



SWTEST

PROBE TODAY, FOR TOMORROW

(Technoprobe TPEG™ MEMS T4 OPM) Eliminates Challenges faced with Cobra-like Solutions



Froilan Jandoc - Allegro Microsystems Phils.
Mer Joy Uy - Allegro Microsystems Phils.



Wally Lacson - Technoprobe Phils.

June 2-5, 2019

OBJECTIVE

The objective of this project is to improve quality, machine utilization and repair-maintenance cost of probe card by converting present technology to best known technology available locally.

BACKGROUND

When the Probe product was initially transferred, the team was tasked with using existing technology being used by AML. Even with experience using this technology, manufacturing experienced quality issues (specifically hitting glass), poor up time and machine utilization, long repair lead-time due to overseas repair and high costs associated with the probe card price and overseas shipping cost.

Due to the negative impact as stated above, the team decided to initially to convert two problematic devices using a locally supplied and supported probe card.

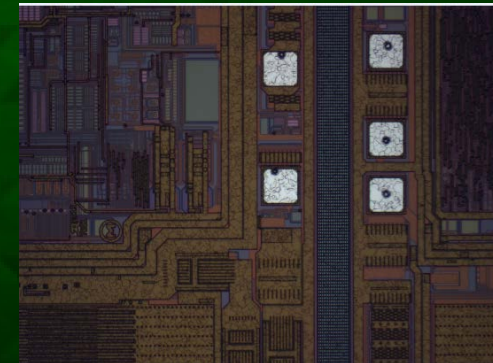
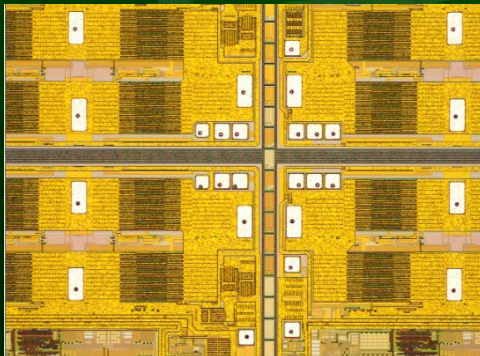
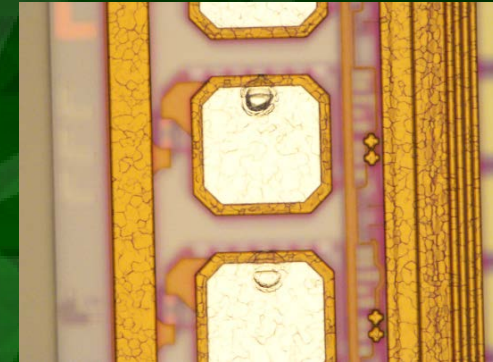
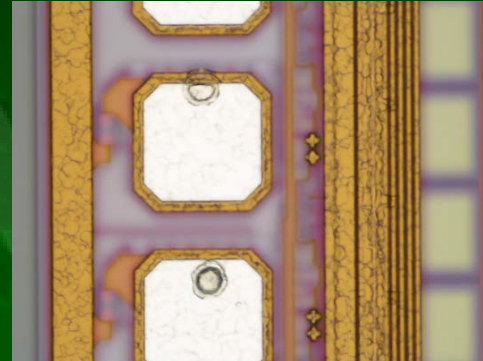
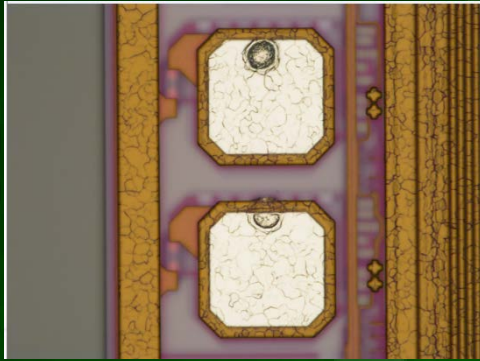
ISSUES PRIOR QUALIFYING T4_OPM

- Frequent hitting glass / probe mark misalignment
- High occurrence of misaligned pins, bent pins, sunken pins and broken pins
- Low mean touch down before repair
- Long probe card repair lead time

TARGETS

- To improve the utilization from 58% to 70%.
- To reduce misaligned probe marks and hitting glass issues by 90%.
- To remove the 100% wafer inspection step.
- To improve repair lead time of probe cards from 8 weeks to 1 week.
- To improve mean touchdown before repair from 25,000 to 350,000.
- To have a probe card vendor with local capability that can accommodate new and challenging designs.

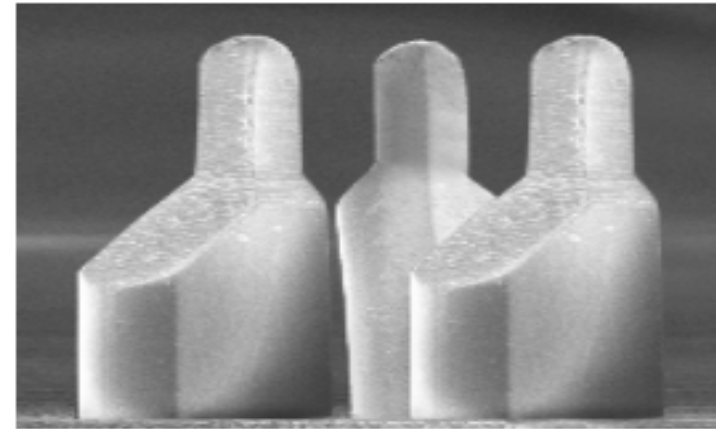
Hitting glass Images using Cobra-like Technology



Technoprobe TPEG T4 OPM specs

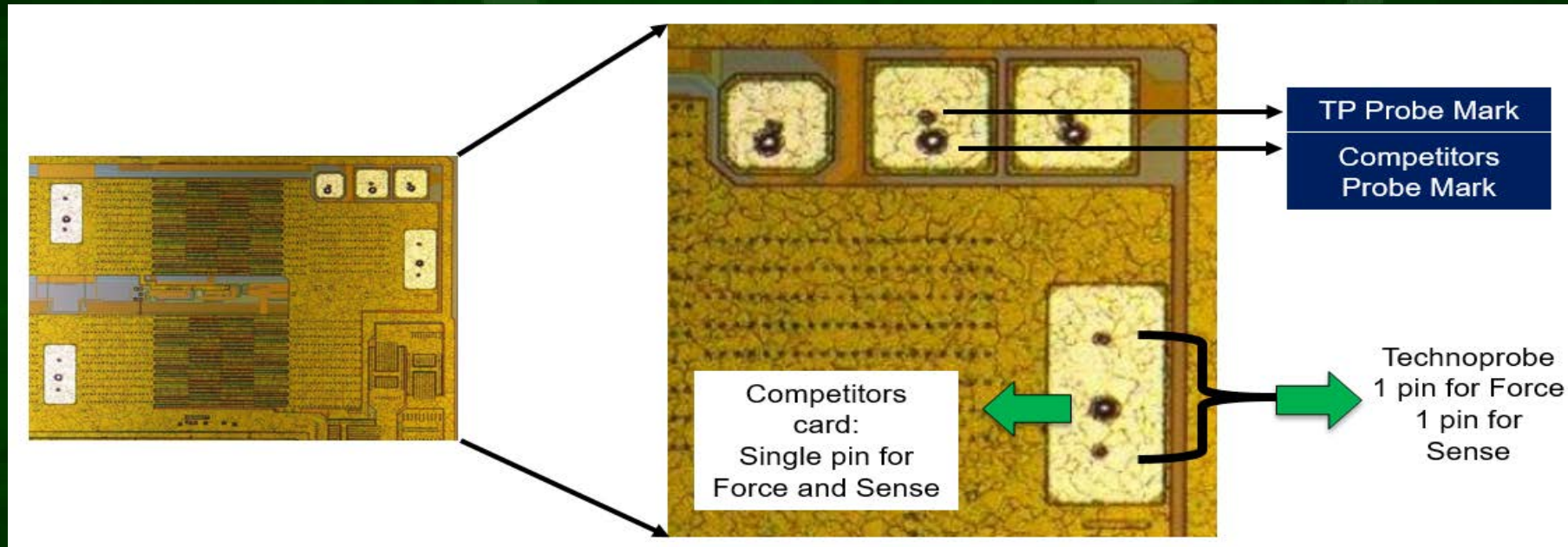
Mems TPEG T4 OPM

- TPEG™ MEMS T4 OPM: Technology applied in addressing ultra high current testing



PARAMETER	TPEG™ MEMS T4 OPM
Needle diameter	Less than 3 mils equivalent
Max pin count	> 20,000 pins
X, Y alignment accuracy and Z planarity	X,Y: $\pm 8 \mu\text{m}$; Z plan: $\Delta 20 \mu\text{m}$
Min pitch and configuration	78 μm Full Array
Pin Current (CCC)	850mA (LCR2), 1150mA (HC5 alloy)
Force (at 3 mils OT)	4.5g at working 3mils working OD

Probe Mark Comparison of Vendor A (Cobra-like Technology) and T4_OPM



T4_OPM - small probe mark even at 75um OD

Cobra-like Technology - large mark with less OD applied (<20 um)

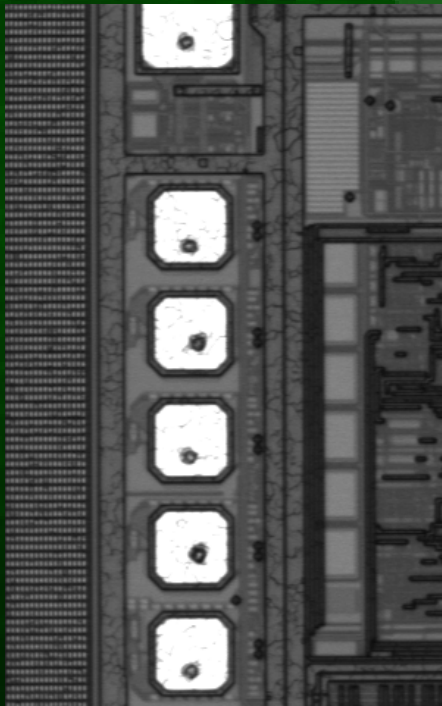
Cobra-like Technology Card has high BCF

Multiple Test 1X / 5X / 10X using T4 TPEG Technology

NORTH

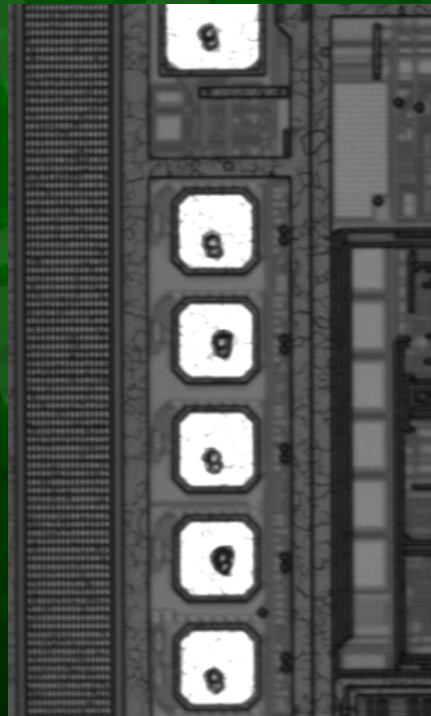
1X TD

PM Measurement = 12um



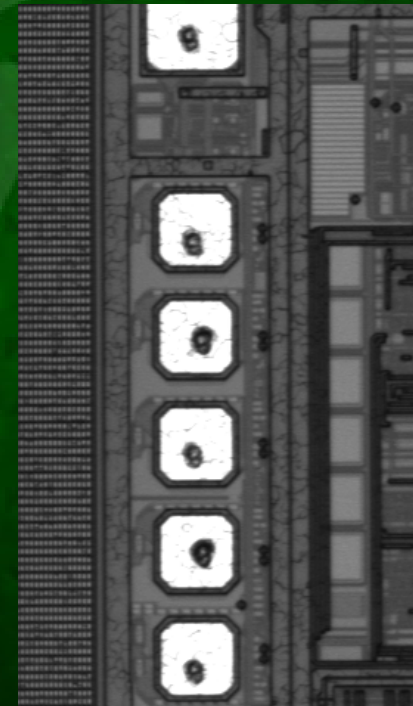
5X TD

PM Measurement = 15um



10X TD

PM Measurement = 16um

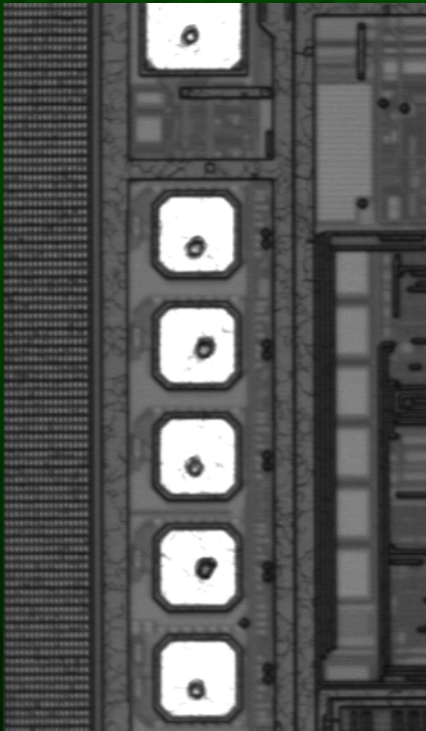


SWTest | June 2-5, 2019

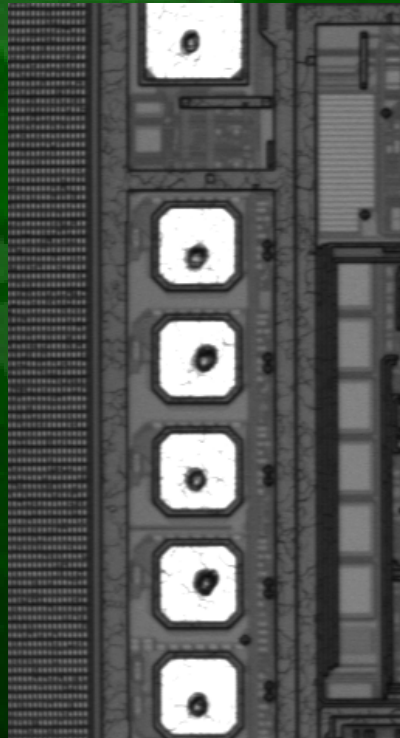
Multiple Test 1X / 5X / 10X using T4 TPEG Technology

SOUTH

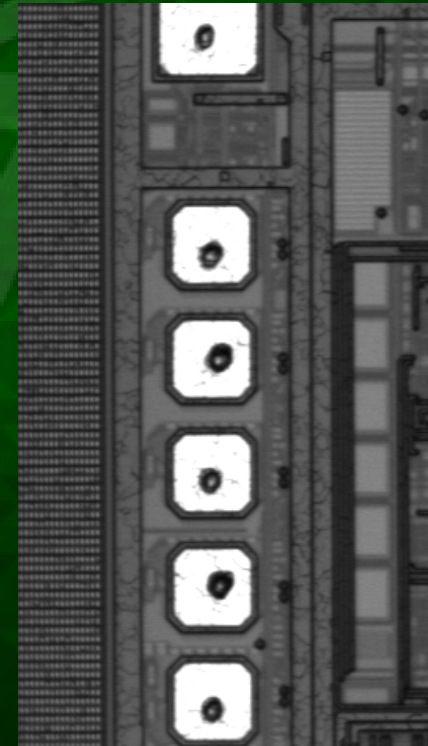
1X TD
PM Measurement = 11um



5X TD
PM Measurement = 14um



10X TD
PM Measurement = 16um

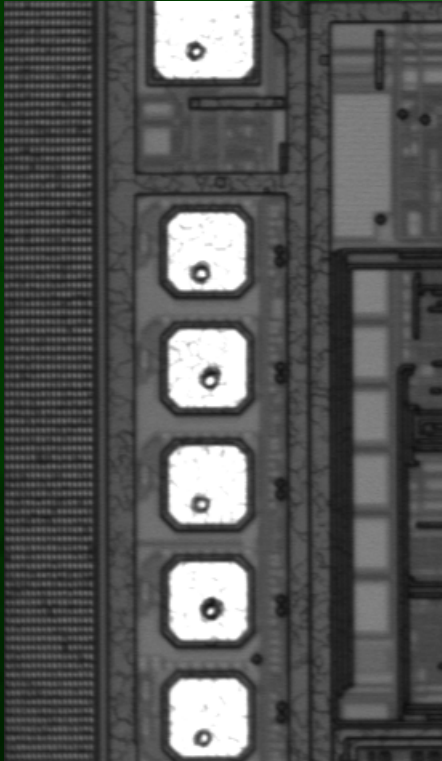


SWTest | June 2-5, 2019

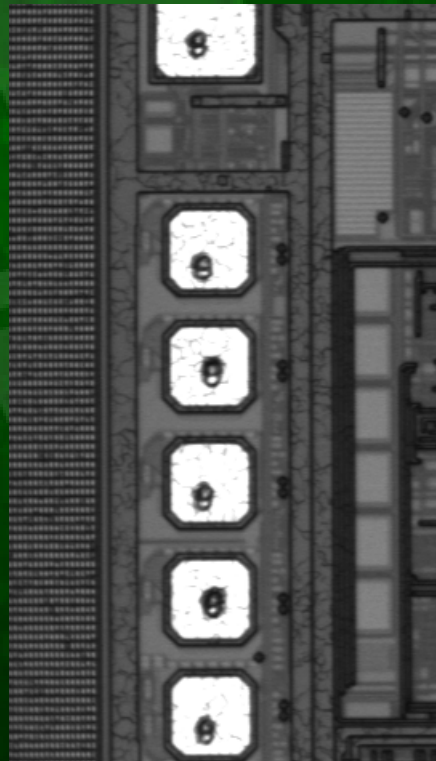
Multiple Test 1X / 5X / 10X using T4 TPEG Technology

EAST

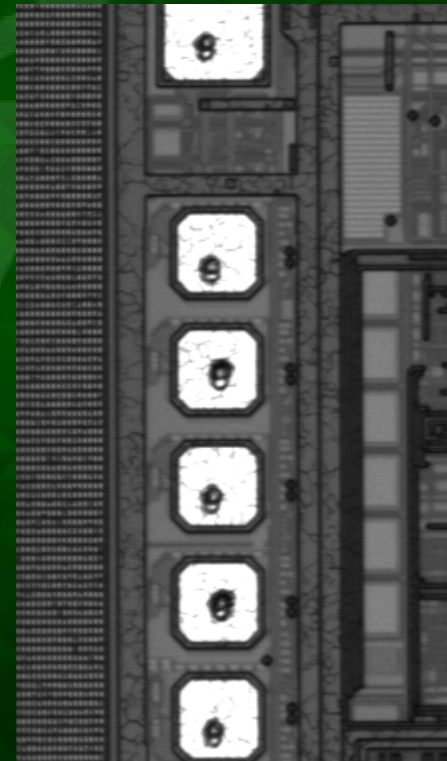
1X TD
PM Measurement = 12um



5X TD
PM Measurement = 14um



10X TD
PM Measurement = 14um

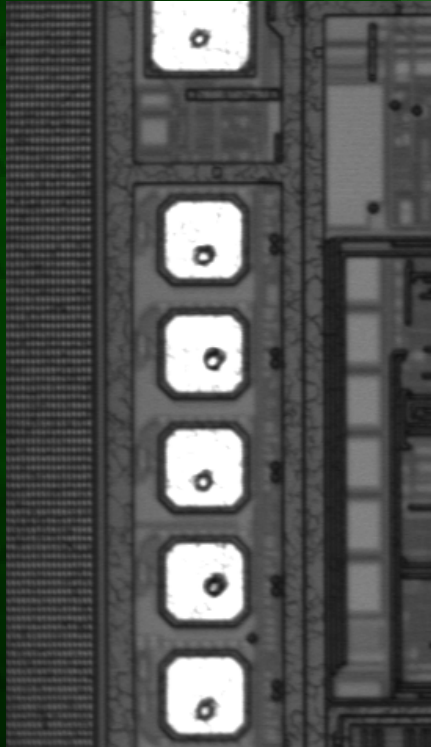


SWTest | June 2-5, 2019

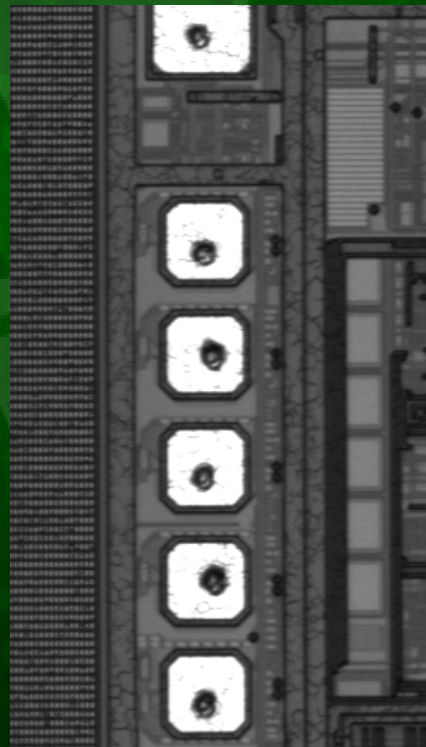
Multiple Test 1X / 5X / 10X using T4 TPEG Technology

WEST

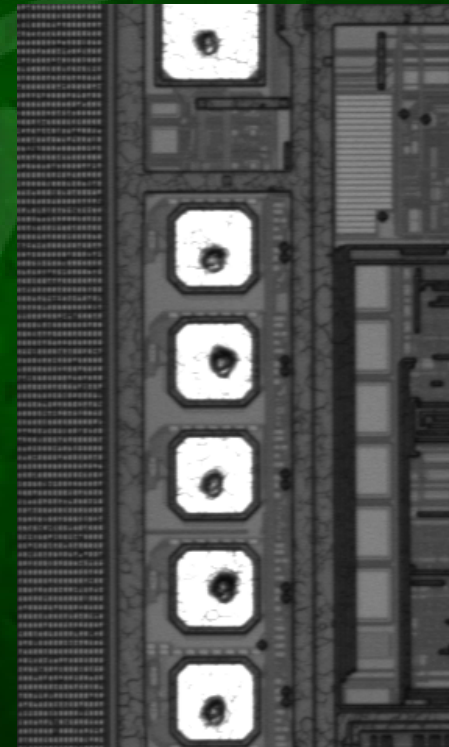
1X TD
PM Measurement = 12um



5X TD
PM Measurement = 14um



10X TD
PM Measurement = 16um



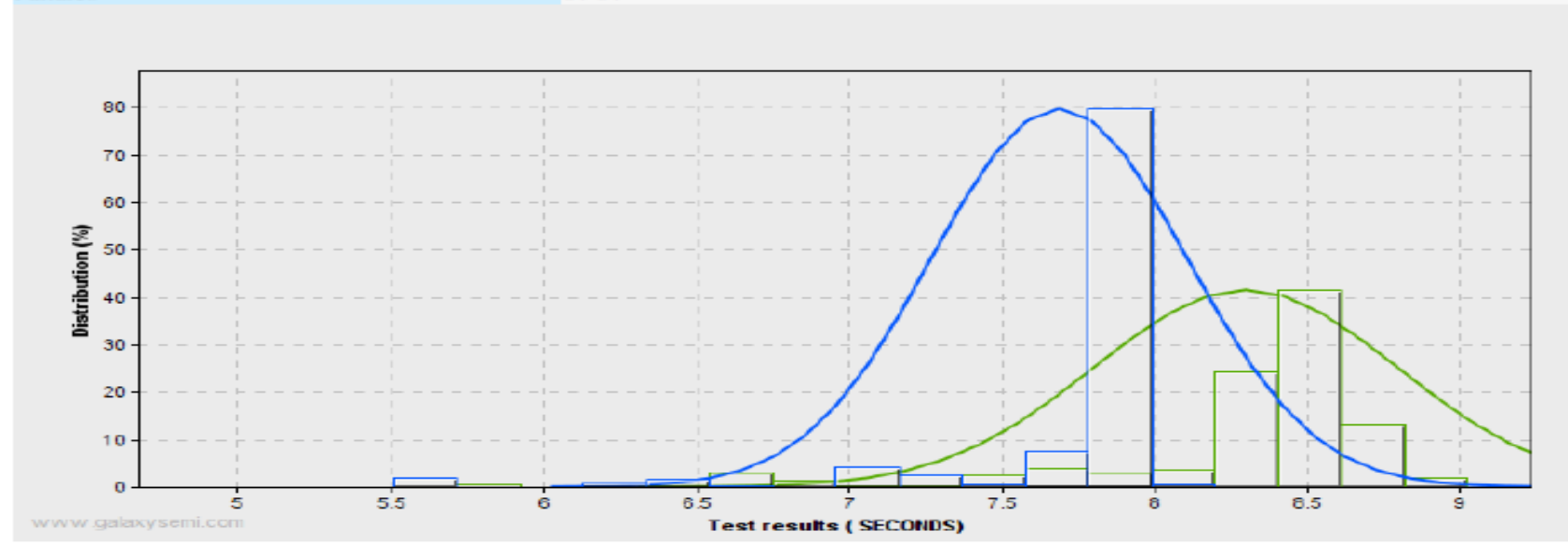
SWTest | June 2-5, 2019

TEST TIME COMPARISON

Cobra-like Technology Probe Card = 8.29861 secs

T4_OPM = 7.68754 secs

Test	99900029
Groups colors	TP Competitor card
Name	TestTime
High Limit	13.2 SECONDS / 13.2 SECONDS /
Low Limit	4.4 SECONDS / 4.4 SECONDS /
Samples	3998 / 3855 /
Mean / Max.shift	7.68754 SECONDS / 8.29861 SECONDS / (6.94%)
Sigma / Max.shift	0.416463 SECONDS / 0.497459 SECONDS / (19.45%)
Cp	3.52 / 2.95 /
Cpk / Max.shift	2.63 / 2.61 / (-0.72%)
Failures	0 / 0 /



SWTest | June 2-5, 2019

Advantages using TP Probe Card

- Repair Lead Time

Vendor	Repair Lead Time
TP	< 1 Week
Competitor Probe Card	1 month

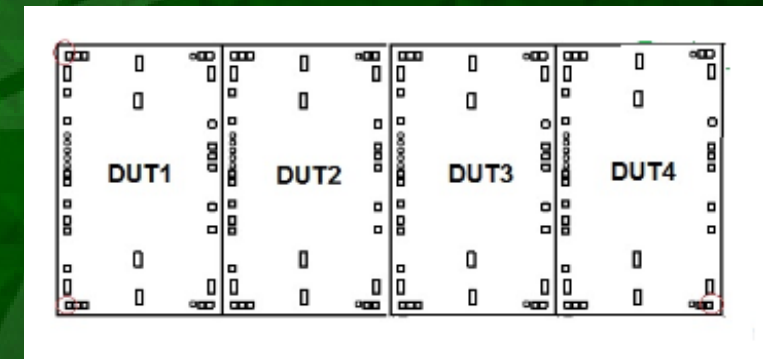
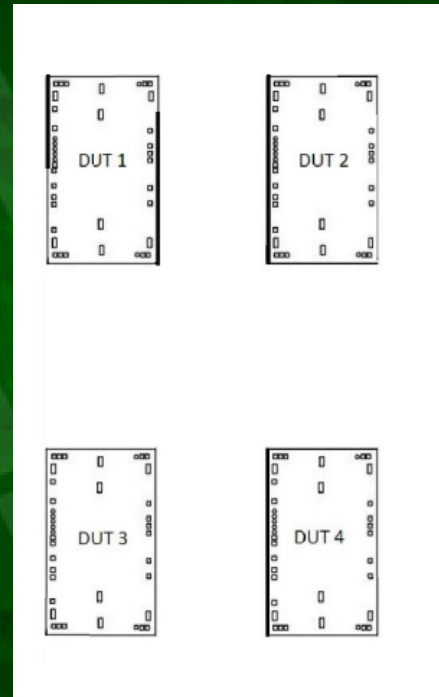
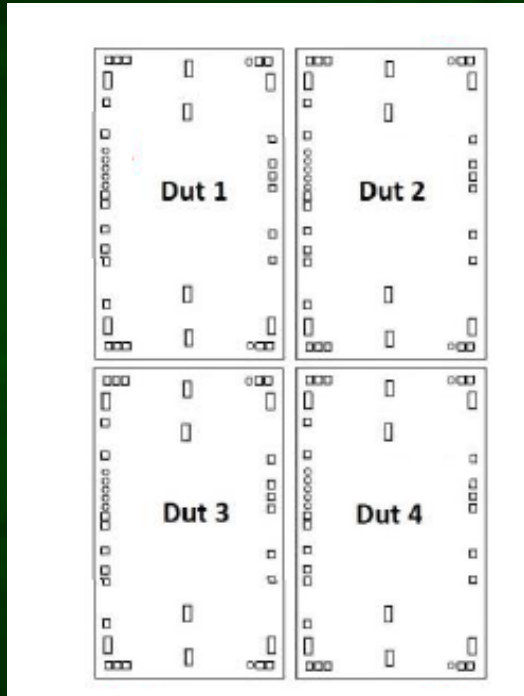
- Prober and Cleaning setup Comparison

Category	Competitor Probe Card	Technoprobe
Probing OD	100 um	40 um
Soak Time	2 Hrs.	2 Hrs.
Preheat Setting	Same	Same
Cleaning settings:		
Cleaning Media	ITS PP-300	WA6000
Cleaning OD	75 um	35um
Cleaning Frequency	125 TD	125 TD

Use less expensive polishing media in comparison with competitor card.

Advantages using TP Probe Card

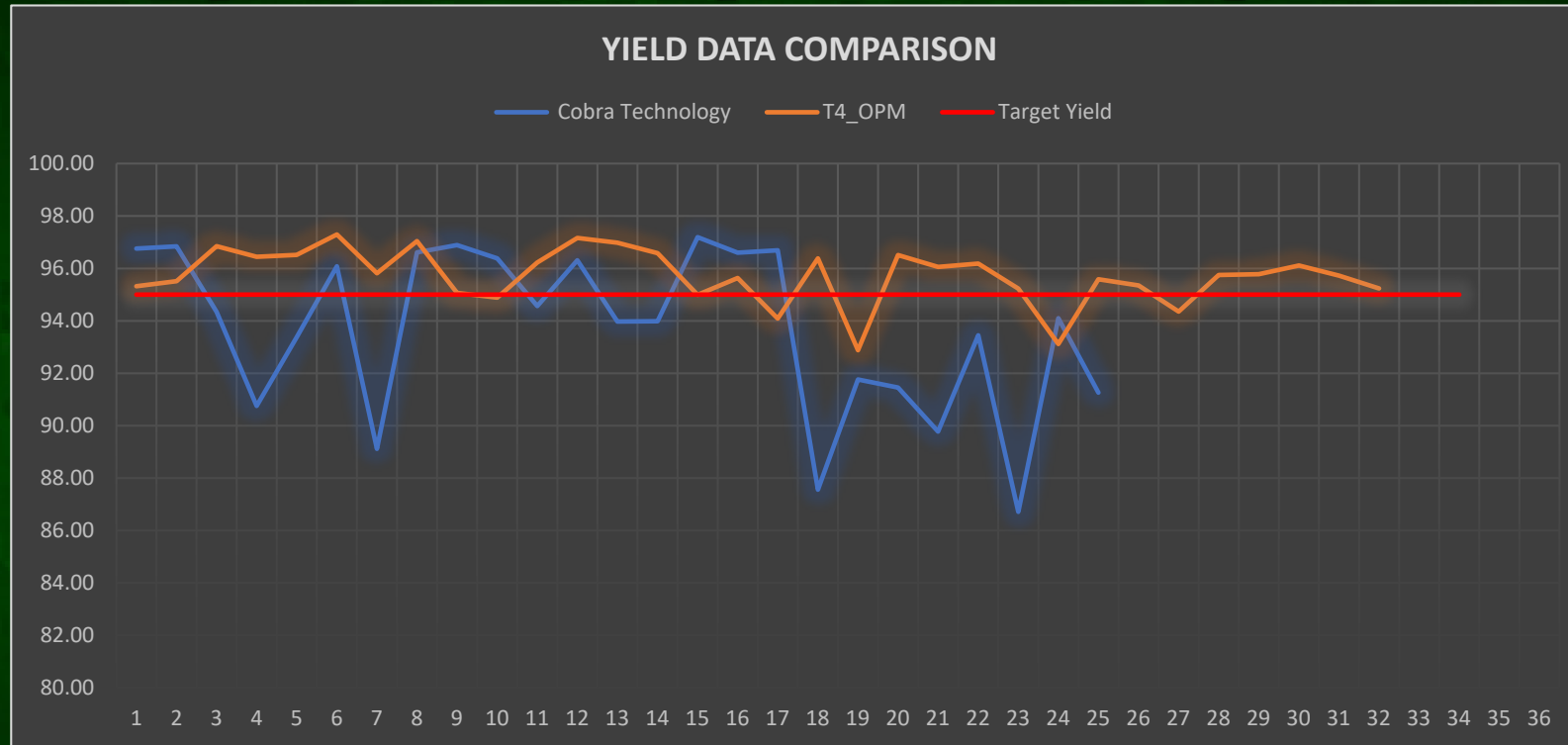
Improved Machine Index Time due to 4X1 or 1X4 configuration



TechnoProbe Card

Competitor Cards

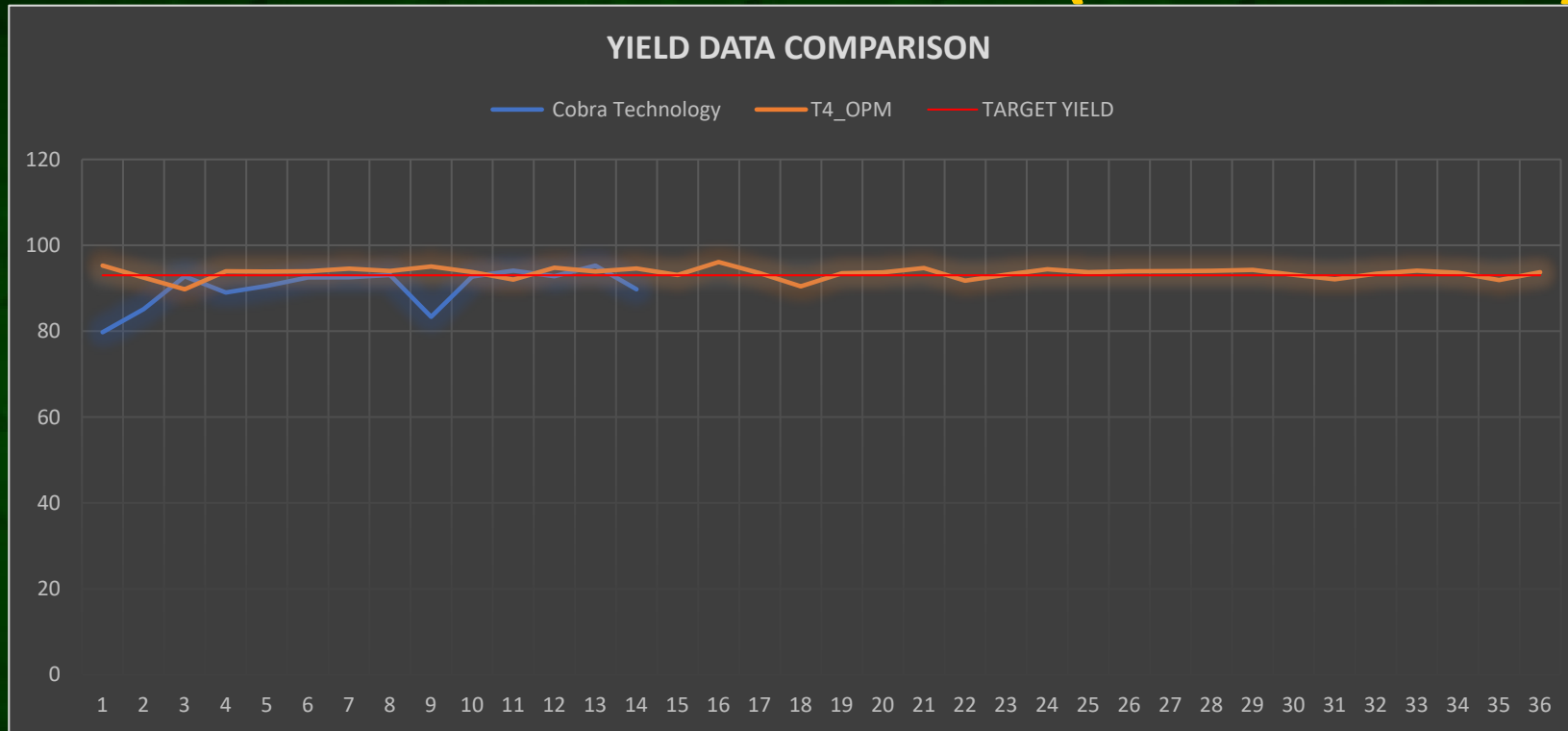
YIELD DATA COMPARISON (XXXX Device)



- Average Probe Yield of 93.62% using Cobra-like Technology Probe card.
- Average Probe Yield of 94.78% using T4_OPM Probe card.
- Significant Probe yield improvement, increased Good Die quantity

SWTest | June 2-5, 2019

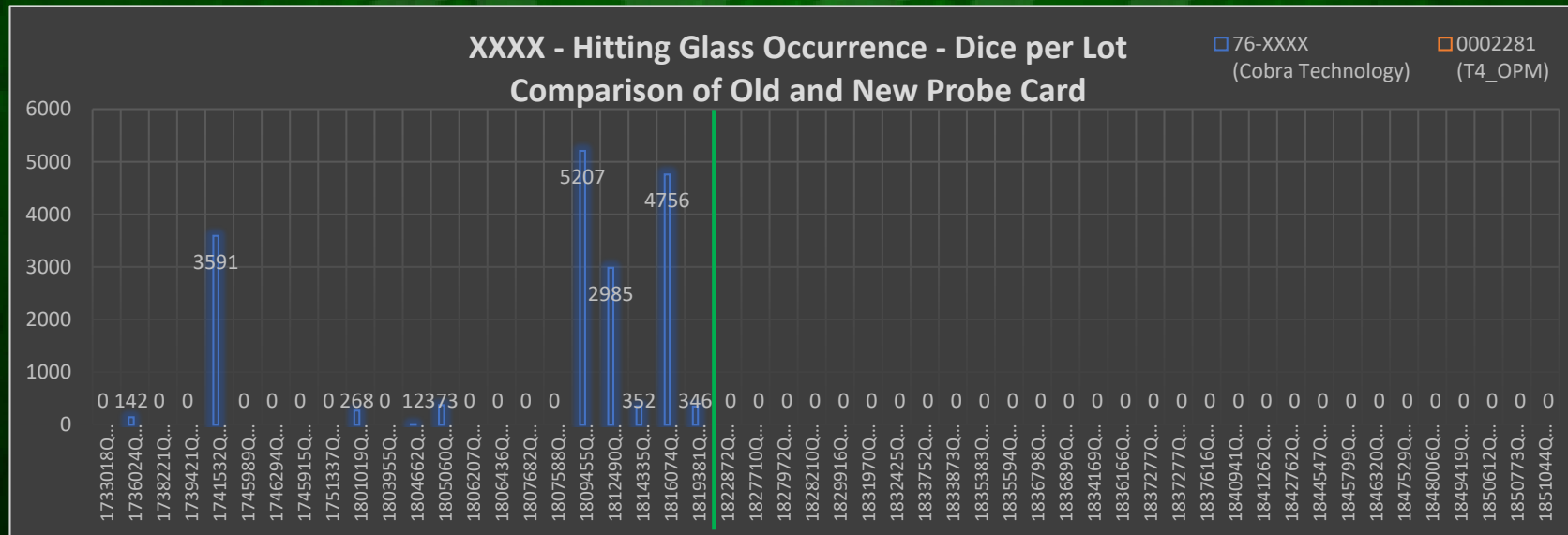
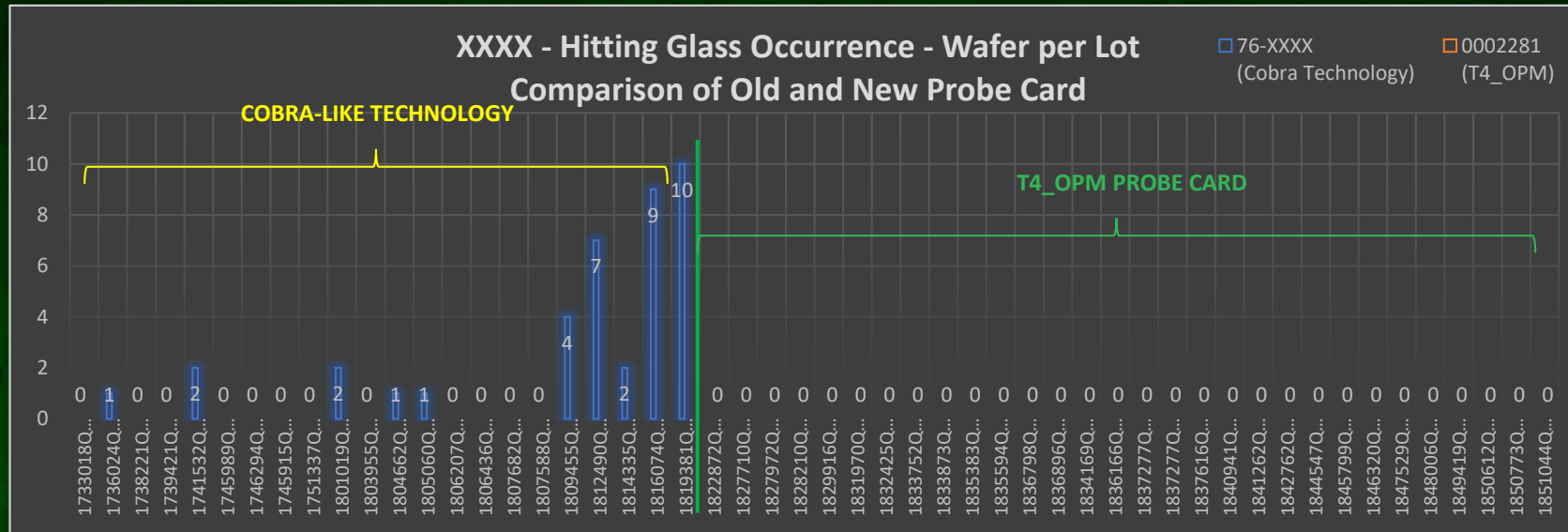
YIELD DATA COMPARISON (YYYY Device)



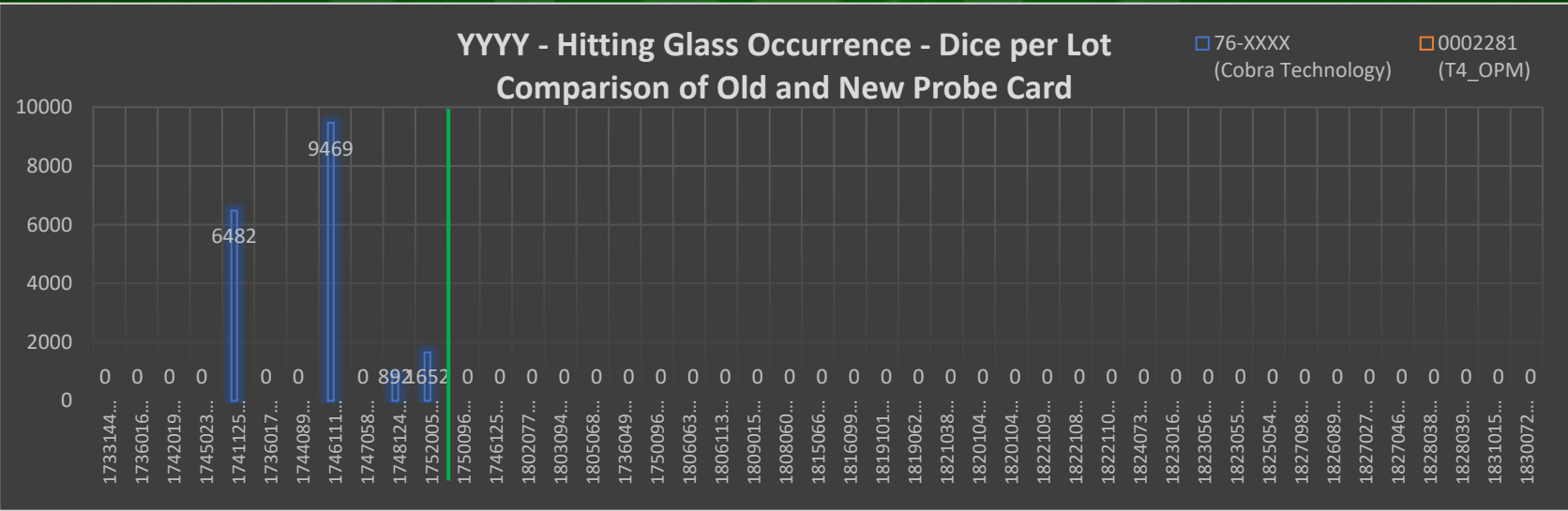
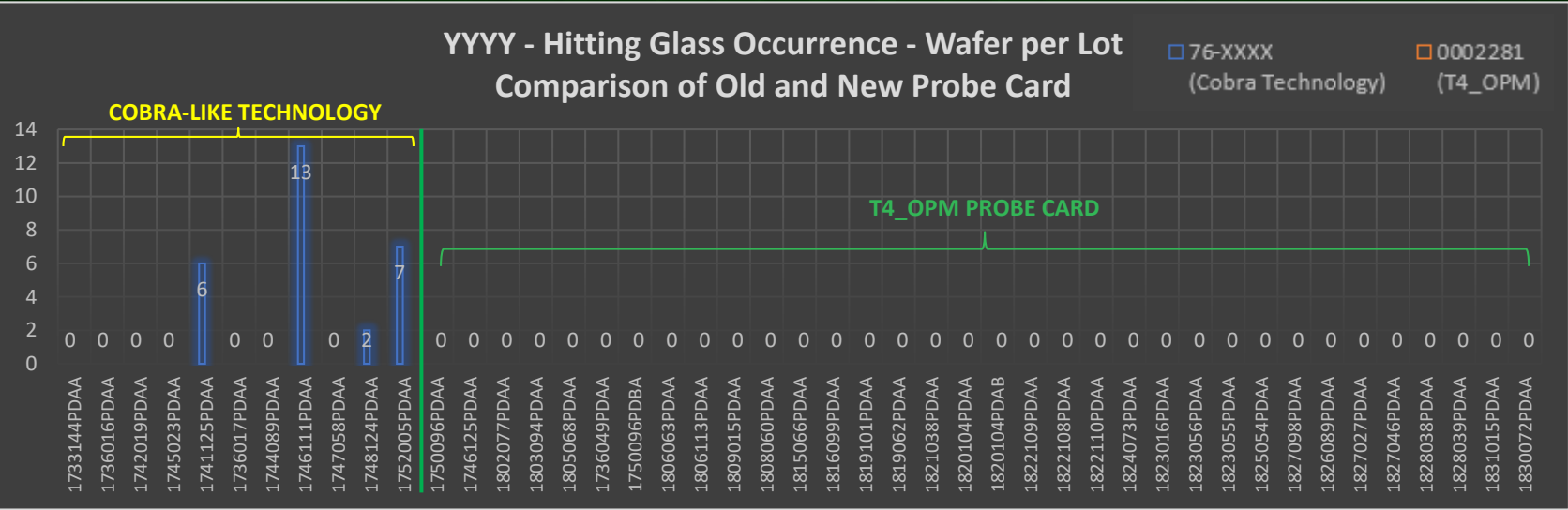
- Average Probe Yield of 90.23% using Cobra-like Technology Probe card.
- Average Probe Yield of 93.55% using T4_OPM Probe card.
- Significant Probe yield improvement, increased Good Die quantity.

SWTest | June 2-5, 2019

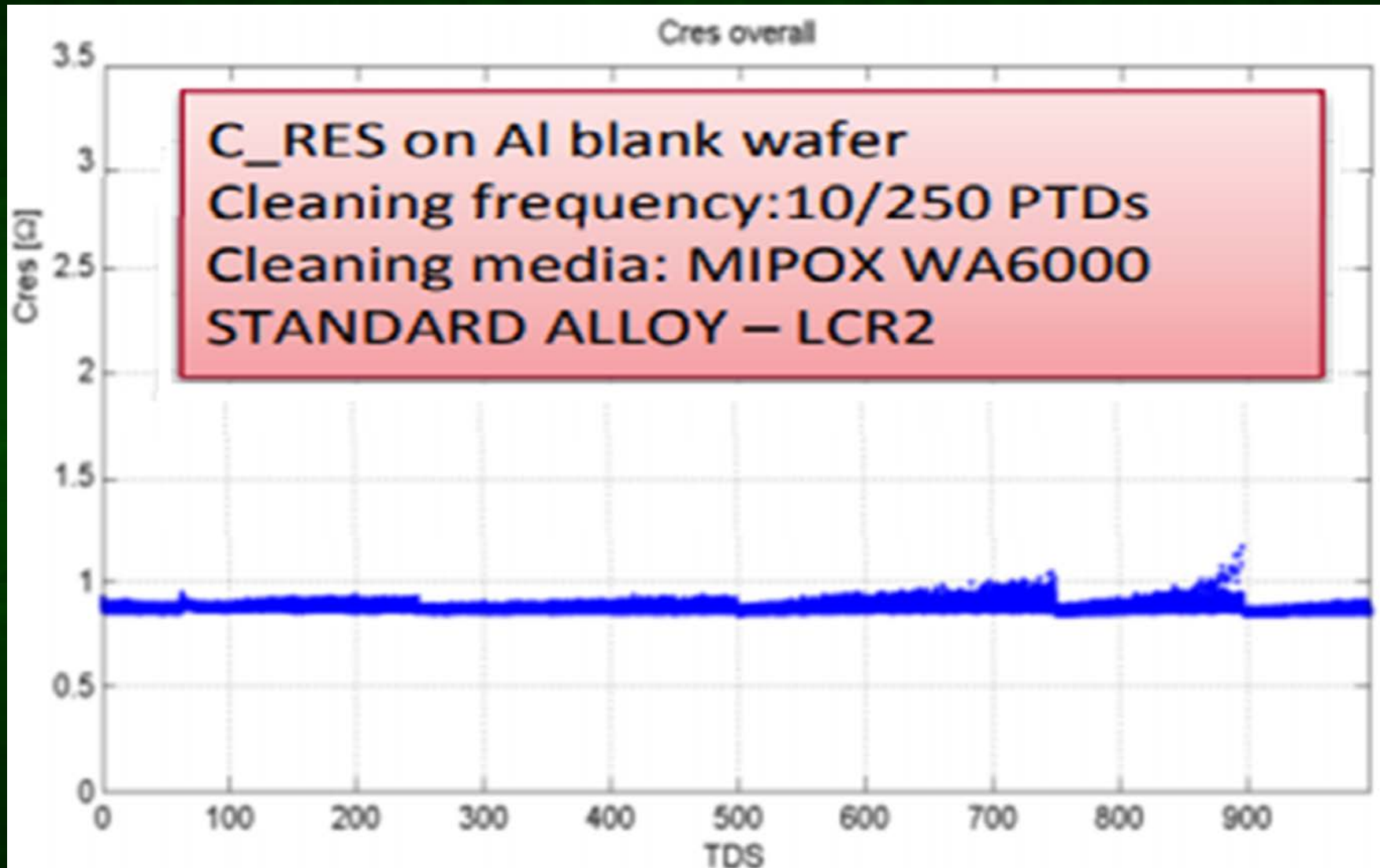
Hitting Glass Occurrence Comparison (XXXX Device)



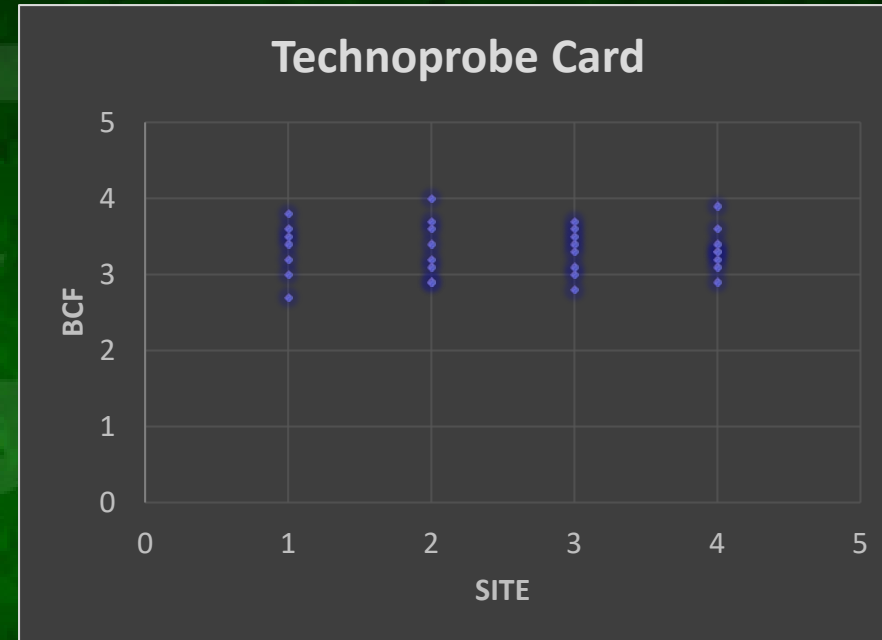
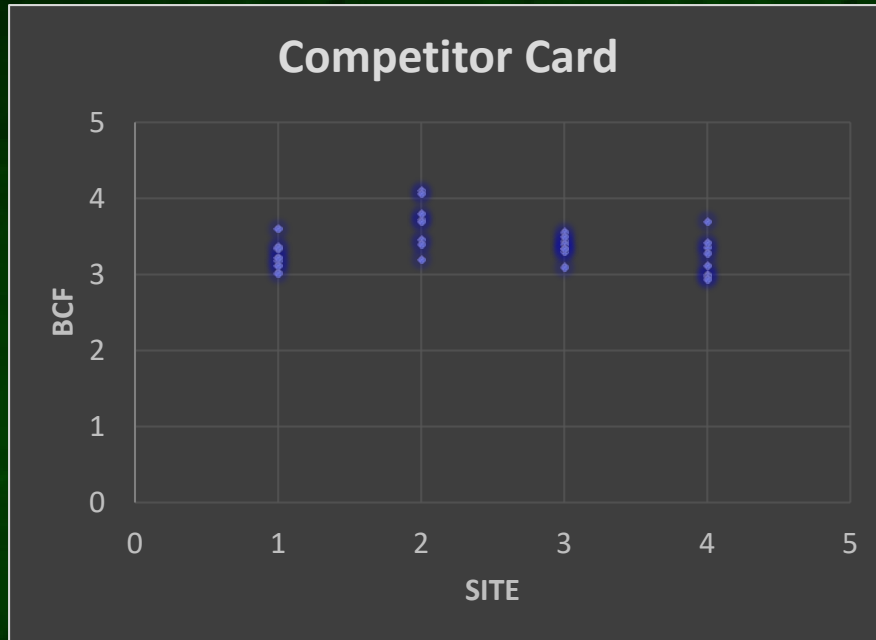
Hitting Glass Occurrence Comparison (YYYY Device)



Contact Resistance Measurements



BCF Comparison of TP and Vertical Cobra-like Probe Cards @ 25um OD



Competitor Card (Cobra-like) @ 25 microns Overdrive

- ❑ BCF reading: 2.9 - 4.1

Technoprobe Card (TPEG T4 OPM) @ 25 microns Overdrive

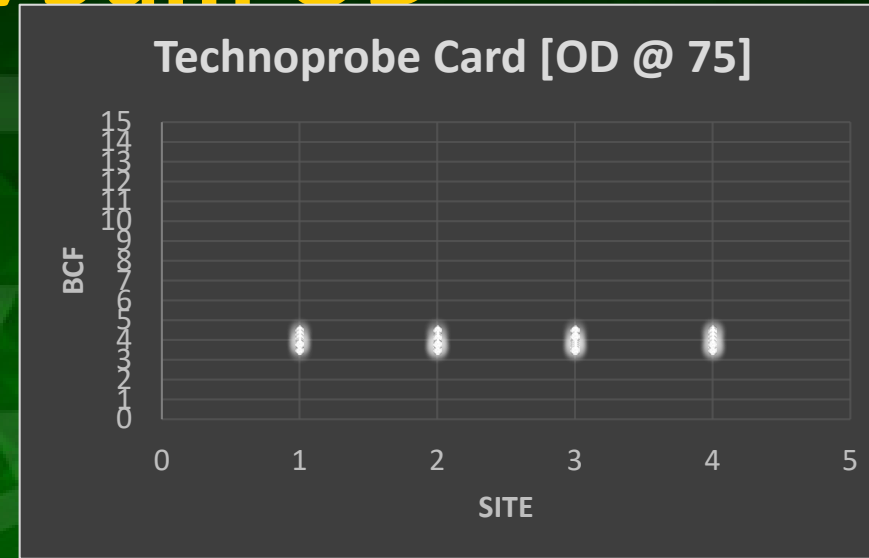
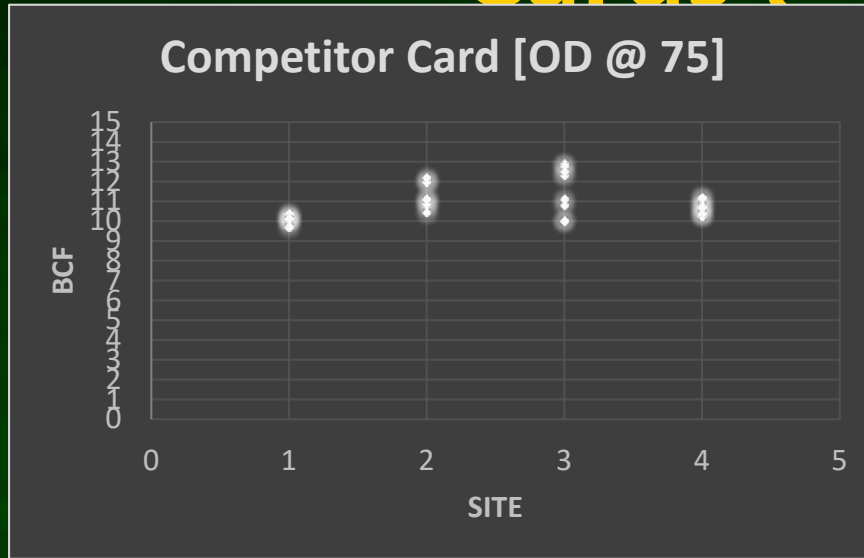
- ❑ BCF reading: 2.7 - 4.0

Conclusion

- ❑ Technoprobe Card and Competitor card BCF performance at 25microns overdrive are almost the same.

SWTest | June 2-5, 2019

BCF Comparison of TP and Vertical Cobra Probe Cards @ 75um OD



Competitor Card (Cobra Like) @ 75 microns Overdrive

- ❑ BCF reading: 9.7 - 12.9

Technoprobe Card (TPEG T4 OPM) @ 75 microns Overdrive

- ❑ BCF reading: 3.7 - 4.6

CONCLUSION:

Competitor Card (Cobra Like)

- ❑ BCF reading increases as the overdrive increases

Technoprobe Card (TPEG T4 OPM)

- ❑ BCF reading was consistent ranging up to 4.5g even though the overdrive applied has different values.

CONCLUSIONS

- Utilization was improved from 58% to 80%.
- Test yield for T4_OPM is significantly improved and increased meeting the target device yield.
- Misaligned probe marks and hitting glass issues are significantly reduced from 40% to 0%.
- 100% wafer inspection was removed, and normal inspection requirement is done on affected devices, thus lot cycle time is improved.
- Rebuild lead time of probe cards was reduced from 6-8weeks to less than 1 week.
- Cobra like technology BCF reading increases as overdrive increases, while T4 BCF reading was consistent ranging up to 4.5g even though overdrive applied has different values.
- Improvement on test time from 8.29 to 7.68 seconds/touch down.

FUTURE PLANS

- ❑ Our Team plans to convert more devices that have similar quality and productivity issues to Technoprobe design.
- ❑ Considering Technoprobe card as an option for new product designs.
- ❑ Follow on activities include collaborating with and evaluating Technoprobe for Hot Probe.

Thank You



Mike Agbesi – Allegro LLC Probe Process Engr.
Mark Harbinson – Allegro LLC Equipment Development Manager
Jim Tan – Allegro Phils. Test Eng'g. Department Manager
Jack Sadie- Allegro Phils. Test and Probe Operation Director



Raffale Vallauri – R&D & Process Eng'g Director
Hellen Kee – Asia Pacific Sales Manager.