nanometrics

SEISMIC SOLUTIONS TAILORED TO YOUR MONITORING OBJECTIVES

Passive seismic

Surface microseismic

Engineering seismology

SEISMIC MONITORING SERVICES

Custom solutions tailored to your monitoring objectives.

Building on over 30 years of seismic instrumentation development, Nanometrics has evolved into a market leader in turnkey seismic monitoring for the energy production sector. As one of the world's largest seismic network operators, we offer proven network design methodology, station deployment and network maintenance capabilities and extensive in-house data processing and analysis experience… everything to expertly and cost-effectively meet all your monitoring needs, including compliance with the latest regulatory requirements, so you can focus on your core business.

‣ **15**
of our regional and national turnkey seismic networks are in operation around the world

‣ **300+**
real-time seismic stations currently under our management in North America and the Middle East

‣ **99+%**
average annual data availability in networks under our operation

Strategic intelligence, fueled by science

INDUCED SEISMICITY MONITORING (ISM)

Our decades-long pedigree in earthquake seismology means we're on the leading edge of technical innovation and evolving industry demands.

1st

to introduce regional traffic light protocol monitoring in Canada

Nanometrics provides customizable seismic monitoring solutions that are tailored to your monitoring objectives. With decades of experience in the study of seismicity, we are able to provide fast, accurate and complete seismic information for passive and induced applications.

Nanometrics' turnkey monitoring solutions use our proprietary broadband arrays with the latest state-of-the-art event detection, communication and advanced AI data processing technology.

We manage all aspects of the network design, permitting, installation, commissioning, data acquisition and processing to enable you to focus on managing risk and business continuity.

BE REGULATION READY IN HOURS, NOT WEEKS

Our stations

Our seismic stations provide continuous operation and uninterrupted data streaming, via a cellular data connection to our cloud-based data center, year-round in any weather condition. Through the use of network performance modeling we maximize the cost effectiveness by ensuring the minimum number of stations are used to meet your monitoring criteria.

Our scientific and operational experience in seismology means we work closely with industry groups, academia and researchers to stay abreast of regulatory discussions and ensure our systems are ready for any potential changes in regulations.

‣ **3-4 hours**
to install one of our autonomous ISM stations

‣ **0 hours**
lost time by our field crews due to an HSE incident

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CRITICAL INFORMATION AT YOUR FINGERTIPS

Our software

The Athena Data Management System is included as part of our seismic monitoring solution, allowing you to browse up-to-date event catalogues, view all recorded event source parameters and waveforms, select and download sections of the catalogue, plot frequency/magnitude relationships for event clusters, examine maps showing distribution of ground motions from each recorded event and track network seismicity rate to manage risks associated with induced seismicity in real time.

Notification alerts are available within minutes of an event and can be customized for specific criteria and event thresholds.

- ▶ **IS management**
- ▶ **3D event seismicity displays**
- ▶ **Stress variations**
- ▶ **Fault and lineament mapping**
- ▶ **Ground motions**
- ▶ **Waveforms**
- ▶ **Magnitudes**
- ▶ **Locations**
- ▶ **Rates of seismicity**
- ▶ **B-values**
- ▶ **Moment tensors**

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24/7

monitoring and on-call service

<2 minutes

for automatic event detection & notification

<30 minutes

for manual review of critical events

Data you can trust to make operational decisions

Our 24/7 cloud-based data center offers data recording, transmission, advanced processing, analysis and customizable notification services.

Nanometrics industry-leading, supervised Machine Learning algorithm, AI Analyst, can now match the accuracy of a live analyst for well constrained events. AI Analyst greatly reduces pick time, increases accuracy and limits analyst bias which enables complete, accurate and consistent assessment of target region seismicity in near real-time. This advanced processing is now included as a standard feature with all Nanometrics monitoring services.

Automatic data processing results from all of our networks undergo additional manual verification by staff at our data centre. Our staffed data center is also ready to provide data analysis at a moment's notice for consultation during operational activities.

MICROSEISMIC MONITORING

Passive Fracture Imaging - A complete understanding of your reservoir management & well completions

Fast, Accurate, and Complete
Machine learning workflows and data processing maximize data and reduce turn-around time, getting you actionable results, quickly.

Improve Decision-Making
Faster results mean that key decisions can be made earlier in the development cycle, reducing drilling and completion costs

Optimize Your Operations
For a fraction of the cost of traditional microseismic surveys you can evaluate your drilling and completions design quickly and easily.

Low Environmental Impact
The lower station count compared to traditional surface acquisitions reduces the environmental footprint while also reducing field exposure and acquisition cost.

Reduce Risk
Combine PFI with real-time induced seismicity monitoring and risk mitigation via the industry's first seismicity management dashboard.

▶ *A turnkey service that makes hydraulic fracture monitoring easy and affordable.*

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▸ Flexible station design combined with Machine Learning accelerates the understanding of your well completions

The combination of the station design and advanced image-based processing provides quick and detailed completion insights which can be used to improve future completions by optimizing drilling and completion parameters such as number of stages, distance between wells and pump times.

The novel surface-based station acquisition design and advanced noise suppression techniques, rooted in machine learning and AI, achieves superior results with fewer stations than conventional surface or downhole deployments. The array can detect events down to or below M-2.0, providing all of the microseismic information required to make important operational decisions.

This leading-edge PFI surface microseismic solution can easily be customized to meet any microseismic detection requirements. By combining a low station footprint with beam-forming processing PFI provides more detectable, locatable, and reliable events with an approachable and scalable service.

SUBSCRIPTION ARRAYS

Our subscription arrays are the most cost-effective way to monitor seismicity and manage risk. In fact, the performance of our subscriber arrays exceed current regulatory requirements.
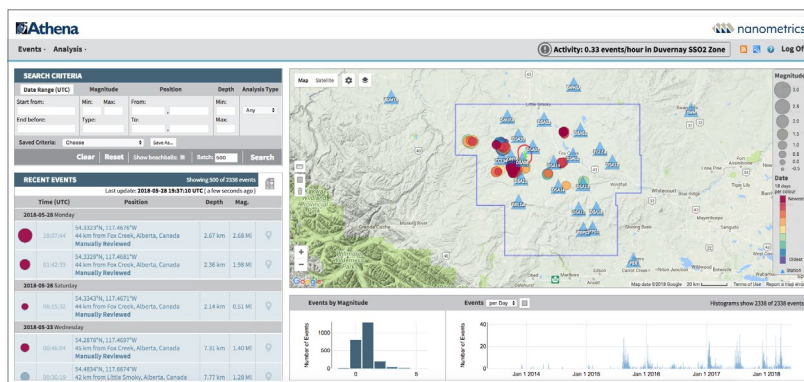
Why subscribe?

- Higher station density and higher monitoring resolution than public arrays

- Flexible subscription term

- No installation or decommissioning costs

- No array expansion costs

- Best-in-class instrumentation

- The same level of service as private arrays

‣ **1st**

to introduce subscription arrays

‣ *Higher monitoring resolution is the key to using seismic data to assist with real-time risk management.*

‣ *We own the equipment and take care of its installation and maintenance. We pay for new stations as needed to cover new subscriber land holdings.*

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▶ We have a number of subscription arrays across North America, ask a sales representative for more information on subscription options in your region

Each subscriber receives:

- High-quality baseline, frac and post completion data, supplemented by data from public stations in the area
- 24/7 central site data acquisition, processing and notifications, including event source parameters and ground motions
- Access to your own private web portal (Athena) for an unlimited number of users. And only you will have access to the data about smaller events on your holdings.

Optional add-ons:

- Shake maps
- Raw waveforms
- Advanced seismic processing:
  - Subspace catalogue enhancement
  - Double difference relocation
  - Moment tensor inversion
  - Deployment of additional subscriber-specific temporary stations

Strategic Intelligence Fueled by Science

Custom solutions tailored
to your monitoring objectives

Advanced signal processing

Manage induced seismicity
risk in real-time

DISTINGUISH natural from
induced seismicity

EXCEED regulatory detection
limits to manage risk and avoid
shutdowns

MEASURE the impact of
detected seismicity via real-time
ground motion measurements
and reports

DELINEATE faults and gain
insight into geomechanical
properties of target reservoirs

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