Development of the DINAMINE technologies

The DINAMINE project is making significant strides in mining innovation. From testing a newly designed jumbo drill rig to developing advanced digital mine models, the project is pushing technological boundaries as it aims for a more efficient, data-driven, and sustainable mining operation of the future.

Continued developments and testing of DINAMINE technologies have for the first time enabled communication between the various technology modules and the integrated mine management system. The project is preparing to test DINAMINE's digital mine planning and managing system at its pilot sites in Norway and Portugal in 2025.

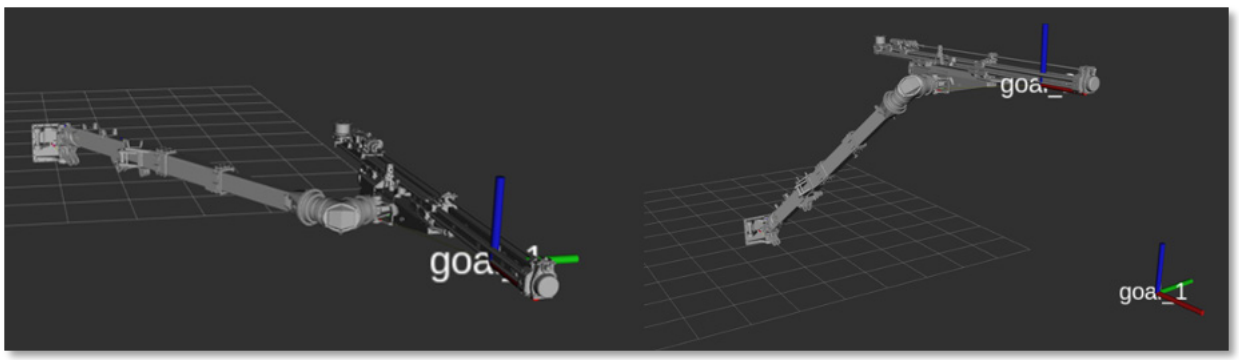
Discover more by reading the 4th issue of the DINAMINE project newsletter!

Drilling jumbo technology

The drilling jumbo has been assembled and is currently undergoing testing at project partner AMV's facilities in Flekkefjord, Norway. The project now has a fully functional drilling jumbo capable of manual drilling.

The AMV drilling jumbo developed in the DINAMINE project will be deployed at the Skaland Graphite project pilot site (Norway)

The drilling boom is also being tested and the team has successfully achieved automatic movement of the boom to simulated coordinates. However, further rigorous testing is required to enhance precision and ensure reliable movements. Achieving the highest possible accuracy is crucial for delivering the desired blast results at the tunnel face.

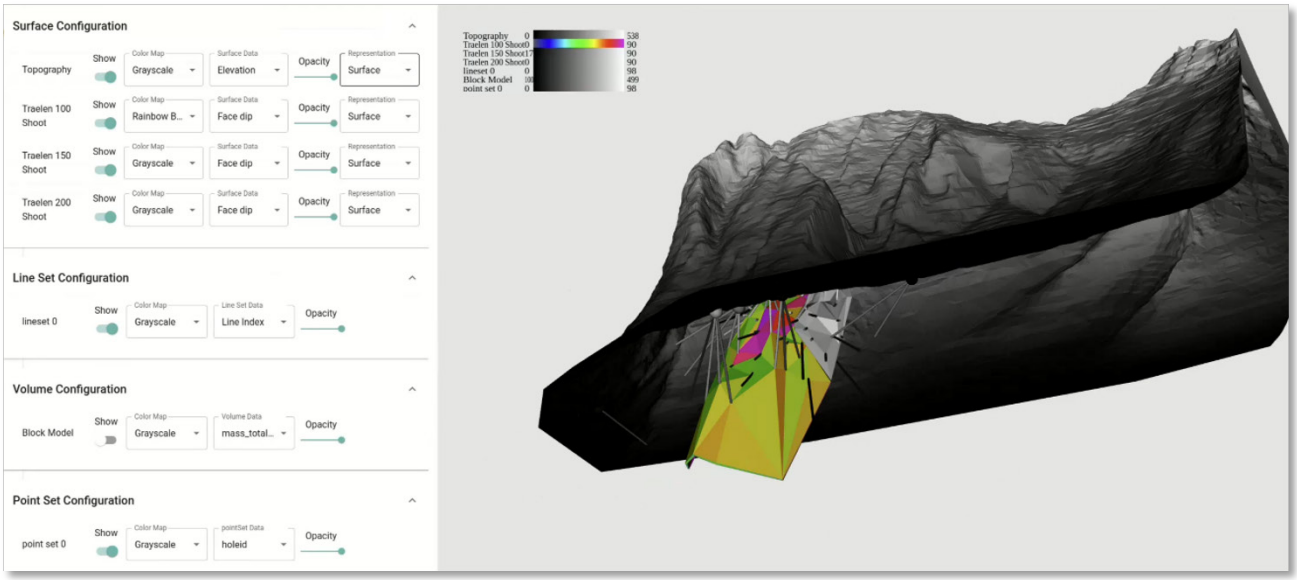


Drilling jumbo boom testing simulation

AMV will continue the development of robotic systems to improve accuracy. In early 2025, the team plans to pre-test the integration of the drilling jumbo with DINAMINE's other technology modules. This pre-deployment testing will ensure seamless operation between the systems before the arrival at the Skaland Graphite project pilot site (Norway).

Mine information model and geophysical characterizarion

The Norwegian Geotechnical Institute (NGI) team has developed the DINAMINE mine information data model, which combines geological and geophysical information to make predictions of the defined mining data in areas which have not yet been mined, using a unique statistical algorithm developed in the project. The model represents the entire rock mass inside the mining zone and is updated with new data in the form of boreholes or mapped points representing specific geological boundaries. The model relies on data from several aspects of the mining operation value chain, including drilling and blasting, mineral processing, and exploration.

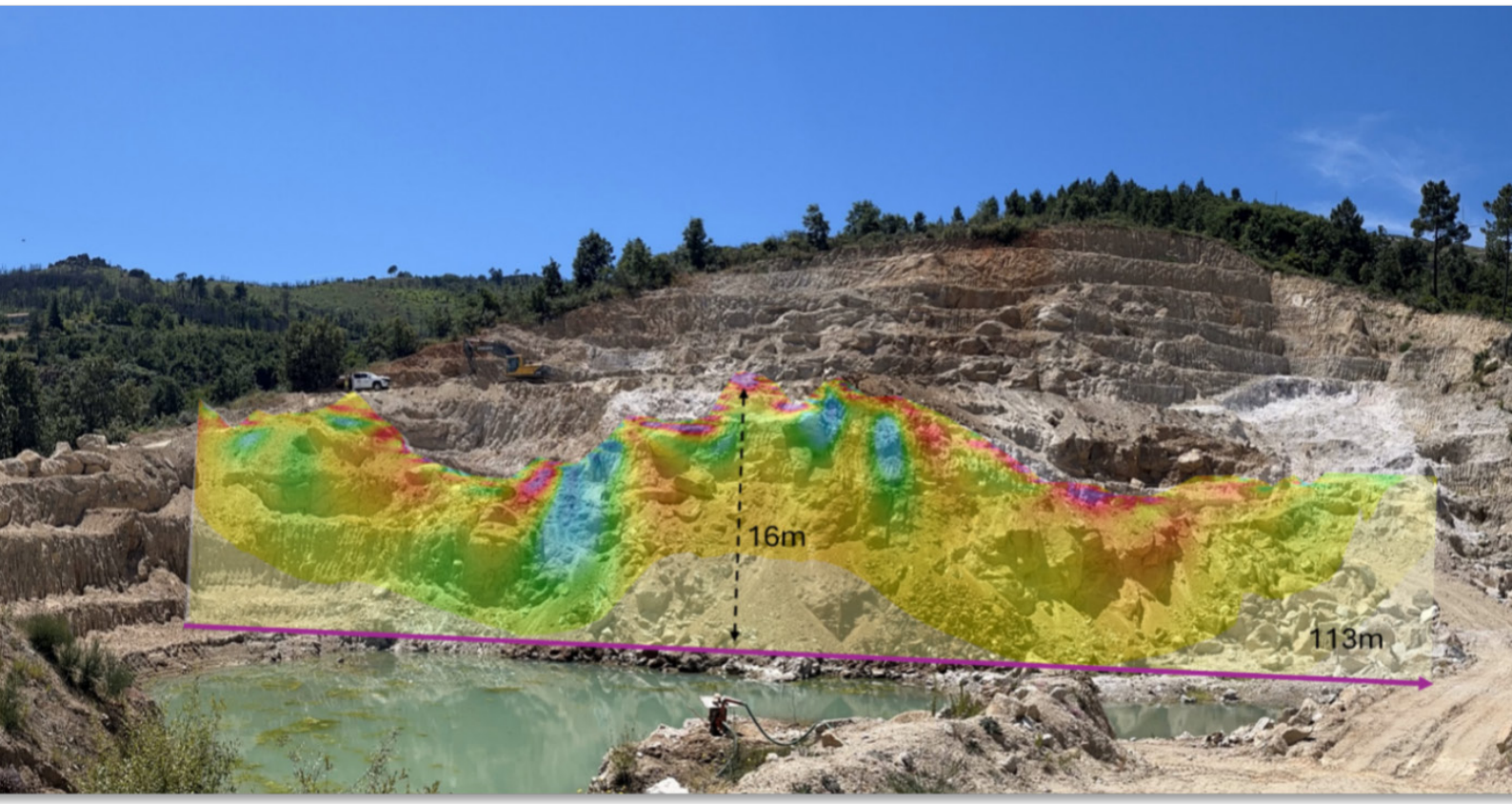


Visualization of the mine information data model for the Skaland Graphite project pilot site.

At the Skaland Graphite pilot site, project partners NGI and Skaland Graphite completed three types of electromagnetic surveys to map the near-mine subsurface to incorporate into modelling and interpretations, in addition to petrophysics laboratory measurements.

Geophysical (Magnetotelluric) measurements were completed at the Skaland Graphite pilot site.

At the Felmica Minerais Industriais pilot site (Portugal), the NGI and Felmica teams used Direct Current Resistivity and Induced Polarization (DCIP), a ground geophysical subsurface mapping method, to map pegmatite deposits in several licensed exploration areas.



Geophysical (DCIP) measurements were completed at the Felmica Minerais Industriais pilot site.

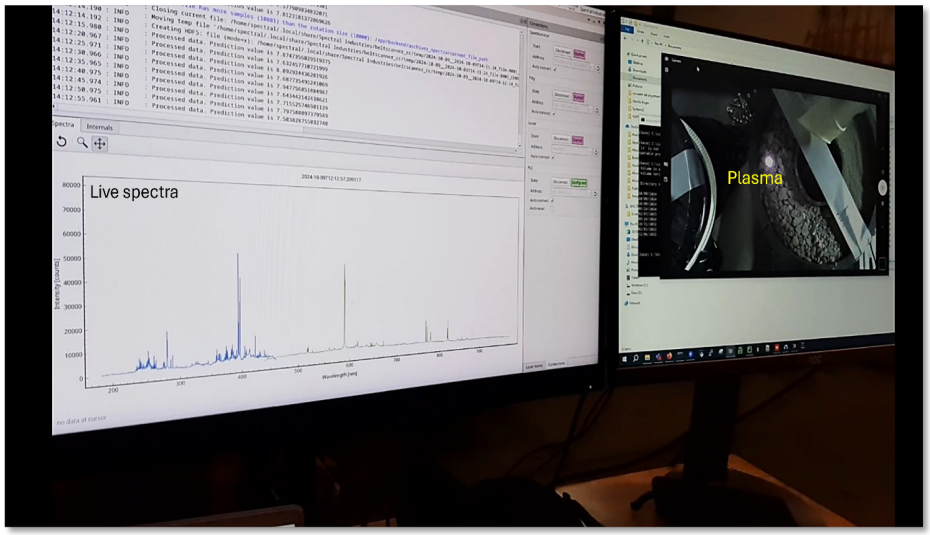
Chemical sensor technology and development of mineral processing model

Project partner Spectral Industries (based in the Netherlands) has developed a set of chemical sensors that use Laser-Induced Breakdown Spectroscopy (LIBS) technology. The LIBS sensors will be deployed at both project pilot sites to measure chemical concentrations of selected elements in several material streams. Conveyor belt LIBS sensors will be installed to monitor input feeds. These customized sensors are now assembled and will be completed and calibrated in the coming months. Both sensors are planned to be operational at the start of 2025.

Conveyor belt LIBS sensors for the analysis of input feed at Skaland Graphite pilot site.

Conveyor belt LIBS sensors for the analysis of input feed at Felmica Minerais Industriais pilot site.

The DINAMINE team is also developing a mineral processing model, which analyses real-time data from the processing plant to estimate the recovery rate, energy and resource consumption during processing in order to optimize the mine performance.



Test measurements using dedicated conveyor belt LIBS sensors.
The right screen shows the LIBS plasma (bright spot) generated by laser irradiation of the rocks, while the left displays the corresponding spectrum information.

Tailings information model

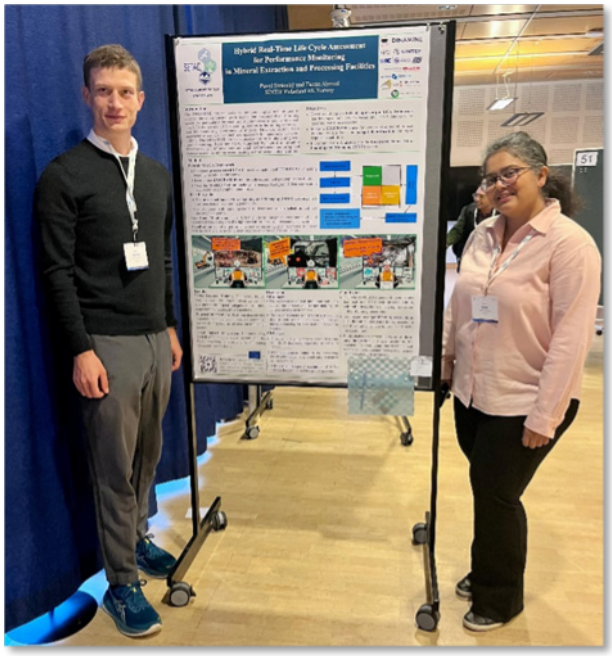
The team conducted preliminary sampling and testing of mine tailings at the Skaland Graphite pilot site and has initiated a larger-scale sampling effort. The first batch of samples has already been analyzed and will be used in combination with on-site chemical testing in 2025 to develop a digital tailings model that will support selective mining practices.

Sampling of mine tailings at Skaland Graphite pilot site.

Life cycle assessment methods

The life cycle assessment (LCA) module in DINAMINE provides insight into the environmental footprint, efficiency, and economic performance of the mining industry. The environmental assessment will identify the most effective ways to increase sustainability, taking into account the entire mining operation value chain. This module approaches a semi-dynamic inventory mapping of all relevant environmental impact data for the mining operation itself from exploration to post reclamation, providing an overview of the mining industry as a whole, and compared with the DINAMINE approach. The LCA technology will allow the project to collect real-time data from the other technology modules to perform a detailed assessment of the environmental footprint of the mining operation.

The research and LCA methodology work from the DINAMINE project has been highlighted in the Life Cycle Assessment community by project partner SINTEF Helgeland (Norway) through participating in national and international events. Notably, the project was represented at the SETAC Europe 26th LCA Symposium, held in October 2024 in Gothenburg, Sweden. This symposium, themed "Making LCA Meaningful: Good Data, Better Models, Sustainable Decisions," provided an excellent forum to engage stakeholders and showcase DINAMINE's innovative approaches to utilizing real-time LCA for sustainable mine management, carbon-neutral logistics, energy-efficient processing, and the reuse of mining waste. The event facilitated valuable discussions and collaborations with professionals from academia, industry, and government agencies, enhancing the project's visibility and impact.



Presentation of DINAMINE at the SETAC Europe 26th LCA Symposium in Gothenburg, Sweden.

System level and connectivity of each of the technology modules

Significant progress has been made towards ensuring the connectivity and interoperability between the various DINAMINE technology modules and the data space of the Integrated Smart Mine Planning and Managing (ISM-PM) system. This represents a crucial milestone in the project, towards a successful demonstration at the two project pilot sites.

Over the past 12 months, the project has transitioned successfully from the design and planning phases to the development of all critical components, creating a platform that is both robust and scalable. The project successfully demonstrated the connectivity between the various modules and the ISM-PM data space, addressing key considerations such as data structure, security measures to mitigate risks from malicious attacks on the online platform, and synchronization to ensure efficient data exchange in this complex environment.

With these developments completed, DINAMINE is moving closer to implementing the ISM-PM system at the pilot sites. This implementation phase will allow the DINAMINE team to evaluate the platform's performance under operating conditions and collect valuable feedback for further refinement and optimization.

Stay tuned for more updates as we embark on our mission to create a mining industry that is greener and more sustainable!

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