nTMM Data Analysis Updates

Alina Moore - UTK – 11/3/2025

- Intensity found to be 1.24E9
- Per second

- Starting with GPM count from reference run R = 168,720,392
- $GPM\ per\ \text{sec} = \frac{R}{1800} = 93733.55$

$$Intensity = \frac{GPMSec * DTCorr * SapphireAtten * 0.76}{GPMEff * 2}$$

$$\frac{93733.55 * 1.15 * 0.908 * 0.76}{(3E-5) * 2}$$

Correction factors and other values

Deadtime correction	1.15
Sapphire attenuation	0.908
GPM efficiency	3.00E-05
Al transmission	0.95
Si attenuation	0.9315
Detector efficiency	0.96
ROI efficiency	0.85
Time sec 1	1800
Time sec 2	1200

½ is here because 50% of neutrons with one of two polarizations are compensated by optical potential

Correcting ROI counts

$$CorrectedROICounts_i = \frac{RawROICounts_i * GPMVariationCorr_i}{AlTrans * SiTrans * DetectorEff * ROIEff}$$

- GPMVariationCorr ($\frac{GPMCountPerSec_i}{RCountPerSec}$) varies for each run because of GPM counts increasing over time

$$\frac{ROI}{Intensity} = \frac{CorrectedROICounts}{Intensity}$$

- When refitting, this will be used as the observed value. Doesn't require time corrections between scan 1 and 2

Going from κ to κ^4

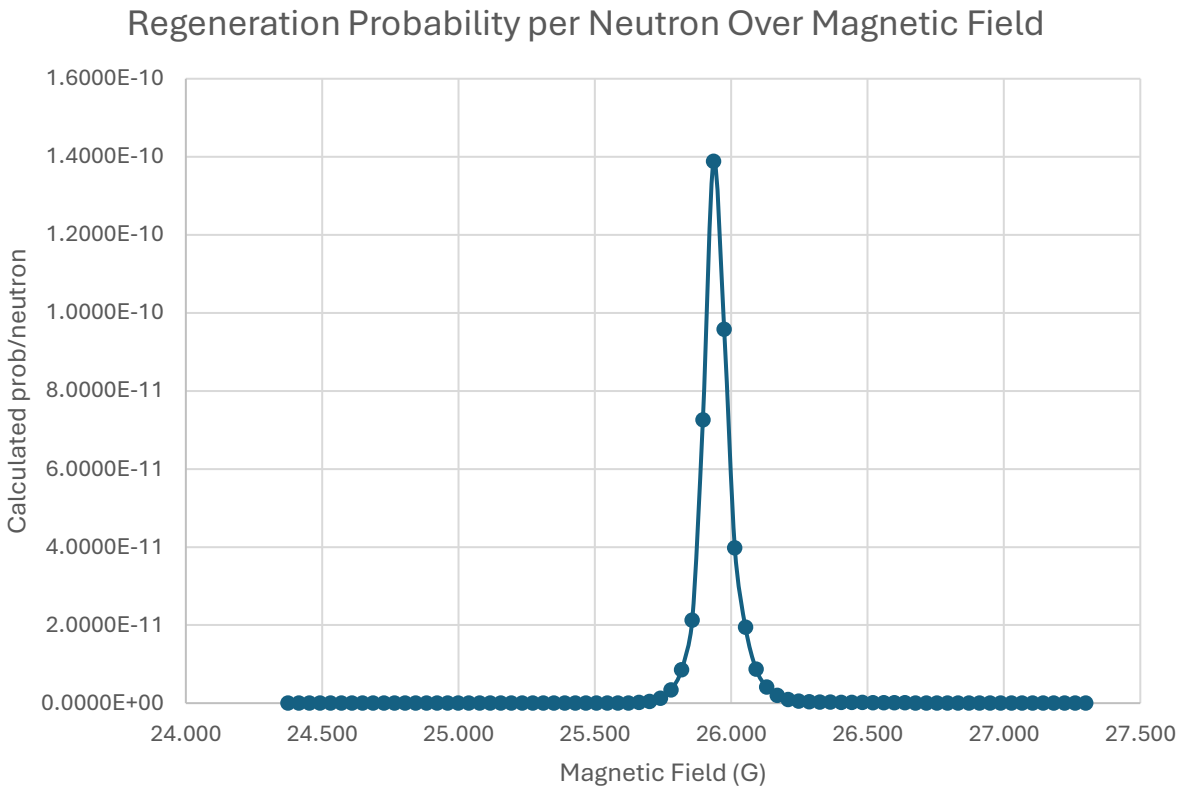
- Assuming κ = 5E-6
- What makes $\kappa^4 = 1.39E-10$, the peak probability given by fit function
- $\mathbf{4.28}(5E-6)^4 = 1.39E-10$

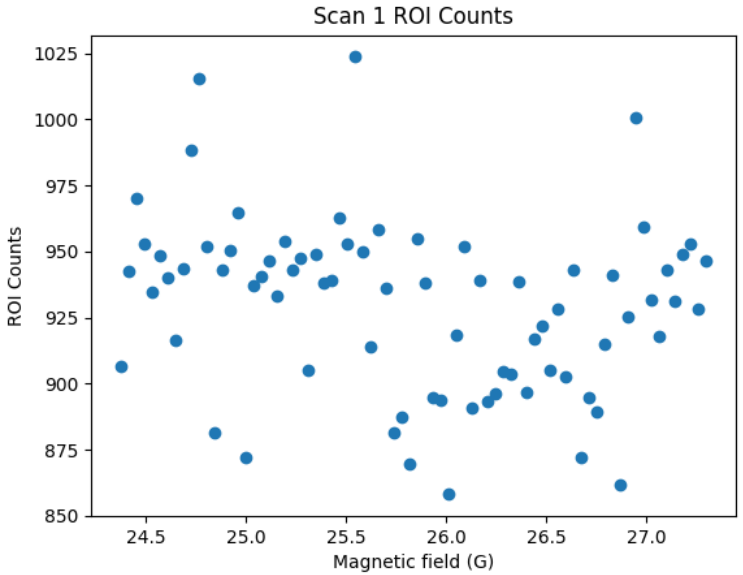
Fitting Updates

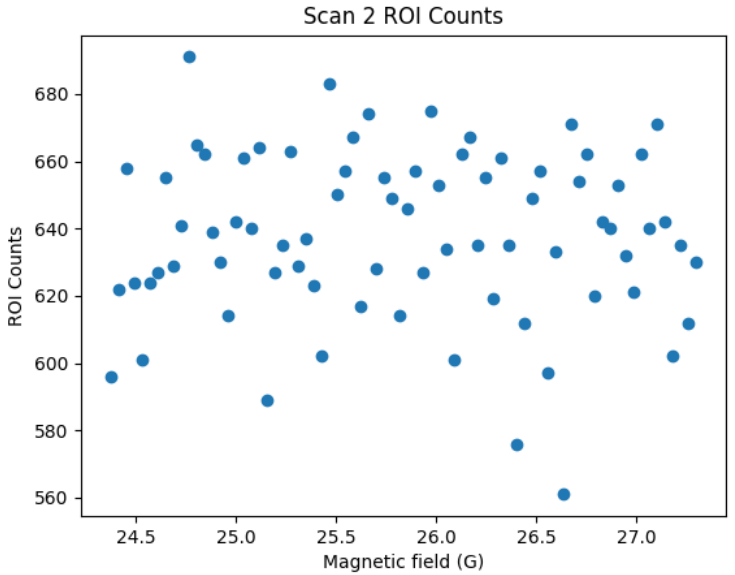
Alina Moore 10/19/2025

Background info

- Probability of neutron regeneration calculated by Yuri (plotted to the right)
  - Its peak is at 25.935 G
- Review of fitting:
  - B is background. This appears “beneath” any effect. These estimates came out right where they should
  - a is proportional to κ^4 and is multiplied by regeneration prob per neutron
  - M is ROI detector count
  - $M = B + a(f(b))$







First attempts

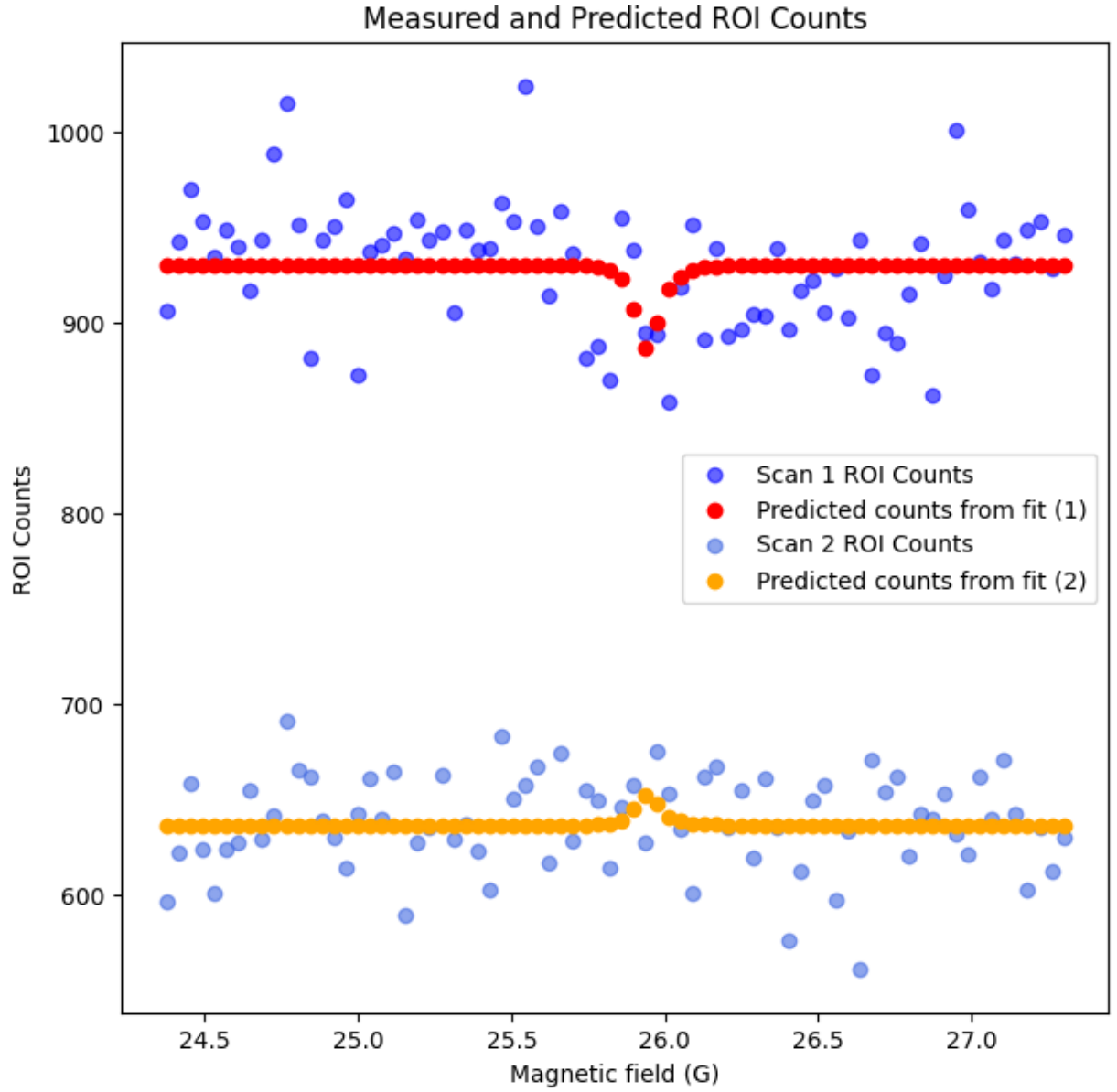
Scan 1

- 30 min runs
- Done from by incrementing current down starting from 0.28
- Negative peak is statistically possible, but odd
- Yuri's idea: may depend on what magnetic field value holds the peak
- Parameter estimates: $a = -3.15 * 10^{11}, B = 930$

Scan 2

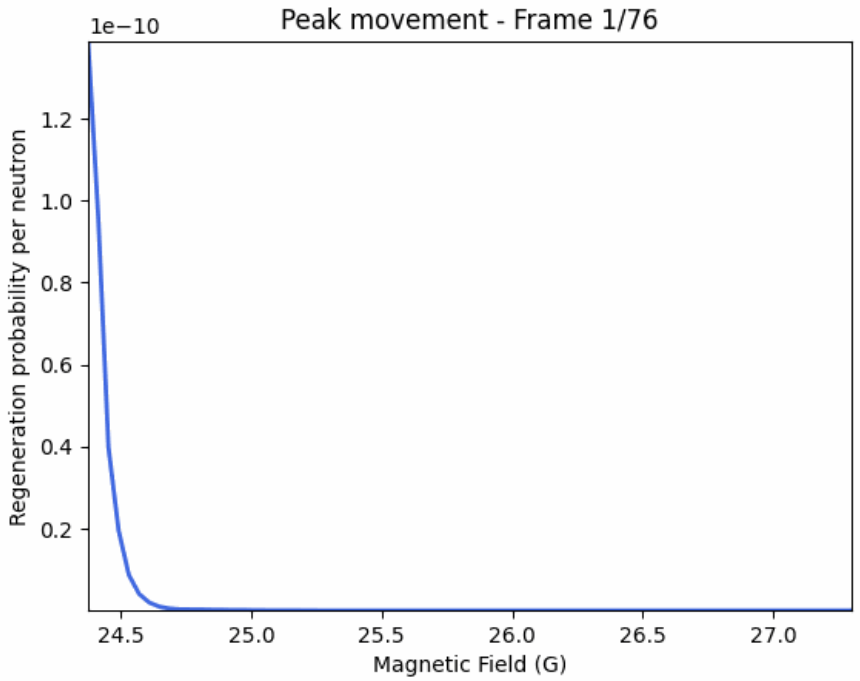
- 20 min runs (counts will be lower)
- Current selected in random order over the same range
- Parameter estimates: $a = 1.15 * 10^{11}, B = 636$

"Predicted" means using the parameters from the fit and generating counts based on this.



Another check

- The probability of neutron regeneration is a function of magnetic field whose peak can be moved along the values of magnetic field

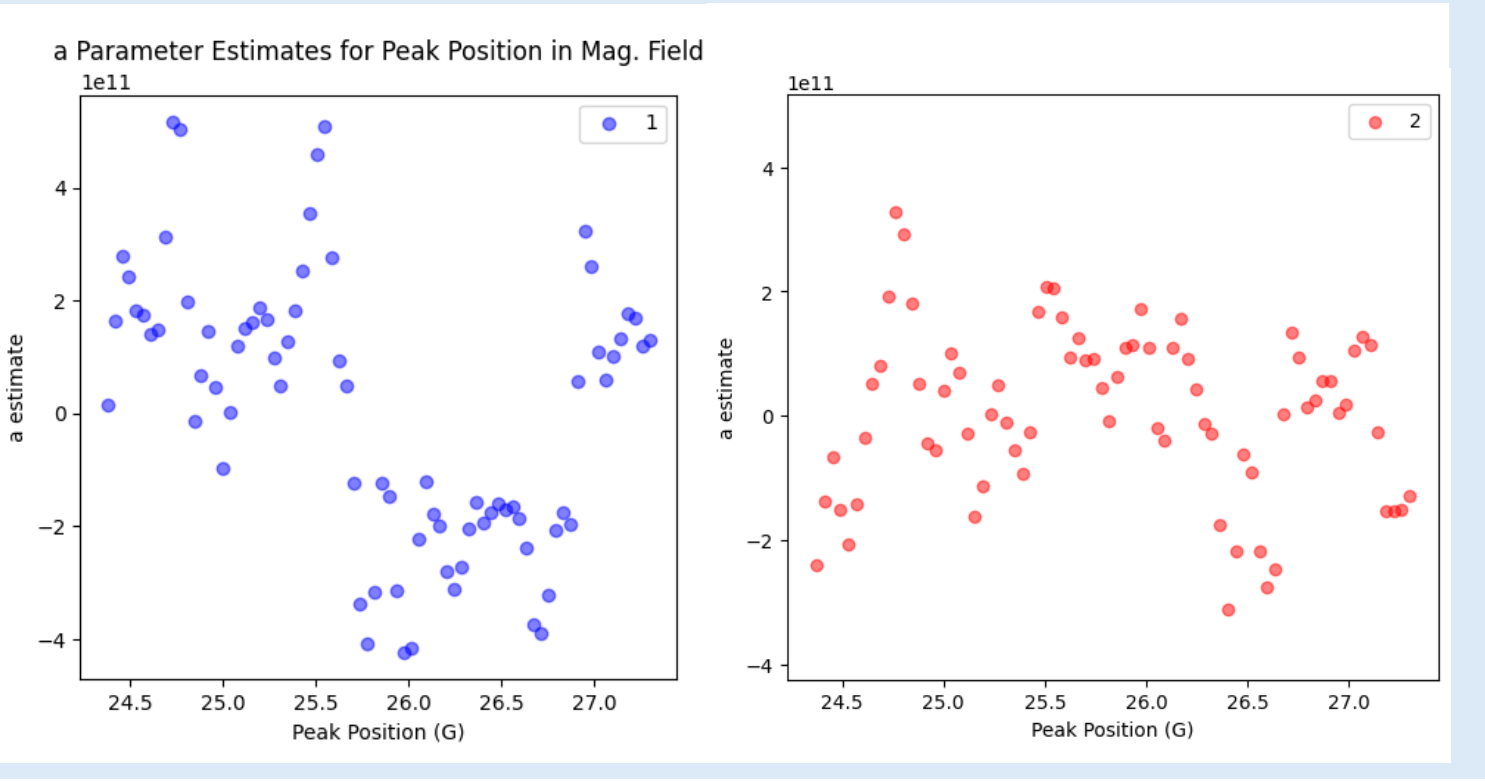


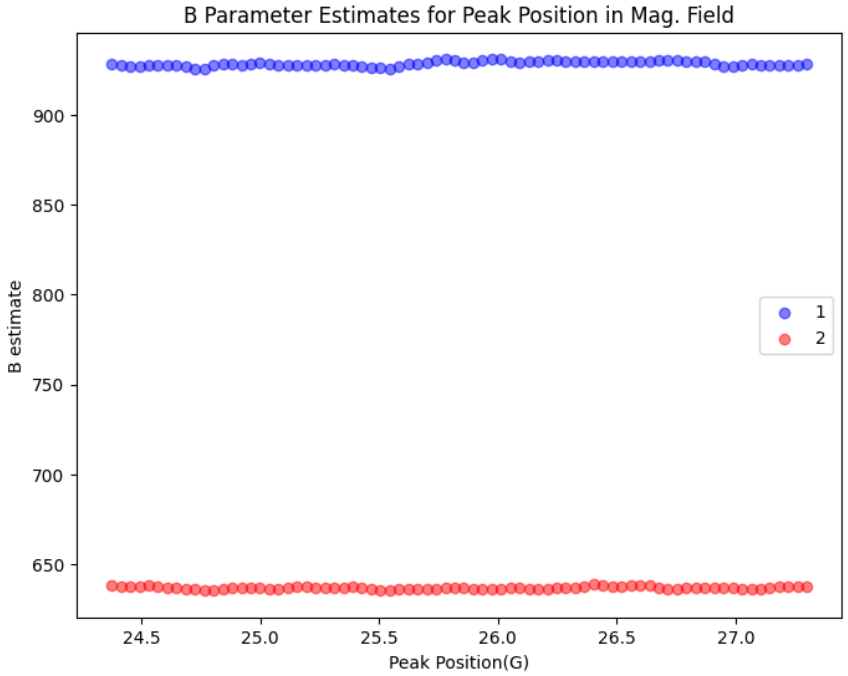
Goal: For the peak set at each of the 76 values of magnetic field we run over, refit both a and B parameters and show them as a function of peak position (G) to see the relationship

- Assumption: when “pushing” the peak along the axis, you can extend the final end values out

- B parameter should be the same for all these. It wouldn’t depend on this
- a may change and be interesting

Plots

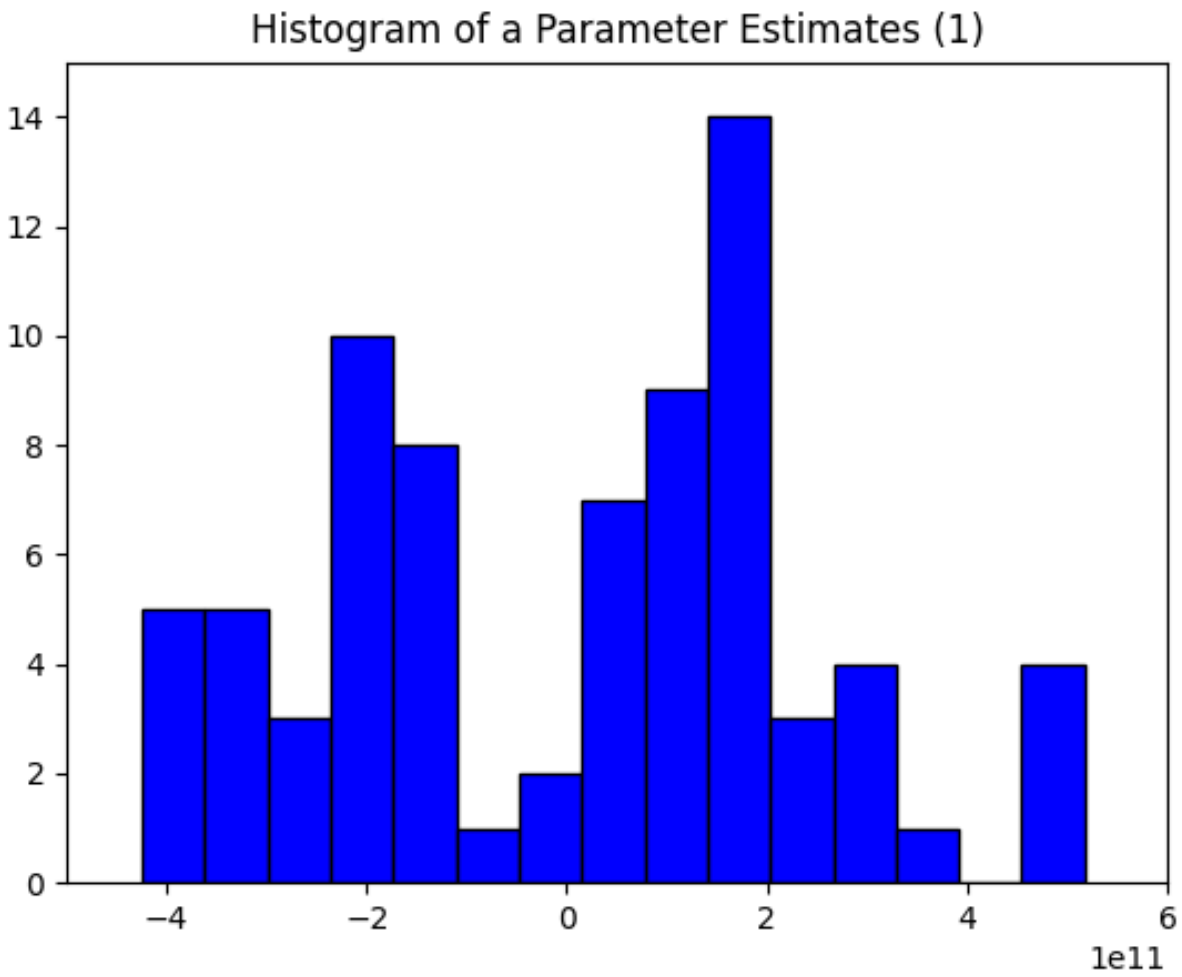


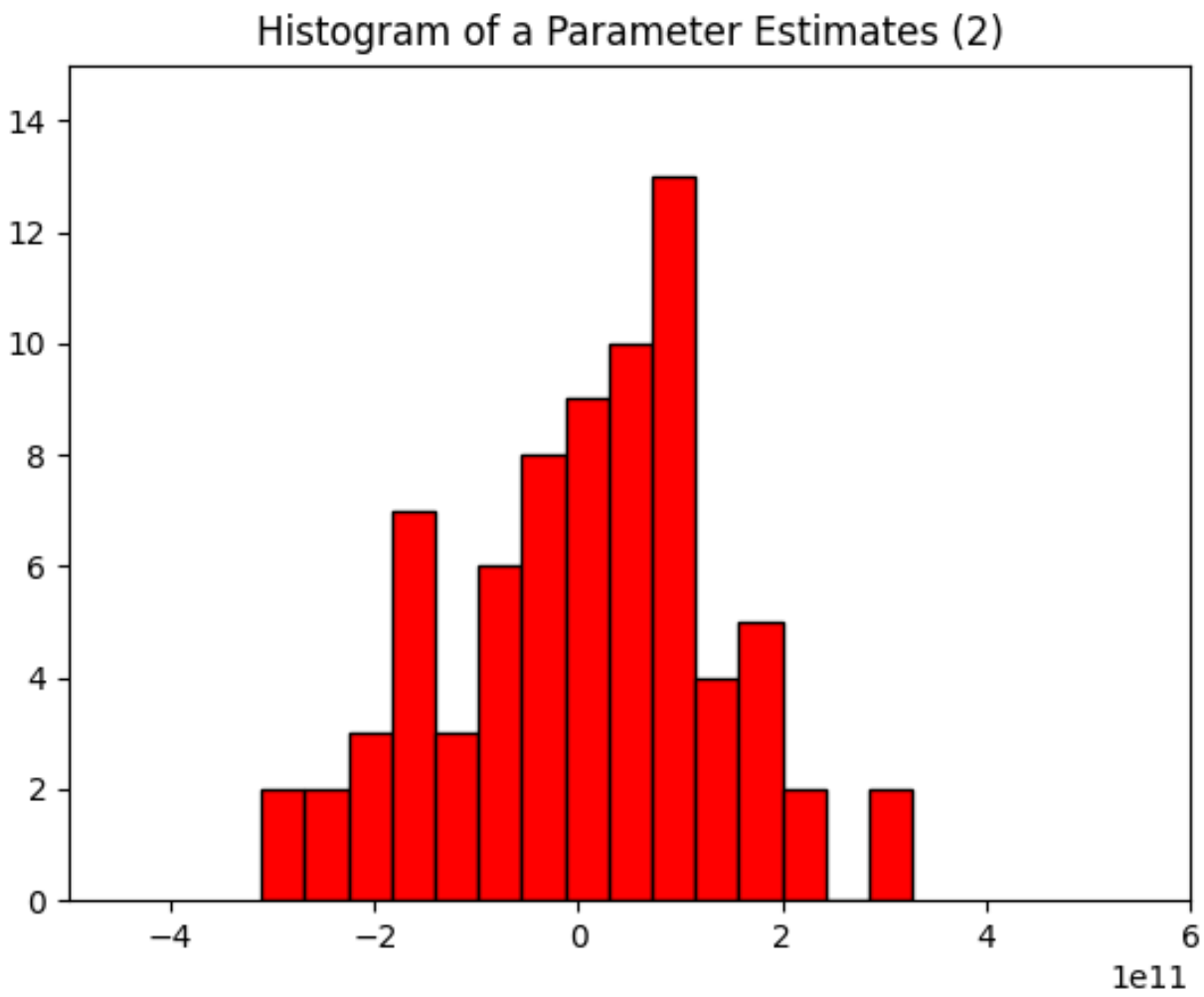


- Dependence here on peak position
- Similar shapes but wider spread and more “extremes” for Scan 1’s a estimates.
- Both have a negative values and a portion around 26.5G that is all negative.
- Some reflection of the shape of the real ROI data

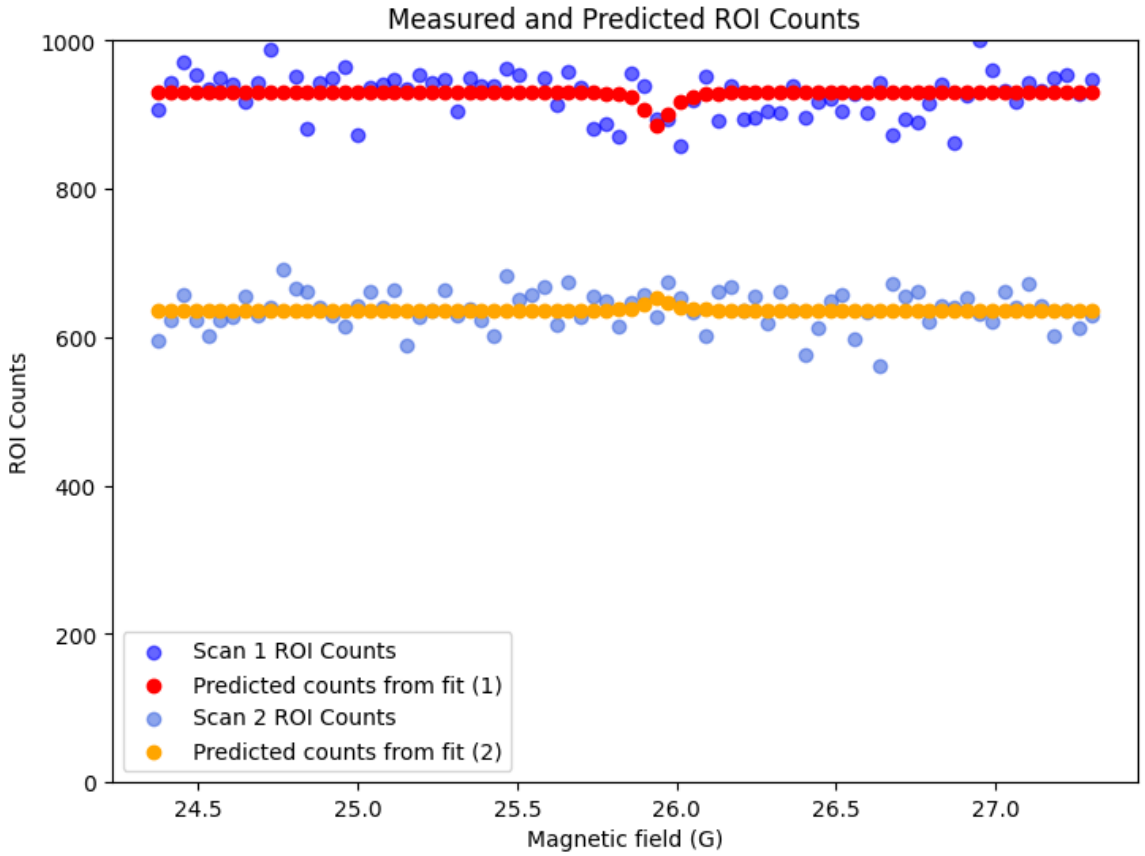
Background parameters made from both sets of real data are consistent and unaffected by where the peak is set at.

Histograms of a distribution





Extra plots



Same scatter with y axis starting at 0

ROI for nTMM

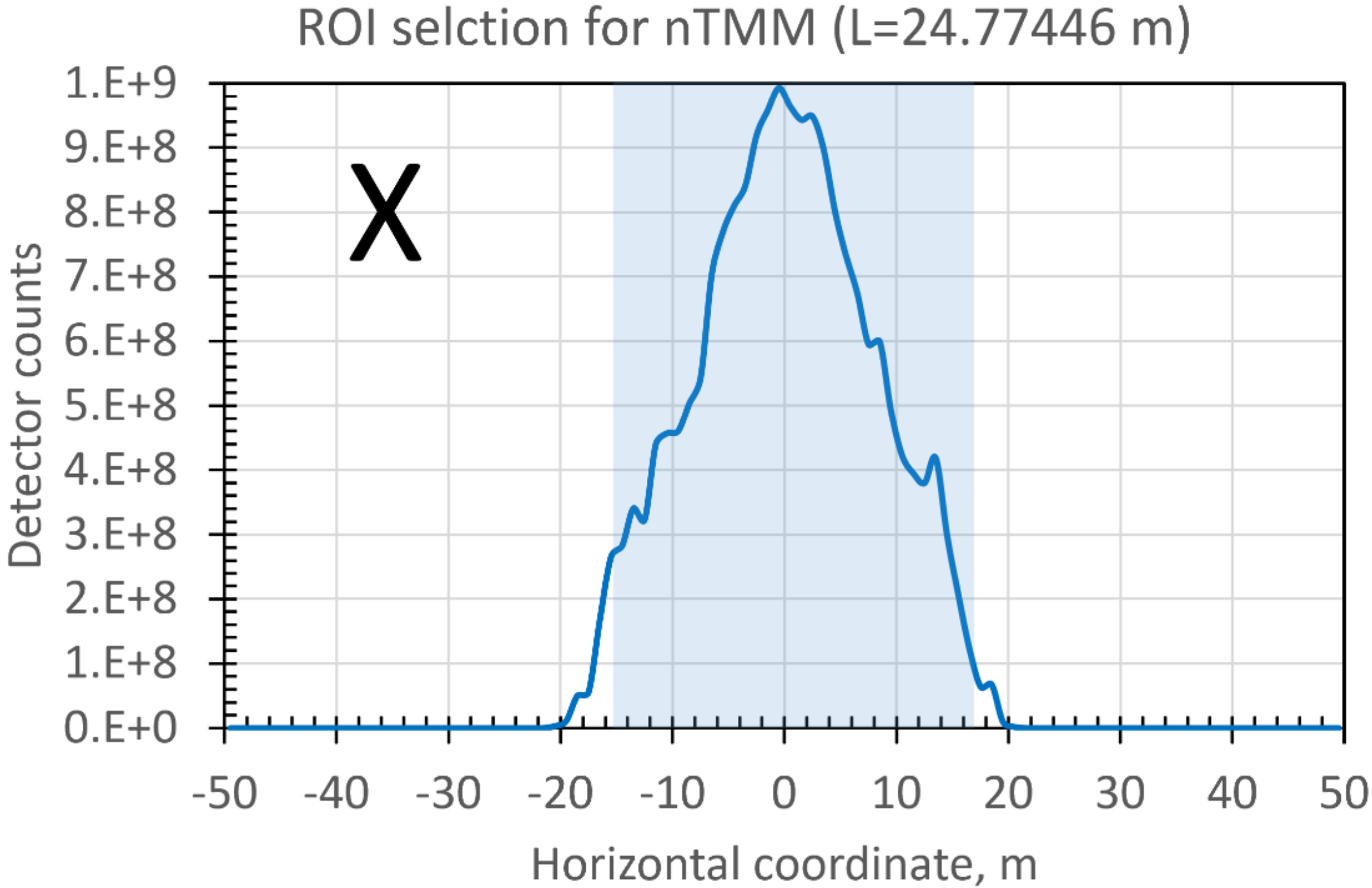
McSTAS recalculation (YK) of beam profile on the detector for nTMM
the source : exit of collimator 6 (exit of collimator 8 used from McSTAS)
Distance from exit #6 to the detector is 24.77446 m

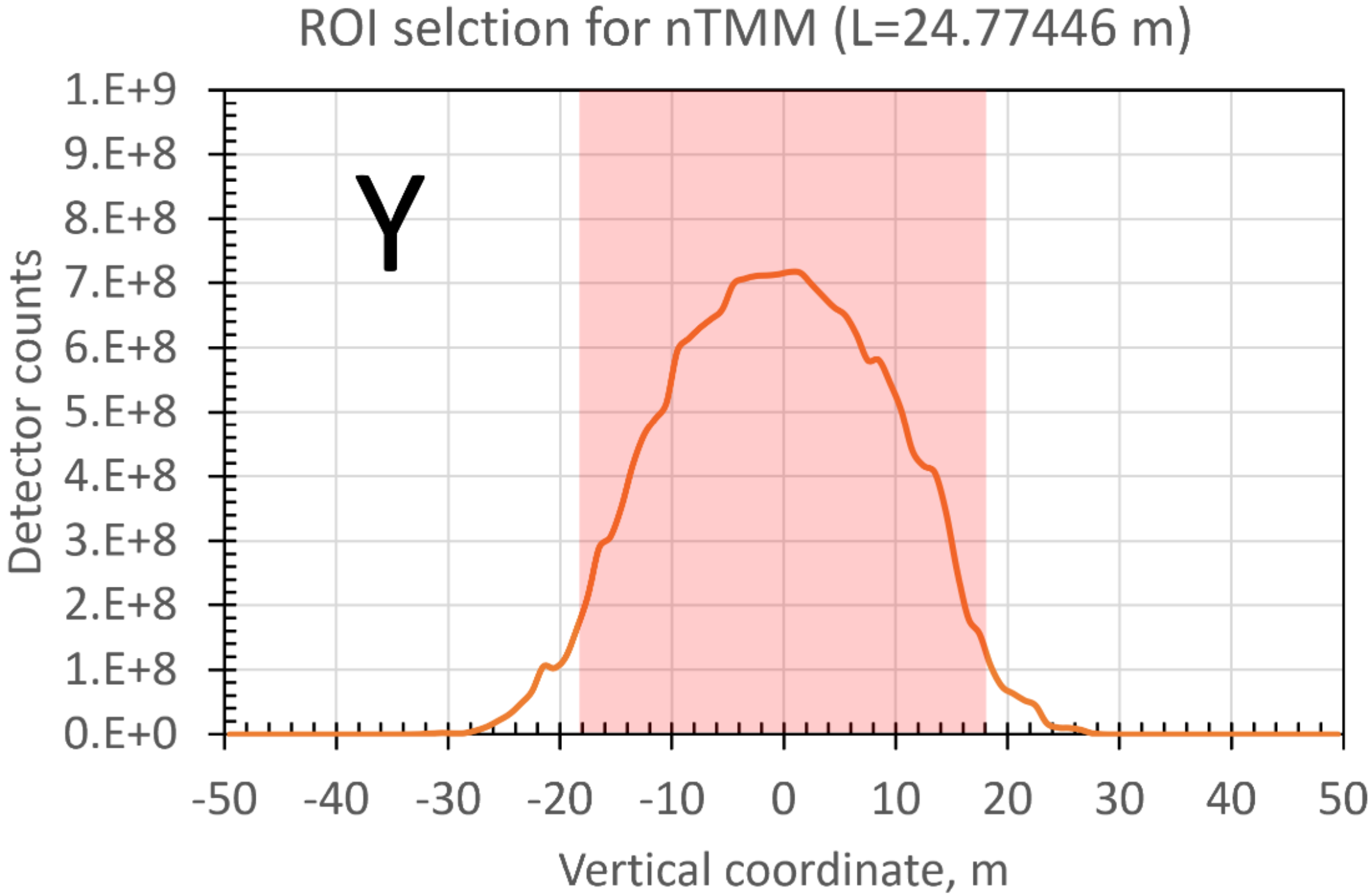
ROI should be used in analysis of nTMM scans

$$ROI_x = \pm 15\ cm$$
$$ROI_y = \pm 18\ cm$$

Efficiency of ROI selection is 90.15%

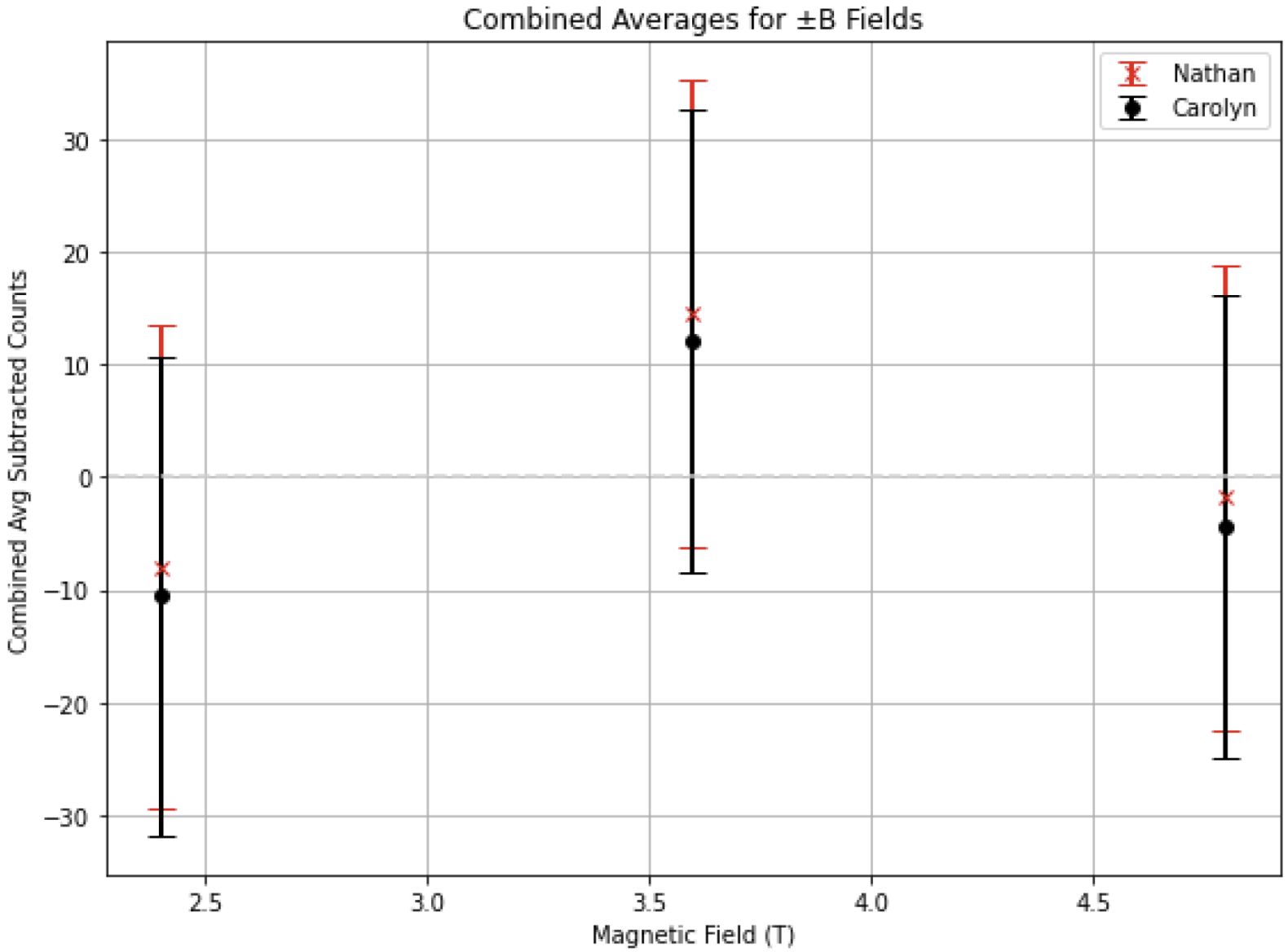
Center of ROI box should coincide with the center of punch-through peak


ROI selction for nTMM (L=24.77446 m)
Detector counts
1.E+9
9.E+8
8.E+8
7.E+8
6.E+8
5.E+8
4.E+8
3.E+8
2.E+8
1.E+8
0.E+0
X
-50
-40
-30
-20
-10
0
10
20
30
40
50
Horizontal coordinate, m


ROI selction for nTMM (L=24.77446 m)
Y
Detector counts
1.E+9
9.E+8
8.E+8
7.E+8
6.E+8
5.E+8
4.E+8
3.E+8
2.E+8
1.E+8
0.E+0
-50
-40
-30
-20
-10
0
10
20
30
40
50
Vertical coordinate, m

November 03, 2025

Carolyn & Nathen Fanal Detector Counts numbers



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B	Carolyn	Nathan	% Diff
±2.4	1.34E-11	1.46E-11	8.76
±3.6	2.21E-11	2.33E-11	5.22
±4.8	1.52E-11	1.63E-11	6.90
All	9.62E-12	1.08E-11	12.21

These subtraction averages are with ROI efficiency correction.
The table shows the averages divided by intensity given by James.

November 03, 2025

Mubu Khan (UKY) – Confirmed Final Transmission Values of GP-SANS Windows

	Orientation	Abs	Coh	Incoh	Total
Si (NIST)	Unknown	Included	Not included	Included	0.973296 ± 0.000000
Si (McStas)	111	Not included	Included	Not included	0.936219 ± 0.022807
Al2O3 (NIST)	Unknown	Included	Not included	Included	0.956682 ± 0.000000
Al2O3 (McStas)	C – axis	Not included	Included	Not included	0.940846 ± 0.022885

0.91122 ± 0.02220

0.90009 ± 0.02189