

# Particle Scan of EIC Far-Forward Region

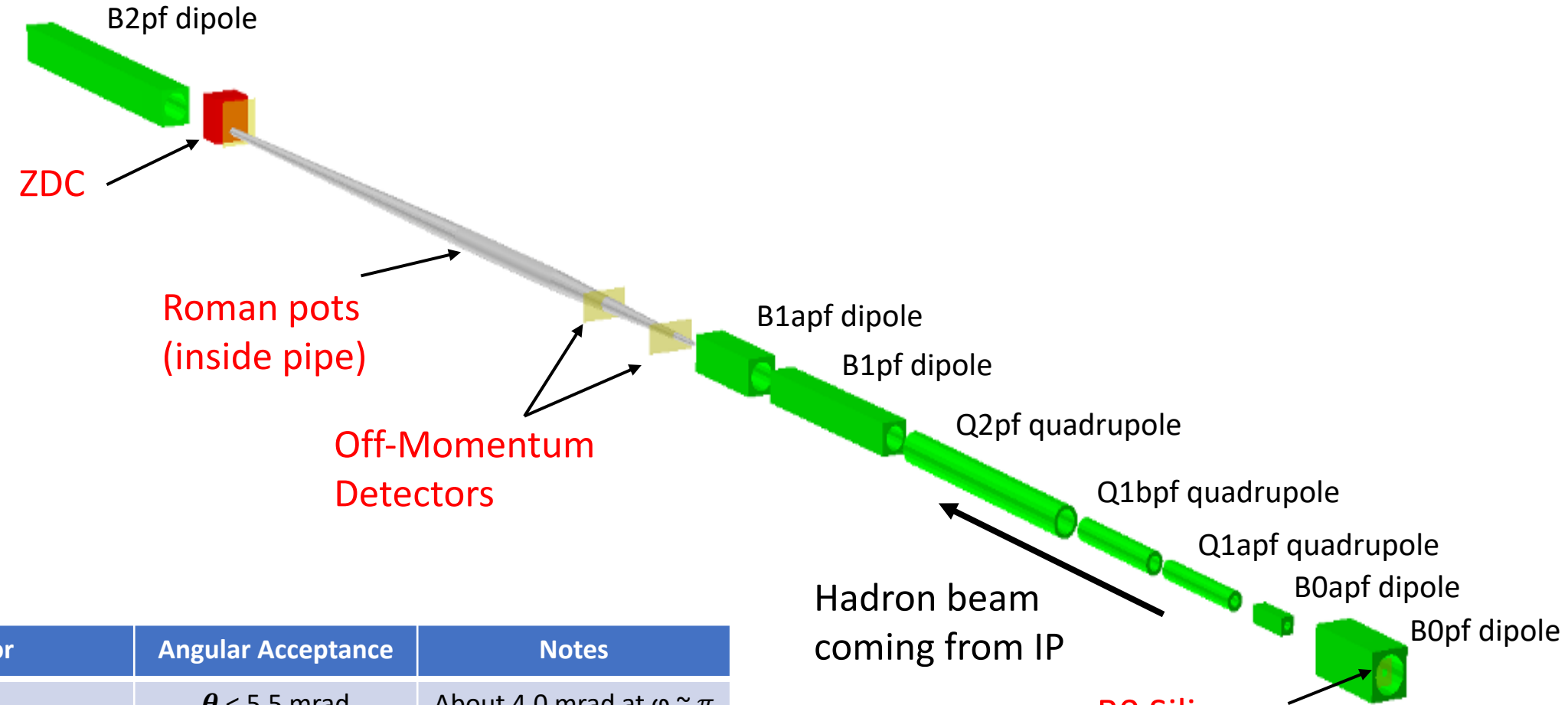
Alex Jentsch

June 26<sup>th</sup>, 2020

# Preliminaries

- Only protons used for this scan.
  - Will repeat for a few other particles, especially pions.
- Used particle gun and sampled the following ranges.
  - $0 < p < 275 \text{ GeV}$ ,  $0 < \varphi < 2\pi$ ,  $0 < \theta < 20 \text{ mrad}$
- Magnets set to the maximum field settings (i.e. the settings for the 275 GeV proton beam).
- All current FF detectors included.
  - Roman Pots
  - Off-Momentum Detectors
  - B0 Spectrometer
  - ZDC (not relevant for protons, but perhaps for pions\*\*)

# Preliminaries

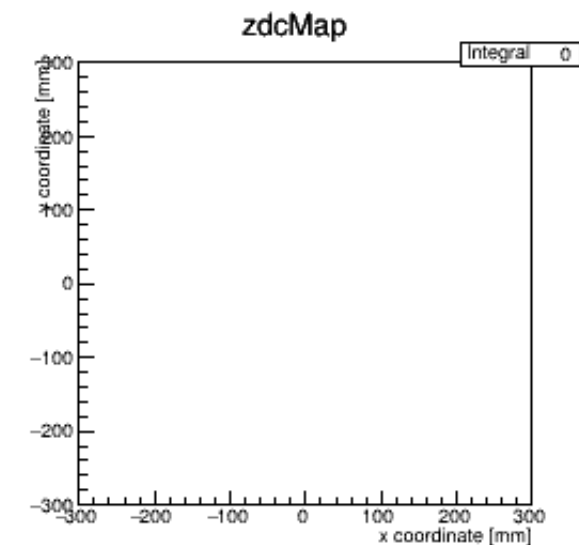
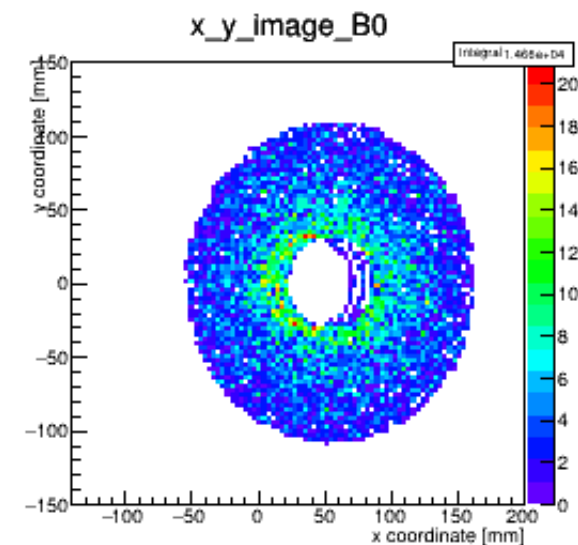
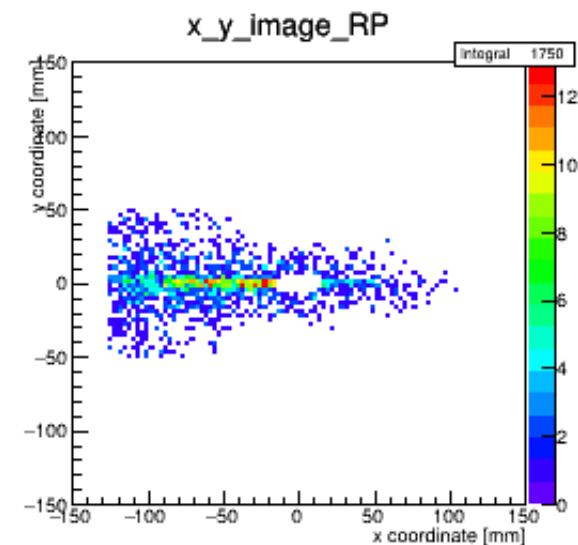
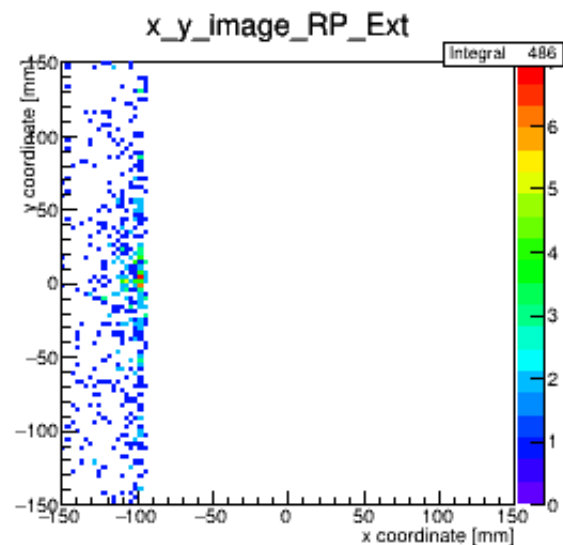
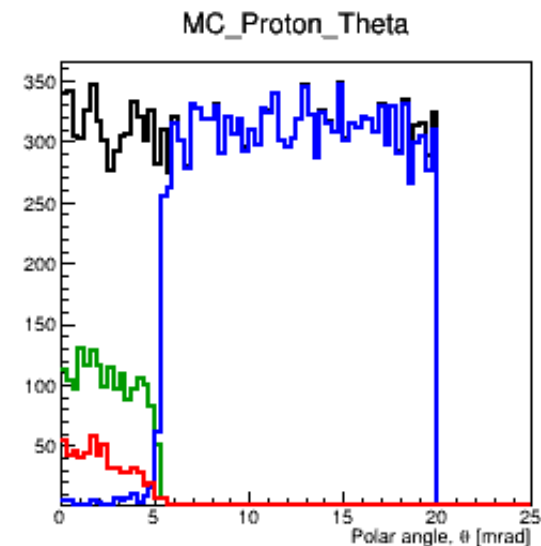
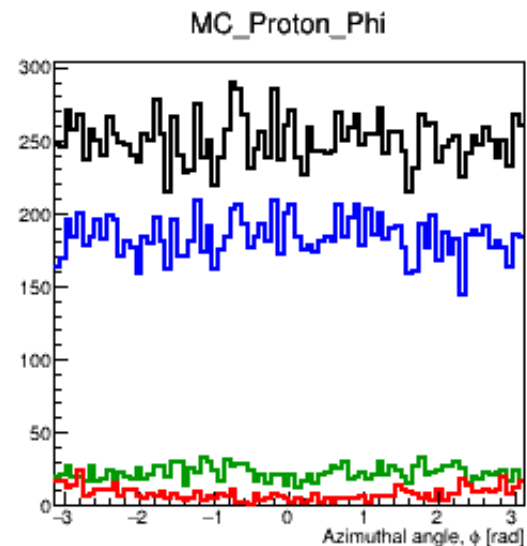
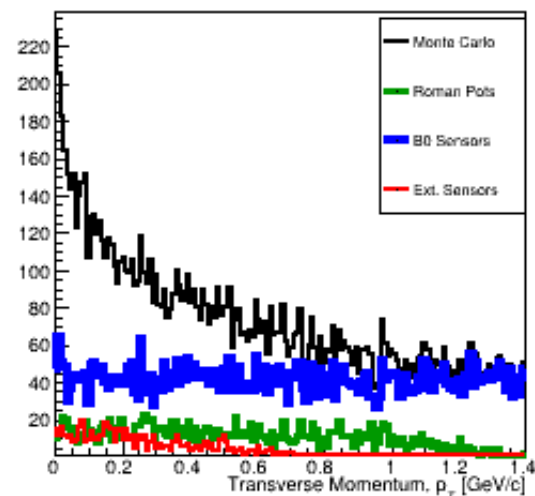
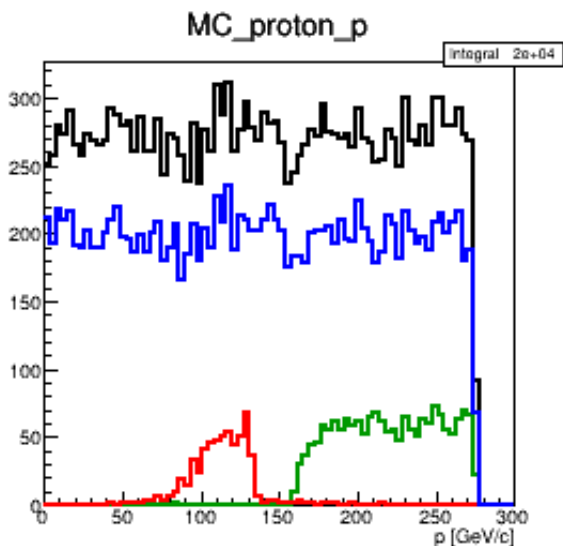


Detector	Angular Acceptance	Notes
ZDC	$\theta < 5.5$ mrad	About 4.0 mrad at $\varphi \sim \pi$
Roman Pots	$0.0 < \theta < 5.0$ mrad	Need $10\sigma$ cut.
Off-Momentum Detectors	$0.0 < \theta < 5.0$ mrad	Roughly $.4 < x_L < .6$
B0 Sensors	$5.5 < \theta < 20.0$ mrad	Still need to optimize.

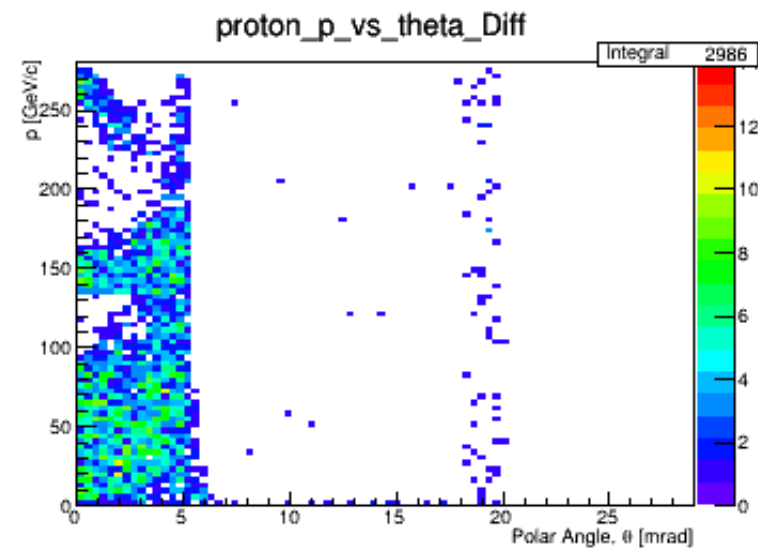
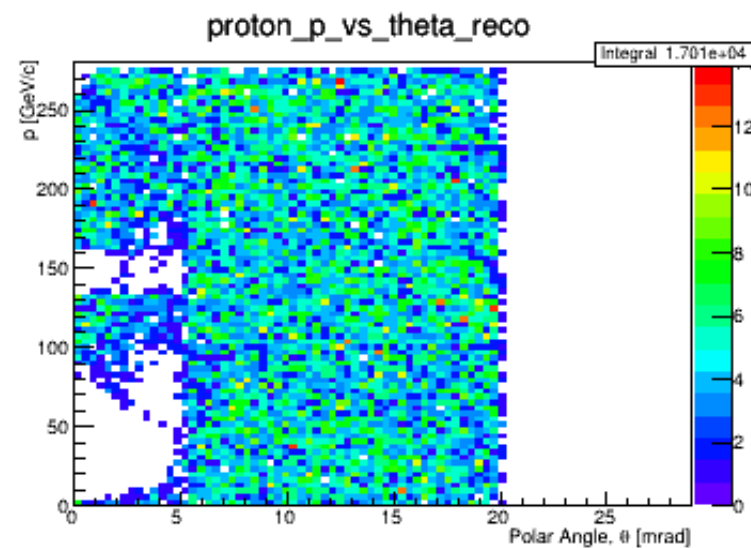
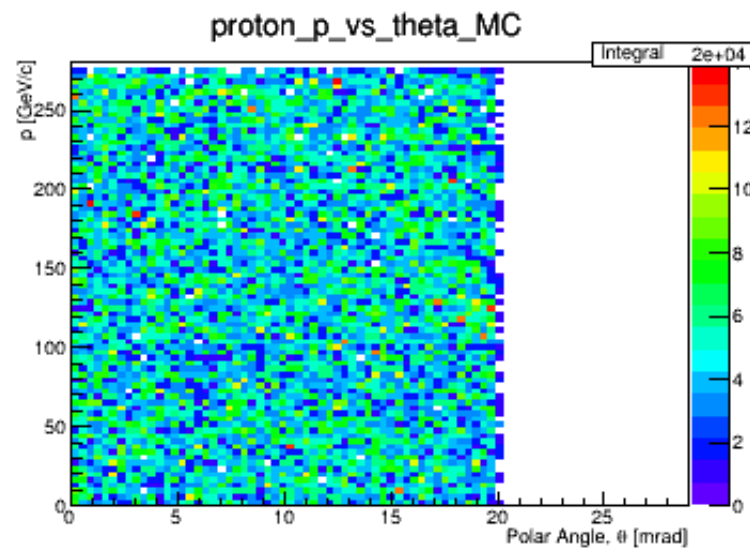
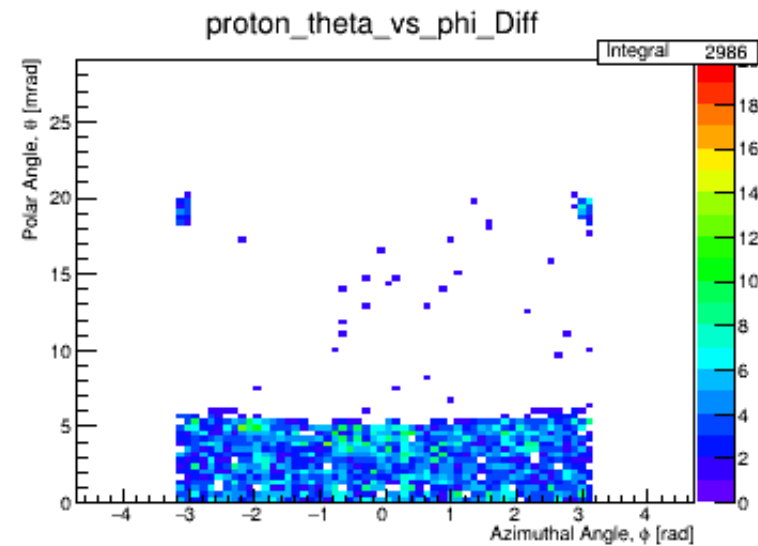
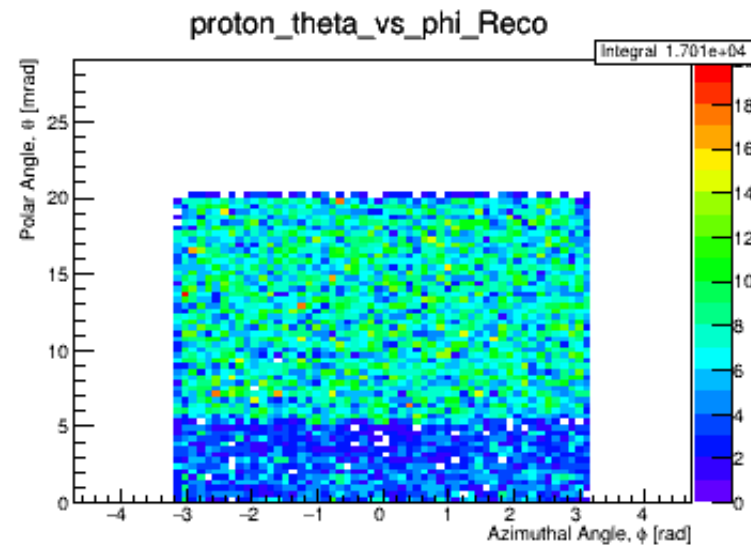
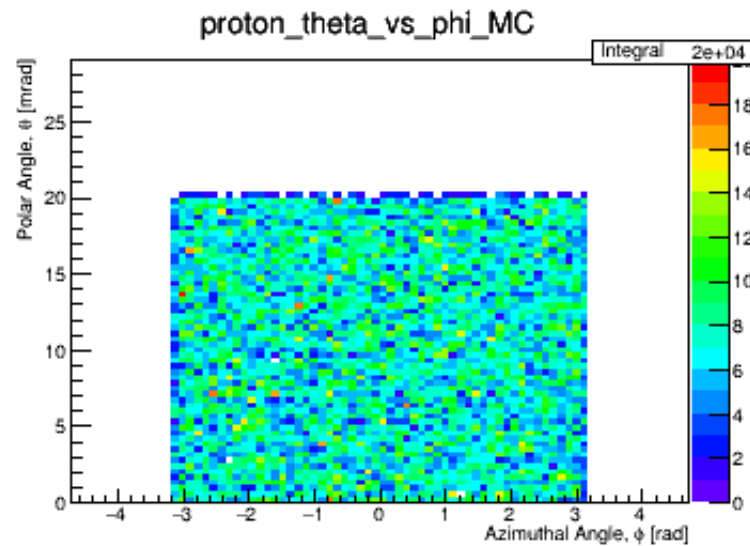
$$x_L = \frac{p_{z,nucleon}}{p_{z,beam}}$$

**B0 Silicon  
Detector**

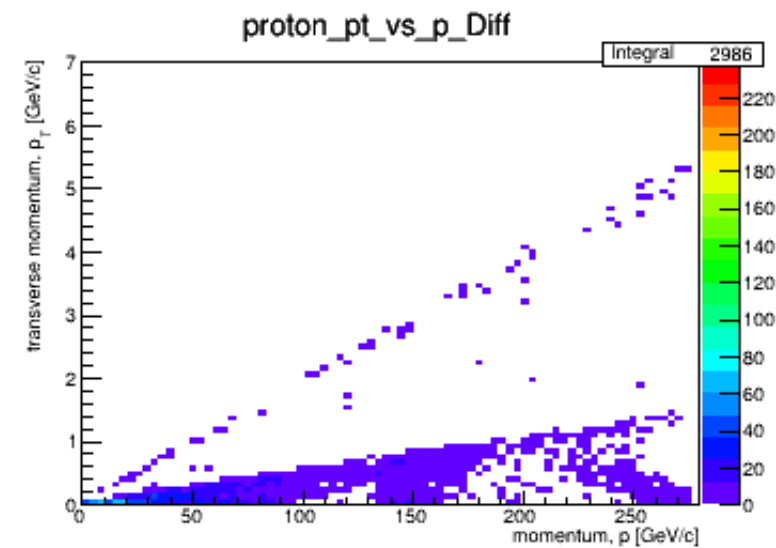
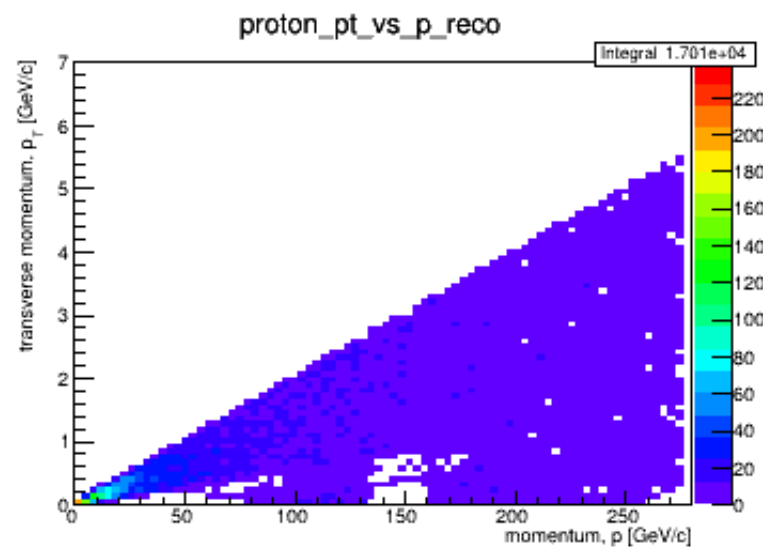
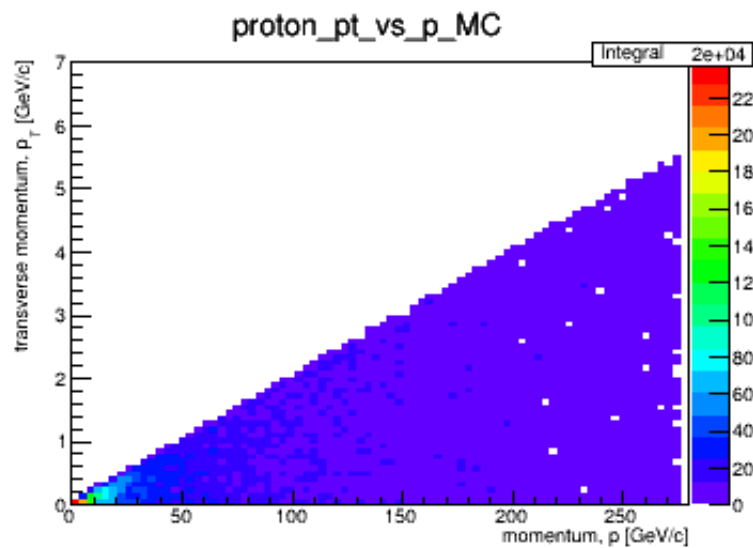
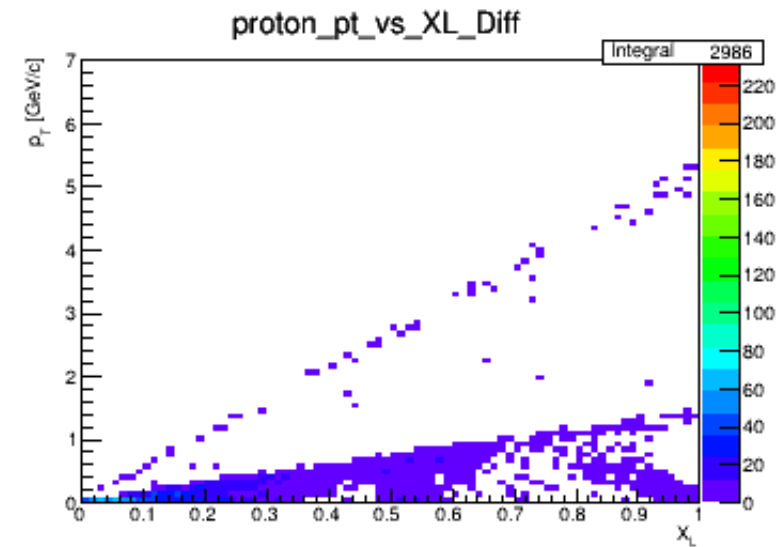
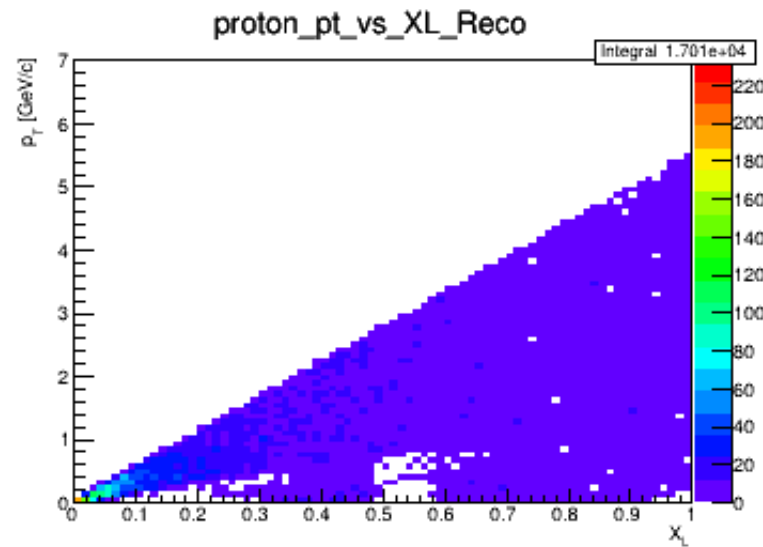
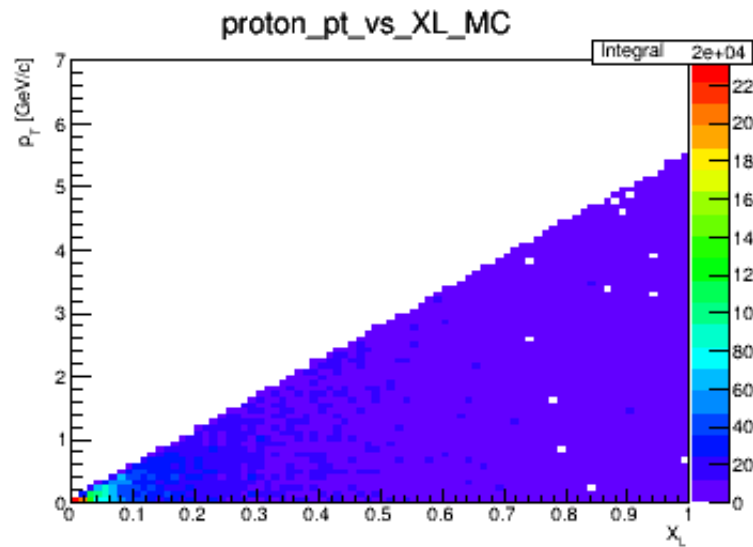
# Results (combined detectors)

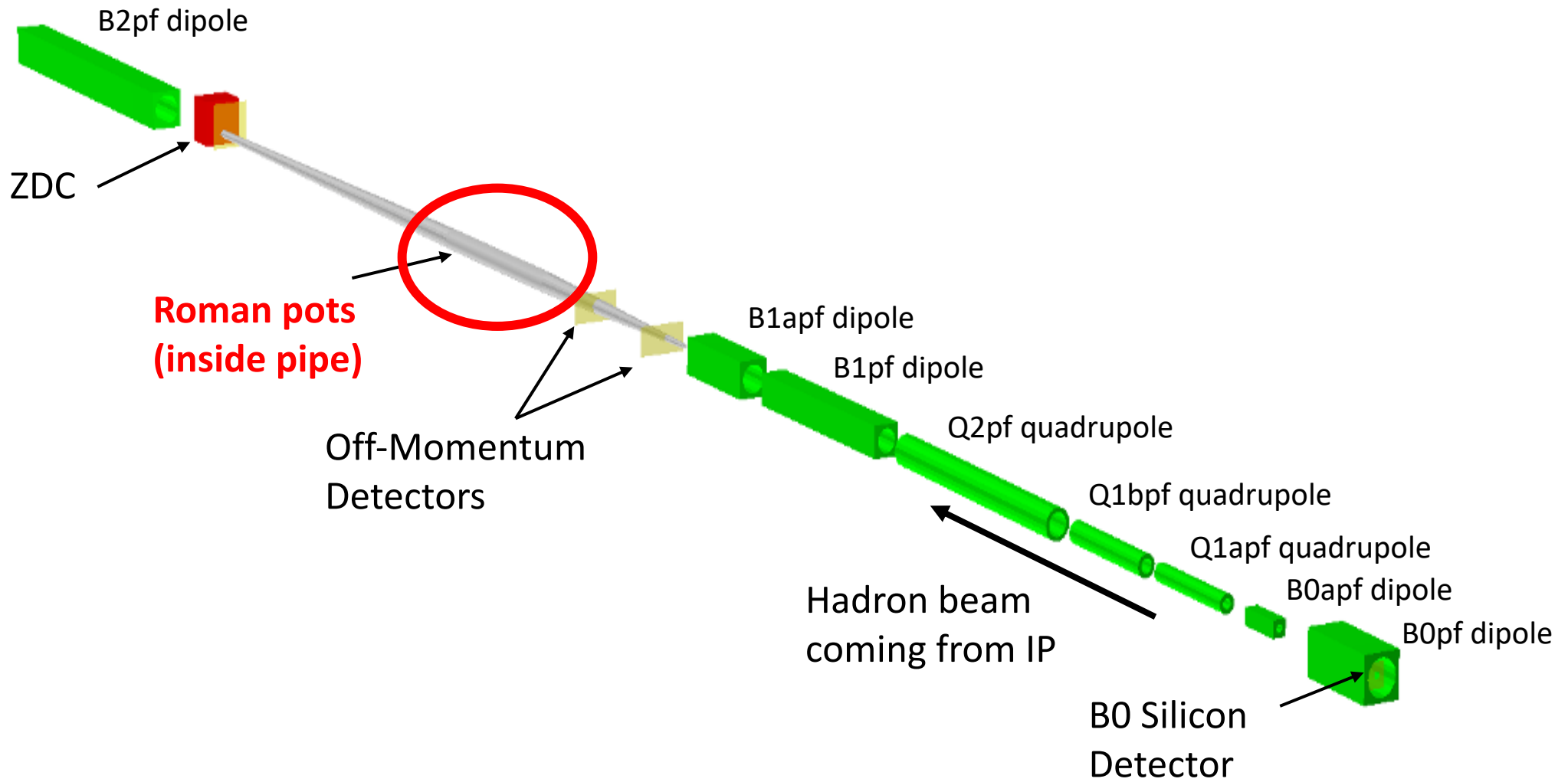


# Results (combined detectors)



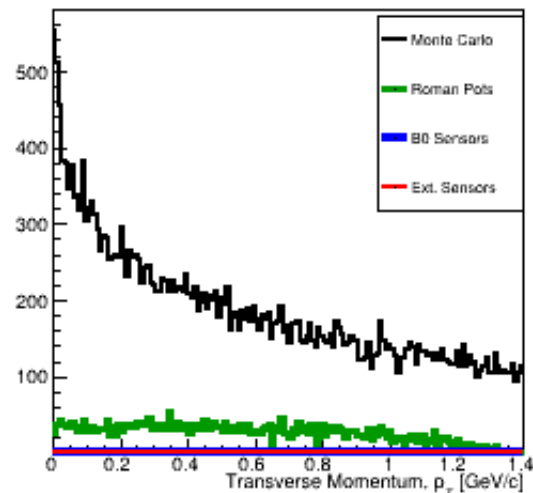
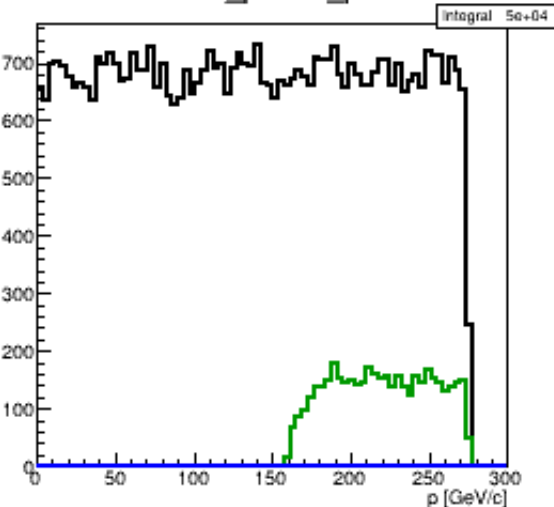
# Results (combined detectors)



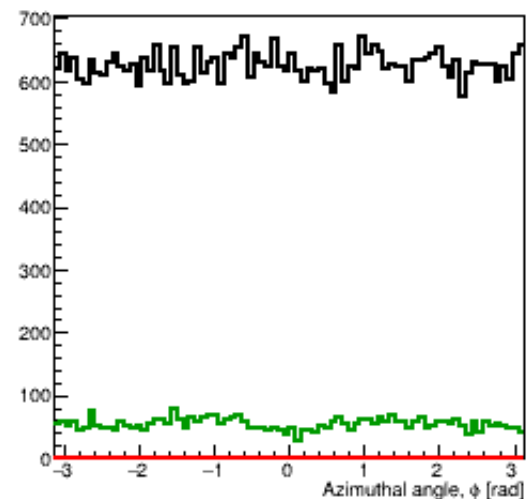


# Results (Roman Pots)

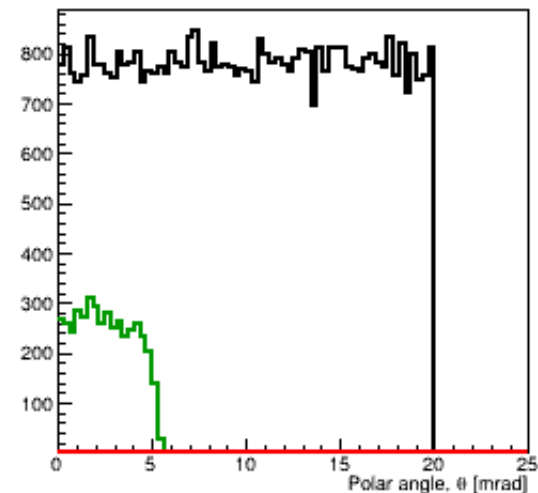
MC\_proton\_p



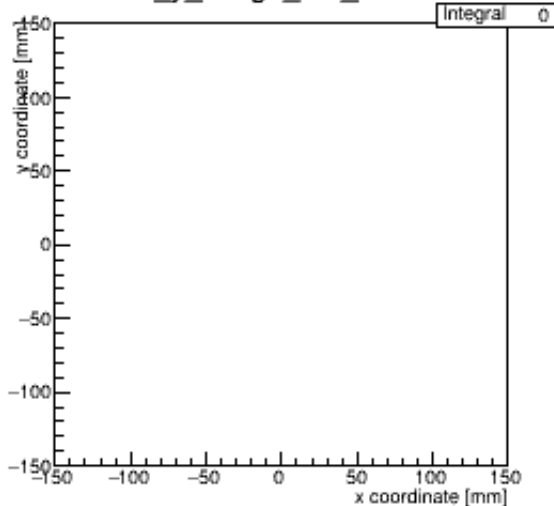
MC\_Proton\_Phi



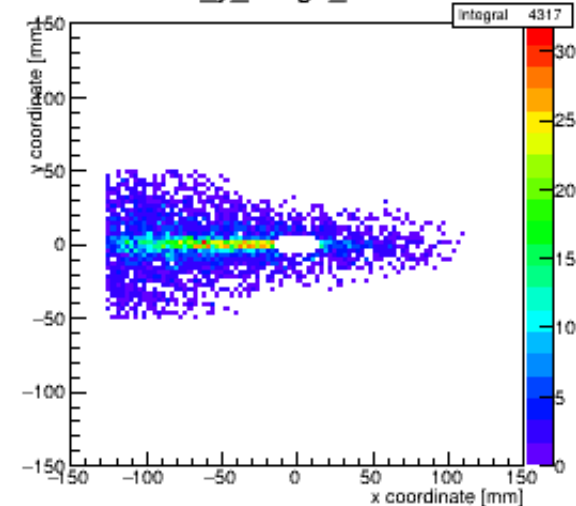
MC\_Proton\_Theta



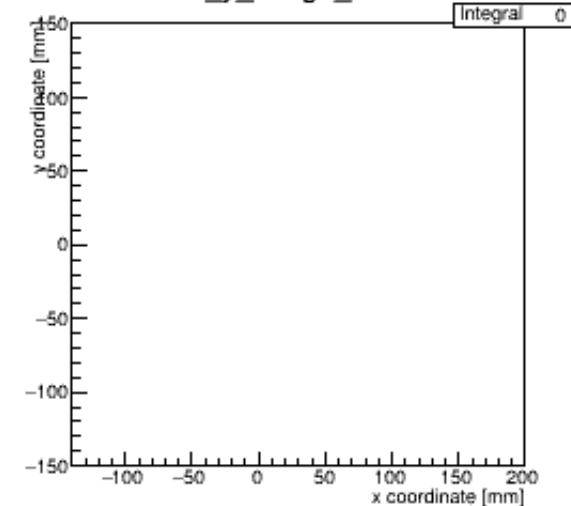
x\_y\_image\_RP\_Ext



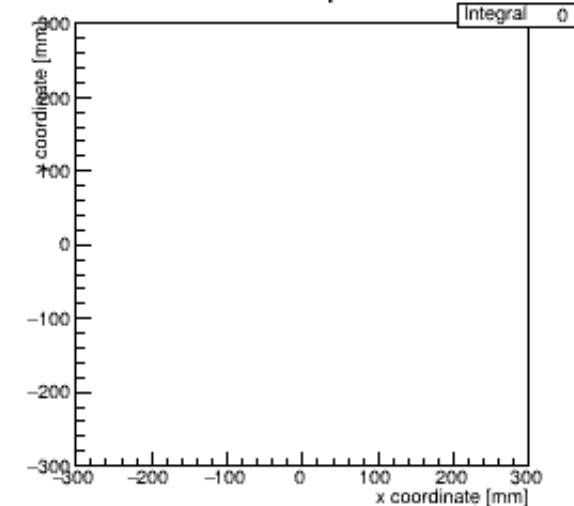
x\_y\_image\_RP



x\_y\_image\_B0

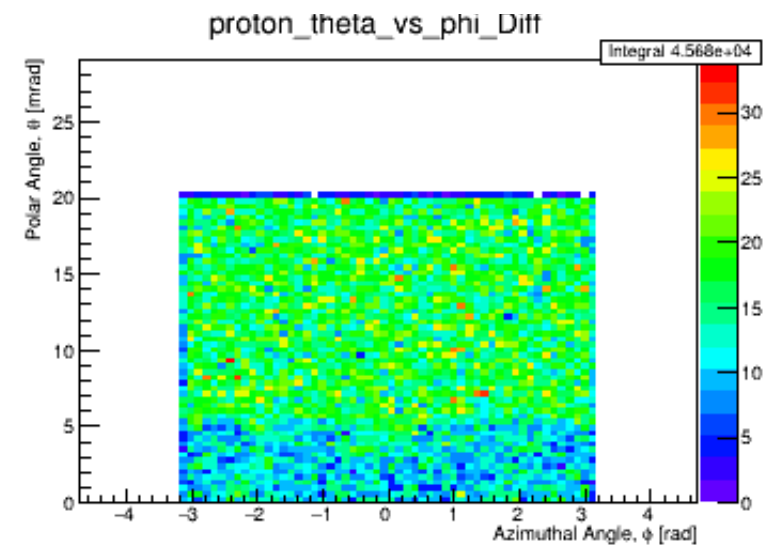
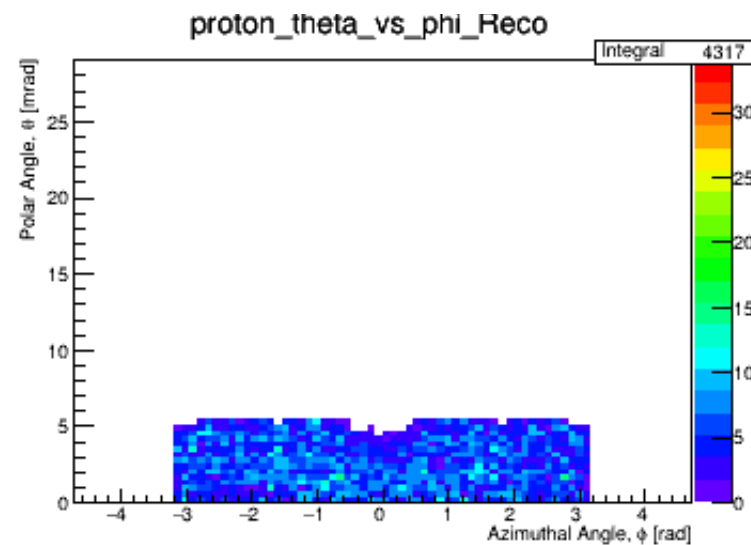
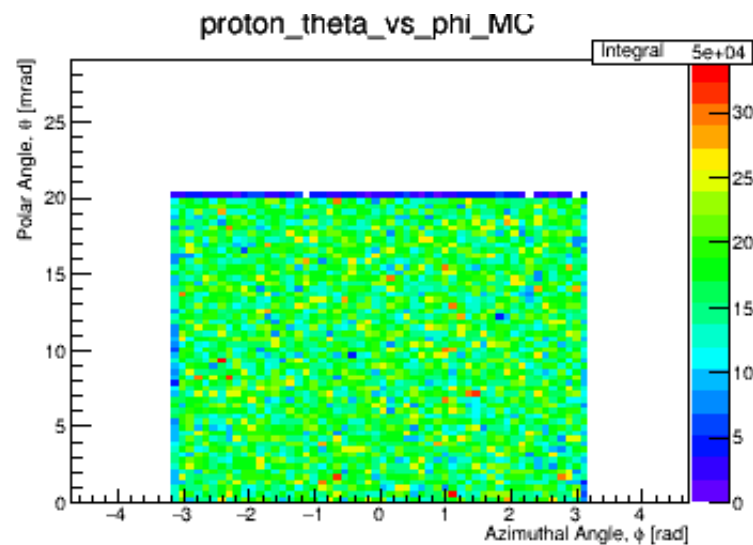
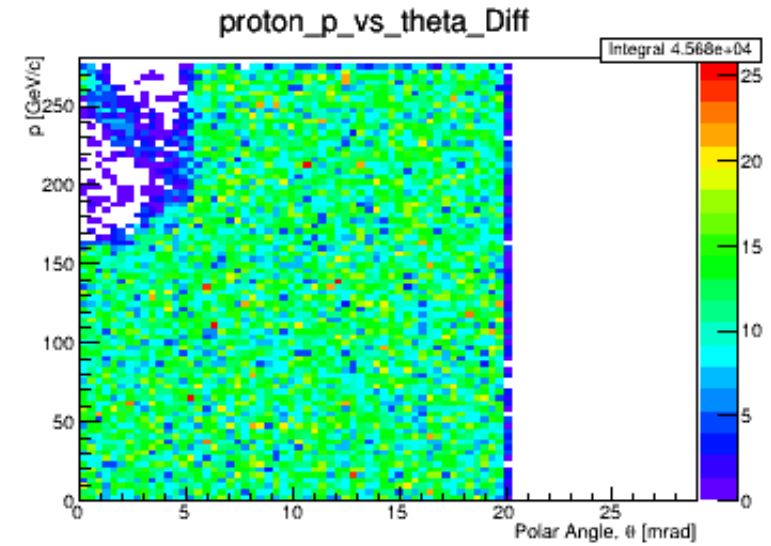
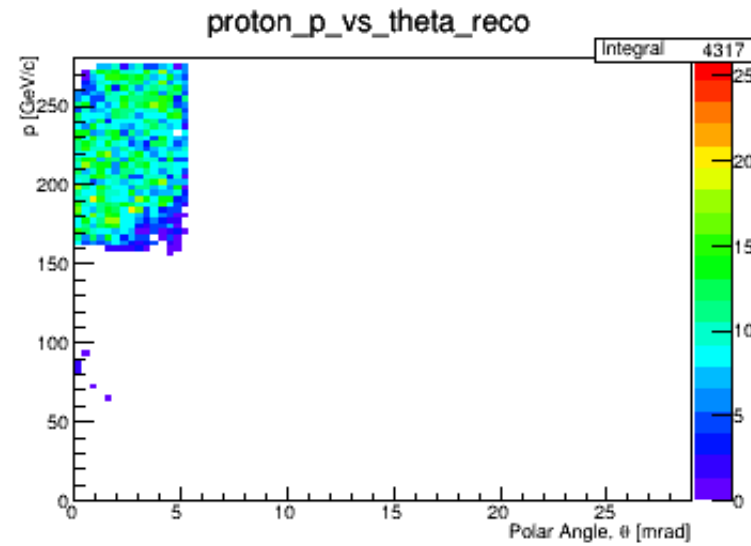
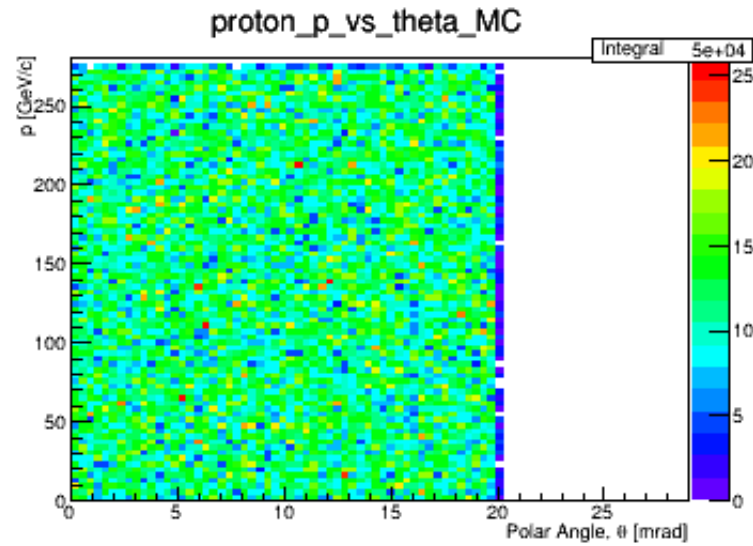


zdcMap

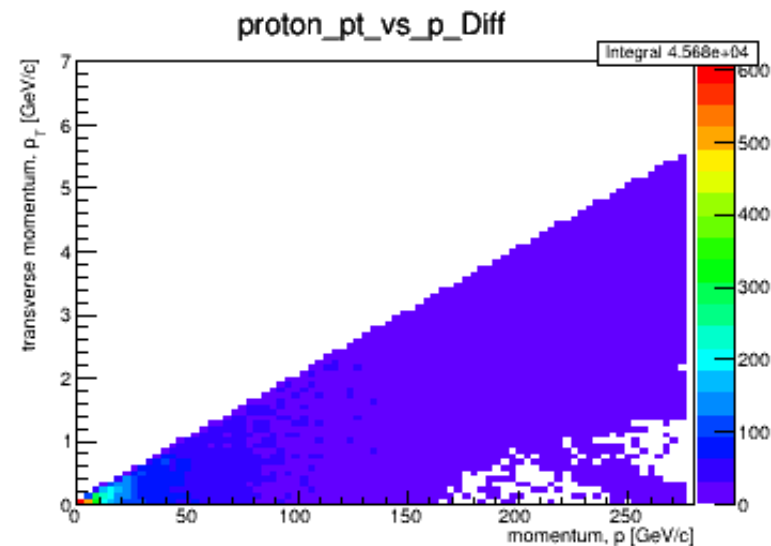
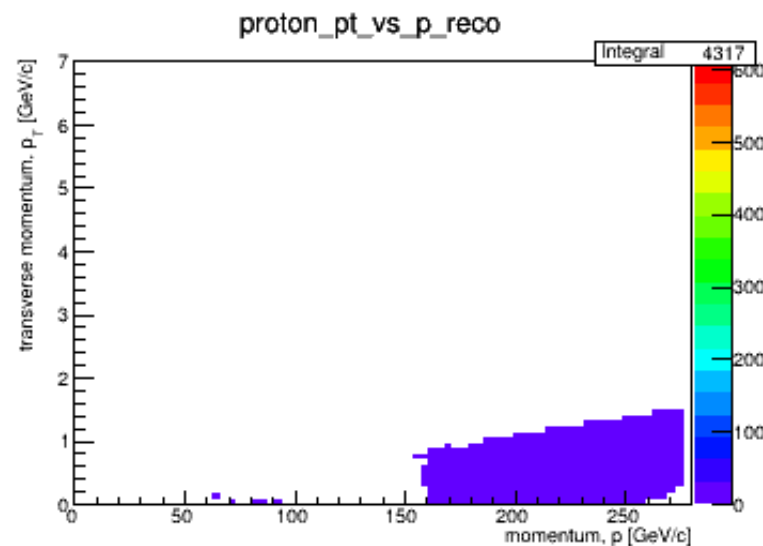
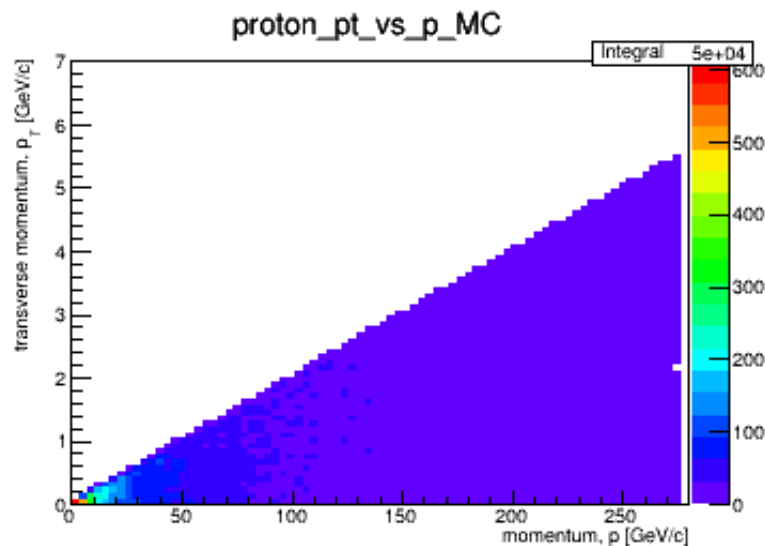
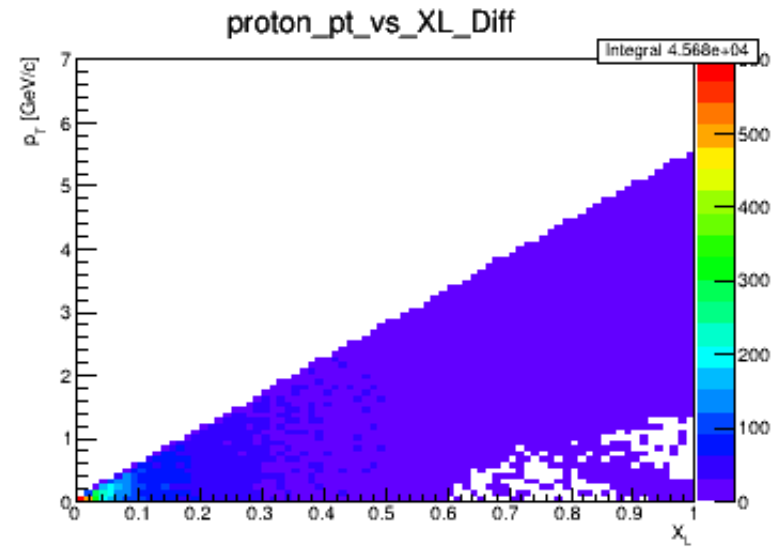
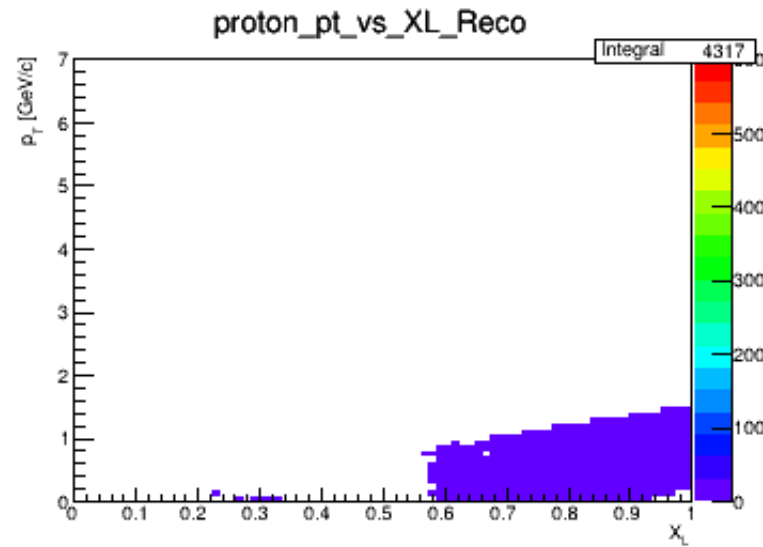
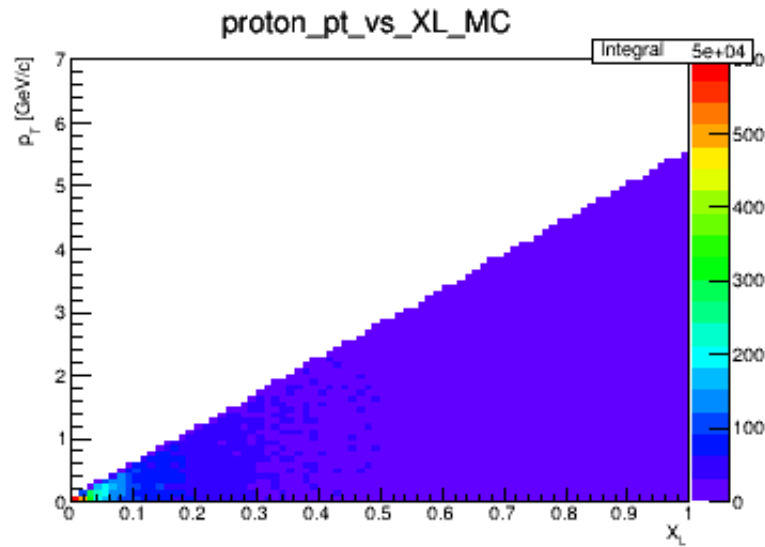


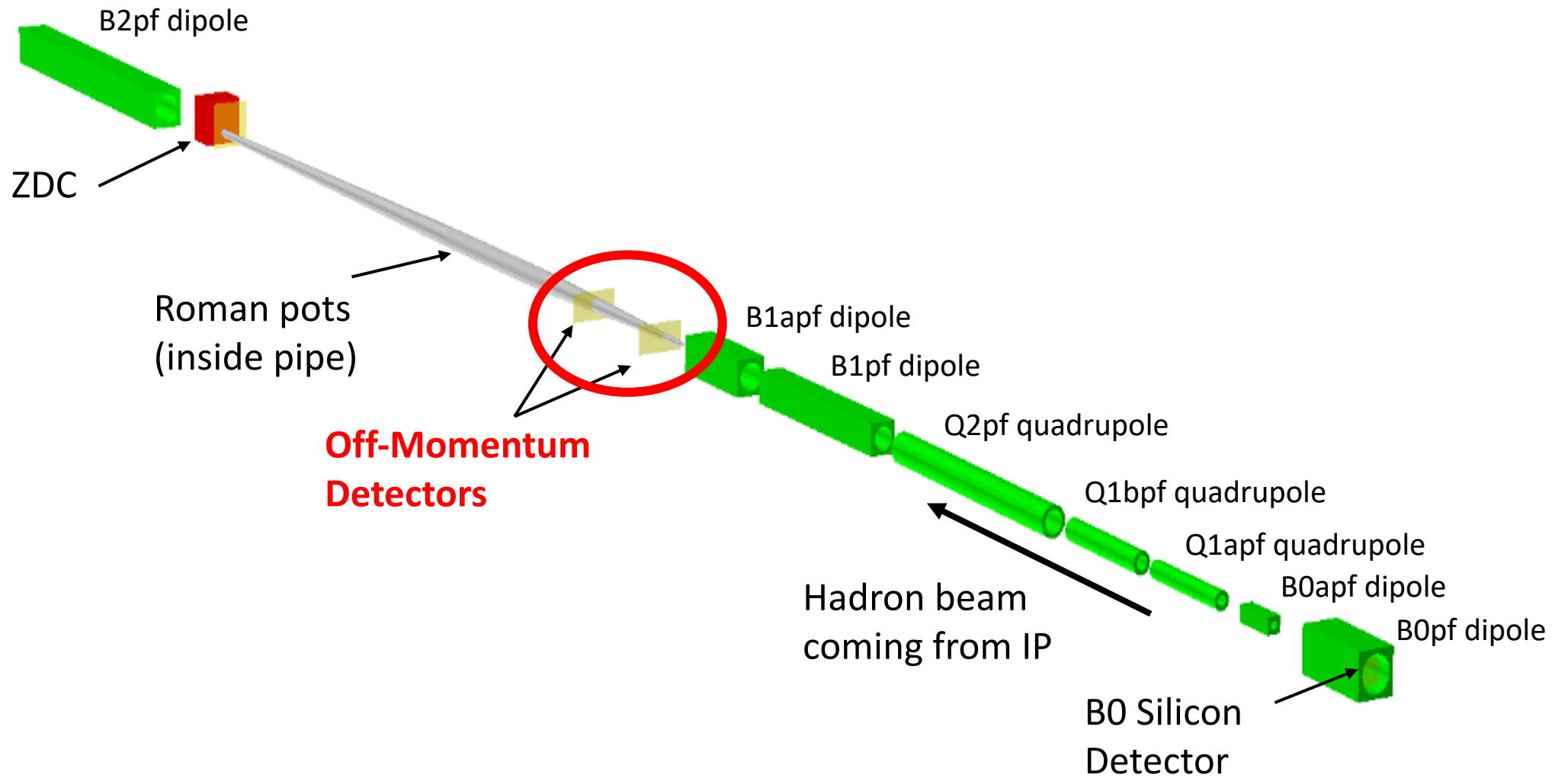


# Results (Roman Pots)

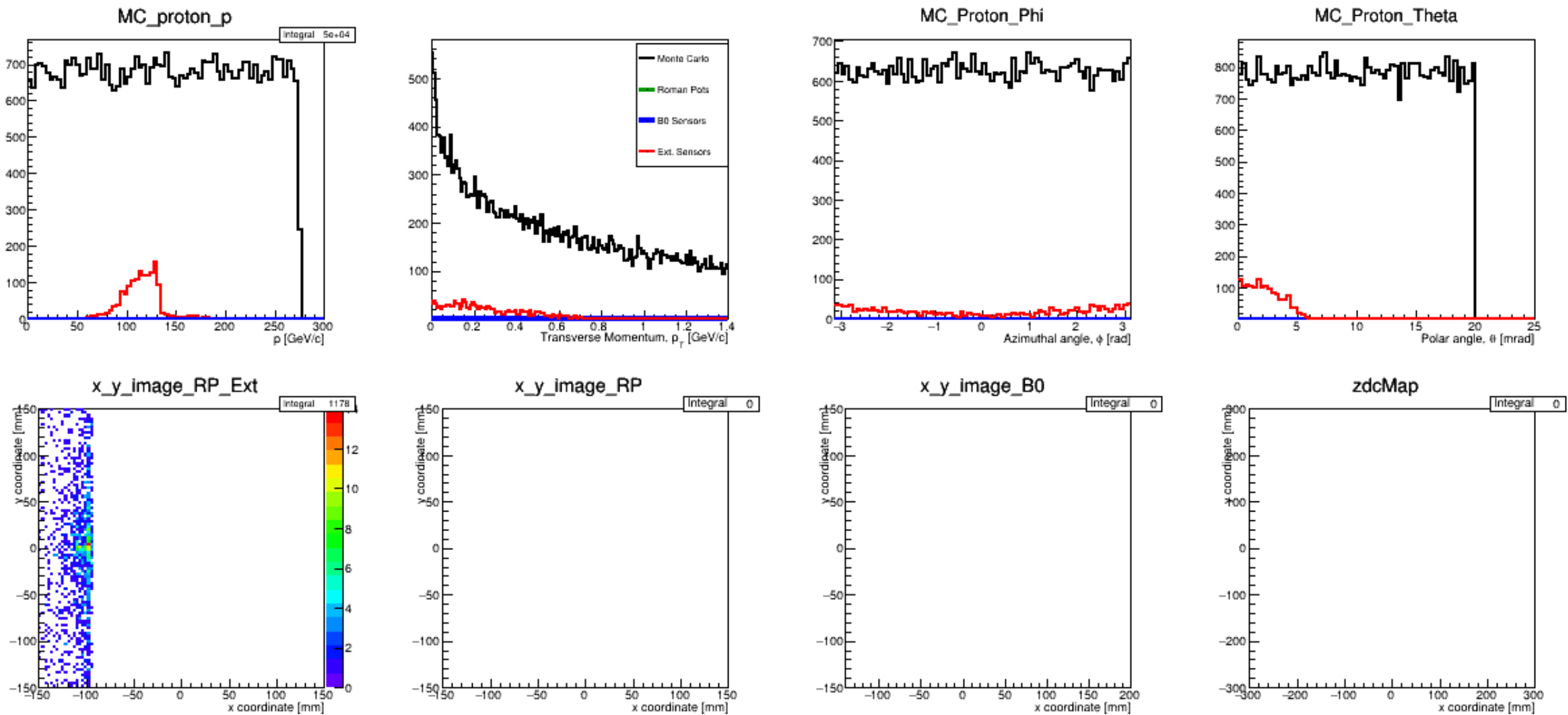


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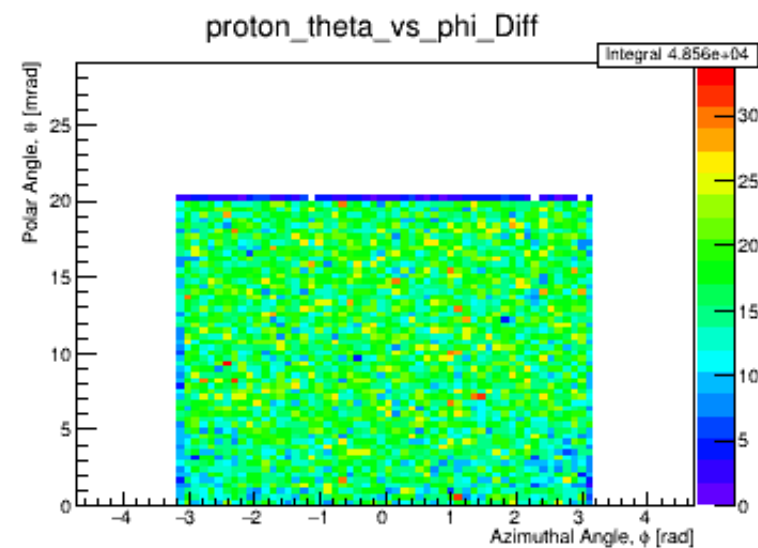
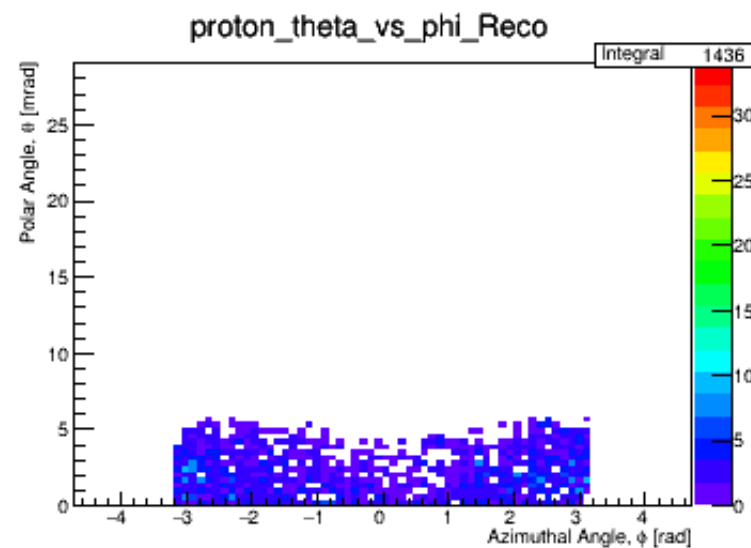
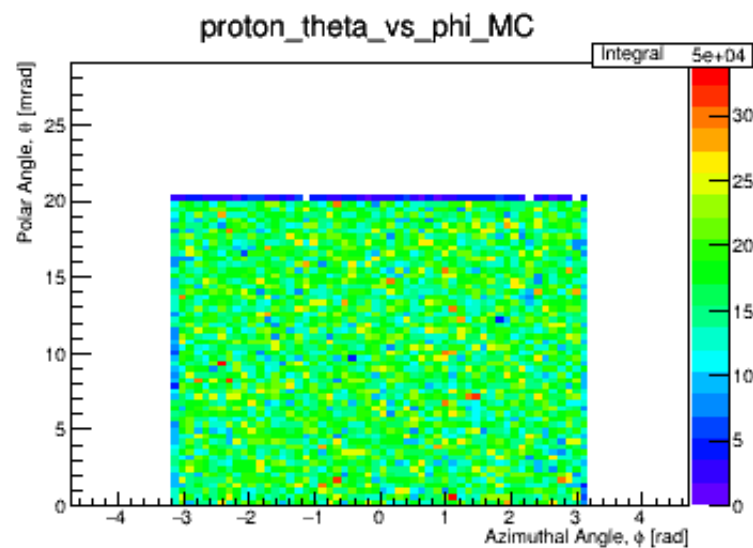
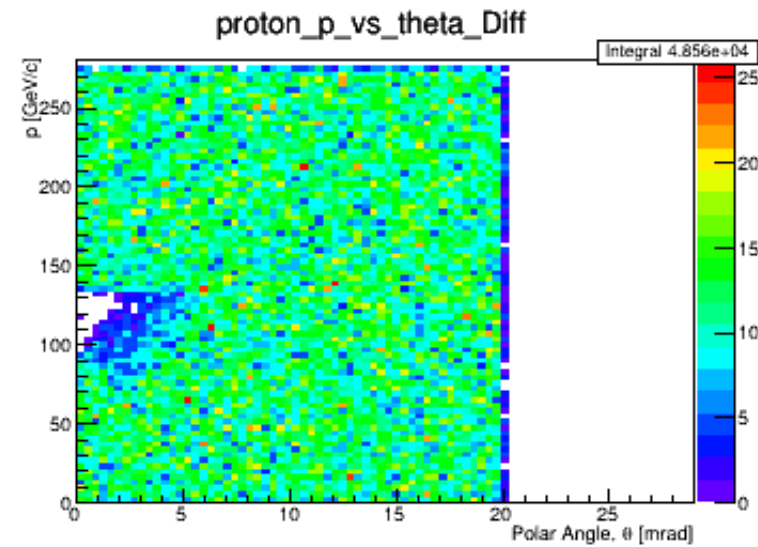
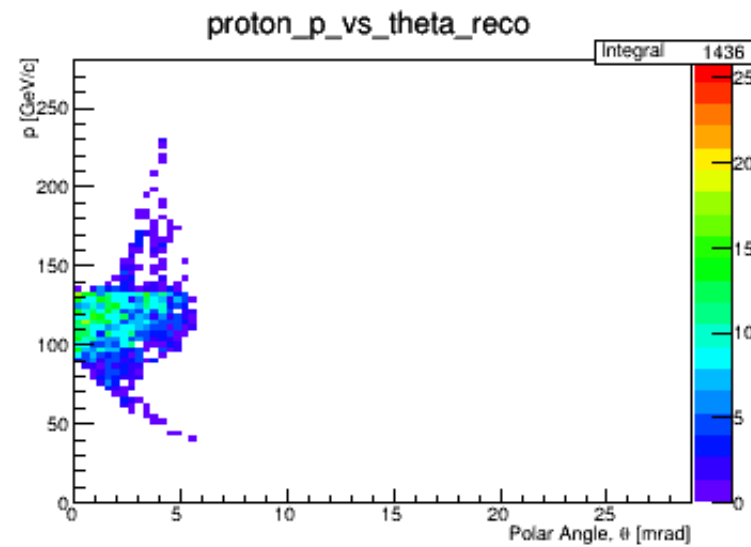
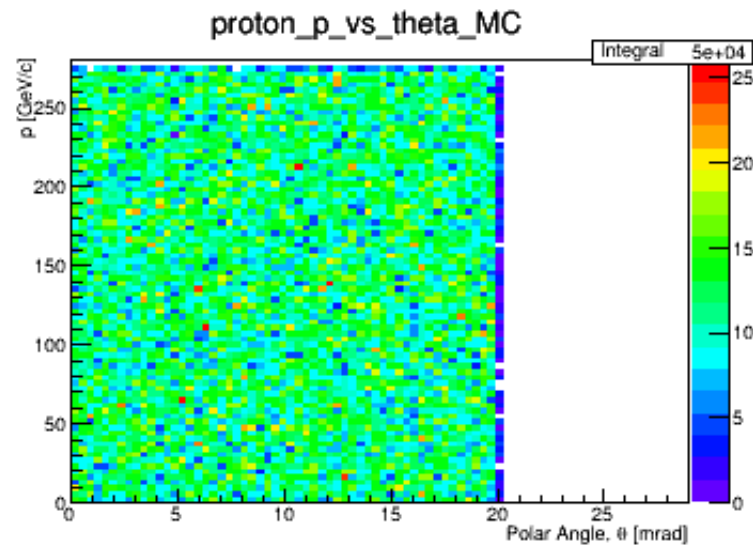




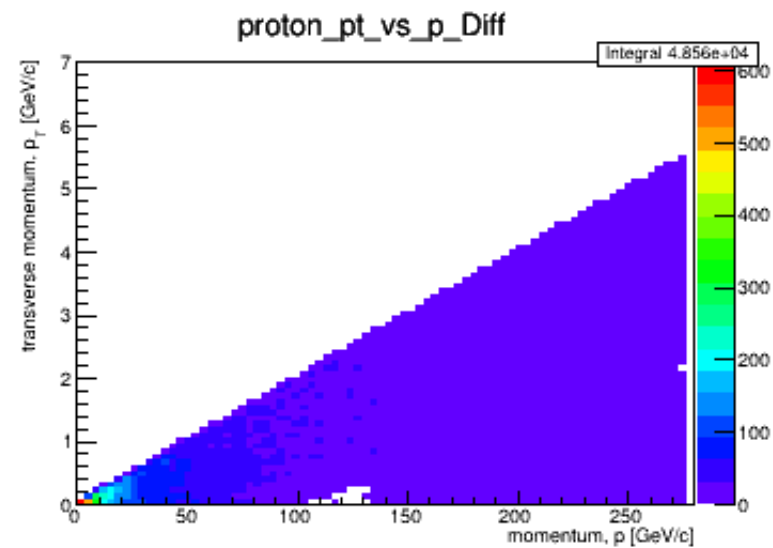
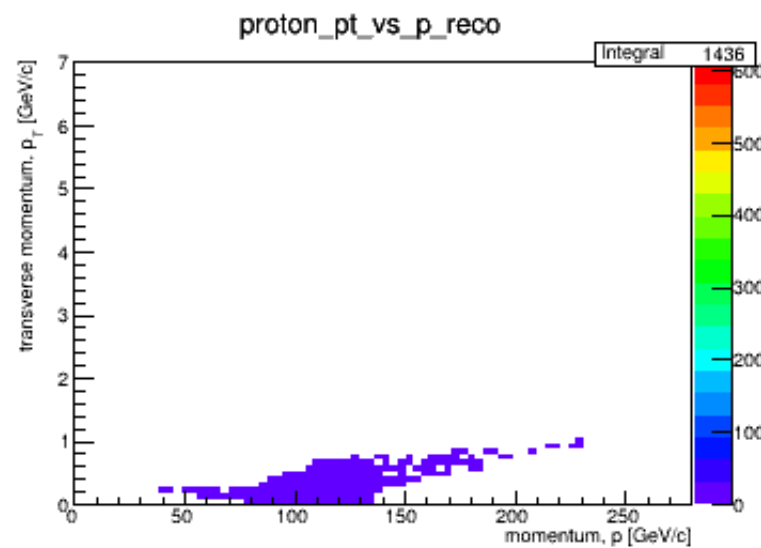
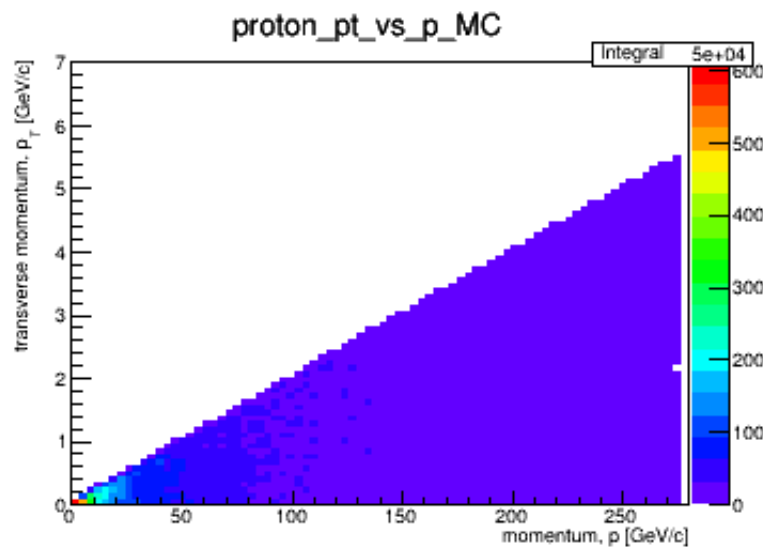
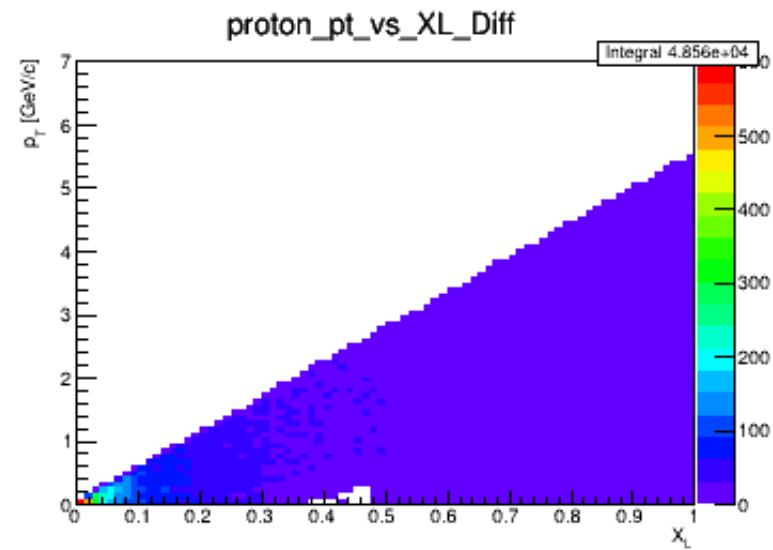
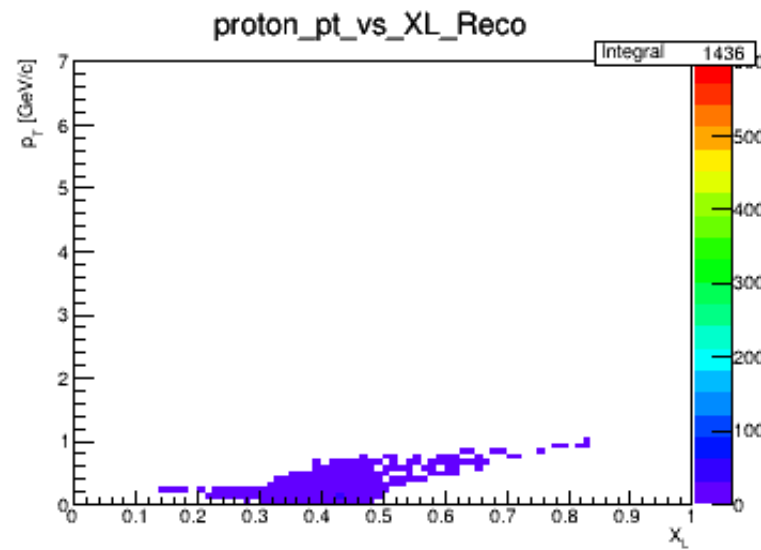
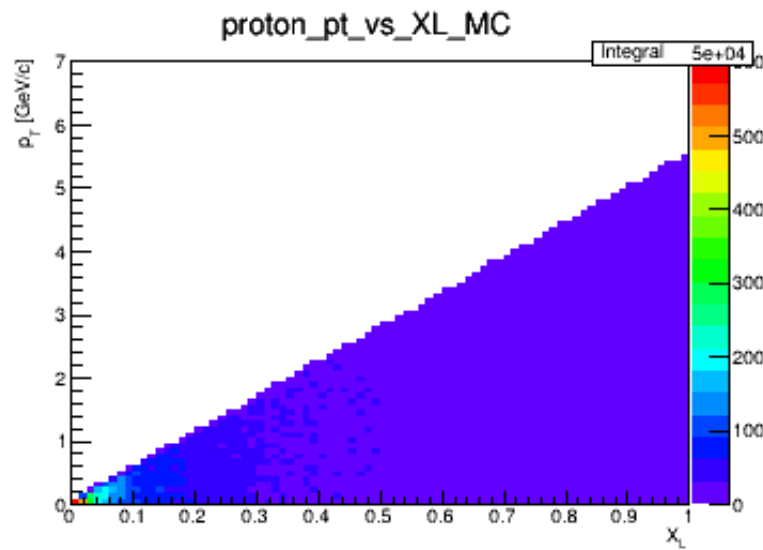
# Results (off-momentum detectors)

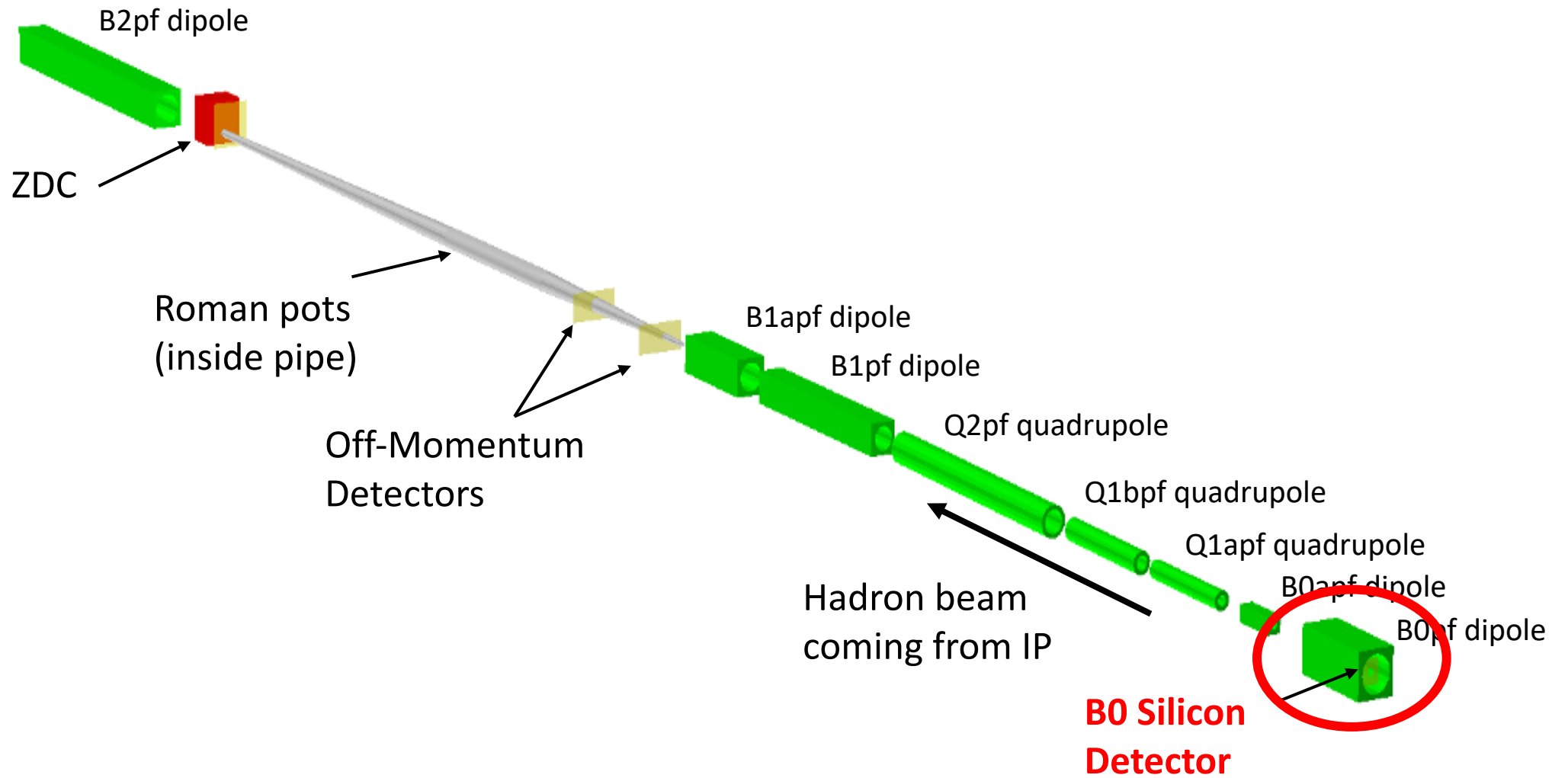


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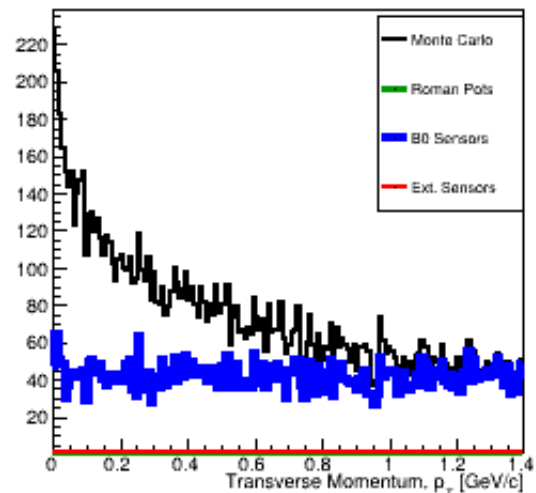
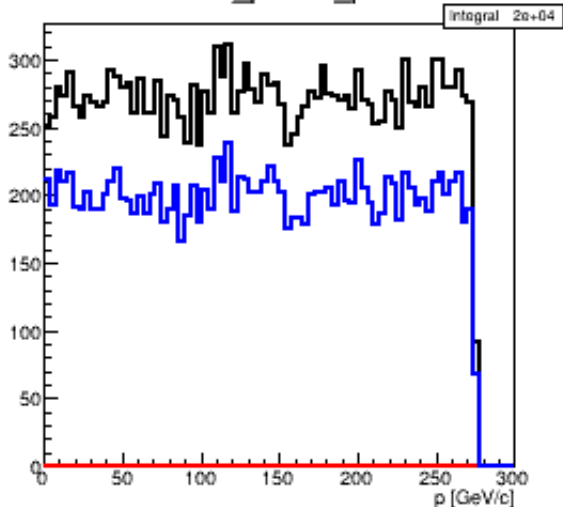
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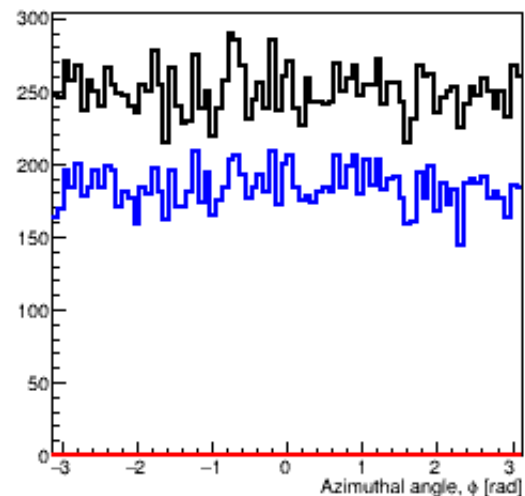


# Results (B0 Detector)

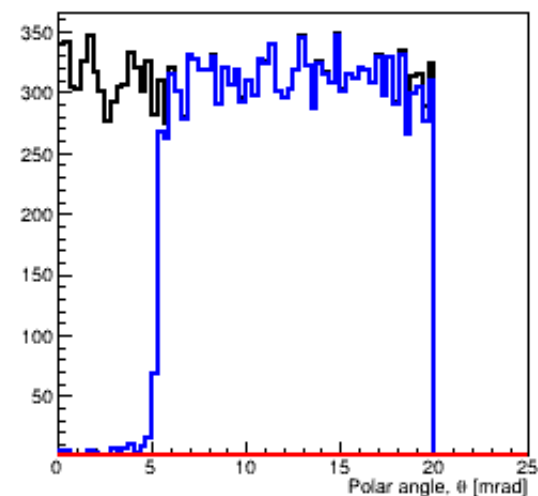
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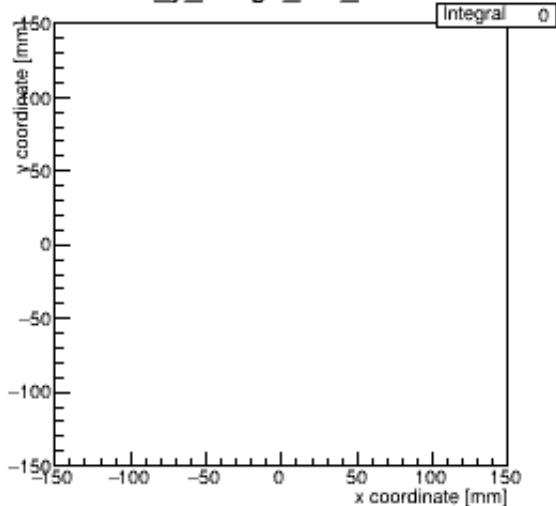
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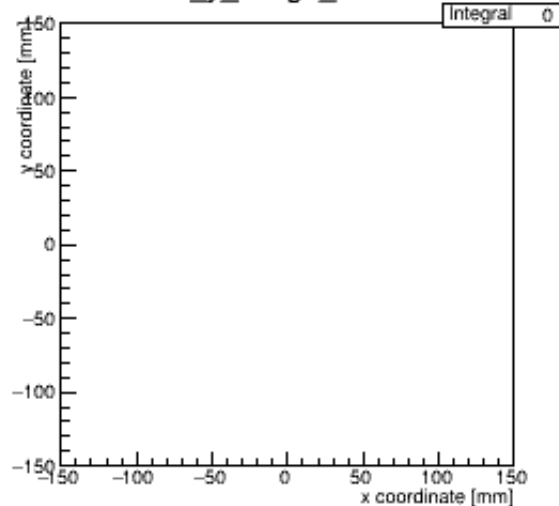
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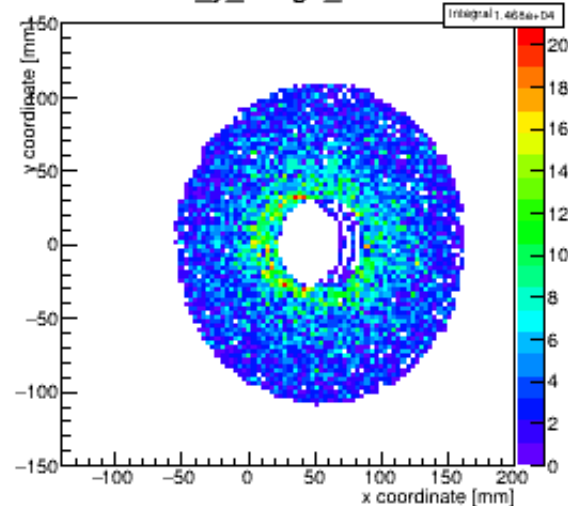
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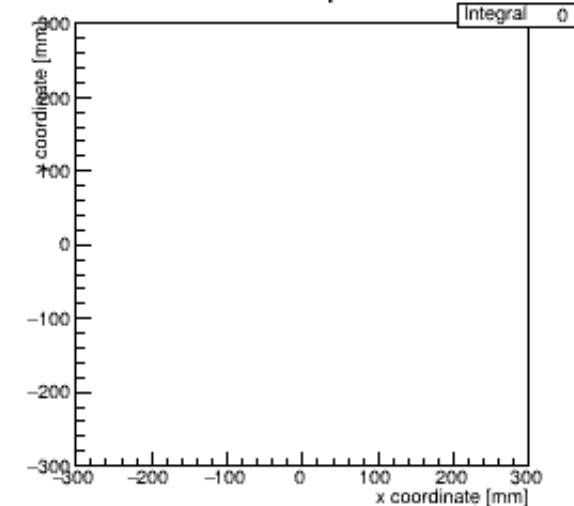
x\_y\_image\_RP



x\_y\_image\_B0

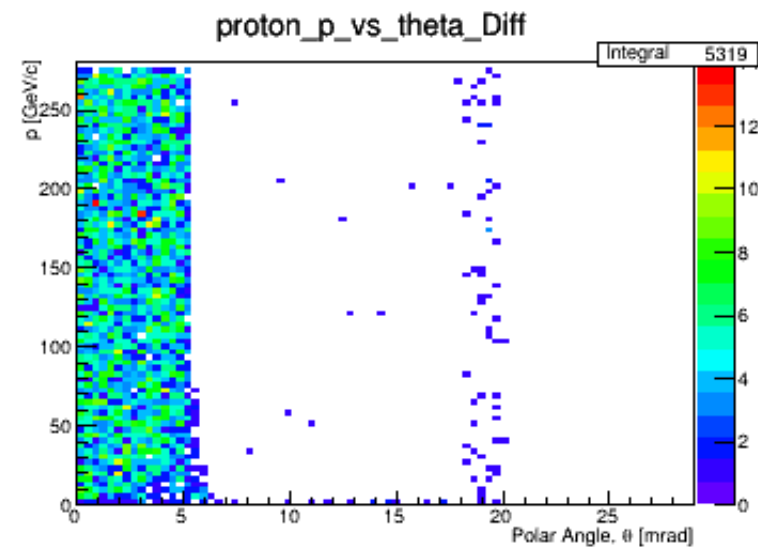
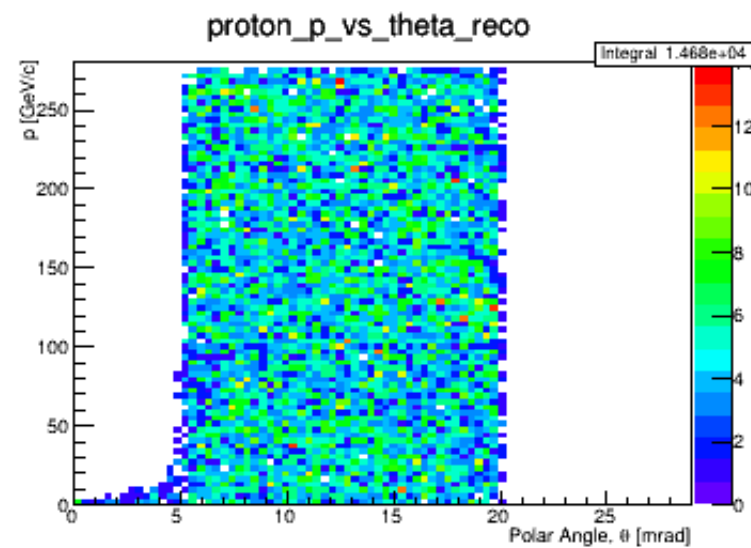
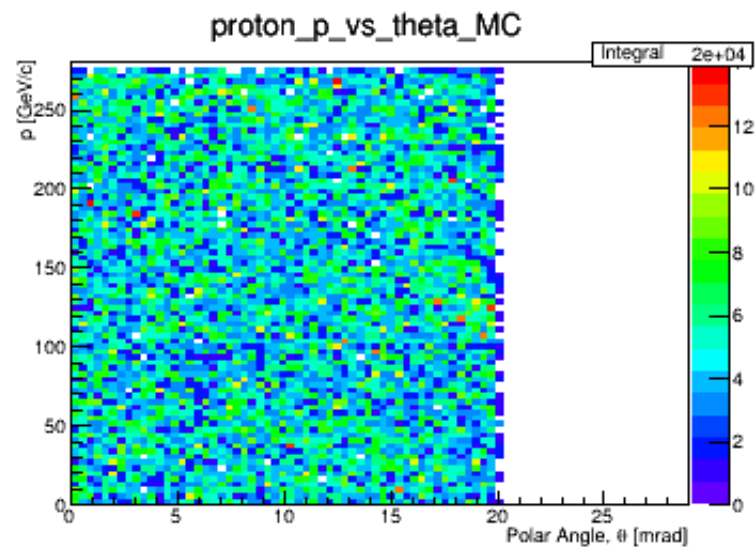
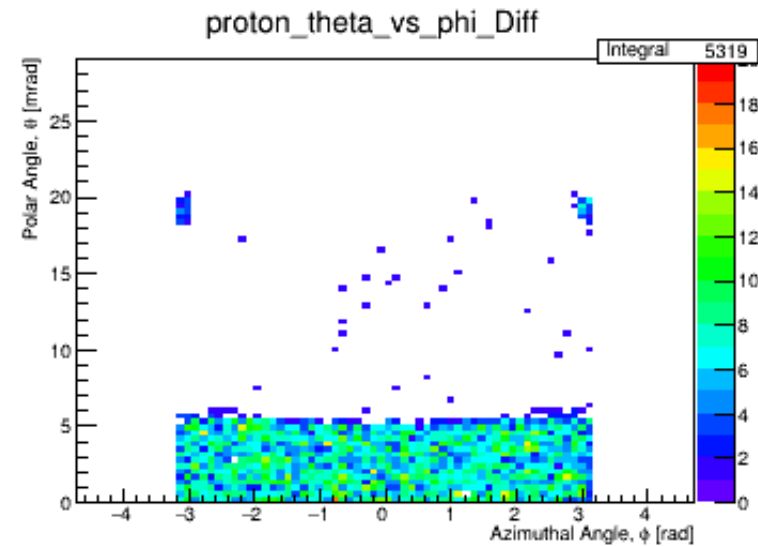
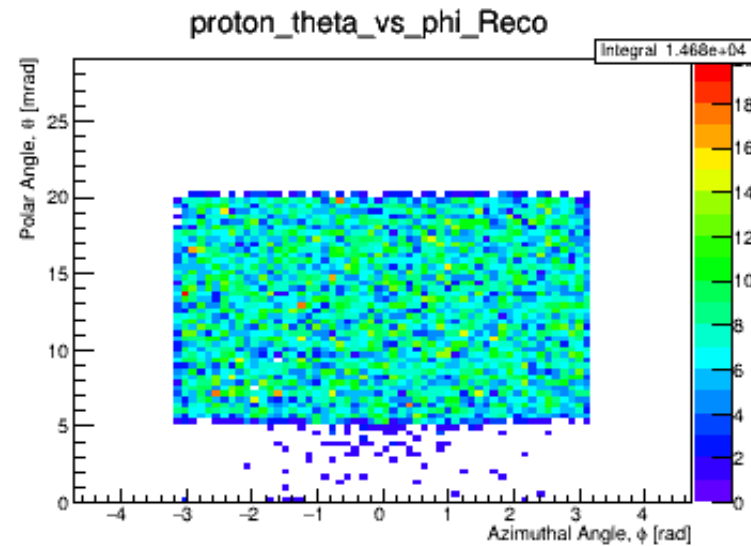
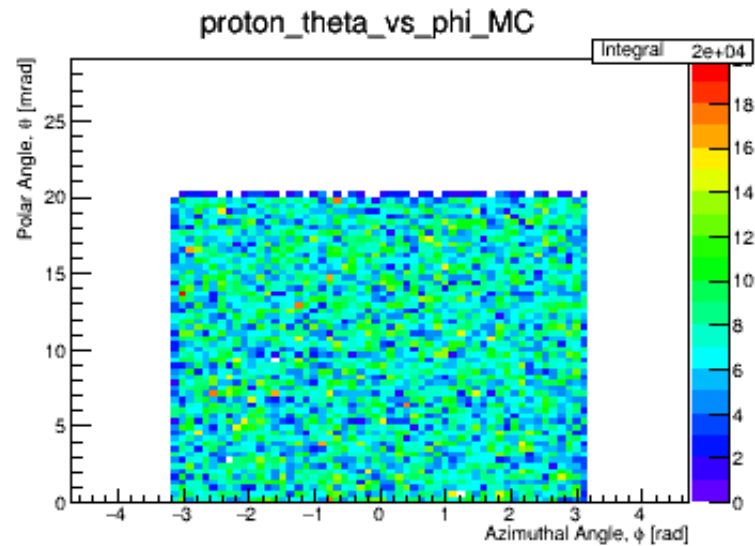


zdcMap



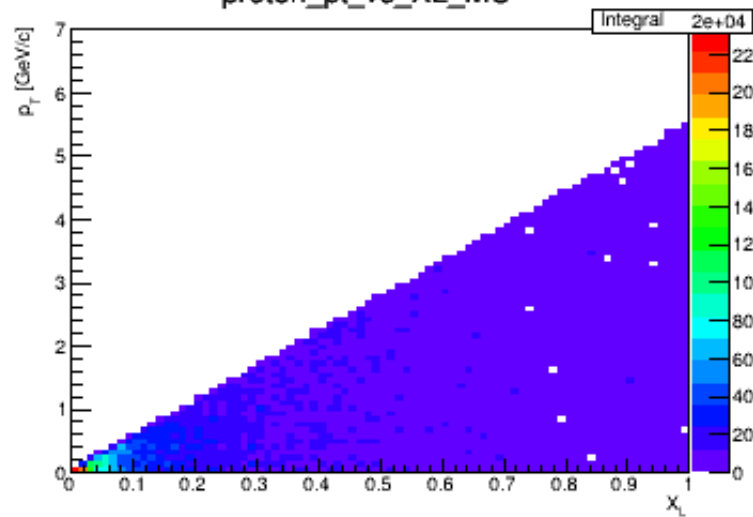


# Results (B0 Detector)

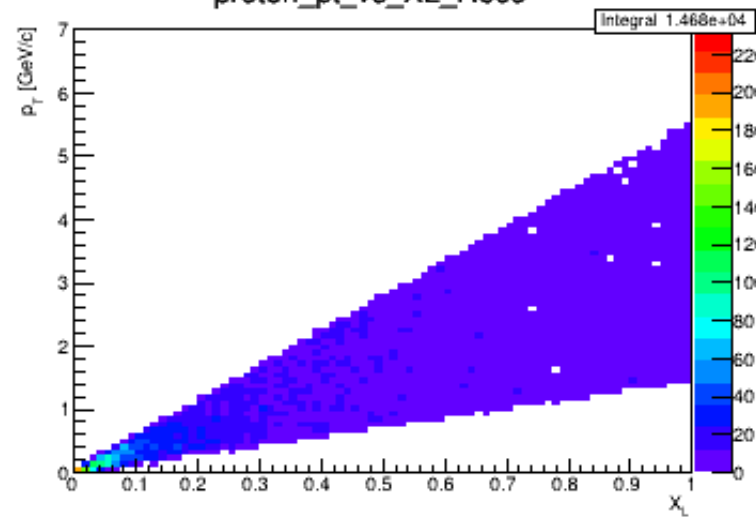


# Results (B0 Detector)

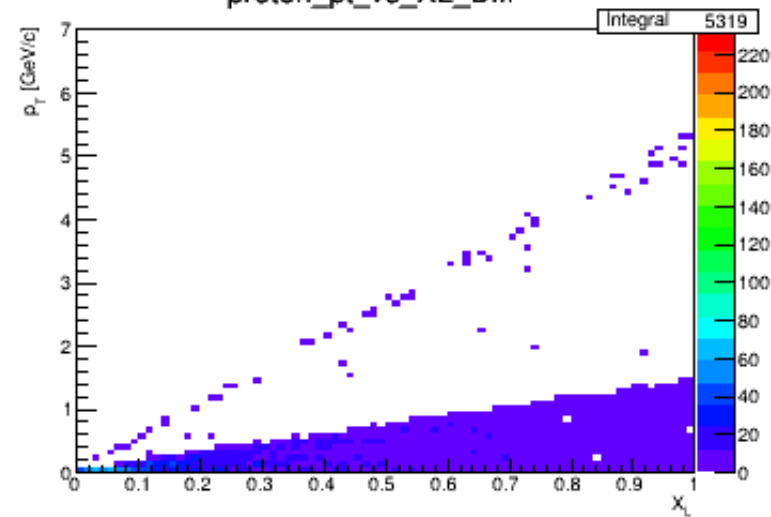
proton\_pt\_vs\_XL\_MC



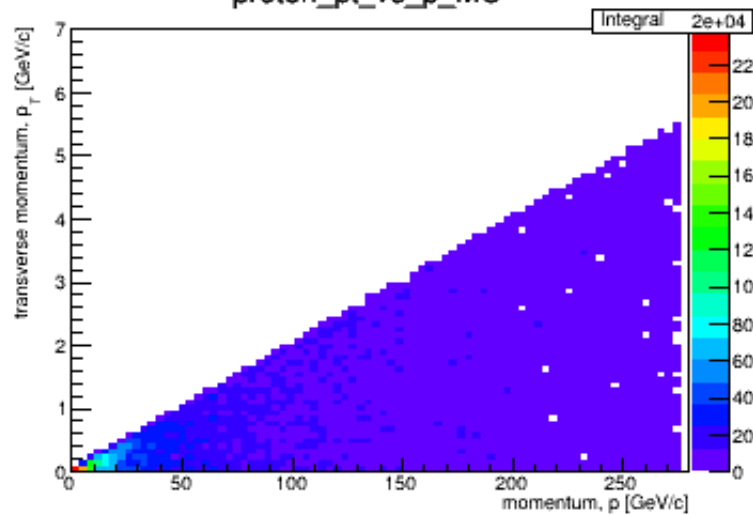
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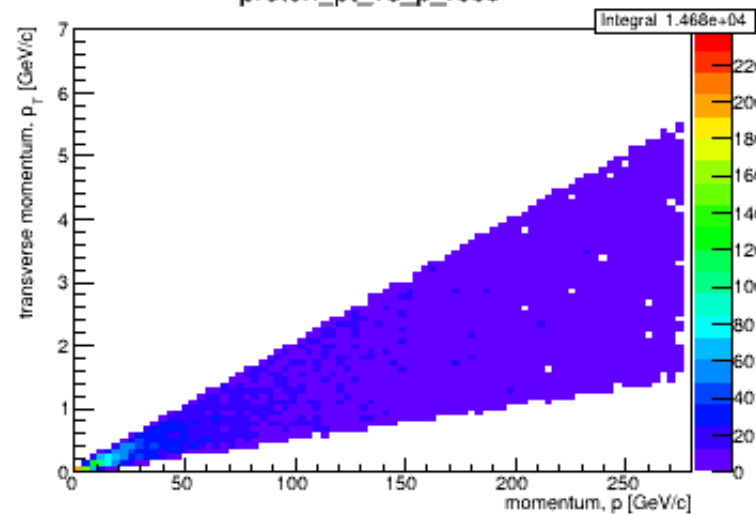
proton\_pt\_vs\_XL\_Diff



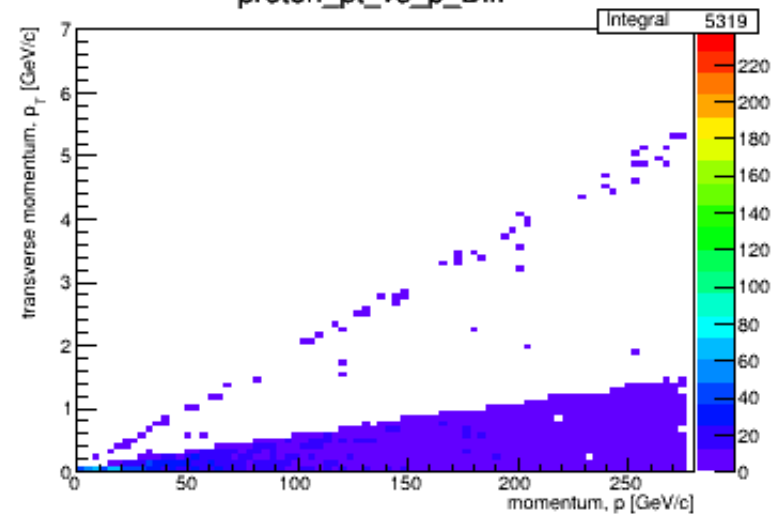
proton\_pt\_vs\_p\_MC



proton\_pt\_vs\_p\_reco



proton\_pt\_vs\_p\_Diff



# Takeaways

- Acceptance looks more or less uniform for  $5.5 < \theta < 20 \text{ mrad}$ 
  - This is where the protons fall nicely into the B0 sensors symmetric in phi.
  - *The B0 engineering design is still in flux, so these acceptances may change in the near future.*
- For  $0 < \theta < 5.5 \text{ mrad}$  things are complicated. The acceptance depends a lot on the longitudinal momentum of the proton compared to the magnet setting.
  - Likely need a 3D parameterization for best accuracy,  $f(\theta, \phi, x_L)$
  - For  $x_L > .65$ , should be okay – but need to be aware of  $10\sigma$  cut.
  - *The Off-Momentum Detectors will also likely have a different acceptance when more engineering details are available.*
- All summarized in a short PDF for folks who need to start the fast smearing now – just be aware of the caveats.