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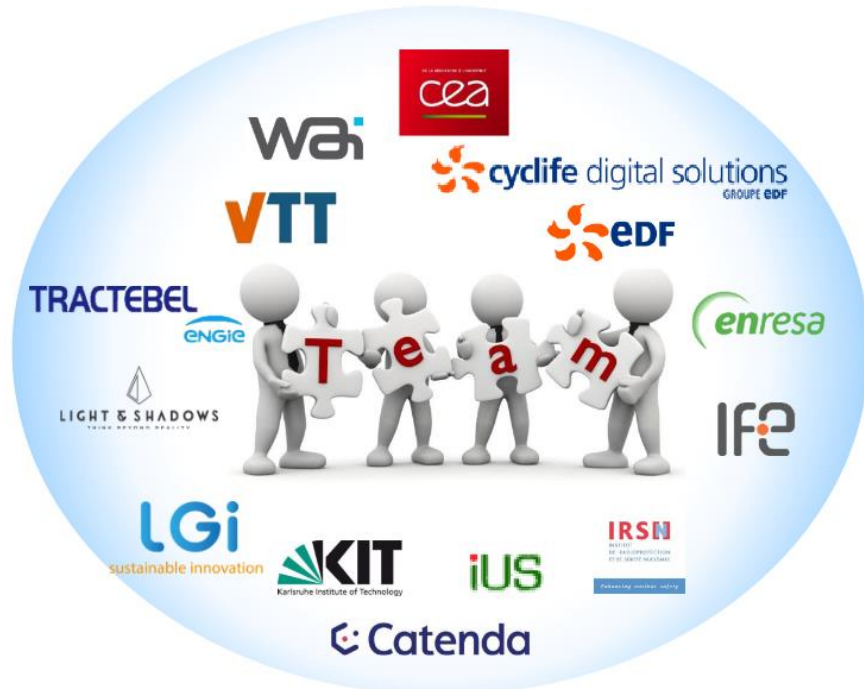
- Introduction
- Objectives
- Work plan
- Main outcomes
  - Ontology
  - PLEIADES Platform
  - Digital Models
- Use of Digital Models & Demonstration on Real Use Cases
- Further Steps



# 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



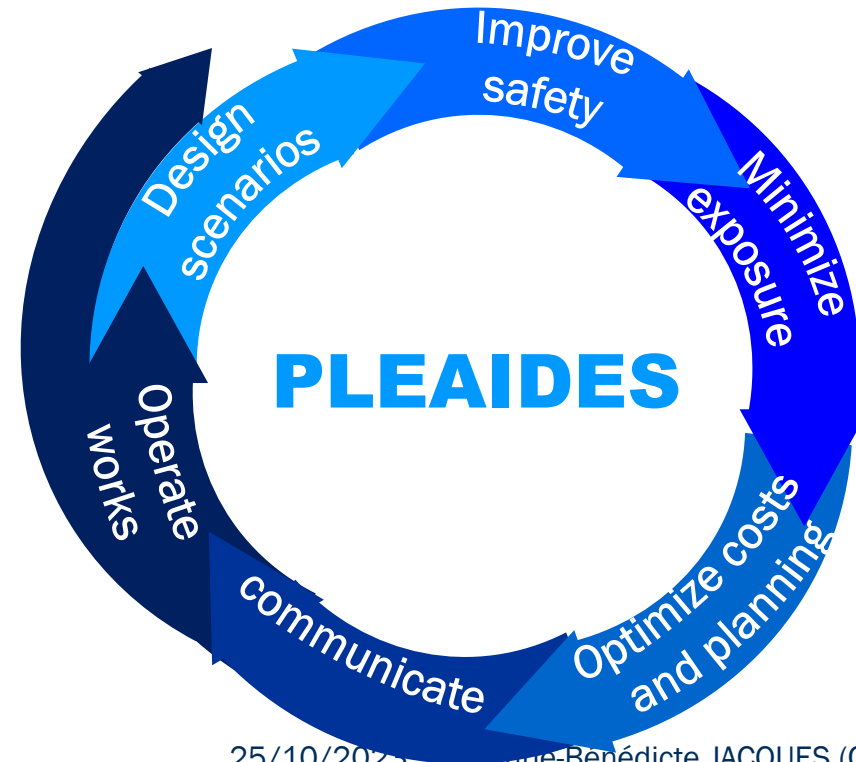
## 3 Use Cases



# 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

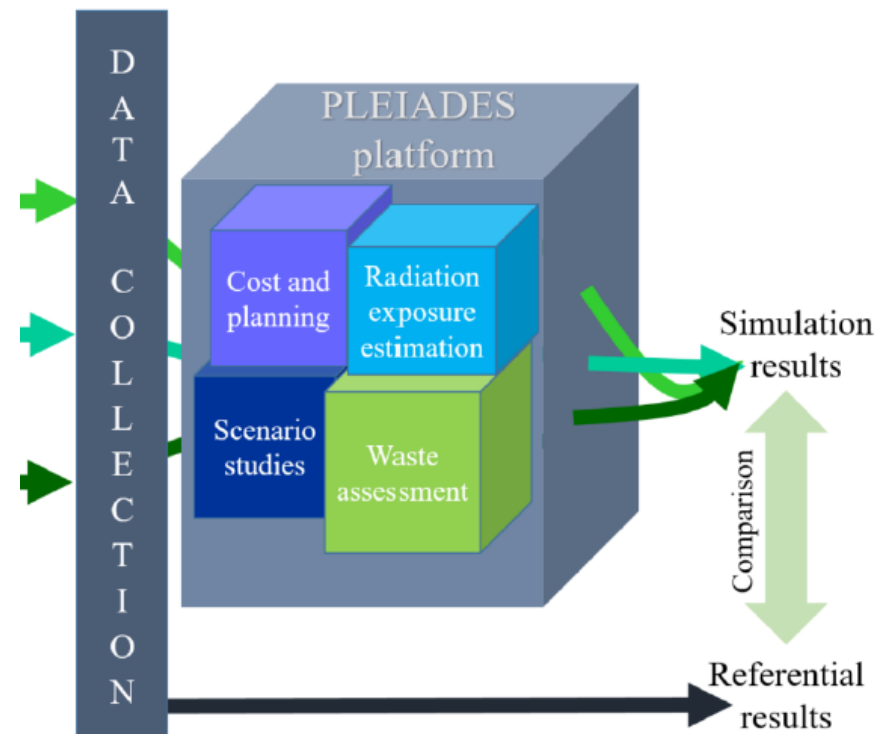
Santa María de  
Garona (SMG)



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

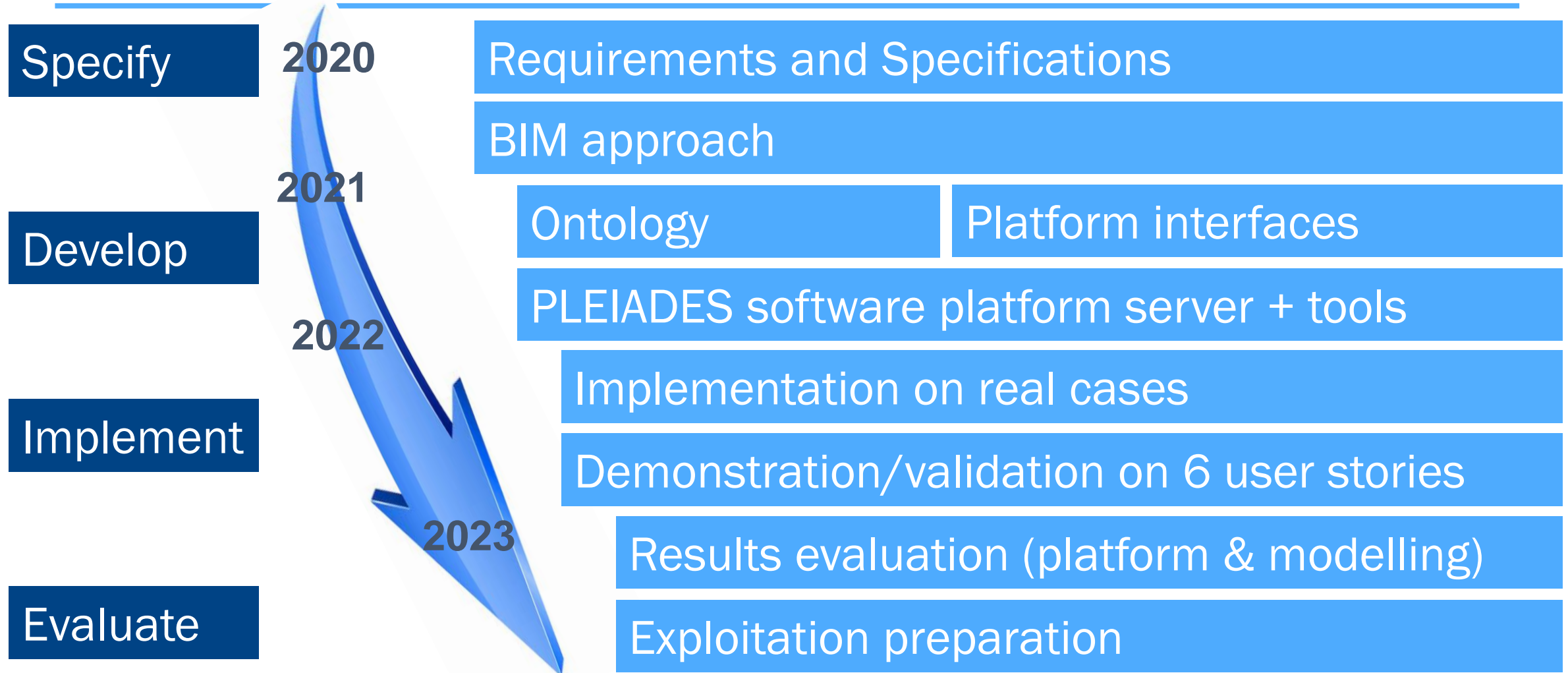
→ Propose an **ontology** for an international standard:

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





# PLEIADES Work plan



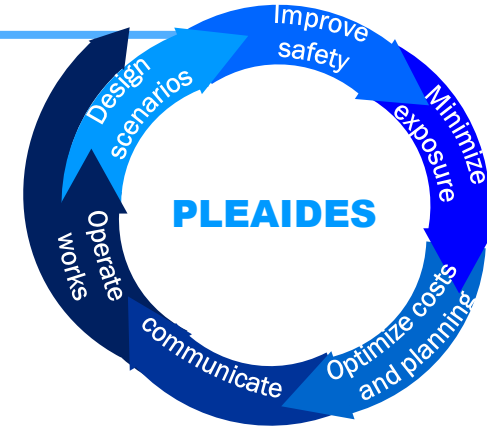
➤ End of project : November 2023



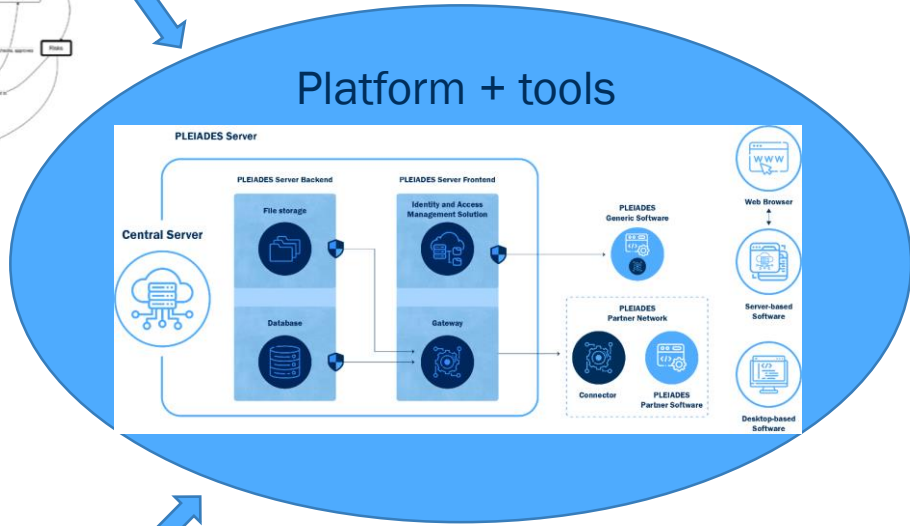
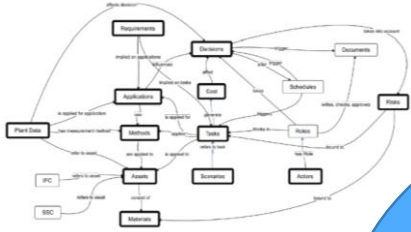
# PLEIADES Outcomes overview

## PLEIADES BIM-based concept

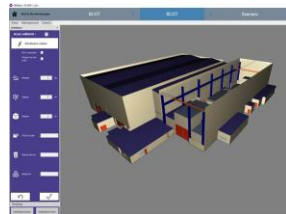
BIM (*Building Information Modelling*) approach to **design scenario, improve safety, minimize radiation exposure, optimize costs and planning, communicate**



Data collection based on decommissioning ontology



3D models



Scenario simulation

SMG



Estimations/Comparison/Decisions

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

HRR

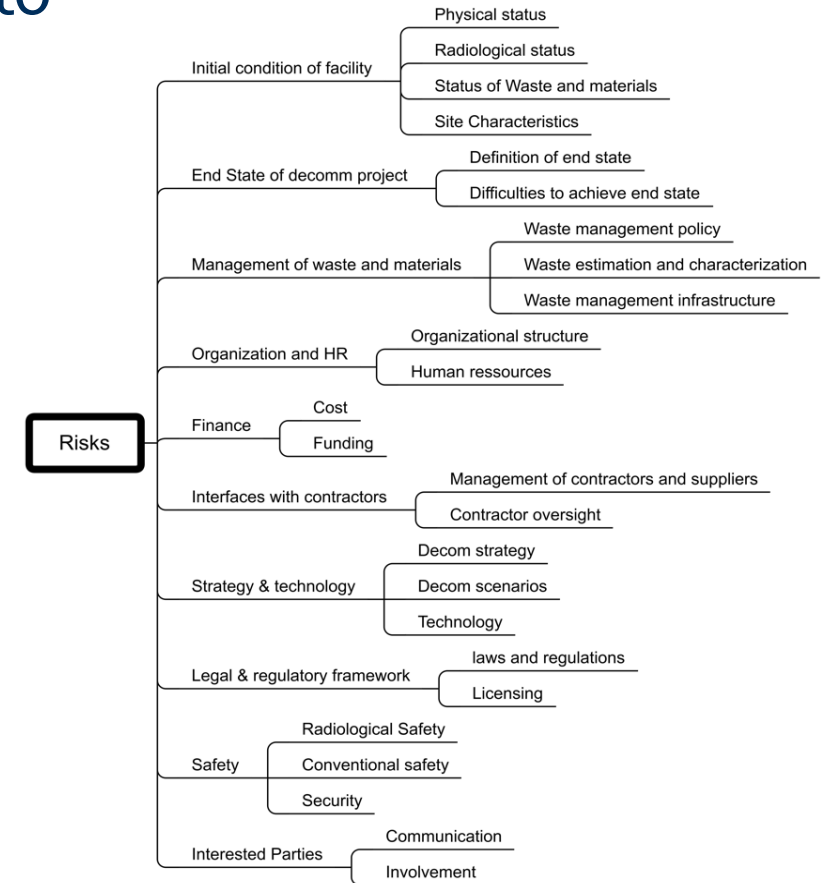
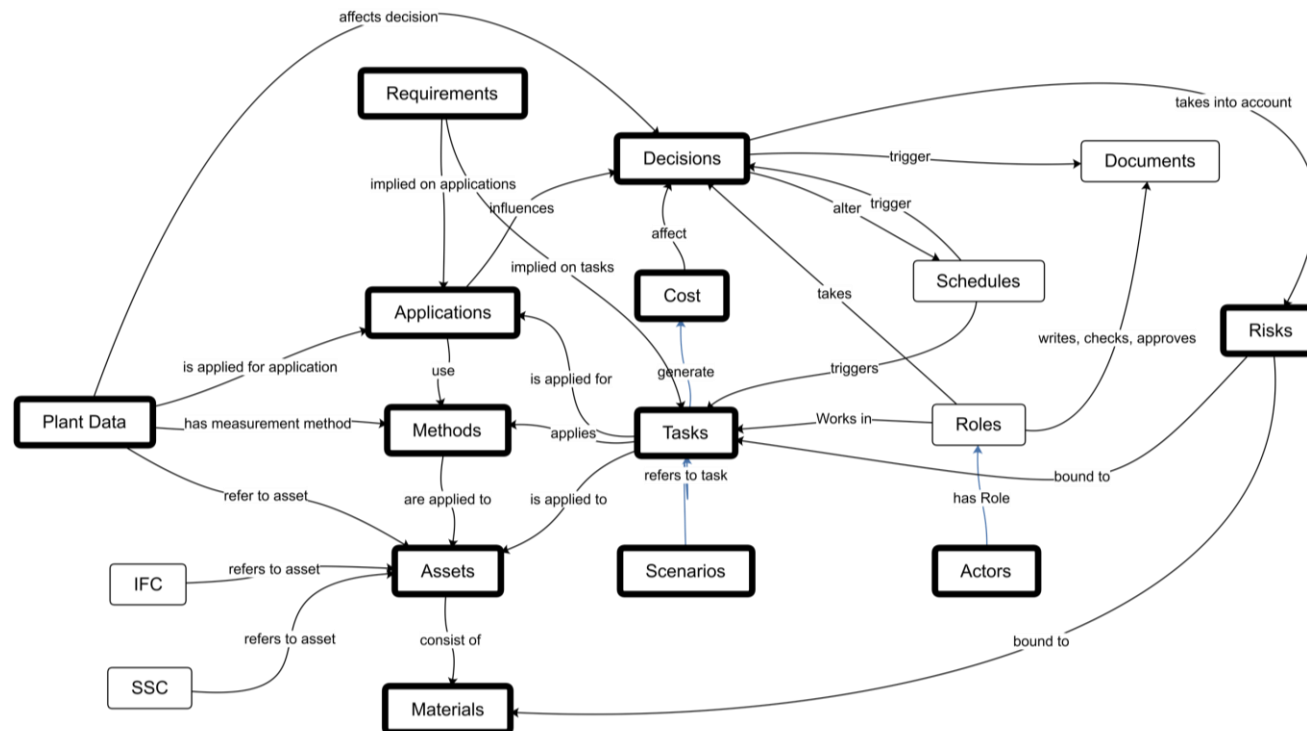


BCOT

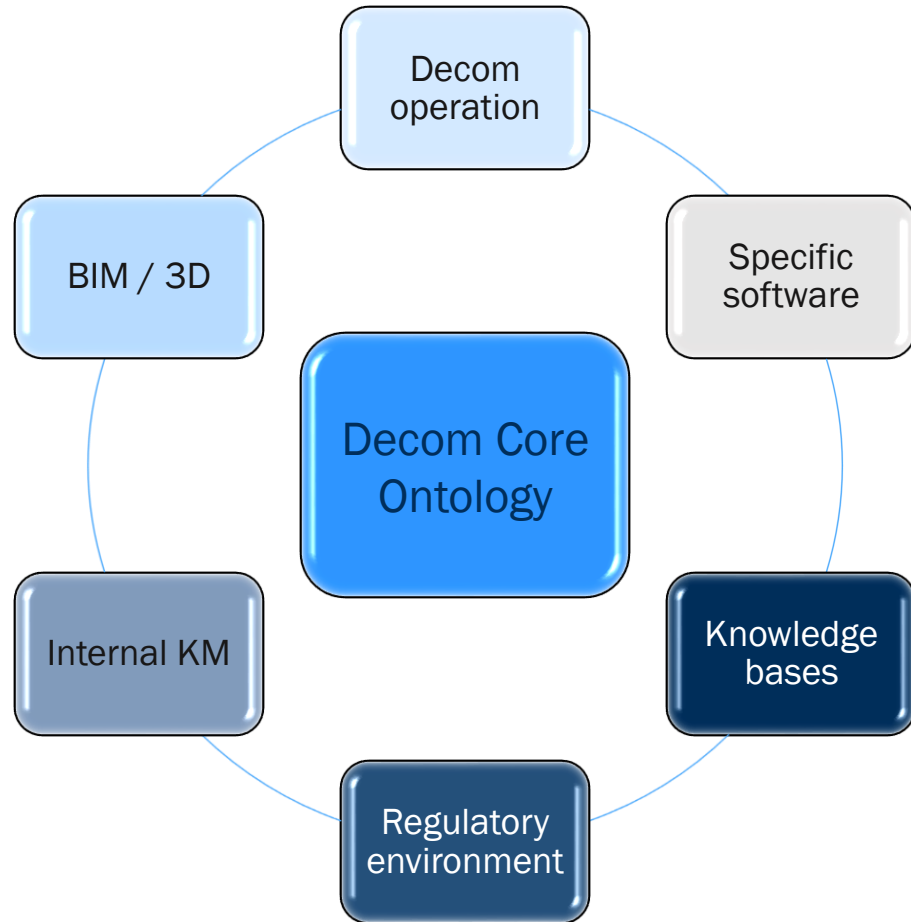


# Ontology

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



# Ontology

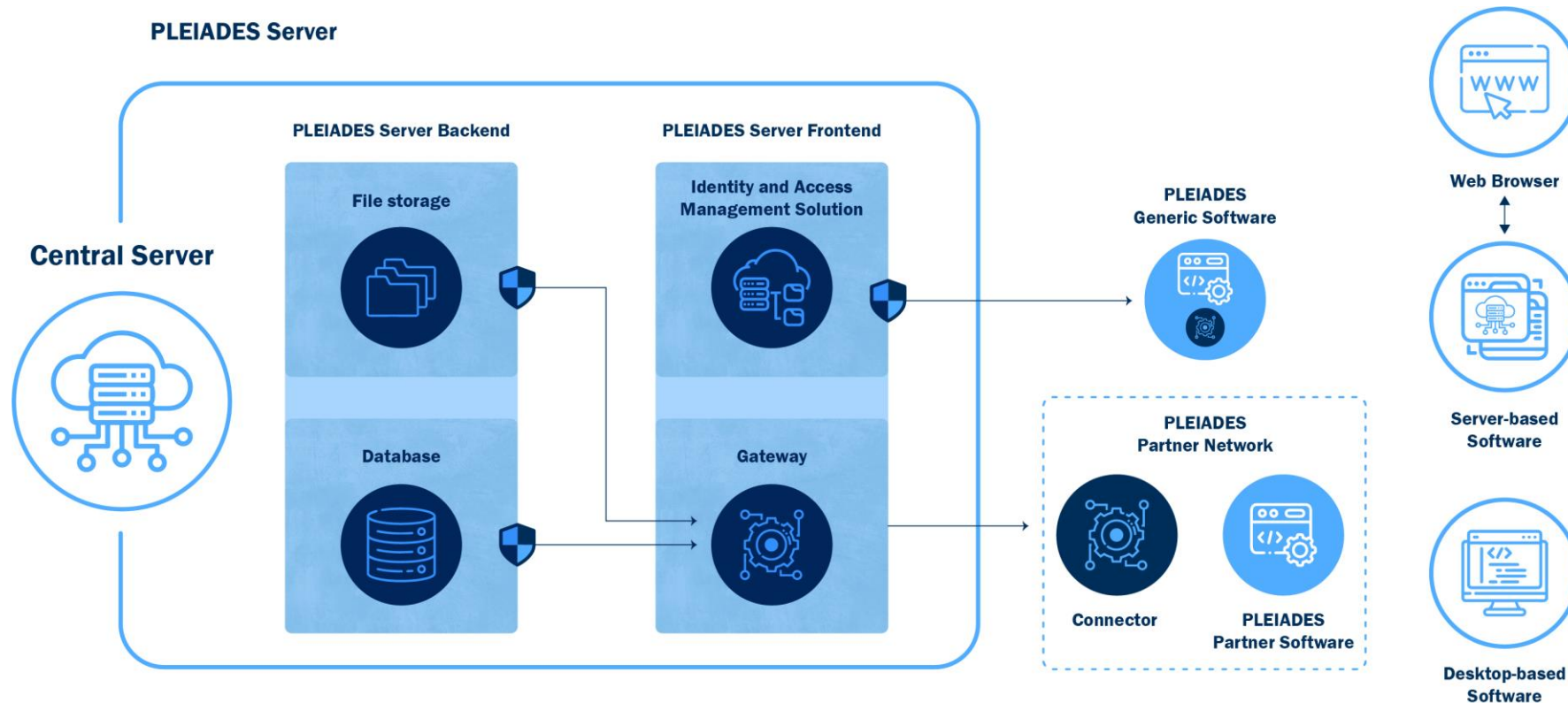


## Results:

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

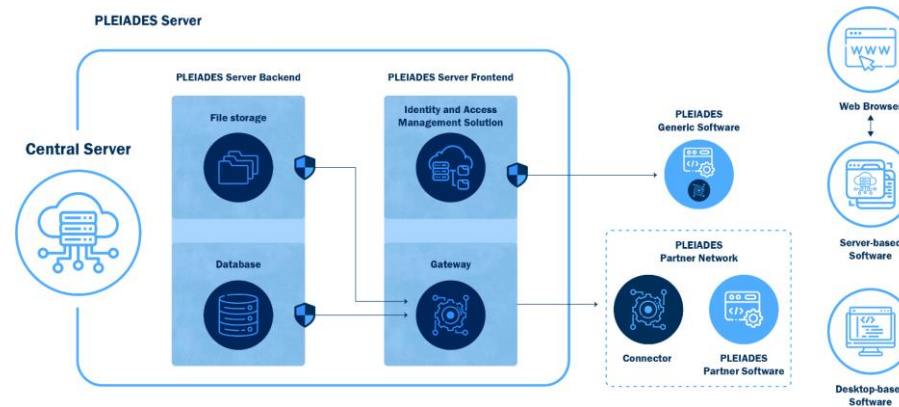
# PLEIADES Platform

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



# PLEIADES Platform

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

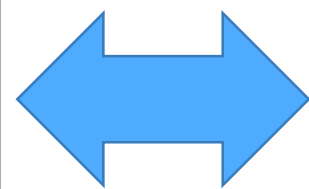


PLEIADES DB browser  
Version 0.1beta

[Add new record](#)

All records  
Show 10 entries

_id	Class	Content	RecordInfo
6229e16c1819e7e781d790f	Actors Teams	<pre>{   "members": "super team",   "membersId": [     {       "memberType": "Actors.Persons",       "memberId": "judo"     },     {       "memberType": "Actors.Persons",       "memberId": "feno"     }   ] }</pre>	<pre>{   "client": "aquilacosting",   "collabor": "8922-89-0873138131_3661" }</pre>



# Digital models

Halden Research Reactor (Norway)

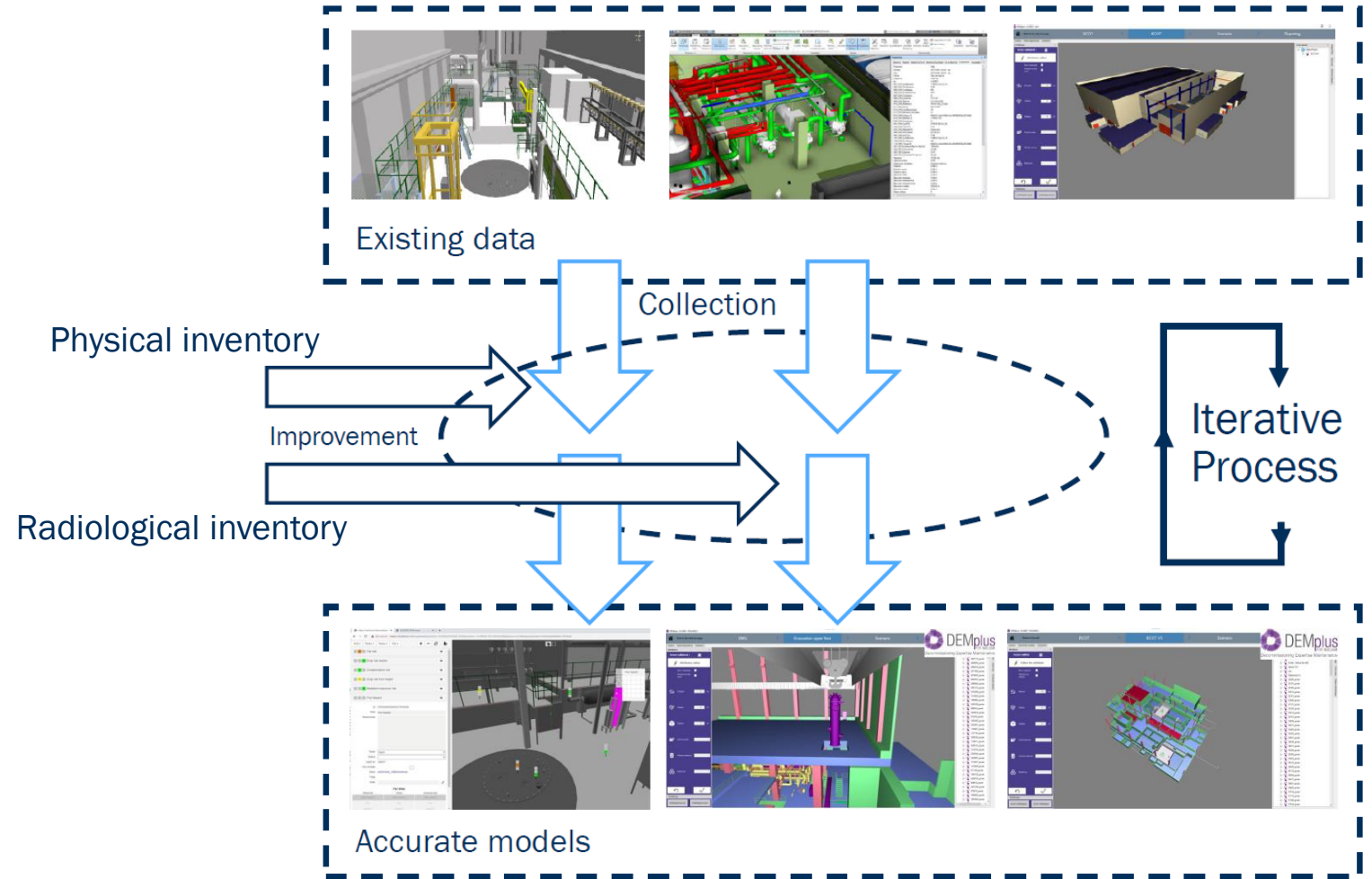
Santa María de Garoña NPP (Spain)

Base chaude opérationnelle du Tricastin (France)

Halden Research Reactor (HRR)  
IFE Institute for Energy Technology

Santa María de Garona (SMG)  
enresa

Base chaude O. du Tricastin (BCOT)  
EDF



# PLEIADES Demonstration on use cases

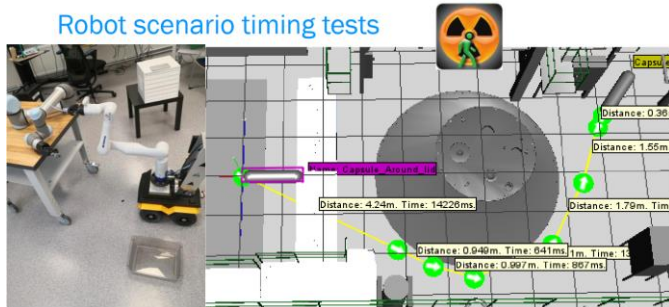
Halden Research Reactor (HRR)



**US#1:**

Manual vs. remote radiological characterization

Robot scenario timing tests



HVRC VRdose® Results

Scenario	Dose (mSv)
Manual scenario	0.3
Remote / robot scenario	0.338

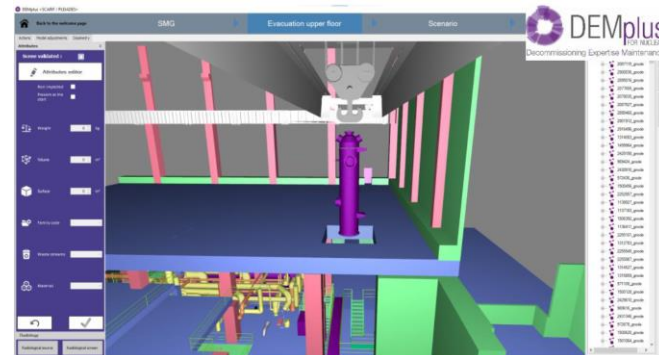
Santa María de Garona (SMG)



**US#2:**

3D supported vs. digitally enhanced dismantling

SMG 3D model visualization on DEMplus®



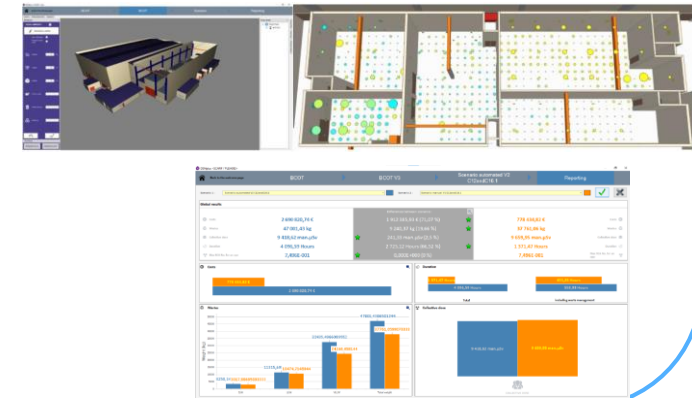
Base Chaude O. du Tricastin (BCOT)



**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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[contact@pleiades-platform.eu](mailto:contact@pleiades-platform.eu)



<http://pleiades-platform.eu>



[@pleiades platform](#)

