

## BACKGROUNDER

May 21, 2020

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## COSMIC-RAY MUON TOMOGRAPHY: HOW DOES IT WORK?

Canada's Ideon Technologies Inc. is a world pioneer in the application of cosmic-ray muon tomography and has developed a discovery platform that provides x-ray-like visibility up to 1 km beneath the Earth's surface.

### What is a muon?

A muon (pronounced *myoo-aan* and named for the Greek letter mu ( $\mu$ ), which is used to represent it) is a naturally occurring sub-atomic particle produced by cosmic rays striking the Earth's atmosphere. These rays are not harmful to us or any other life on the surface of Earth. Muons pass through the surface of the Earth on average about once per minute for every square centimetre.

### What is muon tomography?

Muons lose energy progressively as they pass through the Earth's surface. As they encounter higher-density material, muons lose energy at an accelerated rate, which reduces their intensity. The intensity, and hence the density of the materials encountered, can be measured. Muon tomography maps the intensity of cosmic-ray muons underground, measuring the physical properties in a targeted search area, much like medical tomography images the interior of the body using x-rays. The resulting images are combined to produce a 3D model of any anomalies present.

"Geotomography" is tomography specific to the Earth.

### What is the Ideon Technologies muon tomography discovery platform?

Ideon's proprietary detectors, imaging systems, inversion technologies, and artificial intelligence techniques generate 3-dimensional density signature maps that reliably identify underground anomalies, clearly distinguishing them from their surroundings. When working with clients, Ideon delivers a full survey design, analysis and a 3D density model of the surveyed area, which is then integrated into industry-standard software packages.

### How does it work?

1. Muons travel in straight lines from cosmic rays colliding with matter in the Earth's upper atmosphere.
2. Muons are slowed down as they enter the Earth's surface, as they encounter material of different densities.
3. Subsurface detectors in the survey area measure muon intensity, creating a 60° field of view.
4. The data captured by the detectors is transmitted to the surface, then via satellite to the Ideon cloud.
5. The data is transformed into x-ray-like images of density anomalies in the survey area.
6. Inversion technologies create subsurface 3D density delivered into client software tools.

Read about how the Ideon platform has been deployed in the field and what it has discovered. There are several detailed case studies available at [ideon.ai](https://www.ideon.ai)

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