Pad Damage Management on the Test Floor

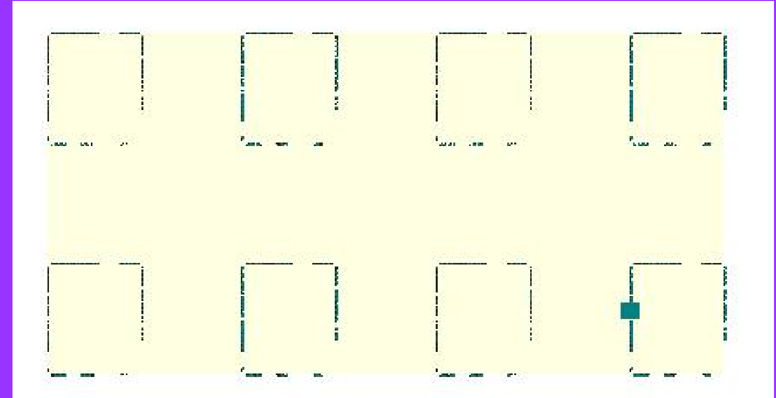
By John Strom – Lifetime Fellow

Agenda

- Overview of Test Setup
- General Analysis of Test Data
- Scrub Depth Analysis
- Punch-Through Analysis
- Bump Measurements
- Conclusions

Testing Overview

- Probe Card –
  - 8 Dut
  - 1208 Probes



- 300mm Prober / Wafer
- Metrology Tool - waferWoRx300
  - Probe Card Measurements - Planarity/Alignment/Diameter (Optical)
  - Wafer Measurements - 2D Scrub Measurements
  - Analysis - Correlation / Probing Process Modeling
  - 3D Scrub Measurements – Scrub Depth
  - 3D Probe Tip Measurements – Tip Profile
  - Punch Through Screening
  - Bump Measurements

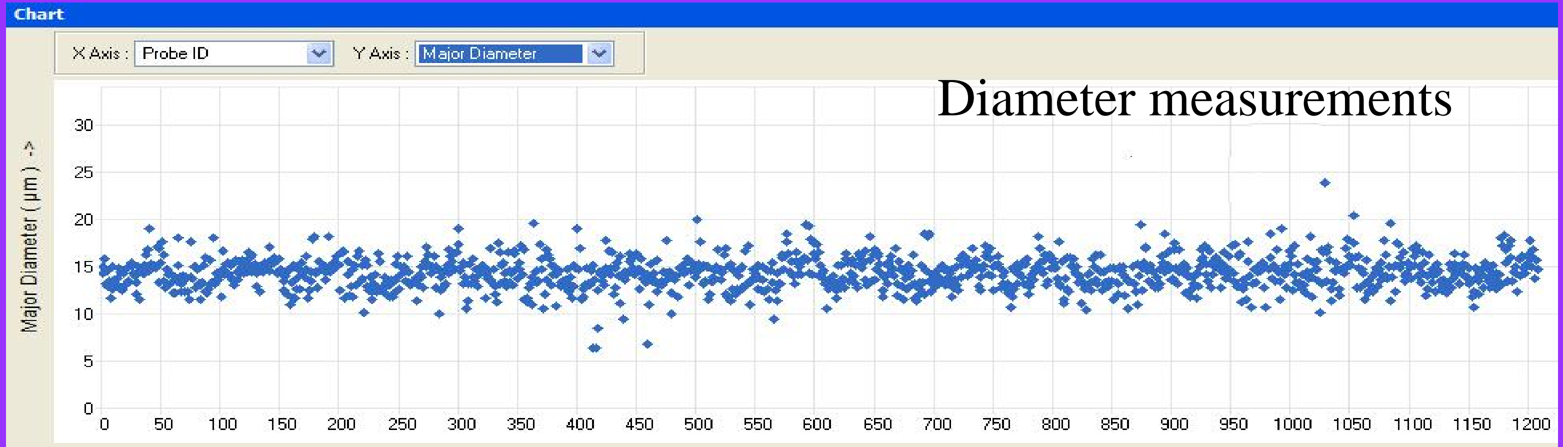
General Analysis of Test Data

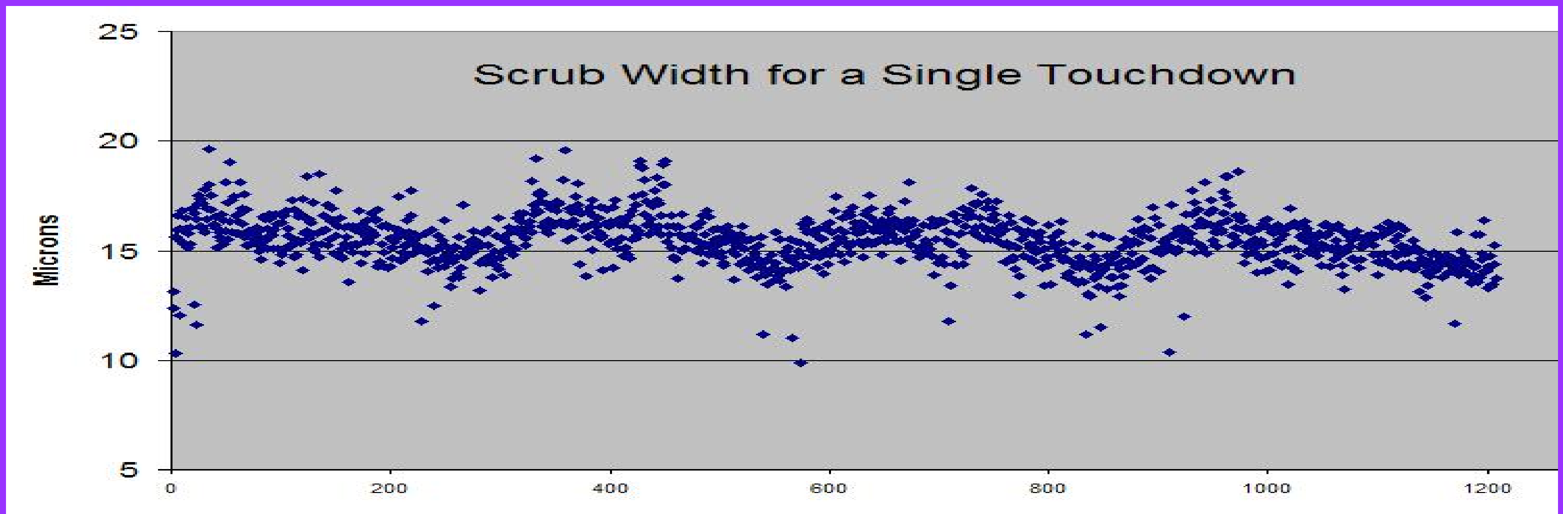
- Probe Card Measurements - (Position and Size)
- Wafer Scrub Measurements - (Position and Size)
- Correlation Analysis

Scrub Width and Tip Diameter

Probe Tip Diameter – Average = 14.3 microns

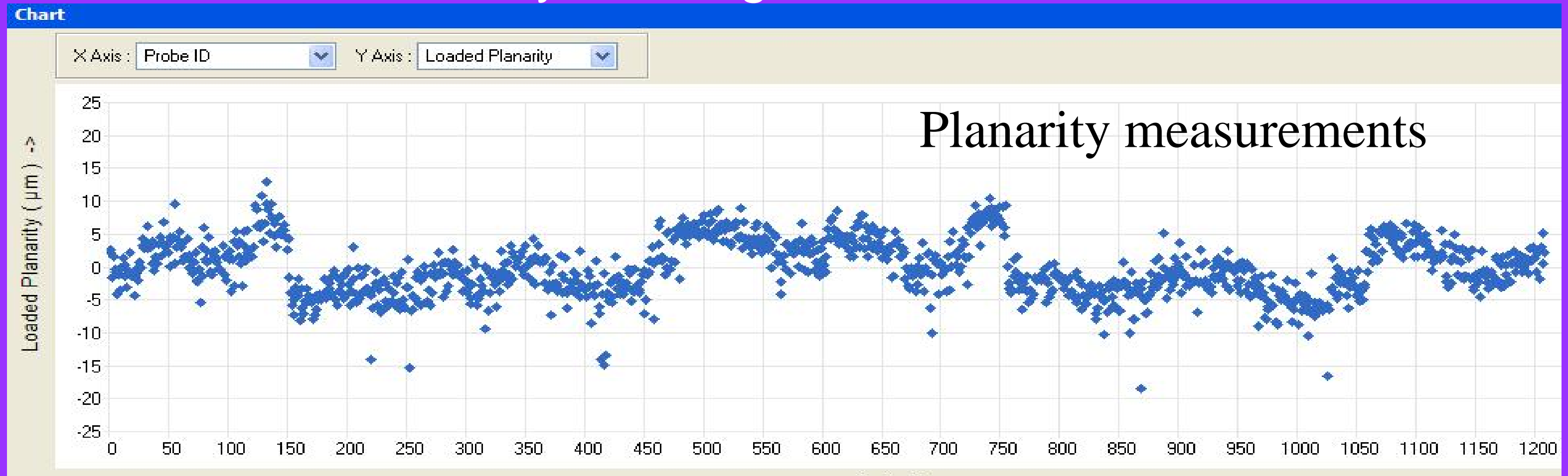
Scrub Width - Average = 15.5 microns

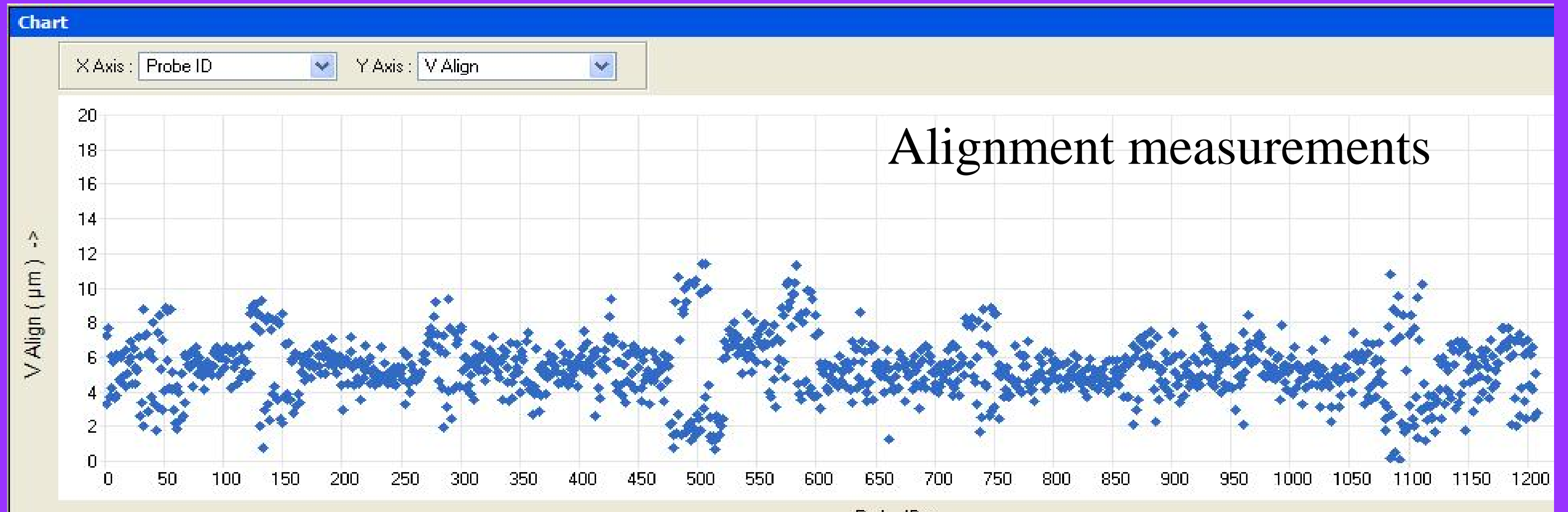




Probe Card : Position Measurements

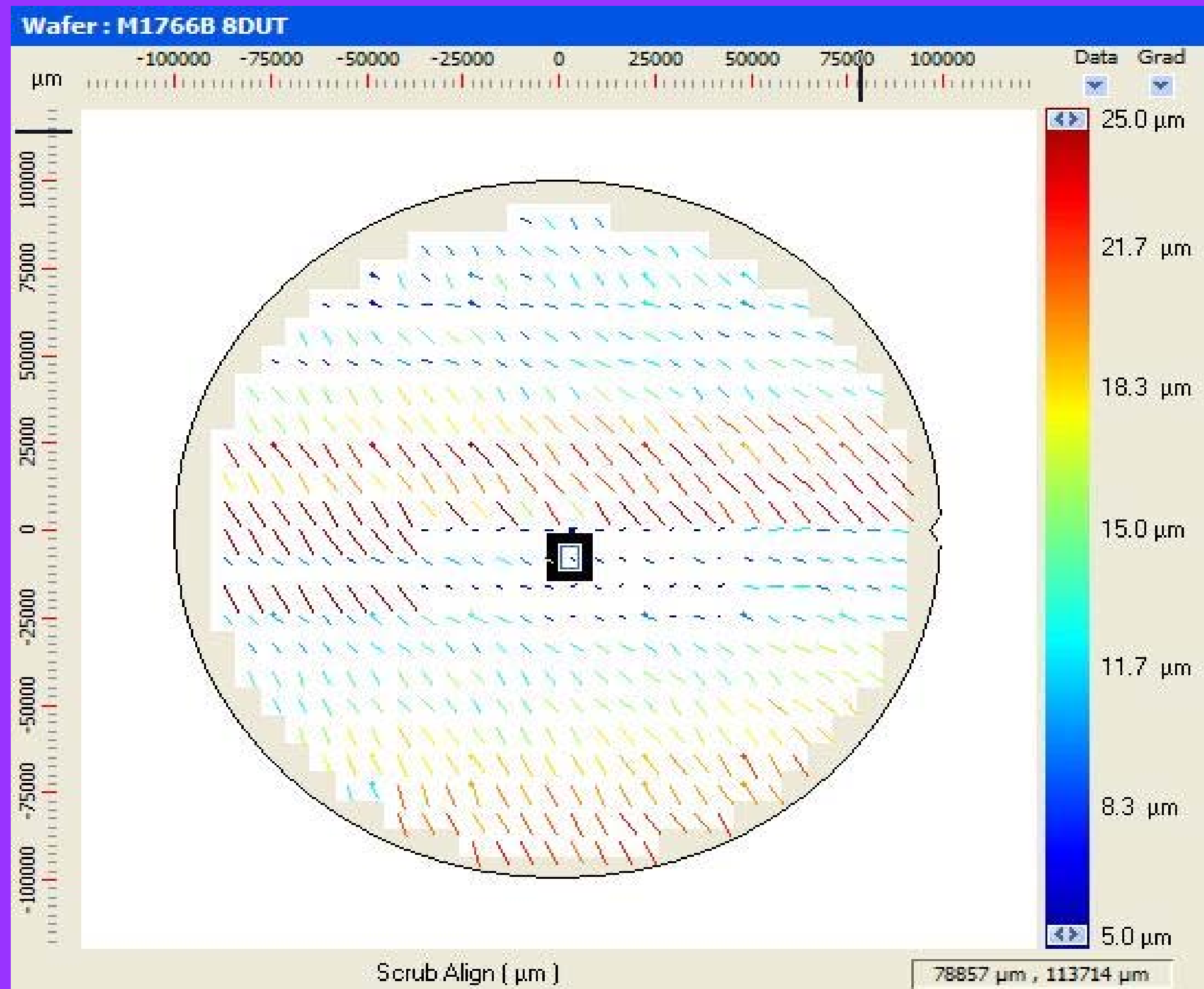
Planarity and Alignment ~ 10 microns





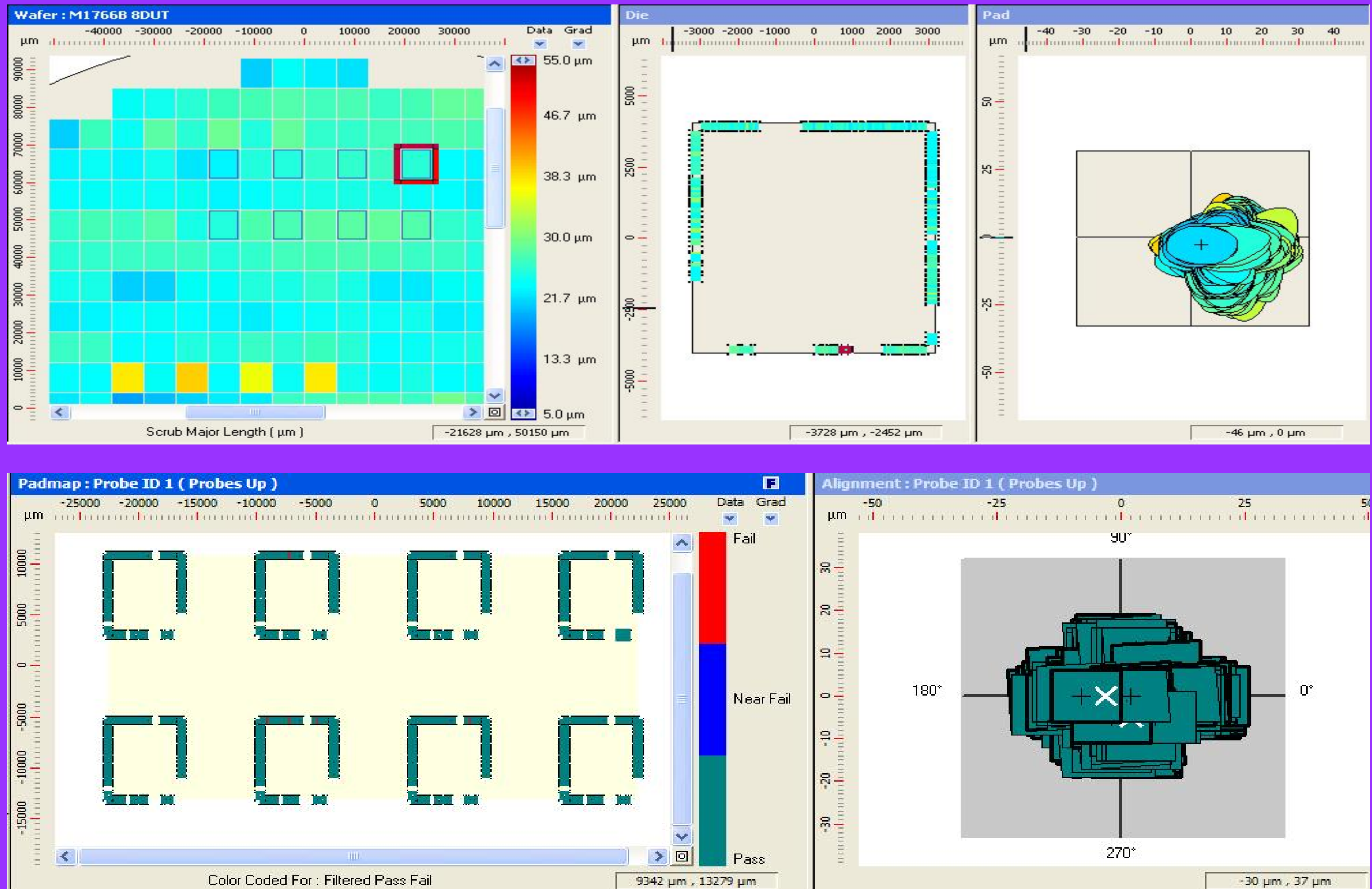
Wafer Measurements - XY

- Scrub XY Position - Vector View (Average XY Position per die)



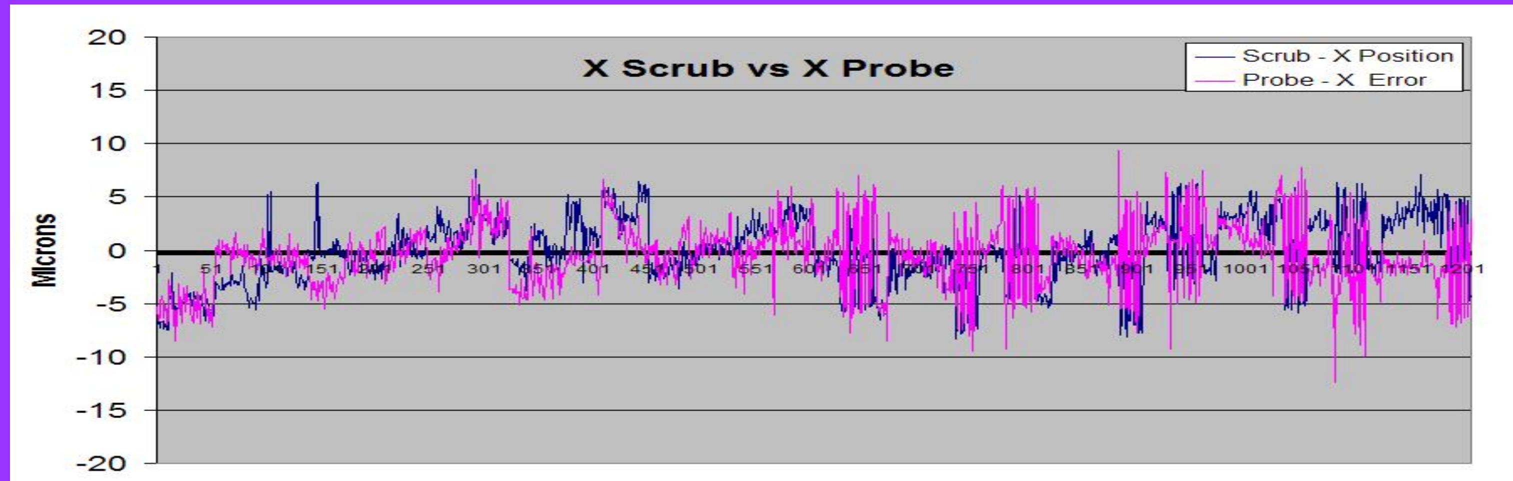
Wafer Measurements - XY

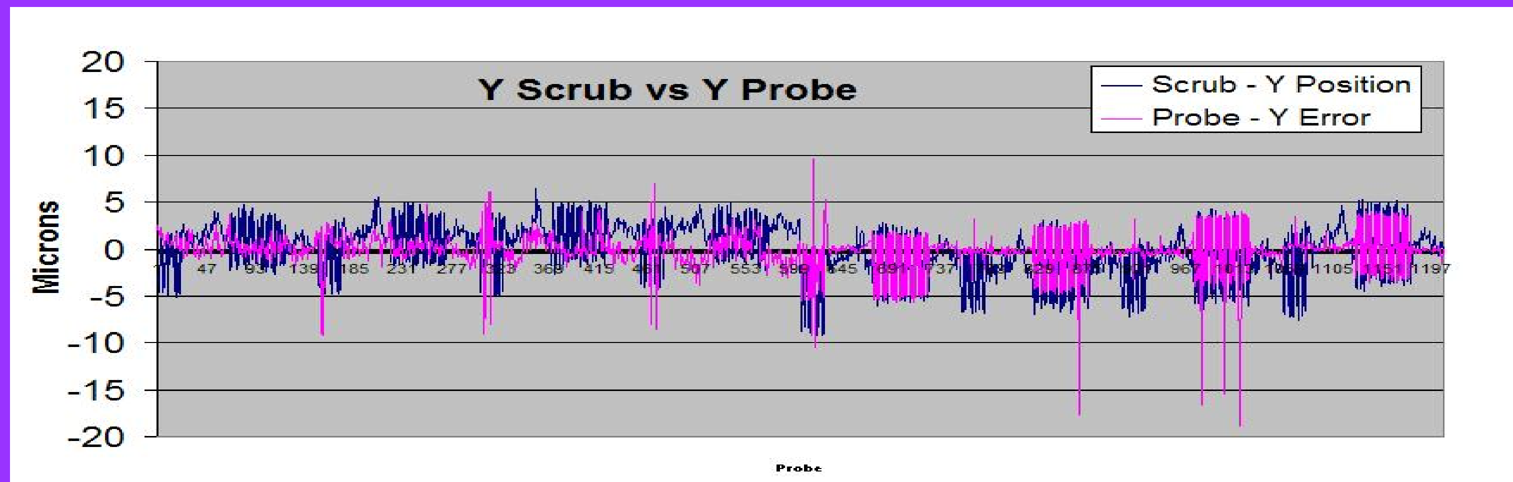
Scrub XY Position Predicted and Measured– Single Touch Down



XY Correlation

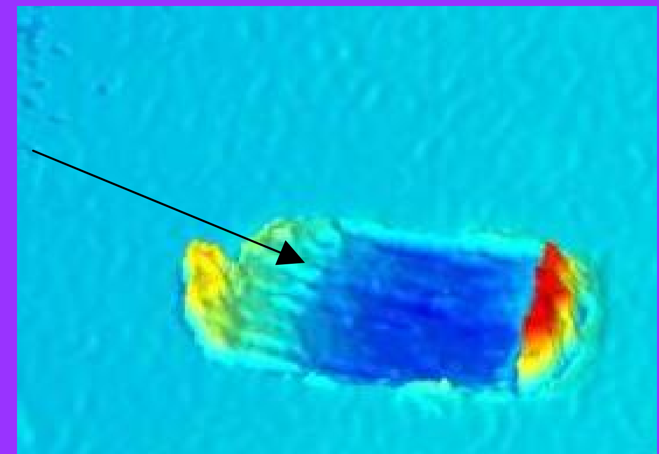
Scrub XY Position Predicted and Measured– Single Touch Down



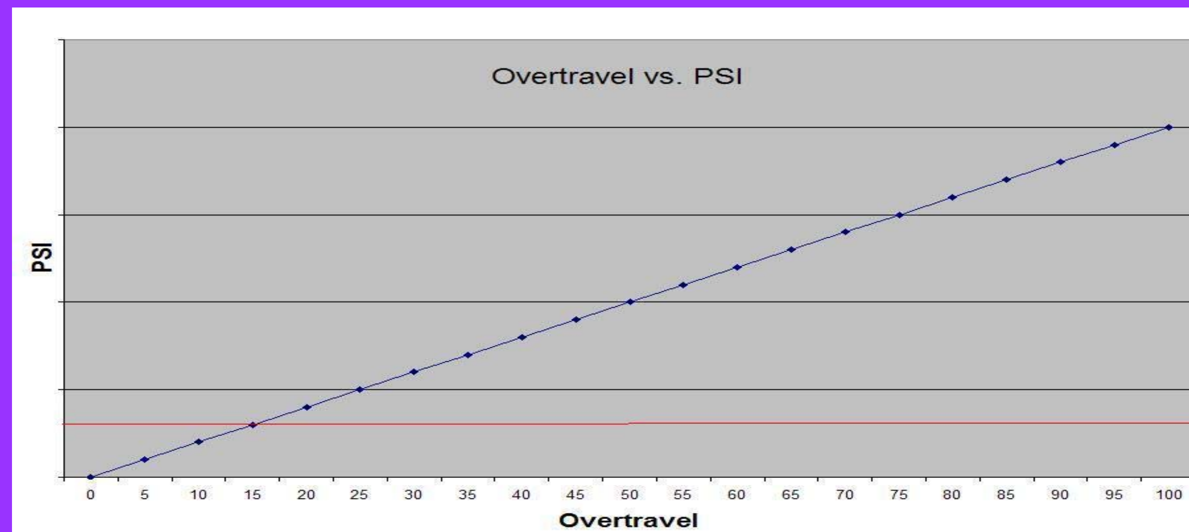


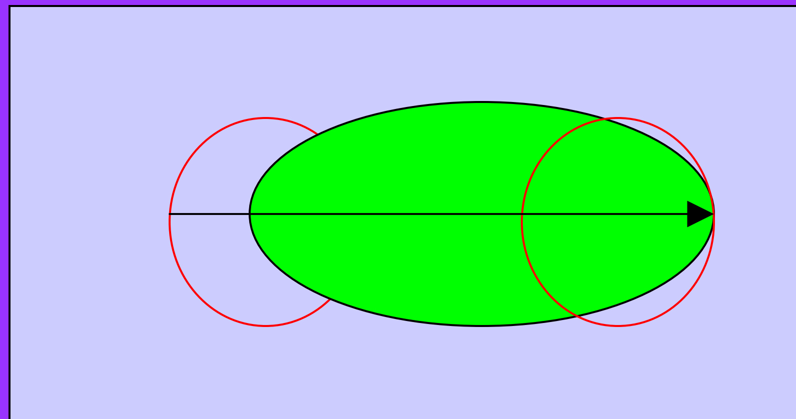
Scrub Depth Analysis Overview

- Pad Material and associated Yield Point
- Probe Tip Shape and Diameter vs Depth
- Scrub Length vs Depth



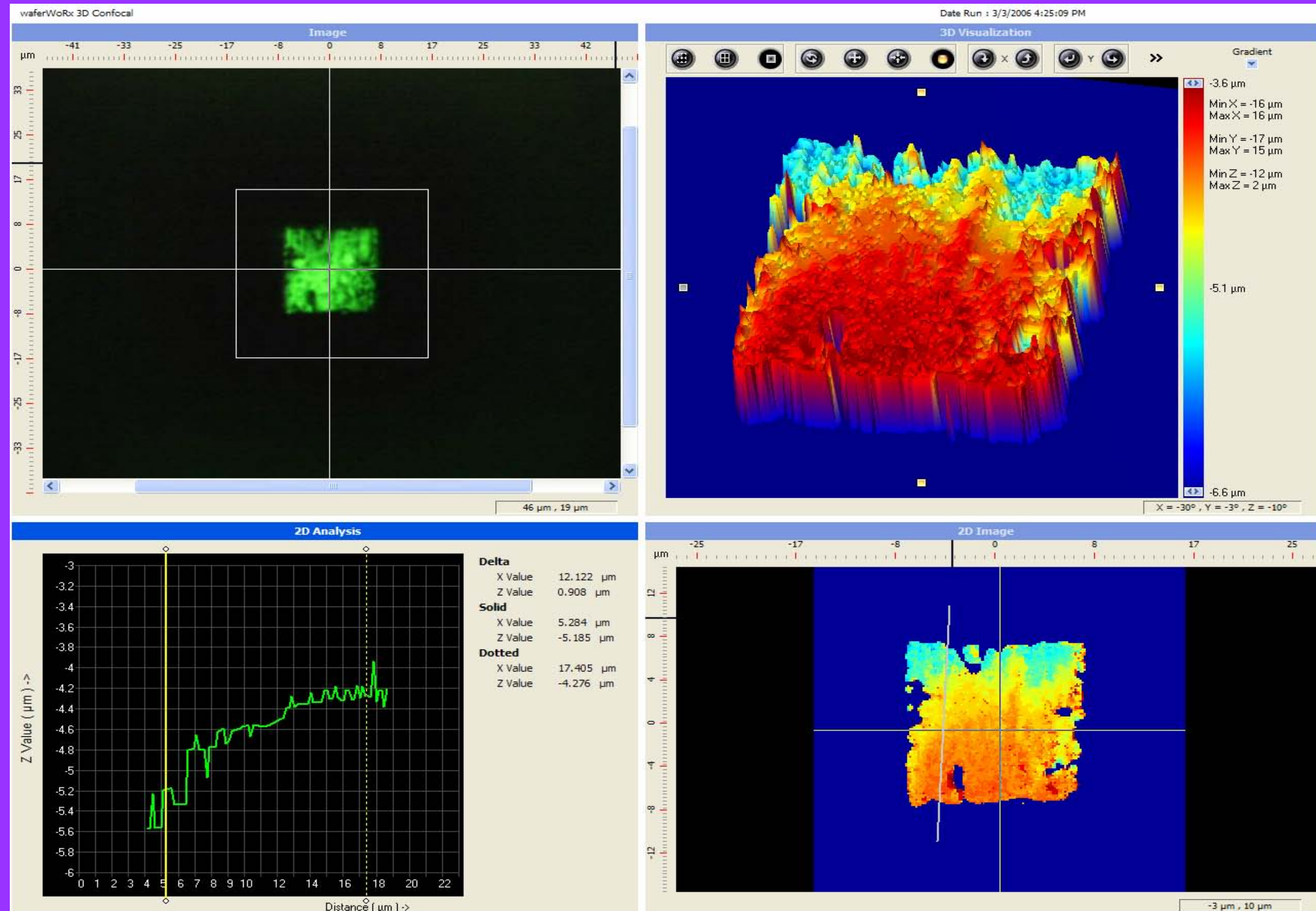
Pad Material and Associated Yield Point





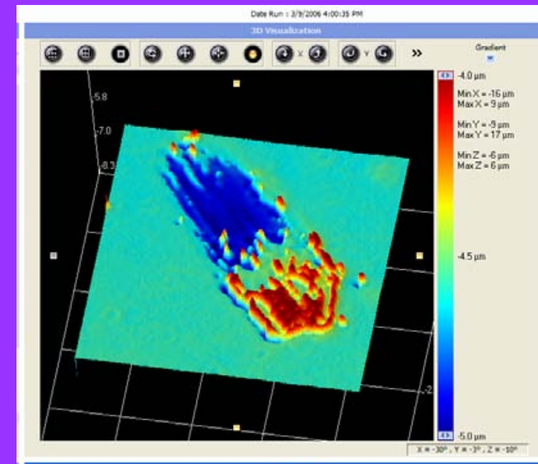
Probe Tip Shape / Diameter

Consistent Shape and Size for majority of probes

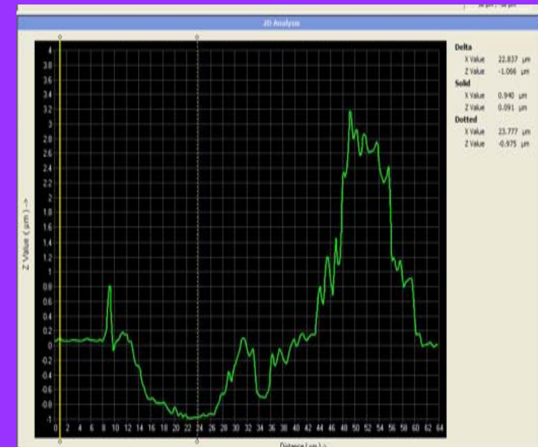


3-D Scrub Depth Measurement

Complete 3-D analysis of scrub marks

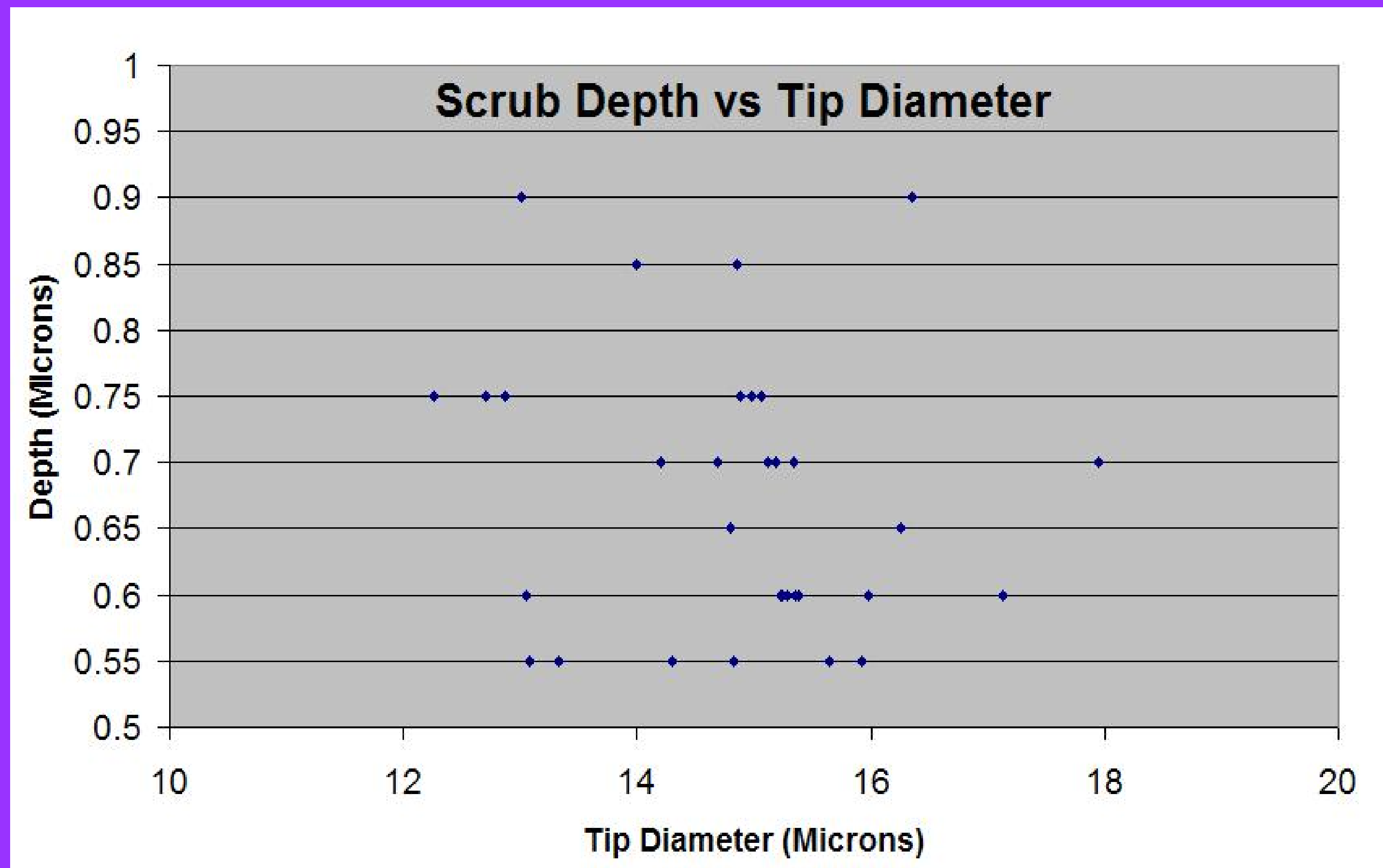


Cross-sectional analysis allows for measurement between any two points



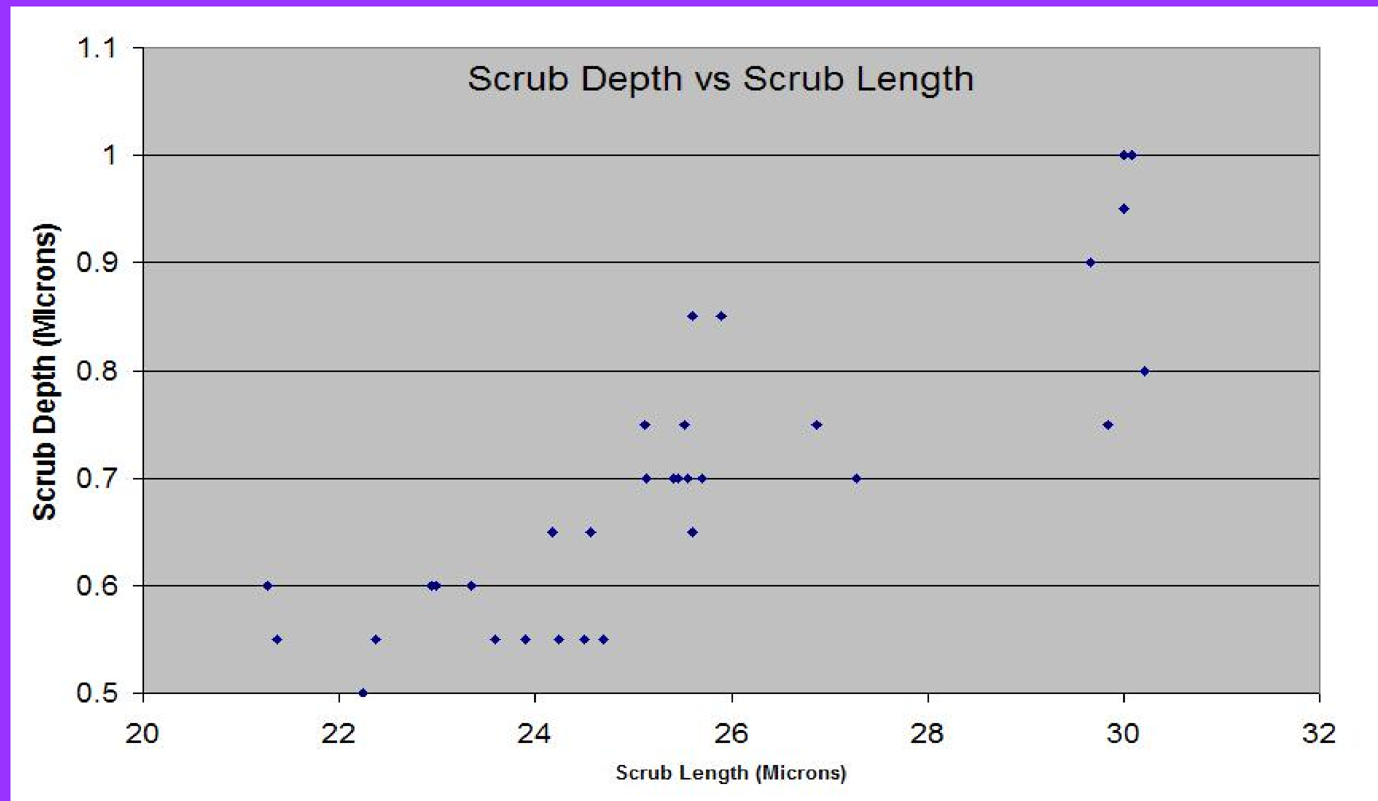
Scrub Depth vs Probe Diameter

Consistent Shape and Size caused very little depth correlation in this data set.

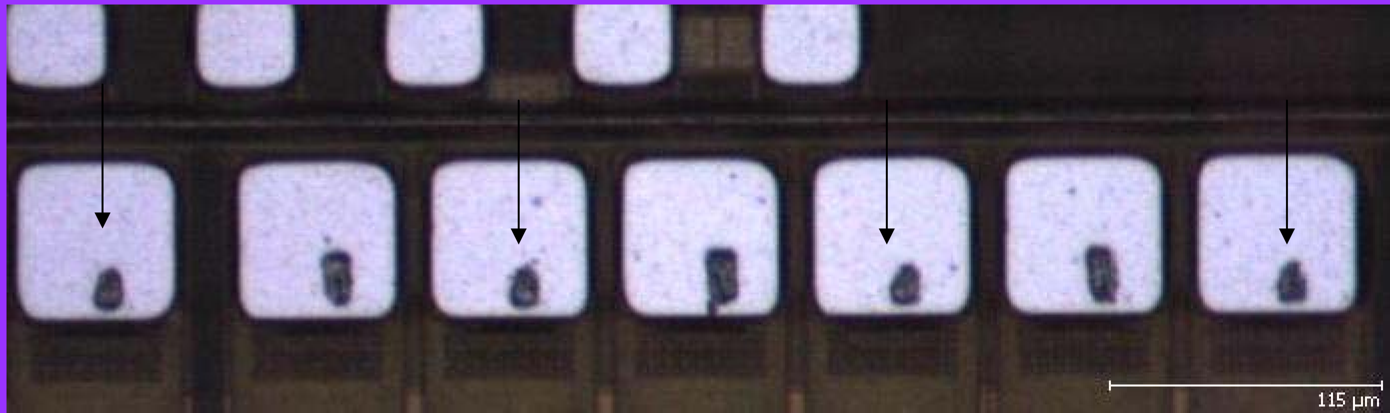


Scrub Depth vs Scrub Length

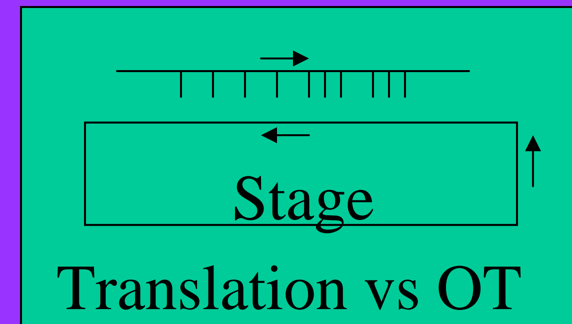
Strong correlation between Scrub Length and Scrub Depth



Scrub Depth vs. Scrub Length

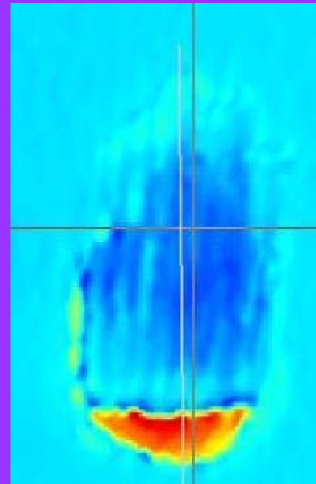


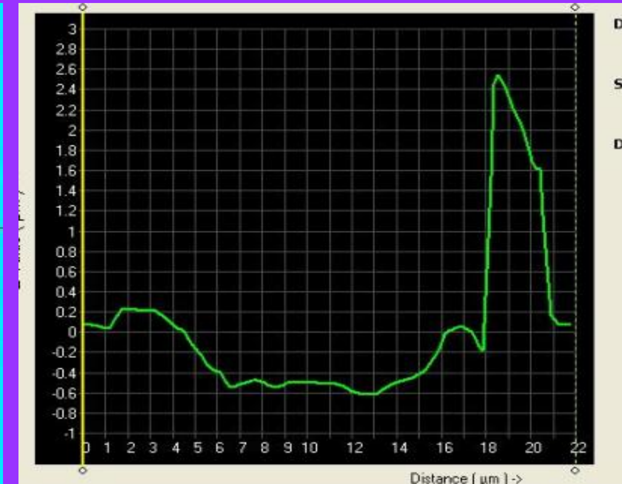
- Probes are planar
- Probes have same force
- Scrubs are longer/shorter because of translation of stage vs. card



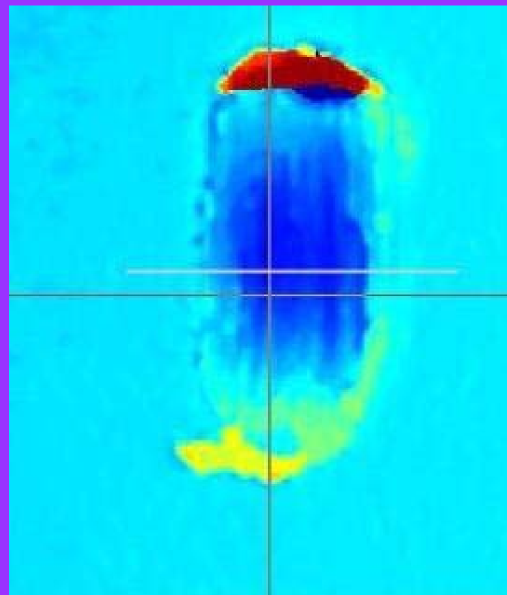
Scrub Depth vs Scrub Length

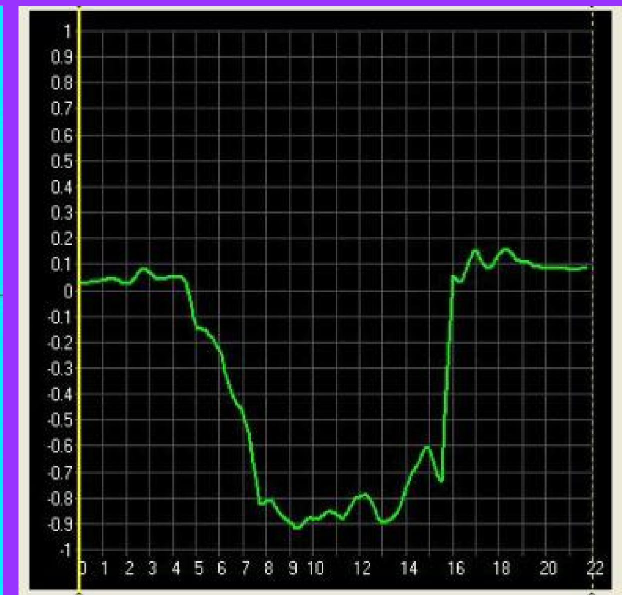
- Short Scrub
  - 22u Long
  - 0.6u Depth





- Long Scrub
  - 30u long
  - 0.9u Depth

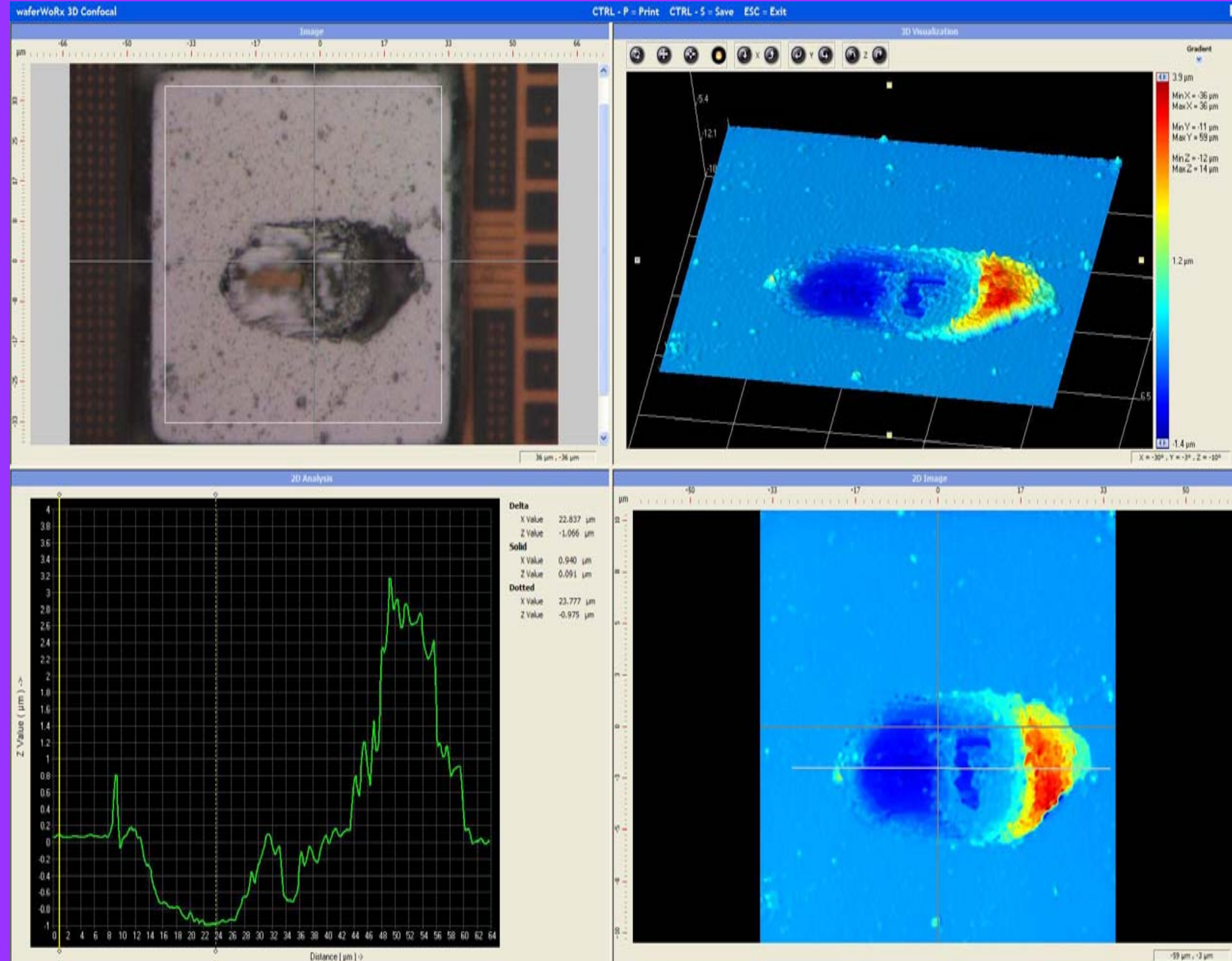




What is Punch-Through?

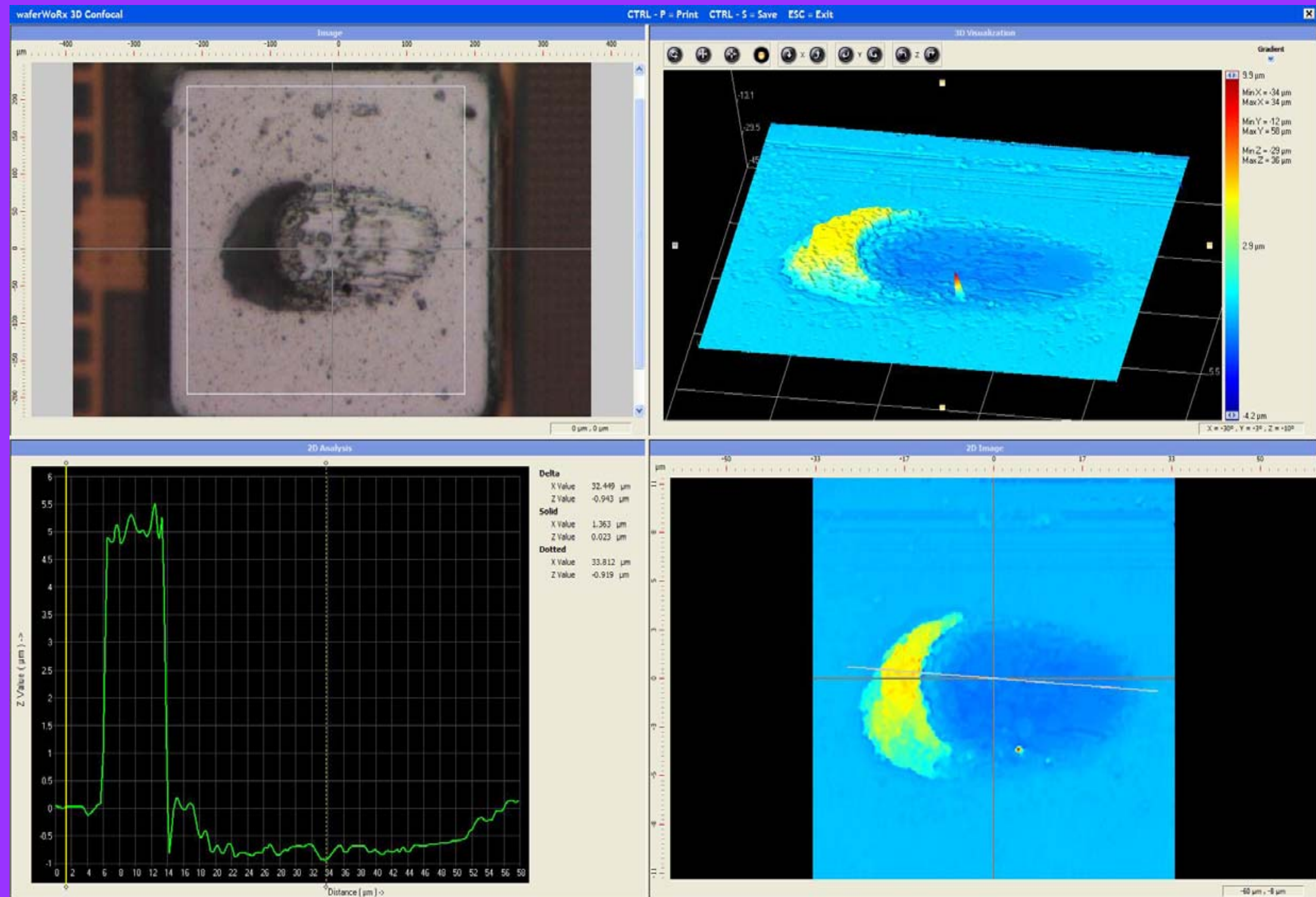
waferWoRx - Spectral Scanning

3-D Measurement - Punch Through



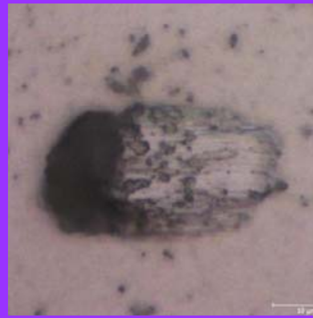
3-D Measurement – Deep Scrub

Scrub Depth Consistently 0.9u with no punch-through



Scrub Depth Repeatability

- Same Probe consistent in producing same scrub depth
- Same Probe consistently punches through to expose substrate


Scrub 1

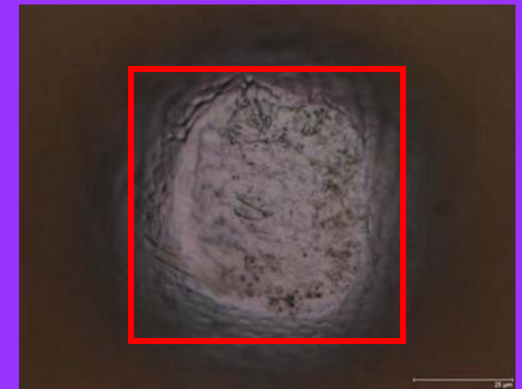
Scrub 2

Scrub 1

Scrub 2

Bump Analysis Capability

- Size and position of scrub
- Height of bump relative to the wafer surface
- Depth of scrub relative to height of the bump
- Planarity of the bumps

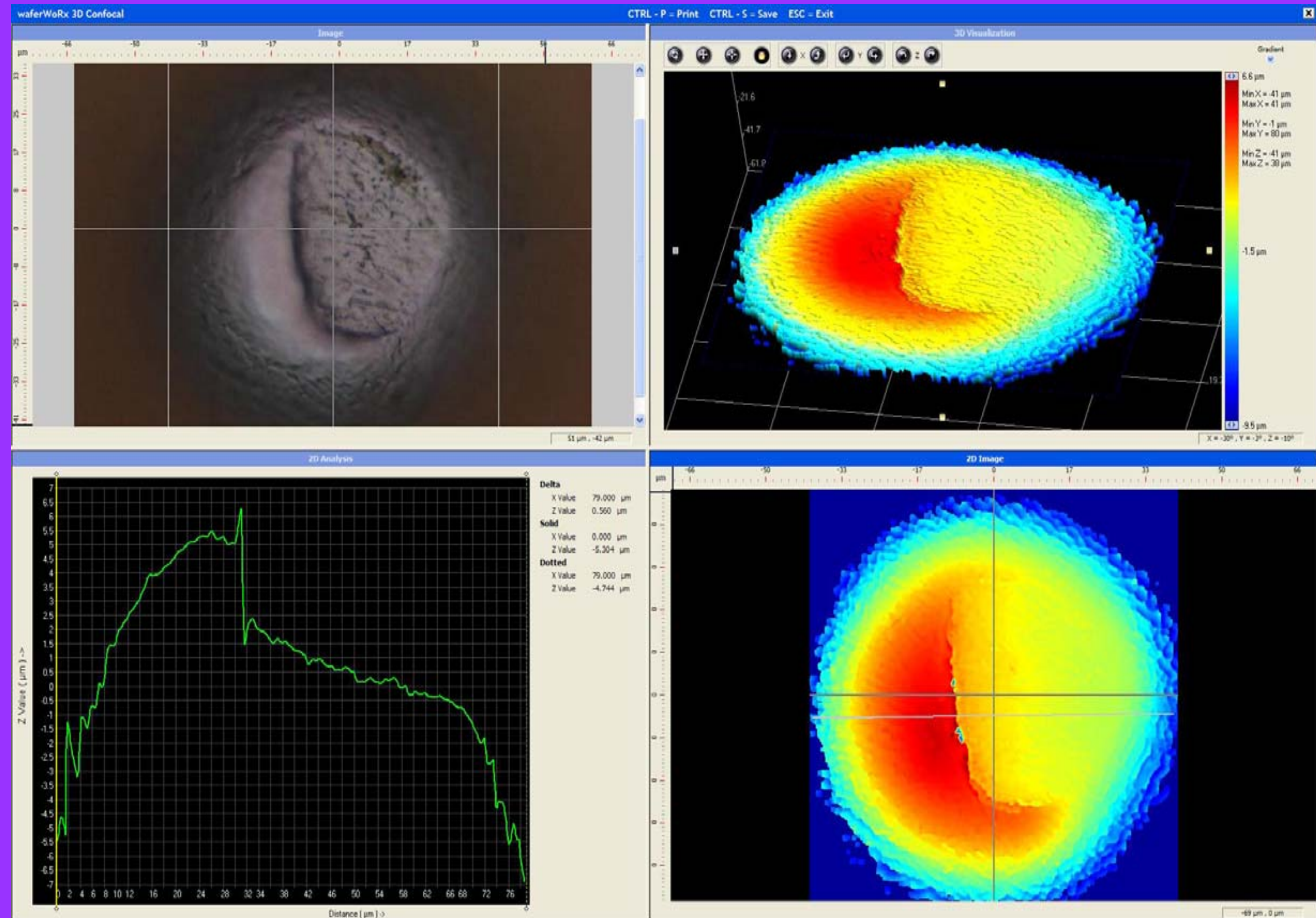


Unprobed

Off center Scrub

Centered Scrub

Bump Analysis 3D / 2D



Conclusion

- waferWoRx300 probe card measurements are correlated to the scrubs
- Controlling scrub length is important to controlling scrub depth
- Depth/Punch through is very repeatable for a probe.