

Solid and Fluid Investigations of the Heat Distribution in and Around a Fighter Aircraft

- The Effect of Important Simulation Parameters

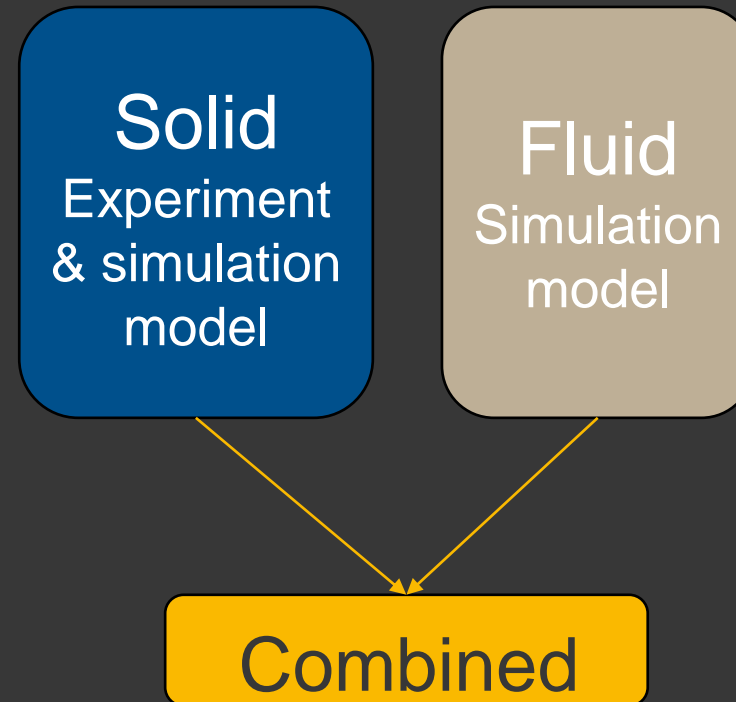
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Introduction

- Objective : Temperature distribution in an aircraft structure
 - Heat generating components
- Experimental & Computational HT: Solid
- CFD: Fluid

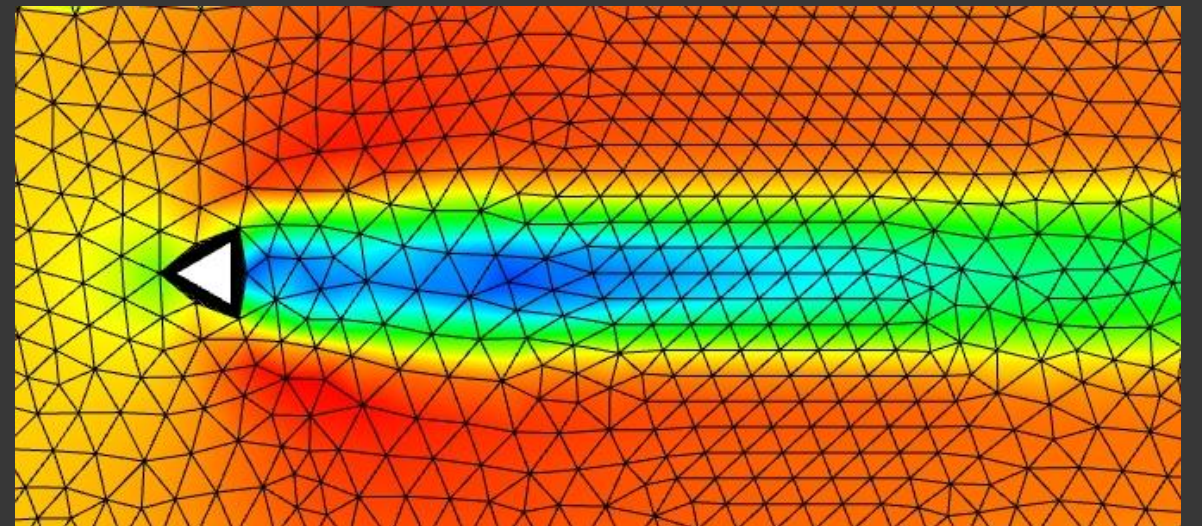
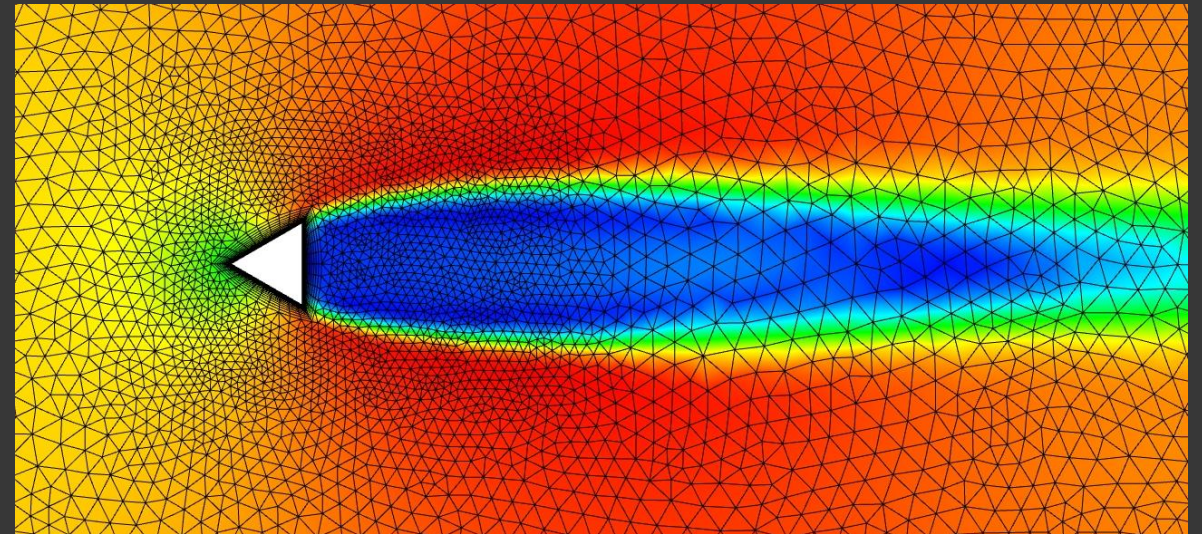


Physical Experiment vs Simulation

- Cost
- Time
- Flexibility
- Resolution of results

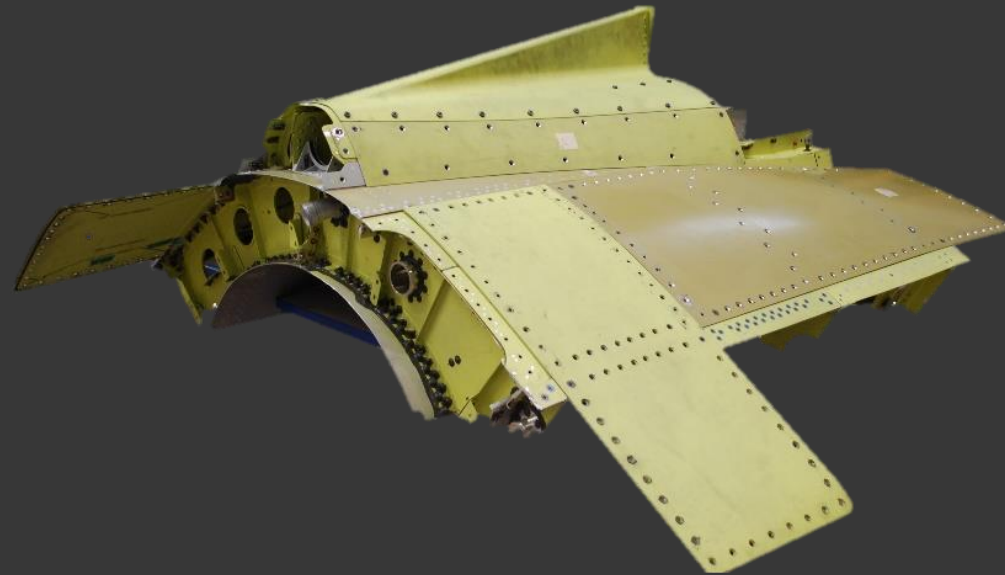
Computational Mesh

- What is a mesh?
- Calculation at the center of each element
- Refinement
 - Computational cost
 - Accuracy
- Mesh Analysis



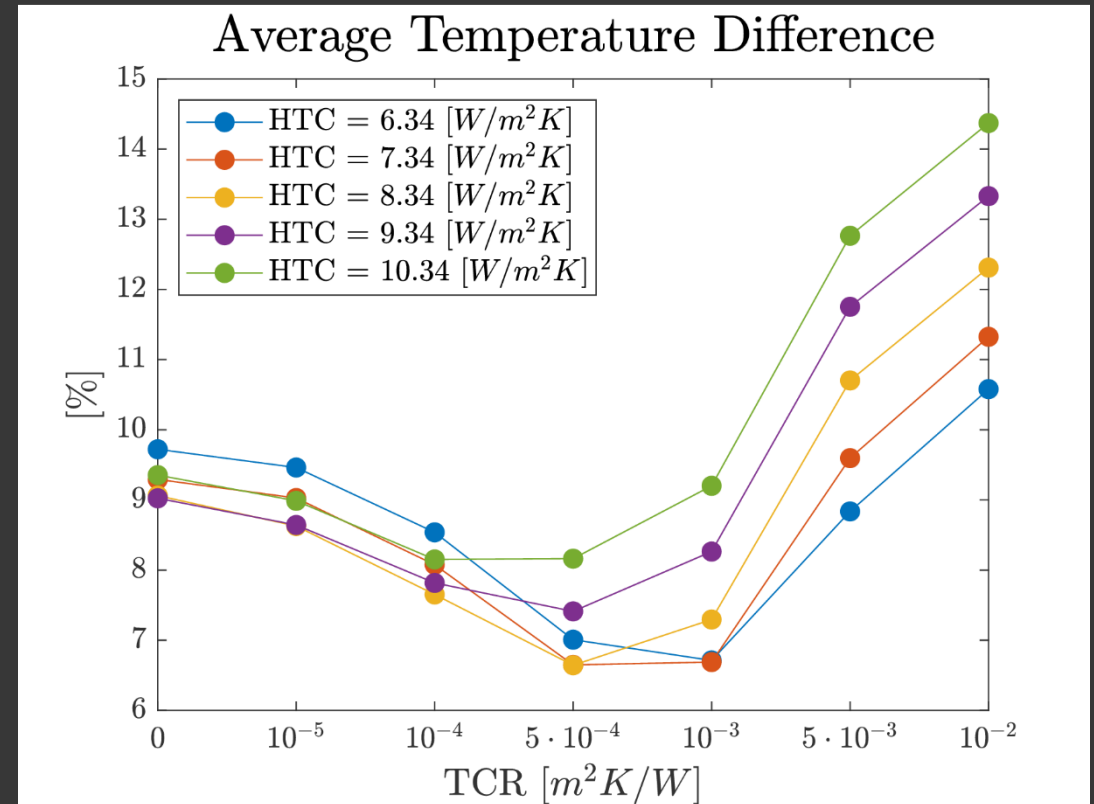
Solid Model - Introduction

- Simulation model
 - Verification
 - Validation

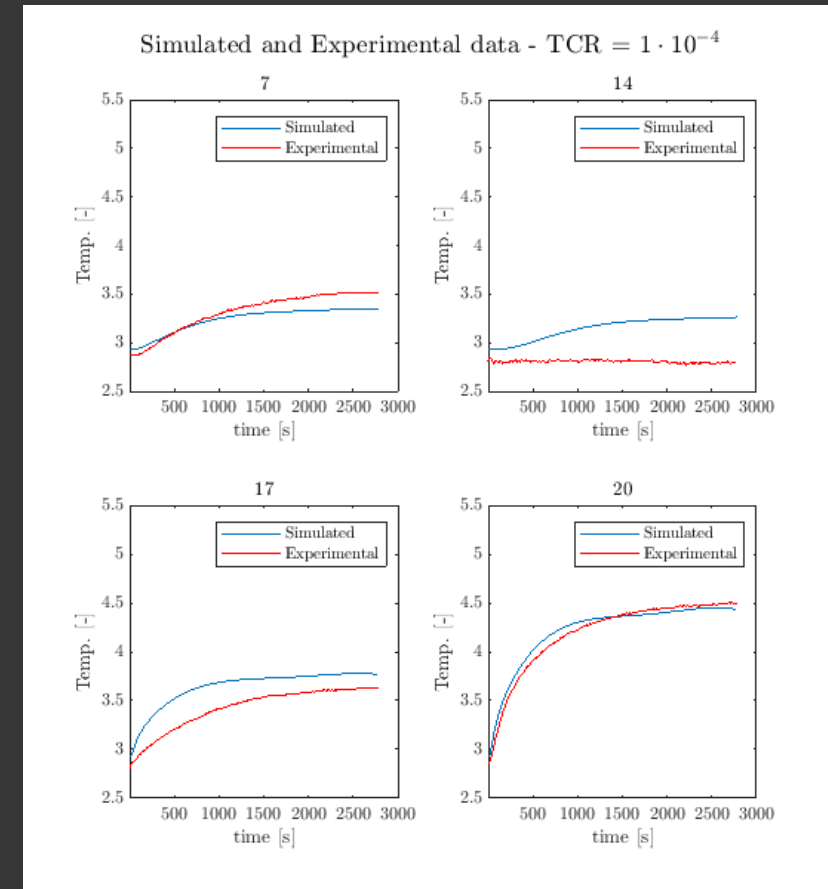
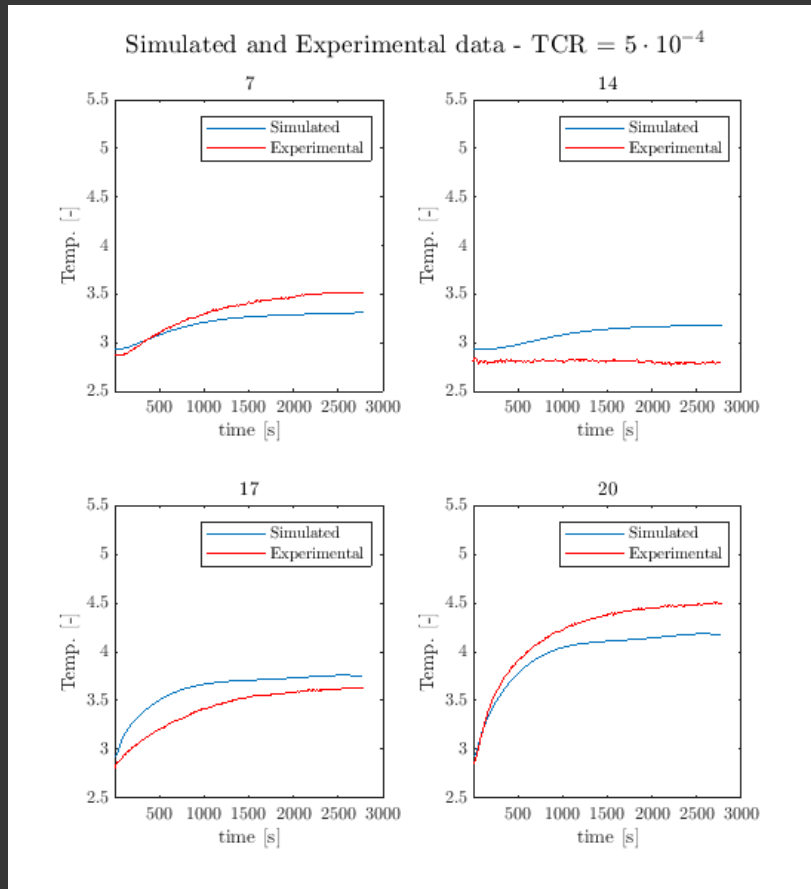


Stationary Results – Solid Model

- Investigated parameters.
 - TCR – Thermal Contact Resistance.
 - HTC – Heat Transfer Coefficient.
- Difference to experimental data: 6,6 %.

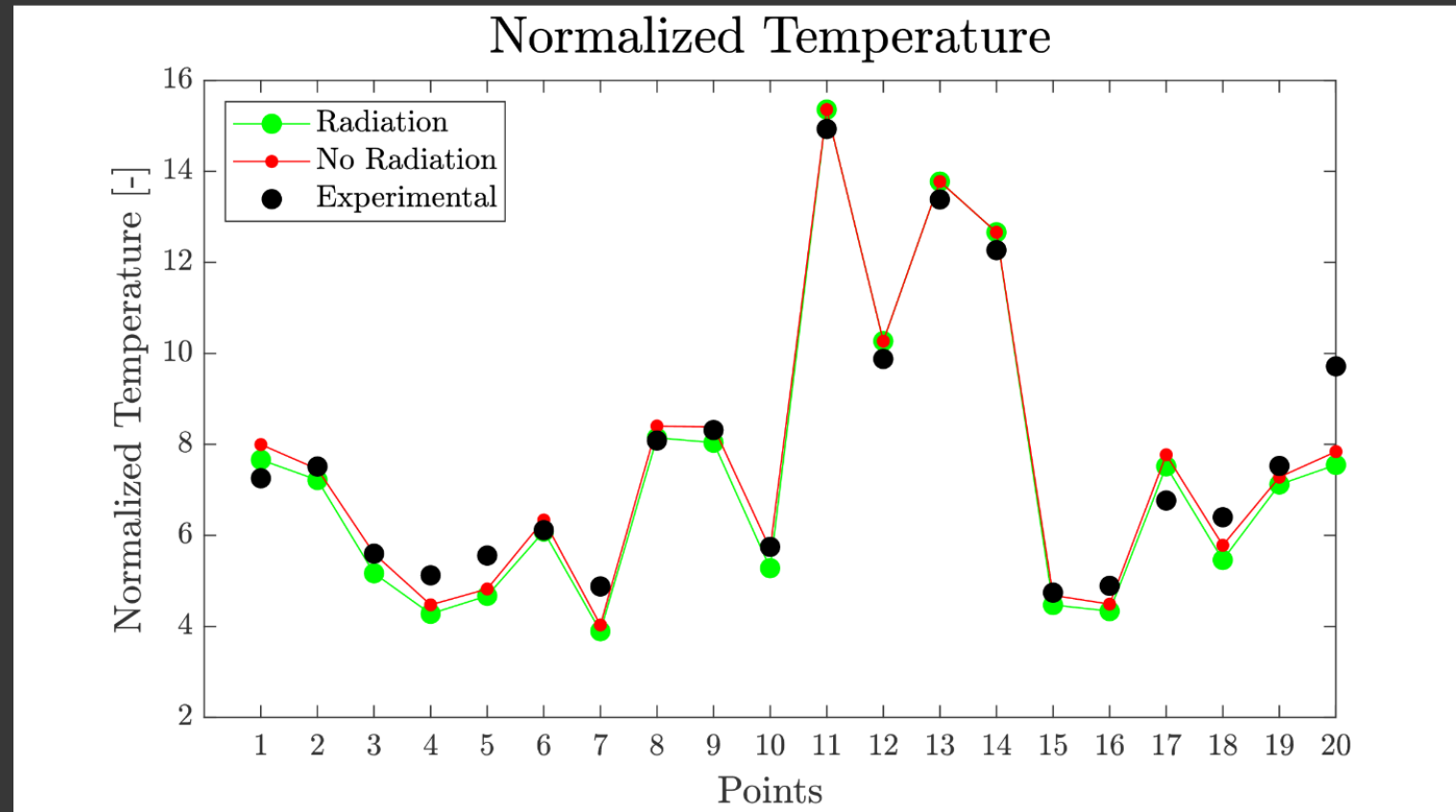


Transient Results – Solid Model



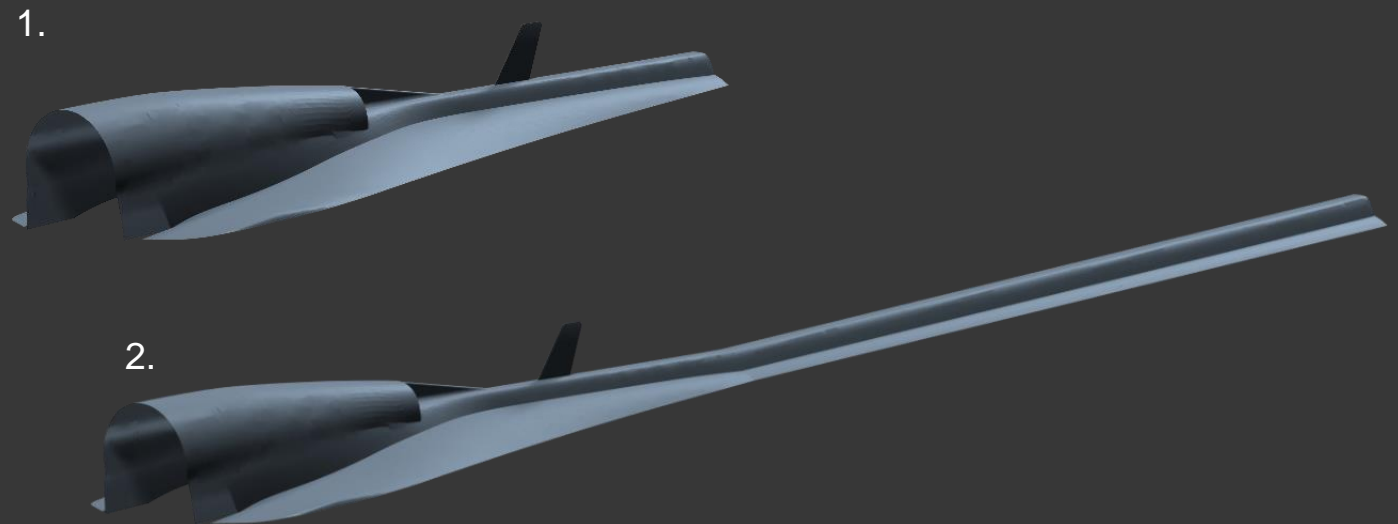
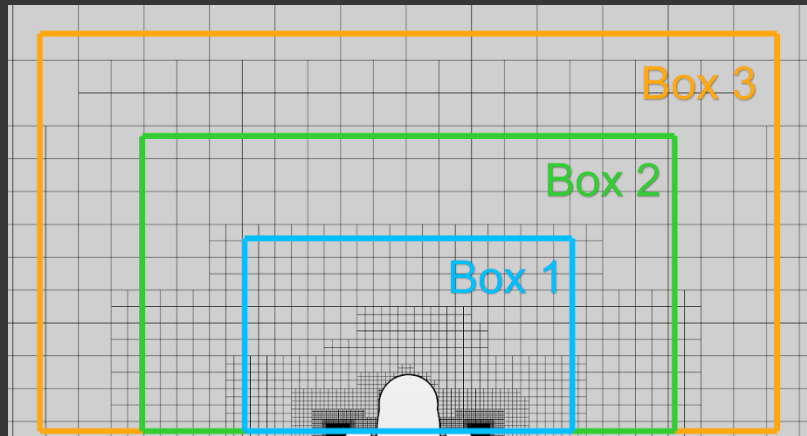
Stationary Results – Solid Model, Radiation

Average difference = 4,6 %



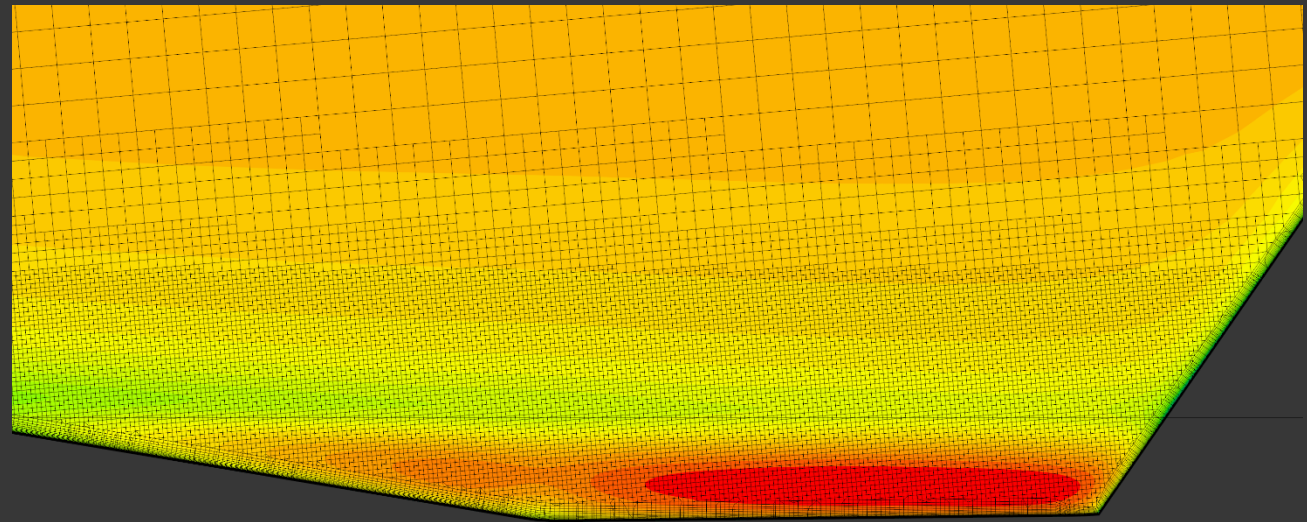
Fluid Model - Introduction

- Verification of model
 1. Mesh analysis
 2. Width and height
 3. Extrusion

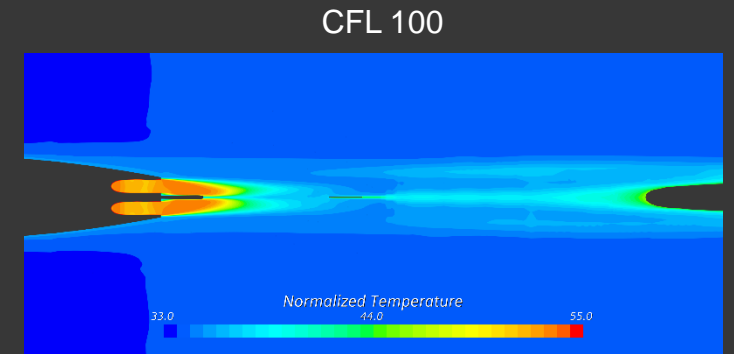
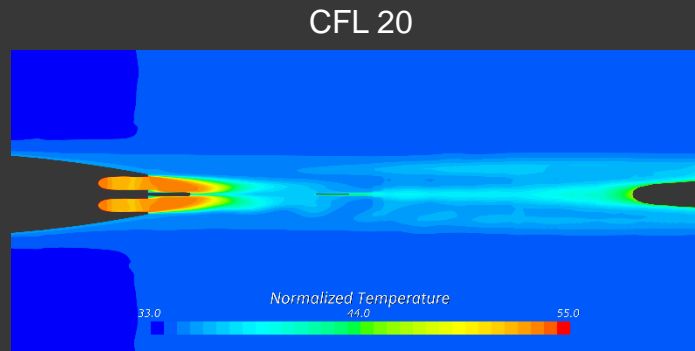
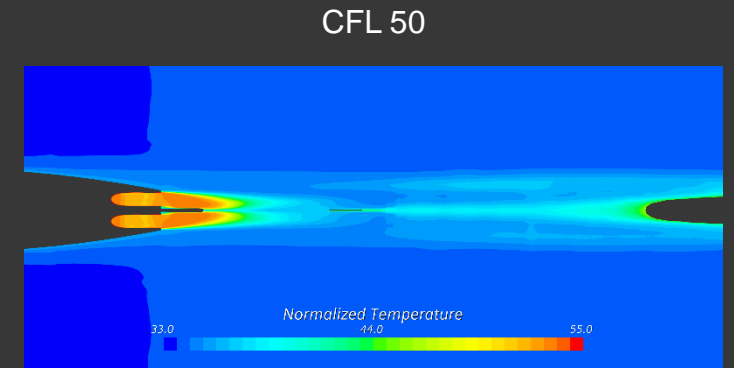
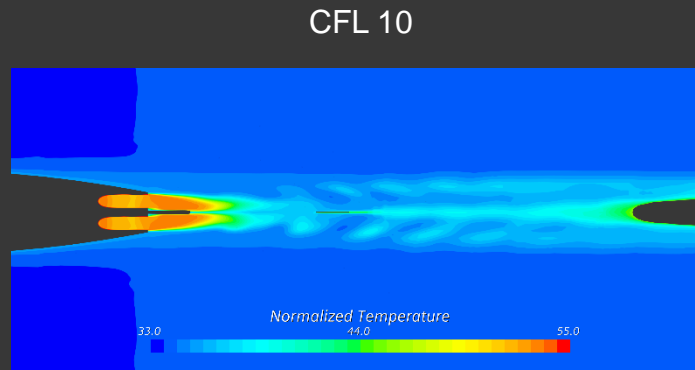
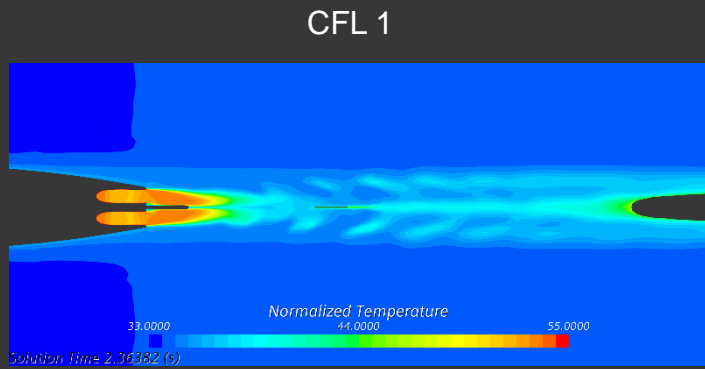


Results– CFL number

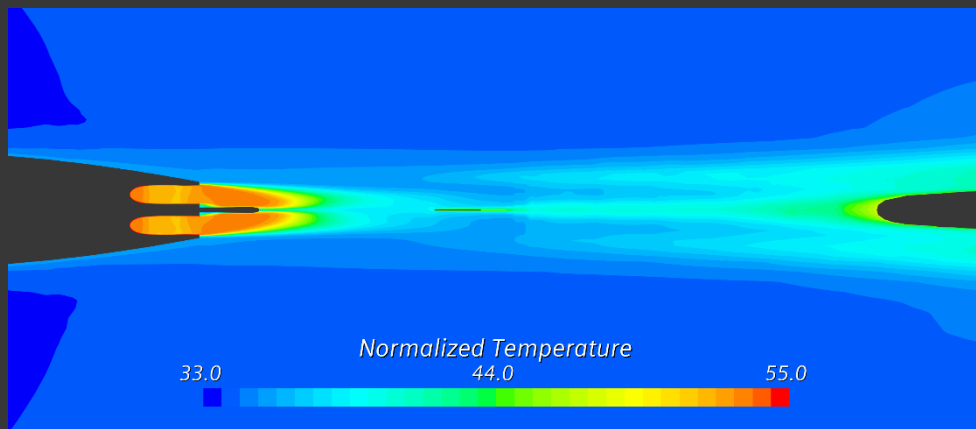
- Transient simulation
 - Time step
- $CFL = \frac{u\Delta t}{\Delta x}$



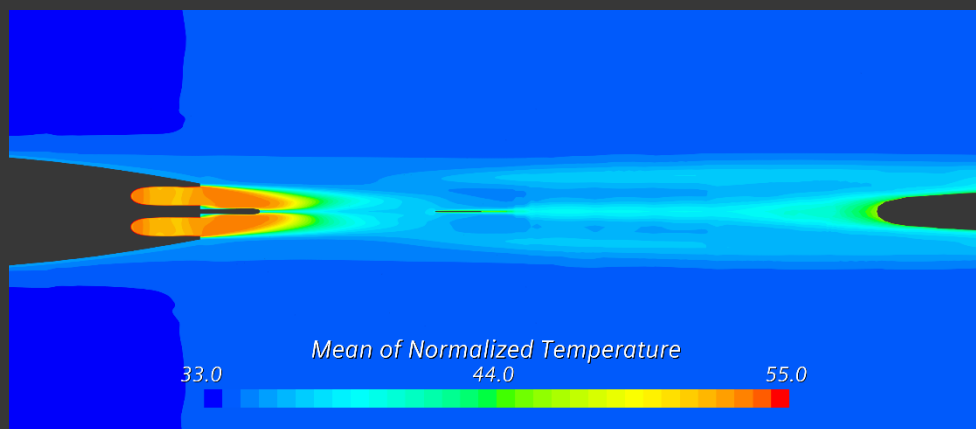
Results – CFL (Instantaneous)



Results – Numerical Technique

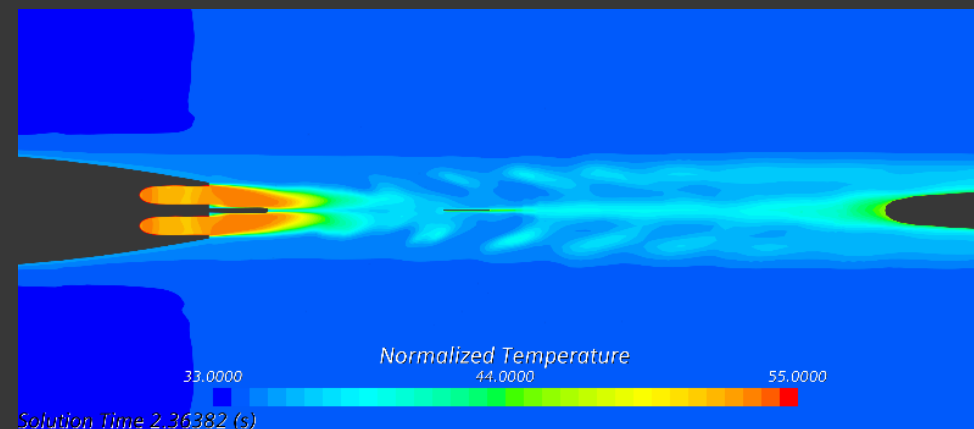


RANS



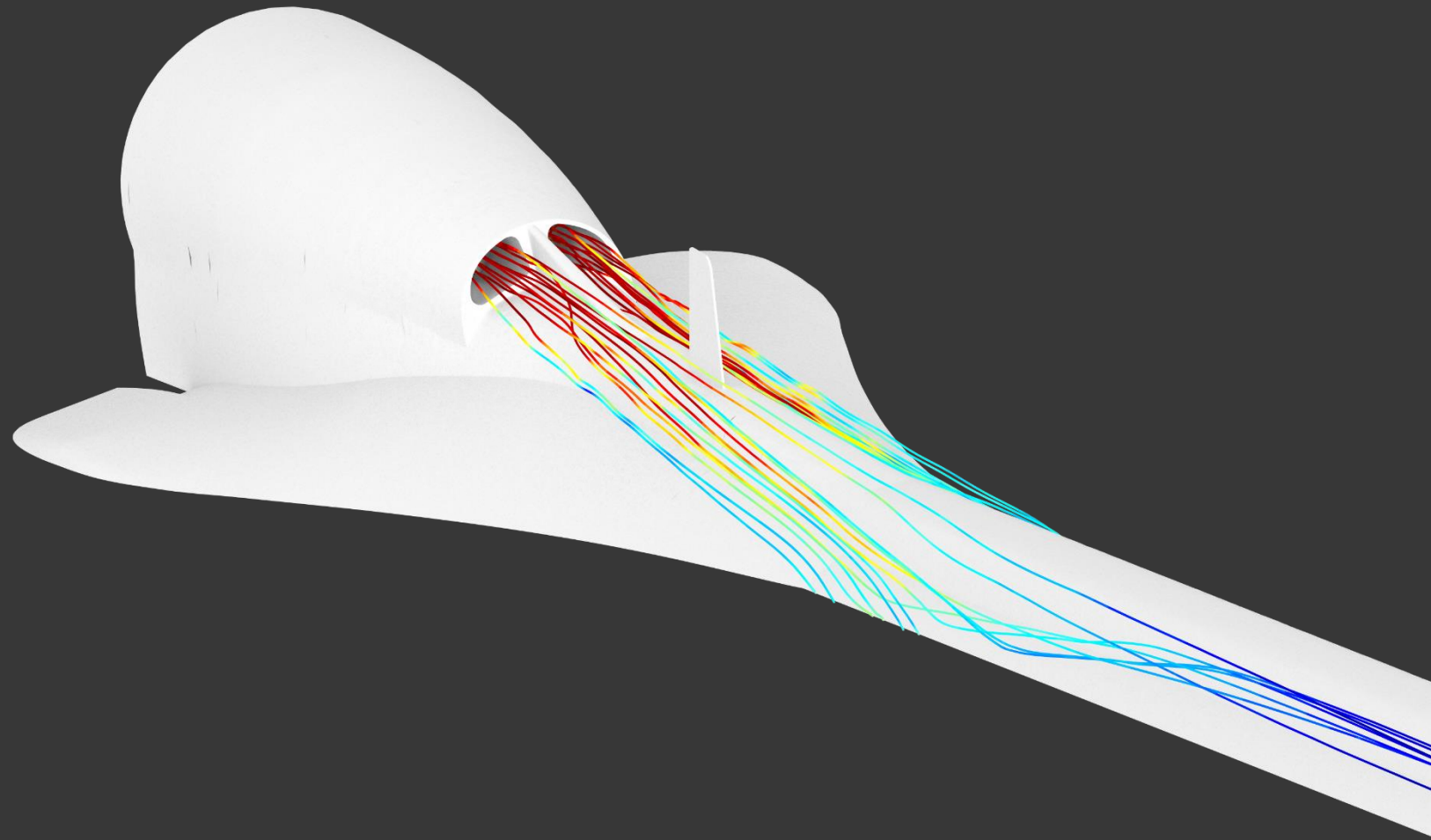
URANS

URANS, CFL 1



Final Thoughts

- A lot to win by using simulation models
- Keep track of introduced errors
 - TCR
 - Mesh
 - CFL



Questions?