# Safeguarding a 27 km Pipeline with DAS
Thailand

A natural gas pipeline operator in Thailand sought out a monitoring solution to protect a 27 km pipeline from Third Party Interference (TPI). Due to the impracticality of having employees patrol an entire pipeline 24/7, an advanced and intelligent solution was needed. AP Sensing's fiber optic Distributed Acoustic Sensing (DAS) technology provides true signal linearity over distance, time and acoustic intensity. Utilizing sophisticated software and machine learning algorithms, the operator detects TPI events such as excavator digging, moving and tapping, as well as manual digging and vehicle movement.

One 70 km AP Sensing DAS unit is used to monitor the pipeline with one channel in a non-redundant setup. The pipeline runs from BV 4.11 to BV 4.9 and is buried at a depth of about 1.5 to 2 m, passing through various soil types and crossing several roads. The diameter of the pipe is 42". An existing telecommunications fiber was already installed along the pipeline, meaning DAS was the best possible solution to monitor this pipeline for TPI, and setup and testing were done with ease.
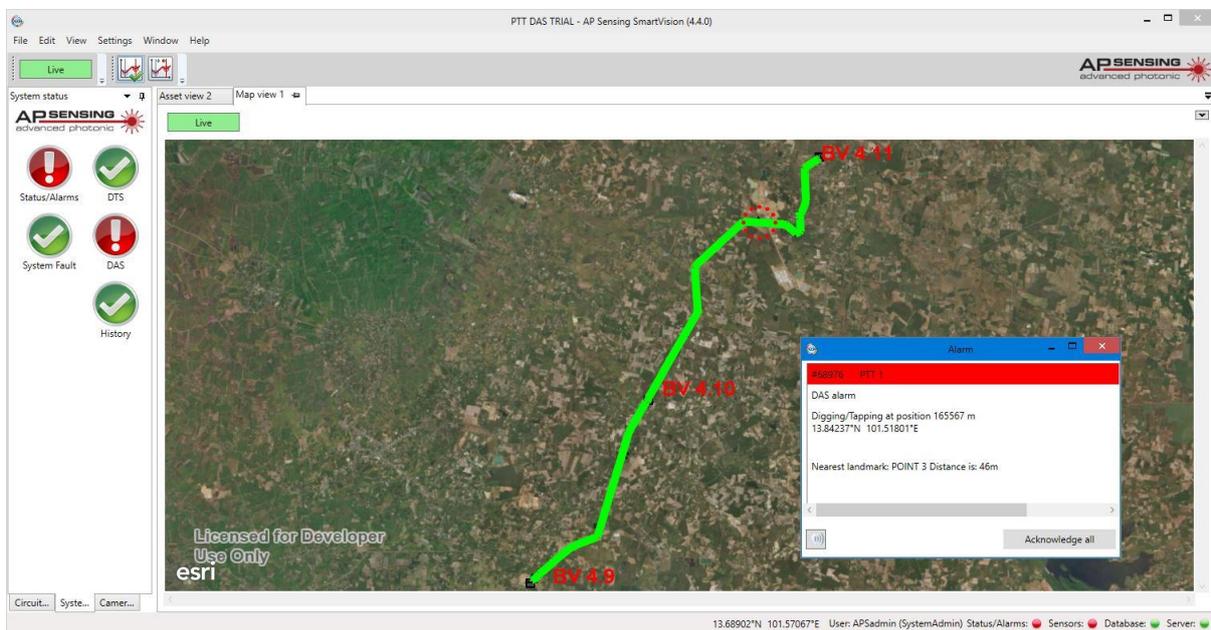
Pipeline route from BV4.11 to BV 4.9; AP Sensing's MapViewer shows Third Party Interference (TPI) event

The client conducted various DAS trials in 2019 to compare AP Sensing to competing systems. In the end, the company selected AP Sensing and is very happy with the results, with forthcoming plans underway.

Leading the Way with Passion.

Trials

In August 2019, excavator digging and tapping tests took place to check the performance of the DAS system. The AP Sensing system successfully detected all intrusion activities, including mechanical digging, manual digging, car movement and excavator movement. These took place at various distances, from directly along the pipeline to 10 m away.

During this trial, blind tests were carried out in different locations. There were "no event" instances as well as manual digging, excavator moving and excavator digging activities. All these events were successfully categorized and detected by the system.

*Excavator Digging & Tapping Test for 5 m and 10 m away from the fiber*
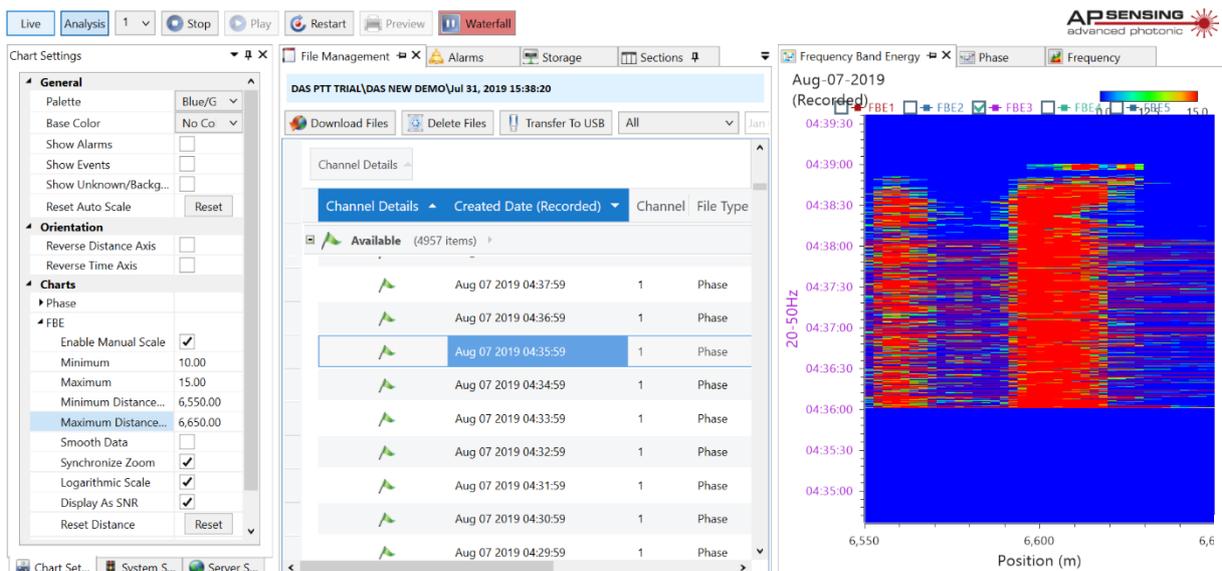
DAS Technology

On further analysis of the data collected, AP Sensing 2P Squared DAS was able to demonstrate pattern recognition as shown below. Utilizing machine learning algorithms, the system triggers alarm according to the event.
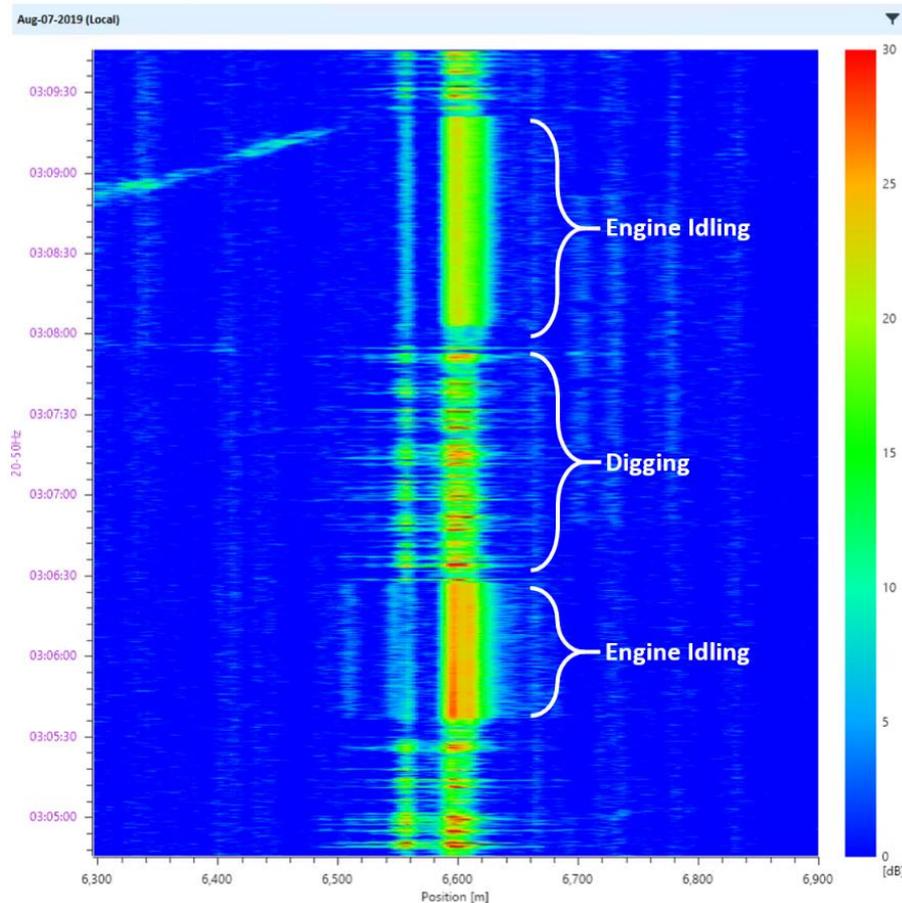
DAS technology is based on Optical Time Domain Reflectometry (OTDR) technology and on the Coherent Rayleigh effect, which is stimulated by minute strain changes in the fiber as a consequence of acoustic or vibrational activity. A DAS installation is like having a very long microphone chain operating over several kilometers that detects only the acoustic signals that it is instructed to detect.

A DAS waterfall screen distinguishing between Excavator Engine Idling or Excavator Digging

AP Sensing utilizes a phase-based DAS as opposed to one that uses amplitude measurements. This enables highly sensitive measurements with advanced signal processing and machine learning techniques. Robust algorithms classify TPI events to distinguish between normal activity and potential threats to the pipeline. The AP Sensing DAS solution delivers a very high Probability of Detection (PoD) to keep false alarms at a minimum.

Pipeline Monitoring Technology

As a supplement, the client also implemented AP Sensing's SmartVision asset visualization software. SmartVision offers at-a-glance monitoring of the entire asset, keeping operators informed of all alarm conditions and threat locations, and enabling quick and informed decision making in critical situations.