



**BETA**  
SIMULATION SOLUTIONS

# Latest & future developments in ANSA & META for CFD

Grigoris Fotiadis

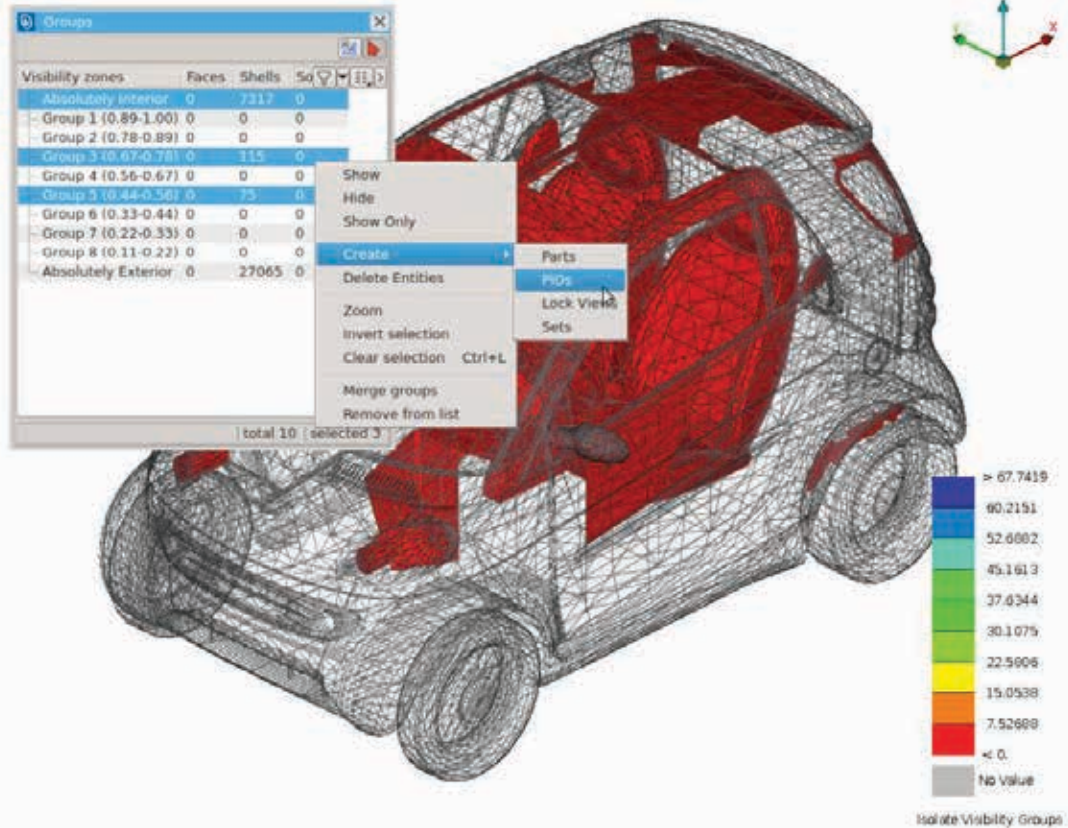
*physics on screen*



Latest developments

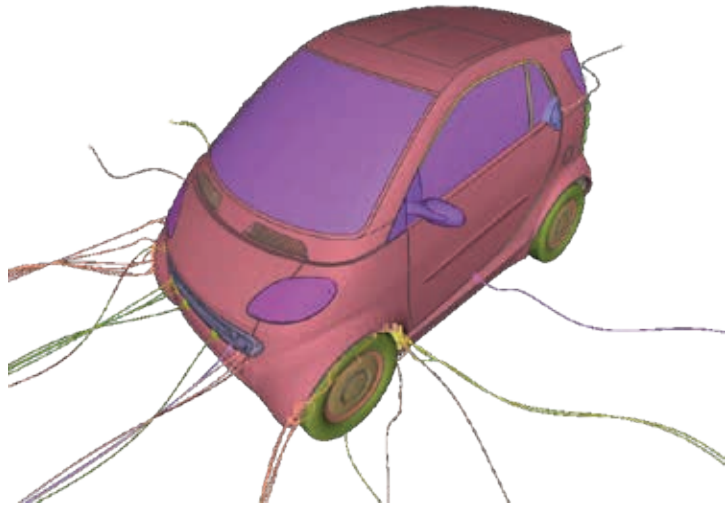
ANSA





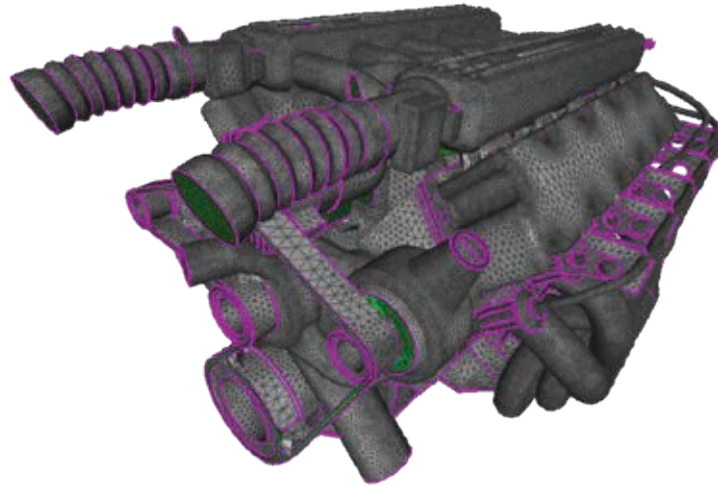
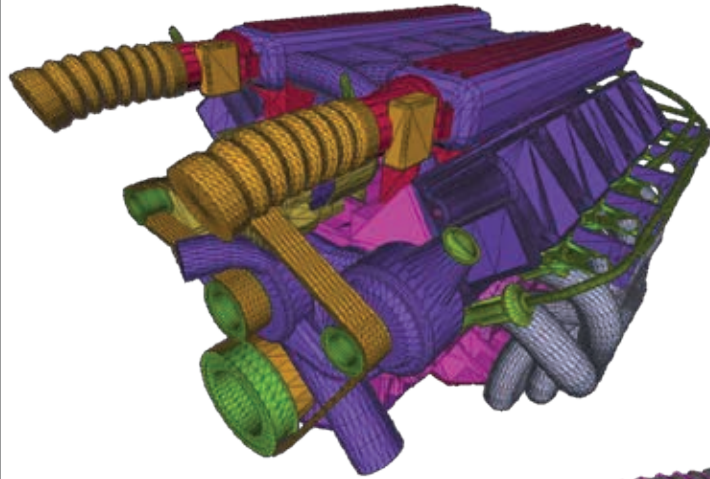
# Visibility Groups

- Grouping of entities based on depth level
- Easy wetted surface extraction



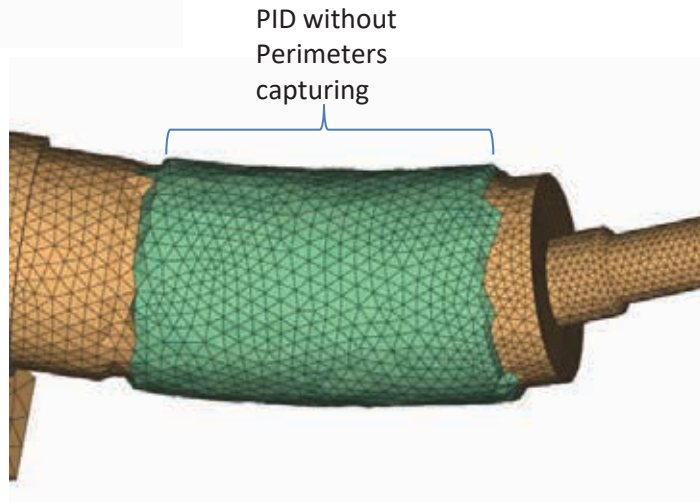
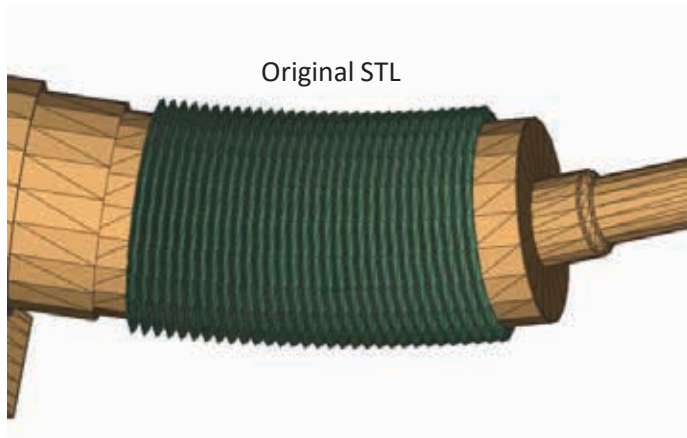
## Leak Tool

- Detect leaks in complicated models with gaps.
- Create a sealed area around a volume of interest



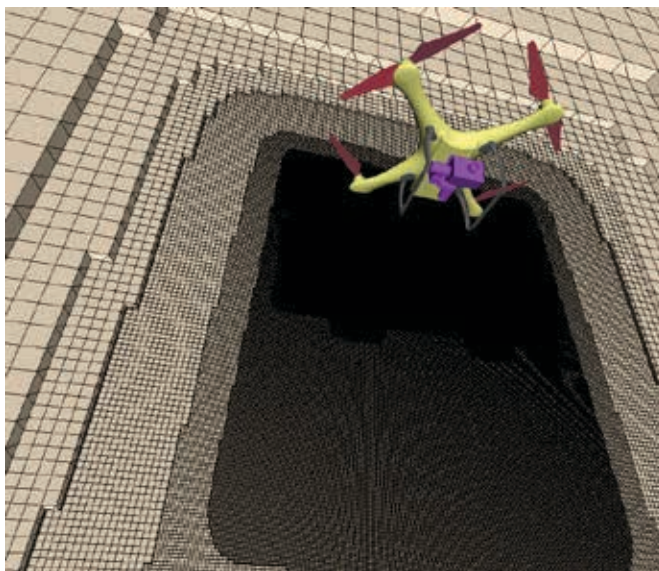
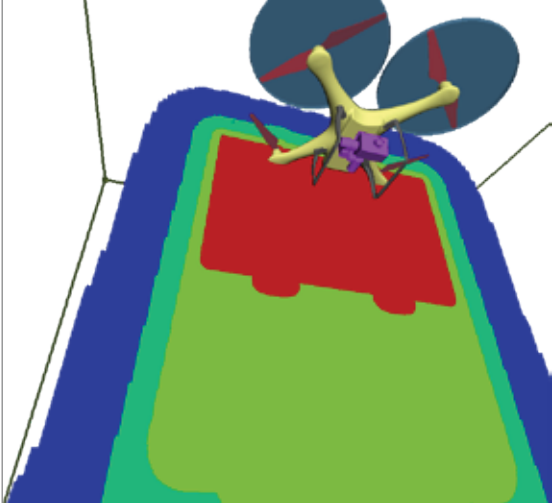
## Wrap surface mesh

- Boost performance in big meshes by making use of CPU threads
- Advanced control of detail capturing



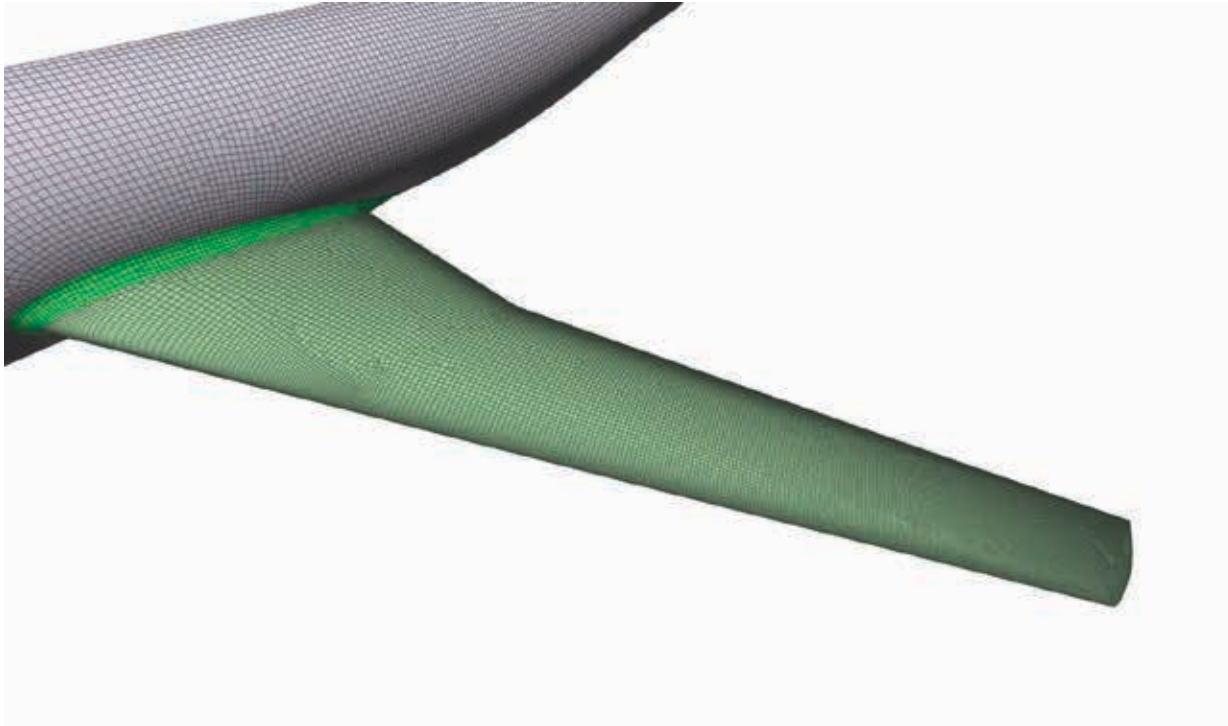
## Wrap surface mesh

- Boost performance in big meshes by making use of CPU threads
- Advanced control of detail capturing



## Size Field

- Create the refinement zones you need via a set of versatile rules
- Dedicated preview for faster refinement zones build up



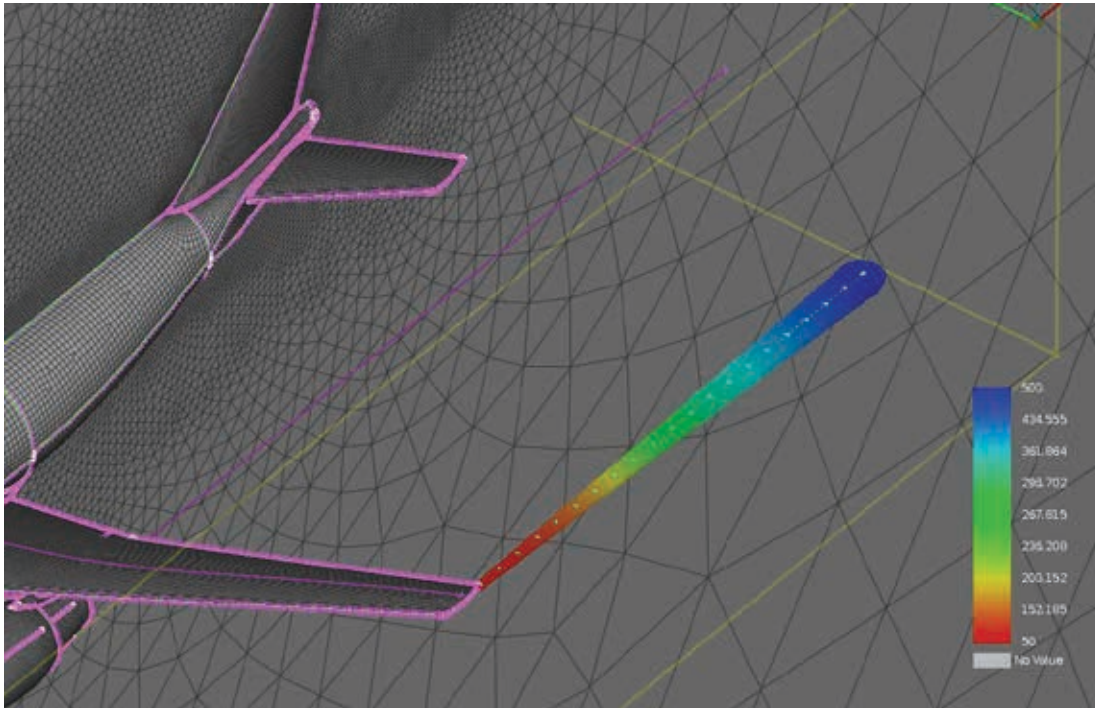
## Size Fields

- Advanced mesh refinement rules

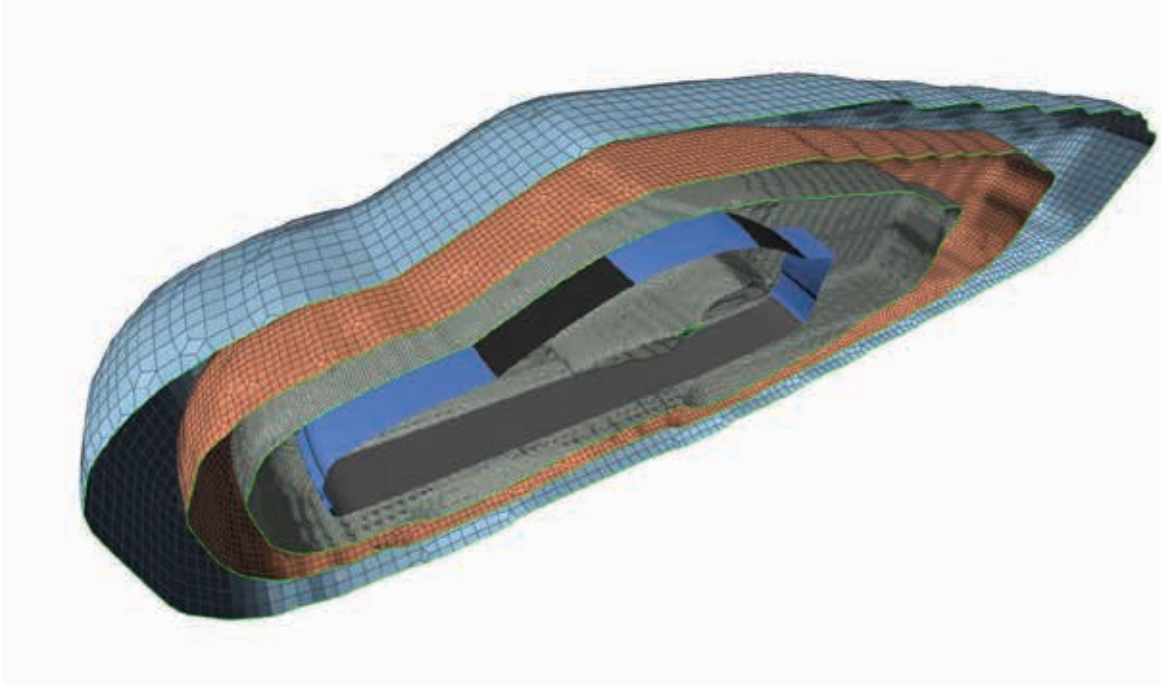


## Size Fields

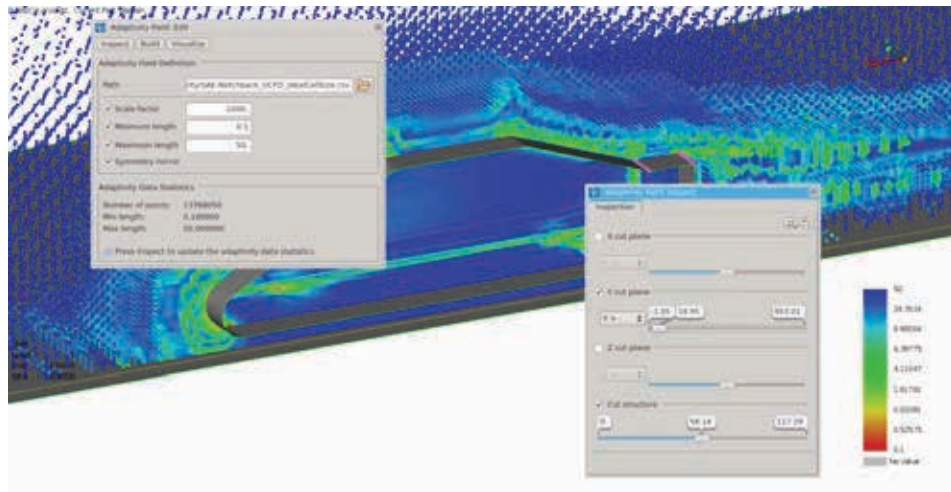
- Advanced mesh refinement rules



## Size Fields

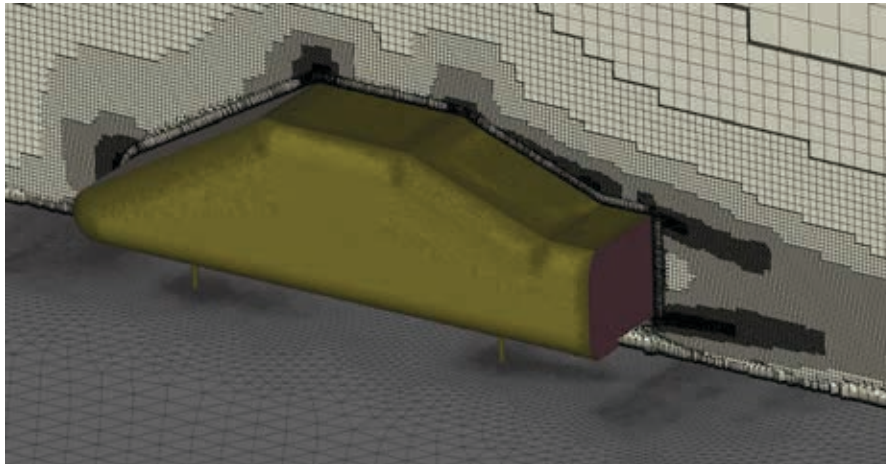


- Advanced mesh refinement rules
- Mesh creation at the size fields boundaries



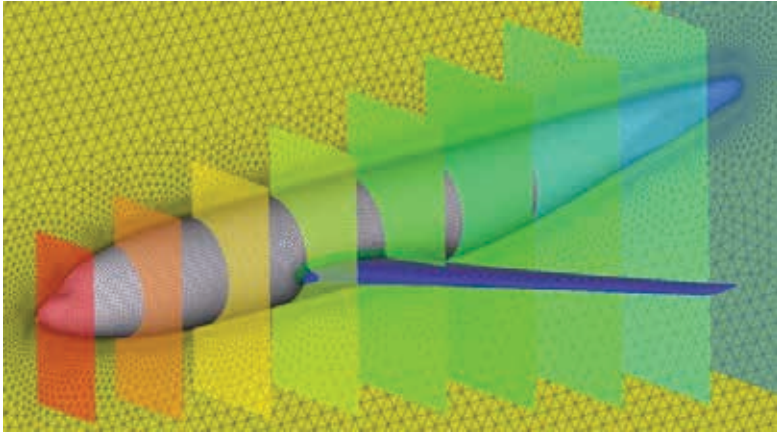
# Adaptivity Field

- Create refinement zones from CFD results
- Dedicated preview for faster refinement zones build up

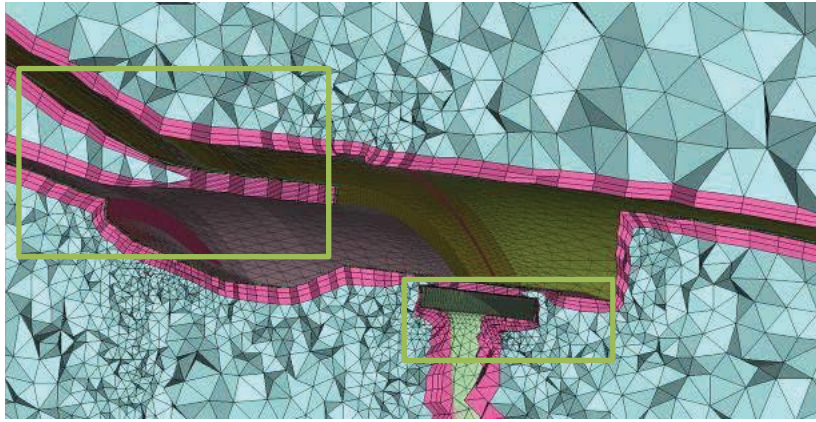


# Boundary Layers generation

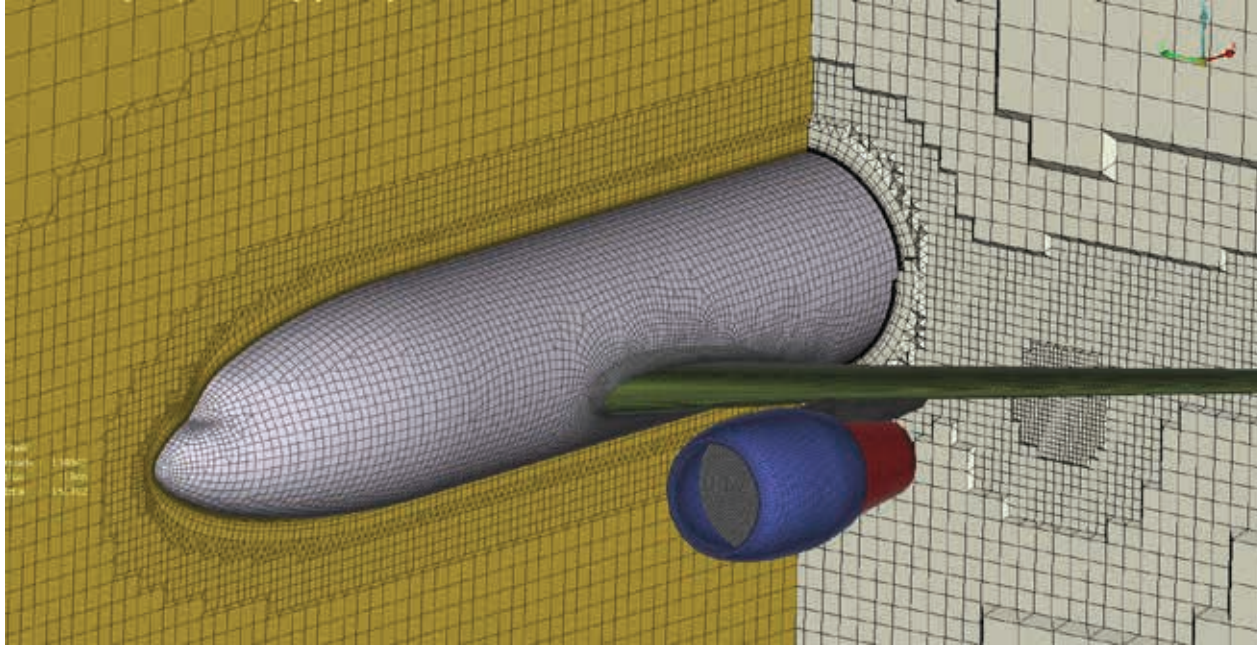
Advanced control of variable thickness layer generation



## Thin areas treatment

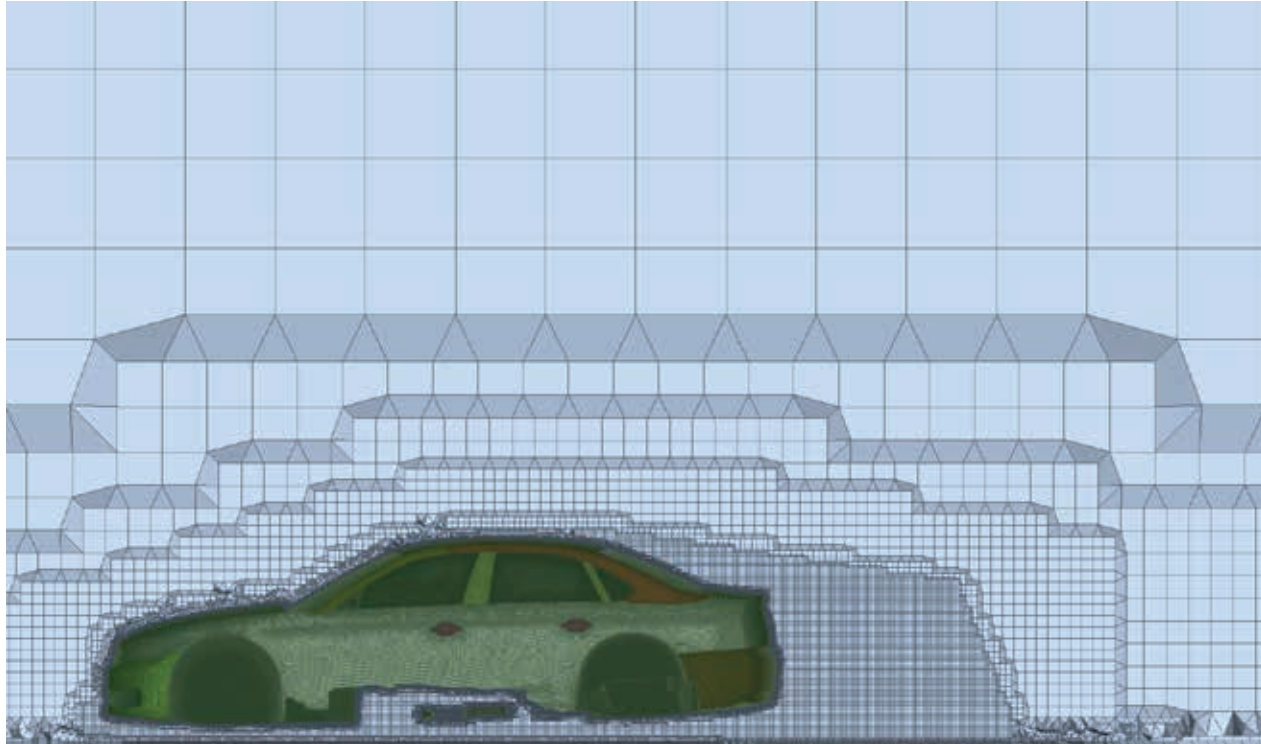


- Imprinted layered mesh generation at thin areas
- Eliminate in-between transition tetras



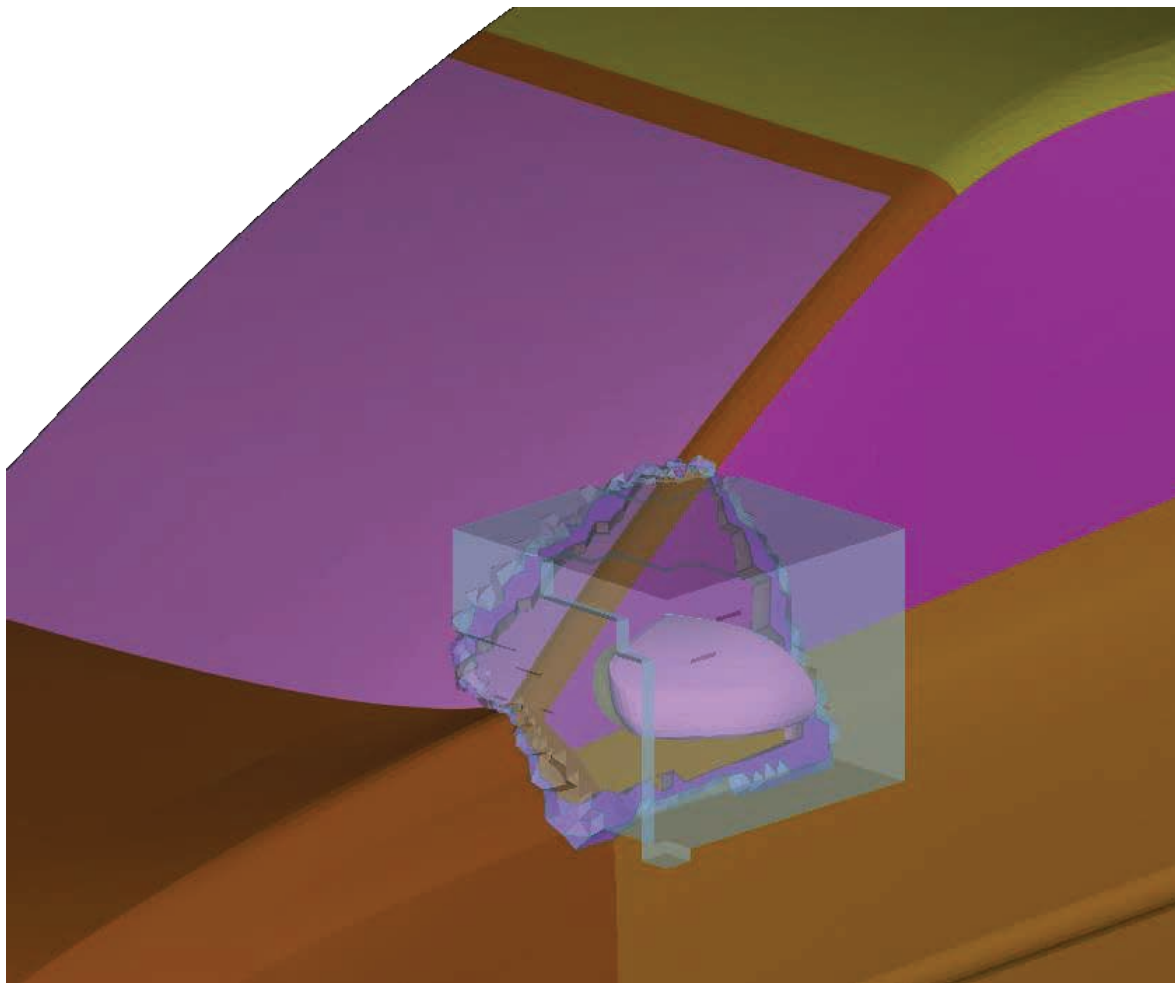
## Hexa Interior enhancements

- Automatic connection of hexa core mesh to symmetry plane
- New option to smooth the transition zones of the hexa core



## Hexa Interior enhancements

- Automatic connection of hexa core to symmetry plane
- New option to smooth the transition zones of the hexa core



## Cavity area

- Create a cavity area to re-mesh only locally during design changes
- Automatic locally re-mesh for “Replace” actions
- Volumes modularity scheme. One cavity area per model variant



# Batch Mesh

- Easy overview and comparison of mesh parameters

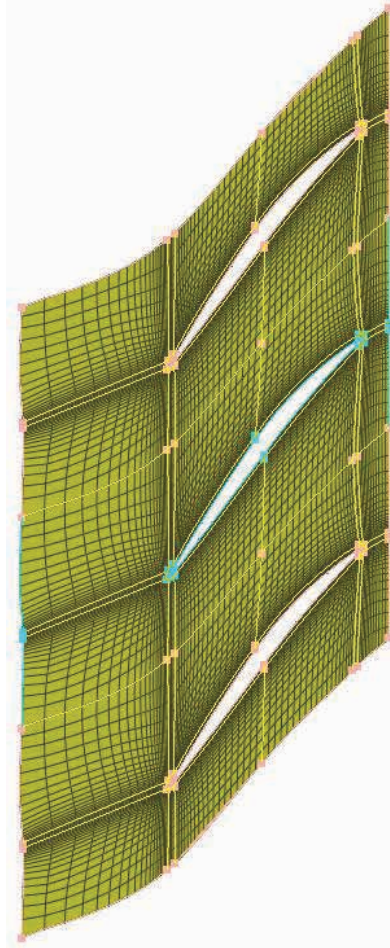
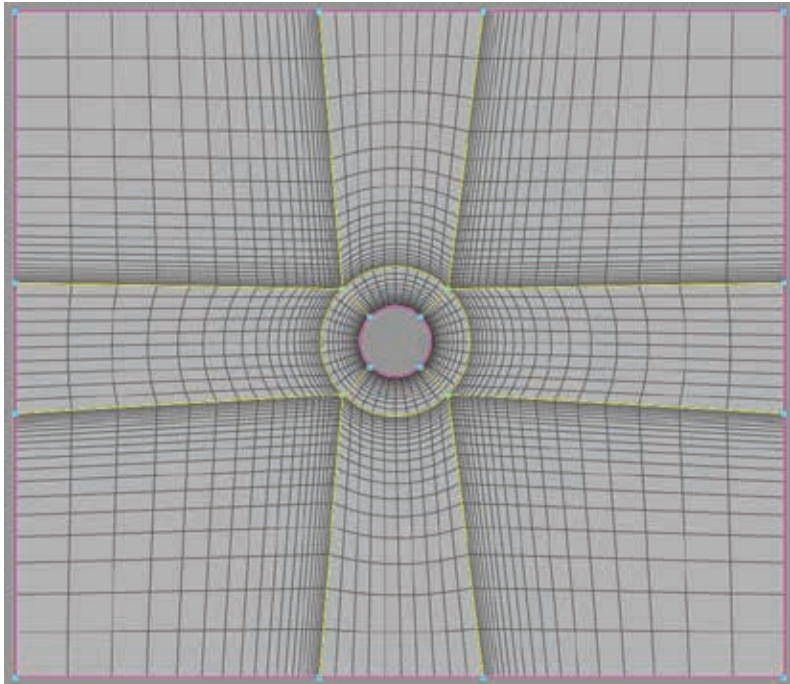
The image displays two software windows from a meshing application. The top window is the 'Batch Mesh Manager', which shows a list of scenarios and their associated mesh parameters. The bottom window is the 'Compare Parameters' dialog, which provides a detailed comparison of mesh parameters across different scenarios.

**Batch Mesh Manager**

Name	Contents	Color	Mesh Parameters	Quality Criteria	Status
Meshing_Scenario_1	14				Compl...
wings	5		CFDmesh		
engine	6		CFD para		
fuselage	1		CFD para		
domain	2		CFDmesh		
Default_Session	0		CFD para		
Layers_Scenario_2	12				
Default_Session	12		CFD para		
Volume_Scenario_3	0				
Default_Session	0		CFD para		

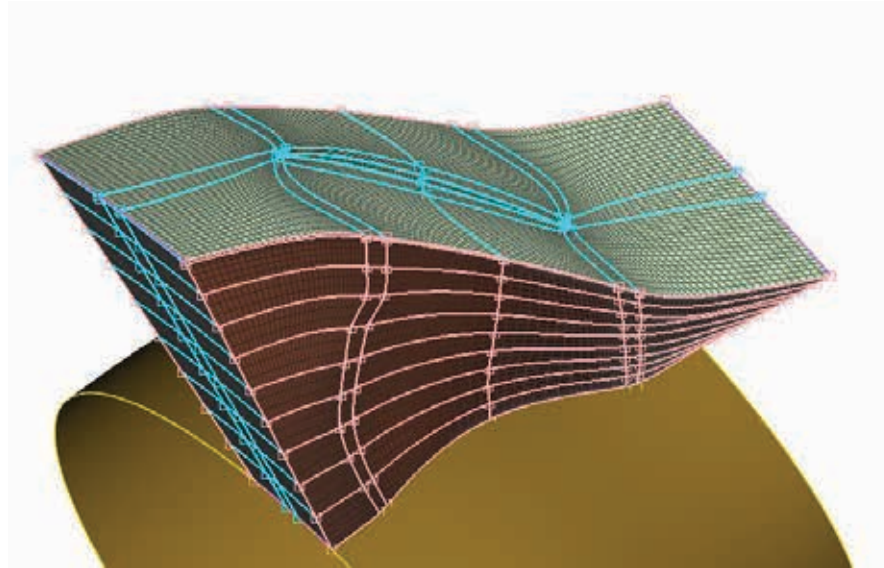
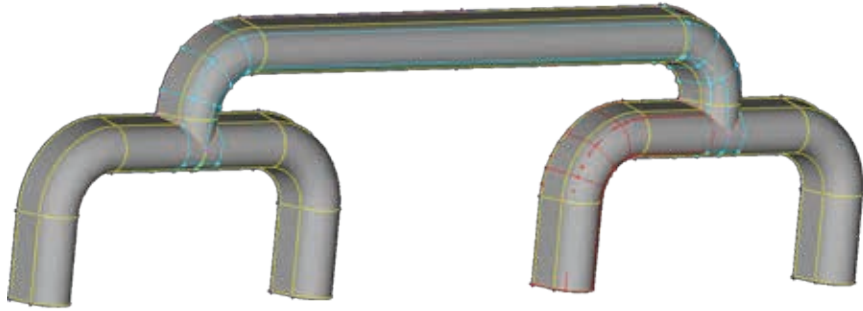
**Compare Parameters**

Parameters	wings	engine	fuselage	
- Mesh Parameters				
Name	CFDmesh 40 300	CFD parameters	CFD parameters	CFD
- General				
Mesh type	CFD Mesh	CFD Mesh	CFD Mesh	CFD
Element type	Tria	Tria	Tria	Tria
Element order	1st Order	1st Order	1st Order	1st O
Existing mesh	Erase	Erase	Erase	Erasc
Perimeters distance	0.333*L	0.4*L	0.4*L	0.33
Maintain sharp edge (by	false	false	false	false
Non feature line perimeters	Fine	Medium	Medium	Fine
Existing features	Keep	Keep	Keep	Keep
Orientation	Keep	Keep	Keep	Keep
Joined perimeters	Reset	Reset	Reset	Reset
- CFD				
Quality rate	1.2	1.2	1.2	1.2
Distortion angle	15	15	15	15
Minimum length	40	40	40	40
Maximum length	100	100	300	100
Between different PIDs/Parts	false	false	false	false
Enable proximity refinement in the same PID/Part	false	false	false	false
Corner Curvature treatment	false	false	rape	false
Additional orientation based treatment	false	false	false	false
- Options				
- FE Parameters recognition				
FE Perimeters: Between Properties	true	true	true	true
FE Perimeters: Between Parts	true	false	false	true
FE Perimeters: Feature Lines	true	true	true	true
Feature Lines: option	Angle	Angle	Angle	Angl
Feature Lines: Angle	20	20	20	20
Feature Lines: Corner angle	40	40	40	40
- Perimeters				
Maintain SET or include bounds	true	false	false	true
Recognize perimeters between SETs	Forbid join	Allow join	Allow join	Forb
Symmetry plane treatment	true	false	false	true
Symmetry plane treatment option	Do not join perimeters	Do not join perimeters	Do not join perimeters	Do n
Treatment	true	false	false	true
- Perimeter size				
- 1				
Default Rule	false	false	false	false



## Hexablock

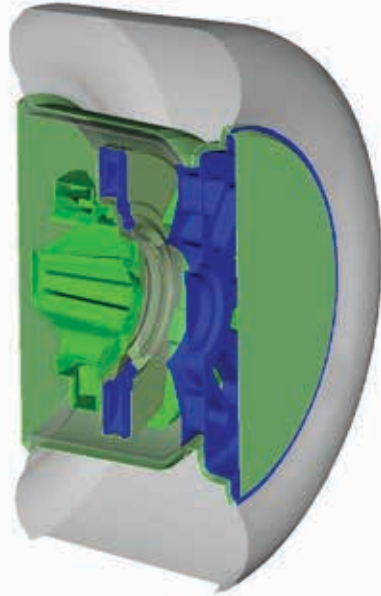
Advanced functionality  
for 2D boxes



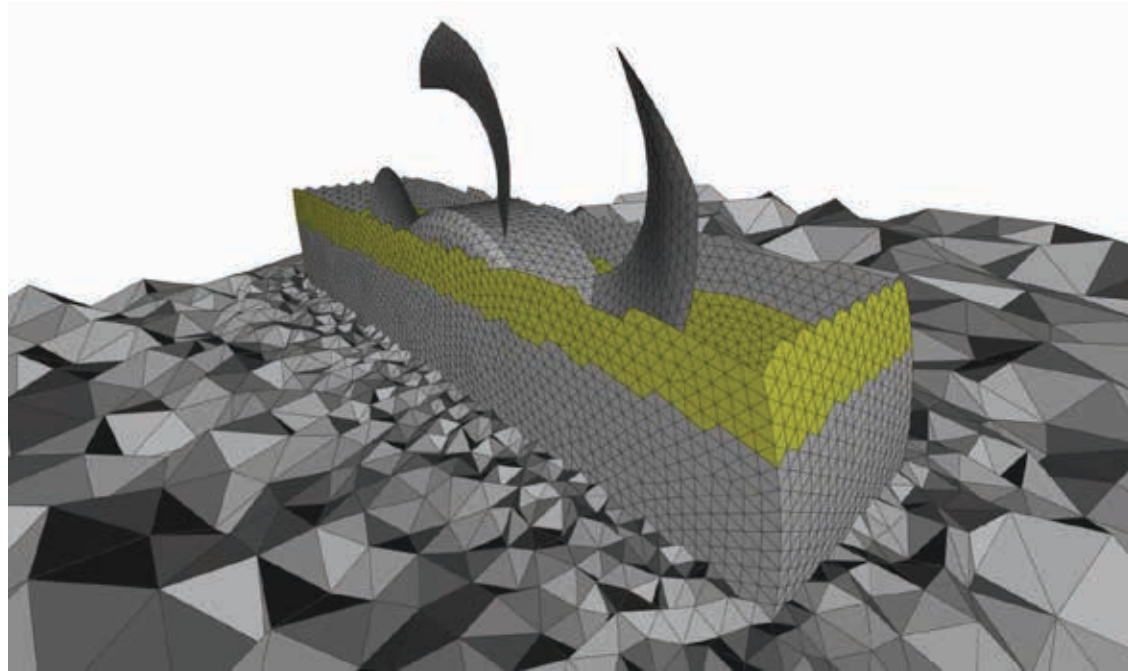
## Hexablock

- Semi-automatic tool to create boxes for tubular models
- Automatic template meshing for rotating machines

## Rotating Interface



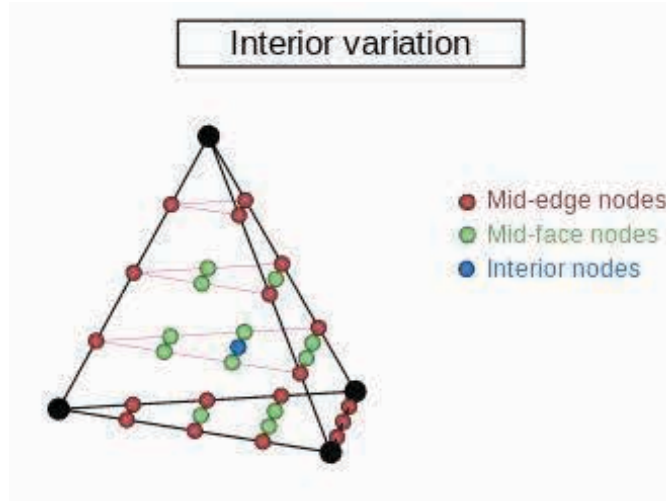
- Automated MRF interface creation
- Option to create planar faces



## Split Mesh Tool

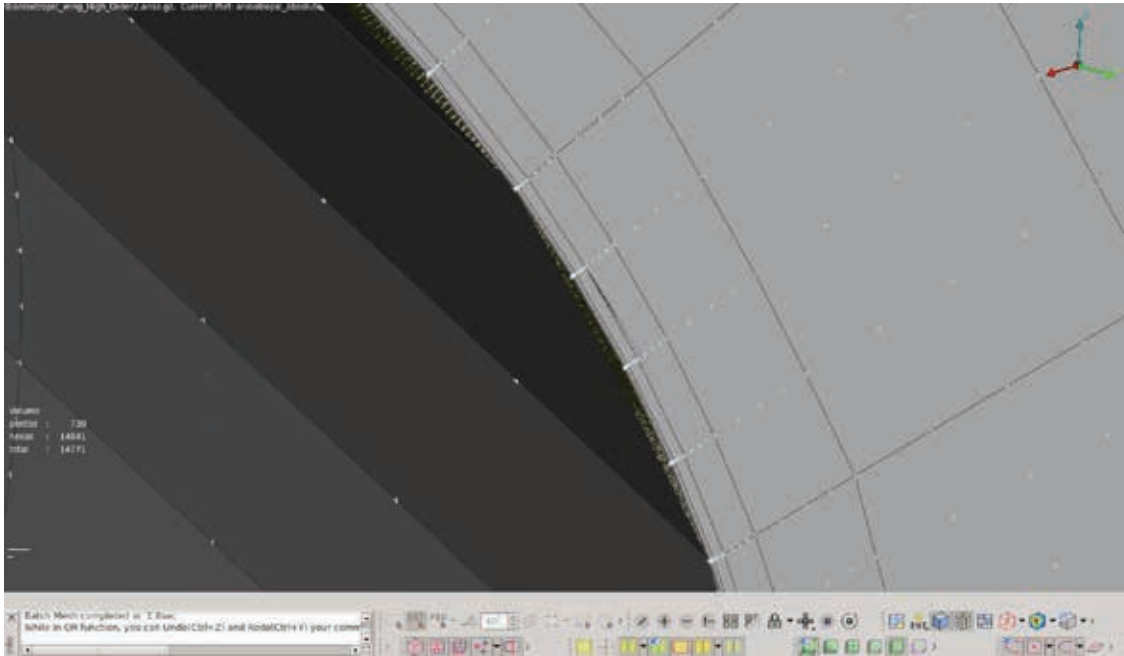
Automated creation of  
moving mesh interfaces

## 4<sup>th</sup> Order



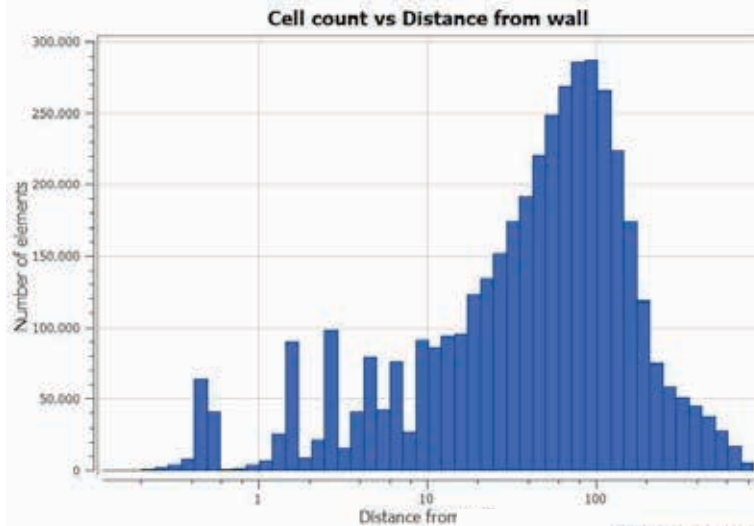
## High Order Mesh support

- Elevation of 1st order mesh to 2nd, 3rd or 4th order
- Light Volume Representation
- Extrude from geometry
- CGNS Output
- Mesh quality calculation



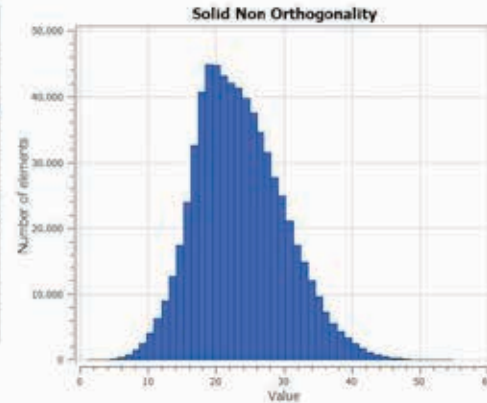
## High Order Mesh support

- Elevation of 1st order mesh to 2nd, 3rd or 4th order
- Light Volume Representation
- Extrude from geometry
- CGNS Output
- Mesh quality calculation



Solid Non Orthogonality (NON ORTHOGONALITY [OPENFOAM])

Solid Non Orthogonality Table			
THRESHOLD Value	75		
MIN Value	1.17709		
MAX Value	54.9651		
MEAN Value	23.442		
HARMONIC MEAN Value	21.5558		
Class	No of Elements	Perc(%)	
1 From: -∞ To: 0	0	0	
2 From: 0 To: 10	5926	0.007909	
3 From: 10 To: 20	213254	31.9524	
4 From: 20 To: 30	340619	51.0339	
5 From: 30 To: 40	100788	15.1013	
6 From: 40 To: 50	6793	1.01632	
7 From: 50 To: 60	41	0.000614314	
8 From: 60 To: 70	0	0	
9 From: 70 To: 80	0	0	
10 From: 80 To: 90	0	0	
11 From: 90 To: 190	0	0	
12 From: 190 To: +∞	0	0	
Out of any class range	0	0	
TOTAL	847811		

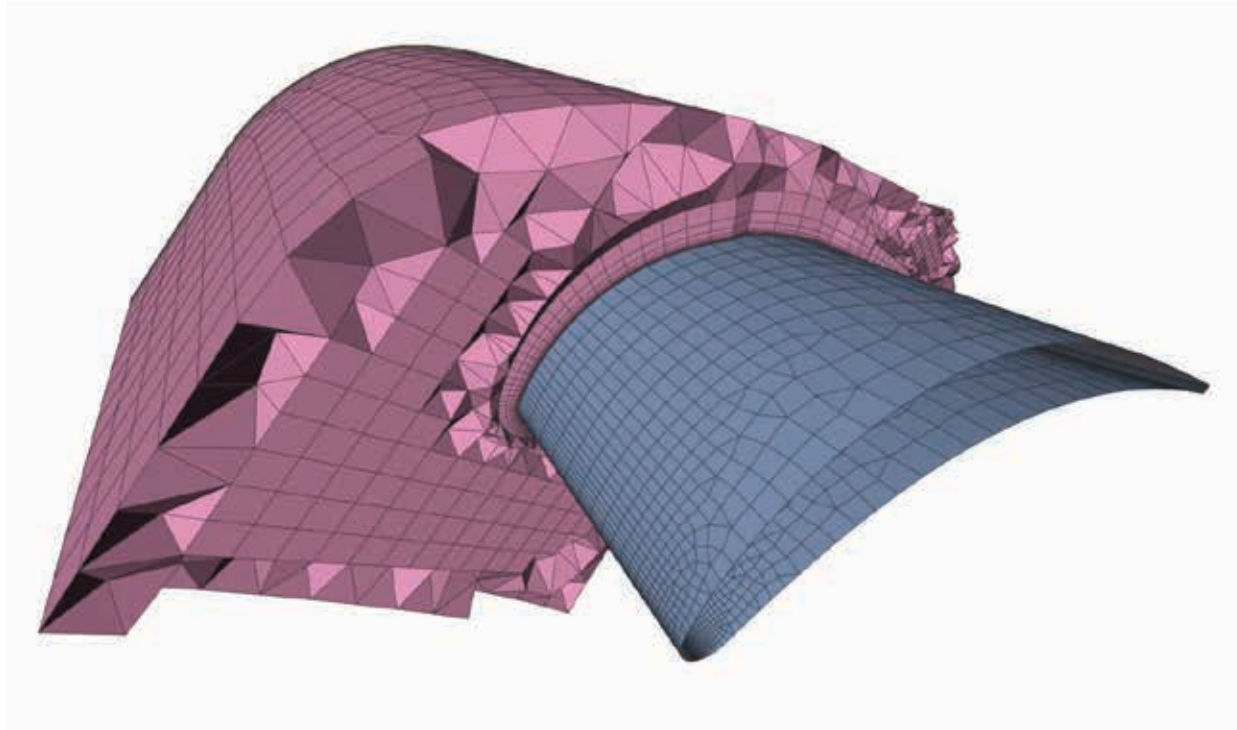


## CFD Deck Report

- Generation of Mesh quality metrics
- Embedded ANSYS Fluent quality libraries



## Hydra: Rolls-Royce CFD code for Jet engine design

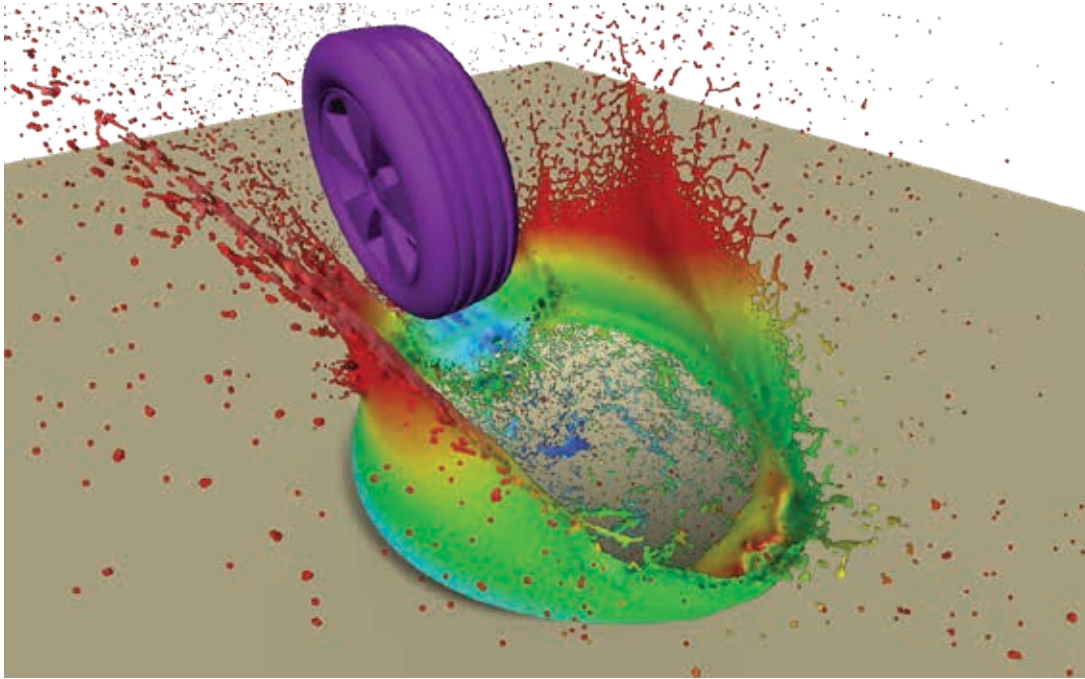


## CFD formats

- Hydra
- Ugrid
- Plot3D

# SPH Solver

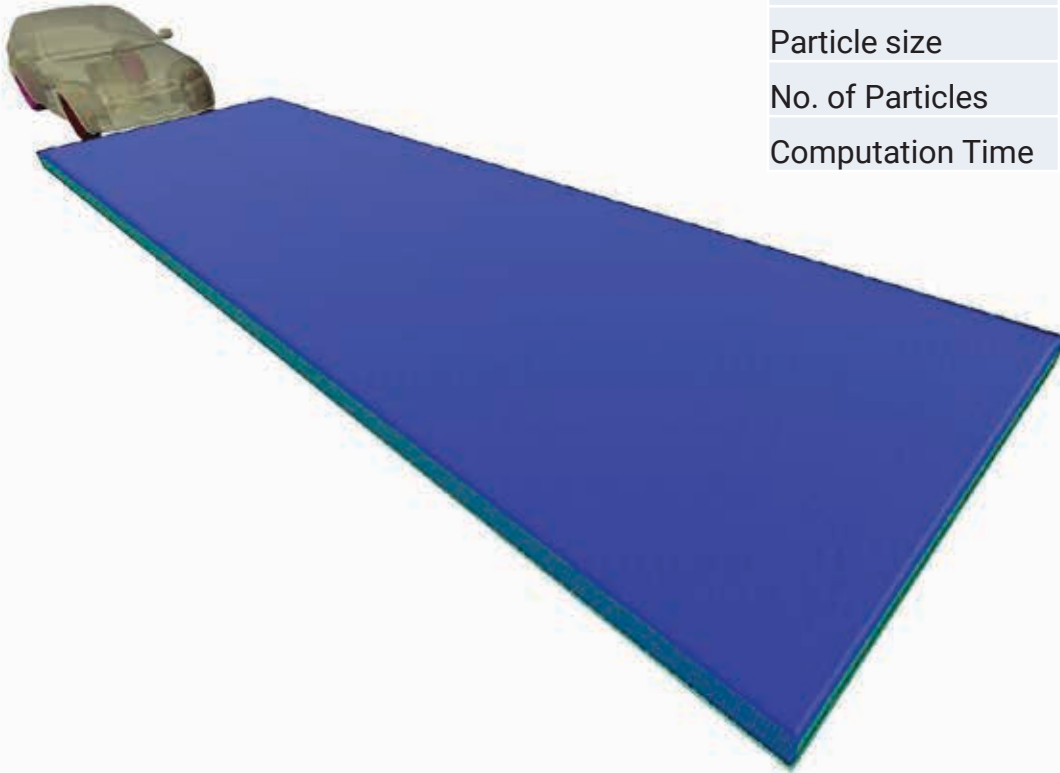
- Integrated in ANSA
- Direct and simple
- Coupled with kinematics
- GPU implementation
- User interaction during solution
- Results fully compatible with META



# SPH Solver

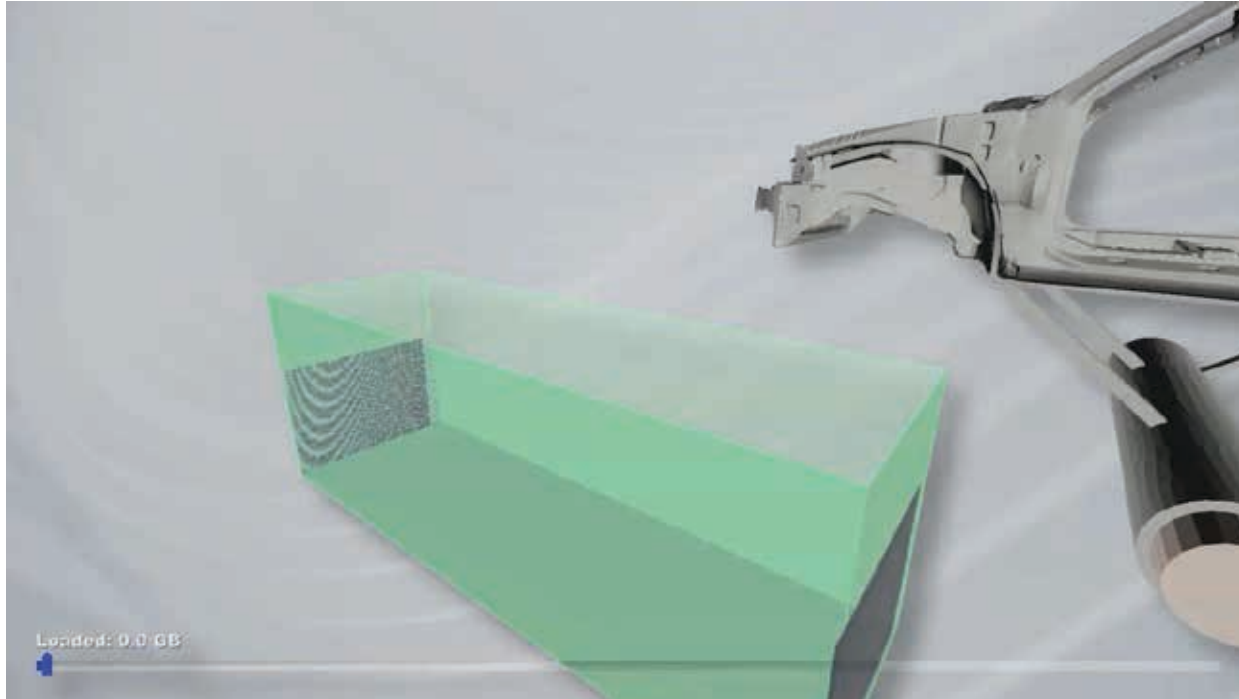
Broader range of applications and significant speed-up of execution

Simulation time	5sec
Particle size	5mm
No. of Particles	5700000
Computation Time	35min

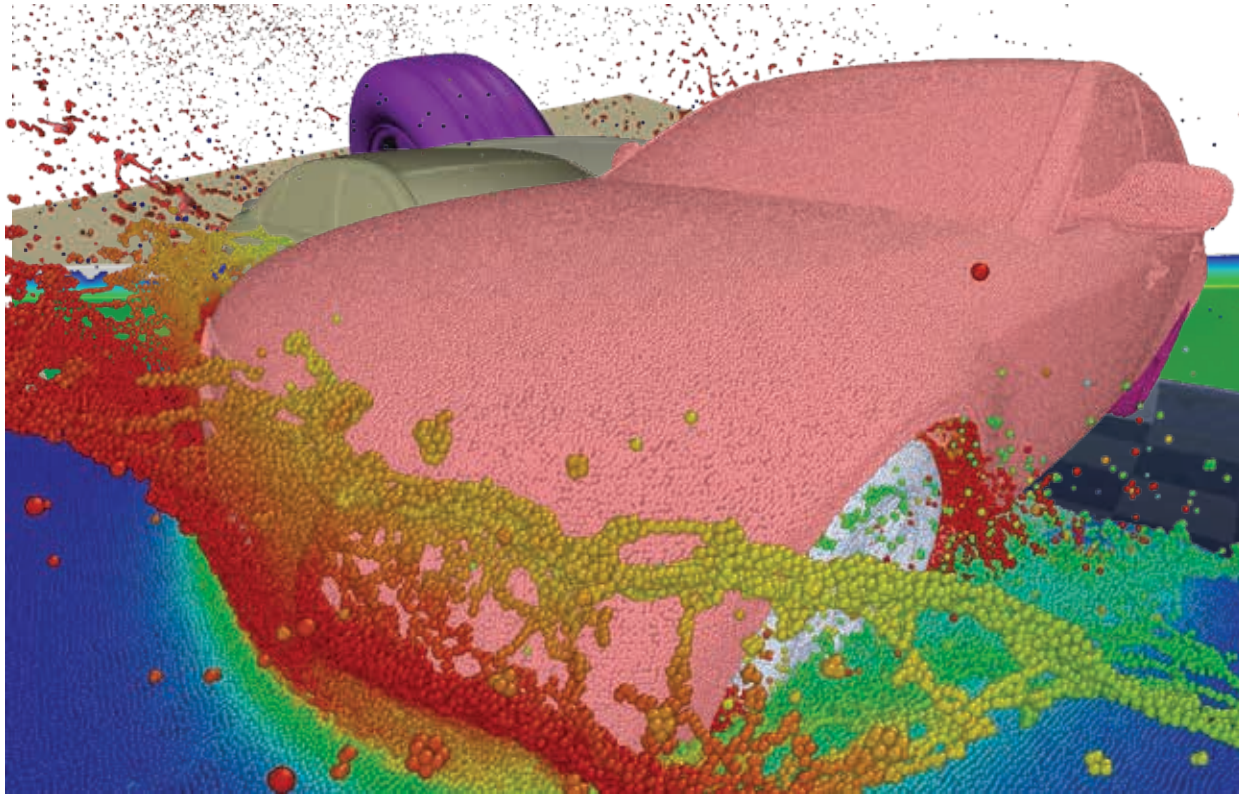


# SPH Solver

- Fast access to results with optimized memory usage
- Animation Bar of results
- Post-simulation video creation



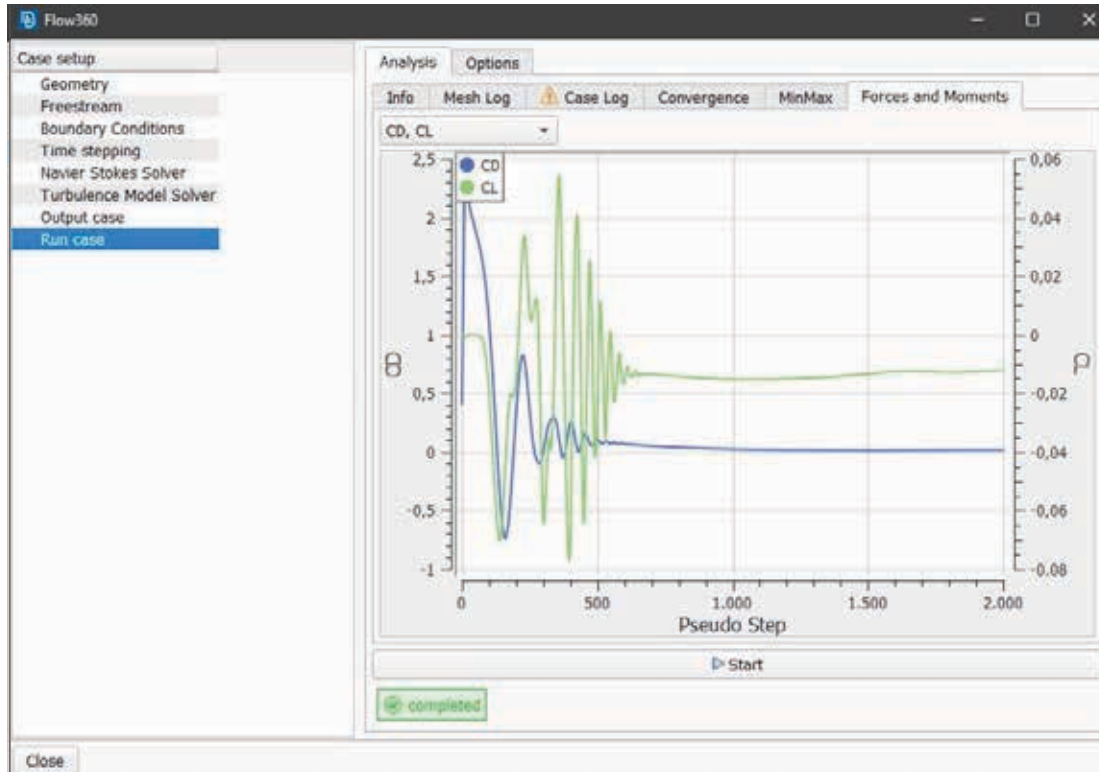
# SPH Solver



Advanced visualization options

- Photorealistic
- Boundary Particles
- Kinetic Energy Fluid
- Pressure

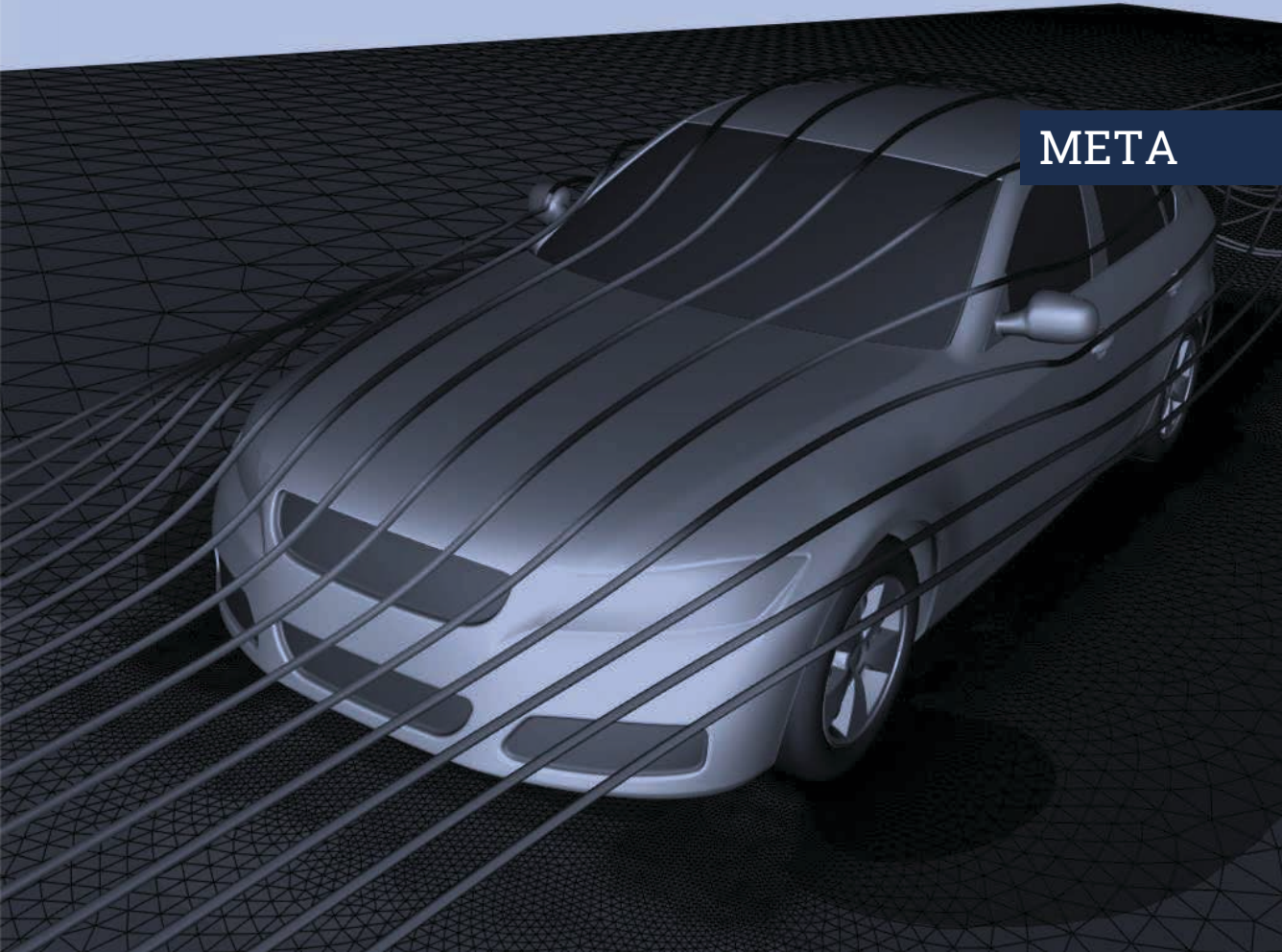
# Flow360 interface

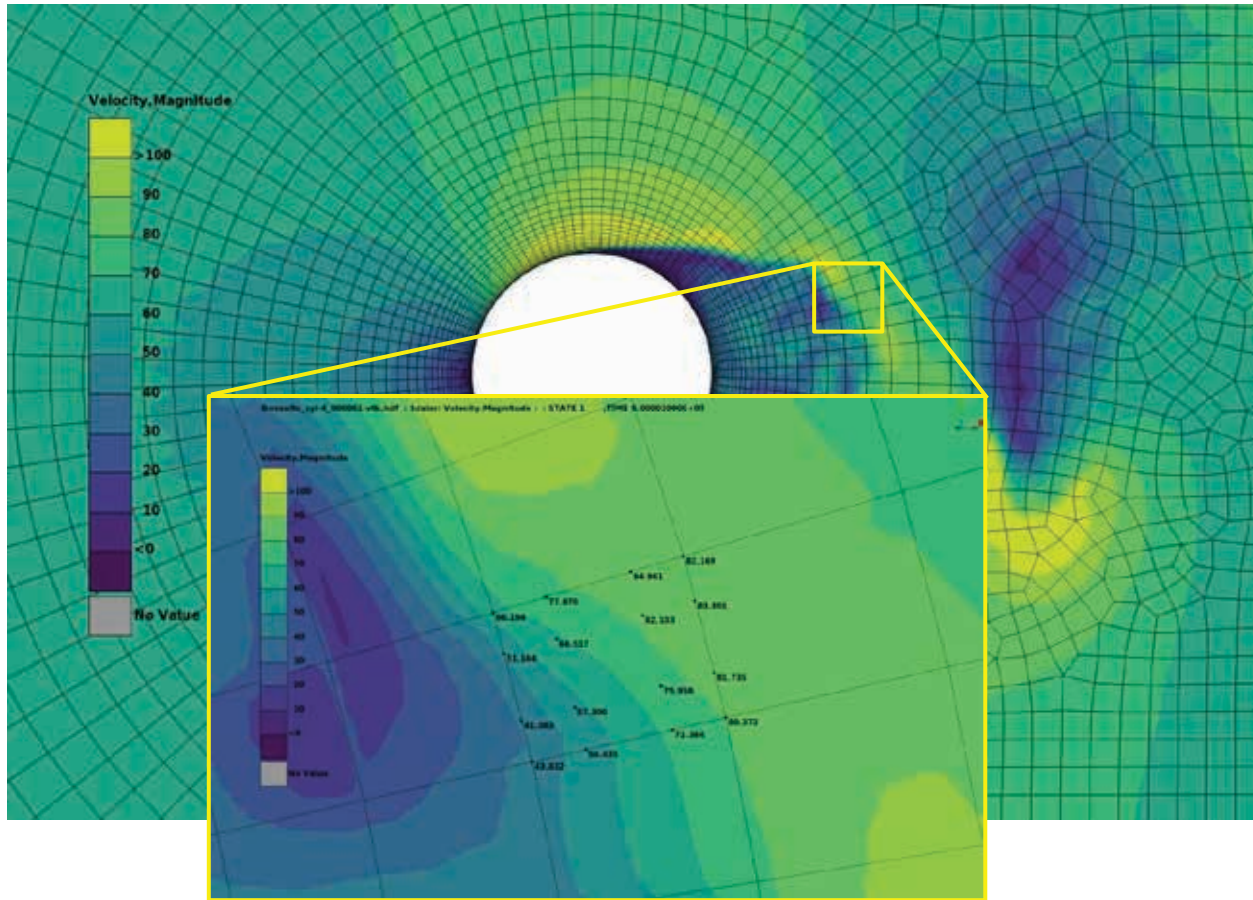


- A very fast CFD solver developed by Flexcompute
- Mesh exported to CGNS
- Results written in .szplt format

## Latest developments

META





# High Order Meshes & CFD Results

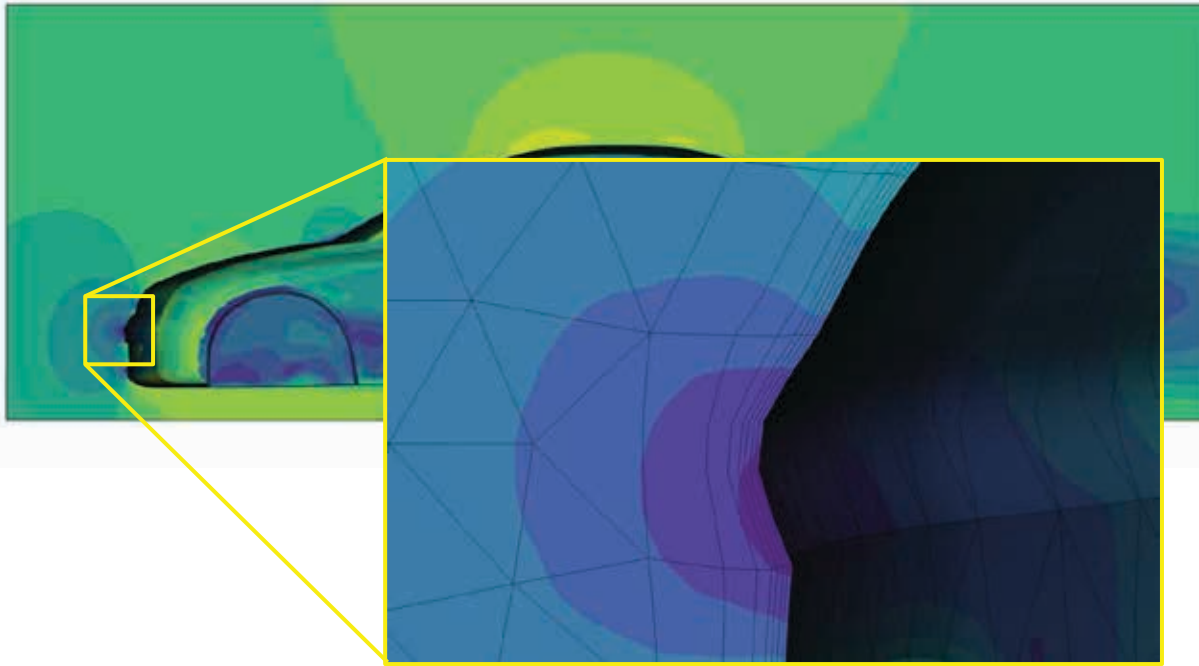
Courtesy of Barcelona  
Supercomputing Center

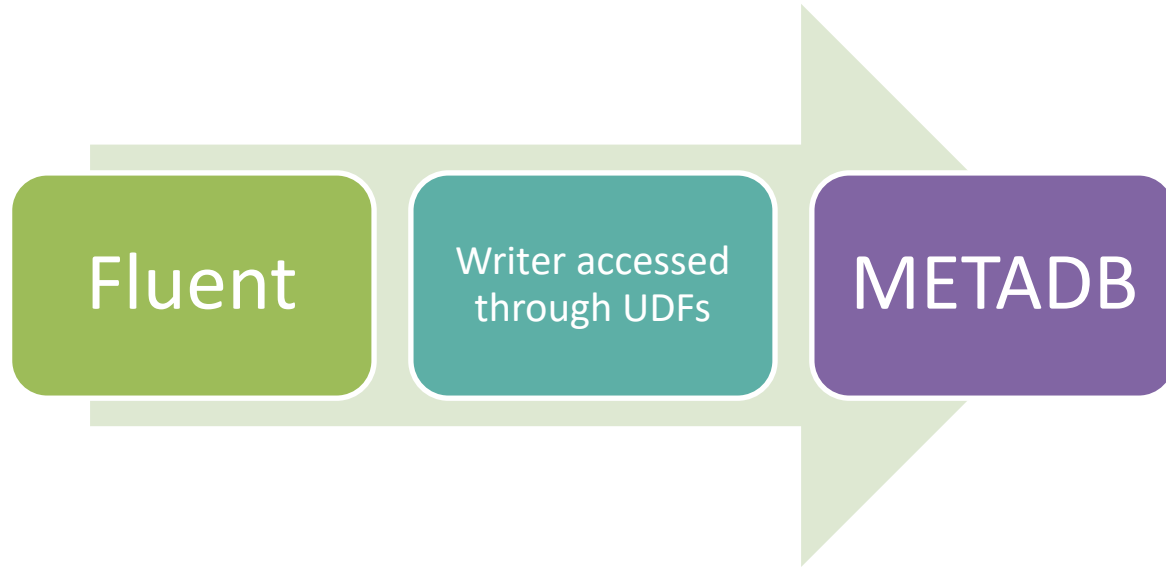
Generated using SOD2D  
a code developed in the Barcelona  
Supercomputing Center

Simulation performed by  
Professor Ivette Rodríguez  
Turbulence and Aerodynamics Research  
Group (TUAREG)  
Universitat Politècnica de Catalunya.



# High Order Meshes & CFD Results





## METADB writer for Fluent

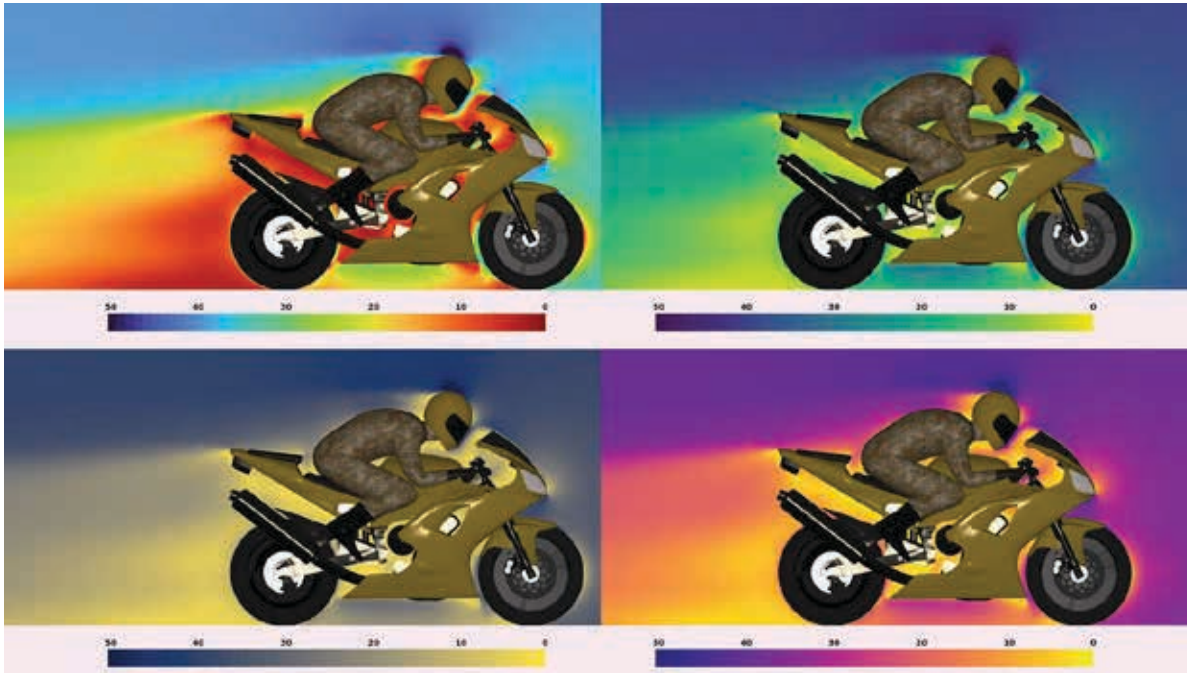
- Write results in META native format directly from Fluent
- METADB compression
- Parameterized through SCHEME language
- Automated through Journal mechanism

# Schlieren Field

Calculation and  
visualization of fluid  
density changes

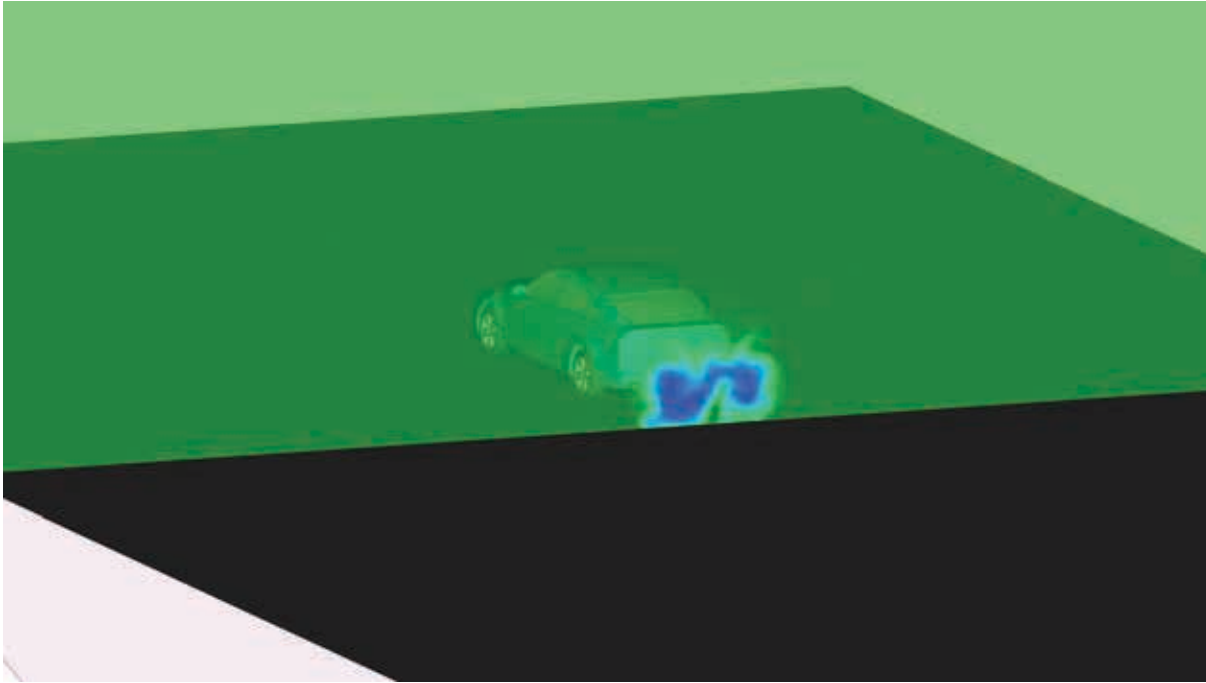


## New color palettes



- Perceptually uniform in black & white and color modes
- Perceived by viewers with color blindness
- High fidelity

## Cut planes

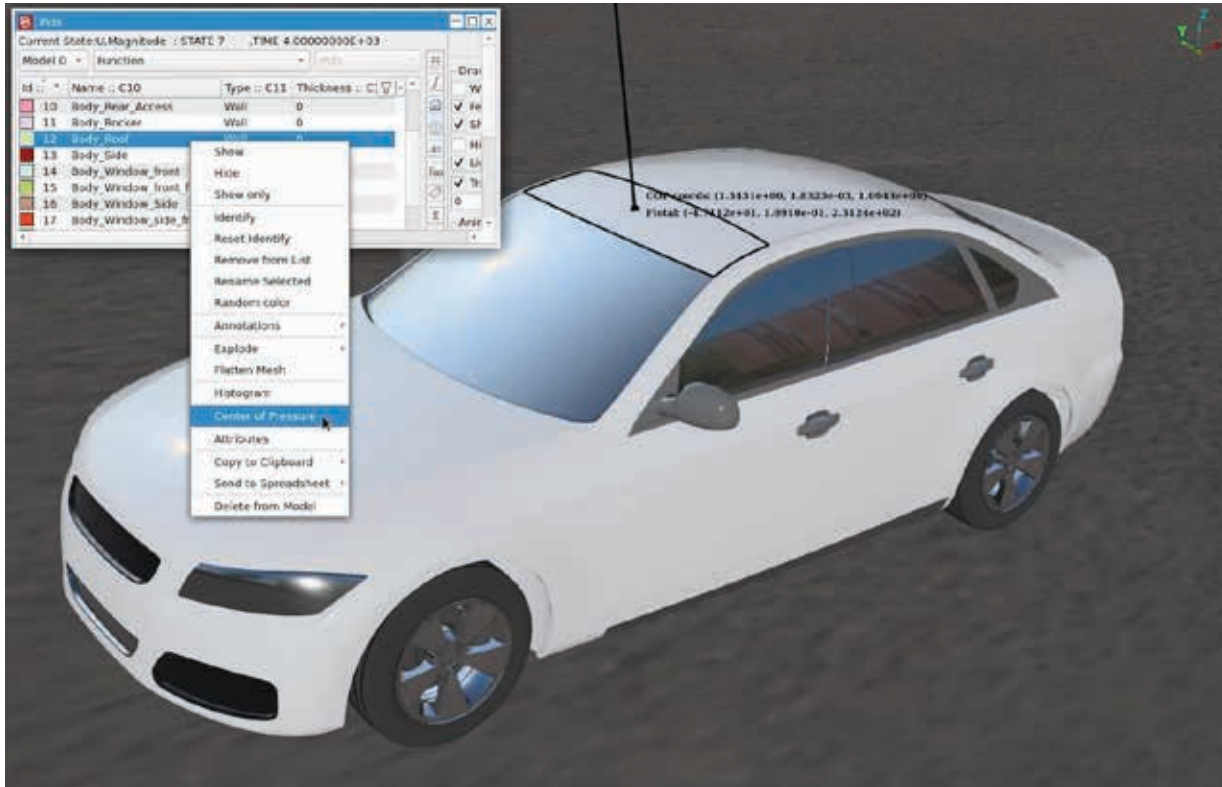


- Transparency
- Custom polygonal or circular section



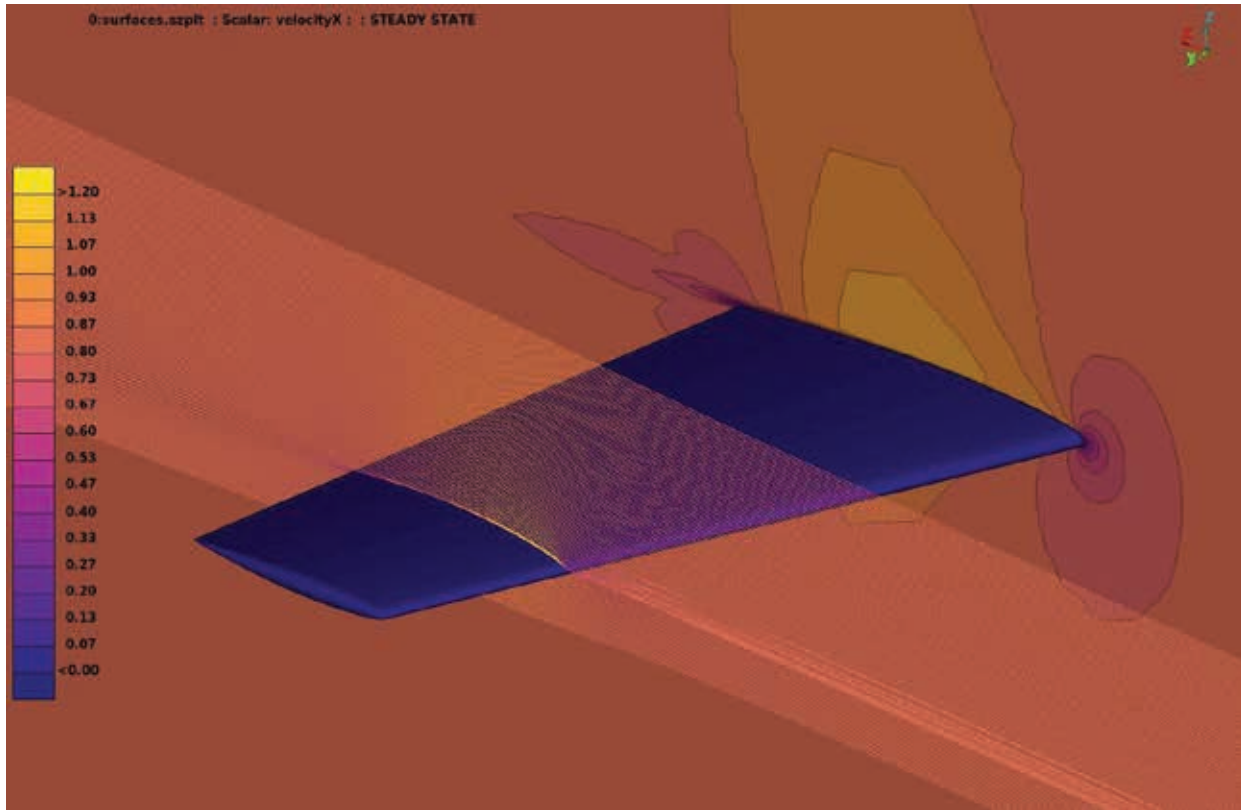
## Cut planes & IsoFunctions

- Parallel cut planes
- Range of IsoFunctions



## Center of Pressure

- Calculation per PID
- Calculation on Cut Planes
- Available also for symmetrical half models



## New formats support

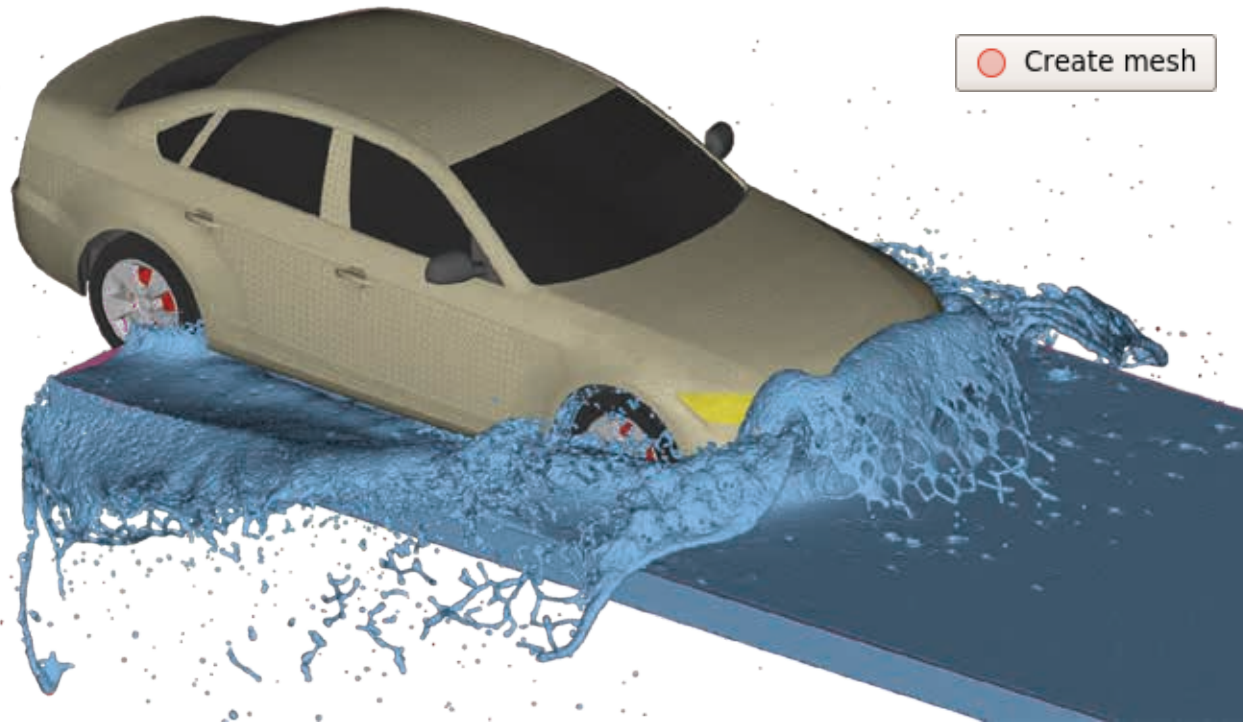
- Tecplot .szplt
- LZMA and LZ4 Paraview format
- Part Manager structure for OpenFOAM models through FATXML



# SPH Solver

Mesh creation out of fluid surface

- At any result state
- Possibility to restrict the area of mesh creation





Stay connected