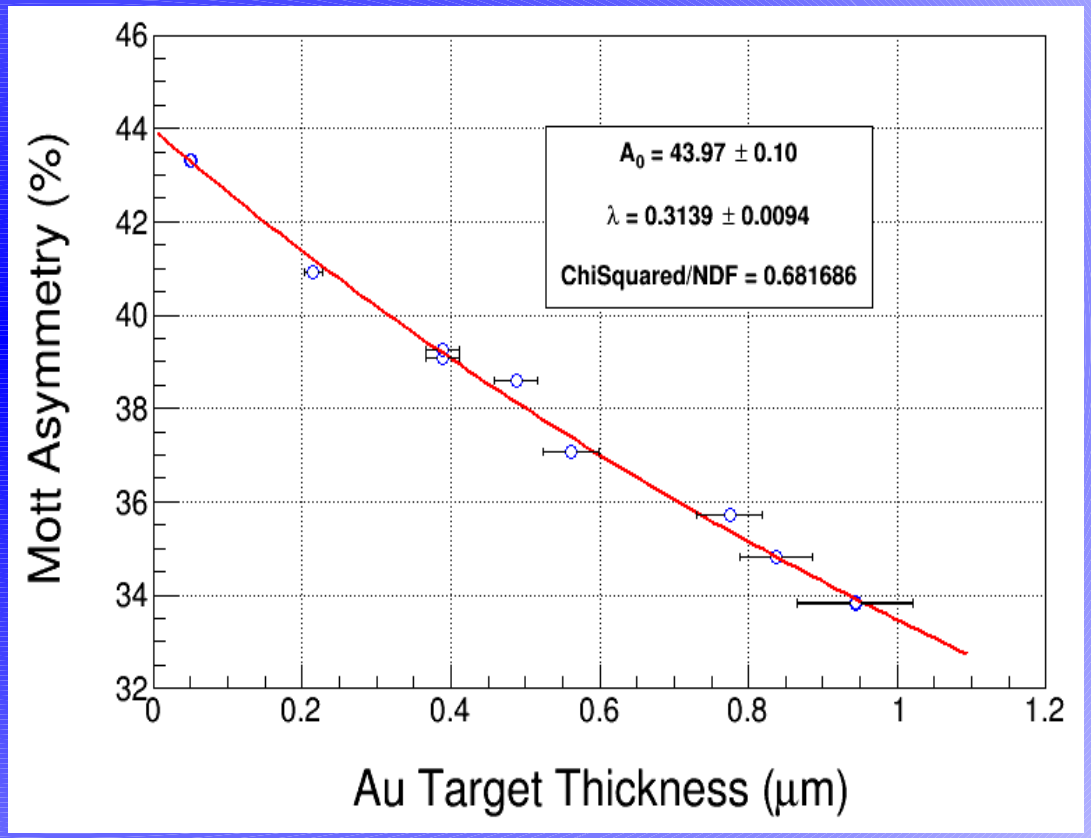
Mott Run 2 Analysis

- Asymmetry versus Thickness: Run 2 versus Run 1 with nominal cuts: E: -1 to + 3 sigma, Time-of-Flight -2 to + 2 sigma
- Asymmetry versus Thickness: Exploring Asymmetry Depedence on Energy Cut in Half-Sigma Slices
- Detector Energy Resolution – Energy Spread Corrected
- Relative Rates Measurement Results

Asymmetry vs Thickness

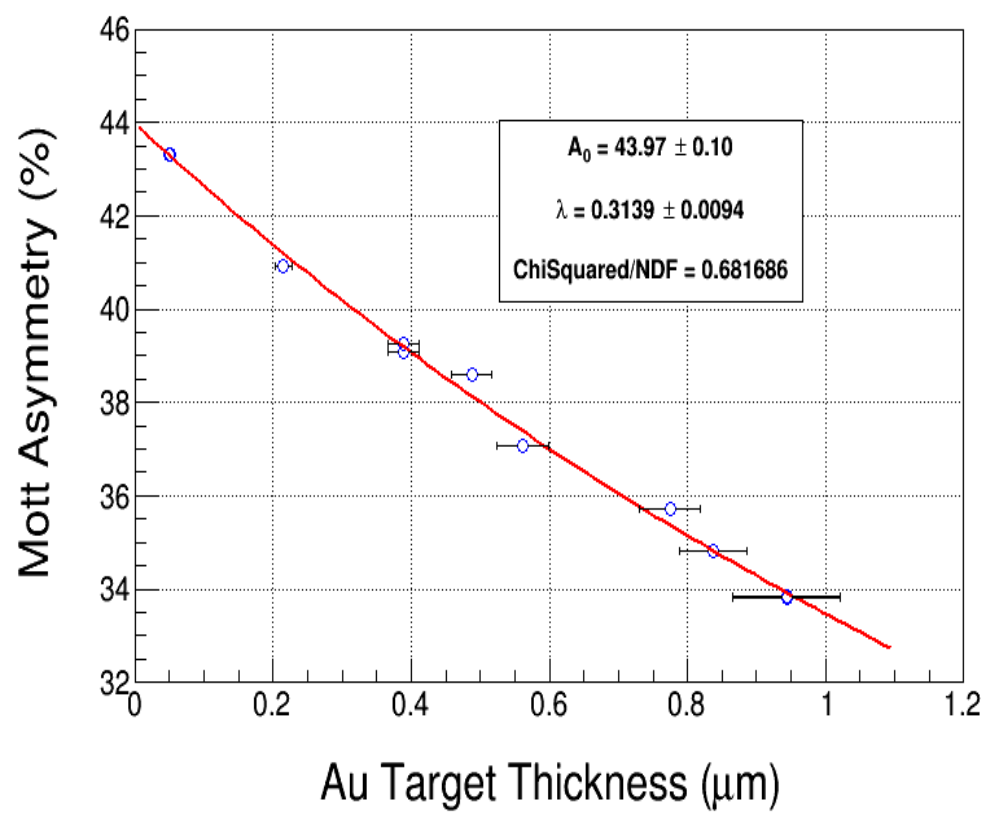
Run 2 – E-Cut: -1 to +3 Sigma, ToF-Cut -2 to +2 Sigma

Target Ladder Position	Nominal Thickness (nm)	FESEM Thickness (nm)	d(FESEM Thickness) (nm)	Asymmetry (%)	d(Asymmetry) %
15	1000	943.71	78.19	33.817	0.0729
2	625	561.18	37.24	37.075	0.0758
13	50	52.03	5.99	43.310	0.1030
14	350	389.44	22.21	39.083	0.0944
3	870	836.76	48.76	34.828	0.0896
1	225	215.17	12.57	40.928	0.0932
4	750	774.57	44.33	35.703	0.0915
5	500	487.58	28.78	38.602	0.0925
12	50	*50.00*	*5.00*	43.311	0.1043
8	350	389.44	22.21	39.264	0.0941
15	1000	943.71	78.19	33.859	0.0445

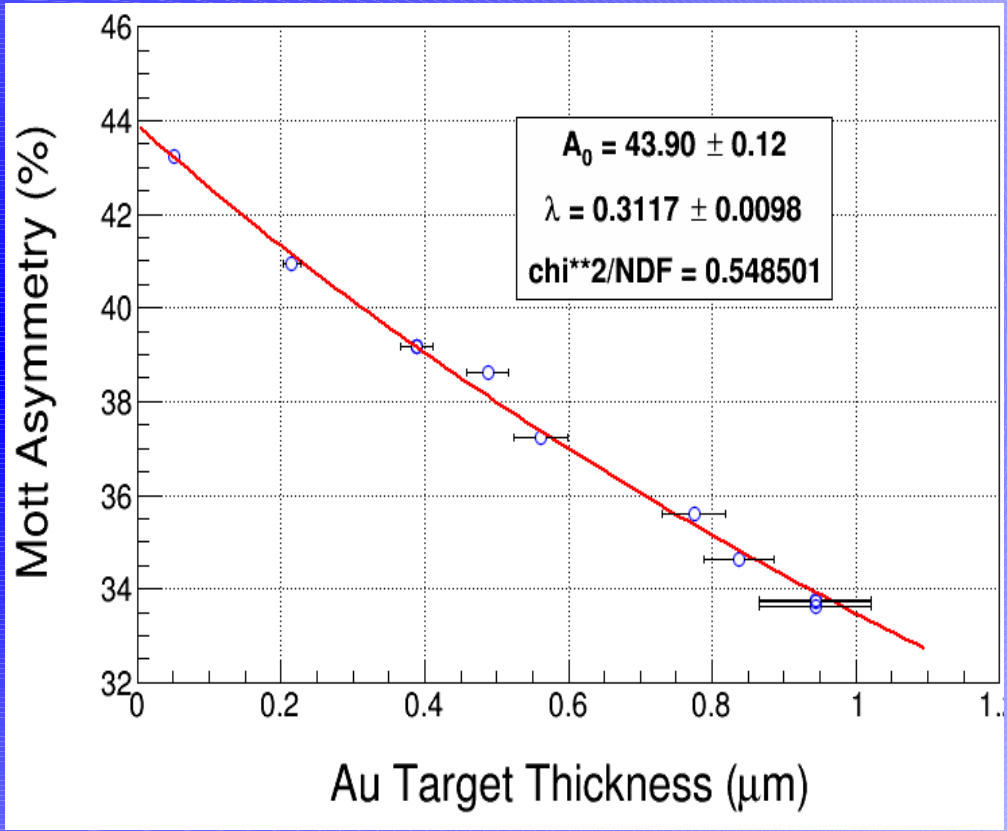


Asymmetry vs Thickness

Run 2 versus Run 1 – Nominal Cuts



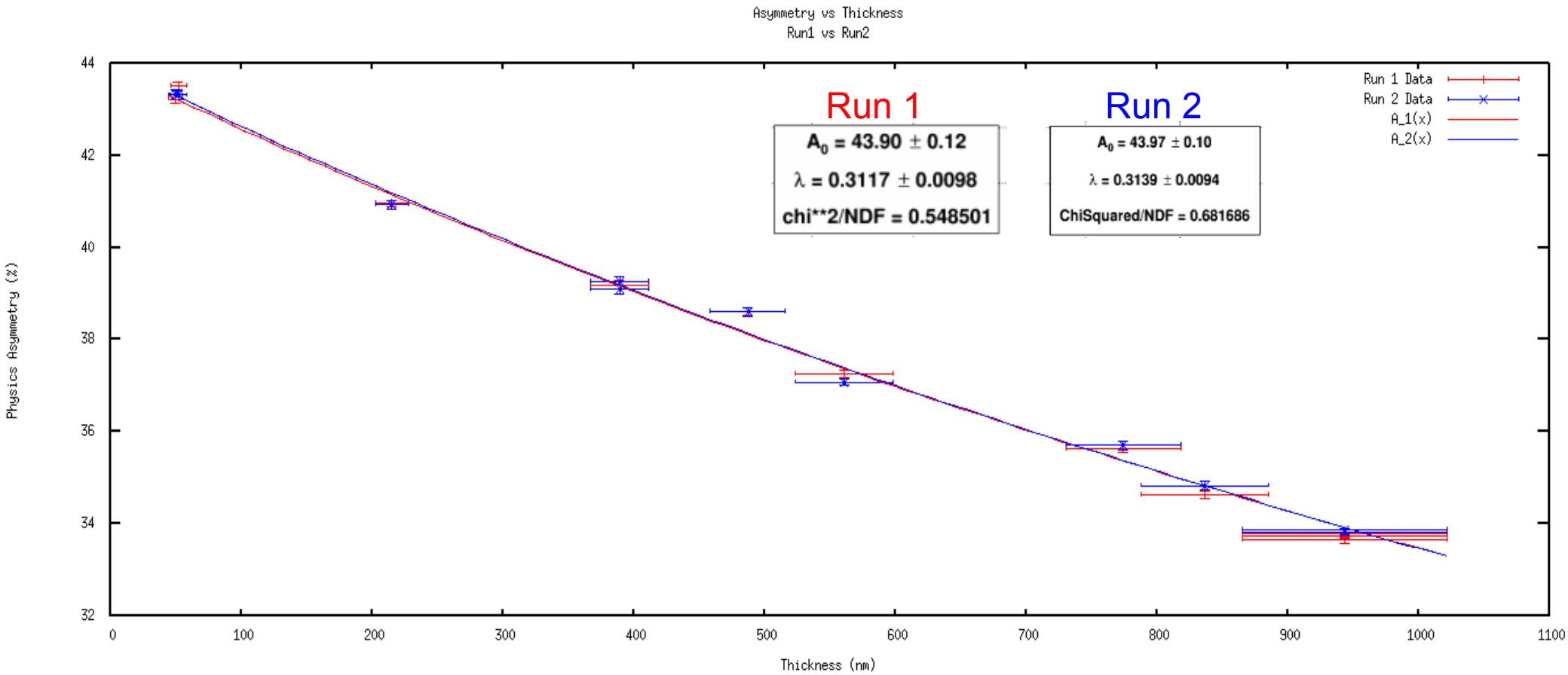
Run 2



Run 1

Asymmetry vs Thickness

Run 2 versus Run 1 – Nominal Cuts



Asymmetry vs Thickness

Run 2 versus Run 1 – Nominal Cuts

Foil				Run 1		Run 2		Asymmetry		
Target Ladder Position	Nominal Thickness (nm)	FESEM Thickness (nm)	d(FESEM Thickness) (nm)	Physics Asymmetry (%)	d(Asymmetry) (%)	Physics Asymmetry (%)	d(Asymmetry) (%)	Percent Difference (%)	Run 2 within Run 1	Run 1 within Run 2
15	1000	943.71	78.19	33.774	0.0801	33.817	0.0729	0.126	yes	no
3	870	836.76	48.76	34.622	0.0782	34.828	0.0896	0.595	no	yes
4	750	774.57	44.33	35.618	0.0817	35.703	0.0915	0.240	no	no
2	625	561.18	37.24	37.246	0.0840	37.075	0.0758	0.460	yes	no
5	500	487.58	28.78	38.608	0.0825	38.602	0.0925	0.016	no	yes
14	350	389.44	22.21	39.185	0.0897	39.083	0.0944	0.261	yes	no
8	350	389.44	22.21	39.182	0.0829	39.264	0.0941	0.209	yes	no
1	225	215.17	12.57	40.959	0.0722	40.928	0.0932	0.076	no	yes
12	50	*50.00*	*5.00*	43.221	0.0887	43.311	0.1043	0.207	no	no
13	50	52.03	5.99	43.506	0.0872	43.310	0.1030	0.451	yes	no
15-stability	1000	943.71	78.19	33.643	0.0614	33.859	0.0445	0.638	no	yes
								A_0	0.159	yes	yes
								Lambda	0.703	yes	no

$A_0 = 43.90 \pm 0.12$

$\lambda = 0.3117 \pm 0.0098$

chi**2/NDF = 0.548501

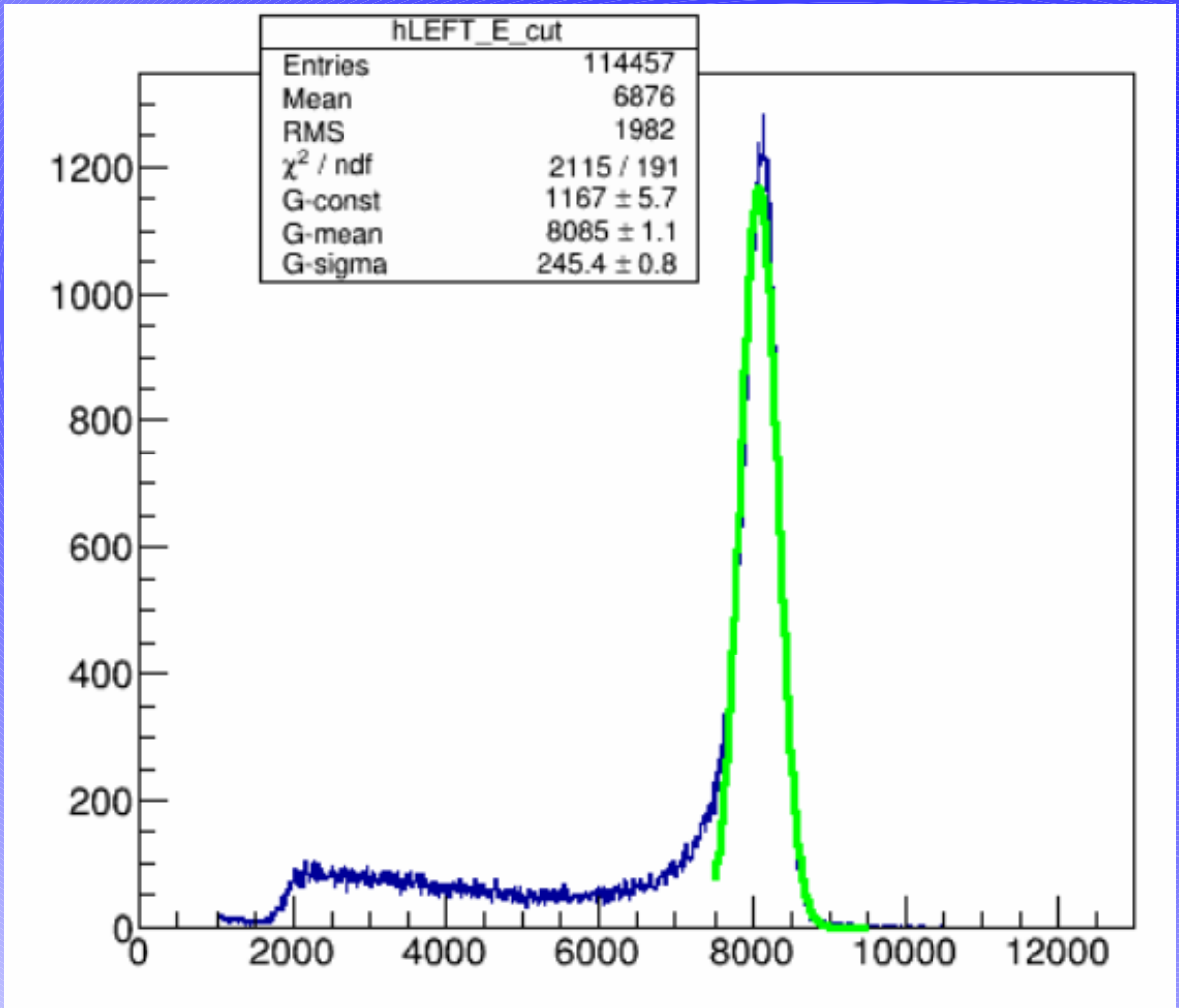
$A_0 = 43.97 \pm 0.10$

$\lambda = 0.3139 \pm 0.0094$

ChiSquared/NDF = 0.681686

Asymmetry Depedence on Energy Cut

- Computed asymmetry for half-sigma-width slices from -4 to +4 sigma of the Gaussian ToF-cut Energy Spectra fit



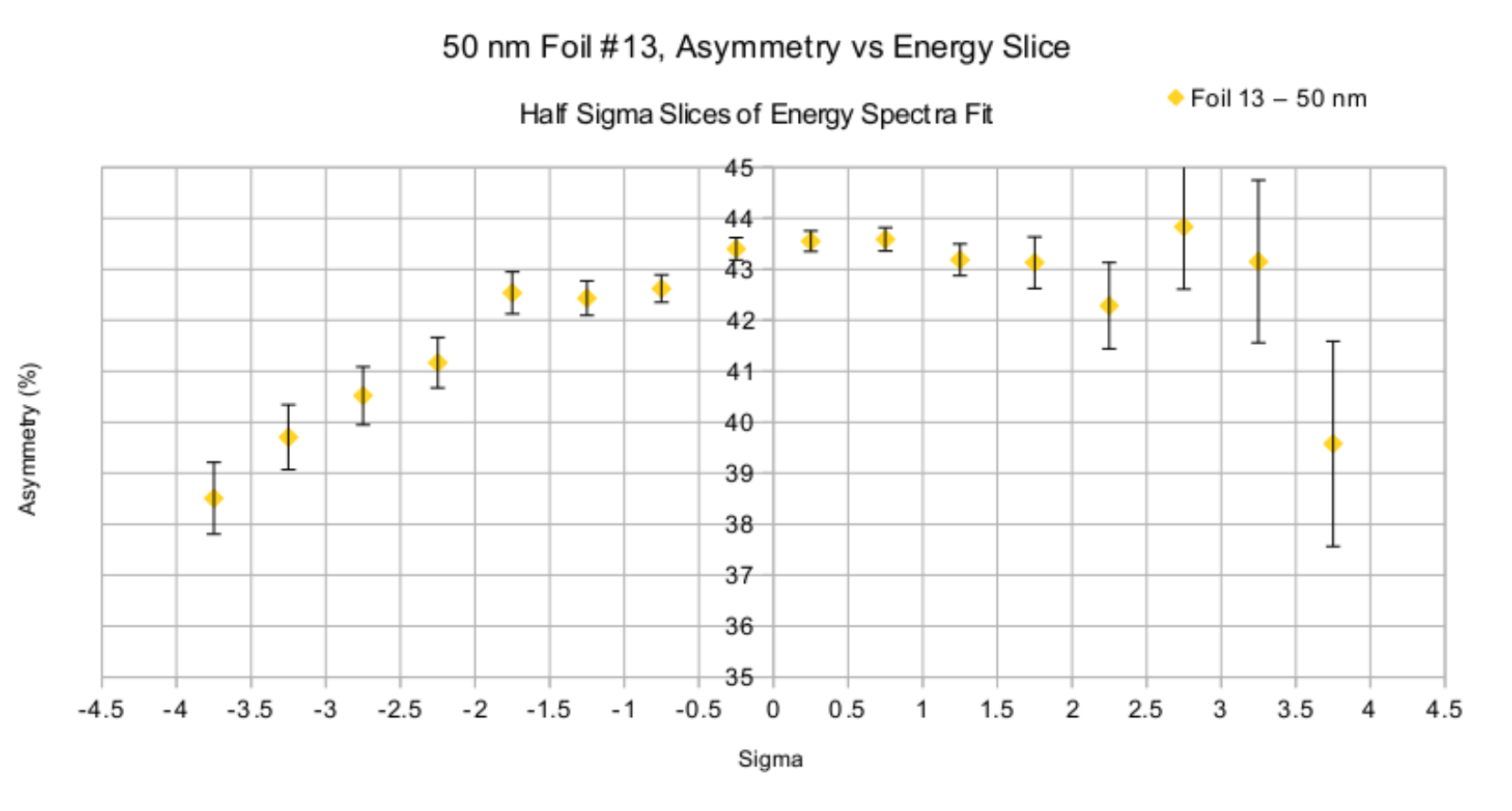
Units of Sigma : Channels

-4 to -3.5 : 7105 to 7228
-3.5 to -3 : 7228 to 7350
...
-0.5 to mean : 7963 to 8085
Mean to 0.5 : 8085 to 8208
0.5 to 1 : 8208 to 8330
...

Mean : 8085
Sigma : 245

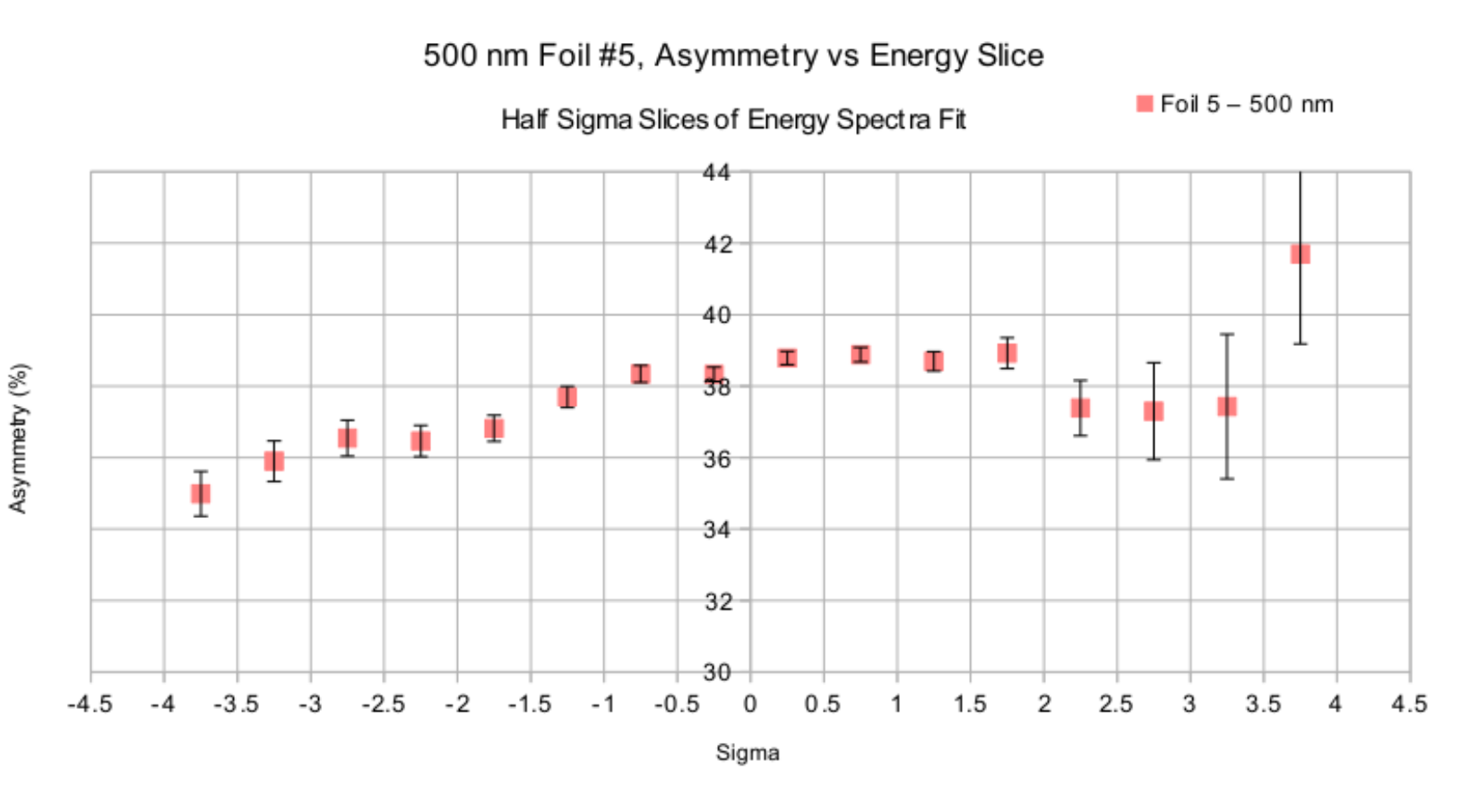
Asymmetry Depedence on Energy Cut

Thin Foil 13, 50 nm



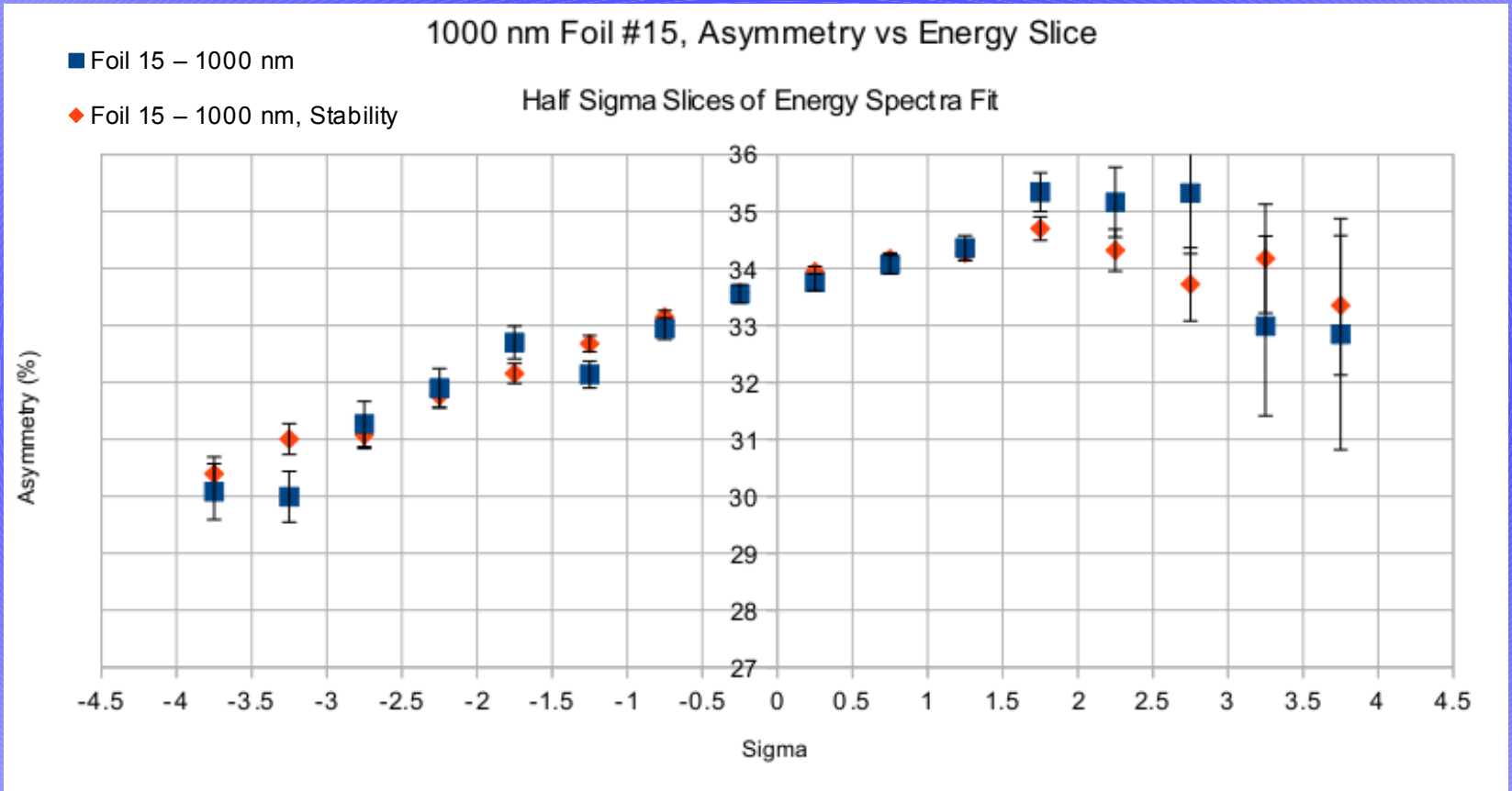
Asymmetry Depedence on Energy Cut

Medium Foil 5, 500 nm

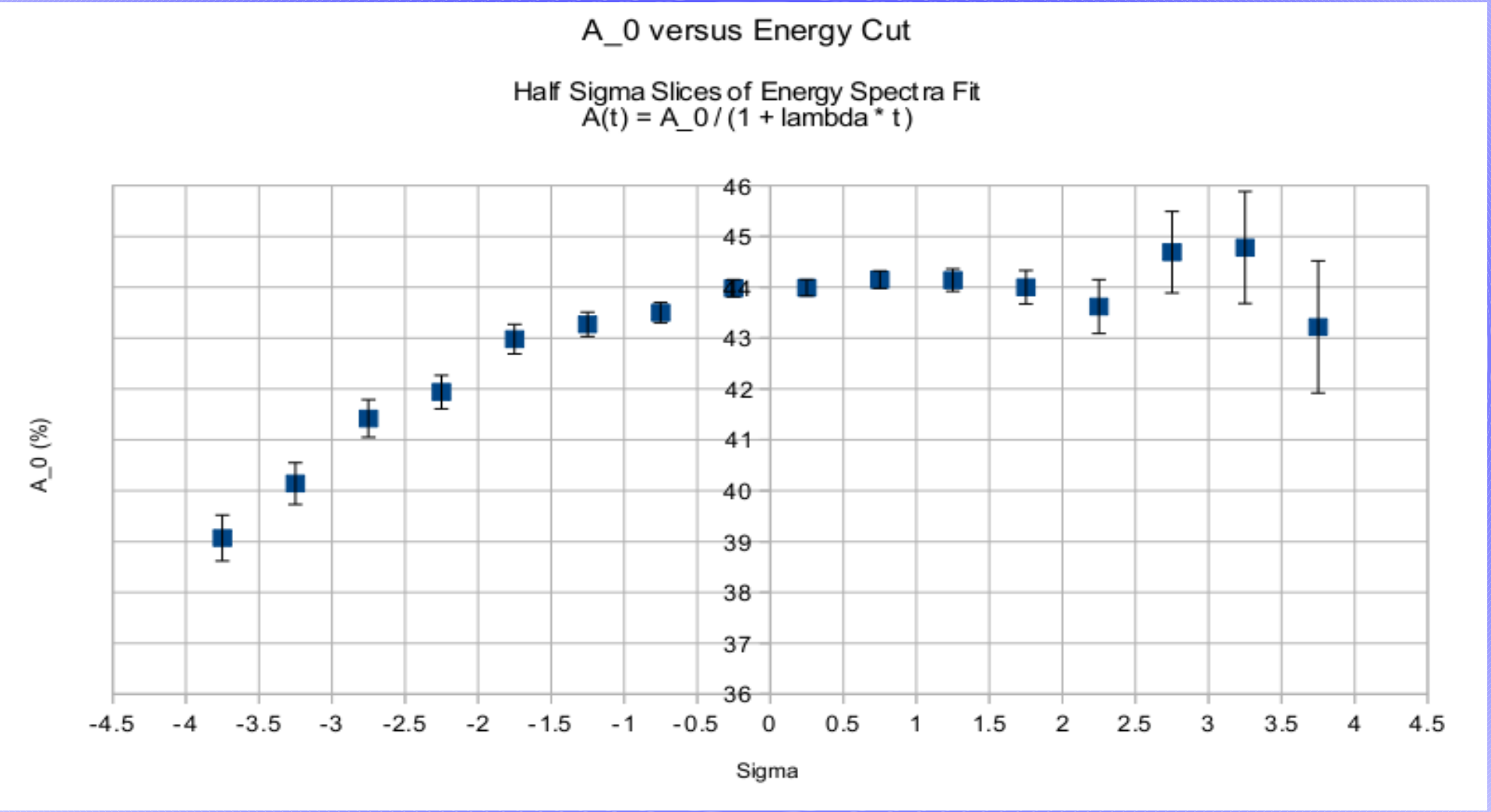


Asymmetry Depedence on Energy Cut

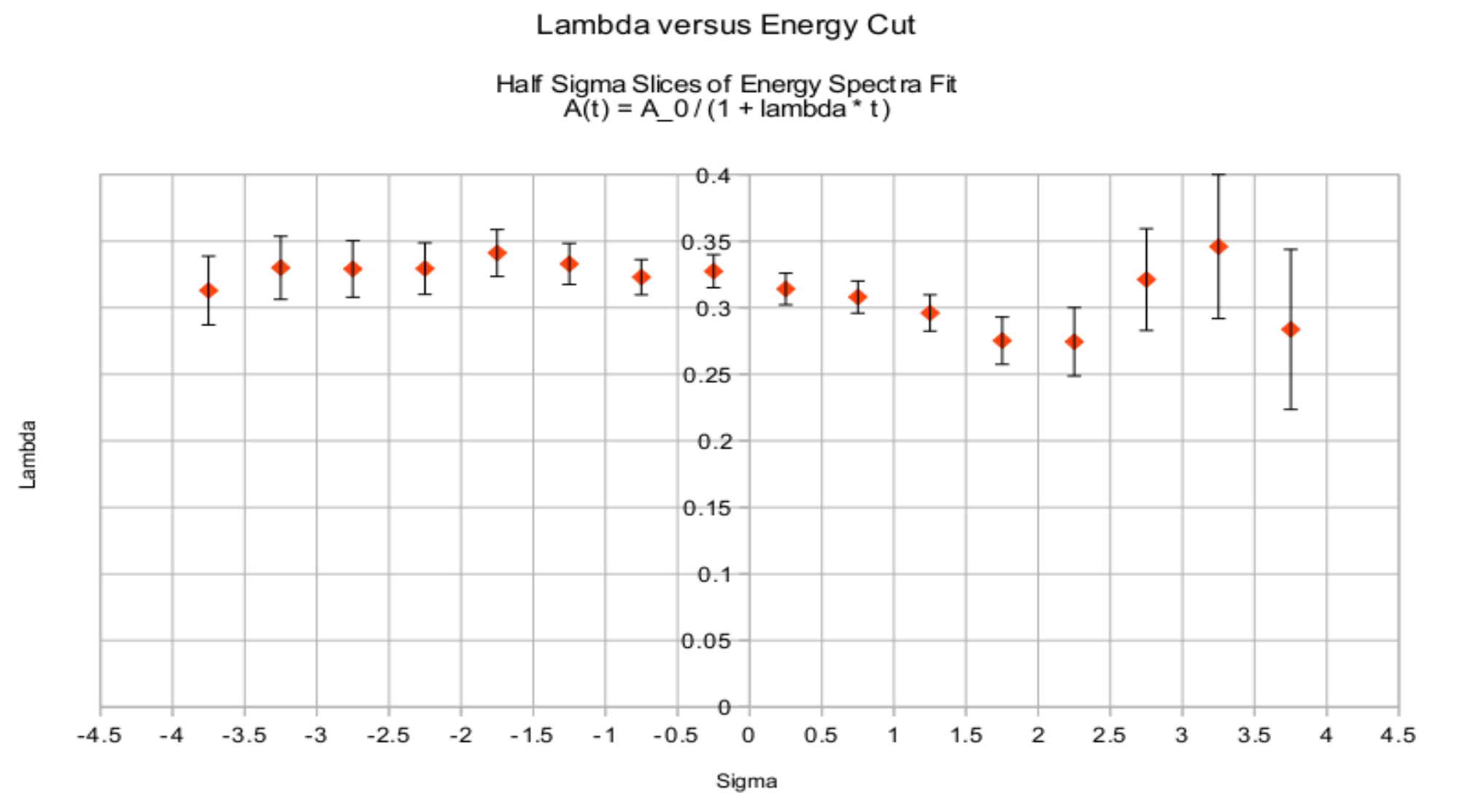
Thick Foil 15, 1000 nm



Asymmetry Depedence on Energy Cut A_0



Asymmetry Depedence on Energy Cut
Lambda



Asymmetry Dependence on Energy Cut plots for every foil on wiki.

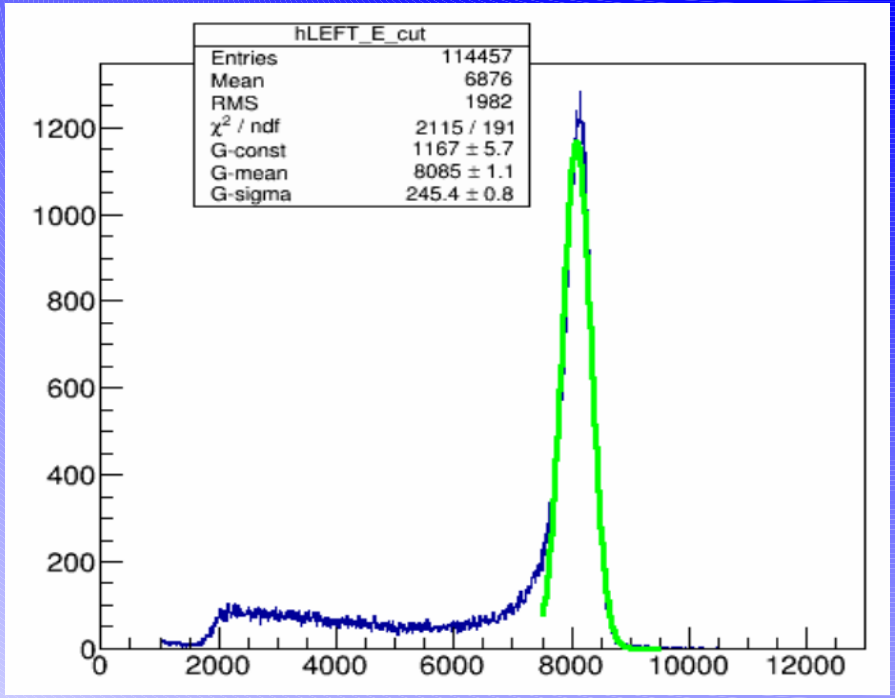
Asymmetry Depedence on Energy Cut

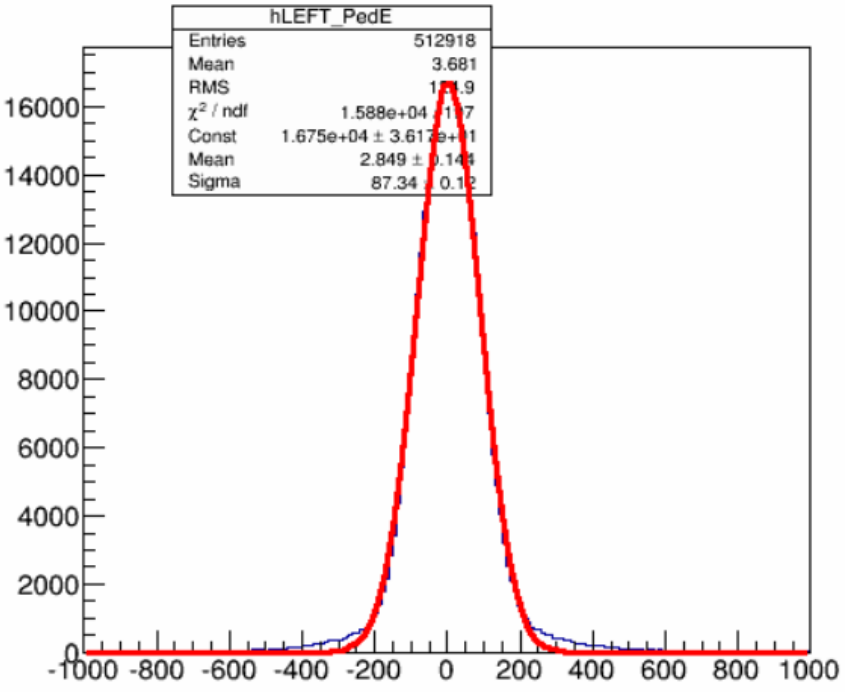
E-fit sigmas	A_0	d(A_0)	lambda	d(lambda)	Chi^2/NDF
-4 to -3.5	39.07	0.45	0.3129	0.0259	0.955
-3.5 to -3	40.14	0.41	0.33	0.0237	1.445
-3 to -2.5	41.42	0.37	0.3291	0.0213	0.751
-2.5 to -2	41.94	0.33	0.3293	0.0193	0.284
-2 to -1.5	42.98	0.29	0.3411	0.0176	0.394
-1.5 to -1	43.27	0.24	0.3329	0.0154	0.726
-1 to -0.5	43.5	0.2	0.3229	0.0132	0.613
-0.5 to mean	43.98	0.17	0.3274	0.0124	0.512
mean to 0.5	43.99	0.16	0.314	0.0119	1.921
0.5 to 1	44.15	0.17	0.308	0.0121	0.583
1 to 1.5	44.14	0.22	0.296	0.0137	0.574
1.5 to 2	44	0.33	0.2752	0.0177	1.12
2 to 2.5	43.62	0.53	0.2744	0.0256	1.178
2.5 to 3	44.69	0.8	0.3211	0.0383	0.616
3 to 3.5	44.78	1.1	0.3458	0.0541	0.789
3.5 to 4	43.22	1.3	0.2836	0.0601	0.891

Detector Energy Resolution – Energy Spread Corrected

- Energy Resolution = (mean / std dev) * 100 (%) of energy spectra
- Corrected for energy spread by fitting detector pedestal – events in a detector when no Mott events in that detector – with a gaussian
- Taking sigma from pedestal fit, corrected E-spectra sigma and recomputed energy resolution

sigma_E_corr = Sqrt (Sigma_E_uncorr^2 – Sigma_Ped^2)





Detector Energy Resolution – Energy Spread Corrected

				Left	Detector	Right	Detector	Up	Detector	Down	Detector
Target Ladder Position	Nominal Thickness (nm)	FESEM Thickness (nm)	d(FESEM Thickness) (nm)	Energy Resolution, Before Pedestal Correction (%)	Energy Resolution, After Pedestal Correction (%)	Energy Resolution, Before Pedestal Correction (%)	Energy Resolution, After Pedestal Correction (%)	Energy Resolution, Before Pedestal Correction (%)	Energy Resolution, After Pedestal Correction (%)	Energy Resolution, Before Pedestal Correction (%)	Energy Resolution, After Pedestal Correction (%)
15	1000	943.71	78.19	3.040	2.842	3.595	3.062	3.515	2.974	3.326	2.940
2	625	561.18	37.24	3.045	2.848	3.592	3.055	3.565	3.016	3.330	2.942
13	50	52.03	5.99	3.332	3.111	3.927	3.320	3.819	3.220	3.656	3.239
14	350	389.44	22.21	2.999	2.793	3.563	3.010	3.529	2.965	3.289	2.901
3	870	836.76	48.76	2.997	2.795	3.550	3.006	3.538	2.976	3.285	2.899
1	225	215.17	12.57	2.988	2.783	3.546	2.994	3.534	2.969	3.299	2.912
4	750	774.57	44.33	2.996	2.791	3.556	3.004	3.529	2.964	3.303	2.917
5	500	487.58	28.78	2.979	2.776	3.538	2.986	3.499	2.936	3.284	2.898
12	50	*50.00*	*5.00*	3.323	3.090	3.925	3.298	3.824	3.205	3.659	3.237
8	350	389.44	22.21	2.961	2.758	3.517	2.960	3.494	2.927	3.235	2.842
15	1000	943.71	78.19	2.994	2.790	3.550	3.003	3.499	2.945	3.282	2.896

Average Change In Energy Resolution After Pedestal/Energy Spread Correction –
Left : -0.207 % Right : -0.560 % Up : -0.568 % Down : -0.393 %

NOTE: The above table averages together runs on a given foil from the Run 2 Thickness versus Asymmetry runs

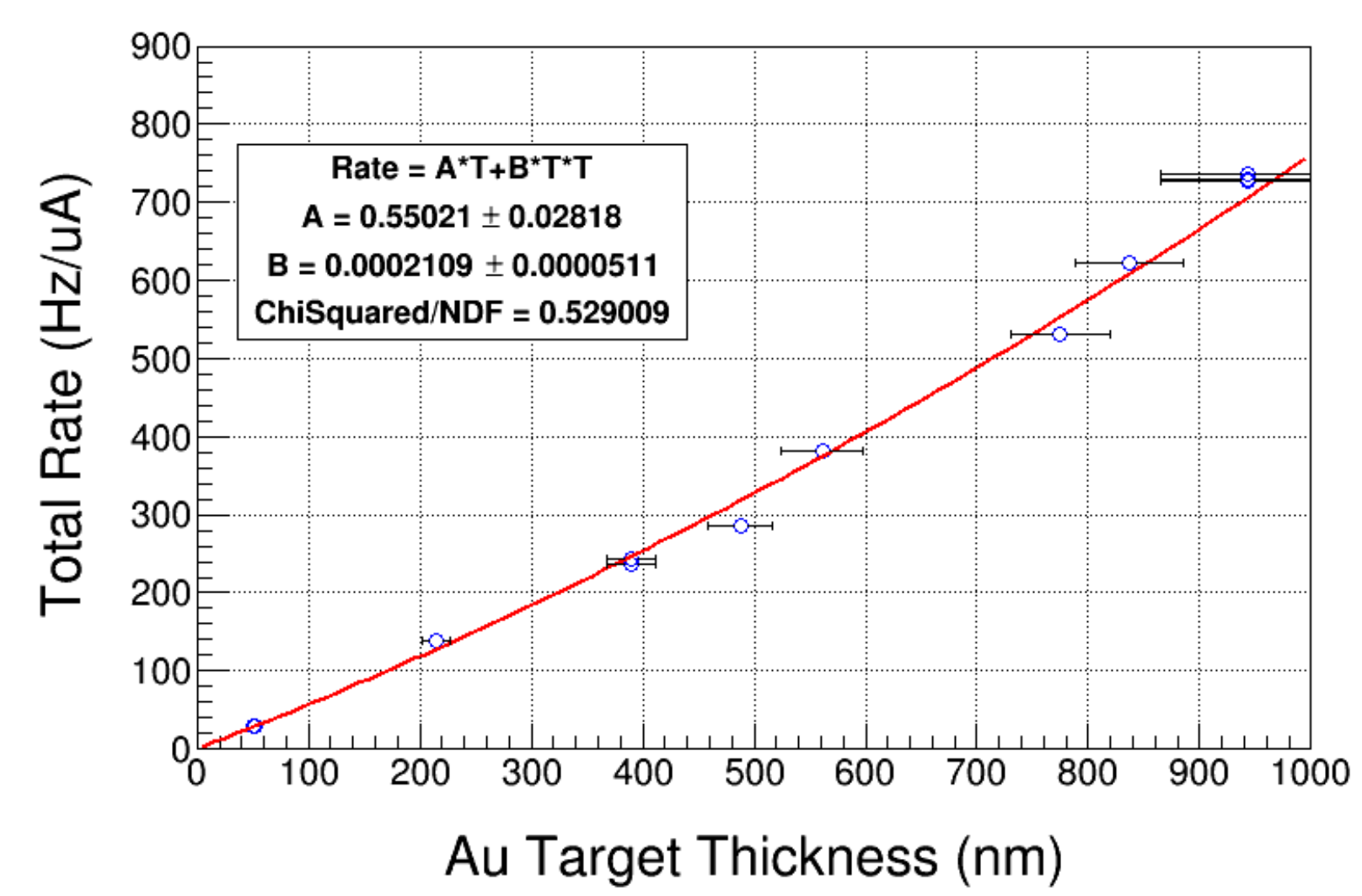
Relative Rates Measurement Results

Single Runs, all with the same current of ~1.15 uA

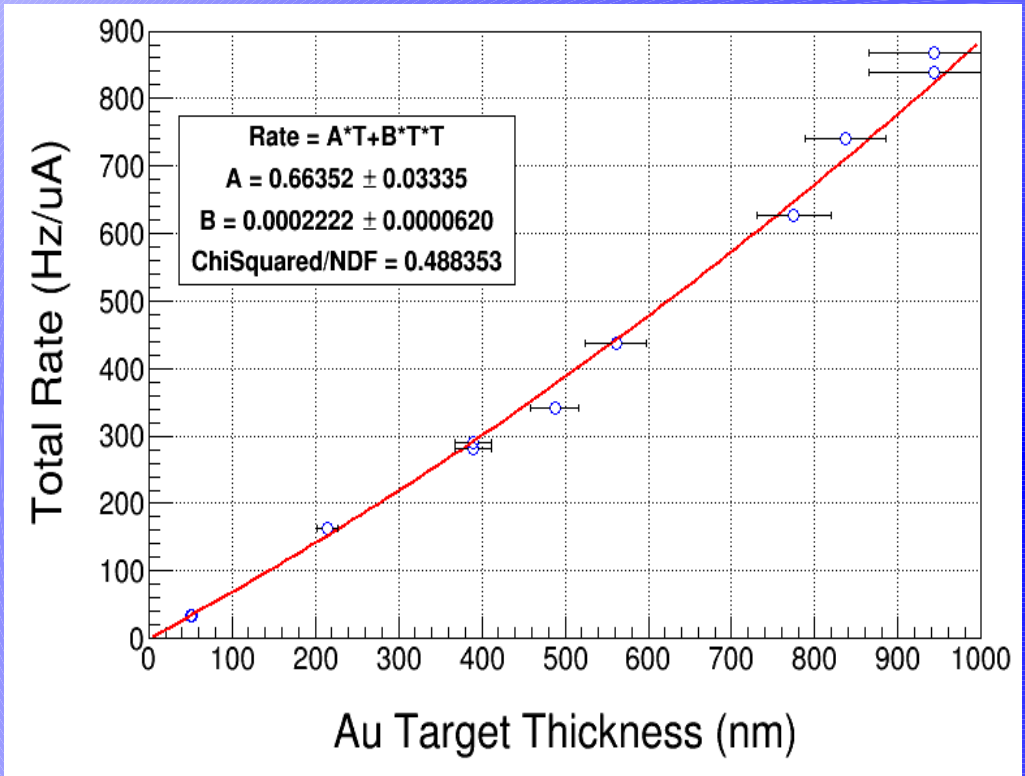
						LEFT		RIGHT		UP		DOWN	
Target Ladder Position	Nominal Thickness (nm)	FESEM Thickness (nm)	d(FESEM Thickness) (nm)	Current (uA)	d(I) (uA)	Rate (Hz / uA)	dR	Rate (Hz / uA)	dR	Rate (Hz / uA)	dR	Rate (Hz / uA)	dR
15	1000	943.71	78.19	1.152	0.0118	178.28	1.85	177.97	1.85	187.43	1.95	186.17	1.94
15	1000	943.71	78.19	1.152	0.0118	178.53	1.91	176.20	1.89	186.34	2.00	186.35	2.00
14	350	389.44	22.21	1.149	0.0117	58.13	0.62	57.98	0.62	59.95	0.64	60.23	0.64
13	50	52.03	5.99	1.148	0.0117	7.16	0.08	6.99	0.08	7.32	0.08	7.46	0.08
12	50	*50.00*	*5.00*	1.149	0.0117	7.00	0.08	6.92	0.08	7.08	0.08	7.28	0.08
8	350	389.44	22.21	1.149	0.0117	59.14	0.63	59.11	0.63	62.15	0.66	62.79	0.66
5	500	487.58	28.78	1.149	0.0117	69.09	0.73	69.51	0.74	73.13	0.78	73.01	0.78
4	750	774.57	44.33	1.148	0.0118	131.41	1.40	128.68	1.37	136.25	1.45	134.04	1.44
3	870	836.76	48.76	1.151	0.0118	153.65	1.64	149.79	1.60	160.08	1.71	159.50	1.71
2	625	561.18	37.24	1.149	0.0118	94.15	1.00	93.14	0.99	97.73	1.04	97.71	1.04
1	225	215.17	12.57	1.150	0.0117	34.37	0.37	33.44	0.36	35.68	0.38	35.29	0.38
15	1000	943.71	78.19	1.150	0.0118	179.30	1.91	181.92	1.94	188.06	2.01	186.88	2.00

Relative Rates Measurement Results

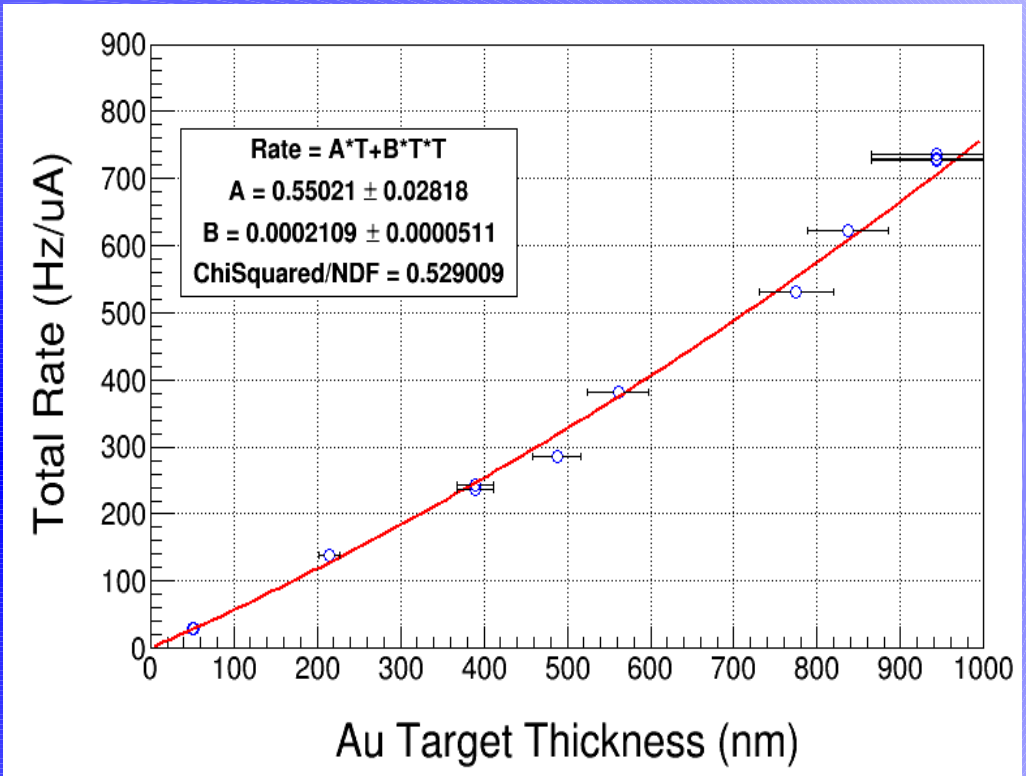
Total Rate versus Thickness



Relative Rates vs Rates from Thickness vs Asymmetry Study



Rates from Asymmetry vs Thickness



Rates from Relative Rates Measurement