

Update on angular resolution of low energy electron tracks in CYGNO

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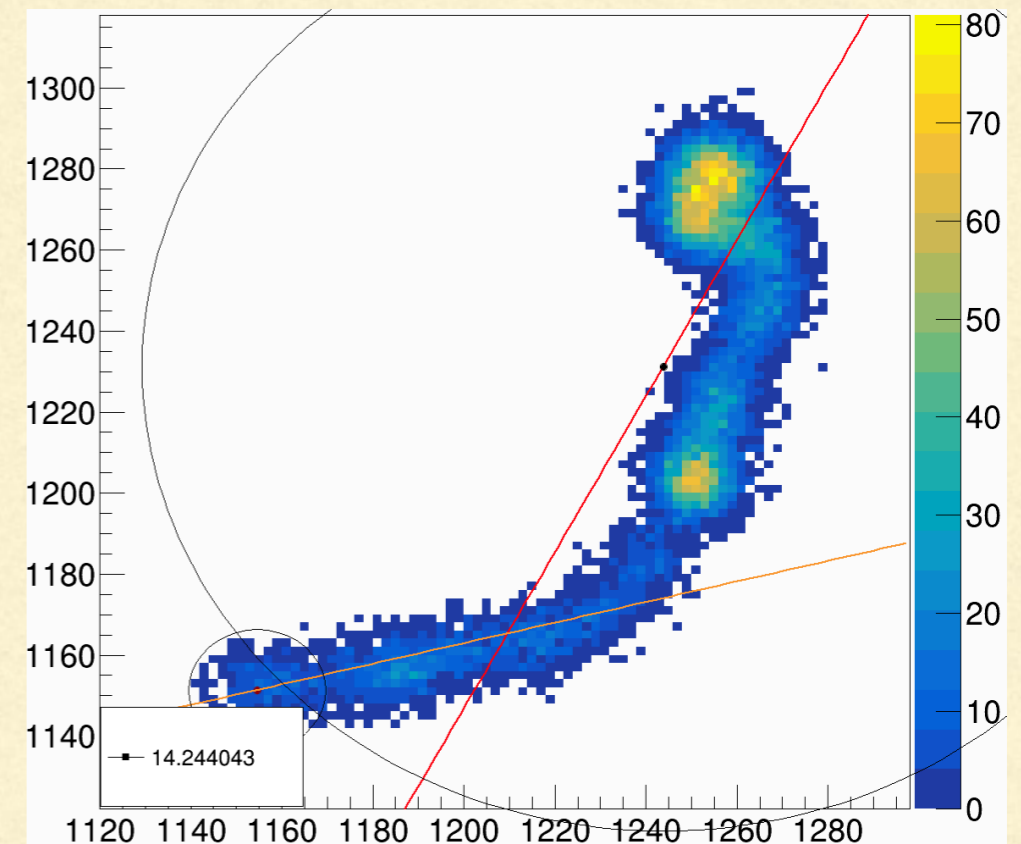
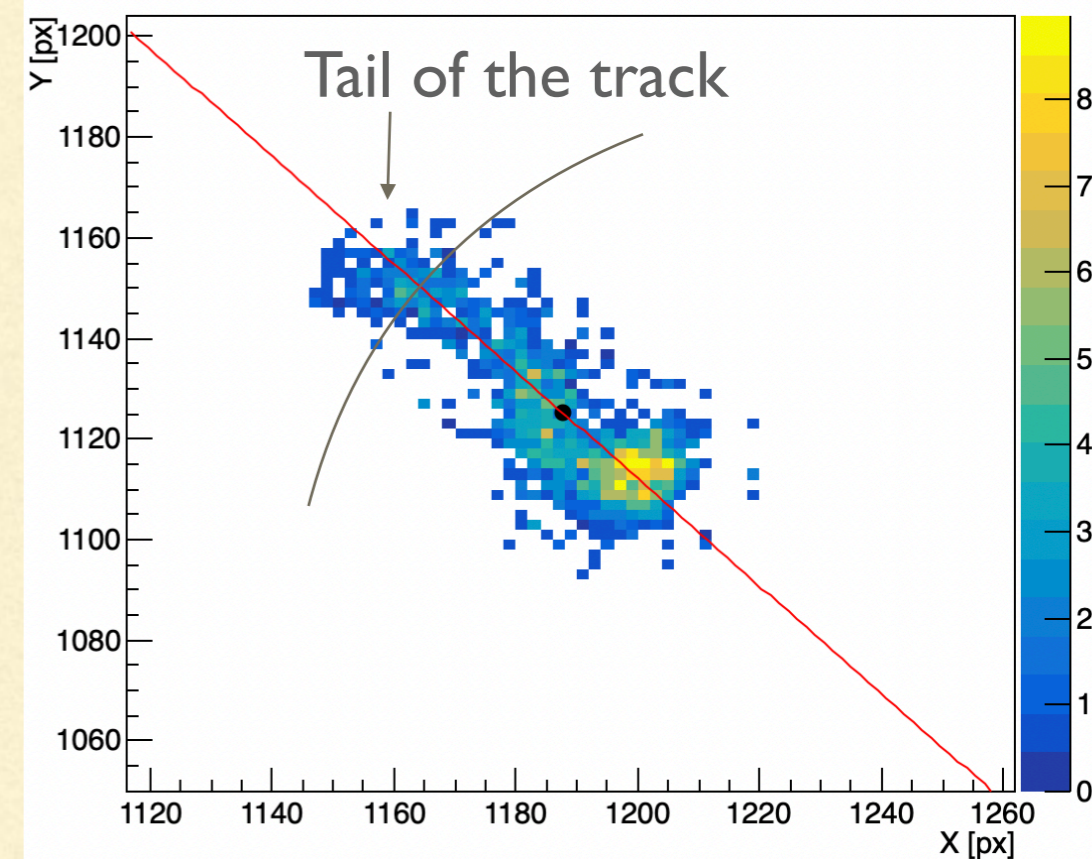
Direction identification

- Tail of the track identified as the point such that:

$$\frac{x'_i}{M_3} < 0 \implies \frac{(x_i - x_c) \cos \Phi_{\max} + (y_i - y_c) \sin \Phi_{\max}}{M_3} < 0.$$

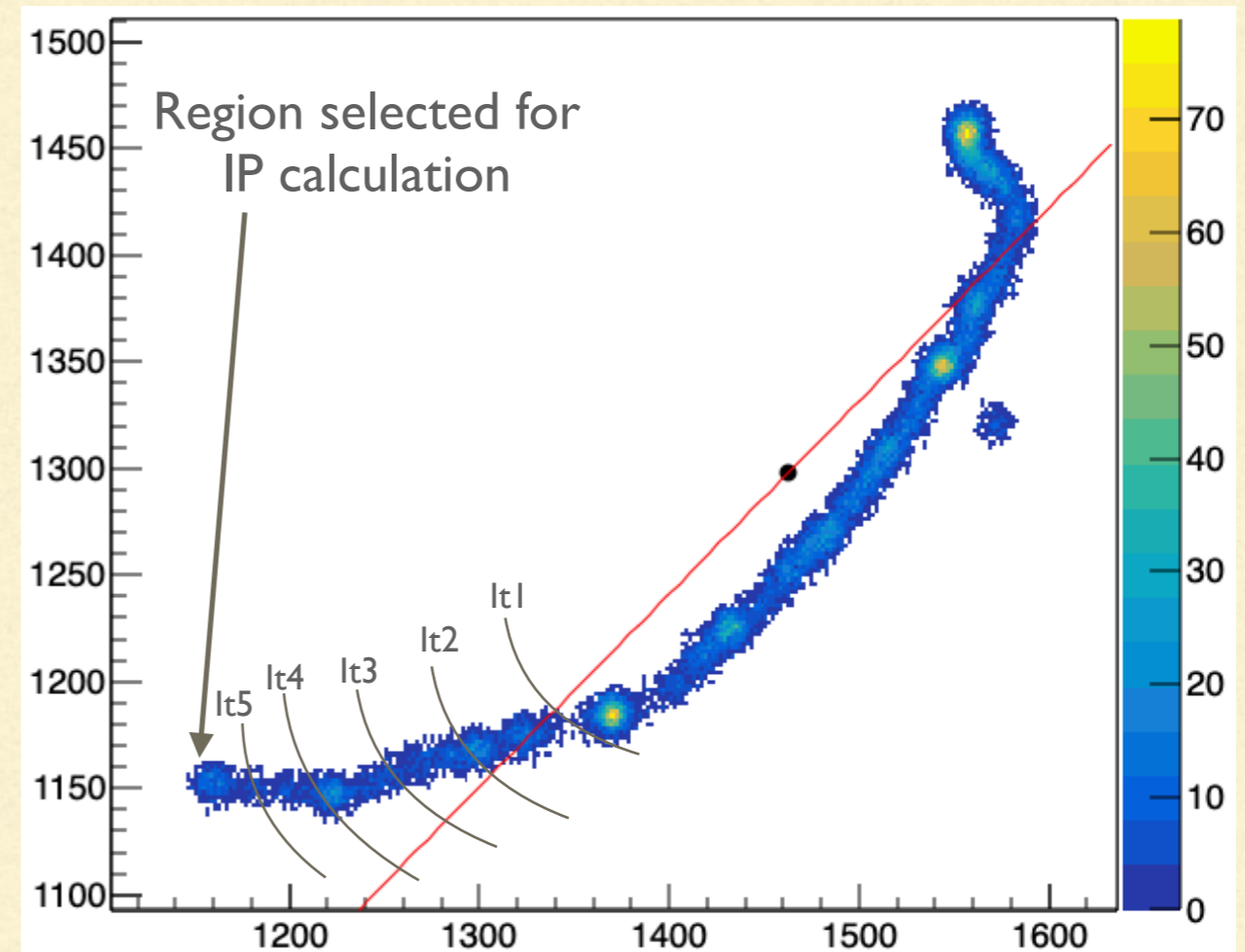
$$r_{\min} < d_{cm}$$

- Angle which maximise the rms of the initial part of the track is within $[-\pi/2, \pi/2]$ (simple direction)

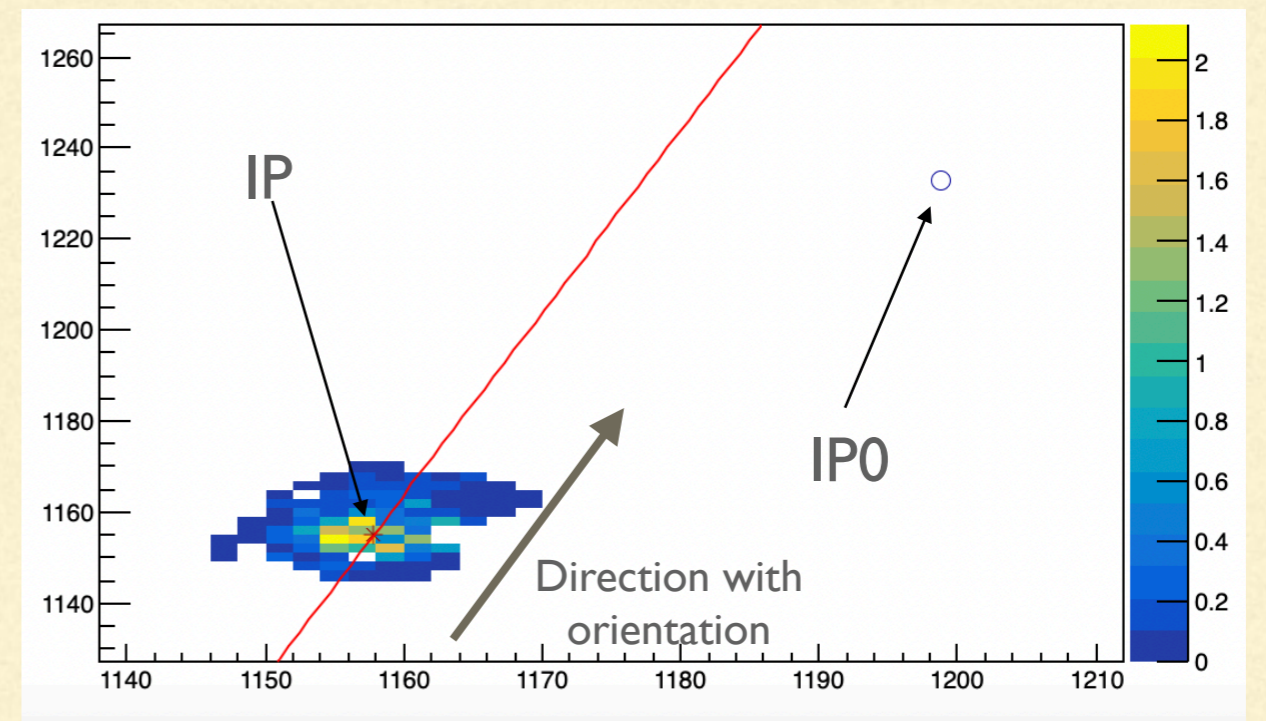
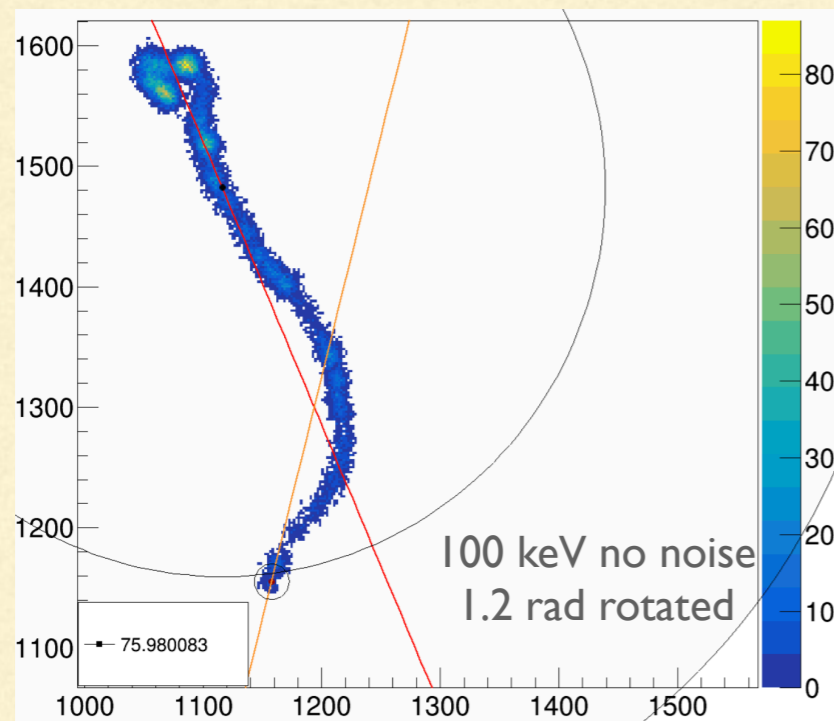
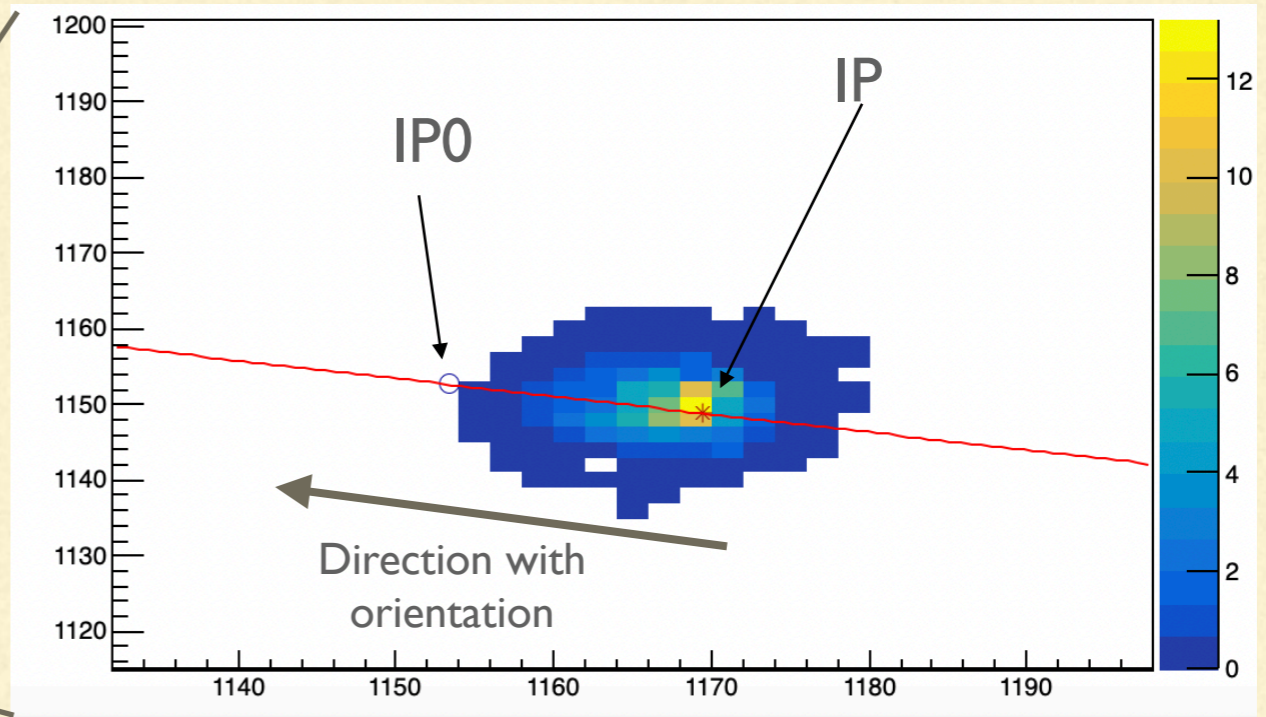
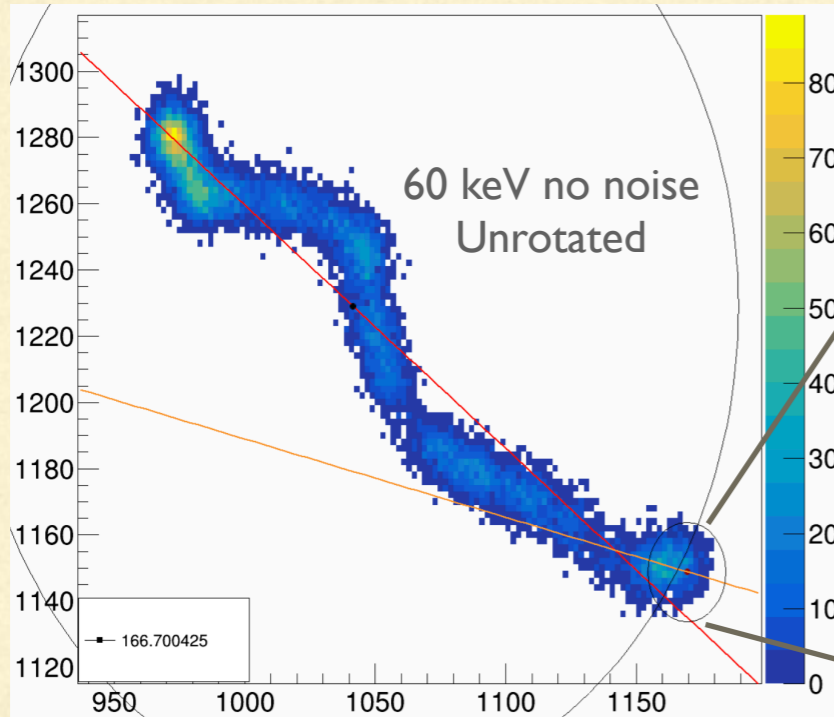


Giving an orientation

- Remember the iterative IP region selection
- The barycenter is calculated for previous iteration (IP0)
- Direction is taken as output of the angle from max RMS calculation (*arctan*) if the IP is on the left of IP0
- Direction is taken with $\pm 180^\circ$ otherwise



Examples



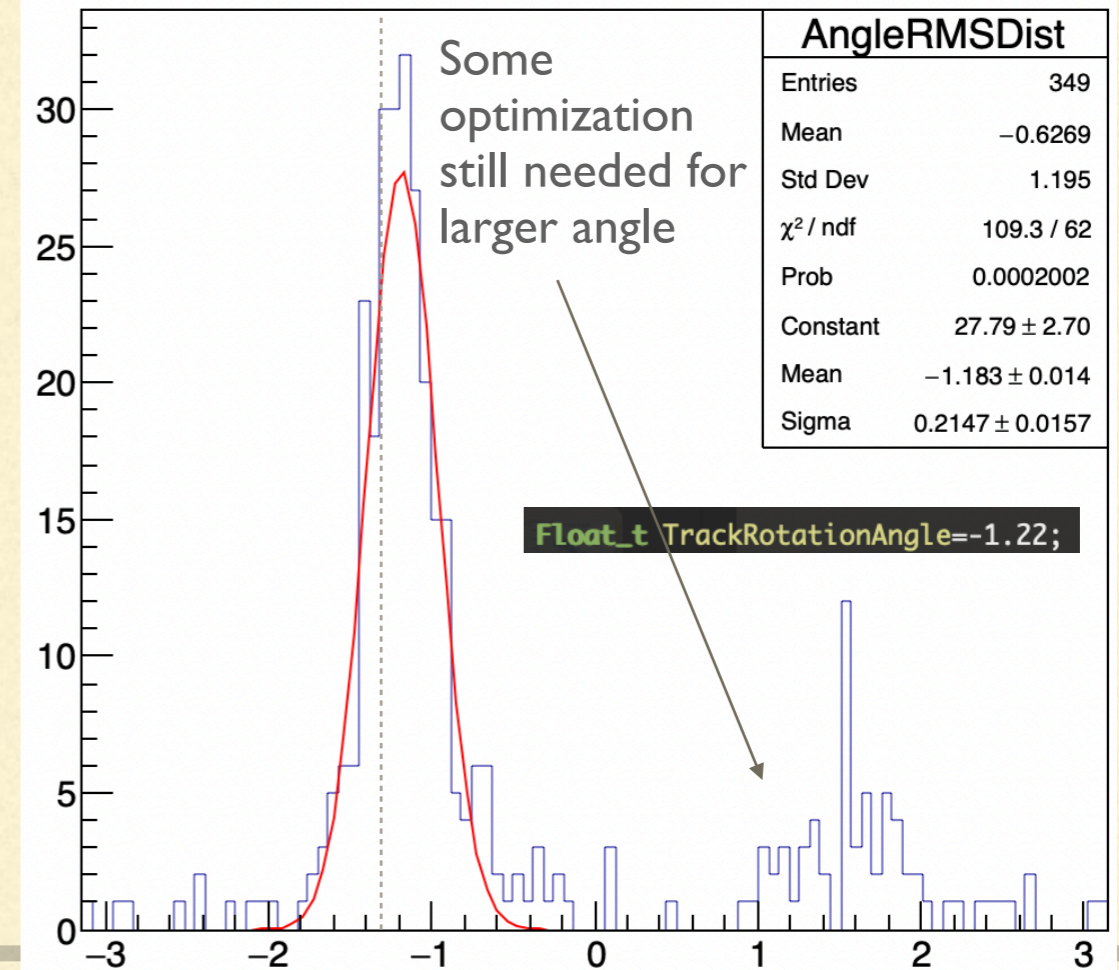
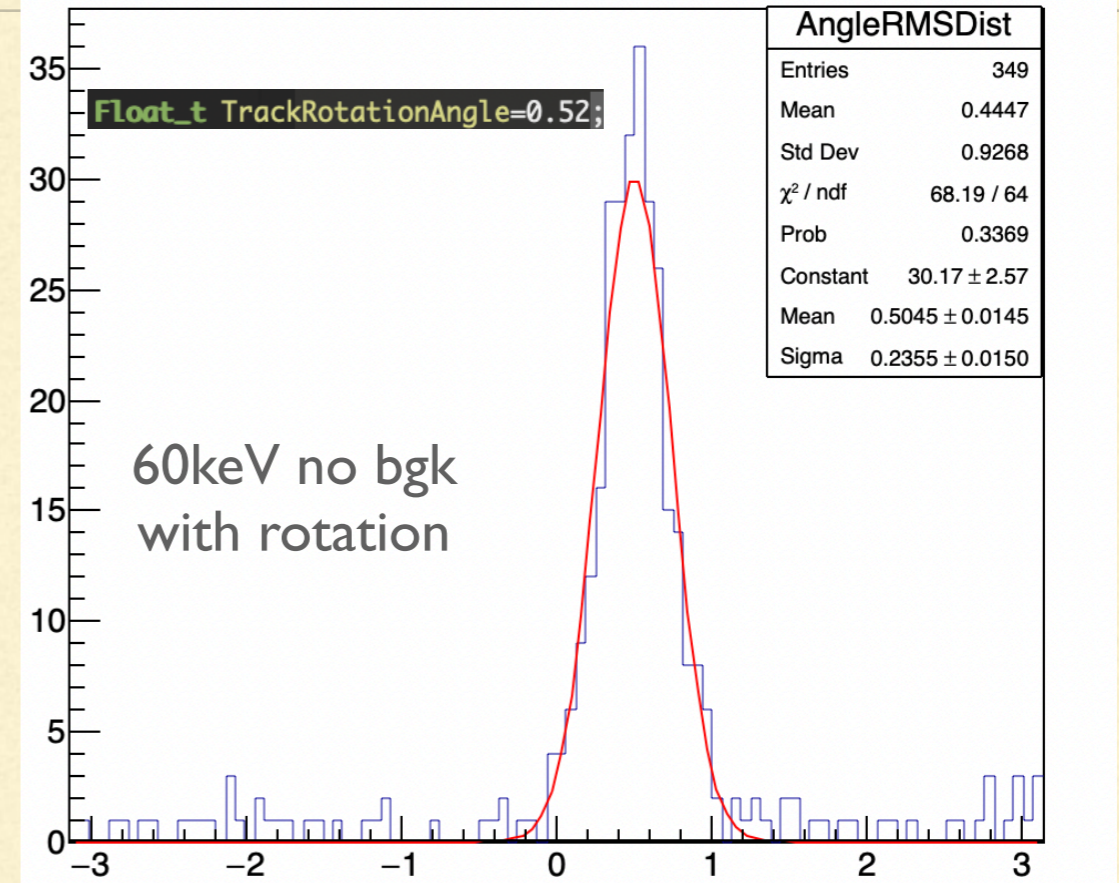
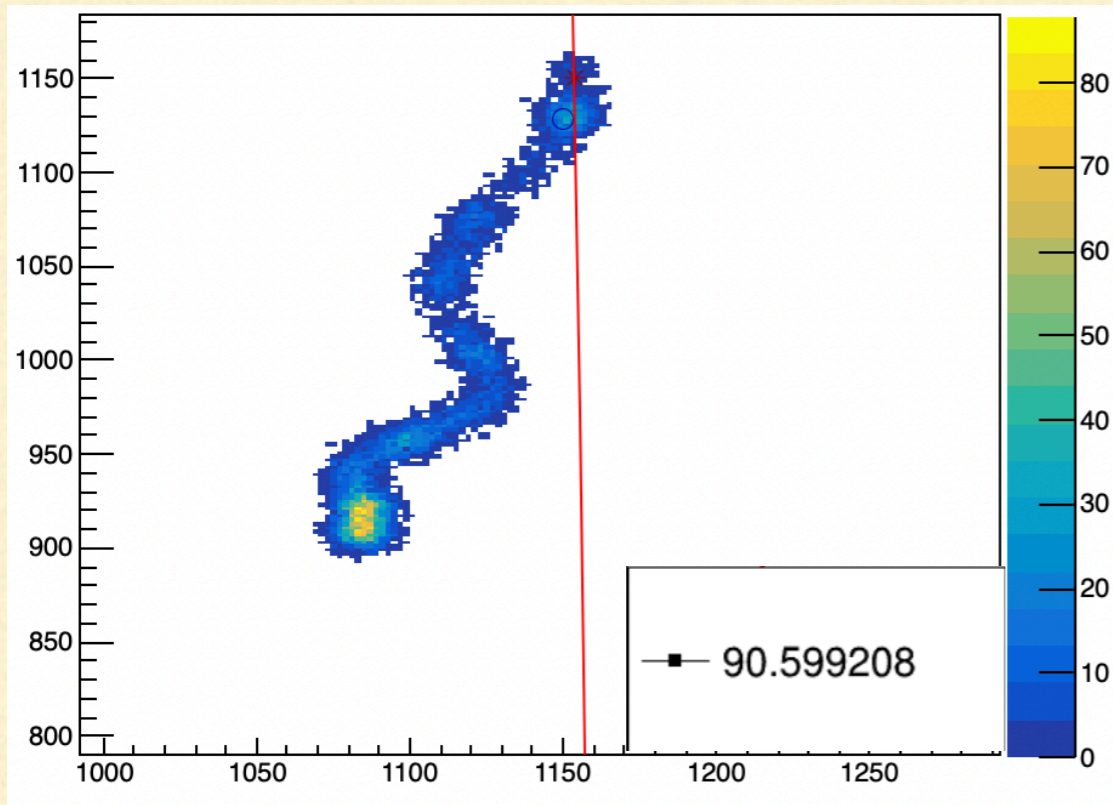
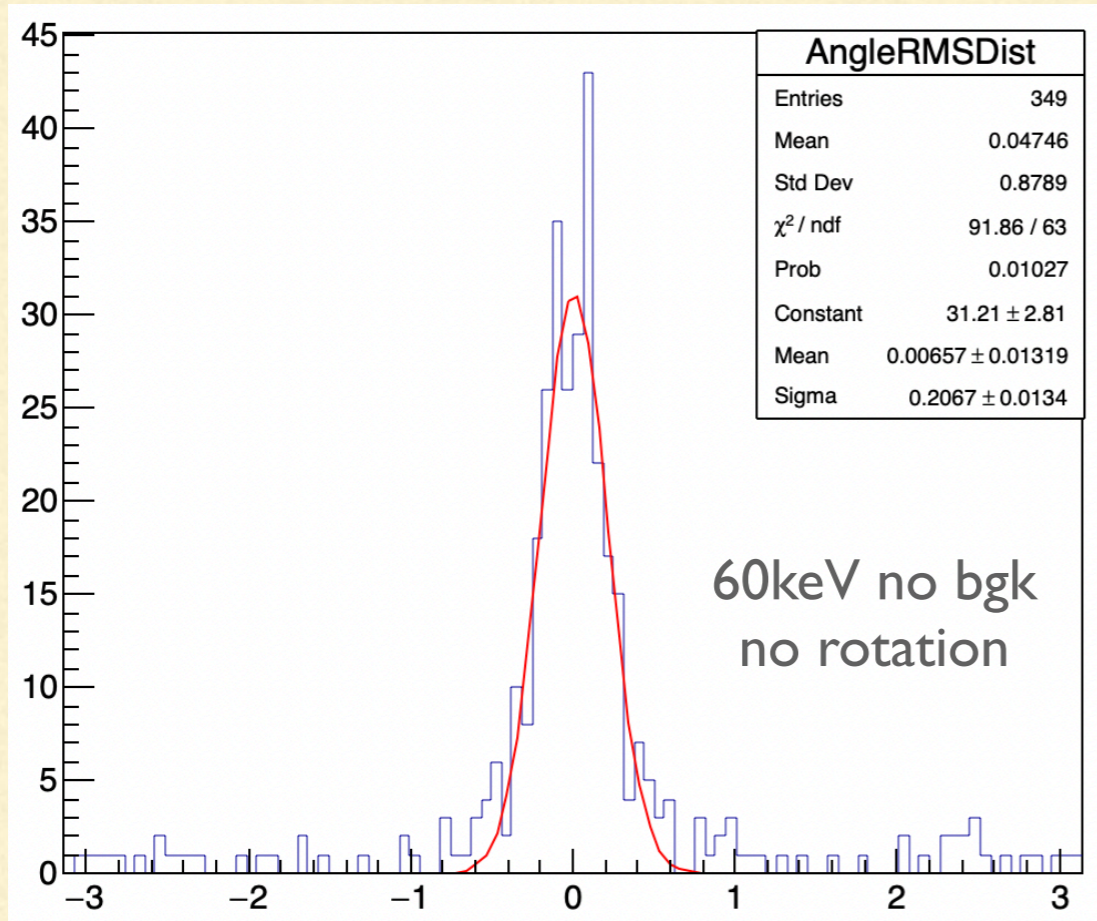
Works on rotated tracks

Head-tail recognition capability

- Head-tail capability quantified as the capability of reconstructing forward tracks $[-\pi/2, \pi/2]$
- Unrotated tracks

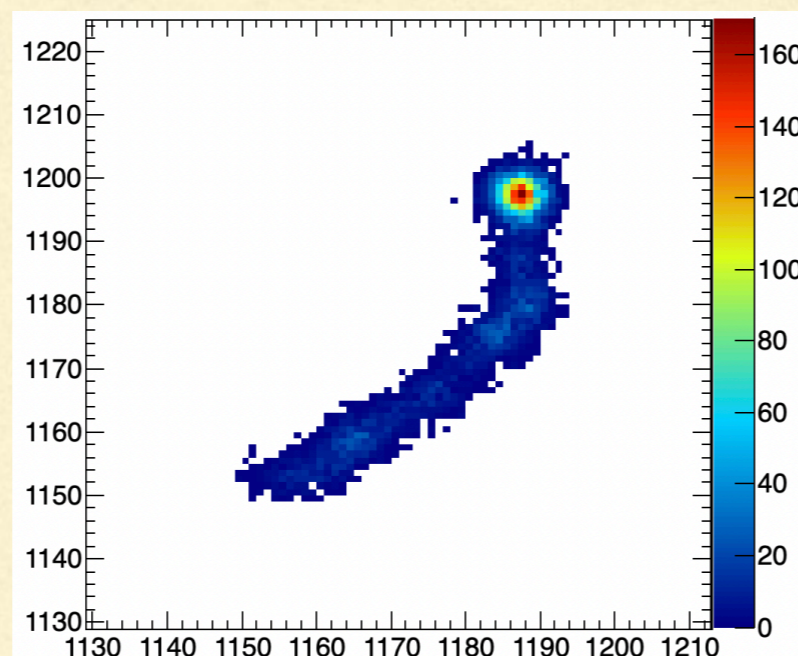
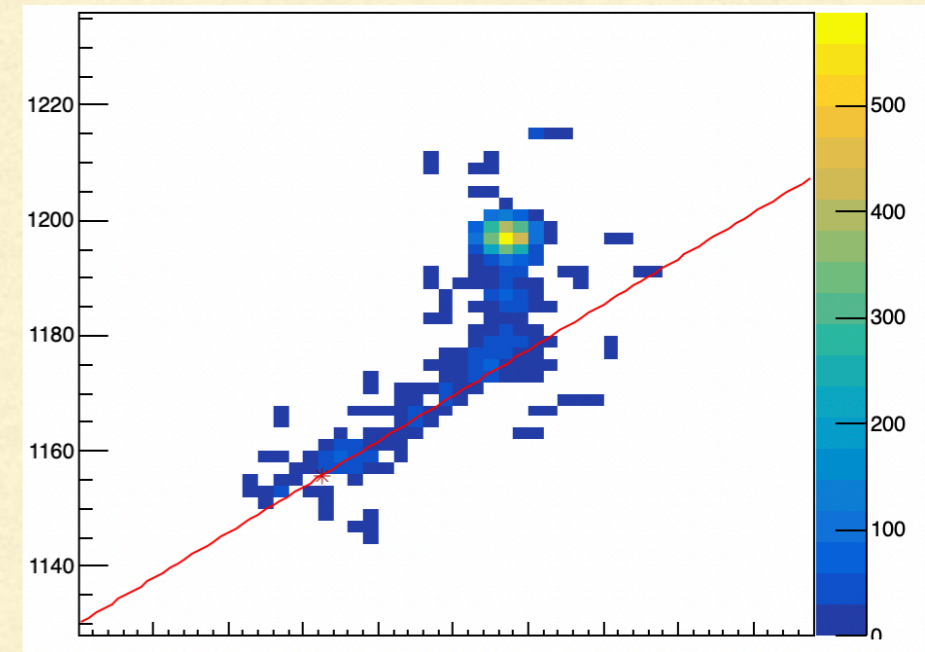
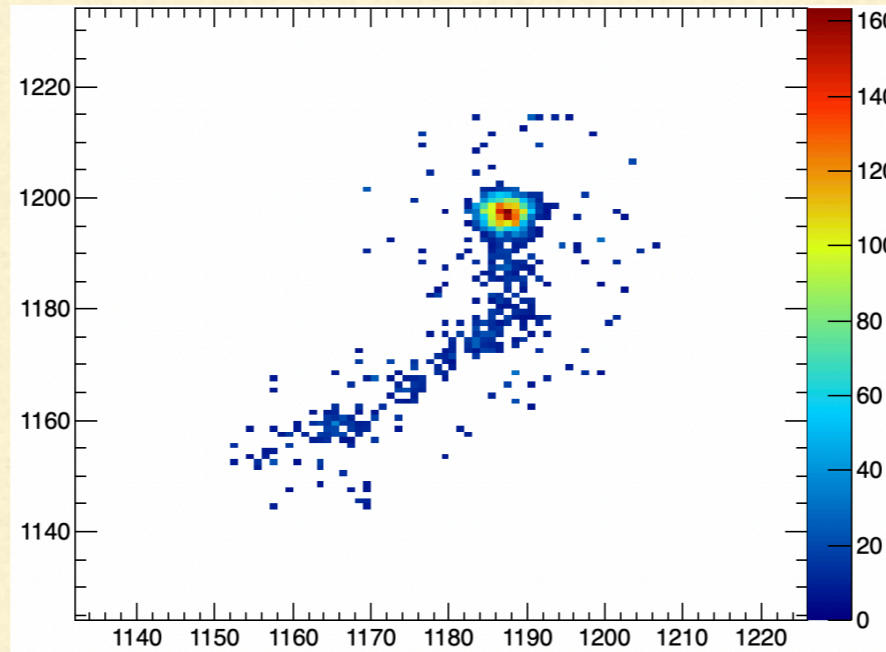
	Data with noise	H-T perc.	Data without noise	H-T perc.
<i>20 keV</i>	$\sigma_\theta = 23.2 \pm 1.7^\circ$	87 %		
<i>30 keV</i>	$\sigma_\theta = 19.0 \pm 1.5^\circ$	84 %	$\sigma_\theta = 18.5 \pm 0.9^\circ$	90 %
<i>60 keV</i>	$\sigma_\theta = 20.1 \pm 1.6^\circ$	83 %	$\sigma_\theta = 12.1 \pm 0.6^\circ$	89 %
<i>100 keV</i>			$\sigma_\theta = 11.4 \pm 0.7^\circ$	91 %

Resolutions on rotated tracks



Study on track with different diffusion

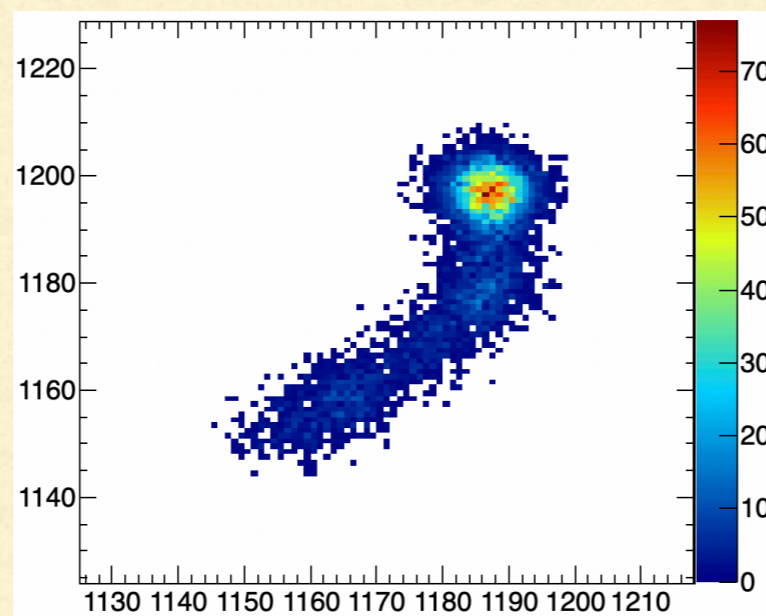
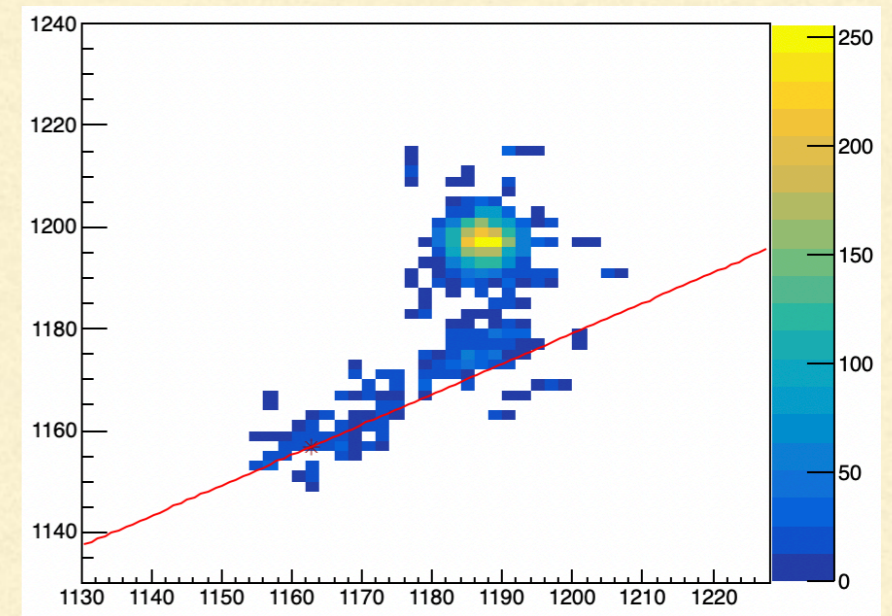
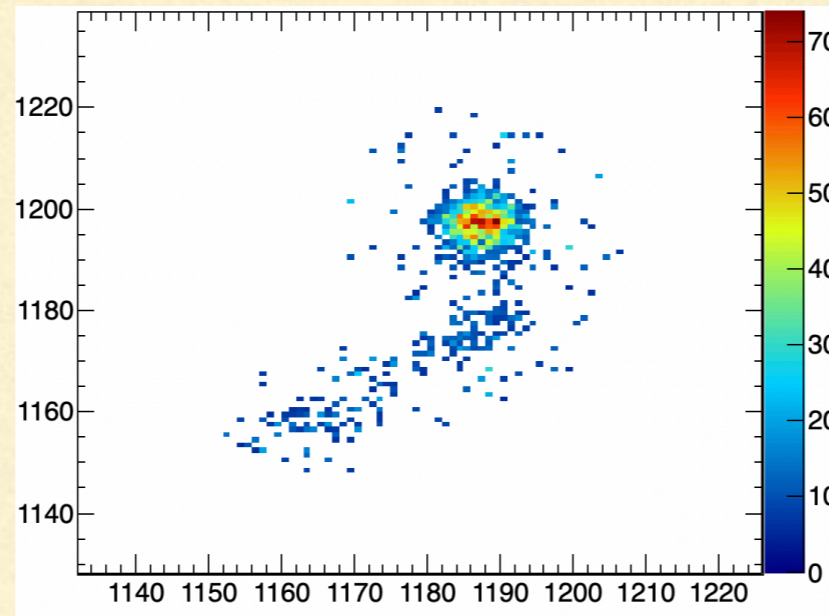
- 30 keV electrons
- 0 cm diffusion
- Pedestal used 3797



- Worse results than 30 keV with 20 cm diffusion

Study on track with different diffusion

- 30 keV electrons
- 10 cm diffusion
- Pedestal used 3797



- Worse results than 30 keV with 20 cm diffusion

Conclusions

- Identification of the track orientation gives good results and works for rotated tracks
- The algorithm works with rotated tracks, further analysis must be done on data with noise
- The analysis of electrons with lower diffusion still must be done
- The head tail recognition capability is above 80% in all cases
- Hints of further improvement in the IP identification can come by a IP recalculation after the circular selection. (Algo must be optimized)