DEVELOPING RESILIENT BIO-INSPIRED MODULAR ROBOTIC MINERS

ROBOMINERS

Sensors overview

Final Conference 14 November 2023
Brussels

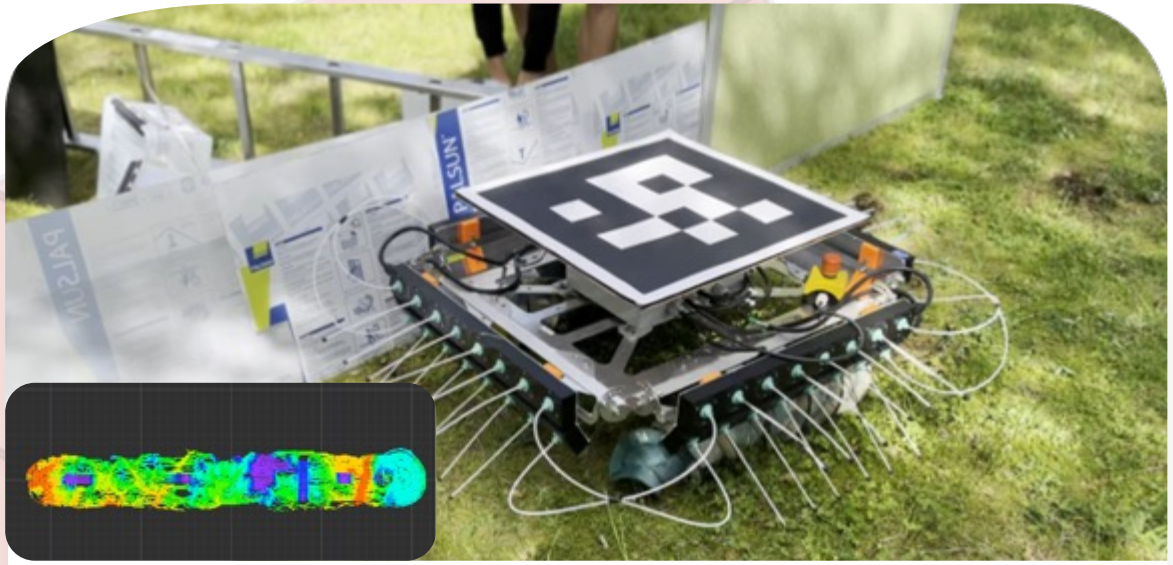
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 820971.

SCENARIOS

- **Clear water, rock face visible**
- Drilling with no fluild, low pressure
- **Good ore/host rock contrast**
- Regular wall surface
- **Mined rock easily transported** via belt system

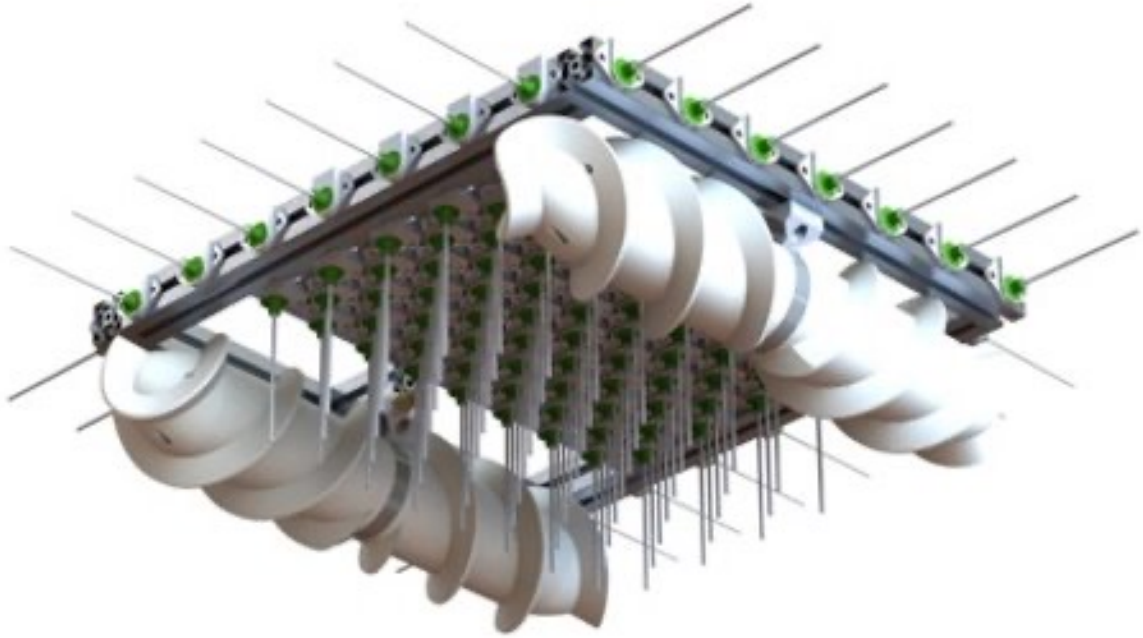
- **Opaque medium**
- Difficult physical access
- **Complex ore**
- Transport pipe with opaque, thick material
- **High pressure, debris and abrasive material**
- **Complex slurry**

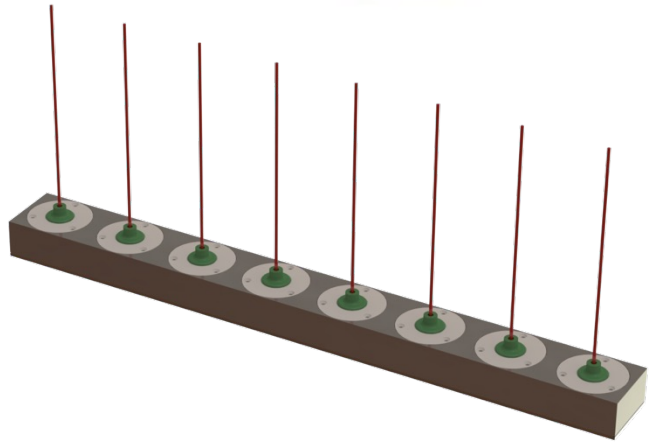
TACTILE MAPPING



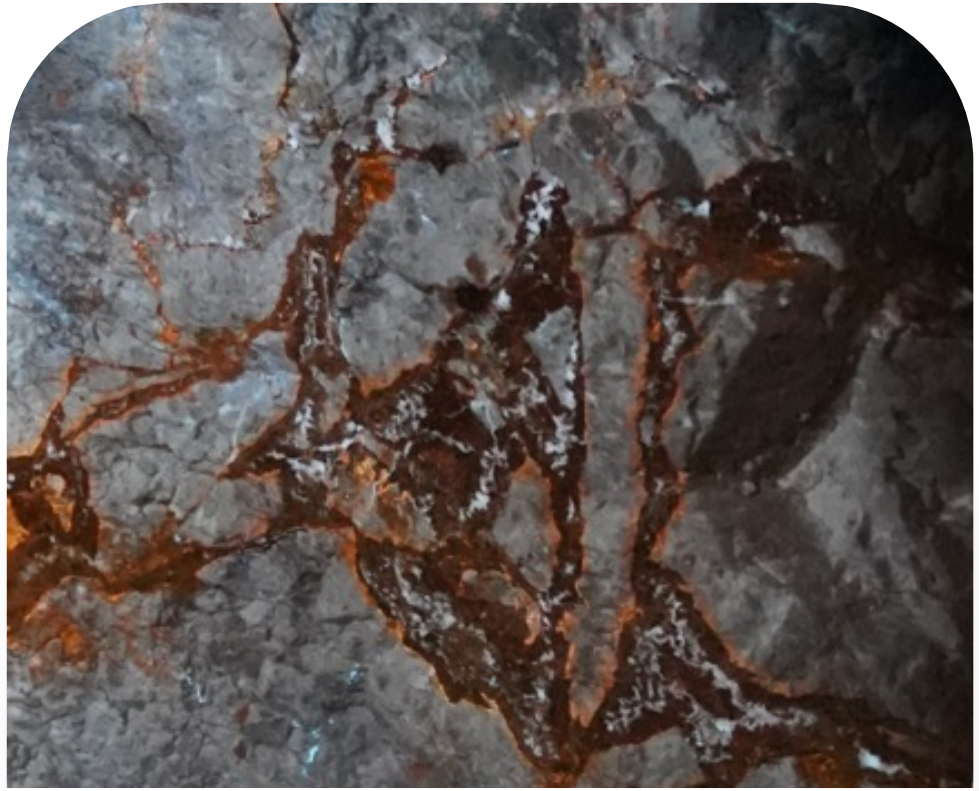
RM3 Mid-range sensor

- Complementary method for visual sensors „filling the gaps“
- Challenges
  - Sensory deprivation
  - Conventional sensors do not work?
  - Few or no reliable landmarks
  - No global reference
  - Dynamic unstructured environment with poor visibility





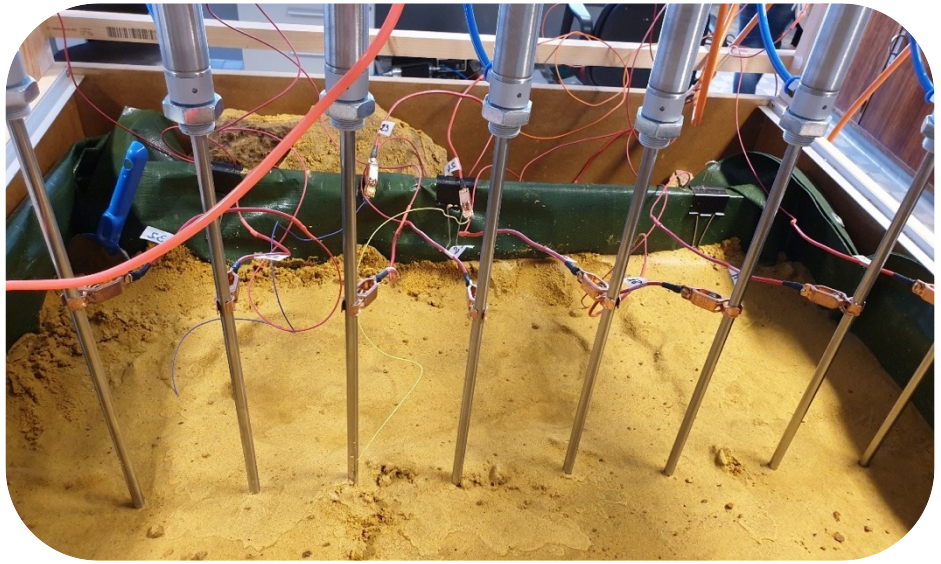
HYPERSPECTRAL MAPPING

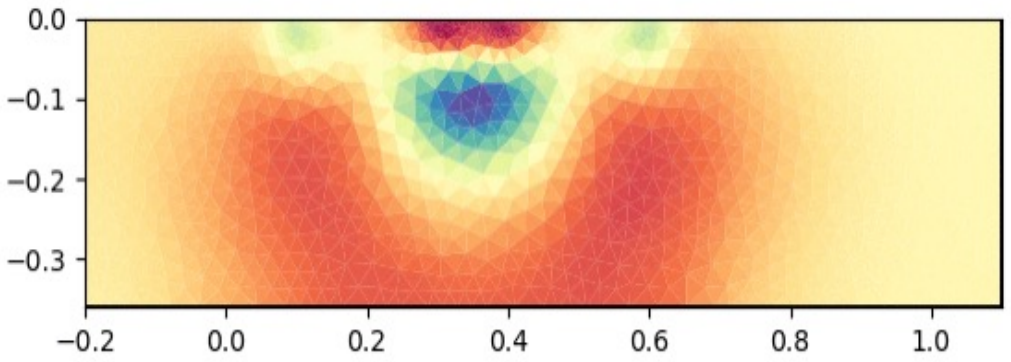


Hyperspectral measurements

- Ultraviolet light help track Sphalerite (ZnS)
- Challenges
  - Miniaturization of hyperspectral cameras
  - Coupling of 2 cameras for extended hyperspectral range
  - Large amount of spectral information
  - Complex ore

GEOPHYSICAL MAPPING

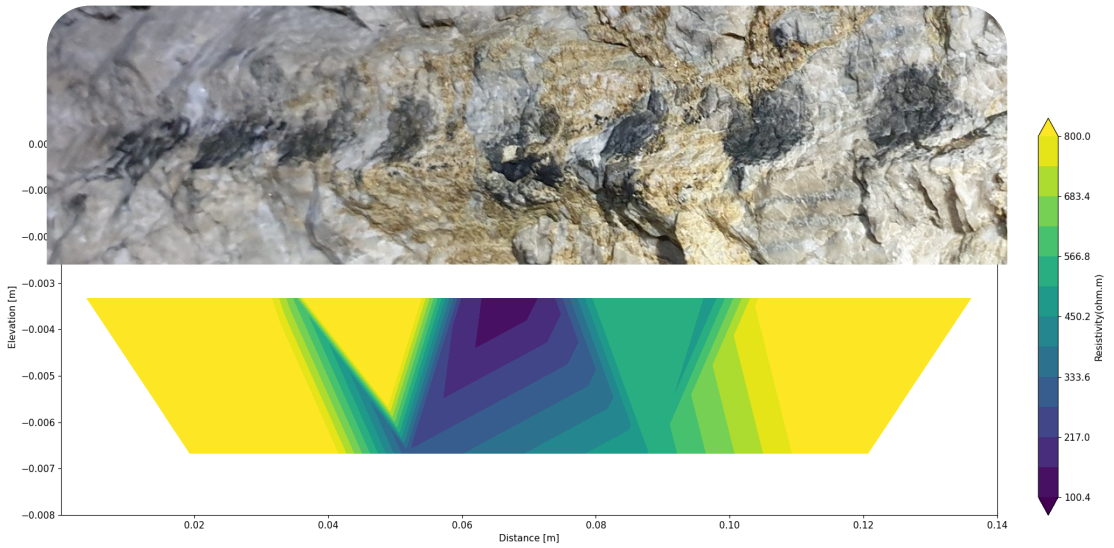




Electric Resistivity and Induced Polarization

- Piston mounted electrodes
- Using the ore vein as medium
- Challenges
  - No rock penetration
  - Use of pressure and slurry for contact
  - Small/irregular electrode spacing

GEOPHYSICAL MAPPING



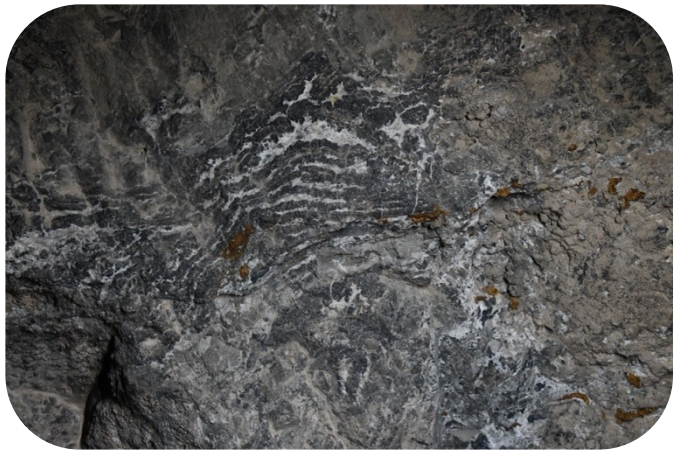
Electric Resistivity and Induced Polarization

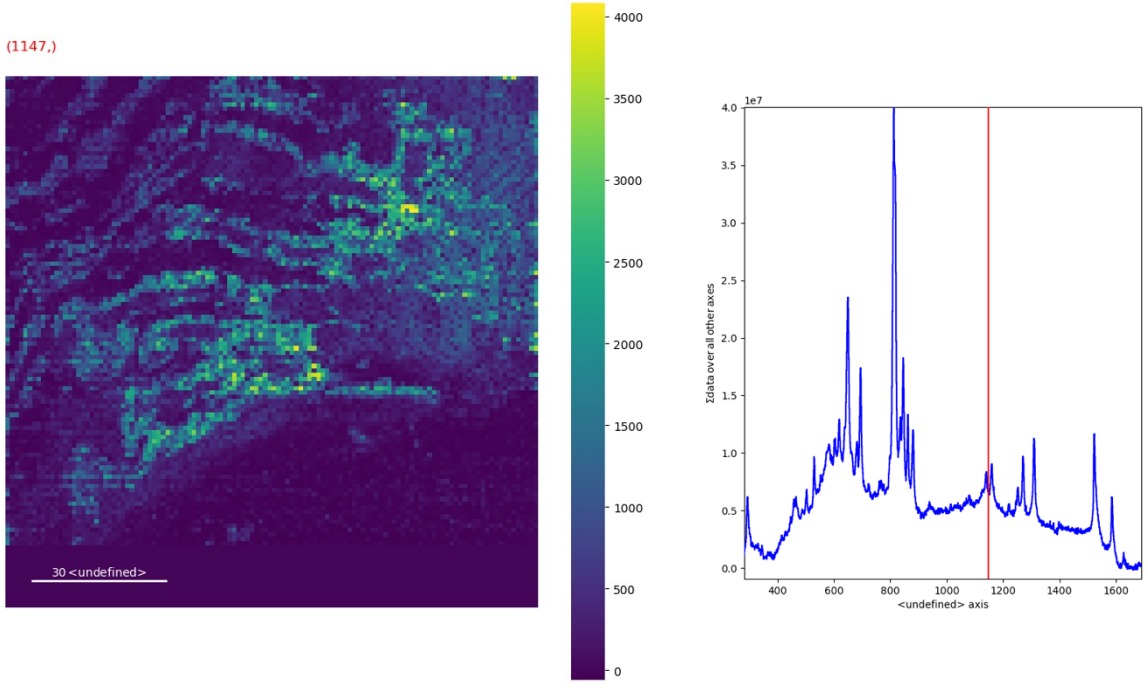
- Detailed mapping for ore following
- Using the ore vein as medium
- Challenges
  - Robotic arm pressure
  - Interface with the wall mine (graphite electrodes)
  - Small electrodes spacing

LIBS – Laser Induced Breakdown Spectroscopy

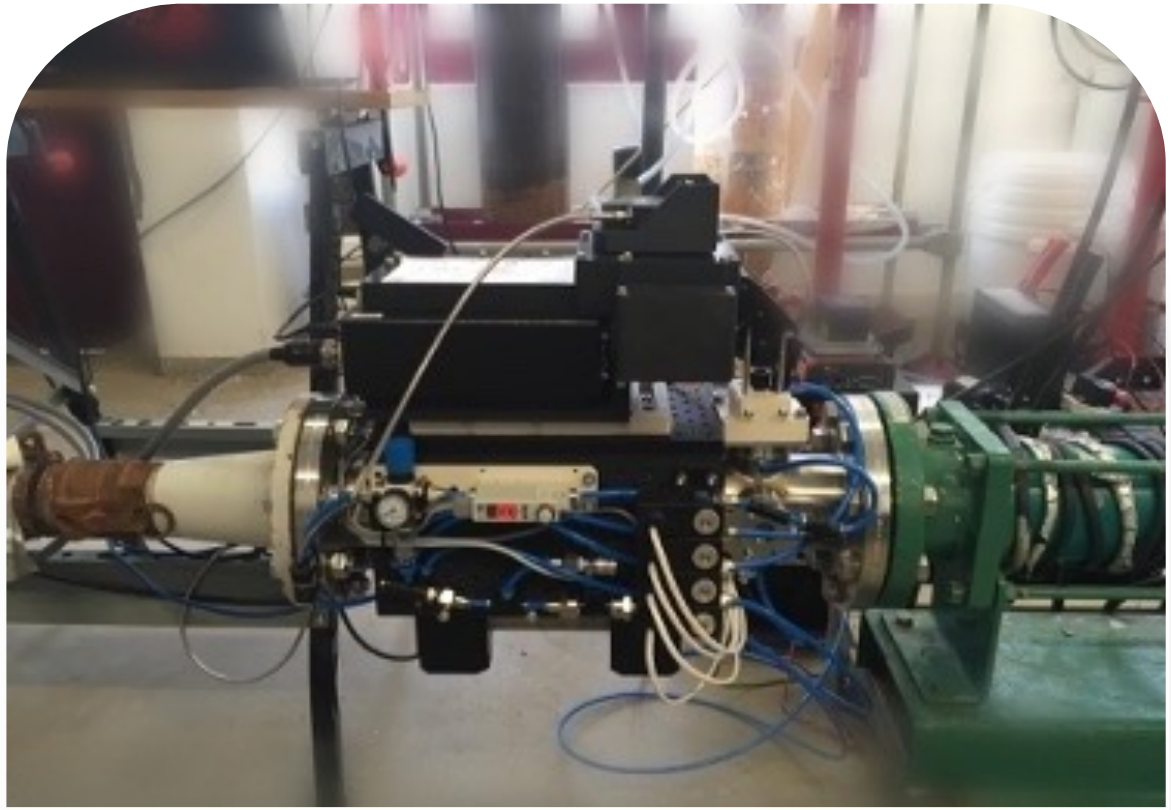
- Mine wall chemical mapping with LIBS
- Challenges
  - Rock face visible
  - Good ore/host rock contrast
  - Irregular wall surface

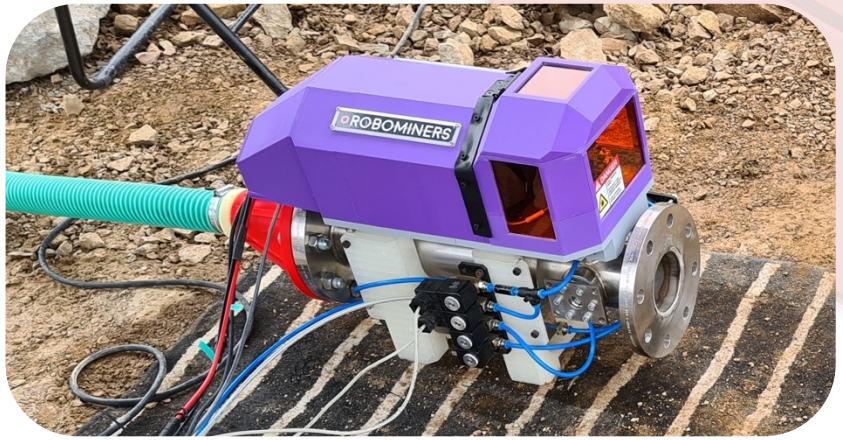
LIBS MAPPING dry

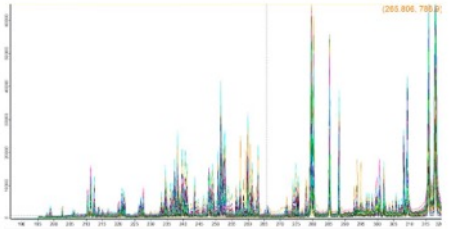




LIBS MAPPING wet



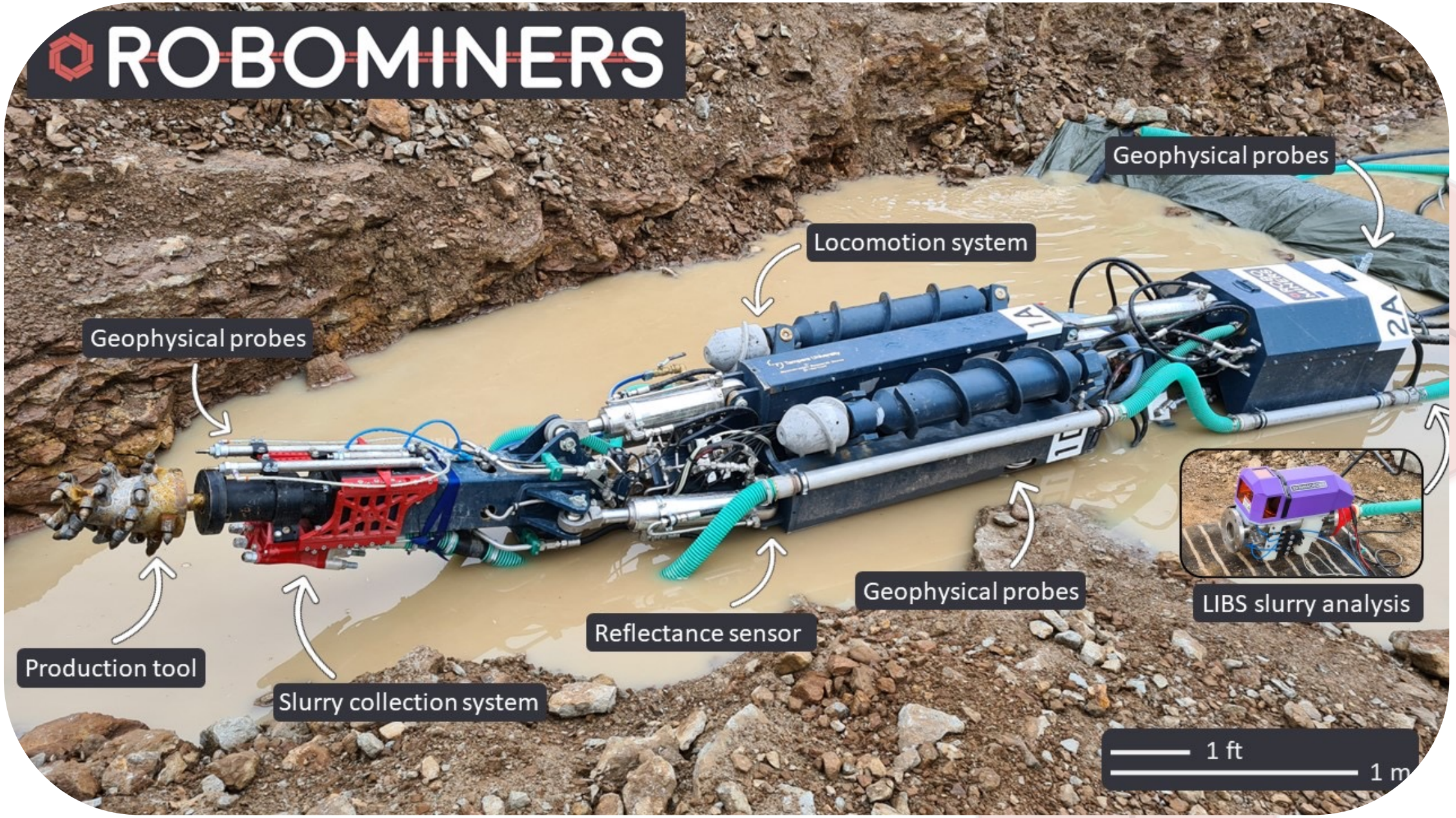




Real-time In-slurry analysis with LIBS and SWIR

- Challenges
  - Opaque medium
  - Transport pipe with opaque, thick material
  - High pressure, debris and abrasive material
  - Complex slurry

RM1 SENSORS


ROBOMINERS
Geophysical probes
Locomotion system
Geophysical probes
Geophysical probes
Reflectance sensor
LIBS slurry analysis
Production tool
Slurry collection system
1 ft
1 m

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Thank you for your attention

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EUROPEAN FEDERATION OF GEOLOGISTS (EFG)

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LA PALMA RESEARCH CENTRE FOR FUTURE STUDIES SL (LPRC)

GEOLOGICAL SURVEY OF SLOVENIA (GeoZS)

RESOURCES COMPUTING INTERNATIONAL LTD (RCI)

GEO-MONTAN

TALLINN UNIVERSITY OF TECHNOLOGY (TalTech)

IGSMIE PAN

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