



PREDIS-EURAD Webinar: Digital Twins in support of Dismantling Projects

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INTERNAL



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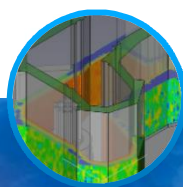
CONFIDENTIAL

Digital Twins in support of Dismantling Projects

BIM & Digital Twin



Dismantling Digital Twin



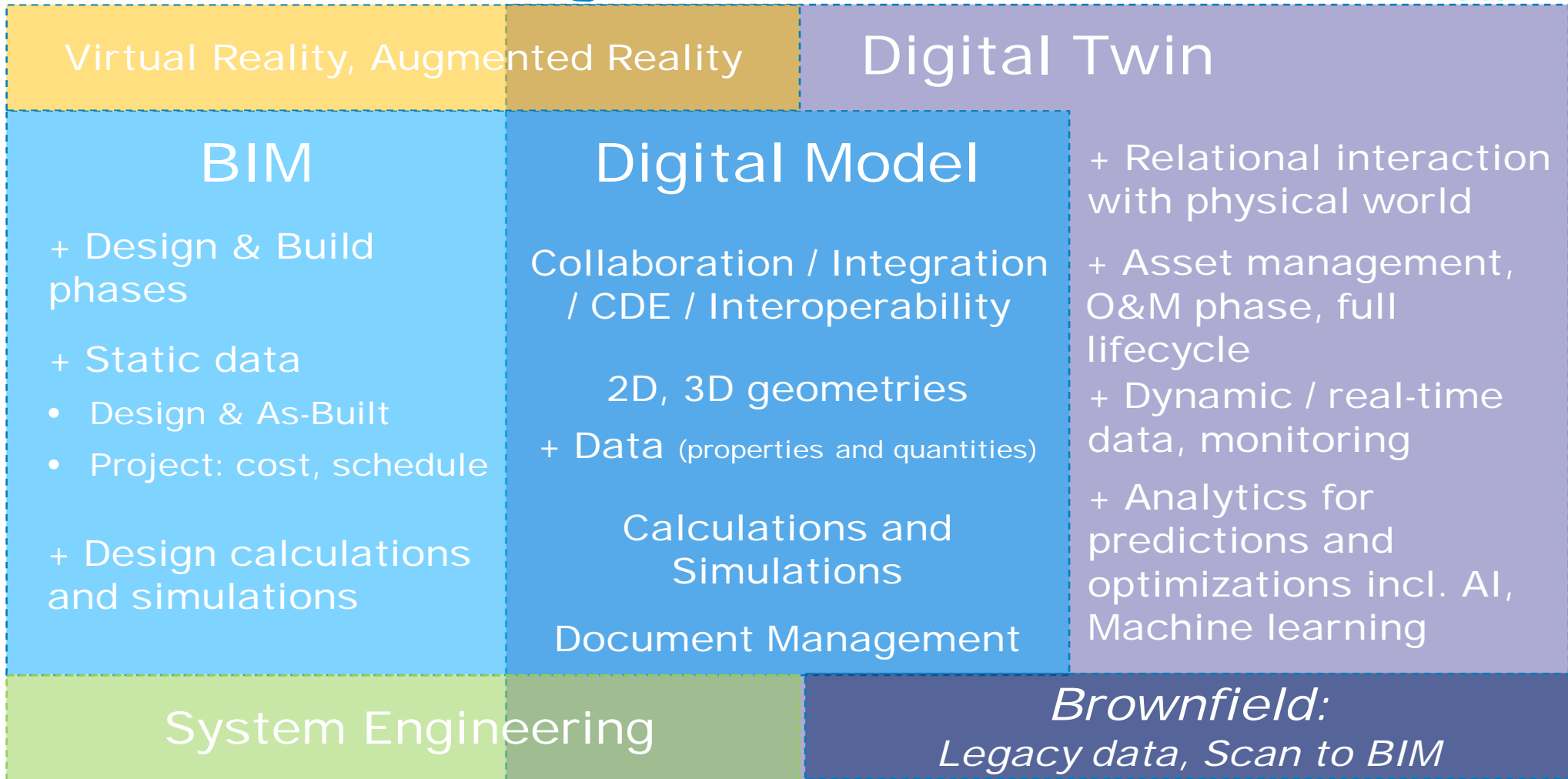
Digital Twins in the Nuclear Industry



Future Development Trends



« BIM » & « Digital Twin »



« Dismantling Digital Twin »

Virtual Reality, Augmented Reality

Digital Twin

★ BIM

- + Design & Build phases
- + Static data
 - Design & As-Built
 - Project: cost, schedule
- + Design calculations and simulations

★ Digital Model

- Collaboration / Integration / CDE / Interoperability
- 2D, 3D geometries
- + Data (properties and quantities)
- Calculations and Simulations
- Document Management

+ Relational interaction with physical world

+ Asset management, O&M -> Dismantling ★

+ Dynamic / real-time data, monitoring

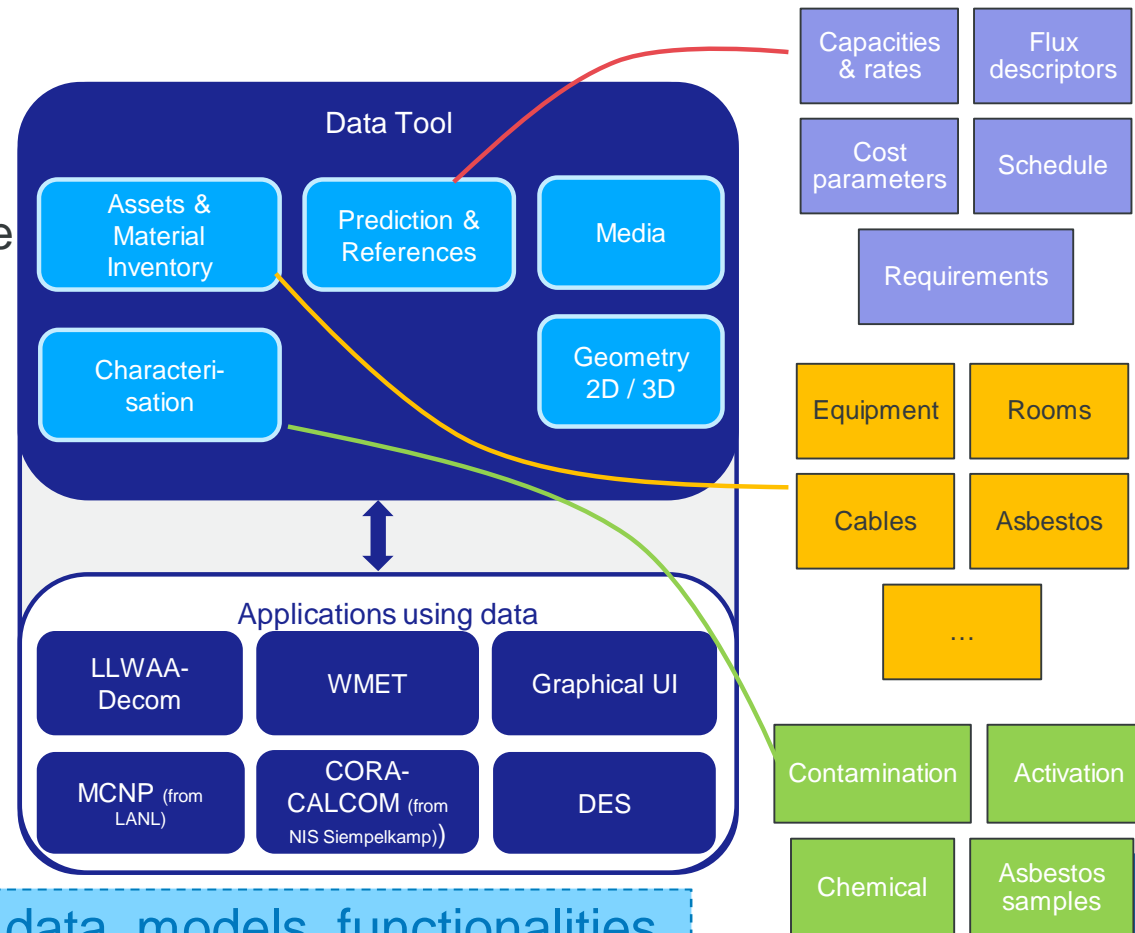
+ Analytics for predictions and optimizations incl. AI, Machine learning ★

★ System Engineering

★ *Brownfield:
Legacy data, Scan to BIM*

Dismantling Digital Twin Objectives

- Consolidated Plant **Inventory** and Digital model
- **Predictions and optimisations:** Waste quantities, Dismantling schedule, cost and resources
- **Simulation** & characterisation of contamination and activation
- **Design** of new waste management facilities + modification of existing installations
- **System engineering**



Interoperability and integration of data, models, functionalities

Consolidated Plant Inventory

The screenshot displays the DAMI interface for a consolidated plant inventory. The left sidebar shows a hierarchical location structure: **CNT2 > N > 5**. The main area features a table of equipment items with columns for FULO name, Equipment Category, NIS Type, Description, Room, and System. A context menu is open over the 'Equipment Category' column, showing options for sorting (Ascending/Descending), locking, and hiding columns. The table lists various equipment such as CAB-C403, PCT3-CRC-F02, PCT2-CR6-P46, and others, each with a unique description and location.

FULO name	Equipment Category	NIS Type	Description	Room	System
CAB-C403	CAB-C	VAL	[NIS_ACRONYM+ VAL] Rev 3 adding NIS Acronym	CNT2/N2/505	CAB
CAB-C403	CAB-C	VAL	[NIS_ACRONYM+VES] FILTRE 4" POIDS ESTIME SVT...	CNT3/D3/391	CAB
PCT3-CRC-F02	CRC	VES	[NIS_ACRONYM+SUP][NIS_ACRONYM+PUM]MALAXE...	CNT3/D3/106	CRC
PCT2-CR6-P46	PUMP	PUM	[NIS_ACRONYM+HEX] [NIS_ACRONYM+SUP] REFRI...	CNT2/N2/500	CR6
PCT2-CR6-Q09	HEAT_EX	HEX	[NIS_ACRONYM+EQPM] CONVOYEUR A CIMENT TRA...	CNT2/N2/321	CR6
PCT2-TDS-V11	HANDLING	EQPM	[NIS_ACRONYM+RC-PMP] ESTIMED WEIGHT FOR T...	CNT2/N2/279	-
PCT3-CRP-P05	PUMP	RC-PMP	[NIS_ACRONYM+MOTR] CAB-PP02	CNT3/R3/411	CRP
PCT2-CAB-P02R-M	MOTORS	PUM	[NIS_ACRONYM+ FAN] Rev 3 adding NIS Acronym	CNT2/N2/304	-
VEA-01	FANS	FAN	[NIS_ACRONYM+SUP][NIS_ACRONYM+PUM]MOTO-P...	CNT3/N3/430	VEA
PCT2-CAB-P02G	PUMP	PUM	[NIS_ACRONYM+SYS] COMPRESSEUR DES GAZ AV...	CNT2/N2/304	CAB
PCT3-TEG-K01	Compressors	COMP	[NIS_ACRONYM+MOTR] VENTILATEUR DE PULSION...	CNT3/D3/315	TEG
PCT3-VEA-A01-M	MOTORS	FAN	[NIS_ACRONYM+HAND] MONORAIL IPN 120	CNT3/N3/430	-
PCT3-MPA-D06	HANDLING	HAND	[NIS_ACRONYM+MOTR] POMPE DE CIRCULATION...	CNT3/D3/113	-
PCT1-CR6-P01DR1-M	MOTORS	PUM	[NIS_ACRONYM+RC-PRS] PRESSURISEUR	CNT1/N1/312	CR6
PCT1-RPP-B01PP	TANK/FILTER/30N EX	RC-PRS	[NIS_ACRONYM+FAN] VENTIL CIRC.REFROIDISS MC...	CNT1/R1/150	HPV

Integration of Inventory & schedule

The screenshot displays the Microsoft Project interface. On the left, the 'WBS Setter' pane shows a table of inventory items. The table has columns for 'InvSubTEID', 'InvRoomID', and 'InvMass'. The items are listed with their respective IDs and masses. Below the table, there is a 'Run Query' button and a 'Base Data' section.

InvSubTEID	InvRoomID	InvMass
1963-8-1	1963	2868.0
1963-9-1	1963	8930.0
1963-9-2	1963	2720.0
1971-19-1	1971	1.29
1971-17-1	1971	3.01
1971-18-1	1971	12.72
1971-9-1	1971	10.0
1972-19-1	1972	17.901
1972-17-1	1972	41.769
1972-18-1	1972	28.408
1972-9-1	1972	908.0
1979-19-1	1979	0.528
1979-17-1	1979	1.232
1979-18-1	1979	4.86
1980-19-1	1980	0.528
1980-17-1	1980	1.232
1980-18-1	1980	4.86
1981-19-1	1981	0.528
1981-17-1	1981	1.232
1981-18-1	1981	4.86

The right pane shows the 'GANTT CHART TOOLS' ribbon and the 'GANTT CHART' view. The chart displays a project schedule with tasks and their durations. The tasks are:

- 10 Preparation work 25 days
- 11 Installation of infrastructure and working areas - LINK to EXTERNAL PROJECT! 25 days
- 12 Removal of stear 35 days
- 13 Removal SG1 (T 10 days)
- 14 Transportation 3 days
- 15 Dismantling SG: 0 days
- 16 Removal SG2 (T 10 days)
- 17 Transportation 3 days
- 18 Dismantling SG: 0 days
- 19 Removal SG3 (T 10 days)
- 20 Transportation 3 days
- 21 Dismantling SG: 0 days
- 22 Cleaning of wor 5 days
- 23 Dismantling pressurizer, pressure relief tank 57 days
- 24 Preparatory activ 15 days
- 25 Installation of v 15 days
- 26 Dismantling Prim 42 days
- 27 Dismantling blo 3 days
- 28 Transportation 5 days

Inventory Digital Model Simulations

TRACTEBEL
ENGIE

FreeCAD 0.19

Fichier Édition Affichage Outils Macro RayXpert Tools MCNP Tools Fenêtre Aide

Monte Carlo WB

Plan de travail 2px | 100.00 mm

Afficher la sélection

Rechercher

demz#MCNP_Cell_1999.Face5 (MCNP_Cell_1999)

Liste des objets sélectionnés

Vue combinée

Modèle Tâches

Étiquettes & attributs

- IIN012
- ENV008
- XUV012
- REACTOR_POOL
 - MCNP_Cell_1999
 - consolidated_meshtali_MCNP_Cell_1999
 - consolidated_meshtali_MCNP_Cell_1999_res

Propriété Valeur

Propriété	Valeur
Isotopes	
CO60	1 106.80
EU152	608 798 911.39
ZN65	576.55
MCNP Data	
Cell_Number	1999
Density	-2.32
Material_N	22
Vue	Données

Page de démarrage demz : 1*

Vue rapport

```

10:37:08 False
10:37:08 ["Touched"]
10:37:08 ["Touched"]
    
```

Console Python

```

>>> # Gui.Selection.addSelection('demz','MCNP_Cell_1999')
>>> # Gui.Selection.clearSelection()
>>> # Gui.Selection.addSelection('demz','MCNP_Cell_1999','Face5',6772.67,-2902.89,19944)
>>>
    
```

Preselected: demz.MCNP_Cell_1008.Face3 (1472.323608 mm, 14.399344 m, 7040.000000 mm)

CAD 35.83 m x 17.55 m

Digital twins in the Nuclear Industry

Fuzzy definition of Digital Twin

- ∅ Importance of user story, **definition of the needs** and requirements

Digital Twin is all about **data**

- ∅ Importance of CDE, integration, interoperability

There is no off-the-shelf “one size fits all” technological solution



Nuclear specificities

- ∅ Need complex **simulations**
- ∅ **Extended** use of data (static... dynamic)
- ∅ Existing assets: challenge of **legacy data** (decentralized, unstructured,...)
- ∅ (Huge) Limitations from **confidentiality** and **accessibility** rules

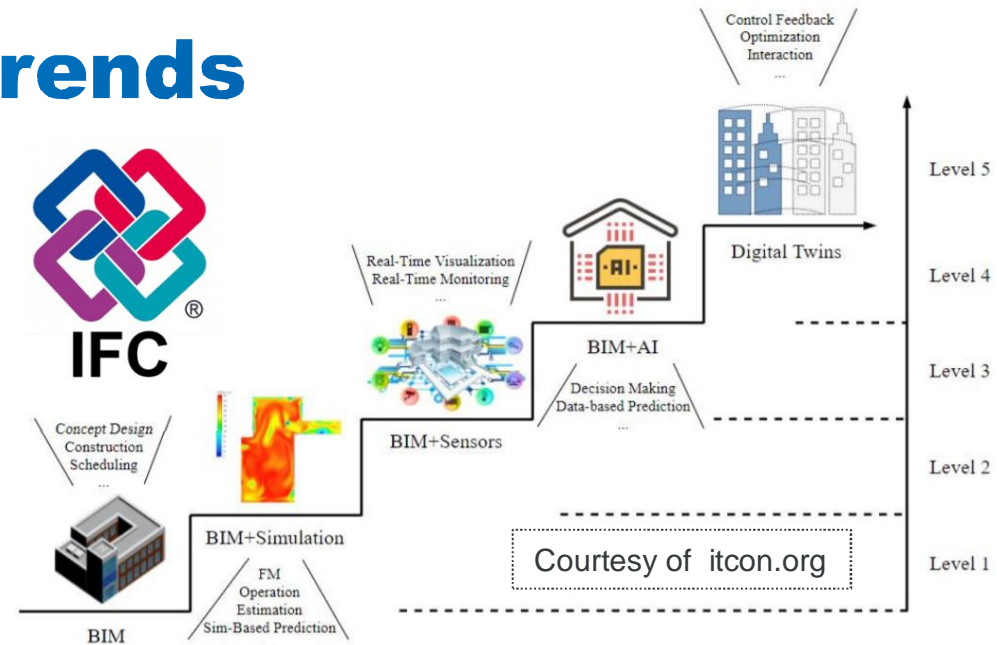
Future development trends

Improvement of Data quality, **Interoperability**, **Standardisation** and openness

- ∅ Increased integration of models & functionalities, stronger **ecosystem**
- ∅ More complex and transverse Multiphysics **simulations**

Integrating data from **sensing** and **real-time** monitoring (IoT)

AI/ Machine learning for real-time simulations and predictions



Virtual Reality, Augmented Reality		Digital Twin
BIM + Design & Build phases + Static data • Design & As-Built • Project: cost, schedule + Design calculations and simulations	Digital Model Collaboration / Integration / CDE / Interoperability 2D, 3D geometries + Data (properties and quantities) Calculations and Simulations Document Management	+ Relational interaction with physical world + Asset management, O&M phase, full lifecycle + Dynamic / real-time data, monitoring + Analytics for predictions and optimizations incl. AI, Machine learning
System Engineering		Brownfield: Legacy data, Scan to BIM





Engineering a carbon-neutral future



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