



Radical improvements to STUK's laboratory analysis capability

GammaRay X

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RADICAL

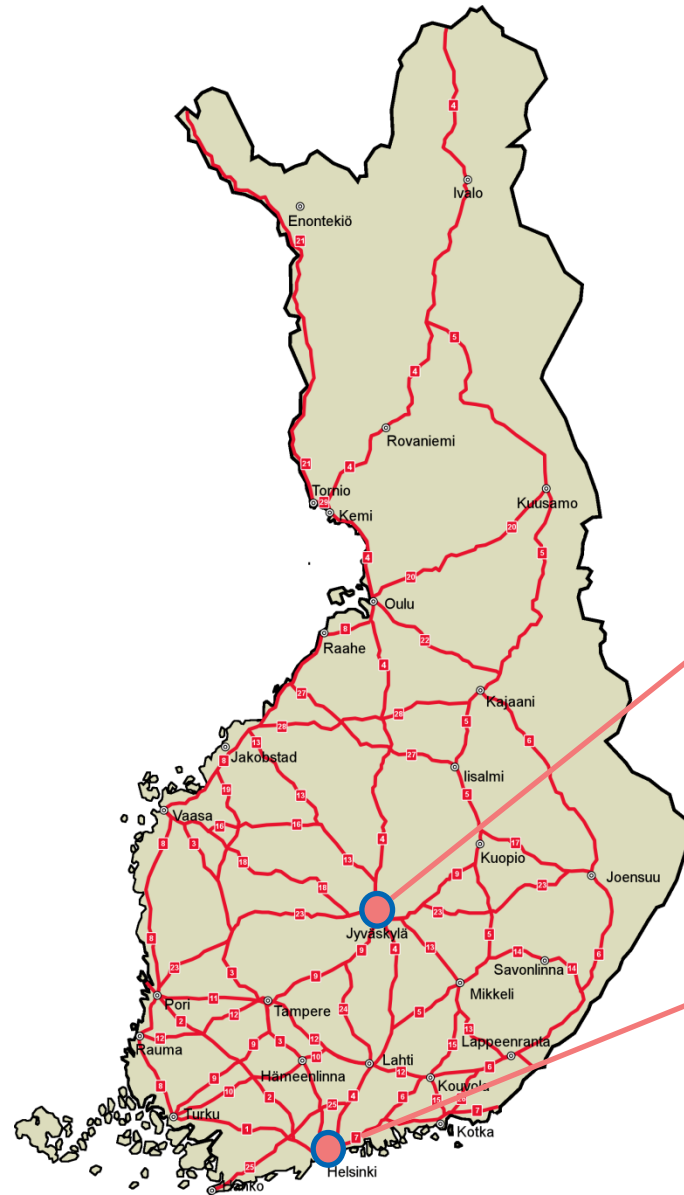
- RADICAL = RAdiation Detection In Coincidence And List mode
- The RADICAL project continues the research done at STUK approx. 2007-2014.
- The project started summer 2018 and ends by the end of 2021.
- Collaboration between STUK and the University of Jyväskylä (JYU).
- Two researchers recruited for the project:
 - Timo Hildén
 - main place of work: STUK, Helsinki
 - Hussam Badran
 - main place of work: University of Jyväskylä
- Other key personnel: Jani Turunen (STUK), Kari Peräjärvi (STUK), Roy Pöllänen (STUK) and Paul Greenlees (JYU)

RADICAL

- Objective of the project is to increase the sensitivity of radiation measurement systems used at STUK's laboratories and provide additional information from a single measurement of a sample.
- The goal is to have new operational laboratory systems that can be used in normal routine measurements.
- The main themes and keywords associated with the project are:
 - coincidence measurements
 - list-mode data
 - multi-parameter data acquisition
 - digital electronics
 - analysis algorithms

RADICAL

- Development of three separate measurement setups
 - PANDA
 - MiniPANDA
 - COSSU
- ...and software for them
 - VISSY



University of Jyväskylä

PANDA

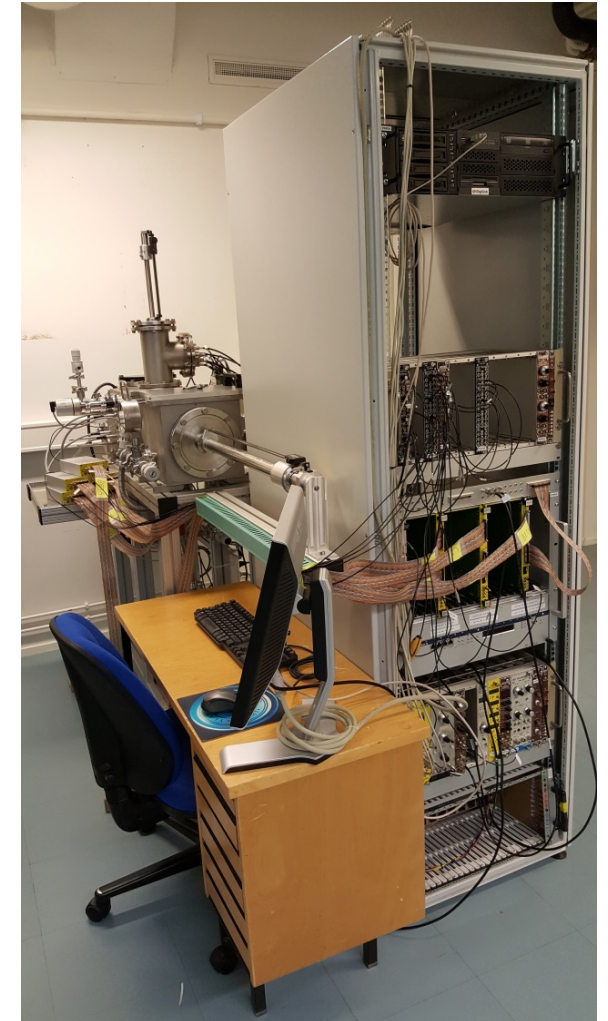
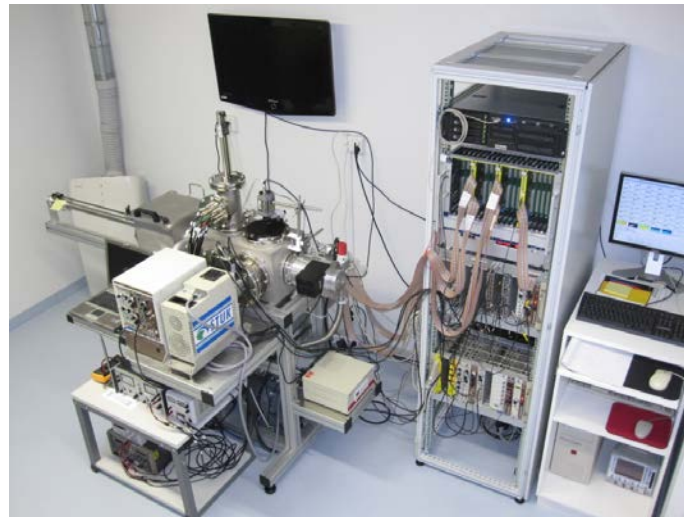
STUK, Helsinki

MiniPANDA
COSSU

PANDA

- PANDA (Particles And Non- Destructive Analysis) was developed for the analysis of radioactive samples related to nuclear safety, security and safeguards (3S).
- PANDA was designed, constructed and tested in STUK 2008-2014.
- Can be used as an operational device and also as a development platform to test new detectors and techniques.
- The device was re-located from STUK to the Accelerator Laboratory of the University of Jyväskylä (JYFL-ACCLAB) in 2016.
- The development of PANDA has continued in the RADICAL project.

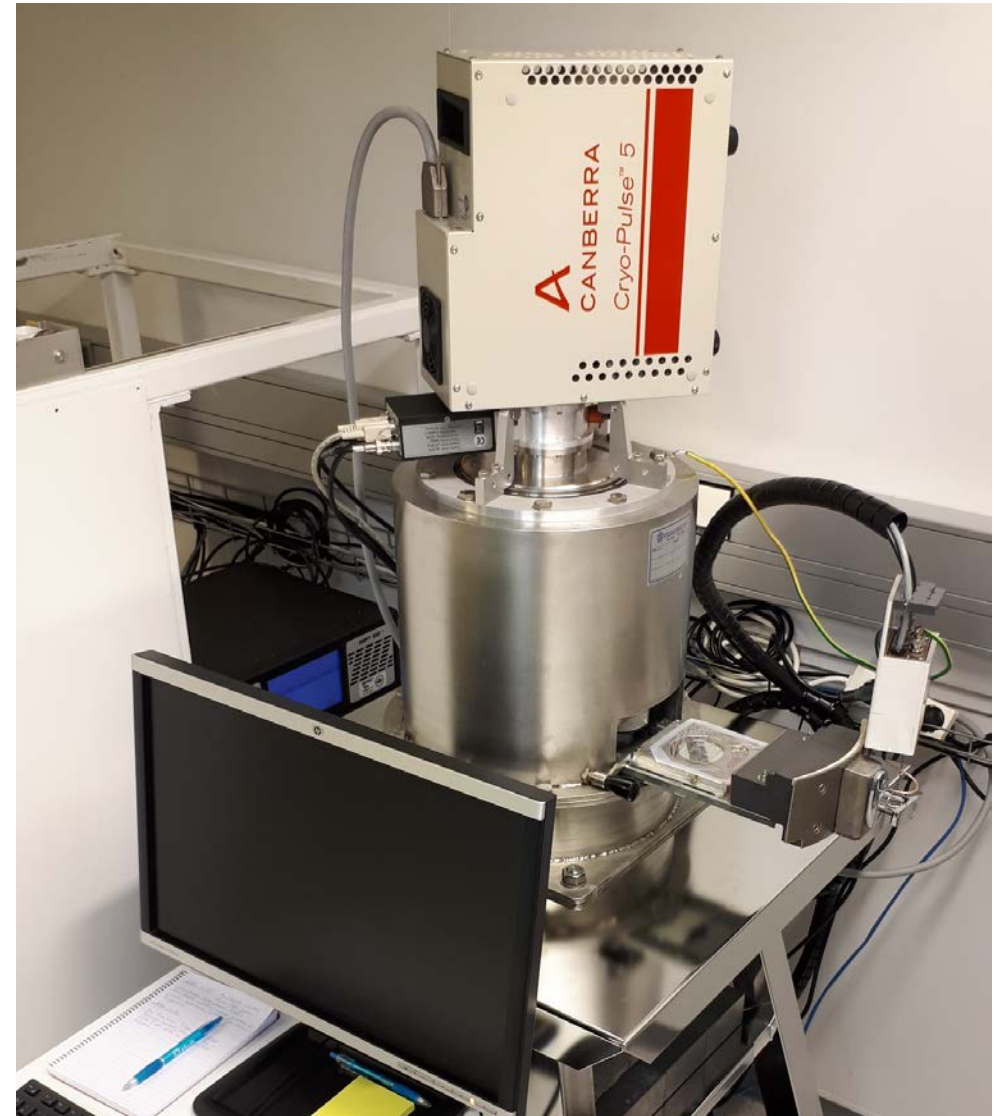
Presentation by Hussam Badran



MiniPANDA

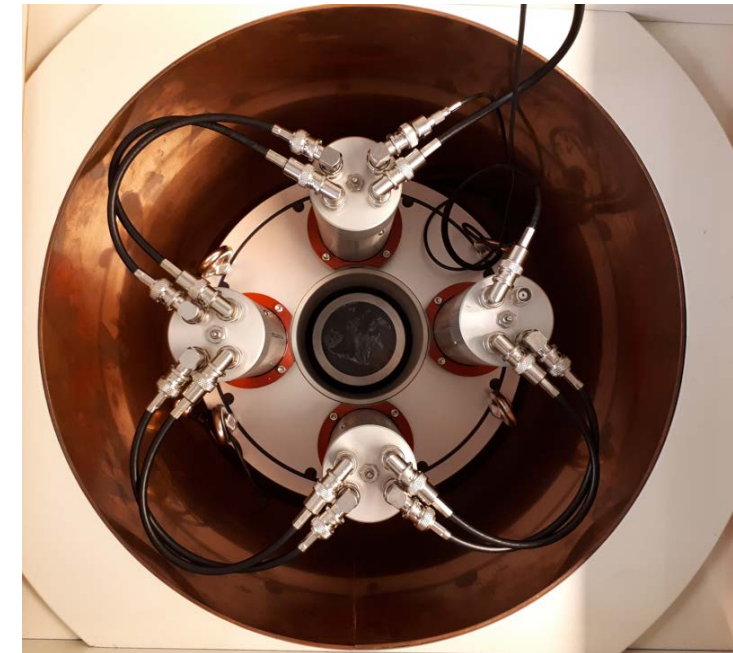
- Originally constructed at STUK after experiences gained with the PANDA device.
- During the RADICAL project the setup was updated, relocated and taken into use in STUK's gamma laboratory.
- MiniPANDA has the capability for coincidence measurements just like PANDA.

Presentation by Timo Hildén



COSSU

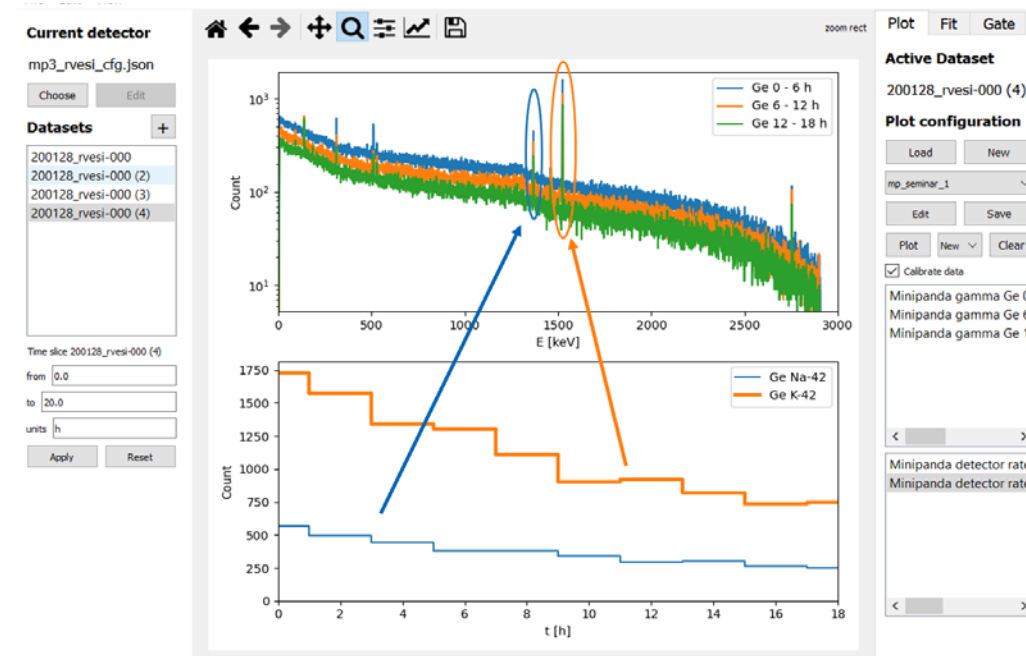
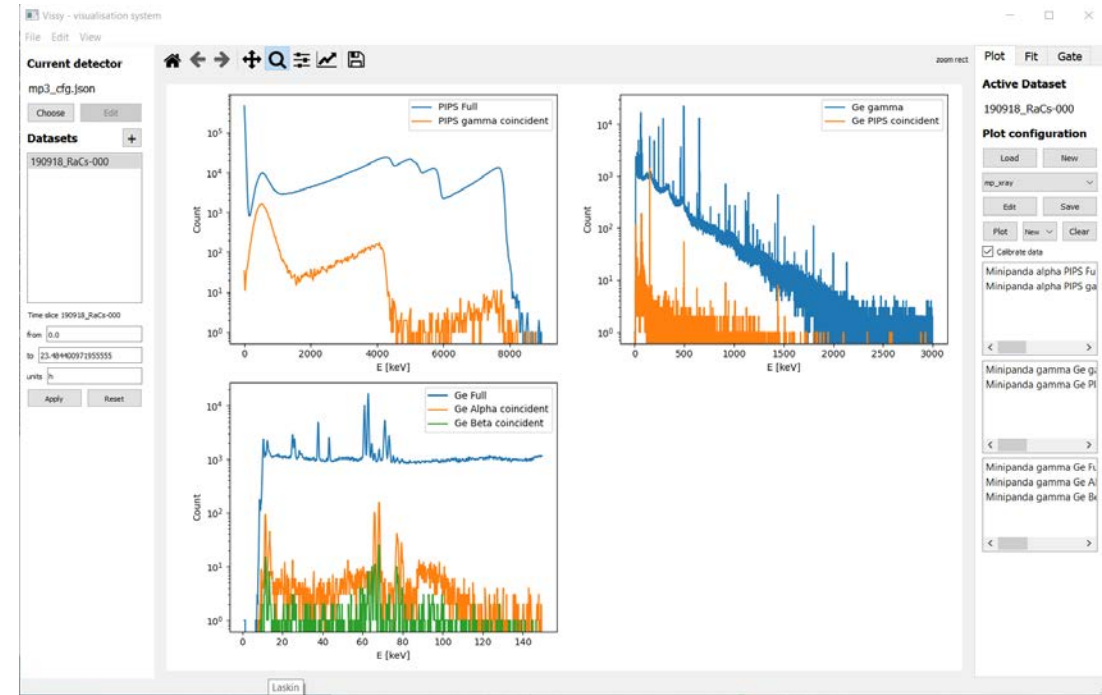
- COSSU = Compton suppression shield.
- New setup built in STUK's gamma laboratory during the RADICAL project.
- Has a germanium detector with surrounding two-piece scintillator detectors (NaI) inside a lead castle.
- Scintillator detectors used as active shields for removing background caused by Compton scattering.



Presentation by Timo Hildén

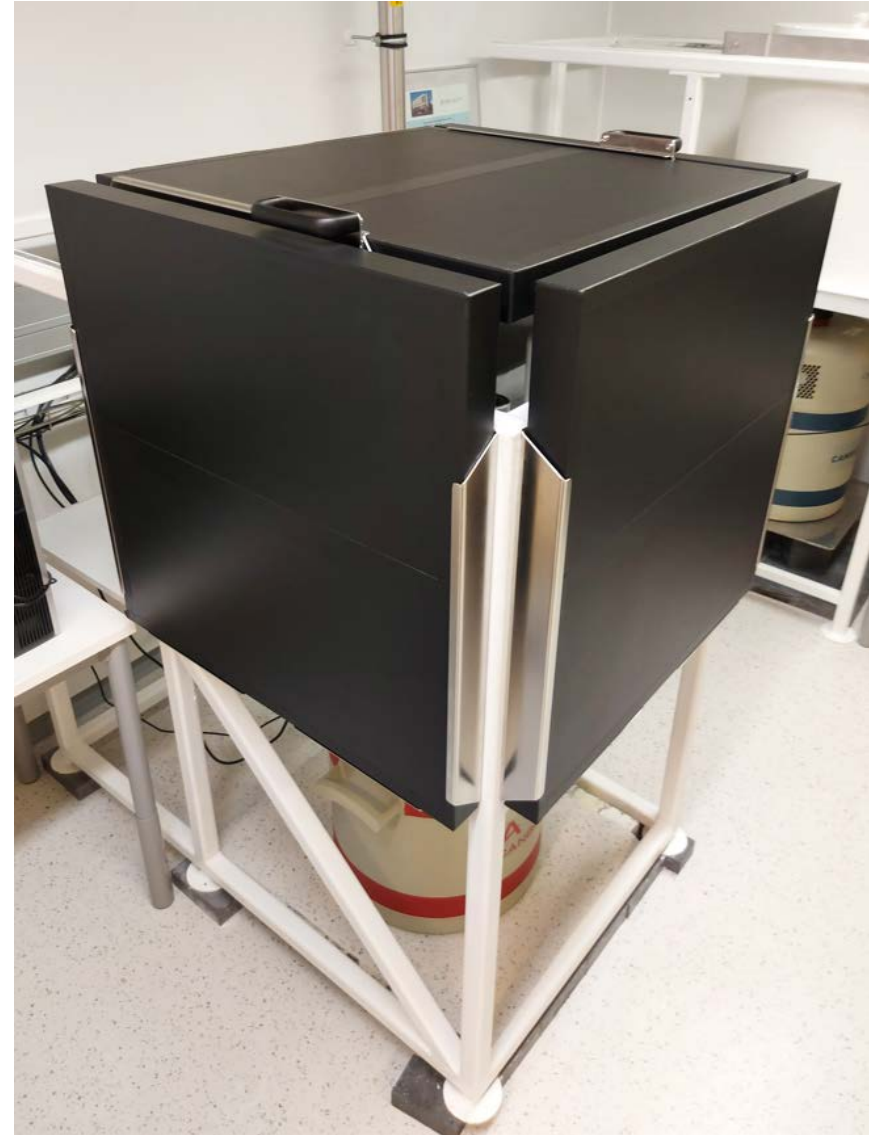
VISSY

- Data from PANDA, MiniPANDA and COSSU saved in list mode.
- VISSY = Software to visualize, sort and analyse list mode data.



Spin-off: COVERT

- COsmic VEto for the Reduction of Total background.
- Plastic scintillator detector plates installed outside the lead shield of one of the Ge detectors in the gamma laboratory.
- Reduction of the background caused by cosmic radiation.
- Setup completed, but not tested or taken into routine use.



Summary

- The objective of RADICAL is to improve STUK's laboratory analysis capability.
 - More information from a single measurement of a sample
 - Lower MDAs / shorter measurement times
- Operational laboratory systems that can be used in normal routine measurements.
- The main products of RADICAL are:
 - PANDA
 - MiniPANDA
 - COSSU
 - VISSY
- Techniques and methods can be later applied to other existing or new measurement setups to improve their performance.

