Effect of ambient temperature

Update of thermal Measurements with fibers

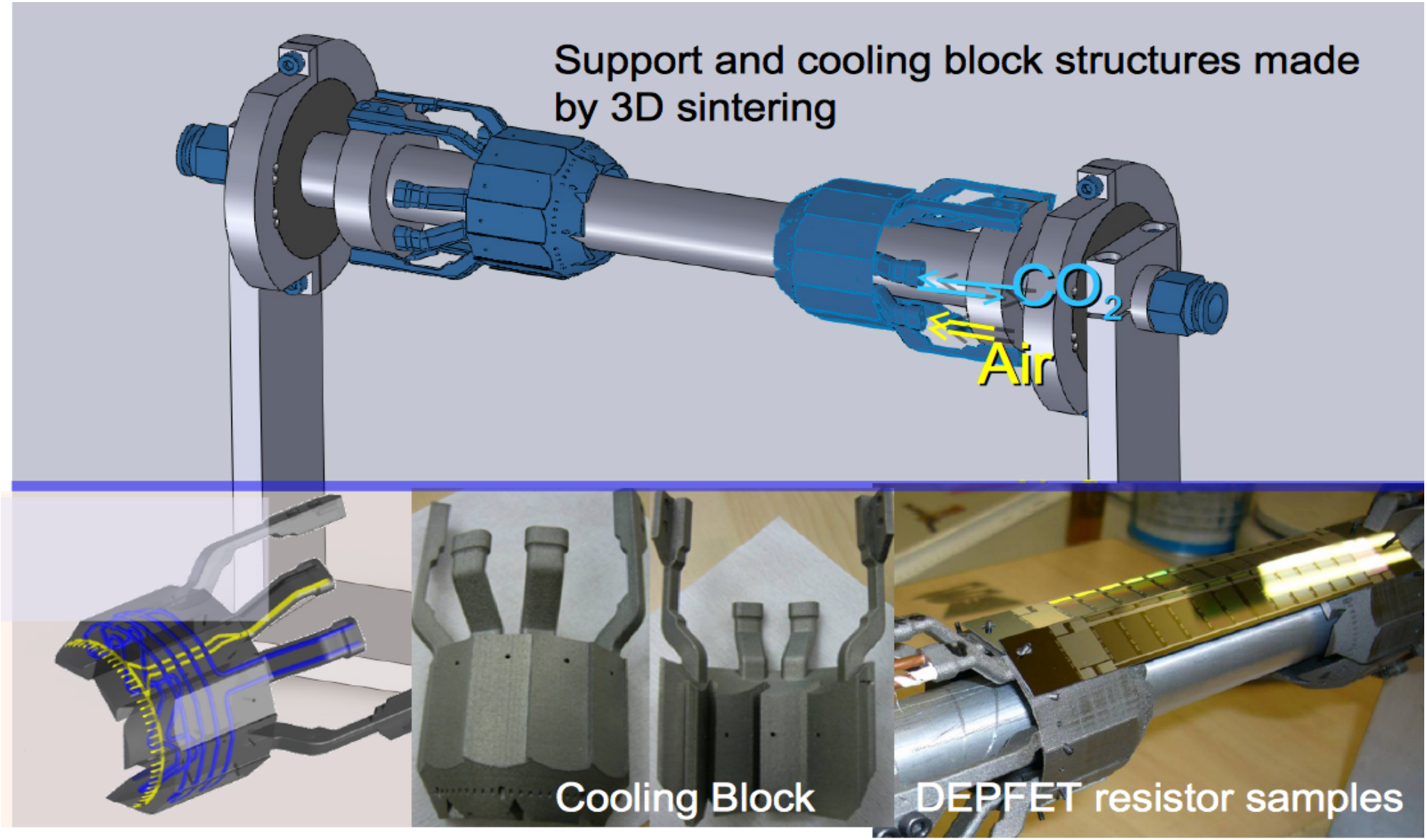
Belle II

DEPFET Active Pixel Detector

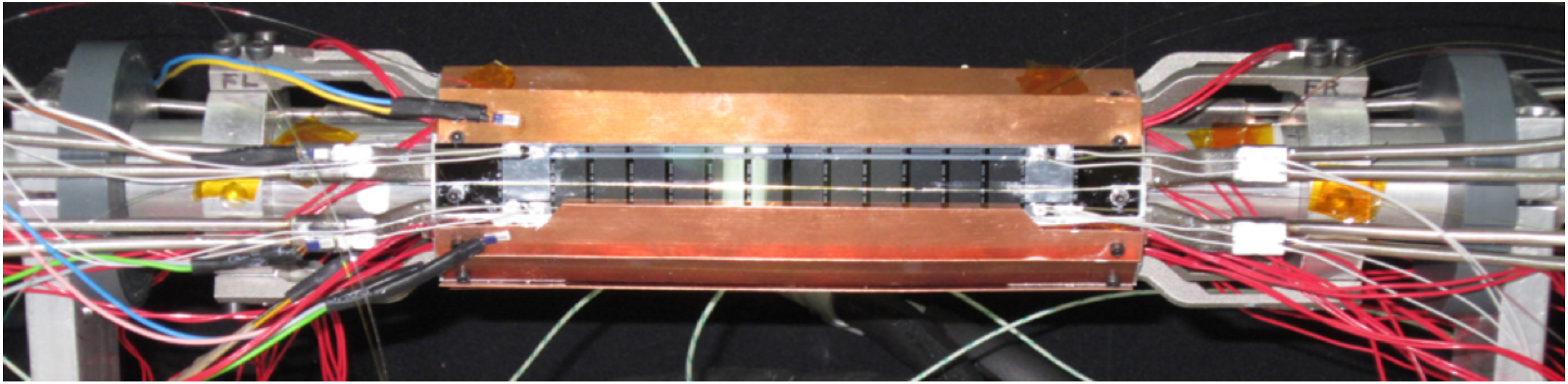
IFIC INSTITUTO DE FÍSICA CORPUSCULAR

IFCA

The Setup: A *gentle* reminder



The Setup: A *gentle* reminder



Stainless Steel Cooling blocks

A single Si thinned detector with built-in heaters

Closed with Cu foil ladders with resistive heaters only on the edges

Beam pipe at 15°C (chiller)

CO_2 on cooling blocks at -35°C

Cooled N_2 injected towards sensor (3bar, 15 l/min flow rate)

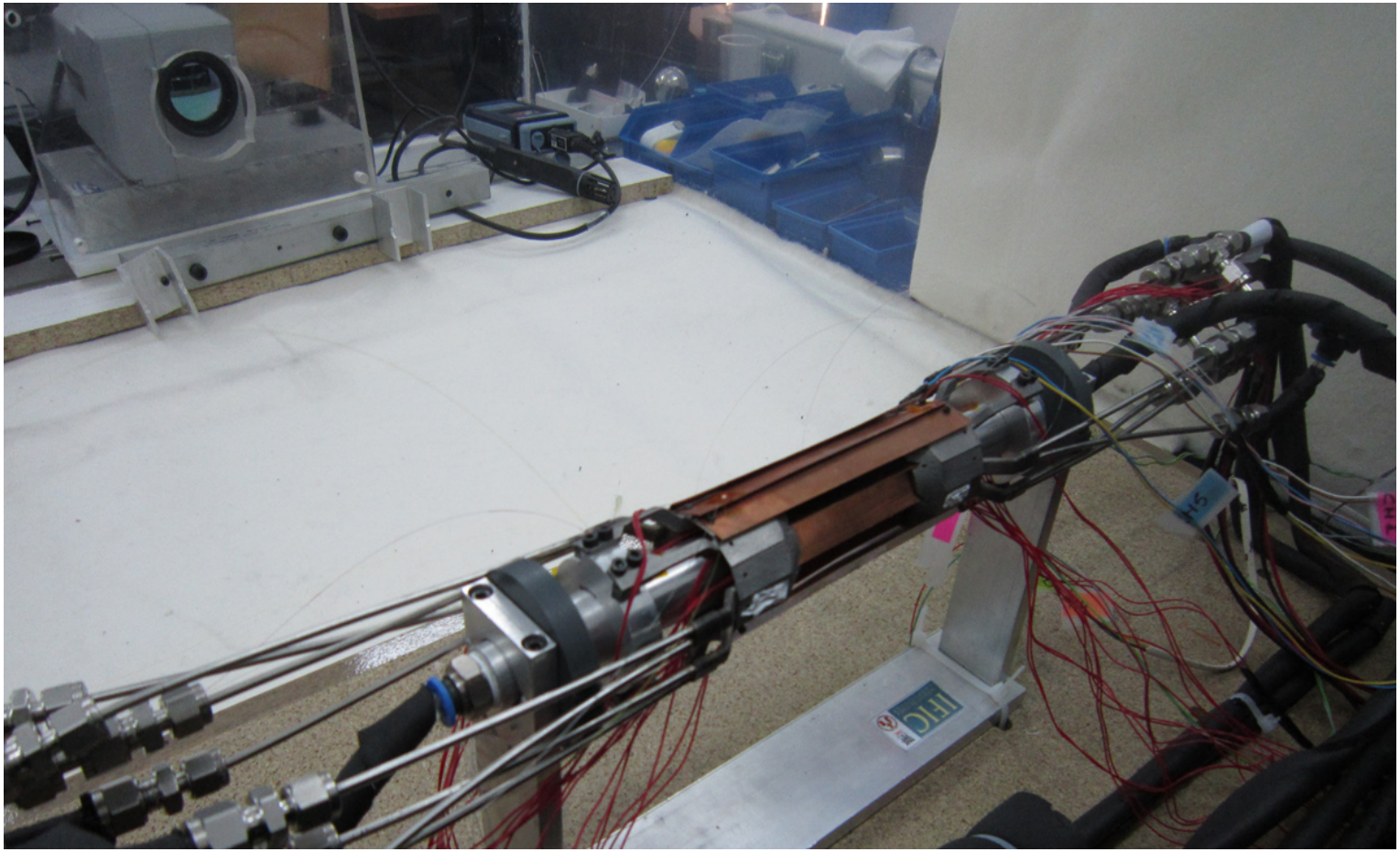
Temperature measured with infrared Thermal Camera, FBG (temp and humidity) and PT100

The Setup: A *gentle* reminder

The whole mockup is in a sealed methacrylate box, which allows control of the "environment" inside

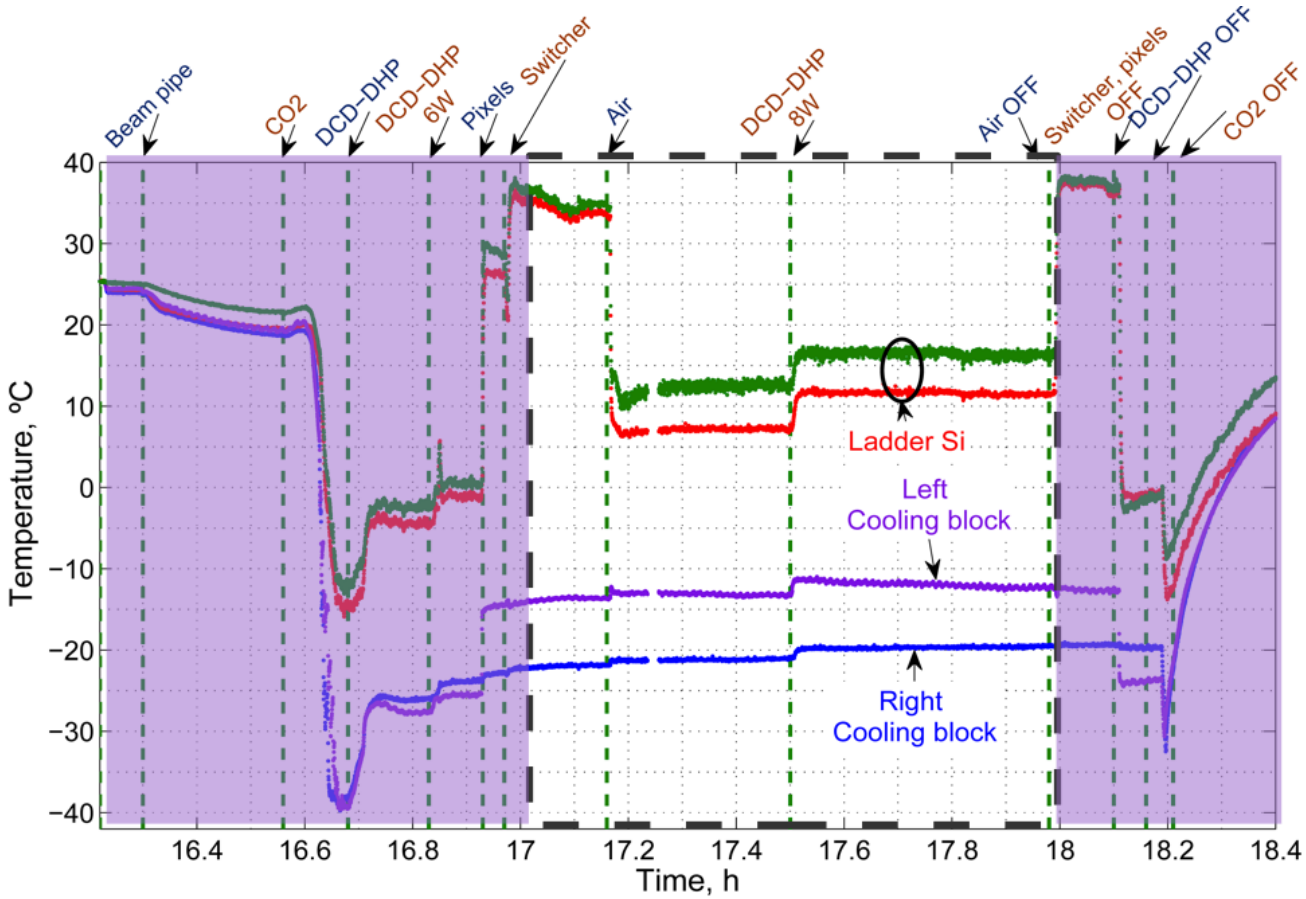
Humidity low and "fixed" to avoid condensation and help with the FBG's

Stable temperature

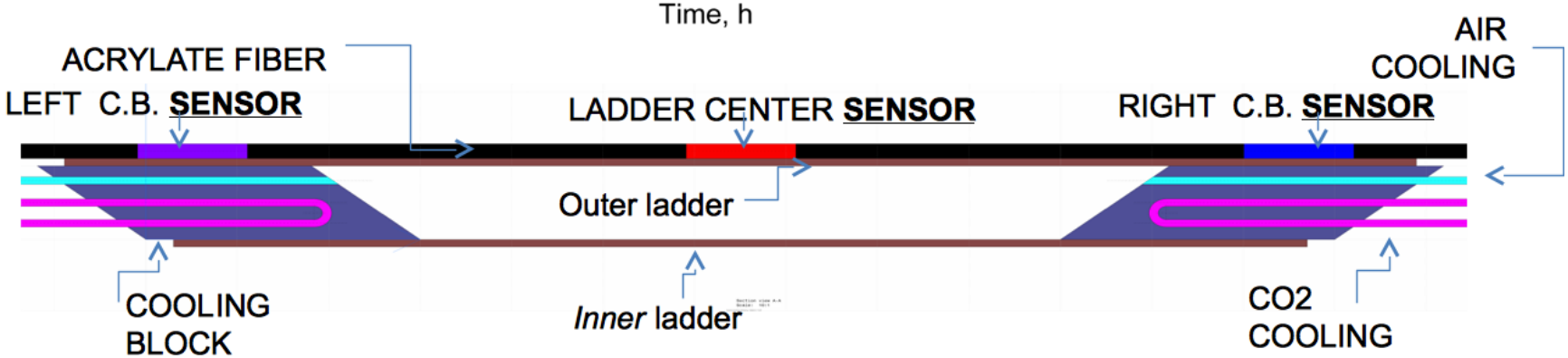


Temperature measured with FBG

External sensor surface monitoring

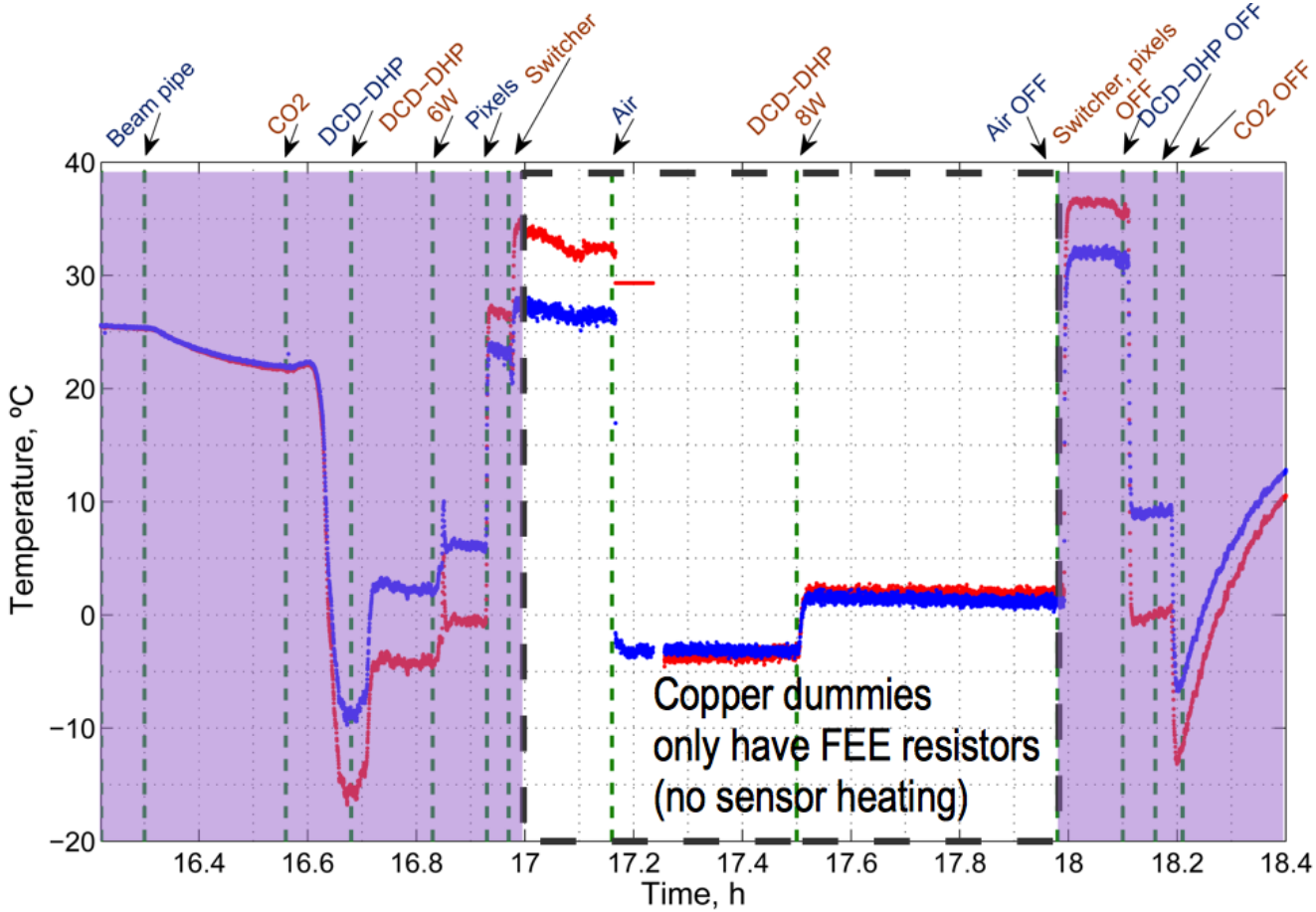


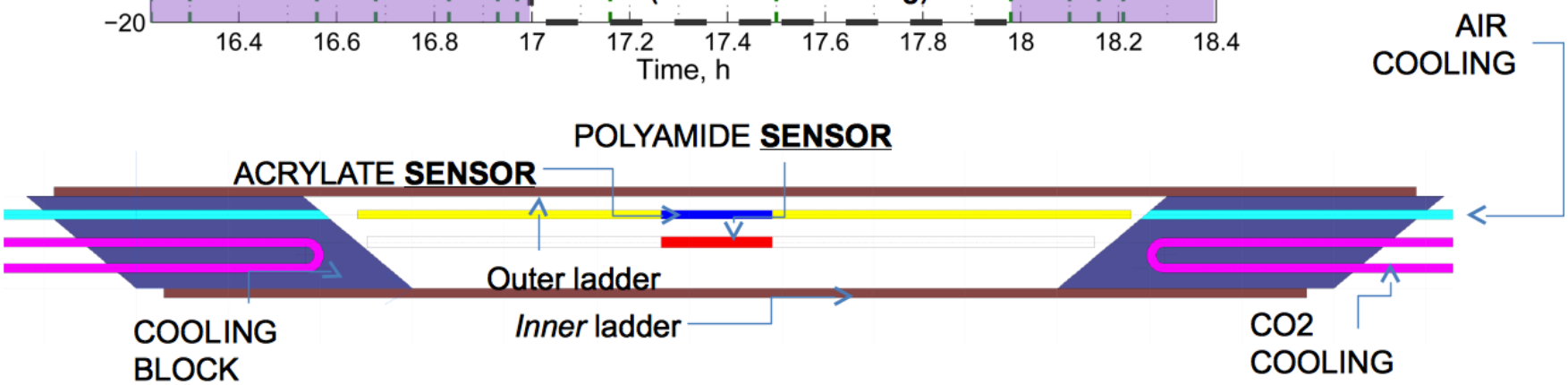
Tamb=25C



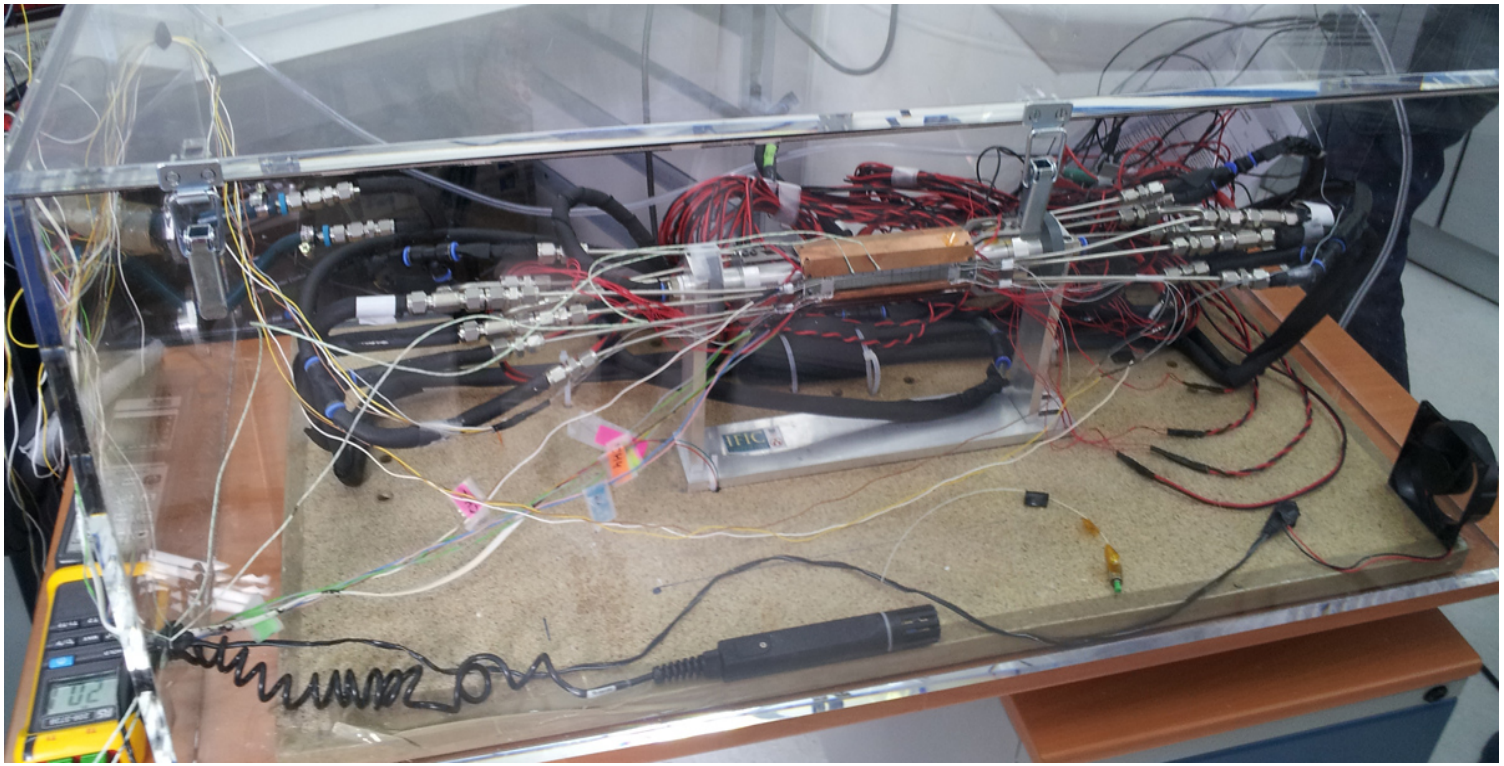
Temperature measurement with FBG

Internal volumen monitoring





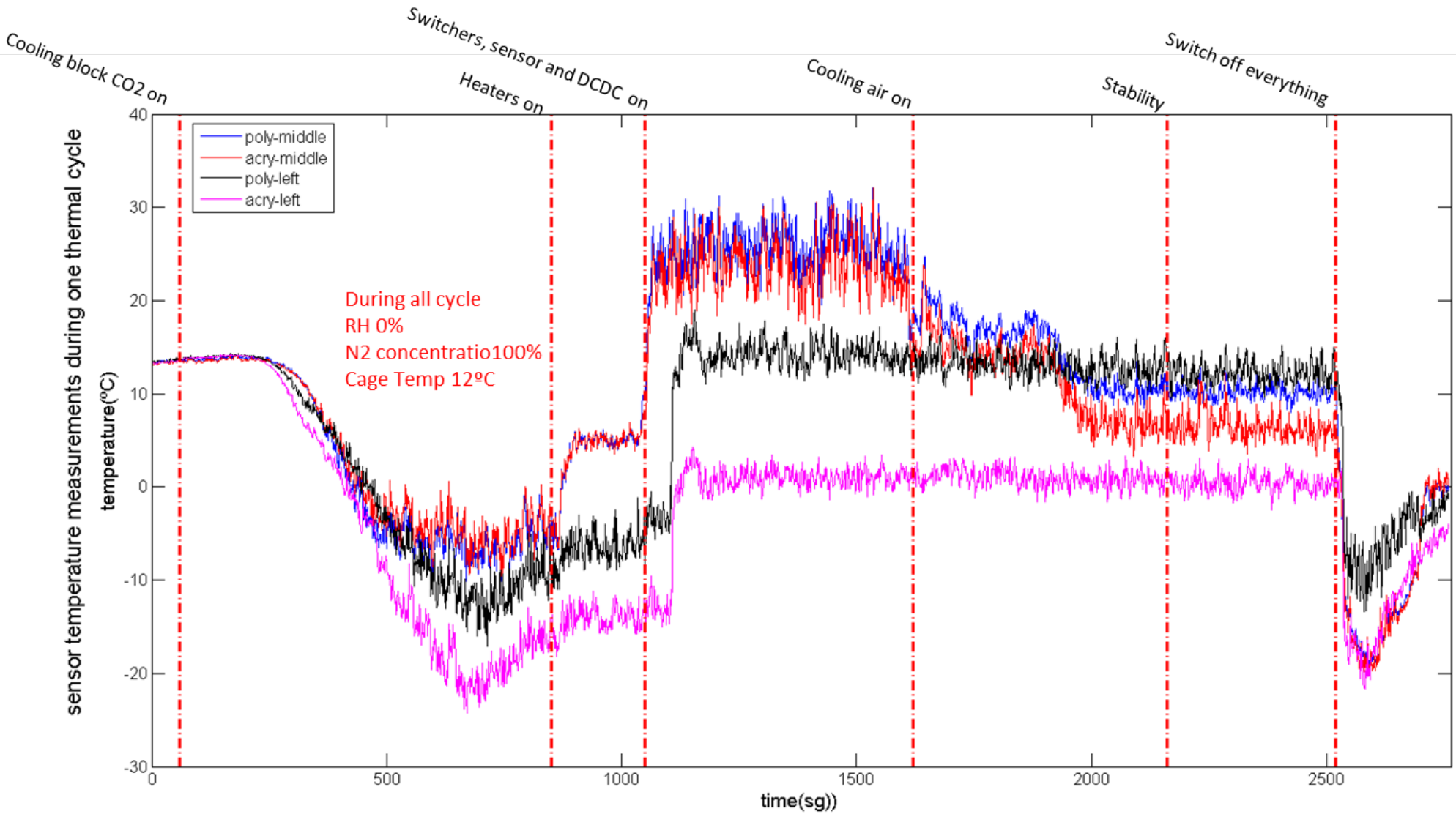
Effect of "ambient" temperature



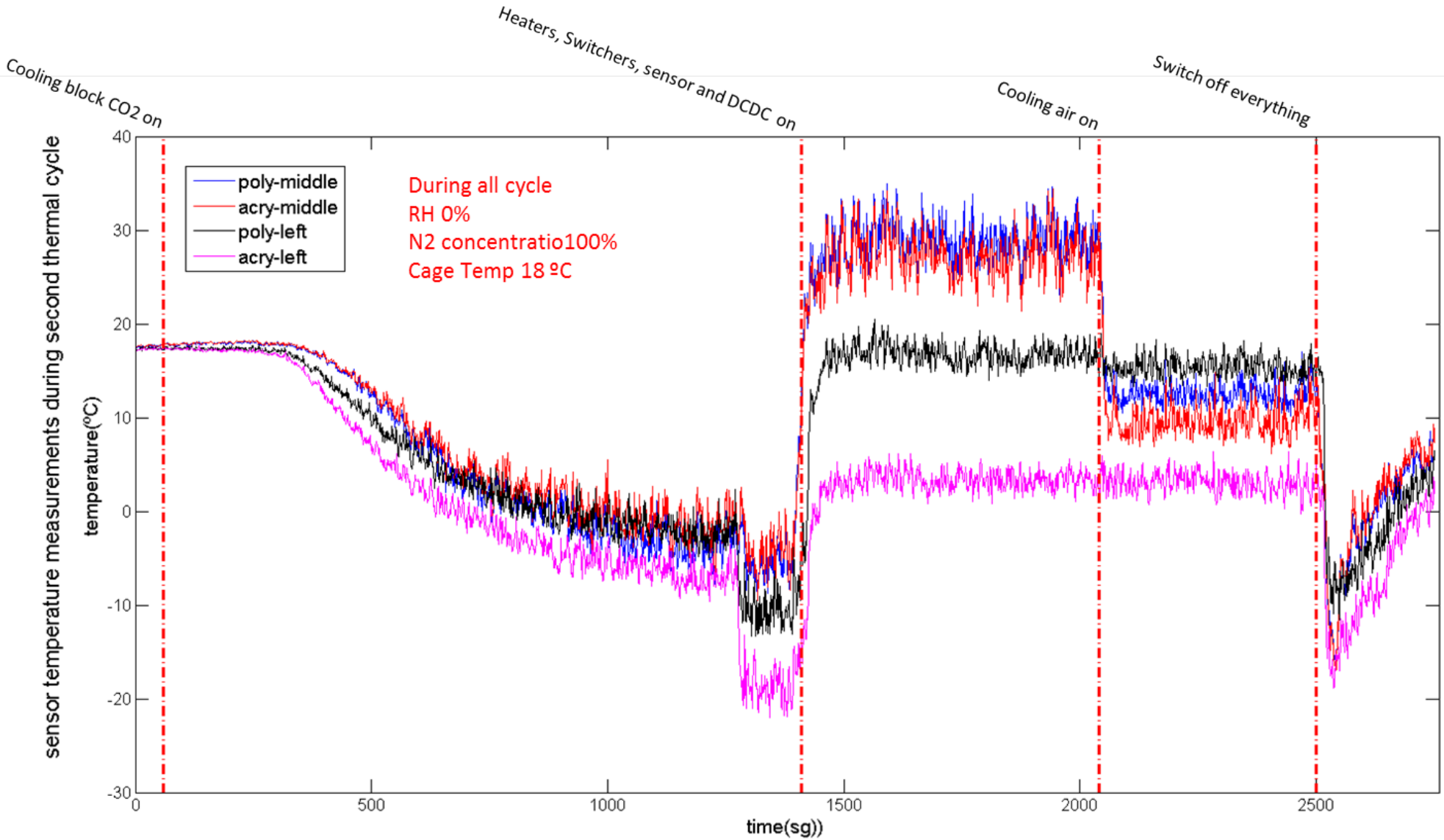
Ambient temperature difficult to "vary" on large volume of the test box
The whole mockup moved to a smaller box:

- Filled with N2 (3 bar and 15 l/min flow rate)
- No thermal camera
- Only FBG and PT100's

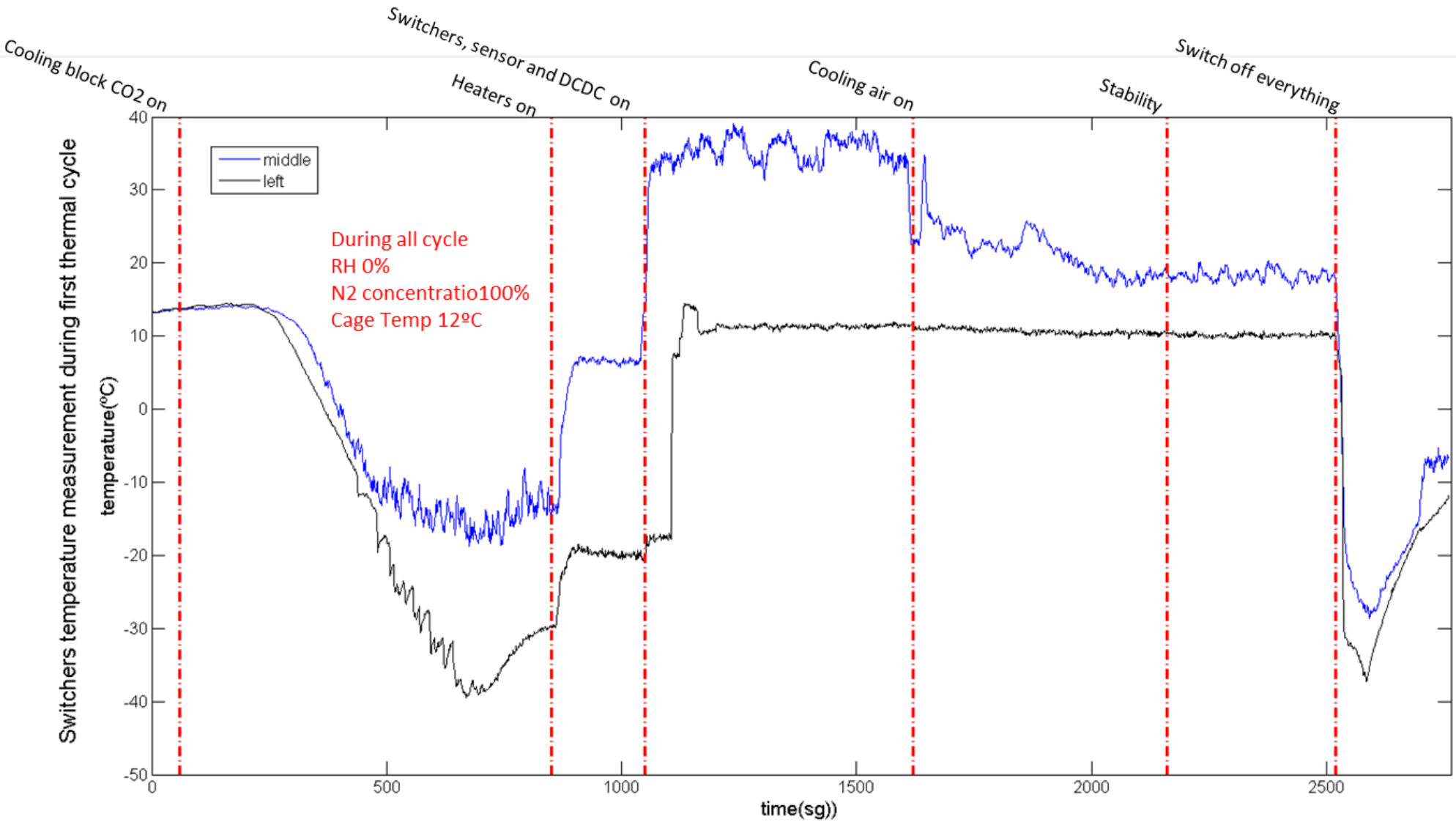
Sensor Temperature



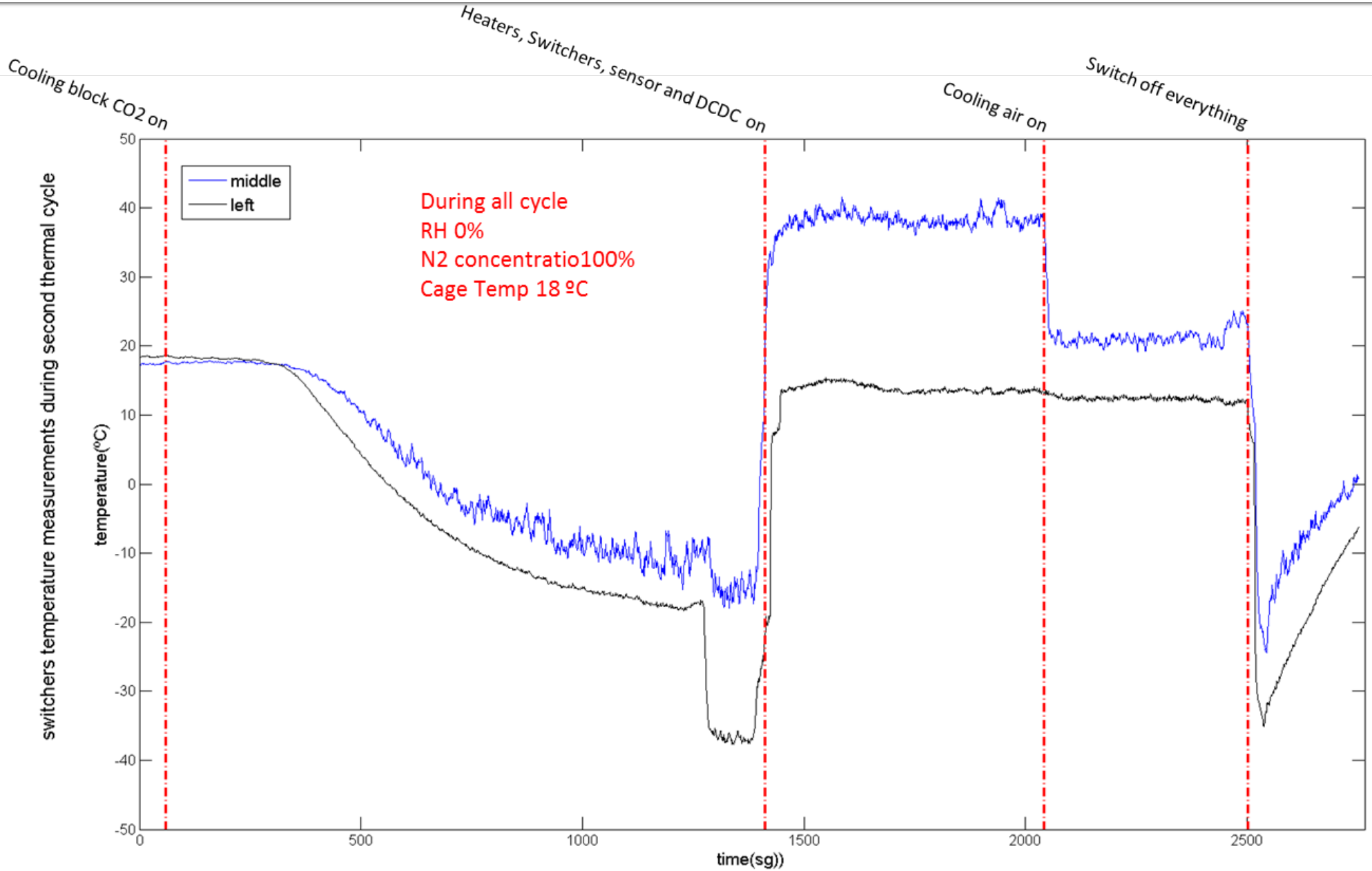
Sensor Temperature



Switcher Temperature

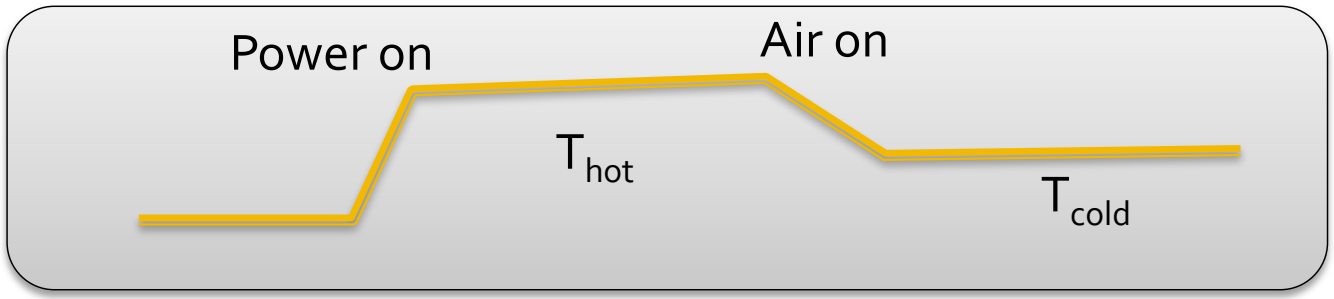


Switcher Temperature



In numbers....

Ambient Temp (±2°C)	No air cooling Temp (±2°C)		Air cooling Temp (±2°C)		T_{hot}-T_{cold} Temp (±3°C)	
	Sensor	Switcher	Sensor	Switcher	Sensor	Switcher
25	35	37	20	25	15	12
18	28	39	10	21	18	18
12	24	36	7	18	17	18



Sensor temperature depends on Ambient temperature
(this is how convection works)

Temp. gradient along the ladder is ~5°C

Conclusions

- FBGs a nice tool to monitor temperature
  - Left picture shows an "accident" with the cooling system. Delta T was >100°C
- FBGs are not sensitive to N2
- We confirm what text-books say about convection…
  - It depends on ambient temperature

CO_2 system failure
(as seen by the beam pipe sensors)