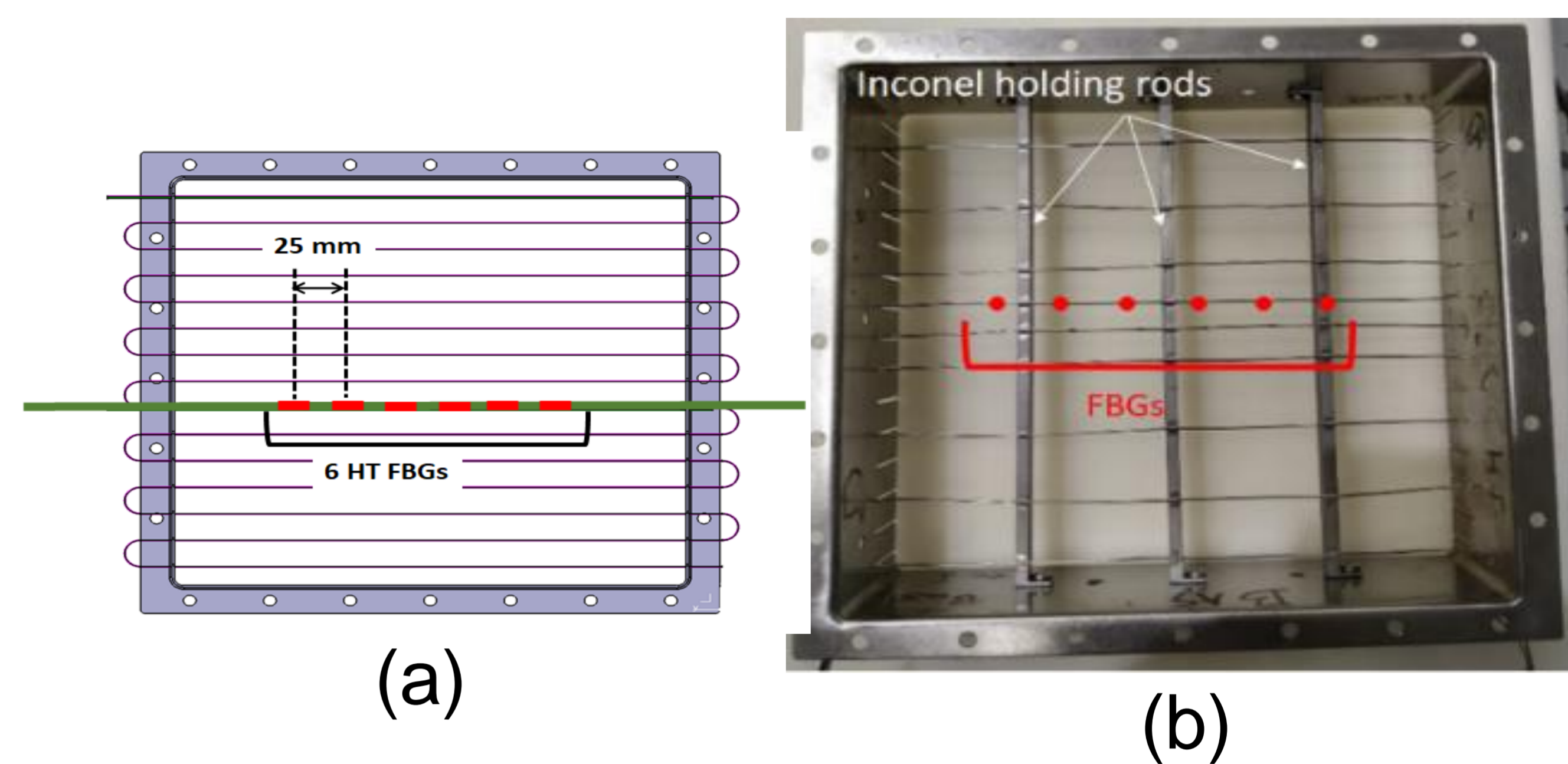
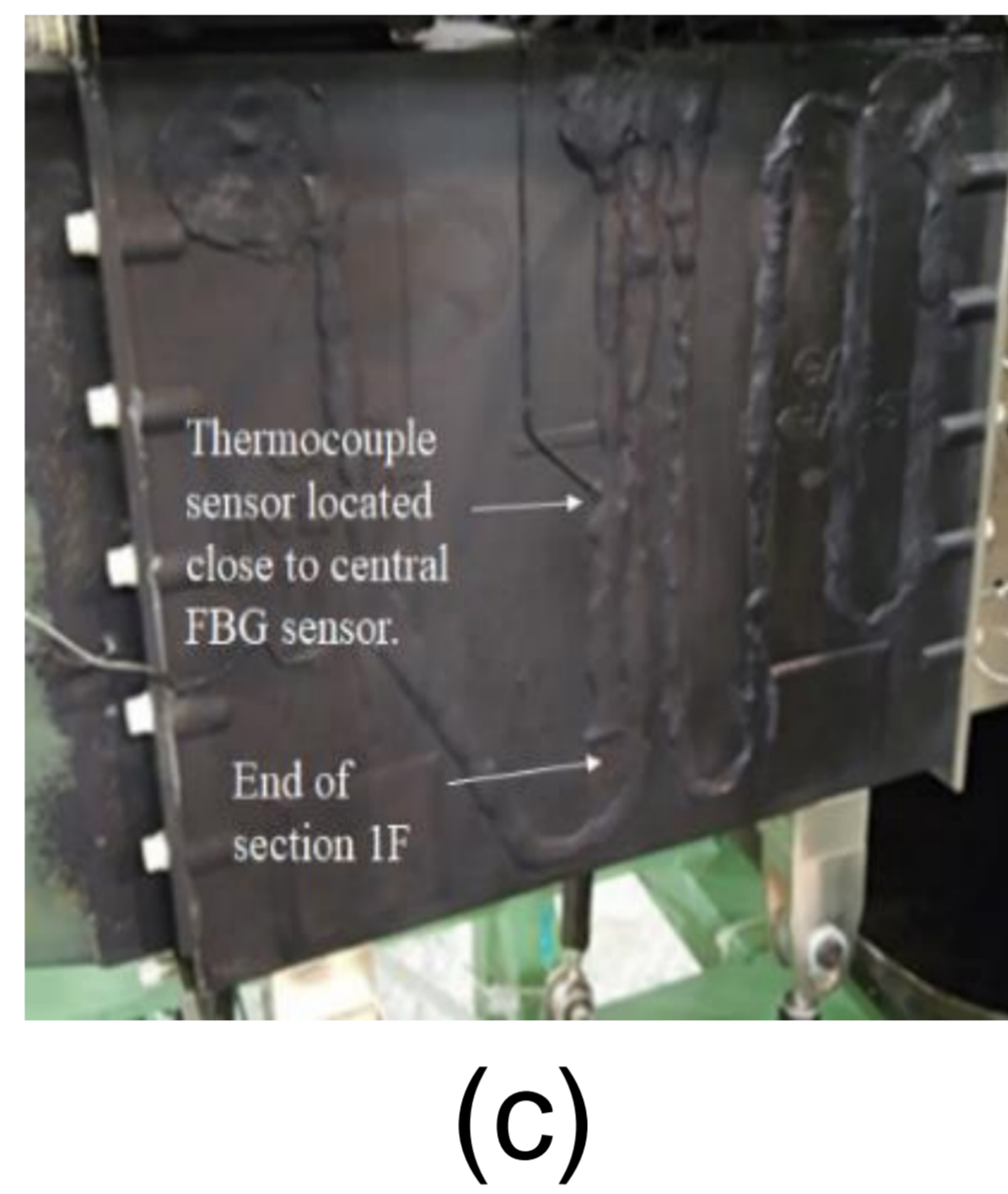
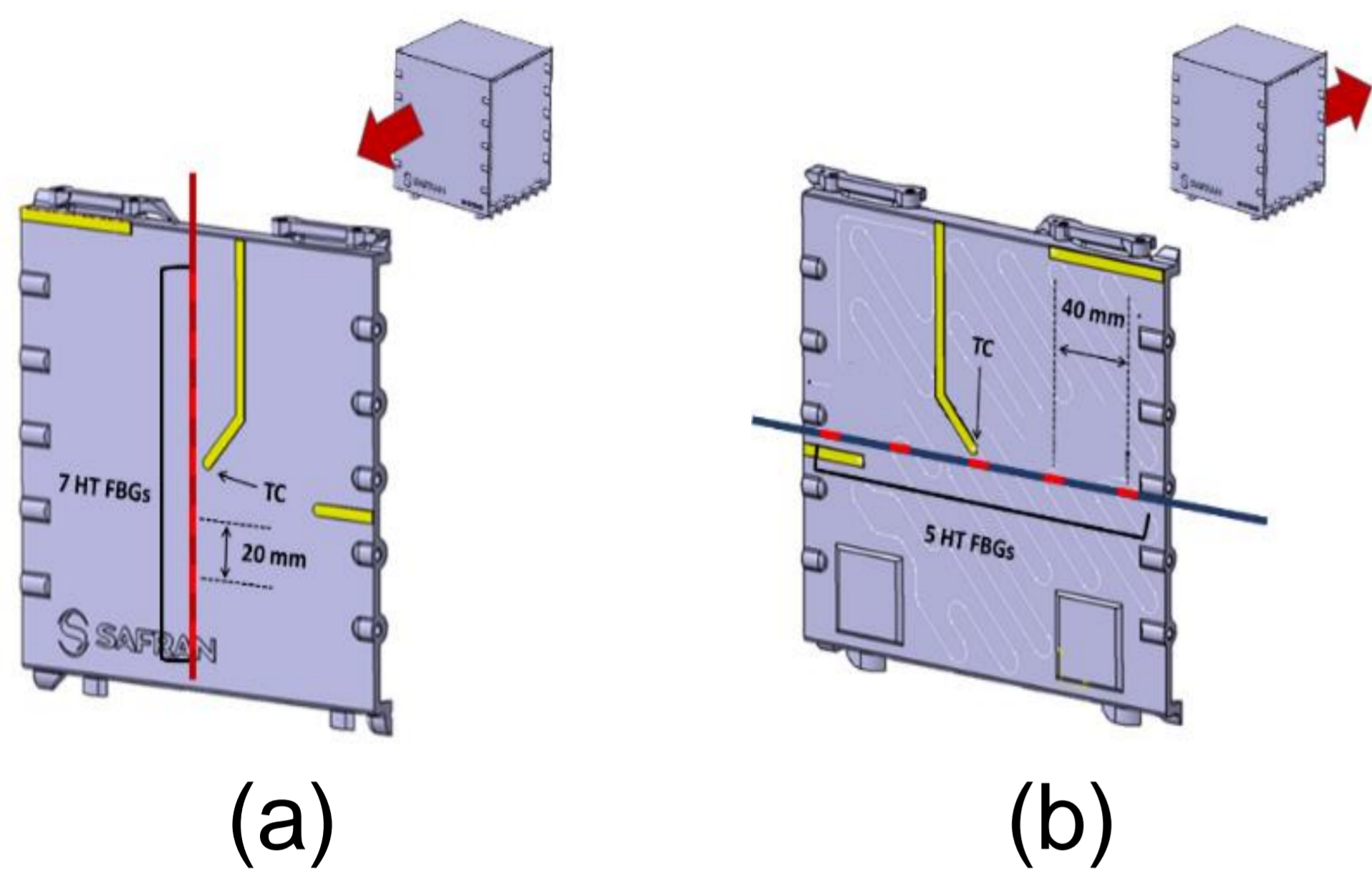


## FIBER BRAGG GRATING TEMPERATURE MONITORING OF HELICOPTER ENGINE MECHANICAL PARTS ON AN ENGINE TEST BENCH

**Abstract:** Fiber Bragg Grating temperature monitoring results of two mechanical parts located in the exhaust system of a helicopter engine test bench are reported and compared to thermocouple and SWIR camera measurements.

### MONITORED PIECES OF THE EXHAUST SYSTEM

18 FBG temperature sensors disposed on two mechanical parts

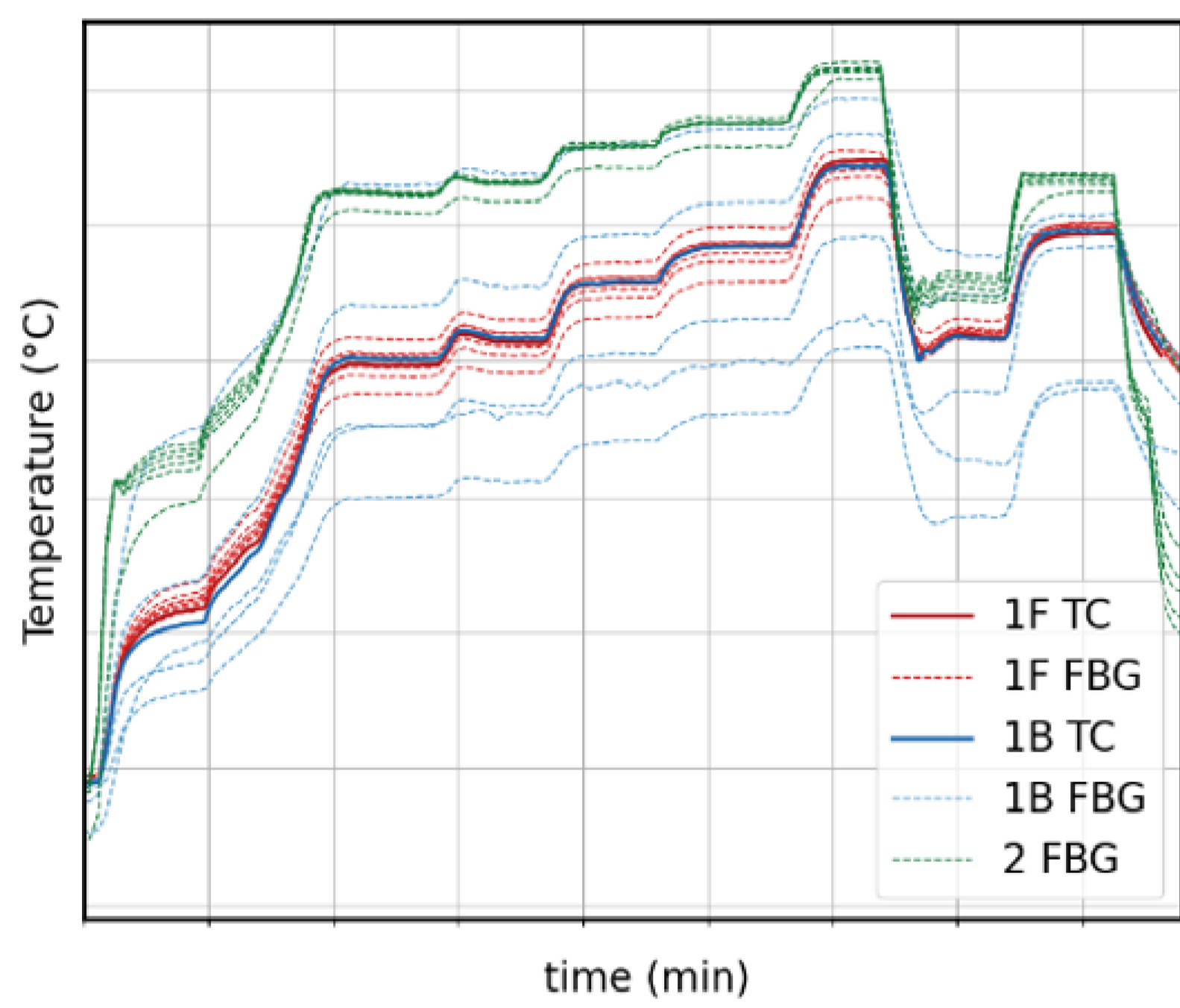


Schematic of monitored piece 1 front and back and disposal of temperature sensors (a and b resp.). (c) photograph of piece 1 front (c).

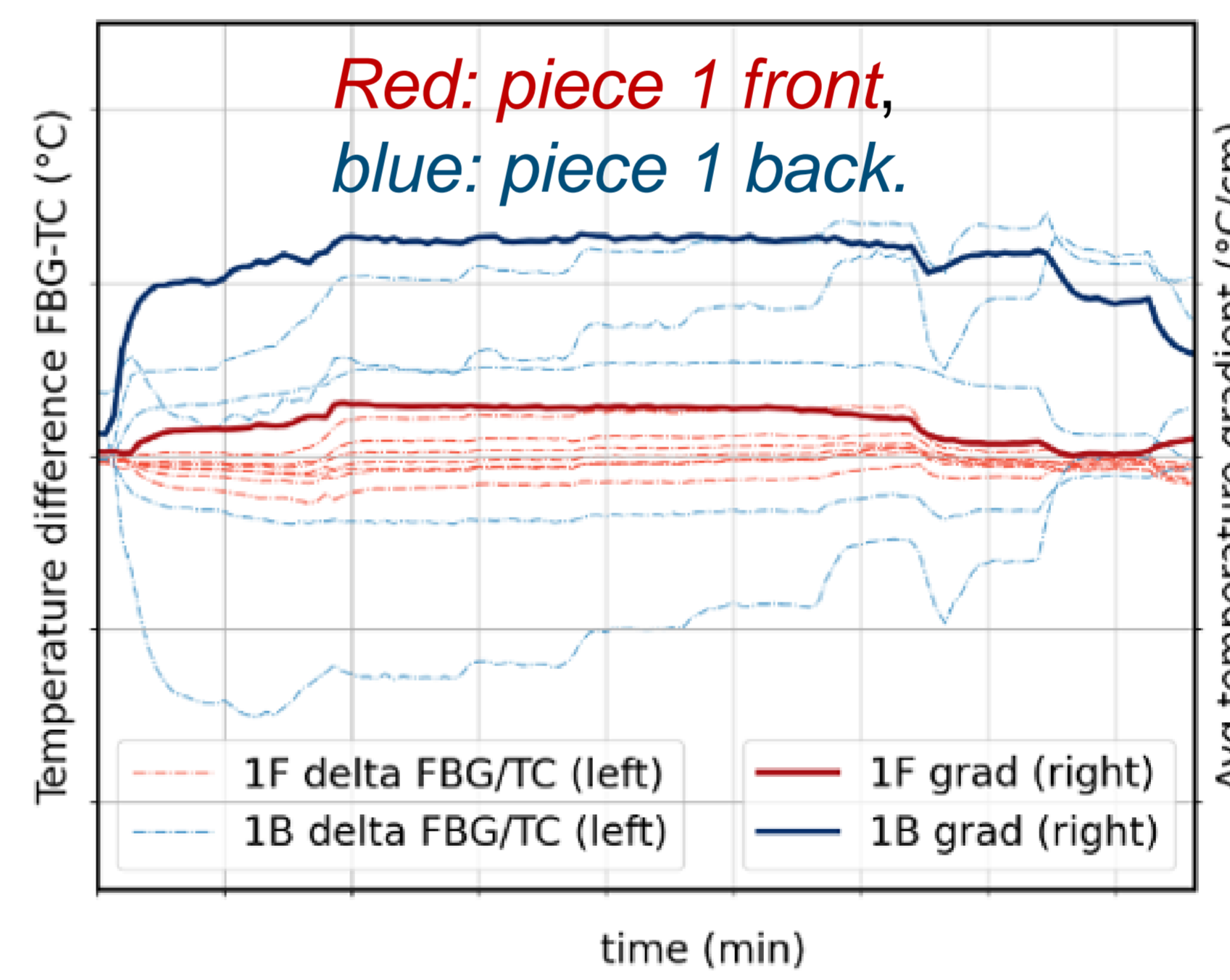
Schematic of monitored piece 2, disposal of temperature sensors (a) and photograph of piece 2 (b).

### MONITORING TEMPERATURE GRADIENTS DURING TEST CYCLES

Variation of air flow rates, steps of a few minutes, up to 600°C.



Red: part 1 front, blue: part 1 back, green: part 2. Solid lines: TC measurements. Dashed lines: FBG measurements.

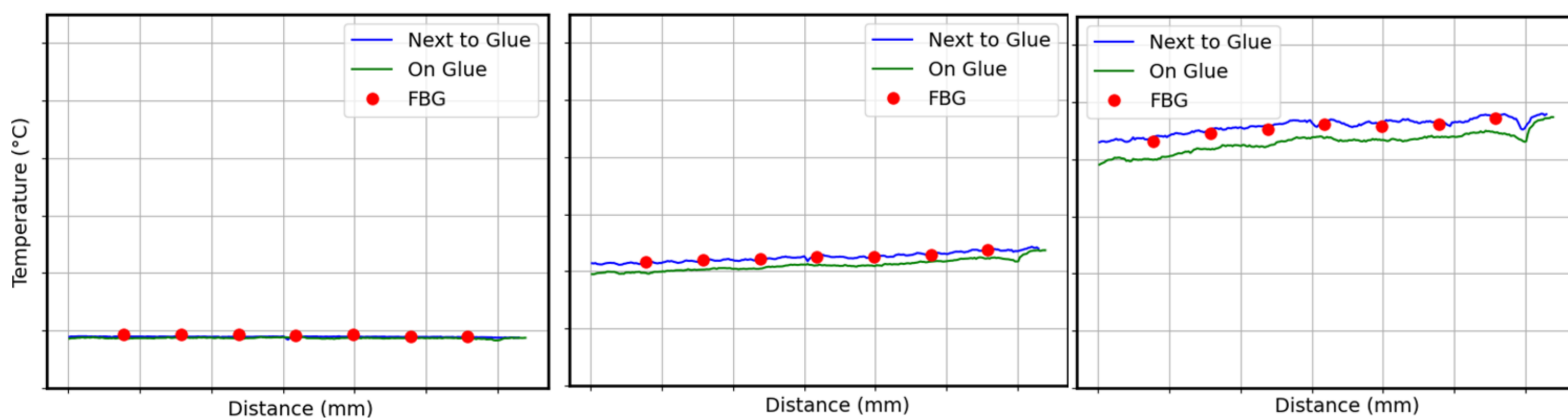


Axis 1 (left, dashed lines) Temperature difference between FBG sensors and TC measurements.

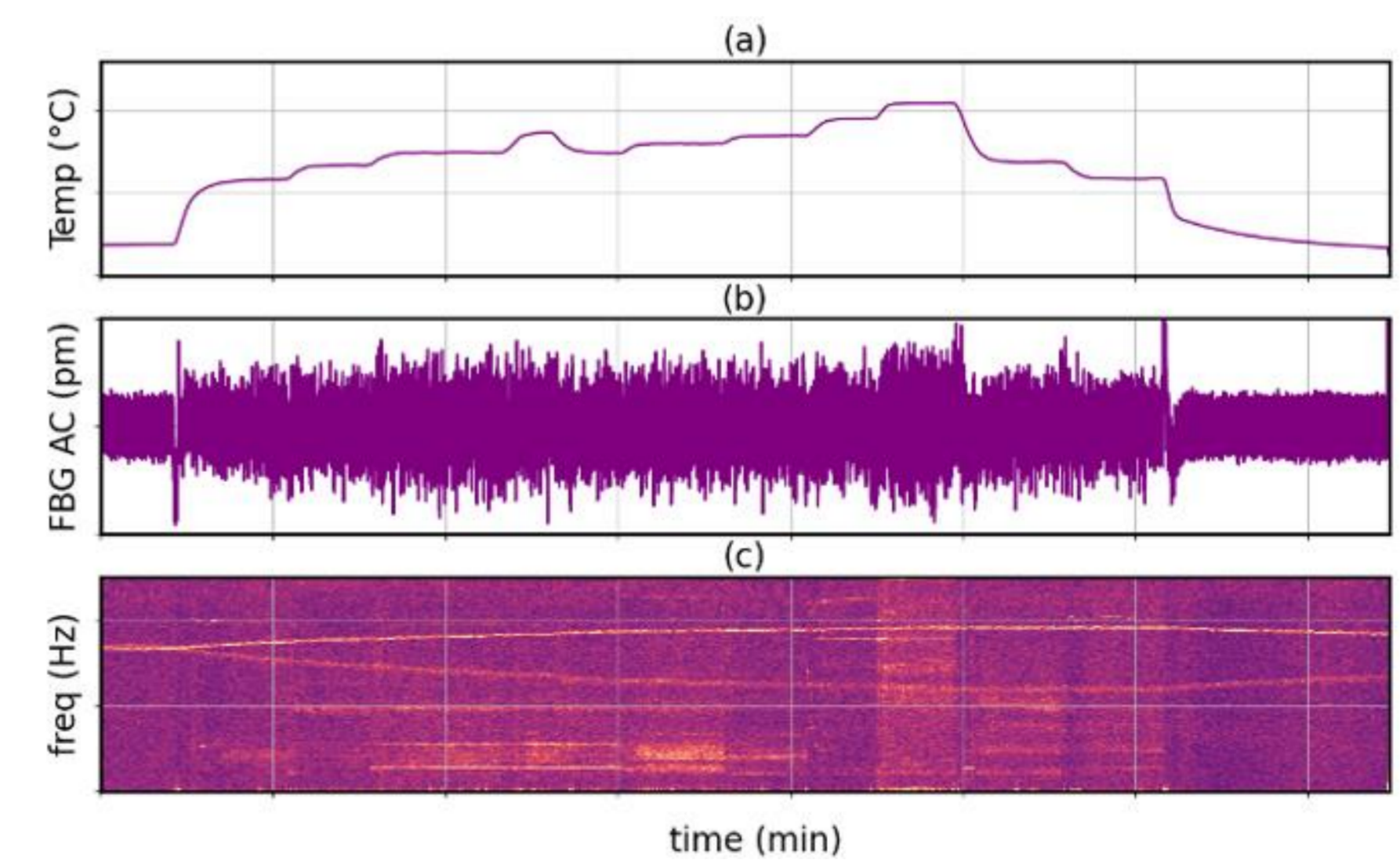
Axis 2 (right, solid lines) average temperature gradient vs time during a test cycle.

Temperature measured during a test cycle vs time for different temperature sensors and different mechanical pieces.

### MEASURED TEMPERATURE COMPARED WITH SWIR PROFILES AND ANALYSIS OF 5-KHZ SIGNAL OF SINGLE FBG SENSOR



Temperature at different instants on piece 1 front. Red dots: FBG sensors. Blue and green lines: profiles extracted from SWIR images on the glue and a few millimeters aside respectively.



FBG signal acquired at 5 kHz during a test cycle. (a) Temperature of sensor, (b) FBG peak signal AC component obtained from difference between signal and signal convoluted by rectangular window (in pm), (c) short-time Fourier transform of this signal.

### Conclusion:

- Temperature measurement as high as 600°C and calculation of temperature gradients.
- Comparison of results obtained with FBGs, TC sensors and SWIR camera.
- Analysis of 5-kHz signal.