COMPANY PRESENTATION

Fibre Optic Sensors and Sensing Systems

Cipalstraat 14
B-2440 Geel
Belgium

FOSS&S

Outline

1. Company
2. Technologies
3. Products
4. Services
5. Applications
6. Near Future

Corporate history

- Belgium based private held company
- Founded 2001
- I.D. FOS Research e.e.i.g. – 12 years experience
- Fibre Optical Sensing

Mission

FOS&S' mission is to become a world wide reference as solution provider within the fibre optical sensing market for standard as well as non-standard sensing applications that require customized developments.

Strategy

FOS&S' strategy is based on internal developments as well as setting up strategic collaborations with other sensing and non-sensing companies in order to compose the best technology and product portfolio to solve our customers' sensing problems.

Technologies

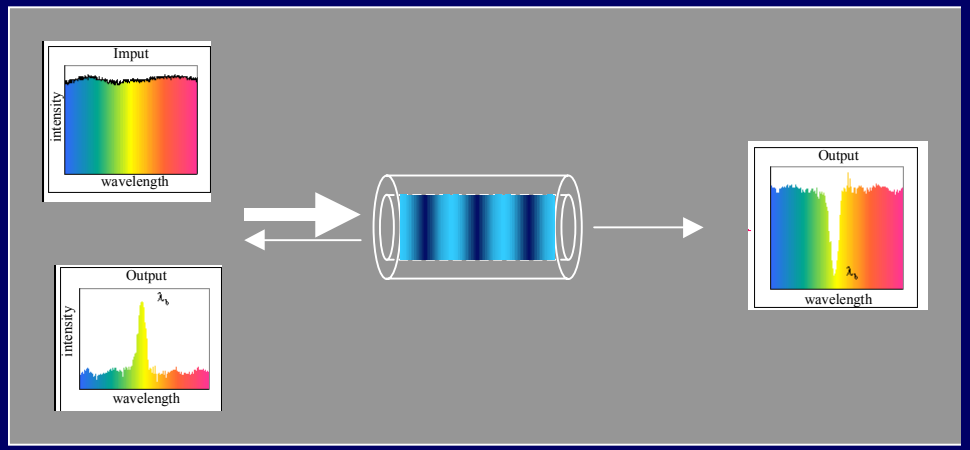
Advantages FO sensors

- Passive components - high life time (20 years)
- Sensing distances > 25 km
- Immune against EM radiation
- Explosion proof
- Ability to multiplex many sensors using only one optical fibre.

Two main technologies

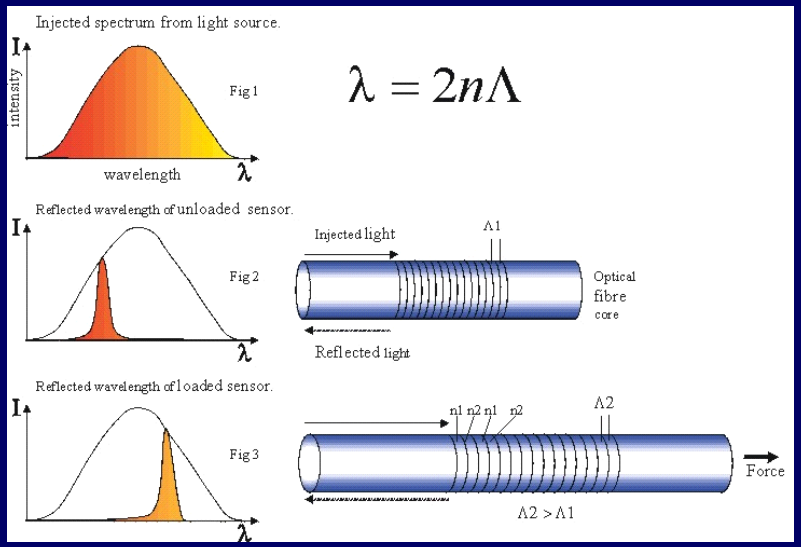
1. Fibre Bragg Grating technology
2. Stimulated Brillouin Scattering

Fibre Bragg Grating principle



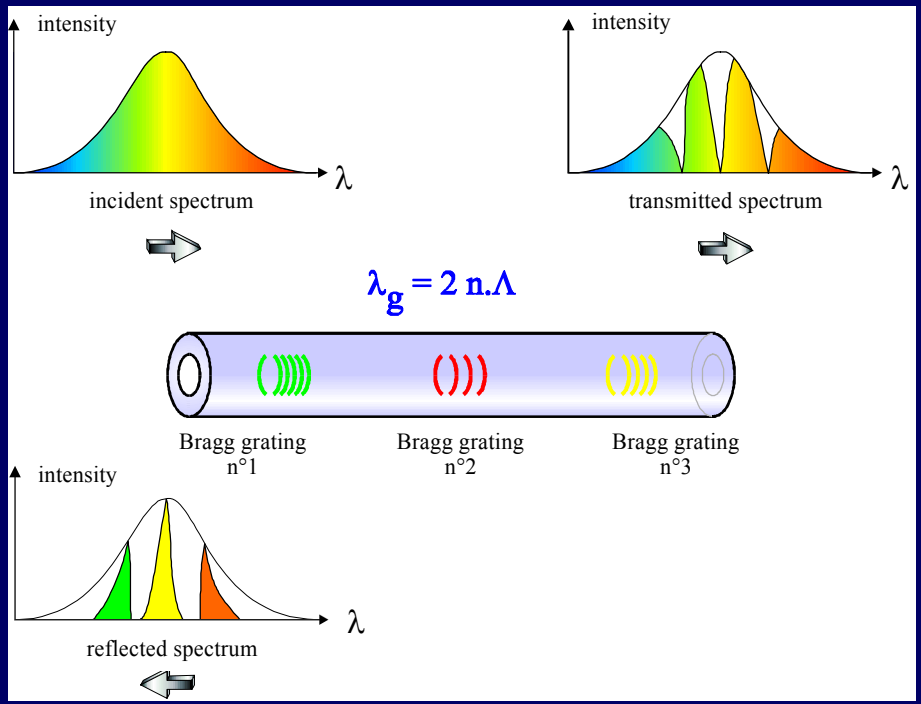
- Standard telecommunication fibre (SMF)
- Periodical modulation of refraction index
- Wavelength specific reflection characteristic

Fibre Bragg Grating characteristics



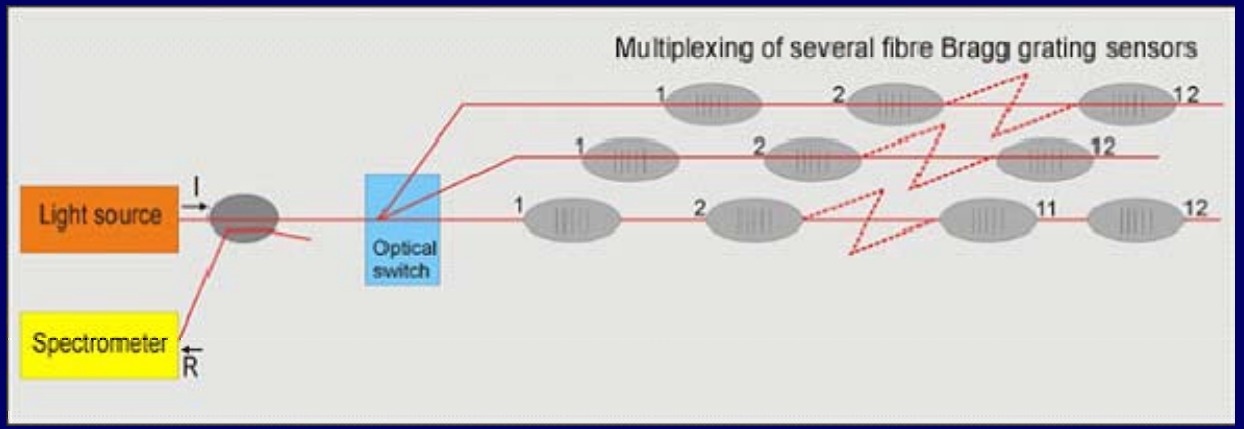
- Temperature sensitivity 10 pm/°C
- Strain sensitivity 1,2 pm / με
- Pressure sensitivity -0,6pm/bar

Multiplexing principle

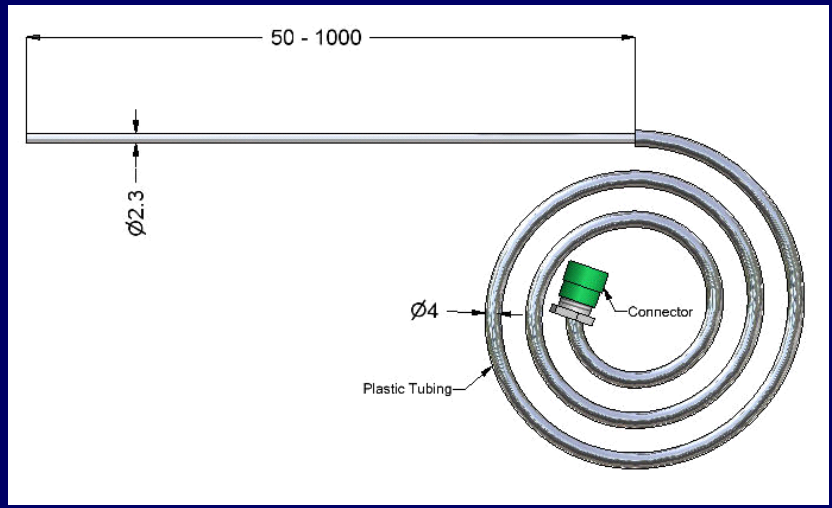


- Series configuration using wavelength domain

Standard measurement principle



Temperature probe



Parameter	*Unit*	*Value*
Temperature resolution	°C	0,1
Temperature accuracy	°C	1°C
Temperature range	°C	-20 to 180
Capillary diameter	mm	2,3
FBG central wavelength	nm	1530 to 1570

Temperature chain

Parameter	*Unit*	*Value*
Temperature resolution	°C	0,1
Temperature accuracy	°C	2°C
Temperature range	°C	-20 to 85
Capillary diameter	mm	2,3
Maximum capillary length	km	30
FBG central wavelength	nm	1530 to 1570
# sensors in series	-	30

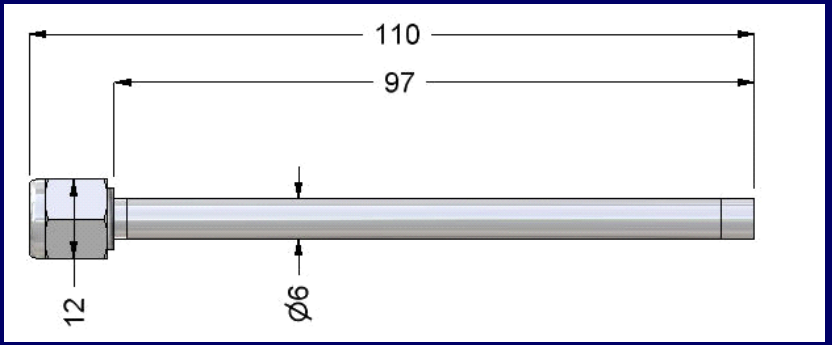
* Higher temperatures possible on special request

Temperature cable

Parameter	*Unit*	*Value*
Temperature resolution	°C	0,1
Temperature accuracy	°C	2°C
Temperature range*	°C	-20 to 85
Cable diameter	mm	12
Maximum cable length	km	30
FBG central wavelength	nm	1530 to 1570
# sensors in series	-	30

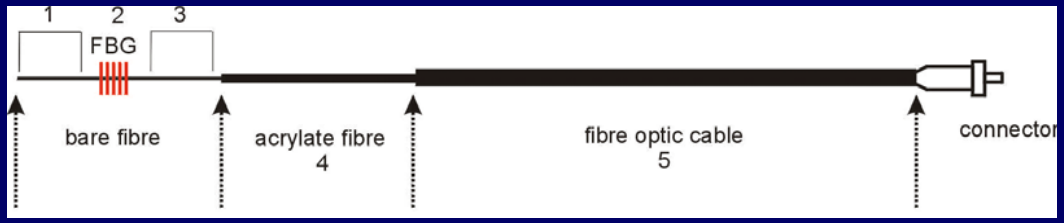
* Higher temperatures possible on special request

High resolution temperature probe



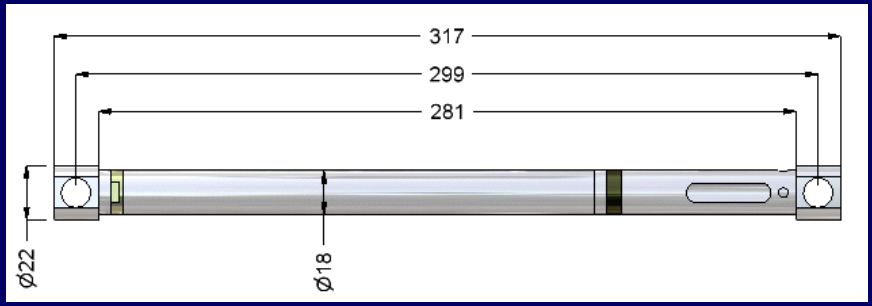
Parameter	*Unit*	*Value*
Temperature resolution	°C	0,04
Temperature accuracy	°C	0,4
Temperature range	°C	-20 to 80
Tube diameter	mm	6
FBG central wavelength	nm	1530 to 1570
Series configuration		YES

Optical Strain gauge



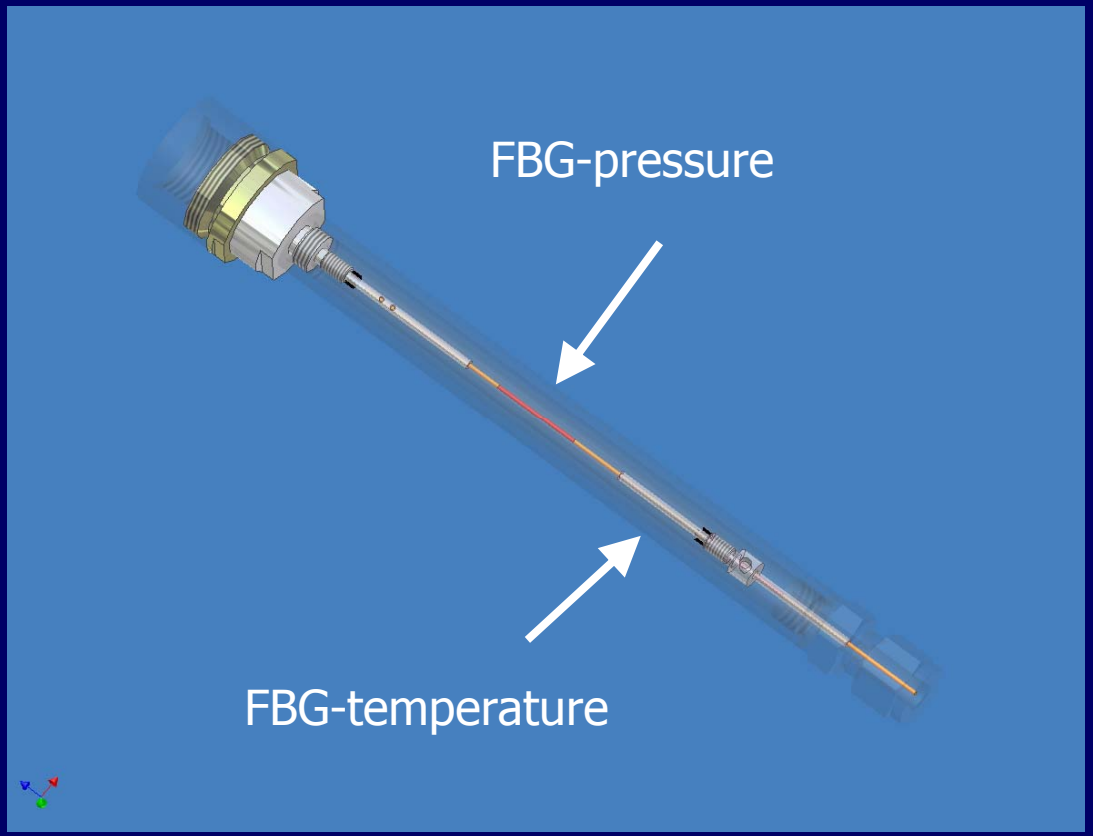
Parameter	*Unit*	*Value*
Strain resolution	με	1
Strain accuracy	με	10
Temperature cross sensitivity	με/°C	8
Temperature range	°C	-20 to 85
Bare fibre diameter	μm	125
Acrylate fibre diameter	μm	250
FBG-Central wavelength	nm	1530 to 1570
Series configuration	-	YES

Mountable strain sensor

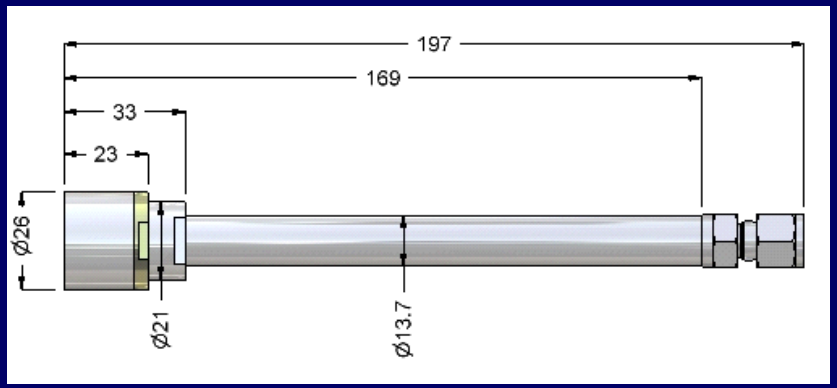


Parameter	*Unit*	*Value*
Displacement range	µm	520
Displacement Resolution	µm	0,065
Displacement Accuracy	µm	0,65
Temperature resolution	°C	0,04
Temperature accuracy	°C	0,4
Wavelength range	nm	1530-1570
Temperature range	°C	0 - 80
Series configuration		YES

Pressure sensor

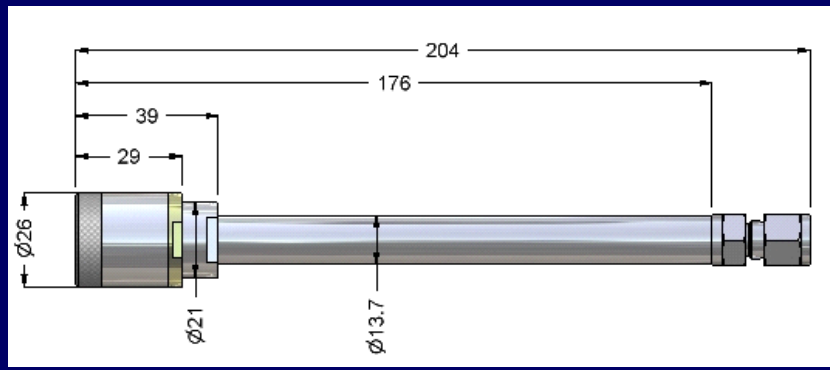


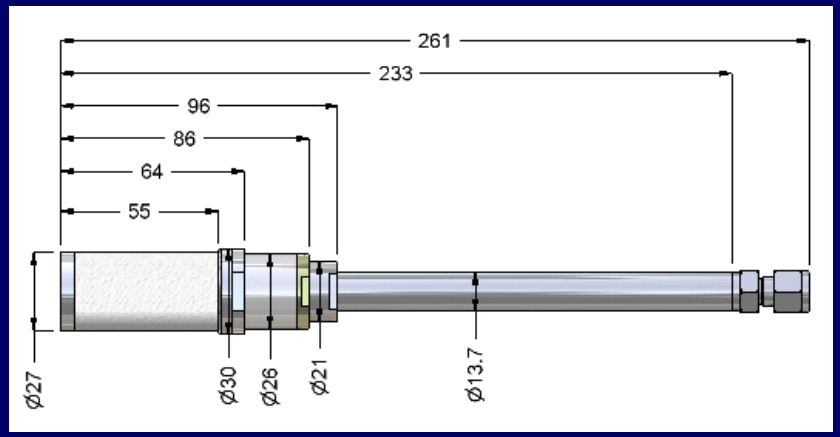
Pressure sensor



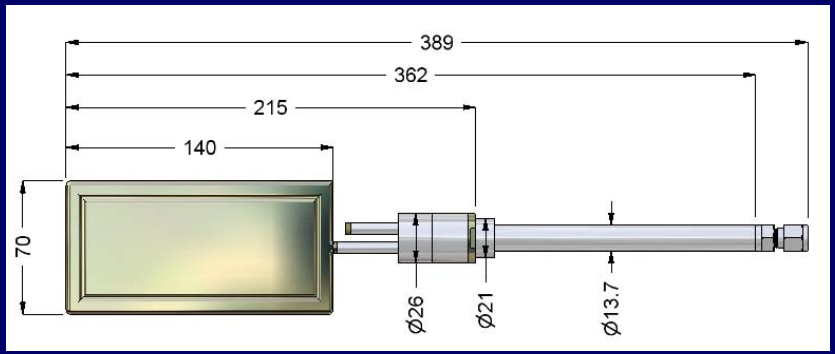
Parameter	*Unit*	*Value*
Pressure range	bar	1-150
Pressure Resolution	bar	0,05% FS
Pressure accuracy	bar	1% FS
Temperature resolution	°C	0,04
Temperature accuracy	°C	0,4
Wavelength range	nm	1530-1570
Temperature range	°C	0 - 80
Series confoguration	-	YES

Pore water pressure sensors



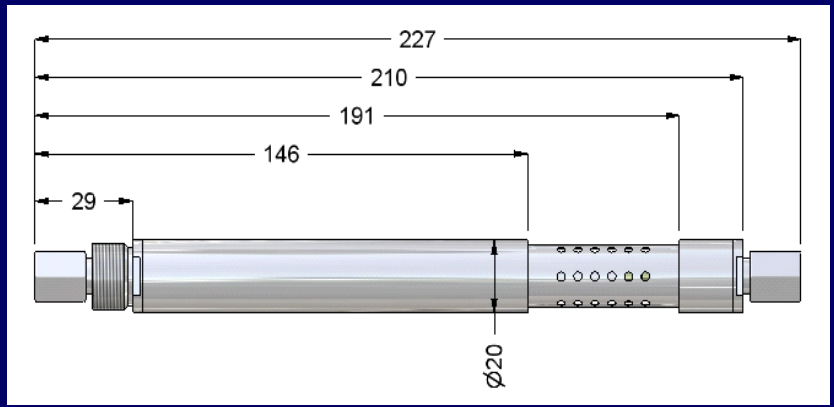


Load cell



Parameter	*Unit*	*Value*
Pressure range	bar	1-150
Pressure Resolution	bar	0,05% FS
Pressure accuracy	bar	1% FS
Temperature resolution	°C	0,04
Temperature accuracy	°C	0,4
Wavelength range	nm	1530-1570
Temperature range	°C	0 - 80
Series confoguration	-	YES

Humidity sensor



Parameter	*Unit*	*Value*
Humidity range	% R. H.	ON/OFF
Threshold value	% R.H.	80
Temperature resolution	°C	0,04
Temperature accuracy	°C	0,4
Wavelength range	nm	1530-1570
Temperature range	°C	0 - 80
Series configuration		YES

Displacement sensor

Parameter	*Unit*	*Value*
Displacement range	mm	10-50
Displacement resolution	mm	0,05% FS
Displacement accuracy	mm	1% FS
Temperature resolution	°C	0,1
Temperature accuracy	°C	1
Wavelength range	nm	1530-1570
Temperature range	°C	0 - 80
Series configuration		YES

SpectralEye interrogator

Spectraleye™ Interrogator

- Portable low cost interrogator
- iPAQ controlled
- 90 minutes battery autonomy
- RS232 for laptop connection
- Window 1530-1570 nm
- Scan rate 1 Hz
- Accuracy 35 pm
- sensing > 25 km
- No optical experience required

Inside the SpectralEye

What's inside:

- Optical performance monitor
- Broadband light source (SLED)
- RS232
- USB
- Lithium Ion battery
- Battery charger

Why a PDA ? (HP5550)

- Touchscreen control
- connectivity (RS232 + USB + WIFI + BLUETOOTH)
- Battery
- Price

Operating system

Why embedded C++ ?

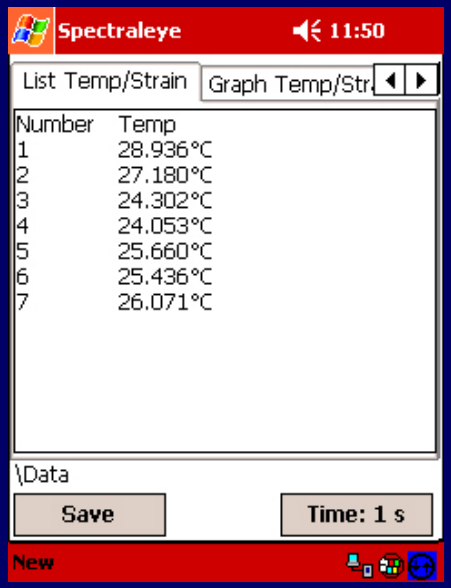
- Execution speed
- Embedded visual basic was too slow
- Object oriented
- Low price
- Labview PDA was incompetent at that time
- Linux incompatible, HP5550 had already Win CE 3.0 installed

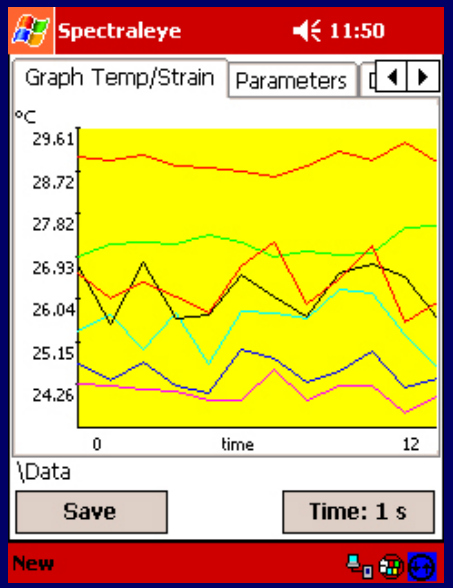
Layout of the housing

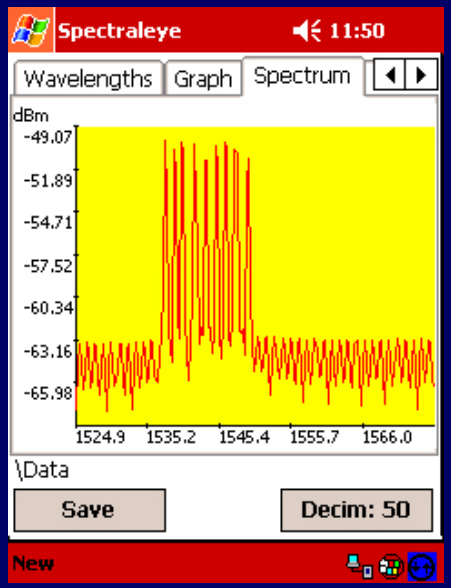
- Portable device
- PDA needed to be removable (sliding mechanism)
- One button launch
- Battery powered
- Battery charger for both hardware and PDA
- Connectivity panel at the top for both electrical and optical connections
- Can be connected to PC without PDA (labview)

Software application

- list with temperature/strain
- temperature/strain in function of time
- Optical spectrum (normal/deconvolved)

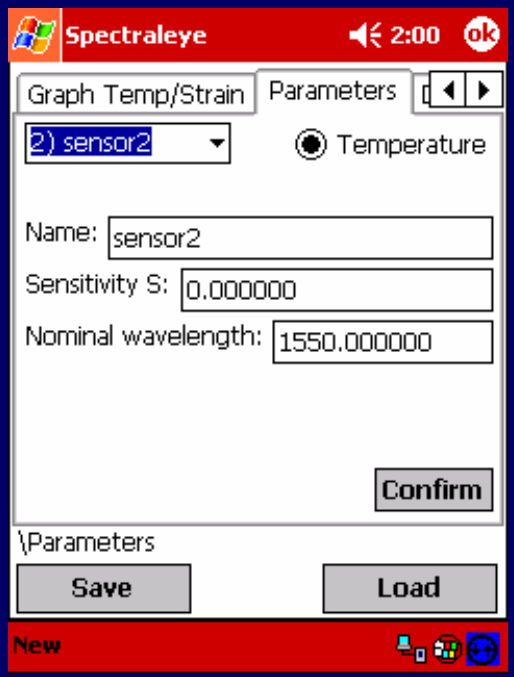


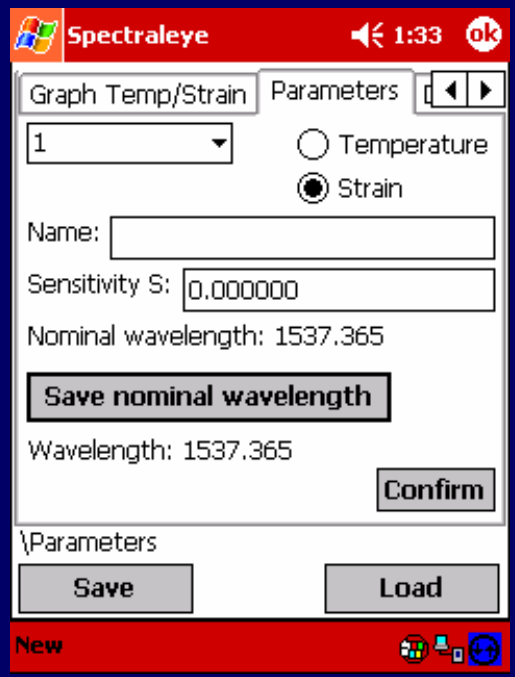




Software application

- configuration temperature sensors
- configuration strain sensors





FBG- datalogger

FBG-DATALOGGER™ Interrogator

- Portable interrogator
- embedded pc controlled
- 90 minutes battery autonomy
- RS232 for laptop connection
- up to 16 channels
- Window 1530-1570 nm
- Scan rate 1 Hz
- Accuracy 10 pm
- sensing > 25 km
- No optical experience required

Inside the FBG-DATALOGGER

What's inside:

- Optical performance monitor
- Broadband high power light sou
(SLED)
- Optical switch 8/16 channels
- Embedded PC
- USB/RS232/LAN/WIFI
- Touchscreen
- NiMh battery 12V/4800 mAh
- Battery charger
- GPRS modem

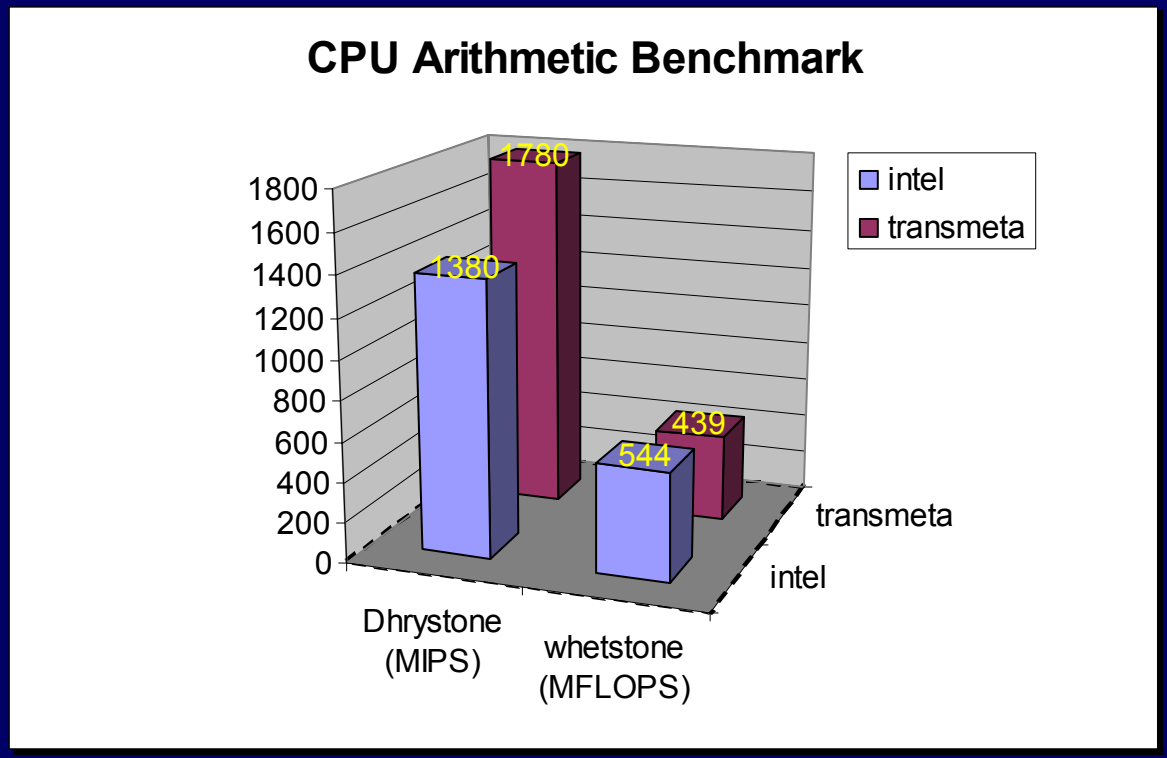
Embedded board

Which board ?

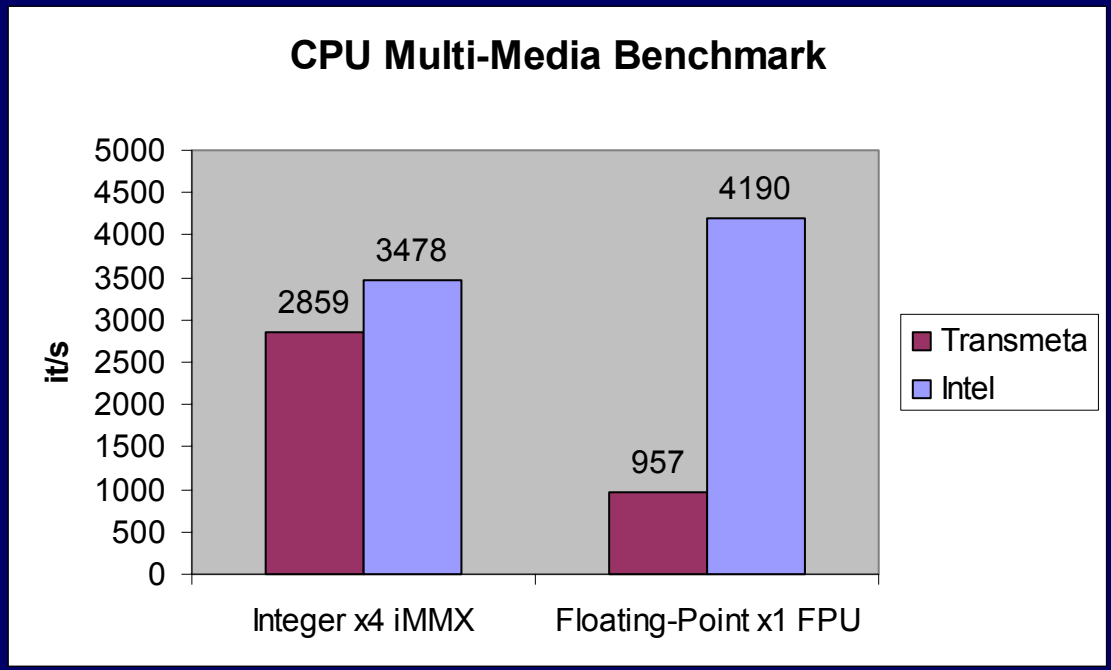
3.5 inch WAFER PC104 board

- Ruggedized
- High temperature ranges (-5°C to 70°C)
- Standarized format (long life time)
- PC104 extension boards (RS232, etc…)
- Connectivity
- low power consumption
- Fanless
- Price

Intel vs Transmeta



Intel vs Transmeta



Specifications

Intel celeron ULV 400 mhz	
Processor	400 Mhz
Memory	512 MByte
Hard disk	512 Mbyte
RS-232	4 ports
USB	2 ports
Ethernet	10/100 MBit
PS2	Mouse + Keyboard
VGA	External connector
TFT screen	7.4 TFT screen+touch (8VA)
GPRS	GPRS module inserted
Low thermal heat production	No active fans
Low power consumption	12 VA / Hour
Dimensions	Max 145 x 108 x 25 mm
Operating temperature	-5°C to +70°C

Operating system

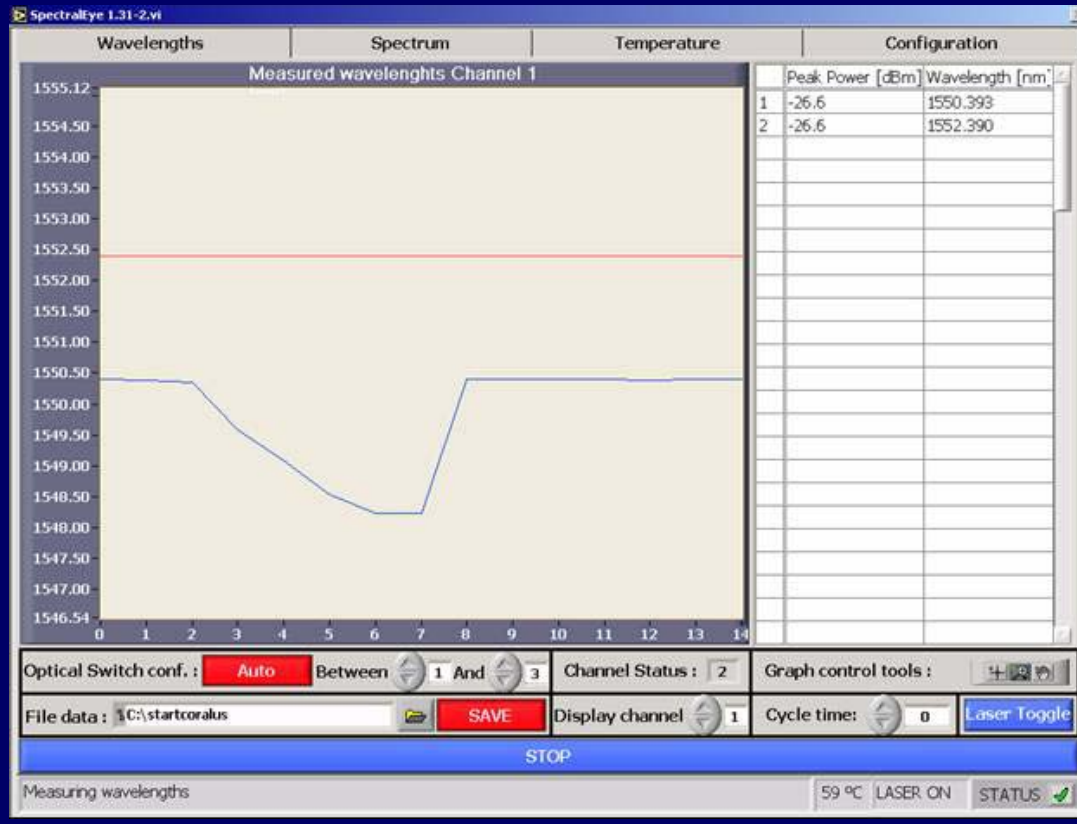
Why windows XP embedded ?

- easily implementation
- Completely windows Xp compatible
- Stripped version (only essential parts remain)
- Labview run-time engine
- Networking
- Remote desktop

- Linux : drivers difficult to find, programming more difficult
- Win CE : to limited

Remote desktop

- Control the unit
- Change parameters
- Download data
- Etc …



GPRS communication

Why GPRS ?

- Long distance and difficult to reach (solar power)
- Harsh environment
- Ability to control unit and download data

Options :
- connection through remote desktop
- automatic data download

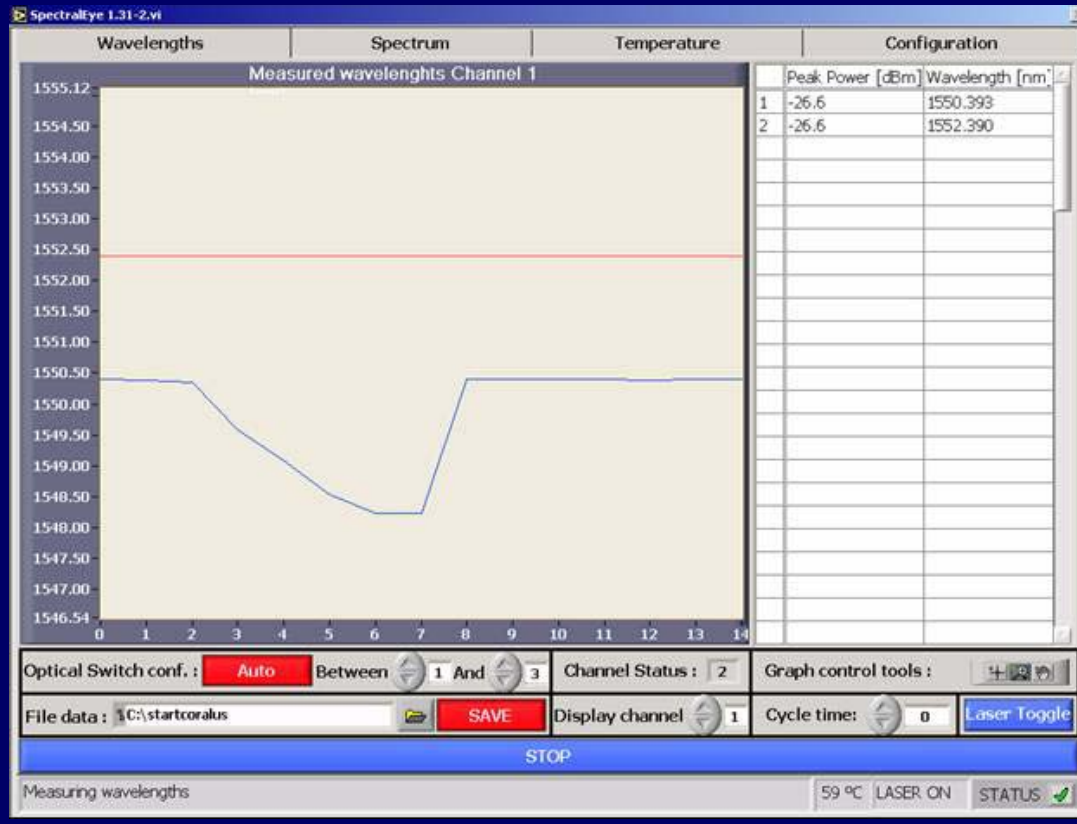
Battery charger and battery

- Battery drives all components
- Small design
- High current loading (4 Amps)
- Continuous working (charging and working)
- Intelligent temperature protection
- Battery NiMh 12V 4800 mAh

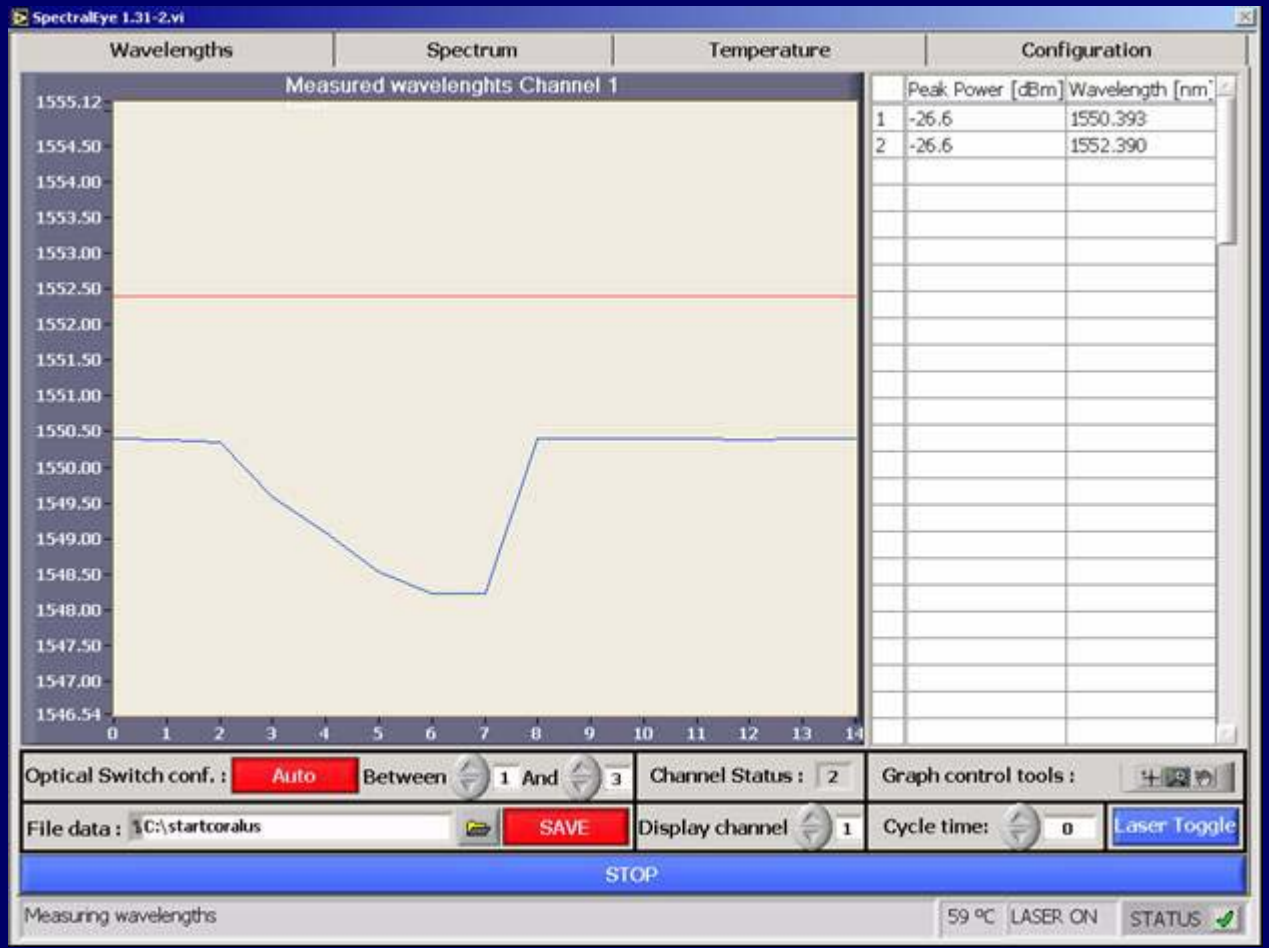
- Power consumption : 24 VA
- Autonomy: 117 minutes

Remote desktop

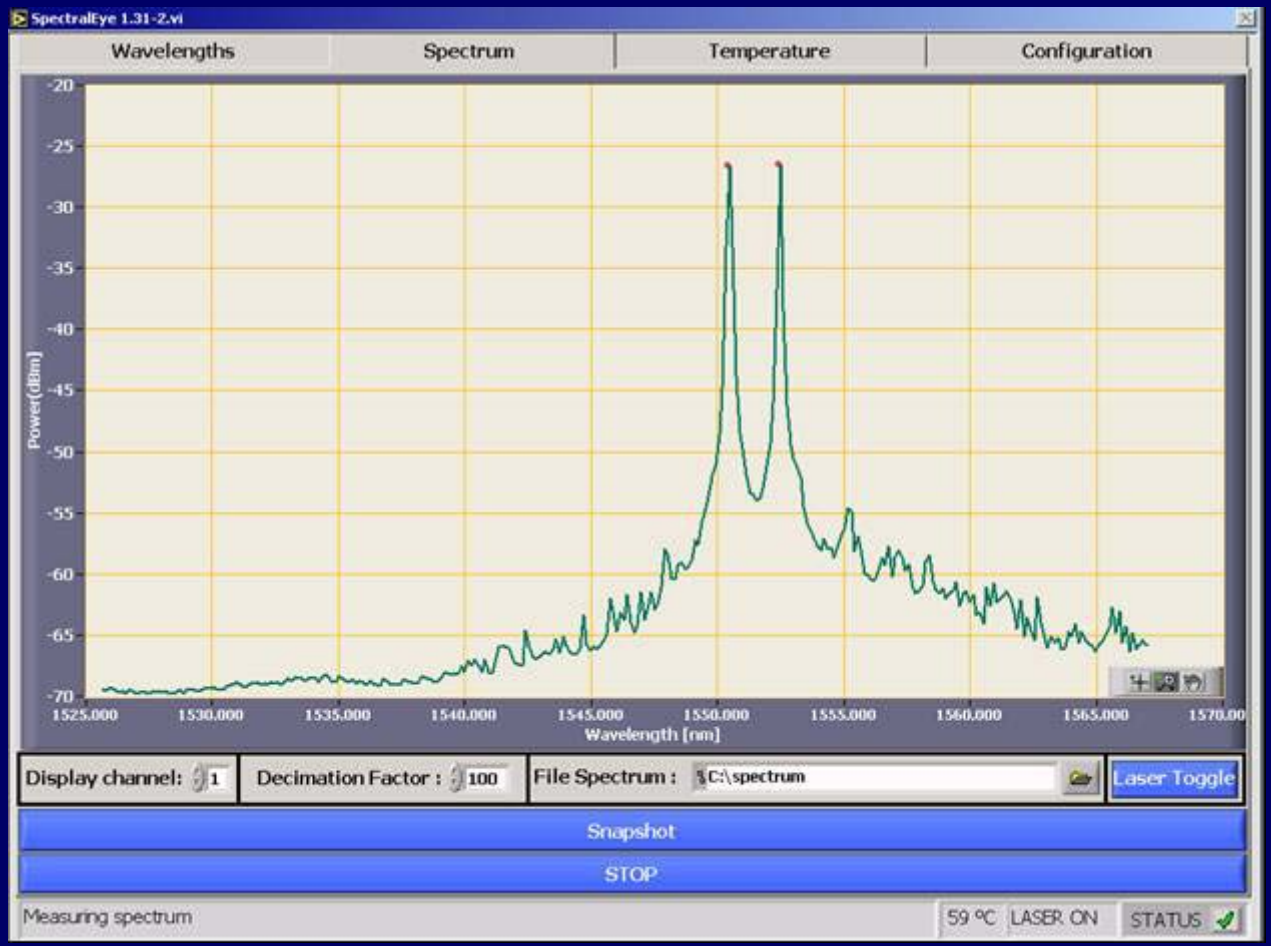
- Control the unit
- Change parameters
- Download data
- Etc …



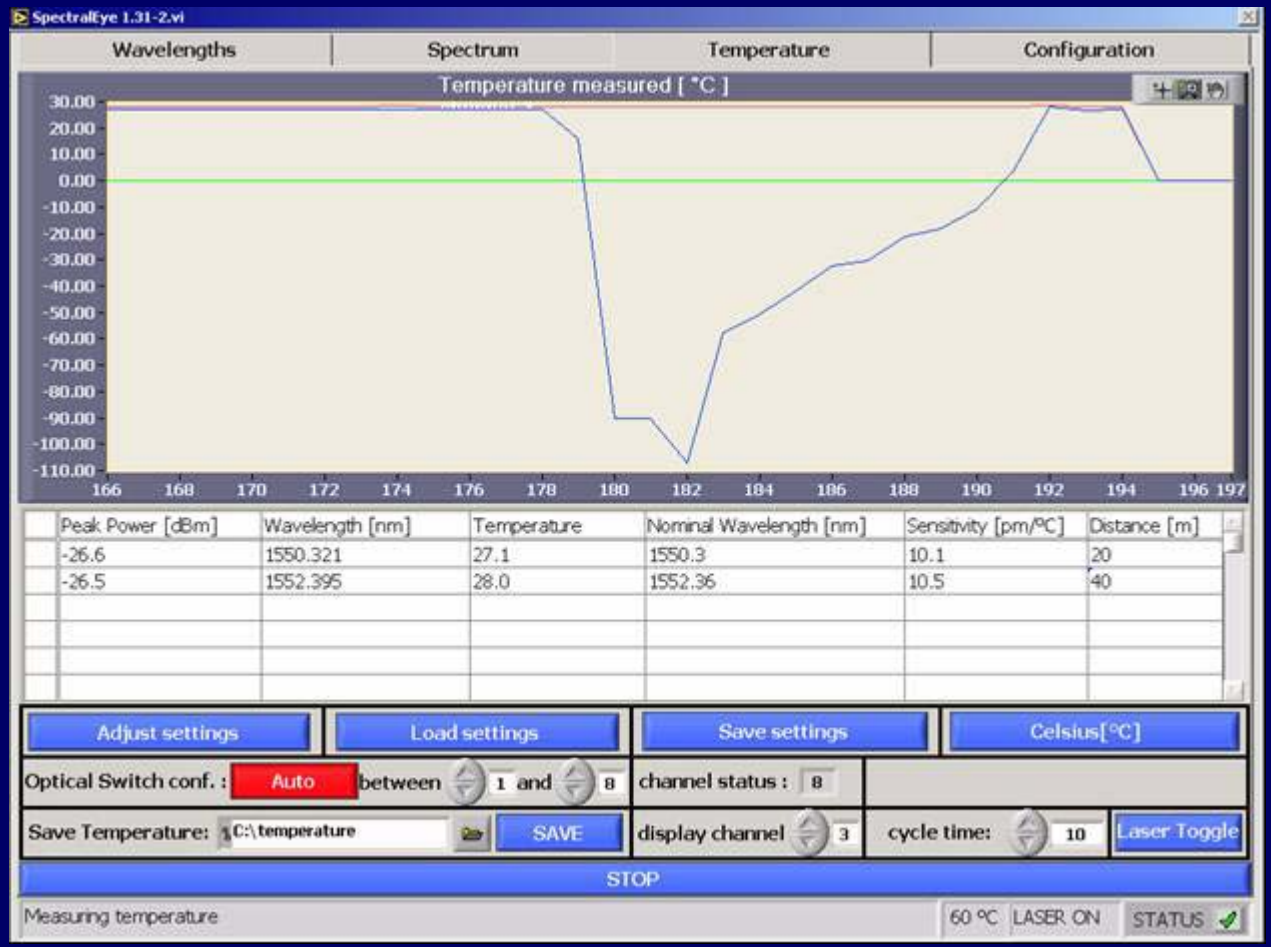
Wavelength TAB



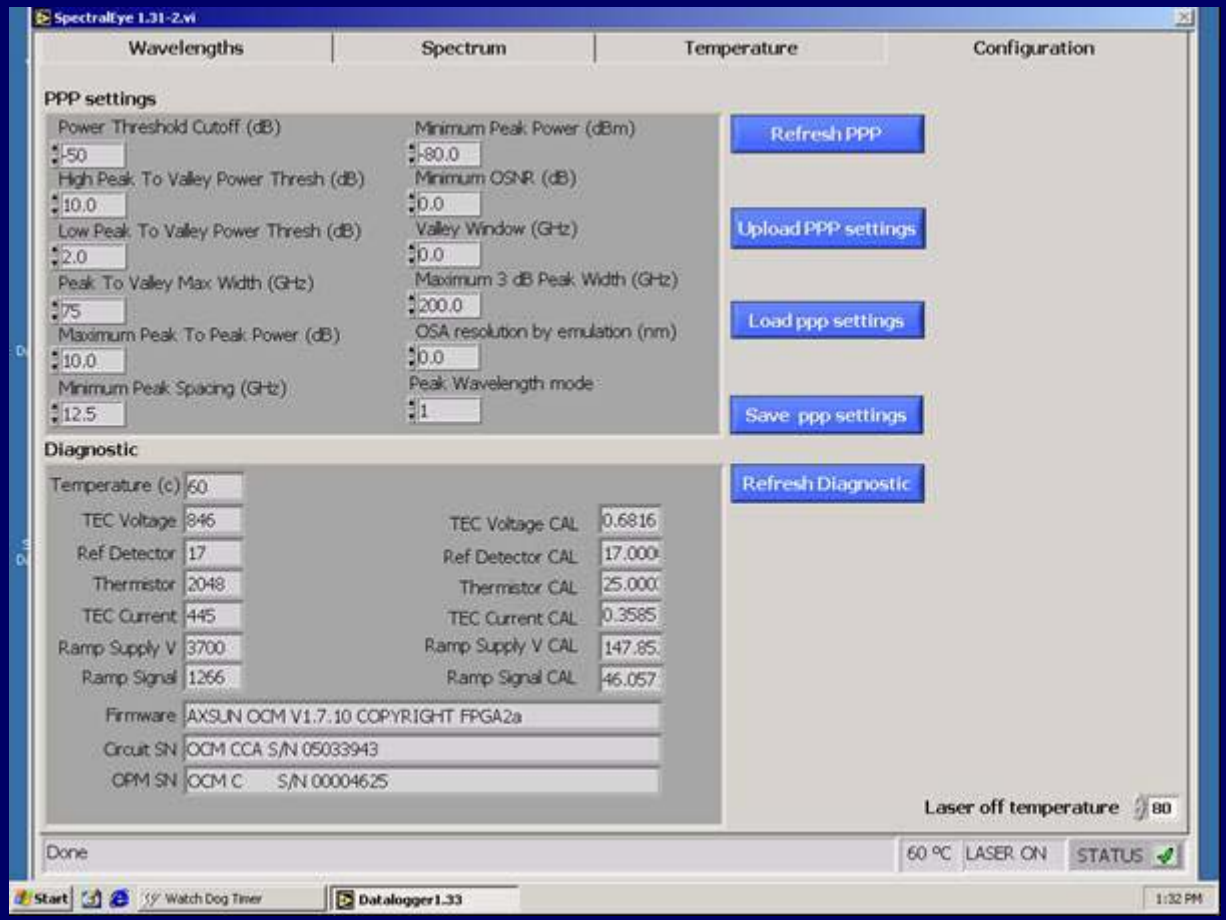
Spectrum TAB



Temperature TAB

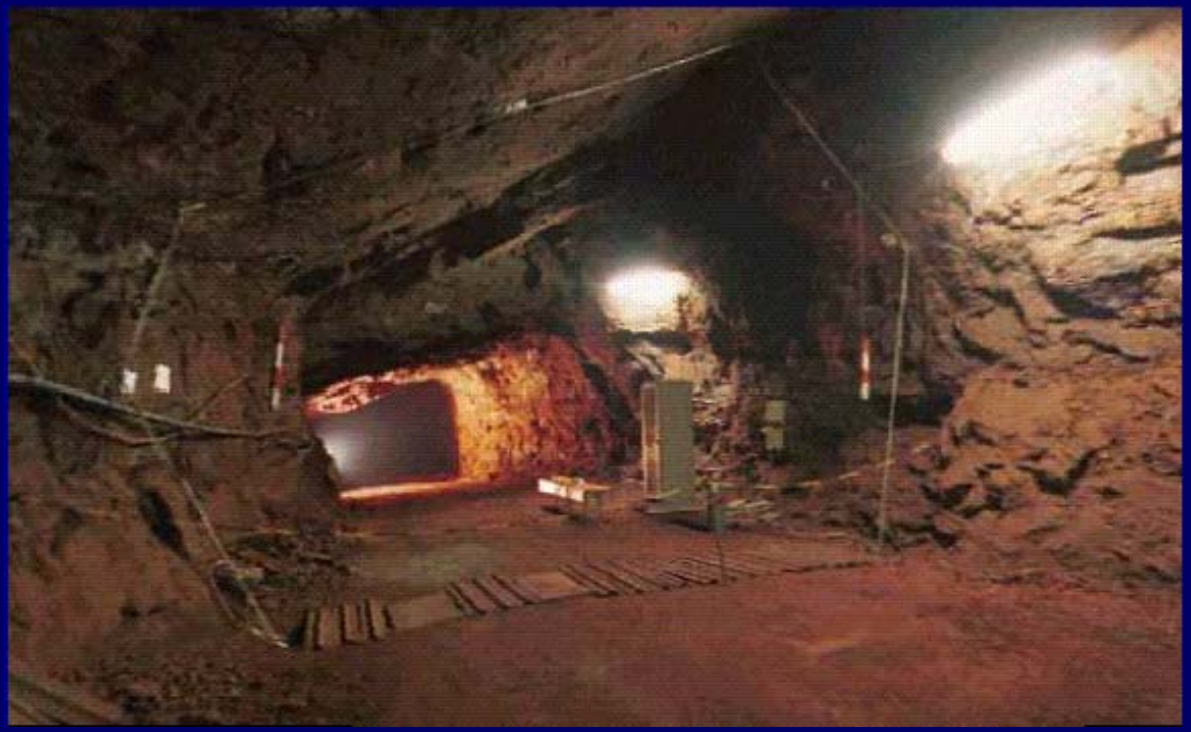


Configuration TAB



Applications – Mining industry

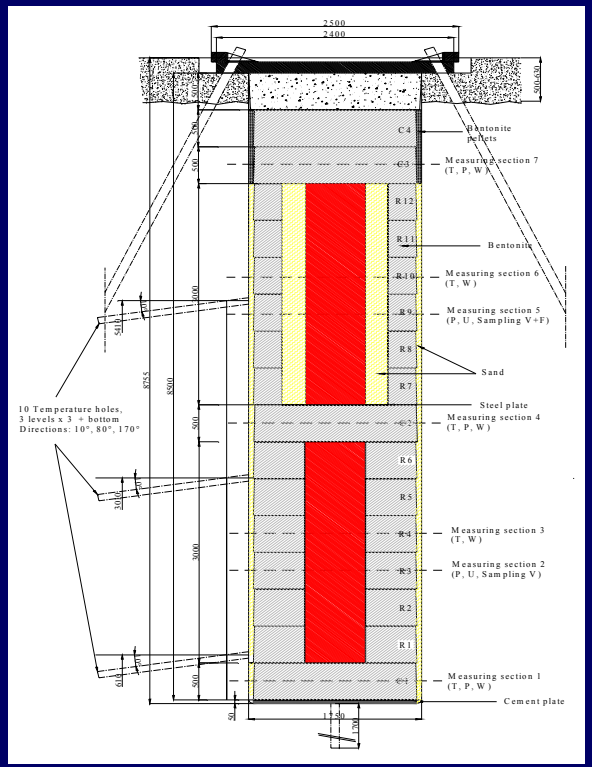
Konrad – salt mine Germany



Measurement set-up

Applications – Mining industry

Aspo – Granite mine Sweden



Characterisation of nuclear waste sealing system

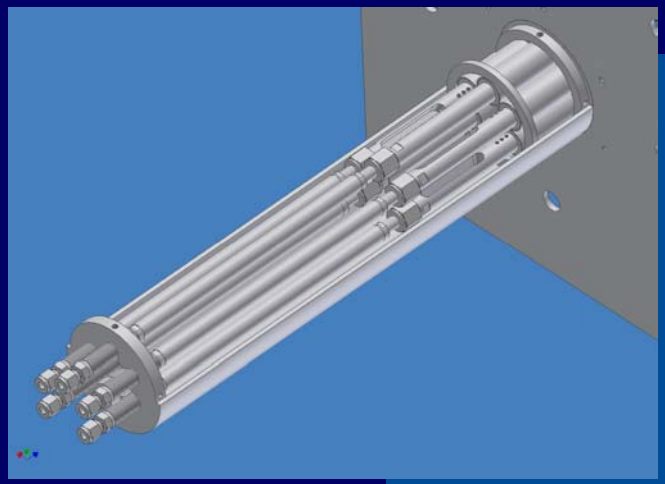
Applications – Mining industry

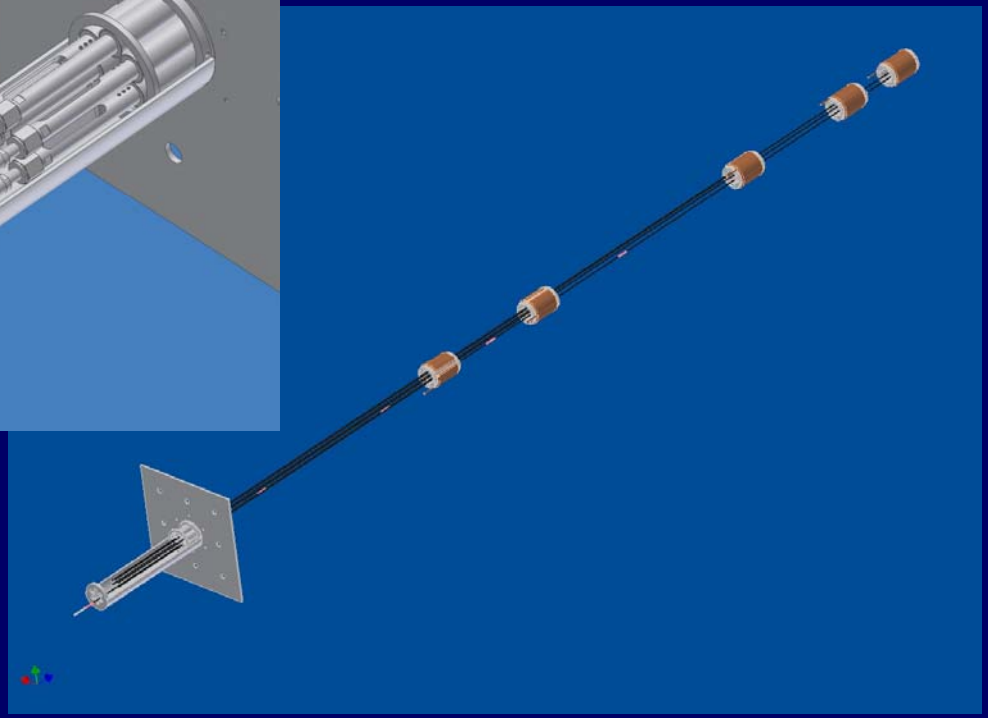
Aspo – Granite mine Sweden

Characterisation of nuclear waste sealing system

Applications – Mining industry

Mont Terri – Clay mine in Switzerland





Measurement of thermal expansion behaviour

Applications – Mining industry

Mont Terri – Clay environment in Switzerland

Measurement of thermal expansion behaviour

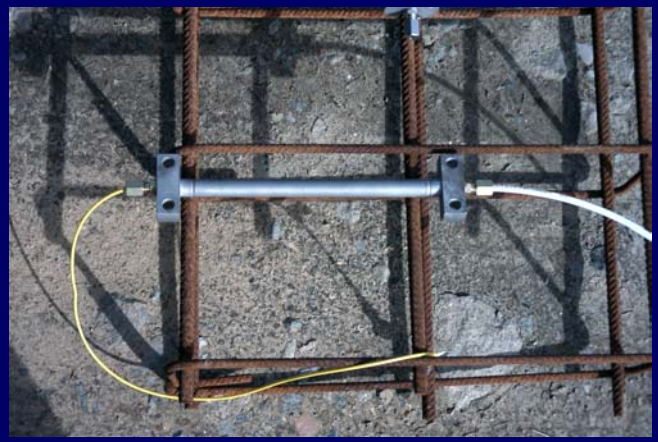
Applications – Mining industry

Mont Terri – Clay environment in Switzerland

Measurement of thermal expansion behaviour

Applications – Civil engineering

Health monitoring of bridges



Brande Bridge in Denmark

Applications – Geotextile industry

Challenge:

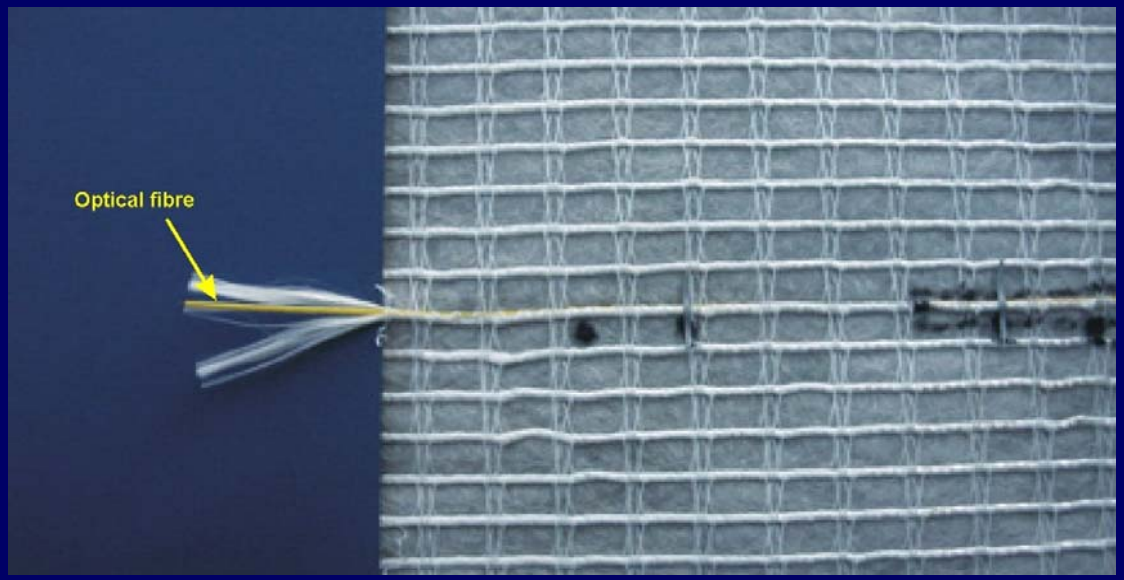
Development of a survey systems for earthworks structures reinforced with geosynthetics in order to increase the safety of civil-engineering infrastructures through cost-effective predictive maintenance.

Example of earth crack under road

Applications – Geotextile industry

Solution:

"Geodetect" – commercialised by **Polyfelt Geosynthetics**



Polyfelt.Rock with optical fibre containing FBGs.

Applications – Oil industry

Challenge:

Distributed temperature sensing of subsea oil pipelines.

Cross section oil pipeline