



Improving Your Probing Process Through Probe Scrub Analysis

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Final Manufacturing Technology Center

Fine Pitch Probe Technology Development Phx. AZ

- Characterize Existing and New Probe Processes
- Characterize Pad Damage Caused By Probe



waferWoRx - Probe Scrub Analyzer

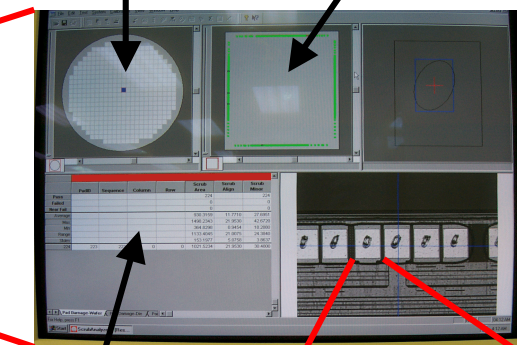
Applied Precision Inc.

Alpha Release

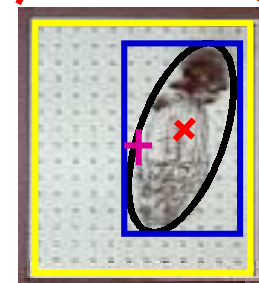







Die Map

Pad Map



3-D Data File



-  = Center of scrub
-  = Bounding Box
-  = Scrub Area Ellipse
-  = Center Passivation
-  = Passivation Opening

Machine Repeatability at 6s = 1.319 microns

X - Repeatability at 6s = 0.857 microns

Y - Repeatability at 6s = 1.002 microns

Experiment Overview

Objective:

Characterize Existing Elevated Temperature Probe Process, With and Without a Probe Card Support Plate.

- Total Process - Scrub Mark Placement Variation
- Wafer to Wafer - Scrub Mark Placement Variation
- Die to Die - Scrub Mark Placement Variation
- Pad to Pad - Scrub Mark Placement Variation
- Percent Pad Damage - Variation



Experiment Procedure

Probe Conditions:

Temperature	Probe Card	Prober	PCB Support
25 degrees C	# 1	# 1	No
135 degrees C	# 1	# 1	No
25 degrees C	# 2	# 2	Yes
135 degrees C	# 2	# 2	Yes

Note: 5 wafers of the same device were probed under each condition.

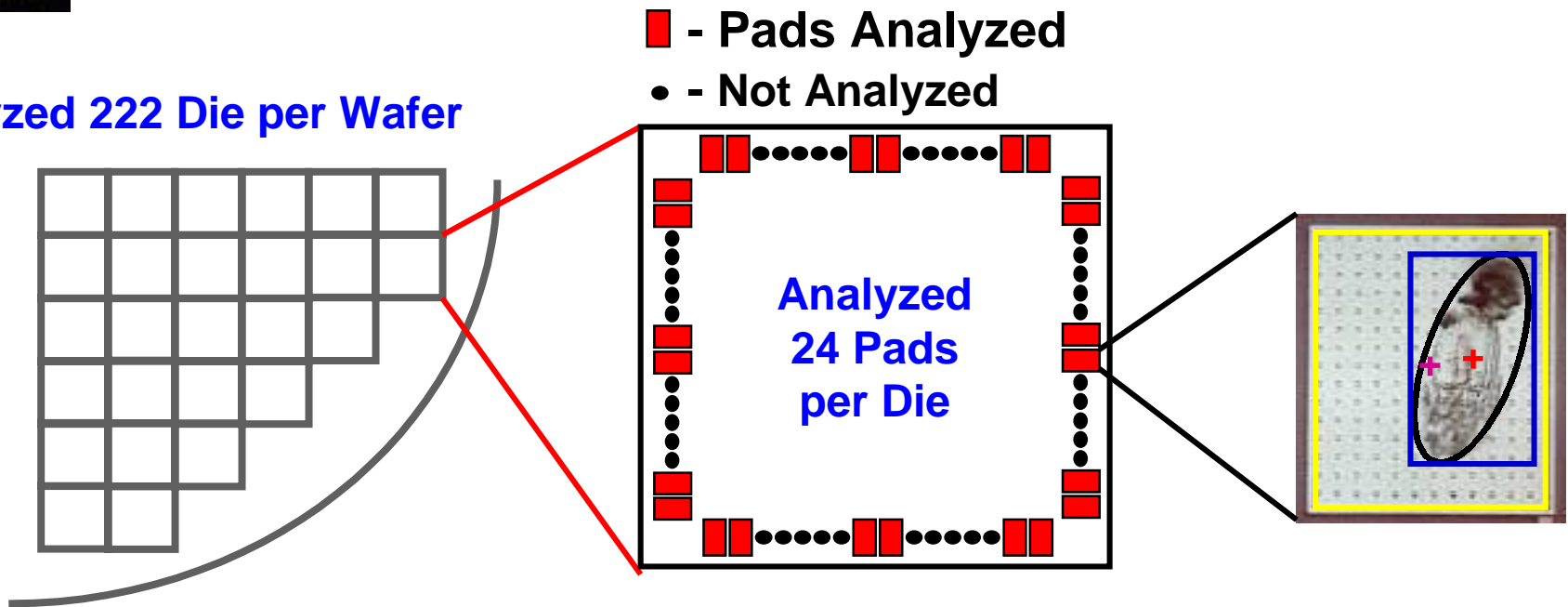
waferWoRx Probe Scrub Analyzer Conditions:

- 20 Wafers
- 222 Die per wafer
- 24 Pads per die (subset of total die per wafer)
- **106,560** Total pads analyzed for 20 wafers
- **Analysis Time for 20 Wafers approximately 8hrs**



Graphical Description of Analysis

Analyzed 222 Die per Wafer



Probe Card Description :

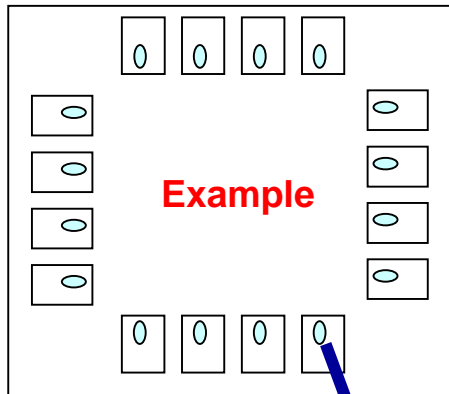
2 - Separate Probe Cards (Same Design)
Cantilever Technology
25 um Tip Diameter
76 um Pitch

Probe Conditions :

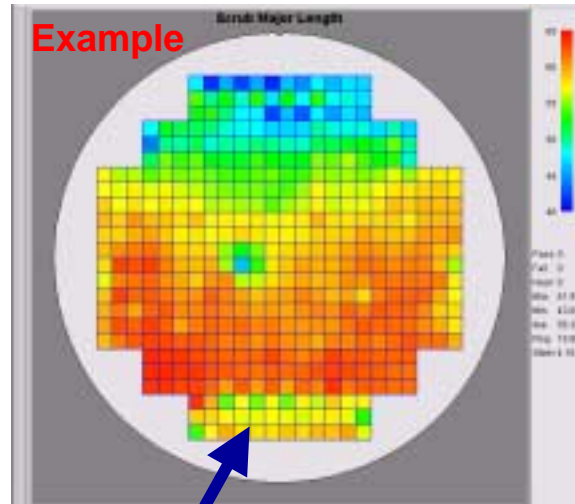
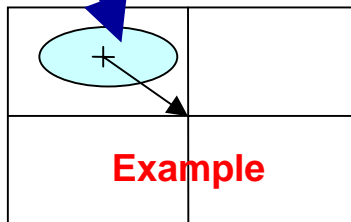
50 um Overdrive
25 degrees C
135 degrees C
76 um Pitch
59 X 96 um Pad Opening

Graphical Data Description

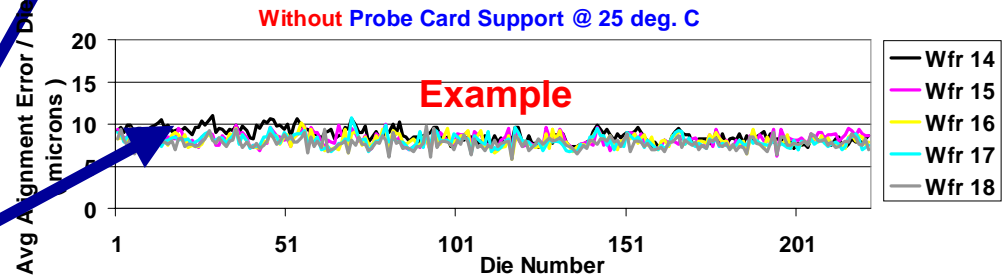
Typical "Sample Set"



Average of All Pads in "Sample Set"



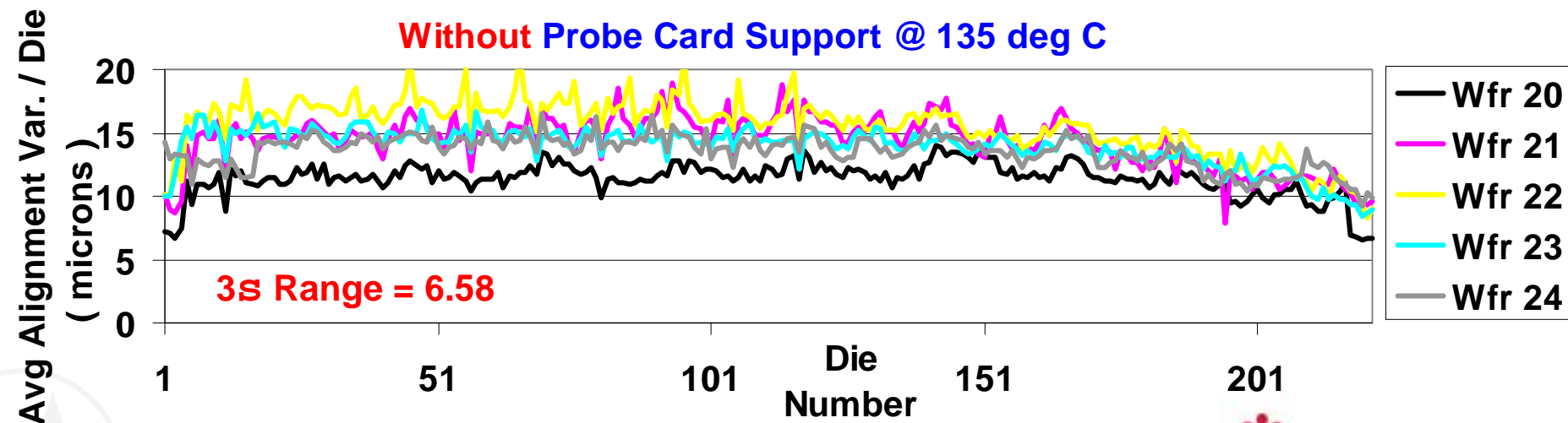
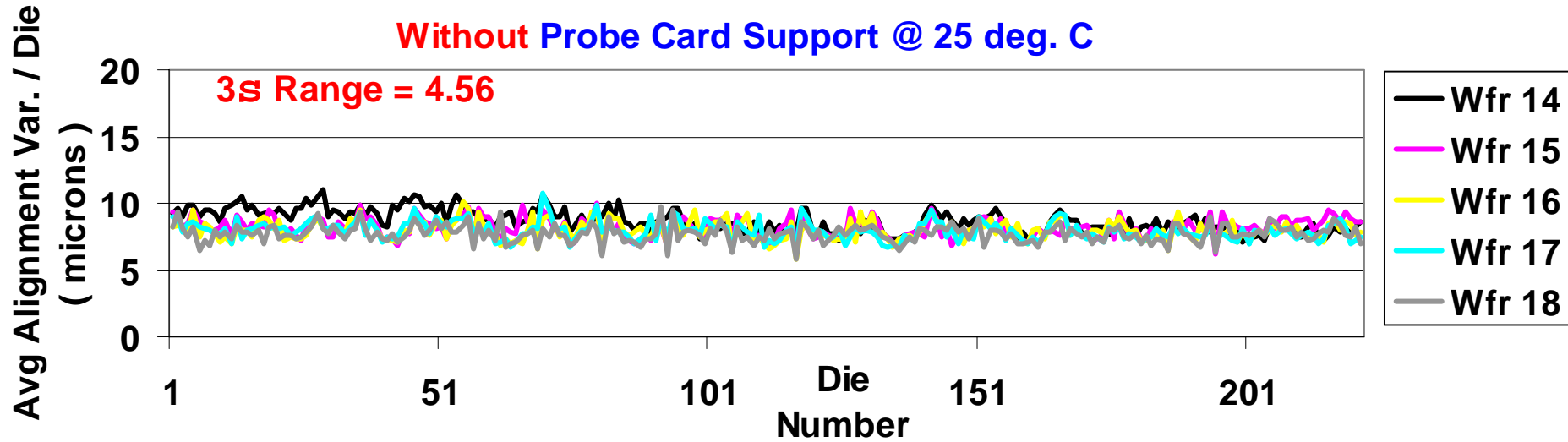
Each square represents the average of a "Sample Set" for a given parameter



Each data point represents the average of a "Sample Set" for a given parameter

Average XY Alignment Variation Per Die

Without Probe Card Support



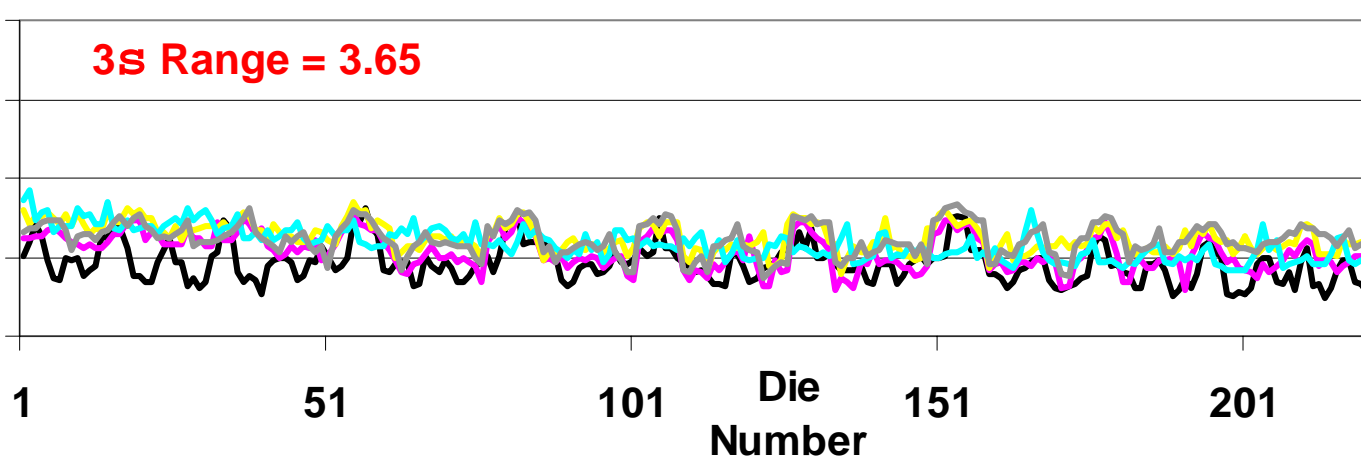
Average XY Alignment Variation Per Die

With Probe Card Support

Avg Alignment Var. / Die
(microns)

With Probe Card Support - @ 25 deg. C

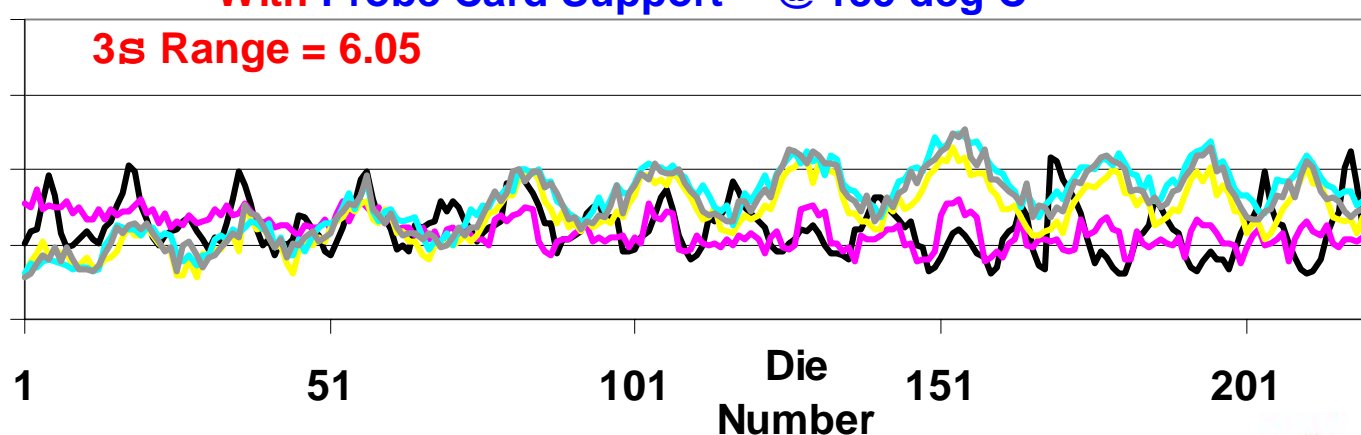
3 σ Range = 3.65



Average Alignment Var / Die
(microns)

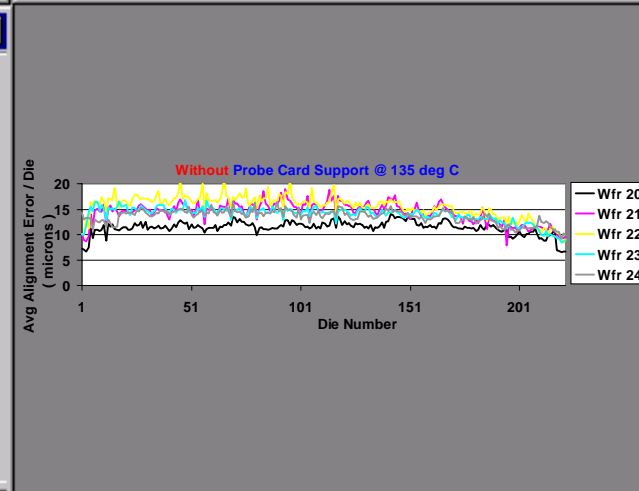
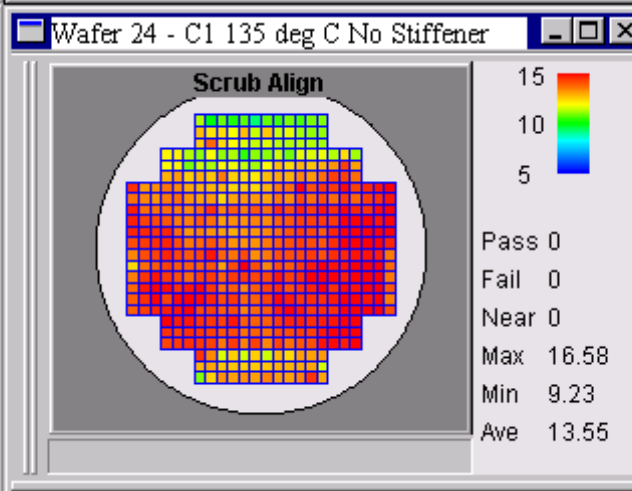
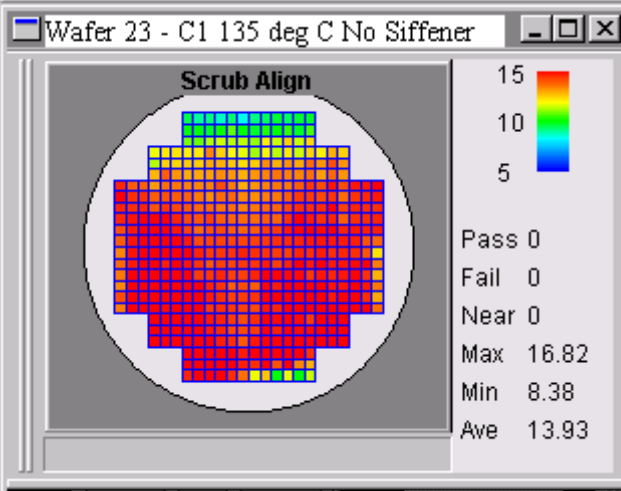
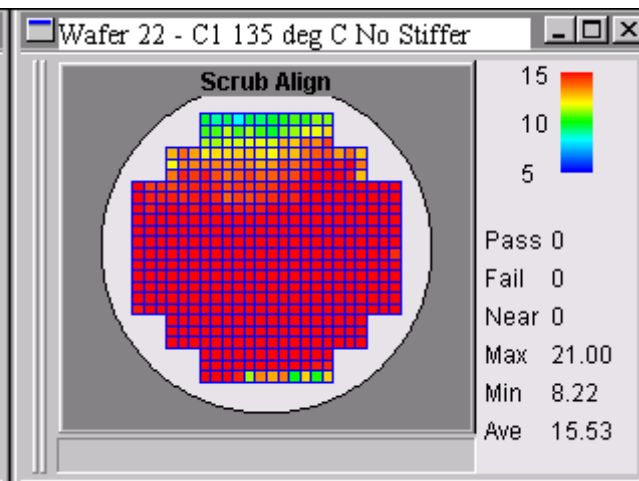
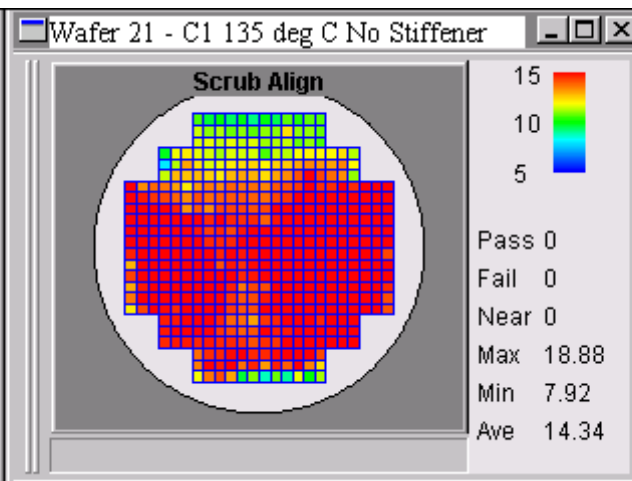
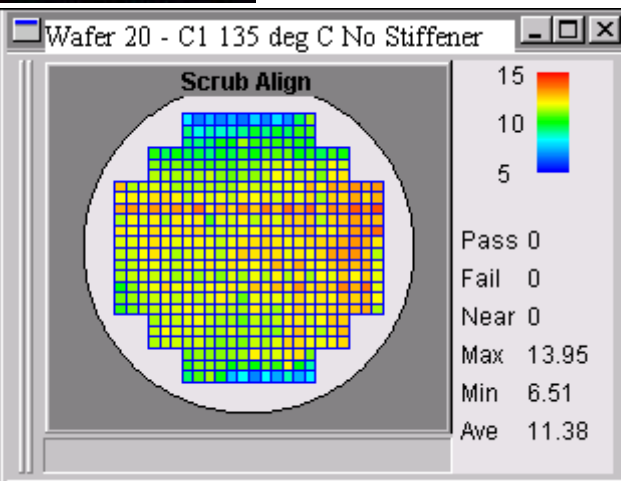
With Probe Card Support - @ 135 deg C

3 σ Range = 6.05



Average XY Alignment Variation Per Die

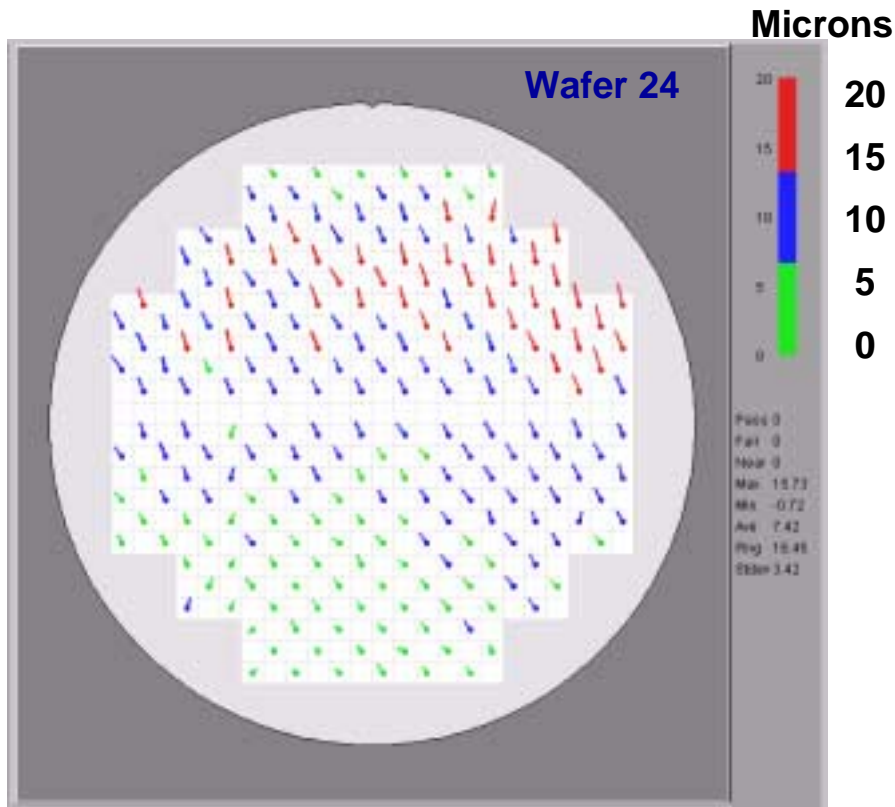
135 degrees C Without Probe Card Support



Die to Die XYZ Alignment Variation Per Die

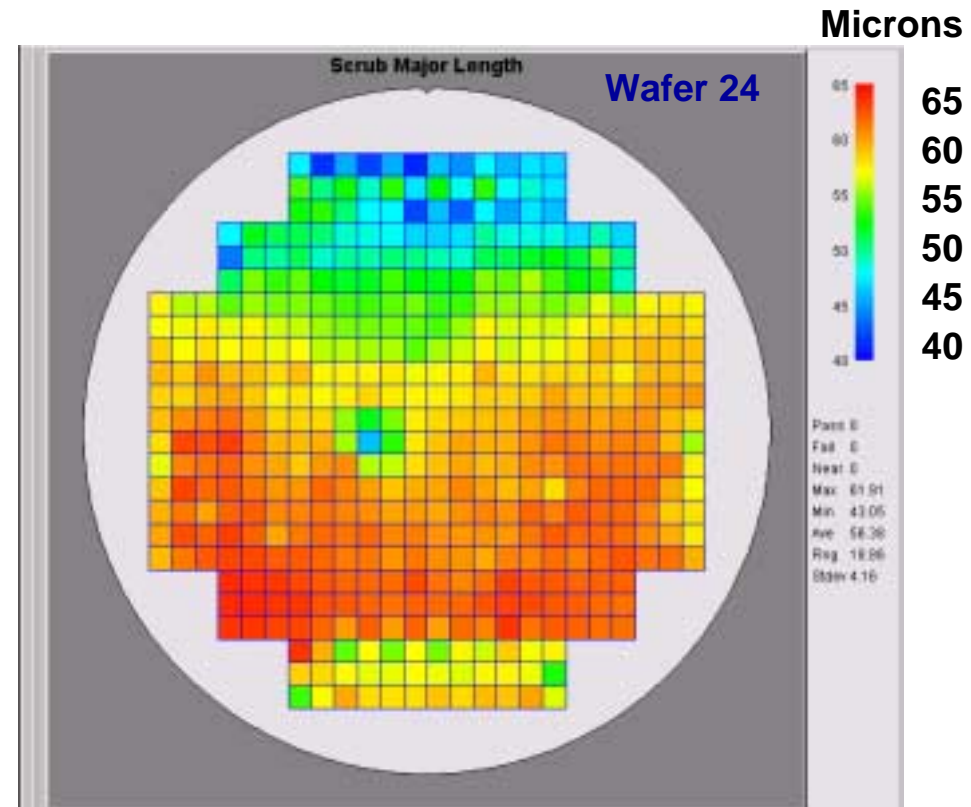
135 degrees C Without Probe Card Support

Average XY Alignment Variation Per Die



Vector Map

Average Scrub Length - Z Variation

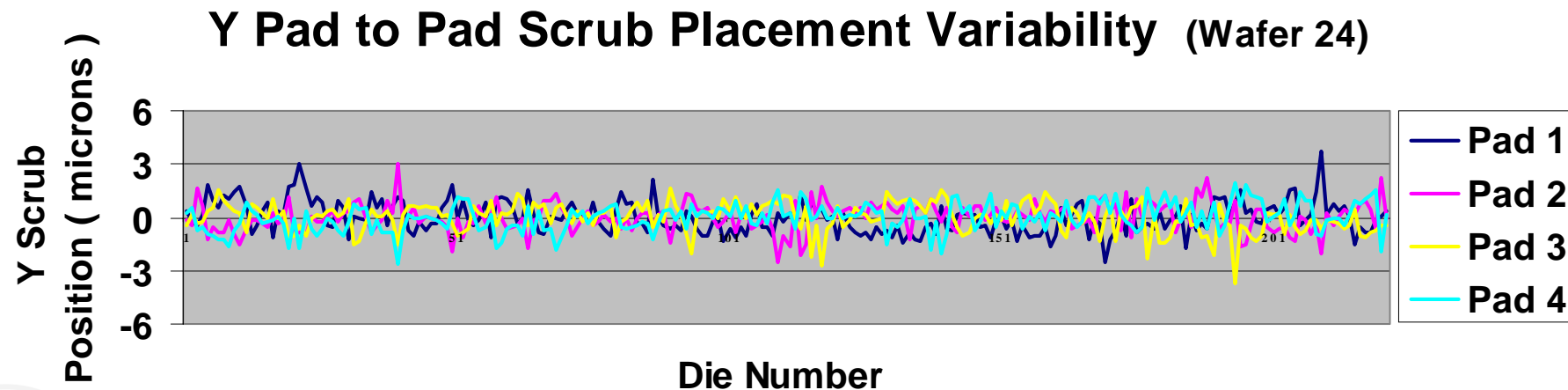
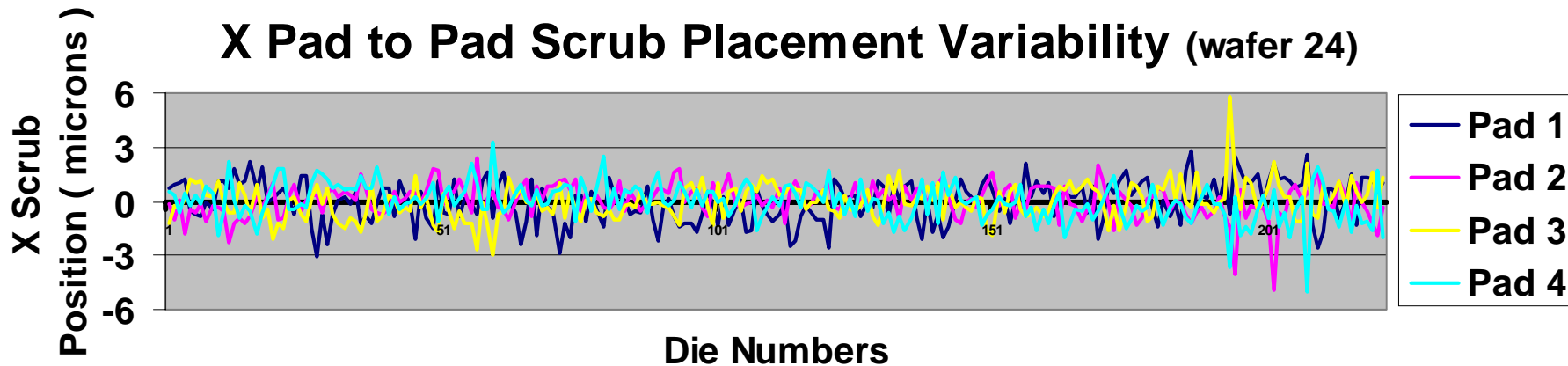


Color Map

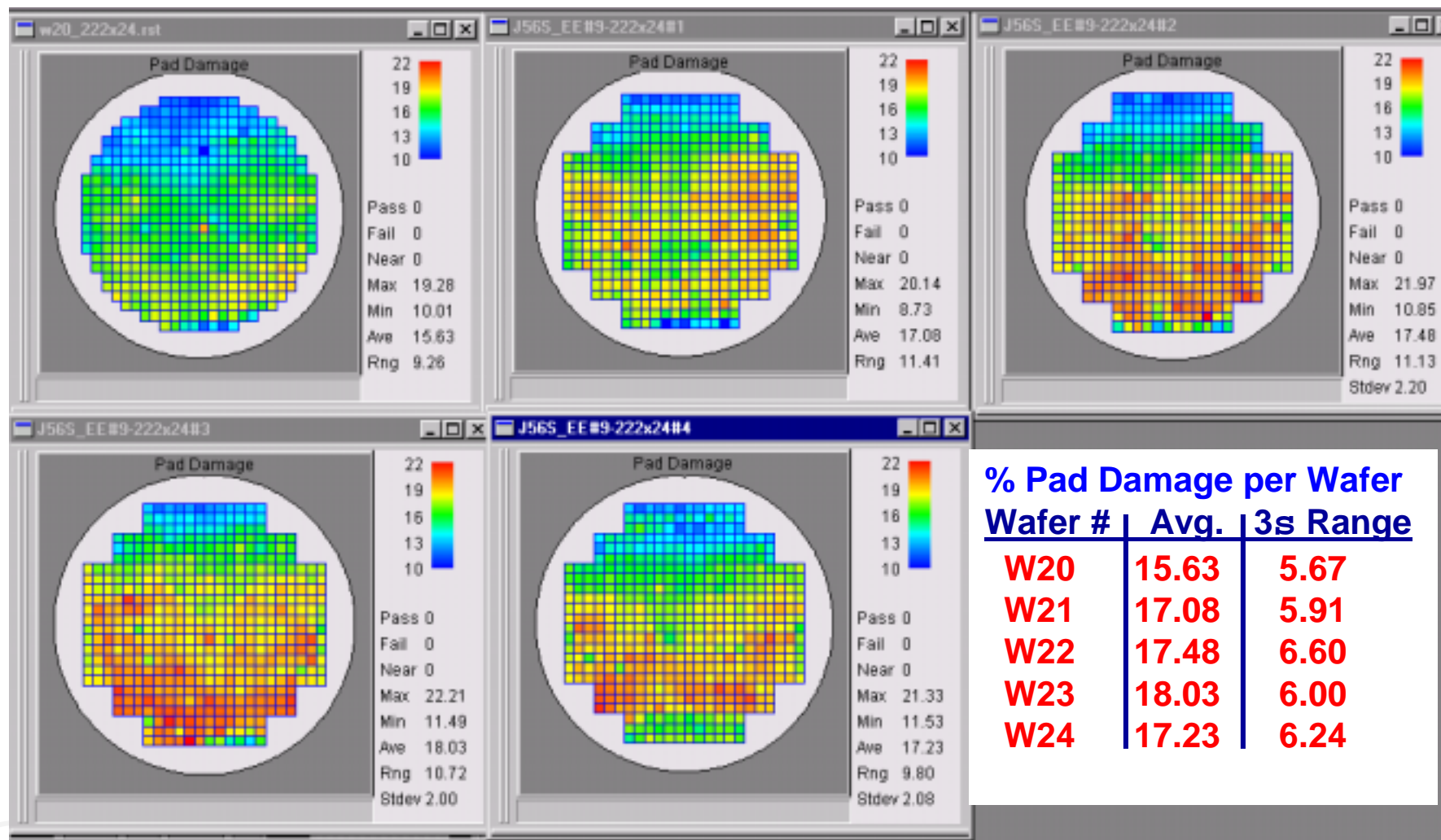


Pad to Pad XY Alignment Variation Per Die

135 degrees C Without Probe Card Support



Percentage of Pad Damage



% Pad Damage per Wafer		
Wafer #	Avg.	3s Range
W20	15.63	5.67
W21	17.08	5.91
W22	17.48	6.60
W23	18.03	6.00
W24	17.23	6.24

Summary of Probe Placement Variation

Scrub Mark Variation Summary for 135 deg C - No PC Support

	Avg Delta (Microns)	3 σ Range (Microns)	Related Probe Condition
Wafer to Wafer Position	13.75		PC#1 No Support
Die to Die XY Position	15.53	10.6	PC#1 No Support
Pad to Pad Position			PC#1 No Support
Percent Pad Damage	17.09		PC#1 No Support
Die to Die Z Effect	56.38	12.48	PC#1 No Support



Conclusion

Capability For Each Probe Condition	Cp	CpK	Min Pad Pitch	Min Pad Size
25 Degrees C - No Support				
135 Degrees C - No Support				
25 Degrees C - With Support				
135 Degrees C - With Support				





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