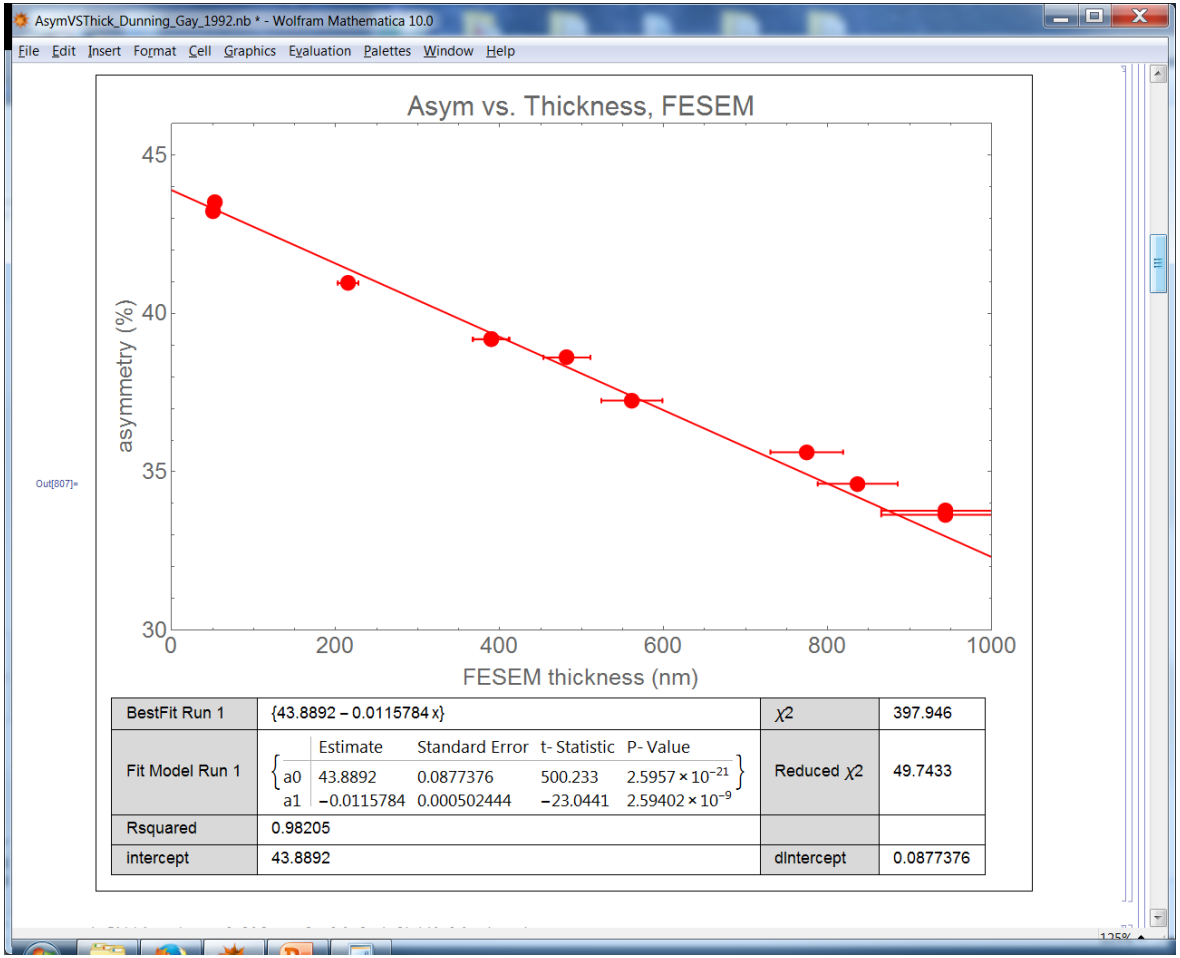
Fitting different functional forms

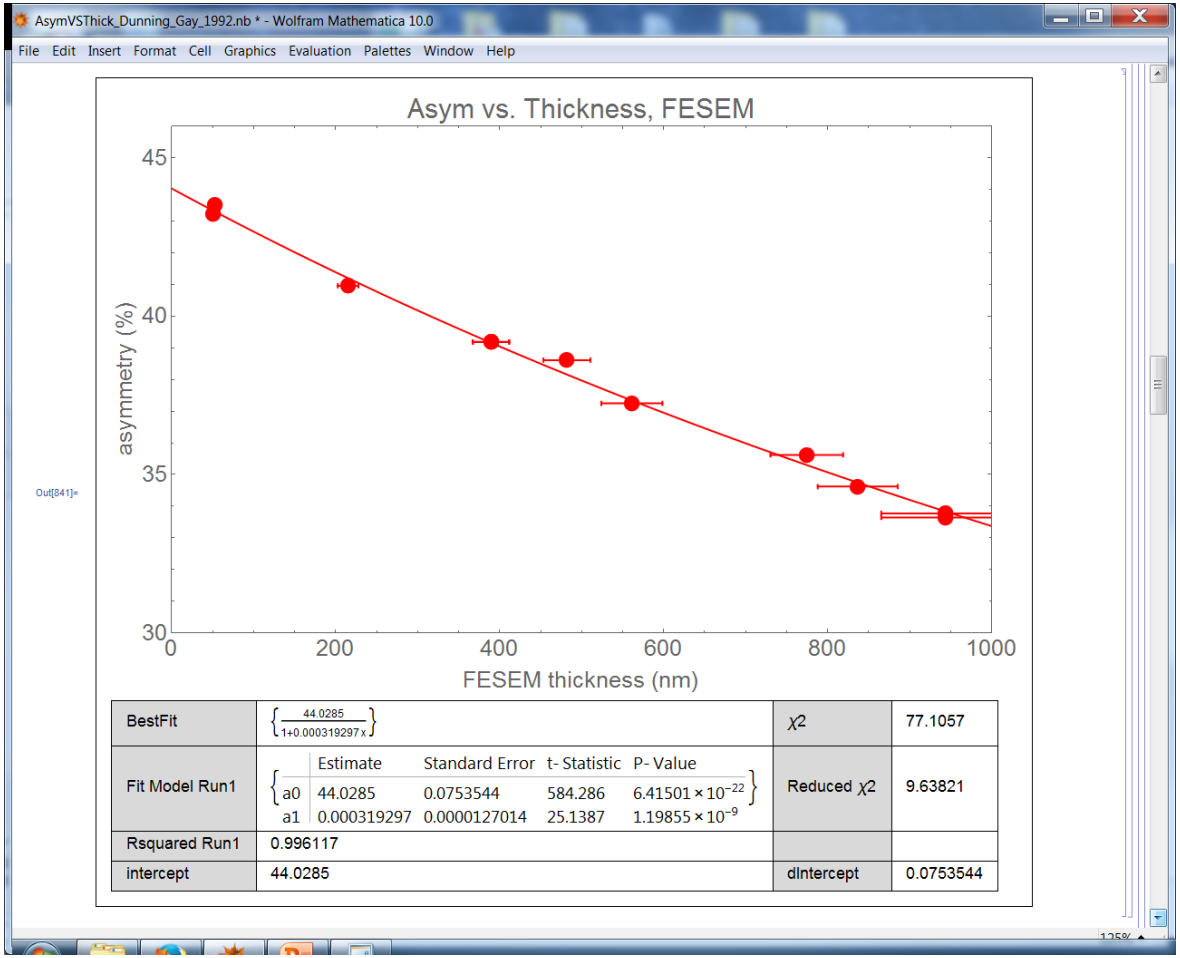
- All data from Run 1
- $\chi^2 = \sum(ydata_i\text{-}f(x_i))\text{^}2/dy_i\text{^}2)$
  - Note – this is not taking into account the x error bars right now, which is incorrect and significant
    - dividing by (dxi^2+dyi^2) makes $\chi^2 << 1$)
    - Doug notes that with the error bars in the x-direction, χ^2 isn't really applicable
  - The weight factors for the fits do take into account the x error bars only
- Reduced $\chi^2 = \chi^2 /(N-\nu-1)$, N number of data pts., $\nu=2$= number fit parameters
- $R^2=1- (\sum(ydata_i\text{-}f(x_i))\text{^}2)/(\sum(ydata_i\text{-mean(ydata)})\text{^}2)$

Fitting to A = a+bT



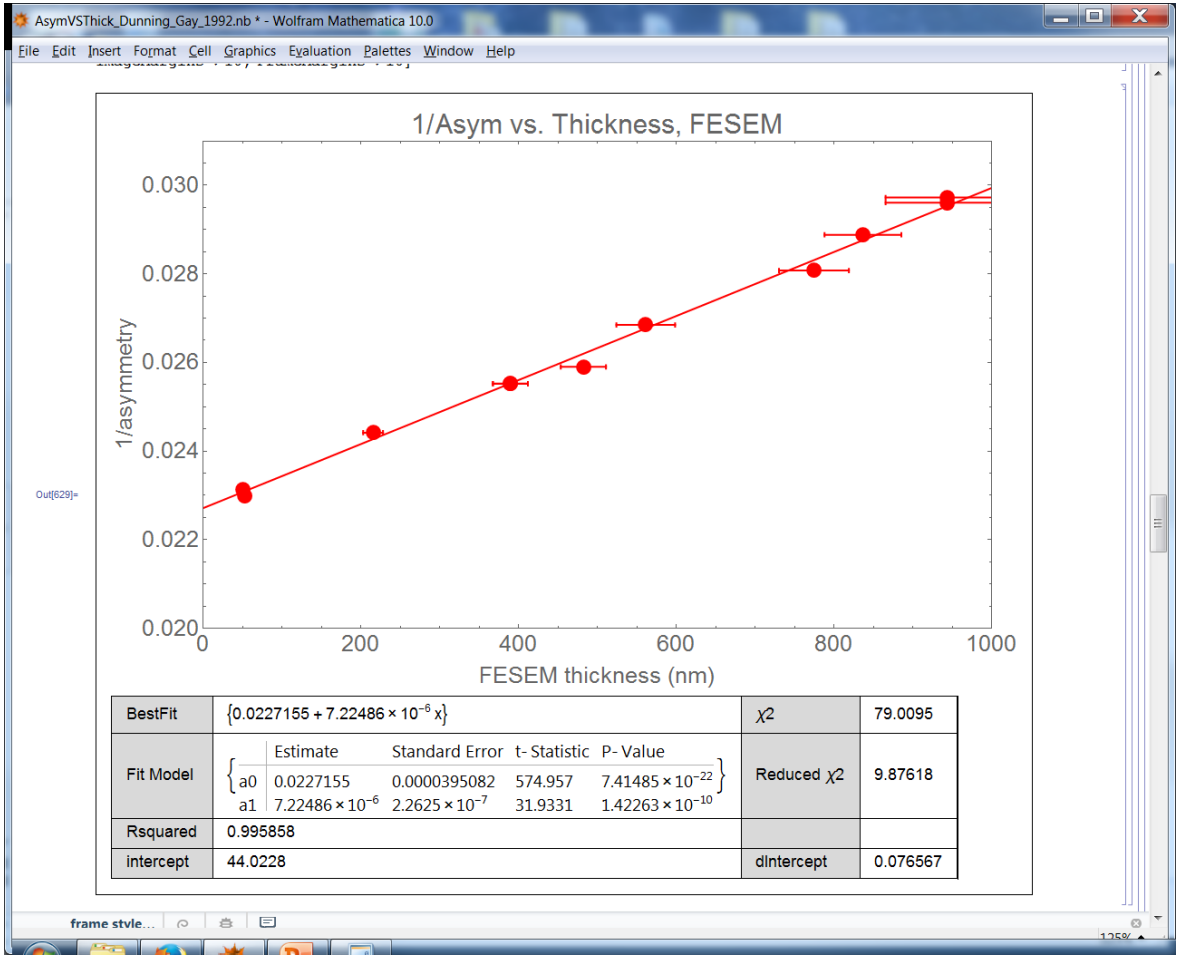
BestFit Run 1	{43.8892 – 0.0115784 x}					χ^2	397.946
Fit Model Run 1		Estimate	Standard Error	t- Statistic	P- Value	Reduced χ^2	49.7433
	a0	43.8892	0.0877376	500.233	2.5957×10^{-21}		
	a1	−0.0115784	0.000502444	−23.0441	2.59402×10^{-9}		
Rsquared	0.98205						
intercept	43.8892					dIntercept	0.0877376

Fitting to A=a/(1+bT)



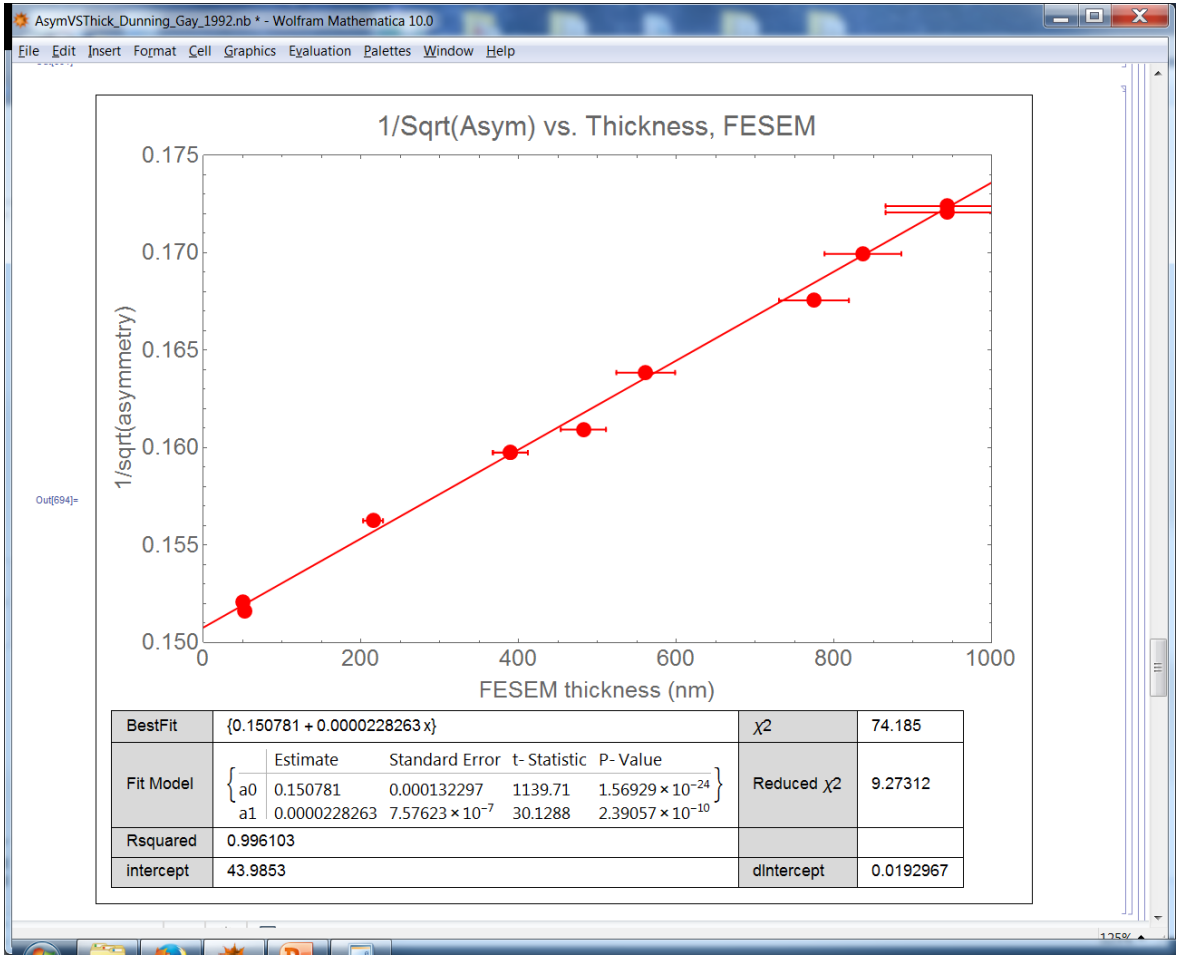
BestFit	$\left\{\frac{44.0285}{1+0.000319297\,x}\right\}$					χ^2	77.1057
Fit Model Run1		Estimate	Standard Error	t- Statistic	P- Value	Reduced χ^2	9.63821
	a0	44.0285	0.0753544	584.286	6.41501×10^{-22}		
	a1	0.000319297	0.0000127014	25.1387	1.19855×10^{-9}		
Rsquared Run1	0.996117						
intercept	44.0285					dIntercept	0.0753544

1/A=a+bT



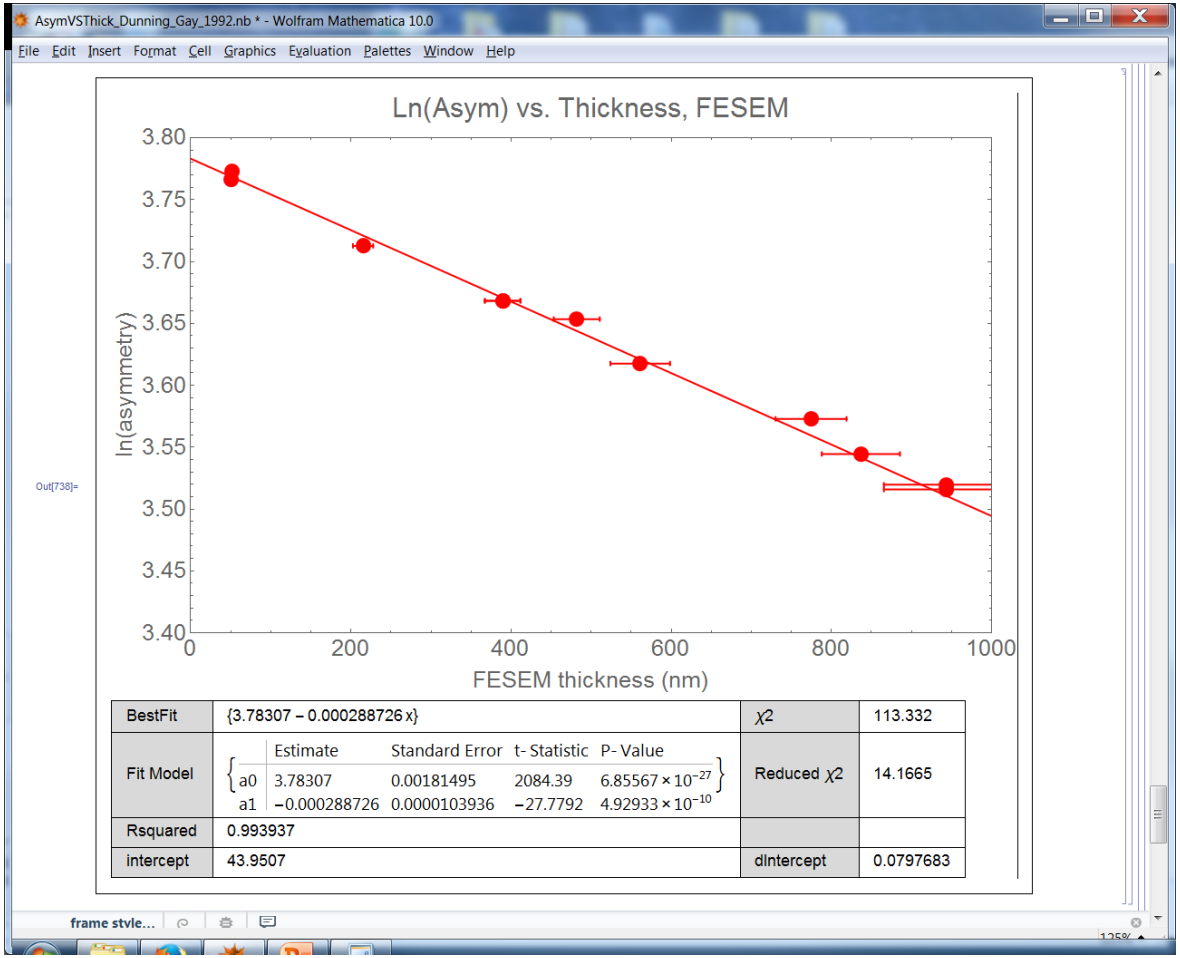
BestFit	$\{0.0227155 + 7.22486 \times 10^{-6}\, x\}$					$\chi 2$	79.0095
Fit Model		Estimate	Standard Error	t-Statistic	P-Value	Reduced $\chi 2$	9.87618
	a0	0.0227155	0.0000395082	574.957	7.41485×10^{-22}		
	a1	7.22486×10^{-6}	2.2625×10^{-7}	31.9331	1.42263×10^{-10}		
Rsquared	0.995858						
intercept	44.0228					dIntercept	0.076567

1/√A = a+BT



BestFit	{0.150781 + 0.0000228263 x}				χ^2	74.185
Fit Model		Estimate	Standard Error	t- Statistic	P- Value	Reduced χ^2	9.27312
	a0	0.150781	0.000132297	1139.71	1.56929×10^{-24}		
	a1	0.0000228263	7.57623×10^{-7}	30.1288	2.39057×10^{-10}		
Rsquared	0.996103						
intercept	43.9853					dIntercept	0.0192967

Fitting ln(A)=1+bT



BestFit	{3.78307 – 0.000288726 x}					χ^2	113.332
Fit Model		Estimate	Standard Error	t-Statistic	P-Value	Reduced χ^2	14.1665
	a0	3.78307	0.00181495	2084.39	6.85567×10^{-27}		
	a1	−0.000288726	0.0000103936	−27.7792	4.92933×10^{-10}		
Rsquared	0.993937						
intercept	43.9507					dIntercept	0.0797683

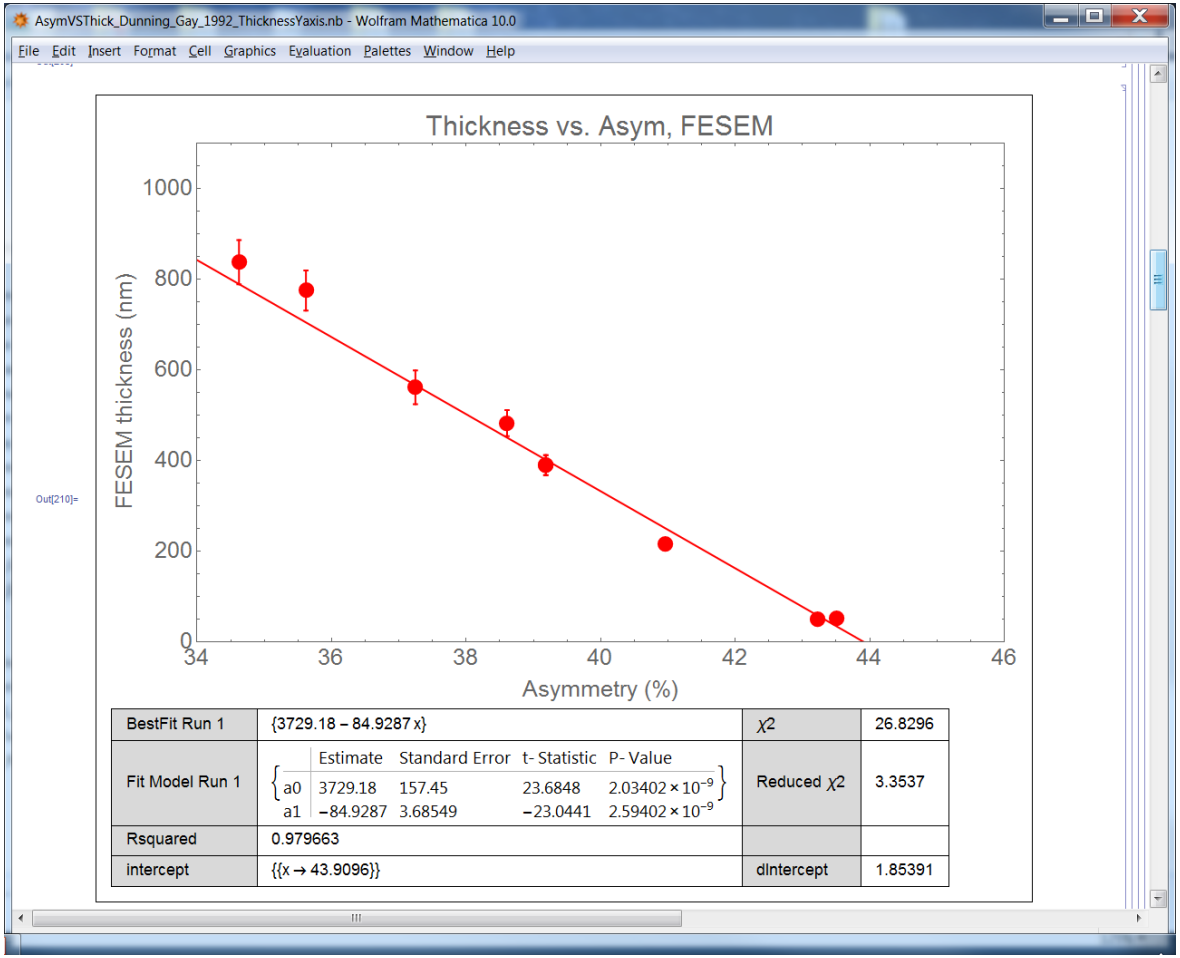
Summary: plotting vs. thickness

function	intercept	dA	R^2	red. χ^2
A=a+bx	43.8892	0.08773	0.98205	49.7433
A=a/(1+bx)	44.0285	0.07535	0.996117	9.63821
1/A=1+bx	44.0228	0.07657	0.995858	9.87618
1/sqrt(A)= a+bx	43.9853	0.01930	0.996103	9.27312
ln(A)=a+bx	43.9507	0.07976	0.993937	14.1665

Now, flip axes to handle thickness error more tidily

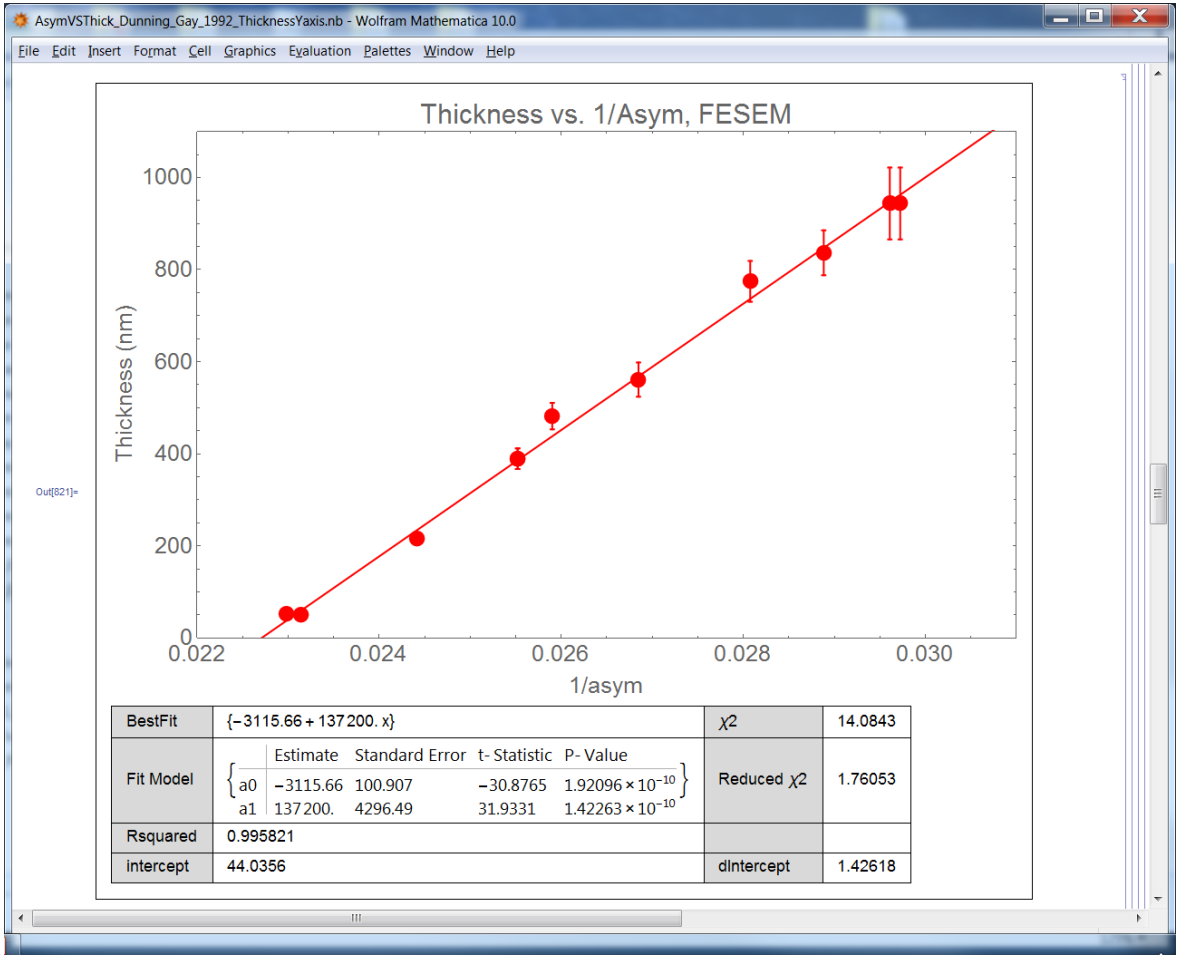
- All data from Run 1
- $\chi^2 = \sum(ydata_i - f(x_i))^2/dy_i^2)$
  - Now the bigger error bars are in both the weights and the Chi squaredReduced $\chi^2 = \chi^2 /(N-\nu-1)$, N number of data pts., $\nu=2$= number fit parameters
- $R^2=1- (\sum(ydata_i - f(x_i))^2)/(\sum(ydata_i - mean(ydata))^2)$

Fitting to T = a+bA: Flipped

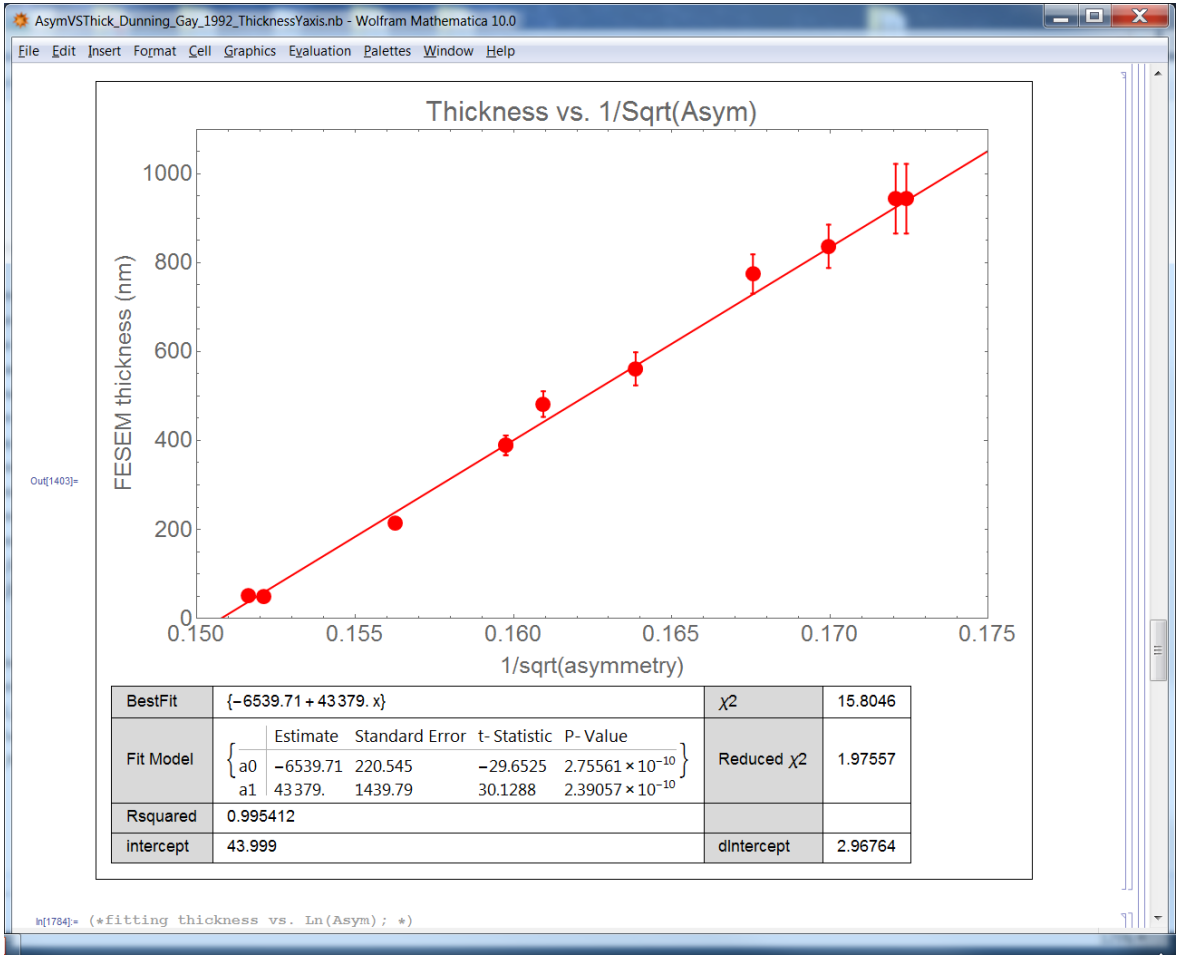


BestFit Run 1	{3729.18 – 84.9287 x}				χ^2	26.8296
Fit Model Run 1		Estimate	Standard Error	t- Statistic	P- Value	Reduced χ^2	3.3537
	a0	3729.18	157.45	23.6848	2.03402×10^{-9}		
	a1	−84.9287	3.68549	−23.0441	2.59402×10^{-9}		
Rsquared	0.979663						
intercept	{{x → 43.9096}}					dIntercept	1.85391

Fitting to T= a+b(1/A): Flipped

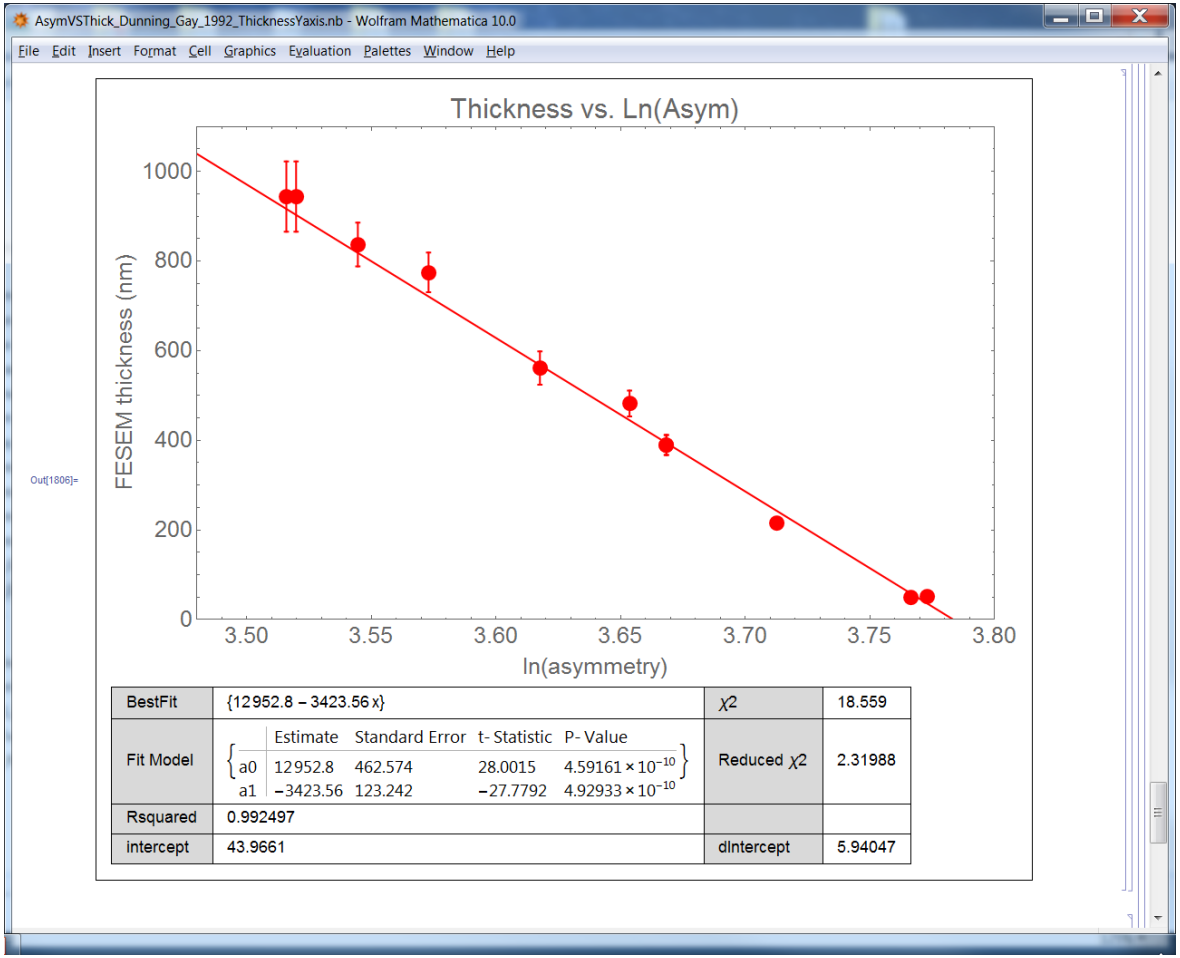


Fitting to T= a+b(1/Sqrt(A)): Flipped



BestFit	{−6539.71 + 43379. x}					χ^2	15.8046
Fit Model		Estimate	Standard Error	t-Statistic	P-Value	Reduced χ^2	1.97557
	a0	−6539.71	220.545	−29.6525	2.75561×10^{-10}		
	a1	43379.	1439.79	30.1288	2.39057×10^{-10}		
Rsquared	0.995412						
intercept	43.999					dIntercept	2.96764

Fitting to T= a+b*ln(A): Flipped



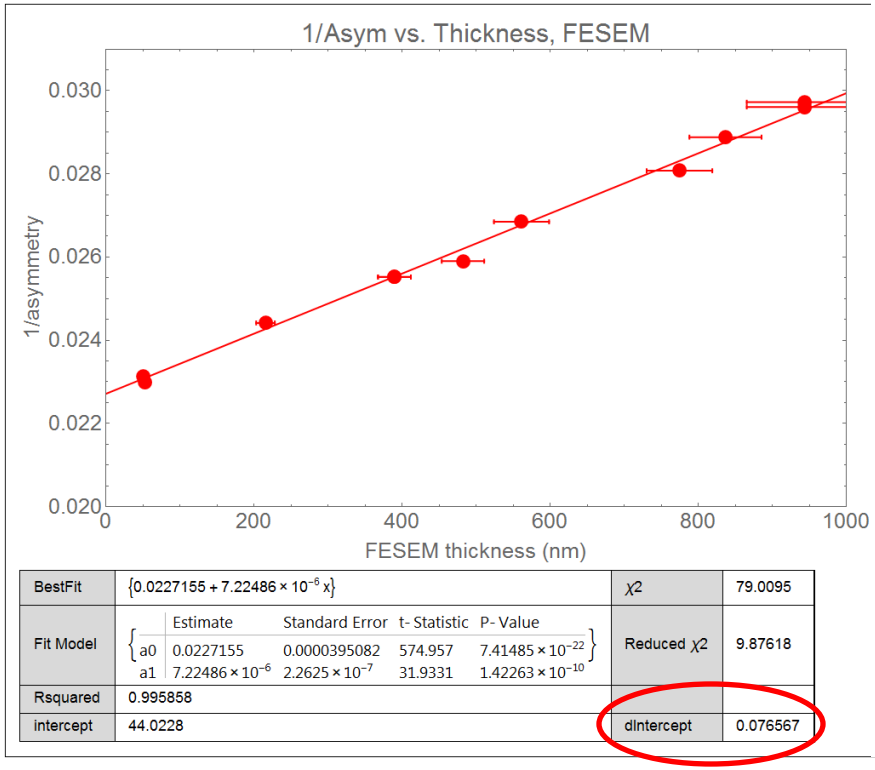
BestFit	{12952.8 – 3423.56 x}					χ^2	18.559
Fit Model		Estimate	Standard Error	t-Statistic	P-Value	Reduced χ^2	2.31988
	a0	12952.8	462.574	28.0015	4.59161×10^{-10}		
	a1	−3423.56	123.242	−27.7792	4.92933×10^{-10}		
Rsquared	0.992497						
intercept	43.9661					dIntercept	5.94047

Summary: plotting vs. thickness

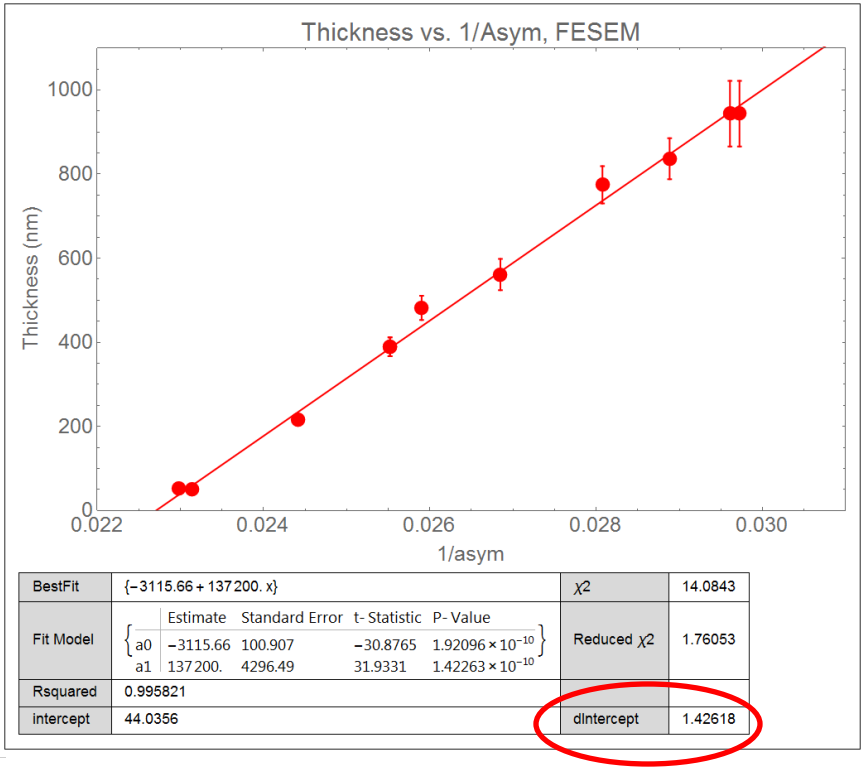
function	intercept	dA	R^2	red. χ^2
A=a+bx	43.9096	1.85391	0.979663	~~3.3537~~ reject
A=a/(1+bx)				
1/A=1+bx	44.0356	1.42618	0.995821	1.76053
1/sqrt(A)= a+bx	43.999	2.96764	0.995412	1.97557
ln(A)=a+bx	43.9661	5.94047	0.992497	2.31988 – nearly reject

Compare two most likely

1/A = a + bT is functionally the same as A=a/(1+bT)



BestFit	$\{0.0227155 + 7.22486 \times 10^{-6}\, x\}$	$\chi 2$	79.0095
Fit Model	Estimate / Standard Error / t-Statistic / P-Value a0: 0.0227155 / 0.0000395082 / 574.957 / 7.41485×10^{-22} a1: 7.22486×10^{-6} / 2.2625×10^{-7} / 31.9331 / 1.42263×10^{-10}	Reduced $\chi 2$	9.87618
Rsquared	0.995858		
intercept	44.0228	dIntercept	0.076567



BestFit	$\{-3115.66 + 137200.\, x\}$	$\chi 2$	14.0843
Fit Model	Estimate / Standard Error / t-Statistic / P-Value a0: −3115.66 / 100.907 / −30.8765 / 1.92096×10^{-10} a1: 137200. / 4296.49 / 31.9331 / 1.42263×10^{-10}	Reduced $\chi 2$	1.76053
Rsquared	0.995821		
intercept	44.0356	dIntercept	1.42618

Very different uncertainties: check correlation matrices?

1	-0.593
-0.593	1

1	-0.999
-0.999	1