Electricity Distribution

Pre-Fix Project

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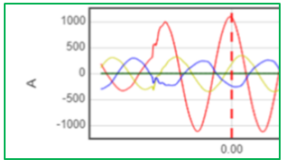
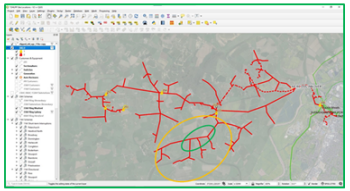
Project Overview

Key Enablers

- High resolution monitoring
- Price Point
- Automation
- Operational information output

Stack value from existing equipment





Interoperability

Detect Pre-Faults

Proactive Network Repair

Reduce CI/CMLs

Increase customer satisfaction

Pre-Fix System Overview

Smart FPI/ APRS/ Recloser

Smart FPI/ APRS/ Recloser

Primary S/S

Smart FPIs

VT

PQUBE

RTU

Smart FPI

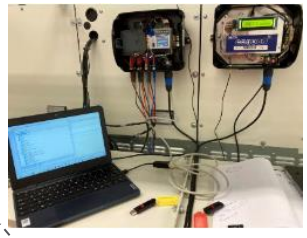
GIS/INM

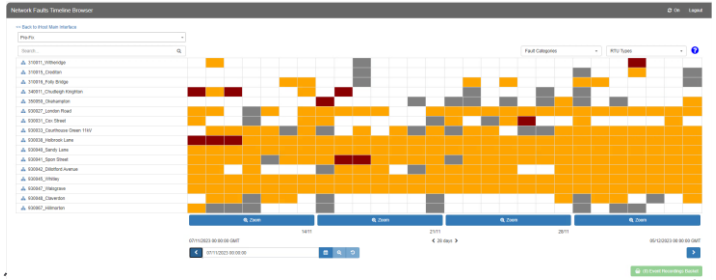
Common Disturbance Information Platform

Processing & Analysis

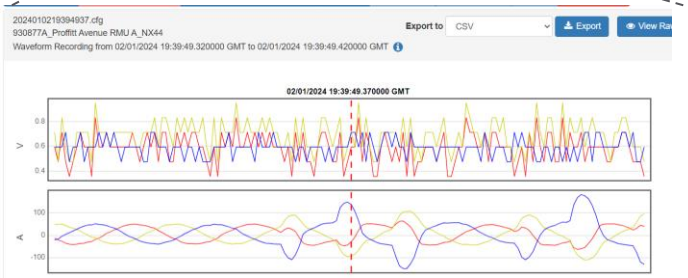
Reports

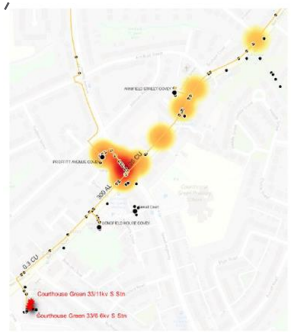
Pre-Fix Processing & Reports



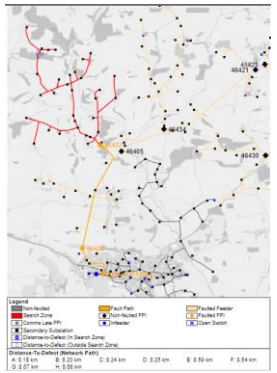


Waveform capture, triggers and filtering → Data Processing → C-DIP Processing → Distance to Pre-Fault/fault Algorithms → Pre-Fault/Fault Visualisation





Current Magnitude



Results – Pre-fault

Is there a pre-fault? → Where is the pre-fault? → How long until it faults?

Successful pre-fault prediction based on correct circuit section being identified.

	Pre-Fault
Underground Cable	10/12*
Overhead line	14/17
Total	**24/29**

*The two incidents were not automatically processed due to filtering.

Pre-Fault Location Example

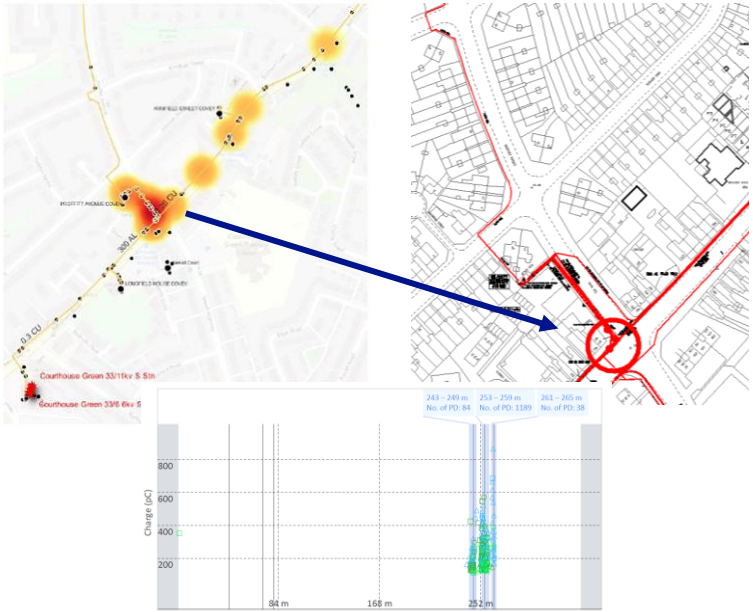
U/G Circuit in Coventry.

Ranging of defects based on current magnitude from captured waveforms identified 3 pre-fault locations.

The circuit faulted in August 2023, within the same circuit section as predicted.

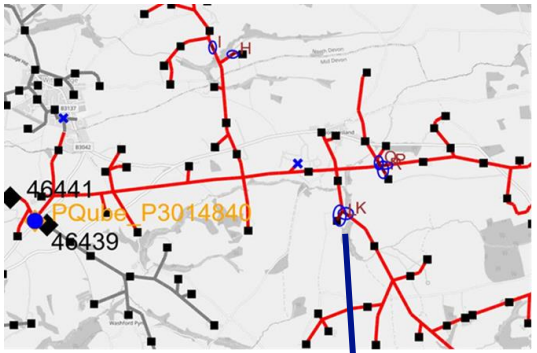
Pre-Fault Location Validation

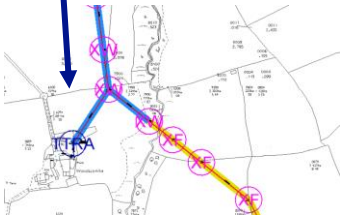
Underground Cable Network



On a circuit section in Coventry, Partial Discharge was found at a joint location, matching Pre-Fault Predictions.

Overhead Line Network

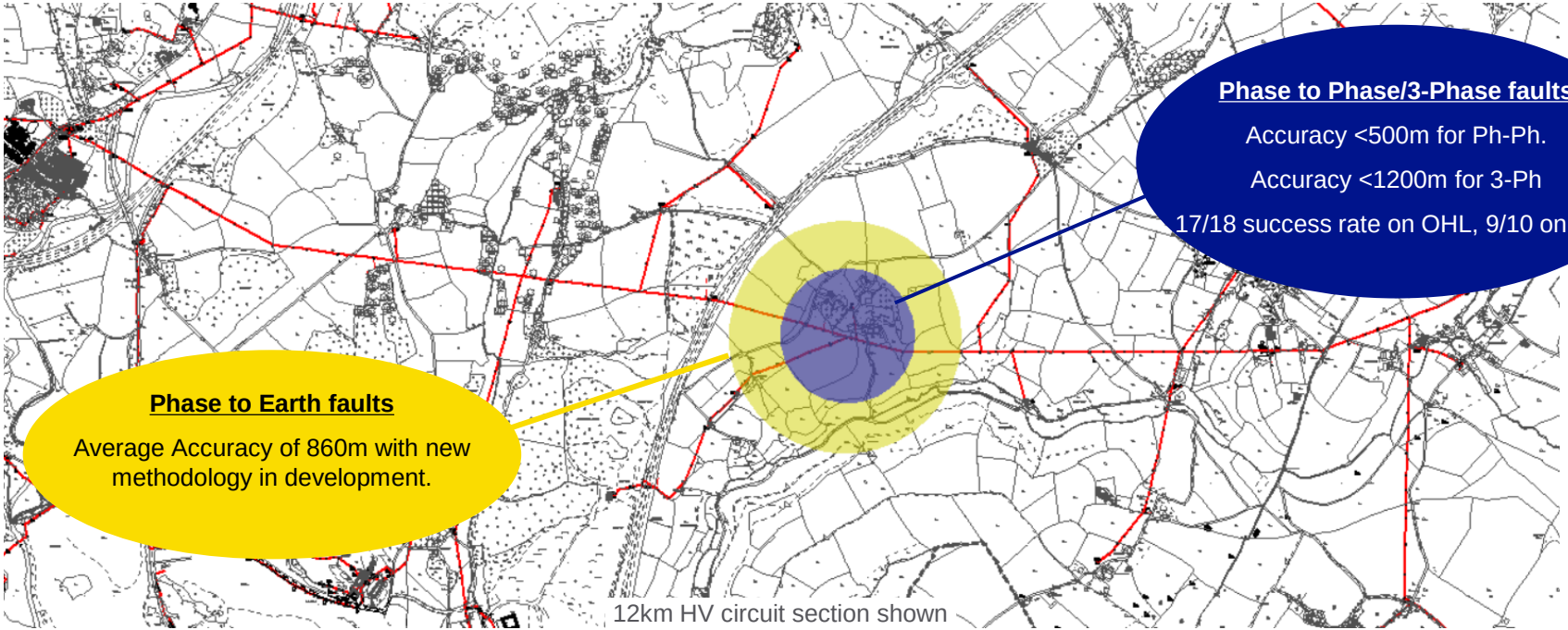




Overhead line pre-fault was detected which informed a helicopter patrol. Trees were found in contact with OHL in predicted pre-fault location.

Results – Post Fault

Where is the Fault ? → Send Field Staff Here



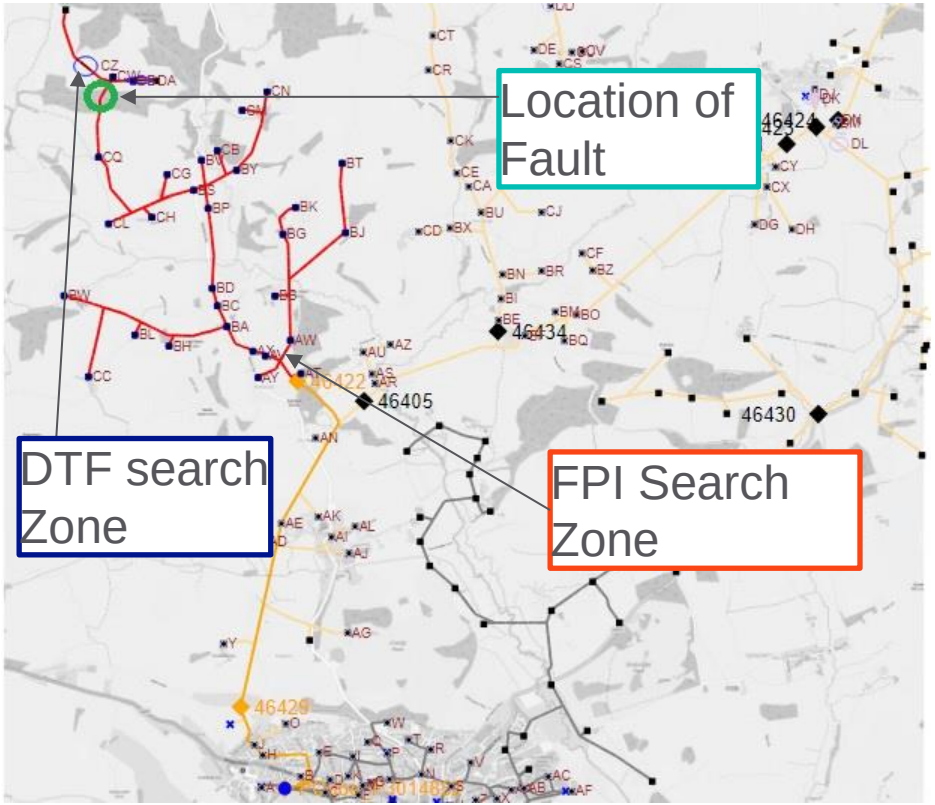
Post Fault Location Example

Conductors down on an OHL circuit in the South West.

Pre-Fix system was able to provide:

- Indicated Search Zone (in red)
- Fault location prediction based on distance to fault algorithm.

24 metres from actual fault

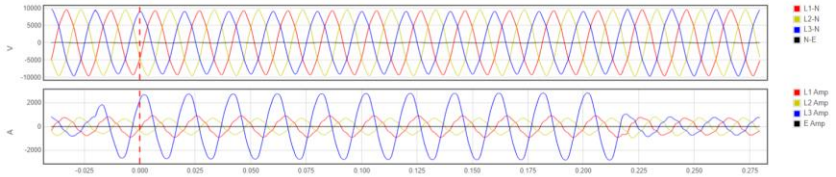


Key Learning

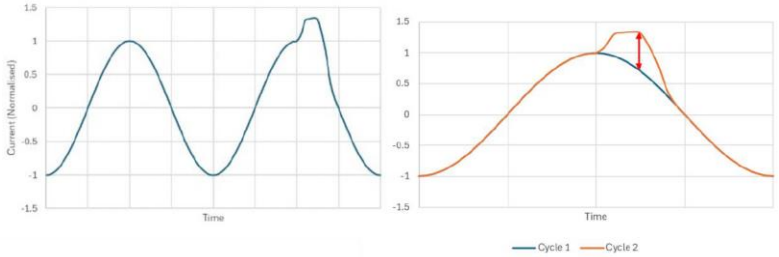
PQM cross-triggering from Fault Passage Indicators

Direct Trigger

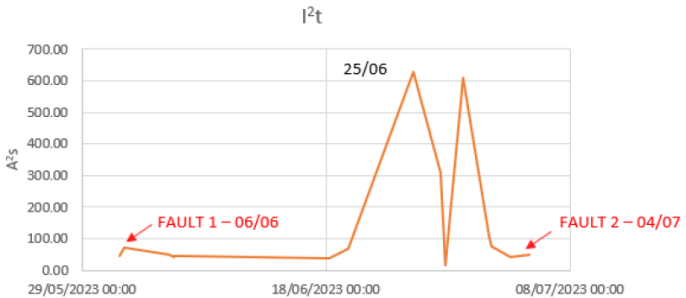
Waveform Classification and New Archetypes



Waveform distortion based triggers



Time to Failure Key Indicators



Operational and system learning reports the from field trial can be found on the Pre-Fix project website.

Next Steps

- **NGED funded expanded trial:**
  - Prove the system across multiple locations/geographies. An additional 19 sites (36 in total)
  - Integration of system into operational processes and procedures.
  - Track and measure benefits to inform business roll out.

- **Follow-on NIA projects:**
  - HV Pinpoint:
    - Develop a methodology for detection and precise location of pre-fault events in the HV underground network.
    - Used in conjunction with Pre-Fix information.
  - HI-5:
    - Longitudinal study into HV cable pre-faults to improve time-to-fail predictions.
    - Network sample size selected to give results statistical significance.

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