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## **PLEIADES: Main outcomes, evaluation and steps forward**

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Nicolas Delannay

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# PLEIADES

Smarter Plant Decommissioning



## PLEIADES: Main outcomes, evaluation and steps forward

M.-B. Jacques (coordinator), J. A. Ridao Cabrerizo, S. Gentes, D. Daniska, N. Delannay et al.

**DigiDECOM23– Helsinki**

25 October 2023



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# Content

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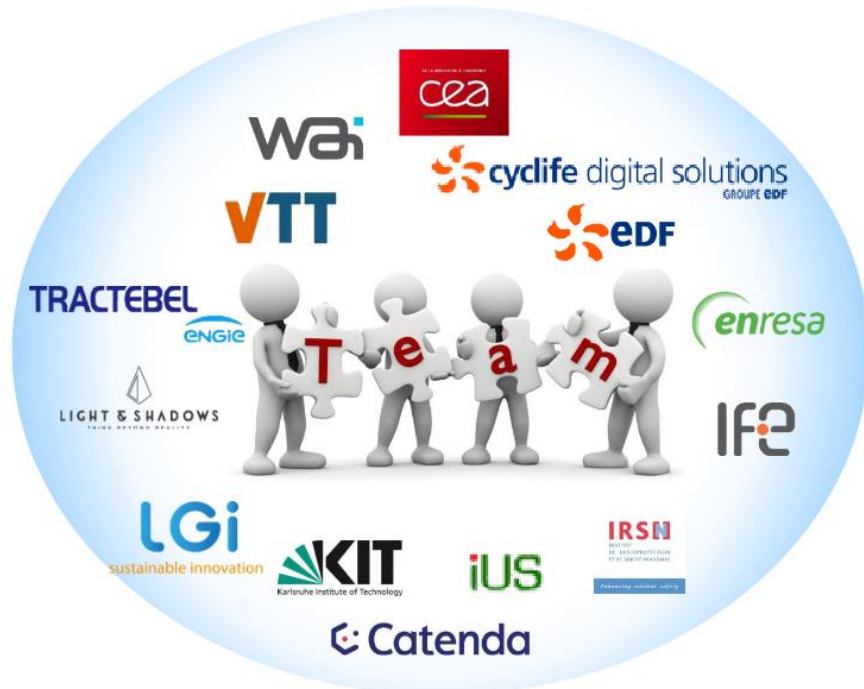
- Introduction
- Objectives
- Work plan
- Main outcomes
  - Ontology
  - PLEIADES Platform
  - Digital Models
- Use of Digital Models & Demonstration on Real Use Cases
- Further Steps



# PLEIADES Overview

- **Platform based on Emerging and Interoperable Applications for enhanced Decommissioning processes**
- **Duration: 3 years (01/10/2020 - 30/11/2023)**

## 14 partners from 7 countries



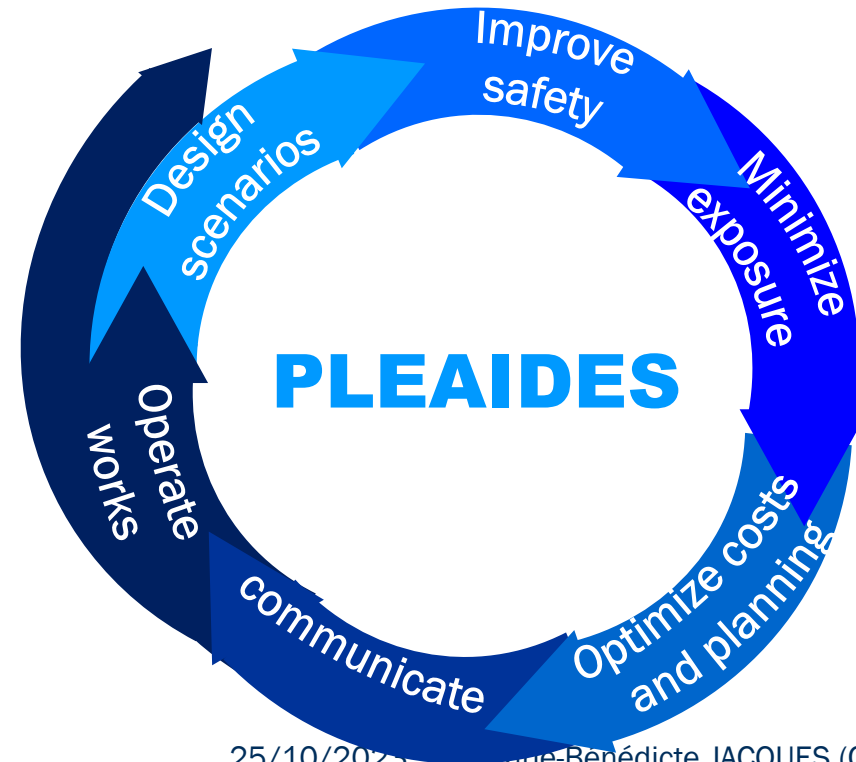
## 3 Use Cases



# PLEIADES: Objectives

✓ Develop an innovative platform based on a BIM approach

→ BIM (*Building Information Modelling*) approach to **design scenario**, **improve safety**, **minimize radiation exposure**, **optimize costs and planning**, **communicate**



# PLEIADES Objectives

✓ Develop an innovative platform based on a BIM approach

→ BIM (*Building Information Modelling*) approach to **design scenario, improve safety, minimize radiation exposure, optimize costs and planning, communicate**

→ 3D modelling & simulation

→ “multi-dimensional modelling”: **3D model, time, dose, feasibility studies, waste and costs**

→ Software **integration** and **interoperability**



1. **3DScanPF (KIT)**: Robotic platform for 3D scans and imaging
2. **DIM (EDF)**: Dismantling Info Modelling system for storing all facility data
3. **Bimsync (CATENDA)**: IFC<sup>1</sup> compatible BIM platform used in construction
4. **iUS IMS (iUS)**: Semantic wiki based nuclear info system
5. **RadPIM (IFE)**: Radiological characterisation tool (part of VRdose family)
6. **VRdose (IFE)**: Detailed job planning tool with a radiological model library
7. **DEMplus (CYCLIFE DS)**: Decision-support tool combined with 3D simulation
8. **Aquila costing (WAI)**: ISDC<sup>2</sup> compatible client-server based costing tool
9. **iDROP (CEA)**: VR dismantling simulation with collision & radiological modelling
10. **WASTREAM** : (**Tractebel**): Low Level Waste Activity Assessment tool
11. **ALVAR (VTT)**: AR<sup>3</sup> training platform with advanced tracking capabilities
12. **INTERACT (LS)**: XR<sup>4</sup> platform with physics engine





# PLEIADES Objectives

✓ Develop an innovative platform based on a BIM approach

✓ Implement on real cases

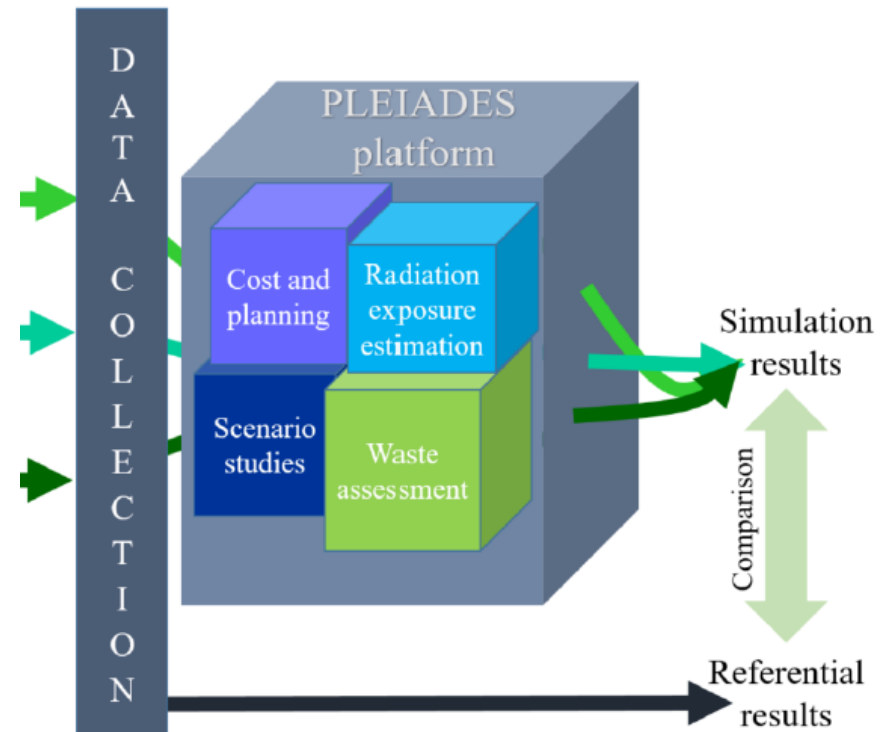
Santa María de  
Garona (SMG)



Halden Research  
Reactor (HRR)



Base Chaude O.  
du Tricastin (BCOT)



# PLEIADES Objectives

✓ Develop an innovative platform based on a BIM approach

✓ Implement on real cases

✓ Develop an associated methodology and prepare it as a standard

→ Establish a **standardized process** to organize the data collected consistent with BIM approach

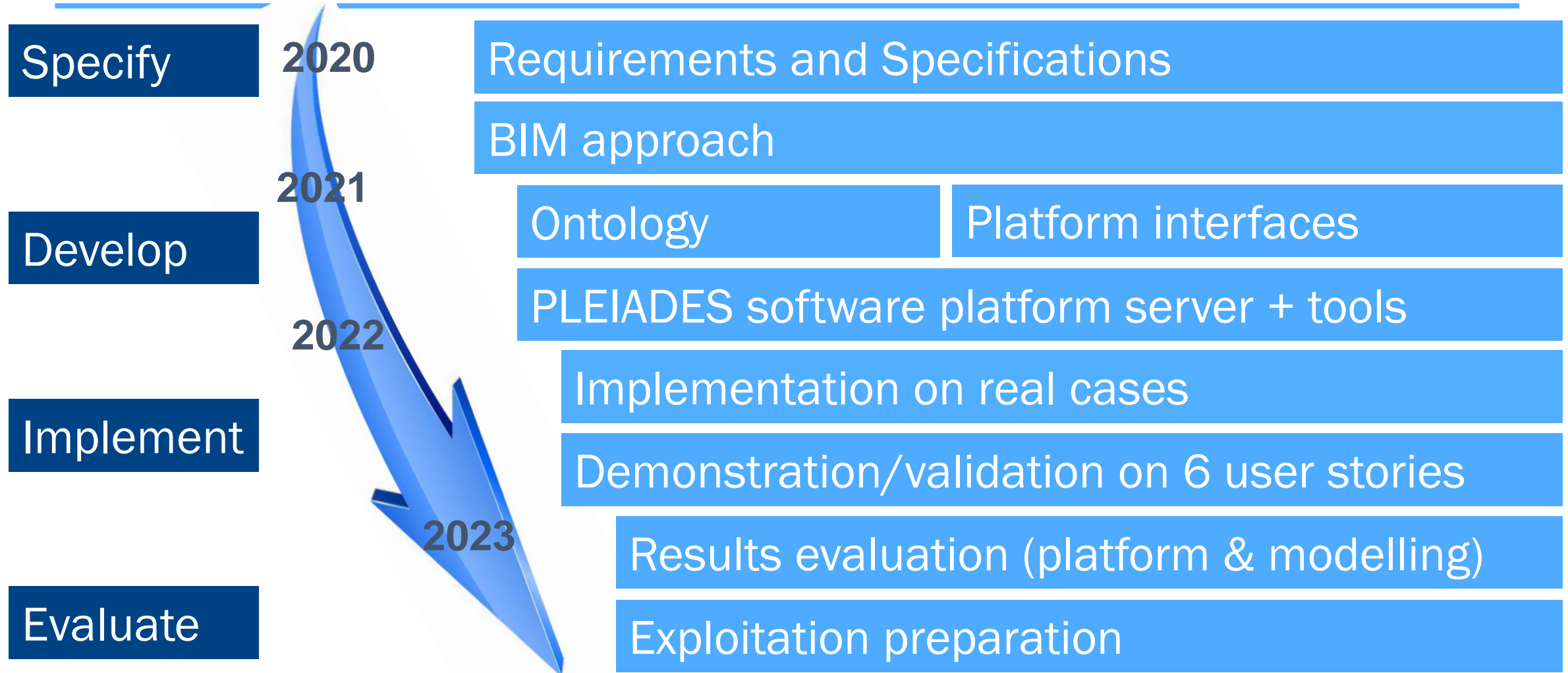
→ Propose an **ontology** for an international standard:

- decommissioning specific terminology / vocabulary definition
- concepts relationships identification
- common understanding
- common knowledge modeling





# PLEIADES Work plan



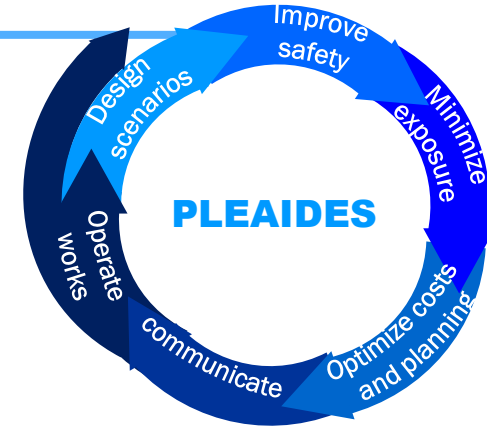
➤ End of project : November 2023



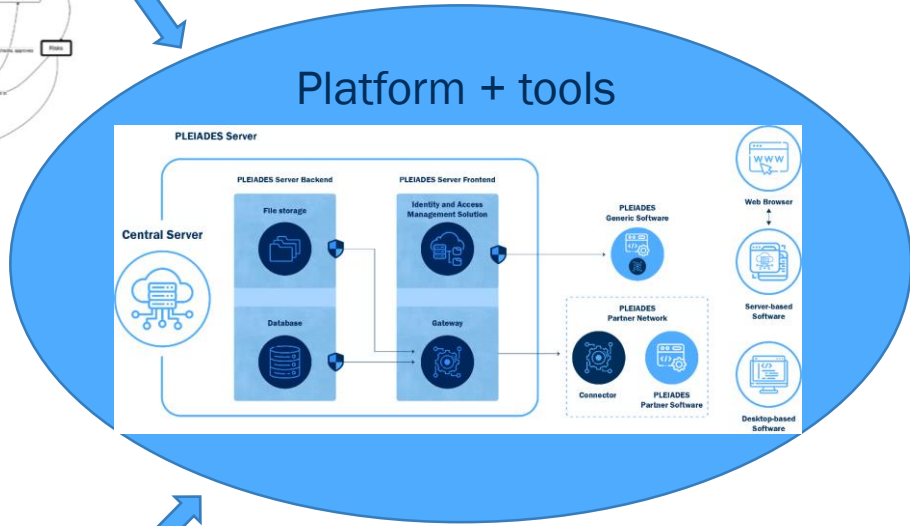
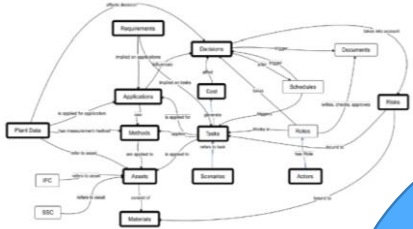
# PLEIADES Outcomes overview

## PLEIADES BIM-based concept

BIM (*Building Information Modelling*) approach to **design scenario, improve safety, minimize radiation exposure, optimize costs and planning, communicate**



Data collection based on decommissioning ontology



Scenario simulation

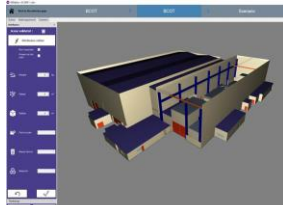
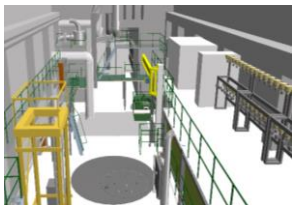
SMG



Estimations/Comparison/Decisions

- Waste management
- Dose exposure
- Cost
- Planning
- ...

3D models



HRR

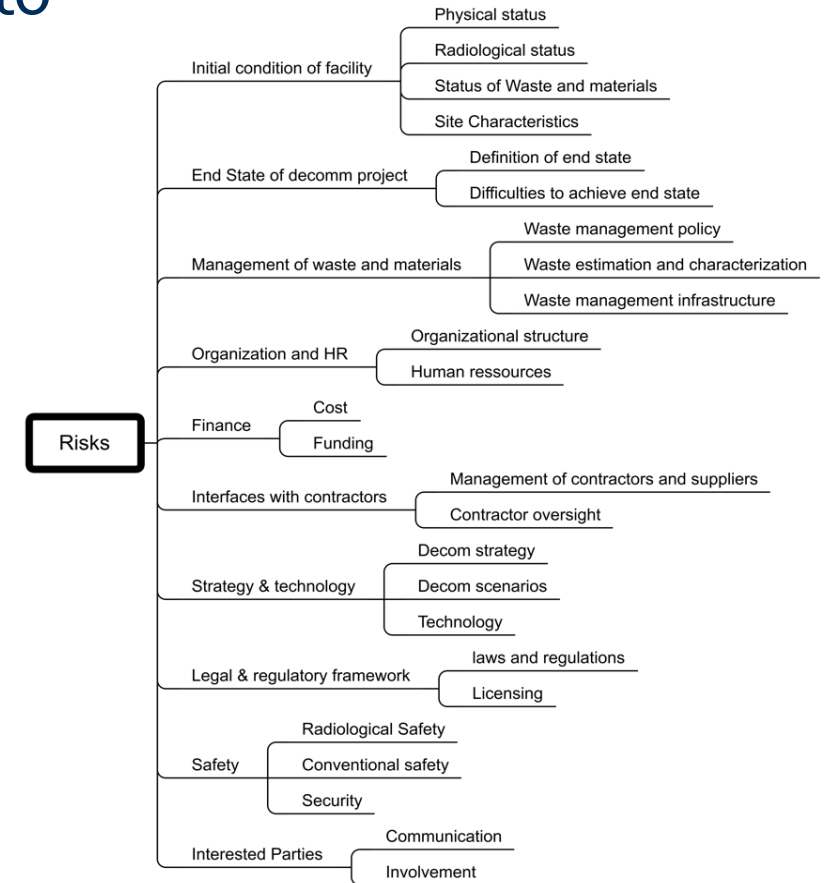
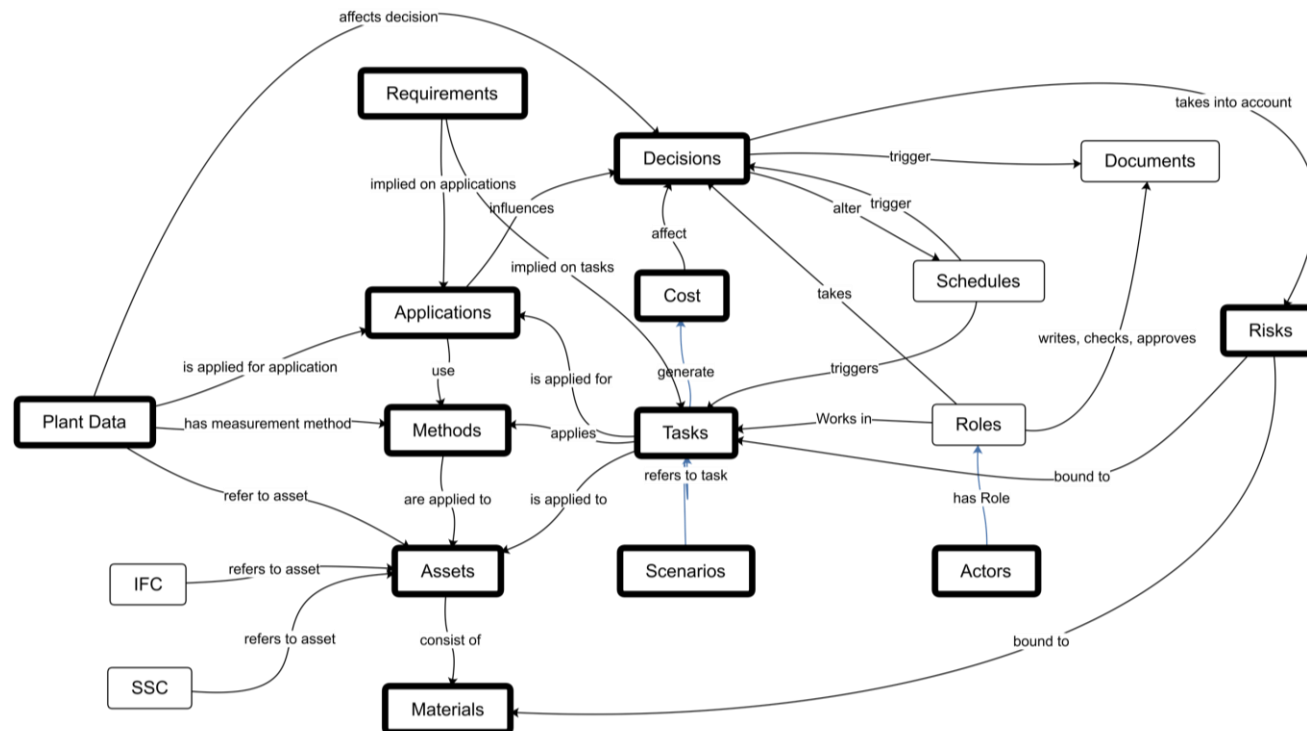


BCOT

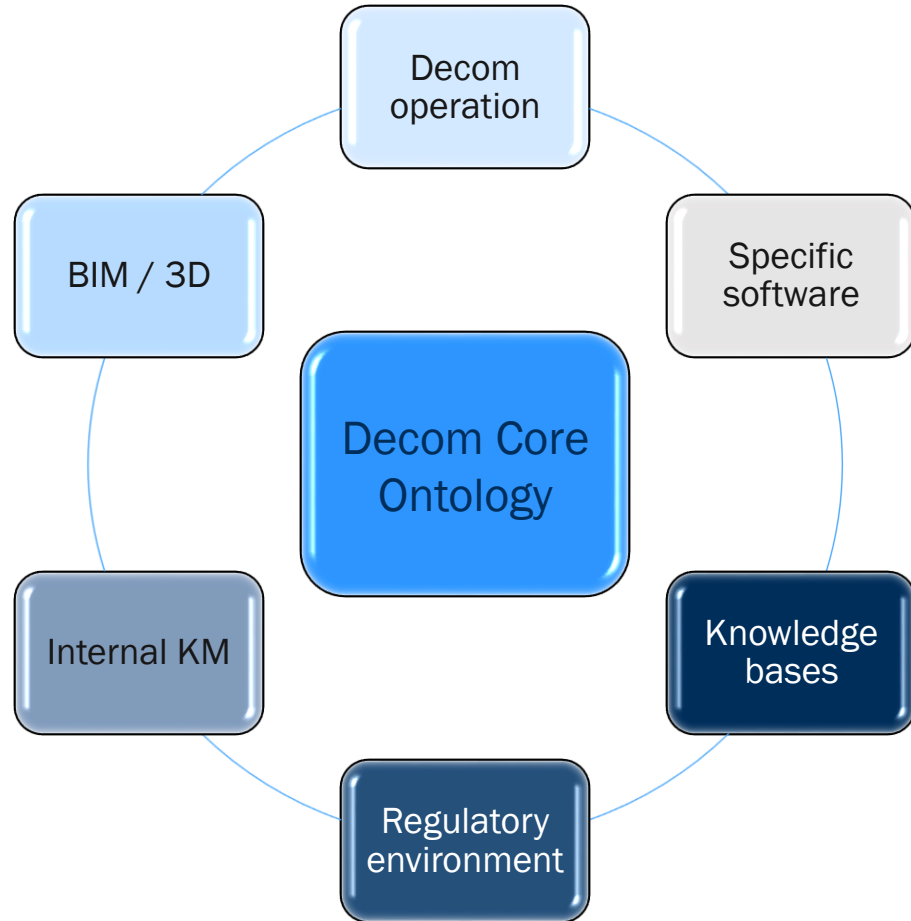


# Ontology

- Achieve: common understanding + data compatibility
- Reuse ontology/taxonomy concept; extended to decommissioning process data



# Ontology

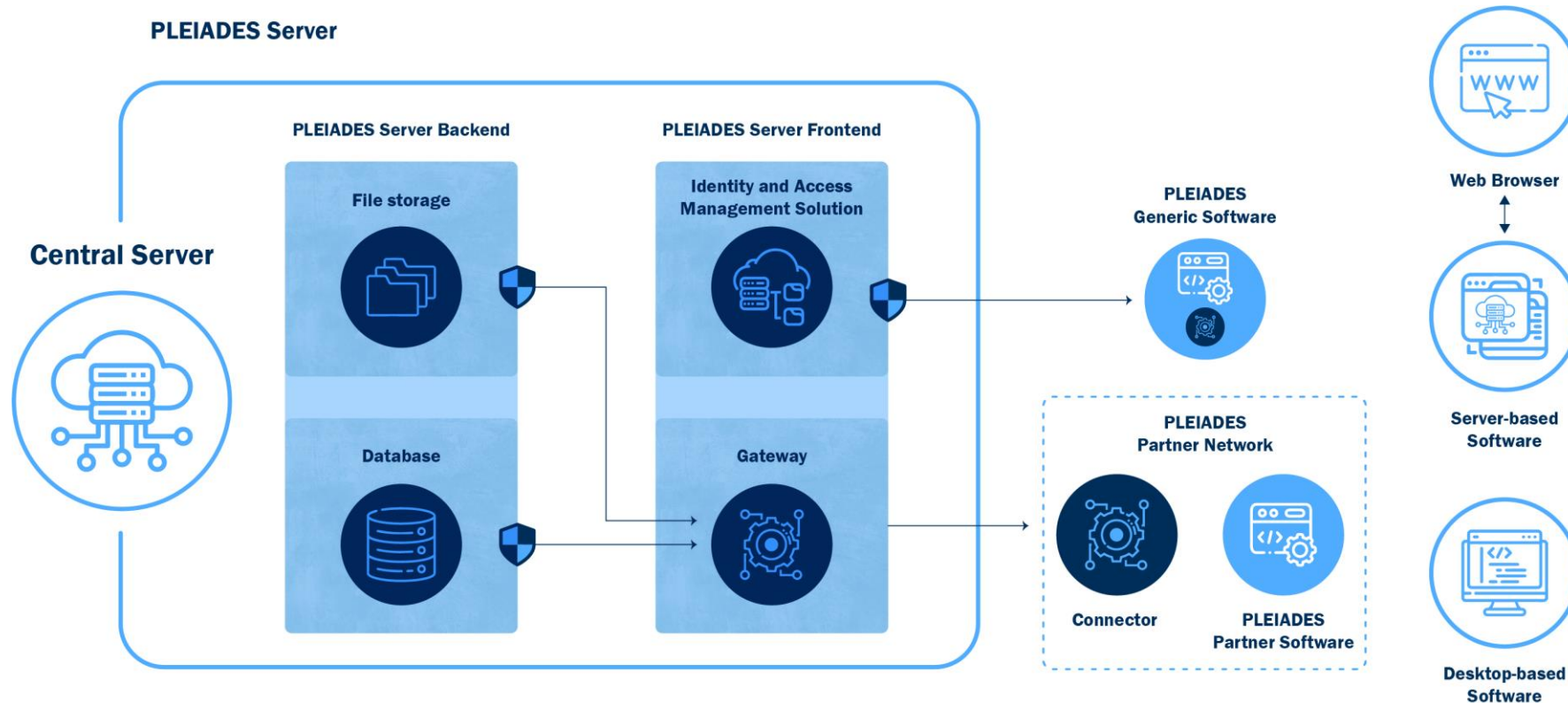


## Results:

- Common understanding + data compatibility
- Easier to connect different applications and knowledge base
- Enabling to reuse the vast decommissioning knowledge
- Basis for PLEIADES platform interfaces

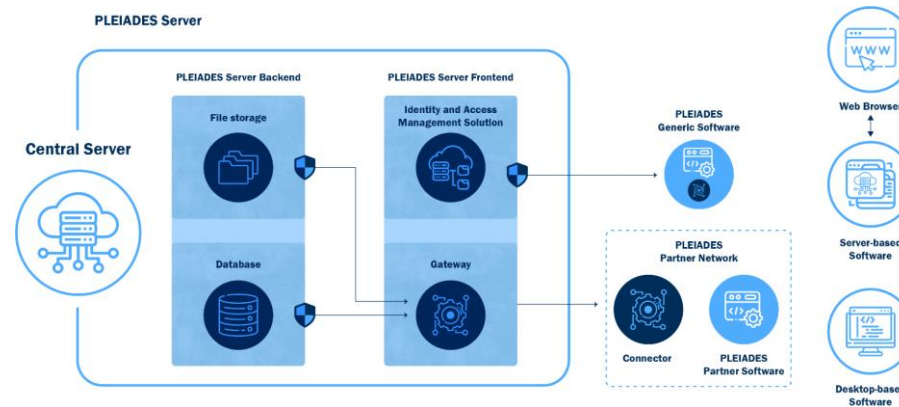
# PLEIADES Platform

- PLEIADES innovative platform has been specified, developed and tested
- Platform is operational



# PLEIADES Platform

→ Platform is **flexible** : SW connection and benefit from common data

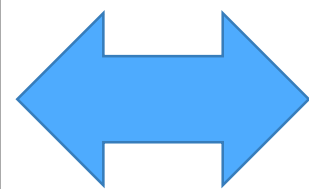


PLEIADES DB browser  
Version 0.1beta

[Add new record](#)

All records  
Show 10 entries

_id	Class	Content	RecordInfo
6229e16c181967e7813790f	Actors Teams	<pre>{   "members": "super team",   "membersId": [     {       "memberType": "Actors.Persons",       "memberId": "judo"     },     {       "memberType": "Actors.Persons",       "memberId": "feno"     }   ] }</pre>	<pre>{   "client": "regulaccounting",   "collabor": "8922-89-0873138153_2661" }</pre>



WASTREAM

AquilaCosting  
Decommissioning & Waste Management Costing Software

drop

INTERACT

DEMplus  
FOR NUCLEAR  
Démantèlement Exploitation Maintenance

ALVAR

VRdose®





# Digital models



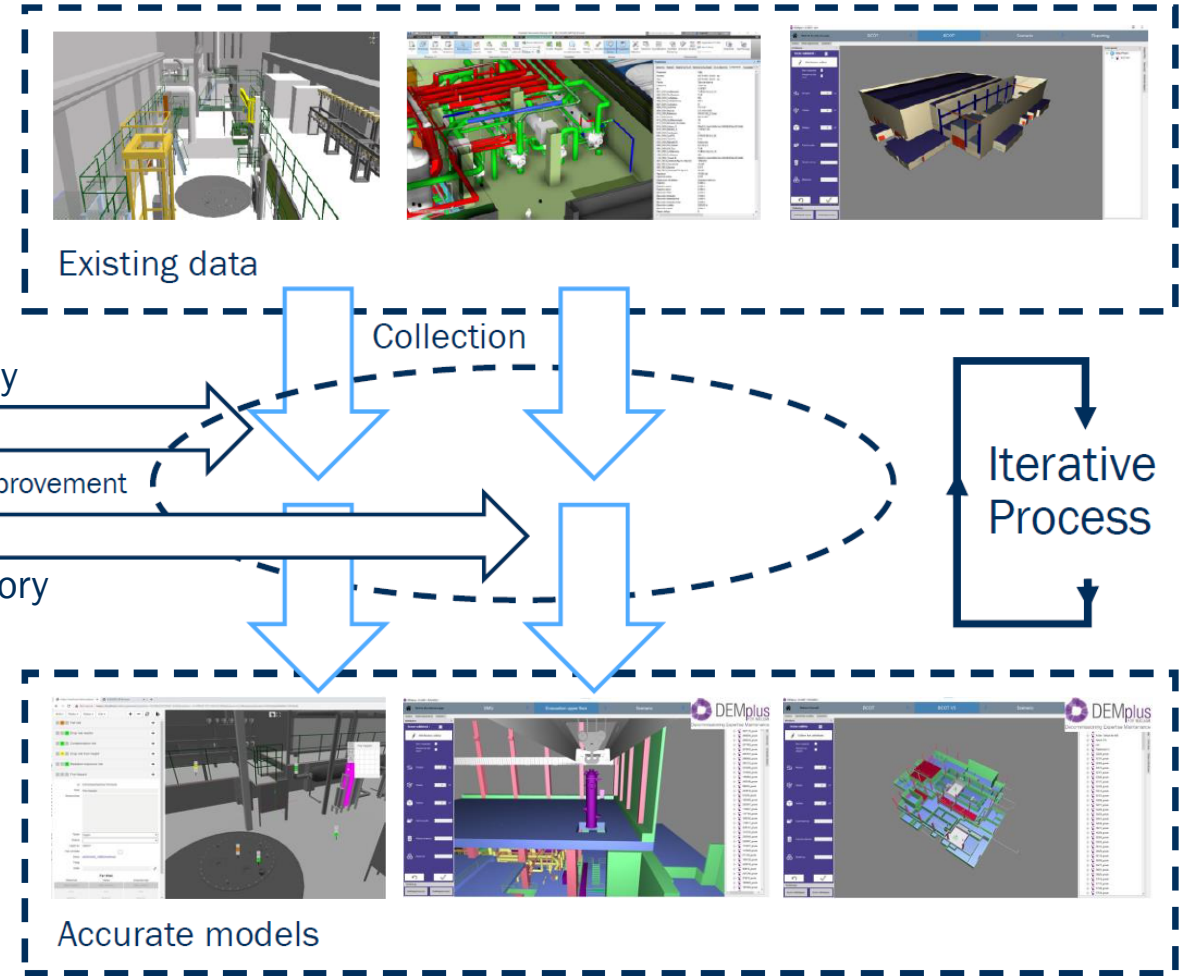
Halden Research Reactor (HRR)



Santa María de Garona (SMG)



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# PLEIADES Demonstration on use cases

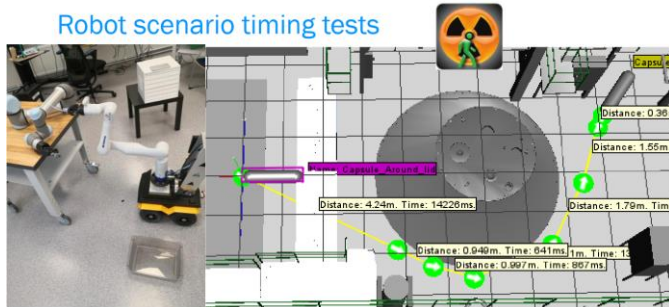
Halden Research Reactor (HRR)



**US#1:**

Manual vs. remote radiological characterization

Robot scenario timing tests



HVRC VRdose® Results	
Scenario	Dose (mSv)
Disaster (Robot)	
Manual scenario	0.3
Remote / robot scenario	0.338

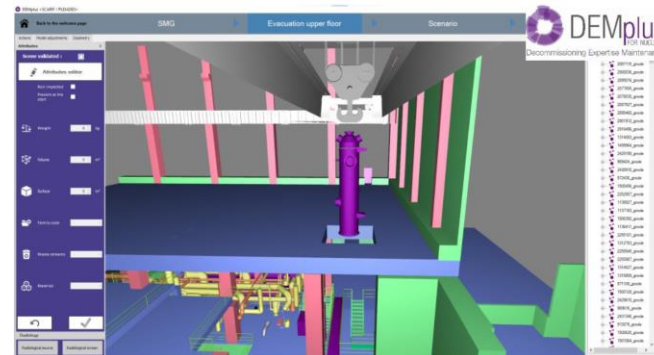
Santa María de Garona (SMG)



**US#2:**

3D supported vs. digitally enhanced dismantling

SMG 3D model visualization on DEMplus®



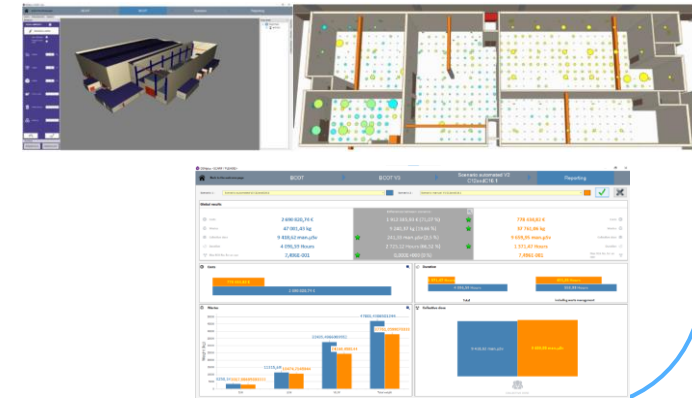
Base Chaude O. du Tricastin (BCOT)



**US#3:**

Manual vs. automated decontamination of surfaces

Test and results from DEMplus® scenario simulations



**US#4:**

Strategic risk management planning

**US#5:**

Regulatory/TSO review capabilities

**US#6:**

Strategic waste management planning



# Steps forward

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- Working Group of IAEA, OECD-NEA and EU-JRC: working on ontology for managing the knowledge on decommissioning  
Future standardization
- Continue in the development of the ontology and the API:
  - Extend the coverage of the supported decommissioning planning activities
  - Integration of other digitalization technologies like artificial intelligence, robotics or integration with sensor networks.
- Promoting the PLEIADES concept



**PLEIADES open workshop today 4pm Special Session**



# Thank you for your attention



## Contact:

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 <http://pleiades-platform.eu>

 @pleiades platform

