Towards the development of industrially useful measurement protocols for nuclear decommissioning

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NuTeC
Nucleair Technologisch Centrum

Outline

1. Introduction

2. Industrially useful characterization methods & reference materials for nuclear decommissioning

3. Automation of measurements during nuclear decommissioning

4. Conclusion & outlook

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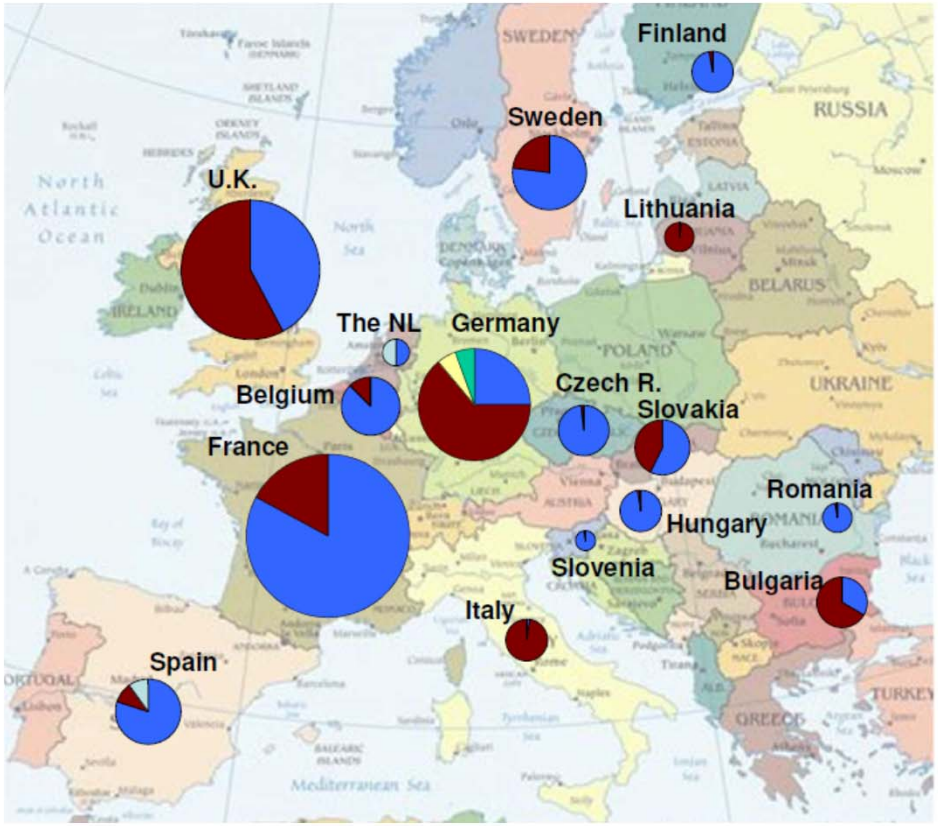
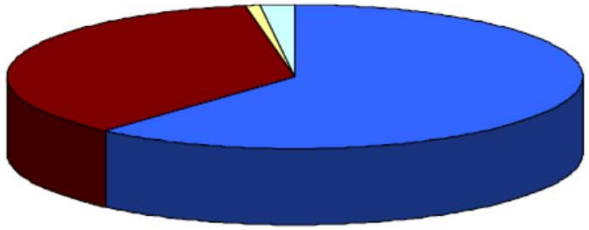
Several nuclear power plants in EU are entering decommissioning

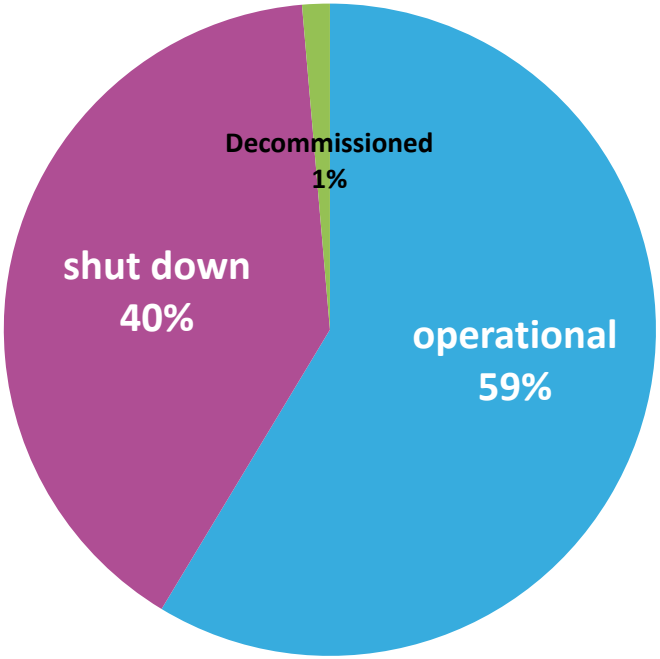


- Operational
- Shutdown - Dismantling
- Fully Dismantled
- Long Term Safe Enclosure



TOTAL
Power reactors in EU: 222
Operating reactors: 131

Several nuclear power plants in EU are entering decommissioning



- How to motivate young researchers/students to do the work?
- Many measurement challenges are present:
  - Suitable measurement methods for challenging environments?
  - Labour intensive methods are used
  - Suitable concrete reference materials are lacking
  - …

Source: Presentation JRC,MOREMA, MOrtar REference MAterial

How to motivate students for a career in nuclear decommissioning?

Problematic issues?

- Breaking down = not attractive
- Do we have to clean up the nuclear heritage of previous generations?
- Once the decommissioning of a plant is completed… What will happen to my job?

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How to motivate students for a career in nuclear decommissioning?

On the bright side:

- **Recycling = cool**
  - Decommissioning to recycle as much as possible
  - Nobel cause: restore a safe environment, closing the nuclear energy cycle

- Emerging activity: possibilities for **career development**
  - **High job security**
  - Options for **traveling** in Europe

How to motivate students for a career in nuclear decommissioning?

On the bright side:

- Much more that cleaning and demolishing:
  - **Appealing technological challenges**
  - Freedom to implement **creative solutions** (much more than in a operational development)

- Money is less of an issue compared to **security / radiation protection**

- **And… one could consider implementing a robotic approach for measurements**

Measurements during nuclear decommissioning

Labour and time intensive measurements:

1. Ambient dose rate and nuclide identification measurements taken at specific places to **map an unknown region**

2. **Surface contamination** measurements

3. **Atmospheric contamination** measurements

4. Measurements for **waste characterization**
   - Especially with the aim of improving free release measurements.

➔ Options for fresh minds to reshape these completely!

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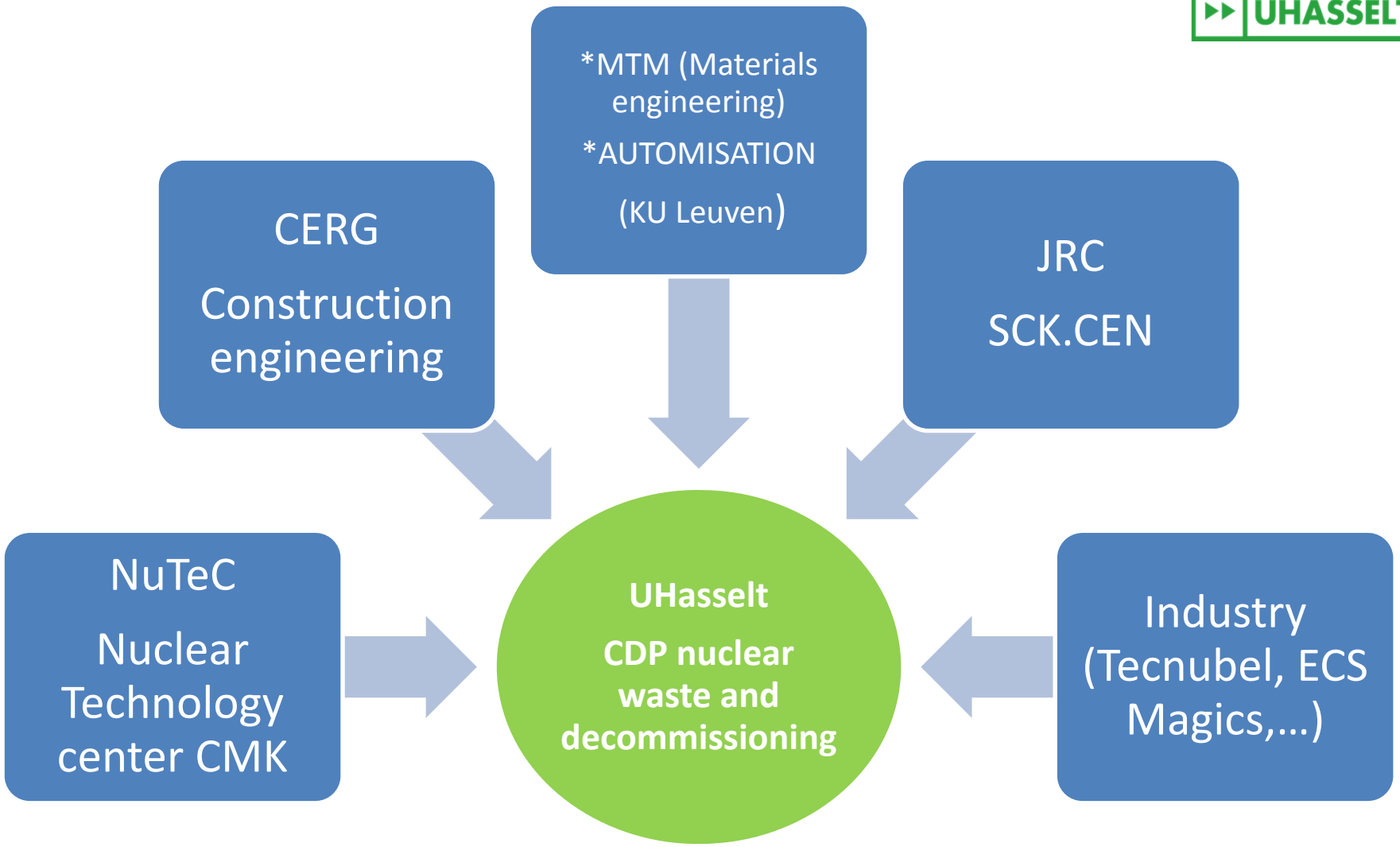
Collaborative Doctoral Partnerships : JRC



Collaboration in education and research

Collaborative Doctoral Partnerships : JRC

- Strong collaboration with JRC in training activities on nuclear waste and decommissioning
  - Eg. During Cherne activities (Nirim2, 25th Nov 2019)

- Collaboration in master thesis and PhD research

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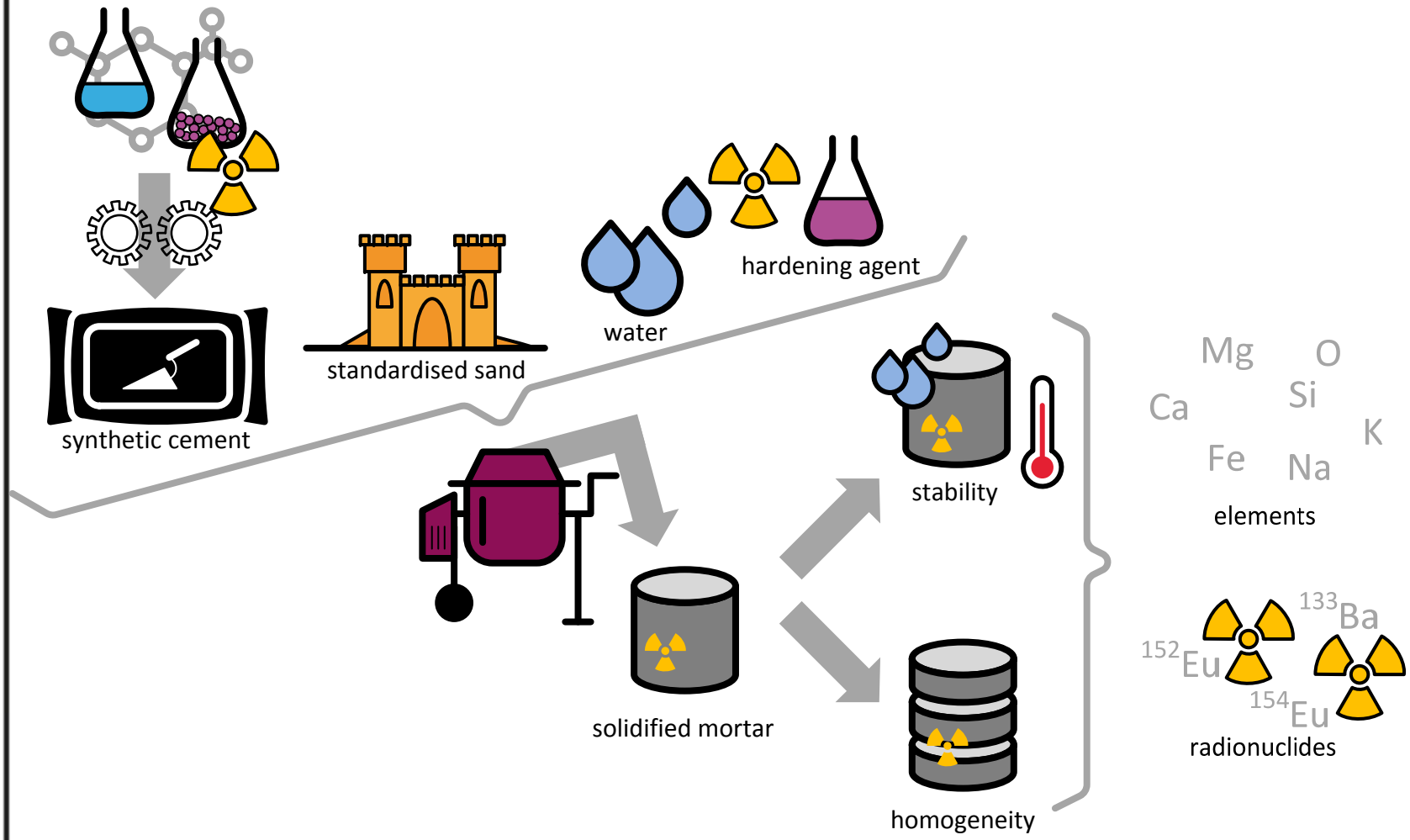

[PhD Lowie Brabants: collaboration JRC-Geel; Nov 2018 – Nov 2022]

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Measurements during nuclear decommissioning

- **Energy transition funds projects**
  - **"Autonomous Robot platform for CHaractERization"** during dismantling, decontamination **(ARCHER)** *[UHasselt, KULeuven, Tecnubel & Magics Instruments]*
  - ***"Automation of clearance measurements during decommissioning"*** *[UHasselt, KULeuven, ECS]*
  - ***"Characterisation during decommissioning"*** *[UHasselt, KULeuven, ECS]*

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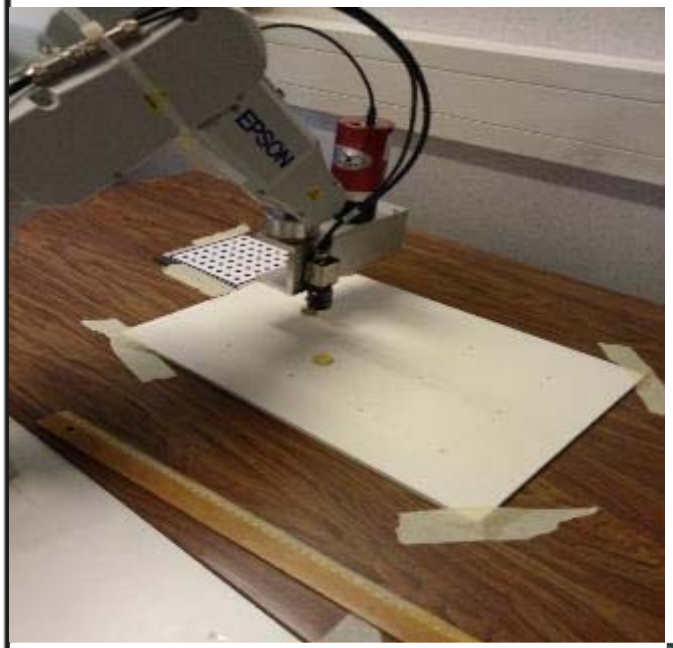
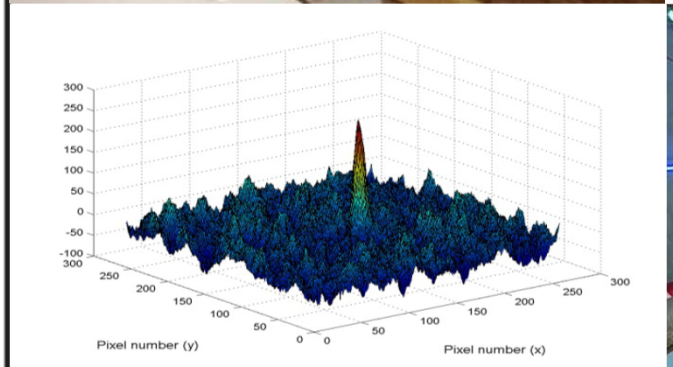
Autonomous Robot platform for CHaractERization during dismantling, decontamination (ARCHER)

Energy transition funds project (funded by Belgian Federal Authority)



- **Exploratory measurements**
- Characterizing/**imaging** of hotspots in potential **high radiation environment**
- Using **light weight probes / camera's** in a **robotics platform**



[UHasselt, KULeuven, Tecnubel & Magics Instruments; Oct 2018 – Oct 2021]

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FOD Economie, K.M.O., Middenstand en Energie

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Automation of clearance measurements during decommissioning

Energy transition funds project (funded by Belgian Federal Authority)

- Development of a **more automated** method for clearance measurements
  - Tool to support **ergonomic** aspects
  - Implementation of **robotic support** tools
  - Improving the **efficiency of the operators**, **traceability** and **reproducibility**
  - **Reducing the margin of error**
- Improving on-site methods
  - Study of **alpha and beta on-site measurement options**
  - **Automated data + position storage**

[UHasselt, KULeuven & ECS; Jan 2019 – Jul 2020]

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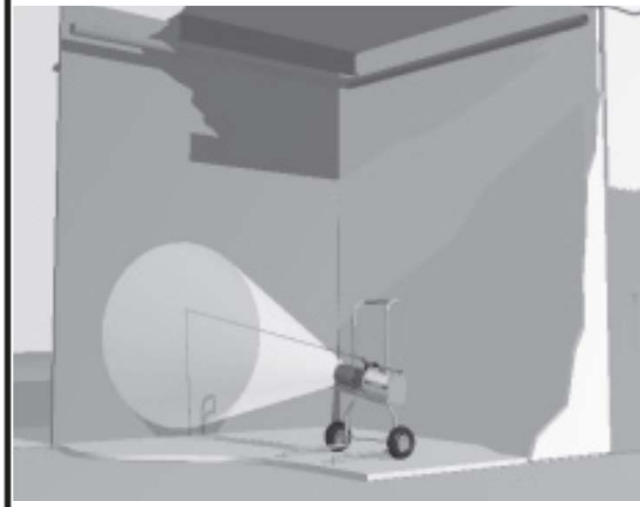
Characterisation during decommissioning

Energy transition funds project (funded by Belgian Federal Authority)



- Study of measurement systems based on **gamma spectroscopy** for **nuclear decommissioning waste in several containers** (200 & 400 l barrels, m^3)
  - Systems for sorting waste in appropriate waste category
- Study of on-site characterisation systems

[UHasselt, KULeuven & ECS; Dec 2018 – May 2020]

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Measurements during nuclear decommissioning

- Demonstration (measurement) tools
  - 3 D (radiological) mapping
- Strong involvement of master students
- Training sessions and dissemination sessions linked to the projects are under preparation

➔ Projects to trigger the imagination for new students to go into field of nuclear decommissioning

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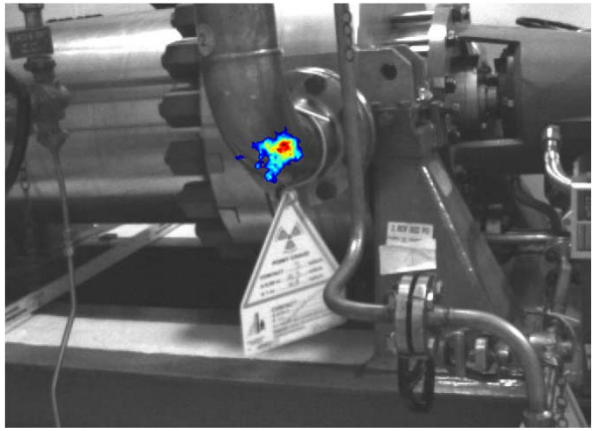

- Automated measurement solutions and reference materials for nuclear decommissioning are under development
- Collaboration academic and industrial partners

- Training sessions and dissemination sessions are under preparation
- These case studies can trigger the interest and involvement of students

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