

# Wigner 121 Scientific Symposium

Wigner Research Centre for Physics  
Institute for Particle and Nuclear Physics  
High Energy Physics Department  
*Innovative Gaseous Detector Development  
Research Group*

## Introduction

- Gaseous particle detectors are key components of High Energy Physics experiments: large volume, large area particle tracking in experiments such as CERN ALICE, ATLAS, NA61 and many more.
- The group performs state-of-the-art R&D both for generic detector physics and for specific projects. Fundamental research (e.g., CERN) and innovative applications (e.g., Muography) are well balanced and synergic
- Made possible by the nationally recognized Research Infrastructure, the "Vesztergombi Laboratory for High Energy Physics"

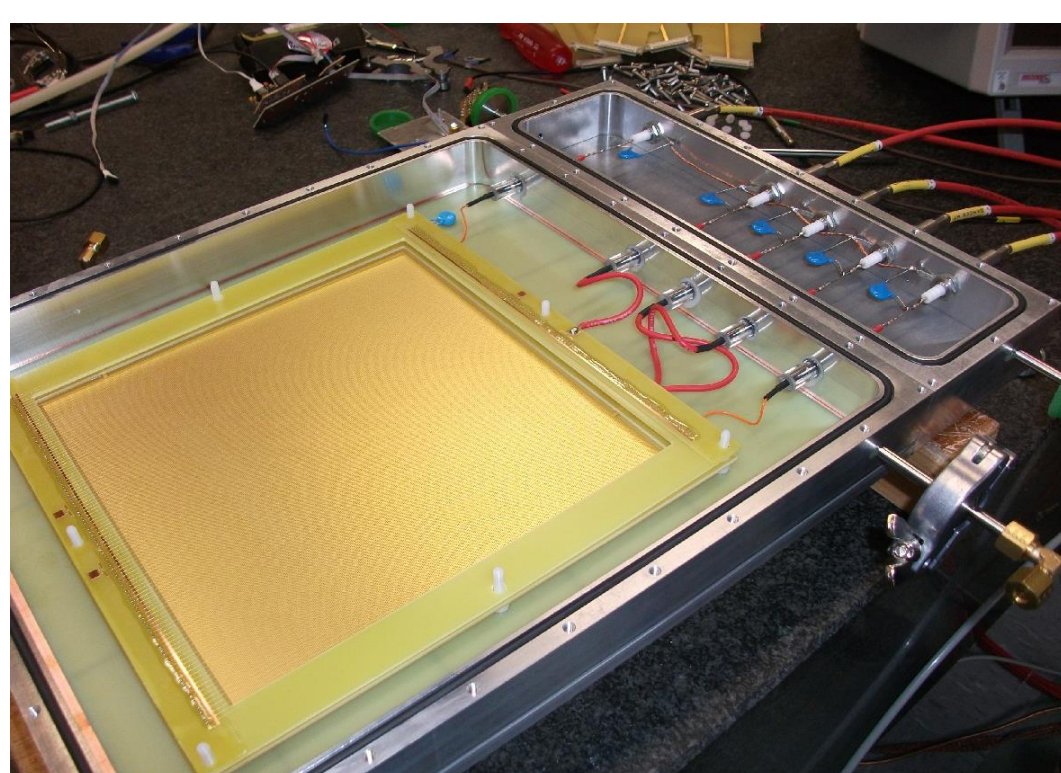
## Projects

- **Fundamental research:** contributing experimental and theoretical High Energy Physics, CERN and beyond
- **Muography:** a non-invasive imaging using cosmic muons for 10–1000 m objects (rock structures, buildings, caves). Applications in volcanology, archaeology, civil-engineering, mining, public safety
- **Detector R&D:** broad range of gaseous detectors for particle tracking, including invention of new technologies, used at CERN experiments ALICE, NA61, RD51, as well as ESS
- **MPGD quality:** Micro-Pattern Gaseous Detectors scanning with single photoelectrons, GEM foils for ALICE TPC Upgrade, detectorphysical inspections

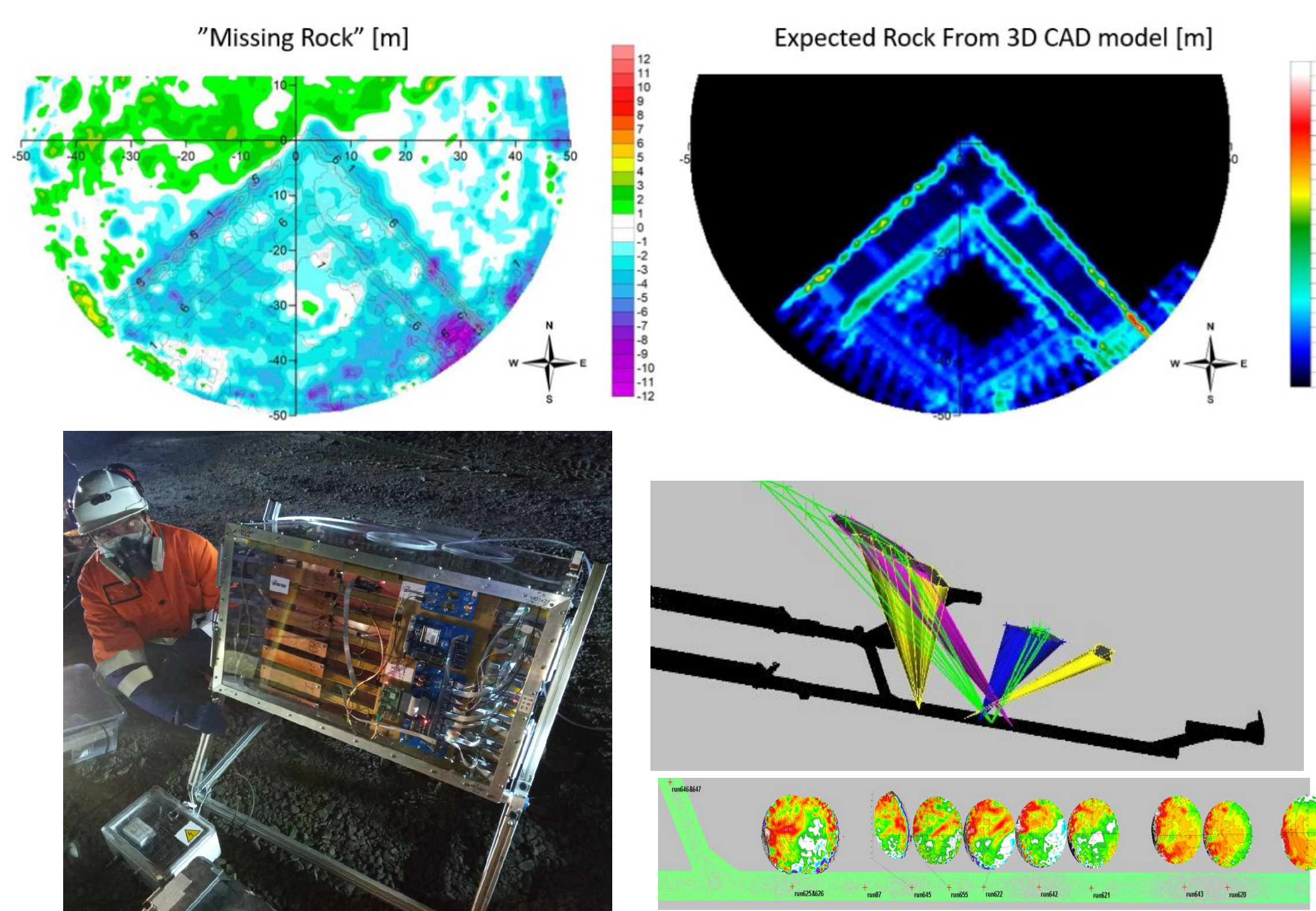
## Publications of the group

- [1] *Close cathode chamber: Low material budget MWPC*, D. Varga et al., Nucl. Instr. Meth. A, **698**:11–18, 2013
- [2] *Muography: Exploring Earth's Subsurface with Elementary Particles*, L. Oláh et al., Wiley AGU Books, 2022
- [3] *Single electron multiplication distribution in GEM avalanches*, A. László et al., J. Instrum. **11**, P10017, 2016
- [4] *High resolution surface scanning of Thick-GEM for single photoelectron detection*, G. Hamar, Nucl. Instr. Meth. A, **694**:16-23, 2012
- [5] *A GEM based TPC for beam monitoring*, G. Galgóczi et al., J. Instrum. **15**, C08027, 2020
- [6] *Toward low gas consumption of tracking detectors in field applications*, G. Nyitrai et al., J. Appl. Phys. **129**, 244901, 2021
- [7] *High-definition and low-noise muography of the Sakurajima volcano with gaseous tracking detectors*, L. Oláh et al., Sci. Rep. **8**, 3207, 2018
- [8] *On generally covariant mathematical formulation of Feynman integral in Lorentz signature*, L. András, Class. Quantum Grav. **39**, 185004, 2022

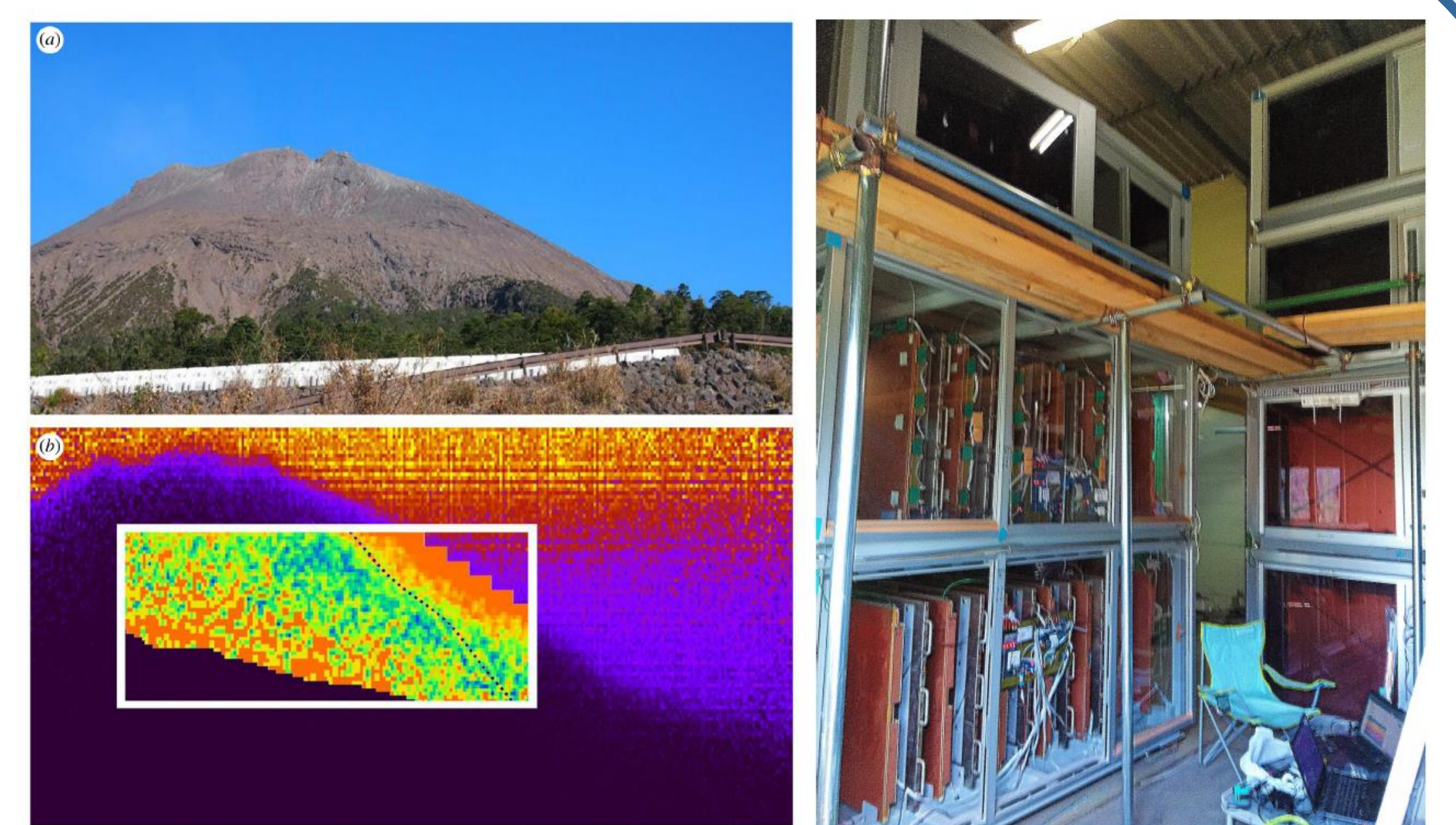
## Research highlights



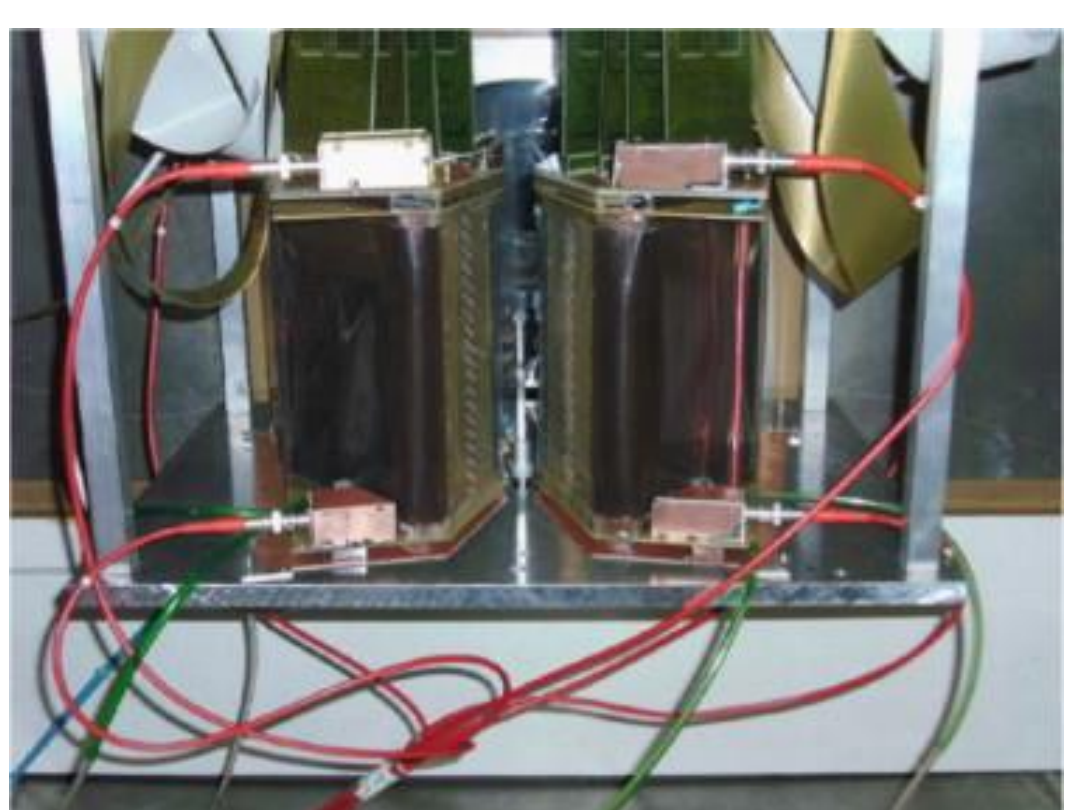
High performance  
Gaseous Tracking Detectors



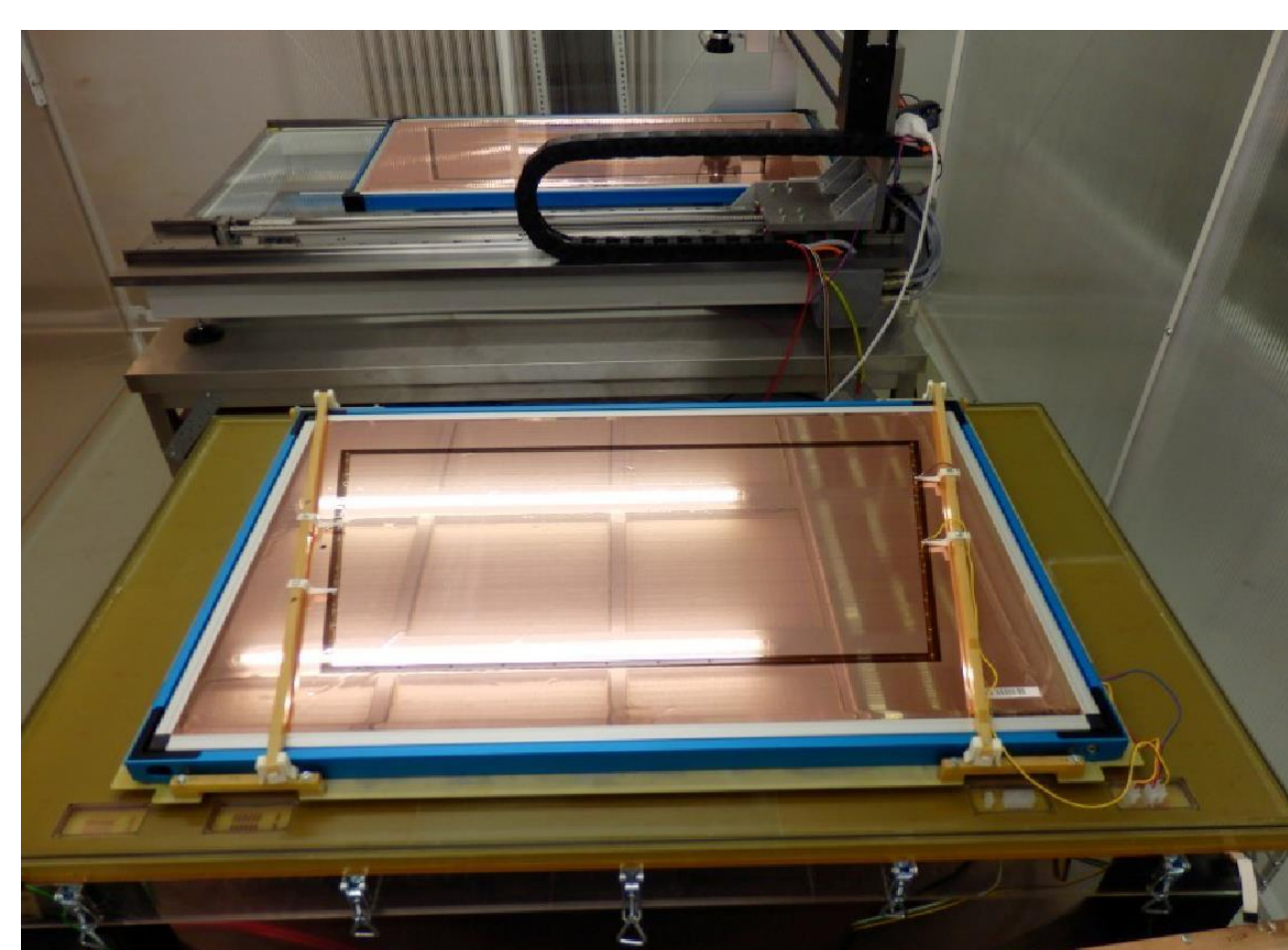
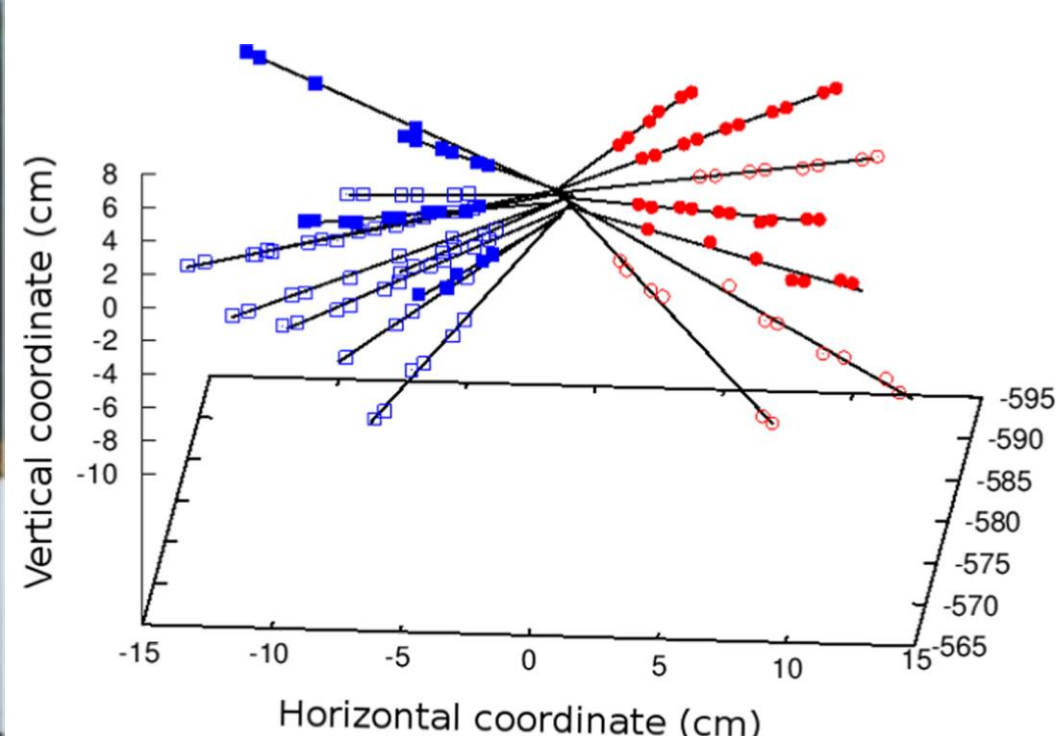
Underground muon imaging for  
archaeology, mining, etc.



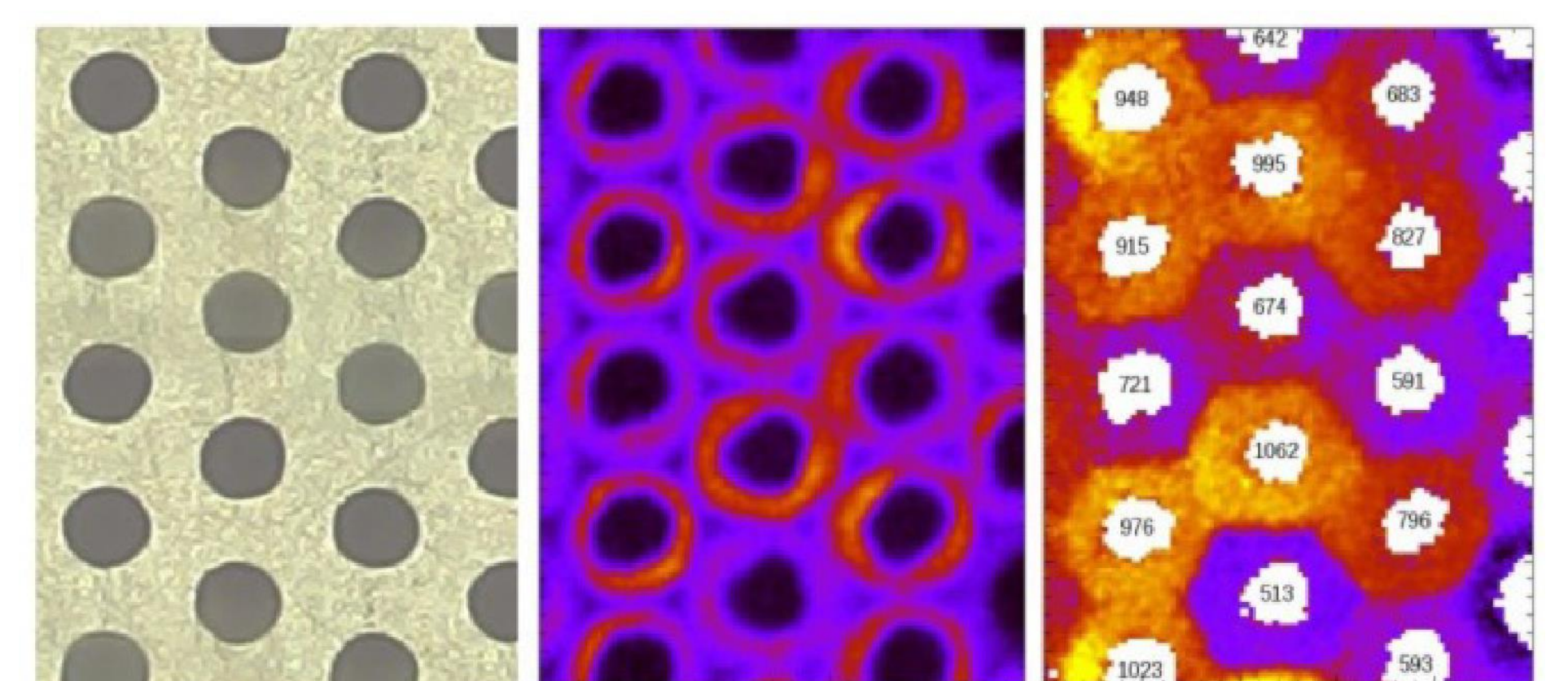
Sakurajima Muography Observatory, Japan  
Volcano imaging (dynamics monitoring)



NA61 Low Momentum Particle  
Detector around the target



ALICE TPC Upgrade: Budapest Quality  
Centre for detector quality assurance



Leopard: (Thick) GEM surface scanning,  
30  $\mu\text{m}$  resolution

