WIREBOND MONITORING SIMPLIFICATION AND CYCLE TIME IMPROVEMENT BY ELIMINATION OF NON-VALUE ADDED ACTIVITIES

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ABSTRACT

One of the requirements stated in the customer Quality Records Documents (QRD) is the In-Process Quality Control (IPQC) and translated to a control plan which has a sampling frequency of per shift per machine. The idea originated when the team was identifying PC activities that involve manual data measurement and have the potential for efficiency improvement. Through data interpretation and analysis, Wirebond IPQC will be the candidate for cycle time improvement, involving most of the manual measurement. The proposal is to improve PC activities using the current metrology tool for Wirebond process in parallel with the qualification of an alternative metrology tool used for other processes. This project resulted in an annual savings of 2.2KUSD and cost avoidance of 32.5KUSD upon implementation.

1. 0 INTRODUCTION

Processes that are consistently not meeting the 100% IPQC hit rate target are Attach Processes and Wirebond. However, for the Attach processes, the reason for not meeting the target is because dry monitoring are not given immediately by the operator because of the timing of unloading at oven cure, hence it is beyond the control of the team. In contrary, Wirebond samples are readily given but monitoring execution is delayed due to the lack of manpower, hence it is within the control of the team. Wirebond IPQC consists of dimensional measurement and destructive test performed in Nikon measuring scope and Dage bond tester, respectively.

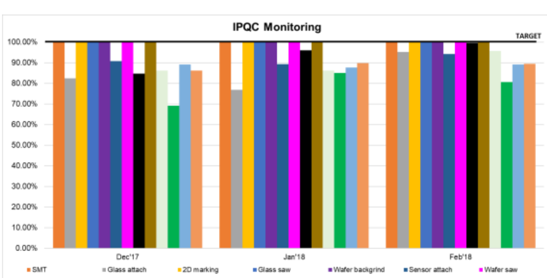


Fig. 1. IPQC Monitoring hitrate for all the processes with IPQC requirement.

1.1 Nikon Measuring Scope

Dimensional measurement at Nikon measuring scope requires personnel to stand and move the stage by rotation of the *x* and *y* knob. Nikon uses point-to-point measurement for *x*, *y* and *z* measurements.

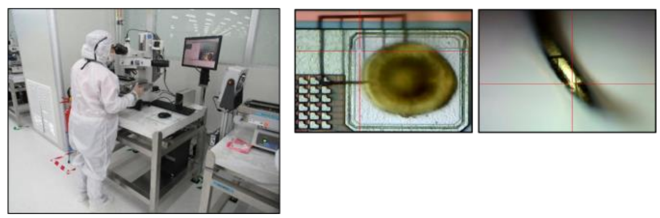


Fig. 2. Nikon measuring scope actual setup and point to point measurement.

1.2 OGP Smartscope

OGP Smartscope uses the average value of the area being measured and has a centroid function for the automatic detection of the area that you want to measure. Capable of programming the dimensional measurement through recipe and requires personnel to a sitting position.

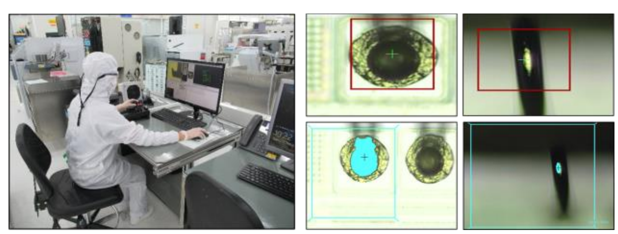


Fig. 3. OGP Smartscope actual setup including the area and centroid measurement.

2. 0 REVIEW OF RELATED WORK

Not Applicable.

3.0 METHODOLOGY

3.1 Define

3.1.1 Problem Statement

Wirebond is consistently not meeting the 100% IPQC monitoring hit rate target. Also, Wirebond has the most number of manual measurement from all the processes with PC monitoring.

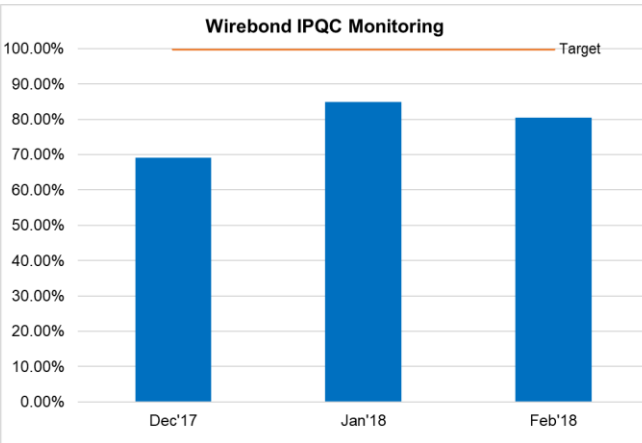


Fig. 4. 3-month Wirebond IPQC monitoring

Wirebond IPQC monitoring has an opportunity to improve the cycle time during dimensional measurement in the manual recording of data in the log sheet and manual encoding of measured data in the SPC software.

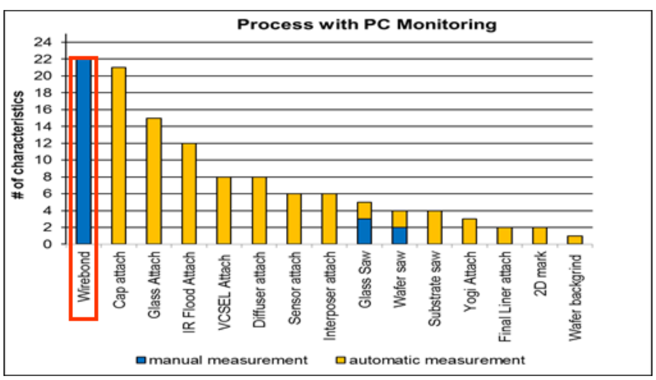


Fig. 5. Bar graph of Processes with IPQC requirements.

3.1.2 Project Metrics

The team identified Quality as the business metric for this project with cycle time as the primary metric. It is expected to require additional OGP metrology tool if the project is implemented since OGP will be qualified as additional metrology tool for Wirebond PC.

Fig. 6. Wirebond IPQC Project metrics.

3.1.3 Initial Objective Statement

The project aims to reduce the cycle time of dimensional PC measurement at Wirebond process to minimum cycle time per machine by end of September 2018.

The proposed solution is to convert manual measurement to automatic measurement by qualifying the OGP to measure dimensional measurement at Wirebond process that will result to cycle time reduction. The graph below shows the breakdown after the implementation of the project.

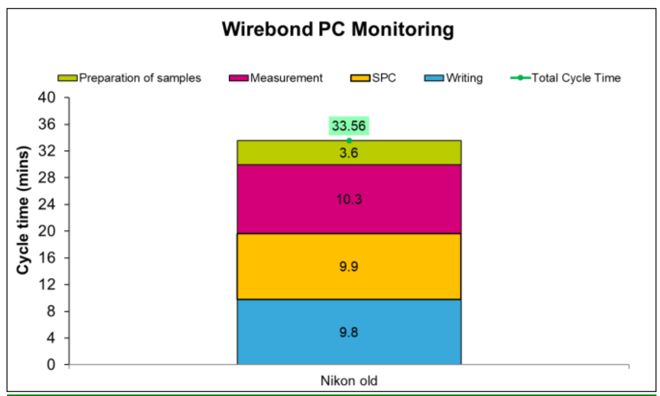


Fig. 6. Wirebond IPQC activities stack bar.

3.1.4 Projected Savings Forecast

The project is estimated to have a cost savings of 2.2KUSD for combined reduction of headcount and elimination of paper consumption during PC monitoring at Wirebond if completed.

3.2 Measure

3.2.1 Detailed Current Process Fow

The steps below enclosed in broken red lines are identified steps that will be changed or improved to reduce the cycle time of PC monitoring at Wirebond due to manual recording of measured data in log sheet, template, and SPC software. Dimensional check is 100% manually measured at Nikon.

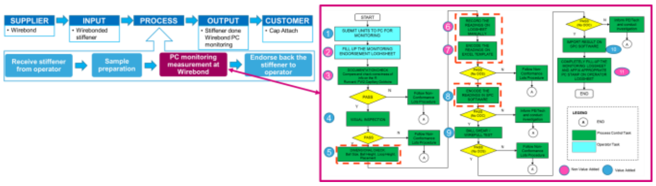


Fig. 7. Detailed Current Process Flow.

3.2.2 Proposed Process Fow

The steps below enclosed in broken blue lines are the improved steps that will reduce wrong data entry during SPC data encoding and eliminate use of paper during PC monitoring at Wirebond. These changes will result in an improvement in the cycle time of PC monitoring by eliminating those manual activities. Ball height and loop height measurement will also be improved by converting from manual to automatic measurement.

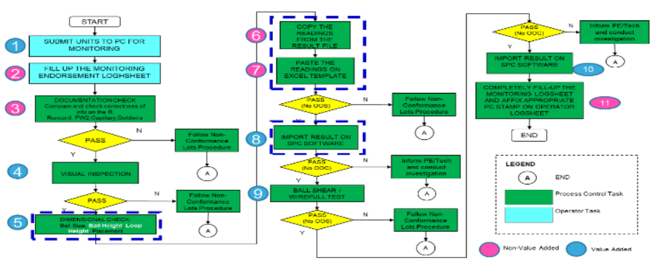


Fig. 8. Proposed Process Flow

3.2.3 Force Field Analysis

The methodology used was Force Field Analysis because the solution is already known for the problem. Comparing the arguments of Forces for Change and Forces Against Change will help to initially assess if the project is worth considering before implementing. This is like providing the advantages and disadvantages if the project will be implemented. Looking at the scores, it is favorable to implement the project rather than oppose it.

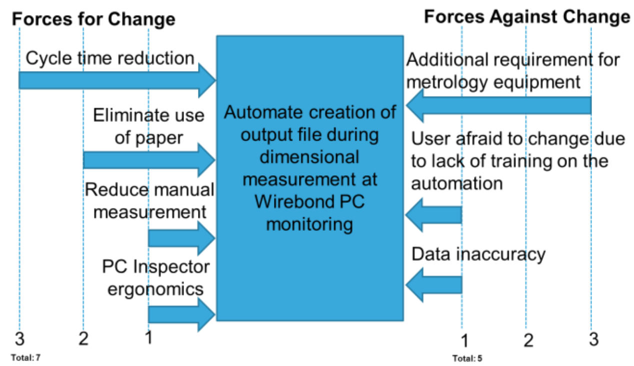


Fig. 9. Force Field Analysis of Automating the output file of dimensional measurement at Wirebond IPQC monitoring.

3.2.4 Capacity and Headcount Requirement

Based on the table below, both Nikon and OGP is sufficient from 200K loading up to 550K loading plan. However, starting from 600K loading plan, there is a need of additional 1 Nikon if cycle time will not be improved.

Table 1. Capacity and Headcount Requirement for Wirebond PC Monitoring

Allocation per Process per Shift:	@200K	@250K	@300K	@350K	@400K	@450K	@500K	@550K	@600K	@650K	@700K
Wirebond	1.00	1.00	1.50	1.50	1.50	2.00	2.00	2.50	2.50	3.00	3.00
Total allocation:	**@200K**	**@250K**	**@300K**	**@350K**	**@400K**	**@450K**	**@500K**	**@550K**	**@600K**	**@650K**	**@700K**
Smartscope Requirement	2.60	2.60	2.60	2.90	3.37	3.79	4.31	4.80	5.26	5.59	6.03
Available Smartscope	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
Smartscope Delta	4.00	4.00	4.00	4.00	4.00	3.00	3.00	2.00	2.00	1.00	1.00
Total allocation:	**@200K**	**@250K**	**@300K**	**@350K**	**@400K**	**@450K**	**@500K**	**@550K**	**@600K**	**@650K**	**@700K**
Nikon Requirement	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	5.00	5.00	5.00
Available Nikon	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Nikon Delta	-	-	-	-	-	-	-	-	(1.00)	(1.00)	(1.00)

3.2.5 Measurement Capability

Looking at the table below, both Nikon and OGP meet the requirement for GRR, Stability, Accuracy and Linearity. This concludes that both Nikon and OGP a qualified tool to be used for the project.

Table 2. Measurement System Analysis (MSA) Table for Nikon and OGP

Metrology	Axis	GRR (<10%)	Stability (# of OOC<1)	Accuracy (p-value >0.05)	Linearity (p-value >0.05)
Nikon	X	2.09%	0	Low – 0.7416 Mid – 0.2869 High– 0.7219	Intercept-0.3649 Label - 0.5313
	Y	6.83%	0	Low – 0.5095 Mid – 0.6050 High – 0.4721	Intercept-0.7325 Label - 0.7375
	Z	3.66%	0	Low – 0.1795 Mid – 0.7173 High – 0.4377	Intercept-0.3895 Label – 0.9583
OGP	X	2.09%	0	Low – 0.7416 Mid – 0.2869 High – 0.7219	Intercept-0.3649 Label - 0.5313
	Y	6.83%	0	Low – 0.5095 Mid – 0.6050 High – 0.4721	Intercept-0.7325 Label - 0.7375
	Z	3.66%	0	Low – 0.1795 Mid – 0.7173 High – 0.4377	Intercept-0.3895 Label – 0.9583

3.2.6 Final Objective Statement

IPQC items are composed of dimensional and destructive measurement. The graph below shows that measurement with writing consumes most of the time therefore, improvement can be made on this activity.

The final objective statement would be "Reduce the cycle time of dimensional PC measurement at Wirebond process from 33mins to 23mins per machine by end of September 2018".

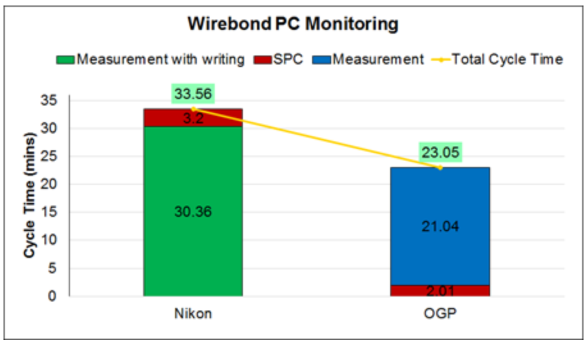


Fig. 10. IPQC Characteristics Wirebond PC Monitoring Stack Bar between Nikon and OGP

3.2.7 Quick Wins

Since most of the cycle time of PC monitoring at Wirebond is due to measurement plus writing, the team explored Nikon capability to produce output file in the form of text file. Upon implementation of output file at Nikon, the cycle time decreases from 33mins to 22mins meeting already the goal for cycle time.

Table 3. Quick Wins at Nikon

Process	Finding/s	Action	Impact	Completion
DIMENSIONAL CHECK: Ball Size, Ball Height, Loop Height, Placement	Record the readings on logsheet manually Encode the readings on Excel template	Implement the program at Nikon that will produce Result file	33% before: 33mins after: 22mins	WW1823 (completed WW1822)

3.3 Analyze

3.3.1 Validation Plan and Result (Cycle Time)

Firstly, the team construct what would be the null and alternative hypothesis. Proving that the null hypothesis (Ho) as the average cycle time of Nikon is the same with OGP if p-value is >0.05 otherwise the alternative hypothesis (Ha) would be the average cycle time of Nikon is greater than OGP if p-value is <0.05.

Table 4. Validation Plan for Cycle Time

Y (or mini Y)	Unit of Measure	Y treated as	X	True nature of X	Levels of X, if discrete or converted into discrete	Hypothesis Statement	
						Null Hypothesis	Alternative Hypothesis
Cycle Time	Min	Continuous	Metrology Tool	Discrete	Nikon OGP	$\mu_{Nikon} = \mu_{OGP}$	$\mu_{Nikon} > \mu_{OGP}$

Second, sample size (denoted as N for the sample size calculator) was computed to identify how much data is needed for the analysis which is 7 subgroups.

Two Means	Inputs	Rev: 1-14-99 Comments
α	0.05	Typically .05
β	0.10	Typically .10 or .20
$\lvert \mu_2 - \mu_1 \rvert$	1.9	Difference to be detected
σ	1	Can be a best guess
1 or 2 Sided	2	Typically 2 sided
N	7	Sample N from each population

Fig. 11. Sample Size Calculator

After collecting the data, it was evaluated if the data is normal or non-normal to identify the correct hypothesis testing to be used in the analysis. Figure below shows that cycle time for OGP and Nikon is normally distributed.

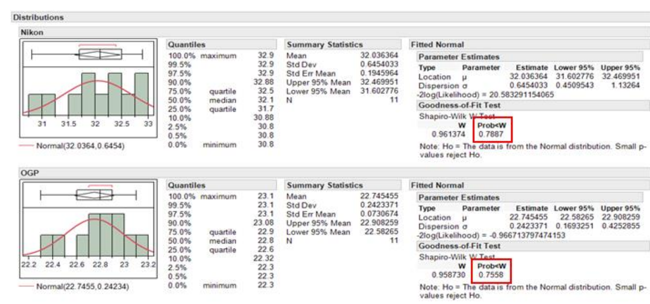


Fig. 12. Normality Test for Cycle Time of Nikon and OGP

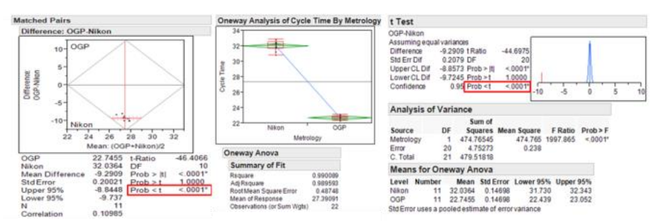


Fig. 13. Hypothesis testing of Mean of Cycle Time

After executing the analysis using matched pair, p-value show above enclosed in rectangular red box is < 0.05 which means that the average cycle time of Nikon is greater than OGP or reject the Ho.

Table 5. Validation Result for Cycle Time average

Process Function	Process Step	Practical Problem	Test Plan	Hypothesis Statement	Conclusion
Wirebond	PC Monitoring	Is Nikon cycle time less than OGP cycle time for Wirebond PC monitoring?	Matched Pair Test	Ho: $\mu_{Nikon} = \mu_{OGP}$ Ha: $\mu_{Nikon} > \mu_{OGP}$	Reject Ho

Table 6. Validation Result for Cycle Time variance

Process Function	Process Step	Practical Problem	Test Plan	Hypothesis Statement	Conclusion
Wirebond	PC Monitoring	Is the variance in Nikon cycle time variance less than OGP cycle time for Wirebond PC monitoring?	2-sample variance test	Ho: $\sigma_{Nikon} = \sigma_{OGP}$ Ha: $\sigma_{Nikon} > \sigma_{OGP}$	Reject Ho

Result below shows that p-value is 0.0047 which is <0.05 therefore concludes that Nikon is has greater spread of cycle time than OGP or reject the Ho.

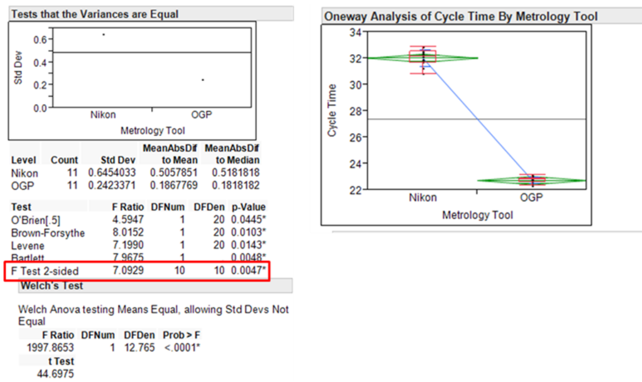


Fig. 15. Hypothesis testing of Stdev of Cycle Time

Table 7. Validation Result for Cycle Time variance

Y (or mini Y)	Unit of Measure	Y treated as	X	True nature of X	Levels of X, if discrete or converted into discrete	Hypothesis Statement: Null Hypothesis	Hypothesis Statement: Alternative Hypothesis	Graphical Analysis	Statistical Test	Beta	Alpha	Delta	Sample Size	p-value	Decision
Cycle Time	min	Continuous	Metrology Tool	Discrete	Nikon OGP	μNikon < μOGP	μNikon > μOGP	Box Plot	Matched Pair test	0.1	0.05	1.9	11	<0.0001	Reject Ho
Cycle Time	min	Continuous	Metrology Tool	Discrete	Nikon OGP	σNikon < σOGP	σNikon > σOGP	Box Plot	2 variance test	0.1	0.05	1.9	11	0.0047	Reject Ho

3.3.2 Validation Plan and Result (Cycle Time)

The same approach was used for dimensional measurement of VCSEL, Sensor, Valencia and RSOB but sample size calculator suggested only 1 subgroup but actual subgroup used is 6. It is found out that all the characteristics are in favor of using Nikon over OGP.

Table 8. Validation Result of Mean and Stdev for Dimensional characteristics.

Y (or mini Y)	Unit of Measure	Y treated as	X	True nature of X	Levels of X, if discrete or converted into discrete	Hypothesis Statement: Null Hypothesis	Hypothesis Statement: Alternative Hypothesis	Graphical Analysis	Statistical Test	Beta	Alpha	Delta	Sample Size	p-value	Decision
VCSEL	mm	Continuous	Metrology Tool	Discrete	Nikon OGP	$\mu_{Nikon} = \mu_{OGP}$	$\mu_{Nikon} \neq \mu_{OGP}$	Box Plot	Various	0.1	0.05	1.9	30	Various	Reject Ho
VCSEL	mm	Continuous	Metrology Tool	Discrete	Nikon OGP	$\sigma_{Nikon} = \sigma_{OGP}$	$\sigma_{Nikon} \neq \sigma_{OGP}$	Box Plot	Various	0.1	0.05	1.9	30	Various	Reject Ho
Sensor	mm	Continuous	Metrology Tool	Discrete	Nikon OGP	$\mu_{Nikon} = \mu_{OGP}$	$\mu_{Nikon} \neq \mu_{OGP}$	Box Plot	Various	0.1	0.05	1.9	30	Various	Reject Ho
Sensor	mm	Continuous	Metrology Tool	Discrete	Nikon OGP	$\sigma_{Nikon} = \sigma_{OGP}$	$\sigma_{Nikon} \neq \sigma_{OGP}$	Box Plot	Various	0.1	0.05	1.9	30	Various	Reject Ho
Valencia	mm	Continuous	Metrology Tool	Discrete	Nikon OGP	$\mu_{Nikon} = \mu_{OGP}$	$\mu_{Nikon} \neq \mu_{OGP}$	Box Plot	Various	0.1	0.05	1.9	30	Various	Reject Ho
Valencia	mm	Continuous	Metrology Tool	Discrete	Nikon OGP	$\sigma_{Nikon} = \sigma_{OGP}$	$\sigma_{Nikon} \neq \sigma_{OGP}$	Box Plot	Various	0.1	0.05	1.9	30	Various	Reject Ho
RSOB	mm	Continuous	Metrology Tool	Discrete	Nikon OGP	$\mu_{Nikon} = \mu_{OGP}$	$\mu_{Nikon} \neq \mu_{OGP}$	Box Plot	Various	0.1	0.05	1.9	30	Various	Reject Ho
RSOB	mm	Continuous	Metrology Tool	Discrete	Nikon OGP	$\sigma_{Nikon} = \sigma_{OGP}$	$\sigma_{Nikon} \neq \sigma_{OGP}$	Box Plot	Various	0.1	0.05	1.9	30	Various	Reject Ho

4.0 RESULTS AND DISCUSSION

4.1 Potential Problem Analysis

The team fine-tuned the OGP recipe to see if there are gaps that need to be corrected and why measurement at OGP and Nikon is not equal. Later it is found out that 1. PC inspectors were measuring different units compared to that programmed with OGP and 2. OGP is programmed with difference reference location with Nikon.

Table 9. Potential Problem Analysis of OGP for Dimensional Measurement.

Best solution	Potential Problem	Potential Cause	Preventive Action	Contingency Plan	EP Level	Responsible	Target	Status
Qualify OGP for dimensional measurement of Wirebond characteristics	Out of specification (OOS) data	Not aligned unit to be measured	Align OGP program to measure the correct unit	Use Nikon if problem will not be fix	3	Brian Paul Villanueva	Wk31'18	Done
	Out of specification (OOS) data	Not aligned wire to be measured per characteristic	Align OGP program to measure the correct wire per characteristic	Use Nikon if problem will not be fix	3	Brian Paul Villanueva	Wk31'18	Done

Deployment to PC inspectors was done to align with the programmed measurement of OGP. Specific wire to be measured was deployed as well so that OGP and Nikon will have the same reference. Fine-tuning was also done to the recipe of OGP to further close the gap between the 2 metrology tools before proceeding with the validation run after the implementation of improvement.

4.2 Validation Result after Improvement

Second validation was conducted to check if improvement is evident after the implementation of corrective actions for gaps that has been found out.

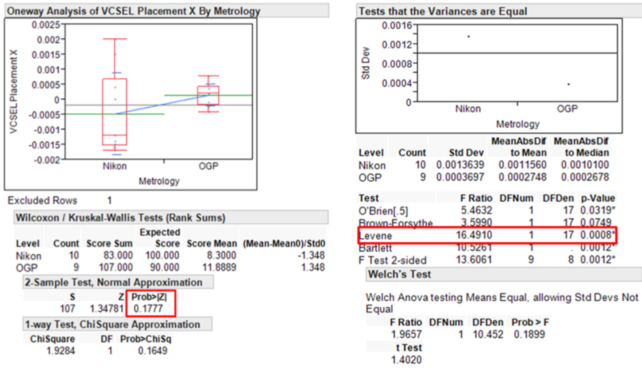


Fig. 16. Hypothesis Testing for mean and variance of Ball Placement X.

Above figure shows Ball placement X p-value for mean >0.05 which mean that OGP has the same measurement with Nikon while for standard deviation p-value is <0.05. This means that OGP has different spread of measurement compared with Nikon. Looking closely at the graphical result, OGP has lower standard deviation therefore it is better than Nikon.

Table 9. Validation Result after correction.

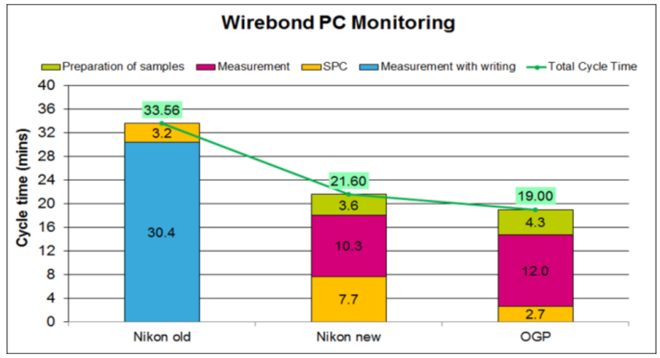
Y (or mini Y)	Unit of Measure	Y treated as	X	True nature of X	Levels of X, if discrete or converted into discrete	Hypothesis Statement: Null Hypothesis	Hypothesis Statement: Alternative Hypothesis	Graphical Analysis	Statistical Test	Beta	Alpha	Delta	Sample Size	p-value	Decision
VCSEL	mm	Continuous	Metrology Tool	Discrete	Nikon OGP	$\mu_{Nikon} = \mu_{OGP}$	$\mu_{Nikon} \neq \mu_{OGP}$	Box Plot	Various	0.1	0.05	1.9	30	Various	Fail to reject Ho
VCSEL	mm	Continuous	Metrology Tool	Discrete	Nikon OGP	$\sigma_{Nikon} = \sigma_{OGP}$	$\sigma_{Nikon} \neq \sigma_{OGP}$	Box Plot	Various	0.1	0.05	1.9	30	Various	Fail to reject Ho
Sensor	mm	Continuous	Metrology Tool	Discrete	Nikon OGP	$\mu_{Nikon} = \mu_{OGP}$	$\mu_{Nikon} \neq \mu_{OGP}$	Box Plot	Various	0.1	0.05	1.9	30	Various	Fail to reject Ho
Sensor	mm	Continuous	Metrology Tool	Discrete	Nikon OGP	$\sigma_{Nikon} = \sigma_{OGP}$	$\sigma_{Nikon} \neq \sigma_{OGP}$	Box Plot	Various	0.1	0.05	1.9	30	Various	Fail to reject Ho
Valencia	mm	Continuous	Metrology Tool	Discrete	Nikon OGP	$\mu_{Nikon} = \mu_{OGP}$	$\mu_{Nikon} \neq \mu_{OGP}$	Box Plot	Various	0.1	0.05	1.9	30	Various	Fail to reject Ho
Valencia	mm	Continuous	Metrology Tool	Discrete	Nikon OGP	$\sigma_{Nikon} = \sigma_{OGP}$	$\sigma_{Nikon} \neq \sigma_{OGP}$	Box Plot	Various	0.1	0.05	1.9	30	Various	Fail to reject Ho
RSOB	mm	Continuous	Metrology Tool	Discrete	Nikon OGP	$\mu_{Nikon} = \mu_{OGP}$	$\mu_{Nikon} \neq \mu_{OGP}$	Box Plot	Various	0.1	0.05	1.9	30	Various	Fail to reject Ho
RSOB	mm	Continuous	Metrology Tool	Discrete	Nikon OGP	$\sigma_{Nikon} = \sigma_{OGP}$	$\sigma_{Nikon} \neq \sigma_{OGP}$	Box Plot	Various	0.1	0.05	1.9	30	Various	Fail to reject Ho

The table above summarizes the result of validation after the correction. It concludes that Nikon and OGP have the same performance if they use them to measure dimensional measurement at Wirebond.

4.3 Validation Result after Improvement

After the correction, cycle time was validated to assess if the goal was still achieved. Graph below shows comparison of cycle time for 3 different scenarios.

Nikon old is the manual measurement with writing and manual data entry in SPC chart. Nikon new uses the Nikon program and output file for automatic transfer of data to SPC chart. OGP meanwhile is the automatic measurement of loop height and ball height with added feature of automatic detection and movement of location per characteristic.



4.4 Validation Result after Improvement

4.4.1 Tangible Benefits

Same headcount reduction will be realized for both 100% and 50% implementation of Wirebond dimensional measurement using OGP.

Table 10. Comparison of headcount reduction for OGP Implementation.

PER SHIFT

		Allocation per Process:	@200K	@250K	@300K	@350K	@400K	@450K	@500K	@550K	@600K	@650K	@700K		
	1	WIREBOND (NIKON + MANUAL WRITING OF RESULTS)	2.00	2.00	3.00	3.00	3.00	4.00	4.00	5.00	5.00	6.00	6.00	AVERAGE HC REQUIREMENT	4
		WIREBOND (NIKON + AUTOMATIC TRANSFER OF DATA)	1.00	2.00	2.00	2.00	2.00	3.00	3.00	3.00	3.00	4.00	4.00	AVERAGE HC REQUIREMENT	3
		HC SAVINGS	1	0	1	1	1	1	1	2	2	2	2	AVERAGE HC SAVINGS	1
	2	WIREBOND (NIKON + AUTOMATIC TRANSFER OF DATA)	1.00	2.00	2.00	2.00	2.00	3.00	3.00	3.00	3.00	4.00	4.00	AVERAGE HC REQUIREMENT	3
		WIREBOND (OGP + AUTOMATIC TRANSFER OF DATA)	1.00	1.00	1.00	2.00	2.00	2.00	2.00	2.00	3.00	3.00	3.00	AVERAGE HC REQUIREMENT	2
		HC SAVINGS	0	1	1	0	0	1	1	1	0	1	1	AVERAGE HC SAVINGS	1
100% OGP	3	WIREBOND (NIKON + MANUAL WRITING OF RESULTS)	2.00	2.00	3.00	3.00	3.00	4.00	4.00	5.00	5.00	6.00	6.00	AVERAGE HC REQUIREMENT	4
		WIREBOND (OGP + AUTOMATIC TRANSFER OF DATA)	1.00	1.00	1.00	2.00	2.00	2.00	2.00	2.00	3.00	3.00	3.00	AVERAGE HC REQUIREMENT	2
		TOTAL HC SAVINGS	1	1	2	1	1	2	2	3	2	3	3	AVERAGE HC SAVINGS	2
50% OGP	4	WIREBOND (NIKON + MANUAL WRITING OF RESULTS)	2.00	2.00	3.00	3.00	3.00	4.00	4.00	5.00	5.00	6.00	6.00	AVERAGE HC REQUIREMENT	4
		WIREBOND (OGP + AUTOMATIC TRANSFER OF DATA)	1.00	1.00	1.00	2.00	1.00	1.00	2.00	2.00	2.00	3.00	3.00	AVERAGE HC REQUIREMENT	2
		TOTAL HC SAVINGS	1	1	2	1	2	3	2	3	3	3	3	AVERAGE HC SAVINGS	2

4.4.2 Cost Avoidance

Usage of 50% OGP for Wirebond dimensional measurement has the same headcount reduction, it is also justifiable to proceed with this setup to avoid 32.5KUSD due to additional OGP required if 100% OGP is required.

Table 11. Capacity and Metrology Tool requirement.

Total allocation:	OGP	@200K	@250K	@300K	@350K	@400K	@450K	@500K	@550K	@600K	@650K	@700K
Smartscope Requirement	100% 50%	3.00 2.33	3.00 2.70	3.60 3.10	3.90 3.40	5.37 4.37	5.79 4.79	6.31 5.31	6.8 5.80	7.26 6.26	7.59 6.59	8.03 7.03
Available Smartscope	-	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
Smartscope Delta	100% 50%	4.00 4.00	4.00 3.00	2.00 3.00	2.00 3.00	1.00 2.00	- 1.00	- 1.00	-	-	(1.00) -	(1.00) -
Total allocation:	Nikon	@200K	@250K	@300K	@350K	@400K	@450K	@500K	@550K	@600K	@650K	@700K
Nikon Requirement	0% 50%	2.00 2.50	2.00 2.50	2.00 2.50	2.00 2.50	2.00 3.00	2.00 3.00	2.00 3.00	2.00 3.00	2.00 3.00	2.00 3.00	2.00 3.00
Available Nikon	-	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Nikon Delta	0% 50%	2.00 2.00	2.00 2.00	2.00 2.00	2.00 2.00	2.00 2.00	2.00 2.00	2.00 2.00	2.00 2.00	2.00 2.00	2.00 2.00	2.00 2.00

4.5 Actual Savings

A 573.47USD savings were realized after the implementation of quick wins last July 2018 that eliminates the paper consumption and reduces the cycle time at Wirebond PC monitoring.

5.0 CONCLUSION

Improvement on cycle time will help to achieve the 100% hitrate on Wirebond IPQC. The goal was achieved by eliminating the non-value added activities and standardization of the procedure.

6.0 RECOMMENDATIONS

It is recommended to use the Nikon with recipe or OGP for dimensional measurement of Wirebond IPQC to achieve the 100% IPQC hitrate target.

7.0 ACKNOWLEDGMENT

The authors would like to acknowledge the following; Peter Escarro and Kristian Paul Gamboa who extended their support on the conceptualization, creation and buy-off of the activities of the metrology tools throughout the projects. Jackie Ruiz, Wency Quita and Mhel Antonio for the guidance, support, and allocation of personnels for this project.

8.0 REFERENCES

1. OGP Smartscope Manual
2. Nikon Measuring Scope Manual

9.0 ABOUT THE AUTHORS

Timothy Renz Michael G. Cruz is a Process Control Engineer (QA Engineer). He earned his Engineering degree in BS Electronics and Communications Engineering from the Technological Institute of the Philippines (Quezon City). He is a certified Six Sigma Green Belt practitioner current employed at STMicroelectronics, Inc. He is currently in the semiconductor industry for 13 years.

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Jeanjer A. Rieza received her diploma in Computer Studies in Systems Technology Institute in San Pedro Laguna. She has 20 years of experience in Automation focusing on Systems and Vision Integration, Data management and Application Development. She is currently a Sr. Technician Specialist in Assembly Central Equipment Engineering at STMicroelectronics Inc.

10.0 APPENDIX

10.1 Solution Formulation

Valid Cause	EP Level	Alternative Solutions	Solution Type	Validation		Measures for Effectiveness					Decision
				Method	Results	Risk	Ease	Cost	Rating	Rank	Go / No Go
Additional requirement for metrology equipment	1	50% allocation for Nikon with recipe for output file	Novel	Simulate metrology tool requirement for 700k loading	No additional metrology equipment is required for 700k loading	10	10	10	1000	1	Go
	1	100% allocation for Nikon with recipe for output file	Benchmark		Additional 1 metrology equipment is required for 700k loading	1	10	5	50	2	No Go

Nikon with recipe for output file is the best solution to eliminate the manual writing of measured data in the logsheet with no additional requirement for metrology equipment.

Best solution	Potential Problem	Potential Cause	Preventive Action	EP Level	Contingency Plan	Responsible	Target	Status
50% allocation for Nikon with recipe for output file	Out of specification (OOS) data	Not aligned unit to be measured	Conduct training on PC inspectors for the changes in methodology	S	Do not use the recipe at Nikon during dimensional measurement	Tim Cruz	Wk22'18	Done
	Out of specification (OOS) data	Not aligned wire to be measured per characteristic	Conduct training on PC inspectors for the changes in methodology	S	Do not use the recipe at Nikon during dimensional measurement	Tim Cruz	Wk22'18	Done
	Data inaccuracy in OGP	Not aligned unit to be measured	Qualify OGP to perform semi-auto measurement	1	Use Nikon with recipe for output file	Tim Cruz	Wk36'18	Done

10.2 Intangible benefits

Hazard Description	Accident Type	Nature of Injury/ Damage	Description/ Error/Risk	Expected Result	Area/ Machine	Suggested Control	EP level (Systemic, Level 1,2, 3,)	Approver
Position	*Improper position, long standing position	Musculoskeletal disorders	Ergonomics concern for PC inspectors during measurement using Nikon. Due to equipment design , standing position is Required. With the 12hrs working requirements, long standing position is observed.	Posture to become progressively worse. Typically, workers will begin to slouch and shift their weight from one foot to another to alleviate strain	PC Wirebond	Switch allocation from Nikon To OGP, vice versa every after 1st break or every 2 hrs. based on allocation (deployed)	S	Jackie Ruiz
						Modification of Nikon table to accommodate chair during measurement (end of Q4'19)	3	Peter Escarro

It is more convenient to use OGP than Nikon because PC inspectors can use chair while performing dimensional measurement.

10.3 Standardization

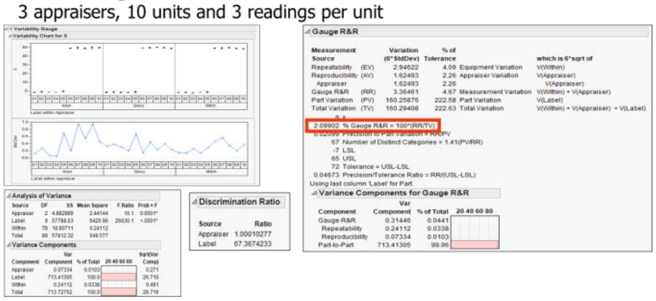
PCP Id	PTM_CAL_050376	**Originator**	Timothy Renz Michael CRUZ
Status	DEPLOYED	**Status Date**	27-Mar-2019
Title	Rosaline Qualification of OGP ...	**Plant**	P1C7
Automotive	☐	**Aerospace & Defense**	☐

10.4 MSA of Nikon

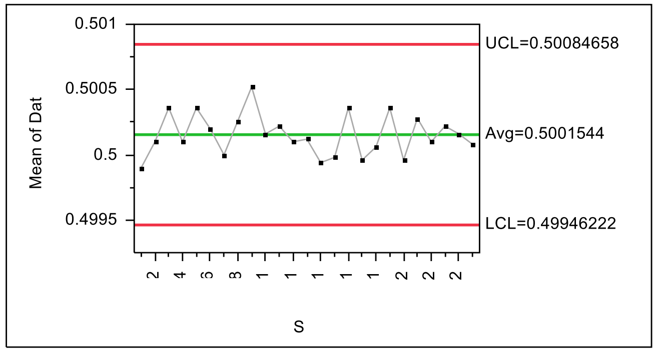
10.4.1 GRR

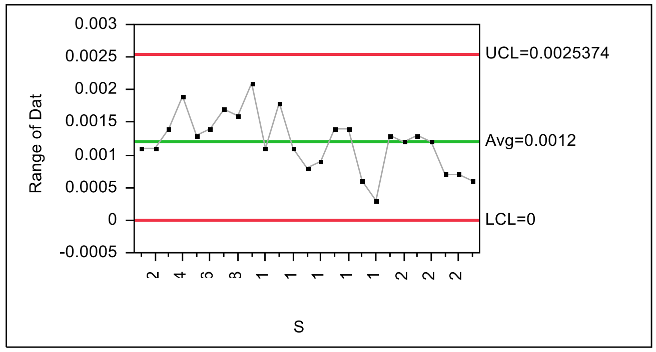
GR&R Design

3 appraisers, 10 units and 3 readings per unit



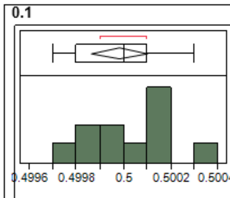
10.4.2 Stability





10.4.3 Accuracy

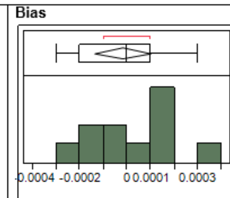
0.1



Quantiles

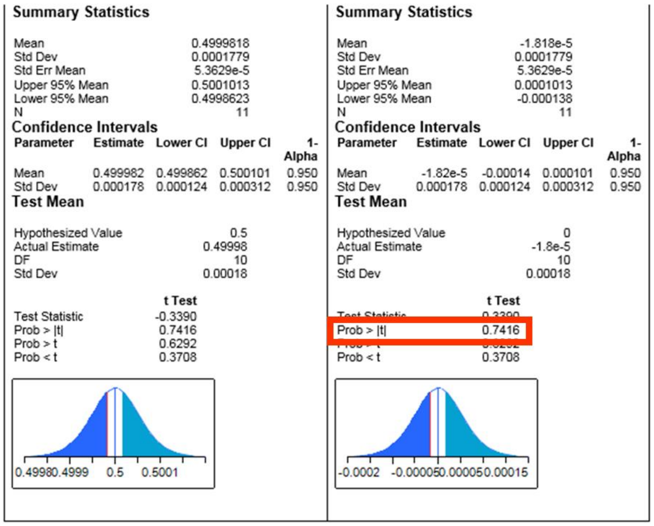
100.0%	maximum	0.5003
99.5%		0.5003
97.5%		0.5003
90.0%		0.50026
75.0%	quartile	0.5001
50.0%	median	0.5
25.0%	quartile	0.4998
10.0%		0.49972
2.5%		0.4997
0.5%		0.4997
0.0%	minimum	0.4997

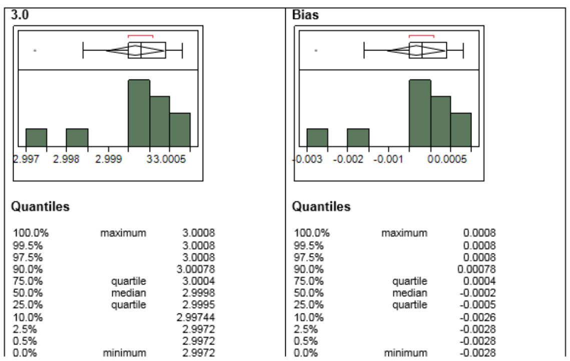
Bias

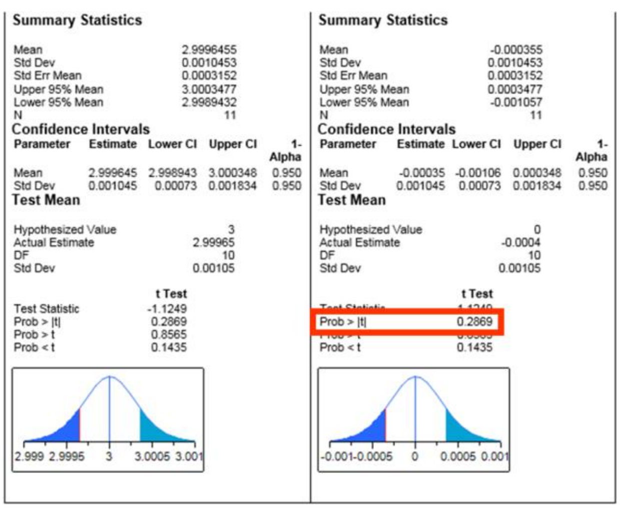


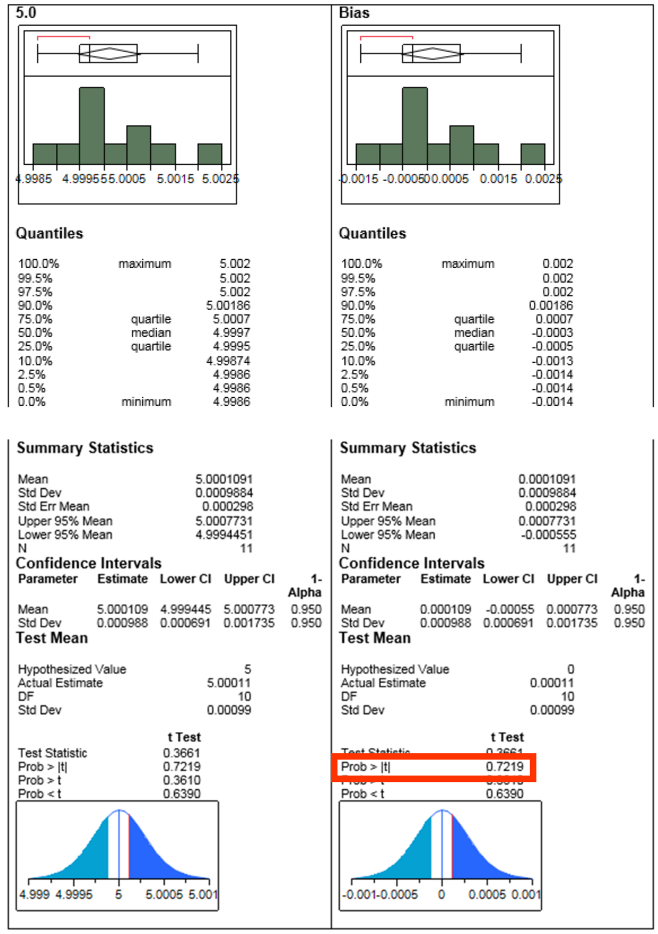
Quantiles

100.0%	maximum	0.0003
99.5%		0.0003
97.5%		0.0003
90.0%		0.00026
75.0%	quartile	0.0001
50.0%	median	0
25.0%	quartile	-0.0002
10.0%		-0.0003
2.5%		-0.0003
0.5%		-0.0003
0.0%	minimum	-0.0003









10.4.4 Linearity