MEYER TURKU
SHIPYARD 1737

Meyer Turku

CSC LUMI HPC

Used for Resistance and Propulsion CFD computations

CONFIDENTIAL

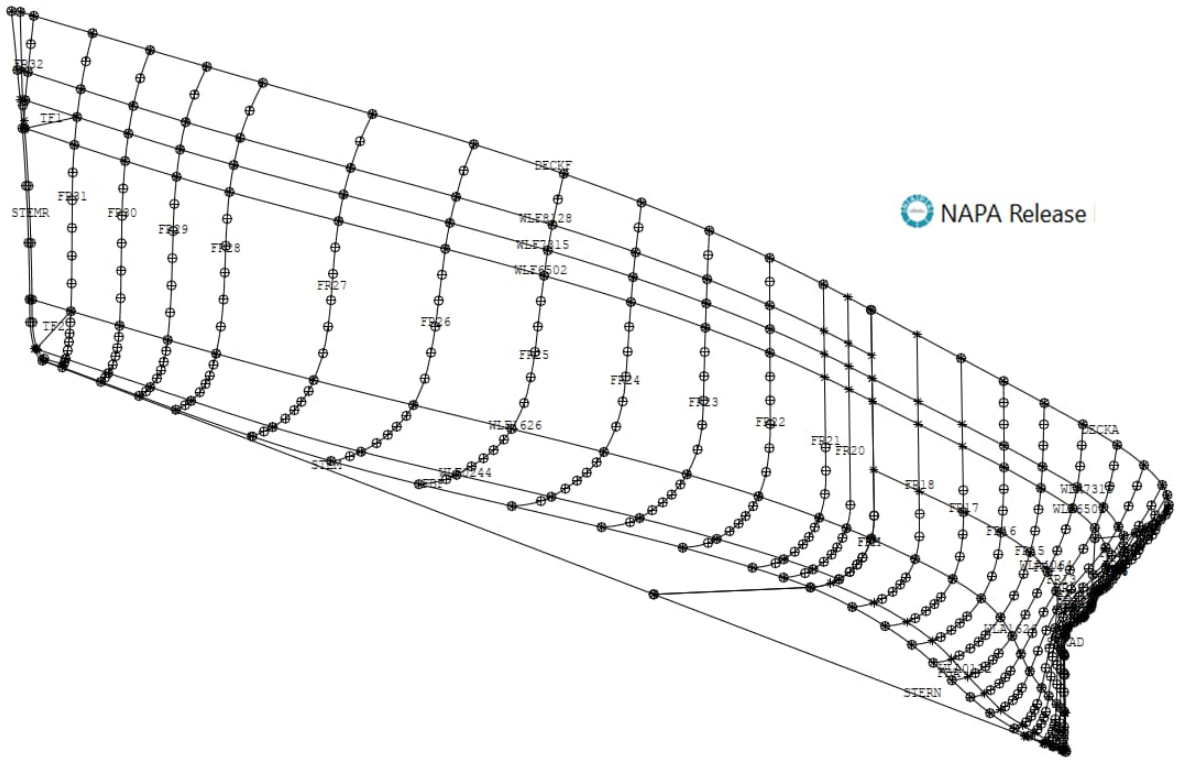
Heikki Piippo, 6.3.2025

AGENDA

- LUMI in CFD
  - workflow Geometry -> CFD
  - PyFoam
  - snappyHexMesh
  - OpenFoam two-phase computation
  - Paraview
  - LUMI interactive Session / Paraview
  - File Transfer / FileZilla
  - PuTTY / command window
  - SLURM for batch jobs

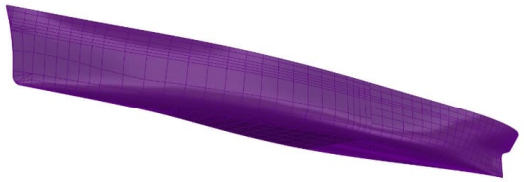
1 / NAPA / Hull Form Definition

- Consists of
  - Points
  - Planes
  - Curves
  - Surfaces



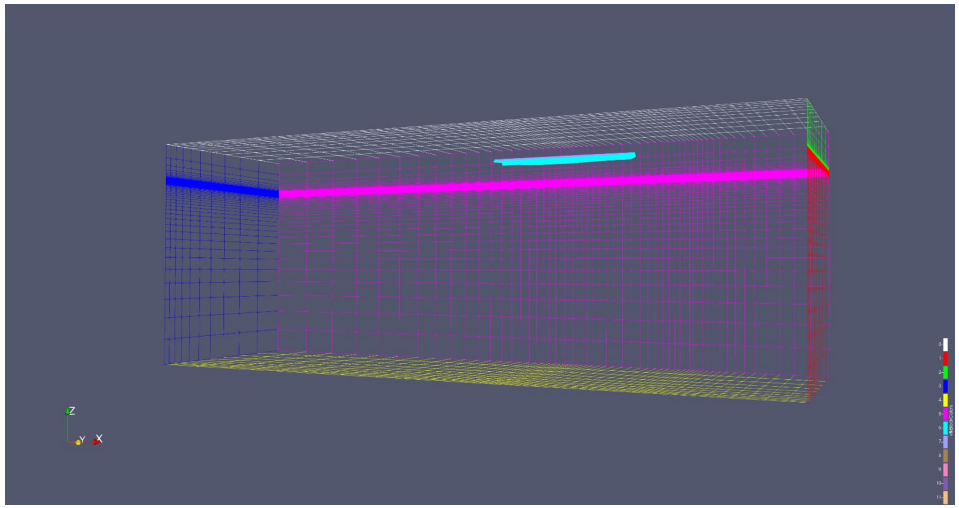
2 / Rhinoceros

- Hull surface imported from NAPA
- Holes in Geometry fixed
- Skeg is trimmed, deck is added and hull above is cut off
- Hull surface is exported to snappyHexMesh



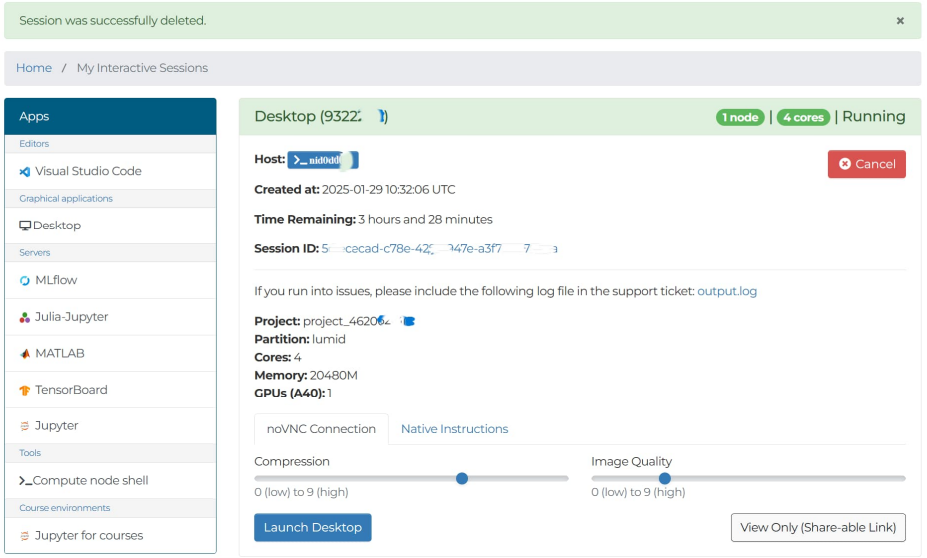
3 / OpenFoam / snappyHexmesh / interFoam

- Hull surface imported to snappyHexMesh
- Mesh generation set up streamlined with PyFoam
- Volume Mesh is created
- interFoam Flow Solver is run (air-water interphase captured by VOF-method)



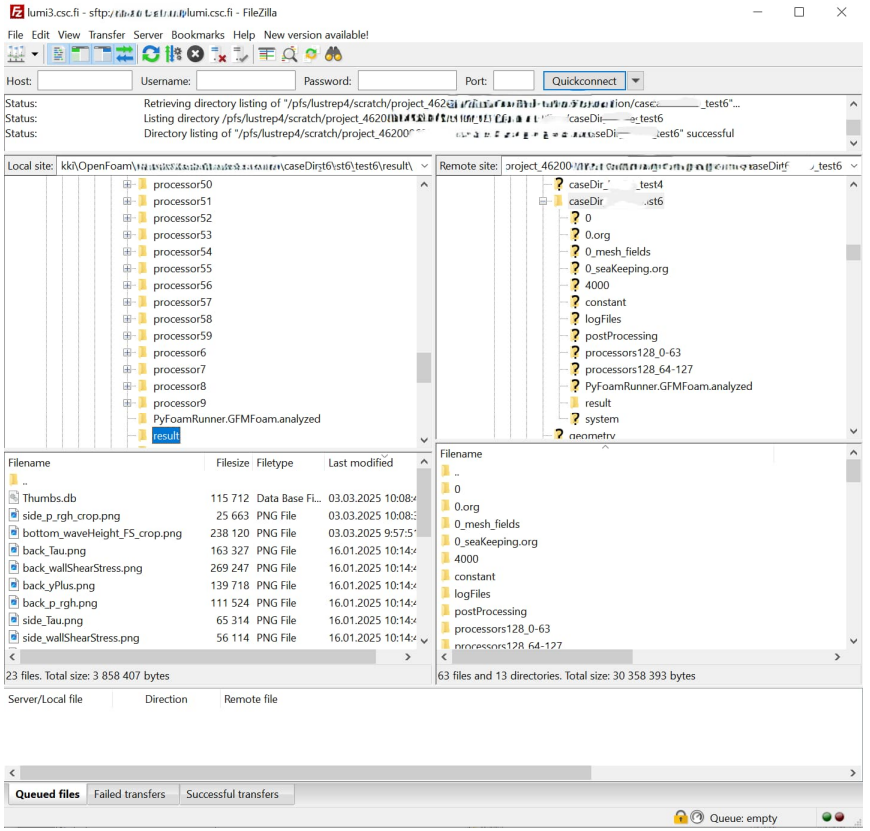
4 / LUMI Interactive Session / Login

- Interactive session with normal desktop graphics is available through lumi.csc website



5 / File Transfer / Filezilla

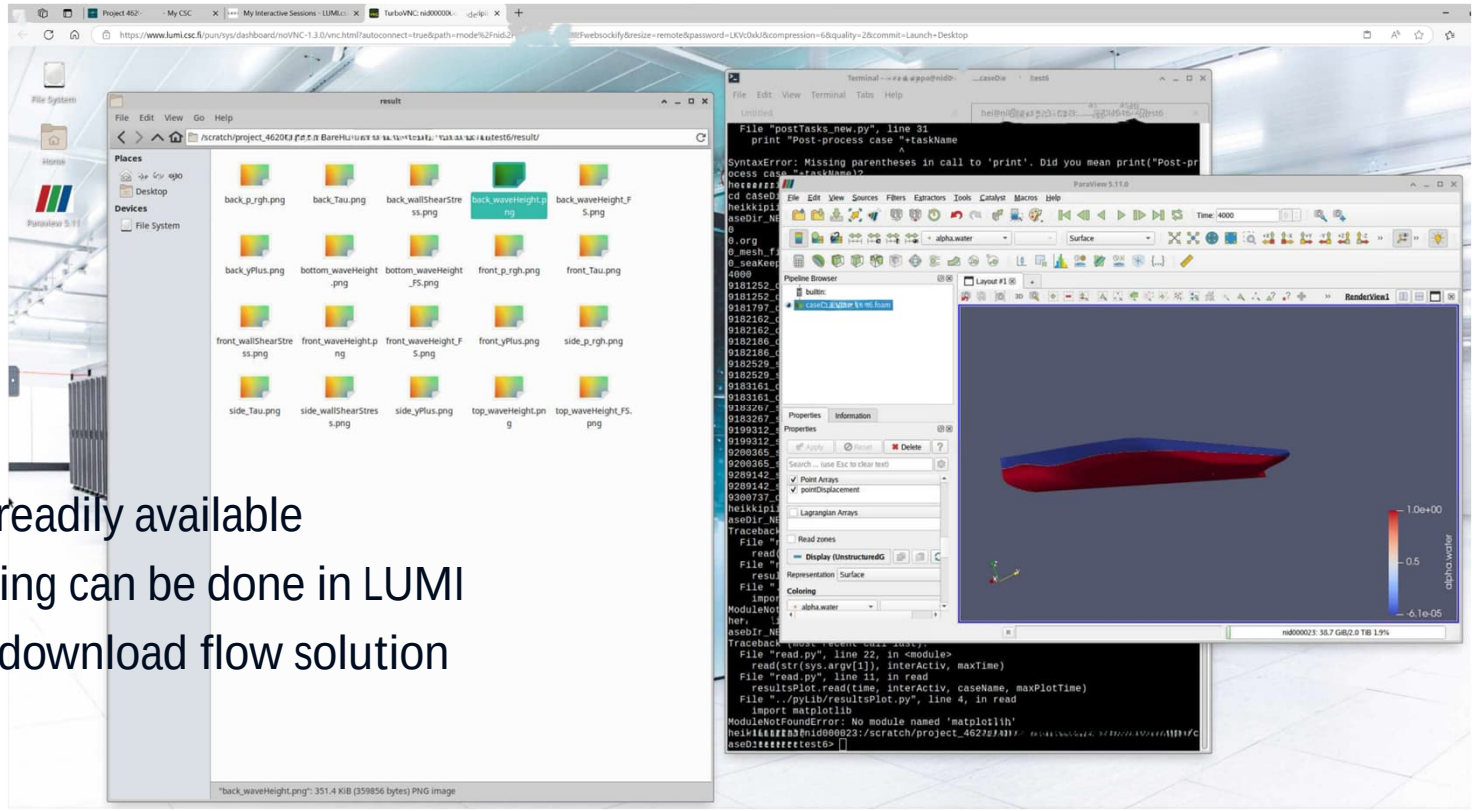
- File transfer to/from LUMI can be done using FileZilla
- Works well



6 / Setup batch run

- PuTTY provides a command window to LUMI
- Batch runs are put to queue system using SLURM
- For debugging process, a separate queue is available

7 / LUMI Interactive Session / Postprocessing



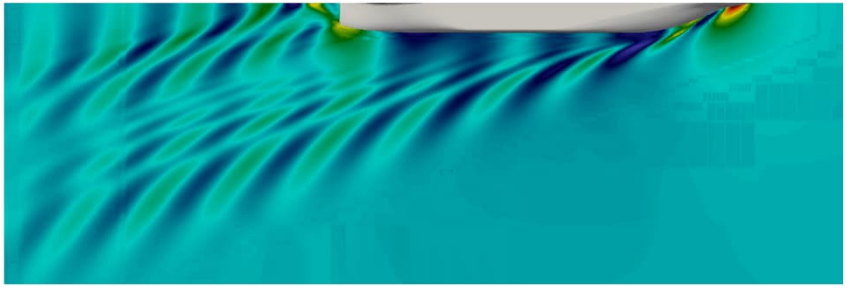
- Paraview is readily available
- Postprocessing can be done in LUMI
- No need to download flow solution

8 / Postprocessing

- Frictional Resistance + Dynamic Pressure Resistance = Total Resistance
- Wake field at propeller disk
- If Actuator Disks are used, then Propeller Power
- Dynamic pressure distribution on hull surface
- Wave system
- Selected streamlines

9 / Summary

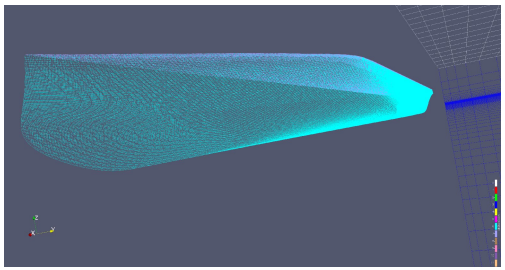
- Hull geometry -> LUMI with FileZilla
- Run SnappyHexmesh with PyFoam scripts
- Debugging is available in a separate queue
- Setup an OpenFoam batch job
- Postprocess in LUMI Interactive Session
- Download only postprocessed results with FileZilla
- Enjoy the results



10 / OpenFoam with LUMI / Conclusions

PROS

- OpenFoam and Paraview are readily available
- Mesh generation, batch jobs and postprocessing are ready to be used
- No software licenses are needed -> No license costs
- LUMI computing power available on demand
- LUMI maintenance is done by CSC
- Helpful LUMI user support is provided by CSC
- CSC is a non-profit organisation with reliable and skillful reputation



CONS

- Learning to use OpenFoam takes quite some time

THANK YOU !

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