# Criteria to choose target foils for 1st experiment

Choose foils to test target thickness extrapolation vs. model

=> one Z maximizes number of points (we'll see if this is necessary)

Choose foils to minimize $(d\varepsilon/\varepsilon)_{stat}$ in reasonable run time

=> gold (Z=79) maximizes $S_{eff}$ and cross-section (we'll see if this is necessary)

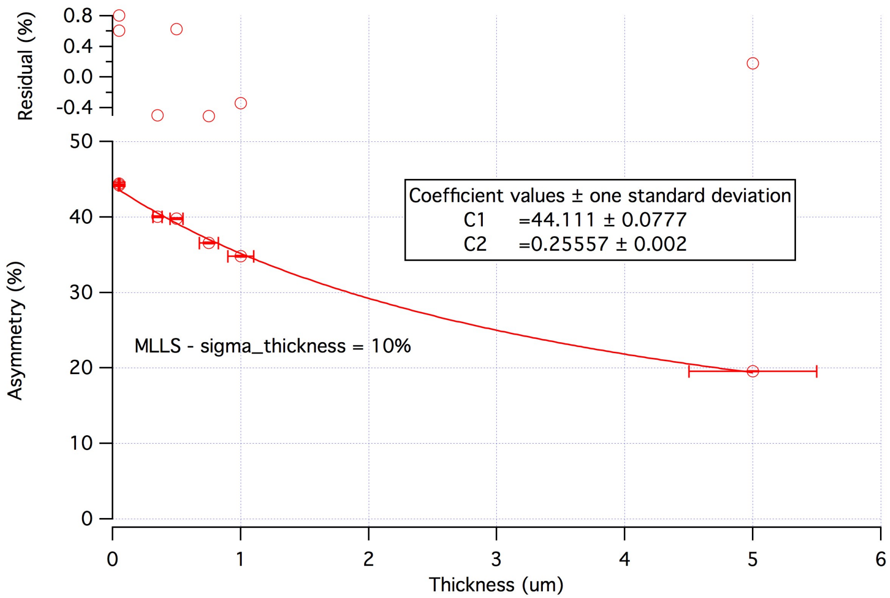
Choose foils to minimize fit uncertainty at zero thickness

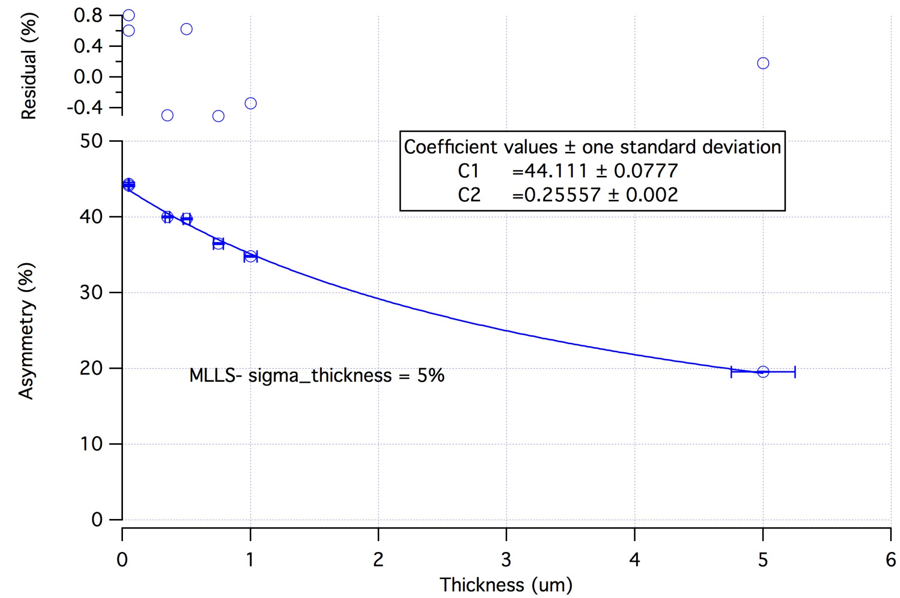
=> Depends upon number, thickness and thickness uncertainty of foils

Foil thickness considerations (per Lebow):

- Standard specification is +/- 10% from exact mechanical thickness
- Variation within < 2%
- Variation within a lot (siblings) < 5%
- Can measure foil at +/- 2% at one micron

Here's our Spring 2014 gold data shown with same statistical uncertainty and fit, but with a either a uniform 10% or 5% thickness uncertainty.



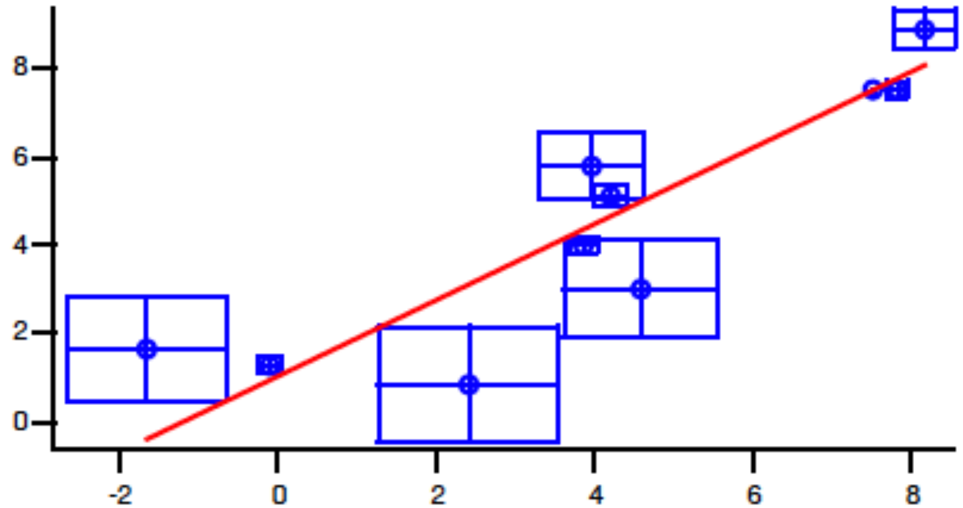




The fit coefficients are identical because the standard MLLS routine does not account for model error, and which leads to a natural bias when using only the dependent uncertainty.

Instead, we should apply a fit that includes a model error, i.e. an uncertainty in the target thickness. One approach is Orthogonal Distance Regression (ODR) or "total least squares".

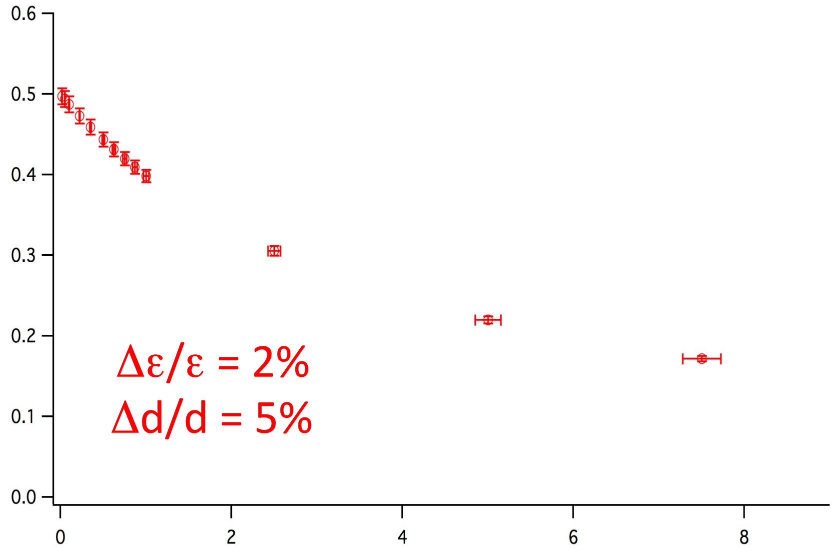
Now testing the curve fitting routine ODRPACK95 which is used by the Igor Pro analysis program. Routine minimize least squares distance by allowing the independent target thickness to vary during the fit progression.

A simple example of an ODR fit is given here where the boxes are residuals (not uncertainties):




I ran into a confusing error. Contacted company and they assured me the package should work the way I intend, so probably a superfluous error on my part. I'll try again…

o = round mount = 9 foils
# = square mount = 5 foils




| Thickness | In chamber | In storage | To Purchase |
|---|---|---|---|
| 0.02 (o) | - | - | 2 (o) |
| 0.05 (o) | 1 (o) | 1(o) | - |
| 0.10 (o) | - | - | 2 (o) |
| 0.225 (#) | - | 3 (#) | - |
| 0.35 (o) | 1 (o) | 4 (o) | - |
| 0.50 (#) | 1 (#) | 2 (#) | - |
| 0.625 (#) | - | 3 (#) | - |
| 0.75 (#) | 1 (#) | 2 (#) | - |
| 0.87(#) | - | 3 (#) | - |
| 1.0 (o) | 1 (o) | 1 (o) | - |
| 2.5 (o) | - | - | 2 (o) |
| 5.0 (o) | 1 (o) | - | - |
| 7.5 (o) | - | - | 2 (o) |
| ? 2nd 0.02 | - | - | - |