

Muography instrumentation developments by the REGARD group

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All colors of Physics



- HEP instrumentation projects
- Underground muography: challenge of mobility
- Surface-based muography: challenge of large size and reduction of low energy background
- Tracking detector option for vulcanology

"Large" collaboration involvements by the group

- CERN RD51: gaseous detector R&D
- CERN NA61:
 detector construction
- CERN ALICE: rebuilding the TPC
- ESS BrightnESS: neutron detector development











Muon radiography: imaging by the cosmic muons



Less material = More particles







Muon radiography: large scale structure visualization



Weet-Feet [m]

 Example: imaging underground shafts



Adv. in HEP 2013 560192 (2013) Journ. Phys. Conf. Ser. 665 (2016) 012032 PoS (NIC XIII) 129 (2015) 6p



Weet Fact Im 1

Natural caves are interesting objects to study but...



 ... a challenging environment





Nucl. Instrum. Meth. A 689 (2012) 60 Geosci. Instrum. Method., 1, (2012) 229 Advances in High Energy Physics, 560192 (2013) 1

Comparing surface with flux may reveal hidden structures _



Indication of a fissure/cave close to Királylaki cave



G. Surányi, Speleo2017 conference

Detectors viable for **volcano imaging**



High efficiency, high mechanical stability



D. Varga et al, Eur. J. Phys. **36** 065006 (2015) D. Varga et al, arXiv:1607.08494, AHEP In Press

Detector construction



 Applicationdriven design





Japanese-Hungarian initiative: Muographic Observation Instrument

- Currently running at Sakurajima (Kyushu)
- 5W wallplug power consumption, 0.5 m²





H. Tanaka, K. Tarou, D. Varga, G. Hamar, L. Oláh: Muographic Observation Instrument Japanese Ref. No.: 2016-087436, date 25/04/2016

Imaging the mountain (see László Oláh's morning talk)



 Mountain "shadow" muogram



Optical image



Ongoing detector construction



- Matured design, consistent performance, existing toling
- Next tracking station, soon be shipped to Japan



Underground detector: "Borehole" installation with NEC



- Detector to be installed at the NEC site in a relevant underground environment
- Trilateralcollaboration: Tokyo U, NEC, Wigner RCP
- Industrial approach, industrial application







- Mugraphy instrumentation developments: high efficiency gaseous tracking detectors
- Background suppression and good angular resolution (<5mrad) requires good tracking detectors

We are grateful to be part of the emerging community, and looking forward to the continuation!

Contributions from

L. Oláh, G. Surányi, G. Hamar, G. Nyitrai, P. Pázmándi etc..