

# Muography at APOGEIA

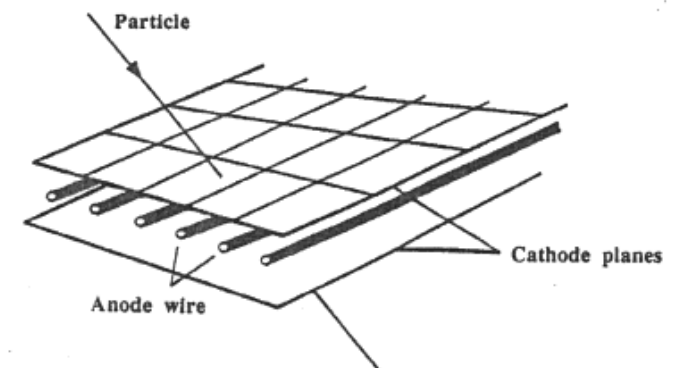
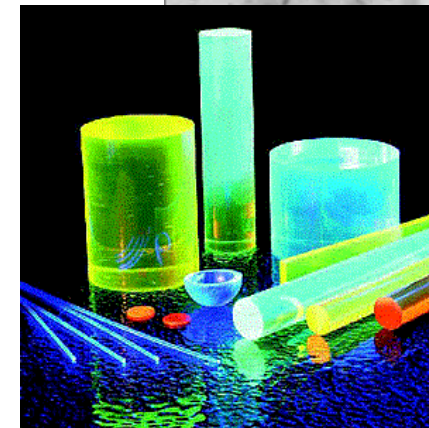
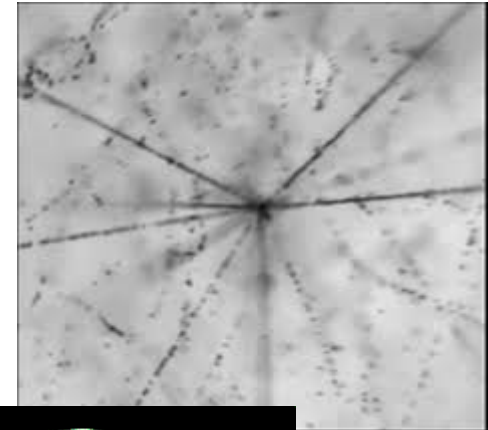
Dezső Varga, with input from many

- Technological comments
- Muography community
- Wigner RCP on-surface (volcano)
- Wigner RCP underground

# Detection technologies, developed for fundamental science



- Emulsions, thick  
“photographic films”  
Easy to deploy, no time resolution
- Scintillators (visible light)  
High efficiency
- Gaseous detectors  
High efficiency, cost efficient, complicated
- Established technologies! APOGEA  
need not make basic developments



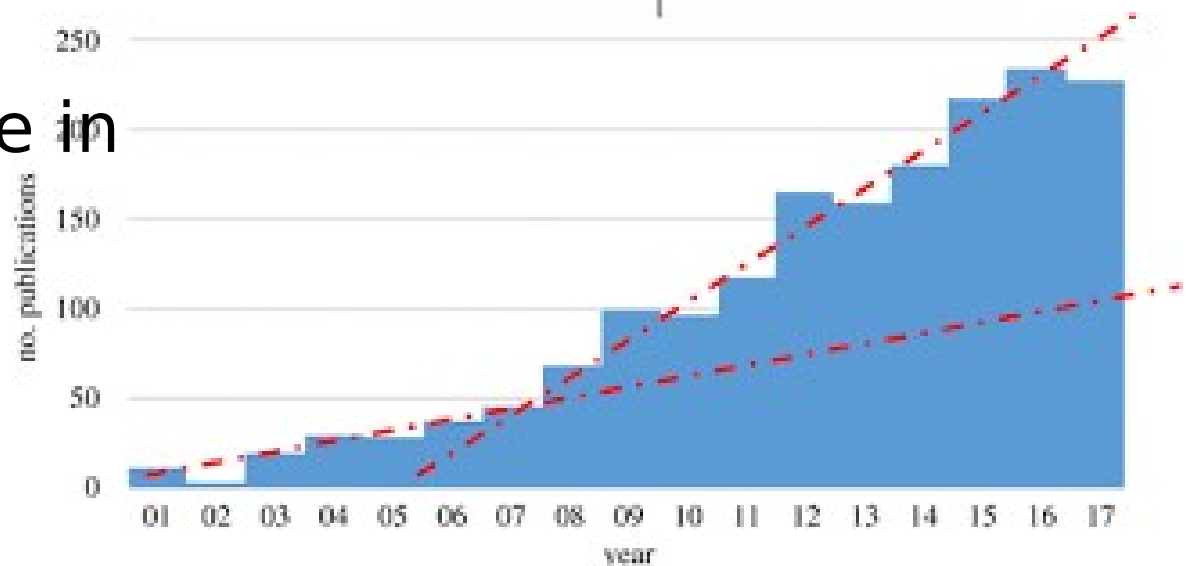
# Muography community

- Community forming around a recently established research field, Europe and Japan leading the progress
- “Muographers” WS series:  
2021 Ghent  
2019, 2018, 2017... Tokyo  
2012 MNR Clermont-F.  
pre 2010 Bern, Napoli, Tokyo

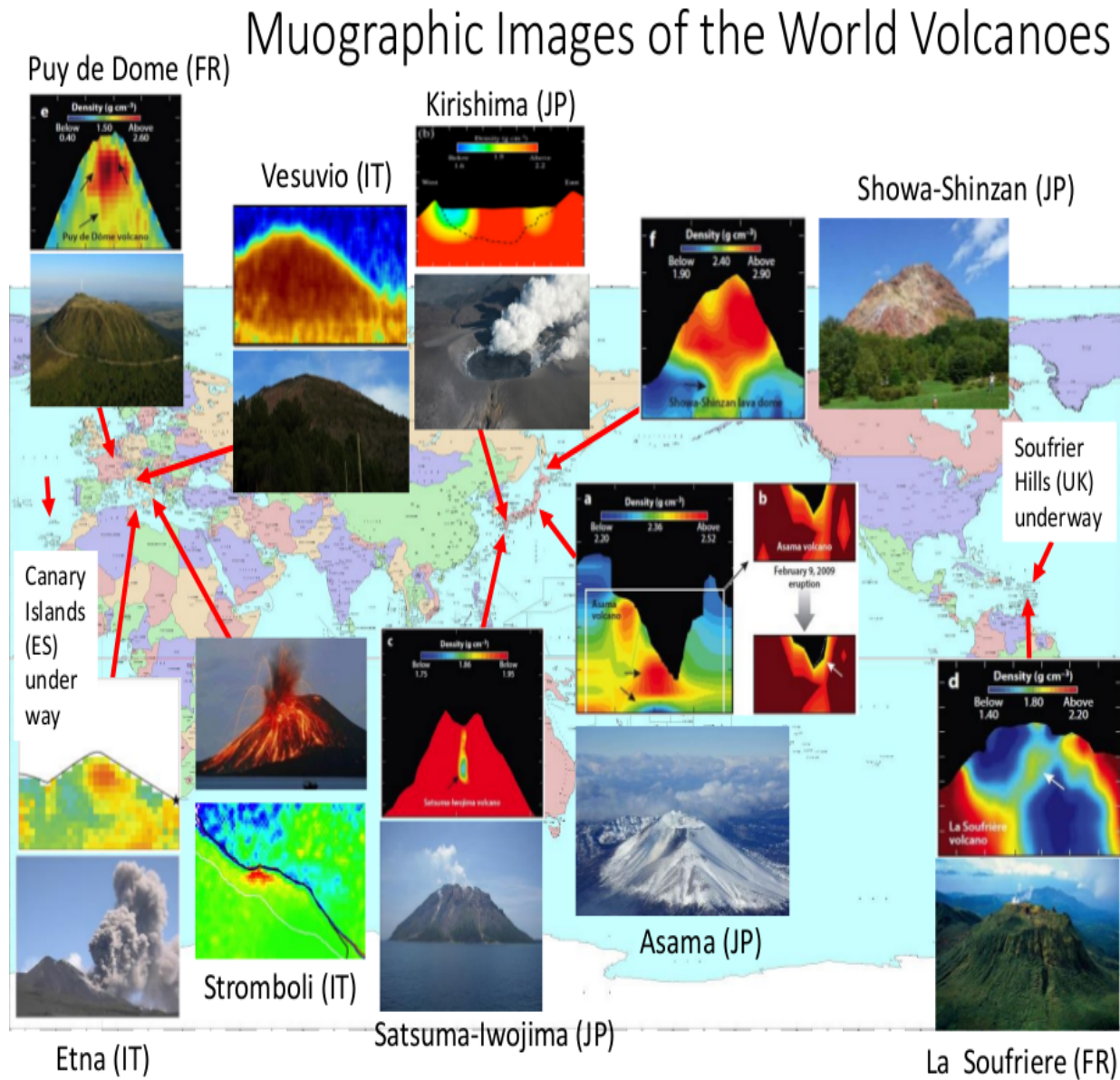


- Explosive increase in publications

(Tanaka 2018)



# APOGEIA will include the most relevant existing volcano muography projects!



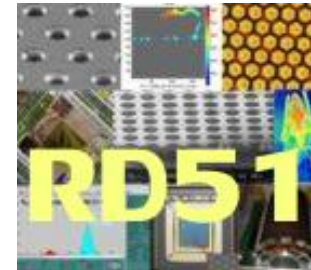
Hiroyuki K.M. Tanaka

# Wigner RCP Detector Physics

group: HEP instrumentation



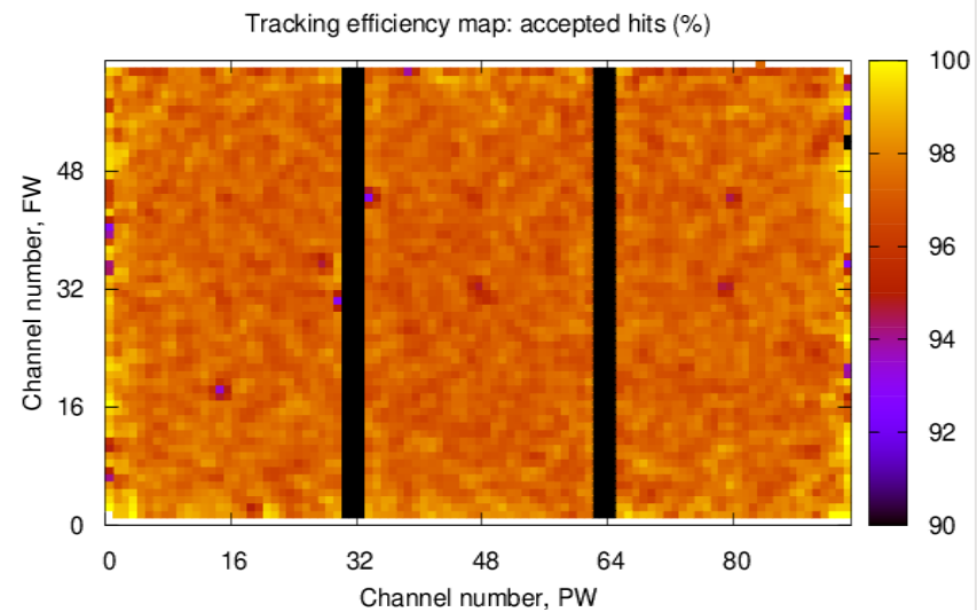
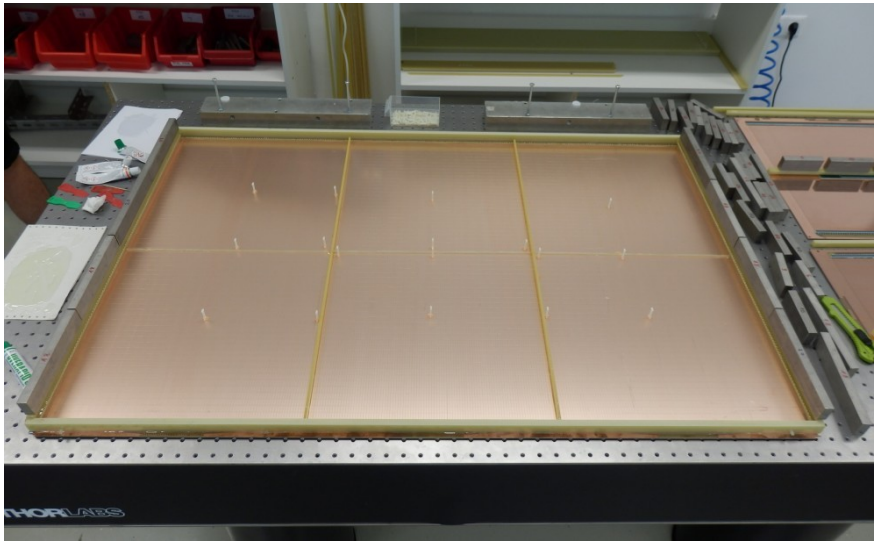
- CERN RD51: gaseous detector R&D
  - CERN NA61:  
detector construction
  - CERN ALICE: rebuilding the TPC
  - ESS BrightnESS: neutron detector development
- 
- Laboratory environment: a nationally recognized infrastructure (by main national funding agency NRDIO)



# Large area MWPC detector construction



- Reliability, durability, scalability by design
- By now 120+ m<sup>2</sup> produced (70 m<sup>2</sup> at SMO)
- Detection efficiency >95%, position resolution 4mm



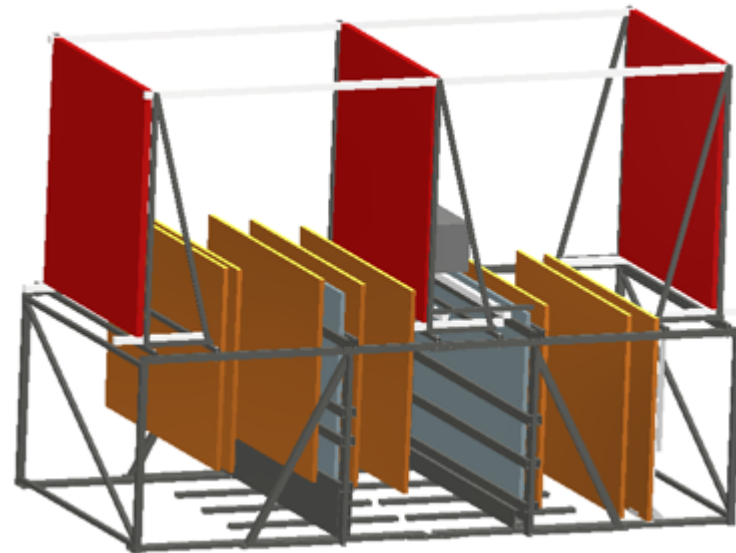
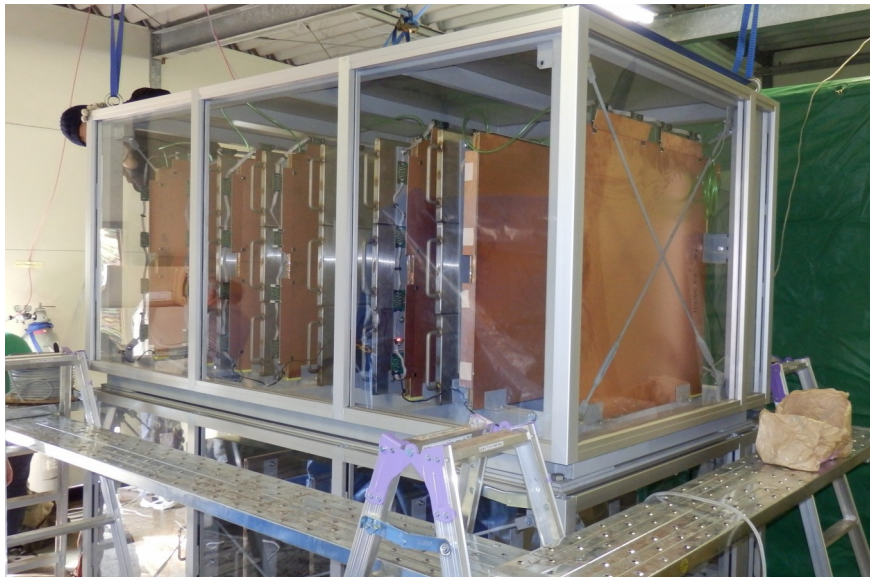
Eur. J. Phys. **36** 065006 (2015), arXiv:1607.08494, AHEP



# Detectors for APOGEIA volcano (on-surface) infrastructures



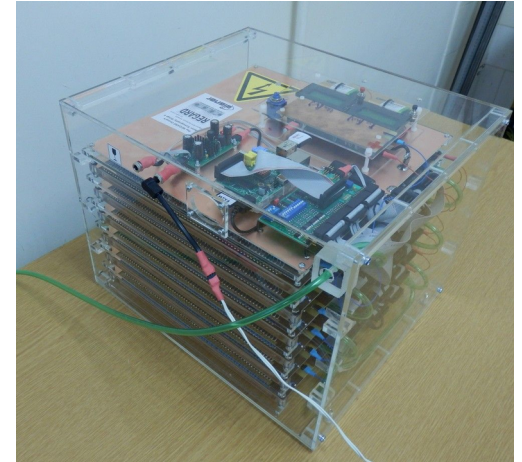
- Based on Sakurajima Muography Observatory (Kyushu)
- **Now total 8.7 square meter**, the world's largest
- To be installed at ETNA (see "PROMETEO") and other sites according to the APOGEIA community requirements



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

# Wigner RCP Underground detector instrumentation for APOGEIA

- Various mobile detectors, in different sizes to match the objectives and the Infrastructures
- Extensive experience available on installation, running and maintenance





# Conclusions

- APOGEIA will have a huge role in making the community more coherent
- Infrastructures of common interest: verification of existing technologies, site characterization (Vesuvius, Etna, LSBB, ...)
- Relevance in geo-sciences: proof-of-concept
- Methodology (!): joint inversion, ML