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Capabilities of fibre optic cables to characterize seismic and explosion events – Case study in an underground laboratory

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Distributed Acoustic Sensing (DAS) technology using fibre optic cables presents a promising tool for detecting, locating and characterizing seismic events, including explosions. This study, based on a real experiment, assesses DAS's capability to enhance nuclear-test-ban monitoring, aligning with CTBT goals. With its ability to transform fibre optic infrastructure into extensive arrays of virtual sensors, DAS can provide high coverage monitoring suitable for remote or restricted areas. This ability presents a game changing alternative to conventional seismic networks.

The Premise-2 experiment, conducted at the Low-Noise Underground Laboratory in Rustrel (France), investigates seismic measurement using fibre optic (DAS), with a comparison to a dense network of traditional sensors (seismometers and accelerometers). This experiment includes both active and passive seismic acquisitions, recording background noise and controlled signals. The experiment involves multiple fiber types and installation methods to examine their impact on measurement precision and signal quality, providing insights into optimizing DAS configurations for nuclear test monitoring. This technology generates a huge data volume and addresses new challenges, necessitating the development of new algorithms and workflows.

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