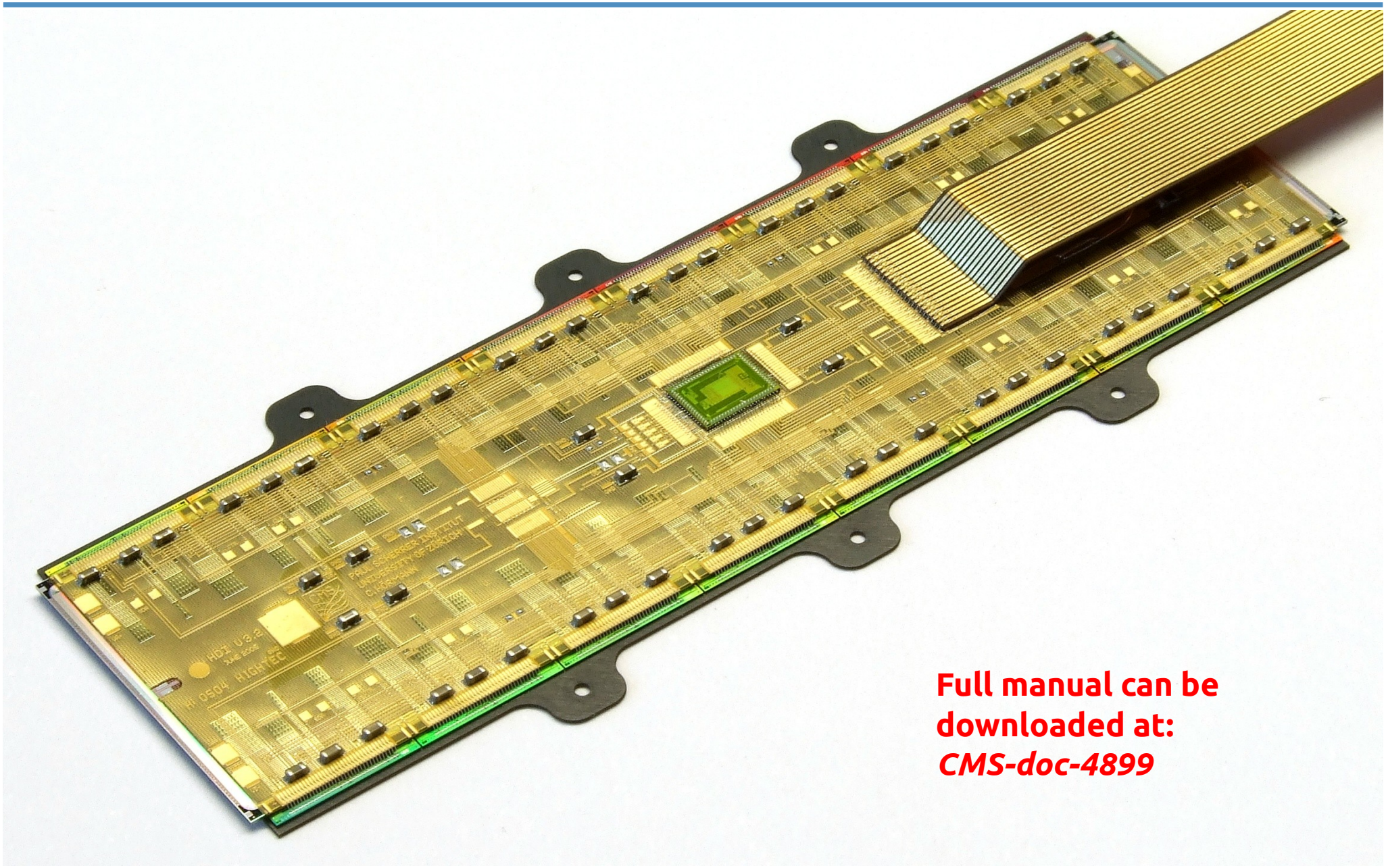
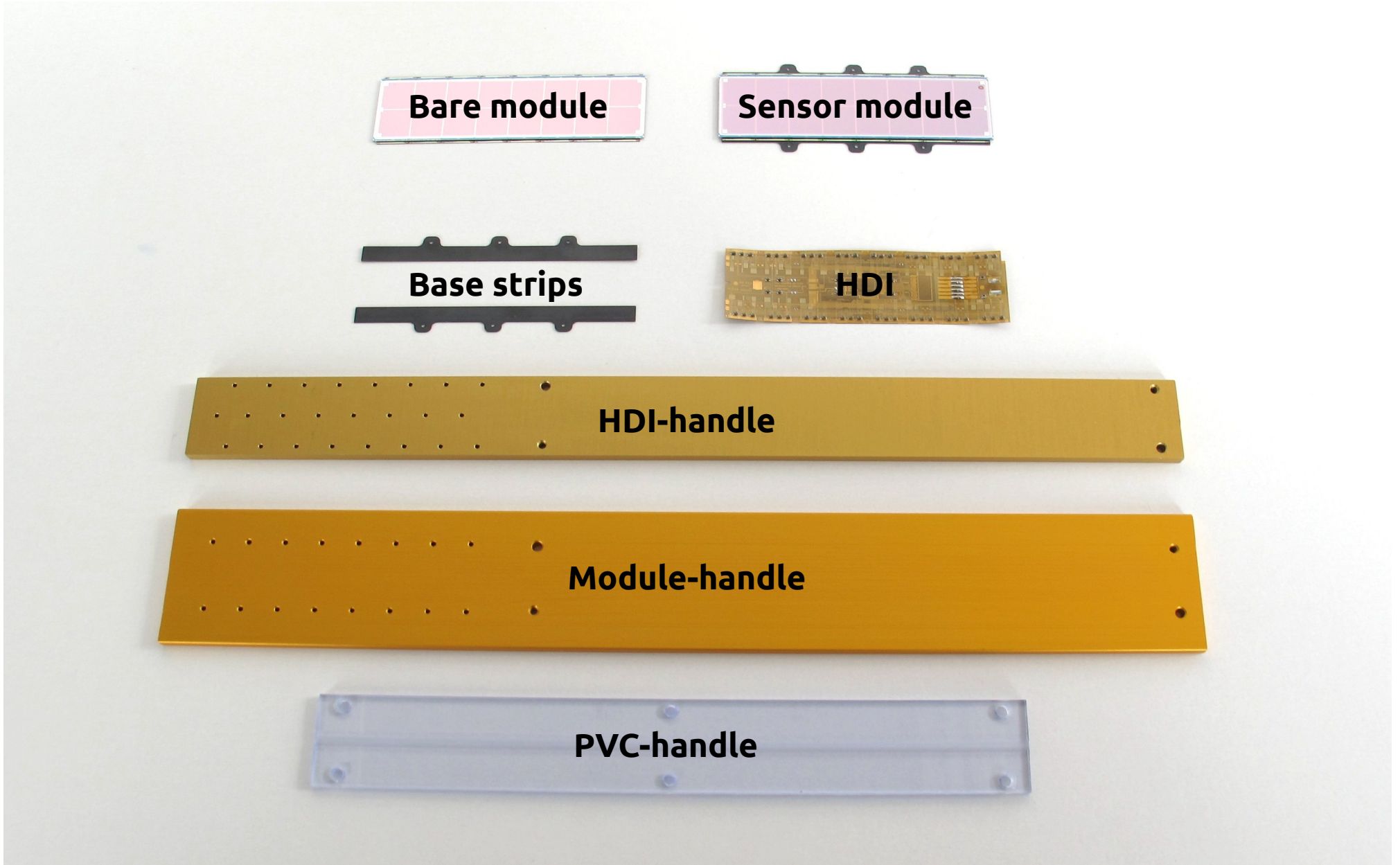
PAUL SCHERRER INSTITUT

BPIX Module Assembly



Full manual can be downloaded at:
CMS-doc-4899

BPIX module glossary



Overview of BPIX module production

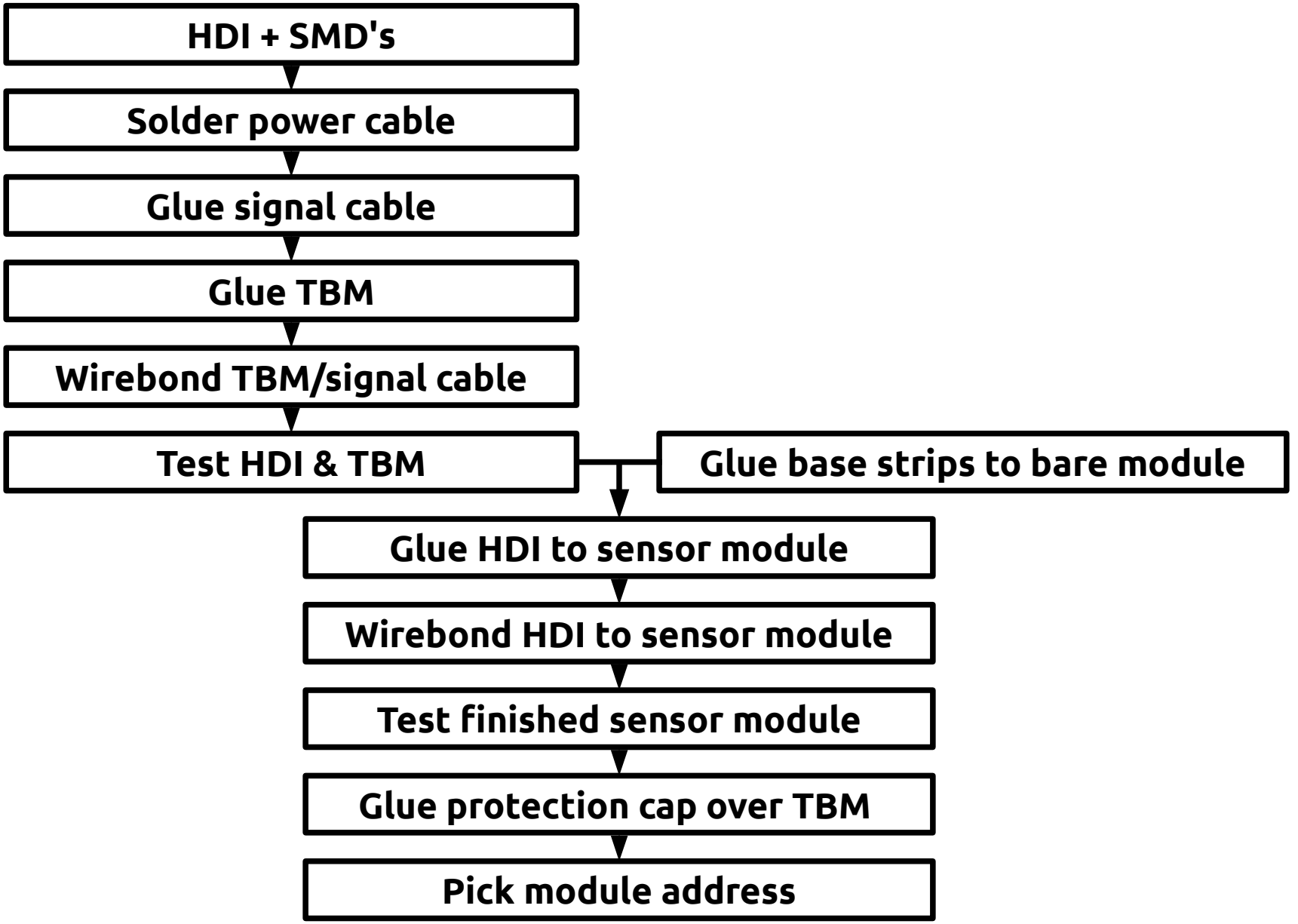
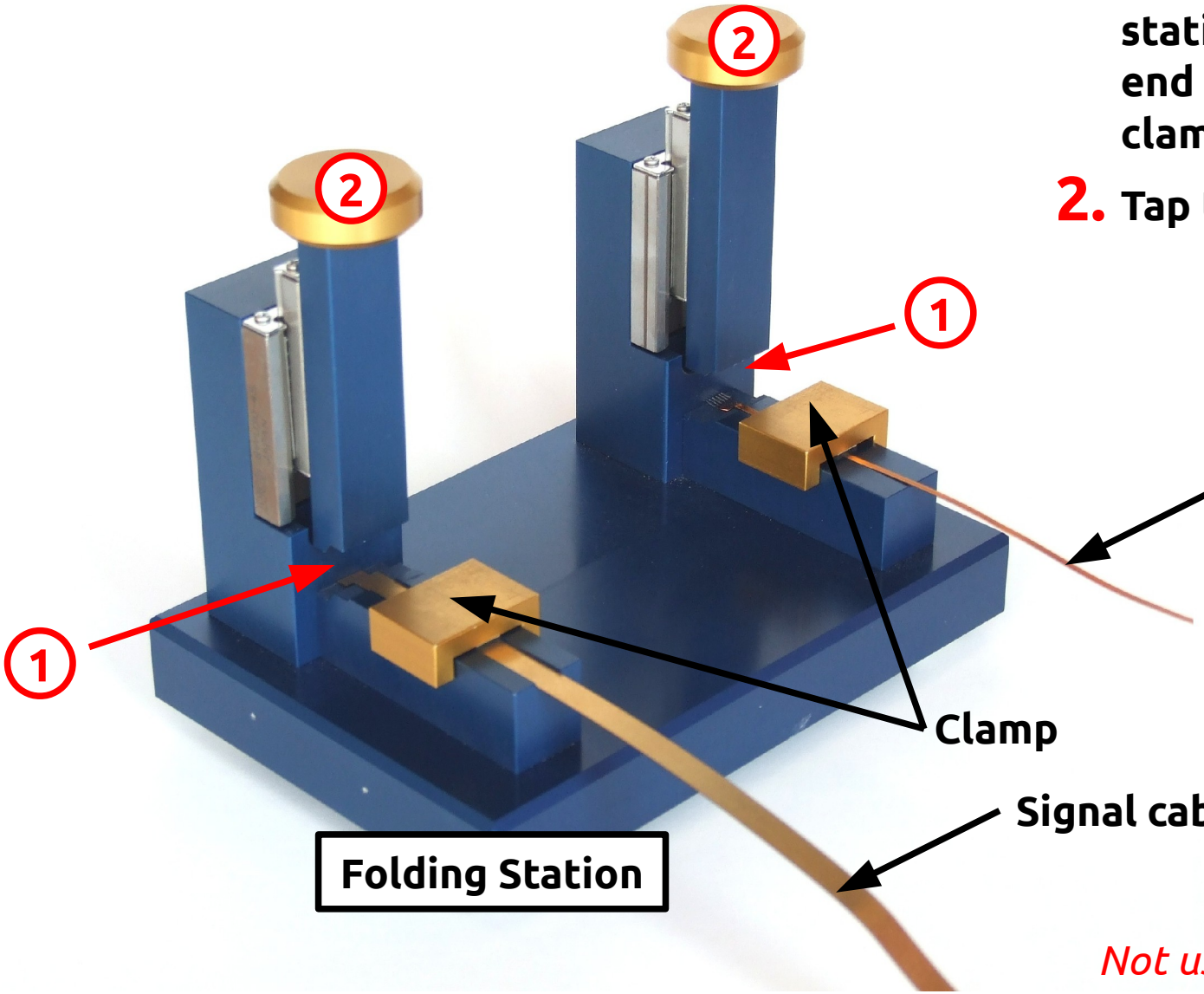


Table of contents

Folding of cables

1. Place cables in the “folding station” all the way to the end stop. Secure cables with clamp.
2. Tap the round knob once.



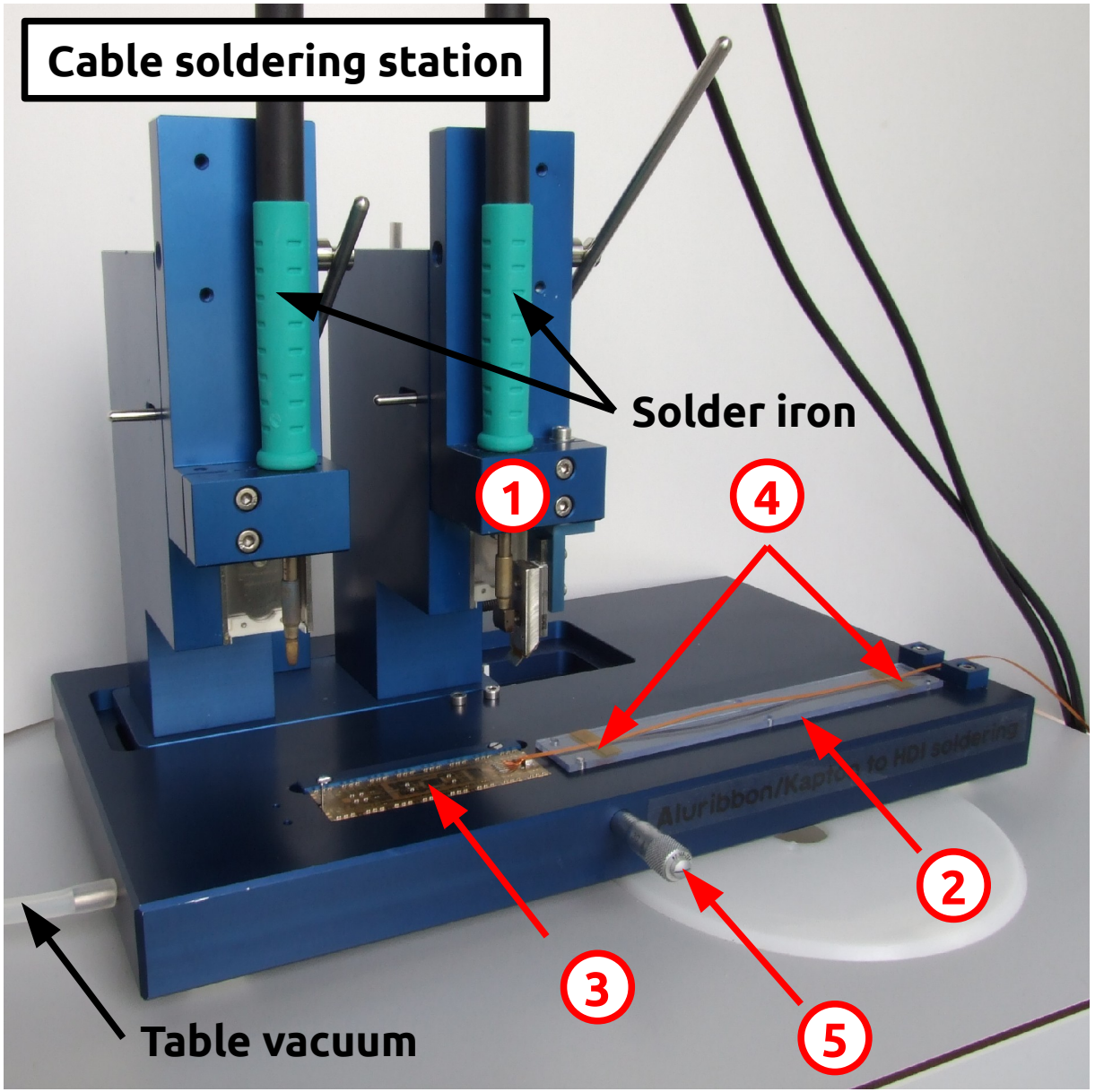
Not used for phase #1 upgrade

Necessary tools for power cable soldering

1. Flux remover
2. Ethanol (tool cleaning)
3. Flux
4. Nail varnish bottle with brush for applying flux
5. Kapton adhesive tape
6. Q-tip
7. Metal brush
8. Small tweezers

Not used for phase #1 upgrade

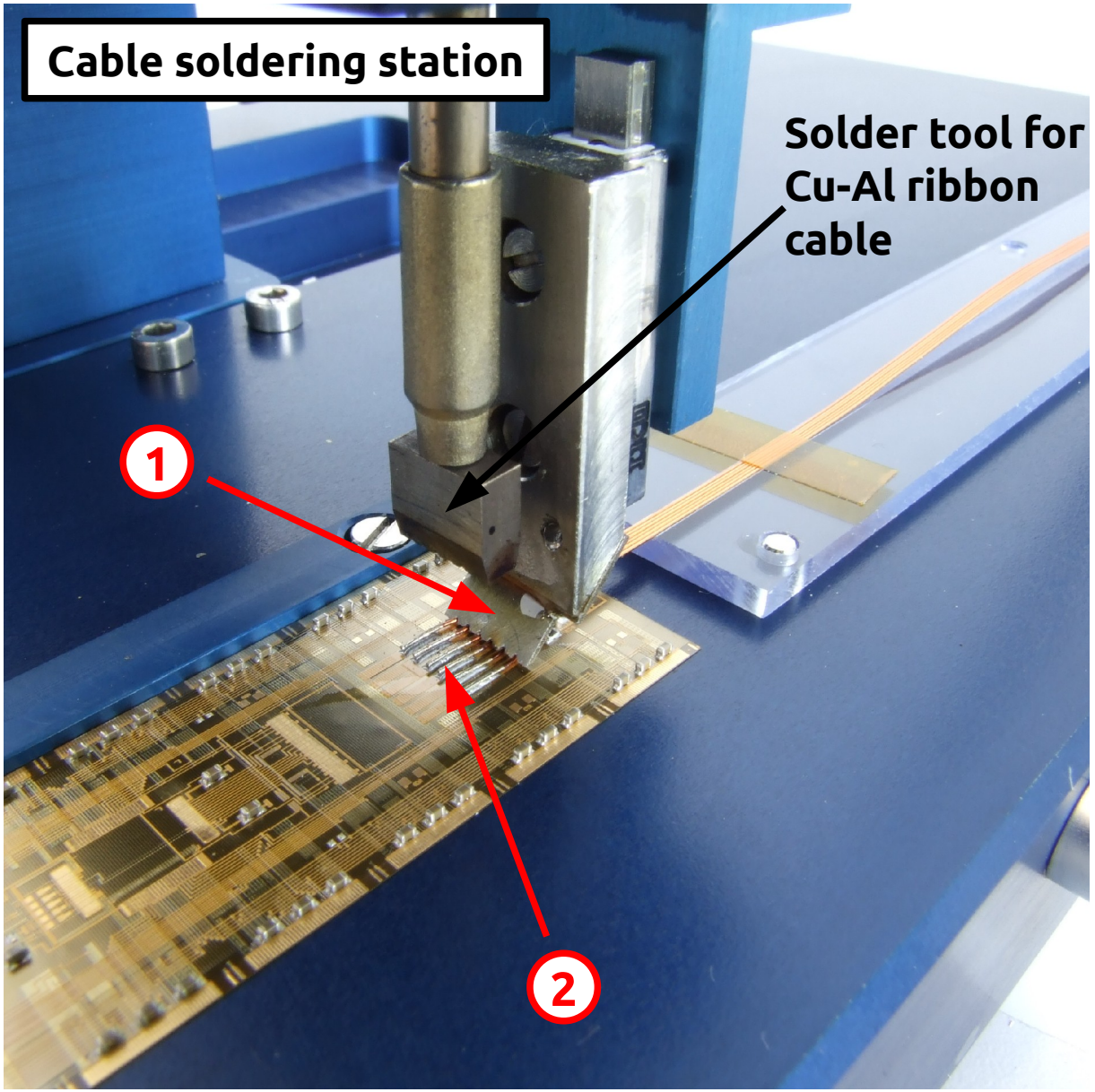
Soldering of Al-Cu power cable



1. Move soldering iron to Al-Cu ribbon cable soldering location.
2. Place PVC-handle on the two alignments pins.
3. Align HDI with the help of pin and upper bar.
   → Table vacuum ON.
4. Place Al-Cu power cable on PVC-handle. Align Al-Cu power cable coincident to solder pads on HDI. Use Kapton adhesive tape to fix power cable in place.
5. Use micrometer screw for alignment improving of Al-Cu power cable.

Not used for phase #1 upgrade

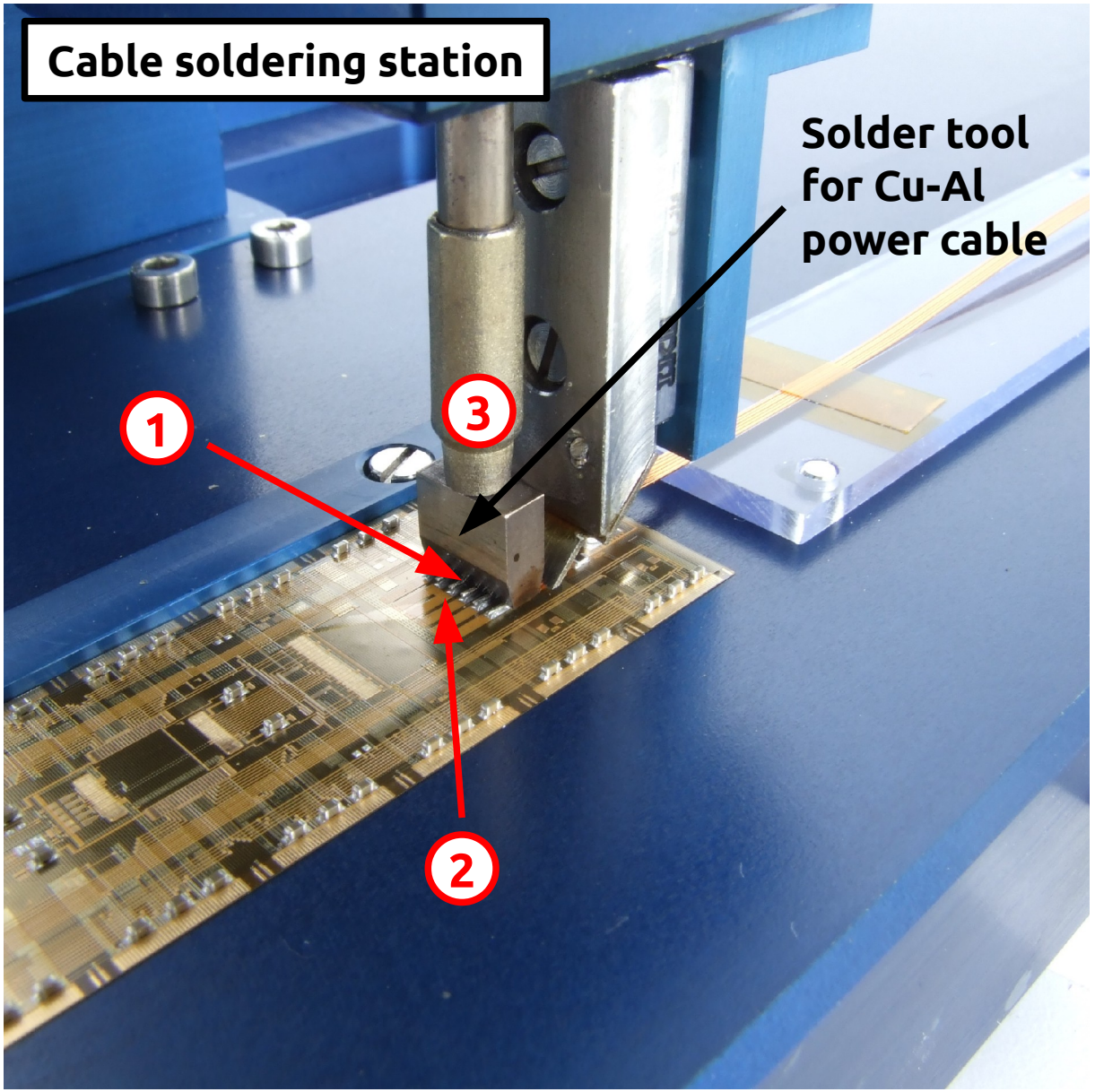
Soldering of Al-Cu power cable



1. Lower the Z-stage until “strands separator” contacts HDI. Hold lever on Z-stage to remain in this position.
2. Use small tweezers to align strands in the “strands separator” until they are coincident with solder pads on HDI.

Not used for phase #1 upgrade

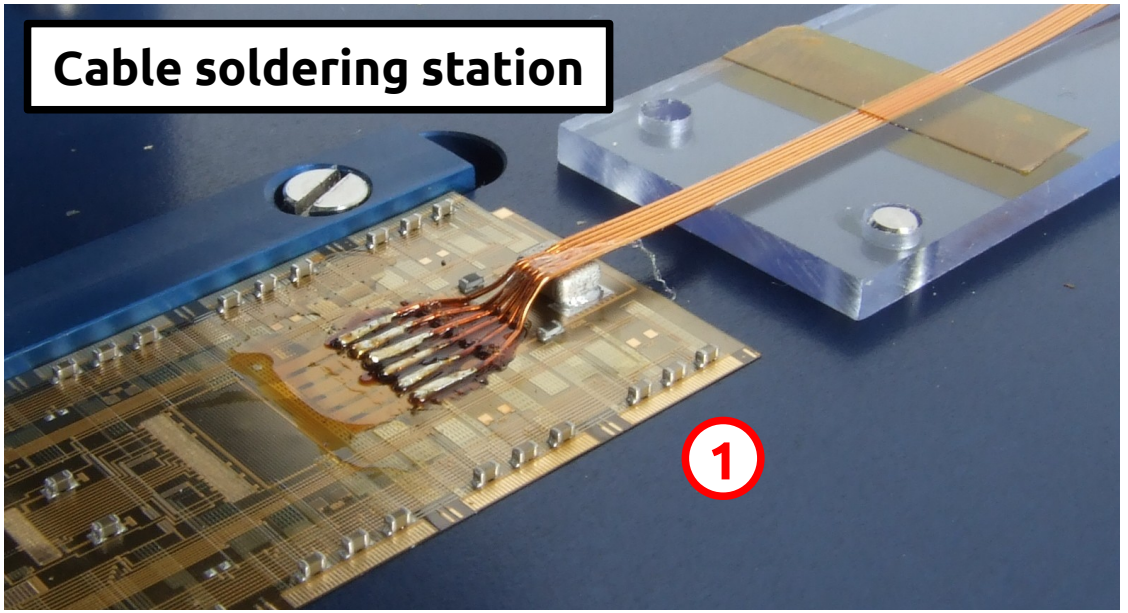
Soldering of Al-Cu power cable

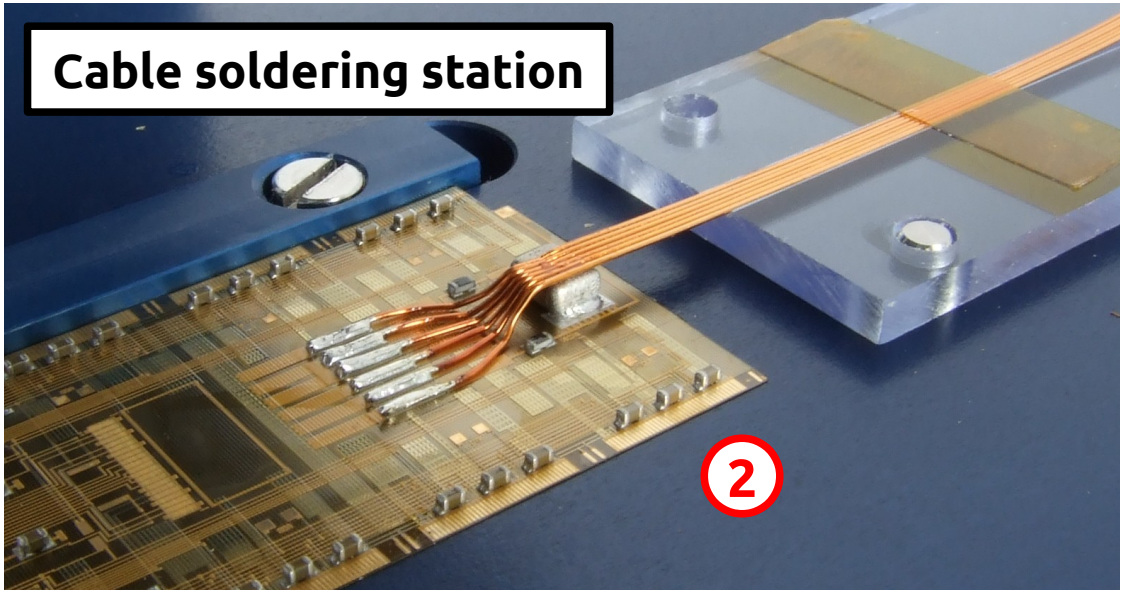


1. Lower the Z-stage fully, so that the solder tool makes contact with the strands. Check, whether all of the strands fits in the little grooves of the solder tool.
2. Now add flux in the solder tool area with the help of the brush from the nail varnish bottle.
3. Switch on the power from the soldering iron (350°C), and wait untill the soldering is done. Often it's necessary to add extra force (by hand) to the Z-stage for melting of the solder. Clean solder tool after every solder joint with metall brush.

Not used for phase #1 upgrade

Soldering of Al-Cu power cable

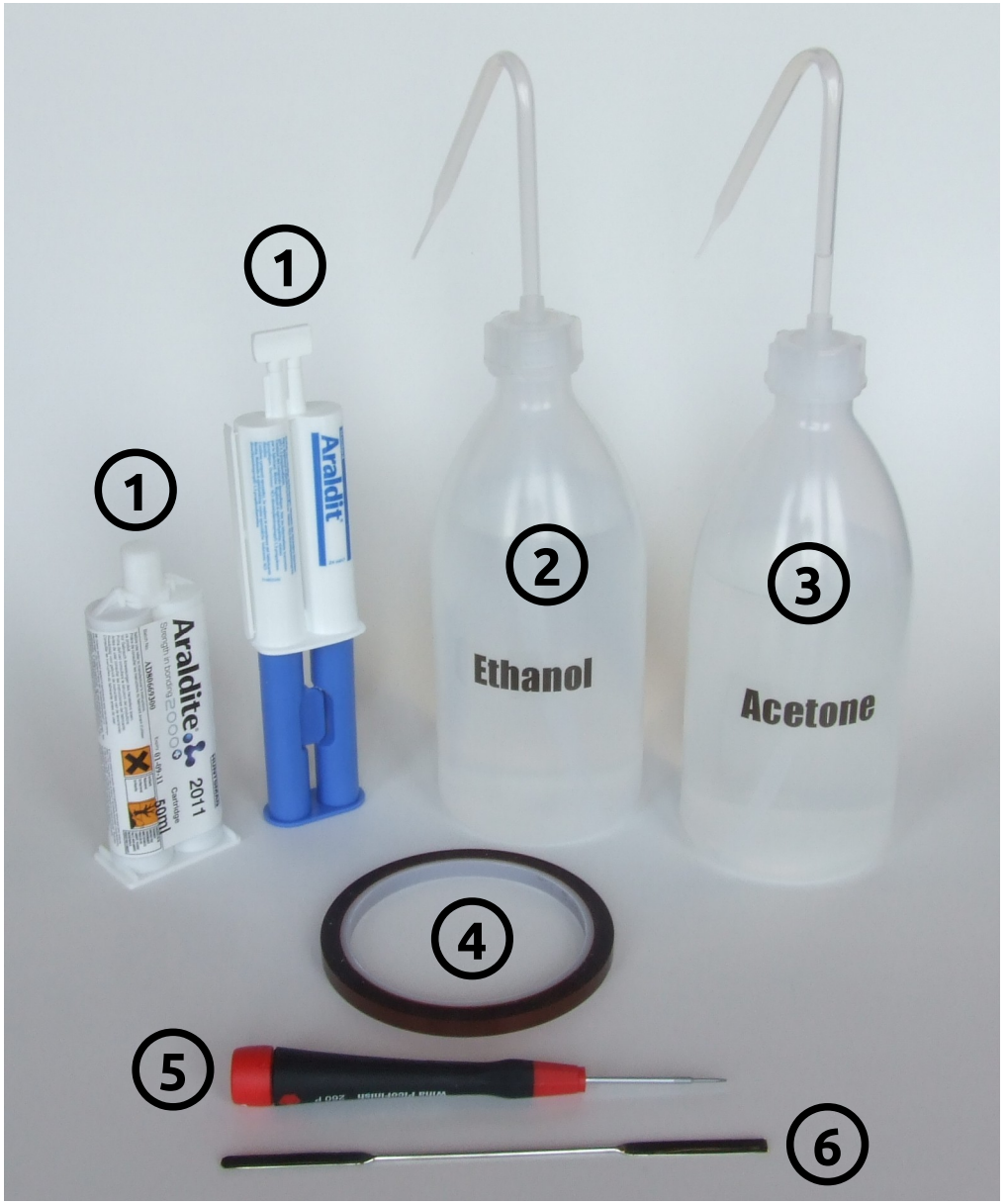




1. After soldering check whether all solder joints are correct. Sometimes re-soldering of some solder joints with a small hand soldering iron is required.
2. First clean the solder area with flux remover and Q-tip. Then do a second cleaning with ethanol and Q-tip. For a realiable wire bonding afterward, it's essential that there are no residues on all wire bonding pads. Always use clean flux remover, ethanol and Q-tips.

Not used for phase #1 upgrade

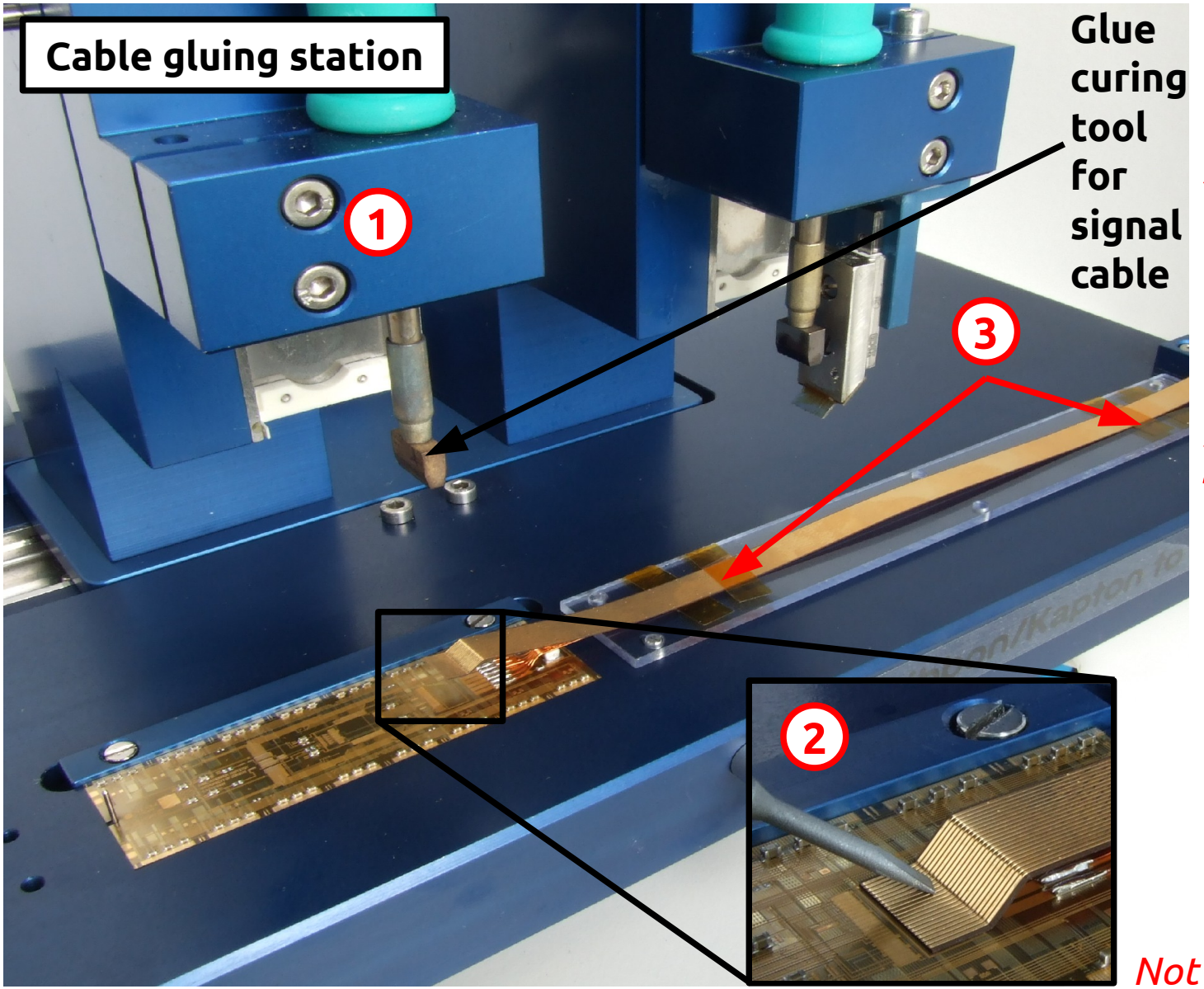
Necessary tools for Kapton signal cable gluing



1. Araldite 2011 (Huntsman) or Araldite Standard
2. Ethanol (tool cleaning)
3. Acetone (HDI – Kapton cable cleaning)
4. Kapton adhesive tape
5. Small screw driver
6. Stirring paddle (for Araldite mixing)

Not used for phase #1 upgrade

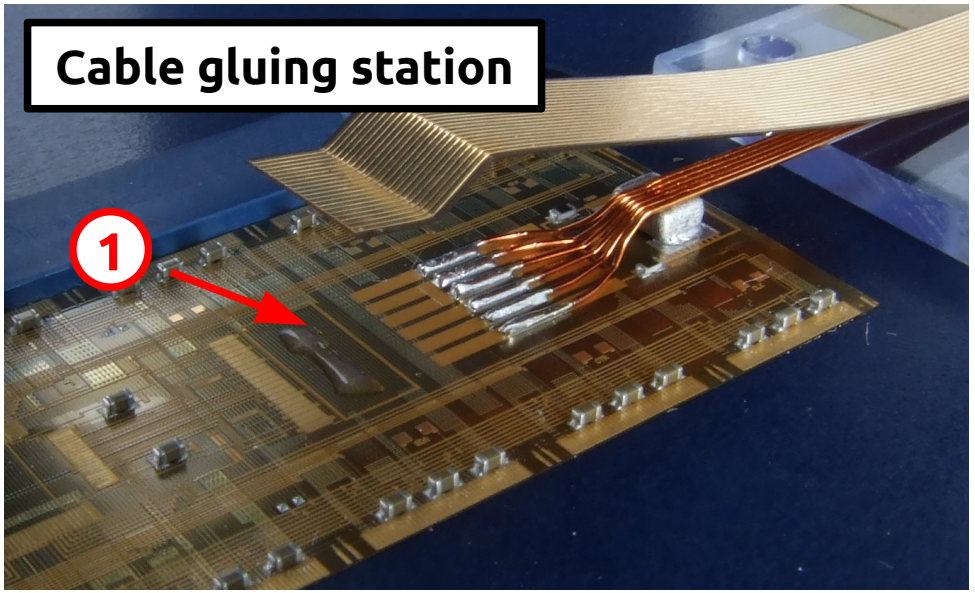
Gluing of signal cable

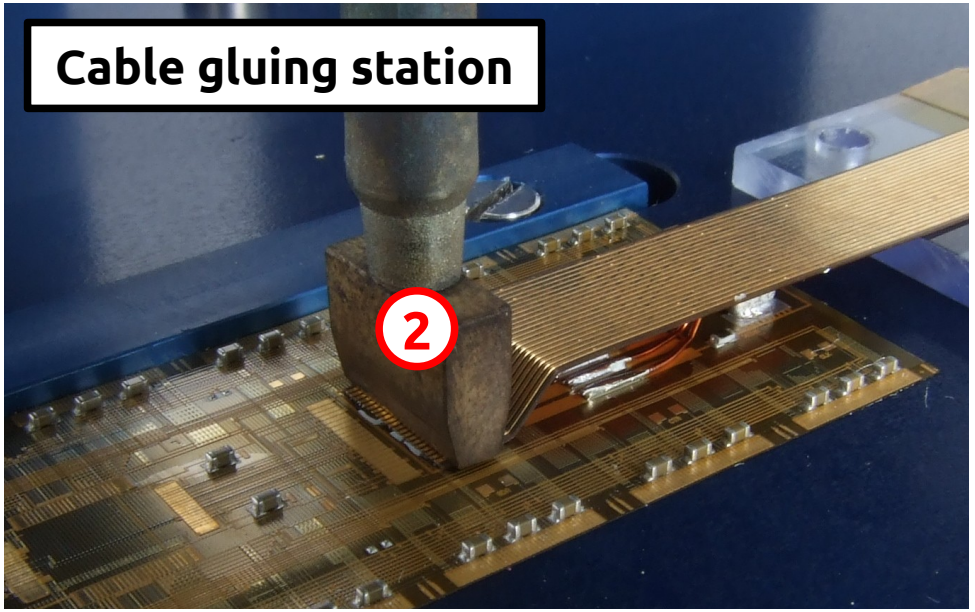


1. Move glue curing tool to gluing position.
2. Press signal cable with small screw driver down to its designed position (marked area).
3. Whilst pressing it down, use Kapton adhesive tape to fix signal cable in place.

Not used for phase #1 upgrade

Gluing of signal cable

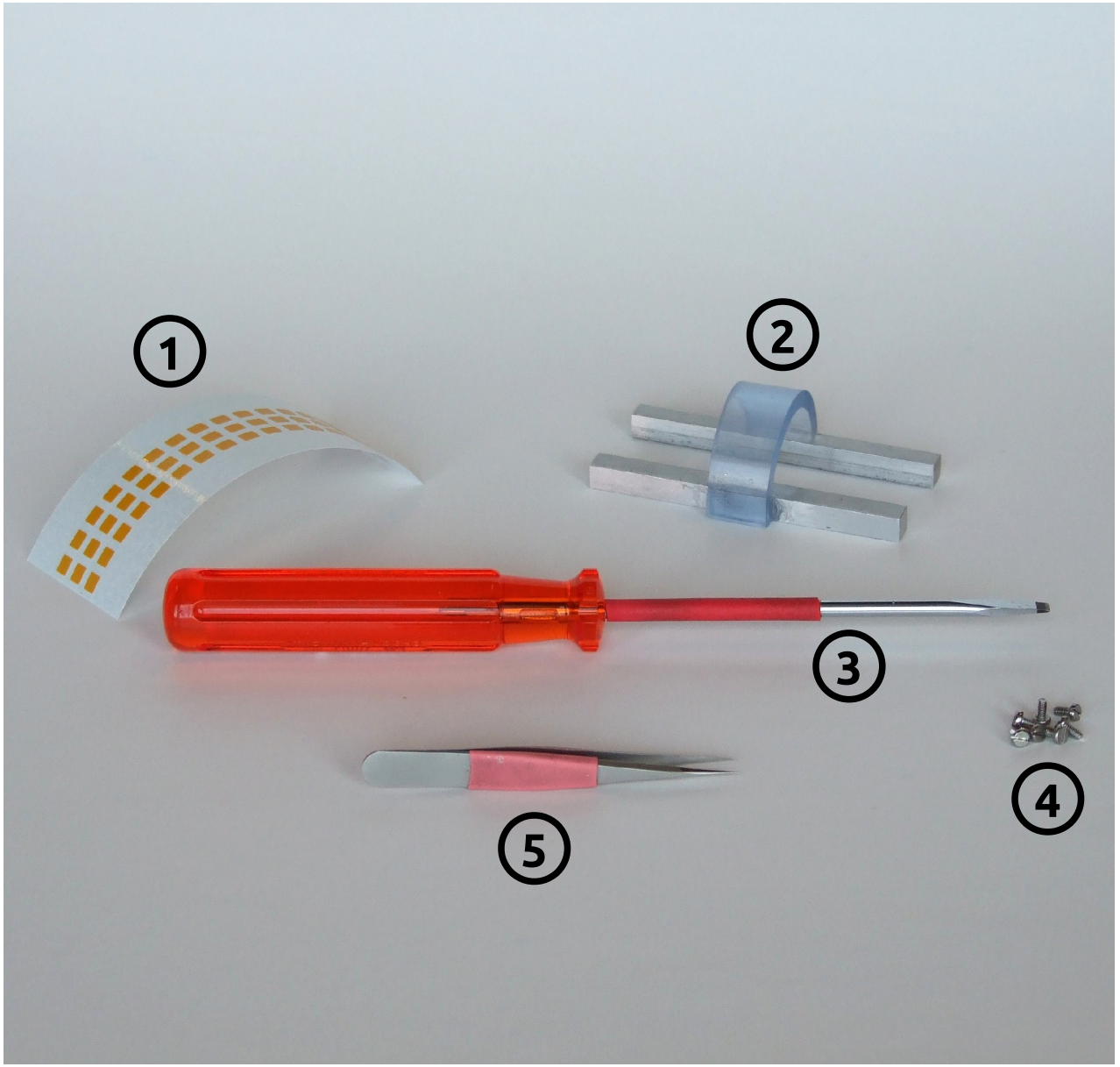




1. Clean HDI and underside of Kapton cable in gluing area with acetone. Apply with the small screw driver only a little amount of Araldite in the marked area.
2. Lower the Z-stage fully. Switch on the power from the curing tool (200°C), and wait about 60 sec. Then switch the power off – and wait until the curing tool temperature is below 100°C. The use of compressed air is possible to reduce waiting time. If you lift the curing tool to early, the signal cable will pop of, since the Araldite is still in a liquid state.

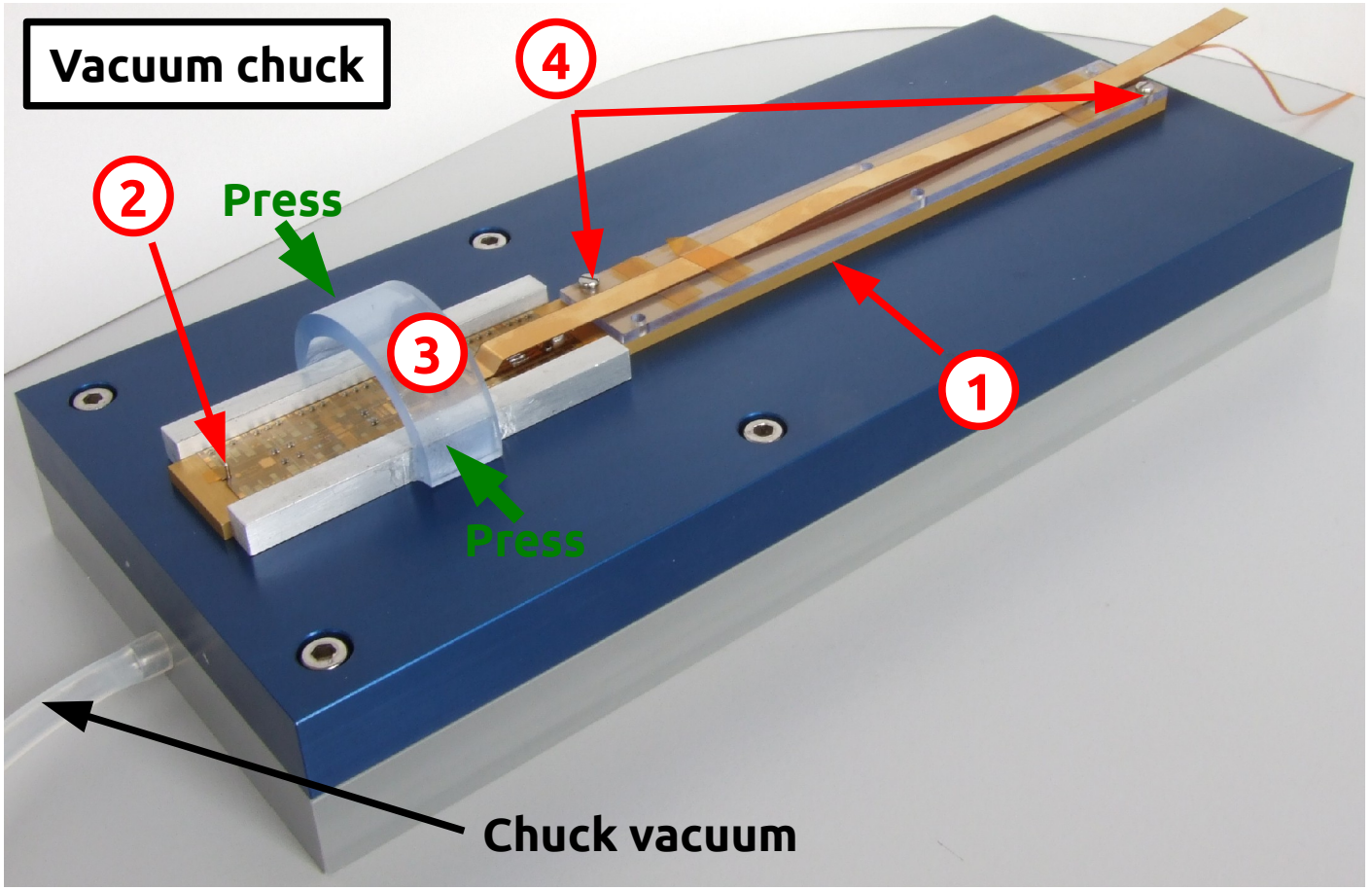
Not used for phase #1 upgrade

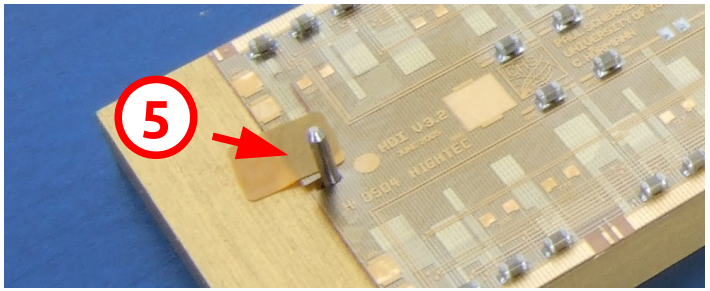
Necessary tools for HDI to HDI handle mounting

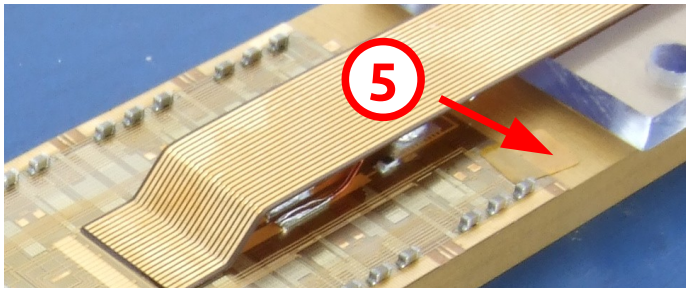


1. Kapton adhesive tape 3x4mm custom-made by www.ibzag.ch
2. Alignment tool
3. Screw driver size 1
4. Screws M2x4mm
5. Small tweezers

HDI to HDI-handle mounting





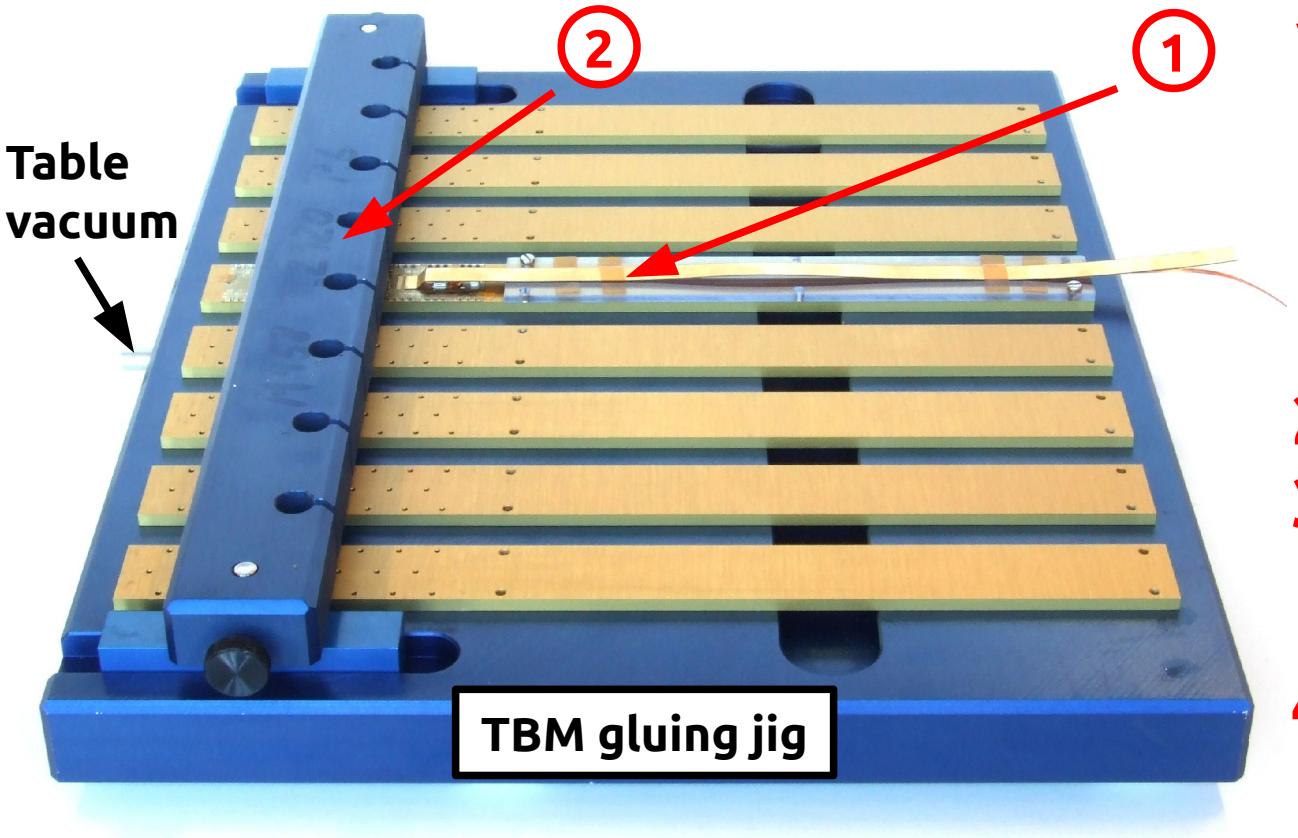


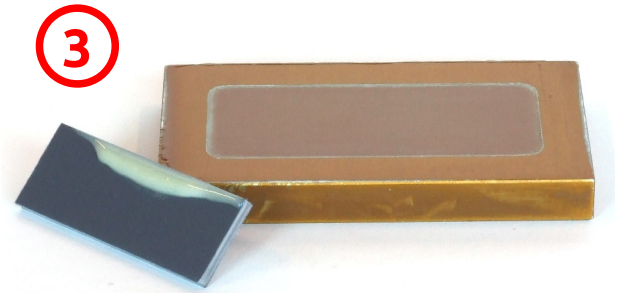
1. Place empty HDI-handle on vacuum chuck.
2. Align HDI on pin.
   → Chuck vacuum ON.
3. Use alignment tool to align HDI parallel to HDI-handle.
   Alignment < 50µm is needed for HDI test and gluing.
4. Secure PVC-handle with 2 x M2x4 on HDI-handle.
5. Use Kapton adhesive tape 3x4mm to secure HDI on HDI-handle. Do not cover test points on HDI!

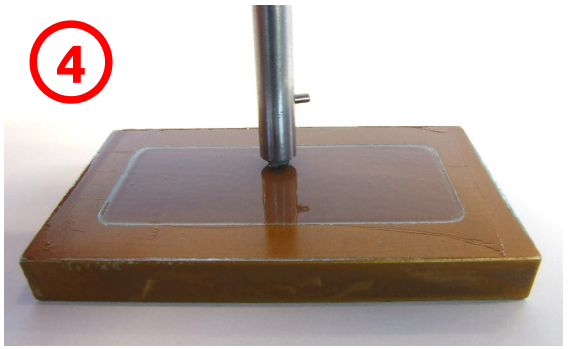
Necessary tools for TBM gluing

1. Araldite 2011 (Huntsman) or Araldite Standard
2. Ethanol (tool cleaning)
3. Acetone (HDI cleaning)
4. Liquid soap
5. Nail brush
6. Squeegee PVC 50x20x3mm (single use)
7. Large anti static tweezers
8. Stirring paddle (for Araldite mixing)

TBM gluing

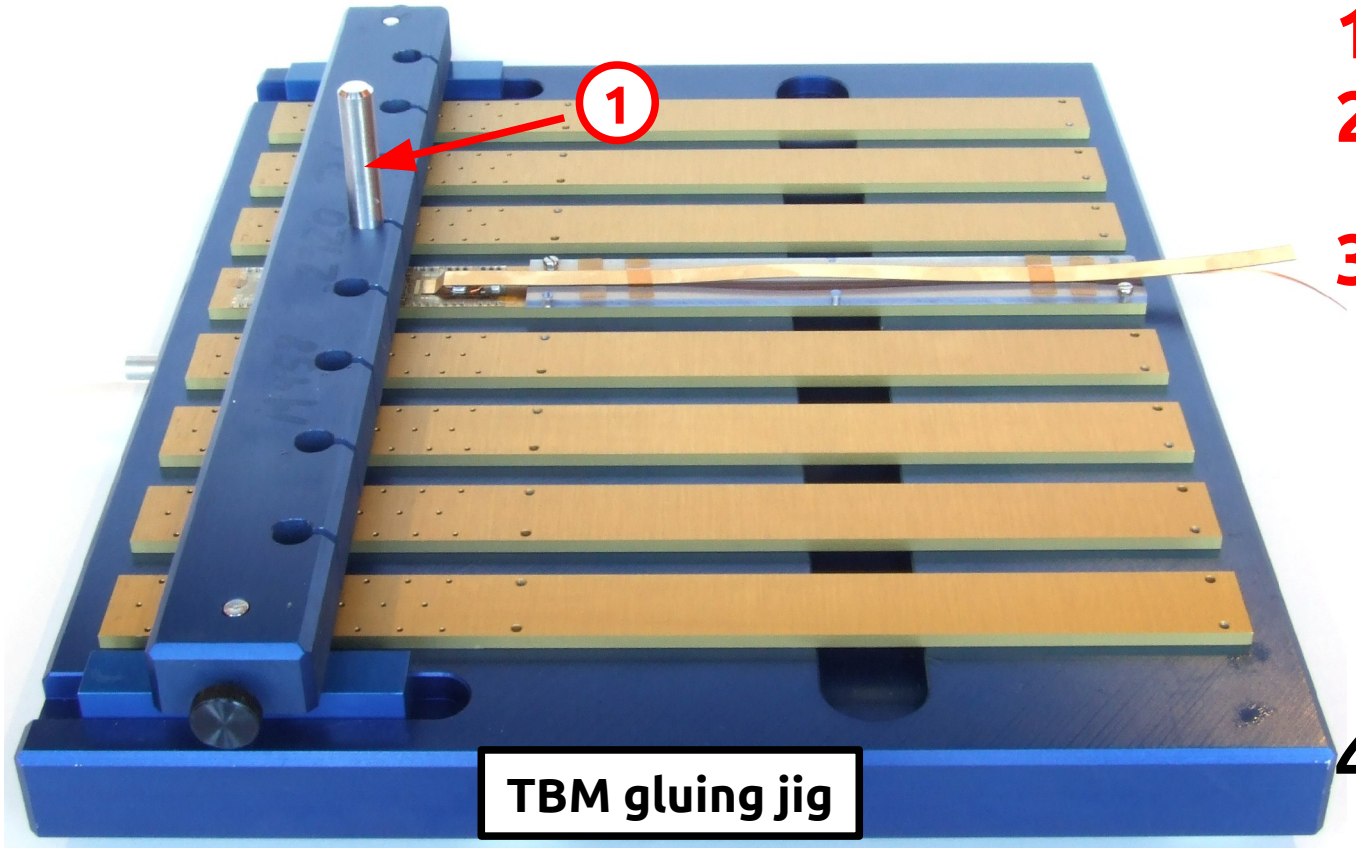


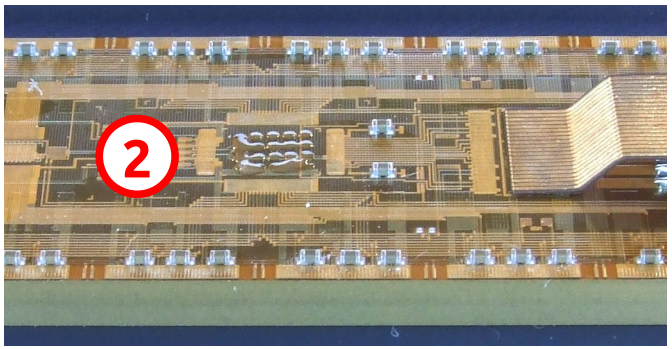


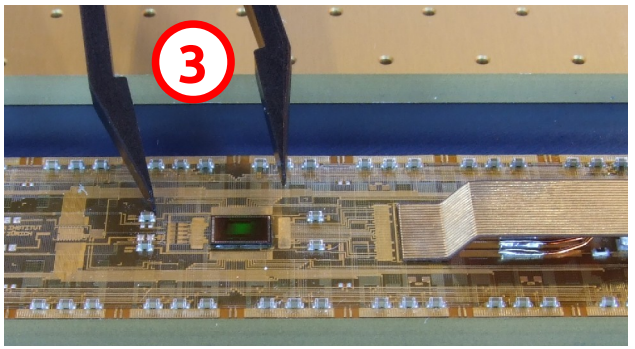


1. Place HDI-handle on TBM gluing jig (up to 8 HDI handles).
   → Table vacuum ON!
   Clean TBM area on HDI with acetone.
2. Place bar on TBM gluing jig.
3. Mix Araldite and pour it into the “epoxy basin” . Use squeegee to flatten Araldite.
4. Dip the epoxy applicator into the glue (repeat this for every gluing joint.)

TBM gluing



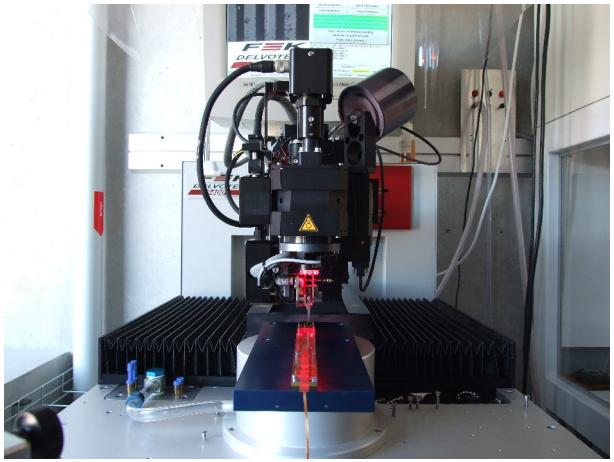


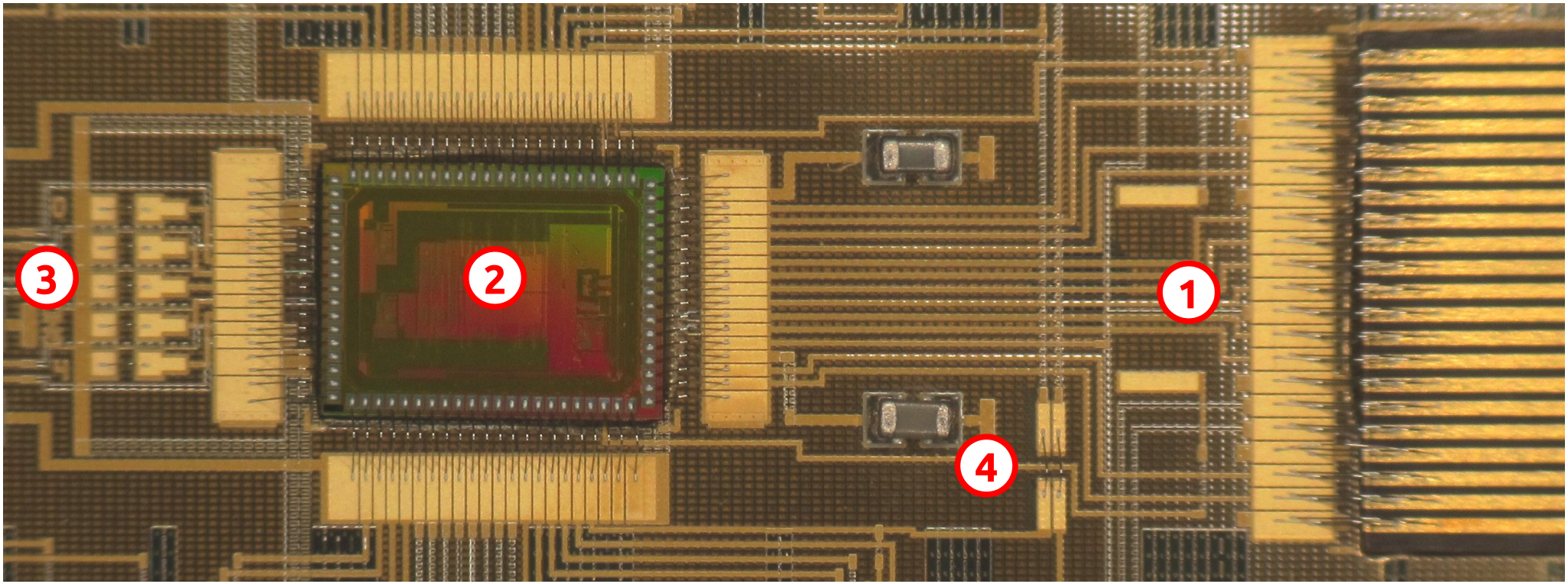


1. Apply glue on all HDI.
2. Close-up of applied glue pattern on HDI.
3. Place the TBM chip with the help of the large anti static tweezers on the HDI (± 0,5mm). Press the chip slightly down, till it lays flat on the HDI. Allow at least 6h for curing of Araldite.
4. Wipe out “epoxy basin” and then clean it under rinsing warm water with the help of liquid soap and nail brush. Do the same with the glue applicator. Rinse the glue applicator afterward with ethanol.

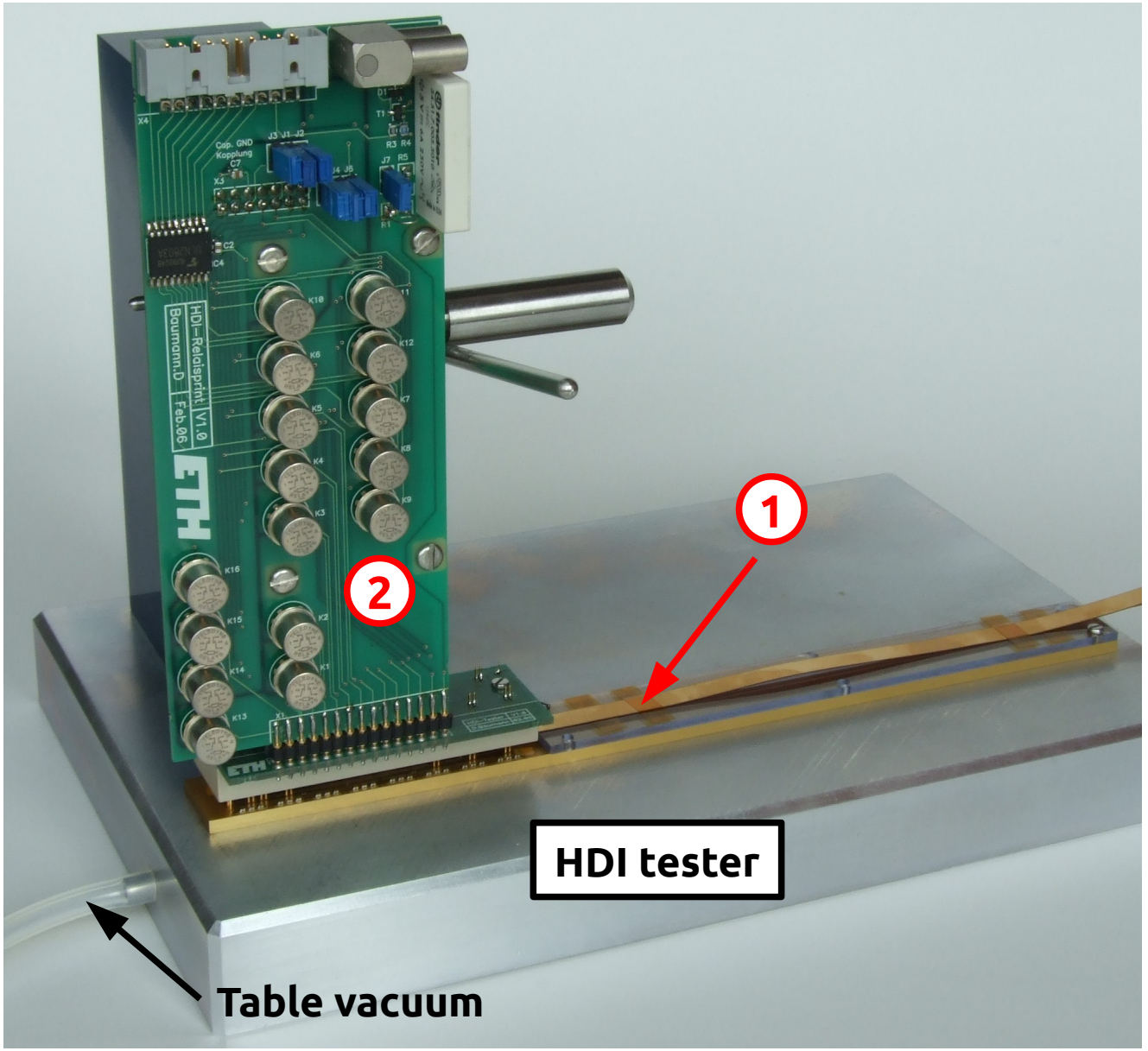
Wire bonding of HDI

1. Wire bonding of signal cable (3 wires/signal).
2. Wire bonding of TBM.
3. Wire bonding of <u>all</u> address lines (5x).
4. Wire bonding of token (2x) **to be removed after successful HDI Test.**



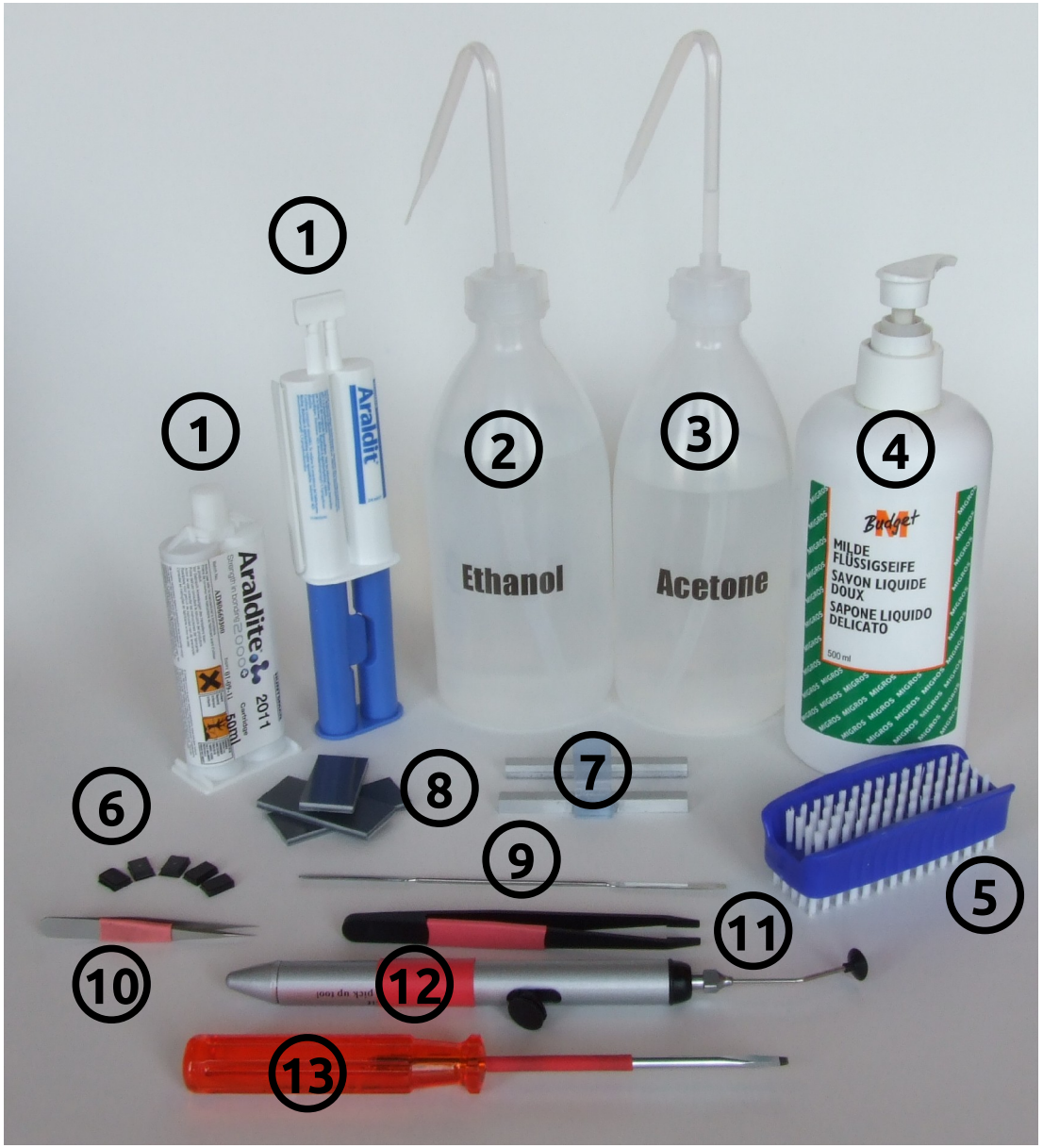


HDI electrical test



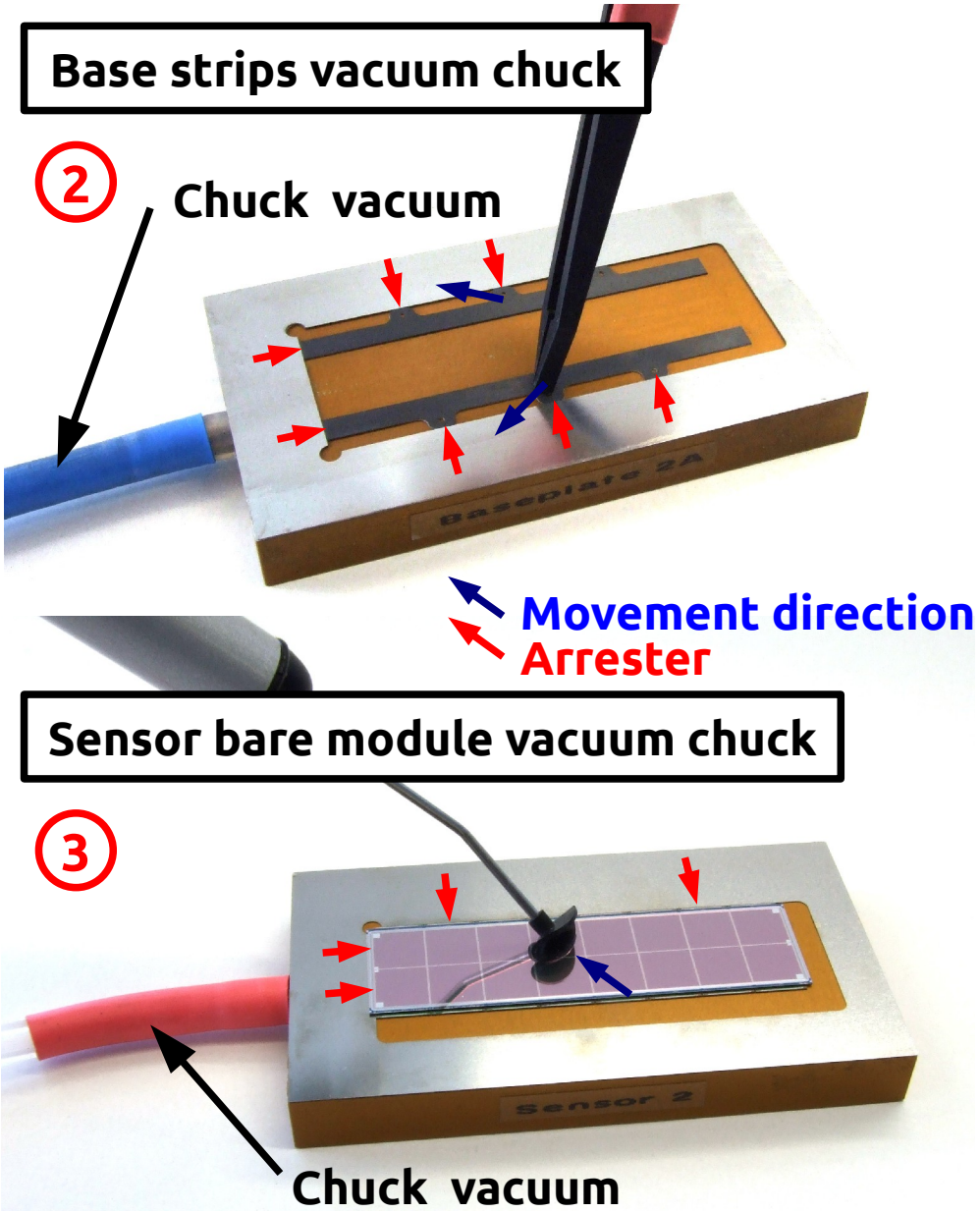
1. Place HDI-handle on “HDI tester”.
   → Table vacuum ON!
2. Lower Z-stage (caution: heavy weight) and check visually whether spring loaded pins match the test pads on the HDI.
3. Run electrical test.
4. After successful testing of HDI remove the two token wire bonds!

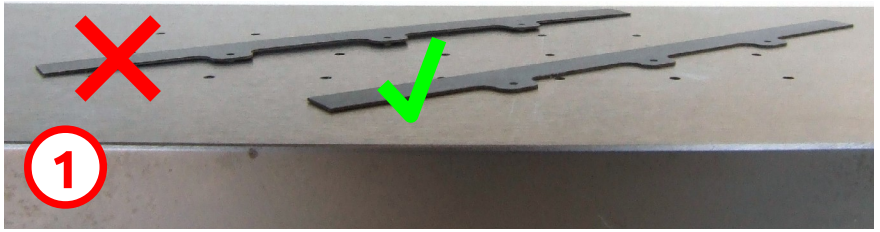
Necessary tools for sensor module gluing



1. Araldite 2011 (Huntsman) or Aradit Standard
2. Ethanol (rubber stamp cleaning)
3. Acetone (Si-Ni base strips cleaning)
4. Liquid soap
5. Nail brush
6. TBM protection cap
7. Alignment tool
8. Squeegee PVC 50x20x3mm (single use)
9. Stirring paddle (for Araldite mixing)
10. Small tweezers
11. Large anti static tweezers
12. Vacuum pickup tool
13. Screw driver size 1

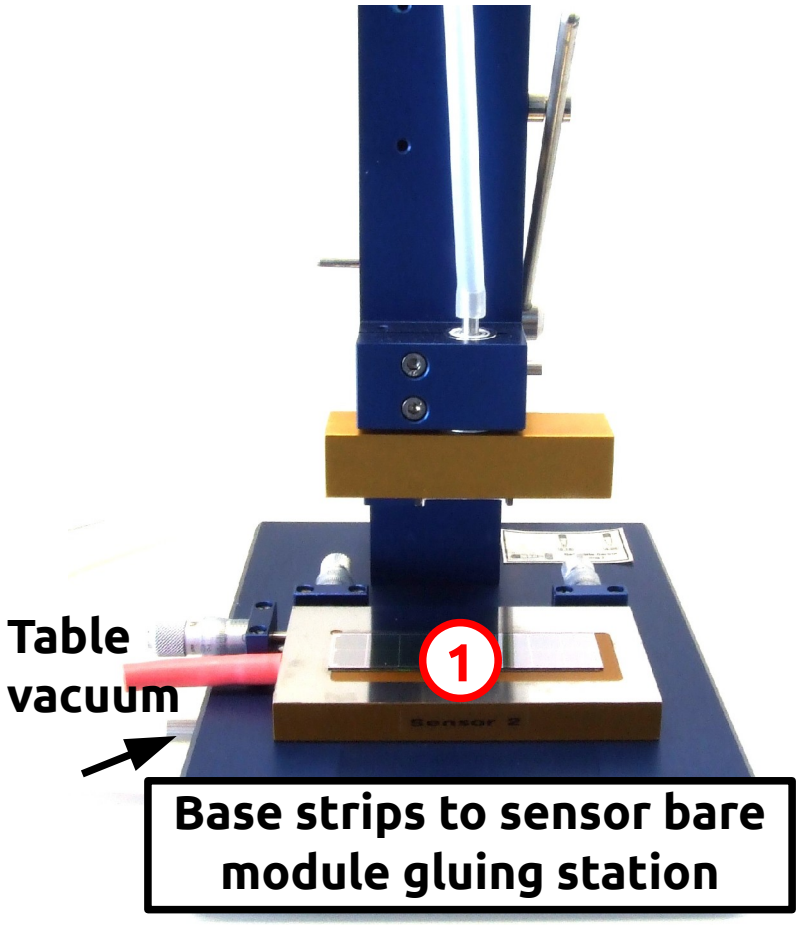
Base strips to sensor bare module gluing

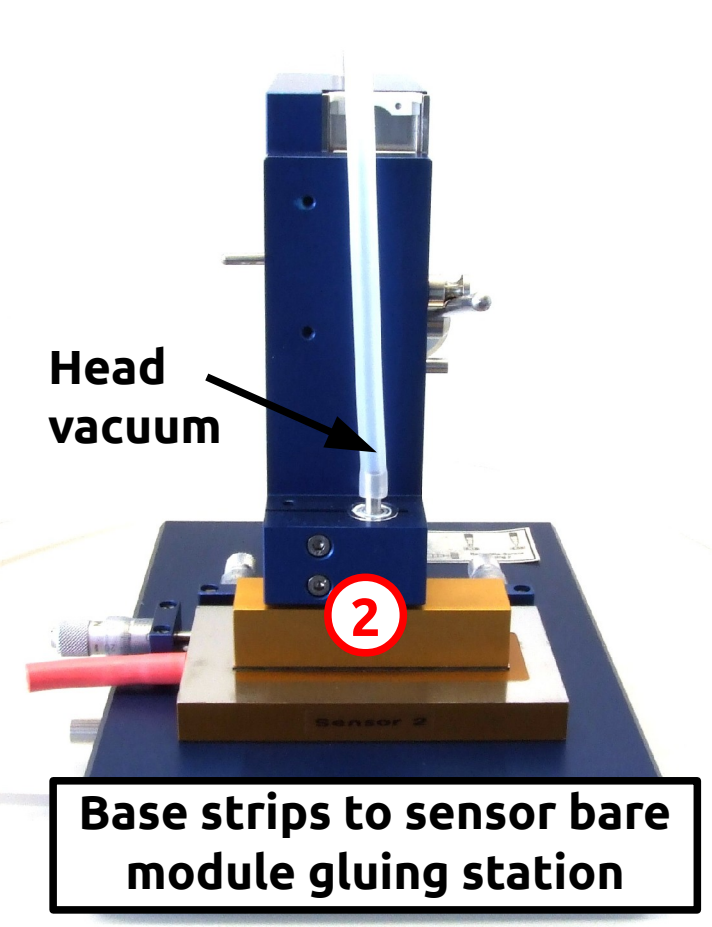




1. Check flatness of Si-Ni strips on a flat surface. **Use only flat ones!**
2. Place Si-Ni strips on “base strips vacuum chuck”. Use tweezer to align the Si-Ni strips with the arrester metal sheet. **Alignment < 50µm is needed.**
   → **Chuck vacuum ON!**
   Clean Si-Ni strips with acetone.
3. Place pre-tested sensor bare module on “sensor bare module vacuum chuck”. Use suction cap from vacuum pickup tool to align sensor bare module with the arrester metal sheet. **Alignment < 50µm is needed.**
   → **Chuck vacuum ON!**

Base strips to sensor bare module gluing

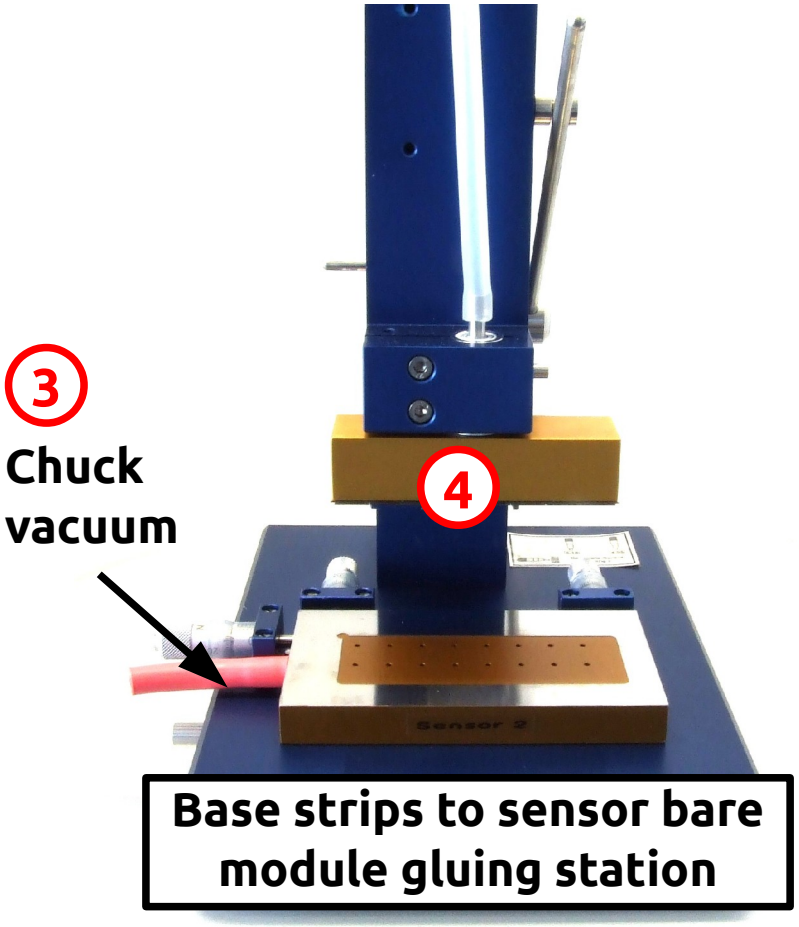


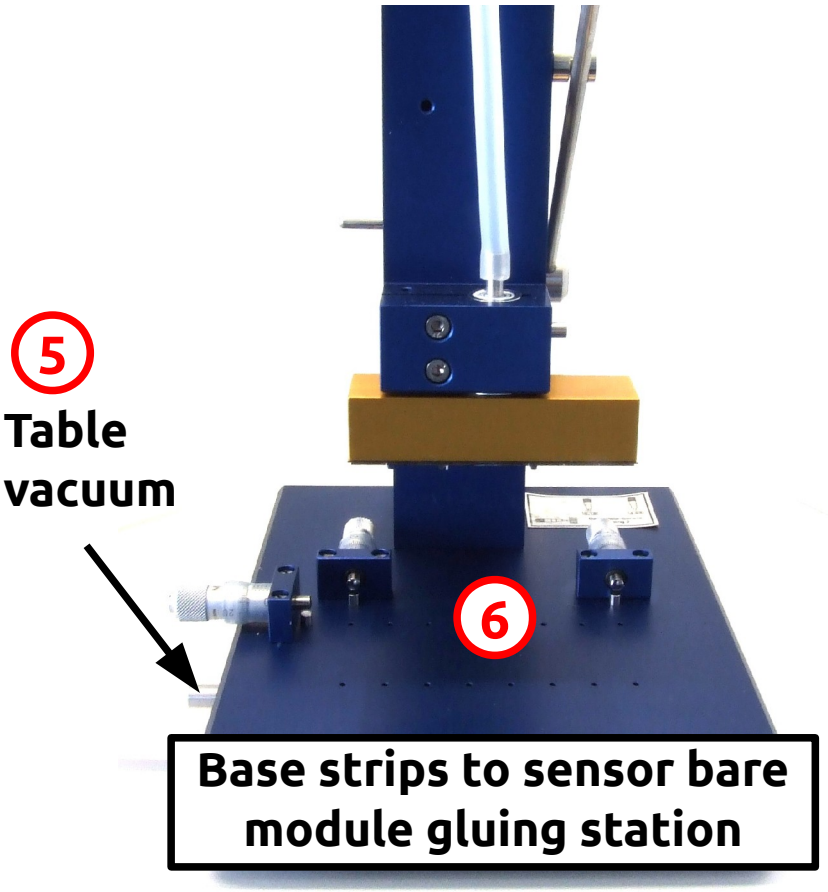


1. Place “sensor module vacuum chuck” on “base strips to sensor module gluing station”. Align on 3 pins.
Alignment < 50µm is needed.
→ Table vacuum ON!

2. Lower Z-stage until vacuum head rest on sensor module.
→ Head vacuum ON!

Base strips to sensor bare module gluing

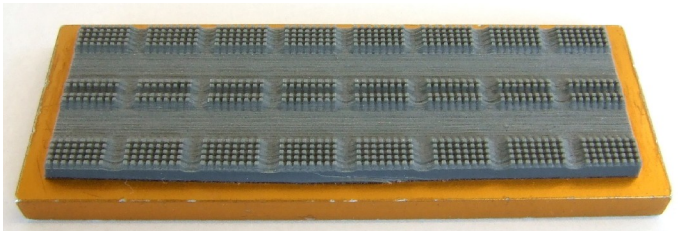




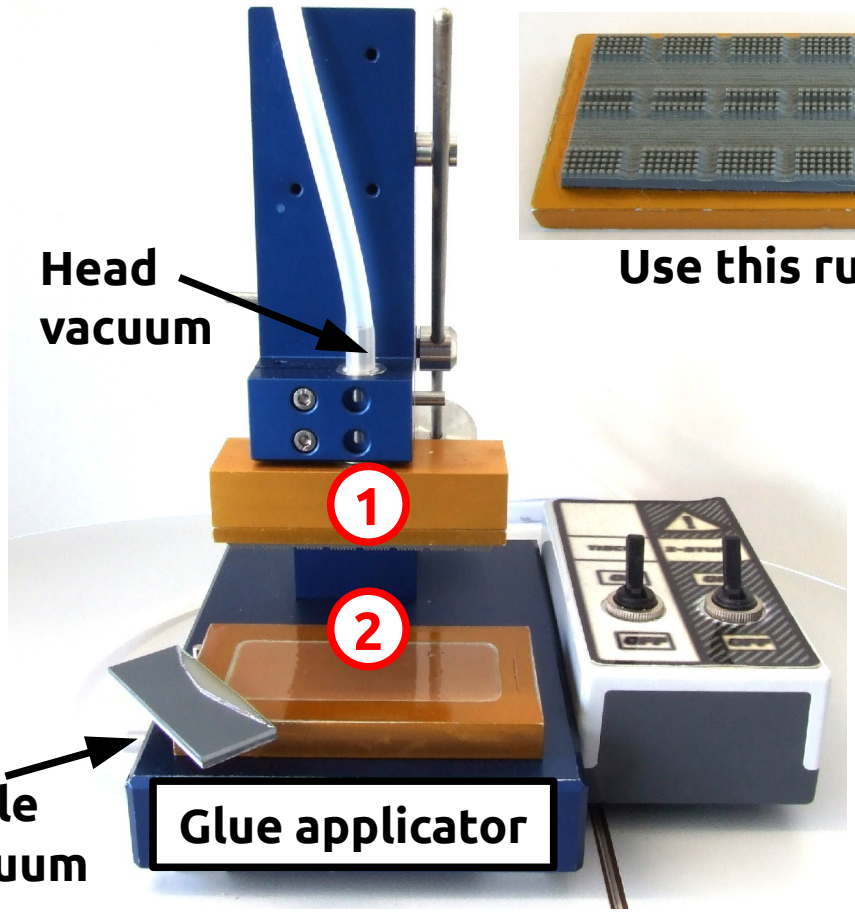
3. → Chuck vacuum OFF!
4. Lift head to upper rest position.

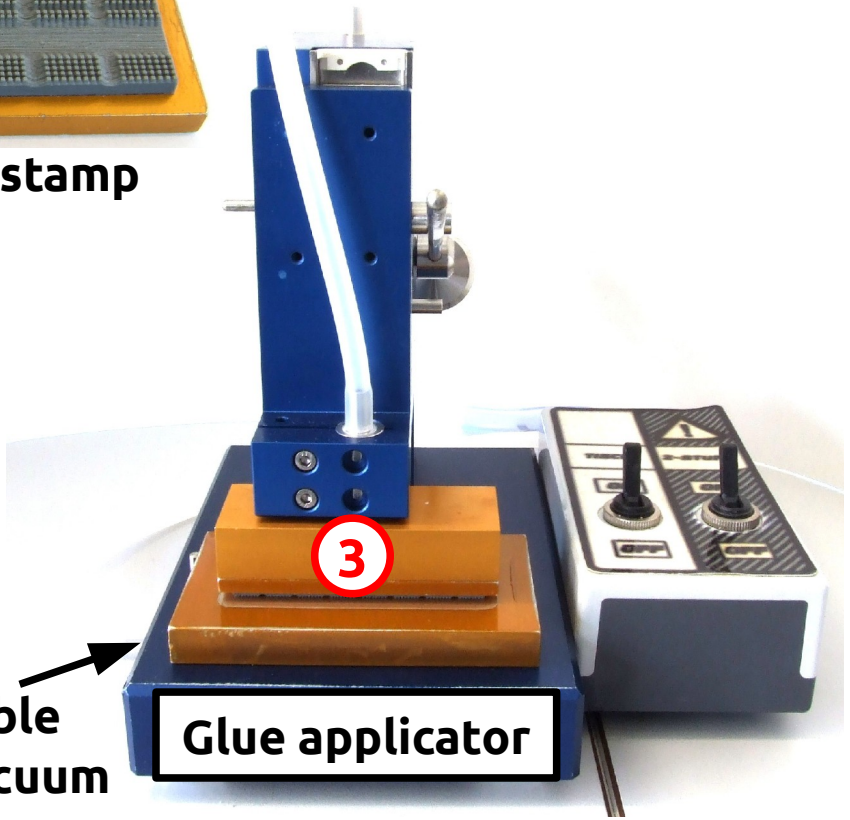
5. → Table vacuum OFF!
6. Remove “sensor module vacuum chuck”.

Base strips to sensor bare module gluing



Use this rubber stamp

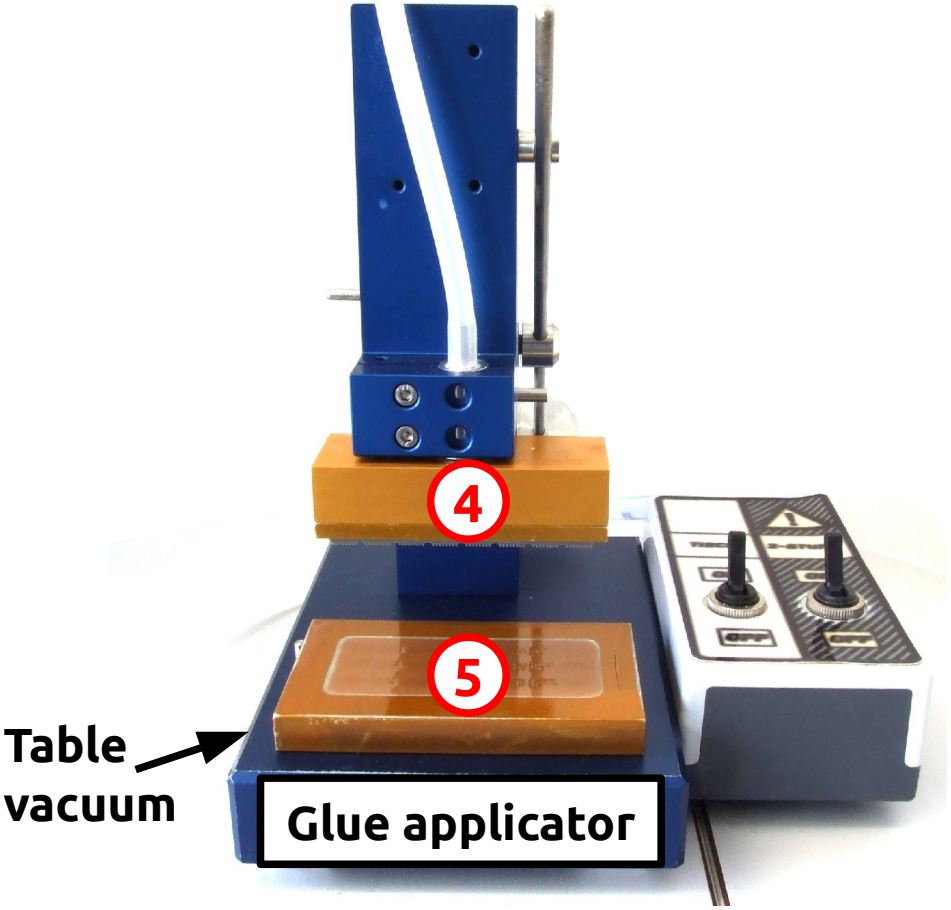


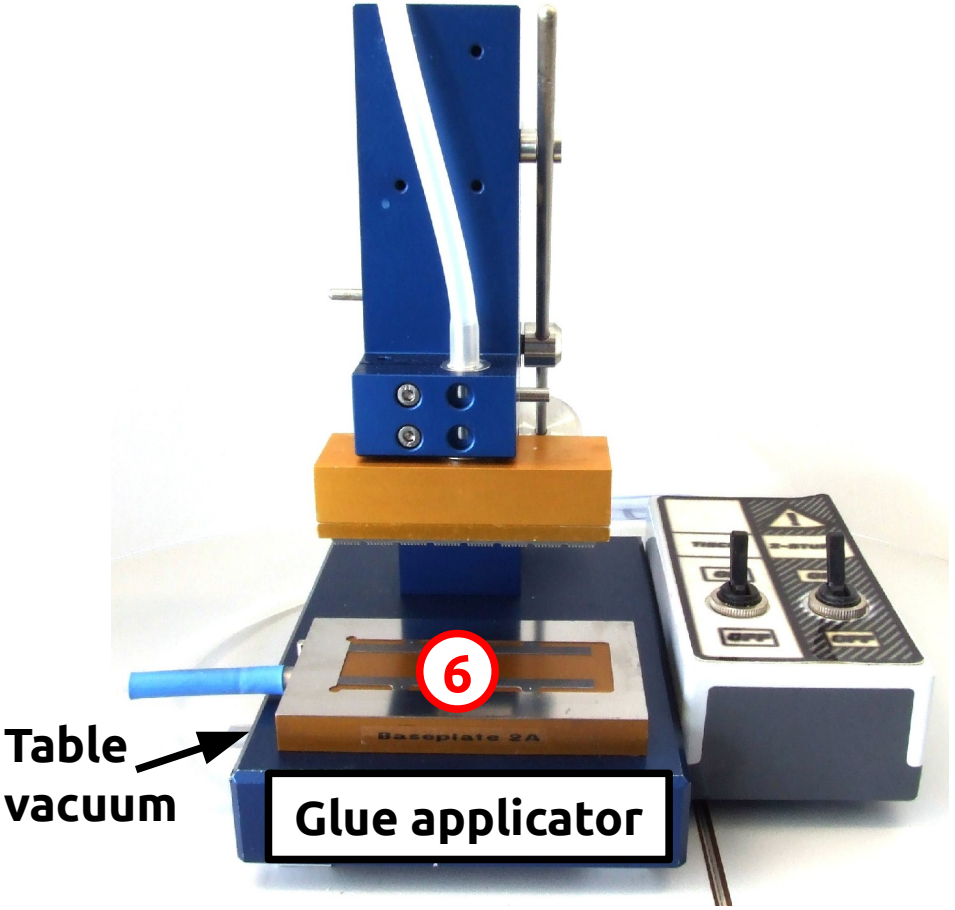


1. Place rubber stamp on head of “glue applicator”.
   → Head vacuum ON!
2. Place “epoxy basin” on table.
   → Table vacuum ON!

3. Lower Z-Stage until rubber stamp rest in “epoxy basin”. Allow rubber stamp to remain in “epoxy basin” for a few seconds.

Base strips to sensor bare module gluing



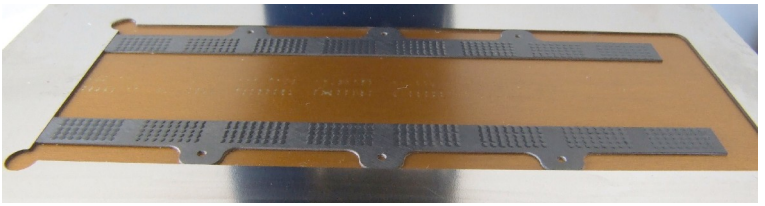


4. Lift Z-stage slowly up to it's rest position.

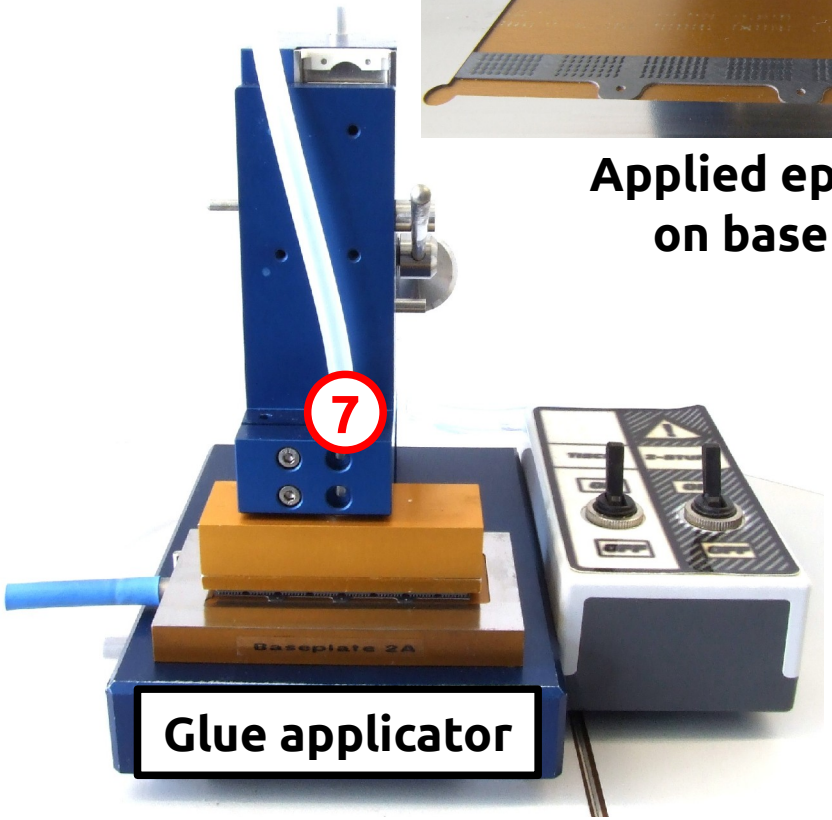
5. → Table vacuum OFF.
Take “epoxy basin” away.

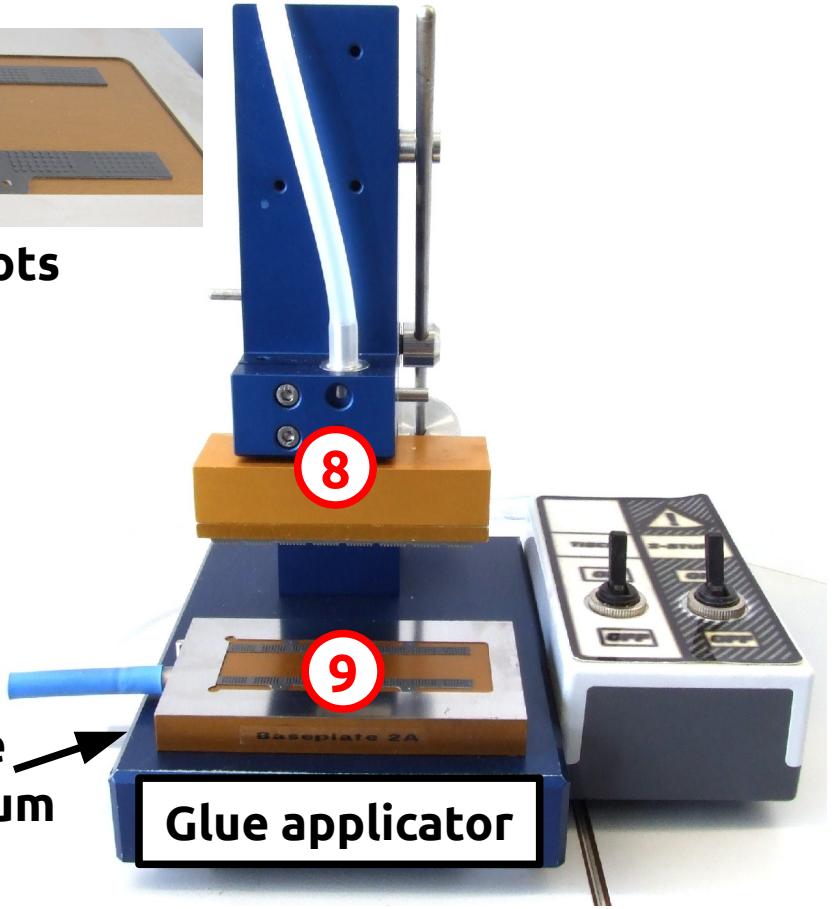
6. Place “base strips vacuum chuck” on table. Align on 3 pins.
Alignment ≤ 50µm is needed.
→ Table vacuum ON!

Base strips to sensor bare module gluing



Applied epoxy dots
on base strips



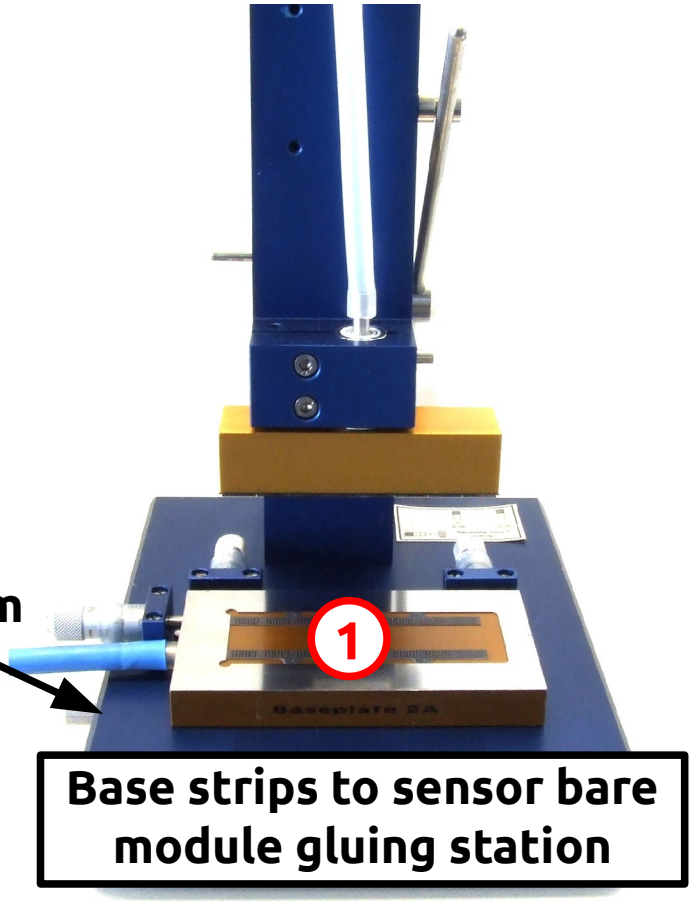


7. Lower Z-Stage until rubber stamp “prints” epoxy dots to base strips. Allow rubber stamp to remain for a few seconds.

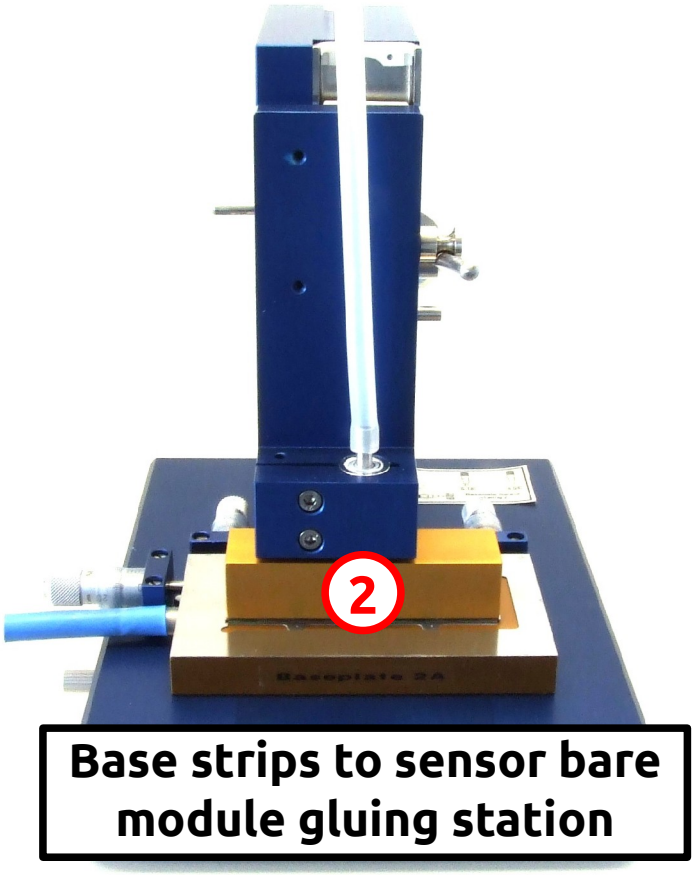
8. Lift Z-stage slowly up to it's upper rest position.

9. → Table vacuum OFF.
Take “base strips vacuum chuck” away.

Base strips to sensor bare module gluing



Base strips to sensor bare module gluing station



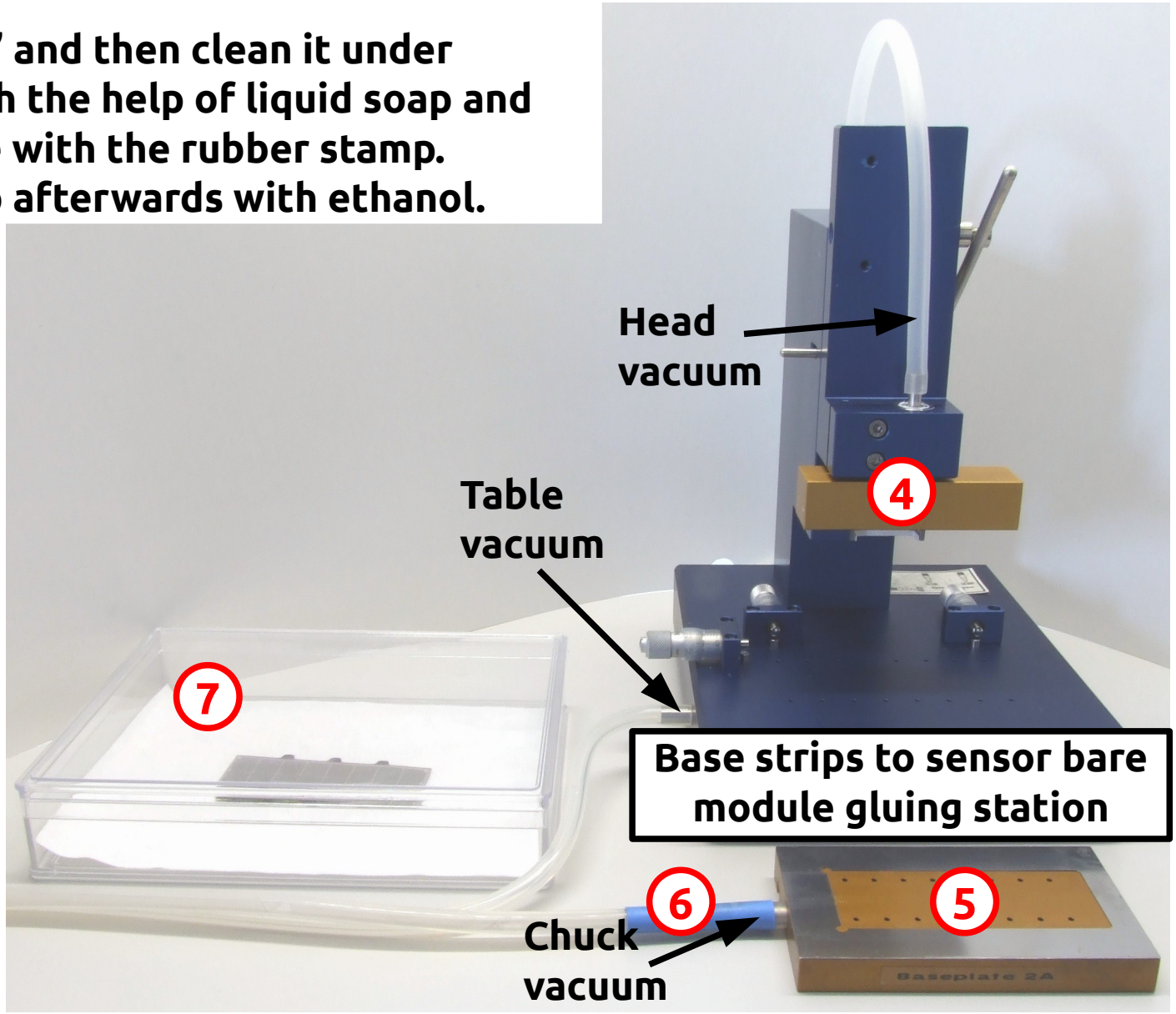
Base strips to sensor bare module gluing station

1. Place “base strips vacuum chuck” on “base strips sensor module gluing station”. Align on 3 micrometer screws. **Alignment < 50µm is needed.**
→ Table vacuum ON!

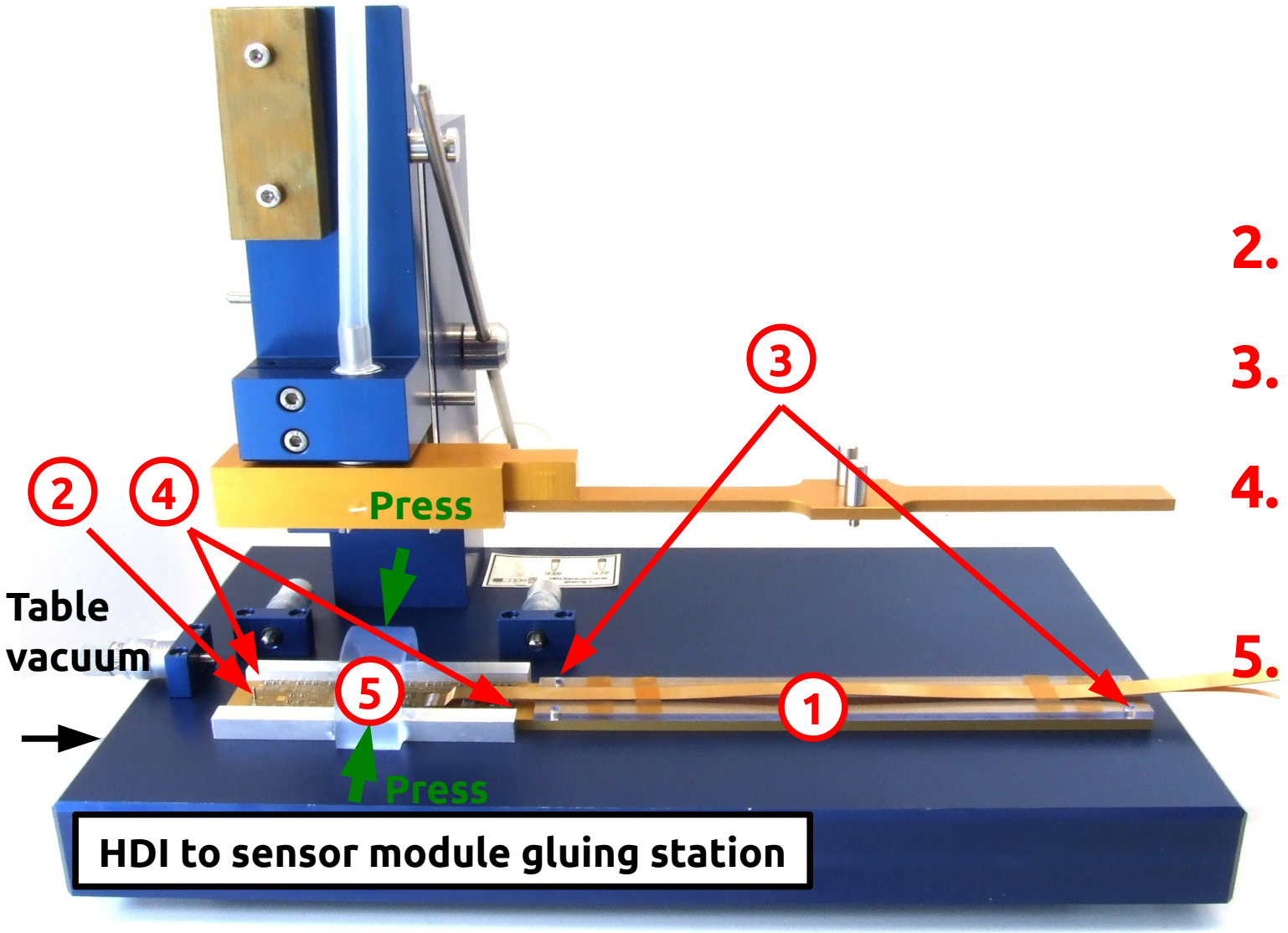
2. Lower Z-stage until sensor bare module rest on base strips. Allow min 6h for epoxy cure.

Base strips to sensor bare module gluing

3. Wipe out “epoxy basin” and then clean it under rinsing warm water with the help of liquid soap and nail brush. Do the same with the rubber stamp. Rinse the rubber stamp afterwards with ethanol.
4. → Head vacuum OFF! Lift Z-stage to upper rest position.
5. → Table vacuum OFF! Take “baseplate vacuum chuck” away.
6. → Chuck vacuum OFF!
7. Take sensor bare module with base stripes away and store it in box (use vacuum pickup tool).

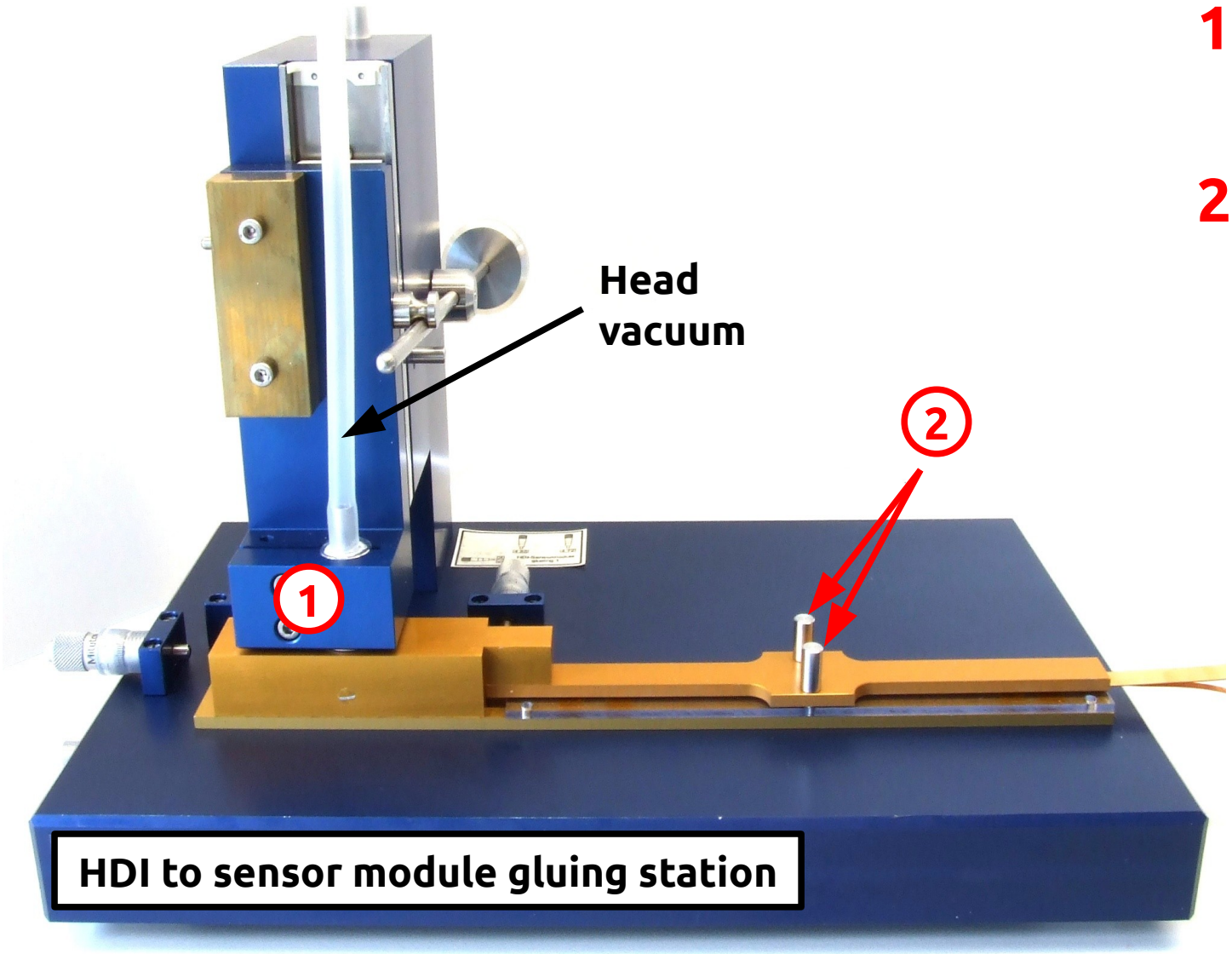


Sensor module to HDI gluing



1. Place HDI-handle on “HDI to sensor module gluing station”.
   → Table vacuum ON!
2. Place alignment pin in the table.
3. Remove the two M2x4mm screws.
4. Remove the two small kapton adhesive tapes.
5. Use the alignment tool to align HDI parallel to the HDI-handle.

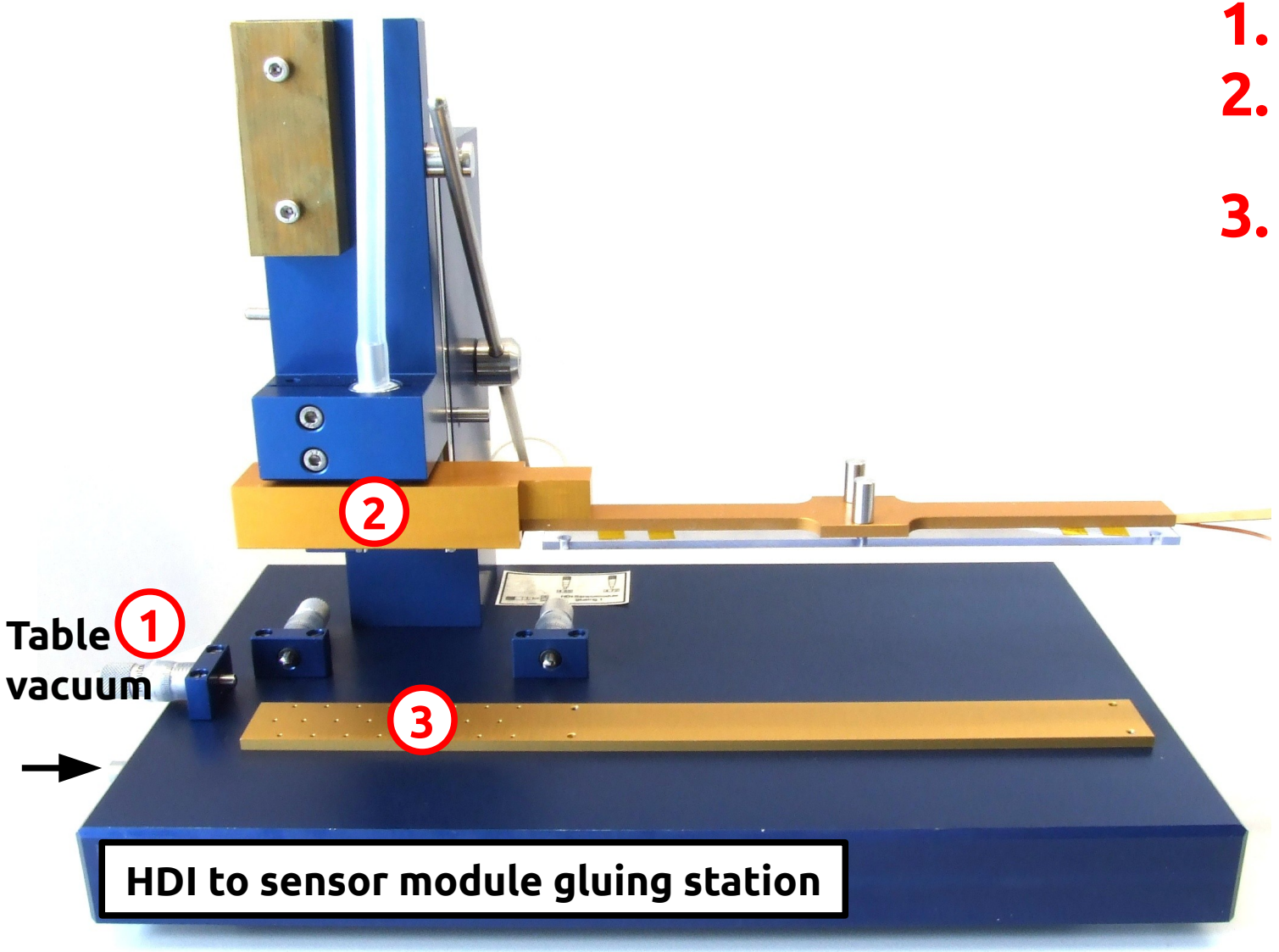
Sensor module to HDI gluing



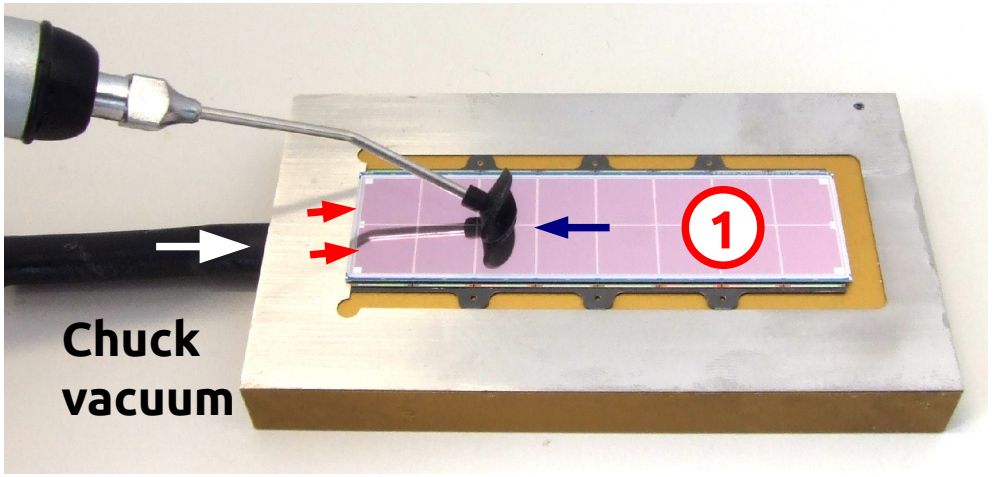
1. **Lower Z-stage until head rest on HDI**
   → Head vacuum ON!
2. **Tighten the two screws to secure PVC-handle.**

Sensor module to HDI gluing

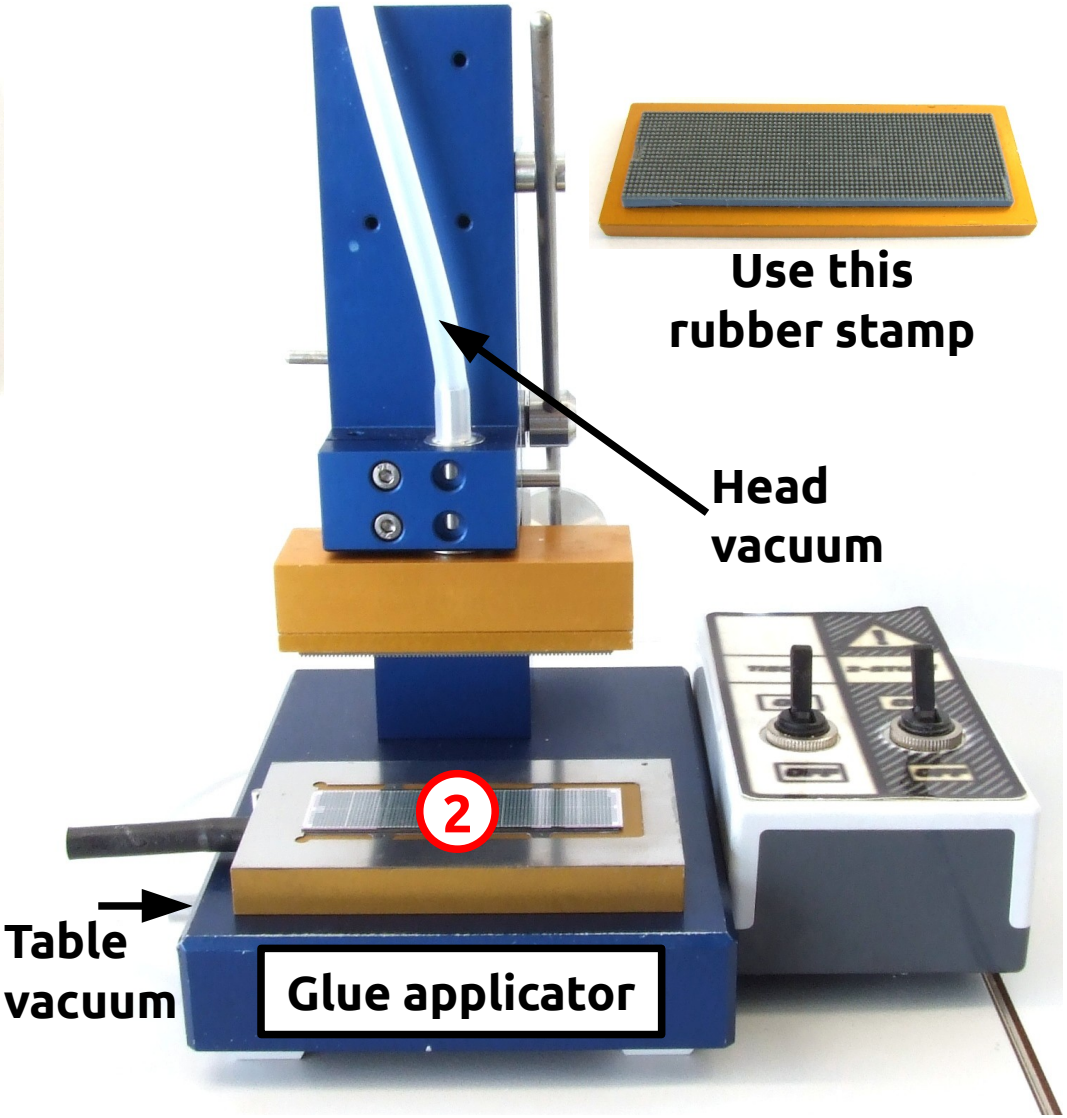
1. → Table vacuum OFF!
2. Lift Z-stage to upper rest position.
3. Remove HDI-handle.



Sensor module to HDI gluing

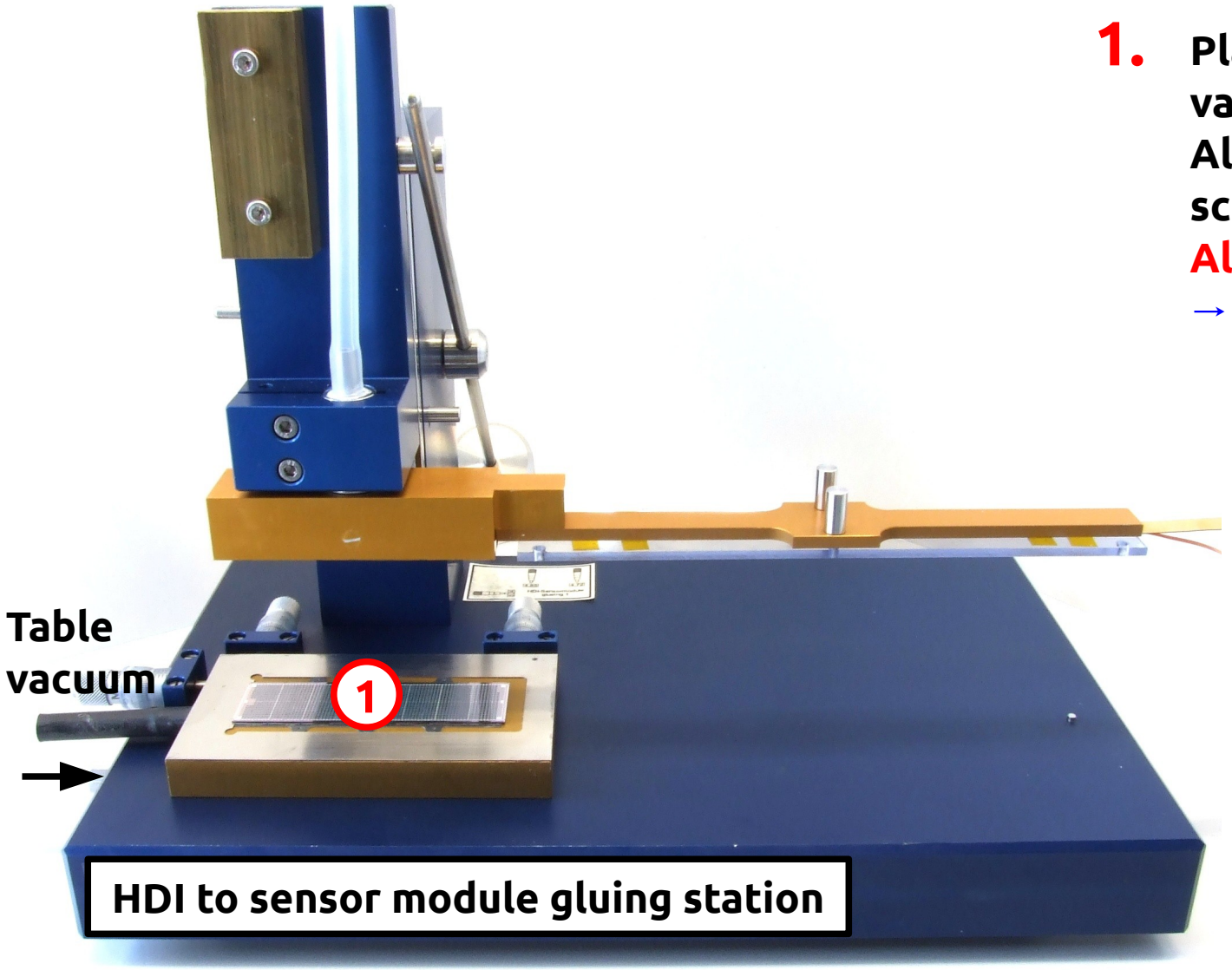


Movement direction
Arrester



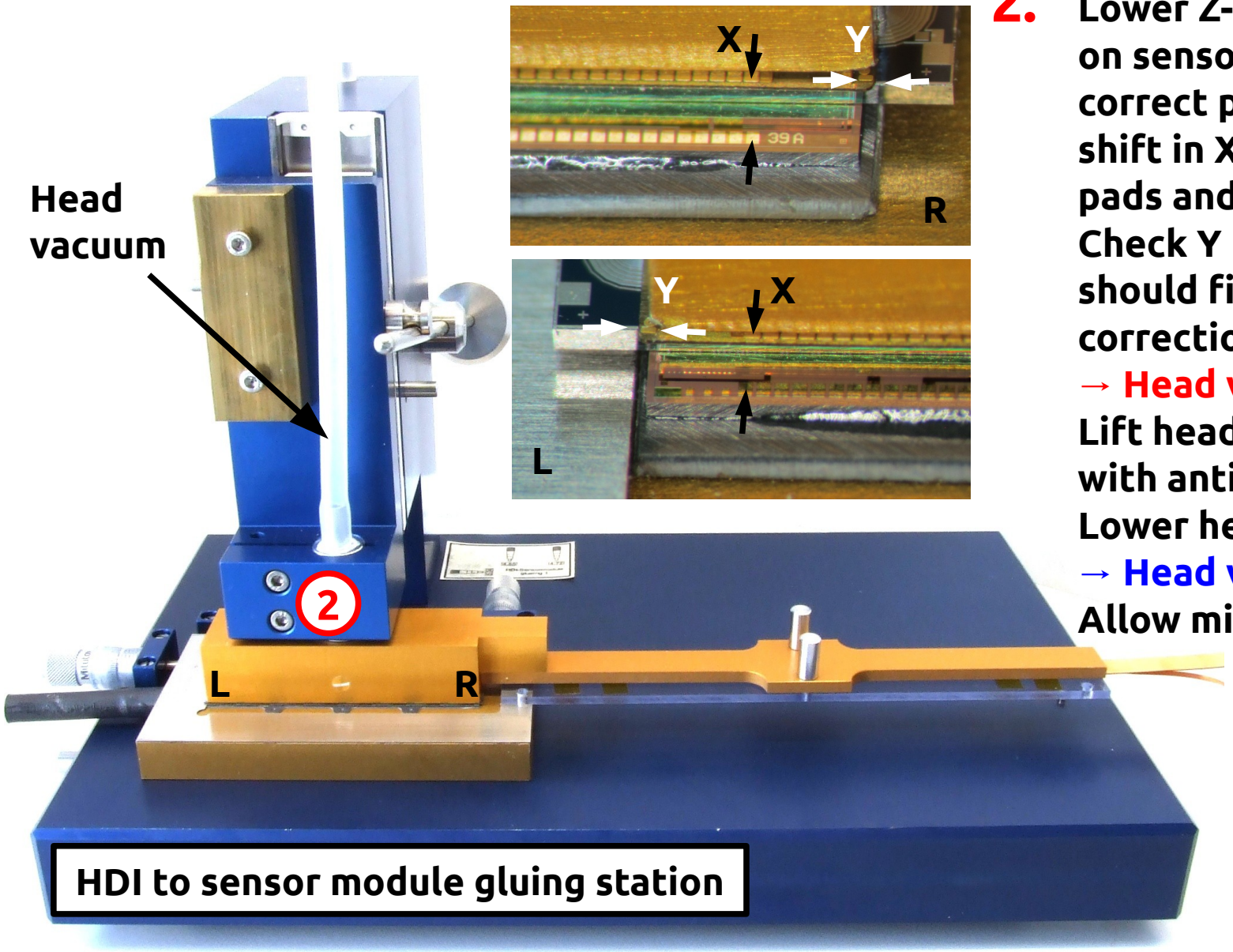
1. Place sensor module on “sensor module vacuum chuck”. Use suction cap from vacuum pickup tool to align sensor module with the arrester metal sheet. Alignment < 50µm is needed.
   → Chuck vacuum ON!
2. Apply glue on sensor module. → See page 25-27.
   DO NOT clean sensor module!

Sensor module to HDI gluing



1. **Place “sensor module vacuum chuck” on table. Align on 3 micrometer screws.**
Alignment < 50µm is needed.
→ Table vacuum ON!

Sensor module to HDI gluing



2. Lower Z-stage until HDI rests on sensor module. Check correct position of HDI! (No shift in X between HDI bond pads and chip bond pads. Check Y position – HDI mark should fits sensor edge) If corrections are needed.

→ **Head vacuum OFF!**

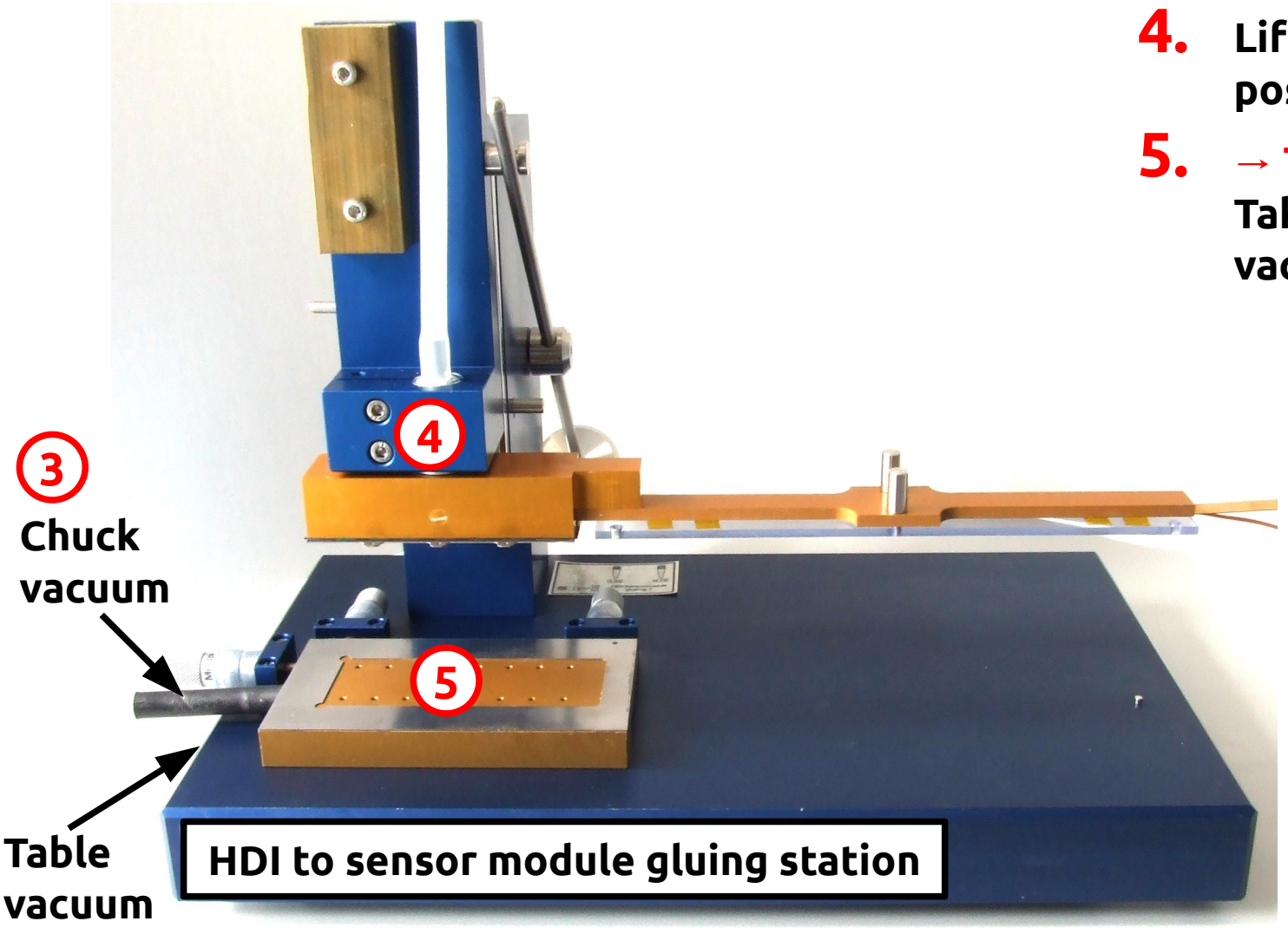
Lift head. Adjust HDI position with anti-static tweezer. Lower head.

→ **Head vacuum ON!**

Allow min 6h for epoxy cure.

Sensor module to HDI gluing

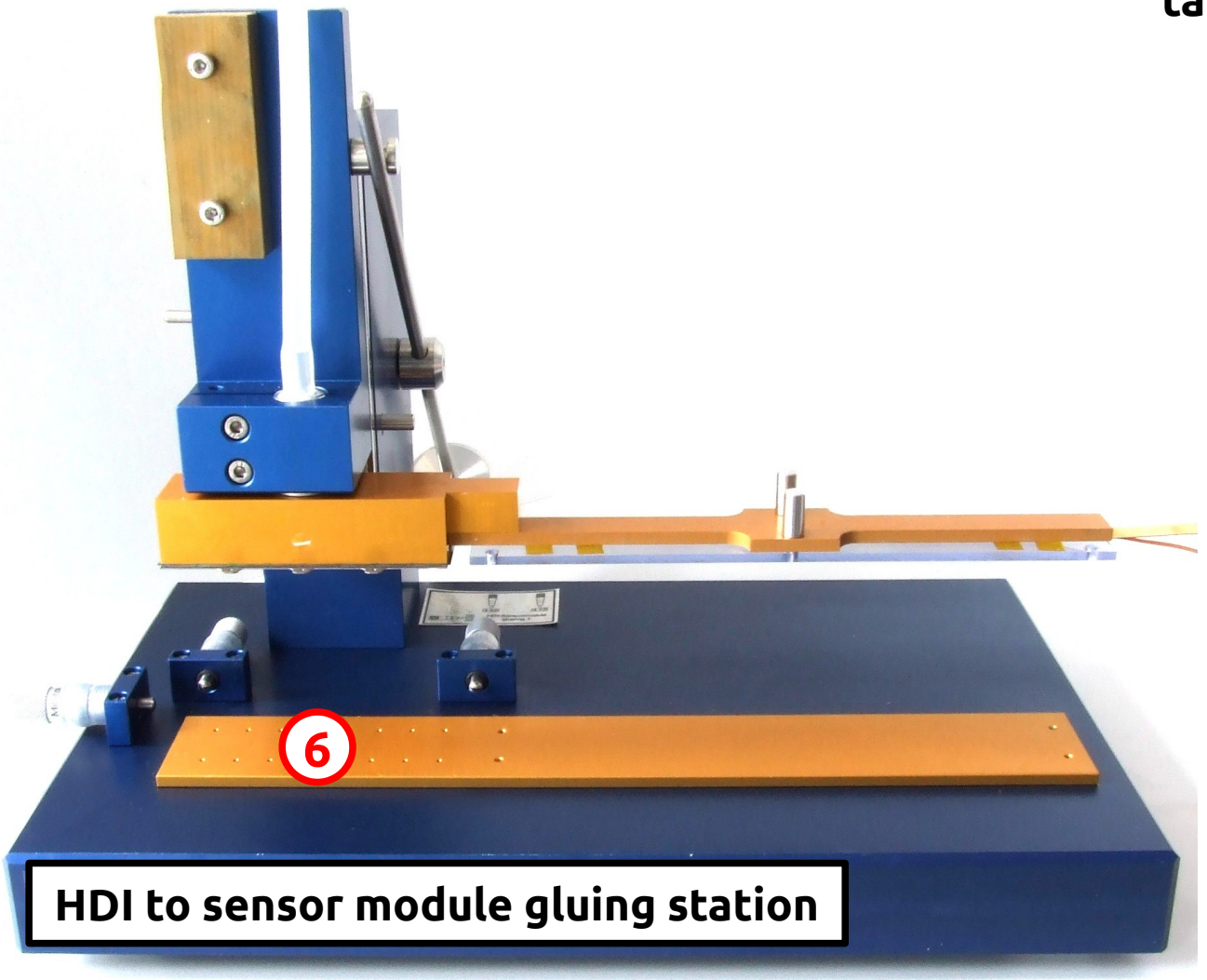
HDI to sensor module gluing station



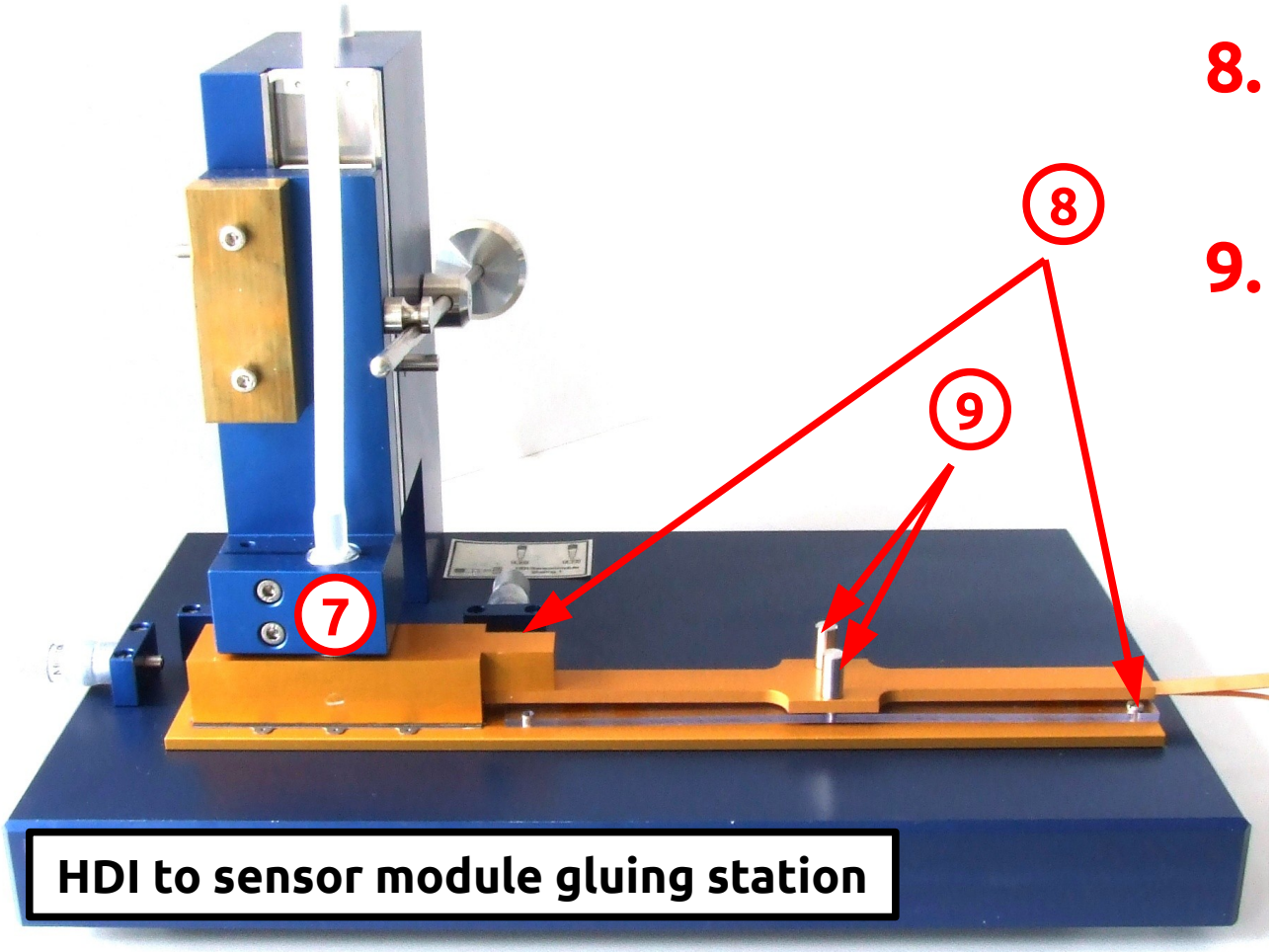
3. → Chuck vacuum OFF!
4. Lift Z-stage to upper rest position.
5. → Table vacuum OFF!
   Take “sensor module vacuum chuck” away.

Sensor module to HDI gluing

6. **Place module-handle on table.**



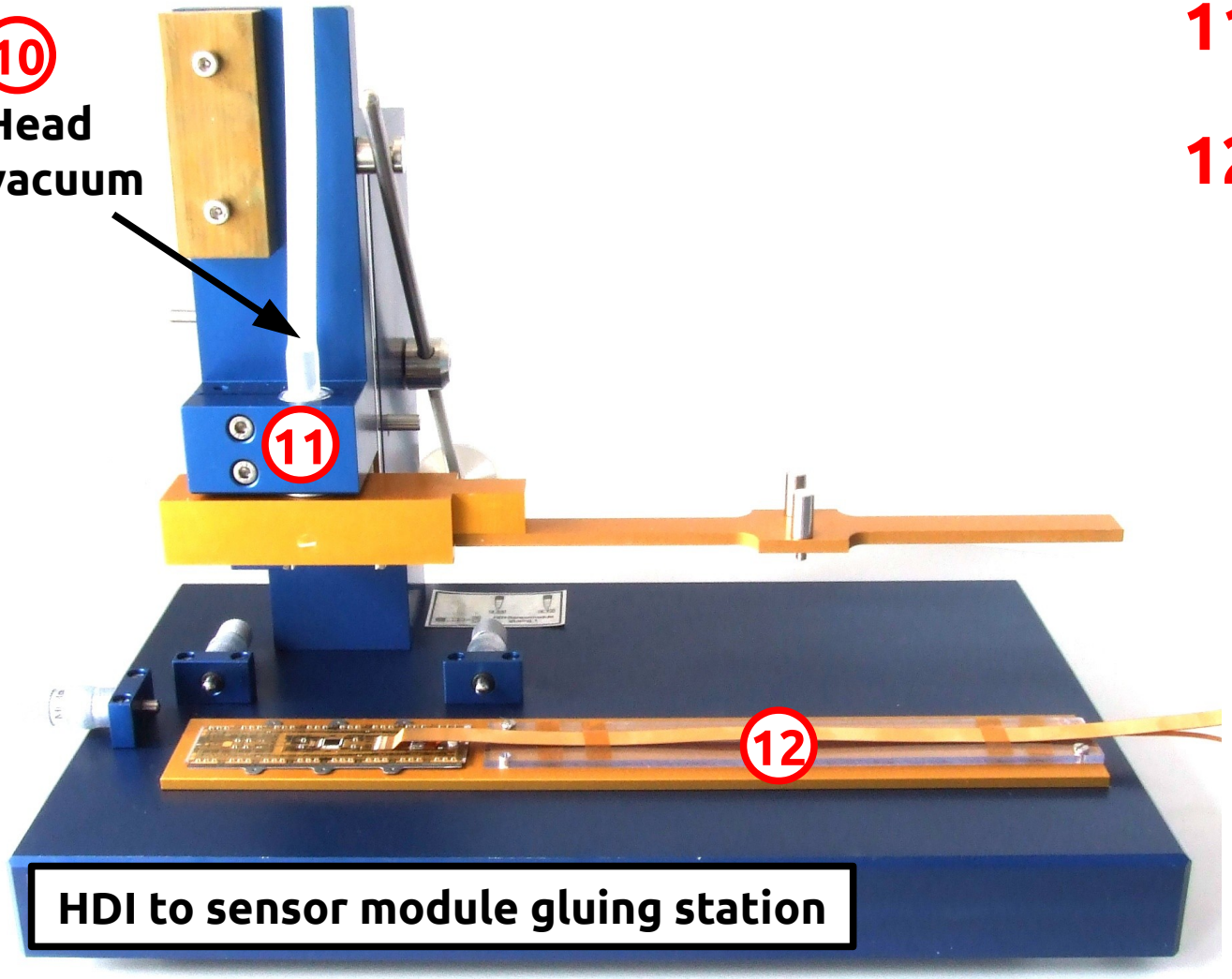
Sensor module to HDI gluing



HDI to sensor module gluing station

7. Lower Z-stage until sensor module rests on module-handle.
8. Use two M2x4 screws to attach PCV-handle to module-handle.
9. Unscrew this two screws.

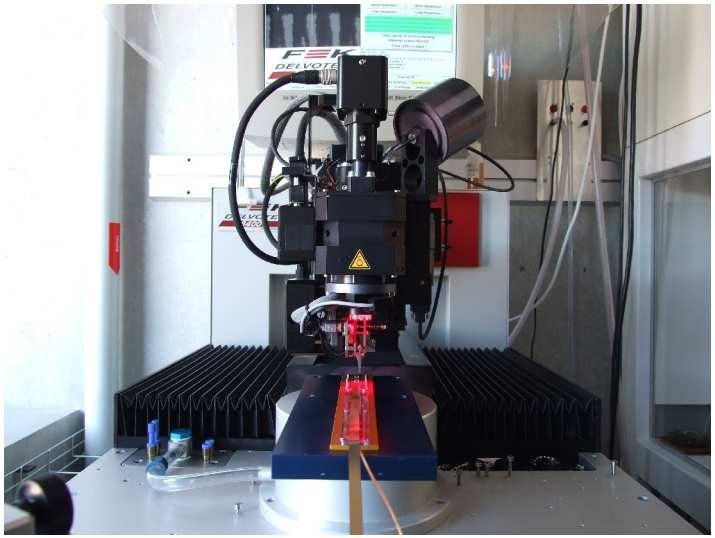
Sensor module to HDI gluing

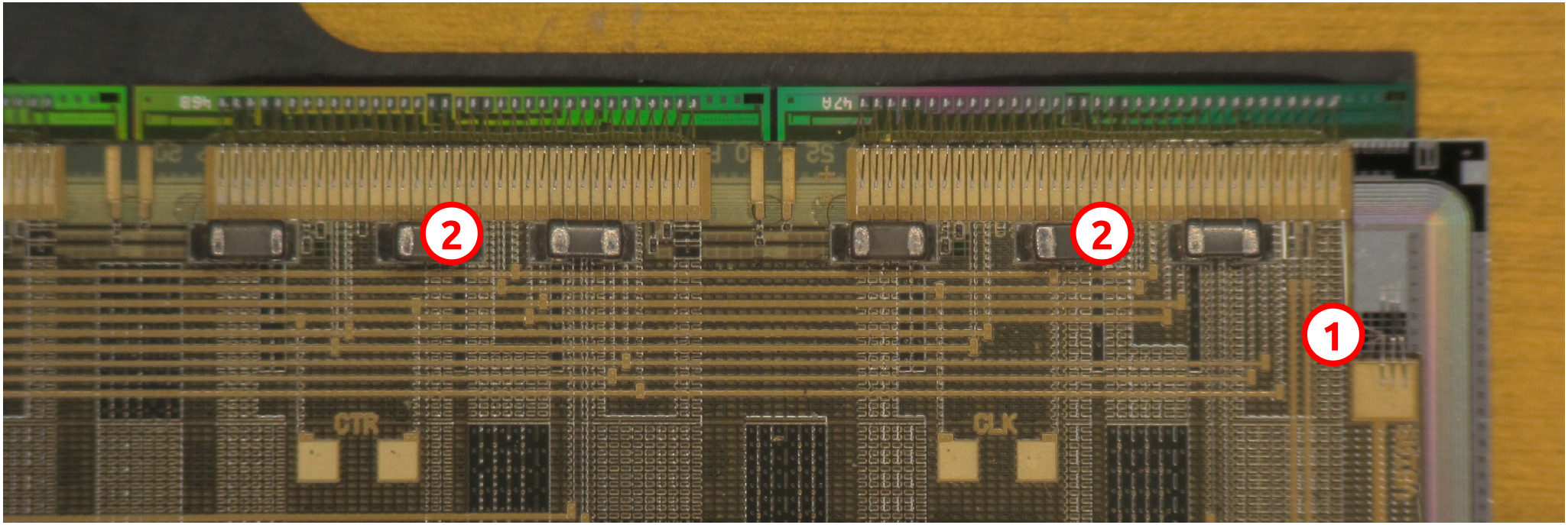


10. → Head vacuum OFF!
11. Lift Z-stage to upper rest position.
12. The finished BPIX sensor module.

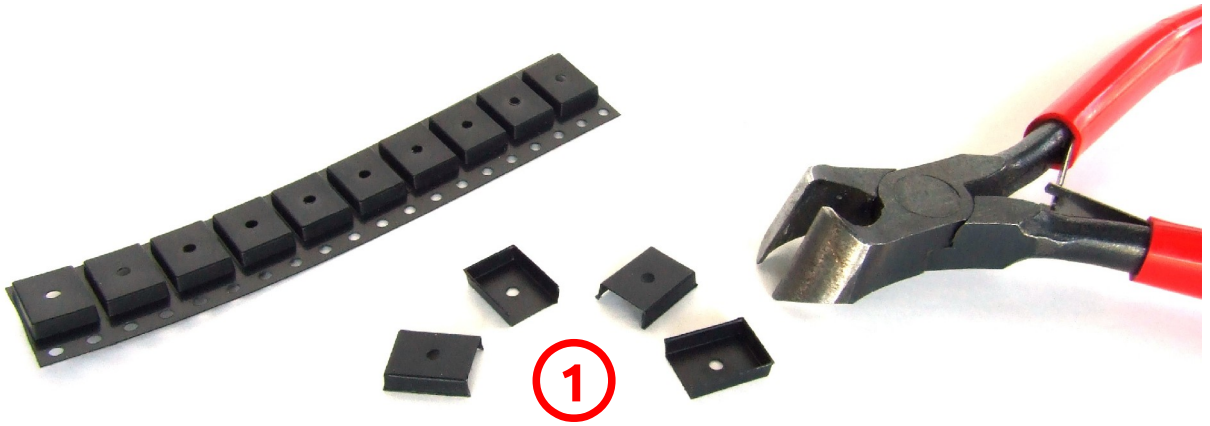
Wire bonding of BPIX module

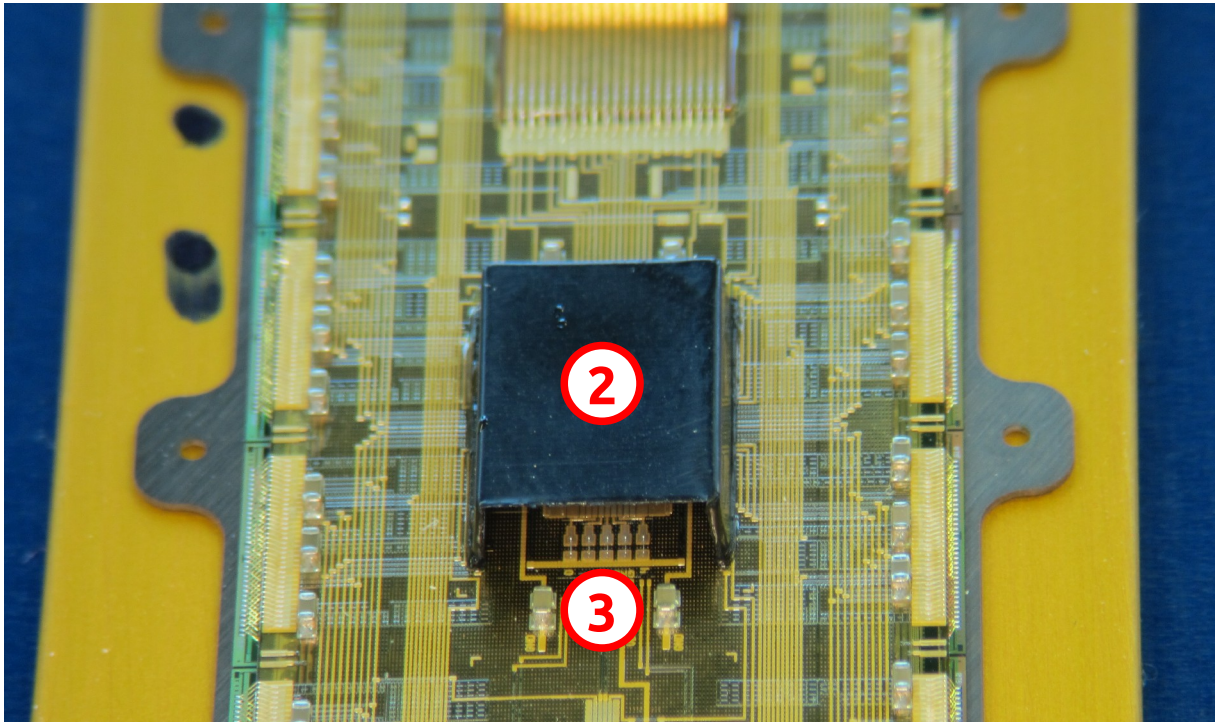
1. Wire bonding of sensor bias (3 wires).
2. Wire bonding of all 16 ROC's (each 35 wires).





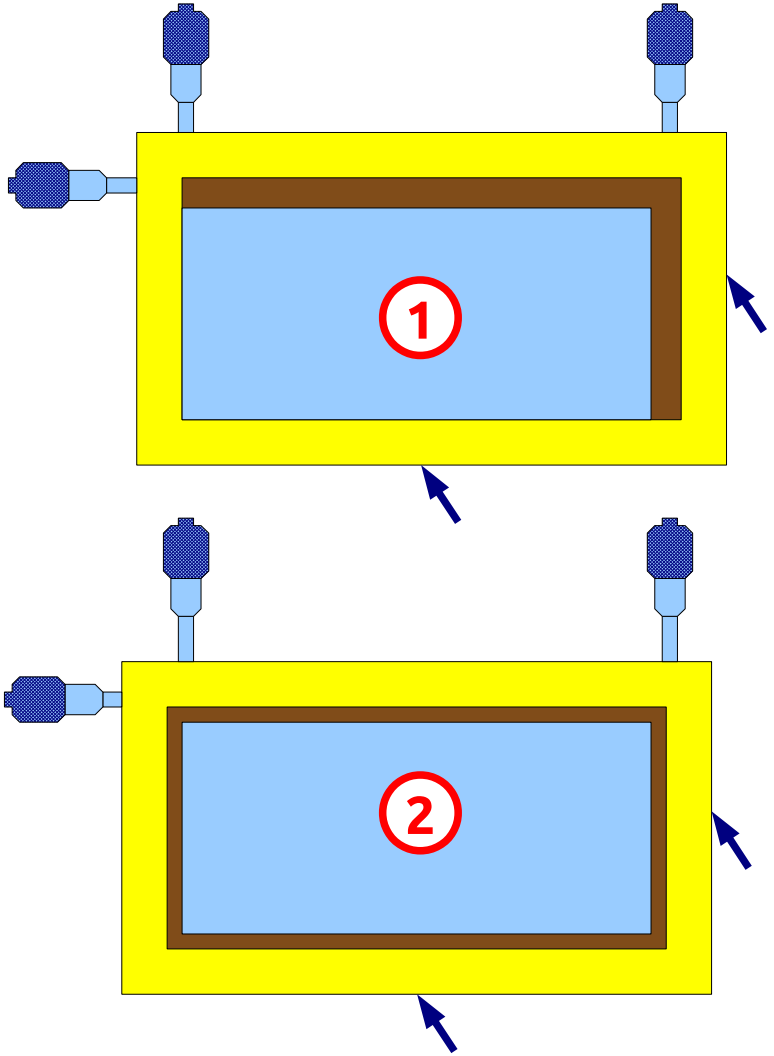
Gluing of TBM protection cap





1. Cut out protection caps from an empty embossed carrier tape with an angled head cutter. Inside dimensions approx. 9x6,5x2mm. Empty (used) embossed carrier tape can be obtained by an assembler of printed circuit boards.
2. Dip protection cap in “epoxy basin” and place it with the help of the anti static tweezers over the TBM.
3. Pick address wire bonds with a small tweezers.

Appendix: How to adjust micrometer screws



1. Lower Z-stage until sensor module rests on base plate (NO vacuum on table – press vacuum chuck with your fingers constantly towards micrometer screws). Adjust the three micrometer screws until the alignment looks like on the drawing (use microscope).
2. Now adjust the micrometer screws by the necessary offset to achieve the designed position of the sensor module relatively to the base plate (NO vacuum on table – press vacuum chuck with your fingers constantly towards micrometer screws).

   Note: Use bad components for adjusting of gluing jigs. Secure micrometer screws.

Press in this direction

Micrometer screw

Vacuum chuck on table

i.e. base plate on chuck → vacuum ON!

i.e. sensor module on Z-stage → vacuum ON!

Appendix: Dimensions BPIX sensor module 2008