NKT Photonics

Distribueret temperaturmåling med optiske fibre – opløsning, gentagelighed og sporbarhed
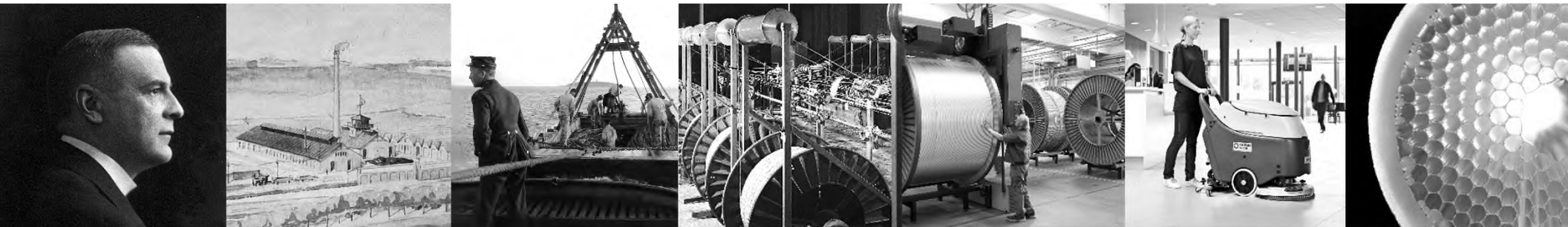
Teknologisk Institut, Aarhus, 10. Oktober, 2019

NKT Photonics

128 Years of Industrial History

1891

2019

Organization

NKT

3700 employees
1.1 bEUR revenue (2018)

NKT

› Northern Europe
› Central Europe
› Eastern Europe
› China

NKT Photonics

› Manufacturing in
  Denmark, Germany,
  UK, Switzerland & US
› Worldwide sales

NKT Photonics

NKT Photonics at a glance

Overview

NKT Photonics
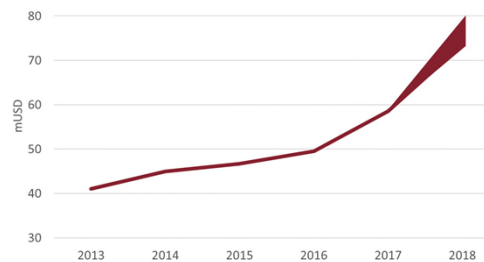
Supplier of fiber-based lasers and sensing systems for industrial and scientific applications

Founded in 1999

By the numbers

370 employees

390 patents and applications

2019 guidance:

$90-95M revenue

15-20% EBITDA

Manufacturing

Manufacturing in
DK, GB, DE, CH and US

>15,000 m² total footprint

>6,000 m² production floor

>15,000 system install base

NKT Photonics

Manufacturing locations

DK - Birkerød	GB - Southampton	DE - Cologne	CH - Zurich
Headquarter + product lines	**R&D + pilot site**	**Product line site**	**Product line site**
			+ ALS Berlin site
Products: SuperK & Koheras lasers, Fibers	Products: SuperK supercontinuum lasers	Products: LIOS sensing systems	Products: Onefive ultrafast lasers

Crystal Fibre • Koheras • SuperK • LIOS • Fianium • Onefive

NKT Photonics

Focused sensing product brands

LIOS ◻ DE.TECT
LINEAR HEAT DETECTION SYSTEMS

Linear Heat Detection

Fire detection in tunnels, metros and other large installations

LIOS ◻ EN.SURE
DISTRIBUTED POWER CABLE MONITORING

Power Cable Monitoring

Temperature monitoring & rating solution for the energy transmission and distribution grid

LIOS ◻ PRE.VENT
INDUSTRIAL TEMPERATURE MONITORING

Industrial Monitoring

Monitoring of refineries, reactor vessels / gasifiers, induction furnaces, LNG tanks, pipelines and other industrial infrastructures
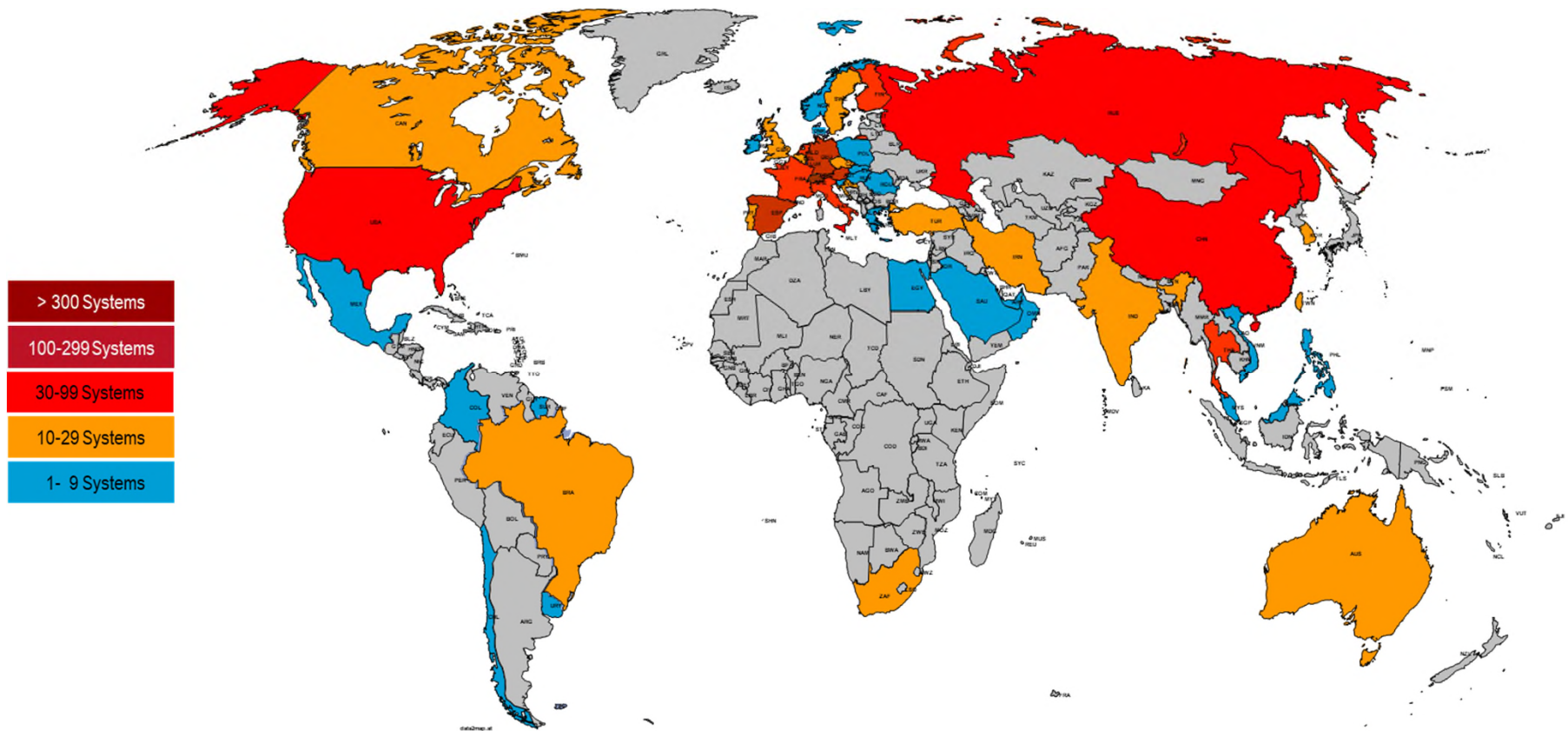
LIOS ◻ WELL.DONE
DISTRIBUTED TEMPERATURE MONITORING

Monitoring for Oil & Gas

Injection & Production monitoring, Fracture monitoring, Well integrity, and CO_2 injection well monitoring

Crystal Fibre • Koheras • SuperK • LIOS • Fianium • Onefive

NKT Photonics

Global success story: 5000+ projects

Legend:
- > 300 Systems
- 100-299 Systems
- 30-99 Systems
- 10-29 Systems
- 1- 9 Systems

Crystal Fibre • Koheras • SuperK • LIOS • Fianium • Onefive

NKT Photonics

Our products

NKT Photonics

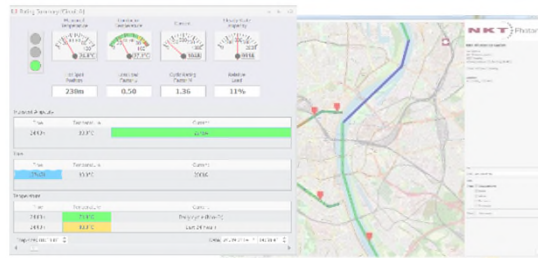# Monitoring Solutions

Software

- Fully integrated Software
- Real Time Thermal Rating (RTTR, DoB)
- SCADA Communication
- Visualization
- Alarm Management

Accessories & Services

- Sensor Cables
- Cabinets/Enclosures
- Project & commissioning Services

Distributed Sensing

DTS – Temperature

- up to 100 km one way
- up to 16 Channels
- Raman OFDR
- Brillouin OTDR
- MTBF > 45 years
- UL, ULC, VdS, and more
- 5,000+ Installations globally

DAS - Acoustic

- up to 70 km
- 2 simultaneous channels
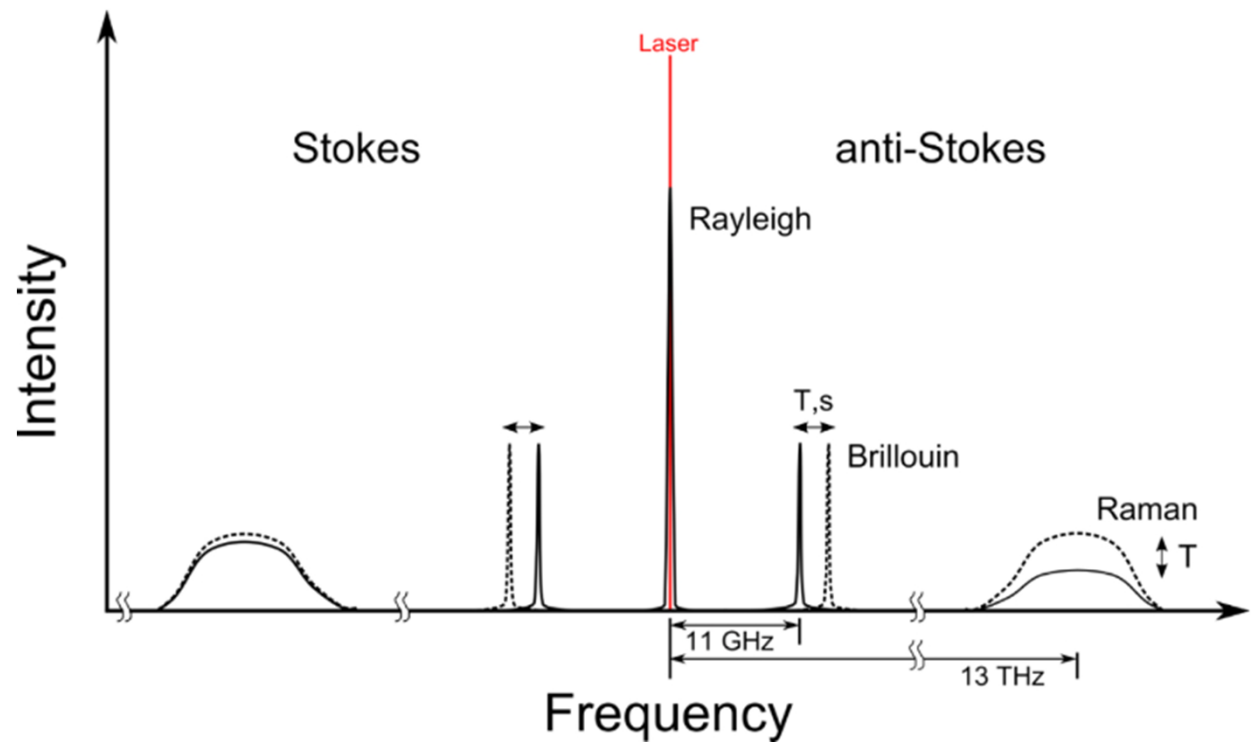- Rayleigh C-OTDR
- MTBF > 20 years

DSS - Strain

- up to 50 km one way
- up to 16 Channels
- Brillouin OTDR
- SIL-2 rating

Crystal Fibre • Koheras • SuperK • LIOS • Fianium • Onefive

NKT Photonics

Distributed Sensing

Backscattering

- Rayleigh (DAS):
- Same wavelength as laser

- Brillouin (Temperature/Strain)
- ~11GHz shift
- Frequency shift: Temperature
- Amplitude deviation: Strain

- Raman (Temperature)
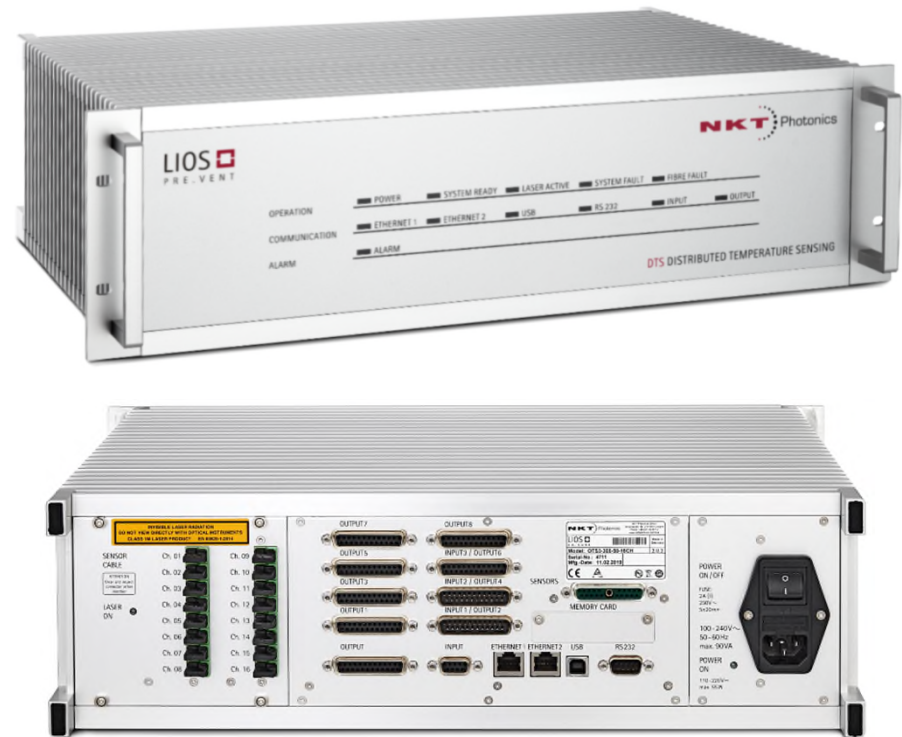- ~13THz shift
- Stokes/Anti-Stokes relation: Temperature

NKT Photonics

Distributed Sensing

	Pipeline Condition Monitoring	Third Party Intrusion/ Security	Geo-Technics	Transport monitoring	Oil & Gas	Industrial process monitoring	Structural Health Monitoring	Power Cable Monitoring
DAS	Leak Instrusion/Security Pig Tracking Hot tap/valve detection	Perimeter security Activity detection Tunnelling detection	Seismic Rock fall Land slide	Train tracking Traffic flow Track/rolling stock condition Rock fall	Seismic Fracking Flow profiling	Conveyor belt		Fault finding TPI (Anchoring) Cable conditions
DTS	Leak Soil erosion		Geothermal Dam/Dyke (leak) Environmental research	Fire detection	Temperature Fracking SAGD Flow	Safety (temperature limit) Plant maintenance Process optimization Conveyor belt	Dam/Dyke (leak)	Load management Fault finding Cable conditions Transformers/
DSS	Land slide Pipeline deformation Subsidence	Tunnelling detection	Land slide Dam/Dyke	Train tracking Track condition Land slide	Casing strain Bore holes deformation Ground deformation	Hoop strain Pipe deformation	Deformation Dam/Dyke Building/Bridges/Piles/Walls	Curvature/Elongation (cable laying and operation)

NKT Photonics

Technical information about DTS

Distributed Temperature Sensing – Raman based

DTS – Temperature

- True Industrial Design
  - Passive cooled, no moving parts
  - 100 % maintenance free
  - Operating temperature: -10°C to +60°C

- Internal storage for 24/7 recording
- Single- and multimode fibres possible
- Range: Up to 40km per channel
- Sampling Interval: down to 0.1m
- Cycle rate: 4s to 15min
- Temperature resolution: down to 0.1K

NKT Photonics

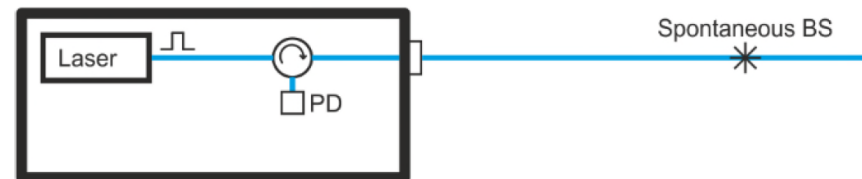# Technical information about DTS

Distributed Temperature Sensing – Brillouin based

Long Range DTS – Temperature

- BOTDR: Single ended → no loop or termination
  True Industrial Design
  - Passive cooled, no moving parts
  - 100 % maintenance free
  - Operating temperature: -10°C to +60°C
- Internal storage for 24/7 recording
- Range: Up to 100km per channel
- Sampling Interval: down to 0.25m
- Temperature resolution: down to 0.1K
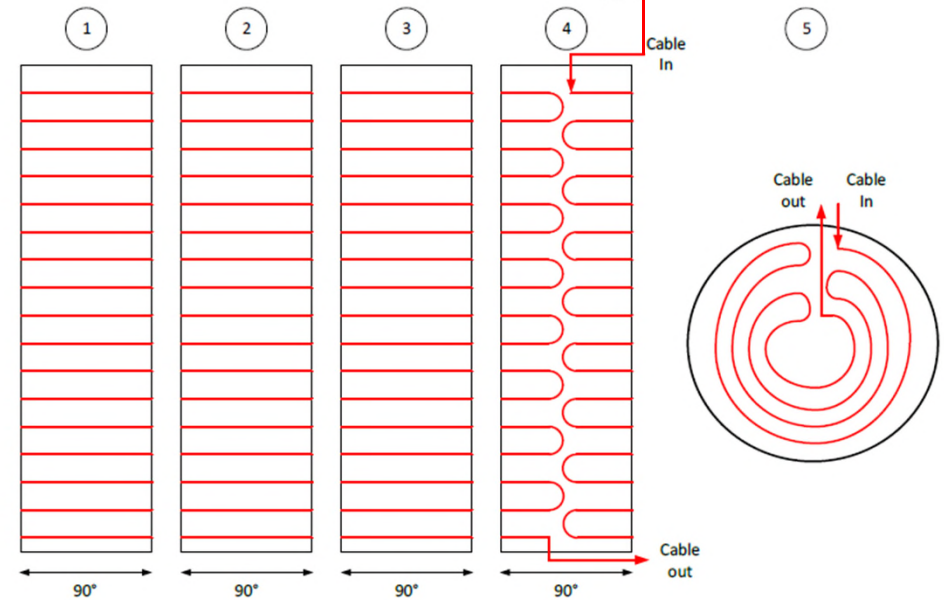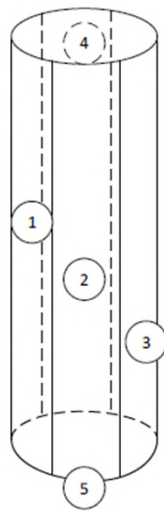- Physical Separation of temperature from strain

BOTDR

Industrial - Application Examples
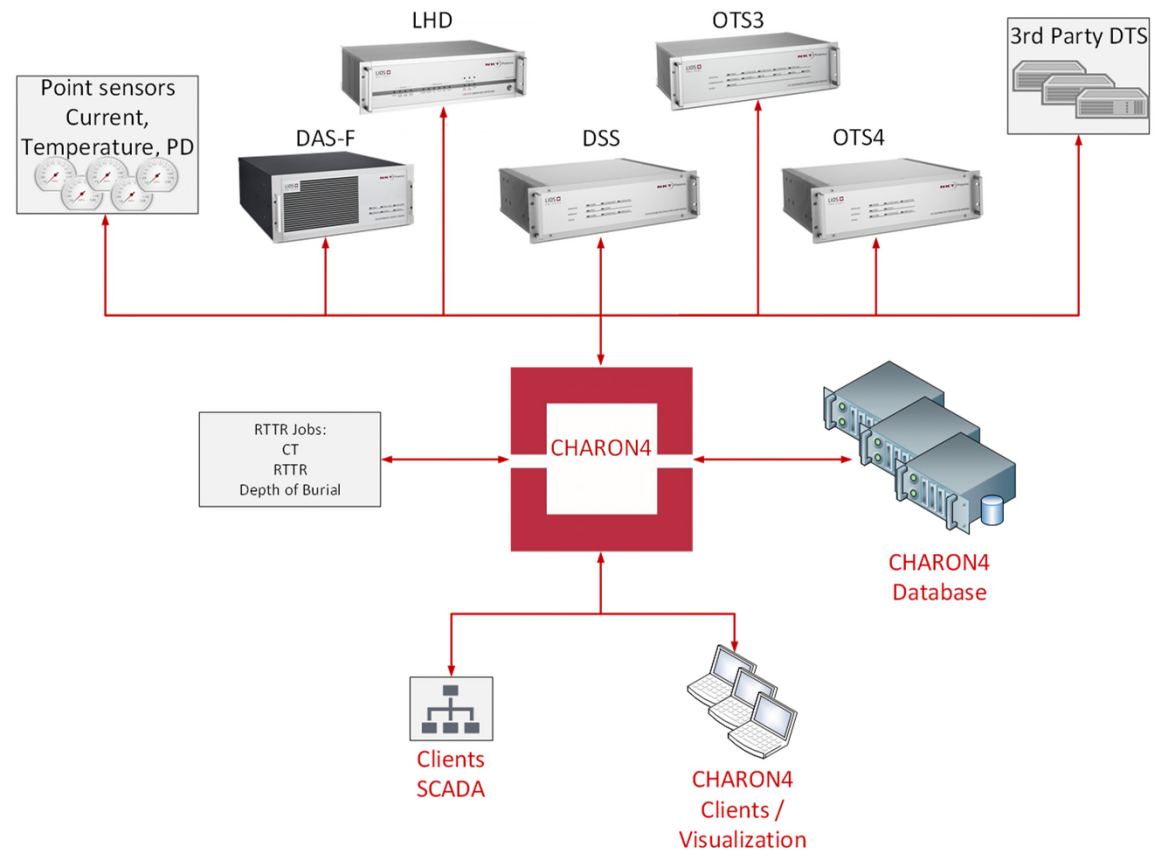
Reactor Surface Monitoring

- Detection of leakages

- Preventive maintenance:
  - Refractory status
  - Insulation
  - Material temperatures

- ATEX approved

- Sensing inside reactor

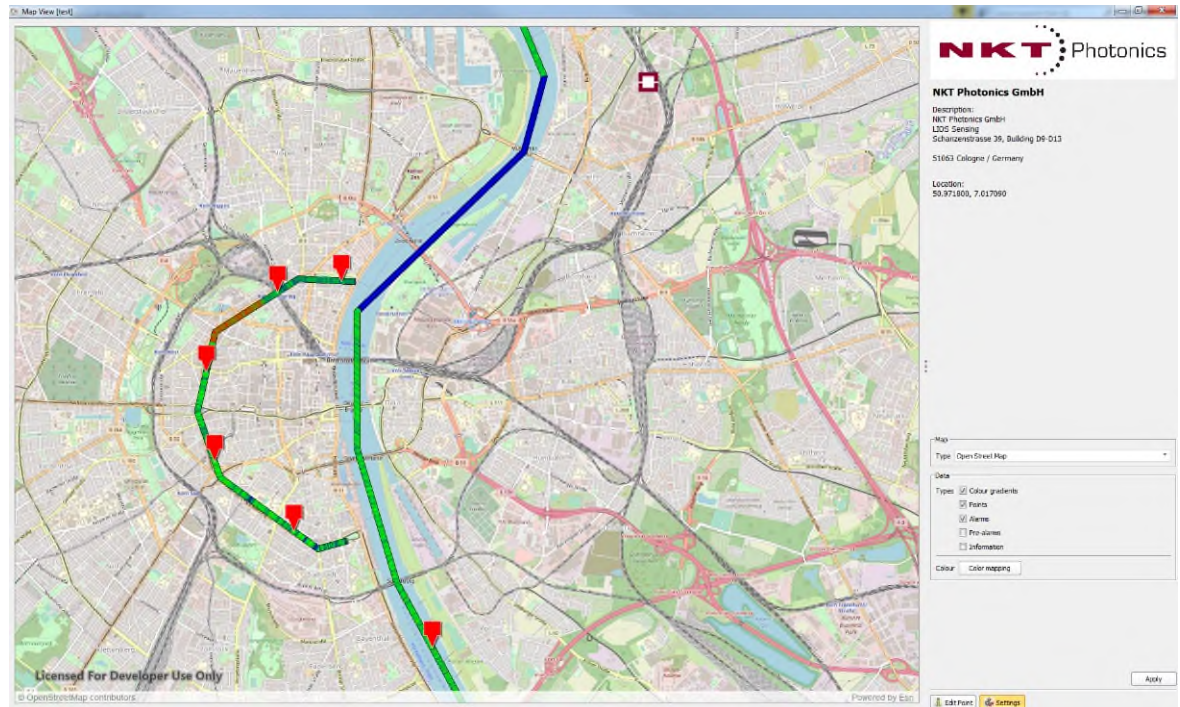NKT Photonics

Software

Charon4 Software Platform

- Fully integrated – all in one

- Dedicated operation (e.g. VM)

- Data processing & unlimited storage

- Commissioning & Operation of DXS

- 3rd Party sensor integration
  - Point temperature sensors
  - Current sensors
  - Partial Discharge
  - 3rd Party DXS
  - And many more

NKT Photonics

Software

Visualization

- GIS/GPS scalable view (similar google maps)

- Alarms, fibre breaks, point of interests

- Up to 1m accuracy

- False color visualization

- Offline capable

NKT Photonics
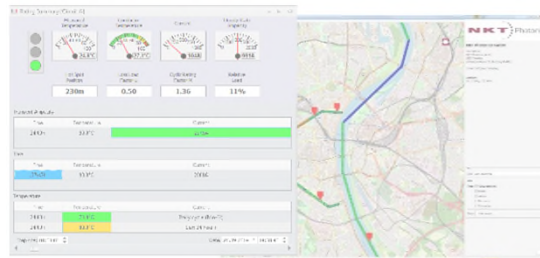
Monitoring Solutions

Sensing Hardware

DXS
- DTS
- DSS
- DAS

Point sensors
- point temperature sensors
- Current sensor

Software

- Fully integrated Software
- Real Time Thermal Rating (RTTR, DoB)
- SCADA Communication
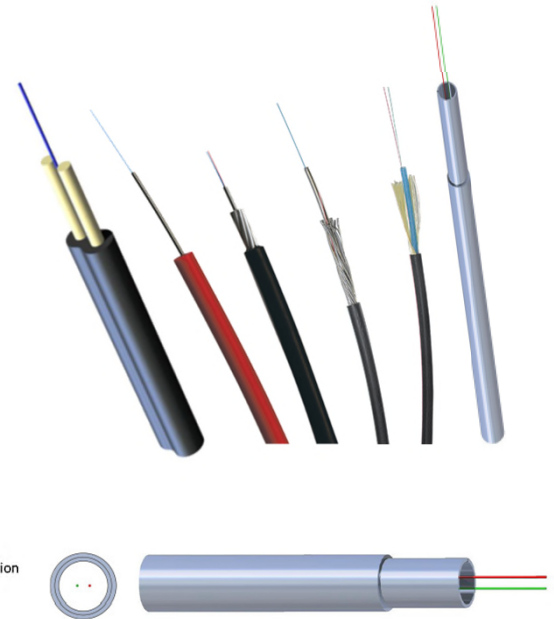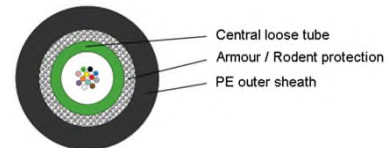- Visualization
- Alarm Management
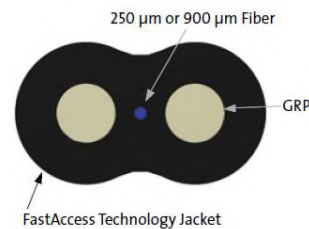
Accessories & Services

- Sensor Cables
- Cabinets/Enclosures
- Project & commissioning Services

NKT Photonics

Accessories & Services

Sensor Cables

- Fibre is our sensor

- Passive (EM & RF immune)

- maintenance free

- Operational temperature: -170°C to 400°C

- Flexible assembly/mounting

- Adaptable to most environments

- Hazardous areas, FIMT, FRNC

- 9µm, GI50, GI62.5

NKT Photonics

Accessories & Services

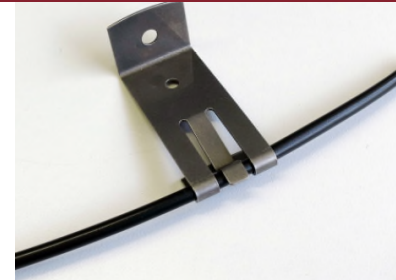| Magnets	Stainless-steel ties	Brackets	Clips
• -40 °C to 525 °C (-40 °F to 950 °F) • Adaptable to asset geometry • Requires magnetic surface	• -40 °C to 525 °C (-40 °F to 950 °F) • Highly adaptable to asset geometry	• -40 °C to 525 °C (-40 °F to 950 °F) • Threaded studs required • Highly adaptable to asset geometry	• -40 °C to 525 °C (-40 °F to 950 °F) • Easy clipping of sensor cable • For long assets (e.g. tunnels)

Crystal Fibre • Koheras • SuperK • LIOS • Fianium • Onefive

NKT Photonics