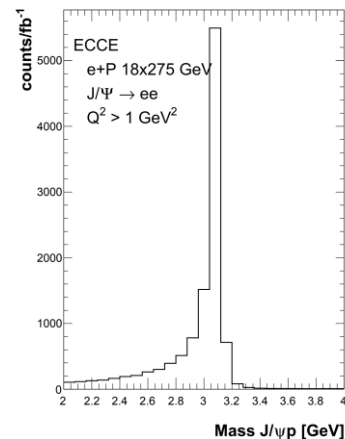
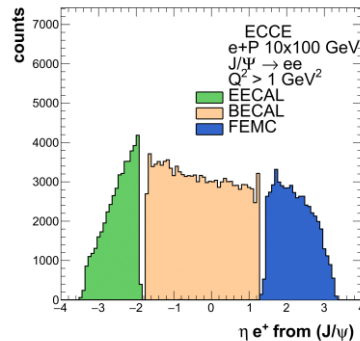
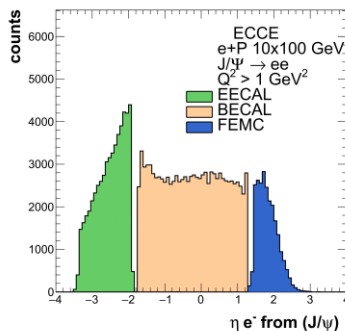
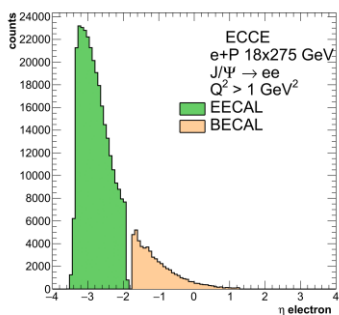


Comparing light and heavy flavors



Exclusive reactions WG

- Most recent major update/news is inclusion of DVMP ep results in our note:
 - e.g. plots below from [N. Santiesteban \(MIT\)](#) for 18 x 275 GeV setting:

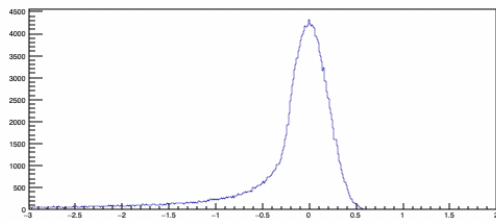


- Majority of final material required for completion of note in overleaf (see DVMP ep below)
- Currently performing final tidying/edits/checks/refinements
- Status on reactions:
 - DVCS ep - text and plots finished, will check for any final missing details
 - DVCS eA - text and plots finished except inclusion of scattered He momentum resolution (<1day work)
 - TCS ep - same as above
 - Phi production in eA - text and plots finished except inclusion of one final background study (<1day work)
 - DVMP ep - plots finished, text started but needs finishing (couple days work)
- Currently discussing in group next steps for follow up studies we wish to be ready before Dec 1, e.g. background and IP 8 studies in case of follow up questions

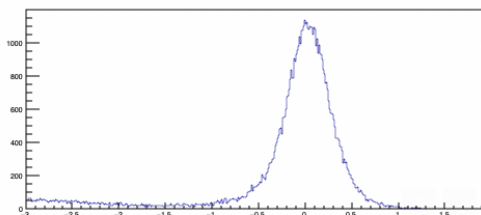
Exclusive reactions WG: ECAL resolution issues

Backwards ECAL

1st
campaign

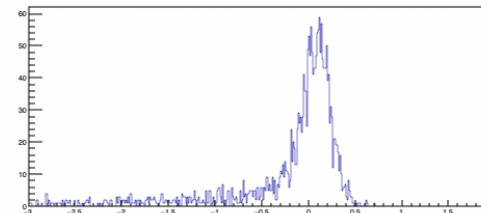


Barrel ECAL

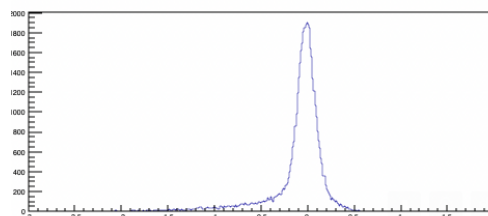
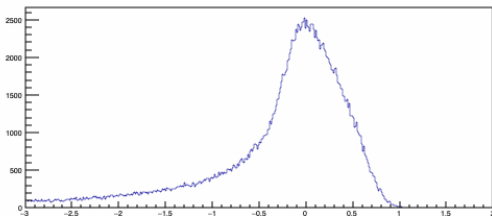


Previous campaign:

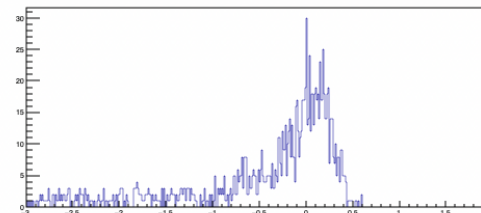
Forward ECAL



2nd
campaign



Prod4.0 results:



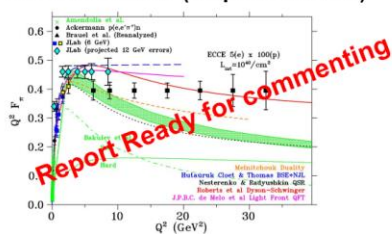
- Cannot be reproduced by Calorimeter WG
- Probably a incorrect use of the calorimeter afterburner

Diffractive & Tagging WG

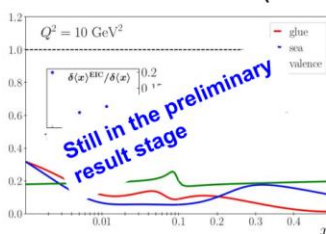
Updates:

- Code available to easily convert from global to local coordinates in far-forward detectors (RP, BO, etc) - works for IP6 & IP8
- New Roman Pots geometry implemented
- Analysis note almost completed (below some examples of physics plots)

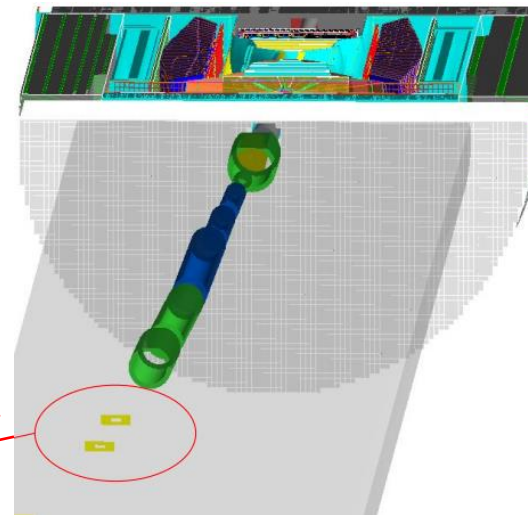
Pion form factor (Stephen & Garth)



Pion Structure Function (Richard)



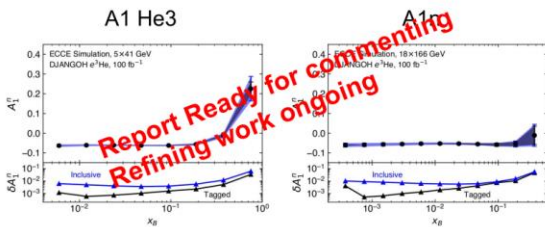
New Roman Pots geometry available



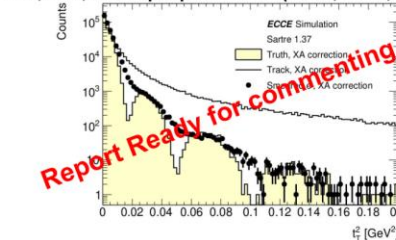
Upcoming work:

- Concentrate on completing the last priority item
 - Pion Structure function
- Next for other studies?
 - Pion Form Factor: IP8 vs IP6, 1.4T vs 3T studies
 - eA diffractive: 1.4 vs 3T study
 - eHe3: refining stage
 - Lower priority studies
 - u-Channel π^0 and ω studies
 - Y exclusive production

A1n through $e^{-3}\text{He}$: 5x41 GeV per nucleon (Dien & Jackson)



eZr, ePb, eAu J/psi production (Peter, Mark, Dhevan)



Summary & Outlook

- All physics WG finalizing analyses and corresponding notes
- Most of the content is already available in the notes
- Call for volunteers to review analysis notes !
- Discussions ongoing with Godparents to choose plots and physics narrative around them
- 3rd simulation campaign will start soon, but will not impact most of the physics analyses
 - SIDIS WG will check improvement in tracking efficiency at ~ 150 deg.

Open questions:

- Want to simulate some IP8 data ?
- Want to simulate some 3T data ?

Fun4All is ready for that, if needed...