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VARD

PIEZO Project : Using CAESES to design a Plug in Electric Platform Supply Vessel

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VARD today

8000
employees

12
countries

7
shipyards

Several specialized subsidiaries

HQ
in Ålesund, Norway

400+
delivered since 2000

Owned by Fincantieri

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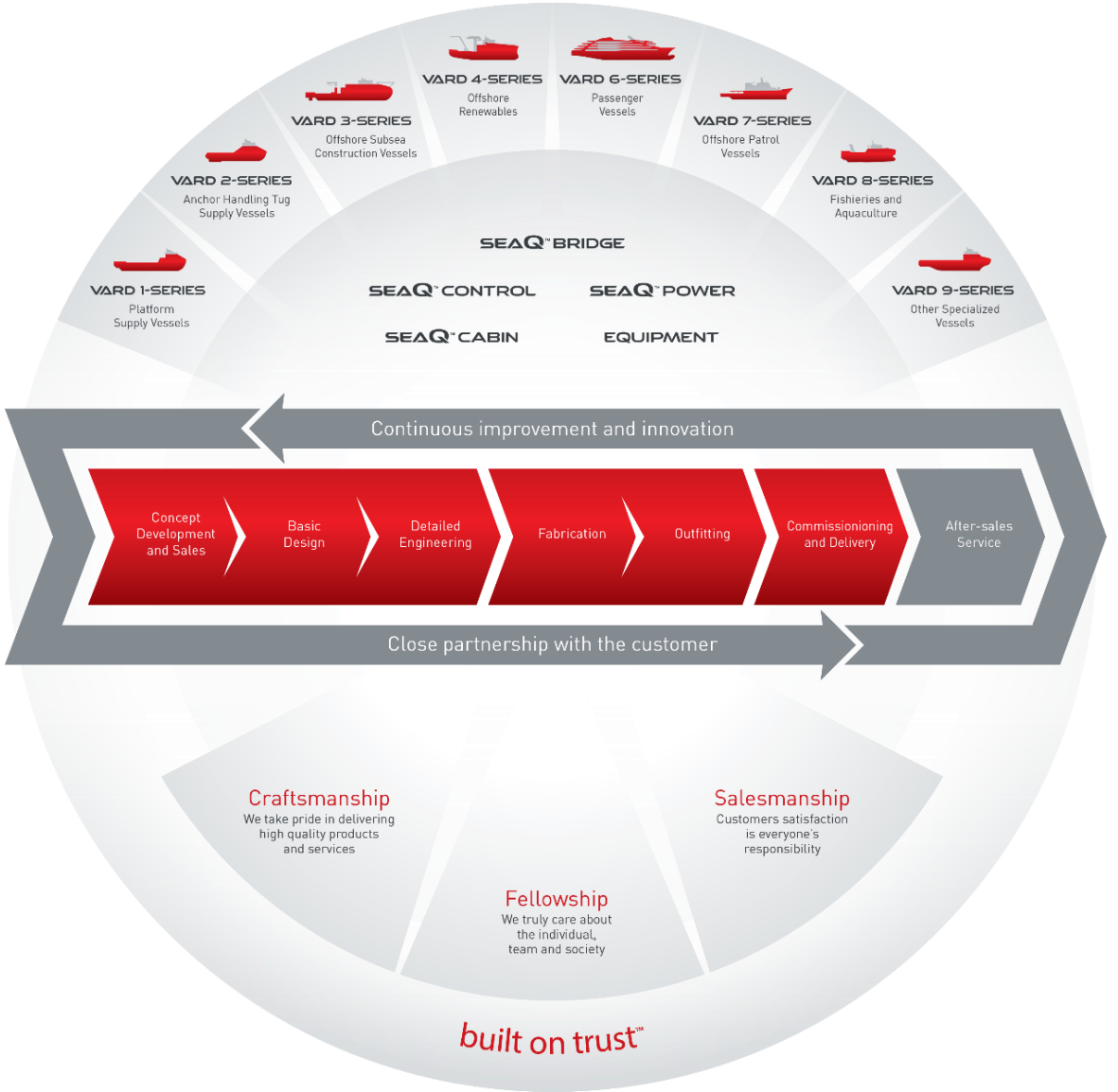
Unique Design and Manufacturing Capabilities



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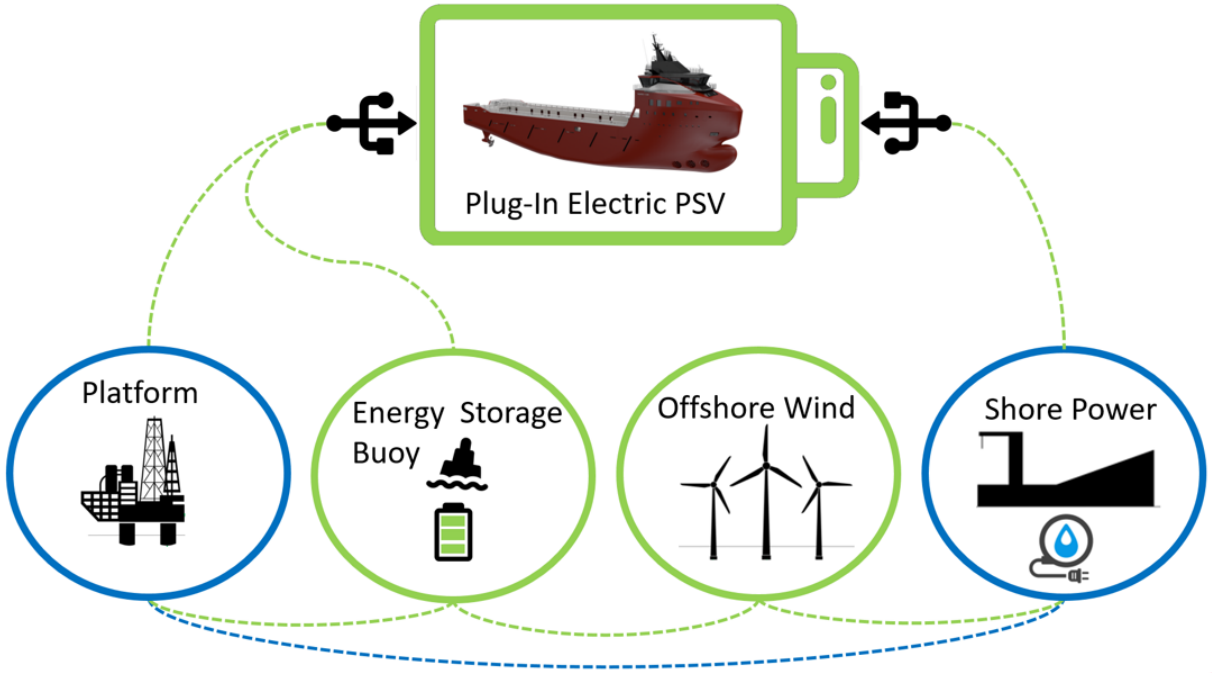
PIEZO : Plugin Electric PSV Project

Develop a concept design for a PSV using batteries as the primary energy source with offshore charging



The Research Council of Norway

Corvus Energy

equinor

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SINTEF

SOLSTAD OFFSHORE

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Full scale logging

SOLSTAD OFFSHORE

PSV Normand Sun

- Delivered 2015
- LOA 95.65m
- Beam 21m
- 4G Connection near land
- from Nov 2021
- > 100 voyages so far

https://www.youtube.com/watch?v=lI9bh5CmWz8

Historical Metocean Data

Copernicus Marine Environment Monitoring Service

- Waves

Copernicus Marine Service

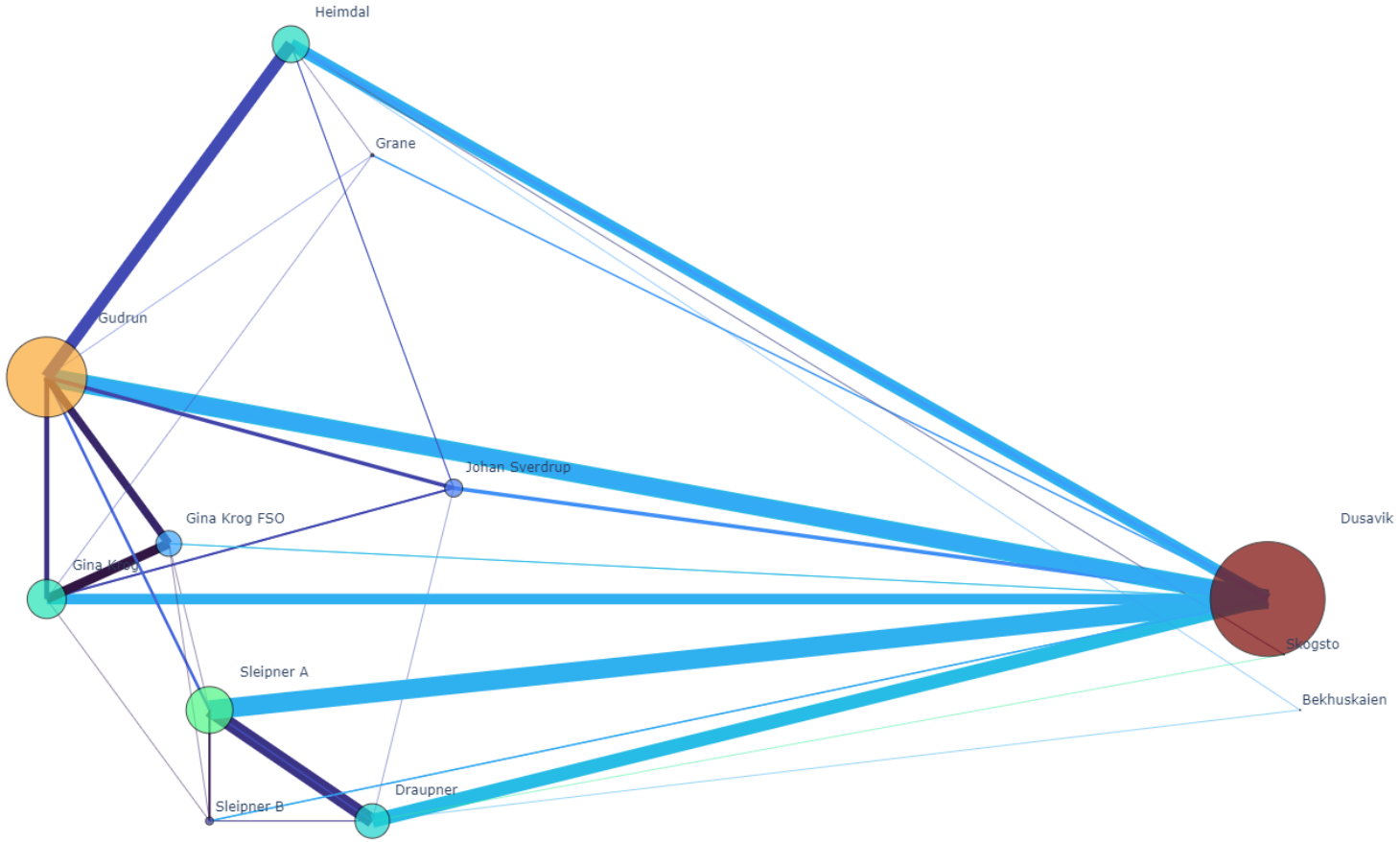
MET Norway

- Wind
- Current

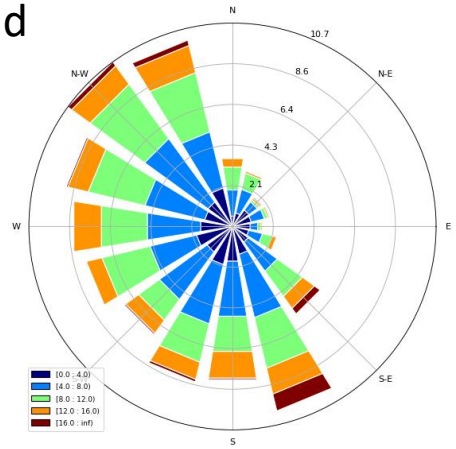
Meteorologisk institutt

Operational Profile

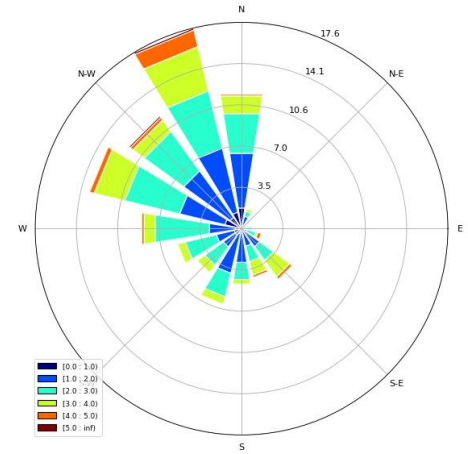
Route graph



Wind



Waveheight



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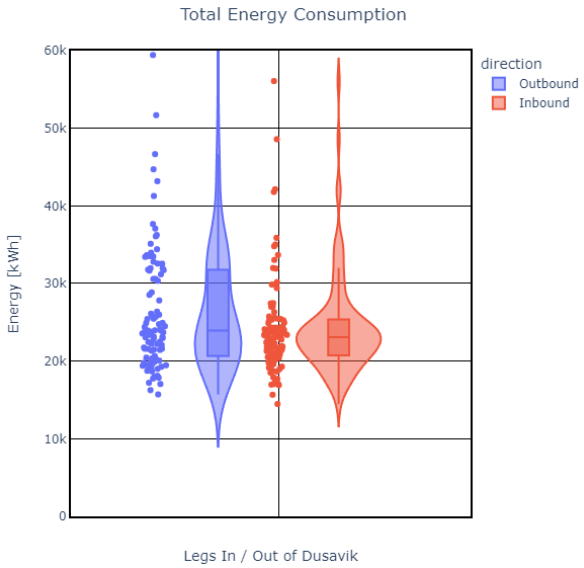
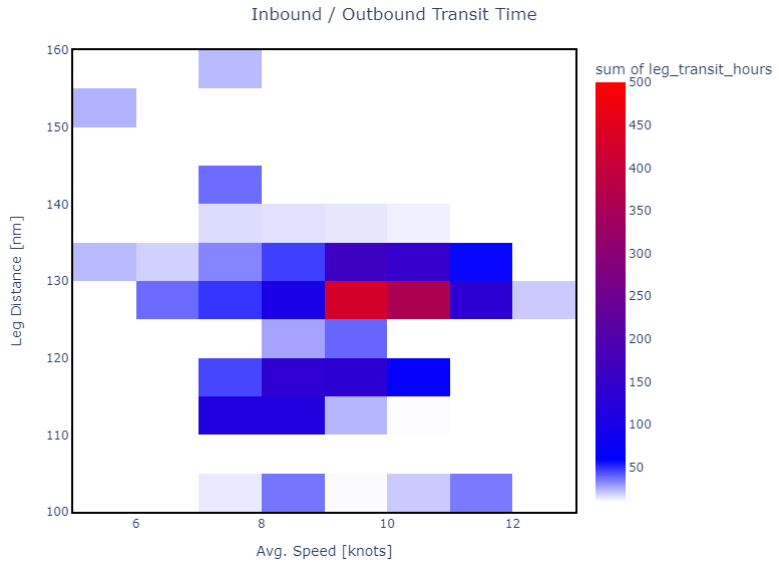
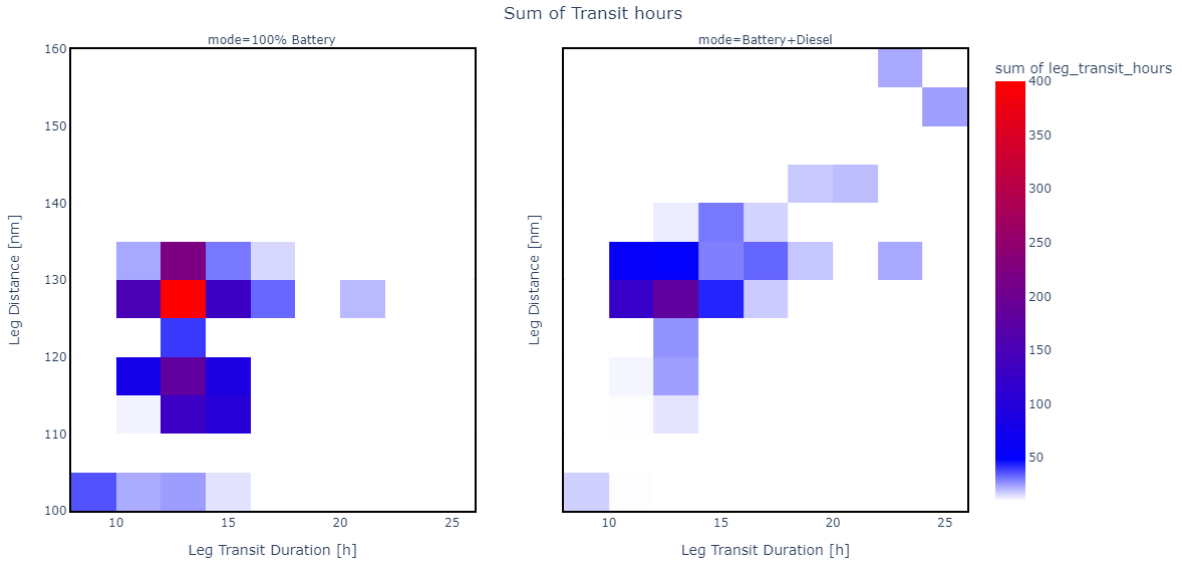
How much energy, range, average speed ?

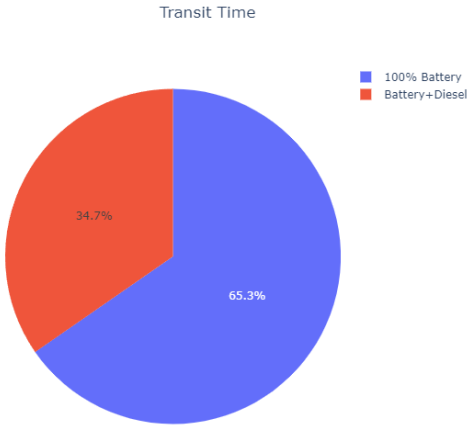
Longest transit legs
Inbound / Outbound from Dusavik





Quick estimate:
42MWh battery
~25MWh available





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AMESim system simulation model

Diesel-electric architecture with battery

Input signals

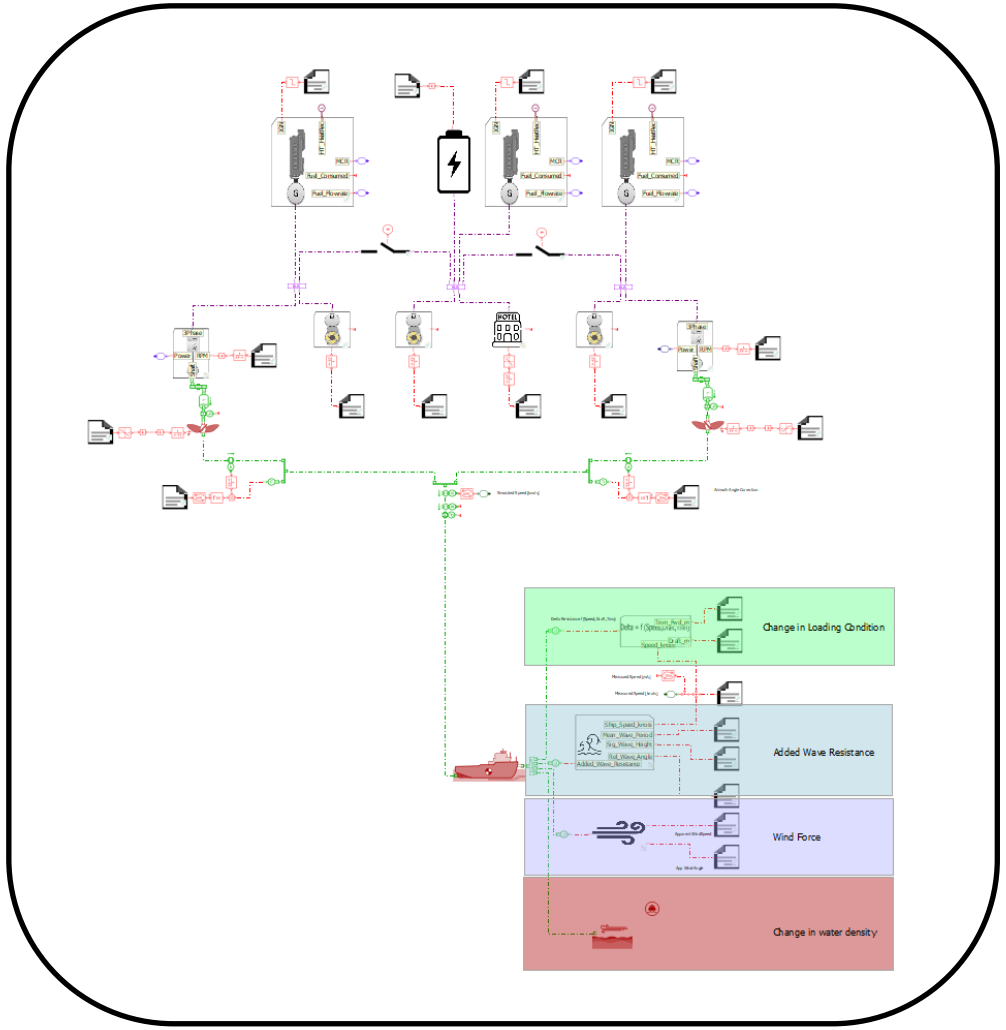
Meas. Propeller RPM
Meas. Propeller Pitch

Hotel Power
Draft, trim
Thruster Power
Diesel Generator on/off

App. Wind speed, dir.
Wave height, period, dir.
Current speed, dir.

Output signals

Propulsor Power electrical, mechanical
Ship speed
Fuel consumption



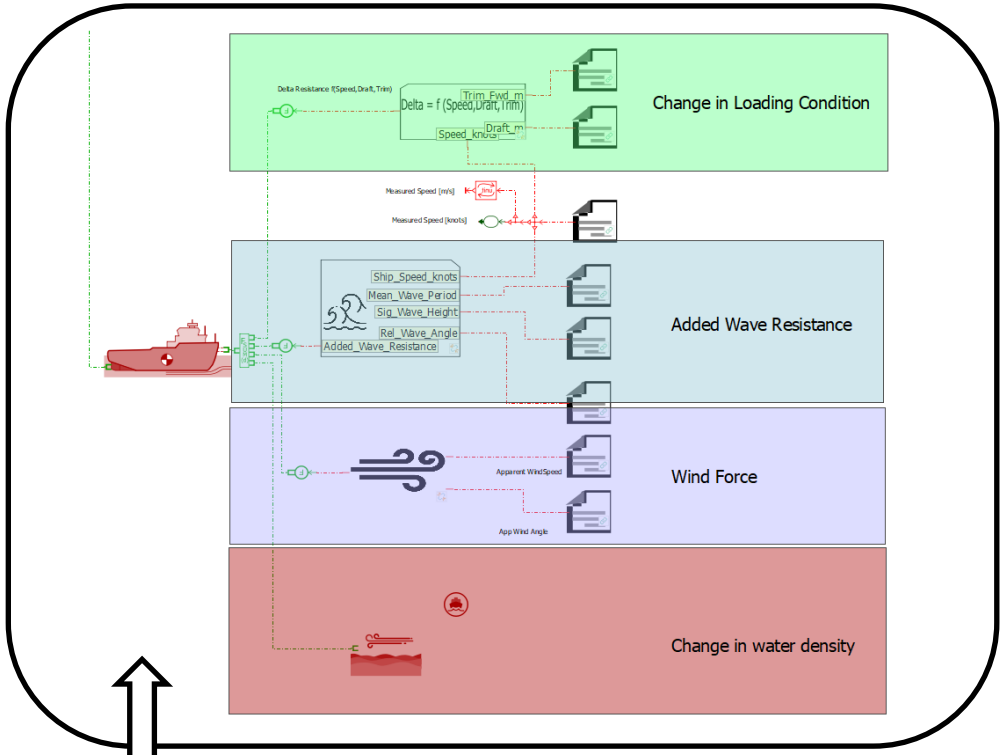
AMESim system simulation model

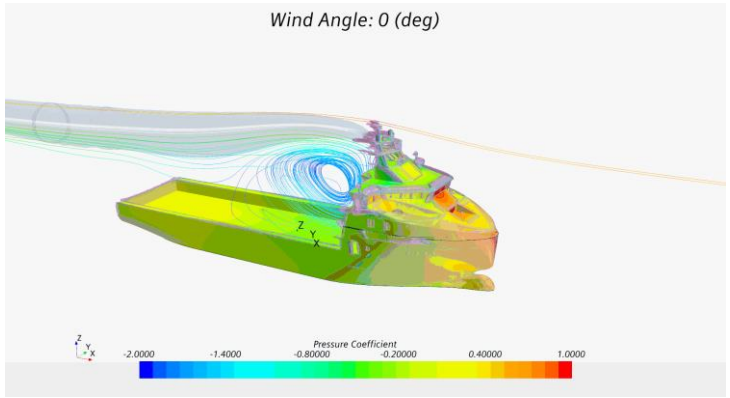
Vessel Data

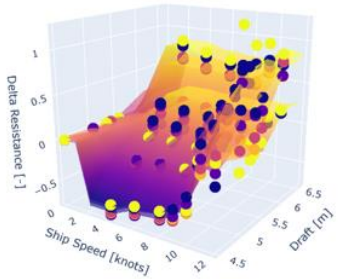
- Predict change in resistance due to loading condition
- Added Wave Resistance = f (Speed, Tm, Rel. Wave Angle)
  - Calculated using
    - Shipflow Motions (headseas)
    - ShipX Veres

- Wind Resistance = f (CFD, App. Wind Speed, App, Wind Dir.)

- *Apply corrections to measured speed to get 10m equivalent*







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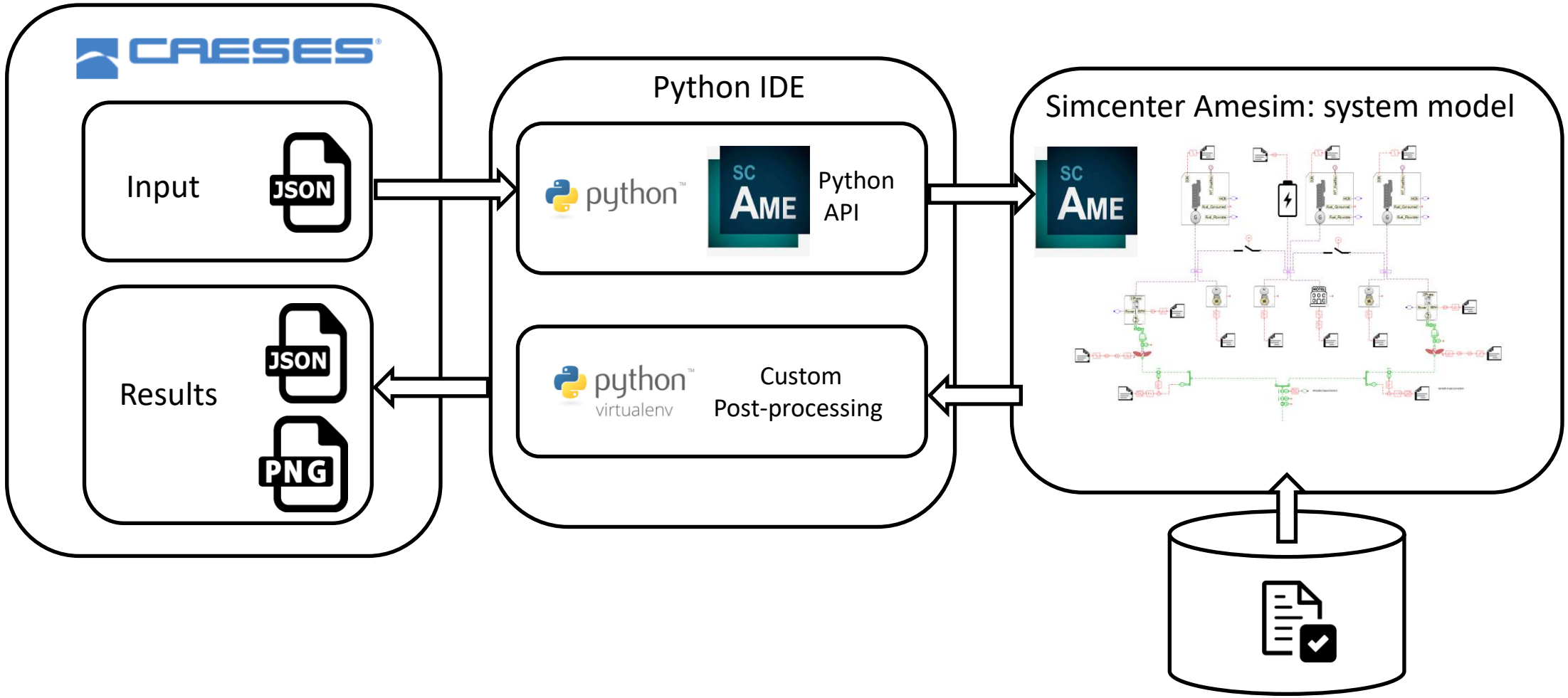
CAESES Amesim Connector



CAESES Amesim Optimize

CAESES

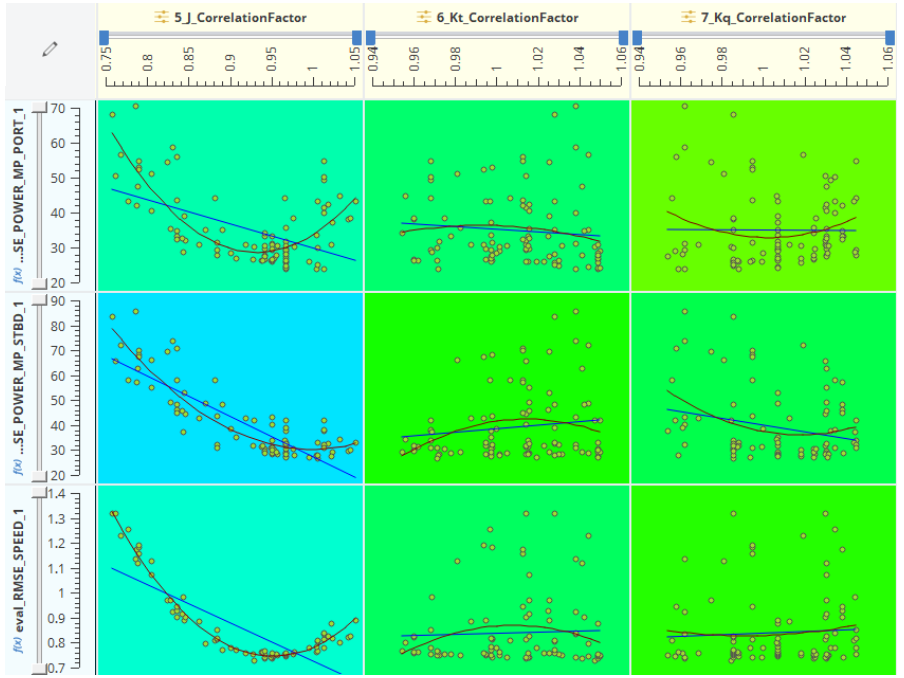
Input JSON

Results JSON PNG

CAESES

MOSA Optimization

- ~Calm Water Leg
- Tune Propeller Curves
- Reduce RMS error b/n
  Measured / Simulated
  - Ship Speed
  - Propulsor Power



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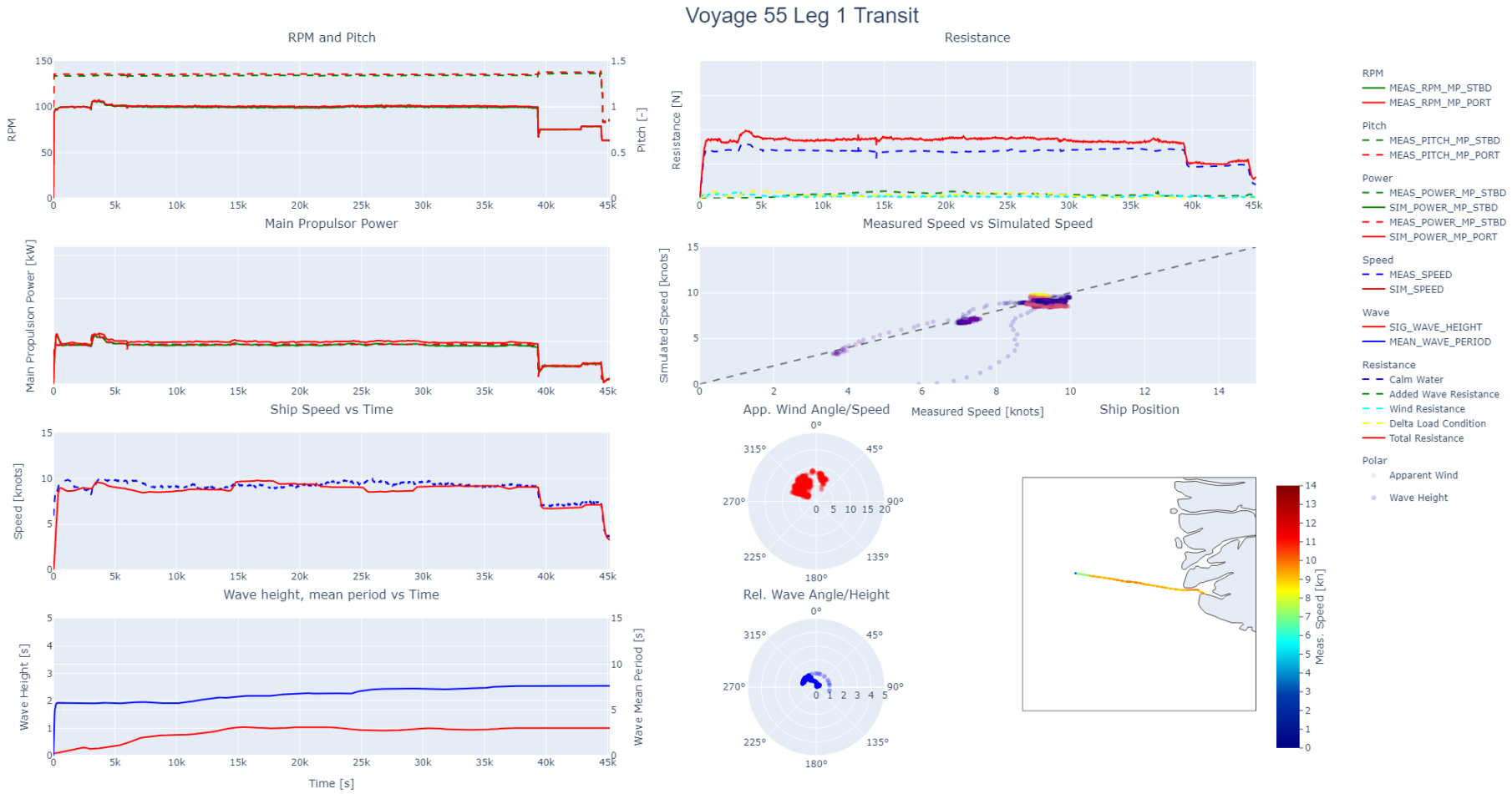
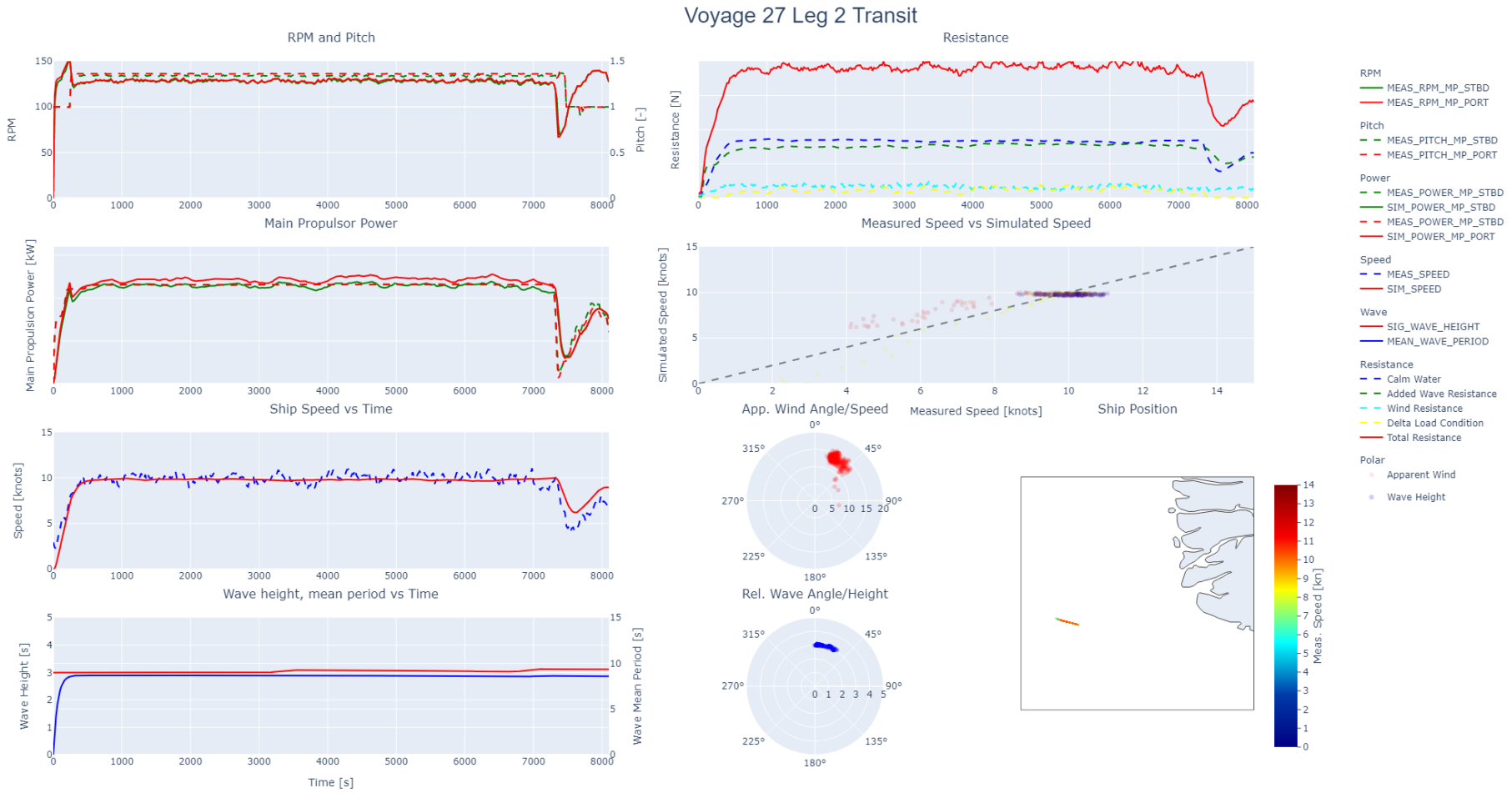
Comparison Simulation Full Scale Measurements



Example: Voyage 55 Leg 1 ~Calm Water Transit Leg

Comparison Simulation Full Scale Measurements



Example: Hs = 3m Head Seas Transit Leg

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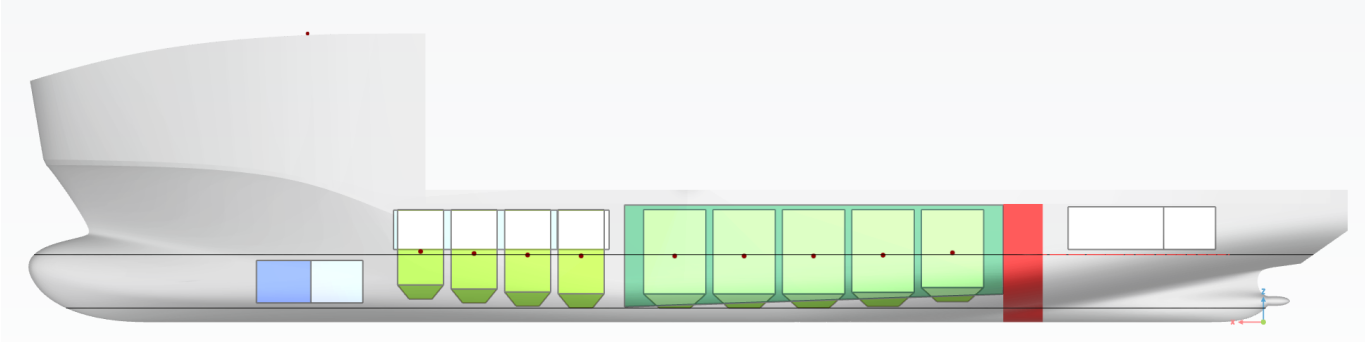
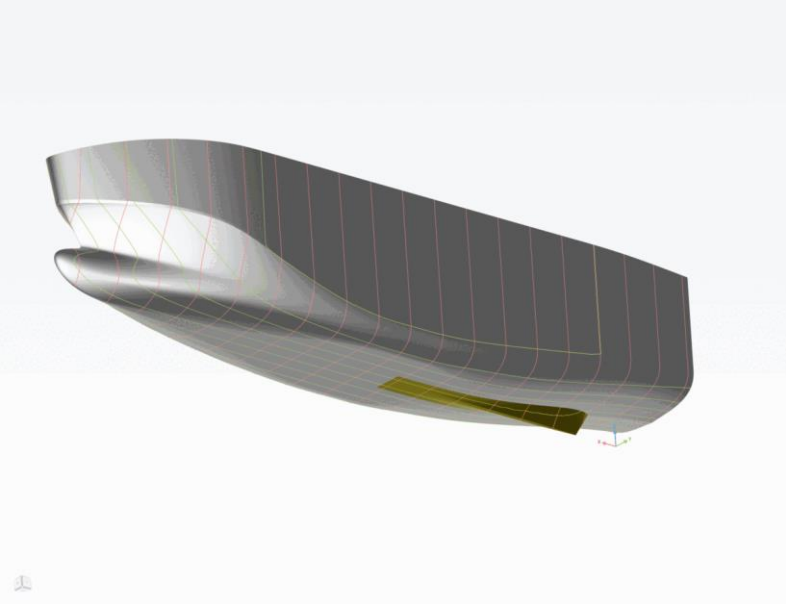
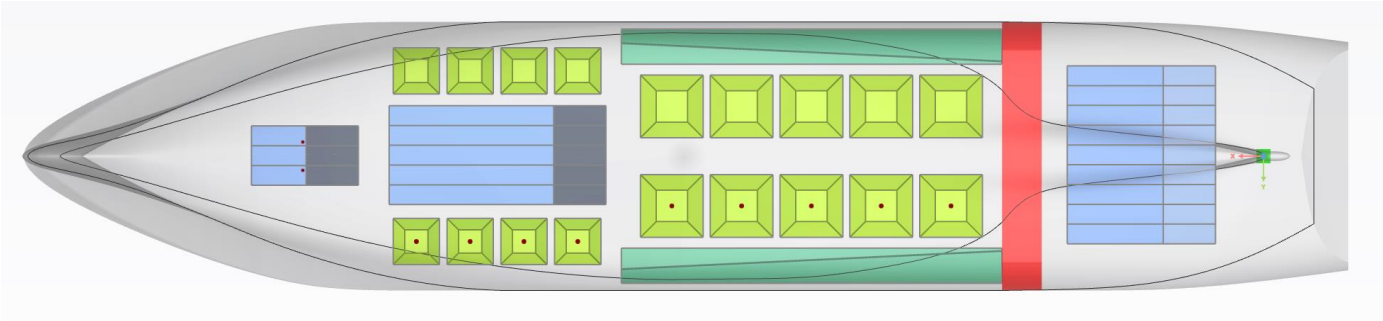
Plug-in Electric PSV Parametric Model

- Parametric Model including
  - Hull Form
  - Bulkhead positions
  - Battery room
  - Cargo Tanks
  - Wing Tanks
  - Deck Area

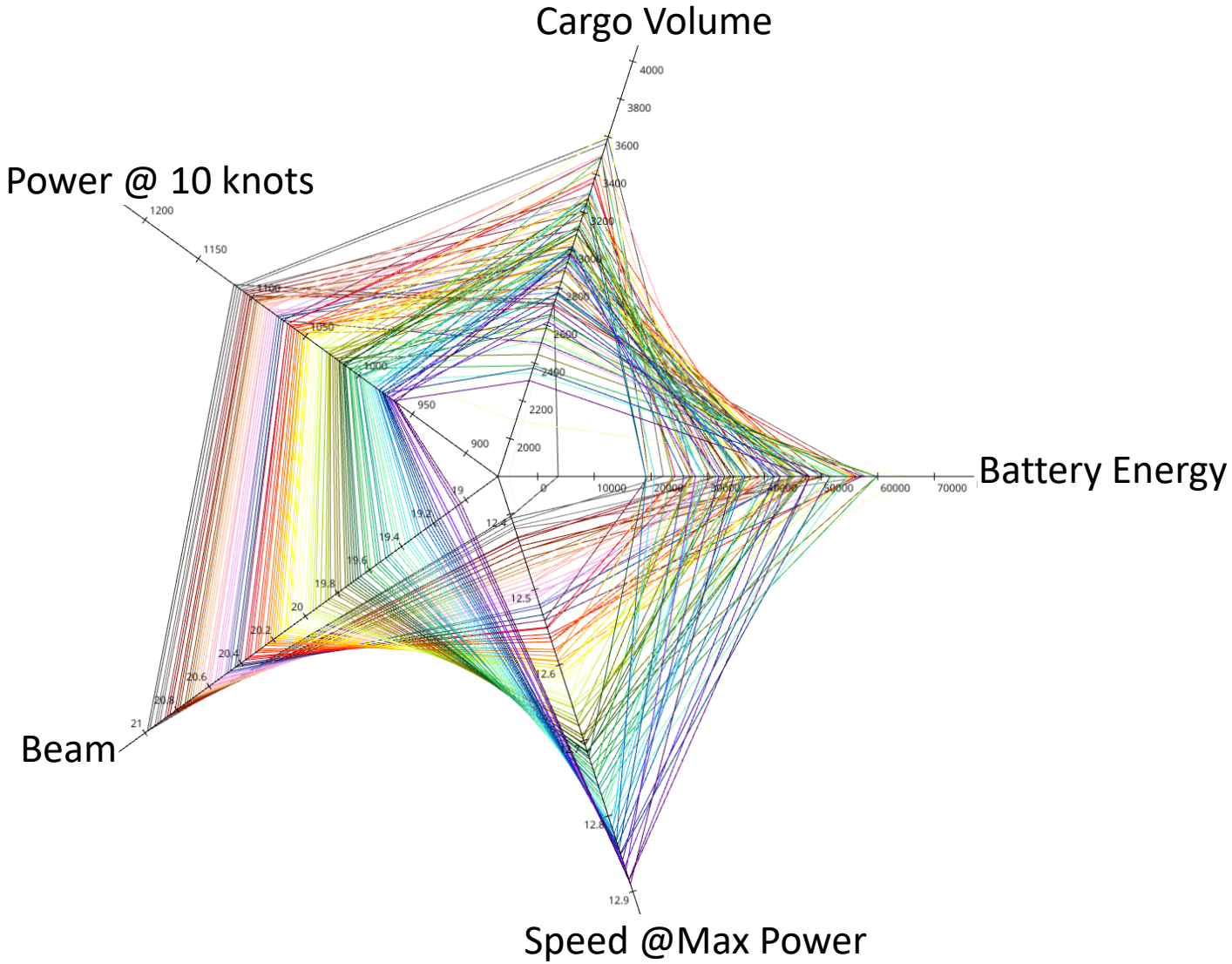






Plug-in Electric PSV Parametric Model

- Preliminary Sobol Design Space Study
  - Resistance and Powering Estimate
    - Hollenbach
    - Wageningen B Propellers

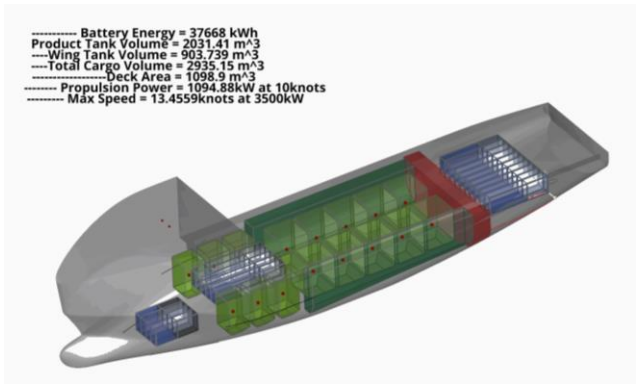


Next Steps : Plug-in Electric PSV Design Optimization

Optimization Goals

- Range
- Cargo Capacity
- Emissions
- Cost

CAESES



- SCAME — System Simulation
- STAR-CCM+ — CFD
- SHIPFLOW (a flowtech product) — CFD
- python™ — Scripts
- ShipX - Vessel Responses

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Summary

- ✓ Amesim model reliably estimates energy consumption in transit
- ✓ CAESES platform enables us to work smarter
- ✓ A PSV with batteries as main energy source is feasible, ideally shorter range first
- ✗ Difficult to install offshore charging at existing platforms
- ✓ Offshore wind service vessels have a more favorable operational profile for offshore charging

Ocean Charger