

Update of Full Simulations of BeAGLE e+D Simulations – and some comments on DAQ

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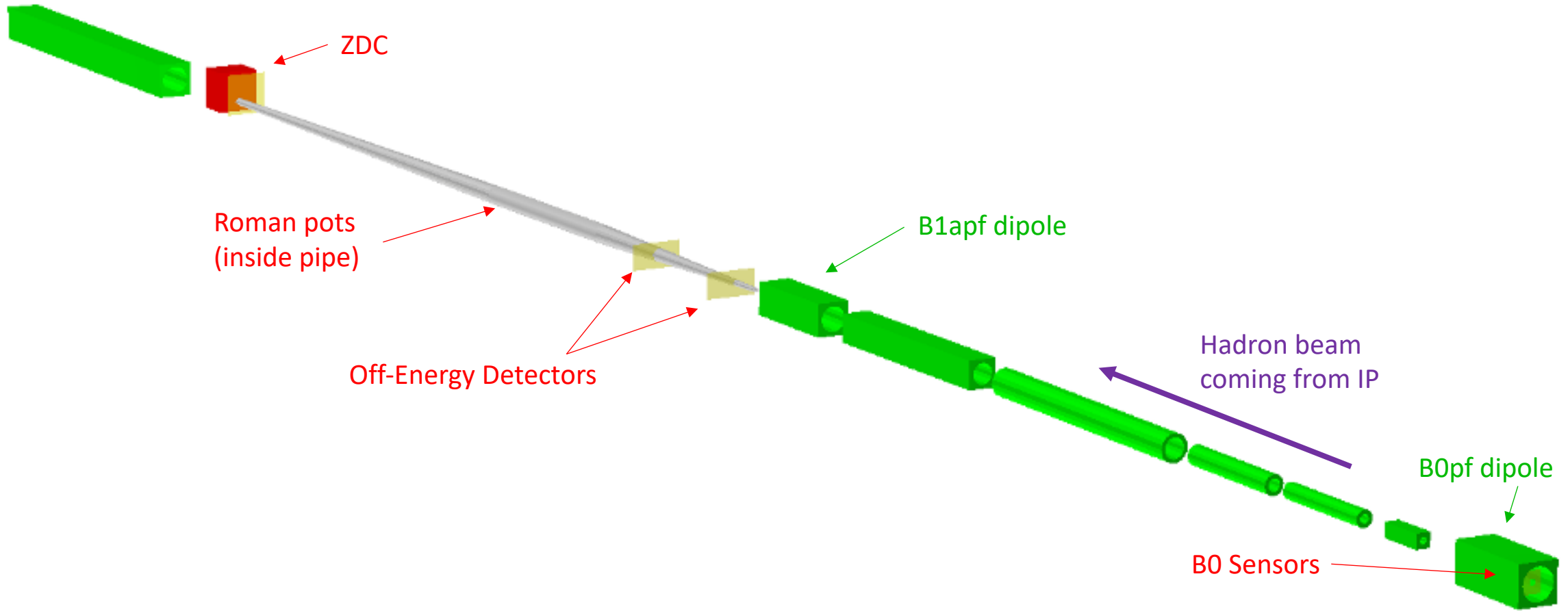
4/23/2020

Preliminaries

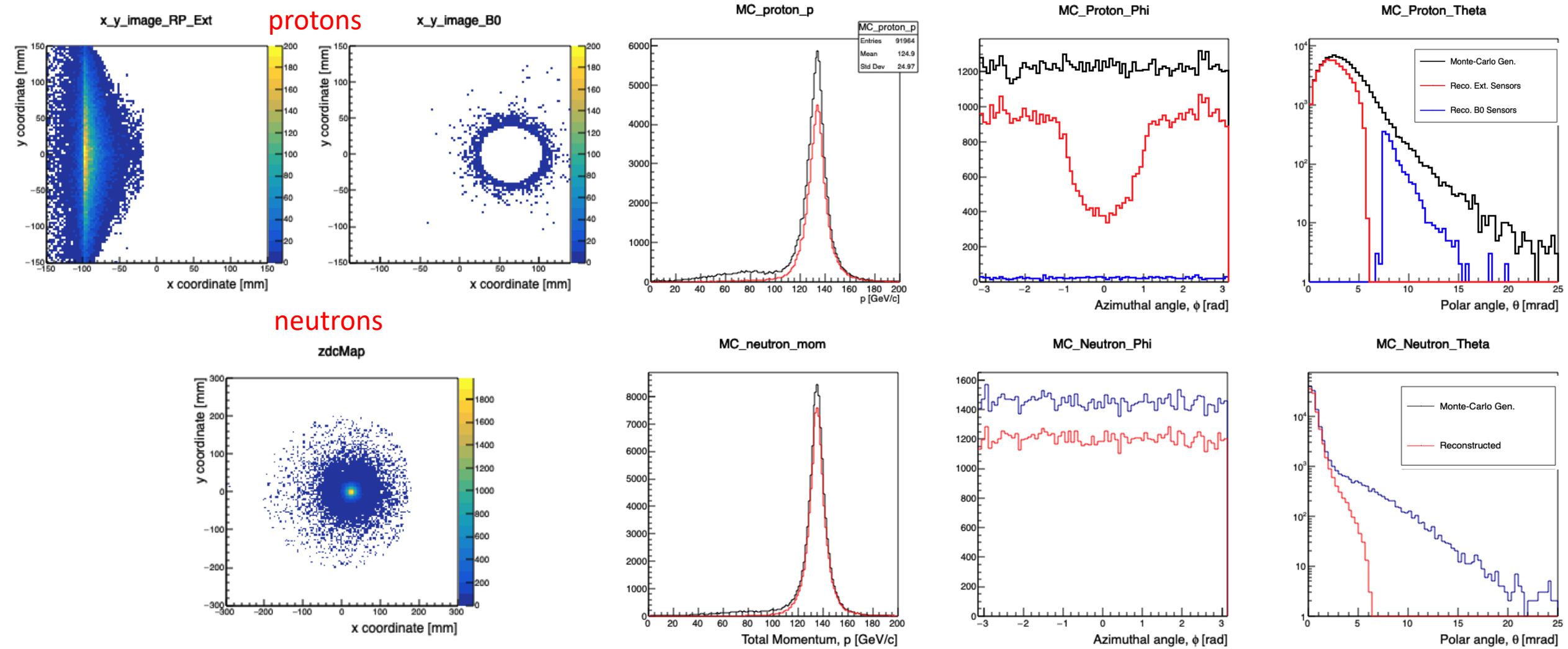
- 18 (GeV) x 135 (GeV/n) e+D events with BeAGLE.
- Results for neutron spectator and proton spectator shown separately.
- ZDC: $\sigma_E \sim \frac{50\%}{\sqrt{E}} + 5\%$, $\sigma_\theta \sim \frac{3 \text{ mrad}}{\sqrt{E}}$
- Off-Energy Detectors: $500\mu\text{m} \times 500\mu\text{m}$ pixels
- B0: $50\mu\text{m} \times 50\mu\text{m}$ pixels
- Angular divergence numbers from “high acceptance – 18x275 GeV – full scope” portion of “eRHIC parameters v6.0” table.
- Beam energy spread $\sim 10^{-4}$
- Vertex smearing (to simulate the crab cavity effect)

Simulation Apparatus

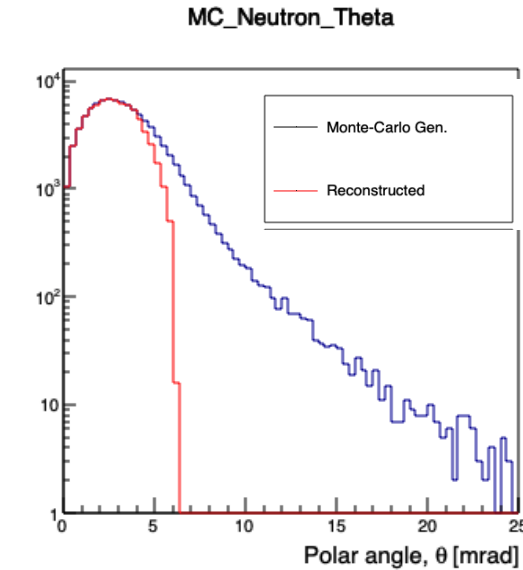
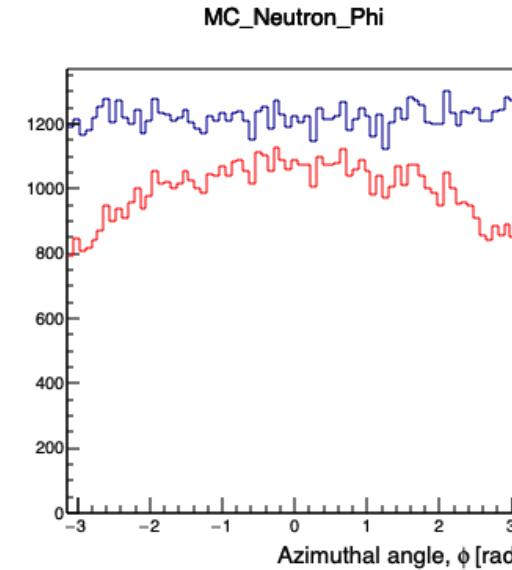
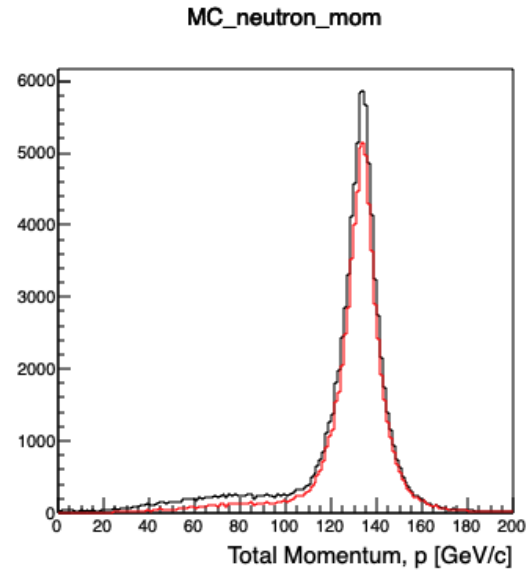
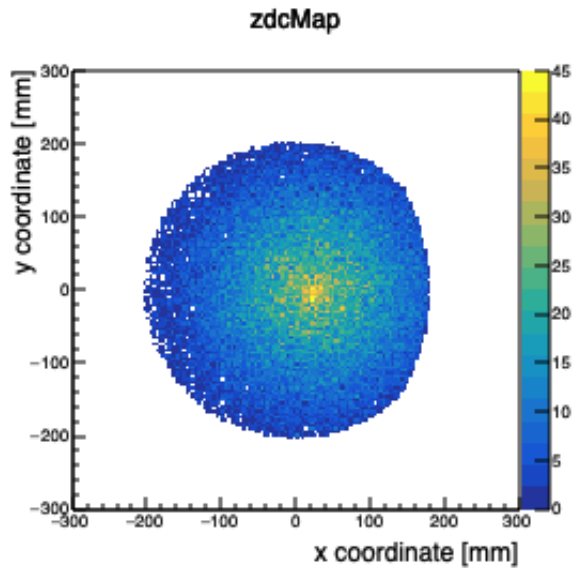
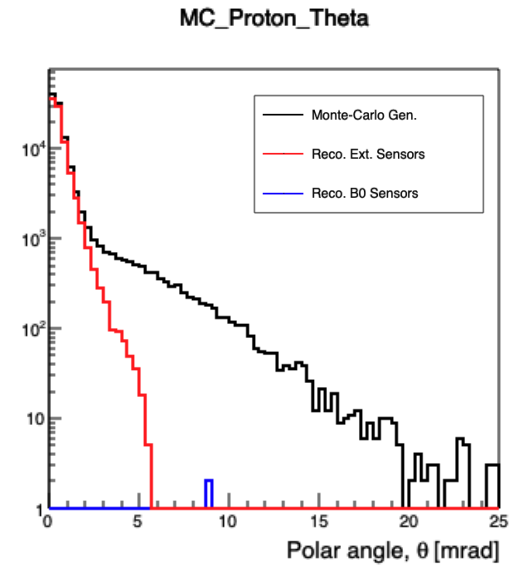
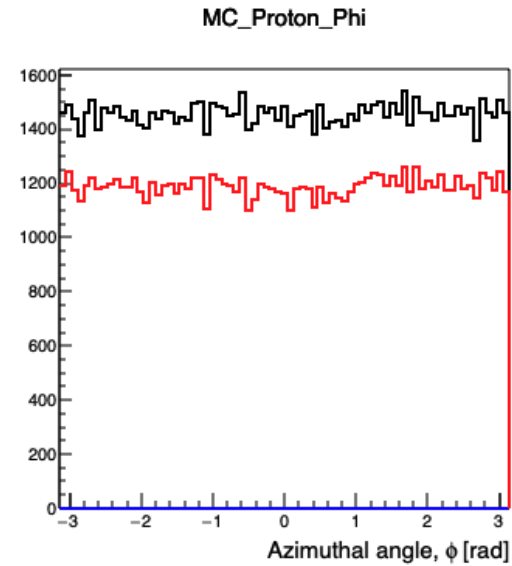
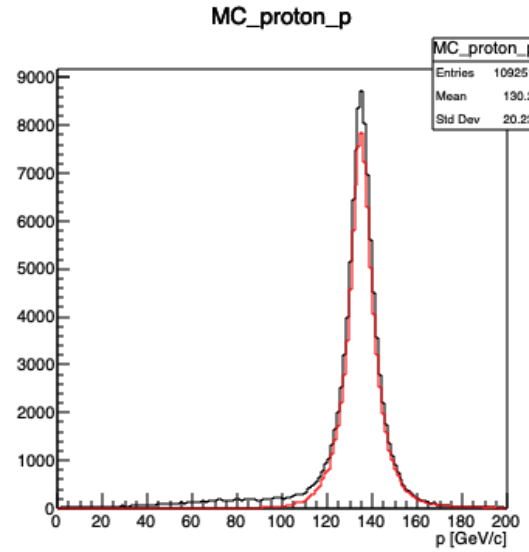
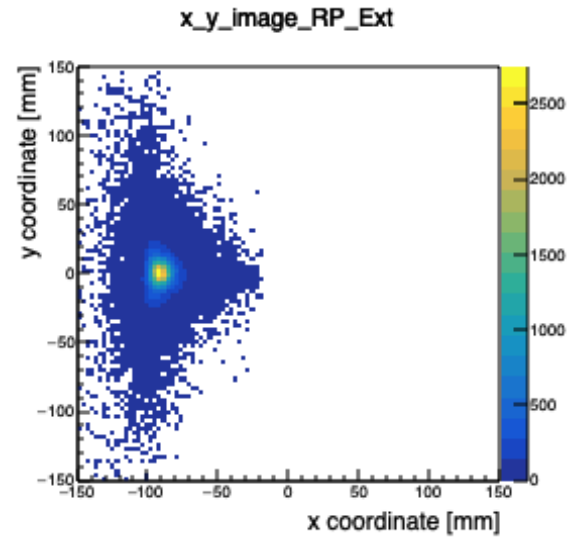
- EicRoot with GEANT4
- Includes ZDC, B0 sensors, Roman Pots, and External Silicon Sensors for particles with different rigidity.



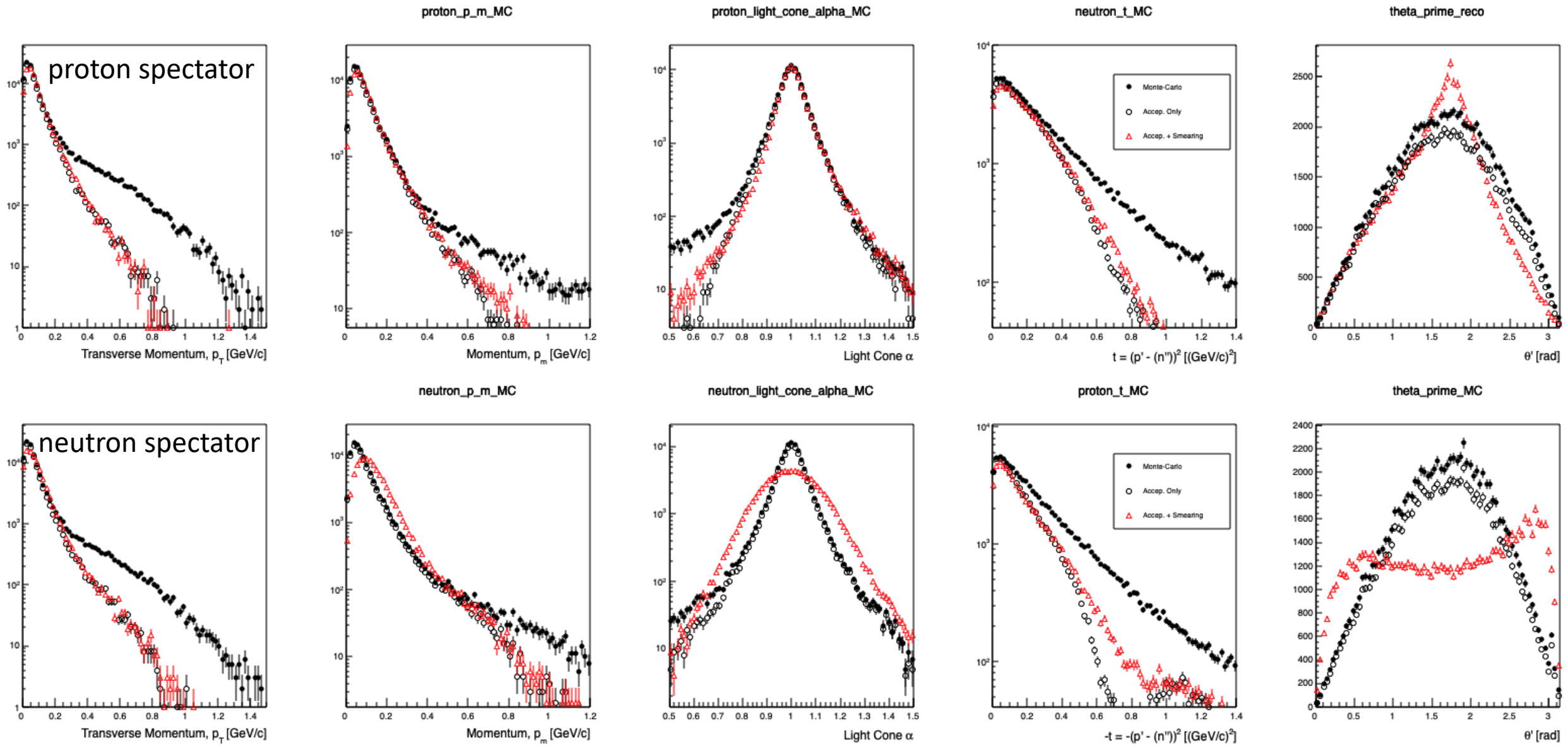
Acceptances - neutron spectator



Acceptances - proton spectator



Preliminary Physics Plots



Resolutions

Protons (pt resolution)	(%)	absolute
Pt < 200 MeV/c	20-40%	26 MeV/c
200 < pt < 500 MeV/c	11-30%	30 MeV/c
Pt > 500 MeV/c	7-23%	33 MeV/c

Neutrons (pt resolution)	(%)	absolute
Pt < 200 MeV/c	30-50%	36 MeV/c
200 < pt < 500 MeV/c	15-31%	48 MeV/c
Pt > 500 MeV/c	12-30%	64 MeV/c

Neutrons (E resolution)	(%)	absolute
Pt inclusive	10%	12 GeV

t resolution	(%)	absolute
t < .1 [GeV/c] ²	37-60%	0.026 [GeV/c] ²
.1 < t < .2 [GeV/c] ²	> 33%	0.049 [GeV/c] ²
.2 < t < .3 [GeV/c] ²	22-38%	0.057 [GeV/c] ²
.3 < t < .4 [GeV/c] ²	21-39%	0.075 [GeV/c] ²
.5 < t < .7 [GeV/c] ²	19-57%	0.092 [GeV/c] ²
.7 < t < 1.2 [GeV/c] ²	> 22%	0.223[GeV/c] ²

These are still preliminary numbers. We need to run more statistics and switch to the correct energy configuration, but the infrastructure is in place and we are close to done with the study.

Additionally, for the protons it is going to make sense to separate the B0 and Off-Energy Detector contributions – they are combined here.

Takeaways

- The main physics plots are ready, minus plot beautification, etc.
- Need to work on cleaning up some of the fits to extract resolutions.
 - Also need to separate the B0 and off-energy detector contributions.
- Once this cleanup is done, we will re-run the whole analysis with the 18x110 beam energy configuration, and with more statistics.

Very Preliminary Comments on DAQ Requirements

- Both Roman Pots and Off-Energy Detectors have same pixel pitch in simulations (.5 mm x .5 mm), and similar size (20 cm x 10 cm for RP, 10cm x 30cm for OED).
 - With those pixels, the RP would have ~80k total, and the OED ~120k.
 - Not exactly sure how many channels.
- From the eRD19 background studies with an older IR configuration, the following was estimated.
 - Beam+gas background rates ~10-25 kHz at the RP.
 - DIS rates ~50-700 kHz, depending on the luminosity (i.e. high accep. vs. high divergence)
- The background study is to be repeated with the modern IR design and parameters (next on my list), so these numbers will be updated along with estimates of the detector occupancies.