

# ECCE Physics Benchmarks Team IB Meeting Report

April 26<sup>th</sup>, 2021

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# Outline

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- Team Organization – Convener List
- PWG Meetings
- Working Group Reports
  - Simulations
  - SDIS
  - Inclusive
  - Jets/HF
- Organization Details
- Conclusions/Outlook

# Conveners

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- **Inclusive reactions:** TBD, TBD
- **Electroweak and BSM:** Sonny Mantry ([Sonny.Mantry@ung.edu](mailto:Sonny.Mantry@ung.edu)), Xiaochao Zheng ([xiaochao@jlab.org](mailto:xiaochao@jlab.org))
- **Semi-inclusive reactions:** Ralf Seidl ([rseidl@ribf.riken.jp](mailto:rseidl@ribf.riken.jp)), Charlotte Van Hulse ([cvanhuls@mail.cern.ch](mailto:cvanhuls@mail.cern.ch))
- **Jets and Heavy Flavor:** Cheuk-Ping Wong ([cpwong@lanl.gov](mailto:cpwong@lanl.gov)), Wangmei Zha (USTC)
- **Exclusive Reactions:** Rachel Montgomery ([Rachel.Montgomery@glasgow.ac.uk](mailto:Rachel.Montgomery@glasgow.ac.uk)), Julie Roche ([jroche@jlab.org](mailto:jroche@jlab.org))
- **Diffraction & Tagging:** Wenliang Li ([billlee@jlab.org](mailto:billlee@jlab.org)), Axel Schmidt ([schmidta@jlab.org](mailto:schmidta@jlab.org))
- **Simulations:** Cameron Dean ([cameron.dean@cern.ch](mailto:cameron.dean@cern.ch)), Jin Huang ([jhuang@bnl.gov](mailto:jhuang@bnl.gov))

# PWG Convener Meetings

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- Meeting of PWG Conveners April 20<sup>th</sup>:
  - <https://indico.bnl.gov/event/11312/>
  - Updates on SDIS and Jets/HF
  - Contribution for Inclusive Group
  - Simulation Requirements
- Meeting of PWG Conveners April 26<sup>th</sup>
  - 930 am EDT: <https://indico.bnl.gov/event/11382>
  - 900 pm EDT Monday April 26th: <https://indico.bnl.gov/event/11383/>
  - Helpful to our international workforce

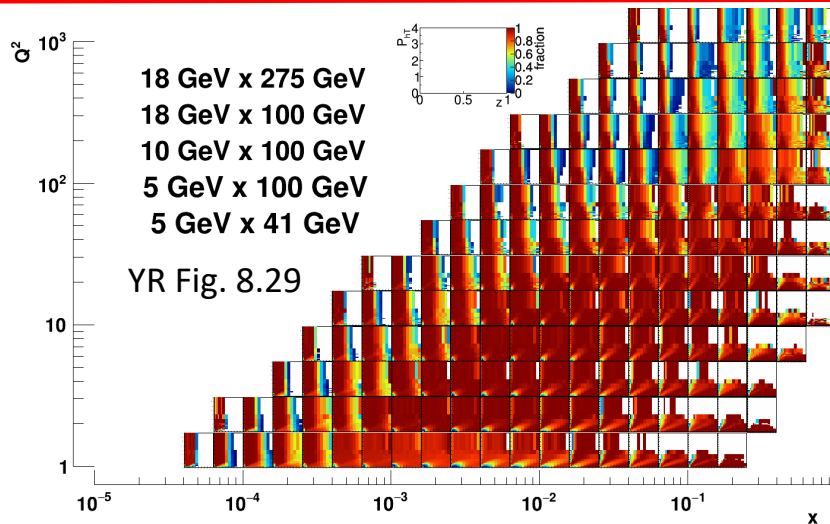
- Office Hours (2 hours per week, alternating T 2-4pm and M 8 – 10 pm EDT)
  - <https://indico.bnl.gov/category/346/>
  - Join at 8pm EDT today for help!
- Move EICdetectors and EICmacros to EIC repositories
  - One repo for eicdetectors and reconstruction code for easy maintenance
- Discussion of statistics
  - Request: ~2000-3000 CPUs for 4 months (May 1-Sep 1) at 75% usage
  - Multiple iterations of 100M simulation sets =~ 1B events simulated
  - Based on sPHENIX MDC1 experience
- Working with Computing Team on issues of Storage
  - 2-tier storage model:
    - Analysis TTree only → 100TB S3
    - DST : about 1MB / event + backup -> 2PB SDCC storage, GPFS or DCache
- MC event generators used during the YR, with their steering cards and MC samples (gathered by Carlos)
  - <https://wiki.bnl.gov/eicug/index.php/ECCE>

- 4D ( $x$ - $Q^2$ - $P_{hT}$ - $z$ ) kinematical + PID coverage figure

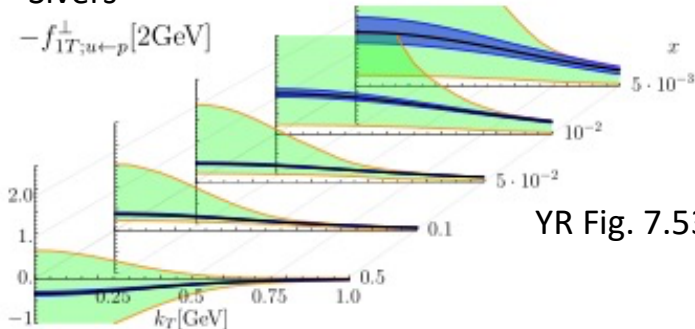
- Choose some  $x$ - $Q^2$  ranges and interpolate due to simulation costs
- $z$ ,  $P_{hT}$  and  $\phi_s$ ,  $\phi_h$  smearing figure for different configurations

- Sivers/Collins/unpol TMD figures

- AUTs require reweighting of events in truth kinematics+parton flavor
- Crossing angle + related acceptance/smearing effects
- Extrapolate from some  $x$ - $Q^2$ 
  - Give to Alexey Vladimirov (Sivers, unpol TMD) or Daniel Pitonyak (Tensor charge) for impact studies



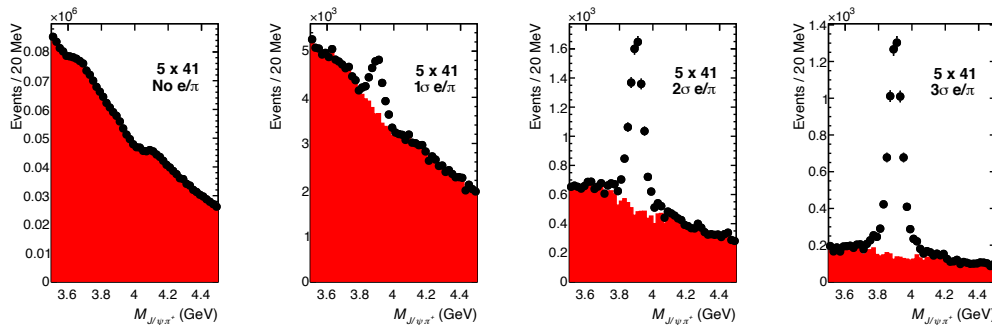
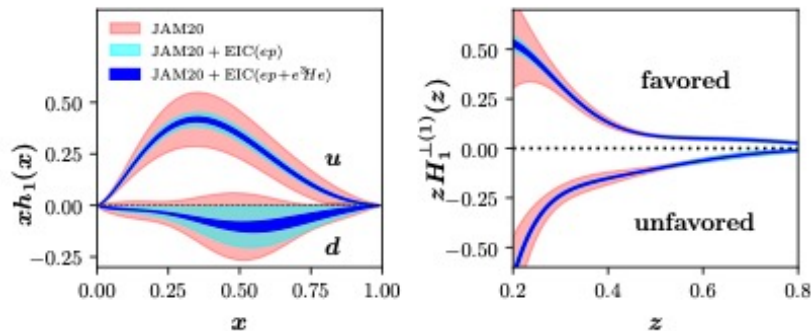
Sivers



- Spectroscopy of X/Y/Z states →  
Photoproduction at forward rapidities
- For Inclusive Group – Nice suggestions from  
Shima Shimizu (RIKEN/JSPS)
  - Resolution plots of DIS kinematic variables
  - Efficiency and/or Acceptance map after a baseline analysis selections
  - Distributions of a few observables including background events
  - Size of systematic uncertainties from major sources in a few ( $x$ ,  $Q^2$ ) bins

Transversity

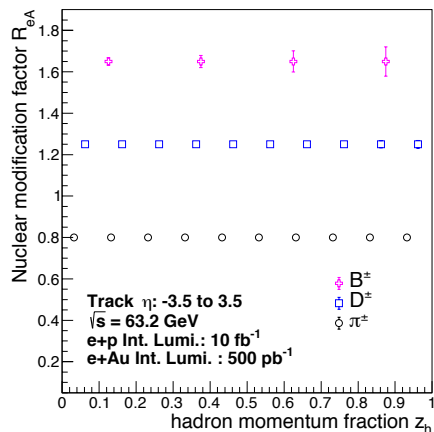
YR Fig. 7.54



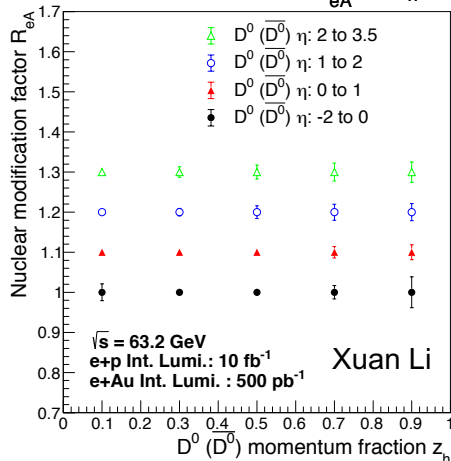
YR Fig. 8.38

- Species
  - $D^0, D^\pm, D_s^\pm$
  - B,  $B_s$
  - $\lambda_c, \lambda_b$
- 
- Mass spectrum: resolution, efficiency, S/B
  - $R_{eA}$  vs  $z_h$ : light vs HF, pseudorapidity dependence
  - Jet  $p_T$  spectrum: light vs HF jet separation

Projected hadron  $R_{eA}$  vs  $z_h$

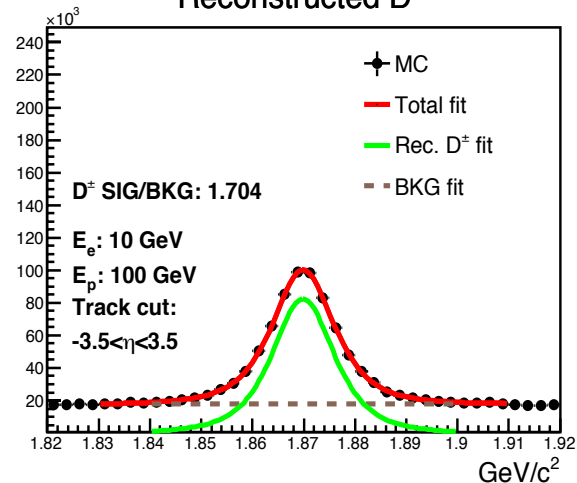


Projected  $D^0 (\overline{D}^0)$   $R_{eA}$  vs  $z_h$

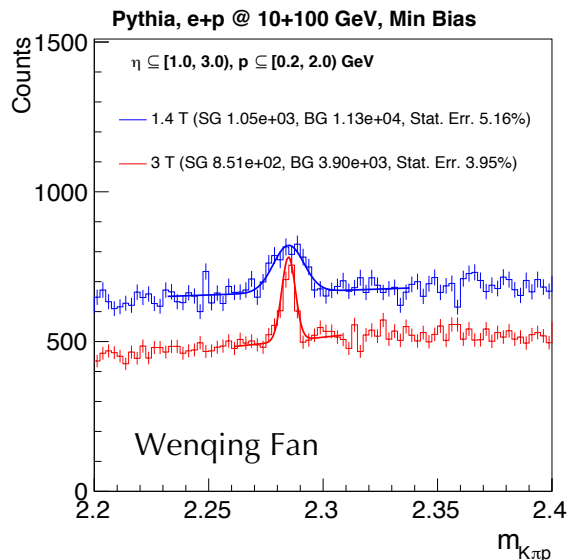


10 fb<sup>-1</sup> 10+100 e+p collision

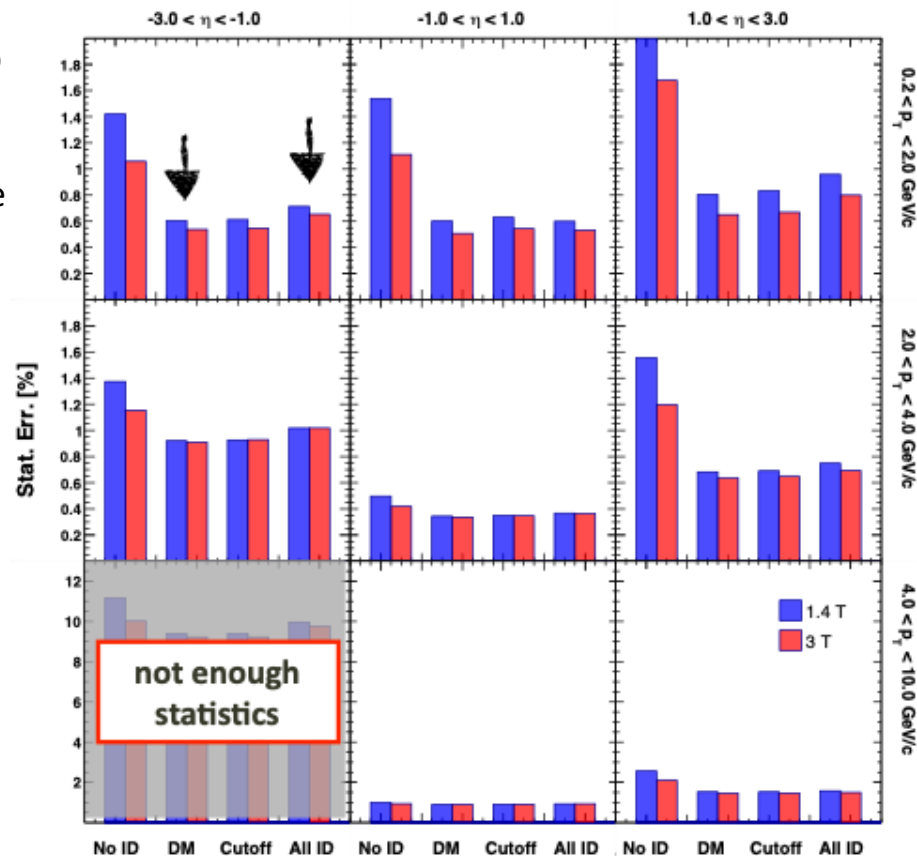
Reconstructed  $D^\pm$







- Low  $p$  cutoff using DIRC+dRICH as PID does not affect  $D^0$  significantly
- 1.4T has nearly the precision of 3T



- **1.4T → 3T**
  - SG drops due to acceptance
  - BG drops due to better momentum resolution (narrower signal region) and fewer low  $p_T$  tracks

# Joining Physics Efforts

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- Mailing list: [ecce-eic-phys-l@lists.bnl.gov](mailto:ecce-eic-phys-l@lists.bnl.gov)
- Mattermost channel: <https://chat.sdcc.bnl.gov/eic/channels/fun4all-ecce>
- Day 1 Checklist at: [https://ecce-eic.github.io/tutorials\\_day1.html](https://ecce-eic.github.io/tutorials_day1.html)
- Computing Office Hours: : <https://indico.bnl.gov/category/346/>
- Wiki: <https://wiki.bnl.gov/eicug/index.php/ECCE>
  - A list of open items will be uploaded to the Wiki this week
  - Send us your students and post-docs!

# Conclusions/Outlook

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- Physics Working Groups are coalescing
  - Everyone should join working group(s) of interest
  - Contact convener or Carlos/Rosi ([munoz@jlab.org](mailto:munoz@jlab.org) [rosijreed@lehigh.edu](mailto:rosijreed@lehigh.edu))
- Simulation Framework is fun4all
  - ECCE is now separate from sPHENIX
  - **Need volunteers to improve ECCE configuration**
    - Contact Simulation Conveners ([jhuang@bnl.gov](mailto:jhuang@bnl.gov) [cameron.dean@cern.ch](mailto:cameron.dean@cern.ch))
- Detector and Physics Decisions need to be reached soon
  - Prepare for production in mid-June!
- First production campaign to start ~May 1<sup>st</sup>

Back-Up

# Initial Steps

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- Yellow report simulation samples are being collected:
  - Generator used
  - Steering cards
  - MC files (when available)
- Initial ECCE configuration available at: [github](#)  
[Fun4All\\_G4\\_EICDetector.C](#)
  - Based on BABAR magnet and YR reference detector to be optimized
- Each PWG will select a few (1-2) key processes
- April Tasks
  - Setup the simulation + analysis chain to evaluate the performance of the initial ECCE configuration
  - Reproduce one WP/YR plot per PWG with low statistics

# Timeline

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- First Simulation Campaign (April 1<sup>st</sup> - May 15<sup>th</sup>)
  - Initial simulation runs using existing implementation
  - Finish implementing ECCE setup
  - Agree on technology, main physics observable and arrange required event generators
- First Analysis Campaign (May – June 15<sup>th</sup>)
  - Determine statistics
  - Iterate: simulation  $\leftrightarrow$  analysis
- Final Production (June 15<sup>th</sup> – August)
- Second Simulation Campaign (July 15<sup>th</sup> – September 1<sup>st</sup>)
  - Analysis of simulation data to demonstrate physics extraction
  - Drafts of physics plots
- Proposal Writing (September 1<sup>st</sup> – October 15<sup>th</sup>)
  - All physics 'plots' are done
  - Compose narrative around simulation results and selected technologies
- Proposal Deadline – **December 1st**

