ECCE Simulation Software from a User Perspective

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ECCE

EIC^2 EIC Center at Jefferson Lab

Who are ECCE Fun4all Users?

My definition

Non ECCE Fun4all Users

SPHENIX Experts who were intimately familiar with Fun4all framework (coresoftware).
Examples: Cameron, Jin, Joe, Friederike, Xuan, ...

ECCE Fun4all Users

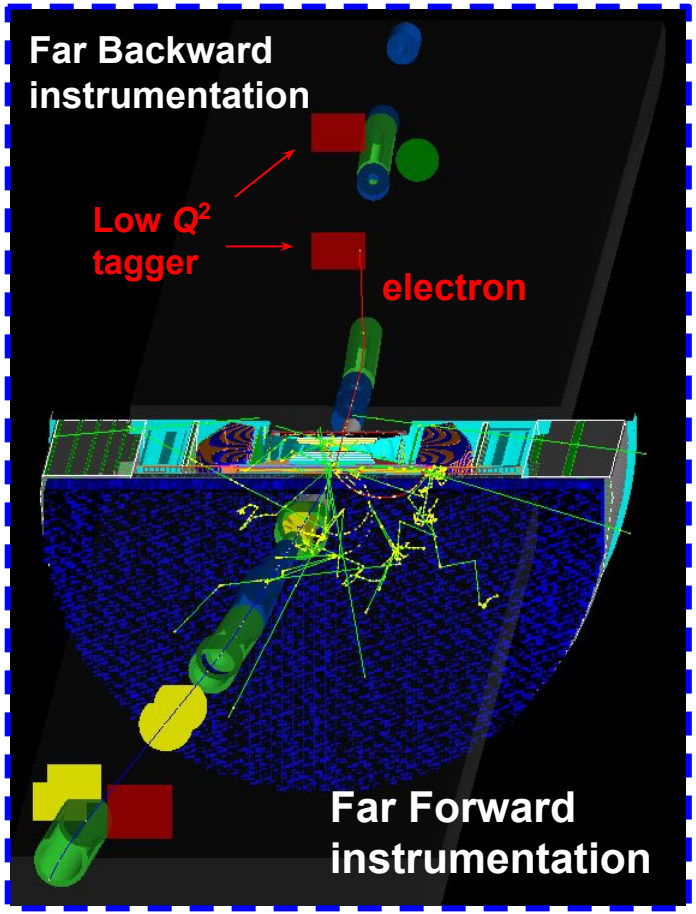
Detector Design: working on specific detector system within Fun4all.
Example: A. Bylinkin, D. Gangadharan, S. Shimizu, N. Wickramaarachchi, W.B Li (me), N. Santiesteban, …

Physics Analysis: developing generator, extract physics observables, determine PID and tracking efficiencies.
Example: S. Kay, D. Nguyen, T. Kutz, K. Gates, C. Van Hulse, P. Steinberg and many many more….

What does it work within ECCE?

- **Key features:**
  - **Each expert has a very limited involvement in every sub tasks, but are involved in many**
  - **There are already multiple generations (layers) of users**
    - **More advanced users are training the newer ones**
  - **Most tasks are user driven:**
    - **Individual detector, individual analysis,**
  - **Shared responsibility:**
    - **Implementing beam parameters**
    - **Job submissions**

Physics Simulated



An XYZ meson photoproduction event:
$e+p \rightarrow e' + p' + X(3872)$, $X(3872) \rightarrow e^+e^-\pi^+\pi^-$

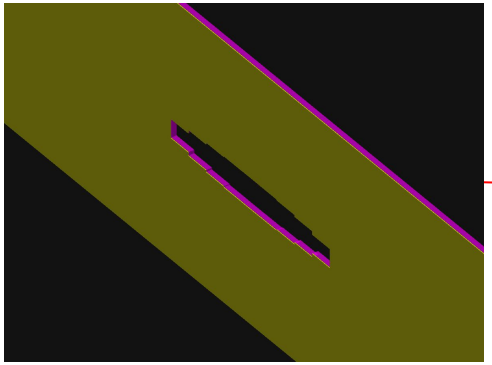
Physics topics and simulation summary:

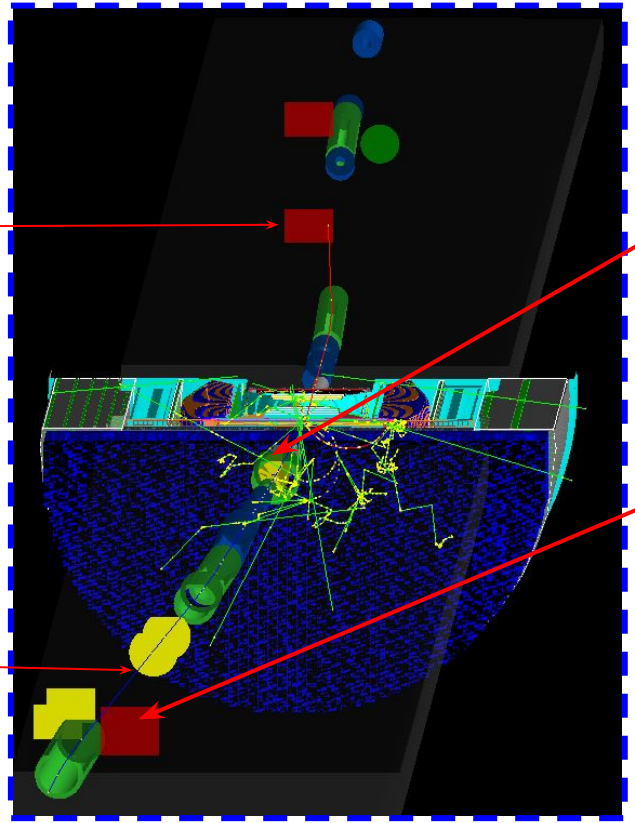
- Simulated physics page: https://wiki.bnl.gov/eicug/index.php/ECCE_Simulations_Working_Group#July_2021_Concept
- Joint responsibility between experts and users
- Extremely helpful experts office hours every Tuesday!

Realistic Detector Model in Fun4All (by users)

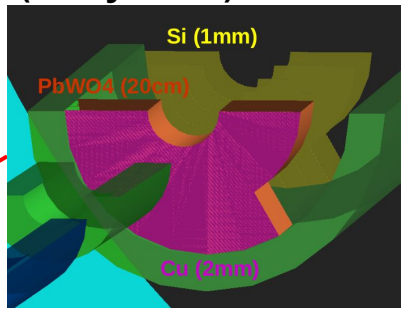
Low Q^2 tagger (A. Bylinkin)

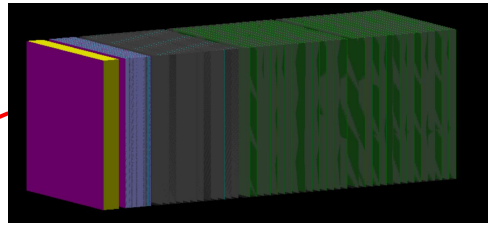
Roman Pots (D. Gangadharan)



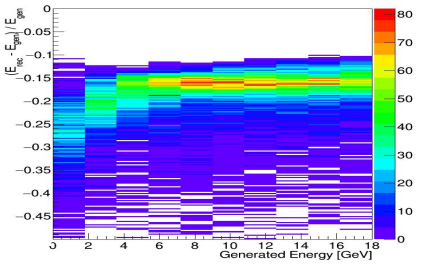


B0 Tracker and Calorimeter (A. Bylinkin)

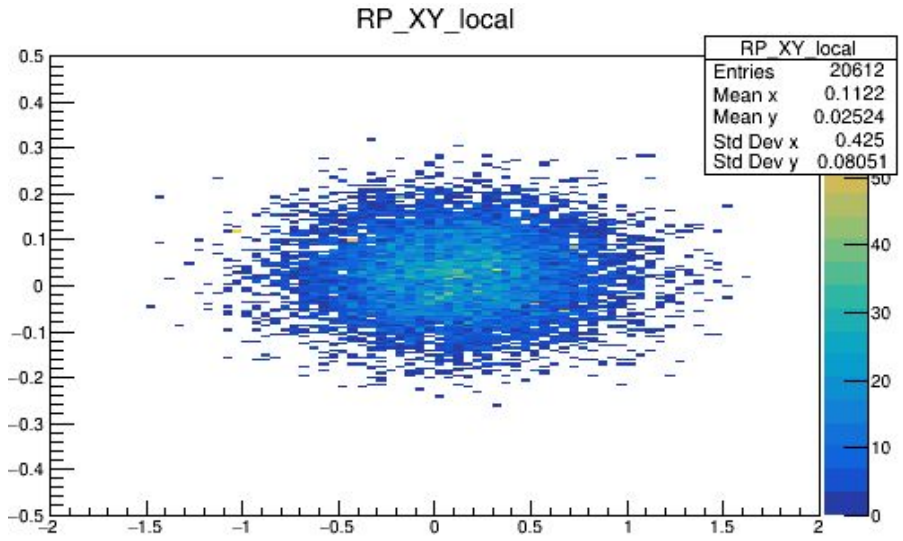




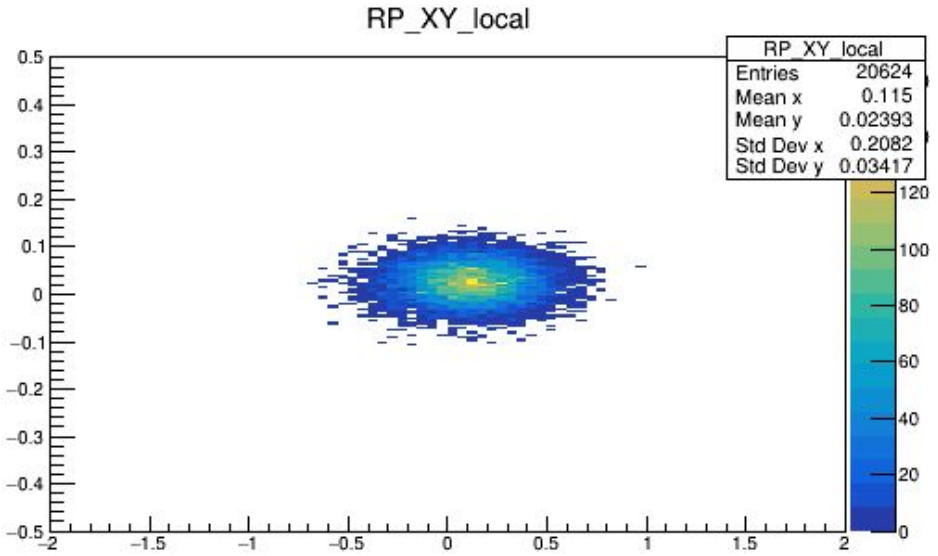
ZDC (S. Shimizu)



Beam Spot at Roman Pot with Different CDR Parameterization



High Divergence Beam Parameterization



High Acceptance Beam Parameterization

A full list of CDR ep and eA scattering beam parameterization is implemented in Fun4all.

Done by Fun4all users

Fun4all Drawbacks from a User Perspective

1. It is a little slow in both processing speed and visualization.
2. Diagnostic process is not intuitive
   - If something goes wrong, there are a great number of possibilities, and it will take a new user a while to find out why.
3. Very specific about the input data format.
   - Complicated solution if a user wants to store extra columns of information from the generator.
4. Very difficult to master SPHENIX analysis class.
   - But there are always examples one could follow.
5. Running singularity package on the farm can be challenging
   - Specific instructions are available: https://wiki.bnl.gov/eicug/index.php/Diffractive_and_Tagging_Physics_Working_Group_Page
6. Afterburners: some are well implemented, some are not.
7. Changes to the main macros branch could takes a day or two to propagate.

ECCE Software Overall and future

- **It was the right thing at the right time!**
  - Fulfills all requirements and delivered the ECCE proposal
- **With expert's help and example**
  - Fun4all includes real detector characterization (including Far forward/backward region)
  - All CDR beam characteristics are included as part of the crossing-angle rotation after-burner.
  - Up-to-date magnetic field setting.
  - **Easy to learn and run, overall, it is robust. Everyone is using the same version of code.**
  - There are a lot of sources for asking for help, great number of experienced Fun4all users.
  - Many available examples to help users to write their analysis plug-in.
- **Fun4all has IP6 and IP8 compatibility**
  - **CORE was also utilized Fun4All to perform rare isotope studies.**
- **Future**
  - **Fun4all continues to serve the community as we move further into the publication stage**
  - **Fun4all IP8 study ready**
  - **Future simulation and analysis can continue to use Fun4all**