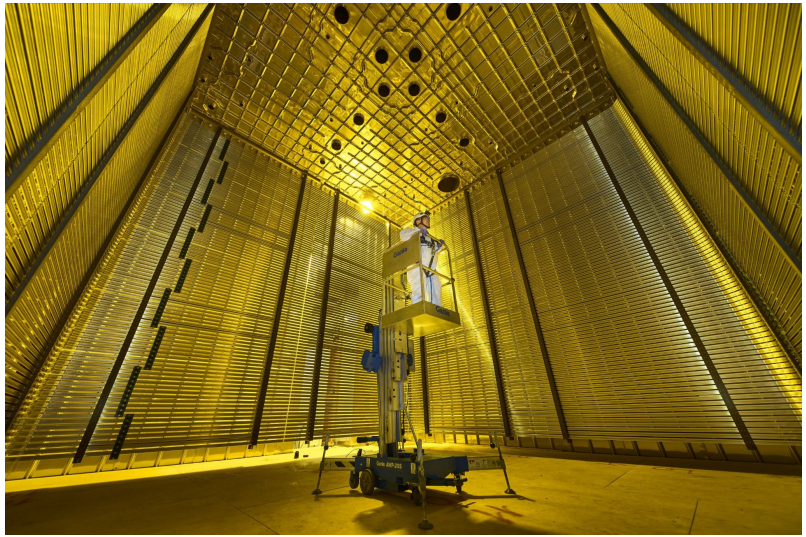
DEWAR 1M MEASUREMENTS

IFIC - Valencia, Spain
DUNE Group Meeting

INTRODUCTION

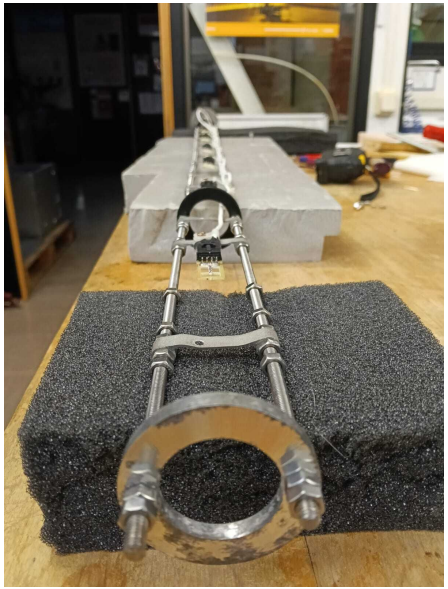


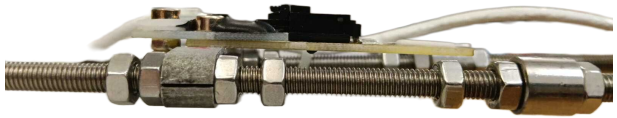
Interior of a **detector** from the DUNE experiment at **CERN**.

Motivation of the TMS

- Argon is renewed every 5 days, injected 0.5–1° C warmer.
- Verify that the obtained temperature map matches expectations — this is the only way to confirm proper recirculation.
- Expected temperature gradients: below **20 mK**.

SET-UP

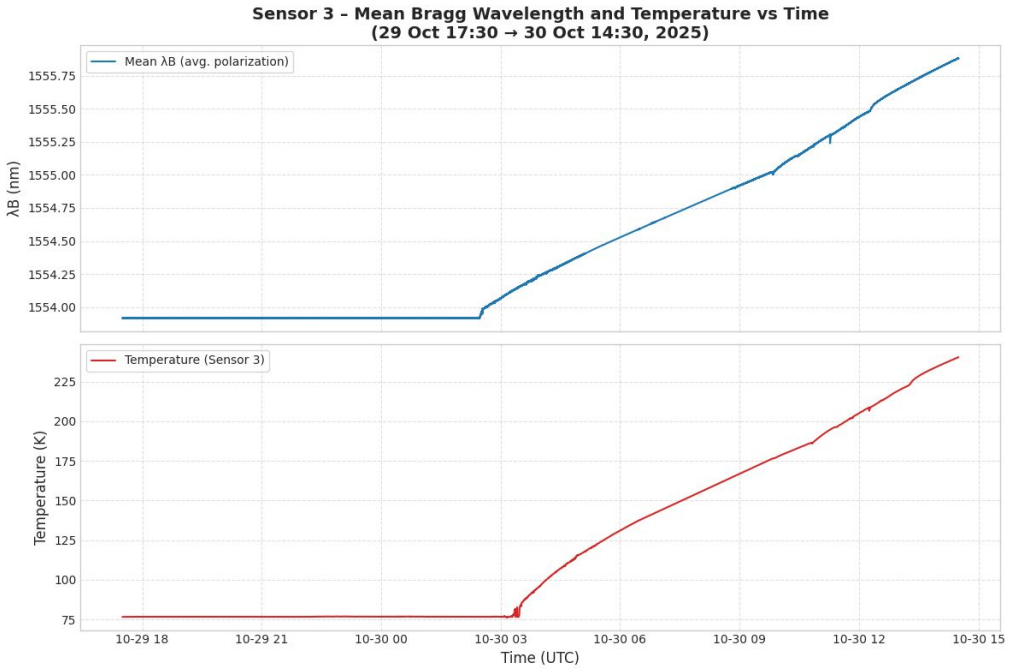




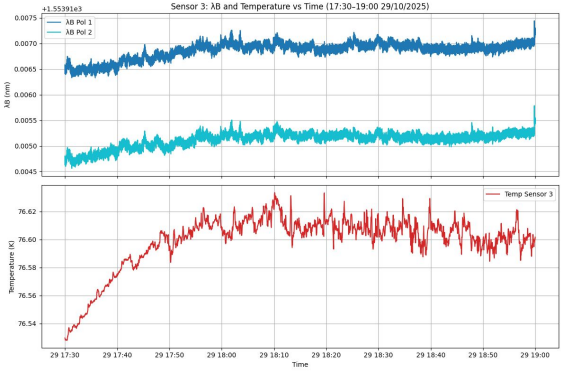
SET-UP

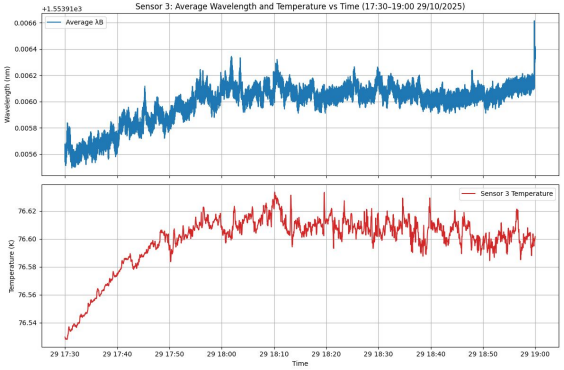
‘DW-2’ Fiber:

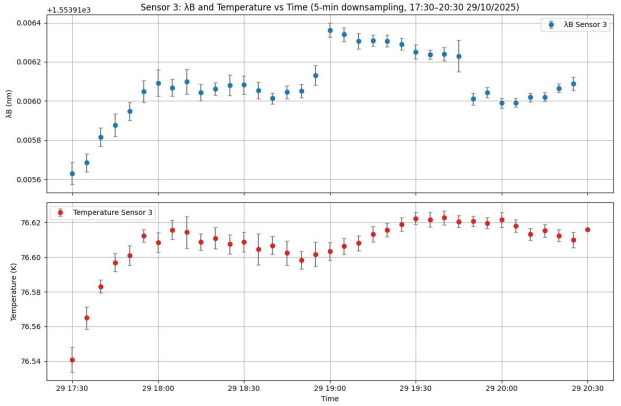
- 5 FBGs with **17 cm** spacing
- **24-hour run**
- **Measurement start:** 17:00h
- **Measurement end:** 15:00h (next day)
- **Lead-in:** 0.24 m
- **Lead-out:** 0.26 m
- **Fiber length:** 1.18 m
- **Spacing:** 0.17 m
- **Sensor length:** 0.10 m

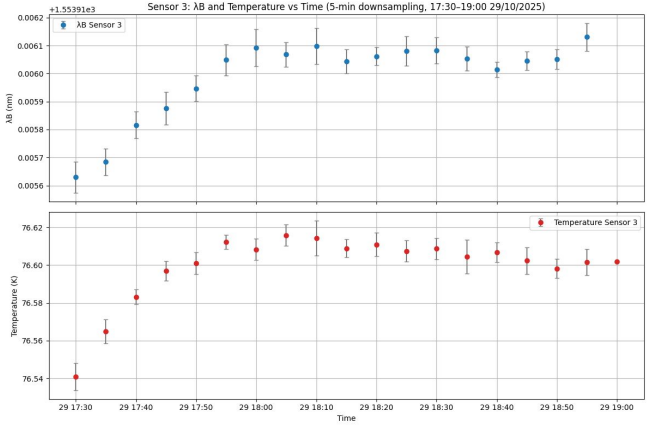


ANALYSIS

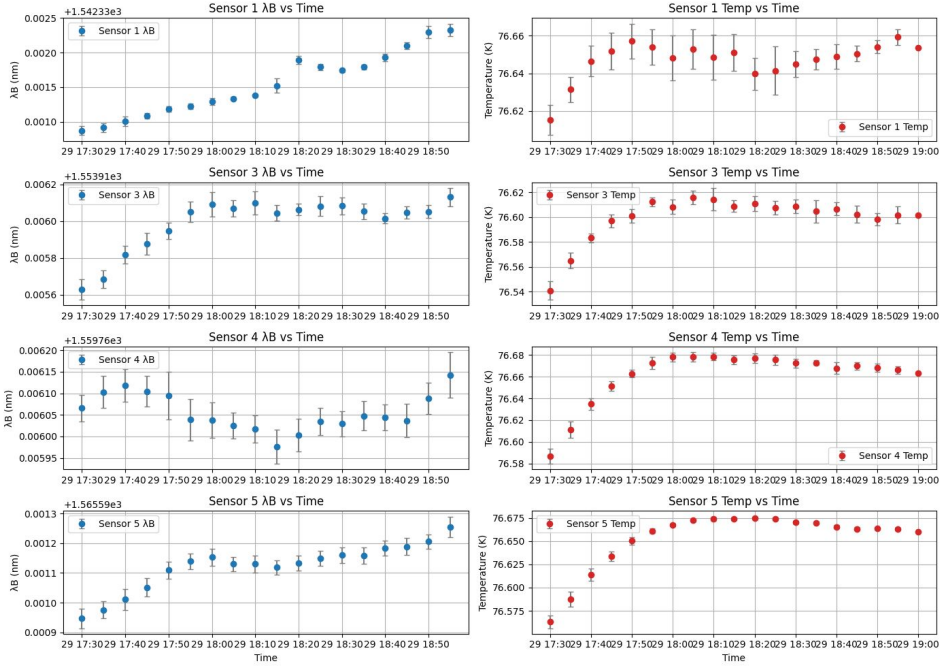

Sensor 3: λB and Temperature vs Time (17:30–19:00 29/10/2025)
λB Pol 1
λB Pol 2
λB (nm)
Temp Sensor 3
Temperature (K)
Time

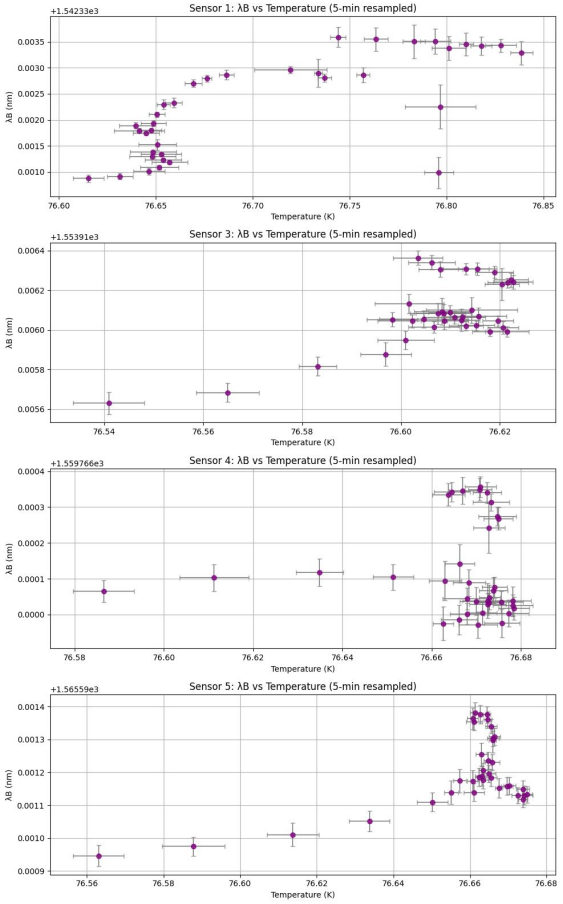

Sensor 3: Average Wavelength and Temperature vs Time (17:30–19:00 29/10/2025)
Average λB
Wavelength (nm)
Sensor 3 Temperature
Temperature (K)
Time


Sensor 3: λB and Temperature vs Time (5-min downsampling, 17:30–20:30 29/10/2025)
λB Sensor 3
λB (nm)
Temperature Sensor 3
Temperature (K)
Time

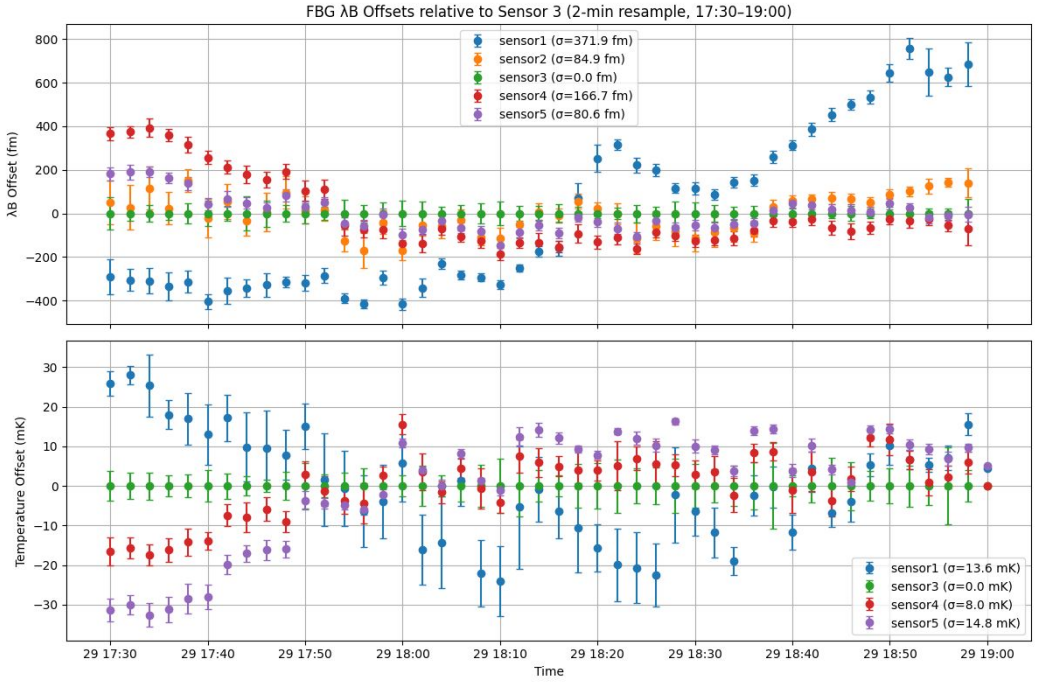

Sensor 3: λB and Temperature vs Time (5-min downsampling, 17:30–19:00 29/10/2025)
λB Sensor 3
λB (nm)
Temperature Sensor 3
Temperature (K)
Time

RESULTS

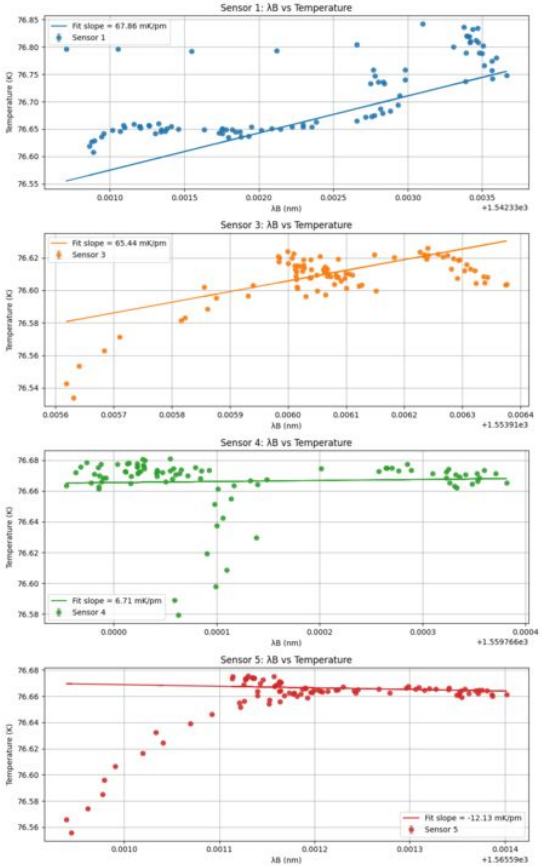

Sensor 1 λB vs Time
Sensor 1 λB
Sensor 1 Temp vs Time
Sensor 1 Temp
Sensor 3 λB vs Time
Sensor 3 λB
Sensor 3 Temp vs Time
Sensor 3 Temp
Sensor 4 λB vs Time
Sensor 4 λB
Sensor 4 Temp vs Time
Sensor 4 Temp
Sensor 5 λB vs Time
Sensor 5 λB
Sensor 5 Temp vs Time
Sensor 5 Temp
λB (nm)
Temperature (K)
Time


Sensor 1: λB vs Temperature (5-min resampled)
Sensor 3: λB vs Temperature (5-min resampled)
Sensor 4: λB vs Temperature (5-min resampled)
Sensor 5: λB vs Temperature (5-min resampled)
λB (nm)
Temperature (K)

RESULTS


FBG λB Offsets relative to Sensor 3 (2-min resample, 17:30–19:00)
sensor1 (σ=371.9 fm)
sensor2 (σ=84.9 fm)
sensor3 (σ=0.0 fm)
sensor4 (σ=166.7 fm)
sensor5 (σ=80.6 fm)
λB Offset (fm)
800
600
400
200
0
−200
−400
Temperature Offset (mK)
30
20
10
0
−10
−20
−30
sensor1 (σ=13.6 mK)
sensor3 (σ=0.0 mK)
sensor4 (σ=8.0 mK)
sensor5 (σ=14.8 mK)
29 17:30
29 17:40
29 17:50
29 18:00
29 18:10
29 18:20
29 18:30
29 18:40
29 18:50
29 19:00
Time

RESULTS


Sensor 1: λB vs Temperature
Fit slope = 67.86 mK/pm
Sensor 1
Temperature (K)
λB (nm)
+1.54233e3
Sensor 3: λB vs Temperature
Fit slope = 65.44 mK/pm
Sensor 3
Temperature (K)
λB (nm)
+1.55391e3
Sensor 4: λB vs Temperature
Fit slope = 6.71 mK/pm
Sensor 4
Temperature (K)
λB (nm)
+1.559766e3
Sensor 5: λB vs Temperature
Fit slope = -12.13 mK/pm
Sensor 5
Temperature (K)
λB (nm)
+1.56559e3

NEXT STEPS

- Fill the **Dewar points** where humidity has been detected.
- **Lift the PVC tube** slightly to avoid excessive boiling of liquid nitrogen when in contact with the Dewar base.
- **Reposition the RTDs** on the rods **7 cm lower** to allow optimal cable routing.
- **Redesign rings and mounting** to enable fiber insertion without twisting or sharp bends.
- **Apply epoxy** at the fiber end to prevent slippage due to the hanging weight.
- **Obtain a PM fiber** and study the **polarization behavior** of light within the fiber.
- **Acquire PEEK fiber** with multiple FBG sensors to continue the study.
- **Repeat the measurement today** with several improvements compared to last week's setup.

NEXT STEPS