ECCE Physics Benchmarks Team Bi-weekly Meeting Report

June 21st, 2021

Carlos Muñoz, Rosi Reed

Physics Team Working Groups

- **Inclusive reactions:**
    Tyler Kutz (MIT), Claire Gwenlan (Oxford)
- **Electroweak and BSM:**
    Sonny Mantry (UNG), Xiaochao Zheng (UVa)
- **Semi-inclusive reactions:**
    Ralf Seidl (RIKEN), Charlotte Van Hulse (IJCLab Orsay)
- **Jets and Heavy Flavor:**
    Cheuk-Ping Wong (LANL), Wangmei Zha (USTC)
- **Exclusive Reactions:**
    Rachel Montgomery (Glasgow), Julie Roche (OU)
- **Diffractive & Tagging:**
    Wenliang Li (W&M), Axel Schmidt (GWU)
- **Simulations:**
    Cameron Dean (LANL), Jin Huang (BNL)

Simulation working group

Item	Task	Required by	Assignee	Status	Goal
1	Create top-level submission scripts	27/5/21	Cameron	Complete	The creation of a single submission script allows PWGs to submit simulation requests in a single style and we take care of the rest
2	Add site-specific production scripts	1/6/21	Cameron & co.	Complete	Requirements for each site can be set from one argument at the top-level
3	Beta-test production scripts at each site	14/06/21	Cameron & co.	In progress	Ensure we can copy files around as needed
4	Debug zombie files	14/06/2021	Cameron & co.	Complete	Every file we produce must be produced correctly and openable
5	Complete detector subsystem simulation setup	14/06/2021	Detector WG	In progress	
5.1	tracking	14/06/2021	Xuan and Nilanga	In progress	Each subsytem for ECCE has either a macro or a class we can import
5.2	PID	14/06/2021	Greg and Xiaochun	In progress	
5.3	Calorimeter	14/06/2021	Friederike and Yongsu	In progress	
5.4	Far forward	14/06/2021	Michael, Igor and Yuji	In progress	
6	Discuss implementation/placement of ECCE	17/6/21	All	Complete	A meeting to finalise final placement of sub-detectors
7	Relay production requirements for Campaign 1	17/6/21	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
8	Full detector integration in simulation and reconstruction	18/6/21	Simulations WG	In progress	Each subdetector compiles without complaint and is placed in ECCE with no overlap
9	Update top-level submissions with PWG info	18/6/21	Cameron	Not started	Each simulation will have their own ASCII file with production parameters.
10	Define production site tasks	21/6/21	Prod. Managers	Not started	Each site knows what their productions responsibilities are
11	Start 10M particle gun and/or SIDIS events	22/6/21	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
12	Analyse 10M particle gun events and SIDIS events	25/6/21	Physics, Computing W	Not started	See "More information" for "Start 10M particle gun and/or SIDIS events" task
13	Meet with PWGs regarding particle gun and SIDIS sim va	29/6/21	Detector & Physics W	Not started	See "More information" for "Start 10M particle gun and/or SIDIS events" task
14	Physics Generation Campaign 1	31/6/21	Simulations WG	Not started	Full scale, production of Multi-100M event set

Simulation working group

➤ 1st Simulation Workshop: April 2

ECCE Simulation Workshop
📅 Friday 2 Apr 2021, 07:00 → 16:45 US/Eastern

Description This is the first ECCE simulations workshop. It is intended as a workshop for students and postdocs who will be actively engaged in ECCE simulations.

📎 📄 Chat Archive 1.txt 📄 Chat Archive 2.txt 📄 Chat Archive 3.txt 📄 ECCESimulations0... 📹 Recording Part1.mp4

📹 Recording Part2.mp4 📹 Recording Part3.mp4

2nd ECCE Simulation Workshop
📅 vendredi 21 mai 2021 à 09:00 → 13:00 US/Eastern

📎 📄 2ndSimWorkshop.p... 🔗 Recording

3rd ECCE Simulation Workshop: https://indico.bnl.gov/event/12245/
    post-production analysis

Event will be recorded for future reference

July 8, 9AM – noon EDT

➤ Reminder: weekly Office Hours & very active Mattermost channels

Inclusive reactions WG

- Main observables: double-differential DIS cross sections $\dfrac{d^2\sigma}{dQ^2\,dx}$

  - Study both NC and CC cross section
  - Beam lepton: study both e^- and e^+ (e^+ CC $\to d$ in proton)
  - Beam hadron: study p, D, ^3He

- Extract F_2, F_L, impact on PDF fits

Simulation plans

- For NC events, use DJANGOH + electron smearing
- For CC events, use DJANGOH + fun4all

DJANGOH generator (with EW WG)

- 10M ep NC events (x9 beam energy settings)
- 10M eD NC events (x6 beam energy settings)
- e^3He NC events (in progress)
- CC events (in progress)

In-progress tasks:

- Extract NC cross sections from smeared DJANGOH events
- Study CC event reconstruction

BSM & Electroweak WG

- NC physics: analyzing $\sin^2\theta_W$ with unfolding technique → ongoing

- CLFV (e → τ): not yet started

- CC physics:

  - studying CC xsec vs. Pe and fitting for M(W_R)
    → ongoing

  - Use hadron states to determine CC kinematics
    → ongoing

- Most are joint with inclusive group

- should we look into e+ physics?

Timeline

May
- Generate MC events for all 9 ep and 6 eD energy combinations – done;
- first round of processing data – done for high-priority topics of NC;
- some physics derivations;
- discussing with JAM group on how to utilize proton data for $\sin^2\theta_W$;

June
- Simulation for detector smearing – 1st round done, need implemented;
- debugging djangoh for low W and rerun all simulations – done;
- study PID requirement, provide inputs to PID group – ongoing;
- Fitting $F_{1,3}$ (γZ), $\sin^2\theta_W$ – ongoing;
- unfolding – ongoing for $\sin^2\theta_W$;
- background simulation – combine with inclusive group – not started yet
- CC channel – combined with inclusive group – ongoing
- discussing with theory + JAM group on how to fit $C_{1,2}$ – ongoing

July
- repeat fast smearing study using "final" ECCE detector configuration;
- check fast smearing with full simulation;
- unfolding asymmetries → send to JAM for fitting;
- continue with CC and CLFV study
- optional: Apv(p), $g_{1,5}(\gamma Z)$

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Semi-inclusive reactions WG

➢ Study of DIS resolution kinematics.

➢ Implementation of Jacquet-Blondel method for DIS kinematics: poor resolution when only considering charged tracks.

➢ PID-resolution implementation from YR: no impact

18 GeV x 275 GeV
18 GeV x 100 GeV
10 GeV x 100 GeV
5 GeV x 100 GeV
5 GeV x 41 GeV
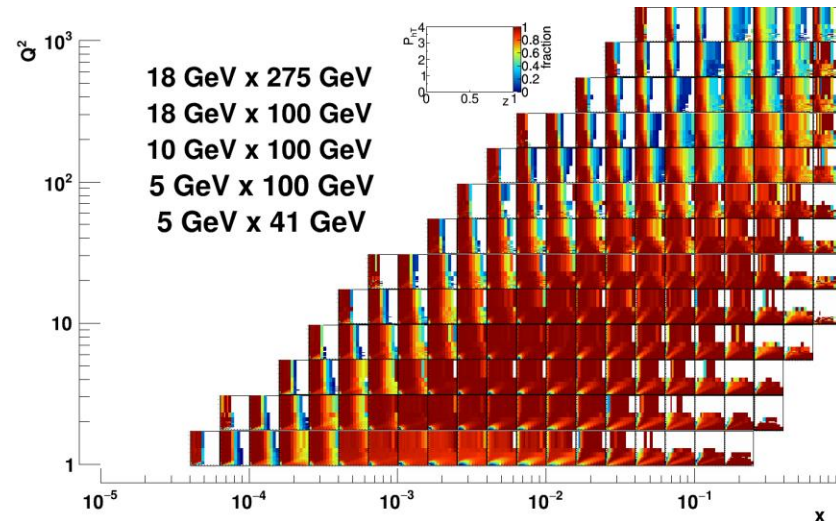
YR Fig. 8.29

Jets & HF working group

Early simulation Results
- R_{eA} projection of charged π, B and D mesons from Pythia simulation with detector performances
- Jet energy scale, energy resolution and eta resolution from full simulation

In Progress
- Charmonium R_{eA}, Jet R_{eA}, jet-hadron correlation
- Implementation of particle flow jets reconstruction
  → improve angular resolution and p_T response

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

Raymond Ehler

https://indico.bnl.gov/event/11764/
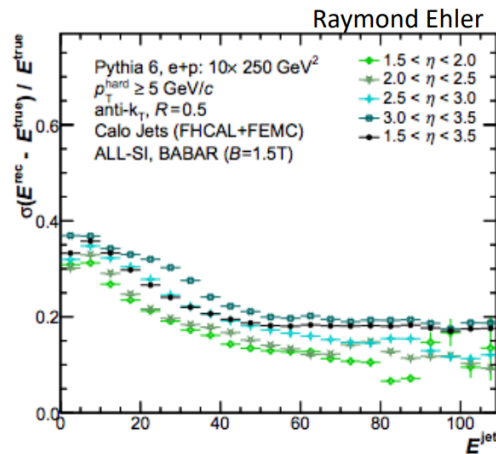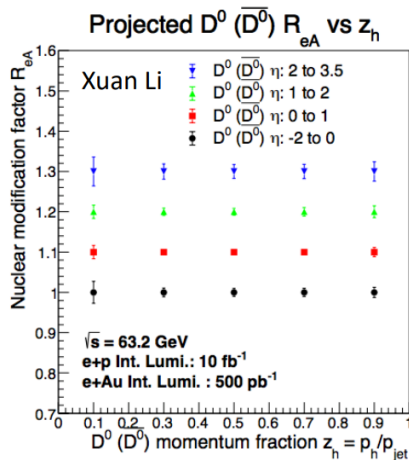
Exclusive Reactions WG

DVCS ep
- MIT using MILOU3D generator
- Now have steering cards from YR and have whole chain (generator -> output) running
- Trying to understand where forward protons are going at highest energy config
- At moment only hit occupancy available from roman pots, more info requested for some higher level physics variables and access to truth info from RP output

DVPi0 ep
- MIT have obtained root files used for YR study

DVCS eHe
- Glasgow working on using TOPEG generator
- Got EICSmear stage working now trying to check Fun4All stage is working (wrote stand alone converter macro from arbitrary root file to Lund text file)
- In parallel, starting to look at particle gun to see where ions go in forward region

DVMP ep (J/Psi)
- University of York starting to work with lAger, on stage of figuring how to get it compatible with EICSmear/Fun4All
- University of York and Virginia Tech coordinating offline to coordinate efforts

DVMP eA (phi, more sensitivity to saturation effects than J/psi)
- Ohio University started to look at BeAGLE generator and eSTARlight, was taking some time to get EICSmear compatibility - after discussion on Friday will move ahead with Sartre

TCS
- Glasgow request sent to theorist for generator already compatible with Fun4All and steering cards for mass simulation
- Awaiting info

Summary:
- In principle 5 generators to be run
- MILOUU3d study currently in most advanced state and most on track, will assess status of others end of this week
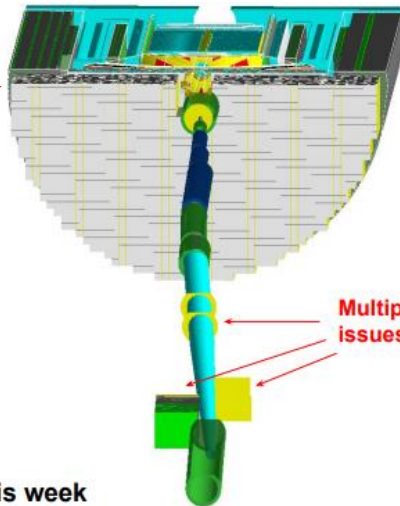
Diffractive & Tagging WG

- Three generators will be ready for first simulation campaign
  - **Priority**: DEMPgen: meson FFs
  - EIC_mesonMC: meson SFs
  - CLASdis: neutron structure
- Particle gun study to test far forward acceptances
- Continuing to test IP6 and (now) IP8 far forward implementations.
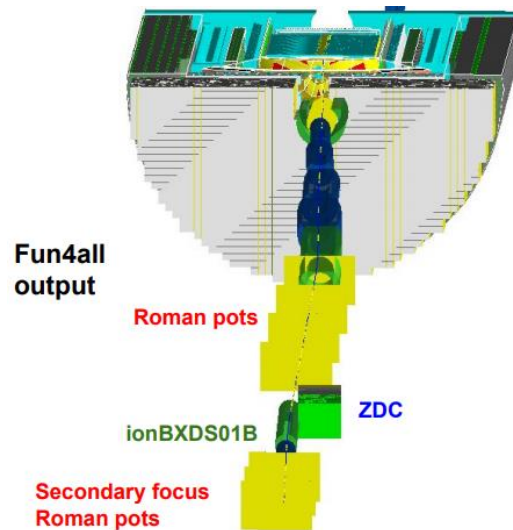- Continuing to study feasibility of coherent diffraction on eA.

IP6 beamline

Multiple rotation related issues were also fixed

This week

IP8 configuration
(released on June 7th)

Fun4all output

Roman pots

ionBXDS01B   ZDC

Secondary focus Roman pots

- **275 GeV proton beam steers well!**

- **Beam pipe is not yet available**
  - Not only in Fun4all

Summary & Outlook

➤ Next few days/weeks are going to be very busy and exciting

➤ First large-scale simulation campaign will start soon

➤ Simulated data should be analyzed quickly and feedback provided to the DWG

➤ Second/final simulation campaign planned for August/September

Still lots of room for new collaborators to join !

Next simulation workshop: July 8
(great opportunity for new students and postdocs to get involved)