



synaptec



Light-speed power network insights

- We invented DES - Distributed Electromechanical Sensing
- Wide area sensor networks - more remote locations, faster, safer, more securely without power or comms
- Transmission-grade remote protection and condition monitoring in one system



Statnett



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

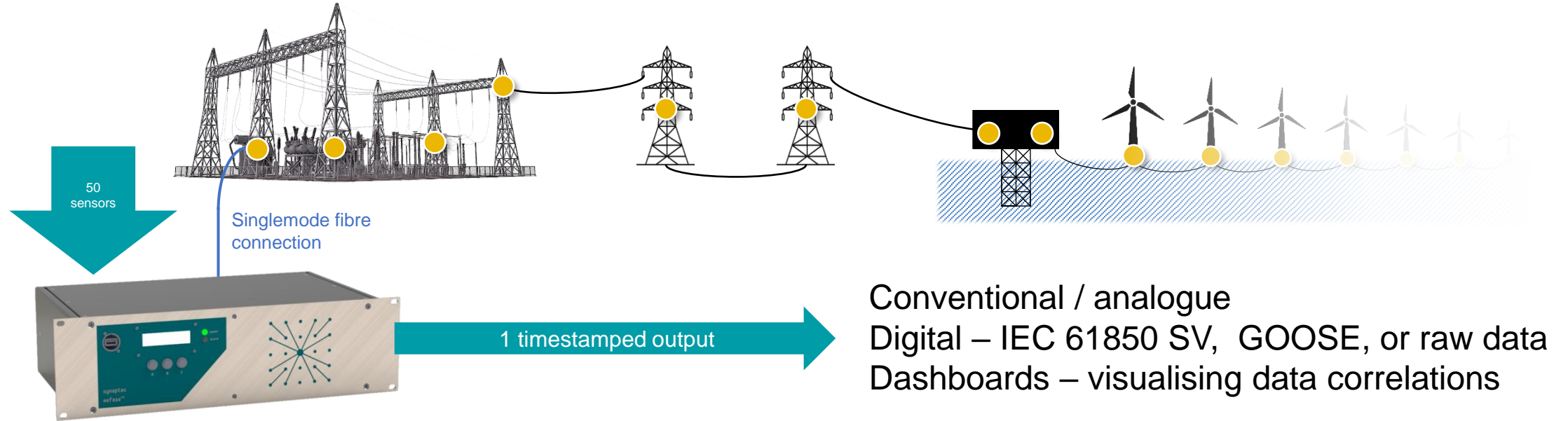
2020



Our technology platform



Using the speed of light to monitor HV systems



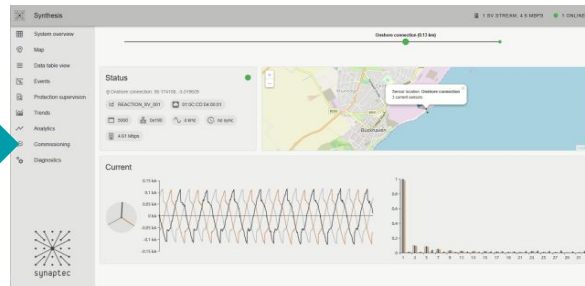
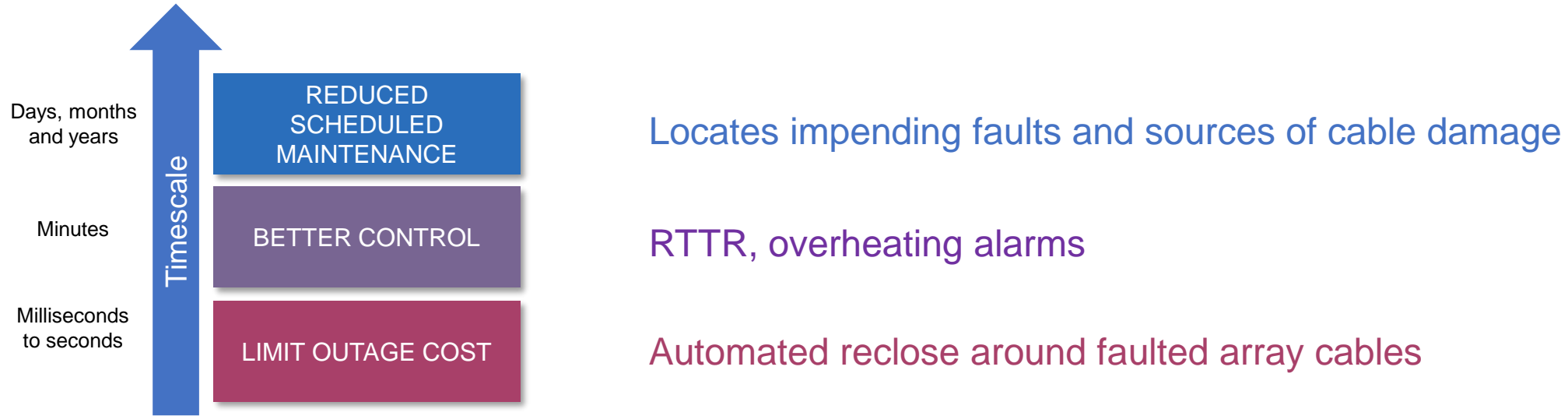
- Uses existing fiber as a network, not a microphone
- Standard CTs and VTs connected passively to fiber – easier and safer to retrofit
- No power, no data, no latency, no wireless, no maintenance
- Faster, longer range and more reliable
- Correlates any mix of voltage, current, strain, vibration, temperature



New insights for offshore wind



Operational benefits



current



voltage



strain
& sag



vibration



temperature

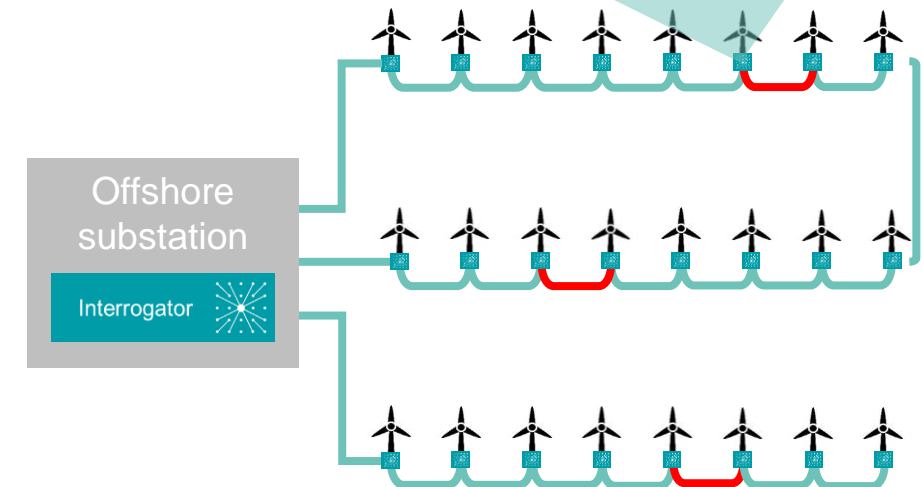




Automated array cable fault response

- Demonstrated at OREC's Levenmouth facility
 - One cable retrofitted with 6 CTs and 6 Temp. sensors
 - Installed and commissioned in one day
 - Streaming correlated Sampled Values (IEC 61850-9-2) at 4.8kHz
- Benefits-
 - Upgrades from distance to multi-zone unit protection
 - Enables auto-reclose on healthy sections
 - Relevant >66 kV w/ SWGR
 - Will enable hot-swap for floating WTG

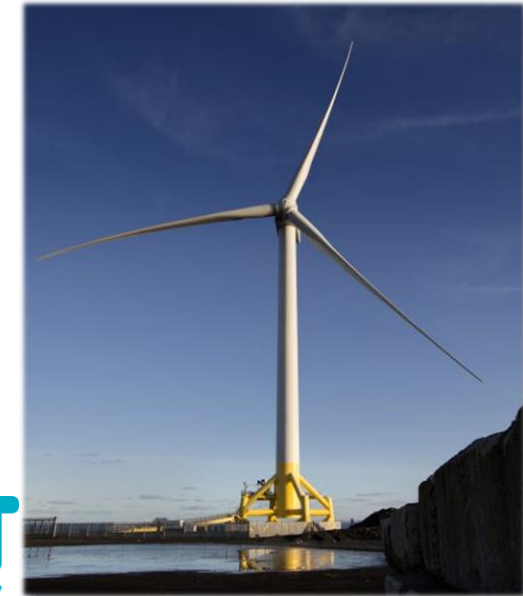
CATAPULT
Offshore Renewable Energy





Real-time control included in system

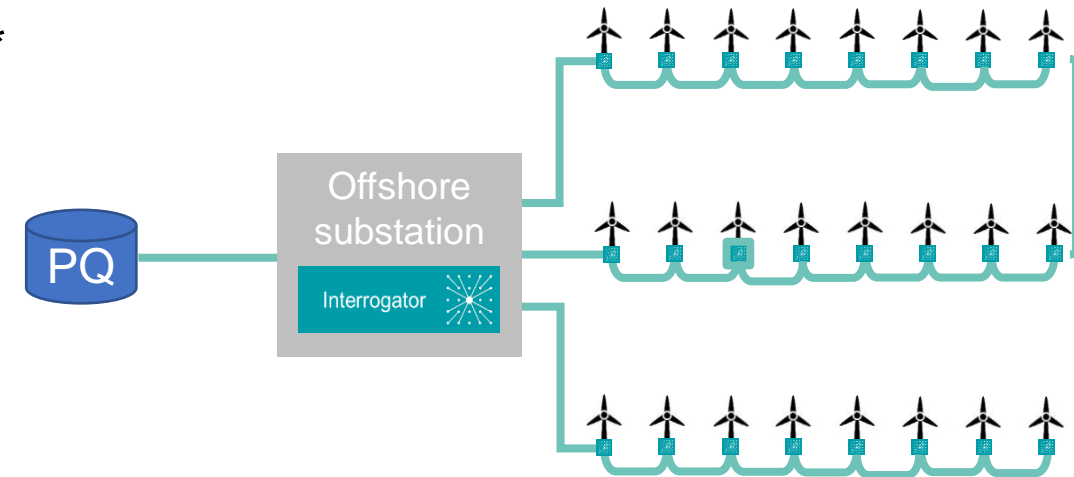
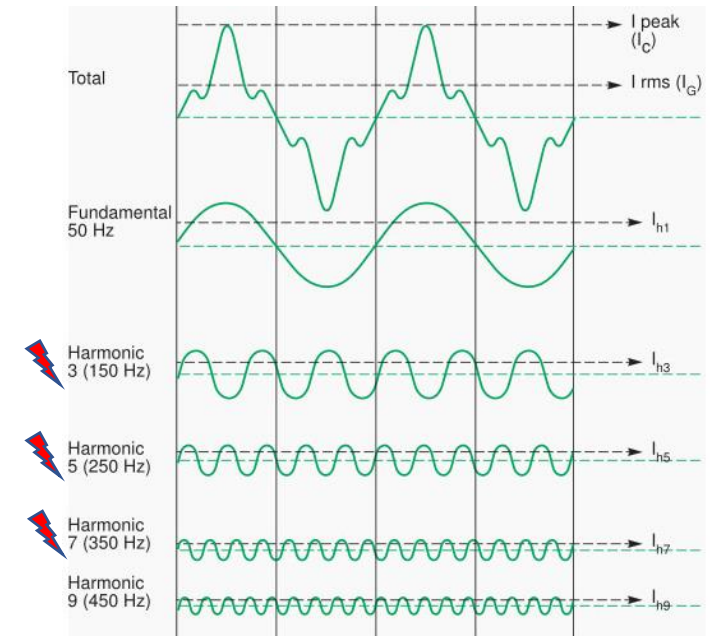
- Overheating alarms
 - Termination failures common, not monitored by DTS
 - Sensors retrofitted to terminations, +/- 0.1°C live readout
 - Easy to set threshold alarms via GOOSE
- Real-Time Thermal Rating (RTTR)
 - Goal to safely realise potential capacity of conductors
 - Live temp + current correlation gives instant control
- Vattenfall installing Q4 for more asset management insight;





Power Quality (PQ) monitoring

- PQ = how much generated power you can't sell
- Every harmonic = loss from a specific source
- PQ Effects
 - Thermal loss (3rd ⚡)
 - Claimed premature cable ageing (5th and 7th ⚡) *
 - Causes Partial Discharge
 - Particularly pronounced with direct drive
- PQ is being monitored today, but
 - not permanently
 - only at substation (net output for grid compliance)

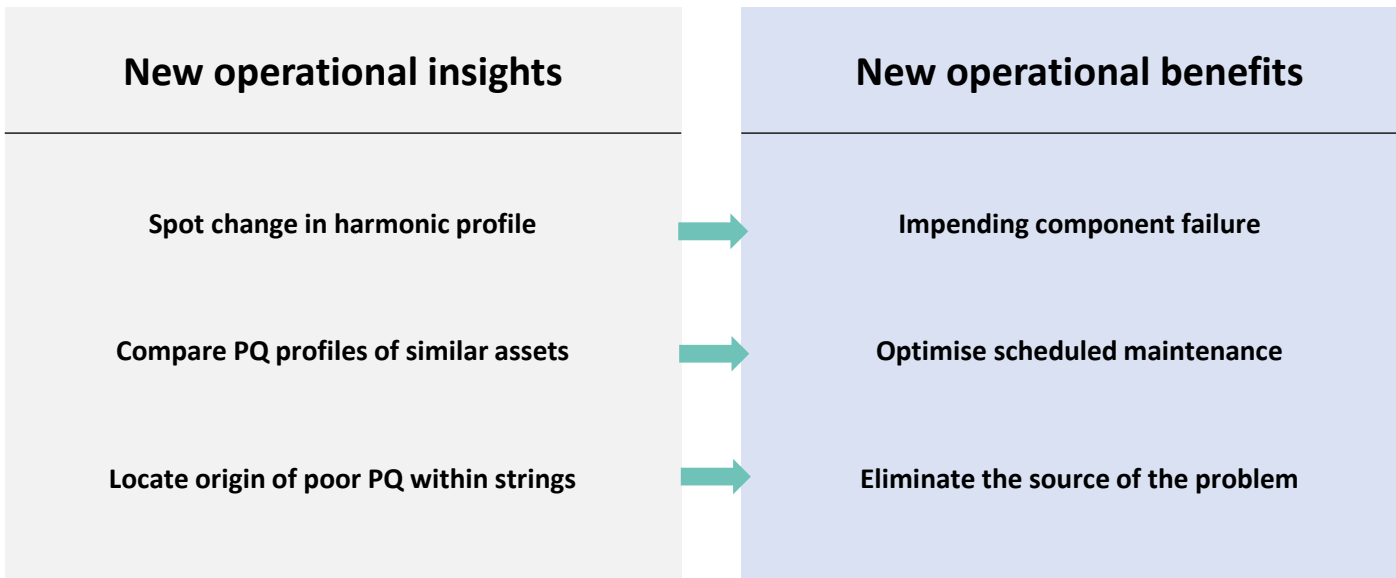
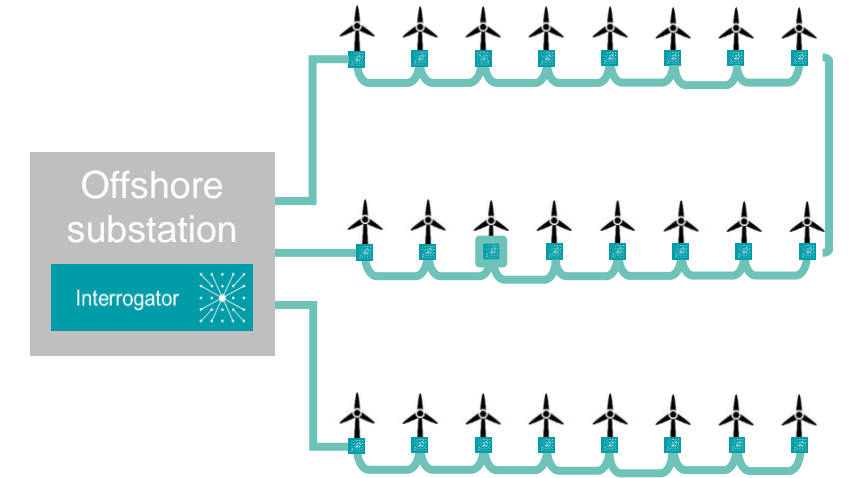


*Sources:
https://strathprints.strath.ac.uk/67614/1/Aizpurua_et_al_NPIC_HMIT_2019_Towards_a_data_analytics_framework_for_medium_voltage_power.pdf
<https://strathprints.strath.ac.uk/33135/1/paper.pdf>



Better Power Quality (PQ) monitoring

- Permanent, streaming PQ data
- PQ injection from every WTG through every cable
- Builds timestamped data history for prognostics





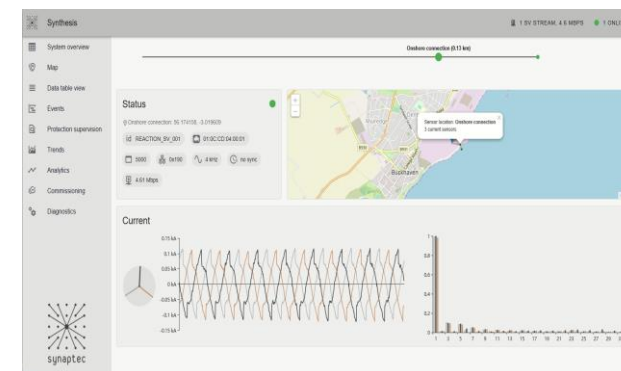
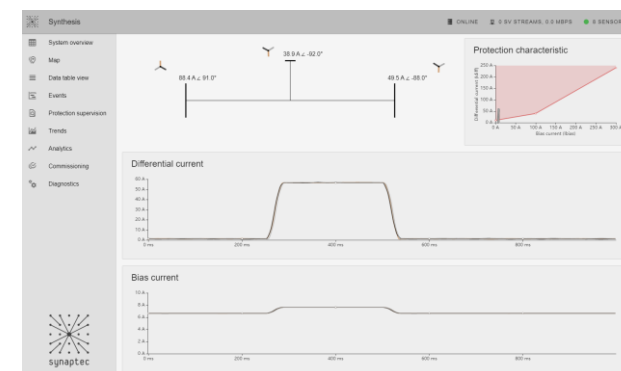
Summary

- Scalable passive power system control
- Repeatably safe and reliable retrofit
- New visibility of termination overheating
- New PQ insights to reduce O&M cost

Asset management

Real-time monitoring

Time-critical control and protection





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