# ISTANBUL TECHNICAL UNIVERSITY CAVITATION TUNNEL

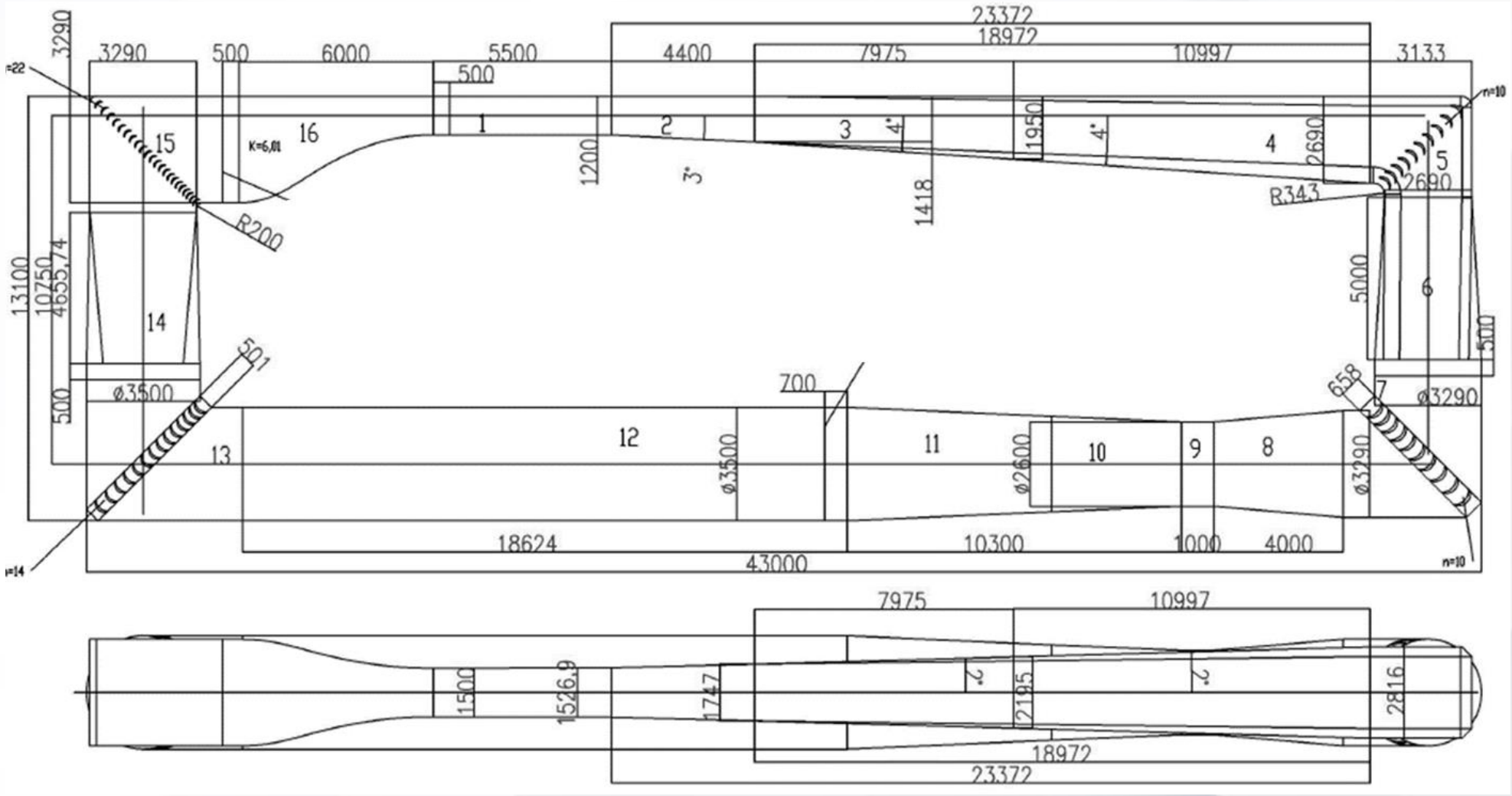

iTOKAT

SSB
SAVUNMA SANAYİİ BAŞKANLIĞI

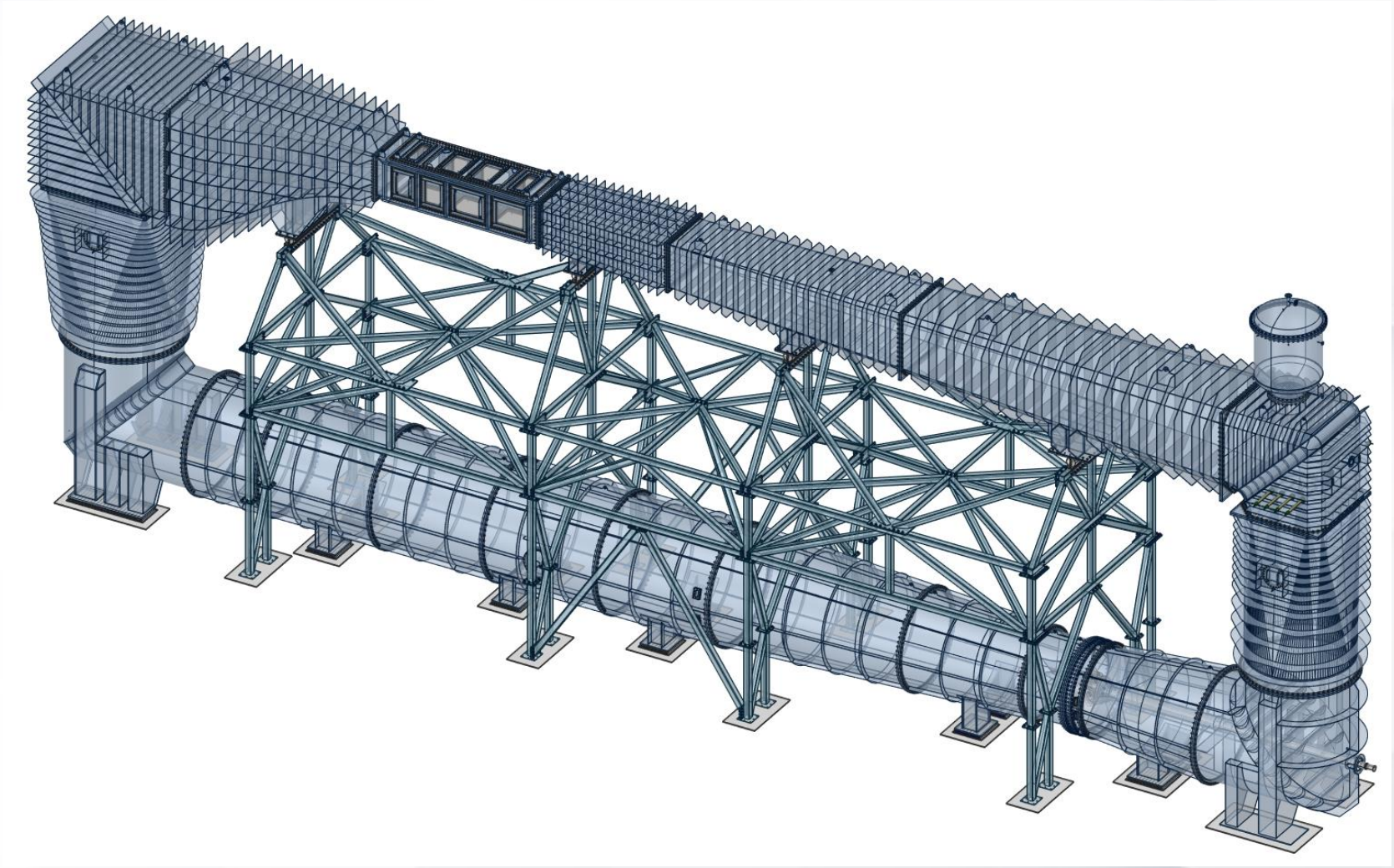
İTÜ
İSTANBUL TEKNİK ÜNİVERSİTESİ
1773

TRtest
Test ve Değerlendirme A.Ş.

# ITUKAT, Schematic View



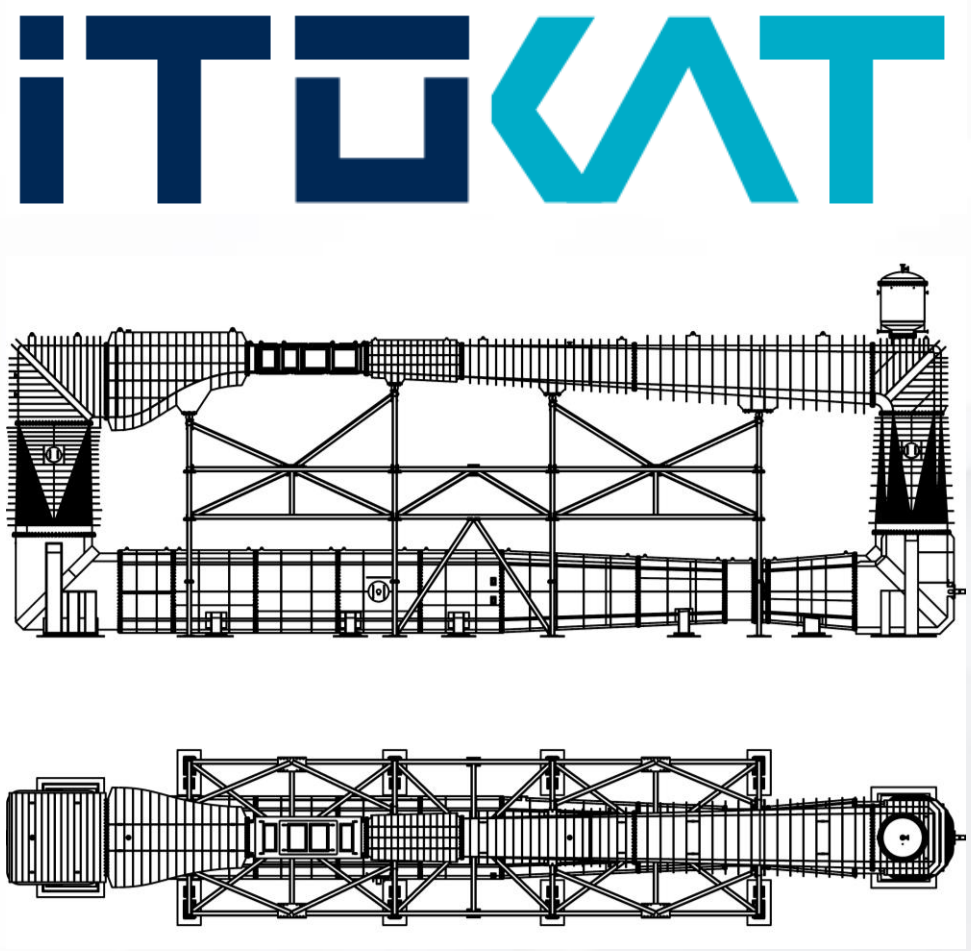
# ITUKAT, 3D View



# Main Features

- 5.5 m test section length ($L_{TS}$)
- 1.5 m x 1.2 m cross section ($B_{TS}$ x $H_{TS}$)
- 16.5 m/s maximum flow velocity
- 1 MW elektric motor
- Pressurisation/ Depressurisation
- Low turbulence intensity (<%1)
- High flow uniformity
- Low acoustic level
- Special acoustic room
- 1000 $m^2$ test floor area
- 12.5 tons crane capacity

# ITUKAT, Photographs



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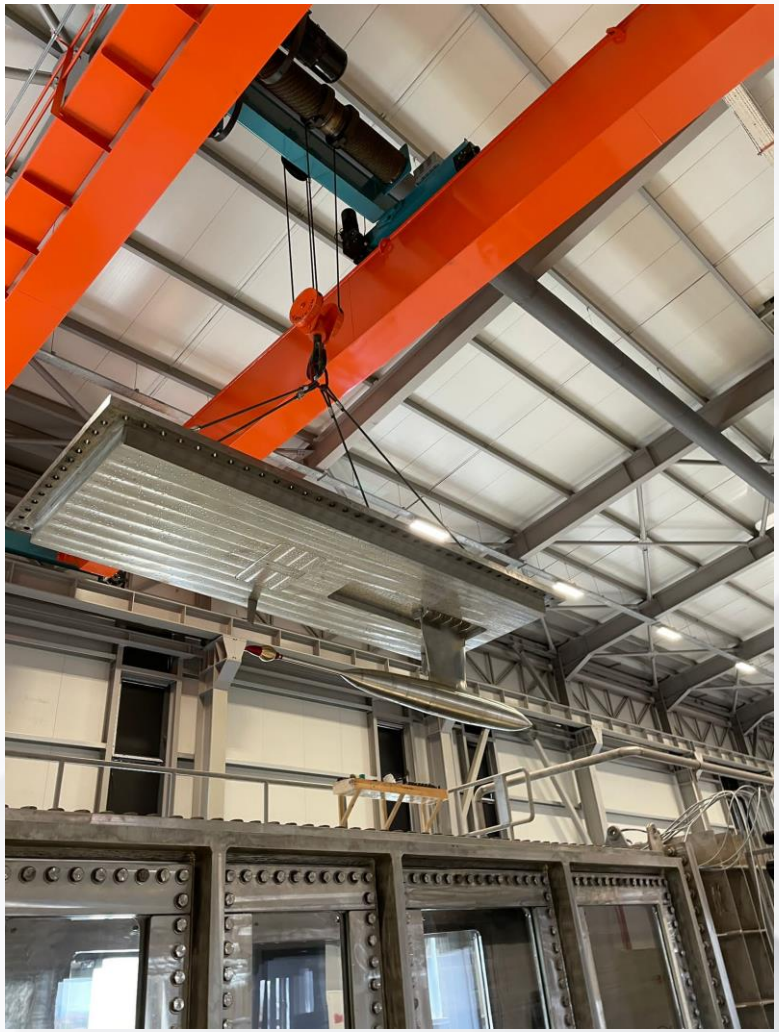
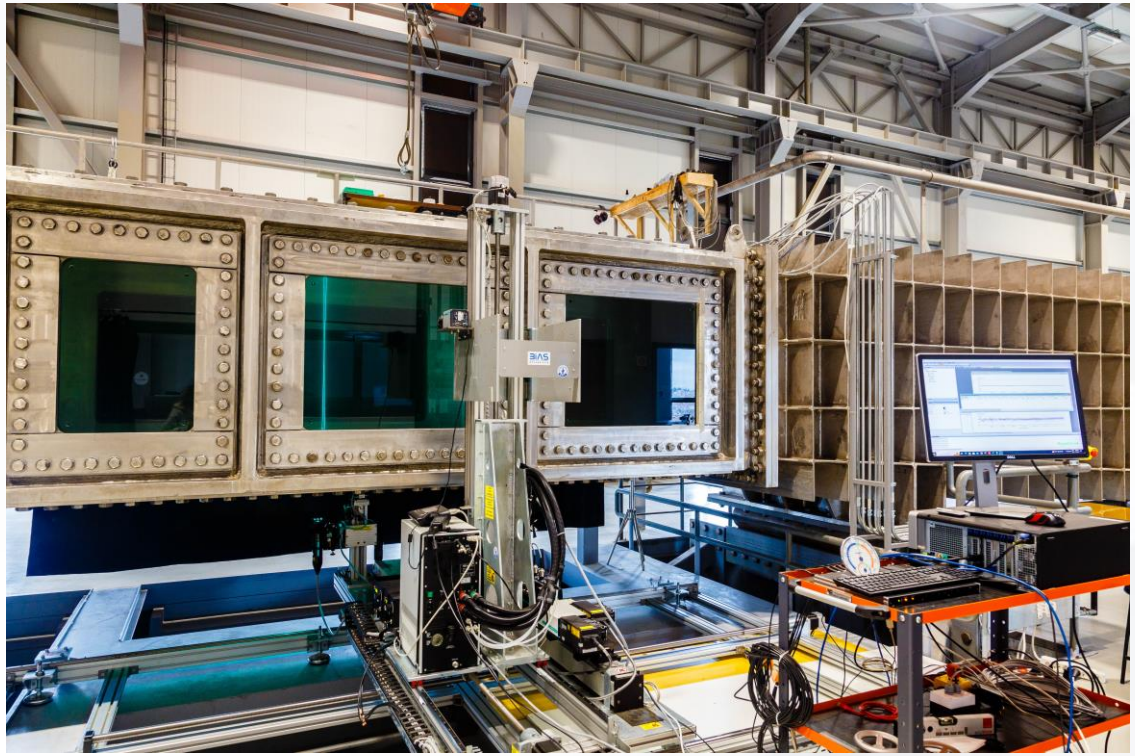


# ITUKAT, Photographs



# ITUKAT, Control Room

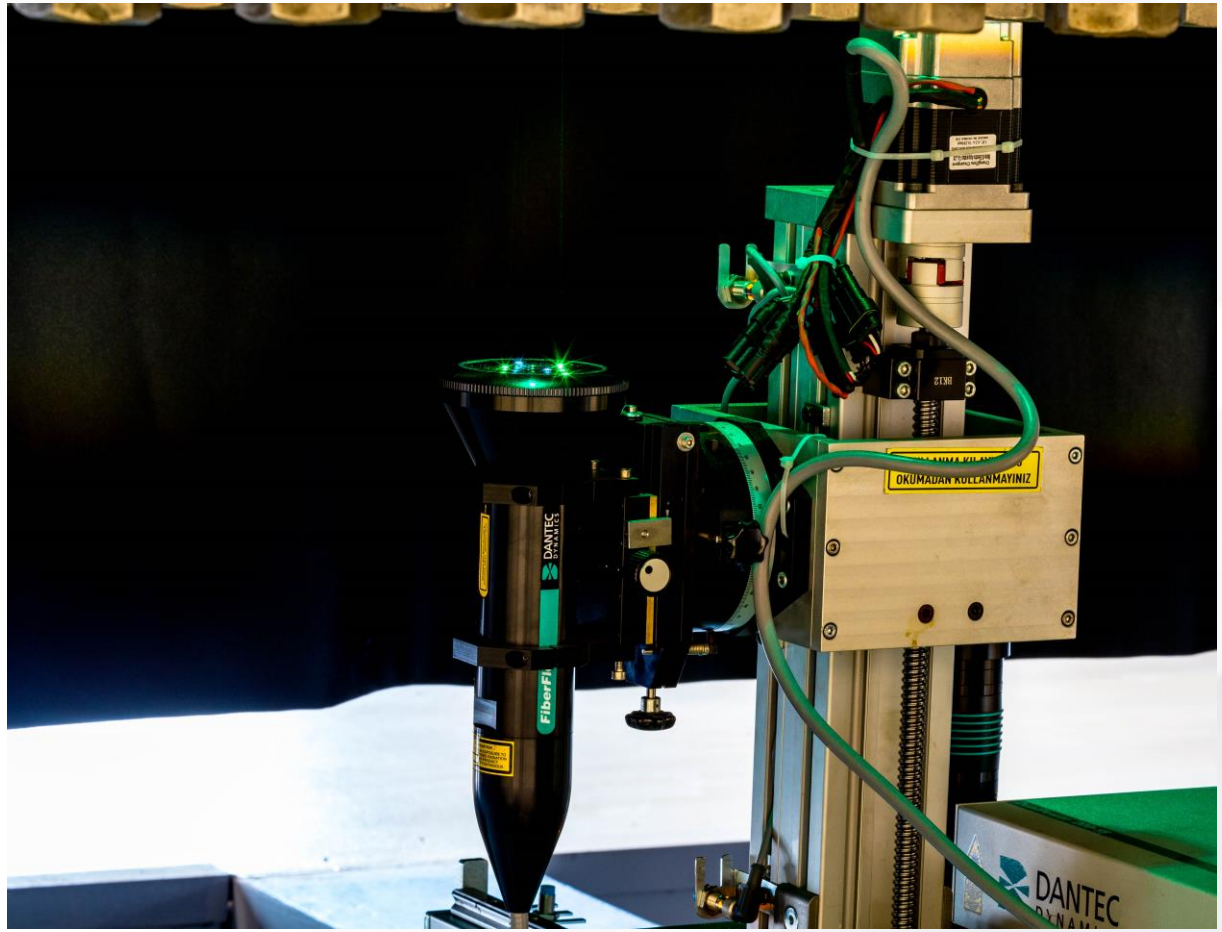
# Experimental Capabilities

- All types of underwater/surface vehicle resistance tests
- Cavitation tests in uniform/non-uniform flow
- Performance and cavitation erosion tests with conventional/ unconventional propellers
- Propeller thrust, torque and pressure measurements in open water and behind the hull conditions
- Detailed flow imaging, wake and boundary layer measurements with the laser-based velocity measurement device
- Propulsion systems and general flow noise measurements

# Measurement Systems

- Laser Doppler Anemometry (LDA)
- Particle Image Velocimetry (PIV)
- Wide range of motion traverse mechanism
- Synchronized stroboscope
- Propeller open water dynamometer
- Self-propulsion dynamometer
- Contra-rotating propeller dynamometer
- Three component loadcell
- Four component loadcell
- Noise measurement system
- Pressure sensor
- High-speed camera

## Laser Doppler Anemometry (LDA)

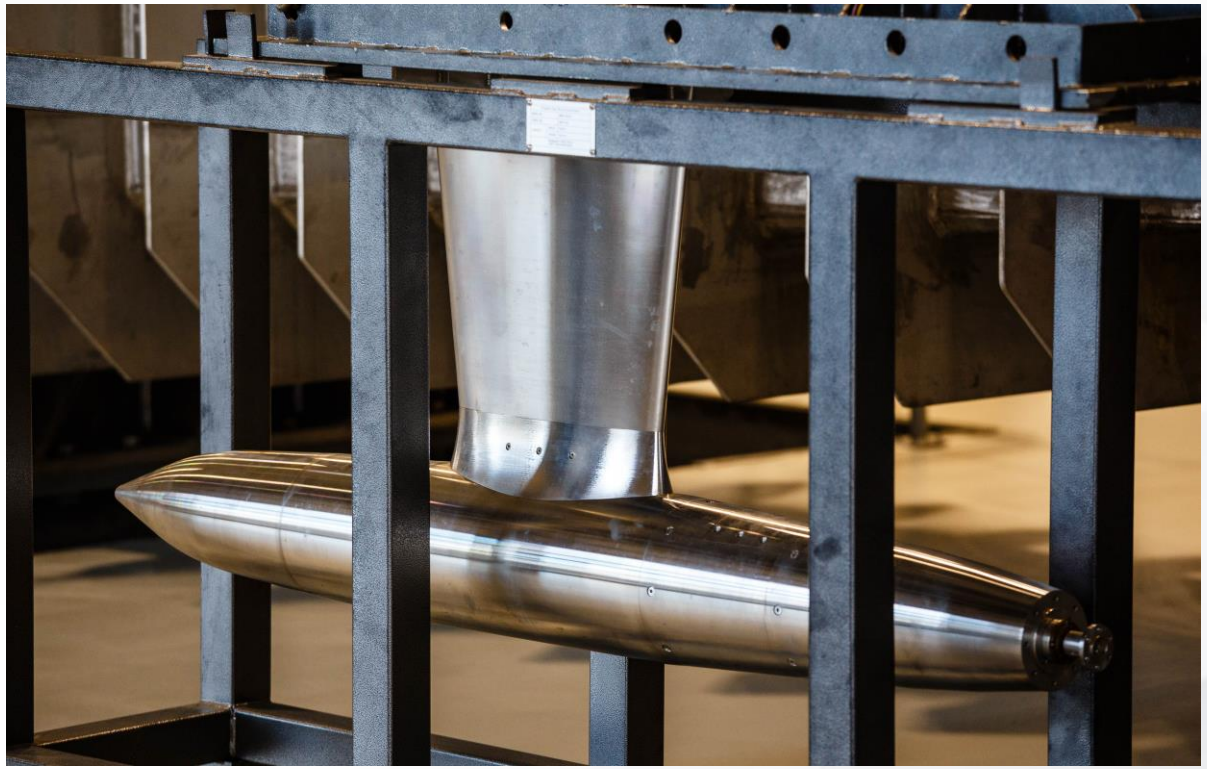



## Particle Image Velocimetry (PIV)

## Traverse mechanism

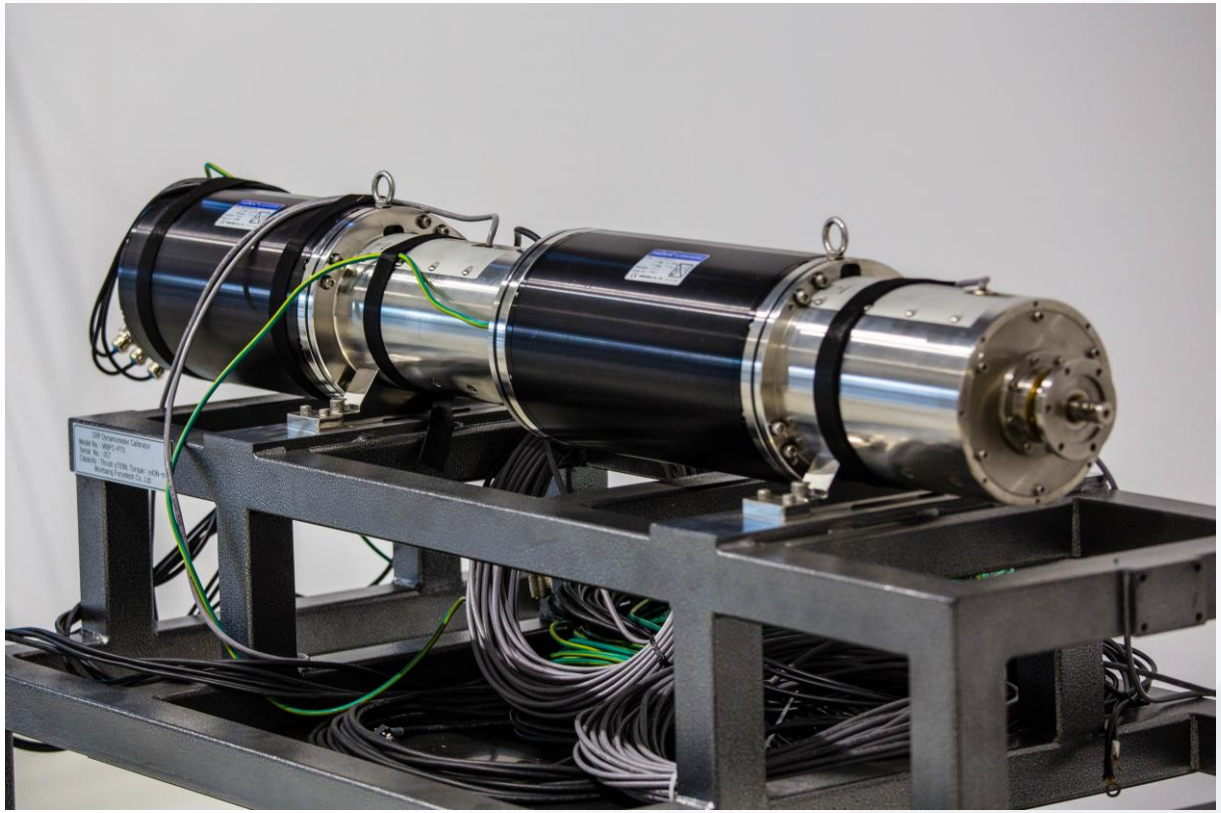

## Synchronized stroboscope

## Propeller open water dynamometer

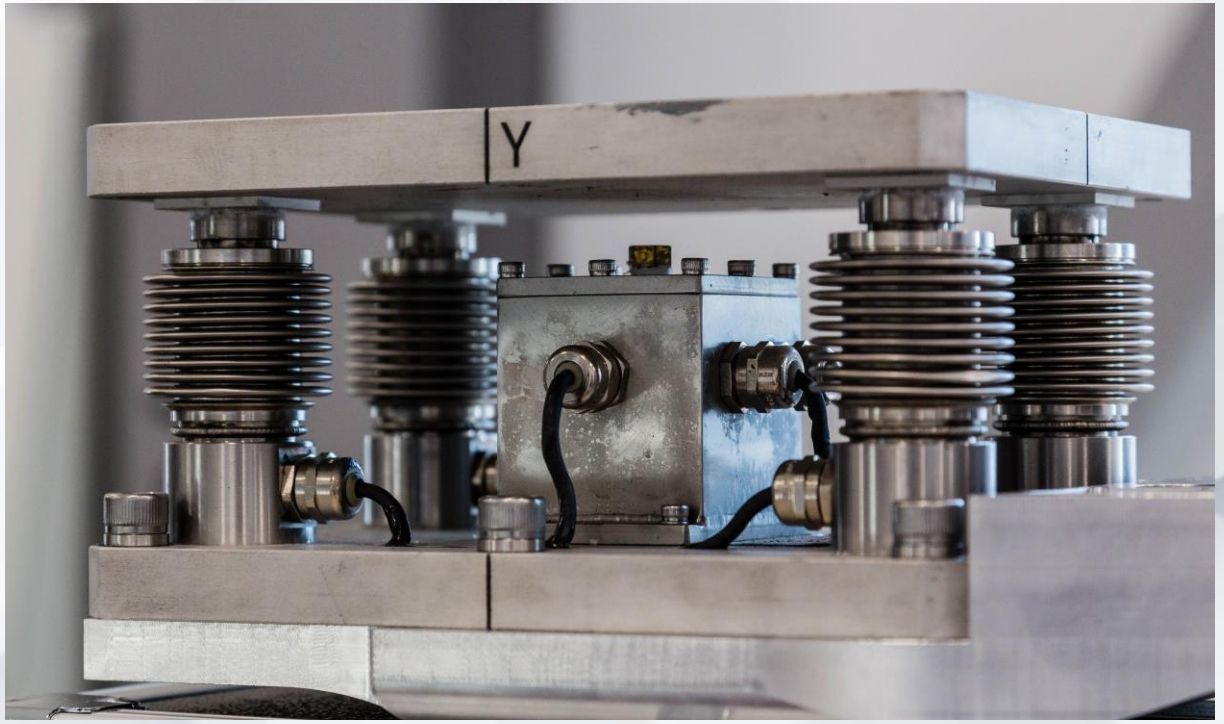


## Self-propulsion dynamometer

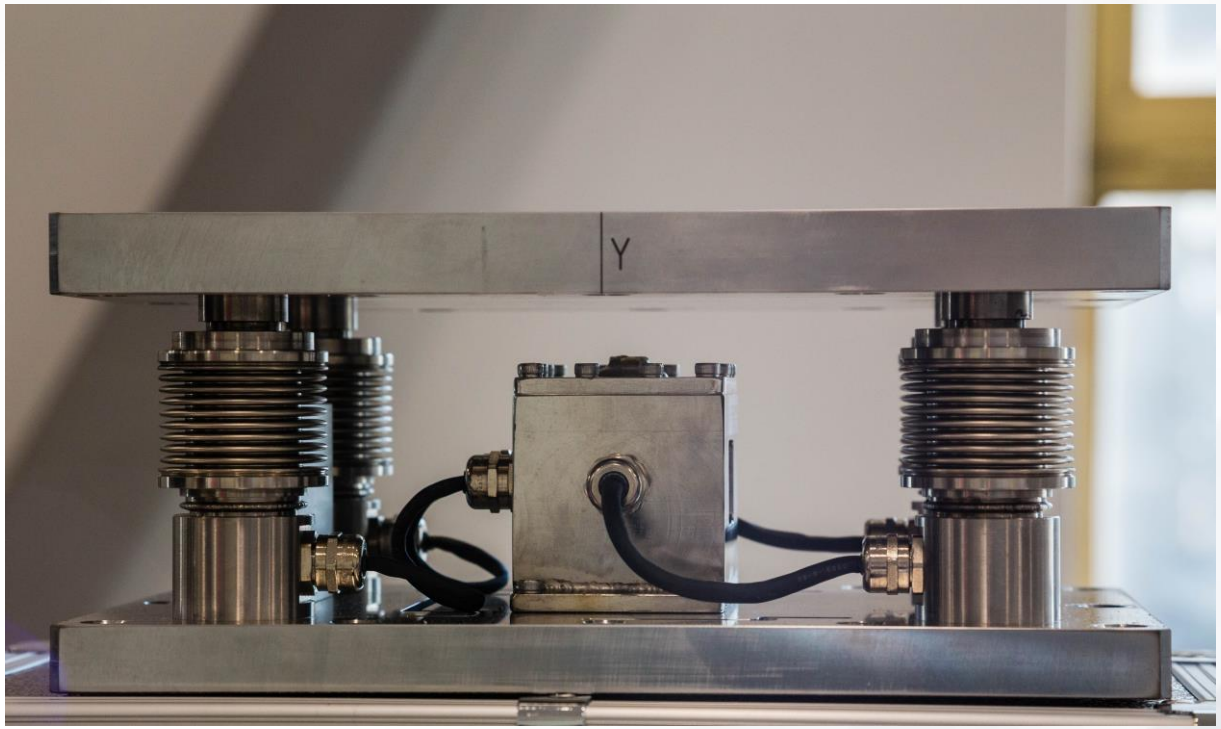
## Contra rotating propeller dynamometer



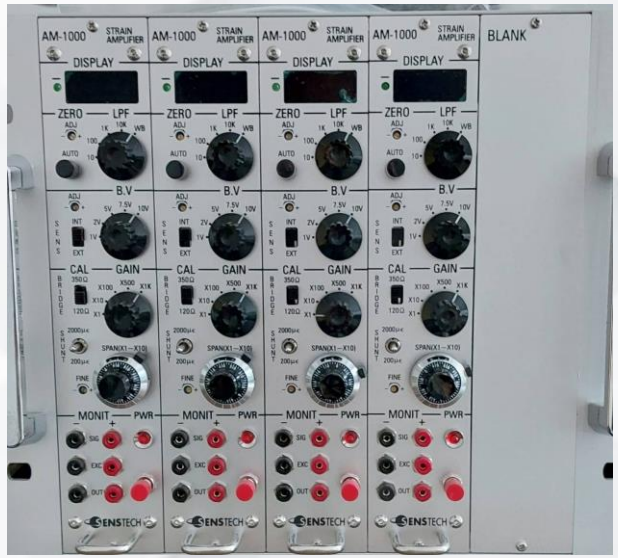
## 3-component loadcell



## 4-component loadcell




## Data acquisition system





HBM QuantumX MX840B Amplifier

ST-AM1000 Amplifier

## Noise measurement system


B&K Type 8103 hydrophone

B&K Type 3052 data acquisition system

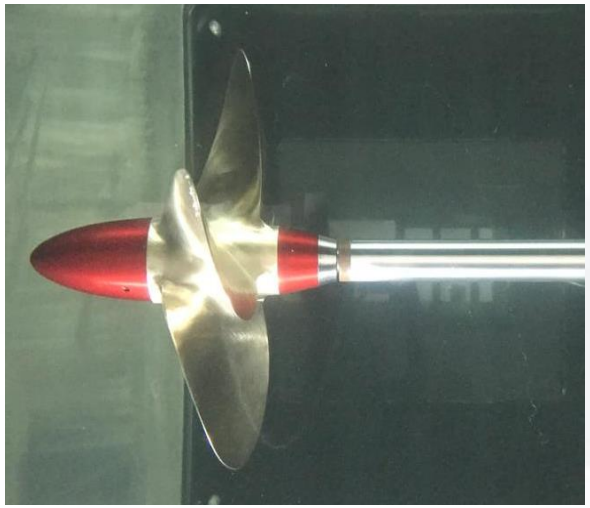
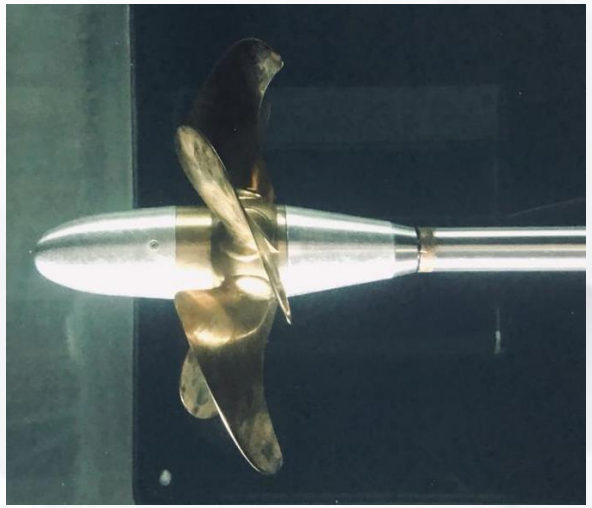
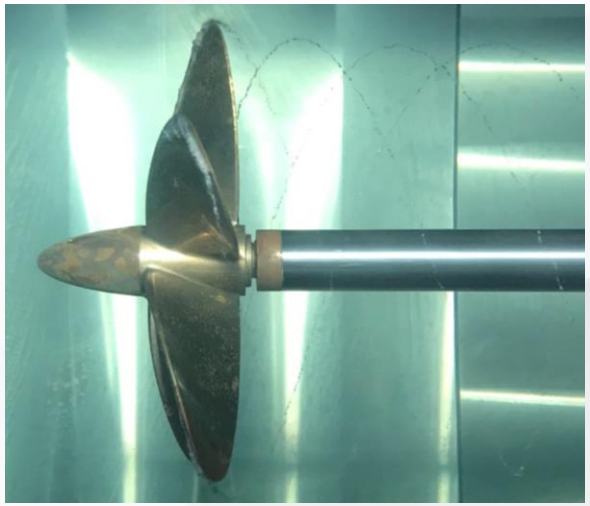
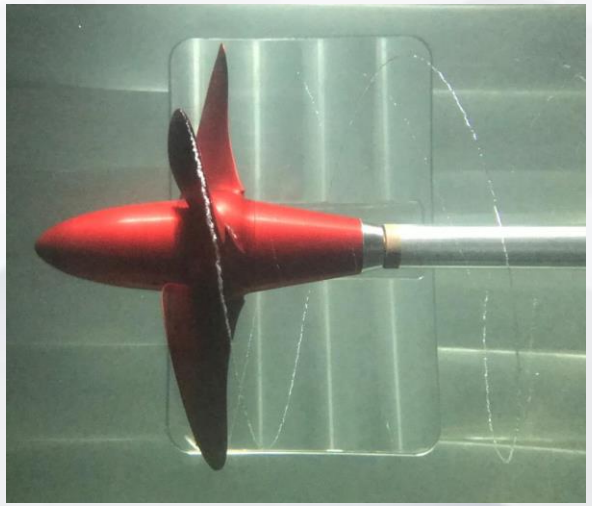
## Pressure sensor

Kulite XTL-193-190 pressure sensor

# High speed camera


Photron Fastcam Nova S6

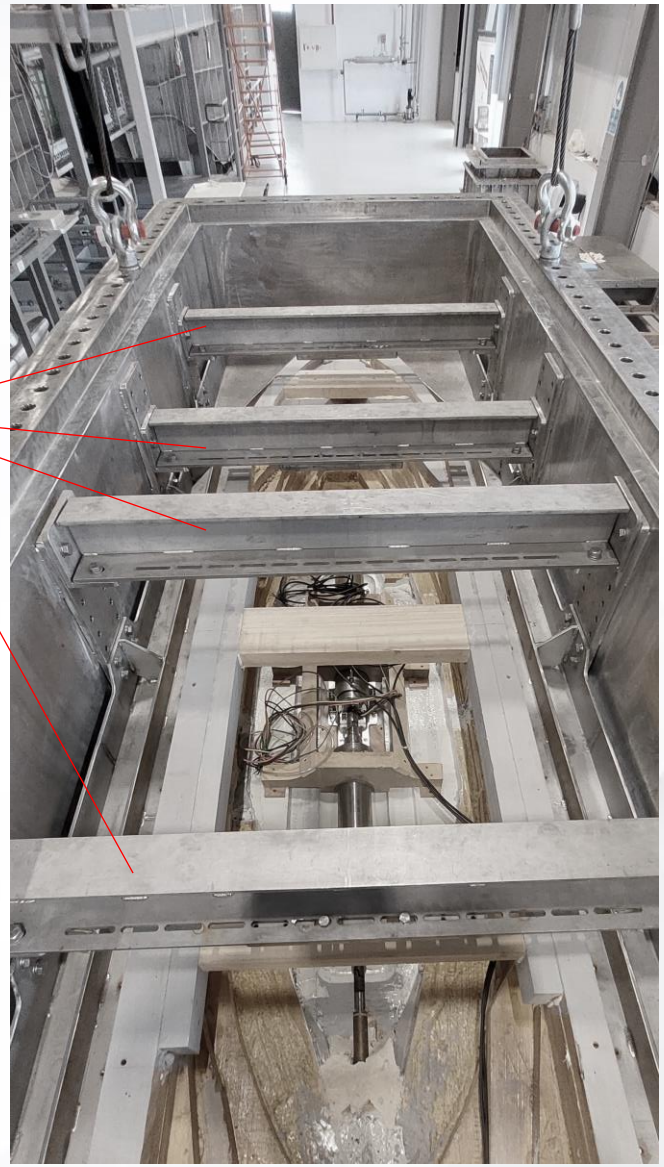
# Open Water Tests

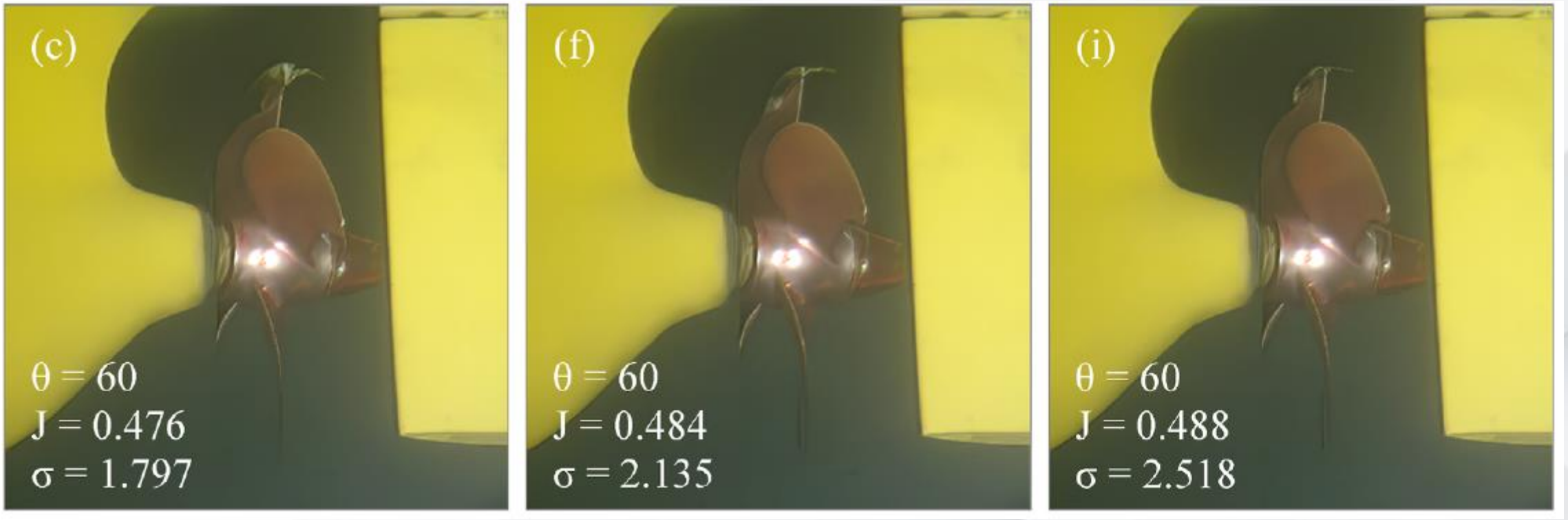
# Ship Model Connection Design

# Cavitation Tests

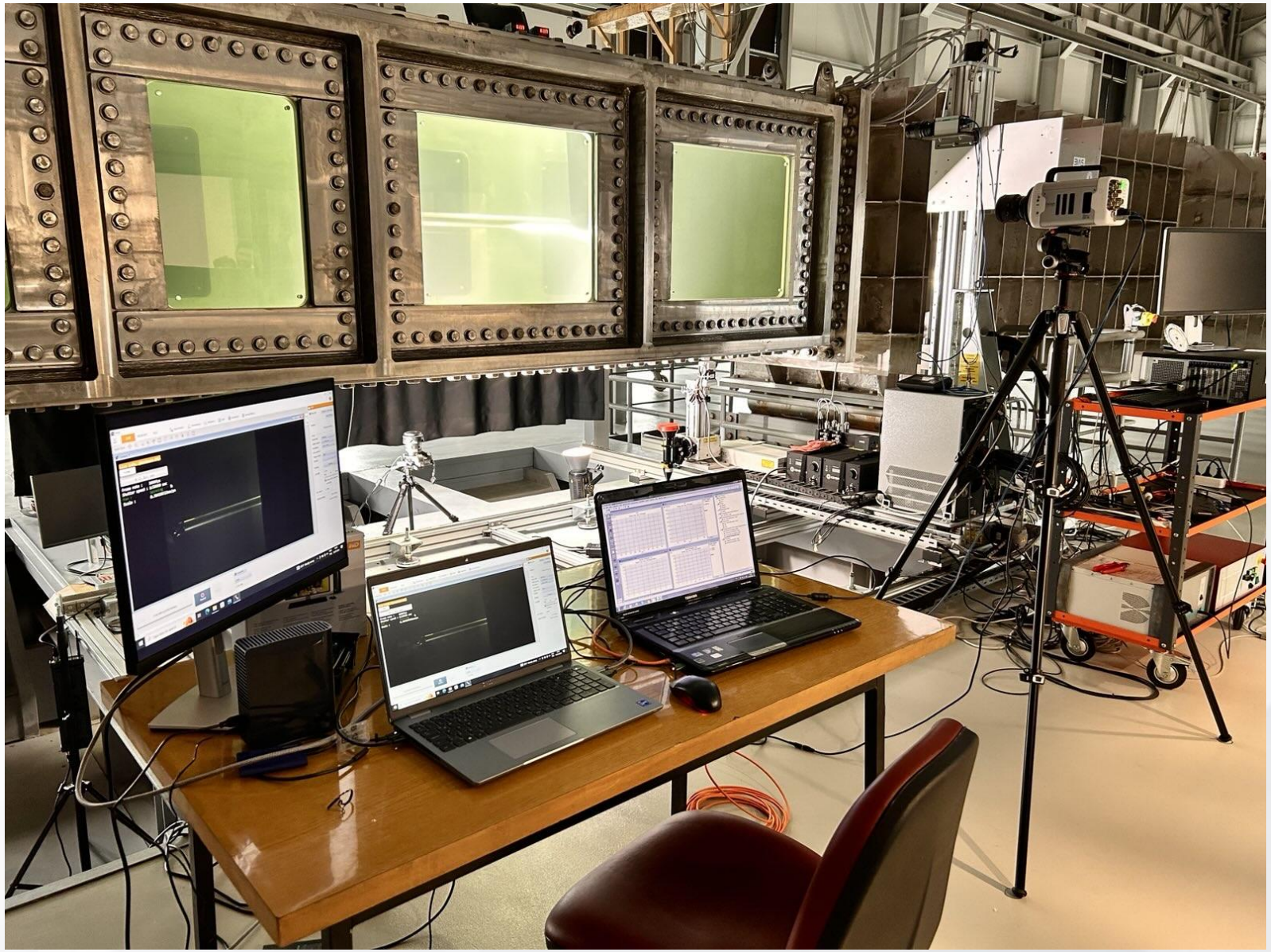
Moveable beams



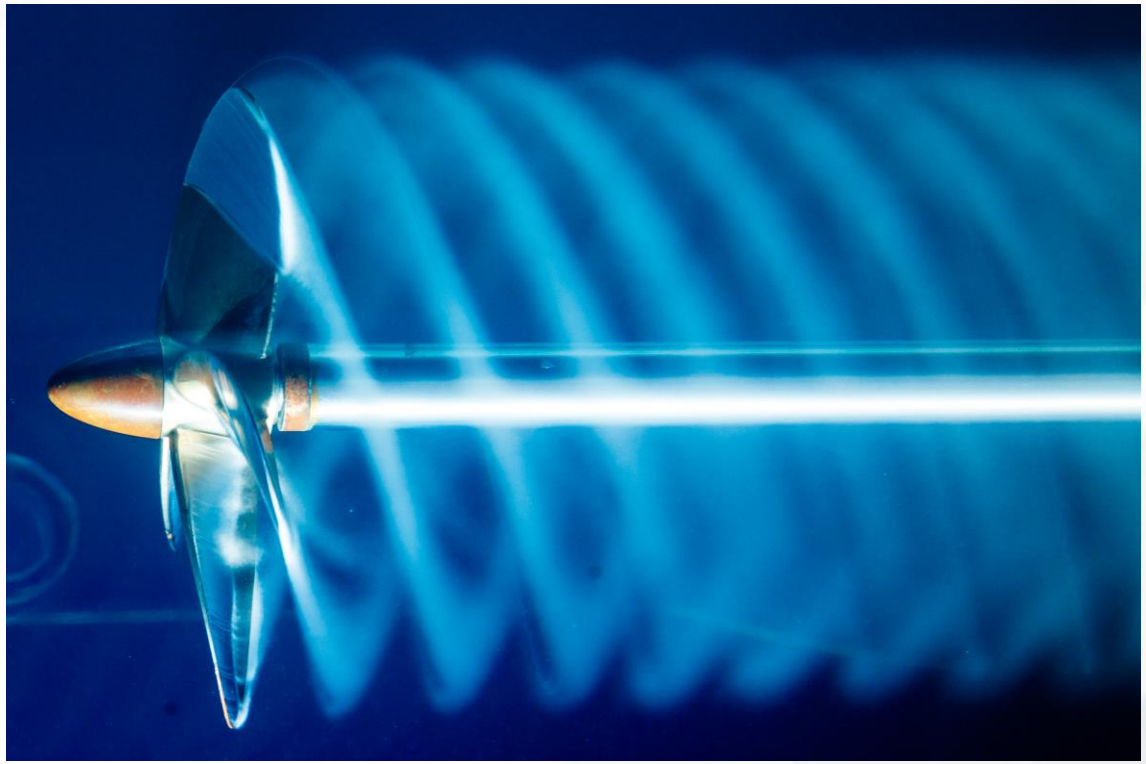
# Cavitation Observation

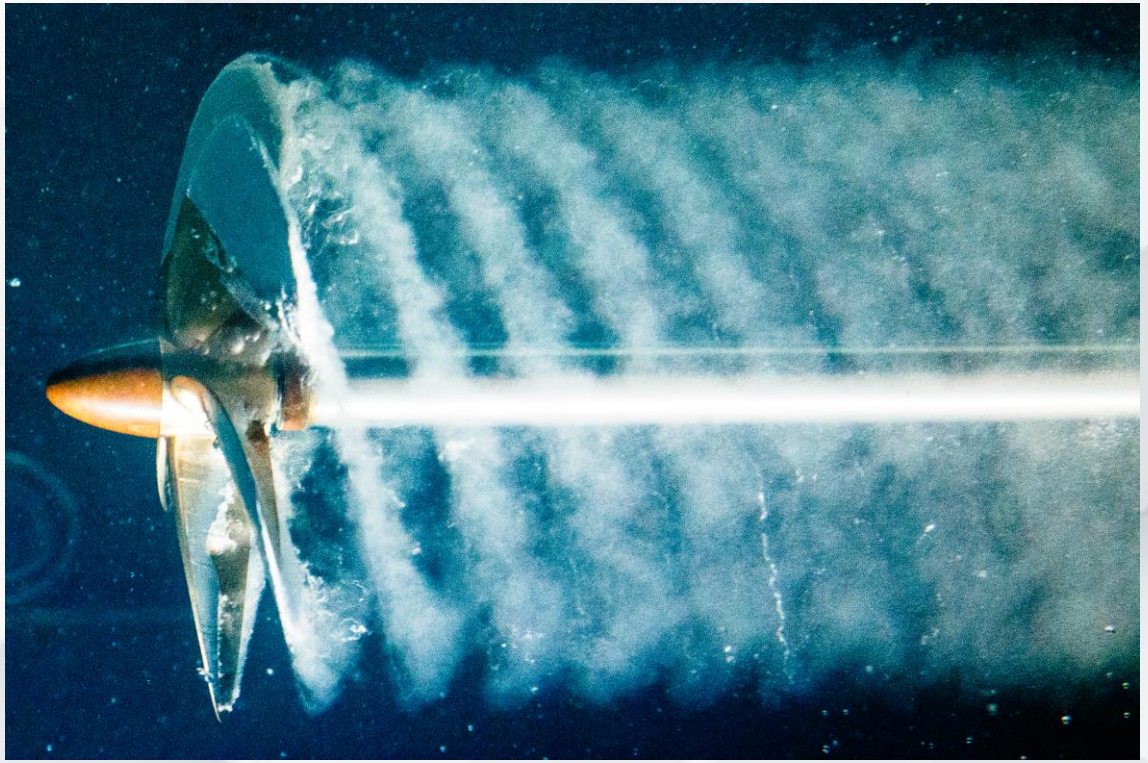


## Cavitation Observation

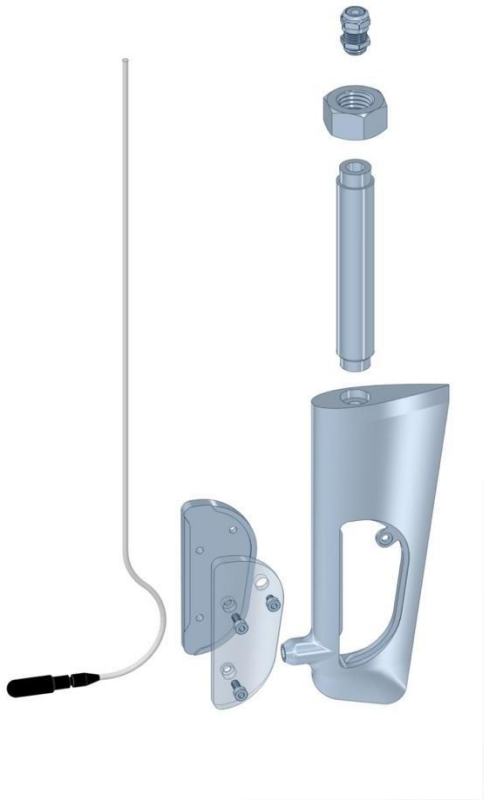


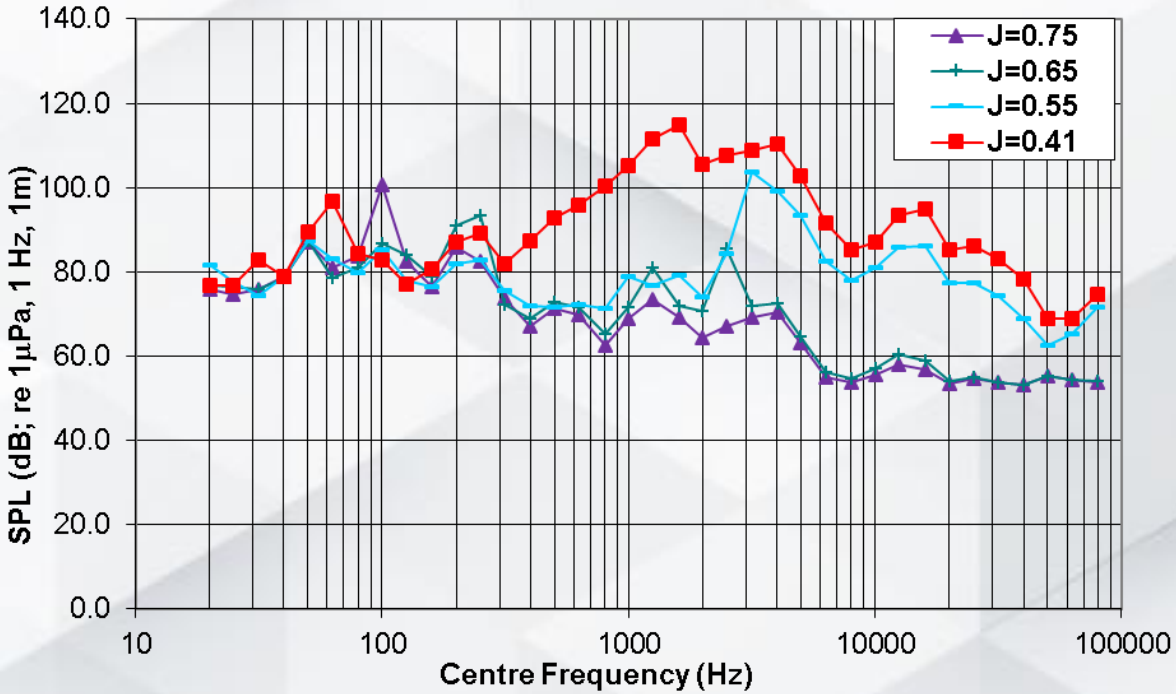
# Cavitation Observation





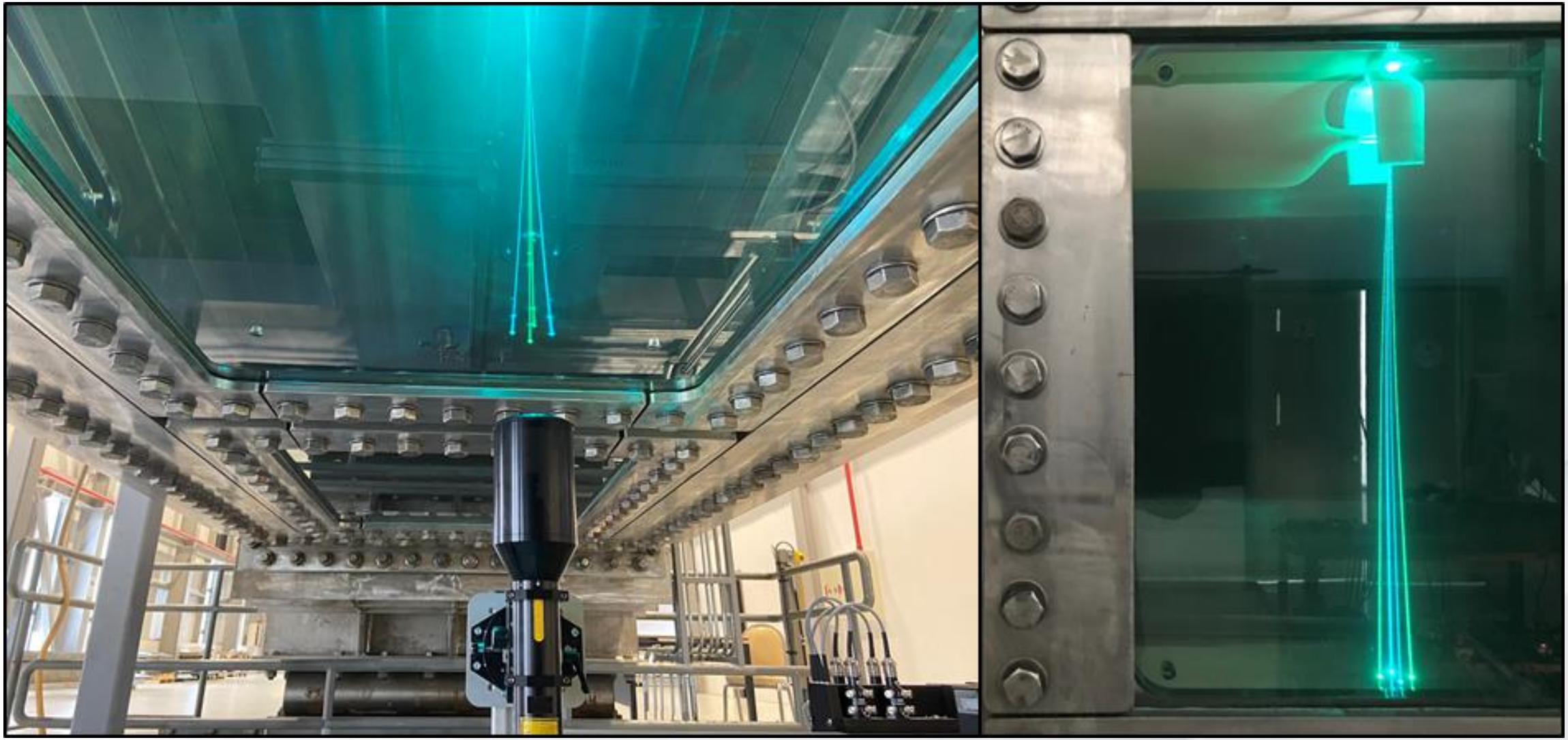
# Noise Measurements



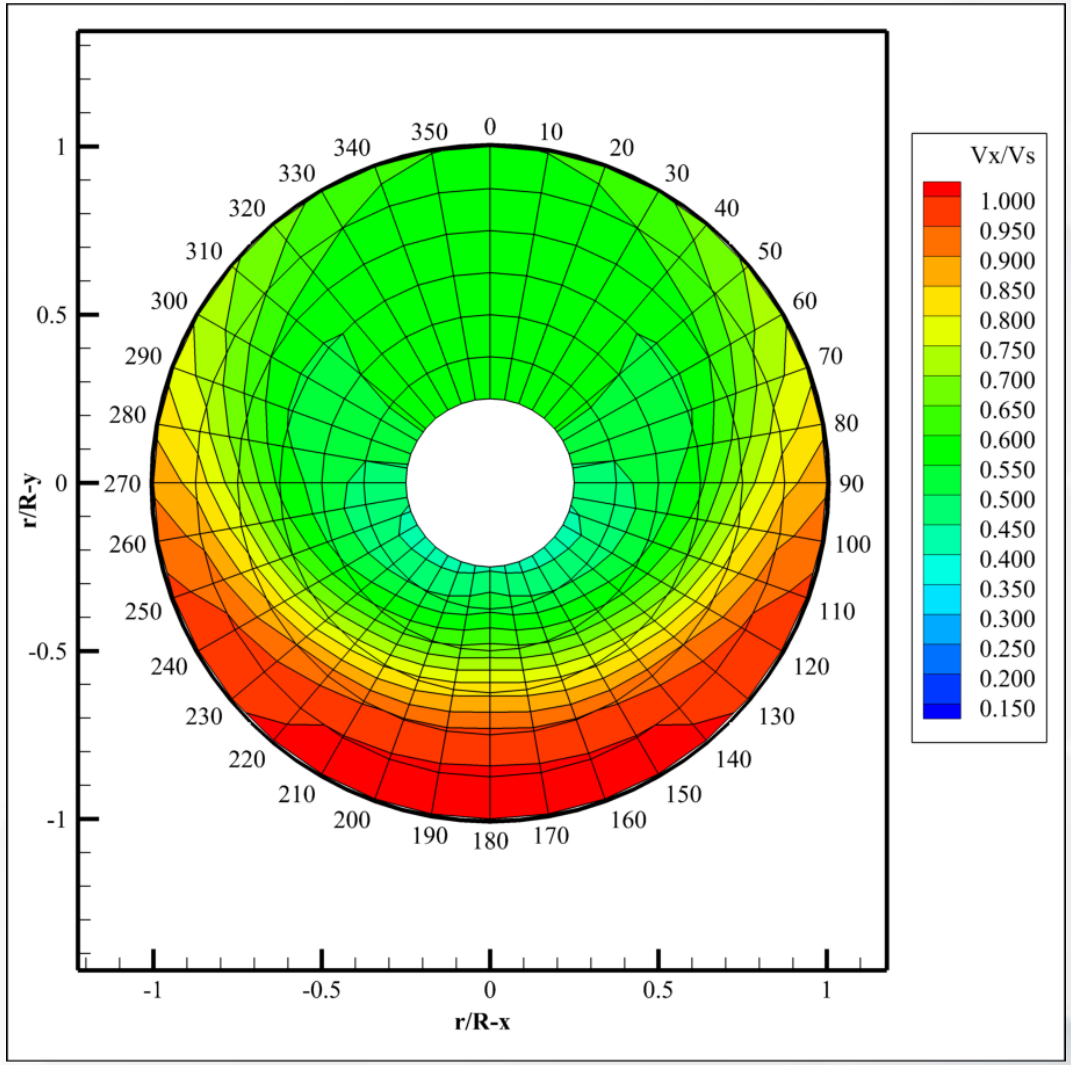


# Pressure Pulse Measurements

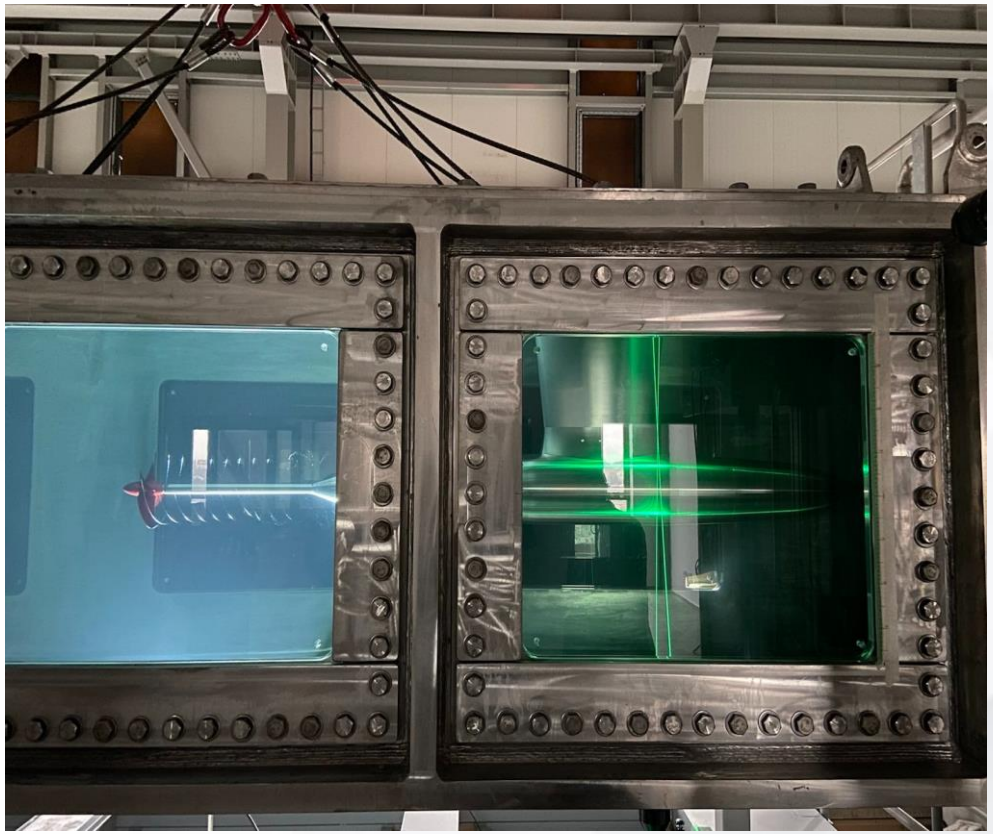
# Wake Measurements

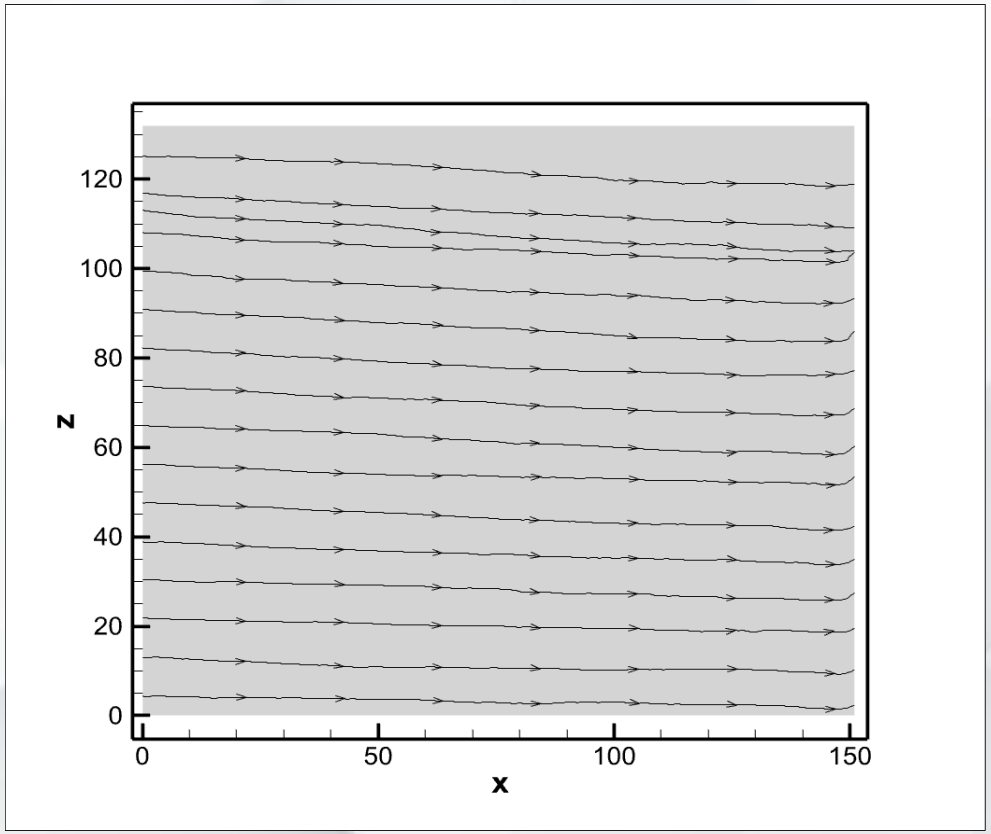


# Wake Measurements

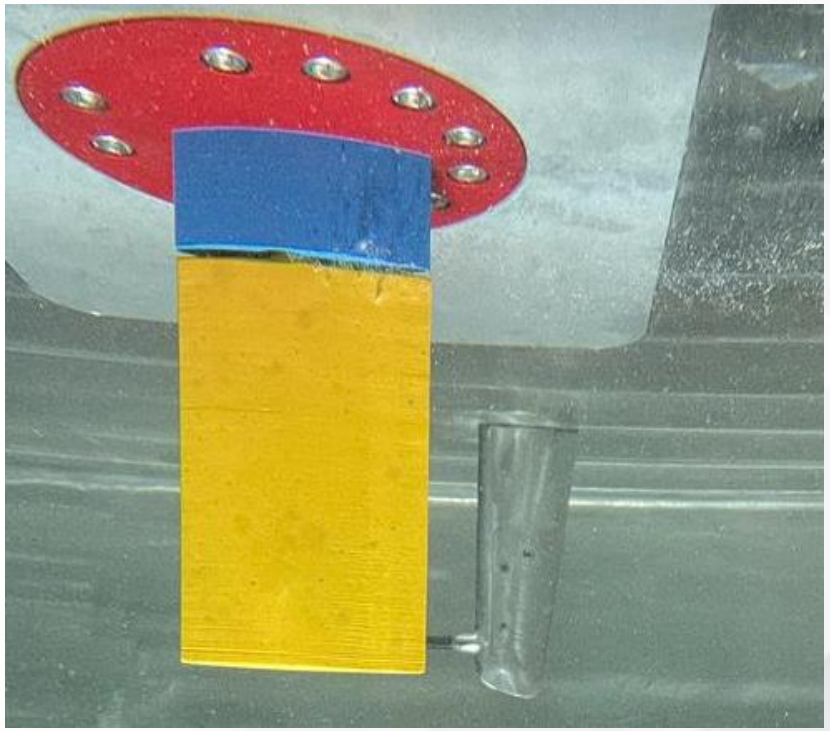


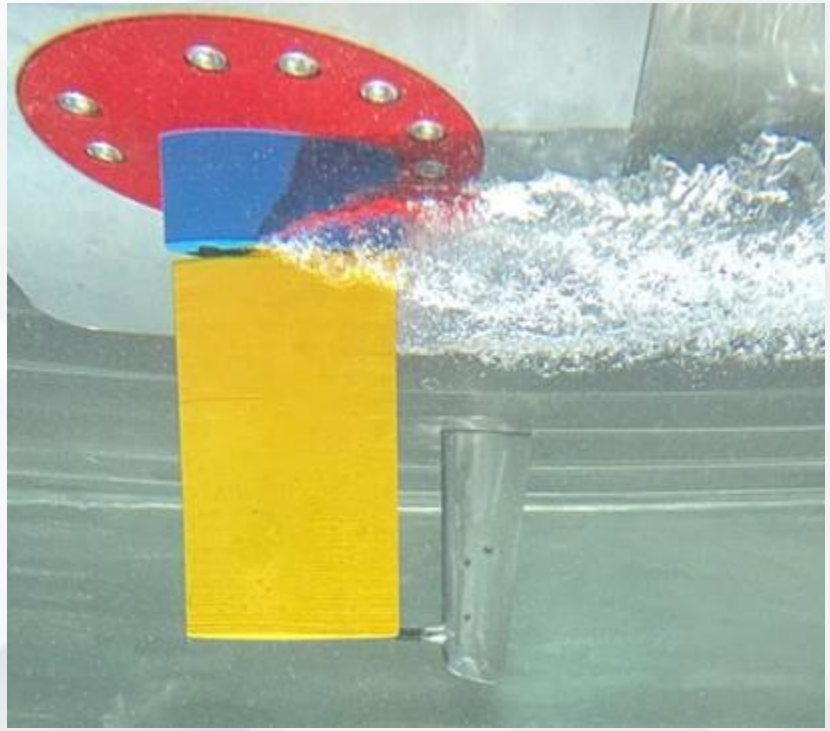
# PIV Measurements



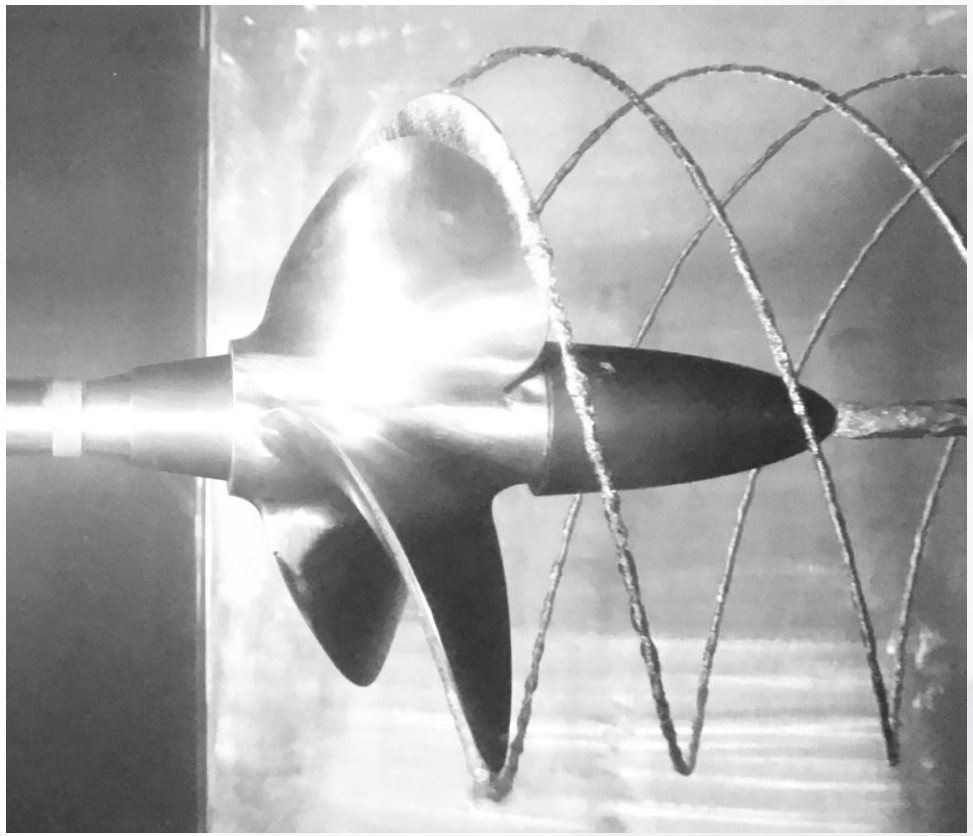


# Rudder Force Measurements

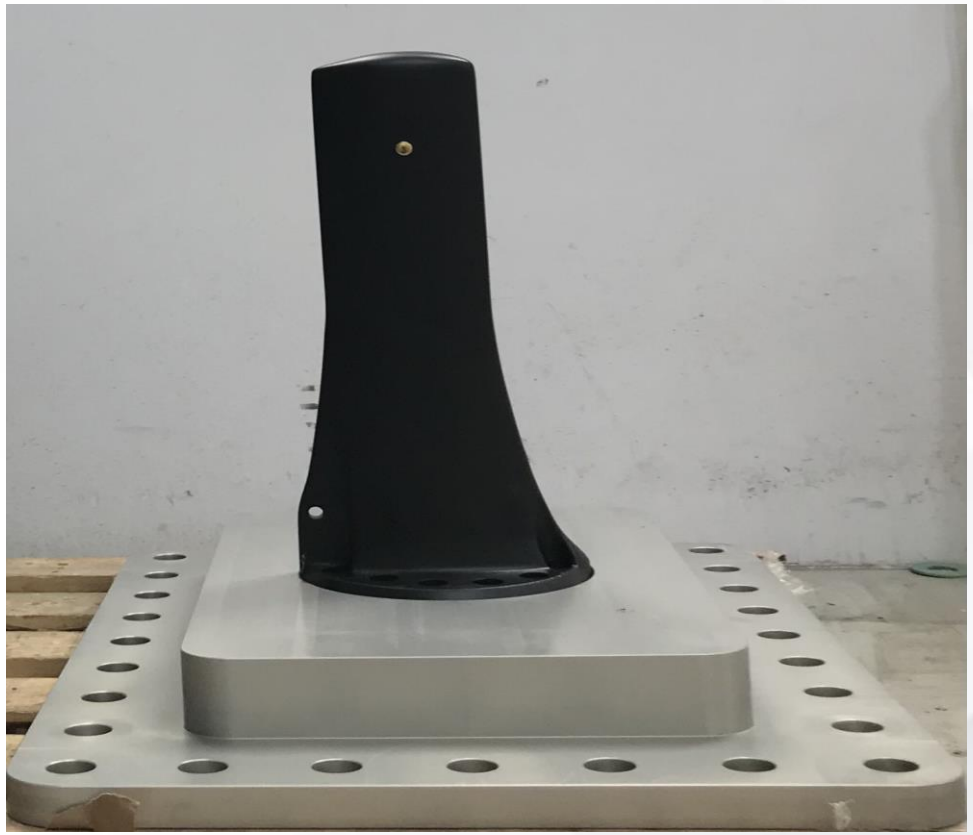


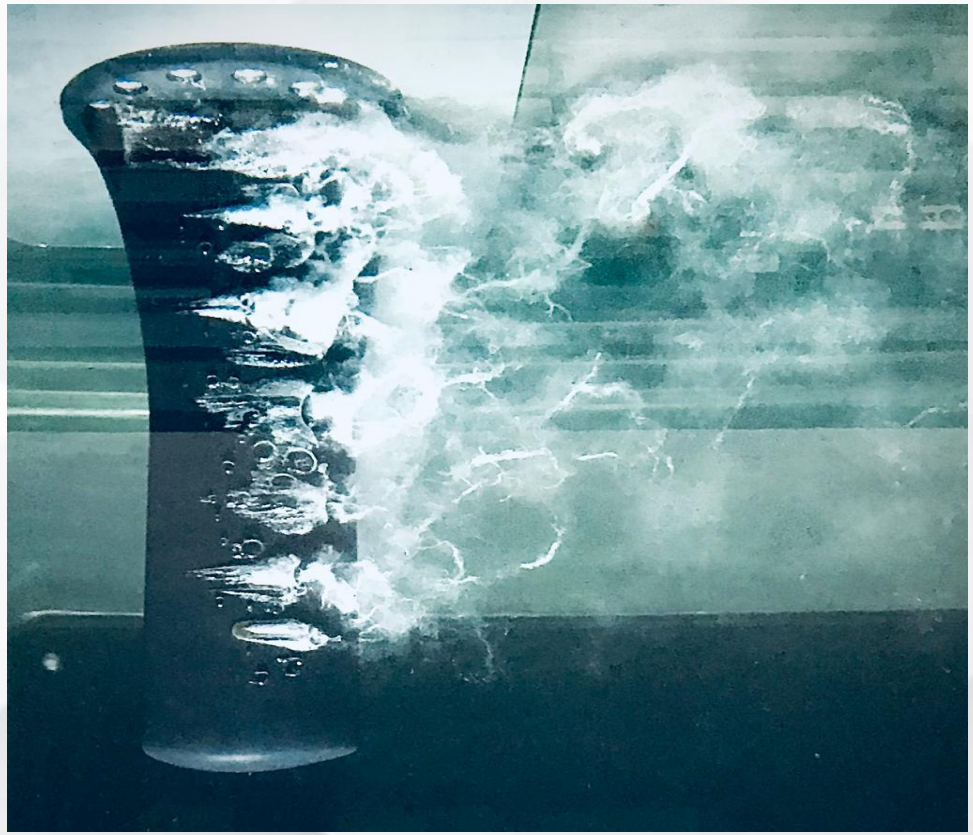


# Cavitation Erosion Tests

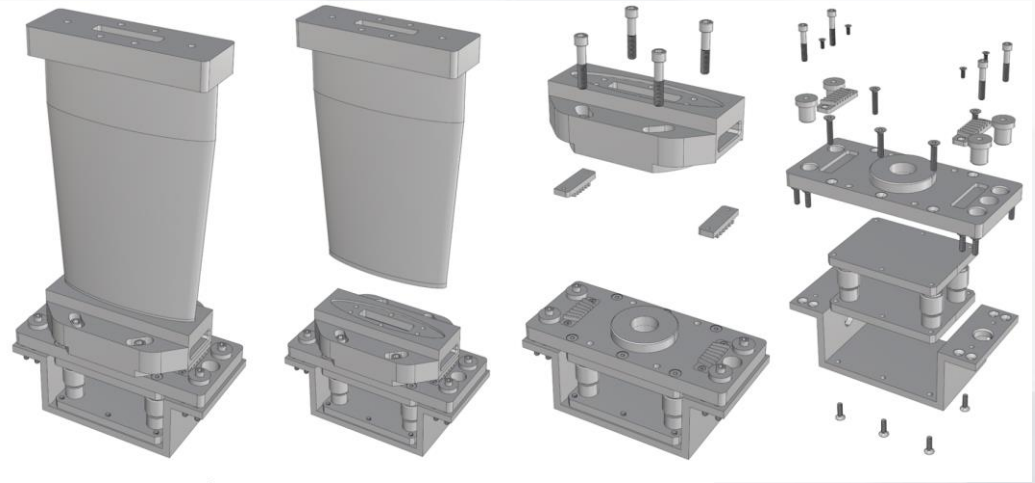


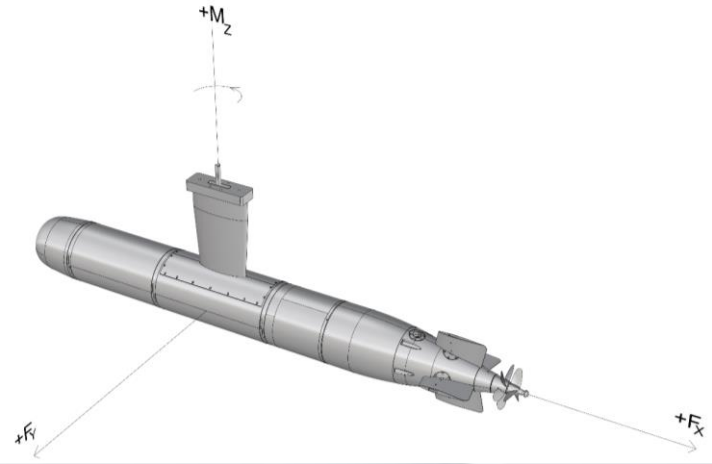
# Speed Log Calibration





# Model Connection Design

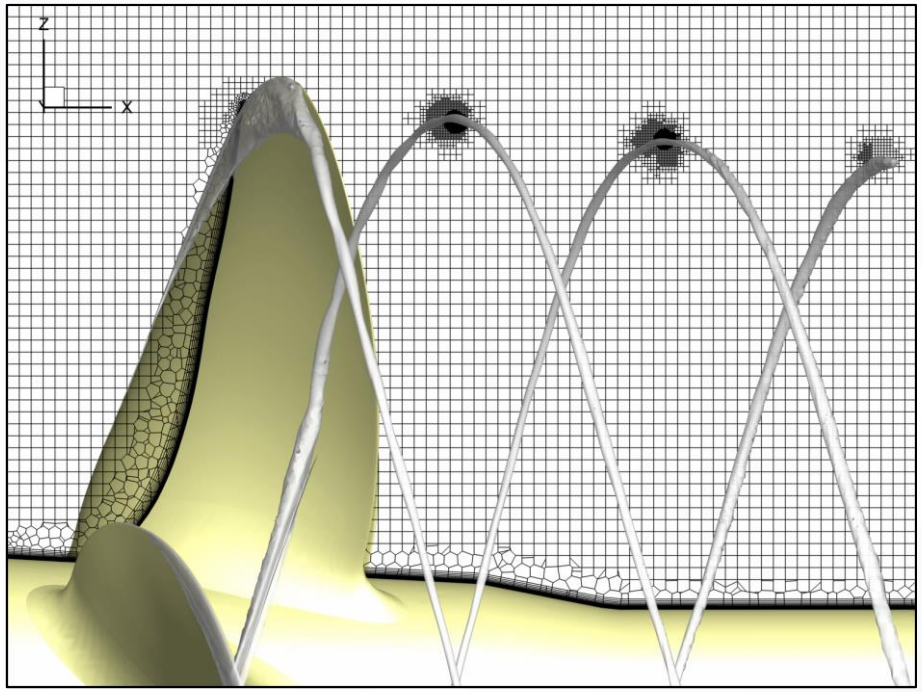


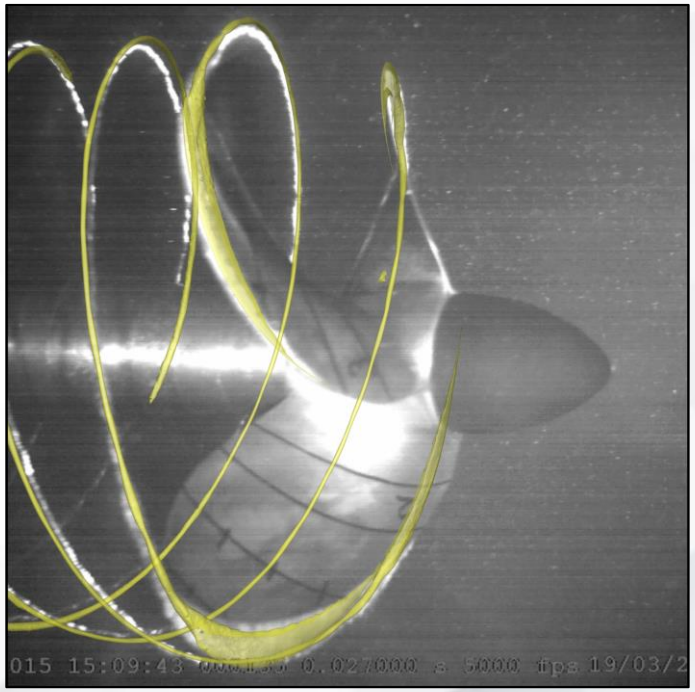


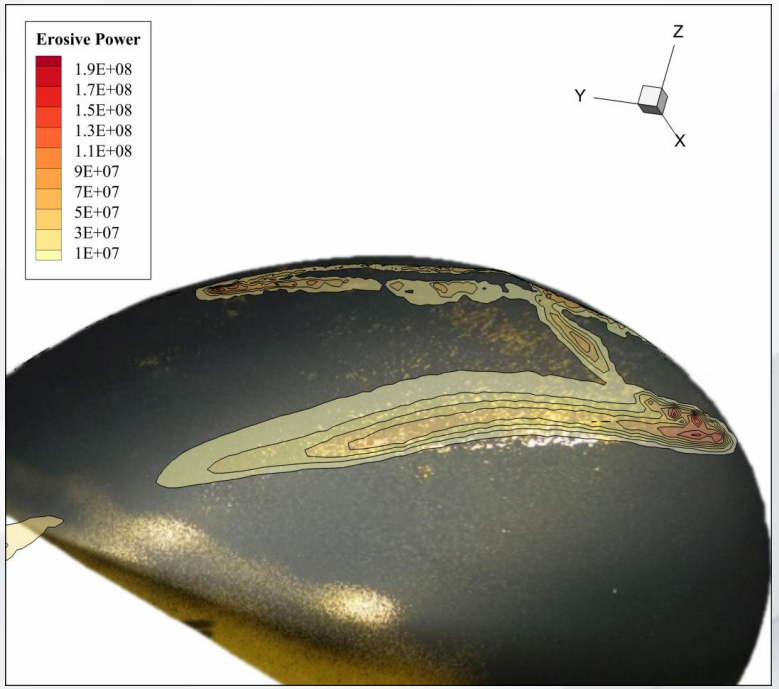
# CFD Analysis

- Multi degree of freedom analyses of underwater/surface vessels
  - ✓ Resistance analysis
  - ✓ Self-propulsion analysis
  - ✓ Wave effect analyses in different sea states
  - ✓ Force and moment calculations
  - ✓ Ship pressure pulse analyses
  - ✓ Wind load analyses
- Propeller performance and cavitation analyses
  - ✓ Propeller open water and cavitation analyses
  - ✓ Thrust and torque calculations
  - ✓ Flow/cavitation noise analyses
- Detailed visualization analyses
- Sloshing analyses

# CFD Analysis

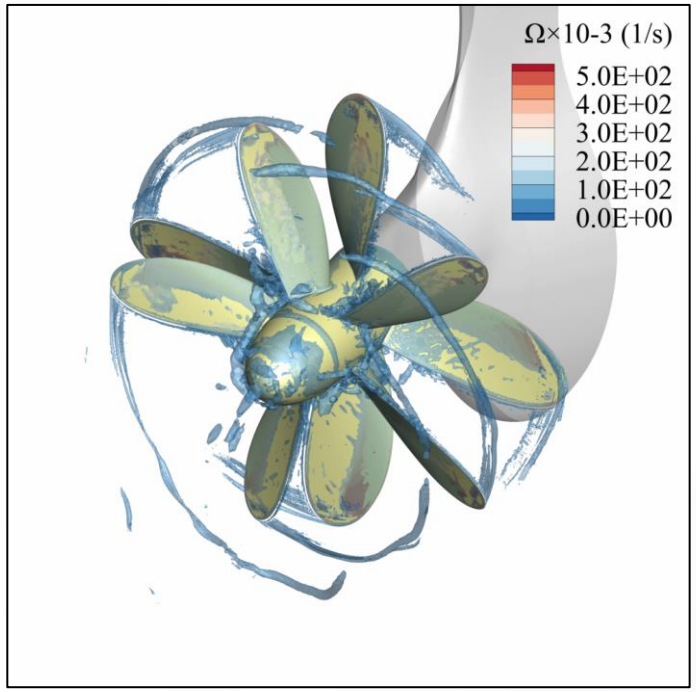


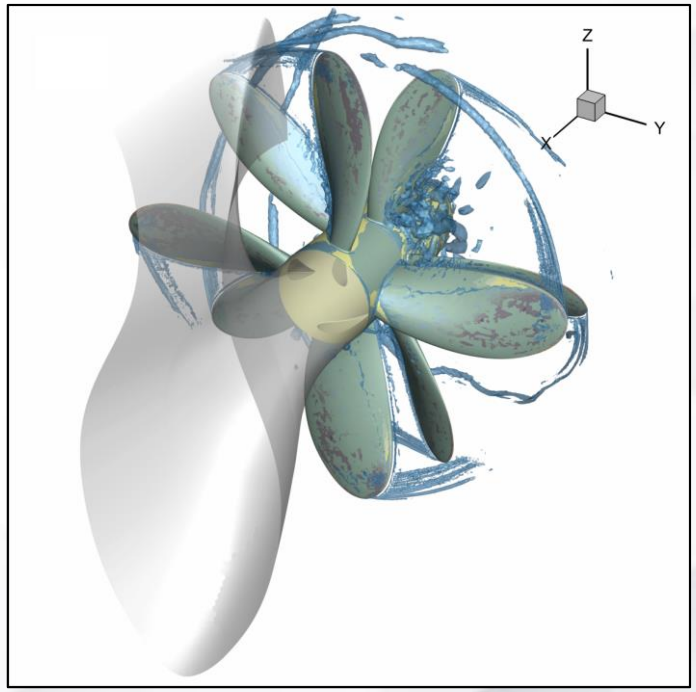



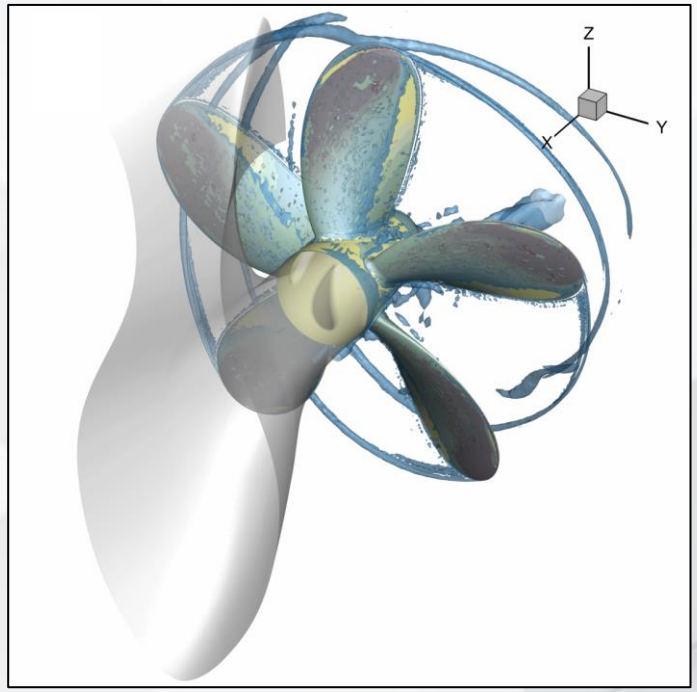



Cavitation analyses

# CFD Analysis

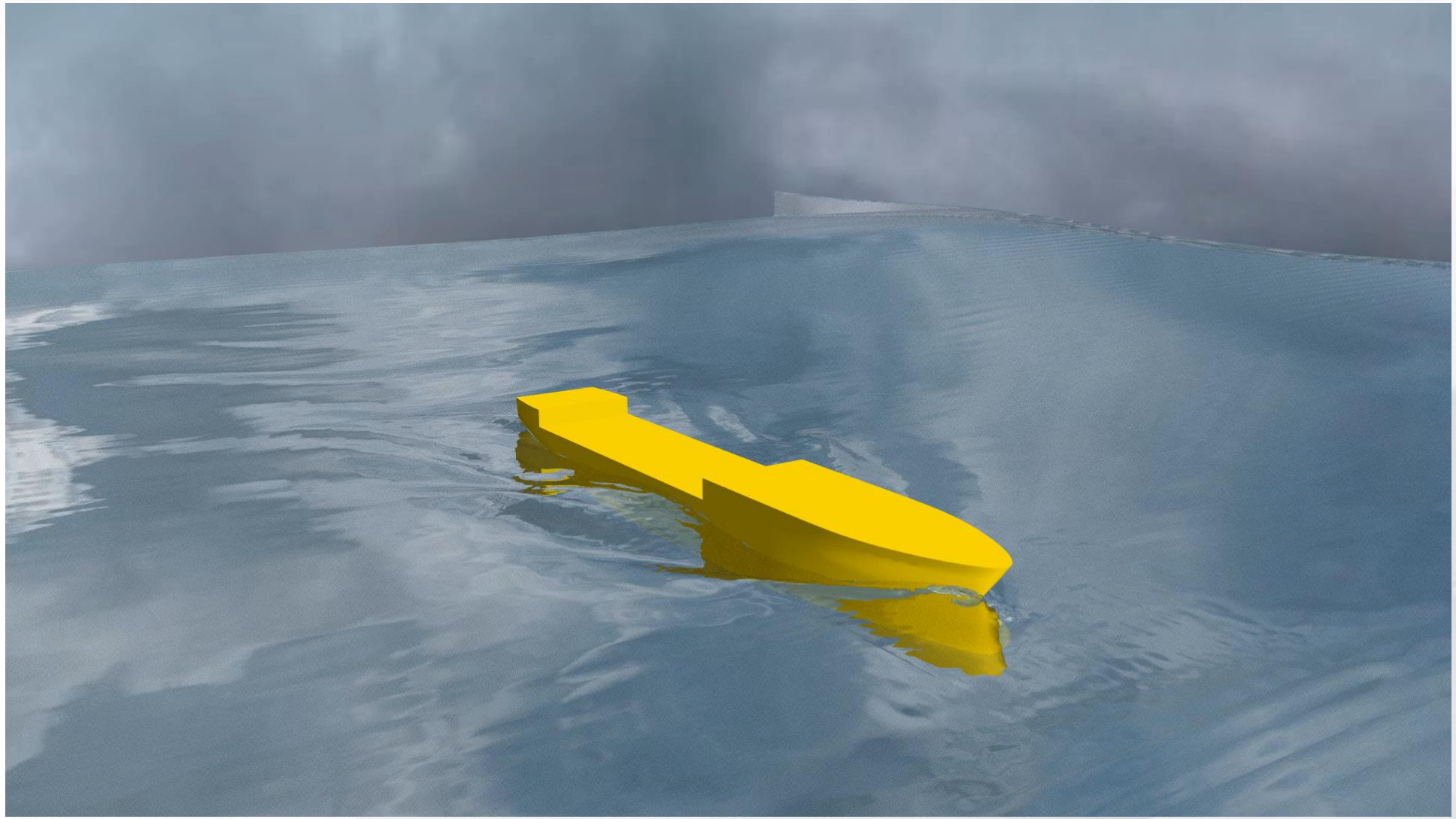


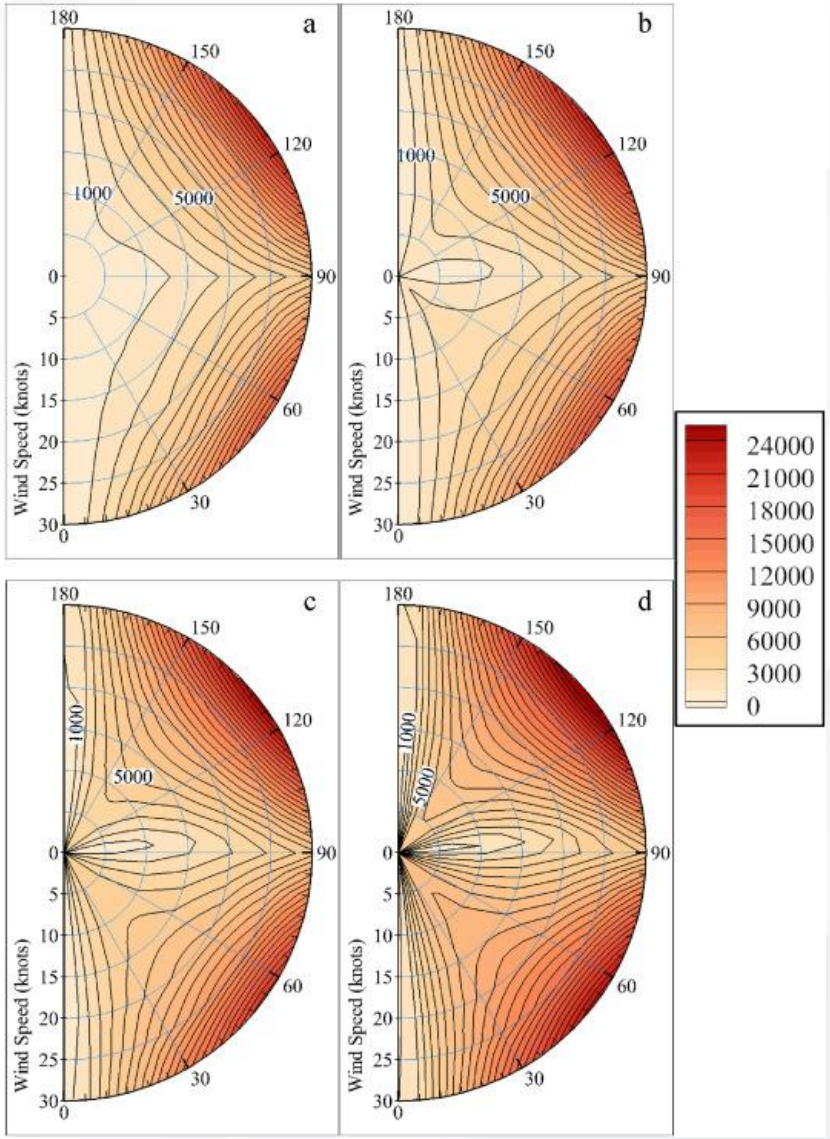

CRP analyses

# CFD Analysis

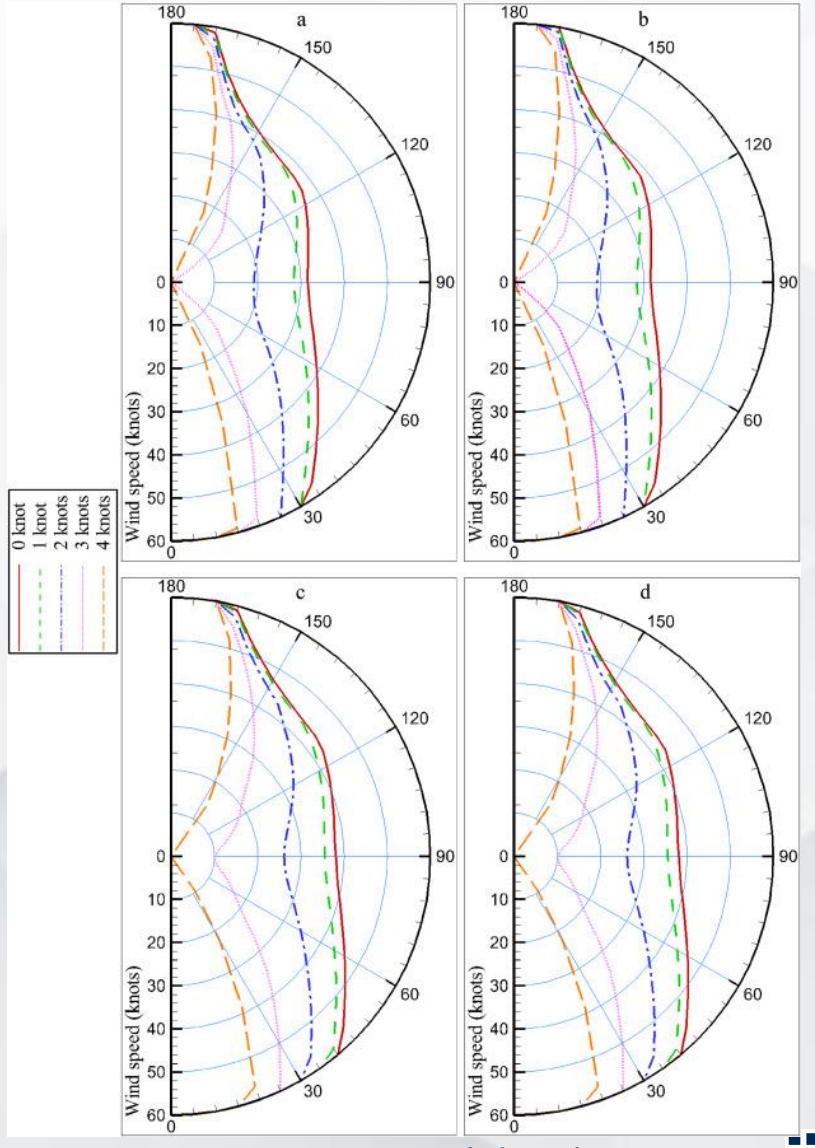


Multi degree of freedom analyses

# CFD Analysis

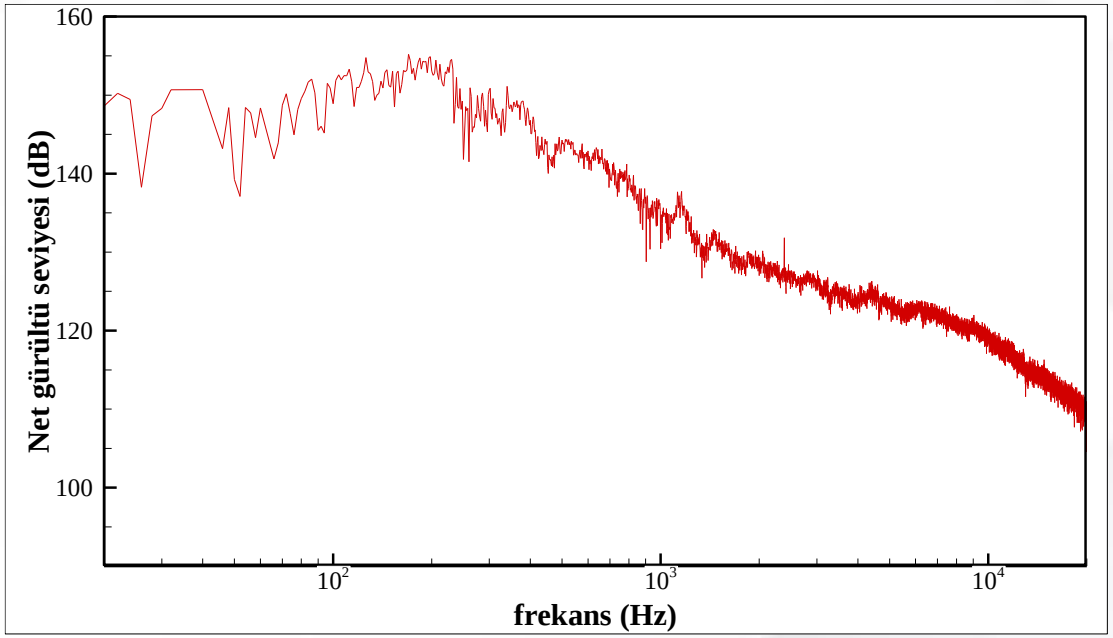



Environmental load polar diagrams

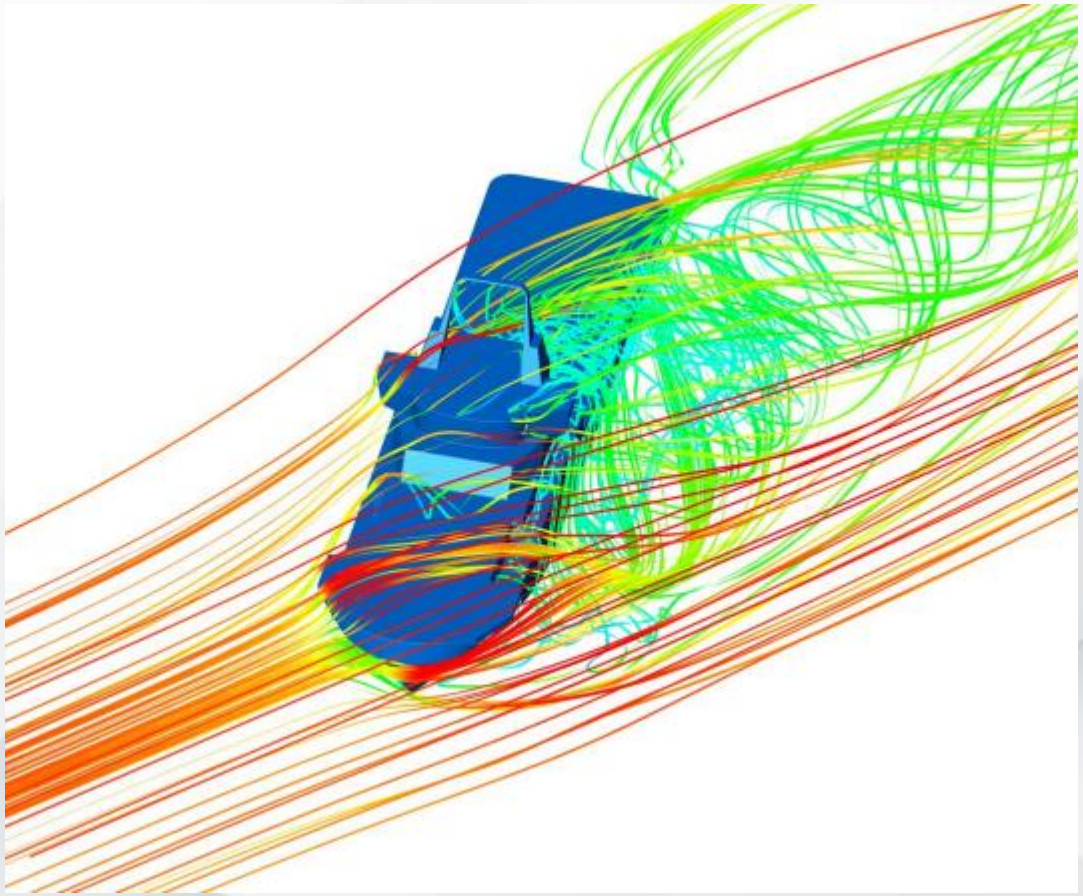



Dynamic positioning capability diagram

# CFD Analysis

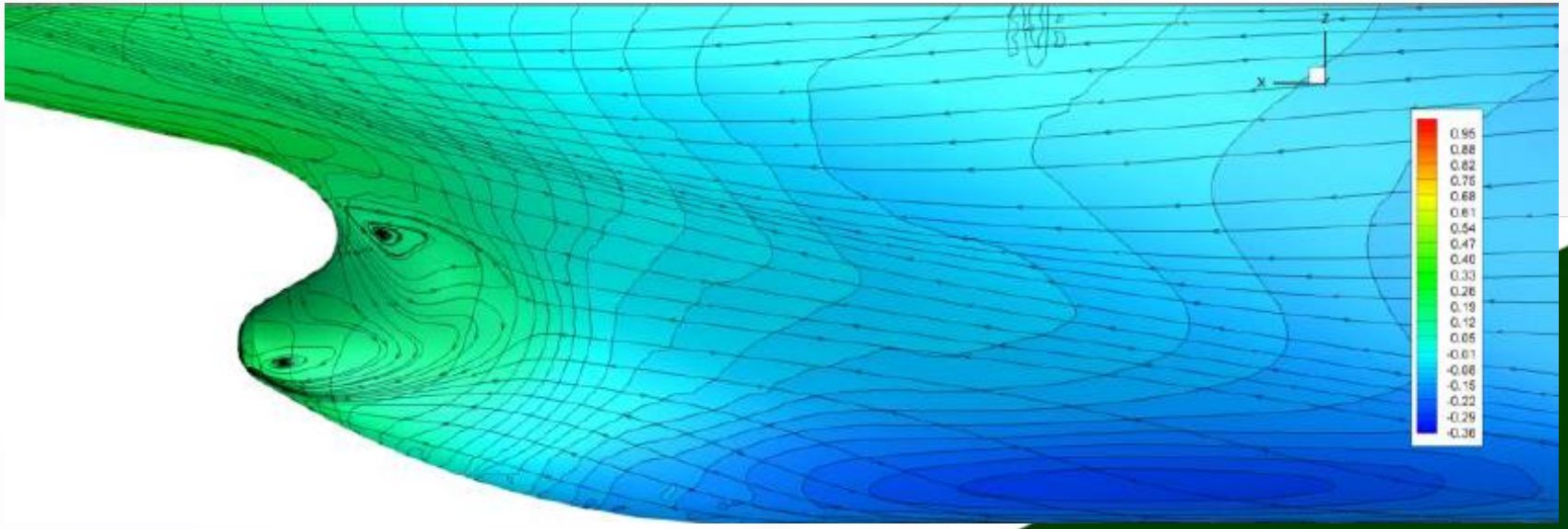


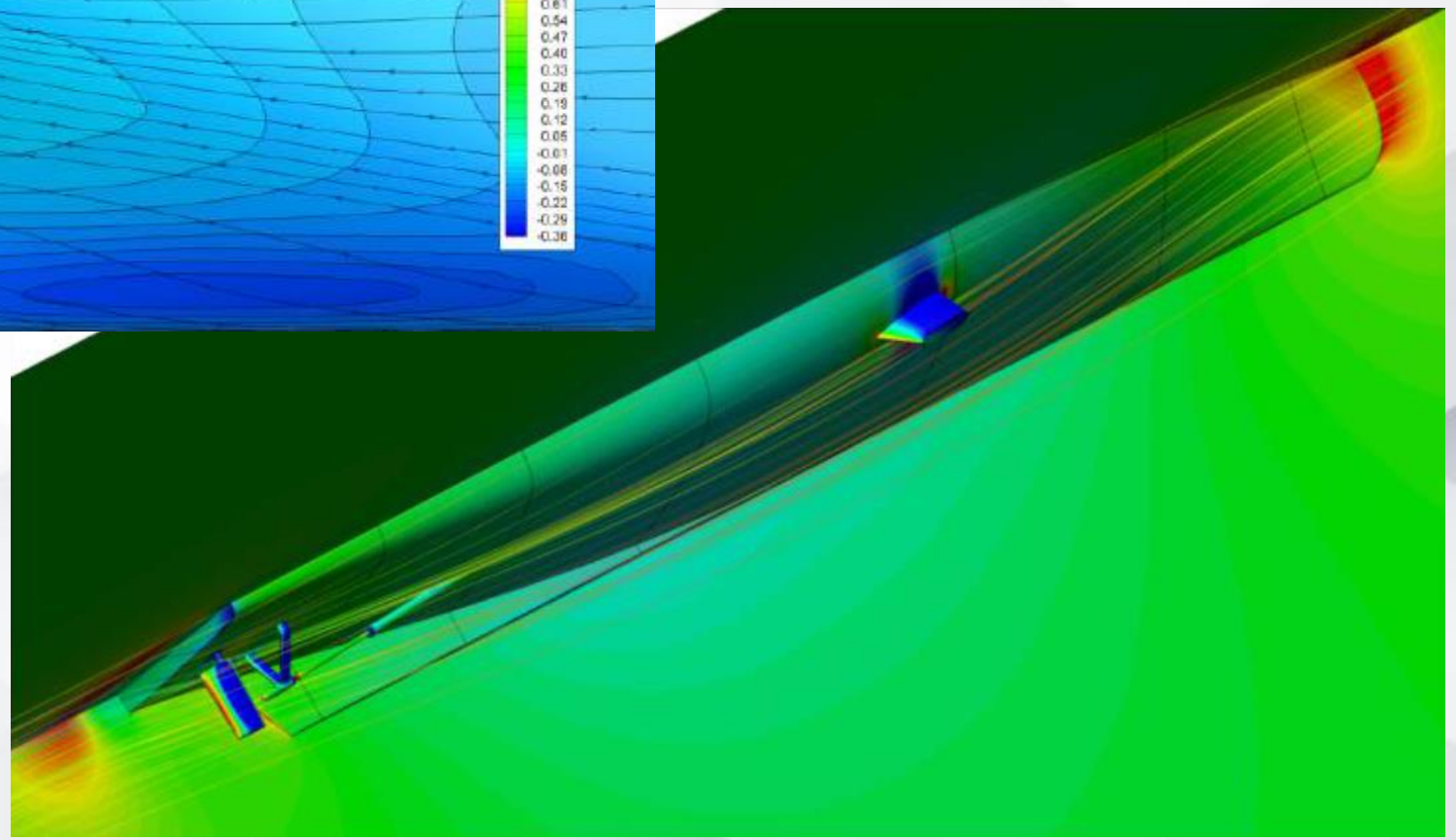

Noise analyses



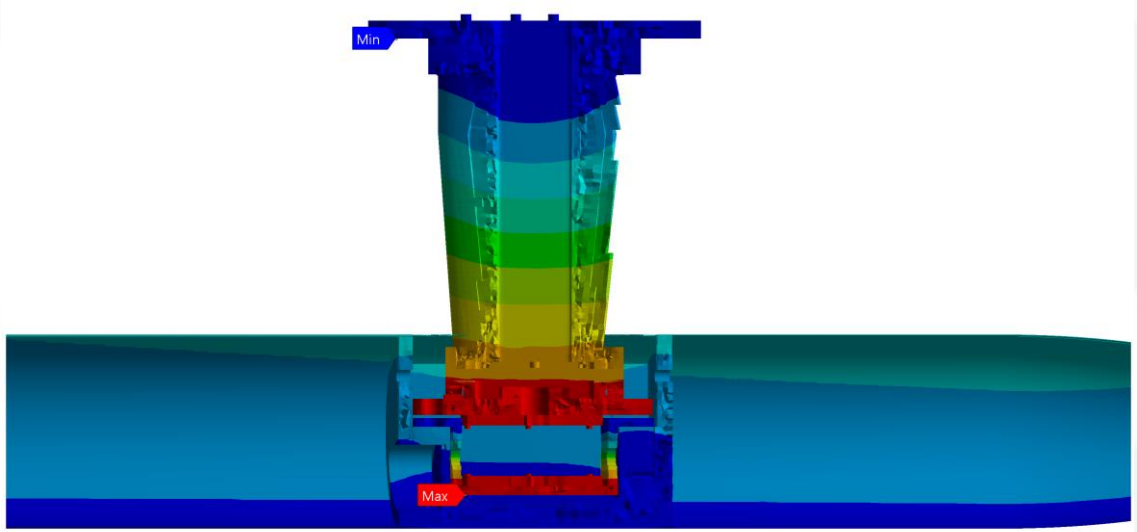
Wind load analyses

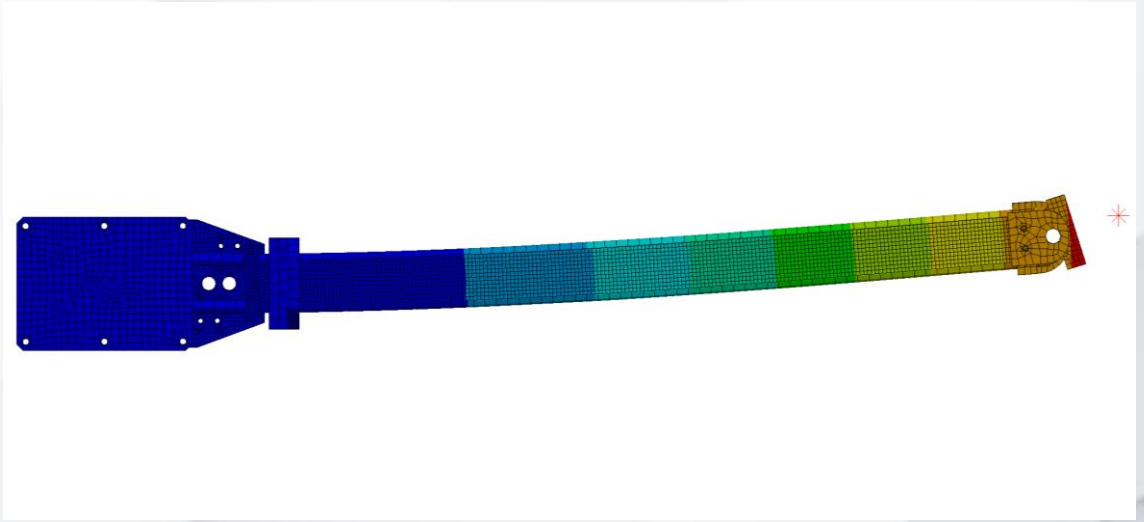
# CFD Analysis



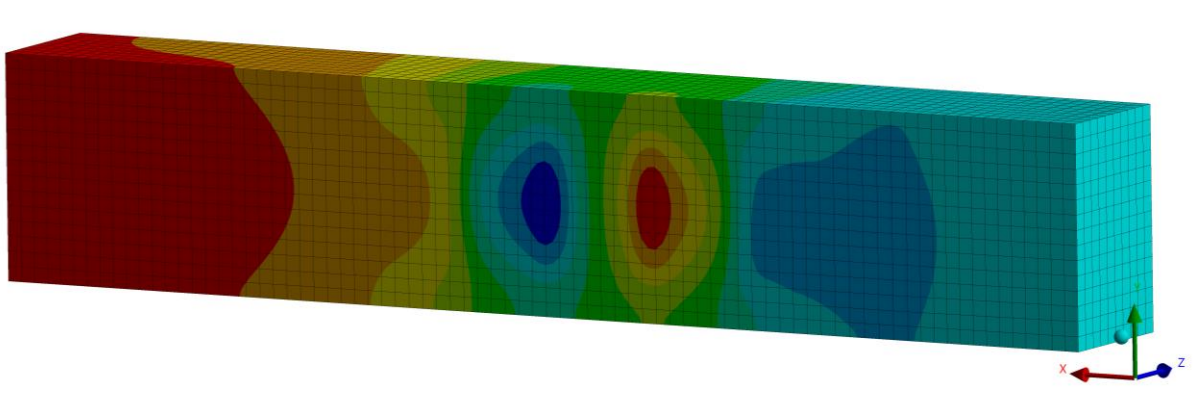



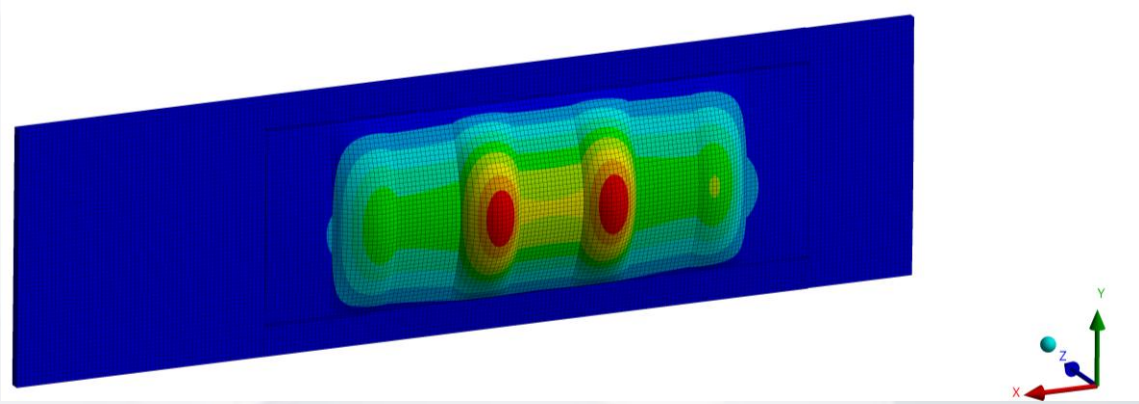
# Structural Analysis



# Structural Analysis





## Completed Projects

- TORK torpedo force, moment, propulsion and noise tests (ASELSAN)
- Numerical and Experimental Investigation of Cavitation Erosion on Ship Propellers (TUBITAK 1001 Project)
- GATERS (Gate Rudder System as a Retrofit for the Next Generation Propulsion and Steering of Ships, EU Projects)
- Offshore Patrol Vessel open water, cavitation and noise measurements tests (ASFAT)
- TF-2000 Frigate open water, cavitation and noise measurements tests (ASFAT)
- ESTHETICS (Energy Saving Techniques for Energy Efficient Vessels and Emission Reduction toward Green Shipping, TUBITAK 2549 Poland)
- LCT ship open water, cavitation and noise measurements tests (ADİK)
- Speed log calibration (Gölcük Tersanesi)

## Completed Projects

- Offshore Patrol Vessel (Stage-2) open water, cavitation and noise measurements tests (ASFAT)
- TF-2000 Frigate (Stage-2) open water, cavitation and noise measurements tests (ASFAT)
- Natural Supercavitation tests (ROKETSAN)

## Ongoing projects

- AKYA torpedo, contra rotating propeller tests (ROKETSAN)
- AKYA torpedo hydrophobic surface coating performance tests (ROKETSAN)
- Artificial Supercavitation tests (ROKETSAN)
- Immersed body geometry force, moment measurements and cavitation tests (TUBITAK-SAGE)
- ORKA Pump-jet propulsion system tests (ROKETSAN)

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# Thank you