

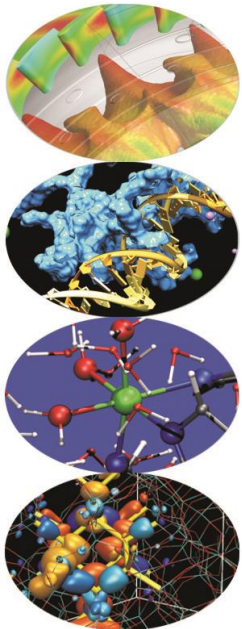
# HPC Computer Aided Engineering @ CINECA

*Raffaele Ponzini Ph.D.*

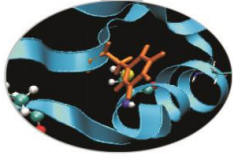
*CINECA*

*SuperComputing Applications  
and Innovation Department – SCAI*

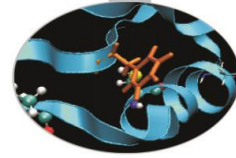
*16-18 June 2014*



# Outline

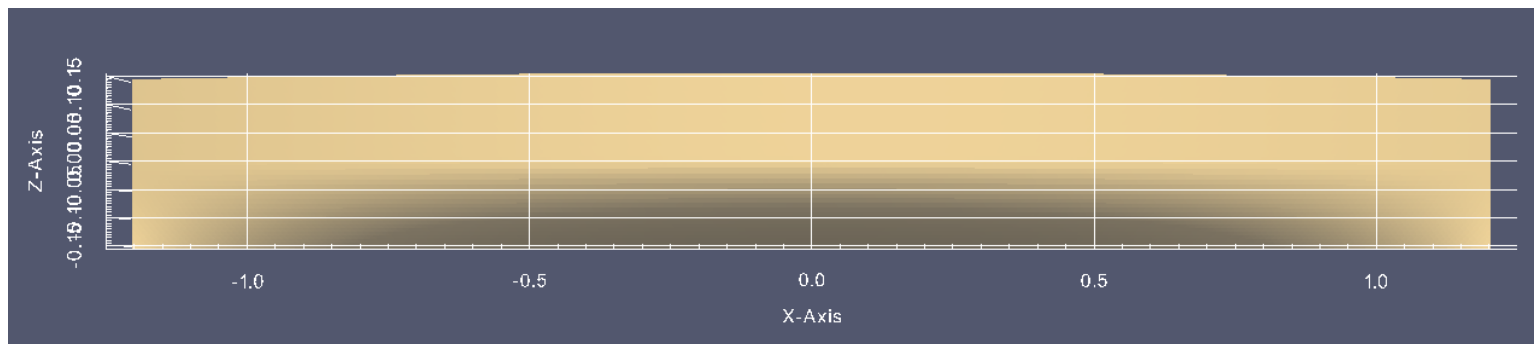
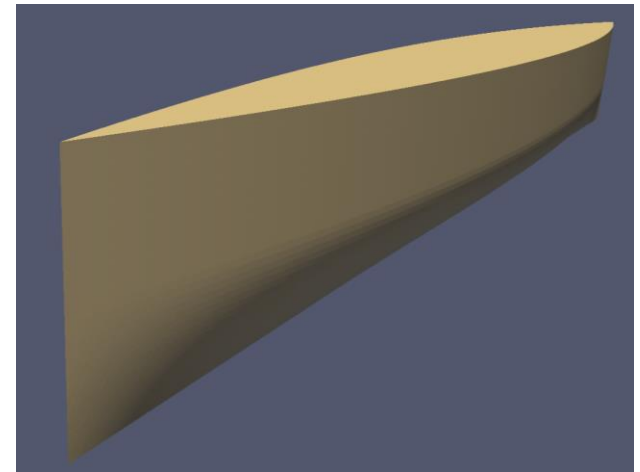


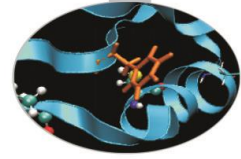
- Evaluation of captive case study in OpenFOAM
- Accuracy
- Scalability
- Robustness



# Wigley Hull

Widely used in marine engineering for validation of measures.





# Accuracy

Mesh size: 1.7 mln cells

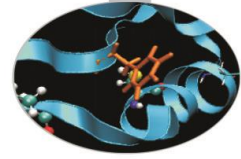
Cores value: 36

Fr number range: 0.250 0.267 0.289 0.316 0.354 0.408

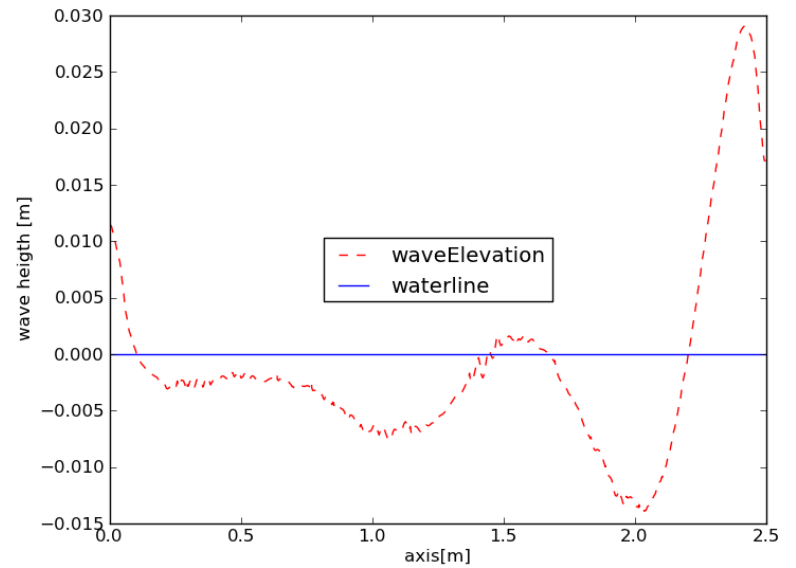
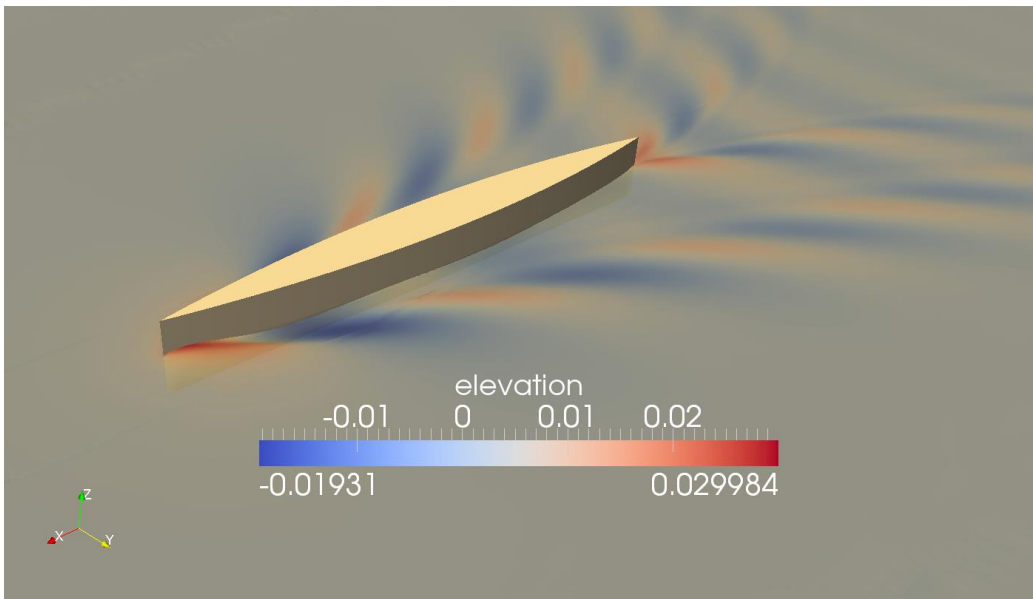
Machine: plx@cineca

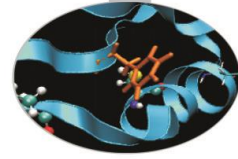
Key value indices: total forces, viscous forces, pressure forces, wave height



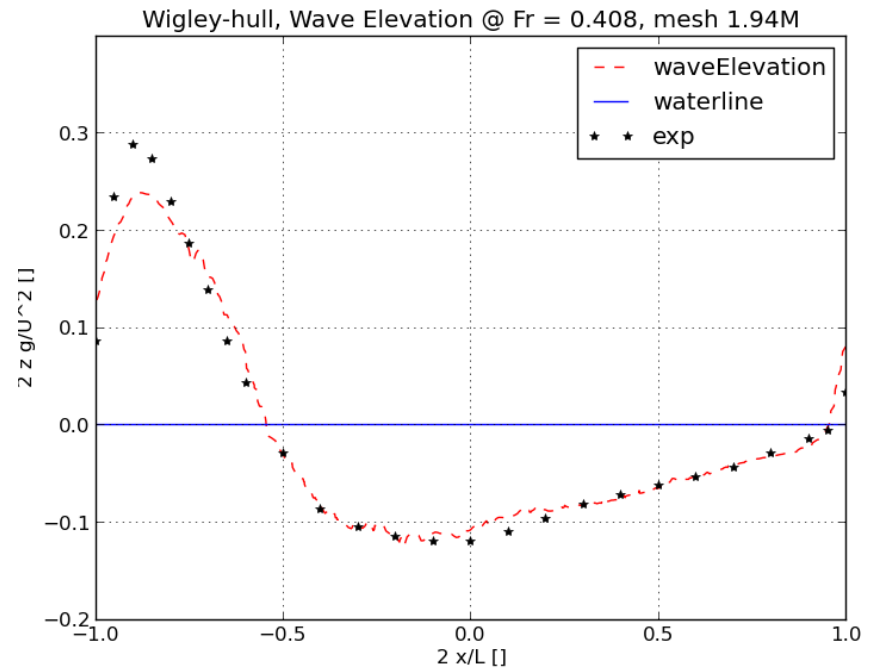
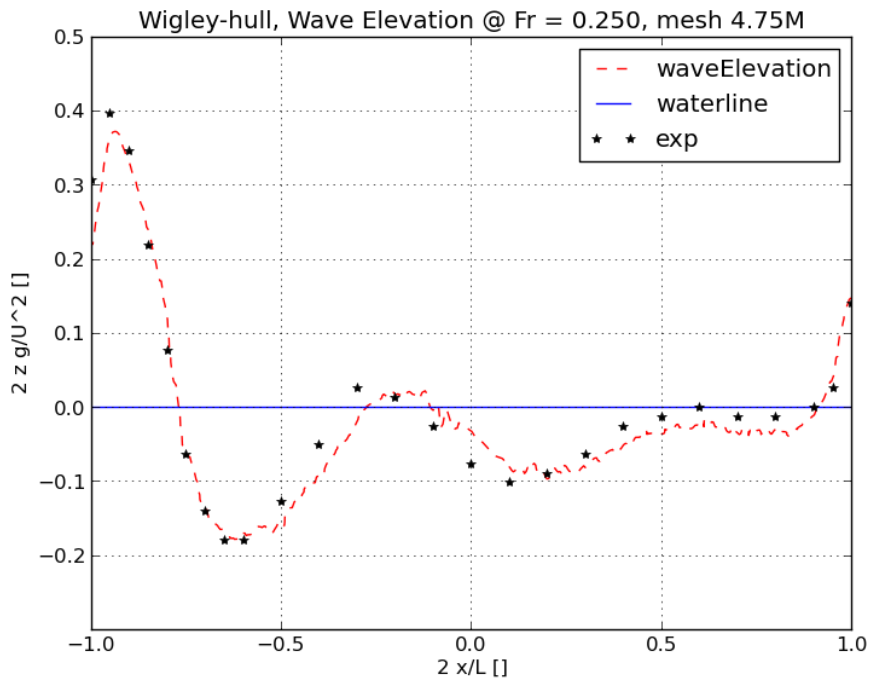


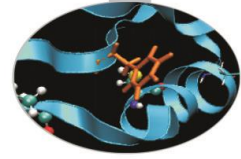
# Wave angle





# CFD VS Experimental data





# Scalability

Mesh size: 1.7 mln cells

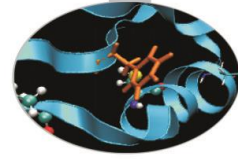
Cores range: 12 – 24 – 36 – 48 - 72

Machine: plx@cineca

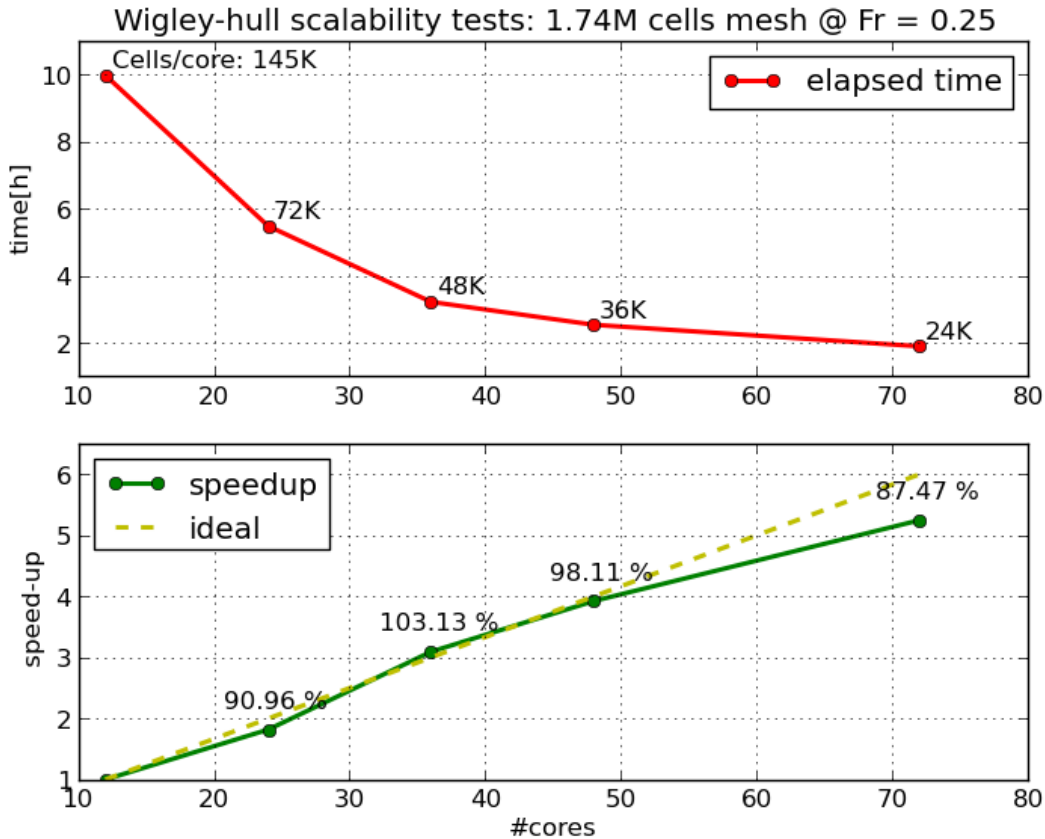
Num. iterations: 5000 (up to convergence)

Key value indices: elapsed-time, speedup, efficiency





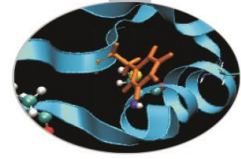
# Scalability



- 2h for convergence
- Higher efficiency with 24k cell/cores







# Robustness

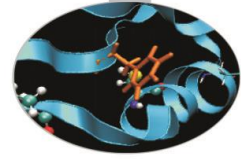
Mesh size range [% cells respect to gold-standard mesh]:

5.0%, 8.0%, 36.%, 100.%(gold-standard)

Cores range: 12 – 24

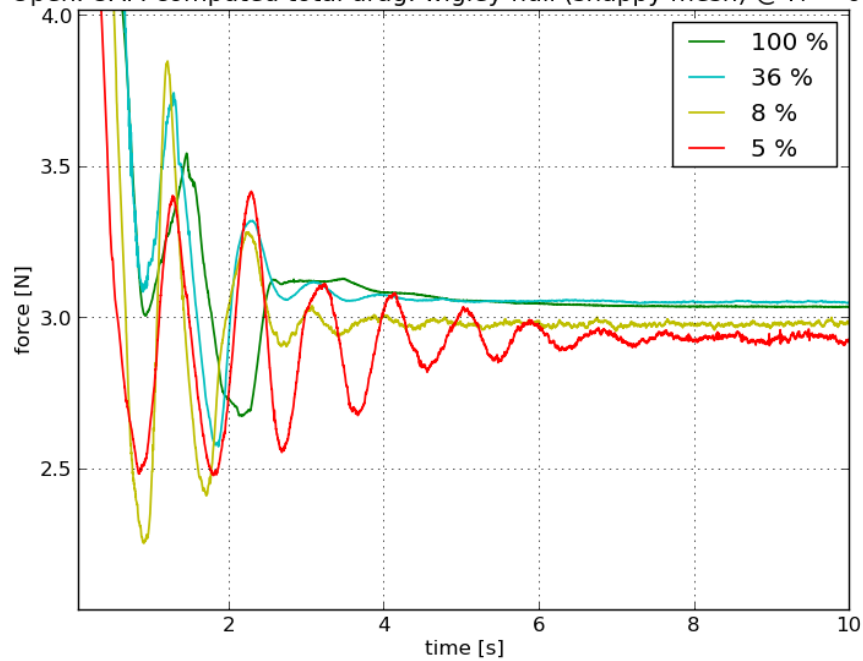
Machine: plx@cinca

Key value indices: total forces

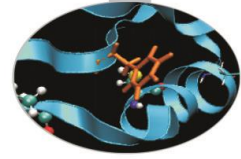


# Robustness

OpenFOAM computed total drag: wigley-hull (snappy mesh) @ Fr = 0.250



Mesh-size	F value [N]	F diff%
100%	3,03	Used-as-GS
36%	3,05	0,6%
8%	2,98	1,6%
5%	2,93	3,3%



# Robustness

OpenFOAM computed total drag: wigley-hull (snappy mesh: 1.8M cells)

