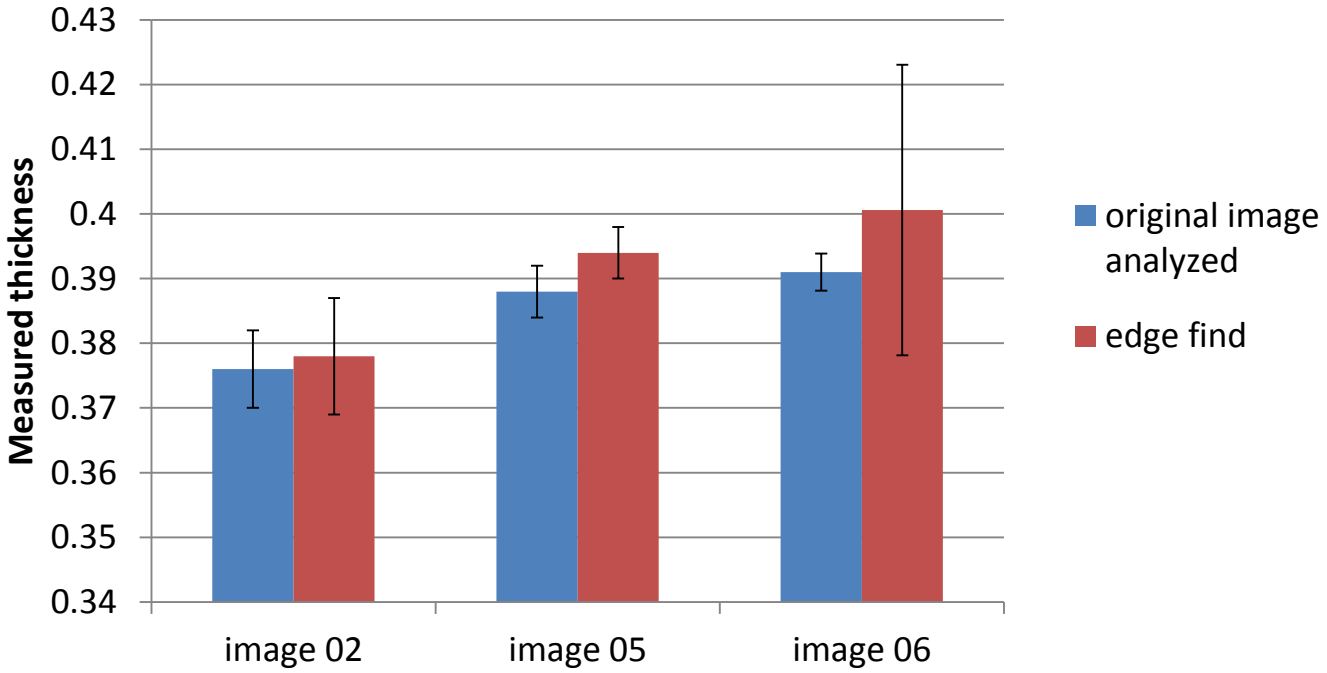
# FE-SEM foil thickness measurements

# Process

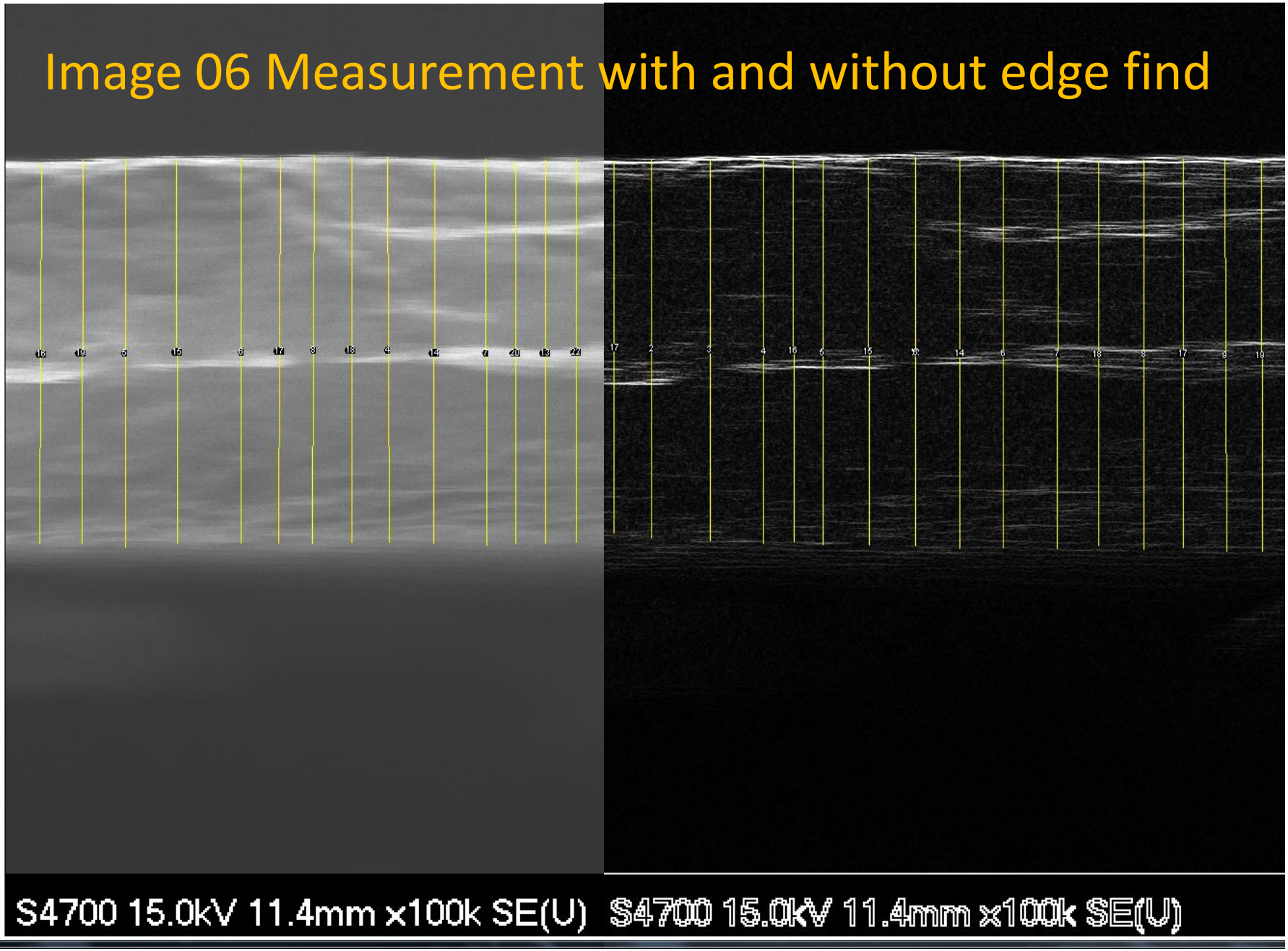
- Mount sister foils to Si wafers
  - Static for thinner foils
  - “glue” with aerodag carbon suspension for thicker
- Mamun makes images
- Use ImageJ software to measure .tiff images saved from FE-SEM process

# Comparison of edge find tool

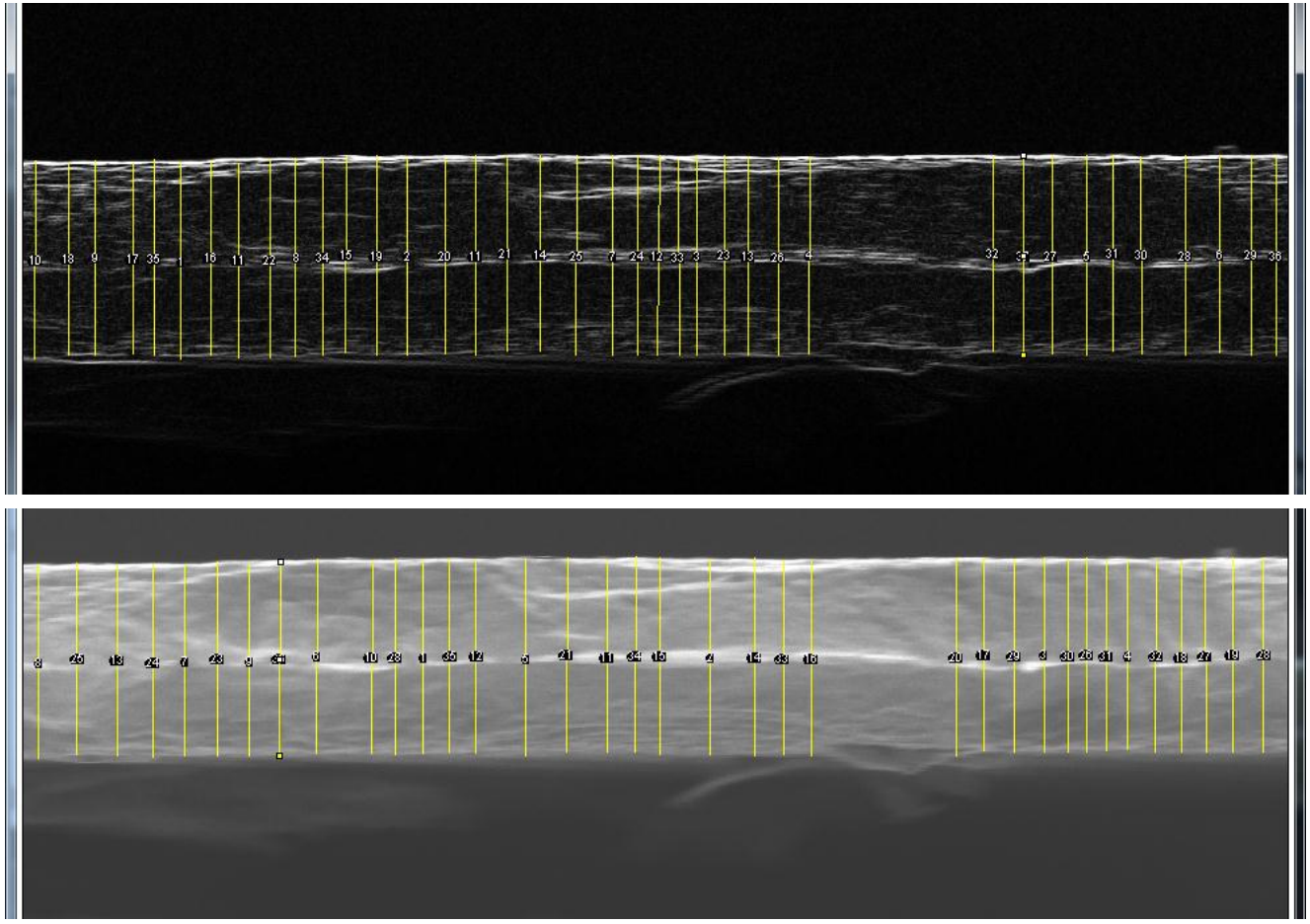
- Analyzed images 05 and 06 with edge contrast on or off
- Find that the edge contrast tends to skew measurements slightly larger
  - Variation between images larger than variation between images
- Conclusion:
  - make sure to go on inside edges of “edge find” line to get more accurate results



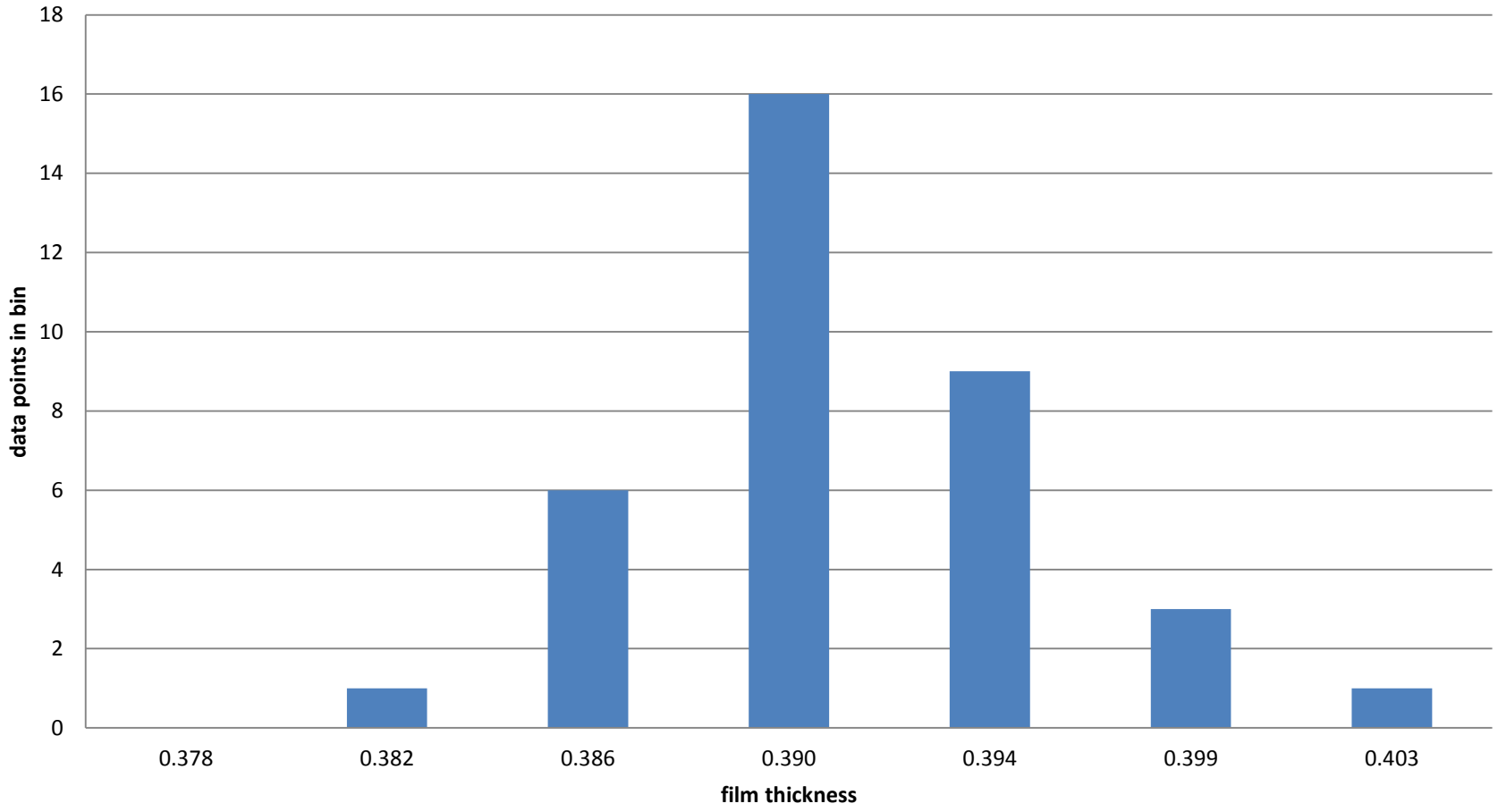
# Image 06 Measurement with and without edge find



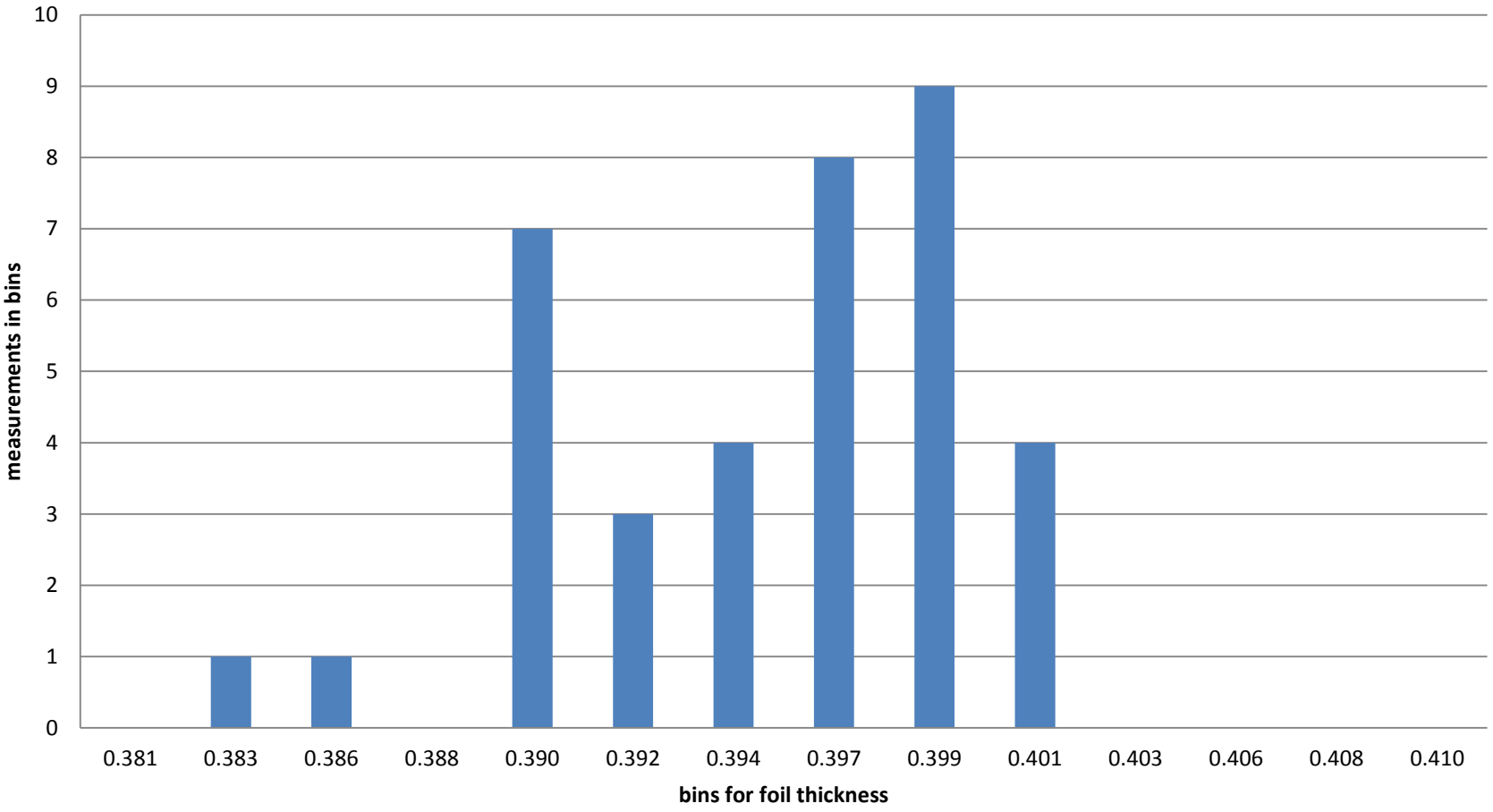
# Image 05: original image, edge find



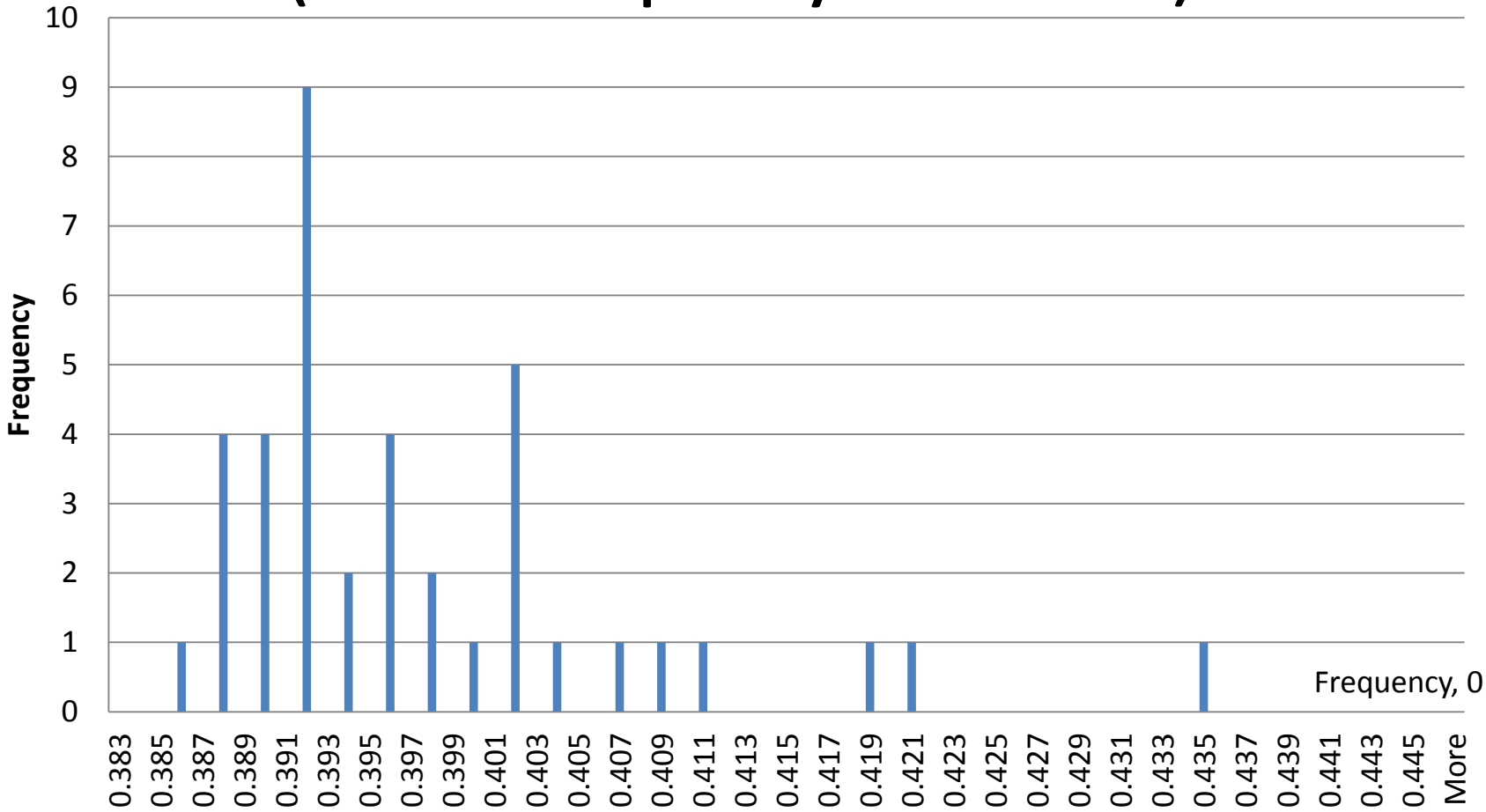
# Statistical analysis of points measured spots selected by eye, original image



# Thickness distribution, edge find 5613D image05, spots selected by eye



# Statistics from even distribution 5613 M05 even stripe distance (don’t skip any oddities)



# 5613D

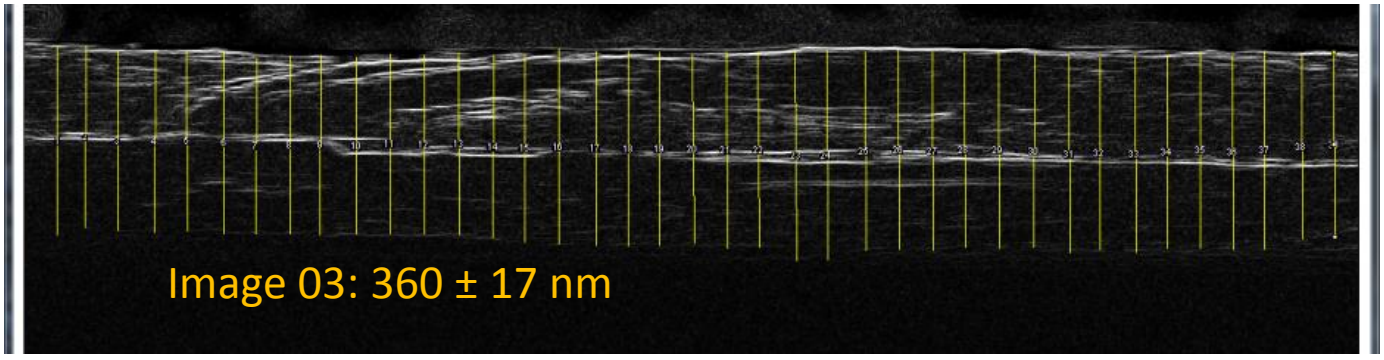


Image 03: 360 ± 17 nm

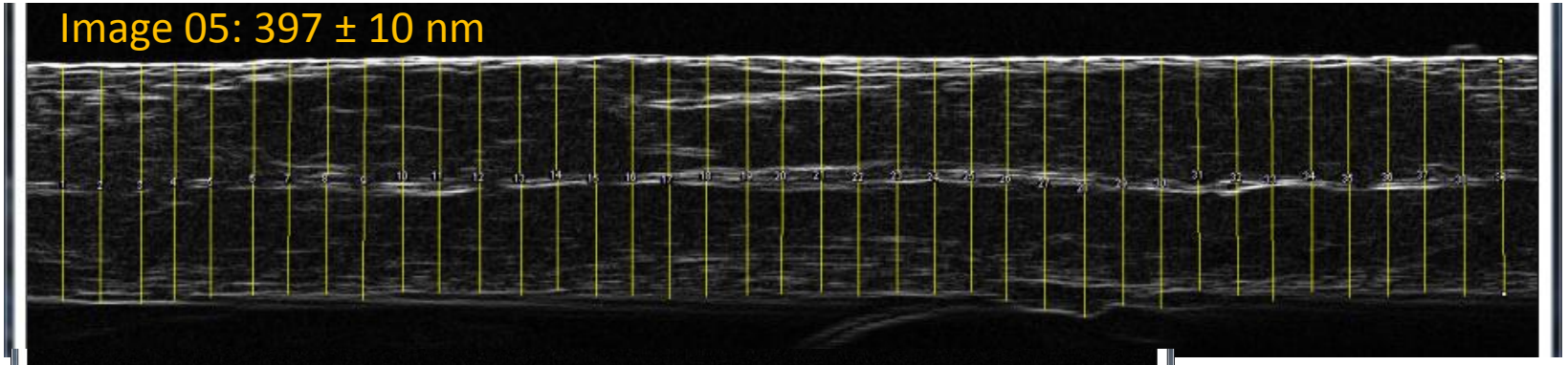


Image 05: 397 ± 10 nm

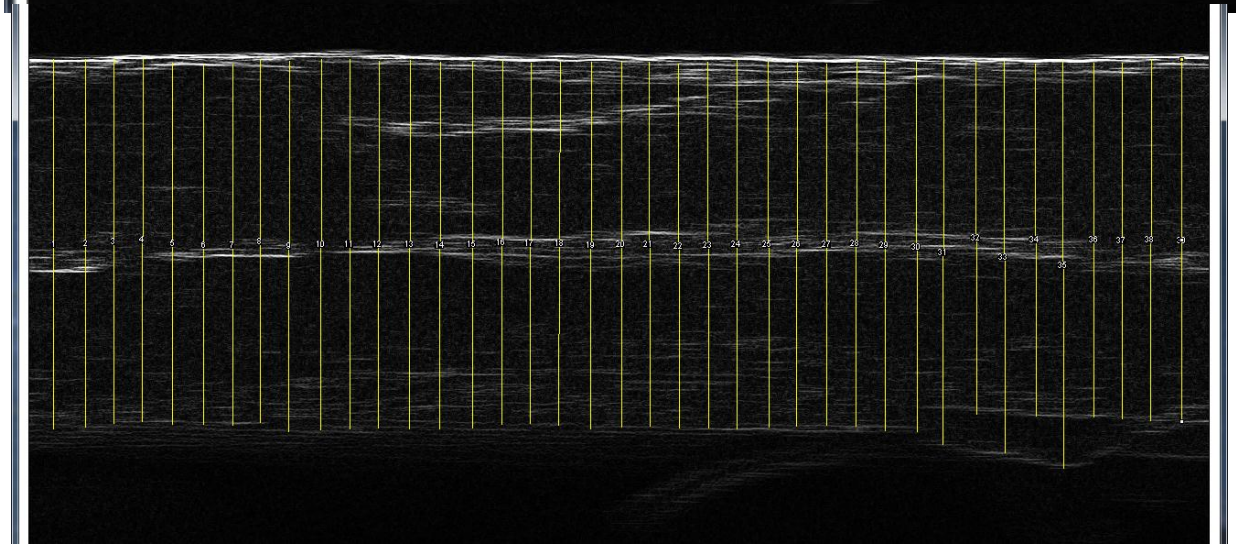
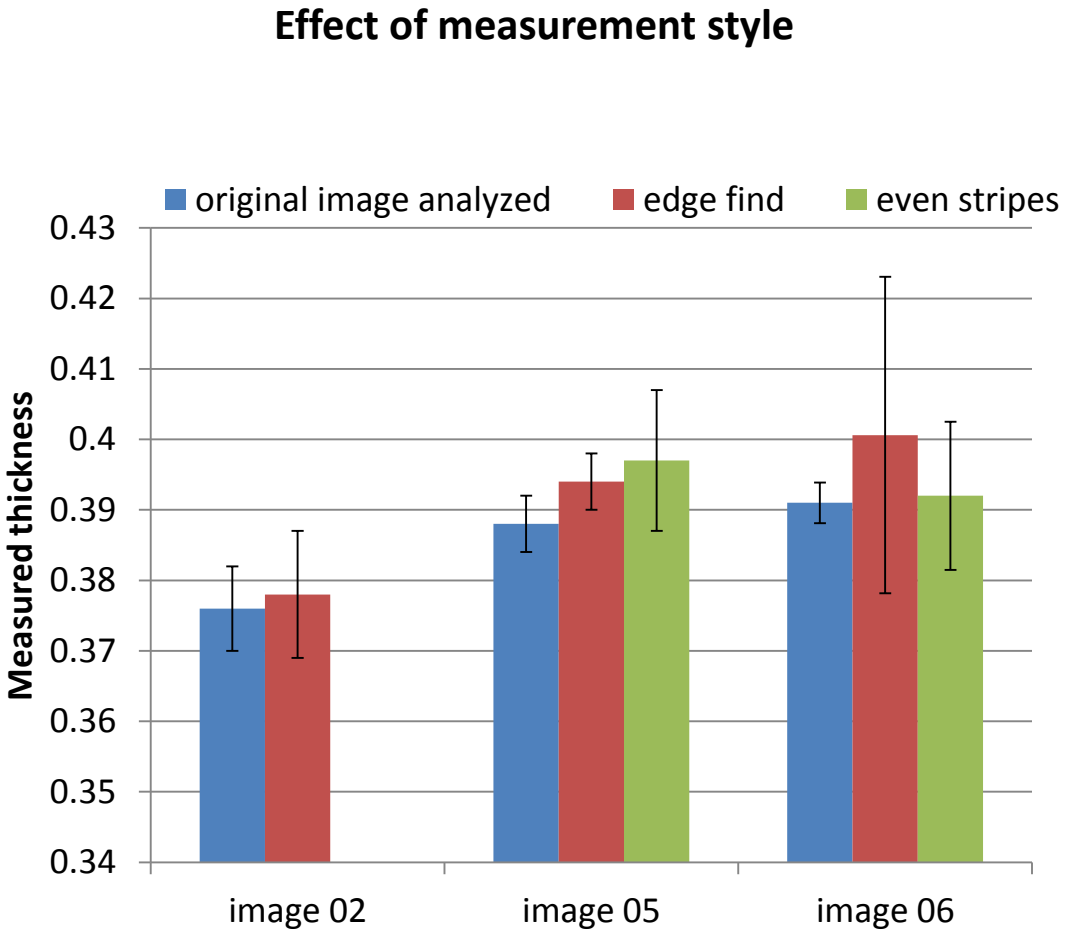


Image 06: 392 ± 10.5 nm

# Conclusions: 5613D



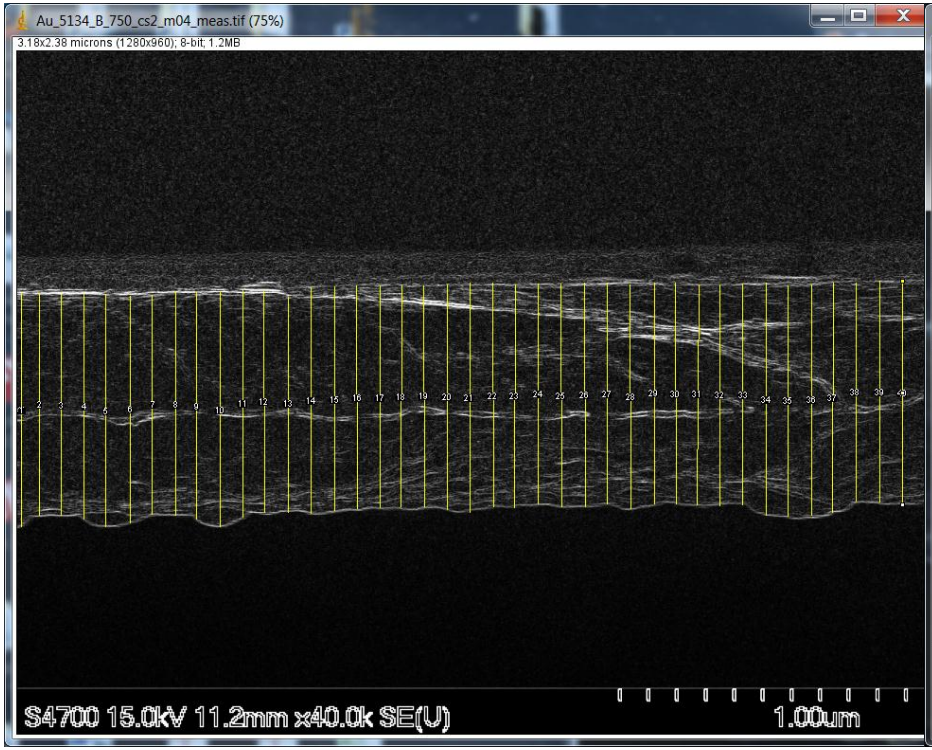

Edge find image,
Weighted mean
0.392 microns ± 0.0036

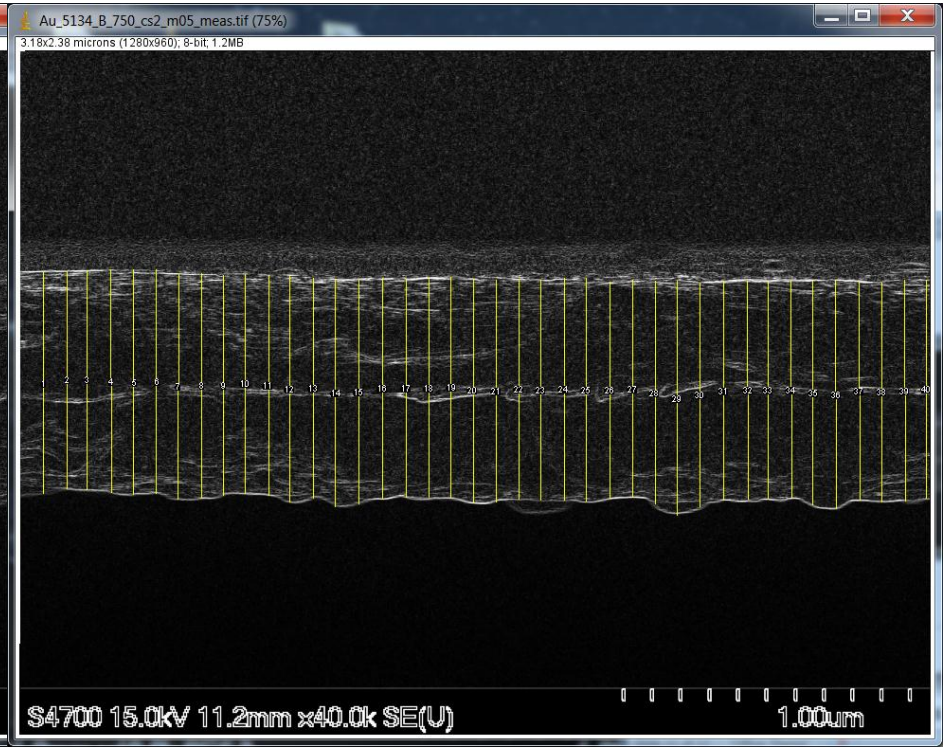
Original image,
Weighted mean
0.388 microns ± 0.0022

Even stripes image,
Weighted mean
0.389 microns ± 0.0066

**Thickness is robust to within error bars for any of the methods**

# Foil 5134



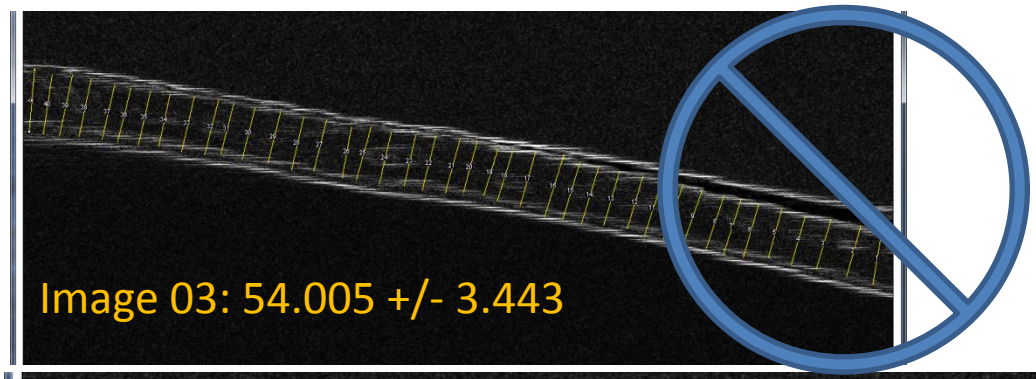




782 ± 16 nm

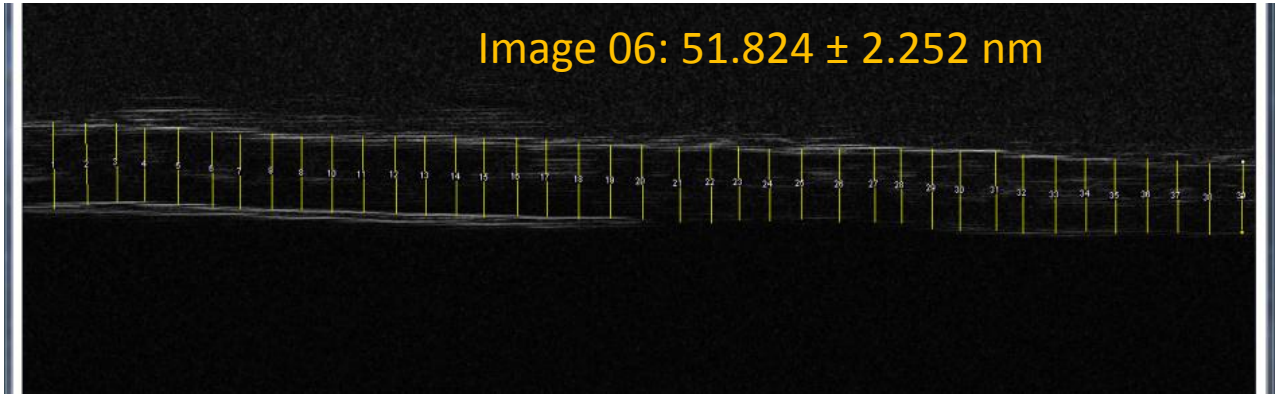
772 ± 13 nm

Average: 776 nm ± 10.1

# Foil 6809

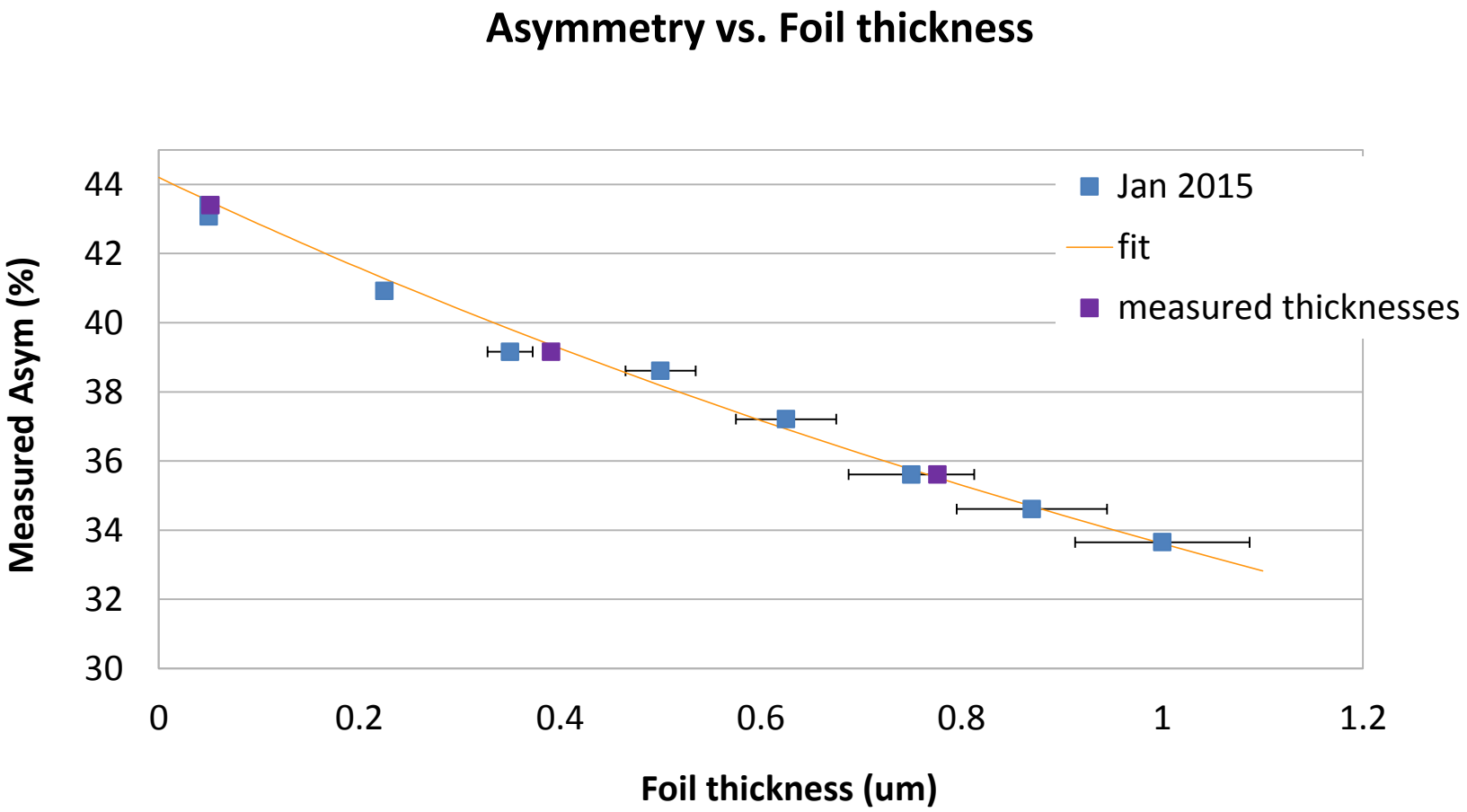







51.539 ± 2.766

| Ladder position | Foil number | Quoted thickness (nm) | Measured thickness (nm) |
|---|---|---|---|
| 13 | 6845 | 50 ± 5 | 51.539 ± 2.766 |
| 1 | 7029 | 225 ± 22.5 | |
| 8 | 5613 | 350 ± 35 | 389 ± 6.6 |
| 5 | 5275 | 500 ± 50 | |
| 2 | 7028 | 625 ± 62.5 | |
| 4 | 5134 | 750 ± 75 | 776 nm ± 10.1 |
| 3 | 3057 | 870 ± 87 | |
| 15 | 5385 | 1000 ± 100 | |


Asymmetry vs. Foil thickness
Measured Asym (%)
44
42
40
38
36
34
32
30
0
0.2
0.4
0.6
0.8
1
1.2
Foil thickness (um)
Jan 2015
fit
measured thicknesses