



Flow Simulation With SOLIDWORKS

SIMULIA Fluid Dynamics Engineer

**Mattias Robertsson
DS EuroNorth**

Who is Presenting ?



Mattias Robertsson
Dassault Systems EuroNorth - Simulation

Sweden

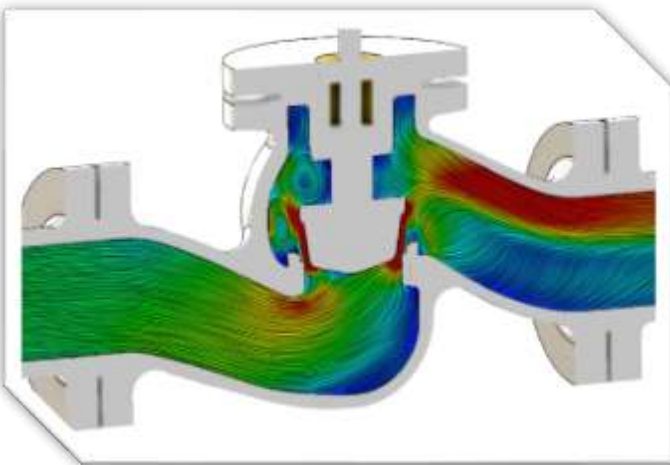


Background

Degree in Mechanical Engineering, Mälardalens Högskola
Mechanical Engineer at ABB

 **SOLIDWORKS** Technical Manager +20 years

**3S SOLIDWORKS
FLOW SIMULATION**

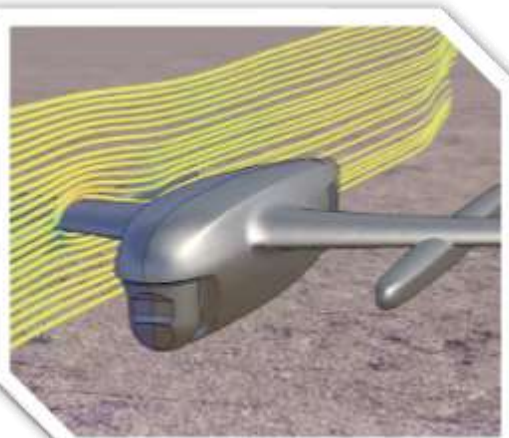


Integrated in SOLIDWORKS



3DEXPERIENCE

FLUID DYNAMICS ENGINEER
CFD SIMULATION ROLE ON 3DEXPERIENCE



3DEXPERIENCE Platform

3S SIMULIA

XFlow



Standalone

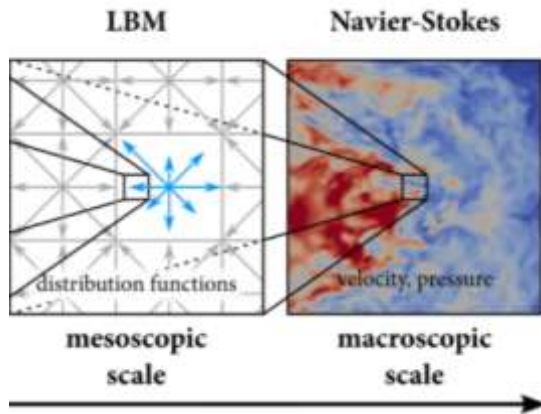
**3S DASSAULT
SYSTEMES**

Theory in CFD software

Lattice Boltzmann

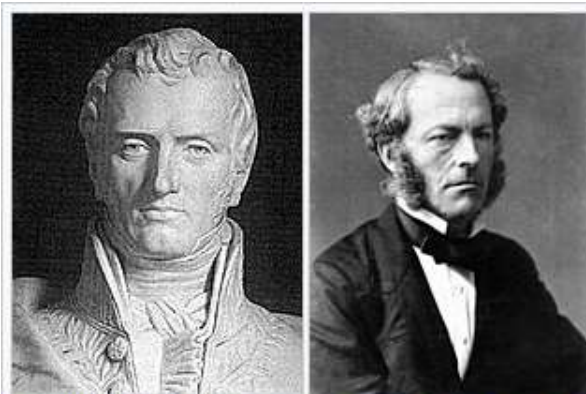


Ludwig Boltzmann



Osborne Reynolds

Navier Stokes



Claude-Louis Navier

George Gabriel Stokes

XFlow

SOLIDWORKS
FLOW SIMULATION

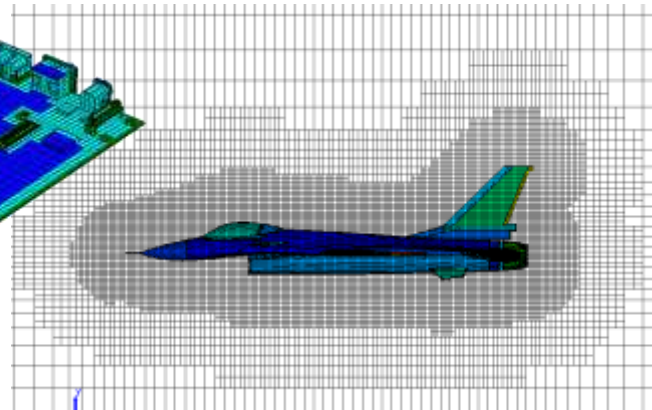
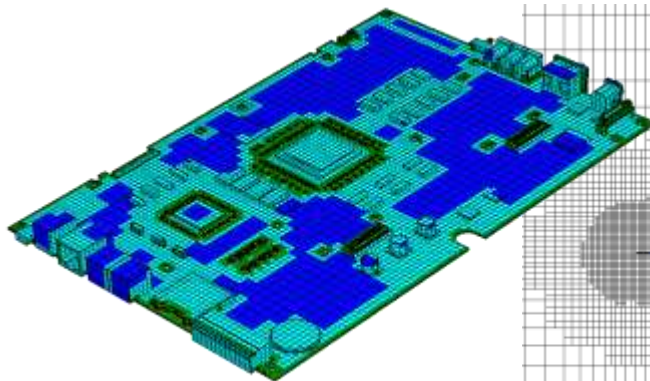
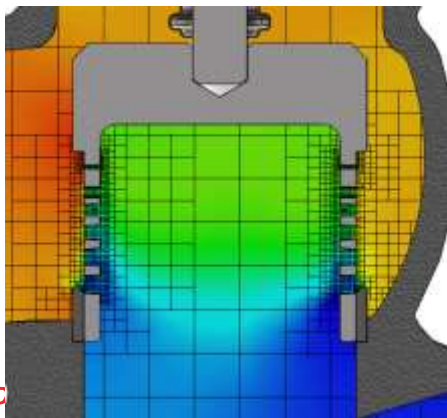
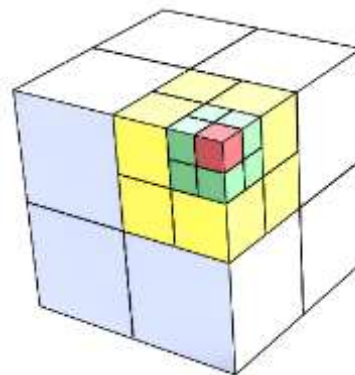
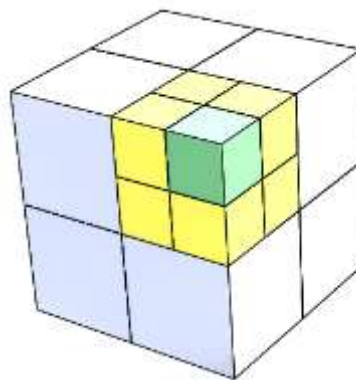
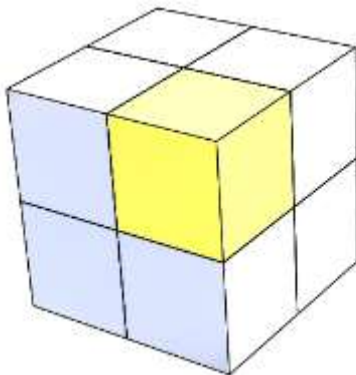
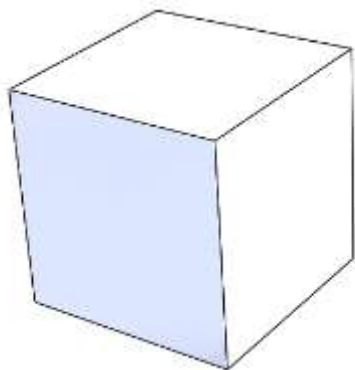
FLUID DYNAMICS ENGINEER
CFD SIMULATION ROLE ON 3DEXPERIENCE

DASSAULT
SYSTEMES

Mesh

Cells

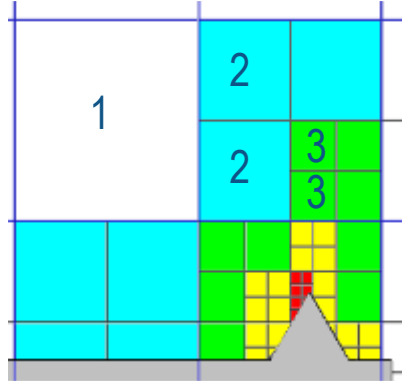
- Refinement levels



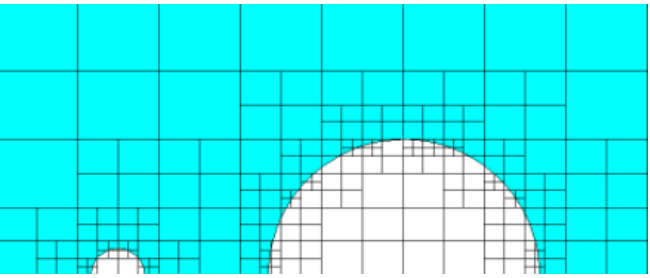
MESHING TECHNOLOGY

© Dassault Systèmes | Confidential Information | [ref.: 3DS_Document_2021]

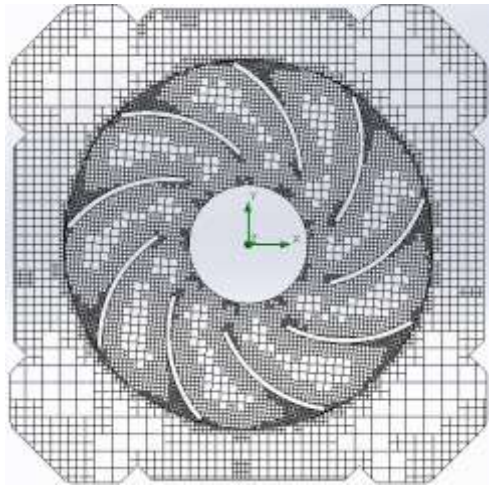
Refinement due to the Cell Mating rule



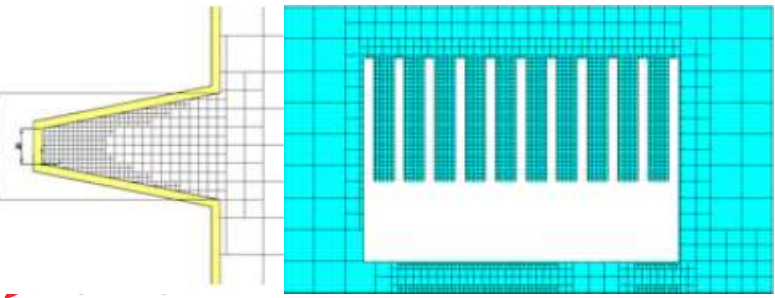
Tolerance Refinement



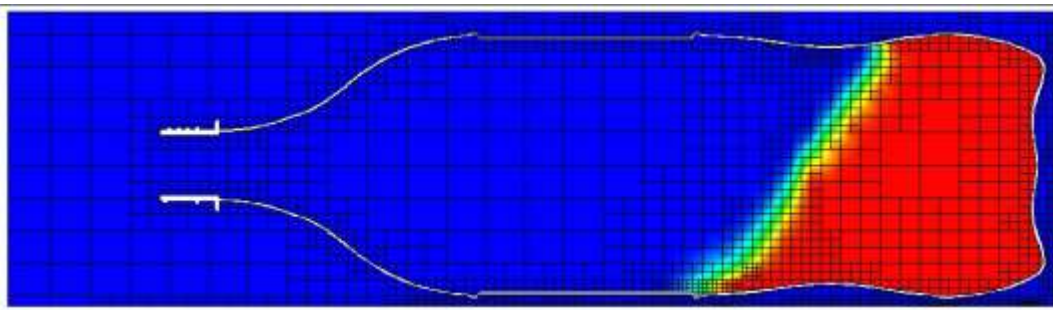
Rotating mesh



Channel Refinement



Adaptive mesh refinement



Computing time

Accuracy



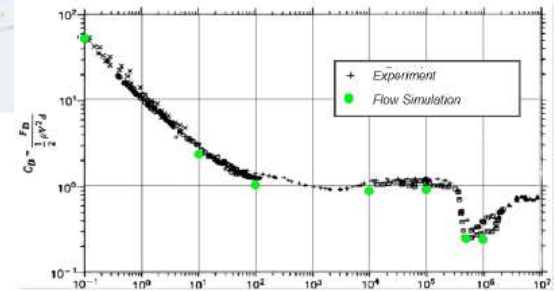
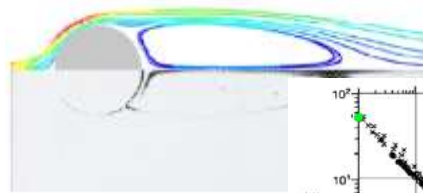
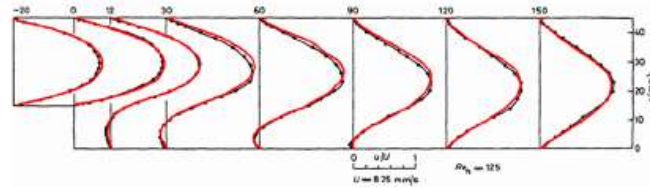
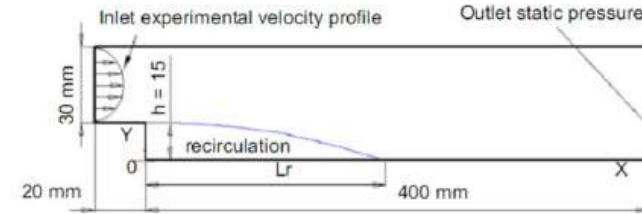
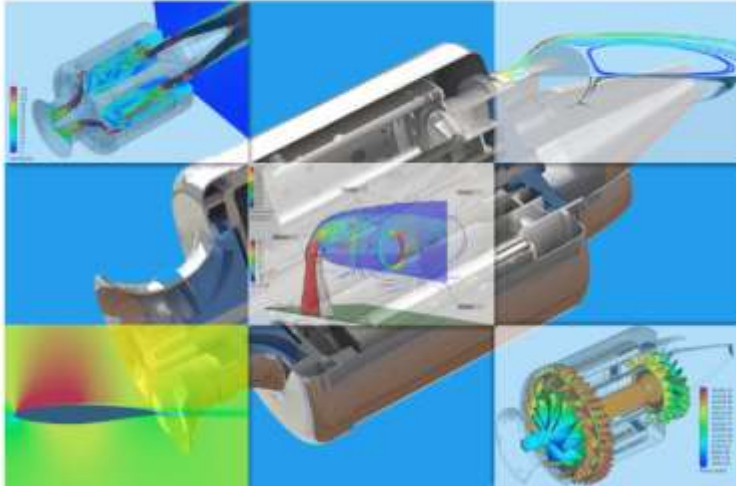
Validation Examples

DASSAULT
SYSTÈMES

SOLIDWORKS

Validation Methodology for Modern CAD-Embedded CFD Code: from Fundamental Tests to Industrial Benchmarks

White Paper



SOLIDWORKS

DASSAULT
SYSTÈMES

SOLIDWORKS Flow Simulation

Capabilities

Steady state / Transient

Gas / Liquids

Newtonian / Non-Newtonian liquids

Laminar / Turbulent / Transitional flow

Subsonic / Transonic / Supersonic

Incompressible / Compressive liquids

Export loads to SW SIMULATION

What can we do ?

Internal flow

External flow

Free Surface

Thermal Management

Mixing / Concentrations

Humidity / Condensation

Noise

Human comfort

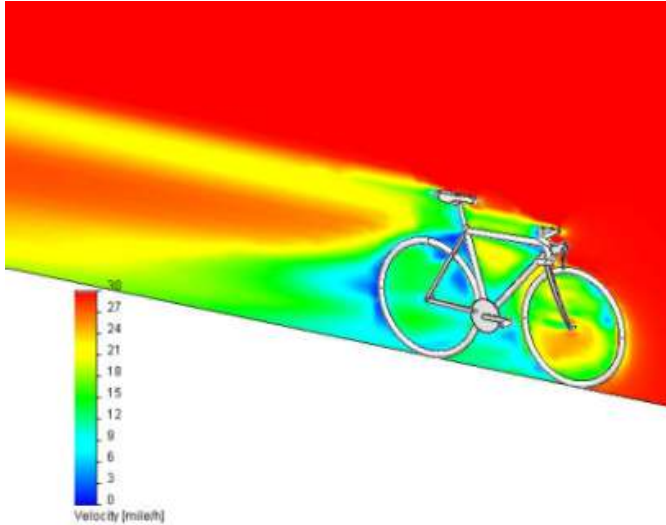
Rotating regions

Particles

Optimization

Steady State or Transient Study

Steady state

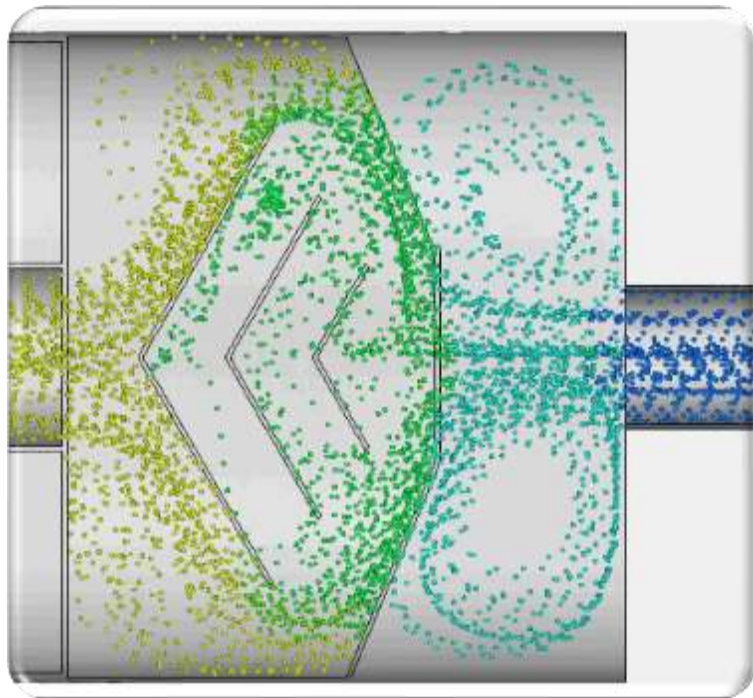


Transient Study



Internal Flow

Understand the flow performance within a design

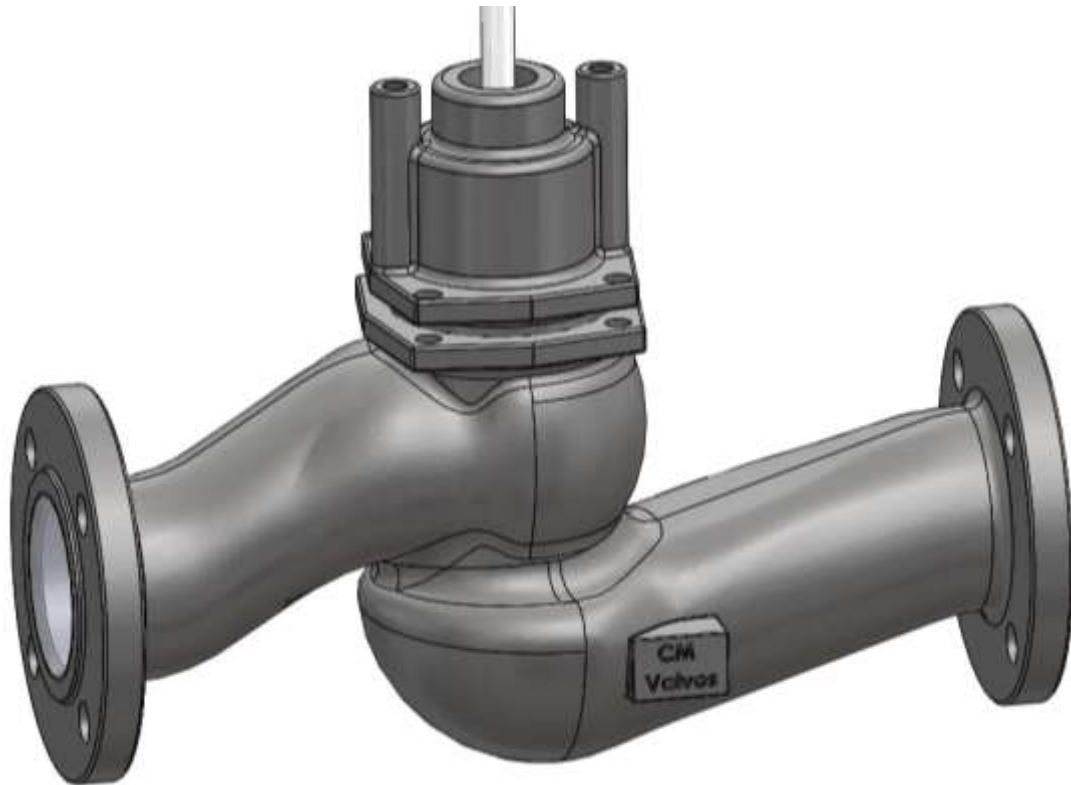


“Better Know How”

Test virtually vs Physical tests



Internal Flow



Easy access to plots

Pressure drop

Velocity

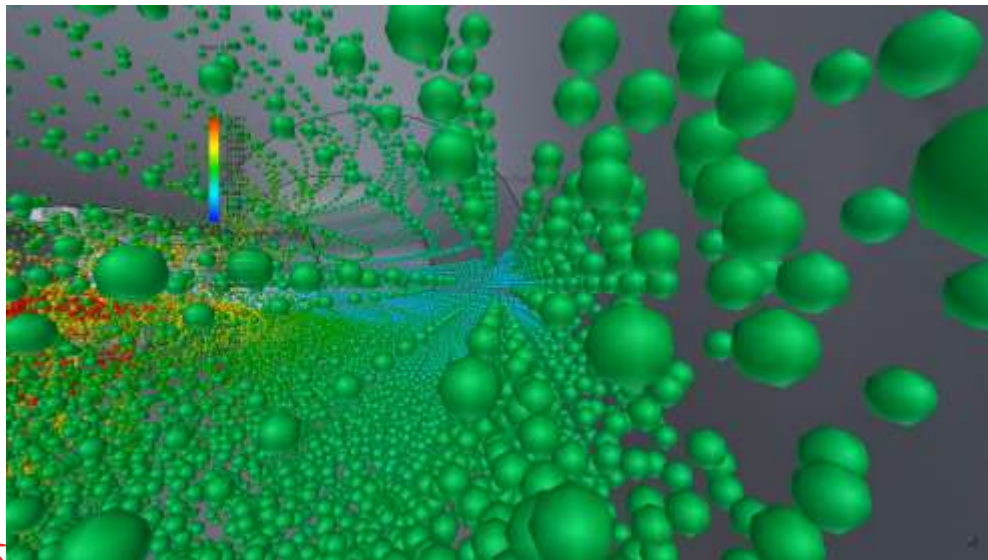
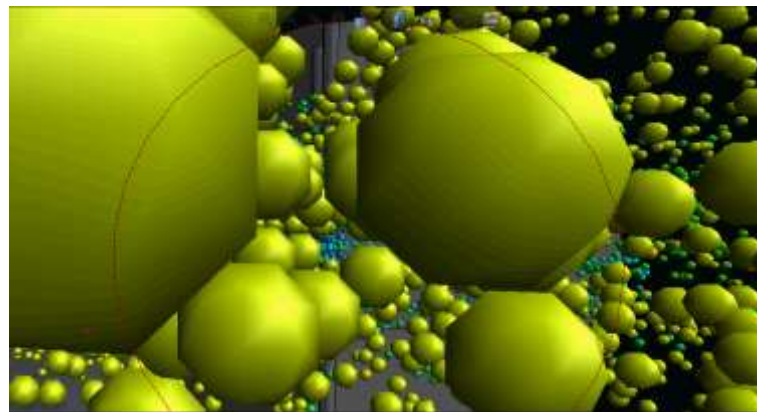
Turbulence

Good visualisations

Internal Flow

Step inside you products

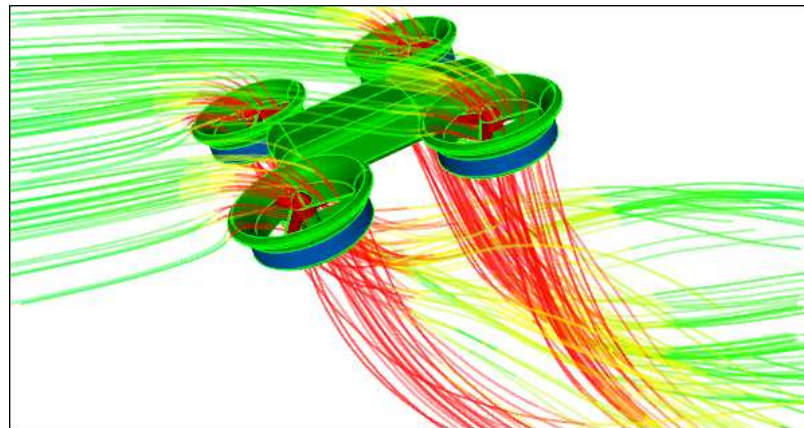
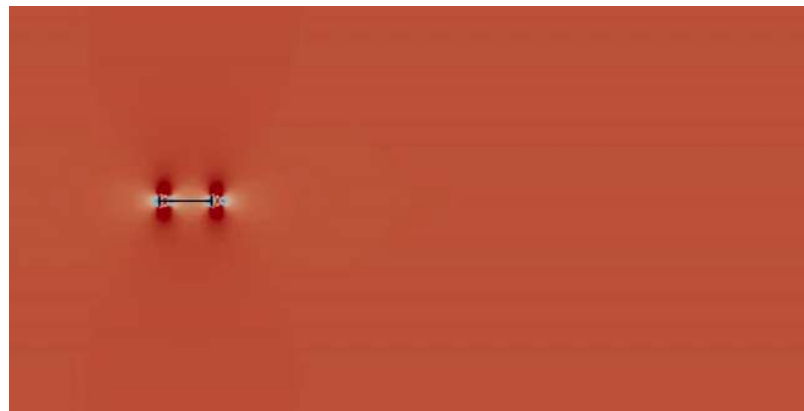
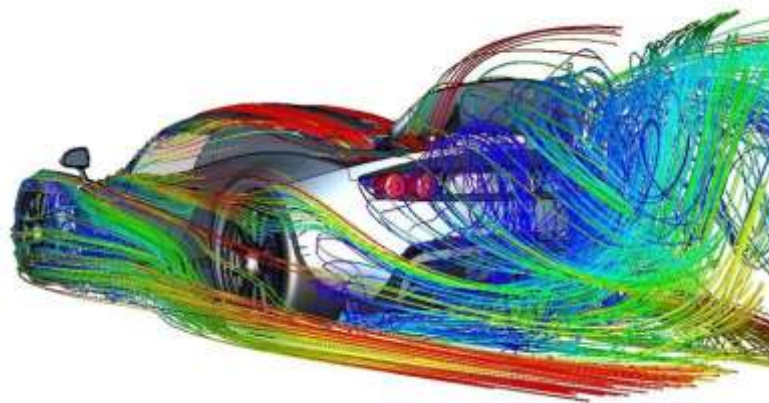
Follow particles



1. Create curve from flow path
2. Make camera follow curve
3. Make SW animation and play flow

EXTERNAL FLOW

- Aerodynamic design
- Drag force
- Turbulence
- Loads on surfaces
 - Export to Simulation tools



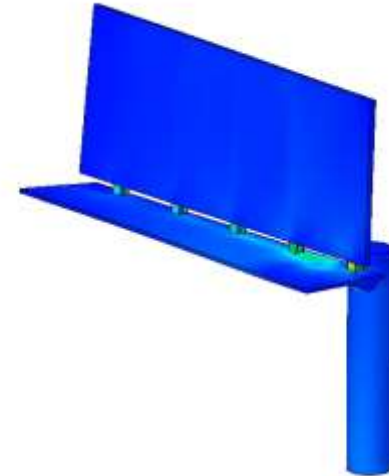
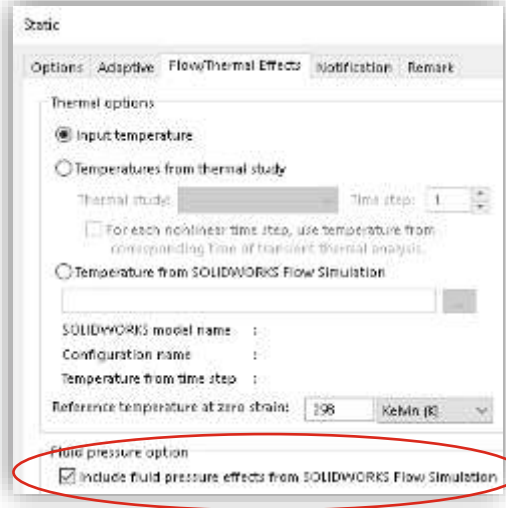
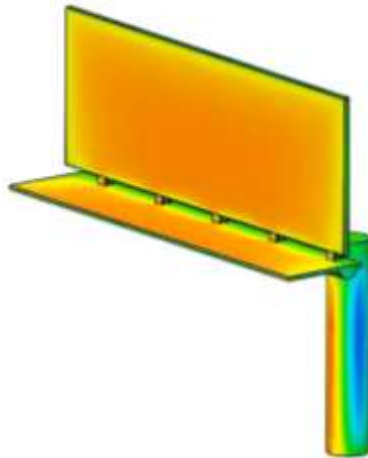
AERODYNAMICS



WIND RESISTANCE

- Use Flow to get loads

And use as load in
SOLIDWORKS Simulation

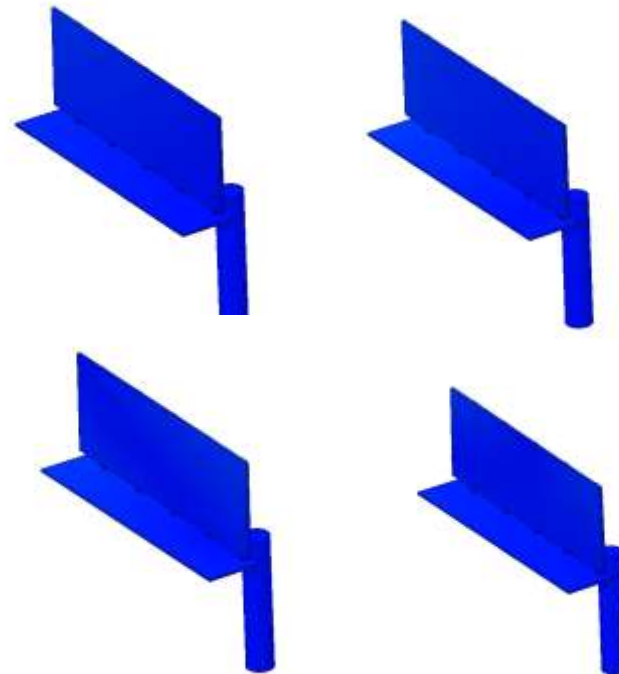
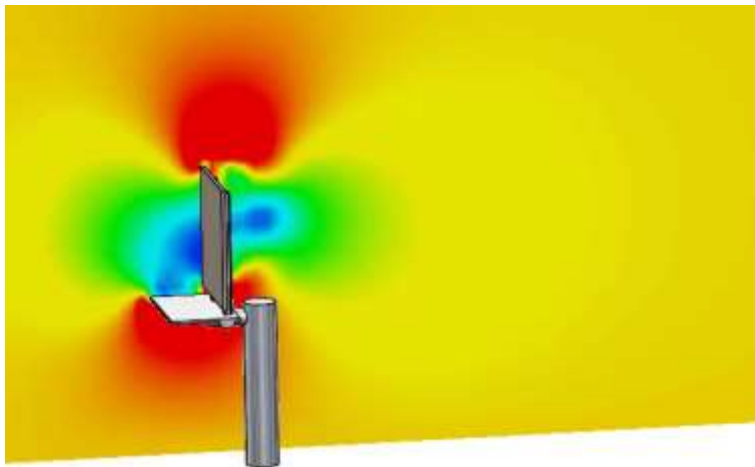
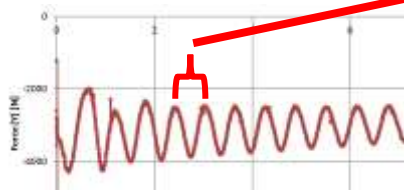


WIND RESISTANCE

- Check turbulence frequency

Resonant Frequencies in SOLIDWORKS Simulation Professional - Frequency

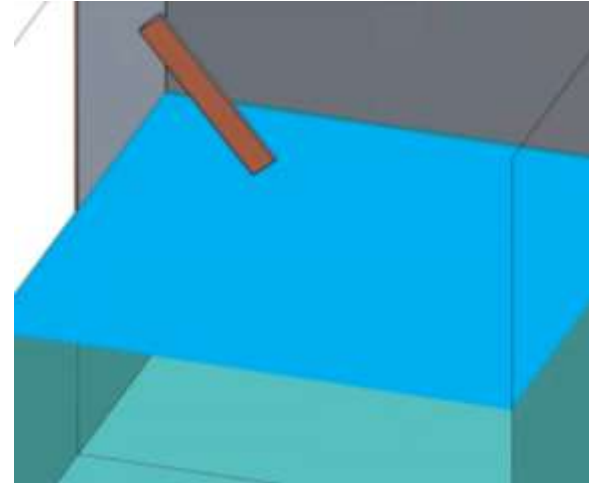
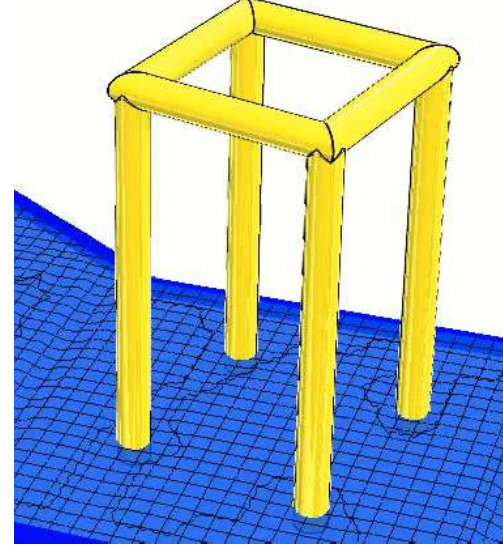
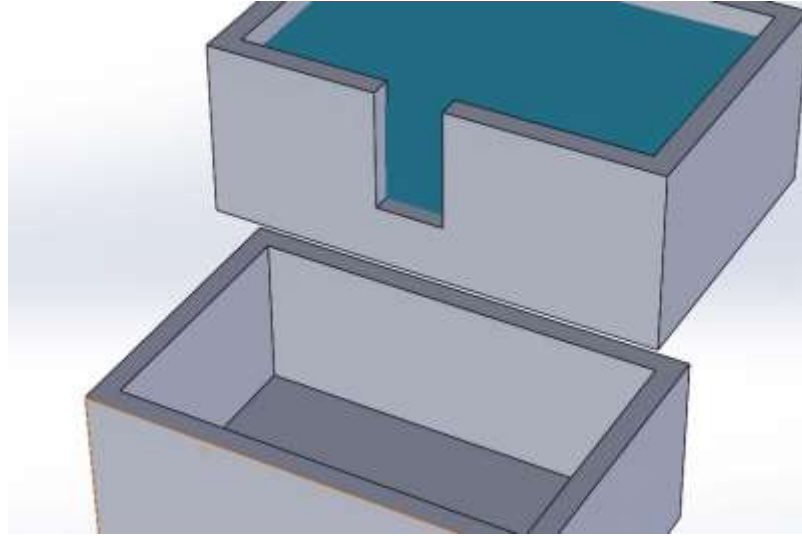
Mode No.	Frequency(Hertz)
1	1.8124
2	1.9445
3	3.959
4	6.0417
5	9.0287



TACOMA NARROWS

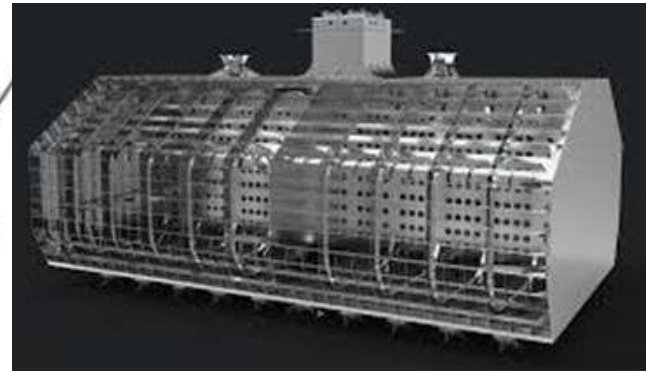


FREE SURFACE

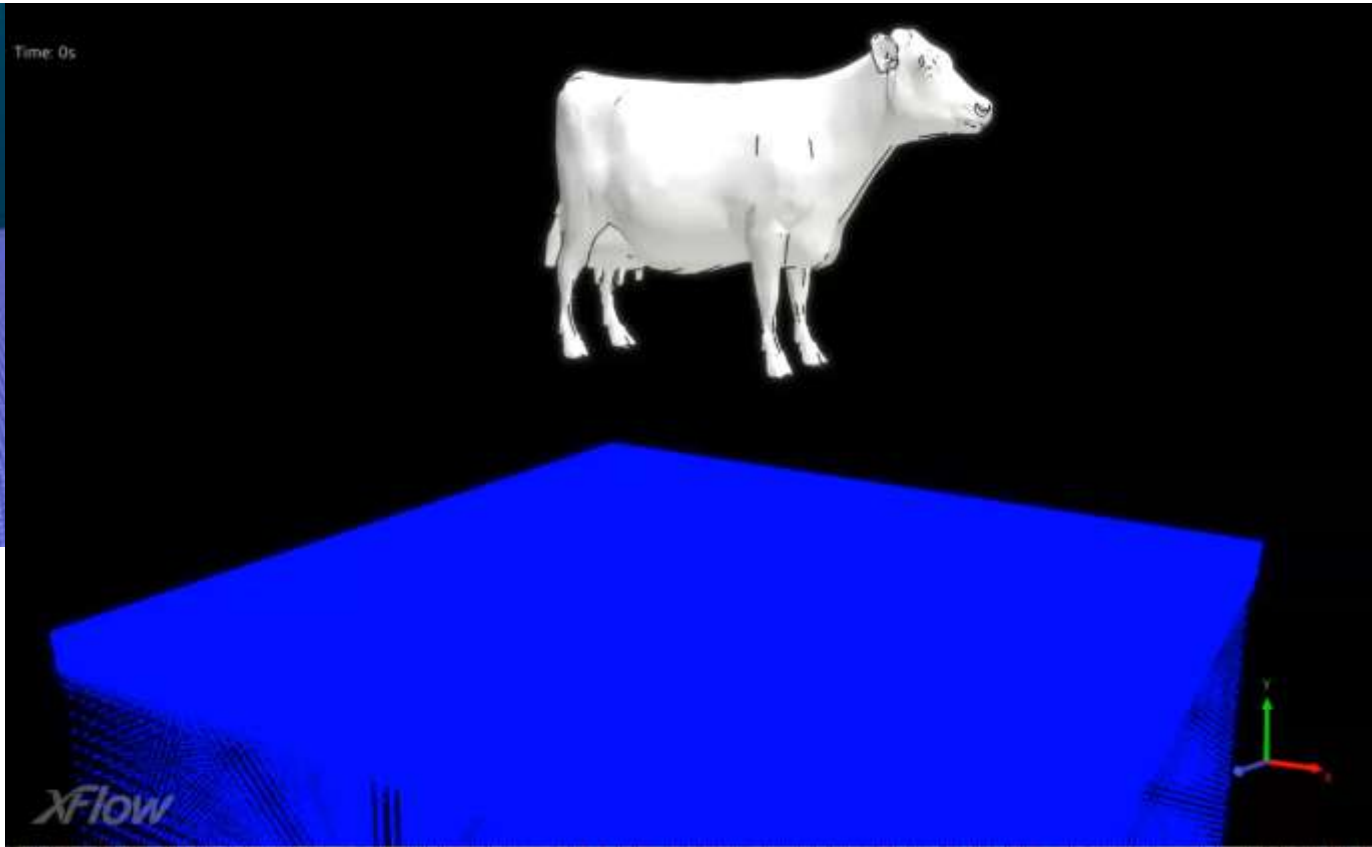
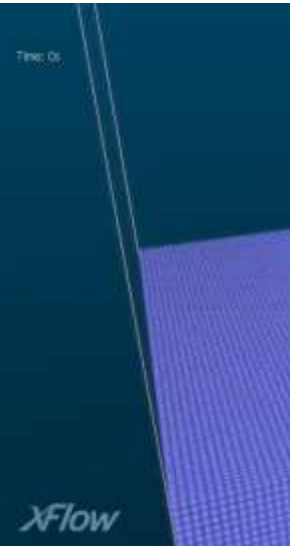


SLOSHING

Problems with moving liquids ?



Free surface in XFlow



THERMAL MANAGEMENT

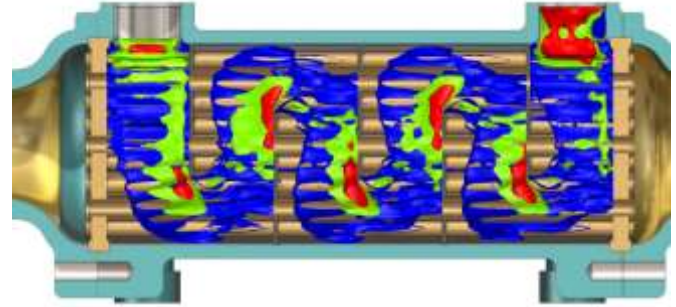
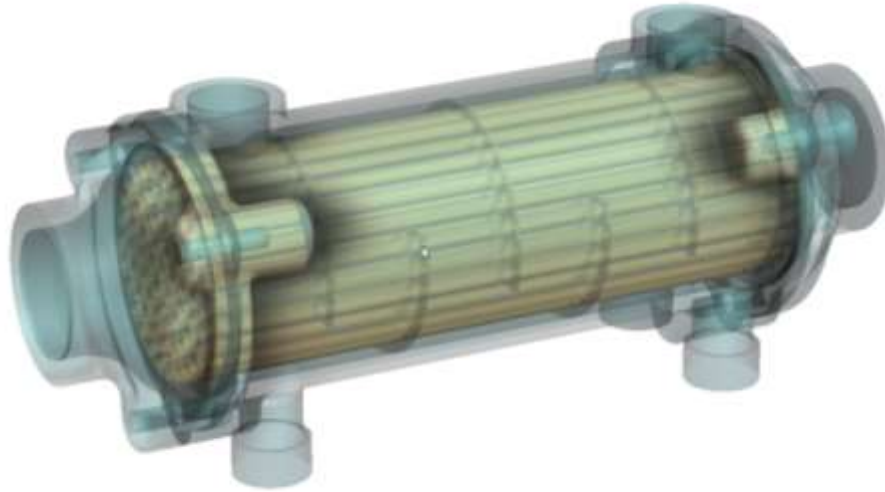
CONVECTION

CONDUCTION

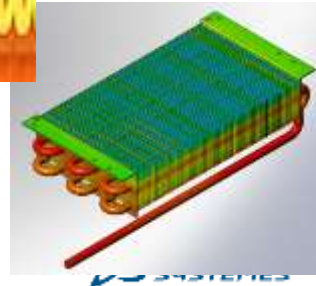
RADIATION



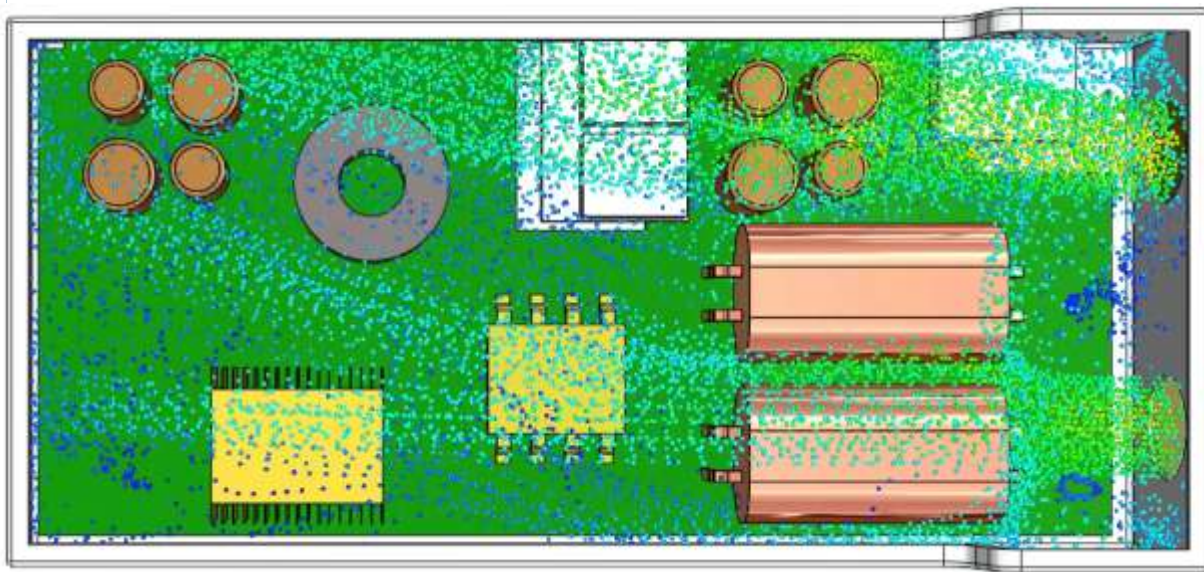
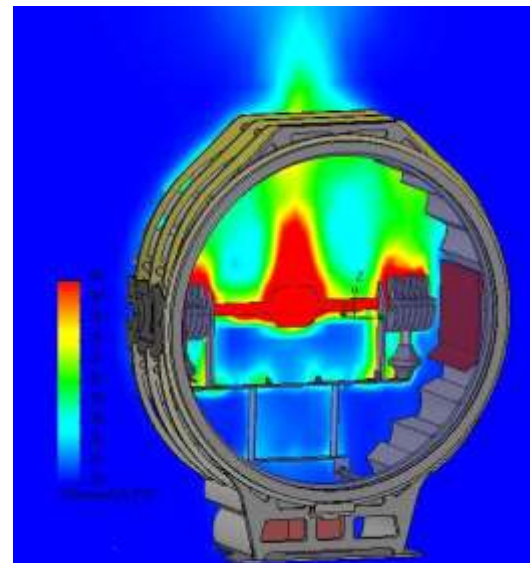
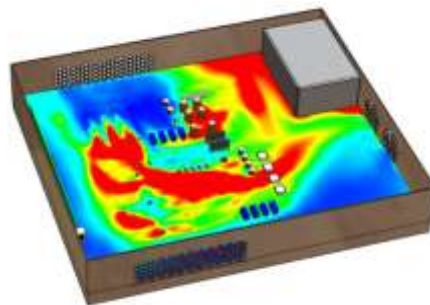
CONDUCTION



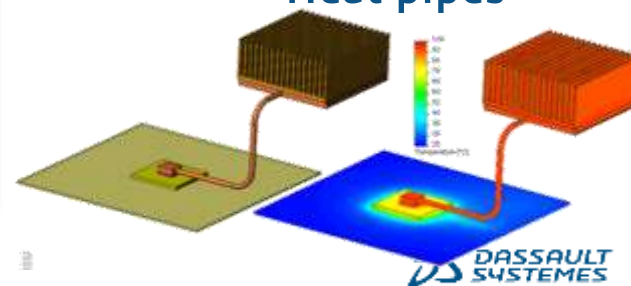
JOULE heating



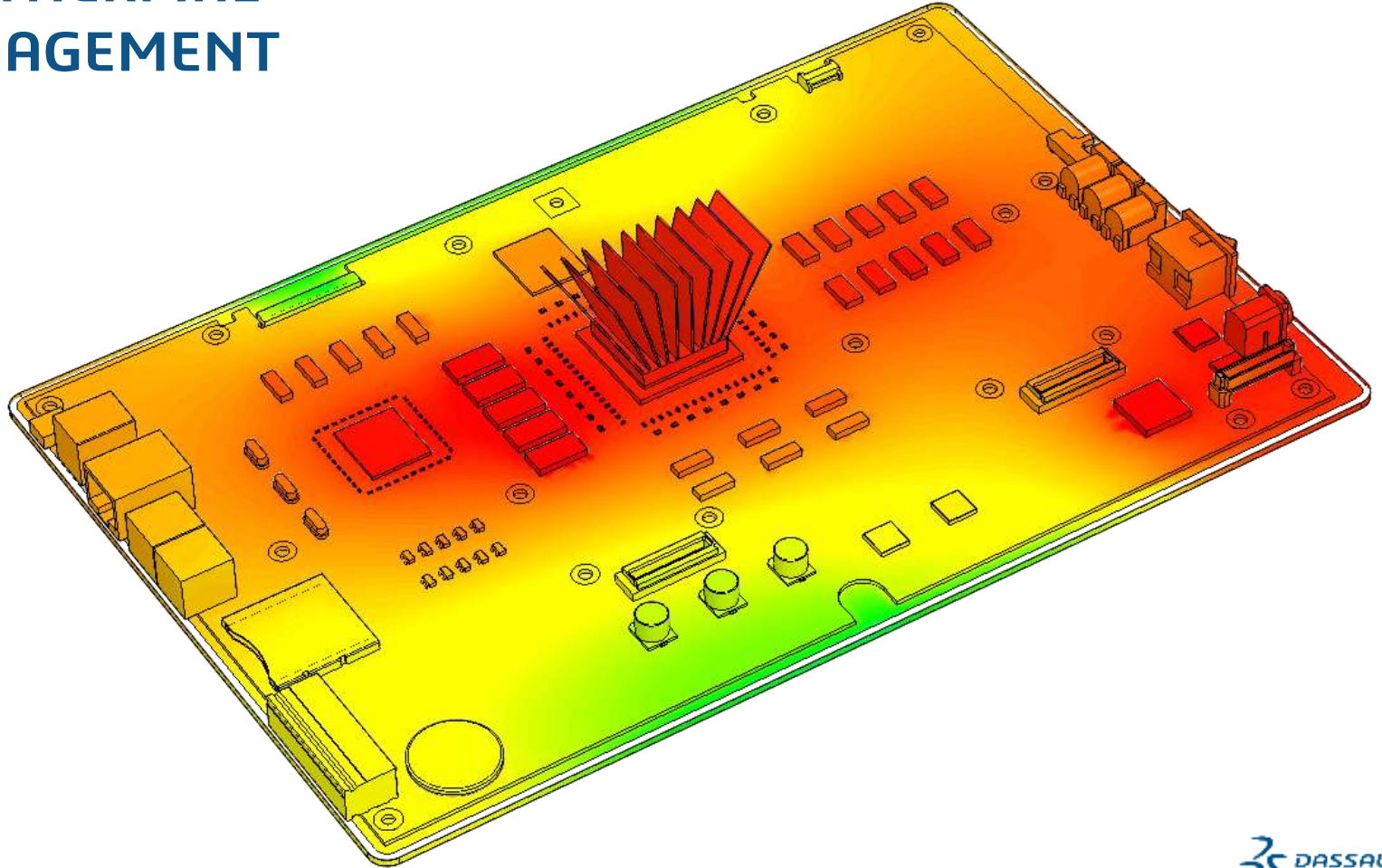
CONVECTION

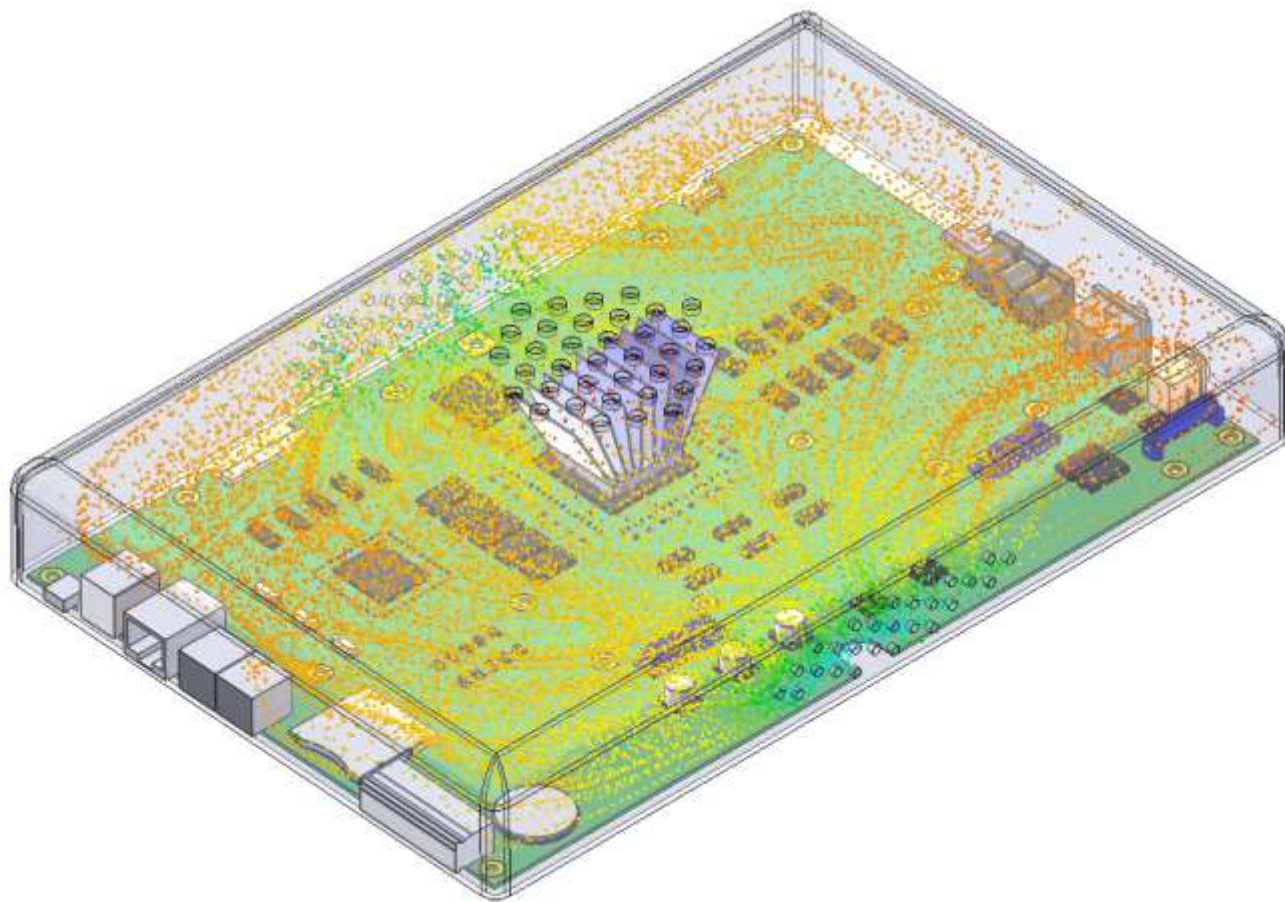


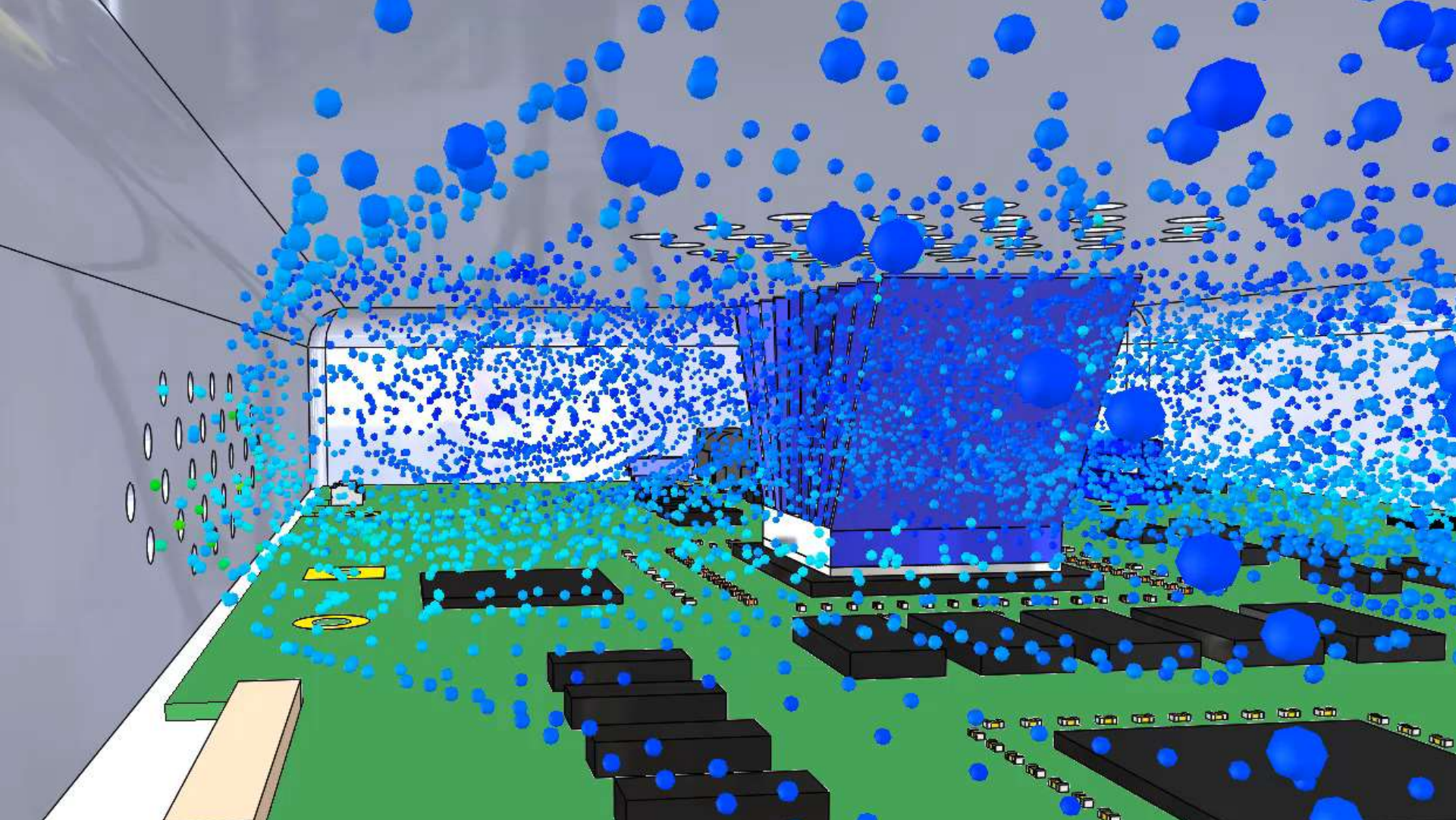
Heat pipes



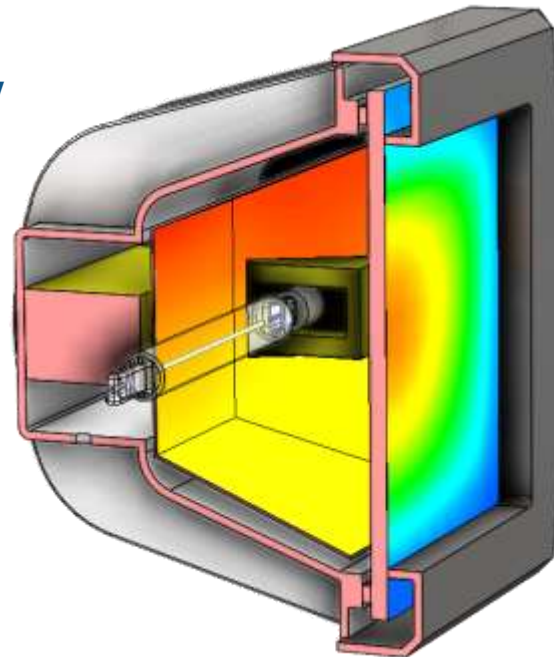
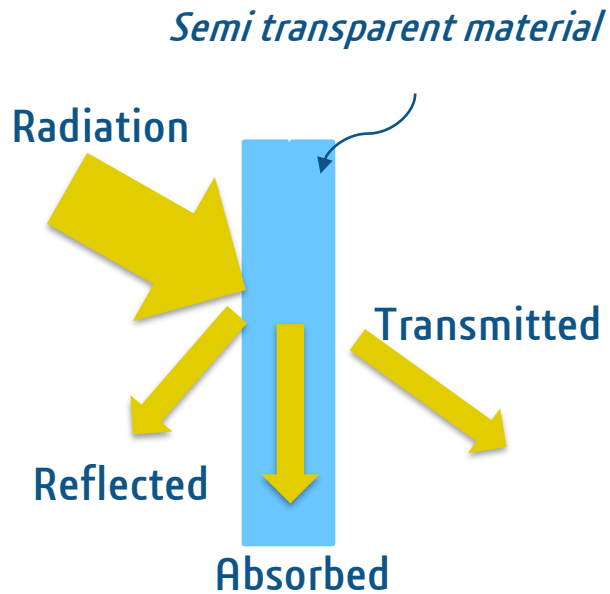
PCB THERMAL MANAGEMENT



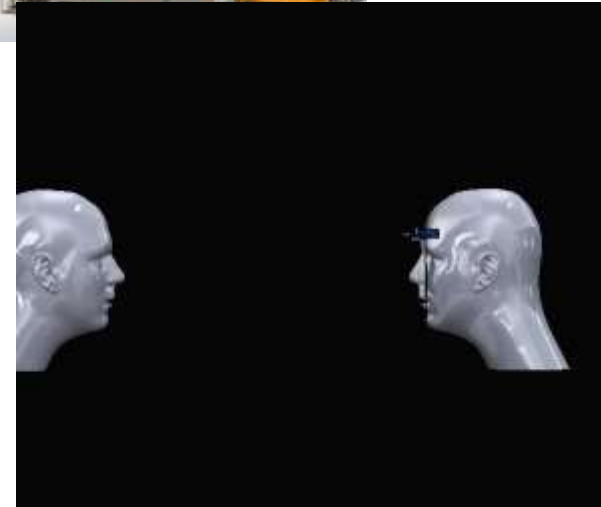
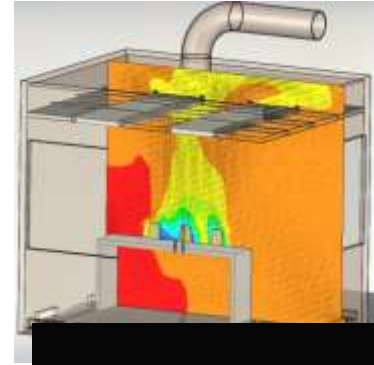
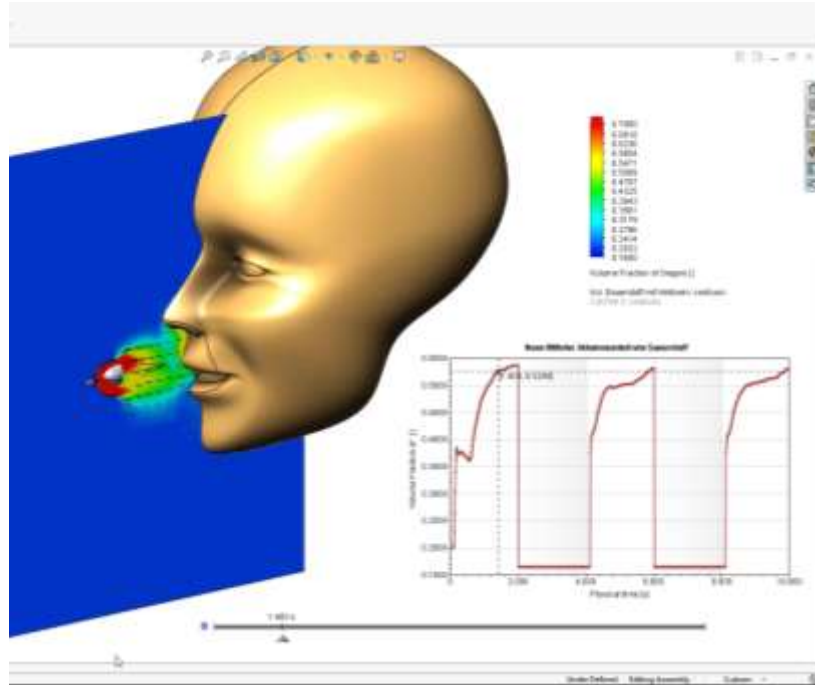




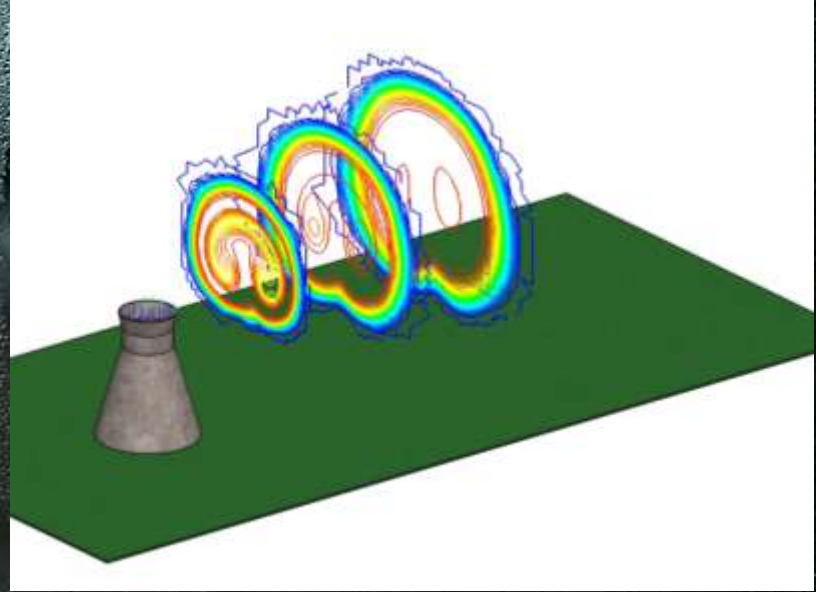
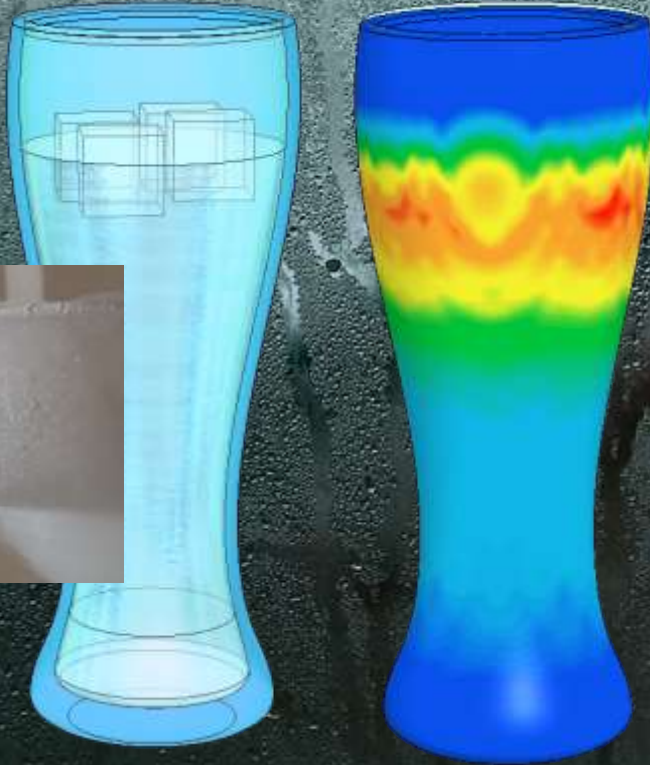
RADIATION



MIXING / CONCENTRATIONS

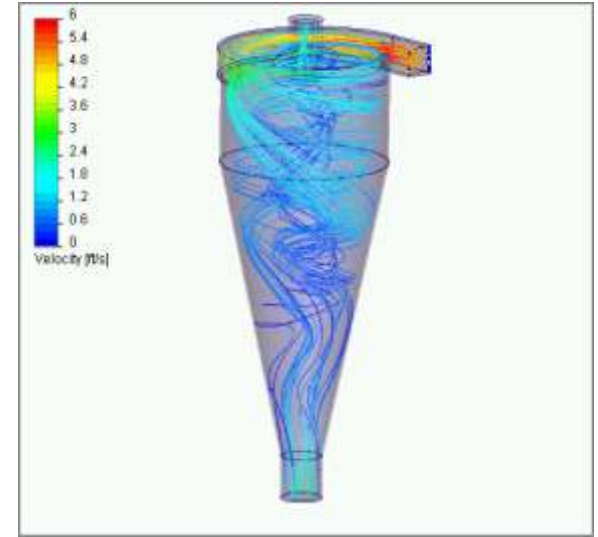
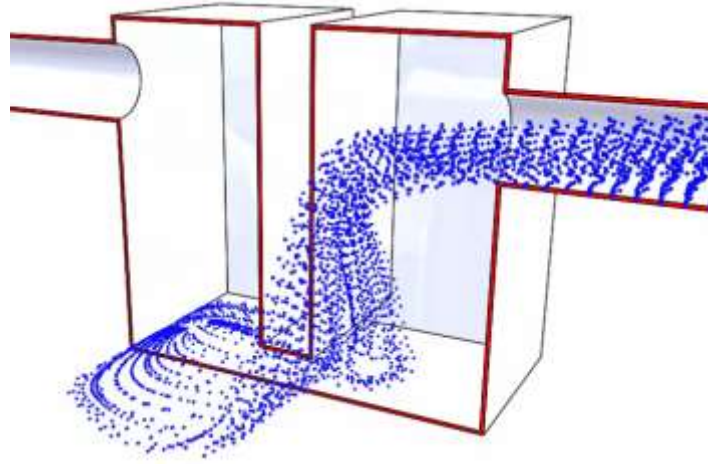


HUMIDITY / CONDENSATION

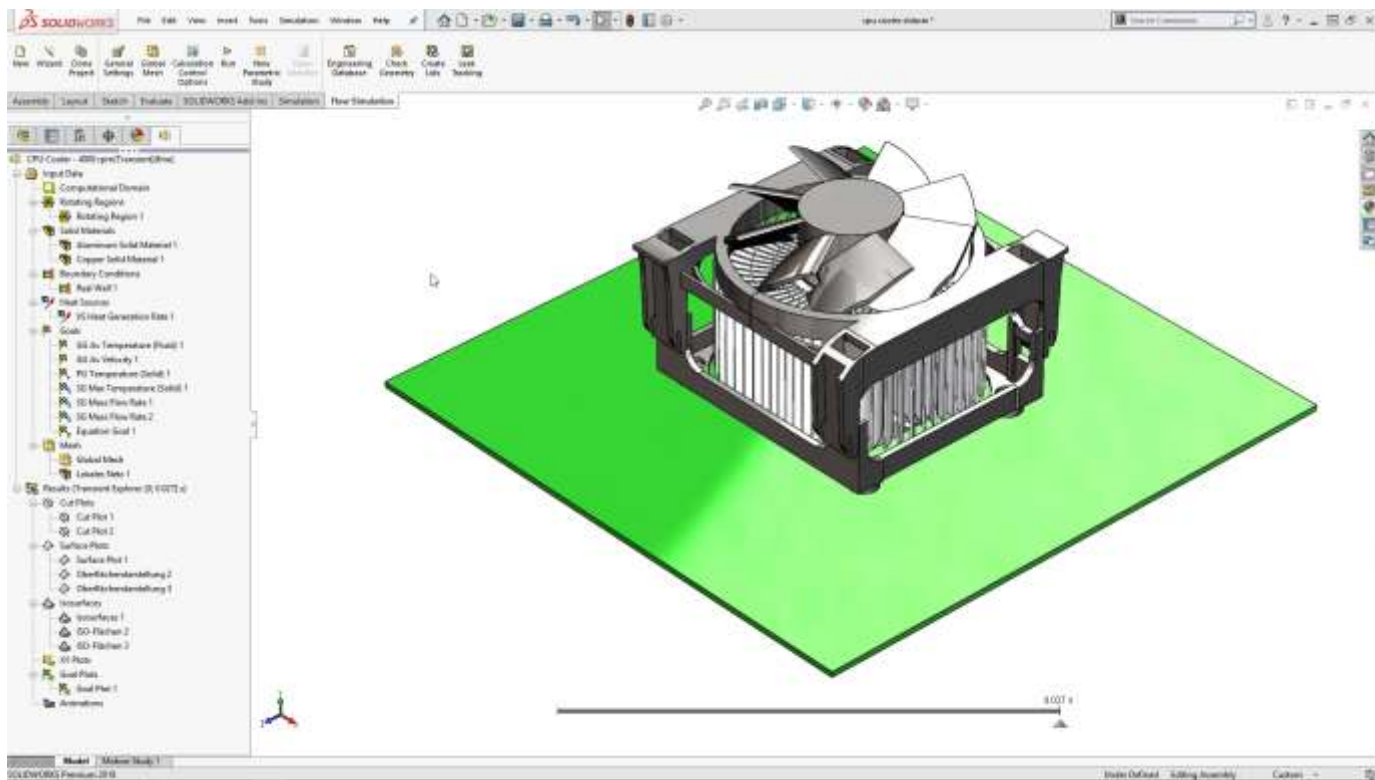


Particle study

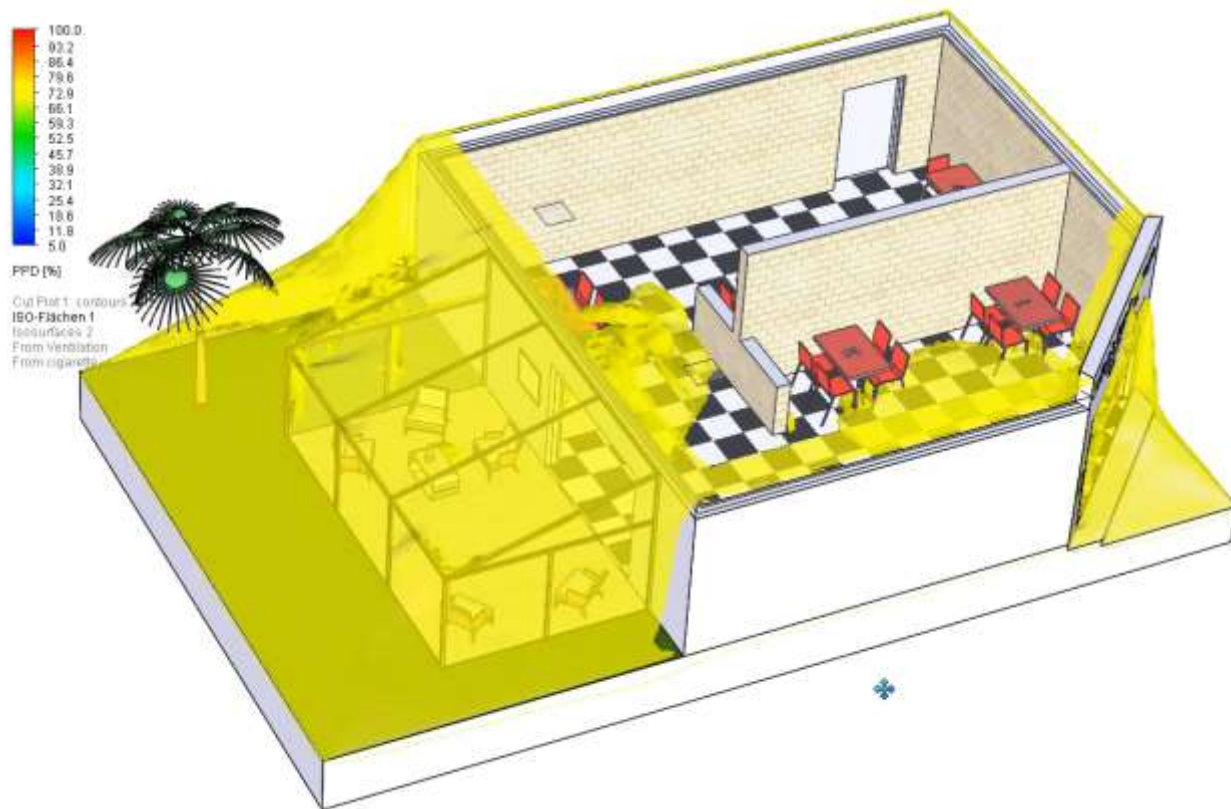
- Understand how particle behaves in a flow
- Particles material accumulation
- Walls erosion



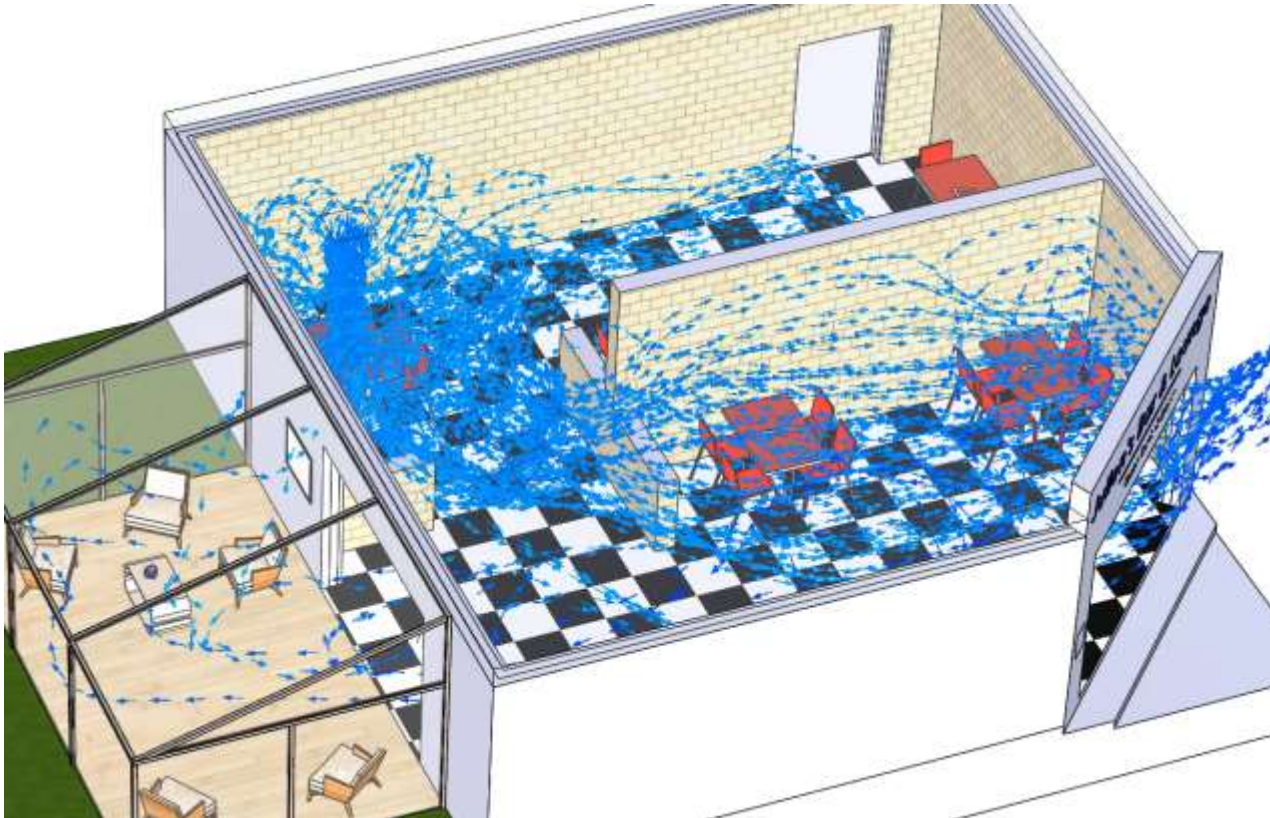
NOISE



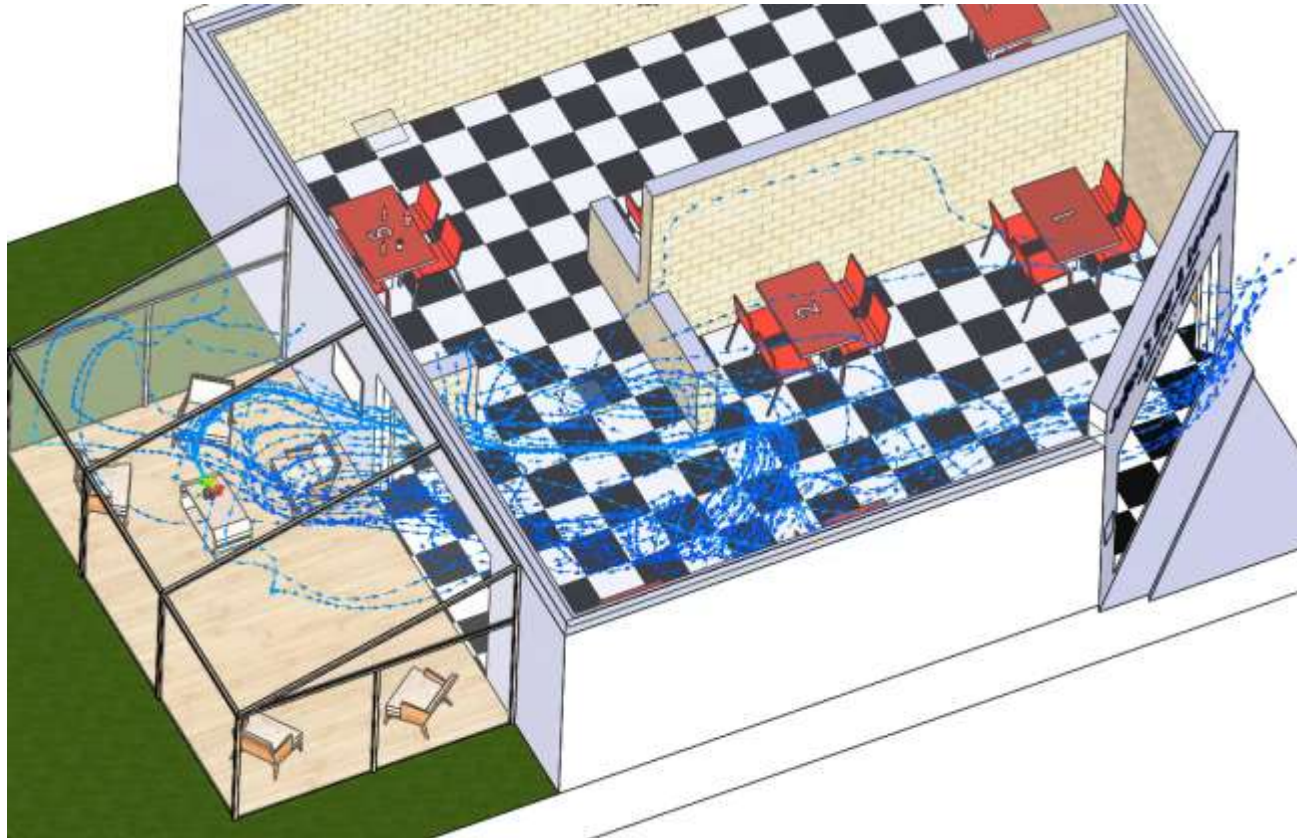
HUMAN COMFORT



VENTILATION

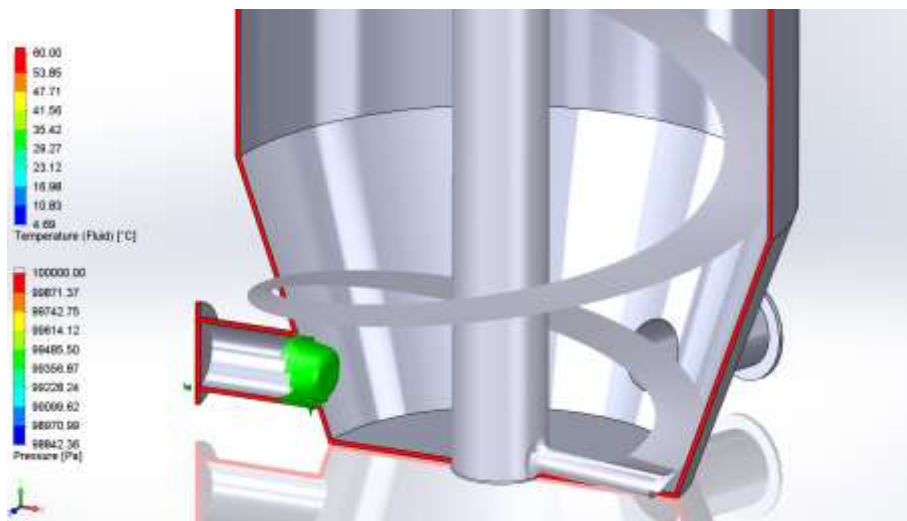
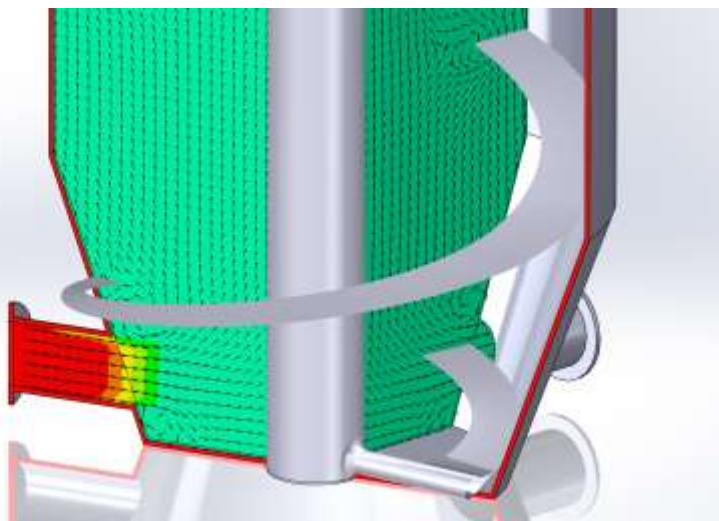


SMOKE ?



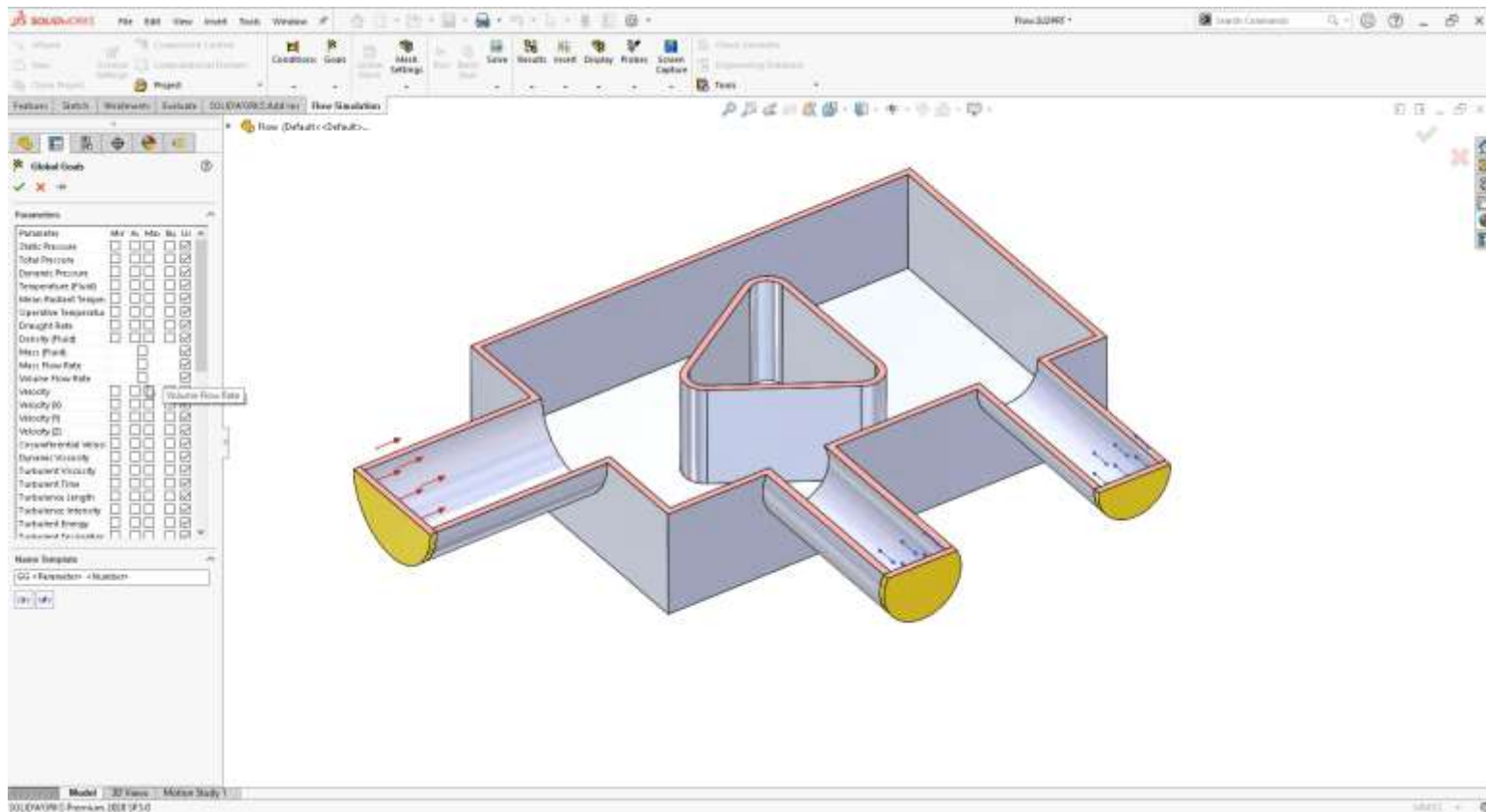
ROTATING PARTS

- 3D Rotating geometry
- Moving mesh

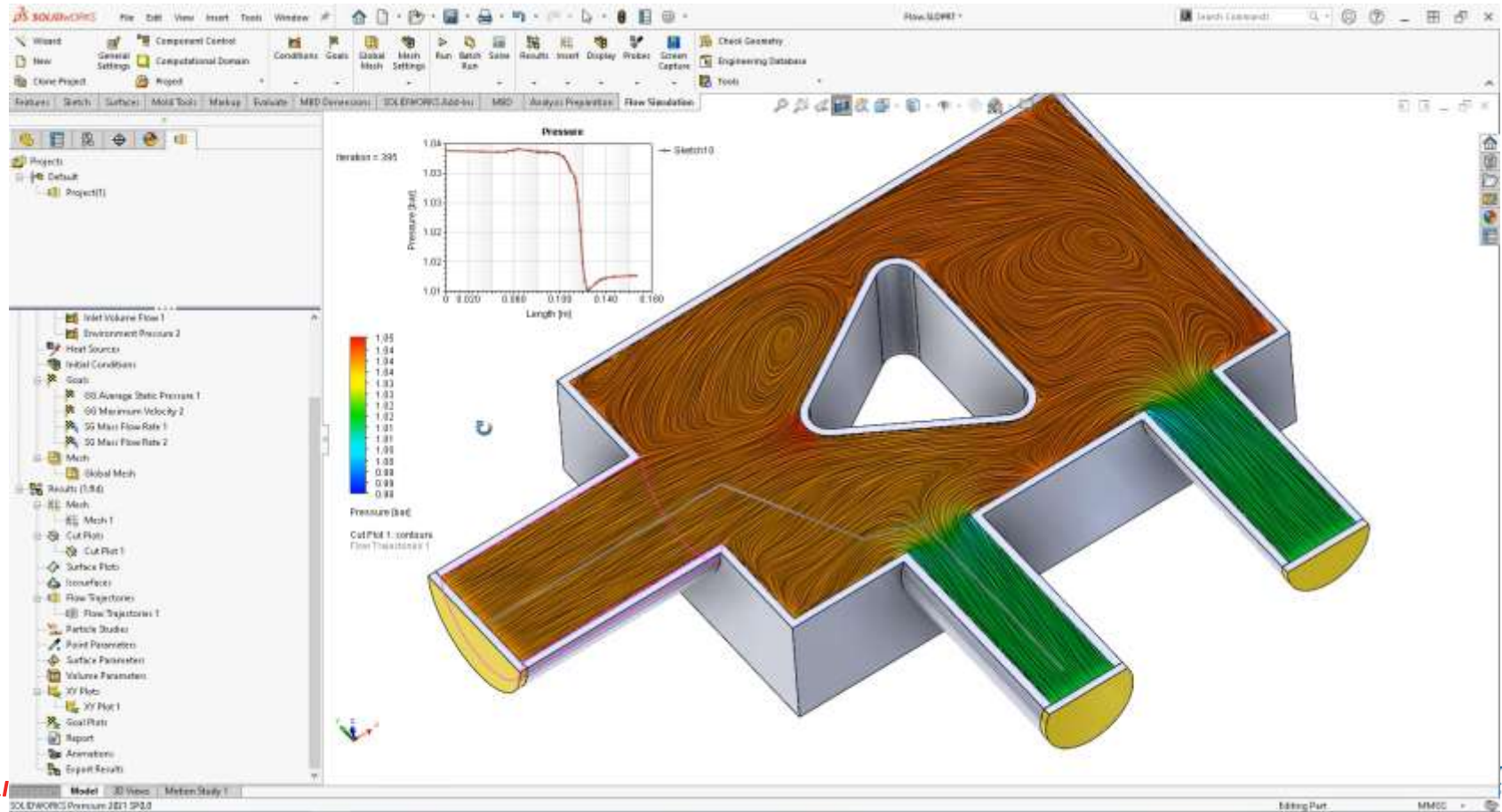


DEMONSTRATION

DEMO EXAMPLE



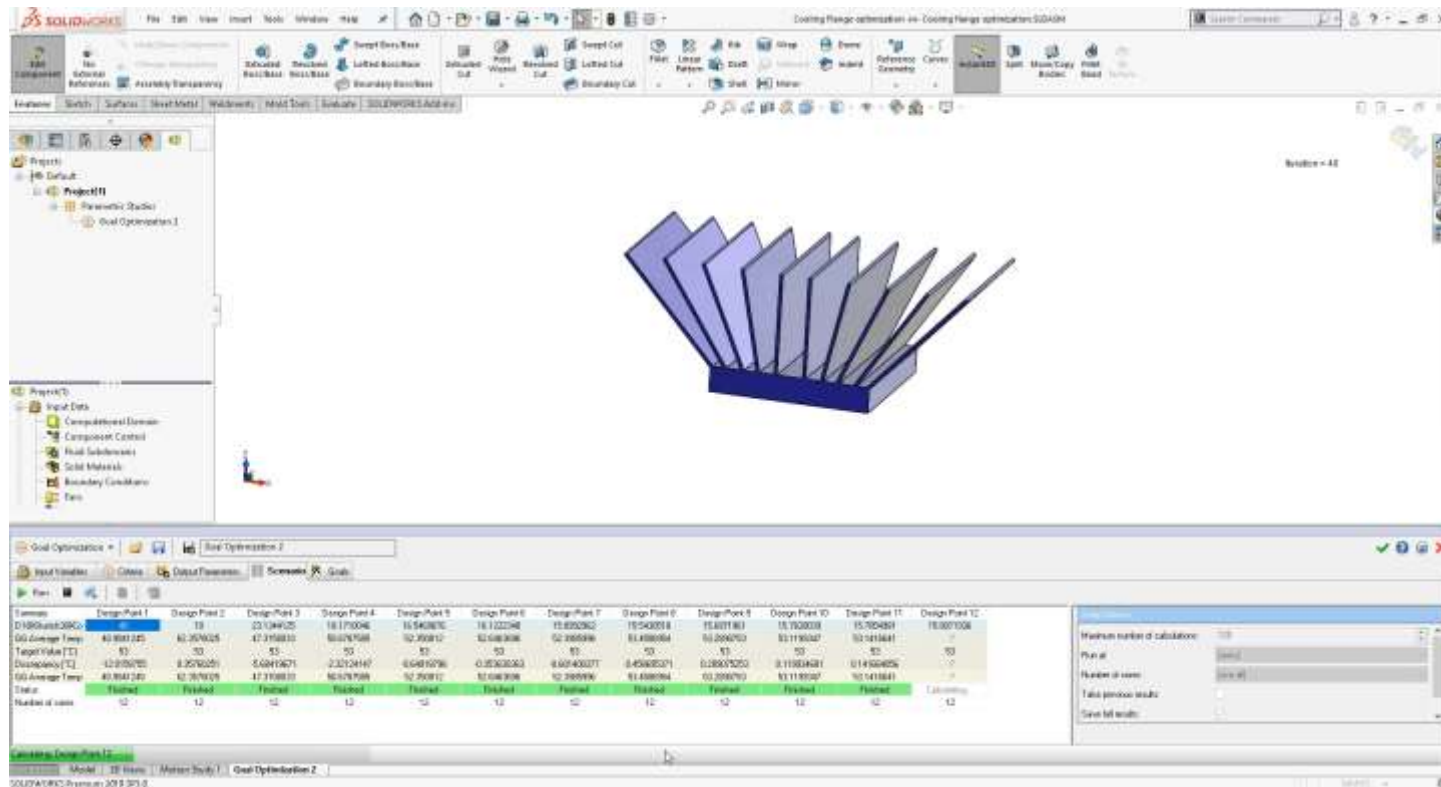
Results



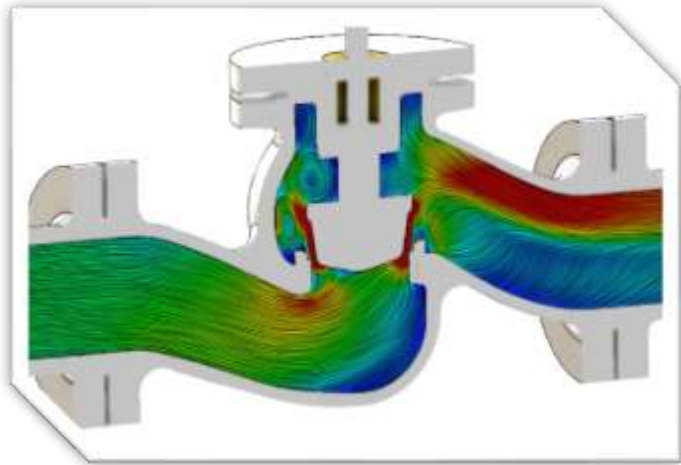
OPTIMIZATION

How to automatically change your
design towards a Simulation Goal

OPTIMIZATION



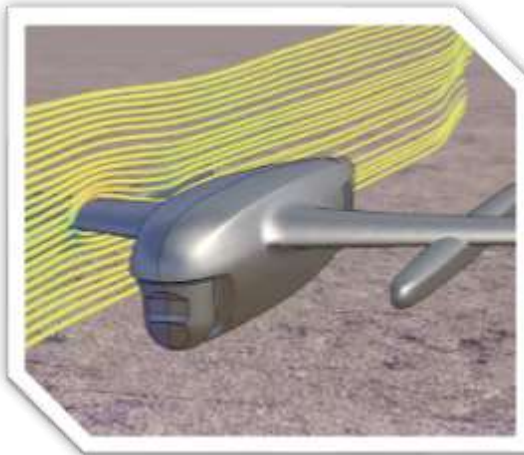
3D SOLIDWORKS
FLOW SIMULATION



Integrated in SOLIDWORKS



FLUID DYNAMICS ENGINEER
CFD SIMULATION ROLE ON 3DEXPERIENCE



3DEXPERIENCE Platform

3D SIMULIA

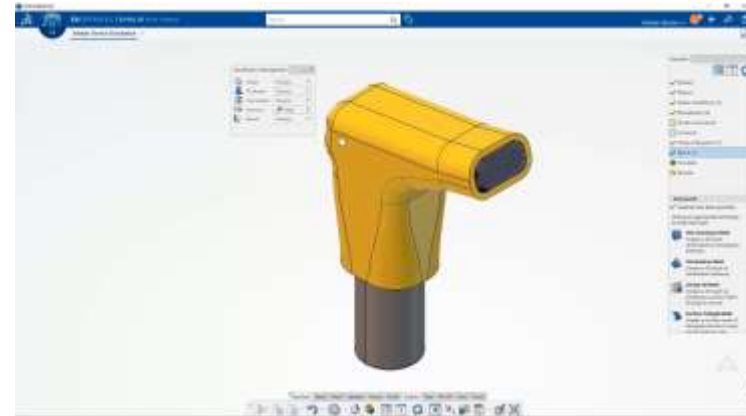
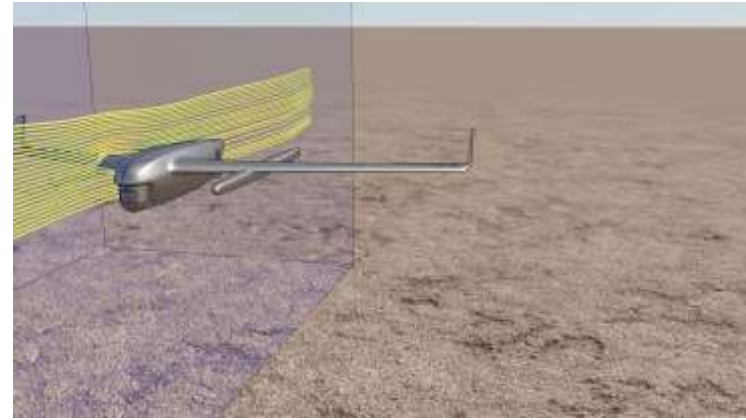
XFlow



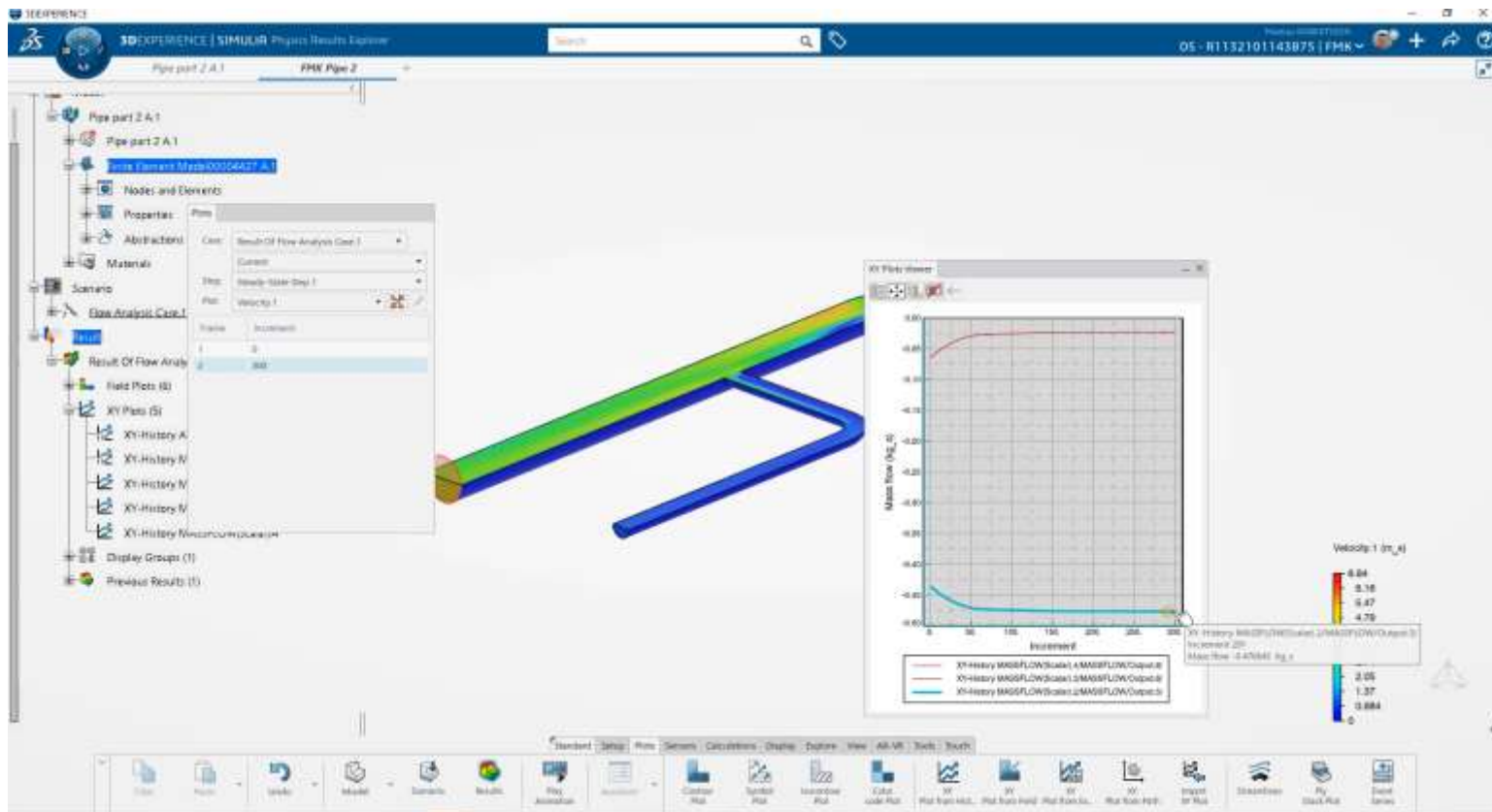
Standalone

WHAT IS UNIQUE ?

- Fluid Dynamics on 3DEXPERIENCE Platform
- No SOLIDWORKS licenses is required
- Body-fitted mesh with boundary layers
- Turbulence Models Realizable k- ϵ , SST k- ω , Spalart – Allmaras
- Run Simulation on the cloud for free, 16 cores
- High Performance Computing (HPC) on cloud up to 144 cores (credits or tokens needed)



DEMONSTRATION



WHY USE FLOW SIMULATION ?



X-Ray



Thermal



Shrink



Wind



Fluids



Time



Future



Money

SOLIDWORKS Flow Simulation

- ❑ Powerful tool to understand fluids flow
 - ❑ Integrated in SOLIDWORKS
 - ❑ Easy to use
 - ❑ Save money with virtual test vs physical
 - ❑ Make design decisions
-
- ❑ Help you design better products!

THANK YOU!

