L6 preparation status and plans

Yoshiyuki Onuki
University of Tokyo

Outline

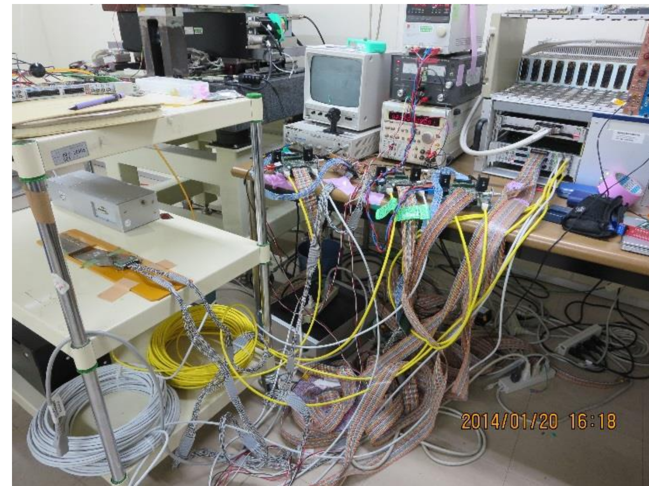
- Electrical QA/QE (Junya Sasaki, University of Tokyo)
- Mechanical QA/QE (Nobuhiro Shimizu, Takeo Higuchi,University of Tokyo, Kavli IPMU)
- Ladder production jigs (Yoshiyuki Onuki, University of Tokyo)
- Wire bonding (Tomoko Iwashita, Kavli IPMU)
- Glue dispensing study (Yoshiaki Seino, Niigata University)
- Pre-bending of Origami+z (Tomoko Iwashita&Nobuhiro Sato&Takeo Higuchi)
- Plan

Electrical QA/QE

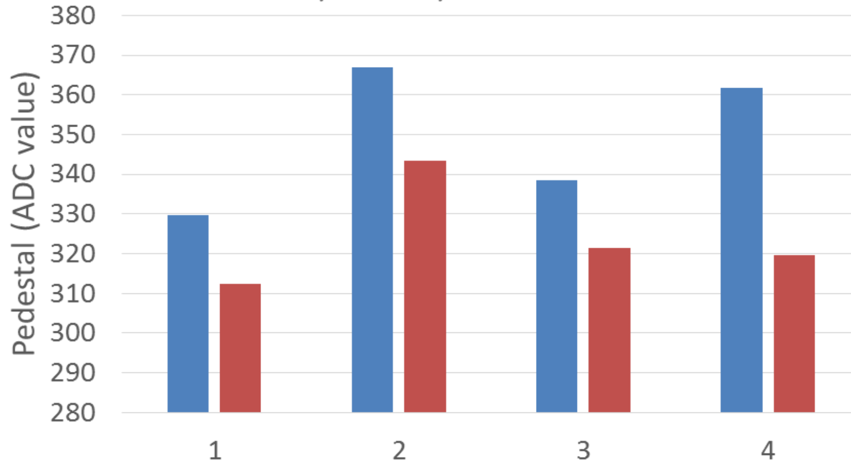
Motivation:

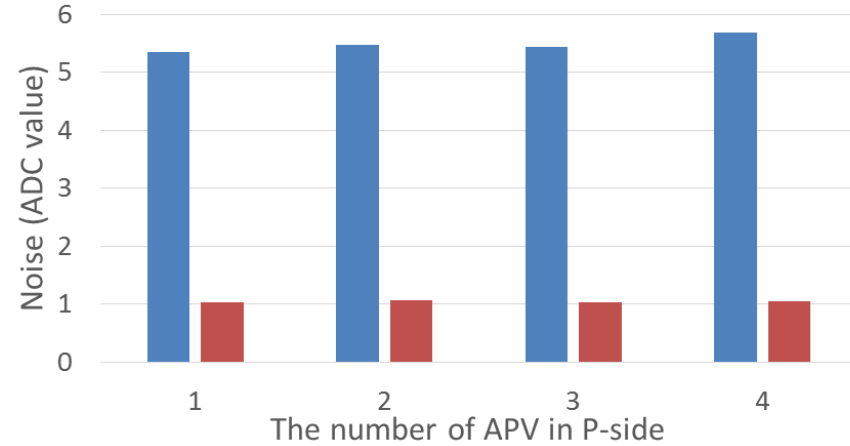
Electrical connection assurance between DSSD-APV25 with comparison before and after the wire-bonding.

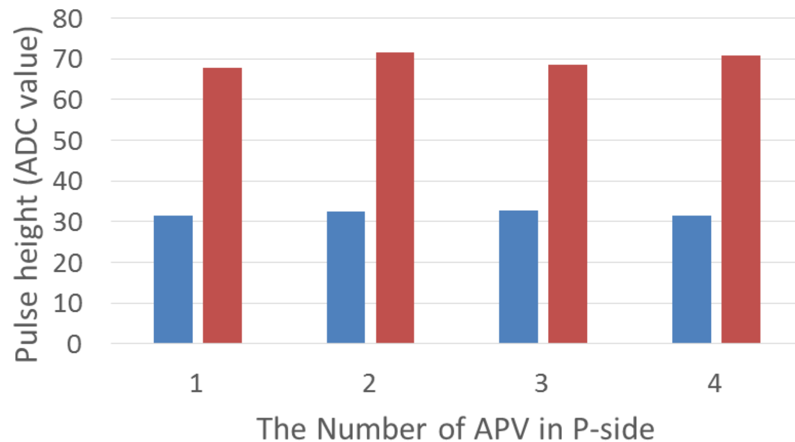
- Origami module assembled in autumn 2011(after bonding. w/ DSSD)
- Origami +z implemented APV25(before bonding. w/o DSSD)
- APVDAQ system at KEK.
  - Measurement of Test pulse height, Noise and Pedestal w/ and w/o DSSD.



Readout test result







w/ DSSD w/o DSSD

	w/ DSSD	w/o DSSD
Pulse Height	LOW	HIGH
Noise	HIGH	LOW
Pedestal	HIGH	LOW

These information can be used for electrical connection assurance of bonding wire between APV25 and DSSD

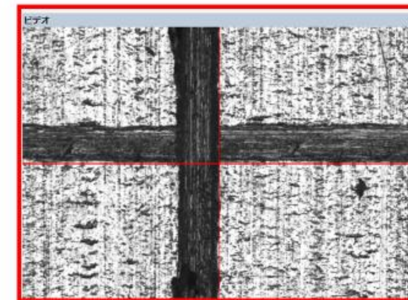
Junya Sasaki(Tokyo)

Mechanical QA/QC

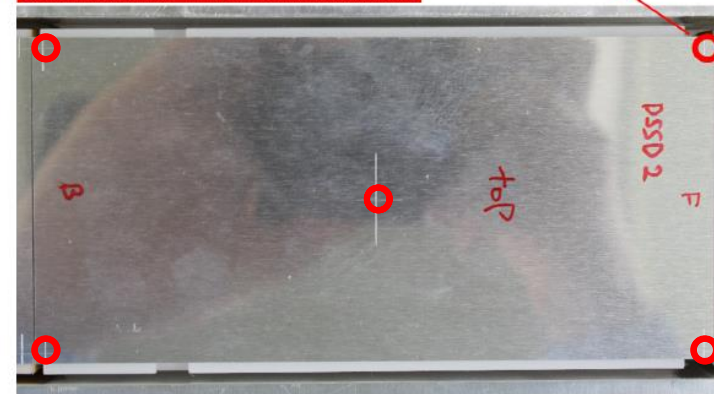
Motivation:

DSSD alignment measurements in the assembly and after the assembly to understand which procedure affect the precision critically.

- DSSD: Al-plates w/ scratched alignment marks.
- Ribs and MBs: rev0
- No Kokeshi-pins
- No FLEXes

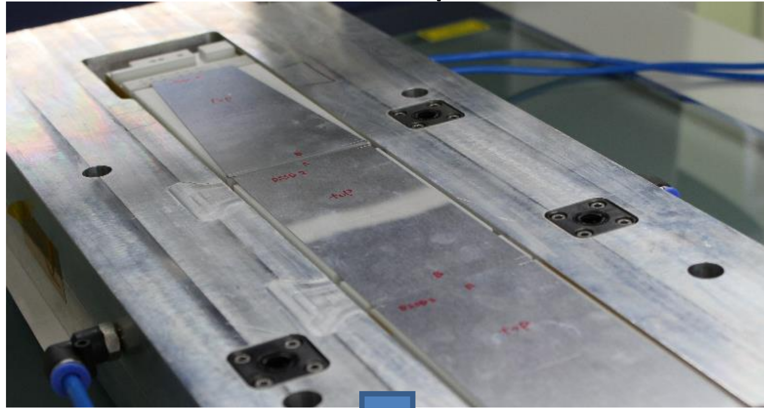


Scratched cross hair substitute for the alignment mark

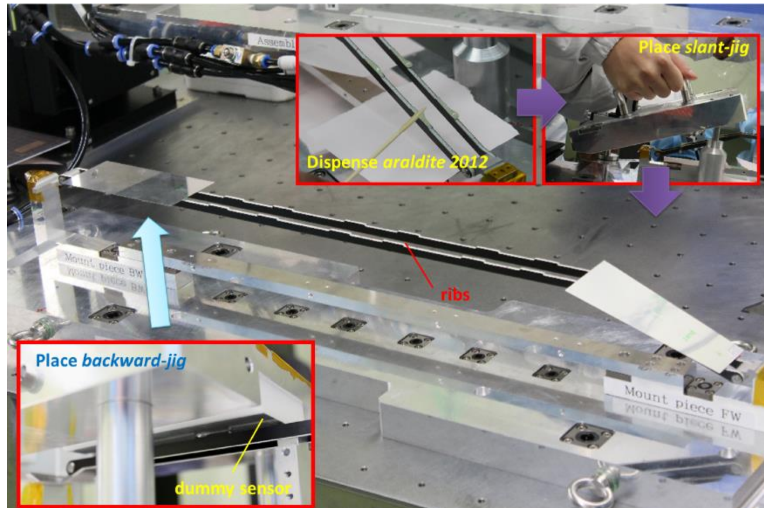


Mech.QA in mockup assembly

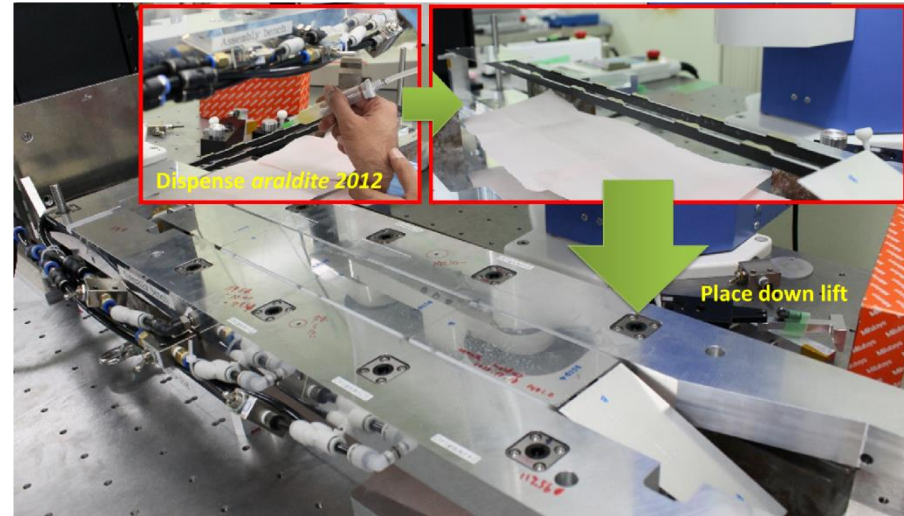
1) DSSD position measurement after placing 5 DSSDs on the flat plane.



2) Gluing FW and BW DSSD on the ribs



3) Gluing Origami DSSD on the ribs

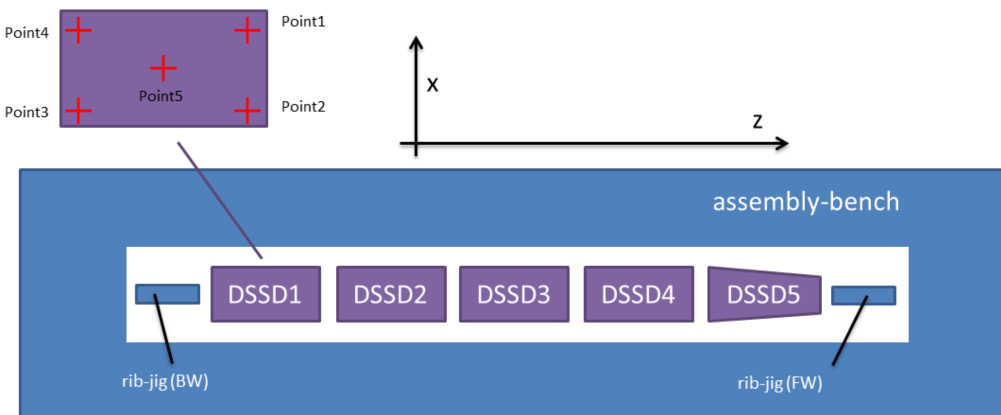


4) DSSD position measurement again

Nobuhiro Shimizu(Tokyo)

Mech. QA result

Point	Δx (μm)	Δz (μm)	Point	Δx (μm)	Δz (μm)
DSSD1			DSSD3		
$\Delta\theta^\star = (5.9 \pm 0.08) \times 10^{-3}$ (rad)			$\Delta\theta^\star = (-4.8 \pm 0.8) \times 10^{-4}$ (rad)		
$\Delta x = -211\ \mu$m, $\Delta z = -21\ \mu$m			$\Delta x = -77\ \mu$m, $\Delta z = 127\ \mu$m		
1	-160	-47	1	-80	126
2	-156	7	2	-81	119
3	-267	6	3	-70	123
4	-269	-45	4	-66	126
5	-211	-21	5	-77	127
DSSD2			DSSD4		
$\Delta\theta^\star = (-4.8 \pm 0.8) \times 10^{-4}$ (rad)			$\Delta\theta^\star = (-5.3 \pm 0.8) \times 10^{-4}$ (rad)		
$\Delta x = -64\ \mu$m, $\Delta z = 131\ \mu$m			$\Delta x = -86\ \mu$m, $\Delta z = 126\ \mu$m		
1	-64	131	1	-91	126
2	-68	127	2	-92	122
3	-58	126	3	-80	120
4	-57	129	4	-83	126
5	-64	131	5	-86	126



- Feedback from Mechanical QA to assembly procedure was established in priciple.
- The Δx, Δz shows the difference of DSSD position between 1) and 4) in previous slide.
- O(100µm) shifts observed. DSSD2-4 shows same shift and rotation tendency.
  - Loose diameter tolerance of linear bush shaft (max. ~60µm)
  - Movement caused by transfer of DSSD from jig to jig (max.~10µm)
  - Movement of MBs. In this assembly, MBs fixed by kapton tape instead of Kokeshi-pin. Same effect as shown the slide might be happen.
- Anyway, we need further mockup study.

Nobuhiro Shimizu(Tokyo)

Ladder production jigs

Feedback from mockup ladder QA result by Shimizu:

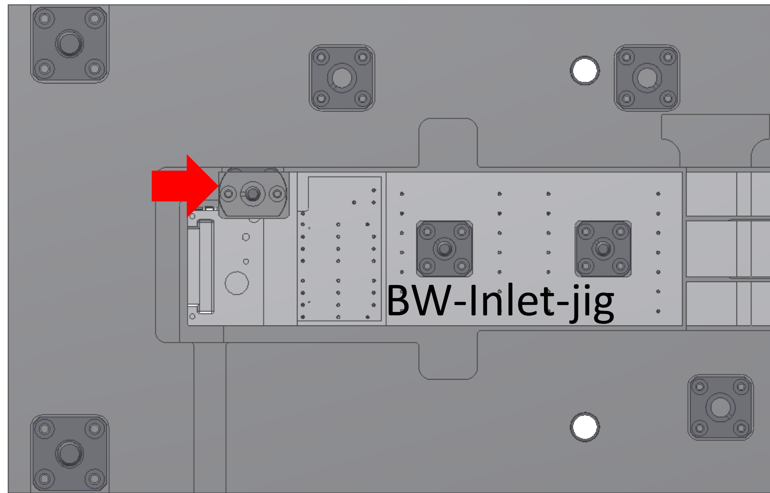
"BW module and three Origami DSSDs have different trans/rotation behavior."

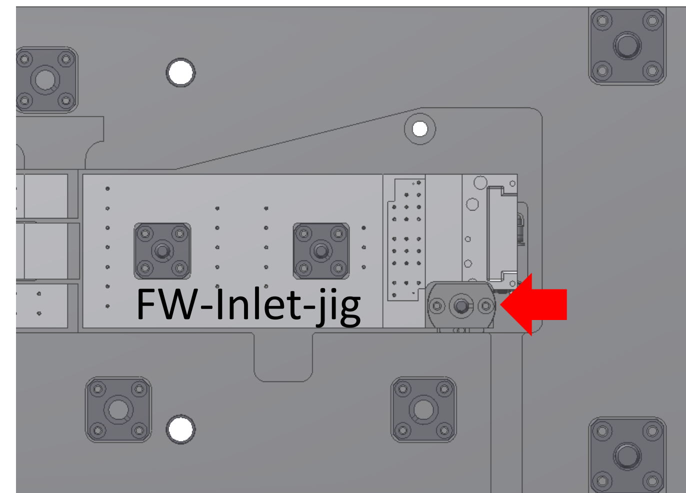
→(I am doubting) 2 possible sources of trans/rotation movement might be happen during the assembly in

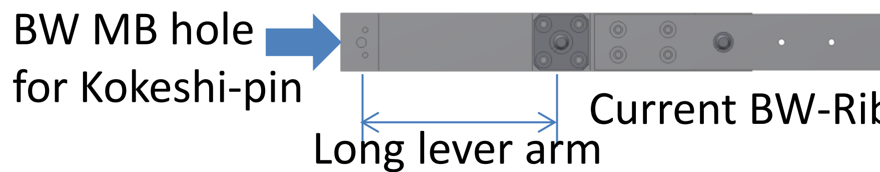
- Backward module assembly procedure.
  - Poor diameter tolerance of shaft pin (Pointed out by Shimizu).
  - BW Inlet-jig and Backward-jig (it may be same situation in FW module)
- Gluing Origami modules on the ribs procedure.
  - Poor diameter tolerance of shaft pin (Pointed out by Shimizu).
  - Rib distortion from MB rotation (Pointed out by Shimizu)
  - Rib-jig and Assembly-bench. Especially Rib-jig.

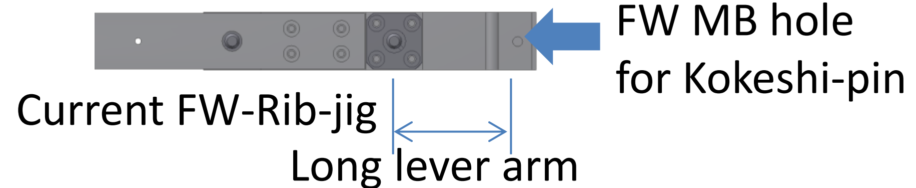
BW(FW) Inlet-jigs and Backward-jig and Rib-jig will be revised.
According to the revise of Inlet-jigs, Basement-jig also will be revised.
I'll release jigs and procedures with revised jigs at up coming B2GM Feb.

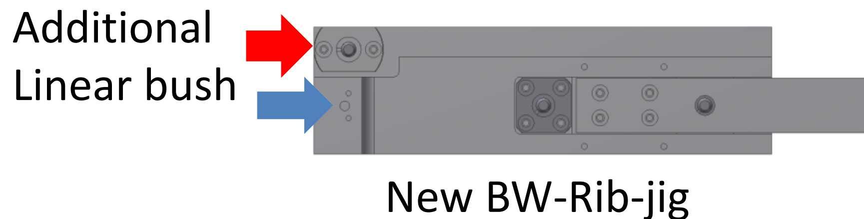
Improvement of Inlet-jig and Rib-jig

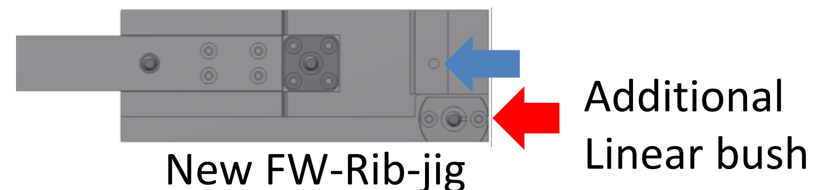








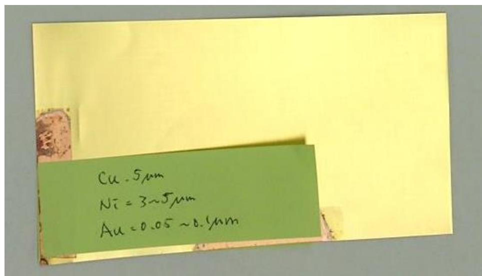


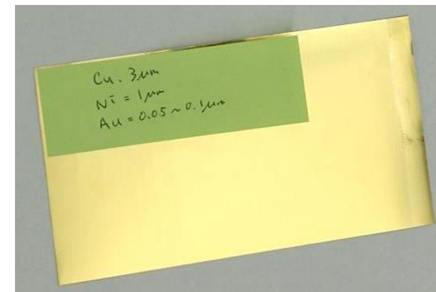


Lever arms between MB hole and next linear bush will be decreased.
Additional linear bush constraint the position and contribute better reproducibility.

Wire bonding

- Comparison of Pull Strength by *Ni* Thickness
  - Tokai-Densi Co., PA1&2 manufacturing company, provide two samples for the checking of bondability
    - Sample A: Cu 3-5μm, Ni 1μm, Au 0.05-0.1μm
    - Sample B: Cu 3-5μm, Ni 3-5μm, Au 0.05-0.1μm
  - Tokai-Densi prefers the Sample A since better yield.

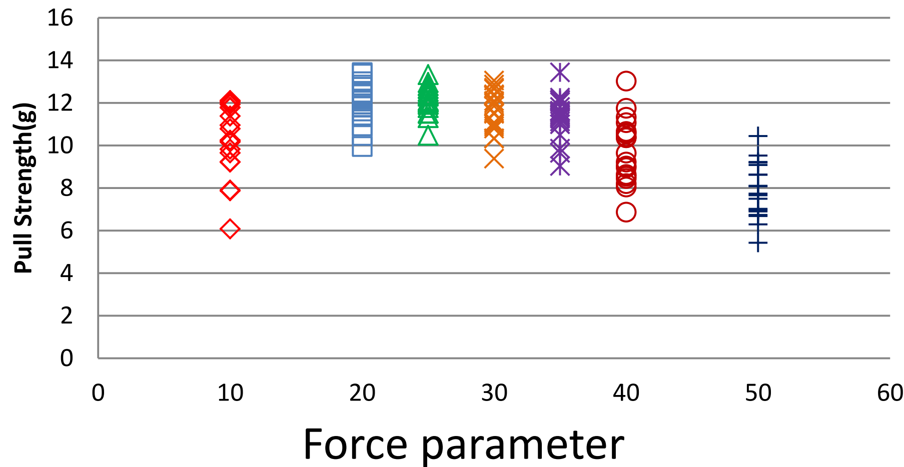


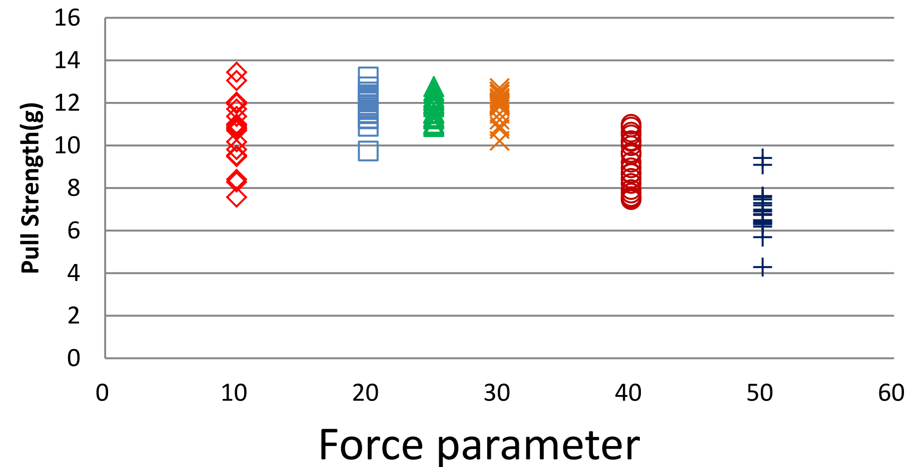


  - Wire bonding and pull test was performed to compare with the bondabilities of sample A and B

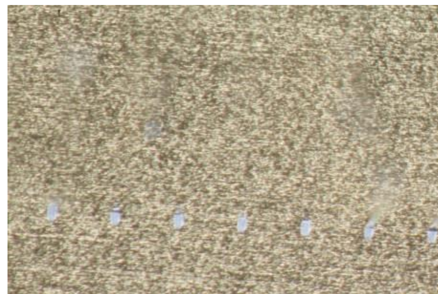
Wire bonding result

After the bonding parameter of power was tuned at 60 to maximum pull strength

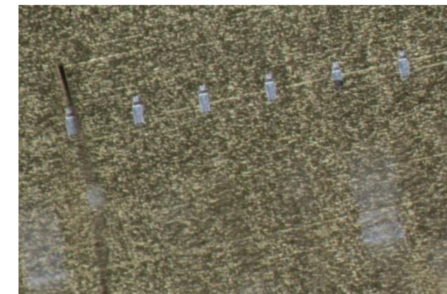




Bond foot at Force 25



Bond foot at Force 25



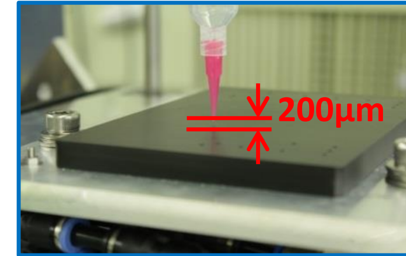
It looks not so different and both usable.
We can accept request of Sample A from manufacturing company.

Tomoko Iwashita(Kavli IPMU)

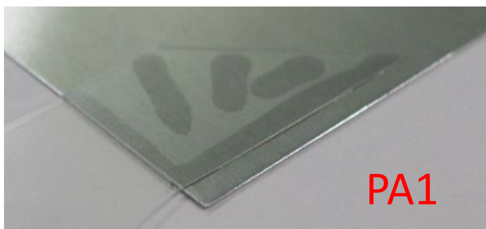
Glue dispensing study

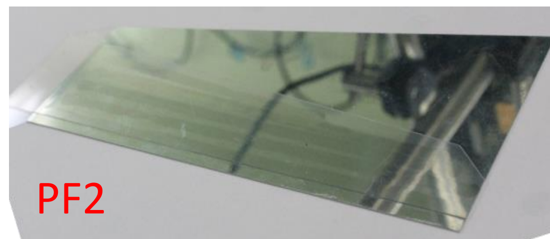
Tuned basic parameters

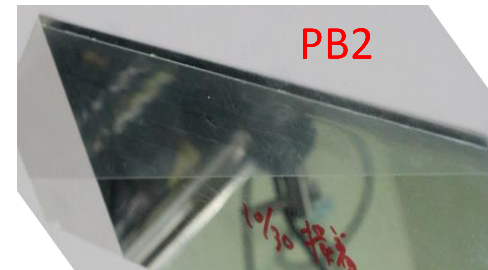
- Glue：Araldite2011(50ml cartridge)
- Temperature of lab-room：23±1℃
- Air pressure：0.4MPa
- Nozzle：Plastic tapared nozzle. Inner diameter 0.25mm, SH25TT-B
- Clearance between the tip of nozzle and the surface：200±18μm
- Dispensing speed：20mm/s for wire bonding part.
- Centrifugal machine：AW-20-3 (rpm=2575) for 400sec
- Time to start dispensing after the mixing: 15 min(incl. test dispensing)

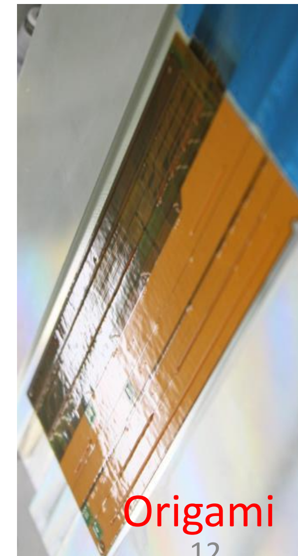


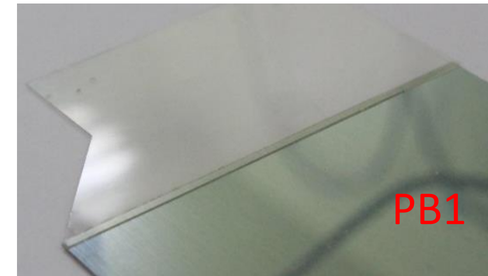
Dispensing patterns









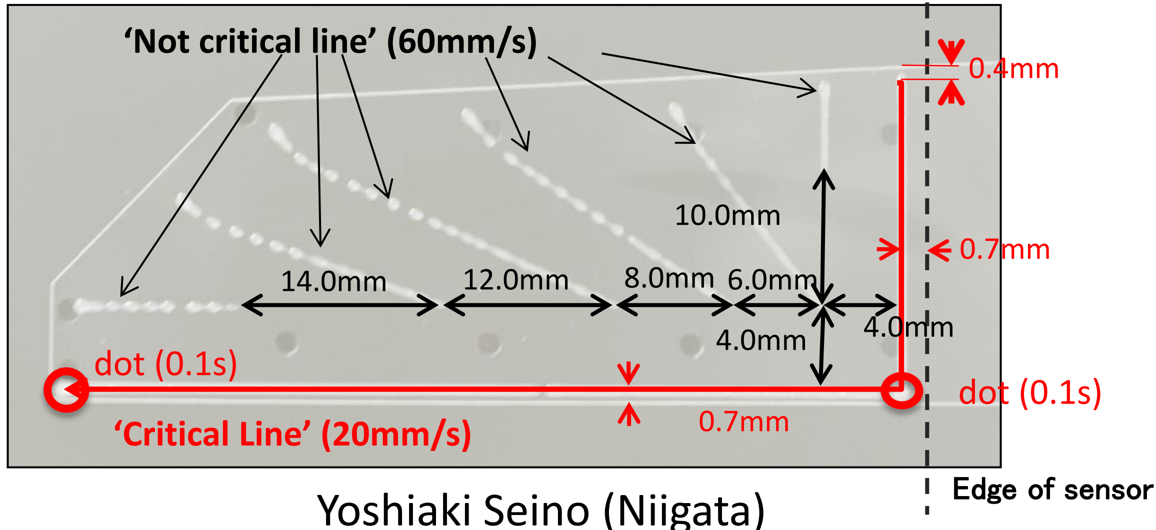


Yoshiaki Seino (Niigata)

Dispensing parameter and pattern

Two sets of glue dispensing parameters:

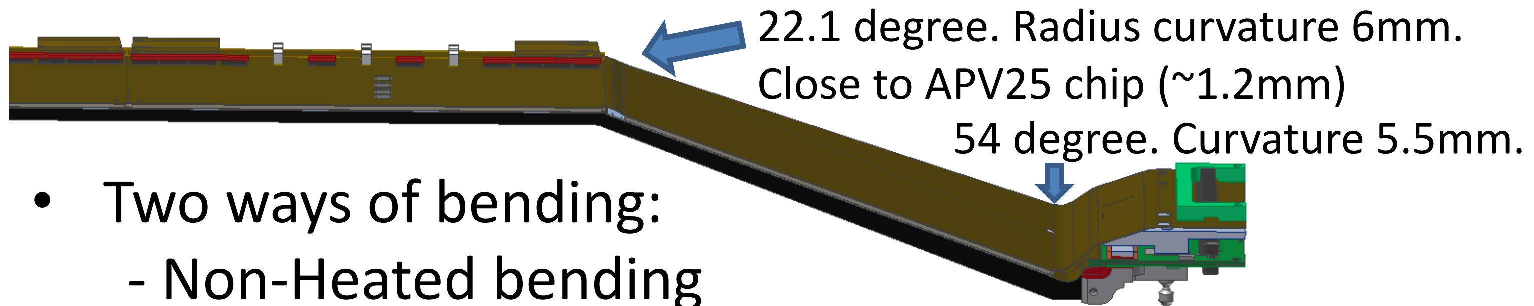
- **Area underneath wire bonding pads**
  - Critical for bondability. **→Should spend much time for better bondability.**
  - Typically small area
  - Should be dispensed uniformly and precisely
- The other area
  - Not critical for bondability
  - Typically larger area
  - Should be faster to cover large area. Viscosity change in a few 10 minutes.



Yoshiaki Seino (Niigata)

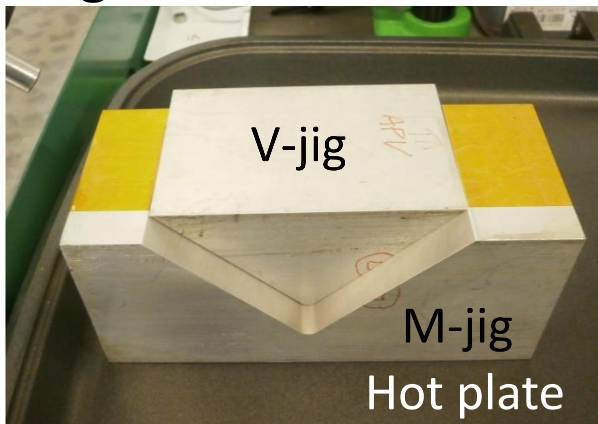
Pre-bending of Origami+z

- Only L6 matter.
  Should be bended before SMDs implementation



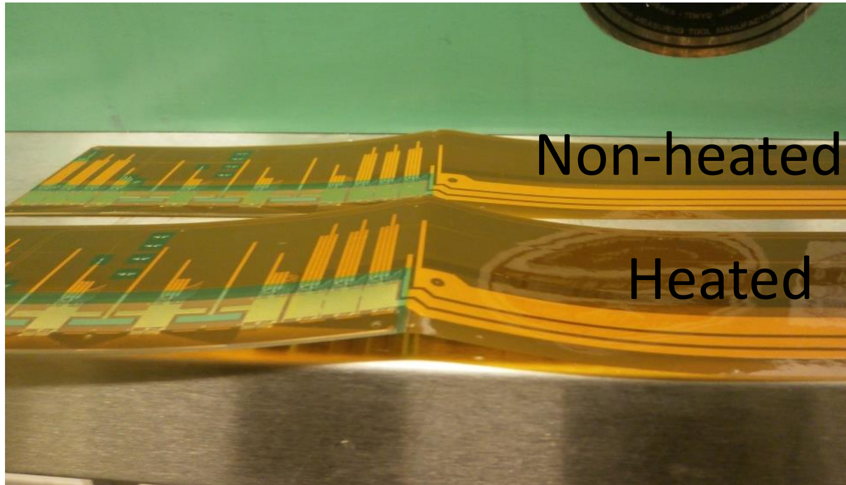
- Two ways of bending:
  - Non-Heated bending
  - Heated bending

- Bending jigs: V-jig and M-jig
  designed and wire-cut from Al block by Sato-san.



Tomoko Iwashita(Kavli IPMU) & Nobuhiko Sato(KEK)&Takeo Higuchi(Kavli IPMU)

Pre-bending of Origami+z



- Two ways were compared.

Heated bending way is hard to be restored compared with non-heated bending way.

- Though we met difficulty that the bending is restored after the reflow of SMDs, we found the sample heated by hot plate setting at 260℃ and bended is not restored after the reflow.

Tomoko Iwashita(Kavli IPMU) & Nobuhiko Sato(KEK)&Takeo Higuchi(Kavli IPMU)

Plan

Ladder assembly meeting at IPMU 4th Feb.

- Production drawing of parts and jigs.
- Assembly procedure incl. gluing, bonding
- FW&BW assembly procedure
- Mech. & Elec. QA procedure…

Let's discuss what items we'll discuss at the meeting.

Items	**Feb**	**Mar**	**Apr**	**May**
Commissioning Elec.QA setup at IPMU	■			
Implementation Elec. QA in the assy proc.		■	■	■
Study of trans/rotation w/ Mech.QA	■			
Release of revised jigs	■			
Manufacturing the jigs	■	■	■	■
Finalizing pre-bending procedure	■			
Gluing study of wrapped PA		■	■	
Wire-bonding study of the wrapped PA.		■	■	■
Mockup assembly	■	■	■	■