OPTIMIZING SPUTTERING PARAMETERS TO MINIMIZE THE ROUGHNESS OF PERMALLOY THIN FILMS

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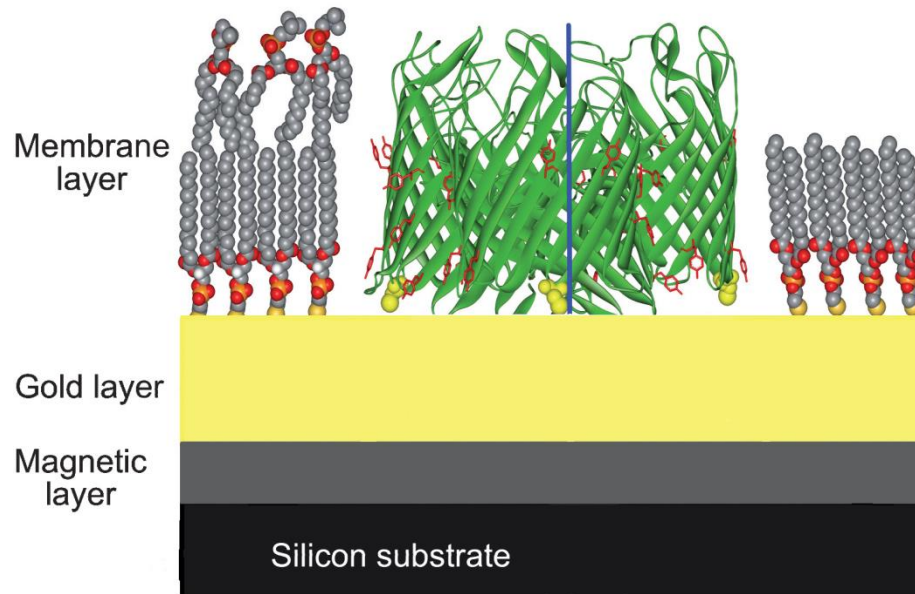**Frank Heinrich**
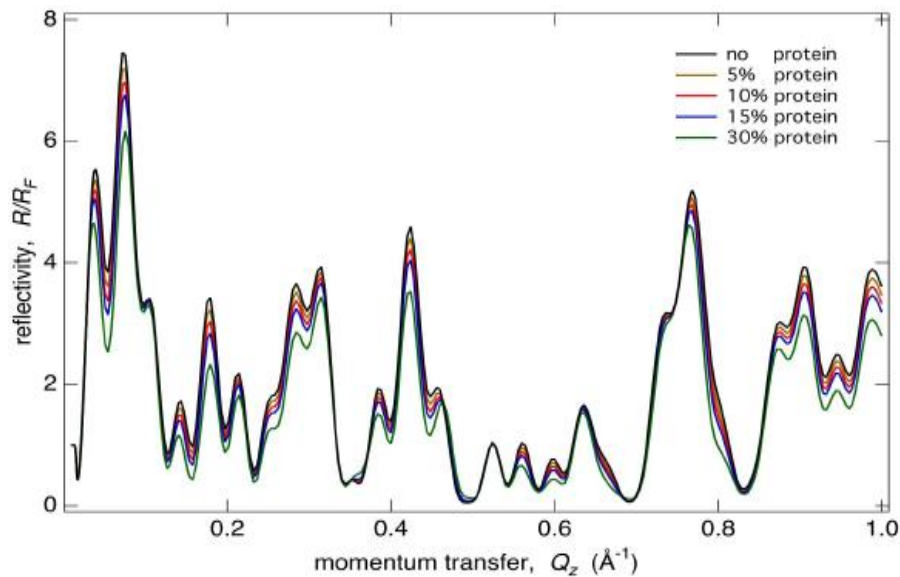
NIST Center for Neutron Research

PURPOSE

- Membrane protein studies
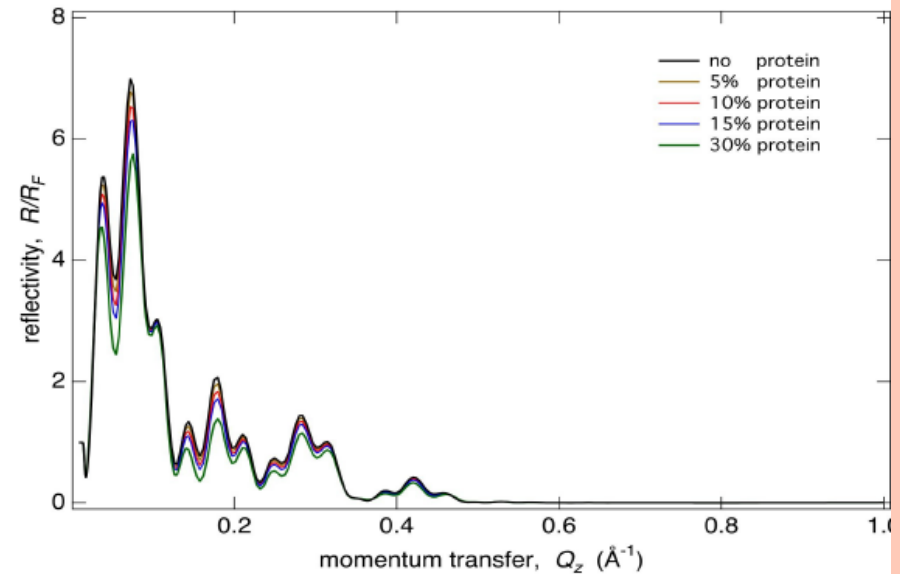 - HIV, Cancer, Parkinson's Disease

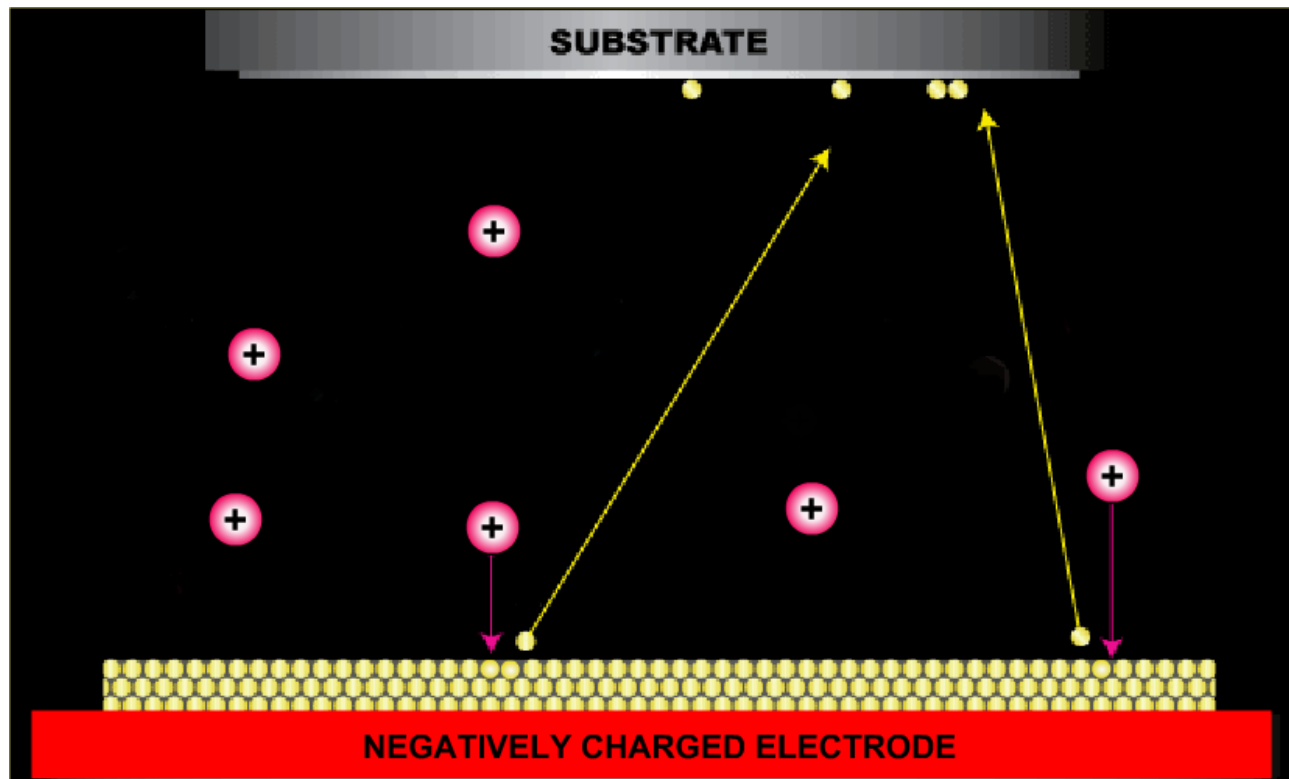# Purpose

- Roughness can obscure the data

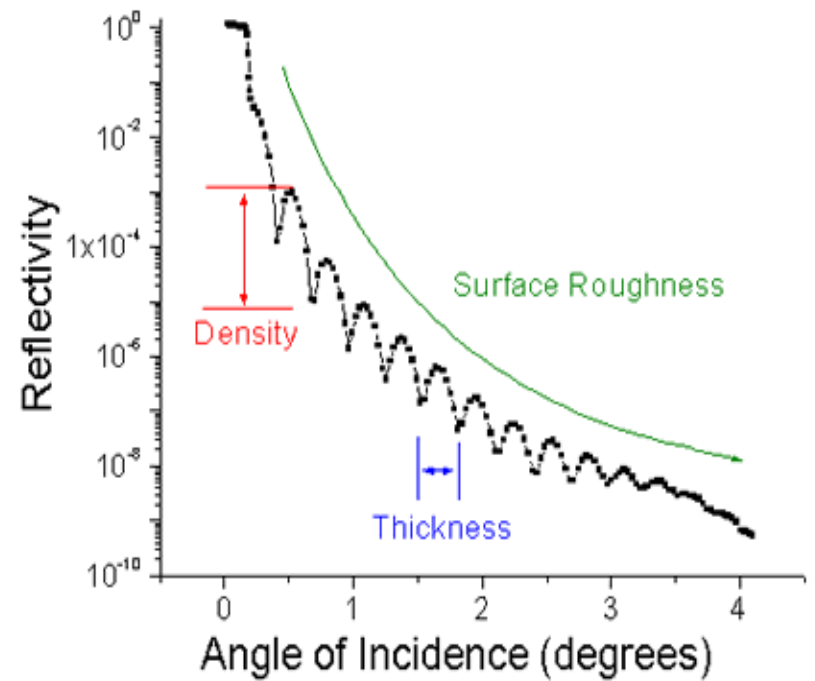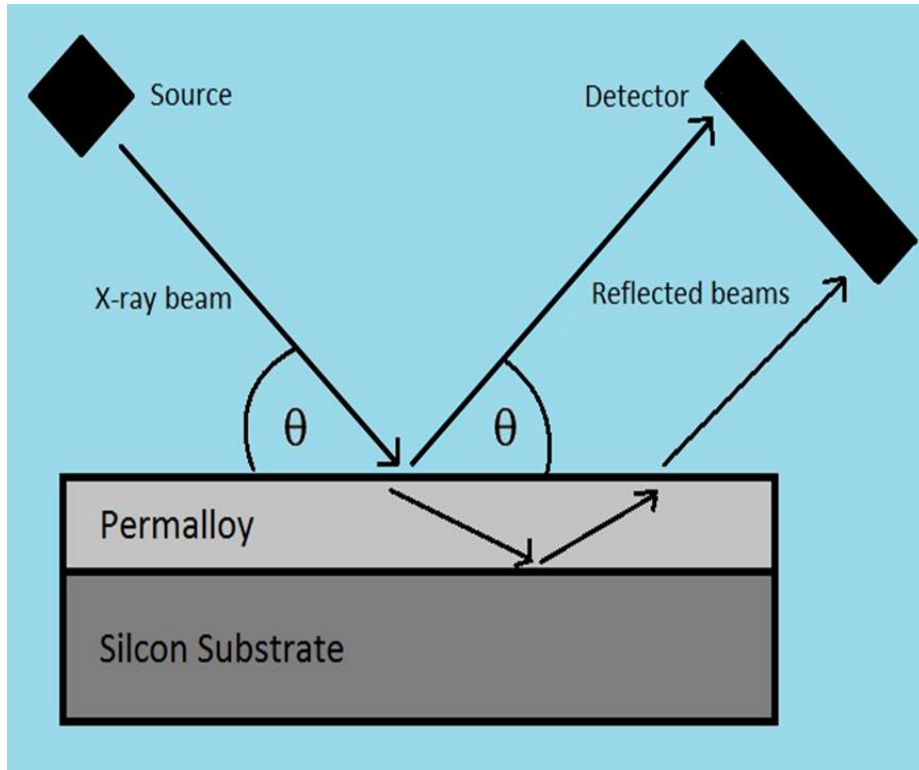Model reflectivity data of alpha hemolysin embedded in a lipid bilayer, **without** interfacial roughness.

Model reflectivity data of alpha hemolysin embedded in a lipid bilayer, **with** interfacial roughness.
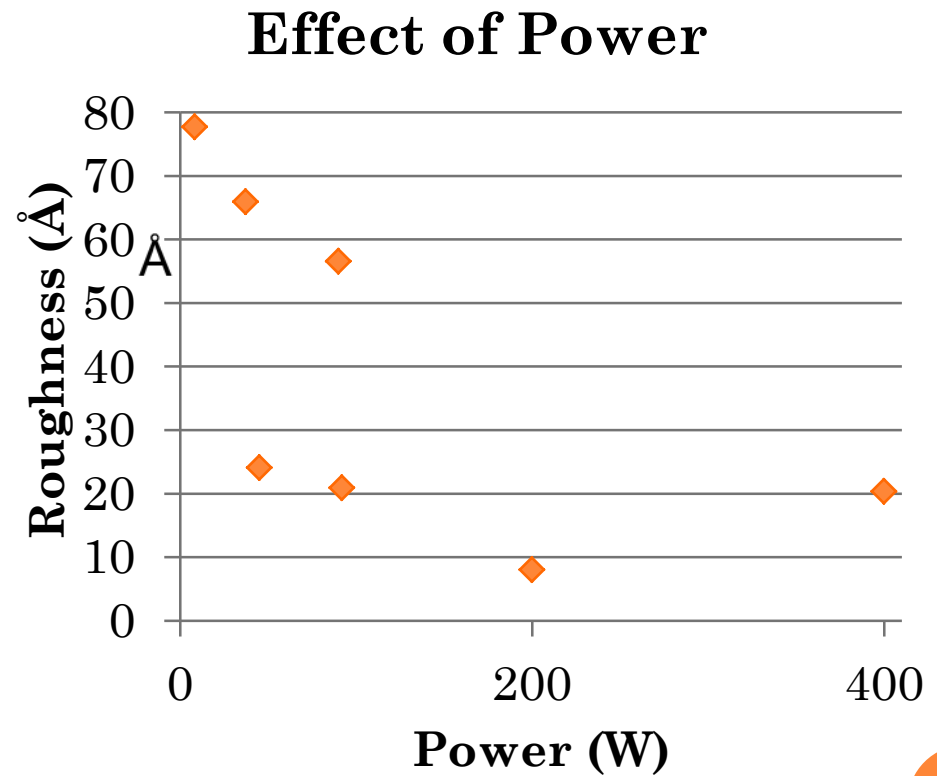
MAGNETRON SPUTTERING

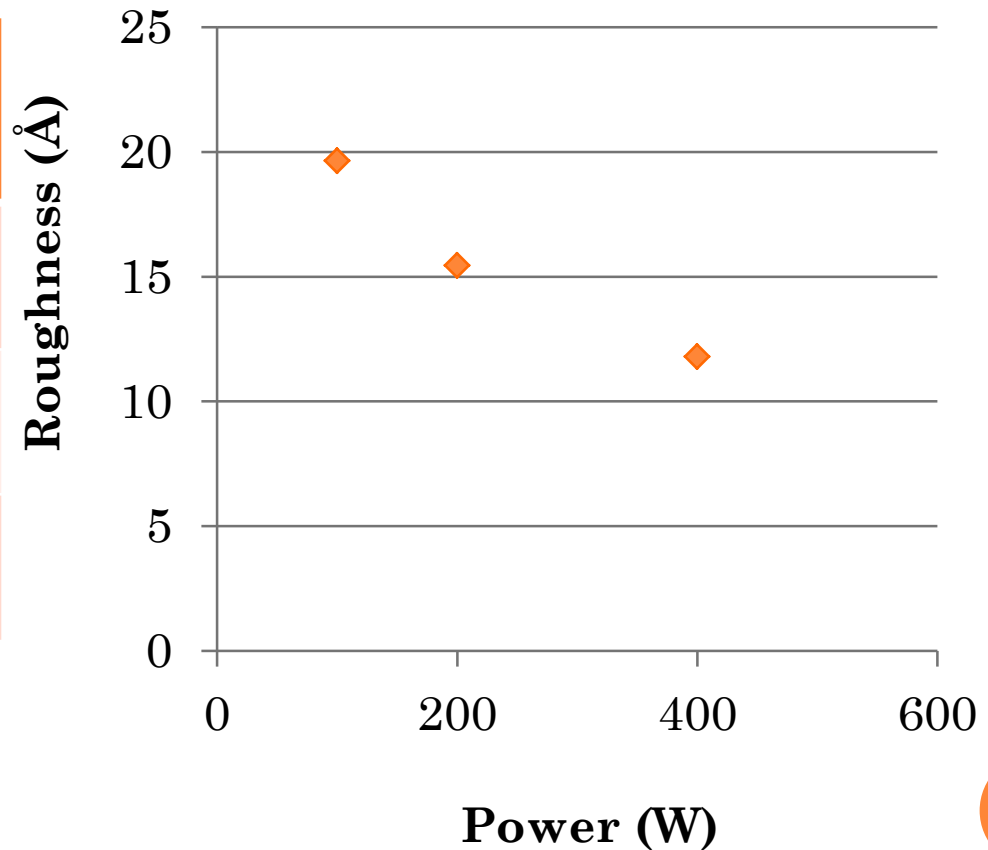# X-Ray Reflectometry

Single Layer Permalloy

Power (W)	Roughness (Å)
8.3	77.71
37.2	65.94
45	24.09 ± 0.24
90	57.03 ± 0.78
92	20.92
200	7.62 ± 0.07
400	19.62 ± 0.16

Effect of Power

PERMALLOY AND GOLD

Power (W)	Roughness (Å)
100	19.64
200	15.45 ± 0.47
400	11.80 ± 0.71

Effect of Power

Permalloy Gold 600W

- Permalloy Roughness: 11.07 ± 0.01 Å
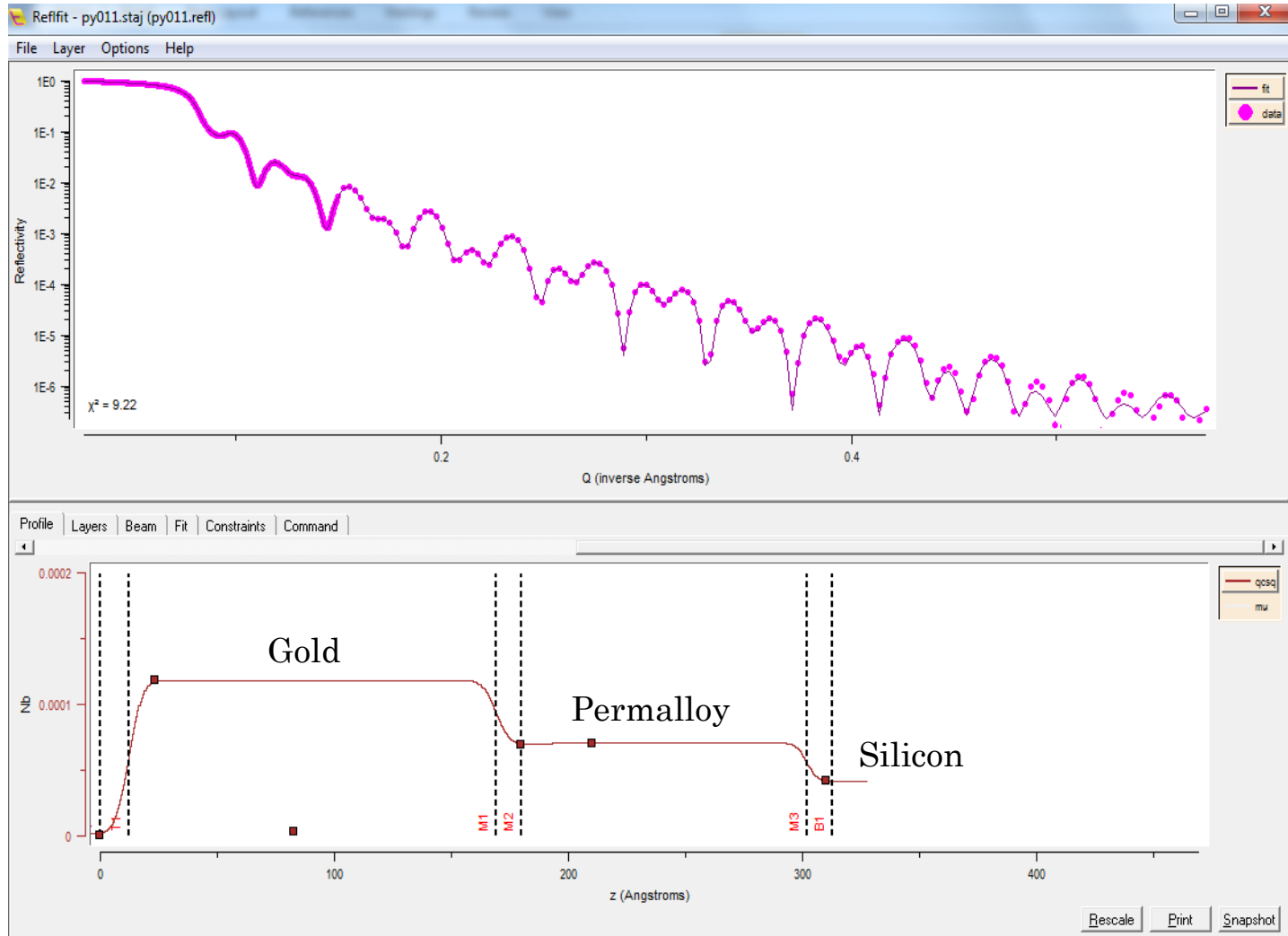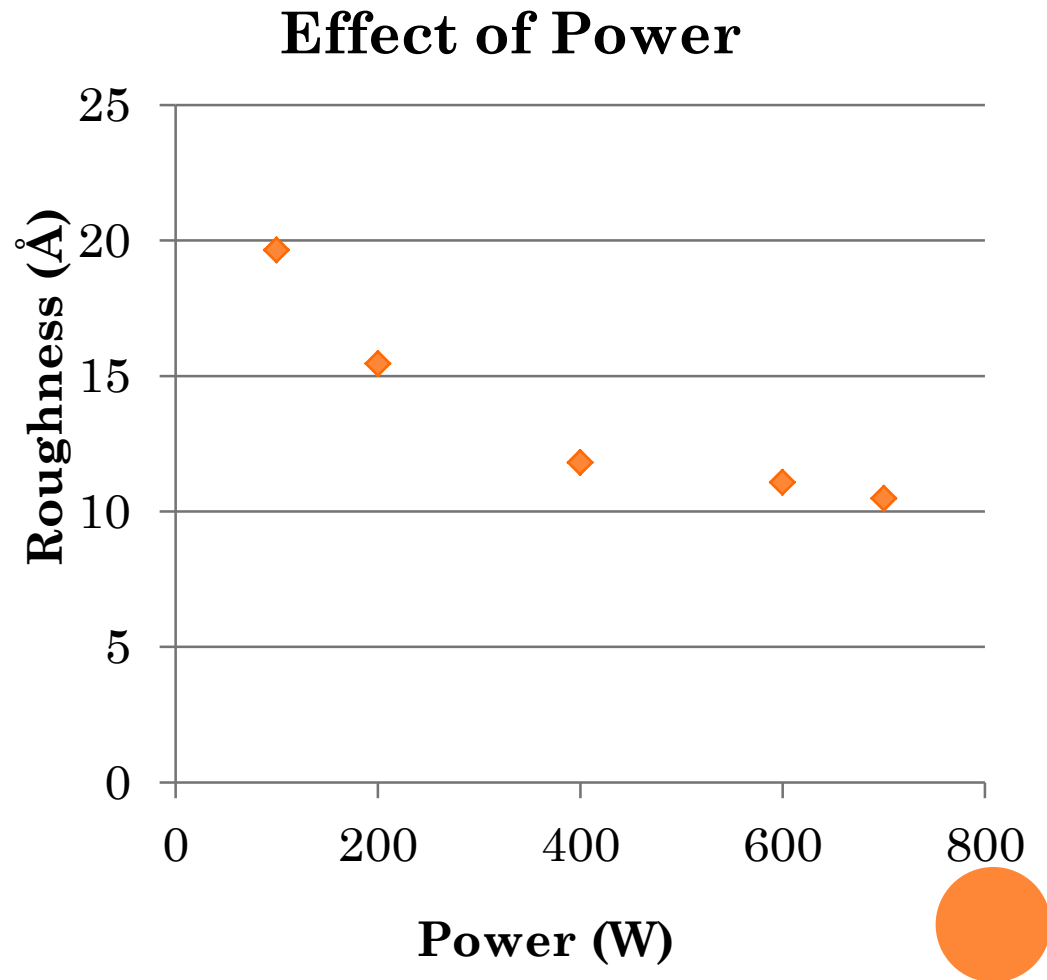- Permalloy Thickness: 125.14 ± 0.07 Å
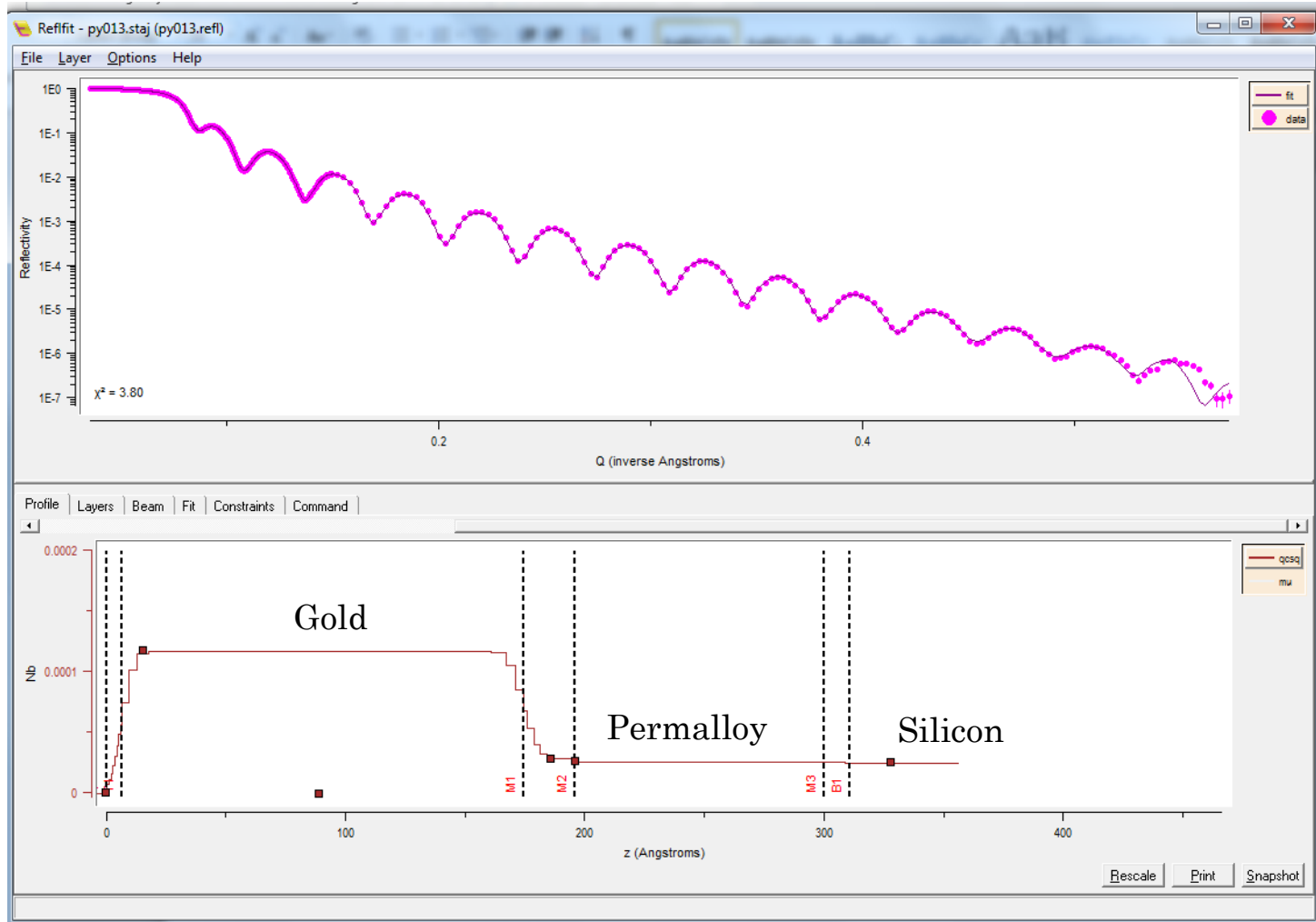
Permalloy Gold 700W

- Permalloy Roughness: 10.485 ± 0.008 Å
- Permalloy Thickness: 132.57 ± 0.03 Å

PERMALLOY AND GOLD

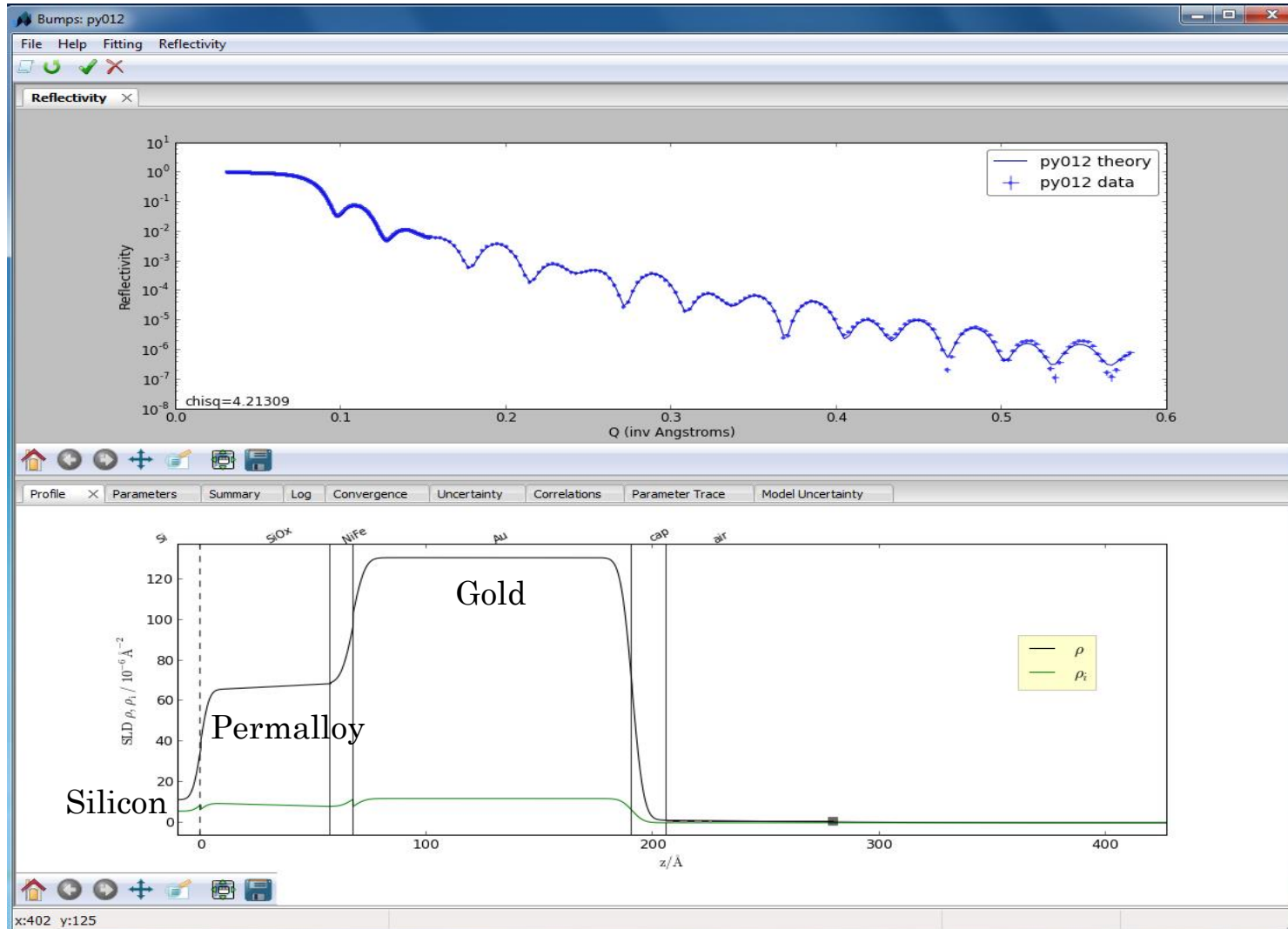| Power (W)	Roughness (Å)
100	19.64
200	15.45 ± 0.47
400	11.80 ± 0.71
600	11.07 ± 0.01
700	10.485 ± 0.008

Effect of Power

CONTAMINATED PERMALLOY GOLD 600W

- Permalloy Roughness: 5.799 ± 0.003 Å
- Permalloy Thickness: 241.64 ± 0.02 Å
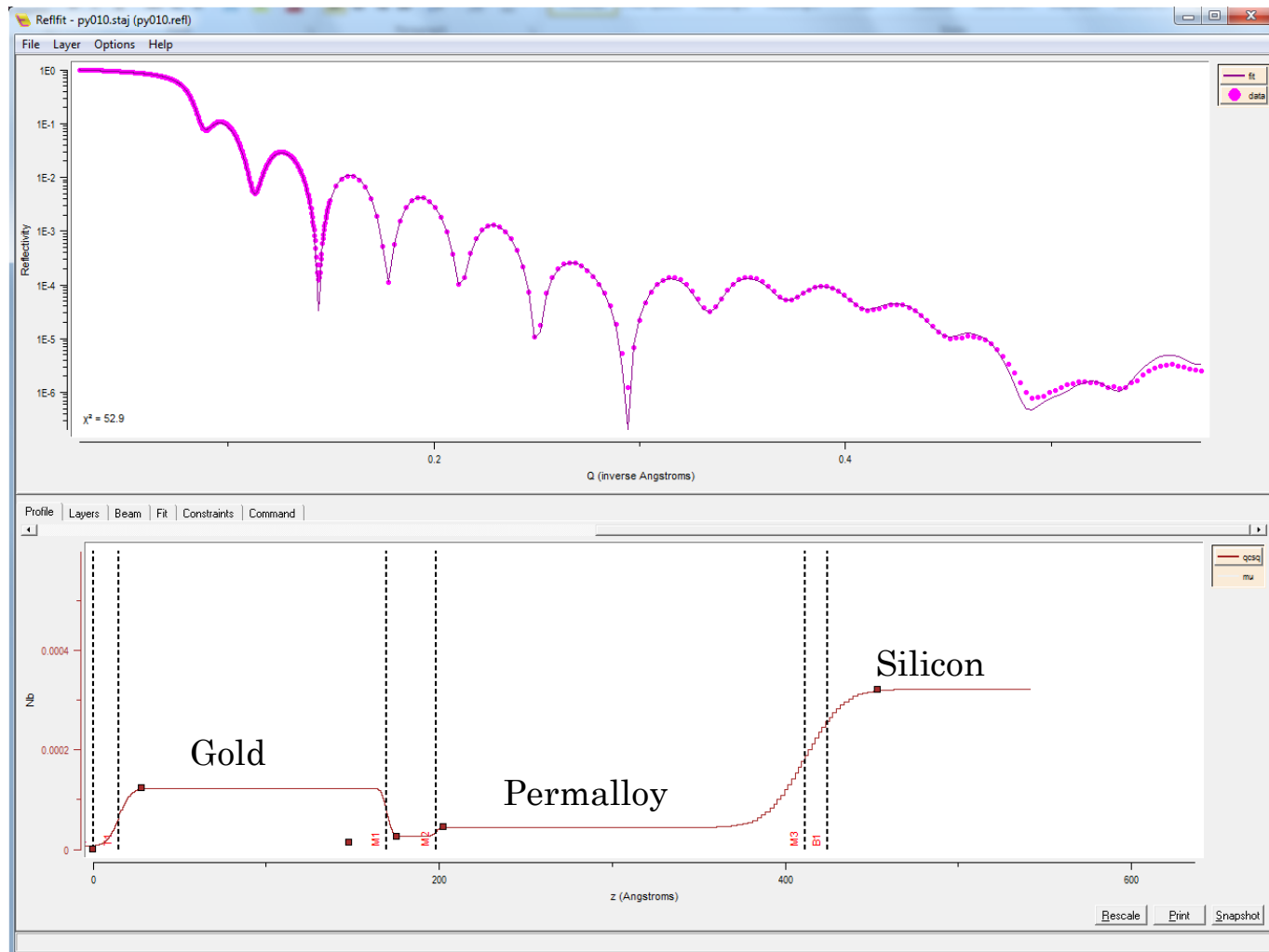
THIN PERMALLOY

- Permalloy Roughness: 4.2187681 ± 0.000008 Å
- Permalloy Thickness: 57.5579 ± 0.0004 Å

Conclusion

- Higher sputtering powers provide lower roughness values
- Gold layer is required to protect samples from the environment
- Continue study of permalloy thickness
- Further areas of study:
  - Effect of silicon substrate temperature
  - Effect of sputter pressure
  - Effect of gold thickness

SPECIAL THANKS TO:

Frank Heinrich

Julie Borchers

Yamali Hernandez

CHRNS

QUESTIONS?