Computer System Interoperability for Nanoscale Materials Testing

Jenny L. Price

Appalachian State University

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NIST CENTENNIAL
1901-2001
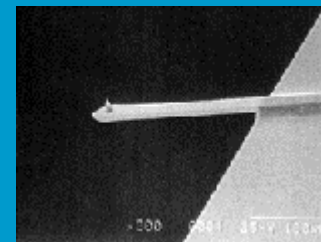

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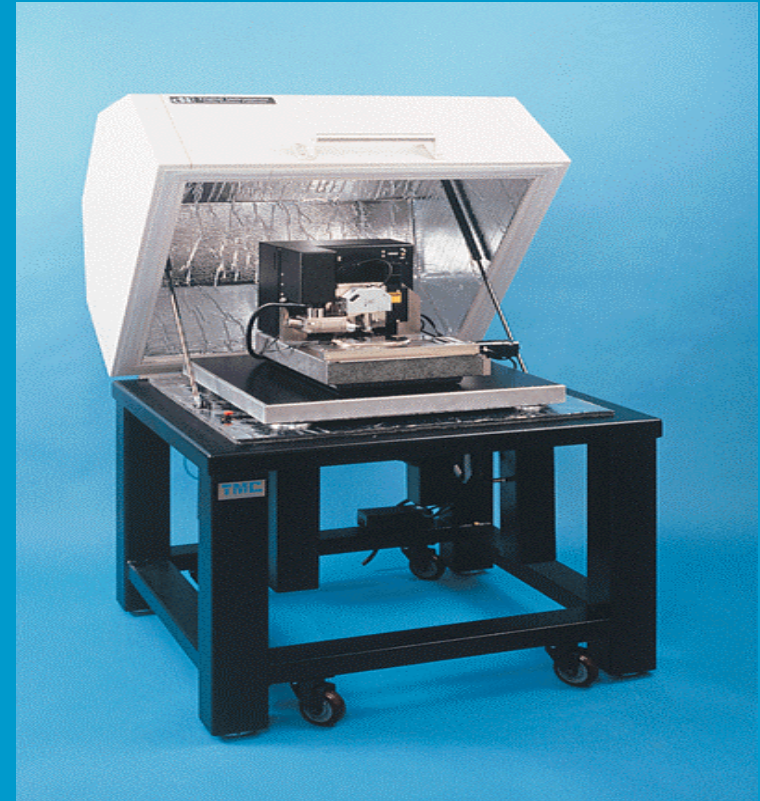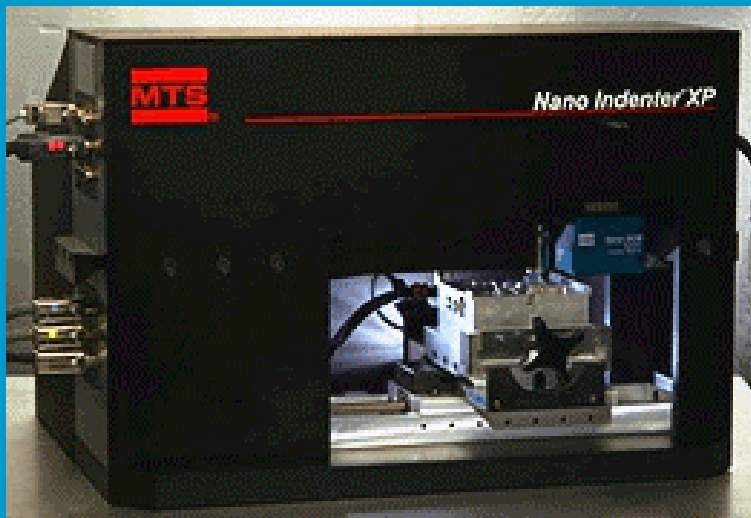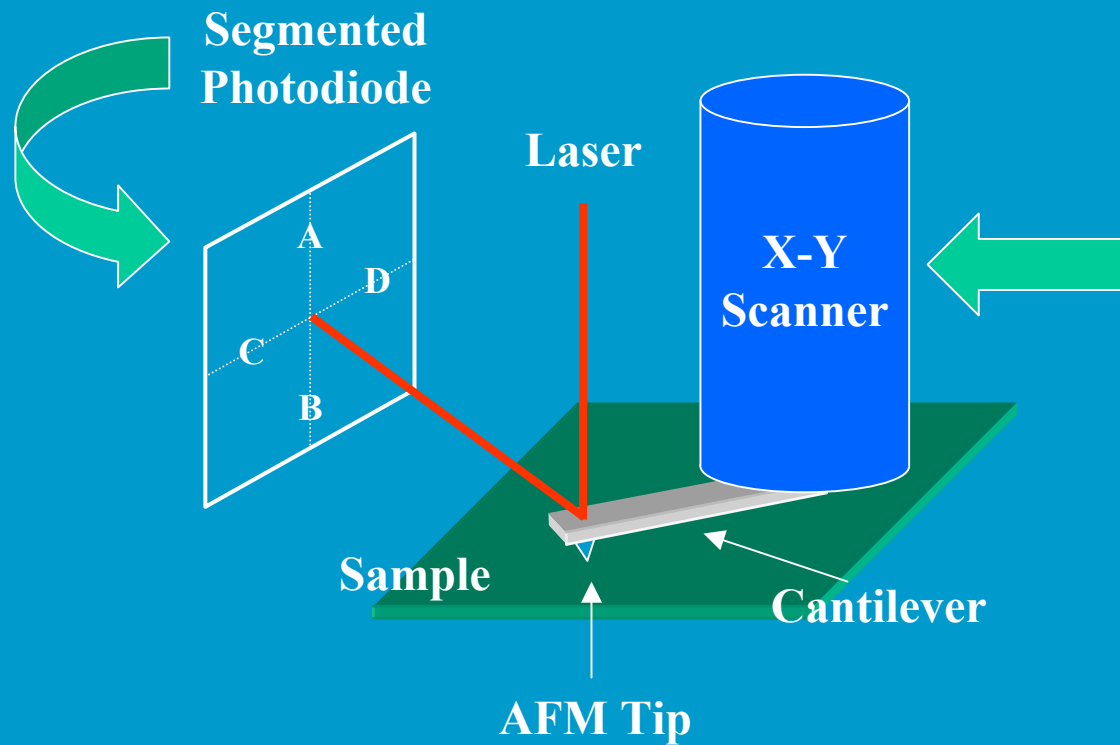Building and Fire Research Laboratory

Outline

- Introduction

- Motivation Behind Project

- Purpose of Project

- Procedure
    - Translating a Computer algorithm
    - Scanning Tip Characterizer Samples
    - Scanning Nanoindenter Tips with an Atomic Force Microscope
    - Determining Actual Shape of Nanoindenter Tips

- Comparing Results

- Acknowledgements

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Introduction

- Basic things to know:
  - Atomic Force Microscope (AFM)
  - AFM Tip
  - Nanoindenter
  - Nanoindenter Tip

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Atomic Force Microscope

Segmented Photodiode

Laser

X-Y Scanner

A

D

C

B

Sample

AFM Tip

Cantilever

Motivation and Purpose

- Nanoindenter Tip shape needed for studies of mechanical properties of polymers

- Service Life Prediction

- Indentation of reference samples normally used to measure tip shape

- Determine Nanoindenter Tips shape by AFM imaging

- Transfer from UNIX to Windows
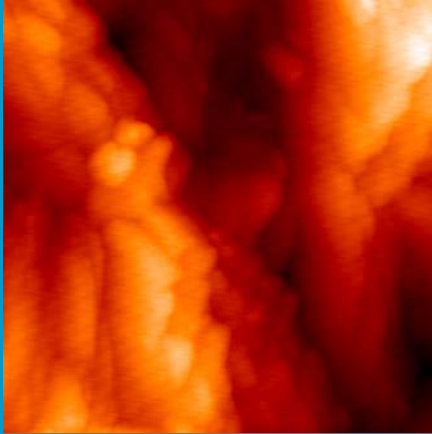
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Translating a Computer Algorithm

- UNIX to PC

- [Dynamic Link Library](#)-

  a file that contains functions which can be called by other programs and DLLs to perform certain tasks and jobs.

- PV Wave
  - read_nano4
  - fast_tipest
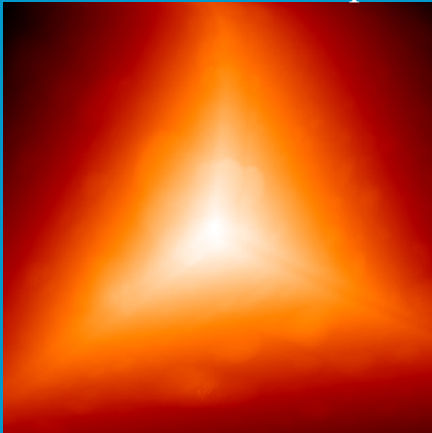 - erosion

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Procedure

Tipcheck Sample
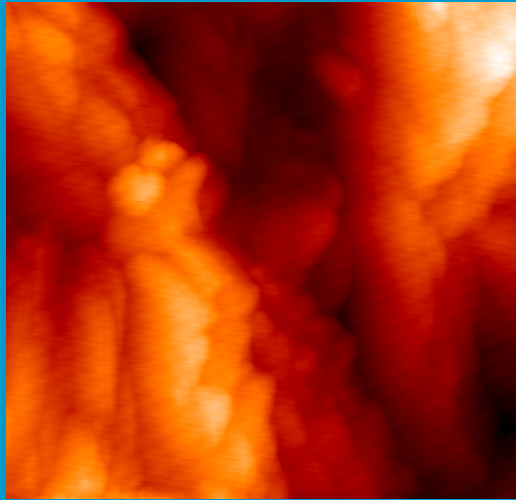
1.
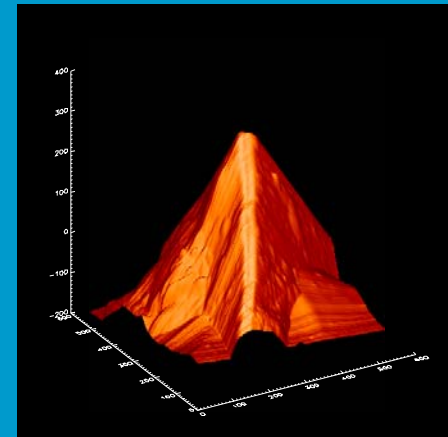
2.

Reconstructed AFM Tip
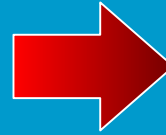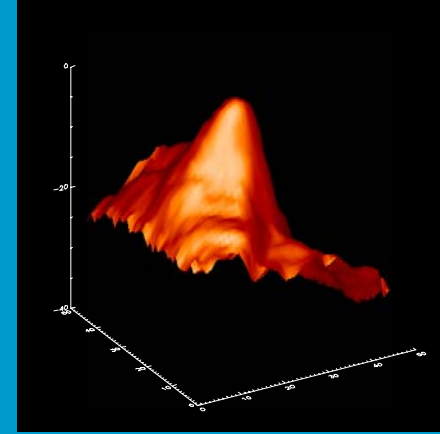
**AFM Image of
Nanoindenter Tip**
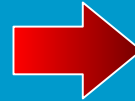
3.

4.

Actual Nanoindenter Shape
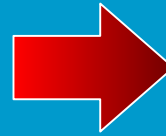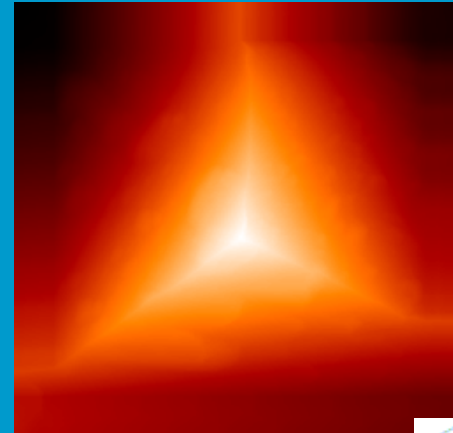
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Reconstruction of the AFM Tip

Tip Characterizer
Sample
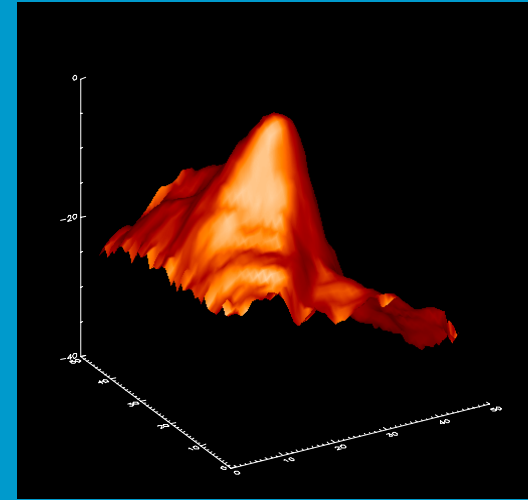
Reconstructed Tip

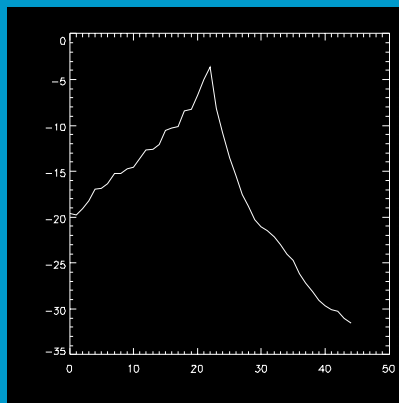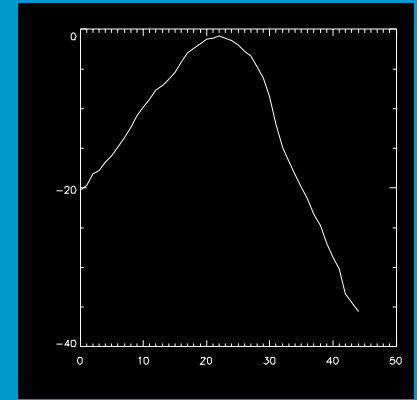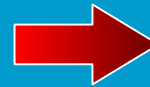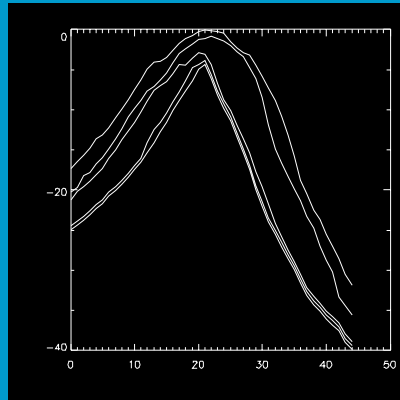AFM image = nanoindenter tip shape + AFM tip geometry

```
wave> read_nano4, "tiart4.f01",data, image

wave> tvscl, image

wave> rtip = fast_tipest (image,45,45,thresh=2.4)

wave> surface, rtip
```
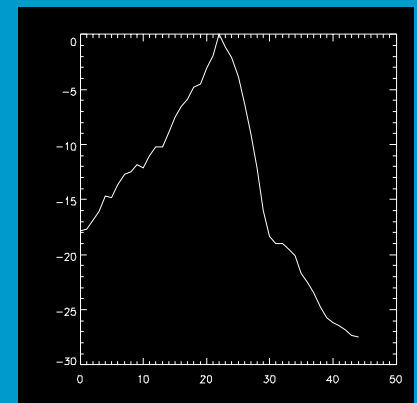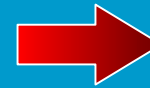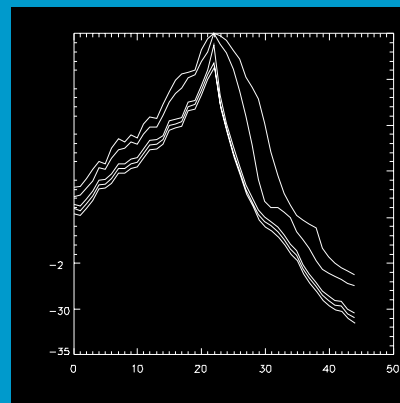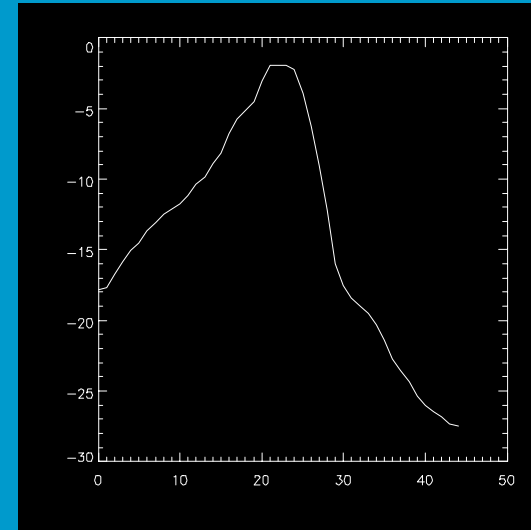
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Choosing a Threshold
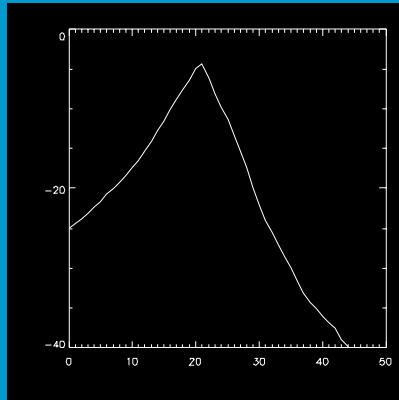
x-cross section

y-cross section
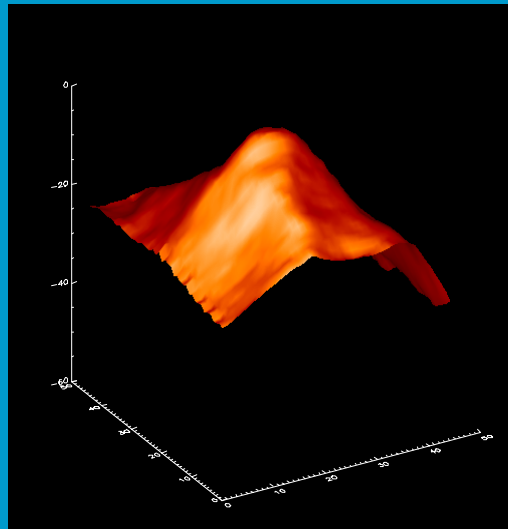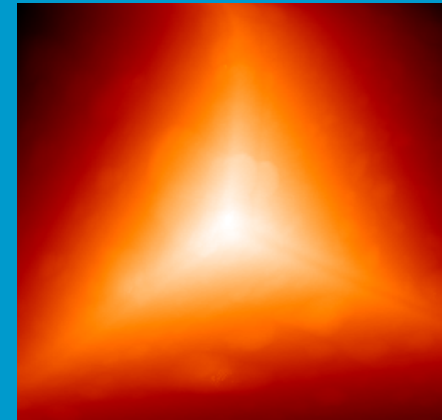
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Median Filtering
y-cross section
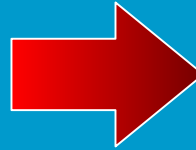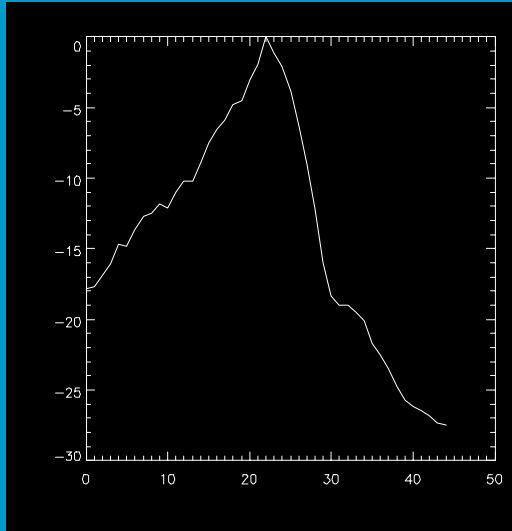
Reconstructed
Tip
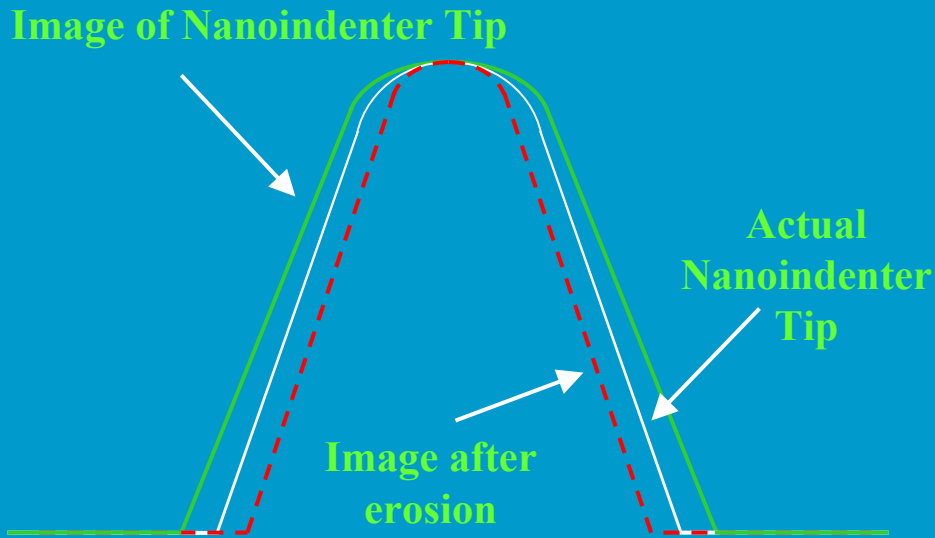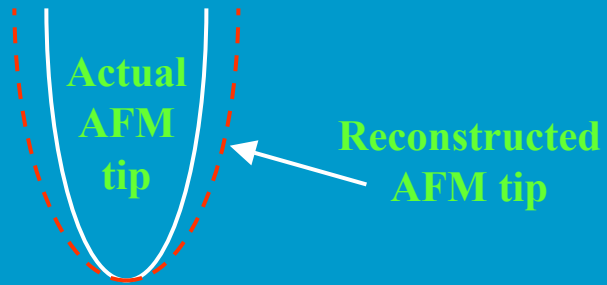
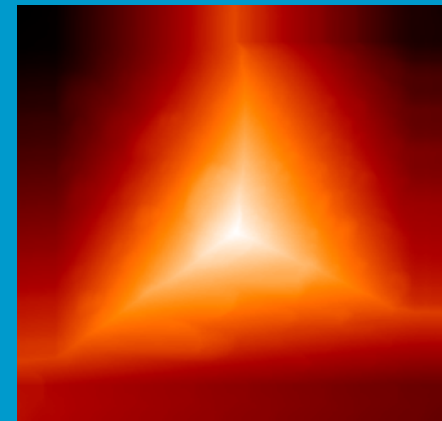*BFRL*

Erosion

Actual AFM tip

Reconstructed AFM tip

Image of Nanoindenter Tip

Actual Nanoindenter Tip

Image after erosion

AFM Image

erosion

Eroded Image
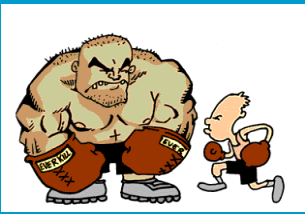
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Area Vs. Height

a_vs_h (berktip, tip1)

y-axis: area (nm^2)

x-axis: height (nm)

Legend: afm image, eroded image
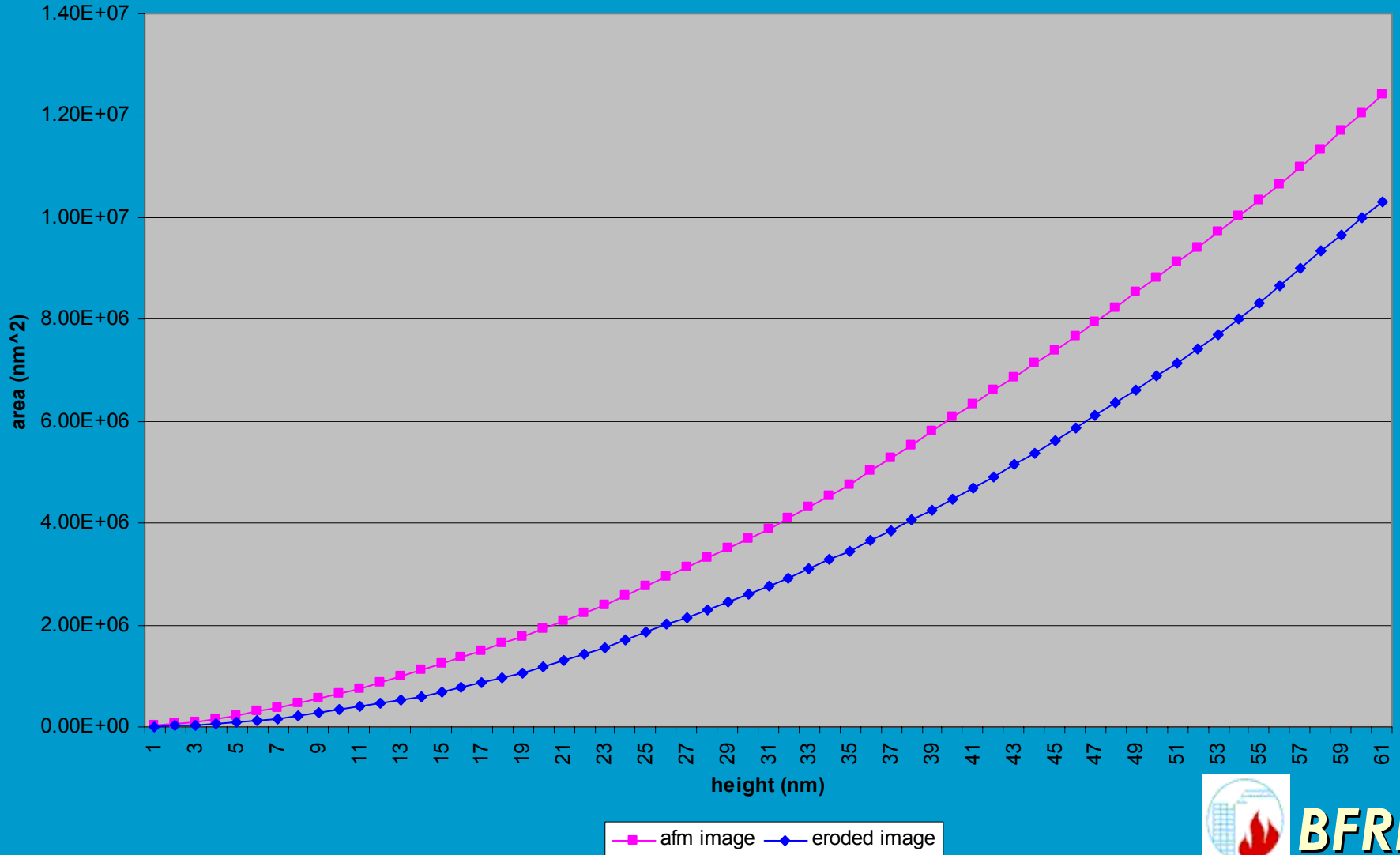
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Acknowledgements

- Mark VanLandingham
- John Villarubia
- Stuart Dolls
- BFRL
- NIST

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