

# Nuclear recoils simulations with SRIM

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CYGNO SIMULATION MEETING – 07/12/2020

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# Cascade reconstruction

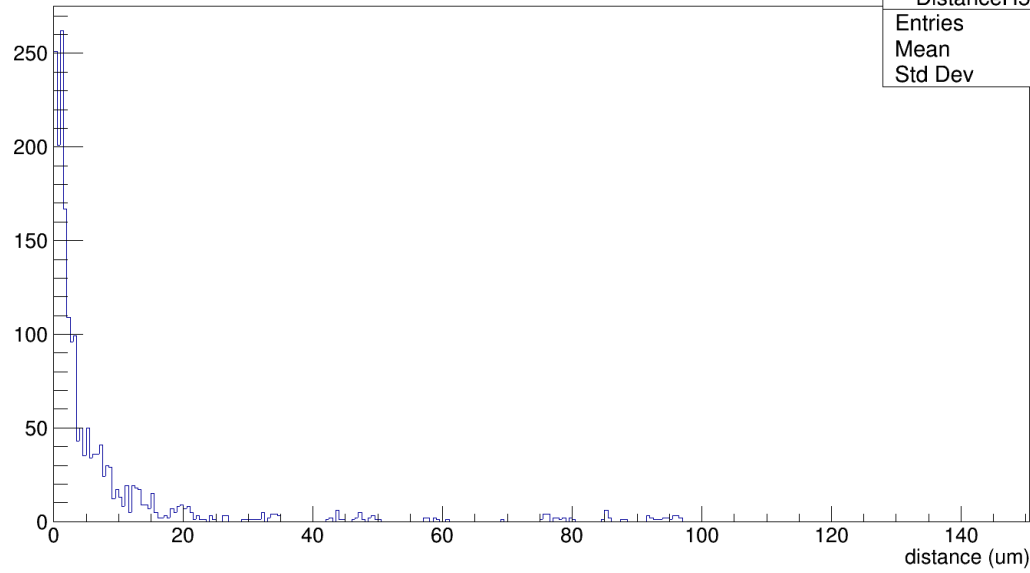
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To overcome the issue of correctly interpreting the information provided by SRIM, we construct secondary cascades with a simplified approach

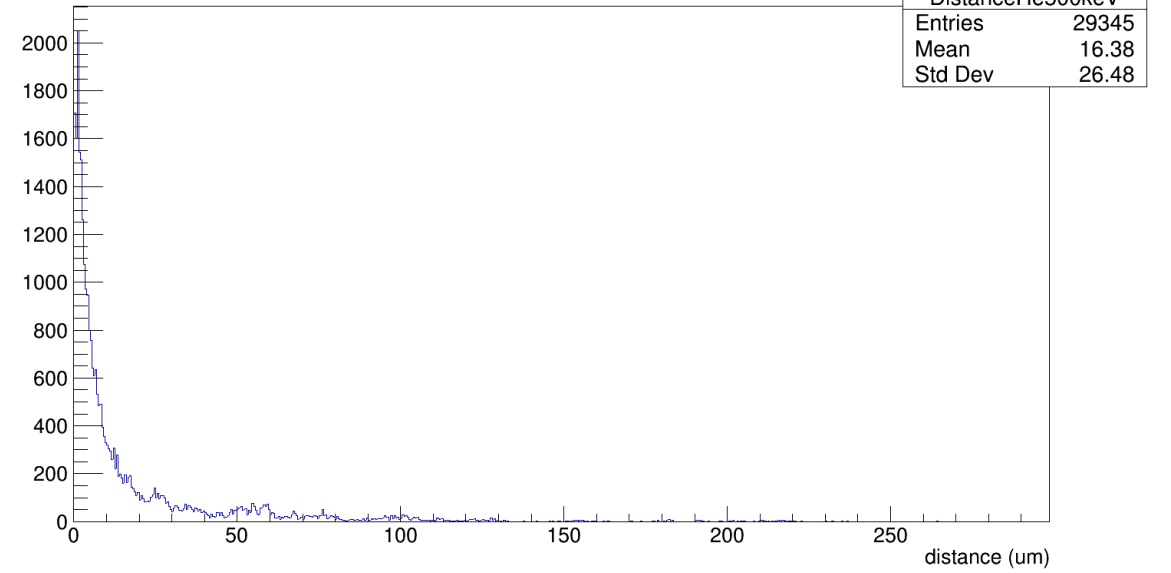
Before doing so, we checked what is the impact of secondary cascades in the spatial distribution of charge production

From the distribution of the distance of the recoils from the starting point of the cascade, we found that the majority of the energy deposit is within  $100\mu\text{m}$  from the primary track, below the spatial resolution

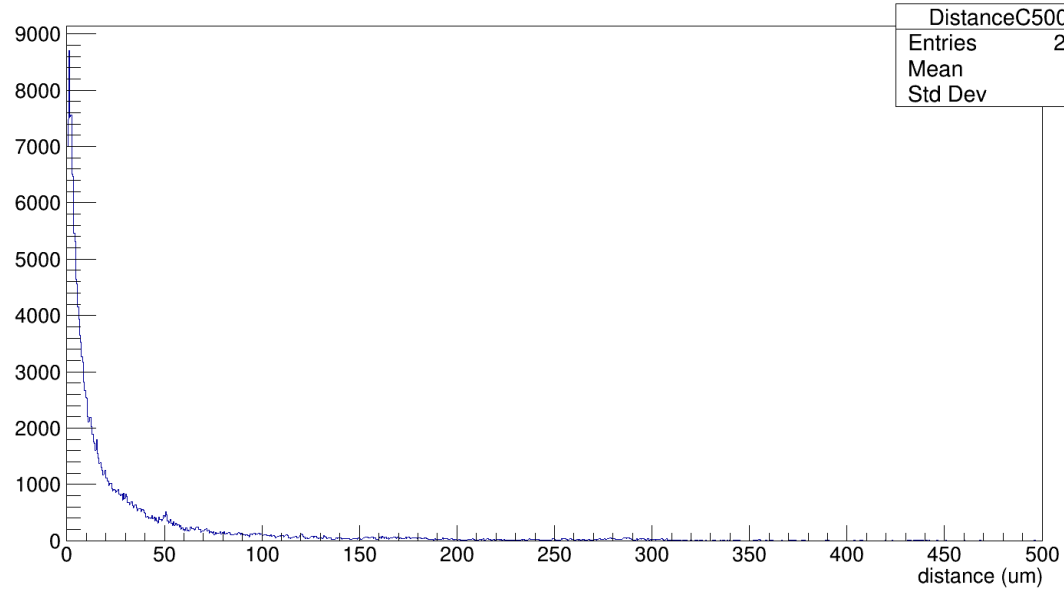
DistanceH500keV



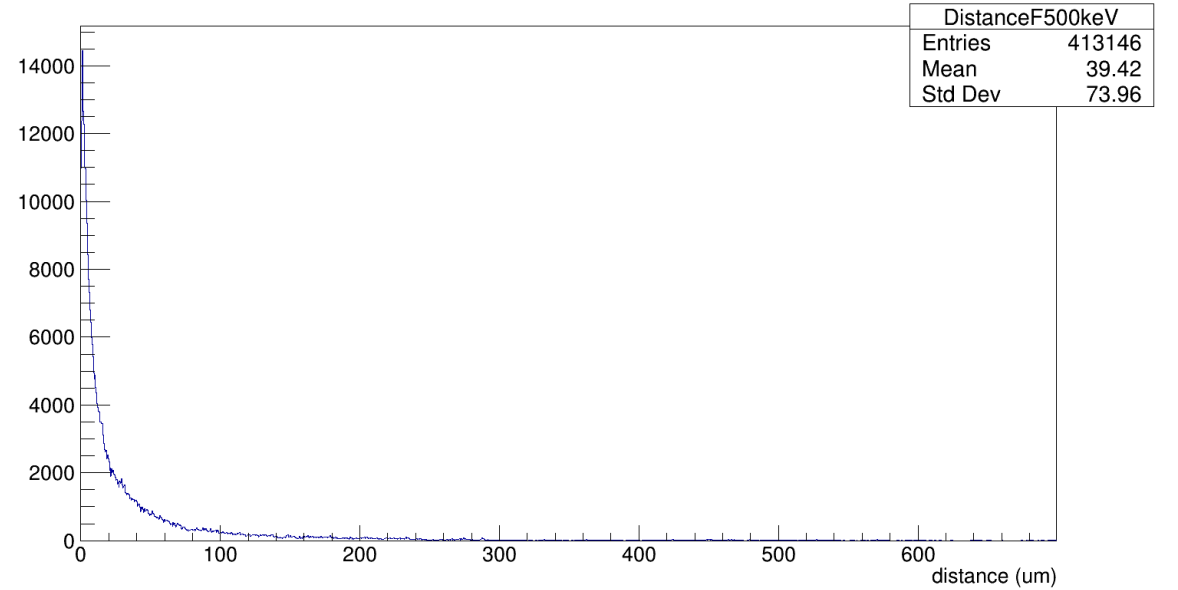
DistanceHe500keV



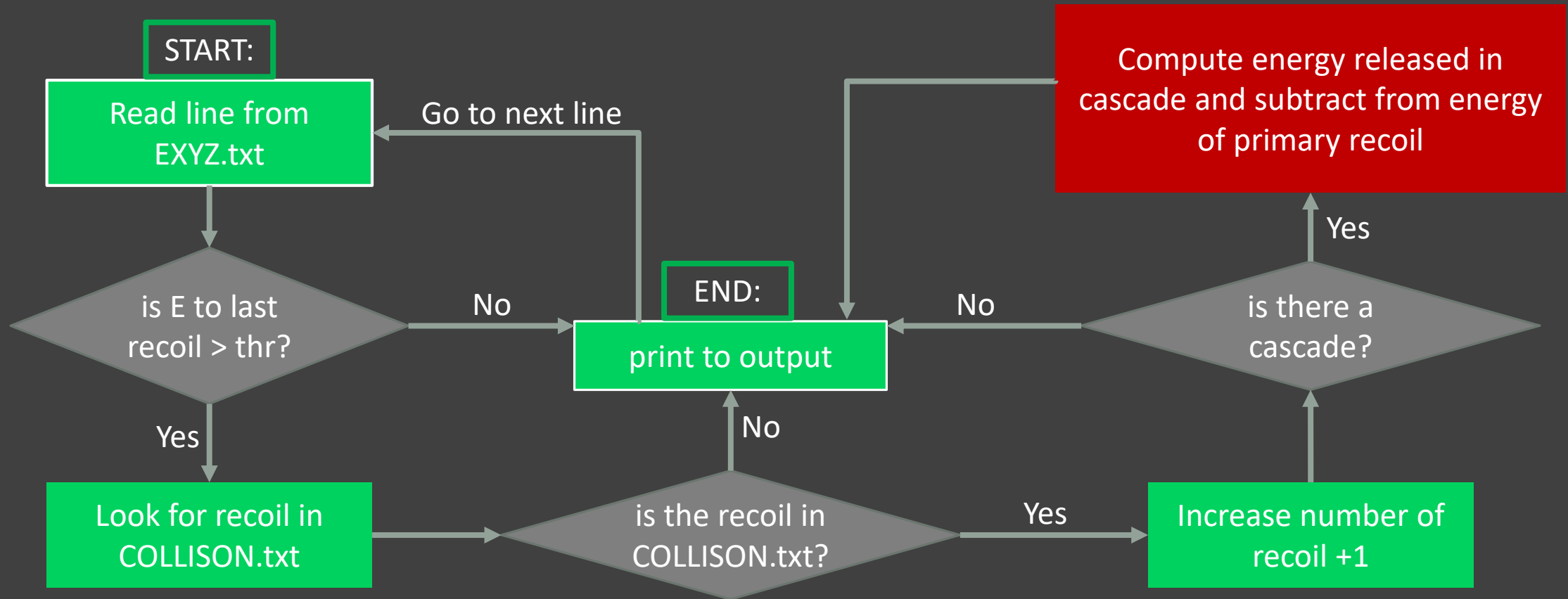
DistanceC500keV



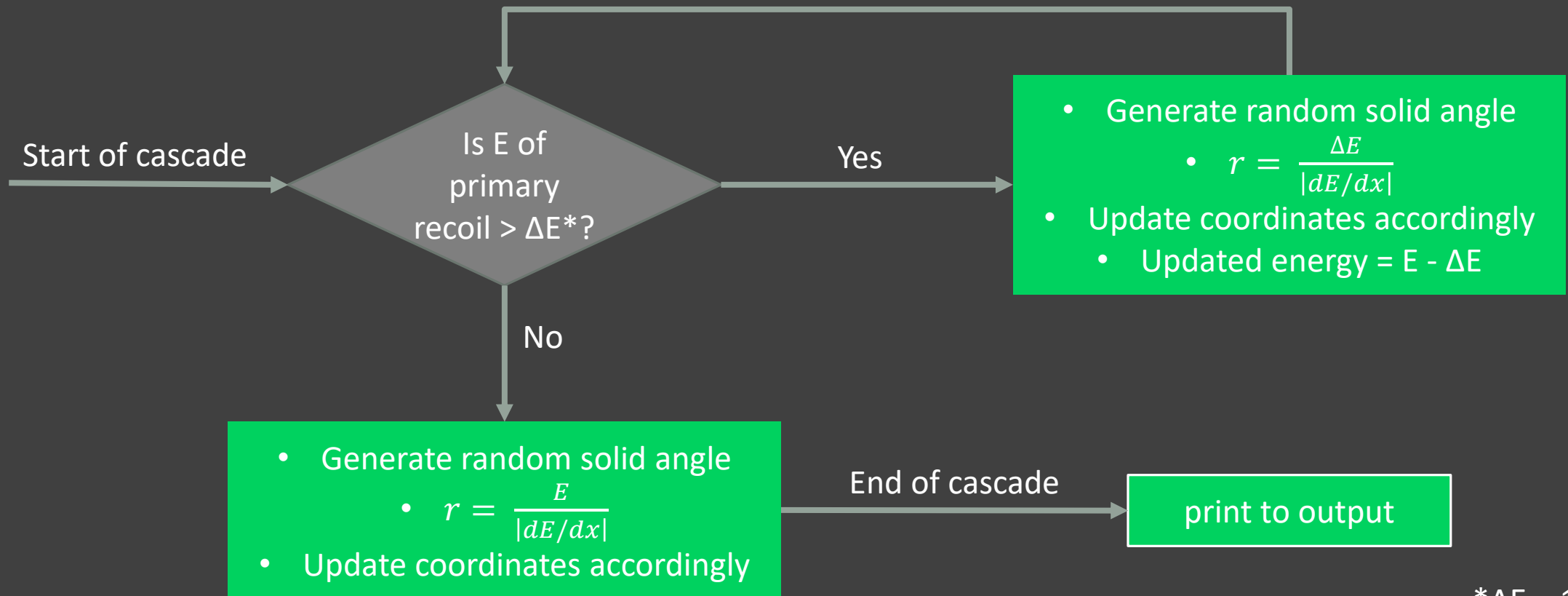
DistanceF500keV



# Cascade reconstruction



# Cascade reconstruction



\*ΔE = 130 eV

# Output file

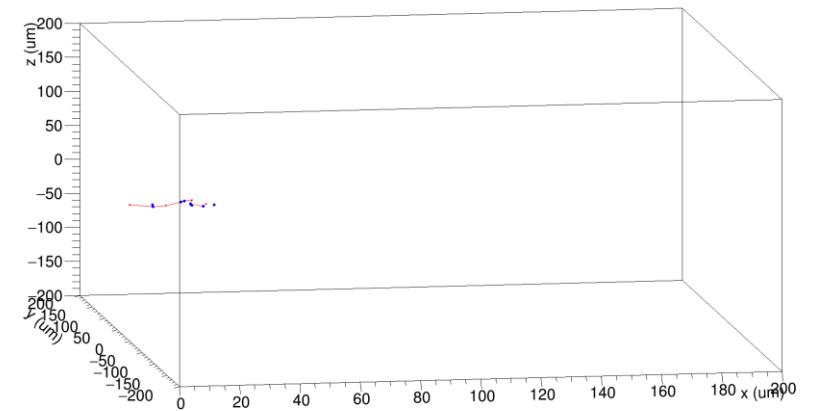
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We simulated 1000 He ions at energies 1, 3, 6, 10, 30, 60, 100 keV as a starting point

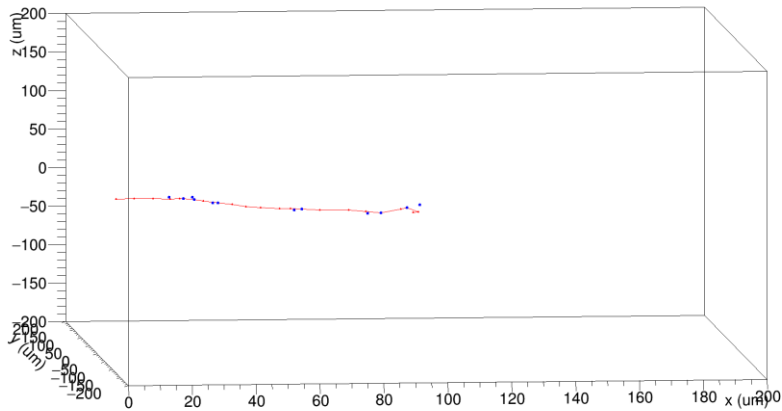
Ion	Recoil	X (mm)	Y (mm)	Z (mm)	Energy deposit (keV)
1	1	0.0143099	-0.00164448	0.00259858	0.010419
1	1	0.013416	-0.001979	0.0020275	0.210691
1	1	0.019297	-0.0037831	0.0010865	0.12892
1	1	0.022617	-0.009657	0.00081613	0.13209
1	2	0.0223072	-0.0151089	-0.002142	0.045048
1	2	0.023597	-0.01468	0.00029725	0.109212
1	2	0.023517	-0.018479	0.0020147	0.10446
1	3	0.0243885	-0.0227084	0.0067984	0.049381
1	3	0.024307	-0.022275	0.0038527	0.11237
1	3	0.019905	-0.022205	0.0079157	0.097409

# Some reconstructed tracks

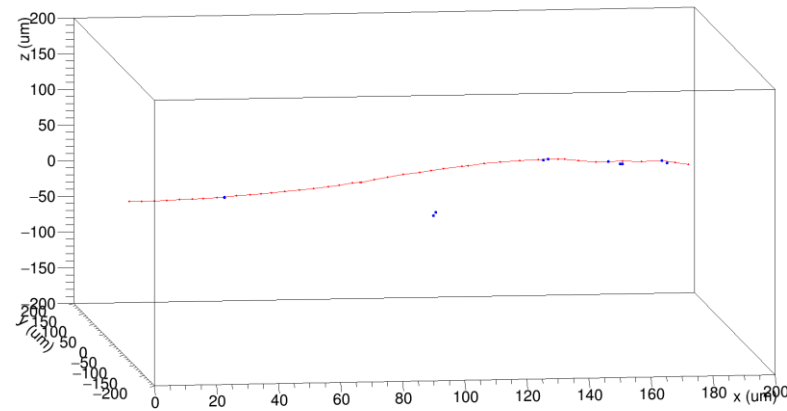
He recoil 1 keV



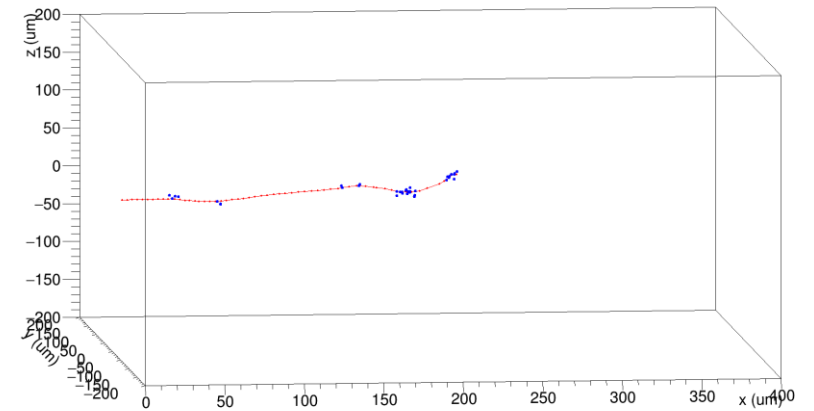
He recoil 3 keV



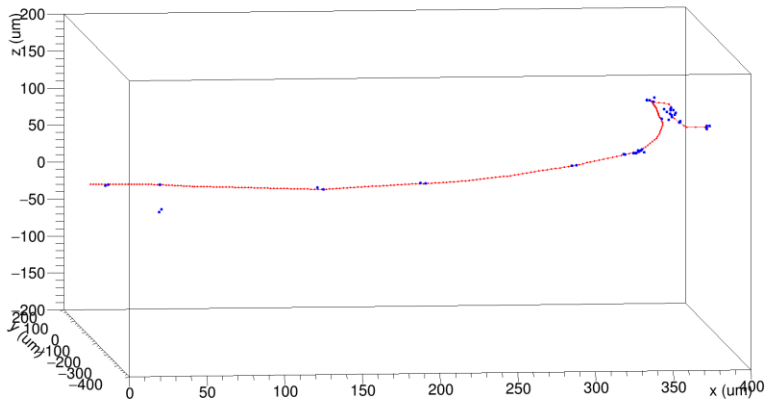
He recoil 6 keV



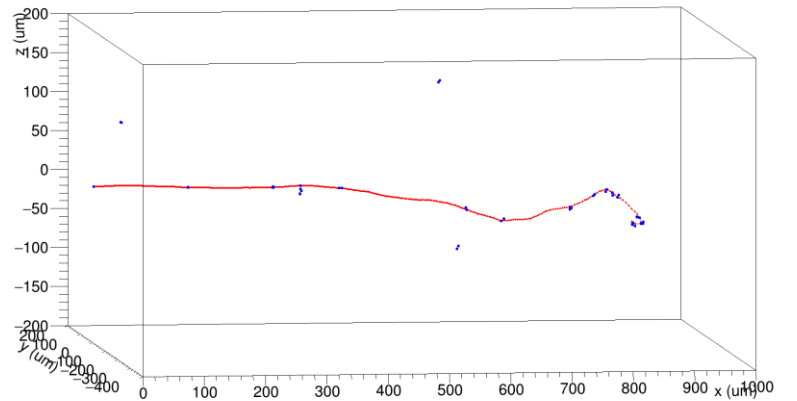
He recoil 10 keV



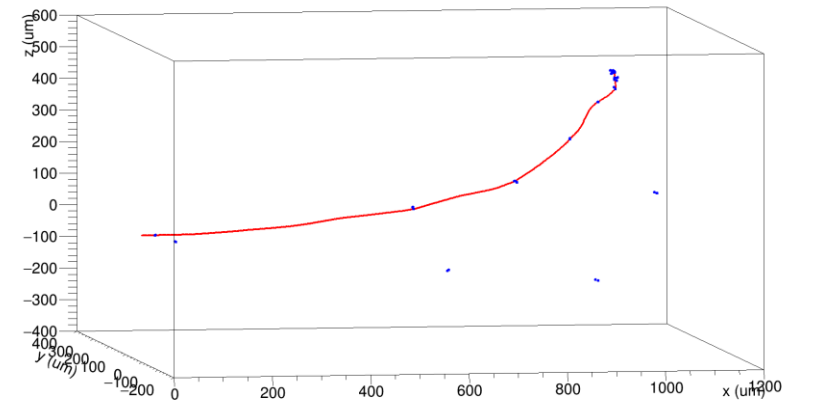
He recoil 30 keV



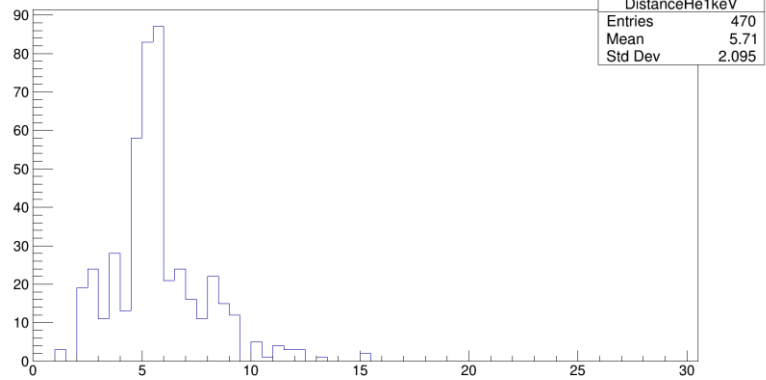
He recoil 60 keV



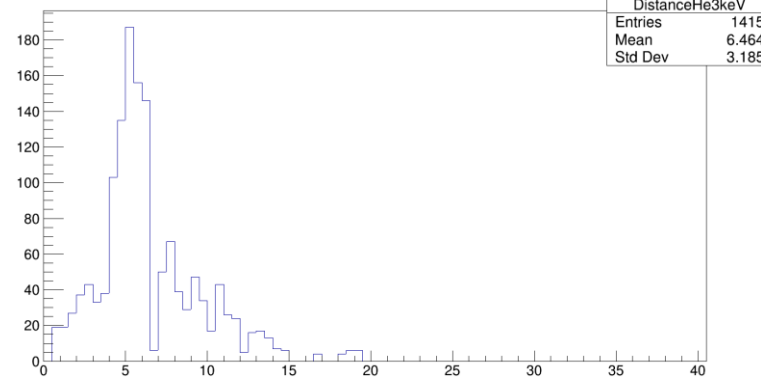
He recoil 100 keV



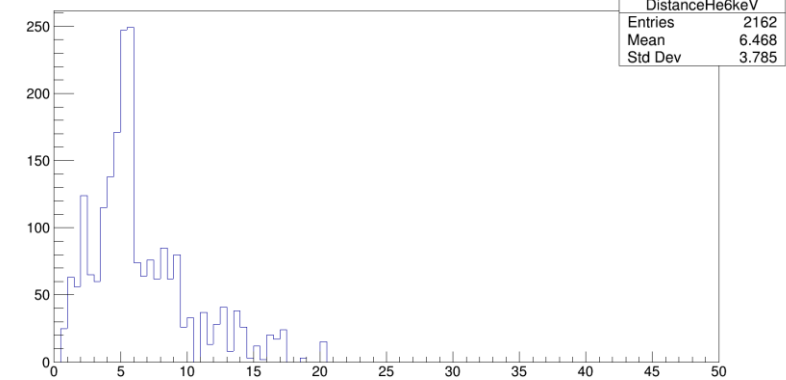
DistanceHe1keV



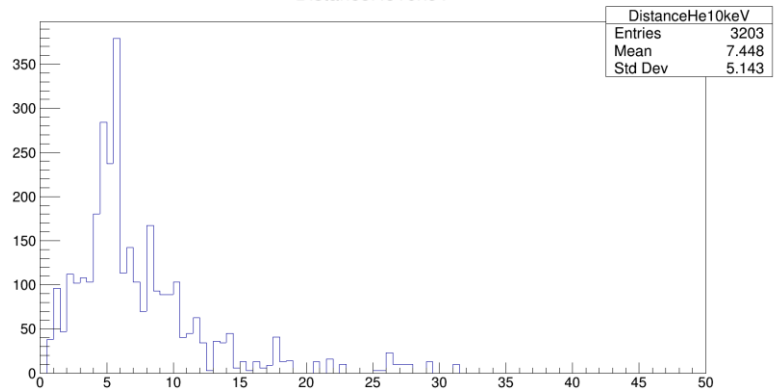
DistanceHe3keV



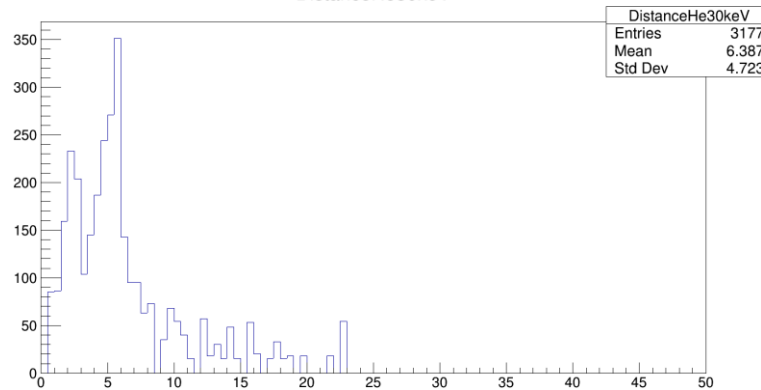
DistanceHe6keV



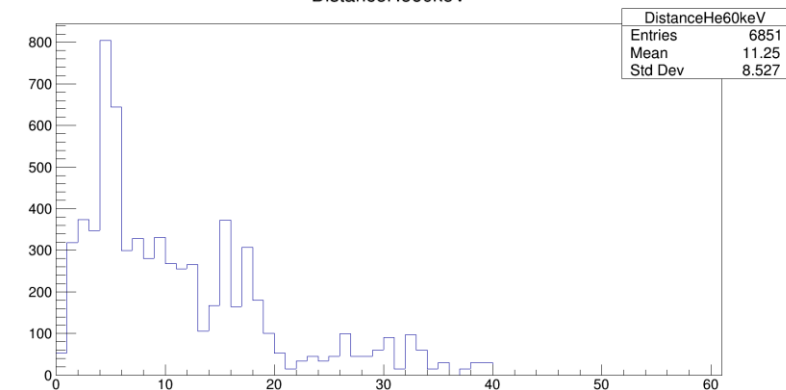
DistanceHe10keV



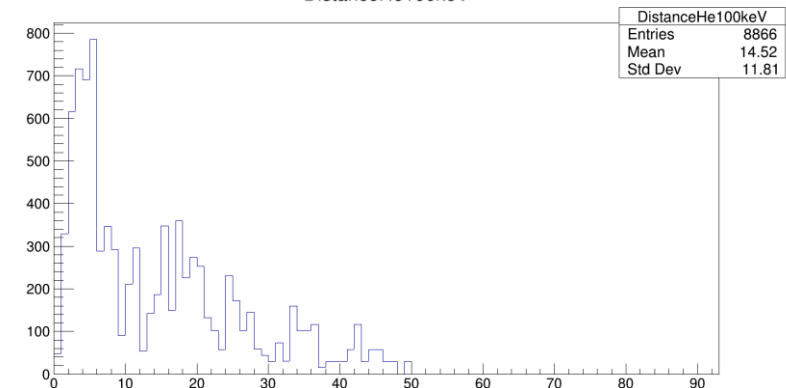
DistanceHe30keV



DistanceHe60keV



DistanceHe100keV



Distributions of distance of recoils from the primary track in the reconstructed cascades



# Conclusions

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- Initial sample for ToyMC done (1000 He tracks)
- Estimate time for He simulation at 1, 3, 6, 10, 30, 60, 100 keV – 110 hours
- Few assumptions were made (random direction change every 130eV deposition, linear interpolation between tabulated stopping power values, ...)
- Need to check if this approximation is adequate