# Fit for Purpose Microseismic Design

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## Abstract

Microseismic monitoring has become a valuable tool for fracture monitoring, reservoir characterization, environmental warning systems. The requirements in terms of acquisition and processing are different within this wide range of applications.

For fracture characterization, a low detection and location magnitude threshold must be achieved (magnitude -2.2 to -2.4) in order to insure that the dataset will accumulate a sufficient number of events. Reaching this magnitude threshold for the target area is problematic for surface monitoring since the amplitude of the seismic signal is significantly reduced along the path from the reservoir to the surface while the seismic noise level is high. Small magnitude events will be more easily detected and located with borehole-recorded data but the magnitude of completion could still be relatively high; moreover, a complex acquisition geometry is necessary to provide enough information for retrieving event attributes related to the source mechanism, attributes that can be used for reservoir modeling and integrated interpretation. At the other end of the spectrum, when monitoring for environmental concerns, a high magnitude threshold is sufficient but a large area must be covered with even and well documented reporting quality.

Microseismic monitoring project planning includes a design component meant to match the requirements related to the monitoring objectives with practical technical constraints. The limitations for the processing and interpretation of borehole data are mainly due to the limited aperture and high waveform complexity. The signal-to-nose ratio is the main parameter that determines in a first approximation if surface monitoring is possible. The results of the field projects that follow the feasibility studies provide the information to validate the methodology and understand better the limitations and the requirements depending on the objectives for microseismic monitoring.