



CFD software verification on an electric airplane utilizing HPC

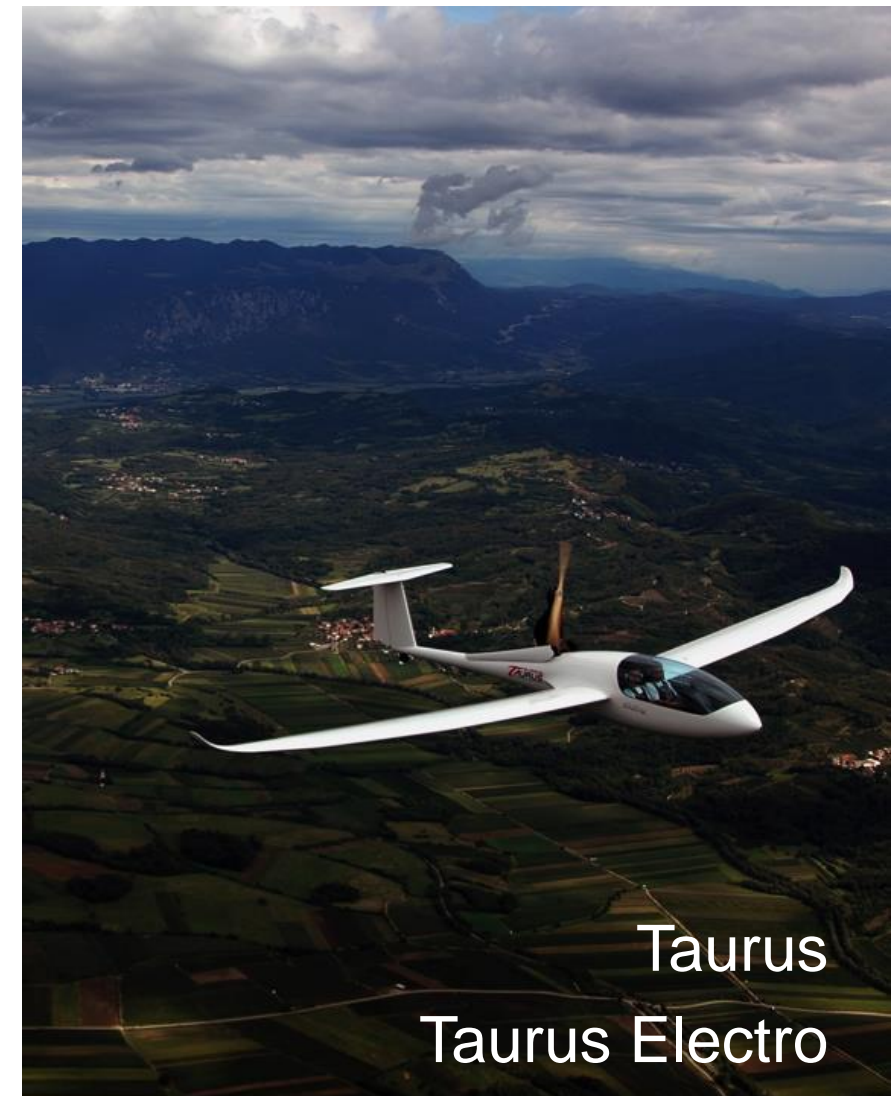
Matej Andrejašič
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Pipistrel Vertical Solutions d.o.o.

Agenda

- ↑ Pipistrel
- ↑ Alpha Electro flight test
- ↑ Numerical calculations
- ↑ Results and conclusions

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Taurus G4 - electric
HY4 - hydrogen



PIPISTREL
VERTICAL
SOLUTIONS

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Alpha Electro tow flight test

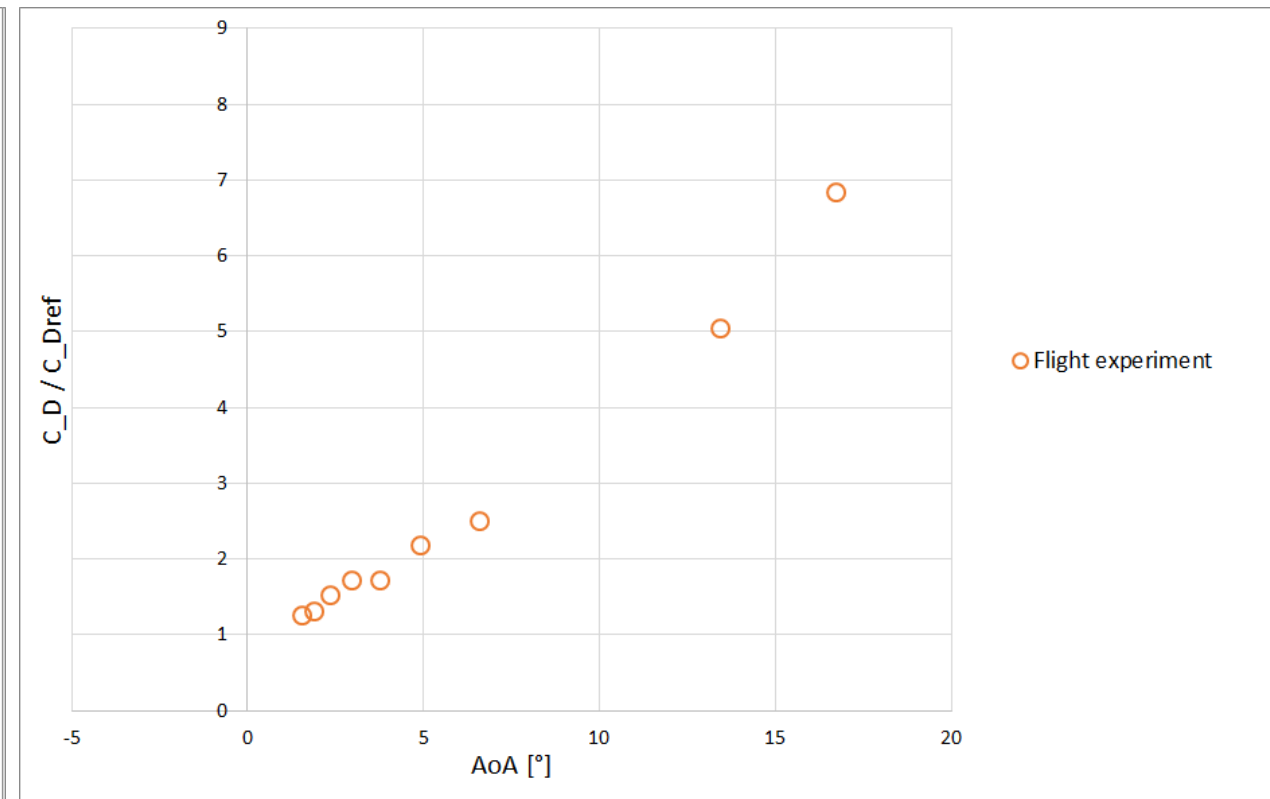
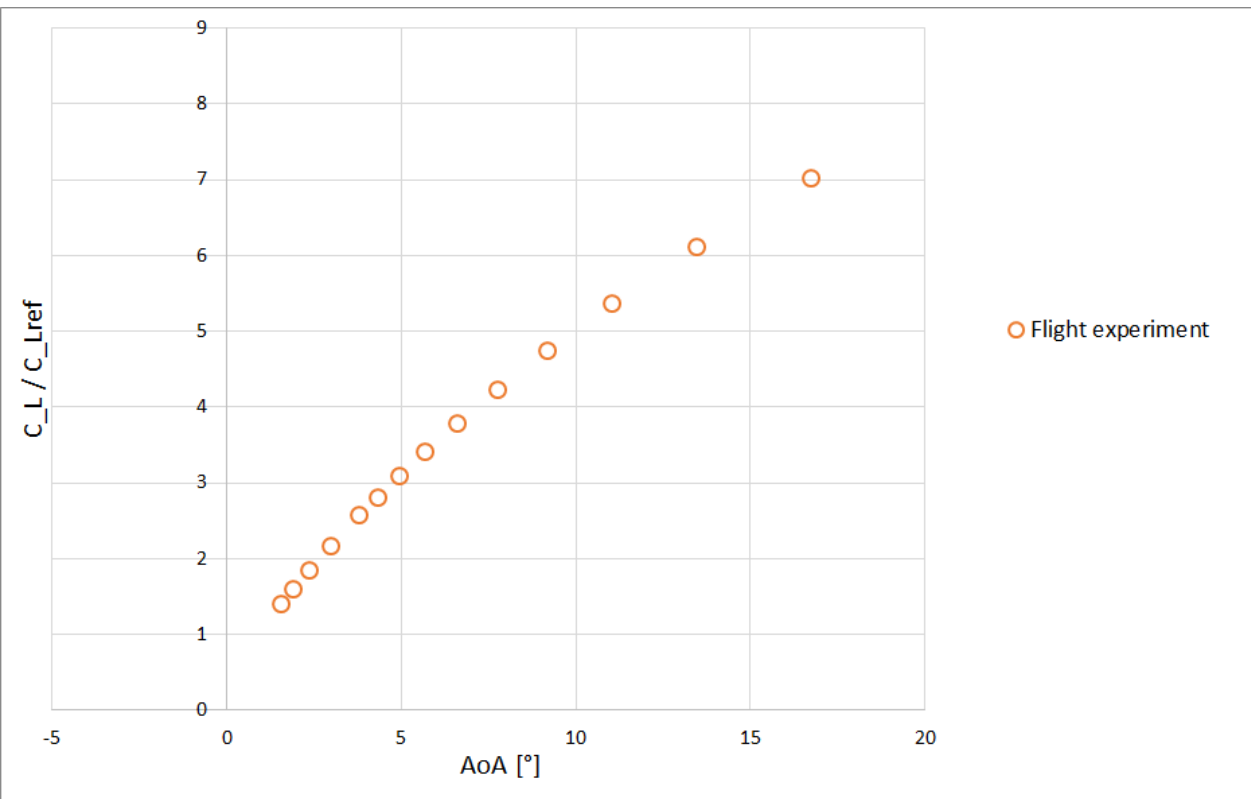


Alpha Electro tow flight test

Pipistrel Vertical Solutions d.o.o.



Tow test results

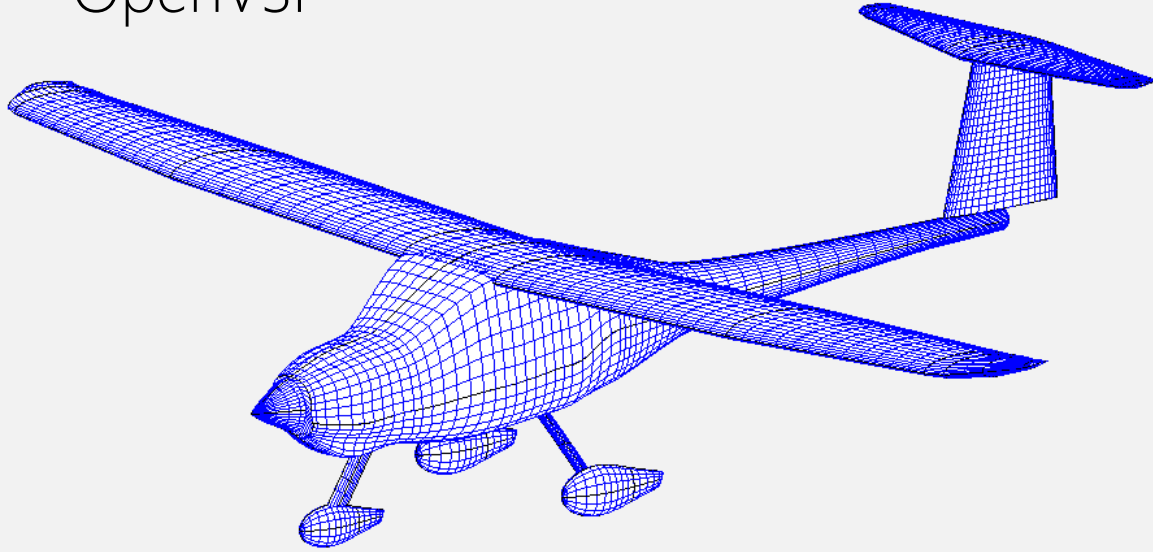


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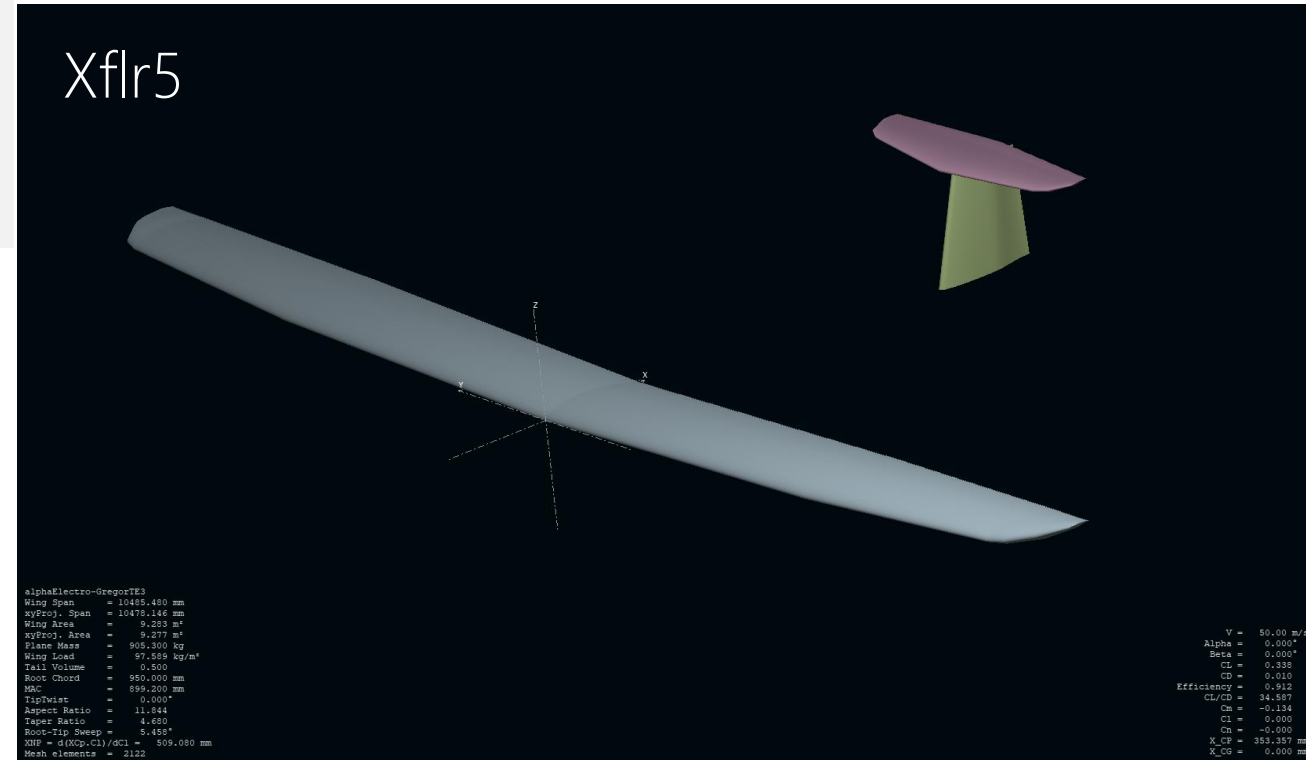
Low fidelity software

OpenVSP

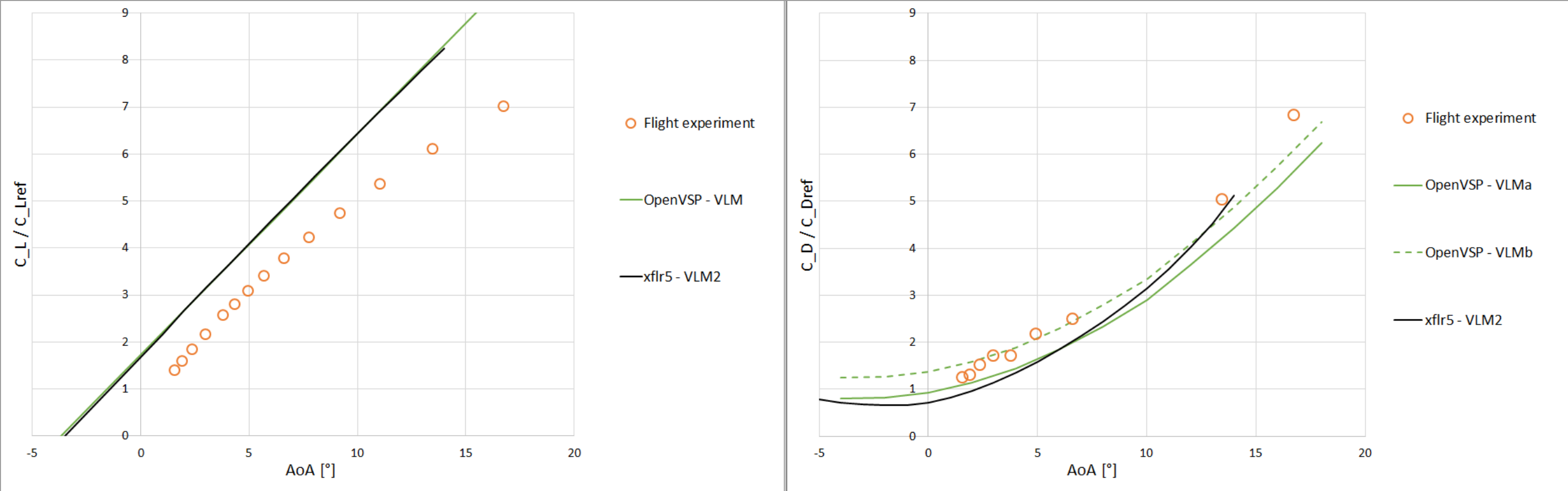


- ↑ Personal PC
- ↑ 1h to prepare
- ↑ Seconds to analyse

Xflr5

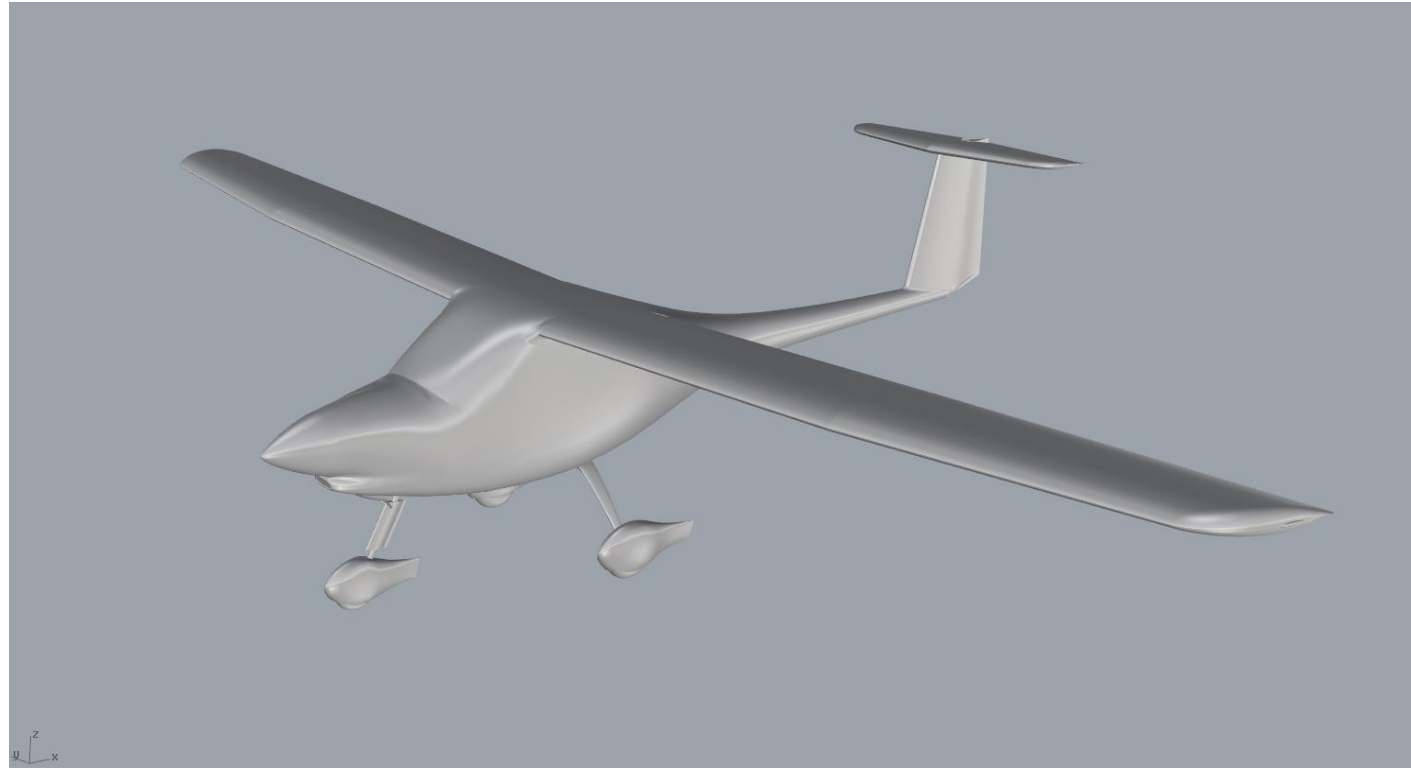


Low fidelity - results

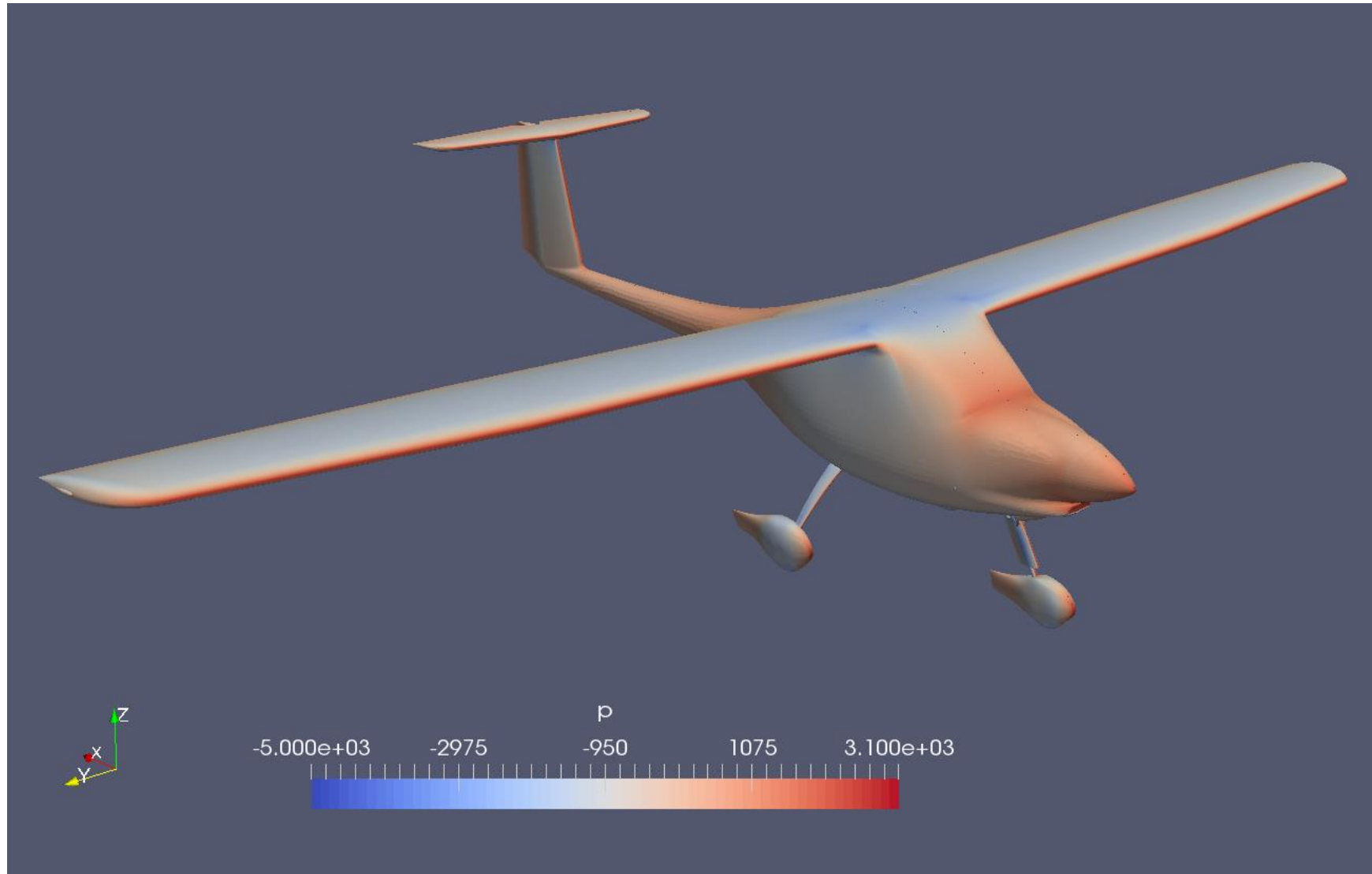


Higher fidelity software - OpenFOAM

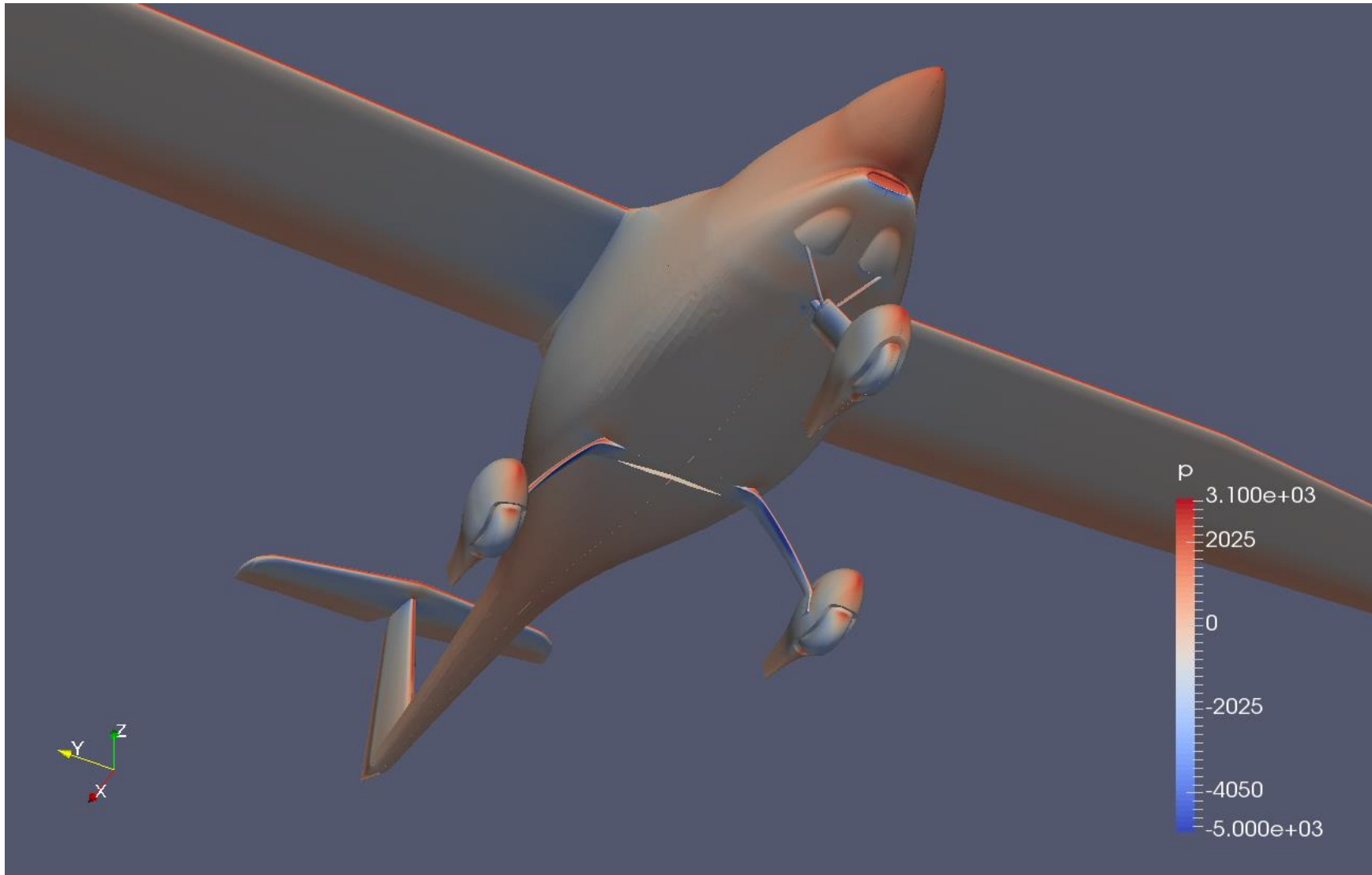
- ↑ OpenFOAM 4.1
- ↑ RANS steady state, incompressible
- ↑ k-omega SST and Spalart-Allmaras turbulence models
- ↑ Different AoAs and velocities
- ↑ Mesh size: 10M cells
- ↑ Symmetry boundary condition



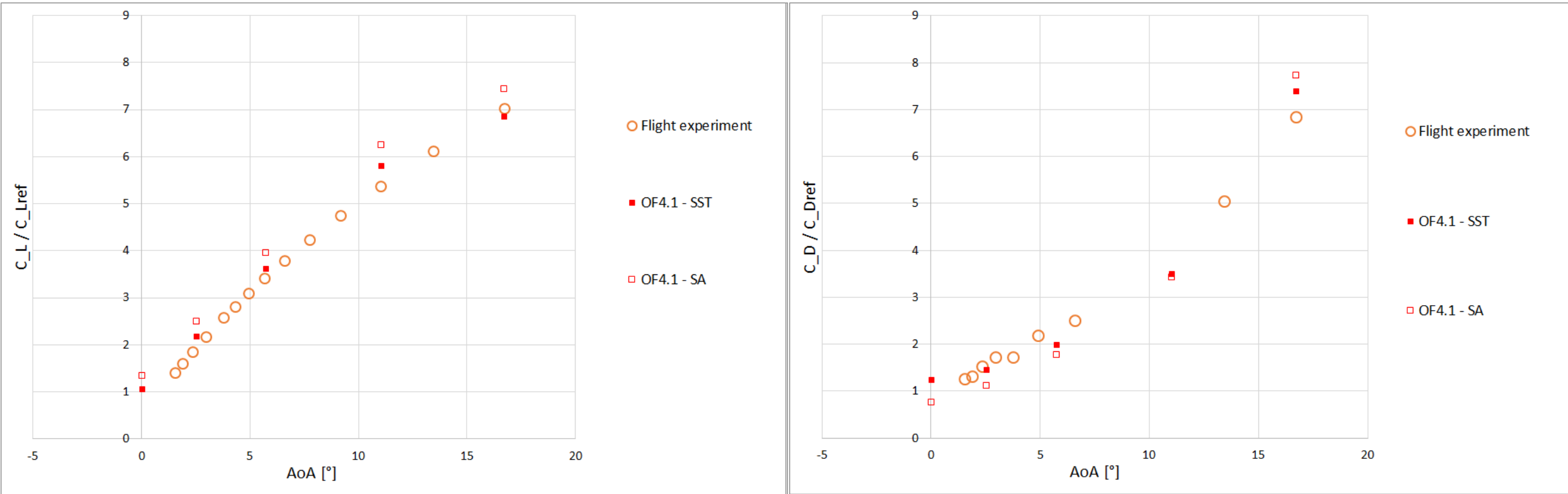
OpenFOAM - results




OpenFOAM - results



OpenFOAM - results



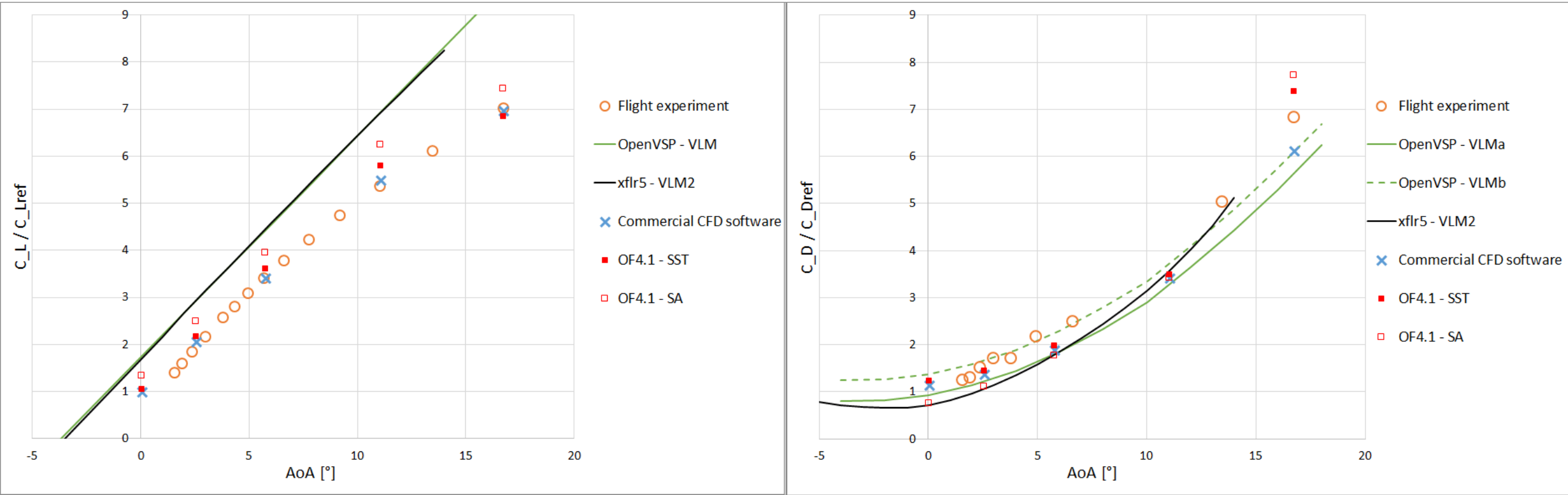
Inhouse cluster vs HPC

| | Inhouse cluster |  HPC |
|------------------------------------|-----------------|---|
| Computing power | 20 CPU cores | 28 CPU cores / point |
| Time to converge | 12h / point | 8h / point |
| Time for complete polar (5 points) | 2.5 days | <u>10h</u> |

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Results



Conclusions

- ↑ Tow flight test experiment
- ↑ Numerical calculations in 4 different software
- ↑ The best results from OpenFOAM k-omega SST and commercial software
- ↑ Low fidelity software can also be used, but with caution
- ↑ Using HPC can substantially accelerate the design work

Thank you for your attention!

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