



# 2021 EPIC Online Technology Meeting

## Distributed Fiber Sensing for Oil and Gas producers

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March 21

# FEBUS OPTICS: A fast growing company

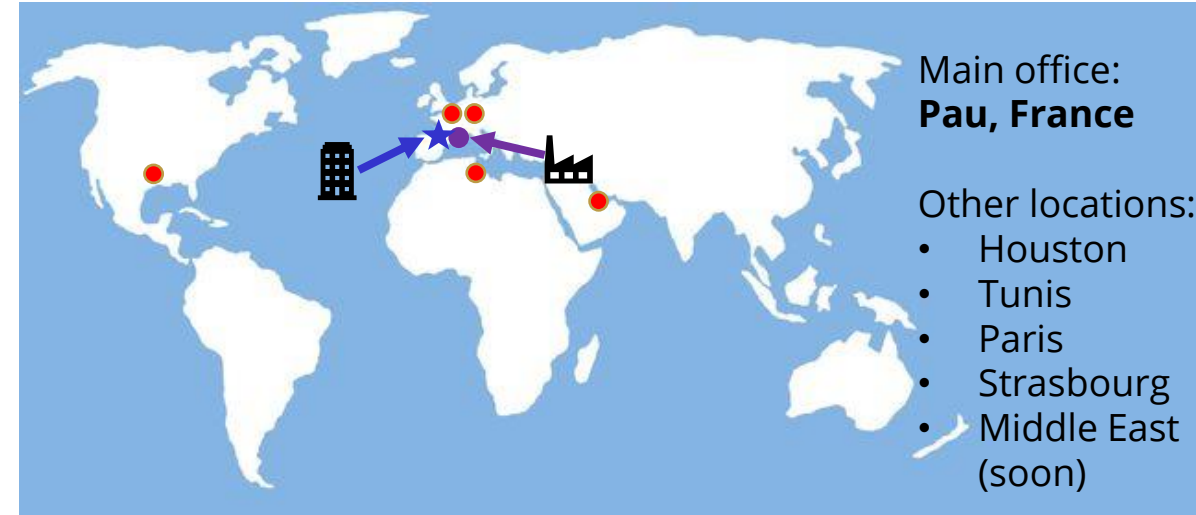
- ✓ **Manufacturer** of innovative and state of the art **distributed optical fiber sensing solutions** based in Pau (France)
- ✓ Founded in May 2015  
Today: 30 employees, **customers all over the world, 70% average revenue increase since 2017.**

✓ **Patented** technologies

✓ **Strong R&D**

✓ FEBUS OPTICS solutions are used in several markets:

- Oil & Gas / Geothermic
- Perimeter security
- Seismic acquisition
- Civil engineering
- Energy transportation
- Marine Renewable Energy



Main office:  
**Pau, France**

Other locations:

- Houston
- Tunis
- Paris
- Strasbourg
- Middle East (soon)



**Labs & facilities**

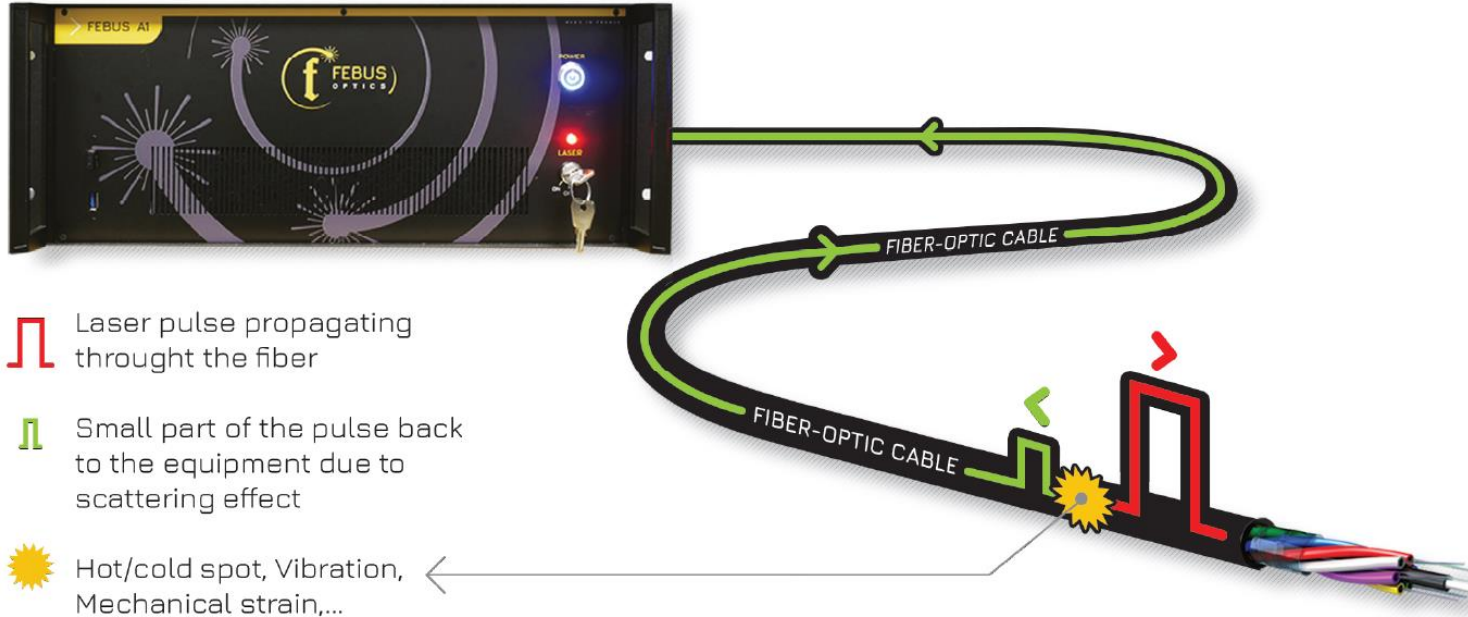


**CESG: for custom test/demonstration in controlled site condition**



# Technology

## General principle of Distributed Sensing



Scattering effect occurs **everywhere along the fiber**, the back-scattering light contains information on **Acoustic** (DAS), **Temperature** (DTS) and **Strain** (DSS) from where it was generated

### Main benefits of the FEBUS units:

- We develop & manufacture all the distributed technologies:
  - DAS (Rayleigh): **Acoustics**
  - DTSS (Brillouin): **Temperature & strain**
  - DTS (Raman): **Temperature**
- **All single ended units**
  - No need for loop backs
  - In case of fiber breakage, measurement up to the break with same performances
  - High redundancy with fewer fibers
- **Ranges of more than 200 km** by using our in-house REM range extenders

## FEBUS' PRODUCTS: 3 main families

### DTS, DSS, DSTS G - series

#### Distributed Strain and Temperature

- Single ended with very high performances
- Long distance range ( > 70 km)
  - G1-R: classic rackable version
  - G1-C: Compact and autonomous
  - G1-D: Dynamic (up to 100 Hz)
- Can be used with Repeaters
- Compatible with any Single-Mode Fiber



### FEBUS In-House Repeater REM

- Range extension for G & A series
- Can bring the range up to 280 km



### DAS

### A - series

#### Distributed Acoustic Sensing

- Real time output
- Gauge length adaptable after measurement
- Long distance range (50 km)
  - A1-R: highest performances for geophysics applications (8 pico-strain noise floor)
  - A1-NEO: unit dedicated to PIDS and pipeline monitoring solutions
- Can be used with Repeaters
- Compatible with any SMF or MMF



### DTS-R

### T - series

#### Distributed Temperature Sensing

- Single ended interrogator
- Real time output
- High flexibility and easily adaptable
- Mid-range capacity (up to 10 km)
- Simple data format exportable to text file (no need to buy proprietary software)
- On demand software and interface development
- Compatible with any Multi-Mode Fiber (MMF)





# MAIN APPLICATIONS



## ➤ Monitoring of infrastructures

- ✓ Strain and settlement
- ✓ Leaks in dams and levees
- ✓ Landslides
- ✓ Fire detection
- ✓ Railway/Road



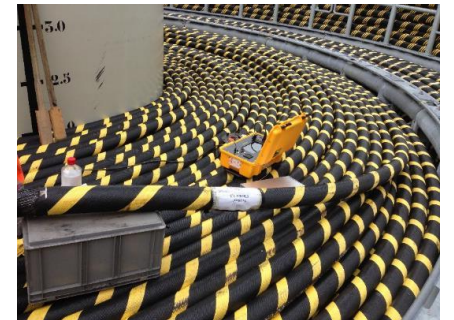
## ➤ Pipeline and SURF

- ✓ Leak detection (LDS)
- ✓ Third party Intrusion (TPI)
- ✓ Strain & soil movement
- ✓ Shock detection



## ➤ Perimeter security

- ✓ Intrusion Detection
- ✓ Integration to supervisor/hypervisor
- ✓ Fence or buried



## ➤ Geophysics and wells

- ✓ Passive and active seismic
- ✓ Vertical Seismic Profiling
- ✓ DAS and DTS for production



## ➤ Power cable and MRE

- ✓ Fault detection
- ✓ Hot spot and RTTR
- ✓ Free-span detection
- ✓ Partial discharge



# Our test center CESG

2500 m<sup>2</sup> for custom tests in controlled site conditions

- State-of-the-art test center to simulate site conditions
- Designed to qualify Distributed Fiber Sensing in various conditions
- **Numerus applications can be tested:**
  - Pipeline leak detection:
    - Both gas and liquid
    - Pressure up to 50 bars
    - 3 different sizes, positions and orientations of leaks
  - Third part intrusion
  - Ground movement/landslides
  - PIDS
  - Cable/umbilical monitoring
  - And more On Demand



**Possibility to perform on-custom test/demonstration**



# Case study: Leak detection system (LDS) on Pipeline

- **Problem:** Need of a fast and cost-effective pipeline monitoring system
- **FEBUS Solution:** Leak Detection system using FEBUS Distributed Temperature Sensing (DTS) and/or Distributed Acoustic Sensing (DAS) fully calibrated in our Test Center (see below)
- **Case study:** Monitoring of TOTAL Diyab pipeline in the UAE (30 km of gaz pipeline)

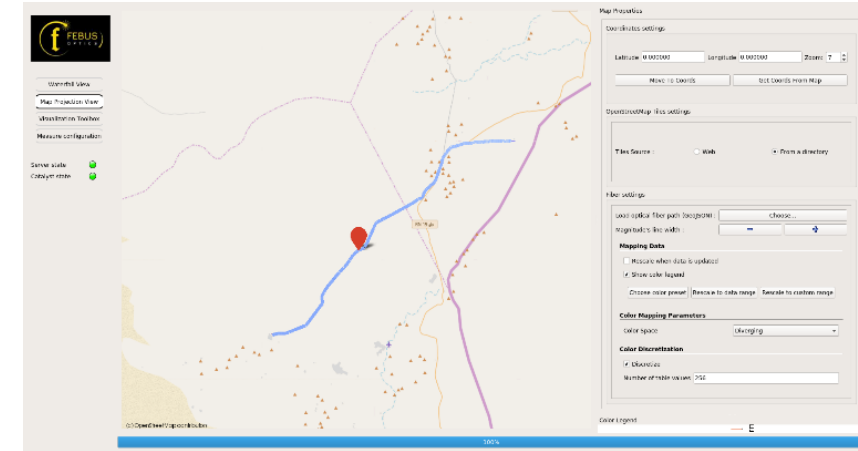


EVENT MONITOR POLICE LOG STATISTICS SITUATION SHARING

Period from 25 February 2023 00:00 to 26 February 2023 00:00

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Example of alert log



FEBUS Test Center for pipeline monitoring

# THEY TRUST US

## CLIENTS

**O&G**

PERN TOTAL OMV bp  
TEREGA TechnipFMC  
MOOG subsea 7  
modis LYTT  
GEOSPACE RINA SAIPEM GOWELL

**Civil Engineering**

GROUPE GEXPERTISE Cerema RATP  
CSIC Cambridge Centre for Smart Infrastructure & Construction  
ANDRA IDIL FIBRES OPTIQUES modis  
GAUSS Géométrie • Auscultation • Surveillance EDF

**Academics**

Le Mans Université TU Delft  
BAM  
University of Cyprus NUS National University of Singapore  
KIT Karlsruhe Institut für Technologie ceia M UNIVERSITY OF MICHIGAN  
Geo AZUR

## PARTNERS

**Cable monitoring & MRE**

Van Oord Marine ingenuity ESB Prysmian Group  
EDF DEANGELI PRODOTTI Every wire, everywhere. Nexans

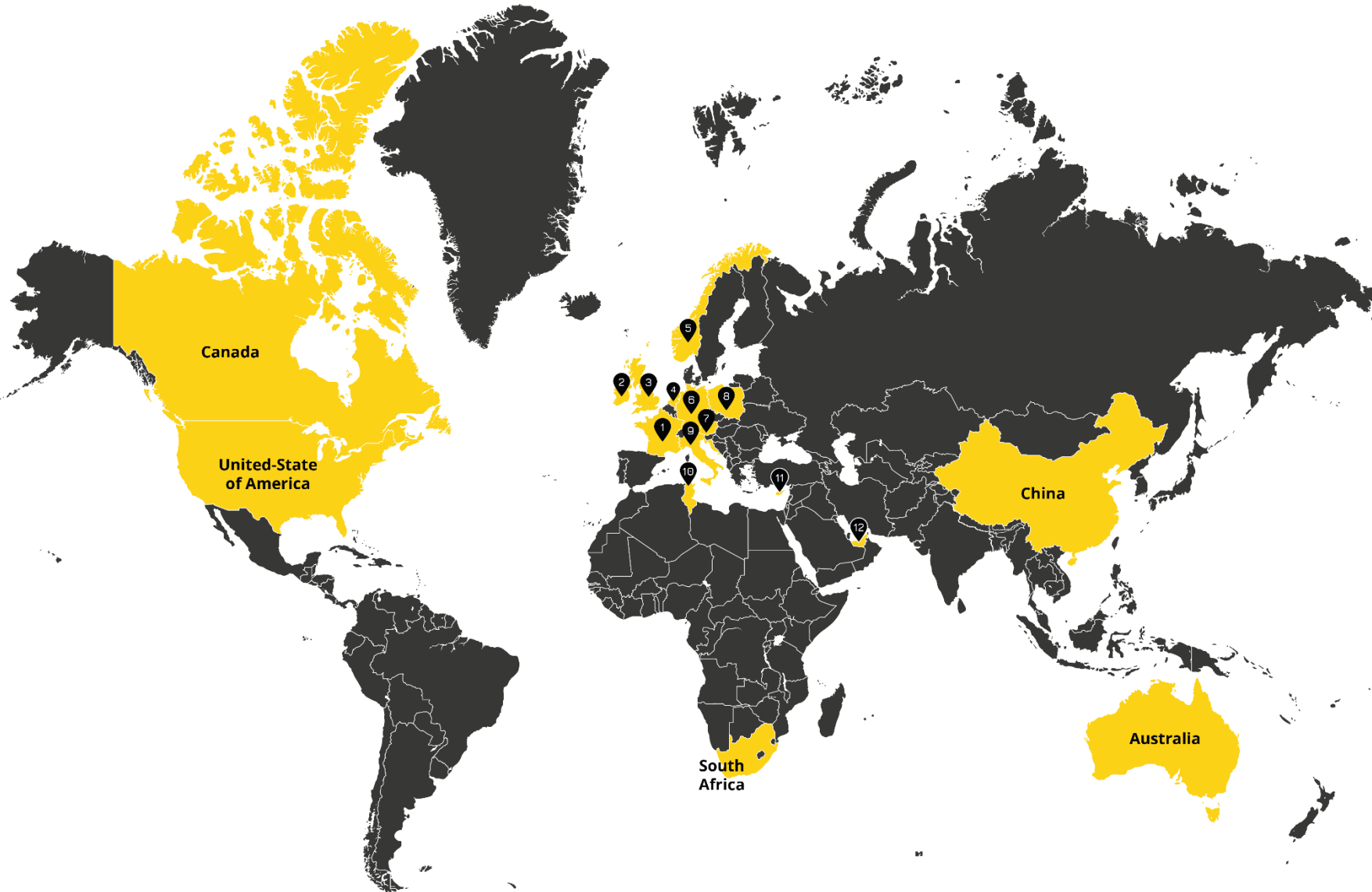
**Geophysics & seismic**

Sercel CGG Passion for Geoscience brgm Géosciences pour une Terre durable  
ASL Avalon Sciences Ltd jms ESG és géothermie

IPGS Institut de Physique du Globe de Strasbourg TELECOM ParisTech  
ISTERre IPGP INSTITUT DE PHYSIQUE DU GLOBE DE PARIS



# A customer base Worldwide



- 1 France
- 2 Ireland
- 3 United-Kingdom
- 4 Netherlands
- 5 Norway
- 6 Germany
- 7 Austria
- 8 Poland
- 9 Italy
- 10 Tunisia
- 11 Cyprus
- 12 United Arab Emirates





[www.febus-optics.com](http://www.febus-optics.com)

Technopole Helioparc - 2 av. Président Pierre Angot - 64000 Pau - France  
**+33 (0)5 64 27 07 43 - [info@febus-optics.com](mailto:info@febus-optics.com)**