

MODATS

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

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Scope & objective

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.

Task 2 : Data Treatment for Increased Confidence in Repository Monitoring

Repository monitoring will be conducted over long periods. This long timescale presents particular challenges for managing data, and making the information acquired for the monitoring programme accessible in order to support decision making. Management of monitoring data requires methods for storing large quantities of data, future-proofing of data management systems, and development of principles, methods, tools and routines for accessing data.

The work in Task 2 will be based on the experience gained from implementation of several full-scale reference experiments (*see figures on the left*) and the datasets that were collected, The Task 2 is divide in 5 main sub-tasks

Task 2.1 : Surveyed URL Experiments

17 experiments that include:
A range of different objectives - e.g. THMC processes, material behaviour and technology performance
Different multi-barrier system components - e.g. geosphere, bentonite buffer and plugs and seals
Different host rocks - e.g. range of clay and crystalline rocks / Active vs. complete and/or dismantled

The **lessons learned from these URL** experiments has been subdivided under the following 5 topics:

1. Monitoring system design.
2. Monitoring system and data QA/QC.
3. Monitoring system performance.
4. Monitoring data management.
5. Monitoring data use.

Task 2.2 : Data Quaty management guidances

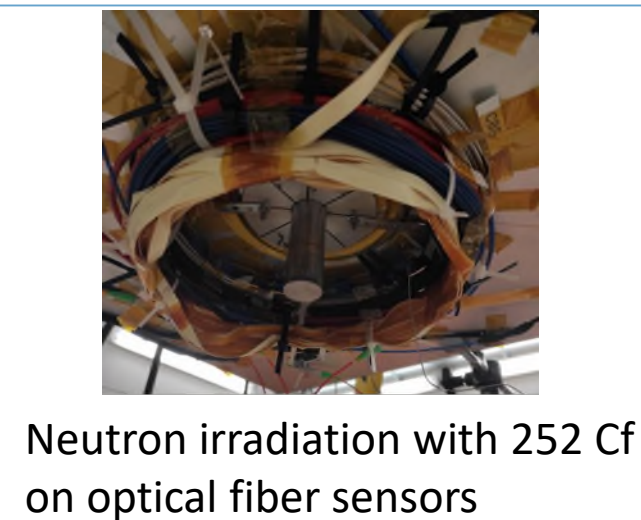
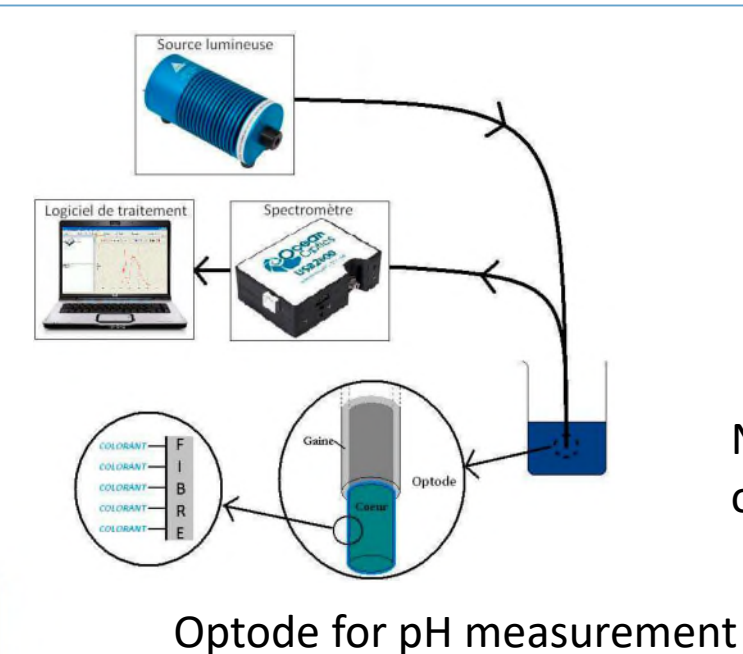
Measurement data is always prone to errors due to, e.g., sensor fouling, calibration drifts, data transfer problems, and configuration errors in data acquisition. To facilitate reliable analysis results, all measurement data has to be curated. Data errors have to be detected and handled. This is carried out by both statistical tests (e.g. measurement readings stuck on a constant value) and deployment of a priori physics-based knowledge (e.g. mass and energy balances). To make computed results traceable, all data curation steps are based on **QA/QC procedures** and recorded in a version control system.

MODATS WP will extend **good practice guidance** by analysing and communicating the quality assurance approaches adopted in the MODATS Reference Experiments, regulatory requirements, recommendations and best international practices related to quality assurance

Task 3 :Novel and Optimised Monitoring Technology for Repository Monitoring

New and emerging sensing methods may change the paradigm of how to monitor waste repositories. In order to push forward what is possible in terms of monitoring, it is crucial to stay abreast with the technological development to apply and adapt emerging technologies to waste repository monitoring and develop new technologies that are suitable for the specific requirements of repository monitoring.

1. Research and further develop innovative sensors and geophysical techniques to measure and infer parameters that are difficult to obtain for long-term monitoring.
2. Develop and qualify optical sensors to get them ready to be used in the initial phase of the development of the geological disposal for temperature and strain measurement.
3. Develop methods to investigate the impact of monitoring technology on the performance of a range of disposal systems.



For more information



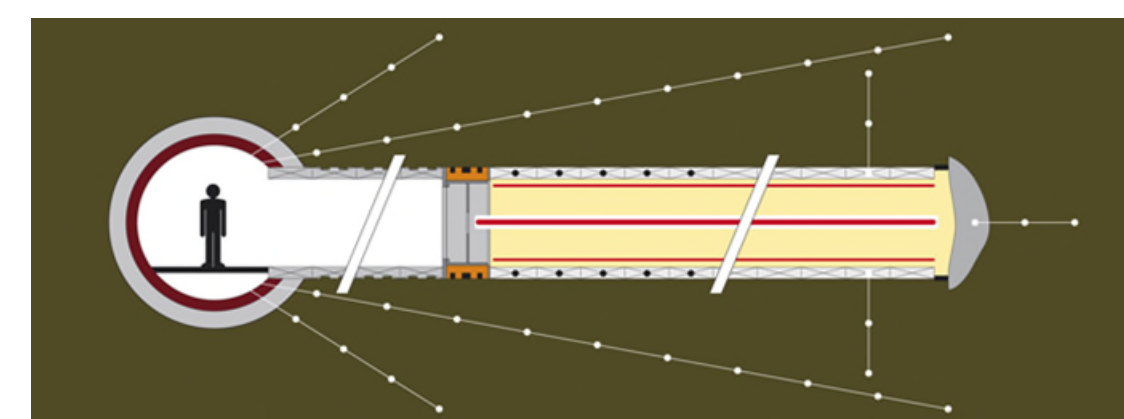
The MODATS WP

DURATION: 3 years (From June 2021 to 2024)

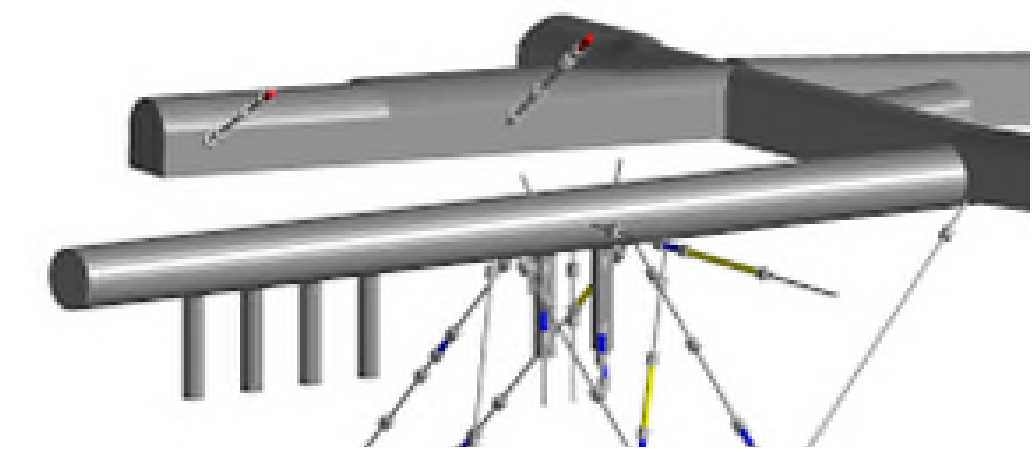
PARTNERS: 21 organizations from 10 countries (6 WMOs, 3 TSOs, 12 REs and 1 CSO)

BUDGET: 4,8 M€ with EU contribution: 2,4M€

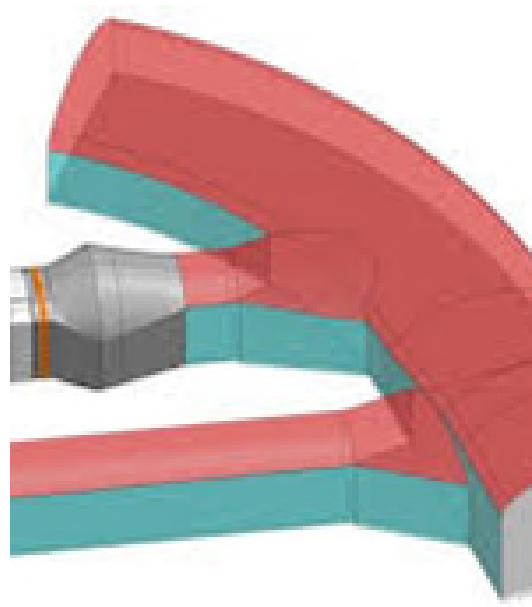
Our Reference Experiments for the MODATS project are the following



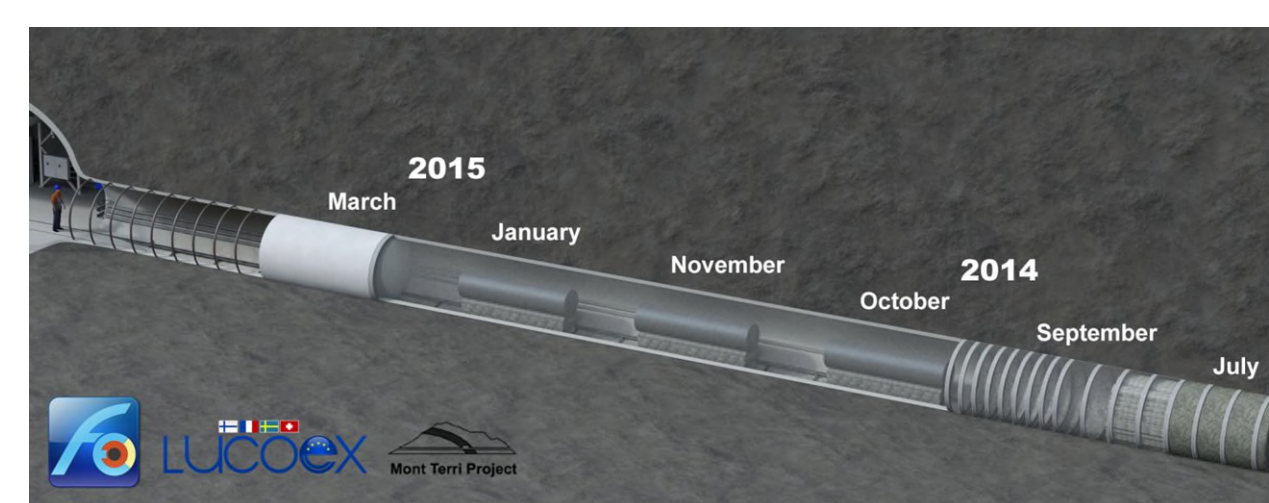
Preliminary demonstration test for CLAY disposal of highly radioactive waste (PRACLAY) experiment (HADES URL, Belgium)



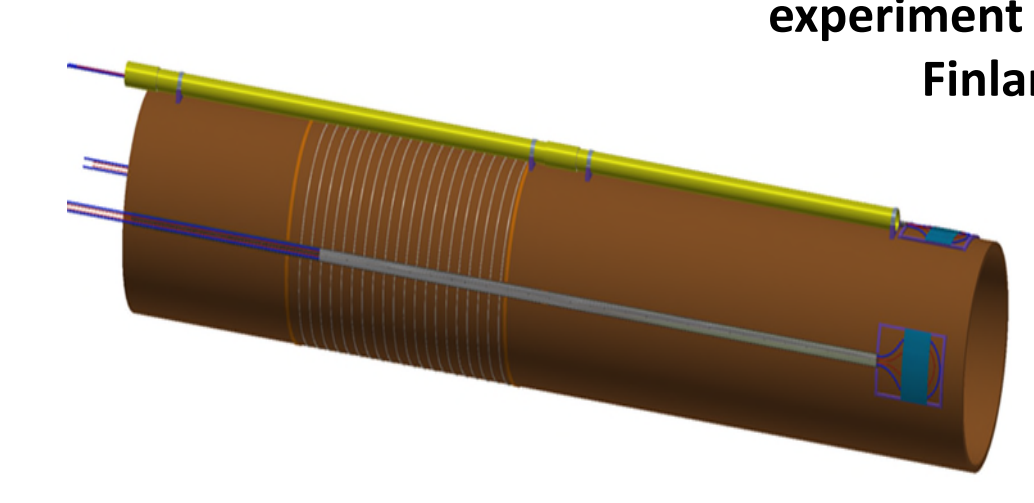
Prototype Repository II experiment (Äspö Hard Rock Laboratory, Sweden)



Posiva Plug (POPLU) experiment (ONKALO, Finland)

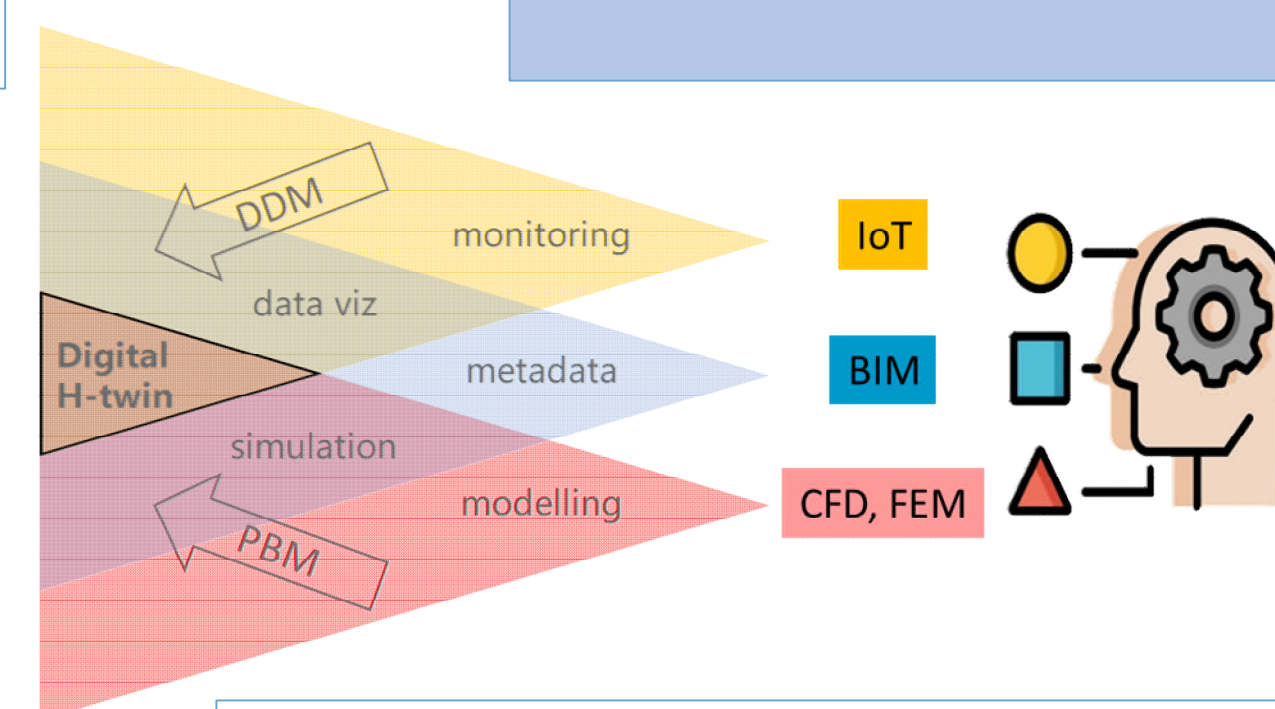


Full-Scale Emplacement (FE) experiment (Mont Terri URL, Switzerland)



ALC1605 demonstrator (Bure URL, France)

Task 2.3&2.4: Data-driven Model and Digital Twin

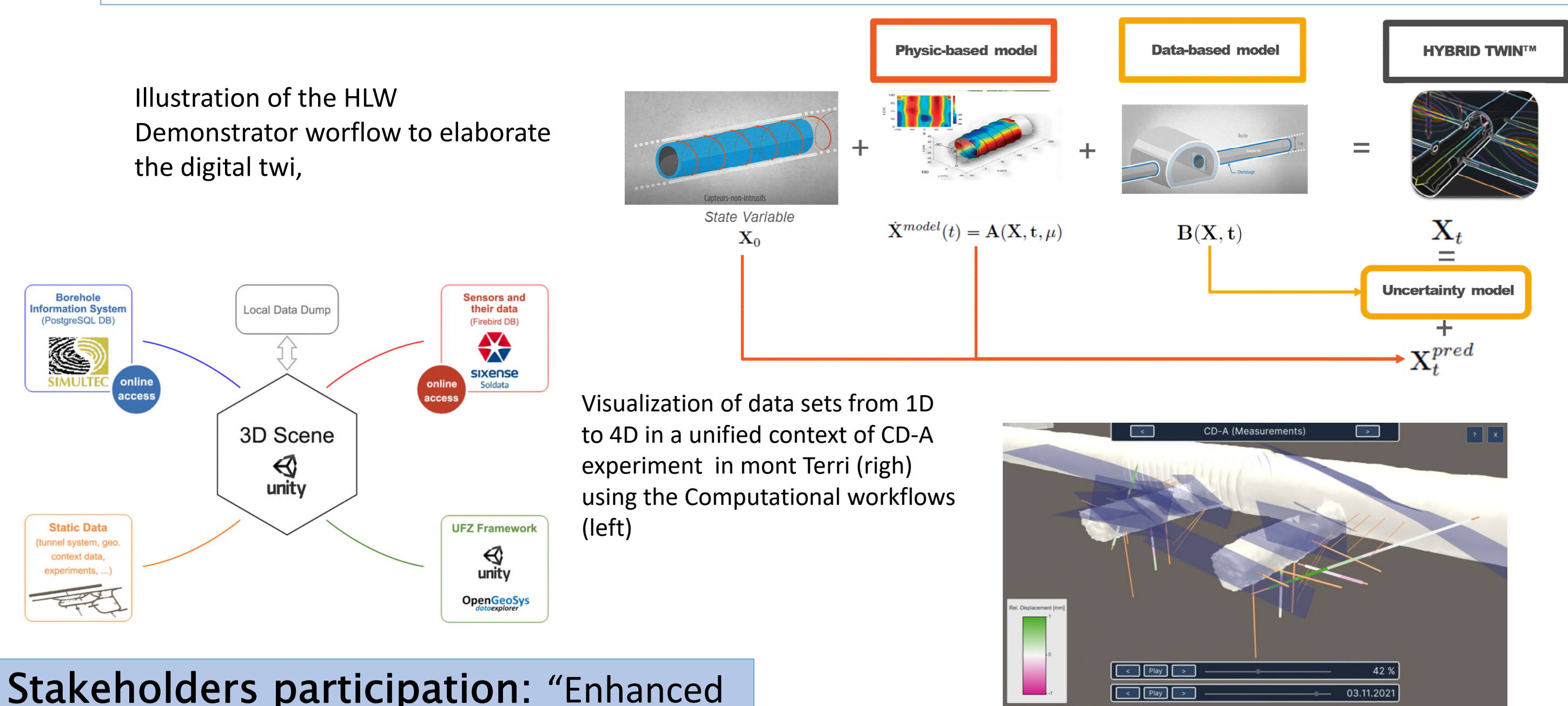


A virtual model designed to accurately reflect a physical object that is updated using real-time data to understand and predict processes occurring in the physical model

In the repository context, it might be assumed that the Digital Twin combines geosphere, excavations / infrastructure and process models, and uses monitoring data to improve understanding and predict evolutions.

Different approaches towards the application of Digital Twins will be developed by the partners inside the MODATS project, The **Digital Twins will be prototyped** and demonstrated based on available data sets and of selected phenomena and processes implemented in the PBM (physical-based model). The development of data driven model is a specific work in side a dedicated subtask (2.3)

See below, the workflow process to elaborate a Digital twin of the High level cell demonstrator in the URL of Bure and experiment in Mont Terri



Task 2.5: Stakeholders participation: “Enhanced System Understanding, Multi-Party Dialogue”

The purpose of this contribution (sub-task 2.5) is to develop an integrated vision of how the monitoring devices and corresponding data production will contribute to develop a shared understanding of the repository system along with the decision-making process from the early phase of authorisation, to subsequent implementation phases, closure and post-closure

Methodology : 3+1 parties” dialogue and mutual understanding between the three EURAD categories of organisation (WMO, TSO and RE) and the EURAD Civil Society Group. Dialogue will be mediated by Civil Society Experts according to the EURAD Double Wing methodology



Digital Twin technology and Virtual reality are new tools to improve engagement and communication with stakeholders and local communities (?)

Conclusions

MoDeRn and Modern2020 projects have included significant research into the role of monitoring in decision making, and stakeholder engagement on monitoring and in European level RD&D. the MODATS WP is undertake R&D into data acquisition, data management and presentation, and use of data in system understanding to increase confidence in the system.