Gluing tests
Carbon fiber + fanout Kapton

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AGENCIA ESTATAL DE INVESTIGACIÓN
GOBIERNO DE ESPAÑA MINISTERIO DE CIENCIA, INNOVACIÓN Y UNIVERSIDADES
GENERALITAT VALENCIANA Conselleria de Educación, Universidades y Empleo
Financiado por la Unión Europea NextGenerationEU
Plan de Recuperación, Transformación y Resiliencia
AITANA

Material available

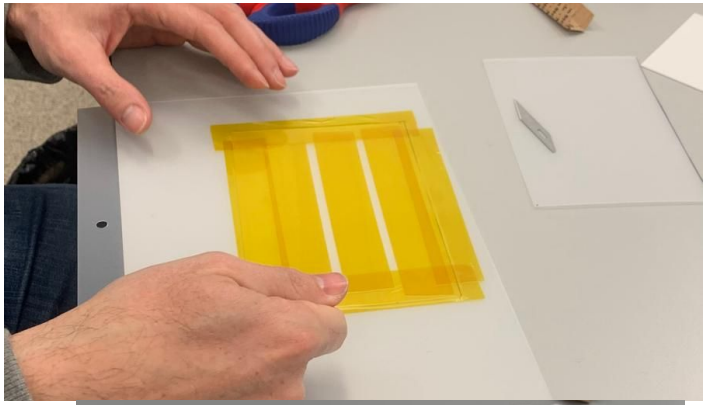
- Received at IFIC from TAU:
  - 19 Fanouts
  - 21 High Voltage Kapton PCB
- Sent from IFIC to AGH U. Krakow:
  - 2 Fanouts

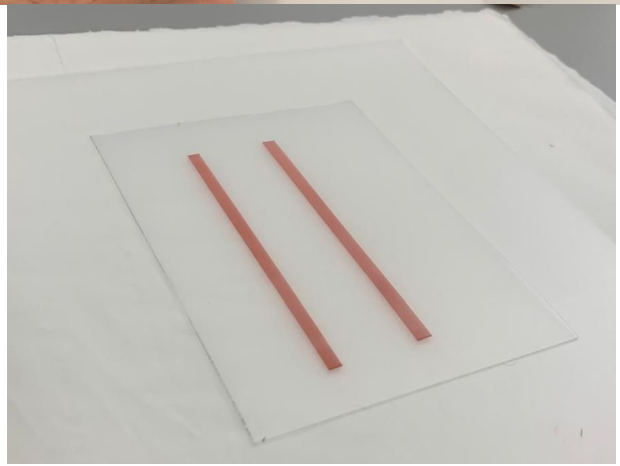
- Available at IFIC:
  - 17 Fanouts
  - 21 High Voltage Kapton PCB
  - 20 Carbon fiber for CSIS (machined in external company WorkShape)
  - 15 Carbon fiber for tests (from ClipCarbono)

Carbon fiber + fanout tests

Kapton tape stencil + silicone glue

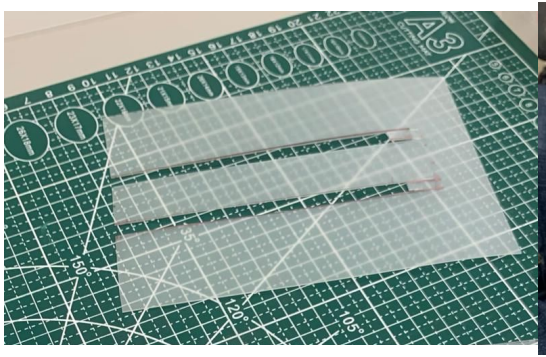
- Spread silicone with a blade
- Thin silicone layer
- Clean edges
- Hard to manipulate Kapton tape
- Hard to position tape

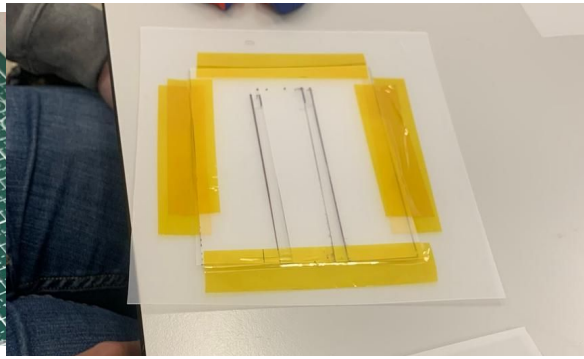


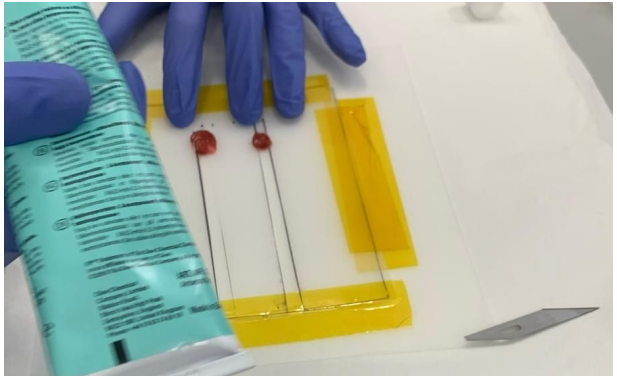


Plastic stencil +Silicone Glue

- Easy to position
- Clean edges

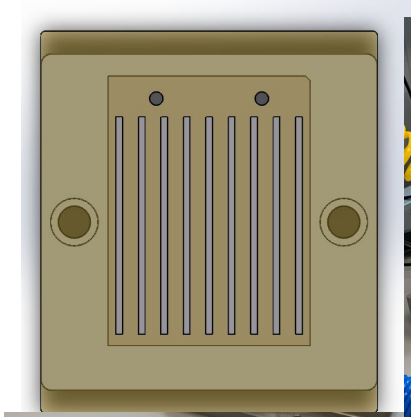


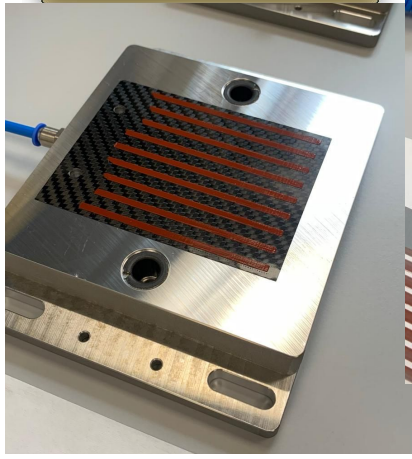


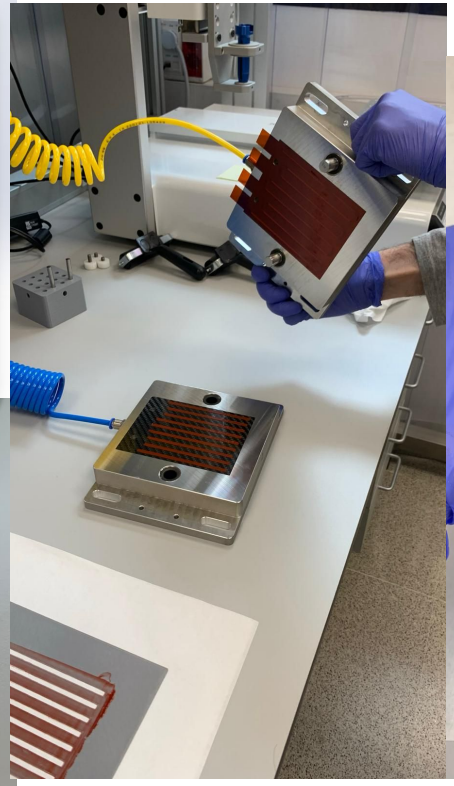


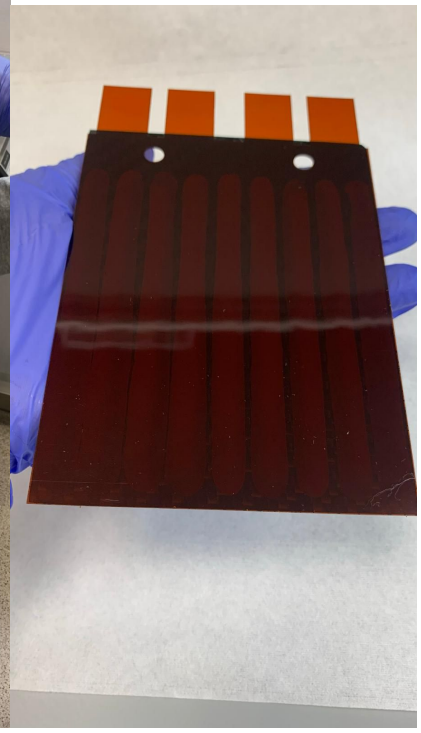
3D Printed stencil + silicone glue

- Worked very well
- Stencil aligned with pins
- Straight lines
- Cleaning stencil is time consuming and messy (lots of wipes)
- Jig positioned and pressed
- Good results and no air bubbles
- 3 units ready to assemble CSIS



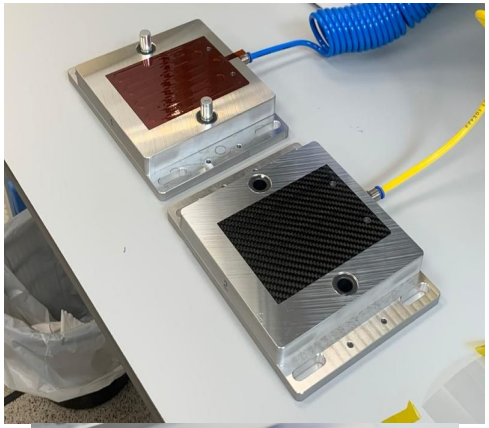


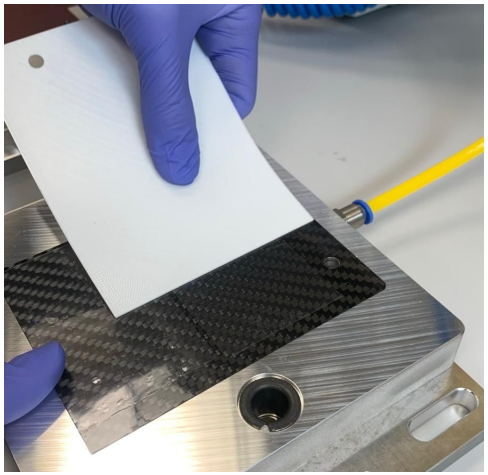


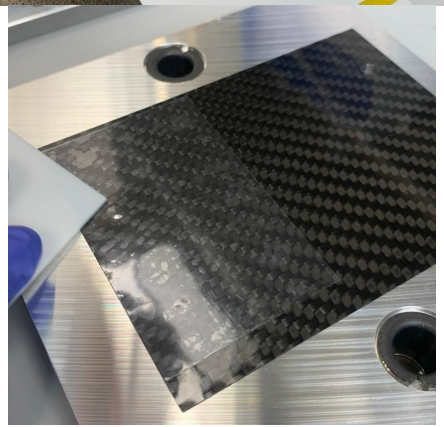


Double sided tape positioned with jigs

- Easy to position
- Air bubbles between CF and tape and between tape and Kapton FO
- Good precision in CF-FO placement because of the use of jigs
- Bonds strongly to both materials







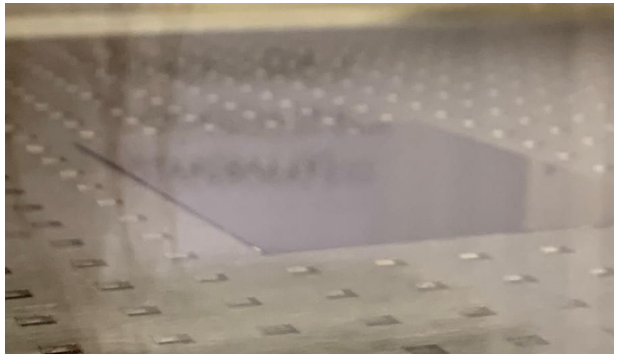
Samples for heating tests

1. CF+Fake Kapton FO+Double sided tape
2. CF+dummy Kapton FO+silicone

Heating cycle: 80 minutes 140 degrees->cooling in oven after cycle

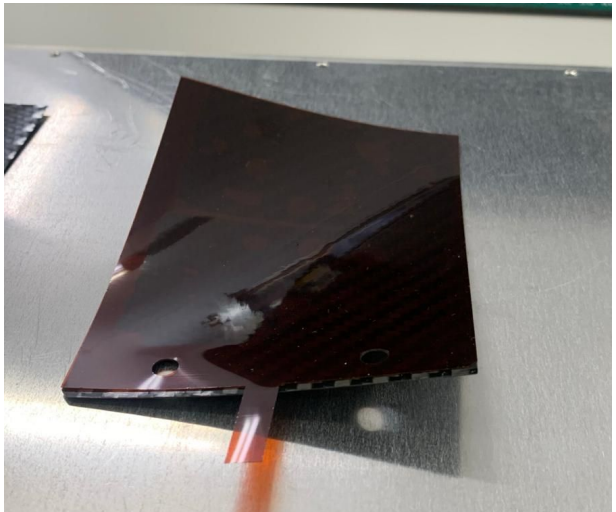
Results 1: CF+Fake Kapton FO+Double sided tape

While heating->OK



Better adhesion to materials after heating (from peel tests)

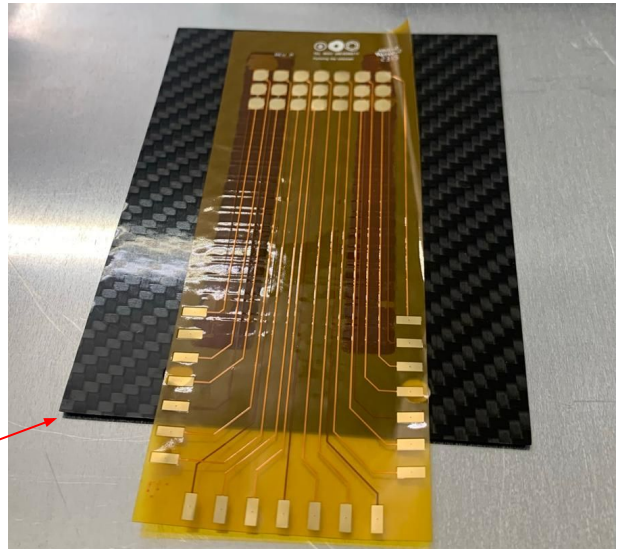
After cooling->Completely deformed



Results 2: CF+dummy Kapton FO+silicone

While heating-> Slightly warped in one direction

After cooling-> Slightly warped in the other direction



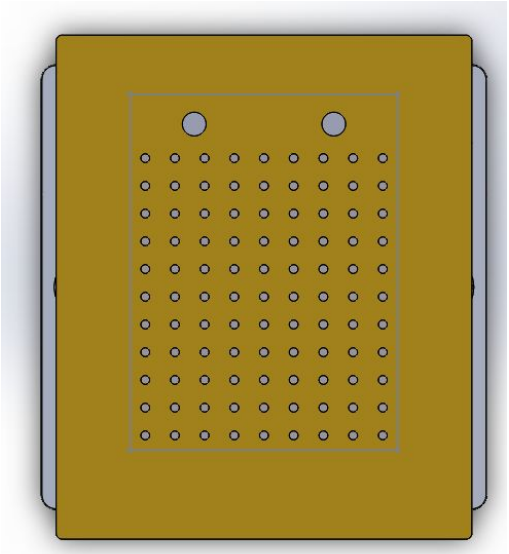
Better adhesion to materials after heating (from peel tests)

Notice bent

Solution?

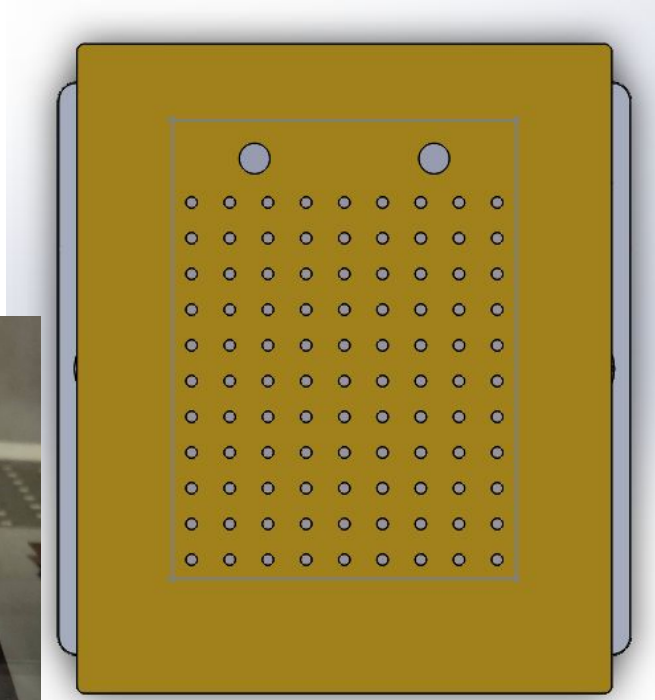
Stencil to deposit silicone circles instead of strips

Results next->



Solution? Not exactly

Stencil to deposit silicone circles instead of strips

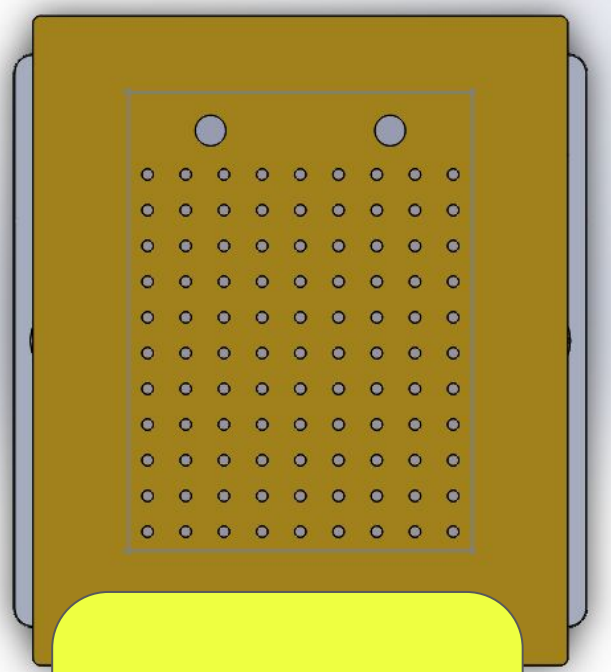


Fake fanout + CF

Bent completely during regular curing cycle

Solution? Not exactly

Stencil to deposit silicone circles instead of strips



Fake fanout + CF

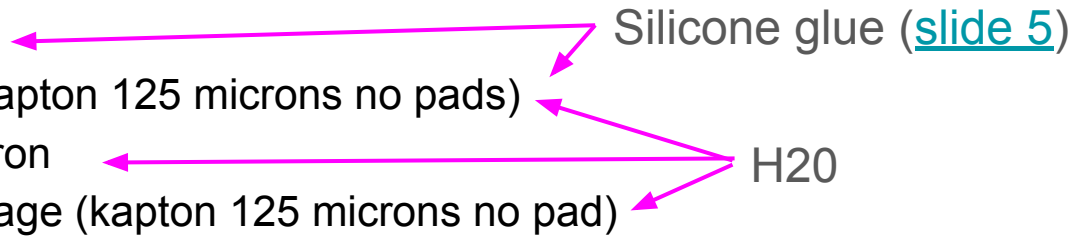
Bent completely during regular curing cycle

Conclusion:
Differences in the thermal expansion of FO,CF and silicone glue

Fake CSIS tests

Tests performed to set the final CSIS glueing procedure in clean room.

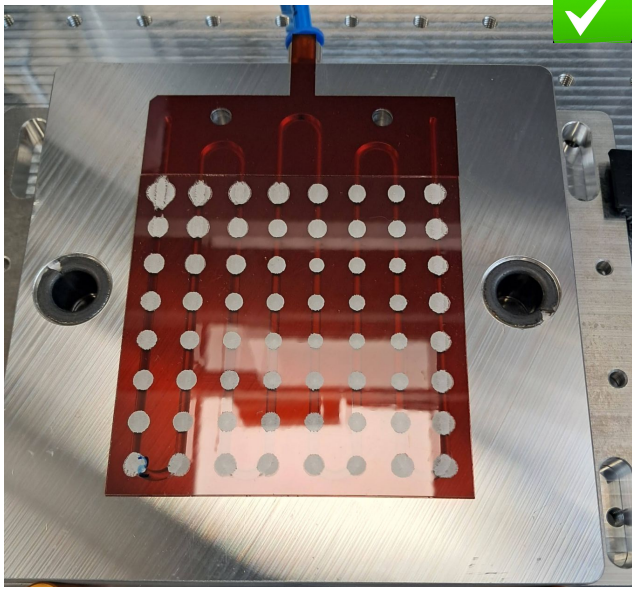
- Layers:
  - Carbon fiber
  - Fake fanout (kapton 125 microns no pads)
  - Glass 700 micron
  - Fake High voltage (kapton 125 microns no pad)



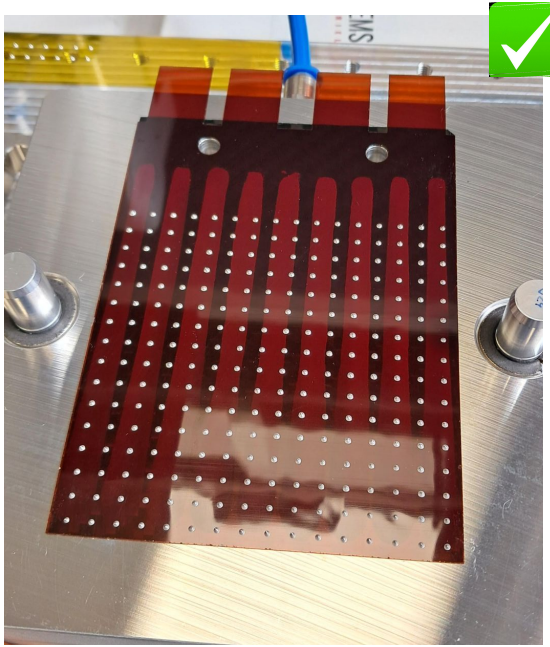
- Oven cycle:
  - 30 minutes at 50 degrees
  - 30 minutes at 80 degrees
  - 4 hours at 100 degrees

Fake CSIS tests

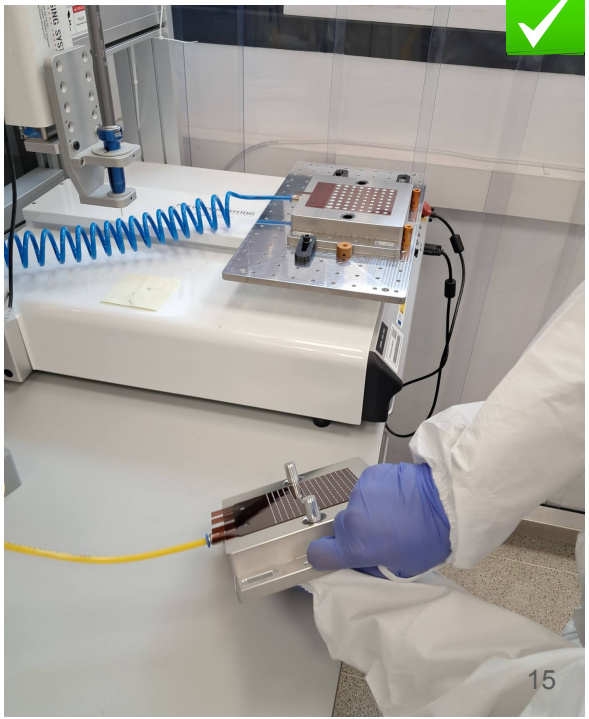
Fake HV + Glass



Glue dots in Fake FO

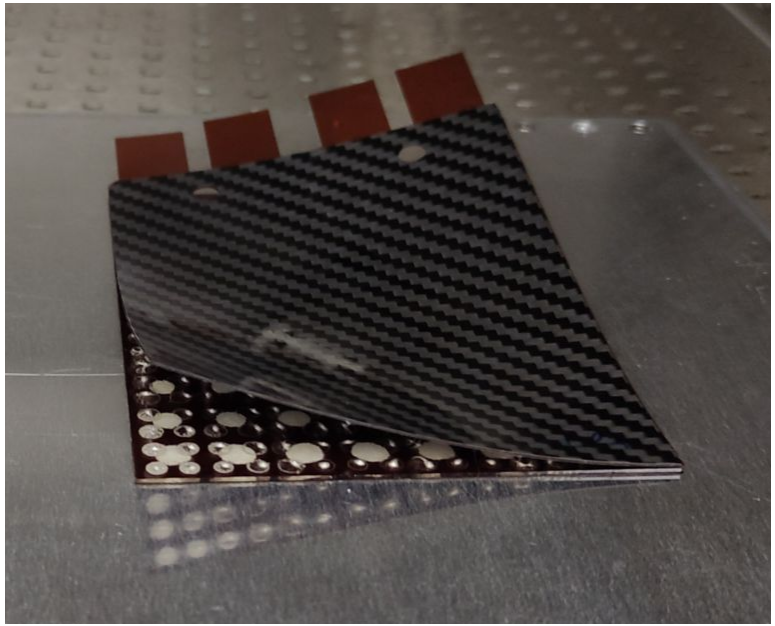


CSIS assembly

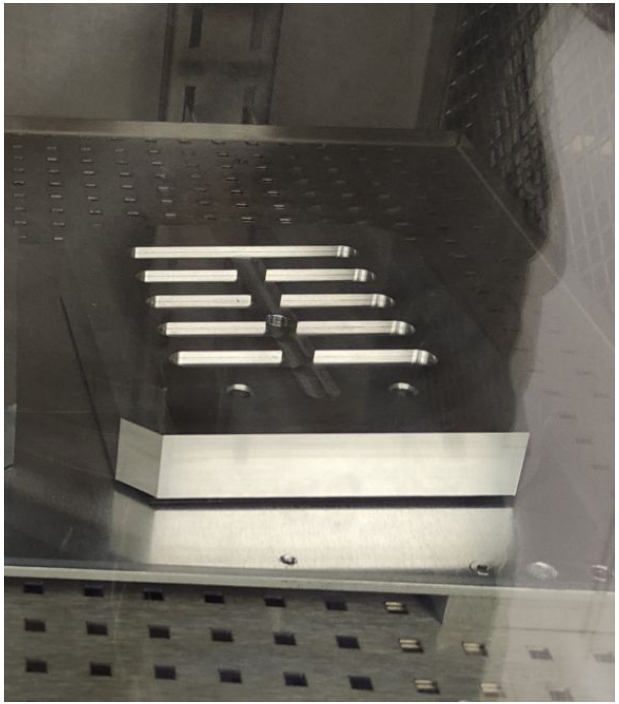


After a few minutes in the oven

- CF+Fake FO with silicone->Bent
- Glue dots were the right size
- Fake HV did not bend



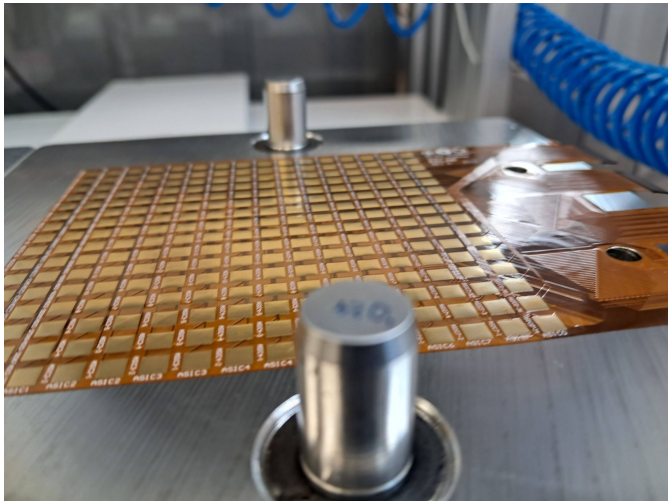
- Added some weight after noticing bending
- After full curing cycle the CSIS is flat



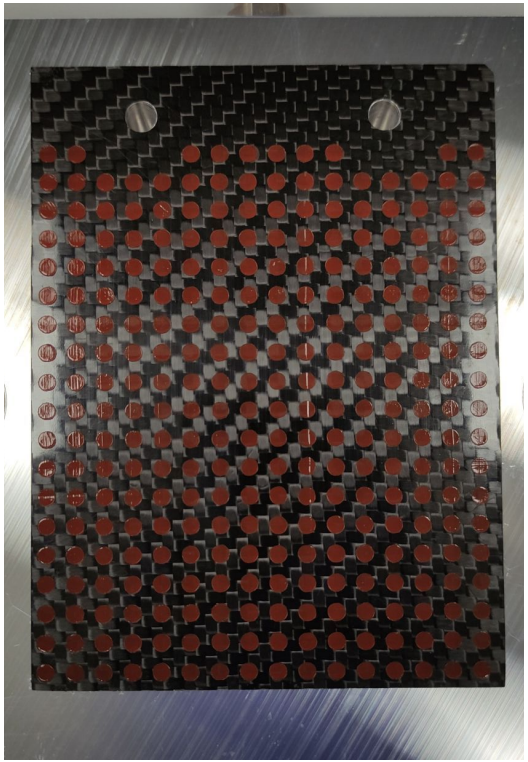
Open question from tests

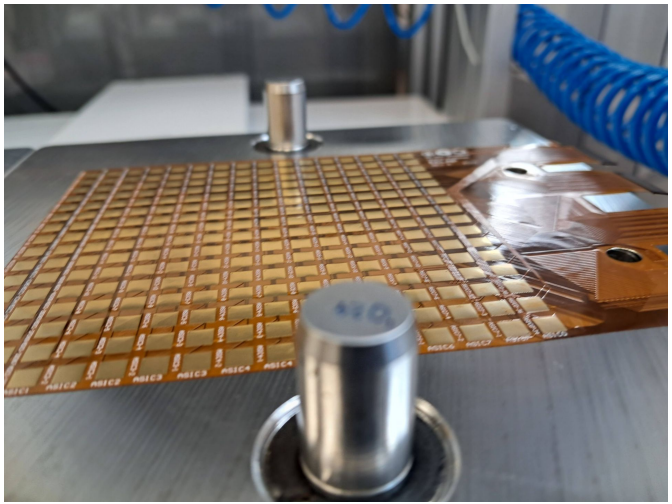
- Will the bending happen with real FANOUT?
- Can we put wet silicone glue in the oven to prevent bending?

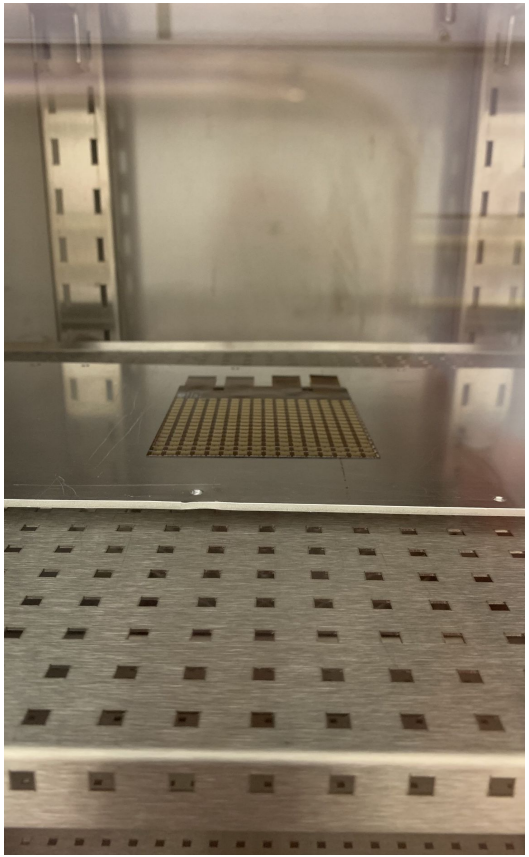
Answer next



Real fanout + CF + wet silicone

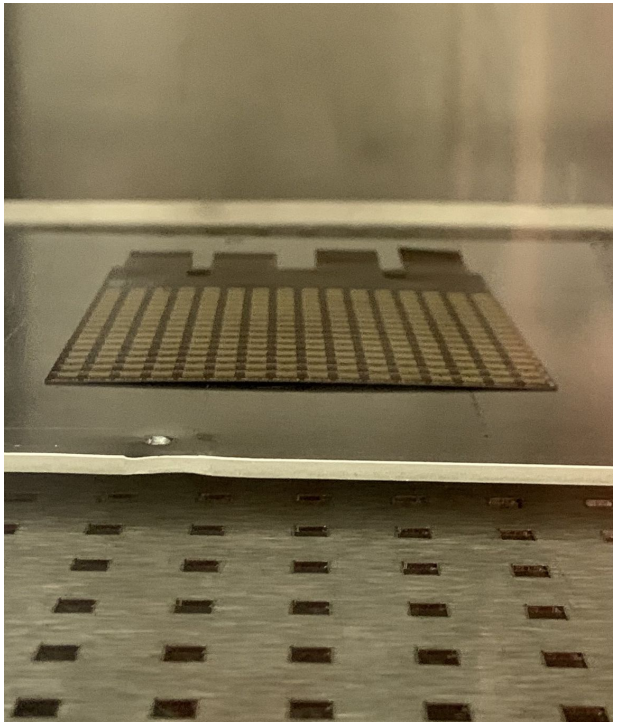






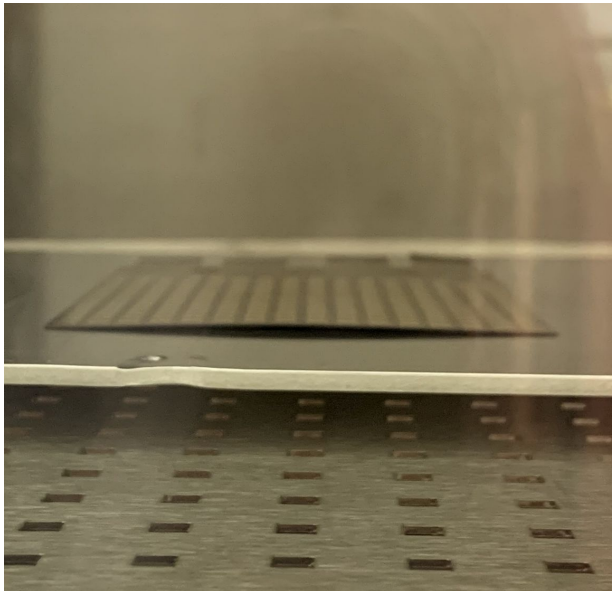
Results: bending

Bending started at 67 degrees



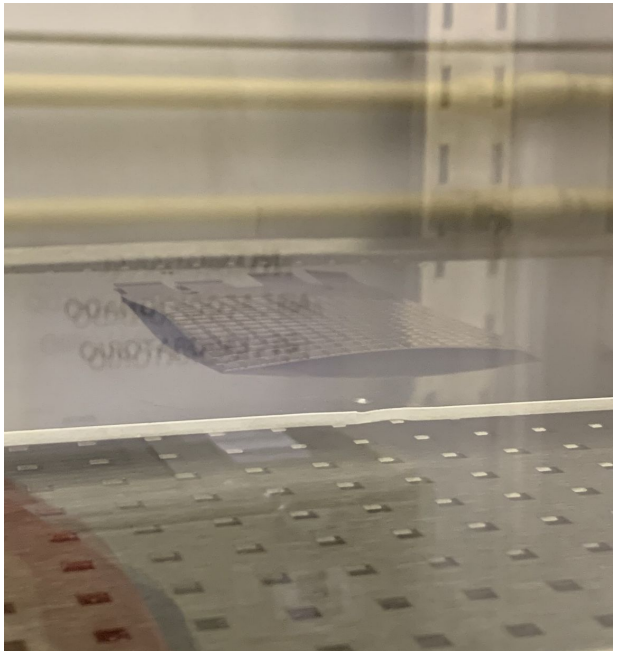
Results: bending

At 78 degrees



Results: bending

At 100 degrees



Conclusions

- Any pre-gluing of carbon fiber to fanout will result in bending from differences in material thermal expansion.
- Can be reduced by keeping CSIS in jig or with weights to flatten but it is risky to put weight with wet H20 glue, the least manipulation the better.
- Possible solutions:
  - Use H20 in all layers and cure once
  - Glue carbon fiber after curing (preferred option)

Next week

1. Glass CSIS with CF gluing after curing
2. Real CSIS with the best CF gluing method
    a. Number to be defined
    b. No PCB design for CSIS testing