

First deployment of a 6-km long  
fiber-optic strain cable on a seafloor  
across an active submarine fault  
(ERC Focus)

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# Introduction

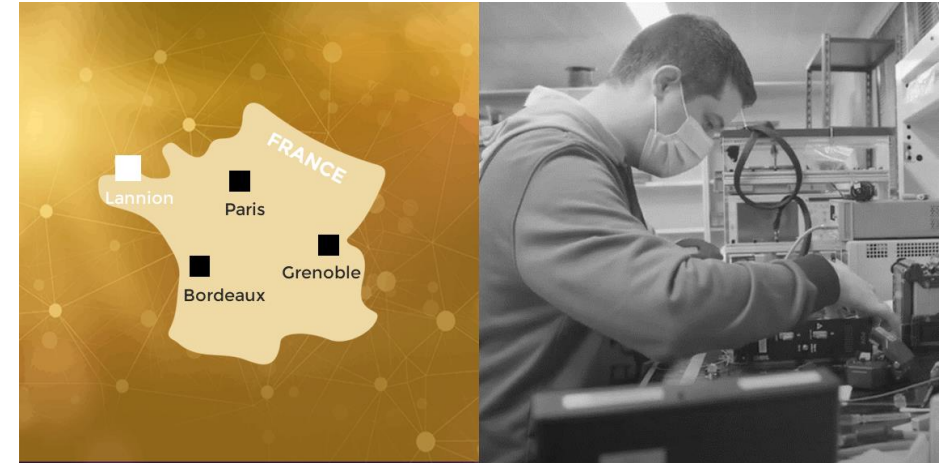
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1. IDIL presentation
2. What is FOCUS project ?
3. Catania area
4. Measurement principle
5. The cable(s)
6. The deployment
7. First results
8. Other site
9. Conclusion

# About the company (Ingénierie Développement Instrumentation Laser)

- **1995:** *Incorporation*
- **2300m<sup>2</sup>** of Headquarter & facility
- **3 Sales offices** in main photonics clusters
- **Team: 65** talented people, led by its CEO Patrice Le Boudec
- **+1000** customers over the globe (90% France, 10% International)
- **~7M€ turnover** +10% annual growth



01	Fiber assemblies & components	1/4
02	Optoelectronic systems & lasers	1/4
03	Spectroscopy & Microscopy	1/4
04	Photonics engineering & services	1/4

## What we do?

A **photonics** solutions provider involved in many far-reaching and collaborative projects.

IDIL is specialized in the **production of optical components** and in the **design, development and assembly of complete optical systems** for the Science, Defense & Industry.



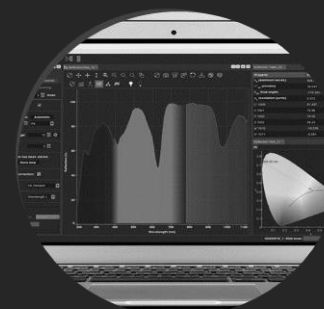
- *Specialized in sensor solutions*
  - *Fiber Bragg Gratings*
  - *Smart cable implementation*
- *For different applications*
  - *Offshore*
  - *Civil engineering*
  - *Material...*



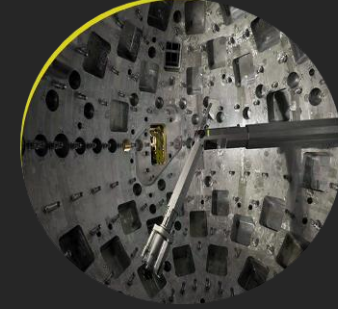
01 Fiber assemblies & components



02 Optoelectronic systems & lasers



03 Spectroscopy



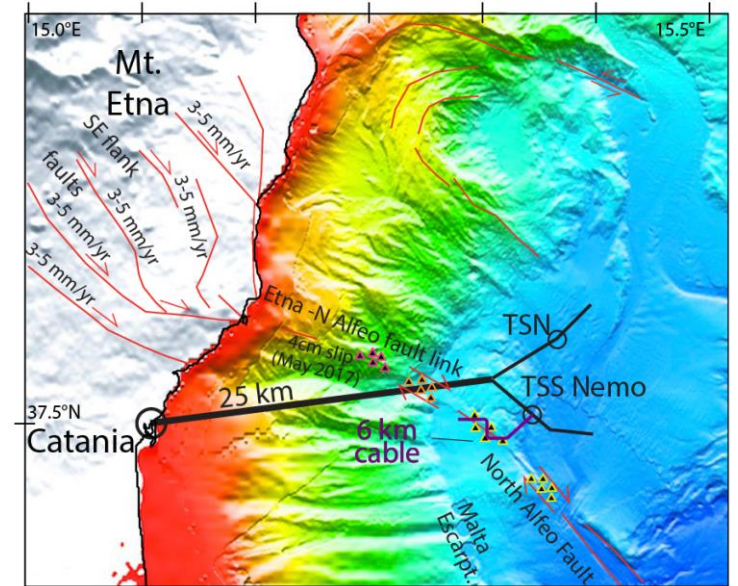
04 Photonics Engineering & services

# FOCUS project

## Fibre Optic Cable Use for Seafloor

Studies of earthquake hazard and deformation

Nov 2018- Nov 2025 : 7 years



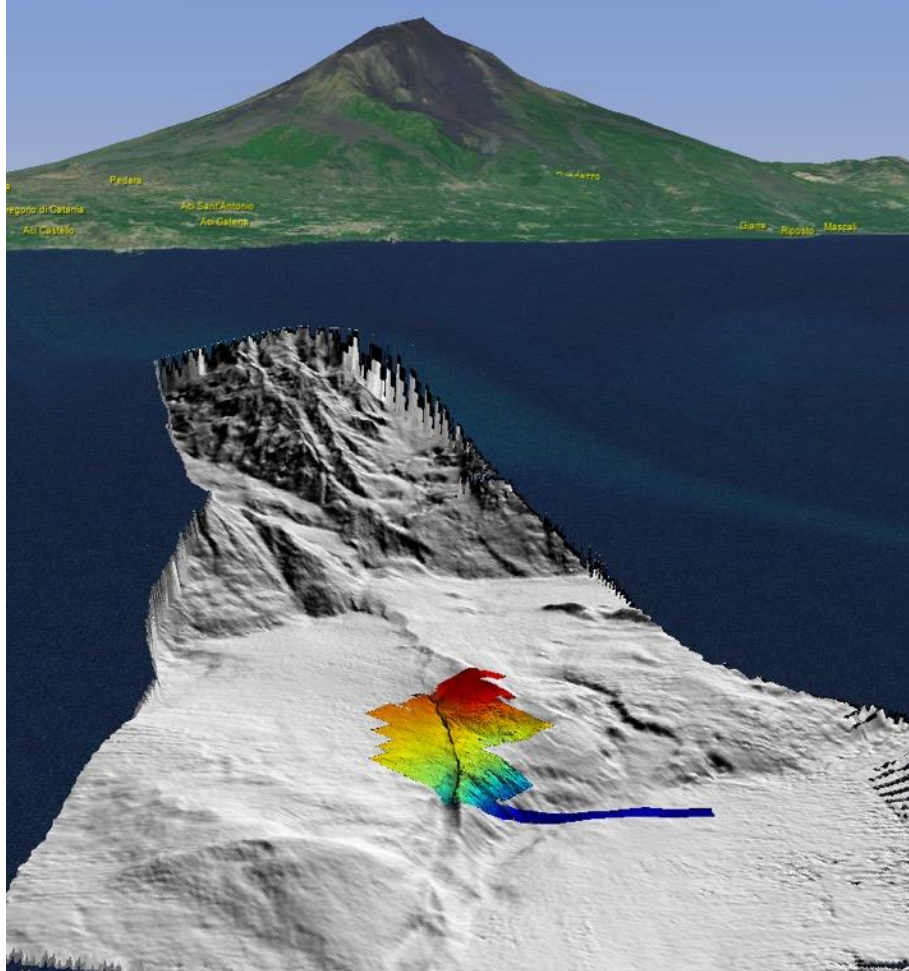
R&D Project Involvement



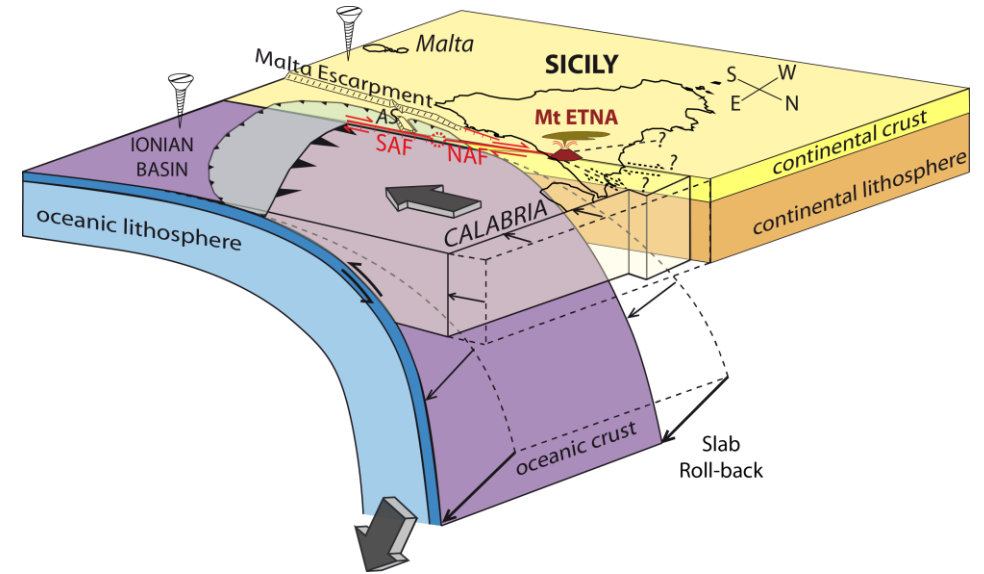
European Research Council  
Established by the European Commission



# Catania area



Fault @ 2000 m depth  
@ 25 km from the coast (Mont Etna)

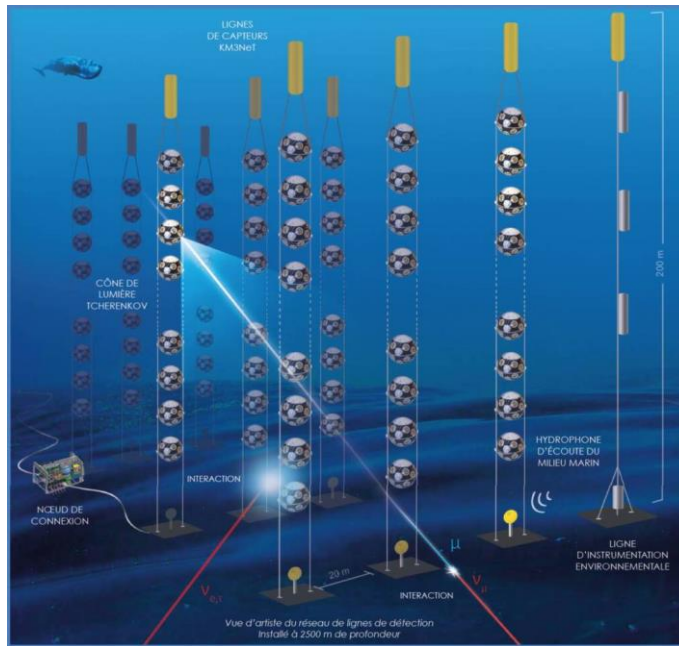


The North Alfeo Fault

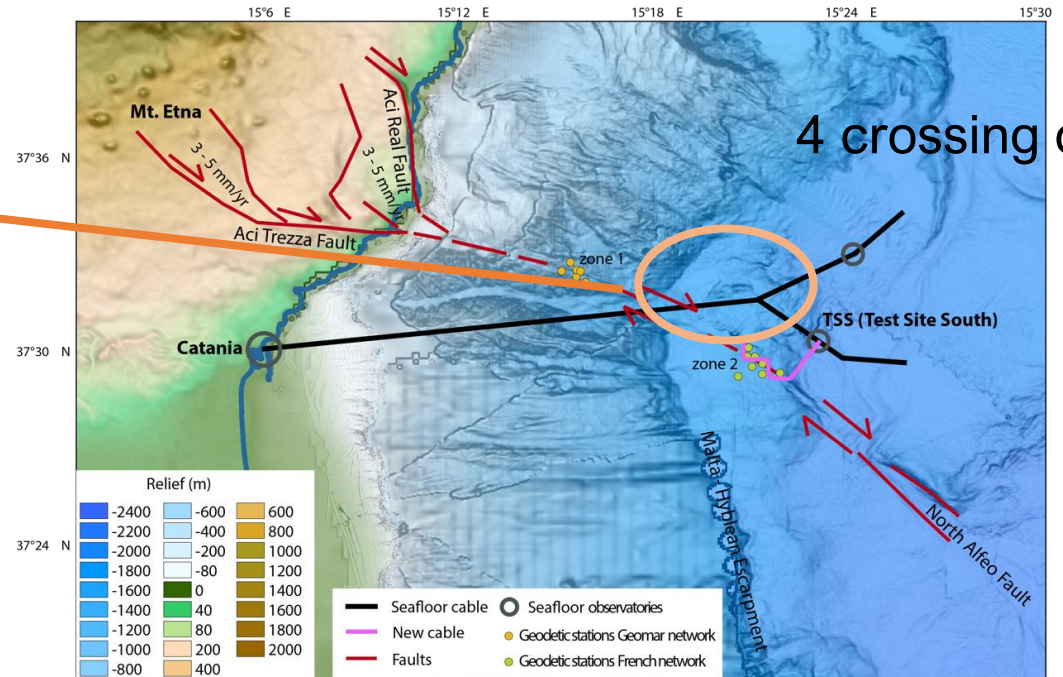
# Catania area

Goal = Deploying a 6 km long optical cable on the fault connected to the 25 km long cable of the INFN used for neutrino detector array. Performing BOTDR<sup>1</sup> measurements on the cable.

R&D Project Involvement



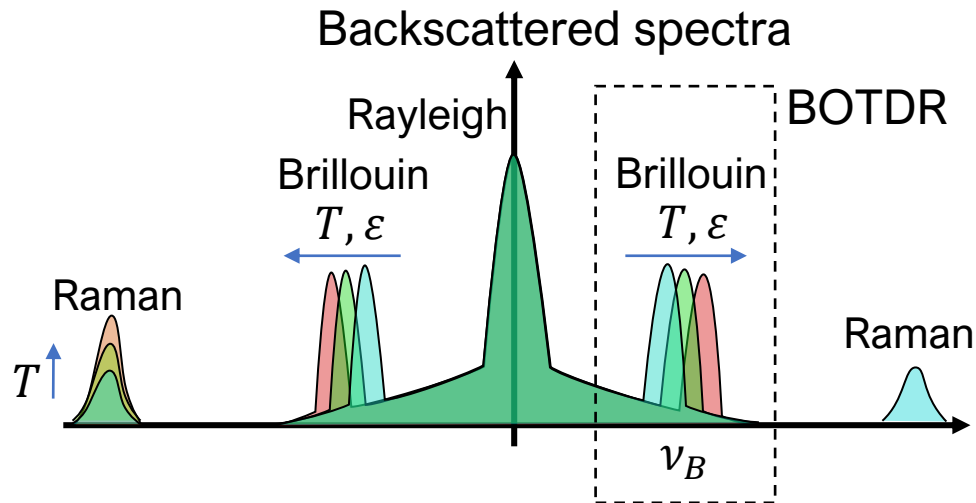
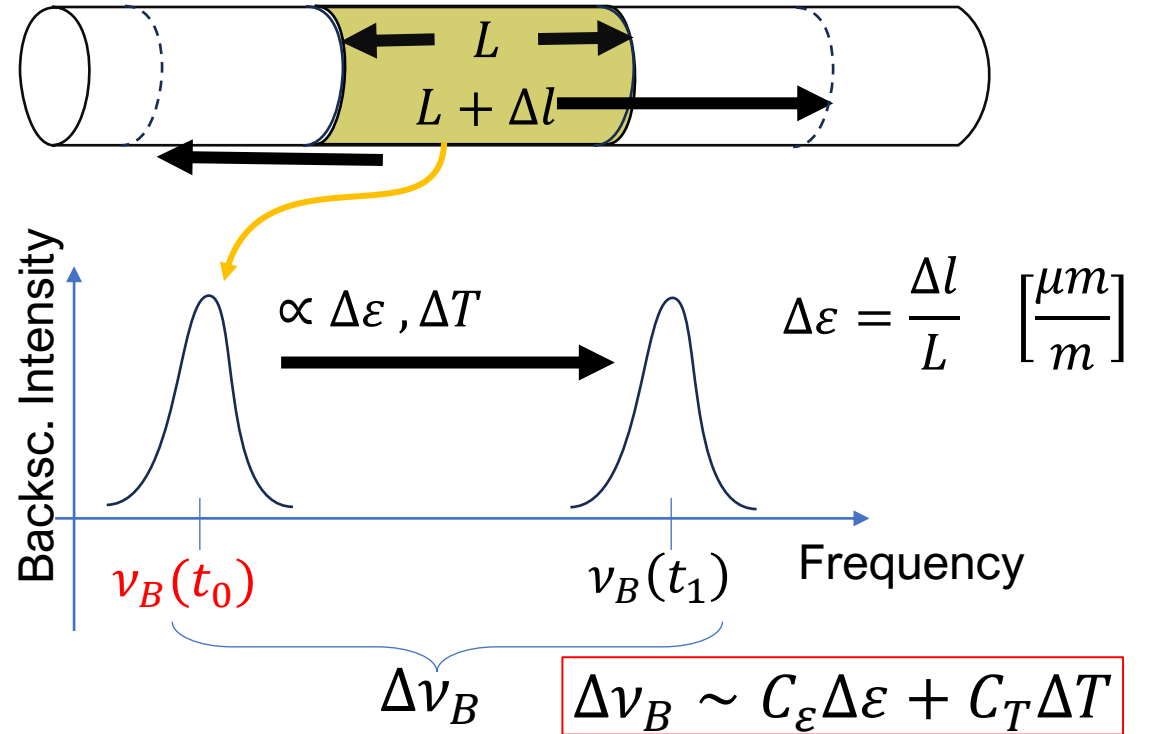
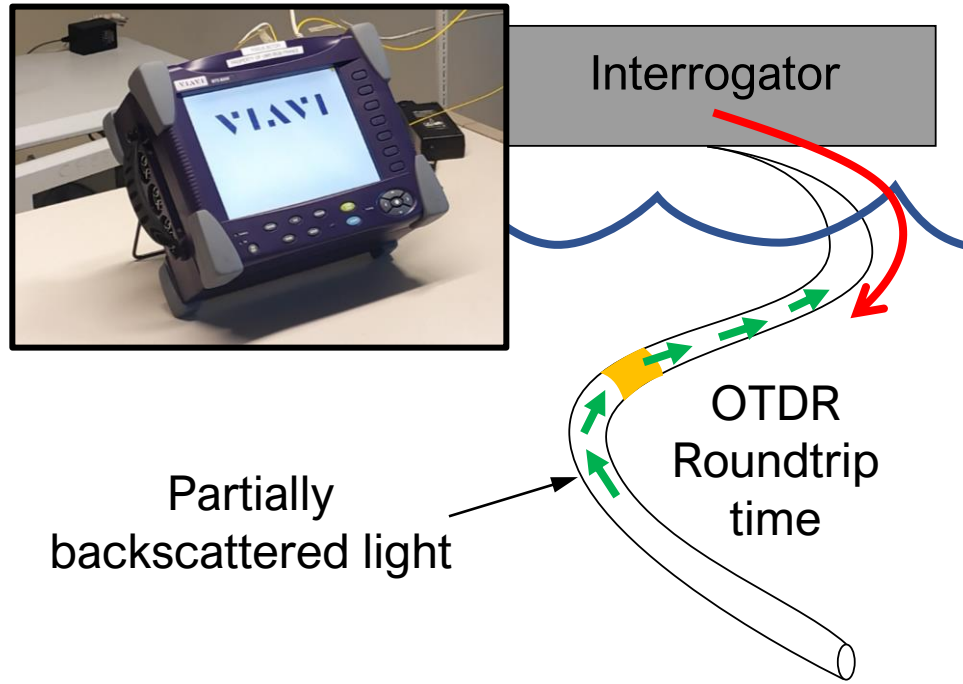
Neutrino detector array



Fault @ 25 km from the Mont Etna. Movement: 1cm/year

<sup>1</sup>BOTDR: Brillouin Optical Time Domain Reflectometry

# Measurement principles and key performances



$\Delta T$ accuracy	0.5 °C
$\Delta \epsilon$ accuracy	10 $\mu\text{m}/\text{m}$ = 0.001%
Range	60+ km
Sampling interval	2 m
Spatial resolution	10 m
Acquisition time	2 hours



# The cable(s), preparation

	<b>Technical Description</b> FO Sensor Cable	Doc No.: TA494-TD
		Issue: 02T
		Date: 2018-10-10
		Page: 7 of 7

4 CROSS-SECTIONAL DRAWING



Drawing No:  
D-11150 Issue 5

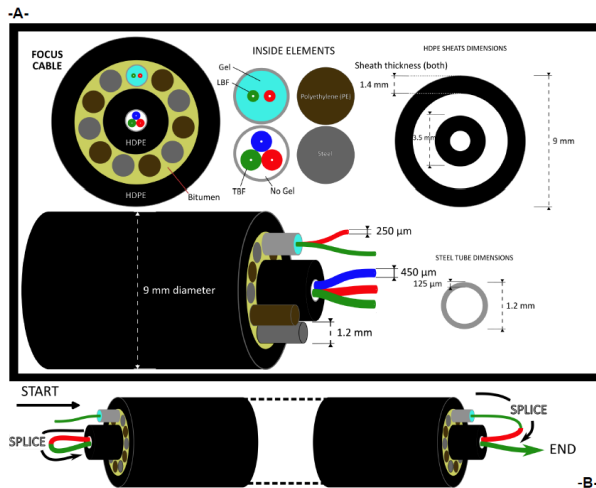
6 km long cable deployed  
2 channels

- 18 km (3 fibres)
- 12 km (2 fibres)

More than 30 km of sensor

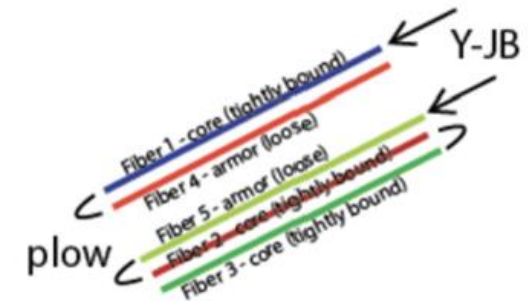
	<b>Technical Data Sheet</b>
10 FO-9/125 + 2 cable Trisens + 2x 3 mm <sup>2</sup>	

1 km long cable under test



5 fibres:

- 2 Loose
- 3 Tight

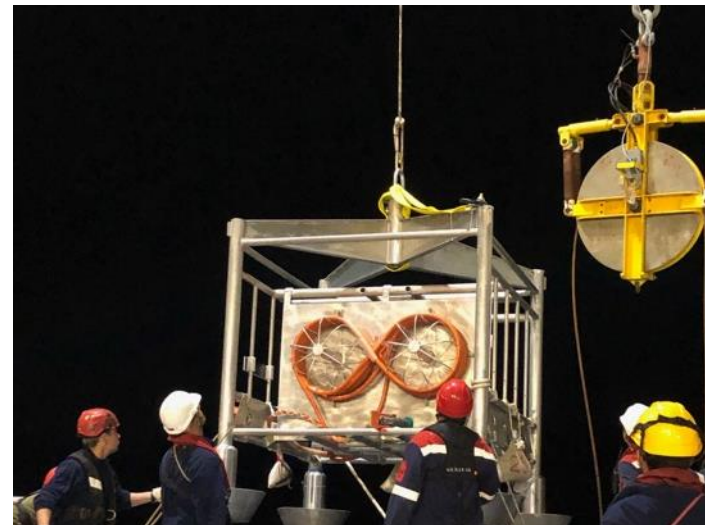


## The deployment (important dates)

- Deployment Oct. 2020
- Bag Drop Operations Sept. 2021
- Strain measurement since Oct. 2020



(1) Instrument deployed from IFREMER's vessel "Pourquoi pas"



(2) Y junction Box



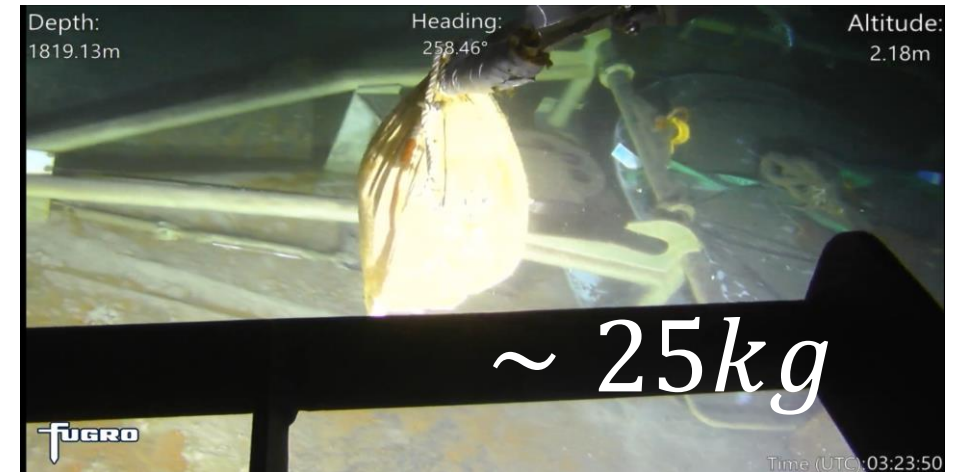
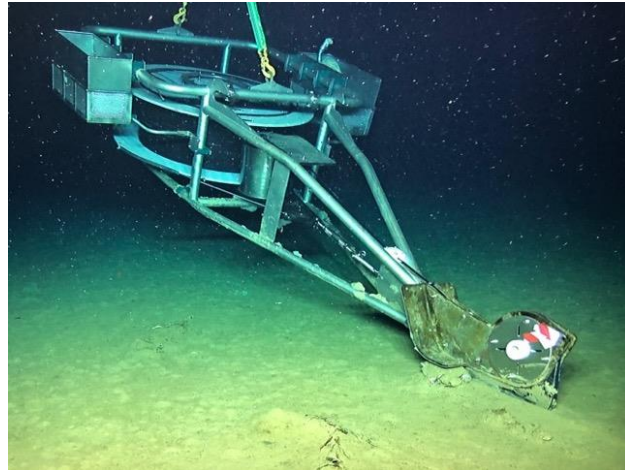
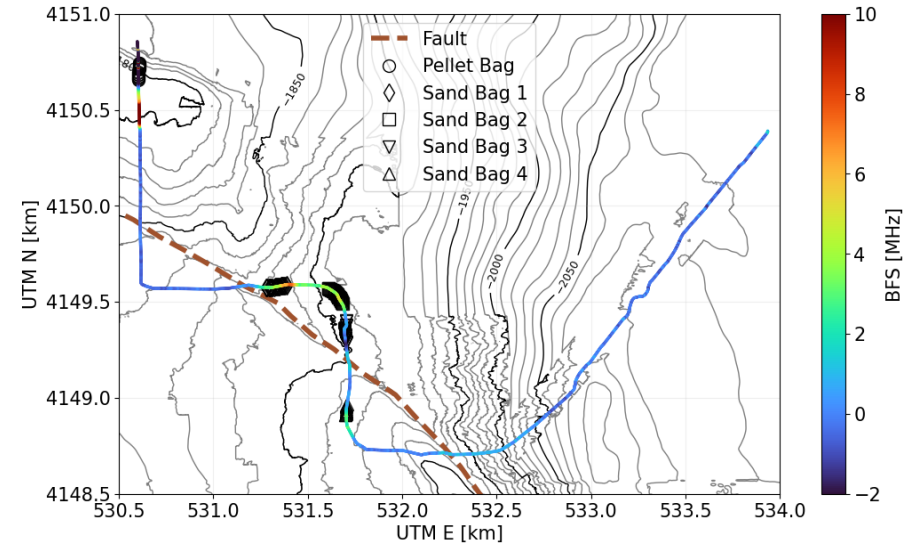
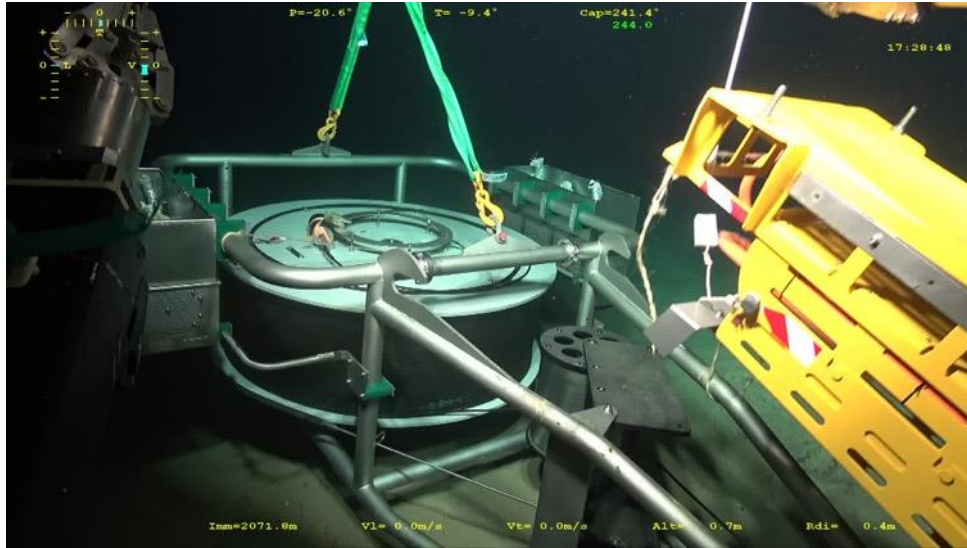
(3) Deep sea plow carried by the ROV Victor

# The deployment (important dates)



Connection to the Y junction box (using ROV Victor)

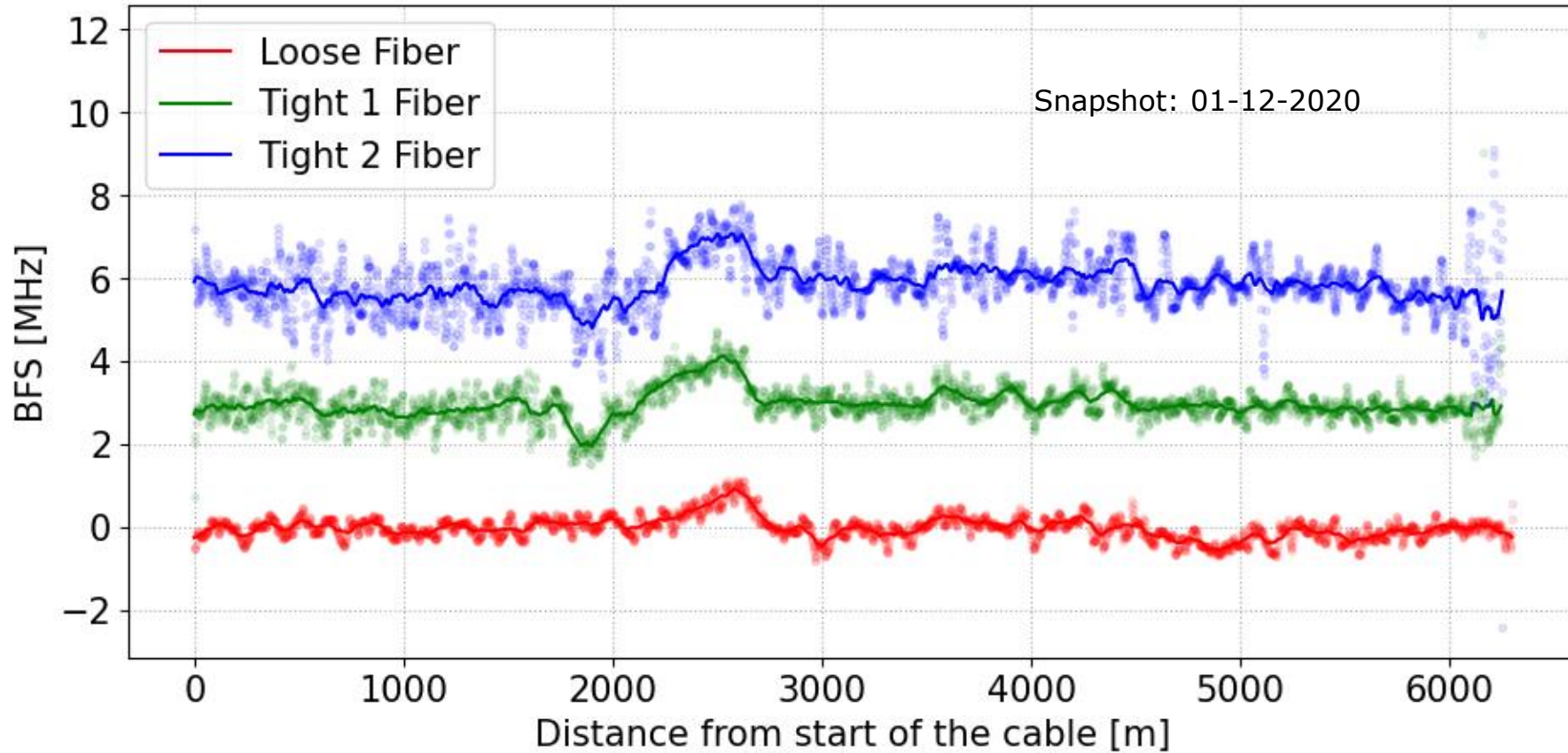
# The deployment (Bag drop operation since 2021)



Plow and cable end module; Deep sea plow for cable laying in the sediments

# First results

15 November 2020 Natural Event

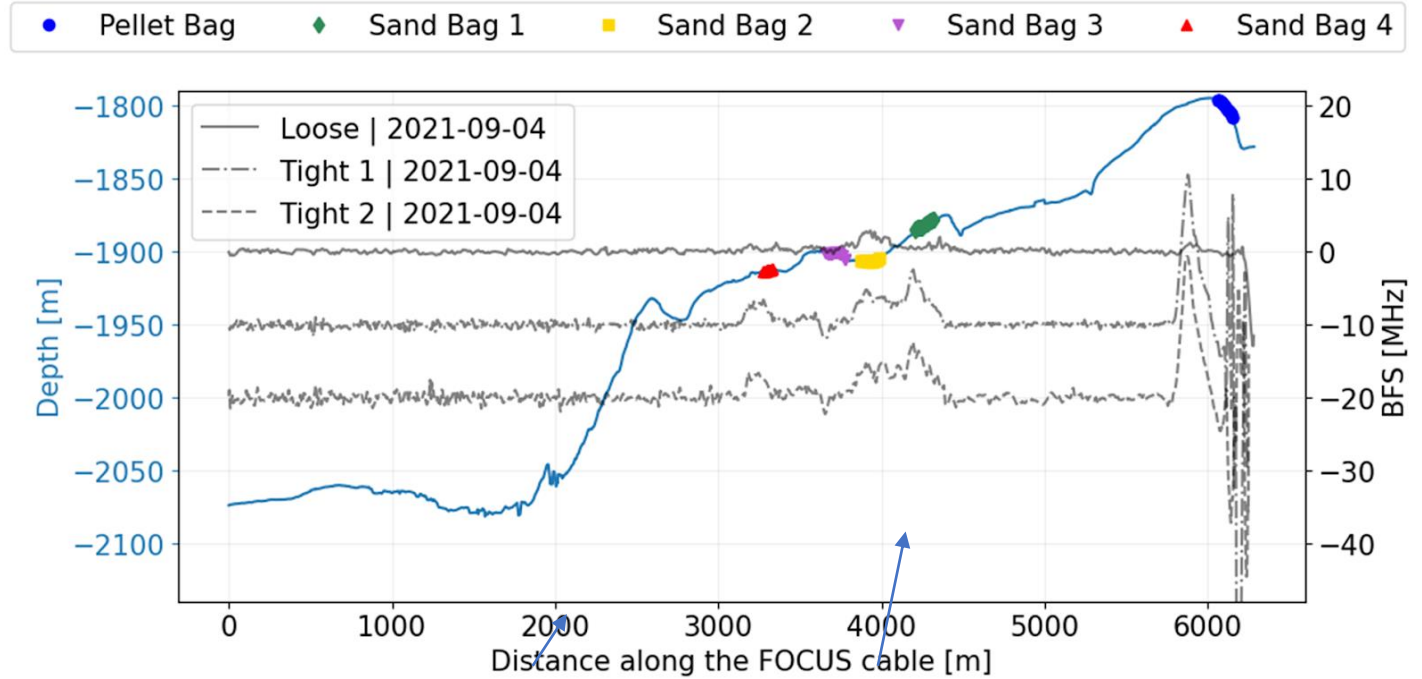


Natural Event Nov 2020

# First results

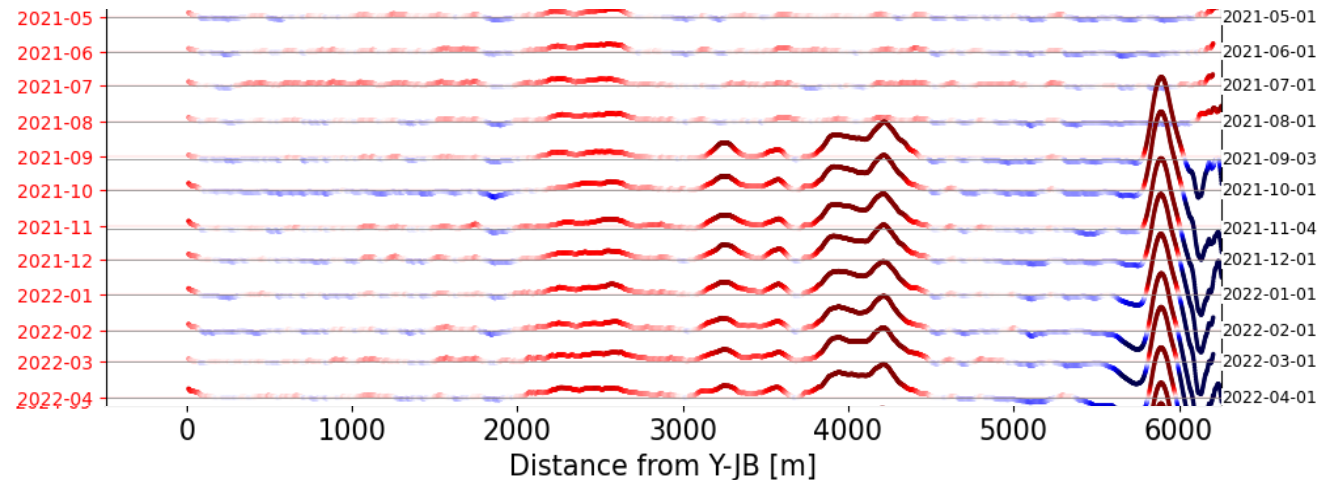
Bag dropping:

- 5 areas
- relaxation with time



150 $\mu\epsilon$  vs  $\sim 0\mu\epsilon$

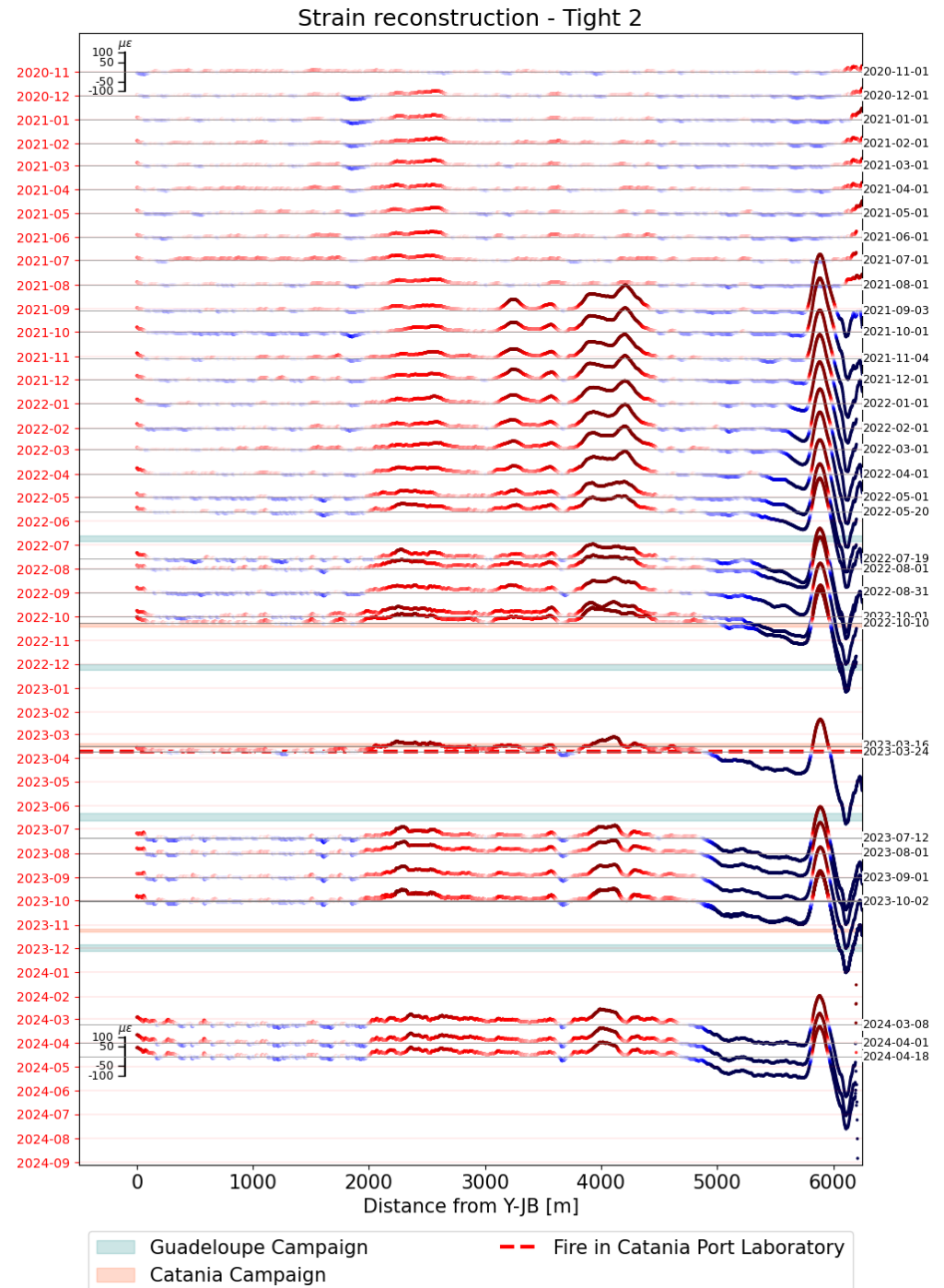
400 $\mu\epsilon$  vs 20 $\mu\epsilon$



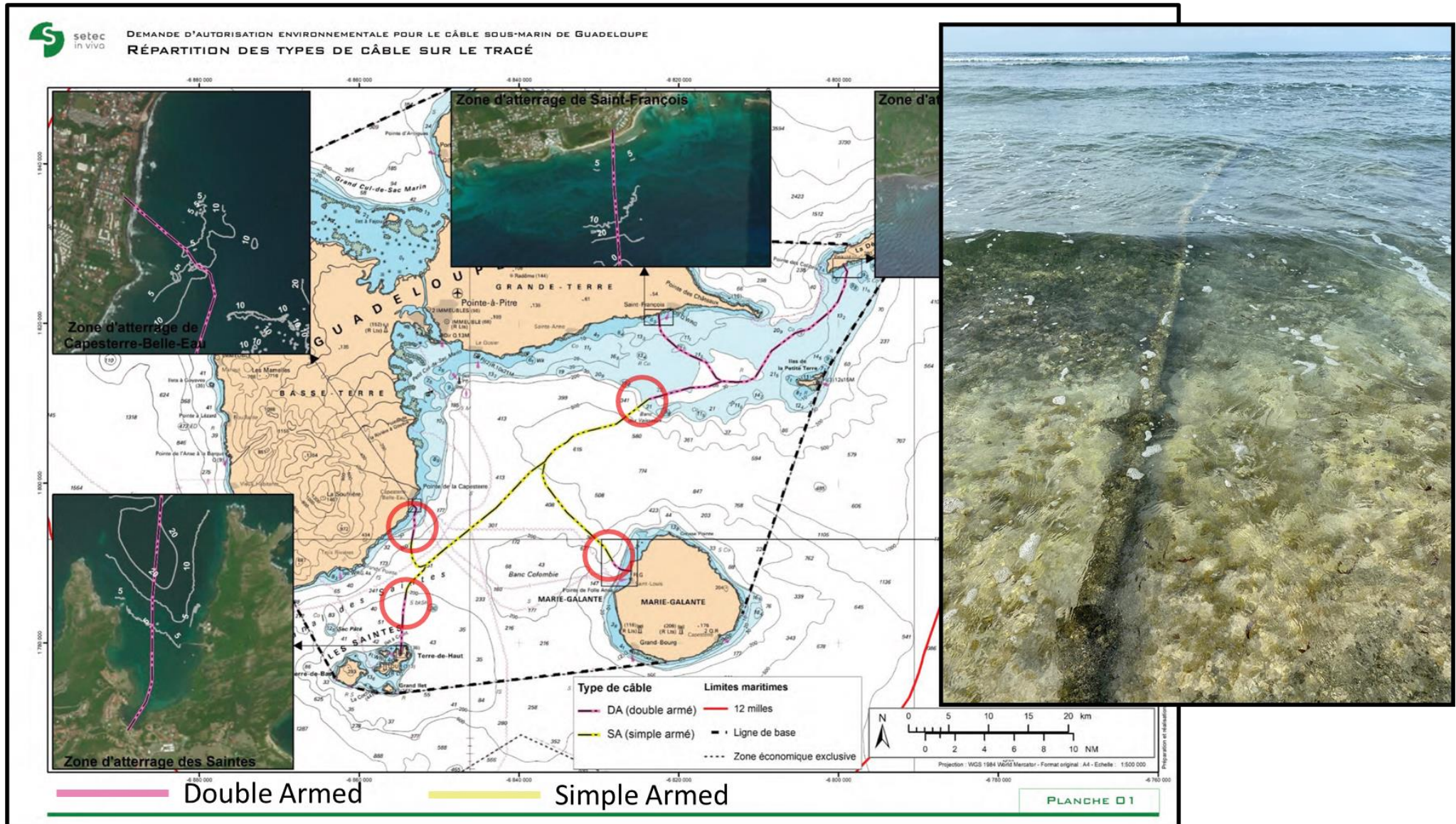
# First results

Almost 4 years of monitoring

- Bag effects relaxation
- No real fault modification

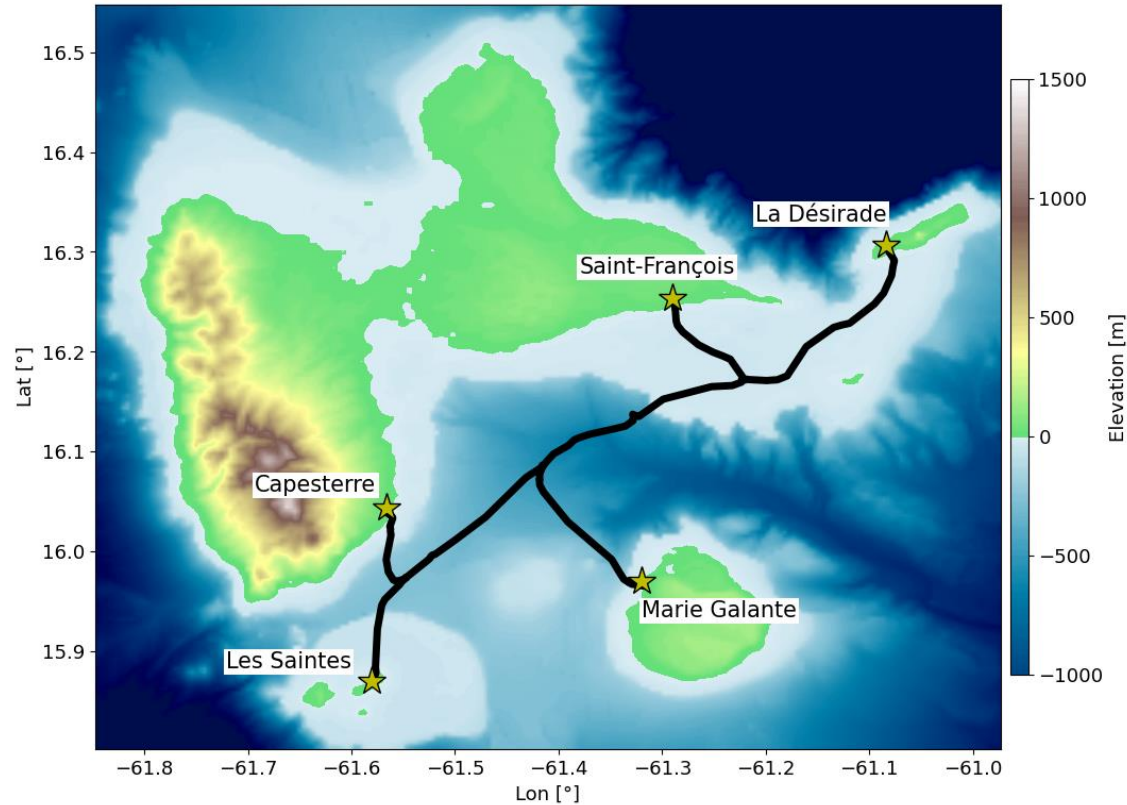


# Other site: Fibres optical cable off Guadeloupe island

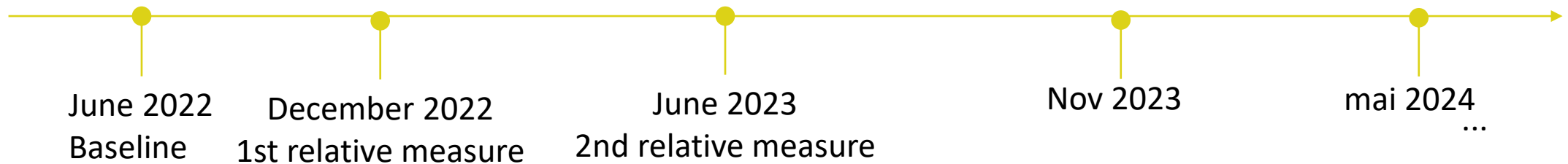




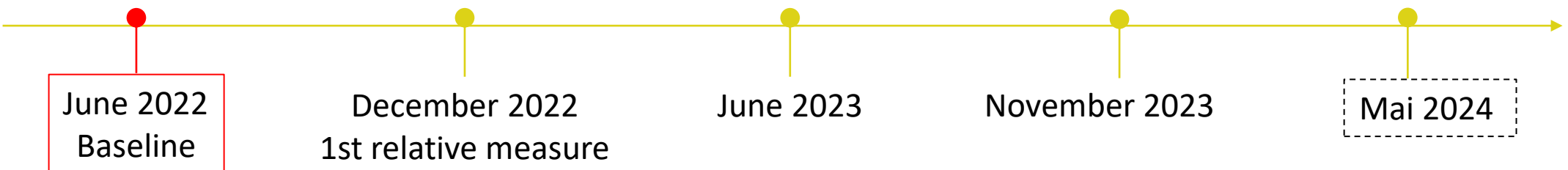
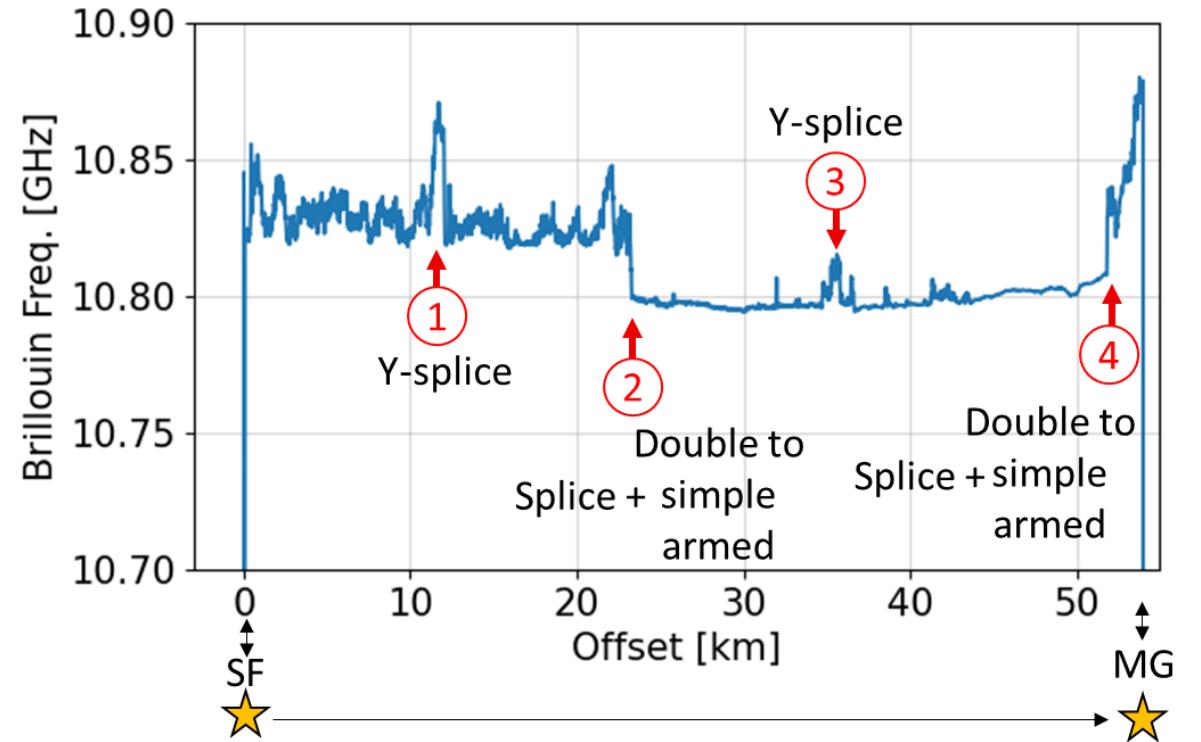
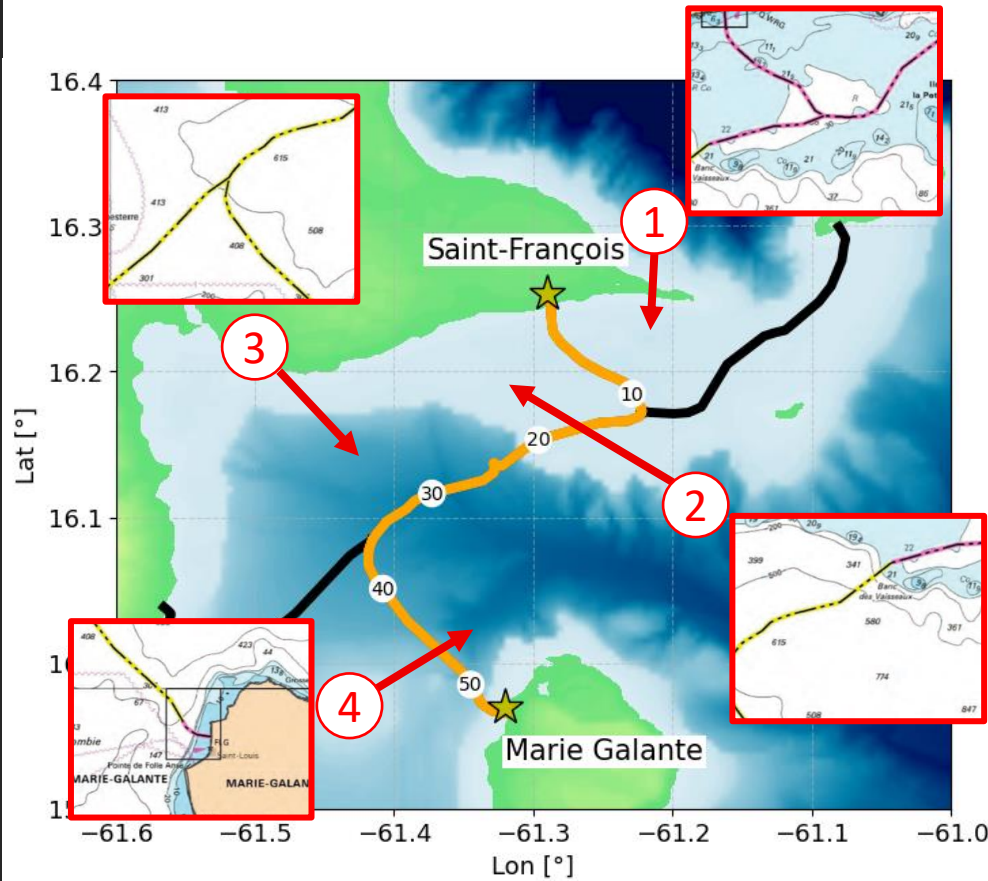
# Monitored paths



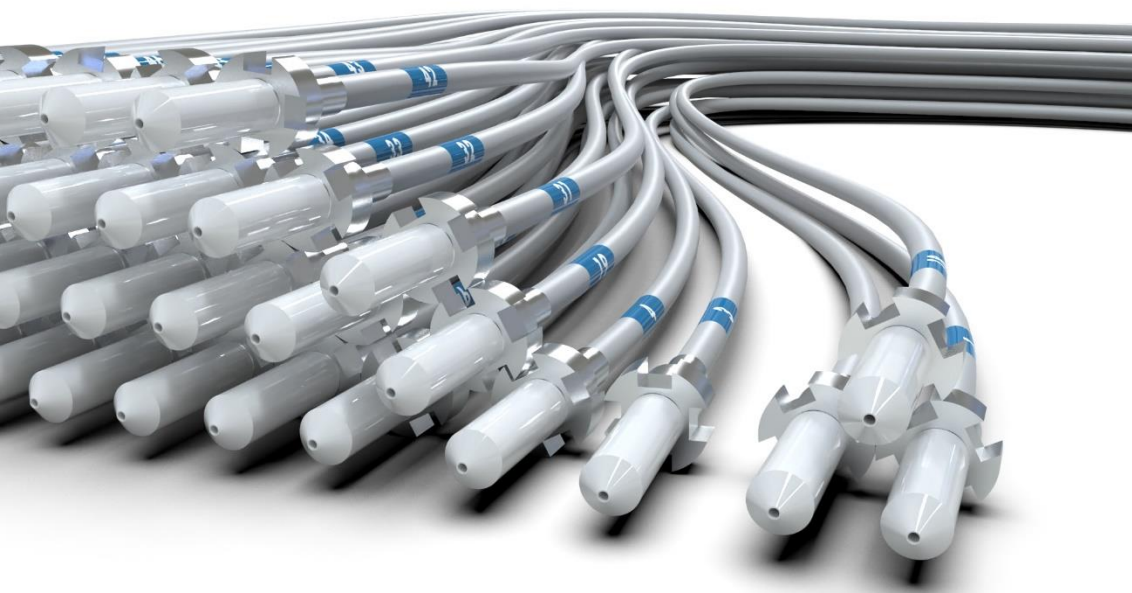
Monitored Paths	Length (km)
Saint-François → La Désirade	36 km
Saint-François ↔ Marie Galante	54 km
Saint-François ↔ Capesterre	63 km
Saint-François → Les Saintes	63 km
Capesterre → Les Saintes	22 km
Capesterre ↔ Marie Galante	45 km



# The baseline: cable characterization from the absolute measurement







**Thank you for your attention**

**Do not hesitate to contact us**

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