HUN-REN Centre for Energy Research

Gamma Spectroscopy activities at the Nuclear Security Department of the Center for Energy Research, Hungary

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Research. Innovation. Impact.

➢Nuclear Security Department in the context of HUN-REN

➢Nuclear Security Department (NSD)

➢Gamma laboratory equipment of the NSD

➢Main activities of the gamma team at the NSD

➢Gamma spectrometry and AI at the NSD

HUN-REN Hungarian research network

(7 research centres, 8 research institutes, and 101 supported research groups)
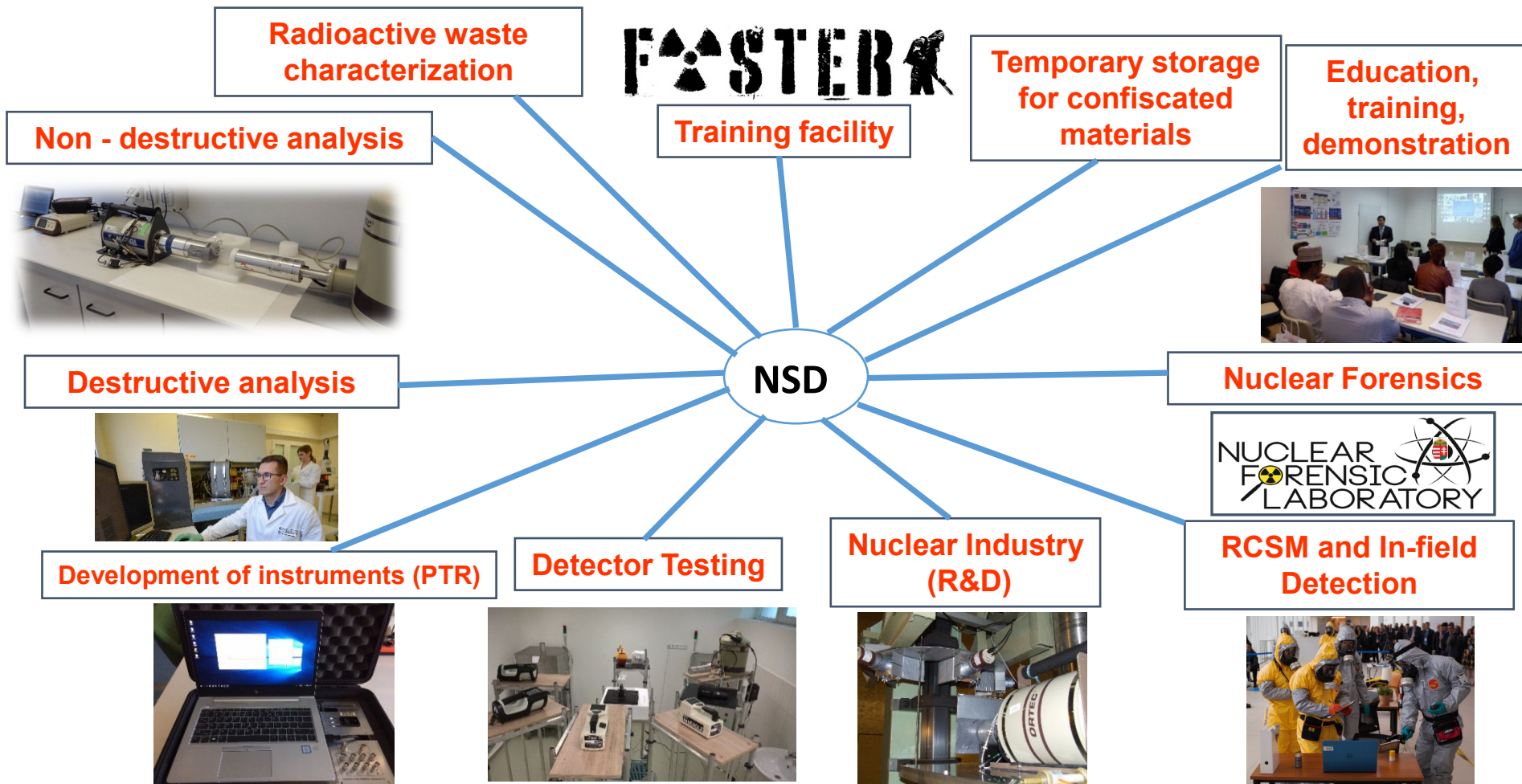
HUN-REN Center for Energy Research

Research groups

Institute for Energy Security and Environmental Safety

Institute for Atomic Energy Research

(8 departments)

Institute of Technical Physics and Materials Science

Nuclear Security Department

The Nuclear Security Department is

- Technical support of
  - Hungarian Nuclear Power Plant
  - Hungarian Law enforcement
  - Hungarian Atomic Energy Authority
- Collaborating Center of the IAEA
- Management of any radiological or nuclear material
- Collaboration with Universities

Radioactive waste characterization

Non - destructive analysis

Training facility

Temporary storage for confiscated materials

Education, training, demonstration

Destructive analysis

Nuclear Forensics

Development of instruments (PTR)

Detector Testing

Nuclear Industry (R&D)

RCSM and In-field Detection

20 members; 7 directly work with gamma spectrometry

The Gamma laboratory of the Nuclear Security Department is equipped with a wide range of gamma detectors for diverse use:

HPGe (high-purity germanium) detectors for precise qualitative and quantitative analysis (coaxial, planar and well-type for special uses)

- LaBr$_3$ scintillation detectors capable of handling higher radiation fields
- Compact CZT (CdZnTe) detectors for hard-to-reach measurement positions

Measurement of a calibration source with 2 HPGe detectors (planar and coaxial) in the Gamma laboratory

Verification of U-enrichment in fresh fuel assembly by using a CZT detector to measure inner pin enrichment (Paks NPP)

Verification of U-enrichment in fresh fuel assembly by using LaBr$_3$ (above) and HPGe (foreground) detectors (Paks NPP)

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- Measurements at Paks NPP (Verification of fresh fuel enrichment after each delivery)

- Technical support activities in the field of nuclear safeguards for the Hungarian Atomic Energy Authority

- Experimental measurements (eg. spent fuel burnup characterization)

- Nuclear forensics

- Measurement surveys at team support

- Measurement of confiscated nuclear and radioactive materials

- Assessment of nuclear material of unknown origin

- Measurements of environmental samples for the assessment of natural radionuclides and checking contamination, as well as age dating (projects related to collaboration with universities)

Nuclear material detection in MOX – mixed oxide fuel –fuel by using planar HPGe detector (MOL, Belgium)

Spent fuel burnup characterization measurement using a coaxial HPGe detector and a narrow collimator (Paks NPP)

Plans

Create an extensive public database of gamma spectra and develop machine-learning algorithms to guide spectrum analysis

Thank you for your attention!