

# Webinar Logistics

- Audio
- Questions' Panel
- Recording and Slides



# Webinar: Empowering Design Engineers with Faster and more Accurate GPU Physics Solvers

Daniel Moses, Sr Applications Engineer DRD Technology

June 27, 2024



<del><b>Webinar 1:</b> Leveraging Real-Time GPU Solvers for Simulation Driven Designs</del>	<del>6/18/24</del>
<b>Webinar 2:</b> Empowering Design Engineers with Faster and More Accurate GPU Physics Solvers	6/27/24

# Agenda

- **Introduction to DRD**
- **GPU Solver Fluids Capabilities**
  - Enhancements
  - GPU CHT Accuracy Benchmark
- **GPU Solver Structural Capabilities**
  - Enhancements
  - Press-fit Accuracy Benchmark

# Mission Statement



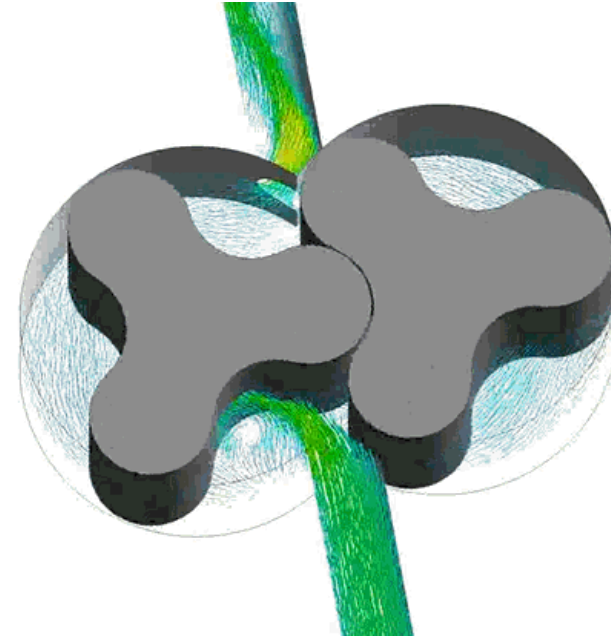
CERTIFIED ELITE CHANNEL PARTNER

DRD helps its customer make effective utilization of Ansys through products sales and a range of services including technical support, training, consulting, mentoring, and technology transfer.

# DRD History

Since 1980, DRD Technology has been focused on engineering simulation.

In 1984, DRD became an Ansys Channel Partner.



“I’ve been working with DRD for 29 years. Working with your team has been one of the more enjoyable parts of my career. You have always been ready to help in any way.”

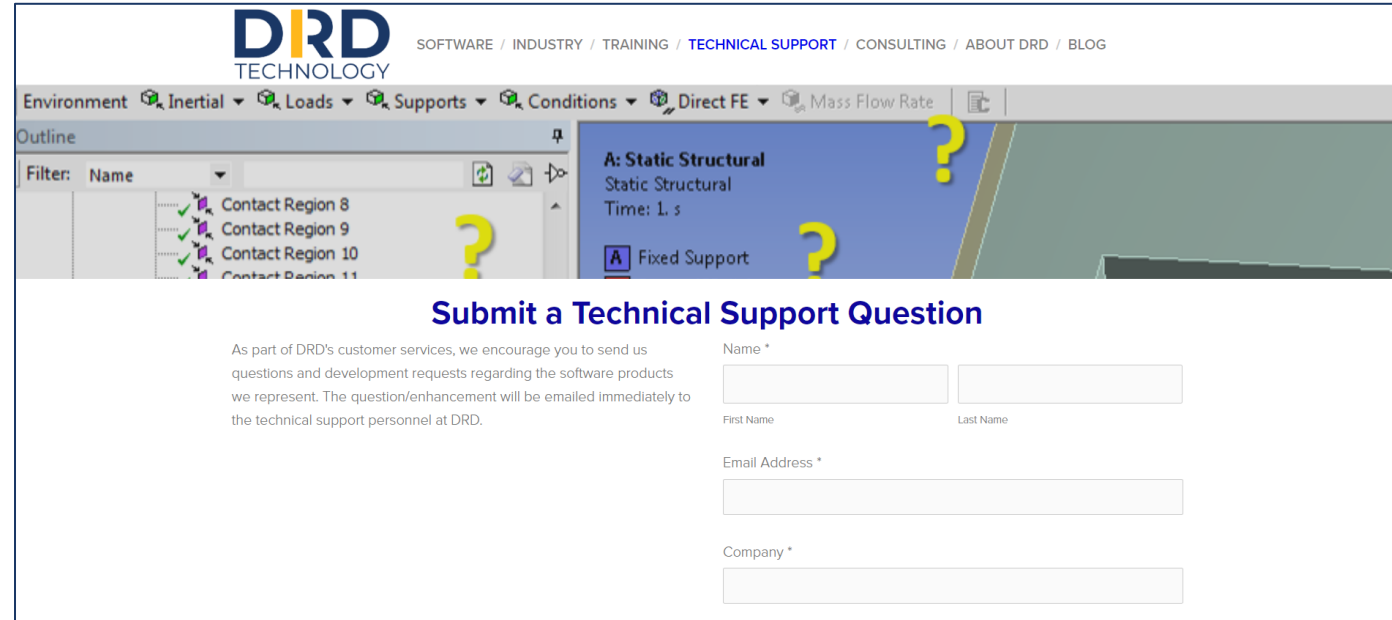
- Rick Kunc  **SOLVAY**  
asking more from chemistry®

# Technical Support Contact Coordinates

Phone: 918 743-3013 ext 1

Email: [support@drd.com](mailto:support@drd.com)

Web: [www.drd.com](http://www.drd.com)



The screenshot shows the DRD Technology software interface. At the top, the DRD logo is displayed with the text "SOFTWARE / INDUSTRY / TRAINING / TECHNICAL SUPPORT / CONSULTING / ABOUT DRD / BLOG". Below the logo, there are several tabs: "Environment", "Inertial", "Loads", "Supports", "Conditions", "Direct FE", and "Mass Flow Rate". The "Supports" tab is active, showing a tree view of "Contact Region 8", "Contact Region 9", "Contact Region 10", and "Contact Region 11". A yellow question mark is placed over the "Supports" tab and the tree view. To the right, a panel titled "A: Static Structural" shows "Static Structural" and "Time: 1. s". Below this, a "Fixed Support" is visible with a yellow question mark. The main content area is titled "Submit a Technical Support Question" and contains a form with the following fields: "Name \*" (split into "First Name" and "Last Name"), "Email Address \*", and "Company \*". A paragraph of text explains that DRD encourages users to send questions and development requests regarding software products, and that the question/enhancement will be emailed immediately to the technical support personnel at DRD.

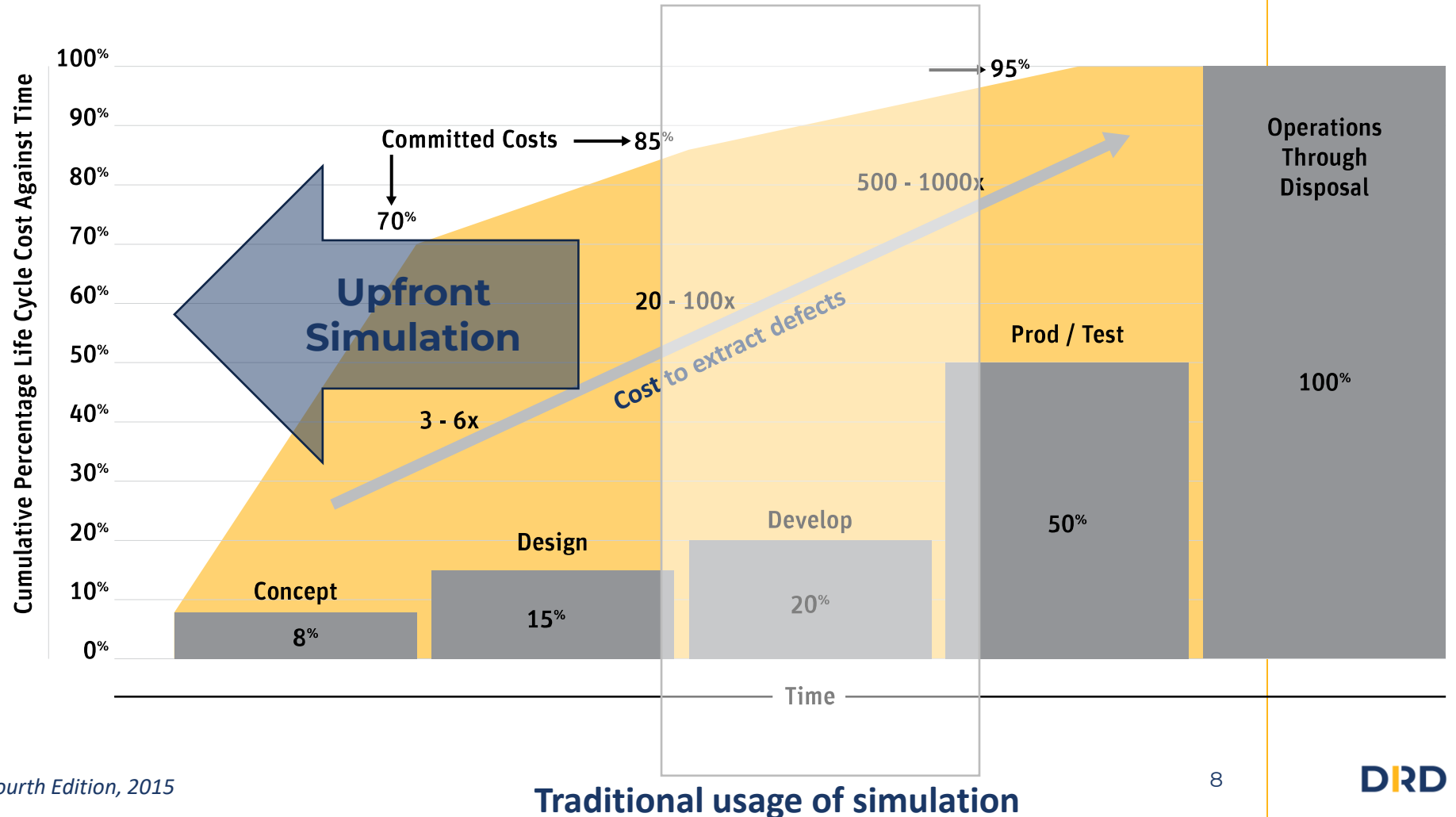
*“The best aspect of the (software) decision was the outstanding support that we get from DRD as they partner with us to make the tool work most efficiently and accurately for us.”*

*Dick Rawlings*

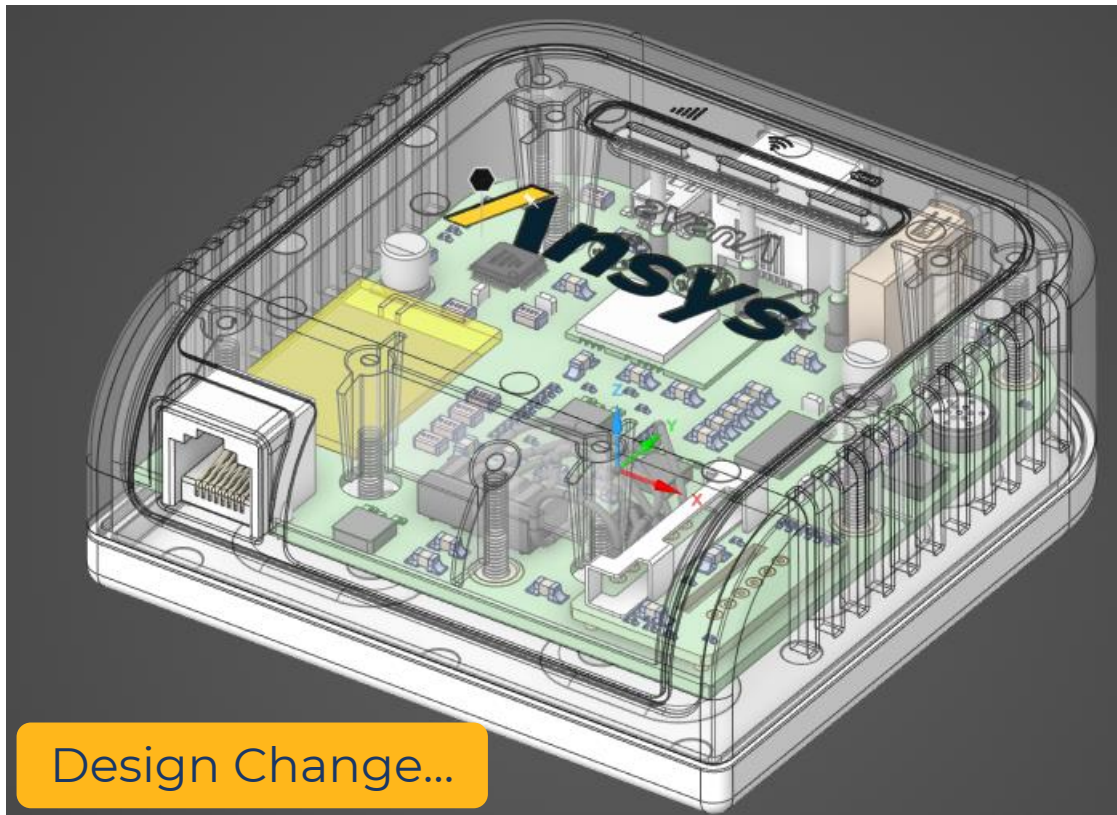
# Review of Webinar 1

Ansys Discovery enables simulation driven design through real time GPU solvers

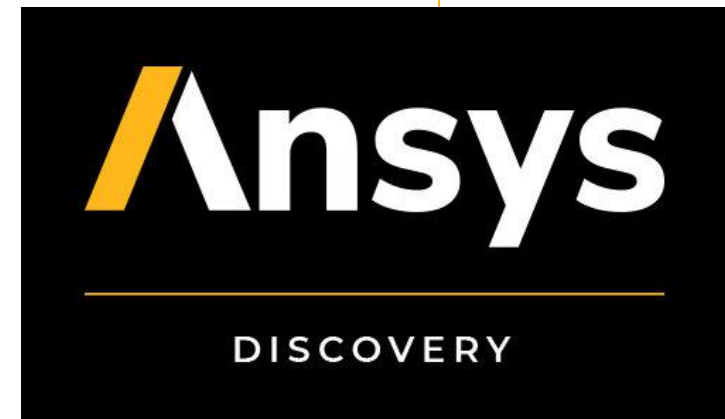
- Cost and Time Efficiency
- Innovation and Flexibility
- Enhanced Product Performance



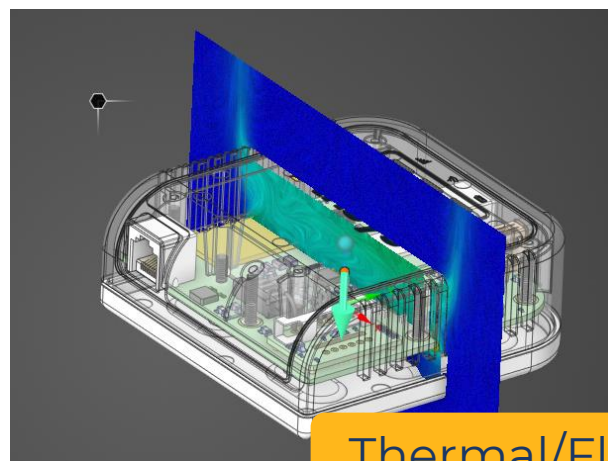




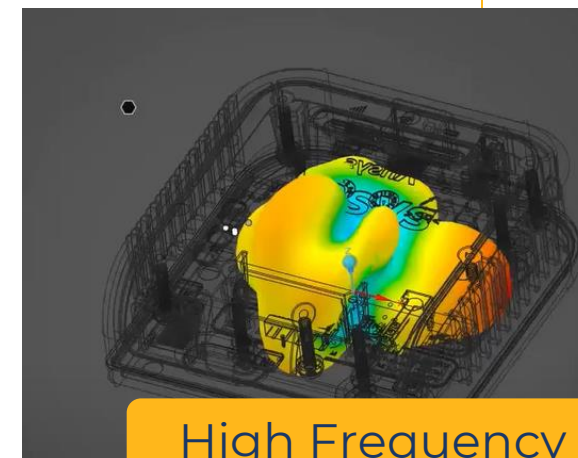
Design Change...



Structural



Thermal/Fluid



High Frequency

# Discovery Supported Physics

Steady State Fluid Flow



Time Dependent Fluid Flow



Topology Optimization



Steady State Solid Thermal



Conjugate Heat Transfer



Time Dependent Thermal Fluid Flow



Steady State Thermal Fluid Flow



Thermal Stress



Antenna



Time Dependent Conjugate Heat Transfer



Static Structural



Time Dependent Solid Thermal



Modal



Modal Optimization



# Fluids

Capabilities and Enhancements

Accuracy Benchmark for CHT

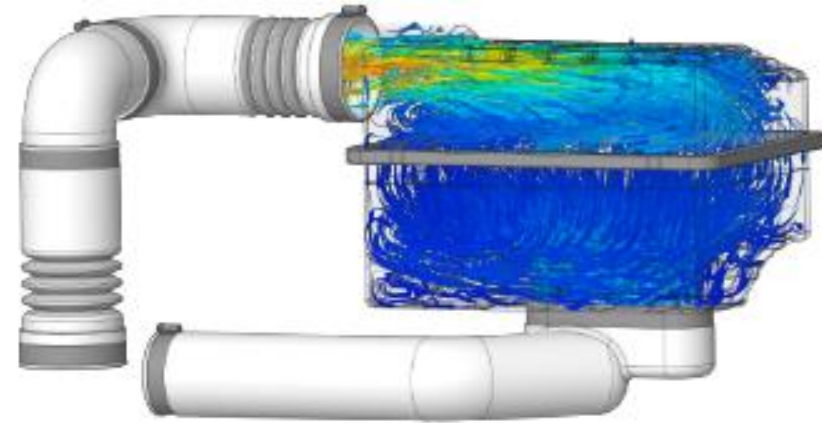
# Discovery Fluid Simulation

## EXPLORE

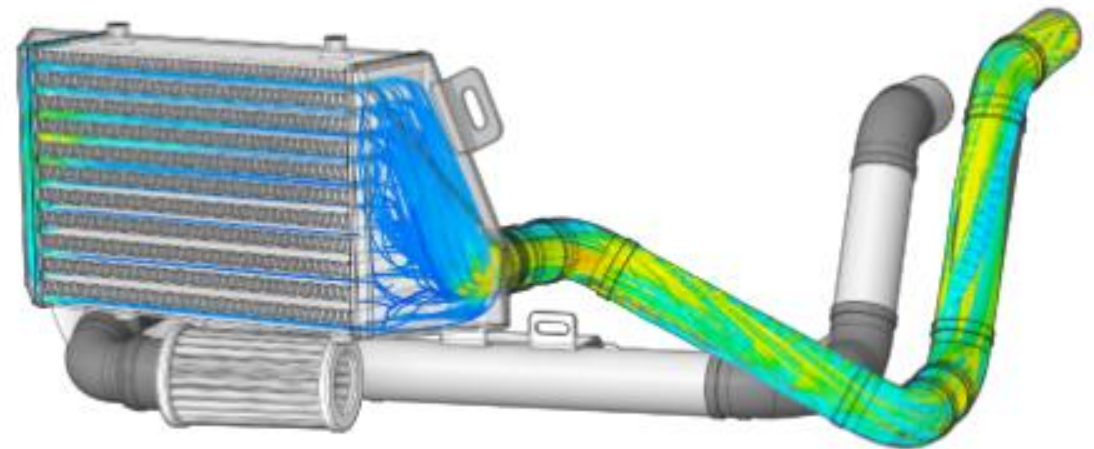
- **Rapid upfront fluid simulation**
  - Fault tolerant simulation with live fluid and heat transfer results via GPU solver
  - Robust fluid volume extraction and discretization of *any* CAD geometry
  - Easily evaluate design changes using interactive geometry modeling

## REFINE

- **Accurate high-fidelity fluid simulation**
  - LiveGX GPU or CPU solution for accurate fluid and heat transfer results
  - Fast geometry clean-up and simplification for high-fidelity simulation
  - Robust polyhedral meshing for enhanced accuracy and efficient memory usage



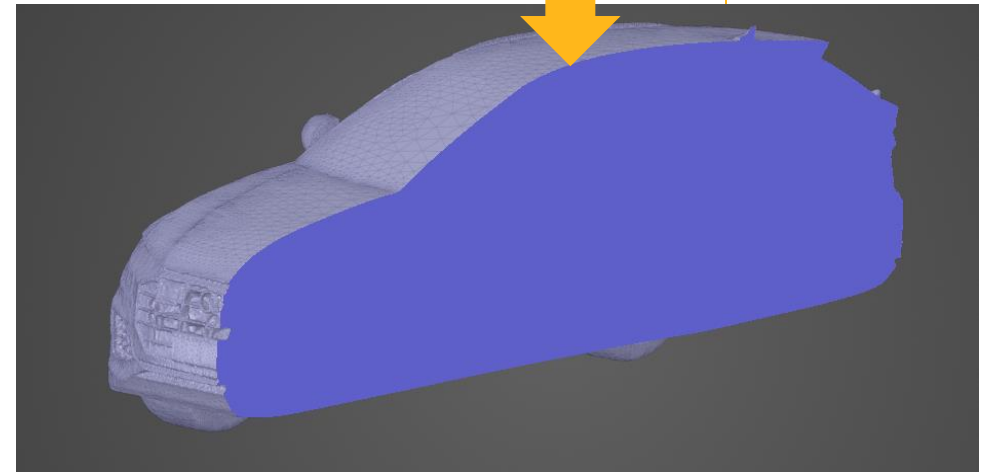
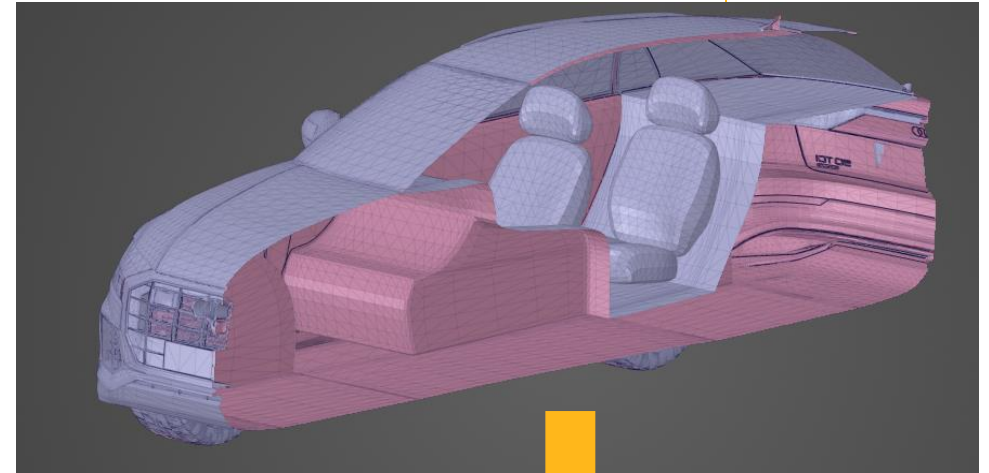
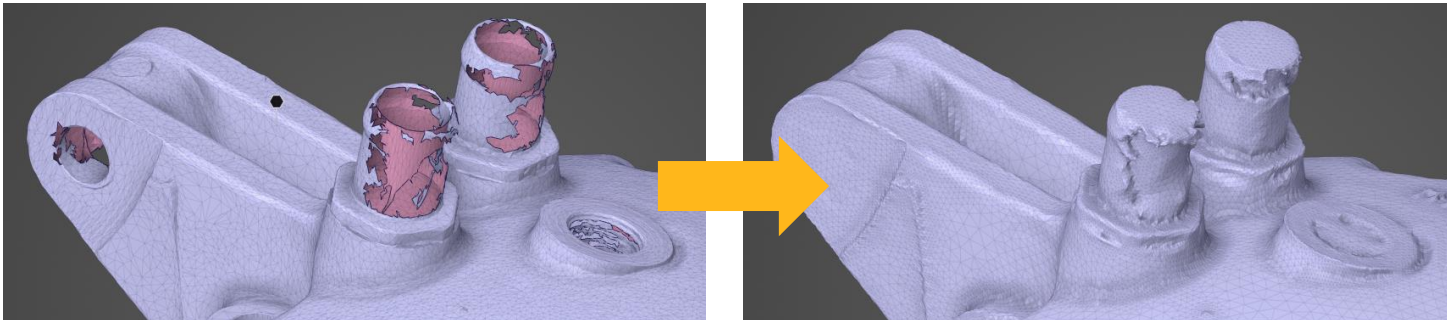
*Air intake modeled with porous media*



*Intercooler flow and pressure drop*

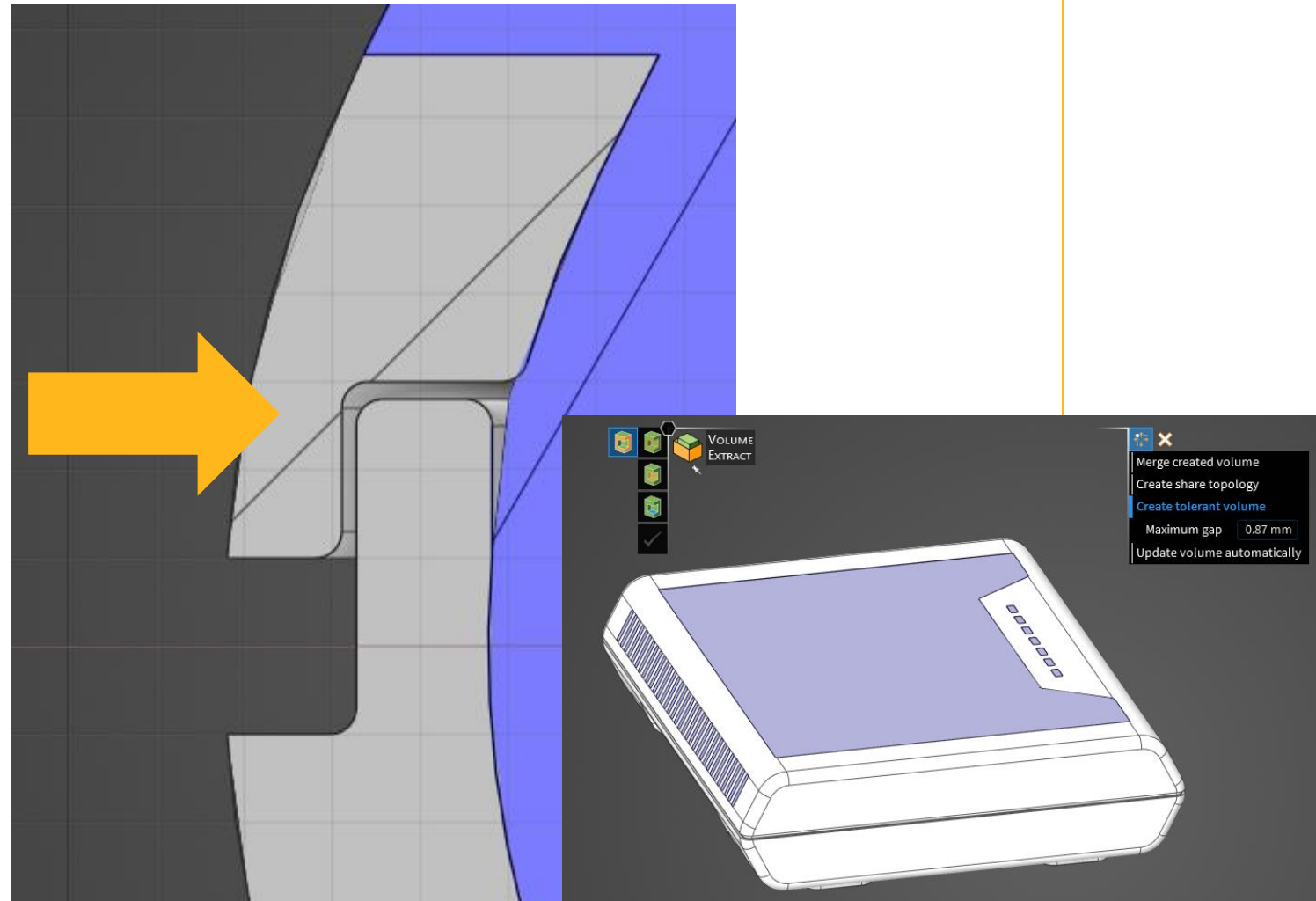
# Shrinkwrap

- New “Remove Interior” option guarantees solid shrinkwraps
  - Great for shrinkwrapping dirty scanned geometry
  - Ensures interior details are ignored and large gaps/openings are removed



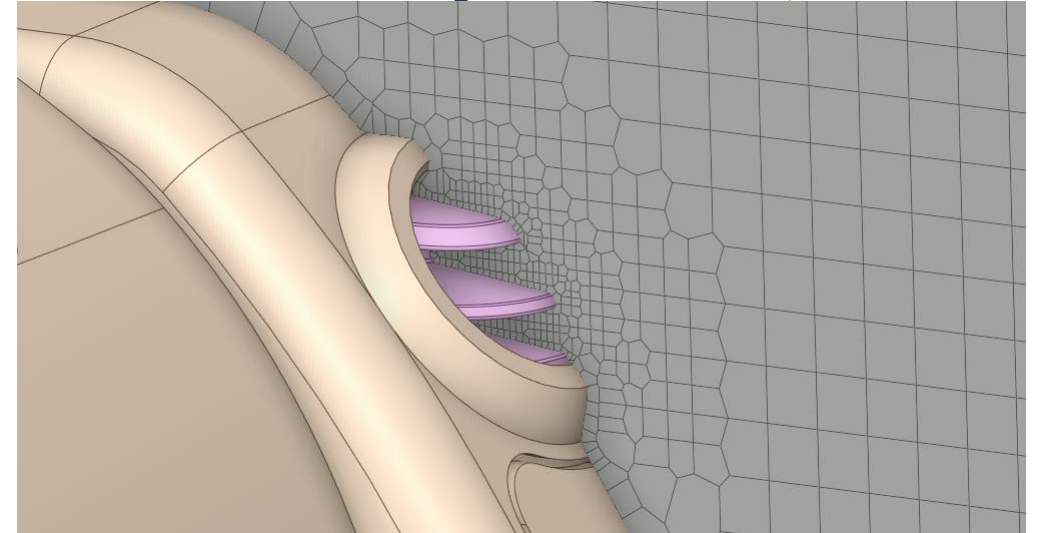
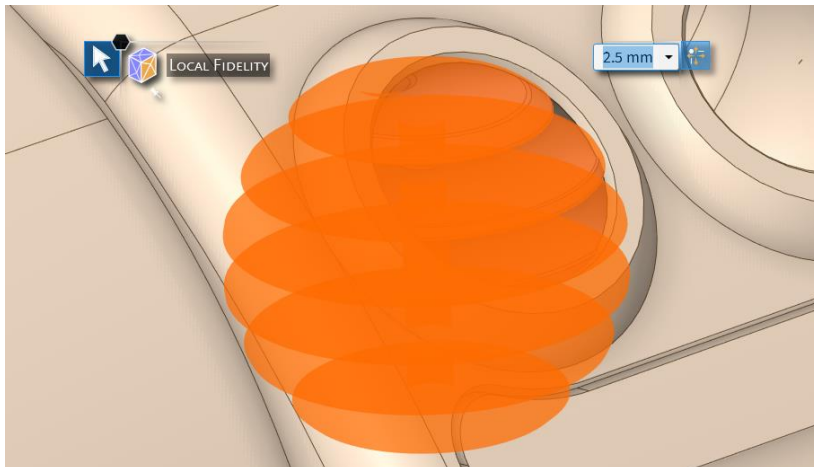
# Tolerant Volume Extract (Beta)

- Allows volumes to be extracted even when manufacturing clearances are present
  - Less manual cleanup needed
  - Ability to detect clearances during extraction

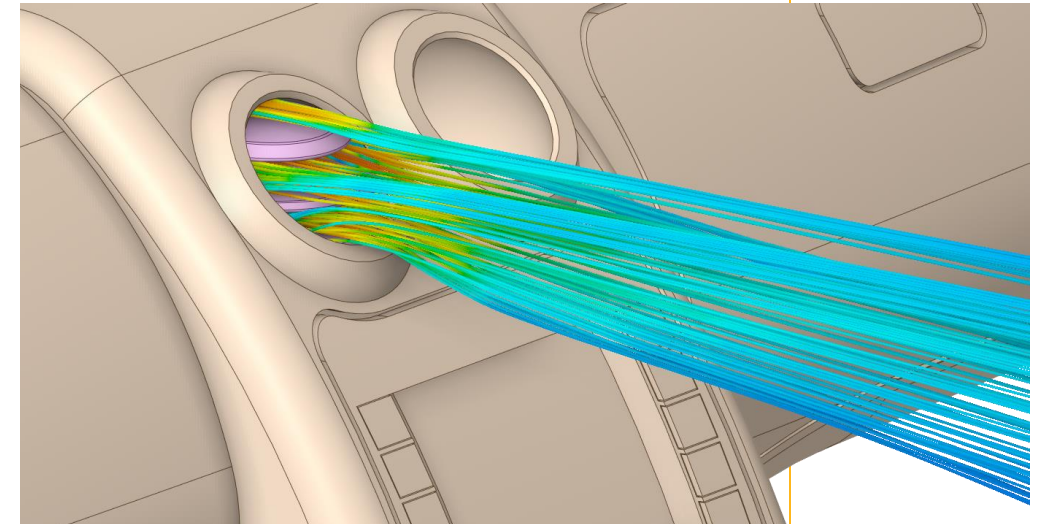


# Local Fidelity on Faces (Explore Fluids)

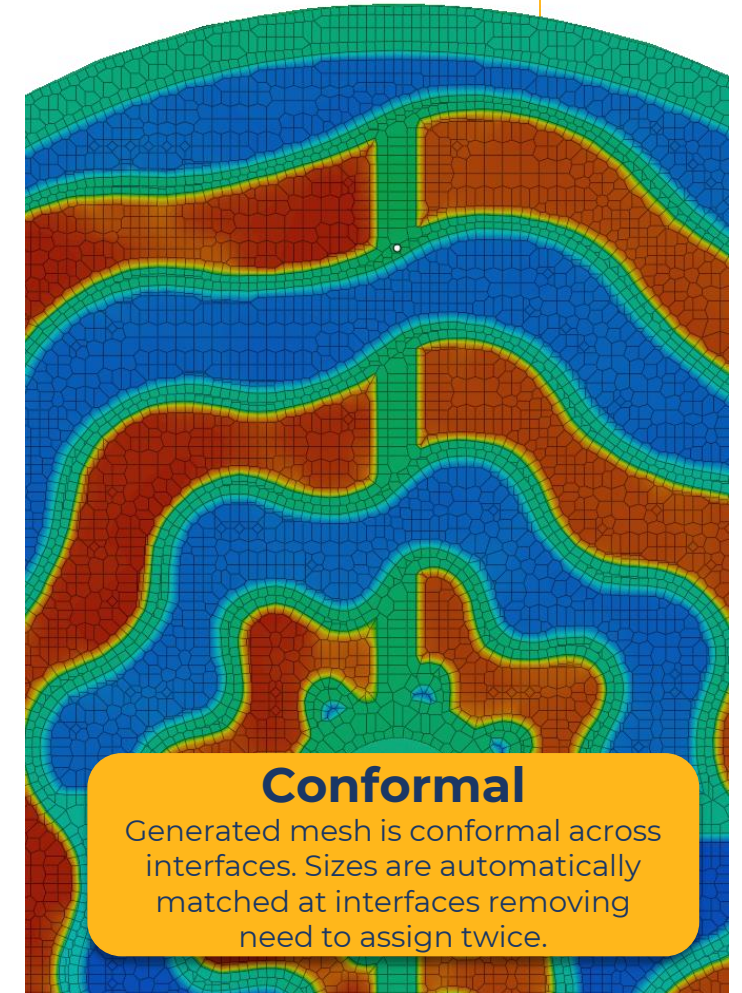
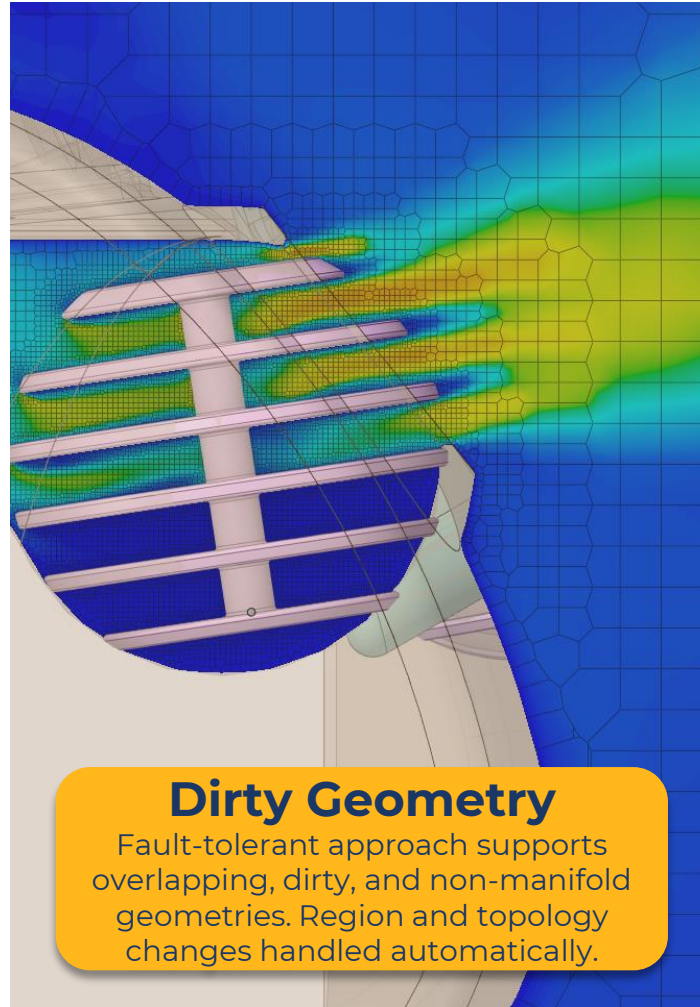
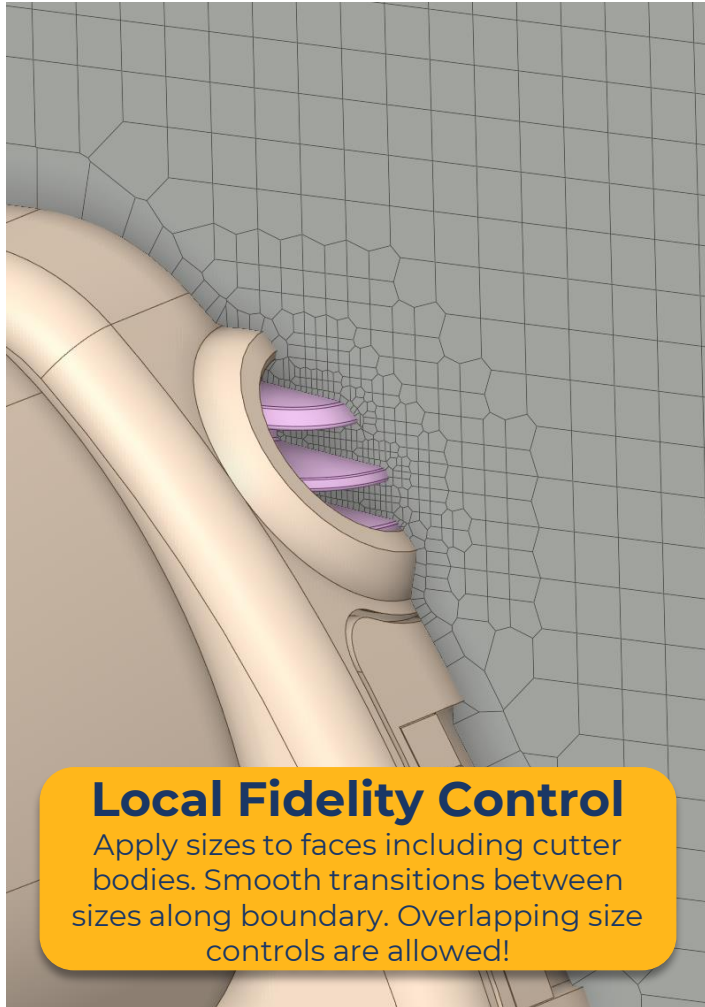
- New GPU meshing with local fidelity on faces
  - Breakthrough robustness and speed
  - Allows mesh size to increase along boundary
  - Better resolution of small components, thin fluid channels, etc.
  - Improves accuracy of simulation with more efficient use of GPU memory



*Mesh on cut-plane with local fidelities*

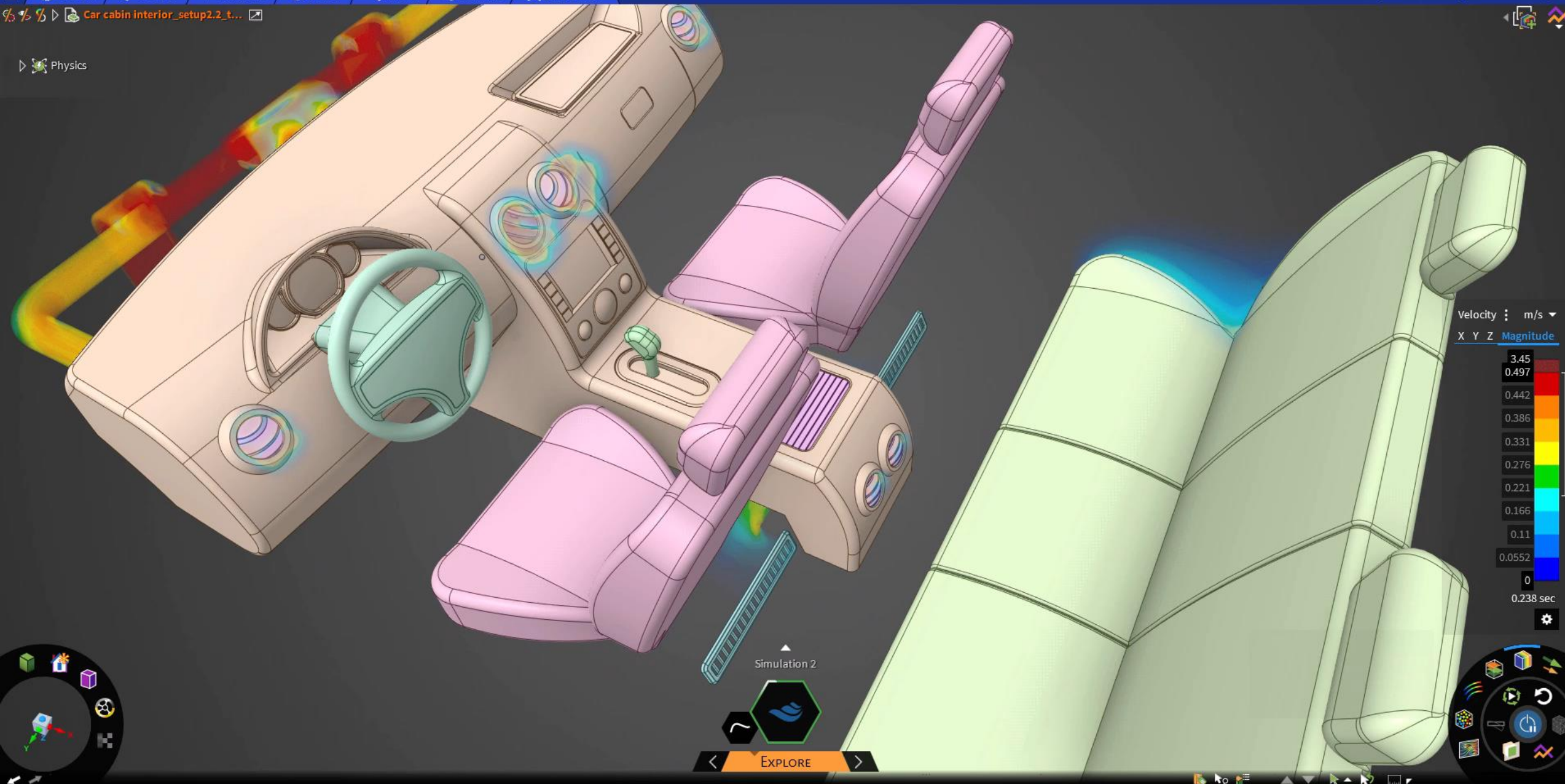


# New GPU Meshing for Fluids (Explore)





Physics



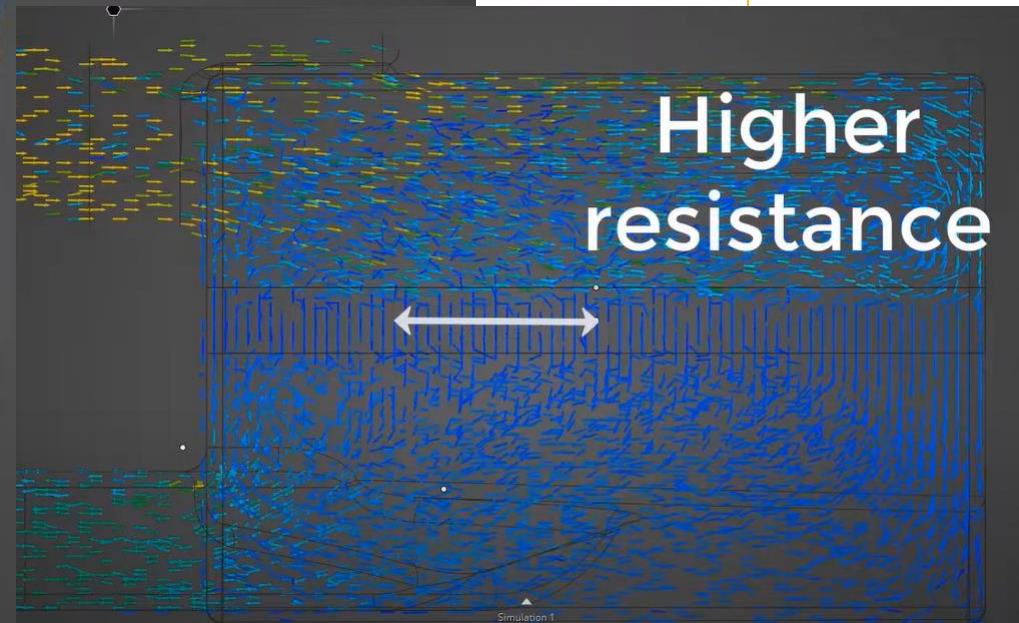
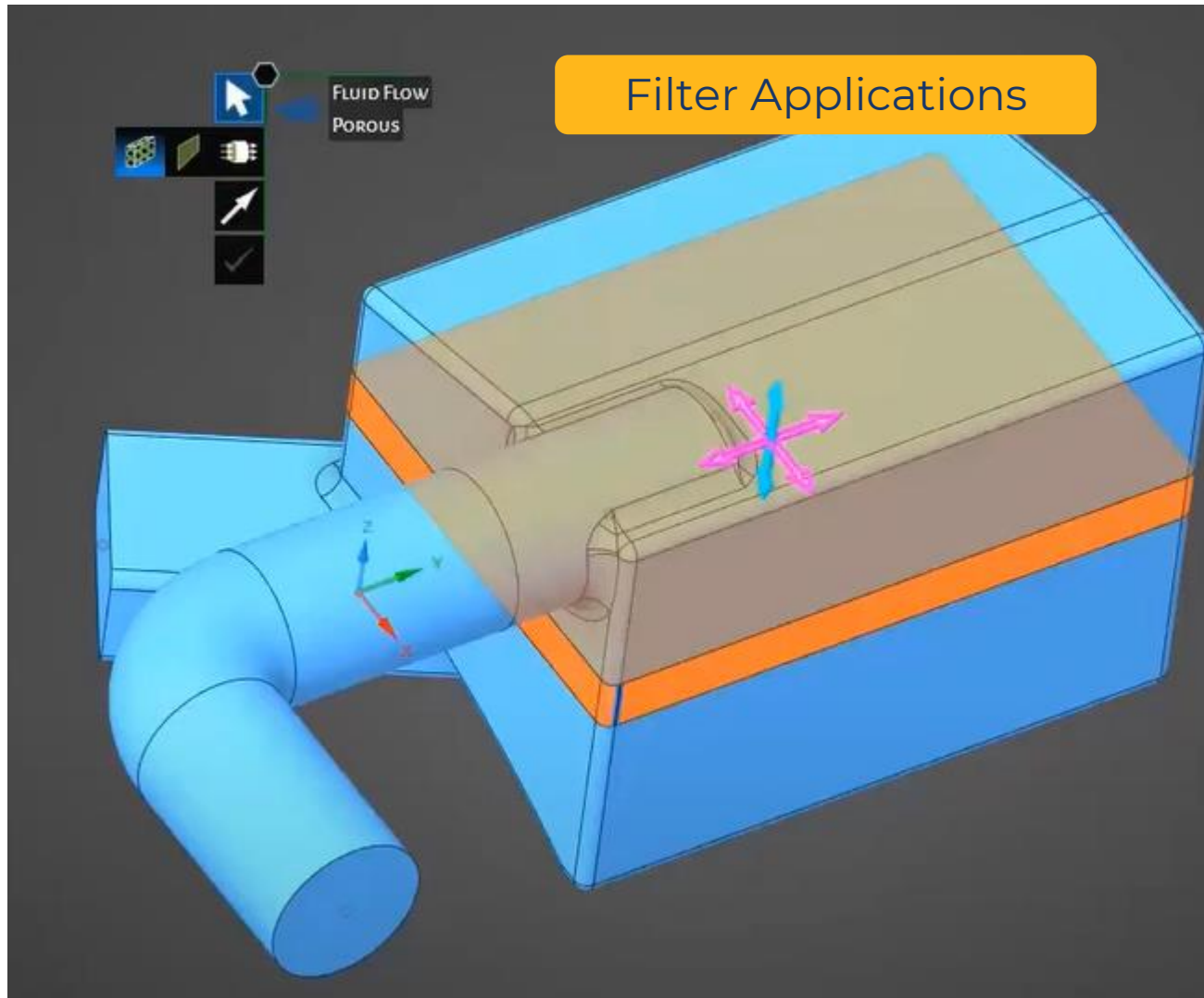
Simulation 2



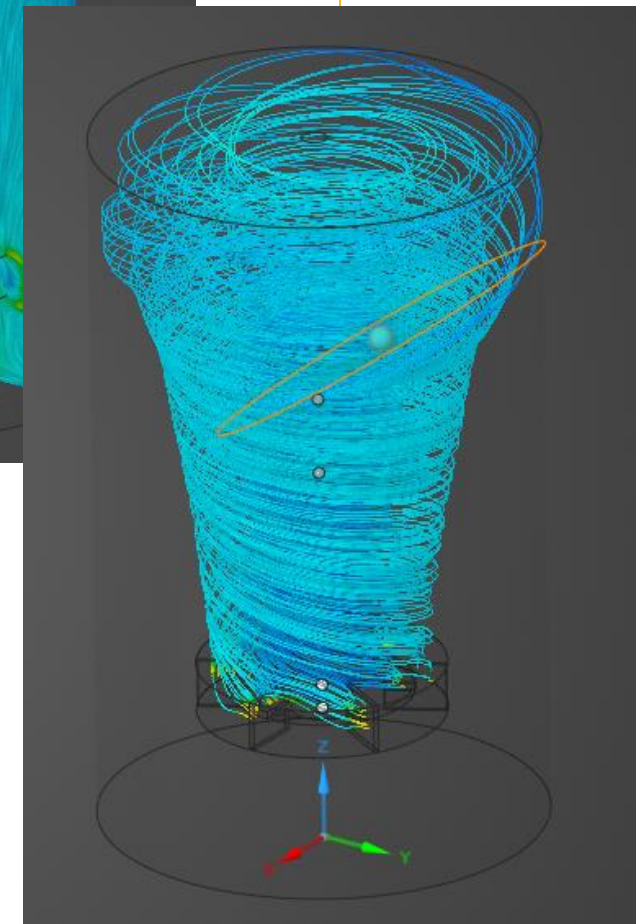
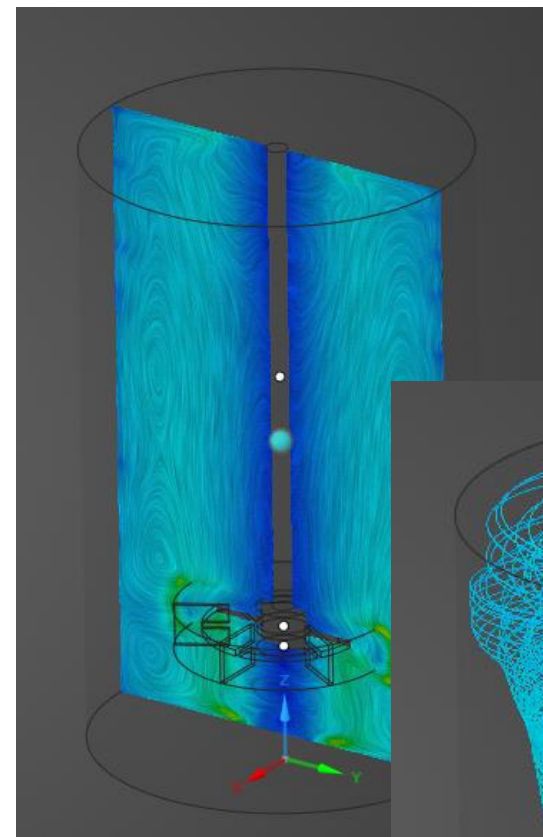
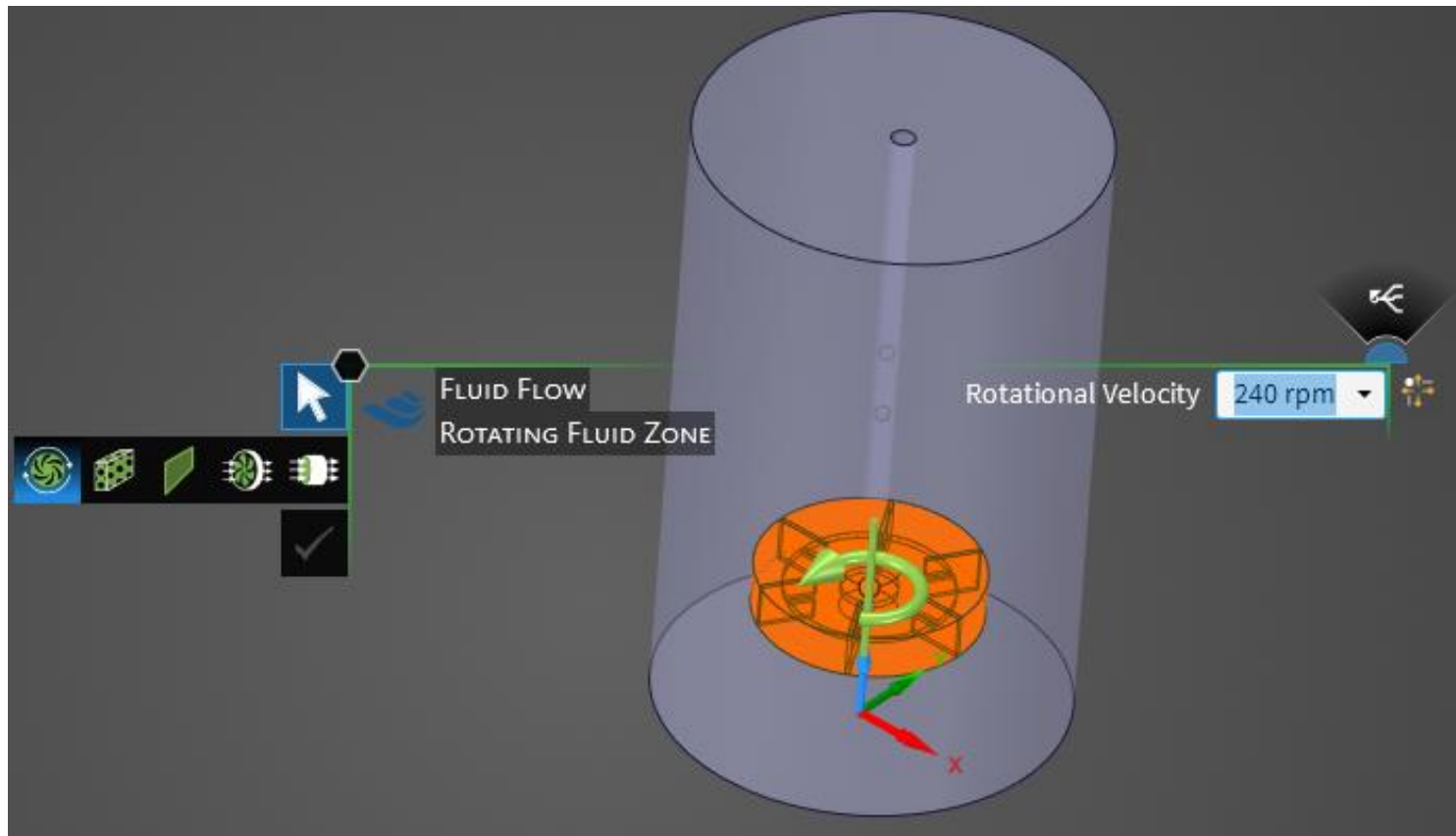
EXPLORE



# Porous Flow

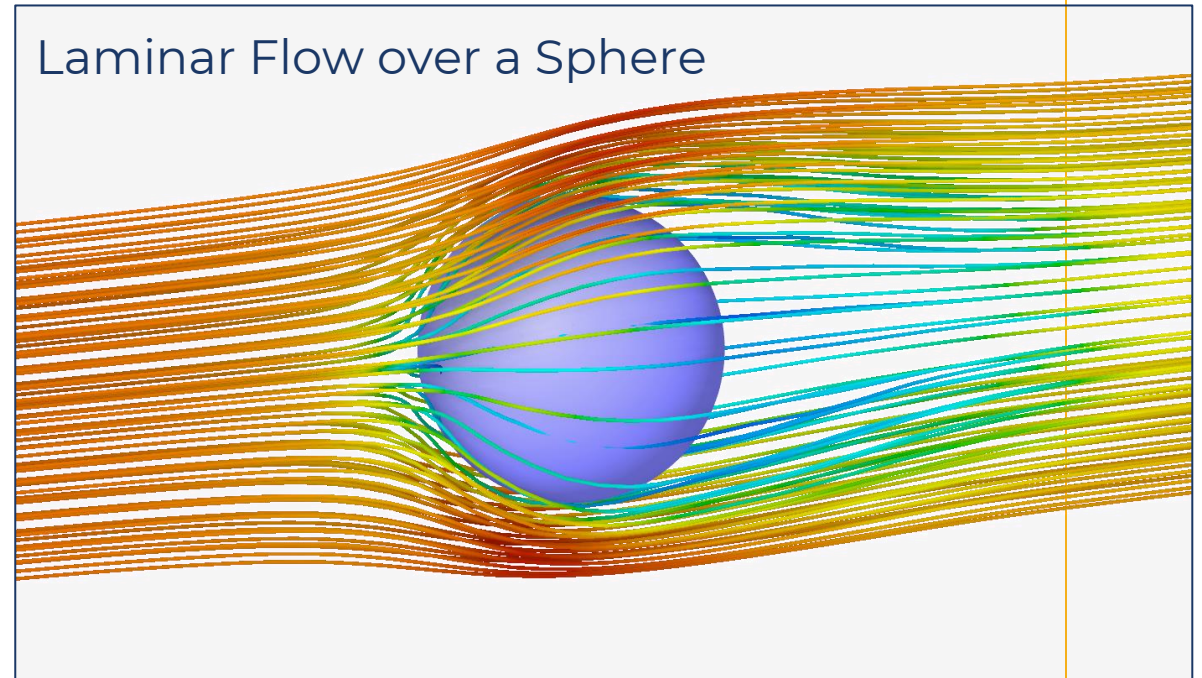


# Rotating Zone



# Enhanced Force Monitors

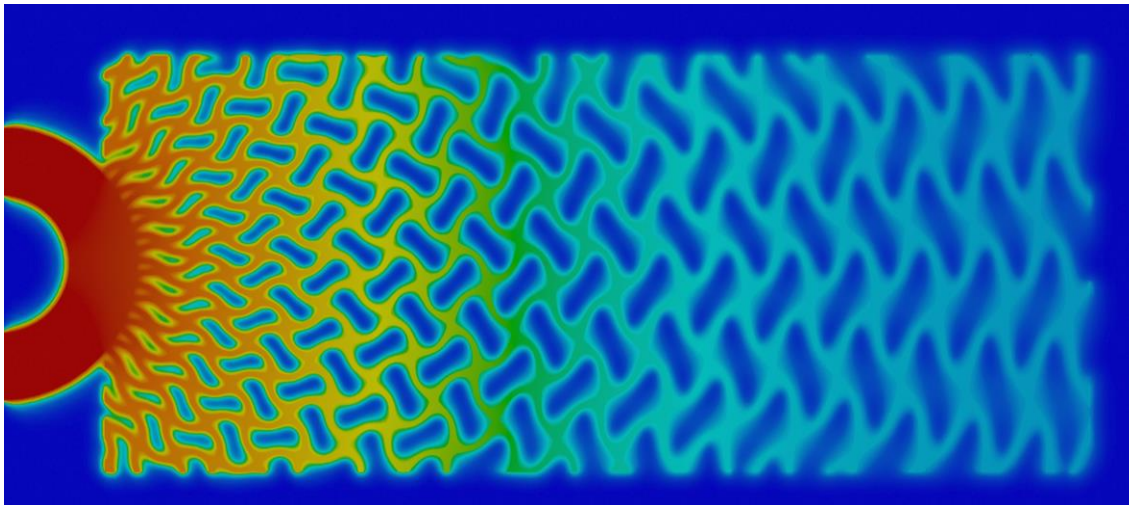
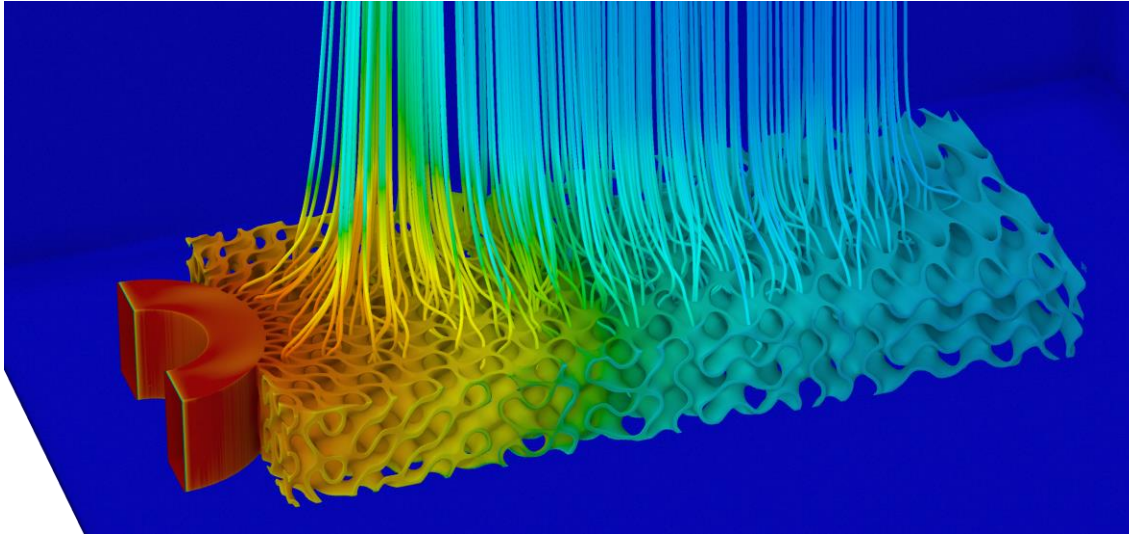
- Enhanced force monitors
  - Force monitors now include viscous shear force in addition to pressure force
  - Improves accuracy of force calculations



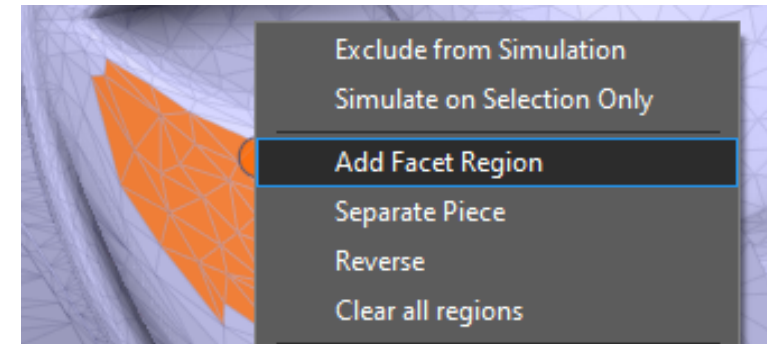
Result	Target	Explore	Ratio
Drag Coef.	1.0994	1.088	0.99

Turton, R.; and Levenspiel, O., *A Short Note on the Drag Correlation for Spheres*, Powder Technology, 47, 83-86, 1986.

# Contacts & Interfaces for Faceted Geometry in Explore (Beta)

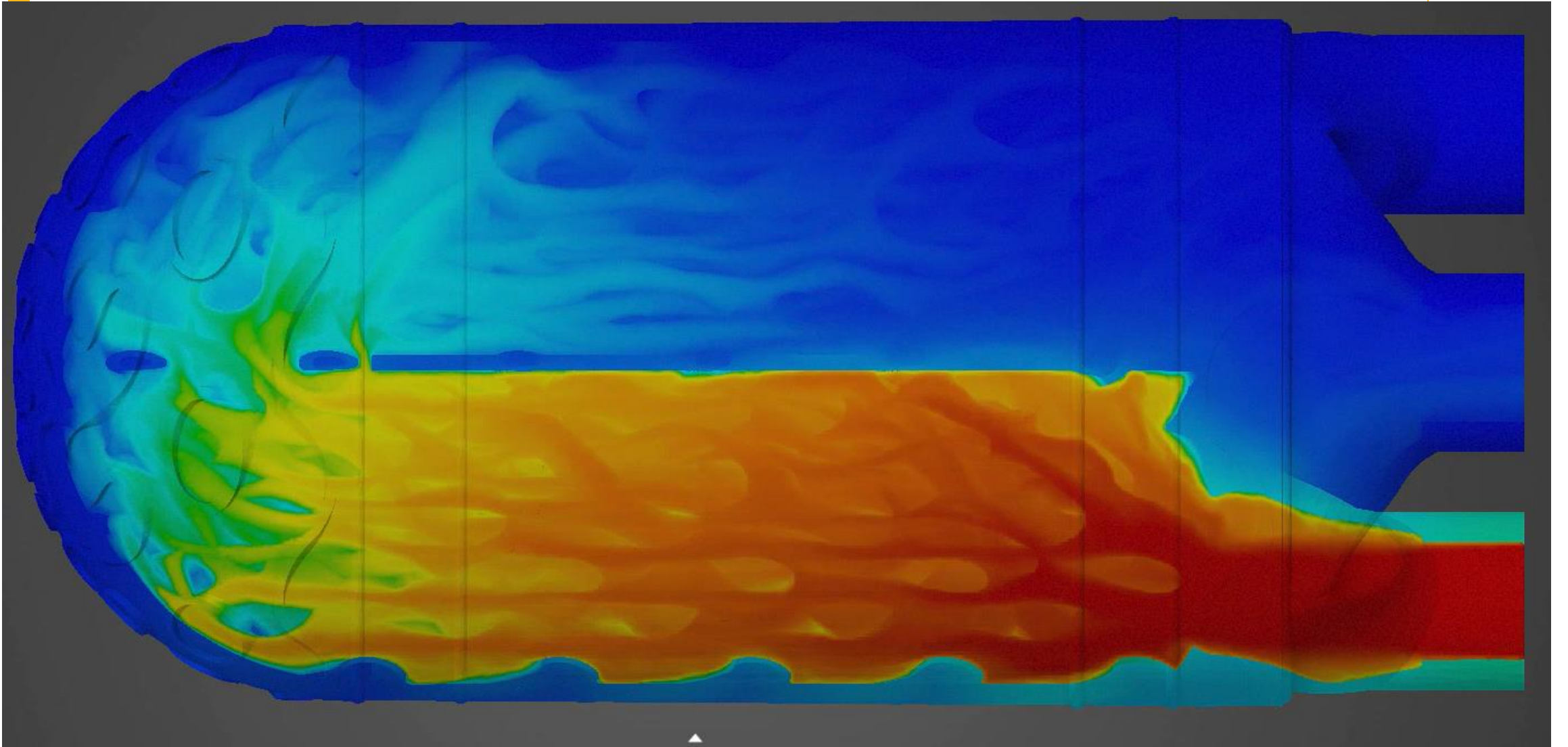


- Enables simulation with multiple faceted bodies
  - Facet regions must be created to assign conditions or monitors
  - Excellent for gyroids and other minimal surface-based heat exchangers

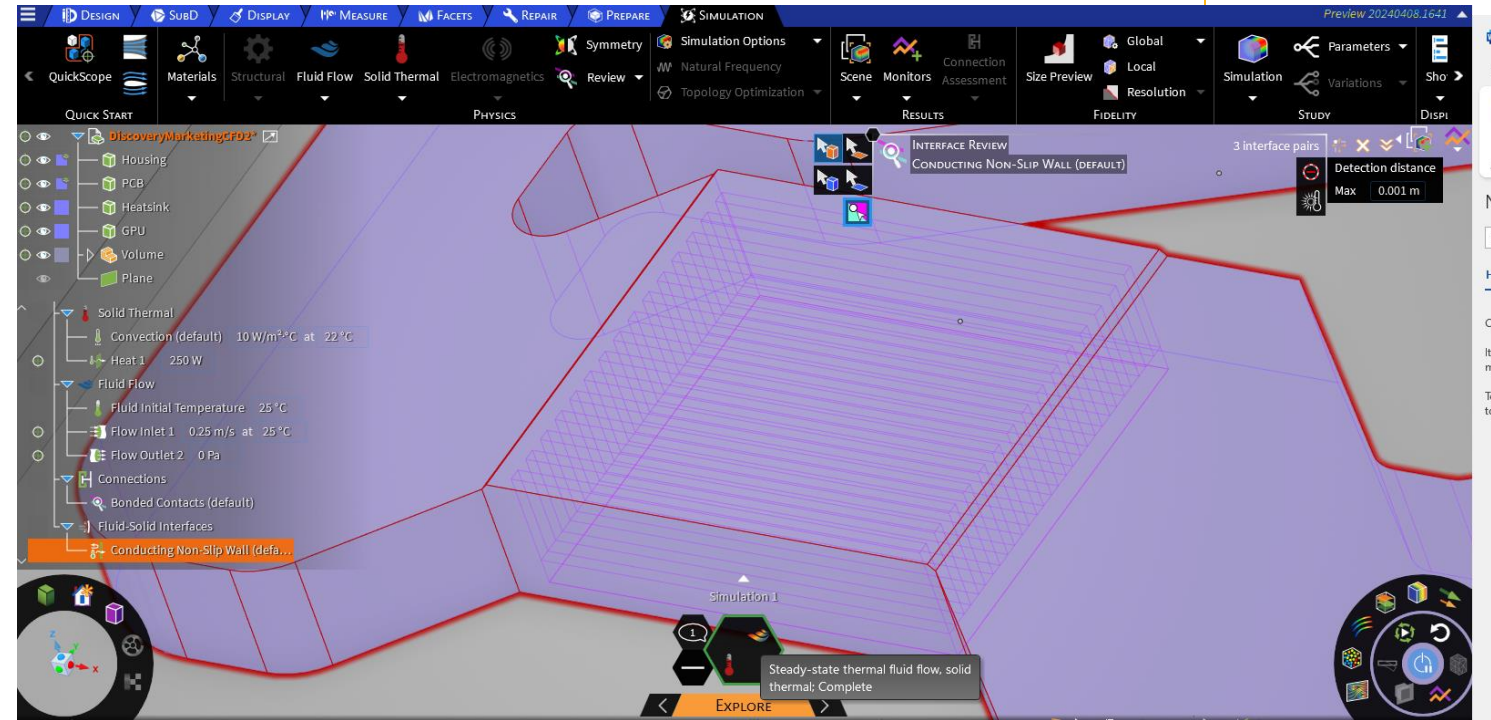
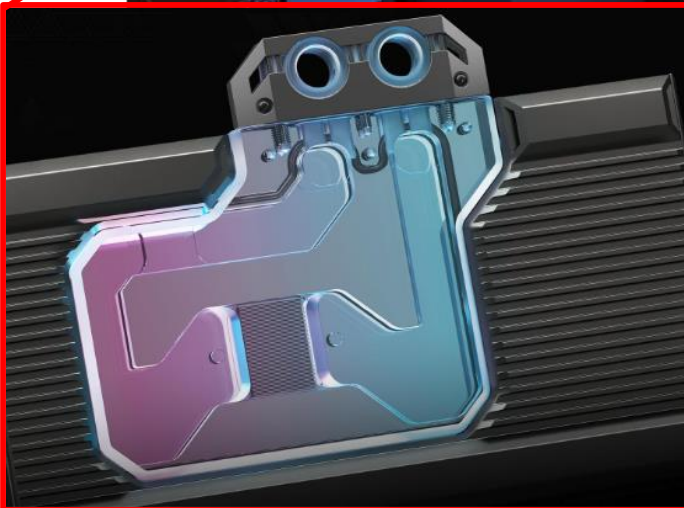
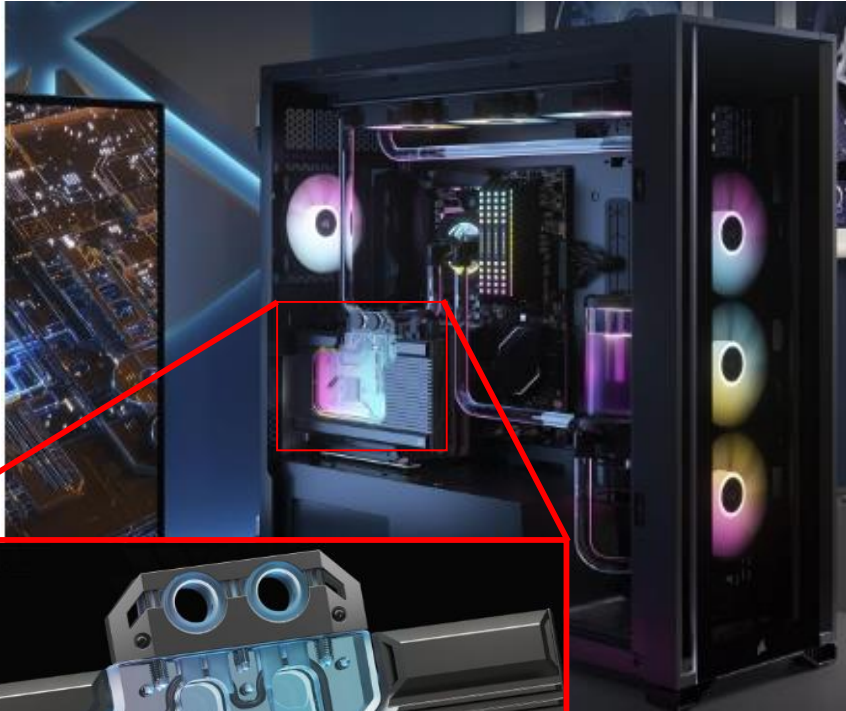


## Beta Options

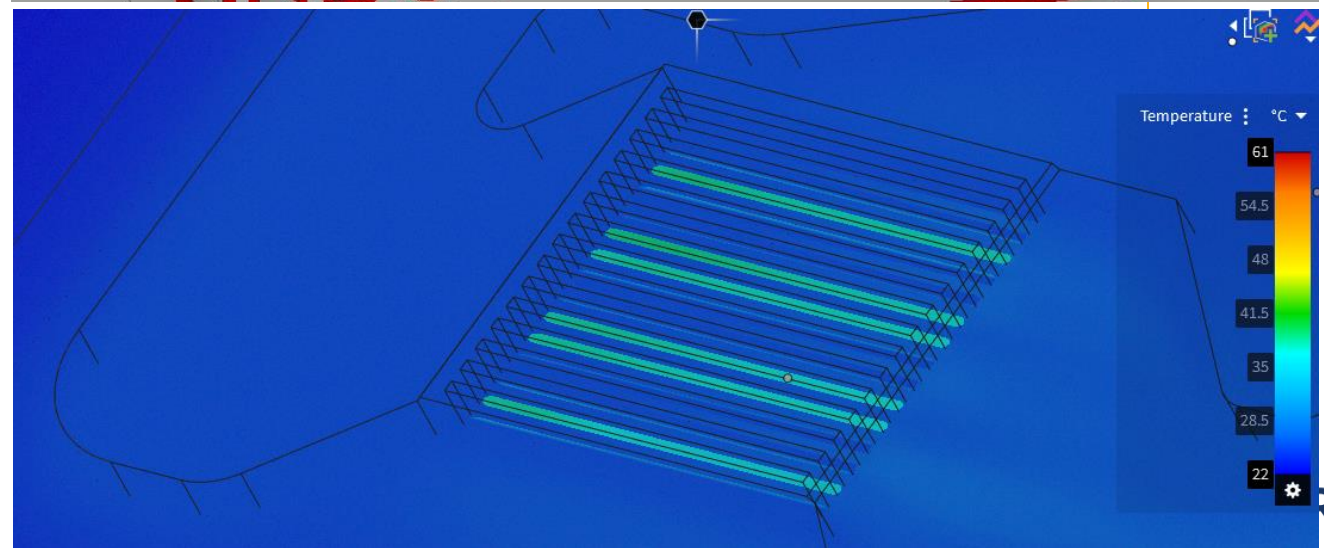
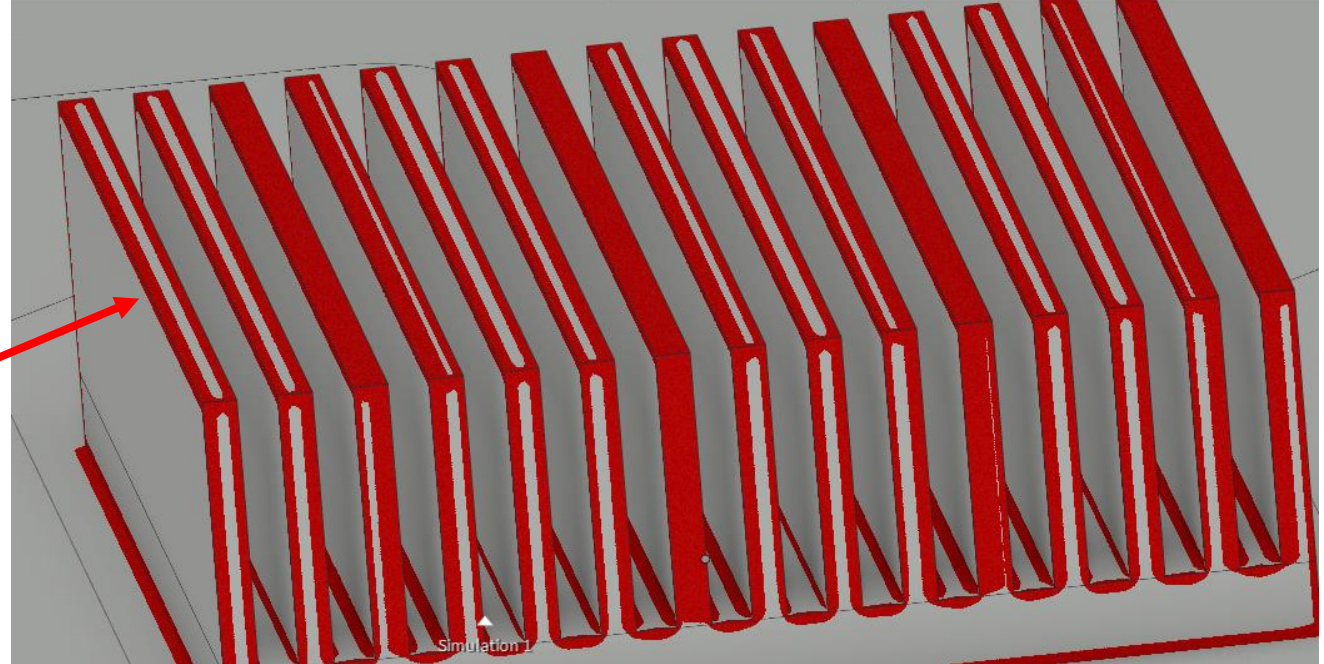
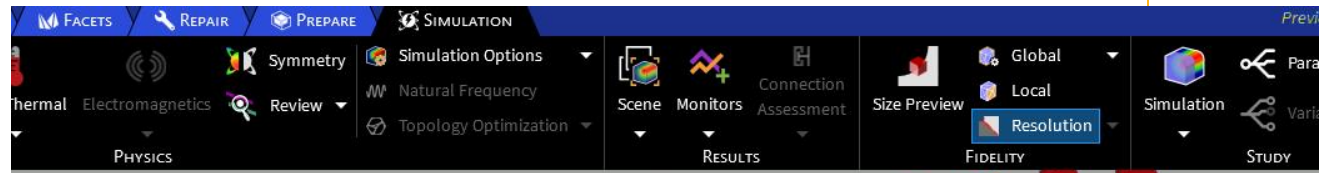
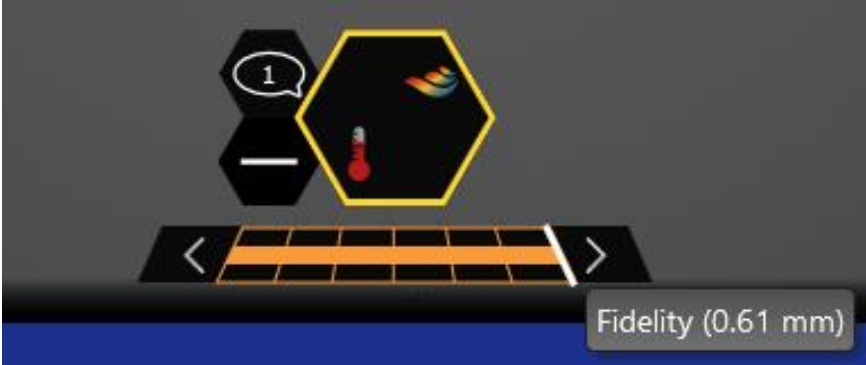
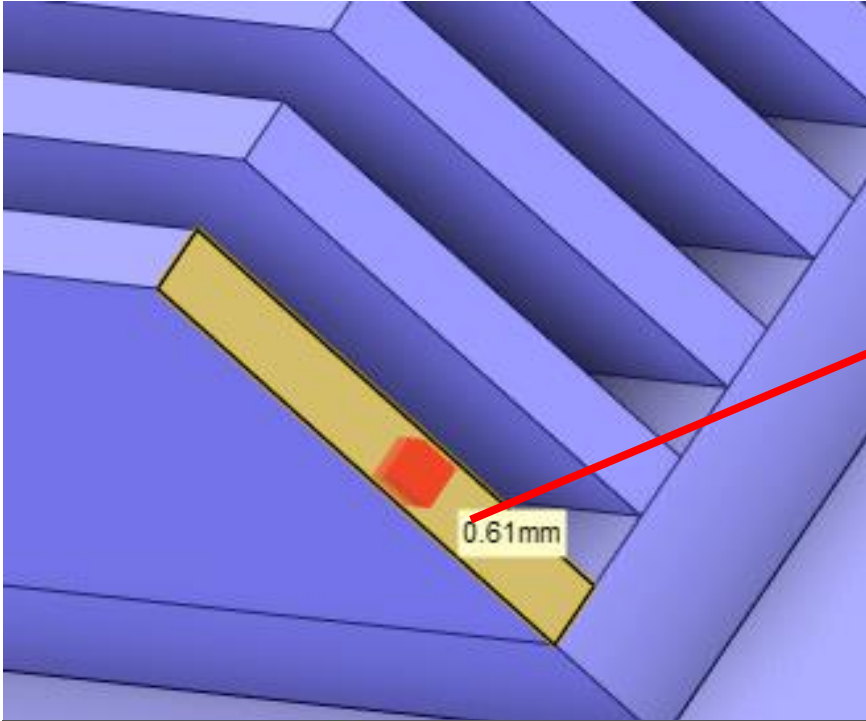
Contact and interface detection for faceted bodies (restart required) ←



# Benchmark: GPU Cooling Channel



# Local Fidelity

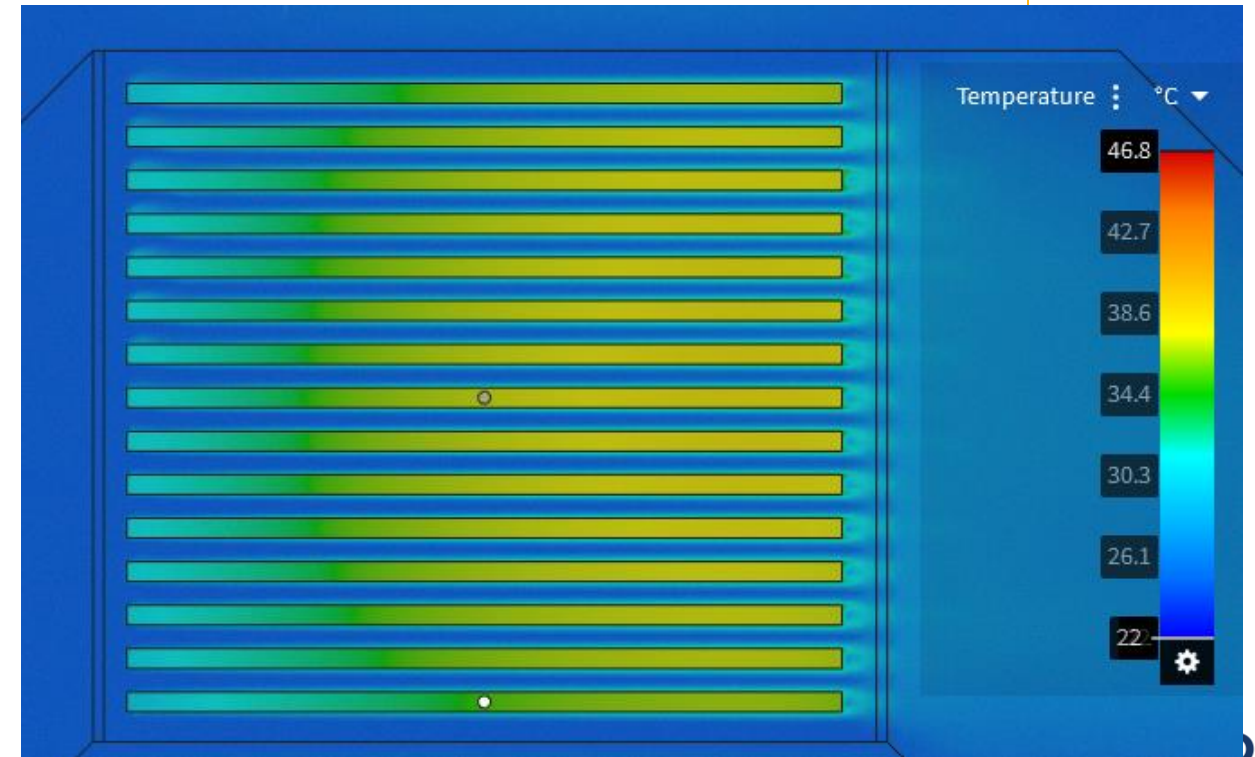
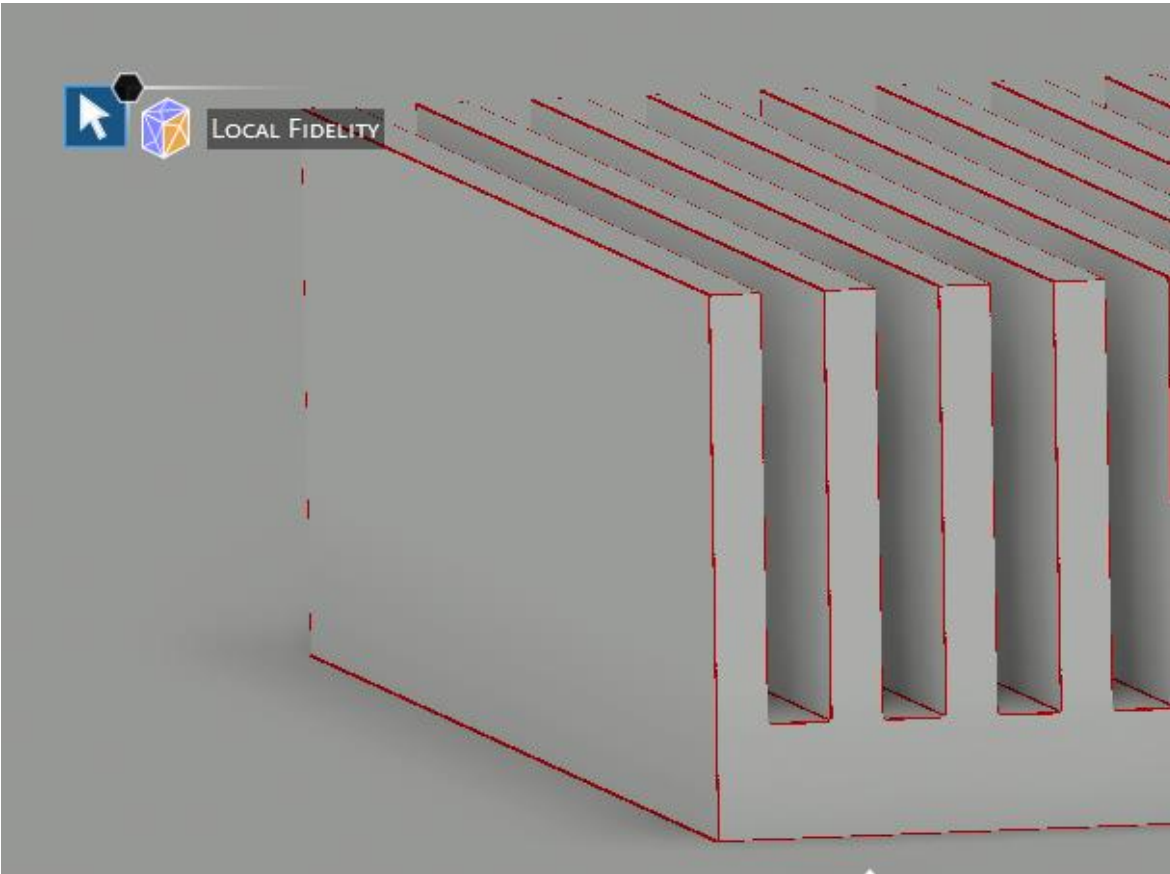
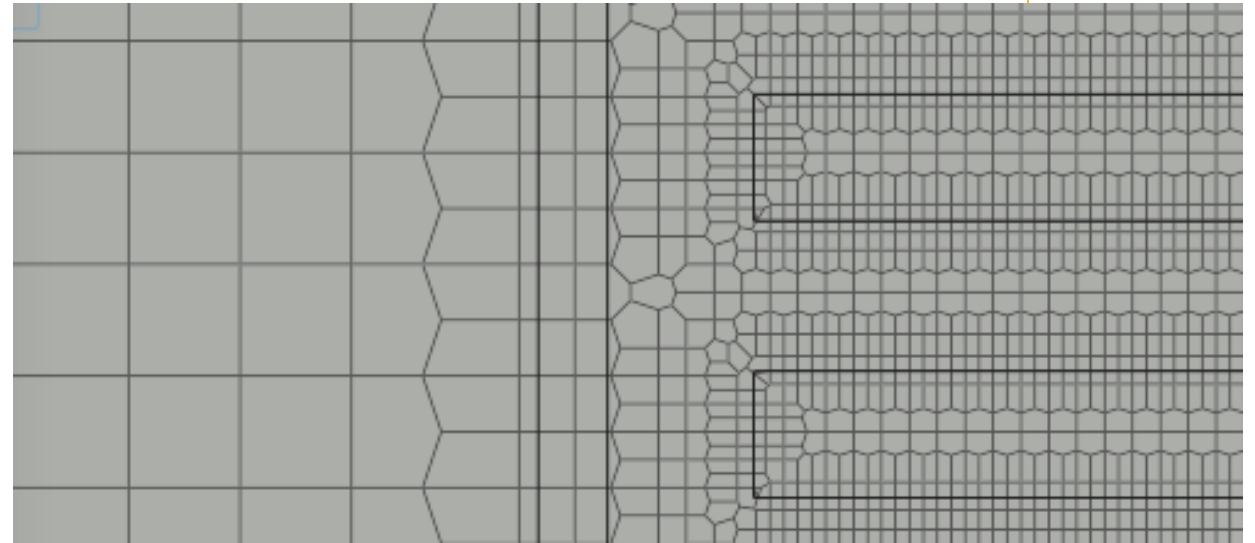


May 10, 2023

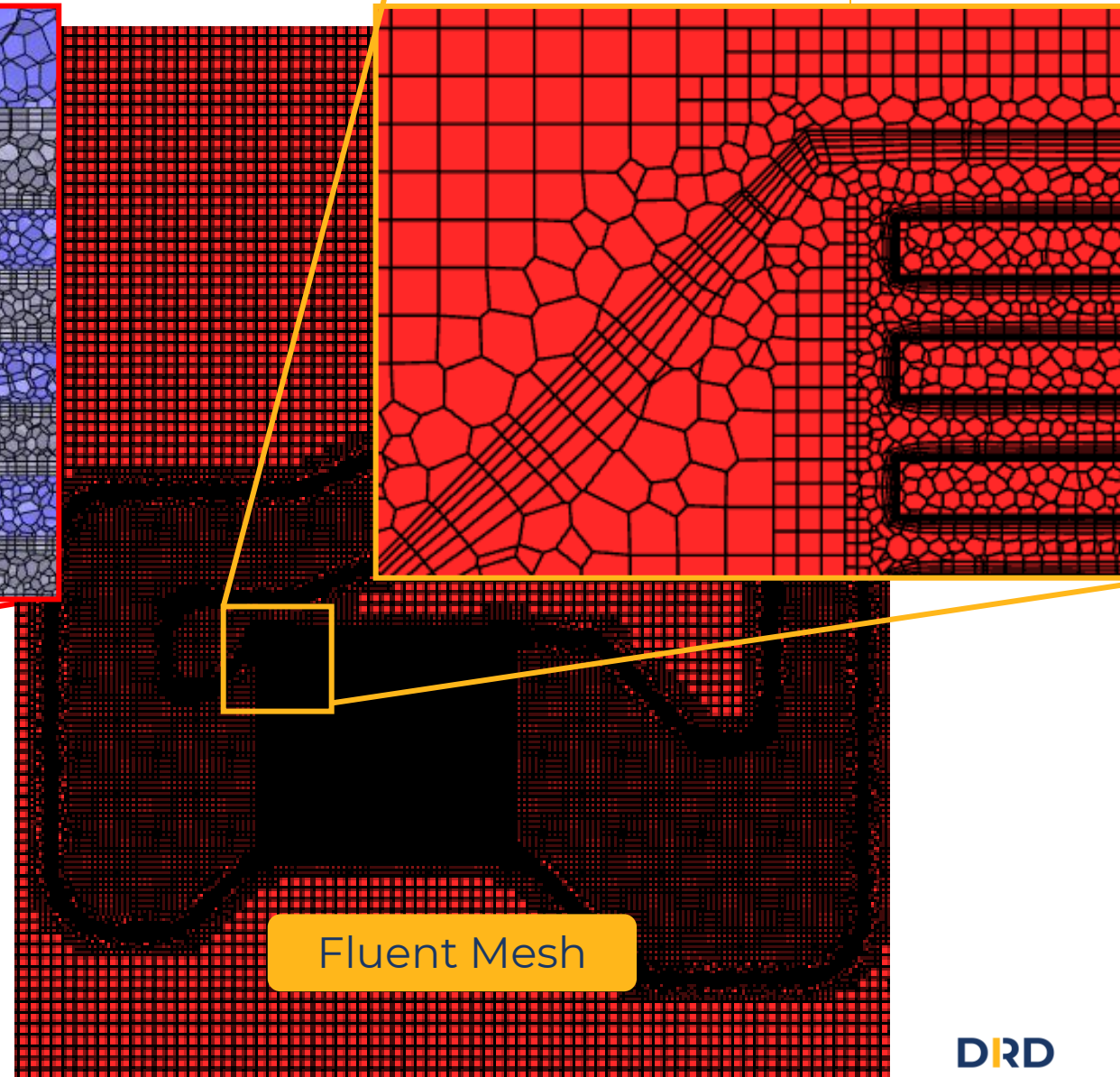
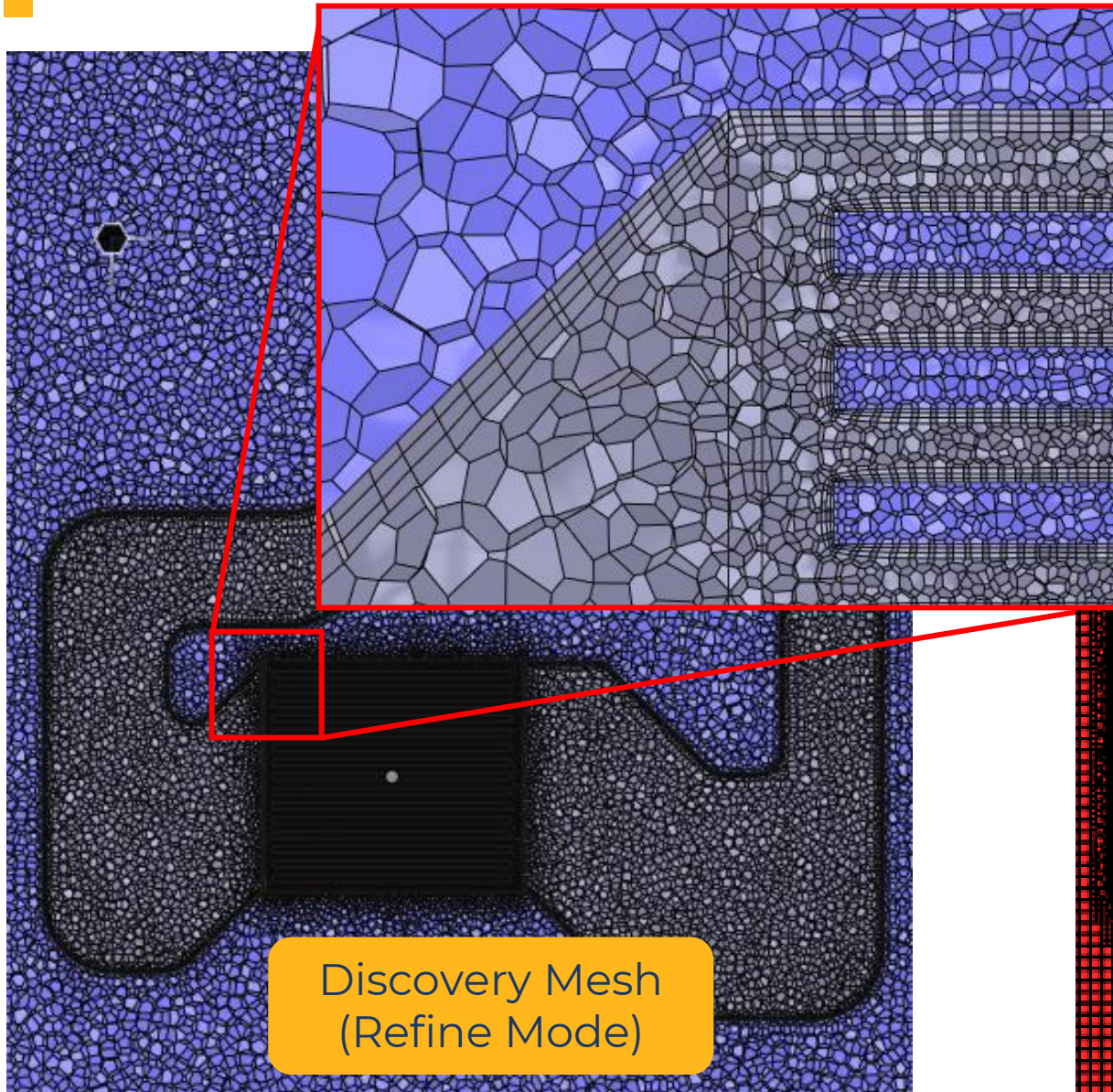
RD



# Explore Mode



# Refine Mode





### Discovery Refine Mode Solution

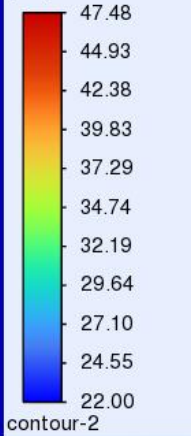
Temperature : °C



Max Temp: 47.4 °C

### Fluent Solution

Static Temperature [°C]



Max Temp: 47.5 °C



# Discovery Refine Yields Practically Identical Results as Ansys Fluent!

Solver	Max Temperature	$\Delta T$ % Error
Ansys Fluent	47.5 °C	N/A
Discovery Explore	46.8 °C	2.7%
Discovery Refine	47.4 °C	0.3%

No CFD Solver License Required!

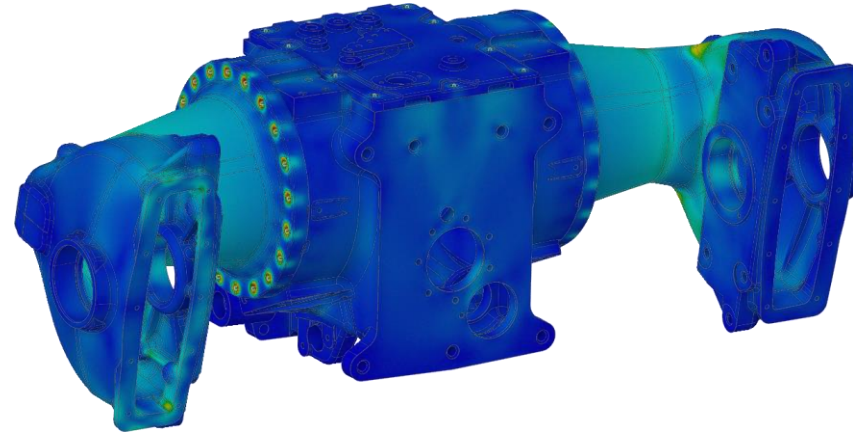
# Structures

Capabilities and Enhancements

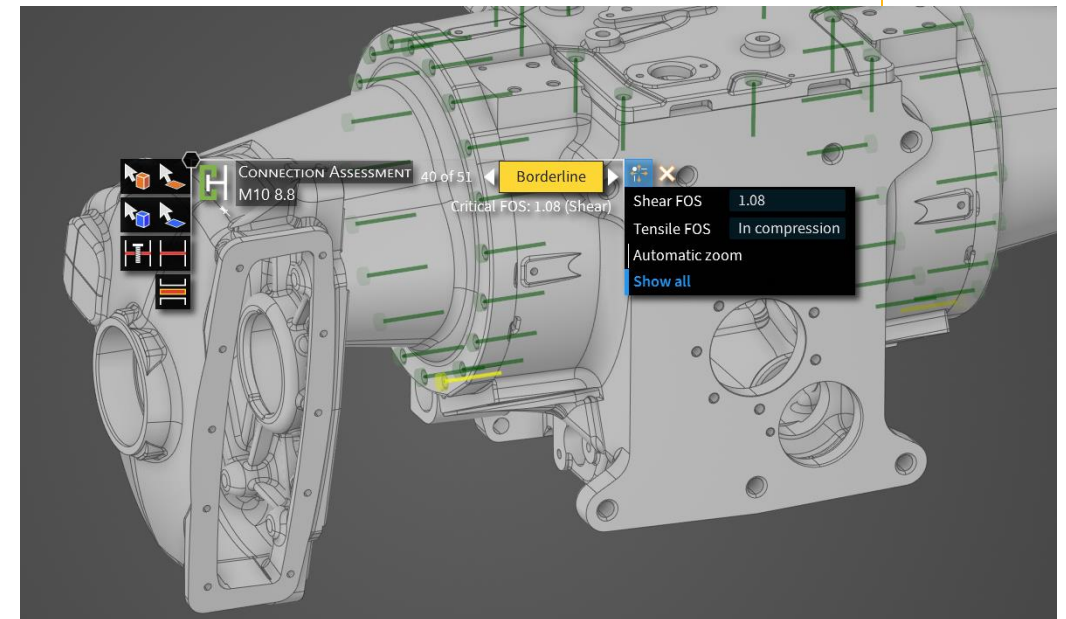
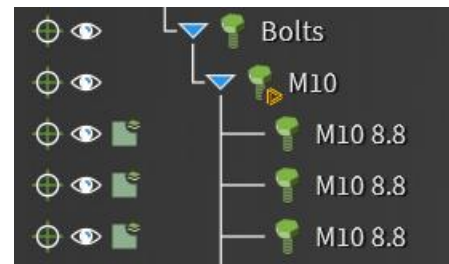
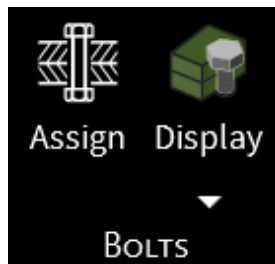
Accuracy Benchmark for Press-Fit Analysis

# Bolt Monitors and Connection Assessment (Explore)

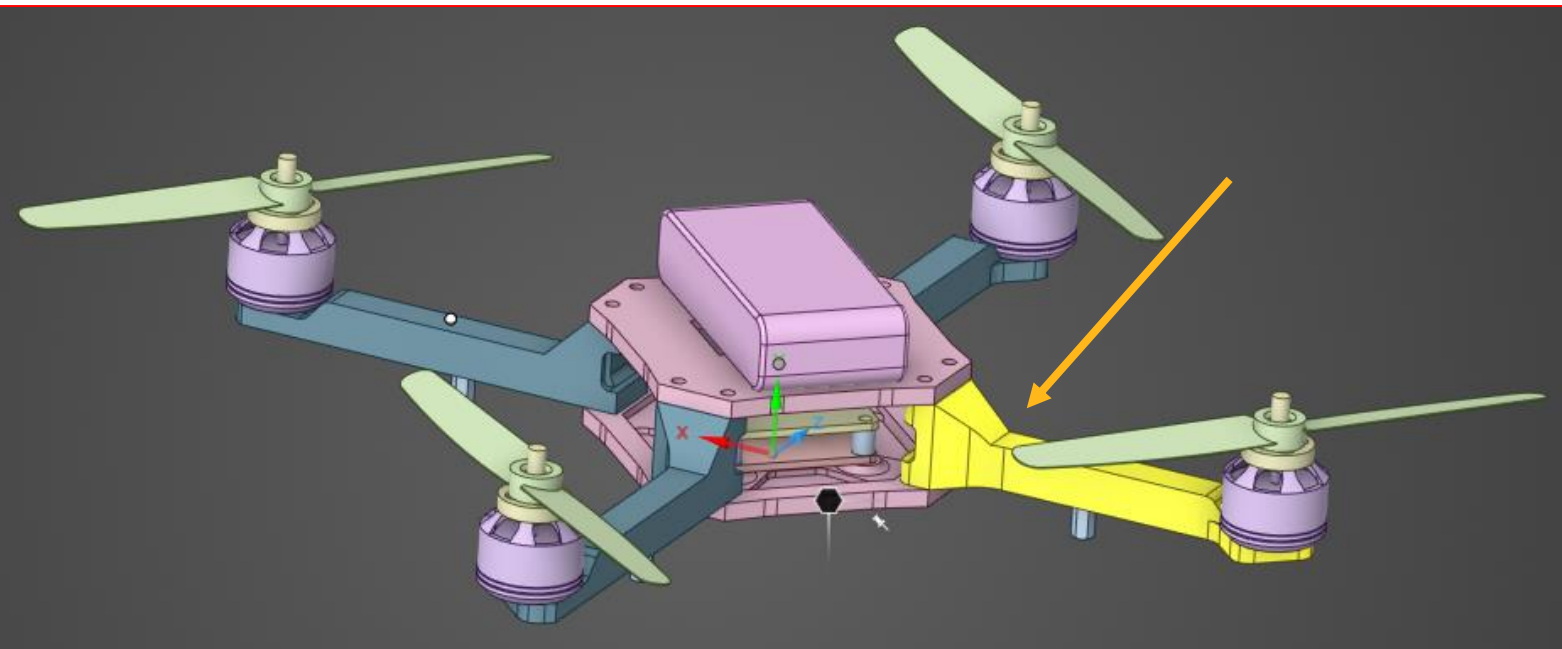
- Bolt force and moment monitors
  - Axial stress, shear force, torsional moment and factor of safety
- Connection assessment tool
  - Determines bolt factor of safety based on modified AISC ASD criteria
- Enhances workflow for upfront simulation of bolted connections



*Tractor axle assembly with idealized pre-tensioned bolts and frictionless contact*

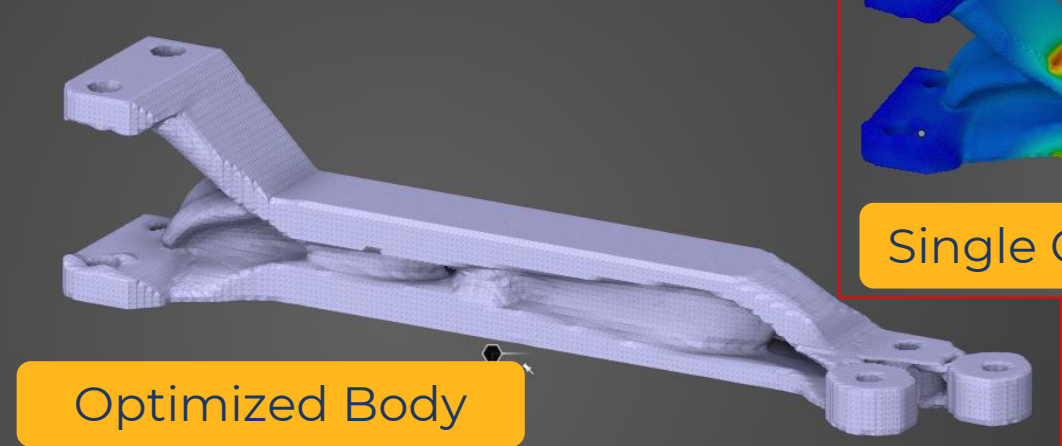
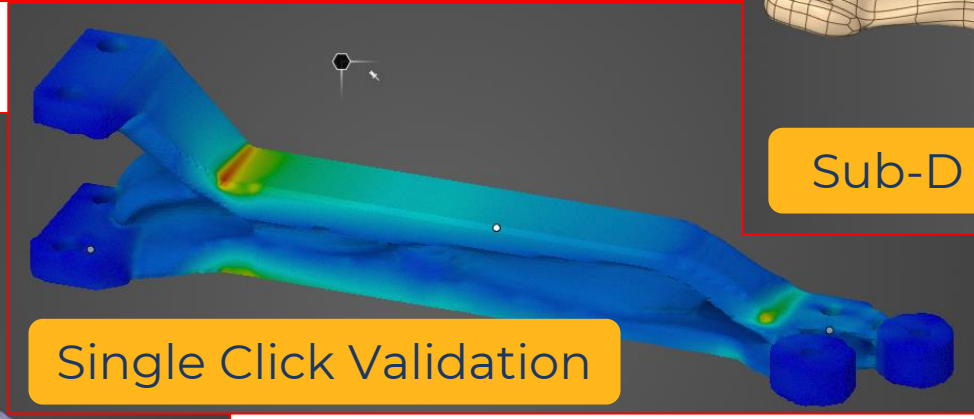
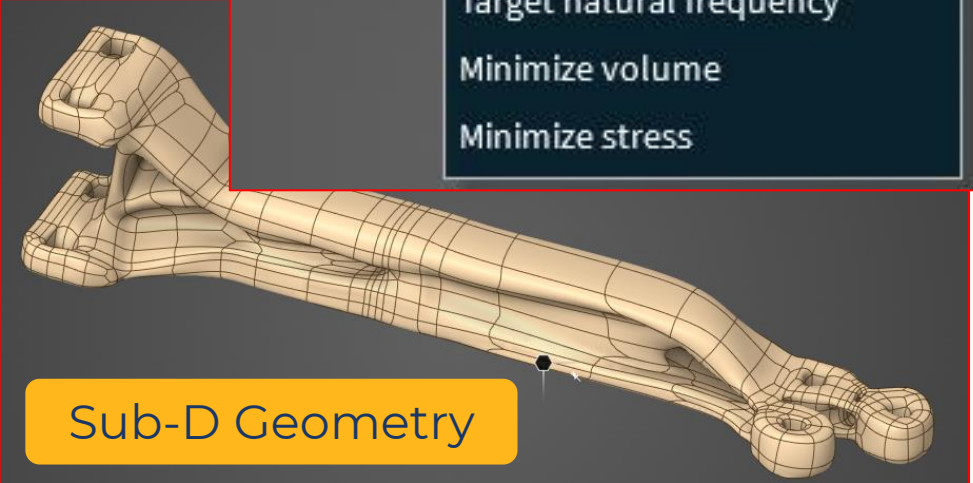


# End to End Topology Optimization



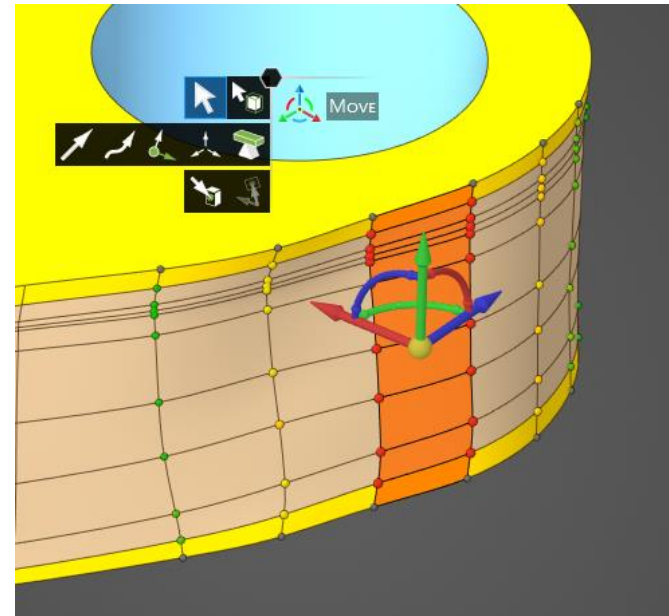
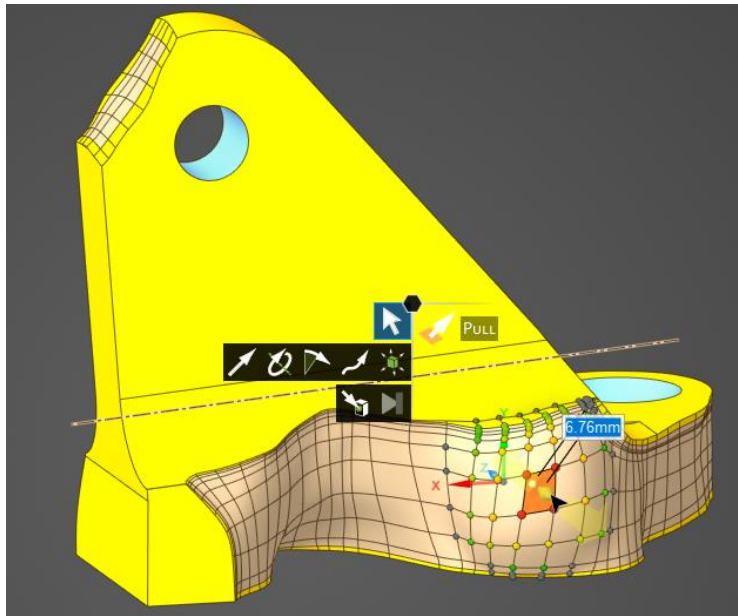
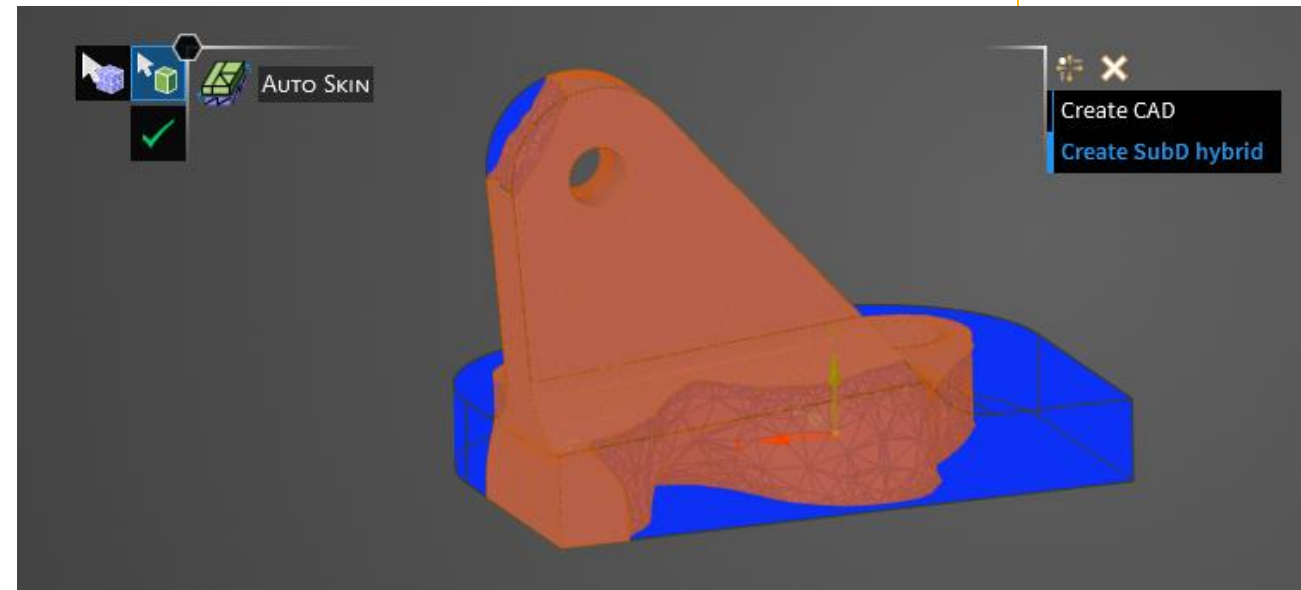
TOPOLOGY OPTIMIZATION

- Maximize stiffness
- Maximize stiffness
- Maximize natural frequency
- Balance stiffness and frequency
- Target natural frequency
- Minimize volume
- Minimize stress



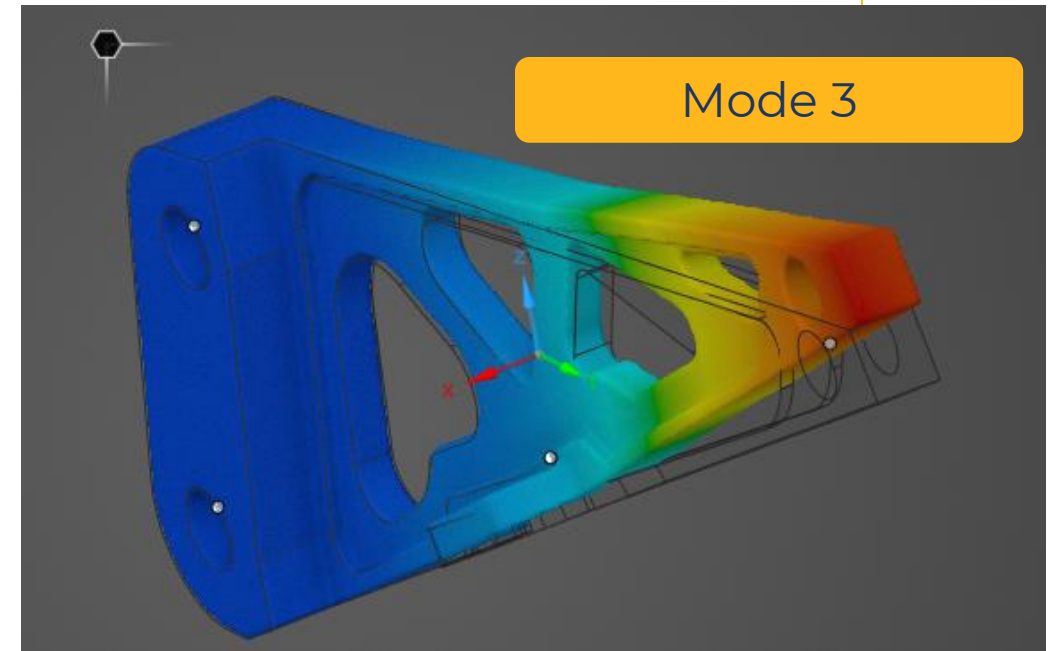
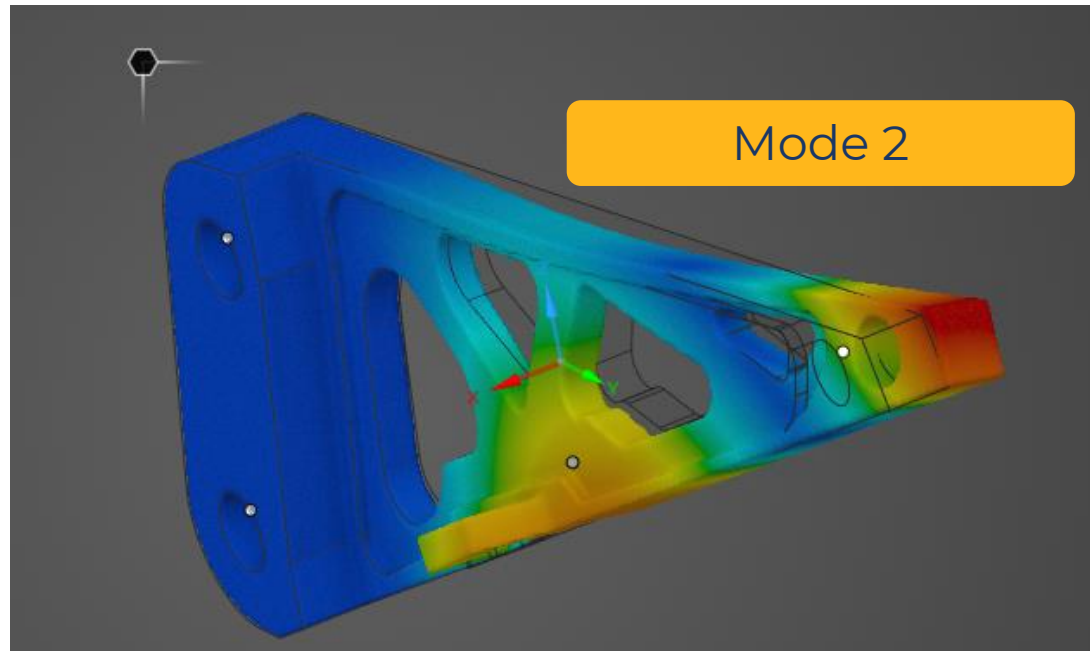
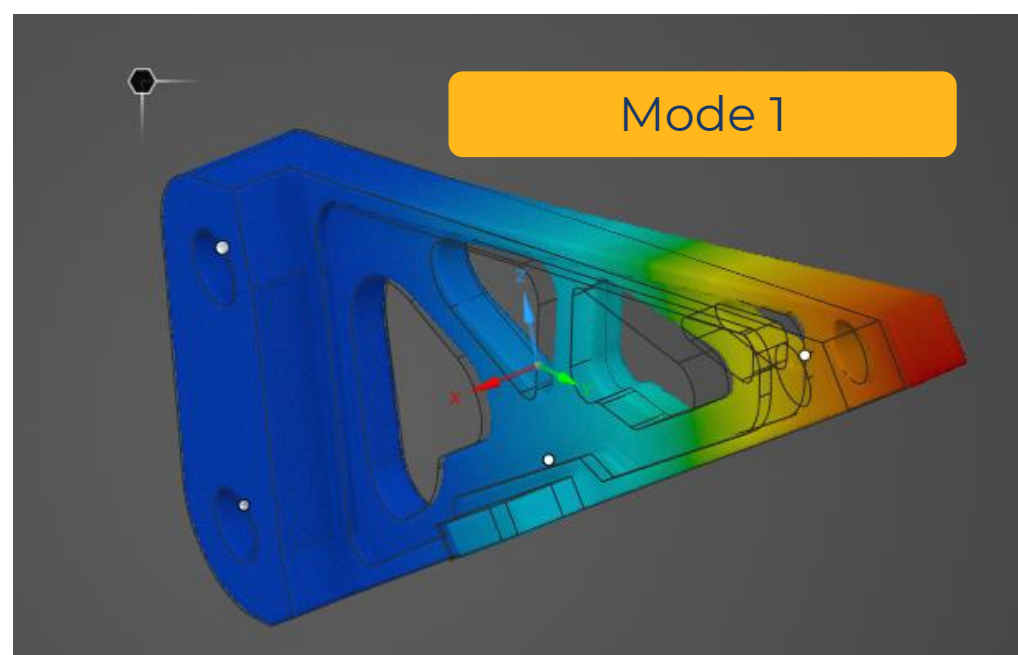
# SubD Hybrid Autoskin

- Hybrid SubD bodies can now be created in the autoskin tool
  - Great for converting topology optimization results from mechanical for further editing
- Hybrid SubD bodies can be transferred to Mechanical for validation simulation



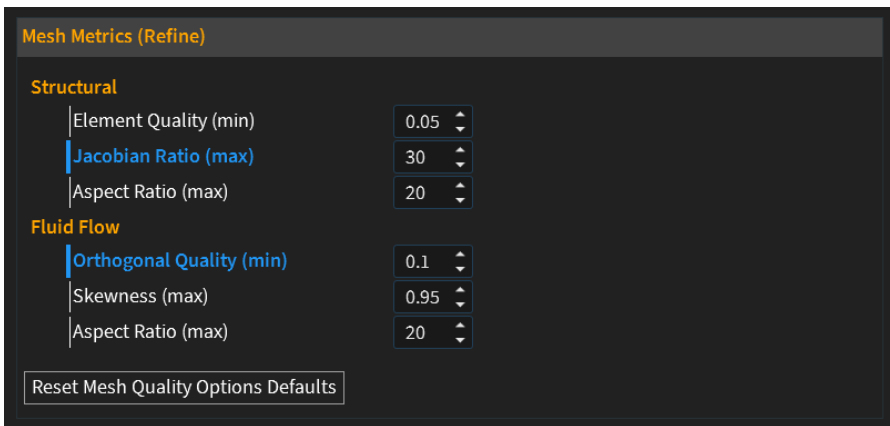


# Modal

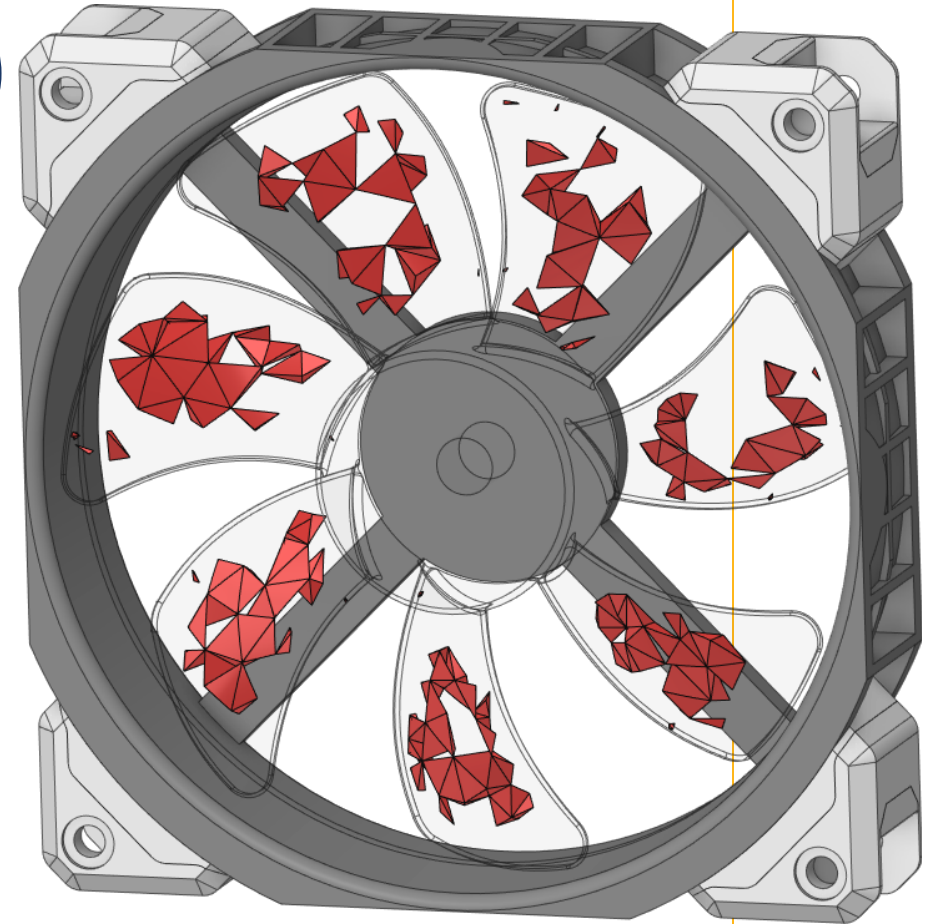



# Mesh Quality Display (Refine)

- Display elements exceeding quality thresholds
  - Default or user defined thresholds
    - Structures: min element quality, max Jacobian ratio and max aspect ratio
    - Fluids: min orthogonal quality, max skewness and max aspect ratio
  - Easier to validate mesh quality and identify areas to apply local fidelity



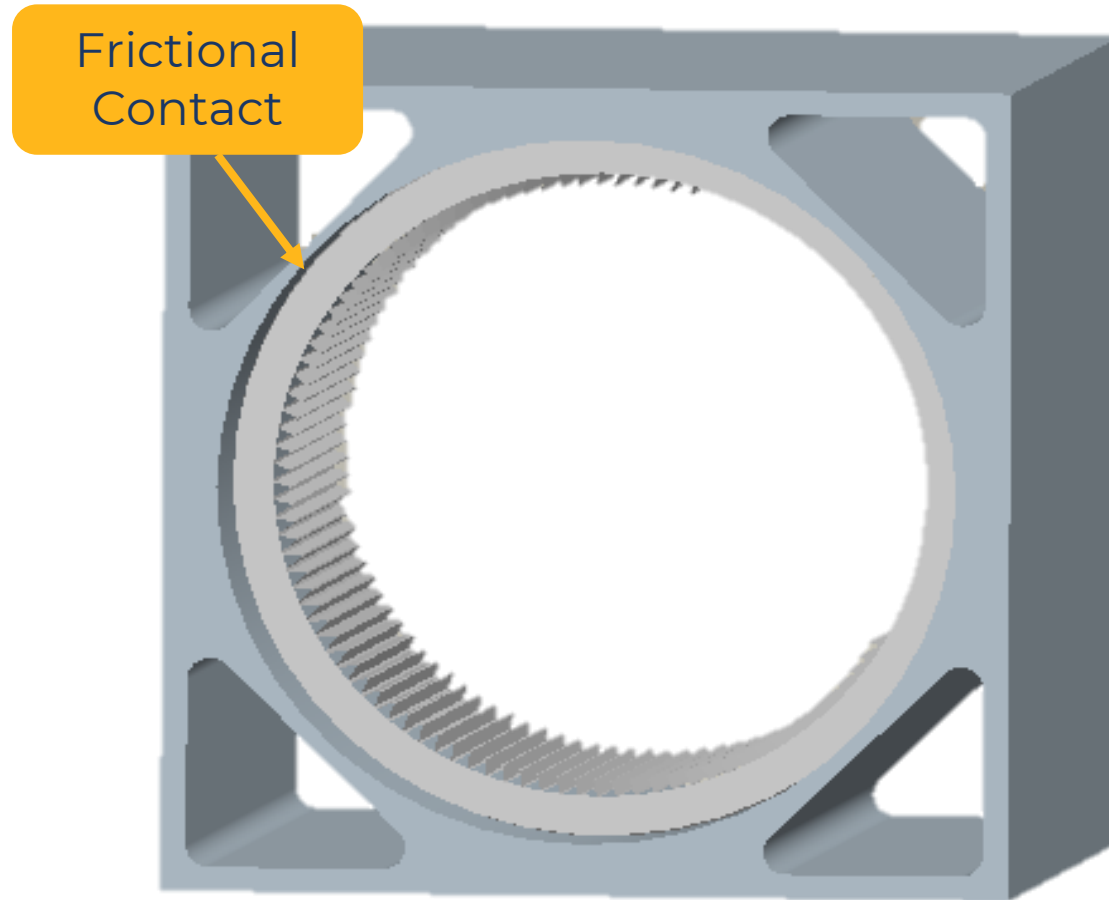
*Easily modify default quality limits in Simulation Options or Physics Settings*



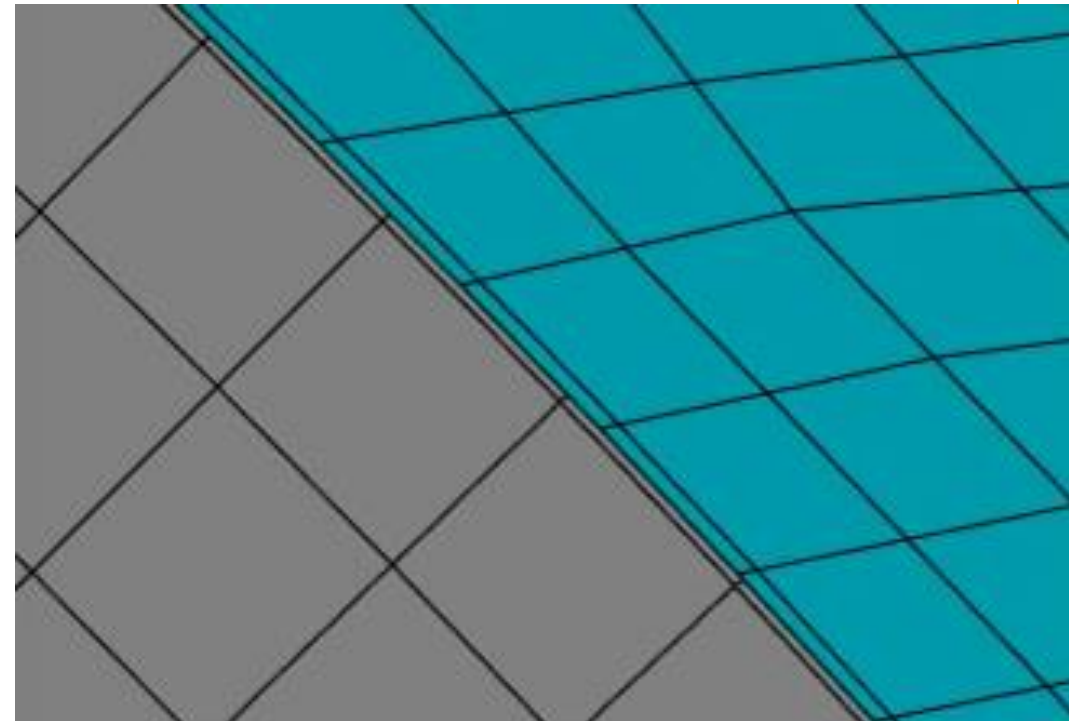
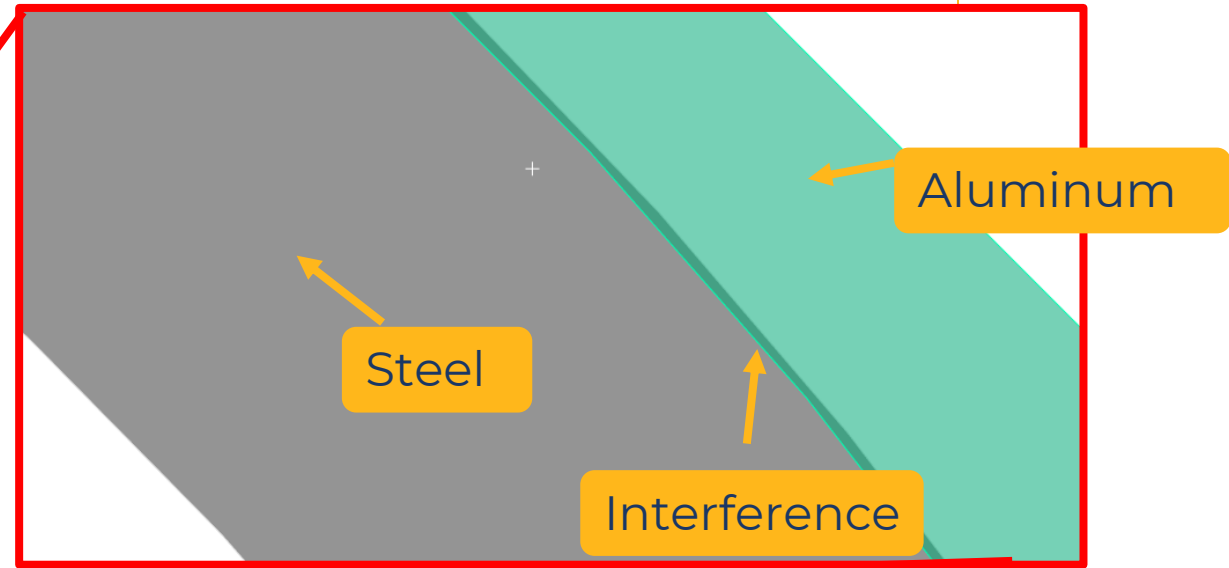
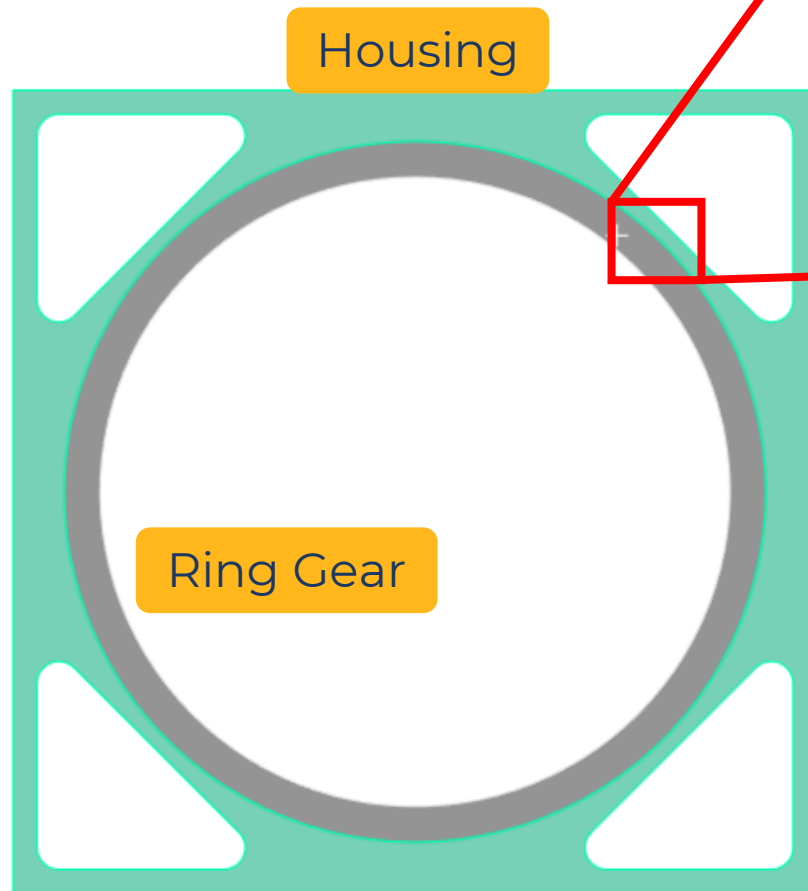
 Some mesh elements exceed the quality threshold of 30 for jacobian ratio. [Review the location](#) of these problematic elements.

*Display elements that do not meet the quality threshold either by clicking on link in the message or using the Resolution display*

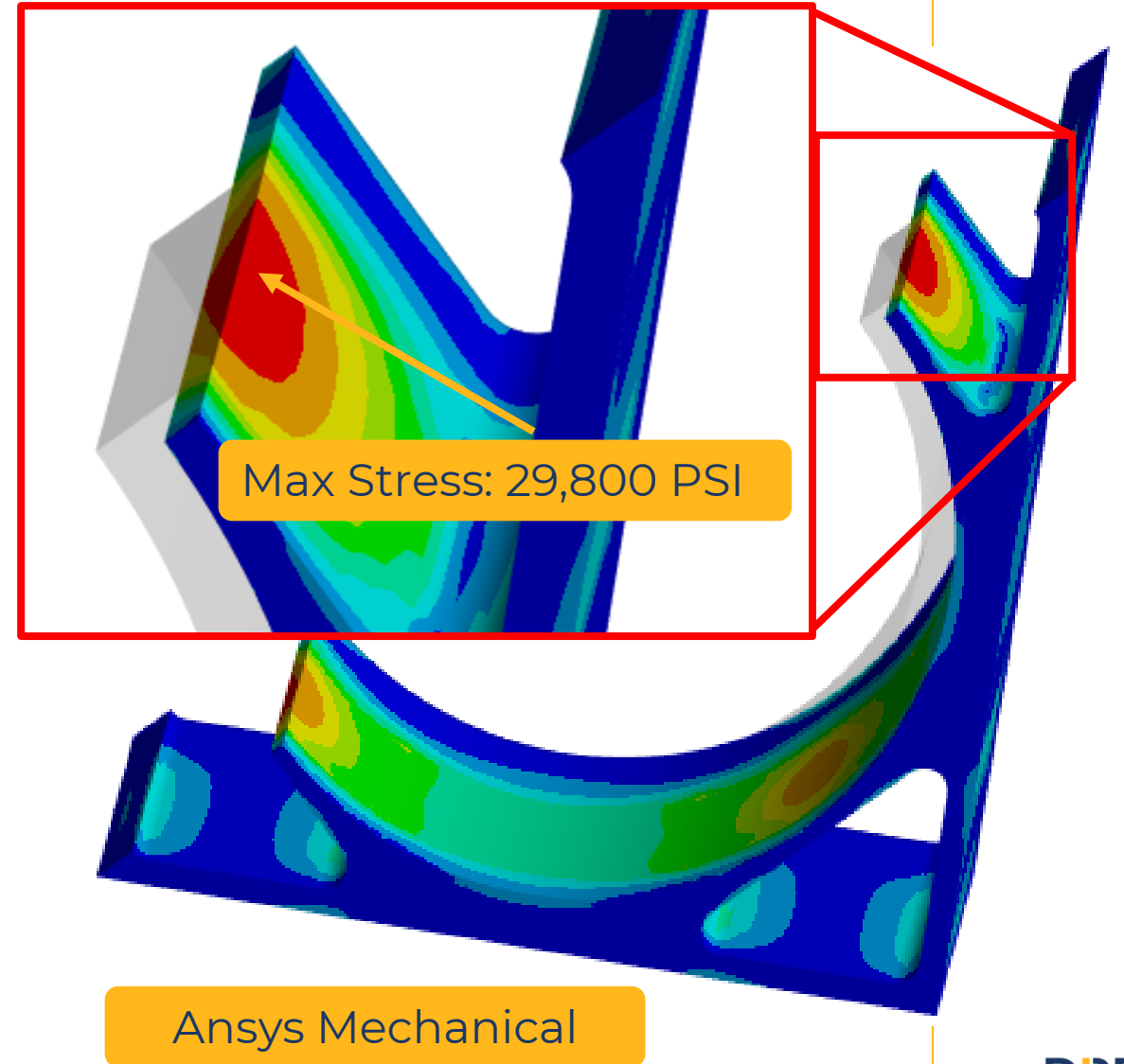
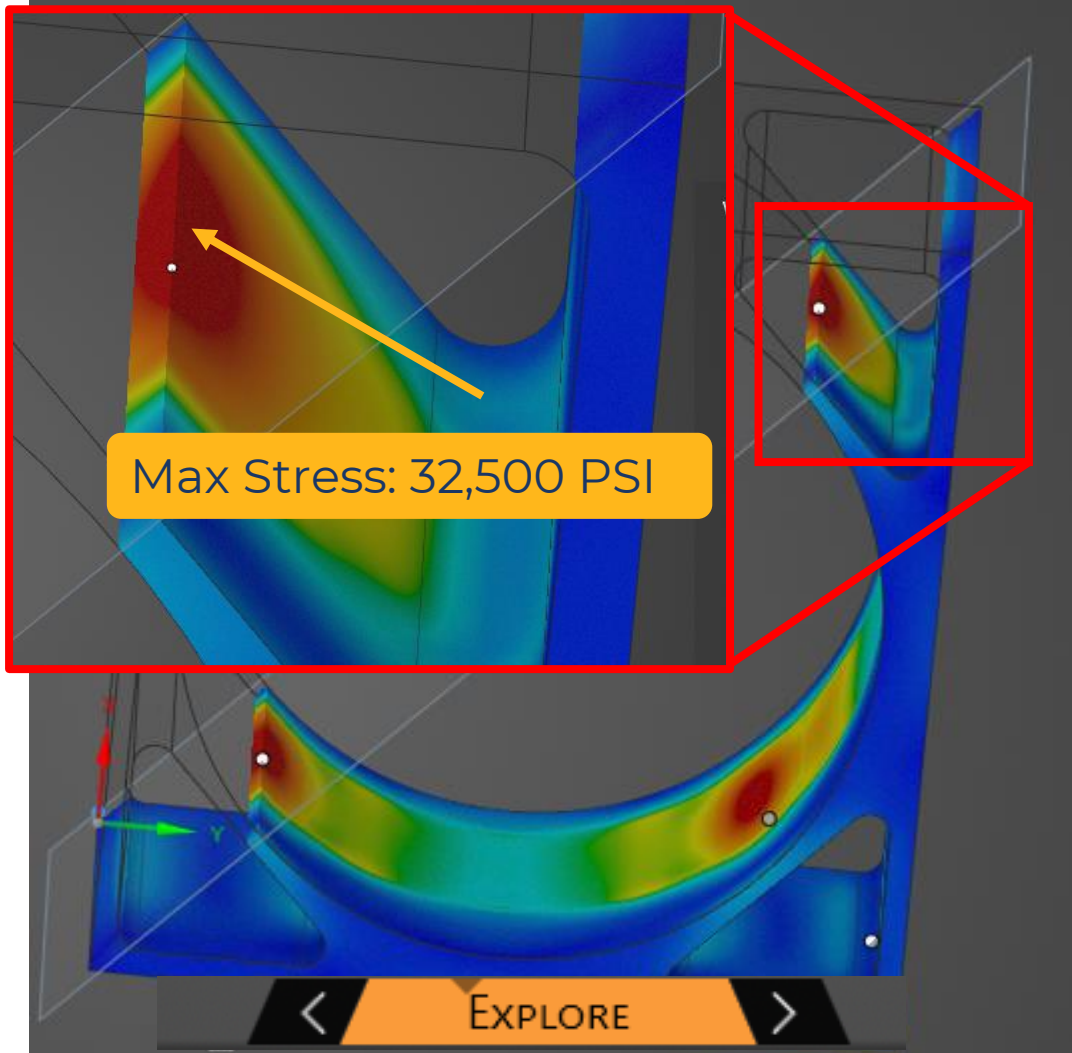
# Press Fit Accuracy Benchmark



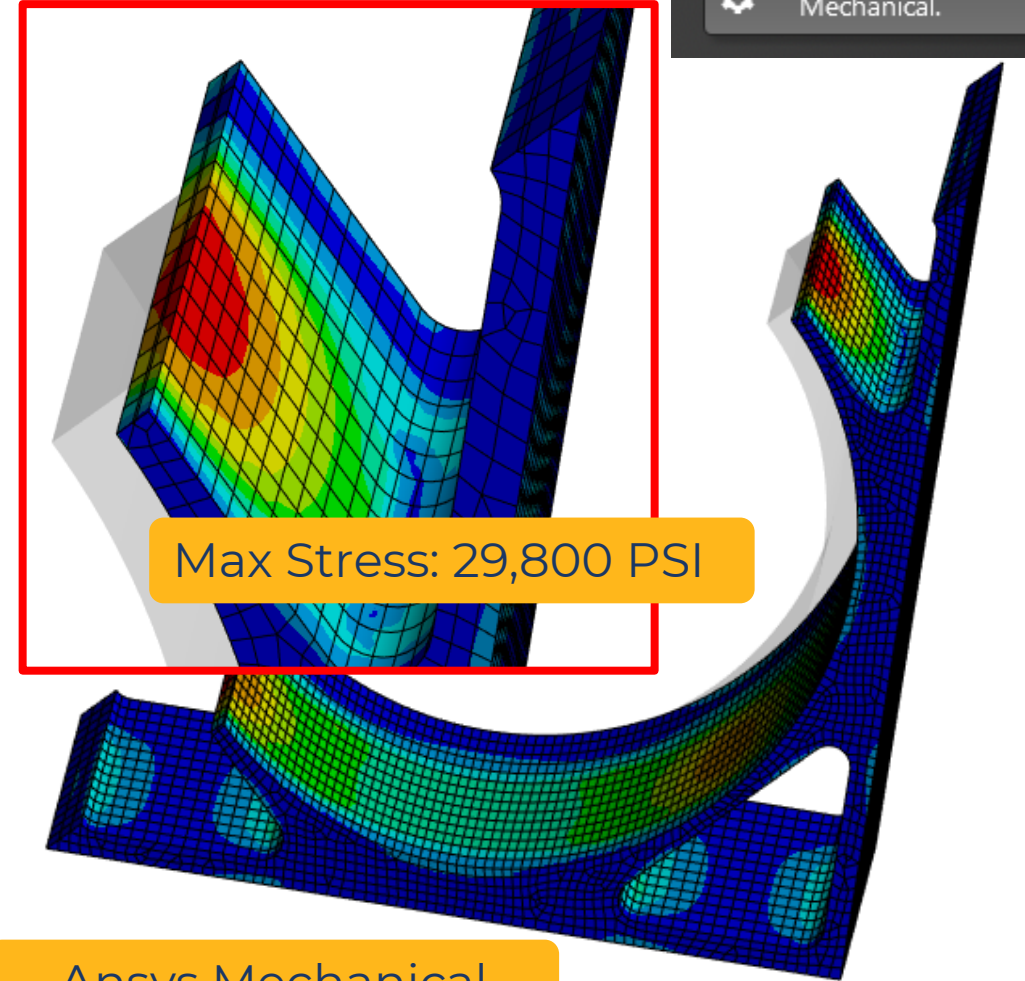
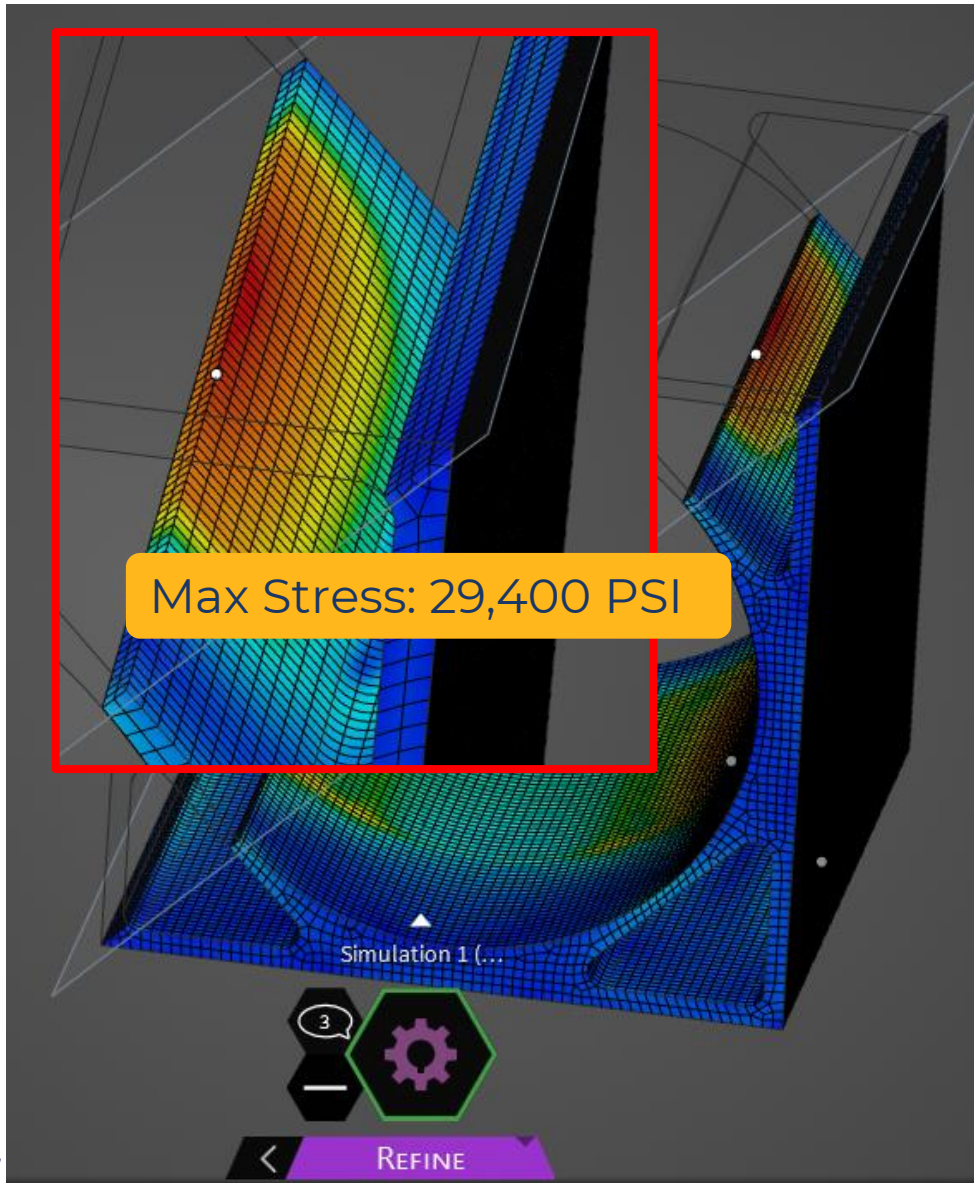
# Benchmark: Press Fit



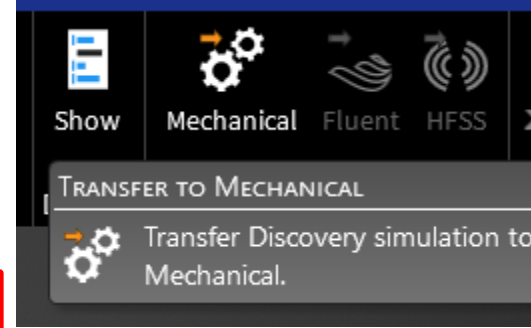
# Ansyes Mechanical Vs Ansyes Discovery Explore



# Ansys Mechanical Vs Ansys Discovery Refine



Ansys Mechanical



# Summary:

Solver	Max Stress	% Error	Solve Time
Ansys Mechanical	29,800 PSI	N/A	161 seconds
Discovery Explore	32,500 PSI	9.1%	67 seconds
Discovery Refine	29,400 PSI	1.3%	180 seconds

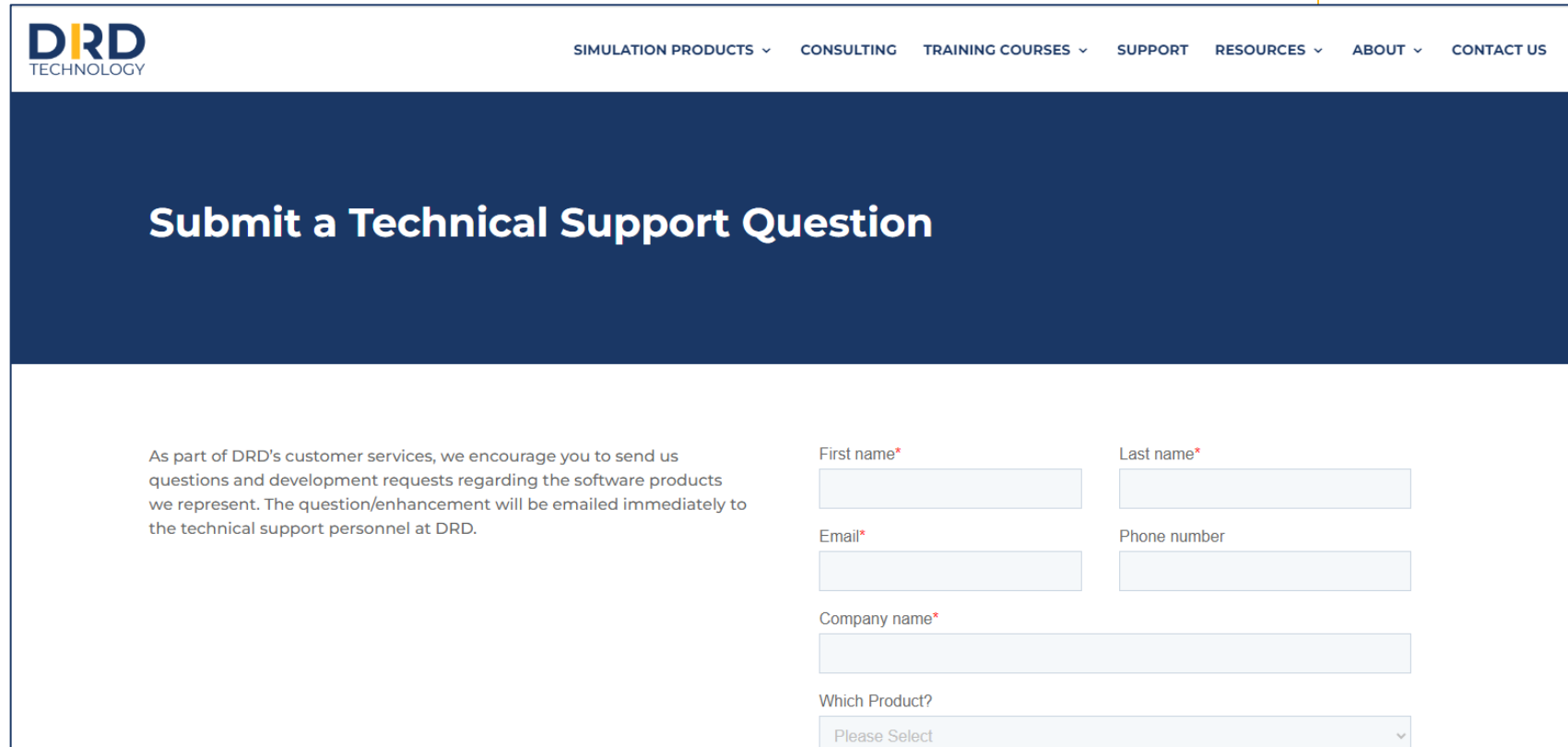
Mech Pro or Higher License Required

# Contact us Today!

Phone: 918 743-3013 ext 1

Email: [support@drd.com](mailto:support@drd.com)

Web: [www.drd.com](http://www.drd.com)



The screenshot shows the top navigation bar of the DRD Technology website with links for SIMULATION PRODUCTS, CONSULTING, TRAINING COURSES, SUPPORT, RESOURCES, ABOUT, and CONTACT US. Below the navigation is a dark blue header with the text 'Submit a Technical Support Question'. The main content area contains a form with the following fields:

As part of DRD's customer services, we encourage you to send us questions and development requests regarding the software products we represent. The question/enhancement will be emailed immediately to the technical support personnel at DRD.

First name\*

Last name\*

Email\*

Phone number

Company name\*

Which Product?



# Questions?

- Please post questions in the Q&A panel chat now