L4-6 Ladder assembly procedure

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Outline

- Updates of ladder assembly procedure for rev2.1
- Integration FW/BW module into ladder.
- Open issues?
- Summary

Updated ladder assembly procedure

https://belle2.cc.kek.jp/svn/groups/vxd_mechanics/svd/ladder_assembly/140823/

- PA1/2 gluing on the DSSD

- FW/BW module assembly by Pisa group
- Implementing of the FW/BW module in the Origami DSSD
- Active alignment of all DSSDs
- Attaching FW/BW APV cover

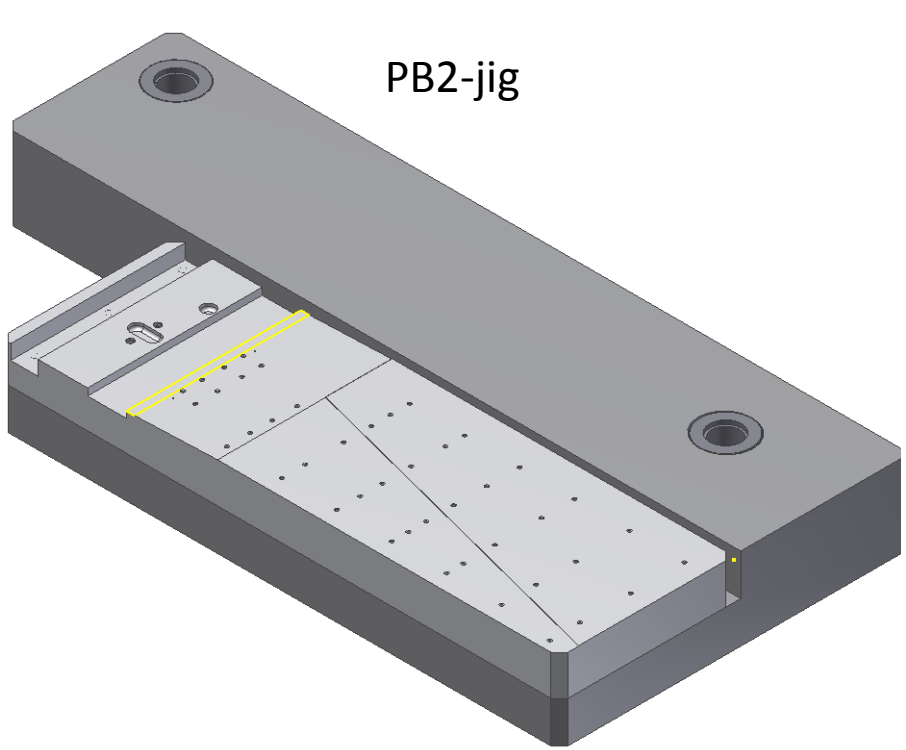
- Gluing ribs and FW/BW MBs
- Gluing FW/BW module on the ribs
- Fixing FW/BW hybrid on the FW/BW MB

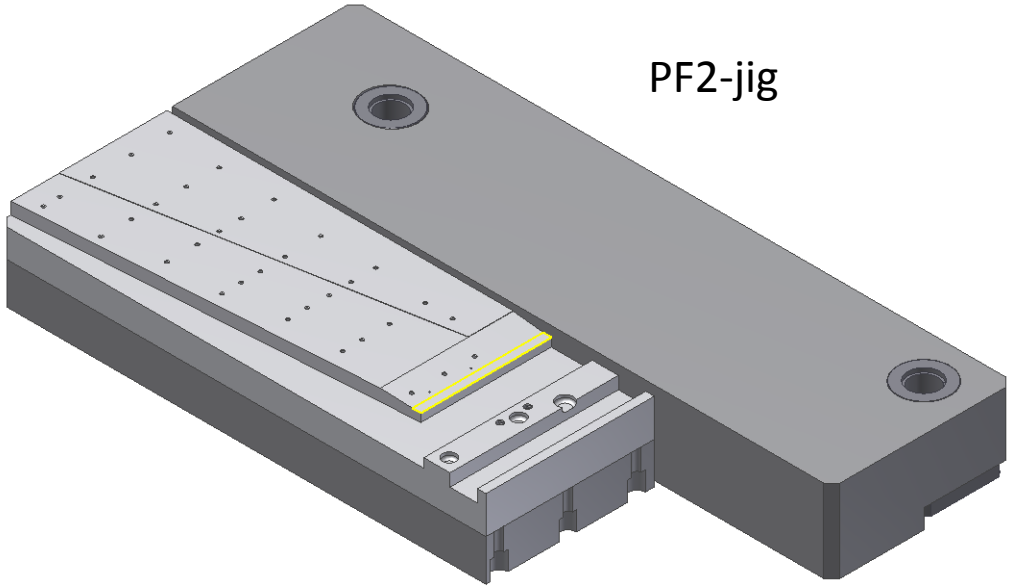
- Gluing AIREX
- Gluing Origami FLEX(es)
- PA wrapping
- Gluing CO2 clip

- Gluing Origami's on the ribs
- Pickup ladder from assembly-bench

Errata in PF2-jig and PB2-jig

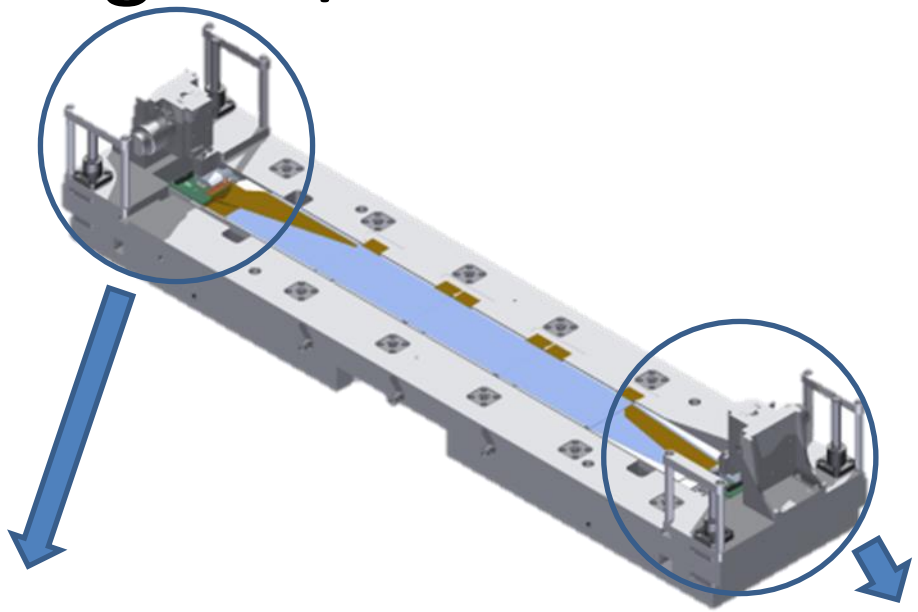
Kamesh pointed out there are two interferences between 3-row-PF2/PB2 and PF2-jig/PB2-jig(Thanks).

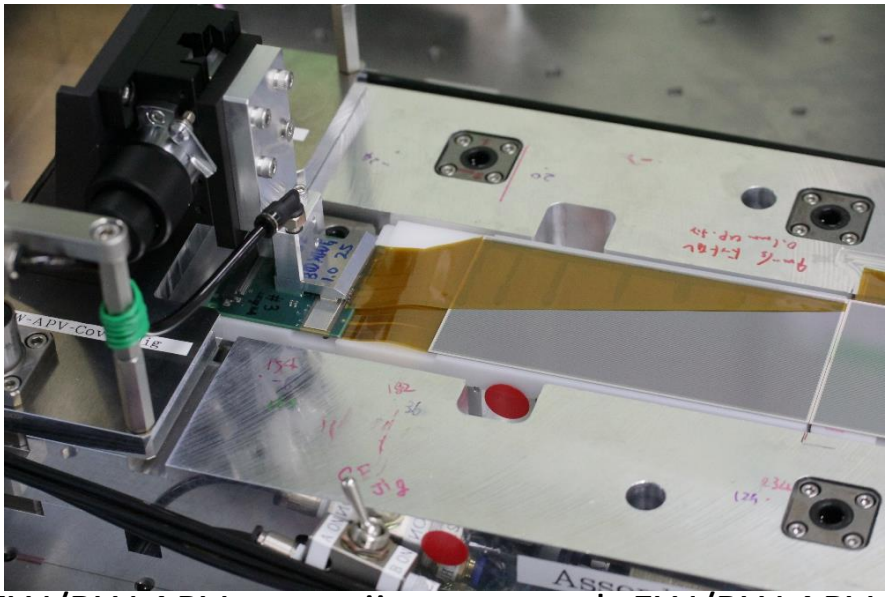


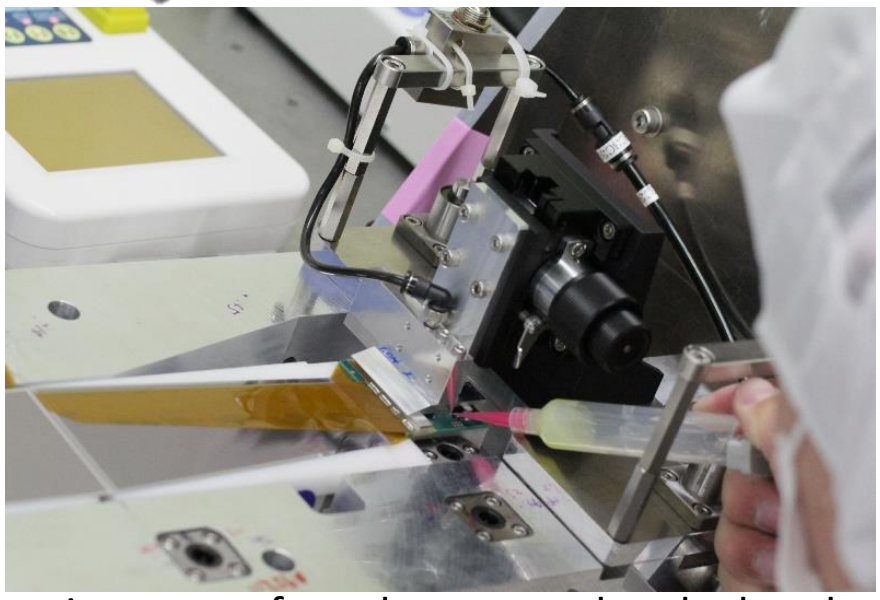


Yellow part should be milled away. Will be update soon.

Attaching FW/BW APV cover w/ jigs







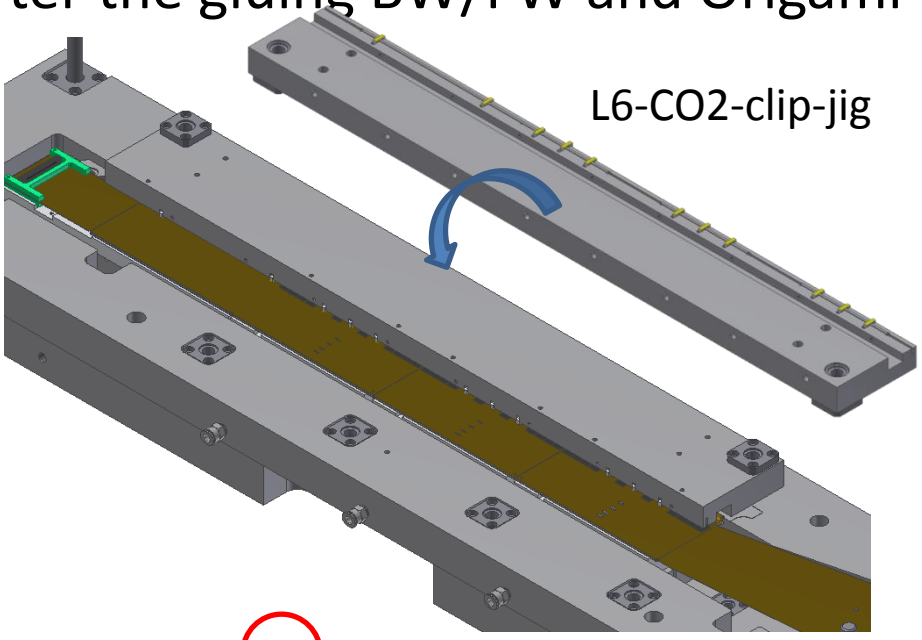
FW/BW APV-cover-jig can attach FW/BW APV cover in more safe and accurate than by hand.

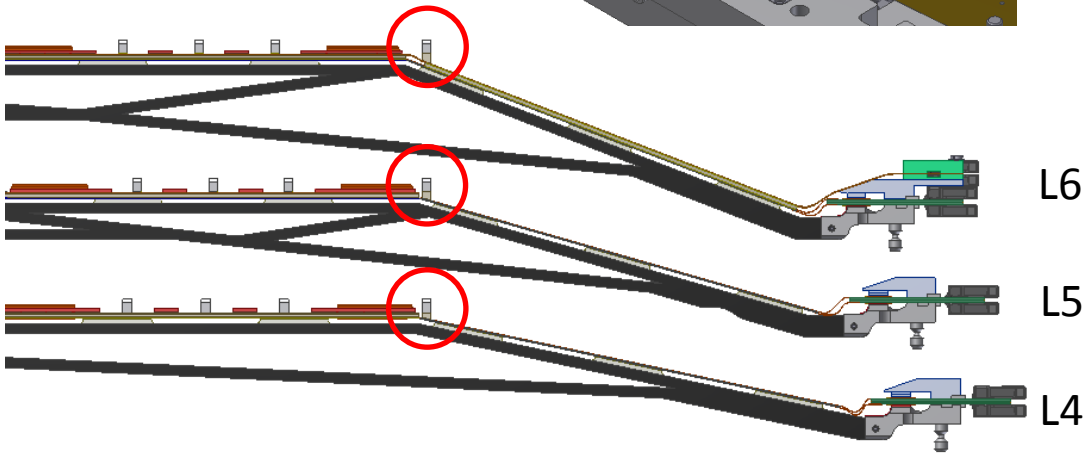
→ See backup

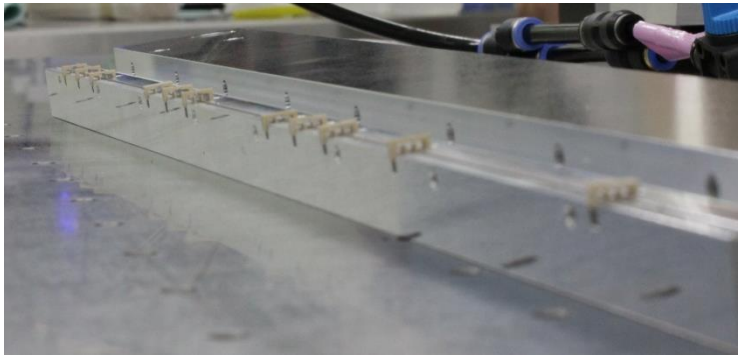
CO2-clip-jig

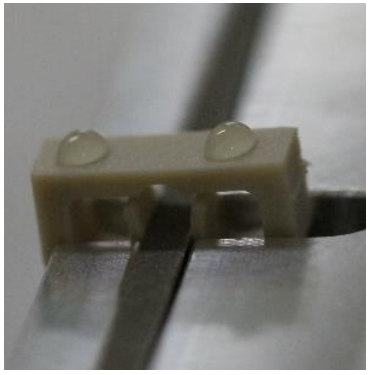
- Originally designed by Florian and ported to L6 case.
- FW CO2 clip is added in rev2.1 and should be taken into account.

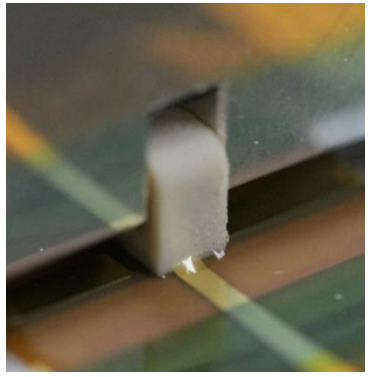
→ After the gluing BW/FW and Origami ?

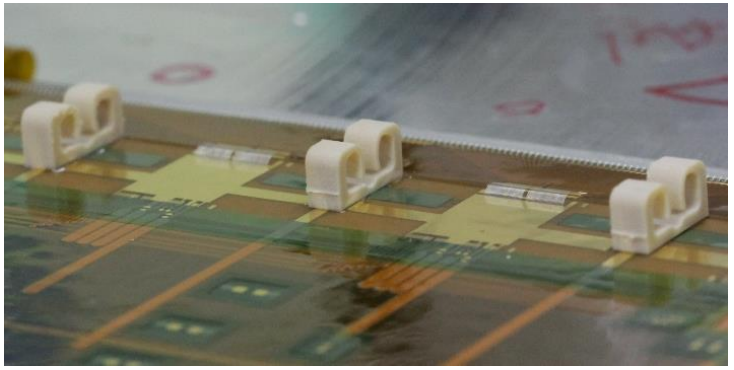












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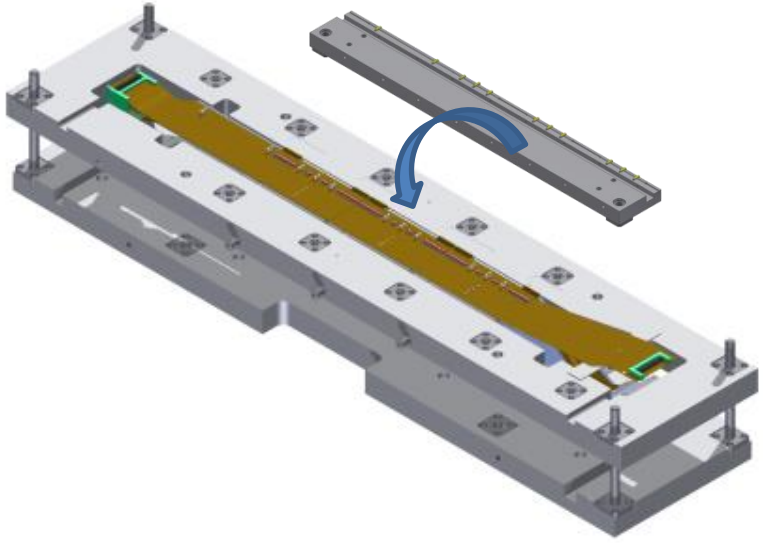
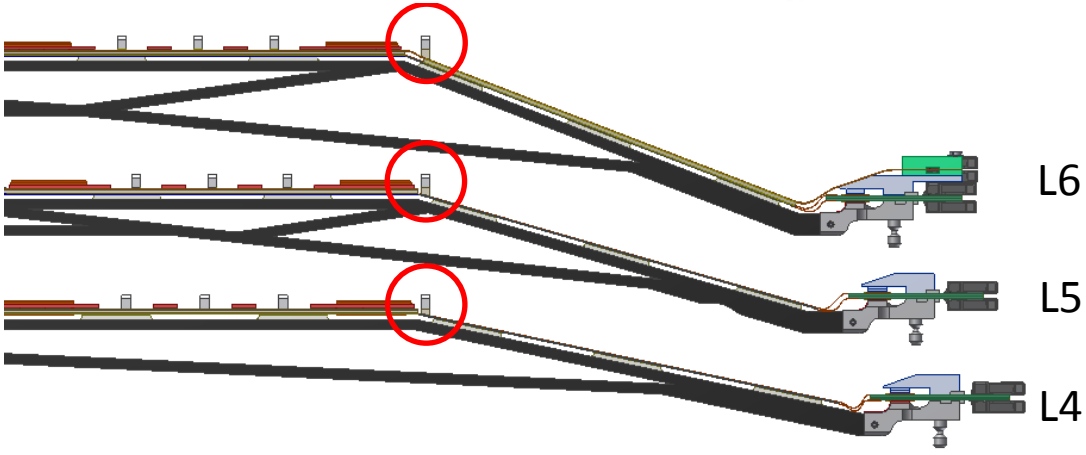
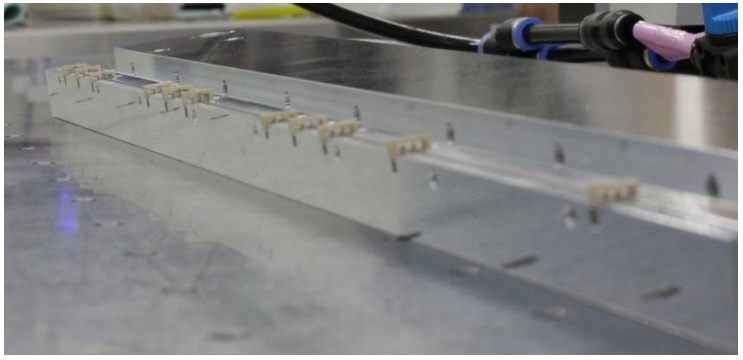
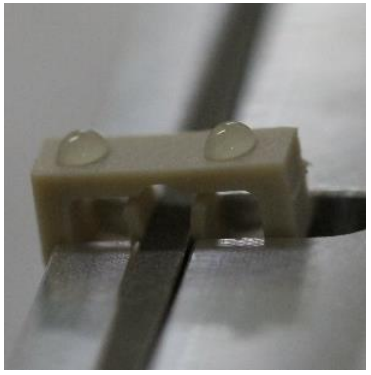
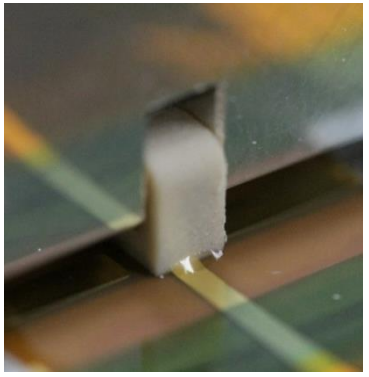
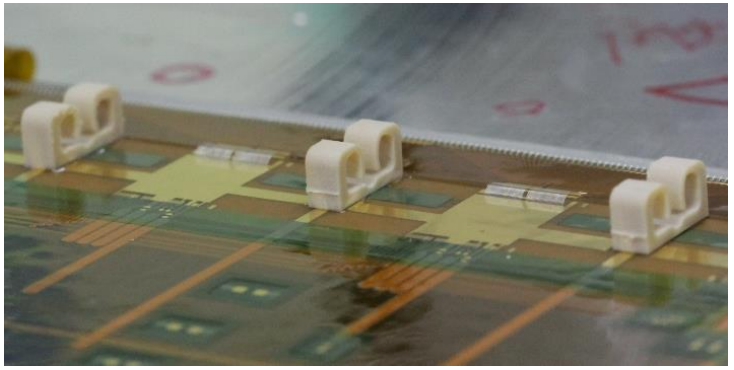












Integration FW/BW module into ladder

Precise 2D CAD designs of FW/BW module are released by HEPHY(Thanks)

https://belle2.cc.kek.jp/svn/groups/vxd_mechanics/svd/pitch_adapters/hybrid+pa_drawings/

What is the next ?

- CAD design of the FW/BW module
  - Above 2D CAD information(xy) + target thickness information(z)
  - Meet agreements with Filippo at last B2GM
    - Inspection of the modules on the MPC with CMM before shipping
    - Z-side up in MPC
    - the position in the z coordinate of the Hybrid on the MPC is set at 345um over the level of the sensor.
    - Is that all interface information ? anything else ?
  - Above included 3D CAD model is very useful for each ladder assembly institute.
- CAD design of the MPC
  - 3D CAD model and 2D production drawings of MPC w/ tolerance
    →Useful for checking interface between MPC and Assembly-bench.
- CAD design of the FW/BW module on the MPC.
  - Useful information for inspection with CMM by each assembly institute.
- Inspection before/after shipping for traceability of what happen in the shipping.
  - Electrical. What property ?
  - Mechanical . What position from what reference ?
- Transportation and integration test w/ mockup FW/BW module on the MPC.

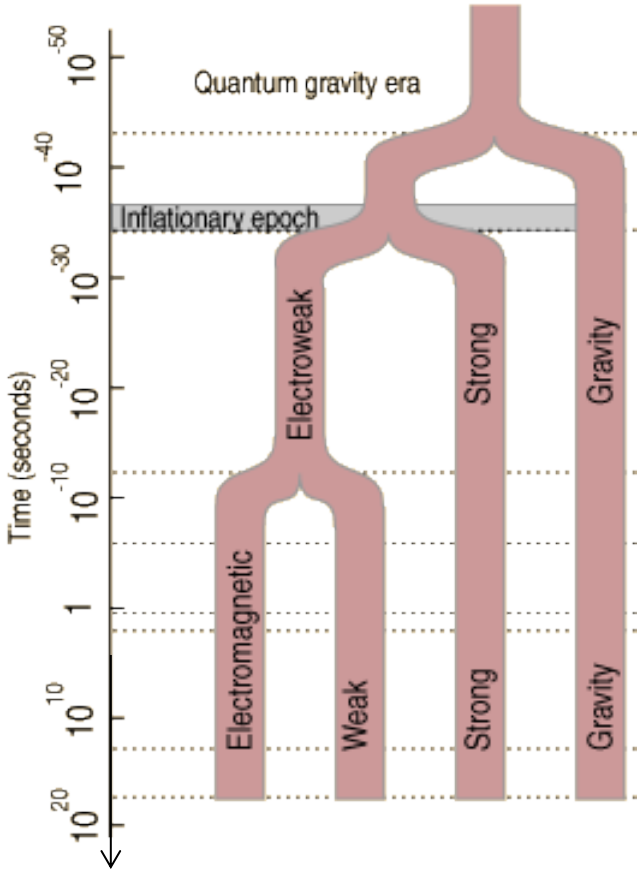
Let's discuss !

Open issues?

- Ladder assembly procedure is just a “theory”.
- We need a lot of assembly “experiment” with dummy/actual components for verification of the procedure.

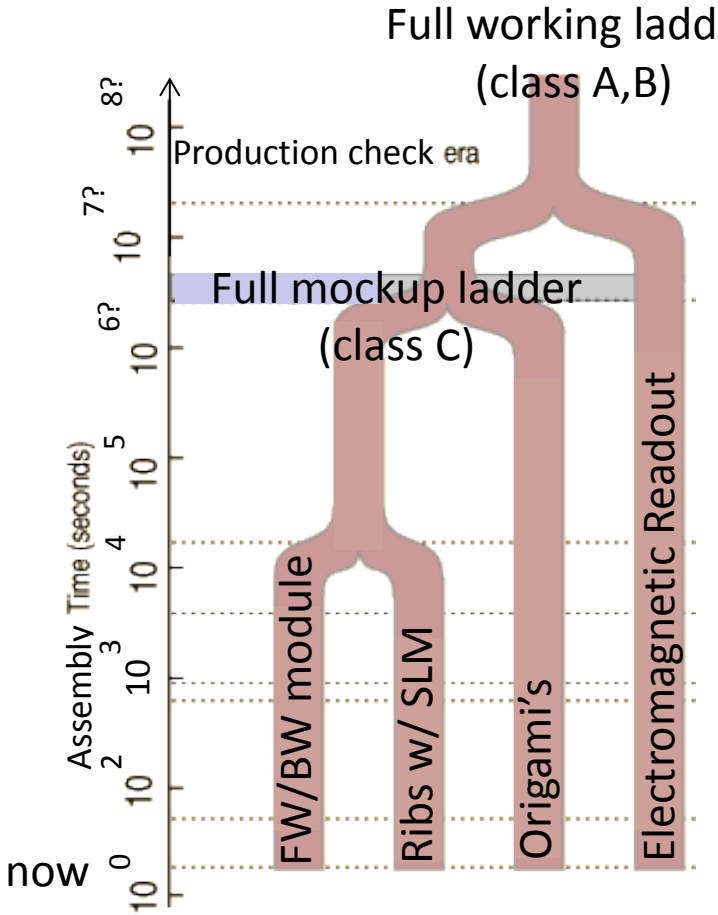
Grand Unification Theory

Theory Of Everything



←Should be checked with experiment and be understood everything.

Grand Unification Theory Of Assembly



←Should be checked with experiment
and be understood everything(of our detector).

Open issues?

- Ladder assembly procedure is just a “theory”.
- We need a lot of “assembly experiment” with dummy/actual components for verification of the procedure.
- We can learn a lot of things (including unexpected one) through the assembly and after the assembly.
  - Welcome to be replaced by more safe and realistic way if you found.
  - Assembled ladder/module can be used for debugging of
    - Electronics → PA0 crack was identified by EQA. Anything else ?
    - Mechanics → Thermal cycling(acceleration) test, cooling, mounting etc.
  - Feedbacks so far.
    - Revised ribs in rev1.0 → rev2.0 feedback from cryogenic test by HEPHY
    - Saving production time by separate FW/BW assembly verified by Pisa group.
    - Length of Origami±z,ce by L6 group and so on.

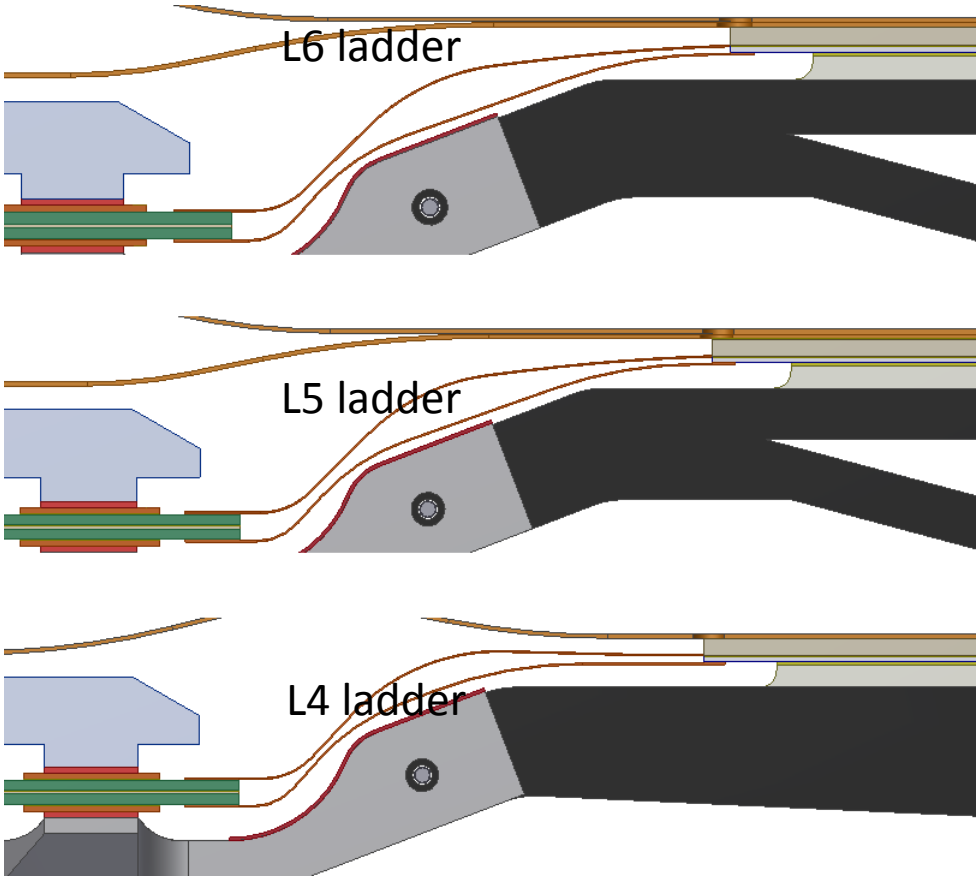
Anything else ? Is that all ?

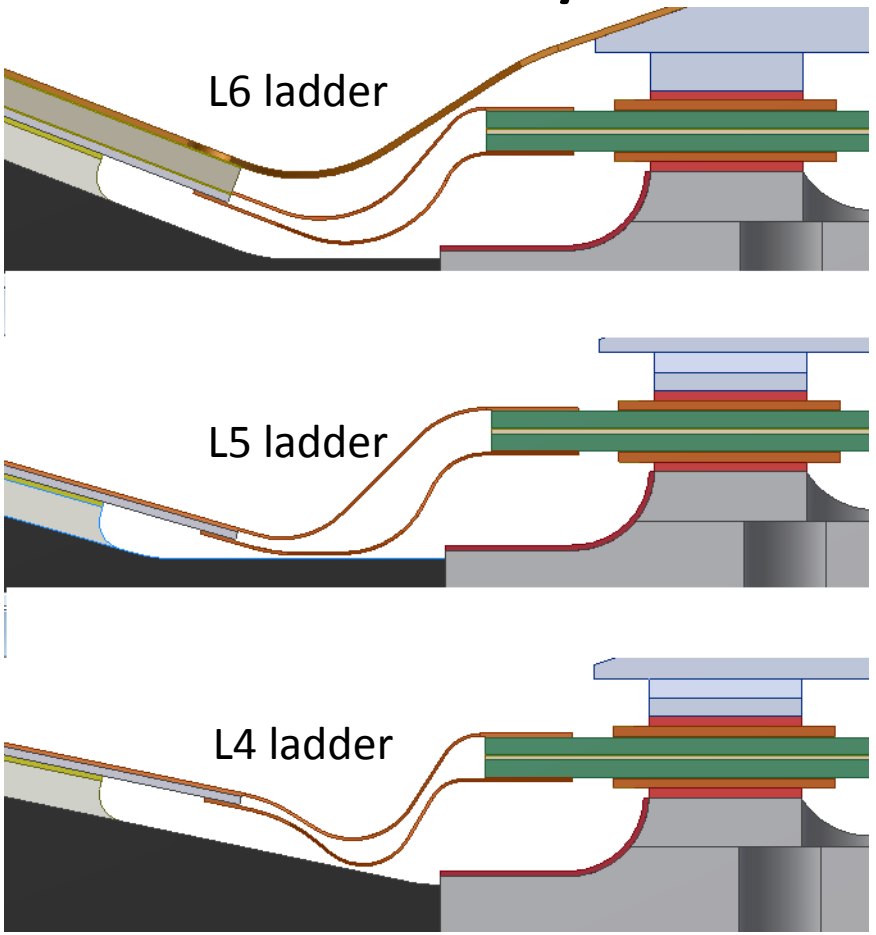
Next, I’ll list up open issues I can rise up.

Mechanical items can be checked w/ full ladder

- Long term stability
  - Gluing between PF(B) and DSSD(narrowest gluing area 1.3mm)
- Thermal cycling
  - Static
  - DAQ running w/o cooling
  - DAQ running w/ cooling (Temperatures in each component should be measured)
- SLM fine turning
  - Optimization of sliding force in appropriate temperature range. Different force in each layer ?
- Deformation
  - Thermal expansion (can be simultaneously measured in thermal cycling)
  - Gravity sag in ladder
    - How big ?
    - Can be parameterized at ladder in each layer ?
    - Can be used initial alignment constant ?
  - DSSD
    - How big ?
    - Can be parameterized at ladder in each layer ?
    - Can be used initial alignment constant ?
  - by cable stress
    - How big ?
    - How to avoid ?
- Handling and transportation
  - Container
  - Handling tool
  - Static charge
  - Safer transportation from each institute to KEK (Need monitoring sensor?)

Tension/Stress on the bended PF/PB





- Narrowest gluing area in PF1/PB1 ~1.3mm.
  c.f. PA wrapping. The width ~2.0mm. Bending radius ~2mm. Passed thermal cycle test@HEPHY
- We met pealing of PF1 in the mockup FW module assembled by L6 group.
- Should thermal cycling(acceleration) test of final full ladder at least.
- Necessary reinforcement connecting between PF1/PB1 and PF2/PB2 at inner-side with glue ?
  →See backup slide

Electrical items can be checked w/ full ladder

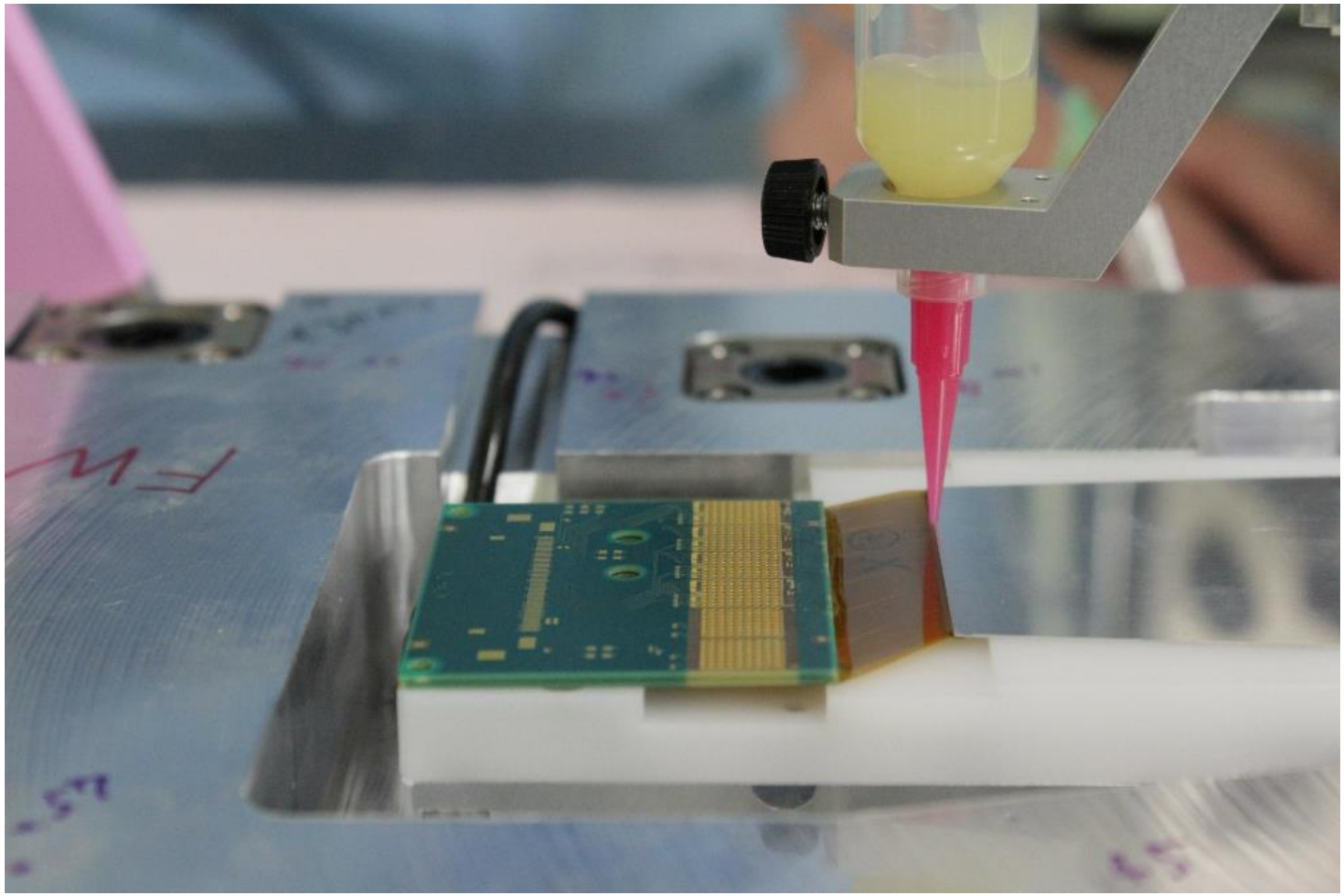
- Verification
  - Readout in Origami+z module
  - Readout in FW/BW module
  - Readout in full ladder(Origami's+FW/BW module)
    - Completion of electrical validation of ladder(adviced by BPAC)
- Burn-in, burn-out
- Laser test
  - Charge sharing
  - Noisy(bad) strip search
- Cryogenic test
  - Noise, leakage current, gain…
- Source/beam/cosmic test
  - S/N, detection eff., leakage current, gain, tracking… etc.

Summary

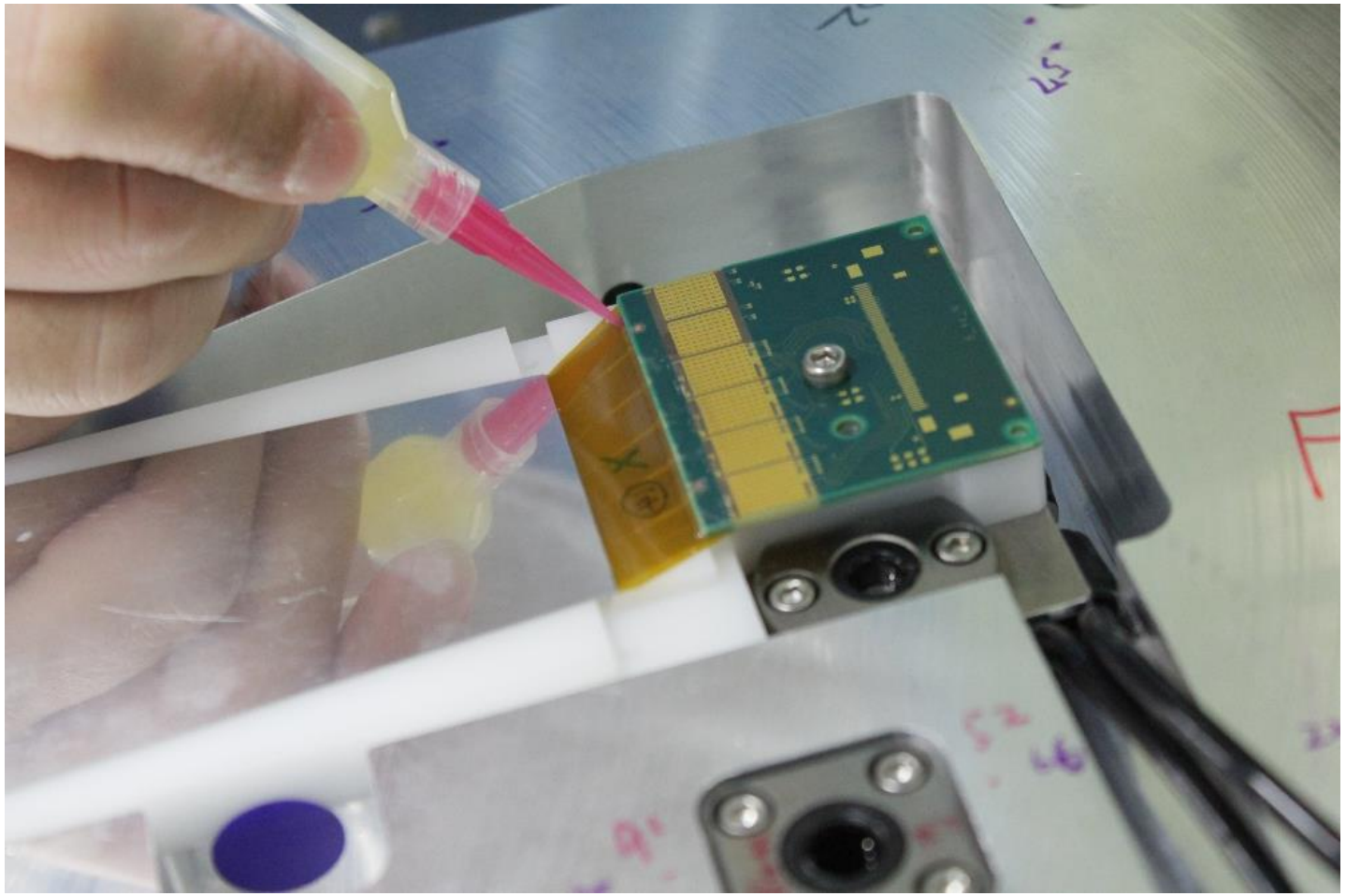
- Updates of ladder assembly procedure for rev2.1
  - PF2-jig and PB2-jig need milling.
  - FW CO2 clip
- Integration FW/BW module into ladder.
  - CAD drawings exchange
  - Inspection items before/after shipping
  - Trial integration w/ mockup FW/BW module on the MPC.
- Open issues?
  - PF/PB long term stability in ladder.
  - Origami+z and fully integrated ladder readability.
  - Is that all ? Unopen issue ?

backup

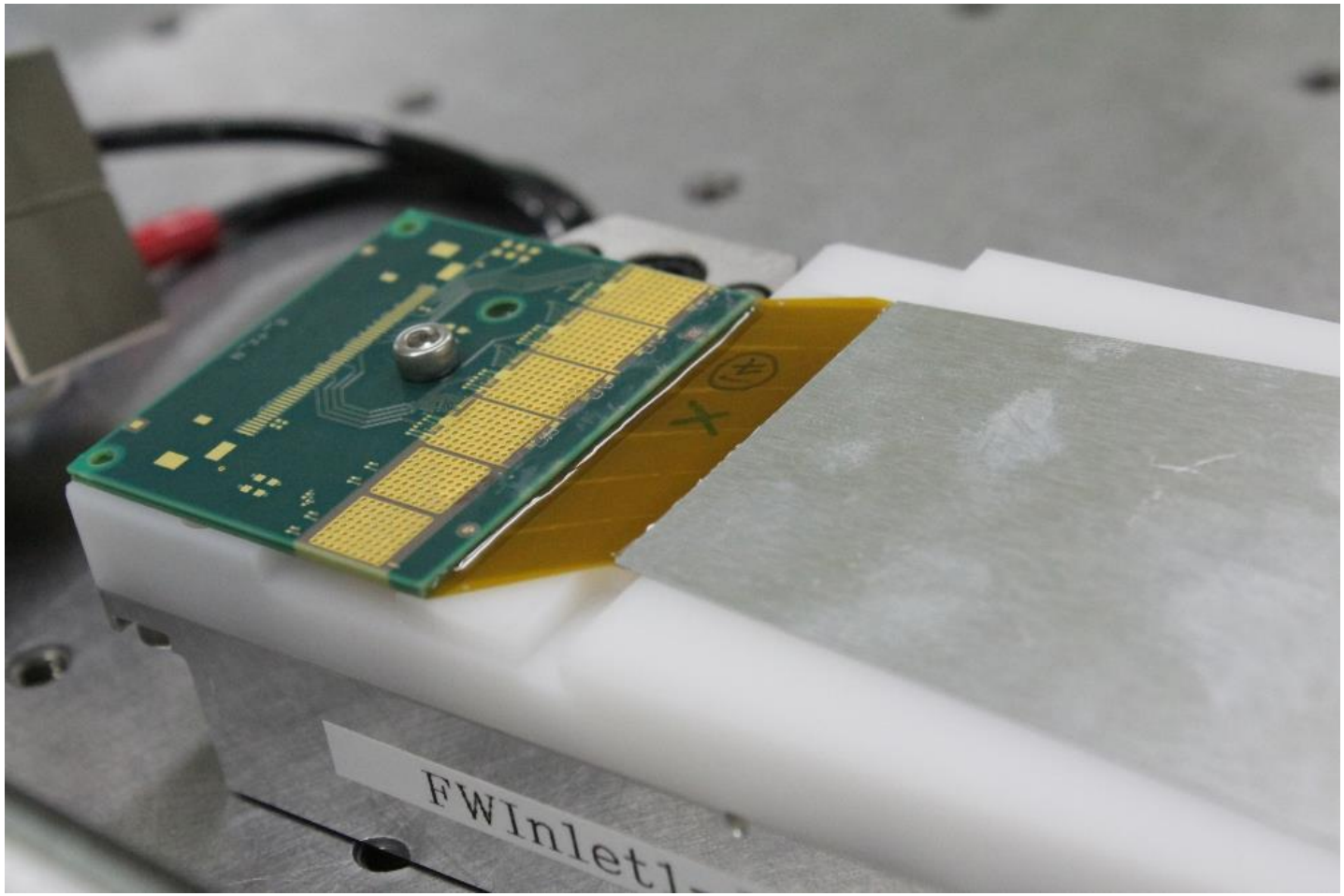
An idea of reinforcement(1)



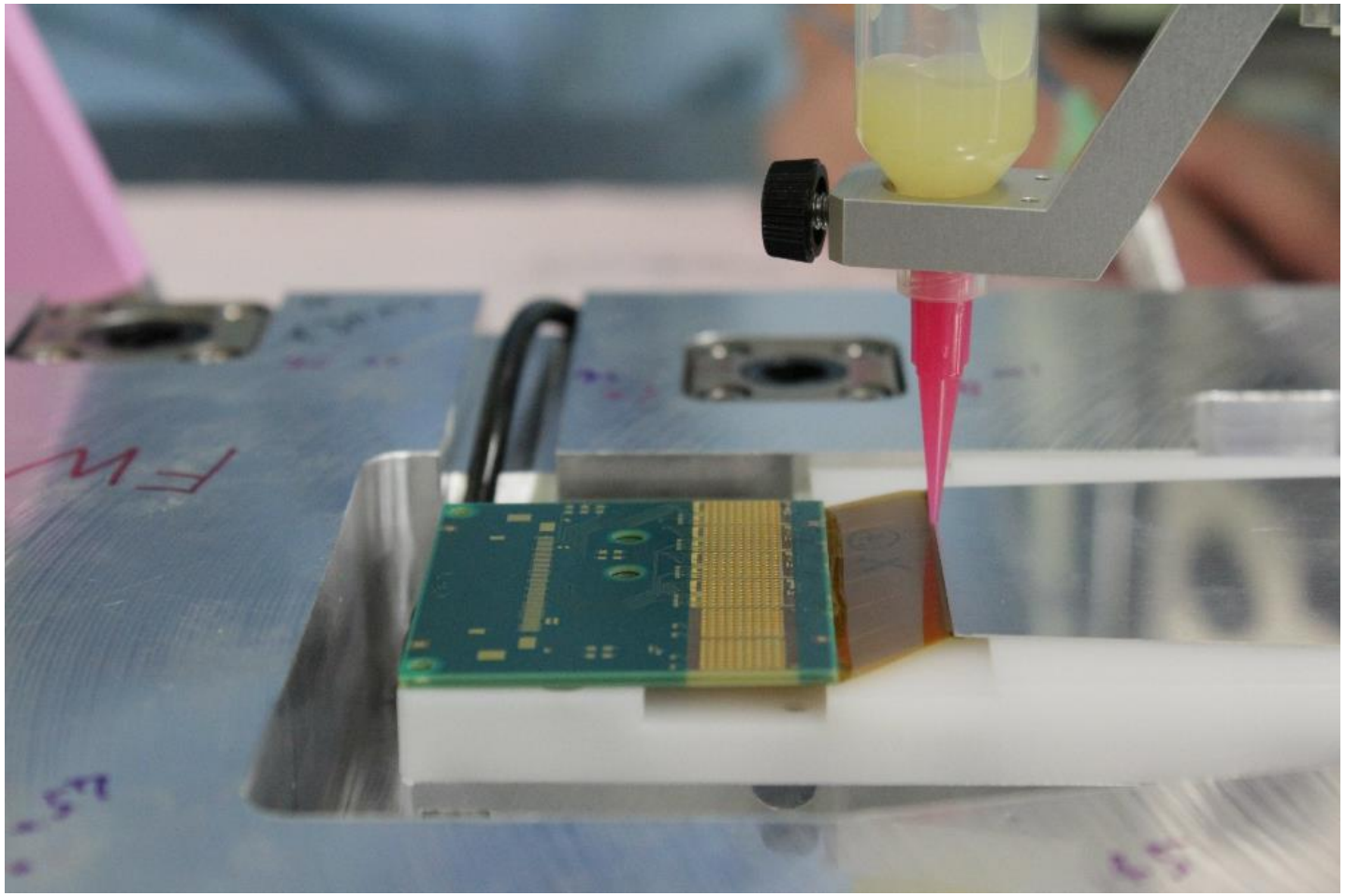
An idea of reinforcement(2)



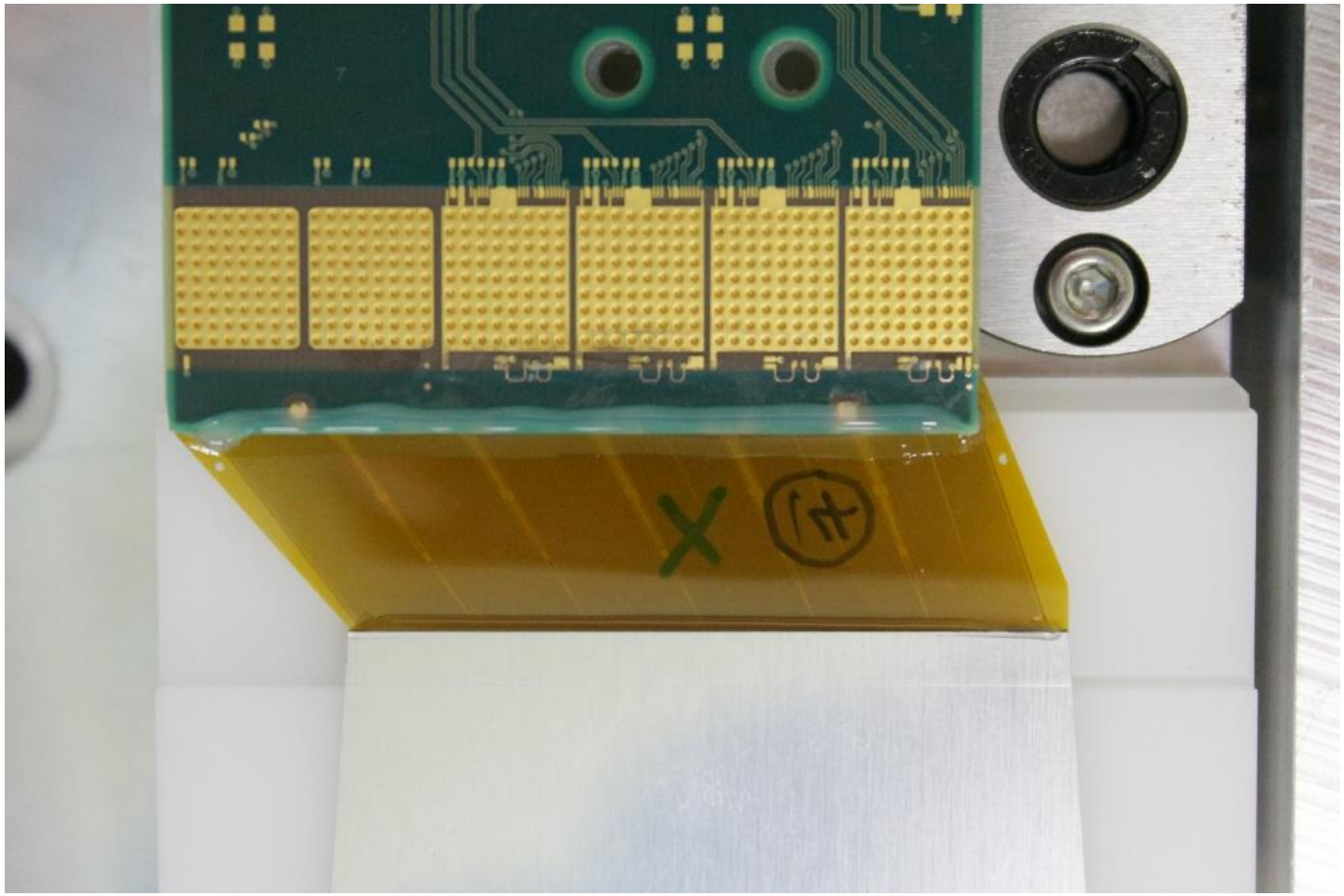
An idea of reinforcement(3)



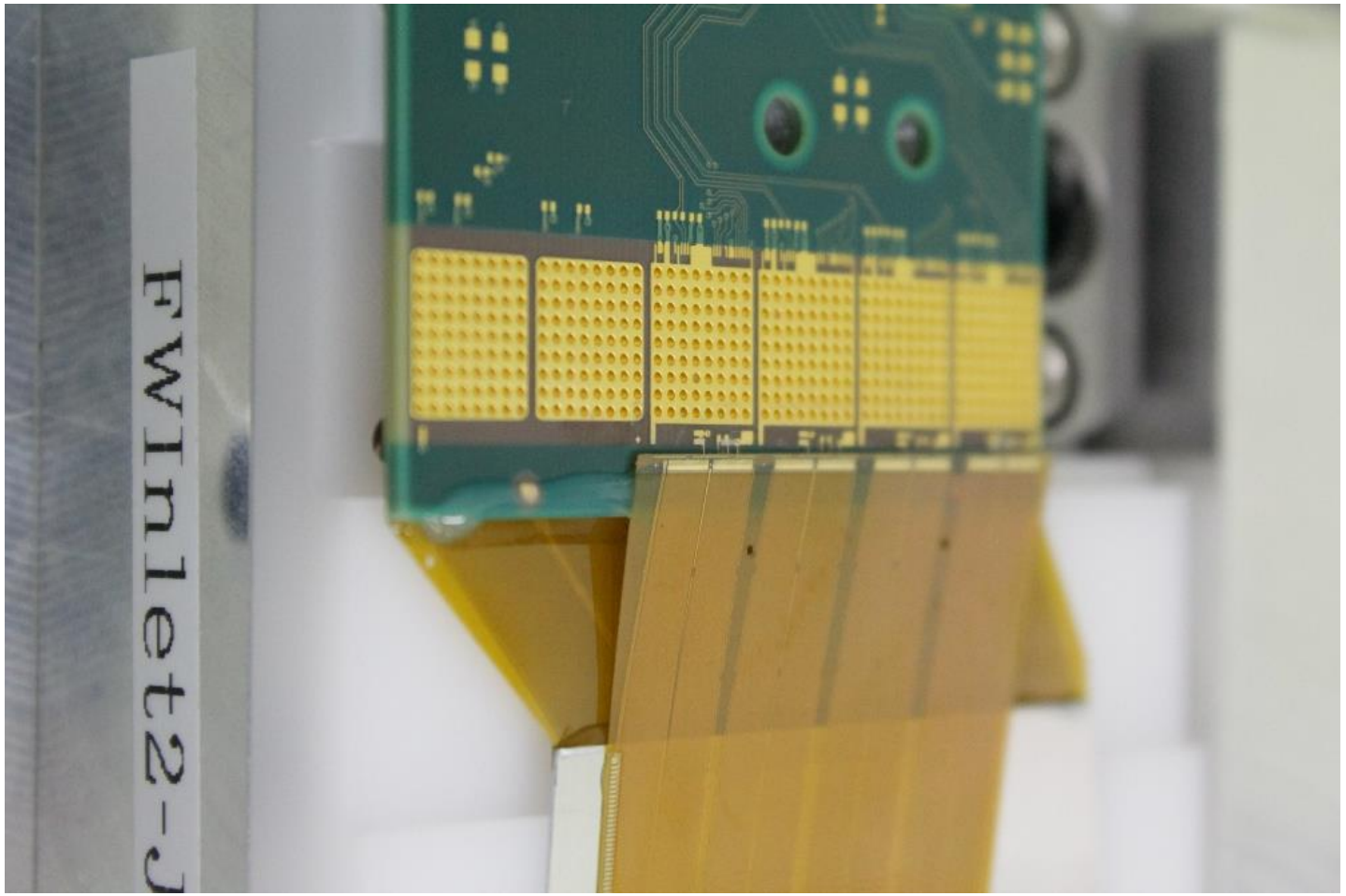
An idea of reinforcement(4)



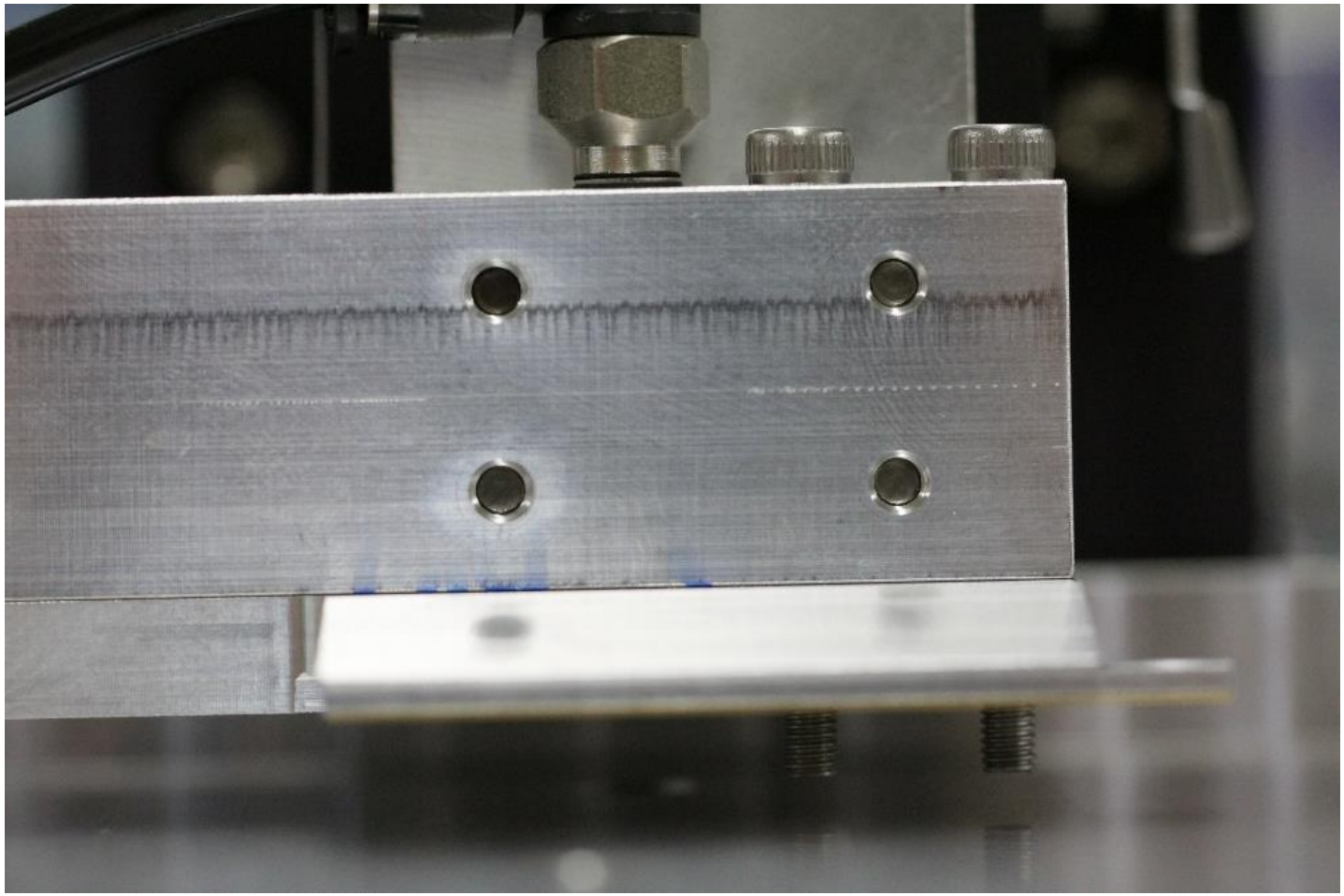
An idea of reinforcement(5)



An idea of reinforcement(6)



APV-cover-jig



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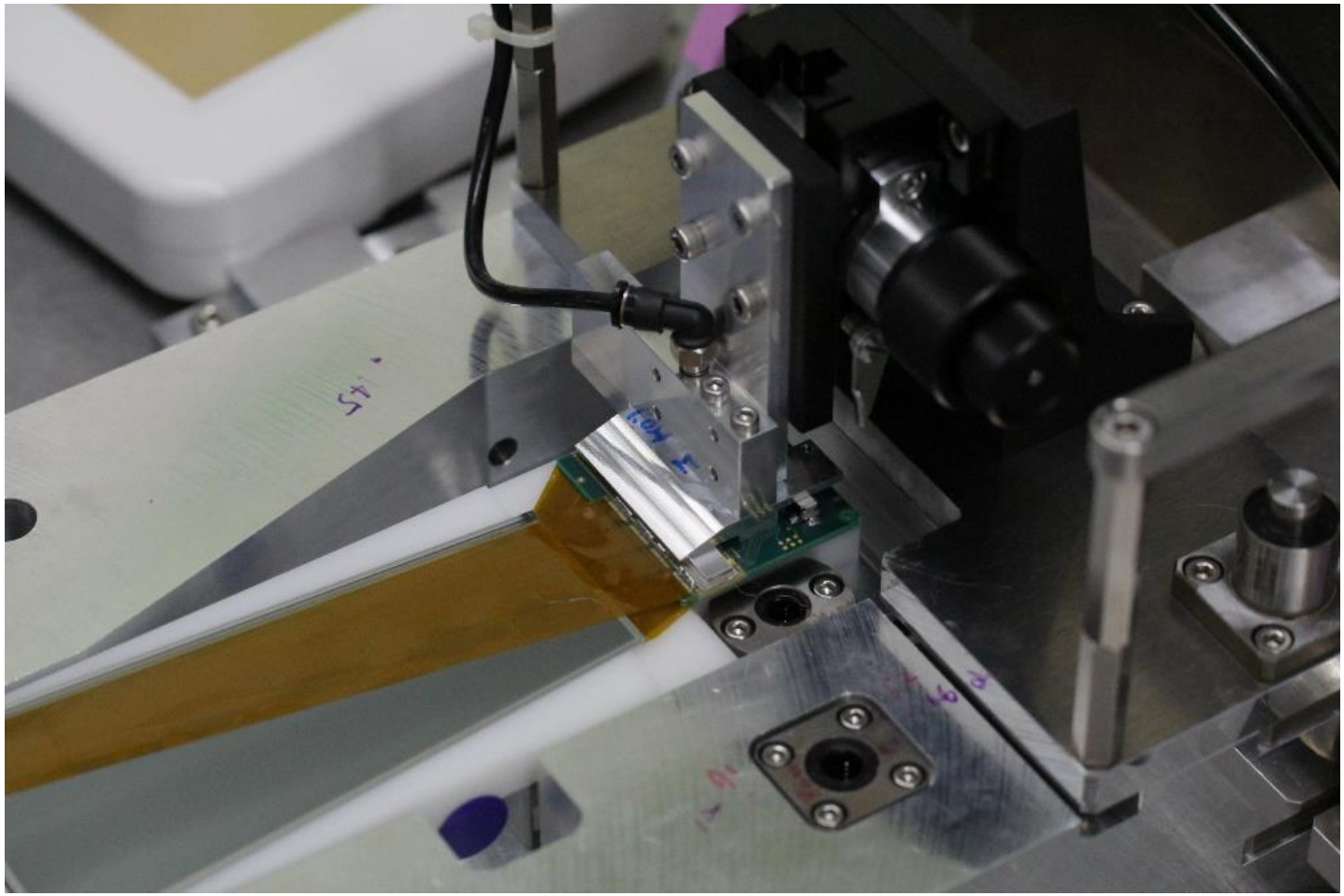

APV-cover-jig

APV cover