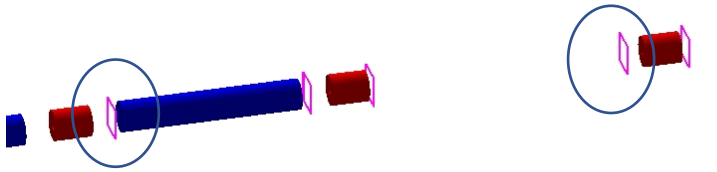
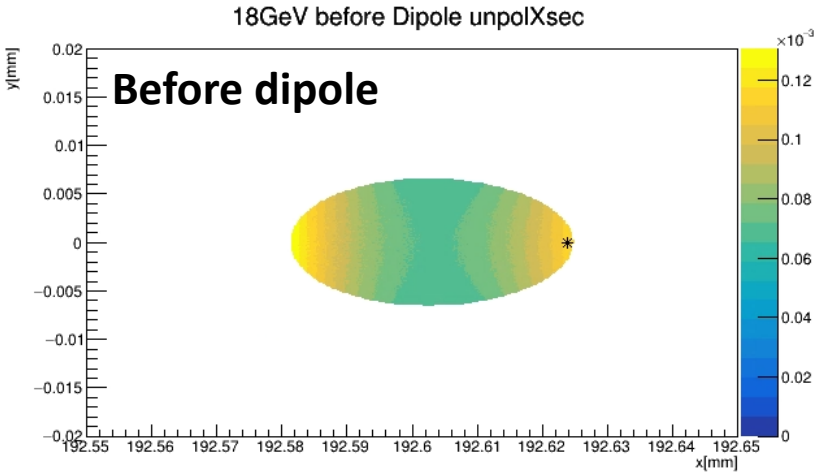
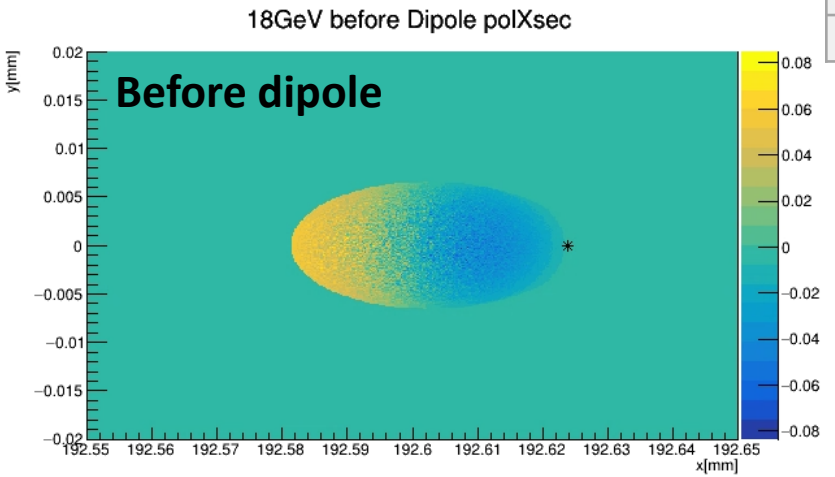
IP6 Compton simulation update

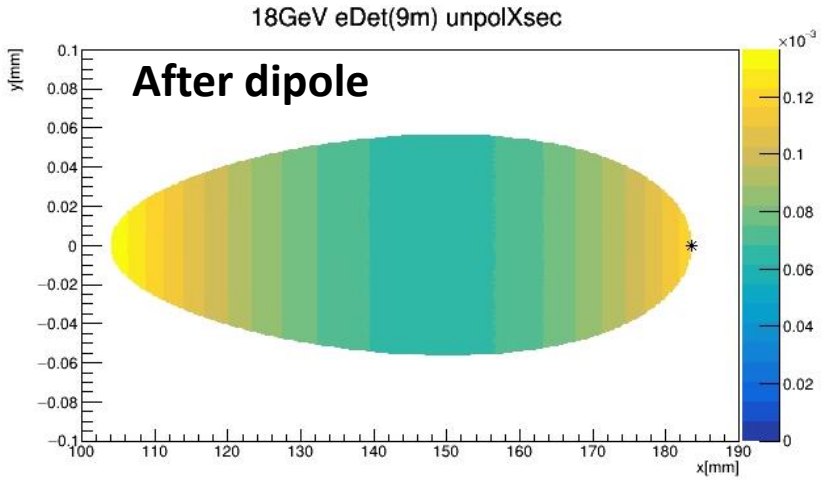
Ciprian Gal

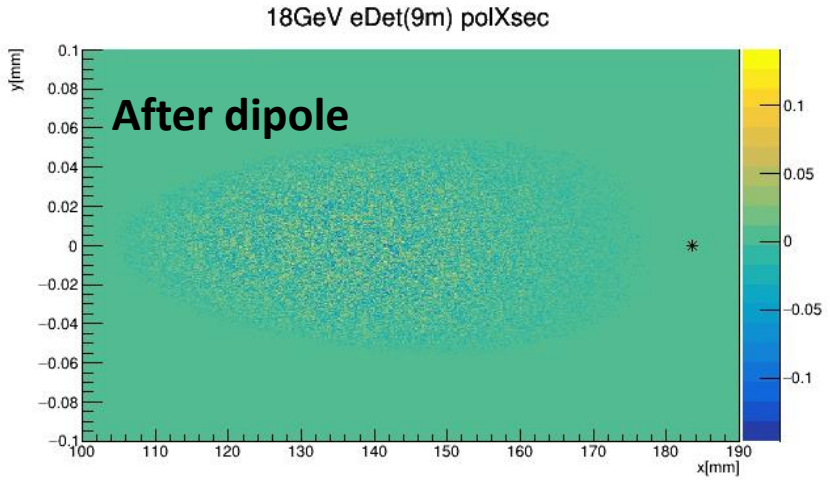
100% horizontal polarization (18 GeV)







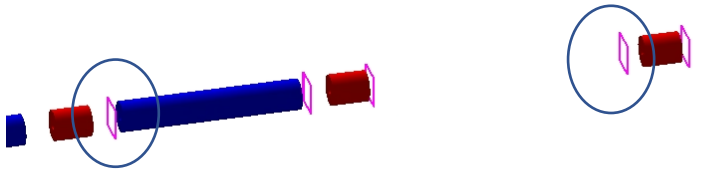


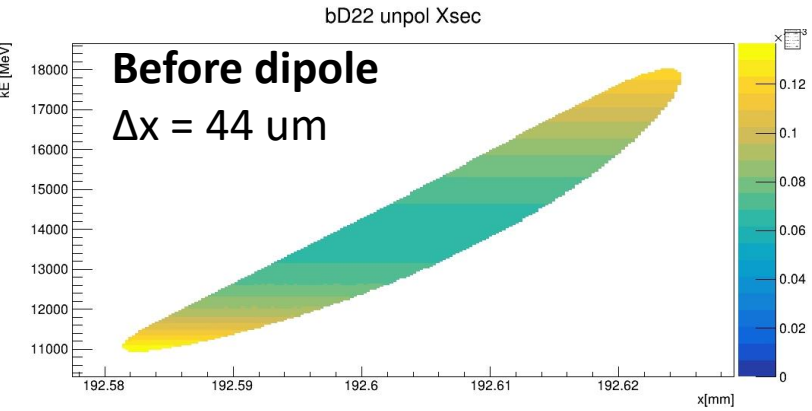


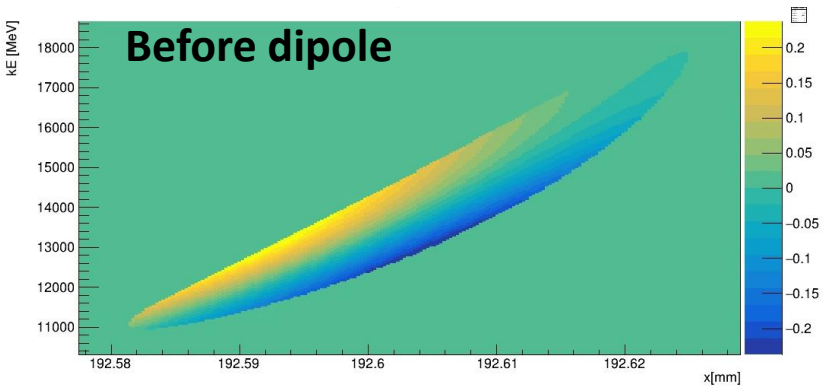
	polarization at Compton IP	
Beam energy [GeV]	Longitudinal [%]	Horizontal [%]
5	97.6	21.6
10	90.7	42.2
18	70.8	70.6

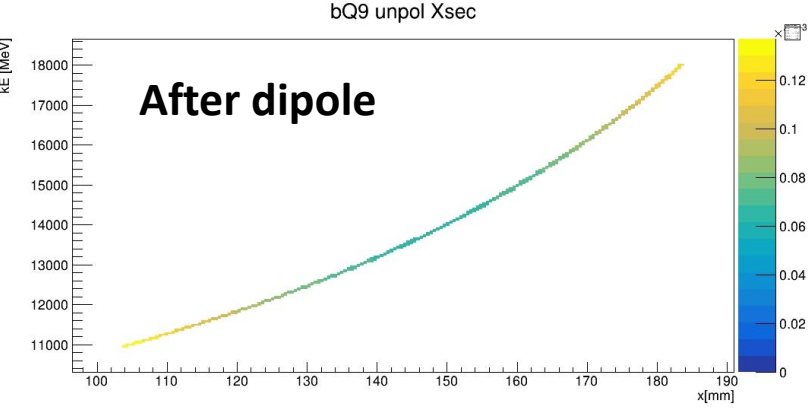
- Last time I showed that we were effectively blind to the horizontal component of the electron polarization due to the dipole

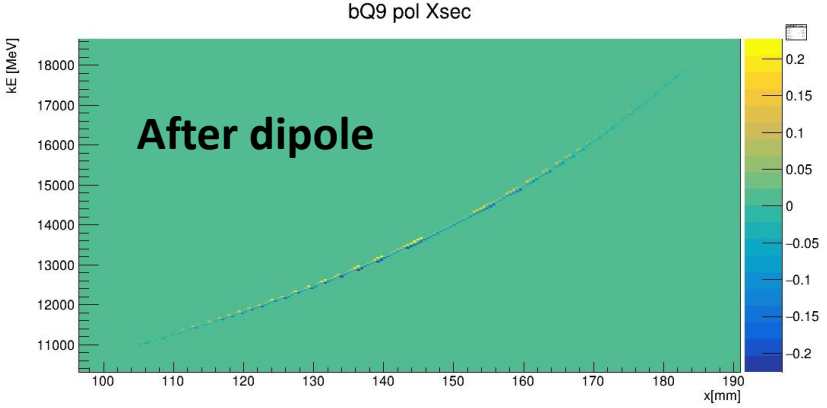
100% horizontal polarization (18 GeV)





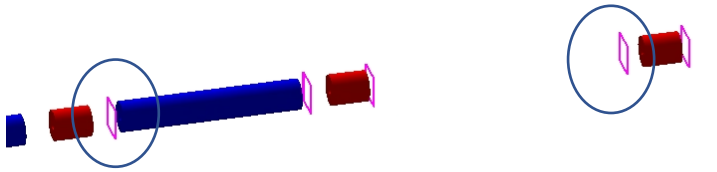


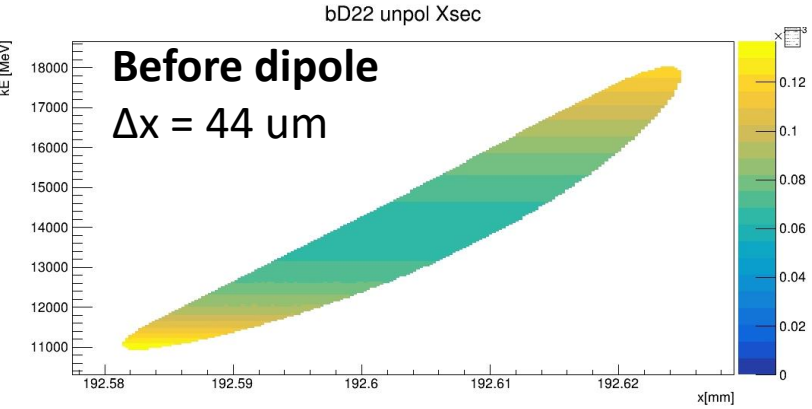


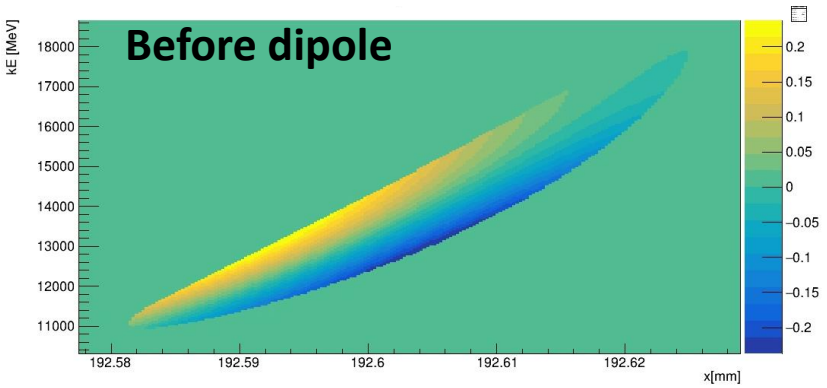


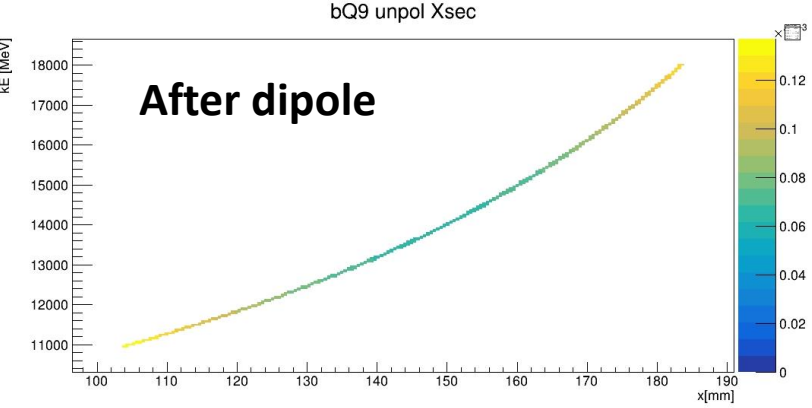
- Before the dipole we can see that each energy “slice” has both positive and negative analyzing powers (separated by ~45um)
- As expected the distribution after the dipole shows a tight correlation with the horizontal position

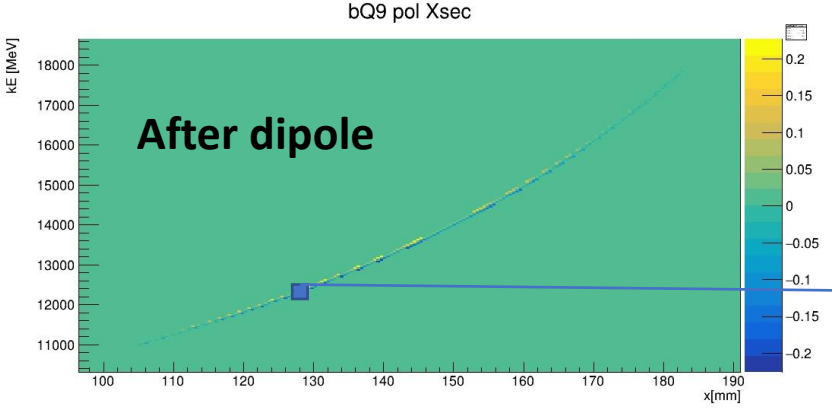
100% horizontal polarization (18 GeV)



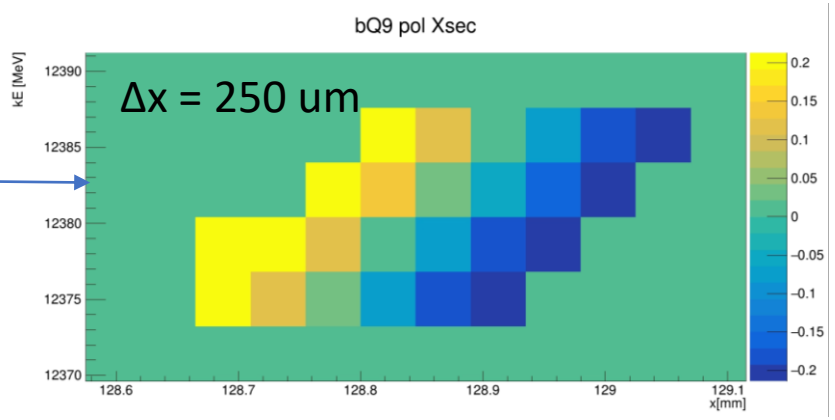




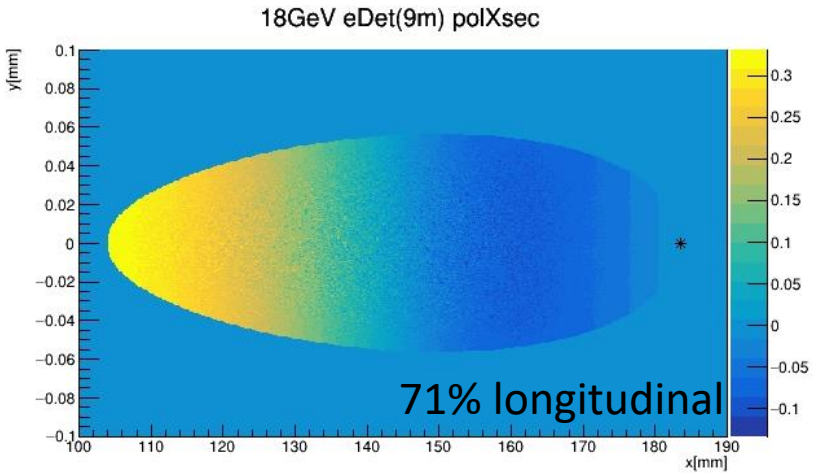


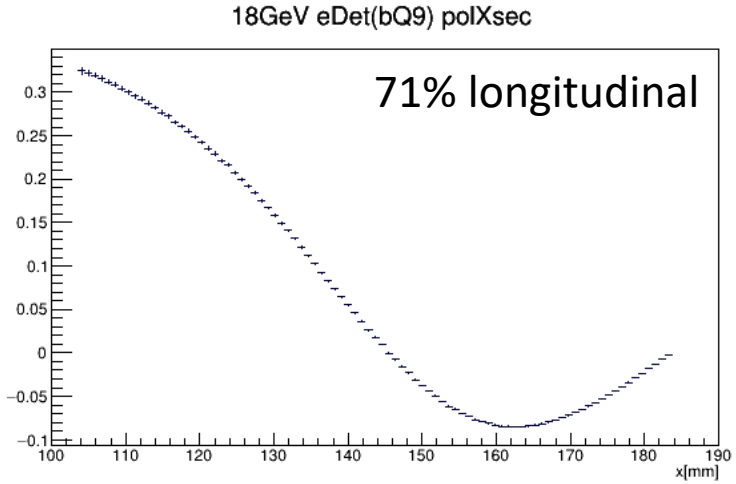


- As expected the distribution after the dipole shows a tight correlation with the horizontal position
- Looking at similar resolutions after the dipole reveals that indeed the L-R asymmetry is preserved (at the level of 250um) for each energy “slice” but projecting it to the x axis will result in averaging of both positive and negative analyzing powers
  - Said another way each x position at the electron detector plane has both positive and negative analyzing powers

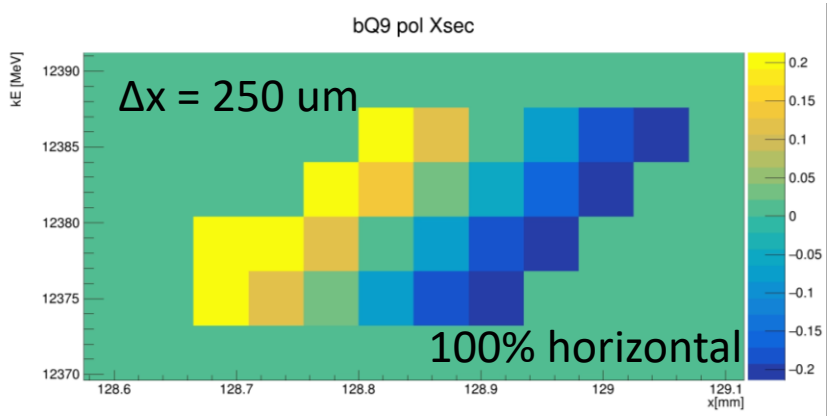


Electron detector location: 18 GeV

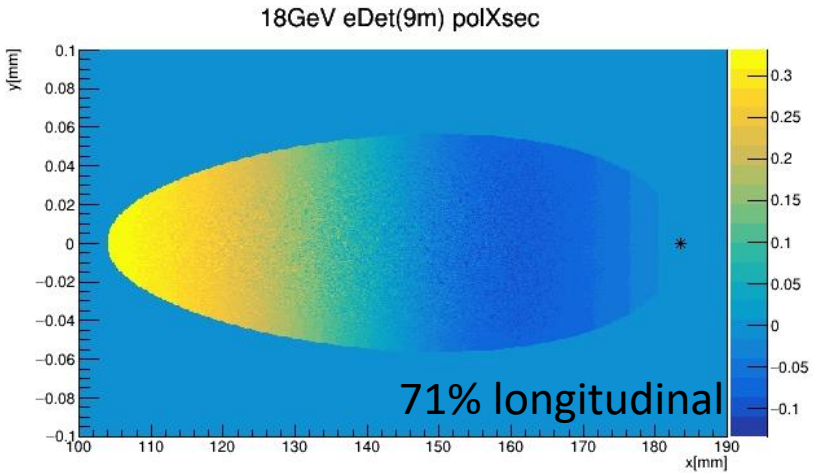


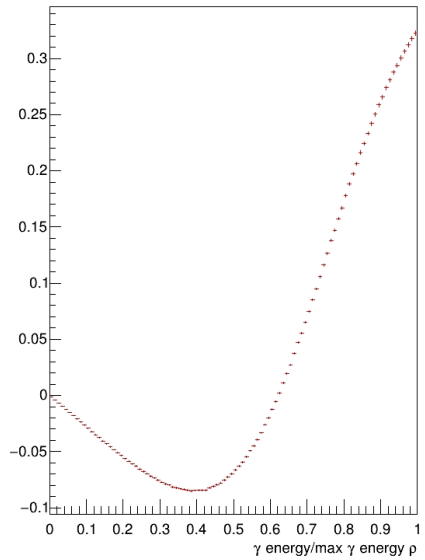


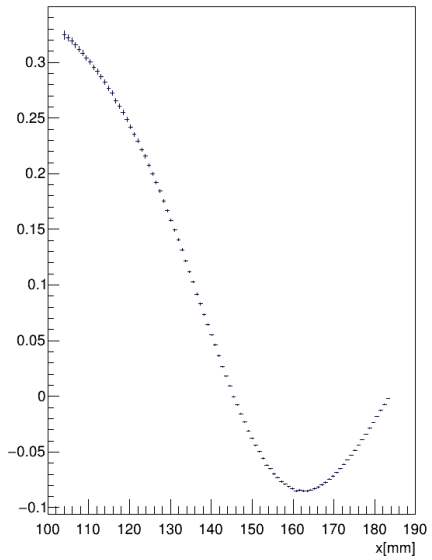
- In addition we should consider that for the actual configuration the LR asymmetry will sit on top of a large variation from the longitudinal component
- Looking at positional information alone effectively hides the LR asymmetry of the horizontal component
  - Potentially adding independent energy information could break this degeneracy but seems like a really difficult task

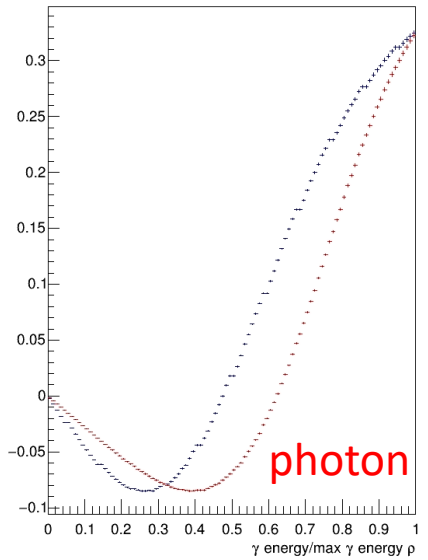


Electron detector location: 18 GeV

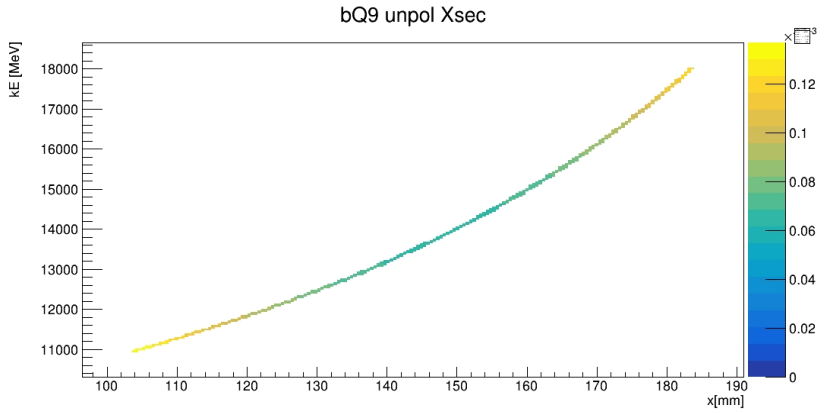




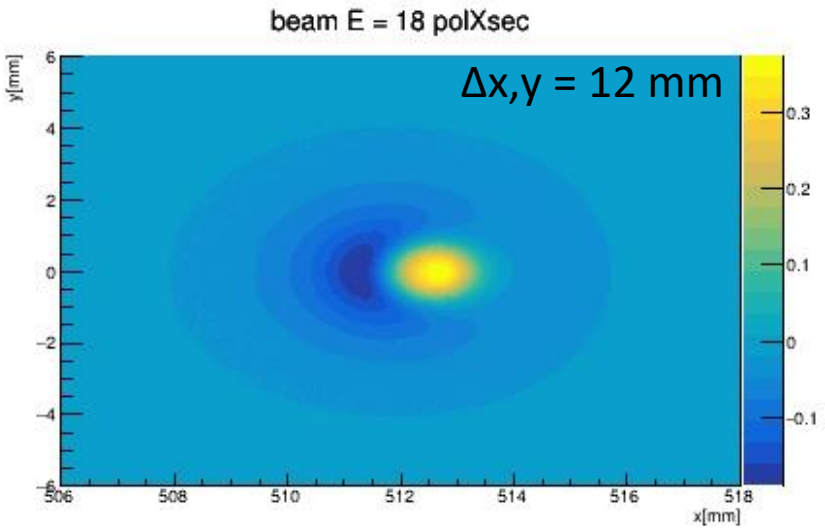


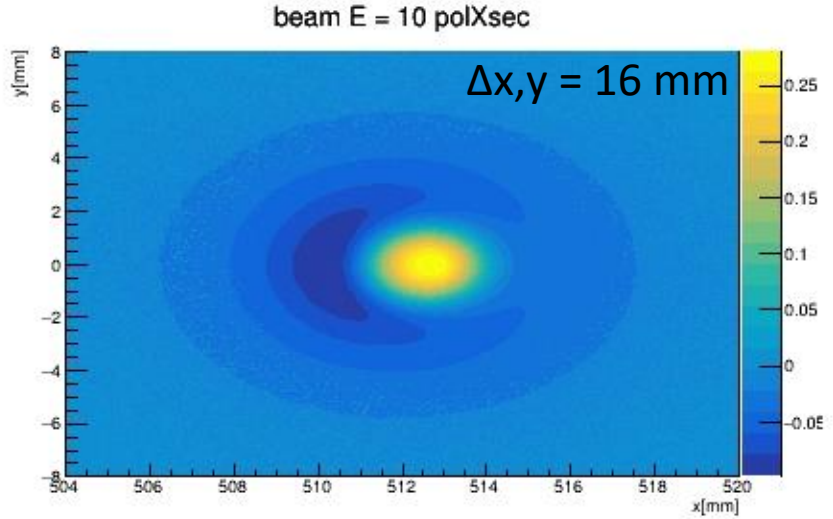


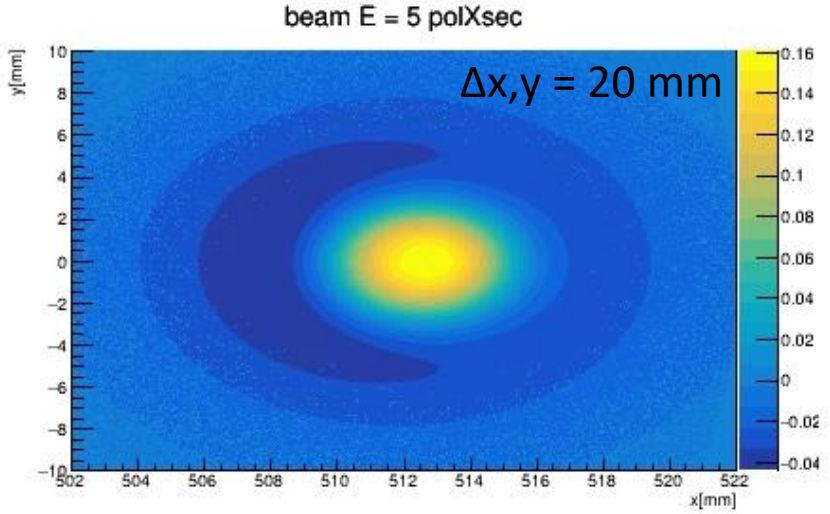
- If we take the electron position analyzing power mirror it and then scale it to fit the rho variable we can see that due to the non-linear correlation between position and energy the distribution is quite distorted
  - Is this related to the path through the quad? – I'd expect we should be able to recover the proper longitudinal dependence but with an additional systematic penalty



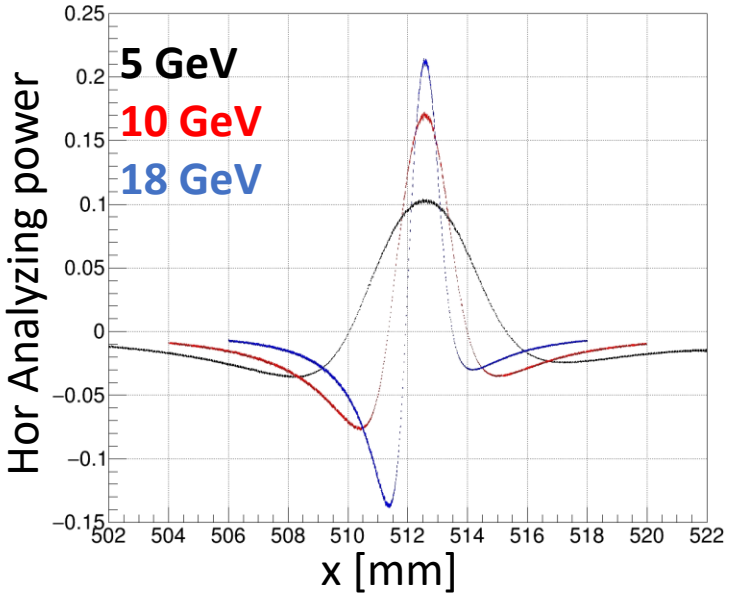
Photon detector distributions

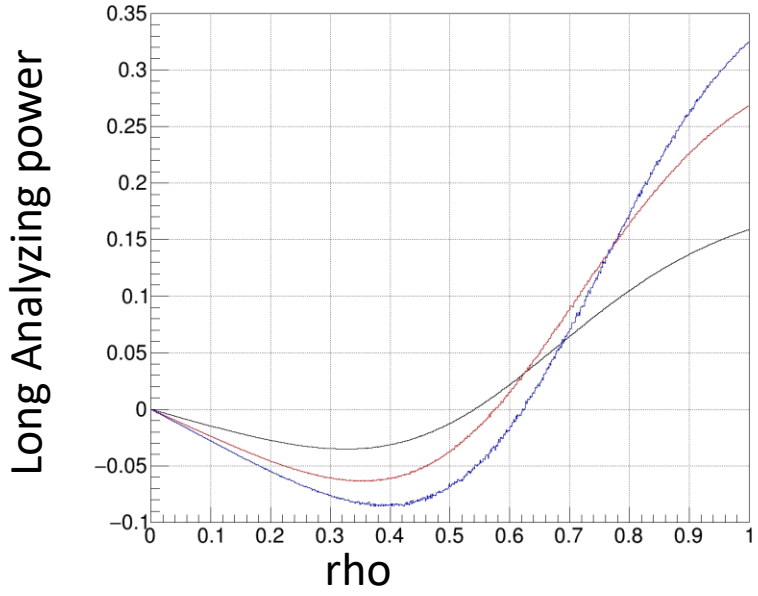




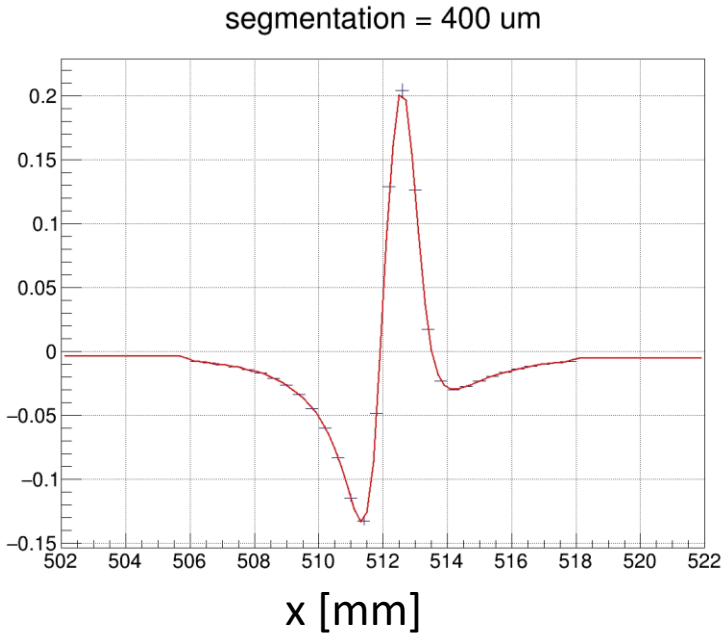


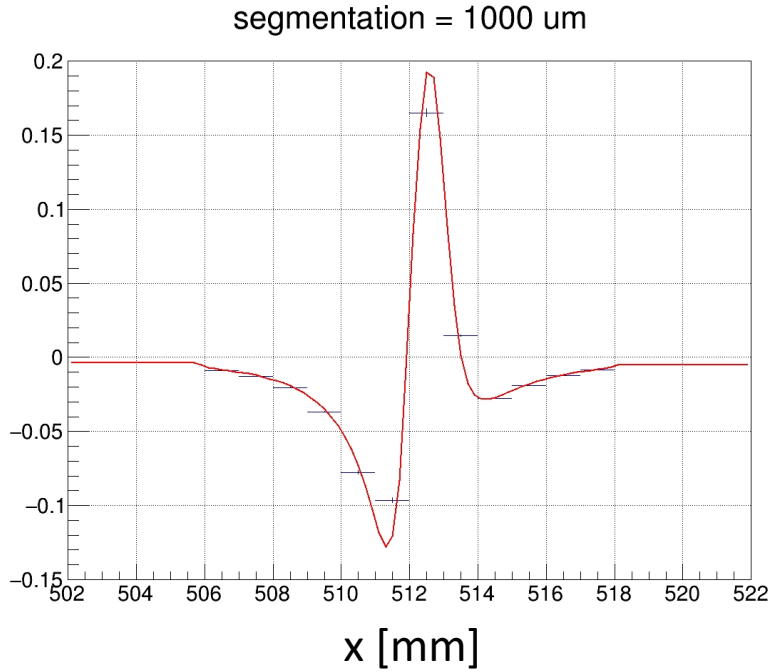
- For the photon detector the asymmetry x dependence can tell us about the horizontal component even after some distortion due to the longitudinal component
- The longitudinal component is straight forward to determine from the energy measurement





Photon detector needed resolutions: 18 GeV





- Following a similar procedure as Dave developed last year I sample from the asymmetry distribution (for 18 GeV) we see at the virtual plane and bin it such that it simulates different detector resolutions
  - The resulting distribution is fit with the ideal asymmetry shape obtained from the simulation
- Fitting the different “detector segmentations” shows pretty good determination of the horizontal components up to segmentations of 1mm

Next steps

- Implement beam crossing and bunch shape effects into the simulation and evaluate impact