
The Trondheim Five

First Tank Tests of WEC Arrays

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This workstream focuses on wave and tidal arrays

- Establish/improve design methods for station keeping of arrays of wave and deep-water tidal energy converters.
- Understand short and long term loading behaviour of a WEC from a realistic combined waves and currents.
- Understand coupled response arising from combined device and mooring loads for deep-water TECs.

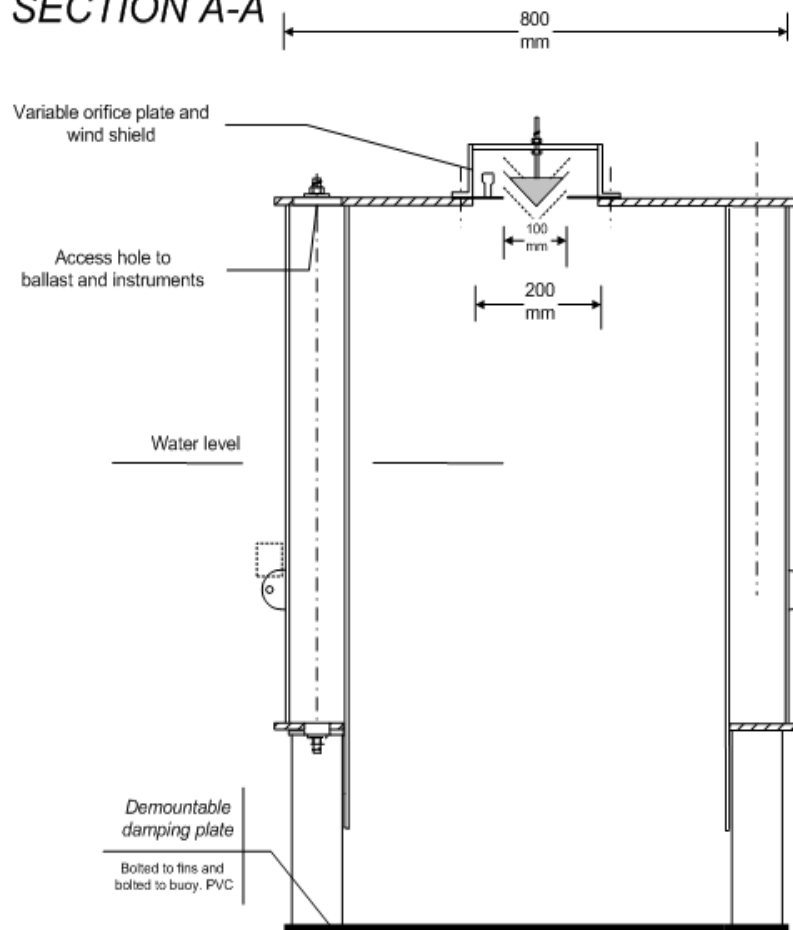
Since last year through EU Hydralab III completed test programme of 5 1/20th scale heaving buoys in NTNU tank in Norway.....

The Tank – 80m x 50m x 10m

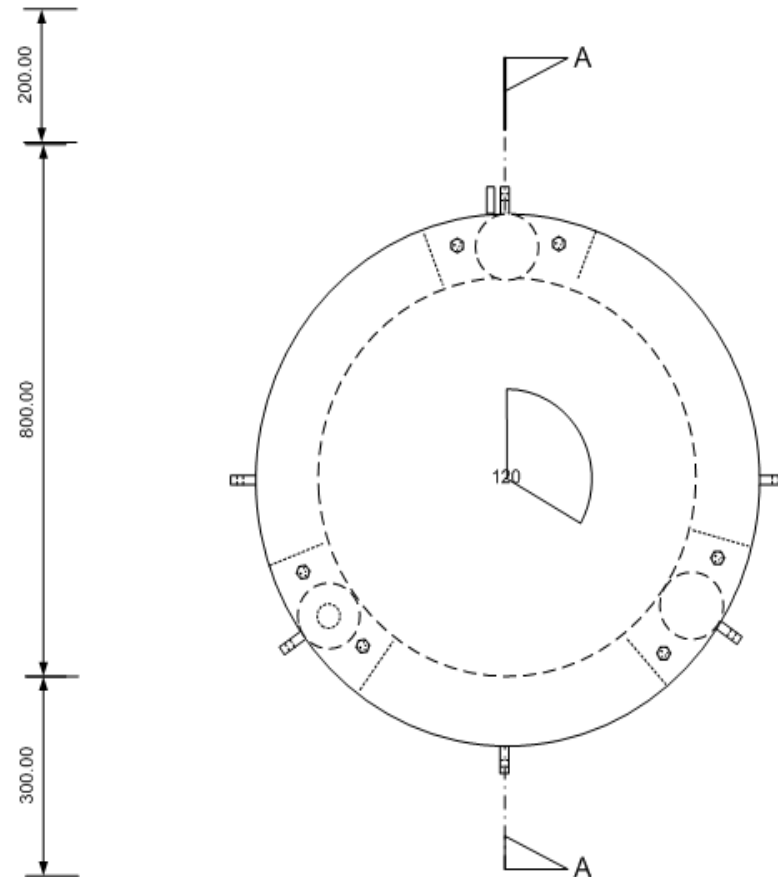


The Buoys

SECTION A-A



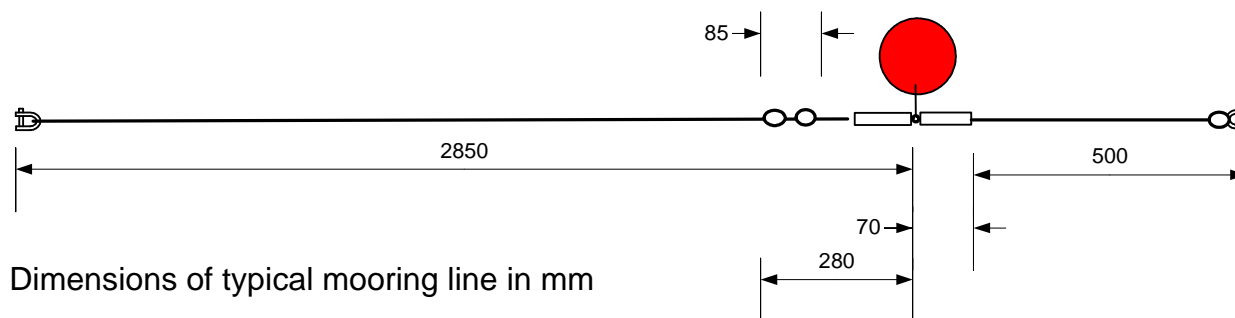
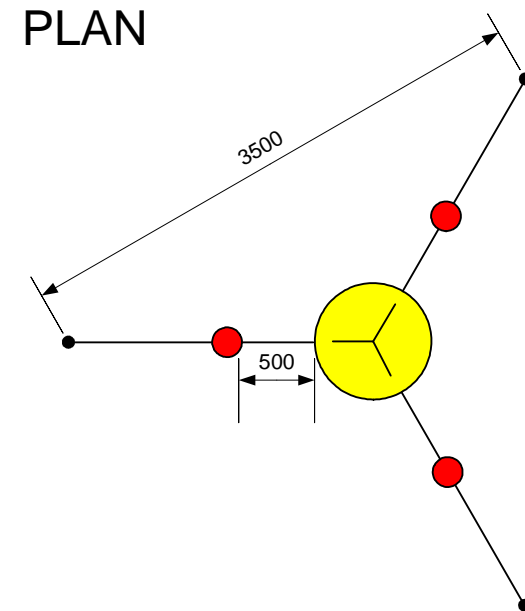
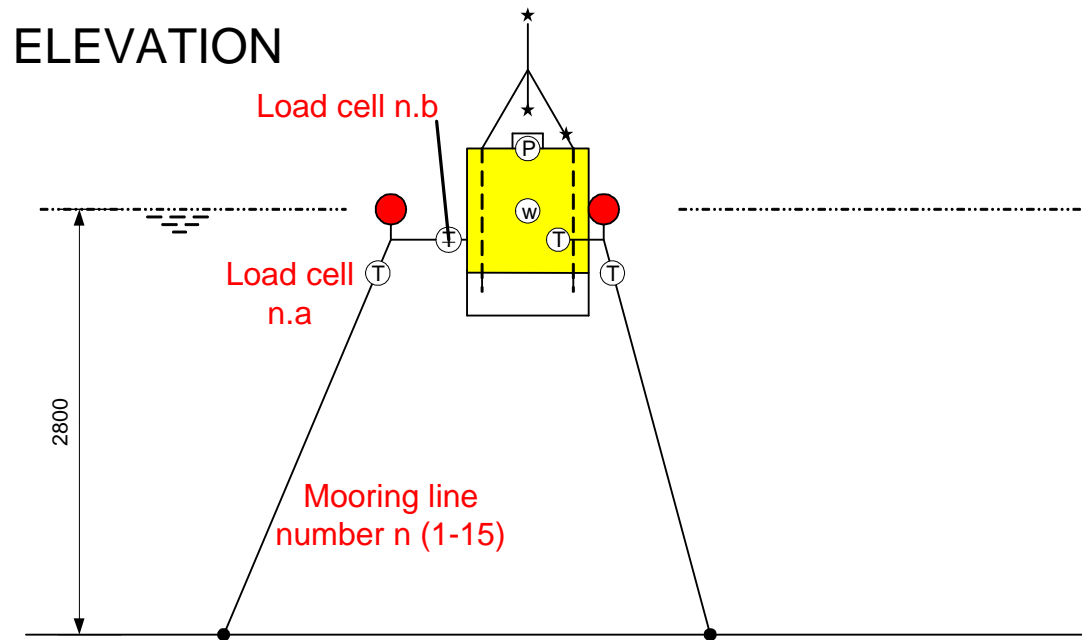
PLAN



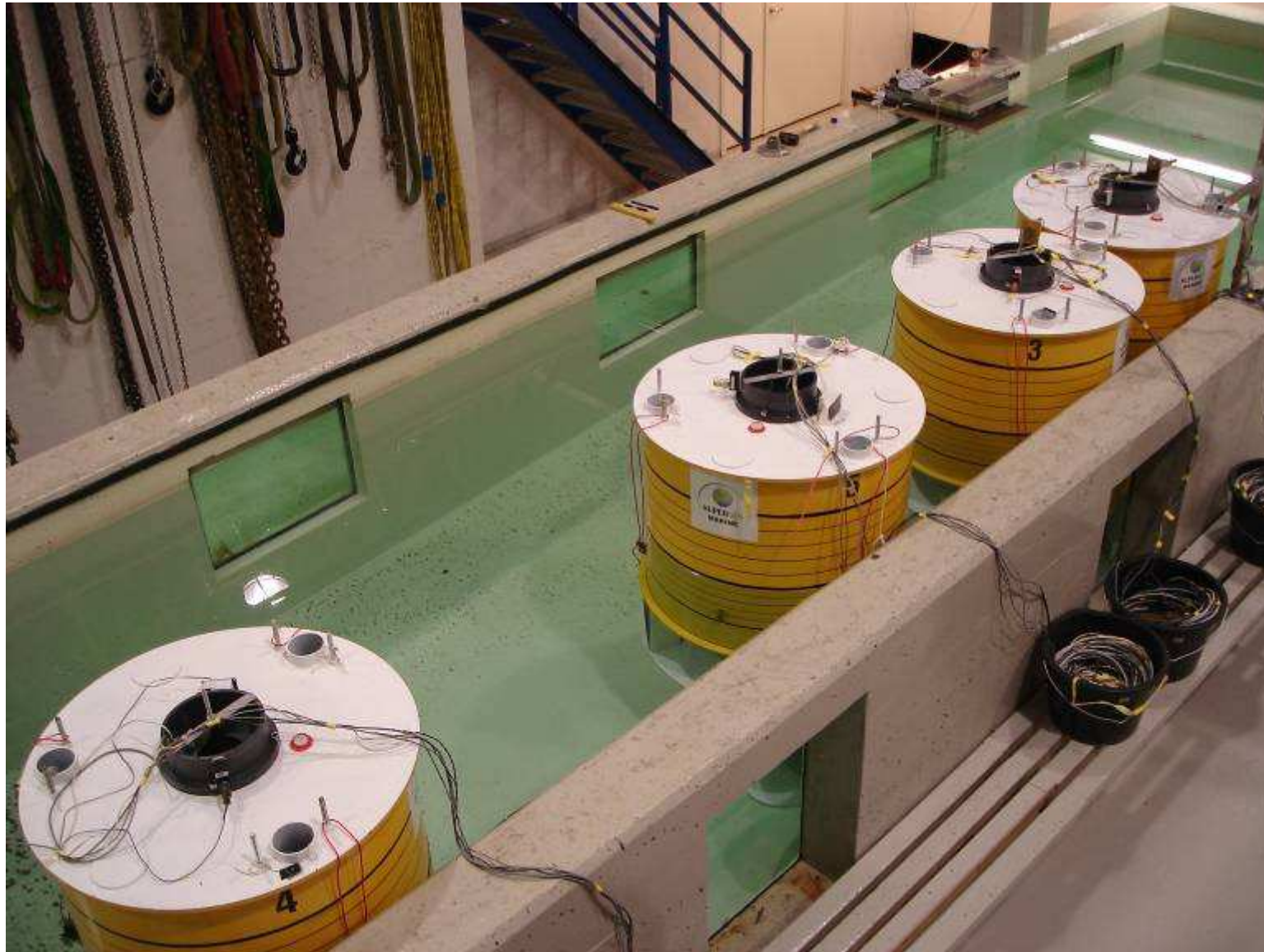
TITLE	MODEL SCALE	DRAWN BY
WEC MODEL (Three Column)	1: 20	B Linfoot

DATE
26/02/2008
REVISED
01/02/2009

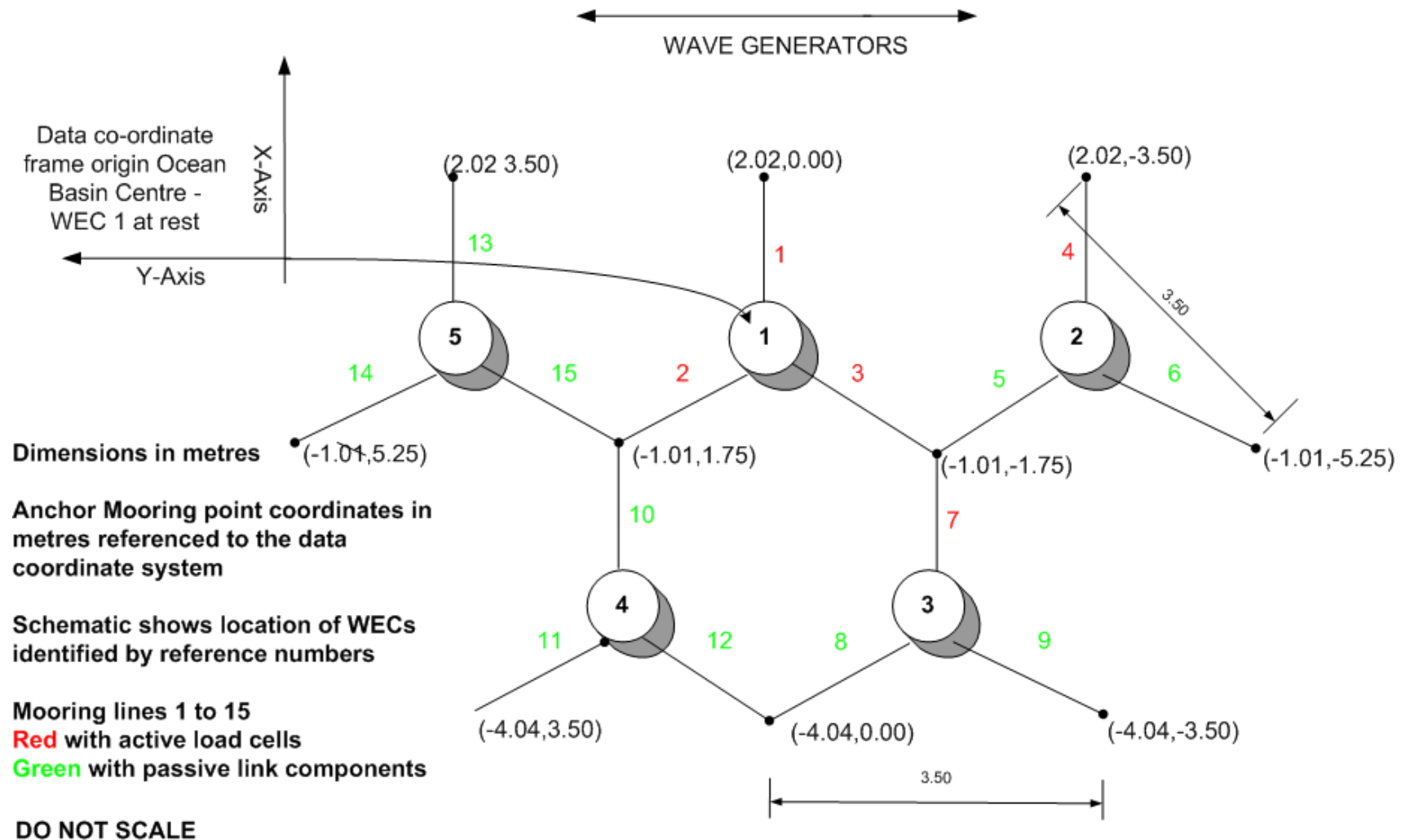
Mooring System



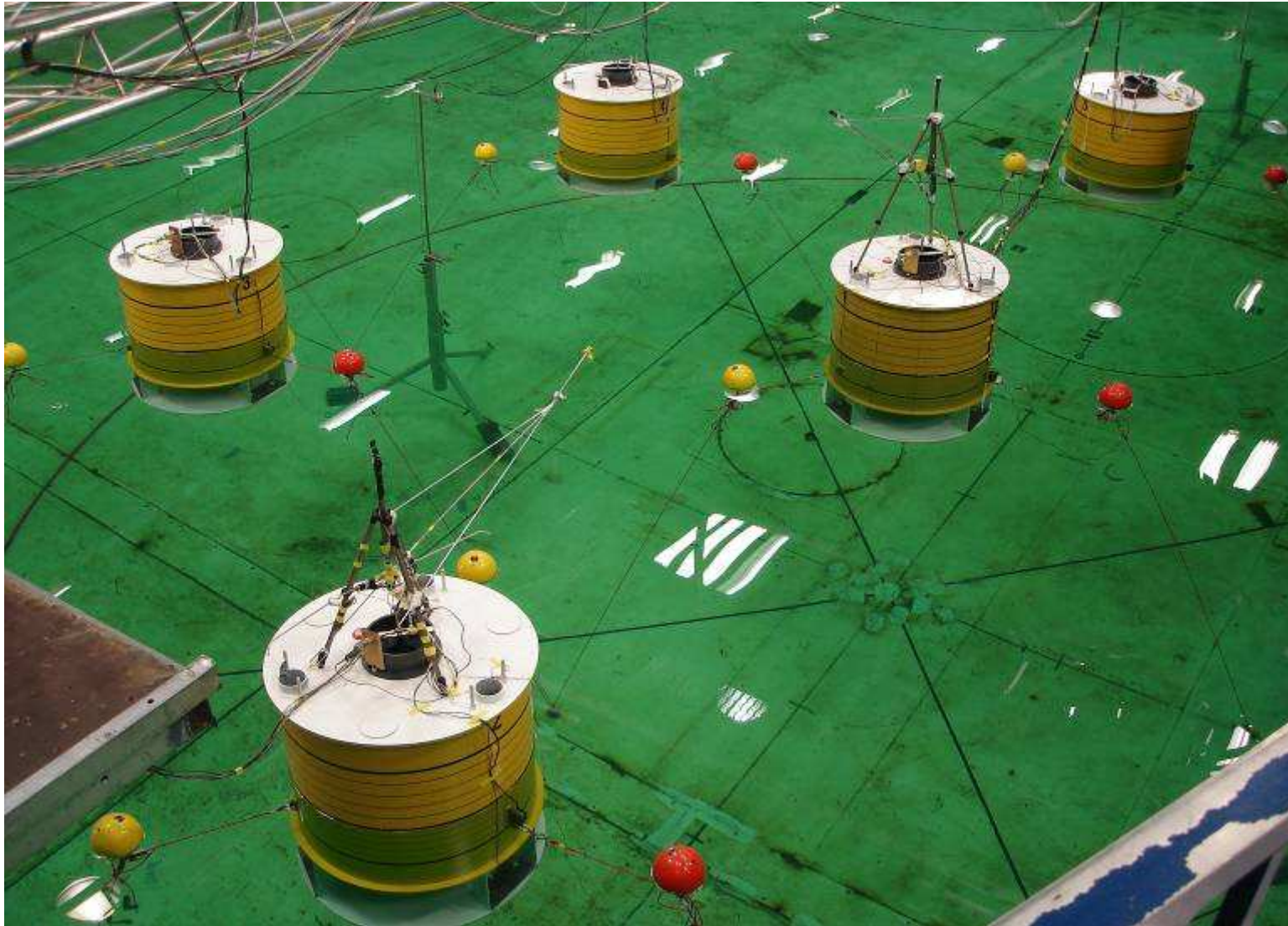
Installation



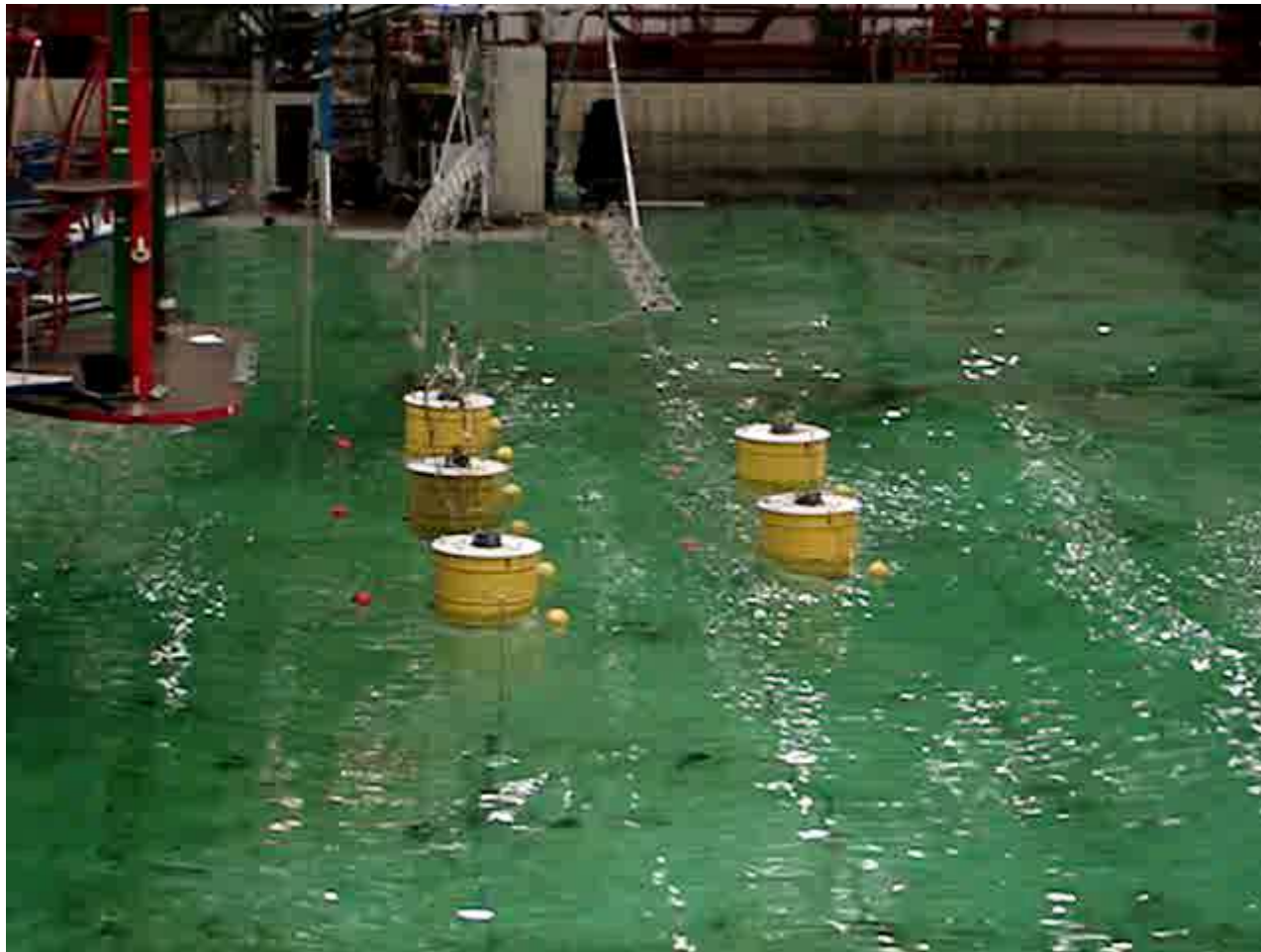
Array Layout



5 WEC Array



RAO test

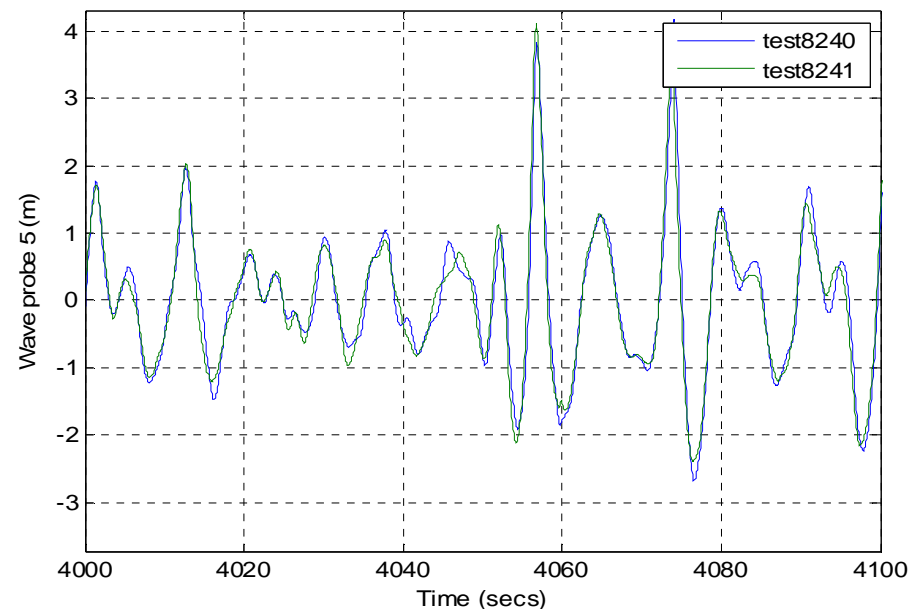


Some results for irregular sea states

Variation of nominal wave amplitude in polychromatic seas

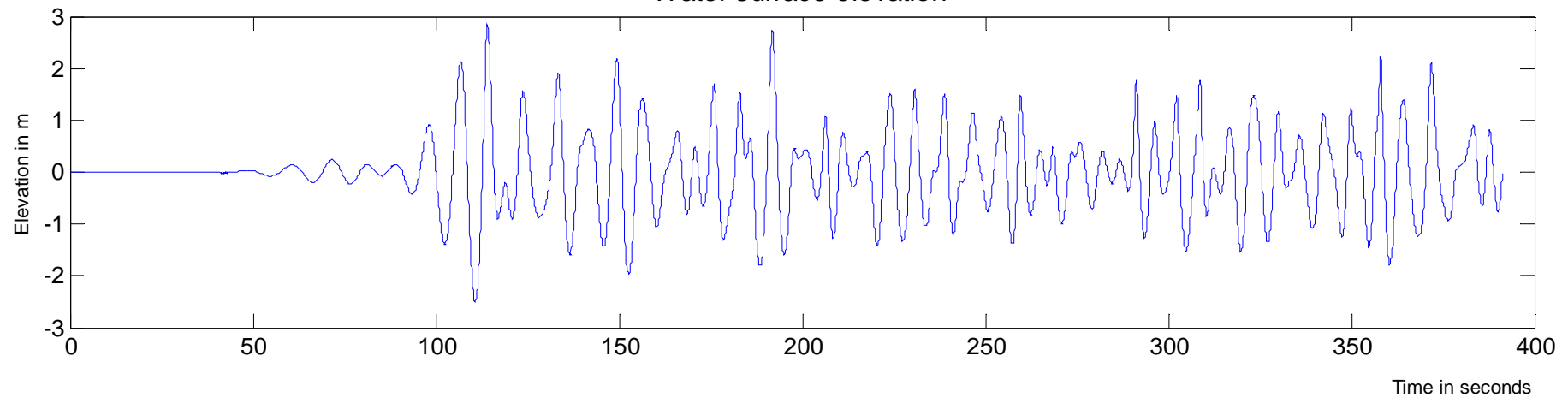
Spectral parameter	Wave probe amplitude (m)					
	1	2	3	4	5	6
Significant wave height (m)	3.81	3.82	3.87	3.82	3.90	3.81
Energy period (secs)	6.70	6.70	6.76	6.73	6.80	6.74
Incident wave power (kW/m)	50.5	50.6	52.5	50.9	53.7	50.6

Comparison of the repeatability of the same generated wave

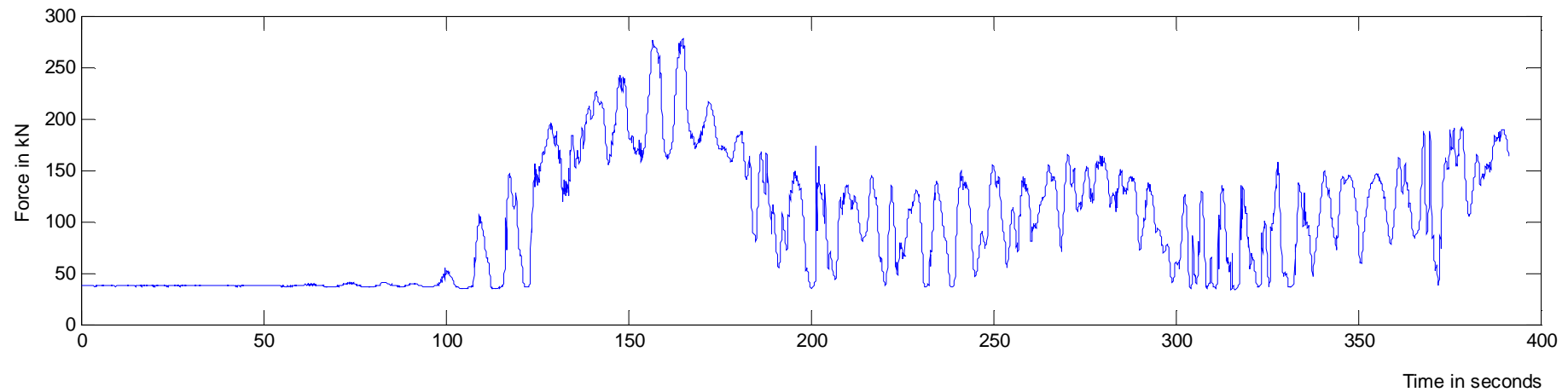


Measured Line Tension in Irregular Waves

Test 3010: $H_s = 3.5\text{m}$ $T_p = 8\text{s}$ Water surface elevation



Line 1a tension



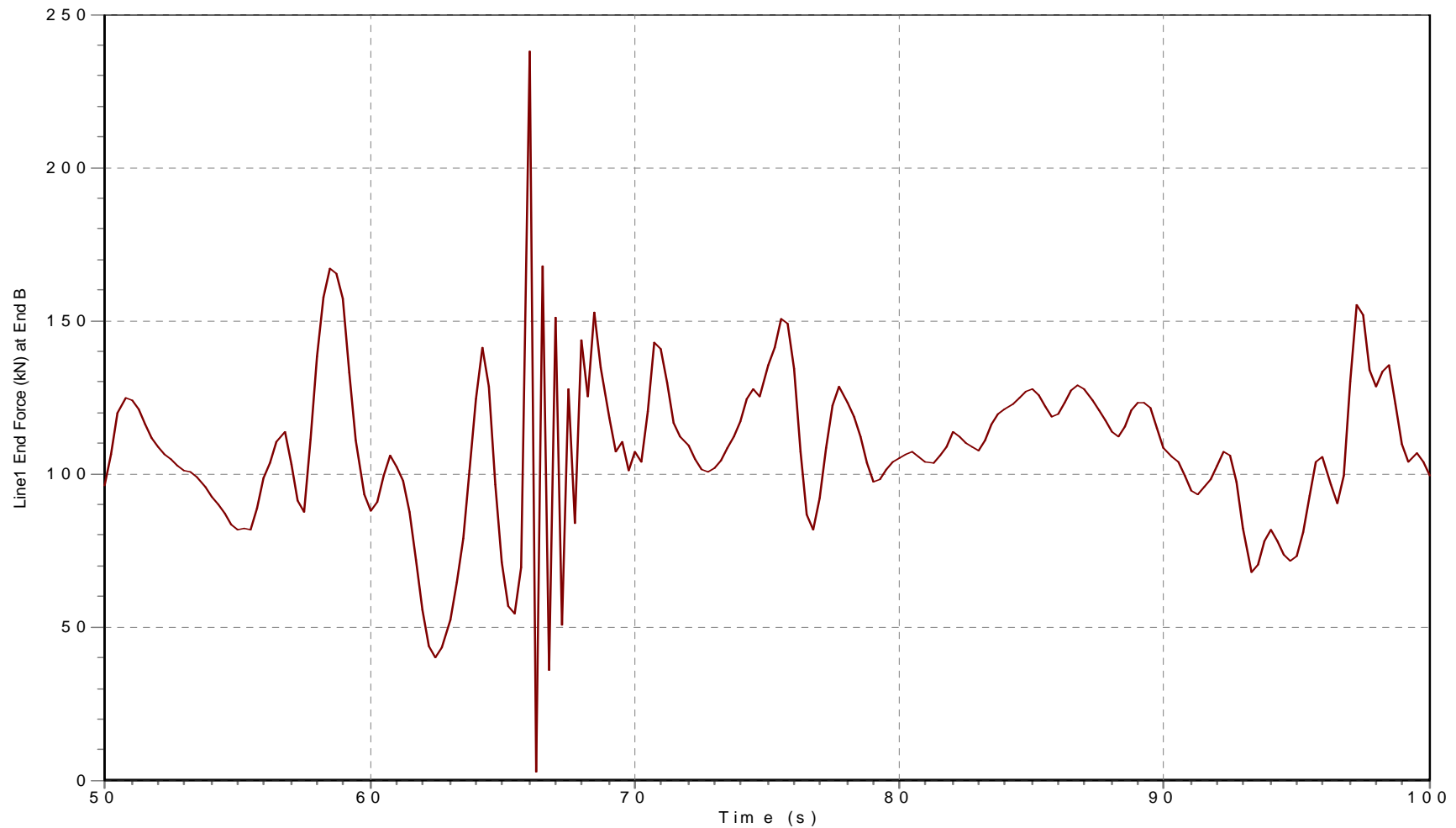
OrcaFlex Simulation

Hs 3.5 Tp = 8s ITTC



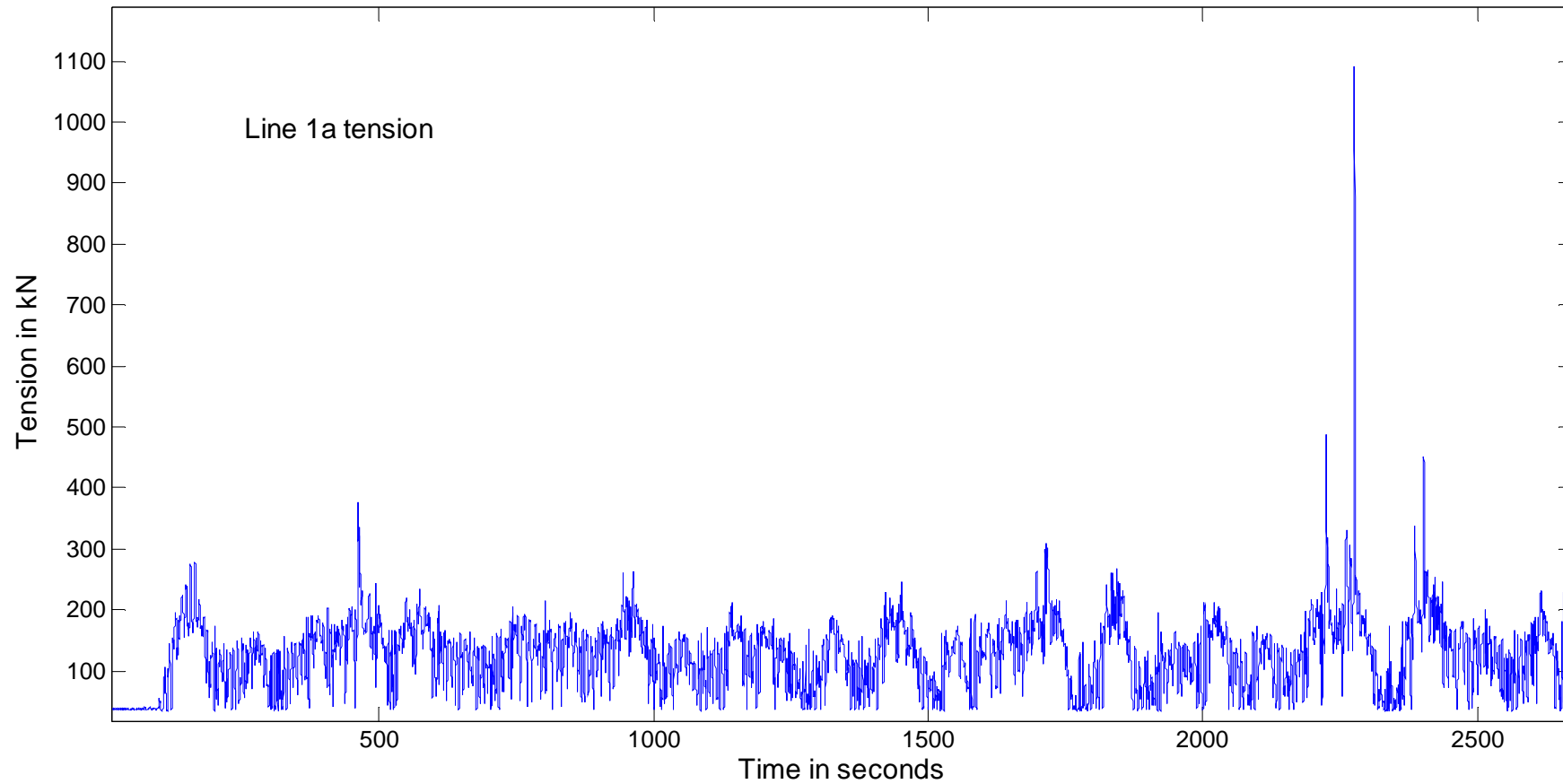
Modelled Line Tension in Irregular Waves

OrcaFlex simulation Hs3.5 Tp 8s ITTC

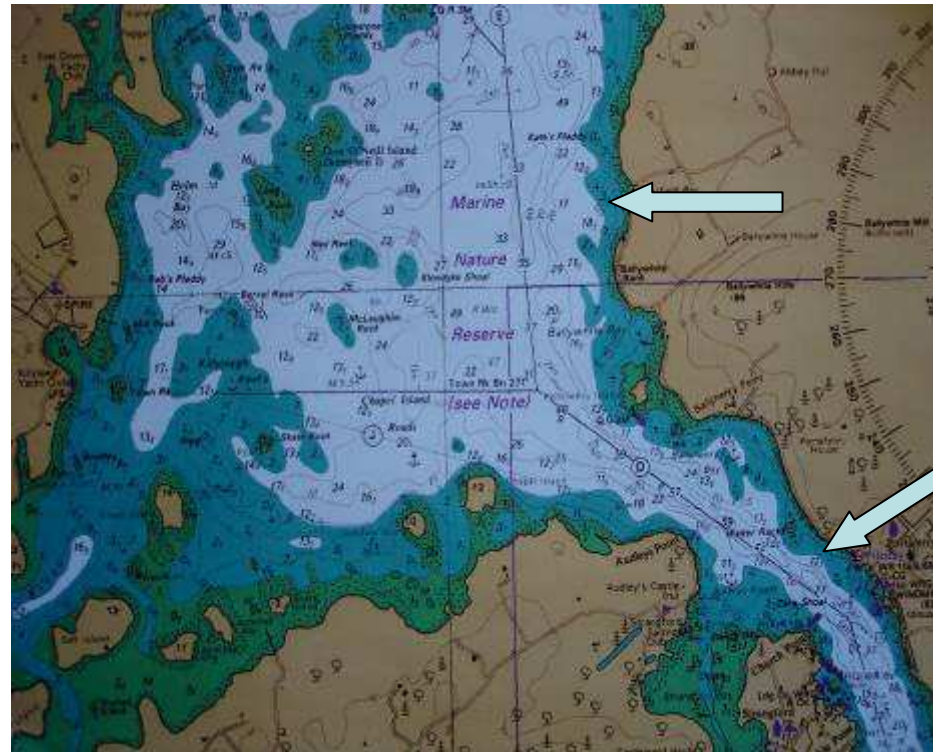


Complete Trondheim record

Test 3010: $H_s = 3.5\text{m}$ $T_p = 8\text{s}$



- Instruments in a vertical stainless steel cylinder
- Site surveys by QUB
- Negotiation of permissions completed
- Discussions about base station facilities
- Onboard data storage
- Mooring system design to cope with 3.5m range of spring tides (= 70 m at full scale)



WEC
Site

TEC
Site

- Trondheim experiments comprised 97 tests in waves and currents in array of 1,3 and 5 WECS
- 500 GB of documentation, data and results are archived on the Supergen web site.
- The results are in broad agreement with repeat tests undertaken at Heriot-Watt University and with Orcaflex simulations.
- Mathematical models (e.g. Simulink) will be developed to describe the relationships between mooring forces and parameters of the wave field
- Preparations for the tests on WECs and TECs at Strangford Lough are well advanced.