IHEP PPA Hybrids Metrology

A	D	E	F
	PPA Workflow		
		hybrid	
	glue	metro	bonded
PPA_LS1	X-GPC-2104-002-H4	X-GPC-2104-002-H4	X-GPC-2104-002-H4
PPA_SS1	X-GPC-2104-002-B-H0	X-GPC-2104-002-B-H0	X-GPC-2104-002-B-H0
	Y-GPC-2105-002-C-H4	Y-GPC-2105-002-C-H4	Y-GPC-2105-002-C-H4
PPA_SS2	X-GPC-2104-002-B-H2	X-GPC-2104-002-B-H2	X-GPC-2104-002-B-H2
	Y-GPC-2105-002-C-H2	Y-GPC-2105-002-C-H2	Y-GPC-2105-002-C-H2

- 5 hybrids so far. 3X and 2Y.
- Here 5 IHEP hybrids + swapped hybrids results shown.

Requirement for hybrid metrology

Z height:

- Glue height (chip-hybrid)
  - Nominal 120; Tolerance: 80-160um;
- Total package height
  - Nominal 800; Tolerance: 760-840um;
  - Tolerance is large so usually pass;

- XY Position:

The chip position over hybrid fiducials:

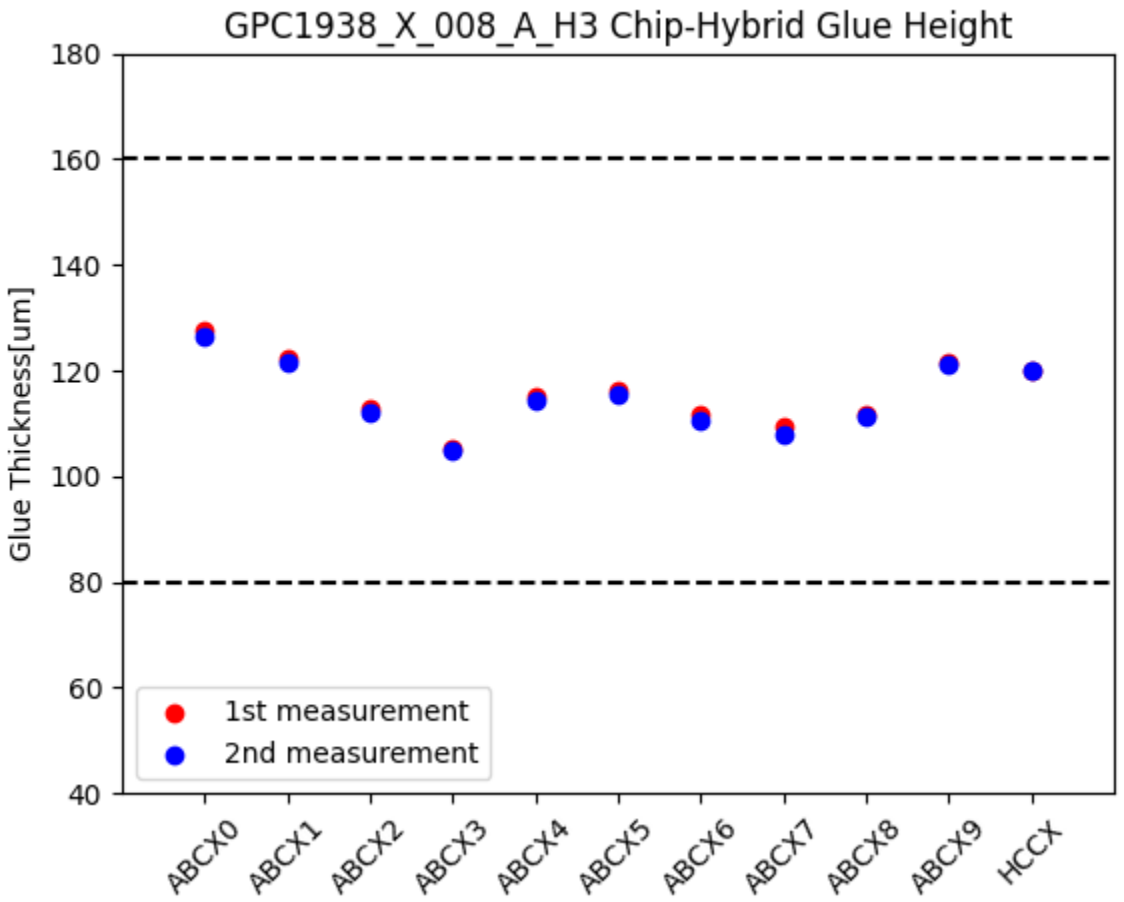
$$\Delta X, Y < 100um.$$

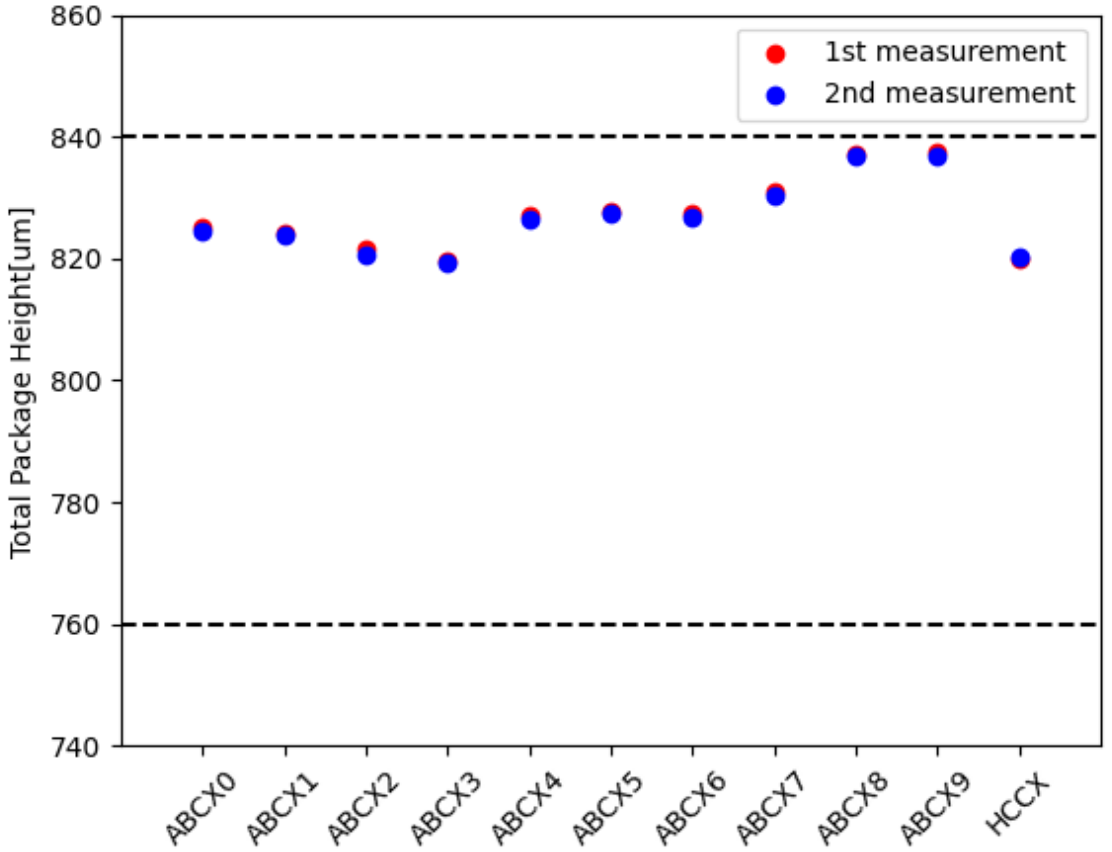
In our current assembly,

Usually several positions beyond the limit.

Swap Hybrid GPC1938_X_008_A_H3

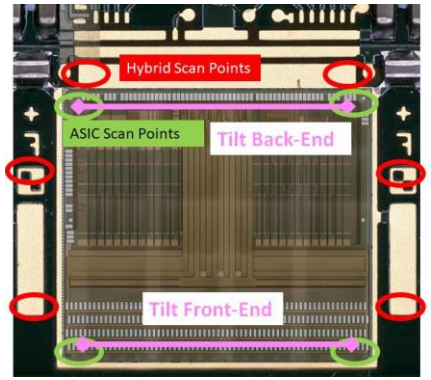
For repeatability test, we measured this hybrid twice.
2 results are consistent to each other.

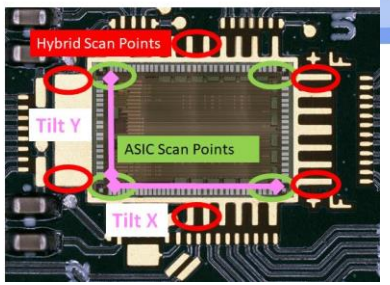


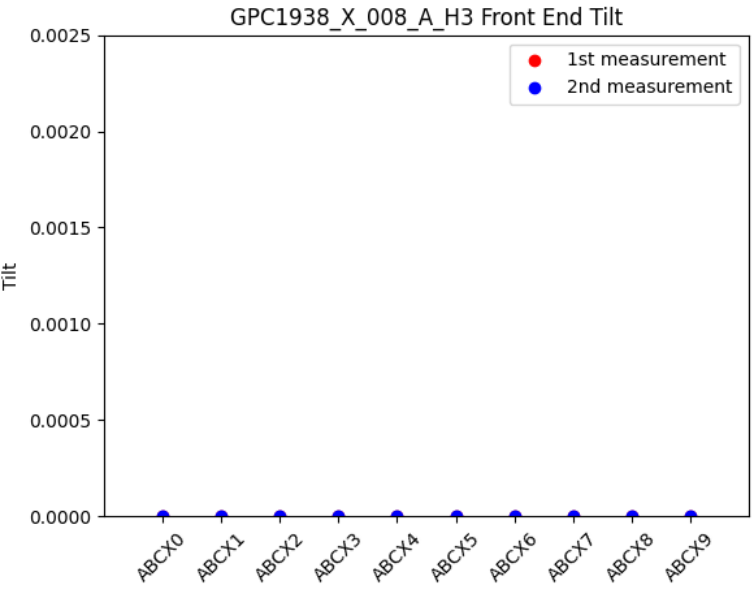


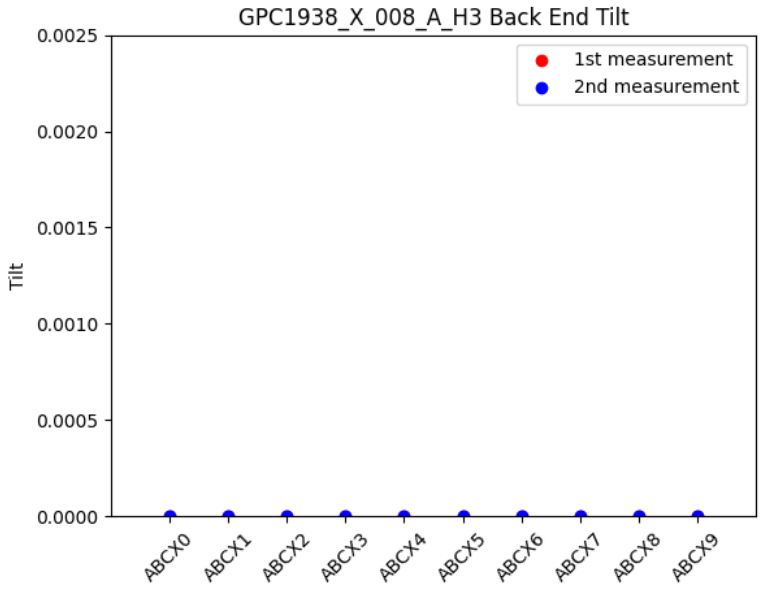
Chip Tilt

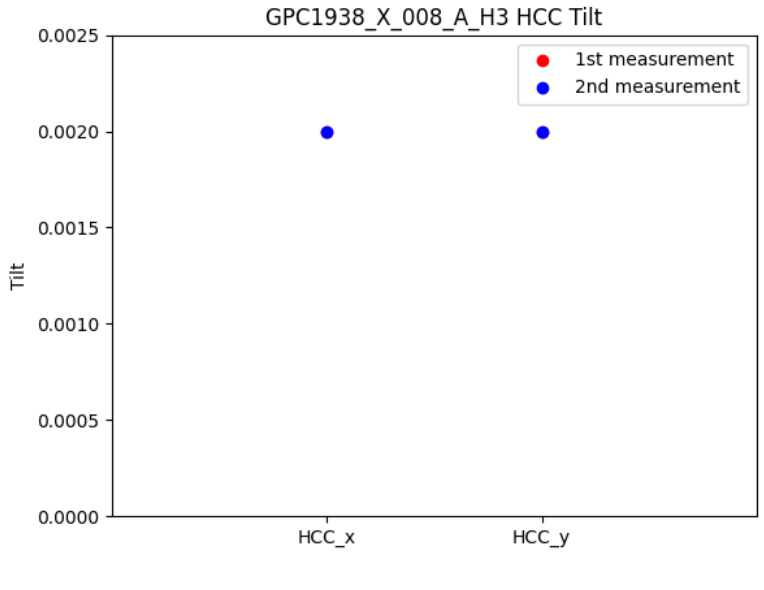
$$\frac{|\Delta z|}{\sqrt{\Delta x^2 + \Delta y^2}}$$







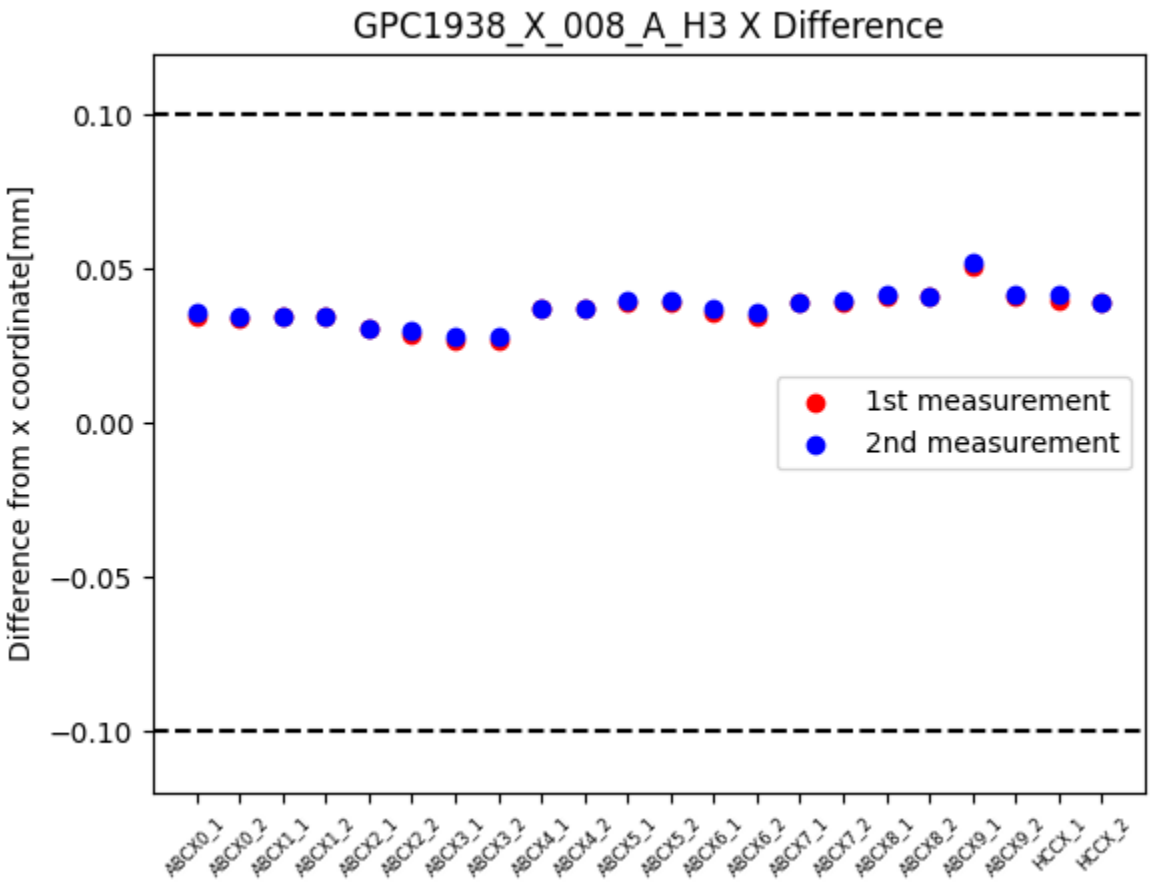


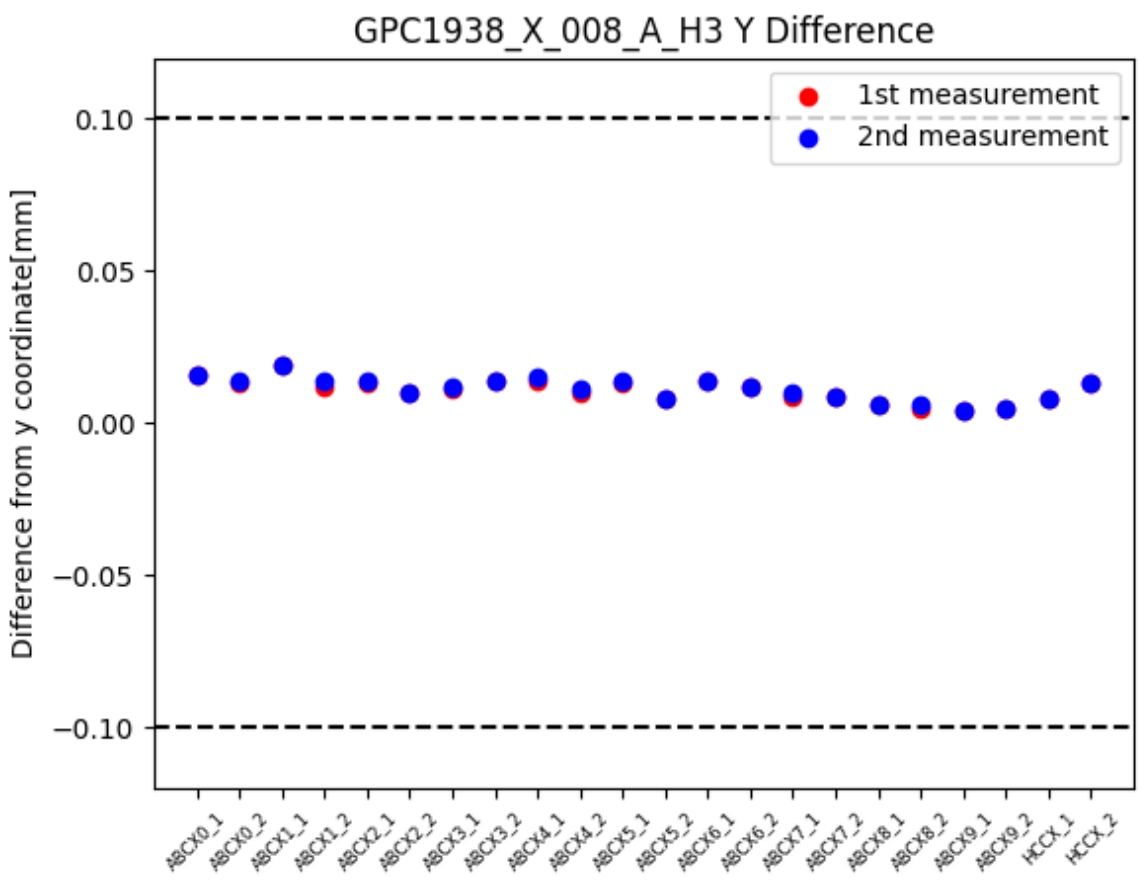


The tilt range is smaller than 0.025. All the results can pass this test.

Position XY

The swap hybrid shows very good agreement in XY position.

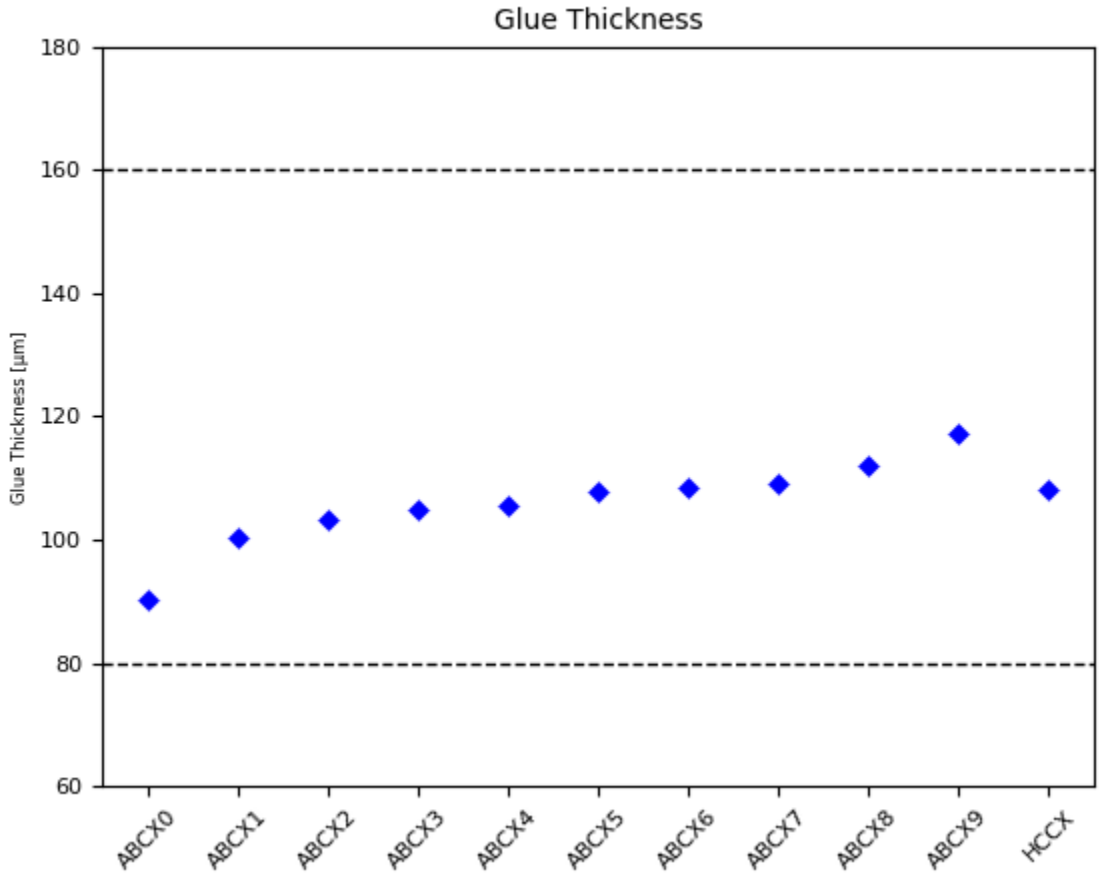


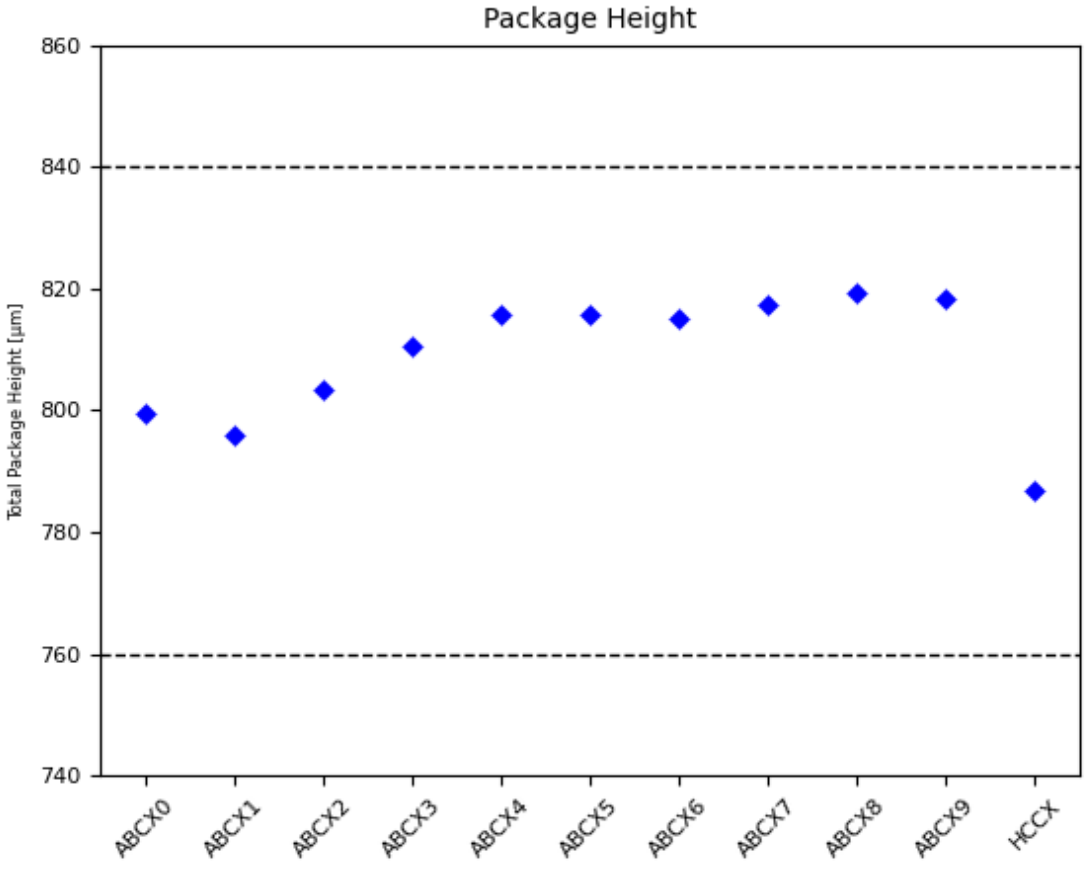


Our script will out put 7 plots. For simplicity, 2 z plots and xy plots will be shown in the following.

IHEP-X-0012, GPC-2104-002-H4

Hybrid on PPA_LS1.
Glue height~100um indicates the glue come out.

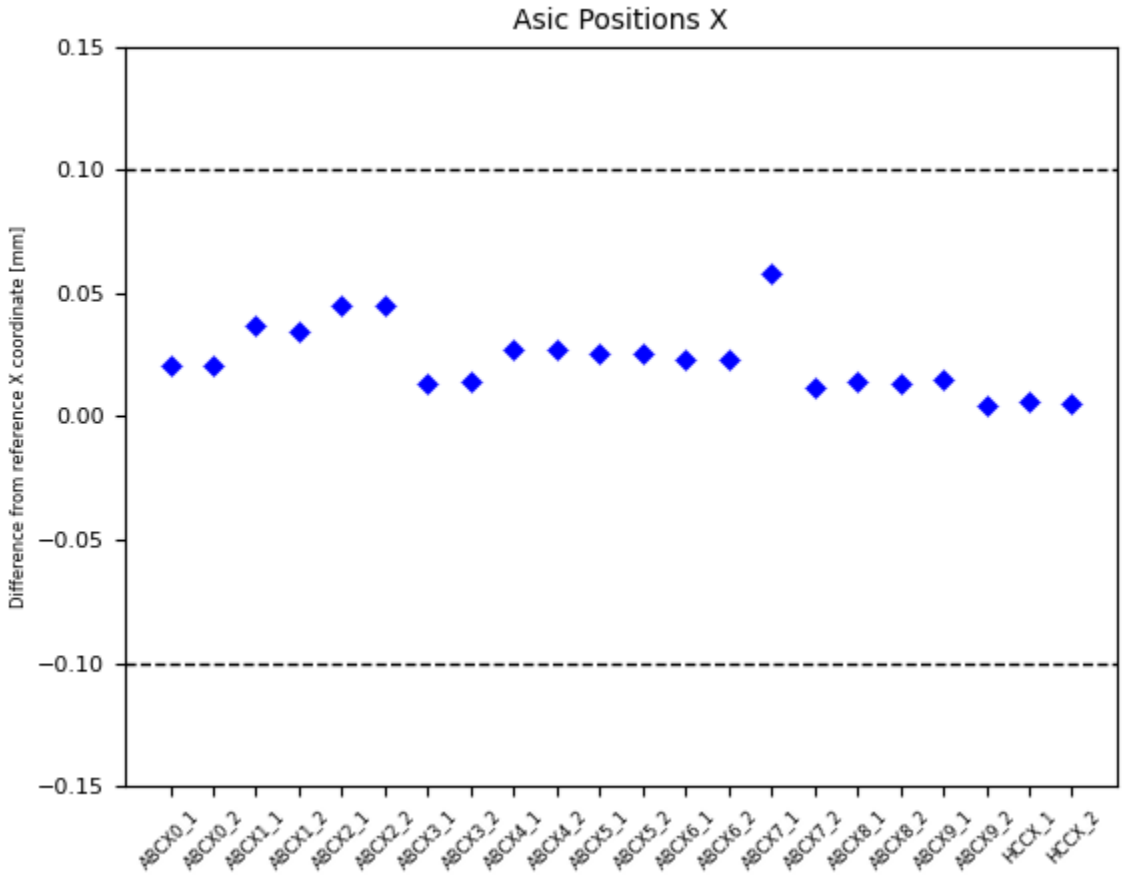


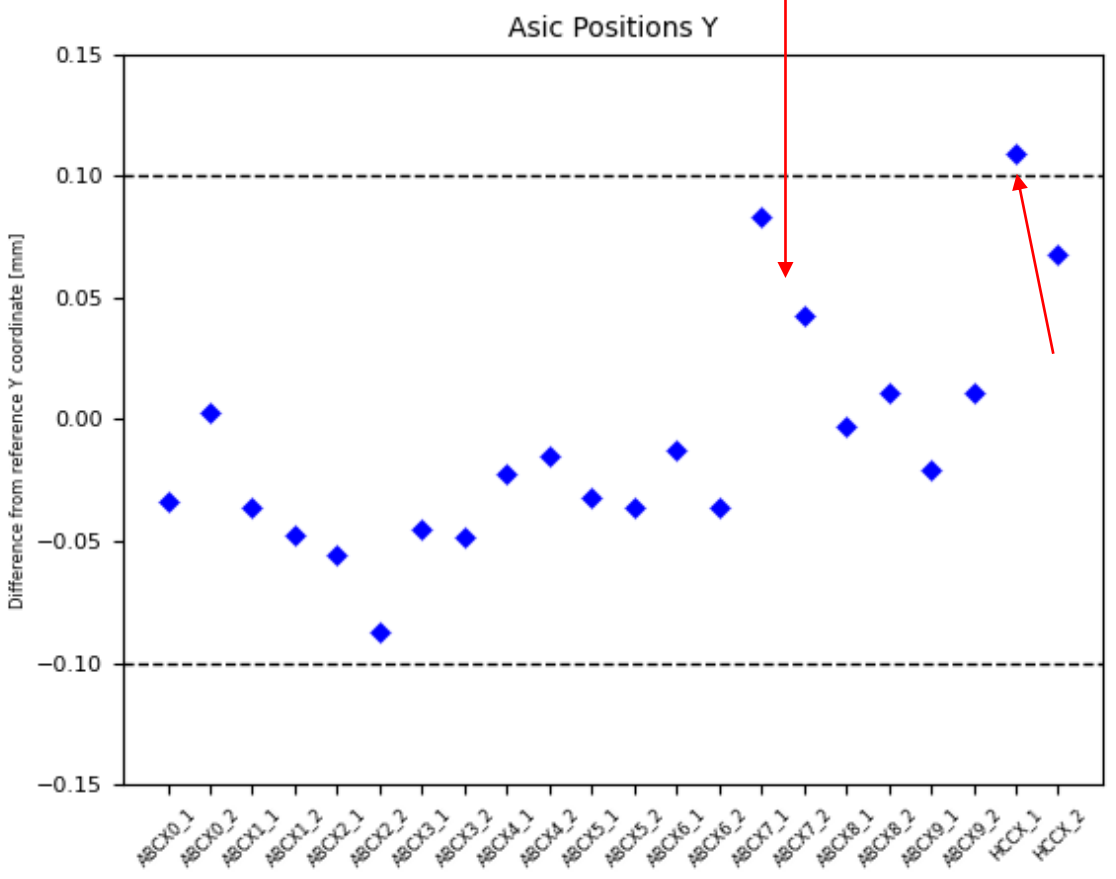


IHEP-X-0012, GPC-2104-002-H4

Now, IHEP hybrids perform good on X position but bad on Y position.

For one chip, the left and right y difference in 80um, with 0.8cm x distance. As the slope 1%, it's large, but difficult to recognize by eye.

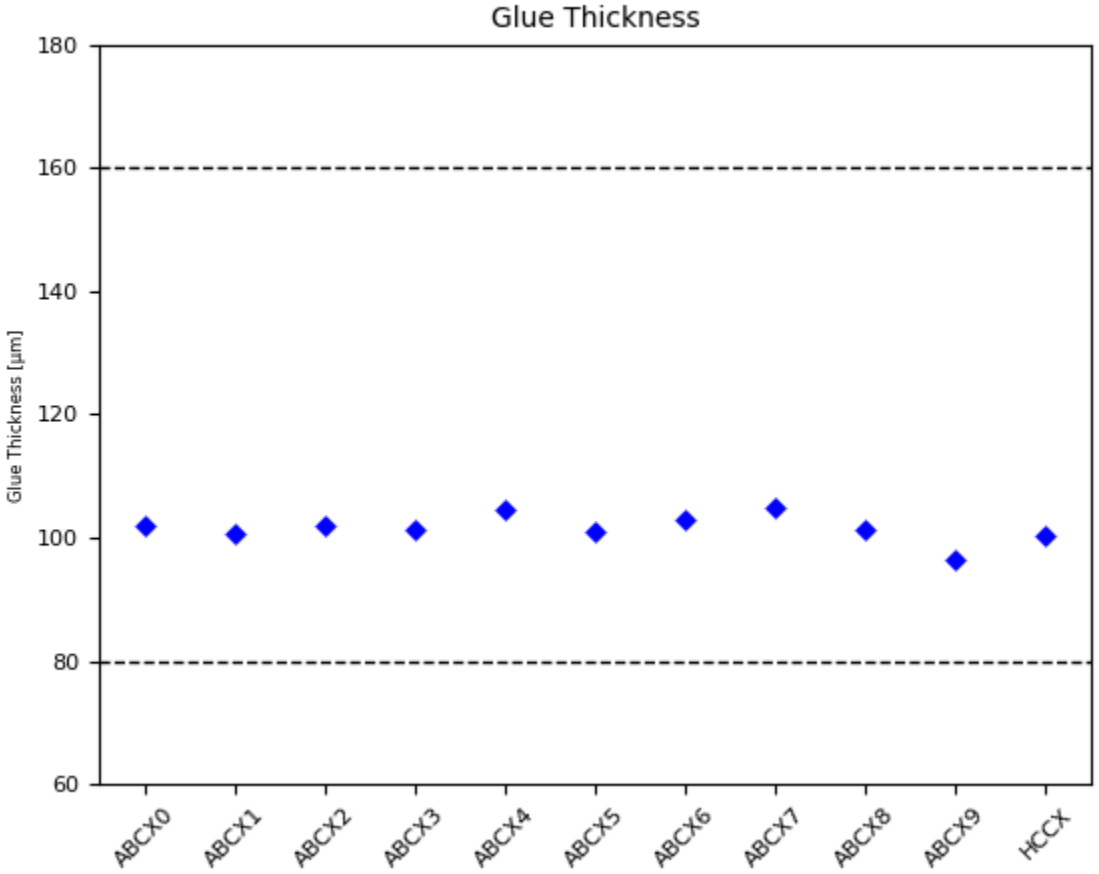


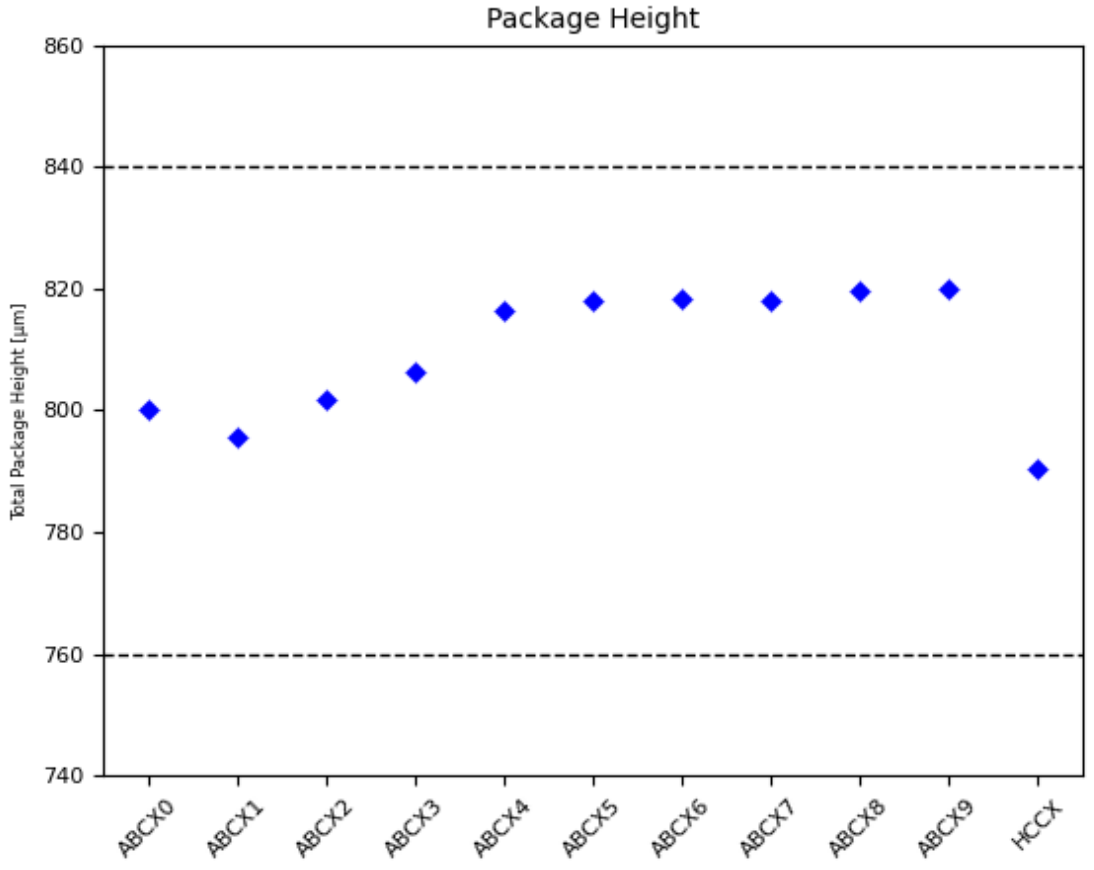


As one Y position beyond the limit, typically the metrology is failed.
But the hybrid still can bond and do electric test.

IHEP-X-0013, GPC-2104-002-H0

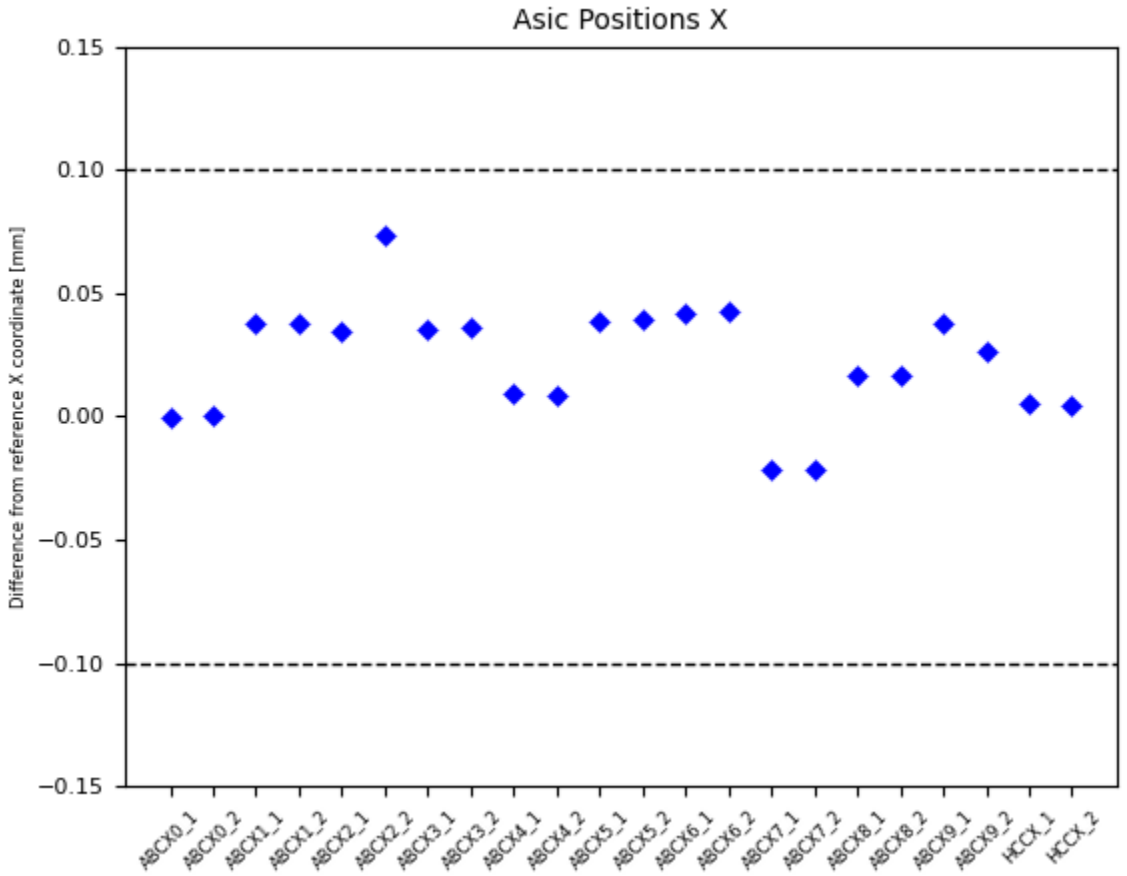
X Hybrid on PPA_SS1.
Same 100um glue height, same shape for package height.
Package height do not consider hybrid plane.
So it’s totally due to the hybrid pickup tool.

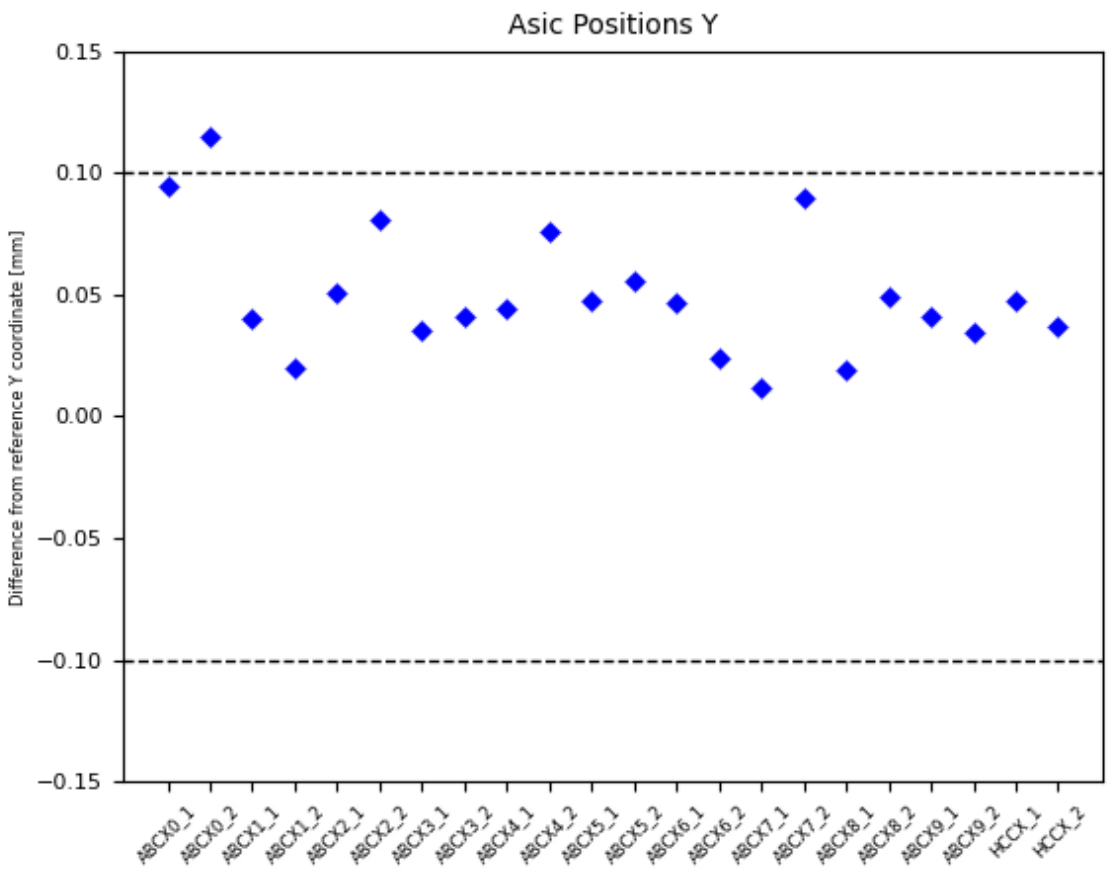




IHEP-X-0013, GPC-2104-002-H0

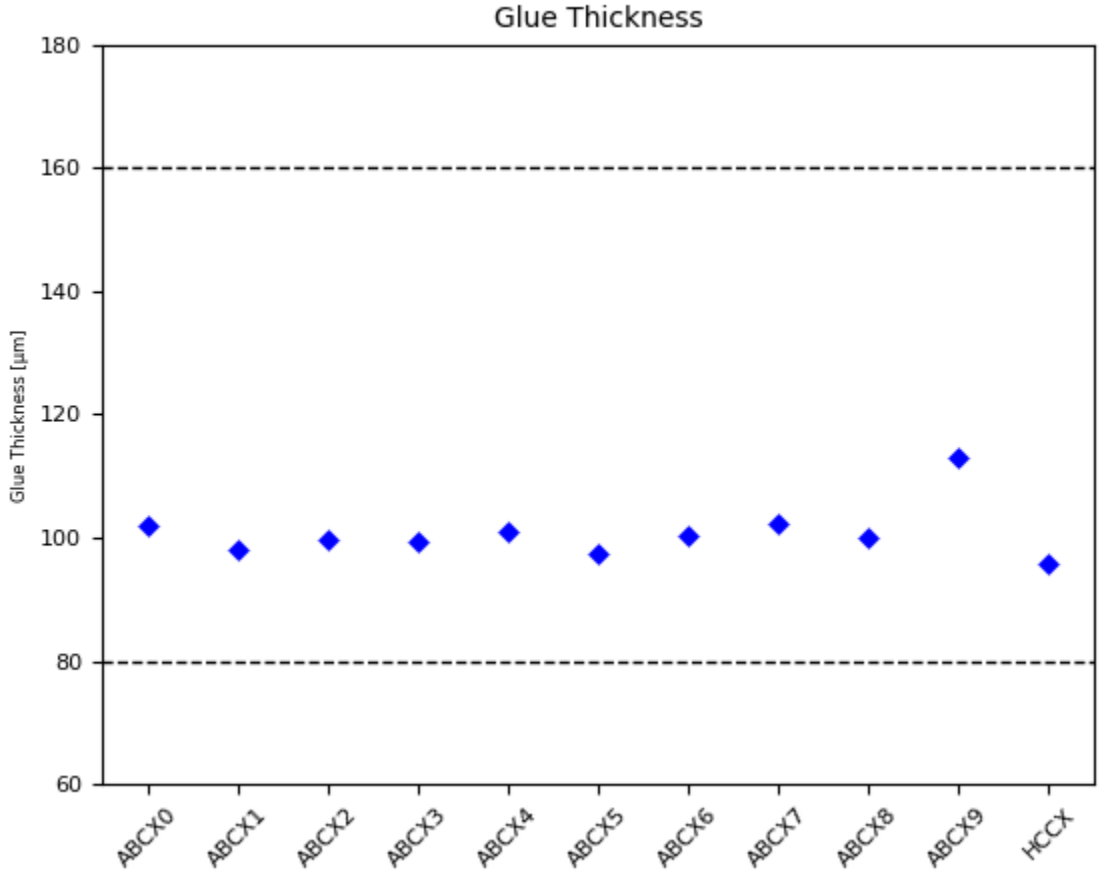
X Hybrid on PPA_SS1.
One y position failed.

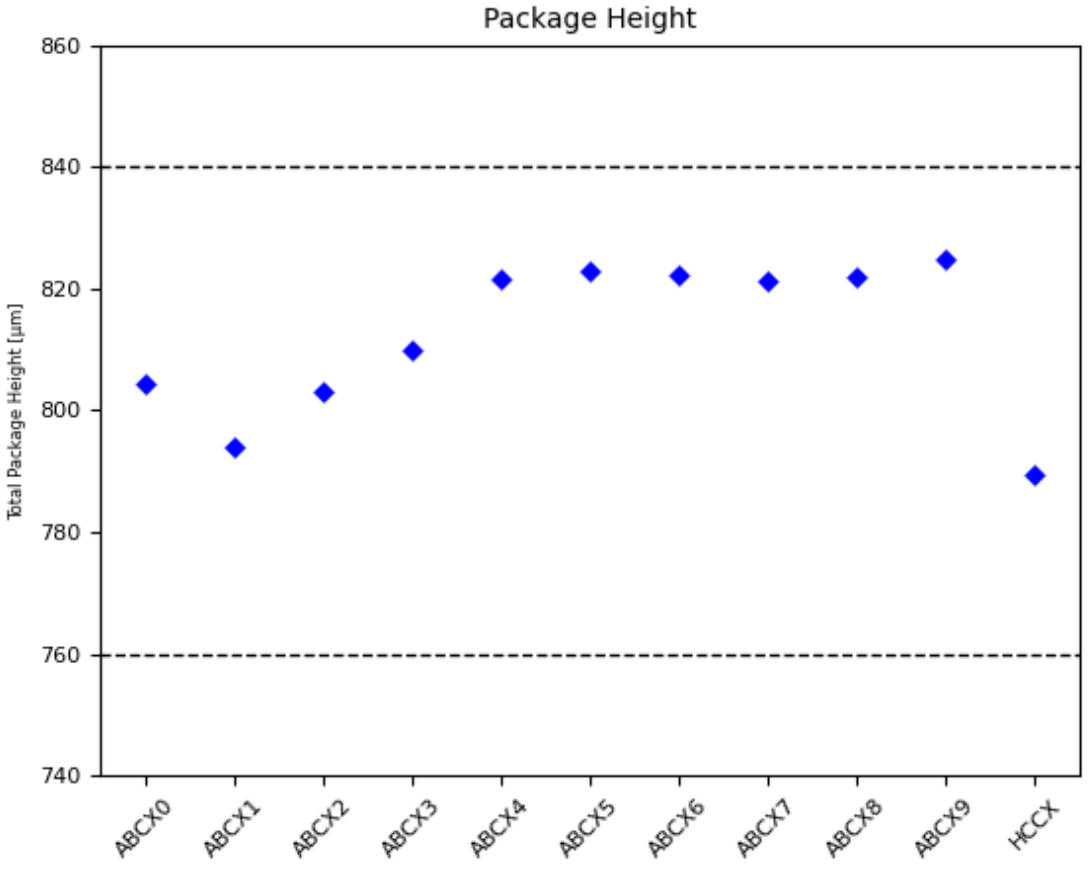




IHEP-X-0015, GPC-2104-002-H2

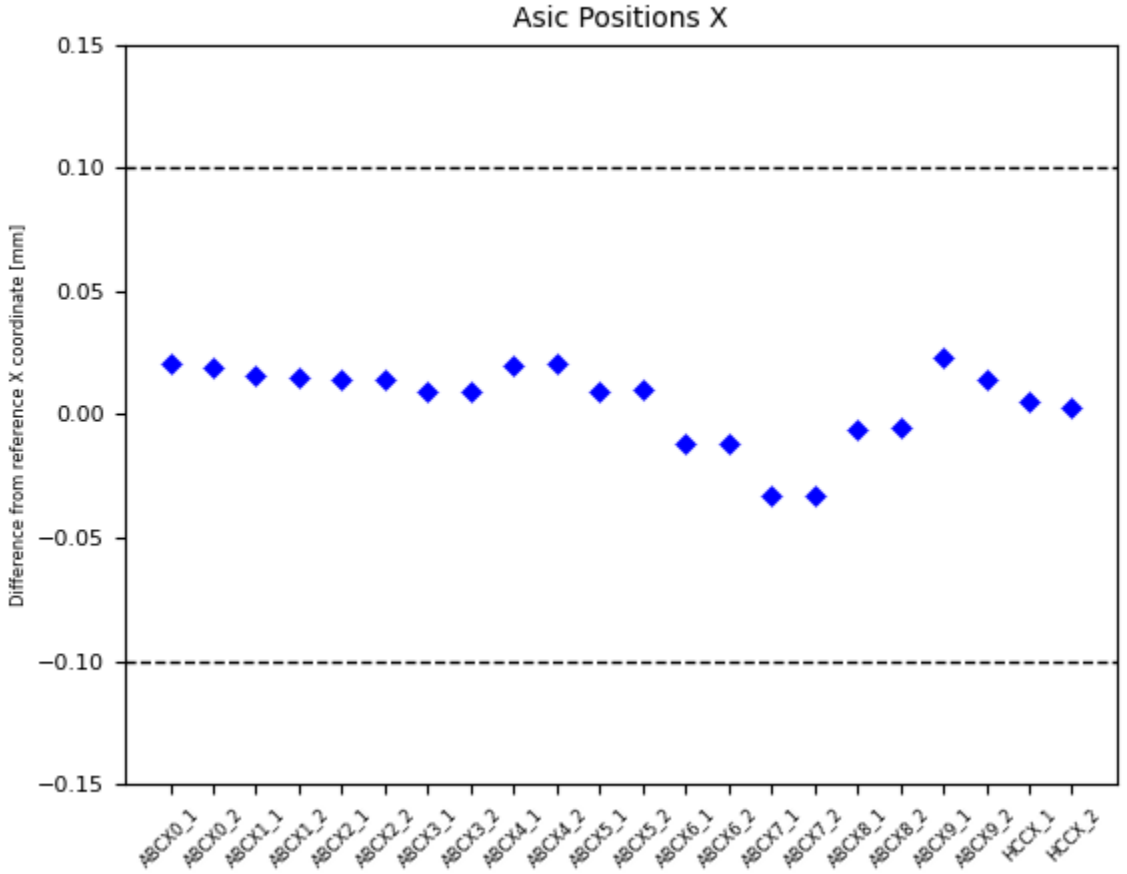
X Hybrid on PPA_SS2.
Same 100um glue height, same shape for package height.
Xiyuan reported that she saw serious glue come out for this hybrid. But in metrology it's in the limit.

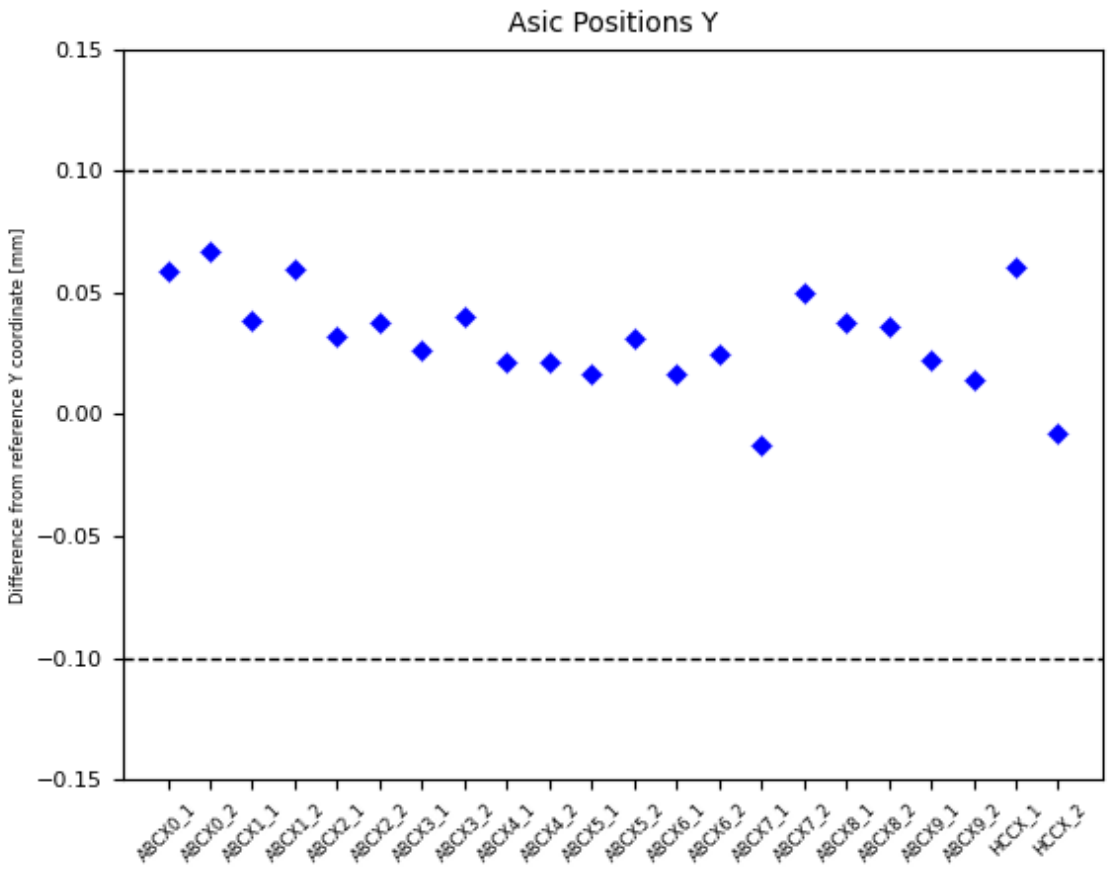




IHEP-X-0015, GPC-2104-002-H2

So far so good. (Good news!)
But difficult to keep this result and avoid the bad y alignment.

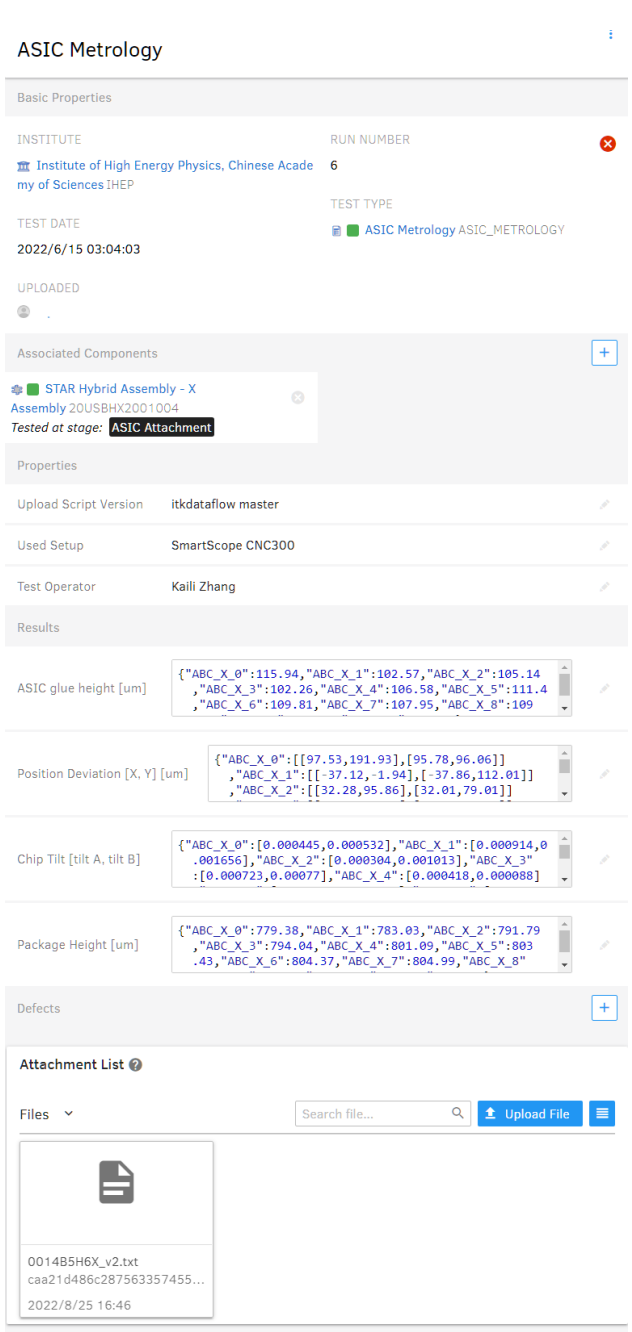




Database

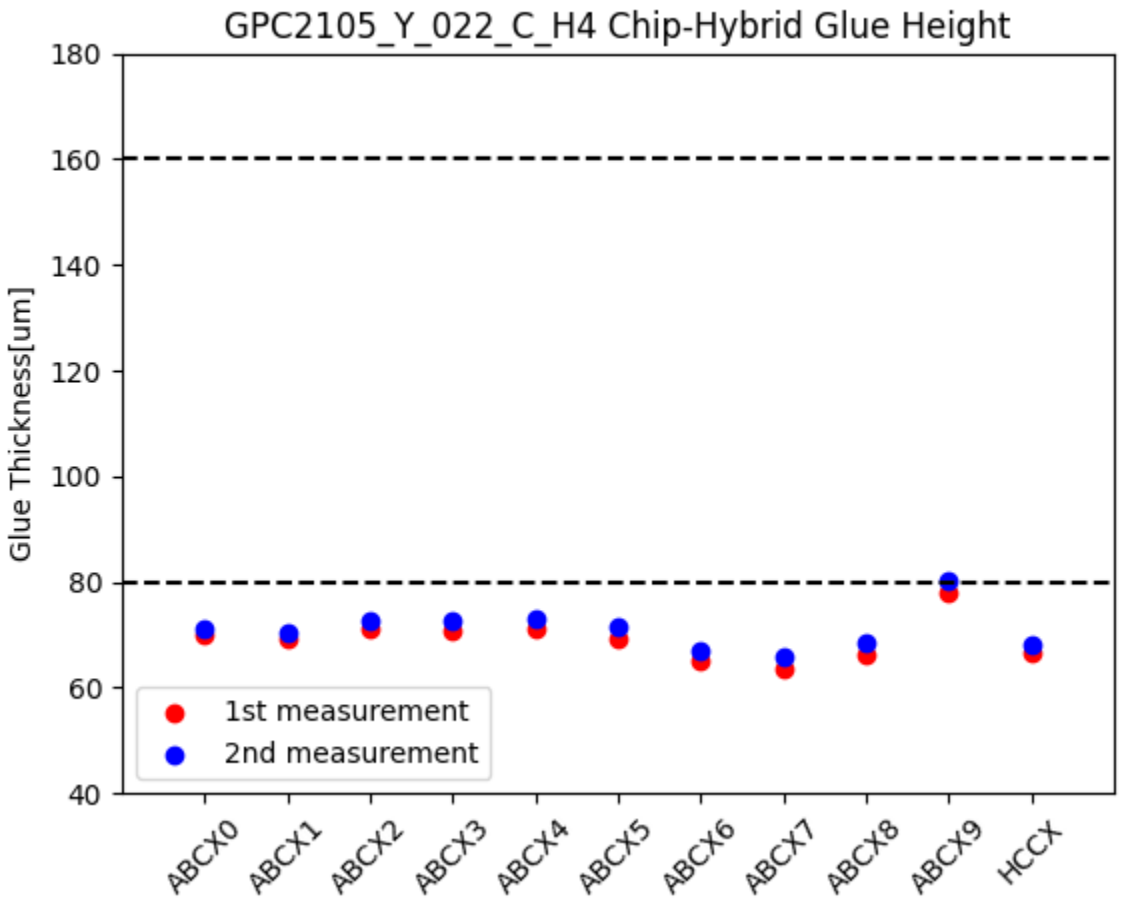
- Database need json file.
- Thanks Shudong to fix the script.

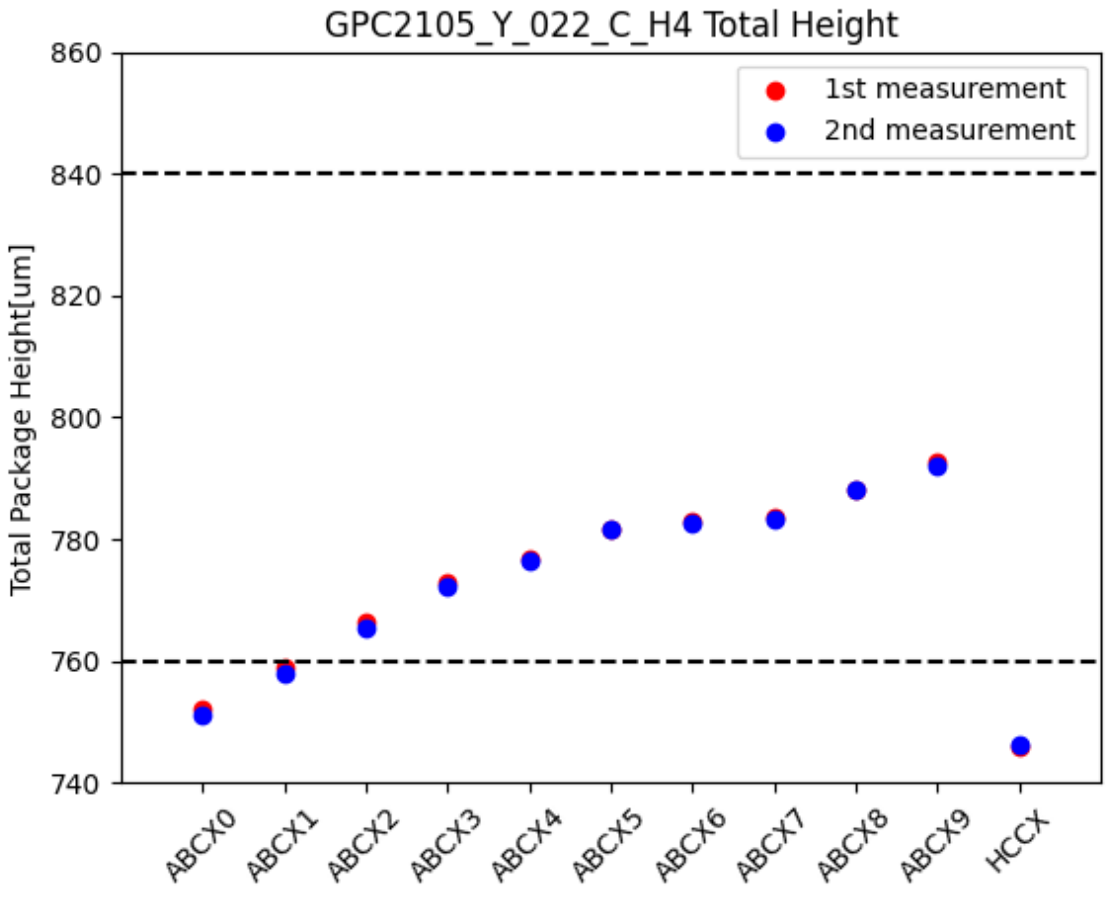
- One typical metrology result in database like:
  - With the raw file uploaded.



GPC2105_Y_002_C_H4

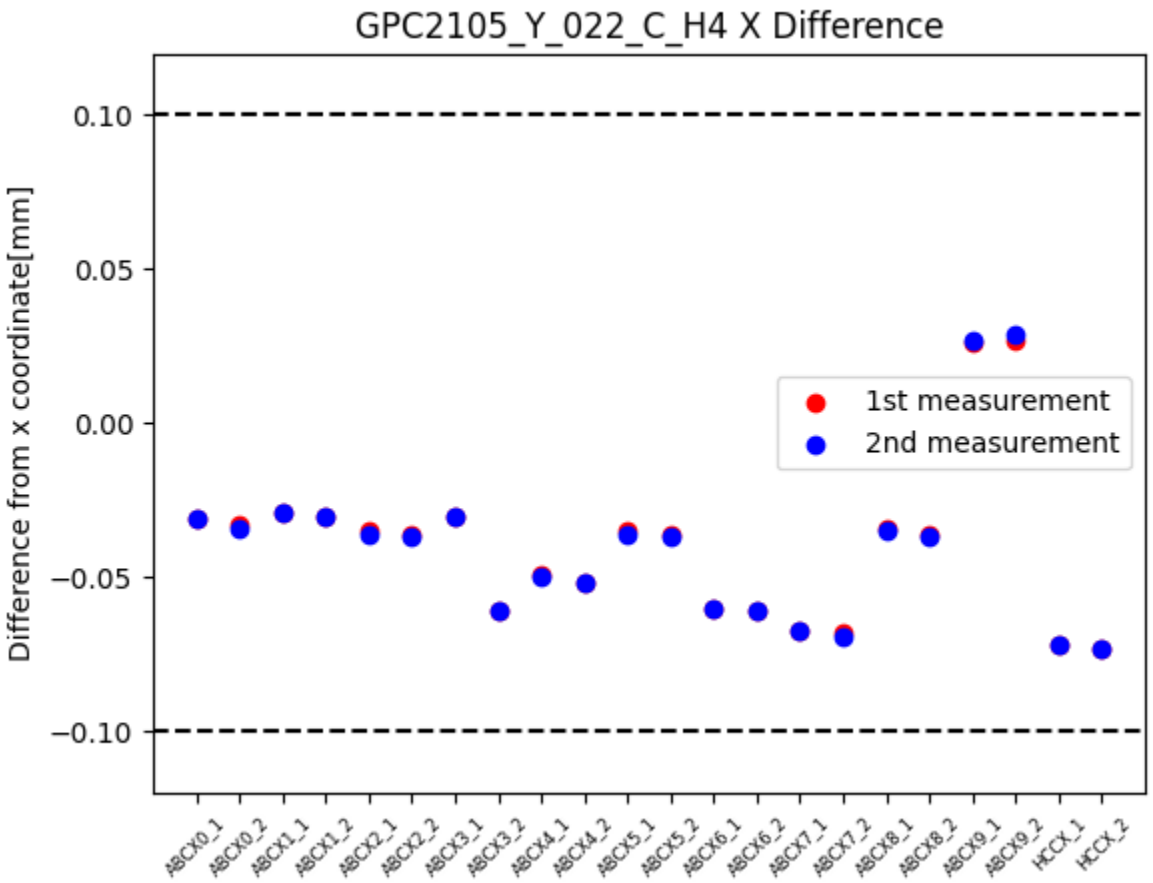
Y Hybrid on PPA_SS1. Twice.
Y pickup tools very buggy.

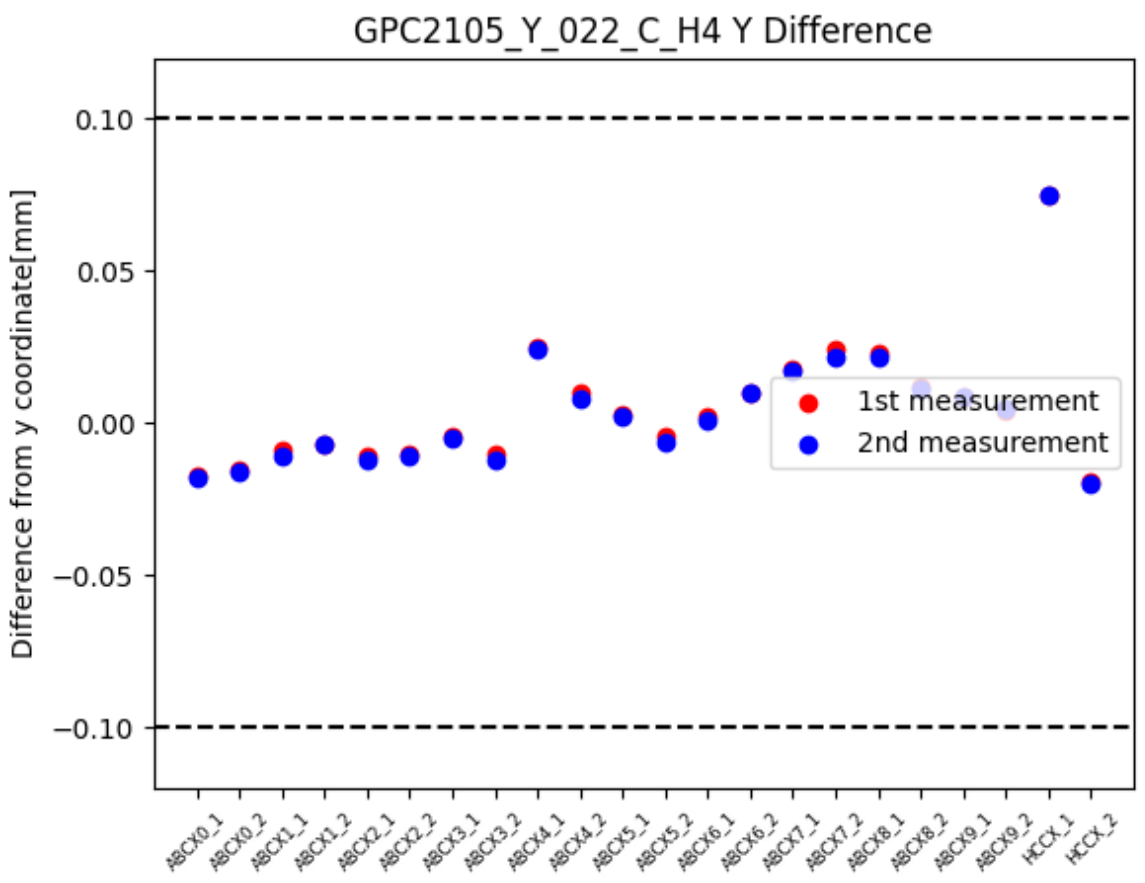




GPC2105_Y_002_C_H4

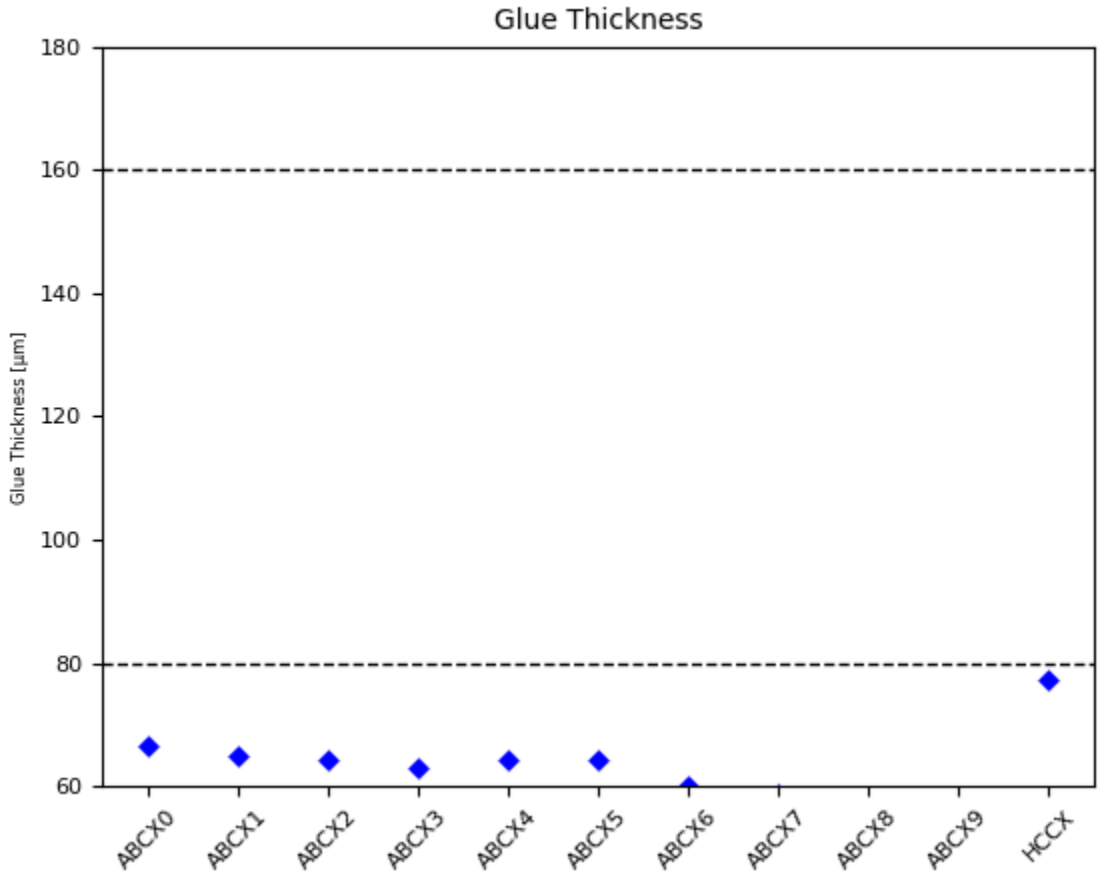
Y Hybrid on PPA_SS1.

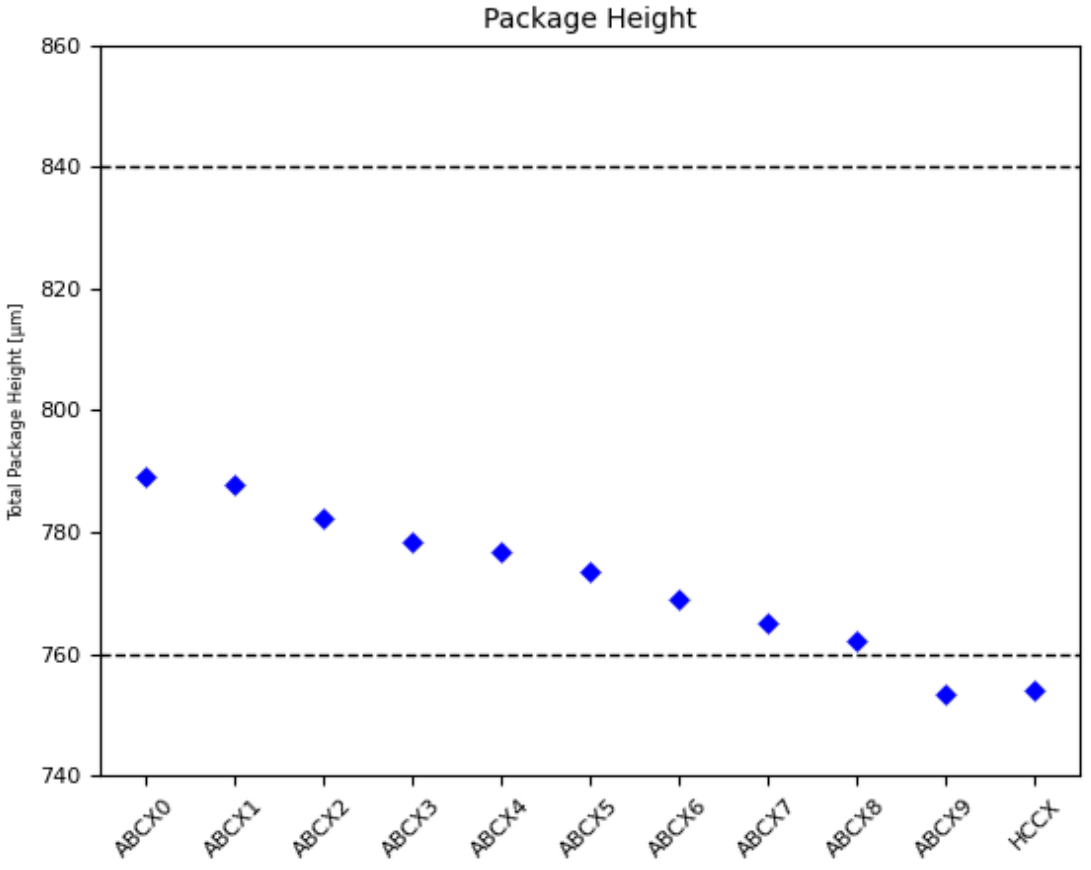




GPC2105_Y_002_C_H2

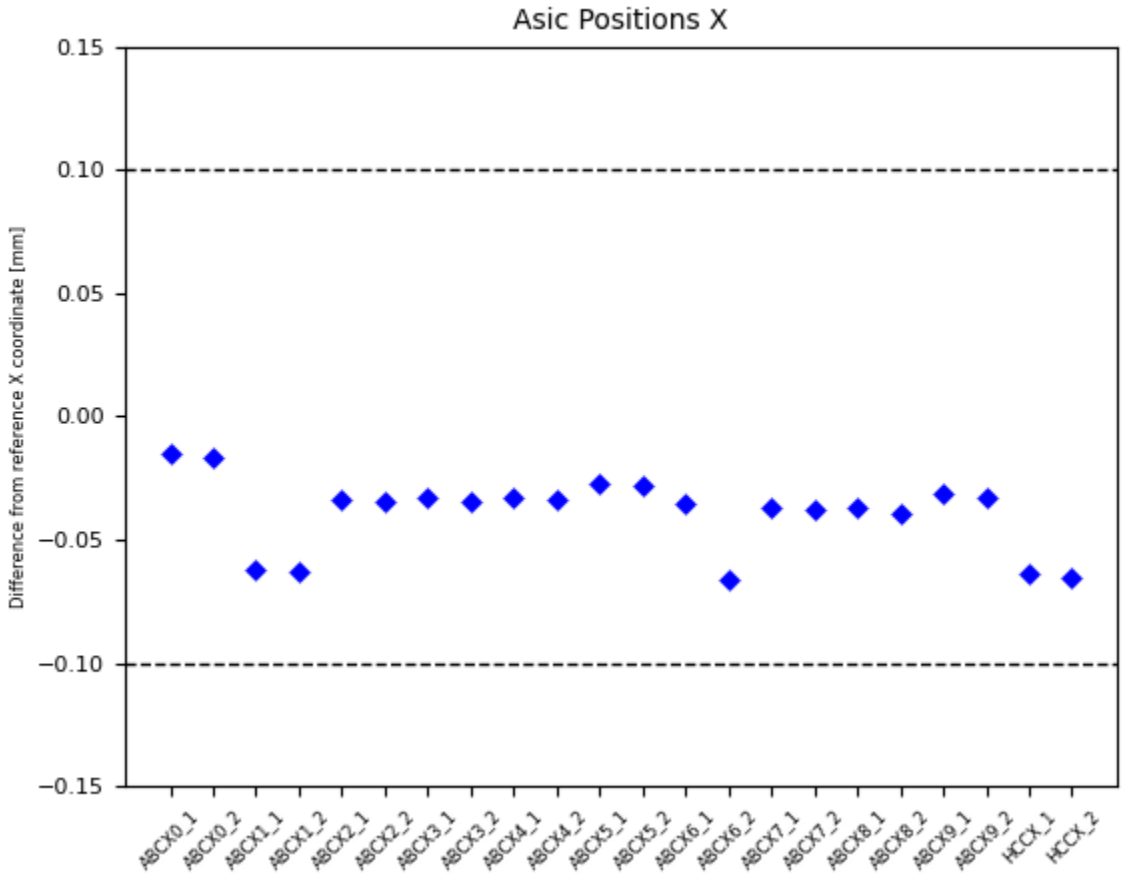
Y Hybrid on PPA_SS2.

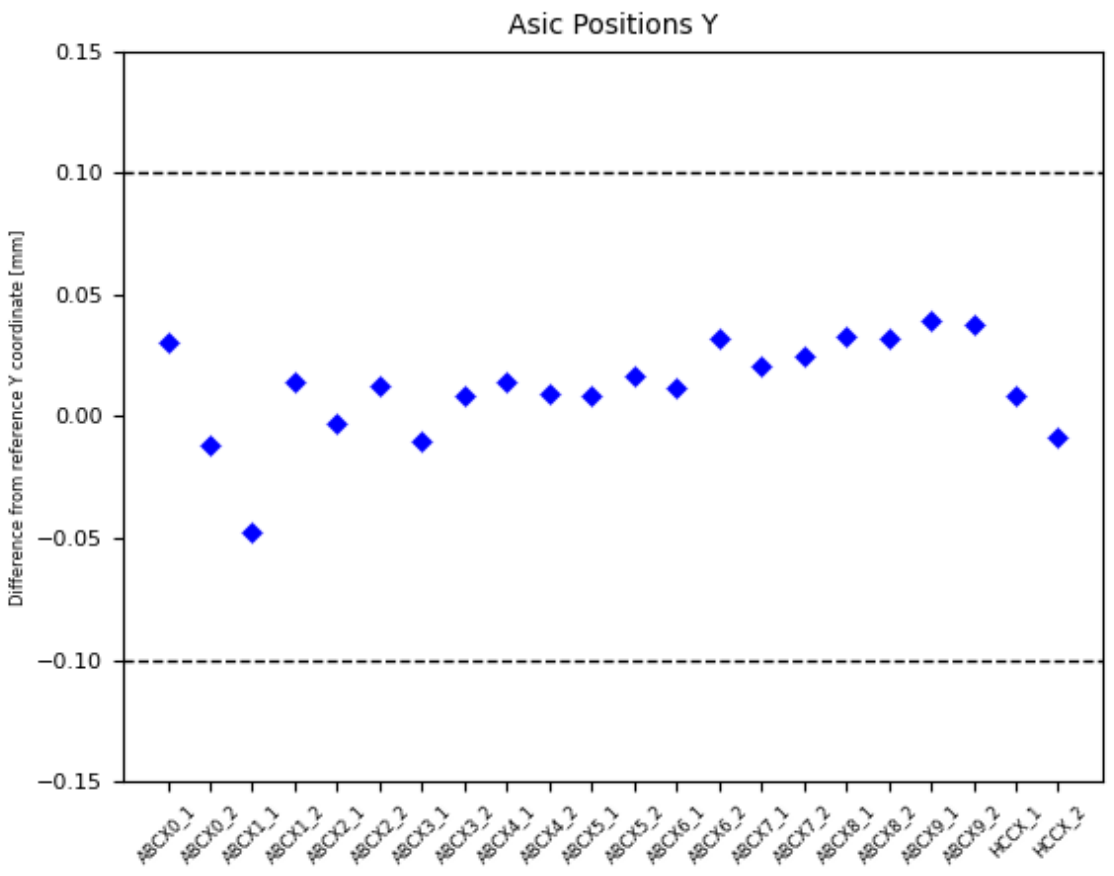




GPC2105_Y_002_C_H2

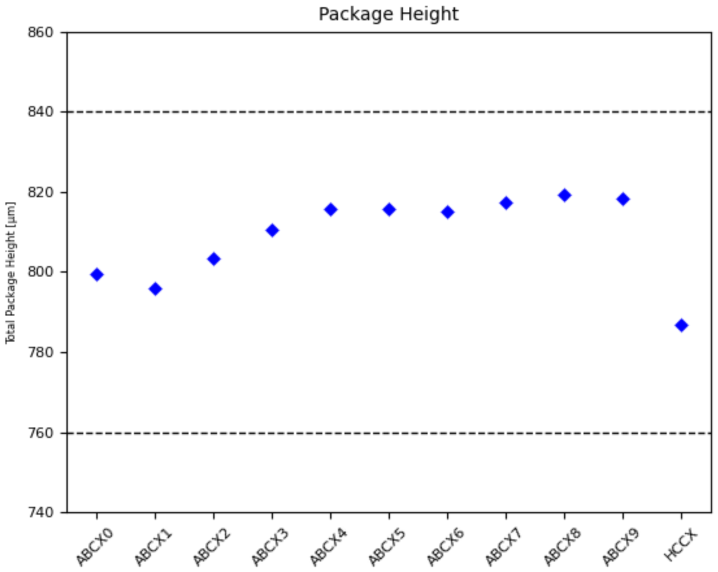
Y Hybrid on PPA_SS2.

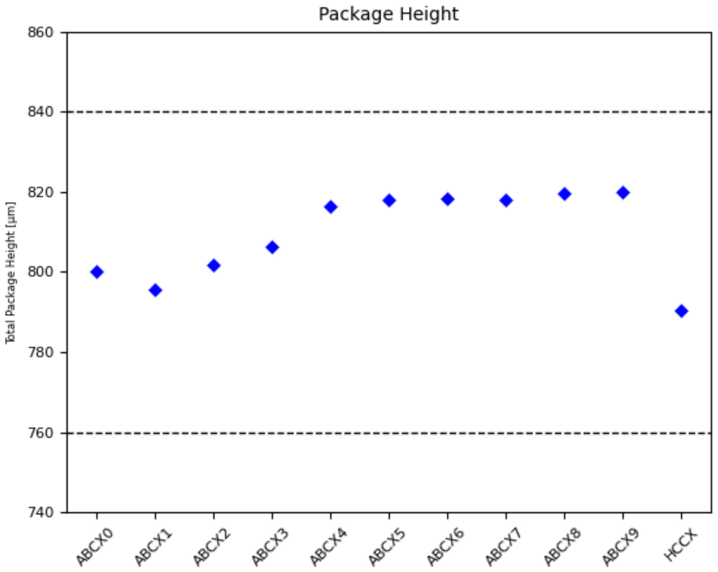


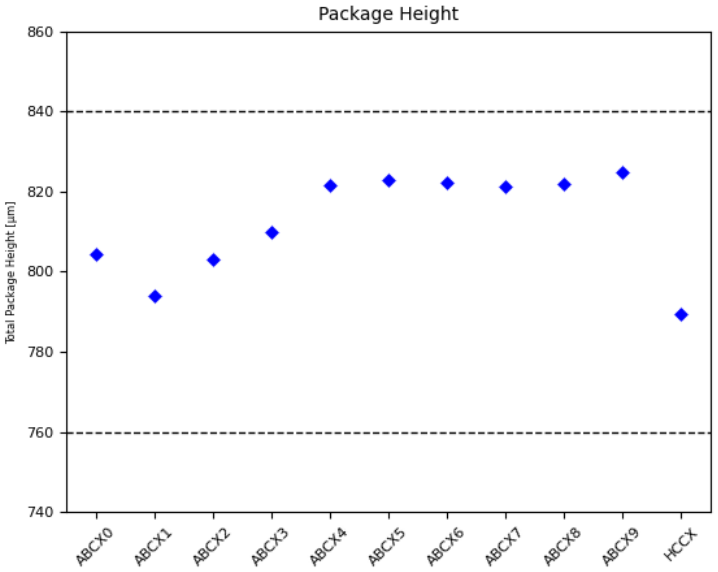


Hint:

X hybrid pickup tool is not calibrated very well.
Package height, the absolute height for chip surface shows pattern.
All glue for x hybrid is ~100um, and several glue come out.







Hint:

Serious issue for y pickup tool.
Glue very insufficient.
Difference shape for total package height
->Relate to assembly technique.