

An overview of gamma-spectrometry activities at VTT

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22/10/2021 VTT – beyond the obvious

Overview

- VTT Centre for Nuclear Safety
- Hot Cells at VTT's CNS (+ HPGe detector #1)
- HPGe detector #2
- Accreditation plans

VTT Centre for Nuclear Safety*

The VTT Centre for Nuclear Safety is a new green field site project:

1/2014: Ground breaking

6/2016: Laboratory-wing ready for move-in

8/2017: Hot cell installation completed

4/2018: IAEA baseline swipe tests

5/2018: License for hot cell operation granted from STUK

- Handling and testing of hot structural materials
- Metallography, dimensioning, marking, hardness, and imaging tools
- Analytical electron microscopy to nano-scale
- Measurements of gamma, beta and alpha radiation
- Chemical analyses across periodic table
- Aerosol, iodine and bentonite laboratories

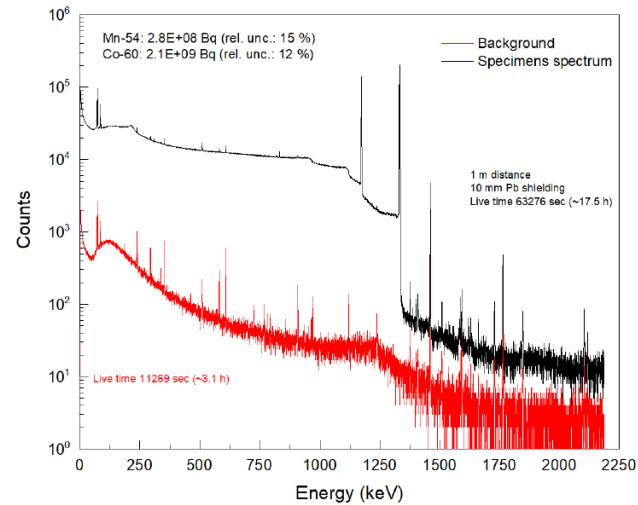


* **Source:** W. Karlsen et al: "New VTT Hot Cells in Operation", Proceedings of SYP2019, <https://ats-fns.fi/en/nuclear-science-technology-symposium/proceedings-2019>

Reception cell in-cell gamma spectrometry*

For confirmation or determination of source term

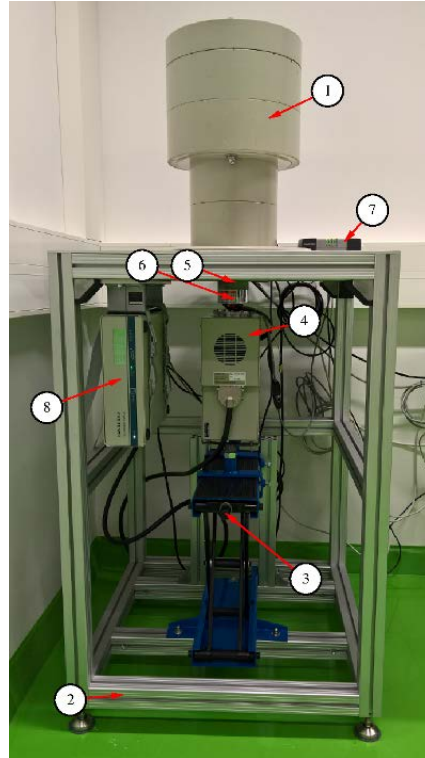
- First hot transport was unloaded into reception cell in mid-2018
- Since then, several transports have been received in the CNS
- Deployment of in-cell gamma spectrometry has been tested



* **Source:** W. Karlsen et al: "New VTT Hot Cells in Operation", Proceedings of SYP2019, <https://ats-fns.fi/en/nuclear-science-technology-symposium/proceedings-2019>

HPGe detector #2

- p-type
 - 15 % relative efficiency
 - 1.8 keV FWHM @ 1.33 MeV
 - P/C ratio 44:1
 - **ISOCS-characterized**
 - Electrically cooled
 - Fitted with lifting device
-
- **Original purpose:** reactor dosimetry
 - **Additional uses:**
 - Waste package characterization
 - Other research/commercial projects
 - Nuclear Material Safeguards
 - (NORMs)



Item #	Component
1	Lead shielding
2	Support table
3	Lifting device
4	Coldhead
5	HPGe detector
6	Pre-amplifier
7	MCA
8	Controller

Sample types

Variable geometry and self-attenuation

Calibration source



Liquid



Liquid



Liquid



Waste package



Paper + gloves



RPV



Metal scrap

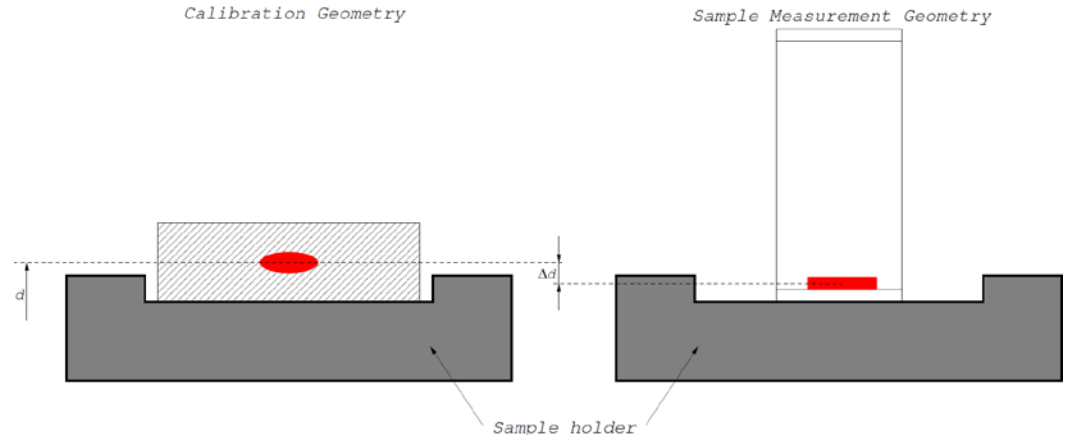


Data analysis

- **Acquisition:** Genie 2000
- **Spectral fit:**
 - Genie 2000
 - Interspec
 - FitzPeaks
 - Hypermet-PC
- **Routine calibrations/checks:**
 - Eff @ 10 cm source-detector
 - Eff @ 20 cm source-detector
 - ISOXSRCE
 - E, FWHM

- **Two paths for absolute-efficiency determinations in complicated geometries:**

1. Geometry composer (ISOCS)
2. Absolute calibration with **certified sources** + **Serpent** (geometry and attenuation corrections)



Accreditation plans

- **Aim:** accreditation of activity determinations by gamma-spectrometry according to ISO 17025
- **The Quality System** addresses:
 - i. Selection and training of personnel
 - ii. Competence monitoring
 - iii. Equipment calibration
 - iv. Proficiency tests
 - v. Applicable standards
 - vi. Deviations
- **Ongoing** since 2019.
Targetting submission in 2021
 - vii. Internal audits
 - viii. Samples
 - ix. Reporting
 - x. Document control
 - xi. Inter-comparisons

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