Grating AFM Measurements

REIXS Spectrometer, CLS

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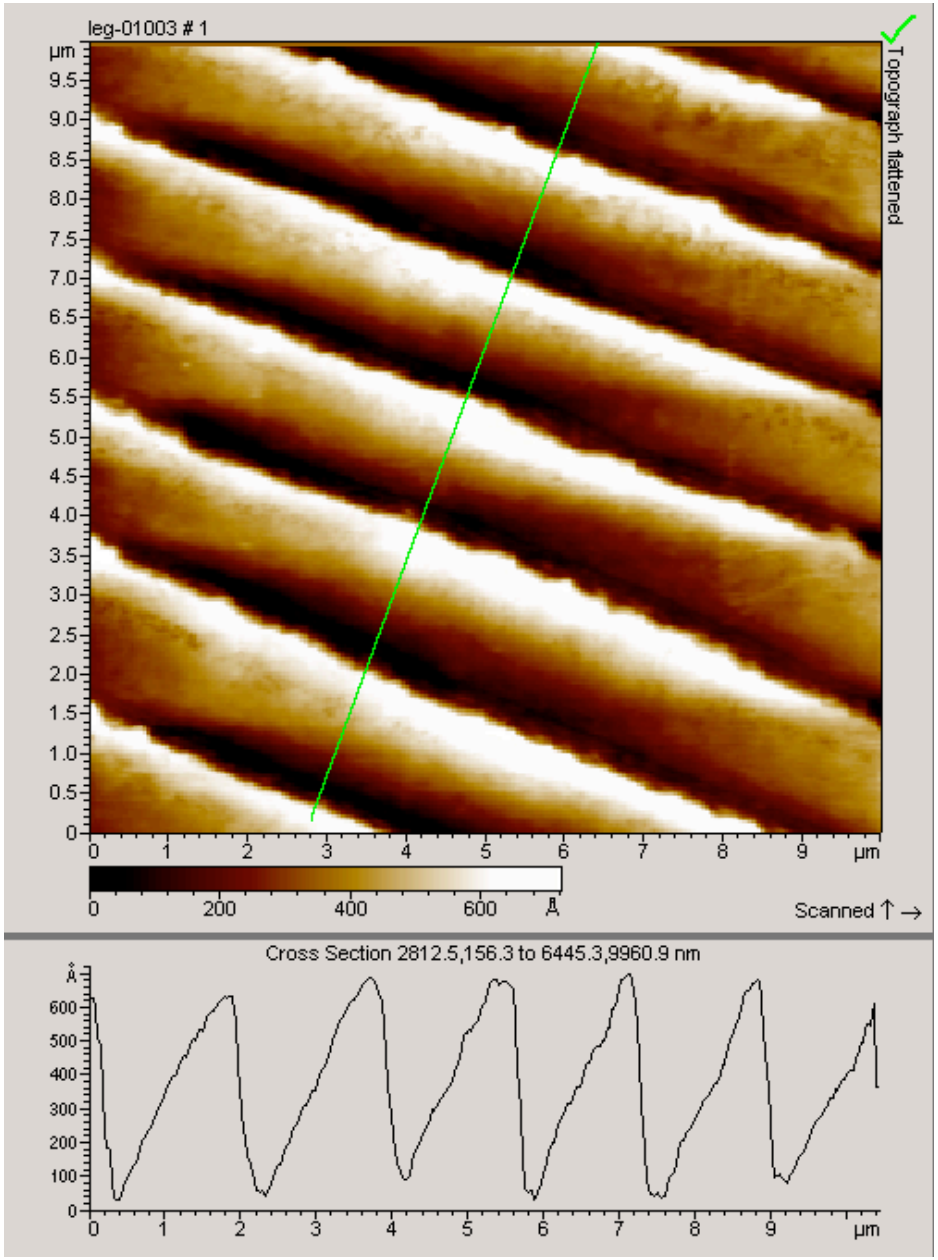
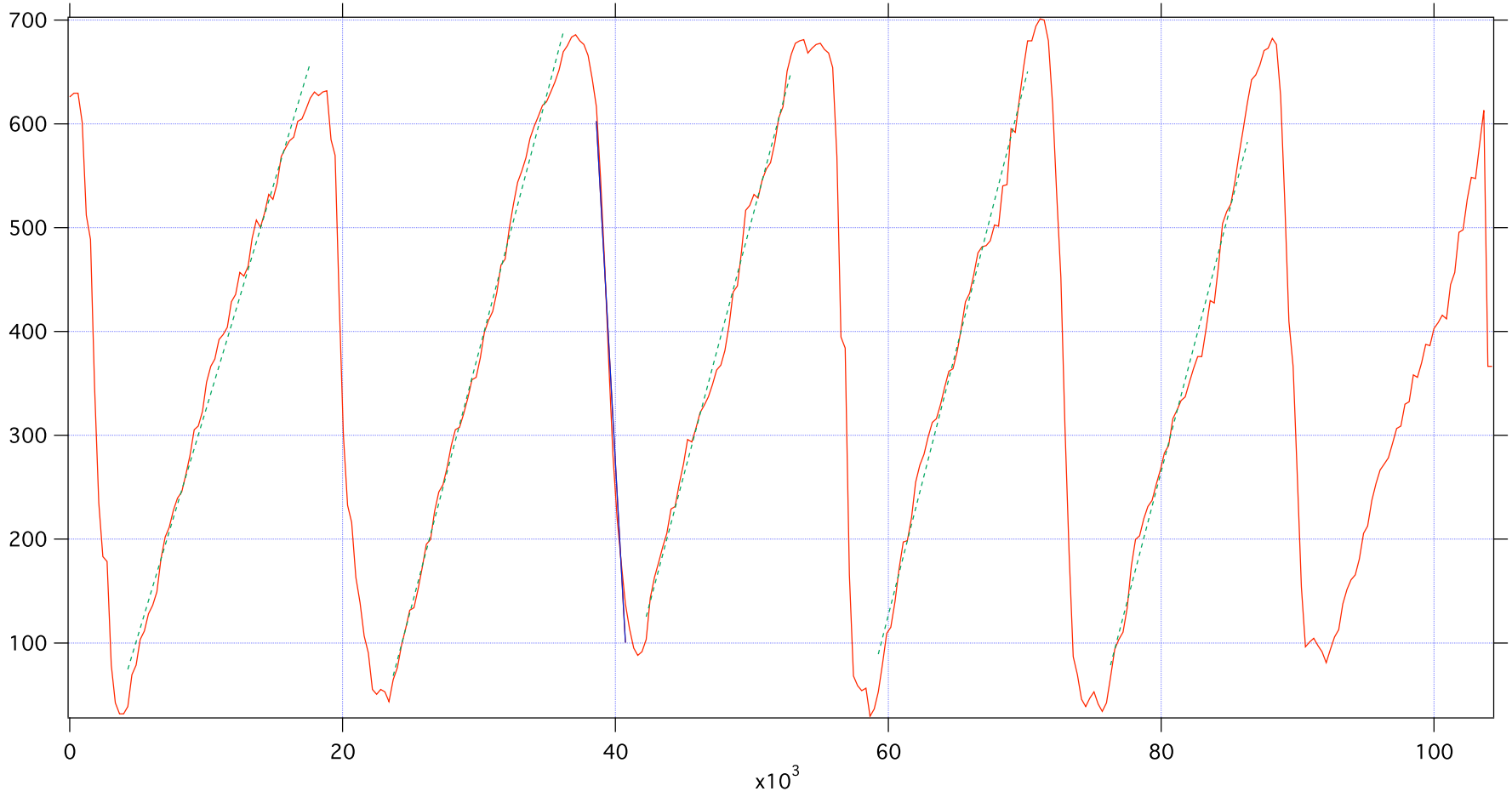
LEG

- Clean triangular profile
- Blaze angle estimated from this cross section: 2.70deg
- Specified blaze angle: 1.85deg
- Efficiency-fitted blaze angle: 2.26deg



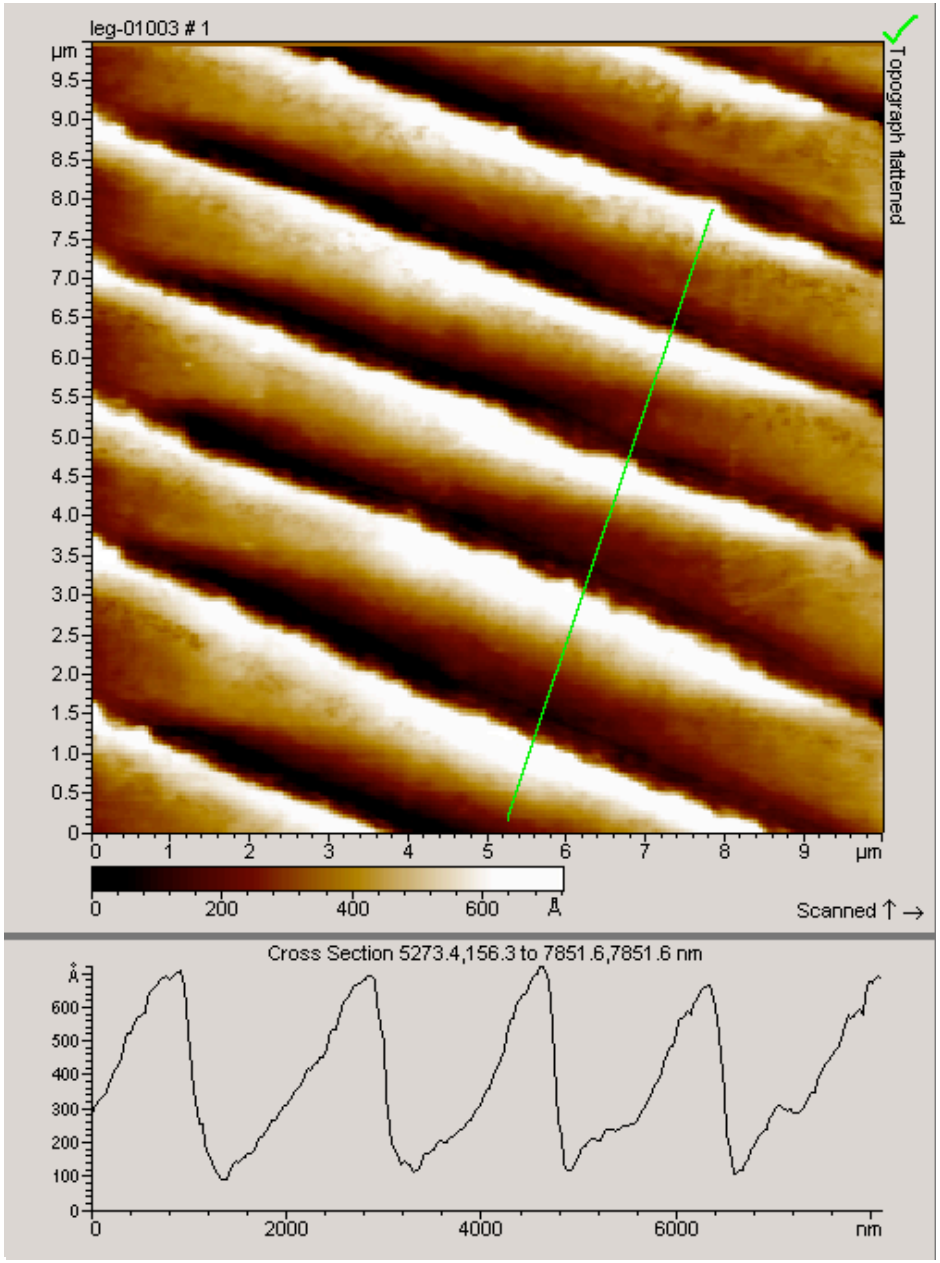
LEG

Peak	Blaze (deg)
1	2.50
2	2.85
3	2.83
4	2.94
5	2.88
AVG	2.80
Rel. to sub:	2.70



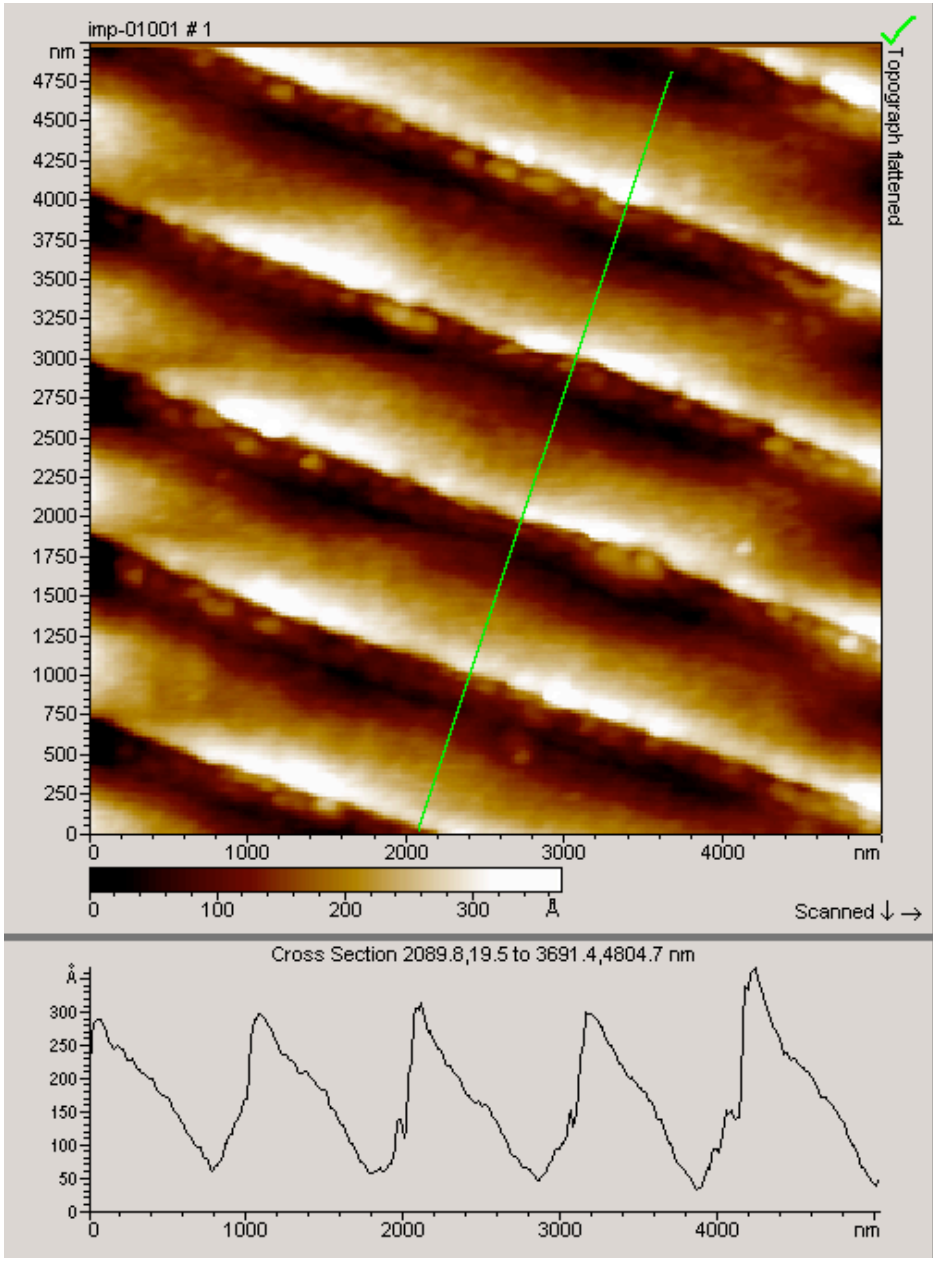
LEG

- Note difference in profile here (same image, different cross section)
- AFM flattening algorithm distortion?
- AFM calibration most accurate at center?
- Grating varies significantly along grooves, and from groove to groove?



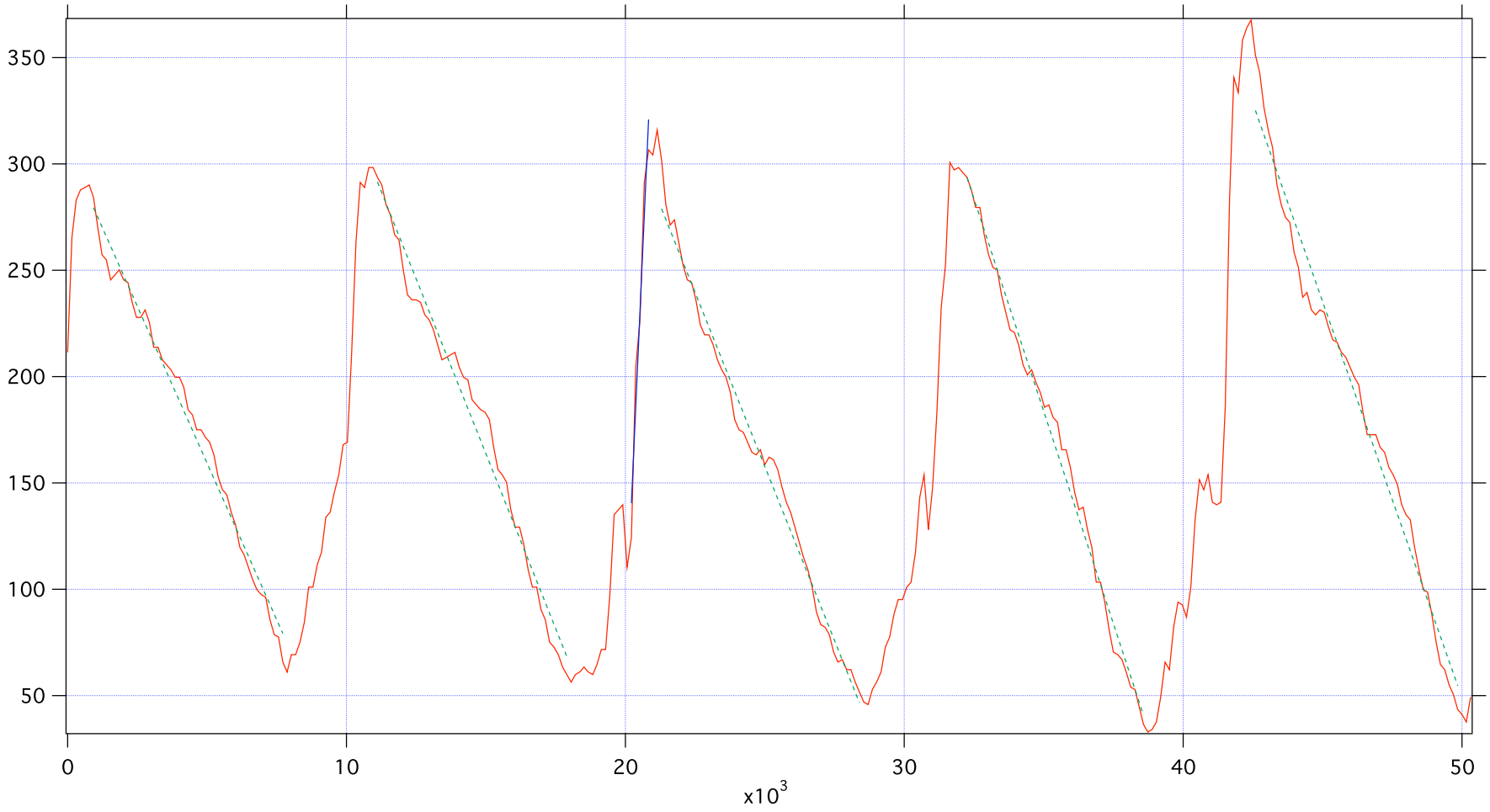
IMP

- Clean triangular profile
- Blaze angle estimated from this cross section: 2.07deg
- Specified blaze angle: 1.11deg
- Efficiency-fitted blaze angle: 1.40deg



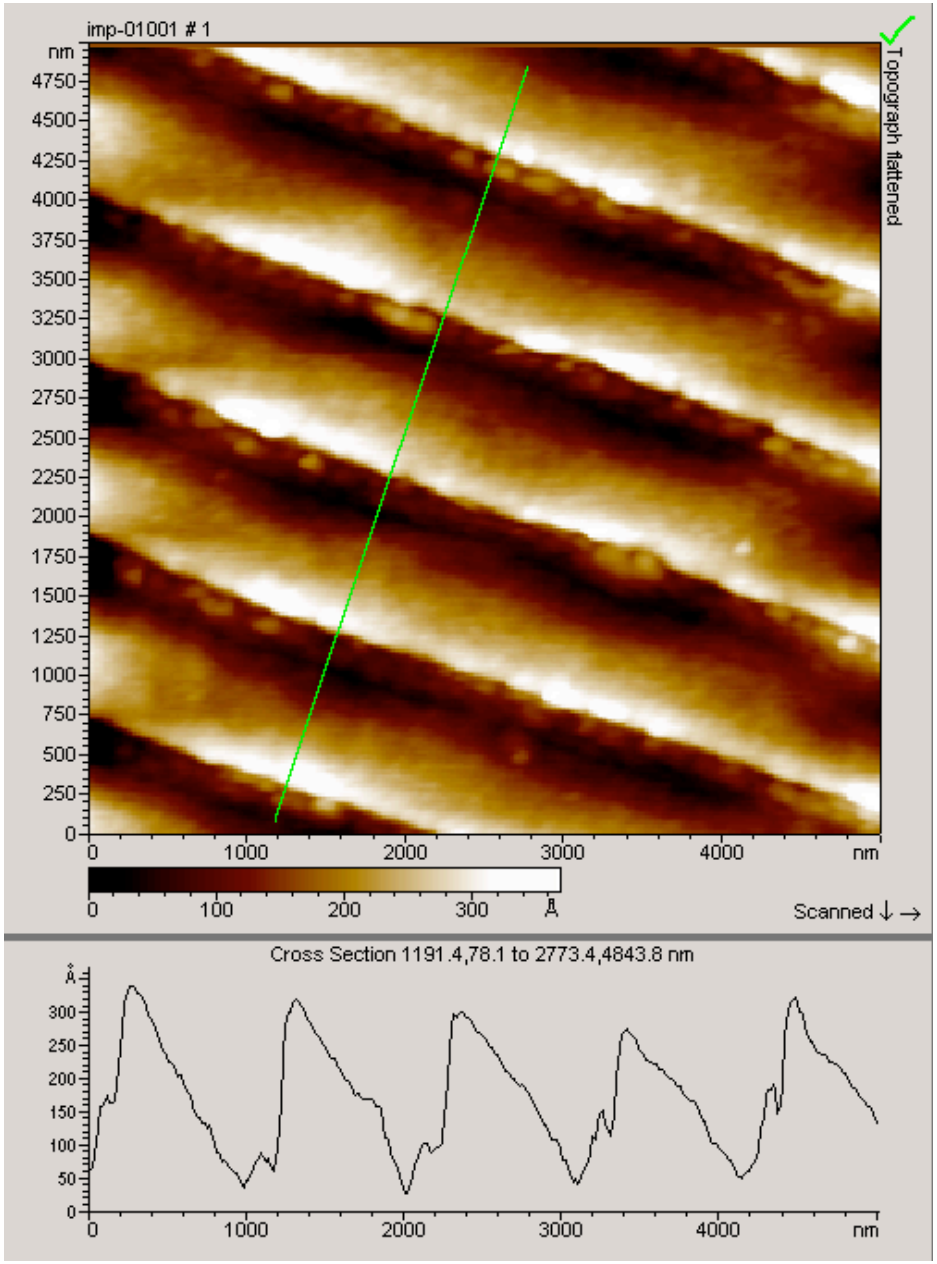
IMP

Peak	Blaze (deg)
1	1.69
2	1.88
3	1.87
4	2.29
5	2.13
AVG	1.97
Rel. to sub:	2.07



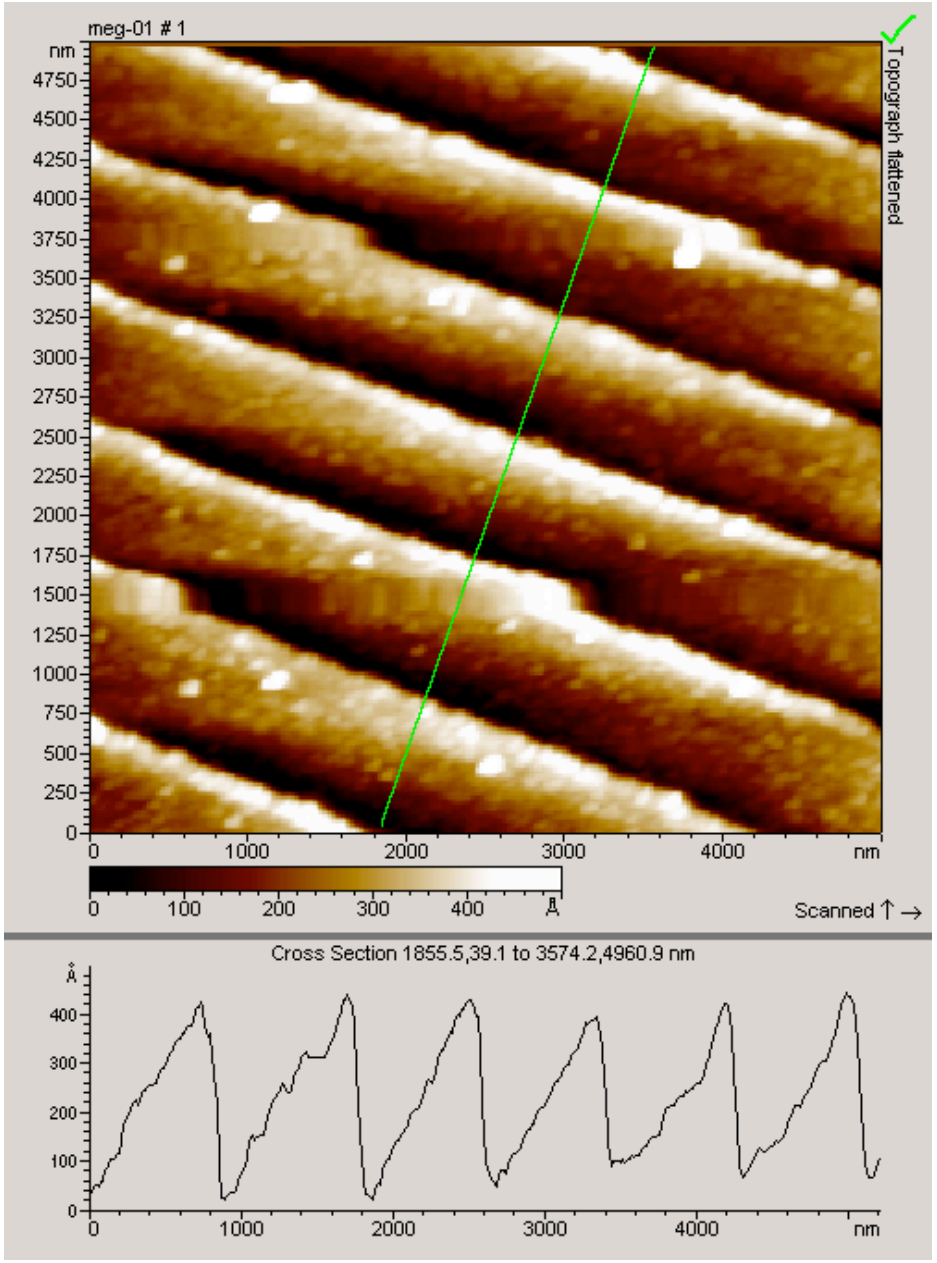
IMP

- Another cross-section



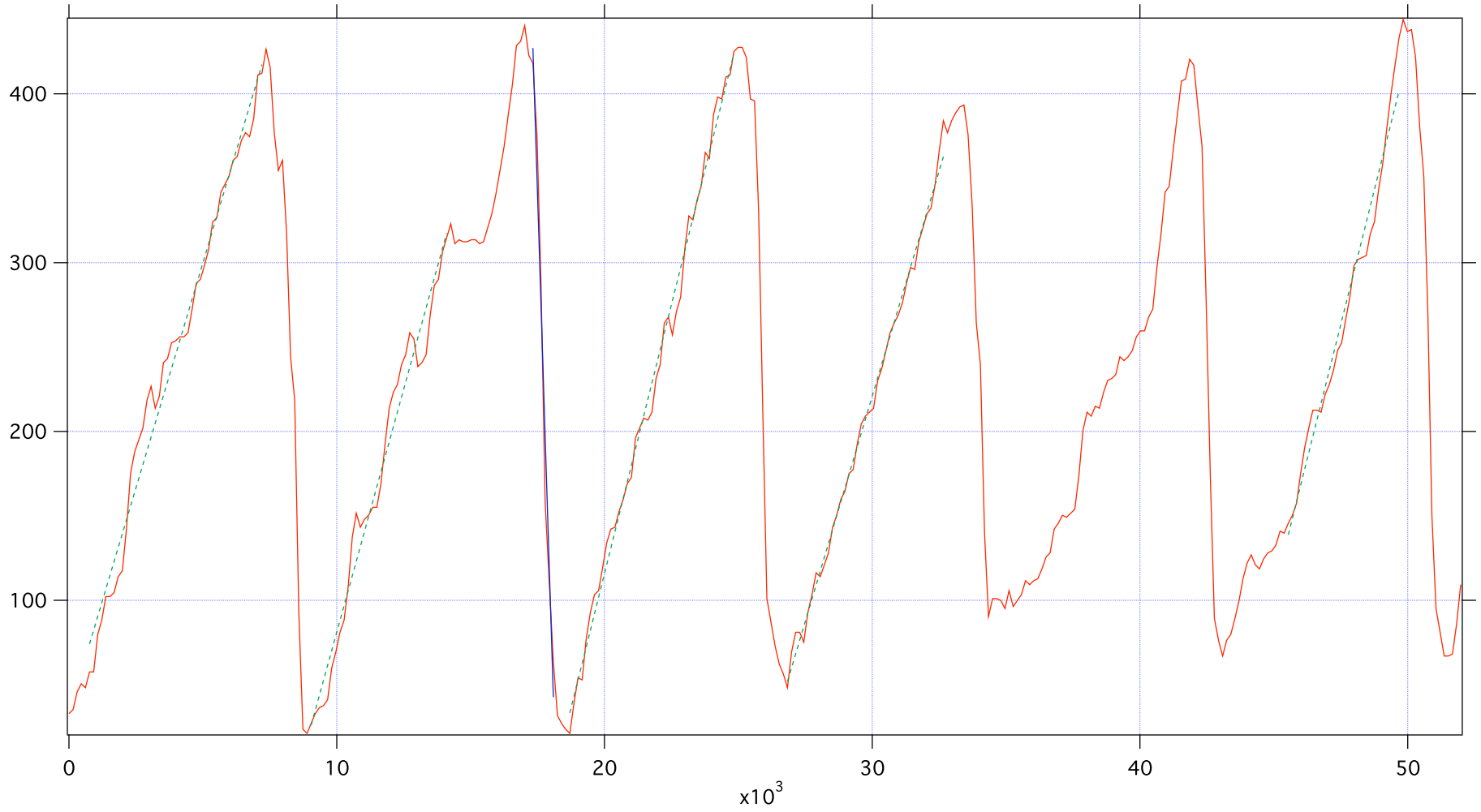
MEG

- Look at the coating roughness!
- Blaze angle estimated from this cross section: 3.24deg!
- Specified blaze angle: 1.48deg
- Efficiency-fitted blaze angle: 1.86deg



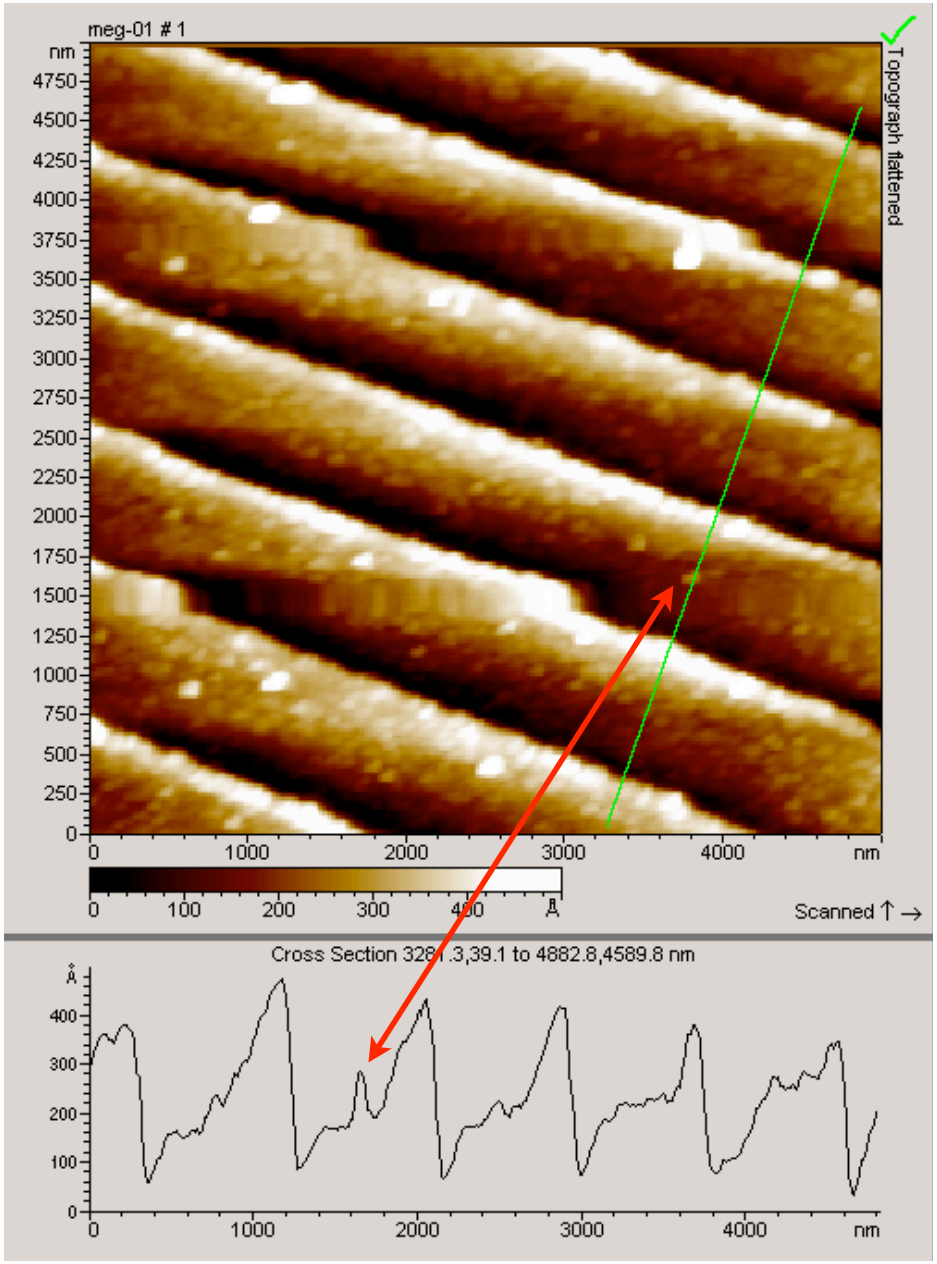
MEG

Peak	Blaze (deg)
1	3.05
2	3.30
3	3.64
4	3.05
5	3.64
AVG	3.34
Rel. to sub:	3.24



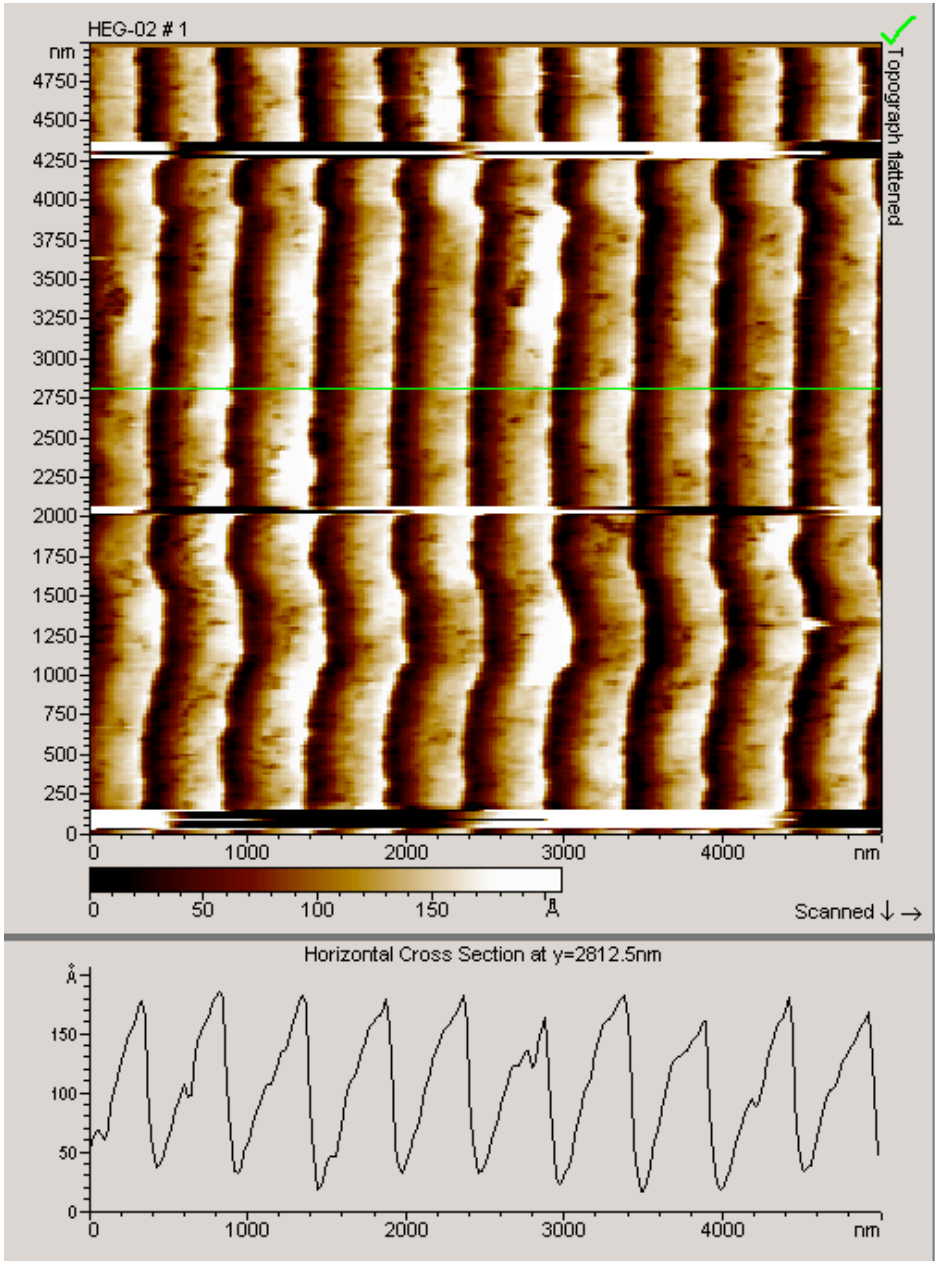
MEG

- Another cross-section
- Note how individual surface bumps distort a cross-section.
- For appropriate blaze angle estimates, need to average all the way down the grooves
- (Impossible to get data from proprietary "Picoscan" software)



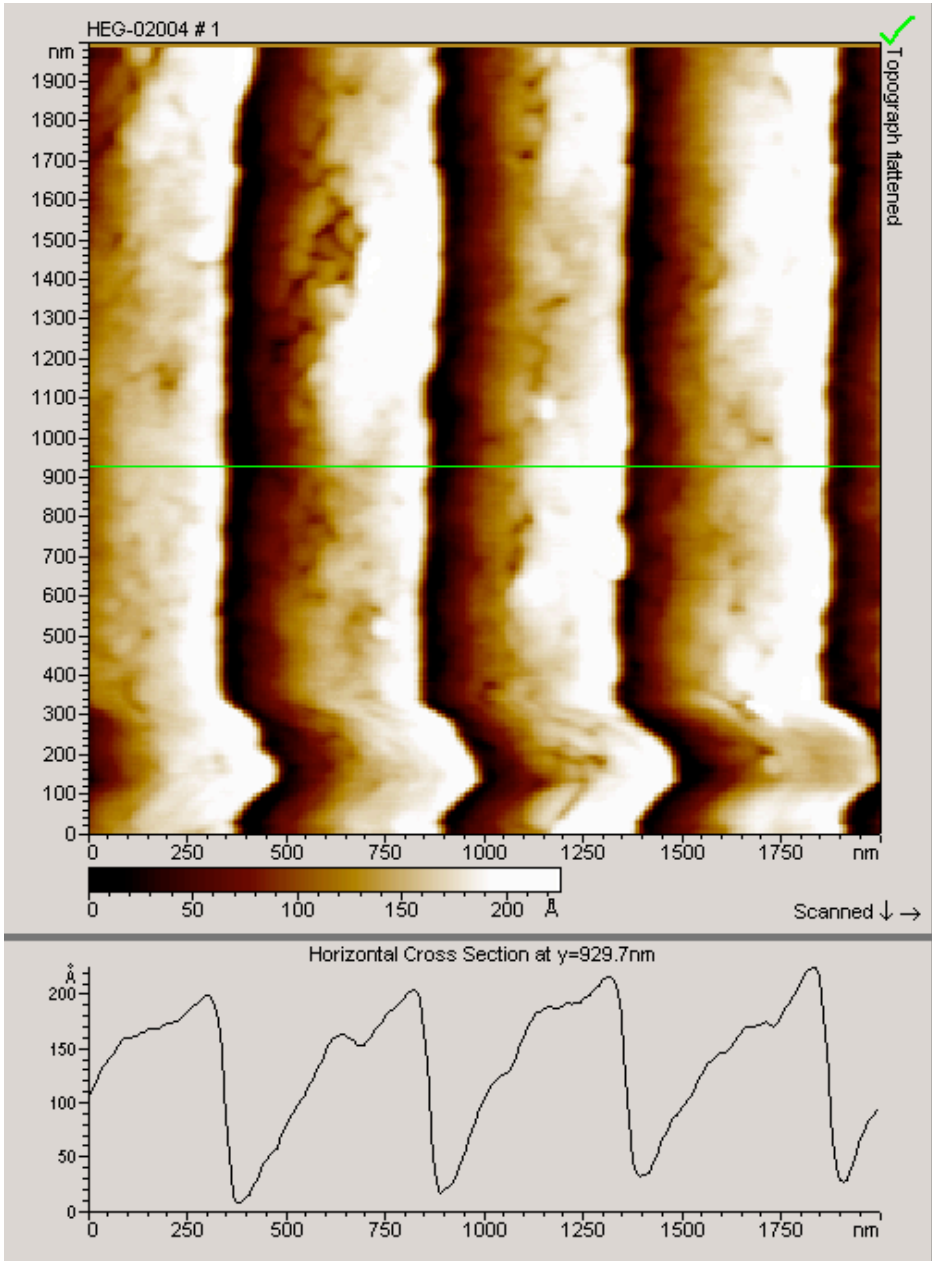
HEG

- Looks smooth from far away...



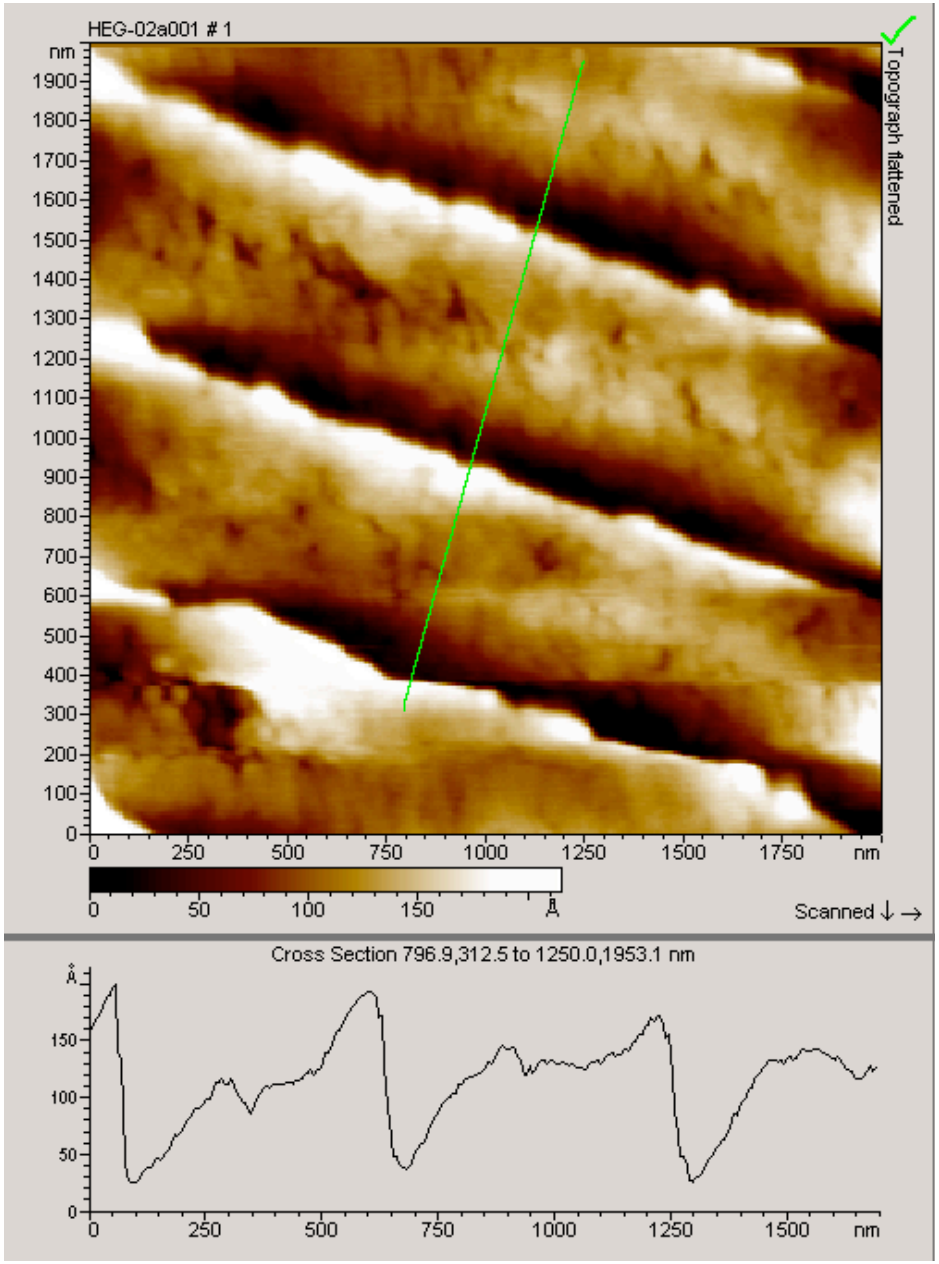
HEG

- High-resolution scan reveals distorted surface



HEG

- High-resolution scan reveals distorted surface
- Is this the real shape of the grating, or an artifact of the AFM?
- How do you estimate a blaze angle from this?



General problems with AFM

- Calibration? No idea if the heights are true calibrated heights.
  - All angles seem way too high.
- Flattening algorithm distortion. No long-range accuracy in heights.
- Question of artifacts... are they in the grating or from the AFM?
- Really need to average along the grooves for decent blaze angle estimate
  - A single cross-section slice is not enough.

Summary

Grating	Grooves (l/mm)	Incidence	Coating	Blaze (nom.)	Blaze (meas)	AntiBl. (meas)
LEG	593.02	86	Au	1.85	2.70	13.3
IMP	892.86	87	Ni	1.11	2.07	16.3
MEG	1187.819	88	Ni	1.48	3.24	26.6
HEG	1985	88	Pt	1.52	??	??