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EPIC Online Technology Meeting on Exploring Emerging Applications for Photonic Integrated Circuits

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Optics11



Amsterdam based company that offers high-end optical sensing systems for a variety of applications (Industrial and Life Science).

Optics11 FAZ

Dublin based company (formerly FAZ Technology and currently part of Optics11 since Dec 2019) developing high-end tuneable laser based FBG interrogators for optical sensing systems.

Unique technology

- World's high-end optical acoustic emission sensing system (OptimAE up to **MHz** rates)
- World's highest accuracy and precision FBG interrogators (FAZ I4 interrogator series up to **kHz** rates)
- Broad portfolio of fiber optic sensors (FP and FBG based to measure strain, temp, accel., pressure, etc.)
- Broad application experience, **Industrial** (SHM, etc.) and **life science** applications (Indentation, Organ-On-a-Chip)
- Developing future generation PIC based interrogators for low-cost, high volume applications, **while maintaining high performance.**



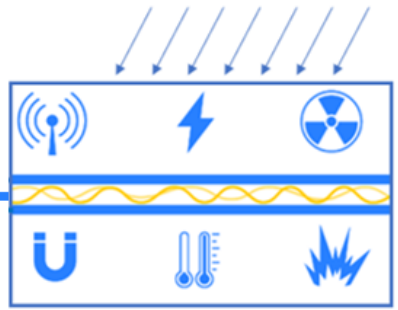
Fiber Optics Sensing System and PIC development



- Reliable high-performance measurements at kHz rates (up to 120 sensors)
- Absolute accuracy < +/-1pm
- long-term precision < 0.1pm
- Repeatability (dynamic) is <0.05 pm
- Based on fast telecom tunable laser with Pol. control support
- High speed spectral measurements (high speed/res OSA) (@1pm resolution and up to 16Hz speed across full C-band)



Impact of external parameters



Modulation Zone

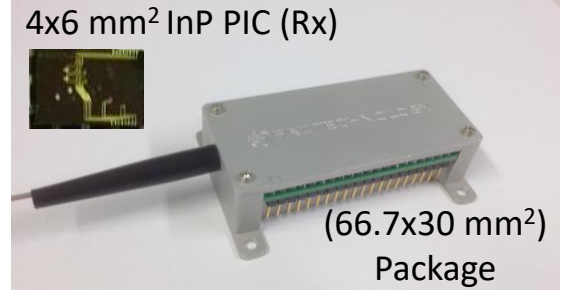
Optical assembly (Rx) (160x100 mm²)



Paradigm MPW



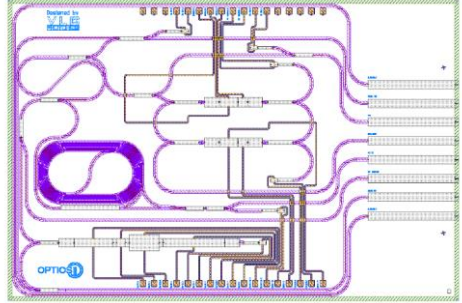
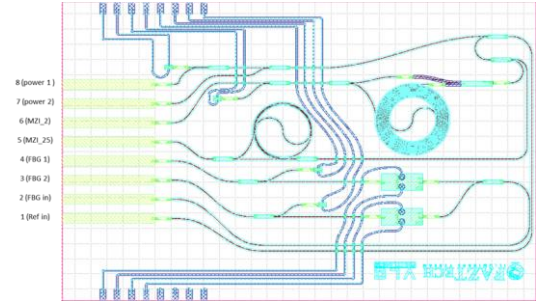
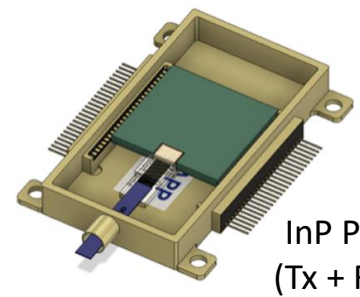
(2013-2017)



DTIF Photonics Manufacturing Pilot Line



(2019-2022)






Applications overview

BRIDGE MONITORING

OPTICS
LEAD BY THE USE OF A FIBER


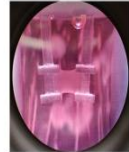
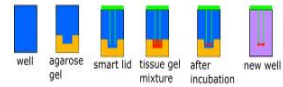



- Bridge over river IJssel
 - Required dynamic strain measurement
- 1 monitoring system
 - Mounted on side of bridge
 - Powered using solar and fuel cell
- 35 sensing points
 - 70 FBGs being monitored
 - Each sensing point measuring temperature and strain
 - Each sensing point recorded at 250Hz

ORGAN-ON-CHIP

OPTICS
LEAD BY THE USE OF A FIBER

- Measure force of contracting organoids
- Embedded excitation
- Up to 92 wells
- Works in the incubator

STRUCTURAL MONITORING OF WIND TURBINES

OPTICS
LEAD BY THE USE OF A FIBER

- High number of sensing points
- Possible to embed on to the (concrete) foundation rebar
- Single readout unit – FAZT I4 Interrogator
- High frequency data collection
- Remote location
- 112 embedded strain gauges
- 4 discrete strain gauges
- 7 temperature gauges
- 2D inclinometers
- 2 axis accelerometers











ACOUSTIC EMISSION PD DETECTION

OPTICS
LEAD BY THE USE OF A FIBER

- Detect Partial Discharge in High voltage applications
 - Pantographs
 - Transformers
 - Cable joints
 - Generators

STRUCTURAL HEALTH MONITORING OF CAVES

OPTICS
LEAD BY THE USE OF A FIBER


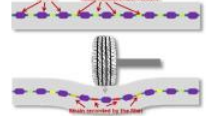

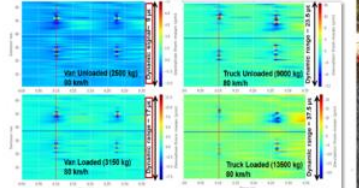


- Cave stability
 - Cave consists of Marl
 - Dug out over the centuries
 - used for tours and need to be monitored for risk of collapse
- 2 different networks monitored
 - 2 installations
 - Each with and 14 + M64S4 expansion module
- 80 sensing points
 - 160 FBGs being monitored
 - Each sensing point measuring temperature and strain
 - Each sensing point recorded every 60 seconds




ROAD & TRAFFIC MONITORING

OPTICS
LEAD BY THE USE OF A FIBER

- High sensitivity to low strain levels
 - $\mu\epsilon$ -level resolution
- Localized & high density measurements
- High speed recording
 - Vehicle passing: a millisecond event
- Cost effective: Single recorder unit for multiple lanes
- Completely buried system no surface visibility
 - Longer lifetime, harder to avoid detection

Questions ?

What can we offer:

- 1- High performance sensing systems for industrial applications (SHM, Energy, etc) and life science applications (OOC, Cell/Tissue indentation, etc).
- 2- Systems for rapid characterization of packaged PICs using high speed spectral measurements up 16Hz with 1pm resolution (40nm).
- 3- Experience in challenging real-world sensing applications (SHM, Industrial, Life Science, etc.)

What are we interested in:

- 1- Fast tuneable lasers (discrete or within a PIC) that could be used for FBG interrogators (kHz continuous sweep rates and LW<20MHz covering C+L bands). (could also be designed for Telecom, OCT, and Lidar)
- 2- Applications where high volume, high performance interrogators are required.
- 3- Standardization of PIC packaging and testing to enable high volume production at low cost.