Activities in Valencia

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Outline

- STATUS AND FUTURE PLANS:
  - Thermal mockup
  - Thermal enclosure (short update)

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THERMAL MOCKUP

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Mock-up: Air cooling

- Working on a PXD mock-up inside a IR transparent cylinder (thermal images)
- Al-beam pipe with cooling (15ºC)
- Support structures similar to the final ones but with mono-phase cooling
  - CO_2 will follow in a second stage
- Ladders: Samples with integrated resistors and transparent dummy ladders

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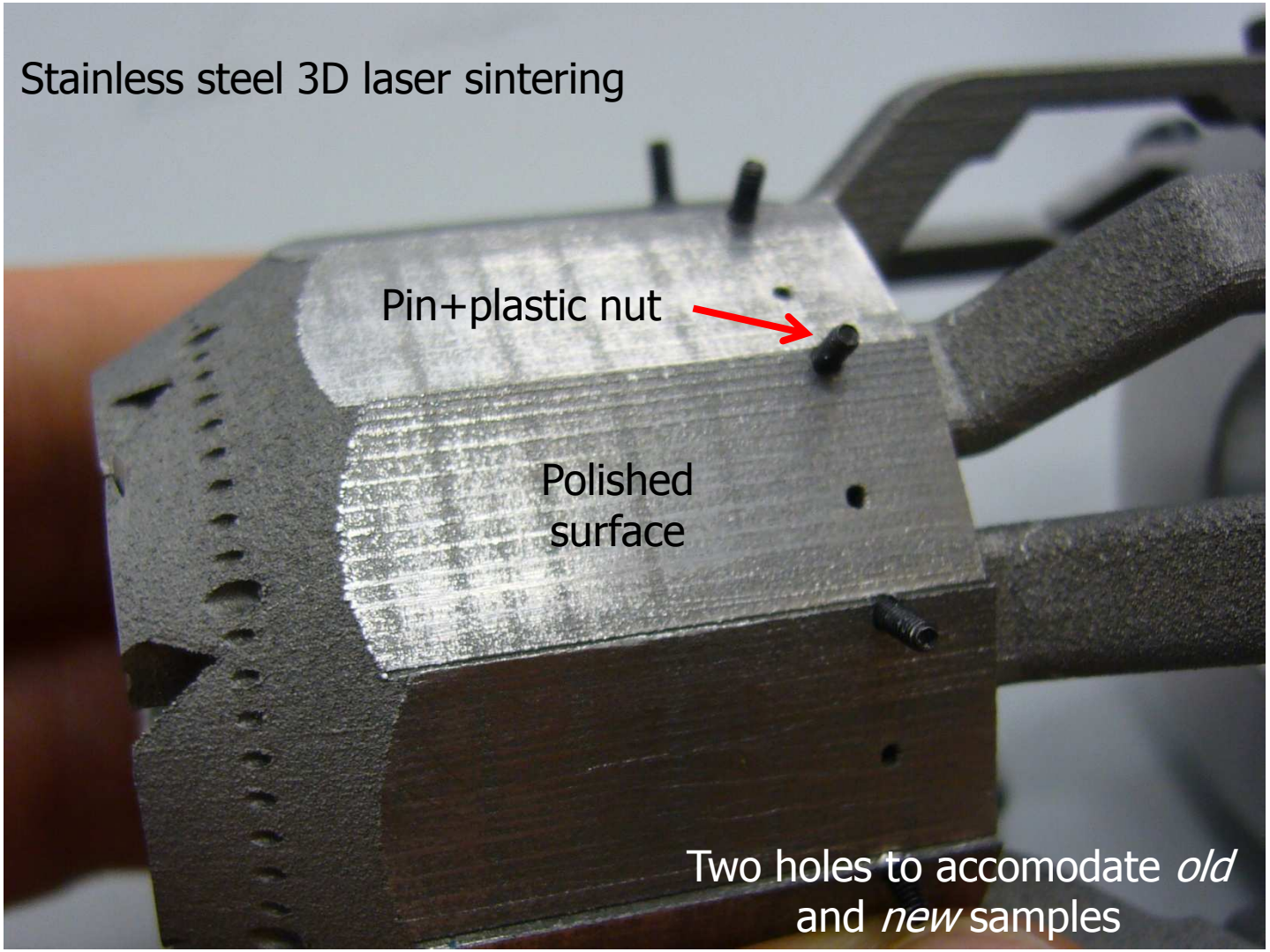
Cooling blocks



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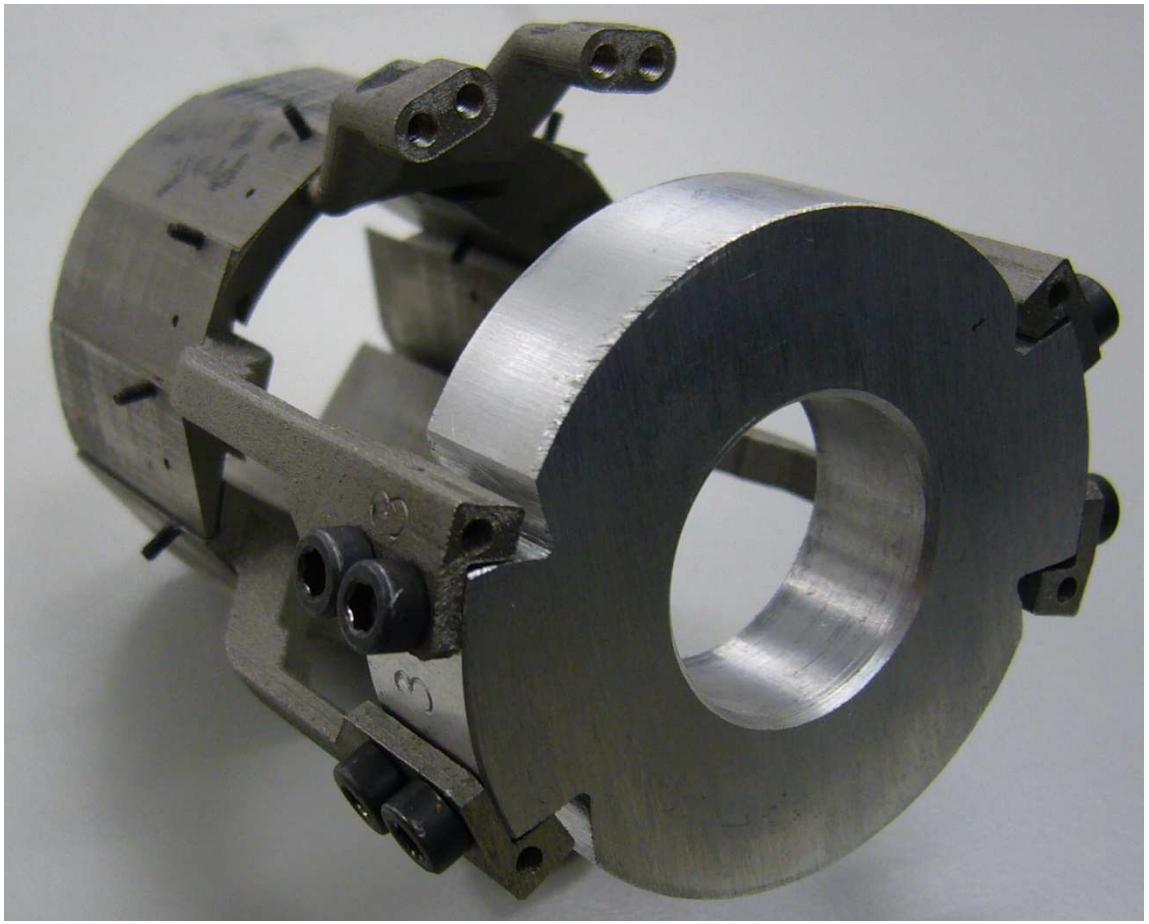
Support rings



- The two independent halves attached to the support ring
- Support ring held to the beam pipe

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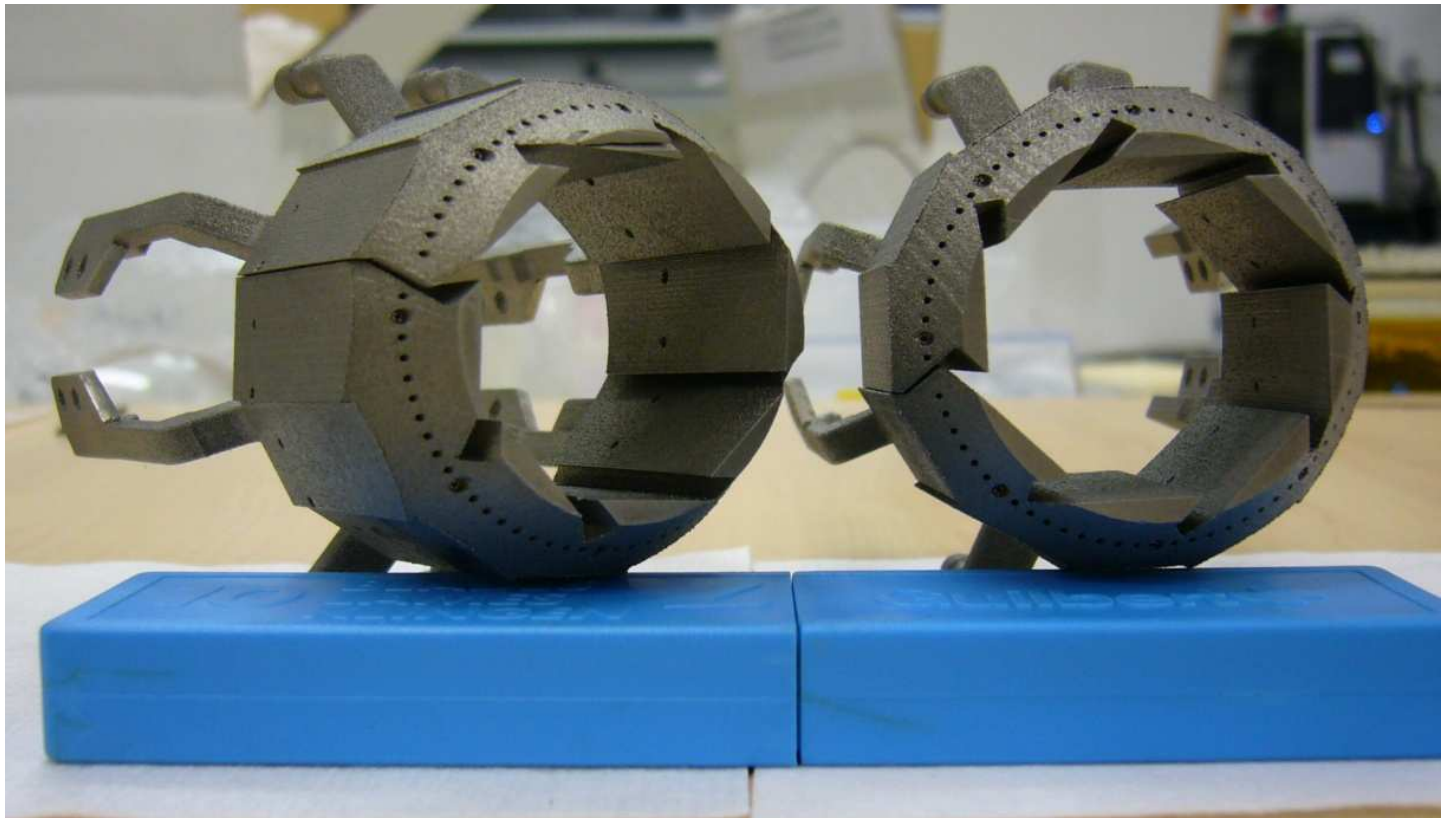
Cooling blocks

The support structures will be populated with dummies (made in polycarbonate) and two silicon samples with resistors integrated



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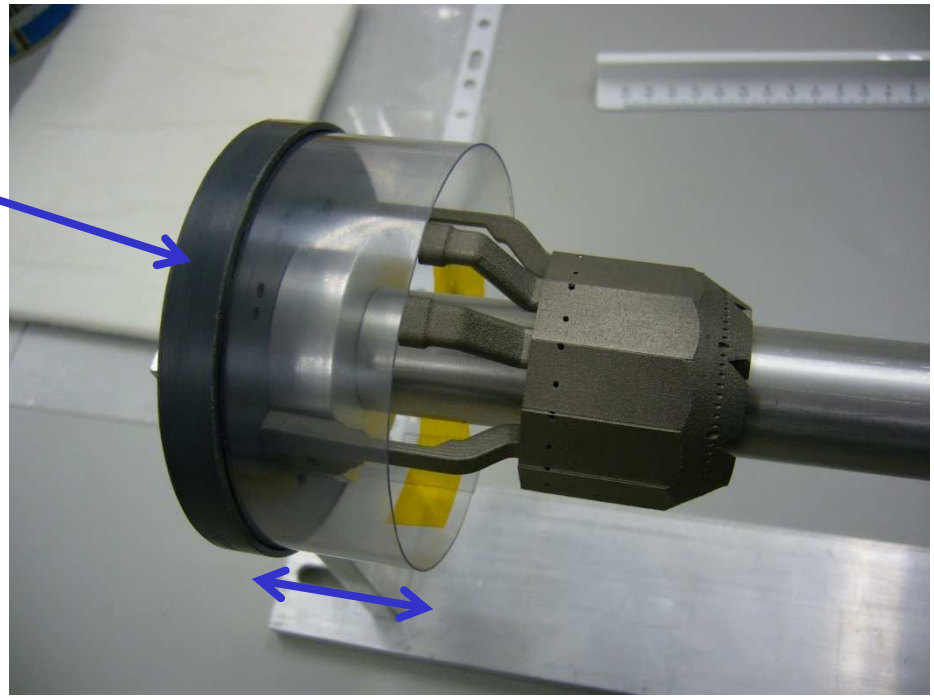
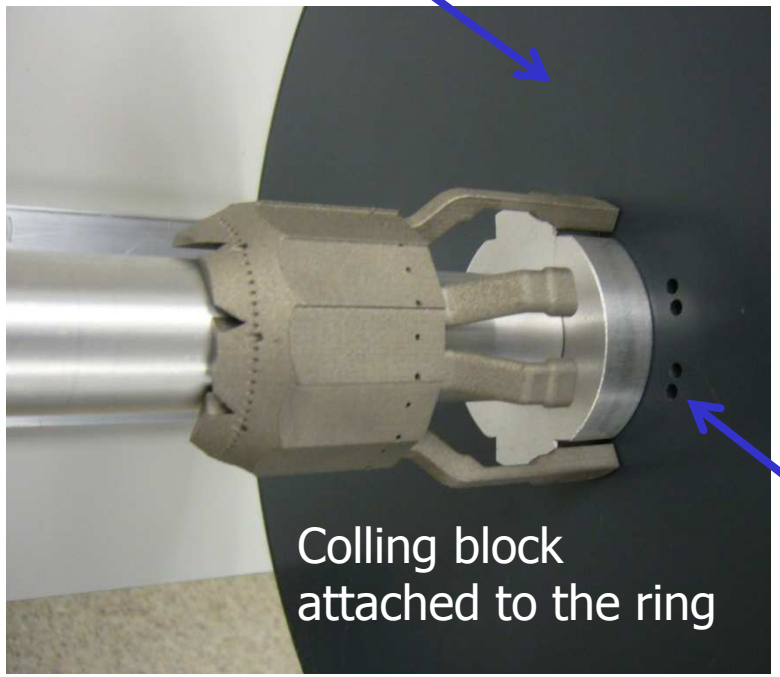
Support rings and working volume

Two PVC "endcaps" will define the working volume: PXD standalone or PXD+SVD





The IR transparent screen will be extended to cover the full volume

Holes for the services (air and coolant)

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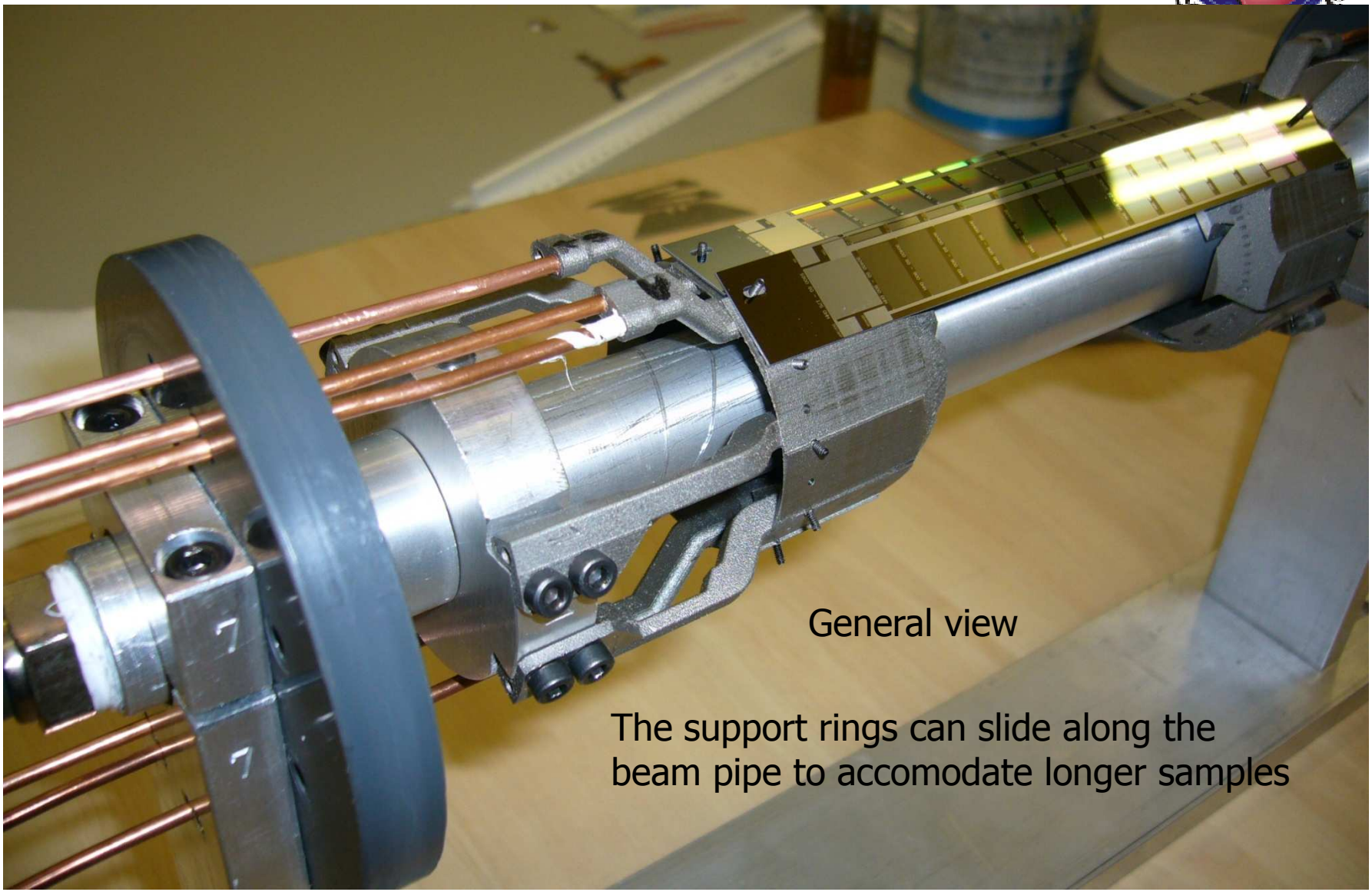
Assembling the full system



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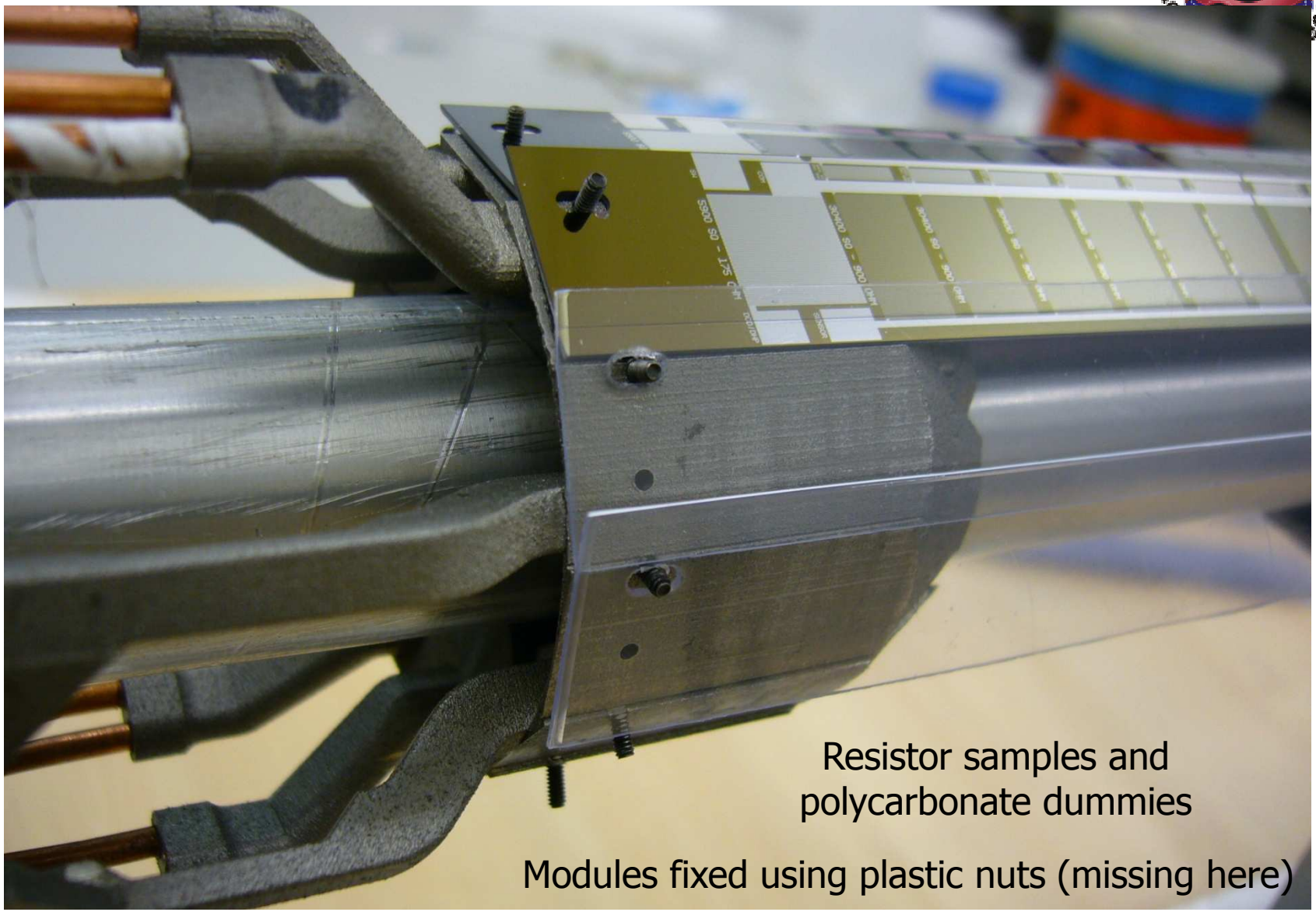

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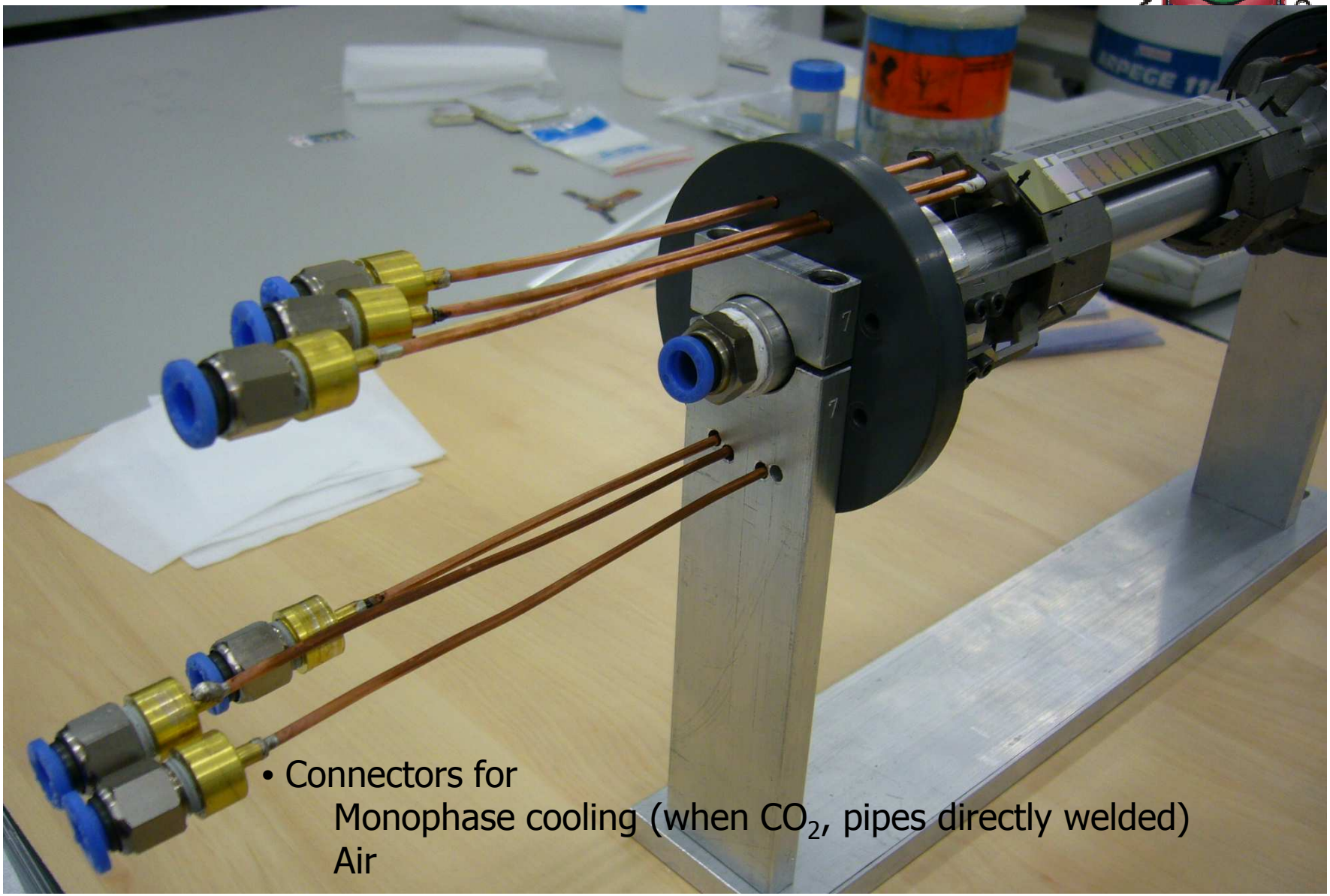

- Connectors for
  Monophase cooling (when CO_2, pipes directly welded)
  Air

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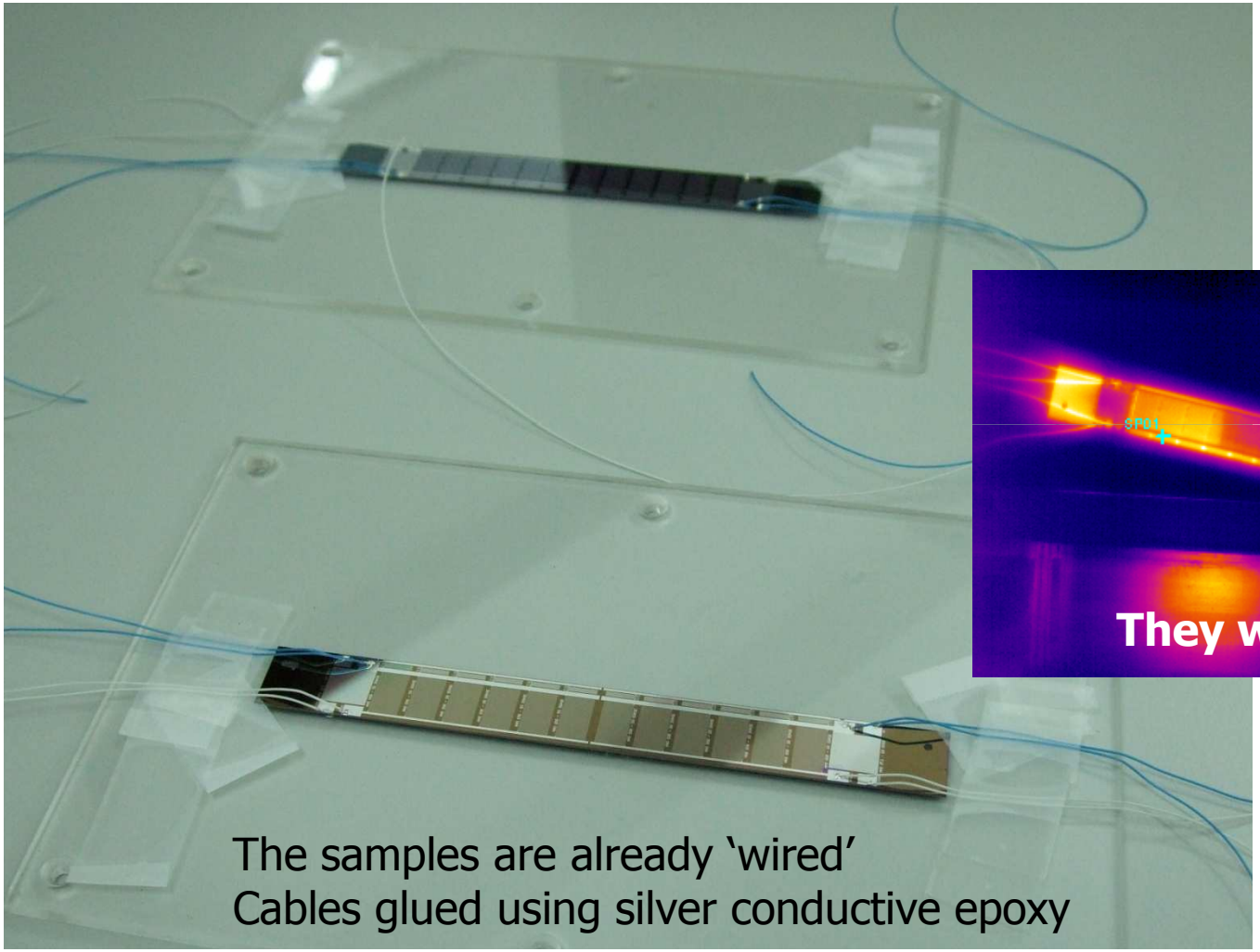
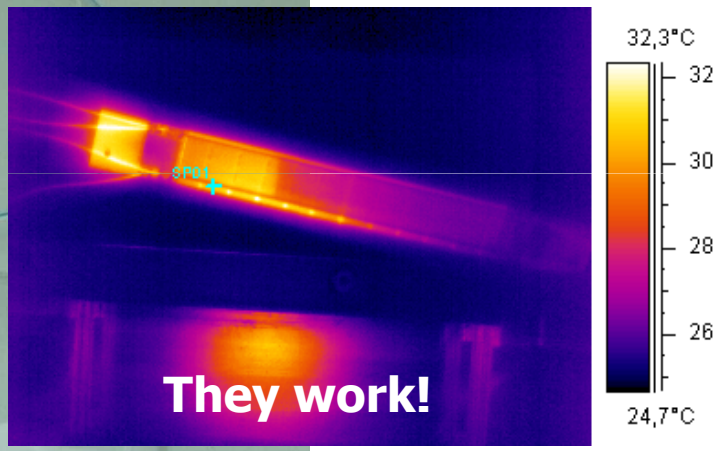
Preparing the samples





The samples are already 'wired'
Cables glued using silver conductive epoxy

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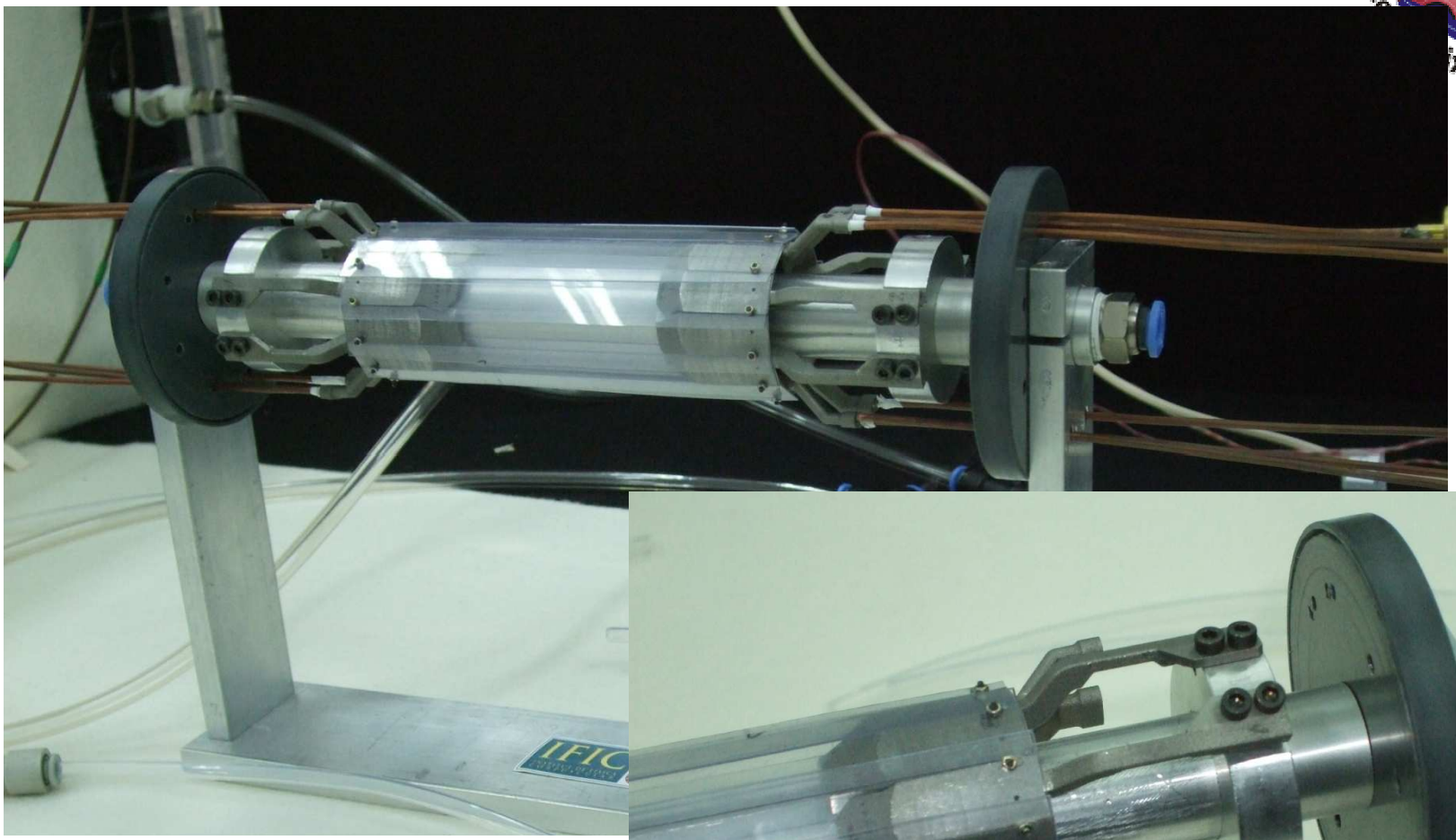
- First foreseen study



Air regime with only polycarbonate dummies

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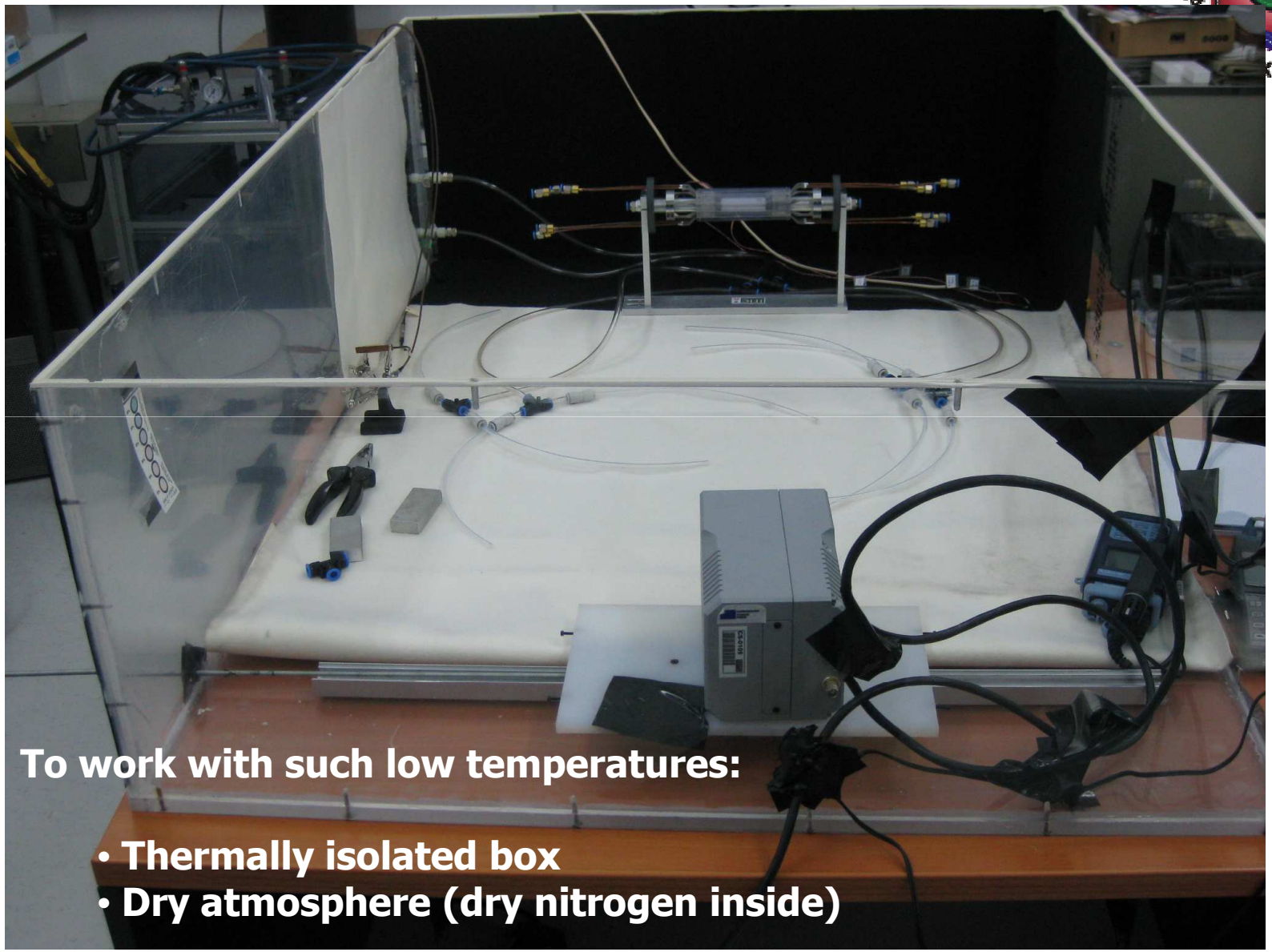
Environment



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New cooling block prototypes

- Cooling block materials:

  - ✓ Thermal conductivity as high as possible
  - ✓ Anti-magnetic
  - ✓ Cope with high pressures (tens of bar)
  - ✓ Availiable to be produced using 3d fast prototyping

Material	Thermal conductivity (W/m·K)	CTE (um/mºC)	Tensile strength (N/mm²)
Stainless steel 17-4	16	11.7	~1000
Stainless steel 15-5	22.6	13	
Steel CL20	15	17	650
AISI 316 steel	16.2	15.9	~600
→ DM20	30	18	400
→ AlSi10Mg	140	21	310
Ti6Al4V	7.2	9.2	1200

CTE_{Si}=3.2um/m ºC

- DM20 is already done

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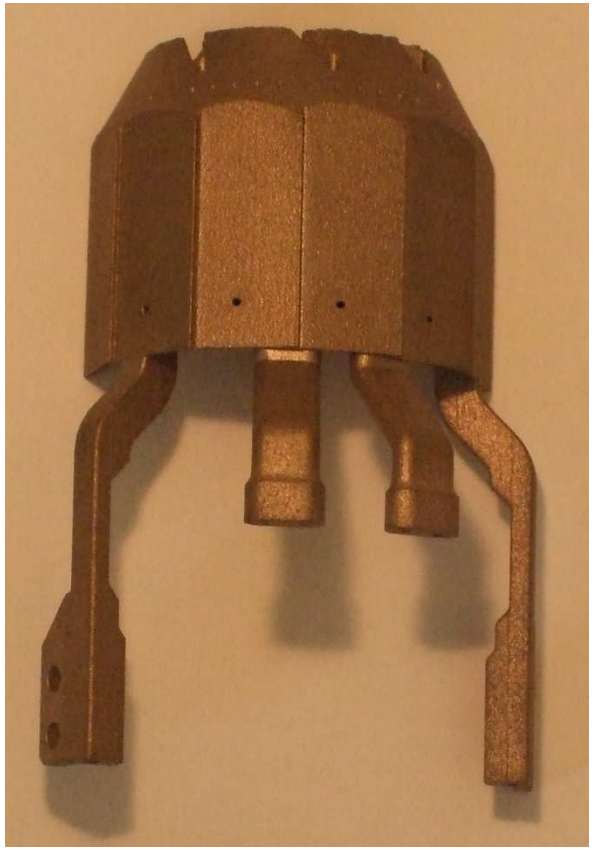
- New cooling block

DM20 (DirectMetal 20) is a bronze-based, multi-component metal powder.

Excellent detail resolution and surface quality.

The surfaces can be easily polished with very little effort



Unfortunately… it presents some residual magnetic behaviour (probably because of Ni)
We can do pressure tests, anyway

- AlSi10Mg will be delivered to Valencia this week

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THERMAL ENCLOSURE

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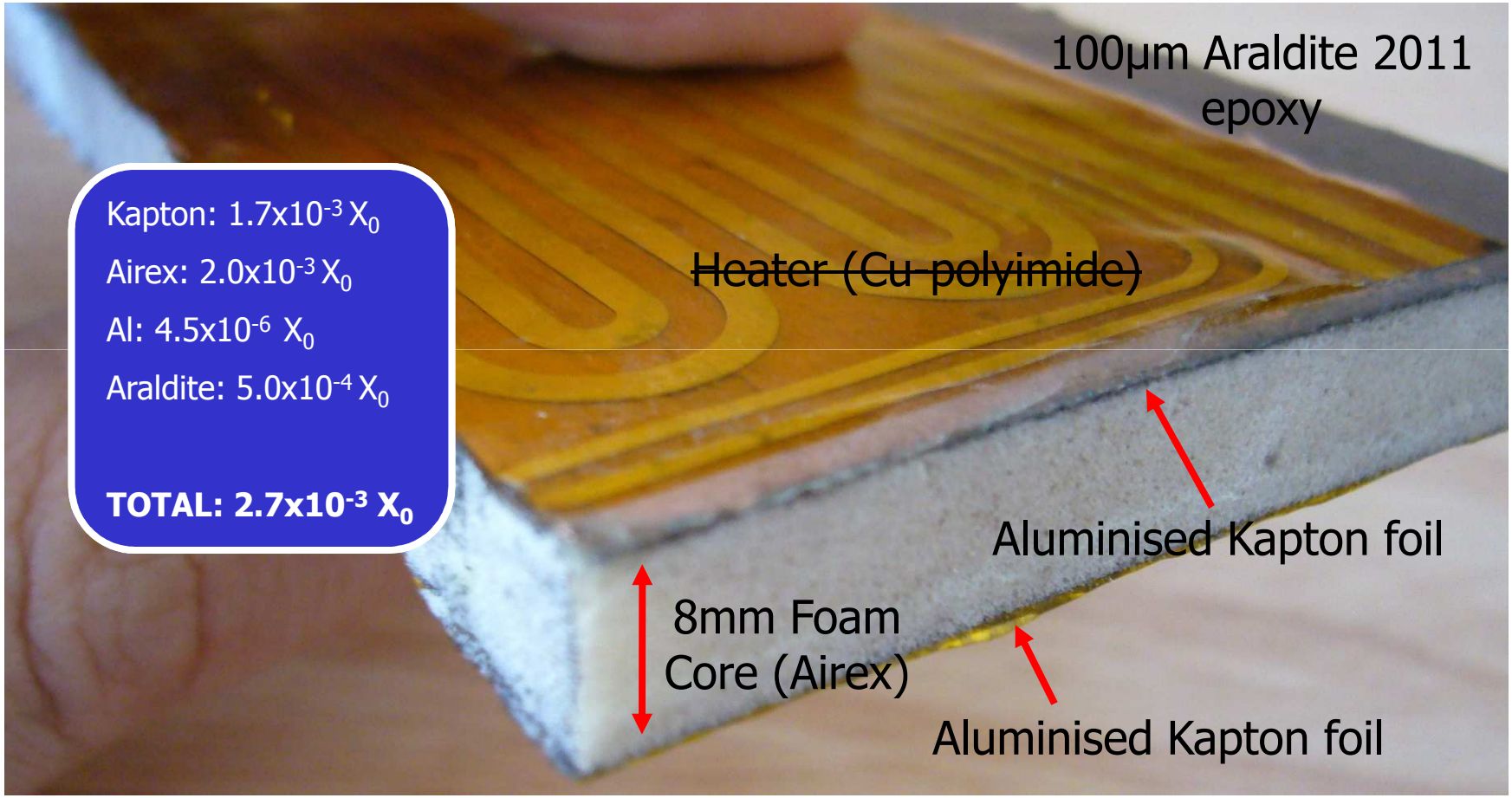
Mini-Airex



2 Al-Kapton (0.8 µmAl; 49.6µm in total): Reduces the radiative heat transfer

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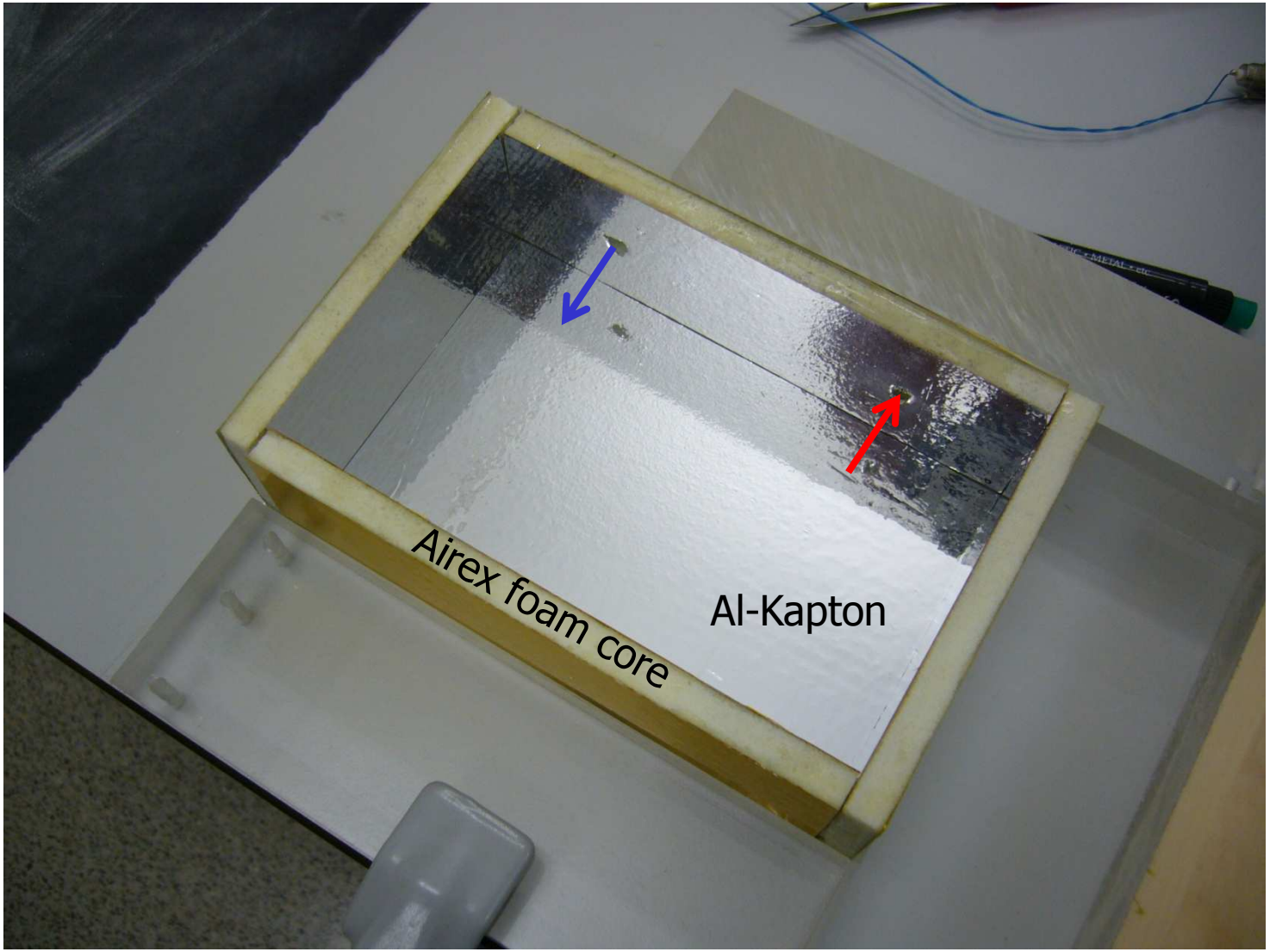
Dummy TE



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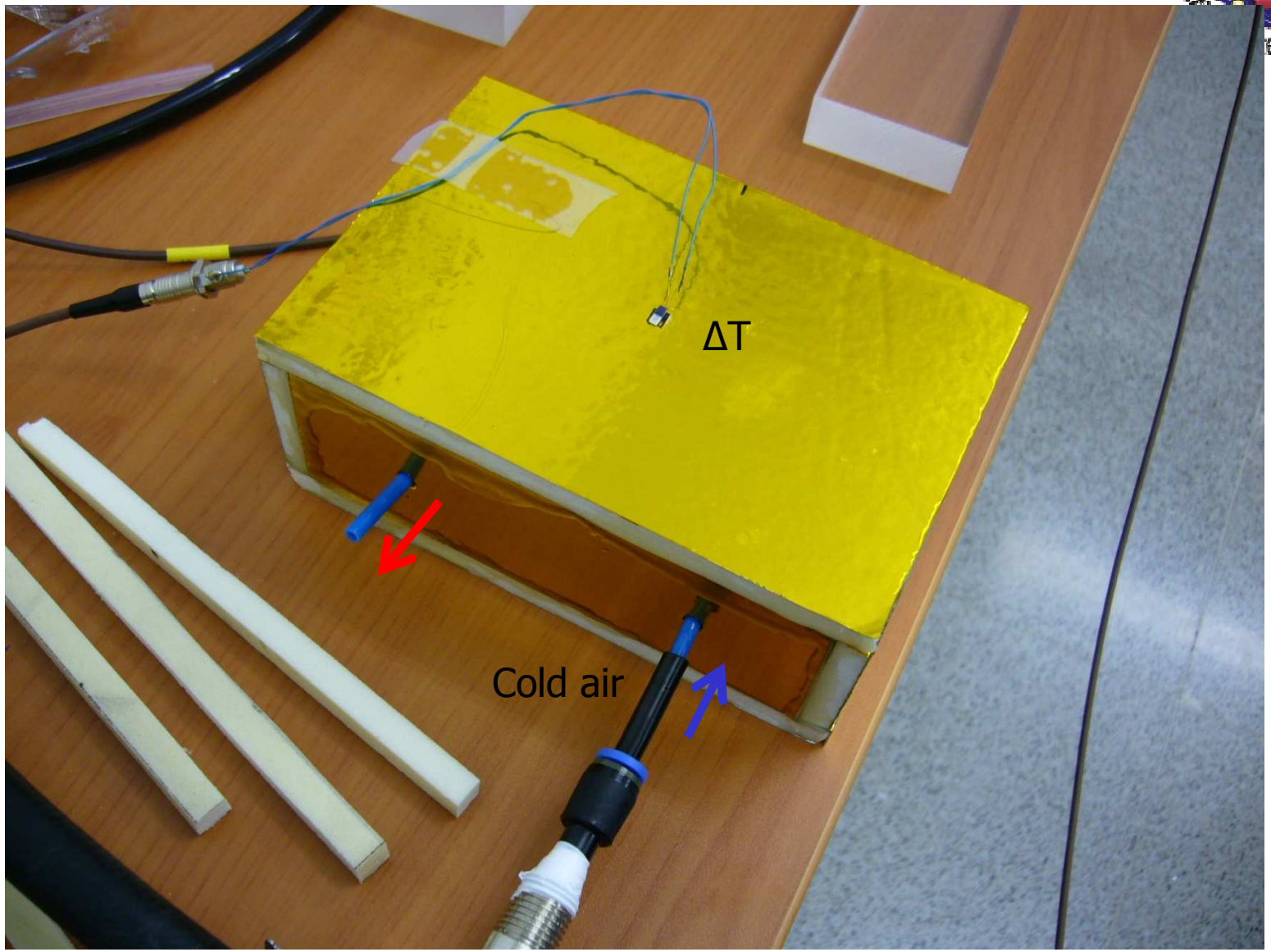
Dummy TE



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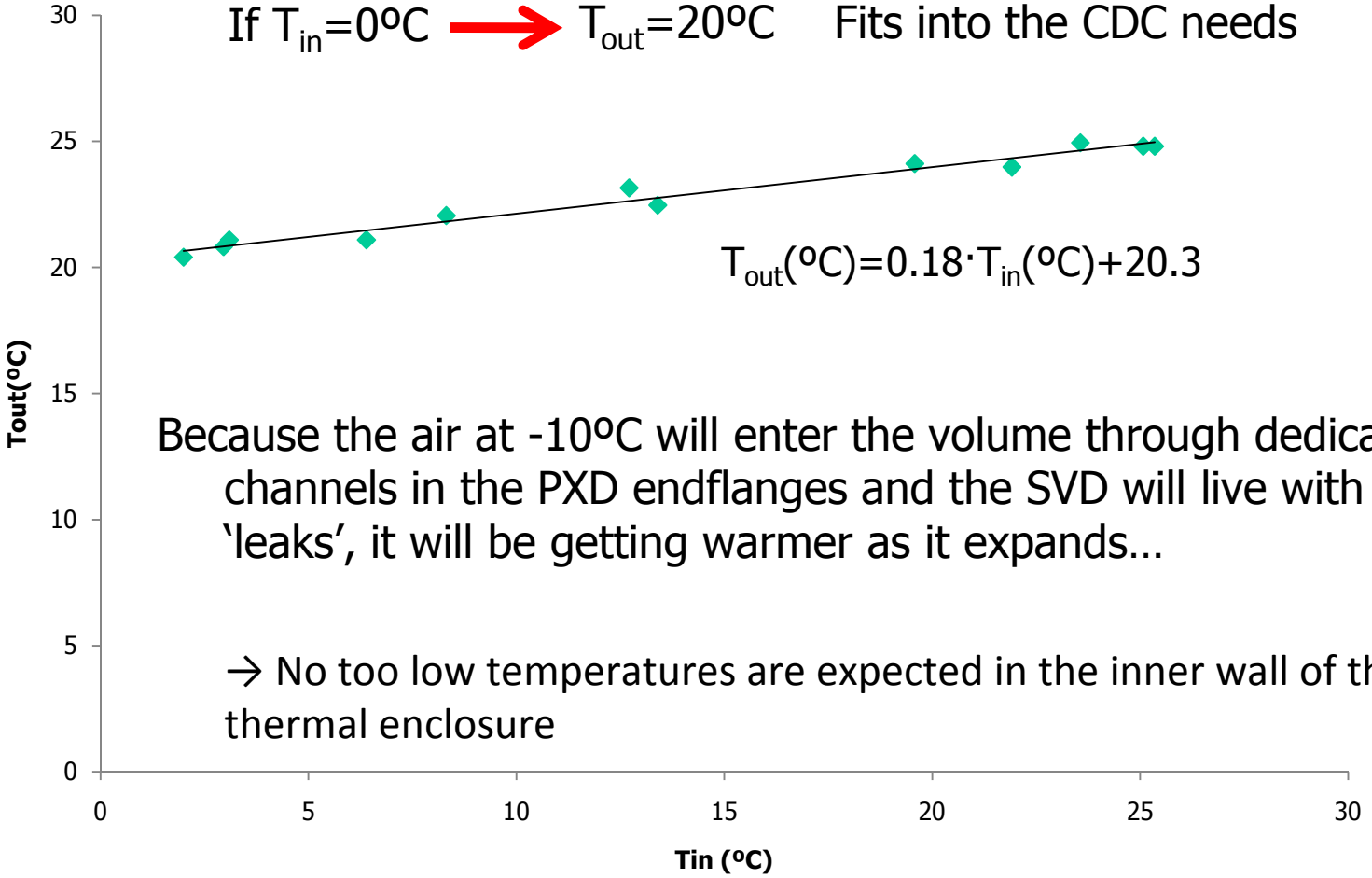
Dummy TE

If T_{in}=0ºC → T_{out}=20ºC Fits into the CDC needs



Because the air at -10ºC will enter the volume through dedicated channels in the PXD endflanges and the SVD will live with our 'leaks', it will be getting warmer as it expands...

→ No too low temperatures are expected in the inner wall of the thermal enclosure

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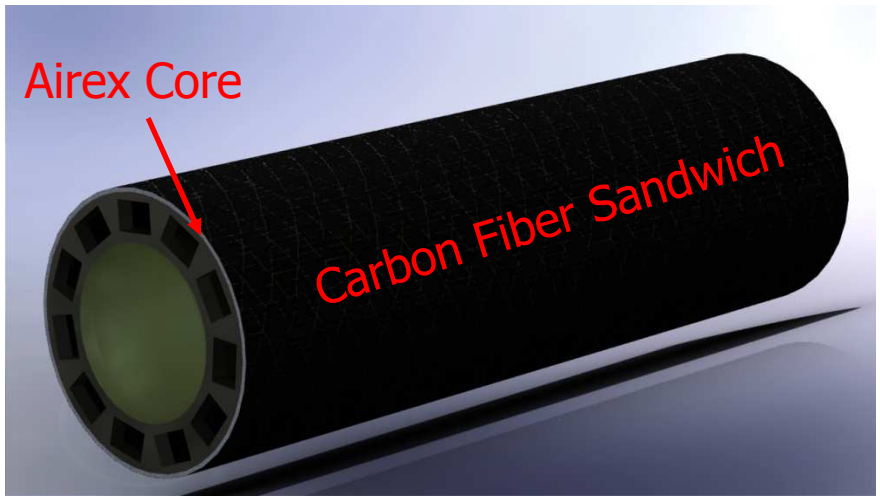
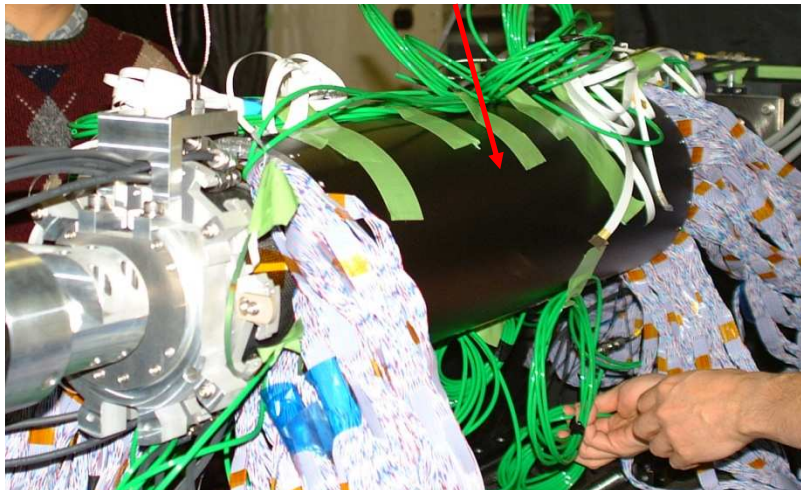
Implementation: Using the barrel support

SVD 2 had a carbon fiber shell to combine forward and backward support

Using the carbon fiber layer covering the SVD, an Airex+aluminised kapton sandwich can be implemented



Carbon Fiber Layer



Work in progress (Valencia and Vienna)

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Conclusions

- Thermal mockup

  The mockup to study the feasibility of the cooling solution is ready.

  First studies will comprise air flow regime.

  Thermal images with the resistor samples will follow soon.

- Thermal enclosure:

  A simple solution works and cope with the requirements

  A detailed implementation is foreseen when fixed the CF shell

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