

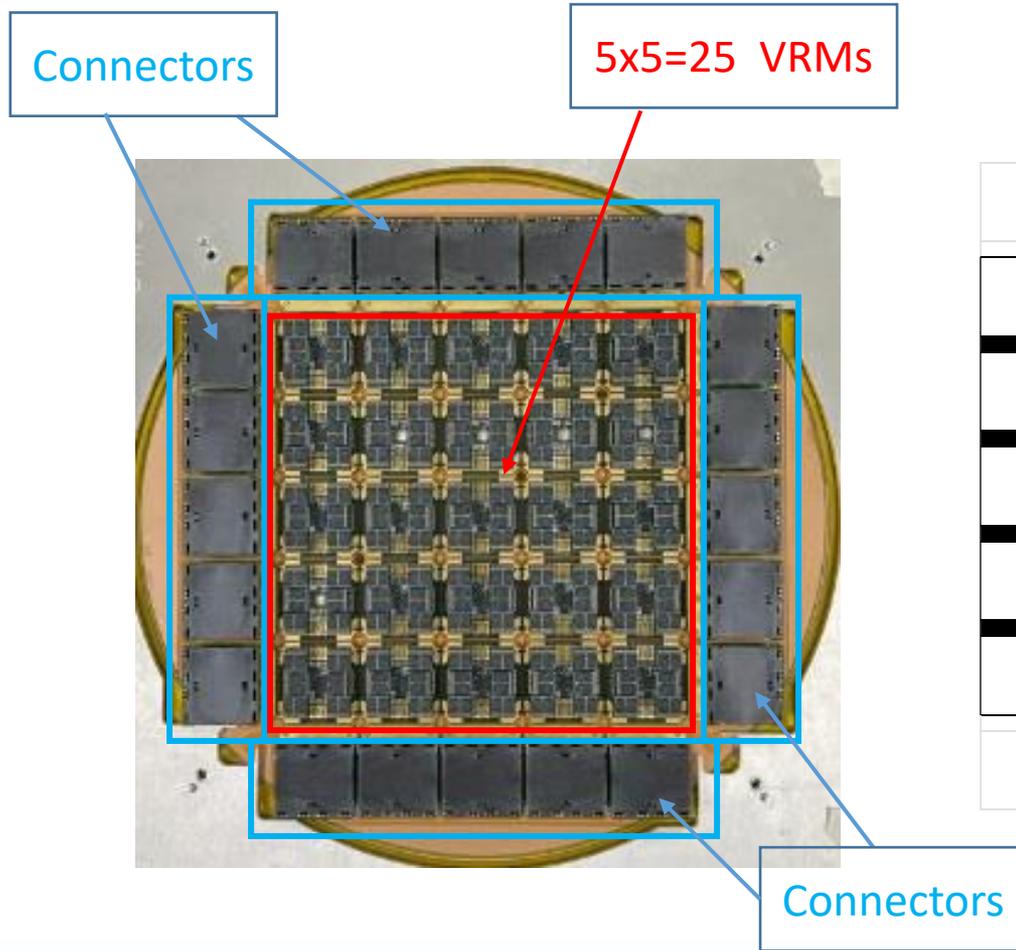
Camalot Prodigy Measure Function Issue Troubleshooting

(S/N 8300-21889)

September 27, 2023

Ken Wu

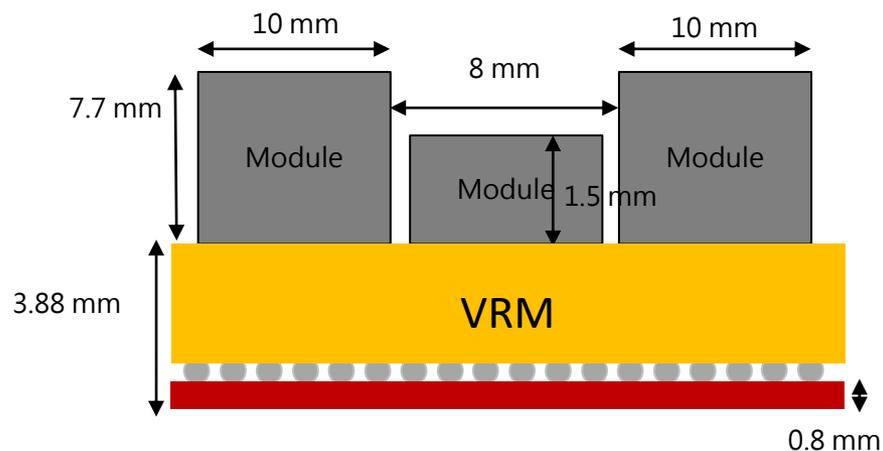
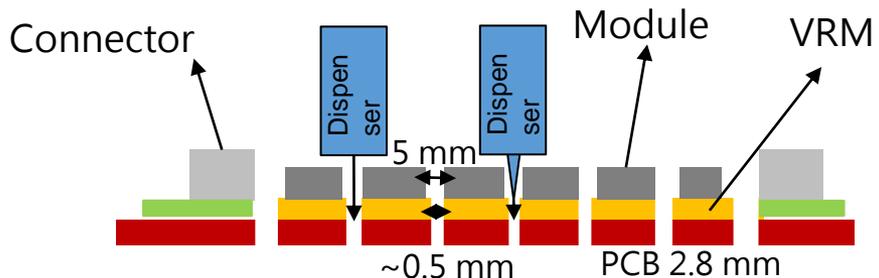
Real Wafer Mapping and Programming Paths



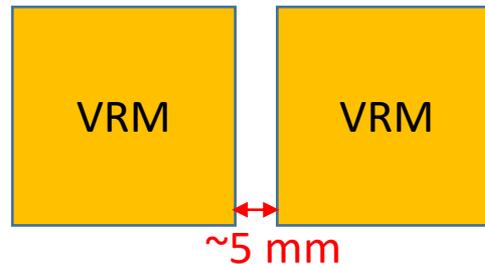
	c	c	c	c	c	
	1	2	3	4	5	
c	v	v	v	v	v	c
	10	9	8	7	6	
c	v	v	v	v	v	c
	11	12	13	14	15	
c	v	v	v	v	v	c
	20	19	18	17	16	
c	v	v	v	v	v	c
	21	22	23	24	25	
c	v	v	v	v	v	c
	30	29	28	27	26	
	c	c	c	c	c	

Passes sequence from 1 to 30

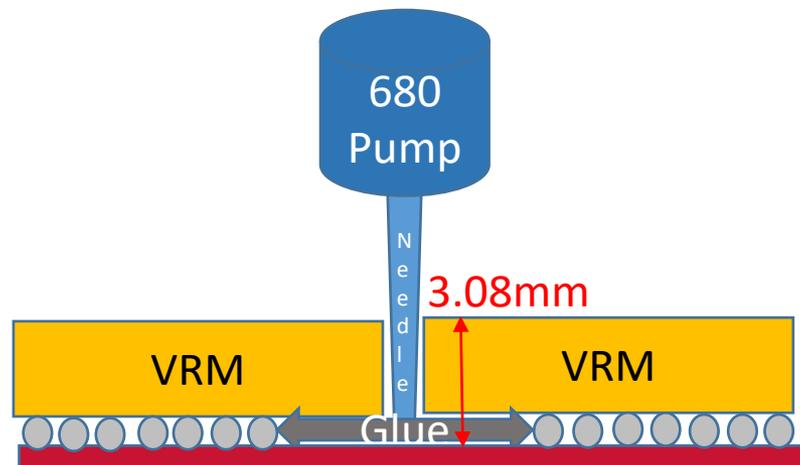
W company Underfill Process



Top view of two VRMs



Side view of two VRMs



Must add the measure function into the program to prevent the glue dispensing needle hitting & damaging the VRM components during the underfill process.

Main Program content with 30 Calls for 30 Paths

Benchmark - Loaded Process Program: C:\Camfiles\NEW1102\0209\New ALL VRM LINE 5 X 5_BVL

File Edit Tools Commands View Operations Maintenance Calibrate Help

Edit Process Programs [C:\Camfiles\NEW1102\0209\New / ?

Creation Info | Properties | Temperatures | Load/Unload Boat | Commands

Command	X Positio	Y Positio	Theta	Name	Reference Designato	Use Centroi	Part
1	133.082	302.523	0	C:\Camfiles\new1102\New ALL WAFER LINEVRM LINE BCVL	1	<input type="checkbox"/>	<input type="checkbox"/>
2	168.152	302.629	0	C:\Camfiles\new1102\New ALL WAFER LINEVRM LINE BCVL	2	<input type="checkbox"/>	<input type="checkbox"/>
3	203.139	302.660	0	C:\Camfiles\new1102\New ALL WAFER LINEVRM LINE BCVL	3	<input type="checkbox"/>	<input type="checkbox"/>
4	238.080	302.719	0	C:\Camfiles\new1102\New ALL WAFER LINEVRM LINE BCVL	4	<input type="checkbox"/>	<input type="checkbox"/>
5	273.061	302.830	0	C:\Camfiles\new1102\New ALL WAFER LINEVRM LINE BCVL	5	<input type="checkbox"/>	<input type="checkbox"/>
6	273.210	276.662	0	C:\Camfiles\new1102\New ALL WAFER LINEVRM LINE BVL	5	<input type="checkbox"/>	<input type="checkbox"/>
7	238.223	276.563	0	C:\Camfiles\new1102\New ALL WAFER LINEVRM LINE BVL	4	<input type="checkbox"/>	<input type="checkbox"/>
8	203.214	276.458	0	C:\Camfiles\new1102\New ALL WAFER LINEVRM LINE BVL	3	<input type="checkbox"/>	<input type="checkbox"/>
9	168.296	276.460	0	C:\Camfiles\new1102\New ALL WAFER LINEVRM LINE BVL	2	<input type="checkbox"/>	<input type="checkbox"/>
10	133.167	276.346	0	C:\Camfiles\new1102\New ALL WAFER LINEVRM LINE BVL	1	<input type="checkbox"/>	<input type="checkbox"/>
11	133.296	240.299	0	C:\Camfiles\new1102\New ALL WAFER LINEVRM LINE BVL	10	<input type="checkbox"/>	<input type="checkbox"/>
12	168.290	240.408	0	C:\Camfiles\new1102\New ALL WAFER LINEVRM LINE BVL	9	<input type="checkbox"/>	<input type="checkbox"/>
13	203.243	240.473	0	C:\Camfiles\new1102\New ALL WAFER LINEVRM LINE BVL	8	<input type="checkbox"/>	<input type="checkbox"/>
14	238.268	240.633	0	C:\Camfiles\new1102\New ALL WAFER LINEVRM LINE BVL	7	<input type="checkbox"/>	<input type="checkbox"/>
15	273.243	240.634	0	C:\Camfiles\new1102\New ALL WAFER LINEVRM LINE BVL	6	<input type="checkbox"/>	<input type="checkbox"/>
16	273.349	204.664	0	C:\Camfiles\new1102\New ALL WAFER LINEVRM LINE BVL	15	<input type="checkbox"/>	<input type="checkbox"/>
17	238.421	204.547	0	C:\Camfiles\new1102\New ALL WAFER LINEVRM LINE BVL	14	<input type="checkbox"/>	<input type="checkbox"/>
18	203.463	204.514	0	C:\Camfiles\new1102\New ALL WAFER LINEVRM LINE BVL	13	<input type="checkbox"/>	<input type="checkbox"/>
19	168.417	204.543	0	C:\Camfiles\new1102\New ALL WAFER LINEVRM LINE BVL	12	<input type="checkbox"/>	<input type="checkbox"/>
20	133.329	204.256	0	C:\Camfiles\new1102\New ALL WAFER LINEVRM LINE BVL	11	<input type="checkbox"/>	<input type="checkbox"/>
21	133.543	168.106	0	C:\Camfiles\new1102\New ALL WAFER LINEVRM LINE BVL	20	<input type="checkbox"/>	<input type="checkbox"/>
22	168.403	168.360	0	C:\Camfiles\new1102\New ALL WAFER LINEVRM LINE BVL	19	<input type="checkbox"/>	<input type="checkbox"/>
23	203.408	168.481	0	C:\Camfiles\new1102\New ALL WAFER LINEVRM LINE BVL	18	<input type="checkbox"/>	<input type="checkbox"/>
24	238.444	168.619	0	C:\Camfiles\new1102\New ALL WAFER LINEVRM LINE BVL	17	<input type="checkbox"/>	<input type="checkbox"/>
25	273.323	168.557	0	C:\Camfiles\new1102\New ALL WAFER LINEVRM LINE BVL	16	<input type="checkbox"/>	<input type="checkbox"/>
26	273.501	132.633	0	C:\Camfiles\new1102\New ALL WAFER LINEVRM LINE BVCL	16	<input type="checkbox"/>	<input type="checkbox"/>
27	238.590	132.573	0	C:\Camfiles\new1102\New ALL WAFER LINEVRM LINE BVCL	17	<input type="checkbox"/>	<input type="checkbox"/>
28	203.573	132.497	0	C:\Camfiles\new1102\New ALL WAFER LINEVRM LINE BVCL	18	<input type="checkbox"/>	<input type="checkbox"/>
29	168.514	132.373	0	C:\Camfiles\new1102\New ALL WAFER LINEVRM LINE BVCL	19	<input type="checkbox"/>	<input type="checkbox"/>
30	133.564	132.313	0	C:\Camfiles\new1102\New ALL WAFER LINEVRM LINE BVCL	20	<input type="checkbox"/>	<input type="checkbox"/>
31	End						

Machine Status: Idle

Progress: 1

SP=15.0

Ready Admin Dispense Off

Sub Program 1 (5 Calls between Connectors & VRMs at the Top area)

Benchmark - Loaded Process Program: C:\Camfiles\NEW1102\0209\New ALL VRM LINE 5 X 5_BVL

File Edit Tools Commands View Operations Maintenance Calibrate Help

Edit Select SubPattern [C:\Camfiles\NEW1102\New ALL W...

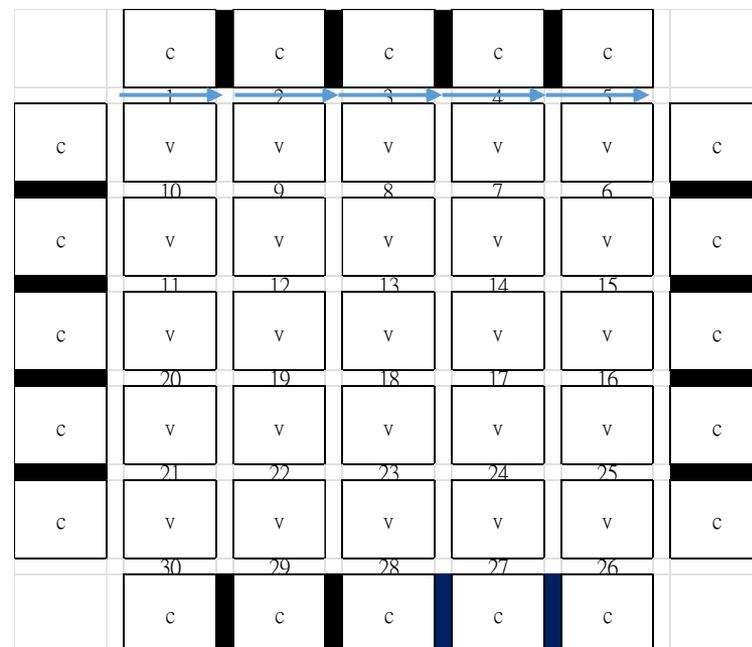
Creation Info Commands

Command	X Positio	Y Positio	X' Positio	Y' Positio	Line Width	Lift Heigh	Dispense Height	Name	R	D
1	Locate	131.025	277.374					c:\camfiles\new1102\F03		
2	Locate	161.357	286.343					c:\camfiles\new1102\C2		
3	Z-Sense	157.172	280.681							
4	Measure	136.092	282.172					C:\Camfiles\NEW1102\New ALL WAFER LINE\Edge BCVL D line		
5	Measure	156.735	282.226					C:\Camfiles\NEW1102\New ALL WAFER LINE\Edge BCVL D line		
6	Line	136.092	282.172	156.735	282.226	500	22.000	-2.000	c:\camfiles\line conn 80 mg	
7	Line	156.735	282.226	136.092	282.172	500	22.000	-2.000	C:\Camfiles\line conn 80 mg	
8	End									

Machine Status: Idle

Progress: 1

Ready | Alarm Condition | Severity | State | Date | Admin | Dispense: Off | SP=15.0



Sub Program 2 (20 Calls between VRMs & VRMs at the central area)

Benchmark - Loaded Process Program: C:\Camfiles\NEW1102\0209\New ALL VRM LINE 5 X 5_BVL

File Edit Tools Commands View Operations Maintenance Calibrate Help

Edit Select SubPattern (C:\Camfiles\NEW1102\New ALL W...

Machine Status: Idle

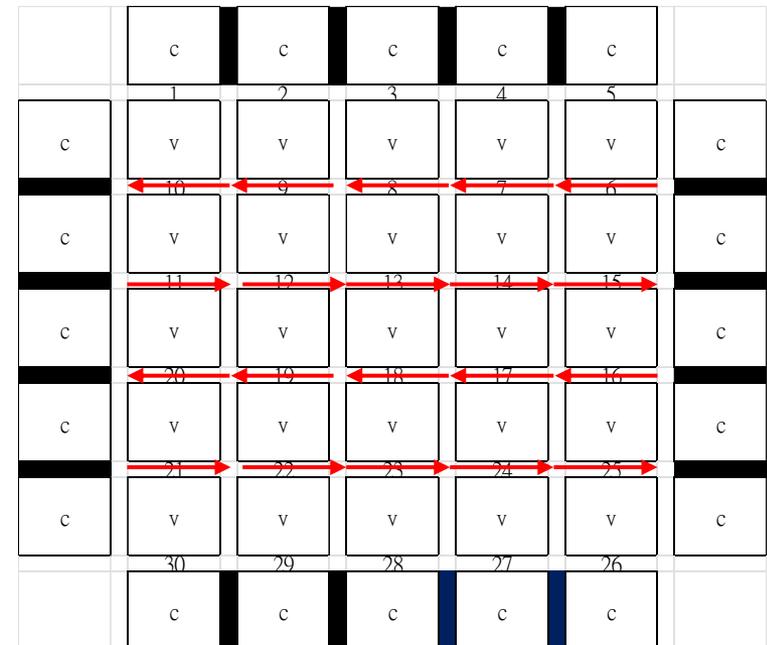
Creation Info: Commands

Command	X Positio	Y Positio	X' Positio	Y' Positio	Line Width	Lift Height	Dispense Height	Name	R	D
1	Locate	188.129	278.845					C:\Camfiles\NEW1102\F01		
2	Locate	221.065	269.076					C:\Camfiles\NEW1102\F02		
3	7 Sense	210.602	275.207							
4	Measure	192.695	273.834					C:\Camfiles\NEW1102\New ALL WAFER LINE\Edge BVL line		
5	Measure	214.979	273.918					C:\Camfiles\new1102\New ALL WAFER LINE\Edge BVL line		
6	Line	192.166	273.857	216.920	273.854	500	22.000	-2.500		
7	Line	216.920	273.857	192.166	273.838	500	22.000	-2.500		
8	End									

Machine Status: Idle

Progress: 1

Ready Admin Dispense Off SP=15.0



Sub Program 3 (5 Calls between VRMs & Connectors at the Bottom area)

Benchmark - Loaded Process Program: C:\Camfiles\NEW1102\0209\New ALL VRM LINE 5 X 5_BVL

File Edit Tools Commands View Operations Maintenance Calibrate Help

Edit Select SubPattern [C:\Camfiles\NEW1102\New ALL W...

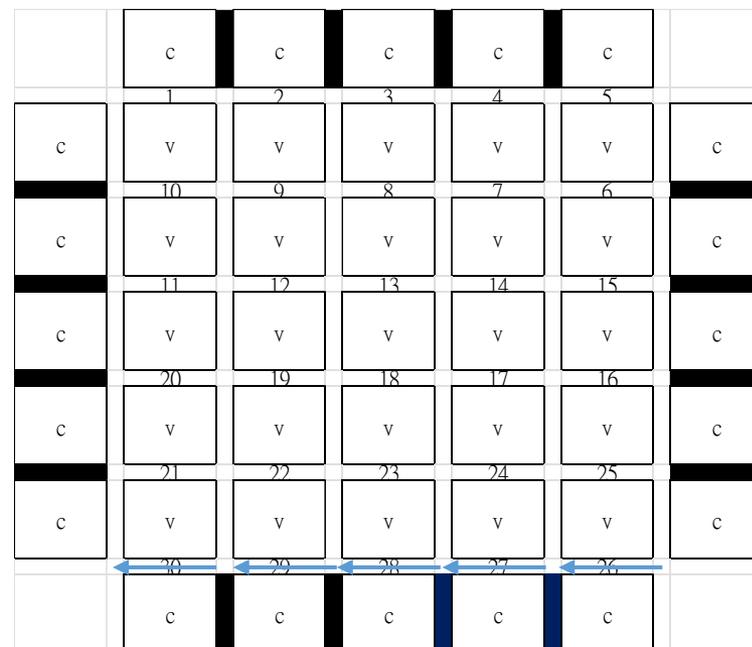
Creation Info Commands

Command	X Positio	Y Positio	X' Positio	Y' Positio	Line Width	Lift Heigh	Dispense Height	Name	R	D
1	Locate	131.025	277.374					c:\camfiles\new1102\F03		
2	Locate	161.357	286.343					c:\camfiles\new1102\C2		
3	Z-Sense	157.172	280.681							
4	Measure	136.092	282.172					C:\Camfiles\NEW1102\New ALL WAFER LINE\Edge BCVLd line		
5	Measure	156.735	282.226					C:\Camfiles\NEW1102\New ALL WAFER LINE\Edge BCVLd line		
6	Line	136.092	282.172	156.735	282.226	500	22.000	-2.000	c:\camfiles\line conn 80 mg	
7	Line	156.735	282.226	136.092	282.172	500	22.000	-2.000	C:\Camfiles\line conn 80 mg	
8	End									

Machine Status: Idle

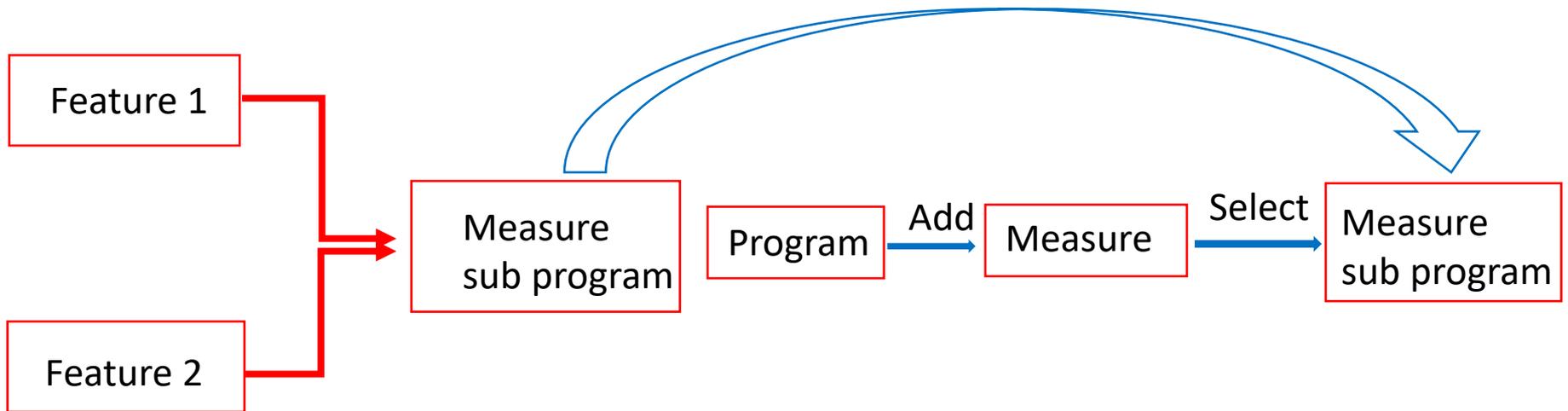
Progress: 1

Ready | Admin | Dispense: Off | SP=15.0



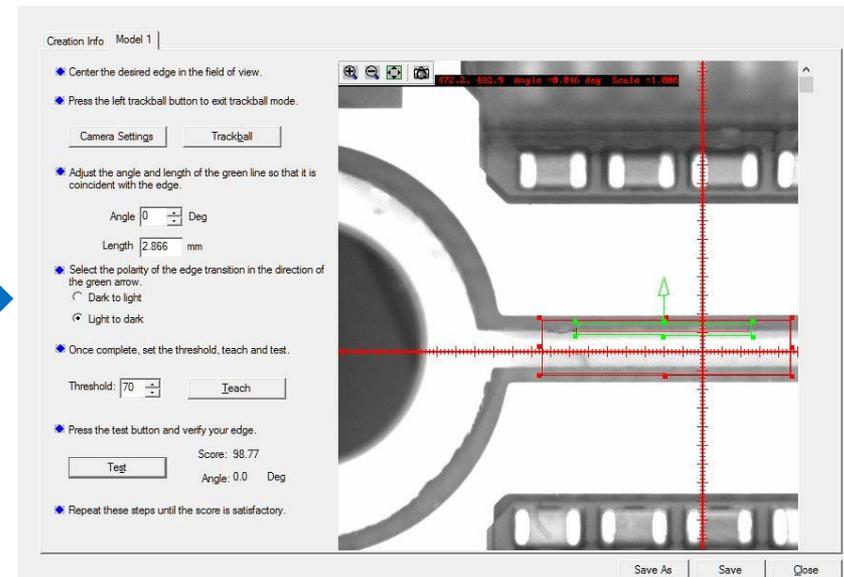
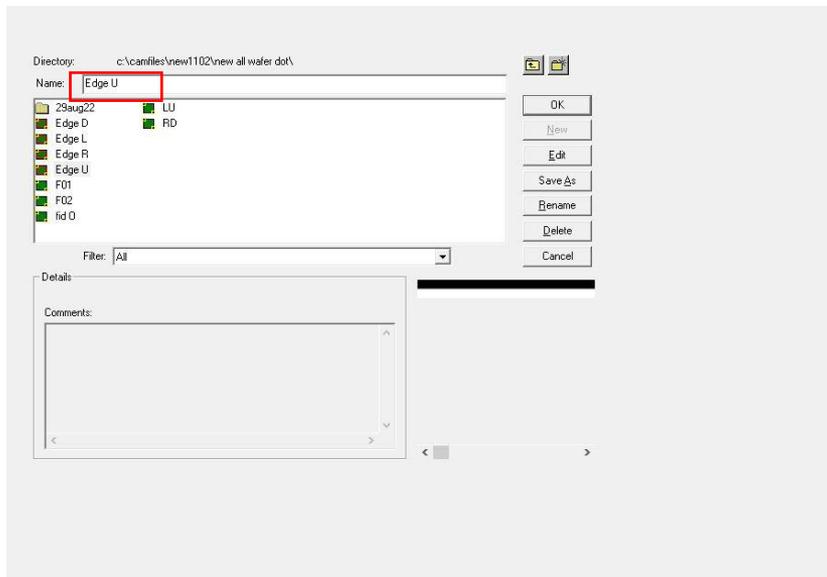
Measure Detect setting structure and procedure

1. Set the discerning features of measure detect, and set two sets of features according to the detection target.
2. Combine two sets of feature into a subroutine of measure detect



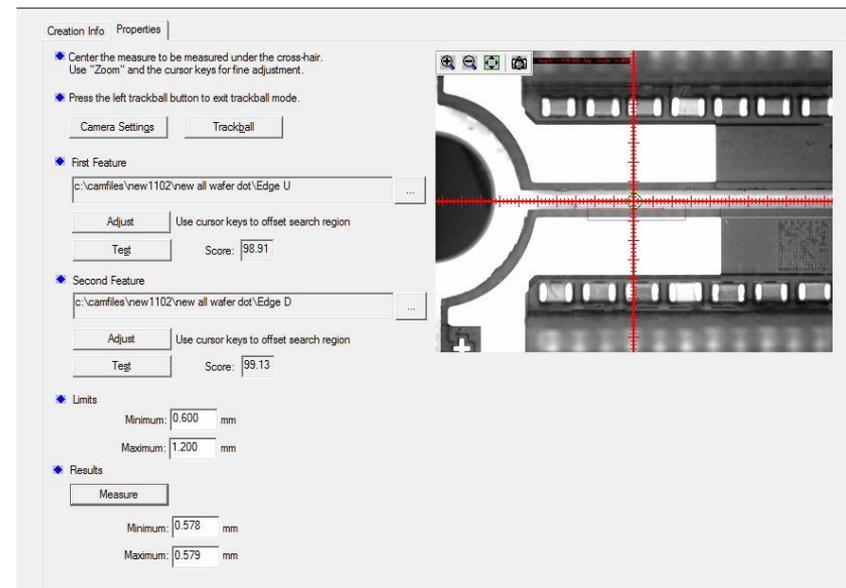
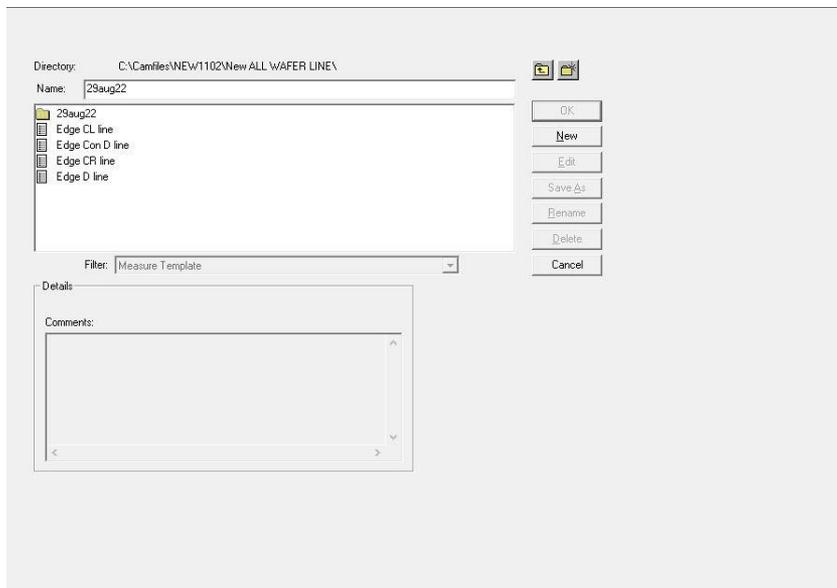
Feature setting:

1. Name the feature target, and then enter the feature point for teach and test, the setting method is to move the green box to the position to teach, as shown on the right in the figure below.
2. After Teach is completed, you can run test to see the score after teach, the higher the score, the better result.

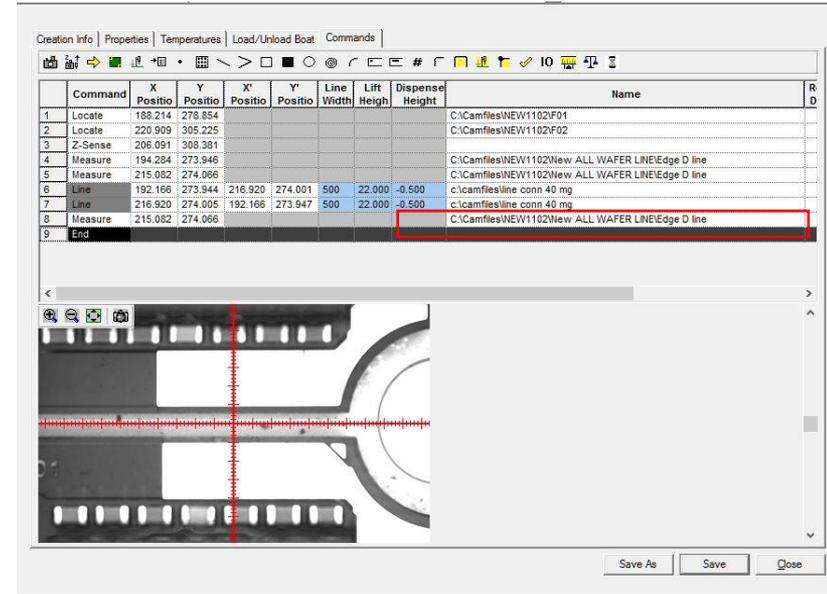
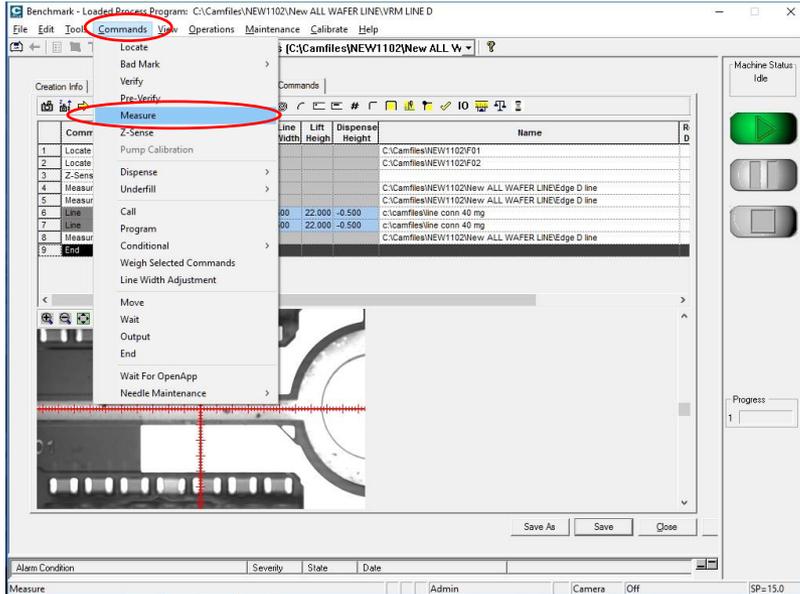


Measure subprogram settings:

1. Create a name for the measure detect subprogram, then enter the subprogram setting screen, bring in the completed feature points for teaching and test respectively.
2. Set the Limit range according to the customer's specification, and after completion, you can measure and get the reading value of the current teaching position.

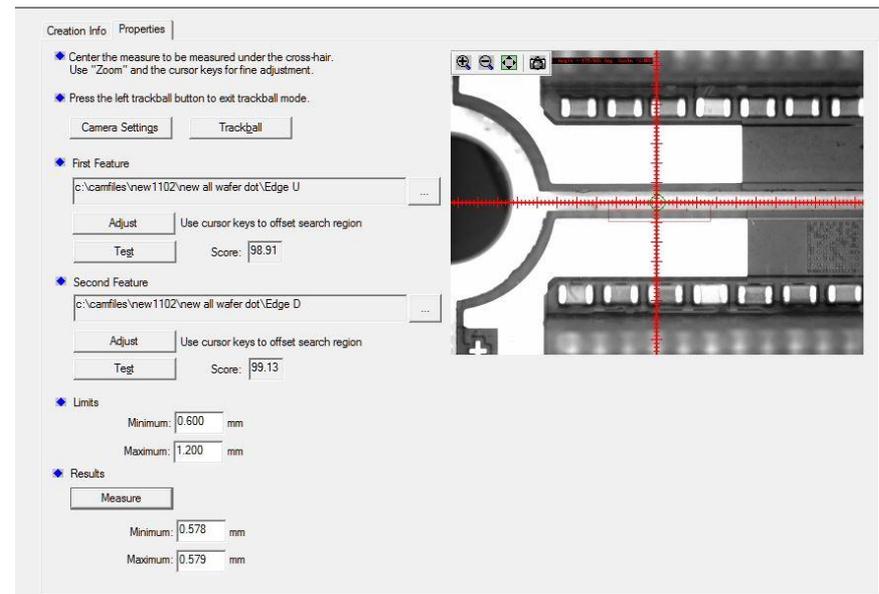
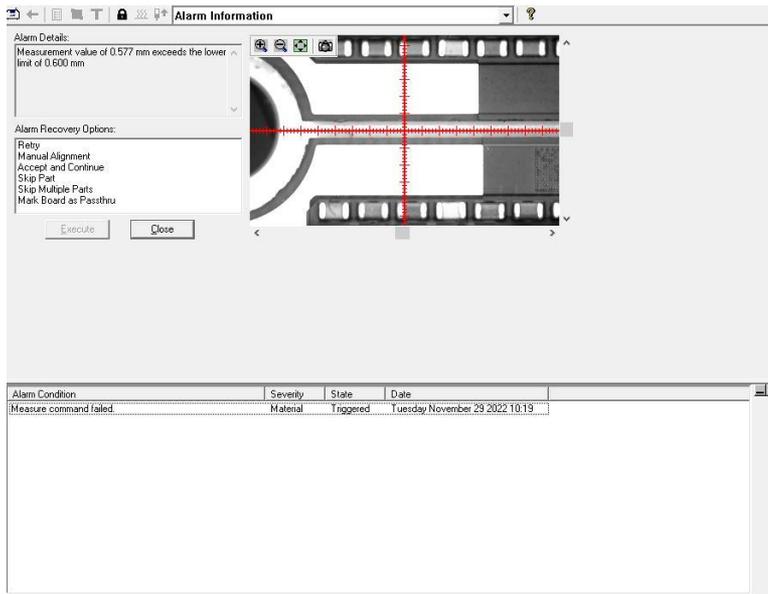


Add a new measure command to the program interface, move the camera to the target position of the detection measure detect, and bring the measure Detect subroutine



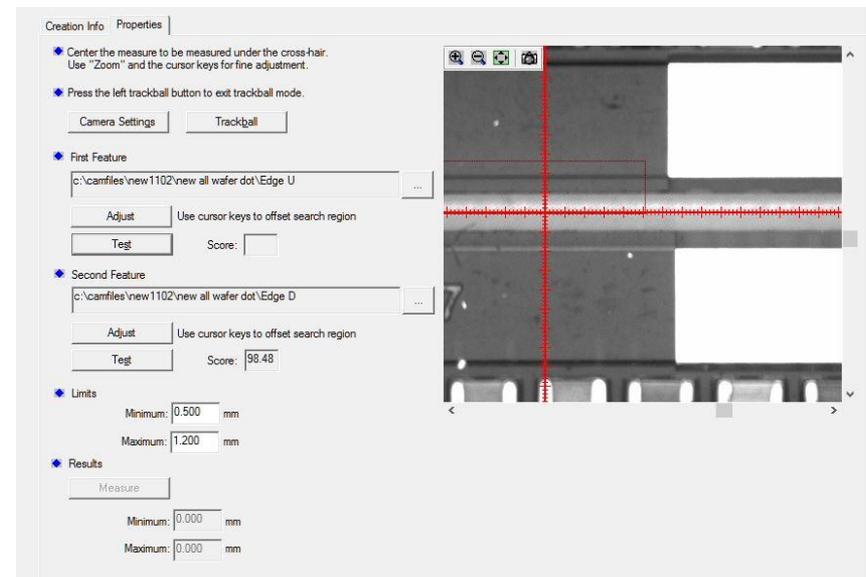
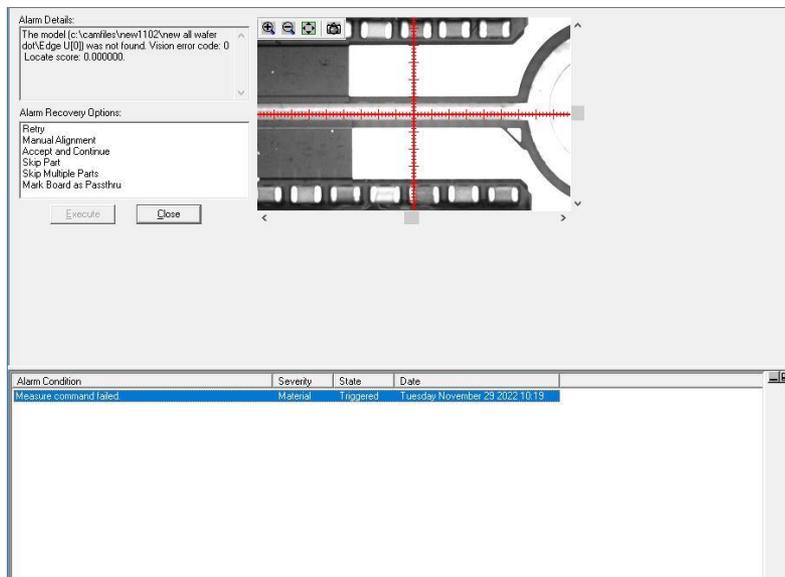
1. When executing Auto Run, if measure detect that the gap is greater than the set limit minimum, the machine will directly perform the next point detection.
2. When executing Auto Run, if the measure detect that the gap is less than the set Limit minimum, the machine will report an error and prompt the test result, which is judged by the operator.

EX : As shown in the figure below, the measure value is 0.577mm, the set Limit value is 0.6mm, $0.578 < 0.6$ mm, the machine will report an error and prompt the test result for operator to make the proper action.



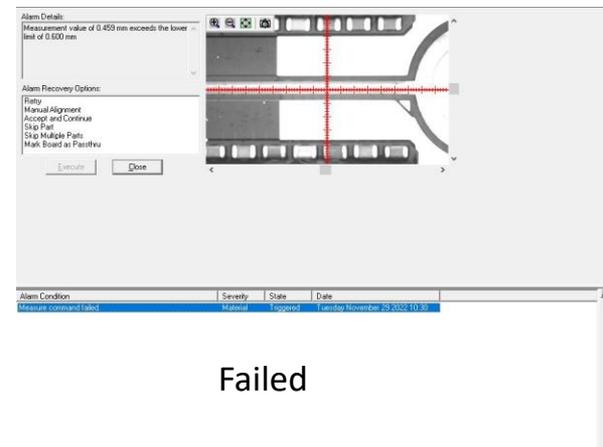
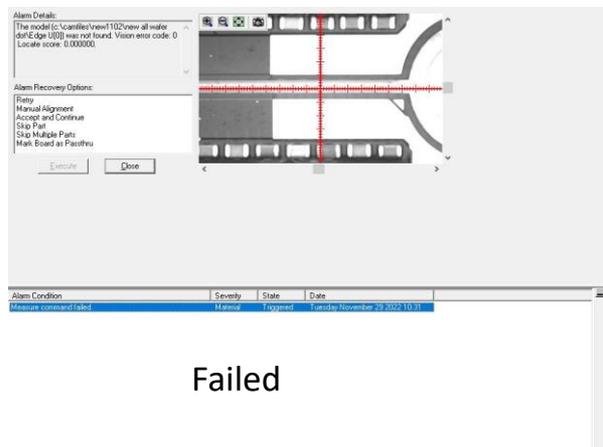
EX: As shown in the figure below, when measure detect cannot detect the setting edge feature, the machine will report an error and prompt the detection result.

- The first feature can't be detected.



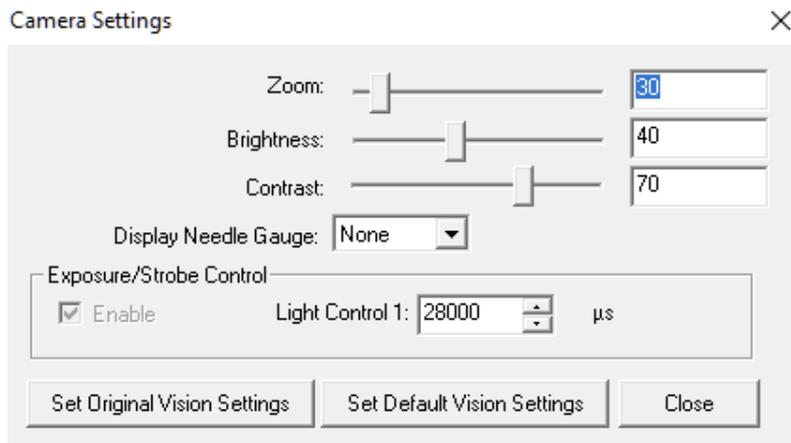
After setting up and repeating measure detection, the failure rate of measure detect was too high in W company, it's about more than **30%** due to the edge can't be found or caught the wrong edge issue.

The respective gap between each group of VRM & VRM modules or VRM & Connector modules, the feature edges are not clear or cut unevenly, resulting in no catching & wrong grasping.

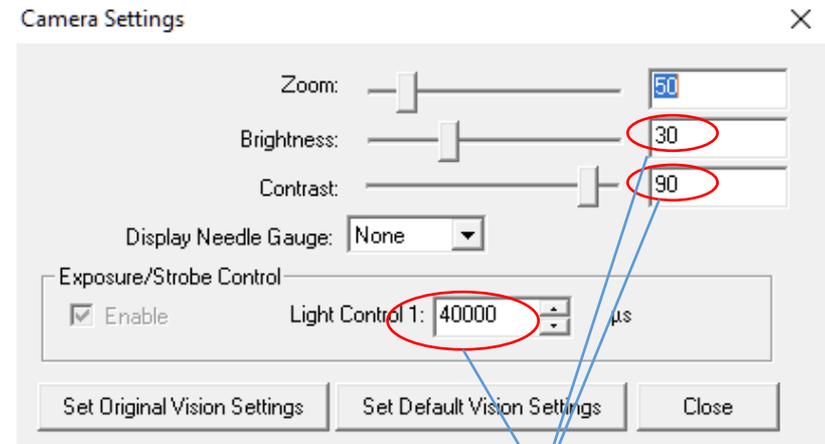


Troubleshooting 1st step:

- Adjusting camera setting brightness & contrast matching, the measure failure rate from **30%** reduced to around **10%**. (Customer's measure detect failure rate requirement specification **< 2%**)
- W company was complained the camera vision device capacity issue and requested it need to be changed to another type for the complete VRMs & Connectors edge detection function requirement.



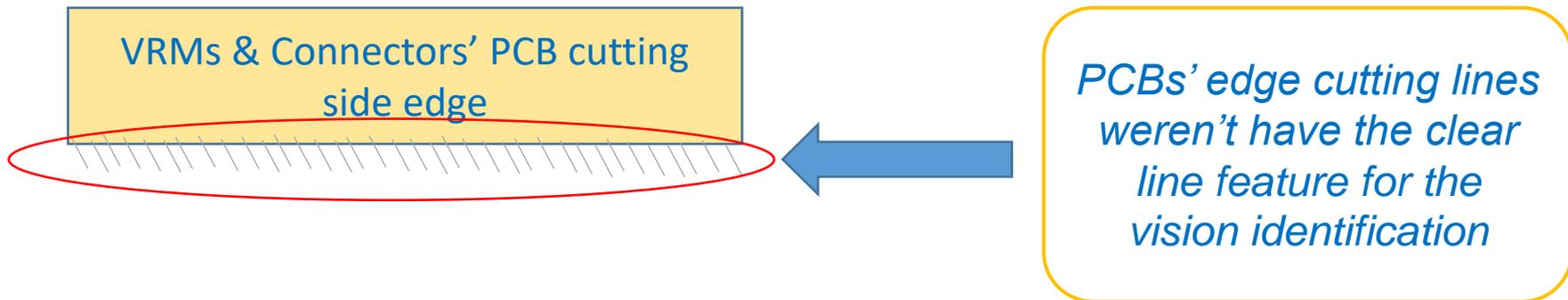
Original camera setting parameters



New camera setting parameters matching

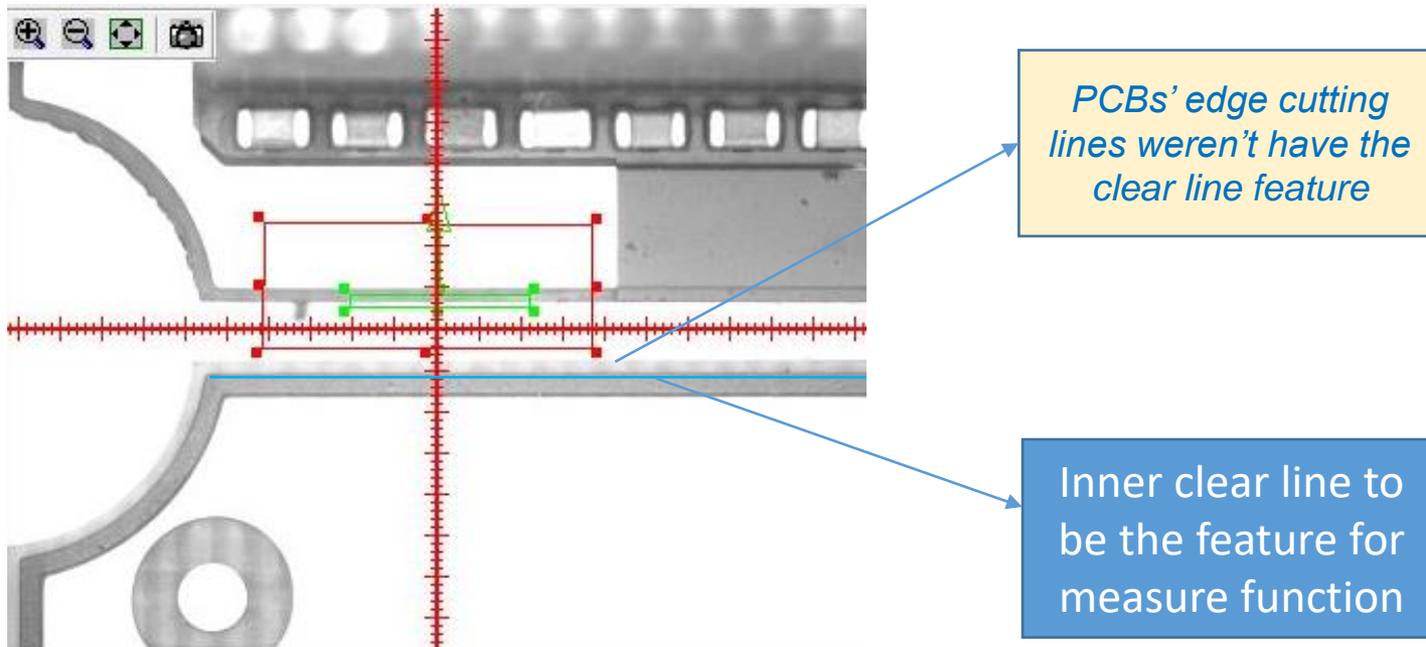
Troubleshooting 2nd step (root cause):

- Gaps between each group of VRM & VRM modules or VRM & Connector modules, the edge line of features were not clear or cut unevenly, color inconsistency, resulting in features were no capturing or wrong feature captured.



Troubleshooting 2nd step actions:

1. Used the **inner clear line** which is just beside the edge to be the edge detect feature.
2. Increasing the low limit (5 + 3mm). (3mm is the gap from the edge to inner clear line pattern)
3. Increasing the high limit (8 + 3mm). (3mm is the gap from the edge to inner clear line pattern)



Measure Function Testing Result Success

1. After changing the inner clear line to be the measure feature and re-defined the Low & High limit the measure function detect failure rate from 10% **reduced to 1%**. (Customer's measure detect failure rate requirement specification **< 2%**)
2. Three full wafers testing which with measure function and real dispensing the glue were success, the detected failure rate which no feature captured or wrong feature detection **< 1%**.

Thank you !