# Report on thermo-mechanical activities at Valencia

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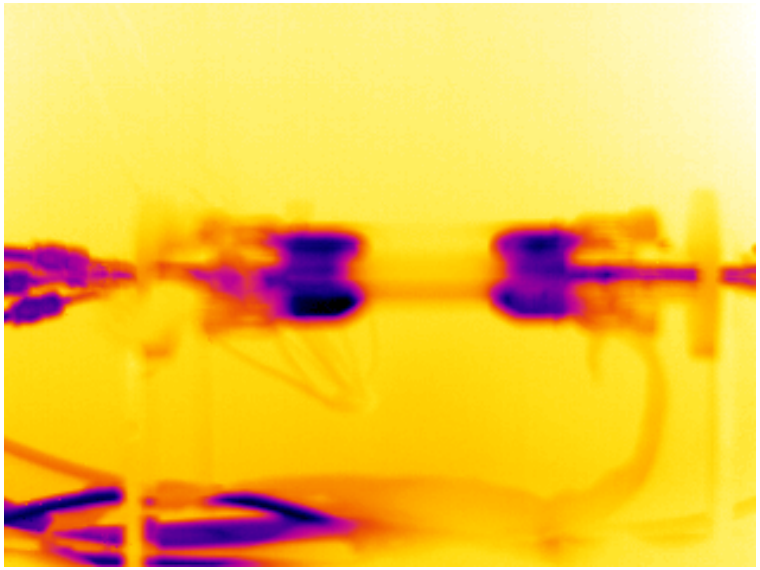
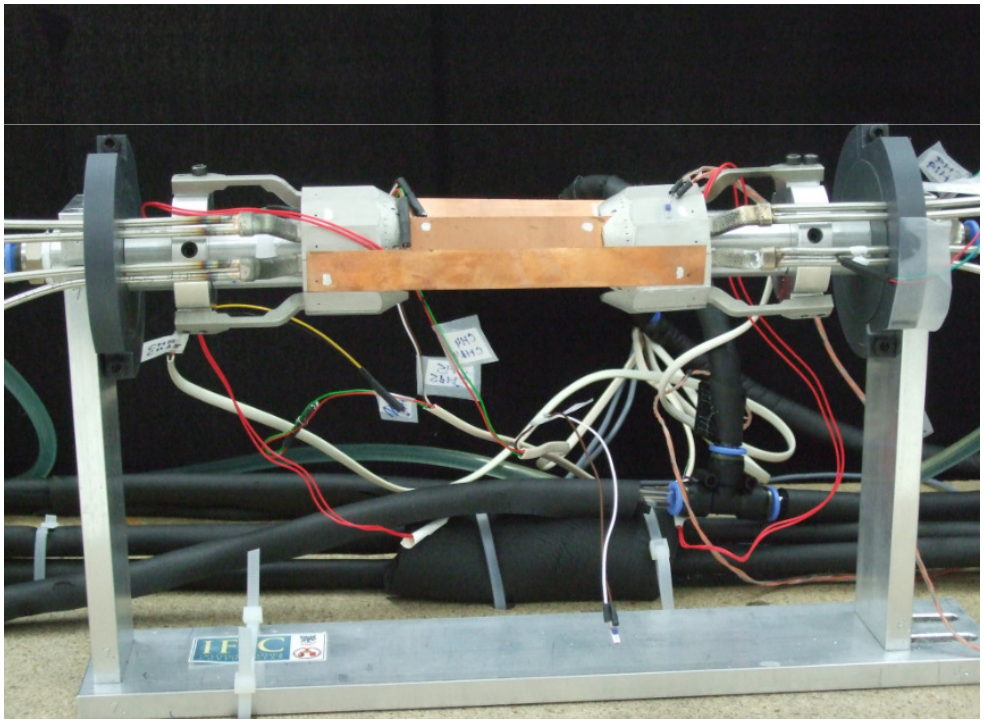


# VLC thermal mock-up status

## Mock-up setup (reminder):

- Beam pipe at room temperature (can be cooled with chiller → 15 °C)
- CrCo end flanges (2), cooled down with $CO_2$ (~12bar→ T~-25°C)
- Cu ladders with heaters:
  Power dissipated along ladder:
  1-4W → T ~ 30°C-60°C;
  4 inner ladders, only one with heater
  1 outer ladder with heater



- Air flow cooling:
  → studies of air velocity
  → studies of power dissipation
  → Aim to cool dry air at several temperatures

- Measure temperature on inner and outer ladders and cooling blocks, with IR camera, calibrated with PT100s and Tipp-ex marks (ε=0.95)

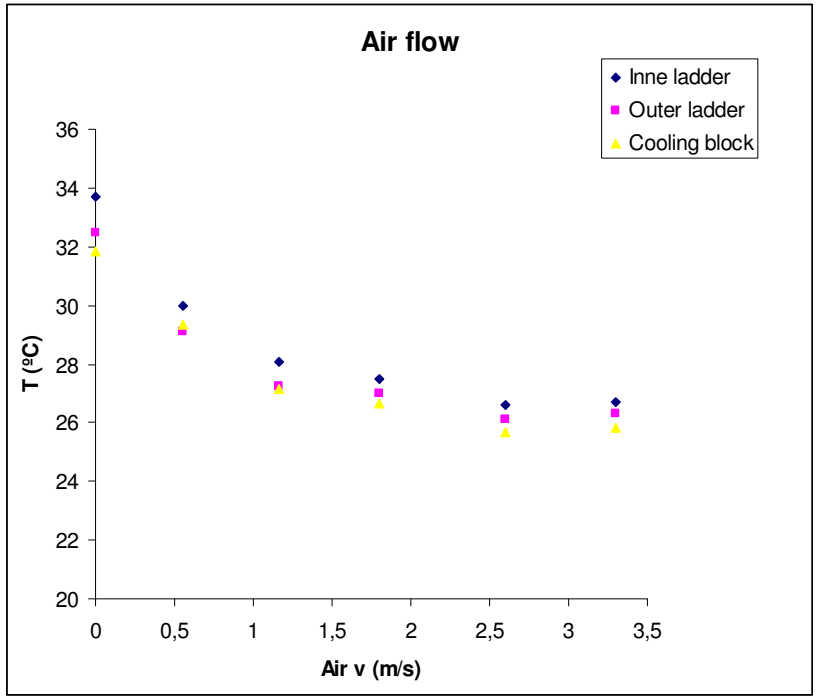
# VLC thermal mock-up status

- Effect of air velocity

→ Air flow at room T, cooling blocks at room T

→ Vary air velocity (from 0 to about 4m/s)

→ Measure temperatures in the inner and outer ladder, and in the cooling block



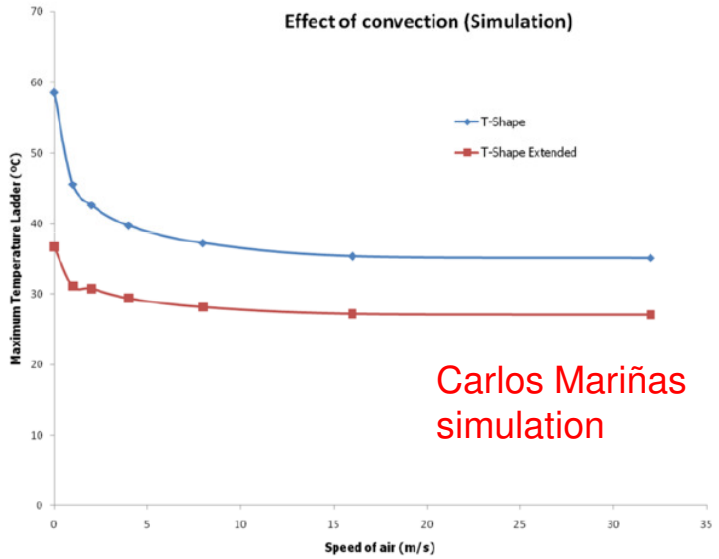




**Figure 6.21:** *Maximum temperature in the ladder as a function of the speed of air (at room temperature), for two configurations of the CVD-Diamond fingers. The t-shape, on covers the full ladder area under the chips while the t-shape extended, covers also the balcony where the Switchers are placed. The cooling block was fixed at 0º C.*

**- It seems that at room temperature, it is enough to have a very low speed flow air to achieve a proper heat dissipation in the ladder (1W→ΔT~ 6-7ºC),**

**- Expected behaviour from Carlos simulations.**

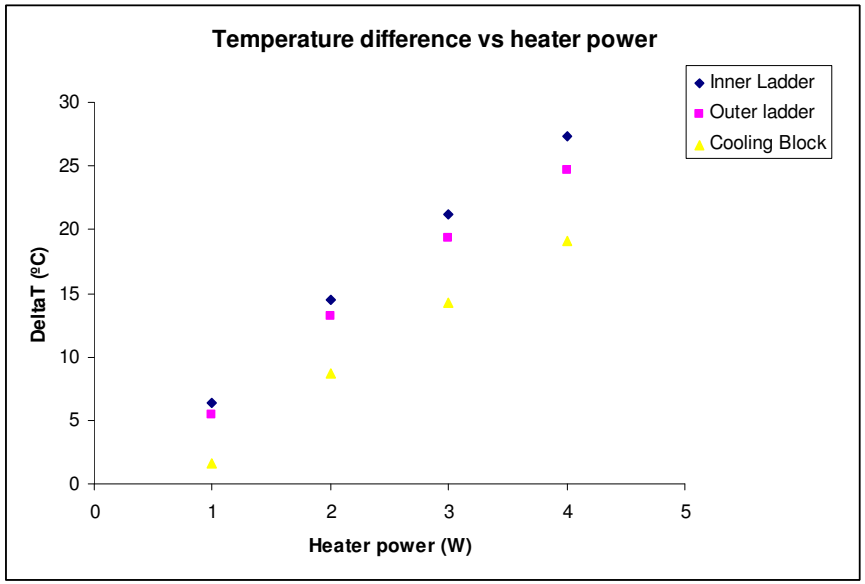
# VLC thermal mock-up status

- Power dissipation:

→ Air flow at room T (fix v ~2m/s), cooling blocks at room T

→ Vary power of the heaters (1W-4W)

→ Measure ΔT=object T without air – object T when having a room T air flow.



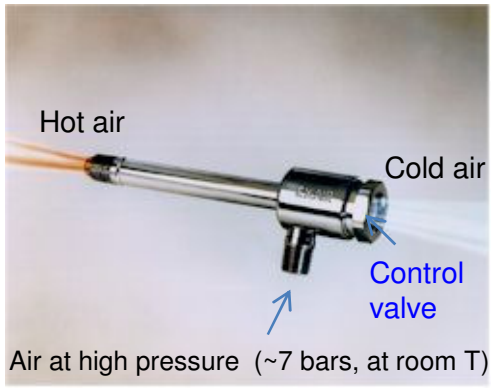

- **Results are linear, with about the same dependence for the ladders and the cooling blocks**
- **Power dissipation increases as power (i.e. heating) increases**

# VLC thermal mock-up status

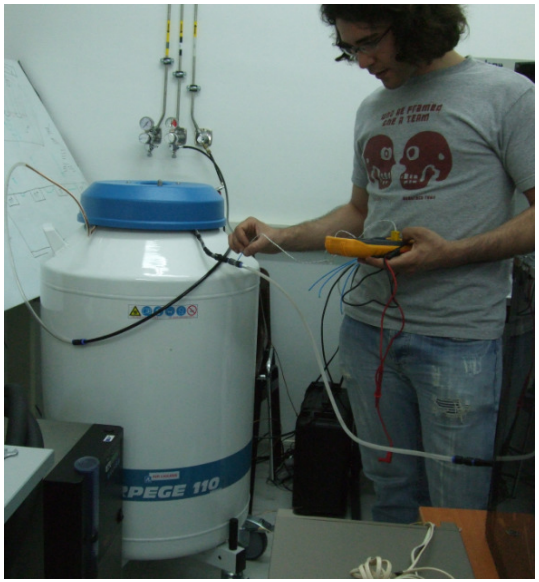
- Air flow temperature studies:

→ Trying to have an air flow at several controlled temperatures (at present difficult):

- **Vortex tube:** It is working properly when it is not connected to the mock-up but once it is connected to the cooling blocks, pressures at the inlet and outlet change in the vortex tube changing temperatures → not cooled air flow arriving to the ladders (ruled out).




- **Air flow cooled with a liquid N2 dewar:** Tried to mix, with a control valve, cooled air with air at room temperature → pressures when the system is connected make the air flow return in the pipe and the temperature is not stable, in addition to have problems with the too cooled air cooled down with the N2 (the CO2 of the air freeze and block the pipes, tubes freeze and broke, etc...).
- Tried to use gaseous N2 going through the liquid N2, using several cupper coils of several thickness and lengths, and then heating the cooled air going through an aluminum block heated with peltier devices.



# VLC thermal mock-up status

- Air flow temperature studies:

- At present we have achieved an air flow ranging from about -30°C to room temperature by cooling gaseous N2 or dry air using the atmosphere inside the N2 dewar instead of the liquid N2 (~ -80C) (the coil does not arrive to touch the N2 liquid) and then heating it with the aluminum block with peltiers.

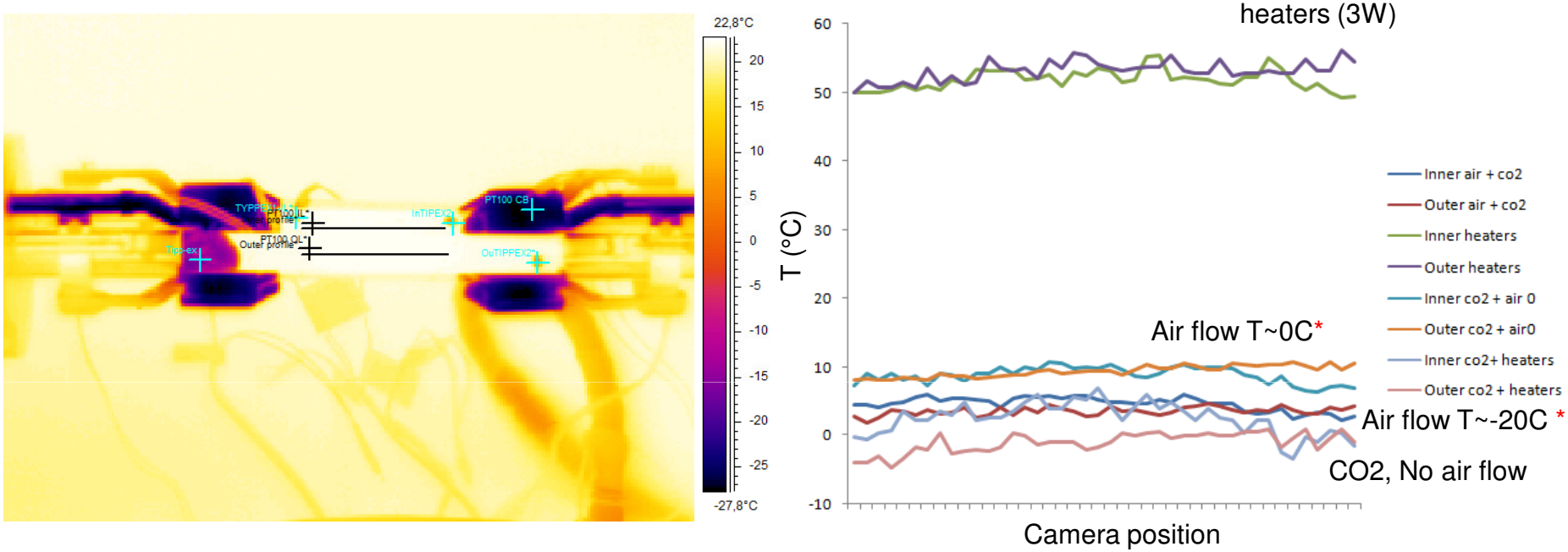
Caveats:

- Still to measure and study the real temperature of the air flow once the system is connected to the cooling blocks (difficult in the thermal isolated box → dampened-movement thermometer)
- Still to study the heating due to the pipe lengths

- Problems in the past days with the the CO2 cylinder: we replaced it and now it is not cooling as expected (gas instead liquid?)

# VLC thermal mock-up status

- Air flow temperature studies:




* entering in the box; T in the CB?

- Camera calibrated with PT100's and tipp-ex marks: results strongly depend on the material emissivity → making a calibration tool to place materials and study ε variations
- It seems that the temperature of the cooling blocks depends on the air flow temperature, so if it is too high makes increase the temperature of the cooling blocks and then of the ladders (cooled down with the CO2)

Still to better quantify, remember that in addition in these samples dummy ladders are not screwed, so the thermal contact is not very good.

# VLC thermal mock-up status

- Conclusions & Plans:

At present performing air flow cooling studies:

→ Difficult to have an air flow at controlled and variable temperature

→ Air flow temperature seems important for the cooling blocks (?)

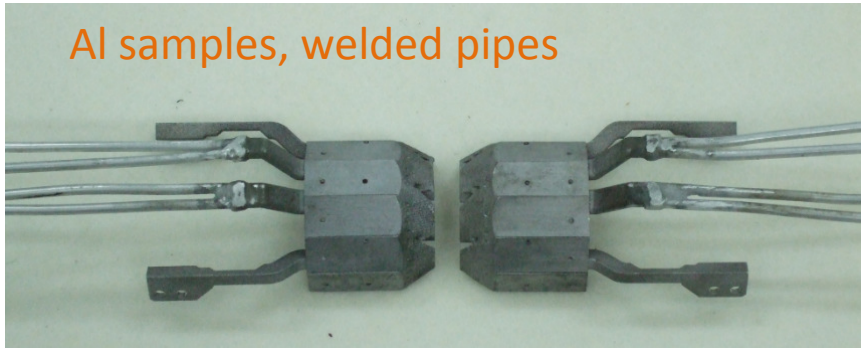
→ Must have a proper IR camera calibration (in process)

→ Must use cooling blocks with screwed ladders (nextly, Al samples)

→ Must use real dummy ladders with electronics to know the power dissipation in the cooling blocks and along the ladders (not homogeneous) (nextly)

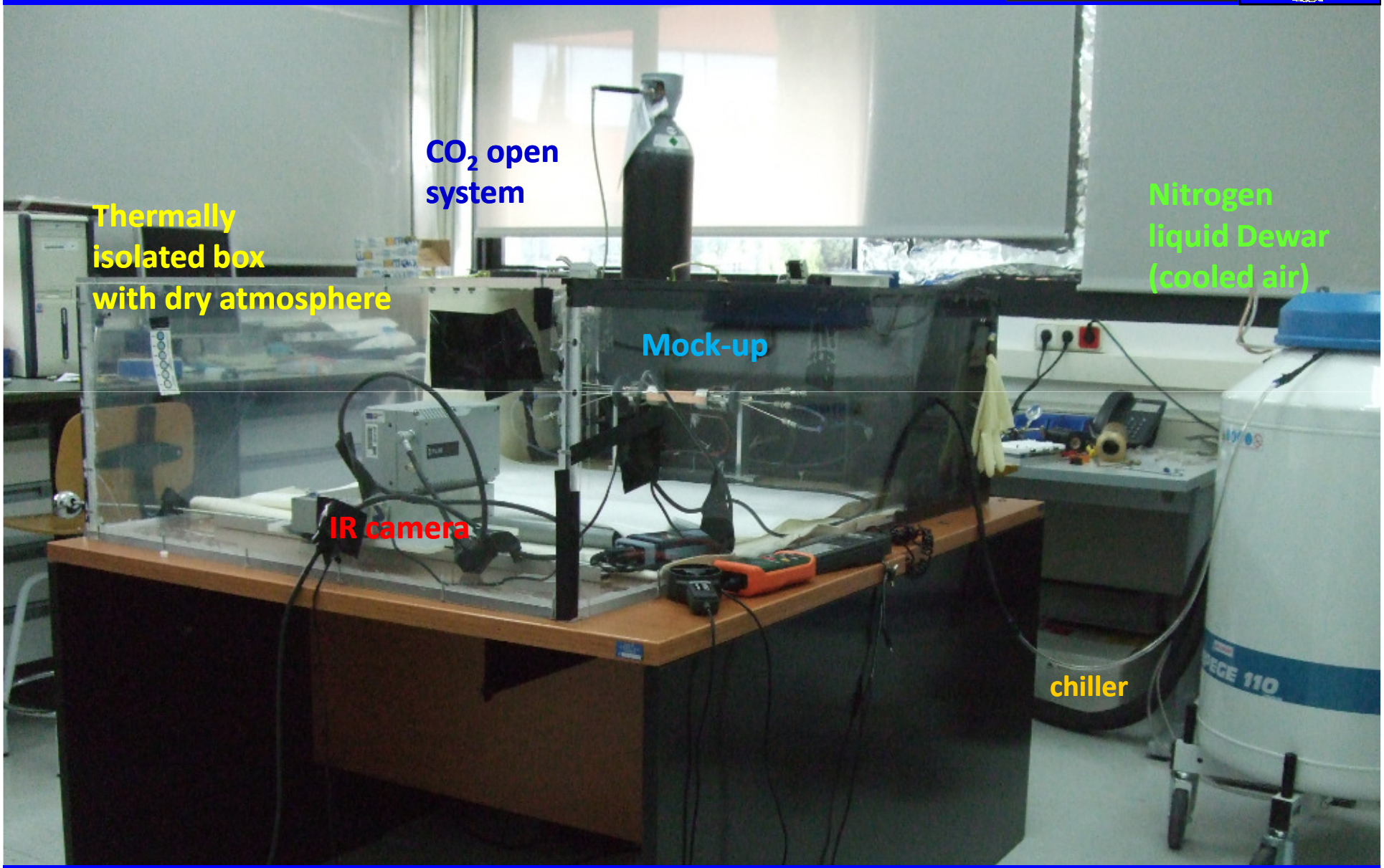
→ Need to close the volume

→ Need to add heaters or real dummies (better)




- The beam pipe temperature is almost not affected by the low temperature of the cooling blocks (about -20C). There should be no problem for the paraffin (question from Ringberg,) We placed a PT100 in the beam pipe to check it.

# VLC Thermal Mock-up



# VLC Thermal Mock-up

- Dummy ladders: