EURAD-MODATS WP

Monitoring Equipment and Data Treatment for Safe Repository Operation and Staged Closure

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SCOPE OF THE MONITORING IN OUR PROJECT

- Monitoring is a broad subject covering all aspects of geological disposal, e.g. monitoring of society and monitoring technical performance of barriers

- Always need to explicitly state the reason for monitoring, what is monitored and the timeframe over which monitoring will be undertaken

- <u>MODATS</u> is focused on monitoring of the engineered barrier system and near-field rock during the operational period in support of post-closure safety demonstration and support for decision making ("repository monitoring")

  - MODATS is more dedicated to the "repository monitoring" = disposal cell + near field

  - Some work may have a slightly different focus, e.g. on monitoring : far field

EU project about monitoring dedicated to geological disposal
www.modern2020.eu

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SCOPE OF THE WP

- The ambition of the MODATS WP is to consolidate the implementation strategy for monitoring systems by developing methods through which confidence can be demonstrated in the data acquired and benefits derived for repository implementation.

- The **overall objective** of the proposed MODATS R&D WP is to evaluate, develop and describe methods and technologies, and to provide the means to measure, treat, analyse and manage data in a consistent manner.

- DURATION: 3 years (From June 2021 to 2024)

- PARTNERS: 21 organizations from 10 countries (6 WMOs, 3 TSOs, 12 REs and 1 CSO)

- BUDGET: 4,8 M€
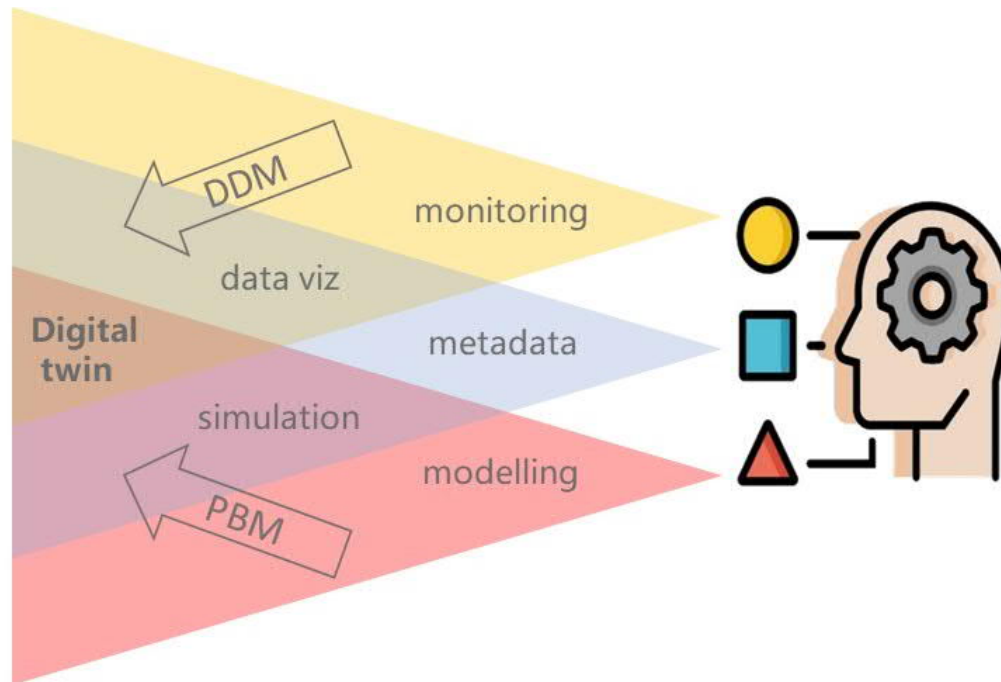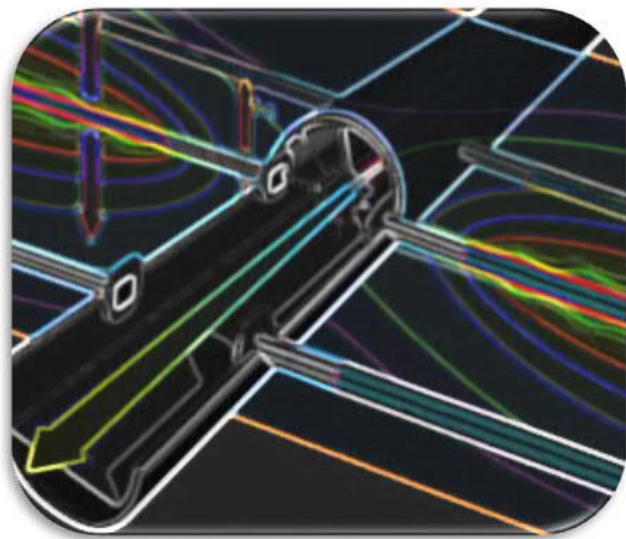
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PARTNERS

6 WMOs

ANDRA · nagra · SKB Svensk Kärnbränslehantering AB · enresa · POSIVA · Radioactive Waste Management

3 TSOs

IRSN INSTITUT DE RADIOPROTECTION ET DE SÛRETÉ NUCLÉAIRE · SSTC NRS · VTT

12 RE

ETH zürich · UFZ HELMHOLTZ Centre for Environmental Research · GFZ Helmholtz Centre Potsdam · cea · CVŘ Centrum výzkumu Řež · AMBERG ENGINEERING · Galson SCIENCES LTD · MUTADIS · EIMV ELEKTROINŠTITUT MILAN VIDMAR · ESV EURIDICE GIE · Arts et Métiers Sciences et Technologies · cnrs · PAUL SCHERRER INSTITUT PSI
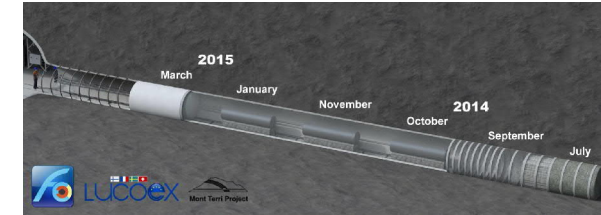
1 CSO

NTW

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(HYBRID) DIGITAL TWIN

- New representation with old tools

- But...... the combination in real time is the challenge

- Manage the data flow quantity in time
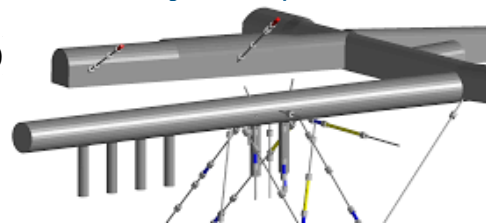
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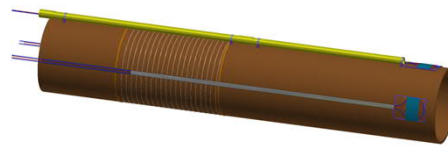
AHA105 (BURE)

FE, (Mont terri)

- Tools or outcomes we are developing:

  - Innovative monitoring technologies: Geophysics techniques, optical fibre sensors... / Interactions between Sensors and the Multi-Barrier System / Multi-Party Dialogue focus on monitoring data

  - challenges related to evaluation of multi-modal data → MODATS task 2 is dedicated to method to manage monitoring data

  - Digital twin development (4 test cases) : development of computer code and demonstration of the Digital Twin concept using data from the Reference MODATS Experiments.

    - Andra : plan lay the foundation for the development of a hybrid twin demonstrator applied to the HA cell case study in the clay concept (Bure). The combination of the data driven model(DDM) and physical based model (PBM)

    - PSI and UFZ will have two different approaches for the development on digital twin on the FE experiment in the Mont Terri

    - VTT will define a software platform to be prototyped and demonstrated supports arranging models of different phenomena in layers Impact of our WP to digital twins
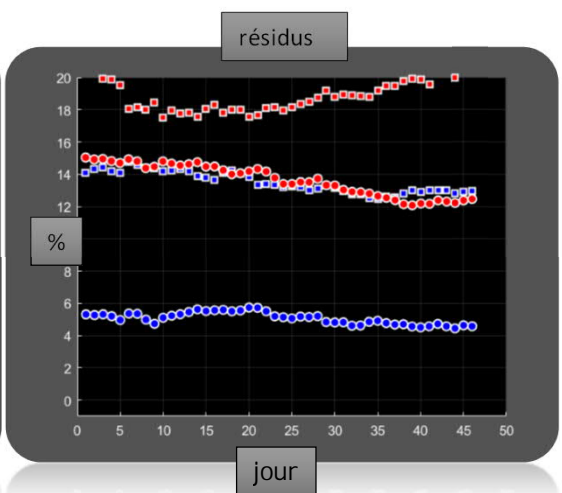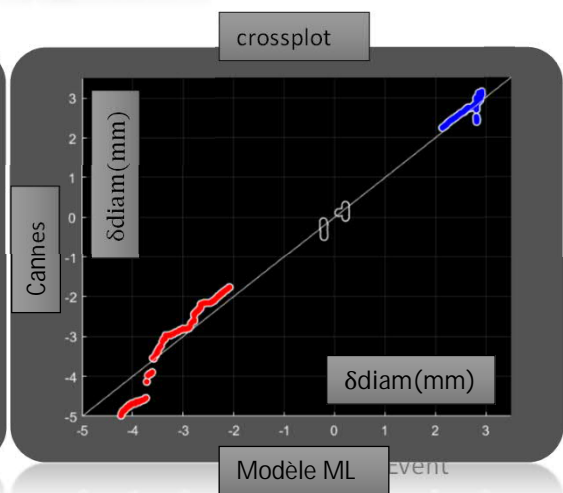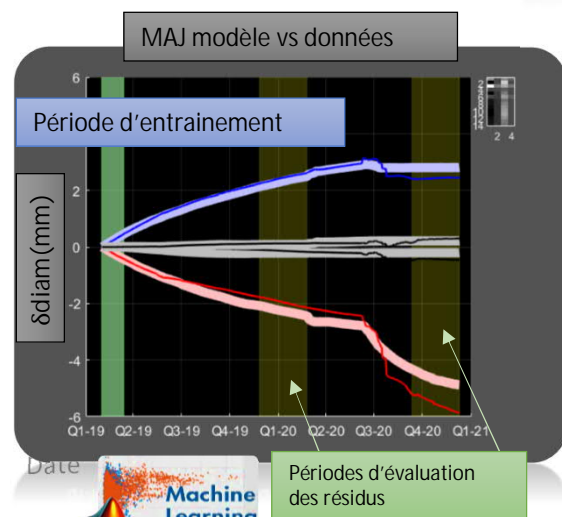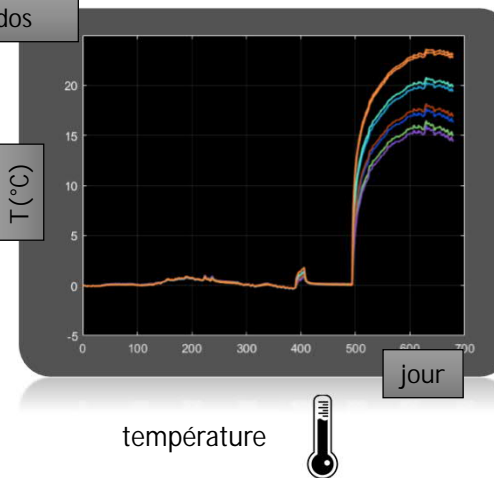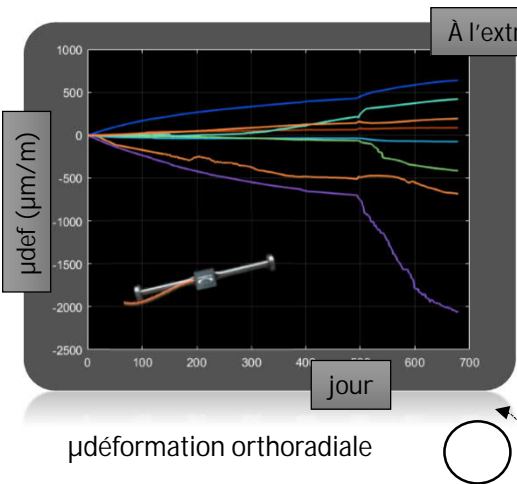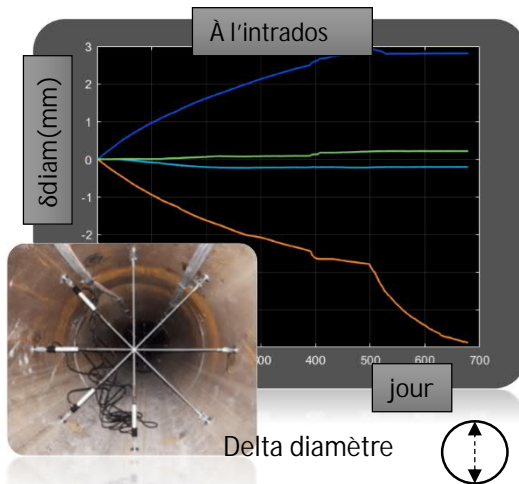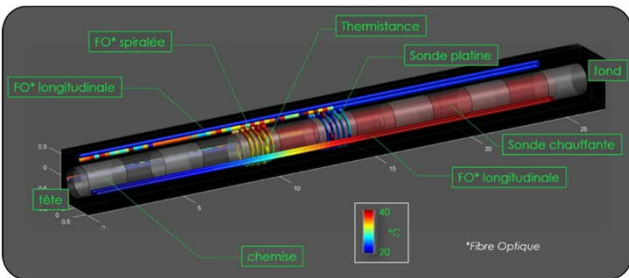
Praclay, (Hades)

POPLU (Onkalo

Prototype repository, (Aspö)
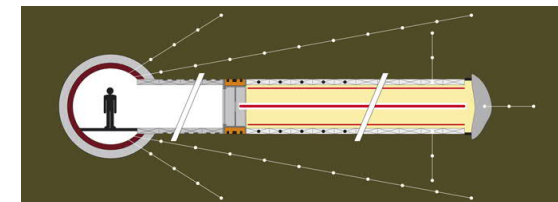
MONITORING DATA USE – E.G. GRAPHICAL COMPARISON AND HISTORY MATCHING.

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- Impact of our WP to digital twins:

  - WMOs
    ......and TSOs

  - Digital Twins can be used to follow the evolution of a repository system via monitoring and make reliable predictions on its future development.

    - First evaluation of the benefit of using a digital twin (decision making – safety assessment)

    - Digital twin help to increase confidence in the integrated monitoring system

    - Digital twin, a communication support between the stakeholders

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- Challenges to overcome, and needs for the future:

  - Digital twin: A Step-by-Step Strategic Plan dedicated to geological disposal/ integration of validated models and process control

  - Data = Data standards / multi-modal data

  - Coordinate multiple tasks simultaneously:=Workflow, coordination and time evolution / Surrogate models

  - Uncertainty = uncertainty types and their possible estimation methods / Uncertainty management and the quantification of trust/ Visualisation of uncertainty

  - topic : Integrating Machine Learning and Predictive Simulation: From Uncertainty Quantification to Digital Twins