Validation of geant4 physics @ JLab regime

Jefferson Lab's CEBAF is an 11 GeV electron accelerator.
Beam is distributed over 4 experimental halls.
Experiments study electro- and photo- production reactions off nucleon targets.

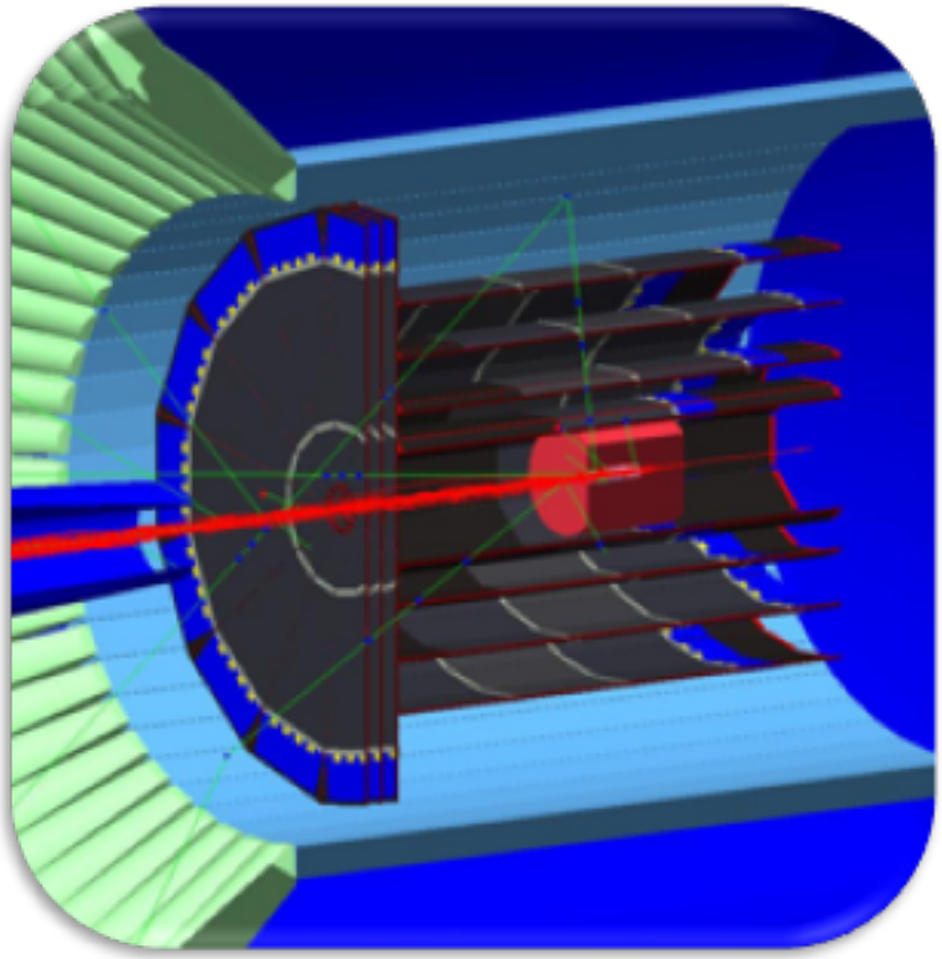
Objective is to validate particle / detector rates @JLab regimes, starting with Hall-B

Hall-B conditions

CLAS12 Nominal Luminosity: L=10^{35} $cm^{-2}s^{-1}$

Target: LH2 $\begin{cases} l_T = 5cm \\ \rho = 0.0708 g/cm^3 \end{cases}$

$$L = R \cdot \frac{\rho N_A l_T}{A} \Rightarrow R_{LH2} = 4.739 \cdot 10^{11} \ \ beam\ electrons/s$$



1/60 of full luminosity
(2000 beam electrons)

Detector Rates: Need electronic time window

- BST Electronics Time Window: 132 ns
- Simulation Time Window: 250 ns:

132,000 electrons / event

for reference, 10K events = 1.32 Billion electrons

Plan and Questions

Validation Plan:

1. Emulate beam settings, targets and fields, starting with Hall-B.
2. Compare particle fluxes / cross sections detector rates with experimental data
3. Build a CI framework to systematically run tests over geant4 versions and geant4 physics list
4. Update geant4 physics validation page accordingly (ideally from CI)

Questions:

1. Is this a good plan? Anything missing?
2. Can we use the modular physics list for this purpose?
3. If yes, which combination of modules?
4. If not, which physics list?
5. Add these simple setups to geant4 examples?