Presentation to
Southwest Test Workshop 2003

Off-Line Chemical Cleaning Technology for Removal of Solder Contaminant from Cobra® Vertical Technology Probe Tips

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Overview

1. Challenges for Chemical Cleaning
2. Variables
3. Benefits of new ProbeWash™ Chemical Cleaning Technology*
4. Components of ProbeWash Assembly
5. Test Results
6. Performance
7. ProbeWash Roadmap
8. Conclusions
9. Appendix: Terminology/Acronyms

Patent Pending

Chemical Cleaning Challenges
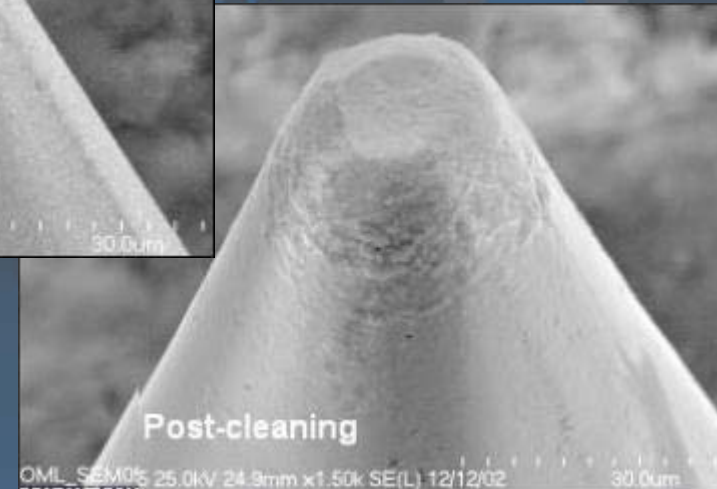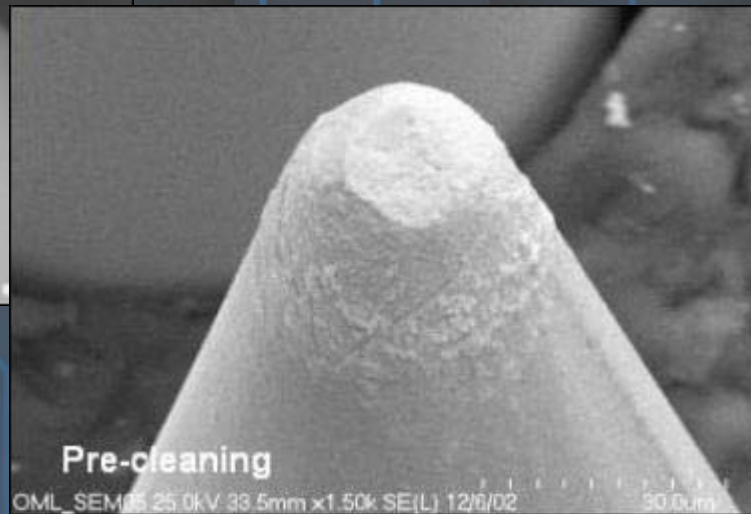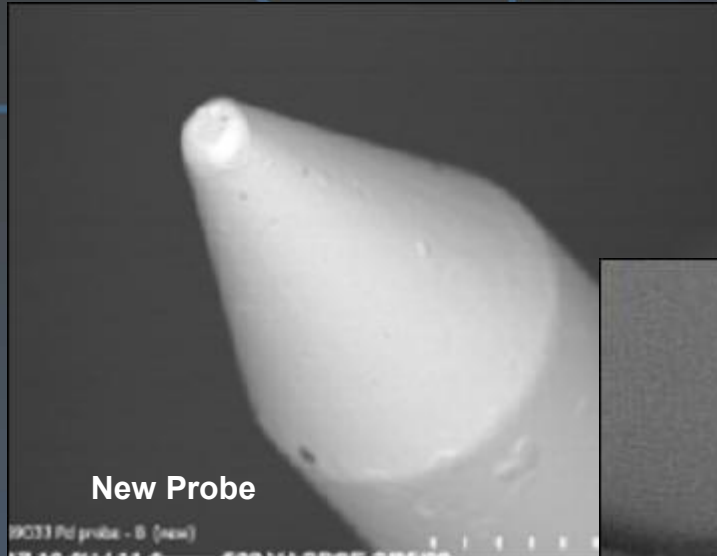
Develop chemical cleaning technology that:

- Is specifically for Cobra vertical contact technology
- Removes solder contaminate from probe tip
- Works quickly for minimal downtime
- Is non-destructive/non-abrasive
- Delivers consistent performance for repeatable results
- Limits chemical exposure of CH to tips only
- Is easy-to-use and requires minimal training
- Has no special facility requirements

Development Considerations

- Efficacy of Chemistry

- Probe Material

- Type of Contaminant

- Exposure Time

- Control of Probe Tip Penetration

# Existing Off-Line Cleaning Method for Solder Contaminate on Cobra Contact

IPA Wash and Brush

New Probe

Pre-cleaning

OML_SEM05 25.0kV 33.5mm x1.50k SE(L) 12/6/02   30.0um

Post-cleaning

OML_SEM05 25.0kV 24.9mm x1.50k SE(L) 12/12/02   30.0um

Why IPA Wash/Brush Doesn't Work

1. Solder accumulations result from both mechanical and electrical transfer phenomenon

Load

Sliding

Asperities interact and adhere
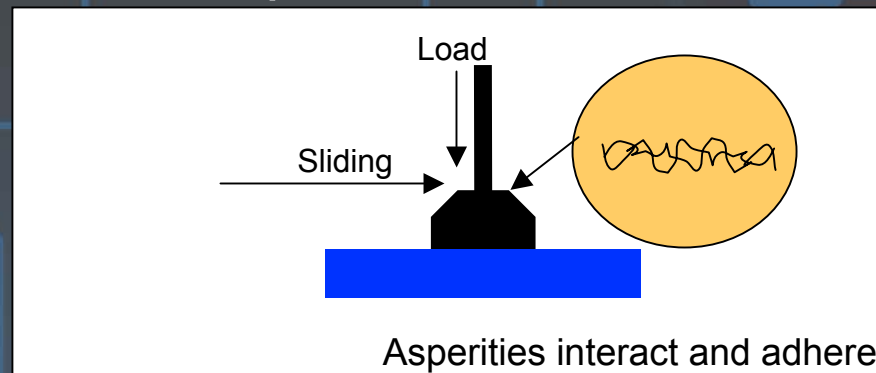
2. Transfer results in a metallic bonding to the probe that can not be removed by brushing
3. Solder accumulation can not be removed with solvents – such as IPA – must be chemically reduced

Benefits of ProbeWash Technology

- Removes solder (SnPb) contaminate
- Reduces C_{Res}
- Has potential to extend test cycles between cleaning
- Improves planarity measurement
- Optimally two minute exposure time
- Non-abrasive for longer probe life

Benefits of ProbeWash Technology

- Pre-loaded chemical cartridge calibration

- Chemistry only contacts probes
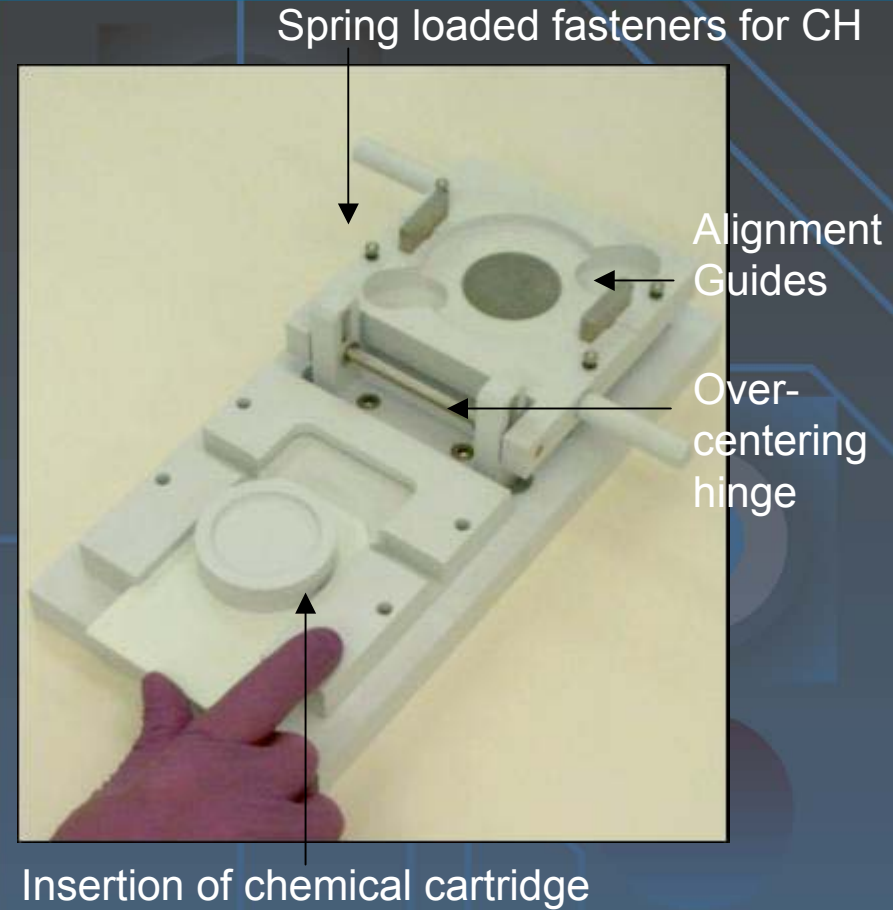
- Fixture design prevents probe damage

Pre-loaded chemical cartridge

Benefits of ProbeWash Technology

- Clean Room Compatible
- Safe
  - All contaminants retained in pad
  - Disposable cartridge
  - No spills or odors
- Compact/Portable
  - Weighs 4.9 lbs.
  - Small footprint – 6"w x 12"l x 4"h

ProbeWash Assembly

Seat for CH

Seat for chemical cartridge

Pre-loaded chemical cartridge

Spring loaded fasteners for CH

Alignment Guides

Over-centering hinge

Insertion of chemical cartridge
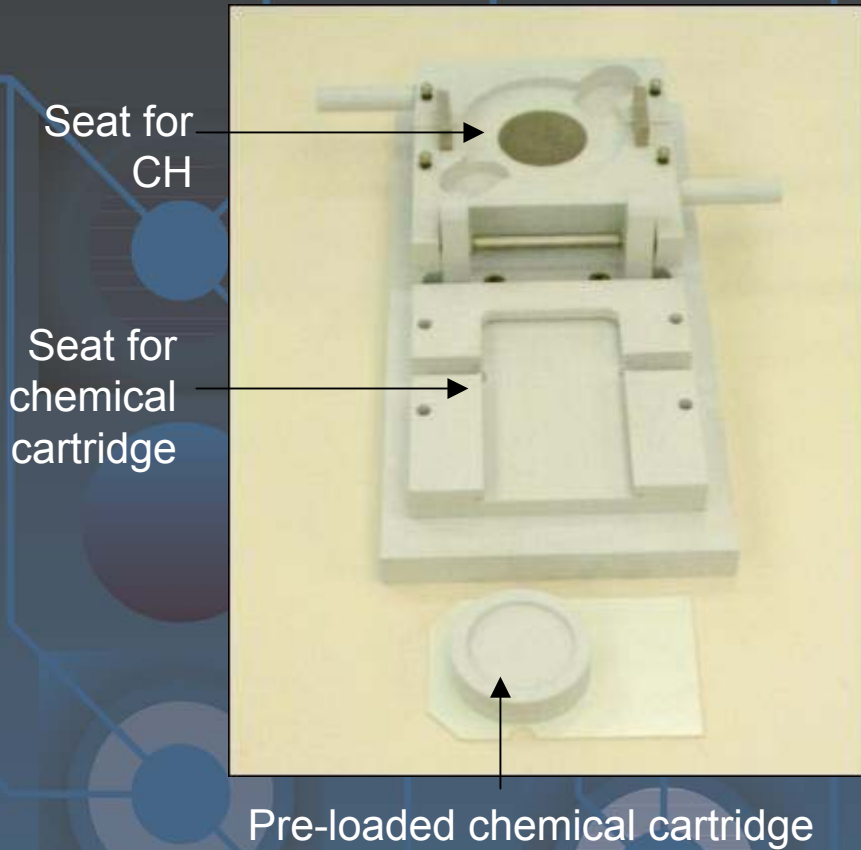
ProbeWash Assembly
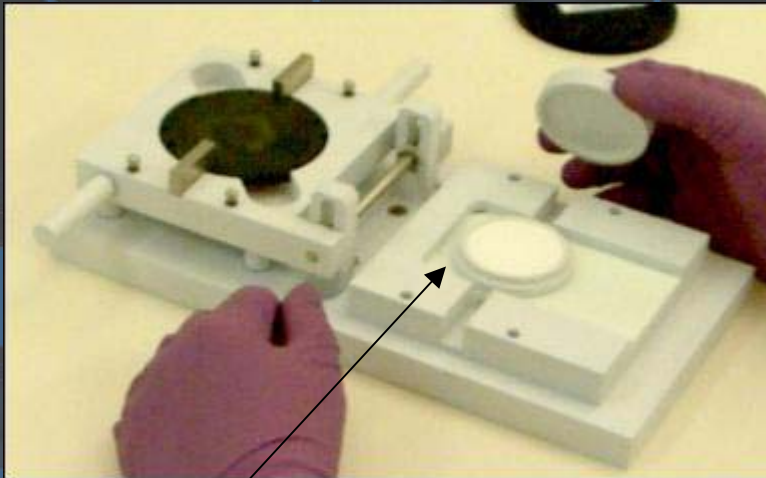
Open chemical cartridge
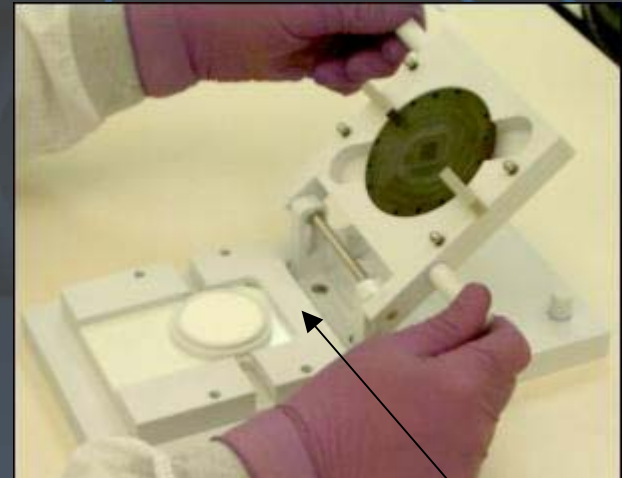
Lift and rotate mounting bracket

Closed assembly in cleaning position
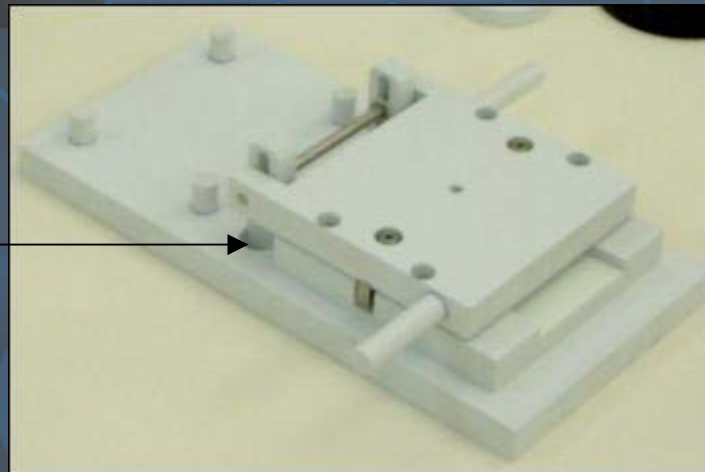
Pre-Loaded Chemical Cartridge

Probe penetration controlled by cartridge
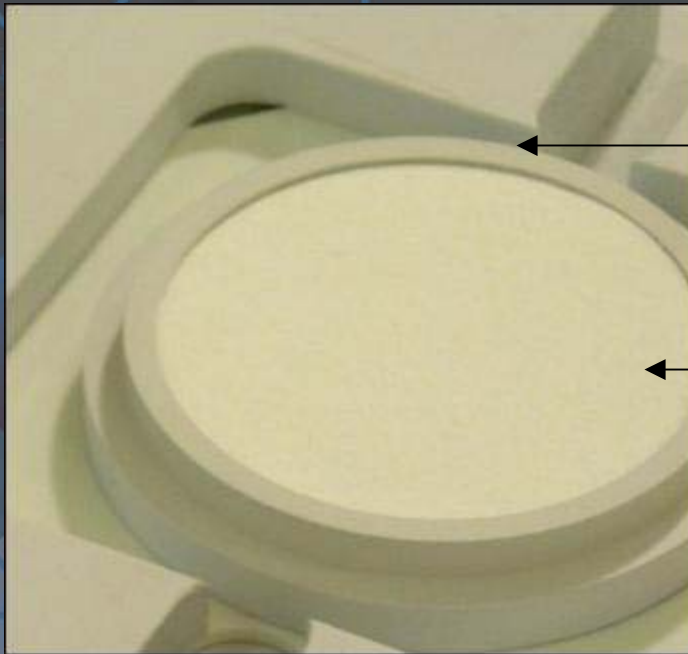
Rim size above the pad controls the probe penetration depth into the pad.

Absorbent pad retains contaminants removed from the probe tips.

4 mil BeCu Probe with Rh and Pd Plating

Before ProbeWash

After ProbeWash

SnPb
Contaminate

SEM - New BeCu Probe with Rh and Pd Plating

0309033 Pd probe - B (new)
B17 10.0kV 11.6mm x500 YAGBSE 2/25/03   100um
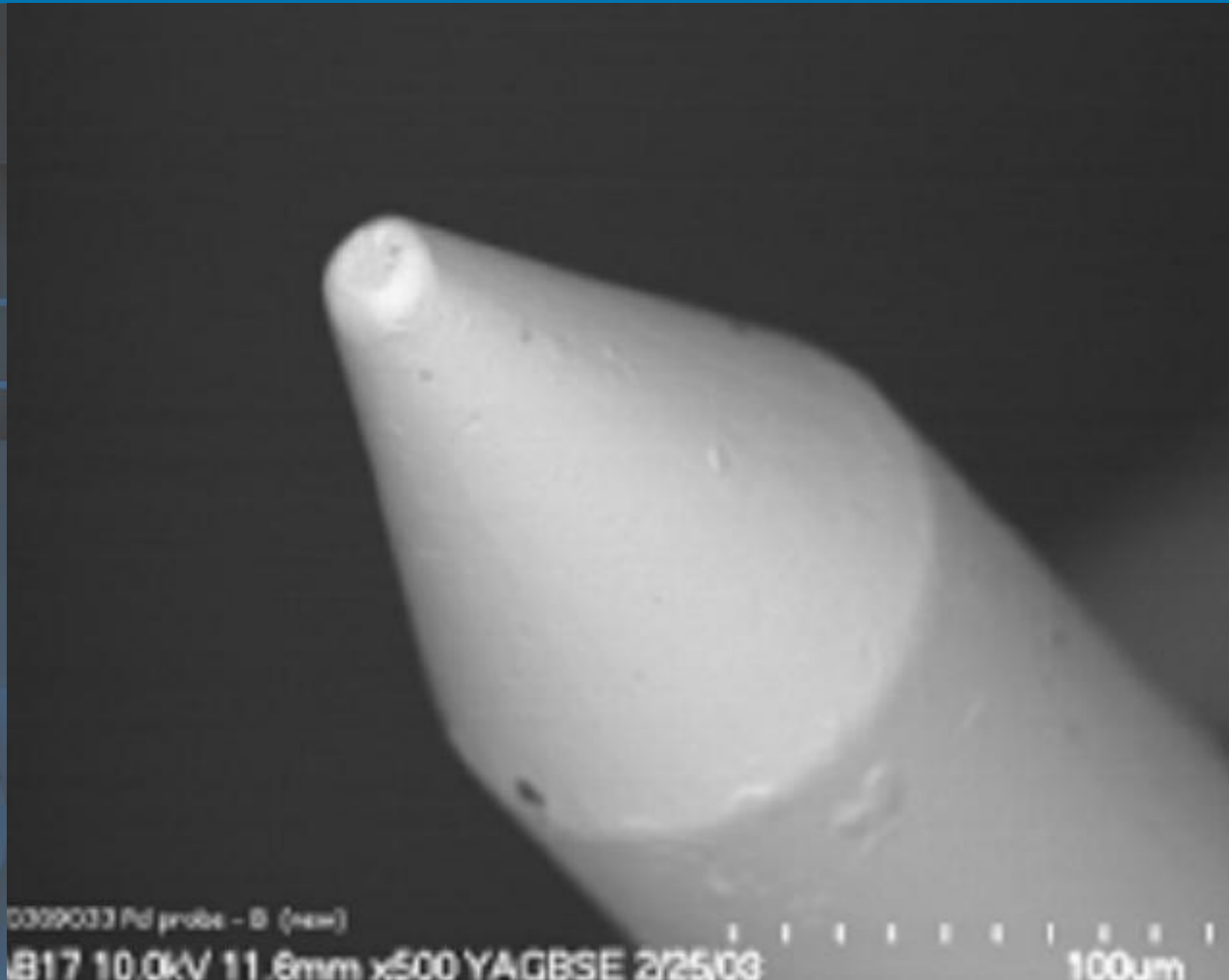
SEM Analysis – After 250M Touchdowns

Before ProbeWash

After ProbeWash

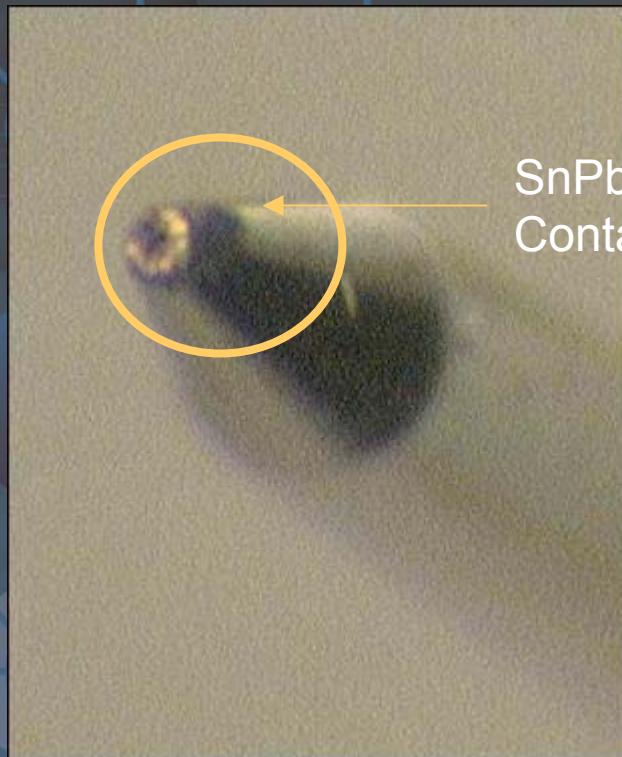| Element	Line	Weight%	K-Ratio	Decon Regions	Cnts/s	Atomic%
Cu	Ka	6.29	0.0690	7.650-8.425	56.62	12.11
Rh	La	28.72	0.2154	2.375-3.020	347.09	34.13
Pd	La	12.63	0.0988	2.510-3.170	155.90	14.52
Sn	La	18.96	0.1243	3.085-3.800	172.06	19.53
Pb	La	33.40	0.2961	10.030-10.960	31.49	19.72
Total		100.00				

Element	Line	Weight%	K-Ratio	Decon Regions	Cnts/s	Atomic%
Cu	Ka	4.32	0.0446	7.635-8.470	20.48	6.90
Rh	La	58.40	0.5738	2.380-3.020	517.75	57.56
Pd	La	37.28	0.3697	2.545-3.140	326.65	35.54
Total		100.00				

SEM Analysis Synopsis
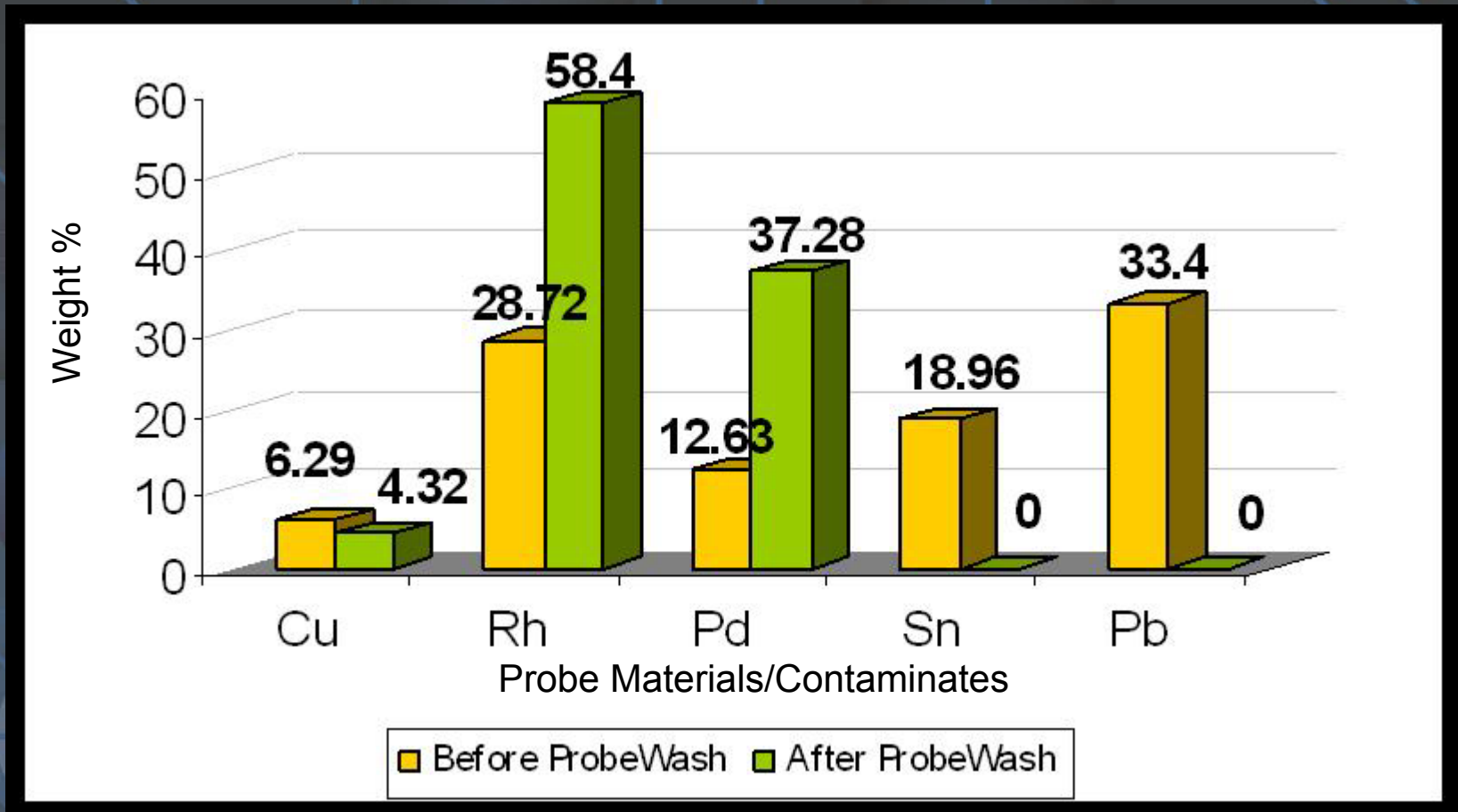
Performance CRes

- JMP analysis indicates statistical difference in the before and after results to a 99.5% confidence.

- No statistical difference between after and the outgoing C_{Res} for this head.

- Statistically as good as new.
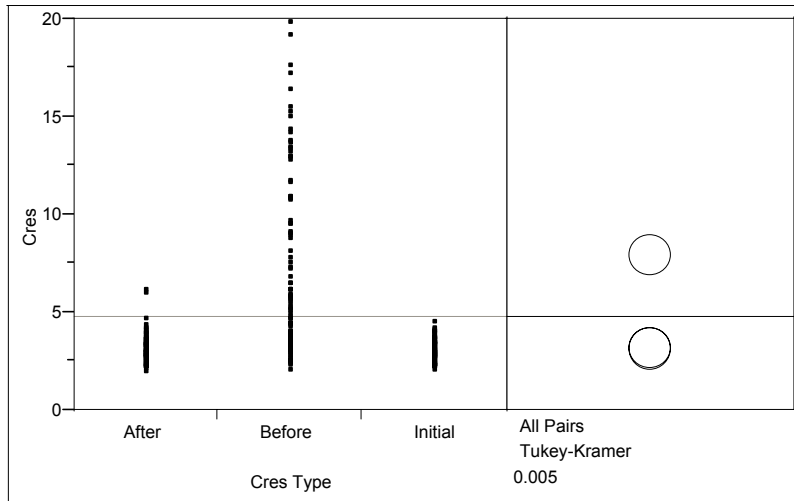
Means Comparisons

Dif=Mean[i]-Mean[j]

	Before	After	Initial
Before	0.0000	4.7459	4.8120
After	-4.7459	0.0000	0.0661
Initial	-4.8120	-0.0661	0.0000

Alpha= 0.01

Comparisons for all pairs using Tukey-Kramer HSD

q*	Alpha
3.15052	0.005

Abs(Dif)-LSD

	Before	After	Initial
Before	-1.4832	3.2597	3.3288
After	3.2597	-1.4892	-1.4201
Initial	3.3288	-1.4201	-1.4832

Positive values show pairs of means that are significantly different.

Level		Mean
Before	A	7.9440291
After	B	3.1980820
Initial	B	3.1320238

Levels not connected by same letter are significantly different

Oneway Analysis of Good Die

- JMP analysis indicates a significant statistical difference between the before clean and after clean with respect to the number of good die tested.

- JMP analysis indicates an increase in the number of good die tested for each wafer.

Means Comparisons

Dif=Mean[i]-Mean[j]

	ProbeWash Clean	No Clean
ProbeWash Clean	0.0000	2.6365
No Clean	-2.6365	0.0000

Alpha= 0.01

Comparisons for all pairs using Tukey-Kramer HSD

q*	Alpha
2.58298	0.01

Abs(Dif)-LSD

	ProbeWash Clean	No Clean
ProbeWash Clean	-2.5906	0.1251
No Clean	0.1251	-2.4296

Positive values show pairs of means that are significantly different.

Level		Mean
ProbeWash Clean	A	147.28571
No Clean	B	144.64921

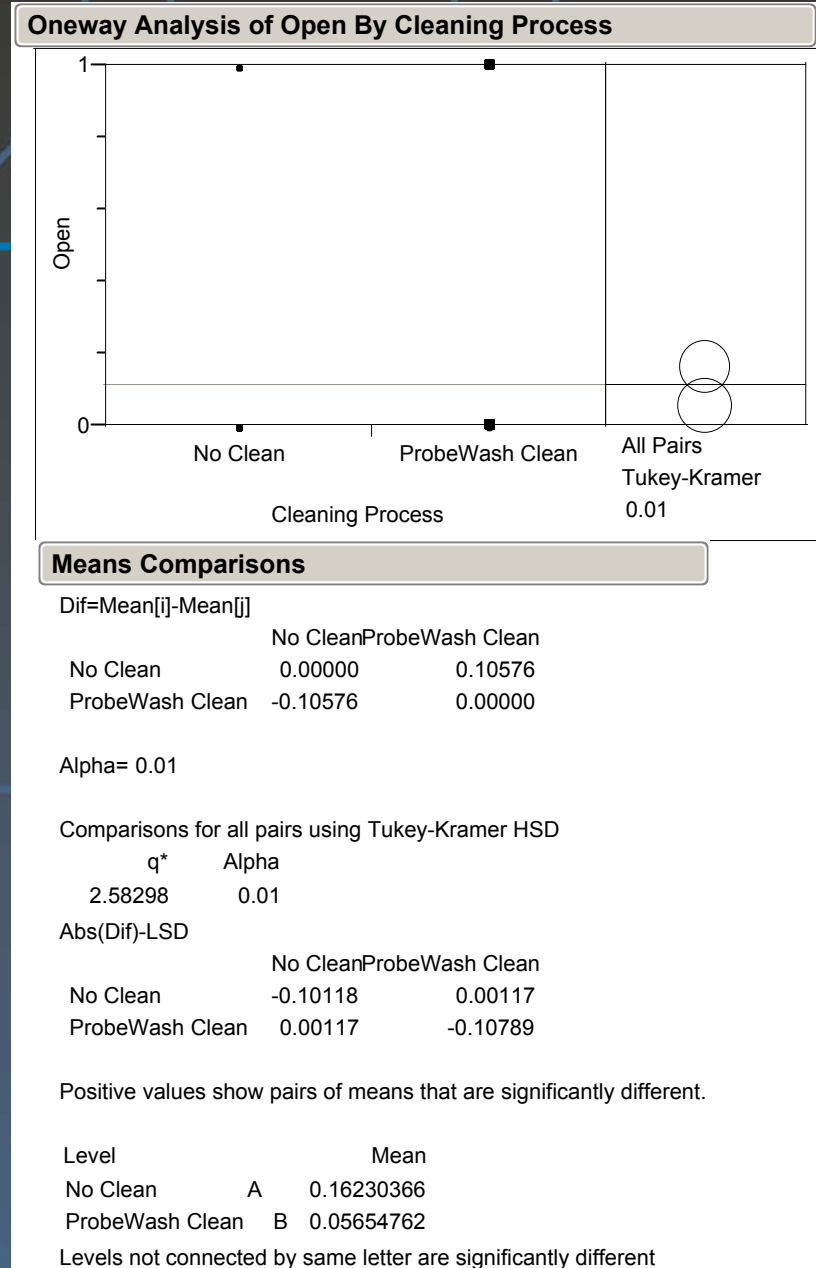Levels not connected by same letter are significantly different

Oneway Analysis of Open Channels

- JMP analysis indicates a significant statistical difference between the before clean and after clean with respect to the number of open channels tested.

- The data indicates a reduction in the number of opens.

Oneway Analysis of Open By Cleaning Process

Means Comparisons

Dif=Mean[i]-Mean[j]

	No Clean	ProbeWash Clean
No Clean	0.00000	0.10576
ProbeWash Clean	-0.10576	0.00000

Alpha= 0.01

Comparisons for all pairs using Tukey-Kramer HSD

q*	Alpha
2.58298	0.01

Abs(Dif)-LSD

	No Clean	ProbeWash Clean
No Clean	-0.10118	0.00117
ProbeWash Clean	0.00117	-0.10789

Positive values show pairs of means that are significantly different.

Level		Mean
No Clean	A	0.16230366
ProbeWash Clean	B	0.05654762

Levels not connected by same letter are significantly different

Performance Planarity

Planarity
20X Batch Test Average - PB3K

● Before ProbeWash ◆ After ProbeWash
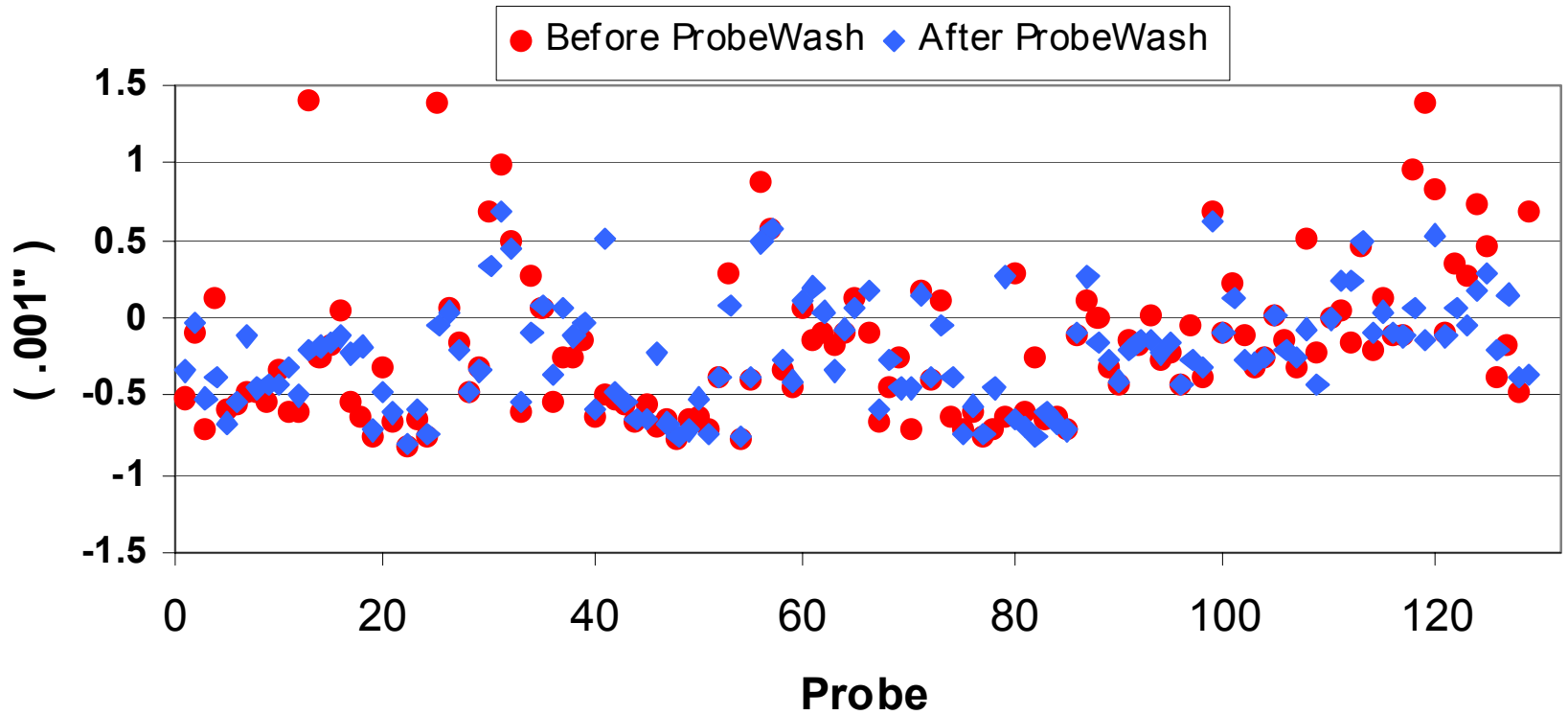
Conclusion

ProbeWash Chemical Cleaning Technology enables removal of solder contaminant from Cobra vertical probes, restoring performance characteristics for improved C_{Res}, planarity and yield.

Wentworth Laboratories

Appendix: Terminology/Acronyms

1. ProbeWash –Chemical Cleaning Technology
2. CH – Cobra Head
3. C_{RES} – Contact Resistance
4. SnPb – Tin Lead (components of solder)
5. Al - Aluminum
6. Cu - Copper
7. Pd – Palladium
8. Rh – Rhodium
9. IPA – Isopropyl Alcohol