Efficiency and survivability of floating OWC moored to the seabed

EsflOWC

Project Reference Number 1193

UNIFI-LABIMA

Infrastructure Access Reports

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ABOUT MARINET

The MaRINET2 project is the second iteration of the successful EU funded MaRINET Infrastructures Network, both of which are coordinated and managed by Irish research centre MaREI in University College Cork and avail of the Lir National Ocean Test Facilities.

MaRINET2 is a €10.5 million project which includes **39 organisations** representing some of the top offshore renewable energy testing facilities in Europe and globally. The project depends on strong international ties across Europe and draws on the expertise and participation of **13 countries**. Over 80 experts from these distinguished centres across Europe will be descending on Dublin for the launch and kick-off meeting on the 2nd of February.

The original MaRINET project has been described as a *"model of success that demonstrates what the EU can achieve in terms of collaboration and sharing knowledge transnationally".* Máire Geoghegan-Quinn, European Commissioner for Research, Innovation and Science, November 2013

MARINET2 expands on the success of its predecessor with an even greater number and variety of testing facilities across offshore wind, wave, tidal current, electrical and environmental/cross-cutting sectors. The project not only aims to provide greater access to testing infrastructures across Europe, but also is driven to improve the quality of testing internationally through standardisation of testing and staff exchange programmes.

The MaRINET2 project will run in parallel to the MaREI, UCC coordinated EU marinerg-i project which aims to develop a business plan to put this international network of infrastructures on the European Strategy Forum for Research Infrastructures (ESFRI) roadmap.

The project will include at least 5 trans-national access calls where applicants can submit proposals for testing in the online portal. Details of and links to the call submission system are available on the project website www.marinet2.eu

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1 Introduction & Background

1.1 Introduction

The present project focuses on floating Oscillating Water Column (OWC) wave energy converters (WECs). For fixed OWC WECs, mounted on coastal structures, the waves that propagate towards the shore are subject to wave energy dissipation. Consequently, floating offshore OWC WECs are more efficient to exploit the available wave energy resources at an area. However, there are still challenges to be overcome in order to increase performance and commercial competitiveness. OWC WECs must be able to cope with a wide range of realistic wave conditions, maintaining efficiency in spite of a large variation of the incoming wave power flux. Moreover, OWC WECs must be able to capture the maximum amount of wave energy, for different wave propagation directions. The mooring system then plays major role on the overall OWC WEC efficiency. So far, laboratory tests conducted on floating OWC WECs focused on 2D problems: the OWC occupied the channel width and in most cases it was fixed (e.g. Iturrioz et al., 2014; Lopez et al., 2014). For floating OWC WECs, Luo et al. (2014) showed that the mooring spring elasticity plays an important role in the power capture and efficiency. However, the authors focused on heave-only OWC WECs. Gomes et al. (2015) analysed an OWC WEC with a spar buoy configuration, conducting experiments at very small scale (1:120) using soft mooring lines, but neither they measured tensions in the lines nor they studied extreme conditions, both fundamental aspects for the design of these moored devices.

The primary objective of the project is to study the fluid-structure interaction between ocean waves and a floating OWC WEC using moorings in order to cover the above knowledge gaps. The optimum layout of the mooring system needs to be studied to increase the lifetime of the OWC WEC under extreme wave conditions and to optimize the overall OWC WEC efficiency. To achieve the primary objective, the project has the following specific objectives:

- At short-term: to generate an experimental database, freely available for public use by the scientific community, and containing all significant variables related to floating OWC WECs (i.e. free-surface elevation and air pressure changes inside the chamber, air flux between the chamber and the atmosphere, tensions in the mooring lines and the motion of the OWC WEC).

- At medium-term: the data will be used for validation of numerical models used by the project partners and by researchers worldwide. An example is the SPH-based DualSPHysics code which, after proper validation, will be able to deal with multi-directional waves. The use of this data is also expected to improve the capabilities of numerical models such as OpenFOAM used to simulate floating WECs.

- At long-term: the project results will enhance the understanding of the OWC WEC response and its mooring system under high energetic sea states in order to improve its efficiency and survivability. This will offer a solid base for future experimental campaign at large model scale.

1.2 Development So Far

1.2.1 Stage Gate Progress

Previously completed: ✓

Planned for this project: ➲

STAGE GATE CRITERIA	Status
Stage 1 – Concept Validation	
• Linear monochromatic waves to validate or calibrate numerical models of the system (25 – 100 waves)	➲
• Finite monochromatic waves to include higher order effects (25 –100 waves)	➲
• Hull(s) sea worthiness in real seas (scaled duration at 3 hours)	
• Restricted degrees of freedom (DoF) if required by the early mathematical models	
• Provide the empirical hydrodynamic co-efficient associated with the device (for mathematical modelling tuning)	➲
• Investigate physical process governing device response. May not be well defined theoretically or numerically solvable	➲
• Real seaway productivity (scaled duration at 20-30 minutes)	
• Initially 2-D (flume) test programme	➲
• Short crested seas need only be run at this early stage if the devices anticipated performance would be significantly affected by them	
• Evidence of the device seaworthiness	
• Initial indication of the full system load regimes	
Stage 2 – Design Validation	
• Accurately simulated PTO characteristics	
• Performance in real seaways (long and short crested)	
• Survival loading and extreme motion behaviour.	
• Active damping control (may be deferred to Stage 3)	
• Device design changes and modifications	
• Mooring arrangements and effects on motion	
• Data for proposed PTO design and bench testing (Stage 3)	
• Engineering Design (Prototype), feasibility and costing	
• Site Review for Stage 3 and Stage 4 deployments	
• Over topping rates	
Stage 3 – Sub-Systems Validation	
• To investigate physical properties not well scaled & validate performance figures	
• To employ a realistic/actual PTO and generating system & develop control strategies	
• To qualify environmental factors (i.e. the device on the environment and vice versa) e.g. marine growth, corrosion, windage and current drag	
• To validate electrical supply quality and power electronic requirements.	
• To quantify survival conditions, mooring behaviour and hull seaworthiness	
• Manufacturing, deployment, recovery and O&M (component reliability)	
• Project planning and management, including licensing, certification, insurance etc.	
Stage 4 – Solo Device Validation	

STAGE GATE CRITERIA	Status
• Hull seaworthiness and survival strategies	
• Mooring and cable connection issues, including failure modes	
• PTO performance and reliability	
• Component and assembly longevity	
• Electricity supply quality (absorbed/pneumatic power-converted/electrical power)	
• Application in local wave climate conditions	
• Project management, manufacturing, deployment, recovery, etc	
• Service, maintenance and operational experience [O&M]	
• Accepted EIA	
Stage 5 – Multi-Device Demonstration	
• Economic Feasibility/Profitability	
• Multiple units performance	
• Device array interactions	
• Power supply interaction & quality	
• Environmental impact issues	
• Full technical and economic due diligence	
• Compliance of all operations with existing legal requirements	

1.2.2 Plan for This Access

Experiments at scale 1:50 were performed in the Wave-Current Flume (LABIMA-WCF), Florence. Two different floating scale models have been tested: 1) the so-called "BOX" model (see Section 2.2.1); 2) the so-called "OWC WEC" model (see Section 2.2.2). Each model includes a set of moorings in catenary (4 mooring lines). Both devices have been constructed at the workshop of Coastal Engineering Research Group at Department of Civil Engineering of Ghent University, in Belgium (http://awww.UGent.be). Note that in preparation of the present tests, a series of experiments using the same scale models (floating "BOX" and "OWC WEC") has been carried shortly before the experimental campaign in LABIMA-WCF. These preparatory experiments have been performed in the 30 m long, 1.0 m wide and 1.2 m high physical wave flume of the Coastal Engineering Research Group at Department of Civil Engineering of Ghent University, in Belgium. Details about these tests and the obtained data are available by the project participants from Ghent University, as well as in the first literature on the EsflOWC project (Stratigaki et al., 2018; Wu et al., 2018; Crespo et al. 2018) and in future publications.

During the tests, the following data has been measured:

- Free-surface elevations close to the wave generator using ultrasonic wave gauges to confirm generation of the target waves; Free-surface elevations by means of three ultrasonic wave gauges located in front of the scale model (to determine the incident and reflected wave components by using the method of Mansard & Funke, 1980); Free-surface elevations inside the OWC WEC chamber using two resistive wave gauges; Free surface elevations at the sides of the OWC WEC (left and right side) using ultrasonic wave gauges and at the lee of the device to measure transmitted waves.
- Change in the air pressure inside the OWC WEC chamber, which has been measured using pressure sensors.
- Flow rate of air through the orifice at the top of the OWC WEC, measured using a hot wire anemometer.

- The motions of the floating OWC WEC (heave, surge, sway, roll, pitch and yaw) measured by a 6-DoF video tracking system.
- Tension at the mooring lines using submerged load cells.

The project has been conducted during the period to 16-11-2017 to 4-1-2018. Building of the experimental set-up and preliminary tests have been conducted during the period 16-11-2017 to 28-11-2017. Productive tests started the 29-11-2017 and lasted until the 4-01-2017.

The day-by-day list of activities is reported in the Annex 6.2.

2 Outline of Work Carried Out

2.1 General experimental set-up

Tests have been performed in the wave-current flume of Florence University (abbreviated as 'LABIMA-WCF'). LABIMA-WCF is a structure completely made of steel and glass side walls, with a total length of 3700 cm, and a width and height of 80 cm. The piston type wave generator is installed at one end of the wave flume and it has a stroke equal to 150 cm, driven by an electromechanical system with an absolute encoder of 0.01 cm accuracy in position.

The models are located 1823 cm away from the wave paddle. A submerged rubble-mound breakwater, consisting of 4-6 kg stones, with a total length of 200 cm and crest submergence of 5-10cm, has been built in the terminal part of the flume; moreover, behind this submerged breakwater, a perforated planar sloping plate with a length of 240 cm was placed to further reduce wave reflection (Figure 2.1). The plate was perforated with holes of 1cm of diameter in a 2cm X 2cm grid and positioned with slope value of 1/3. The estimated wave reflection coefficient *Kr* for the whole dissipative system (submerged breakwater and perforated planar sloping plate) is in the range 10-20% for the tested range of wave heights (5-17cm), periods (0.8-2.3s) and water depth (50 and 60 cm).

The wave flume is instrumented with 10 ultrasonic Wave Gauges (WGs). The details of the locations from the paddle is given in Table 2.1.

Table 2. 1 Distances of the ultrasonic WGs from the wave paddle and position of the scale model (OWC WEC/BOX).

Ultrasonic wave gauge	x (cm)	y (cm)
WG1	1268	40
WG2	1549	40
WG3	1823	66
WG4	1823	14
WG5	1878	40
WG6	2013	40
WG7	2113	40
WG8	2253	40
WG9	2268	40
WG10	2298	40
Model	1823	40

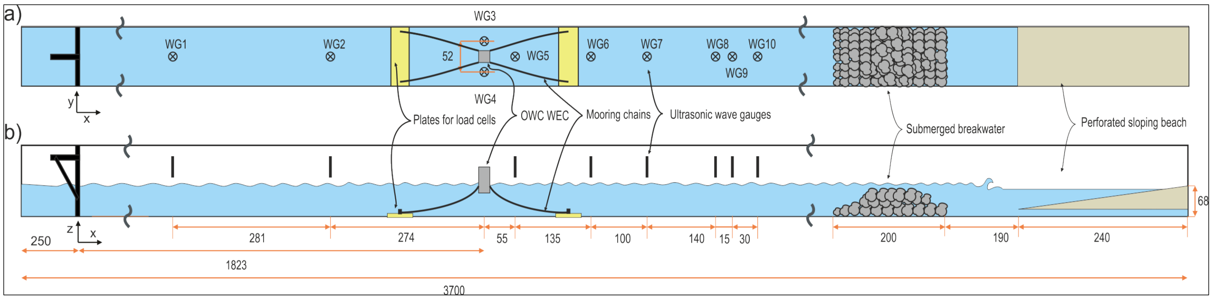

Figure 2.1. Experimental set up along the LABIMA-WCF wave flume: a) plan view, b) middle line cross-section (all dimensions are in cm)

2.2 Scale models tested

Two different scale models have been tested. The first one is a floating closed box ("BOX" model) and the second one is a scale model of a generic floating Oscillating Water Column Wave Energy Converter ("OWC WEC" model).

2.2.1 The BOX scale model

The BOX scale model is a box with 200x200x132mm dimensions (Figure 2.2). The BOX model is made of light PVC material with density of 570 kg/m^3. A 324 mm high plate has been attached to the front face of the BOX, on which reflective markers have been installed to be used by the motion tracking system as shown in Fig. 2.2.

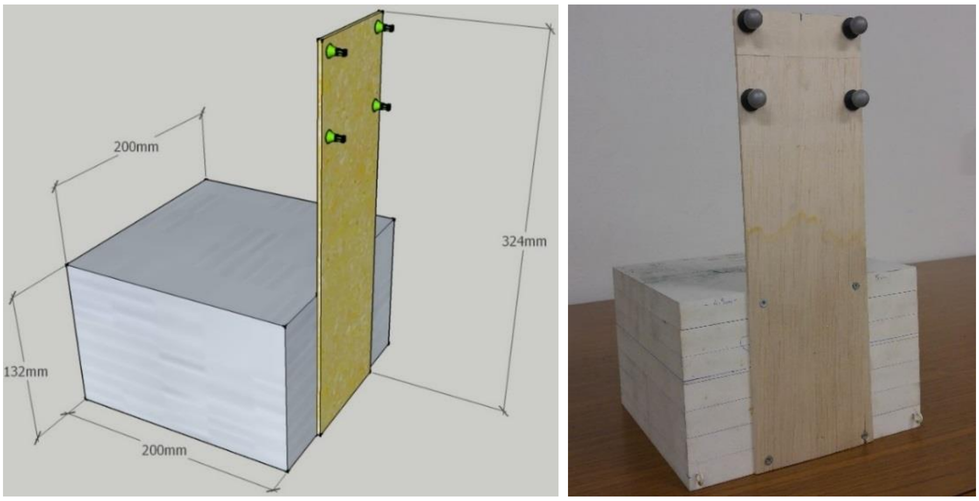

Figure 2.2 The BOX scale model: sketch and dimensions (left); the box model as built (right).

2.2.2 The OWC WEC scale model

The tested OWC WEC scale model has a rectangular prism shape with 200x200x440mm dimensions (see Fig. 2.3). The geometry of the OWC WEC tested during the EsflOWC project corresponds closely to that of the fixed OWC WEC previously studied at LABIMA-WCF, both experimentally and numerically (Crema et al., 2015, Simonetti et al., 2017).

A 3D sketch of the geometry of the OWC WEC scale model is presented in Figure 2.3 (a-b) and a side cross-section is shown in Figure 2.3 (d). As the frontal wall and the back wall are asymmetrical to the principle axis, the model is destabilized and extra ballast (Figure 2.3 (b)) is required to lower down the Center Of Gravity (COG, see Figure 2.3 (d)) and prevent capsizing. Using a light PVC material with density of 570 kg/m^3 to build the main structure and light expanded polystyrene (EPS) foam blocks around the four sides, both the buoyancy and stability are enhanced to ensure a safe operation during the tests. To simulate the OWC WEC turbine Power-Take-Off (PTO) damping, orifices are drilled on the top plate of the scale model. All relevant dimensions of the model are provided in Figure 2.3 (a).

The OWC WEC scale model has been tested using three different orifice diameters:

- 57 mm (code OWC1)
- 30 mm (code OWC2)
- 12 mm (code OWC3)
- OWC without top plate (roof) (code OWC4).

As mentioned above, extra floaters (15x75mm, thickness x height) and bottom hanged weights are attached to satisfy the balance of the model. These weights are:

- A total of 778g comprising extra floaters (15x75mm, thickness x height, pink colour in Fig. 2.3) and bottom hanged weights (green colour in Fig. 2.3).
- An extra weight of 55 g, attached on top of the model on the back wall, in order to satisfy the balance.
- The total weight of the four ball markers (equal to those used in Fig. 2.3-right) used by the video motion tracking system is 6 g.
- The weight of the air tube attached on the cover orifice (yellow colour in Fig. 2.3) and the support structure for the hot wire anemometer is 98g for OWC1, 63g for OWC2, 44g for OWC3 (since OWC4 has no roof, no additional weight for air tube and support structure are present on it).

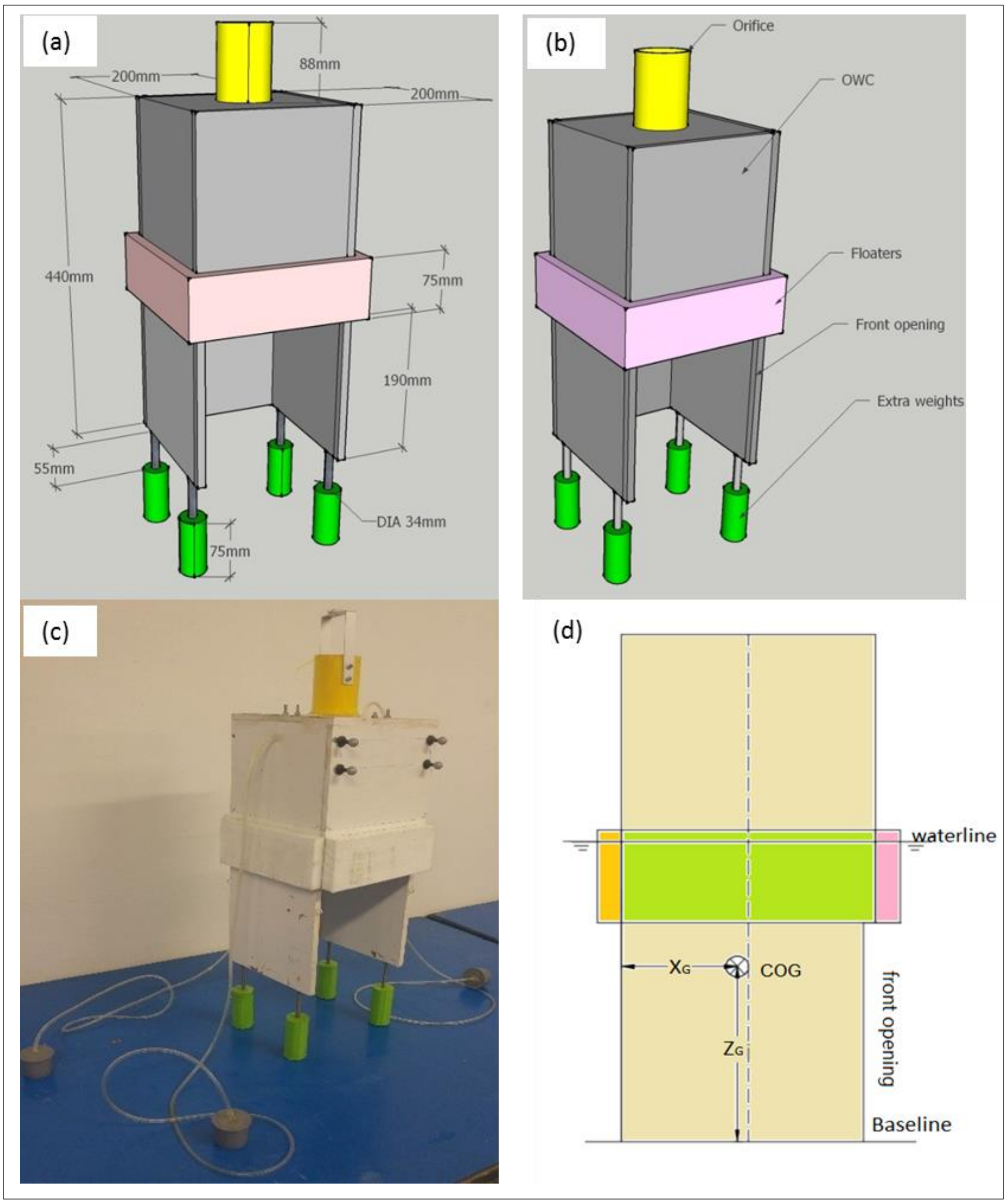

Figure 2.3. The OWC WEC scale model: (a) 3D sketch showing all basic dimensions; (b) 3D sketch showing all important parts; (c) photo of the actual model; (d) cross-section along the middle X-Z plane and COG.

The total mass is 2735g for OWC1, 2695g for OWC2 and 2675g for OWC3, 2348g for OWC4. Please note that the moment of inertia test is planned to be conducted at the laboratory of Ghent University in Belgium, and thus inertia information will be reported in the future by Stratigaki et al. 2018.

The COG coordinates, X_G and Z_G, are presented in Figure 2.3(d), and specifically:

- For OWC1: X_G = 86 mm, Z_G = 161 mm;
- For OWC2: X_G = 86 mm, Z_G = 157 mm;
- For OWC3: X_G = 85.5 mm, Z_G = 155 mm;
- For OWC4: X_G = 84 mm, Z_G = 119 mm;

The model is symmetrical along the flume axis, and therefore Y_G has 0 mm offset from the Y-direction center plane.

2.3 Mooring System

The mooring system connects the scale model to the wave flume bottom through four chains with a length of 1450 mm each (Figure 2.2).

The chains are connected to the Load Cells (LCs) with cotton soft ropes passing through eye hooks. The length of the rope between the eye hook and chain is 85 mm. The LCs are fixed on a 15 mm thick plate. The overall distance of the load cell connection point from the wave flume bottom is 43 mm. The LC faces are arranged to be parallel to the tensile forces from the mooring chain.

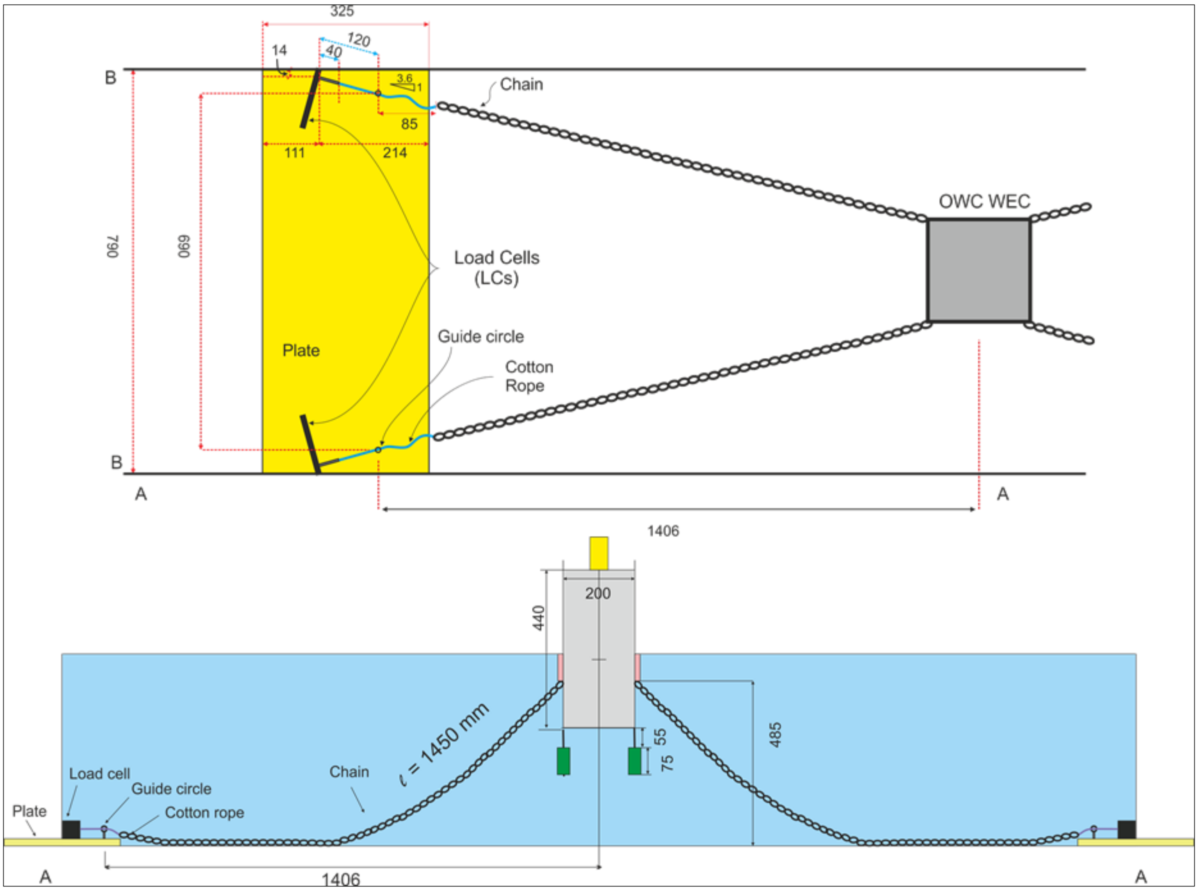

Figure 2.4. Top view (top) and front view (bottom) of the mooring system used for the BOX and for the OWC WEC models (all dimensions are in mm).

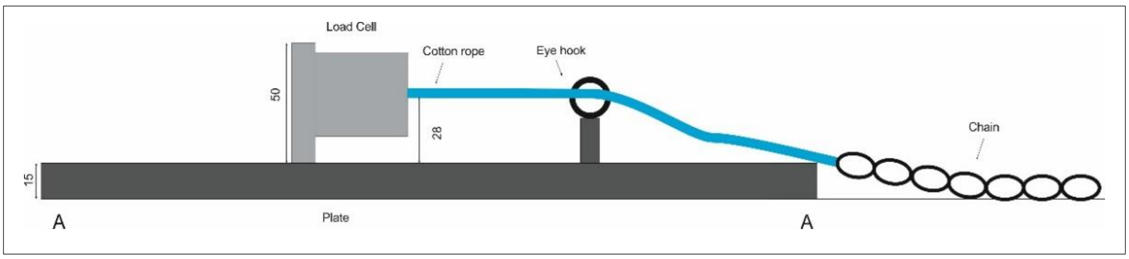

Figure 2.5. The mooring system used for the BOX and for OWC WEC tests: detail of the load cell connection to the wave flume bottom (all dimensions are in mm).

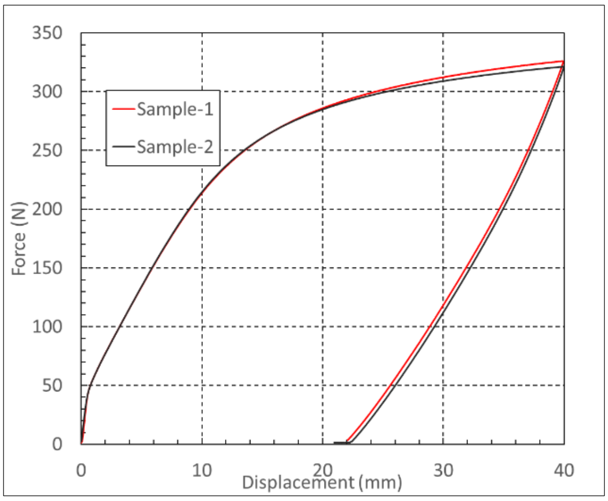

Figure 2.6. The tension-elongation relationship of the chain mooring lines which have been used at LABIMA.

The chain weight is 0.607 g/cm, and the volume is 0.105 cm^3/cm. The length of each chain segment is 0.8 cm. The elasticity properties of the chain are acquired through tensile tests performed at the laboratory of Ghent University (www.ugent.be). The tensile test results are shown in Fig. 2.6 and the elasticity of the chain in small amplitude deformation is 18.95 N/mm.

2.4 Details of employed instrumentation

The BOX model and the OWC WEC model are instrumented with:

- 10 ultrasonic Wave Gauges (WG) located along the LABIMA-WCF as indicated in Figure 2.1 and Table 2. 1.
- load cells (LCs) for measuring the mooring forces, fixed to the model with the mooring configuration described in Section 2.3.
- a video motion tracking system (VT) which includes three cameras to compute the 6 degree of freedom (DoF) of the models.
- the OWC WEC model is also instrumented with 2 resistive type wave gauges (RWGs), 3 pressure transducers (PTs) and a hot wire anemometer (HW) measuring respectively the internal free surface elevation, the differential pressure and the air flow velocity in the air tube.

A regular video camera (VC) has been used to obtain video recording through the wave flume glass side wall.

2.4.1 Ultrasonic Wave Gauges (WGs):

To measure the incident and the reflected waves, 10 WGs have been used (Figure 2.7 and 2.8). The employed WGs measure the free surface displacement with an accuracy of 1 mm at a distance from the sensor in the range 60-500 mm and belong to Series 943-M18-F4V-2D-1C0-330E by HONEYWELL (Figure 2.8).

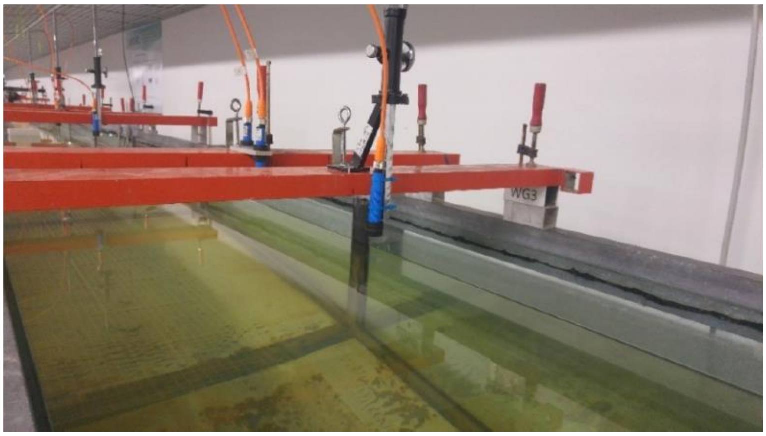

Figure 2.7 Ultrasonic wave gauges installed at LABIMA-WCF.

Max. sensing distance:	500 mm
Min. sensing distance:	60 mm
Switching frequency:	100 ms
Repeatability:	0,2 % or ±1 mm

OUTPUT	TERMINATION	REFERENCE
0-10 V	Connector	943-F4V-2D-1C0-330E
0-10 V	Cable	943-F4Y-2D-1C0-330E
4-10 mA	Connector	943-F4V-2D-1D0-330E
4-20 mA	Cable	943-F4Y-2D-1D0-330E

Figure 2.8, Ultrasonic wave gauges HONEYWELL Series 943-M18-F4V-2D-1C0-330E (left) and technical data sheet (right).

Along the centreline of the wave flume, and starting from the wave paddle, two WGs are located before, and six WGs are located after the model. At the location of the model, two WGs are installed along both sides of the model (WG3-WG4). The last three WGs (WG8-WG9-WG10) are located close to the passive absorption dissipative beach and are used for wave reflection analysis (see Fig. 2.1 and Table 2.1). The sampling frequency of the ultrasonic WGs is 1 kHz. The calibration of the ultrasonic WGs has been conducted by measuring the distance between the WGs and a horizontal plate which is located at different distances away from the WG head (Figure 2.9)

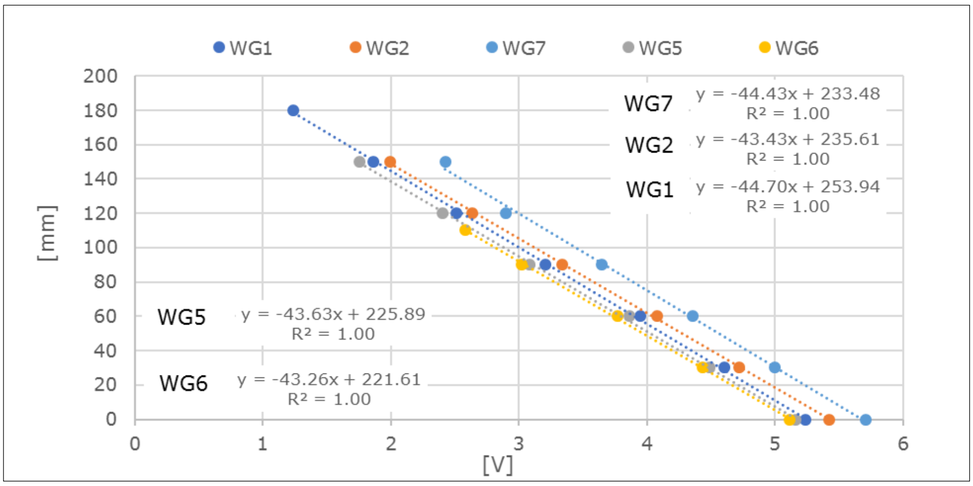

Figure 2.9 Calibration curves for WGs WG1, WG2, WG3

2.4.2 Resistive Wave Gauges (RWGs):

Two Resistive Wave Gauges (RWGs) are installed inside the chamber of the OWC WEC model to measure the water surface variation in the chamber. RWG1 is installed on the internal side of the OWC WEC front wall (with regard to the wave propagation direction), and RWG2 is installed on the internal side of the OWC WEC rear wall (Figure 2.10, left). The sampling frequency of the RWGs is 1 kHz. To conduct the calibration of the RWGs, the OWC WEC model was located in a bucket where the water level was changed step by step and the related voltage output was collected (Figure 2.10, right, Figure 2.11).

Figure 2.10. Resistive type Wave Gauges (RWGs) installed inside the OWC WEC chamber (left). Experimental set-up for the calibration of the RWGs (right).

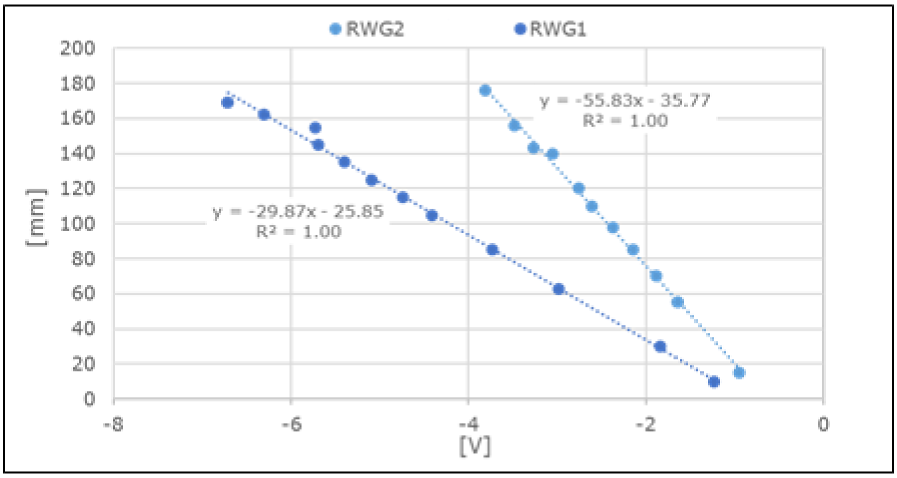

Figure 2.11. Calibration curves for RWG1 and RWG2.

2.4.3 Load Cells (LCs):

Four load cells (abbreviated as LCs) are installed on the bottom of the wave flume to measure tension loads originating from the mooring lines. The LCs have a measure loading capacity with a FS of 5 kg and an accuracy ± 0.01%FS. The LCs (Figure 2.12) are monoaxial load cells employed to measuring the horizontal force. To avoid cross-field disturbance effects, an eye hook is fixed 80 mm away from the LC head to guide a cotton rope, connected to the load cell and to the chain, to transfer just the horizontal force (see Fig. 2.5). The sampling frequency of the LCs is 1 kHz. To calibrate the load cell a plastic bucket, which is connected to the LC, is filled with water with fixed incremental known weights (Figure 2.12, b and c). Then electrical outputs from the LC is correlated to the known water weights (Figure 2.13).

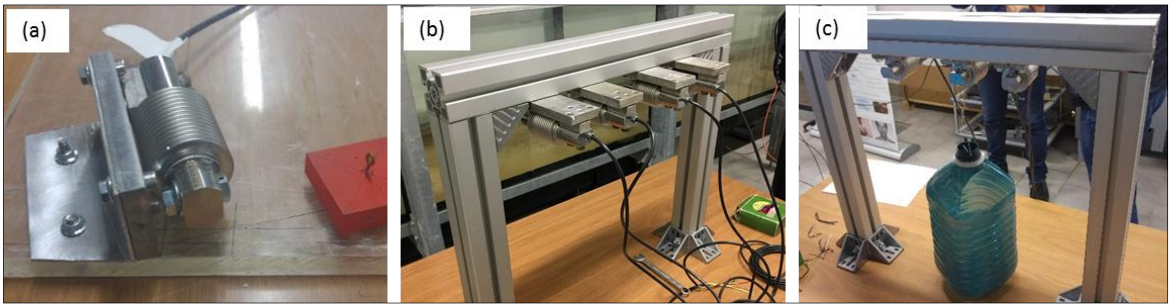

Figure 2.12. Load Cells (LCs) employed for the tests: Detail of a LC (a); Calibration apparatus (b,c).

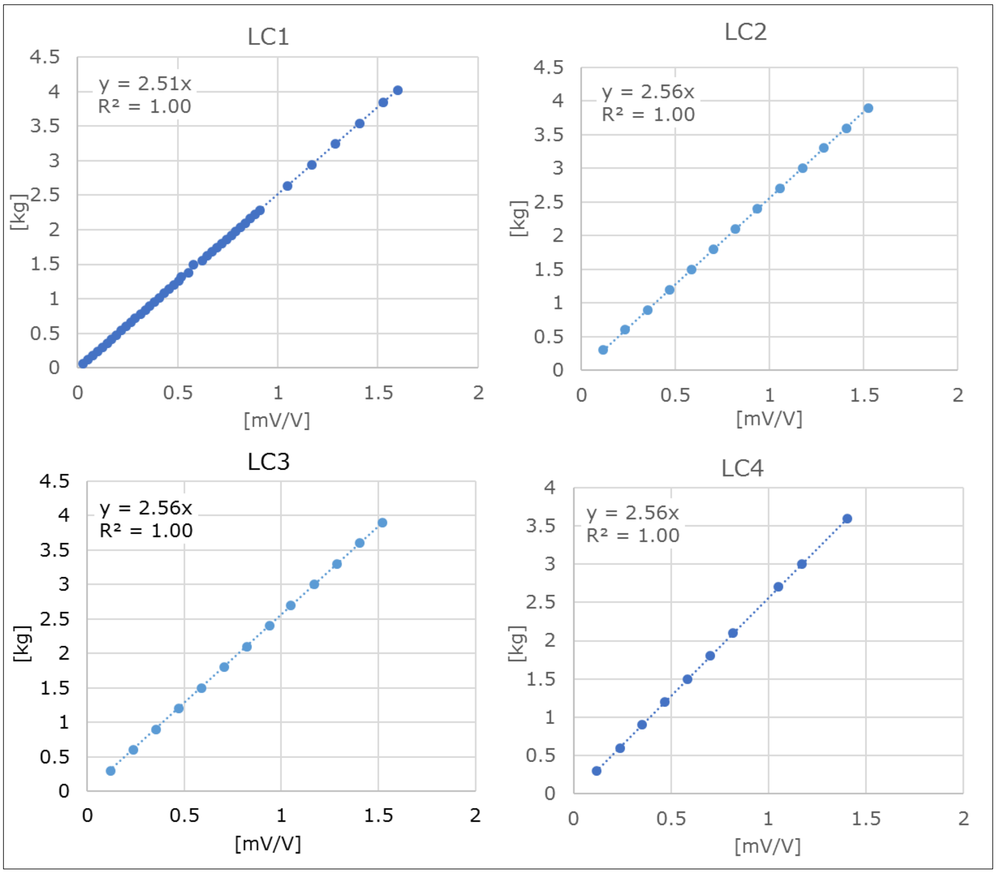

Figure 2.13. Calibration curves for the load cells LC1, LC2, LC3, LC4.

In order to test the influence of the "eye hook and cotton rope arrangement" in the measured force when the cotton rope slides on the eye hook due to angled chain direction a sensitivity test was performed. For this purpose, two LCs were connected to each other by the two ends of the same cotton rope; the cotton rope was tensioned and one LC was rotated thus that the cotton rope was forced to slide on the eye hook; at sane time, the force on the second LC was transferred by the cotton rope that did not slide on the related eye hook. Measurements have been recorded for different angles (Figure 2.14, Figure 2.15). Due to the geometrical features of the mooring lines system the max possible angle is about 20° for which the related error resulted about 10%.

Figure 2.14. Set up employed for the sensitivity tests of Load Cells (LCs) for angle variations.

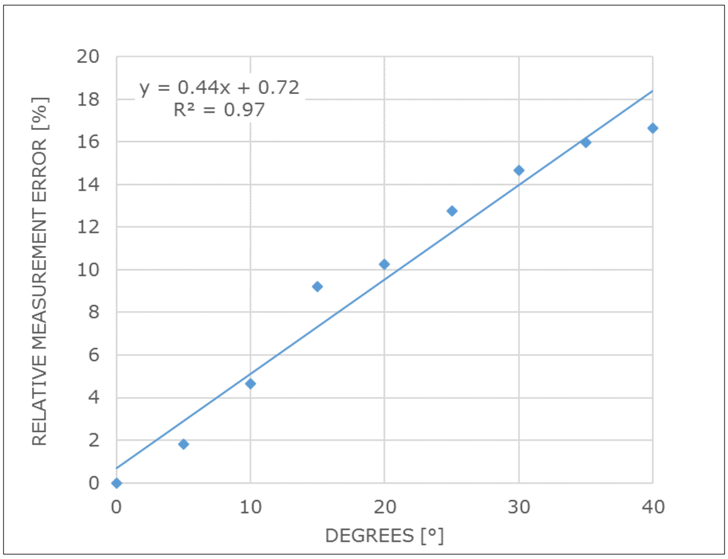

Figure 2.15. Relative error in the measurement of the LCs as a function of the angle of force application.

A sketch showing the positions and naming of the used load cells is presented in Figure 2.16.

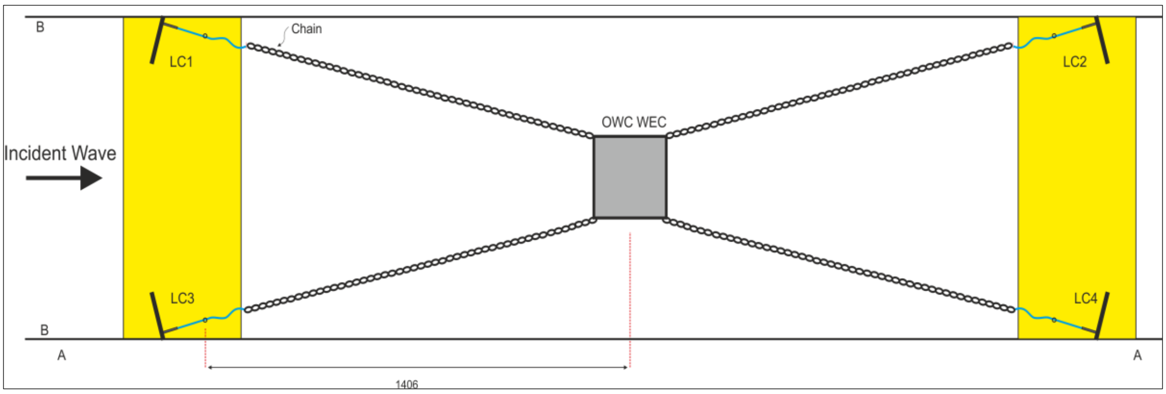

Figure 2.16. Sketch showing the positions and naming of the load cells in the LABIMA-WCF wave flume.

2.4.4 Hot-Wire anemometer (HW):

A Hot-wire anemometer (abbreviated as HW) has been used to measure air velocity in the air tube.

A specific calibration rig is used to calibrate the sensor (Figure 2.17, a and b). The calibration curve for the HW is reported in Figure 2.18.

During the tests the HW has been installed in the air tube located at the orifice of the OWC WEC model. The height of this tube is 88 mm (see Figure 2.17(a)) and the sensor was placed at the middle of this height. The sampling frequency of the HW is 1 kHz.

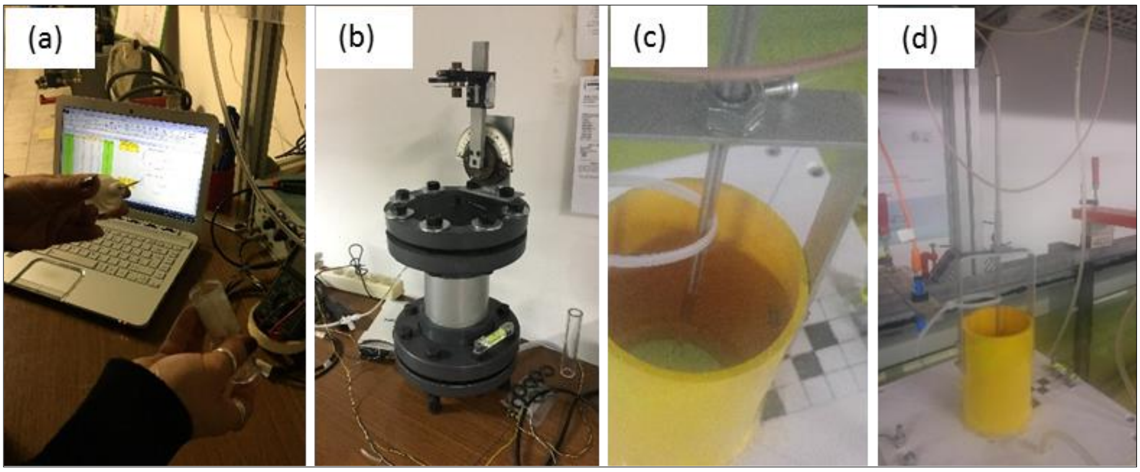

Figure 2.17. Hot Wire Anemometer (HW): calibration apparatus (a-b); HW installed on the top plate of the OWC WEC model (c-d).

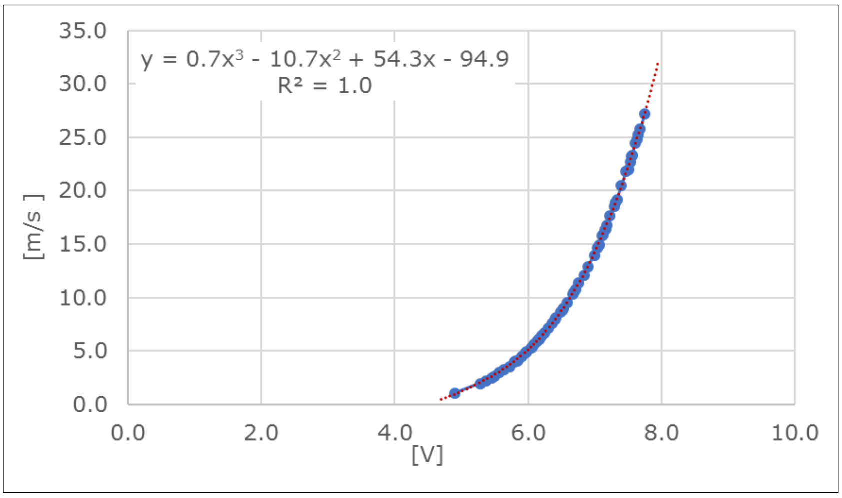

Figure 2.18. Calibration curve for the Hot Wire Anemometer (HW).

2.4.5 Pressure Transducers (PTs):

Differential Pressure Transducers (abbreviated as PTs) of the KELLER Series 46X (Figure 2.19) with a full scale (FS) of 100 mBar and accuracy of ± 0.1%FS have been used to measure pressure variations in the OWC WEC chamber. The locations of their attachment on the OWC WEC model are shown in Fig. 2.20 (e).

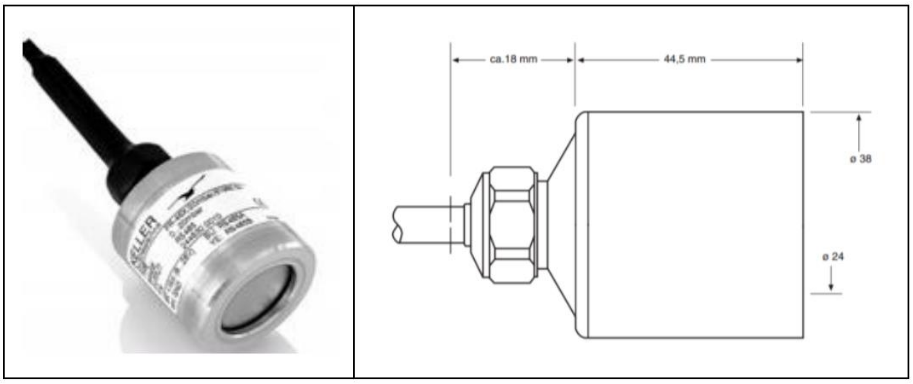

Figure 2.19. Pressure transducer-KELLER Series 46X, picture and technical drawing.

Each transducer is located outside the wave flume (Figure 2.20 (a-b) and is connected to the OWC WEC model through a small flexible plastic tube (see transparent small tubes in Figure 2.20 (c-d)) which can transmit pressure variation insight the OWC WEC chamber without adding any additional weight on the model, and thus without affecting externally its dynamics. Two tubes are located on both sides of the OWC WEC while the third one is located on the top of the OWC (Figure 2.20 (c-d)).

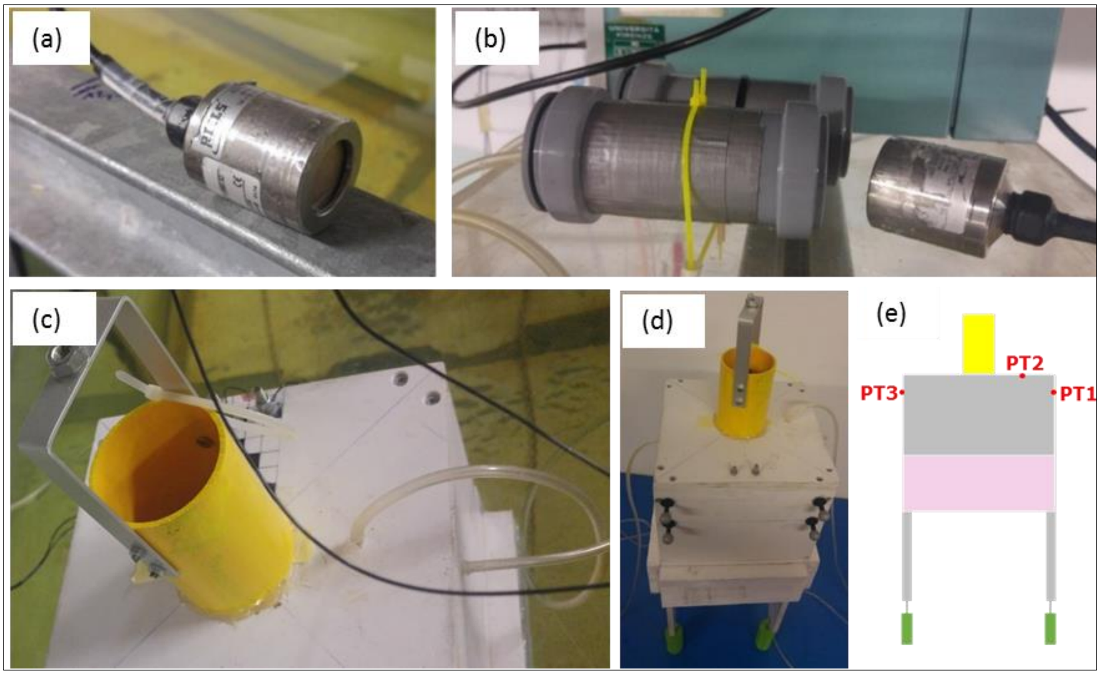

Figure 2.20. Pressure Transducer PT (a); set-up of the pressure transducers on the floating OWC model (b,c); Photo (d) and sketch (e) of the PTs position on the OWC and PTs naming.

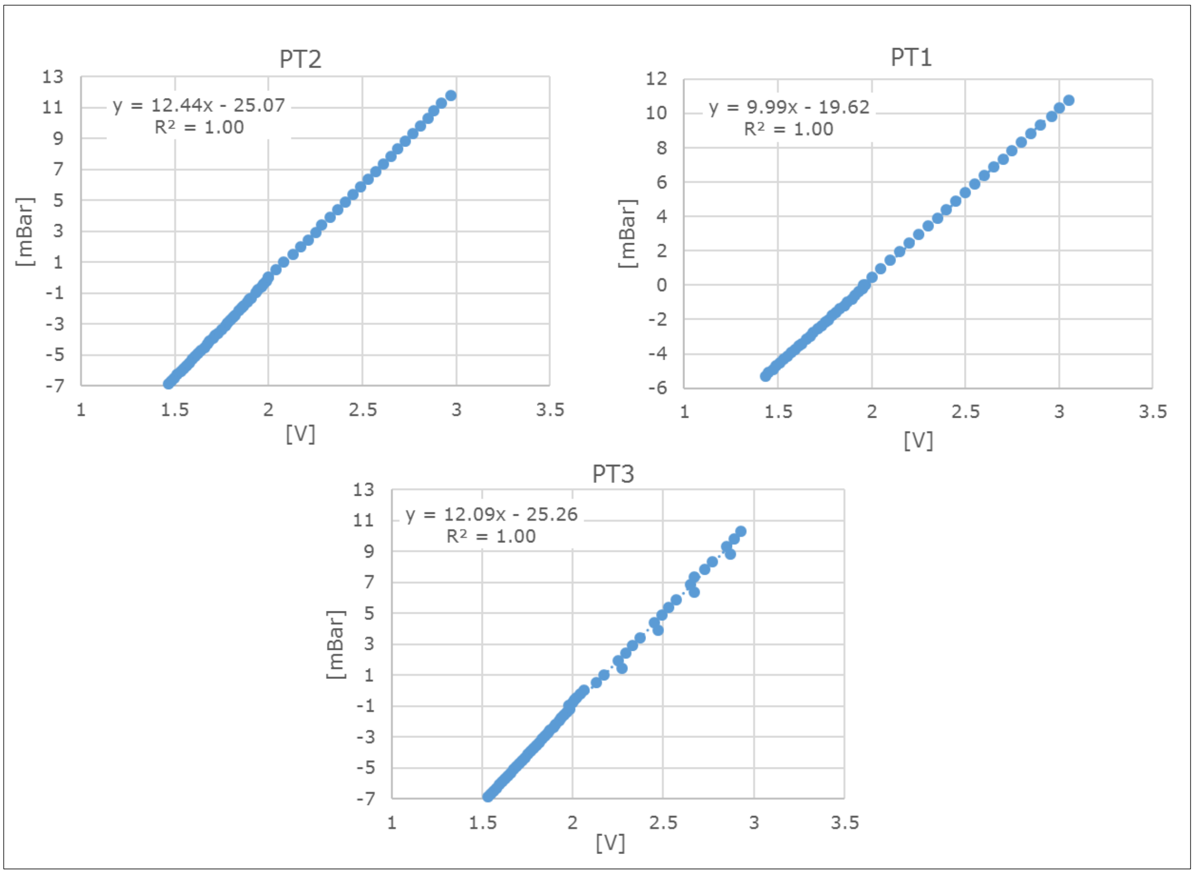

Figure 2.21. Calibration curves for Pressure Transducers (PTs).

2.4.6 Video motion Tracking system (VT):

Video motion Tracking (abbreviated as VT) is the process of locating a moving object (or multiple objects) with up to six degrees of freedom (6DOF) of motion over time, using a camera. During the present tests, the VT uses three cameras (see Figure 2.22).

The VT system was located perpendicular to the LABIMA-WCF axis, at a distance of 17.1 m from the wave paddle (see Fig. 2.22). A sketch of the coordinate system used for the obtained 6-DoF data is shown in Figure 2.22(c).

Calibration of the VT system is checked with the help of an ultrasonic wave gauge used to measure the heave motion of the top plate (roof) of the BOX model. The heave motion data recorded by both systems are almost equal, while only a small difference is observed. This difference is expected, as the VT system considers the motion of the Gravity of Centre (GOC) of the BOX while the acoustic wave gauge considers the motion of the top plate of the BOX.

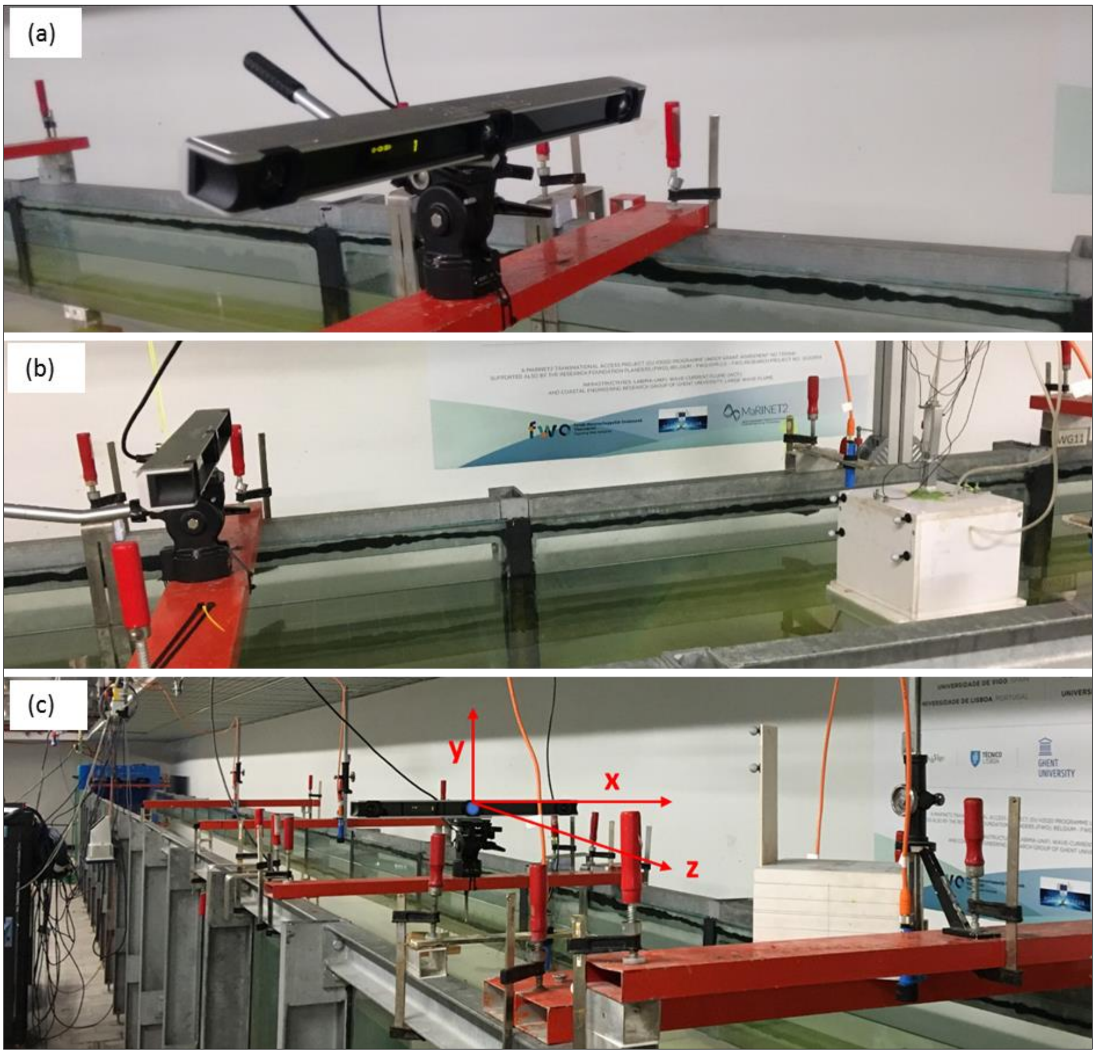

Figure 2.22. The OptiTrack video motion tracking system: the three cameras of the VT attached on a single axis (a); the VT facing the four 'ball' markers attached on the BOX model (b); sketch of the coordinate system used for the Video Motion Tracking system (c).

2.5 Tests

2.5.1 Hydrodynamic Conditions

A total of 41 different combinations of wave and test conditions were initially planned to be tested using the BOX model, and the OWC WEC models with different orifices at the top (see initial test matrix in Table 2.2). Among the 41 sets of wave conditions in the initial test matrix, the 8 cases (H15, H16, H21, H22, H28, H34, H35, H38) have not been tested since it has been observed, either that wave breaking occurs in a zone immediately after the wave paddle, or that there was an overflow of water along the lateral side walls of the wave flume.

Tests H07 and H14 have been repeated 10 times each (BOX and variants of OWC WEC model) to create specific benchmarking tests for validation of numerical models.

Most of the tests were run in a water depth of 60 cm, while tests with H39, H40 and H41 have been repeated also in a water depth of 50 cm for the case of the OWC WEC.

Only regular waves have been tested and wave periods (T) range from $0.8 \leq T \leq 2.3\ s$. Each test runs for a duration, t_d, of 5T of ramp up, plus 20T, plus 5T of ramp down. 10 seconds of pre-trigger and 30 seconds of post-trigger are used for each test. For free drift tests on the BOX model (*Section 2.5.3*), test duration is about 6T, including a ramp up and a ramp down having each a duration T.

Table 2.2 Initial tests matrix showing hydrodynamic conditions, test duration and naming of the tests.

Code name (-)	Water depth, d (m)	Wave period, T (s)	Wave height, H (m)	Test duration, t_d (s)	
H01	0.6	0.80	0.05	24	
H02	0.6	1.00	0.05	30	
H03	0.6	1.30	0.05	39	
H04	0.6	1.60	0.05	48	
H05	0.6	1.90	0.05	57	
H06	0.6	2.10	0.05	63	
H07	0.6	2.10	0.06	63	
H08	0.6	0.80	0.08	24	
H09	0.6	1.00	0.08	30	
H10	0.6	1.30	0.08	39	
H11	0.6	1.60	0.08	48	
H12	0.6	1.90	0.08	57	
H13	0.6	2.10	0.08	63	
H14	0.6	2.10	0.10	63	
H15	0.6	0.80	0.11	24	Not executed due to wave breaking in front of the wave paddle
H16	0.6	1.00	0.11	30	Not executed due to wave breaking in front of the wave paddle
H17	0.6	1.30	0.11	39	
H18	0.6	1.60	0.11	48	
H19	0.6	1.90	0.11	57	
H20	0.6	2.10	0.11	63	
H21	0.6	0.80	0.13	24	Not executed due to wave breaking in front of the wave paddle
H22	0.6	1.00	0.13	30	Not executed due to wave breaking in front of the wave paddle

H23	0.6	1.30	0.13	39	
H24	0.6	1.60	0.13	48	
H25	0.6	1.90	0.13	57	
H26	0.6	2.10	0.13	63	
H27	0.6	2.30	0.13	69	
H28	0.6	1	0.15	30	Not executed due to wave breaking in front of the wave paddle
H29	0.6	1.30	0.15	39	
H30	0.6	1.60	0.15	48	
H31	0.6	1.90	0.15	57	
H32	0.6	2.10	0.15	63	
H33	0.6	2.30	0.15	69	
H34	0.6	1	0.17	30	Not executed due to wave breaking in front of the wave paddle
H35	0.6	1.3	0.17	39	Not executed due to wave breaking in front of the wave paddle
H36	0.6	1.60	0.17	48	
H37	0.6	1.90	0.17	57	
H38	0.6	2.10	0.17	63	Not executed due to water overflow along the wave flume side walls
H39	0.5	0.80	0.04	68	
H40	0.5	1.00	0.04	70	
H41	0.5	1.40	0.04	74	

A series for device decay tests have been performed to study the pitch, roll, surge, heave, sway, yaw of both the BOX and OWC WEC model. A total of 229 tests have been conducted, as reported in Annex 6.1. The day-by-day activity in the wave flume is summarized in Annex 6.2.

2.5.2 Decay tests with the BOX model

Decay tests for the motion of the BOX model were performed for surge, heave, sway, pitch and yaw.

2.5.2.1 Surge Decay Test of the BOX model

Surge decay tests were performed on the moored BOX model as follow: first, the BOX model was connected to a rope and pulled toward the wave paddle in the direction parallel to the wave flume axis (Figure 2. 23). Then the rope was cut by burning it and consequently the BOX was released, resulting in the surge decay motion of the BOX model.

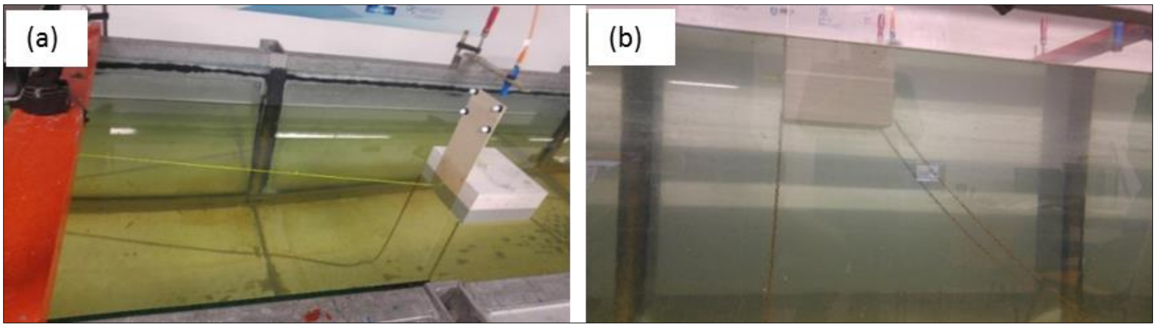

Figure 2. 23 Experimental set up used for the decay tests for surge motion of the BOX model: rope holding the model in position (a); side view of the starting position of the BOX model for surge decay test (b).

2.5.2.2 *Heave Decay Test of the BOX model*

Heave decay tests were performed on the BOX model, both in the not-moored and moored configuration as follow: first, the BOX model was connected to a rope and lifted (Fig. 2.24). Then the rope was cut by burning it and consequently the BOX is released, resulting in the heave decay motion of the BOX model.

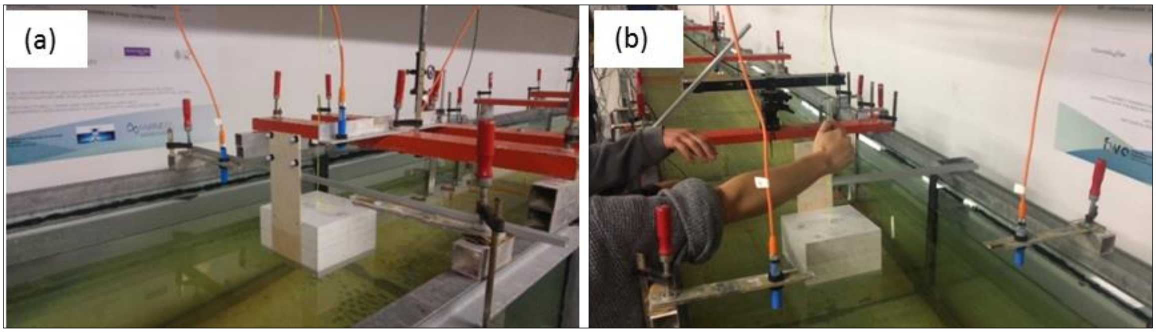

Figure 2.24. Experimental set up used for the decay tests for heave motion of the BOX model: rope holding the BOX model in position (a); cutting the rope operation to realise the model (b).

2.5.2.3 *Sway Decay Test*

Sway decay tests were performed on the moored BOX model as follow: first, the BOX model is connected to some ropes and pulled toward the lateral side of the wave flume, with a translation in x-direction (reference coordinate system as in Figure 2.22(c)). Then the rope is cut by burning it and the box is left free to move, resulting in the sway decay motion of the BOX model.

2.5.2.4 *Pitch Decay Test of the BOX model*

Pitch decay tests were performed on the BOX model, both in the not-moored and moored configuration as follow: first, the BOX model is connected to a rope and bend at approximately 45° with a rotation around the axis transversal to the wave flume (x-axis according to the reference coordinate system depicted in Figure 2.22(c)). Then the rope is cut by burning it and consequently the BOX is released, resulting in the pitch decay motion of the BOX model (Figure 2.25).

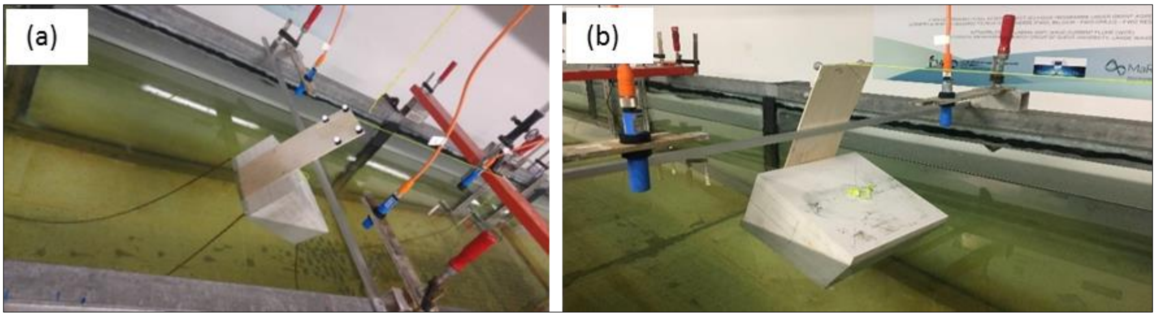

Figure 2.25. Experimental set up used for the decay tests for pitch motion of the BOX model: starting configuration for the tests for the moored (a) and not-moored (b) models.

2.5.2.5 Yaw Decay Test

Yaw decay tests were performed on the moored BOX model as follow: first, the BOX model is connected to two ropes and bend at approximately 45° with a rotation around the vertical axis (y-axis according to the reference coordinate system depicted in Figure 2.22(c)). Then the two ropes are released, resulting in the yaw decay motion of the BOX model (Figure 2.26).

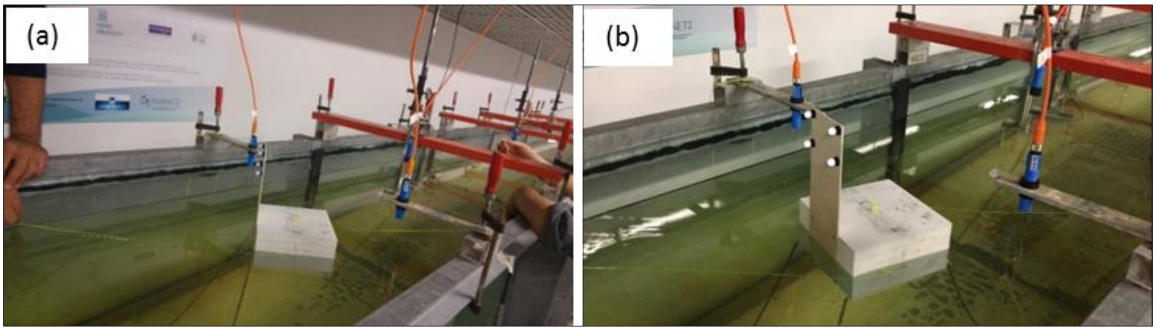

Figure 2.26. Experimental set up used for the decay tests for yaw motion of the BOX model.

2.5.3 Free drift tests with the BOX model

Free drift tests on the BOX model were also performed (*BOX_F_H10_sid01* and *BOX_F_H10_sid02*, with naming convention as in Section 3.1.1.). The BOX model in not-moored condition is tested under the regular wave H10 (Table 2.2). The test duration of the free drift tests is about 6T, including a ramp up and a ramp down having each a duration equal to T. A 10 seconds pre-trigger time was used.

2.5.4 Decay tests with the OWC WEC models

Decay tests for the motion of the OWC WEC models (OWC1, OWC2 and OWC3) were performed for surge, heave, sway, pitch, roll and yaw. Decay tests were not performed for OWC4, i.e. the OWC chamber without top cover.

2.5.4.1 Surge Decay Test of the OWC model

Surge decay tests were performed on the moored OWC WEC models. The OWC model is connected to a rope and pulled toward the wave paddle in the direction parallel to the wave flume axis. Then the rope is cut by burning it and consequently the OWC model is released, resulting in the surge decay motion.

2.5.4.2 Heave Decay Test of the OWC model

Heave decay tests were performed on the moored OWC WEC models. The OWC model was connected to a rope and lifted. Then the rope was cut by burning it and consequently the BOX was released, resulting in the heave decay motion of the BOX model.

2.5.4.3 Sway Decay Test

Sway decay tests were performed on the moored OWC WEC models. The OWC model is connected to some ropes and pulled toward the lateral side of the wave flume, with a translation in x-direction (reference coordinate system as in Figure 2.22(c)). Then the rope was cut and the box is left free to move, resulting in the sway decay motion of the BOX model.

2.5.4.4 Pitch Decay Test of the BOX model

Pitch decay tests were performed on the moored OWC WEC models. The OWC model was connected to a rope and bend at approximately 45° with a rotation around the axis transversal to the wave flume (x-axis according to the reference coordinate system depicted in Figure 2.22(c)). Then the rope is cut by burning it and consequently the model was released, resulting in the pitch decay motion.

2.5.4.5 Yaw Decay Test

Yaw decay tests were performed on the moored OWC WEC models. The OWC model was connected to two ropes and bend at approximately 45° with a rotation around the vertical axis (y-axis according to the reference coordinate system depicted in Figure 2.22(c)). Then the two ropes were released, resulting in the yaw decay motion.

2.5.4.6 Roll Decay Test

Roll decay tests were performed on the moored OWC WEC models. The OWC model was connected to two ropes and bend at approximately 45° with a rotation around the wave flume axis (z-axis according to the reference coordinate system depicted in Figure 2.22(c)). Then the two ropes were released, resulting in the roll decay motion.

2.5.5 Tests with the BOX and the OWC WEC models under wave action

The BOX model and the OWC WEC models (OWC1, OWC2, OWC3 and OWC4) were tested under the wave action characterized by the hydrodynamic conditions of *Section 2.5.1* (Figure 2. 27).

The experimental set up and the mooring characteristics for the tests under the wave action are described in *Section 2.1* and *Section 2.2* respectively.

Note that in the database, tests with models under wave action are referred to as "Productive tests".

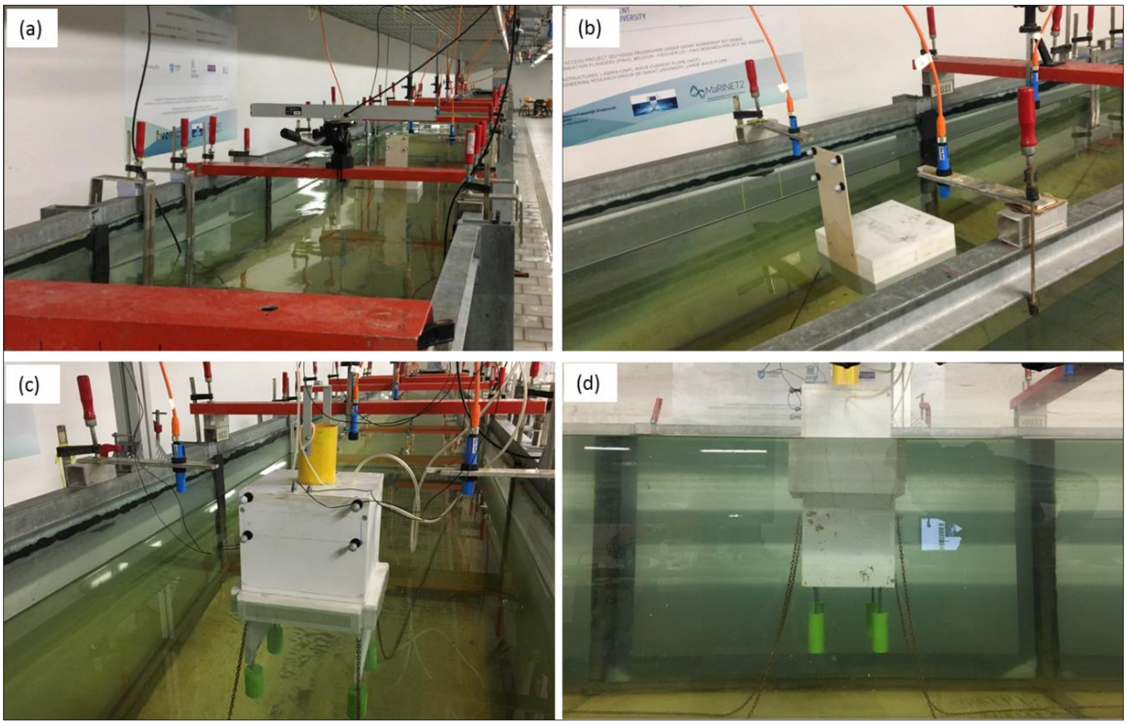

Figure 2. 27. The BOX model tested under wave action (a, b); the OWC WEC model tested under wave action (c, d).

3 Results

The EsflOWC project had the main outcome to produce an extensive database containing all significant variables related to the tested model, i.e. the floating BOX and floating OWC WECs (i.e. free-surface elevation, air pressure changes inside the chamber, velocity of the air flux between the chamber and the atmosphere, tensions in the mooring lines and the motion of the model in its 6-DoF). The data acquired during the EsflOWC project is stored in an online archive accessible via the link:

- https://www.labima.unifi.it/vp-167-esflowc.html

Note that in the database, tests with models under wave action are referred to as "Productive tests". Data Analysis is currently going on and will be disseminated in future research publications.

3.1 Structure of the database and Data validation

3.1.1 Naming of the tests

Each test has been labelled according to the following name code:

<MODEL>_<CHAIN>_<WAVE>_<SID>

where the meaning of each part of the name code is as follows:

<MODEL> can be:

BOX

OWC1 - OWC with 57 mm orifice

OWC2 - OWC with 30 mm orifice
OWC3 - OWC with 12 mm orifice
OWC4 - OWC without top cover (no roof)

<CHAIN> can be:

M – model with mooring

F – model not moored

<WAVE> can be:

H01, H02, etc … *see Section 2.5.1*

<SID> indicates a repetition test, for repeated tests (just waves with hydrodynamic conditions H07 and H14 have been repeated 10 times, in all the other cases it is always *sid01*).

For example: OWC01_M_H01_sid01

3.1.2 Database directory structure

The data base is composed of the following two main directories:

(i) **RawData**, containing the output of the acquisition system "as is", ordered chronologically and divided into subfolders corresponding to the date the tests have been made (see Annex 6.2);

(ii) **ValidatedData**, where the data are classified based on the test typology (i.e., BOX or OWC WEC model tests, tests with models under wave action or model decay tests), preliminary checked and subjected to de-noising and down-sampling operations (see *Section 2.6.3*. for a detailed description of these operations).

For example, the **RawData** directory structure is as follow:

RawData
29-11-17
BOX_F_H10_sid01.csv
BOX_F_H10_sid01.tsv
....

In the case of the directory '**ValidatedData'** the data are saved in '.txt' files under the DATA folder while the related plots are under the FIGURES folder. Each data file name has the same root of the test plus one more extension to relate its content to the specific measurements:

<SENSOR> is the name of the sensor and it can be:

WG_n – Ultrasonic wave gauge number n
LC – Data from the load cells LCs
PT – Data from the pressure transducers PTs
RS – Data from the resistive wave gauges RWGs
HW – Data from the Hot Wire Anemometer HT

DOF – Data from Video Tracking System VT
PaddleDisplacement – effective paddle displacement as measured during the test.

Each data file has a header where basic information such as sampling frequency, meaning of the column, etc … are summarized

For example, the structure of the directory '**ValidatedData'** is as follows:

```
ValidatedData
        OWCTests
                DecayTests
                ProductiveTests
                        OWC1_M_H01_sid01
                                data
                                        OWC1_M_H01_sid01_DOF.txt
                                        OWC1_M_H01_sid01_HW.txt
                                        OWC1_M_H01_sid01_LC.txt
                                        OWC1_M_H01_sid01_PaddleDisplacement.txt
                                        OWC1_M_H01_sid01_PT.txt
                                        OWC1_M_H01_sid01_RS.txt
                                        OWC1_M_H01_sid01_WG.txt
                                figures
                                ....

        BOXTests
                DecayTests
                ProductiveTests
                        BOX_M_H07_sid01
                                        data
                                        BOX_M_H07_sid01_DOF.txt
                                        BOX_M_H07_sid01_LC.txt
                                        BOX_M_H07_sid01_PaddleDisplacement.txt
                                        BOX_M_H07_sid01_WG.txt
                                 figures

                        ….
```

3.1.3 Data validation

The following treatment has been applied to the validated data (**ValidateData** dataset directory):

- Signals from the WGs are zeroed at still water condition, filtered with a moving average filter and down sampled from 1000 Hz to 20 Hz;
- No treatment is applied to the signals from the LCs;
- Signals for the RWGs are zeroed at still water condition, filtered with a moving average filter and down sampled from 1000 Hz to 20 Hz;

- Signals for the PTs are zeroed at still water condition, filtered with a moving average filter and down sampled from 1000 Hz to 20 Hz;
- Signals for the VT are zeroed at still water condition and down sampled from 120 Hz to 20 Hz.
- Signals from the HW are not post processed, i.e. they have an acquisition frequency of 1000 Hz and no filtering operation is applied.
- For decay tests, only the data relative to the DOF examined in each test is saved in the *ValidatedData* (e.g., only pitch signal for pitch decay tests, and so on) both for the OWC WEC and the BOX model. In the Raw data is possible to find the motion relative to the other DOF, which are, anyway, negligibly small compared to the one the model is being tested for.

Overall, specific issues and observation noted during each test, information related to the quality check of the data, problems that may affect the obtained results are reported in *Appendix 6.2 – Notes on Database*.

4 Further Information

4.1 Scientific Publications

Stratigaki, V., D. Kisacik, M. Wu, T.Verbrugghe, C. Altomare, P. Troch, A. J.C. Crespo, M.Hall, L. Cappietti, I. Simonetti, P. Balitsky, G. V. Fernandez, R. B. Canelas, L.M.M.de Almeida, M. Gómez-Gesteira, J.M. Domínguez, P. Stansby, R. M.L. Ferreira. 2018. The EsflOWC project: An experimental study of the motion and mooring behaviour a floating closed cube and a floating Oscillating Water Column Wave Energy Converter. In preparation for submission to journal.

A.J.C. Crespo, M. Hall, J.M. Domínguez, C. Altomare, M. Wu, T. Verbrugghe, V. Stratigaki, P. Troch, M. Gómez-Gesteira. 2018. Floating Moored Oscillating Water Column with Meshless SPH Method. Accepted for the OMAE-2018 conference.

Wu M., Stratigaki V., Verbrugghe T., Troch P., Altomare C., Crespo A., Kisacik D., Cappietti L., Domínguez J., Hall M., Gómez-Gesteira M., Stansby P., Birjukovs Canelas R., Ferreira R. 2018. Experimental Study of Motion and Mooring Behavior of a Floating Oscillating Water Column Wave Energy Converter. Submitted to the Coastlab-2018 Conference.

4.2 Website & Social Media

Website LABIMA: http://www.labima.unifi.it/vp-167-esflowc.html

Website UGent: awww.ugent.be

Online Photographs Link:
http://people.dicea.unifi.it/cappietti/Research/MARINET2/EsflOWC/PicturesAndVideos/

5 References

Crema, I., Simonetti, I., Cappietti, L., Oumeraci, H., 2015, *Laboratory Experiments on Oscillating Water Column Wave Energy Converters Integrated in a Very Large Floating Structure*. 11th

European Wave and Tidal Energy Conference, EWTEC 2015, Nantes, France; 09/2015, ISSN 2309-1983.

A.J.C. Crespo, M. Hall, J.M. Domínguez, C. Altomare, M. Wu, T. Verbrugghe, V. Stratigaki, P. Troch, M. Gómez-Gesteira. 2018. Floating Moored Oscillating Water Column with Meshless SPH Method. Accepted for the OMAE-2018 conference.

R.P.F. Gomes, J.C.C. Henriques, L.M.C. Gato, A.F.O. Falcão, 2016. Wave power extraction of a heaving floating oscillating wáter column in a wave channel, Renewable Energy, 99, 1262-1275.

Iturrioz, A., Guanche, R., Lara, J.L., Vidal, C., Losada, I.J., 2015. "Validation of OpenFOAM for Oscillating Water Column three-dimensional modelling". Ocean Engineering, 107, pp. 222-236.

López, I., Pereiras, B., Castro, F., Iglesias, G., 2014. "Optimisation of turbine-induced damping for an OWC wave energy converter using a RANS-VOF numerical model". Applied Energy, 127, pp. 105–114.

Luo, Y., Wang, Z., Peng, G., Xiao, Y., Zhai, L., Liu, X., Zhang, Q., 2014. "Numerical simulation of a heave-only floating OWC (oscillating water column) device". Energy, 76, pp. 799-806.

E.P.D. Mansard, E.R. Funke, The measurement of incident and reflected spectra using a least square method. Proceedings of the 17th ICCE, 1 (1980), 154-172.

Simonetti, I., Cappietti, L., ElSafti, H., Oumeraci, H., *Optimization of the geometry and the turbine induced damping for fixed detached and asymmetric OWC devices: A numerical study*, Energy 139 (2017) 1197-1209.

Stratigaki, V., D. Kisacik, M. Wu, T.Verbrugghe, C. Altomare, P. Troch, A. J.C. Crespo, M.Hall, L. Cappietti, I. Simonetti, P. Balitsky, G. V. Fernandez, R. B. Canelas, L.M.M.de Almeida, M. Gómez-Gesteira, J.M. Domínguez, P. Stansby, R. M.L. Ferreira. 2018. The EsflOWC project: An experimental study of the motion and mooring behaviour a floating closed cube and a floating Oscillating Water Column Wave Energy Converter. In preparation.

6 Appendices

6.1 Test matrix

The following table lists all the tests performed, with the associate nomenclature to access the results in the tests database. For each test, the pre-trigger time before wave generation is 10 s, and the post-trigger time after the wave maker stopped is 30 s.

Test n°	TEST name code	Model	Water depth, d (m)	Wave period, T (s)	Wave height, H (m)	Wave generation (s)
1	BOX_M_H07_sid01	BOX	0.6	2.1	0.06	63
2	BOX_M_H07_sid02	BOX	0.6	2.1	0.06	63
3	BOX_M_H07_sid03	BOX	0.6	2.1	0.06	63
4	BOX_M_H07_sid04	BOX	0.6	2.1	0.06	63
5	BOX_M_H07_sid05	BOX	0.6	2.1	0.06	63
6	BOX_M_H07_sid06	BOX	0.6	2.1	0.06	63
7	BOX_M_H07_sid07	BOX	0.6	2.1	0.06	63
8	BOX_M_H07_sid08	BOX	0.6	2.1	0.06	63
9	BOX_M_H07_sid09	BOX	0.6	2.1	0.06	63
10	BOX_M_H07_sid10	BOX	0.6	2.1	0.06	63
11	BOX_M_H14_sid01	BOX	0.6	2.1	0.1	63
12	BOX_M_H14_sid02	BOX	0.6	2.1	0.1	63
13	BOX_M_H14_sid03	BOX	0.6	2.1	0.1	63
14	BOX_M_H14_sid04	BOX	0.6	2.1	0.1	63
15	BOX_M_H14_sid05	BOX	0.6	2.1	0.1	63
16	BOX_M_H14_sid06	BOX	0.6	2.1	0.1	63
17	BOX_M_H14_sid07	BOX	0.6	2.1	0.1	63
18	BOX_M_H14_sid08	BOX	0.6	2.1	0.1	63
19	BOX_M_H14_sid09	BOX	0.6	2.1	0.1	63
20	BOX_M_H14_sid10	BOX	0.6	2.1	0.1	63
21	OWC1_M_H01_sid01	OWC1	0.6	0.8	0.05	24
22	OWC1_M_H02_sid01	OWC1	0.6	1	0.05	30
23	OWC1_M_H03_sid01	OWC1	0.6	1.3	0.05	39
24	OWC1_M_H04_sid01	OWC1	0.6	1.6	0.05	48
25	OWC1_M_H05_sid01	OWC1	0.6	1.9	0.05	57
26	OWC1_M_H06_sid01	OWC1	0.6	2.1	0.05	63
27	OWC1_M_H07_sid01	OWC1	0.6	2.1	0.06	63
28	OWC1_M_H07_sid02	OWC1	0.6	2.1	0.06	63
29	OWC1_M_H07_sid03	OWC1	0.6	2.1	0.06	63
30	OWC1_M_H07_sid04	OWC1	0.6	2.1	0.06	63

31	OWC1_M_H07_sid05	OWC1	0.6	2.1	0.06	63
32	OWC1_M_H07_sid06	OWC1	0.6	2.1	0.06	63
33	OWC1_M_H07_sid07	OWC1	0.6	2.1	0.06	63
34	OWC1_M_H07_sid08	OWC1	0.6	2.1	0.06	63
35	OWC1_M_H07_sid09	OWC1	0.6	2.1	0.06	63
36	OWC1_M_H07_sid10	OWC1	0.6	2.1	0.06	63
37	OWC1_M_H08_sid01	OWC1	0.6	0.8	0.08	24
38	OWC1_M_H09_sid01	OWC1	0.6	1	0.08	30
39	OWC1_M_H10_sid01	OWC1	0.6	1.3	0.08	39
40	OWC1_M_H11_sid01	OWC1	0.6	1.6	0.08	48
41	OWC1_M_H12_sid01	OWC1	0.6	1.9	0.08	57
42	OWC1_M_H13_sid01	OWC1	0.6	2.1	0.08	63
43	OWC1_M_H14_sid01	OWC1	0.6	2.1	0.1	63
44	OWC1_M_H14_sid02	OWC1	0.6	2.1	0.1	63
45	OWC1_M_H14_sid03	OWC1	0.6	2.1	0.1	63
46	OWC1_M_H14_sid04	OWC1	0.6	2.1	0.1	63
47	OWC1_M_H14_sid05	OWC1	0.6	2.1	0.1	63
48	OWC1_M_H14_sid06	OWC1	0.6	2.1	0.1	63
49	OWC1_M_H14_sid07	OWC1	0.6	2.1	0.1	63
50	OWC1_M_H14_sid08	OWC1	0.6	2.1	0.1	63
51	OWC1_M_H14_sid09	OWC1	0.6	2.1	0.1	63
52	OWC1_M_H14_sid10	OWC1	0.6	2.1	0.1	63
53	OWC1_M_H17_sid01	OWC1	0.6	1.3	0.11	39
54	OWC1_M_H18_sid01	OWC1	0.6	1.6	0.11	48
55	OWC1_M_H19_sid01	OWC1	0.6	1.9	0.11	57
56	OWC1_M_H20_sid01	OWC1	0.6	2.1	0.11	63
57	OWC1_M_H23_sid01	OWC1	0.6	1.3	0.13	39
58	OWC1_M_H24_sid01	OWC1	0.6	1.6	0.13	48
59	OWC1_M_H25_sid01	OWC1	0.6	1.9	0.13	57
60	OWC1_M_H26_sid01	OWC1	0.6	2.1	0.13	63
61	OWC1_M_H27_sid01	OWC1	0.6	2.3	0.13	69
62	OWC1_M_H29_sid01	OWC1	0.6	1.3	0.15	39
63	OWC1_M_H30_sid01	OWC1	0.6	1.6	0.15	48
64	OWC1_M_H31_sid01	OWC1	0.6	1.9	0.15	57
65	OWC1_M_H32_sid01	OWC1	0.6	2.1	0.15	63
66	OWC1_M_H33_sid01	OWC1	0.6	2.3	0.15	69
67	OWC1_M_H36_sid02	OWC1	0.6	1.6	0.17	48
68	OWC1_M_H37_sid01	OWC1	0.6	1.9	0.17	57
69	OWC2_M_H01_sid01	OWC2	0.6	0.8	0.05	24
70	OWC2_M_H02_sid01	OWC2	0.6	1	0.05	30
71	OWC2_M_H03_sid01	OWC2	0.6	1.3	0.05	39
72	OWC2_M_H04_sid01	OWC2	0.6	1.6	0.05	48

73	OWC2_M_H05_sid01	OWC2	0.6	1.9	0.05	57
74	OWC2_M_H06_sid01	OWC2	0.6	2.1	0.05	63
75	OWC2_M_H07_sid01	OWC2	0.6	2.1	0.06	63
76	OWC2_M_H07_sid02	OWC2	0.6	2.1	0.06	63
77	OWC2_M_H07_sid03	OWC2	0.6	2.1	0.06	63
78	OWC2_M_H07_sid04	OWC2	0.6	2.1	0.06	63
79	OWC2_M_H07_sid05	OWC2	0.6	2.1	0.06	63
80	OWC2_M_H07_sid06	OWC2	0.6	2.1	0.06	63
81	OWC2_M_H07_sid07	OWC2	0.6	2.1	0.06	63
82	OWC2_M_H07_sid08	OWC2	0.6	2.1	0.06	63
83	OWC2_M_H07_sid09	OWC2	0.6	2.1	0.06	63
84	OWC2_M_H07_sid10	OWC2	0.6	2.1	0.06	63
85	OWC2_M_H08_sid01	OWC2	0.6	0.8	0.08	24
86	OWC2_M_H09_sid01	OWC2	0.6	1	0.08	30
87	OWC2_M_H10_sid01	OWC2	0.6	1.3	0.08	39
88	OWC2_M_H11_sid01	OWC2	0.6	1.6	0.08	48
89	OWC2_M_H12_sid01	OWC2	0.6	1.9	0.08	57
90	OWC2_M_H13_sid01	OWC2	0.6	2.1	0.08	63
91	OWC2_M_H14_sid01	OWC2	0.6	2.1	0.1	63
92	OWC2_M_H14_sid02	OWC2	0.6	2.1	0.1	63
93	OWC2_M_H14_sid03	OWC2	0.6	2.1	0.1	63
94	OWC2_M_H14_sid04	OWC2	0.6	2.1	0.1	63
95	OWC2_M_H14_sid05	OWC2	0.6	2.1	0.1	63
96	OWC2_M_H14_sid06	OWC2	0.6	2.1	0.1	63
97	OWC2_M_H14_sid07	OWC2	0.6	2.1	0.1	63
98	OWC2_M_H14_sid08	OWC2	0.6	2.1	0.1	63
99	OWC2_M_H14_sid09	OWC2	0.6	2.1	0.1	63
100	OWC2_M_H14_sid10	OWC2	0.6	2.1	0.1	63
101	OWC2_M_H17_sid01	OWC2	0.6	1.3	0.11	39
102	OWC2_M_H18_sid01	OWC2	0.6	1.6	0.11	48
103	OWC2_M_H19_sid01	OWC2	0.6	1.9	0.11	57
104	OWC2_M_H20_sid01	OWC2	0.6	2.1	0.11	63
105	OWC2_M_H23_sid01	OWC2	0.6	1.3	0.13	39
106	OWC2_M_H24_sid01	OWC2	0.6	1.6	0.13	48
107	OWC2_M_H25_sid01	OWC2	0.6	1.9	0.13	57
108	OWC2_M_H26_sid01	OWC2	0.6	2.1	0.13	63
109	OWC2_M_H27_sid01	OWC2	0.6	2.3	0.13	69
110	OWC2_M_H29_sid01	OWC2	0.6	1.3	0.15	39
111	OWC2_M_H30_sid01	OWC2	0.6	1.6	0.15	48
112	OWC2_M_H31_sid01	OWC2	0.6	1.9	0.15	57
113	OWC2_M_H32_sid01	OWC2	0.6	2.1	0.15	63
114	OWC2_M_H33_sid01	OWC2	0.6	2.3	0.15	69

115	OWC2_M_H36_sid01	OWC2	0.6	1.6	0.17	48
116	OWC2_M_H37_sid01	OWC2	0.6	1.9	0.17	57
117	OWC3_M_H01_sid01	OWC3	0.6	0.8	0.05	24
118	OWC3_M_H02_sid01	OWC3	0.6	1	0.05	30
119	OWC3_M_H03_sid01	OWC3	0.6	1.3	0.05	39
120	OWC3_M_H04_sid01	OWC3	0.6	1.6	0.05	48
121	OWC3_M_H05_sid01	OWC3	0.6	1.9	0.05	57
122	OWC3_M_H06_sid01	OWC3	0.6	2.1	0.05	63
123	OWC3_M_H07_sid01	OWC3	0.6	2.1	0.06	63
124	OWC3_M_H07_sid02	OWC3	0.6	2.1	0.06	63
125	OWC3_M_H07_sid03	OWC3	0.6	2.1	0.06	63
126	OWC3_M_H07_sid04	OWC3	0.6	2.1	0.06	63
127	OWC3_M_H07_sid05	OWC3	0.6	2.1	0.06	63
128	OWC3_M_H07_sid06	OWC3	0.6	2.1	0.06	63
129	OWC3_M_H07_sid07	OWC3	0.6	2.1	0.06	63
130	OWC3_M_H07_sid08	OWC3	0.6	2.1	0.06	63
131	OWC3_M_H07_sid09	OWC3	0.6	2.1	0.06	63
132	OWC3_M_H07_sid10	OWC3	0.6	2.1	0.06	63
133	OWC3_M_H08_sid01	OWC3	0.6	0.8	0.08	24
134	OWC3_M_H09_sid01	OWC3	0.6	1	0.08	30
135	OWC3_M_H10_sid01	OWC3	0.6	1.3	0.08	39
136	OWC3_M_H11_sid01	OWC3	0.6	1.6	0.08	48
137	OWC3_M_H12_sid01	OWC3	0.6	1.9	0.08	57
138	OWC3_M_H13_sid01	OWC3	0.6	2.1	0.08	63
139	OWC3_M_H14_sid01	OWC3	0.6	2.1	0.1	63
140	OWC3_M_H14_sid02	OWC3	0.6	2.1	0.1	63
141	OWC3_M_H14_sid03	OWC3	0.6	2.1	0.1	63
142	OWC3_M_H14_sid04	OWC3	0.6	2.1	0.1	63
143	OWC3_M_H14_sid05	OWC3	0.6	2.1	0.1	63
144	OWC3_M_H14_sid06	OWC3	0.6	2.1	0.1	63
145	OWC3_M_H14_sid07	OWC3	0.6	2.1	0.1	63
146	OWC3_M_H14_sid08	OWC3	0.6	2.1	0.1	63
147	OWC3_M_H14_sid09	OWC3	0.6	2.1	0.1	63
148	OWC3_M_H14_sid10	OWC3	0.6	2.1	0.1	63
149	OWC3_M_H17_sid01	OWC3	0.6	1.3	0.11	39
150	OWC3_M_H18_sid01	OWC3	0.6	1.6	0.11	48
151	OWC3_M_H19_sid01	OWC3	0.6	1.9	0.11	57
152	OWC3_M_H20_sid01	OWC3	0.6	2.1	0.11	63
153	OWC3_M_H23_sid01	OWC3	0.6	1.3	0.13	39
154	OWC3_M_H24_sid01	OWC3	0.6	1.6	0.13	48
155	OWC3_M_H25_sid01	OWC3	0.6	1.9	0.13	57
156	OWC3_M_H26_sid01	OWC3	0.6	2.1	0.13	63

157	OWC3_M_H27_sid01	OWC3	0.6	2.3	0.13	69
158	OWC3_M_H29_sid01	OWC3	0.6	1.3	0.15	39
159	OWC3_M_H30_sid01	OWC3	0.6	1.6	0.15	48
160	OWC3_M_H31_sid01	OWC3	0.6	1.9	0.15	57
161	OWC3_M_H32_sid01	OWC3	0.6	2.1	0.15	63
162	OWC3_M_H33_sid01	OWC3	0.6	2.3	0.15	69
163	OWC3_M_H36_sid01	OWC3	0.6	1.6	0.17	48
164	OWC3_M_H37_sid01	OWC3	0.6	1.9	0.17	57
165	OWC2_M_H39_sid01	OWC2	0.5	0.8	0.04	68
166	OWC2_M_H40_sid02	OWC2	0.5	1	0.04	70
167	OWC2_M_H41_sid03	OWC2	0.5	1.4	0.04	74
168	OWC4_M_H02_sid1	OWC4	0.6	0.6	1	0.05
169	OWC4_M_H04_sid1	OWC4	0.6	0.6	1.6	0.05
170	OWC4_M_H05_sid1	OWC4	0.6	0.6	1.9	0.05
171	OWC4_M_H06_sid1	OWC4	0.6	0.6	2.1	0.05
172	OWC4_M_H17_sid1	OWC4	0.6	1.3	0.11	39
173	OWC4_M_H18_sid1	OWC4	0.6	1.6	0.11	48
174	OWC4_M_H19_sid1	OWC4	0.6	1.9	0.11	57
175	OWC4_M_H20_sid1	OWC4	0.6	2.1	0.11	63
176	OWC4_M_H29_sid1	OWC4	0.6	1.3	0.15	39
177	OWC4_M_H30_sid1	OWC4	0.6	1.6	0.15	48
178	OWC4_M_H31_sid1	OWC4	0.6	1.9	0.15	57
179	BOX_F_H10_sid01	BOX	0.6	1.3	0.08	39
180	BOX_F_H10_sid02	BOX	0.6	1.3	0.08	39
181	BOX_F_HEAVE_DECAY_sid1	BOX	0.6	decay test ip y= +50mm		
182	BOX_F_HEAVE_DECAY_sid2	BOX	0.6	decay test ip y= +55mm		
183	BOX_F_PITCH_DECAY_sid1	BOX	0.6	decay test ip θ=+24.6deg, y=+8mm		
184	BOX_F_PITCH_DECAY_sid2	BOX	0.6	decay test ip θ=+16.2deg, y=+3mm		
185	BOX__F_HEAVE_DECAY_sid3	BOX	0.6	decay test ip y=+48mm		
186	BOX_F_HEAVE_DECAY_sid4	BOX	0.6	decay test ip y=+46mm		
187	BOX_M_HEAVE_DECAY_sid1	BOX	0.6	decay test ip y=+66mm		
188	BOX_M_PITCH_DECAY_sid1	BOX	0.6	decay test ip θ=+32.3deg, y=+14mm		
189	BOX_M_SURGE_DECAY_sid1	BOX	0.6	decay test ip z=-75mm		
190	BOX_M_SURGE_DECAY_sid2	BOX	0.6	decay test ip z=-177mm		
191	BOX_M_SWAY_DECAY_sid1	BOX	0.6	decay test ip x=-204mm		
192	BOX_M_YAW_DECAY_sid1	BOX	0.6	decay test ip φ=-42.4 deg		
193	OWC1_M_HEAVE_DECAY_sid1	OWC1	0.6	decay test ip y=+52.5mm		
194	OWC1_M_HEAVE_DECAY_sid2	OWC1	0.6	decay test ip y=+99mm		
195	OWC1_M_PITCH_DECAY_sid1	OWC1	0.6	decay test ip θ=+32deg, y=+70mm		
196	OWC1_M_PITCH_DECAY_sid2	OWC1	0.6	decay test ip θ=+27deg, y=+66mm		

197	OWC1_M_YAW_DECAY_sid1	OWC1	0.6	decay test ip ψ=-40 deg
198	OWC1_M_YAW_DECAY_sid2	OWC1	0.6	decay test ip ψ=-43.8 deg
199	OWC2_M_HEAVE_DECAY_sid1	OWC2	0.6	decay test ip y=+109mm
200	OWC2_M_HEAVE_DECAY_sid2	OWC2	0.6	decay test ip y=+107mm
201	OWC2_M_PITCH_DECAY_sid1	OWC2	0.6	decay test ip θ=+22 deg, y=-10mm
202	OWC2_M_PITCH_DECAY_sid2	OWC2	0.6	decay test ip θ=+28 deg, y=-18mm
203	OWC2_M_YAW_DECAY_sid1	OWC2	0.6	decay test ip ψ=-40 deg
204	OWC2_M_YAW_DECAY_sid2	OWC2	0.6	decay test ip ψ=-21 deg
205	OWC3_M_HEAVE_DECAY_sid1	OWC3	0.6	decay test ip y=+47mm
206	OWC3_M_HEAVE_DECAY_sid2	OWC3	0.6	decay test ip y=+44mm
207	OWC3_M_SWAY_DECAY_sid1	OWC3	0.6	decay test ip x=+213mm
208	OWC3_M_SWAY_DECAY_sid2	OWC3	0.6	decay test ip no data
209	OWC3_M_SURGE_DECAY_sid1	OWC3	0.6	decay test ip z=+171mm
210	OWC3_M_SURGE_DECAY_sid2	OWC3	0.6	decay test ip z=+163mm
211	OWC3_M_PITCH_DECAY_sid1	OWC3	0.6	decay test ip θ=+13.5 deg, y=-5mm
212	OWC3_M_PITCH_DECAY_sid2	OWC3	0.6	decay test ip θ=+11.5 deg, y=-5mm
213	OWC3_M_YAW_DECAY_sid1	OWC3	0.6	decay test ip ψ=-37.3 deg
214	OWC3_M_YAW_DECAY_sid2	OWC3	0.6	decay test ip ψ=-35 deg
215	OWC3_M_ROLL_DECAY_sid1	OWC3	0.6	decay test ip φ=+14.4 deg, y=-7mm
216	OWC3_M_ROLL_DECAY_sid2	OWC3	0.6	decay test ip φ=+16.7 deg, y=-7mm
217	OWC1_M_SWAY_DECAY_sid1	OWC1	0.6	decay test ip x=-220mm
218	OWC1_M_SWAY_DECAY_sid2	OWC1	0.6	decay test ip x=-218mm
219	OWC1_M_SURGE_DECAY_sid1	OWC1	0.6	decay test ip no data
220	OWC1_M_SURGE_DECAY_sid2	OWC1	0.6	decay test ip no data
221	OWC1_M_SURGE_DECAY_sid4	OWC1	0.6	decay test ip z=-259mm
222	OWC1_M_ROLL_DECAY_sid1	OWC1	0.6	decay test ip φ=+17.3deg
223	OWC1_M_ROLL_DECAY_sid2	OWC1	0.6	decay test ip φ=+18deg
224	OWC2_M_SWAY_DECAY_sid1	OWC2	0.6	decay test ip x=-198mm
225	OWC2_M_SWAY_DECAY_sid2	OWC2	0.6	decay test ip x=-183mm
226	OWC2_M_SURGE_DECAY_sid1	OWC2	0.6	decay test ip z=-244mm
227	OWC2_M_SURGE_DECAY_sid2'	OWC2	0.6	decay test ip z=-177mm
228	OWC2_M_ROLL_DECAY_sid1	OWC2	0.6	decay test ip φ=+21.5deg
229	OWC2_M_ROLL_DECAY_sid2	OWC2	0.6	decay test ip φ=+27.6deg

6.2 Day-by-day activity (Log book)

Date	Activities	NOTEs
29/11/17	• BOX_F_H10_sid1 • BOX_F_H10_sid2 • BOX_F_HEAVE_DECAY_sid1 • BOX_F_HEAVE_DECAY_sid2 • BOX_F_PITCH_DECAY_sid1 • BOX_F_PITCH_DECAY_sid2	**BOX_F_H10_1, BOX_F_H10_2** Drift tests on the box, not moored.
30/11/17	• BOX__F_HEAVE_DECAY_sid3 • BOX_F_HEAVE_DECAY_sid4 • BOX_M_HEAVE_DECAY_sid1 • BOX_M_PITCH_DECAY_sid1 • BOX_M_SURGE_DECAY_sid1 • BOX_M_SURGE_DECAY_sid2 • BOX_M_SWAY_DECAY_sid1 • BOX_M_YAW_DECAY_sid1 • BOX_M_H07_sid1 • BOX_M_H07_sid2 • BOX_M_H07_sid3 • BOX_M_H07_sid4 • BOX_M_H07_sid5 • BOX_M_H07_sid6 • BOX_M_H07_sid7 • BOX_M_H07_sid8 • BOX_M_H07_sid9 • BOX_M_H07_sid10 • BOX_Mmod_H14_sid1	**BOX_F_HEAVE_DECAY_3and4:** decay test for the free floating BOX with ultrasonic wave gauge on top of the BOX to compare the signal of WG4 with that of the OptiTrack.
01/12/17	• BOX_M_H14_sid1 • BOX_M_H14_sid2 • BOX_M_H14_sid3 • BOX_M_H14_sid4 • BOX_M_H14_sid5 • BOX_M_H14_sid6 • BOX_M_H14_sid7 • BOX_M_H14_sid8 • BOX_M_H14_sid9 • BOX_M_H14_sid10	
06/12/17	• OWC1_M_H01_sid1 • OWC1_M_H02_sid1 • OWC1_M_H03_sid1 • OWC1_M_H04_sid1 • OWC1_M_H05_sid1 • OWC1_M_H06_sid1 • OWC1_M_H07_sid1 – sid10 • OWC1_M_H08_sid1 • OWC1_M_H09_sid1	OWC_M_H07_sid1 – sid10: Test repeated 10 times
07/12/17	• OWC1_M_H010_sid1 • OWC1_M_H011_sid1 • OWC1_M_H012_sid1 • OWC1_M_H013_sid1 • OWC1_M_H014_sid1 – sid10	OWC_M_H014_sid1 – sid10: Test repeated 10 times

	• OWC1_M_H017_sid1 • OWC1_M_H018_sid1 • OWC1_M_H019_sid1 • OWC1_M_H020_sid1 • OWC1_M_H023_sid1 • OWC1_M_H024_sid1 • OWC1_M_H025_sid1 • OWC1_M_H026_sid1 • OWC1_M_H027_sid1 • OWC1_M_H029_sid1 • OWC1_M_H030_sid1	
11/12/17	• OWC1_M_H030_sid2 • OWC1_M_H031_sid1 • OWC1_M_H032_sid1 • OWC1_M_H033_sid1 • OWC1_M_H036_sid1 – sid 2 • OWC1_M_H037_sid1 • OWC1_M_HEAVE_DECAY_sid1 • OWC1_M_HEAVE_DECAY_sid2 • OWC1_M_PITCH_DECAY_sid1 • OWC1_M_PITCH_DECAY_sid2 • OWC1_M_ROLL_DECAY_sid1 • OWC1_M_ROLL_DECAY_sid2	OWC_M_H036_sid1 – sid 2 HW not working for sid1, test repeated (sid2)
12/12/17	• OWC2_M_HEAVE_DECAY_sid1 • OWC2_M_HEAVE_DECAY_sid2 • OWC2_M_PITCH_DECAY_sid1 • OWC2_M_PITCH_DECAY_sid2 • OWC2_M_ROLL_DECAY_sid1 • OWC2_M_ROLL_DECAY_sid2 • OWC2_M_H01_sid1 • OWC2_M_H02_sid1 • OWC2_M_H03_sid1 • OWC2_M_H04_sid1 • OWC2_M_H05_sid1 • OWC2_M_H06_sid1 • OWC2_M_H07_sid1 – sid10 • OWC2_M_H08_sid1 • OWC2_M_H09_sid1 • OWC2_M_H010_sid1	OWC2_M_H07_sid1 – sid10 Test repeated 10 times
13/12/17	• OWC2_M_H011_sid1 • OWC2_M_H012_sid1 • OWC2_M_H013_sid1 • OWC2_M_H014_sid1 – sid10 • OWC2_M_H017_sid1 • OWC2_M_H018_sid1 • OWC2_M_H019_sid1 • OWC2_M_H020_sid1	OWC2_M_H014_sid1 – sid10 Test repeated 10 times
15/12/17	• OWC2_M_H023_sid1 • OWC2_M_H024_sid1 • OWC2_M_H025_sid1 • OWC2_M_H026_sid1	

	• OWC2_M_H027_sid1 • OWC2_M_H029_sid1 • OWC2_M_H030_sid1 • OWC2_M_H031_sid1 • OWC2_M_H032_sid1 • OWC2_M_H033_sid1 • OWC2_M_H036_sid1 • OWC2_M_H037_sid1	
18/12/17	• OWC3_M_H01_sid1 • OWC3_M_H02_sid1 • OWC3_M_H03_sid1 • OWC3_M_H04_sid1 • OWC3_M_H05_sid1 • OWC3_M_H06_sid1 • OWC3_M_H07_sid1 – sid10 • OWC3_M_H08_sid1 • OWC3_M_H09_sid1 • OWC3_M_H10_sid1 • OWC3_M_H11_sid1	OWC3_M_H07_sid1 – sid10 Test repeated 10 times
19/12/17	• OWC3_M_H012_sid1 • OWC3_M_H013_sid1 • OWC3_M_H014_sid1 – sid10 • OWC3_M_H017_sid1 • OWC3_M_H018_sid1 • OWC3_M_H019_sid1 • OWC3_M_H020_sid1 • OWC3_M_H023_sid1 • OWC3_M_H024_sid1 • OWC3_M_H025_sid1 • OWC3_M_H026_sid1	
20/12/17	• OWC3_M_H027_sid1 • OWC3_M_H029_sid1 • OWC3_M_H030_sid1 • OWC3_M_H031_sid1 • OWC3_M_H032_sid1 • OWC3_M_H033_sid1 • OWC3_M_H036_sid1 • OWC3_M_H037_sid1 • OWC3_M_HEAVE_DECAY_sid1 • OWC3_M_HEAVE_DECAY_sid2 • OWC3_M_SWAY_DECAY_sid1 • OWC3_M_SWAY_DECAY_sid2	
21/12/17	• OWC3_M_SURGE_DECAY_sid1 • OWC3_M_SURGE_DECAY_sid2 • OWC3_M_PITCH_DECAY_sid1 • OWC3_M_PITCH_DECAY_sid2	OWC2_M_H39-40-41 Tests in a 0.5 m water depth

	• OWC3_M_YAW_DECAY_sid1 • OWC3_M_YAW_DECAY_sid2 • OWC3_M_ROLL_DECAY_sid1 • OWC3_M_ROLL_DECAY_sid2 • OWC1_M_SWAY_DECAY_sid1 • OWC1_M_SWAY_DECAY_sid2 • OWC1_M_SURGE_DECAY_sid1 • OWC1_M_SURGE_DECAY_sid2 • OWC1_M_SURGE_DECAY_sid4 • OWC1_M_ROLL_DECAY_sid1 • OWC1_M_ROLL_DECAY_sid2 • OWC2_M_H39_sid1 • OWC2_M_H40_sid1 • OWC2_M_H41_sid1	
22/12/17	• OWC2_M_SURGE_DECAY_sid1 • OWC2_M_SURGE_DECAY_sid2 • OWC2_M_SWAY_DECAY_sid1 • OWC2_M_SWAY_DECAY_sid2	
03/01/18	• OWC2_M_ROLL_DECAY_sid1 • OWC2_M_ROLL_DECAY_sid2	
04/01/18	• OWC4_M_H02_sid1 • OWC4_M_H04_sid1 • OWC4_M_H05_sid1 • OWC4_M_H06_sid1 • OWC4_M_H17_sid1 • OWC4_M_H18_sid1 • OWC4_M_H19_sid1 • OWC4_M_H20_sid1 • OWC4_M_H29_sid1 • OWC4_M_H30_sid1 • OWC4_M_H31_sid1	OWC4 – tests with the OWC WEC without top cover, water depth d=0.6m

6.3 Notes on the *ValidatedData* database

GENERAL COMMENTS:

- In the BOX model tests, signal acquired from wave gauge WG8 correspond to that acquired from WG7. This is due to a problem in the connection of the cable of sensor WG8 to the main signal acquisition unit. In the data from the BOX model tests, the signal from WG8 should not be used. The problem was fixed during the OWC WEC models (OWC1, OWC2, OWC3, OWC4) tests, i.e. in the OWC WEC data both the signal from WG7 and WG8 can be used.

SPECIFIC COMMENTS:

Test:	Note:
OWC1_M_SURGE_DECAY_sid1	Overall data not acquired properly – this test was removed from the 'ValidatedData' directory and the test was repeated, a valid acquisition of the same test can be found in OWC1_M_SURGE_DECAY_sid4
OWC1_M_SURGE_DECAY_sid2	Overall data not acquired properly – this test was removed from the 'ValidatedData' directory and the test was repeated, a valid acquisition of the same test can be found in OWC1_M_SURGE_DECAY_sid4
OWC2_M_SWAY_DECAY_sid2	Signals acquisition stops before the end of the test

OWC1_M_H05_sid01	PT3 not properly recording → negative trend towards -0.1 mbar
OWC1_M_H07_sid03	PT3 not properly recording → negative trend towards -0.1 mbar
OWC1_M_H07_sid10	PT3 not properly recording → positive growing trend towards +0.1 mbar
OWC1_M_H08_sid01	problems on WGs signals (spikes) – during this test, the wave steepness was too high for the ultrasonic wave gauges to properly measure the water level variation
OWC1_M_H14_sid01	PT3 not properly recording → positive growing trend towards -0.4 mbar
OWC1_M_H14_sid04	PT3 not properly recording → negative trend towards +0.1 mbar
OWC1_M_H24_sid01	PT3 not working (constant signal-1 mBar)
OWC2_M_H08_sid01	problems on WGs signals (spikes) – during this test, the wave steepness was too high for the ultrasonic wave gauges to properly measure the water level variation
OWC2_M_H25_sid01	RWG2 (rear resistive gauge) not working – flat signal due to a possible cable connection problem
OWC2_M_H26_sid01	RWG2 (rear resistive gauge) not working – flat signal due to a possible cable connection problem
OWC2_M_H27_sid01	RWG2 (rear resistive gauge) not working – flat signal due to a possible cable connection problem
OWC2_M_H29_sid01	RWG2 (rear resistive gauge) not working – flat signal due to a possible cable connection problem
OWC2_M_H30_sid01	RWG2 (rear resistive gauge) not working – flat signal due to a possible cable connection problem
OWC2_M_H31_sid01	RWG2 (rear resistive gauge) not working – flat signal due to a possible cable connection problem
OWC2_M_H32_sid01	RWG2 (rear resistive gauge) not working – flat signal due to a possible cable connection problem
OWC2_M_H33_sid01	RWG2 (rear resistive gauge) not working – flat signal due to a possible cable connection problem
OWC2_M_H36_sid01	RWG2 (rear resistive gauge) not working – flat signal due to a possible cable connection problem

OWC2_M_H37_sid01	RWG2 (rear resistive gauge) not working – flat signal due to a possible cable connection problem
OWC2_M_H39_sid01	RWG2 (rear resistive gauge) not working – flat signal due to a possible cable connection problem
OWC2_M_H40_sid01	RWG2 (rear resistive gauge) not working – flat signal due to a possible cable connection problem
OWC3_M_H02_sid01	RWG2 (rear resistive gauge) not working – flat signal due to a possible cable connection problem
OWC3_M_H08_sid01	problems on WGs signals (spikes) – during this test, the wave steepness was too high for the ultrasonic wave gauges to properly measure the water level variation
OWC3_M_H14_sid04	RWG1 (front resistive gauge) not working – flat signal due to a possible cable connection problem
OWC3_M_H14_sid05	RWG1 (front resistive gauge) not working – flat signal due to a possible cable connection problem
OWC3_M_H14_sid06	RWG1 (front resistive gauge) not working – flat signal due to a possible cable connection problem
OWC3_M_H14_sid07	RWG1 (front resistive gauge) not working – flat signal due to a possible cable connection problem
OWC3_M_H14_sid08	RWG1 (front resistive gauge) not working – flat signal due to a possible cable connection problem
OWC3_M_H14_sid09	RWG1 (front resistive gauge) not working – flat signal due to a possible cable connection problem
OWC3_M_H14_sid10	RWG1 (front resistive gauge) not working – flat signal due to a possible cable connection problem
OWC3_M_H17_sid01	RWG1 (front resistive gauge) not working – flat signal due to a possible cable connection problem
OWC3_M_H18_sid01	RWG1 (front resistive gauge) not working – flat signal due to a possible cable connection problem
OWC3_M_H19_sid01	Strong noise level on LCs
OWC3_M_H20_sid01	Strong noise level on LCs
OWC3_M_H27_sid01	RWG2 (rear resistive gauge) not working
OWC3_M_H29_sid01	Camera acquisition note properly working (some gaps in the data are present)