



synaptec

Light-speed power network insights

- Synaptec developed the first **completely passive** solution for **distributed** electrical and mechanical sensing
- Unified electrical and mechanical visibility and control of power systems at **unprecedented speed, range, locations & price**
- Developed for subsea, proven in offshore wind & transmission, uniquely **automates condition monitoring and electrical protection** of remote MV and HV assets



Stat**nett**

WILLIAMS | ADVANCED
ENGINEERING

CATAPULT
Offshore Renewable Energy

 **sse**


VATTENFALL

Founded in 2015

UK's first
digital
substation

Centralised
busbar
protection

Proof of
concept for
offshore wind

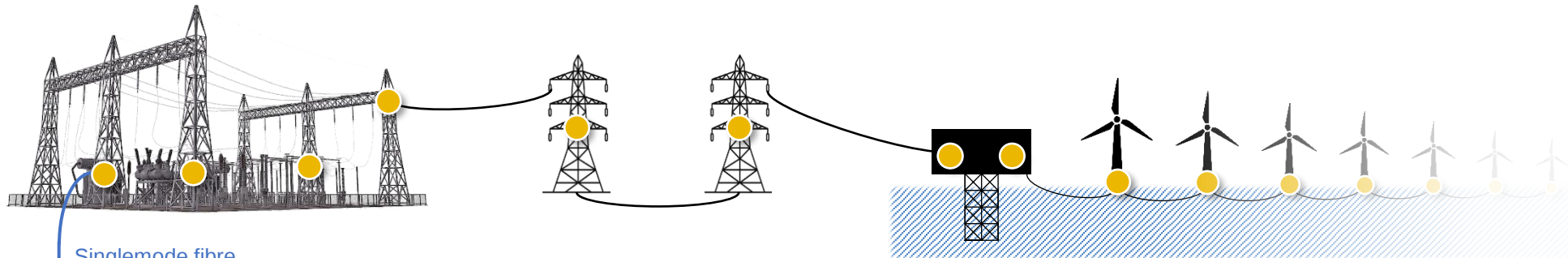
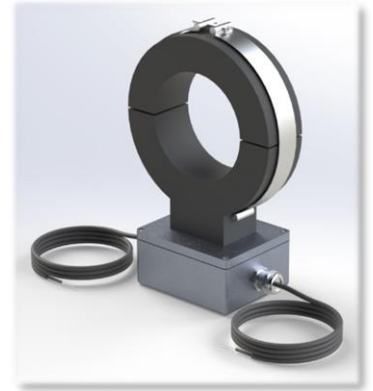
"No-build" grid
connections

First scale
offshore
deployment

2020

Distributed electro-mechanical sensing

- Our **passive** fiber sensor networks provide **distributed** measurements of **electrical & mechanical parameters**
- Passively measures any combination of **voltage, current, strain, vibration, temperature, humidity**
 - IEC compliant, primary or secondary-connected electrical sensors for new or retrofit applications
 - Mechanical sensors mount on the desired substrate using **existing, safe installation techniques**
- Leverages **standard optical fiber available** in power networks (e.g. in all power cables)
 - Up to **50 sensors per fiber** are easily spliced in without any requirement for auxiliary equipment
 - Measurements are encoded in wavelength (colour) of light: **immune to EMI** and **inherently secure**



Singlemode fibre
connection



- A single **Interrogator IED** installed in the substation processes all sensors
 - Reaches sensors at an unprecedented distance of **100 km per fiber**
 - The Interrogator is the **only** powered and time-synced device in the system

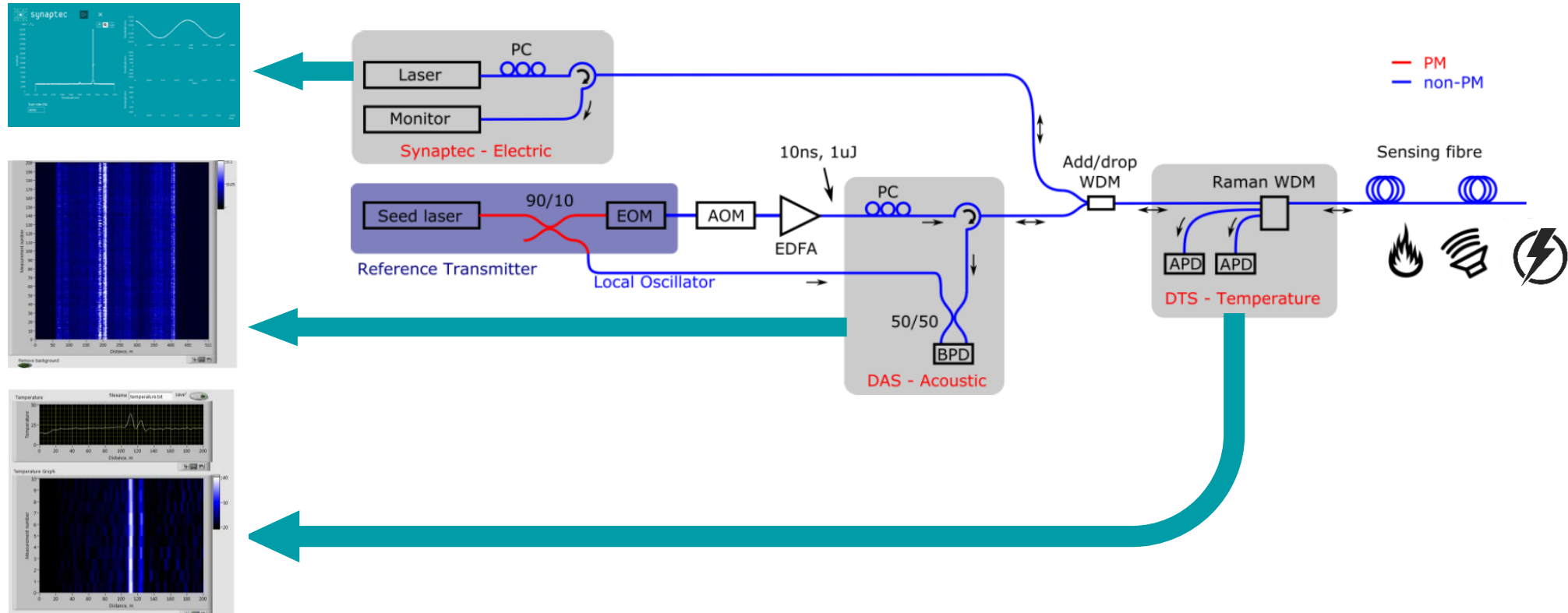


CLEMATIS

- Program completed end 2018 with Fraunhofer and EMEC
- Proved we can run DES (Distributed Electrical Sensing) with DAS and DTS through same fiber
- Provides holistic monitoring of temperature variation + disturbances + electrical parameters

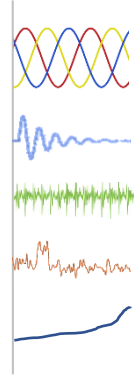
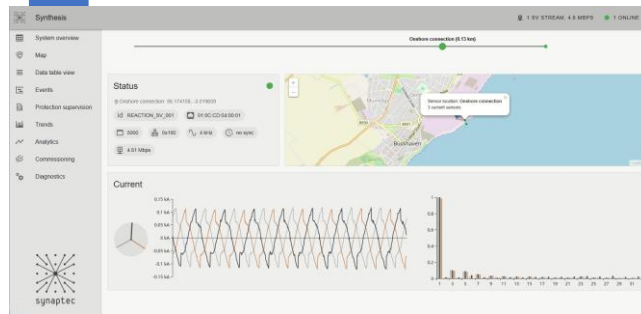
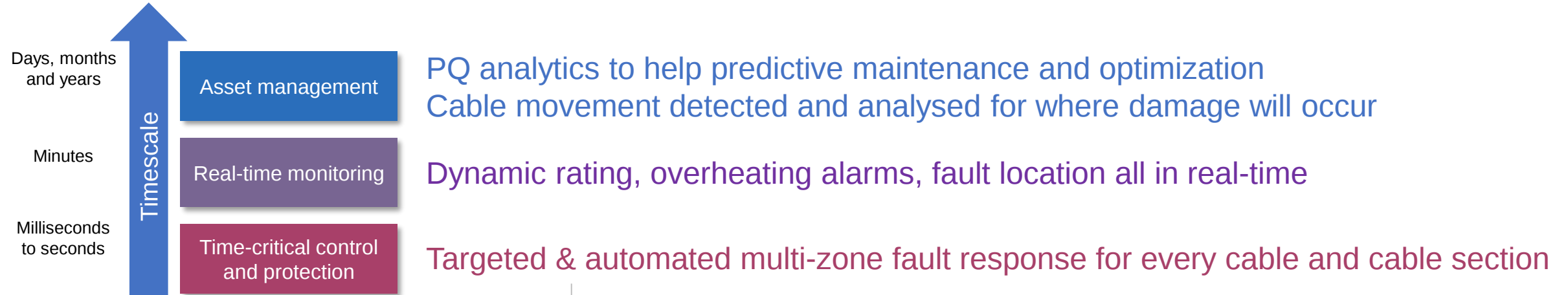


Triangulated view of cable performance





Benefits over three distinct timescales



current



voltage



strain
& sag



vibration



temperature

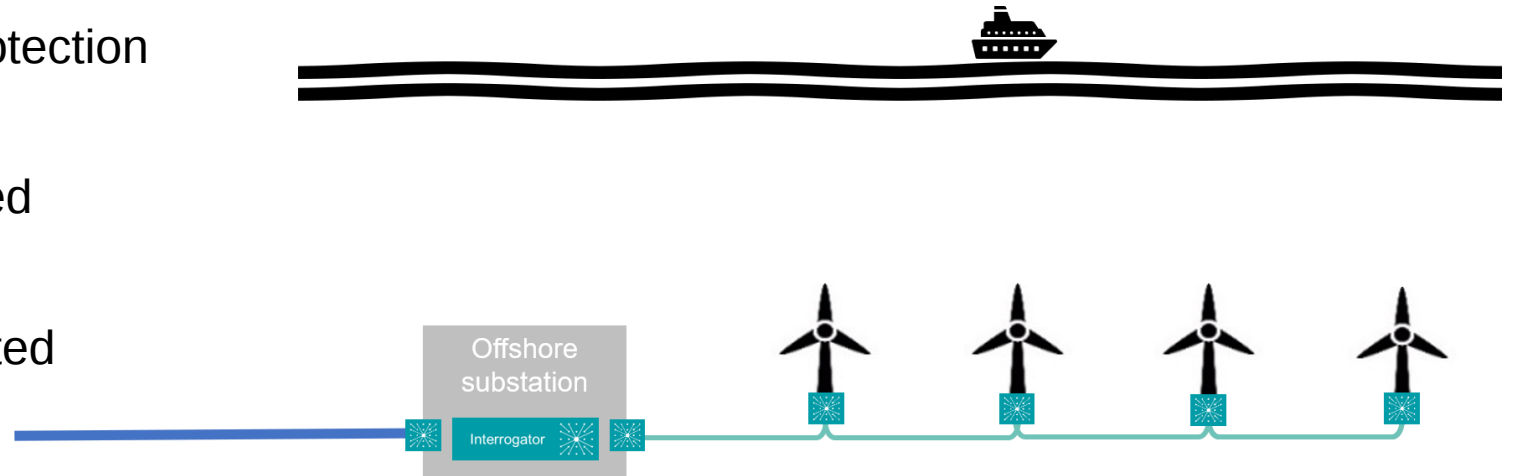


Point sensors can co-habit fibre with DAS systems



Instrumentation for protection

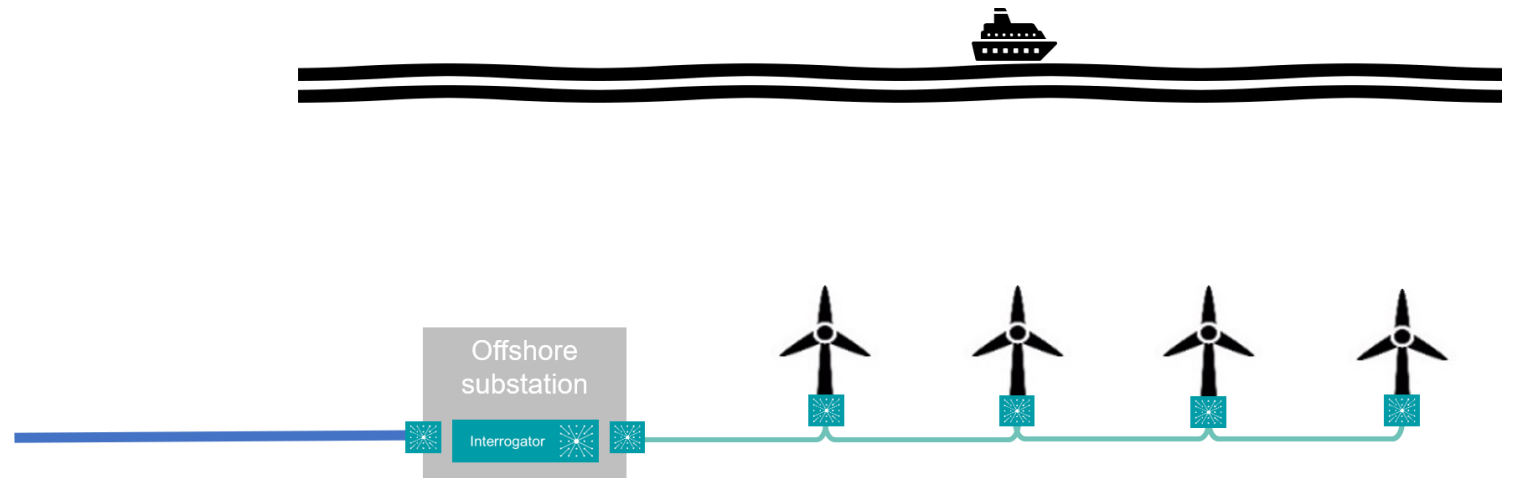
- Enables differential current unit protection of every individual array cable
- Auto-reclose up-to or around faulted cables
- Avoids exposing HV assets to faulted currents a second time
- Lose one cable, not the entire string





Real-time monitoring

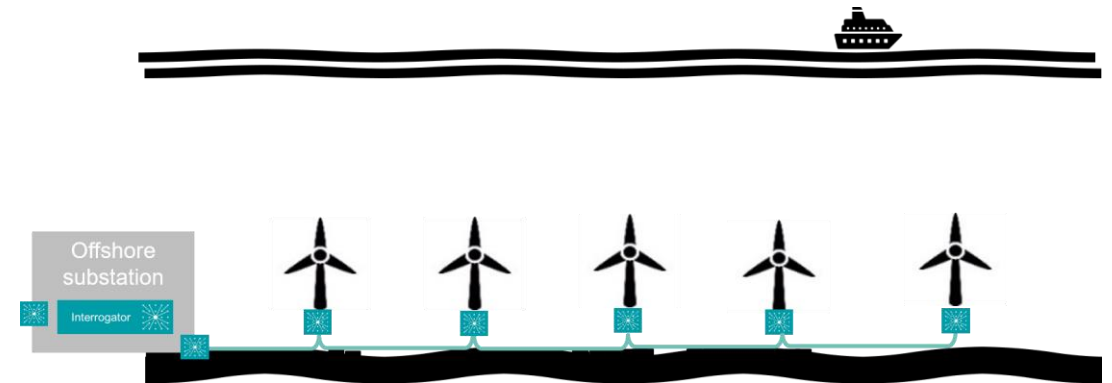
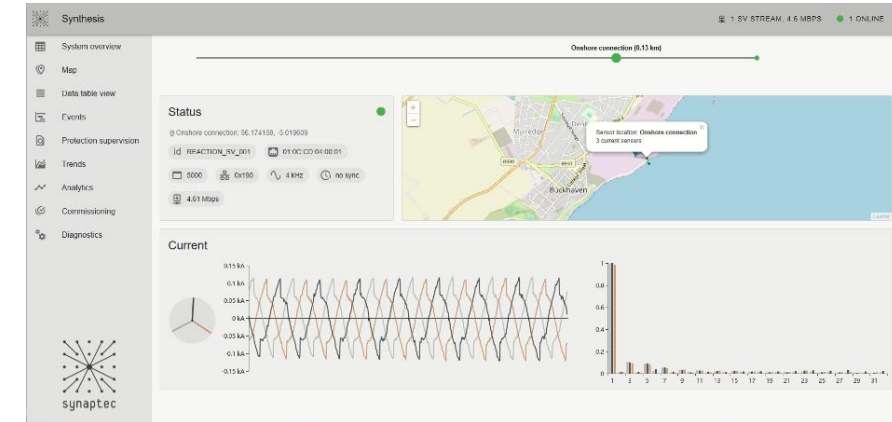
- Time-correlated temperature & electrical monitoring
- Live view of cable capacity
- Enables safe increase or decrease of current in real-time beyond static line ratings
- Continuous optimization of asset use
- Monitoring thermal bottlenecks





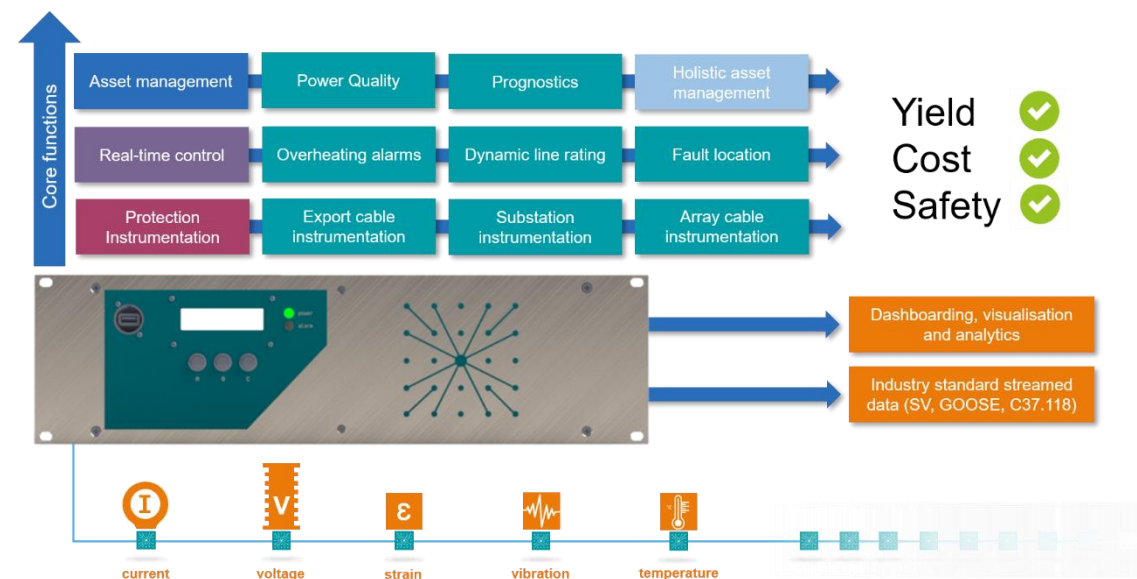
Asset management

- Event analysis:
 - Know when and where events happen
 - Instantly correlate multiple indicators
- Data behind losses & non-compliance
 - Oscillation detection
 - Power Quality analytics
 - Performance outliers and deviation
 - Task-driven predictive maintenance
- Cable movement data from DAS
 - Strumming detection
 - Determine high risk areas for pinning



Summary

- Unique new platform for passive monitoring of remote and inaccessible HV assets over unprecedented distances
 - Bringing together electrical and mechanical point sensing with Distributed Acoustic Sensing
- We welcome input from operators and developers



Ready to trial at scale to improve safety, yield, and cost on existing or new projects



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