

# ECCE Physics Benchmarks Team IB Meeting Report

August 16<sup>th</sup>, 2021

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# Current Status

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- 2<sup>nd</sup> campaign last details being worked out
- Most physics working groups using Truth PID
  - Interface with PID working group/Calo Working group
- Sanity Checks
  - As results are finalized need to determine analysis-specific checks
- Analysis notes
  - In progress (32 accompanying notes!)

# Reminder: Top Physics Priorities

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## Inclusive

- F2A @ low-x [Saturation, nuclei]
- A1p vs. x [Spin & Flavor, nucleon]
- A1n vs. x [Spin & Flavor, nucleon]
- Twist-3 gTq vs. x [Spin & Flavor]

## SIDIS

- Quark Sivers function [Momentum imaging, nucleon]
- Sea quark helicities via SIDIS A1 A<sub>LL</sub> measurements [Spin & Flavor, nucleon]

## Electroweak and BSM

- Parity violating asymmetries
- Charged Lepton Flavor Violation

## Heavy Flavors and Jets

- In medium correction for heavy flavor [Hadronization, nuclei]
- Di-hadron correlations [Saturation, nuclei]

## Exclusive

- DVCS ep [Position Imaging, nucleon]
- DVCS eA [Position Imaging, nuclei]
- J/ψ production in ep [Position Imaging, nucleon]

## Diffraction & Tagging

- A1n from double tagged <sup>3</sup>He [Spin & Flavor]
- Diffractive meson (J/ψ) production [Saturation]
- Pion structure [Mass]
- Kaon FF [Mass]

# Simulation Working Group

Item	Task	Required by	Assignee	Status	Goal
1	Discuss implementation/placement of ECCE	21/7/21	All	Complete	A meeting to discuss status of sub-detectors
2	Discuss latest ECCE detector status	28/7/21	All	Complete	A meeting to finalise final placement of sub-detectors
3	Complete detector subsystem simulation setup	30/07/2021	Detector WG	In progress	Each subsystem for ECCE has either a macro or a class we can import
3.1	tracking	30/07/2021	Xuan and Nilanga	In progress	
3.2	PID	30/07/2021	Greg and Xiaochun	In progress	
3.3	Calorimeter	30/07/2021	Friederike and Yongshu	In progress	
3.4	Far forward	30/07/2021	Michael, Igor and Yuji	In progress	
4	Relay <b>changed</b> production requirements for Campaign 2	6/8/21	Physics WG	In progress	Each PWG knows what generator they are using, they have files with generated events and they know how many events they want
5	Update top-level submissions with PWG info	9/8/21	Cameron	Not started	Each simulation will have their own ASCII file with production parameters.
6	Define production site tasks	9/8/21	Prod. Managers	Not started	Each site knows what their productions responsibilities are
7	Full detector integration in simulation and reconstruction	6/8/21	Simulations WG	Not started	Each subdetector compiles without complaint and is placed in ECCE with no overlap
8	Start 10M particle gun and/or SIDIS events	16/8/21	Prod. Managers	Not started	Particle gun gives a quick check of some performance (i.e. tracking), SIDIS gives us global acceptance and more tracks per event
9	Analyse 10M particle gun events and SIDIS events	17/8/21	Physics, Computing V	Not started	See "More information" for "Start 10M particle gun and/or SIDIS events" task
10	Meet with PWGs regarding particle gun and SIDIS simulation	19/8/21	Detector & Physics W	Not started	See "More information" for "Start 10M particle gun and/or SIDIS events" task
11	Physics Generation Campaign 2	19/8/21	Simulations WG	Not started	Full scale, production of Multi-100M event set

2<sup>nd</sup> campaign readiness meeting Wednesday → Ready to launch

# Inclusive Working Group

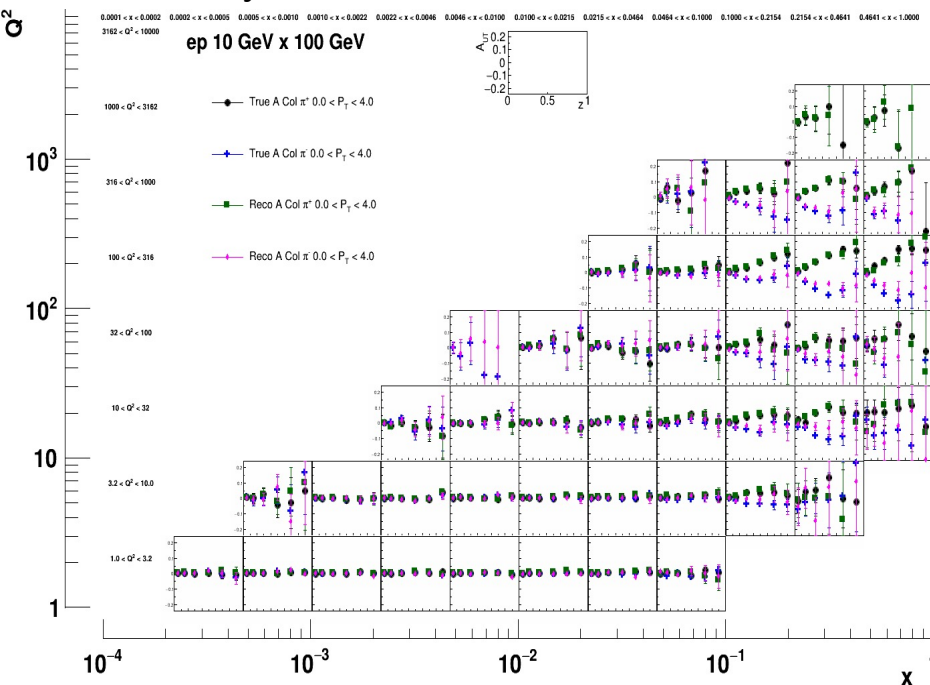
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- In progress/upcoming tasks:
  - Validate fast smearing with full simulation results
  - Study & implement PID (currently rely on truth info)
  - Reconstruction method performance
  - Cross-section analysis

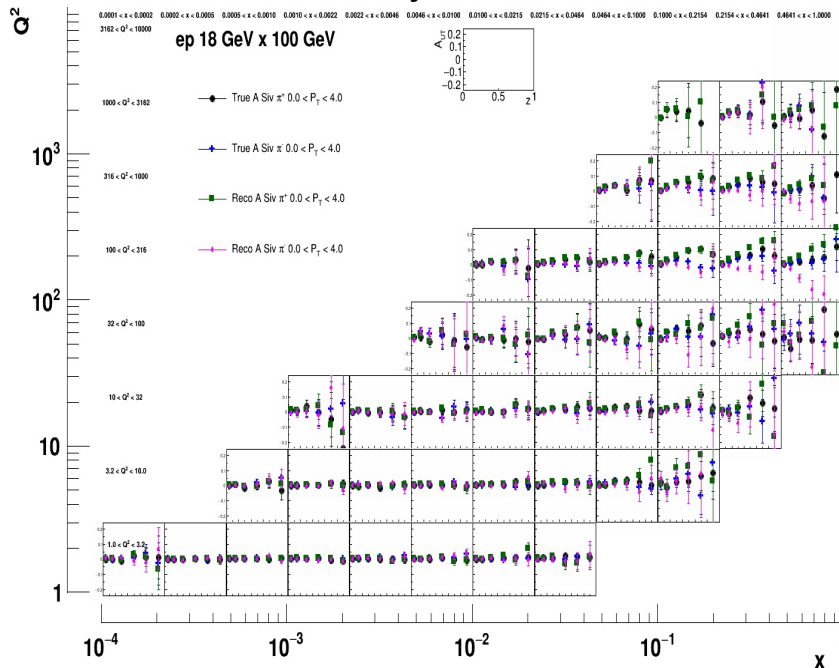
# SIDIS Working Group

- DIS Reconstruction via scattered lepton
- Hadron ID still using PDG information
- Reweighted asymmetries based on truth  $x$ ,  $Q^2$ ,  $z$ ,  $P_T$ ,  $\phi_h$ ,  $\phi_S$ , struck parton flavor

Collins asymmetries



Sivers asymmetries



# Diffraction and Tagging Working Group

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- Recent updates at:
  - <https://indico.bnl.gov/event/12732/>
- 50 cm shift for IP6
- Simulation Round #3 (r3) issued identified for B0
  - Will be fixed for Round #4
- Looking into IP8 naming and configuration

# Exclusive Working Group

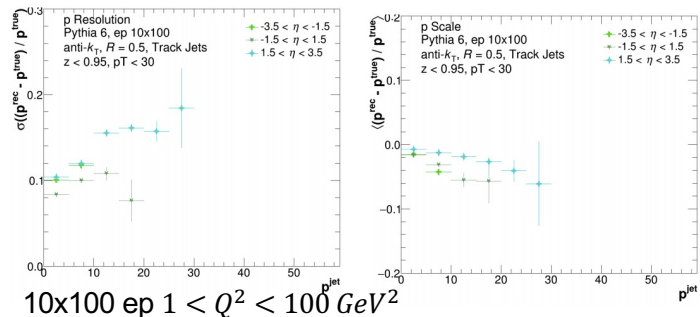
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- Priority studies:
  - DVCS ep (MIT, OU)
  - DVMP ep (VT, UoY, UConn)
- Key reactions for extraction of GPDs
- Crucial for multi-dim. imaging of quarks and gluons inside nucleon
- Also studying:
  - DVCS eA (currently eHe) (UoG)
  - DVMP eA, currently  $f$  production due to its greater
  - sensitivity to gluon saturation effects than  $J/\Psi$  (OU)
  - Coherent  $J/\psi$  production with eA (BNL) and related
  - studies into incoherent backgrounds and  $p_t$  resolutions
  - Possible future study into color transparency



# Jets and HF Working Group

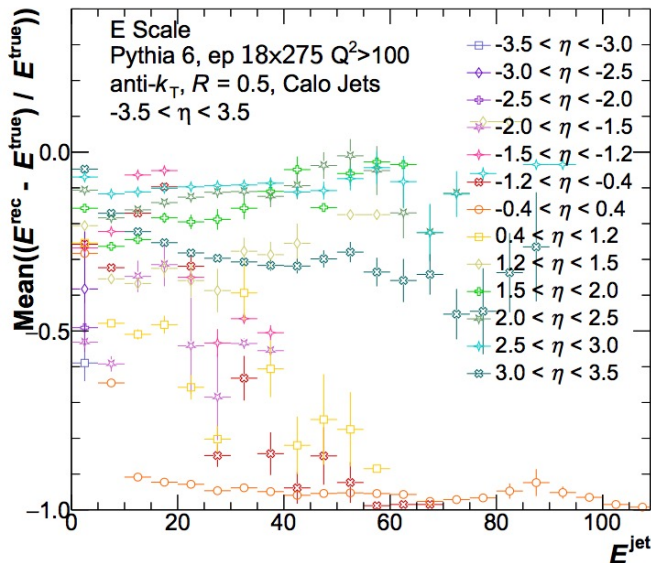
## Track Jet performance – Full Momentum Res/Scale



Tristan Protzman, Lehigh University

## Calorimetry Jet Energy Scale

Raymond Ehlers, ORNL



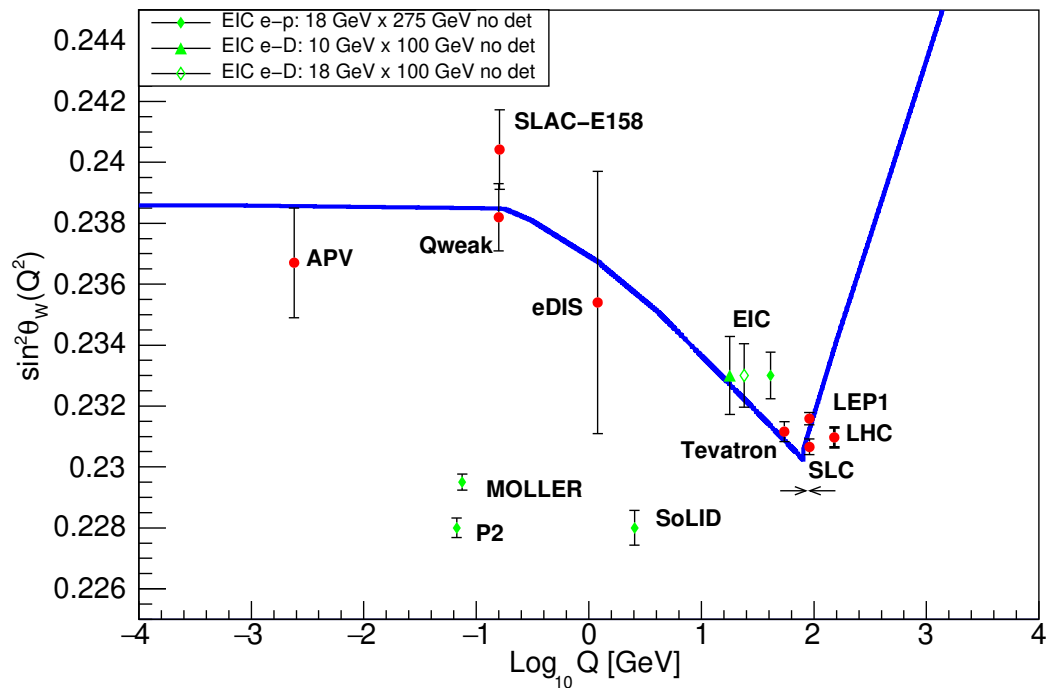
## Discussion:

- Any plan on other calorimetry calibration?
- Can we have the calorimetry calibration centralize in one place?

- Energy scale in the forward region ( $1.5 < \eta < 3.5$ ) looks fine after FEMC and FHCAL calibration
- No calibration in the backward and midrapidity region  
→ Energy scale degrades in  $-3.5 < \eta < 1.5$

# EW and BSM Working Group

- 100 fb<sup>-1</sup> each for ep 18x275, eD 10x100 and eD 18x100 (80% electron polarization)
- internal radiation simulated and unfolded, full data set fitted
- Caveat: still need to implement PDF uncertainties, June production detector fast smearing, and Z terms.



# Conclusions/Outlook

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- First large simulation campaign completed
- Second campaign final configuration nearly complete
  - Meeting between physics/detector groups (readiness review: <https://indico.bnl.gov/event/12704/>)
- Campaign requires ~150M events → 2 weeks production time
- Call for analysis notes as supplementary documents for proposal
  - Please start/update progress