$^{19}\mathrm{F}(\gamma,\alpha)^{15}\mathrm{N}$ Systematic Studies

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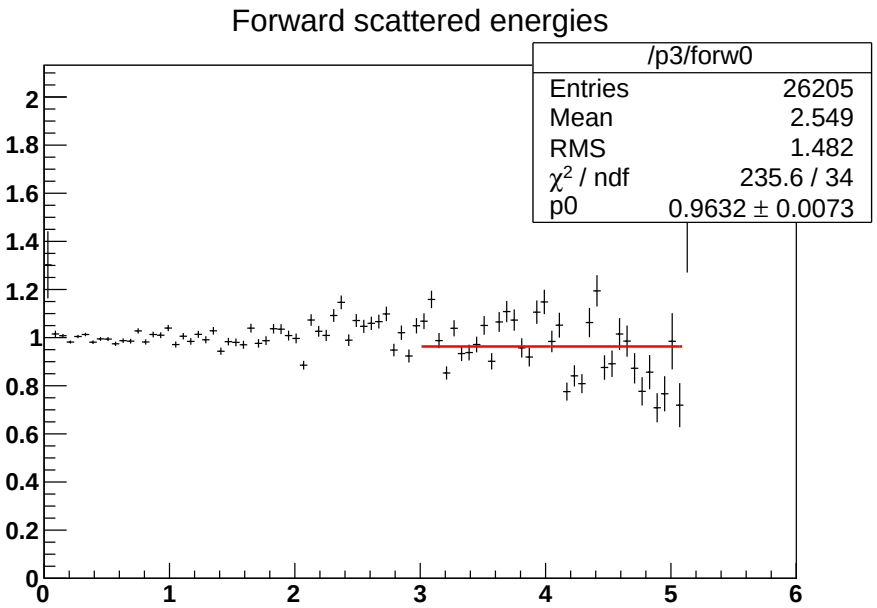
Summary

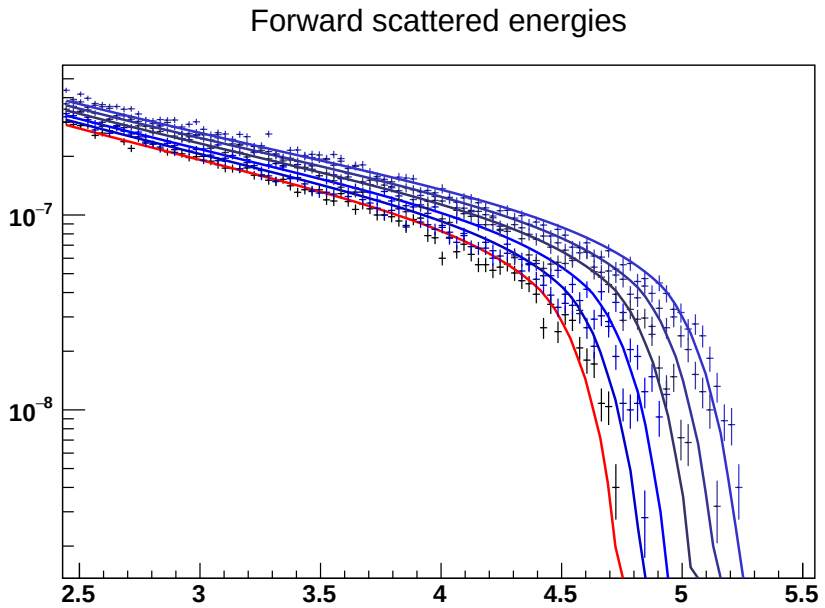
- Continued evaluation of systematics with available statistics
- Absolute energy variations presented last time
- Geant4 simulations for position and resolution
  - Statistics necessary are limiting factor
  - Whit implemented suggestion of energy cutoff

Table provided

Electron Parameter	Desired Beam Control	Desired Beam Knowledge	Measurement or example for reference	Possible action to improve or achieve desired Beam Control
Energy Range	4.5-5.5 MeV	0.1% (~5 keV)	2.0% (worst case – orbit unknown) 0.3% (best case – orbit/stray included)	Improve PS (5mA FS ~ 0.18%), evaluate w/ new Hall probe
Energy Step	0.1 MeV	0.02% (~1 keV)	<0.15% (0.06% PS regulation + 0.13% BPM resolution for angle)	Evaluate process and w/ new Hall probe
Energy Spread	<0.06%	<0.06% (~3 keV)	9-14 keV (2K/4K test using 2D harp and 0L02 Twiss)	Implement harp to measure beam size and min. energy spread w/ 0L02
Beam Current	1 nA – 100 uA	?	BCM (1% >1 uA cal'd FC2)	Implement isolated dump + picoammeter for low/all currents
RMS sigma at radiator	1 mm	?	a) Use viewer/camera b) Meas. 0L02, propagate	Implement harp to measure beam twiss, set/know spot size w/ 0L02
RMS diverg. at radiator	Not specified	?	Not done	Implement harp to measure beam twiss, set/know divergence w/ 0L02
Position at radiator	Photons centered on collimator	0.1 mm	Used x-ray screen to center beam on radiator, and recorded BPM's in 5D line,	Procedure to transfer radiator centering to electron beam positions between each energy/configuration

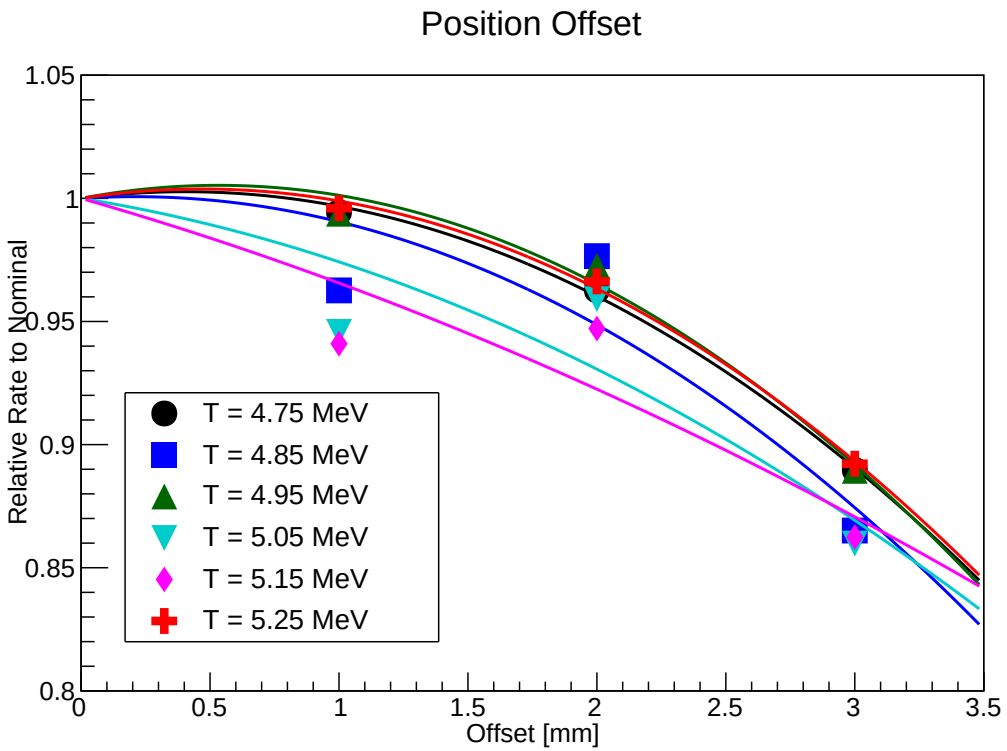
Position Parameter Sensitivies





- Statistics near end point relatively poor
- Assumed position parameters are insensitive to energy spectrum
- Tried just taking ratio and refitting (both gave similar results)

Position Offset Changes

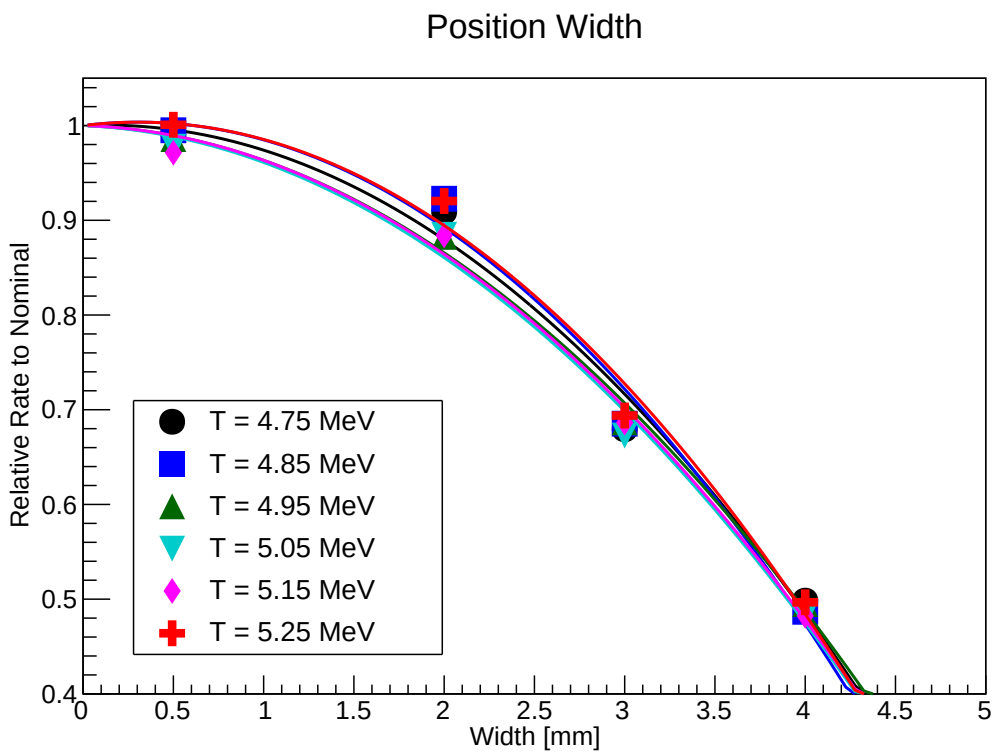


- Statistics have few percent noise to them
- Assumed quadratic form

$$\delta \approx 0.0015x[\mathrm{mm}] - 0.014(x[\mathrm{mm}])^2$$

- 1 mm constraint appears to be sufficient for $< 5\%$

Position Width Changes

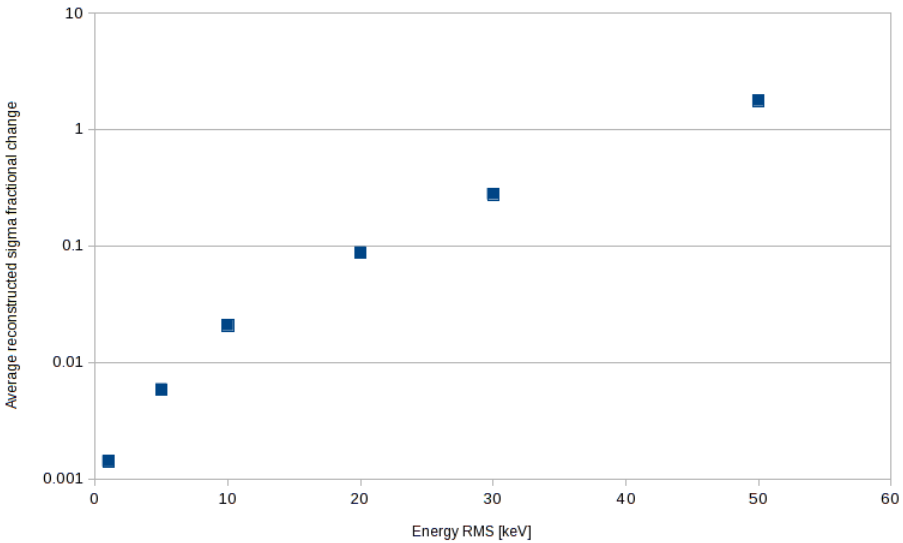


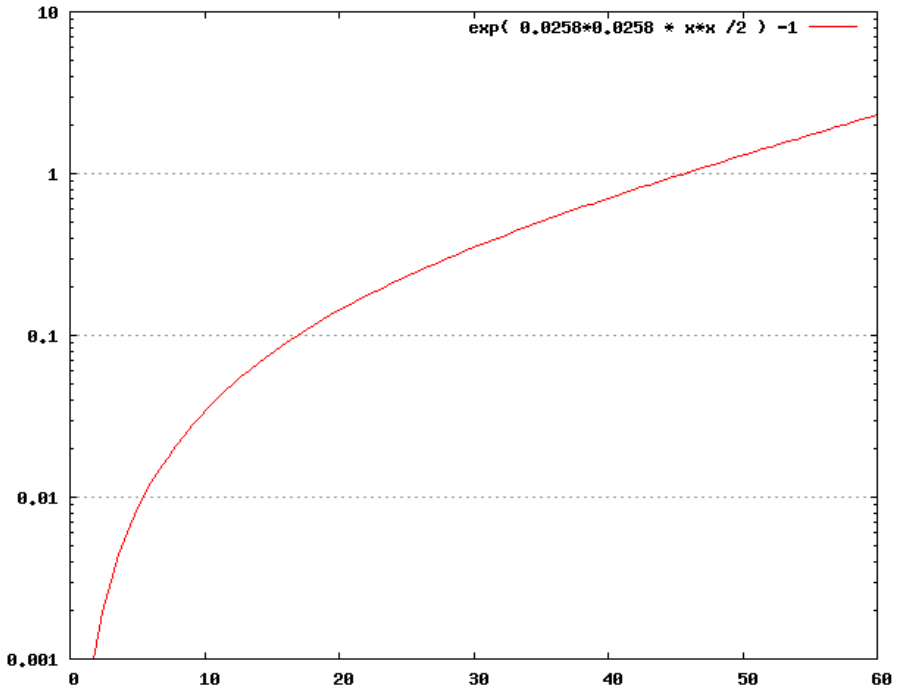
- Also assumed quadratic form

$$\delta \approx 0.006x[\mathrm{mm}] - 0.034(x[\mathrm{mm}])^2$$

- Effect is much larger, espeically as width $\sim$ radius
- 1 mm RMS constraint appears to be sufficient for $< 5\%$

Energy Width Sensitivity





- Statistics unavailable to do with Geant4
- Used previous functional form with resolution
- 10 keV looks to be acceptable resolution
- Also did BoE with σ is exponential $\rightarrow$ prediction of rate change by completing square with gaussian resolution (makes sense)
- Will continue to verify