

APPLICATION NOTE



PERIMETER INTRUSION DETECTION SOLUTION (PIDS)

WHAT IS THE NEED ?

Perimeter security for highly sensitive area such as :

- > Oil and gas facilities
- > Border
- > Storage plants
- > Power plants
- > Military restricted areas

FEBUS OPTICS PIDS PERFORMANCES

- > Real-time alerting of any intrusion (digging, fence-climbing, fence cutting)
- > Up to 50 km
- > Up to 1 m location accuracy
- > FOLog software for data acquisition/merging
- > FOGuard software for event classification, mapping and alerting
- > Interoperability with global automation system (with CCTV/PTZ camera)
- > Environmental condition filtering

FIELD DEPLOYMENT

Fiber optic cable is deployed in many ways :


- > On fence
- > On wall
- > Buried
- > Using existing telecommunication network


> WHY & HOW


FEBUS A1 device is a Distributed Acoustic Sensing (DAS) system that provides acoustic sensing typically every 1 m over several tens of kilometers with optical fiber cable deployed on or near the highly sensitive area perimeter. The FEBUS A1 device can be connected to optical fiber cables already installed. This range can be extended, up to more than 100 km with dedicated optical repeaters. **FEBUS A1 series** devices convert the installed single mode fiber optic cable into a sequence of "Virtual Geophones" that are spaced 1 meter apart, over tens of kilometers. By this operation, the installed fiber optic cable is acting as a sensor all along the asset. The only requirement is to connect the device to one end of one free core of the fiber optic cable. This system is specifically designed to meet harsh environment requirements with a single-ended connection to the optical fiber sensing cable.

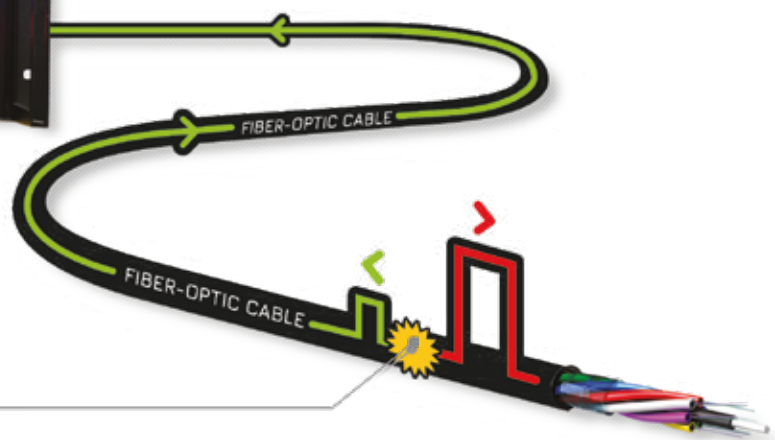


> FEBUS A1 operating principle

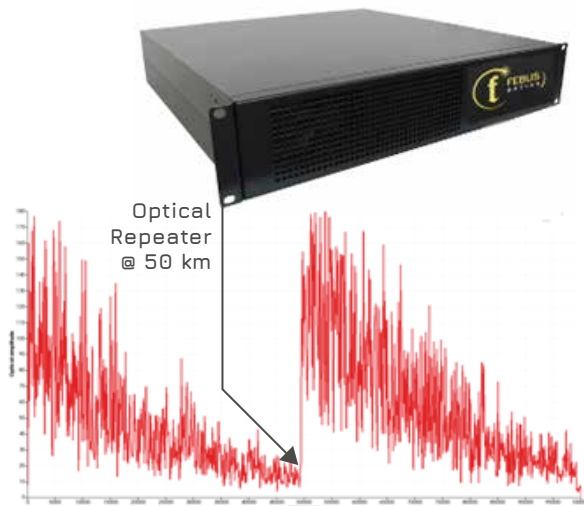
 Laser pulse propagating through the fiber

 Small part of the pulse back to the equipment due to scattering effect

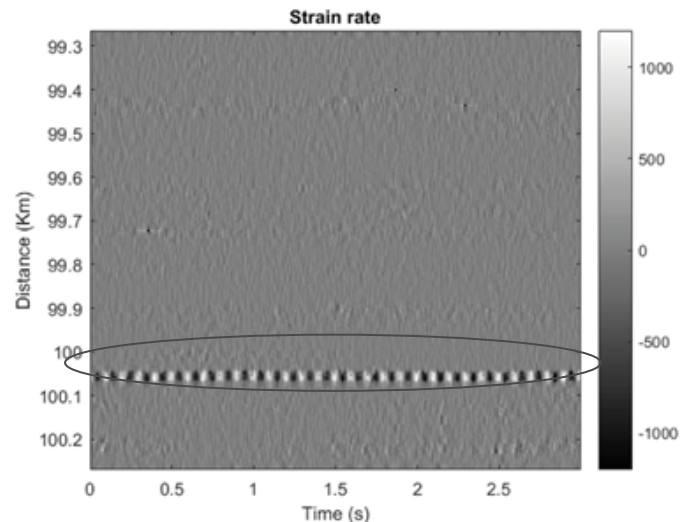
 Acoustic and Vibration signals



> FEBUS OPTICS Distributed Sensing Unit Operating principle.



> Optical amplitude along the fiber



> Vibration measurement @ 100km

FOLog/FOGuard software included :

- > Evolutive filtering
- > Alert management
 - . Mapping recording to field GPS coordinates
 - . Alert acknowledgment

Interoperability with third party system :

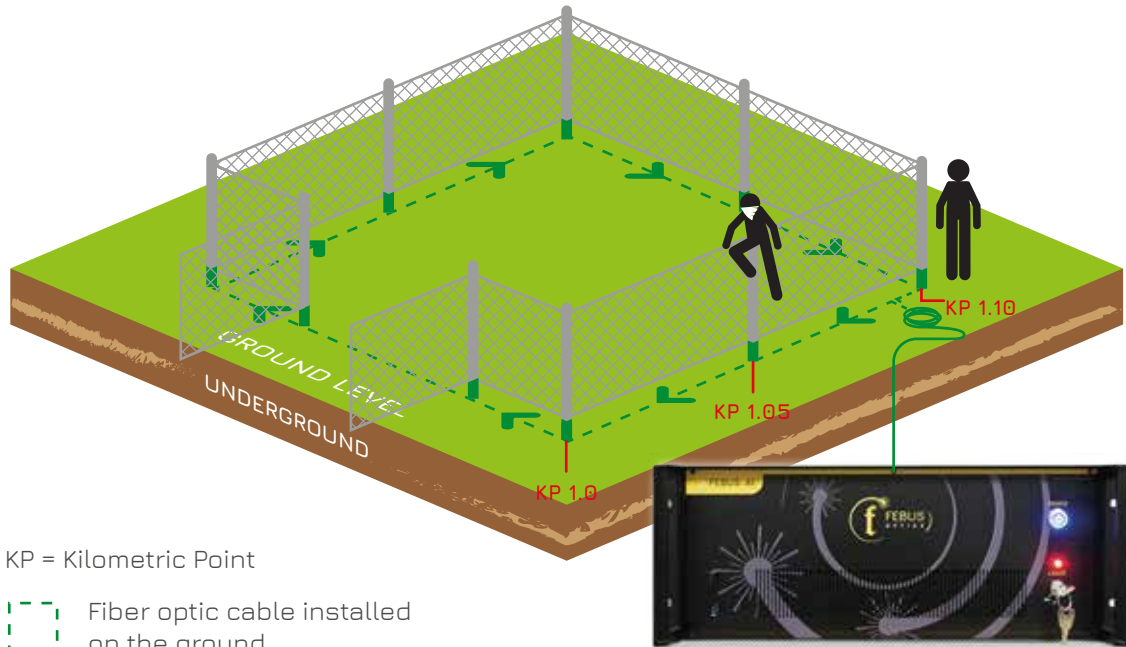
- > SCADA
- > Global Automation system (relay module, MODBUS, OPC)

FEBUS OPTICS offers :

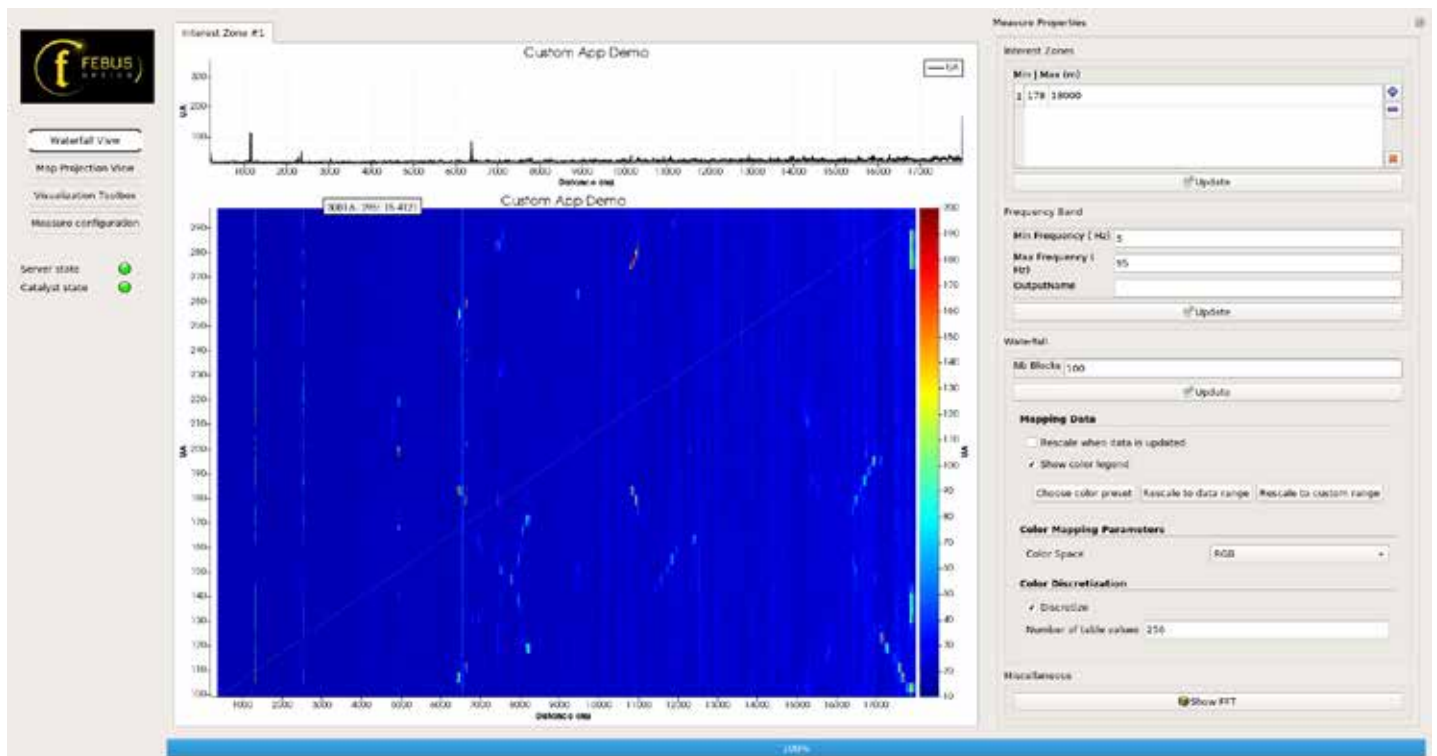
- > Desktop study, FAT, SAT
- > Commissioning, Installation, Training
- > Continuity of operation (providing all necessary [switching automation] spare parts)
- > FEBUS OPTICS experts are focused to fit accurately customer needs

> OPERATION

The FEBUS A1 software displays any intrusion events when it occurs nearby the fence. This is displayed in Waterfall mode (2nd picture). For instance; two intrusion attempts at 1.05 Km (fence climbing) and at 1.10 Km (activity nearby the fence), are detected. As shown in the second picture. The FEBUS A1 software displays the first intrusion was attempted at 30 s from the current measurement time and the second one at 50 s:



FOGuard is an intuitive software dedicate to end users to keep an eye on their infrastructure. As a standard, it shows classic and pratical visualization of **acoustic waterfall views**.



In addition, FOGuard offers a **unique system of map projection** with use of OpenStreetMap online or offline. It allows the user to easily draw the path of the optical fiber cable along his infrastructure (pipeline, fence, ...) **using GPS coordinates from field surveys**. Different levels of alerts can be displayed on the map.

> OPERATION

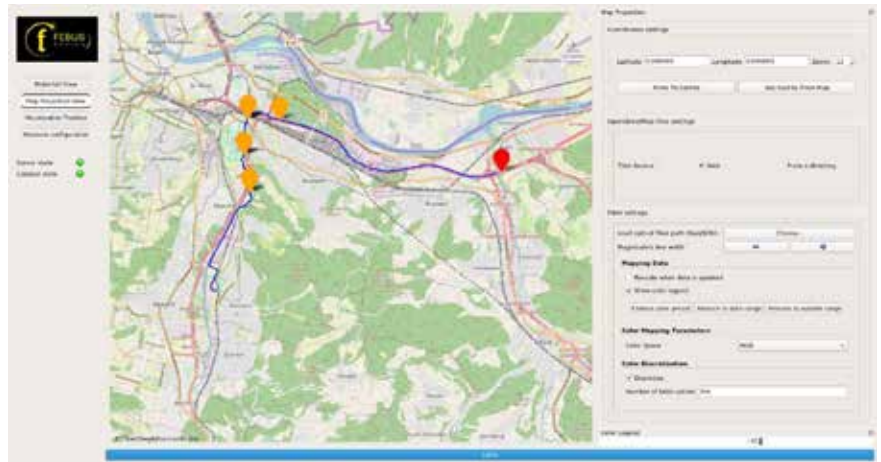
Moreover, FOGuard performs event classification, using algorithms based on ensemble learning methods. Using tens of parameters extracted from DAS signals, the detected events can be classified with a confidence rate of more than 90% as:

Intrusion events detected (early detection tens of meters away from the fiber-optic cable)

- > Drilling
- > Excavating
- > Blasting
- > Fence/wall climbing

FOGuard sends alarms to a third party SCADA or Automation system through MODBUS over TCP/IP protocol. According to the exact requirements of the end users, FEBUS OPTICS experts can tailor the alarm emission process.

> Real Time Mapping view: events classified as low priority are marked with yellow bubbles, event leading to an alarm is marked with a red bubble



> FEATURES & PERFORMANCES

Range	50km (100km with 1 repeater)
Spatial Resolution	1 m to 50 m
Event Location Accuracy	Better than 10 m
Sampling Interval	1 m to 10 m
Event Detection capabilities (and lateral distance from the fiber optic cable)	Excavation @ 10 m
	Hammer, Compactor @ 30 m
	Drilling @10m
	Rock fall @ 50 m
	Blasting (Mine)
	Earthquake of magnitude as low as 0.5
	Vehicle approach/crossing
	Pedestrian crossing
Animals crossing	

* The thresholds depend on the actual fiber optic deployment (cable positioning and sheathing, soil compaction)