# ECALp
# Sensor plane status

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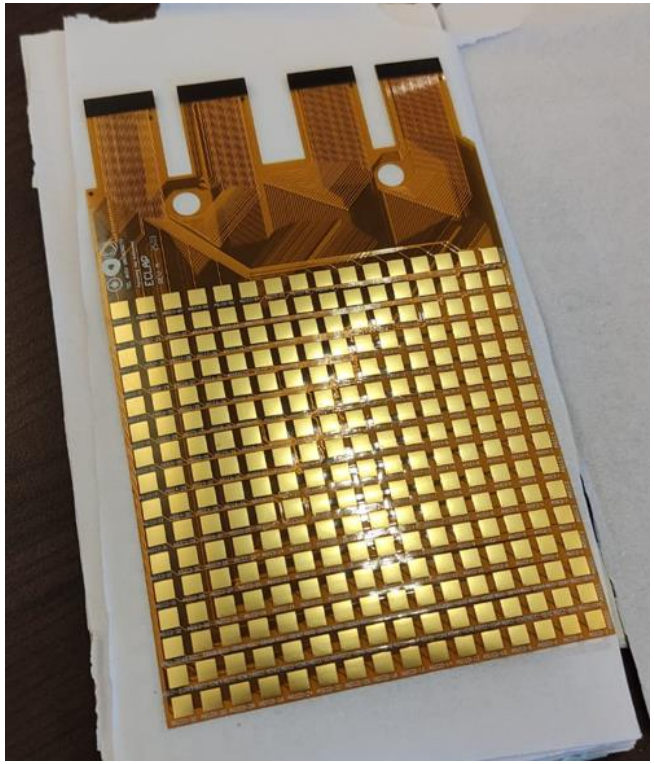
Plan de Recuperación, Transformación y Resiliencia

# Metrologies – CF manufacturing

- Results of CF metrologies were disappointing. We ruled out this manufacturer.
- We haven't found another manufacturer. 4 companies were contacted, asked if they could do the job and if not, if they would recommend a company to do it.
- Asked Francois Boyer, from composite lab at CERN, if they could manufacture the part.
- Would contact ARISTO (cutting machine equipment manufacturer) to make some tests.
- We are considering using an alternative material. More on that idea at the end.

# Metrologies – Fan out kapton

- Metrologies will be done with the new Fan Out Kapton provided by Yan during this DESY workshop.
- We will check thickness, general dimensions and quality of the edges during W6-W7
- We will do the same as soon as we receive HV kaptons.

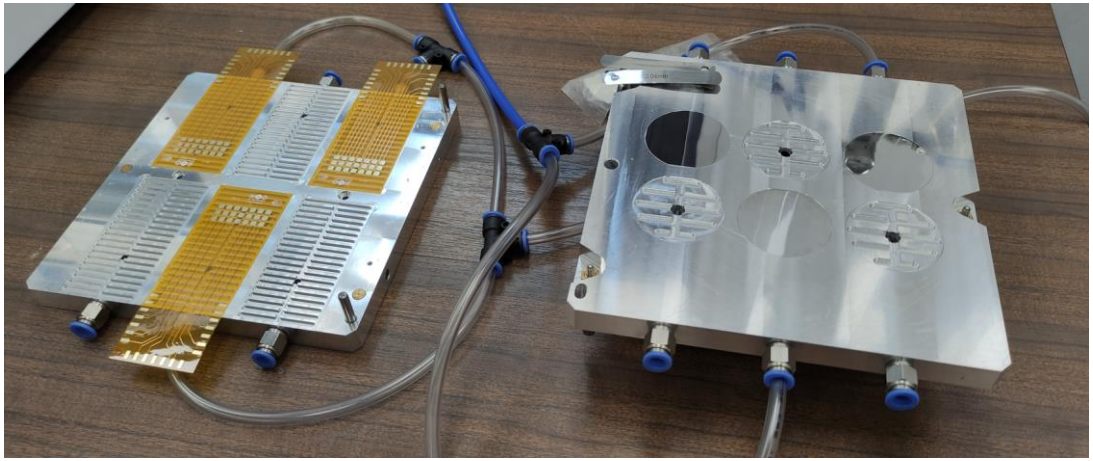


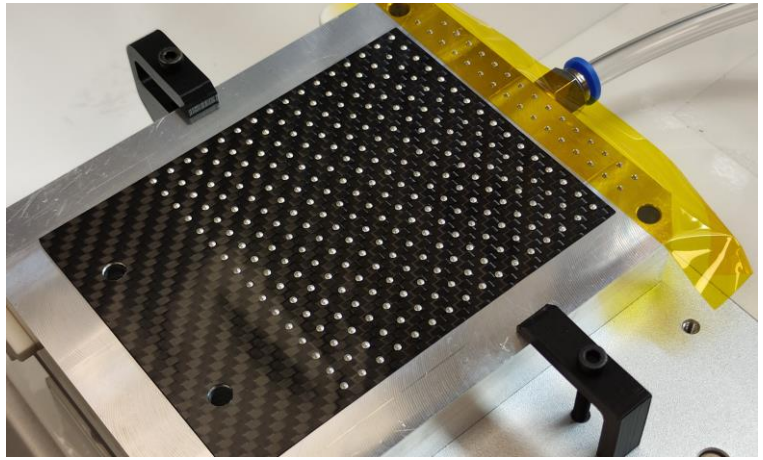
ECALp Fan Out Kapton revA

# Gluing

In previous tests we managed to:

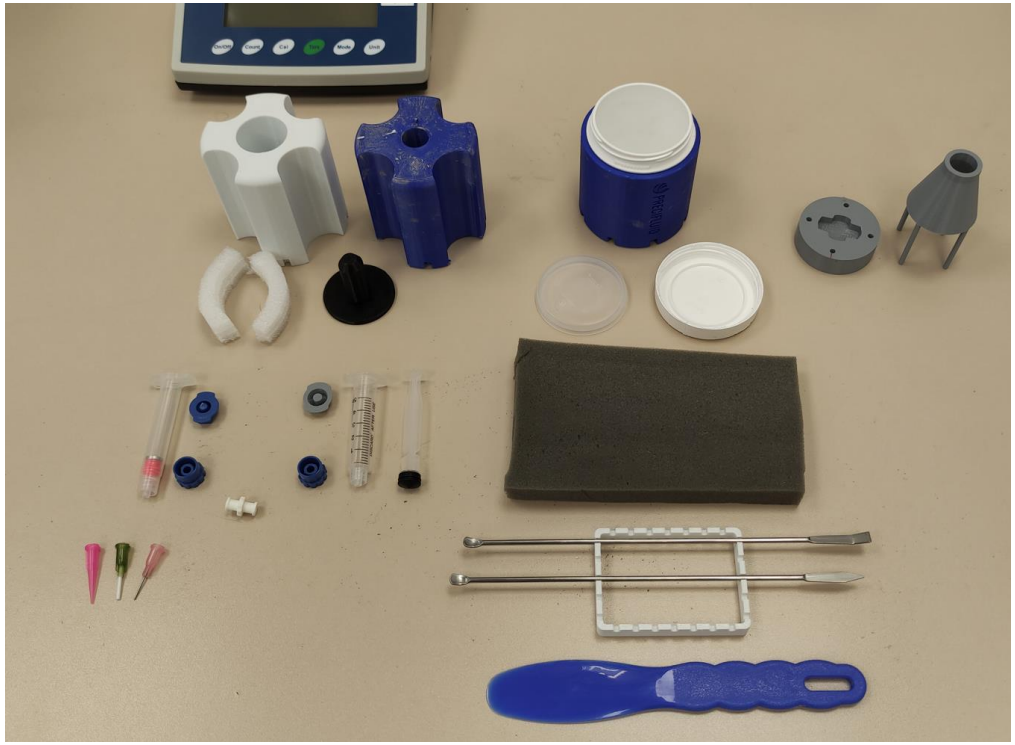
- Develop a procedure to mix the bicomponent epoxy glue with only 5% mass loss.
- Develop a procedure to assembly a sensor plane using our tooling.
- During W6-W7 we will assembly CALICE sensors. We will rehearse and consolidate the procedure.
- W15-W16 start assembling ECALp sensor planes.

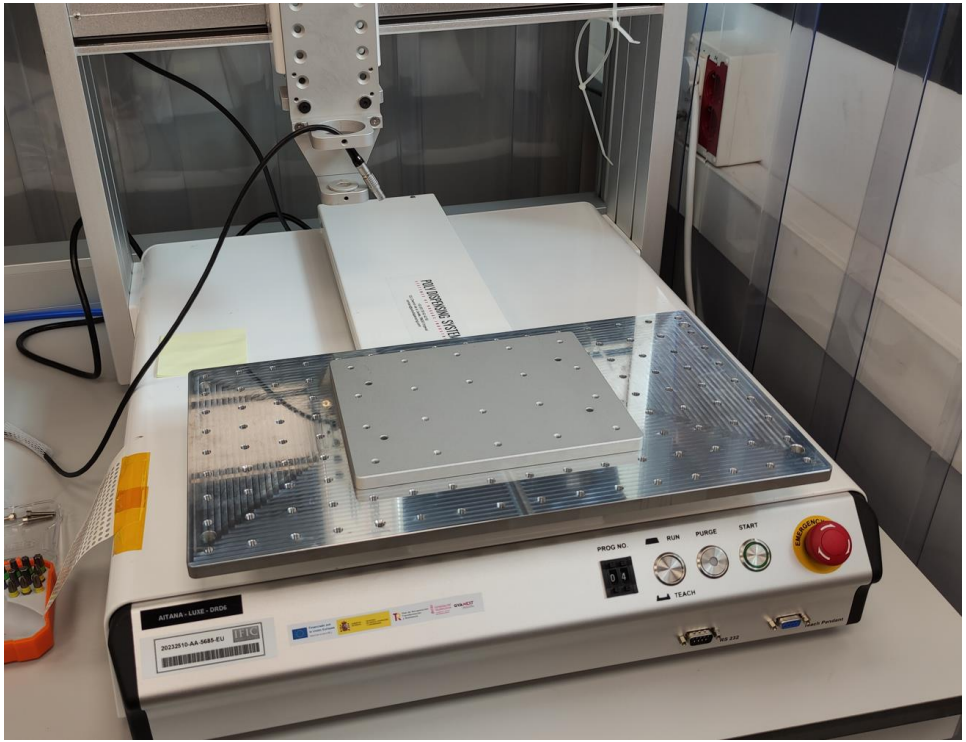




# Gluing

Glue mixing tooling

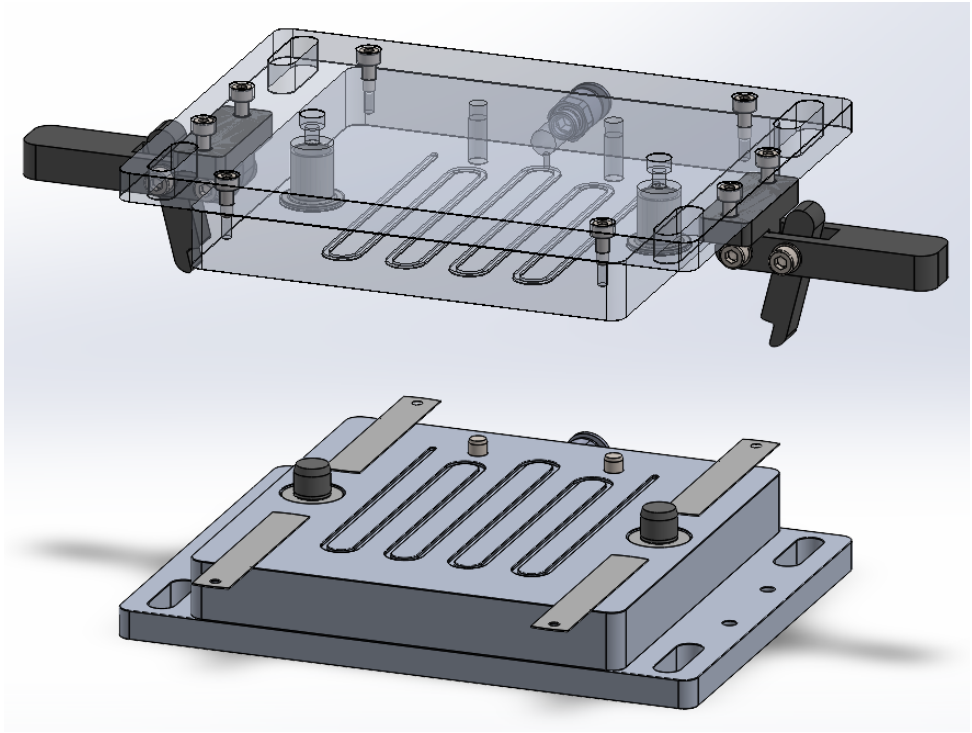





New and bigger table for the dispenser robot

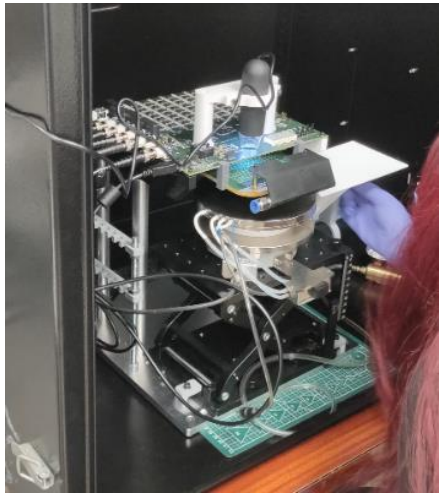
# Tooling

- Jigs are next in the queue for manufacturing at IFIC workshop.
- The design was ready months ago, but some other jobs (from our side and other projects) have been fabricated first.
- W7-W8 jigs finished, checked and tuned.



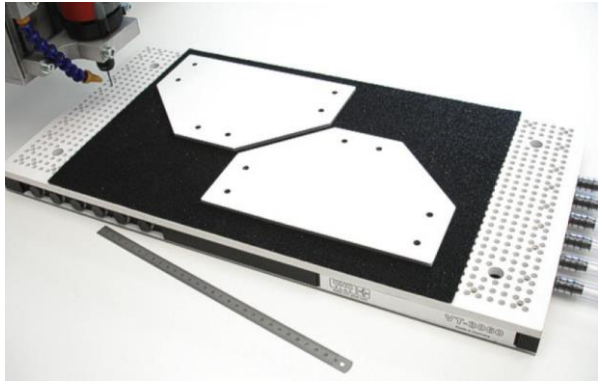
# Clean room

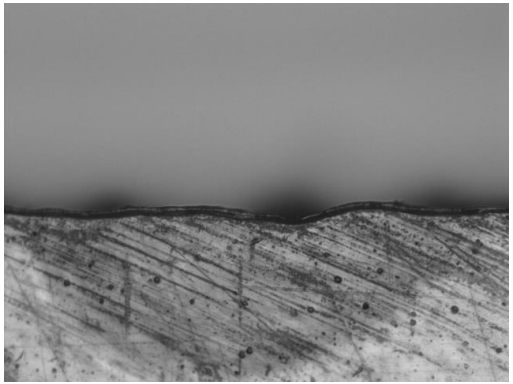
- Clean room is ready.
- Particles in the air were measured (ISO5 compliant)
- We have an ultrasonic cleaner for the jigs and gluing tools.
- Probe station is almost ready.

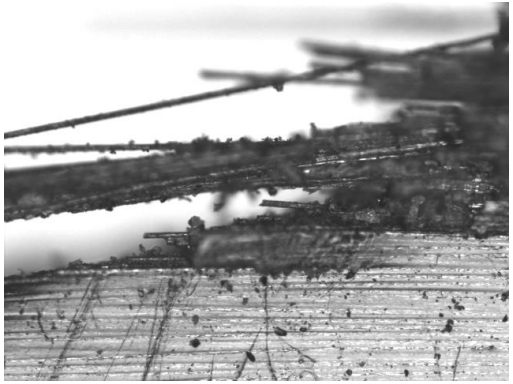


# CF manufacturing challenges

- Work holding: vacuum or gluing. Prone to lifting during machining.
- Drilling holes is difficult because the reduced rigidity of the sheet.
- CF dust is hazardous. Aspiration of dust or machining under water (both with filtration systems). This usually leads to have dedicated machines to do the jobs. For example, at DESY it is not allowed to cut CF in its workshops.
- Laser cutting is not suitable because it burns the material.
- There are special composition CFRP laminates for machining, but I haven't found them in thin laminates.
- Not found yet a reliable provider for this part that will meet the specifications.
- We will explore cutting it with an ARISTO machine.

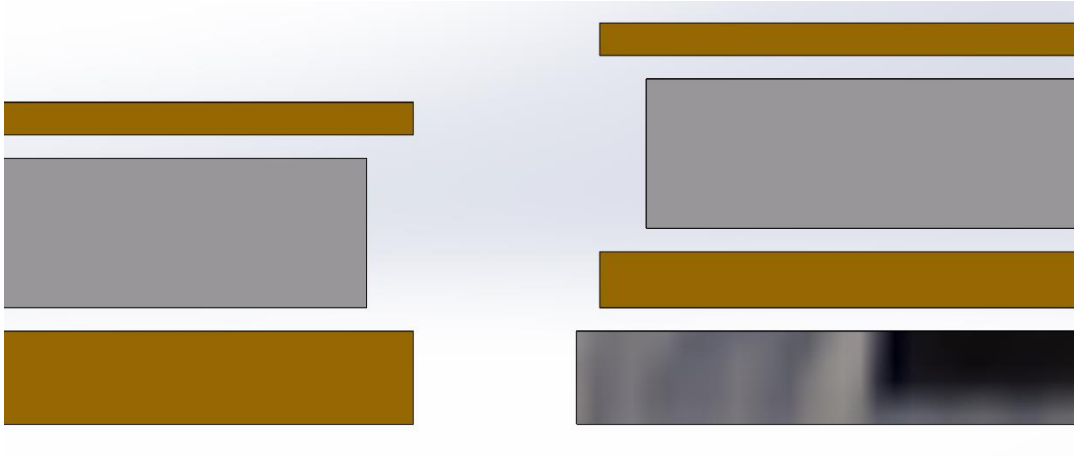


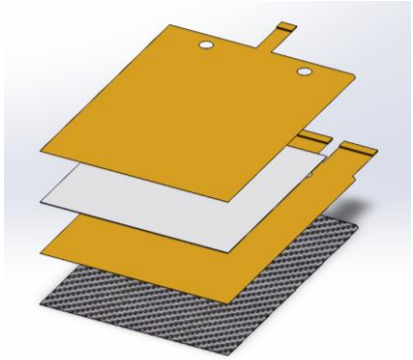




# Is there an alternative?

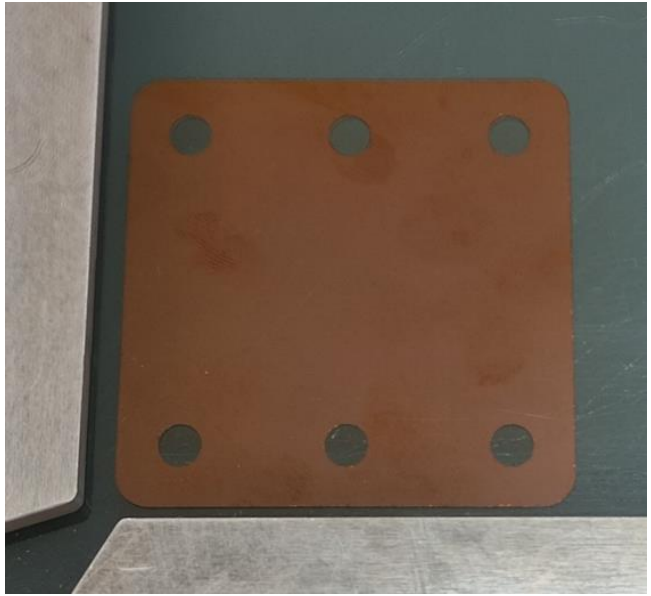
- What is the function of the CF layer? Are there any mechanical requirements for this layer? Could we change the material? What if we made it from Kapton? And if so.... Why do not consolidate functions in the same part?
- We would like to explore the possibility of eliminating the CF layer and make a thicker HV Kapton or Fan Out Kapton to give rigidity to the sensor plane.
- One less component means one less gluing step. Reduces costs and CF technical challenges.
- Thicker FO or HV Kapton. Which one?
- In the picture below, thicker Fan Out just for comparison. Overall sensor plane thickness reduced in 170 um.





# Exploration - thicker kapton

- To move in this direction, we manufactured a 70um Kapton sample at IFIC using laser cutting.
- Edge circularity and edge “sharpness” were good enough, taking into account that our laser cutting machine is not a state of the art equipment and the cutting parameters (speed, power, pulsating frequency were not finely tuned).
- I find interesting using Kapton because it is cheap (both the raw material and the cutting process), fast to manufacture and I believe we can adjust the design and the cutting parameters so that we reach the required specifications.



70um Kapton test sample.

80x80mm square with 6.0 mm holes spaced 47.0 mm.

# Exploration - thicker kapton

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Círculo: C1_1(ID:44, a partir de 8 puntos)
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    Circular. =                                  0,015772

Círculo: C1_2(ID:53, a partir de 8 puntos)
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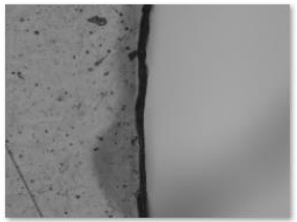
```

| | HP1 | HP2 | HP3 | HP4 | HP5 |
|---|---|---|---|---|---|
| **Linealidad L1** | **0.103** | 0.04 | 0.053 | 0.055 | 0.049 |
| **Linealidad L2** | 0.022 | 0.056 | 0.02 | 0.053 | 0.005 |
| **Distancia L1-PV1** | 89.652 | 89.958 | 89.875 | 89.935 | 89.877 |
| **Distancia L1-PV2** | 89.663 | 89.936 | 89.904 | 89.933 | 89.871 |
| **Distancia L1-PV3** | 89.709 | 89.94 | 89.859 | 89.933 | 89.889 |
| **Distancia L1-PV4** | 89.728 | 89.917 | 89.832 | 89.898 | 89.855 |
| **Distancia L1-PV5** | 89.752 | 89.941 | 89.821 | 89.906 | 89.848 |
| **Distancia L1-PV6** | 89.761 | 89.958 | 89.841 | 89.885 | 89.837 |
| **Distancia L1-PV7** | 89.806 | 89.955 | 89.863 | 89.898 | 89.865 |
| **Distancia L1-PV8** | 89.786 | 89.96 | 89.891 | 89.892 | 89.86 |
| **Linealidad PV** | 0.042 | 0.045 | 0.078 | 0.027 | 0.04 |
| **Distancia L2-PH1** | 119.767 | 119.81 | 119.778 | 119.775 | 119.825 |
| **Distancia L2-PH2** | 119.756 | 119.796 | 119.752 | 119.76 | 119.816 |
| **Distancia L2-PH3** | 119.75 | 119.775 | 119.734 | 119.781 | 119.792 |
| **Distancia L2-PH4** | 119.776 | 119.801 | 119.742 | 119.809 | 119.792 |
| **Distancia L2-PH5** | 119.812 | 119.84 | 119.764 | 119.853 | 119.819 |
| **Linealidad PH** | 0.022 | 0.056 | 0.02 | 0.053 | 0.005 |
| **Diámetro C1** | 6.072 | 6.067 | 6.064 | 6.07 | 6.052 |
| **Circularidad C1** | 0.064 | 0.075 | 0.032 | 0.063 | 0.037 |
| **Diámetro C2** | 6.03 | 5.95 | 6.058 | 5.982 | 6.014 |
| **Circularidad C2** | 0.013 | 0.054 | 0.041 | 0.055 | 0.045 |
| **Diámetro C3** | 6.03 | 6.044 | 6.04 | 6.038 | 5.991 |
| **Circularidad C3** | 0.069 | 0.043 | 0.029 | 0.049 | 0.038 |
| **Distancia C2-C3** | 0.075 | 0.187 | 0.138 | 0.096 | 0.14 |
| **Distancia C1-PMC** | 46.948 | 47.066 | 47.001 | 47.019 | 46.946 |
| **Distancia L1-C1** | 21.313 | 21.368 | 21.376 | 21.334 | 21.45 |
| **Distancia L2-C1** | 109.697 | 109.843 | 109.812 | 109.86 | 109.822 |

# Alternative?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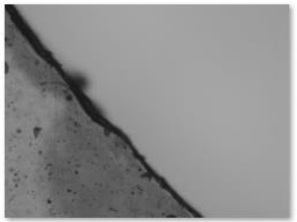
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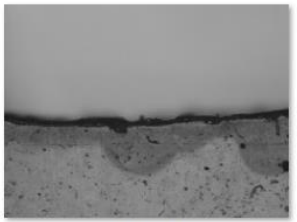
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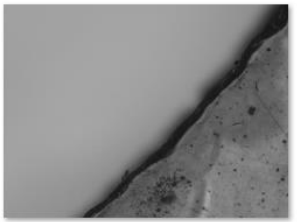
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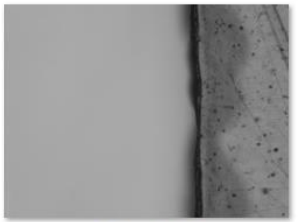
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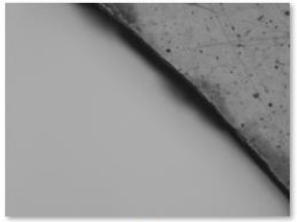
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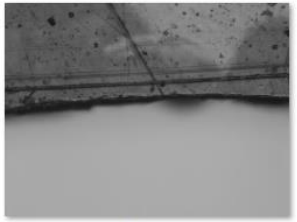
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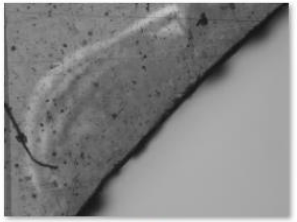
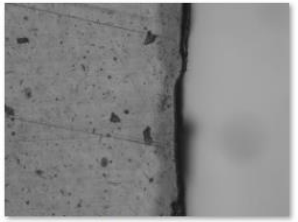

C_1_2_3.tif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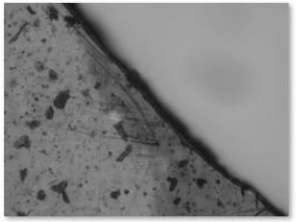
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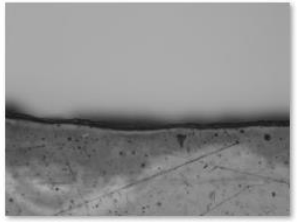
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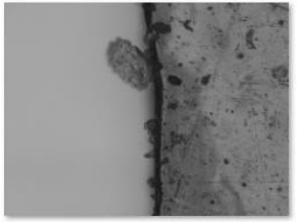
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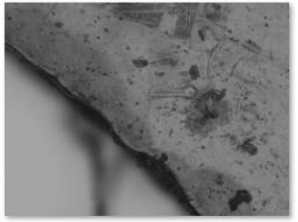
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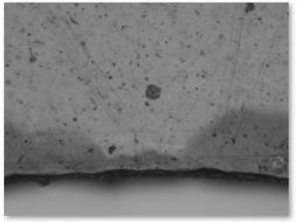
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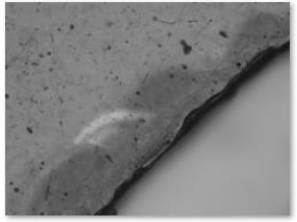
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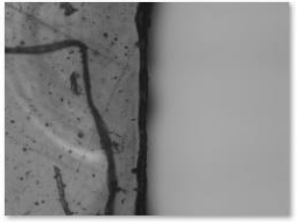
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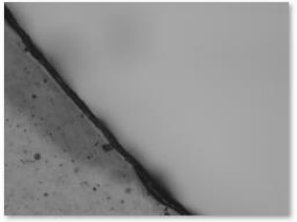
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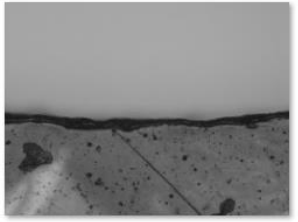
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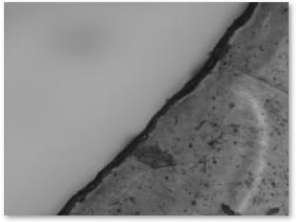
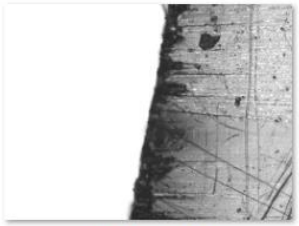

C_2_1_7.tif

Kapton test cut

# Alternative?


HP1__C2_1.tif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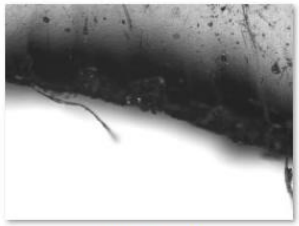
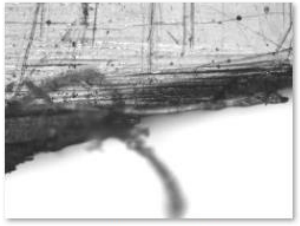
HP1__C2_3.tif


HP1__C2_4.tif


HP1__C2_5.tif

HP1 CF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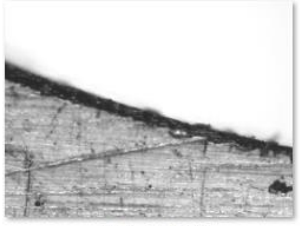
HP1__C3_1.tif


HP1__C3_2.tif


HP1__C3_3.tif


HP1__C3_4.tif


HP1__C3_5.tif


HP1__PH0.tif


HP1__PH1.tif


HP1__PH2.tif


HP1__PH3.tif


HP1__PH4.tif


HP1__PH5.tif


HP1__PH6.tif

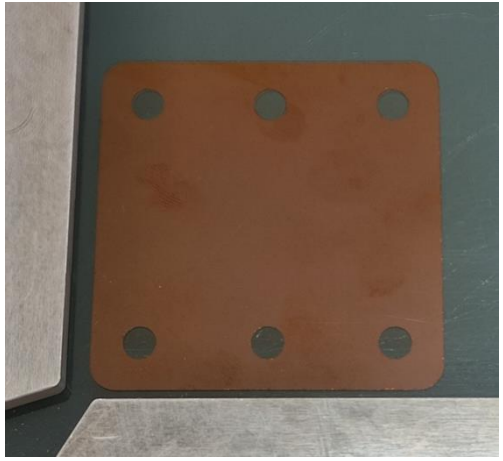

HP1__PV0.tif


HP1__PV1.tif

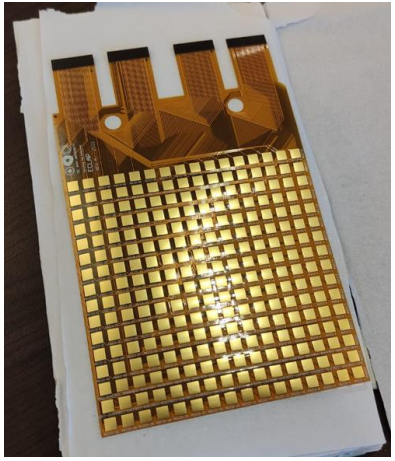
# Kapton alternative?

- We are in conversations with some manufacturers (circuit-labs, Wurth electronics) to manufacture a Kapton with the geometry of the CF to perform metrology and check its rigidity.
- If the results are promising, we could consider manufacturing a thicker HV Kapton or Fan Out Kapton.

First



Then this?



# Schedule

- A rough schedule of our next steps.

| | | | | | | | | | | 30 june to 6 july |
|---|---|---|---|---|---|---|---|---|---|---|
| **W5** | **W6** | **W7** | **W8** | **W9** | **W10** | **W11** | **W12** | **W13** | **W14** | **W27** |
| DESY workshop | FO metrologies | | | | | | | | | |
| | CALICE gluing | | | | | | | | | |
| | | | Jig tuning and testing | | | | | | ECALp gluing | |
| | | | | | Slow month because of holidays | | | | | |

# This is the end

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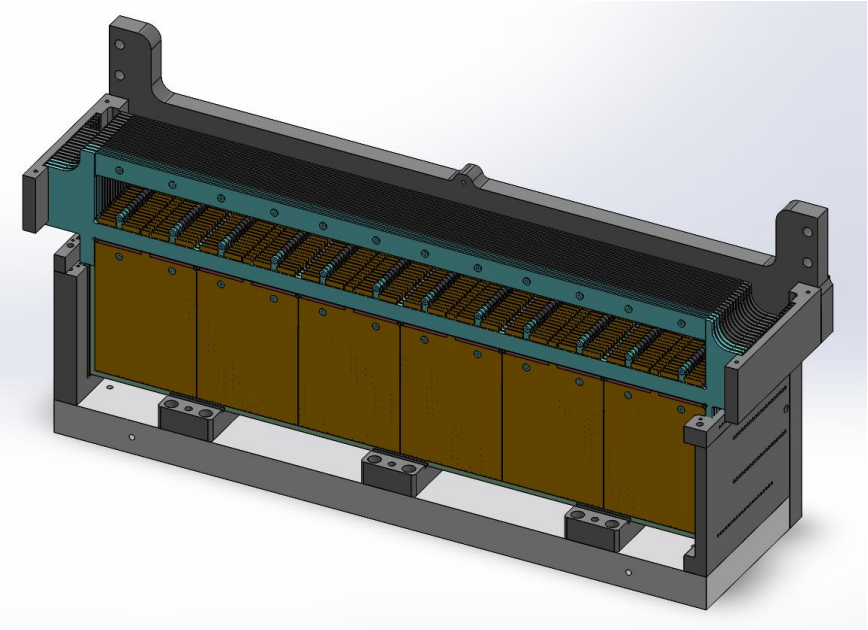
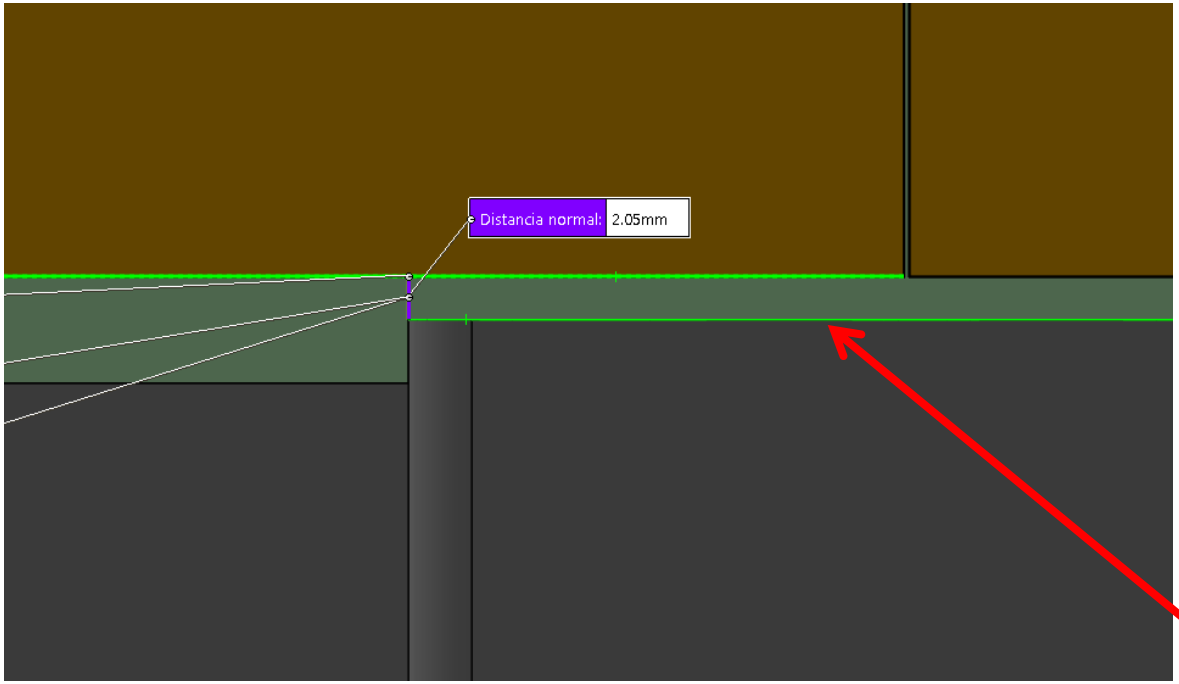
Thank you for your time.




Distancia normal: 2.05mm