FACULTY OF ENGINEERING
AND ARCHITECTURE

DEPARTMENT OF CIVIL ENGINEERING
COASTAL ENGINEERING RESEARCH GROUP

Offshore Renewables at UGent: Numerical and Experimental modelling

Coastal Engineering Research Group

Dr ir. Efrain Carpintero Moreno

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Who are CERG - Coastal Engineering Research group?

The **coastal engineering group** is a dynamic research group at UGent

Research expertise:

- ❑ Coastal resilience and hard coastal structures
- ❑ Wave energy converters
- ❑ Floating offshore wind
- ❑ Wave structure interactions
- ❑ Wave propagation

professors: Peter TROCH, Andreas KORTENHAUS, Maximilian STREICHER, em. Julien DE ROUCK

Postdocs and associated staff: Efrain CARPINTERO, Annelie BAINES-MAITLAND, Ben SHABARI, Rafail IOANNOU, Vicky STRATIGAKI

number of researchers: 30
number of technical and administrative staff: 10



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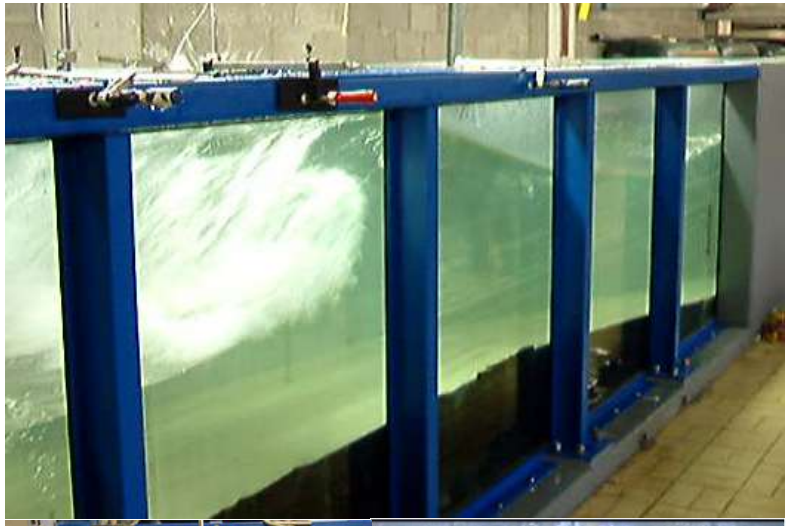
telephone: +32 (0)9 264 54 89 website address: awww.ugent.be

Research Facilities:

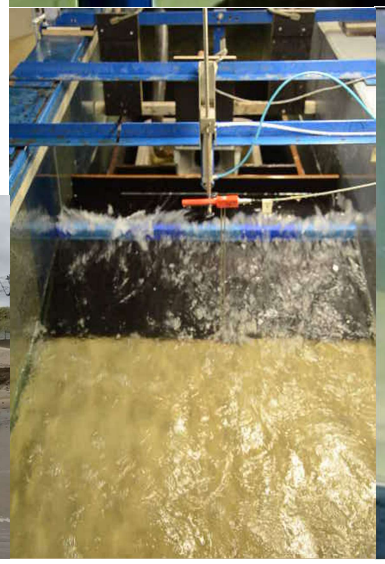
Expertise in **physical modelling** for coastal and offshore applications

Research facilities

- ❑ **Large wave flume** at CERG in Ghent
  - 2D waves & current generation: 30m x 1m x 1.2m
- ❑ **Coastal & Ocean Basin**: 3D wave basin
  - 3D waves and current generation
  - 30m x 30m, up to 1.4 m depth
- ❑ **Saltwater flume**
- ❑ **Field measurements**
  - Living Lab Raversijde







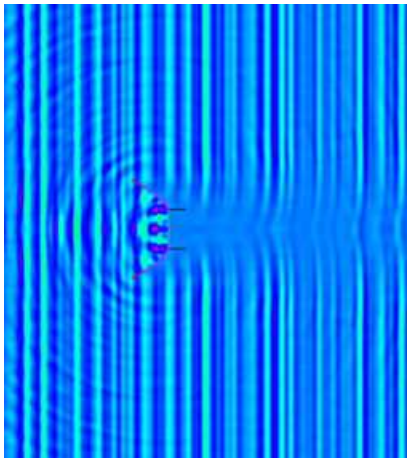


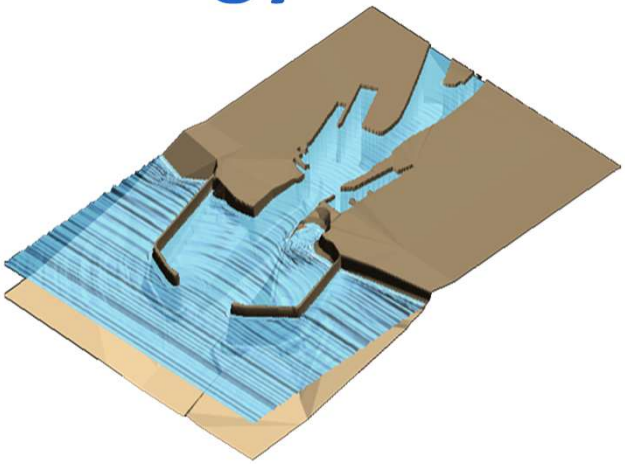
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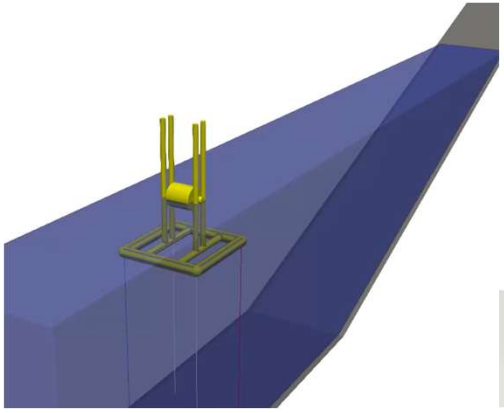
Numerical modelling for renewable energy

Expertise in **development of numerical modelling** for coastal and offshore applications

- **MILDwave**
  - Mild slope equations solver developed at UGent
- **SWASH**
  - Shallow water equations
  - Collaboration with TU Delft (IG waves)
- **OpenFOAM**
  - High fidelity Navier-Stokes solver
  - Modelling flow around Nature Inclusive Designs
- **DualSPHysics**
  - High fidelity Navier-Stokes solver
  - Extreme waves and large motions of renewable energy systems









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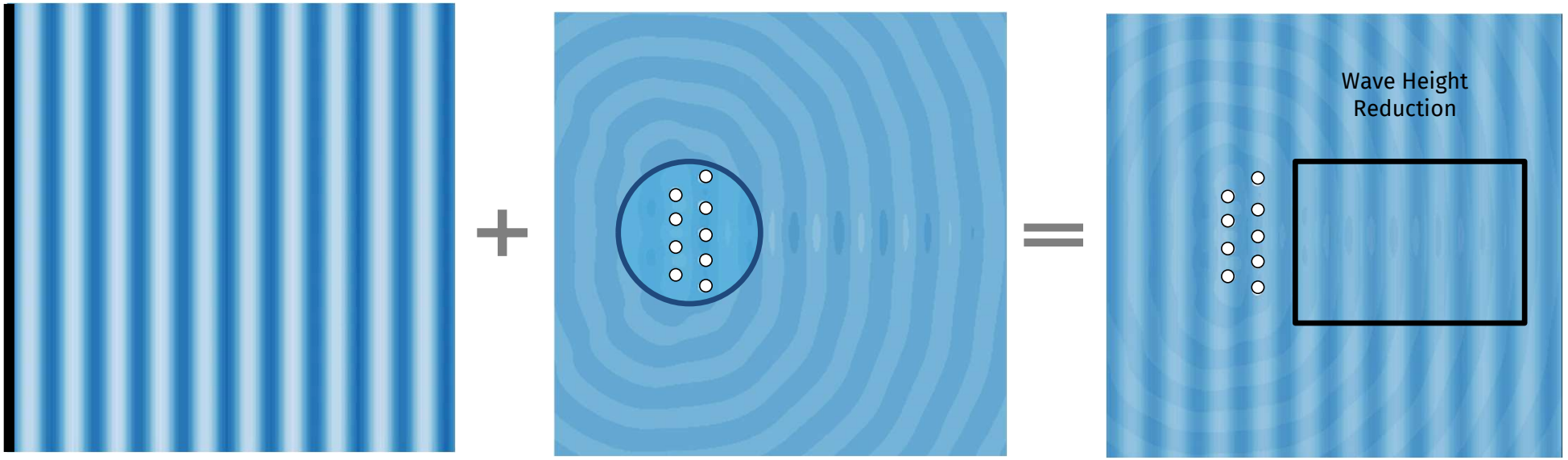
Wake effects behind a WEC farm: MILDwave

MILDwave-NEMOH coupled model

MILDwave
INCIDENT RUN

NEMOH -> MILDwave
PERTURBED RUN

MILDwave
TOTAL WAVE FIELD



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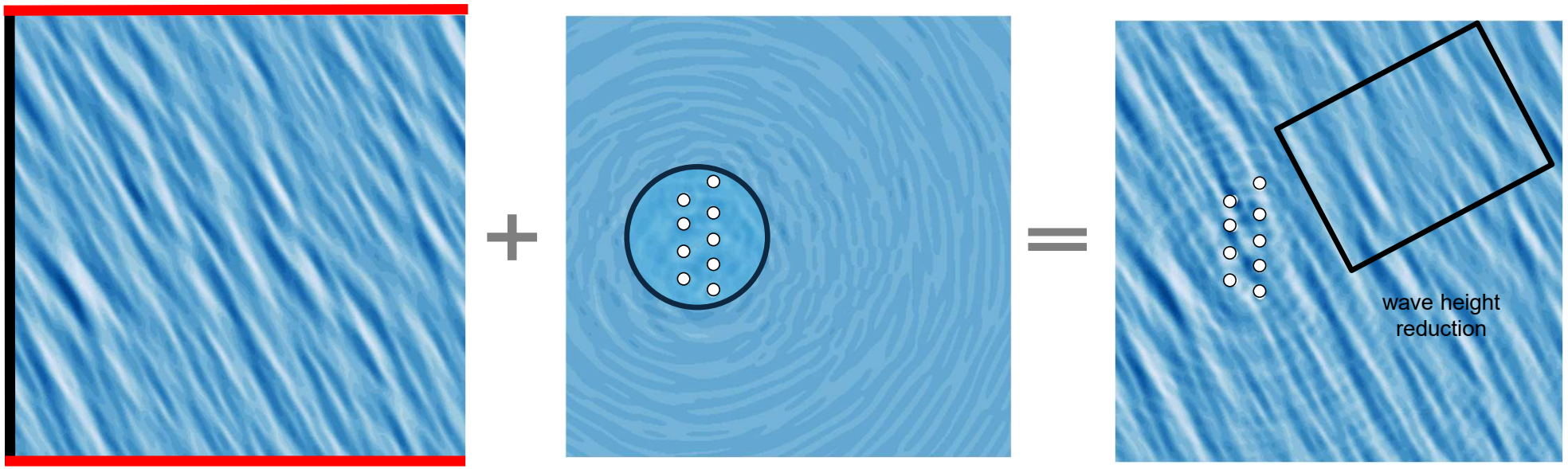
Wake effects behind a WEC farm: MILDwave

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INCIDENT RUN

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MILDwave
TOTAL WAVE FIELD



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SPH Modelling

DualSPHysics software

SPH: meshless method

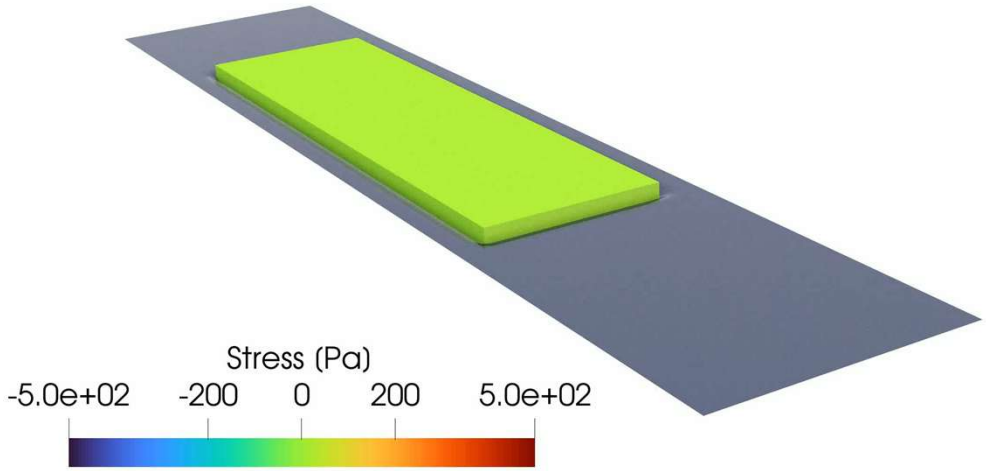
Coupled with "**Project Chrono**" and "**MoorDyn**"

Suitable to simulate more extreme environments



FOWT: DualSPHysics and MoorDyn+ modelling DeepCwind OC4

2D & 3D numerical hydrodynamic validation of **very flexible floating solar platforms**

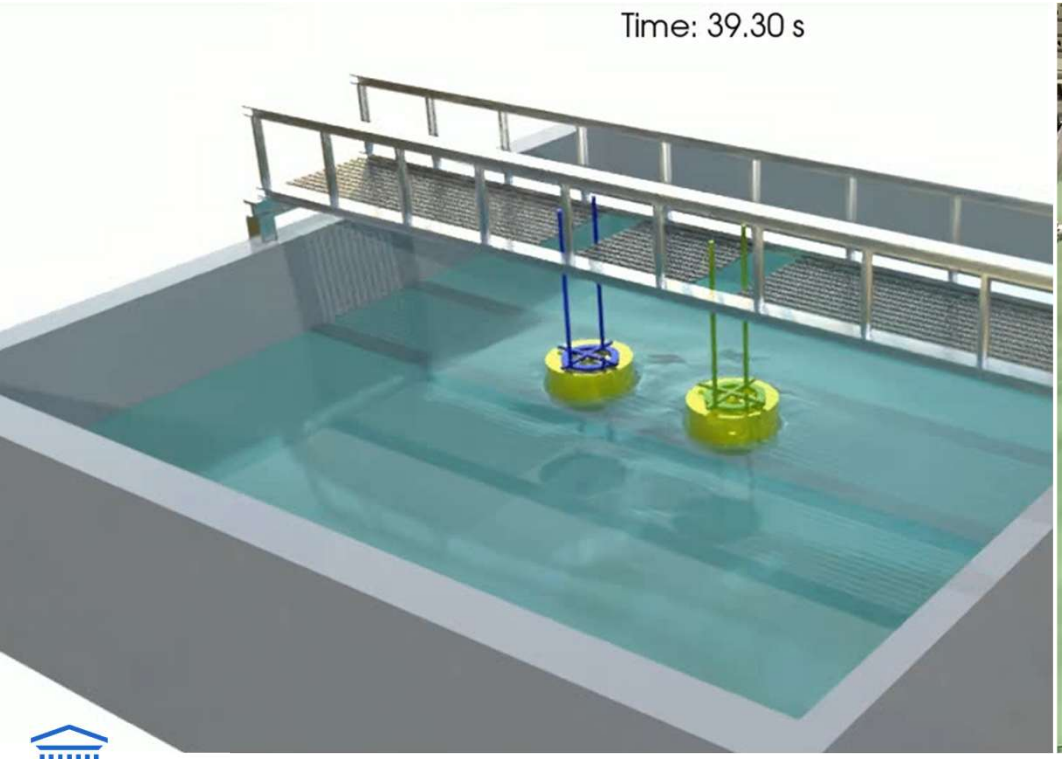


Stress σxx, deriving from My

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In-house ORE research: WECfarm

DualSPHysics Simulation

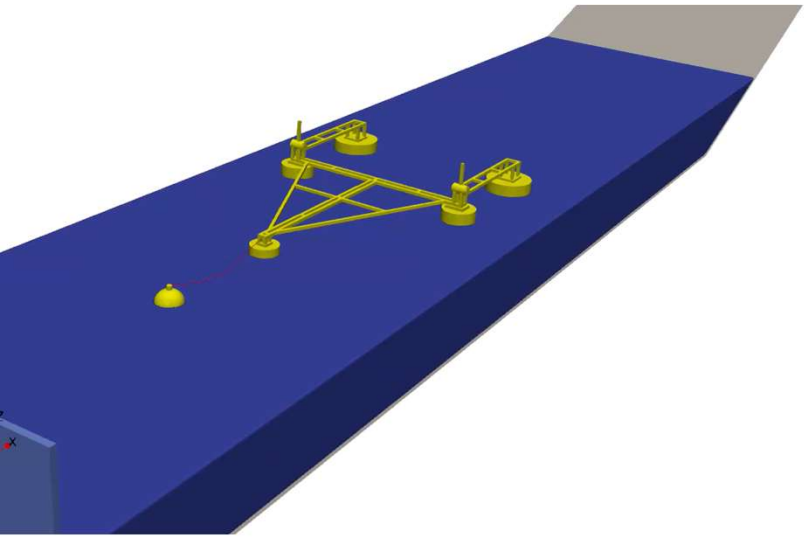


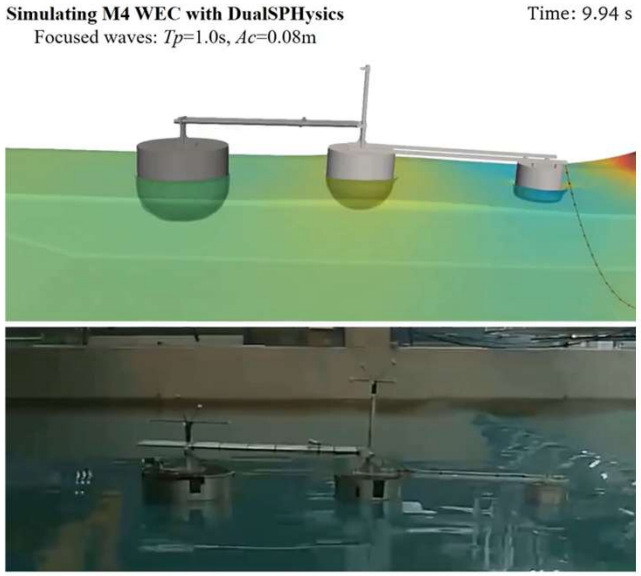
Experimental tests

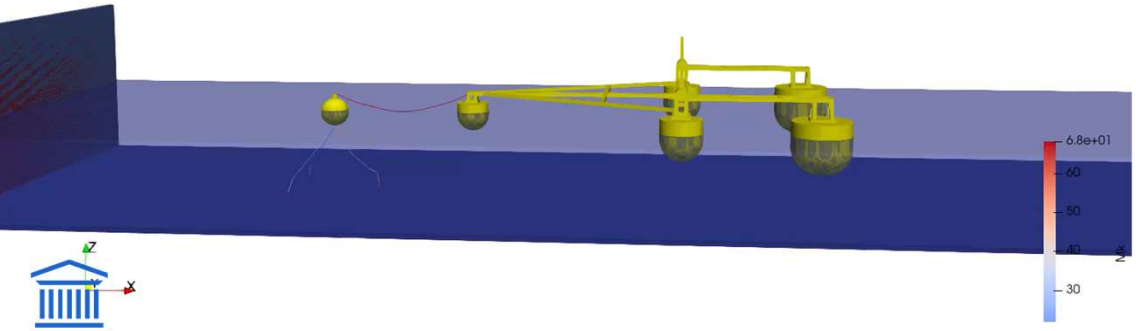


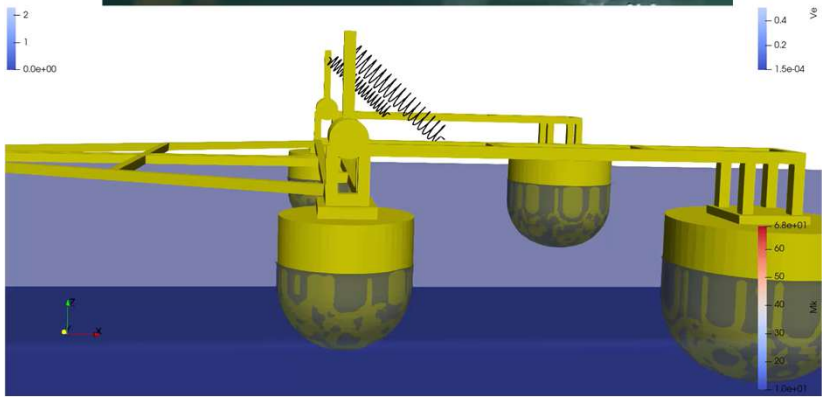
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In-house ORE research: M4 wave energy converter









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Research and Collaboration Projects for ORE industry

INF4INITY

Funded by the European Union

Nature inclusive designs for subsea components of floating offshore wind installations

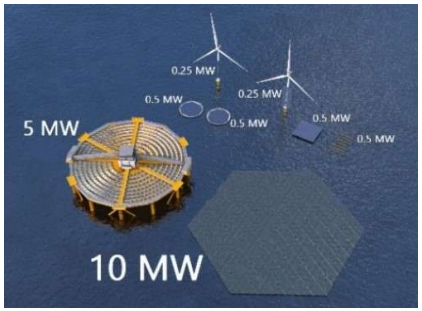
BEL - Float

Catalyzing the Belgian industrial expertise in floating wind through academic innovation

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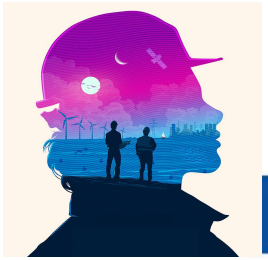
MP Multi Use

Multi-(re)-use scenarios for existing offshore infrastructure



marinerg-i

European Research Infrastructure for offshore renewables



Offshore4Sure

Funded by the European Union

To accelerate the regional energy transition while stimulating blue economy

Interreg

Co-funded by the European Union

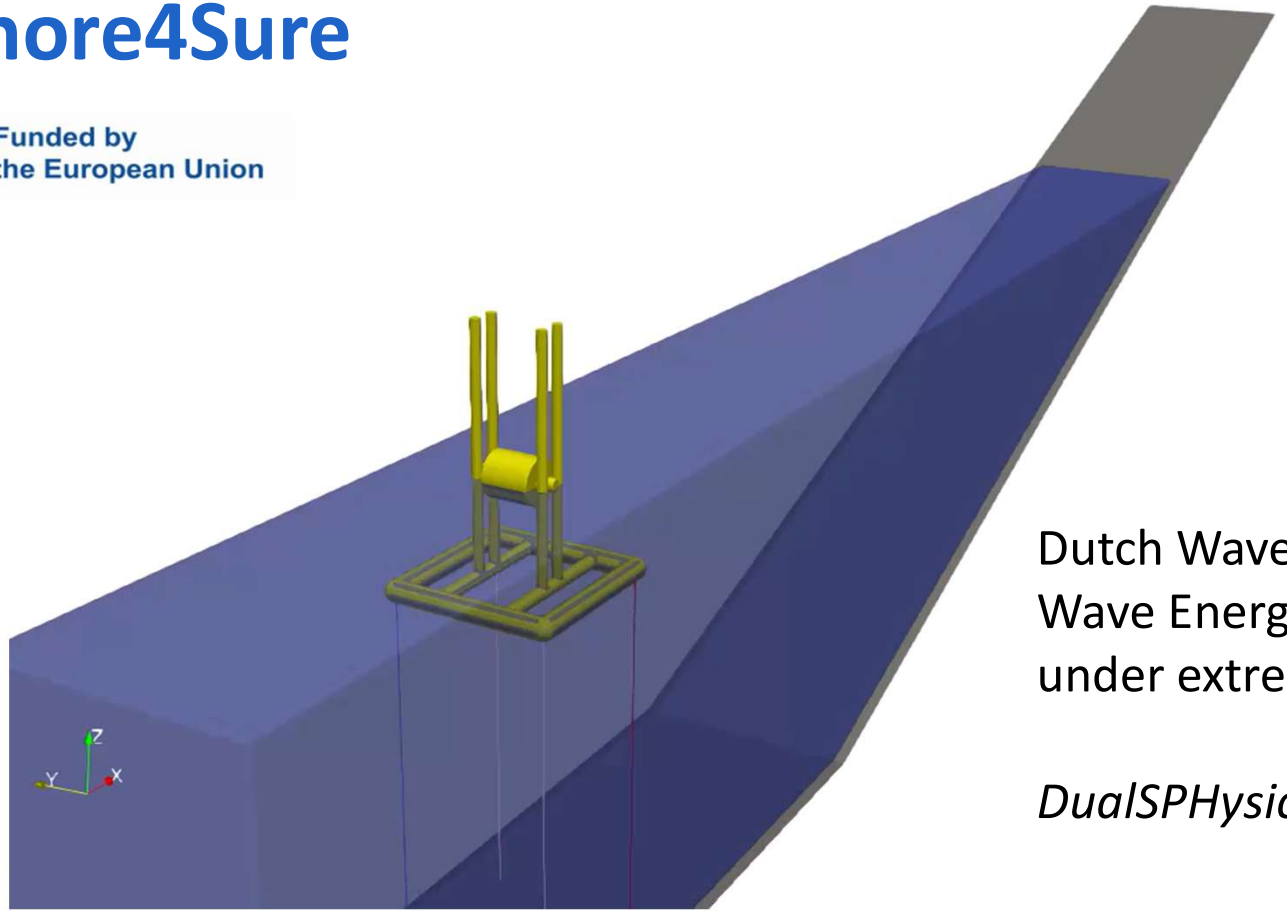
North-West Europe

OFFSHORE PROOF

Accredited offshore testing network driving renewable energy uptake at sea

Offshore4Sure

Funded by the European Union



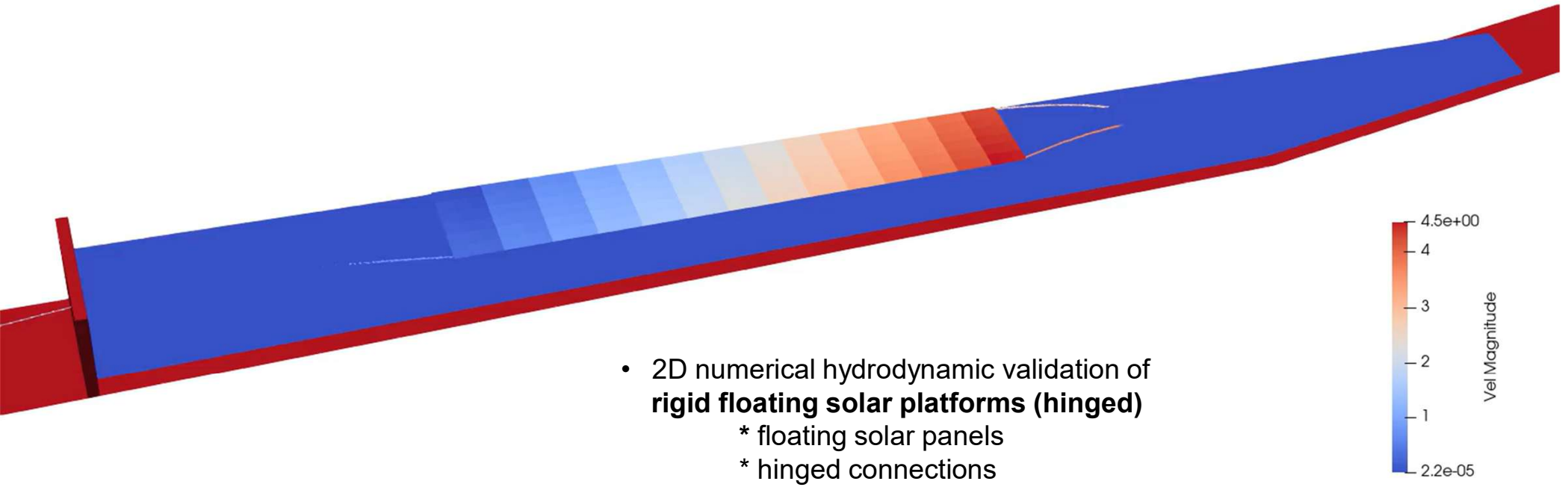
Dutch Wave Power:
Wave Energy Converter
under extreme loads

DualSPHysics Simulation

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Offshore4Sure

Funded by the European Union



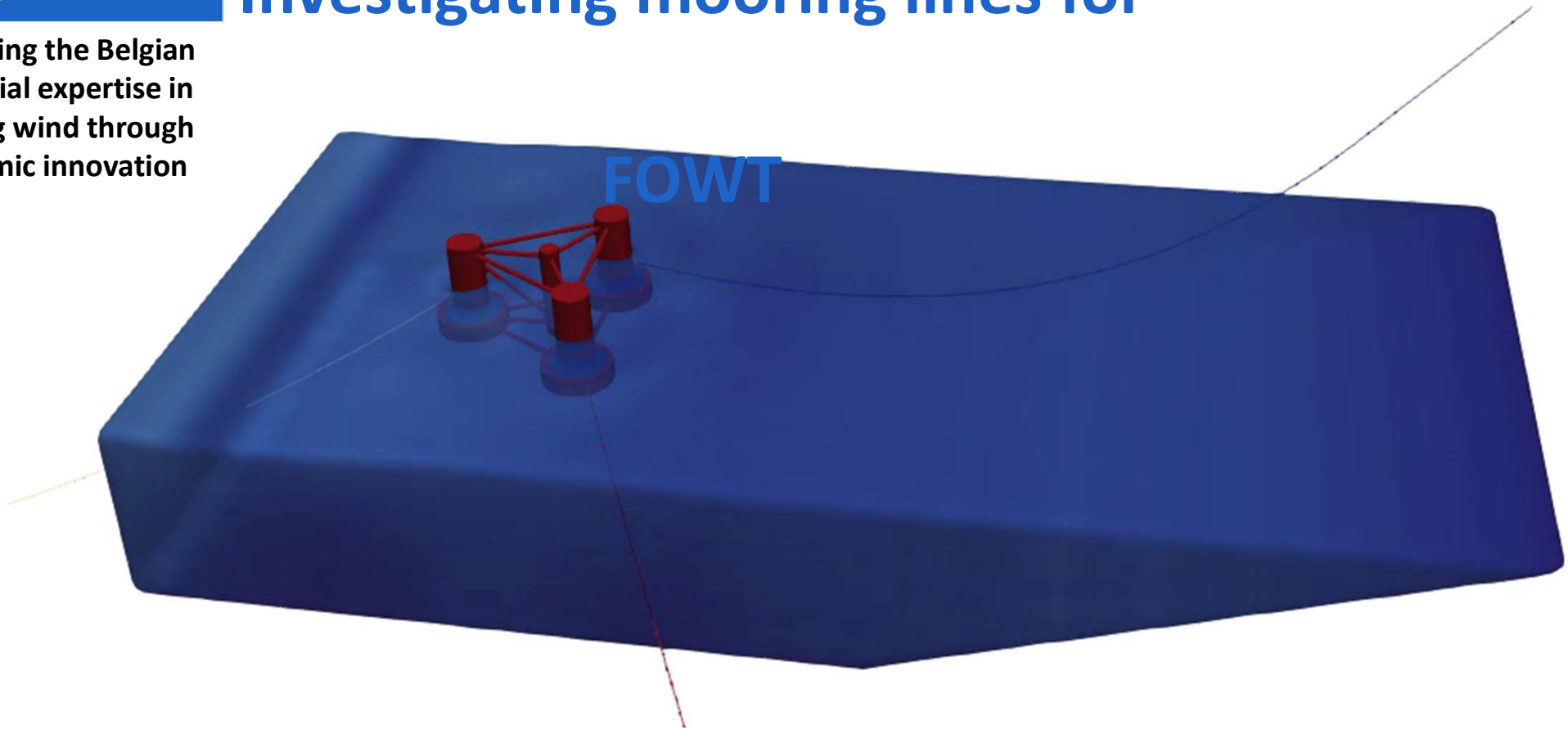
- 2D numerical hydrodynamic validation of **rigid floating solar platforms (hinged)**
  - * floating solar panels
  - * hinged connections
  - * mooring lines
  - * irregular waves

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BEL - Float

Catalyzing the Belgian industrial expertise in floating wind through academic innovation

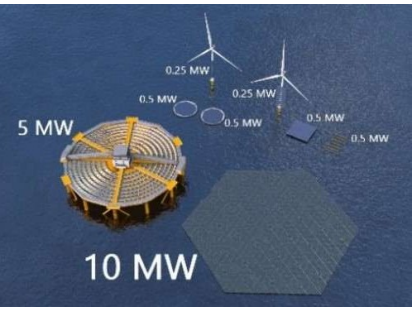
Investigating mooring lines for FOWT



DualSPHysics Simulation of the OC4 planned Q4 2026!

Experiments at COB

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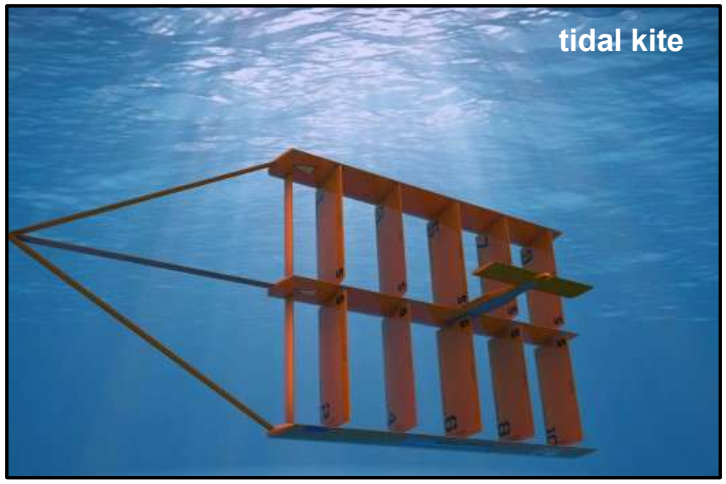


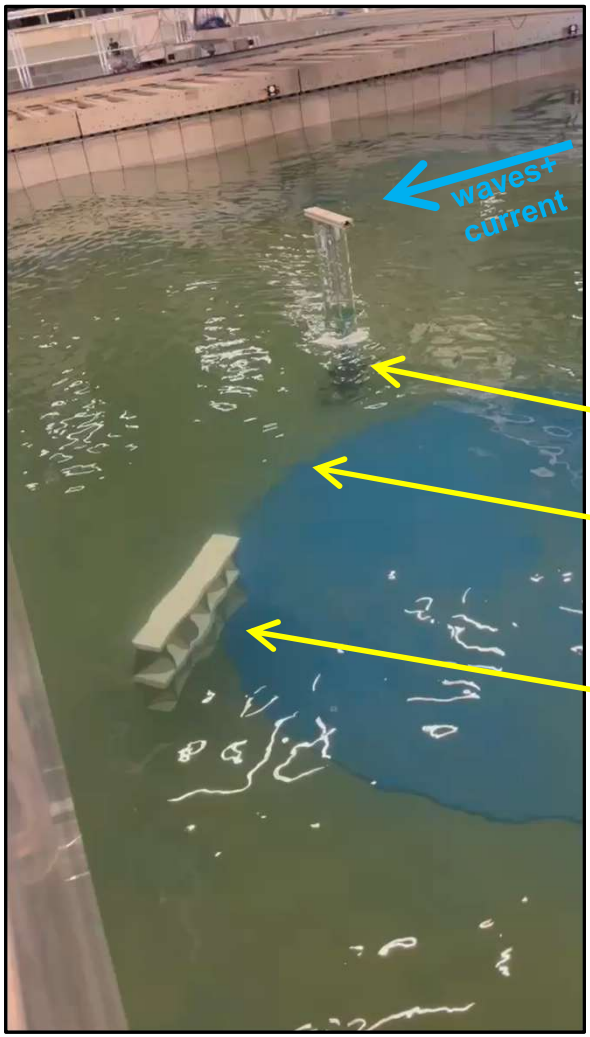
MP Multi Use: Experimental modelling of a tidal kite

Multi-(re)-use scenarios for existing offshore infrastructure

Experiments at the COB

- first ever use of the wave & current systems combined





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VUB VRIJE UNIVERSITEIT BRUSSEL

IMDC

sirris

UGent ←→ MARINERG-i

From transnational access to shaping a European research infrastructure

UGent participation grows with the consortium: ACCESS → CORE PARTNER → WP LEADERSHIP → IMPLEMENTATION

1 — 2 — 3 — 4

MARINET / MARINET2

Transnational access

2 successful UGent applications

MARINERG-i

Core consortium partner

European RI development

MARINERG-i PP

Core partner · Co-leader WP5

Profiling · capacity · impact

UGent contribution in PP

T2.2 Infrastructure profiling & GAP analysis
T5.2 Capacity building & infrastructure development
T5.4 Technical impact management

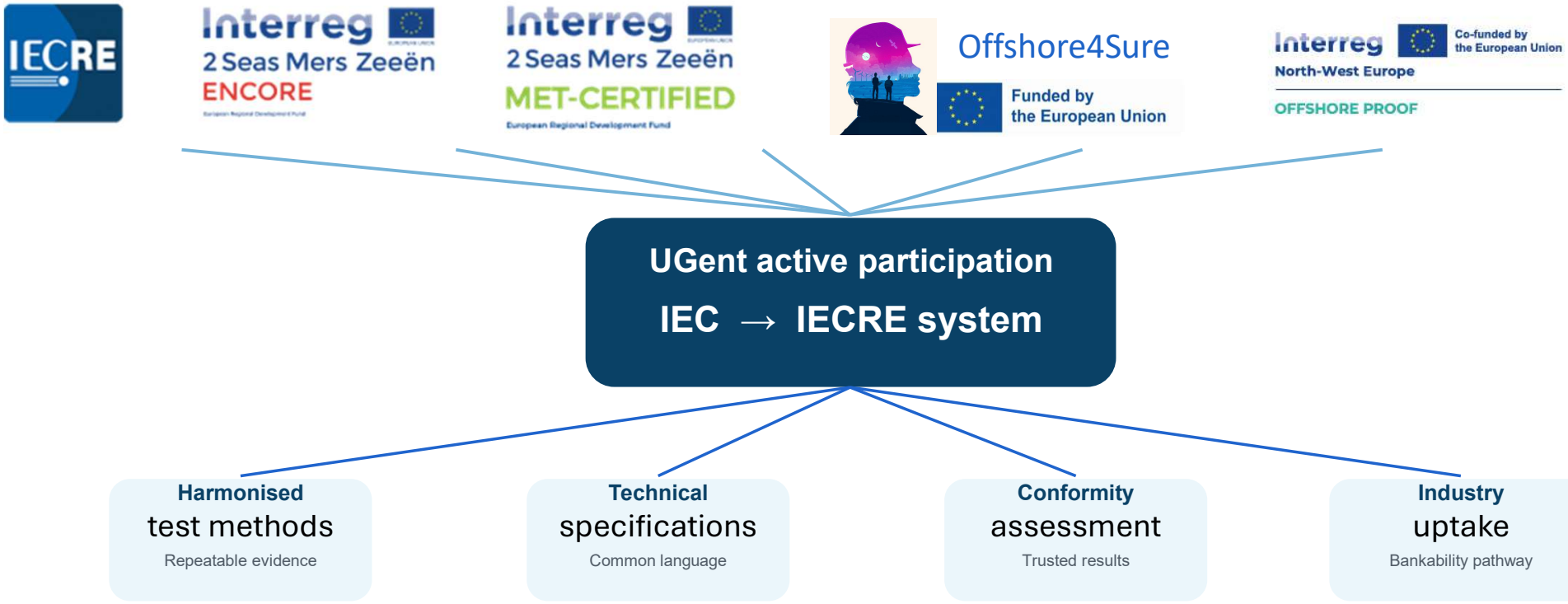
MARINERG-i IMP

Core consortium partner

Implementation & consolidation

Projects → standards → certification

UGent connects applied ORE projects with active participation in the IECRE conformity-assessment ecosystem

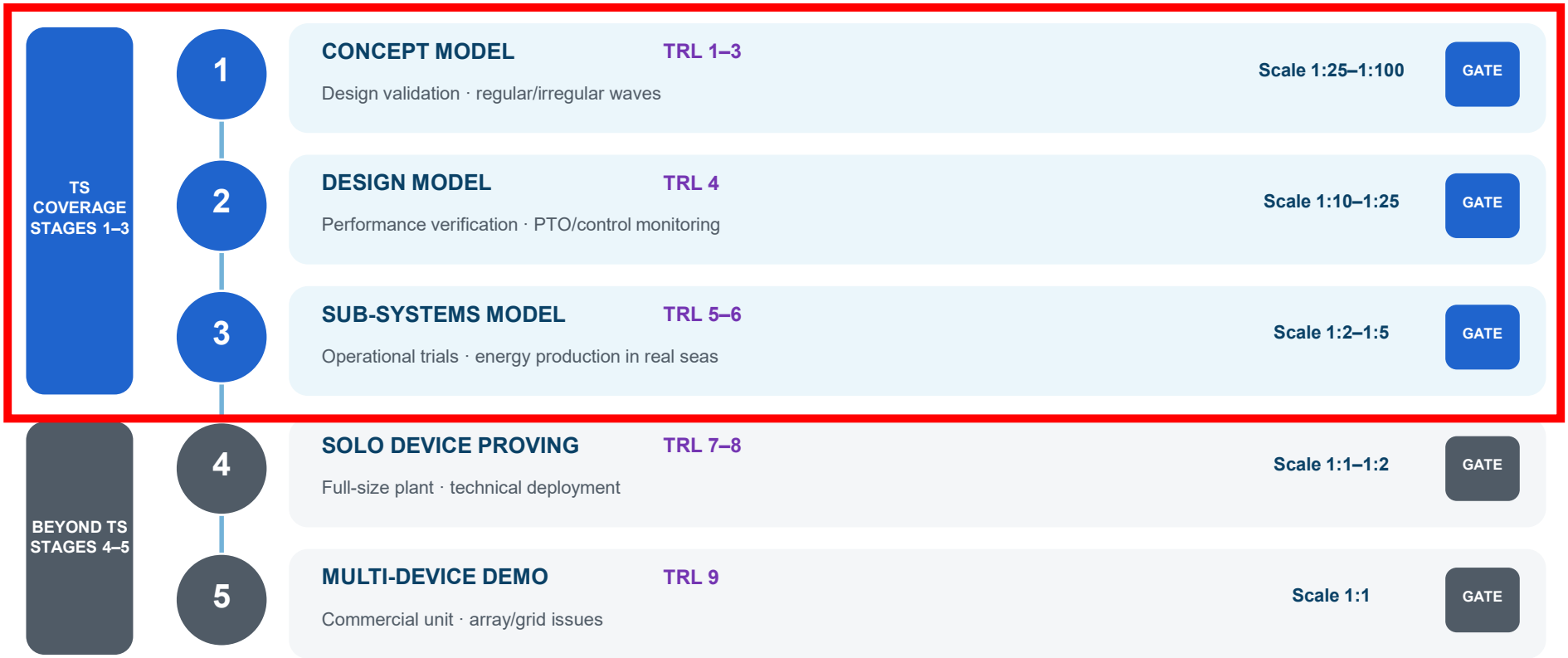


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PROJECT EXPERIENCE ⇄ STANDARDISATION ⇄ CERTIFICATION PRACTICE

Testing development pathway

A stage-gated sequence: evidence matures as technology progresses from concept to commercial readiness



Each gate asks a different question: Does the evidence justify moving to the next level of realism, scale and risk?

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Thanks !!!

Dr ir. Efrain Carpintero Moreno
Research & Academic staff

Prof. Peter TROCH
Director Coastal Engineering Research Group

DEPARTMENT OF CIVIL ENGINEERING
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Ghent University
@ugent
@ugent
Ghent University

E peter.troch@ugent.be; efrain.carpinteromoreno@ugent.be
T +32 9 264 54 89

www.ugent.be
awww.ugent.be
cob.ugent.be

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