



LUPA: An Open-Source Lab Scale WEC



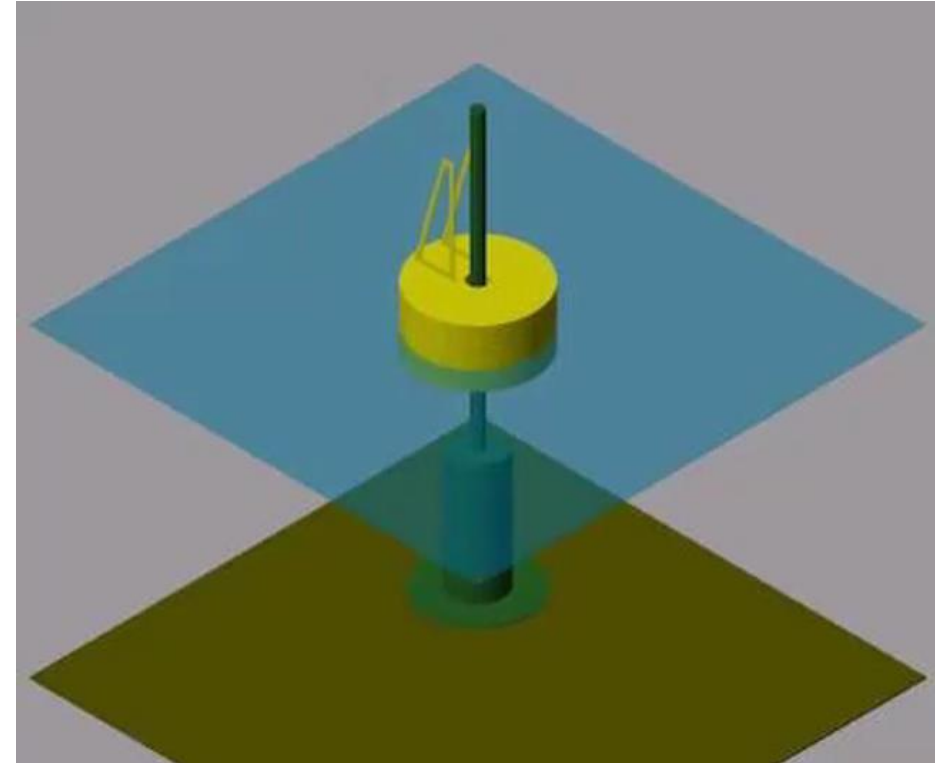
Motivation

Modular & Flexible

Incremental Complexity

Open-Source & Validated

Successes & Failures



LUPA - Two-body point absorber

+ 3 modes of operation

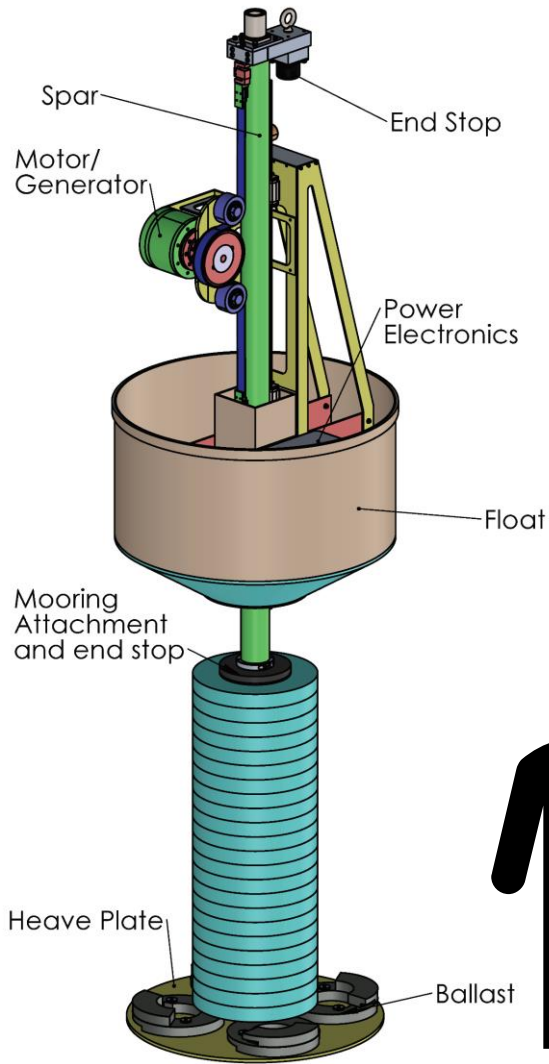
Generator/PTO control

Gear Ratio

Float geometry

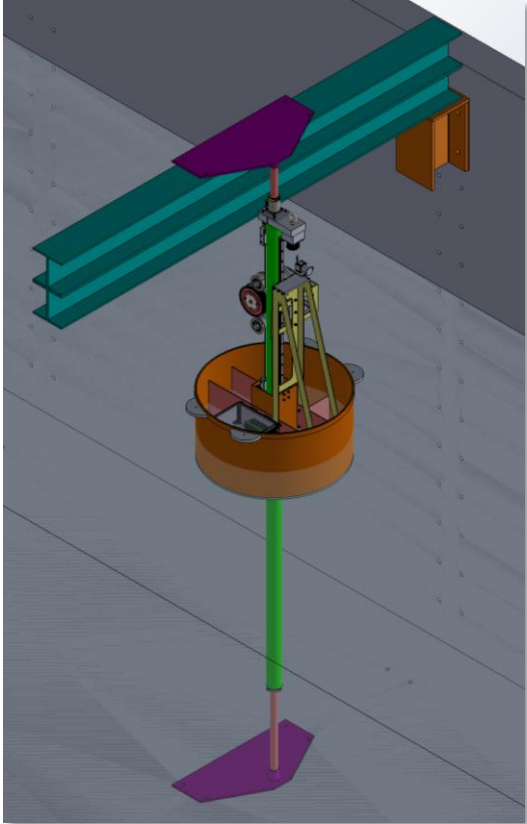
Mooring Configuration

Heave plate geometry

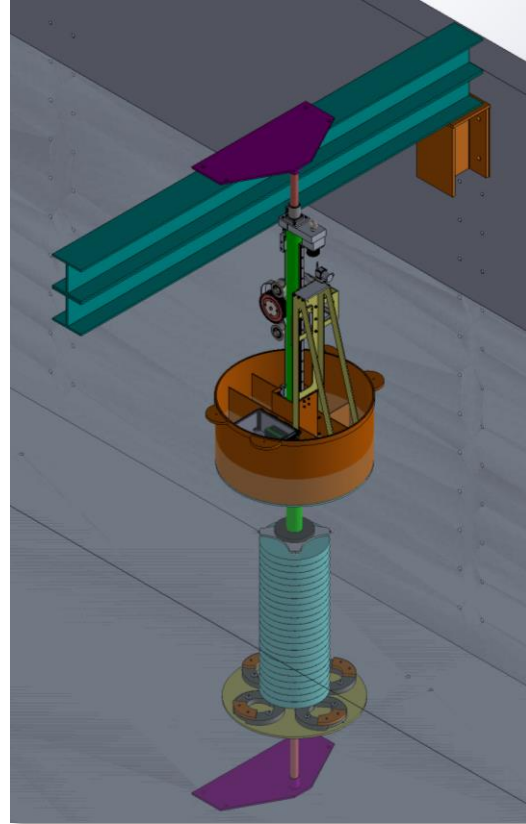


Specification	Value	Units
Scale	1/20	m/m
Float Diameter	1	m
Total height	3.7	m
PTO Stroke Length	0.5	m
Mass	436	kg
Motor Continuous Torque	46	Nm
Water Depth	2.7	m

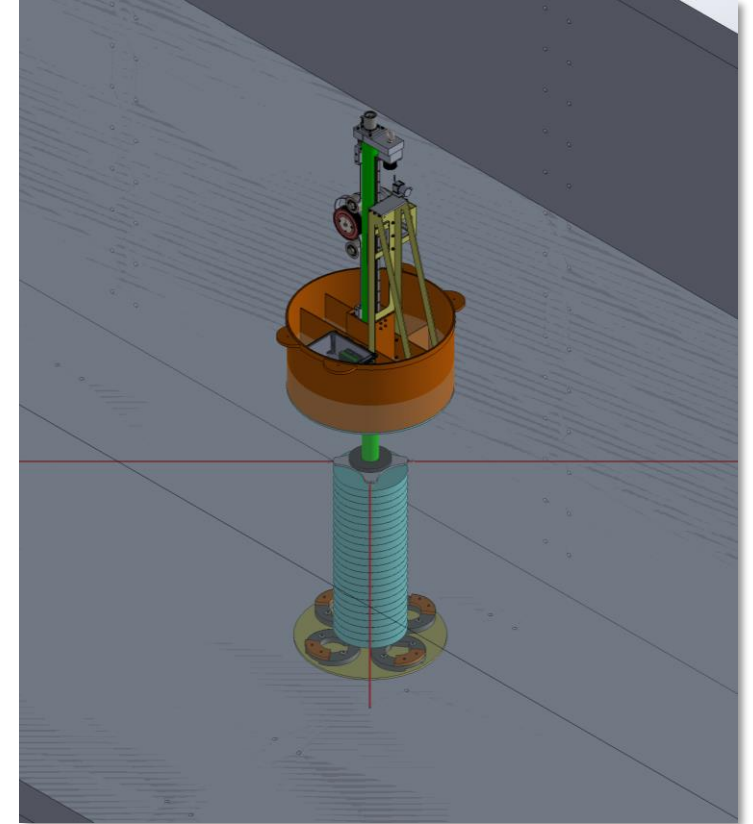
Incremental Complexity



One-body, 1 DOF

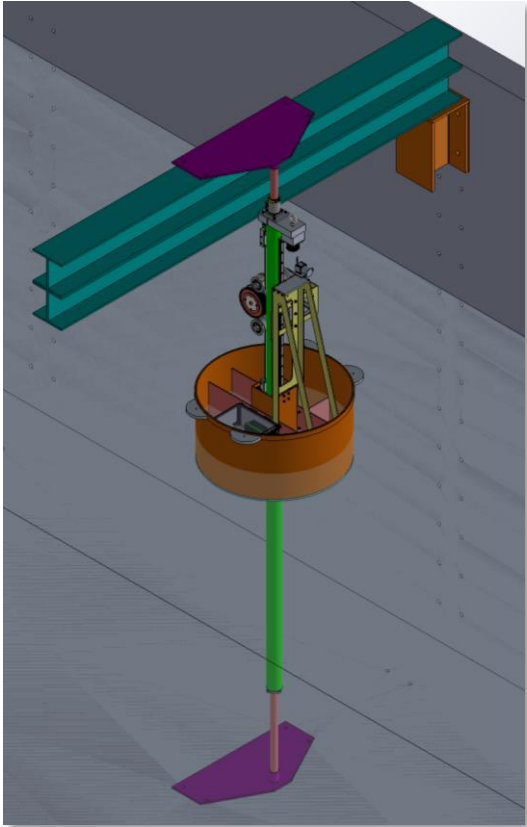


Two-body, 1 DOF

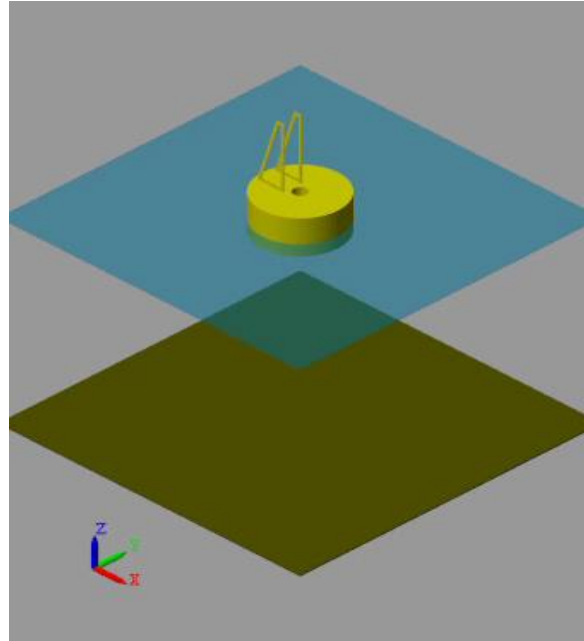


Two-body, 6 DOF

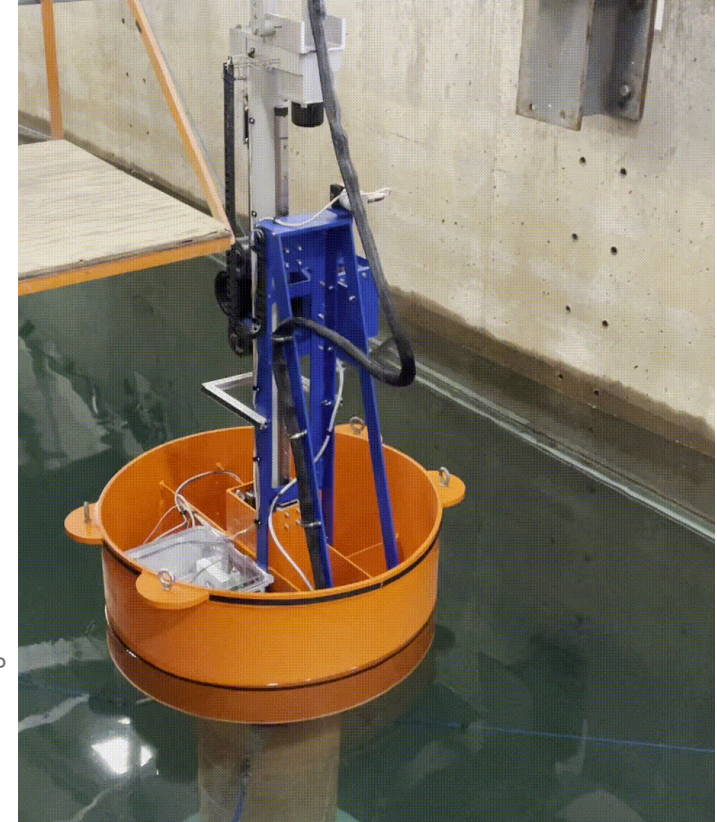
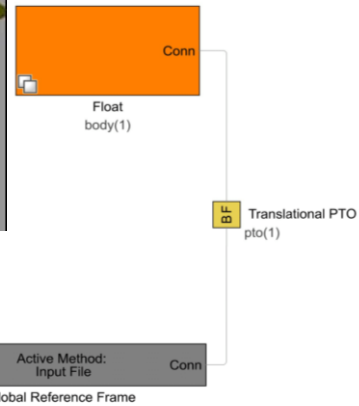
One-Body, Heave Only



Solidworks

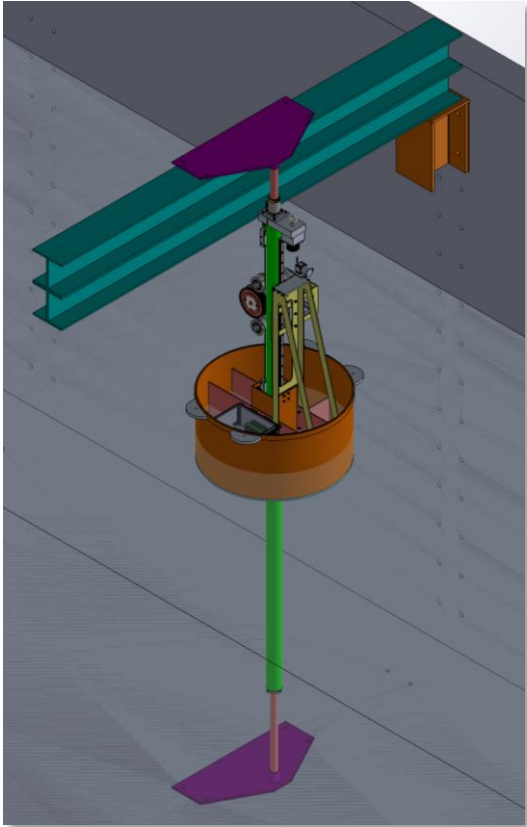


WEC-Sim Model

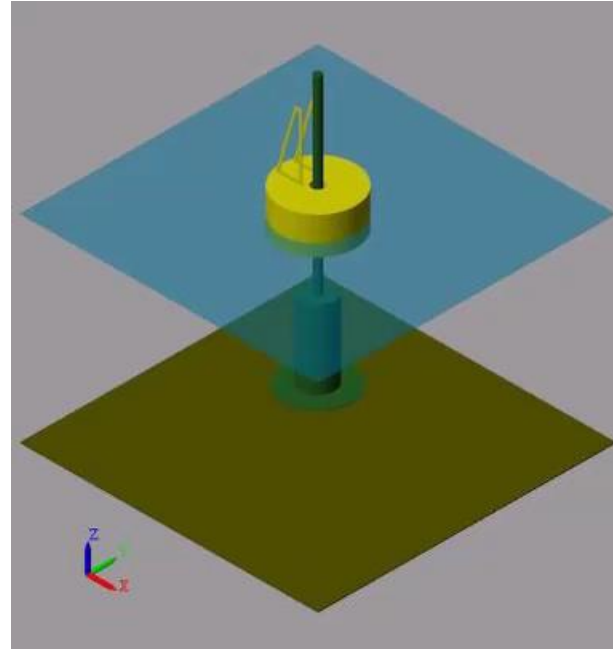


Experimental Data

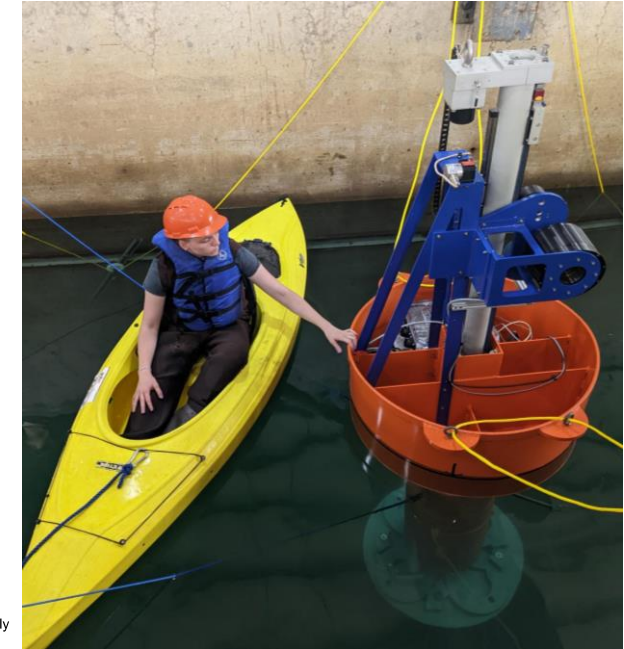
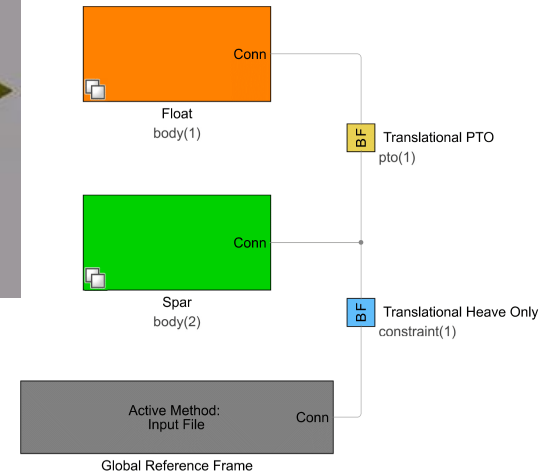
Two-Body, Heave Only



Solidworks

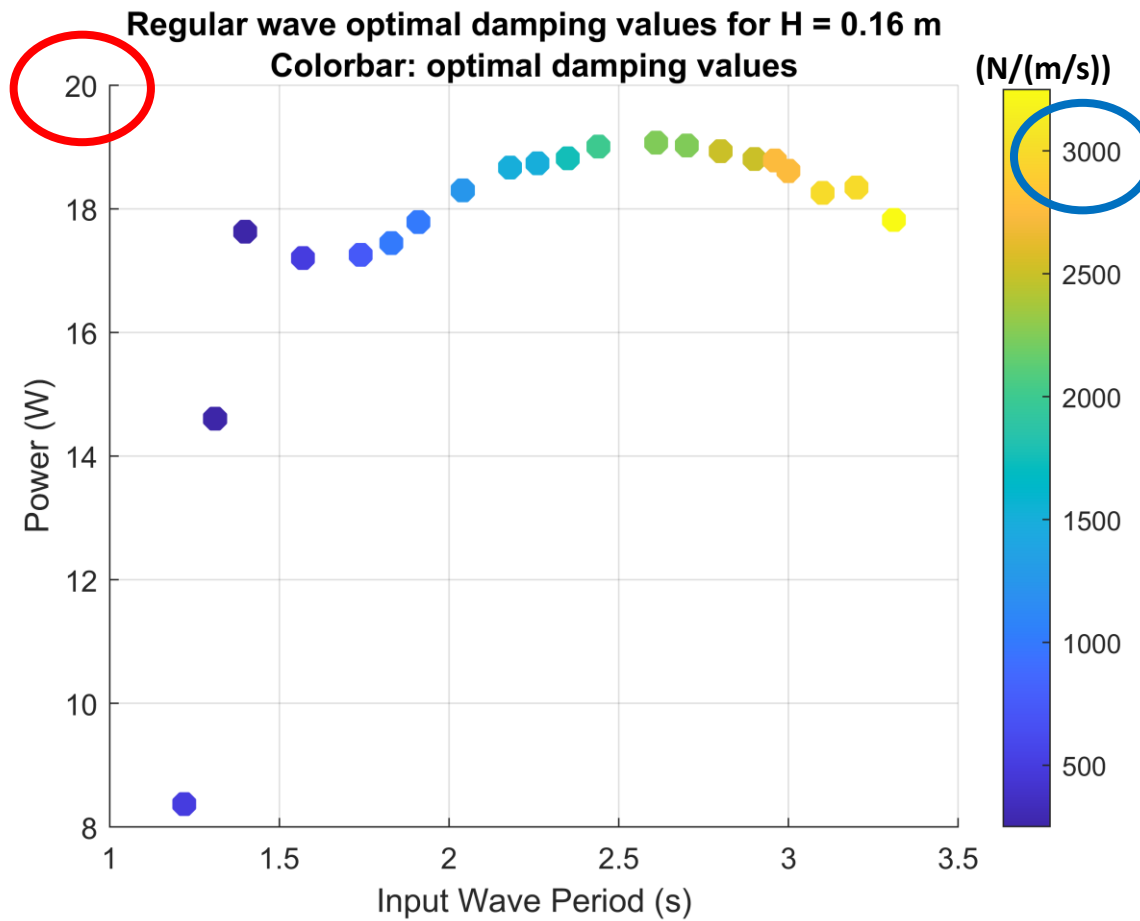


WEC-Sim Model

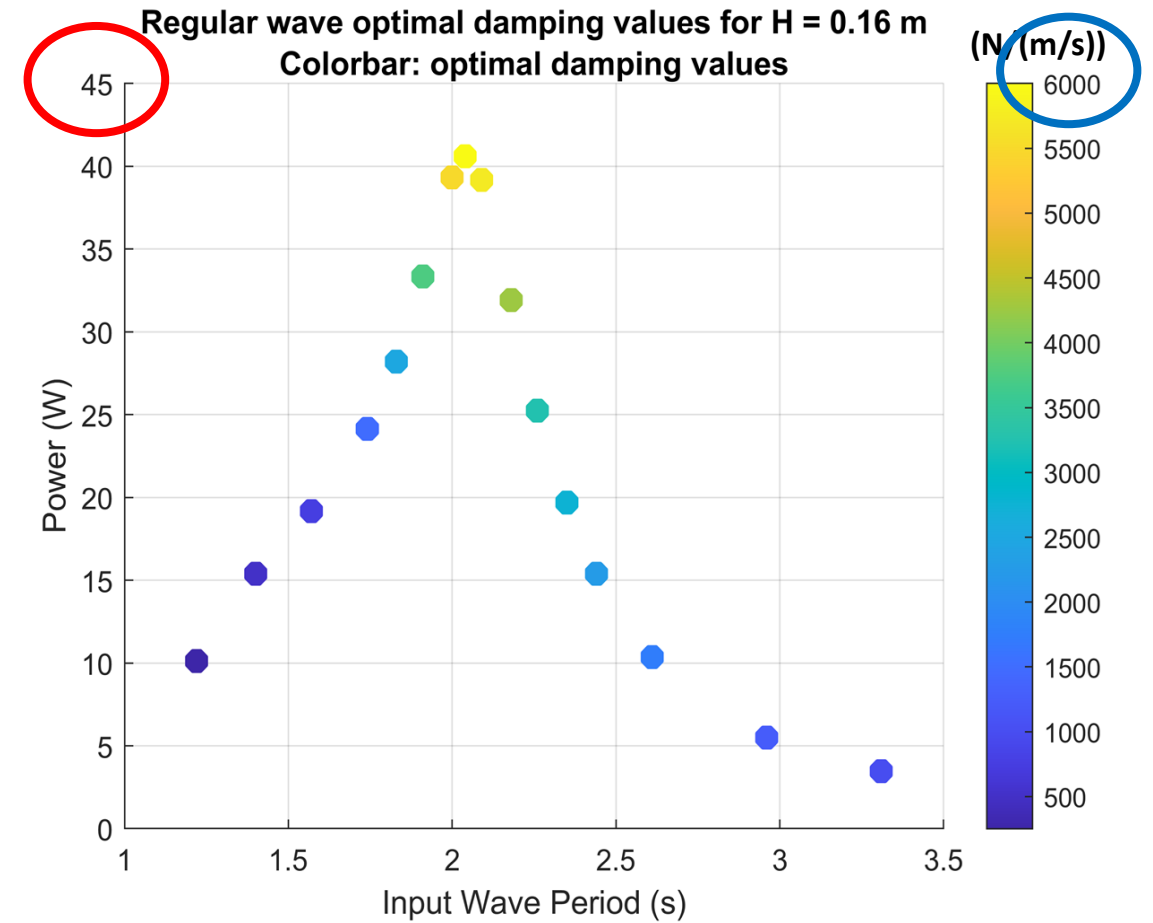


Experimental Data

WEC-Sim Results

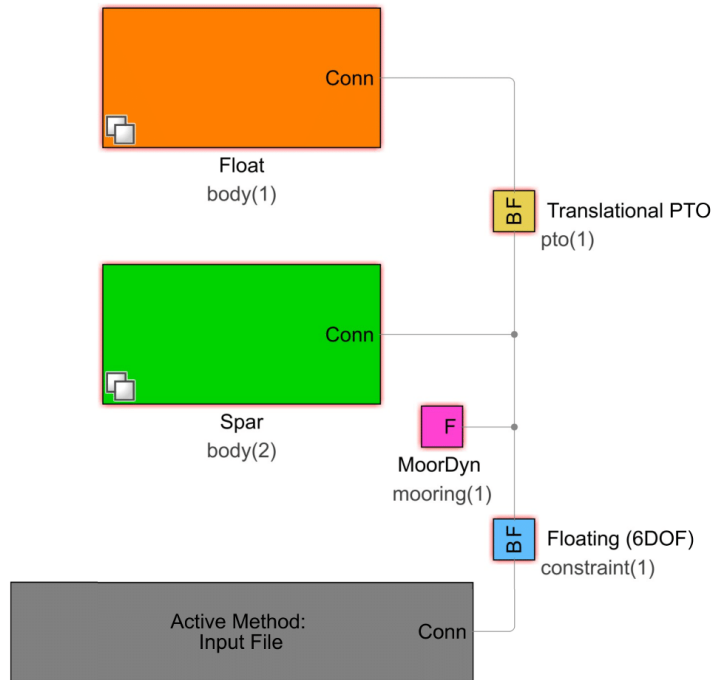


One-body heave only



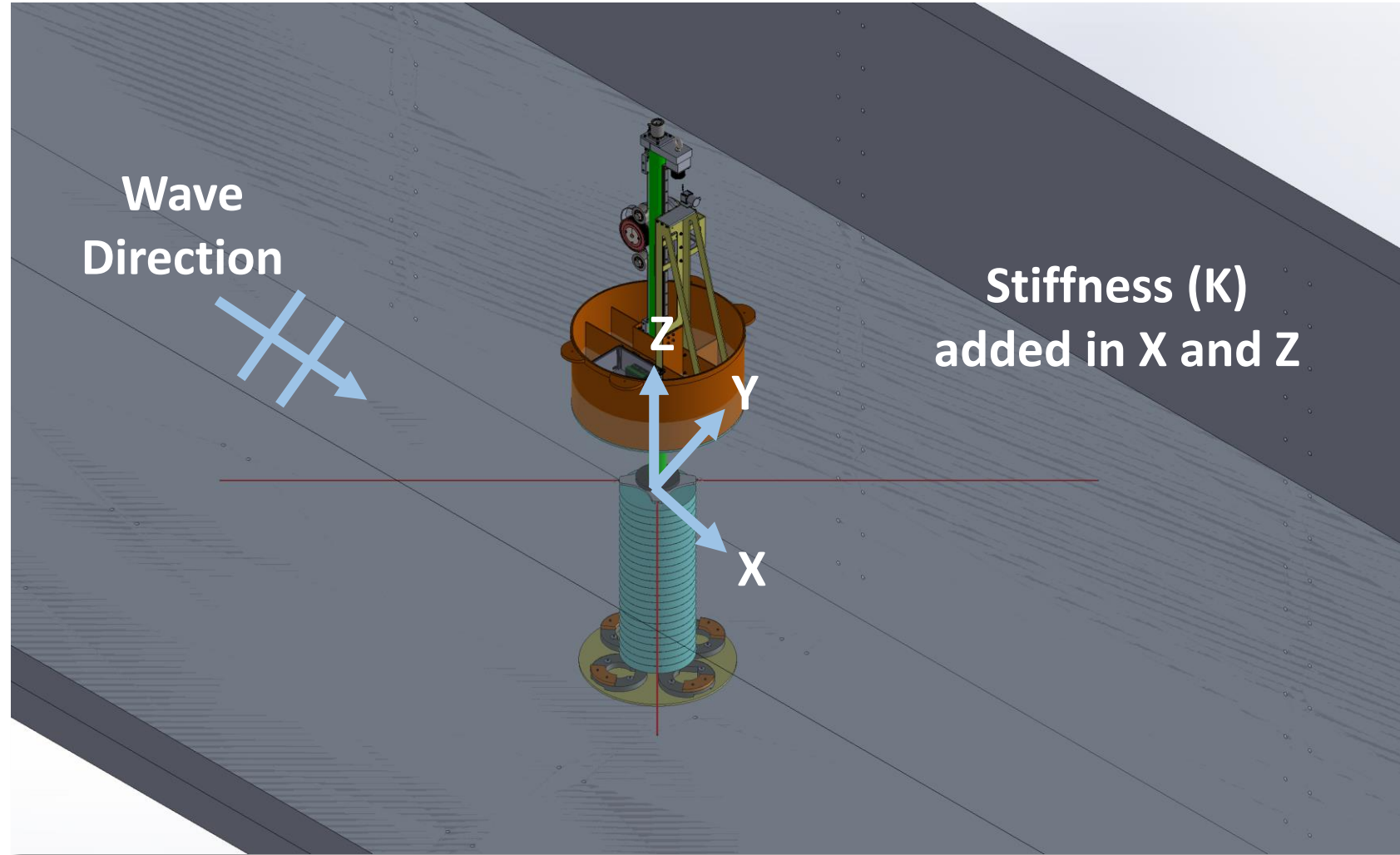
Two-body heave only

Two Body, 6 DOF

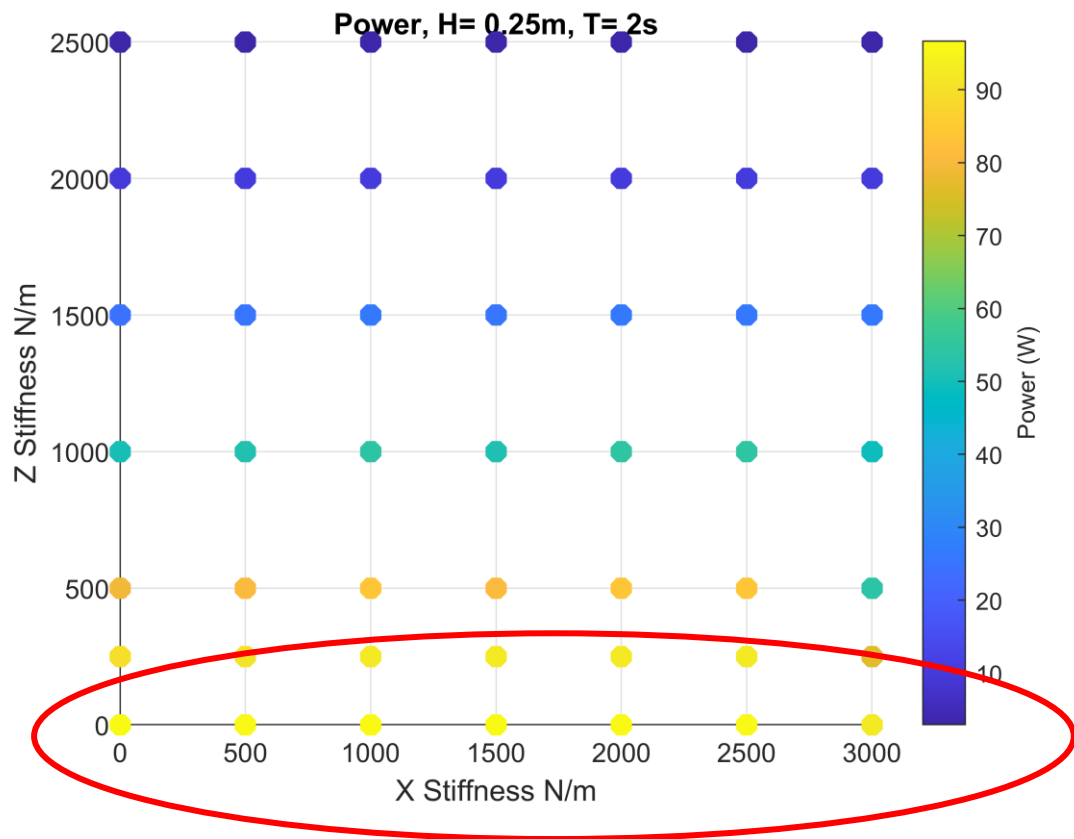


WEC-Sim Model

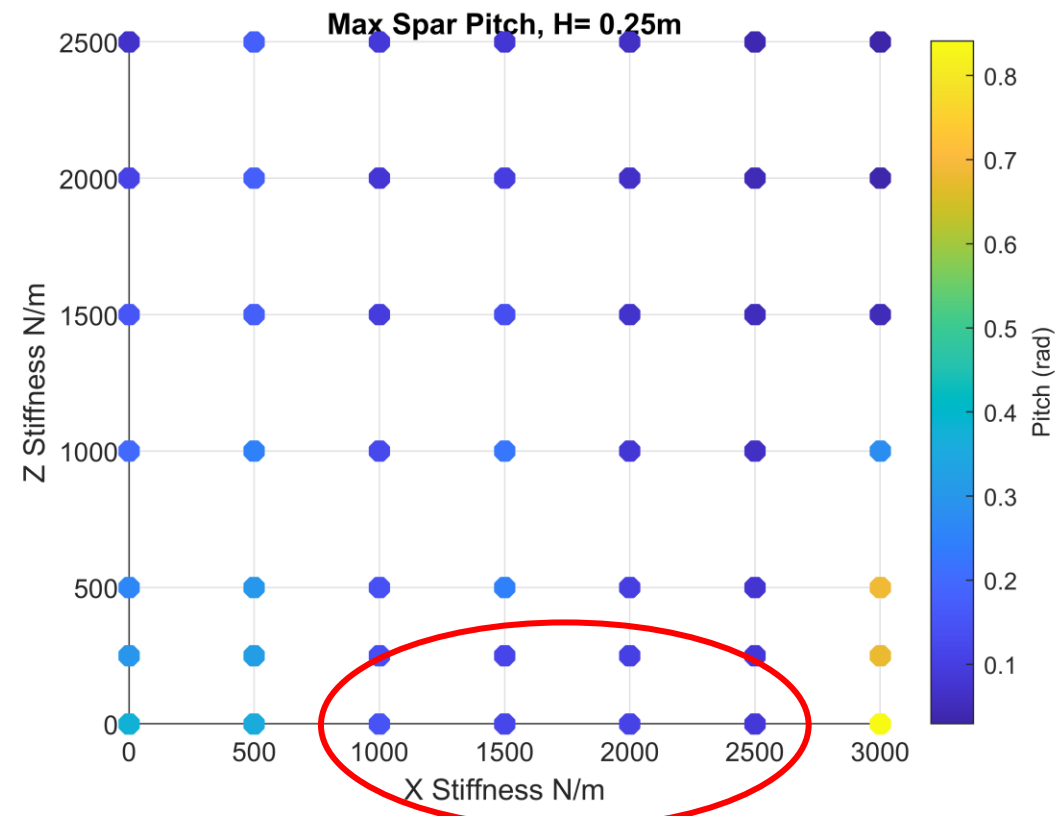
Mooring Matrix and Cable Block



6 DOF, WEC-Sim Results



Maximize power



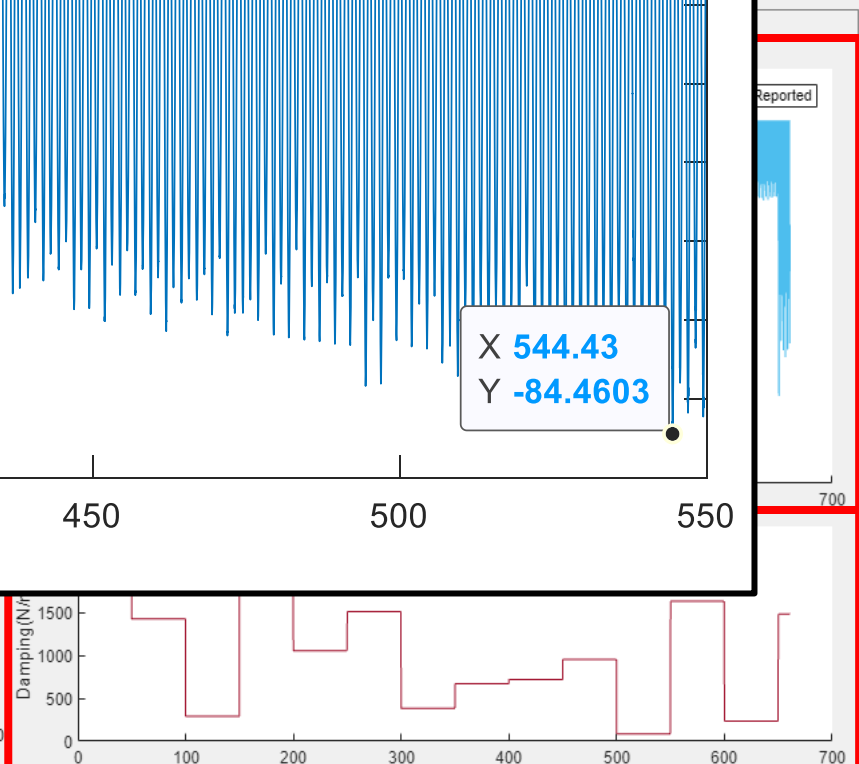
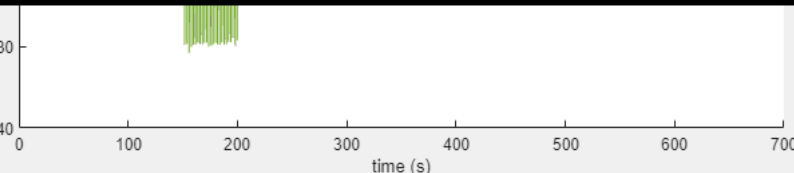
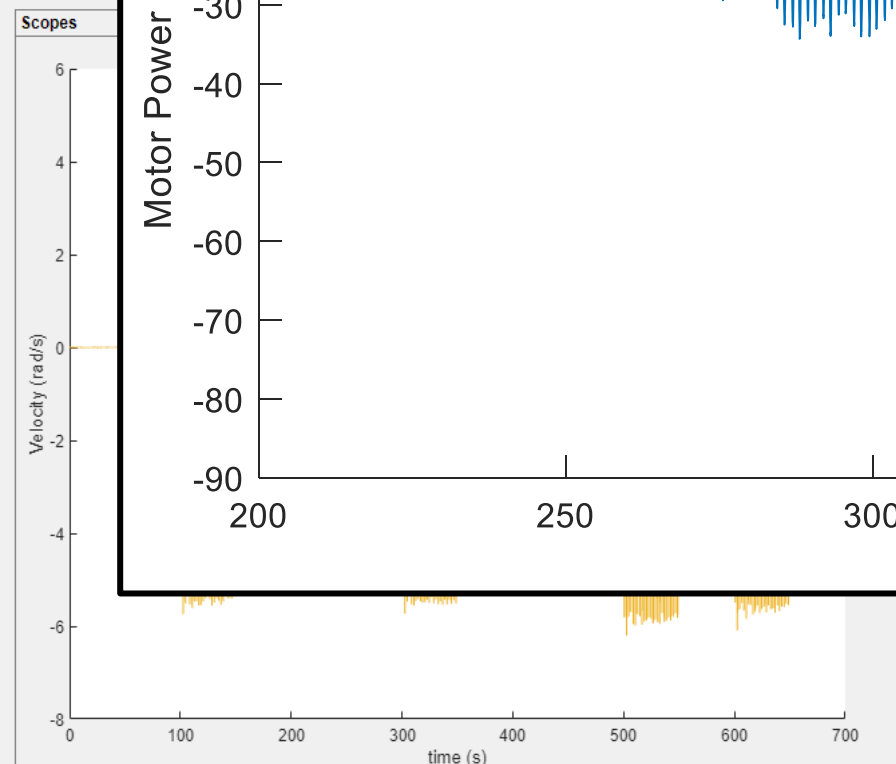
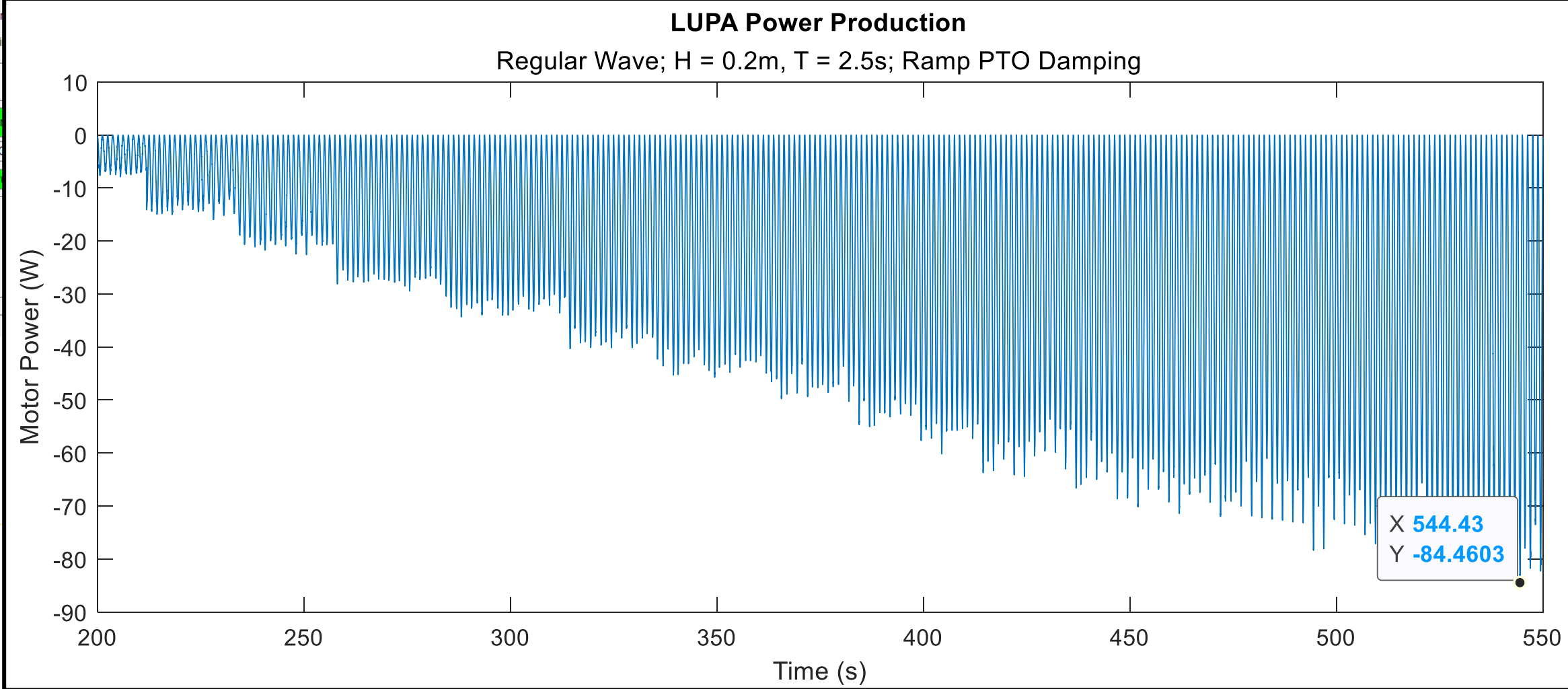
Minimize pitch

App Ctrl
Project: LUPA
Experiment: 20221010_Regular1Body1DOF

Reference Signal
Signal: None
Amplitude: 0

Motor Feedback
Motor Current
Commanded Current

Linear Motion Feedback
-200
-160
-0.3
-0.24
-0.18
-0.12
-0.06
0
-0.06
-0.1
-0.14
-0.18
-0.22
-0.26
-0.3



Open-Source and Validated (TBV)

The screenshot shows the top navigation bar with 'LUPA v4.4' and a search box. A sidebar on the left contains a 'Home' section and a 'Developer Manual' section with links to 'Introduction', 'Theory Manual', 'User Manual', and 'Developer Manual'. At the bottom, there are 'Other Versions' and 'v: master' dropdown menus.

» LUPA (Lab Upgrade Point Absorber)

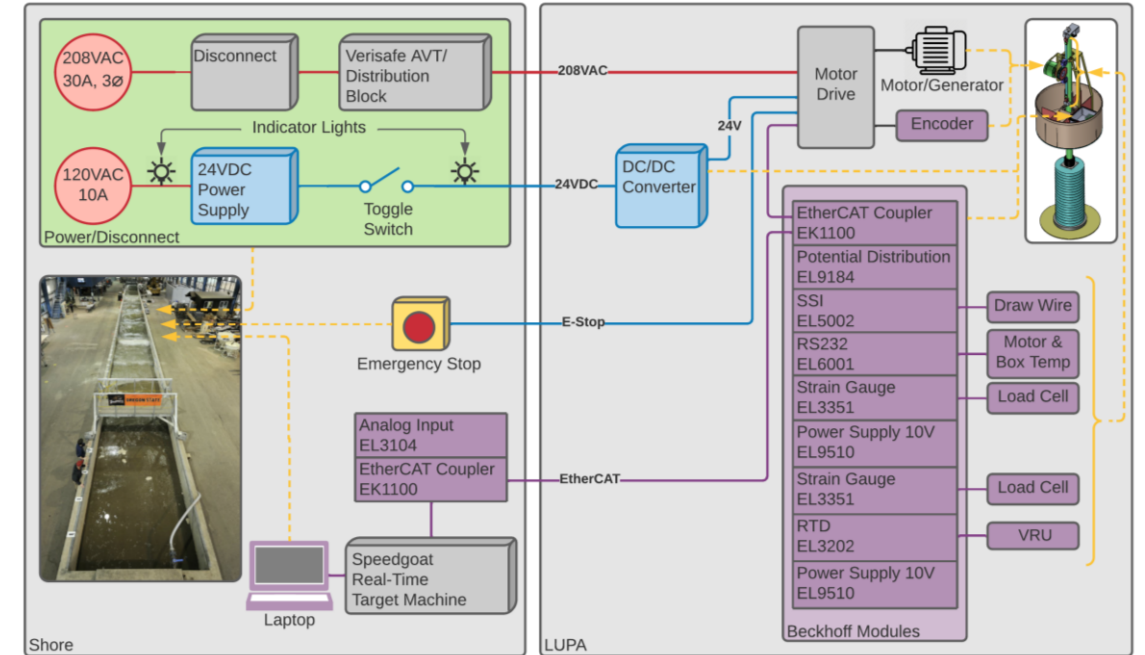
[View page source](#)



LUPA (Lab Upgrade Point Absorber)

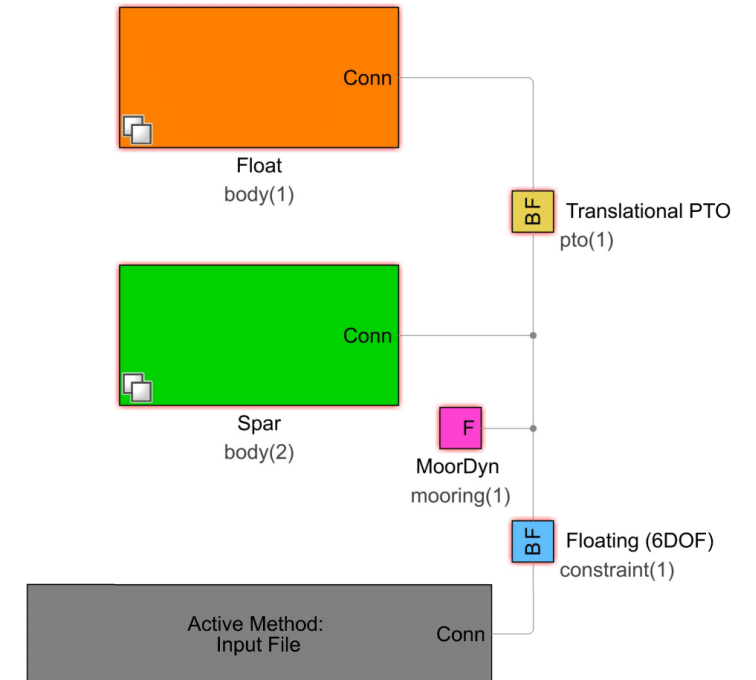
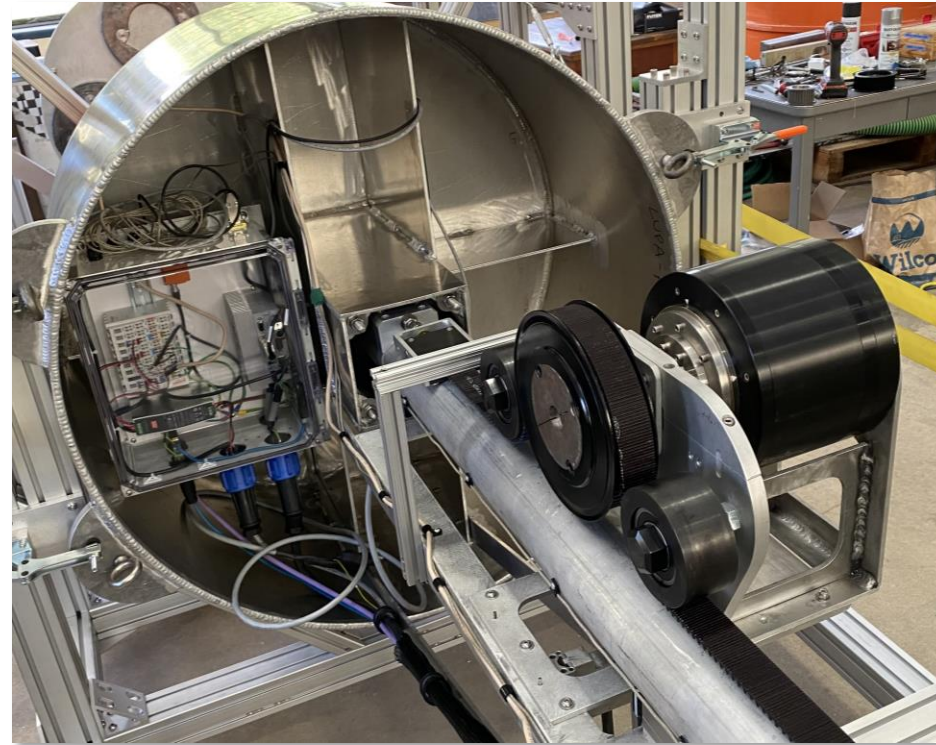
LUPA (Lab Upgrade Point Absorber) is a robust, open-source Wave Energy Converter designed for deployment in the O.H. Hinsdale Wave Basin. LUPA can operate as a one-body, two-body (heave only), and a three-body 6 degrees of freedom system. This WEC is designed for researchers to perform experimental validation of control systems, hull and heave plate geometries, moorings, and can be adapted for many other research objectives. The [LUPA Repository](#) contains WEC-Sim example files and code to process data. CAD models, data, papers, videos, and photos are linked in this page.

LUPA Developers



<https://pmec-osu.github.io/LUPA/>

Lessons Learnt



Minimizing Friction

Sizing Components

Model Tank Mooring

Future Work

'Validation' of Optimized Hull and Heave Plate Shapes

WEC Hydrodynamics for AUV Docking and Recharge

WEC Power Dynamics in Remote Microgrids

Non-Linear Wave Structure Interaction Models

WEC Power Integration in OSU Campus Grid

Yours ?

