FLOATING ENERGY RESEARCH FORUM

DTAm Structural Health Monitoring
Vs in-situ data

© PRINCIPIA

20/11/2024

**DTA M
SHM solution**

- Introduction to DTA-m

- First comparisons with in-situ data

- Conclusions

DTA M = practical tool for predictive maintenance of offshore systems

Indirect monitoring = fruitful compromise

- To control the on-going fitness for purpose during the entire field life
- Fast data processing to give clear indicators for decision making
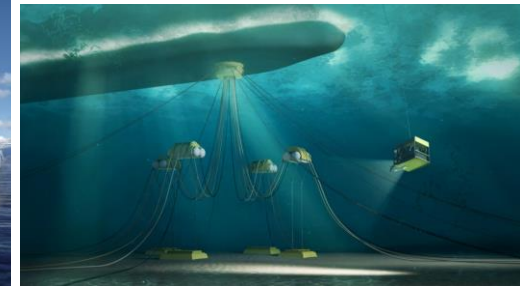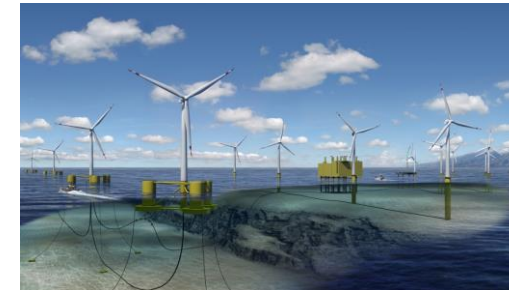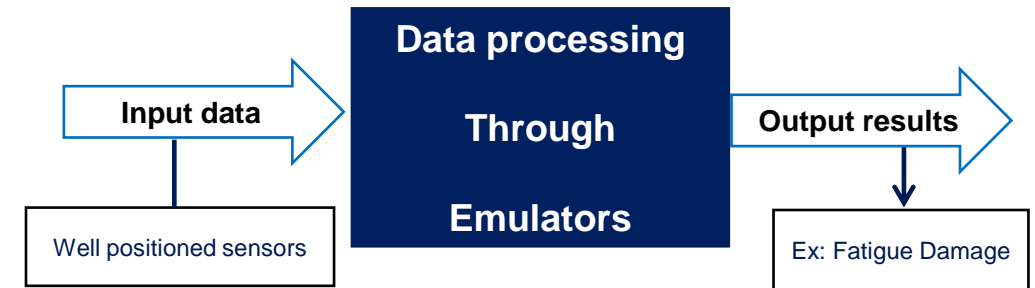- Constant check that what happens on-site confirms design phase results

- **Limited CAPEX :**
  - Very few captors needed in dry zone;
  - No environmental data required;
  - Limited impact on installation & exploitation.

- **Limited OPEX :**
  - Real time automatic data processing;
  - Reduced data storage and handling;
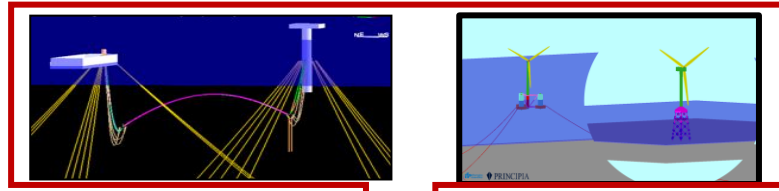 - Live update possible: add new observations.

- **Pragmatic approach adaptable to the project context**

Input data → Well positioned sensors

Data processing Through Emulators

Output results → Ex: Fatigue Damage

DTAm presentation FER 2024 – 20 November 2024

PHIMECA PRINCIPIA

DATA PROCESSING

- **Learning/training Phase ➜ from design phase results**

Emulator to be generated

$$Output = Fct(input) \approx g(concise\ representation)$$

"signature" of the input data to be determined
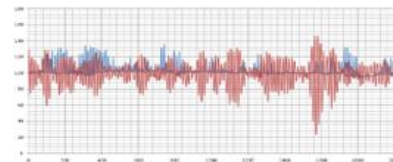
- **Prognosis Phase ➜ Software component**

DTAm presentation FER 2024 – 20 November 2024
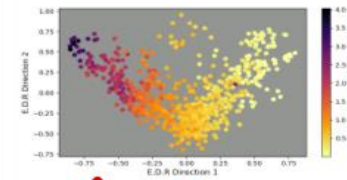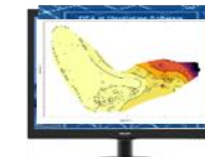
The technological platform has been already delivered for the follow-up of risks and mooring lines integrity

Fatigue Life of Steel Catenary Risers

TotalEnergies

Status : DEMO installed in TOTAL Energies offices and being proposed to TOTAL's projects
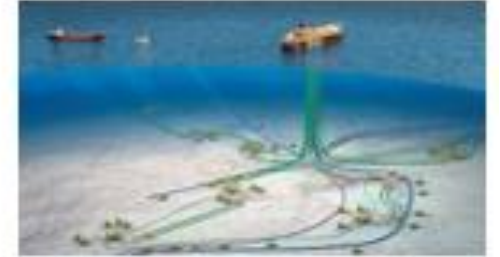
Fatigue Life of Chain Mooring Lines

Imodco

Status : Monitoring tool installed on-board since July 2019

Fatigue Life of Steel Offloading Lines

subsea 7

Status : Jubilee project - Monitoring system installed Offshore in November 2020

Extension to Floating Wind turbines

✓ PGL : *Waiting for PGL system complete installation*

European FEDER founding

✓ *Proof of Concept study for a typical FOWT*

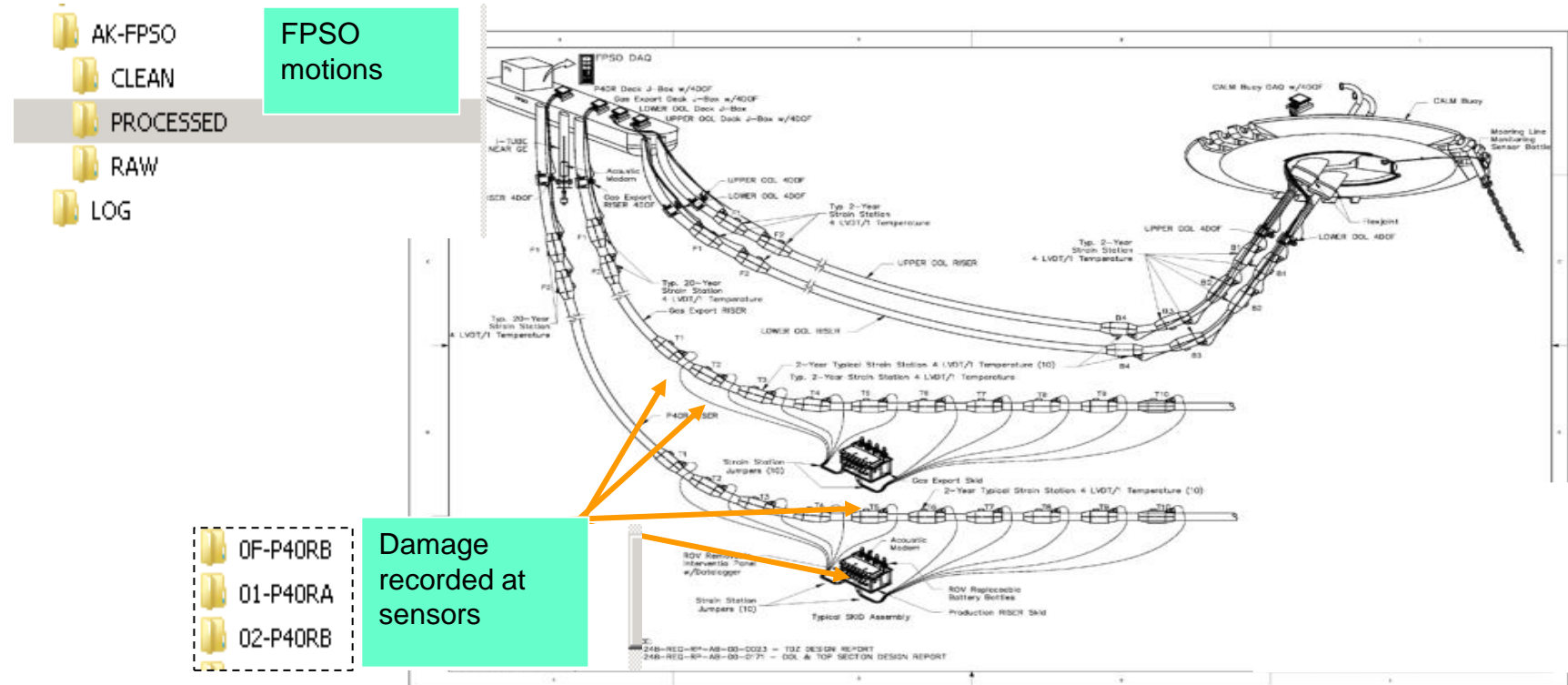**DTAm presentation FER 2024 – 20 November 2024**

DTA M
Structural Health Monitoring

First Comparisons with
in-situ data

Context : TOTALEnergies

Steel Catenary Riser project with a distributed sensors installed since 2009

Comparisons with in-situ data

Oil&Gas project case

In"real life" ➜ Recorded Data exploitation is a very though task and time consuming !

- ✓ Global consistency is not always clear
- ✓ Data extraction is quite time consuming
- ✓ Data files available from 23/03/2009 to 08/01/2011

DTAm presentation FER 2024 – 20 November 2024

PHIMECA PRINCIPIA

Validation of the Design model used for the learning phase

Comparisons with in-situ data

Oil&Gas project case
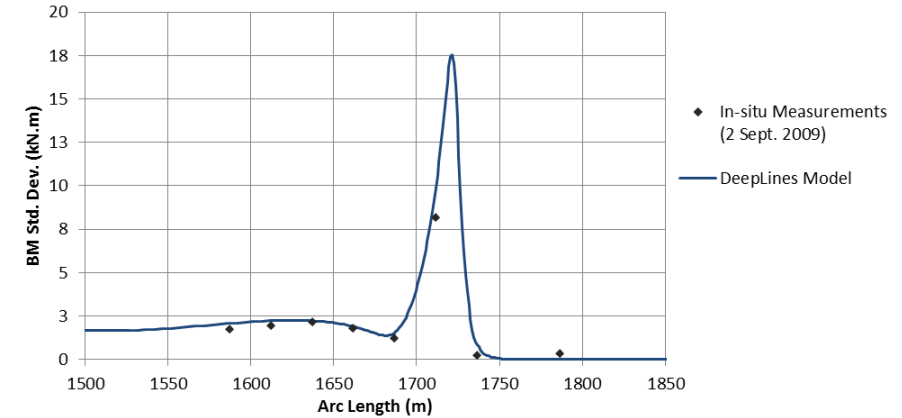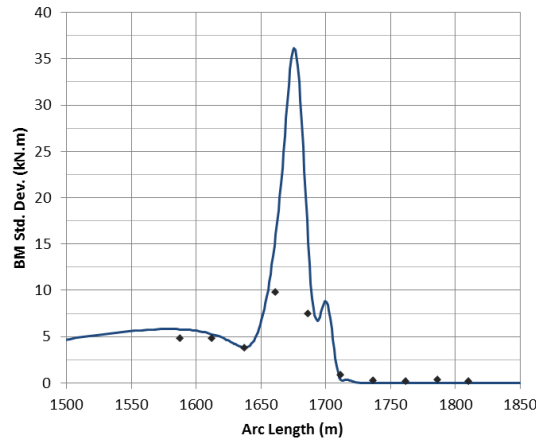
Outcomes:
- ✓ good correlation
- ✓ Peak of damage can be missed by sensors

➤ Adjustment of the solution with emulators giving the MAX DAMAGE at TDZ

FPSO motions → **Input data** → **Data processing** → **Output results** → *MAX DAMAGE at TDZ*

DTAm presentation FER 2024 – 20 November 2024

Cross check validation with damage recorded by subsea sensors

Comparisons with in-situ data

Oil&Gas project case

DTAm presentation FER 2024 – 20 November 2024
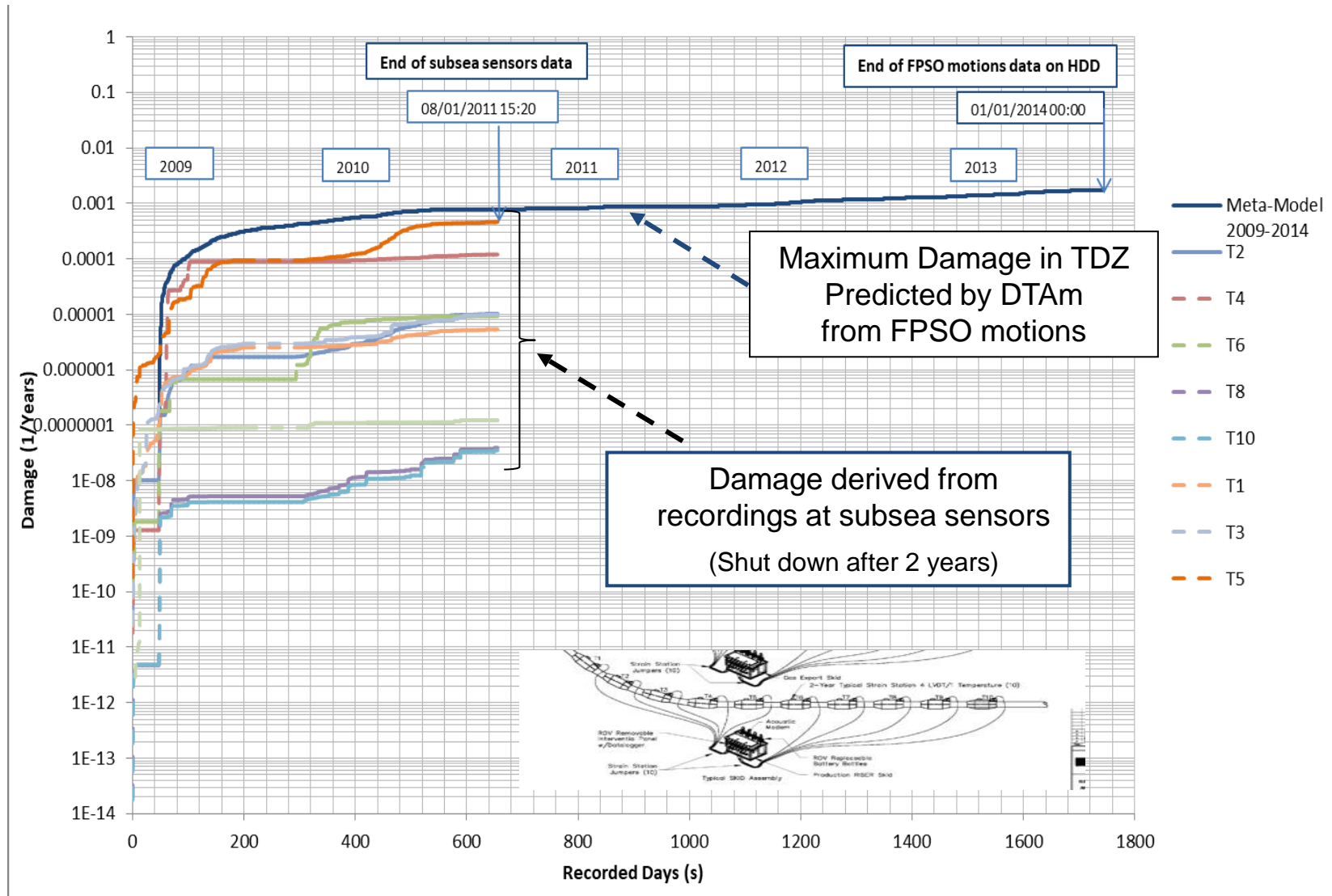
> TOTALEneriges : Complete Deployment (2025)
>
> Extension to other projects

DTAm

Oil&Gas project case

Next Step

Offshore Project

PI cloud

End User

DTAm

Monitoring Centre in PRI office

DTAm presentation FER 2024 – 20 November 2024

TetraSpar Demonstrator : *real-world data from METCentre test site in Norway*
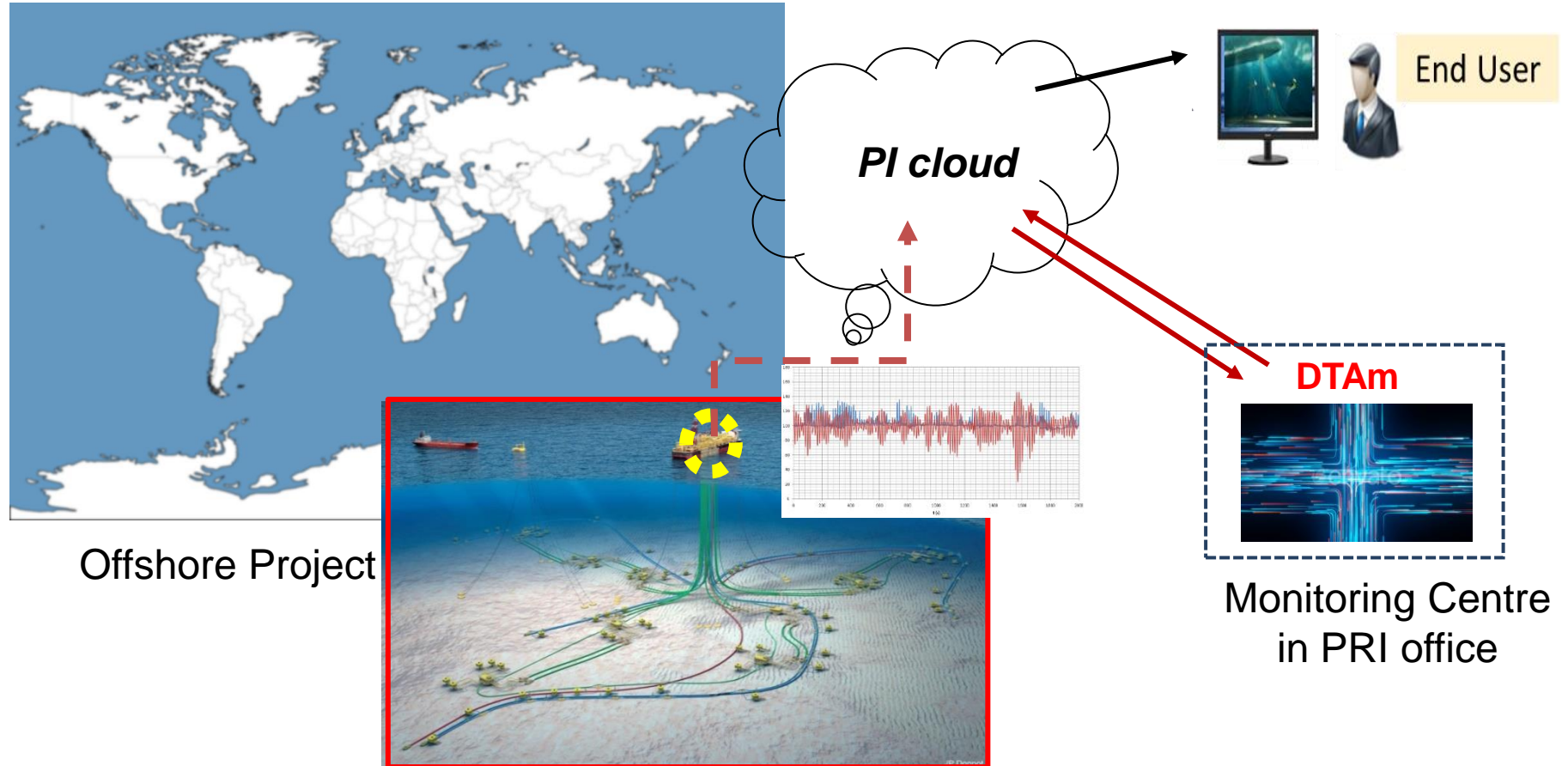
Comparisons with in-situ data

MRE case

Context :

✓ PRI selected with 7 other participants for the Tetraspar Innovation Challenge which gives access to in-situ data

✓ PRI previously involved in one step of the design phase (DeepLines WIND model developed at that time)

✓ For a proof of concept, a preliminary learning phase performed based on a limited DLC matrix

✓ First batch of data delivered in August 2024 and data analysis is still under going

✓ Only very preliminary results are presented here with "on shelve" models (Model update and new learning phase planned later)

DTAm presentation FER 2024 – 20 November 2024
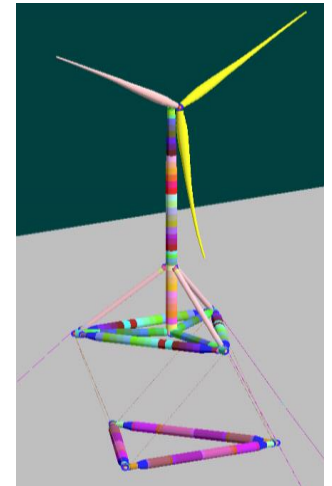
DTA M
Structural Health Monitoring

Conclusions

DTAm solution:
- ✓ Indirect SHM monitoring = fruitful compromise
- ✓ One part of a global digital twin
- ✓ Pragmatic approach adaptable all along the asset lifetime

Oil&Gas:
- ✓ Good comparison with in-situ data for a real project case
- ✓ Deployed on projects

MRE :
- ✓ Work in progress for the validation wrt in-situ data (Pilot parks context)

- ✓ R&D funding (ADEME) recently awarded:
  - • Extension to indicators for extreme events
  - • Extension to wind farms

**DTA M
Predictive Condition
Monitoring**

Thank you for
your attention