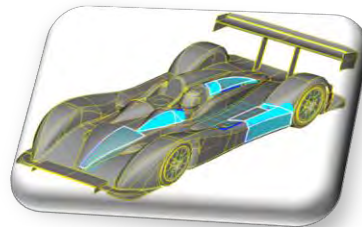
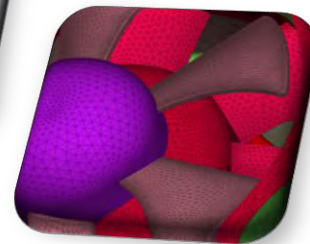


# ANSA & $\mu$ ETA : powerful pre- and post-processing for advanced CFD simulations

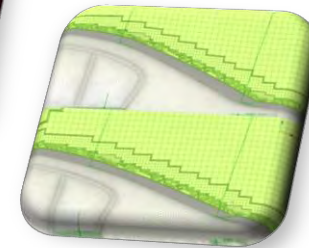
January 2015



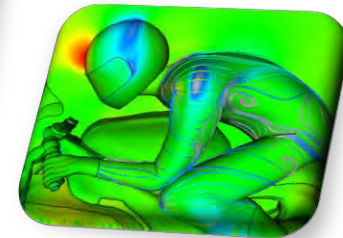
*geometry*



*mesh*



*morph*



*results*

BETA CAE Systems S.A.  
Kato Scholari, Thessaloniki,  
GR- 57500 Epanomi, Greece  
Tel :+30-392-021420  
Fax :+30-392-021417  
Email : [ansa@beta-cae.gr](mailto:ansa@beta-cae.gr)  
URL : <http://www.beta-cae.gr>

## ANSA pre-processor specifications

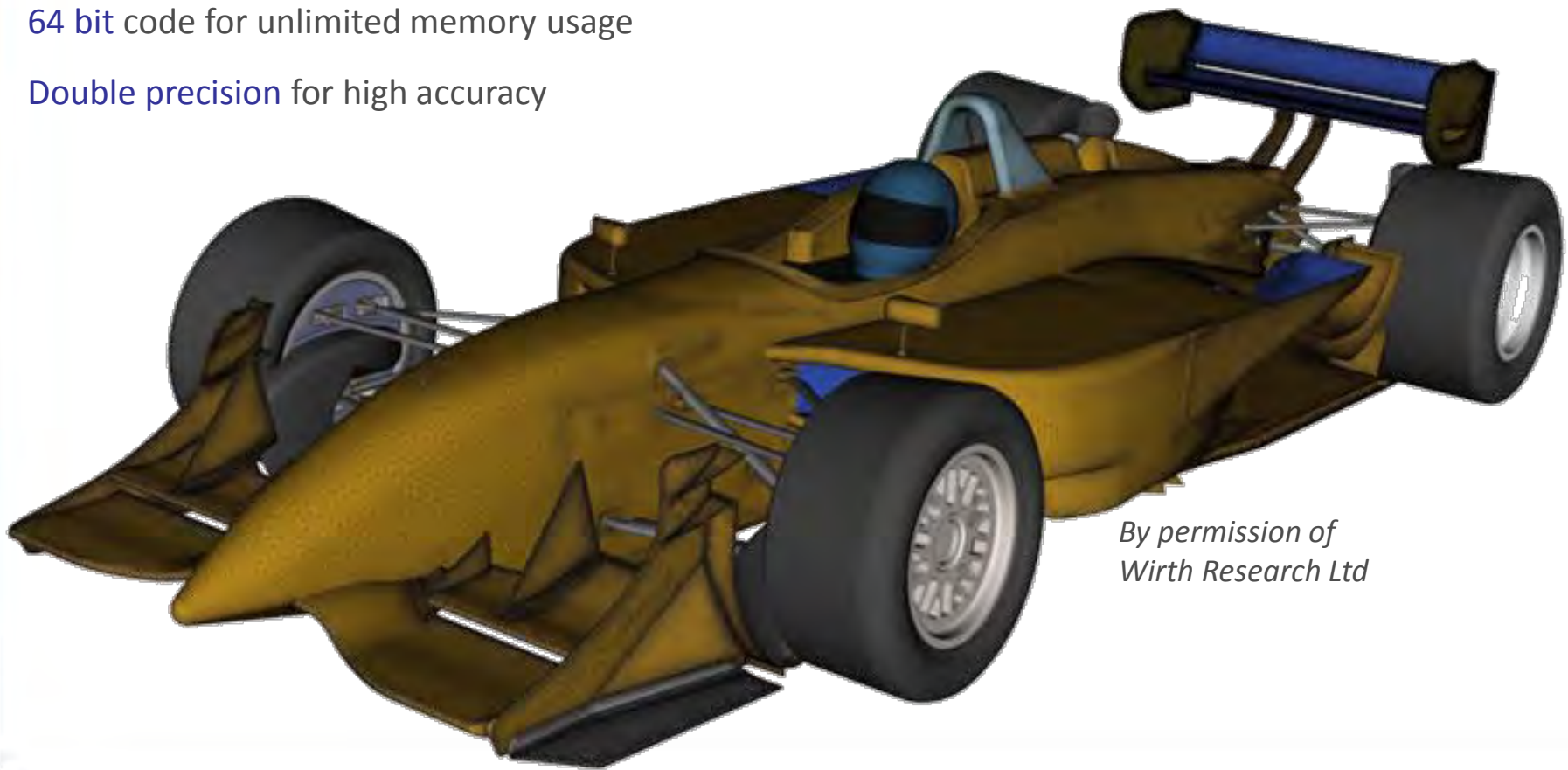
Supported platforms:

- Linux
- Windows XP / Vista / 7 / 8
- MacOS

Parallel processing on **multi core** hardware for maximum speed

**64 bit** code for unlimited memory usage

**Double precision** for high accuracy



*By permission of  
Wirth Research Ltd*

# Input/Output

Neutral CAD formats:

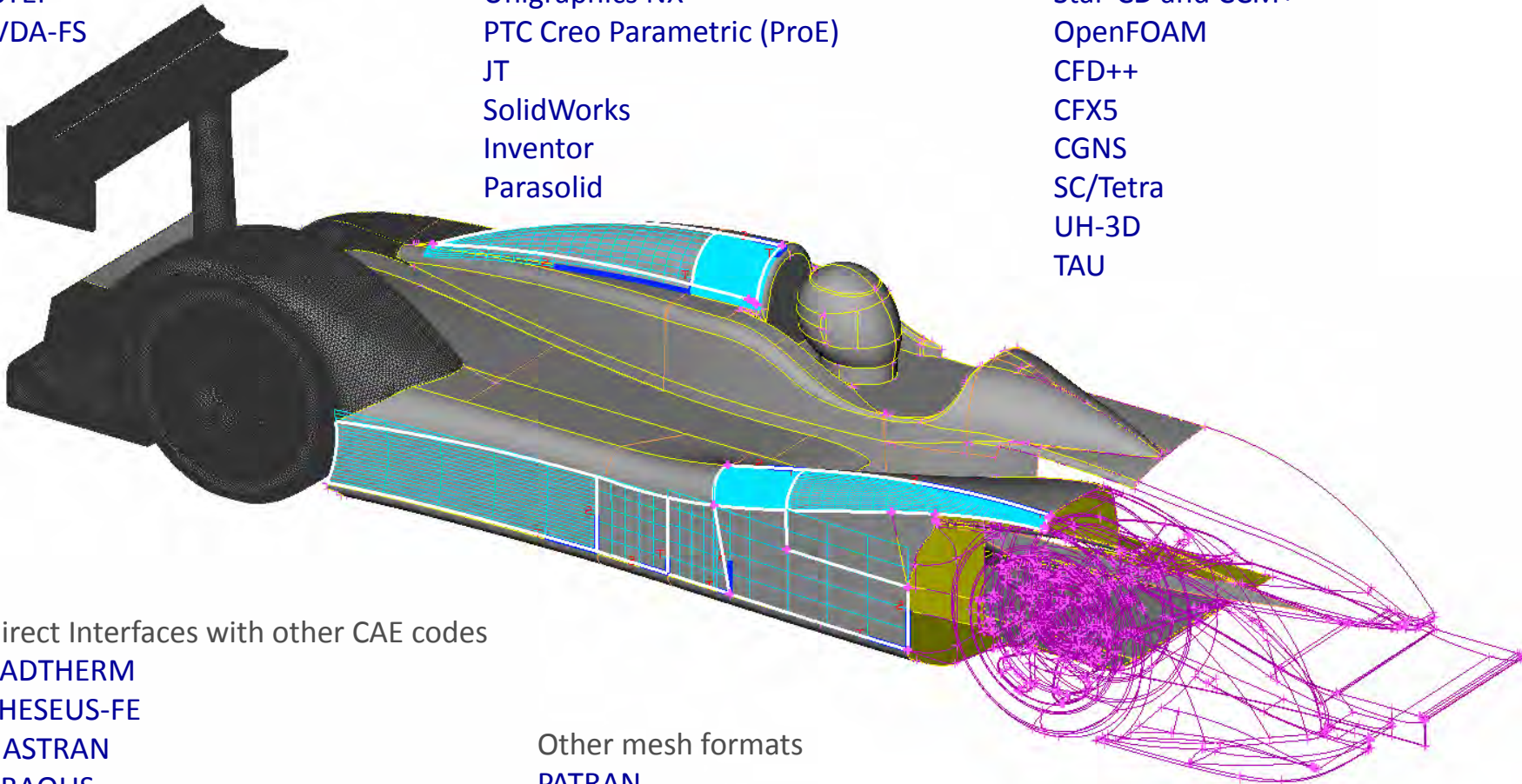
IGES  
STEP  
VDA-FS

Native CAD formats:

CATIA V4 & V5  
Unigraphics NX  
PTC Creo Parametric (ProE)  
JT  
SolidWorks  
Inventor  
Parasolid

CFD formats:

Fluent  
Star-CD and CCM+  
OpenFOAM  
CFD++  
CFX5  
CGNS  
SC/Tetra  
UH-3D  
TAU



Direct Interfaces with other CAE codes

RADTHERM  
THESEUS-FE  
NASTRAN  
ABAQUS  
ANSYS  
LS-DYNA  
and more..

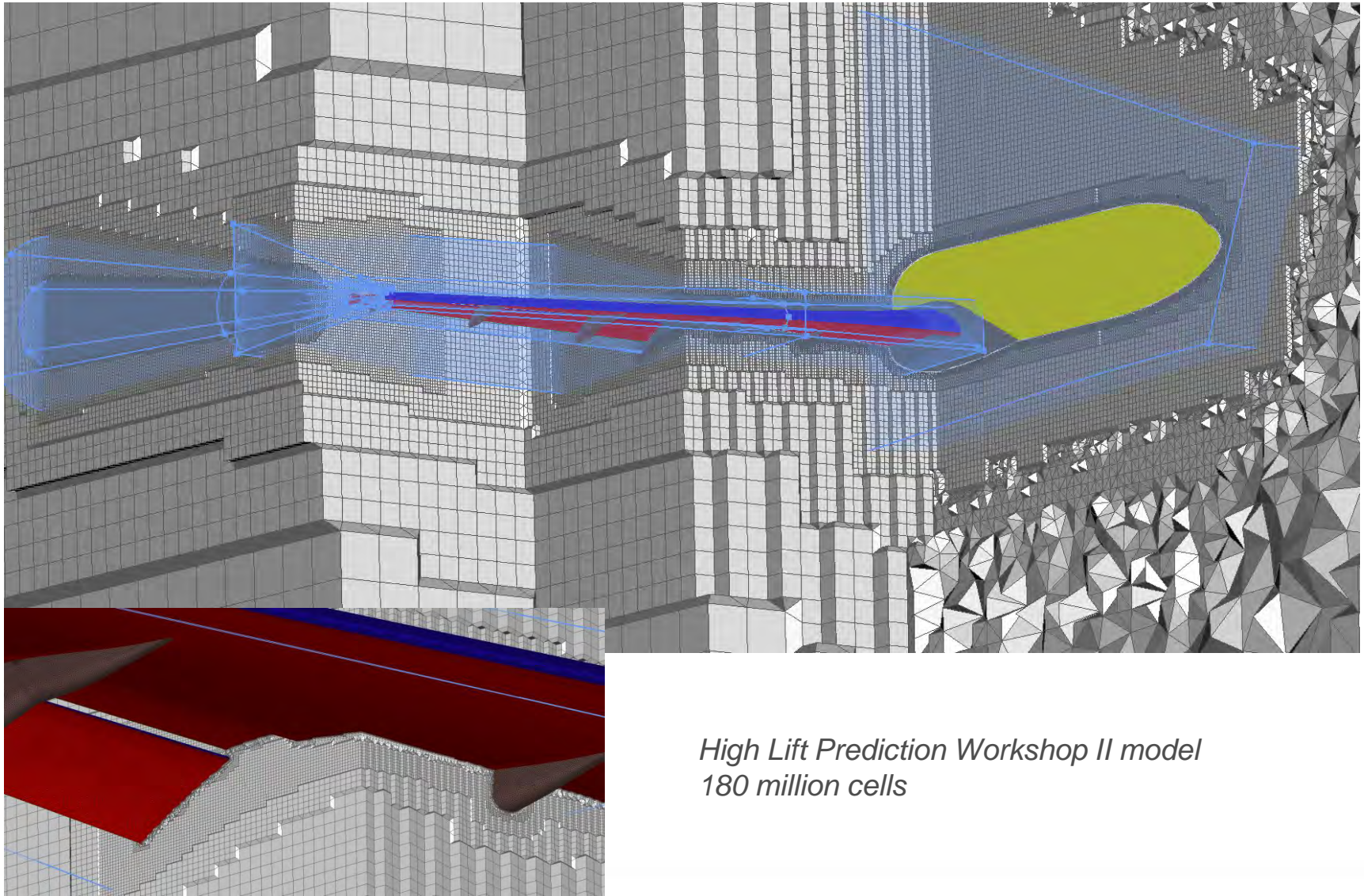
Other mesh formats

PATRAN  
STL  
VRML  
and more..

*By permission of Wirth Research Ltd*

## Industrial scale pre-processing

Powerful generation and visualization of large CFD models



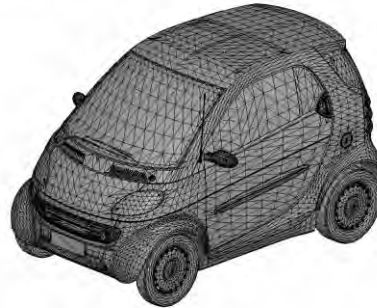
*High Lift Prediction Workshop II model  
180 million cells*

# Geometry

# Geometry handling

“CAD feel”, easy-to-use functions for creation and manipulation of geometrical entities (points, curves, surfaces)

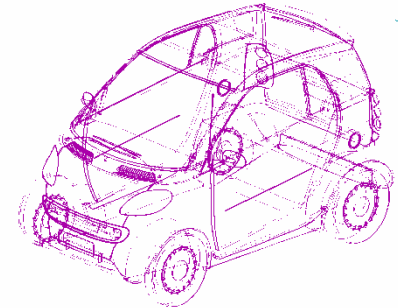
ANSYS v12.1.5 64bit



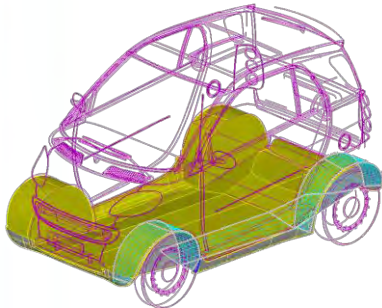
ANSYS v12.1.5 64bit



ANSYS v12.1.5 64bit



ANSYS v12.1.5 64bit



ANSYS v12.1.5 64bit



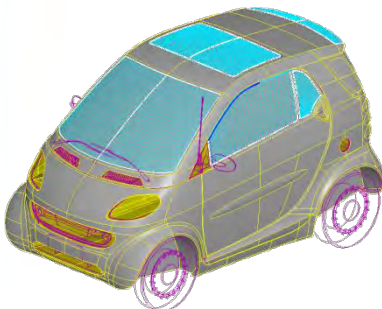
ANSYS v12.1.5 64bit



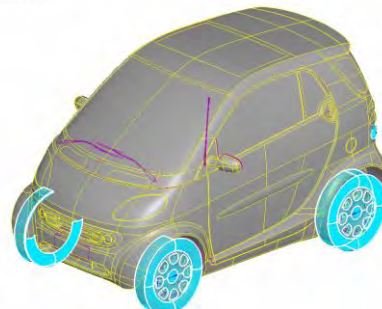
ANSYS v12.1.5 64bit



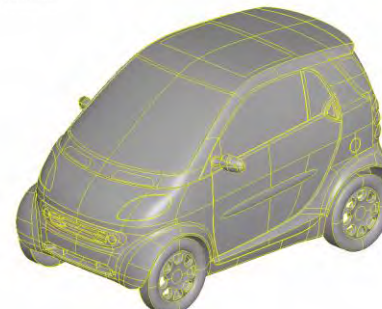
ANSYS v12.1.5 64bit



ANSYS v12.1.5 64bit



ANSYS v12.1.5 64bit

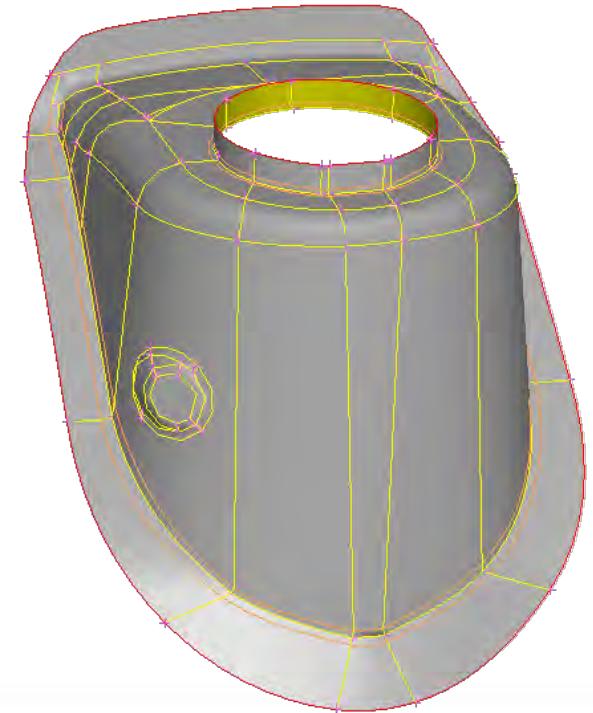
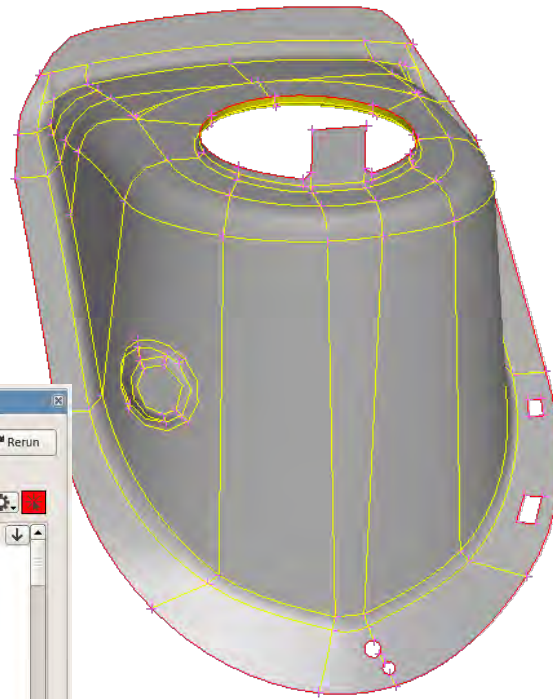
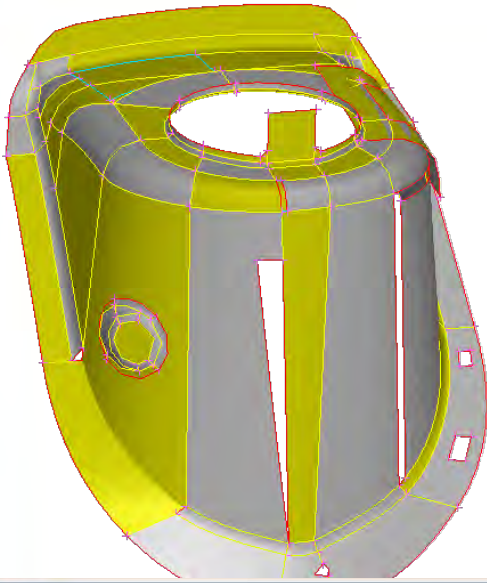


ANSYS v12.1.5 64bit



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## Geometry handling: Advanced automatic and manual clean up tools



Checks Manager - Geometry

← Back Rerun

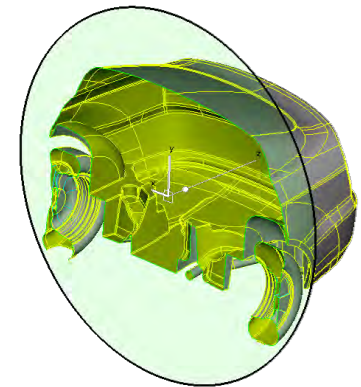
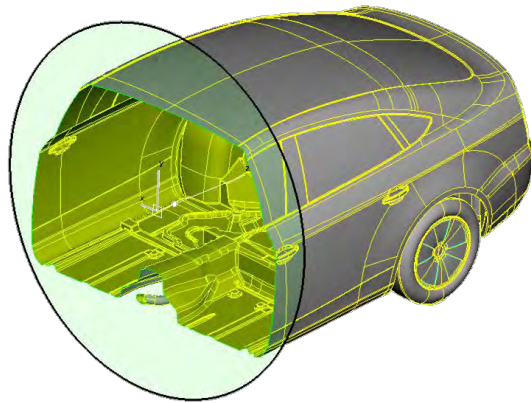
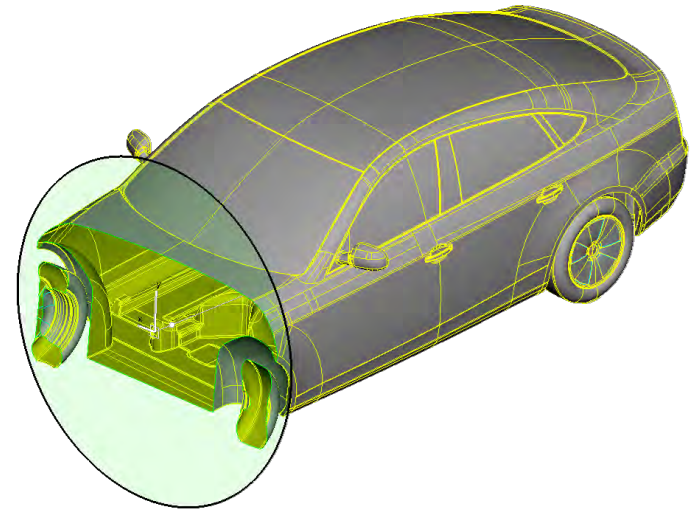
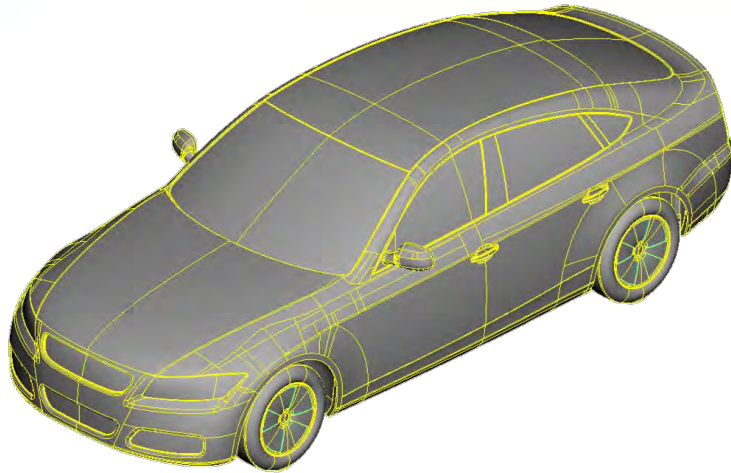
Icons: Home, Zoom, Rotate, Search, Settings, Stop

Type	Entity	ID	Description
Error	FACE	1	Triple Cons
Error	FACE	6	Triple Cons
Error	FACE	61	Triple Cons
Error	FACE	83	Triple Cons
Error	Overlapping Faces: 1 52		
Error	Crack Between Faces: 63 ...		
Error	FACE	1	Single Cons
Error	FACE	2	Single Cons
Error	FACE	3	Single Cons
Error	FACE	4	Single Cons
Error	FACE	5	Single Cons
Error	FACE	7	Single Cons

total 51 | selected 0

Name	Value
Single Cons	<input checked="" type="checkbox"/>
Cracks	<input checked="" type="checkbox"/>
Overlap Faces	<input checked="" type="checkbox"/>
Needle Faces	<input checked="" type="checkbox"/>
Triple Cons	<input checked="" type="checkbox"/>
Collapsed Cons	<input checked="" type="checkbox"/>
Unchecked Faces	<input checked="" type="checkbox"/>
Unmeshed Macros	<input type="checkbox"/>

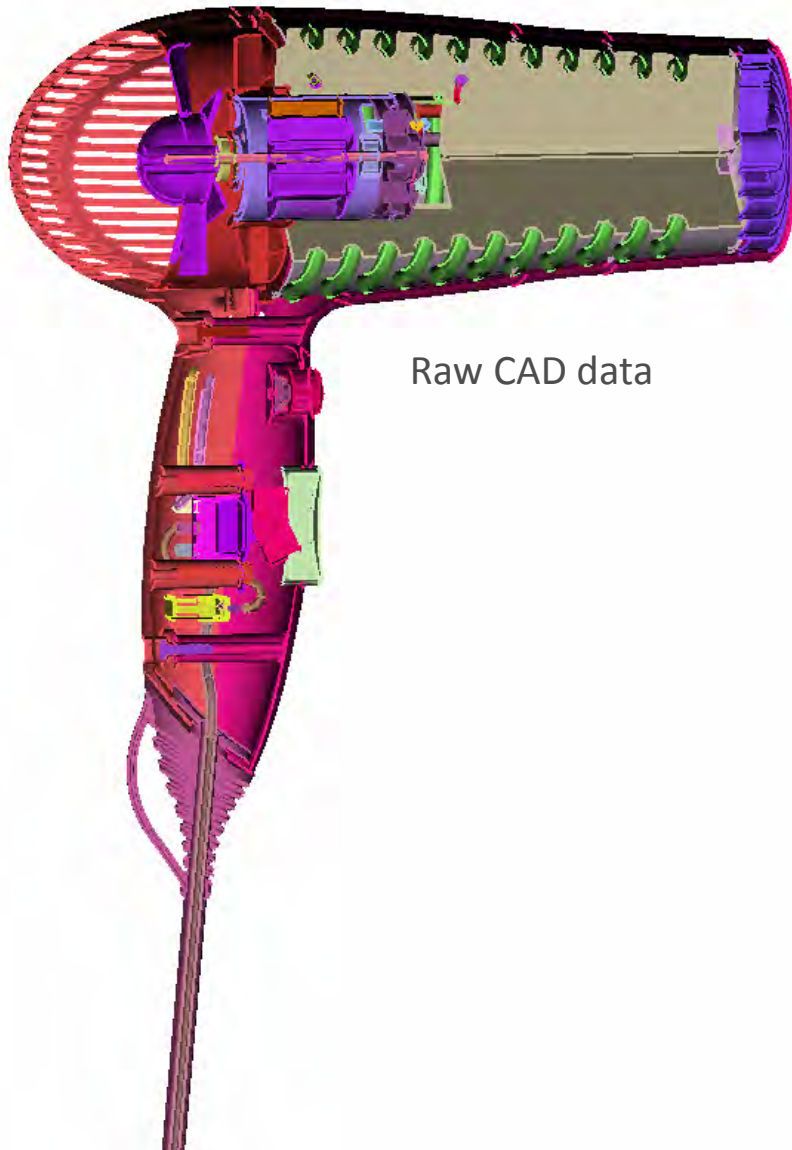
## Cutting planes for model examination and cross section creation



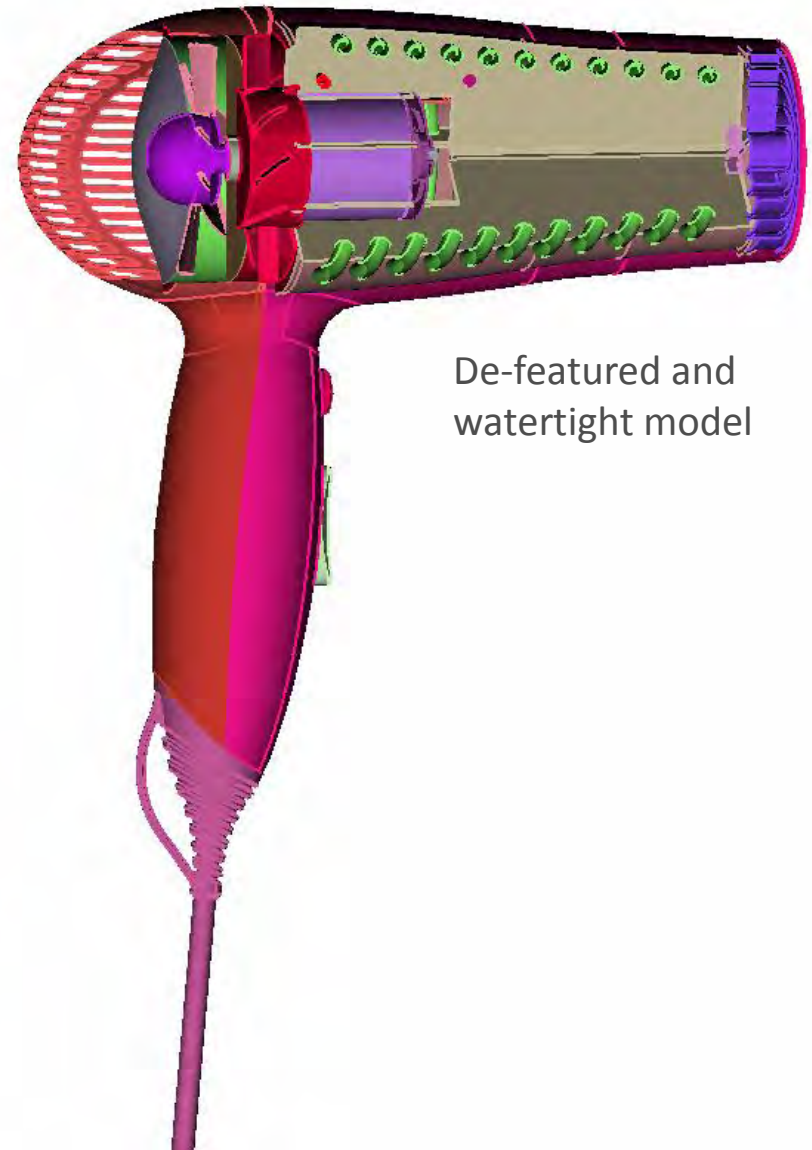
*DrivAer model courtesy of Technical University of Munich*



## Geometry handling: De-featuring and watertight model preparation



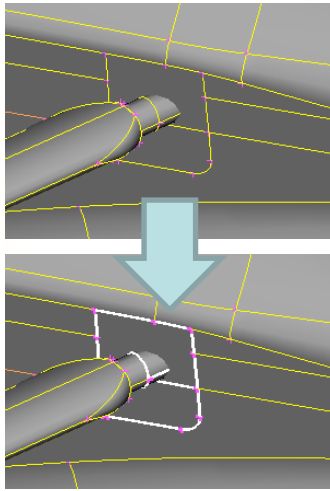
Raw CAD data



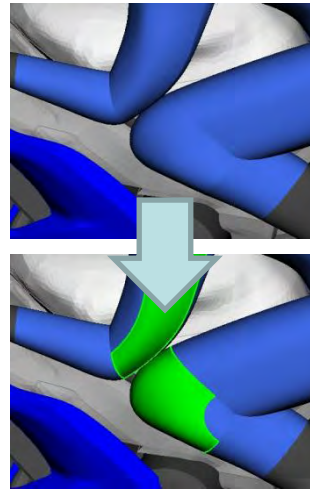
De-featured and  
watertight model

# Geometry handling: identification and isolation tools for:

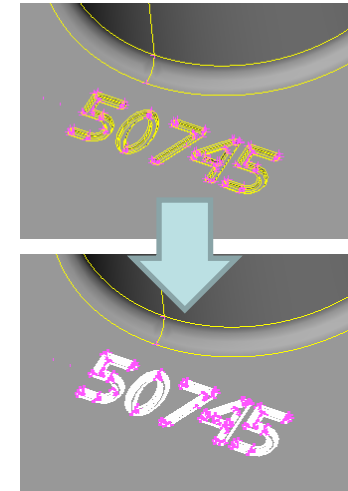
Intersections



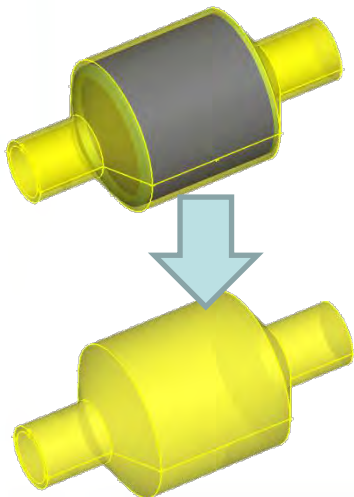
Contacts/Proximities



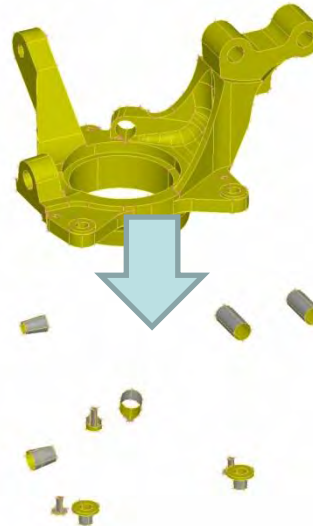
Emboss logos



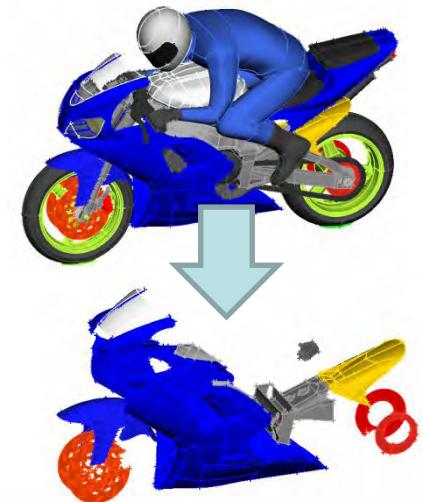
Outer skin



Inner passages

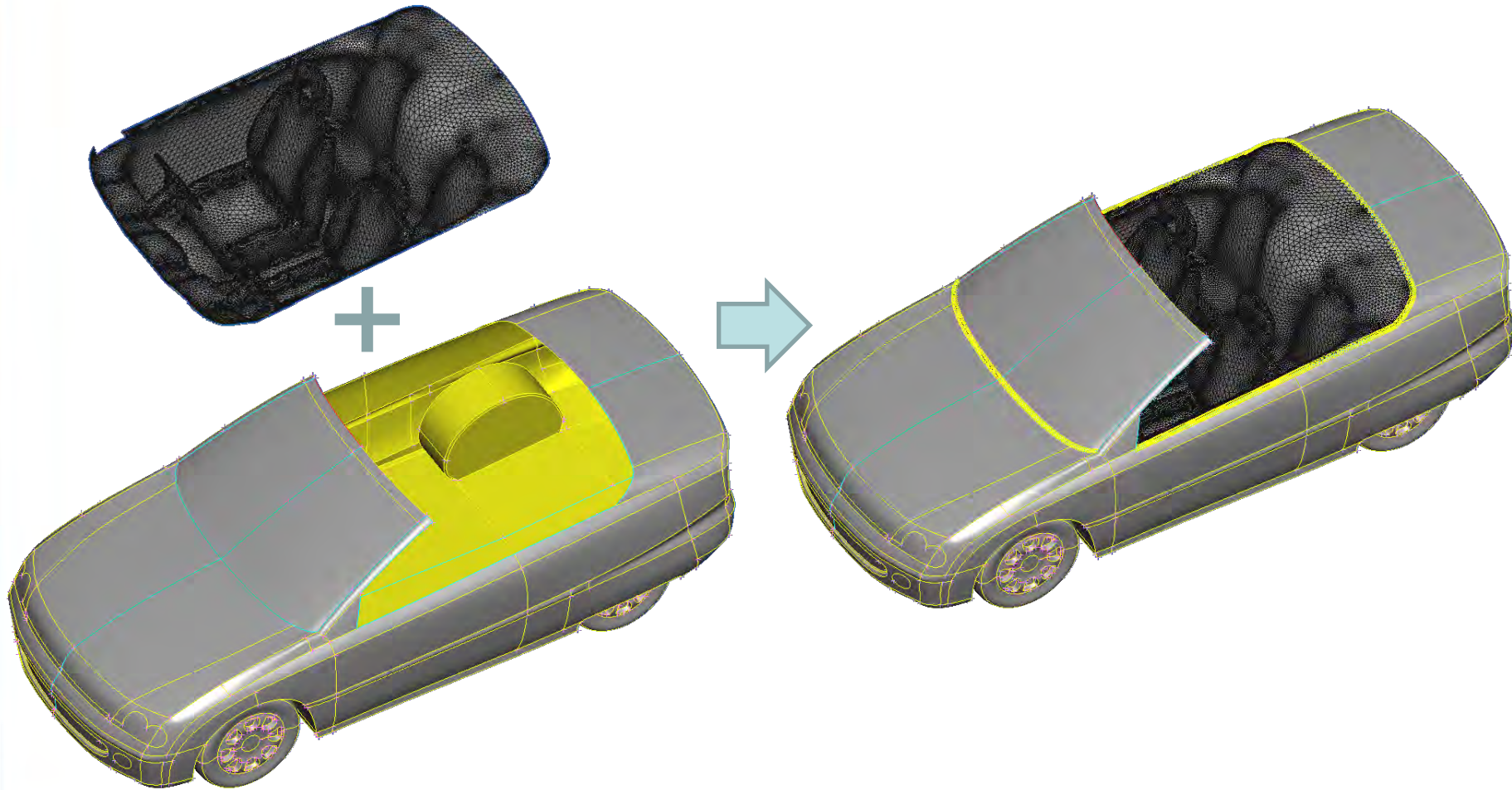


Baffles

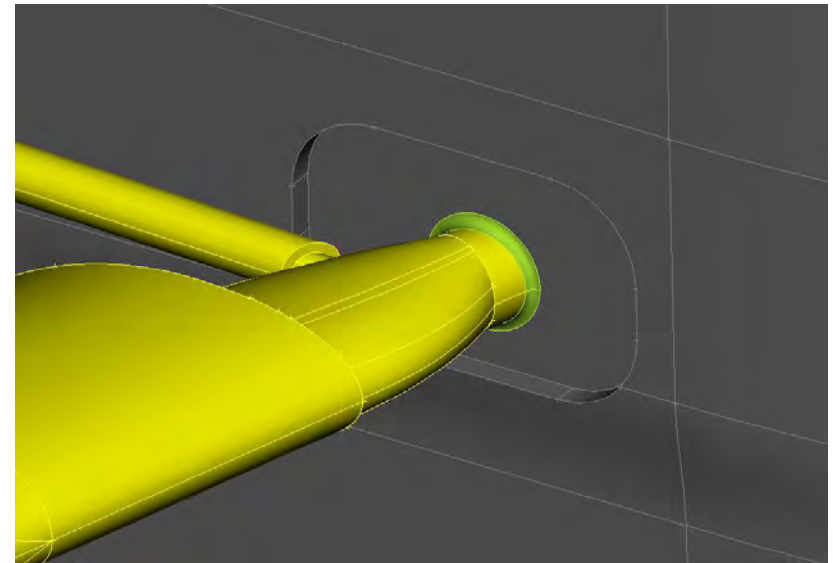
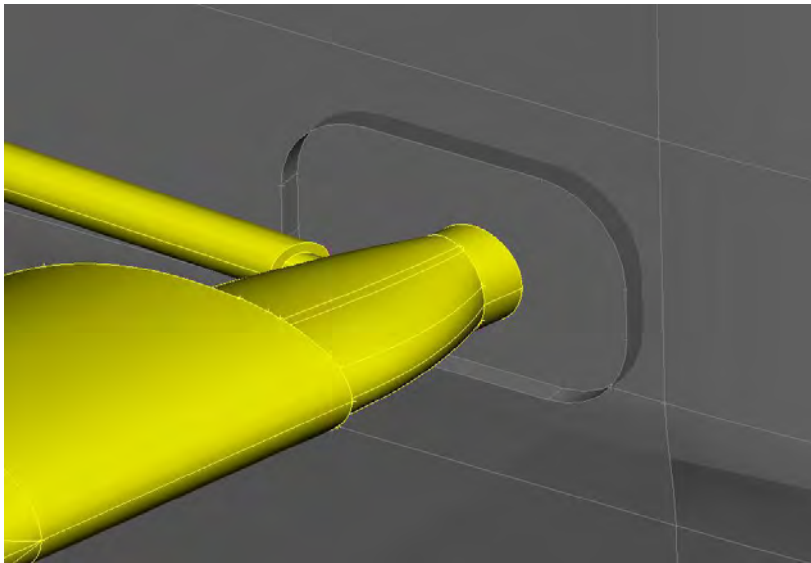
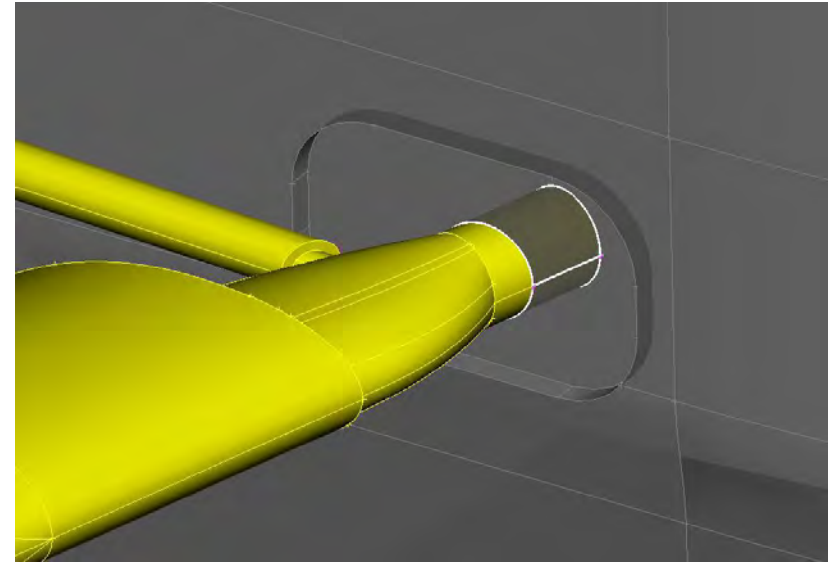
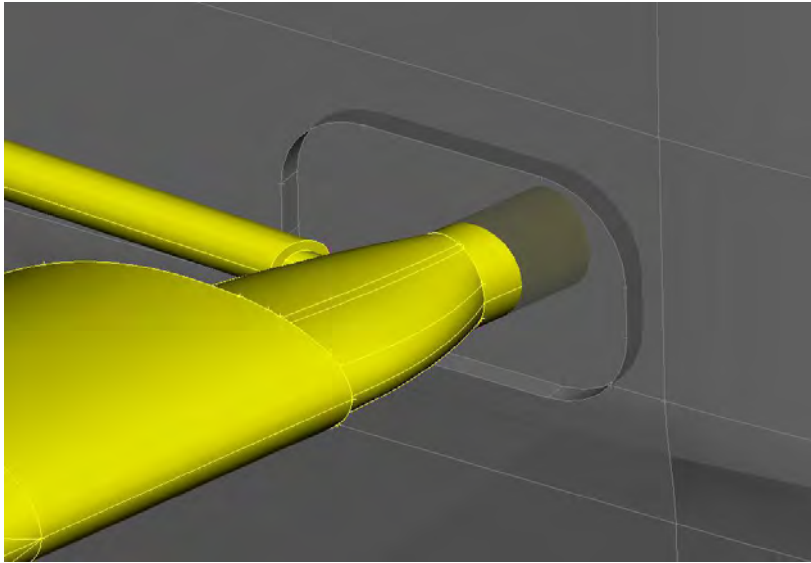


## Combining geometry and FE-model mesh

Powerful tools for management and connection of CAD geometry and existing FE-mesh



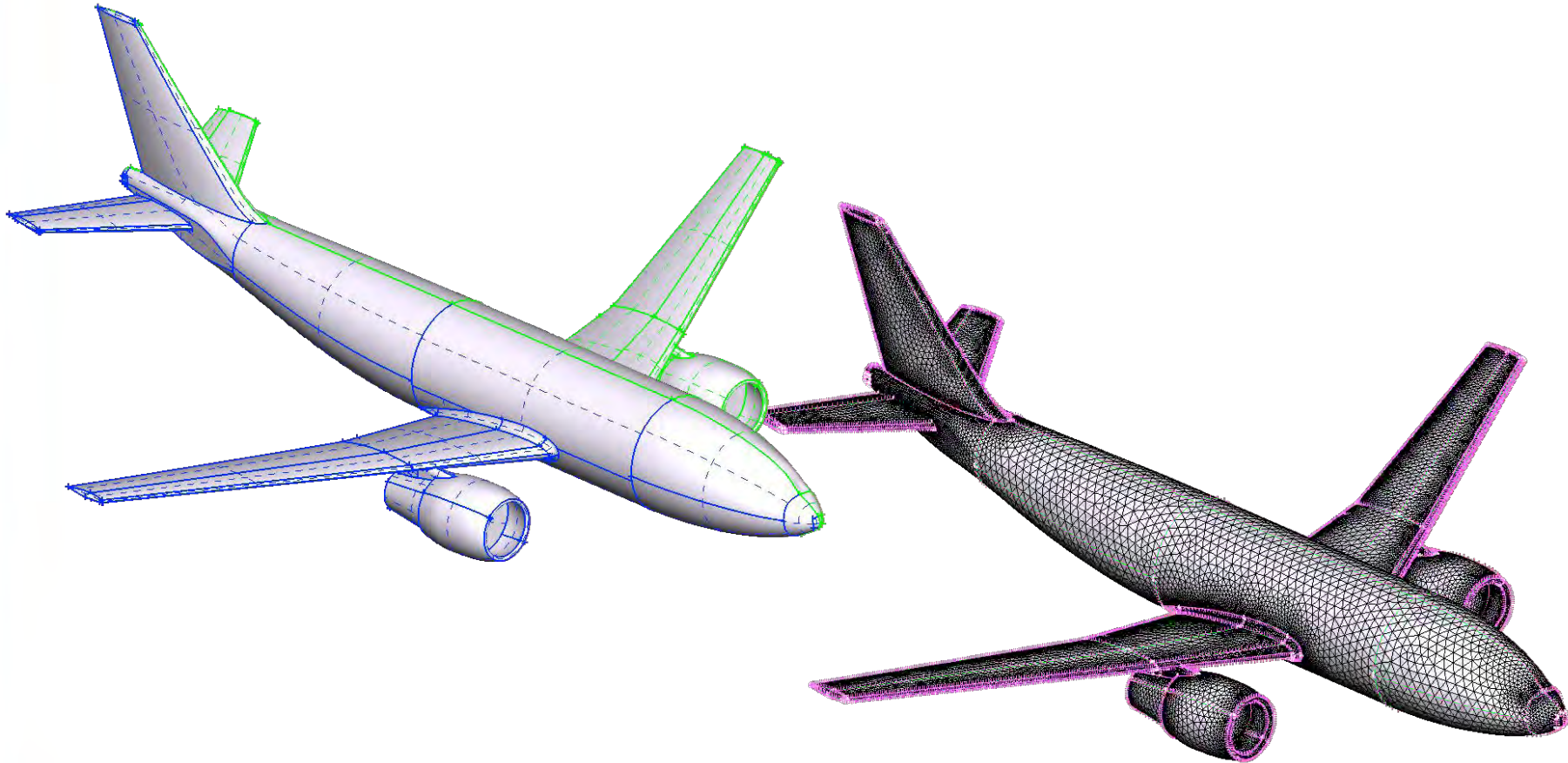
## Boolean operations in geometry with option for fillet creation



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## Geometry handling: Linked geometry

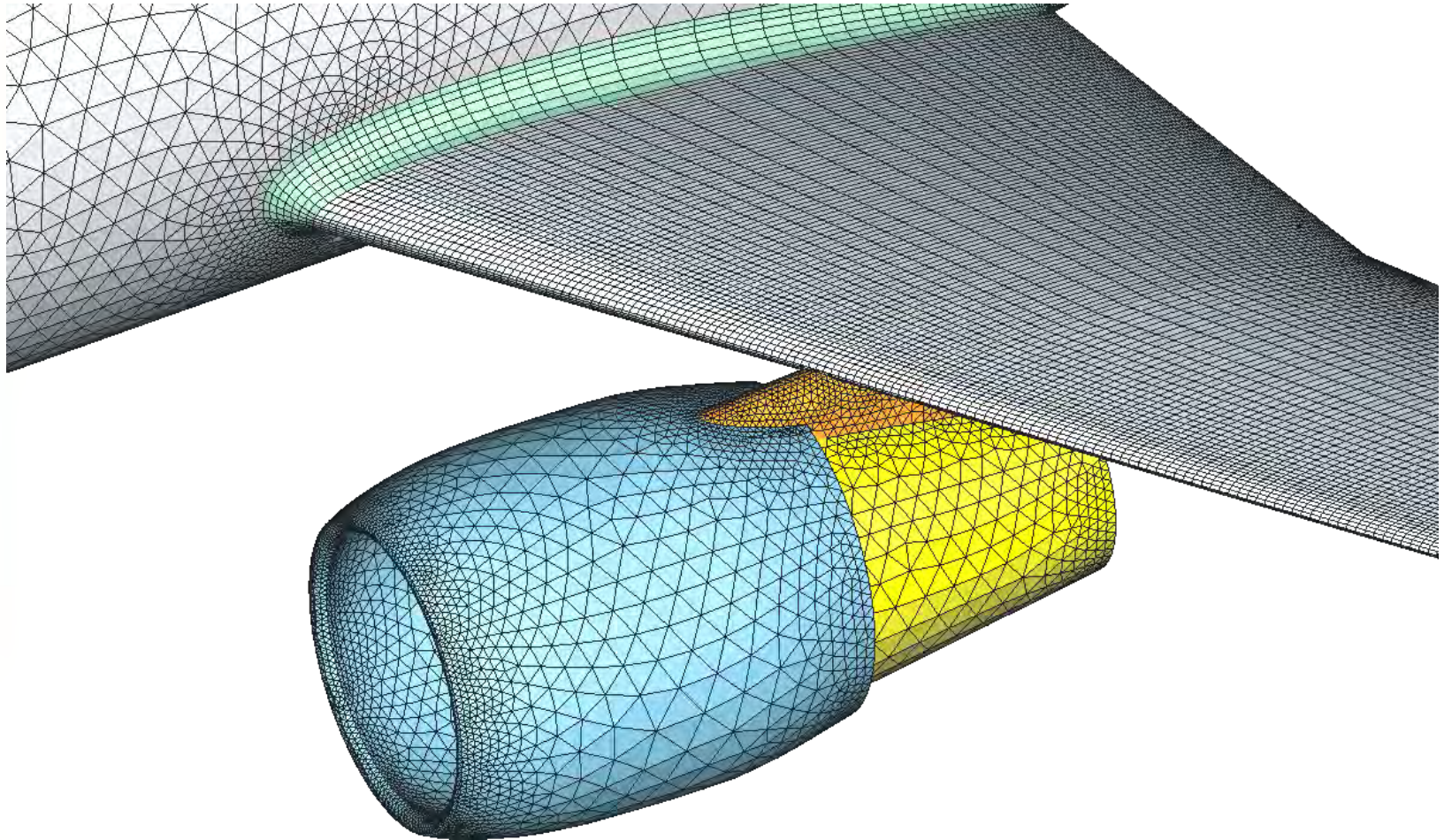
Speed-up model preparation using automatic identification of similar geometry & replacement with linked geometry



# Surface Meshing

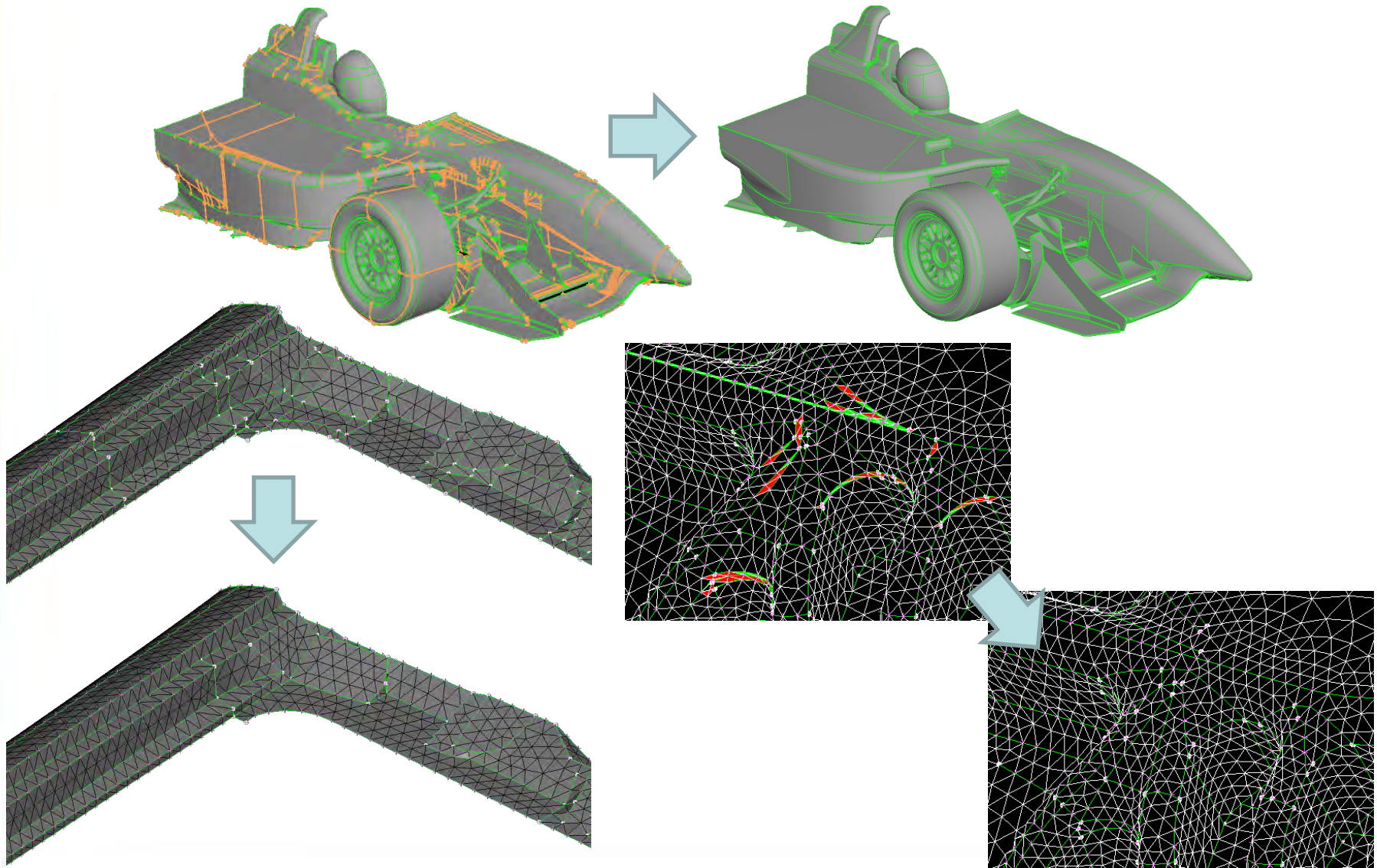
## Surface meshing

Multiple algorithms for tria, quad or mixed-type shell mesh



## Surface meshing

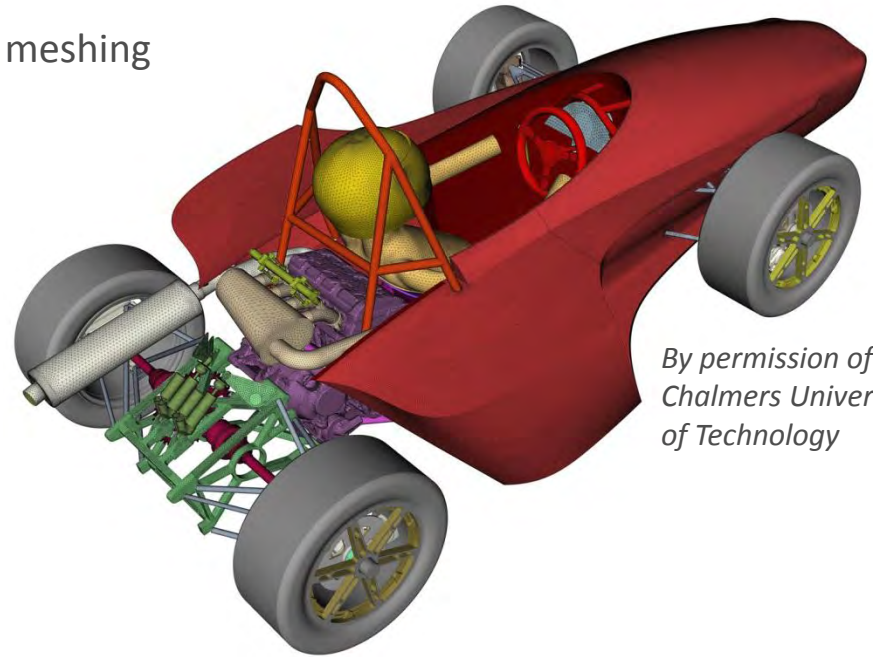
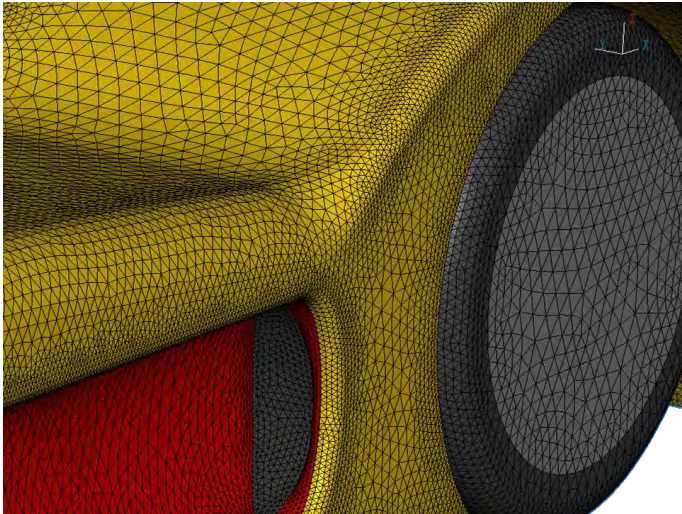
Automatic Macro Area merging for high quality surface mesh



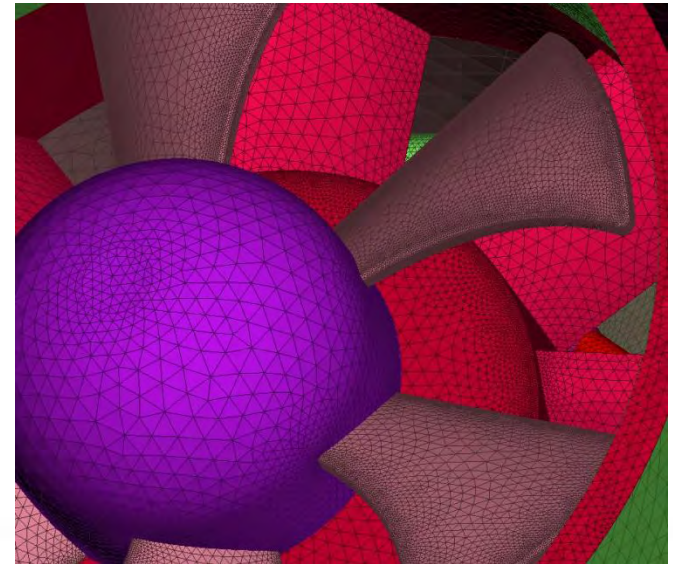
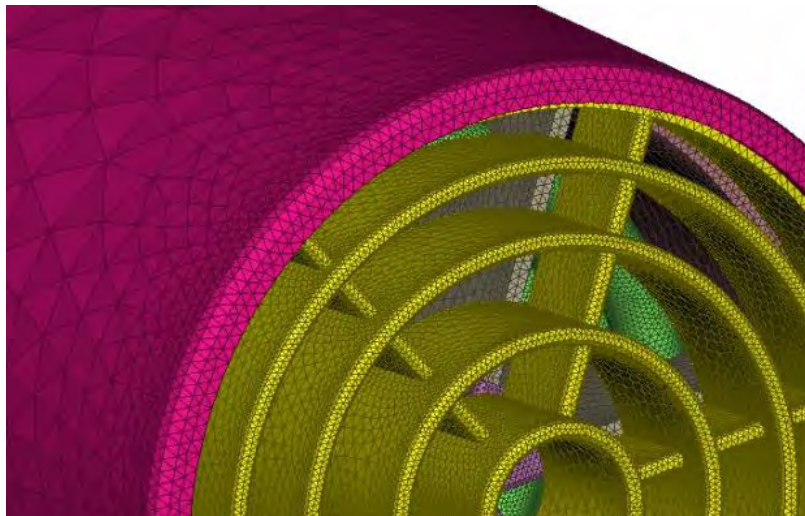


## Surface meshing for CFD

Fully automatic Curvature Dependent surface meshing with user controlled growth rate, min & max element size and mesh feature angle

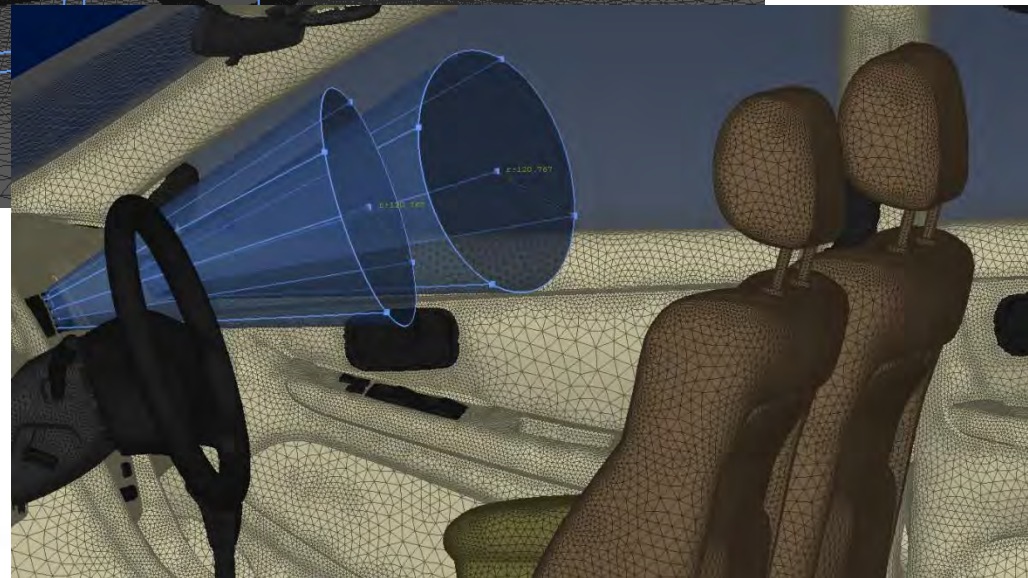
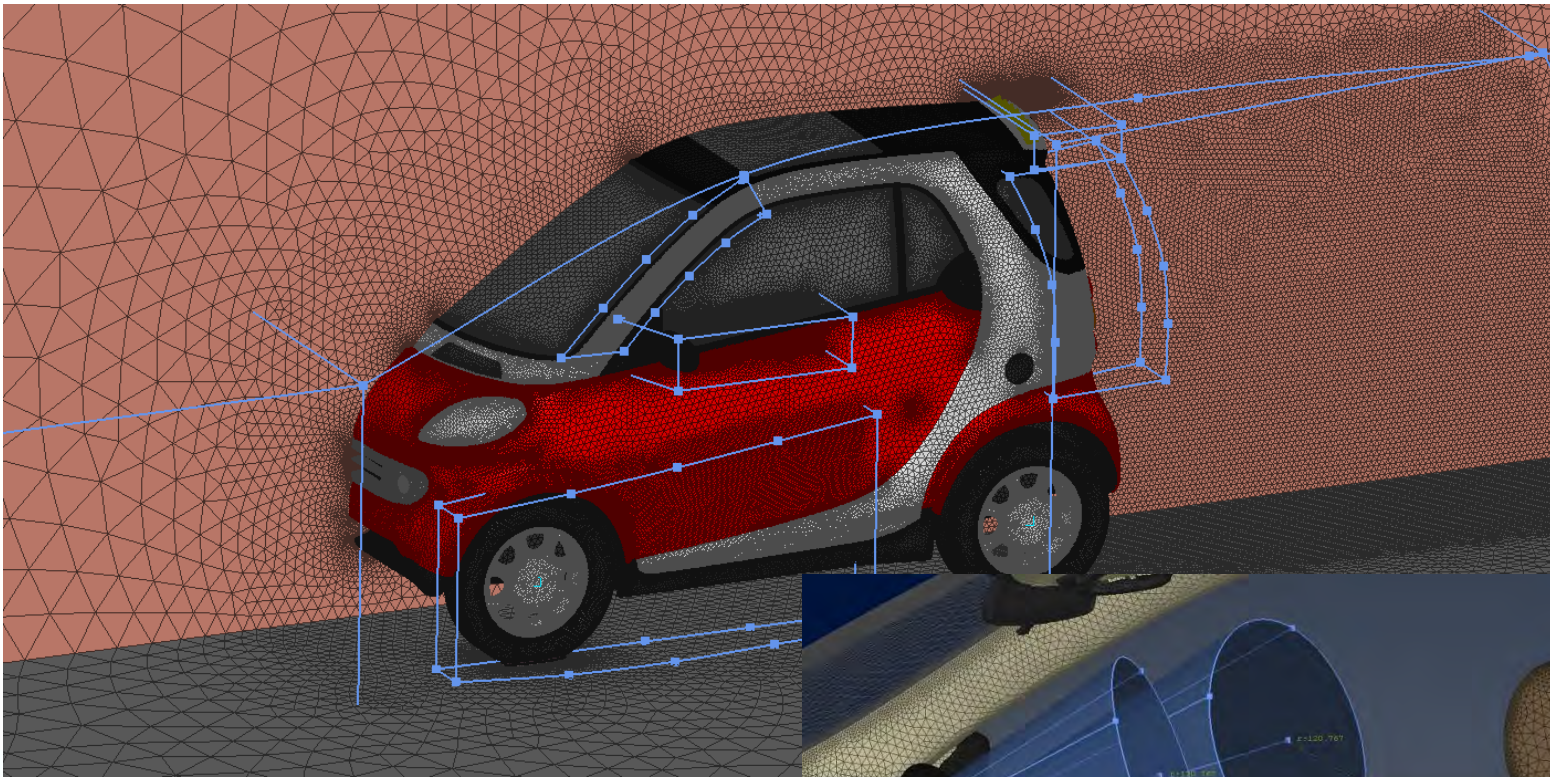


*By permission of  
Chalmers University  
of Technology*

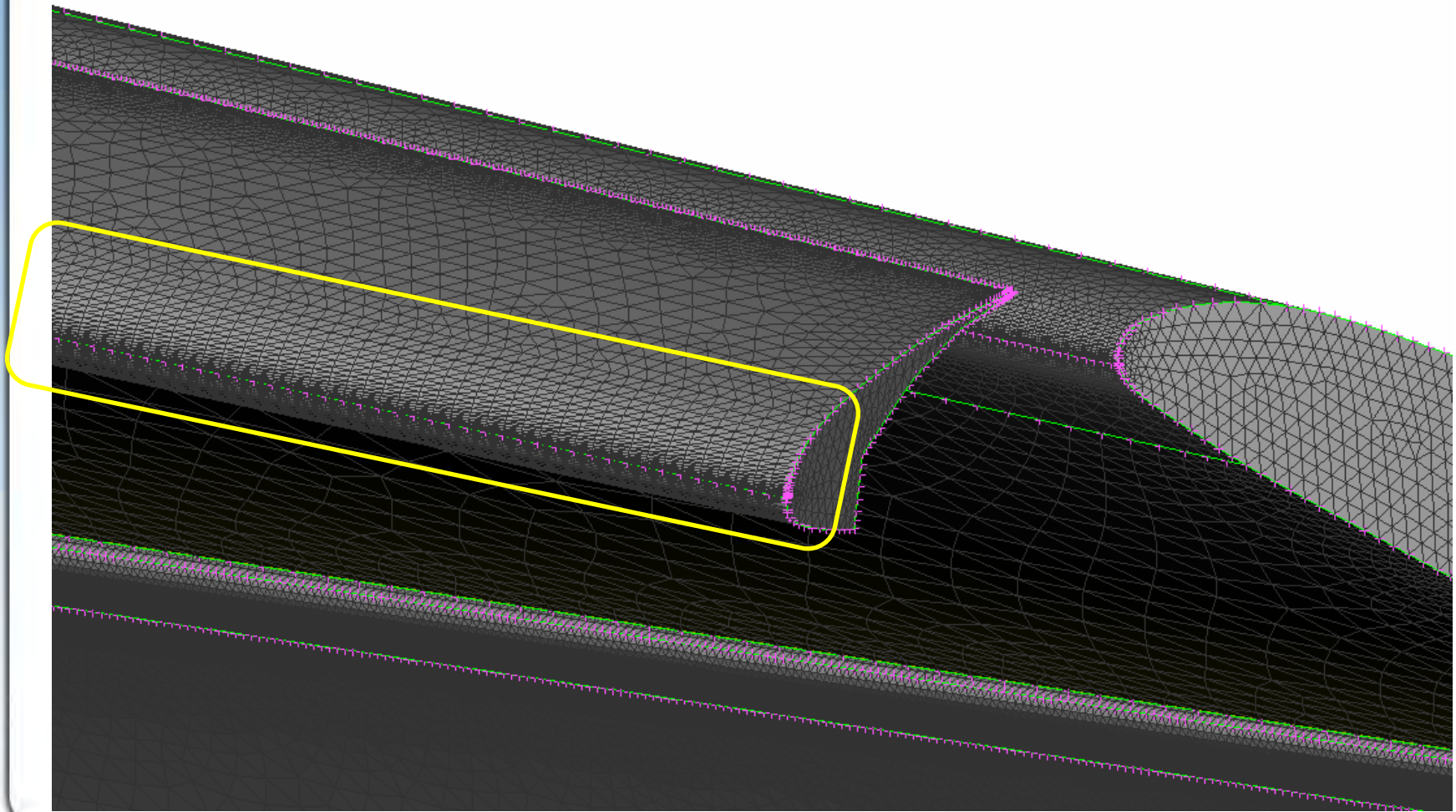


## Surface meshing: Size Boxes

Size Boxes of arbitrary shape for local surface mesh control

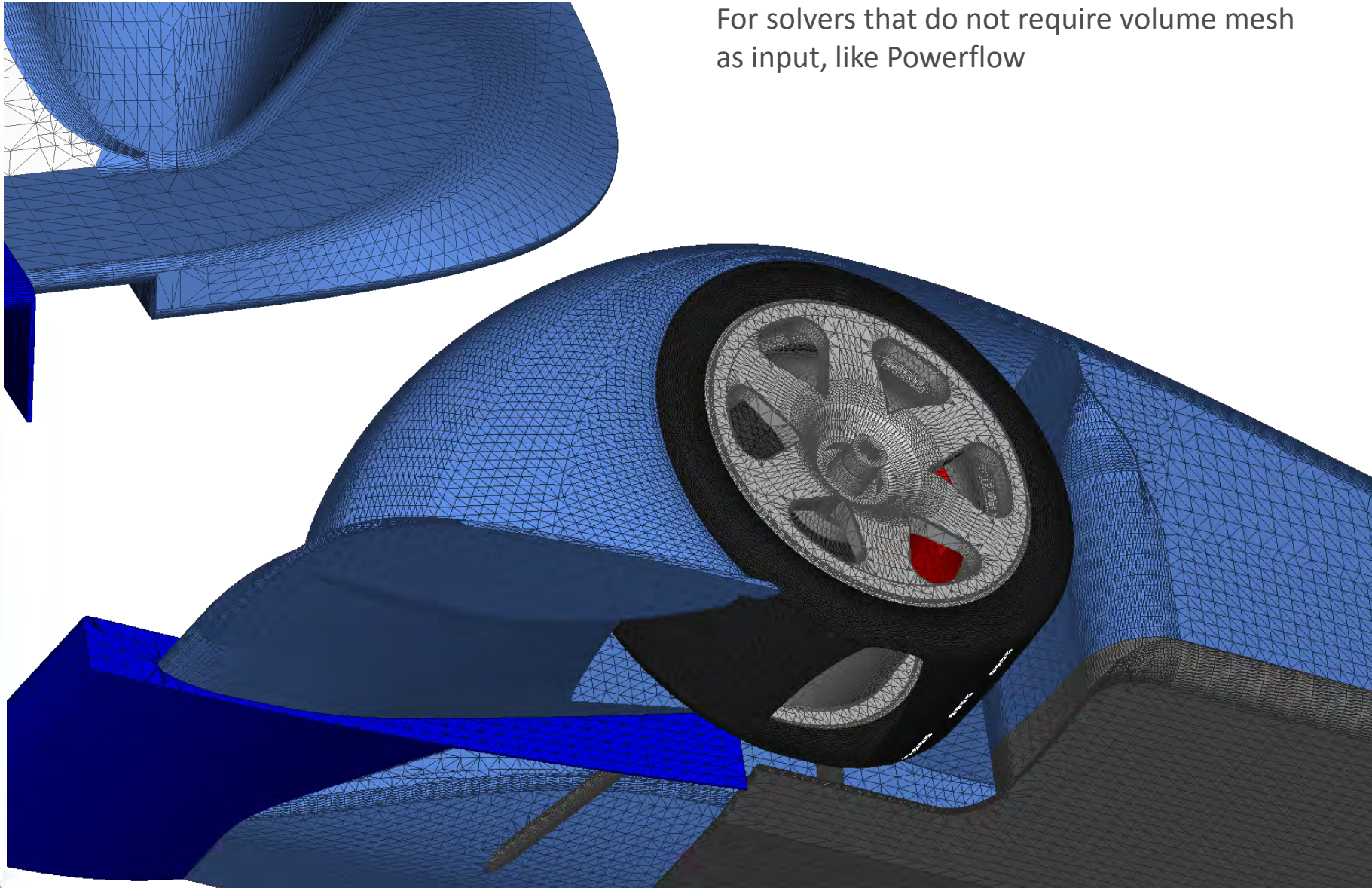


## Combined CFD and anisotropic meshing for aerospace applications



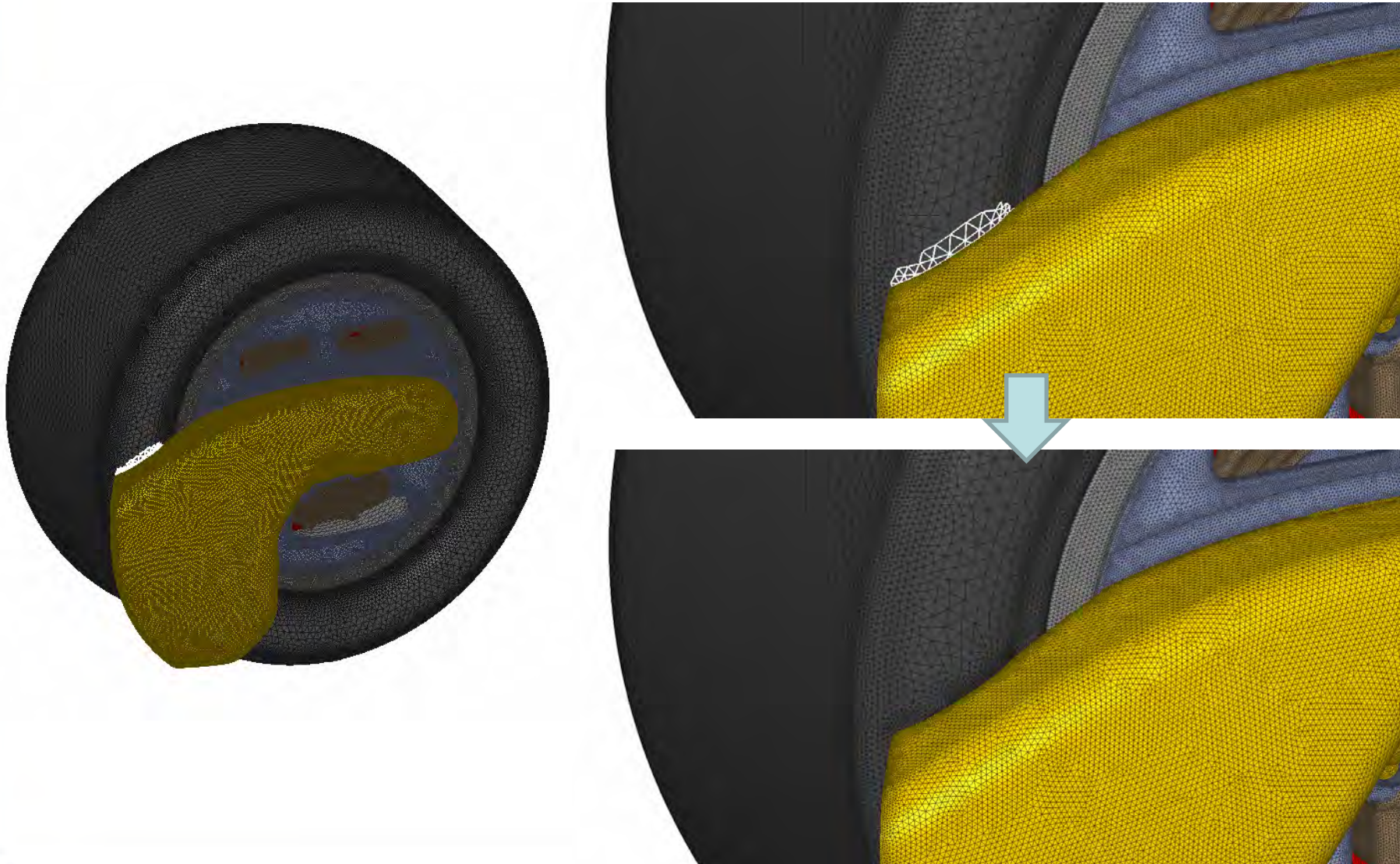
## Surface meshing: STL algorithm

For solvers that do not require volume mesh as input, like Powerflow



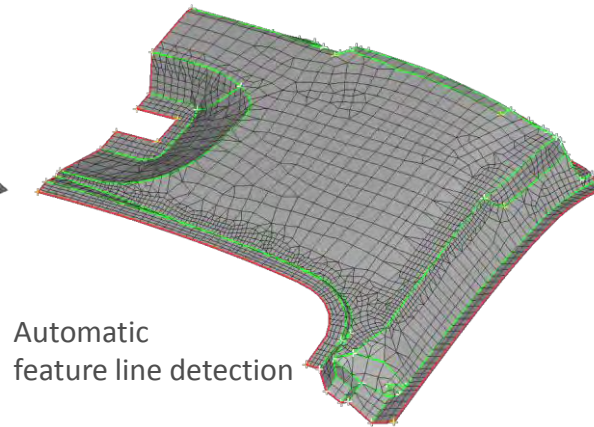
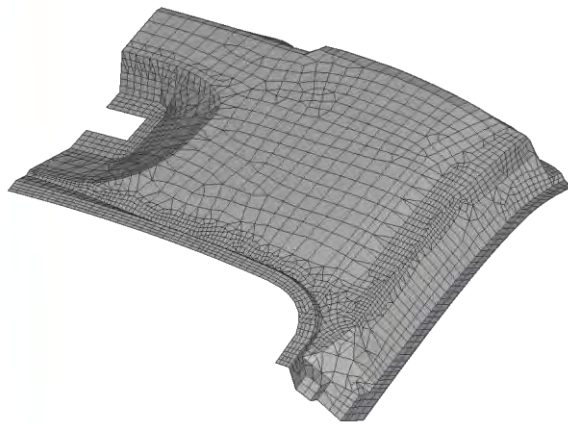
## Surface meshing – proximity detection

Proximity detection in shell mesh and auto-refinement

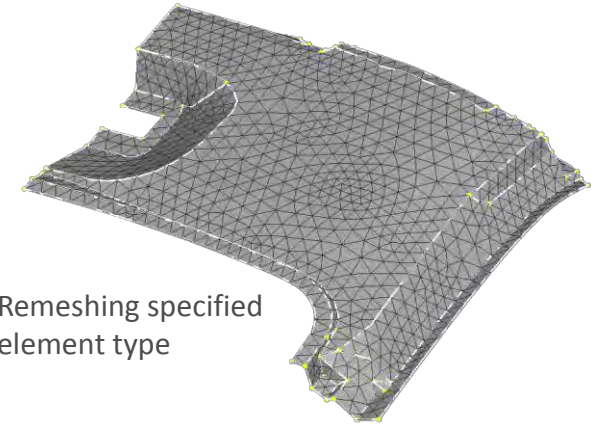


## Surface meshing - Reconstruction

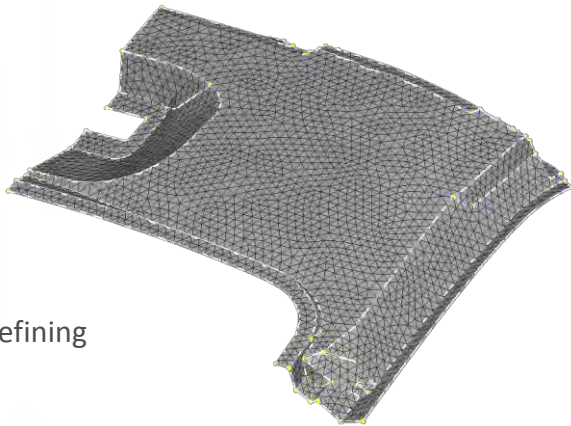
Reconstruction of existing FE-model mesh for element type modification, quality improvement, refinement, or coarsening



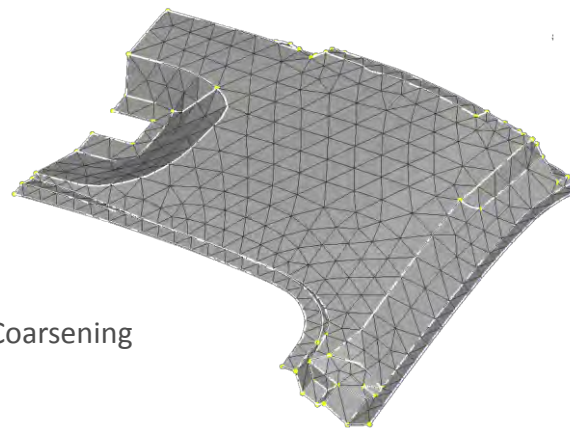
Automatic  
feature line detection



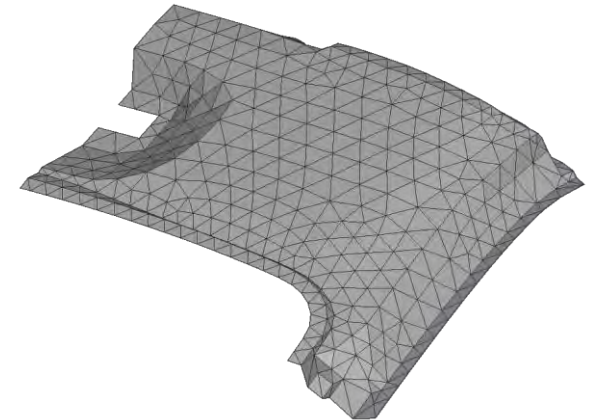
Remeshing specified  
element type



Refining

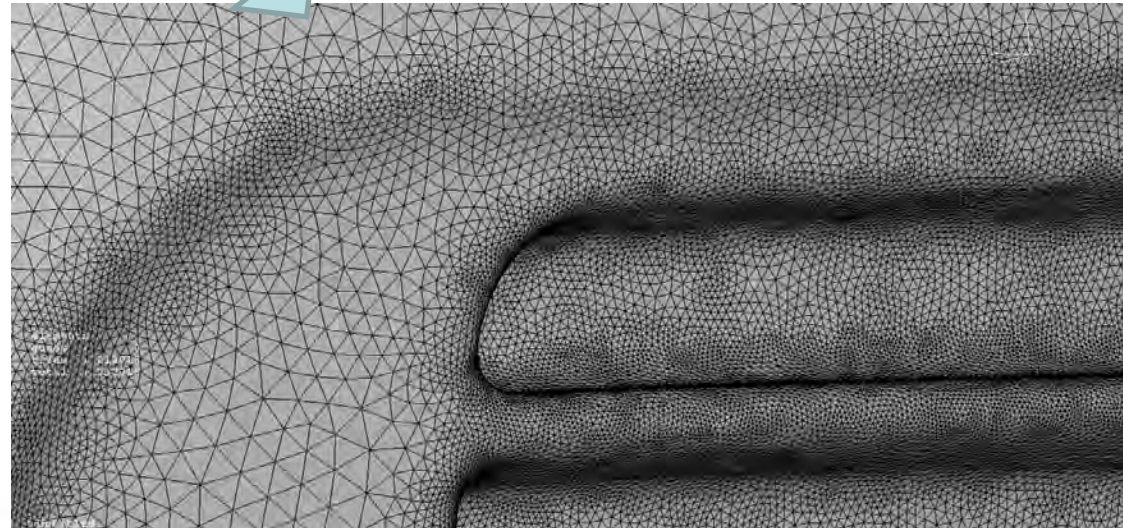
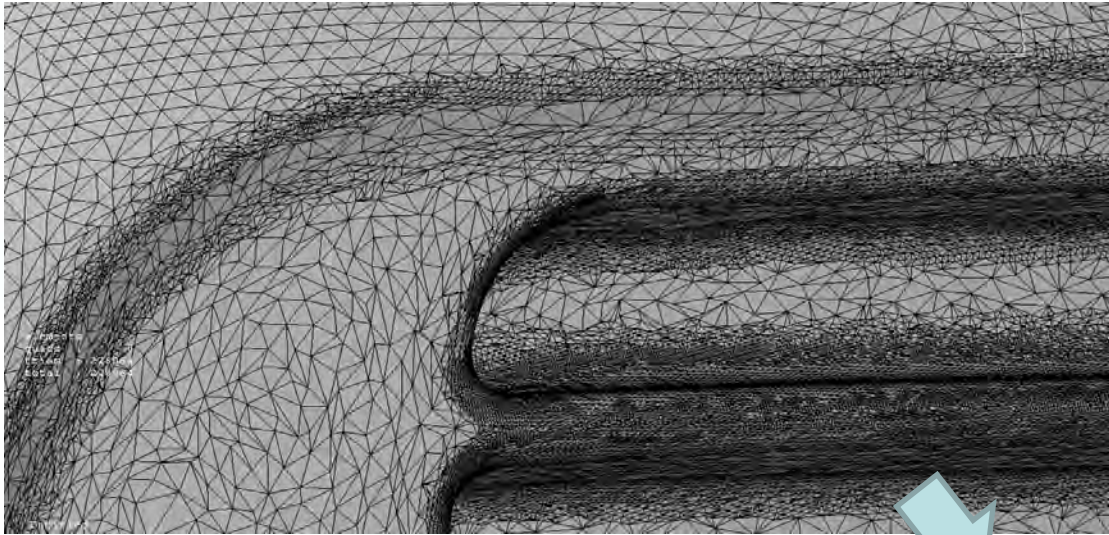


Coarsening



## Surface meshing - Reconstruction

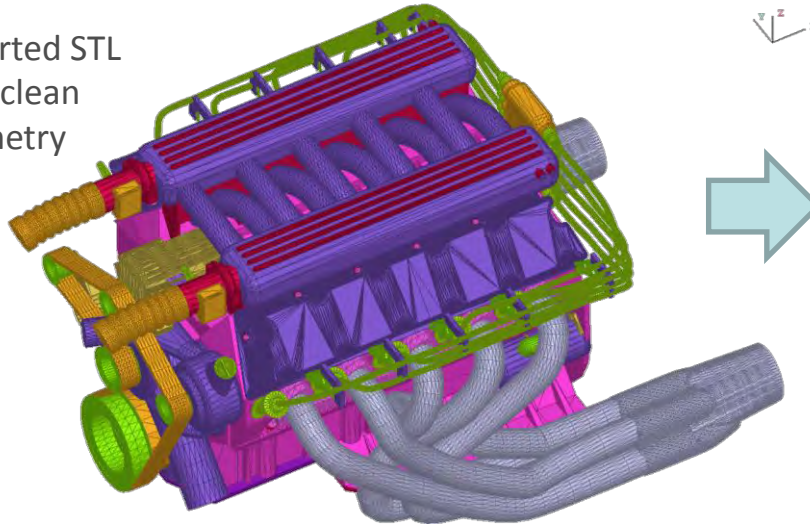
Reconstruction of bad quality STL mesh respecting local size and curvature



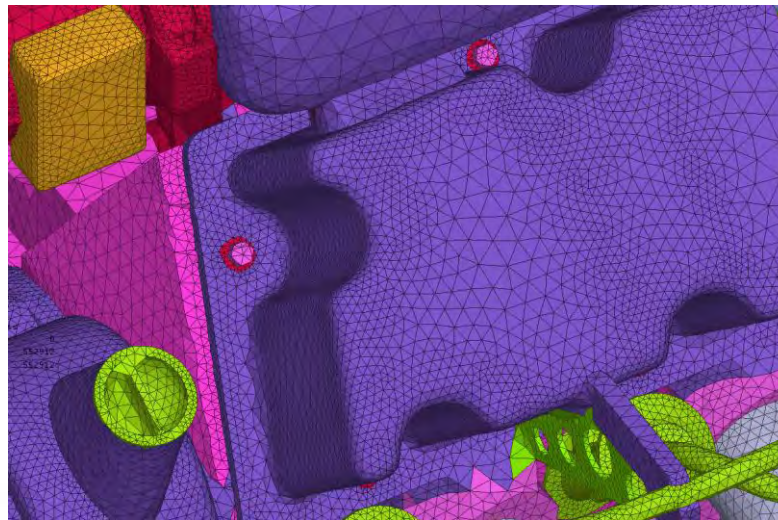
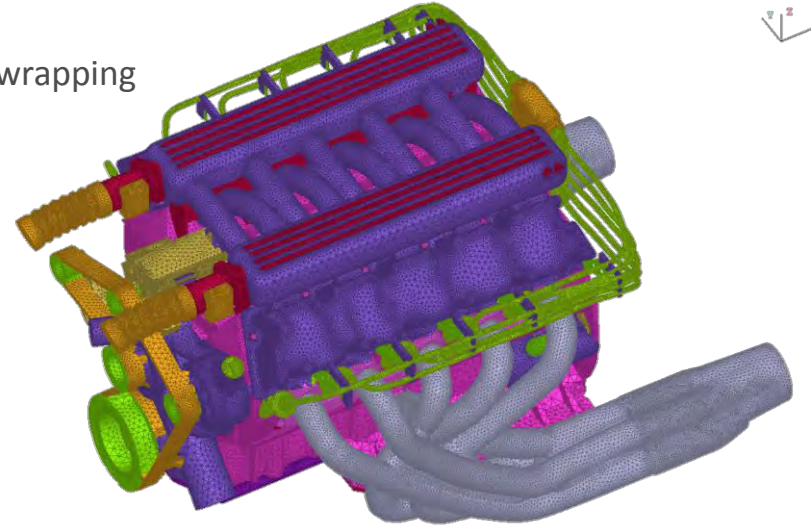
## Surface Wrapping

Variable length Wrapping, capturing local curvature and model feature lines

Imported STL  
or unclean  
geometry



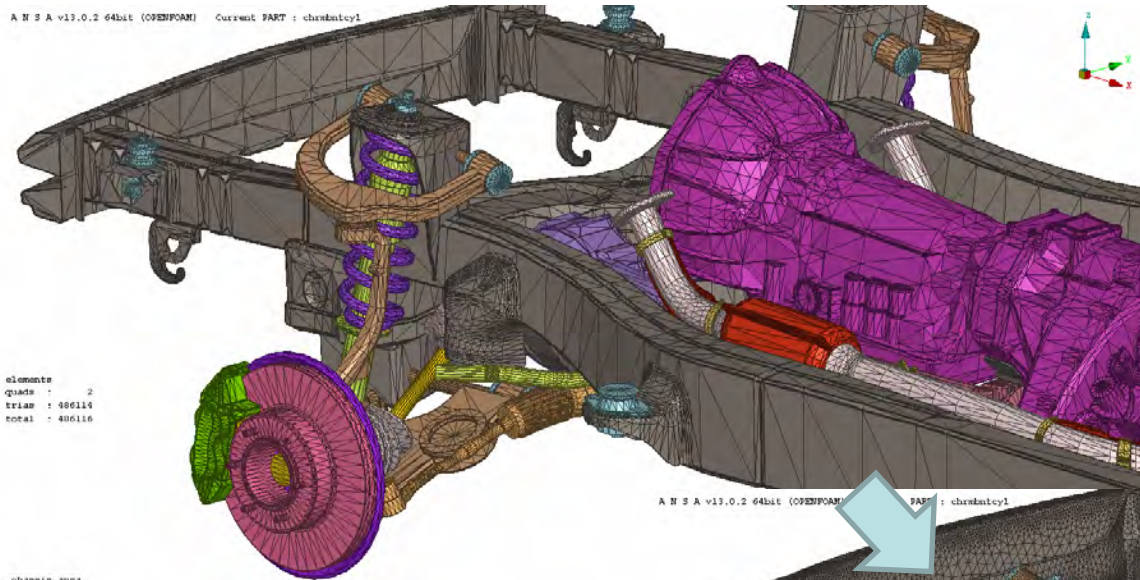
wrapping



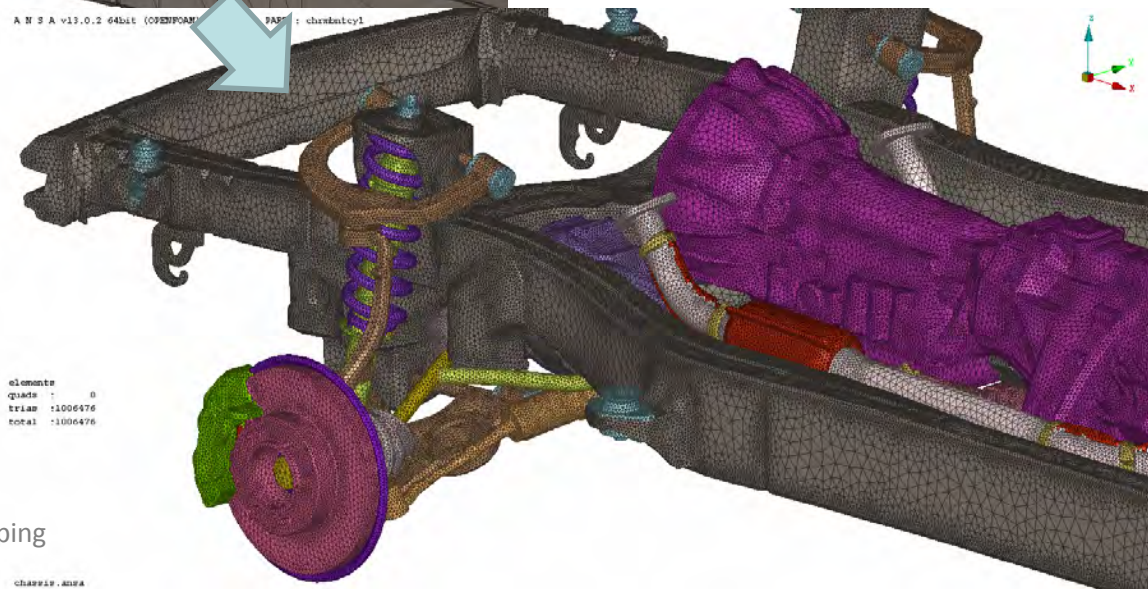


# Surface Wrapping

Variable length Wrapping, capturing local curvature, model feature lines with proximity refinement and contact prevention



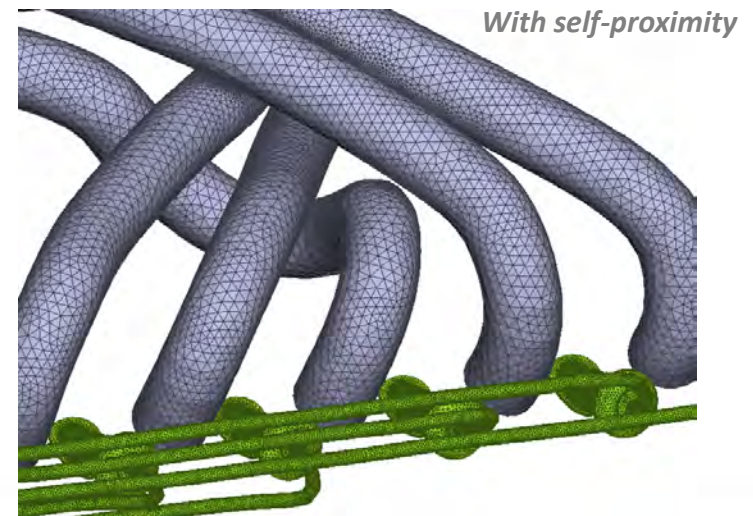
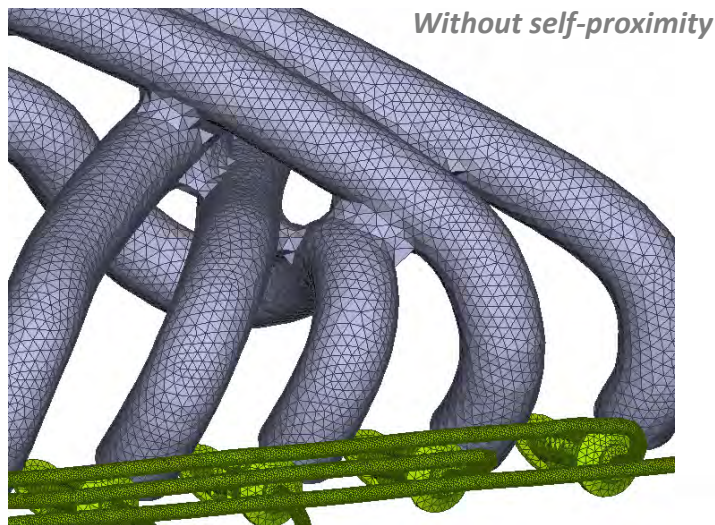
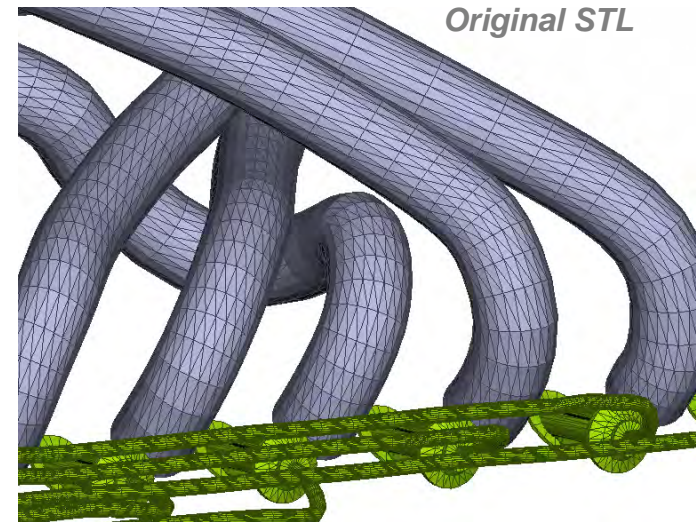
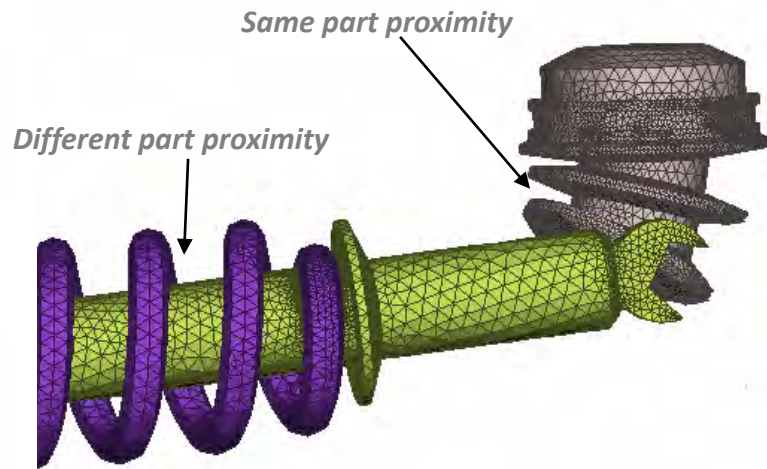
Input STL data  
Treatment (hole and gap closure)



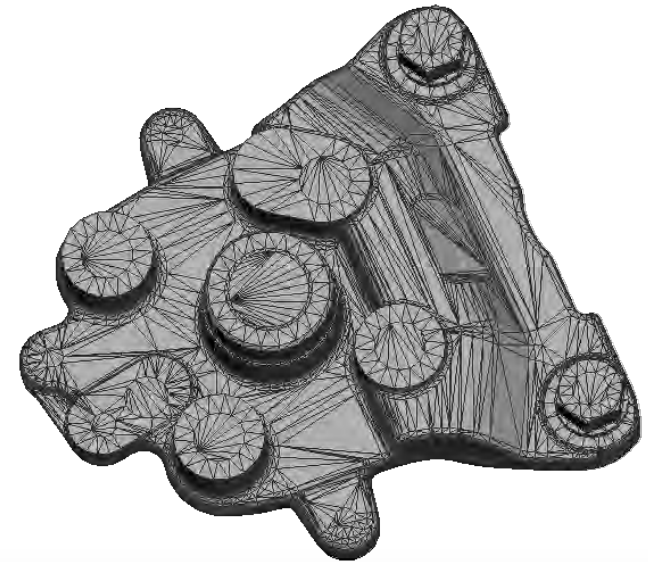
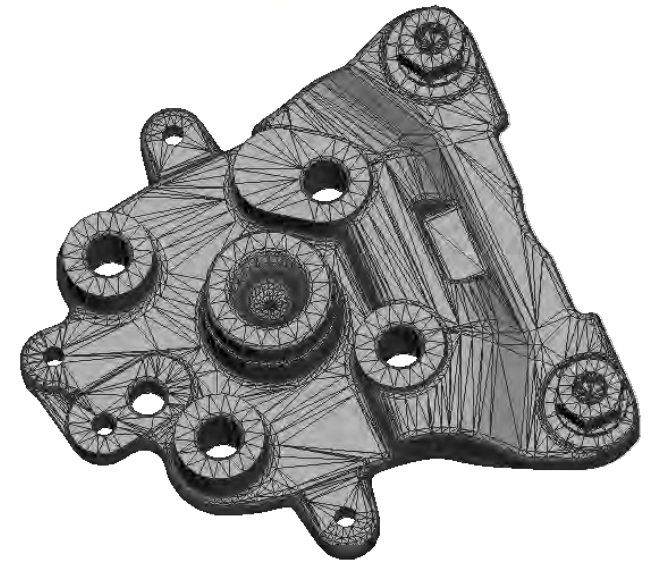
Surface Wrapping

## Surface Wrapping: proximity refinement options

Ability to specify proximity refinement settings to avoid fused areas between different or same parts

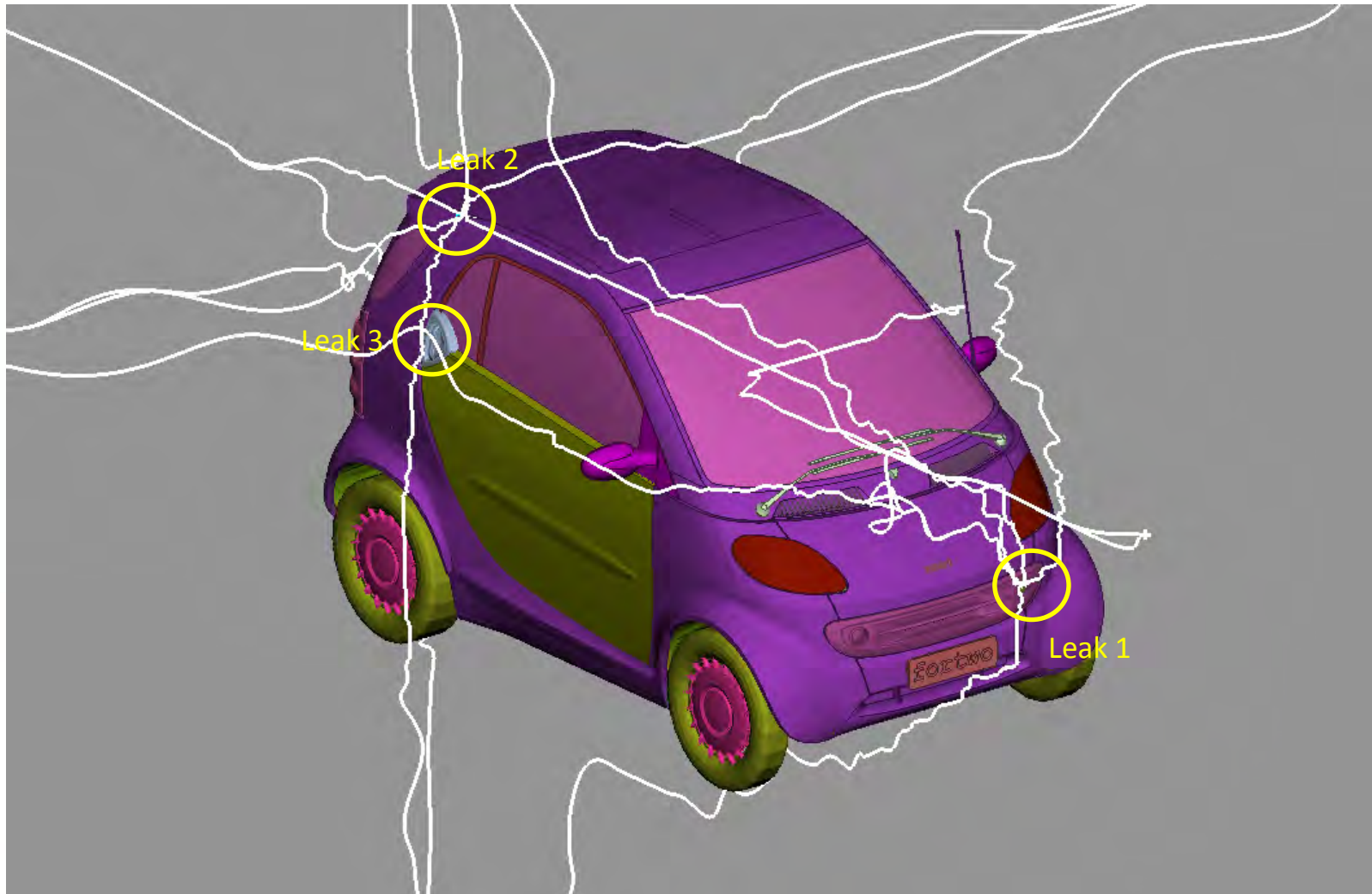


## Automatic detection and removal of gaps and features

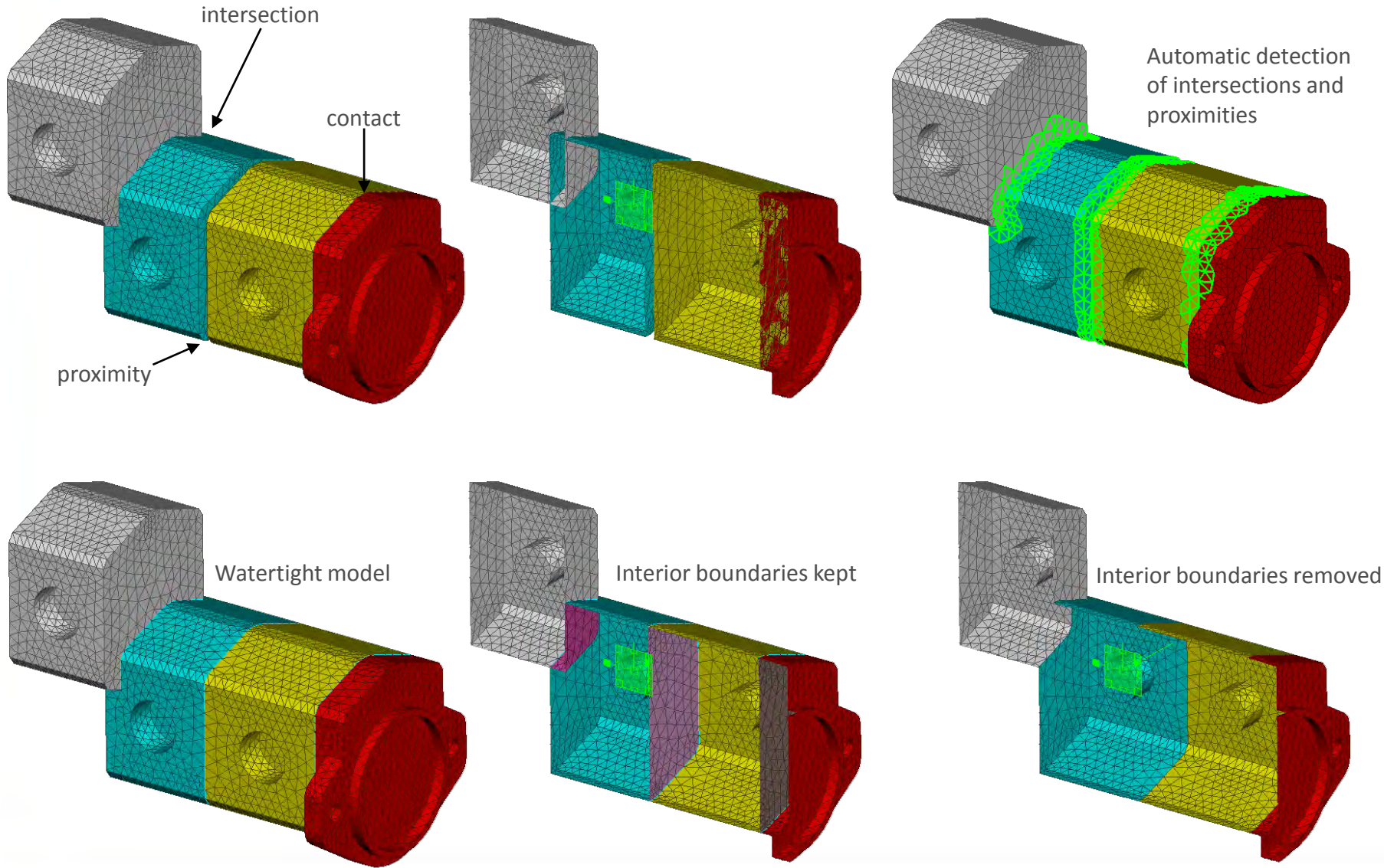


## Surface Wrapping: leak detection tools

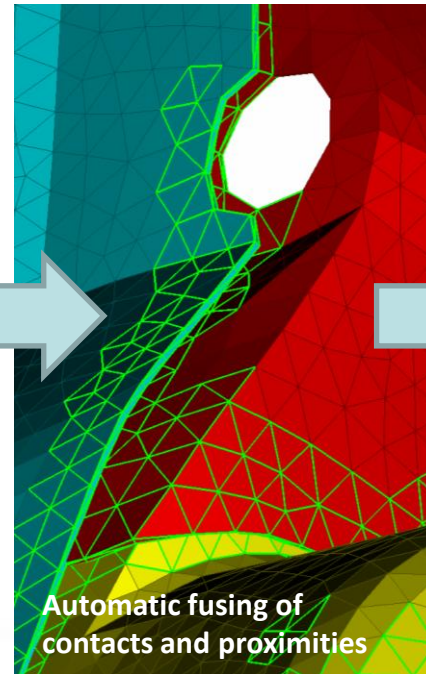
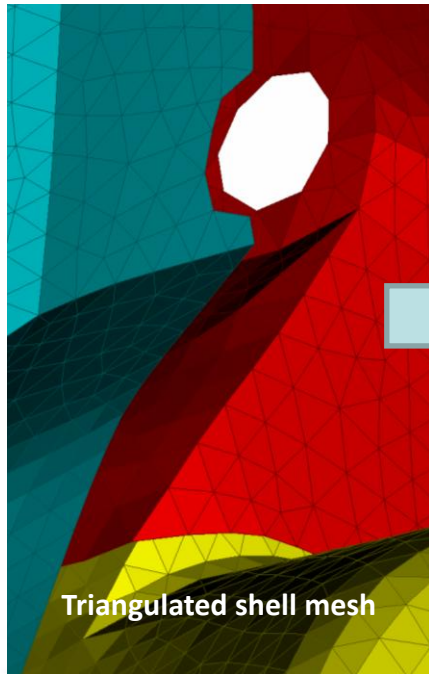
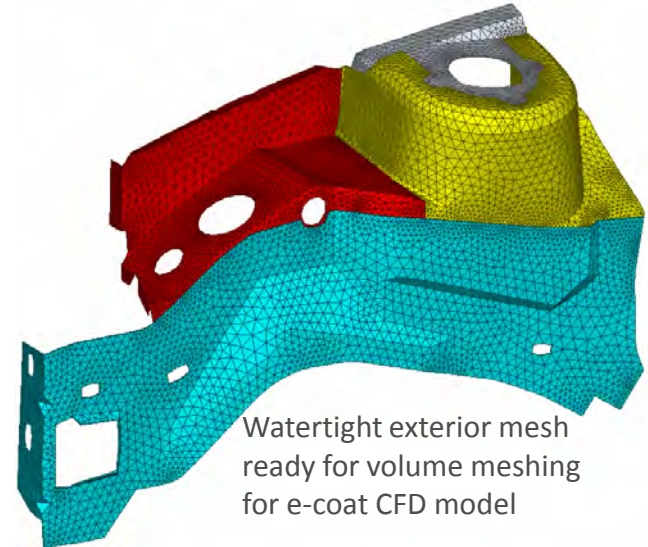
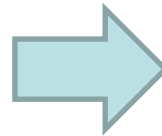
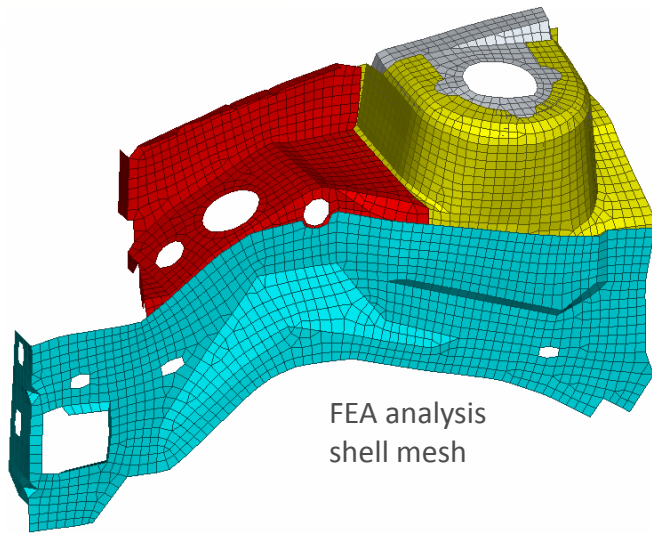
Identification of multiple leak paths for multiple user specified source points



# Watertight model creation for intersections, contacts and proximities



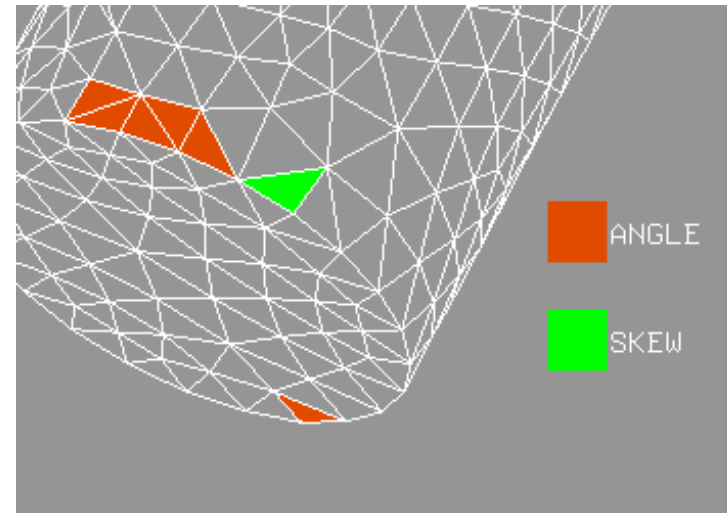
# Efficient creation of models for e-coat simulations starting from FEA meshes



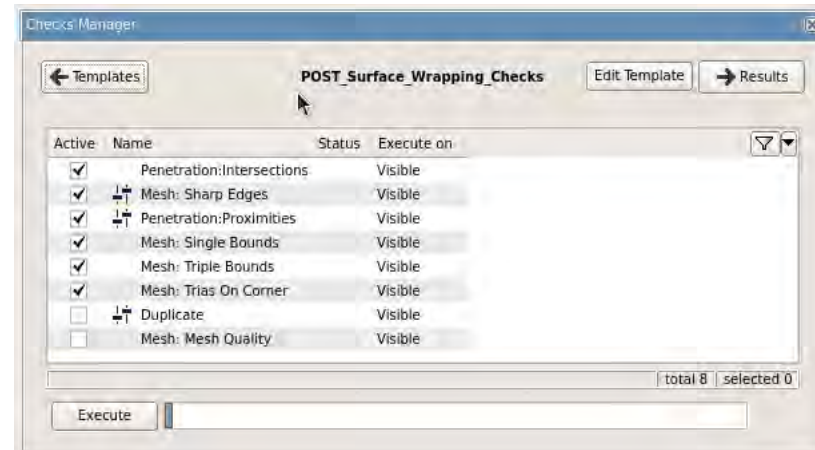
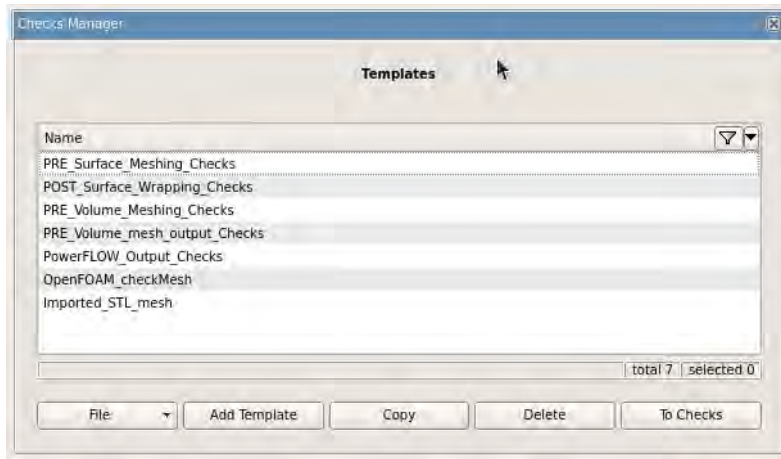
## Surface meshing: Checks

Quality check according to multiple criteria (skewness, angle squish, length, aspect, warp, etc.) and solvers (Fluent, Star, OpenFOAM etc.)

Clear identification of poor-quality elements



Template controlled mesh integrity checks (locate unmeshed areas, free edges, proximities and penetration areas, duplicate elements etc.)



Comprehensive mesh information and quality statistics

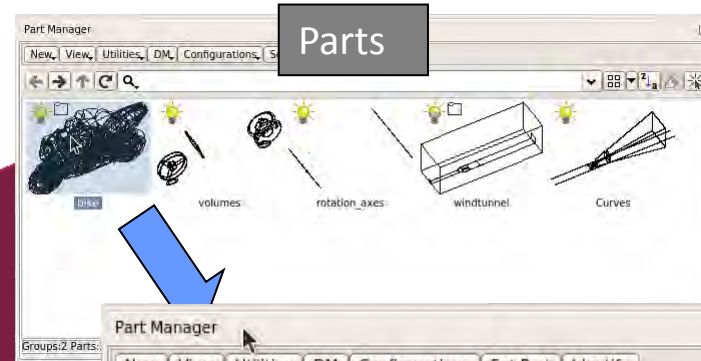
# CFD model management

Double parallel model management tools: Properties (corresponding to CFD model zones) and Parts (assembly hierarchy extracted from CAD data)

**Properties**

Id	Name	TYPE	Num.Elem	USE_IN_MODEL
15	front_brake_caliper	wall	1309	✓
16	front_fairing	wall	3396	✓
17	front_fairing_zero	wall	16335	✓
18	front_forks	wall	7469	✓
19	front_mud_guard_zero	wall	2483	✓
20	fuel_tank	wall	5795	✓
21	headlights	wall	568	✓
22	interior_front_contact_pat...	internal	80	✓
23	interior_front_wheel_MRF	internal	5716	✓
24	interior_radiator_downstr...	internal	1071	✓
25	interior_radiator_upstream	internal	1071	✓
26	interior_rear_contact_patc...	internal	94	✓
27	interior_rear_wheel_MRF	internal	3758	✓
28	radiator_sides	wall	372	✓
69	radiator_sides_no_layers	wall	50	✓
29	rear_body	wall	9452	✓

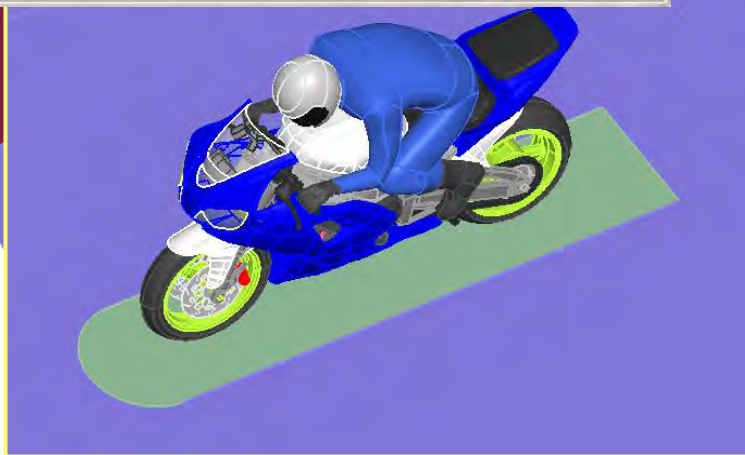
PROPERTY total 70 selected 0



**Part Manager**

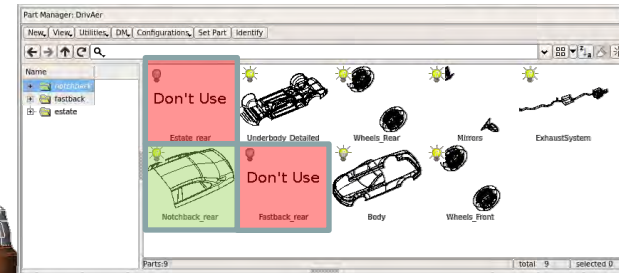
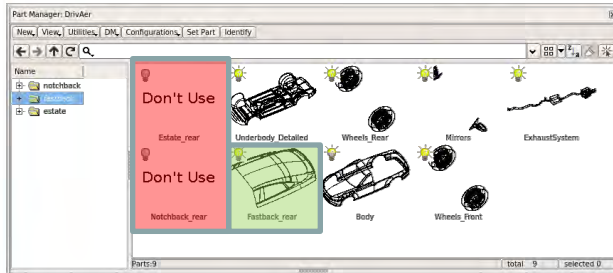
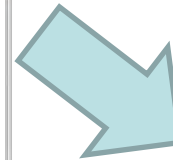
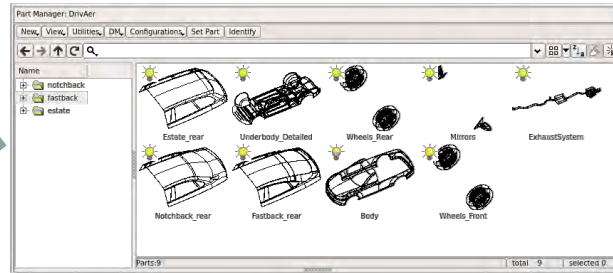
Name	Module Id	Version	Study Version	Re
bike			0	
biker			0	
rider-body	52		0	
rider-boots	50		0	
rider-gloves	51		0	
rider-helmet	48		0	
rider-visor	49		0	
interior			0	
motrobike			0	
Curves			0	
rotation_axes			0	
volumes			0	
windtunnel			0	
inlet	56		0	
outer ground	59		0	
outlet	58		0	
road	60		0	
road-near	61		0	

Groups:5 Parts:57 total 62 selected 0





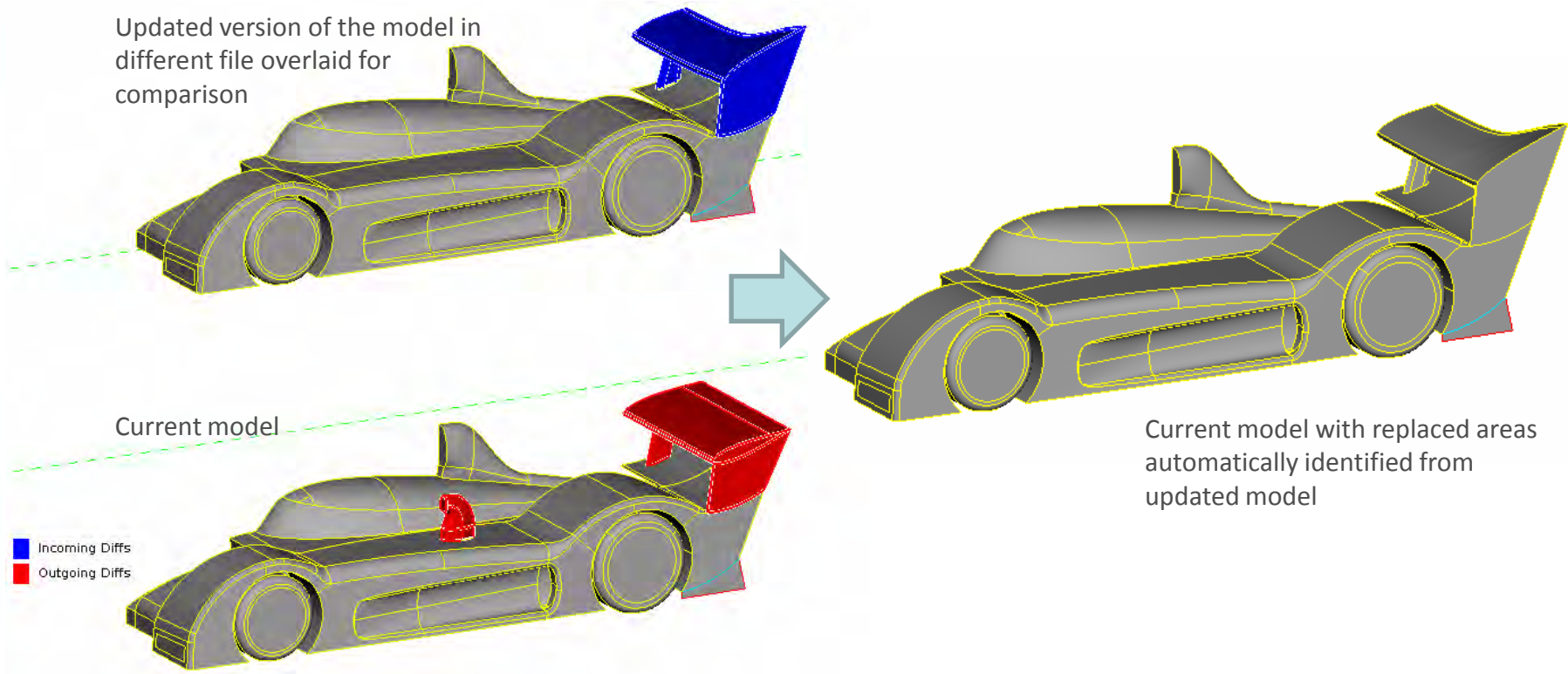
# Configurations Management functionality handling three variants in one file



*DrivAer model courtesy of  
Technical University of Munich*

## CFD model management

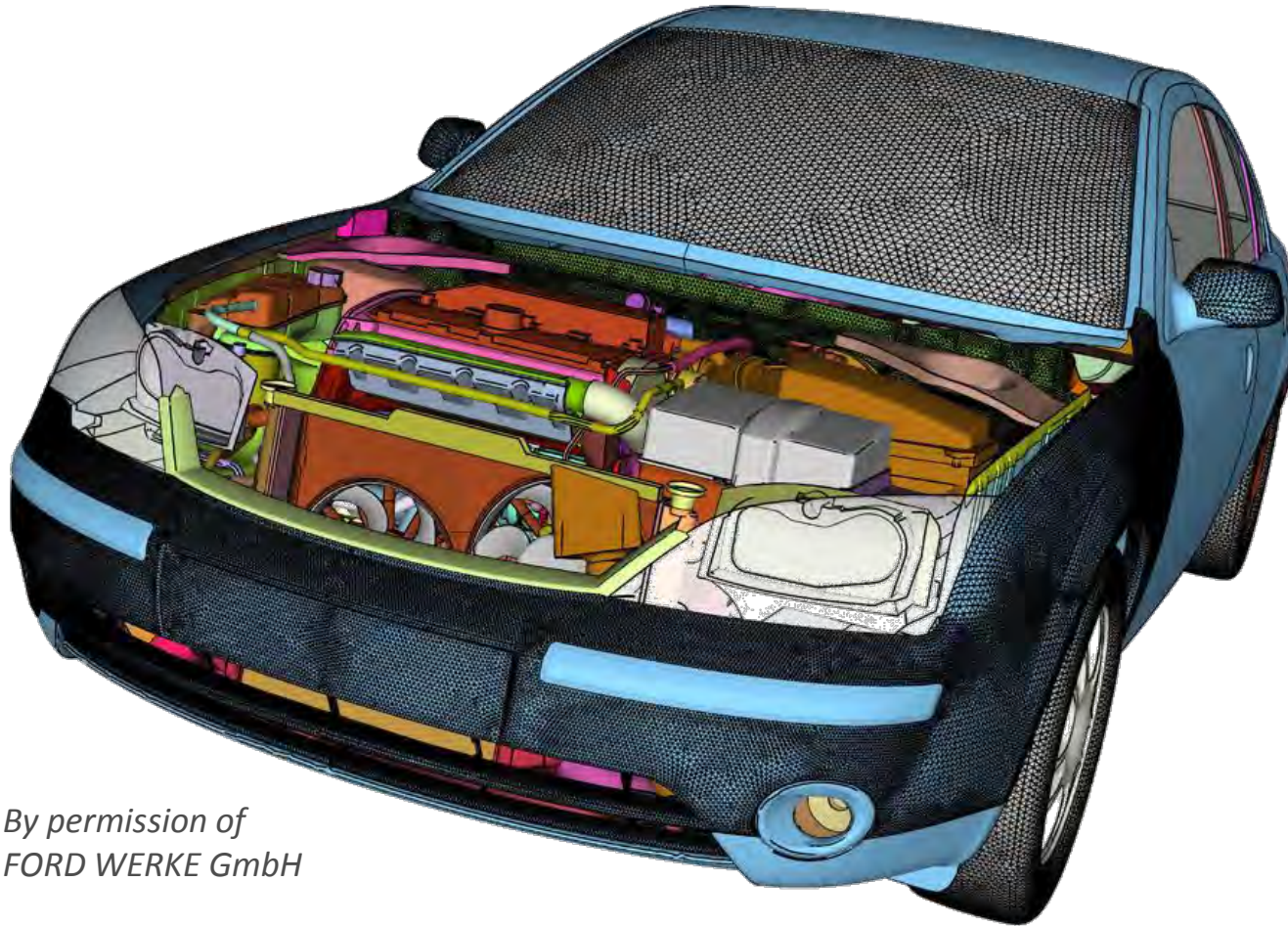
Functionality to compare current model with updates in other ANSA files, identify differences in geometry, or other attributes, and automatically update the current model with the necessary differences only



# Volume Meshing

## Volume meshing

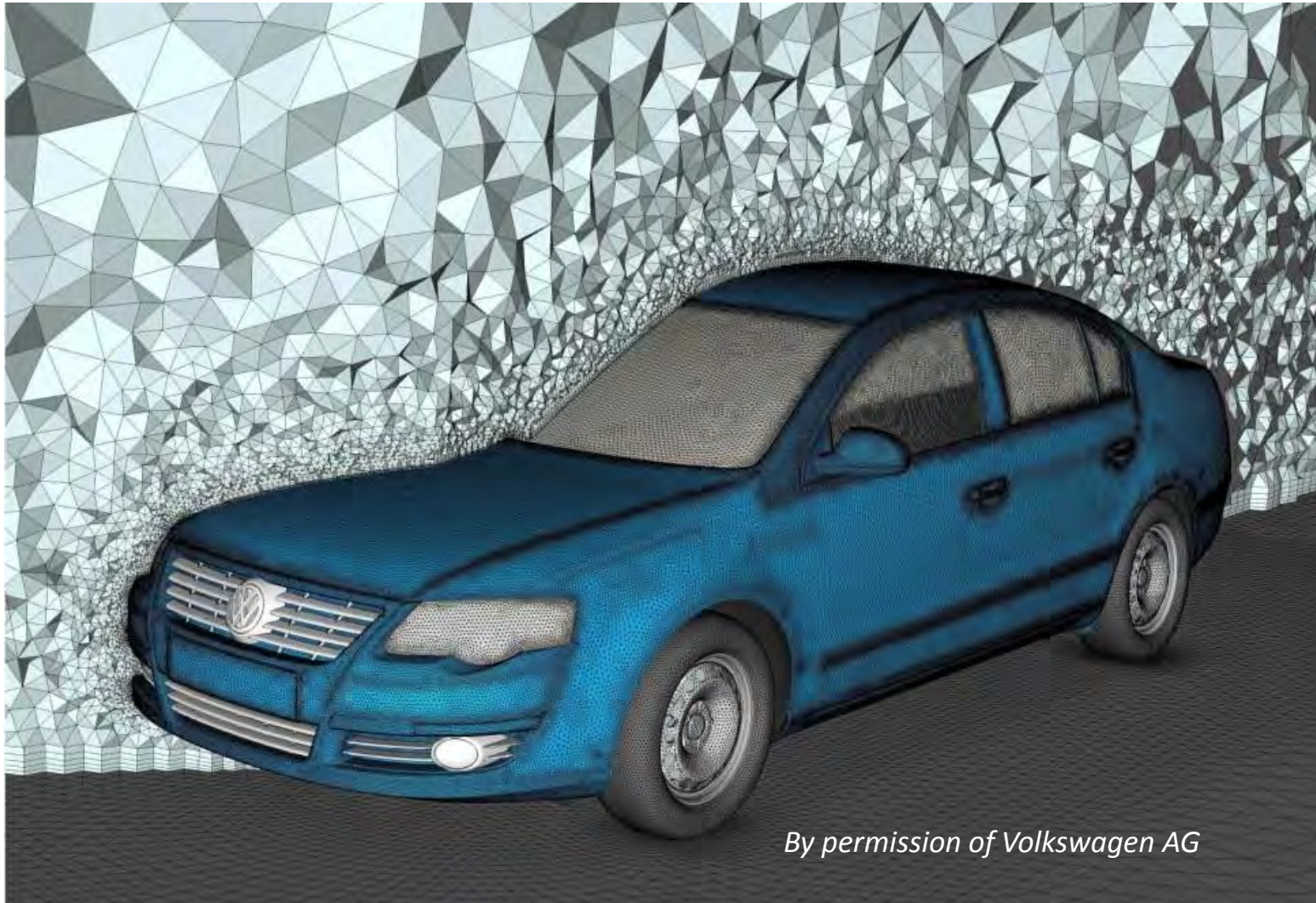
Fully automatic volume and sub volume detection applicable to the most complex problems



*By permission of  
FORD WERKE GmbH*

## Volume meshing

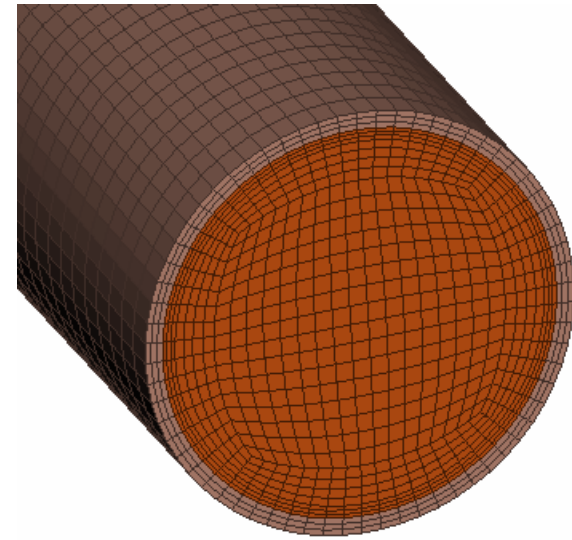
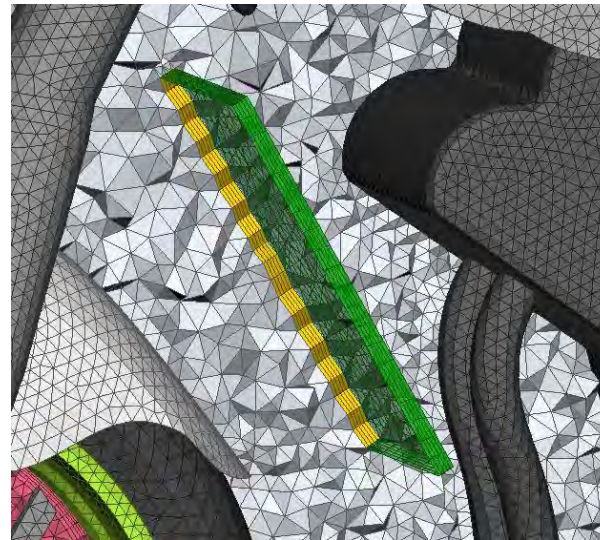
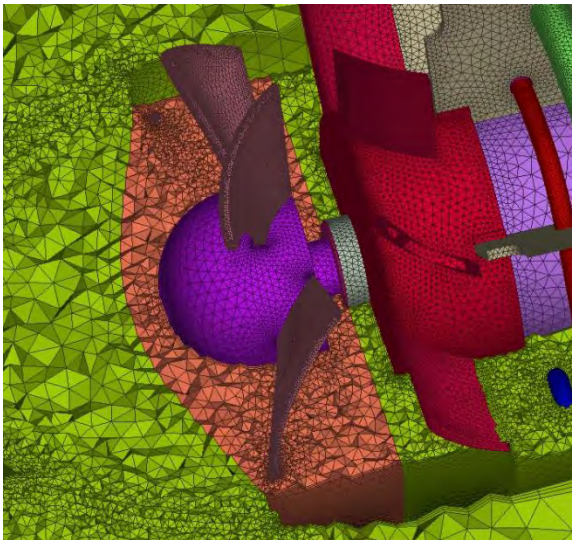
Fast and robust volume meshing for all types of elements  
(tetra, pyramid, prism, hexa and polyhedron)



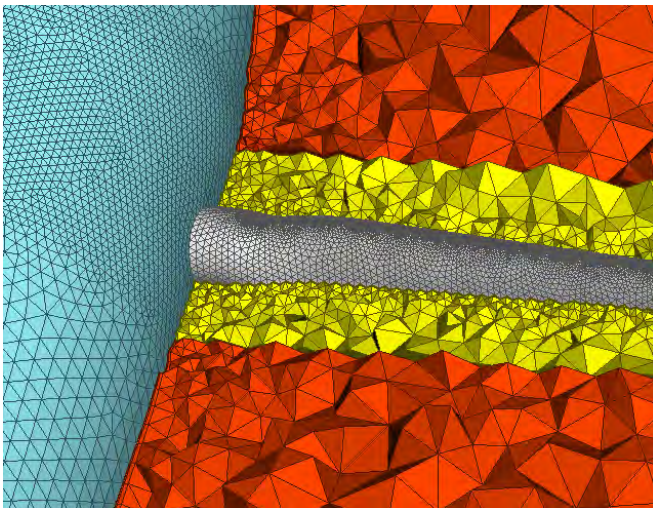
*By permission of Volkswagen AG*

## Volume meshing: Definition of multiple fluid and solid zones

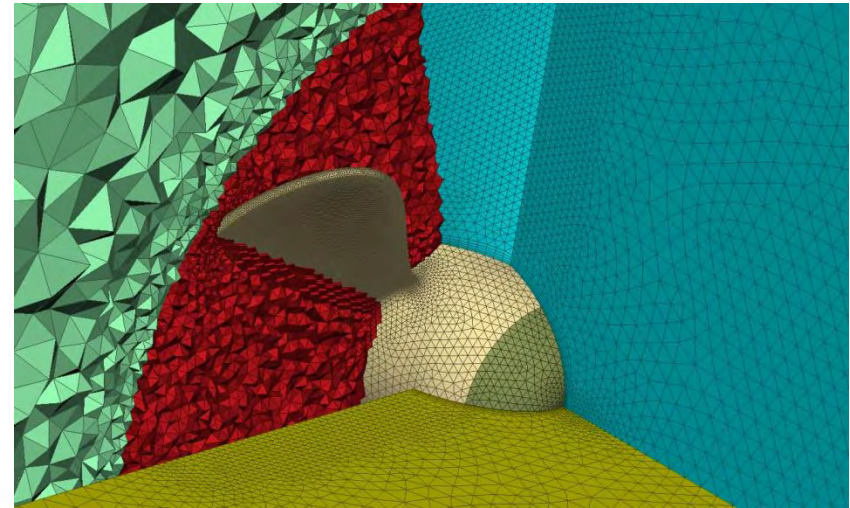
Conformal mesh for MRF and porous zones and for conjugate heat transfer analyses



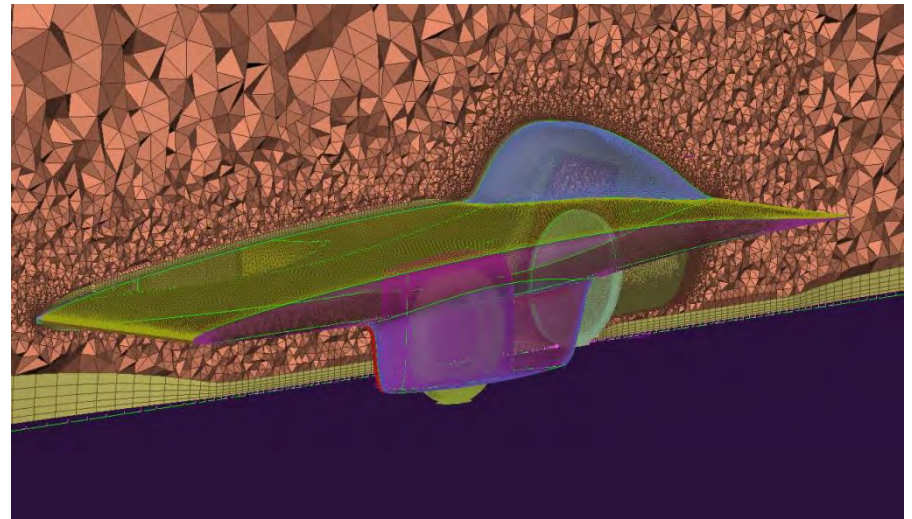
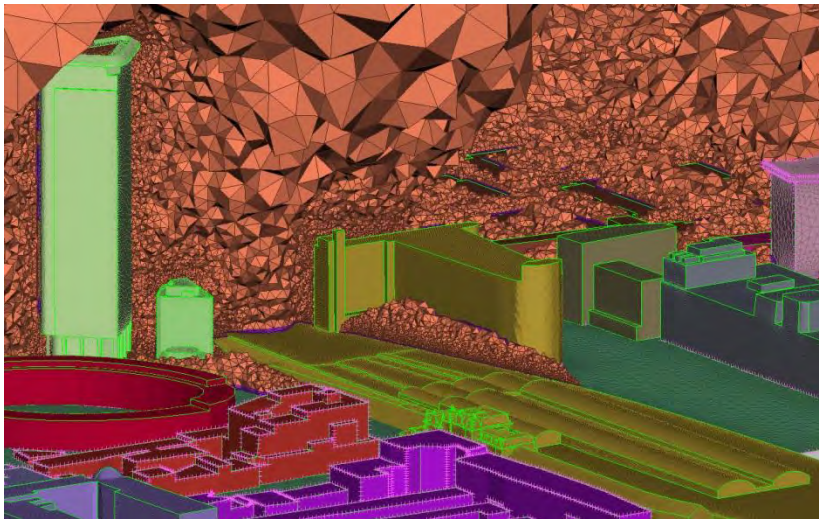
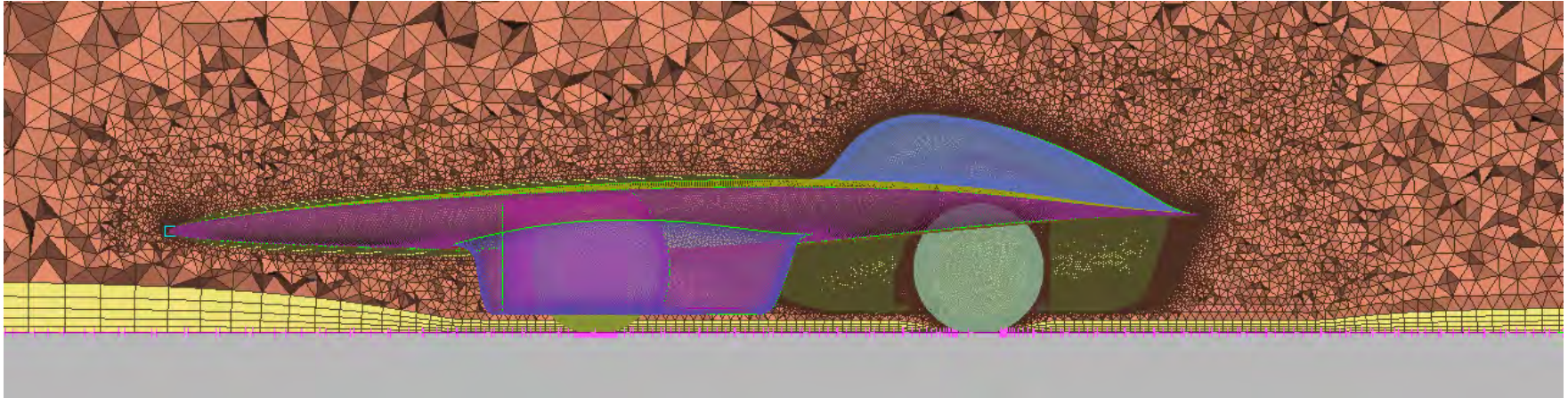
Non-conformal mesh for moving mesh analysis



Periodic BCs matching node meshes

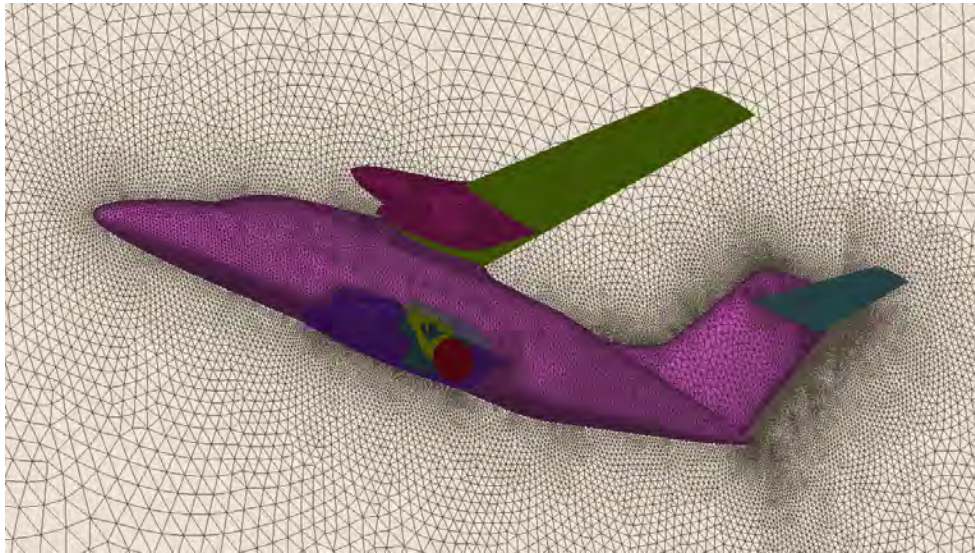
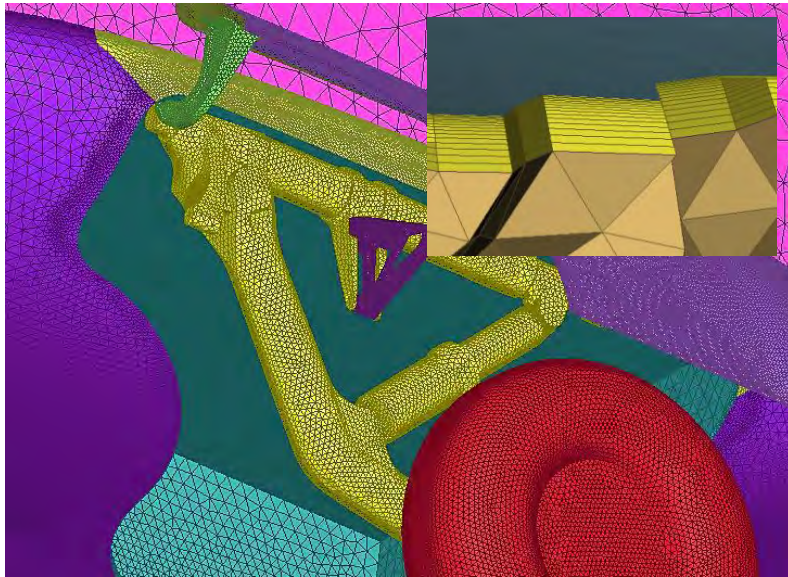


# Volume meshing: Solar car and urban environment CFD simulations



*Courtesy of Actiflow BV*

## Volume meshing: EV-55 outback CFD study

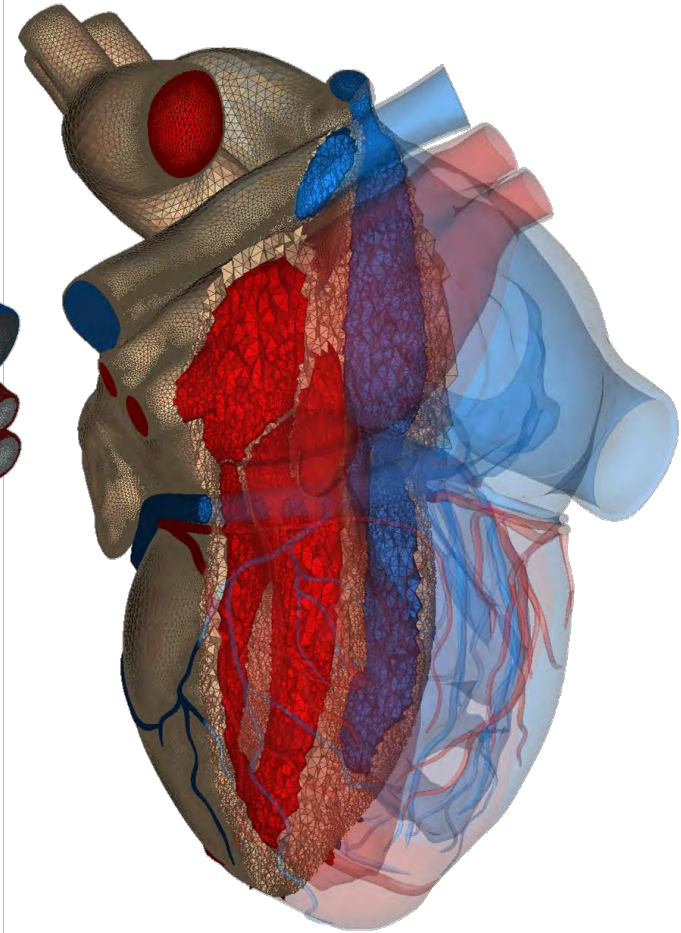
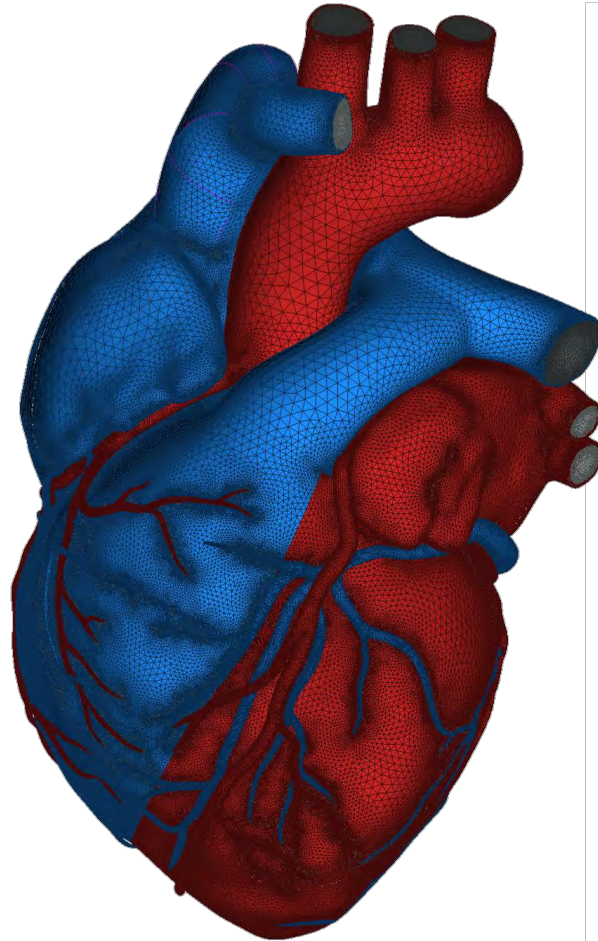
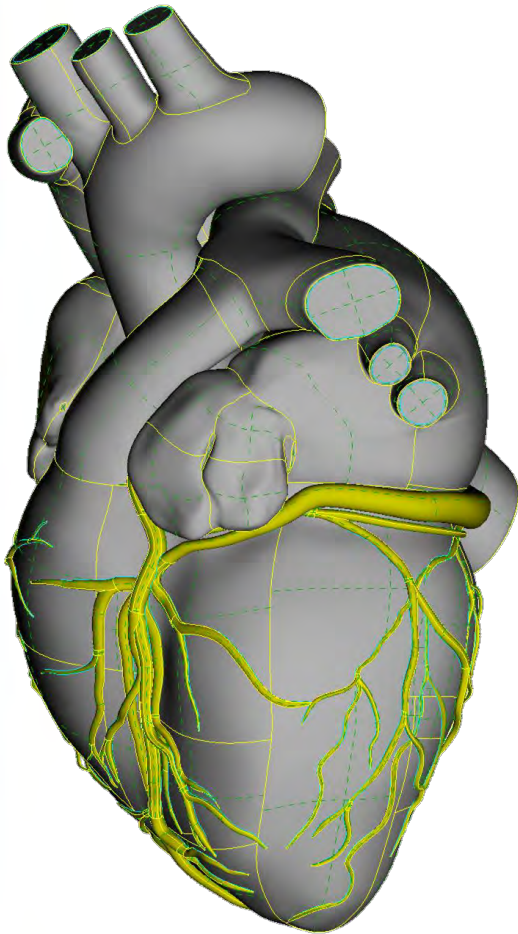


*Courtesy of Evektor*



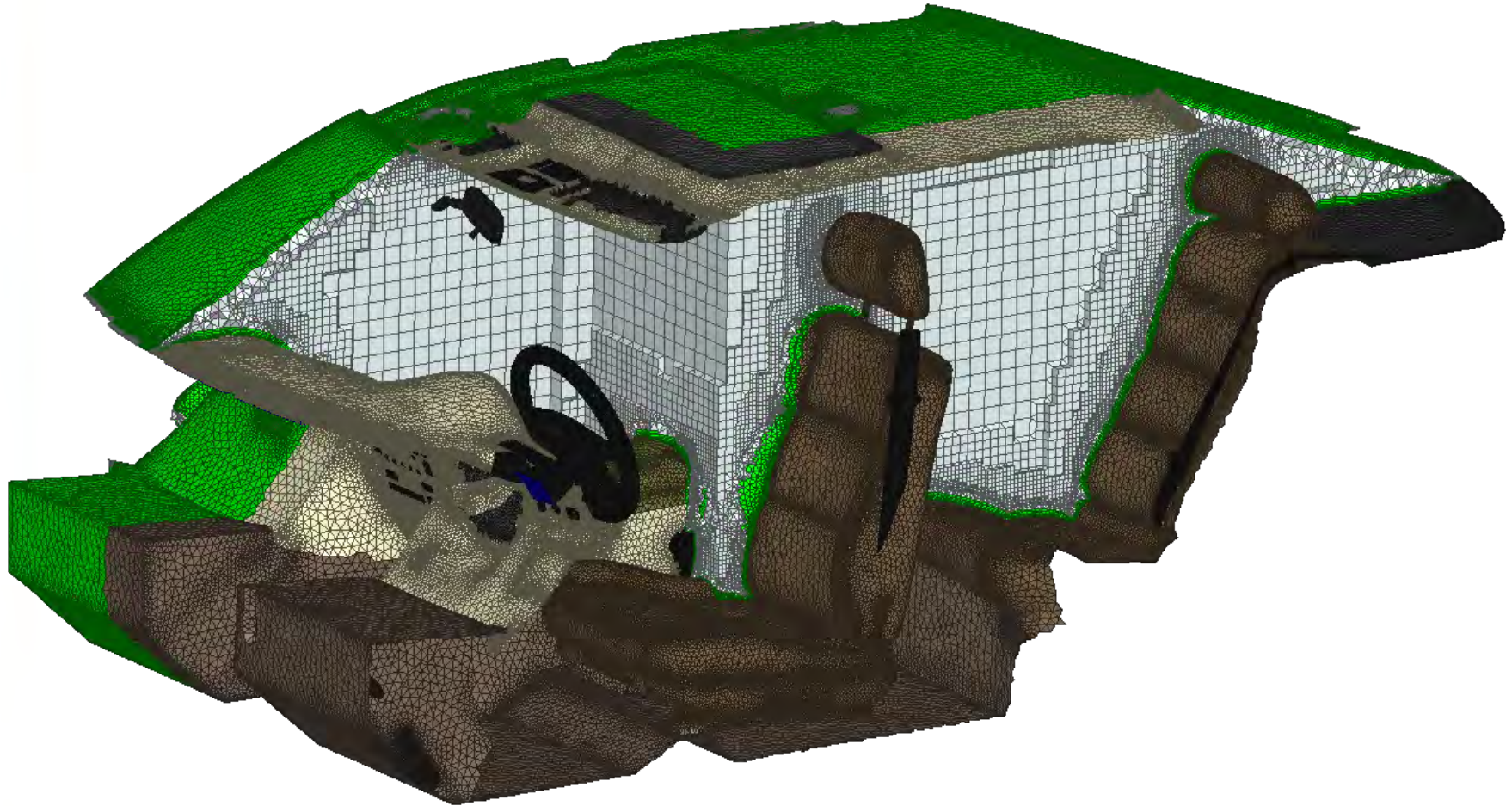
## Complete volume mesh of a human heart

2 million trias, 23 million prisms and tetras



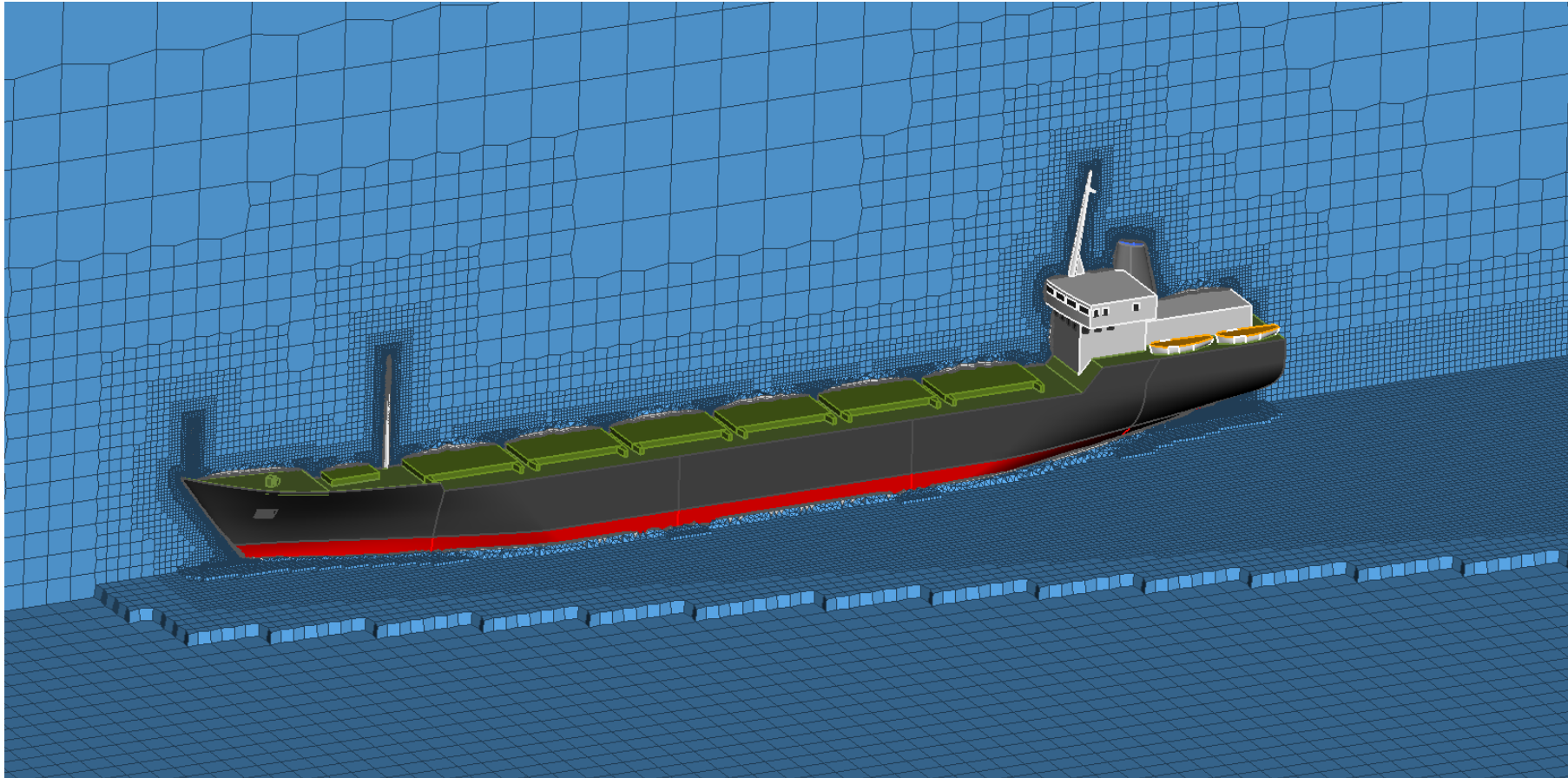
## Hexa Interior algorithm

Fully-conformal variable size Hexa-Interior mesh with prism and pyramid transitions



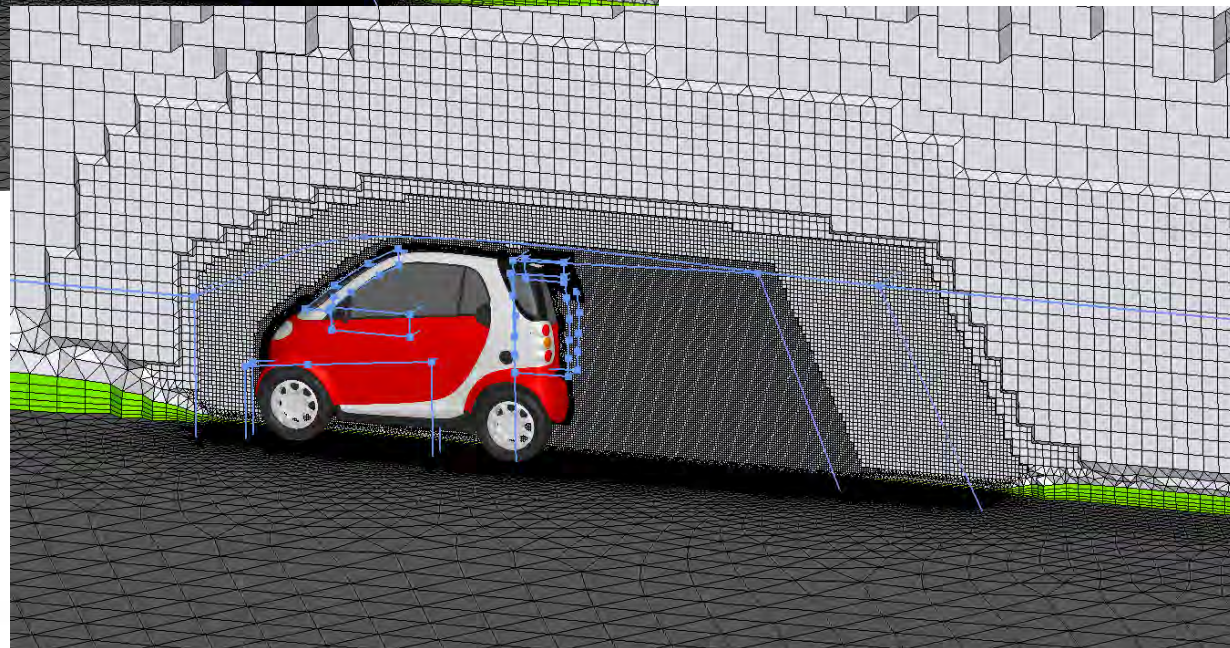
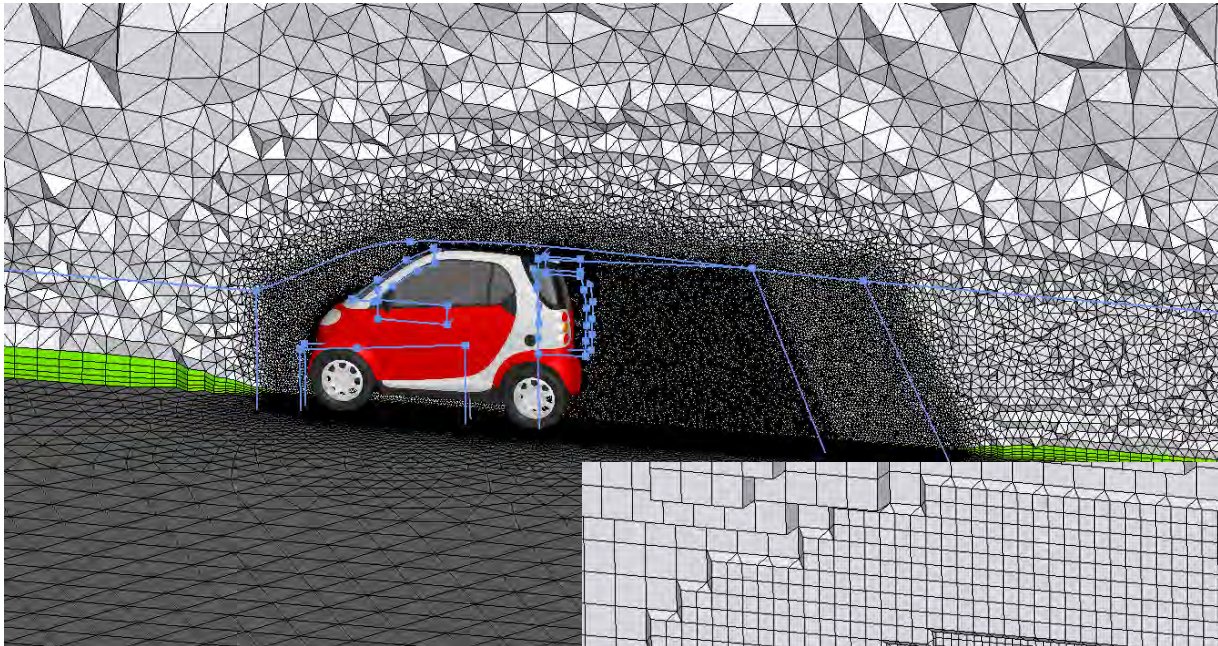
## Polyhedral type volume meshing algorithm

Variable size hexa mesh with polyhedral elements for transitions



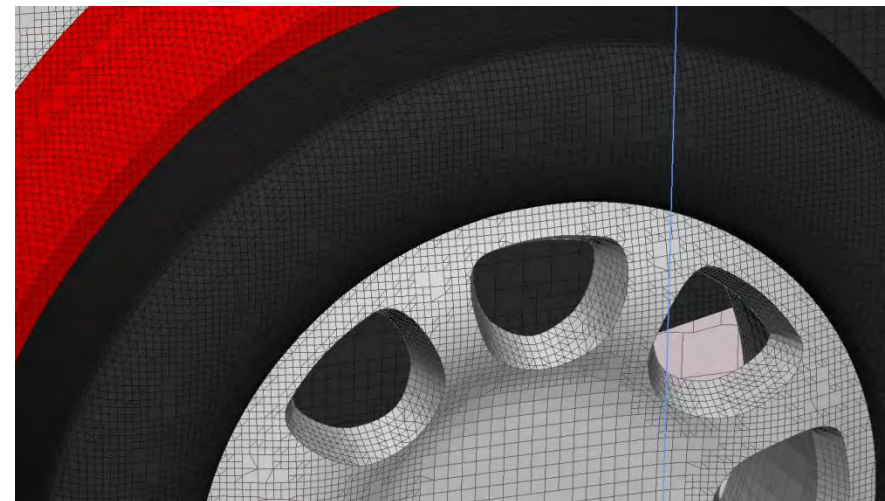
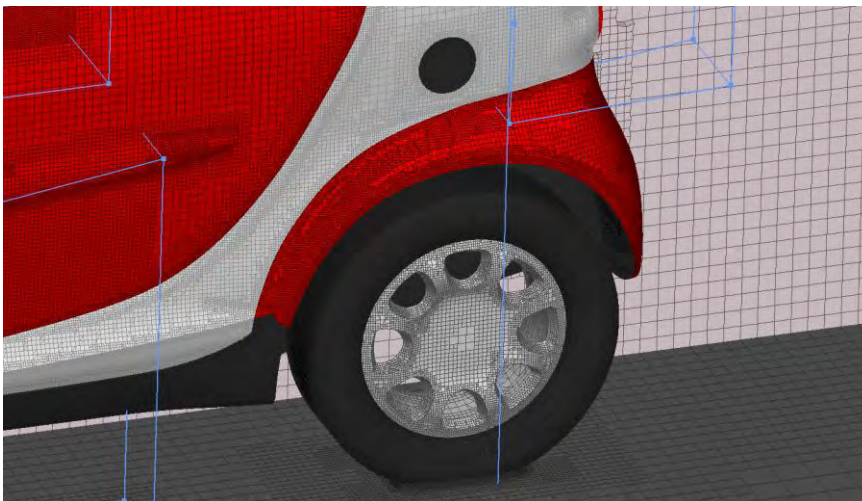
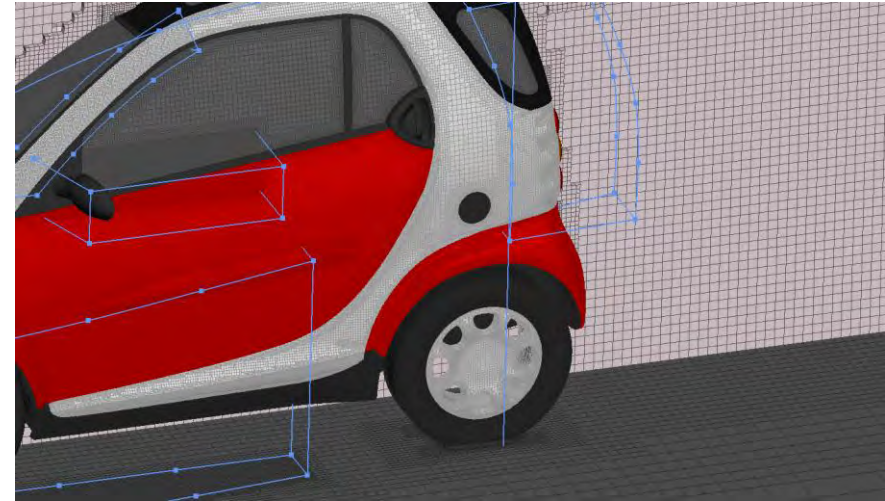
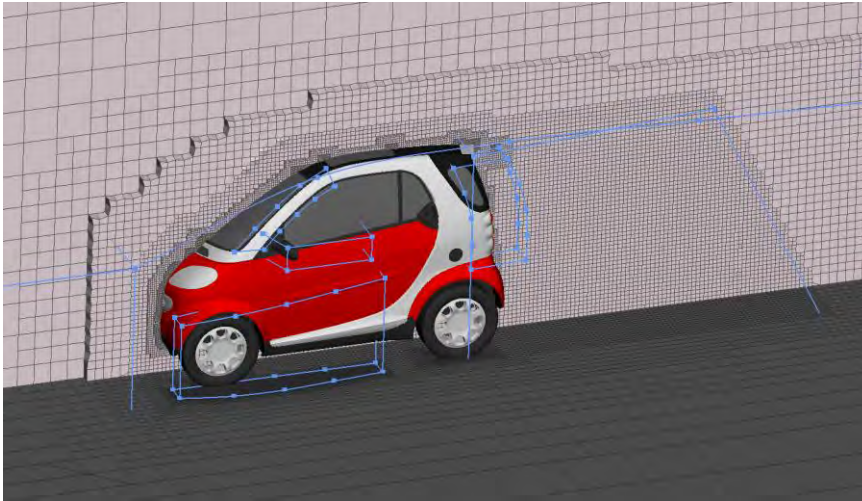
## Volume meshing: Size Boxes

Size Boxes controlling max element size



## Trim hexa/polyhedral mesher

Fully automated, highly controllable, trim hexa and polyhedral mesh generation without the need for watertight volume definitions, running on multi core machines



## Volume meshing: Boundary layers generation

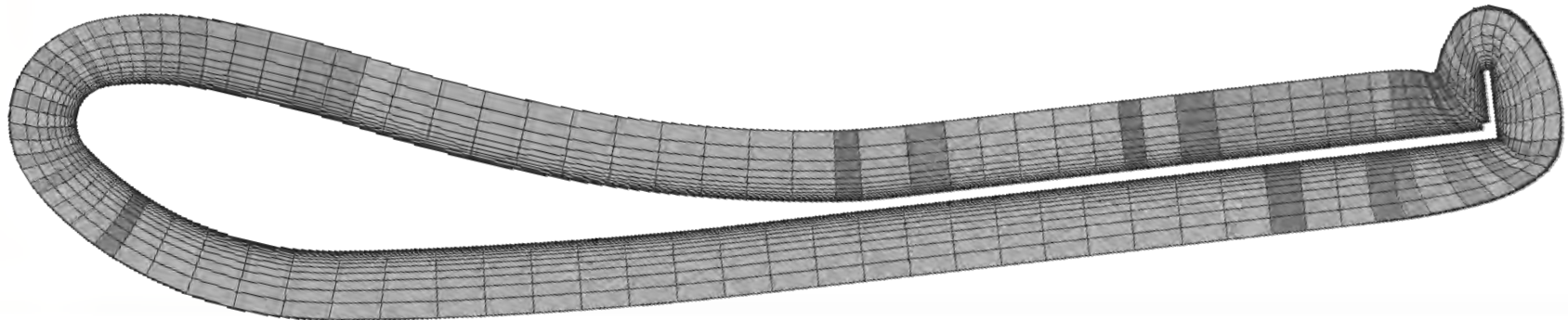
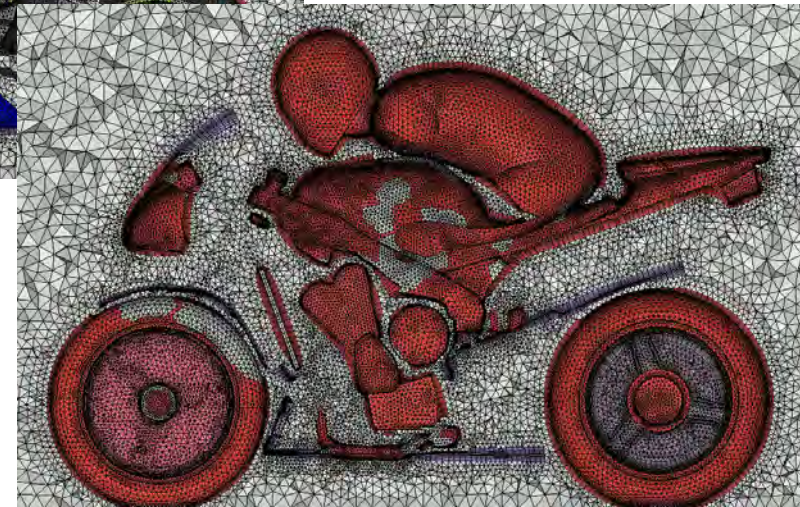
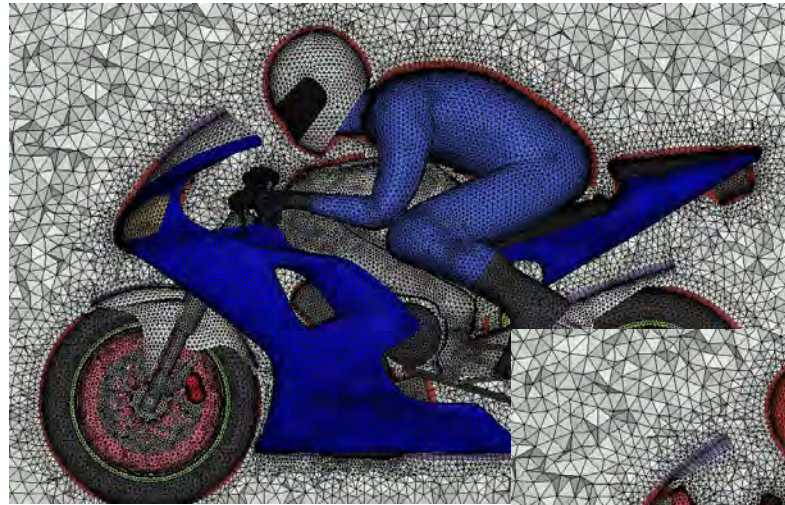
Multiple options:

Auto exclude or collapse areas

Controlled Layer Squeezing to avoid intersections

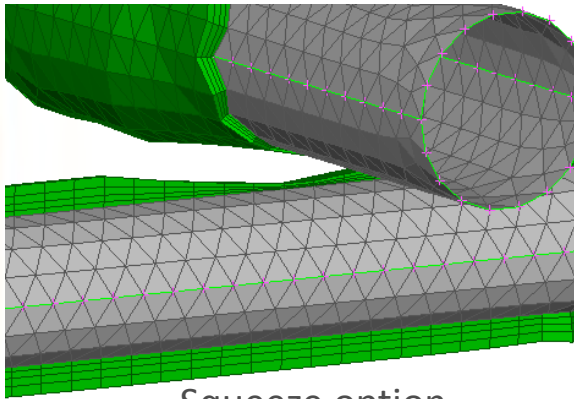
Layers from selected areas with different settings

Layers from zero-thickness walls

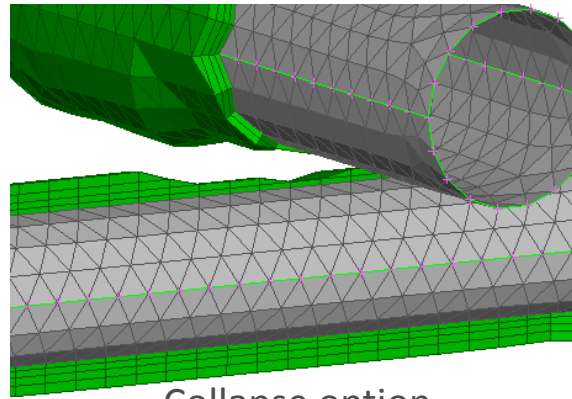


## Boundary layers exclude mode

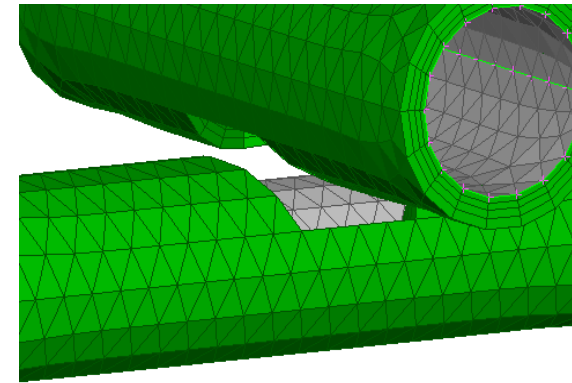
Automatic fix of intersection and proximities in any of three options



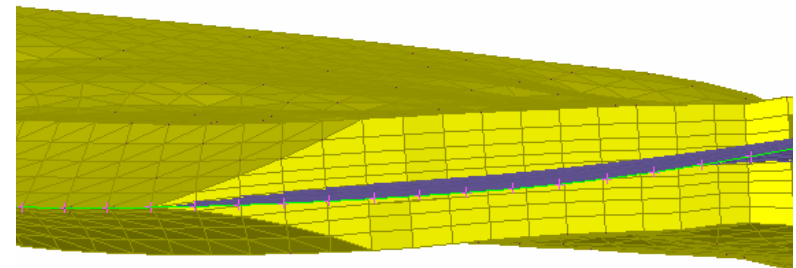
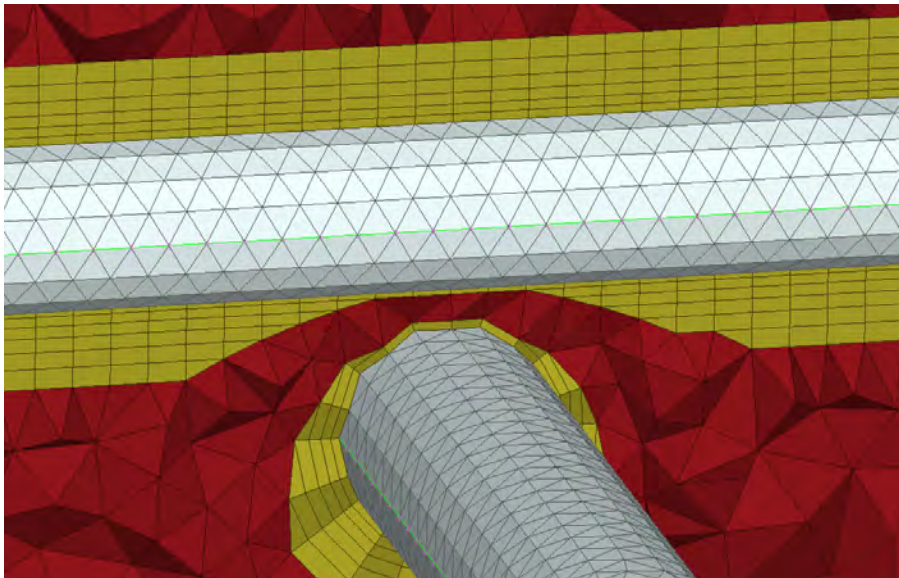
Squeeze option



Collapse option



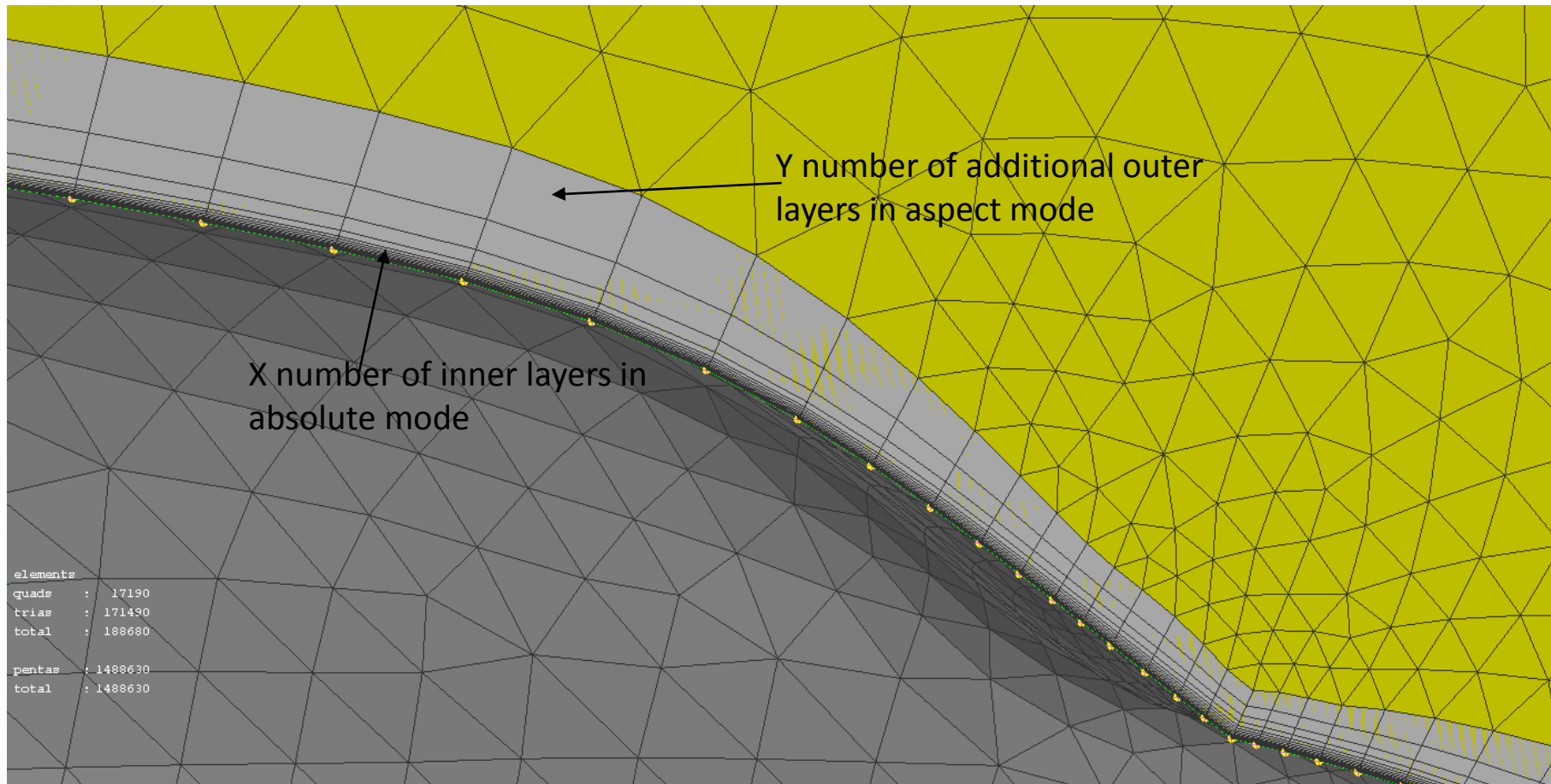
Exclude option



Collapse free edges

## Flexible specification of layer growth

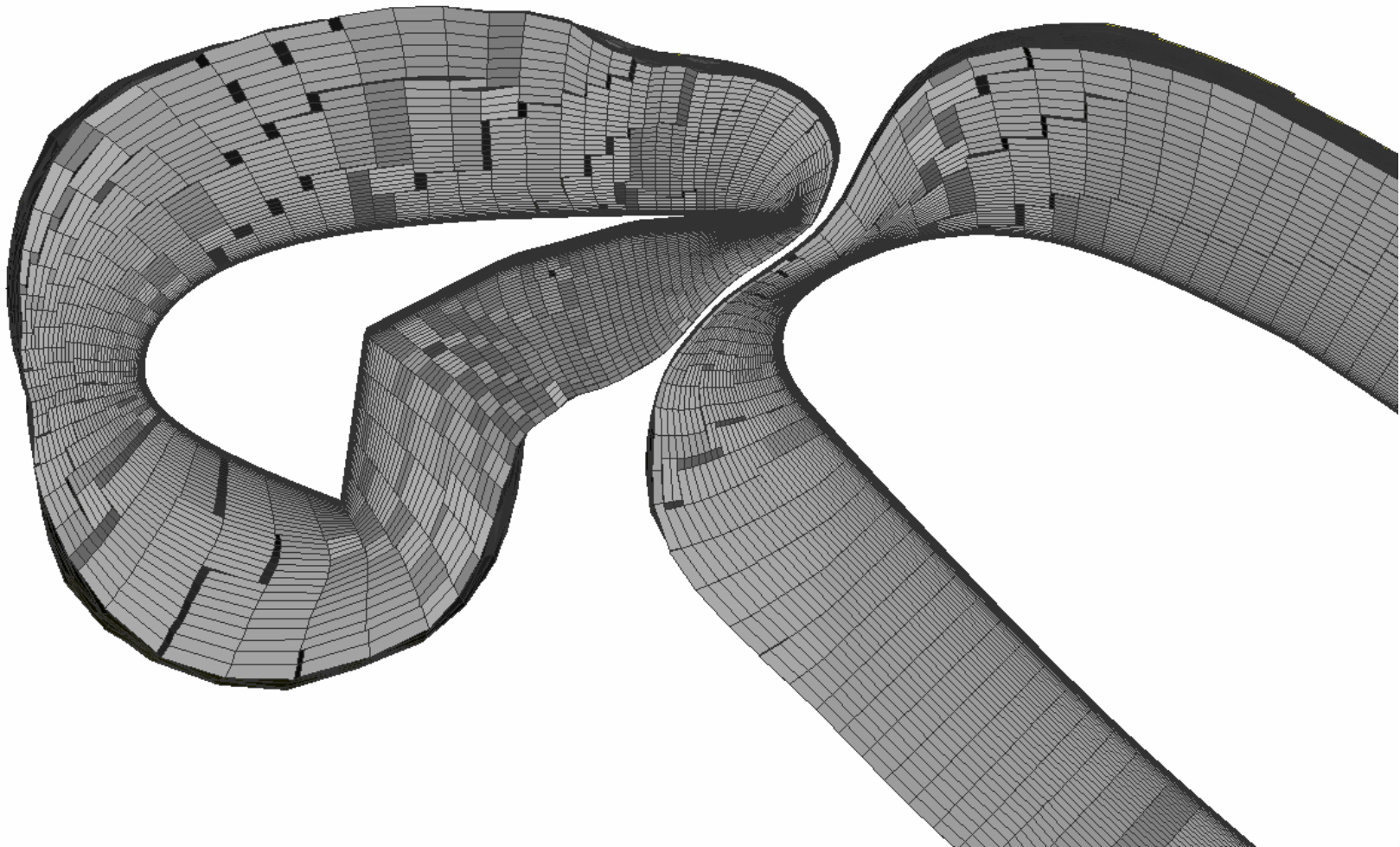
Ability to create an X number of layers in absolute height mode and then switch to aspect mode for the outer additional layers, thus ensuring a good cell volume change between the layers and the tetra mesh



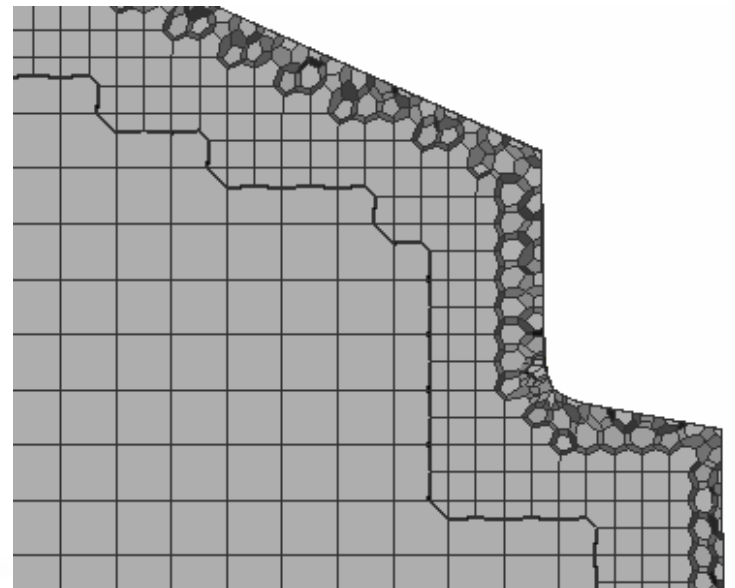
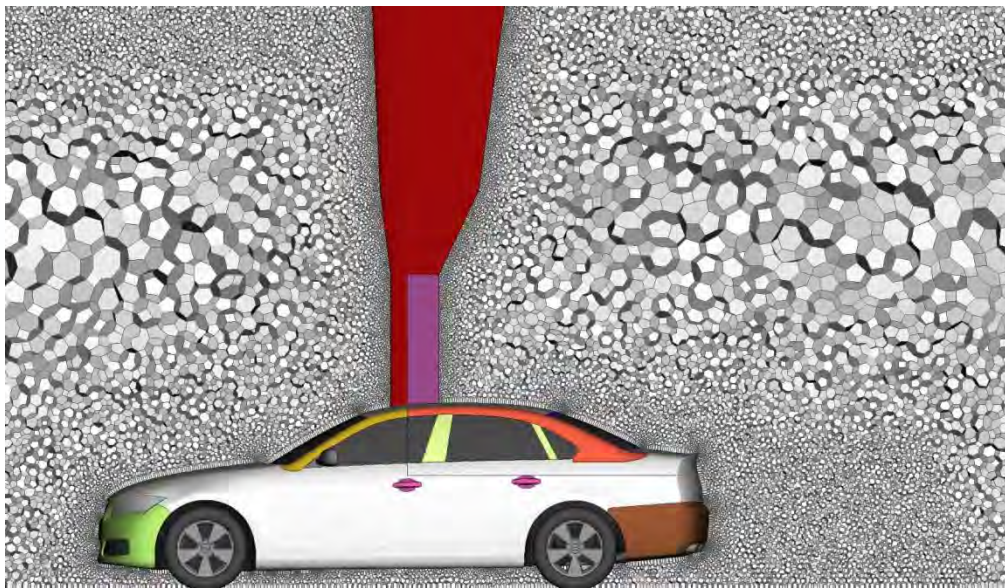
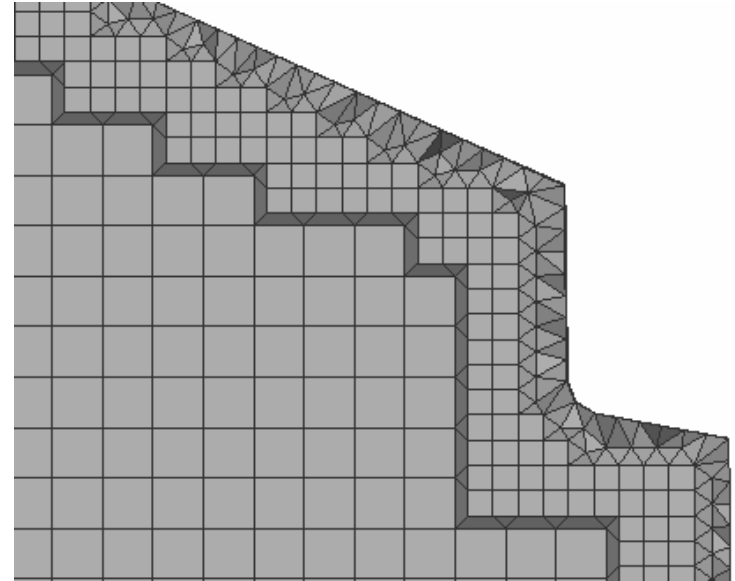
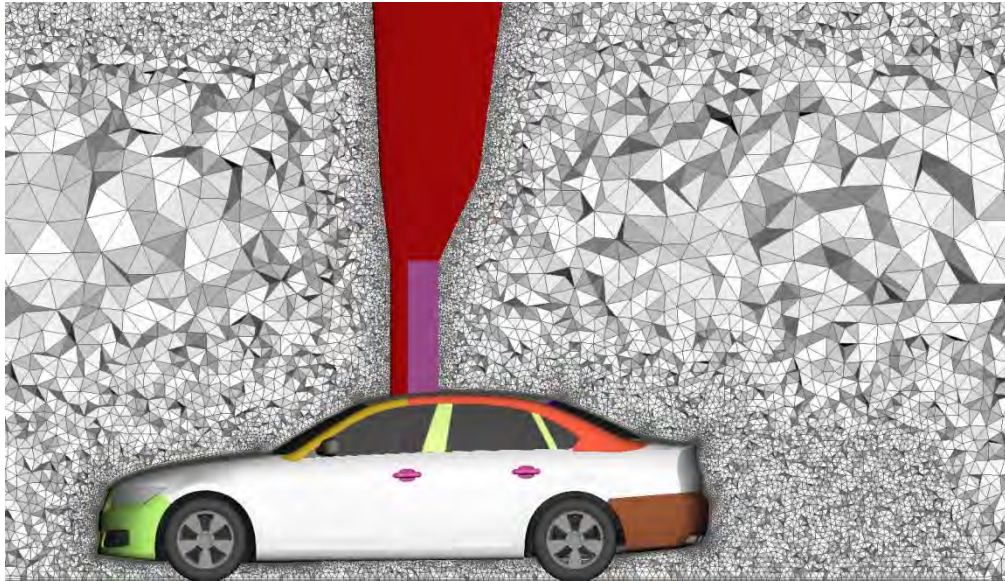


## Robust layers generation at extreme heights

Powerful algorithm for very large total layer height and severe proximities

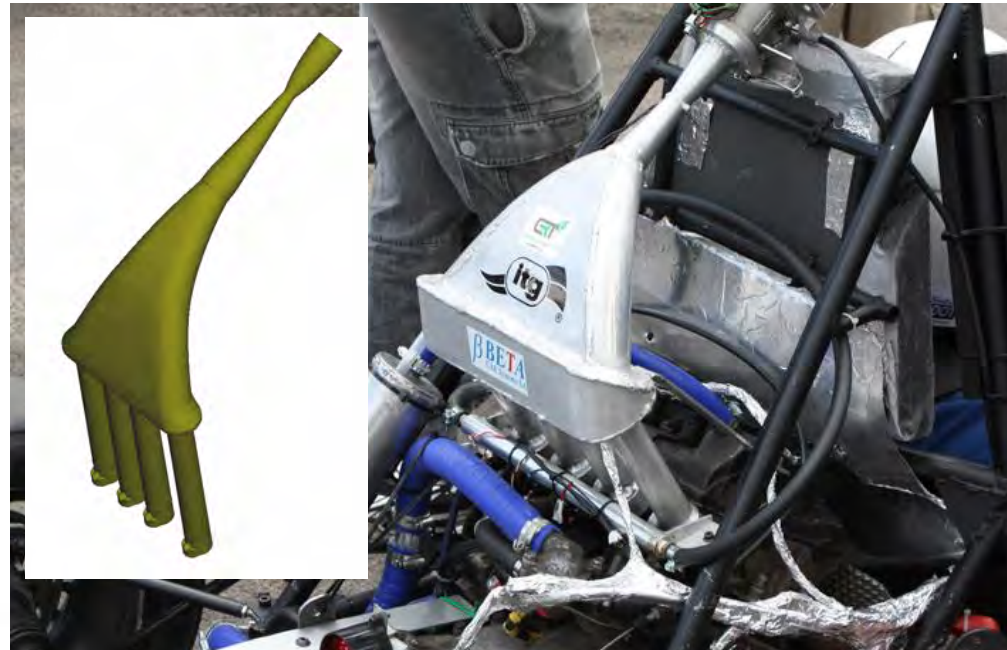
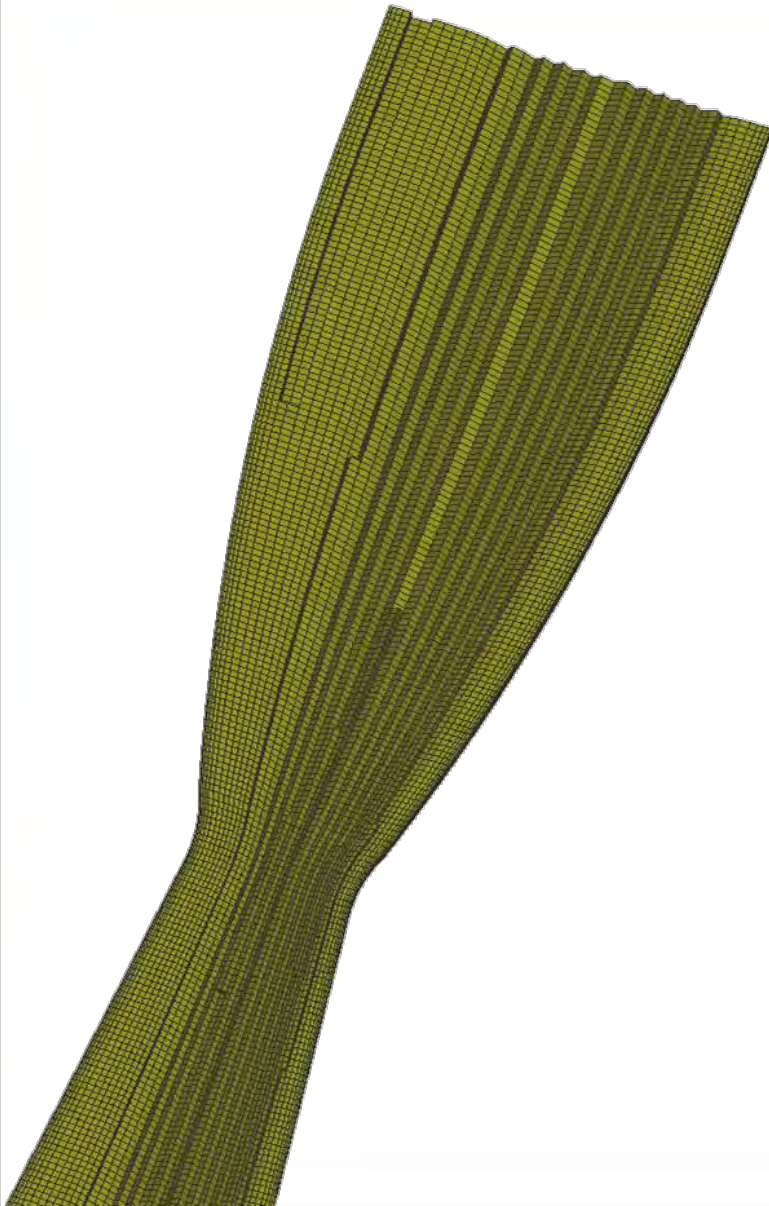


## Conversion of hybrid to polyhedral meshes



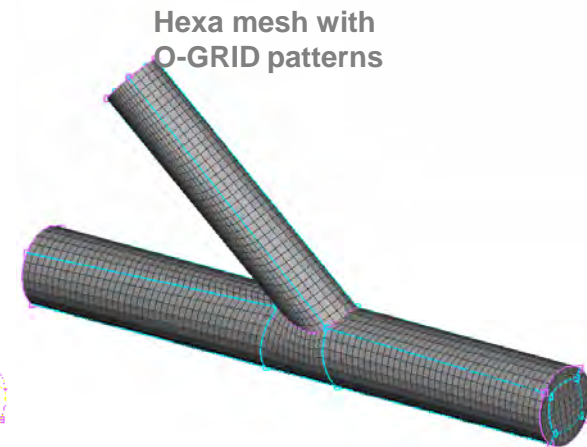
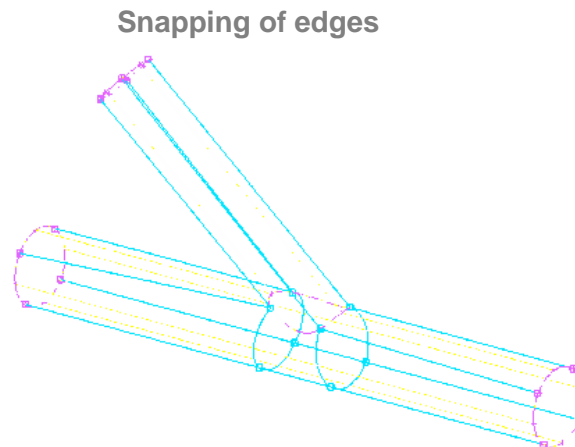
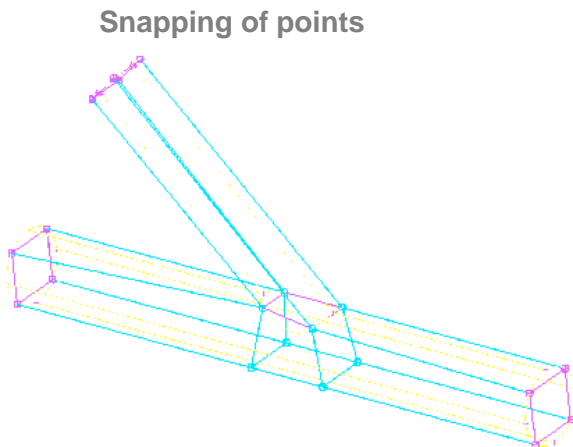
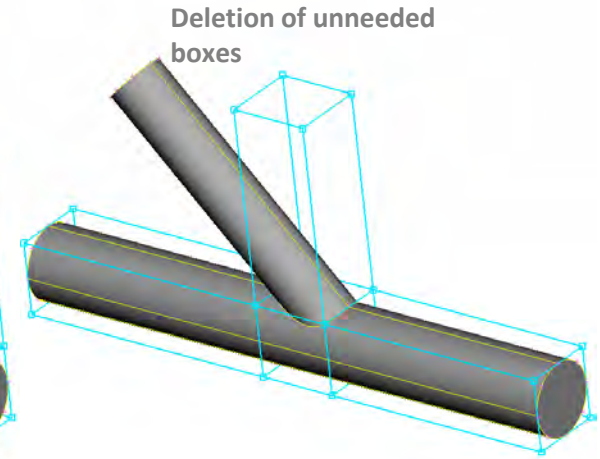
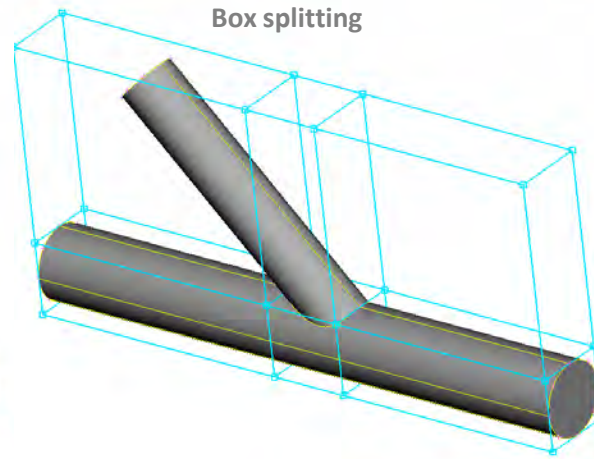
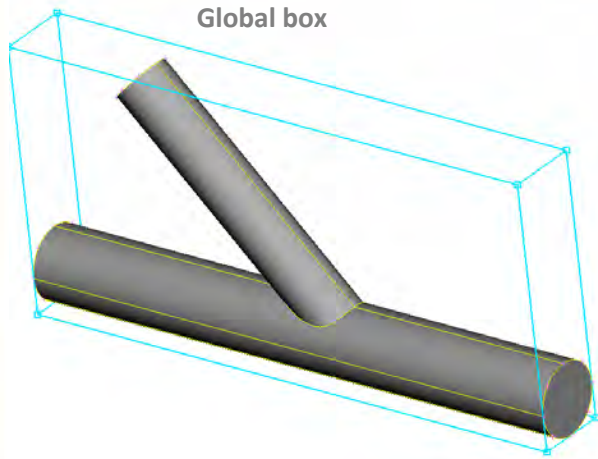
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## Volume meshing: Hexa/Penta map meshing



# HexaBlock meshing

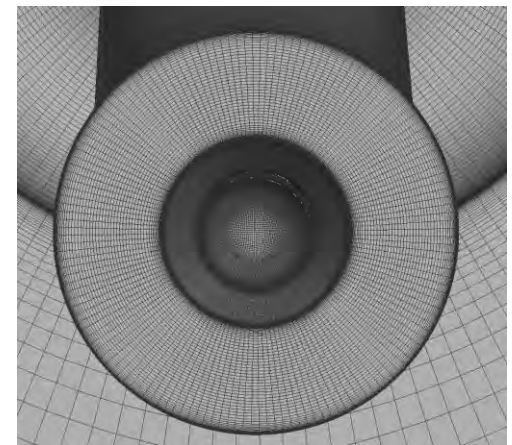
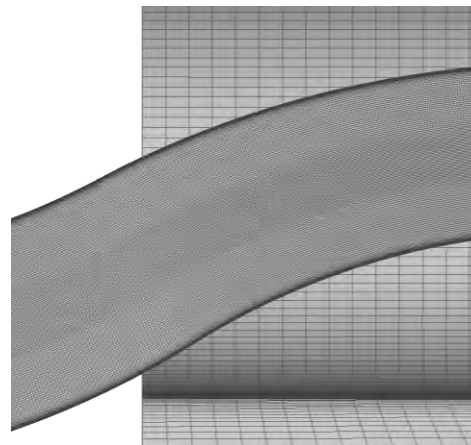
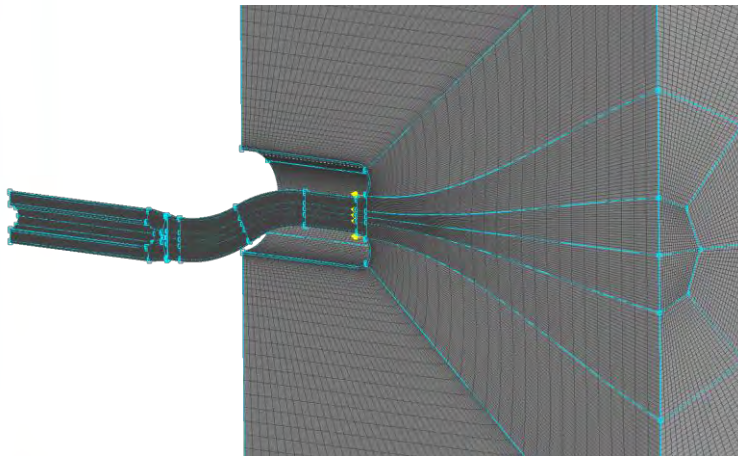
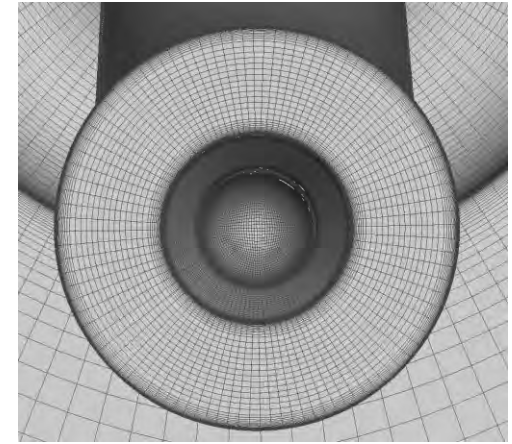
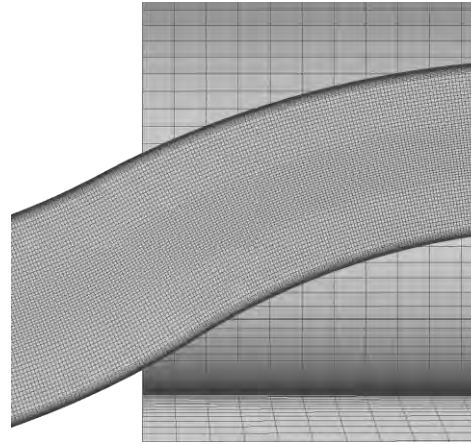
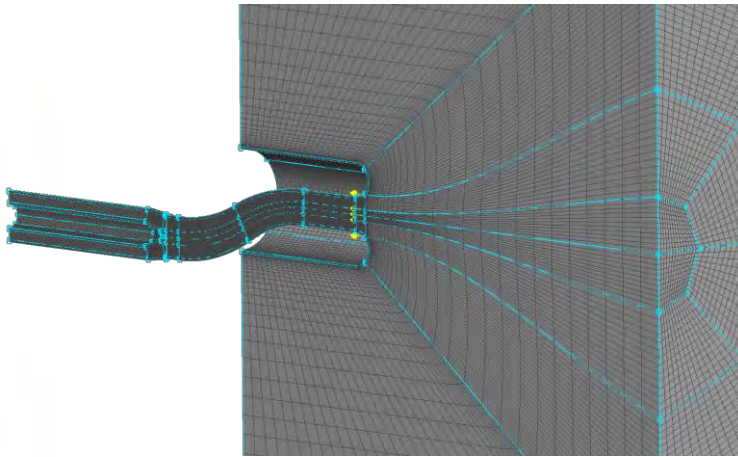
Hexa meshing based on block structures associated to the model



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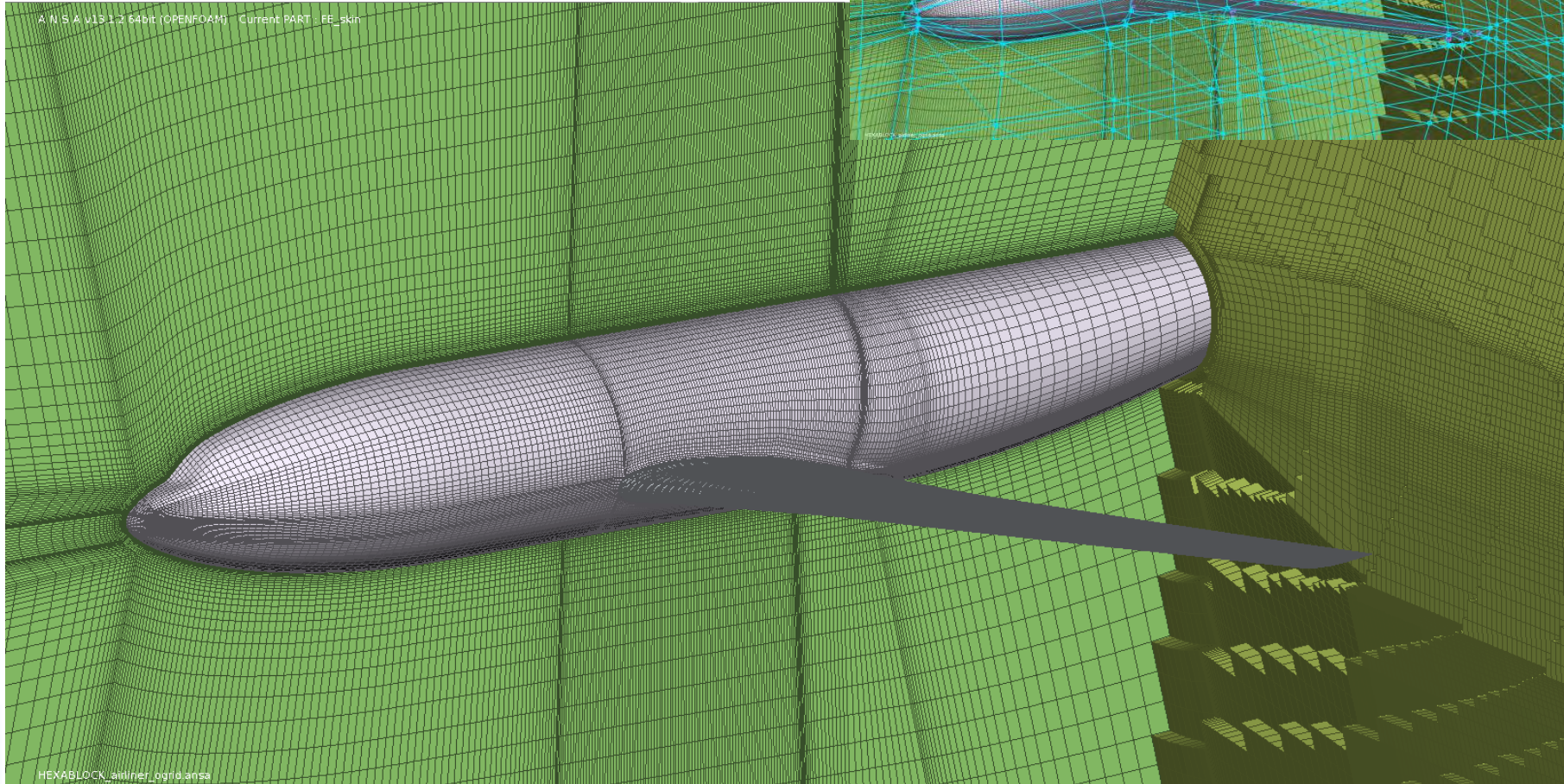
# HexaBlock meshing

Numerical simulation of flow through S-duct - 1<sup>st</sup> Propulsion Aerodynamics Workshop July 2012



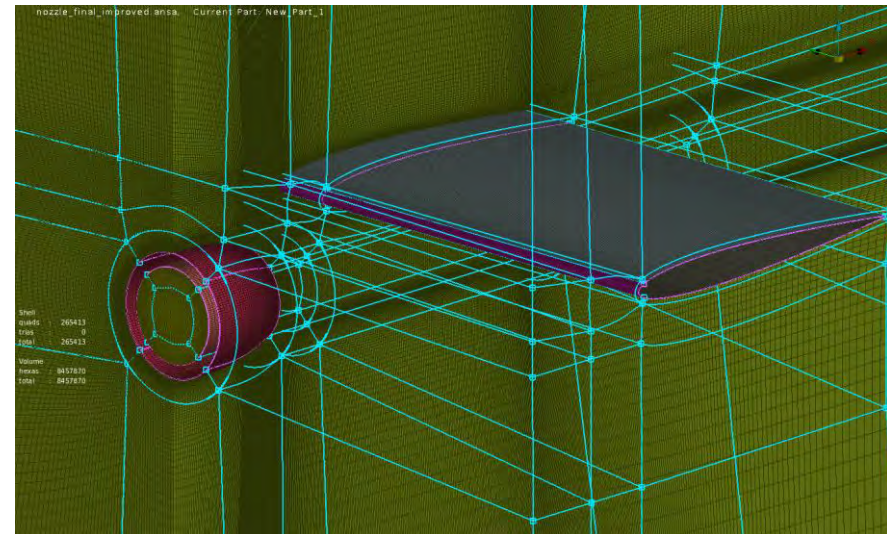
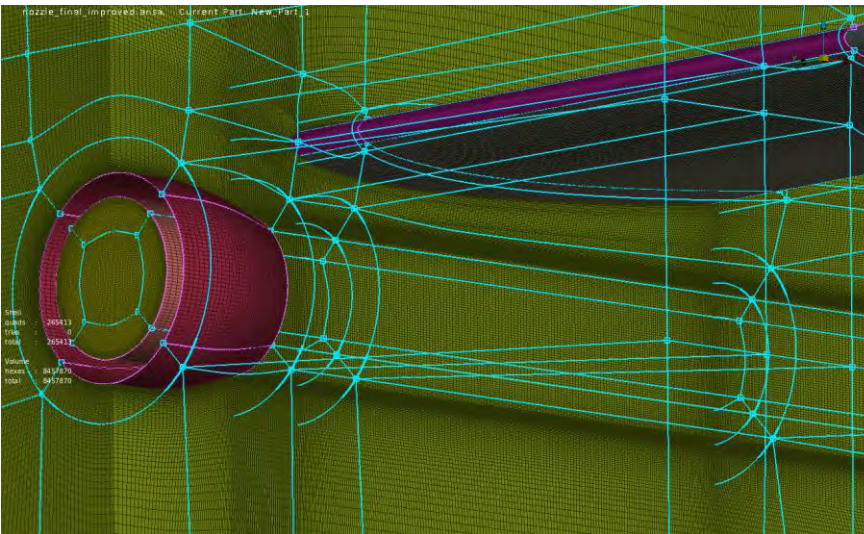
# HexaBlock meshing

Hexa meshing based on block structured boxes

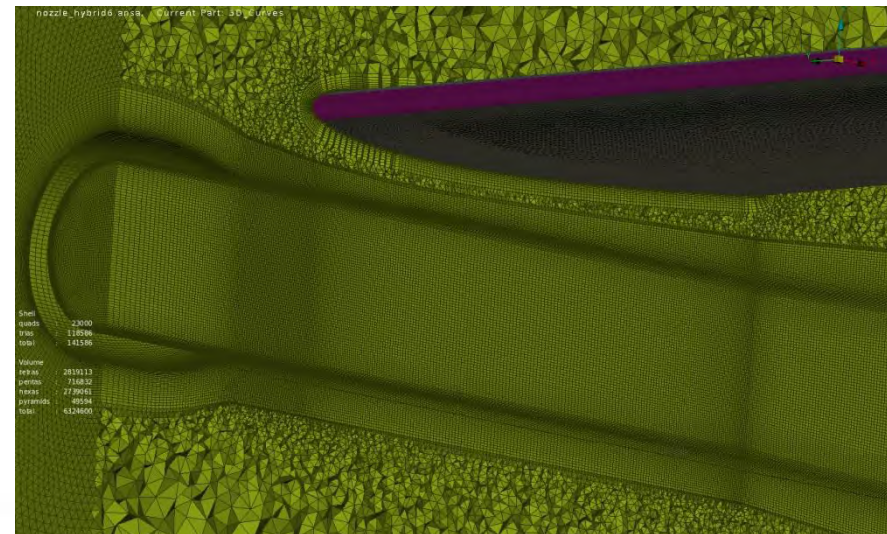
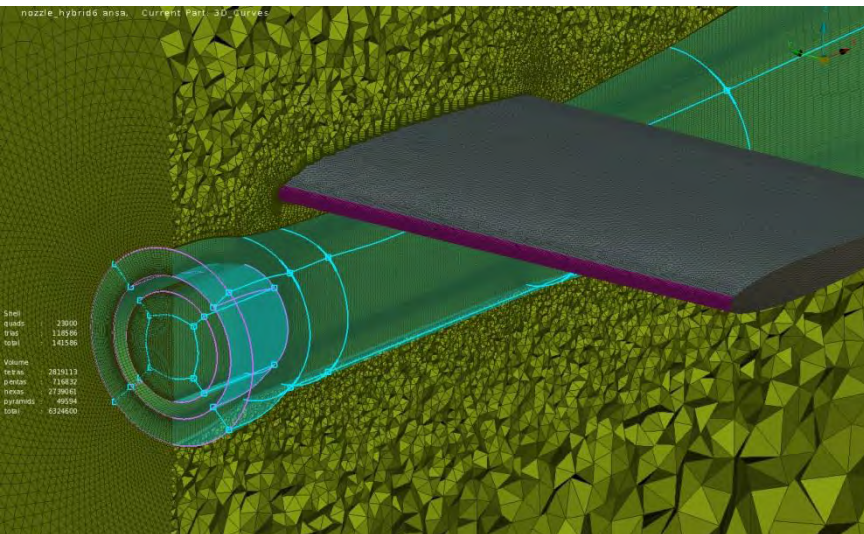


# HexaBlock meshing: generic jet exhaust under wing

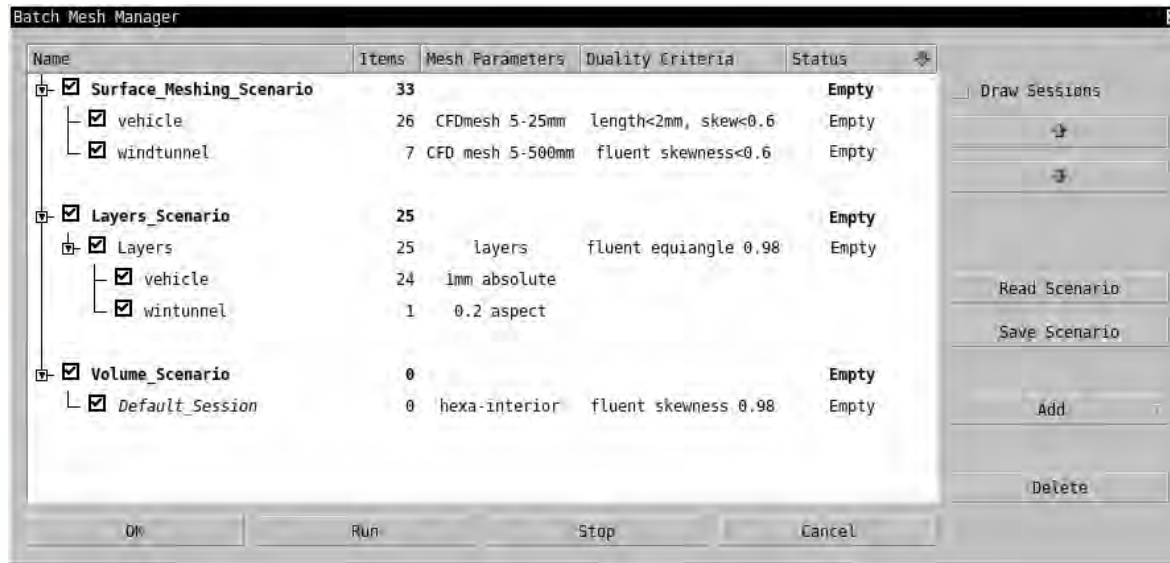
## Pure Hexa Mesh



## Combination of hexa mesh with hybrid mesh

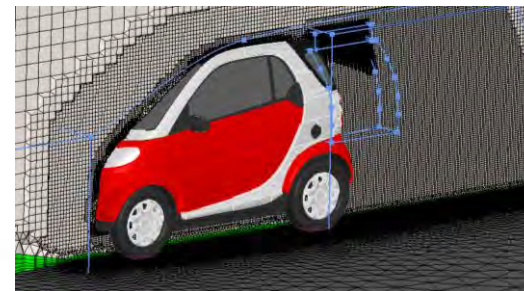
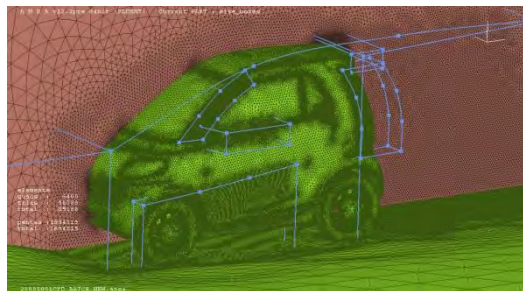
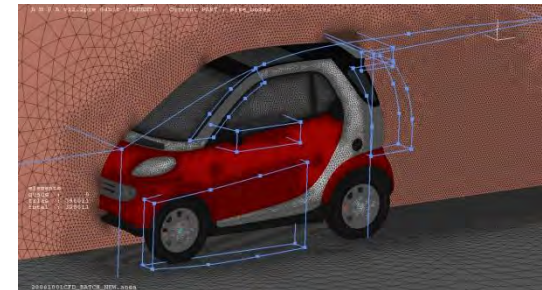
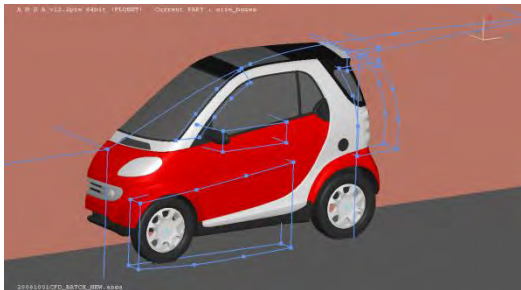


# Batch Mesh tool for complete CFD meshing automation



Batch Mesh provides:

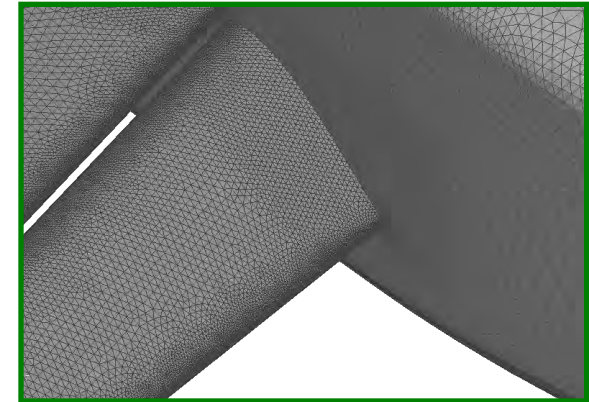
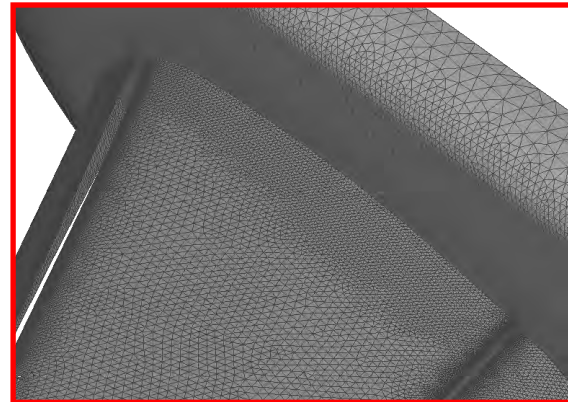
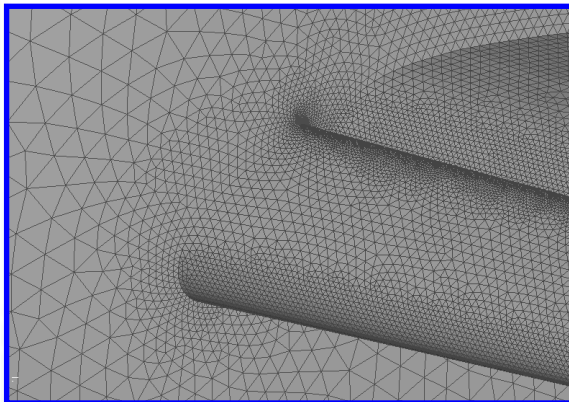
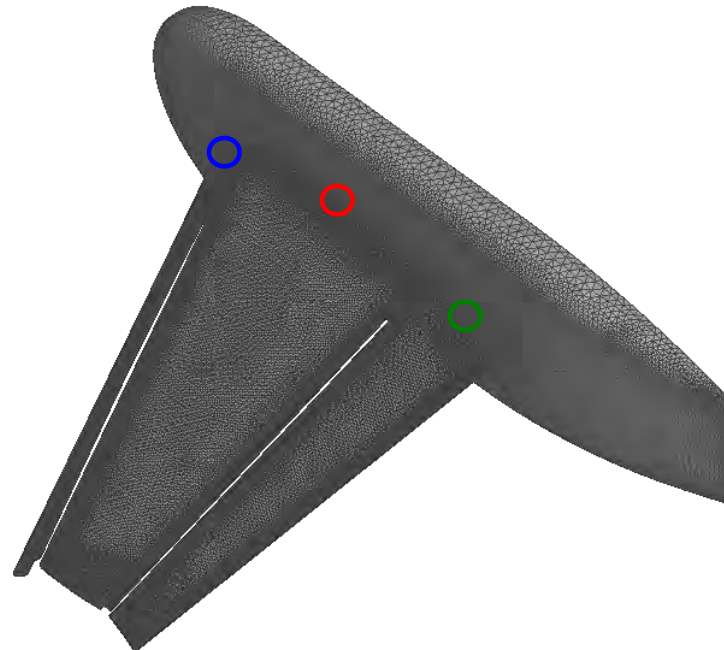
- Automation
- Consistency
- Mesh specs traceability





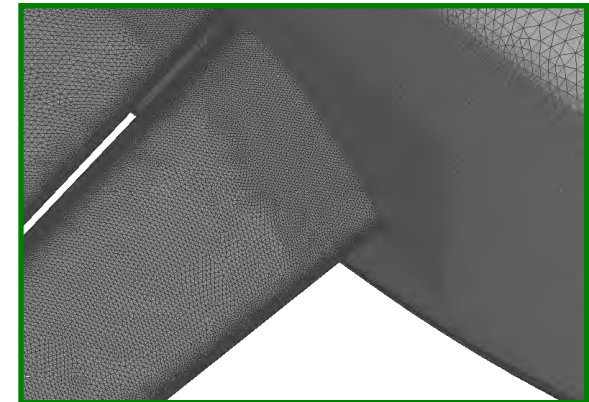
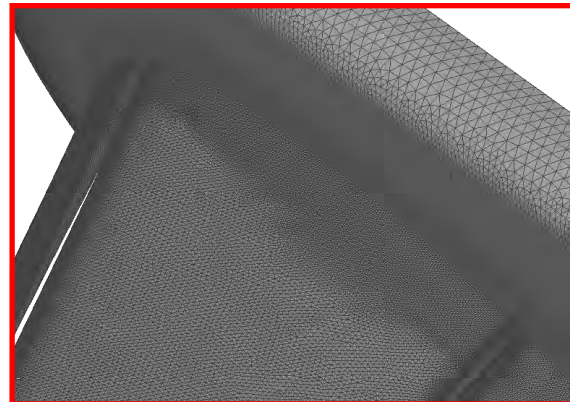
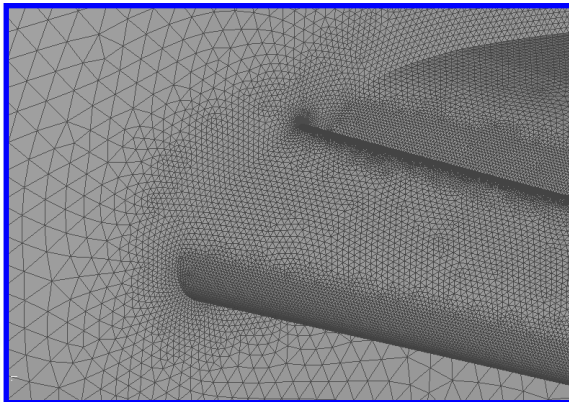
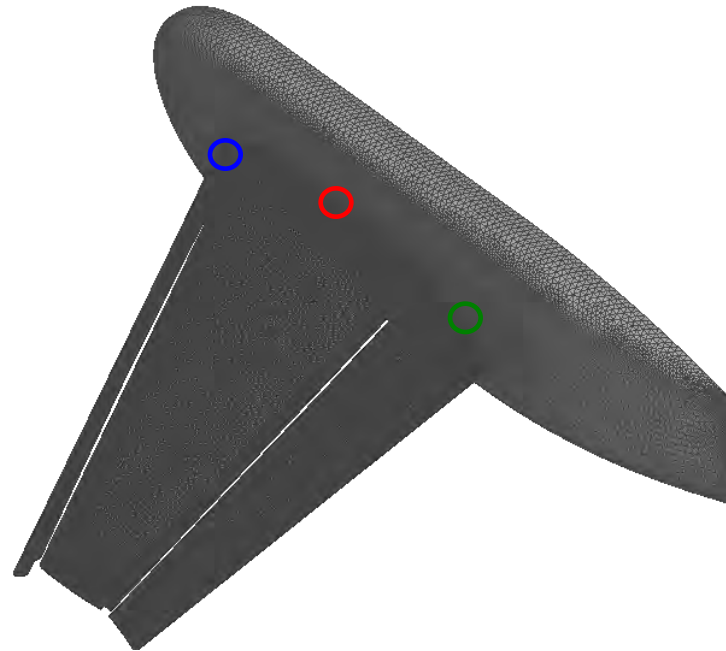
# Automated mesh refinement study - 1st High Lift Prediction Workshop

Coarse



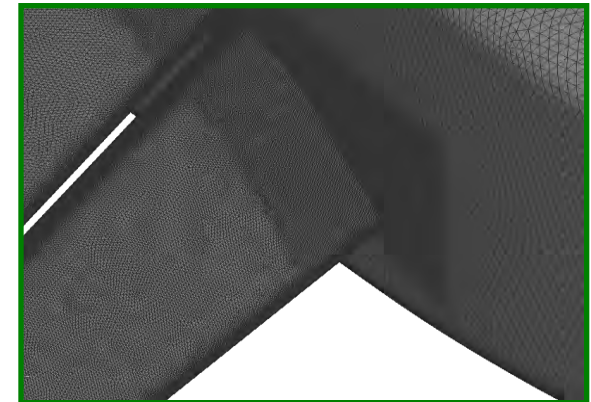
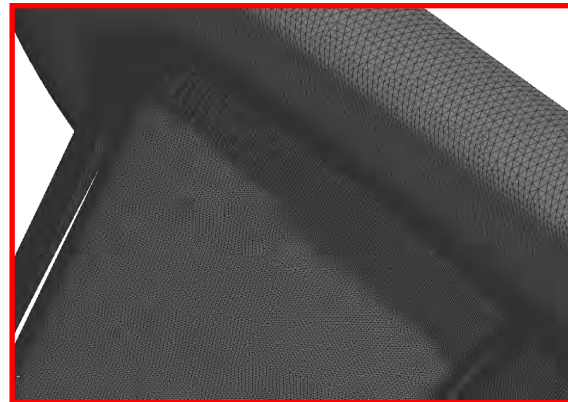
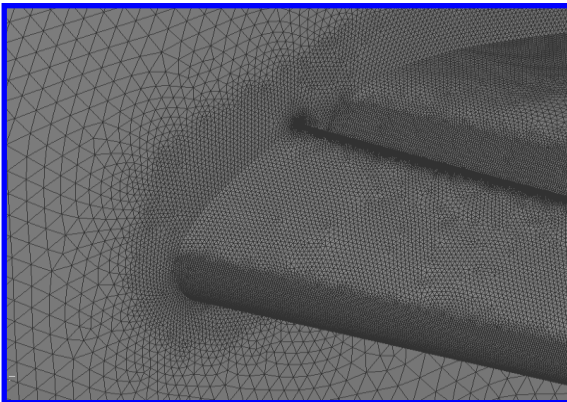
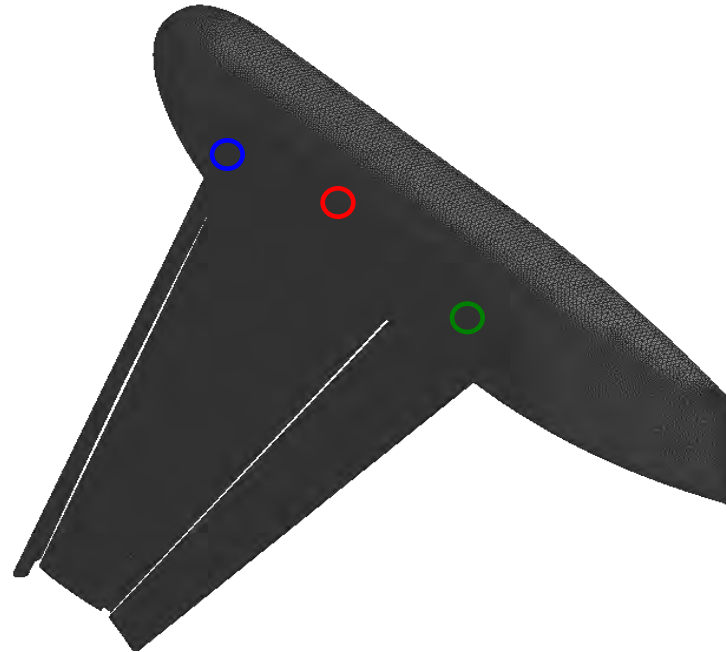
# Automated mesh refinement study - 1st High Lift Prediction Workshop

Medium



# Automated mesh refinement study - 1st High Lift Prediction Workshop

Fine



# Solver Setup

# Boundary Condition type specification for various CFD solvers

beta\_cc\_for\_demo\_18\_passengers.ansa, Current Part: driver

Id	Name	ZONE_TYPE	Num.Elem	USE_IN_MODEL	THICK
34	manikin_skin	wall	4575	✓	1.
35	manikin_upper_body	wall	13194	✓	1.
36	muffler	wall	4189	✓	1.
37	rr_disc_brake	wall	1804	✓	1.
38	rr_disc_calliper	wall	960	✓	1.
39	rr_suspension	wall	1502	✓	1.
40	symmetry	symmetry	27596	✓	1.
41	tyre_front	wall	7726	✓	1.
42	tyre_rear	wall	7894	✓	1.
43	wheel_front	wall	7305	✓	1.
44	wheel_rear	wall	7298	✓	1.
45	windtunnel_inlet	velocity-inlet	457	✓	1.
46	windtunnel_outlet	pressure-outlet	636	✓	1.
47	windtunnel_road	wall	20795	✓	1.
48	windtunnel_sides	symmetry	4194	✓	1.

FACE\_ZONE [SHELL\_PROPERTY]

Name: tyre\_front

FROZEN\_ID: NO

ZONE\_ID: 41

MID: tyre\_front

TRIM: NG

USE\_IN\_MODEL: YES

- axis
- exhaust-fan
- fan
- inlet-vent
- intake-fan
- interface
- interior
- mass-flow-inlet
- outflow
- outlet-vent**
- periodic
- porous-jump
- pressure-far-field
- pressure-inlet
- pressure-outlet
- radiator
- symmetry
- velocity-inlet
- wall

total: 48 selected: 0

NOT Select Any Entity

Current perimeter length: 20. (read: 10.)  
Current distortion distance: 15.% (read: 15.%)  
Current distortion angle: 0. (read: 0.)  
While in NOT function, you can Undo(Ctrl+Z) and Redo(Ctrl+Y) your commands.

Output also in CGNS and CFX5 formats

# Full support of OpenFOAM mesh and case setup

The screenshot shows the ANSA v14.1.2 interface with the following components:

- Properties Table:**

Id	Name	TYPE	Num.Elem	USE_IN_MODEL	THICK
1	air		12225		
2	inlet	patch	30	<input checked="" type="checkbox"/>	1
3	outlet	patch	57	<input checked="" type="checkbox"/>	1
4	upperWall	wall	223	<input checked="" type="checkbox"/>	1
5	lowerWall	wall	250	<input checked="" type="checkbox"/>	1
6	frontAndBack	empty	24450	<input checked="" type="checkbox"/>	1
- PROPERTY [SHELL\_PROPERTY] Dialog:**
  - Name: inlet
  - FROZEN\_ID: NO, FROZEN\_DELETE: NO, DEFINED: YES, TRIM: NO, USE\_IN\_MODEL: YES
  - PID: 2, TYPE: patch
  - Numerical Type p: zeroGradient
  - Numerical Type U: fixedValue, U x-value: 10, U y-value: 0, U z-value: 0
  - Numerical Type k: fixedValue, k value: 0.375
  - Numerical Type epsilon: fixedValue, epsilon value: 14.855
  - Numerical Type nut: calculated, nut value: 0
- OpenFoam Case Parameters Dialog:**
  - general | controlDict | decomposeParDict | fvSchemes | fvSolution | transport | turbulence
  - Time Control:
    - application: [empty]
    - startFrom: startTime, startFrom: 0.
    - stopAt: endTime, stopAt: 1000.
    - deltaT: 1.
    - adjustTimeStep: [empty]
    - maxCo: [empty]
    - maxDeltaT: [empty]
  - Data Writing:
    - writeControl: timeStep
    - writeInterval: 50.
    - purgeWrite: 0
    - writeFormat: ascii
    - writePrecision: 6
    - writeCompression: uncompressed
    - timeFormat: general
    - timePrecision: 6
    - graphFormat: raw
  - Data reading:
    - runTimeModifiable: Yes
    - function: User Function

Boundary conditions, porous and MRF zones, turbulence models, controlDict support, integrated checkMesh and more

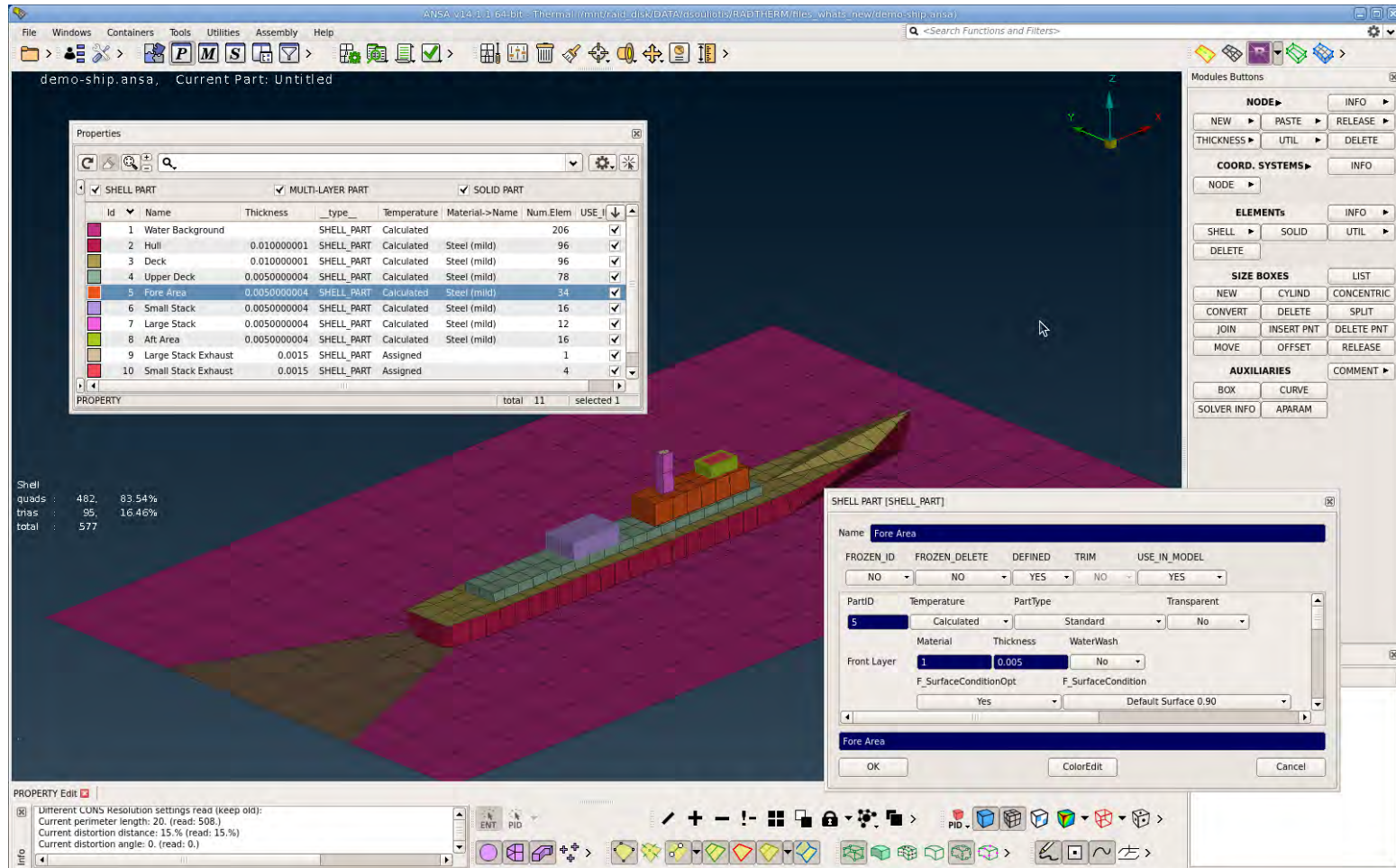
# Thermal Management simulations support for RadTherm and THESEUS-FE

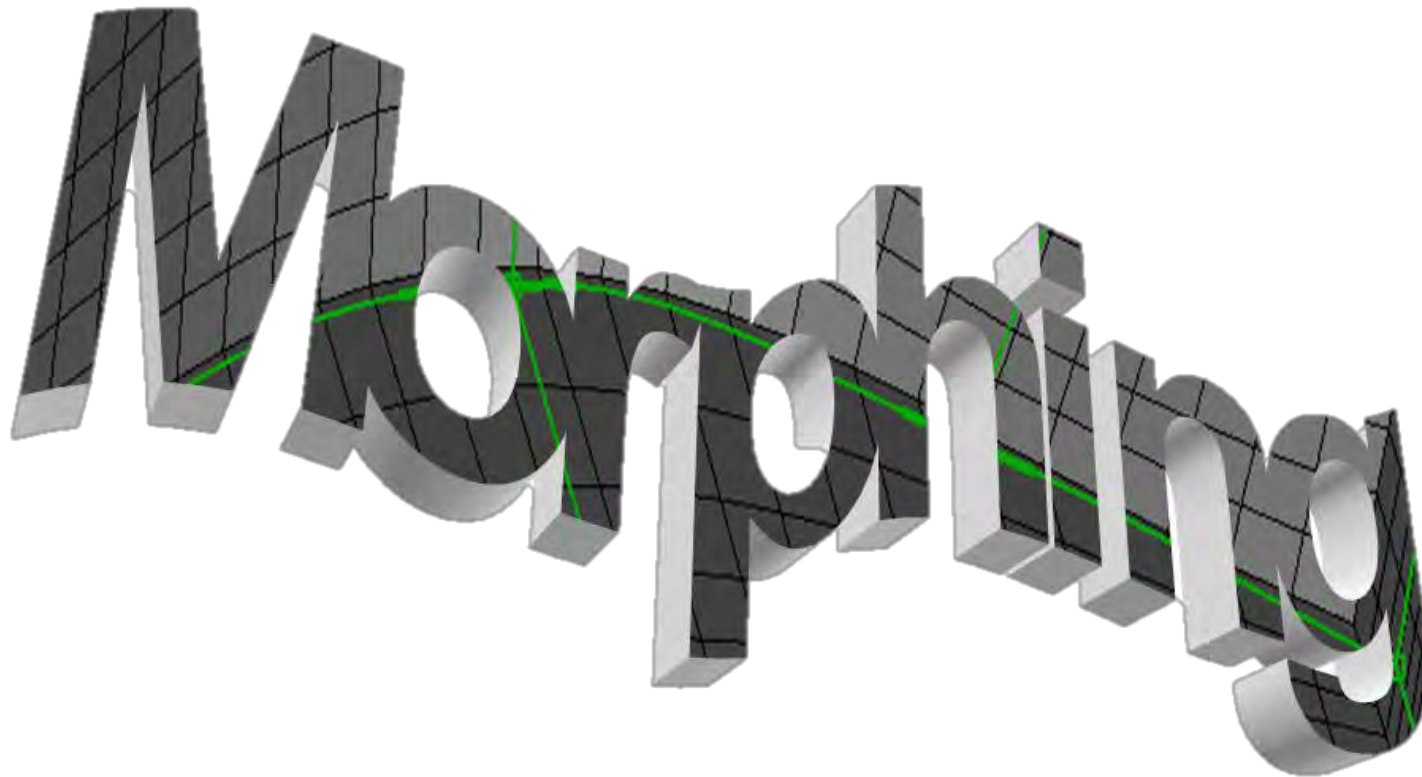
Direct I/O of native \*.tdf files (Radtherm) and \*.tfe files (THESEUS-FE)

Support of shell and solid mesh, Parts (single and multilayer)

and Assemblies, Materials, Boundary conditions

and main solver settings







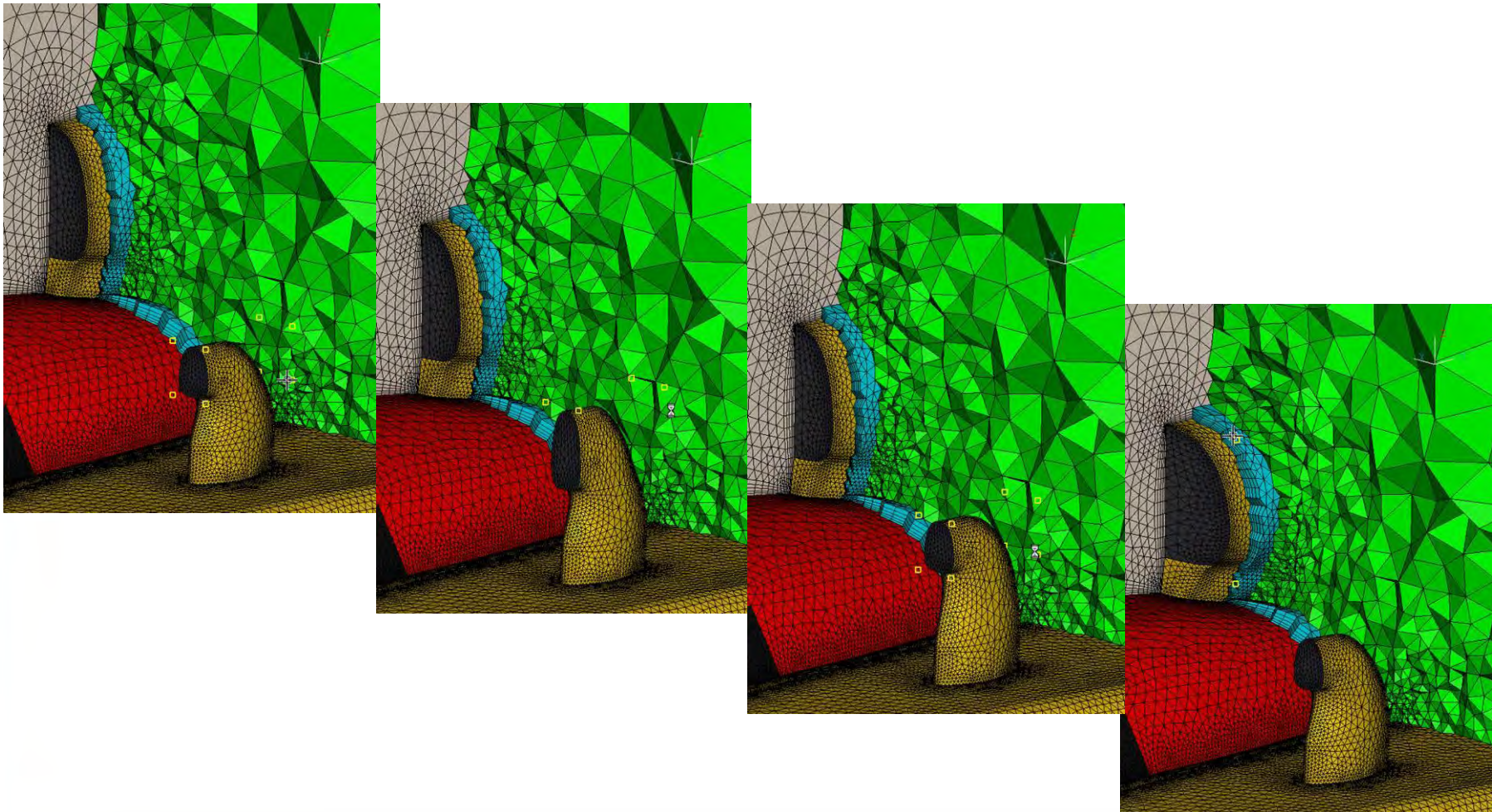
## ANSA Morphing

ANSA morphing tool has the following advantages:

- It provides flexible parameterization of your CFD model
- It is highly controllable allowing the user to perform the exact modifications that are required
- It allows scaling and history tracking of morphing actions
- It is applicable to surface & volume mesh and geometry
- It employs fast morphing algorithms that can be used efficiently and robustly on large CFD models
- It is integrated in the same environment so that it can be used in conjunction with the powerful ANSA functionality for geometry handling and surface and volume meshing
- Morphing can be performed interactively or in pure batch mode, also coupled with optimizer software
- It can be used with direct interfaces with all major CFD codes, like Fluent, Star CCM+, and OpenFOAM among others

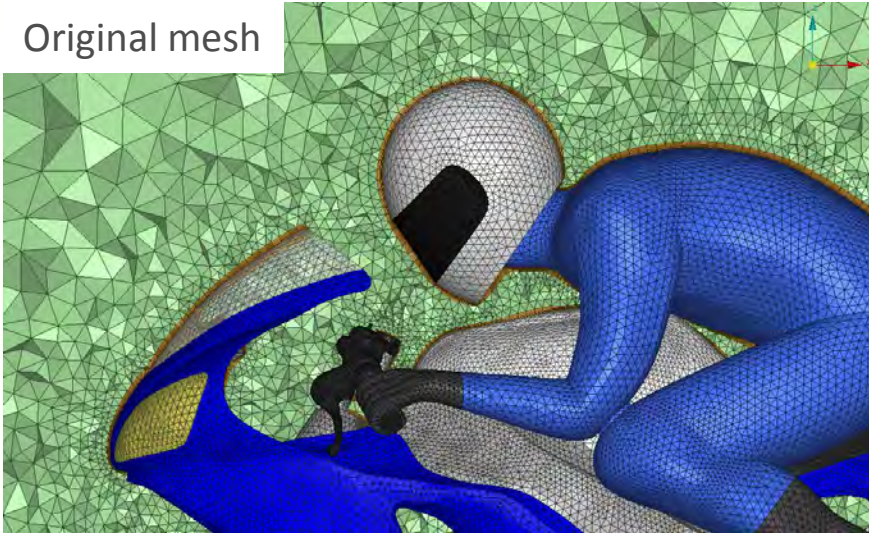
## Morphing

Morphing of shell and volume mesh by user-interaction, or in batch mode accelerates engineering development

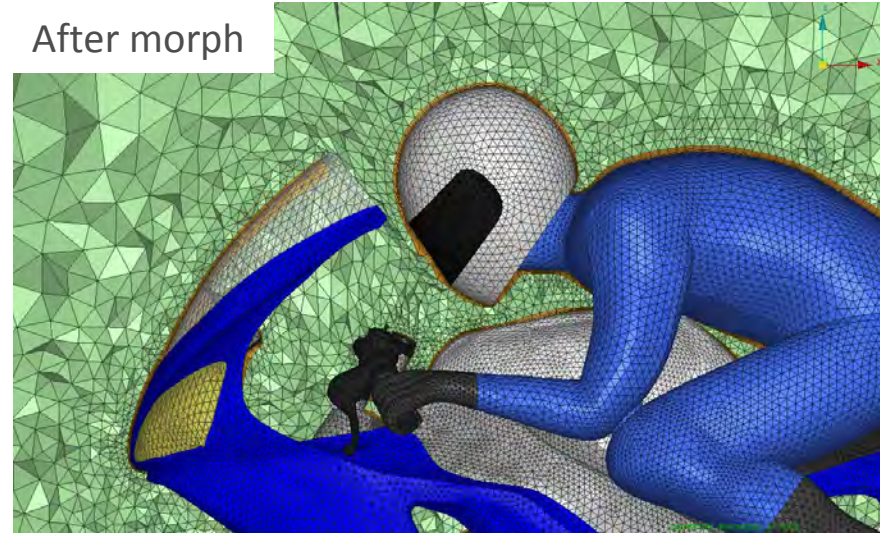


# Mesh Reconstruction after large deformations

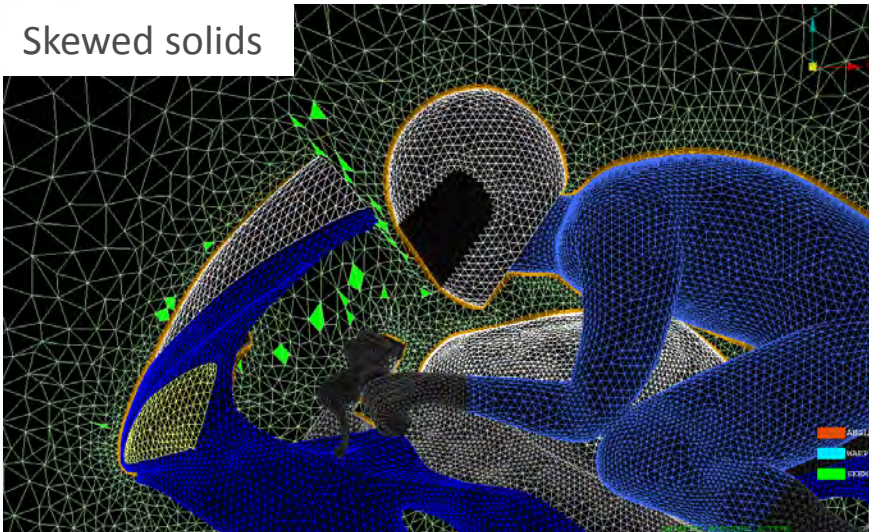
Original mesh



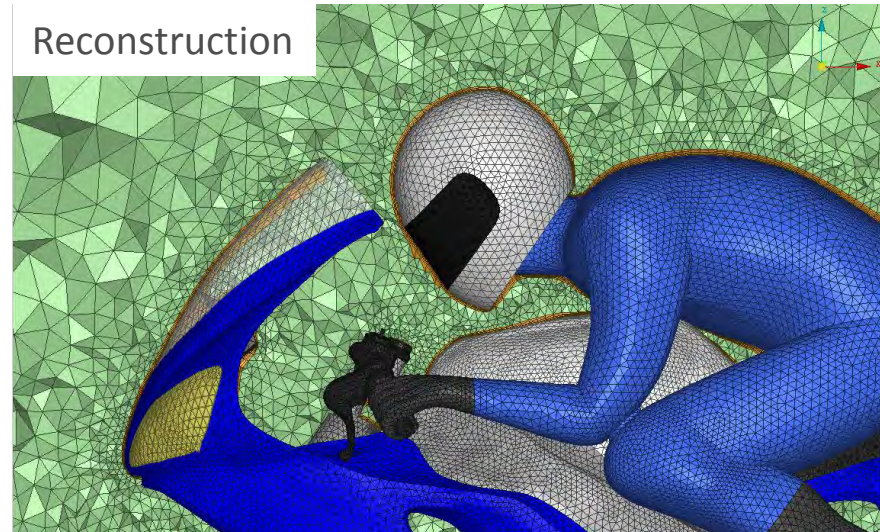
After morph



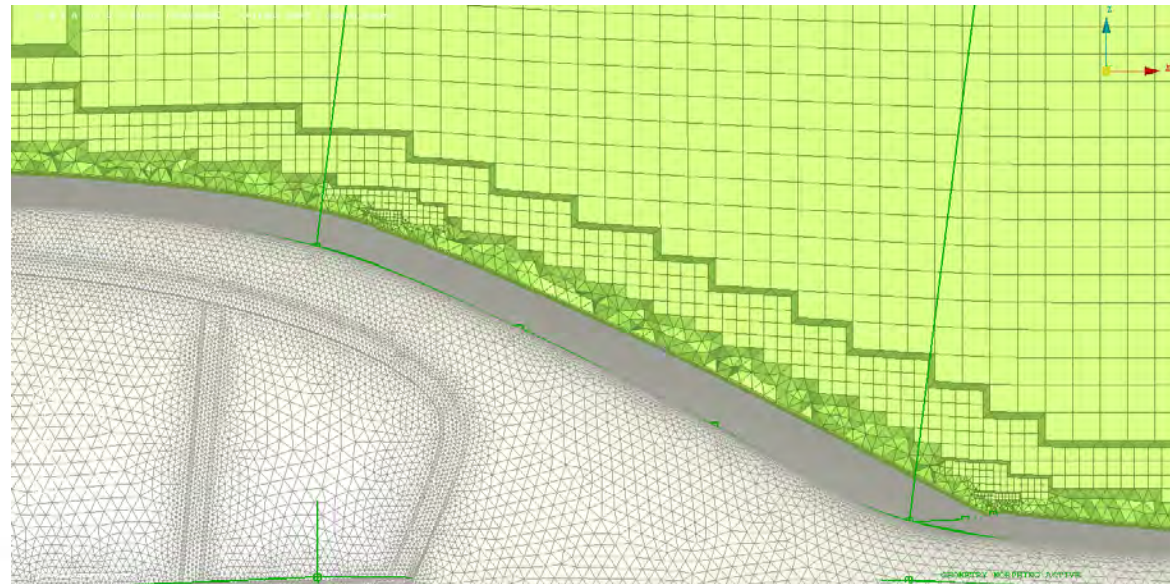
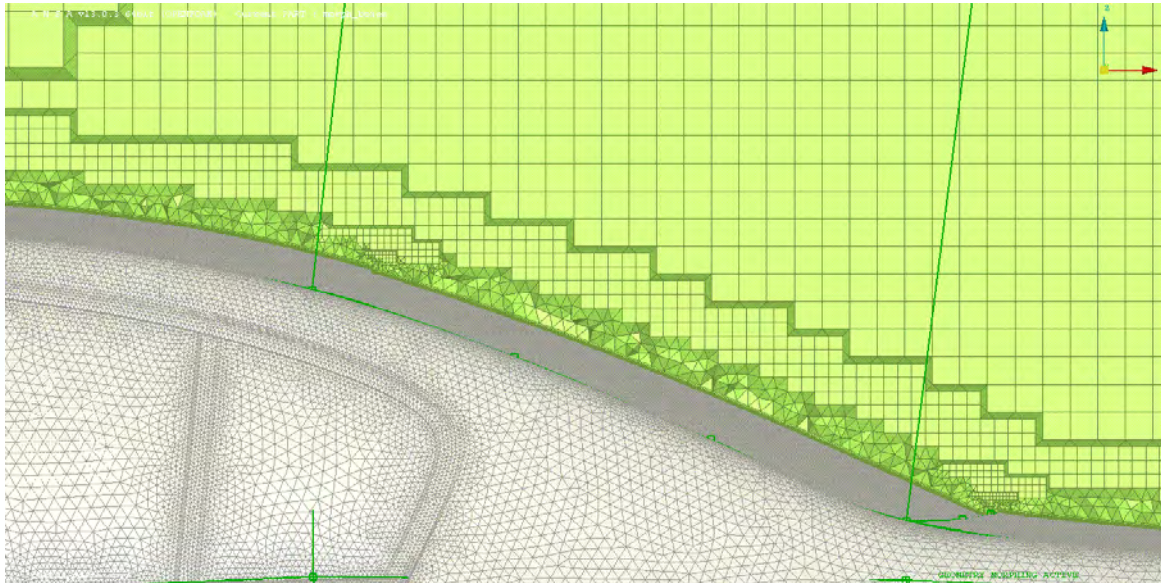
Skewed solids



Reconstruction

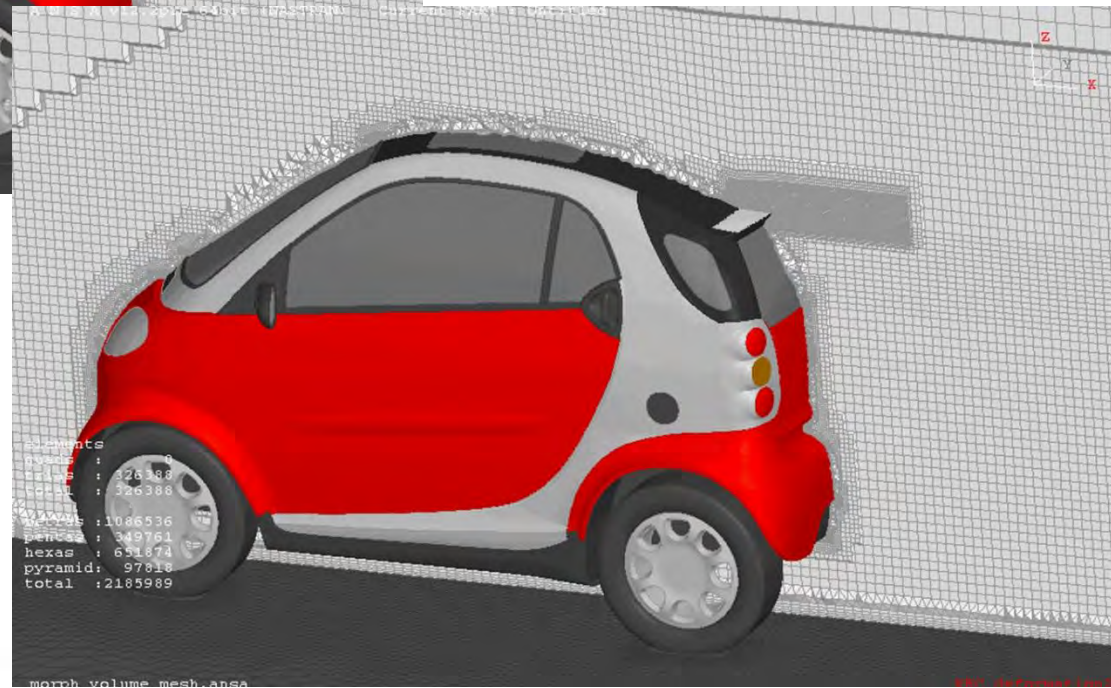
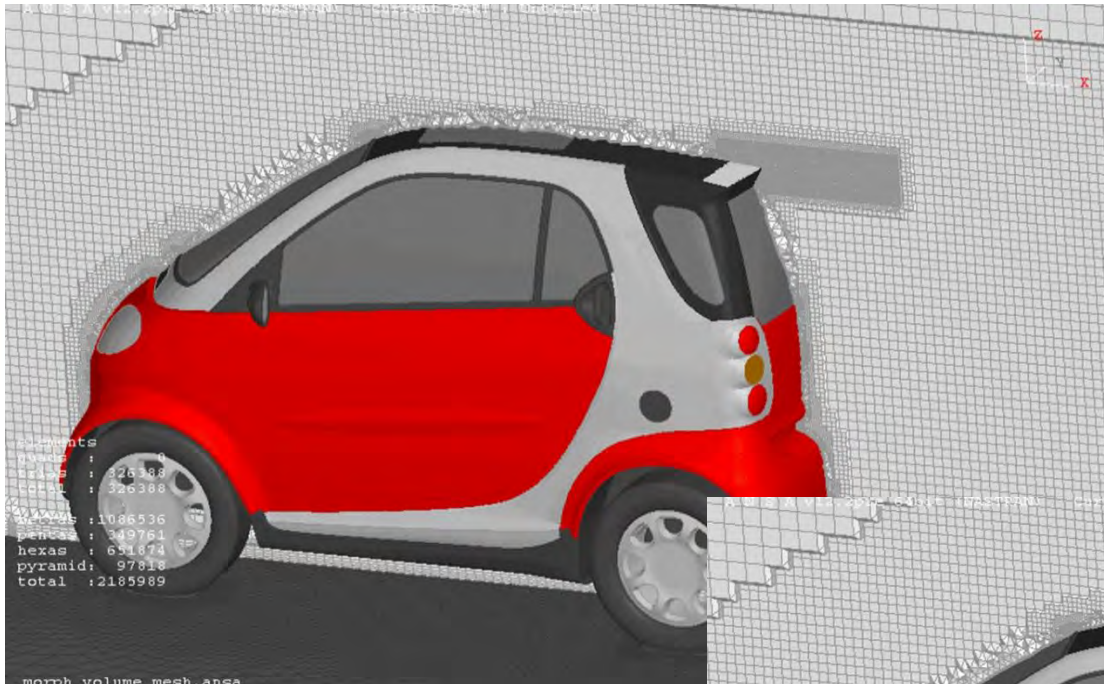


## Morphing – Rear windscreen morph

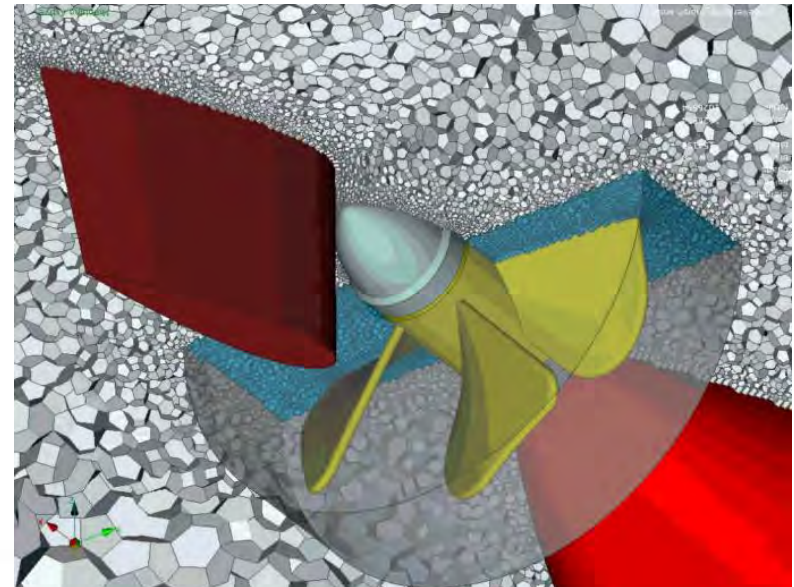
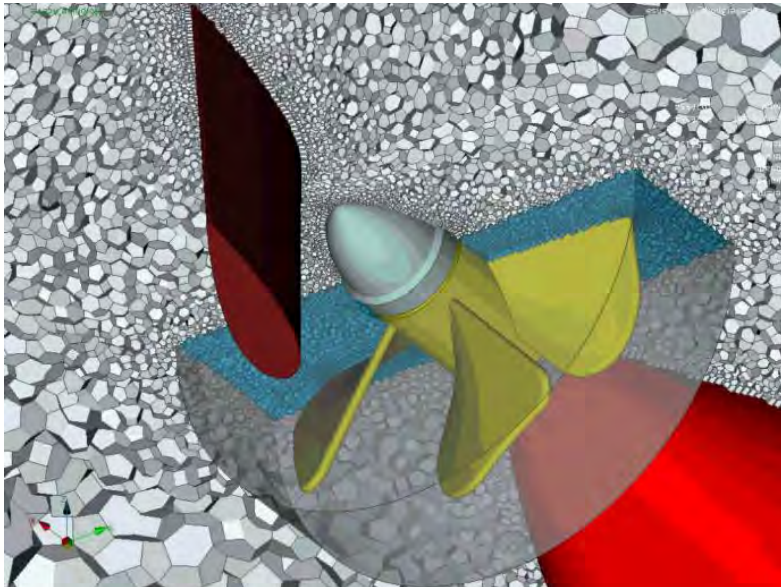
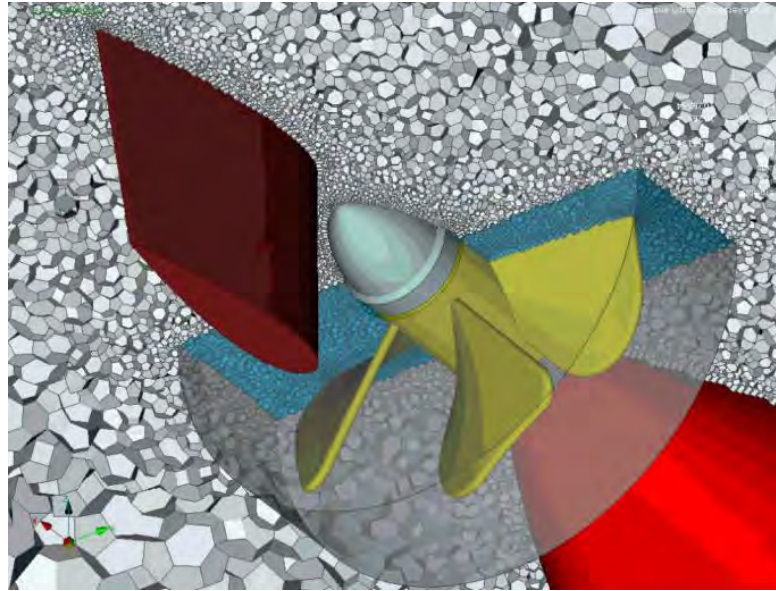


*By permission of Volkswagen AG*

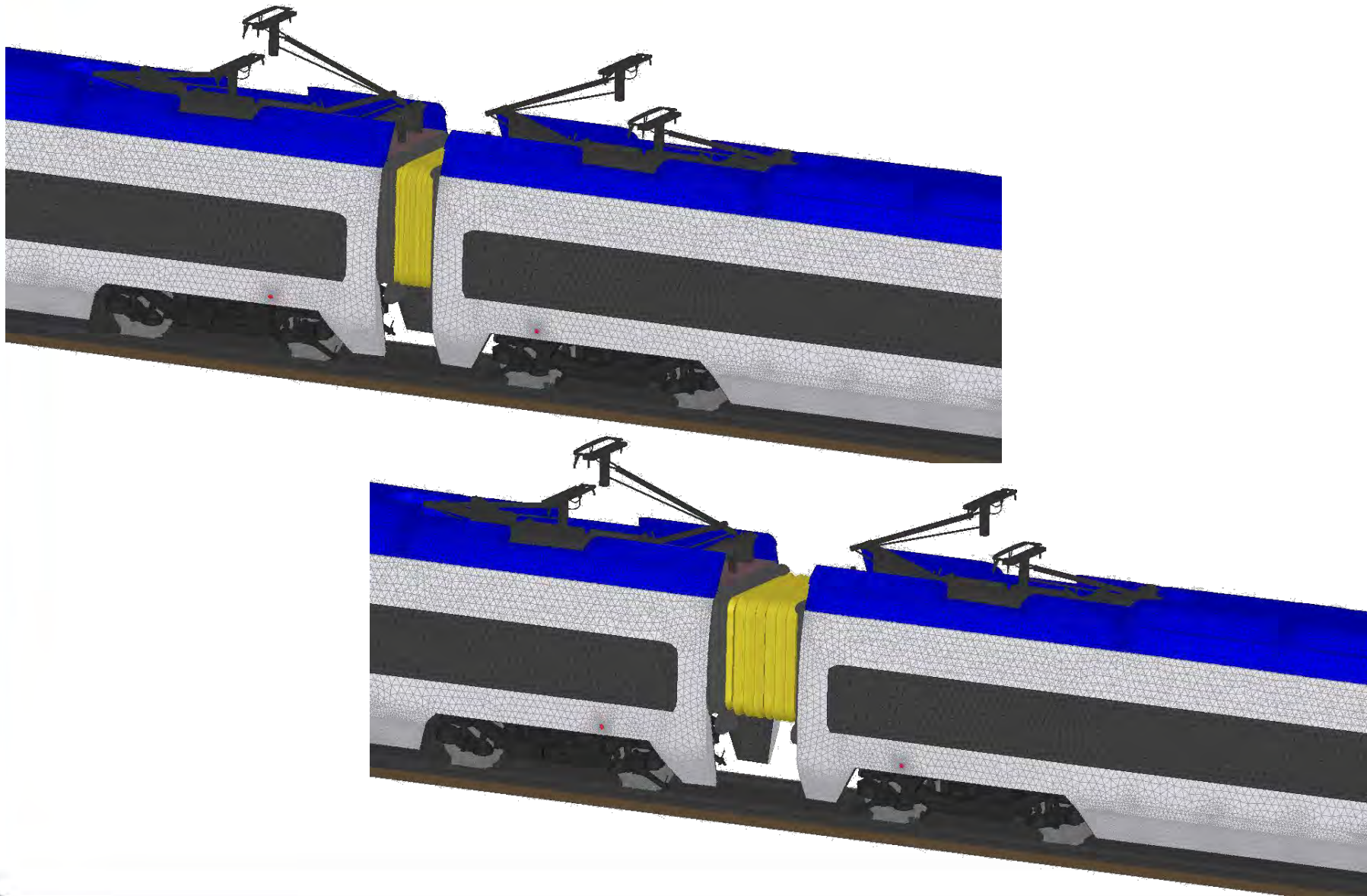
## Morphing – External Aero



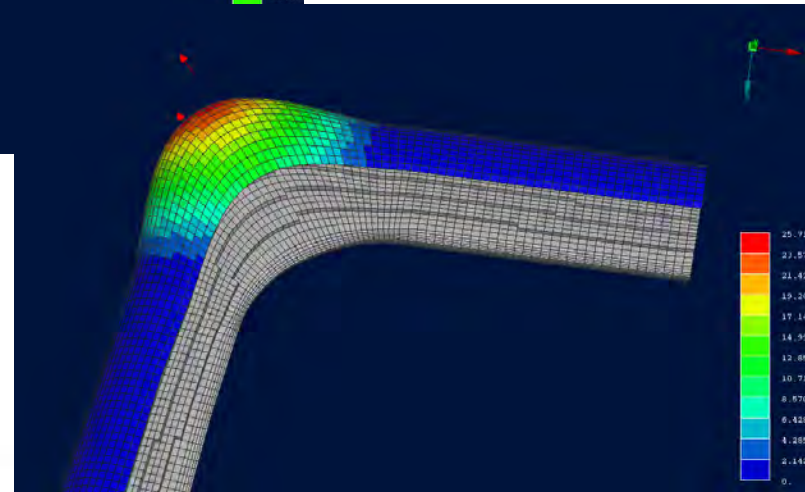
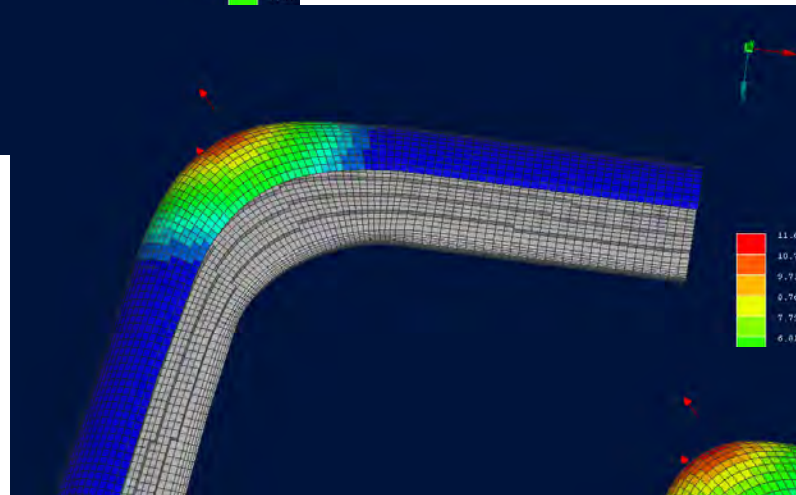
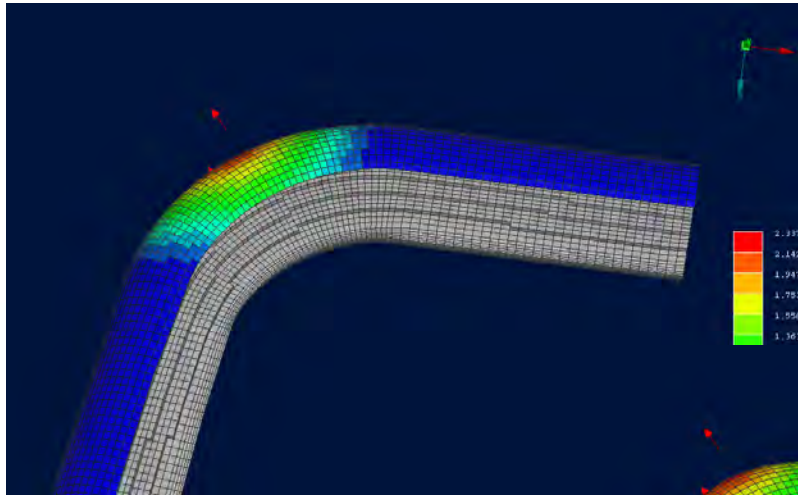
## Morphing – rudder angle change



## Morphing – External Aero – changing the gap of trains



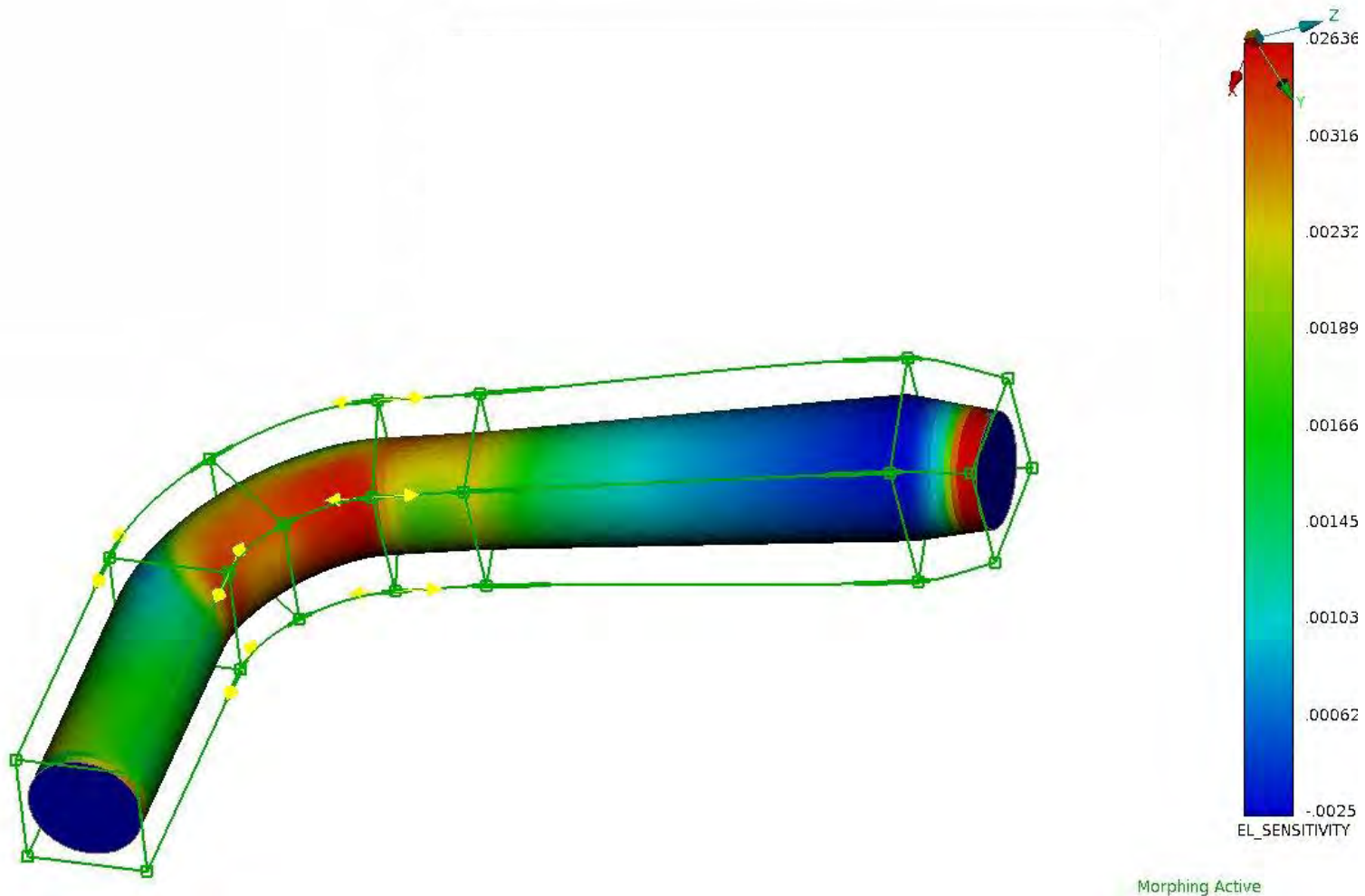
# Morphing – Scaling deformations





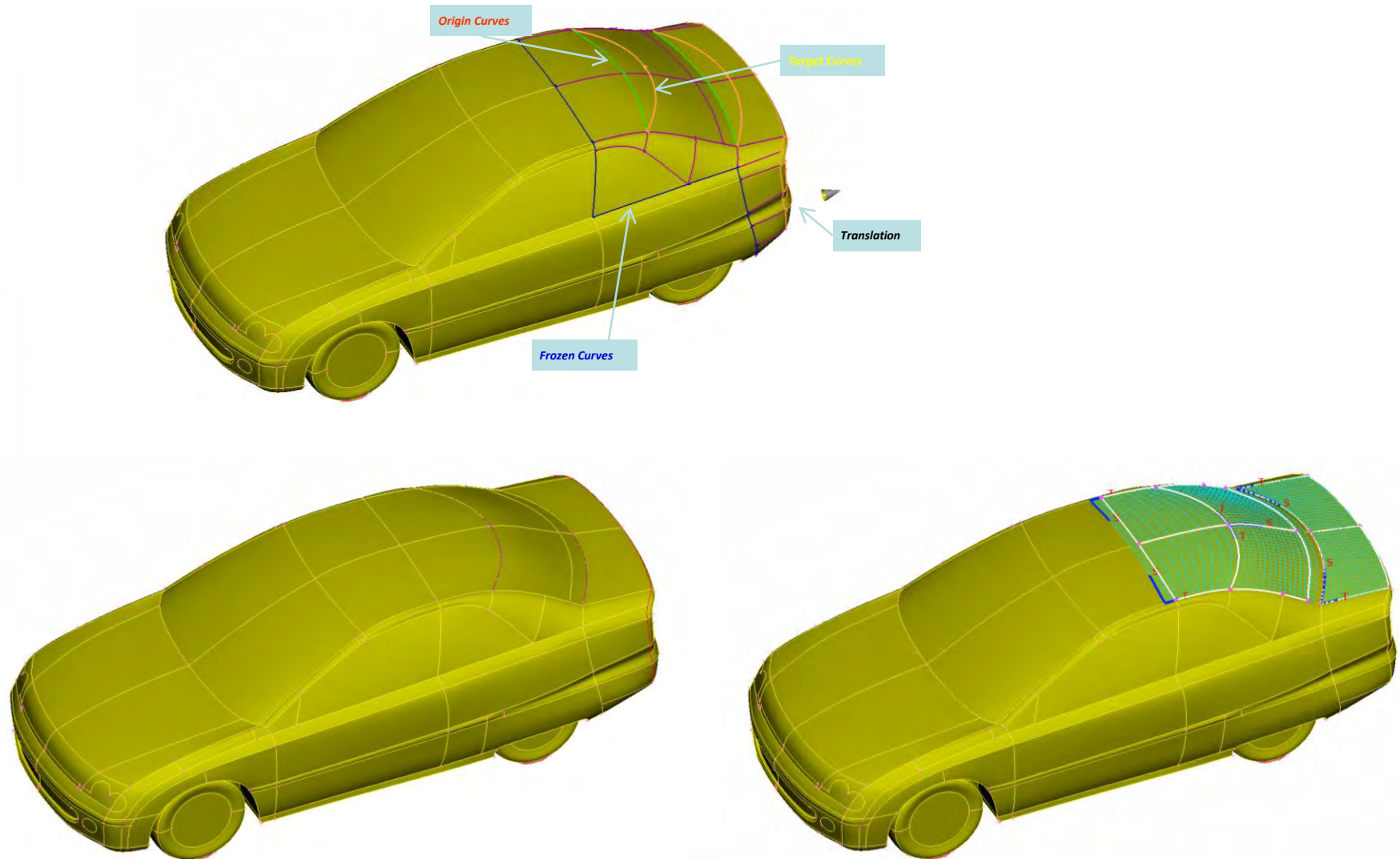
## Adjoint solver sensitivity based optimization

Sensitivity Based optimization with ANSA morphing boxes and parameters that control the motion of morphing points using solver calculated sensitivities



## Morphing of Geometry or FE without Boxes

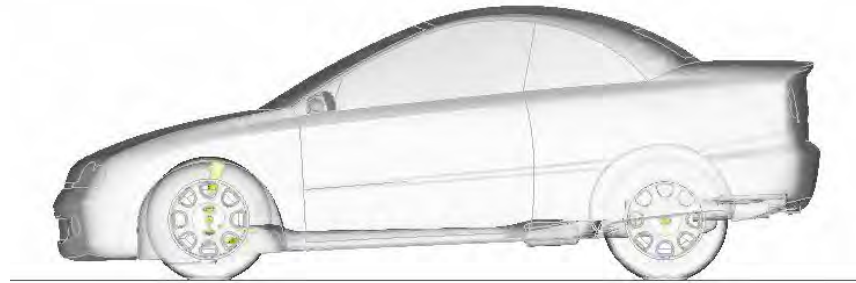
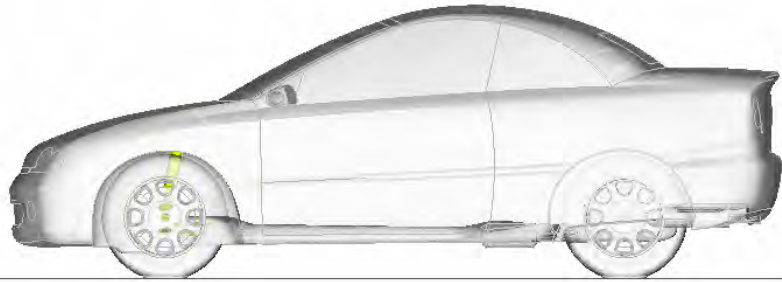
Combinations of snapping of model features to target curves and rigid transformations



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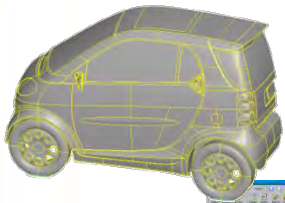
## Morphing of Geometry or FE without Boxes: changing the ride height setup

Positioning of the suspension setup without losing the watertight integrity and quality of the mesh

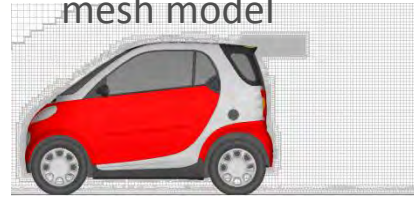


# Morphing – Optimization loop

original CAD



mesh model



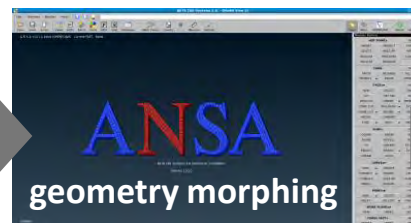
optimum  
p1 , p2 , p3



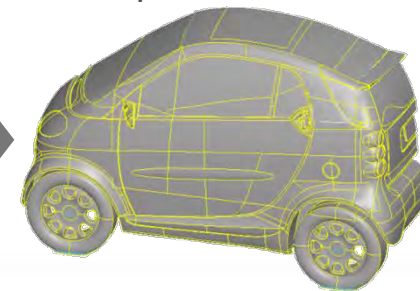
p1 , p2 , p3  
.....

OPTIMIZER

$C_L, C_D$



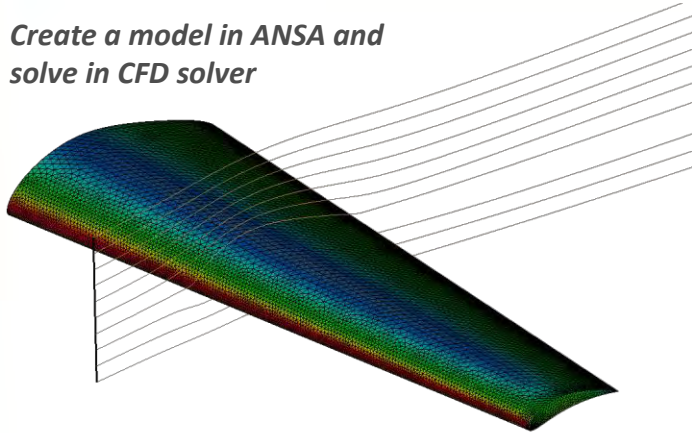
optimized CAD



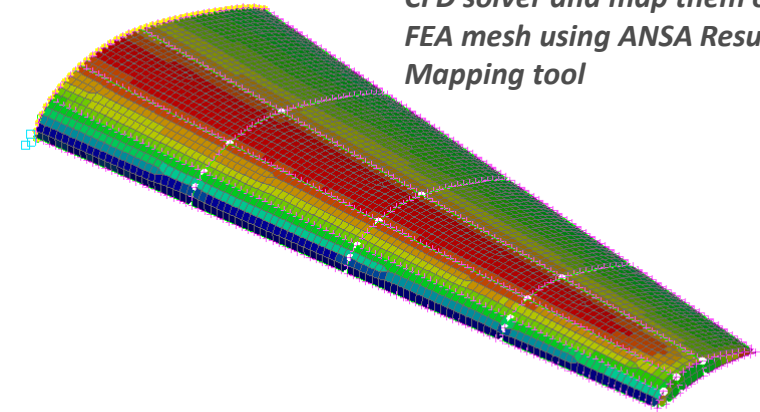
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# CFD – FEA two way coupling

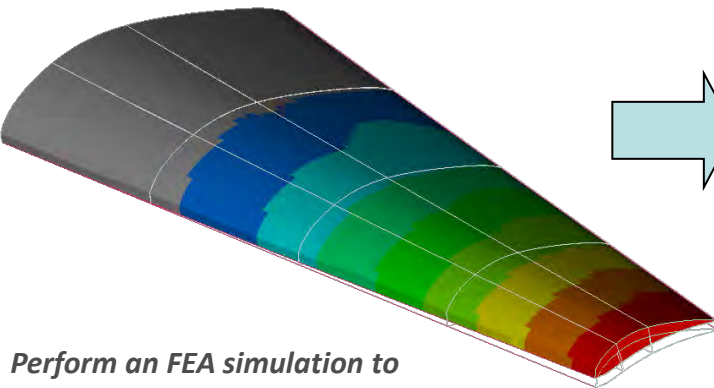
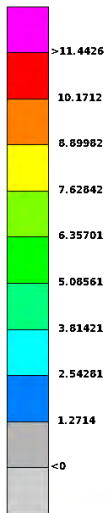
Create a model in ANSA and solve in CFD solver



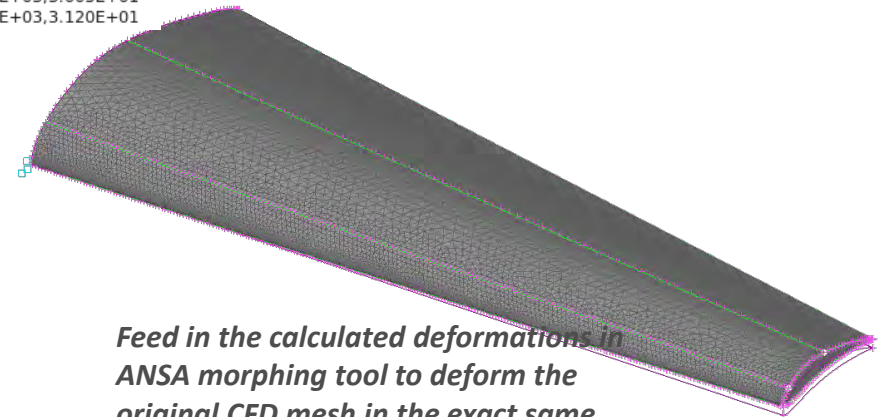
Extract the pressures from the CFD solver and map them on an FEA mesh using ANSA Results Mapping tool



```
ld,DispX,DispY,DispZ,PosX,PosY,PosZ
1,0.000E+00,0.000E+00,0.000E+00,2.668E+01,-7.650E-05,4.030E+01
2,1.947E-01,1.373E-01,7.191E+00,1.033E+02,-7.499E+02,4.637E+01
2,1.947E-01,1.373E-01,7.191E+00,1.033E+02,-7.499E+02,4.637E+01
3,3.121E-01,-1.953E-03,1.112E+01,7.755E+01,-1.000E+03,4.157E+01
3,3.121E-01,-1.953E-03,1.112E+01,7.755E+01,-1.000E+03,4.157E+01
3,3.121E-01,-1.953E-03,1.112E+01,7.755E+01,-1.000E+03,4.157E+01
4,3.487E-01,-1.965E-01,1.102E+01,4.613E+01,-1.000E+03,3.005E+01
5,3.450E-01,-1.737E-01,1.105E+01,5.671E+01,-1.000E+03,3.120E+01
```



Perform an FEA simulation to calculate the deformations



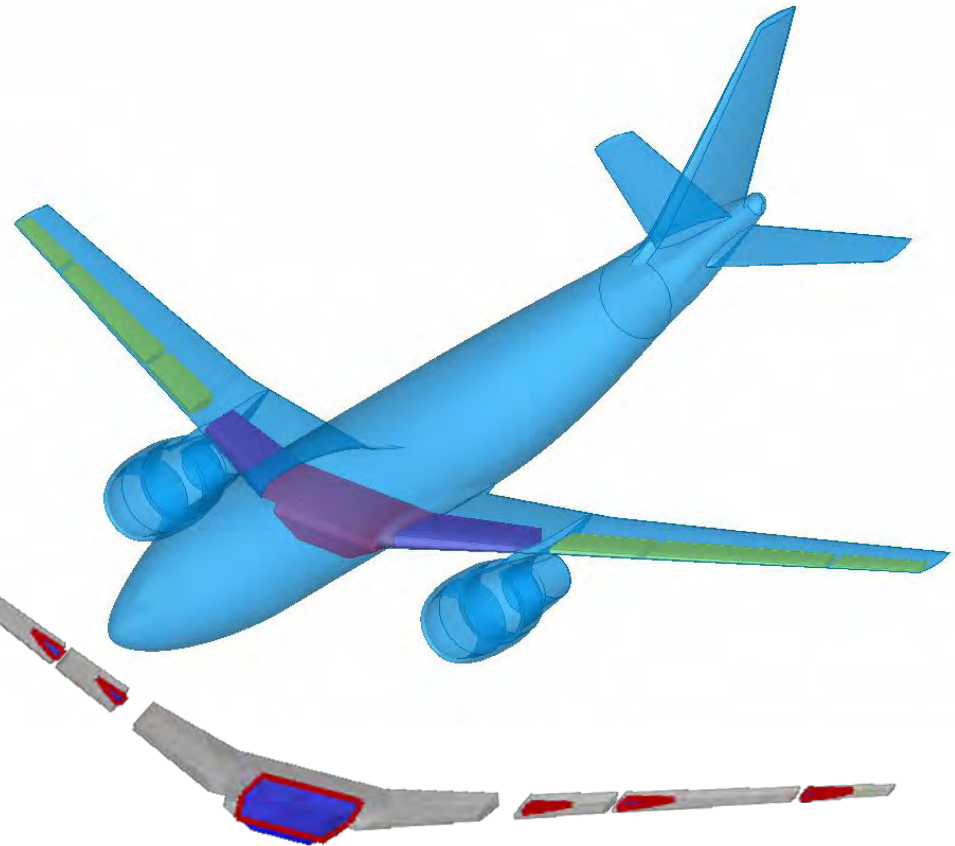
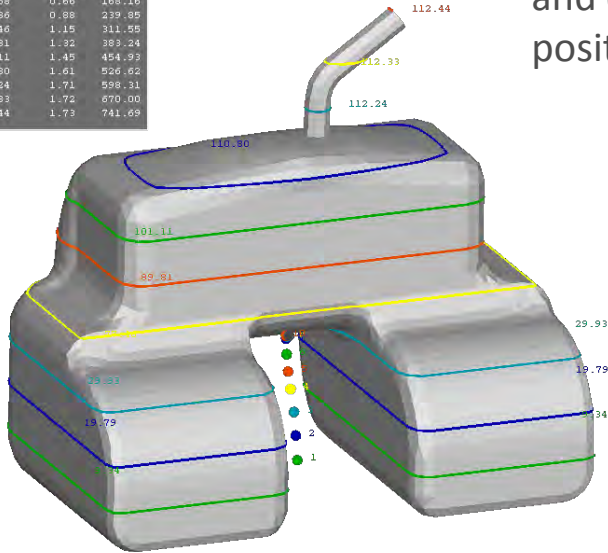
Feed in the calculated deformations in ANSA morphing tool to deform the original CFD mesh in the exact same manner

# Liquid Level Calculations

# Fuel and resting liquid calculations

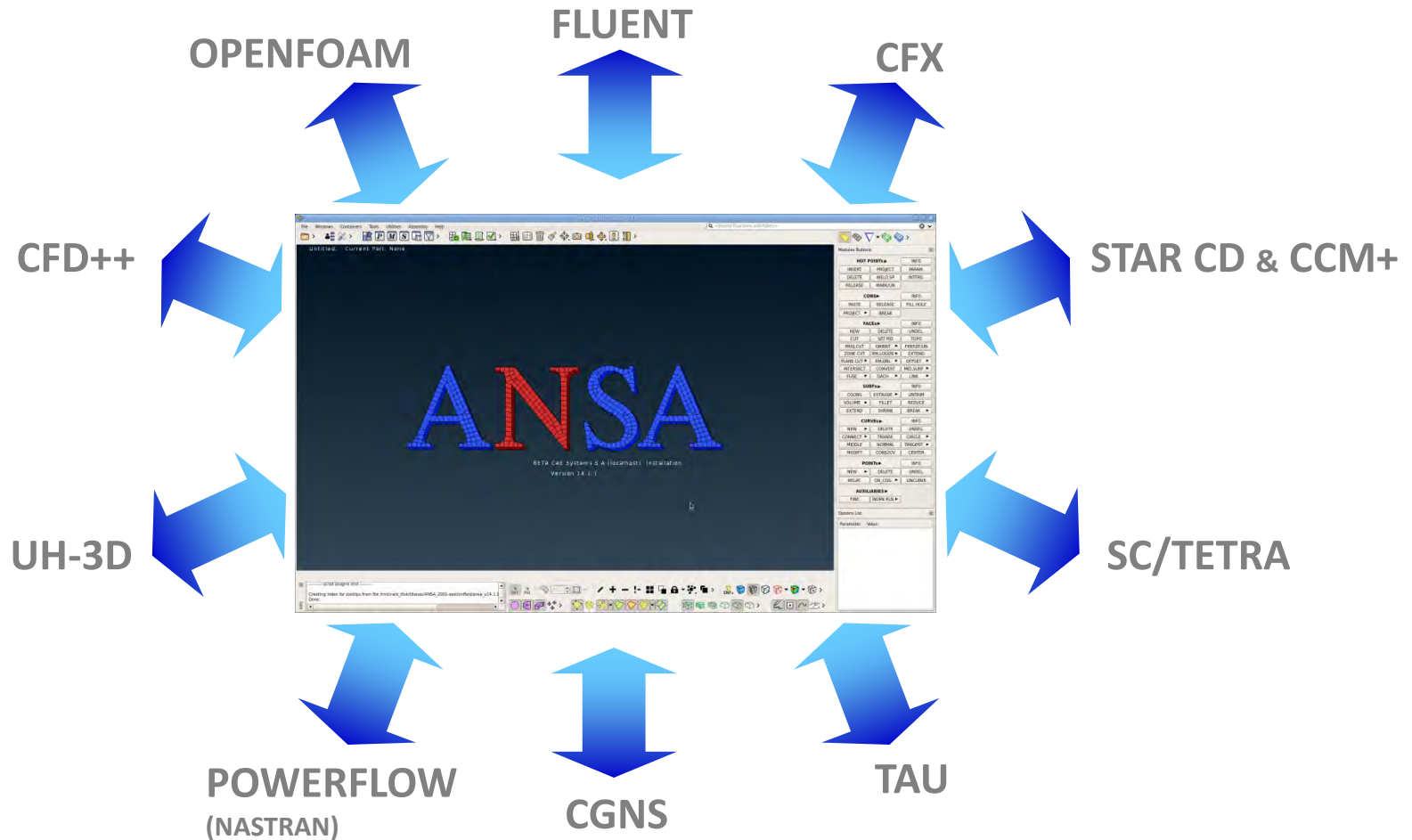
Calculation of liquid volume, levels and centre of gravity for various tank configurations and positions

Liquid	Wall	Height
18.68	0.44	86.47
39.58	0.66	168.16
59.86	0.88	239.85
77.46	1.15	311.55
89.81	1.32	383.24
101.11	1.45	454.93
110.80	1.61	526.62
112.24	1.71	598.31
112.33	1.72	670.00
112.44	1.73	741.69



Unused liquid traps

# One common pre-processing platform for several codes



NASTRAN, ABAQUS, ANSYS,  
RADTHERM, THESEUS-FE and more...





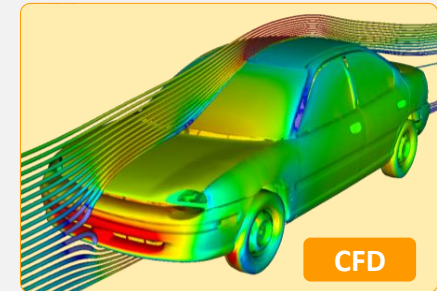
# Post-Processing

## About $\mu$ ETA post-processor

An advanced CAE post-processing tool for FEA and CFD analysis

Basic concepts and features:

- Powerful tools for 3D & 2D Post Processing for all disciplines
- High performance graphics
- Low memory footprint
- Best-in-class multi-model handling
- Generation of high-quality reports
- Outstanding automation capabilities



### From solver results to report

- 3D post processing
- 2D post processing
- User calculations
- Correlation studies
  - Reporting
- Automation tools



## Supported formats

### Anslys Fluent

- Fluent 2d and 3d \*.msh, \*.cas, \*.dat
- CFDpost compatible \*.cdat

### OpenFOAM

- ascii/binary data, partitioned results
- FEMZIP file support

### StarCCM+

- \*.ccm and \*.sim files

### CFD++

### SC/Tetra

### Anslys CFX

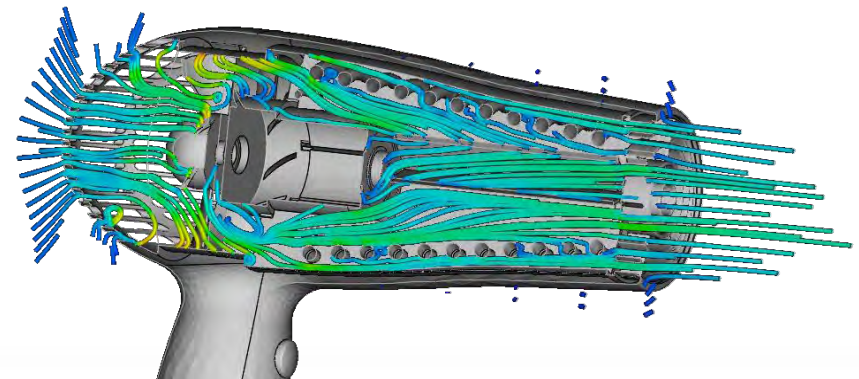
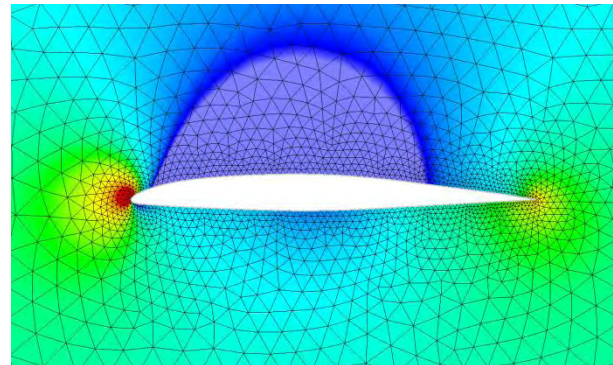
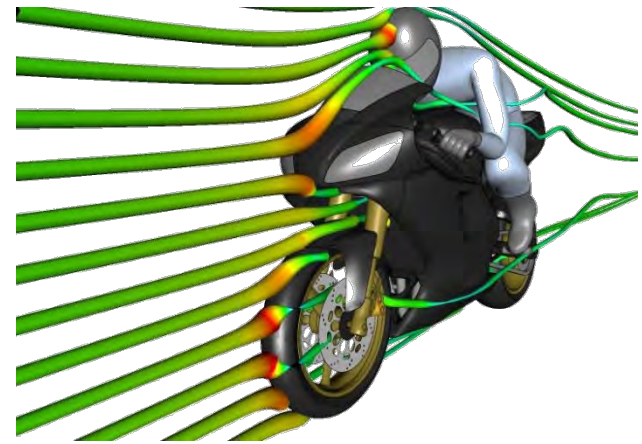
### Ensign

### Tecplot

### Fieldview

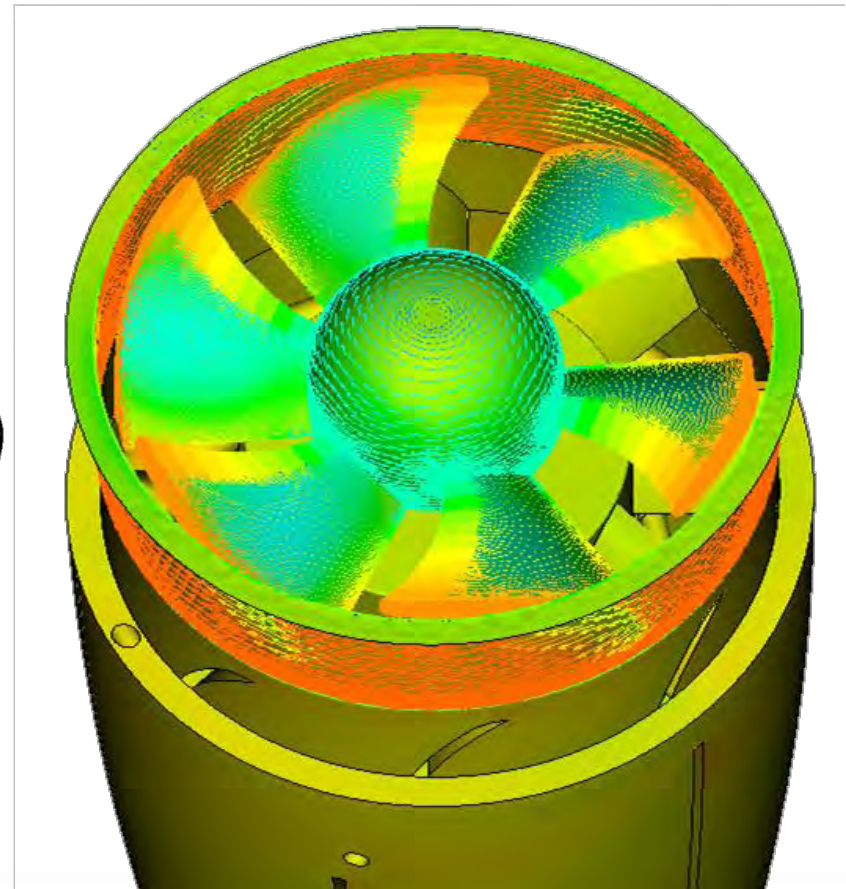
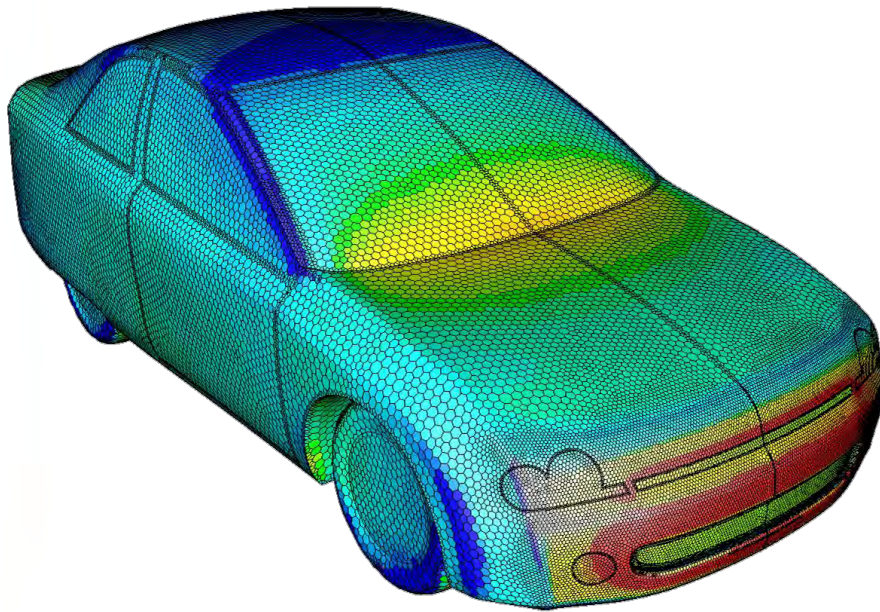
### Radtherm

### Theseus- FE

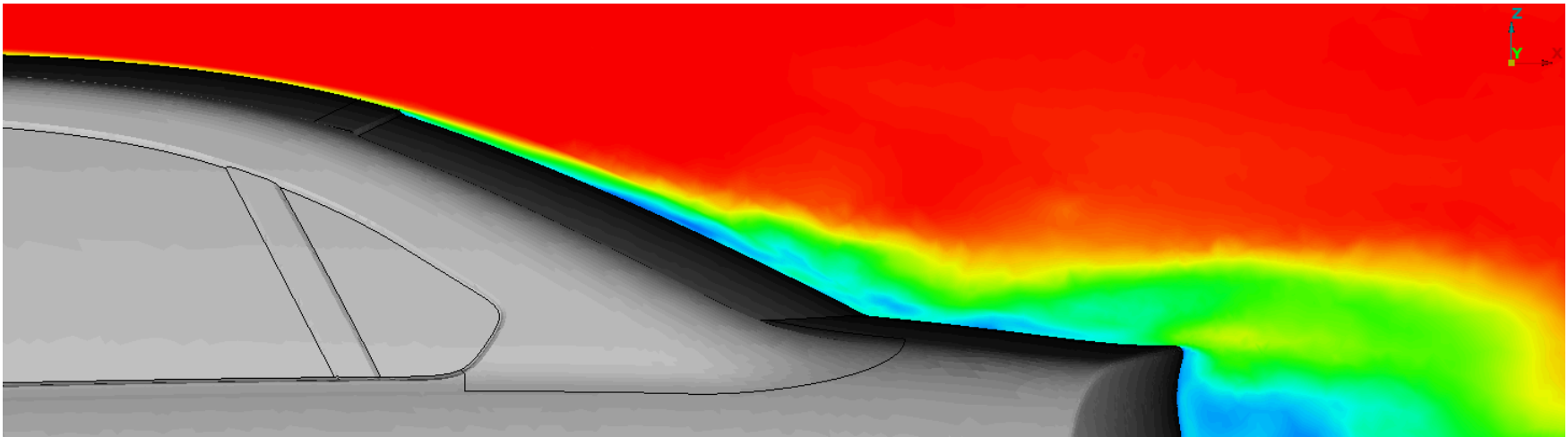
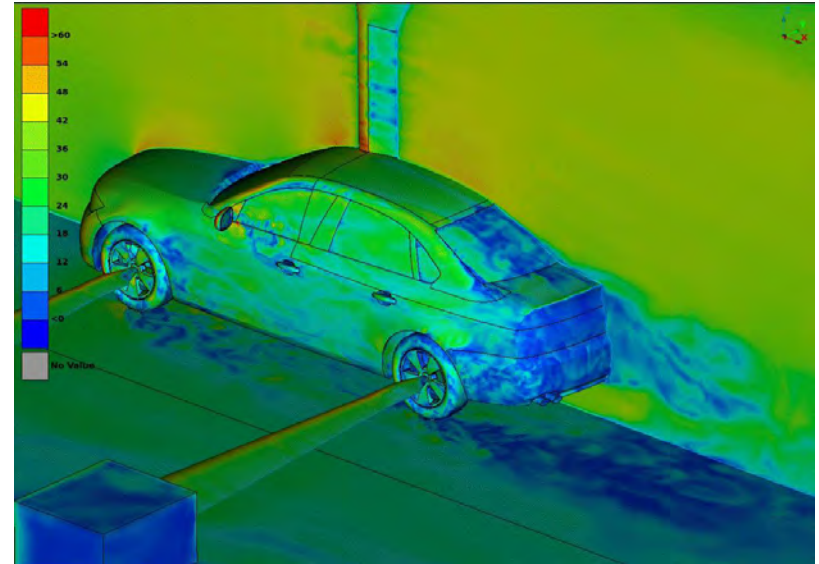
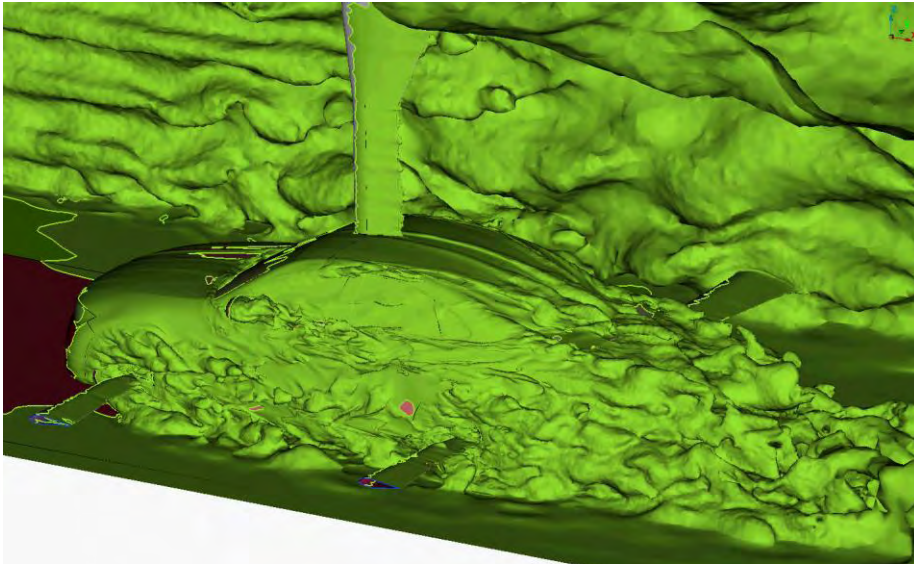


## Supported Features

- Standard and Polyhedral elements
- Steady state and transient results
- MRF (multiple reference frame) zones and moving mesh

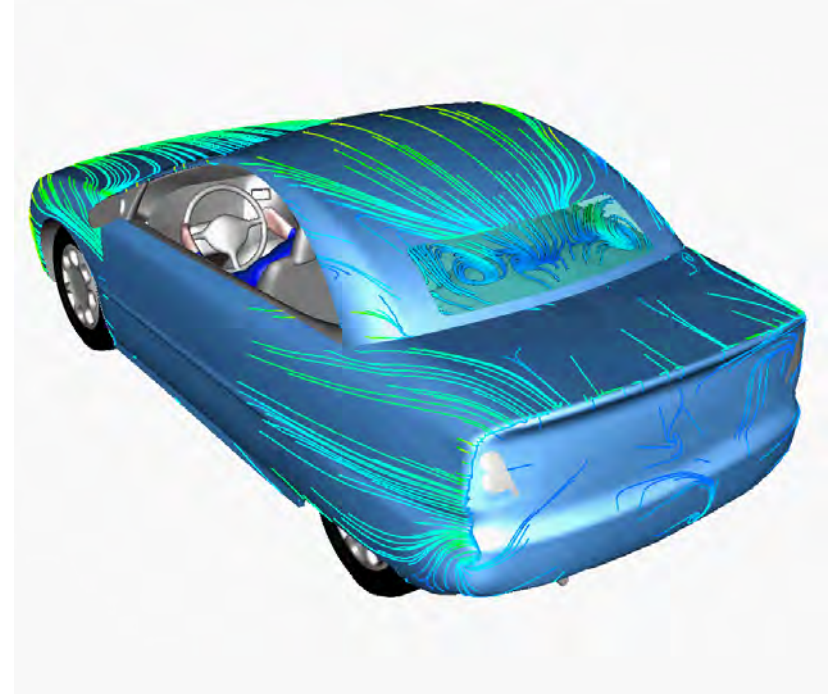
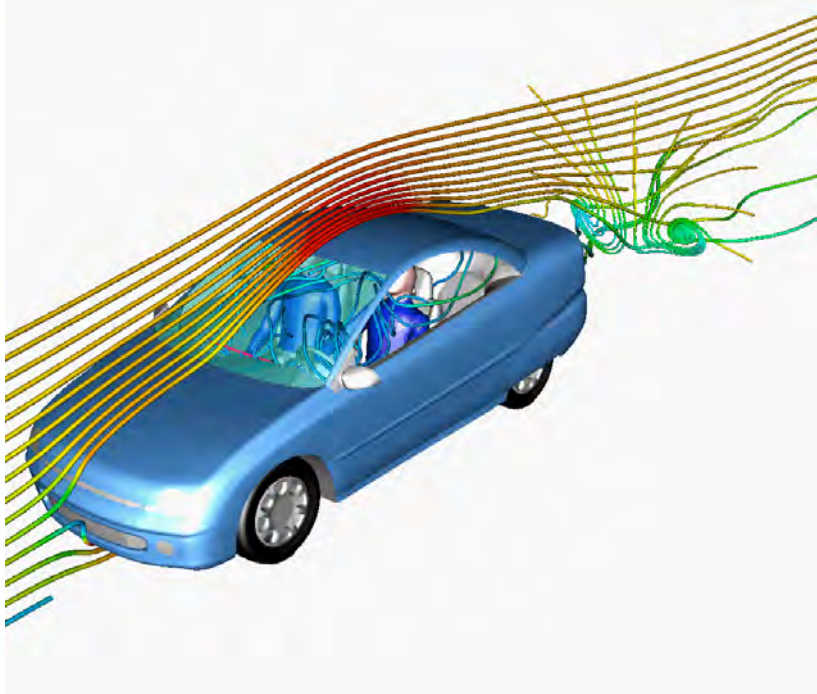


## Visualization of Cut Planes and Iso-Surfaces

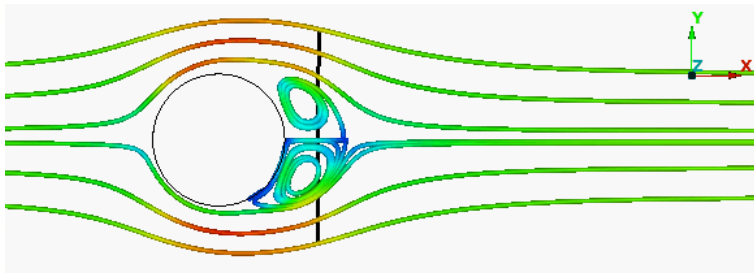


*DrivAer model courtesy of Technical University of Munich*

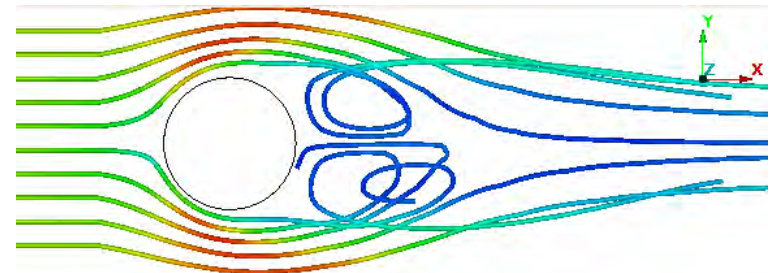
## Visualization of Streamlines and Oil-flow paths



### Creation of Streamlines and Pathlines for transient analyses

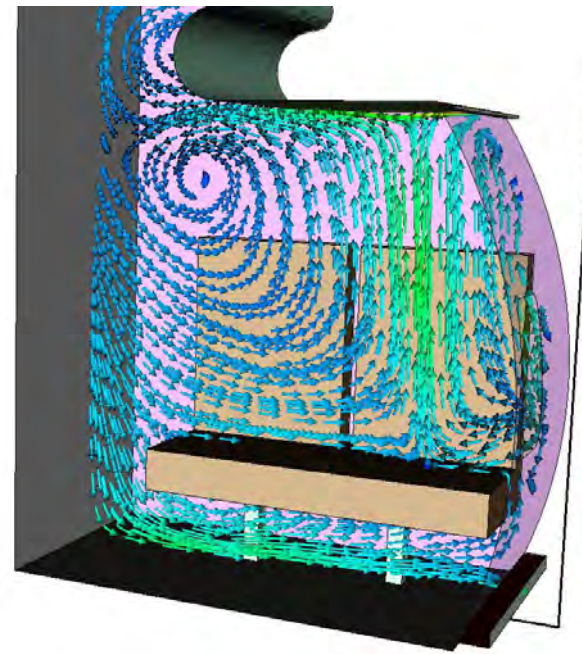
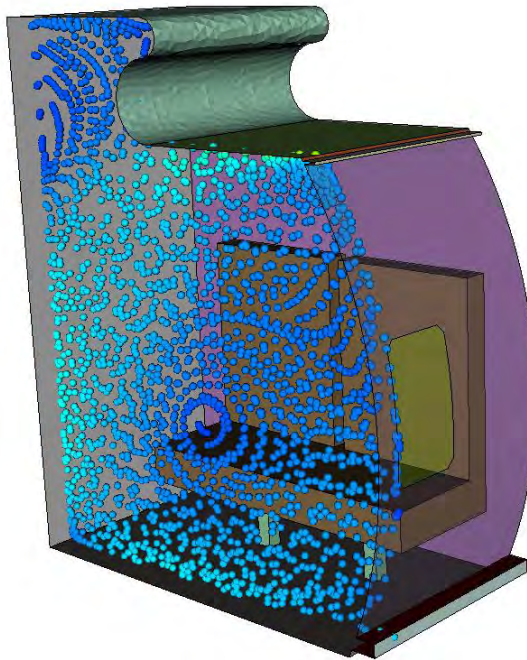
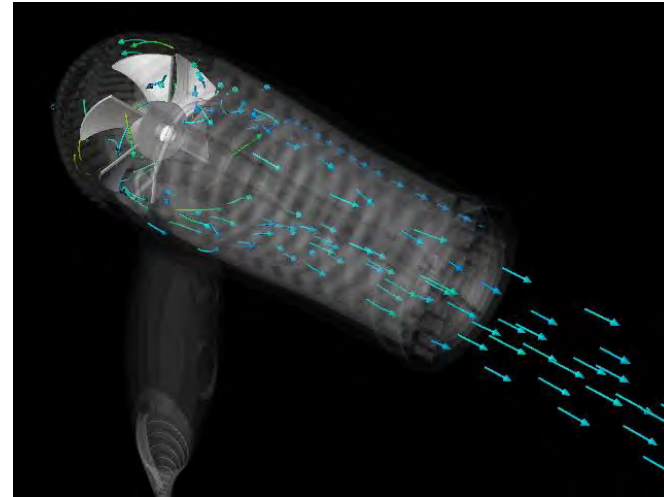
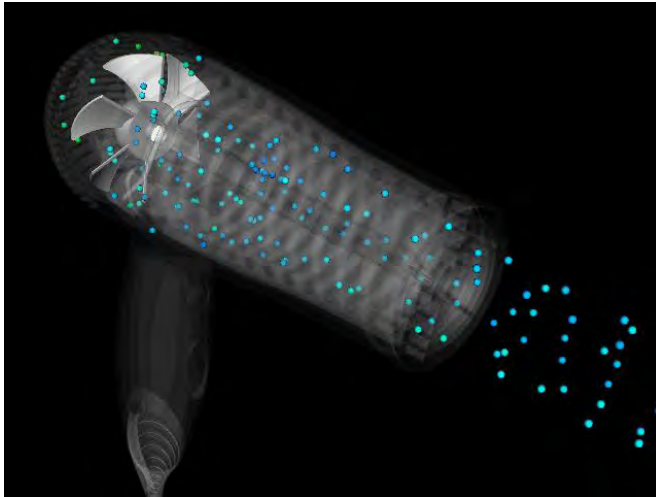


Transient Streamlines



Pathlines

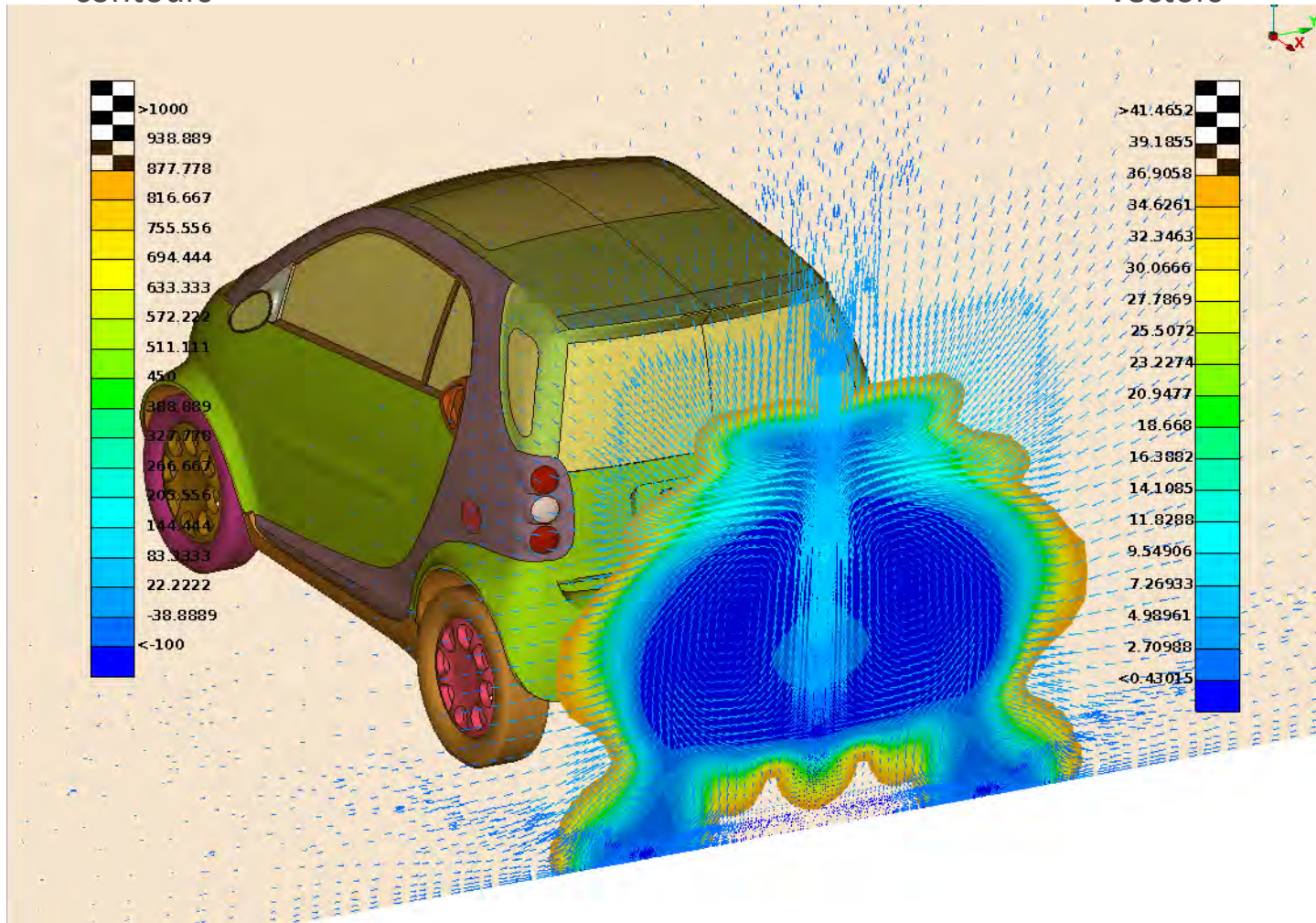
## Multiple streamline visualization options



# Double fringe bars for simultaneous display of contour and vector data

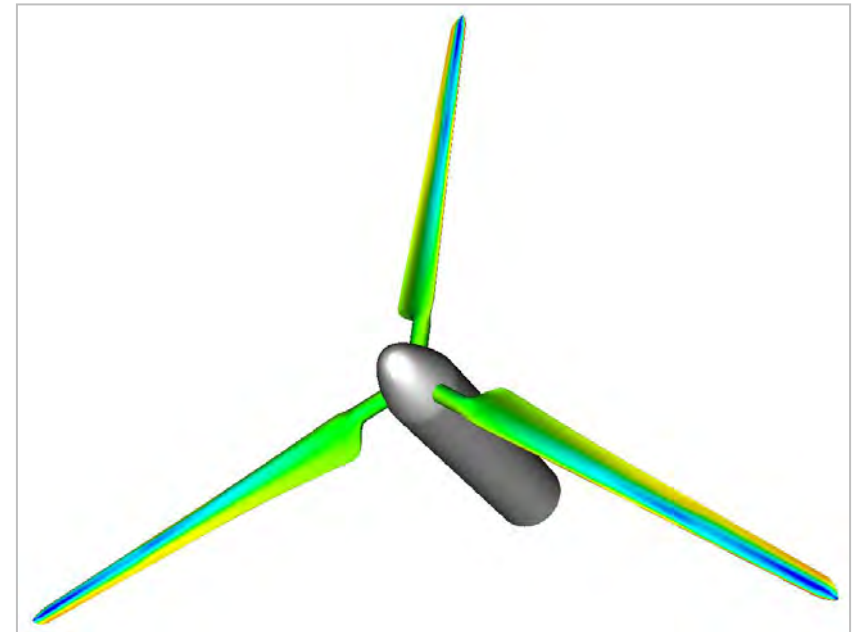
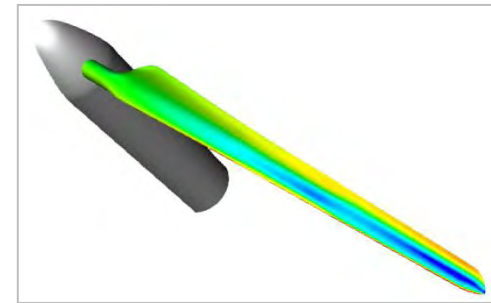
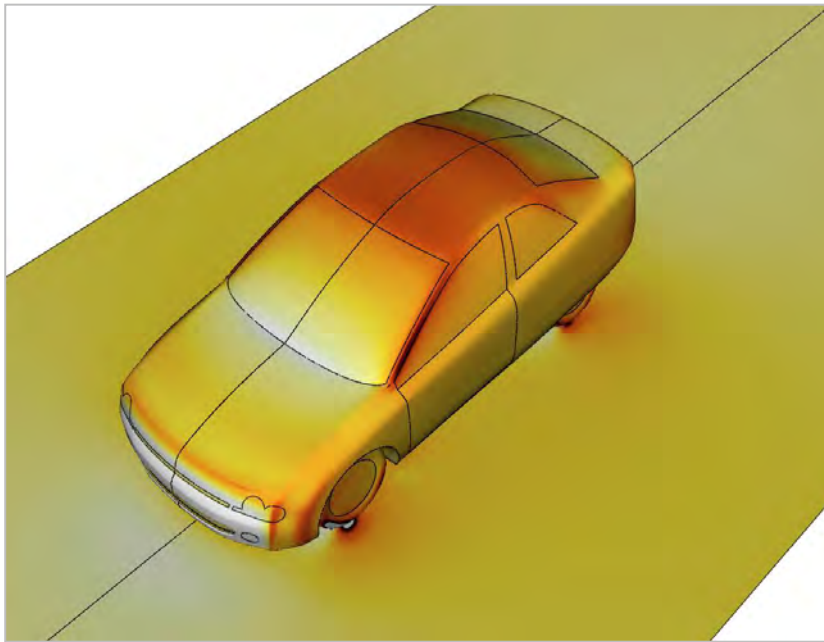
Total pressure contours

Velocity vectors



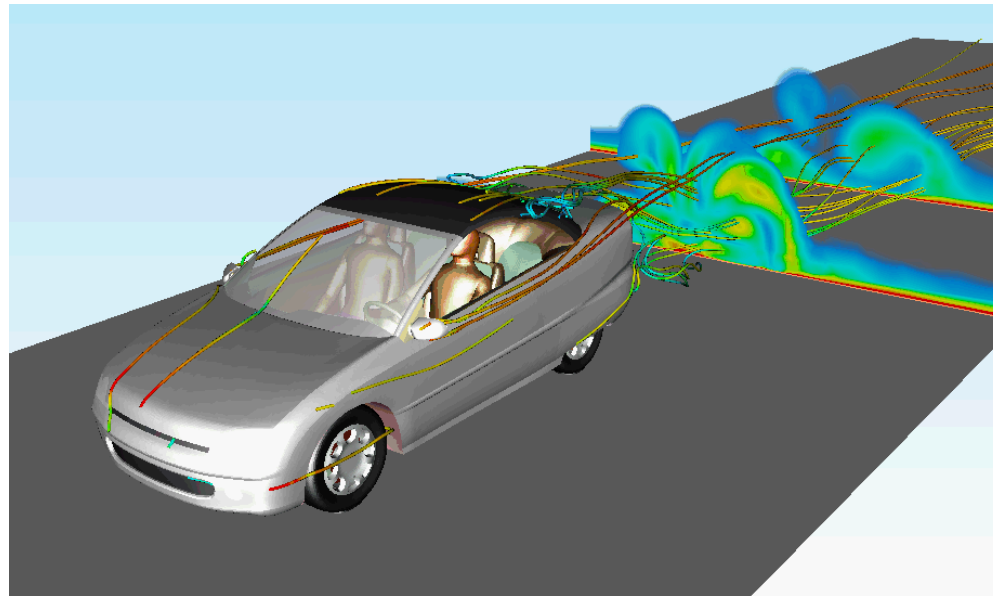


## Symmetric and periodic display of results

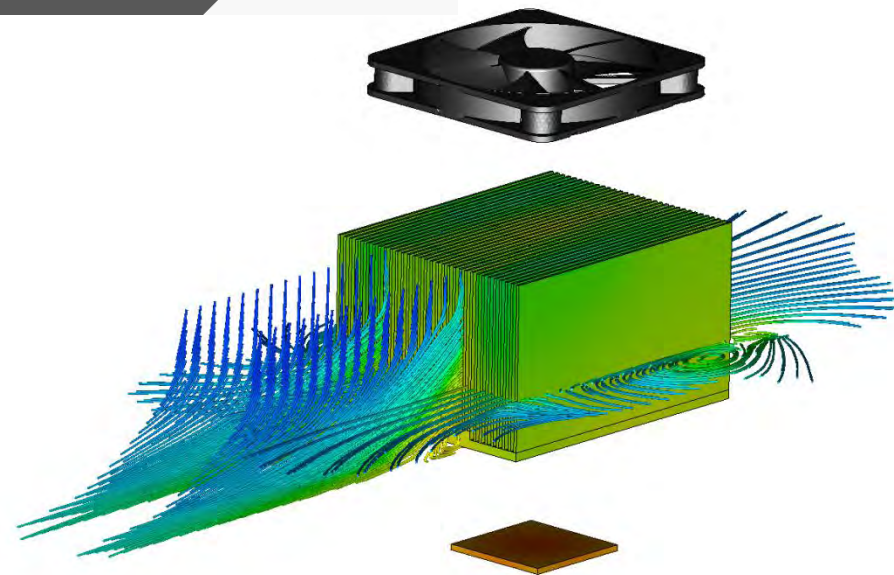
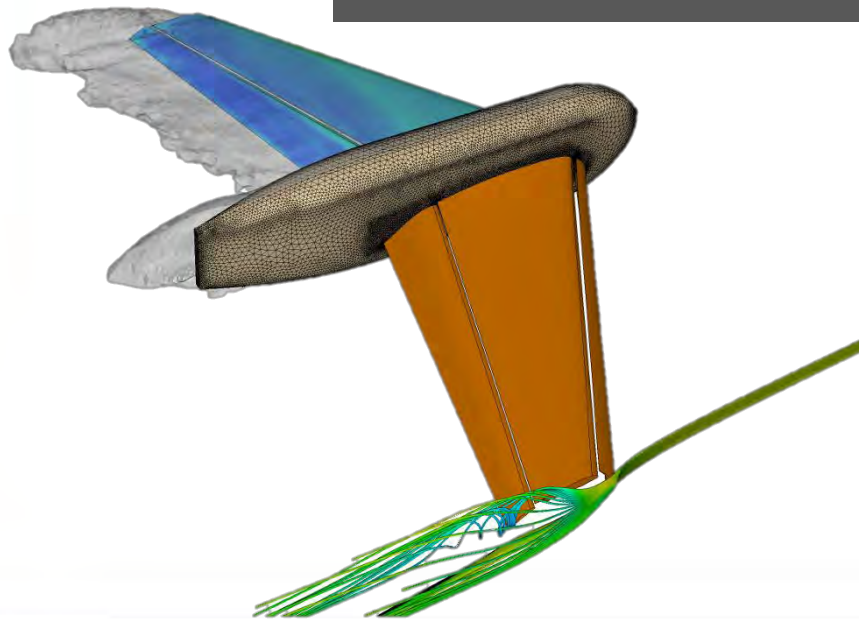


## Image and video output in numerous formats

- JPEG
- PNG
- TIFF
- BMP
- GIF
- PS
- EPS



- MPEG
- AVI
- Animated GIF



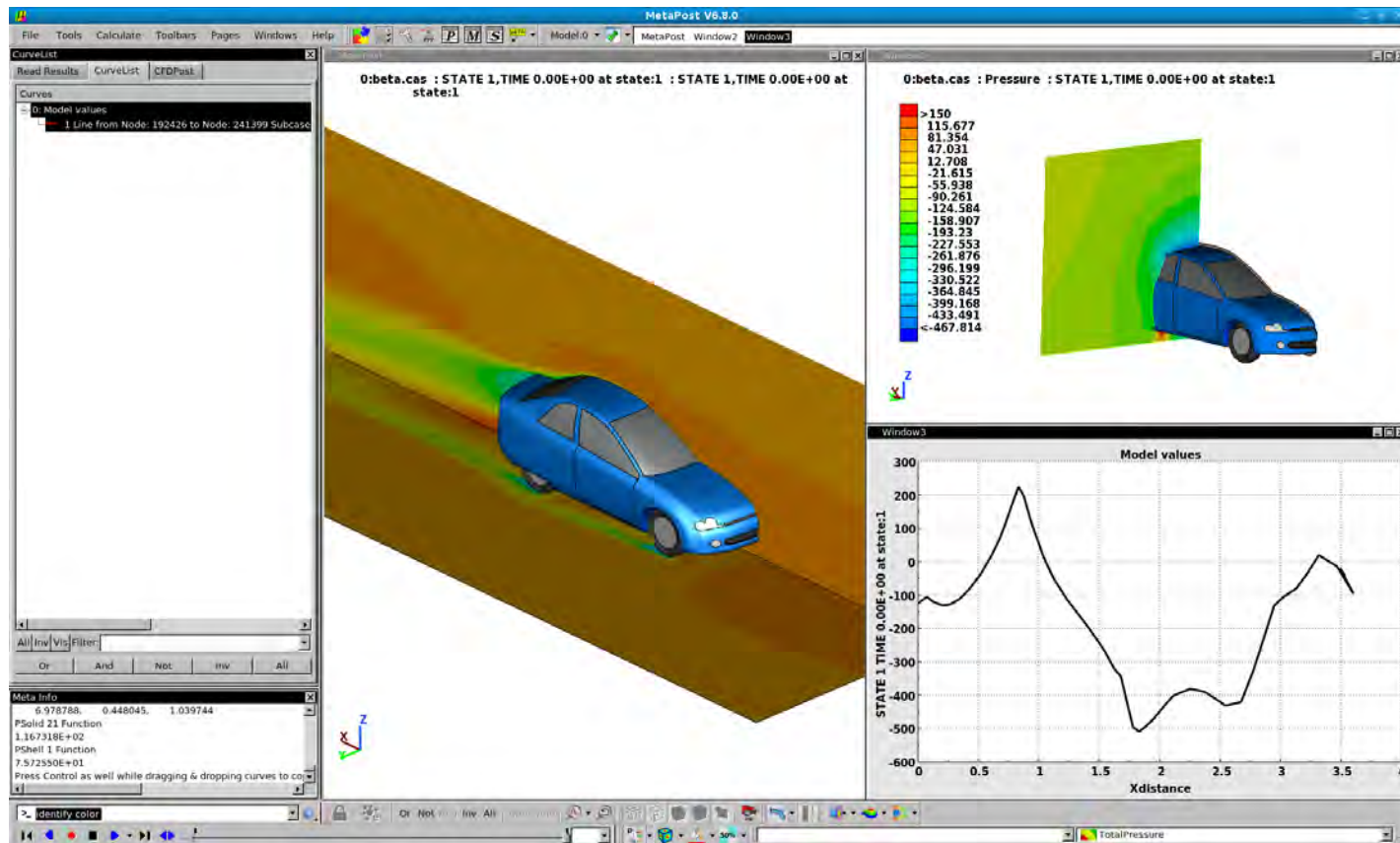
## Camera Match tool

Correlate physical images and videos with CFD results



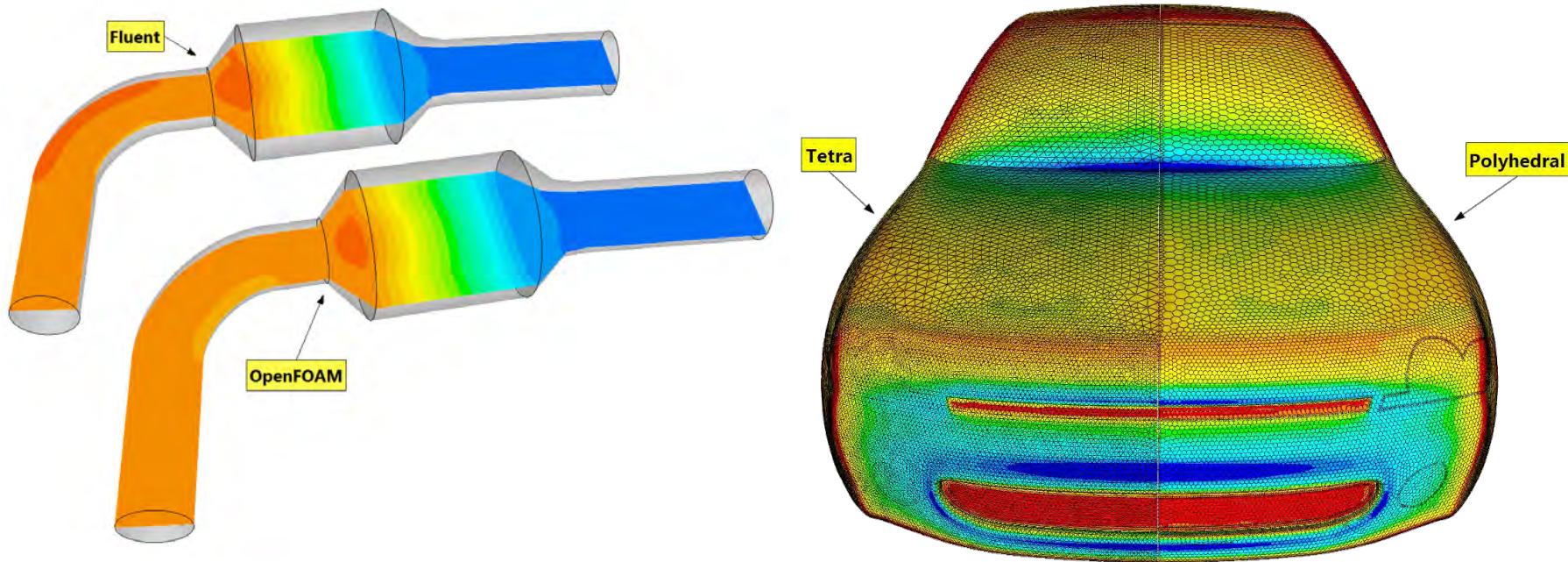
## Multi Windows

- 3d and 2d windows
- Setup styles and entities visibility per window
- Different models can be placed in one or more windows



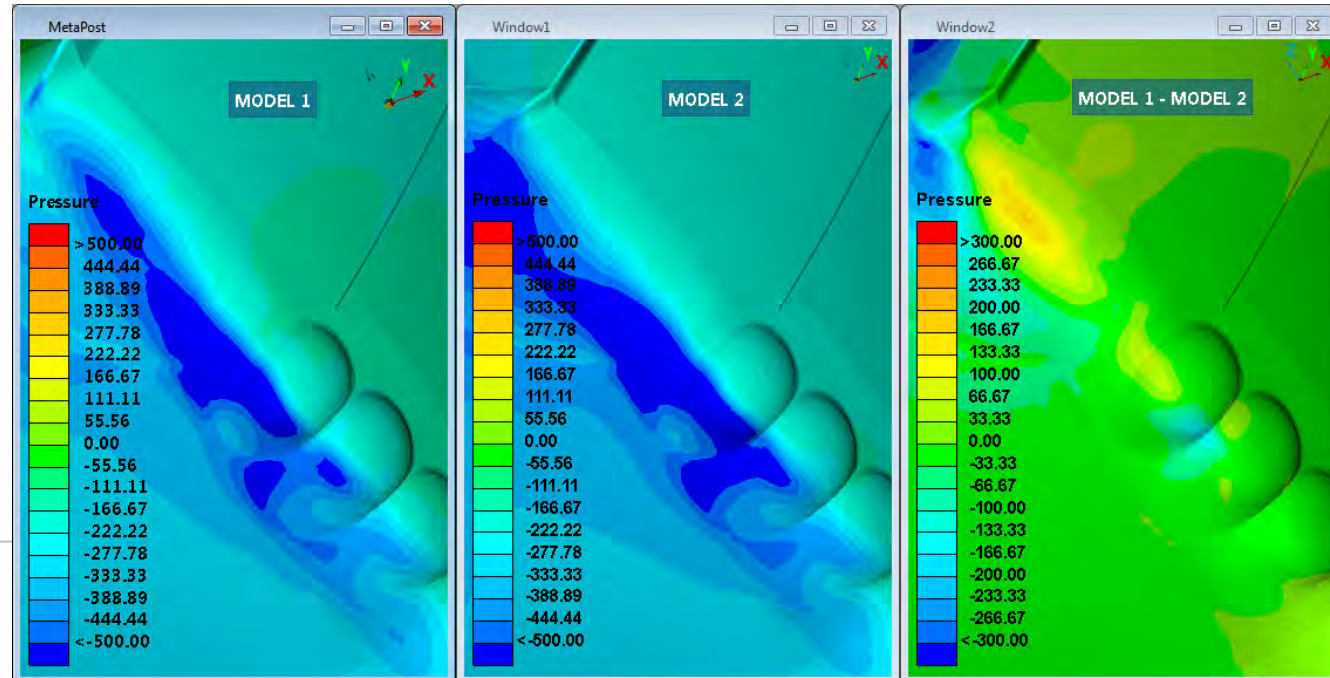
## Model comparison

Load multiple models and compare cases from different solvers, meshes, physical models and numerical setups

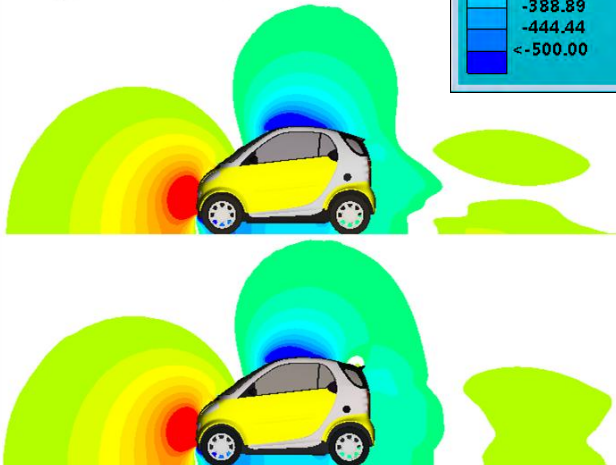


# Model Comparison

Map results from one model to another and calculate their differences



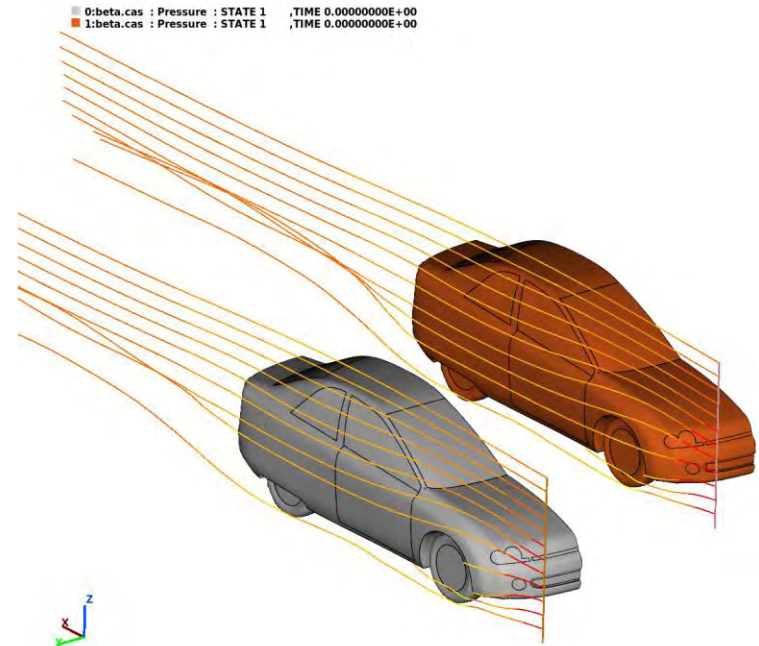
0:morphed\_spoiler\_up.cas : STATE 1 ,TIME 0.00000000E+000  
1:morph\_down.cas : STATE 1 ,TIME 0.00000000E+000



## Model Overlay

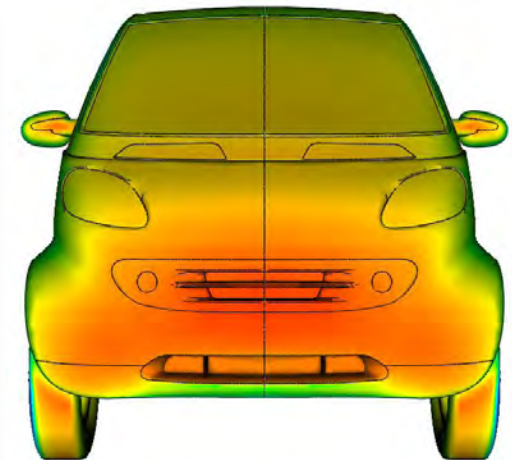
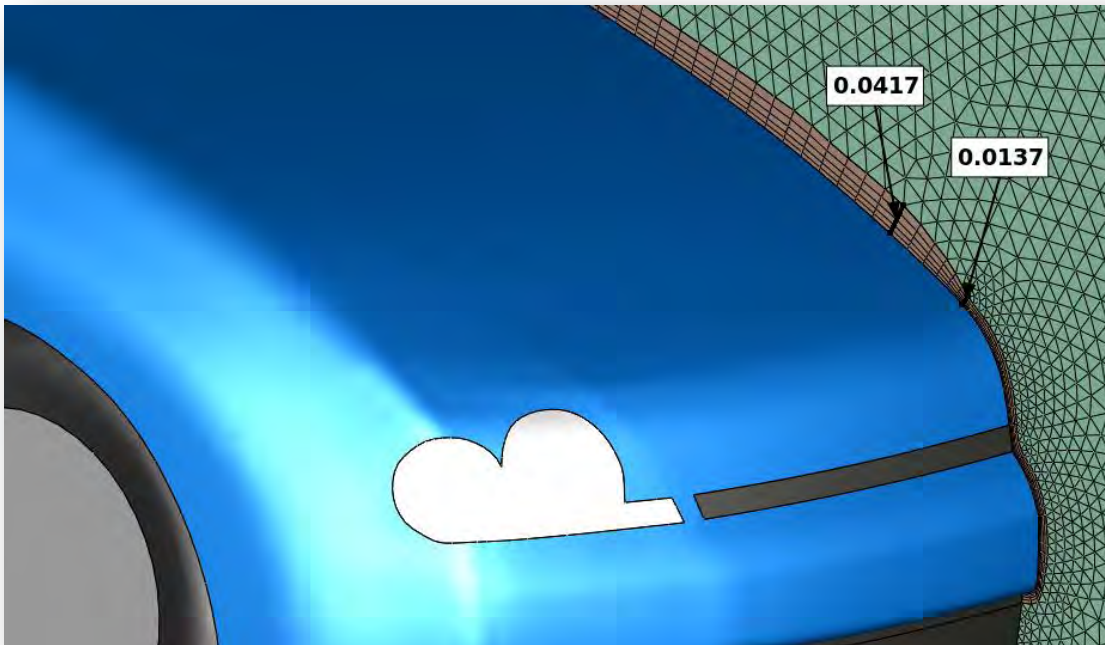
Overlay and compare multiple iterations of data

- Set the respective files or paths of the second model
- All new data are automatically overlaid on the respective windows



## Query of model dimensions

- Measurement of distances
- Projected Area measurement

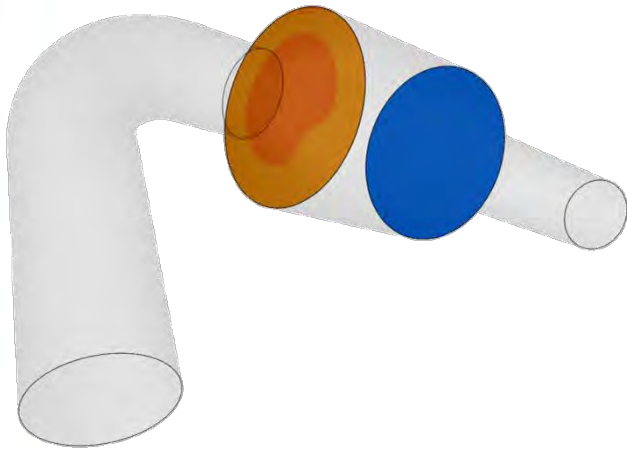


Projected Area: 1.884



## Calculations

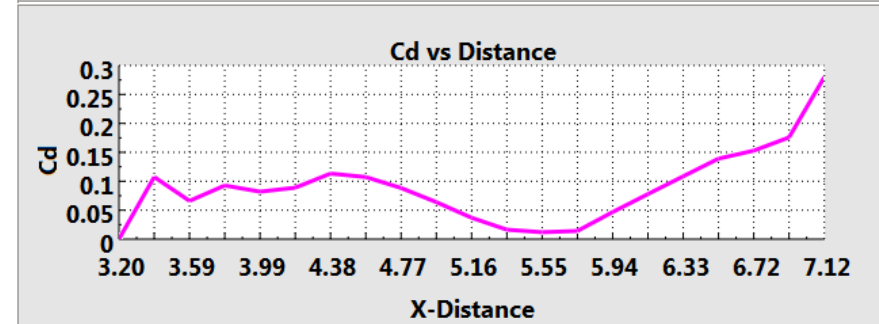
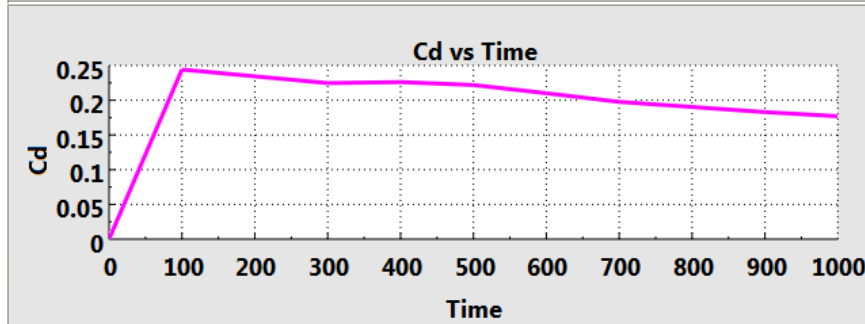
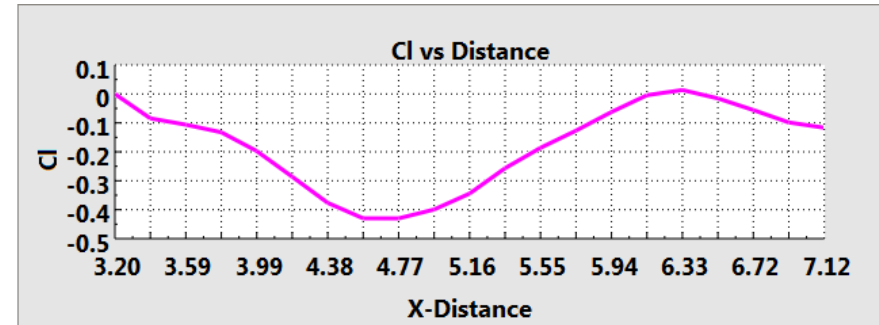
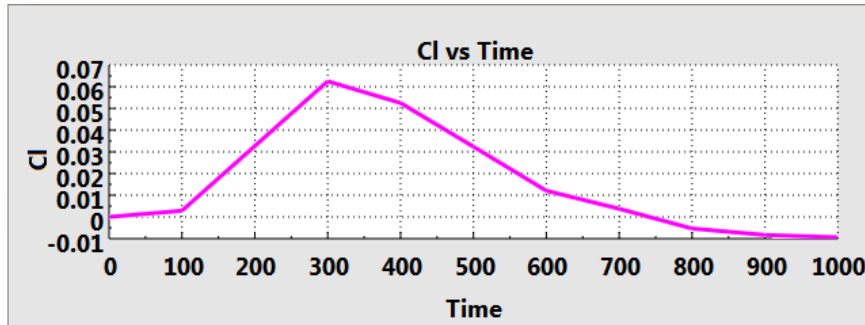
- Drag/Lift Forces and Coefficients
- Moments
- Surface/Volume integrals
- Results Sum, Average, Difference
- Pressure Drop example:



Surface Integrals		
Pid	Name	Area Weighted Average
2	interior_downstream_cat	1187.68000
3	interior_upstream_cat	17057.3000
Sum		18244.98
Avg		9122.49
Diff		15869.62

# Plots

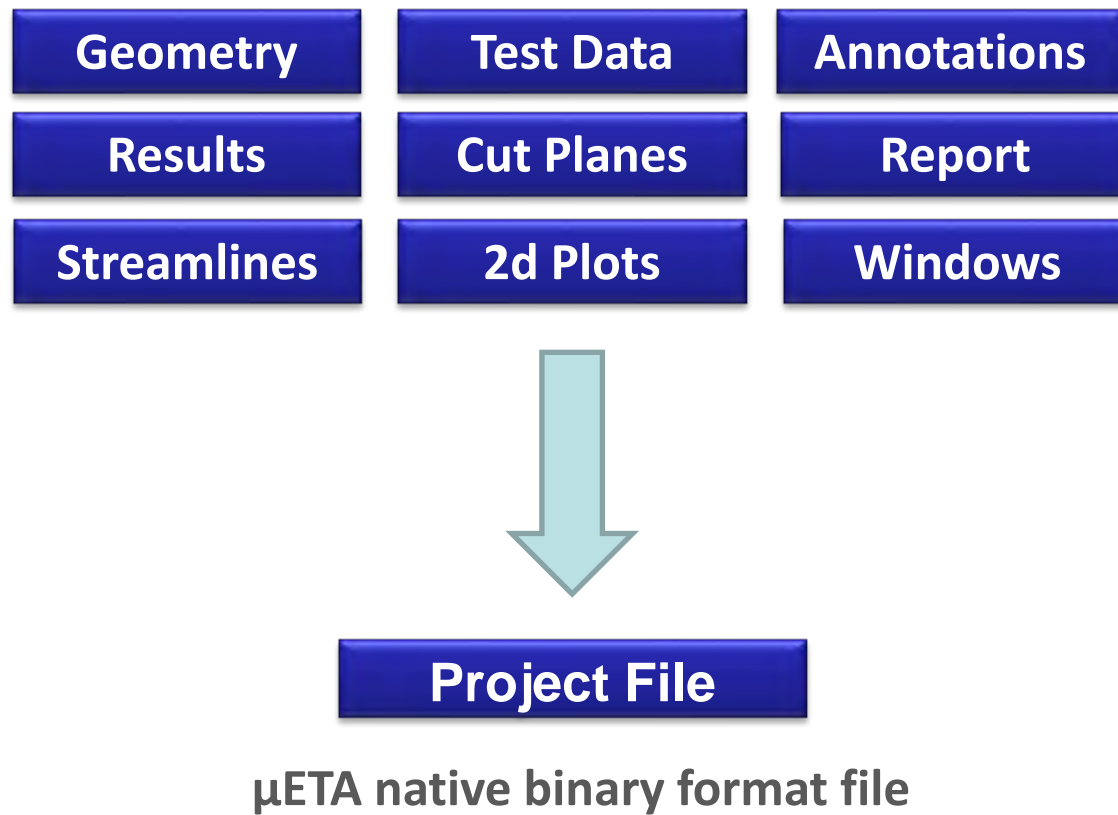
Cd/Ci plots vs Time/Distance



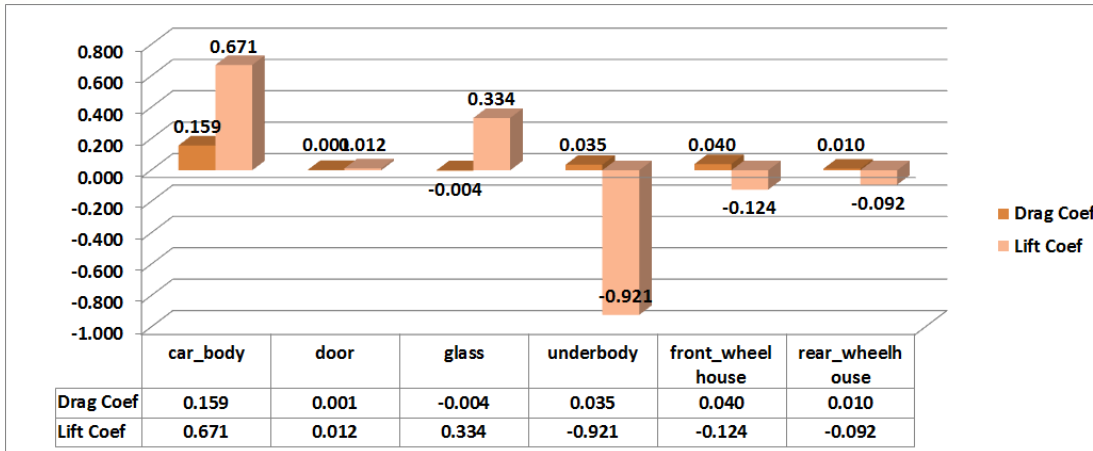
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## Project Files

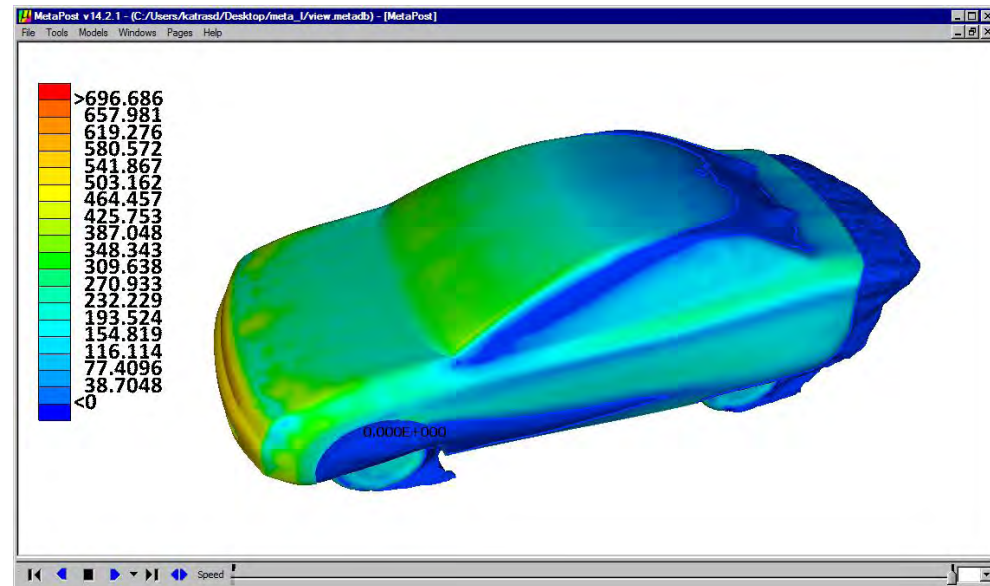
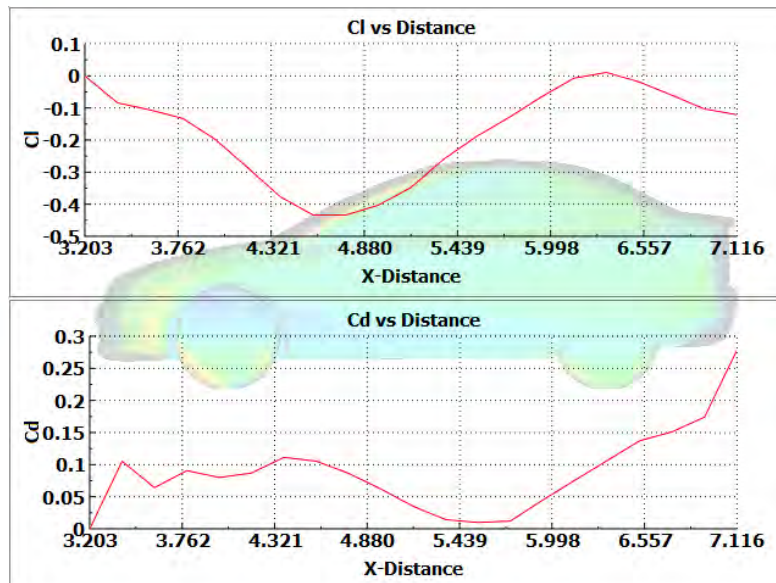
Output all current entities, results & objects in a project file



# Summary report



Forces-Coeffs			
Pid	Name	Drag Coef	Lift Coef
1	car_body	0.159	0.671
2	door	0.001	0.012
3	glass	-0.004	0.334
4	underbody	0.035	-0.921
5	front_wheelhouse	0.040	-0.124
6	rear_wheelhouse	0.010	-0.092
Total		0.27832966	-0.12114441



## Report capabilities

- Create HTML, PPTX or PDF reports
- Add images and videos
- Support of  $\mu$ ETA viewer objects
- Reports can be tagged, stored and quickly recovered

The screenshot displays the 'Report Composer' application window. The main workspace shows a report layout with a slide containing a table and an image of a car model. The car model is a 3D visualization with a color scale legend on the left, ranging from blue (<math>< 0</math>) to red (>696.686). Below the image is a table titled 'Forces-Coeffs' with the following data:

PId	Name	Drag Coef	Lift Coef
1	car_body	0.159	0.671
2	door	0.001	0.012
3	glass	-0.004	0.334
4	underbody	0.035	-0.921
5	front_wheelh	0.040	-0.124
6	rear_wheelho	0.010	-0.092
Total		0.27832966	-0.12114441

An 'Add Tag' dialog box is open in the foreground, showing a tree structure of tags and their values:

Tag	Value
Shape	
Customer	BETA-CAE Systems S.A.
Model	BETA Car Example File
Date	2013-08-27
Project	05.01.00001
Results	Total Pressure
Table	Drag Lift Coefs

# μETA Viewer

- License free reduced version of μETA
- Web Browser, PowerPoint Plug-in and standalone executable
- Loads Project Files only

**Summary report**

**Forces-Coeffs**

Pid	Name	Drag Coef	Lift Coef
1	car_body	0.159	0.671
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4	underbody	0.035	-0.921
5	front_wheelhouse	0.040	-0.124
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Total		0.27832966	-0.12114441

**CI vs Distance**

**Cd vs Distance**

ANSA and μETA v14.0 powerful pre- and post-processing for advanced CFD simulations  
January 2013 18

**μETA Viewer  
as PowerPoint  
Plug-in in Slides**

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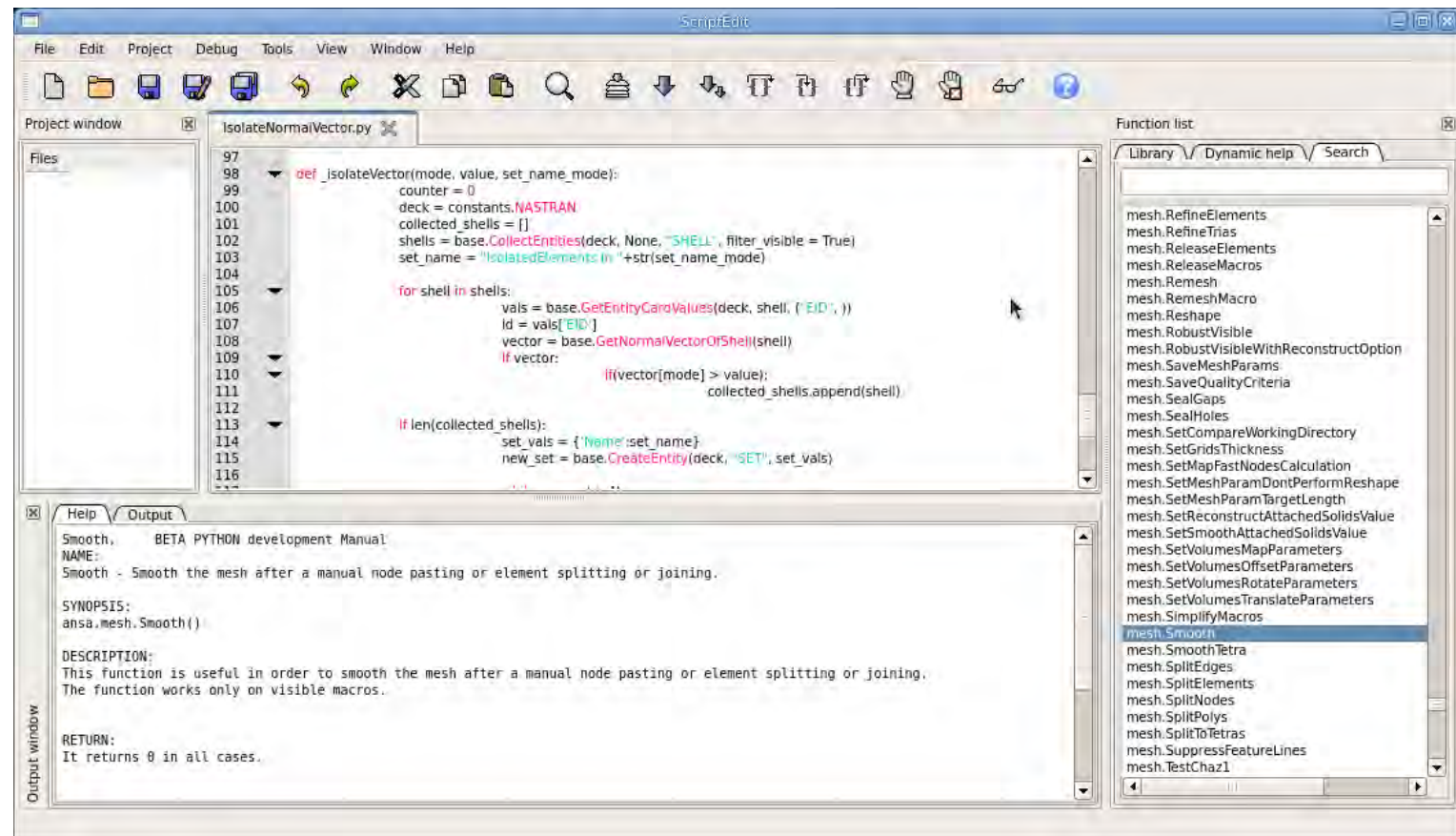
# Scripting language

## Scripting language support in ANSA and $\mu$ ETA

Creation of user defined functions through scripting for automation and customization of specific tasks, extending further the software's functionality

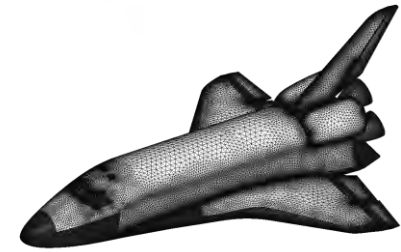
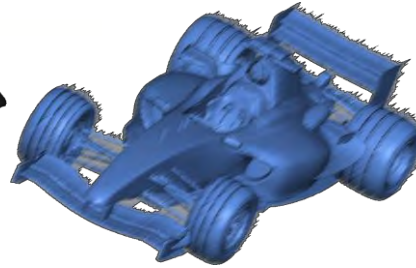
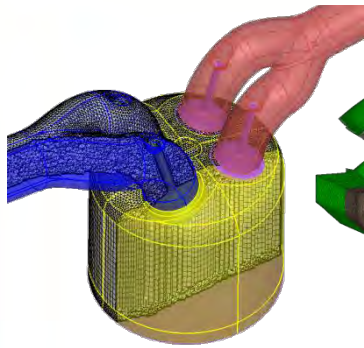
Build-in script editor for script creation, debugging and execution

PYTHON programming language support

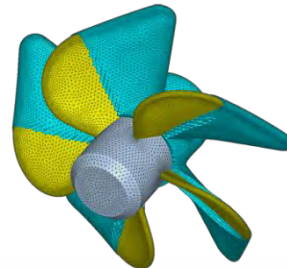
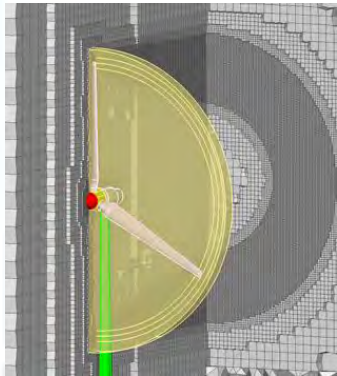
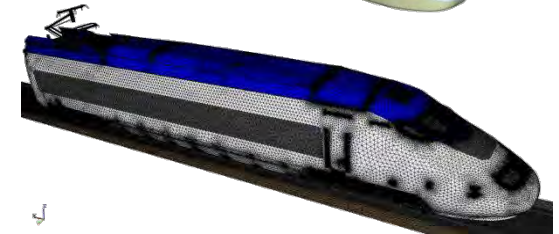
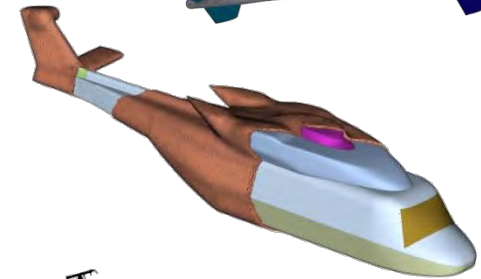
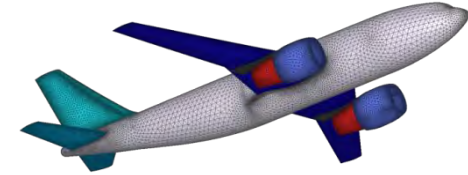




# Application industries



*Automotive*  
*Motorsports*  
*Aerospace*  
*Rail*  
*Marine*  
*Energy*  
*Electronics*  
*and more..*



## Conclusions

**ANSA** covers all the CFD pre-processing needs in a single environment, from CAD import, to advanced model management , geometry cleanup and preparation, automated surface and volume meshing and finally morphing and optimization.

It offers to the user the choice between high quality mesh generation on the geometry level and also quick meshing solutions like surface wrapping, depending on the needs and resources of the project.

**ANSA** provides high quality meshes for all CFD solvers, offering the possibility to make comparisons or use several codes depending on your needs and is also one common pre-processor platform for all other CAE disciplines, facilitating data exchange between different departments.

**μETA** provides powerful automated post-processing for CFD and integrates with **ANSA** as a complete pre and post-processing solution for industrial applications.

For more information please contact us at:

e-mail: [ansa@beta-cae.gr](mailto:ansa@beta-cae.gr)

URL: <http://www.beta-cae.gr>