Corporate Overview

Fiorenzo Spadoni
Yachting Sector Manager

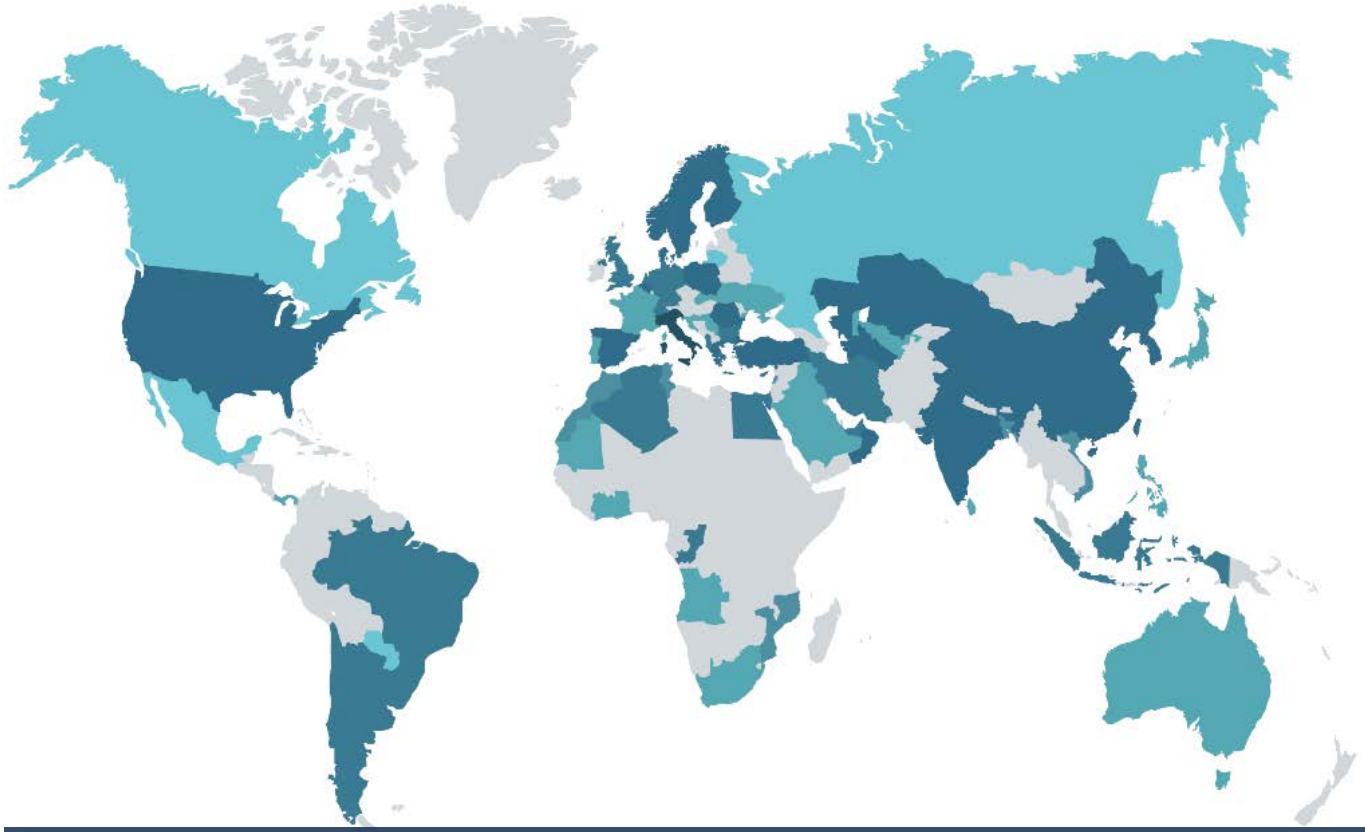
Competence and Experience

OVER 150 YEARS OF EXPERIENCE

RINA provides certification, testing, inspection and consulting services across different sectors through a global network of 170 offices in 65 countries.

RINA is a member of key international organizations and an important contributor to the development of new legislative standards.

What is RINA today



3700
Colleagues

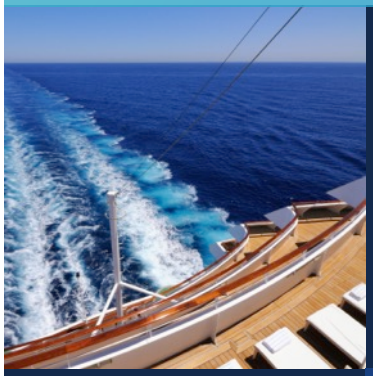
170+
Offices

65+
Countries

LEVEL OF RINA PRESENCE

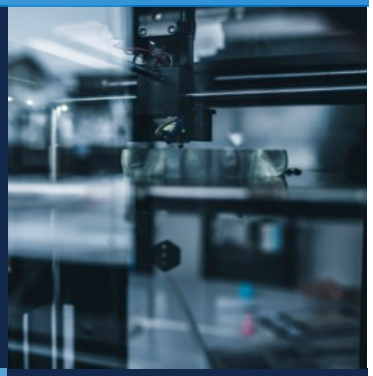
Our markets

SERVICES FOR:



Marine

Industry



Energy

Transport & Infrastructure

Certification

RINA YACHT SERVICES

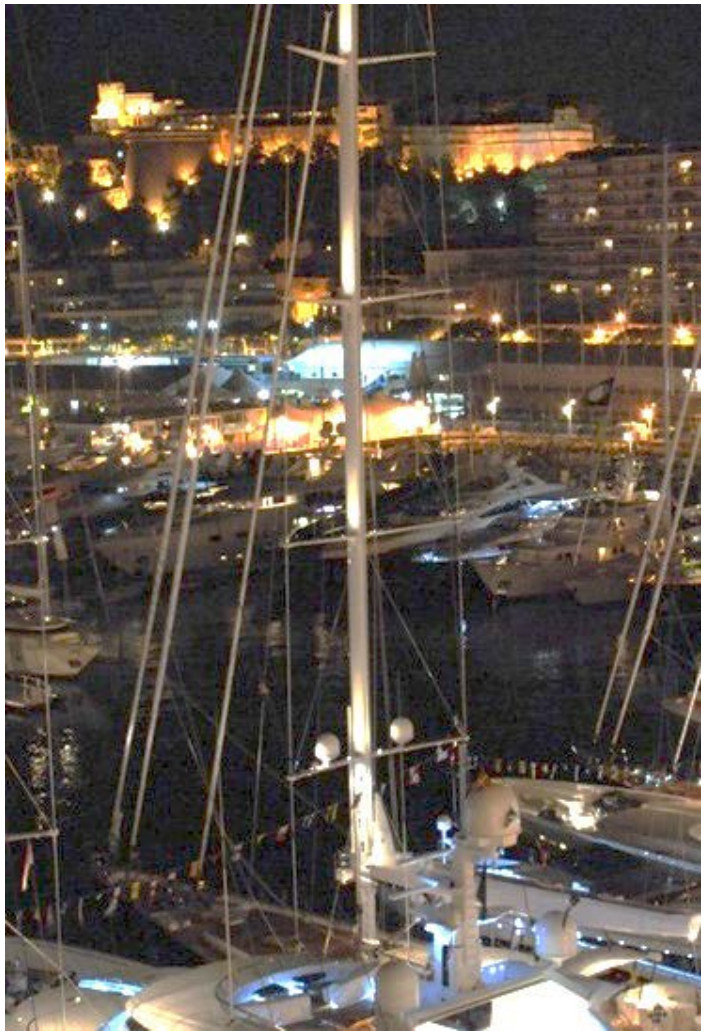
Some figures

- 1.300 classed yachts
- > 30% market share
- 250 new projects worldwide

- 4 dedicated Plan Approval Centres:
- Italy, Turkey, China, UK + Hamburg

International Recognitions

- Certifying Authority for small commercial vessels (MCA, Malta..)
- Notified Organizations for EC directive 2013/53/EU, NMMA technical body
- Recognized organization by MCA for large commercial yachts
- Recognized by around 100 flag administrations



RINA rules
pleasure standard

RINA Rules for yachts (private service)

- Different requirements according to size and material of construction
- Typical classification marking:
  - C ✠ HULL; ● MACH; Y; Unrestricted navigation

RINA rules commercial standard

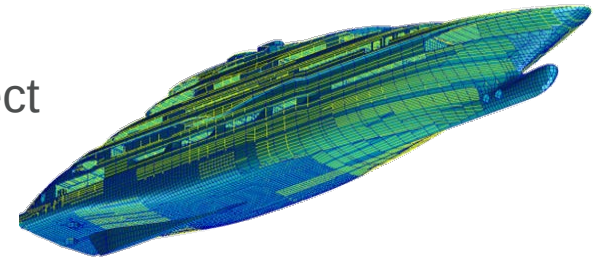
RINA Charter Class (commercial service)

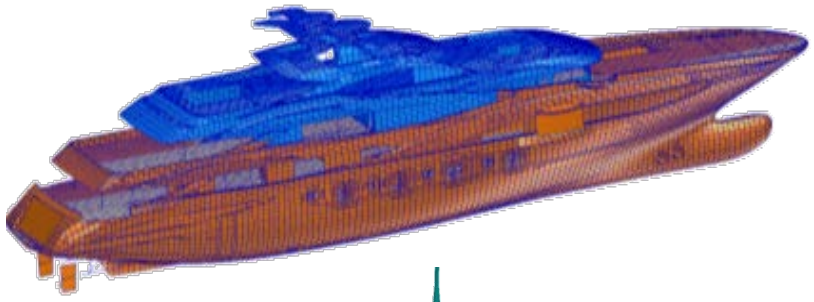
- Requirements in line with MCA - LY3
- Load Line and structural fire protection
- Typical classification marking:
  - C ✠ HULL; ✠ MACH; Ych; Unrestricted or Short Range navigation

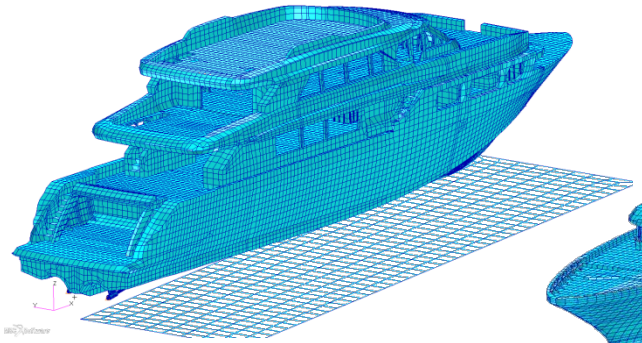
Additional Services

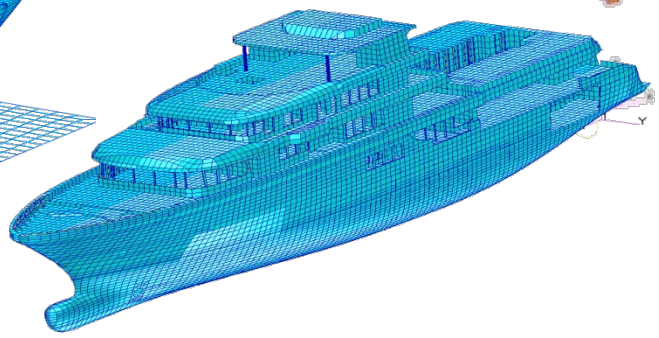
FEM for The Comfort

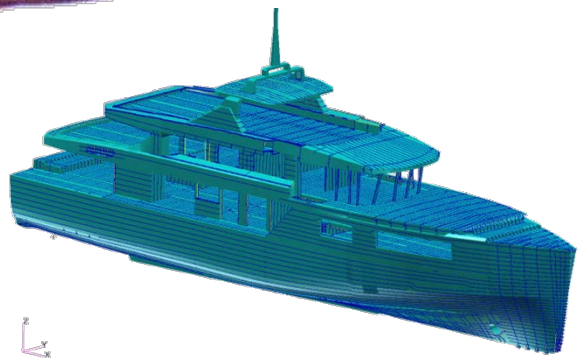
- Global and local FEM structural direct calculations
- Natural frequency analysis with the added mass effect
- Forced Vibration Analyses in frequency domain
- Comparison of the results with the COMF-VIB requirements







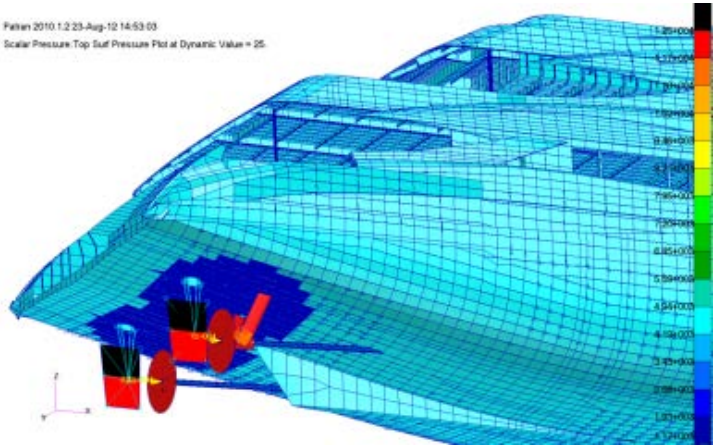


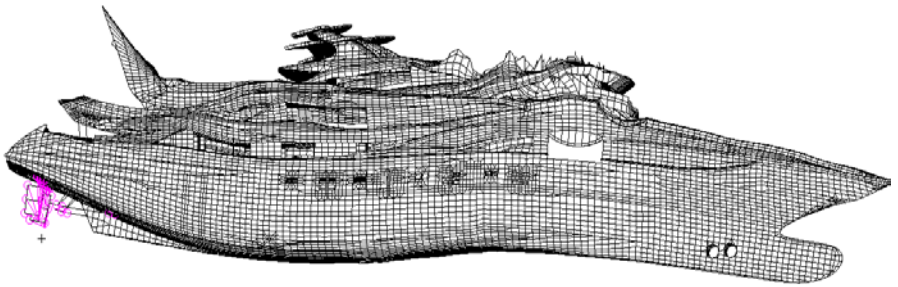


Vibration prediction

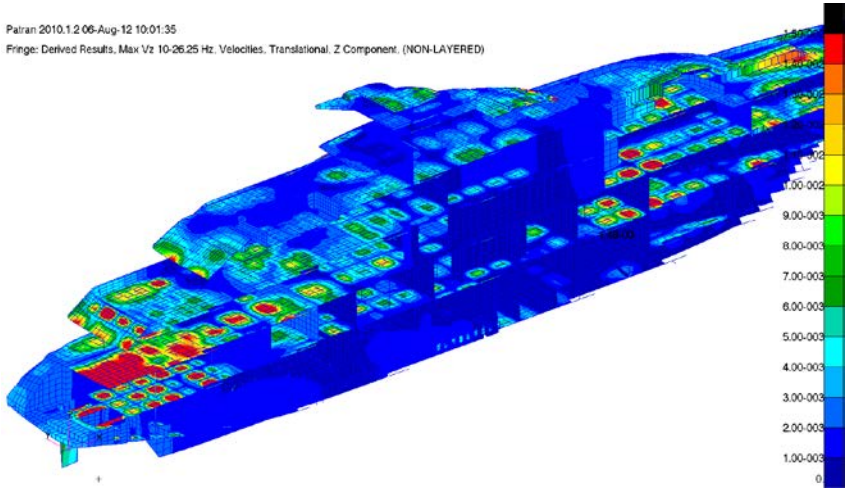
Vibration prognosis:

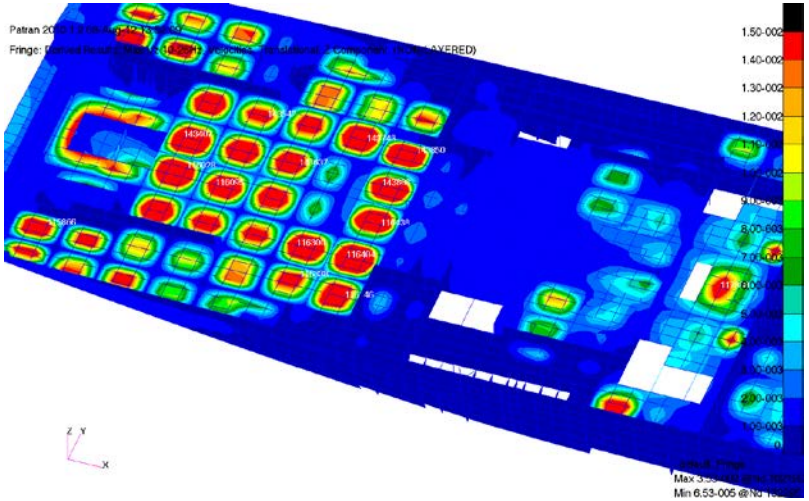
- Global vibration analysis through finite element method (FEM), taking into account also the effects of the fluids through the added mass capability of the Nastran code
- Detailed local dynamic analysis by means of forced vibration response with refined (fine mesh) FEM model
- Whirling analyses of the shaft line





Vibration prediction

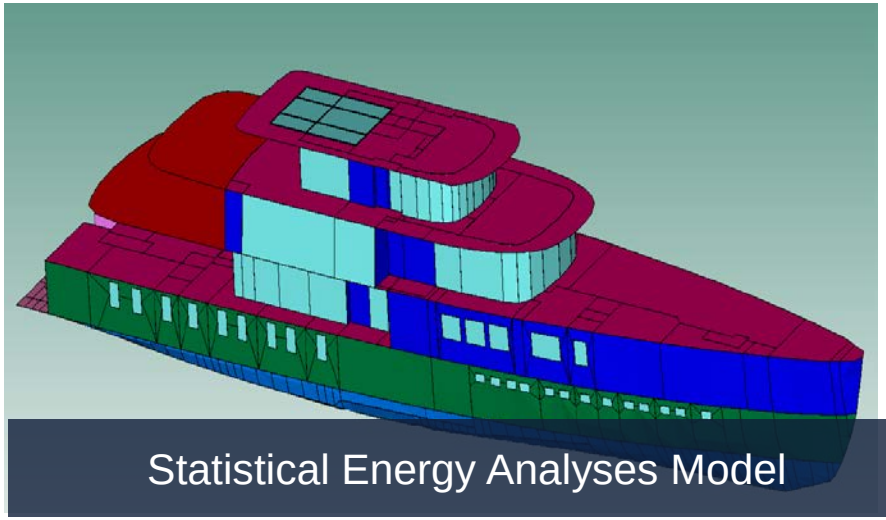




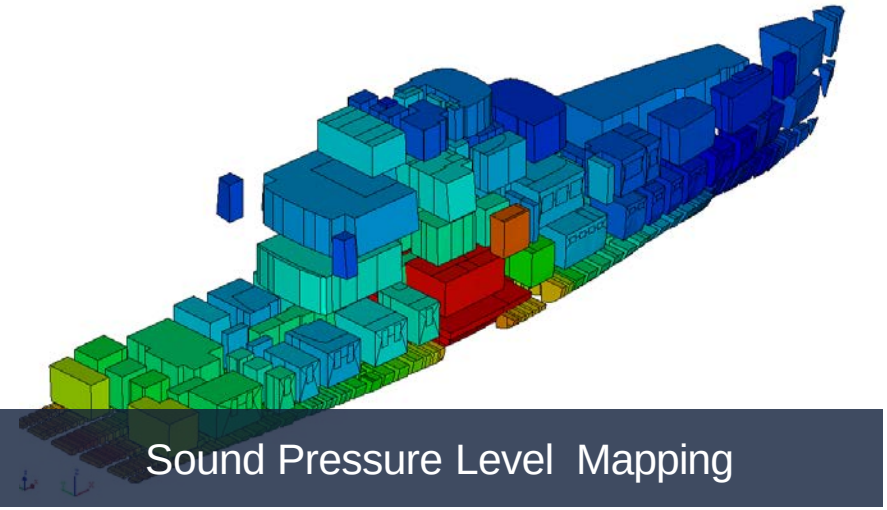
90m steel yacht
Vibrations' hotspots

SEA - Introduction

- Statistical energy analysis is a method for studying diffusion of acoustic and vibration statistical energy term in a system
- The Energy is the primary response quantity of interest, Secondary variables such as displacement and pressure are found from vibration energy



Statistical Energy Analyses Model



Sound Pressure Level Mapping

Case study Hybrid local model

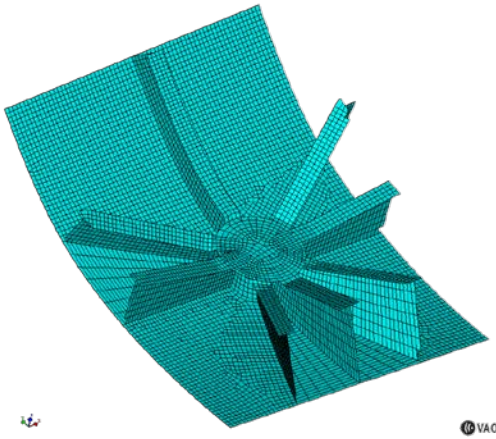
HYBRID COMPONENT MODEL

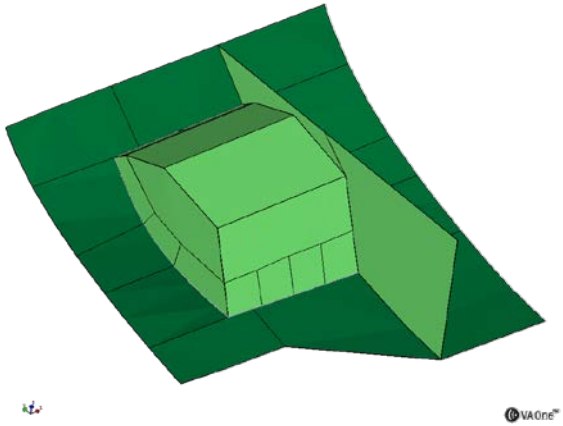
FE:

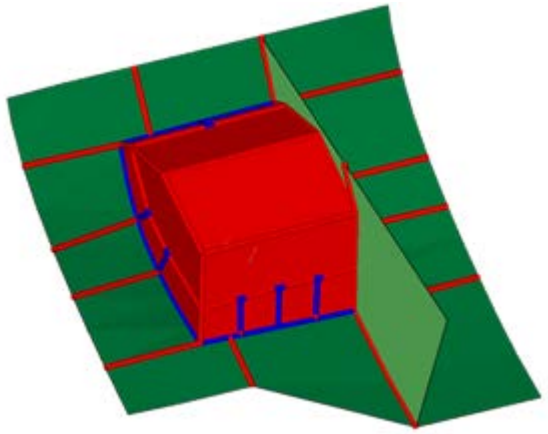
- Structures of the foundation where the fin actuator is fitted

SEA:

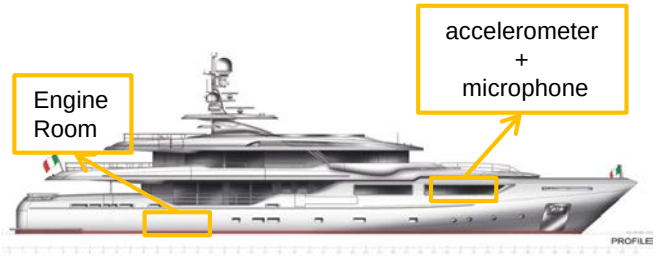
- Panel of the fin stabilizer compartment and surrounding panels of the hull



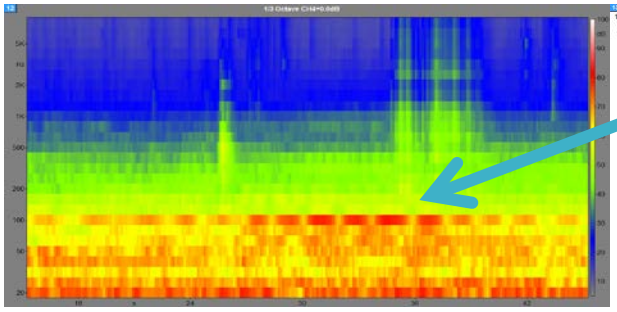


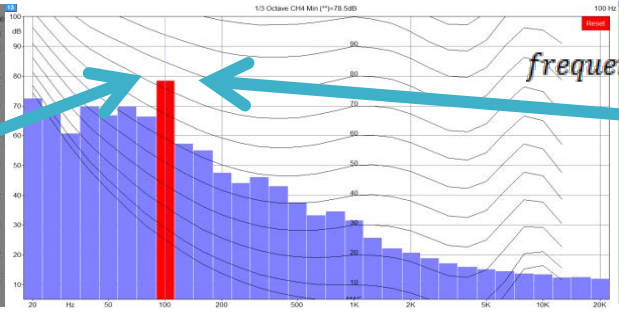


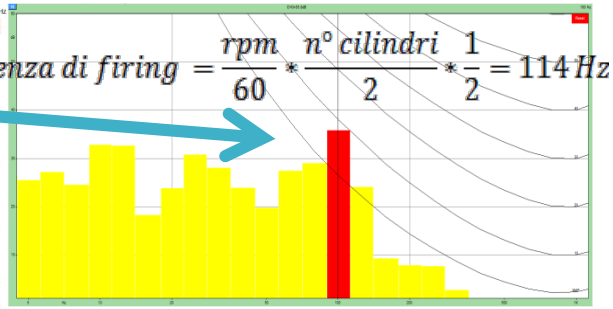
Glass surface critical item for COMFORT



Radiate Noise from Large Windows Glass (dominant tone)



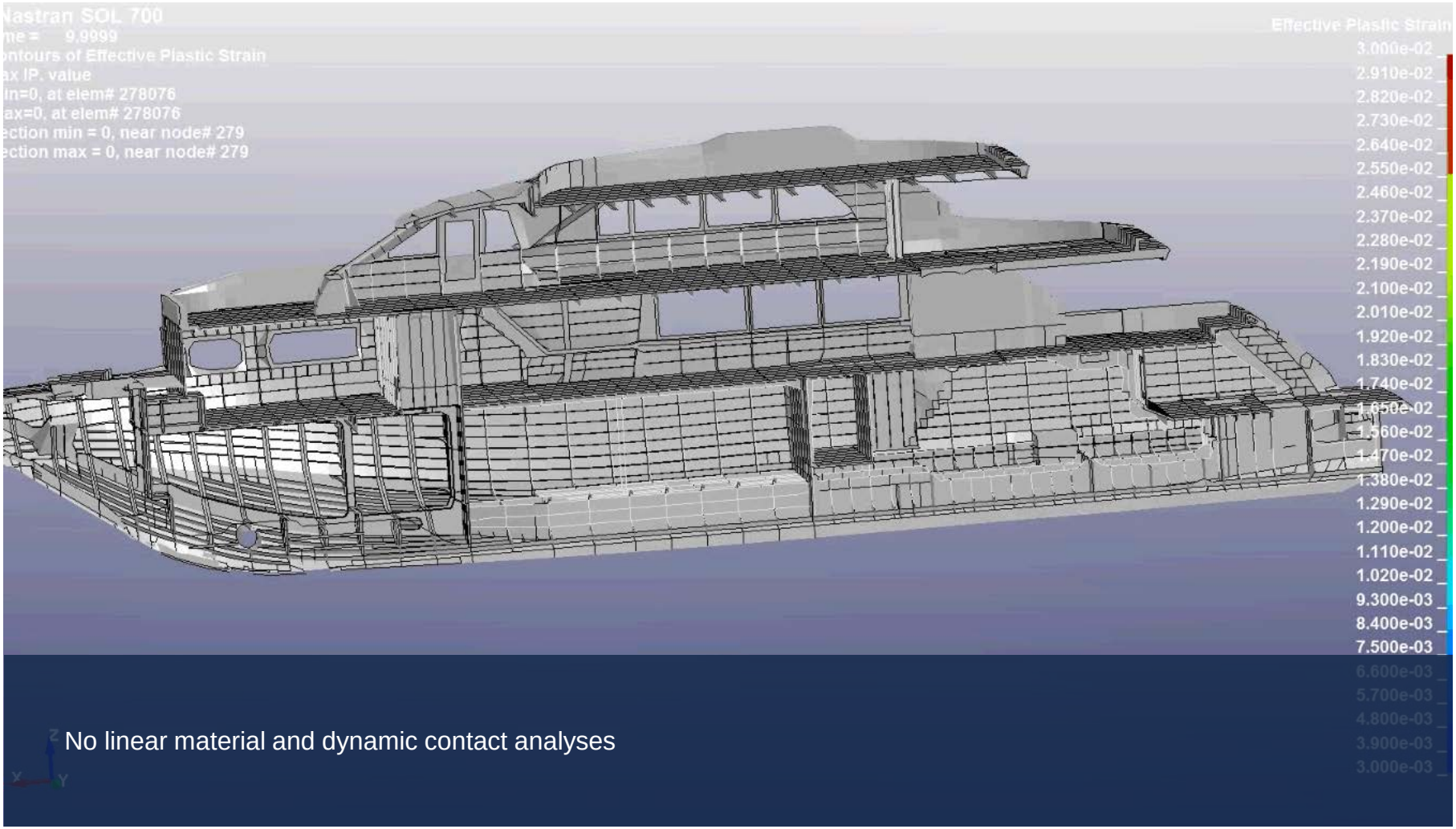




$$frequenza\ di\ firing = \frac{rpm}{60} * \frac{n^{o}\ cilindri}{2} * \frac{1}{2} = 114\,Hz$$

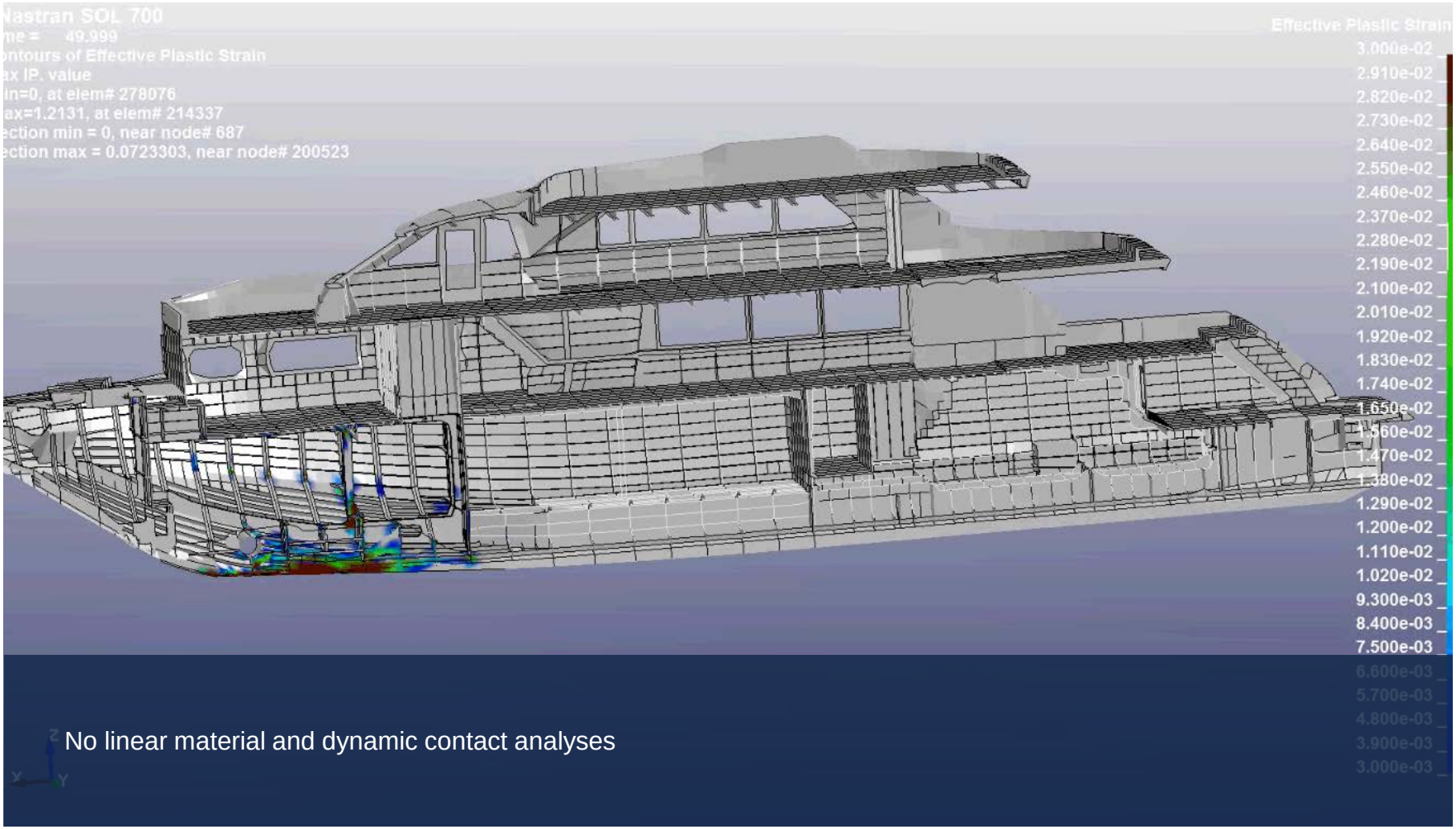
Sonogram Sound Pressure Level inside cabin	ISO-phone curves and airborne noise spectrum	ISO-phone curves and structural borne noise spectrum (windows)

Structural Integrity by FEM with Global Model



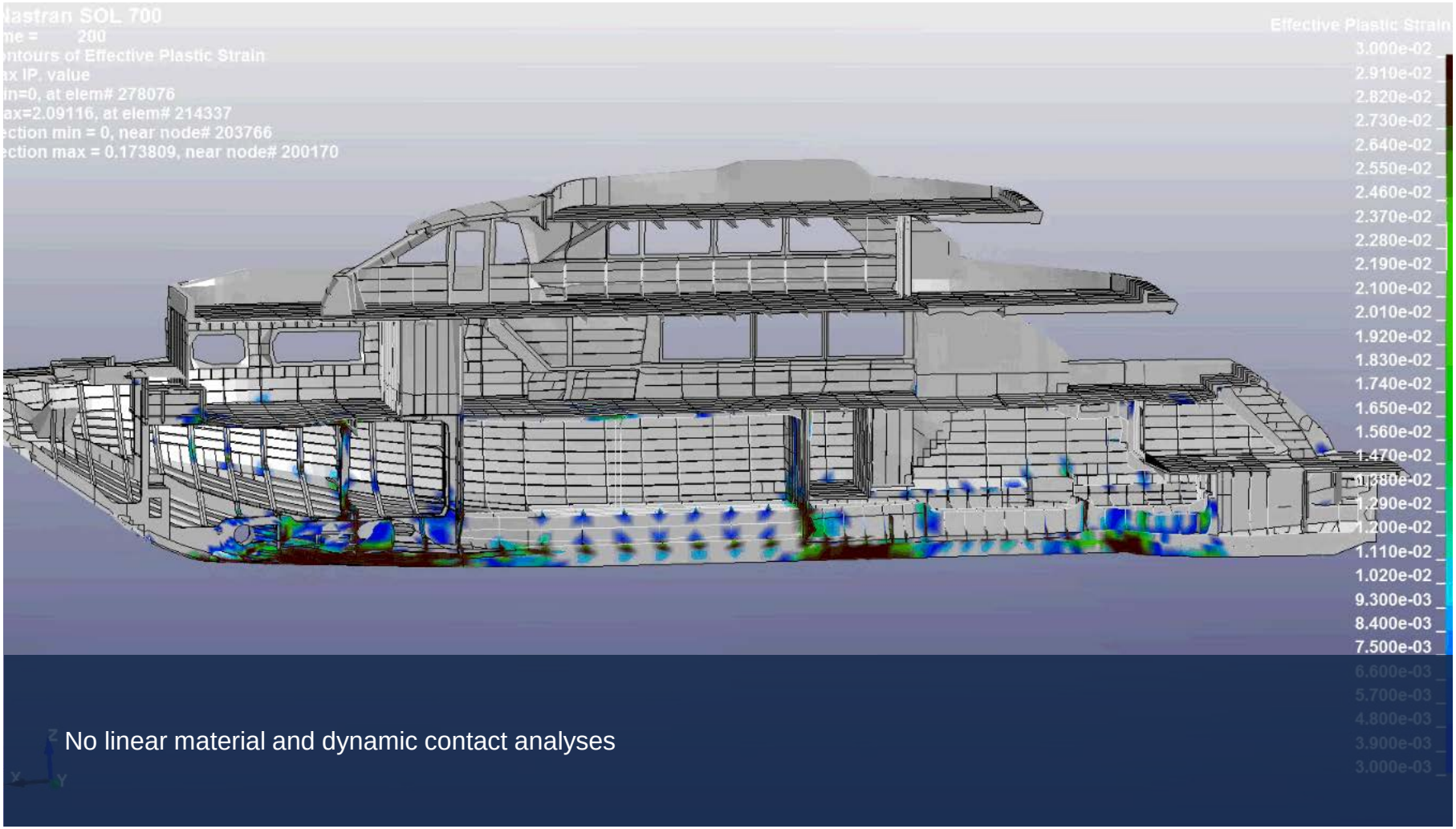
No linear material and dynamic contact analyses

Structural Integrity by FEM with Global Model



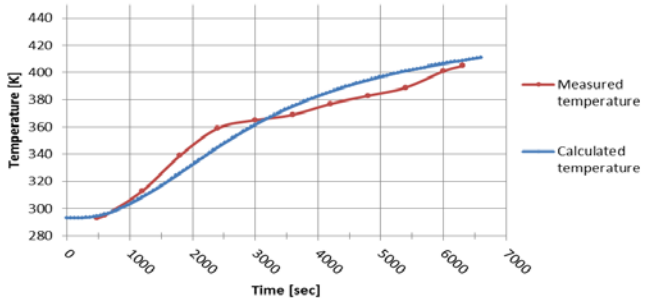
No linear material and dynamic contact analyses

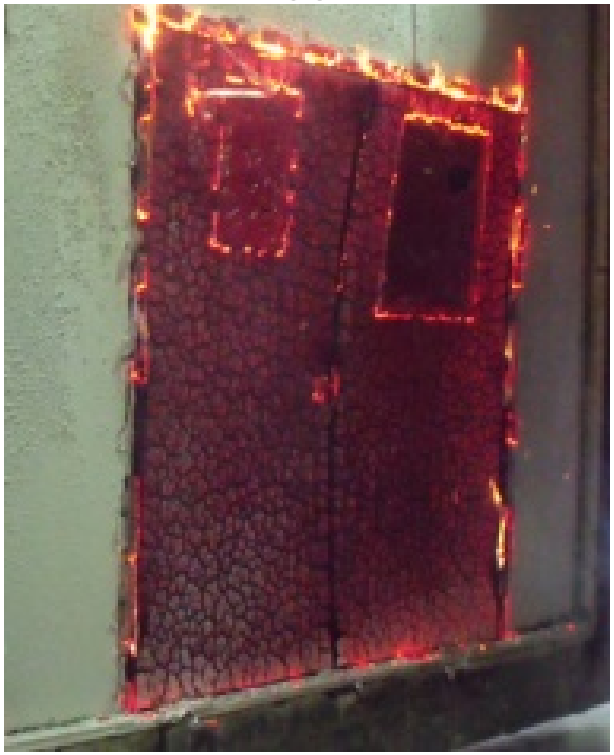
Structural Integrity by FEM with Global Model

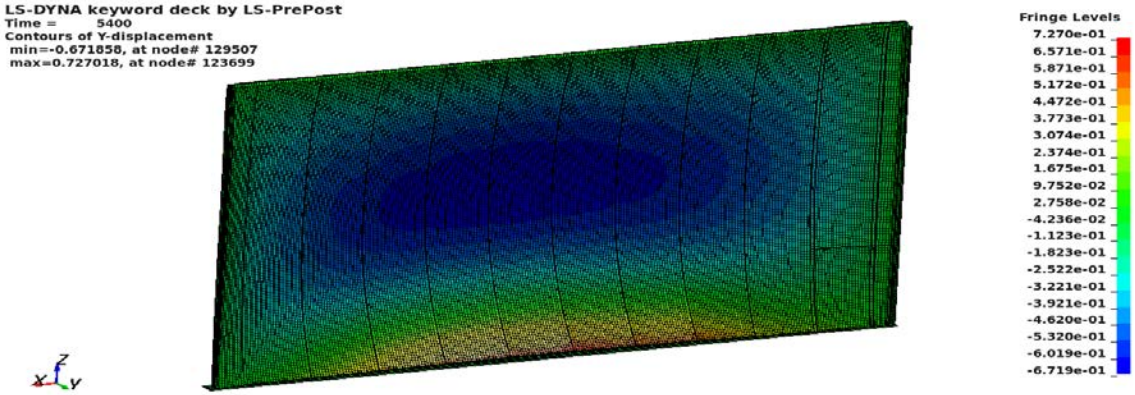


No linear material and dynamic contact analyses

Fire Test Extension



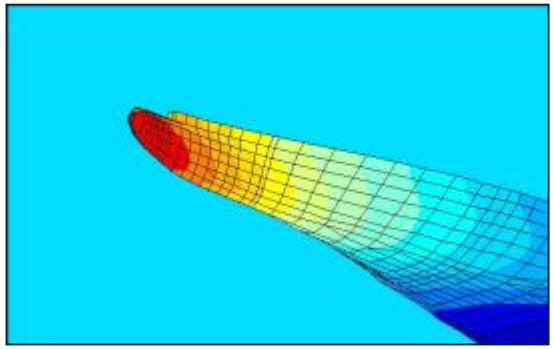




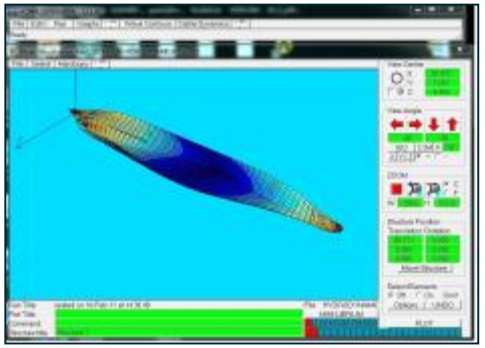
Seakeeping

Seakeeping behaviour of the ship is assessed

- Evaluation of seakeeping behaviour by means of industry recognised ANSYS AQWA software
- Direct calculation of loads on particular hull shapes not covered by Rules formulae (for direct strength assessment)
- Evaluation of comfort related to seasickness
- Evaluation of ship motions, deck wetness index, pressure mapping
- Pool sloshing



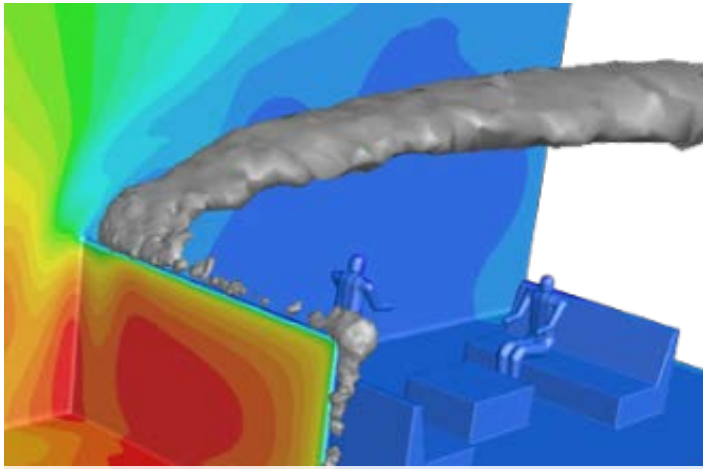
Pressure mapping on the complete hull surface



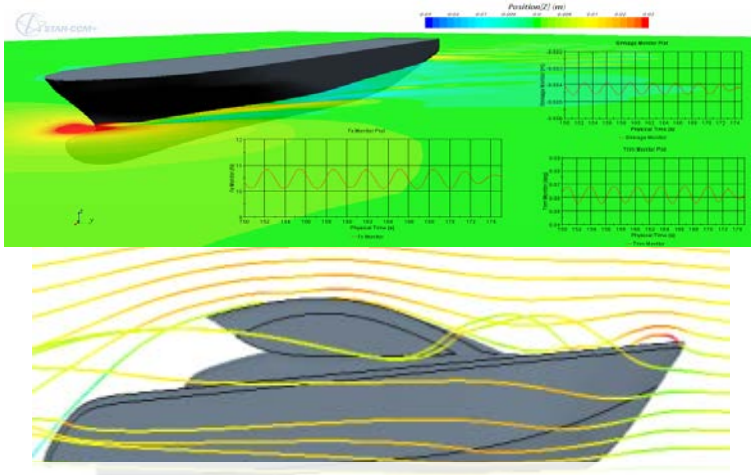
Pressure mapping: particular on the bulbous bow

CFD studies

- Comfort-related airflow detailed analysis
- Thermal distribution
- Turbulence analysis and aerodynamic noise evaluation
- Detailed coupling of natural and forced airflow convection



Aerodynamic pressure and iso-dB turbulence-related noise



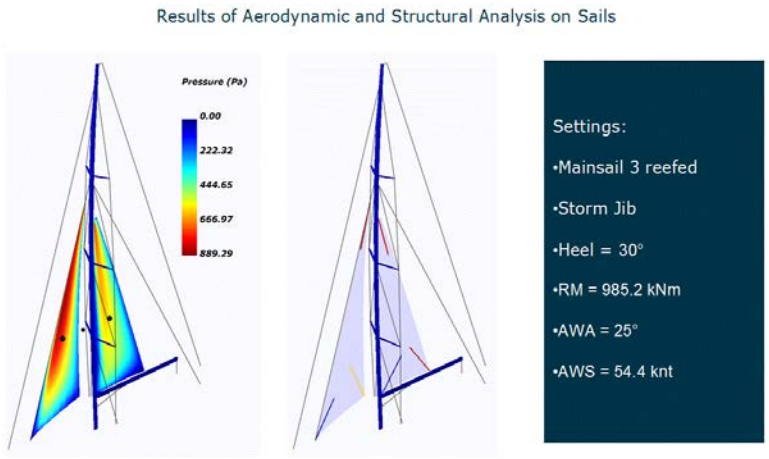
Airflow Streamlines around a ship deck

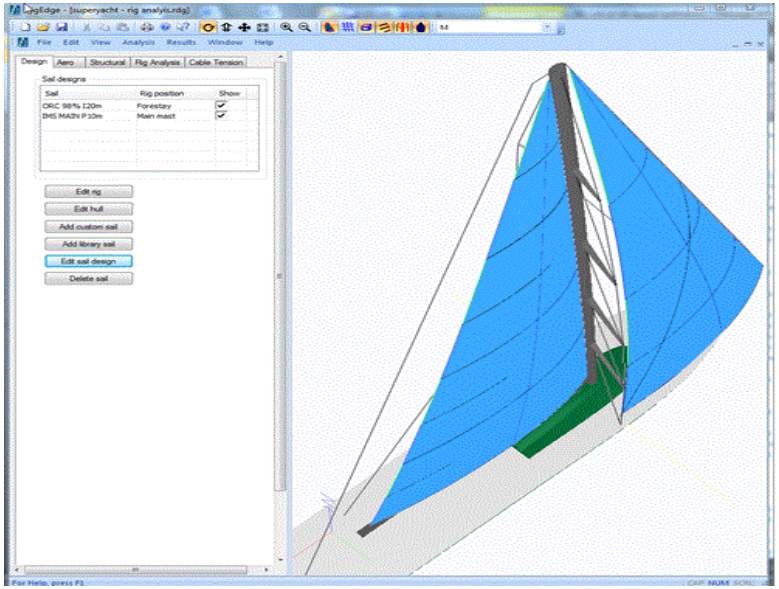
RINA RIG Rules: advanced tools

Inertial loads:

Structural assessment, RINA-Smar Azure software

- CFD + FEM integrated software
- “Dynamic” add-on for inertial loads
- Critical acceleration assessment





THESIS PROPOSALS

1. NUMERICAL AND EXPERIMENTAL INVESTIGATION OF THE EFFECT OF VISCOELASTIC DAMPING MATERIALS

2. WHIRLING CALCULATION ON SUPERYACHT: CRITICAL PARAMETER INVESTIGATION AND SENSITIVITY ANALYSIS

Via Corsica, 12 - 16128
Genova - Italy
P. +39 010 53851 | info@rina.org

rina.org