

ENGINEERING SERVICES 2016 г.

Automotive Engineering

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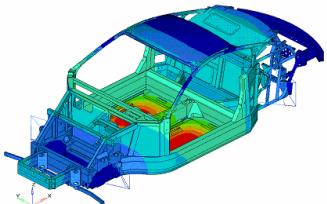
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+7 (8482) 51-09-84
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- ▶ 2005 – Odintsovo, Moscow Region
 - ▶ Competencies: CAE and Optimization, CAE methods development
 - ▶ Projects with European companies
- ▶ 2006 – Opening of Engineering Center in Togliatti, Samara Region
 - ▶ Participant of LADA 2116 (AVTOVAZ) project
- ▶ 2007 - 2008 – Projects with AVTOVAZ, KAMAZ and European companies
- ▶ 2009-2010 – Projects with automotive suppliers of AVTOVAZ/Renault/Nissan
 - ▶ Competencies: CAD/CAE/Optimization, CAE methods development, plastic components design
- ▶ 2013 – Components development in engine subsystem design, interior and mechanisms design and others
- ▶ 2014 – more than 300 different complexity projects ((from 2 weeks to 1 year)
- ▶ 2016 – Component development in powertrain, arctic vehicles

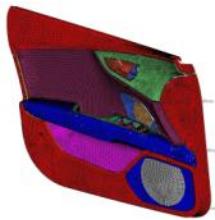


COMPANY COMPETENCIES

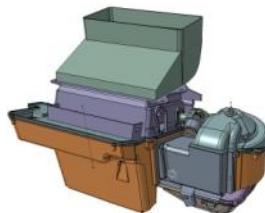
FROM NUMBER TO KNOWLEDGE



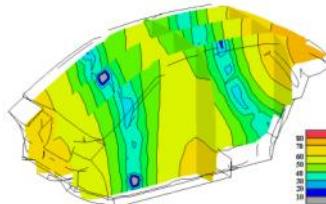
BiW Engineering



Interior&Exterior Engineering



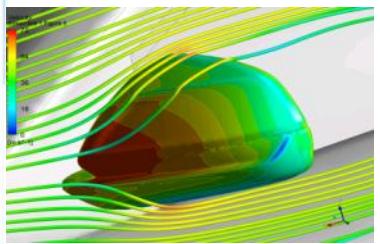
HVAC Engineering



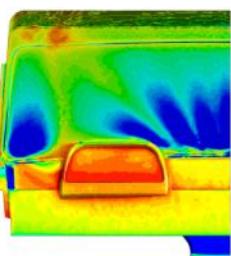
NVH Engineering



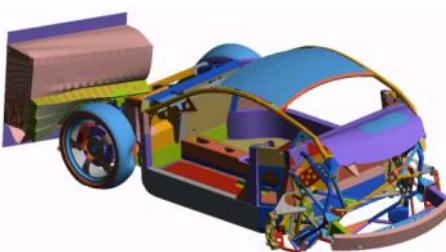
Units Engineering



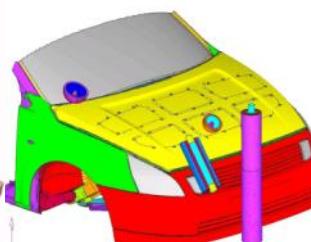
Aerodynamics



Thermal Engineering



Passive Safety
Engineering



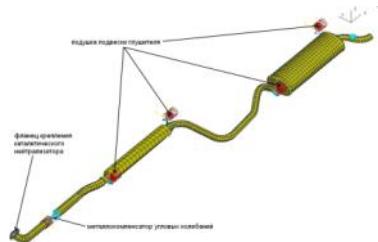
Pedestrian Safety
Engineering



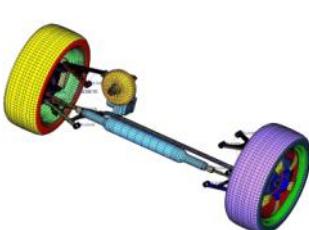
Brake system
Engineering



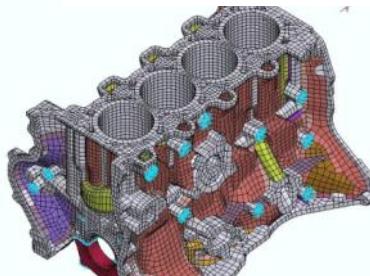
Intake Engineering



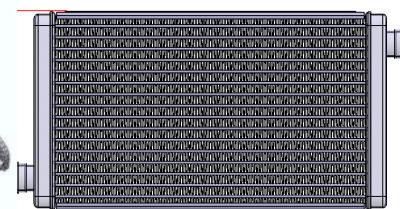
Exhaust Engineering



Suspension Engineering



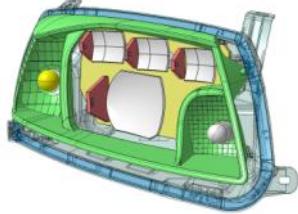
Engine Subsystems
Engineering



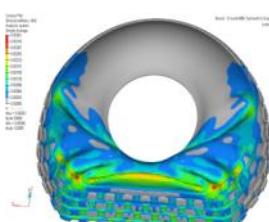
HeatExchanger
Engineering



Transmission
Engineering



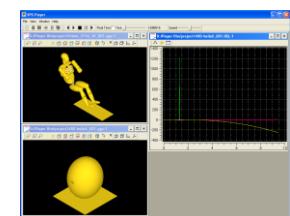
Lighting Engineering



Rubber Engineering



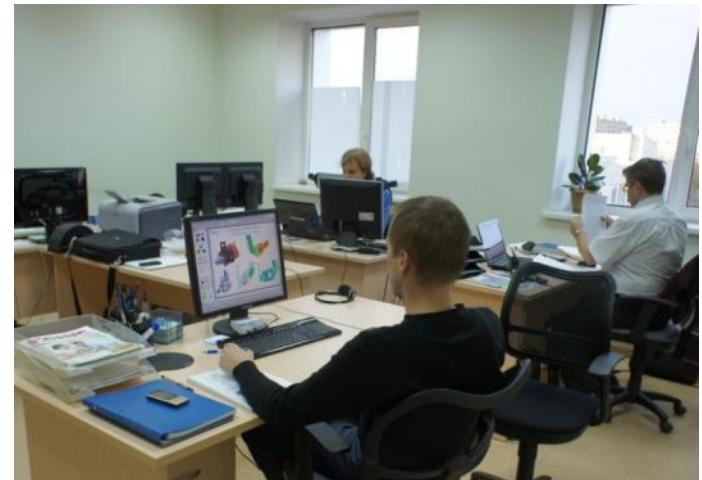
Engine Mounting
Engineering



Engineer Software
Development

Company Description

- ▶ **Engineering Office, Togliatti**
- ▶ **Quality System:** plans certification ISO 9001
 - + elements of ISO 16949 (FMEA and others) in 2016
- ▶ **Team**
 - ▶ All engineers are Master degree
 - ▶ + 2 Phd, 2 postgraduate students
 - ▶ More than 50 scientific articles, 2 books
 - ▶ Experience in automotive industry more 20 years
 - ▶ Experience in CAE more 10 years
- ▶ **Qualification, experience, learning**
 - ▶ Catia, NX, SolidWorks
 - ▶ LS-Dyna, MSC.Nastran, Ansys, SimulationX, PRADIS, Ansys CFX, Star CCM, Fluent, Ansa, HyperMesh, OptiStruct, Code-Aster, OpenFoam, Matlab
 - ▶ Learning of ISO/TS 16949, VDA 6.3, APQP, NPI, 5S, Lean office, PPAP, LS-Dyna, Catia, NX
- ▶ **Software/Hardware**
 - ▶ CAD: Catia V5 (license), NX (rent)
 - ▶ CAE: LS-Dyna (license + cluster rent), ANSYS CFX (cluster rent), MSC.Nastran (rent), PRADIS (home design software), Code-Aster, OpenFoam, Salome (GNU)
 - ▶ Project and Data Development: PLM TeamCenter, PDM Redmine
- ▶ **Statistics for 11 years (2005-2016)**
 - ▶ More 380 projects for automotive industry and others
 - ▶ Projects duration from 2 weeks to 2-3 years
 - ▶ Work with 6 Worldwide OEMs



▶ **3D Design, Drafting, Quality Management**

- ▶ Body In White
- ▶ Mechanisms of Vehicle
- ▶ Exterior and Interior of Vehicle
- ▶ Plastic elements
- ▶ Systems of Engine (Intake and Exhaust Systems)
- ▶ HVAC
- ▶ HeatExchangers
- ▶ Transmission (Driveline, GearBox, Final Drive, Axles)
- ▶ Suspension
- ▶ Brake System

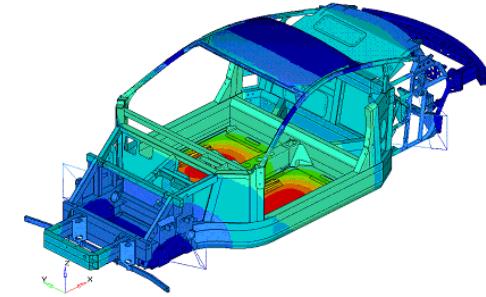
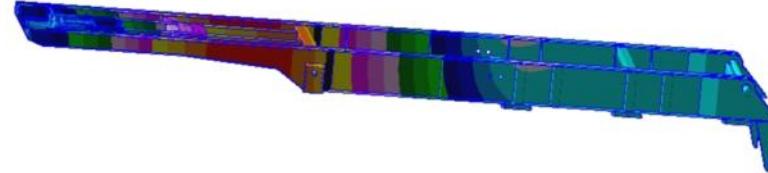
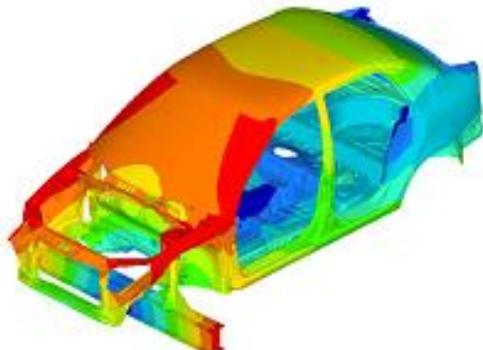
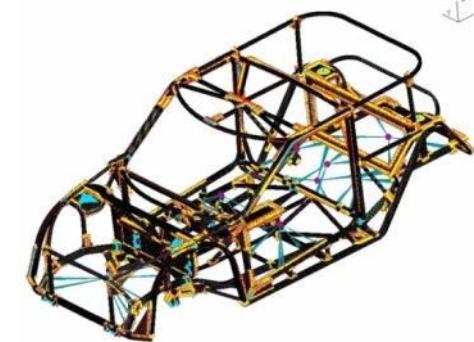
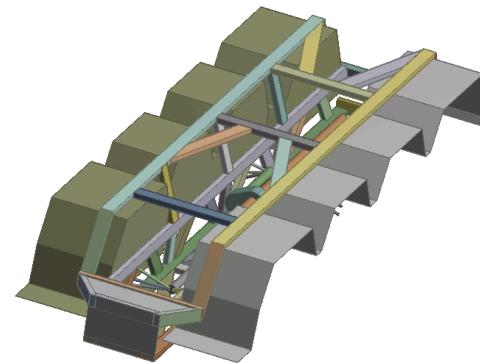
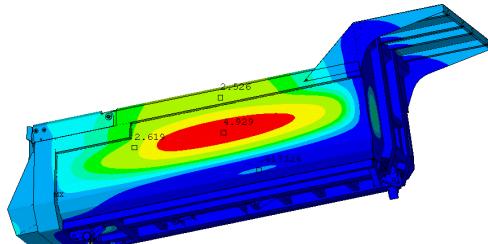
▶ **CAE Simulation**

- ▶ Strength analysis
- ▶ Modal and Frequency analysis, Vibroacoustic (NVH)
- ▶ External and Internal Aerodynamics
- ▶ Passive Safety analysis
- ▶ Dynamic of mechanisms, hydraulics, pneumatics
- ▶ NVH analysis
- ▶ System analysis

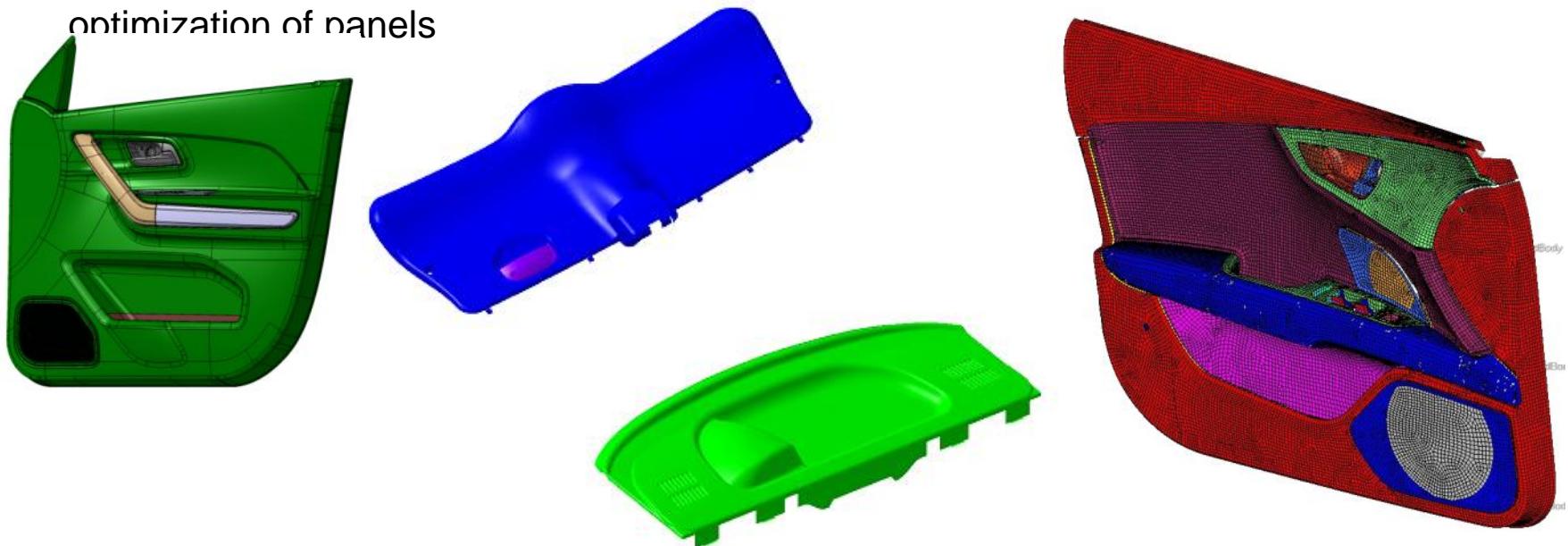
▶ **Optimization and multivariate analysis**

Solutions for Body-In-White

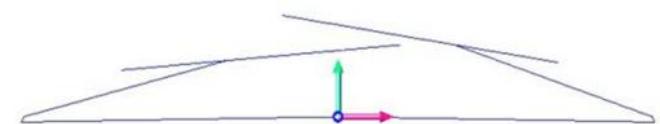
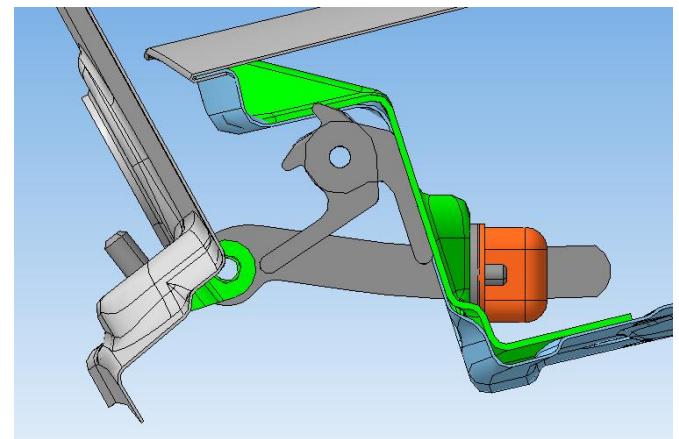
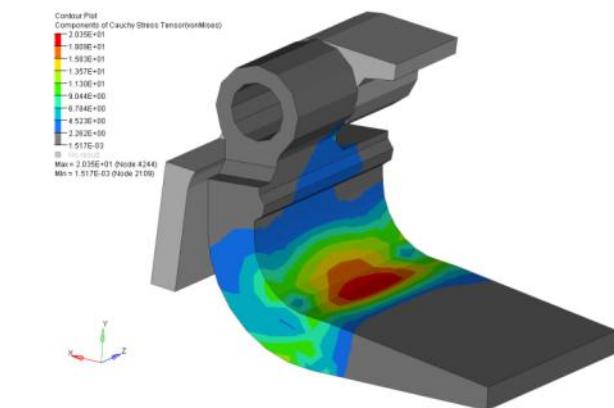
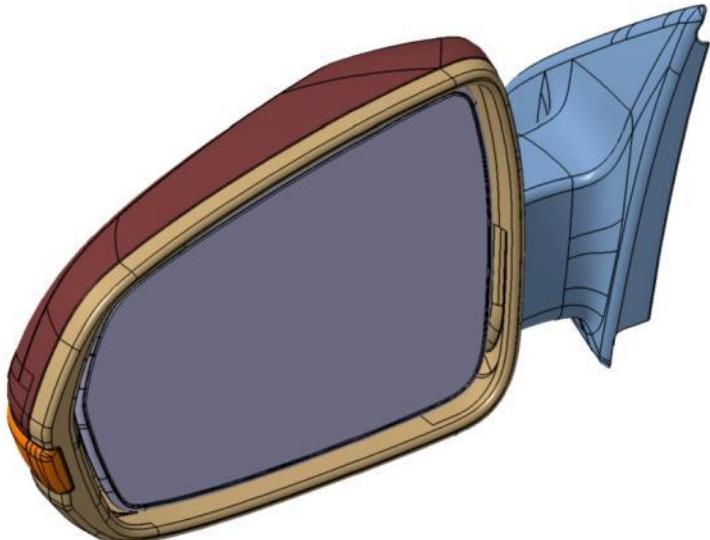
- ▶ Design of Body-In-White and his elements
- ▶ Packaging
- ▶ Drafting (ISO/GOST Standards), FMEA
- ▶ All types of FEA (strength, vibroacoustics, acoustics, crash-tests)
- ▶ Passive Safety analysis (driver/occupants/pedestrian)
- ▶ Optimization of mass, stiffness and eigen-frequencies. Shape and thickness optimization of panels



- ▶ Dashboard, doors and roof panels design
- ▶ Design of interior elements (handles, levers, plafonds, mats, cover plates, sound-proofing)
- ▶ Exterior Design (A-Class Surfaces)
- ▶ Packaging
- ▶ Drafting, DFMEA
- ▶ All types of FEA (strength, vibroacoustics, acoustics, crash-tests, internal aerodynamics, thermal)
- ▶ Passive Safety analysis (driver/occupants/components)
- ▶ Optimization of mass, stiffness and eigen-frequencies. Shape and thickness optimization of panels

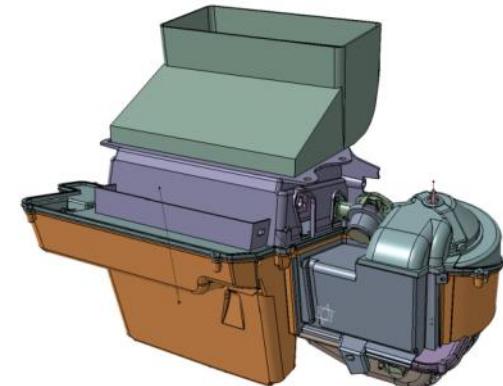
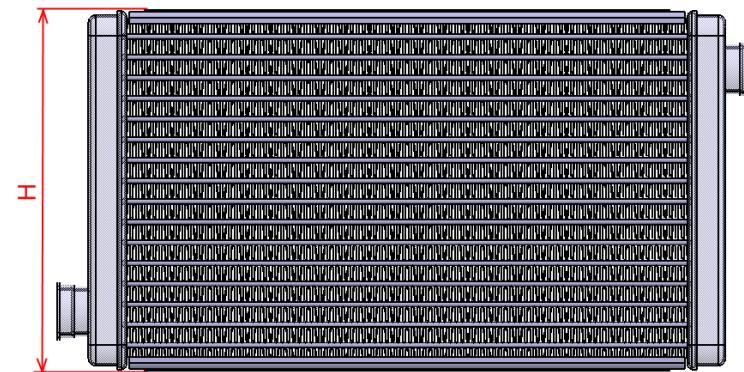
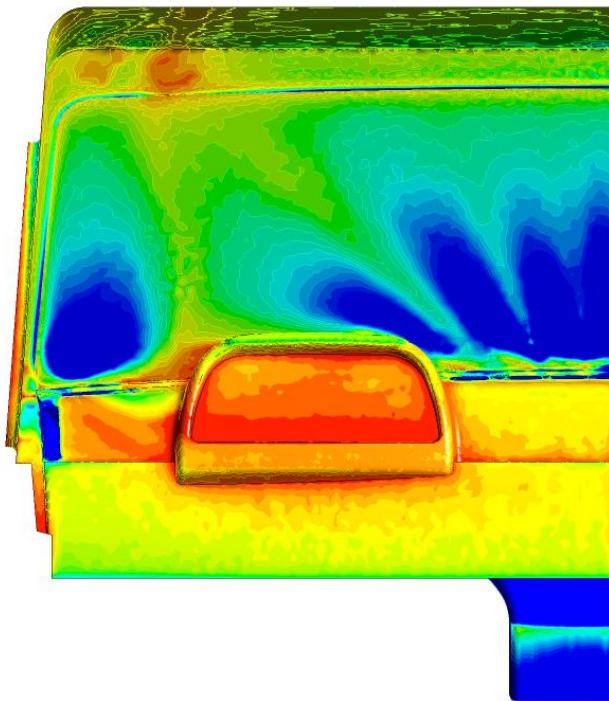


- ▶ **Design of Units**
 - ▶ Mirrors
 - ▶ Windows wipers and raisers
 - ▶ Door stops and hinge
 - ▶ Pedals, levers, locks, handles
- ▶ **Multi Body Simulation**
- ▶ **Analysis and optimization of Strength**

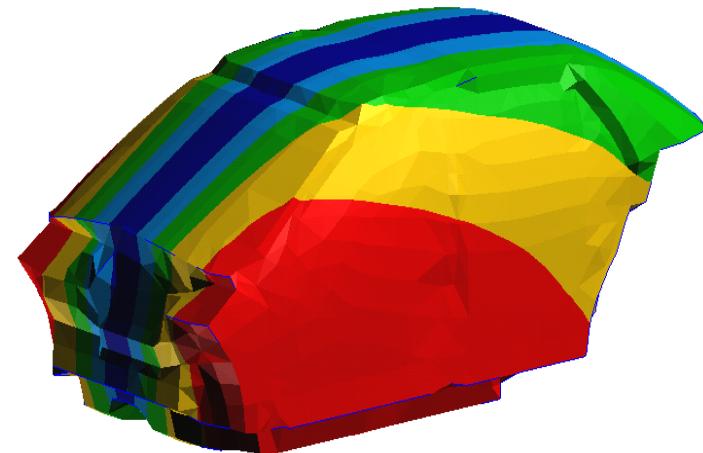
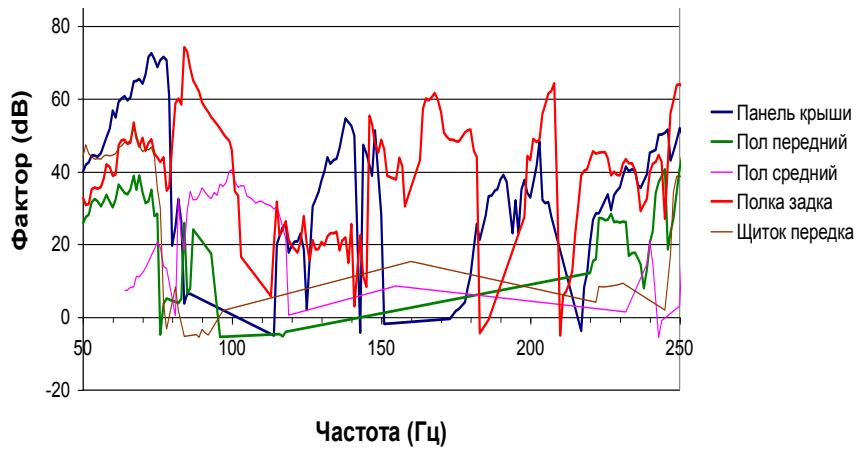
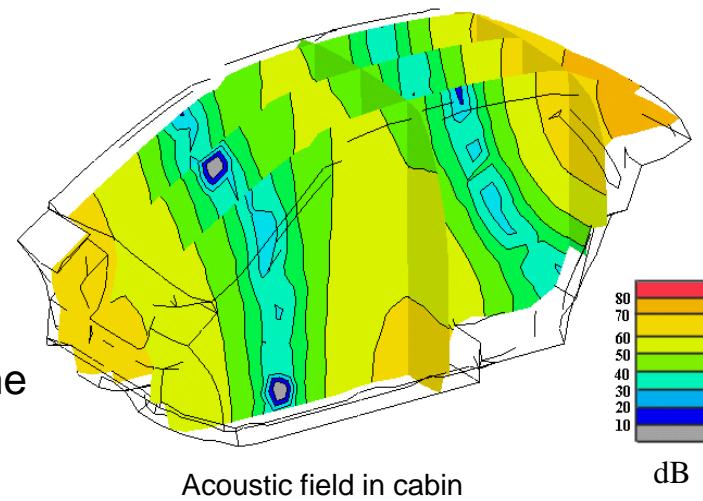


Solutions for HVAC

- ▶ Airway design
- ▶ Design elements of HVAC system
- ▶ Efficiency analysis of HVAC
- ▶ Climate analysis cabin (defrosting, air flow analysis)
- ▶ Analysis and shape optimization of channels
- ▶ Noise decreasing

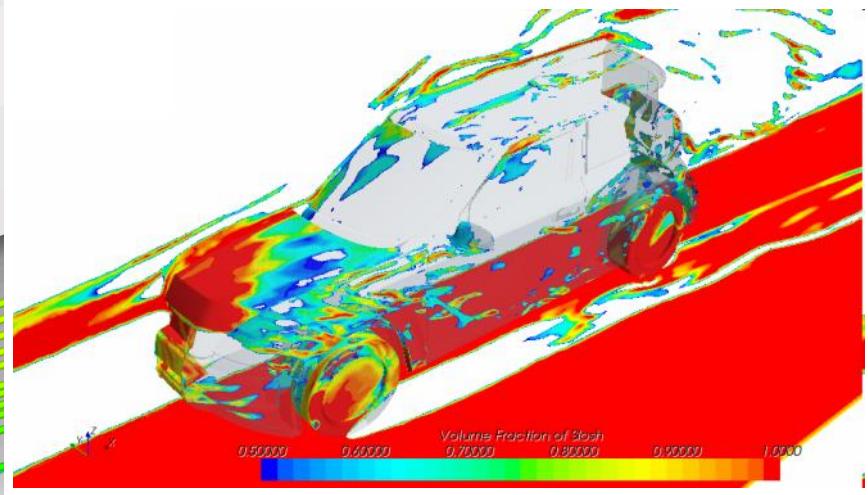
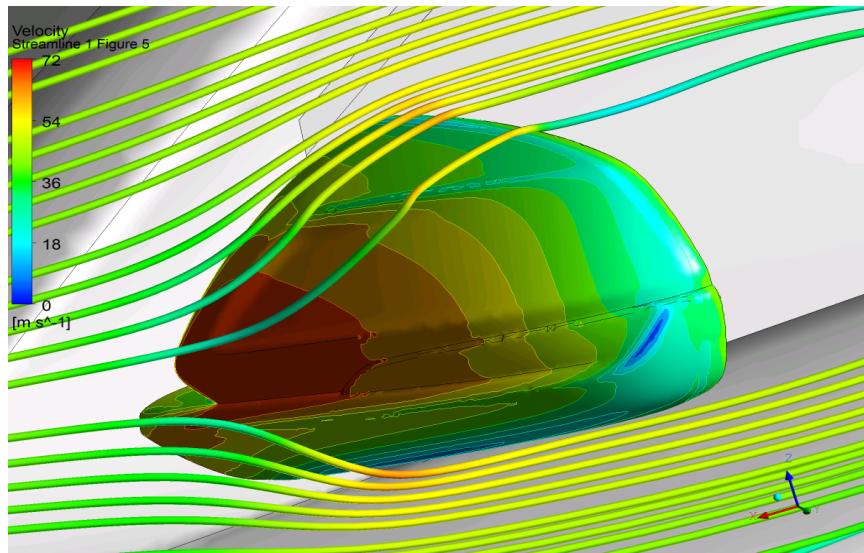
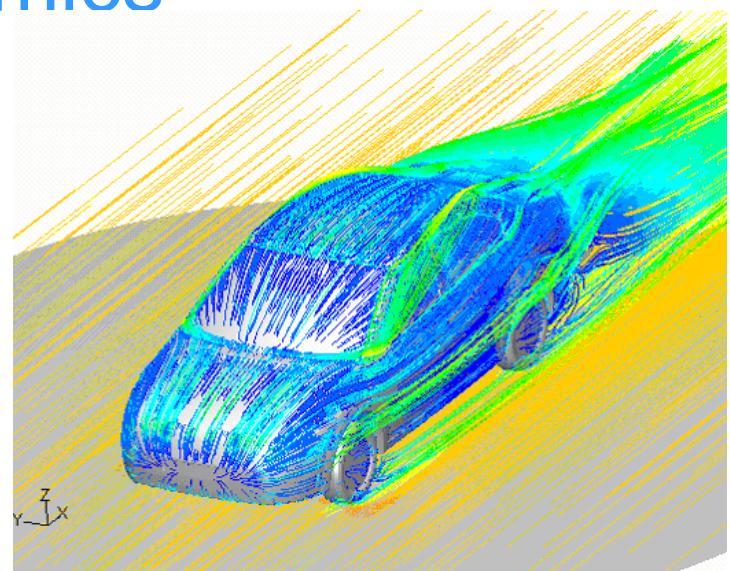


- ▶ **Structural Analysis**
 - ▶ Local dynamic stiffness
 - ▶ Dynamic stiffness sensitivity analysis
- ▶ **Noise and vibration**
 - ▶ Vibration transfer functions
 - ▶ Analysis of transfer paths of vibrations
 - ▶ Eigenfrequencies and modal of acoustic volume
 - ▶ Transfer function of structural internal noise
- ▶ **“Poor” points analysis of structure**
 - ▶ Analysis of transfer paths of structural internal noise
 - ▶ Modal contribution in the summary acoustic response
 - ▶ Body panel contribution in the summary acoustic response



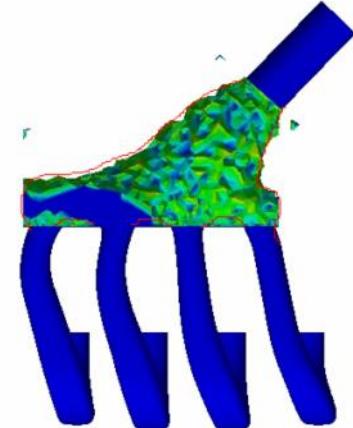
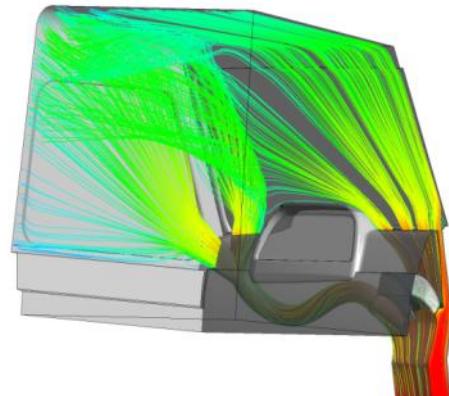
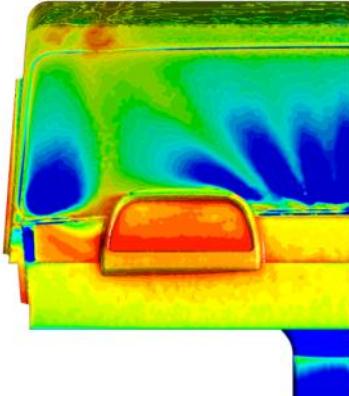
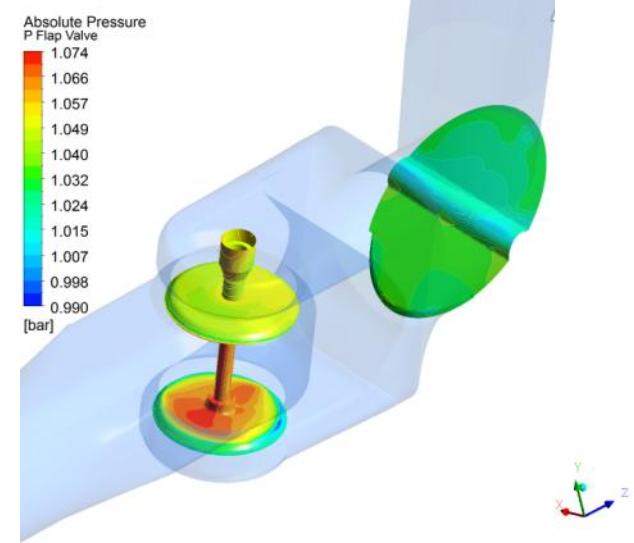
Solutions for External Aerodynamics

- ▶ Cx,Cy and other ratios analysis
- ▶ Dirty analysis
- ▶ Optimization of shape
- ▶ Optimization of lamps position
- ▶ Optimization of heat-exchanger position
- ▶ Aero-acoustics estimation



Solutions for Internal Aerodynamics

- ▶ **Climate cabins analysis**
 - ▶ Heating and defrosting analysis
 - ▶ Air flow optimization in cabins
- ▶ **Underhood space analysis**
 - ▶ Heat exchange analysis
 - ▶ Optimization of ventilation
- ▶ **HVAC analysis**
 - ▶ Airway optimization for pressure drop and noise decreasing
- ▶ **Fuel system analysis** (filling, slashing, frosting-defrosting of tank)



Analysis according rules

- ▶ Bus crash-test (ECE R66, ECE R107)
- ▶ Crash-test (ECE R94, EG 96/79, ECE R95, EG 96/27, ECE R42 and EuroNCAP)
- ▶ M2, M3 class (ECE R52)
- ▶ Pedestrian safety (EG 03/102, EG 04/90)

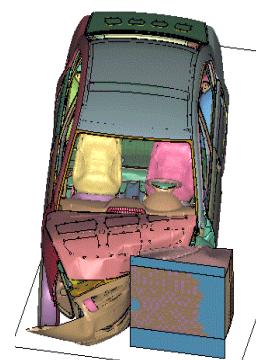
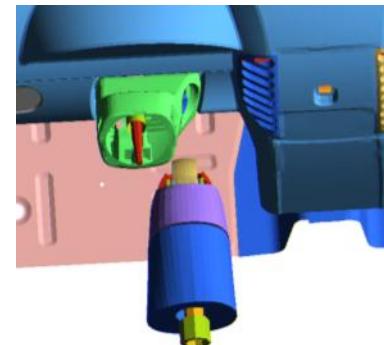
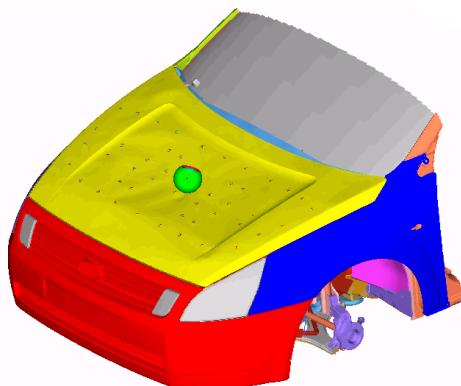


Component test

- ▶ Belts (ECE R14), Locks (ECE R11), Seat (ECE R17)
- ▶ Chest impact (ECE R12), Head impact (ECE R12)
- ▶ Dashboard panel, knee zone (ECE R21, EG 74/60, EuroNCAP)
- ▶ Fuel system analysis (ECE R34)

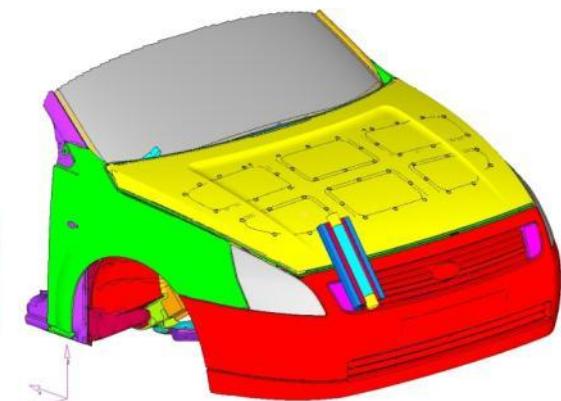
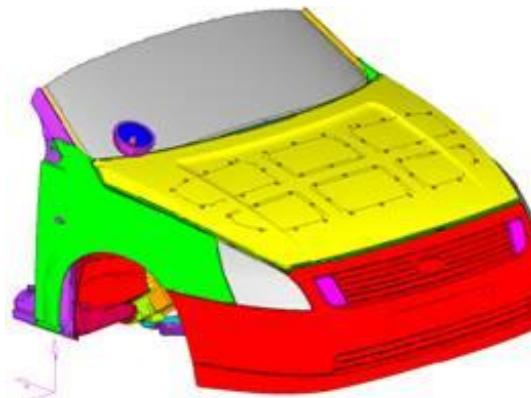
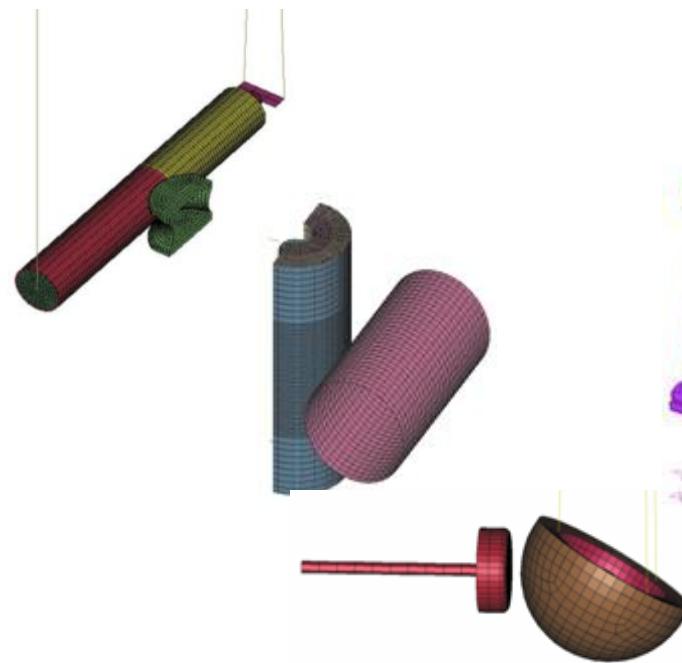
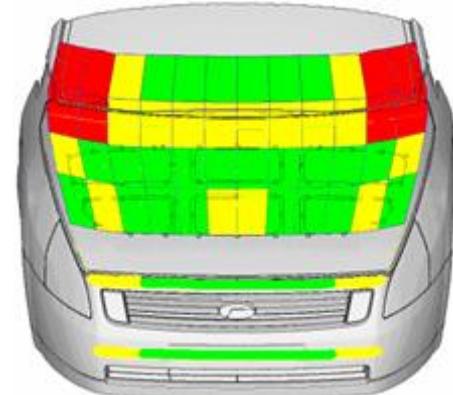
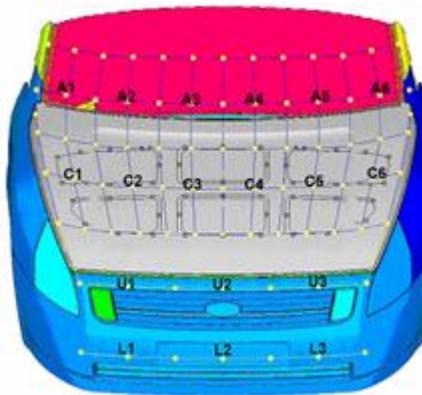
Simulation maintenance for certification

- ▶ Partner of certification company “Polinom” for cars certification



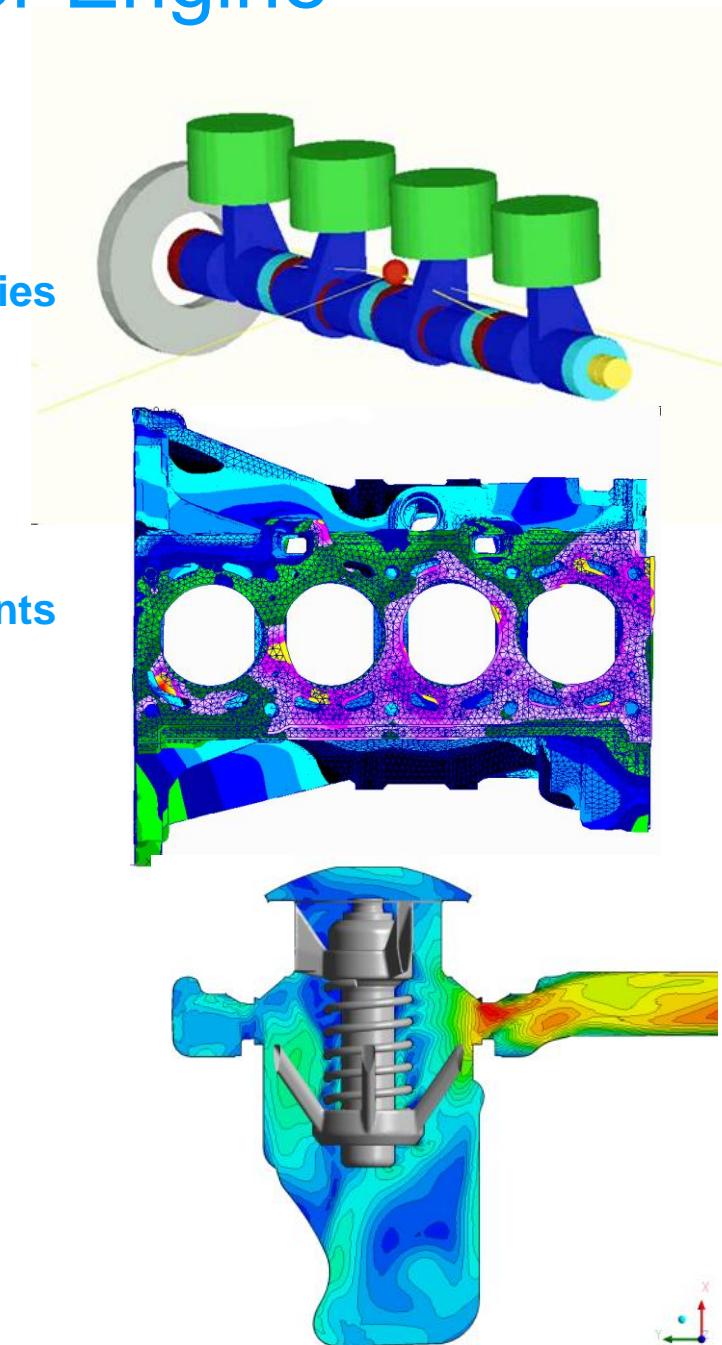
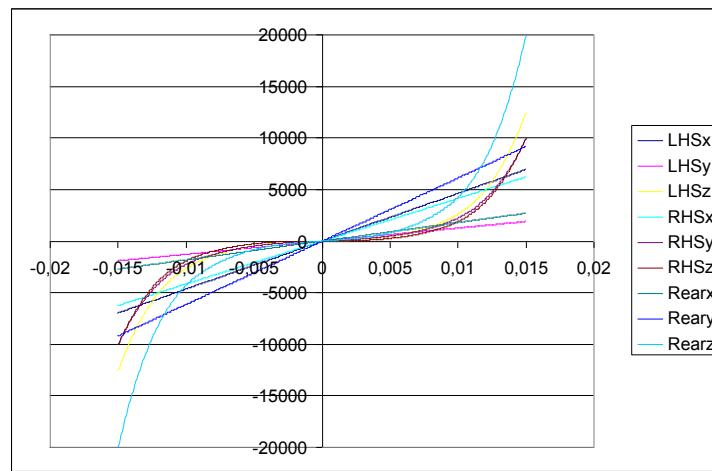
Pedestrian Safety

- ▶ Impactors calibration
- ▶ Finite element model creation
- ▶ Adult head analysis
- ▶ Children head analysis
- ▶ Lower legform analysis
- ▶ Upper legform analysis
- ▶ Estimation according EuroNCAP



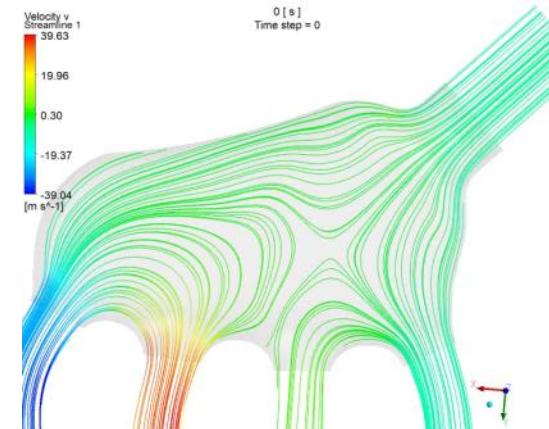
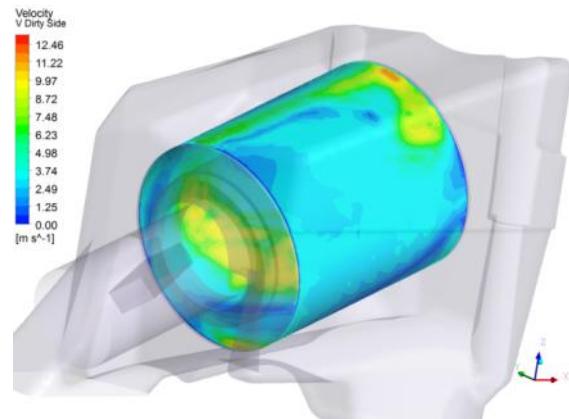
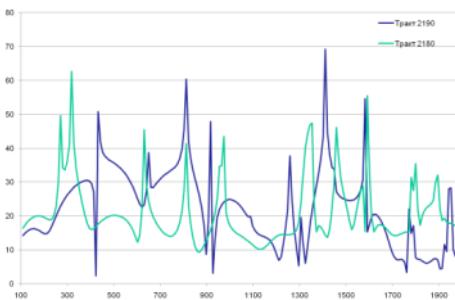
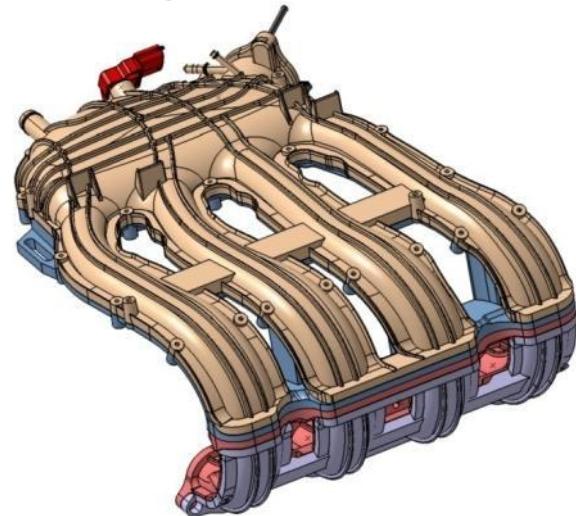
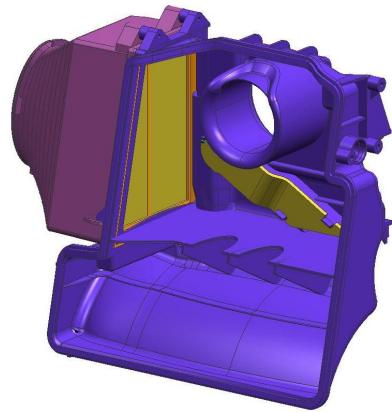
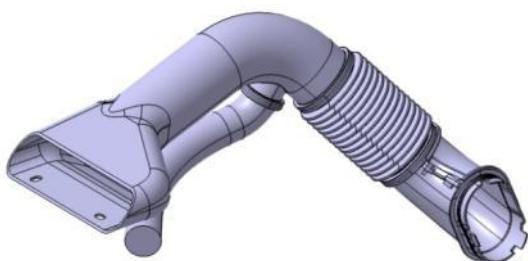
Solutions for Engine

- ▶ Mount optimization
- ▶ Analysis and optimization of cooling system
- ▶ Strength and stiffness analysis of bodies (cylinder block, crank case and so on)
- ▶ Topology optimization of case shape
- ▶ Structure-Acoustic coupling analysis
- ▶ CFD analysis of fuel system
- ▶ Topology and size optimization of elements (crank, piston, conrod, camshaft)
- ▶ 1D/3D system simulation
- ▶ Combustion analysis



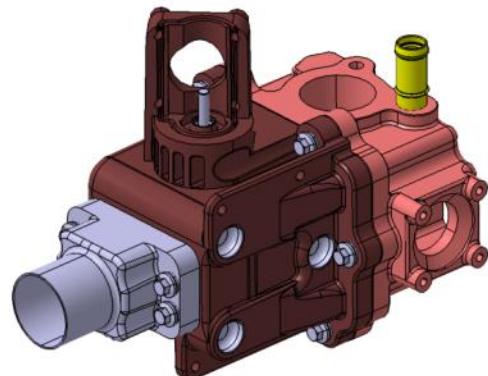
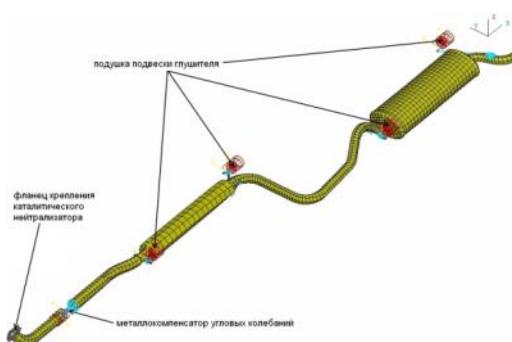
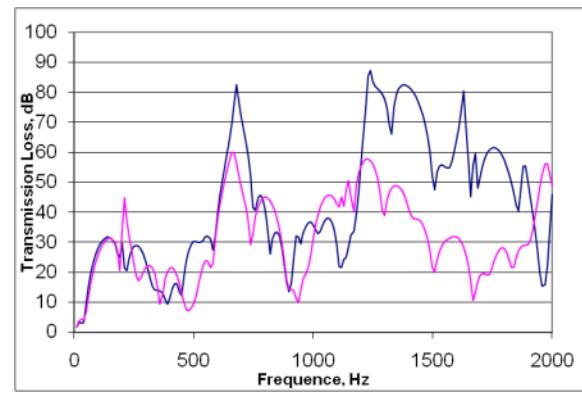
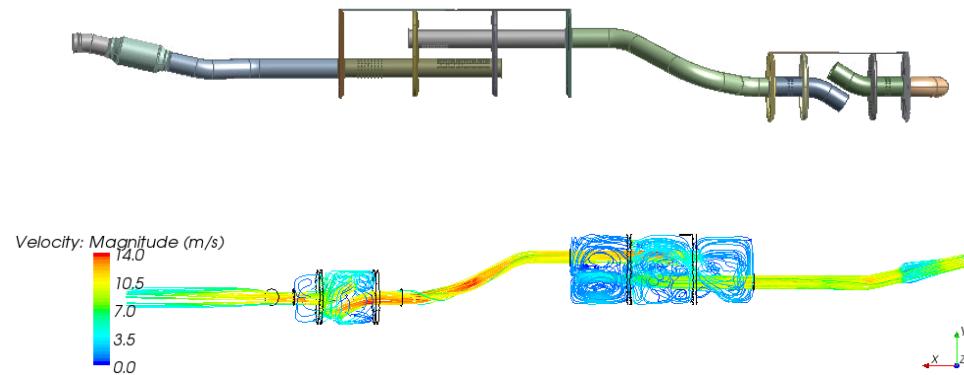
Solutions for Intake systems

- ▶ Design of Inlet pipe, Intake unit, Filter
- ▶ CFD analysis of Intake systems
- ▶ Shape optimization of Intake unit and Inlet pipe
- ▶ Acoustics design of Inlet pipe (mufflers and resonators design)



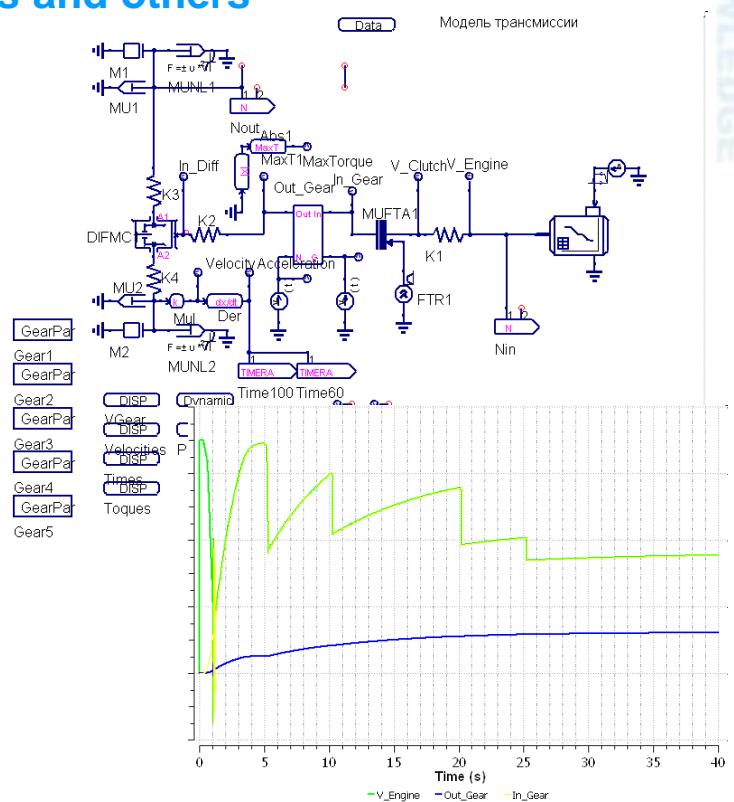
Solutions for Exhaust systems

- ▶ Design of “hot” and “cold” parts of Exhaust system
- ▶ CFD analysis of Exhaust system, pressure drop decreasing
- ▶ Acoustic design of Exhaust system (mufflers and resonators design)
- ▶ FEA (Strength, Vibration and Durability analysis) of Exhaust system
- ▶ Analysis and optimization of recirculation gas system (EGR)



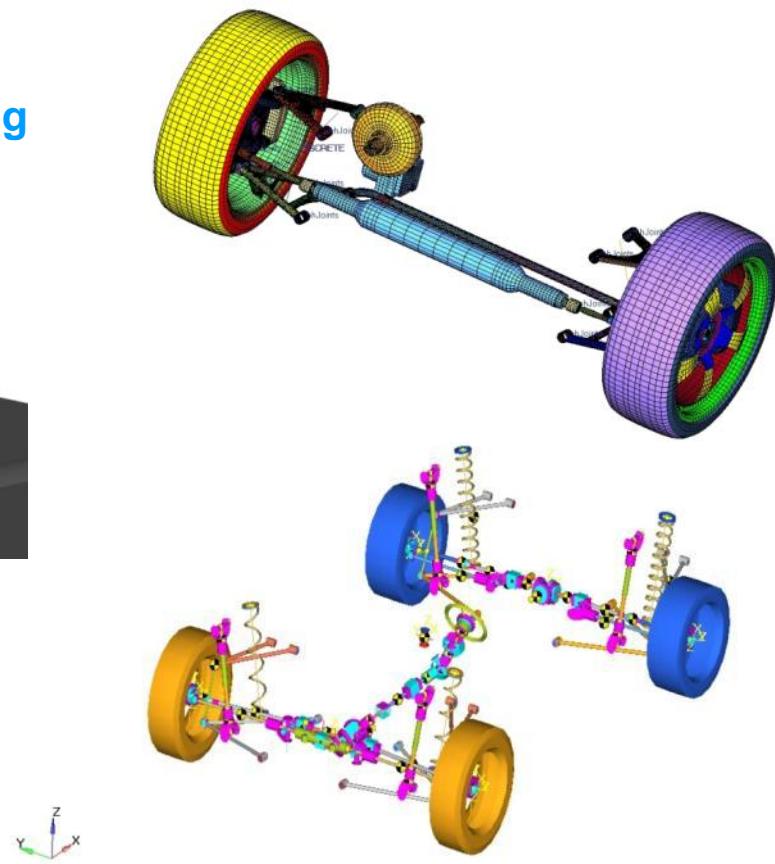
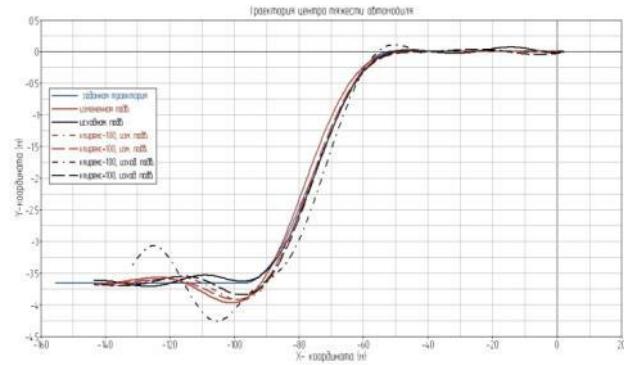
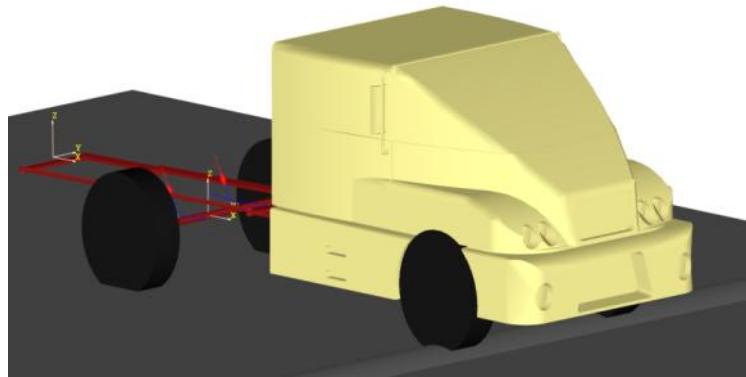
Solution for Powertrain

- ▶ Longitudinal Dynamic and optimization of gear ratio
- ▶ Loads Analysis for motion Modes
- ▶ Gear Design (GearBox, Final Drive, Differentials, ...)
 - ▶ Gears Design (Helical, Hypoid ,...)
 - ▶ Housing stiffness topology optimization
 - ▶ NVH analysis
 - ▶ Oil and Thermal analysis
- ▶ FEA Strength analysis for gears, shafts, levers and others



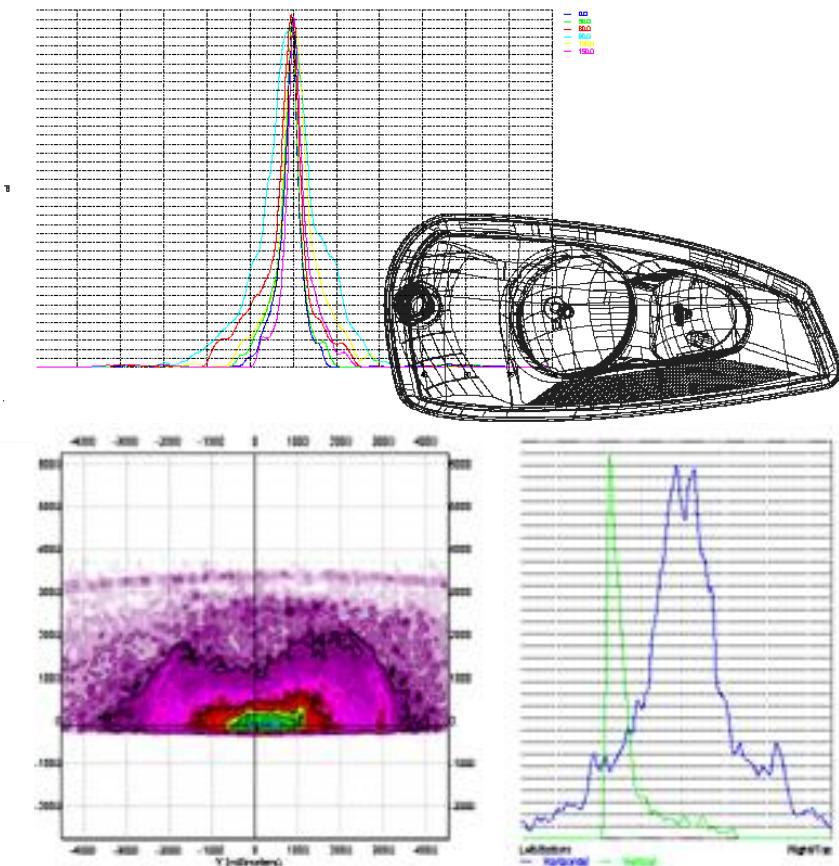
Solutions for Suspension and Chassis

- ▶ Design of Suspension and elements
- ▶ Multi Body Simulation
 - ▶ Steerability, Smoothness analysis
 - ▶ Load on Body analysis
- ▶ FEA (Strength, Vibration analysis)
- ▶ Optimization of Suspension and Steering

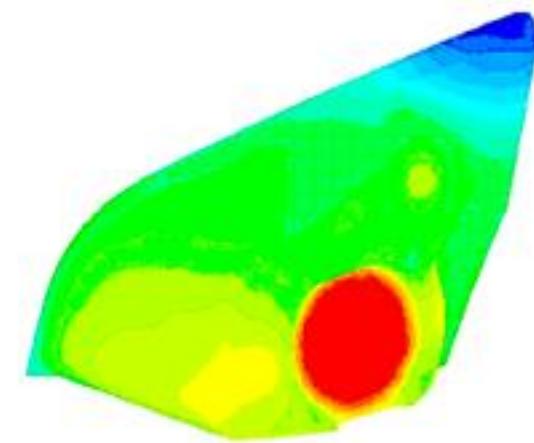
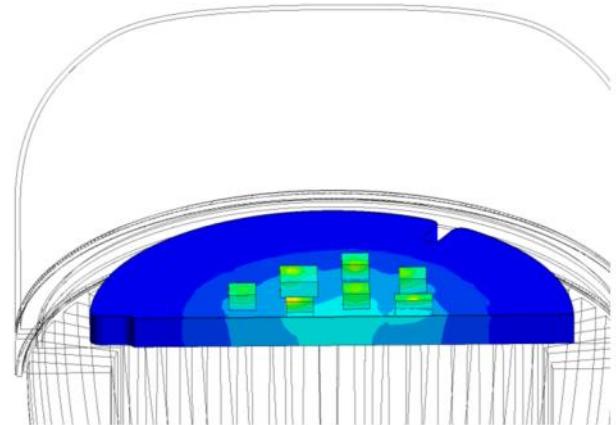


Solutions for Optics

- ▶ Illumination analysis
- ▶ Reflector design
- ▶ Thermal analysis



Illumination analysis



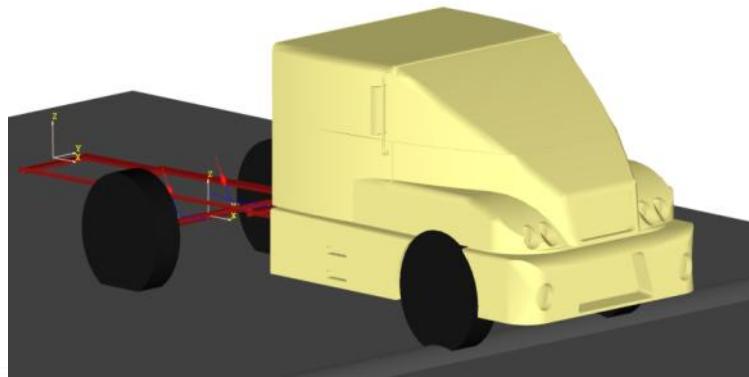
Thermal analysis

System Simulation

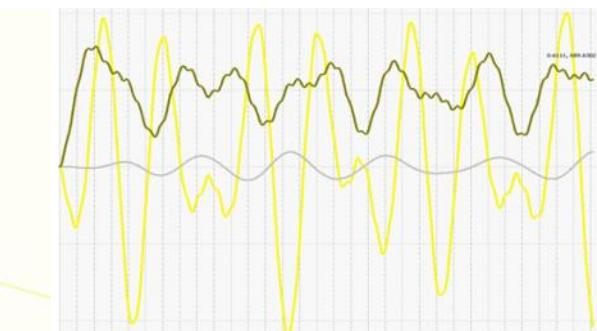
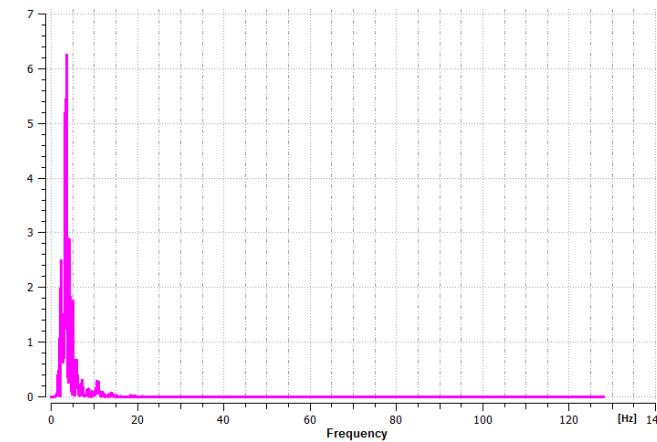
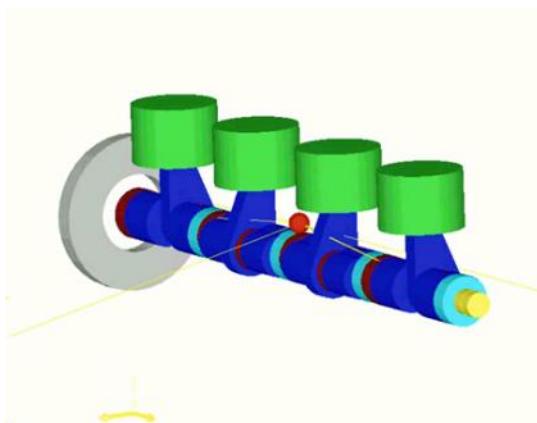
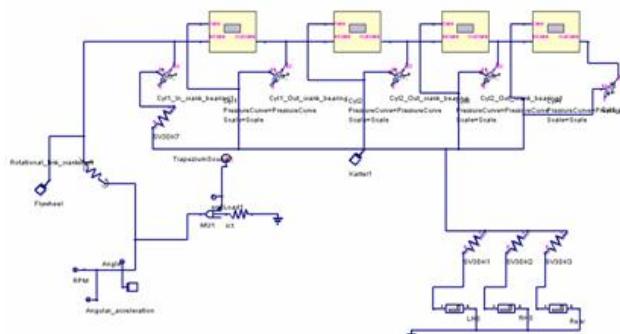
Multiphysical Block Simulation

- ▶ Mechanics + Hydraulics + Pneumatics + Electronics

Ride Analysis



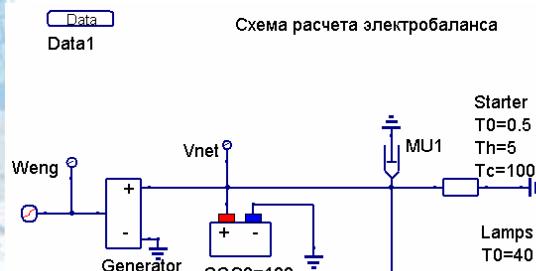
Engine NVH Analysis



Experience:

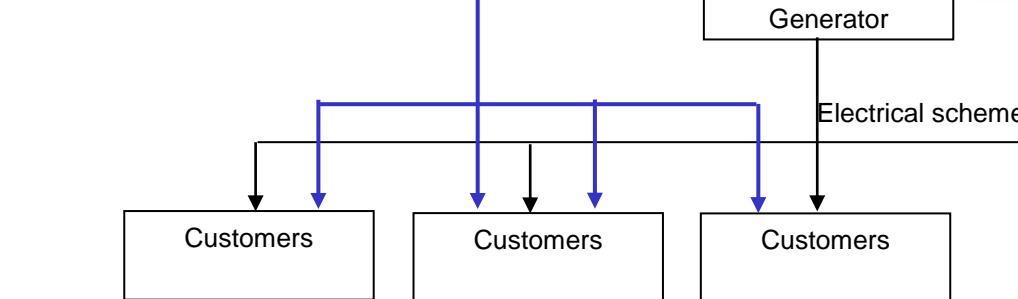
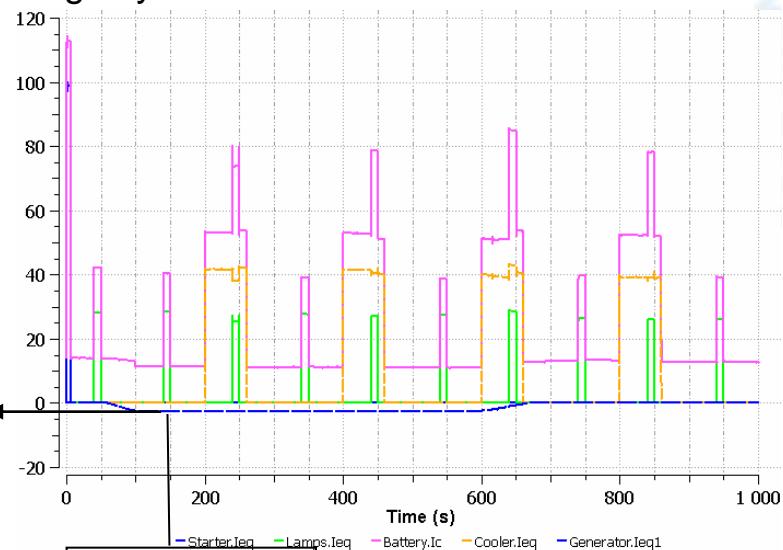
- Matlab (10 years)
- SimulationX (3 years)
- PRADIS (15 years)

Electrical Balance of Vehicle Analysis



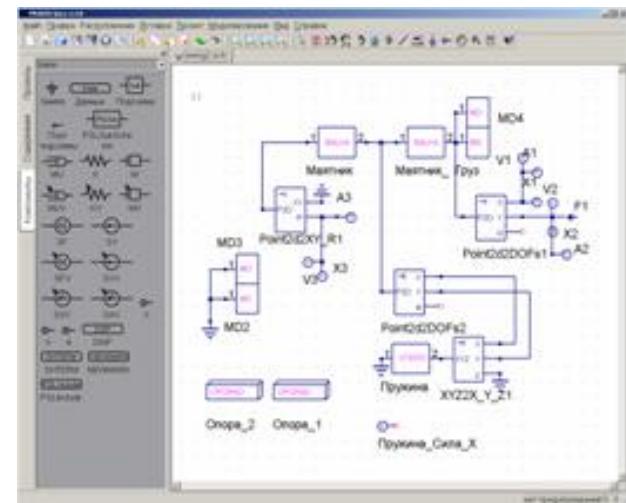
Dynamic
Dynamic1 DISP Scheme_disp

- electrical and mechanical coupling
- driver model
- environment model
- dynamic analysis
- battery charge dynamic



► **PRADIS is own software for system analysis**

- Multiphysical system dynamic analysis
- Biomechanics (dummy simulation)
- Car mechanism analysis
- More 160 models (mechanics, electronics, pneumatics, hydraulics, finite elements)



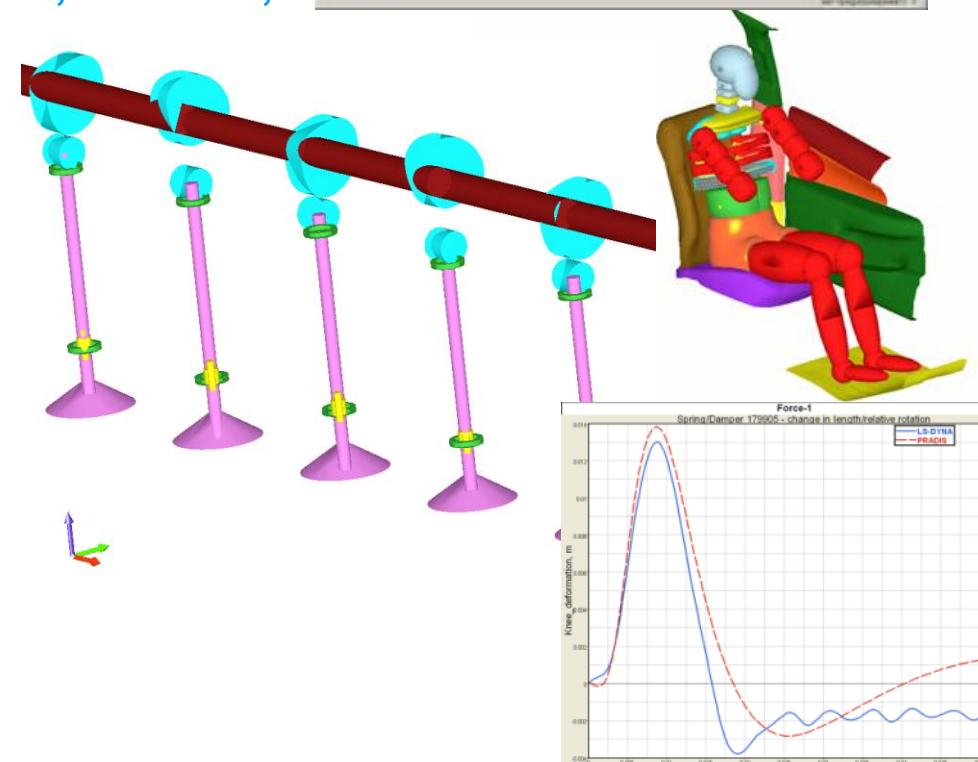
► **Modelica models development**

► **OpenCASCADE Experience (3D Geometric Kernel)**

► **Languages Experience: C/C++, Fortran, Modelica, Python, Java, Matlab**

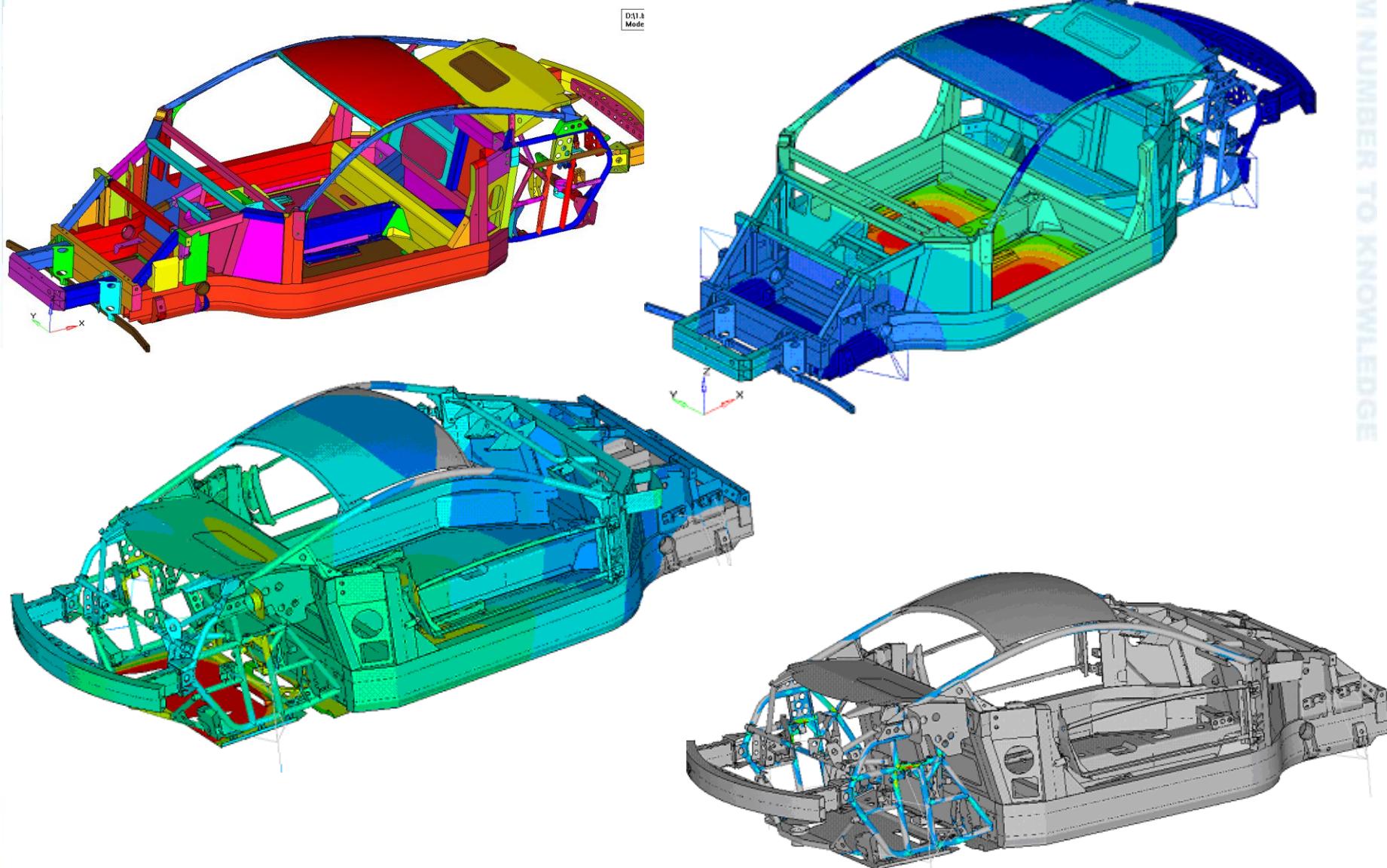
► **Projects:**

- 2D Schematic preprocessor
- 3D Postprocessor
- Suspension analysis
- Engine Vibration analysis
- Engine System analysis
- Electrical Balance analysis
- Dummy Simulation (EuroSID, Hybrid)

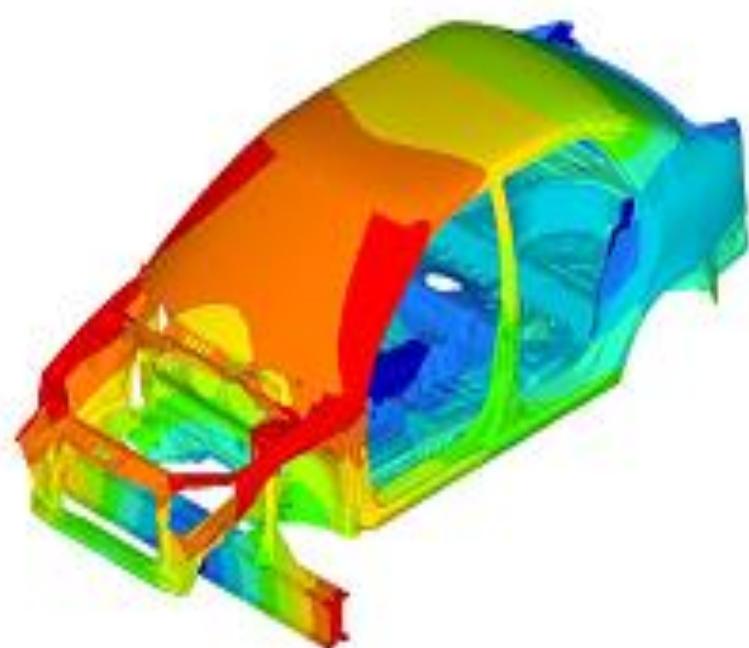
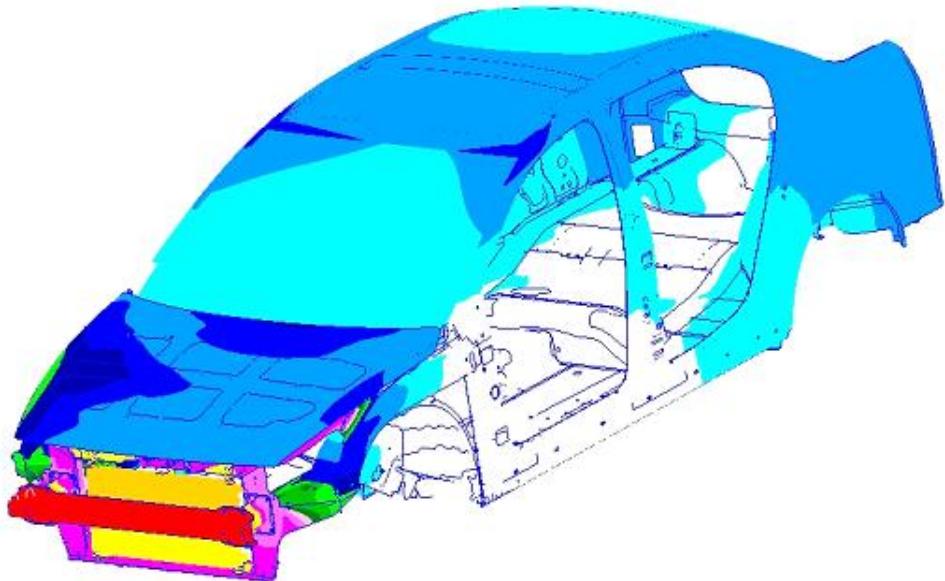


PROJECT EXAMPLES

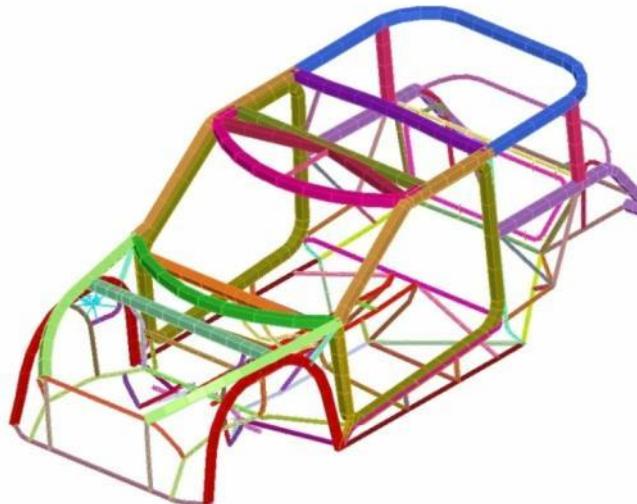
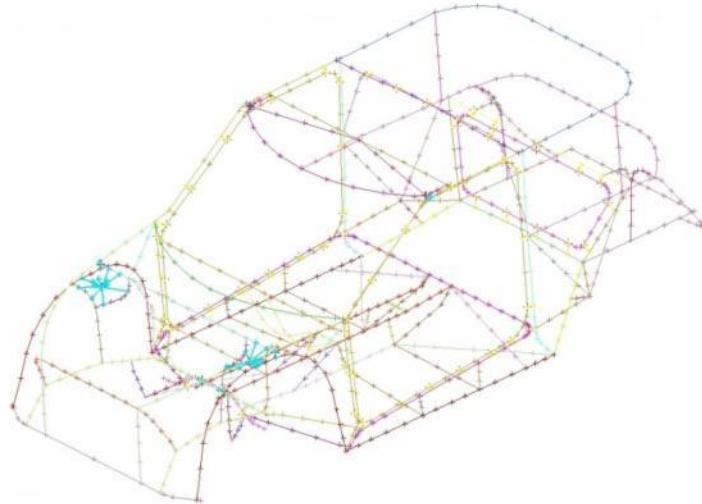
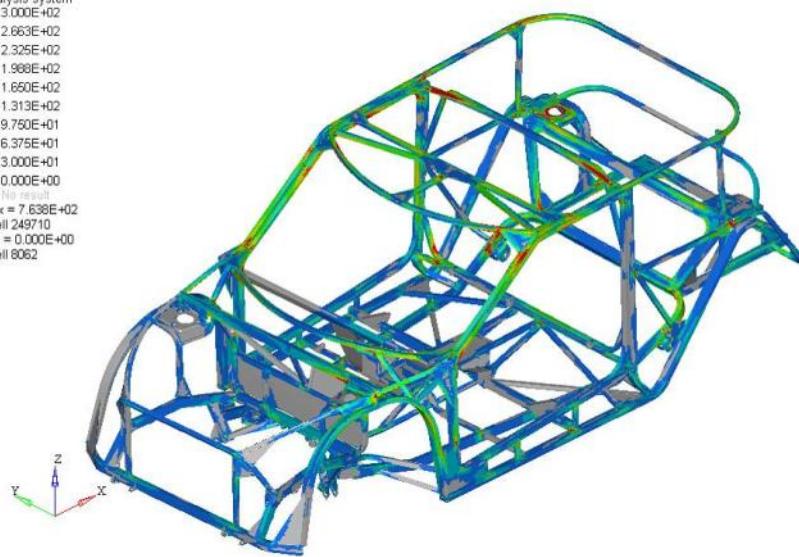
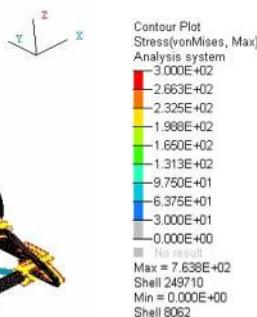
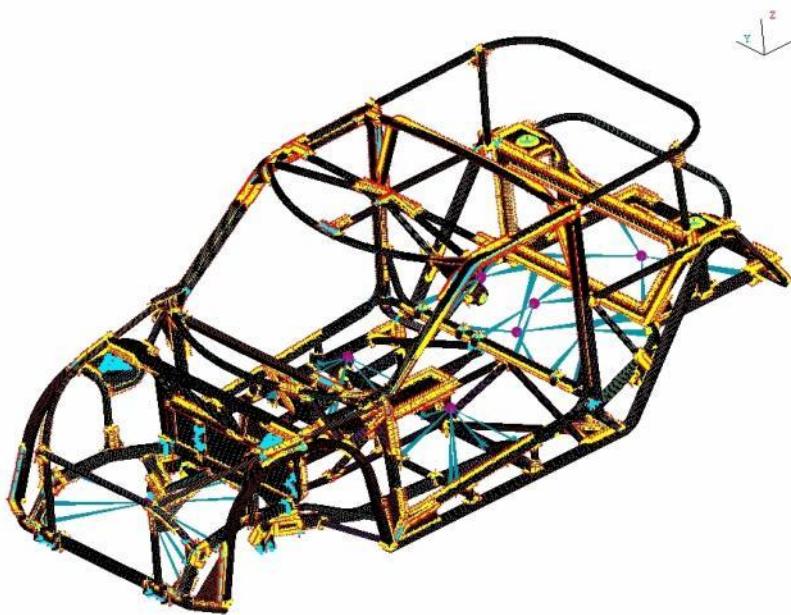
Strength analysis of sport-car



Strength analysis of BiW

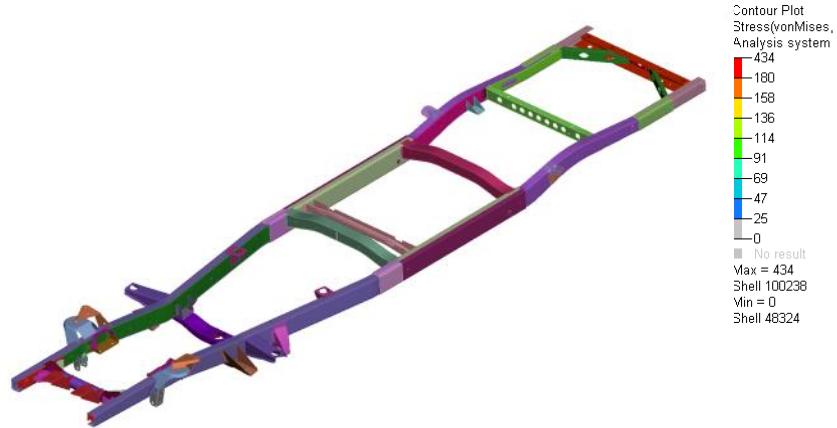


Passenger Car Body Optimization

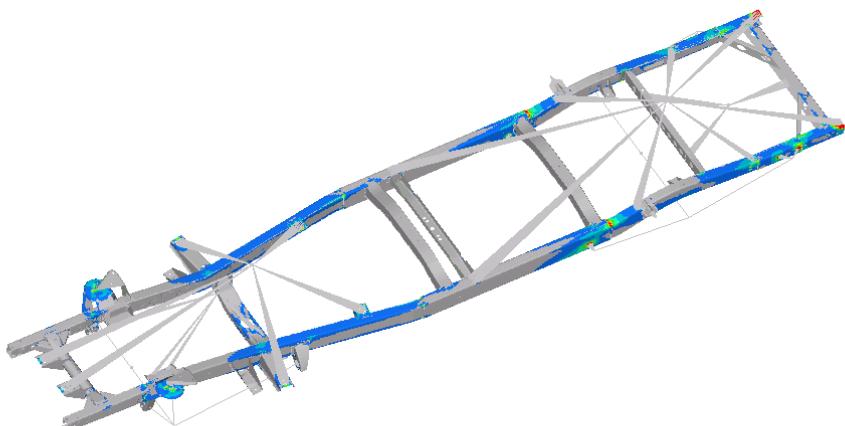


Initial Car Body was analysed and offered optimized construction, which has increased torsional stiffness in 2 times and decreased mass on 5%.

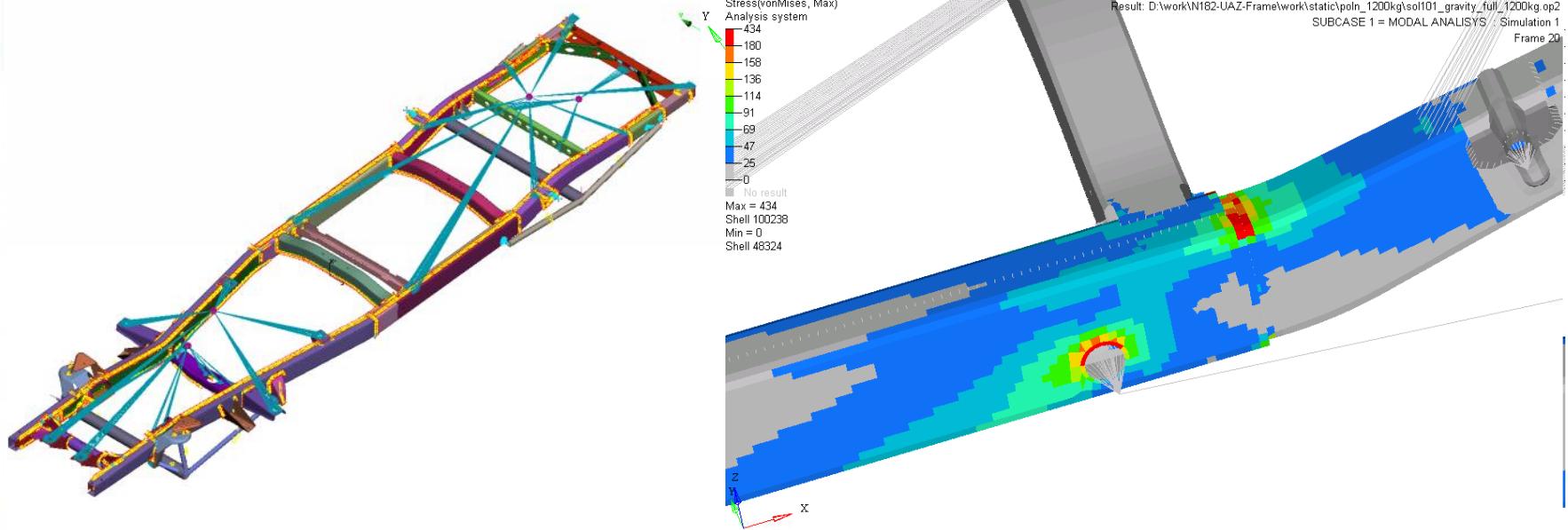
Frame Strength Optimization



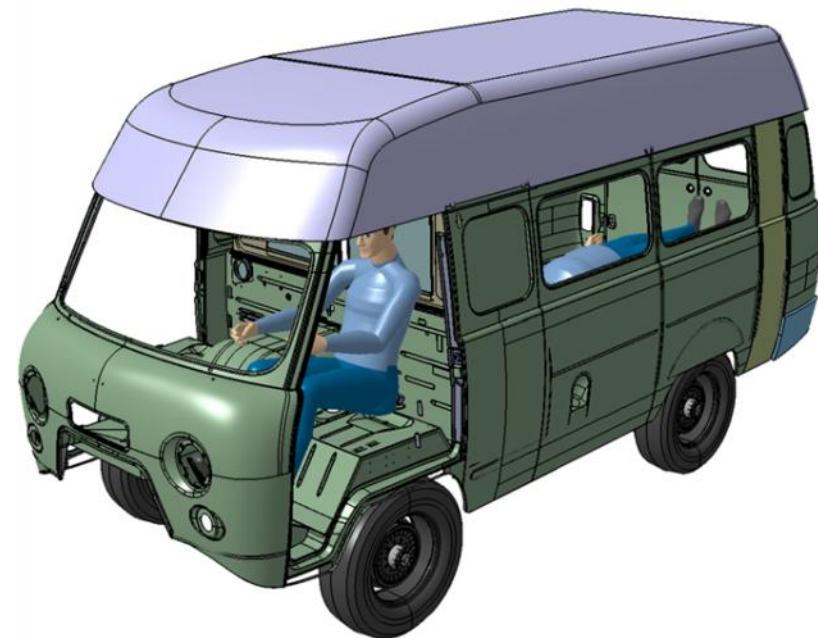
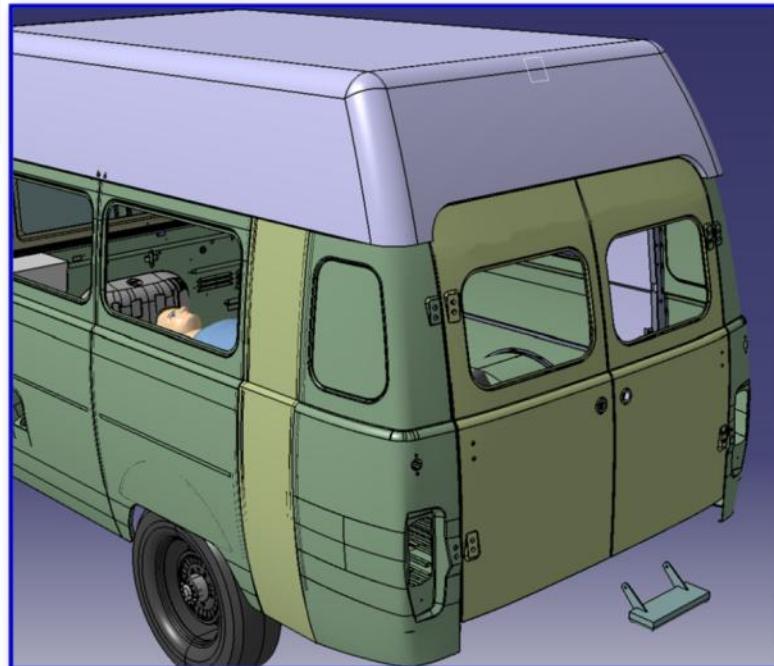
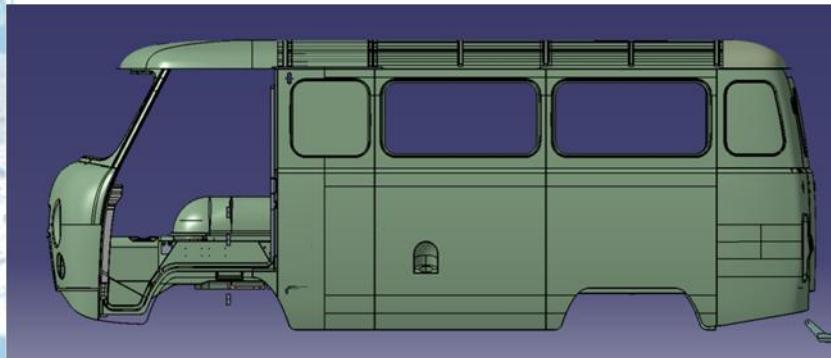
Model info: D:\work\N182-UAZ-Frame\work\static\poln_1200kg\sol101_Gravity_full_1200kg.dat
Result: D:\work\N182-UAZ-Frame\work\static\poln_1200kg\sol101_gravity_full_1200kg.op2
SUBCASE 1 = MODAL ANALYSIS : Simulation 1
Frame 20



Model info: D:\work\N182-UAZ-Frame\work\static\poln_1200kg\sol101_Gravity_full_1200kg.dat
Result: D:\work\N182-UAZ-Frame\work\static\poln_1200kg\sol101_gravity_full_1200kg.op2
SUBCASE 1 = MODAL ANALYSIS : Simulation 1
Frame 20

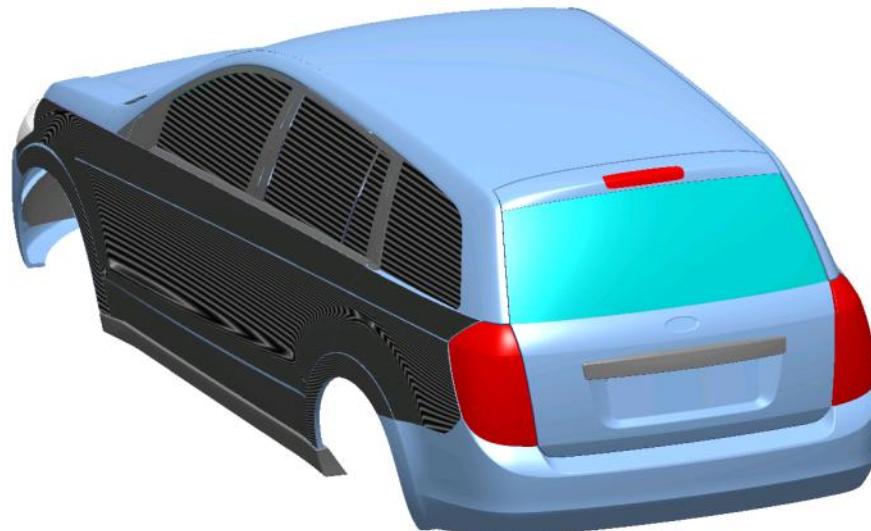
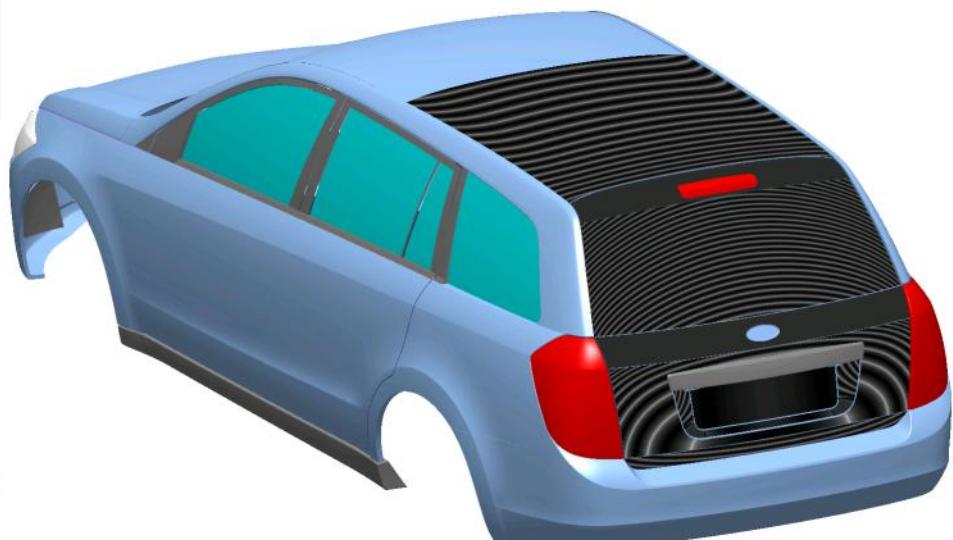
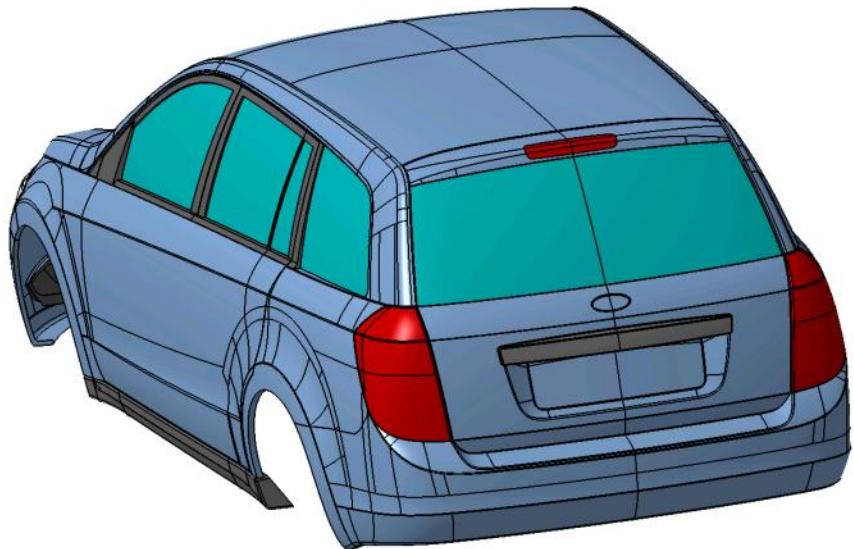


Packaging UAZ

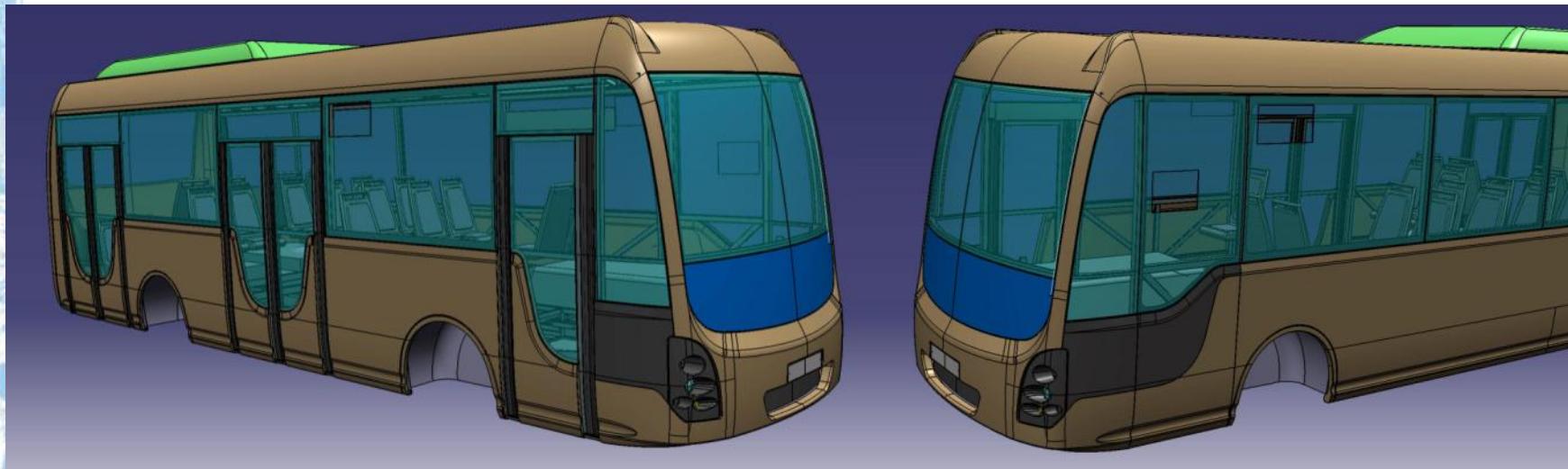


A-class Surfaces Design

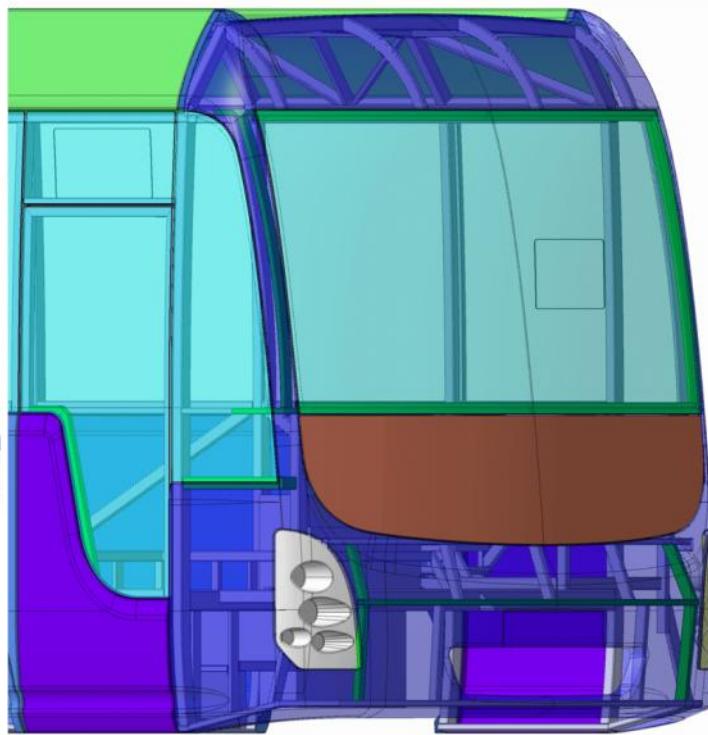
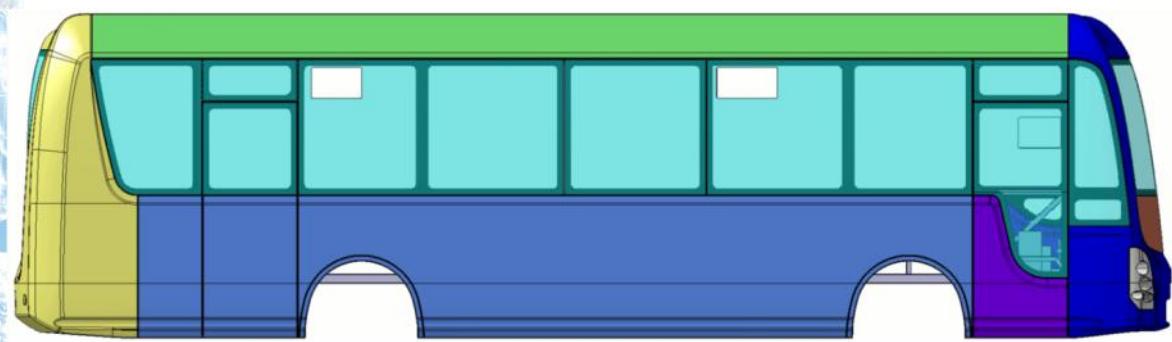
FROM NUMBER TO KNOWLEDGE



Exterior and Interior Bus Design

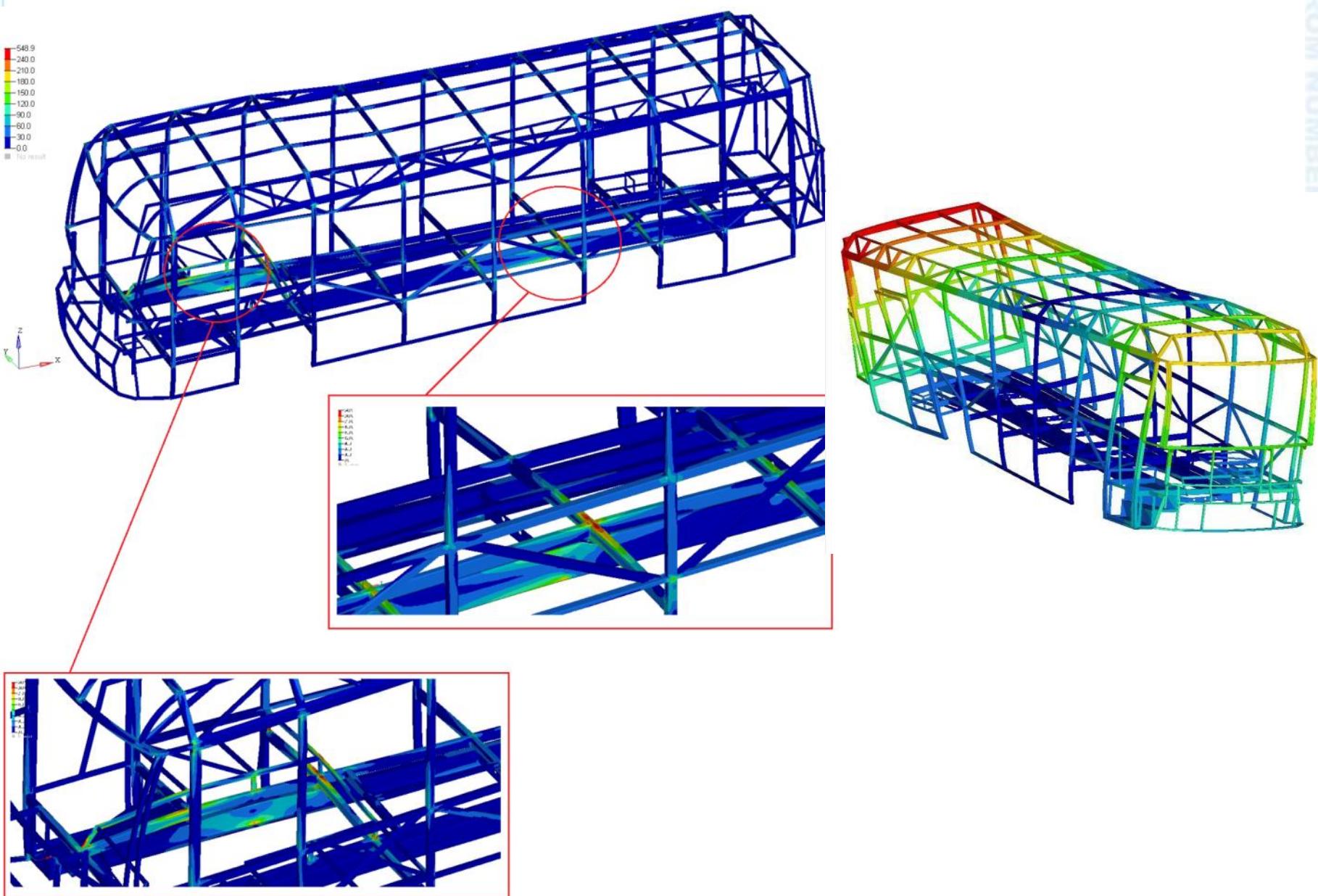


FROM NUMBER TO KNOWLEDGE



Strength, Stiffness and Modal analysis of Bus

FROM NUMBER



Prototypes of Designed Buses



City Bus

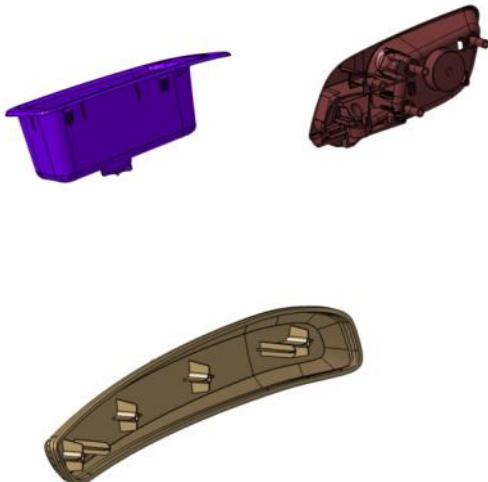
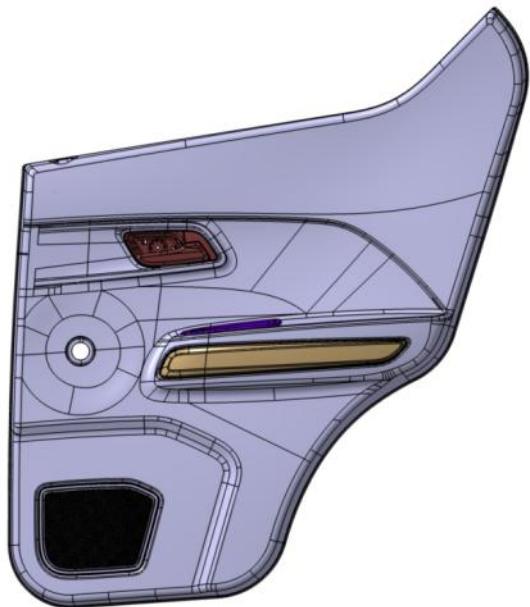
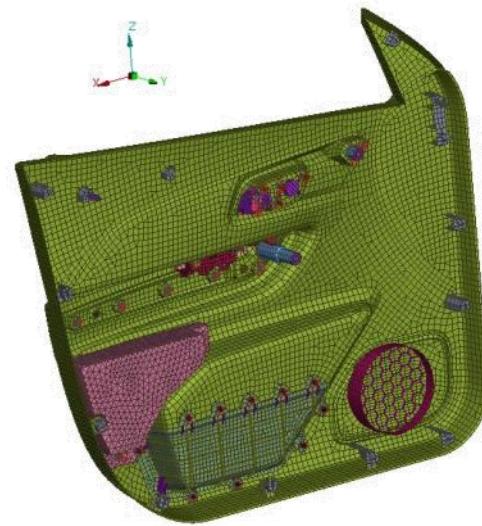
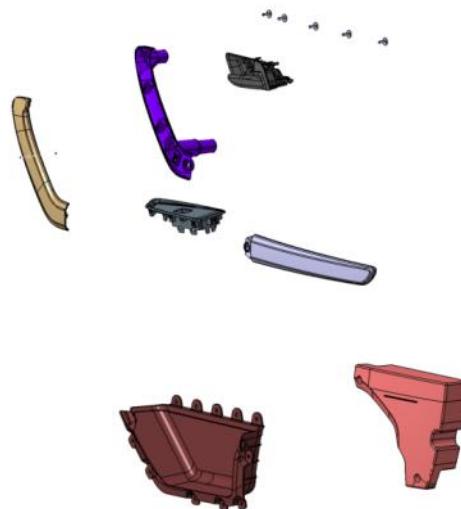


SubCity Bus

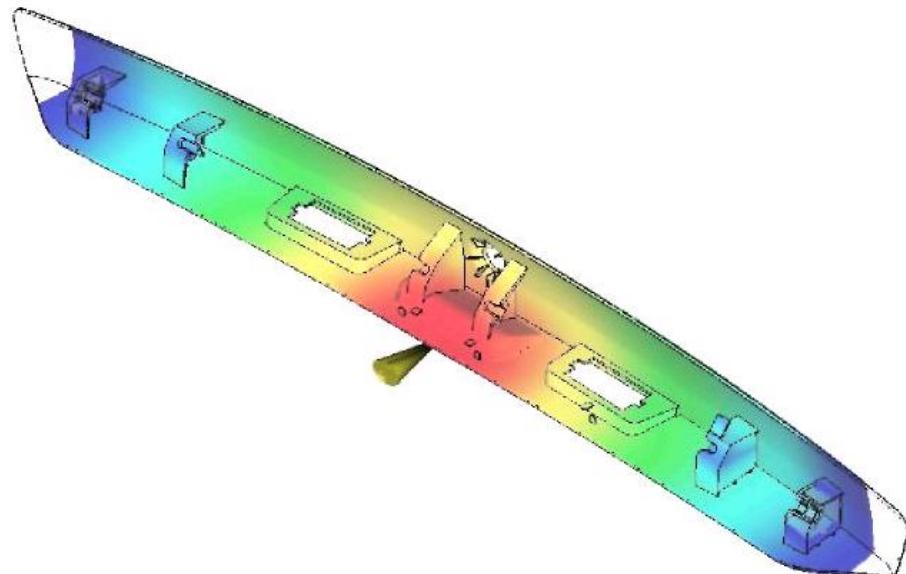
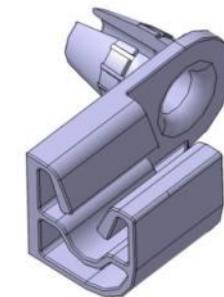
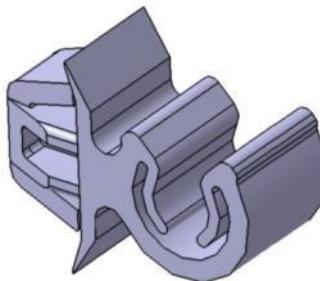
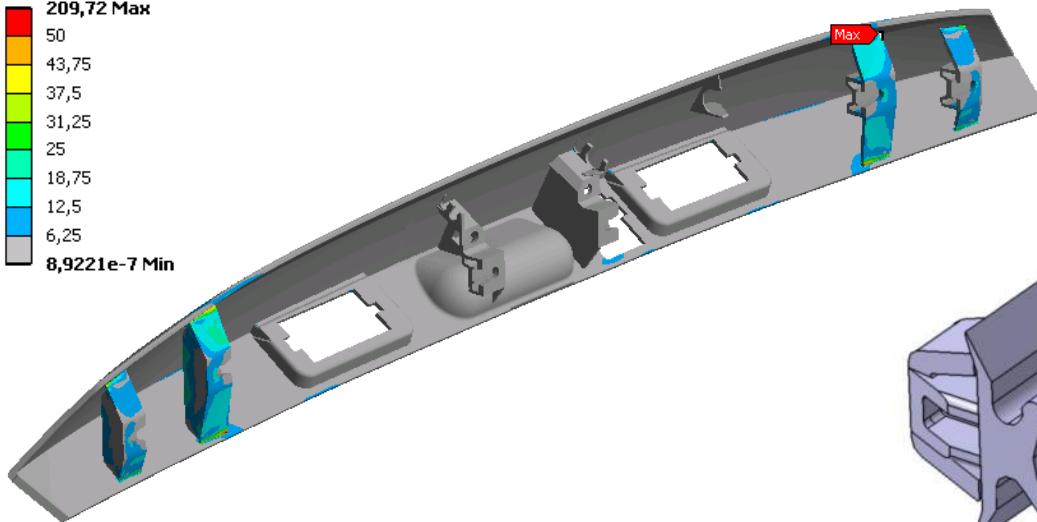
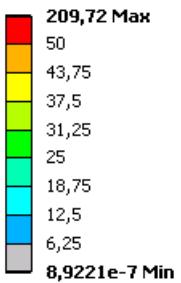


Door Covers Design and Crash Analysis

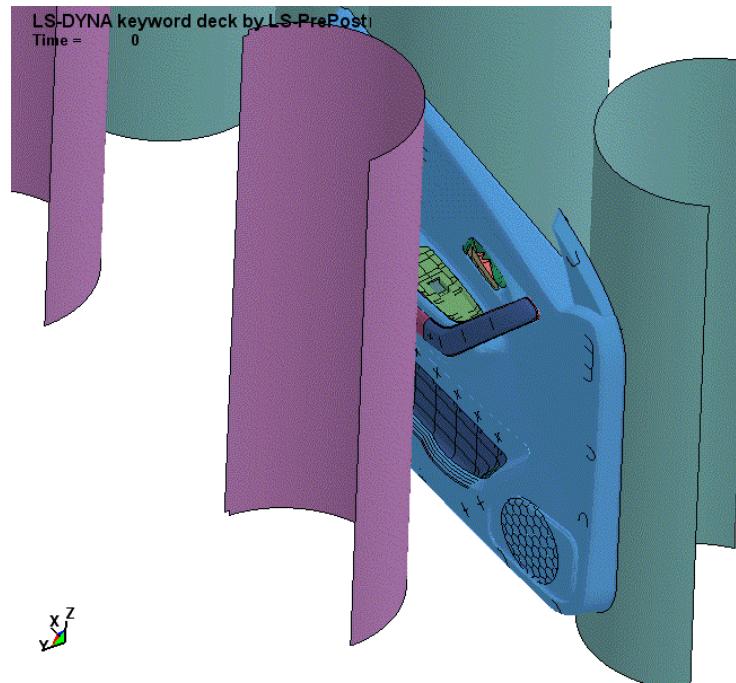
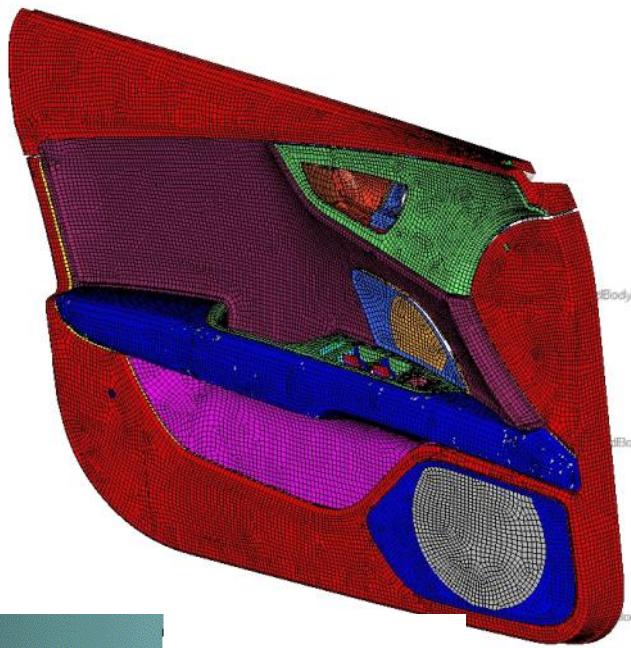
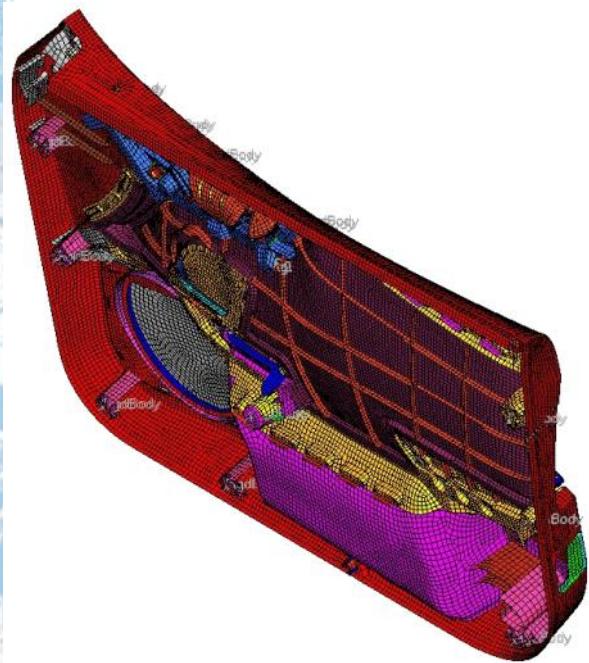
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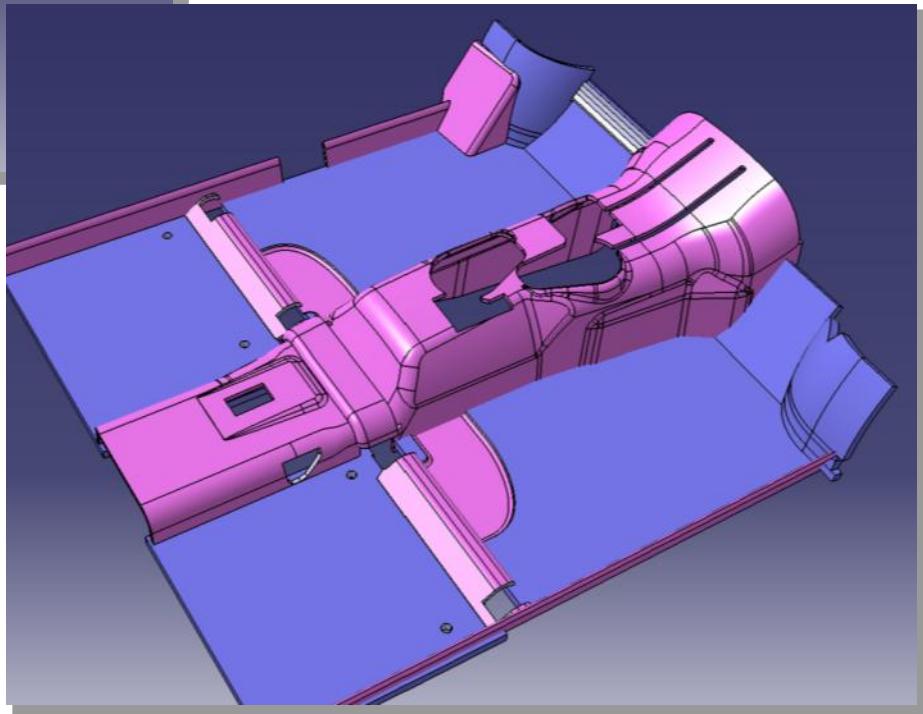
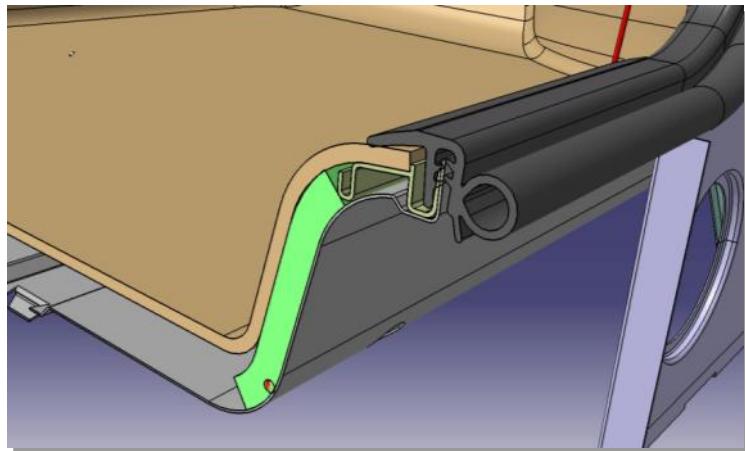
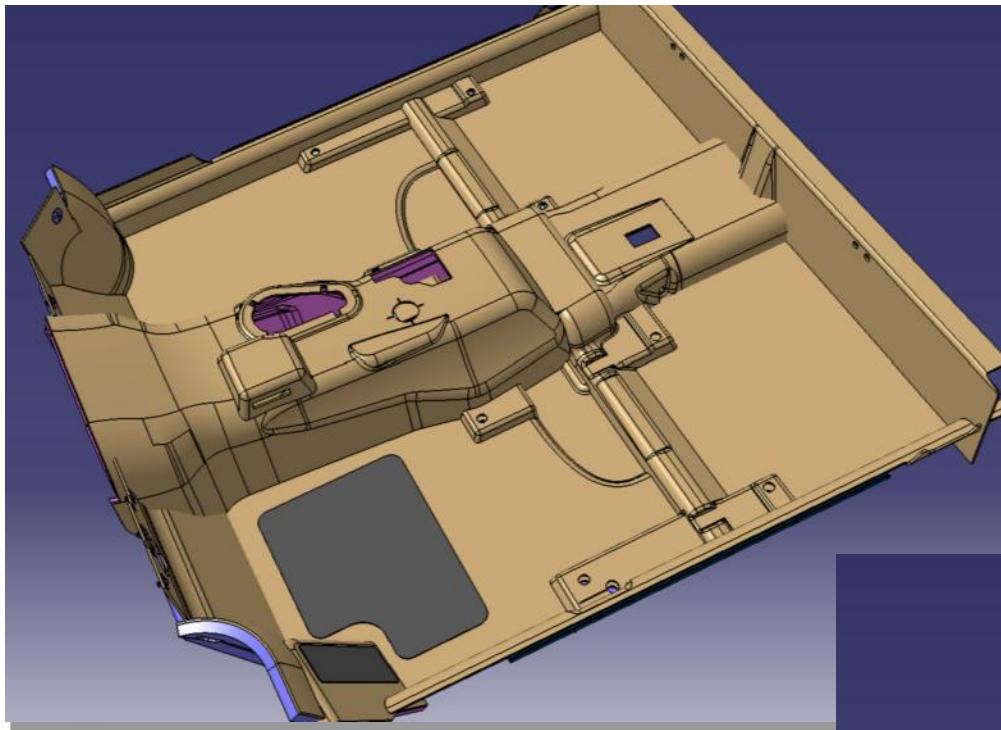
Plastic Design. Strength and moldflow analysis



Crash-Test Analysis of Door

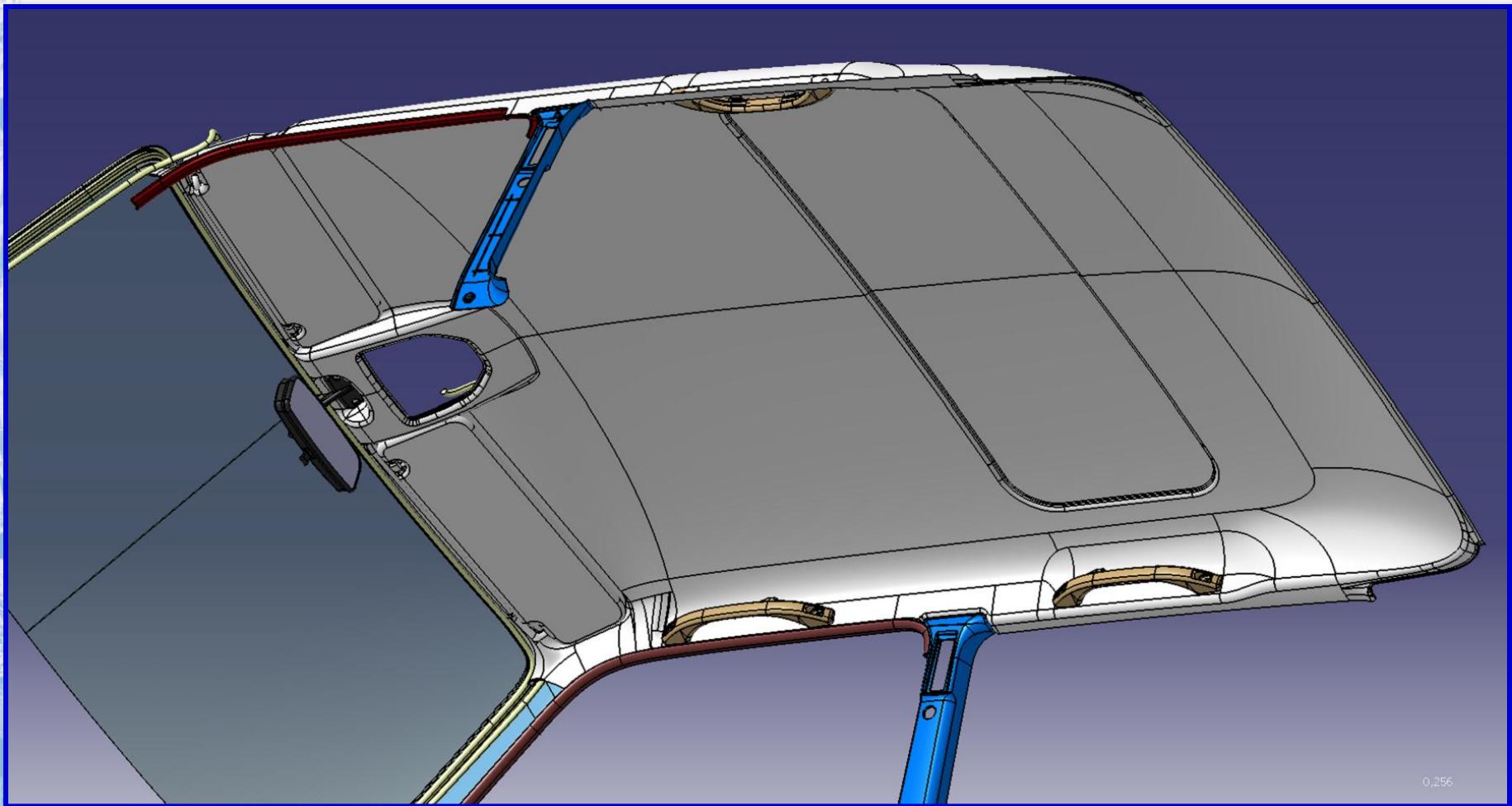


Cover Design

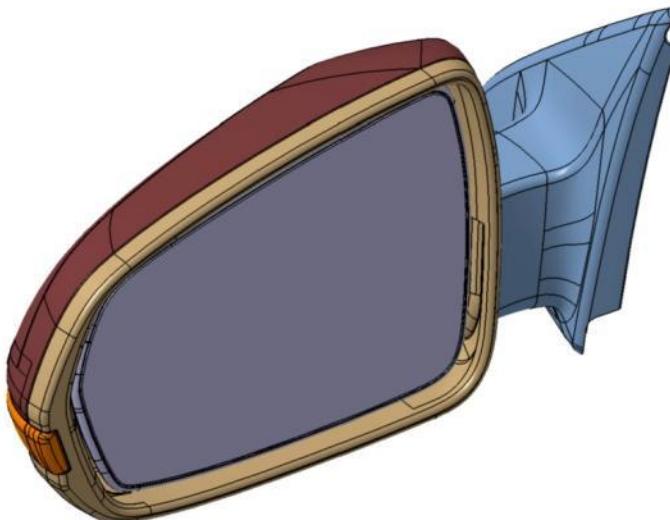


Cover Design

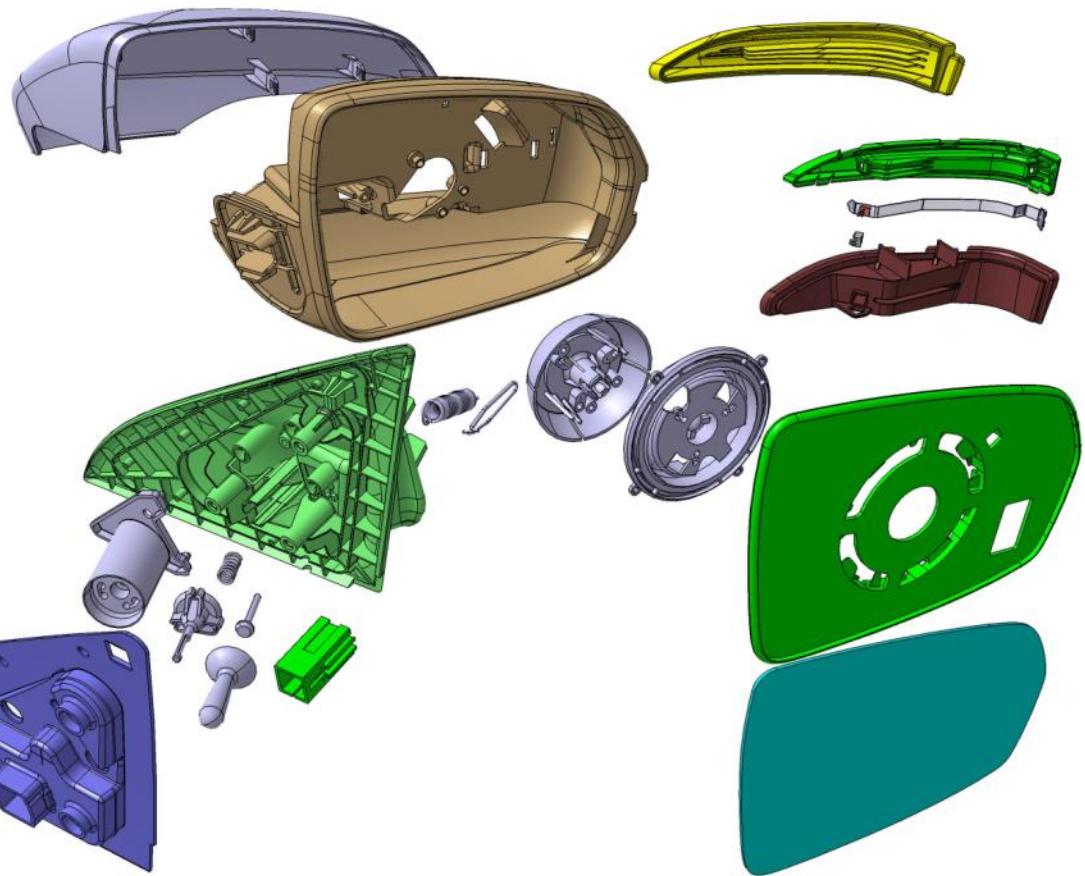
FROM NUMBER



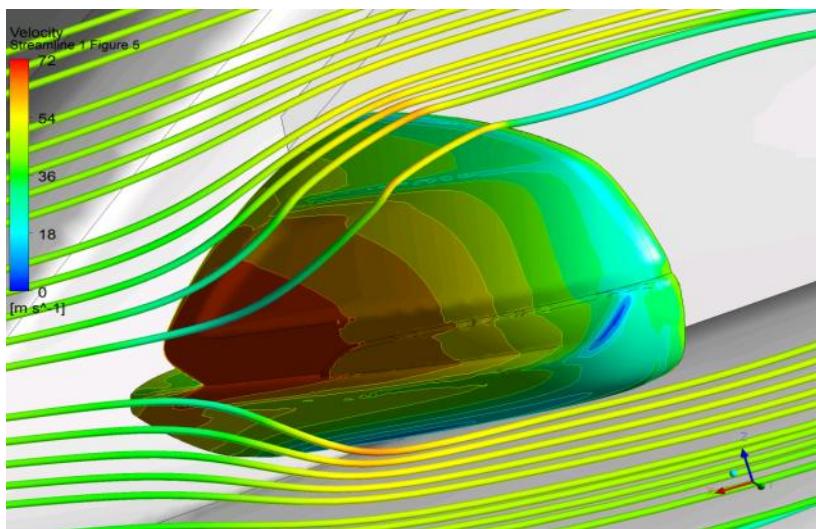
Design of External Mirror



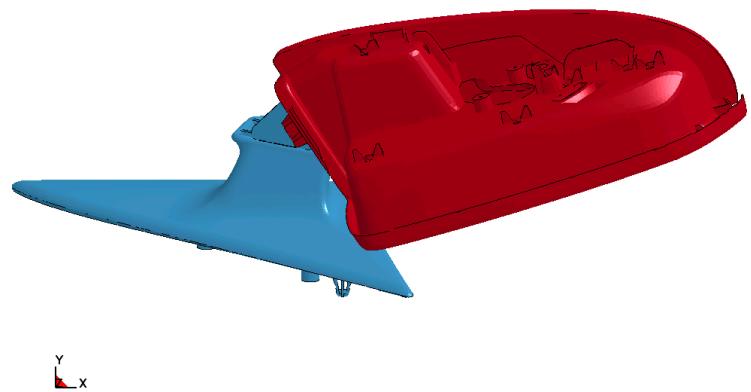
- ▶ Design
- ▶ Aerodynamic analysis
- ▶ Strength and vibration analysis
- ▶ Visibility analysis
- ▶ Drafting, FMEA



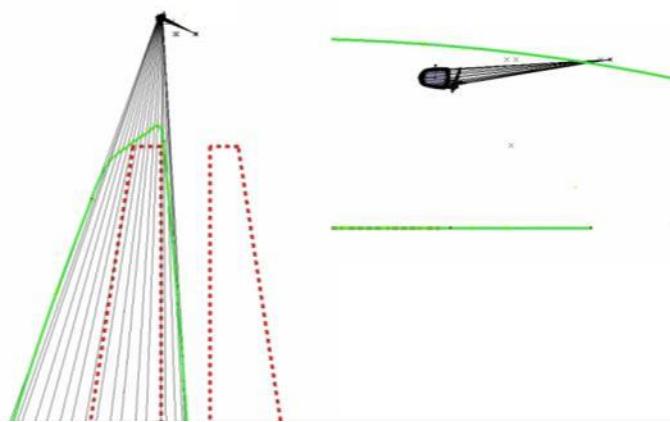
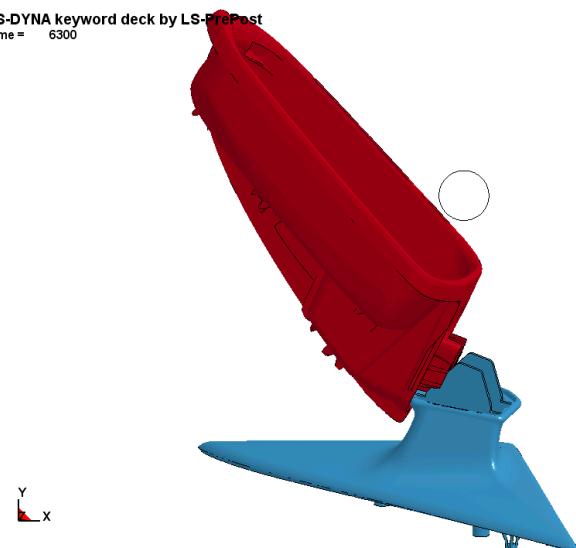
Mirror analysis



Aerodynamic analysis



LS-DYNA keyword deck by LS-PrePost
Time = 6300

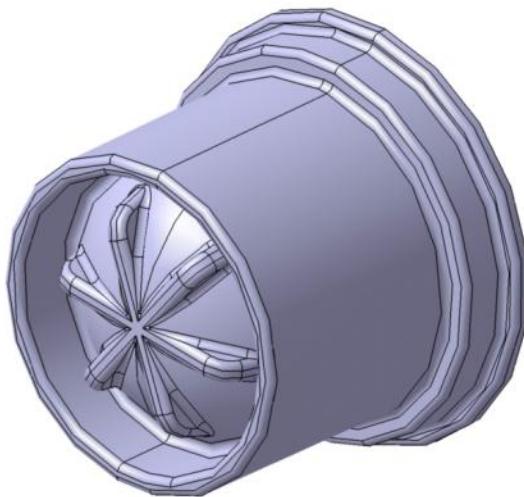


Visibility analysis

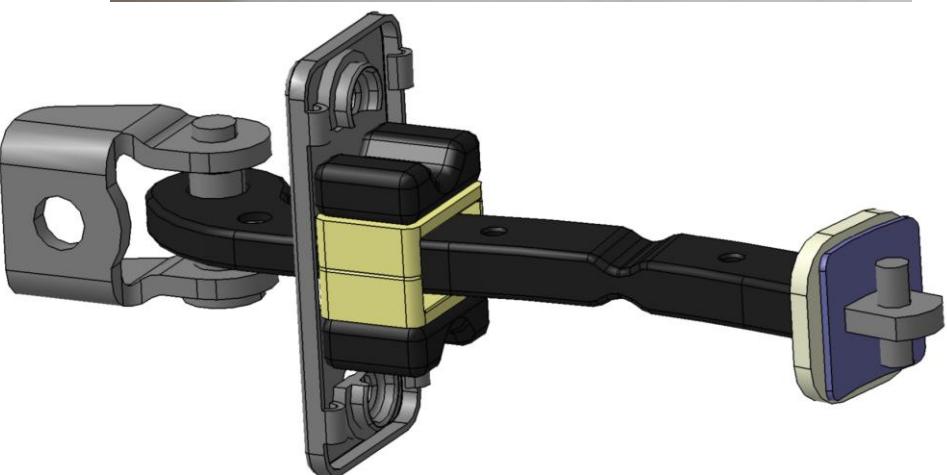
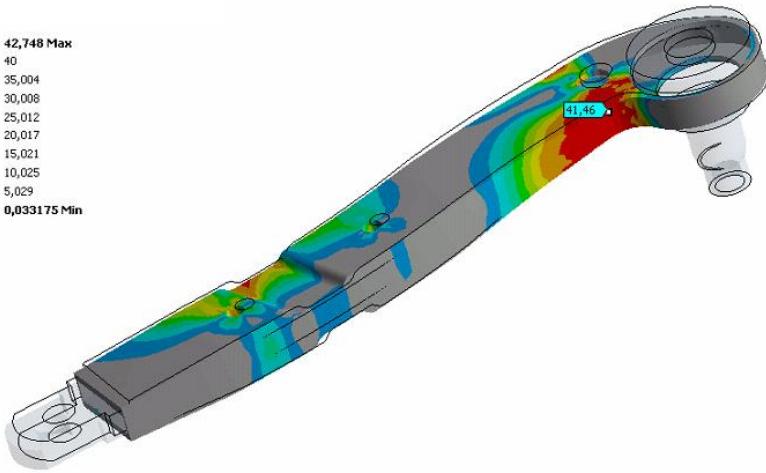
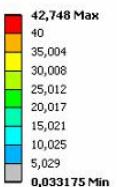
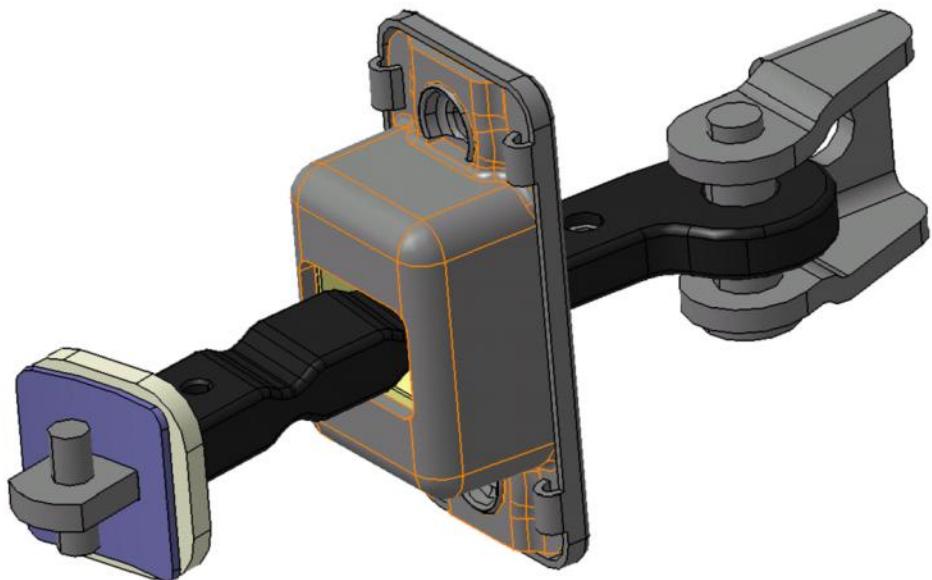
Cinematic analysis

Linkage Design

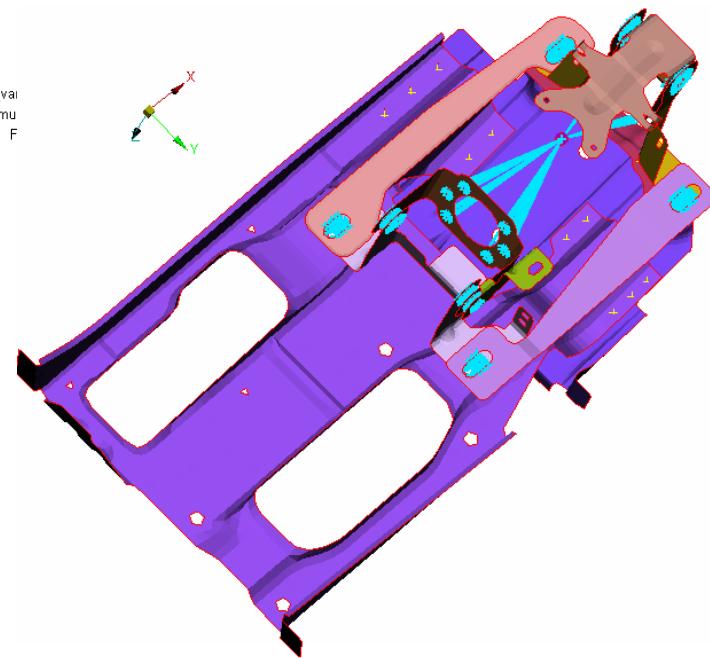
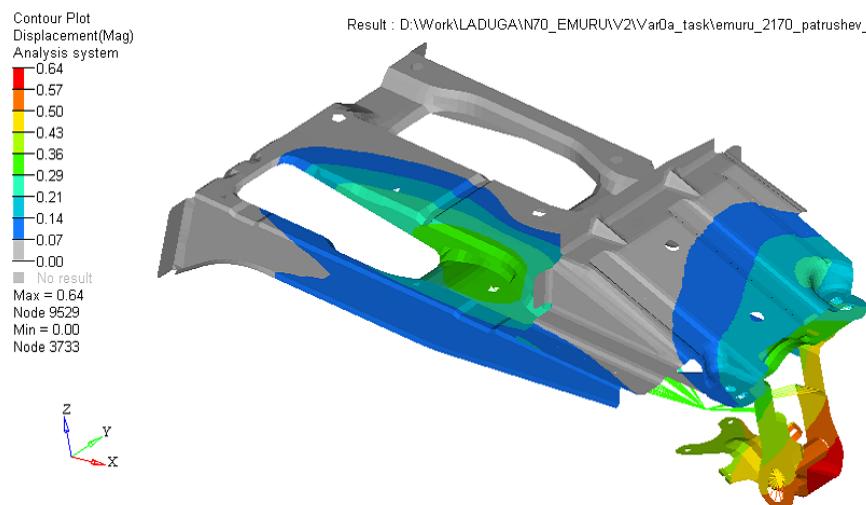
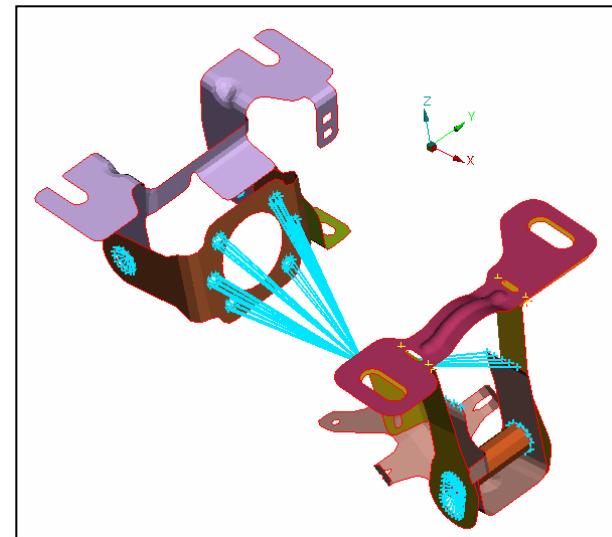
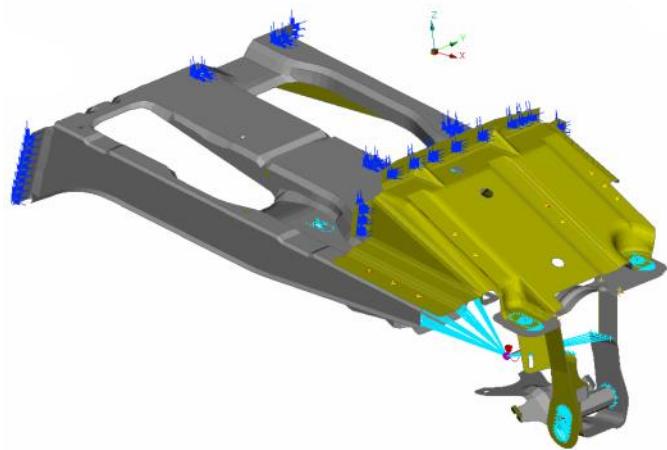
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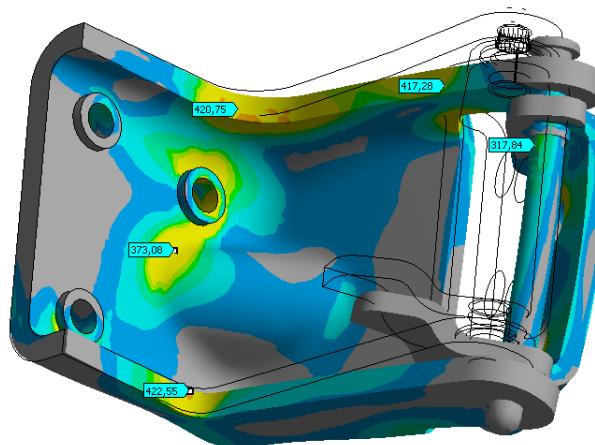
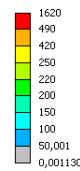
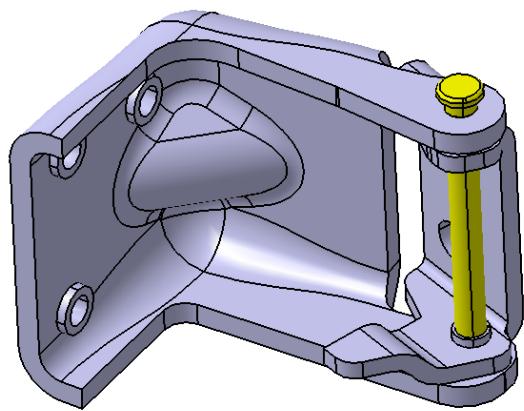
Plastic Door Limiter



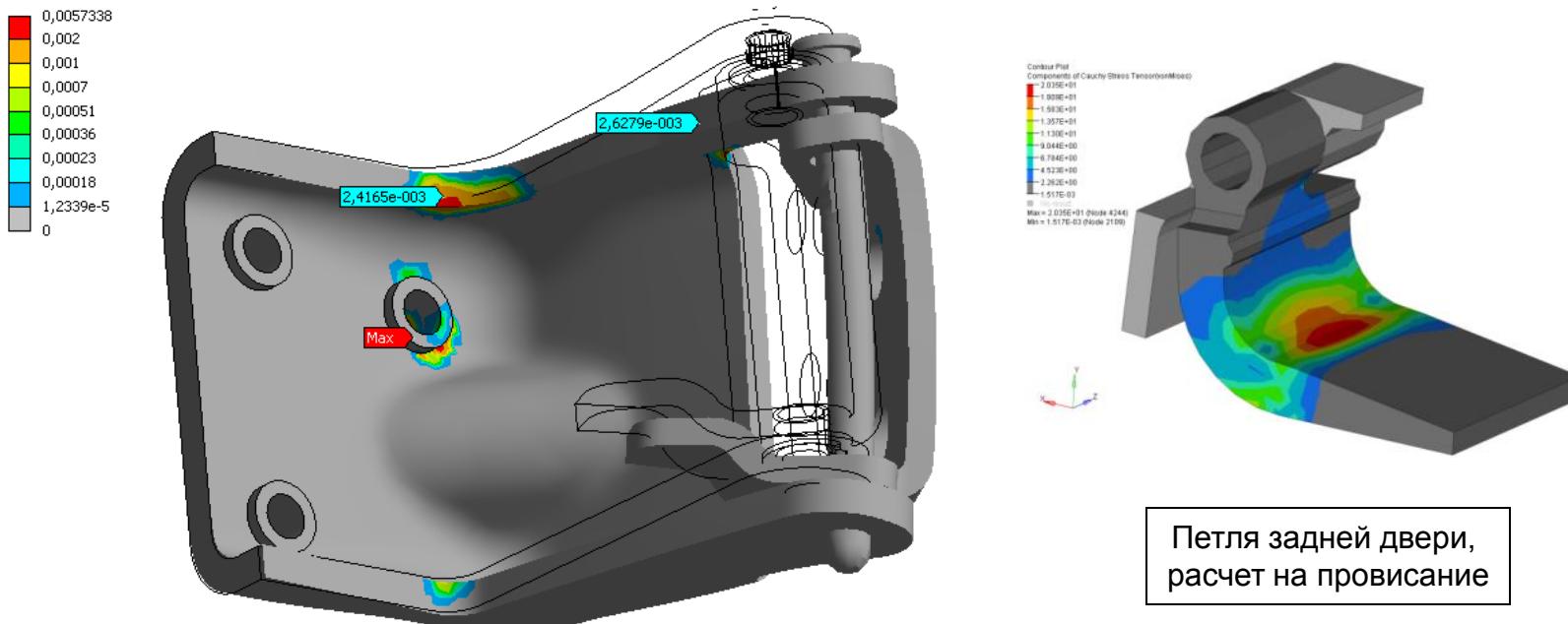
Analysis and Optimization of Bracket



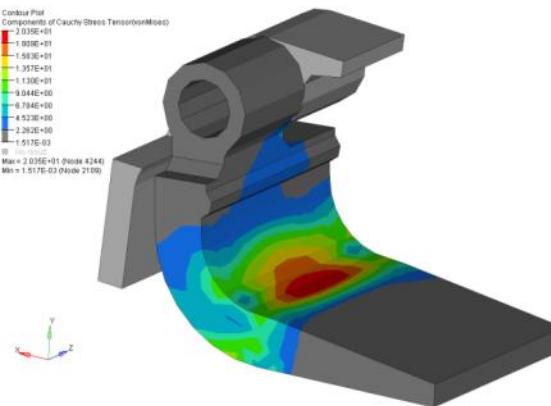
Analysis of Door Hingen



Напряжения по Мизесу, МПа

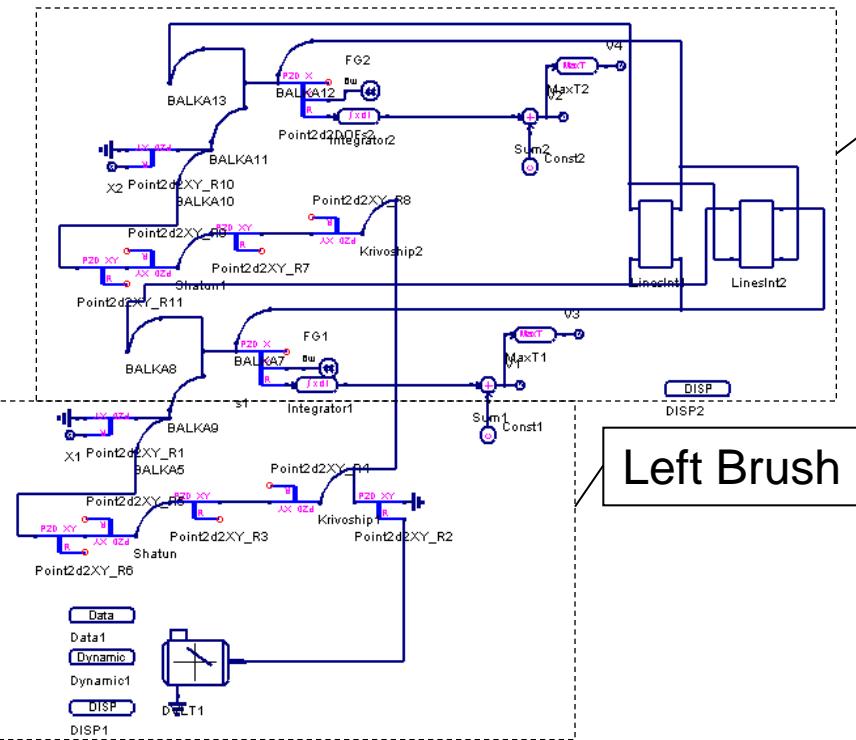


Пластические деформации

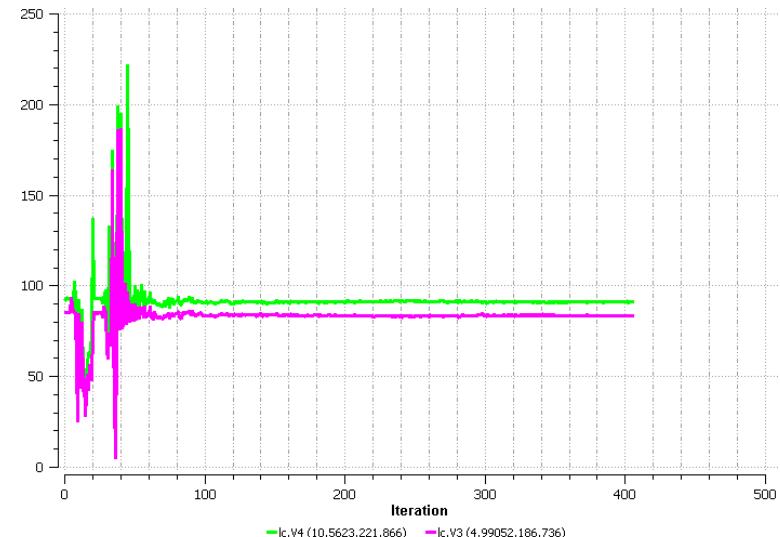


Петля задней двери,
расчет на провисание

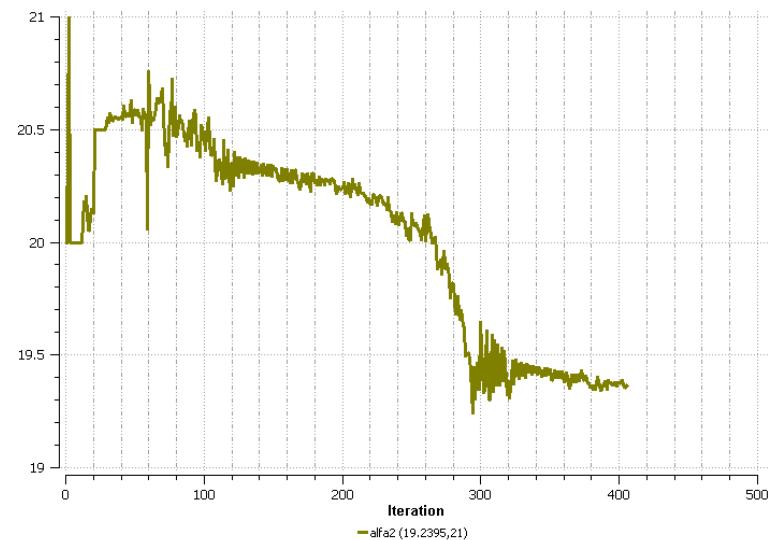
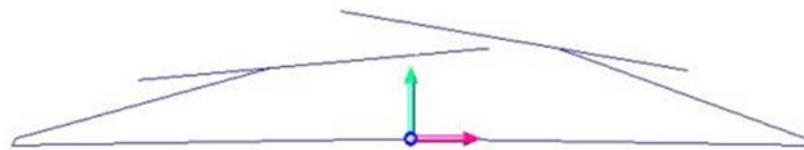
Windscreen Wiper Optimization



Right brush

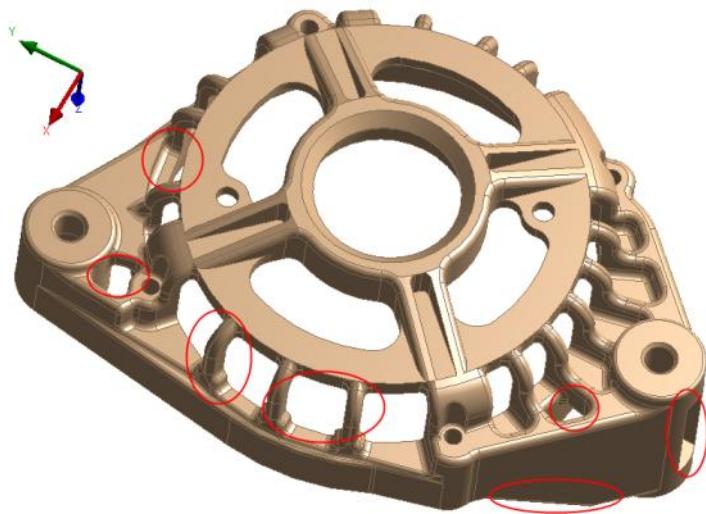
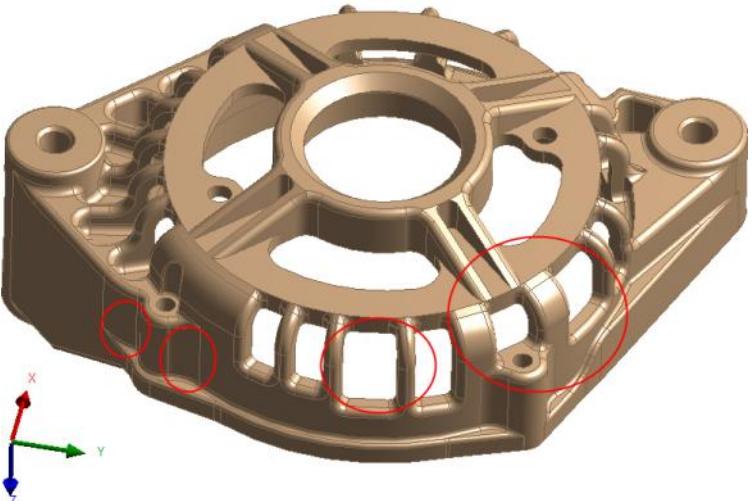


Left Brush





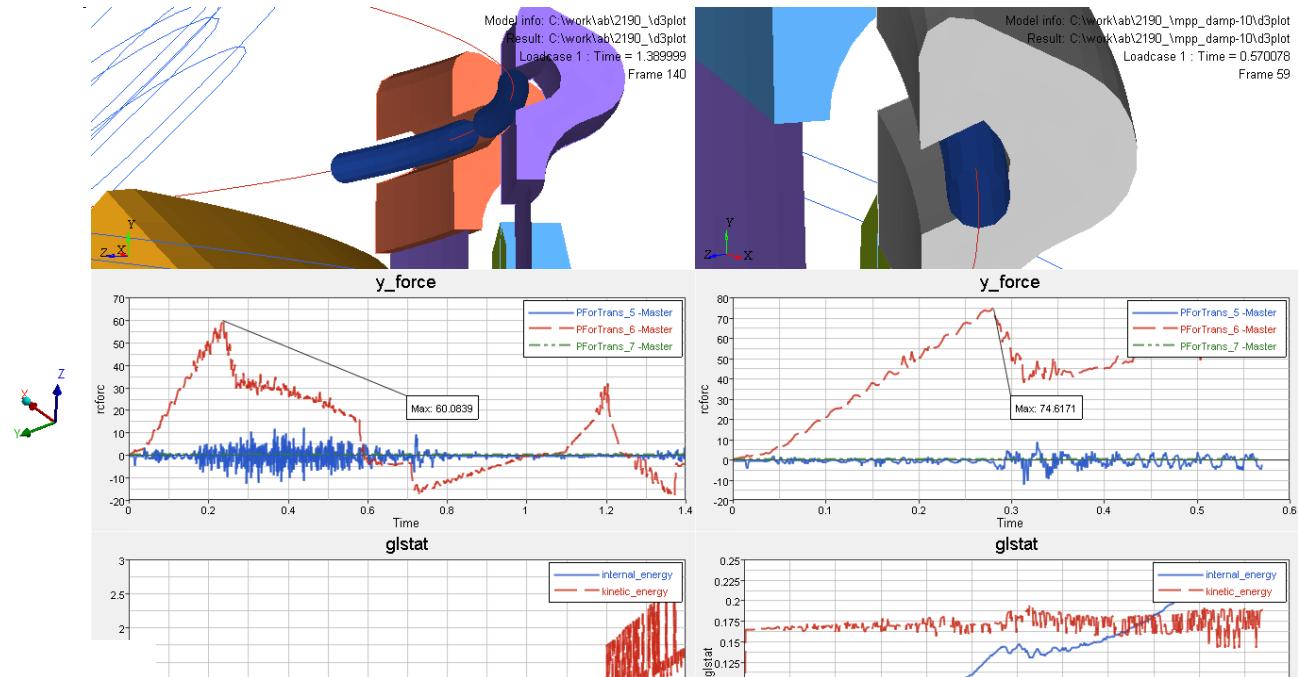
First Variant



Optimized Variant

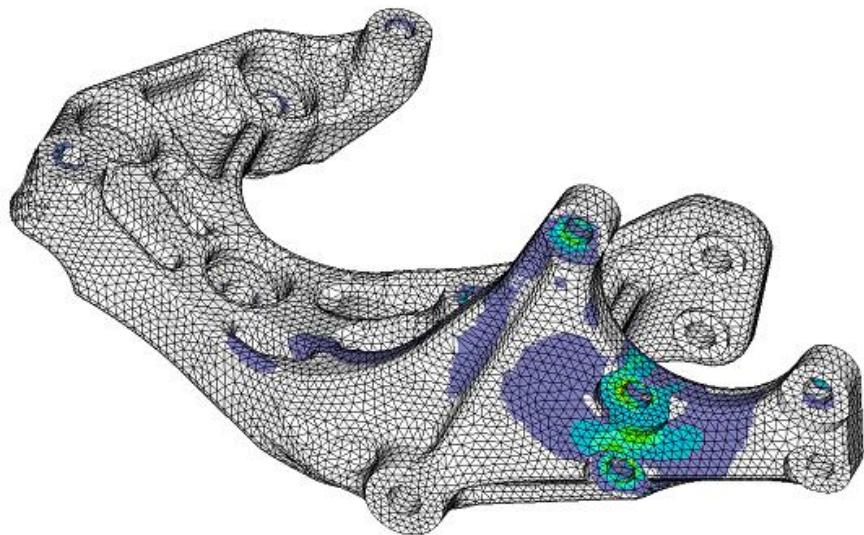
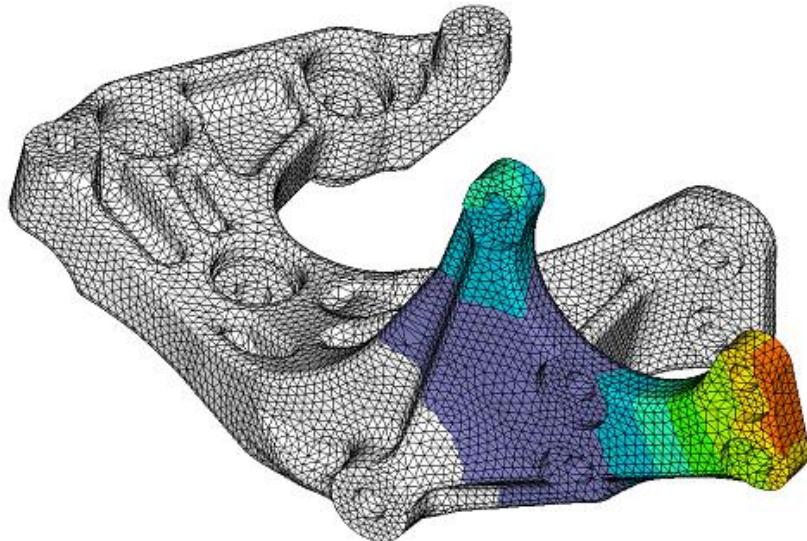
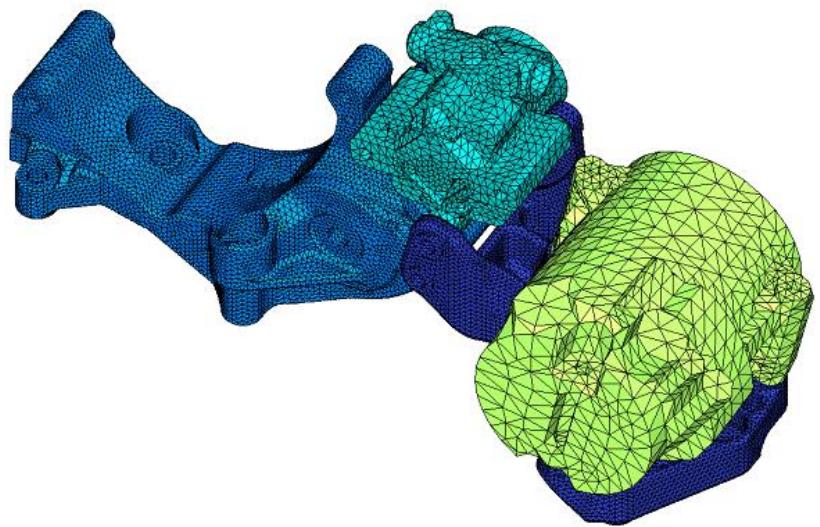
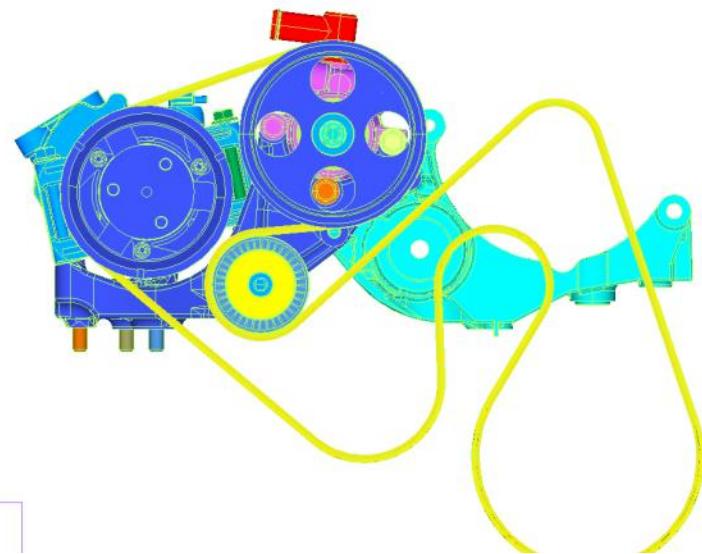
Reduce mass on 11,5%. Vibrostrength is the same

Wheel Cover Design and Analysis

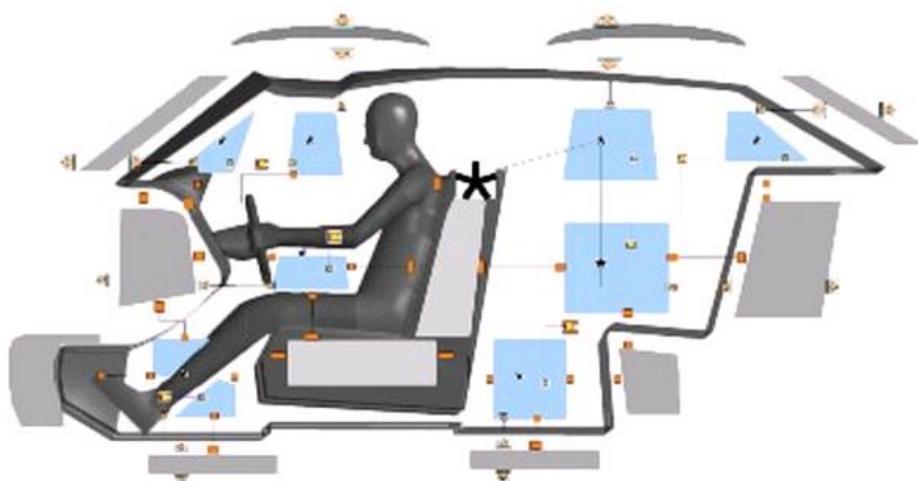


Bracket Analysis

FROM NUMBER TO KNOWLEDGE

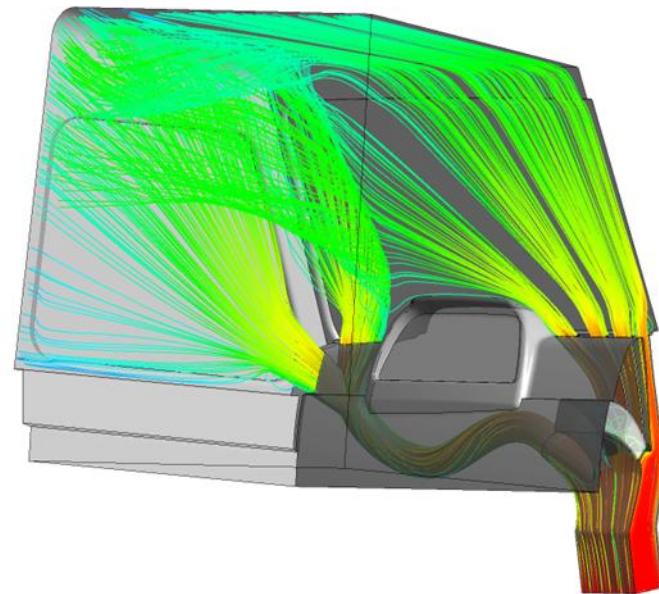
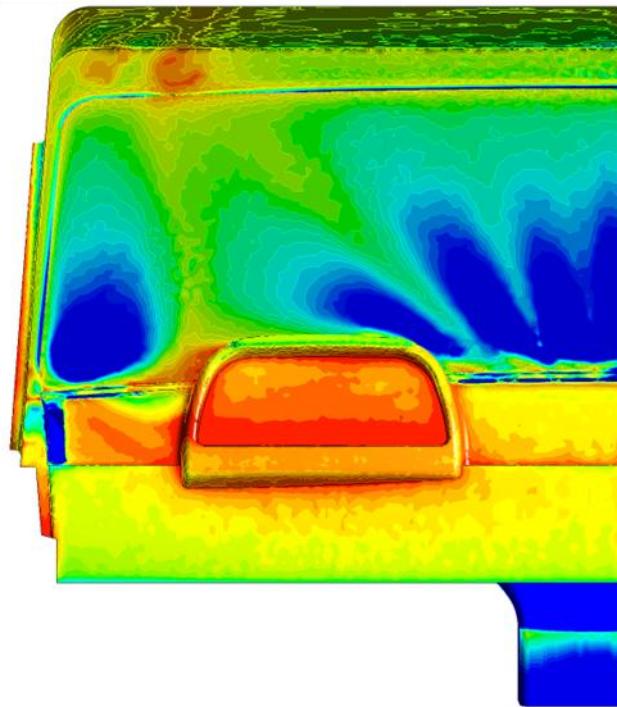
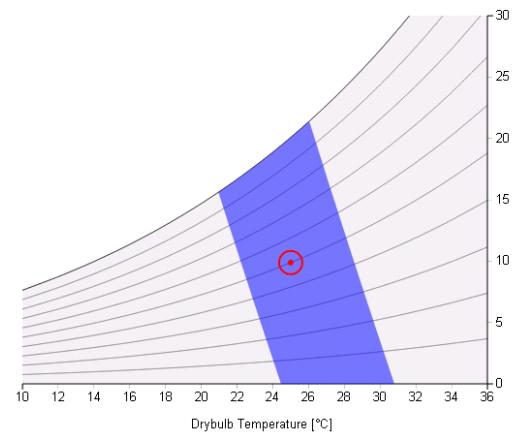


HVAC Design. Defrosting Analysis

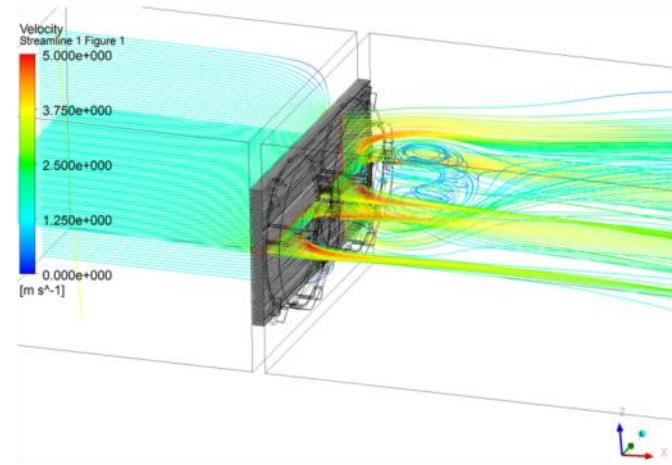
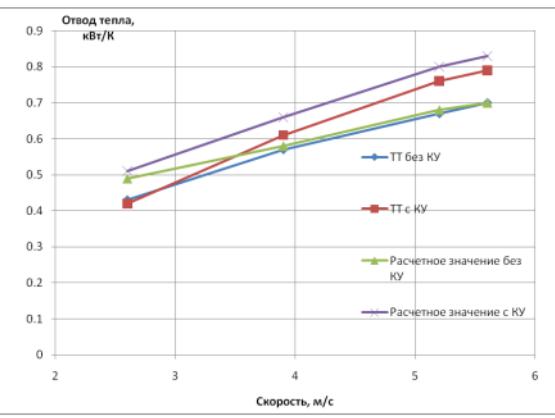
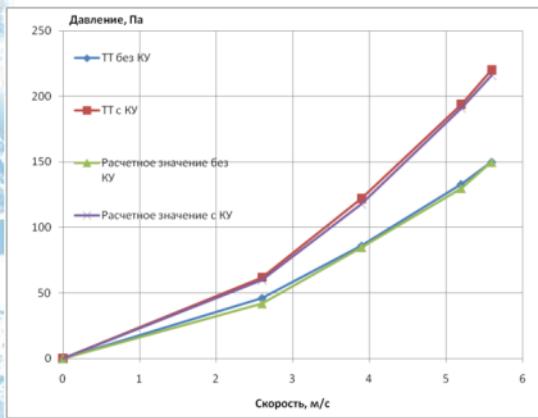
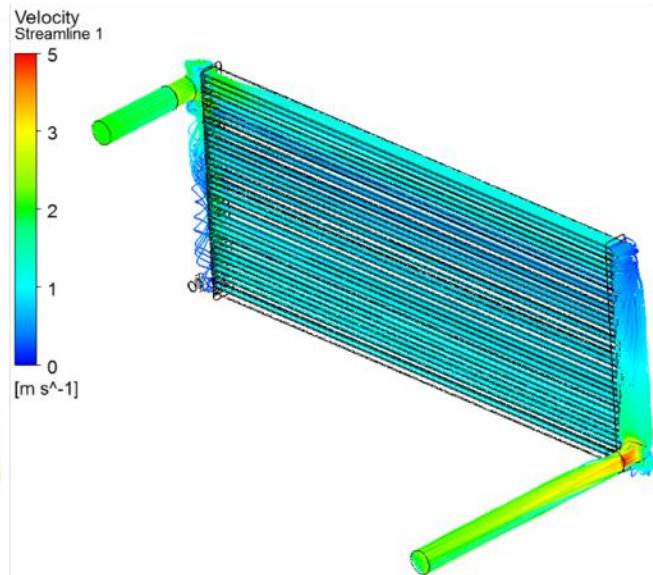
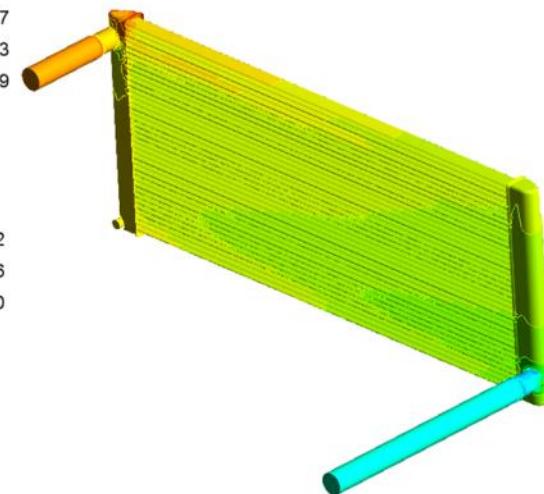
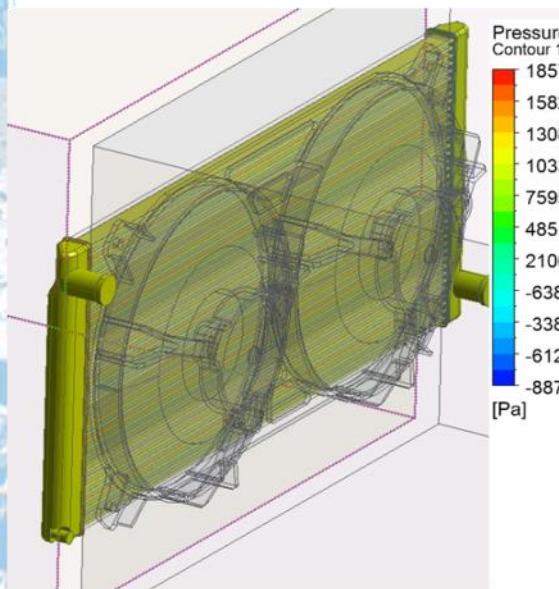


PMV
PPD
Sensation

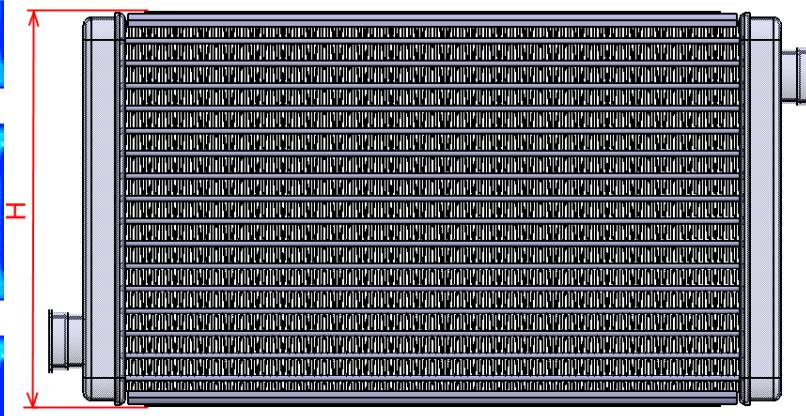
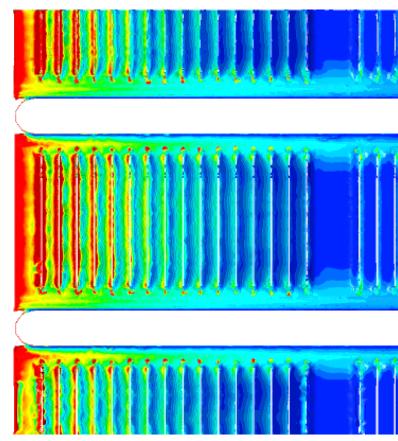
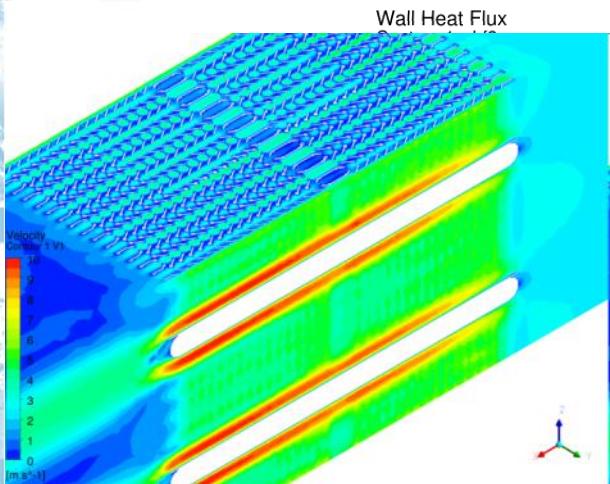
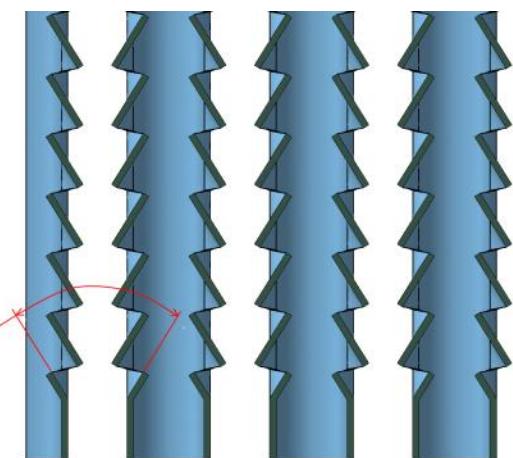
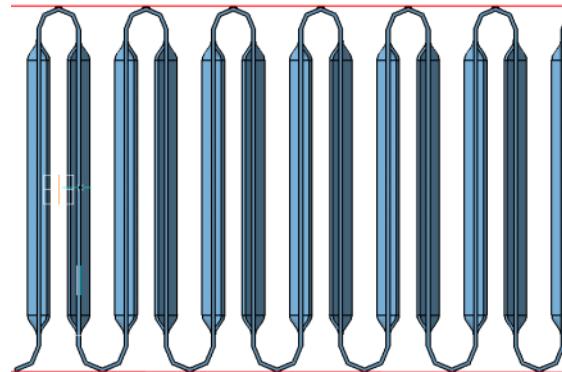
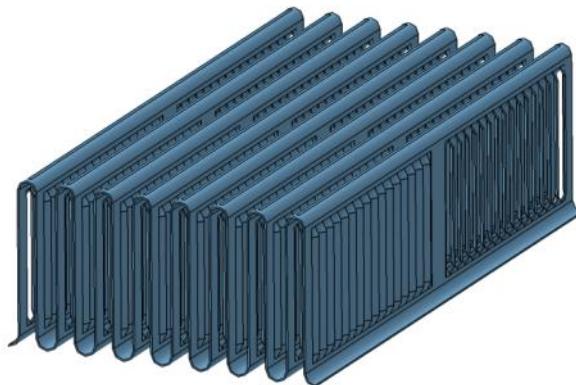
-0.06
5%
Neutral



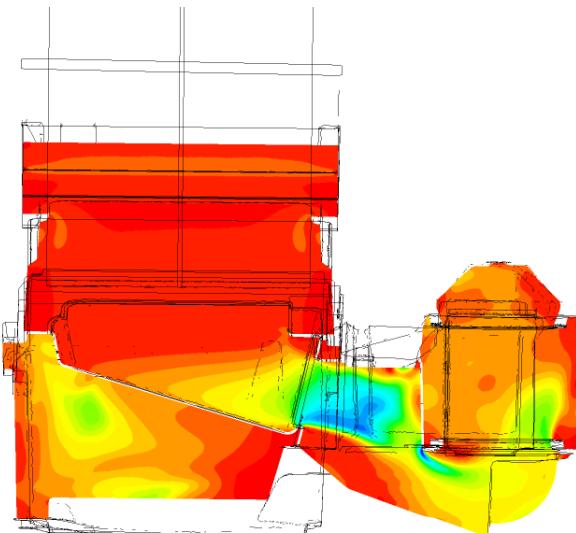
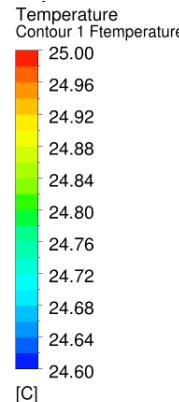
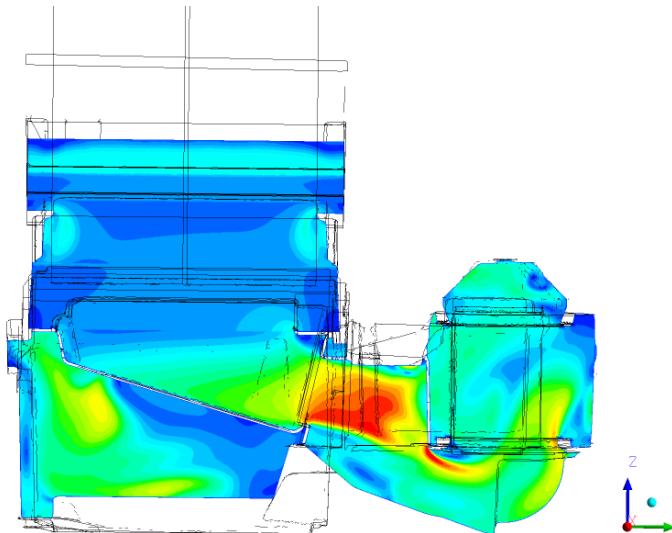
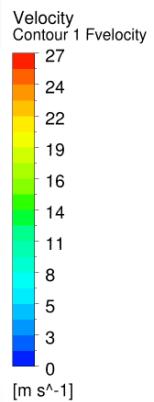
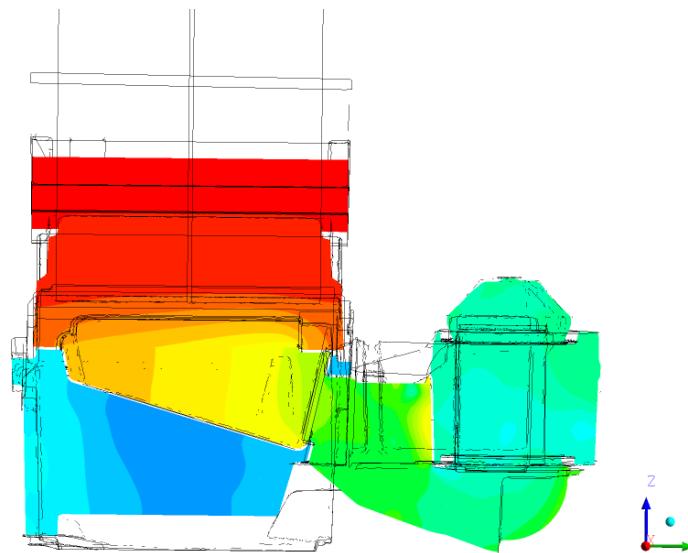
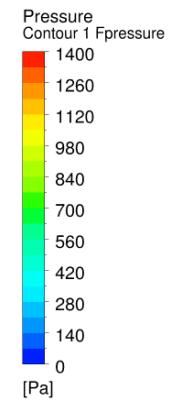
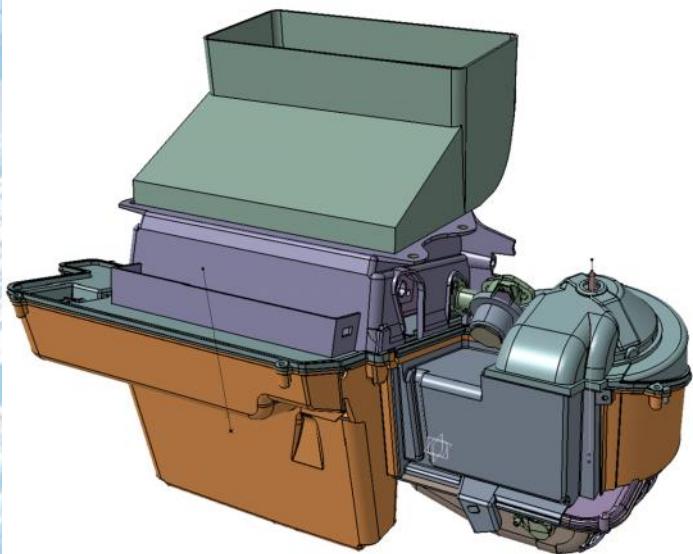
Engine Heatexchanger analysis (LADA 4x4 M3)



Fins CFD analysis and HVAC Heatexchanger design (LADA 4x4)

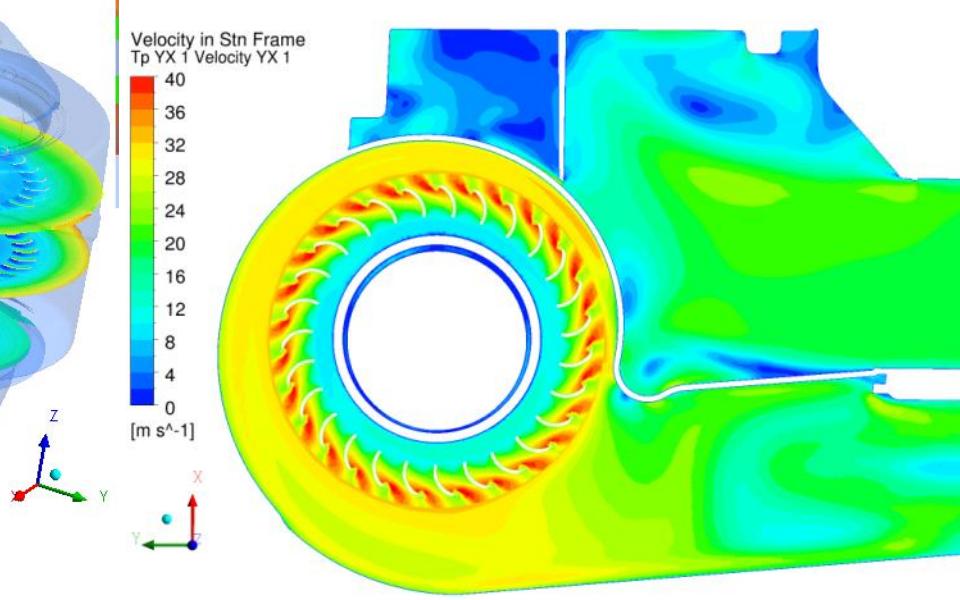
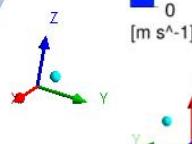
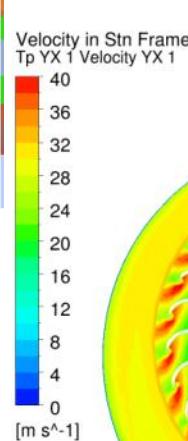
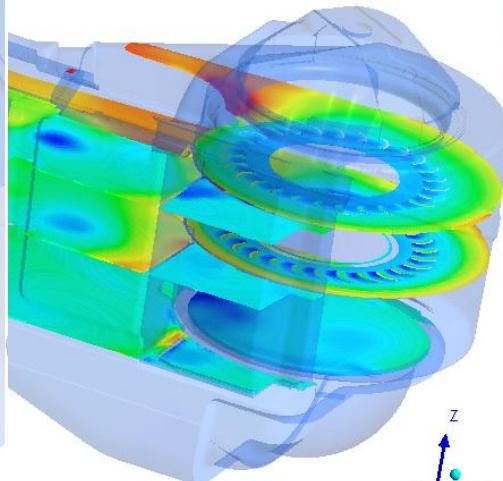
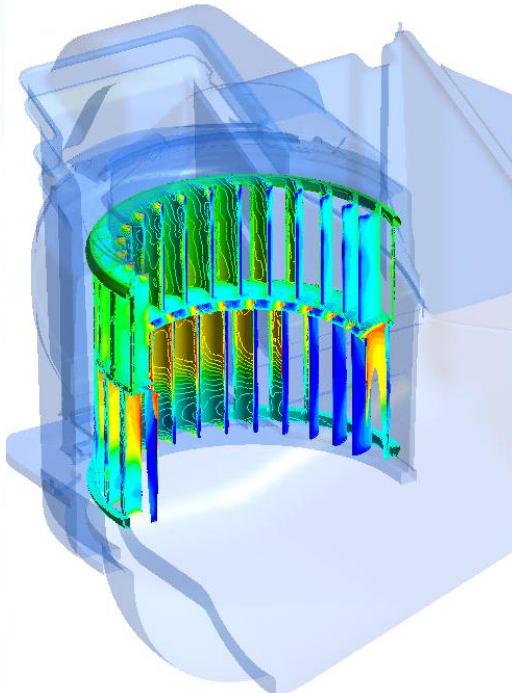
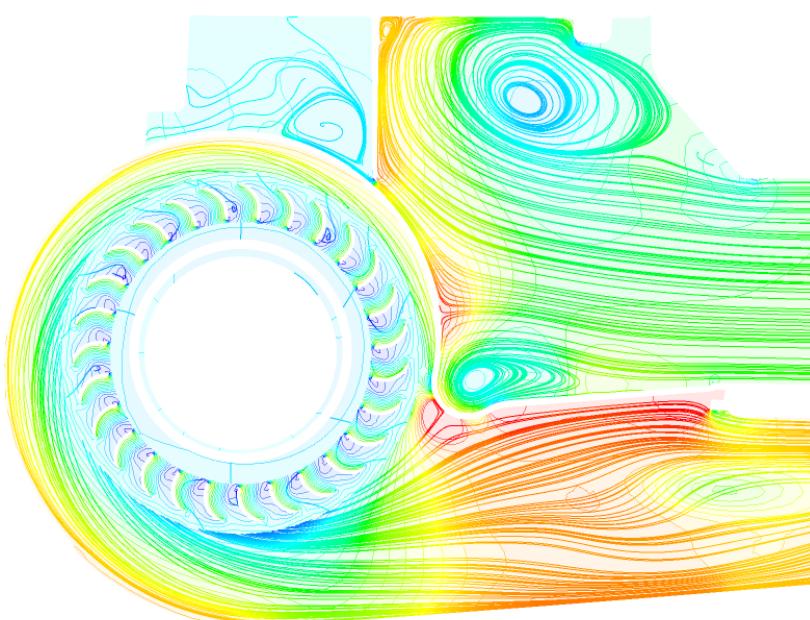
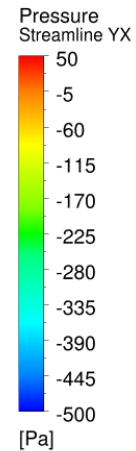
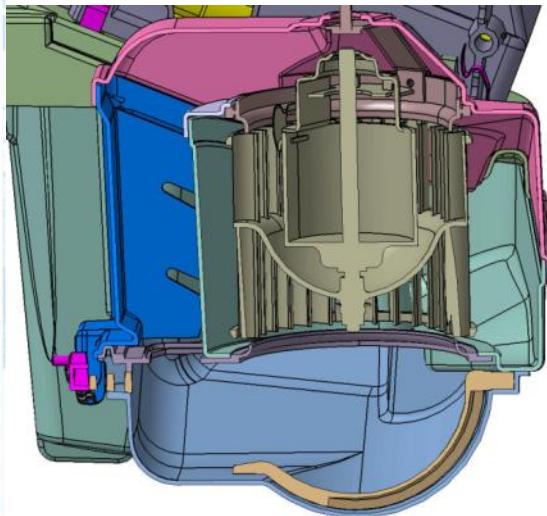


Design and Analysis of Clymatic Unit (LADA Urban)



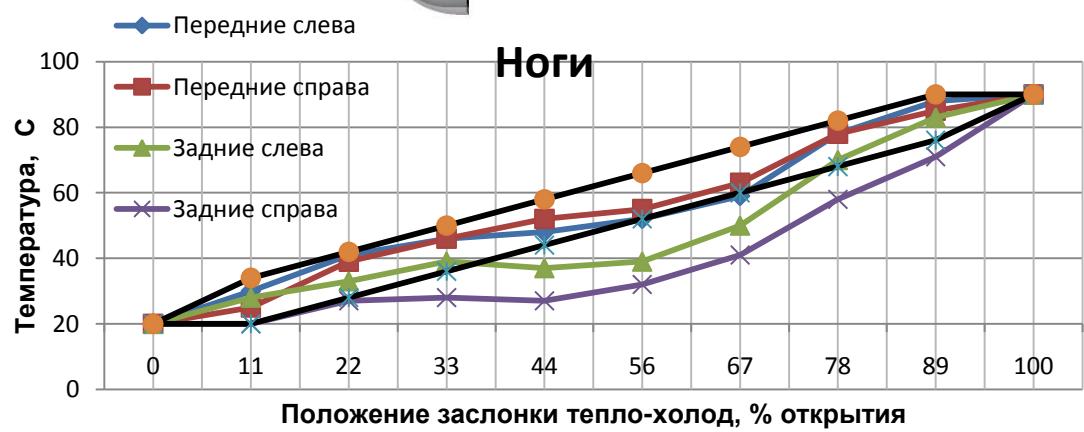
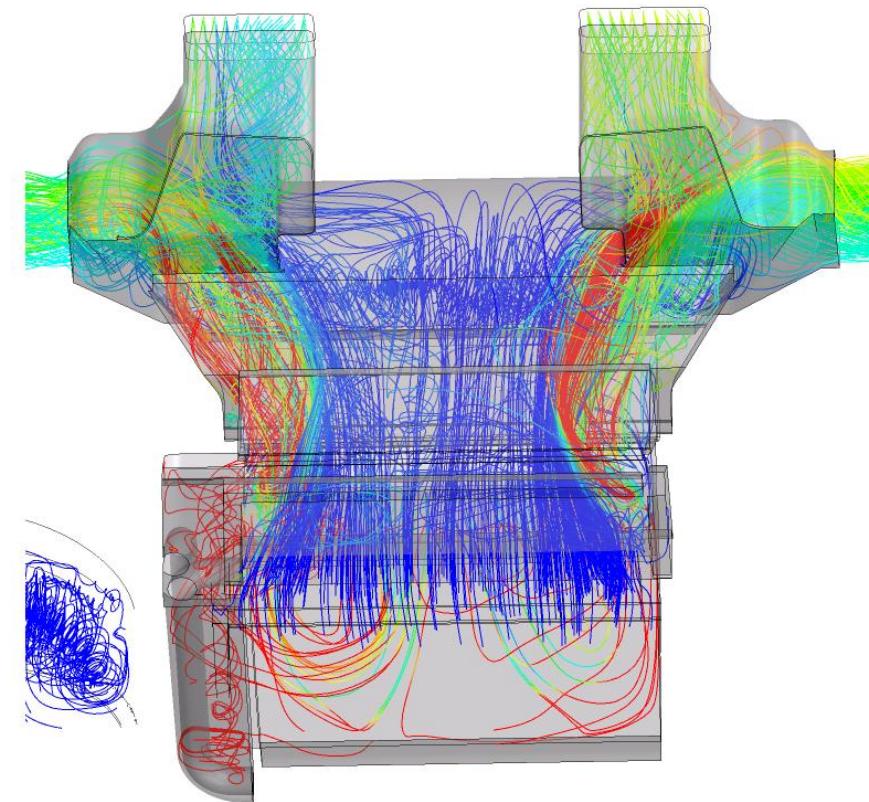
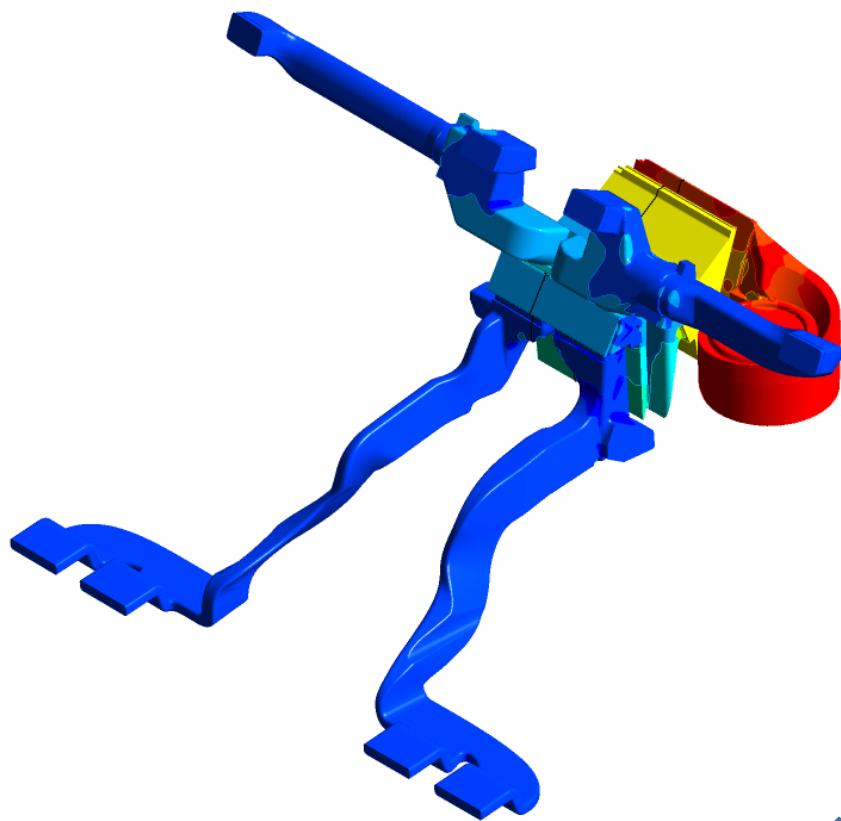
Fan simulation

FROM NUMBER TO KNOWLEDGE

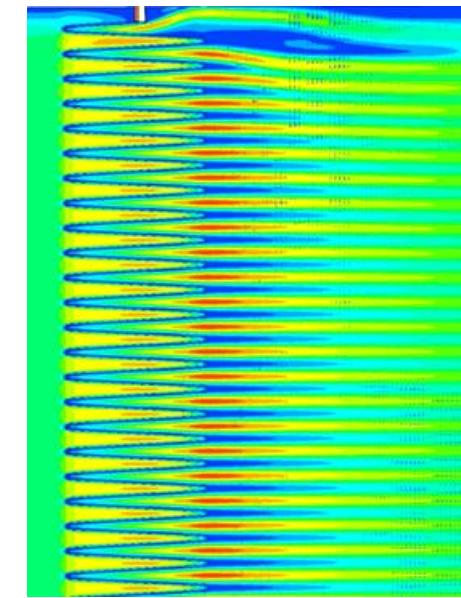
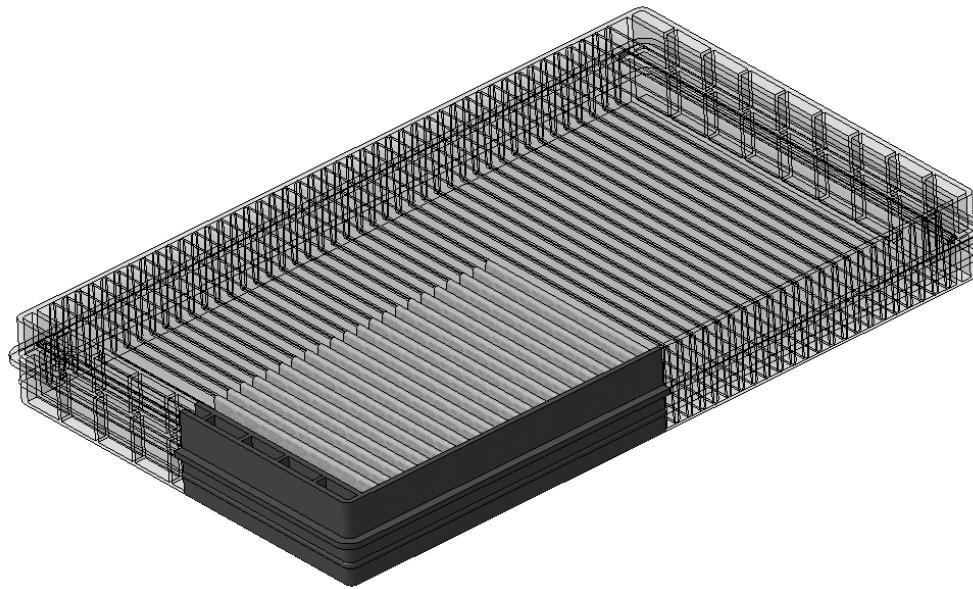


HVAC Design and Simulation

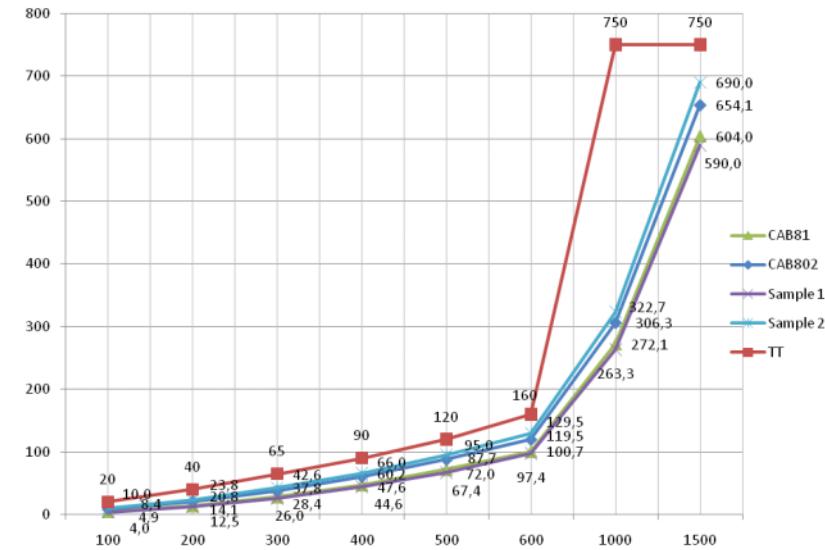
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Air Compartment Filter Design (LADA Kalina)

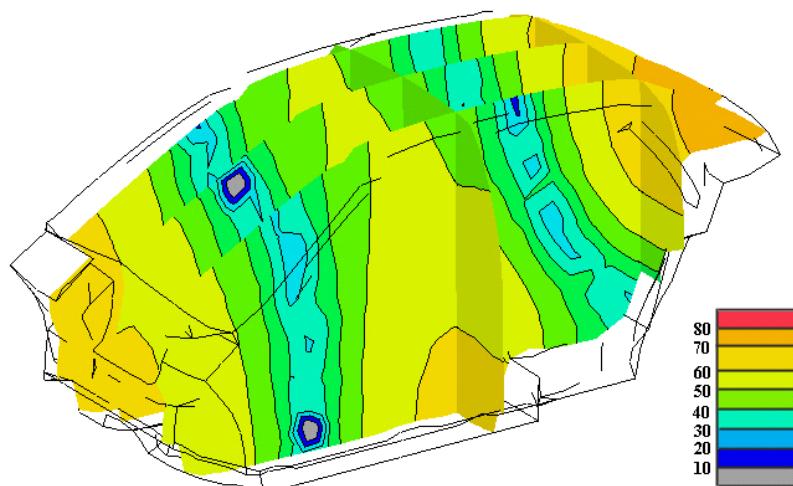


- ▶ Design
- ▶ Dust analysis
- ▶ CFD analysis
- ▶ Optimization of stiffness
- ▶ Pressure Drop analysis
- ▶ Drafts creation (ESKD / ISO)

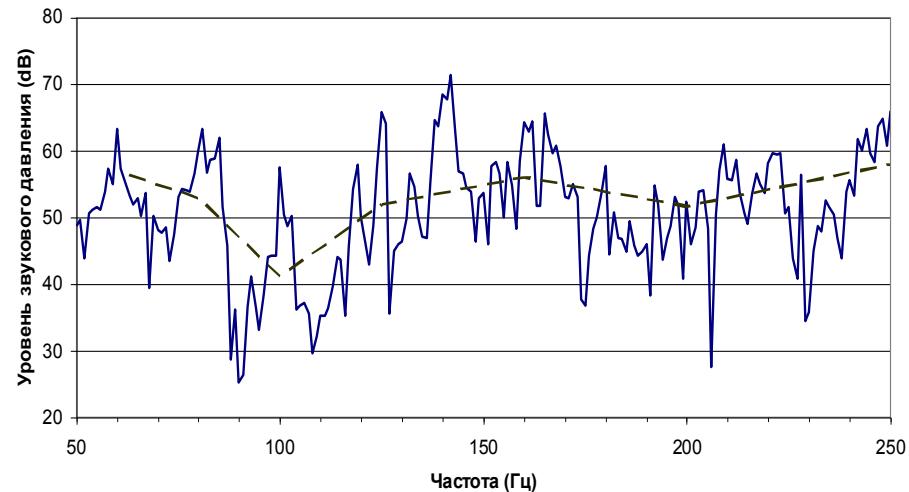


Optimization of Car Body

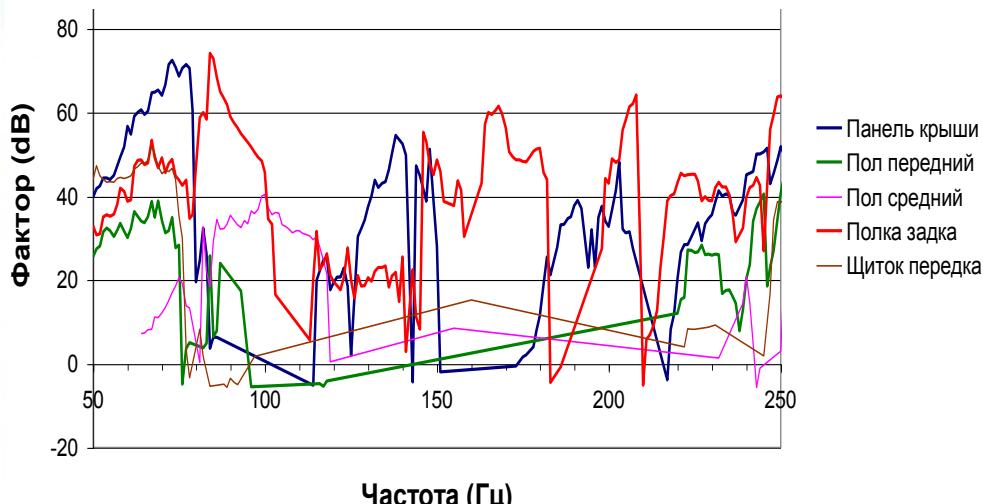
vibroacoustic characteristics



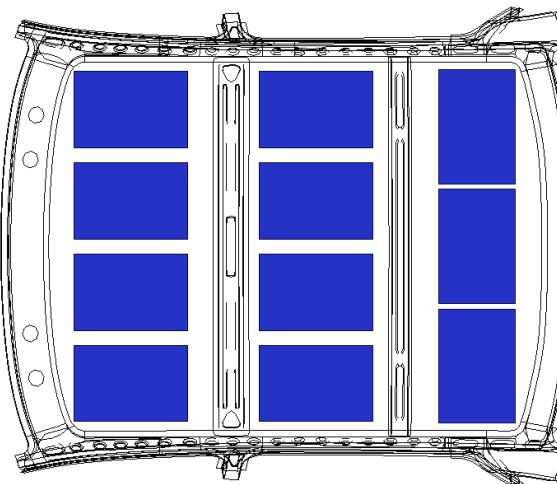
Acoustic Fields Distribution



Total Transfer Function for Head Zone

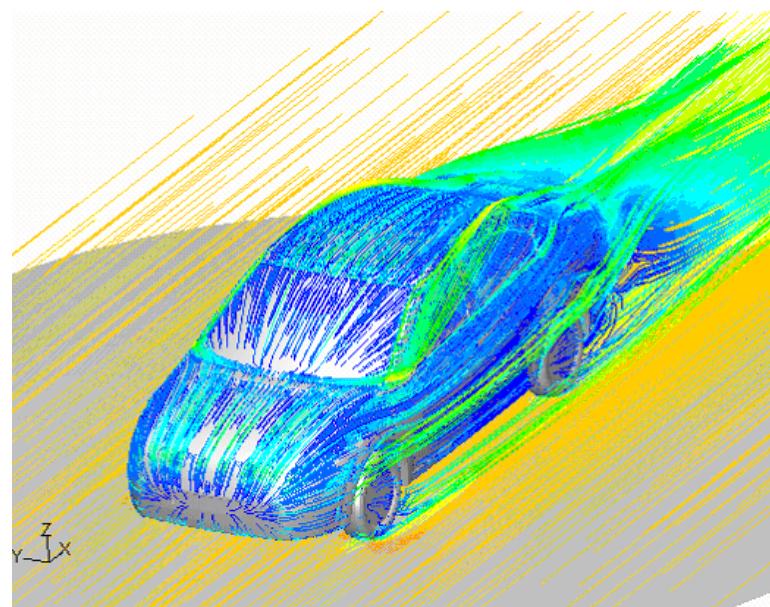
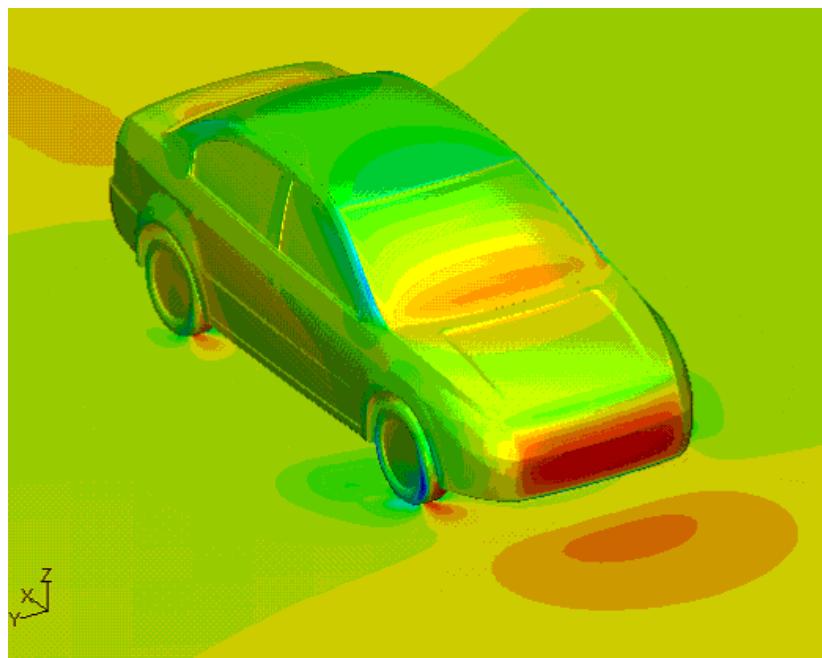
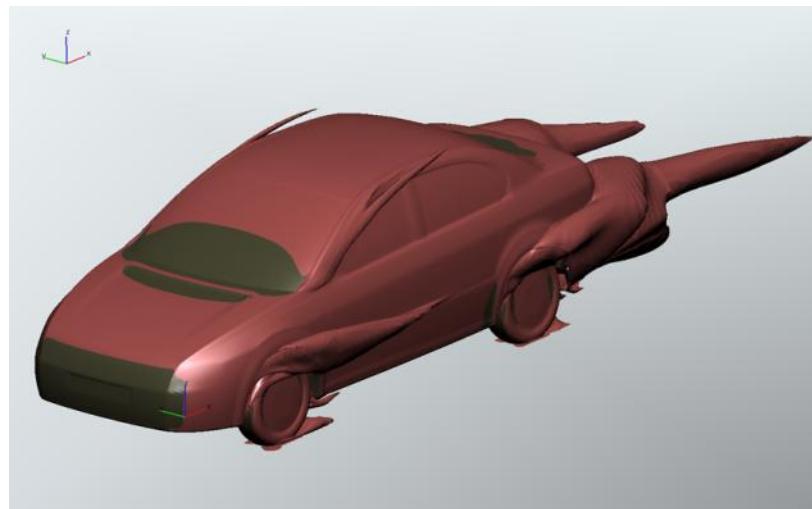


Estimating of contribution of the body panels vibration



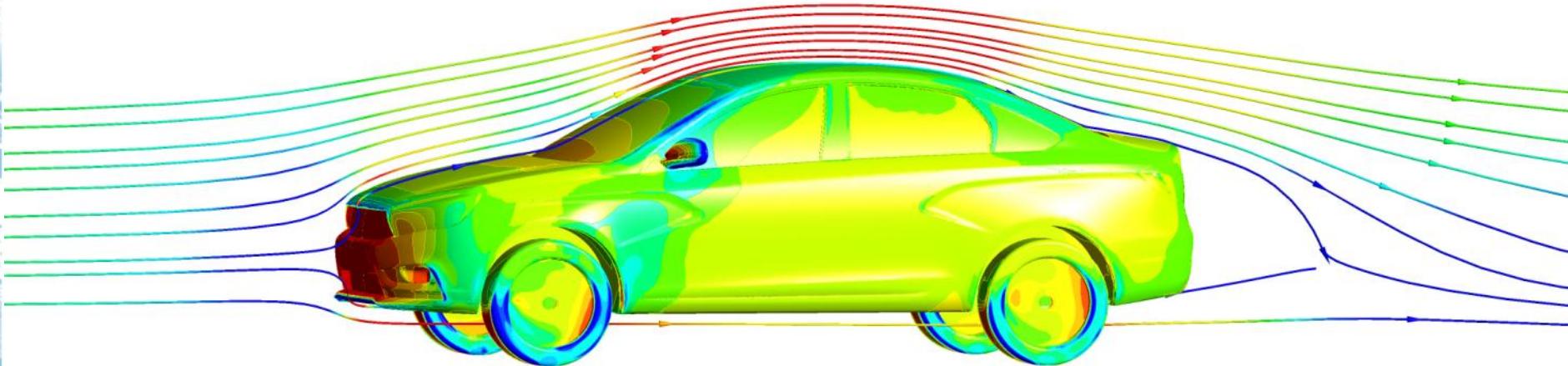
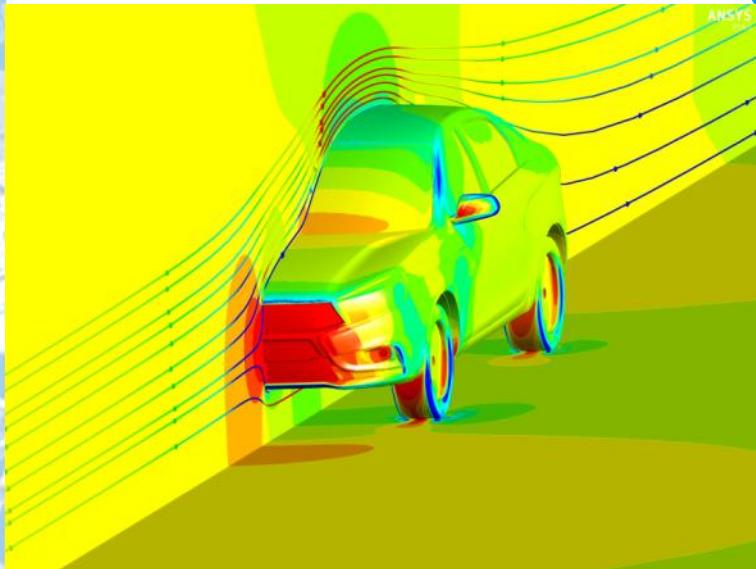
Optimal placement of damping coating on the roof

External Aerodynamics Analysis

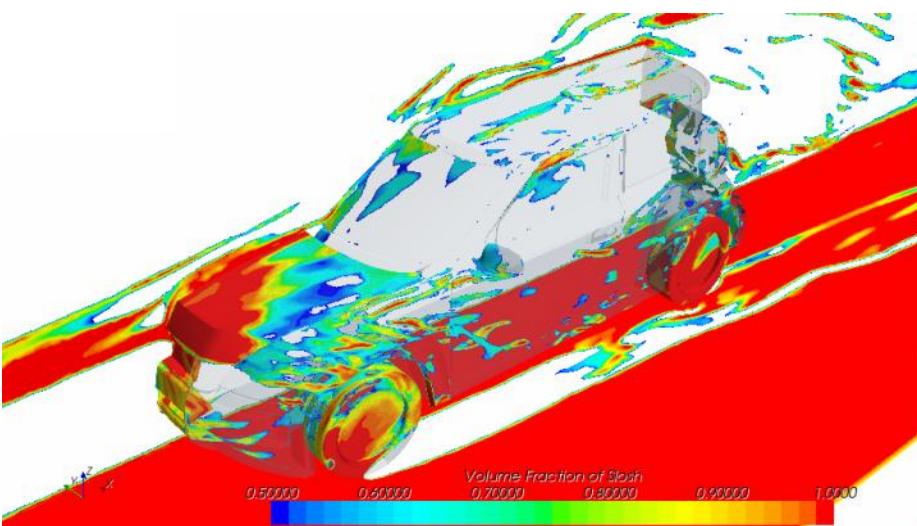
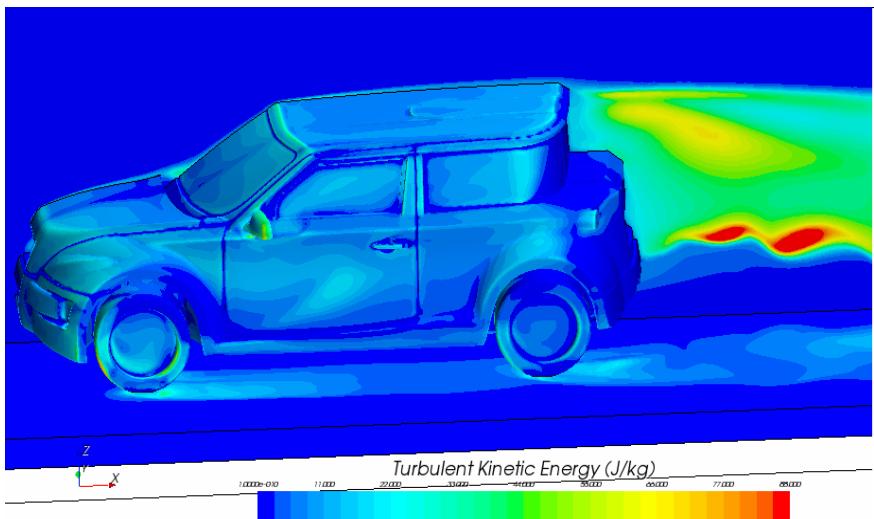
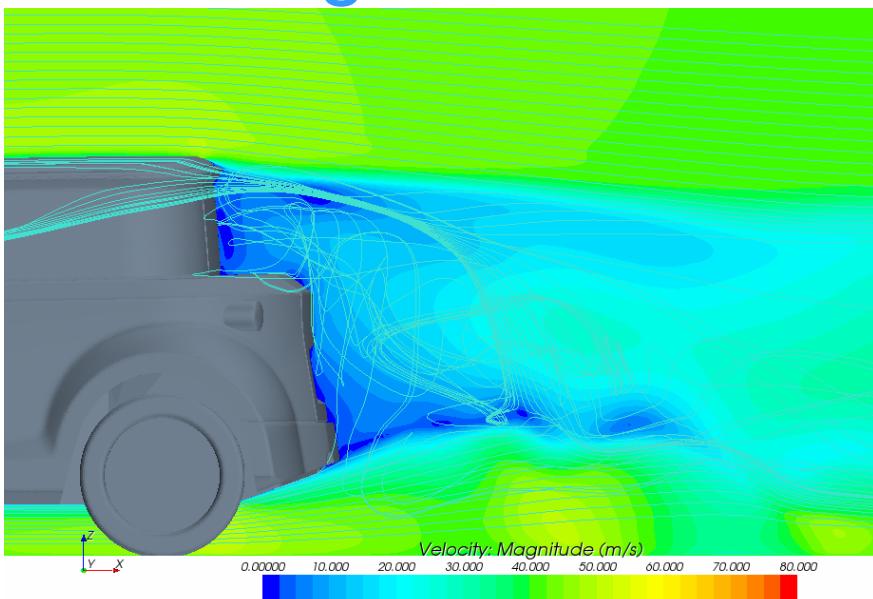
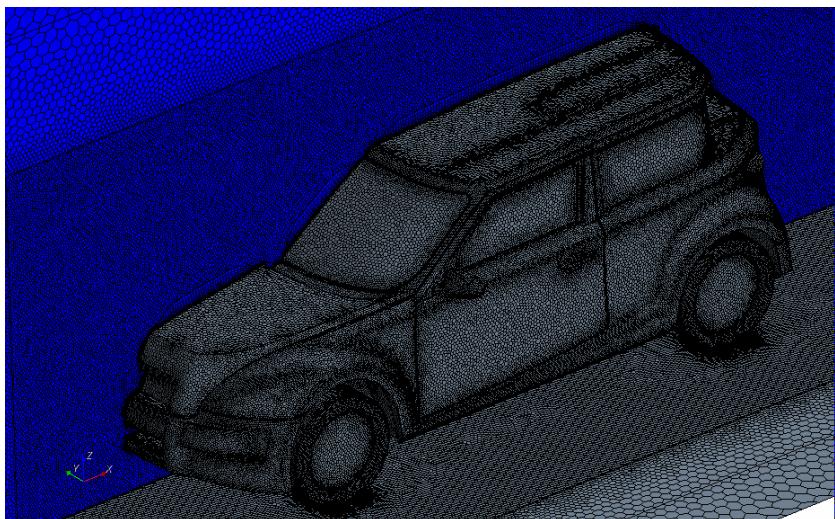


External aerodynamics (LADA Vesta)

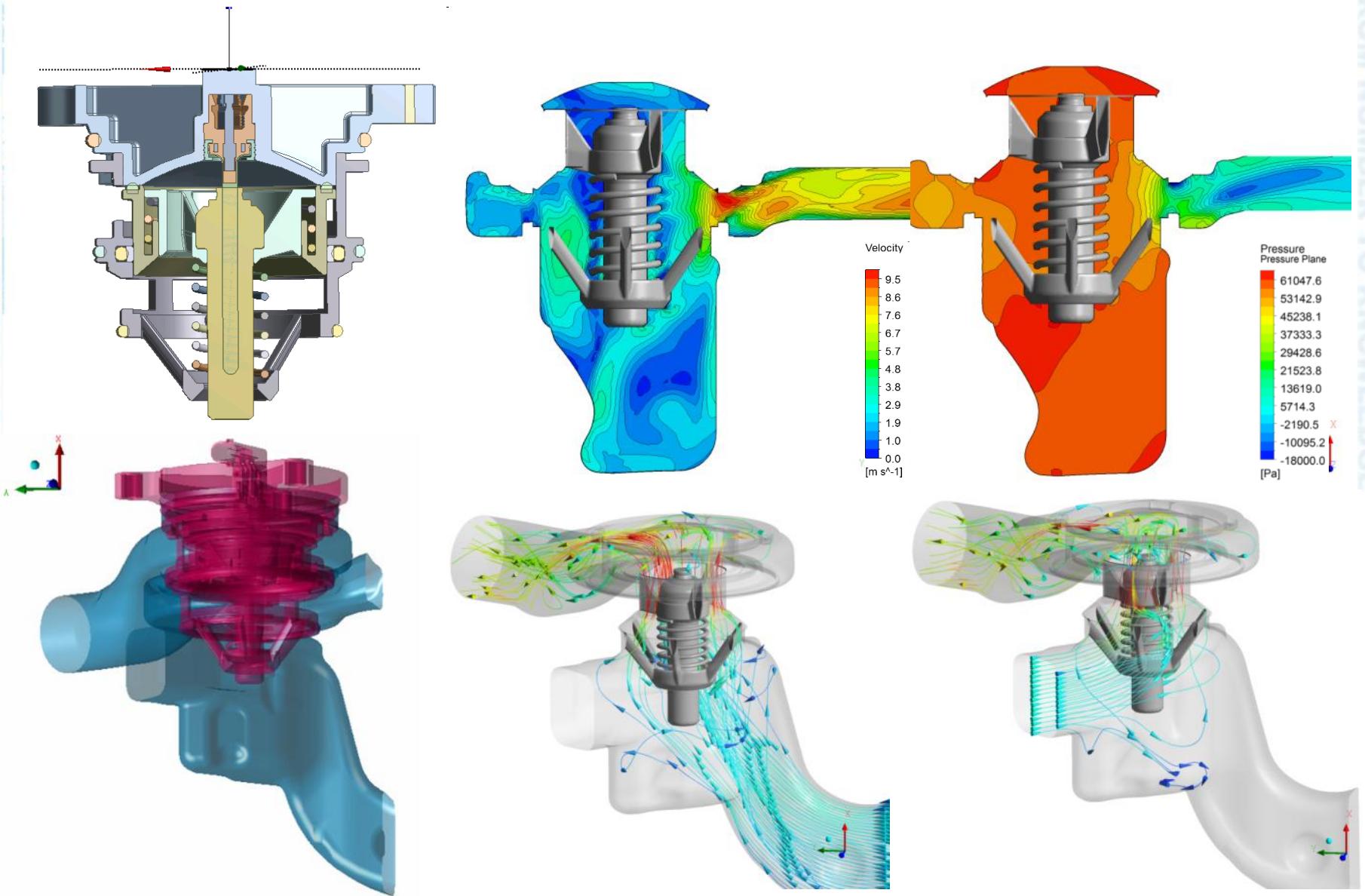
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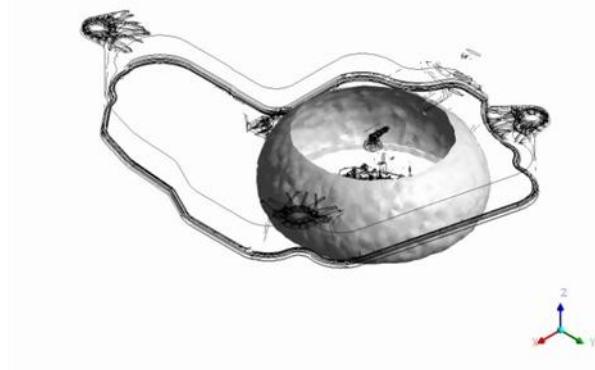
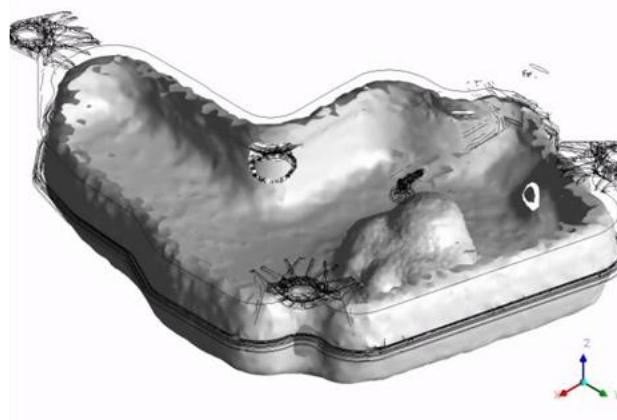
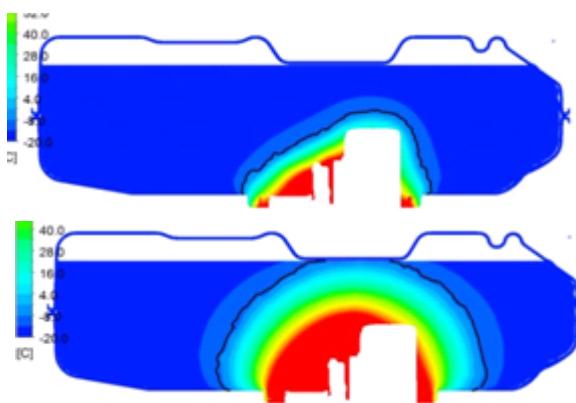
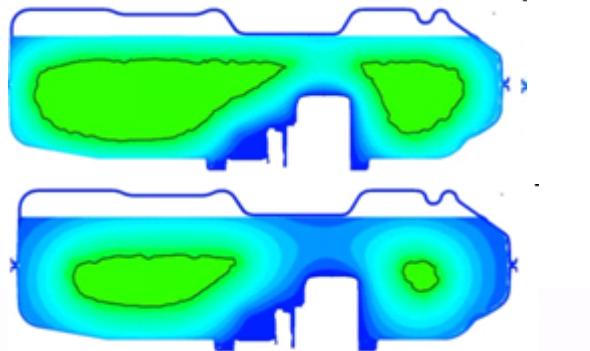
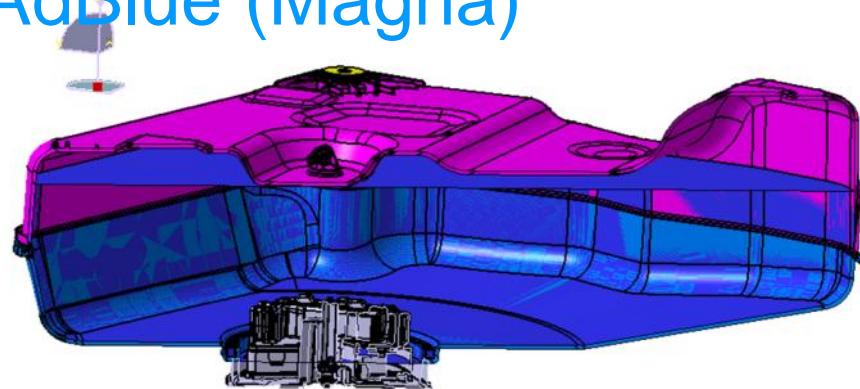
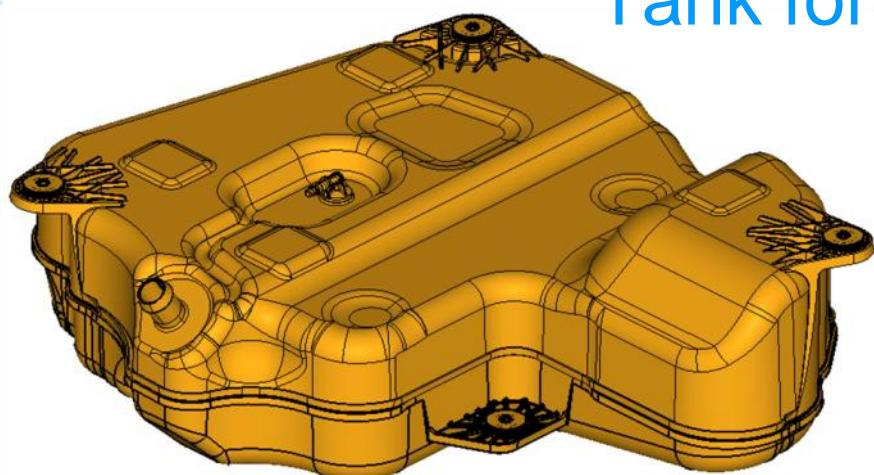
External Aerodynamics Analysis and Dirt Estimating



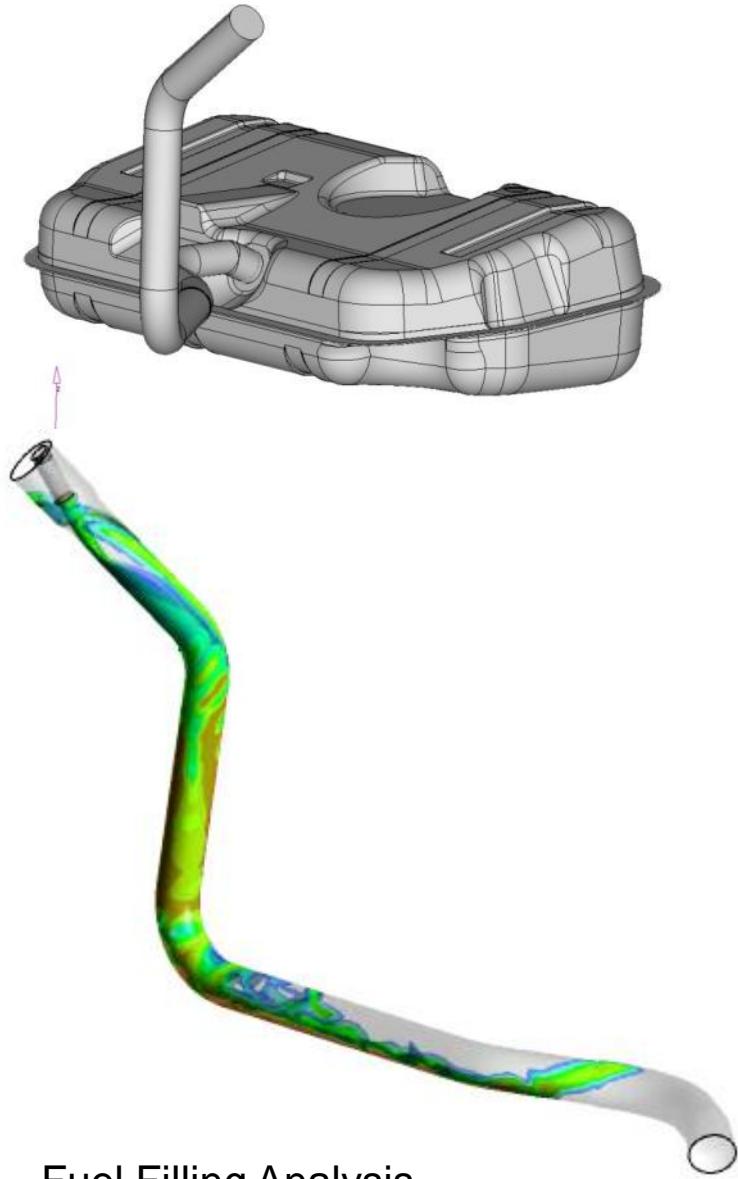
CFD Analysis of Valve (Cooling System)



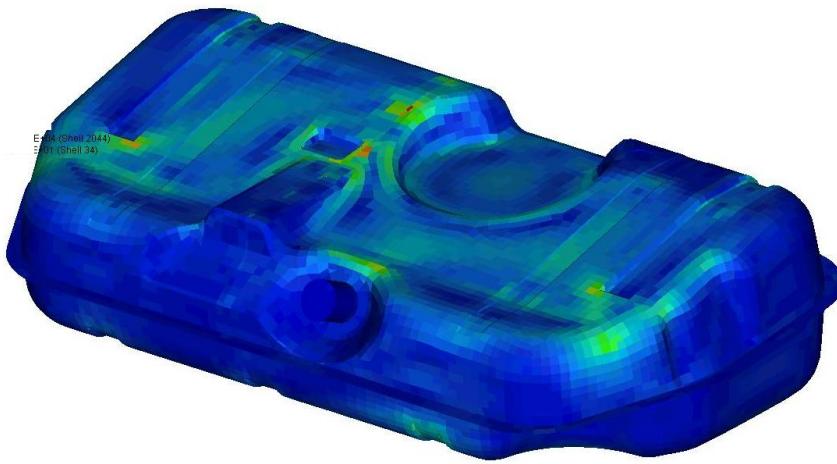
Frosting and Defrosting analysis of Tank for AdBlue (Magna)



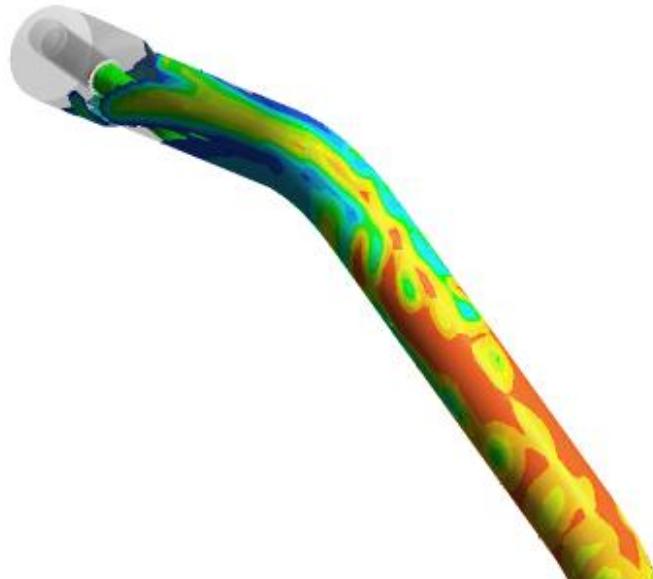
Fuel filling analysis and Tank Drop analysis



Fuel Filling Analysis

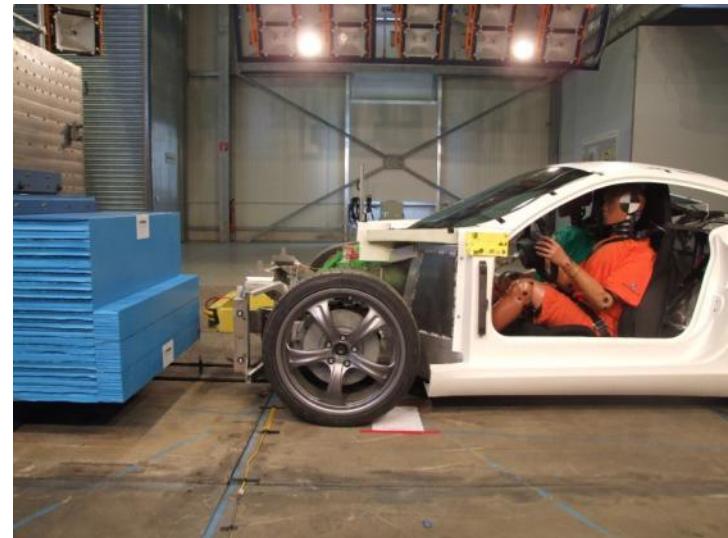
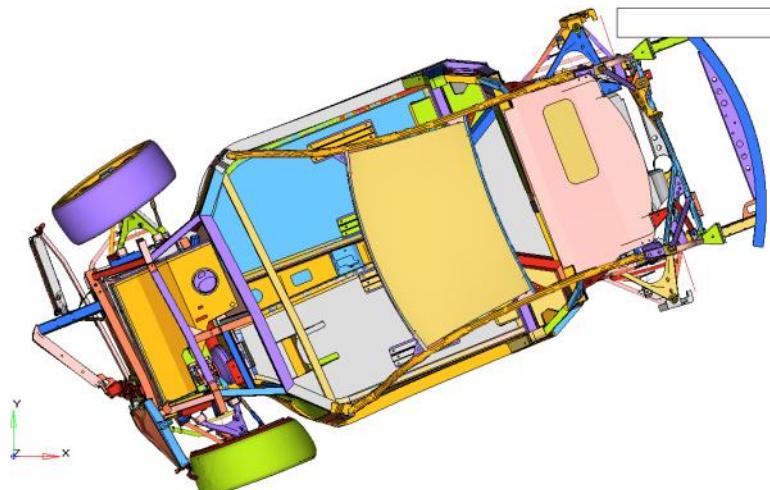
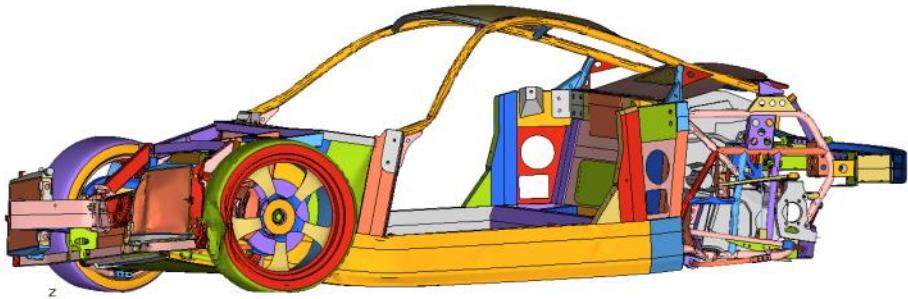
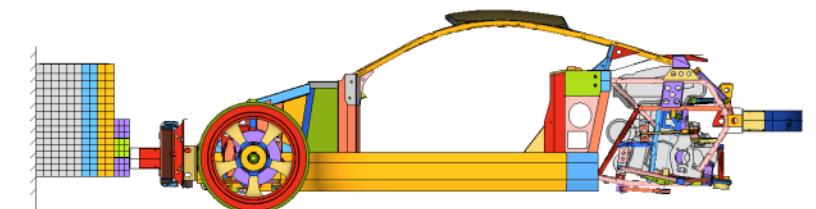
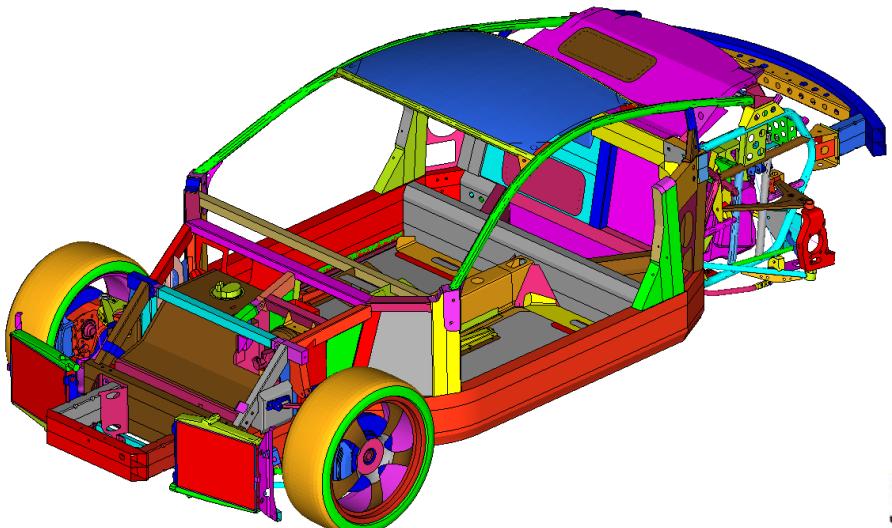


Fuel Tank Drop Analysis

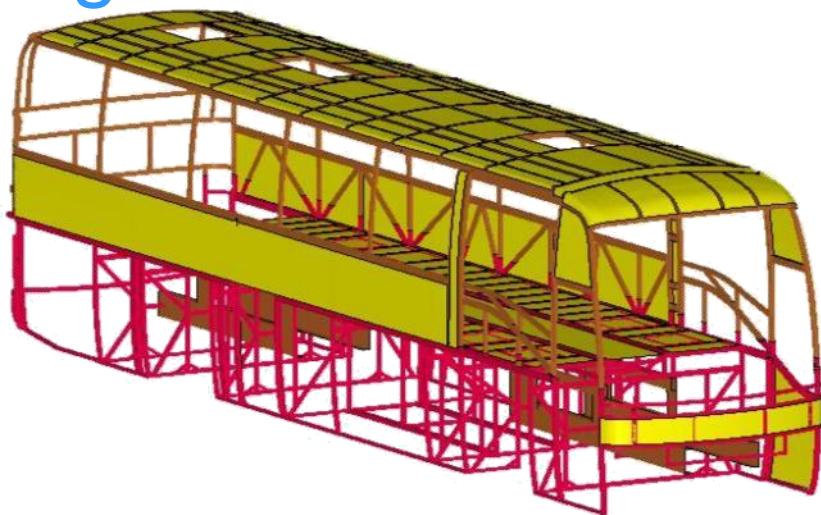
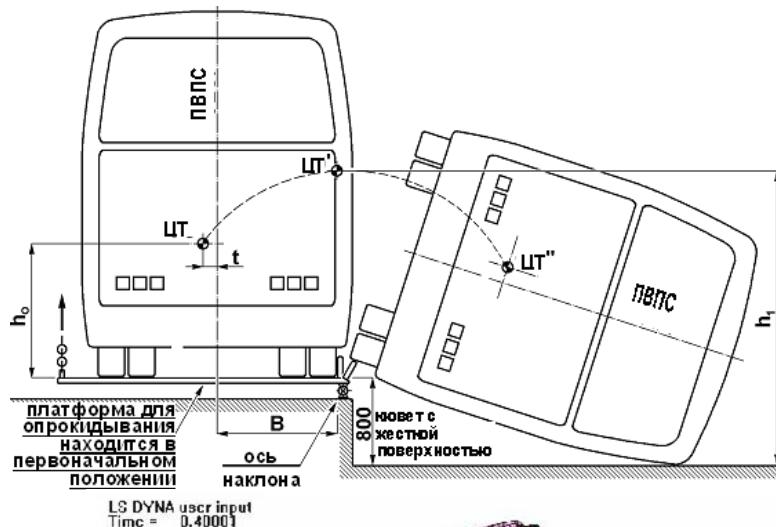


Crash-test of sport-car

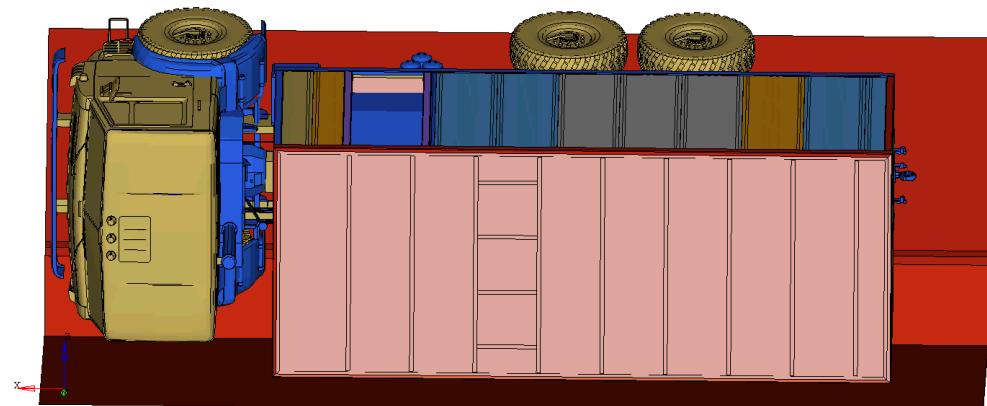
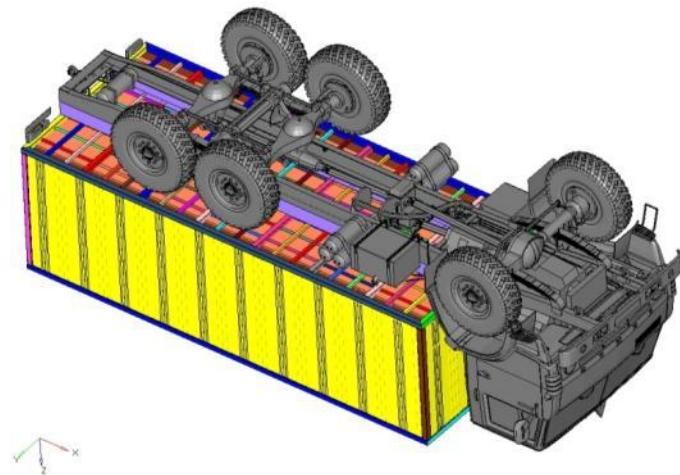
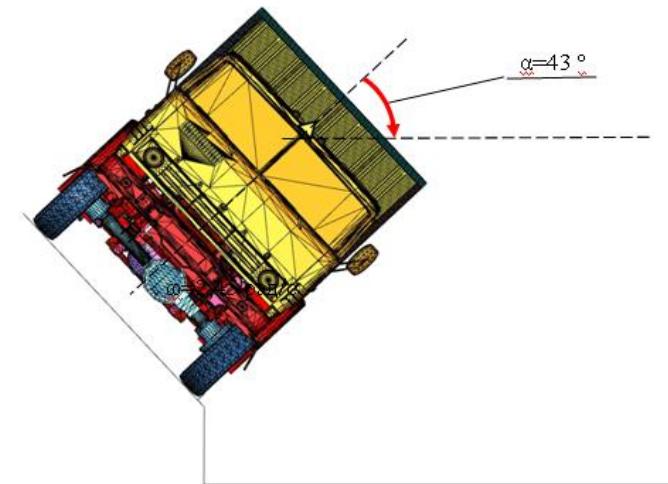
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Passive Safety analysis of Bus according R66

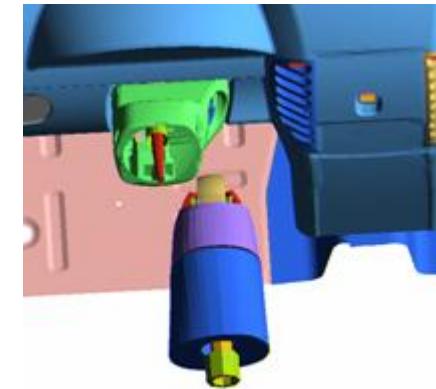
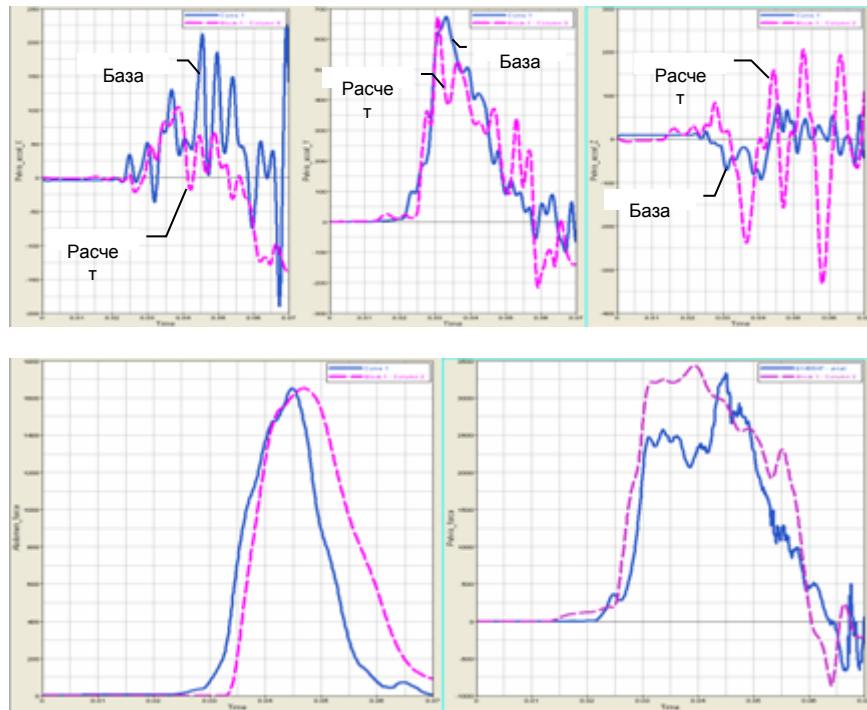


Passive Safety analysis of Truck according R66



Dummy Simulation (multibody dummy model creation)

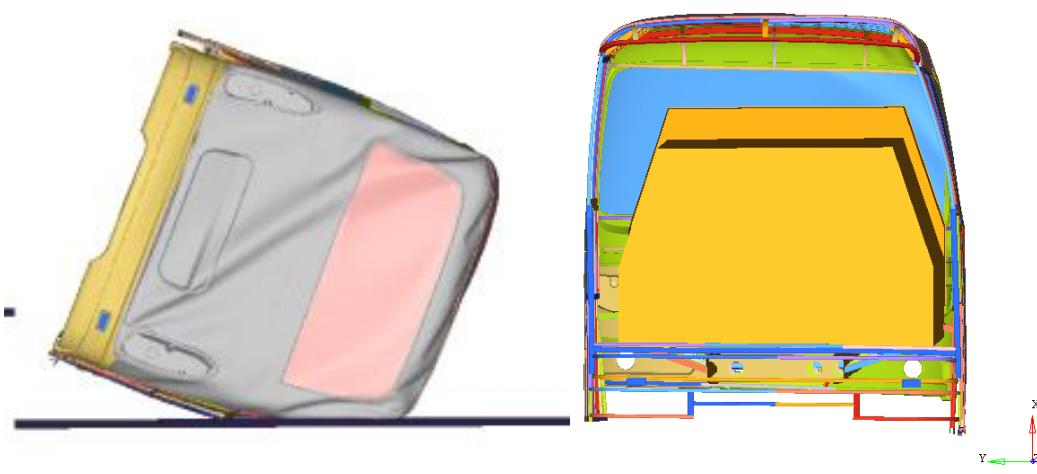
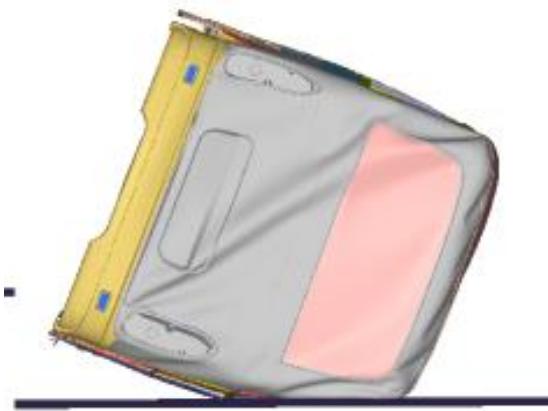
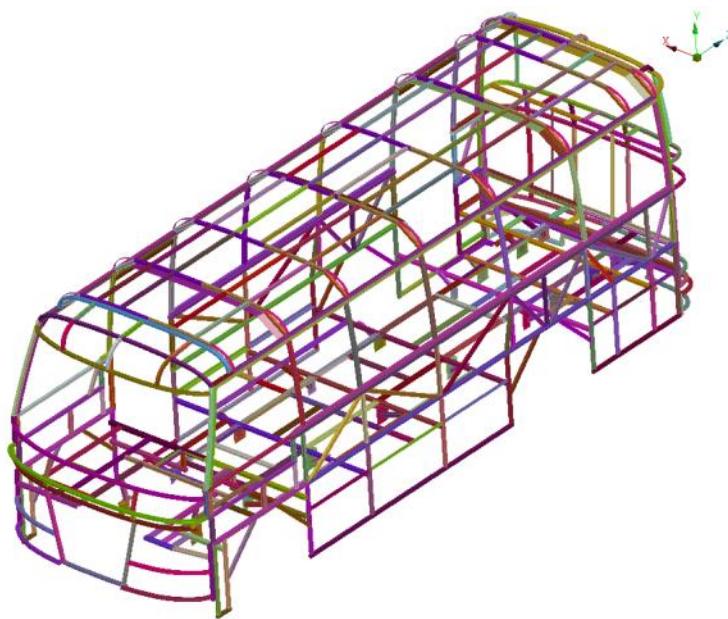
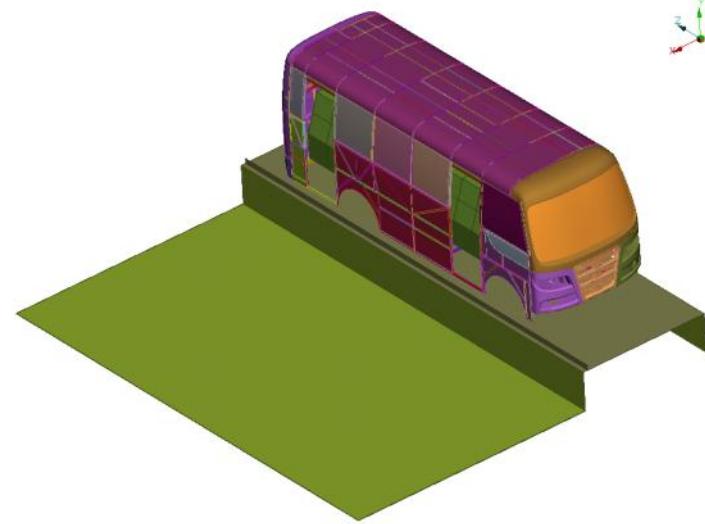
EuroSID-I, Hybrid-III



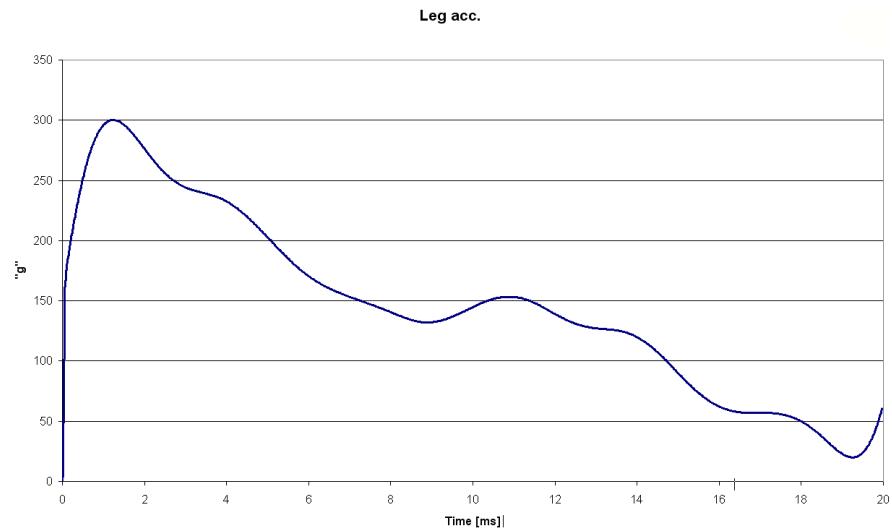
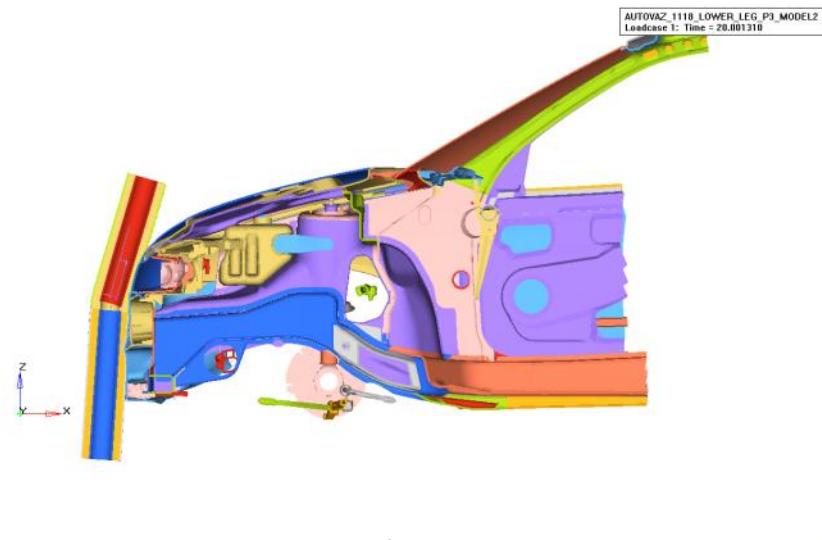
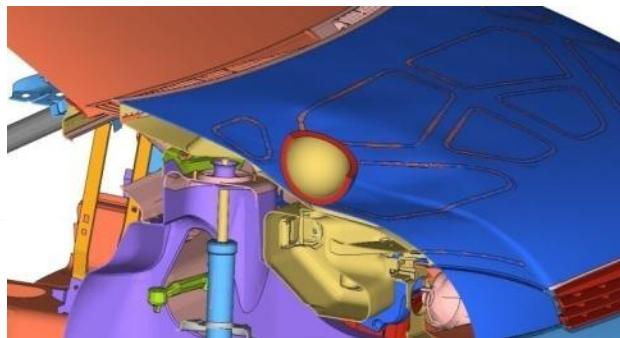
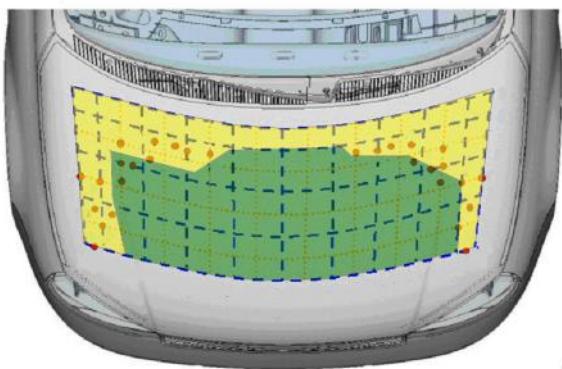
Multibody dummies with FE-dummy comparison

Interior analysis

Passive Safety analysis of Bus according R66

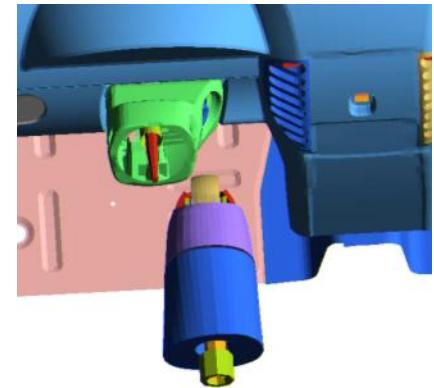
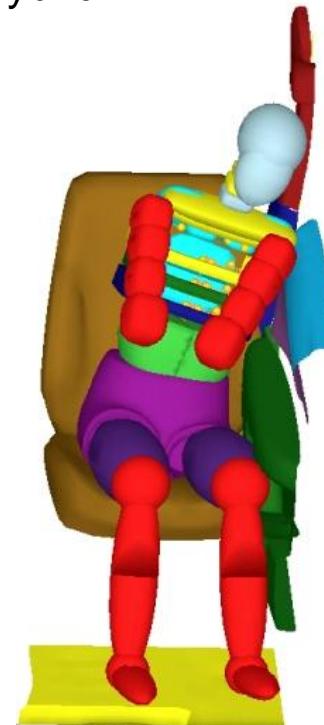
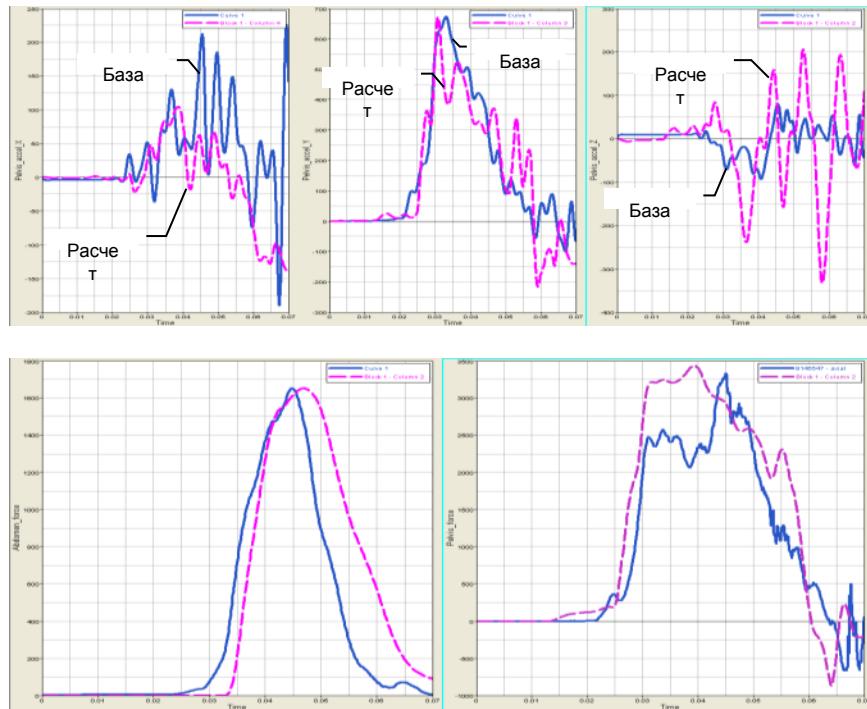


Pedestrian Safety



Dummy Design and Anslysis

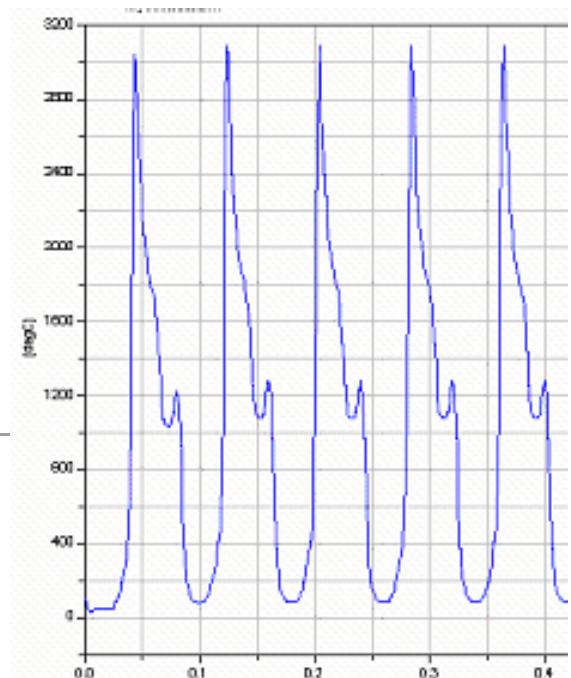
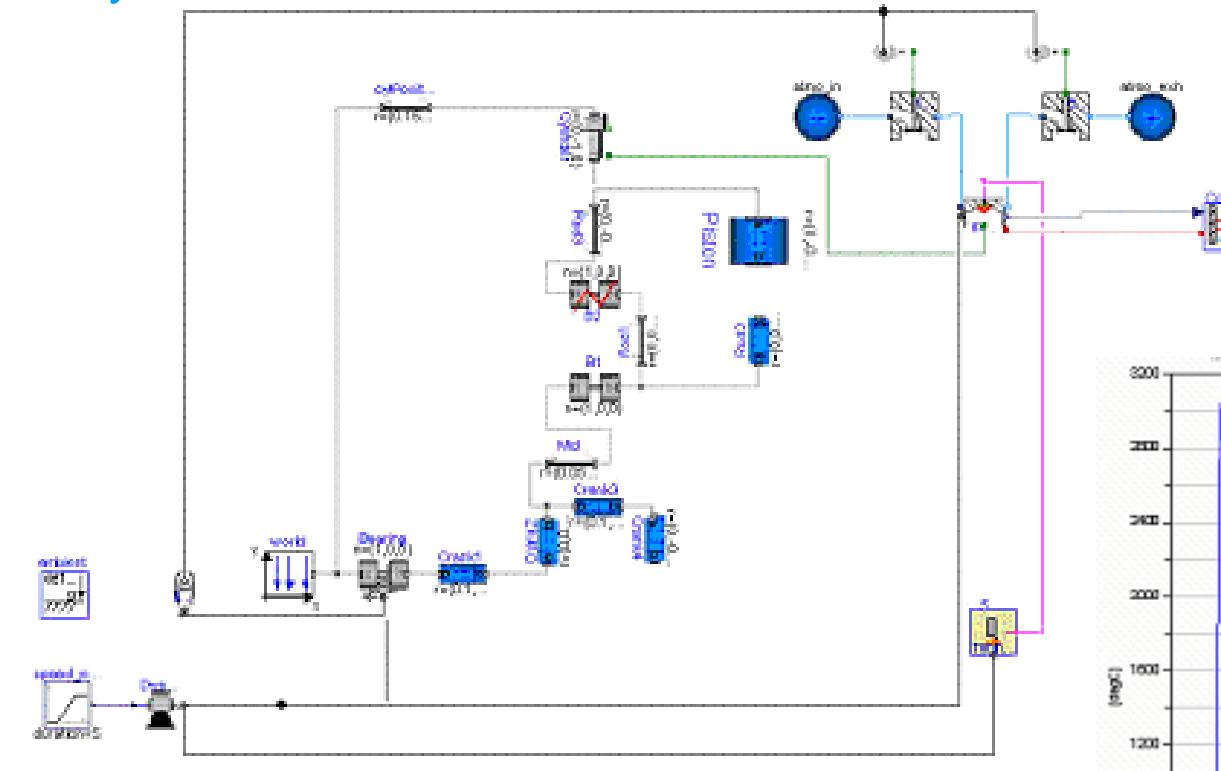
EuroSID-I, Hybrid-III



Сравнение КЭ модели и многотельной модели

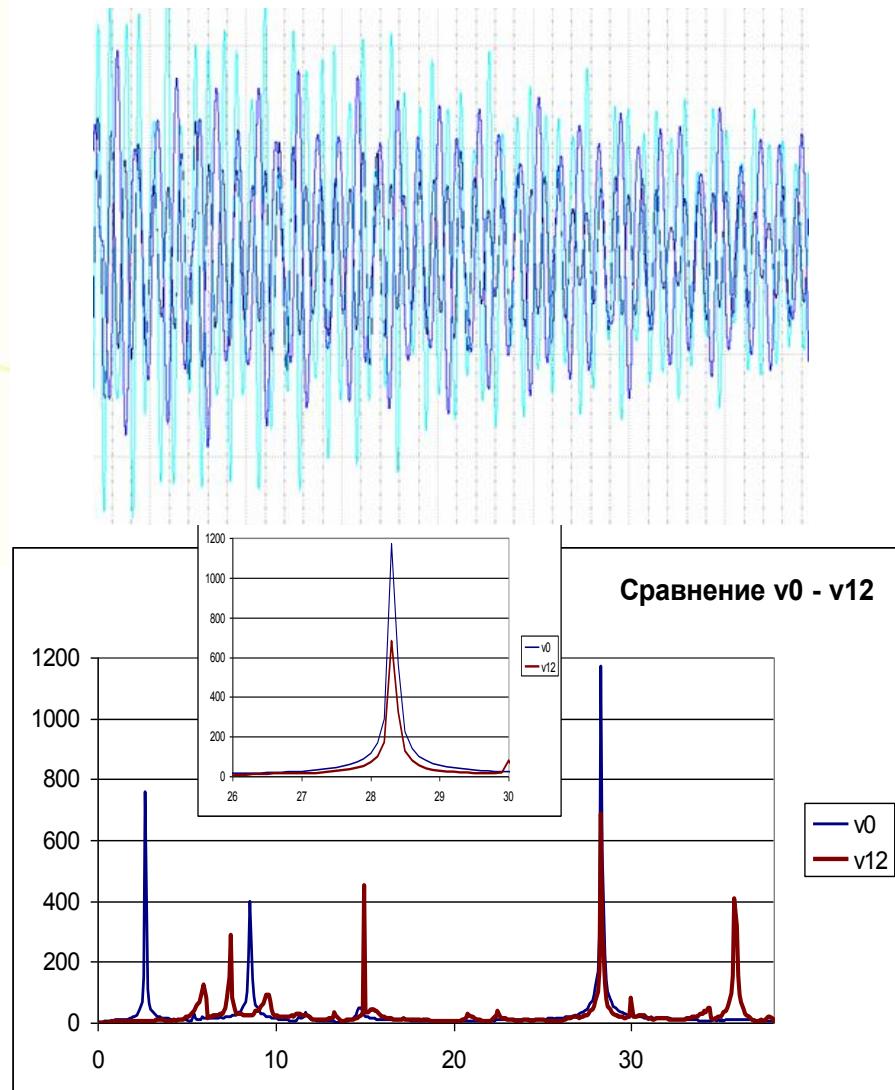
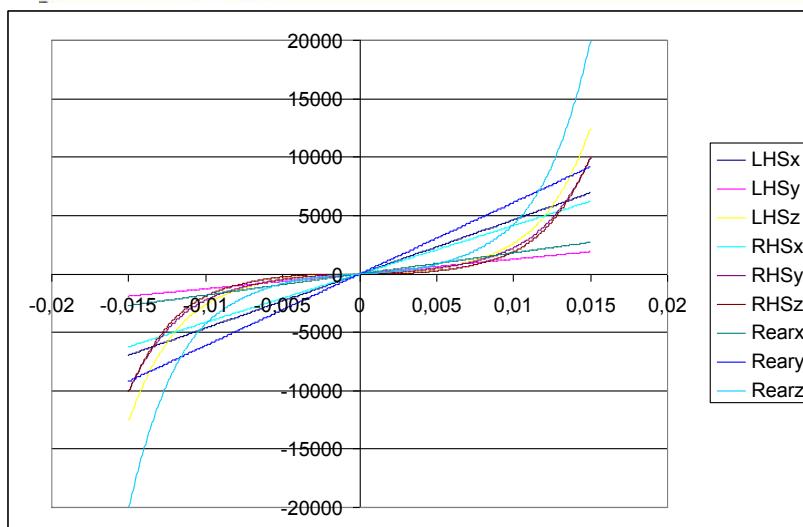
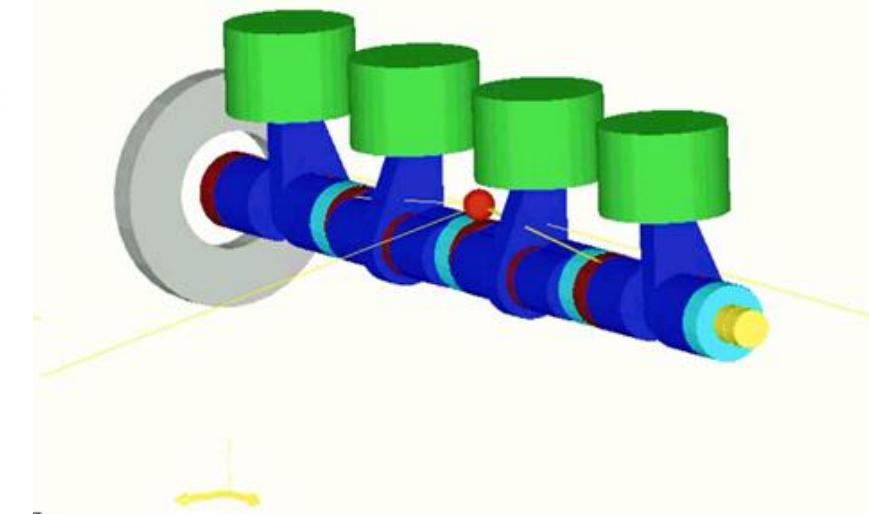
Анализ интерьера

- ▶ Internal Combustion Engine on system level
- ▶ System Solution



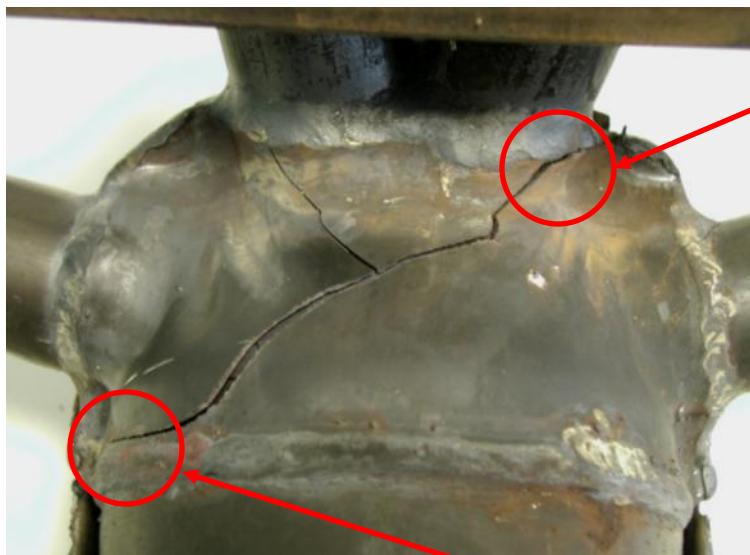
- ▶ Engine Model and simulation results (using Modelica (SimulationX, PRADIS, Dymola))

Engine Mounts Optimization

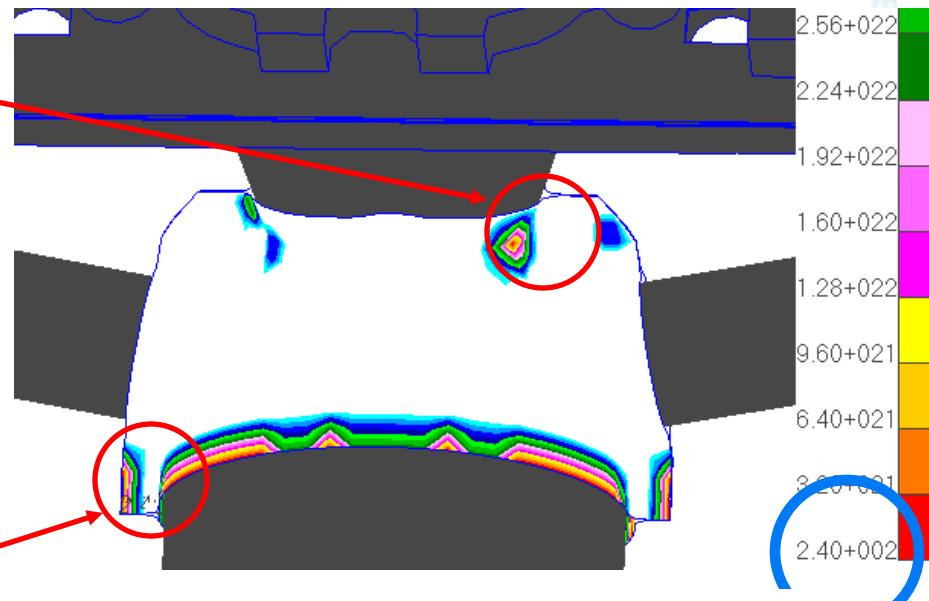


► Decreasing of vibration is to 1,7 times.

Durability Analysis of Catalytic Collector



The results of nature life cycle testes (30 – 50)% from necessary

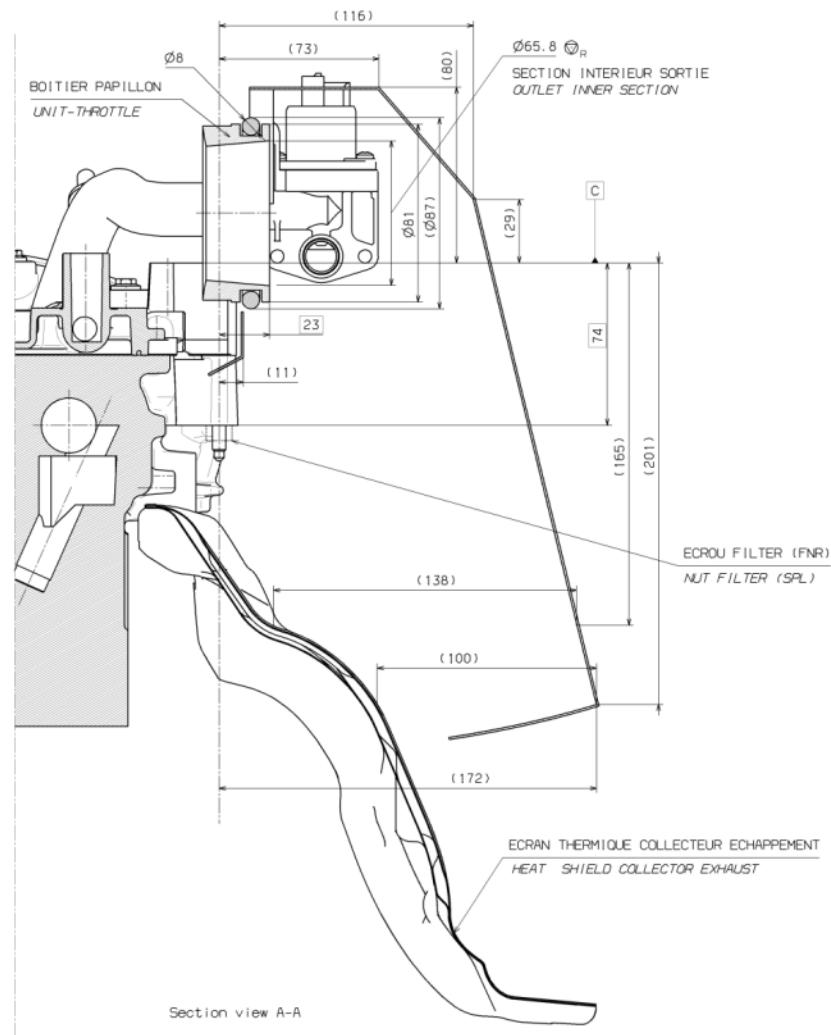
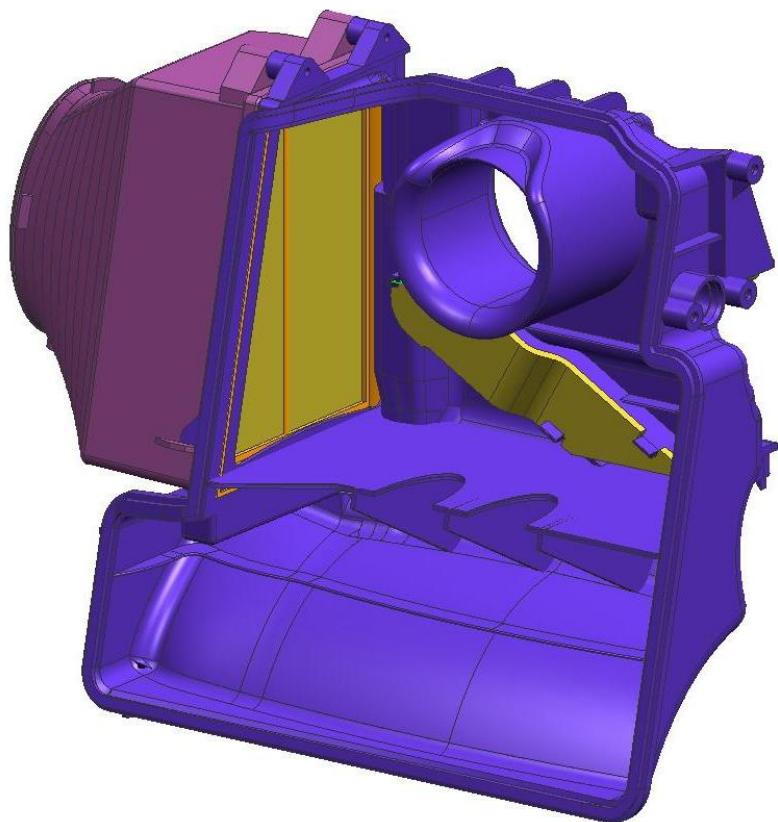


The results of durability analysis – 50% (240 cycles from necessary 480)

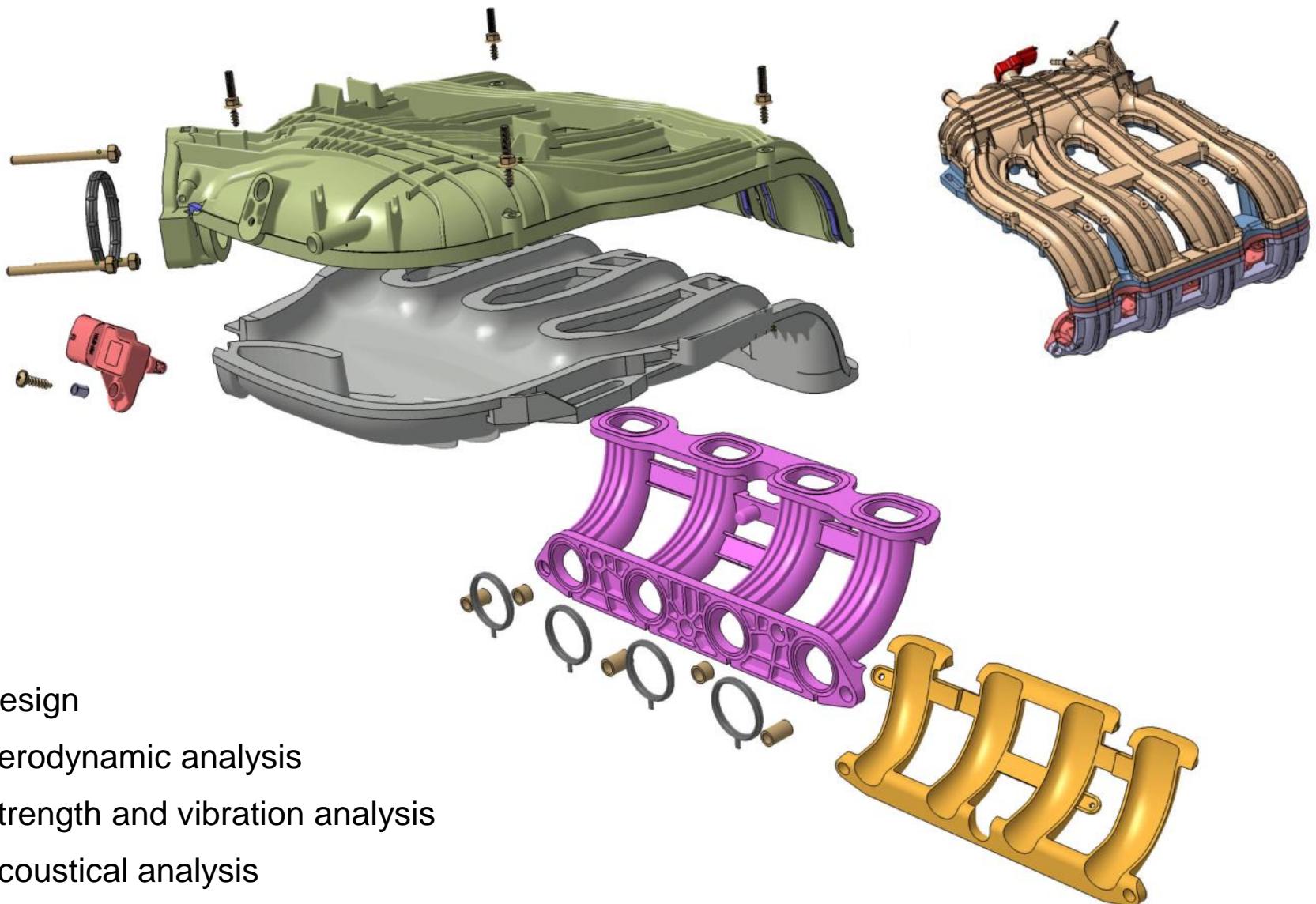


High Convergence

Engine Air Filter Design (Renault)

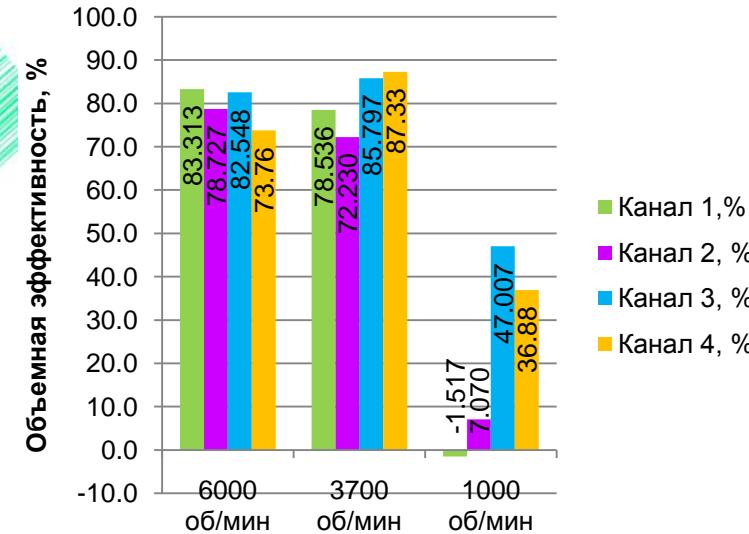
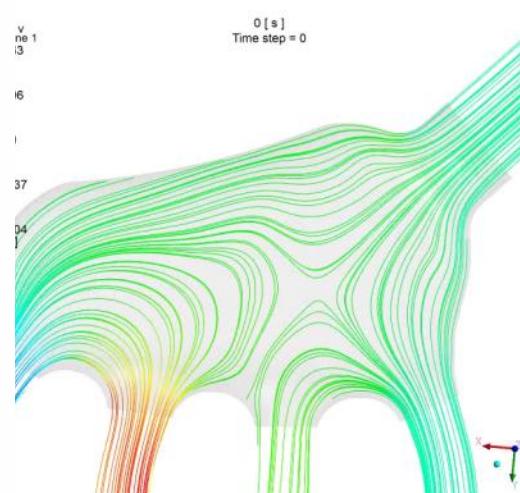
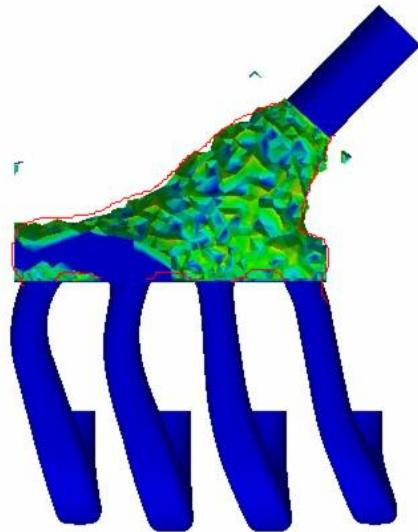


Design of Intake unit

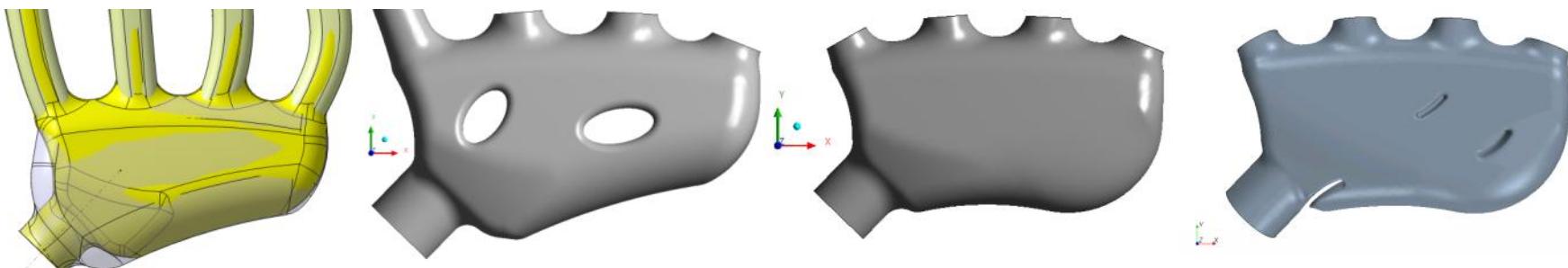


- ▶ Design
- ▶ Aerodynamic analysis
- ▶ Strength and vibration analysis
- ▶ Acoustical analysis
- ▶ Drafting, FMEA

Manifold Shape Optimization



Non stationary compressed fluid analysis

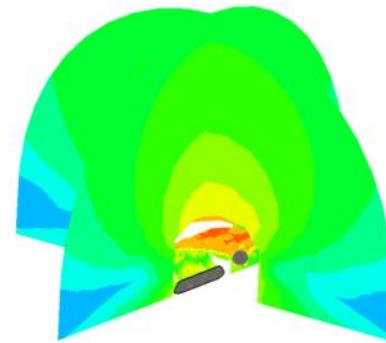
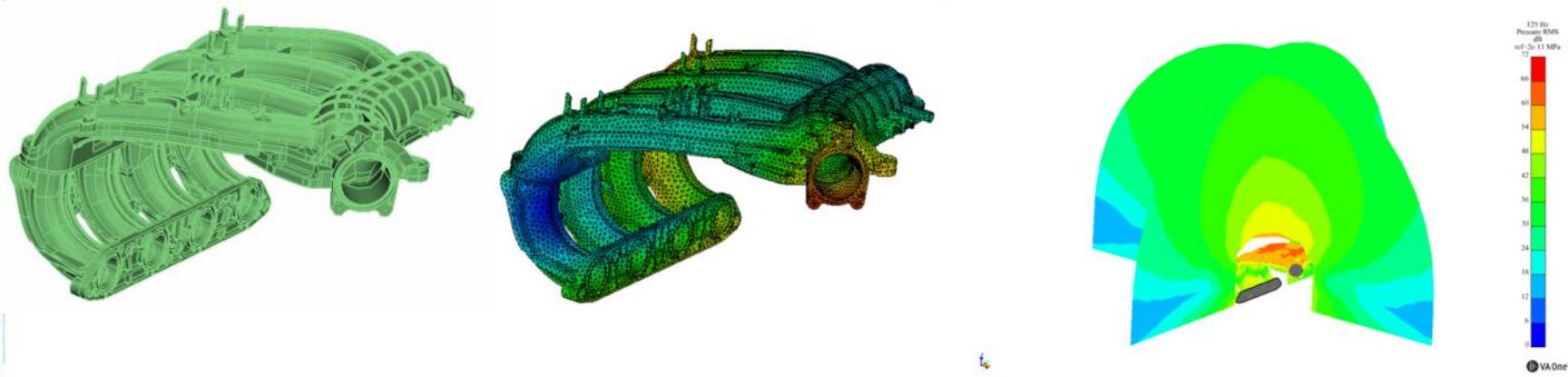


44 variants of geometries + Adjoint shape optimization

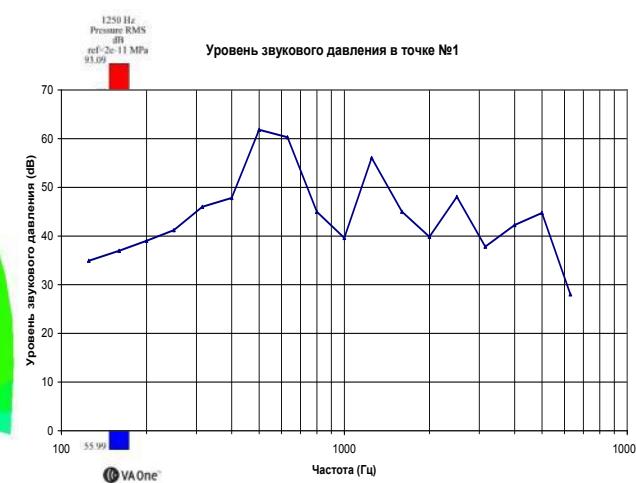
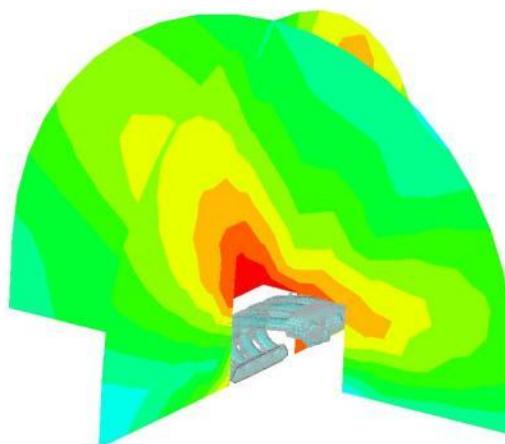
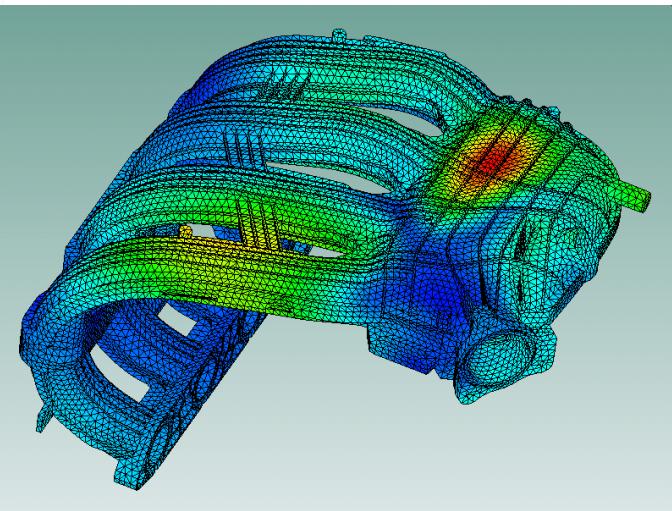
Air Filling Ratio	rpm	Runner 1, %	Runner 2, %	Runner 3, %	Runner 4, %	Total, %	Irregularity, %
Aluminium Variant 1st	3700	75,7	67,5	84,2	84,2	77,9	19,8
	6000	77,8	65,7	67,5	72,6	70,9	15,5
Variant 40a	3700	87,8	81,5	88,2	80,9	84,6	8,2
	6000	81,0	75,0	76,7	72,0	76,2	11,1

Inlet Manifold Radiation Noise Analysis

FROM NUMBER TO KNOWLEDGE

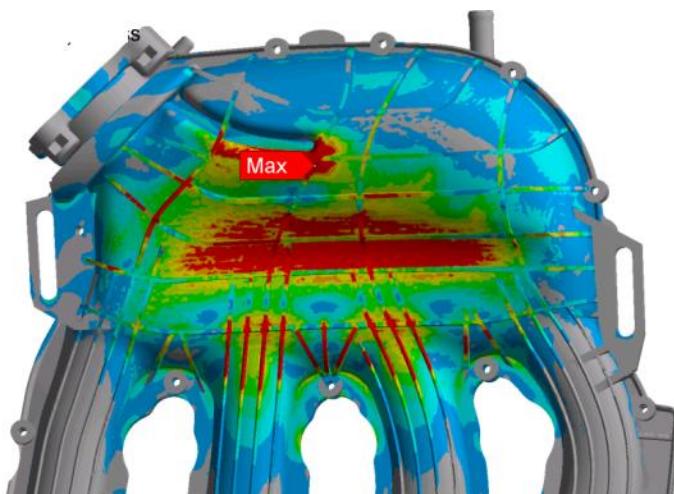


127 dB
Pressure RMS
ref=2e-11 MPa
12
108
100
96
92
88
84
80
76
72
68
64
60
56
52
48
44
40
36
32
28
24
20
16
12
8
4
0
VA One®

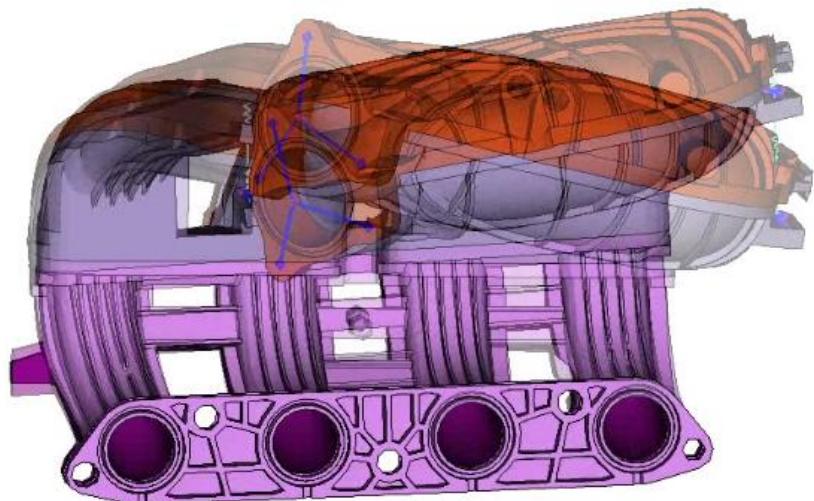


Strength and Vibration Analysis

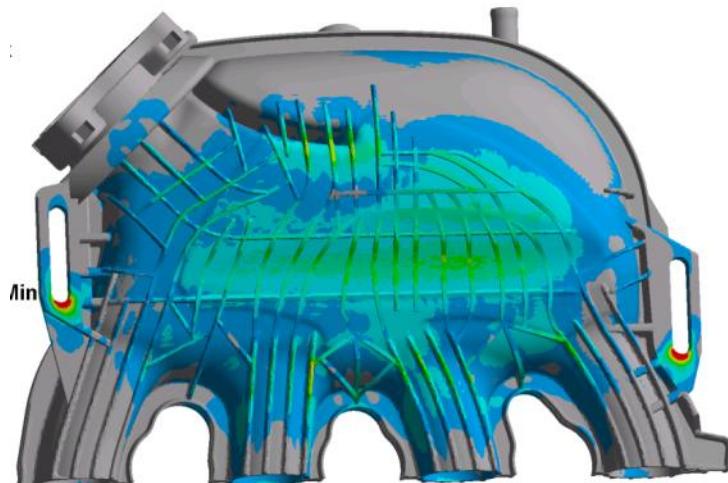
Before optimization



Mode 2. 314 Hz

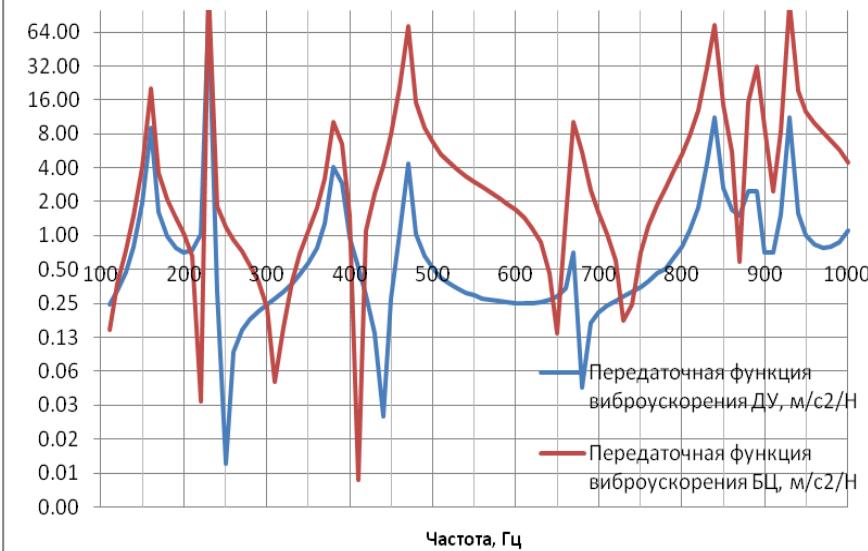


After optimization



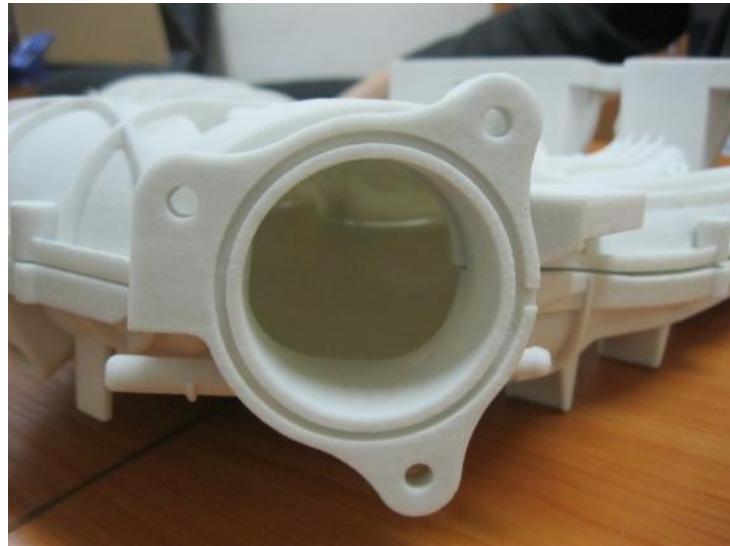
Виброускорение,
м/с²

Передаточные функции виброускорений



Rapid Prototyping of Intake Manifold

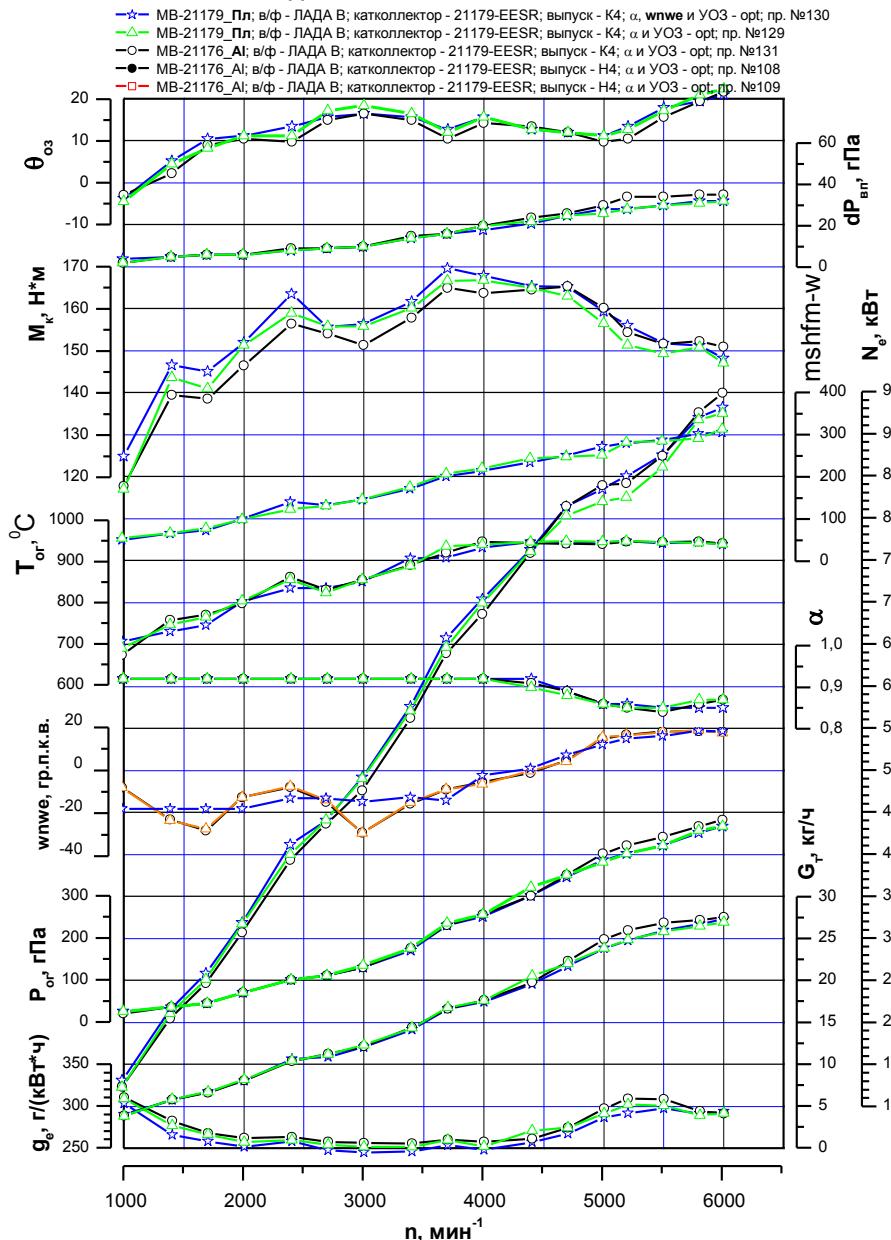
FROM NUMBER TO KNOWLEDGE



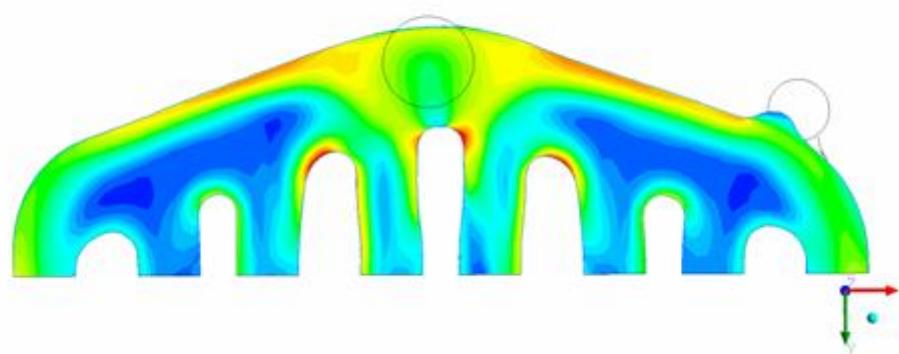
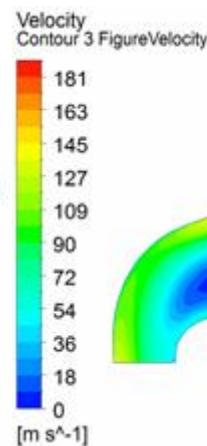
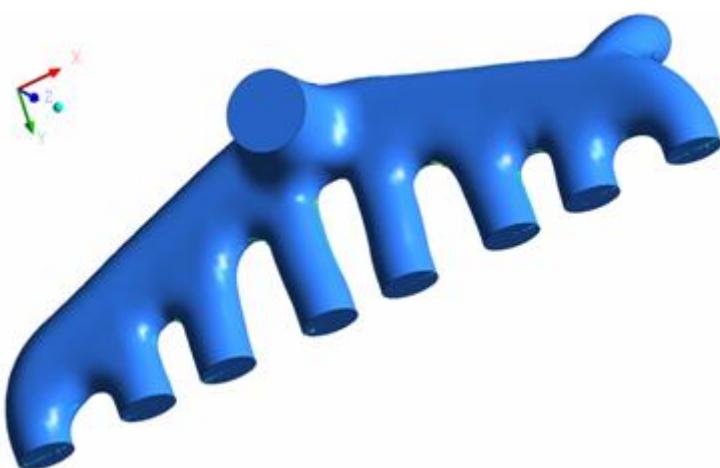
Results of Experimental Validation

Внешняя скоростная характеристика
Двигатель ВАЗ-21176 №0000960

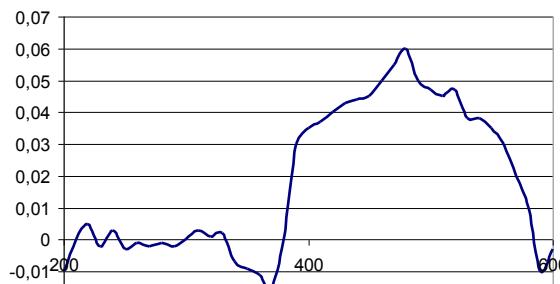
- ▶ + 5 kW of Engine Power
- ▶ Better fuel Economy
- ▶ Better Moment



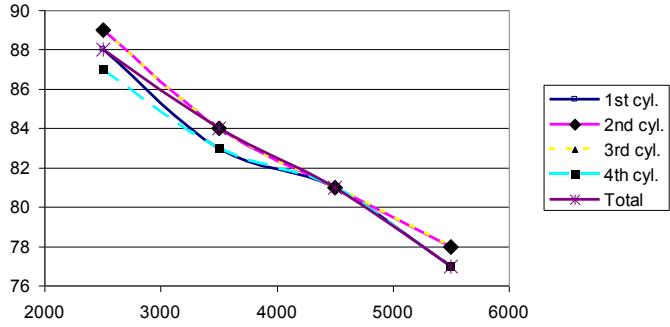
CFD/Aeroacoustic analysis (Renault)



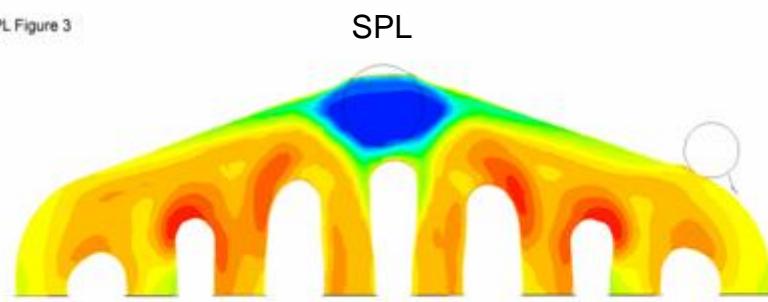
Mass flow for 4th cylinder, kg/s



Volume Efficiency % from rpm

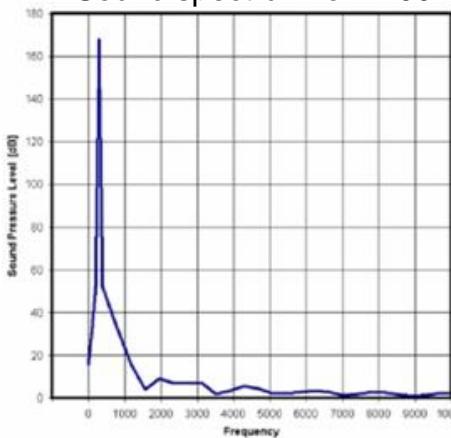


vSPL
Contour SPL Figure 3

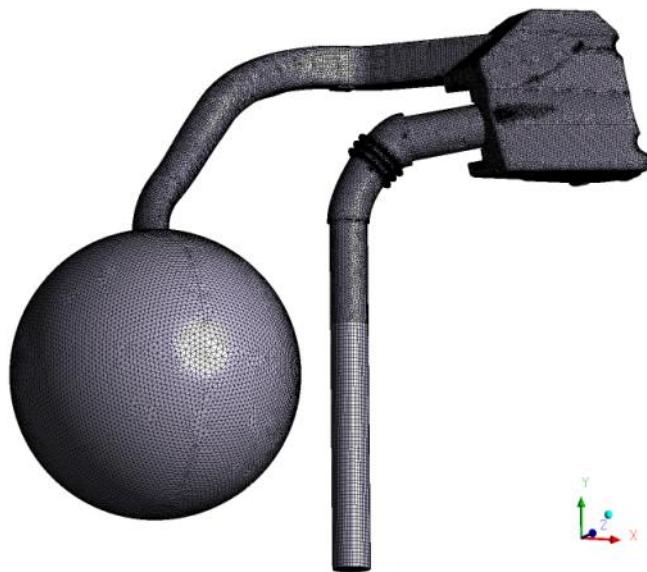


SPL

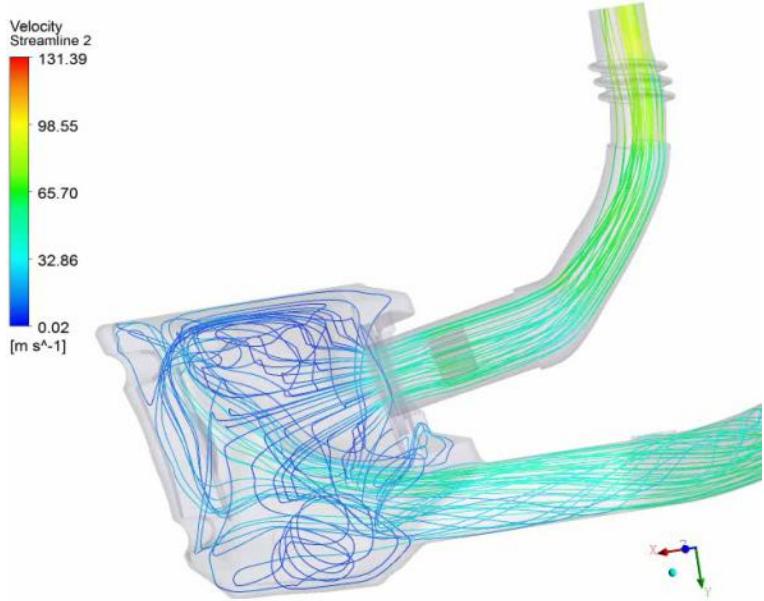
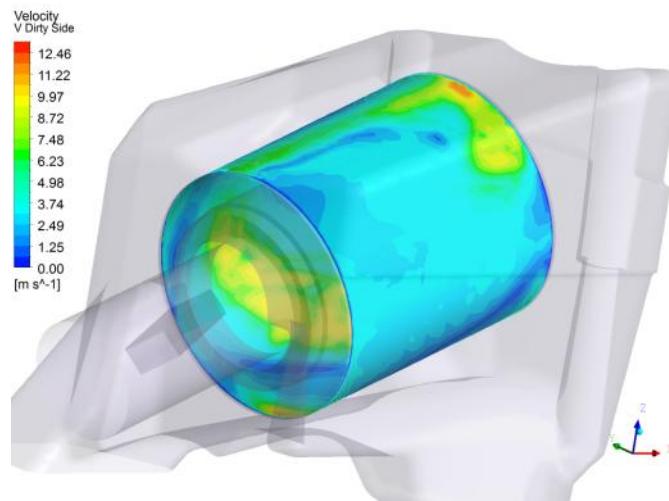
Sound spectrum for 1200 rpm



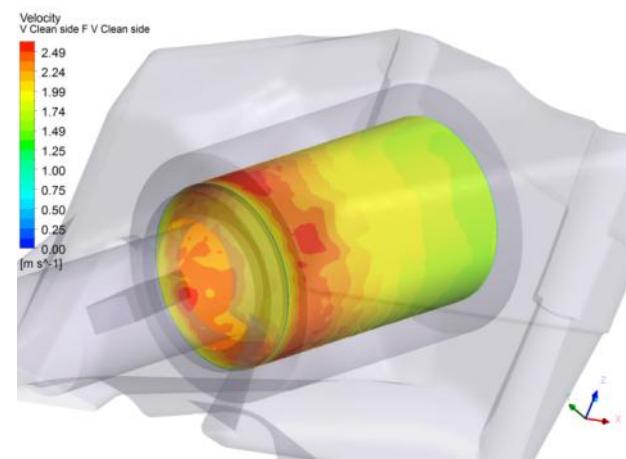
Air Engine Filter Optimization (Opel Astra)



Dirt Side

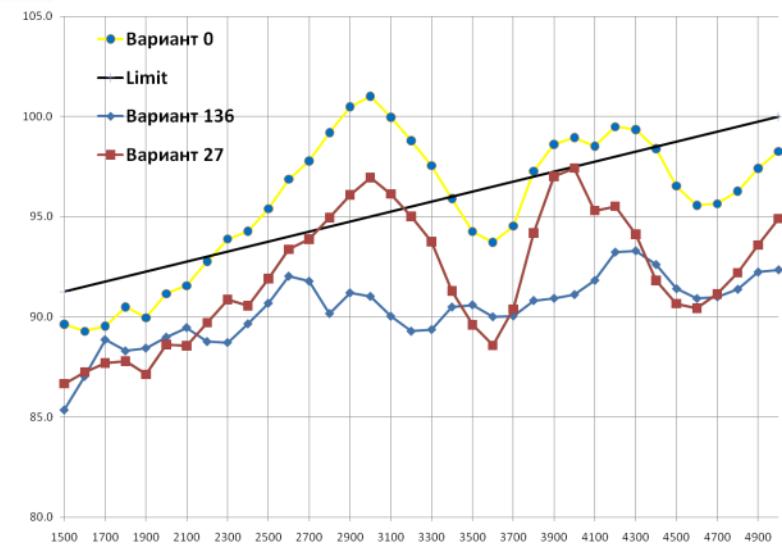
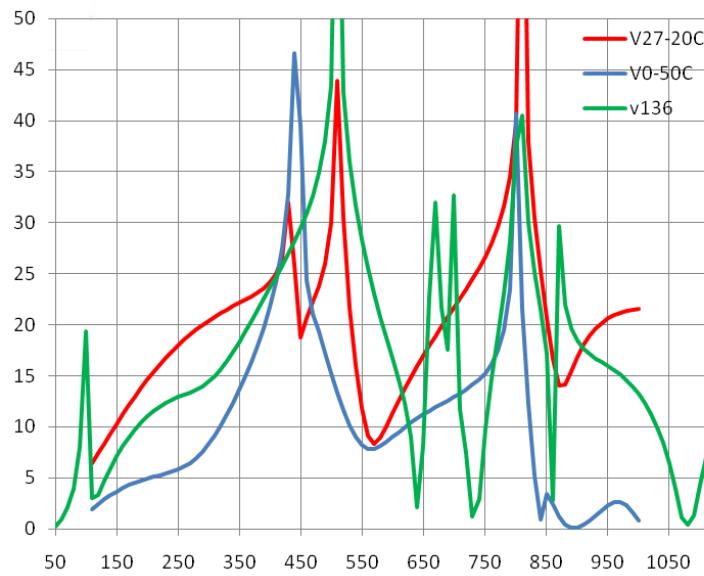
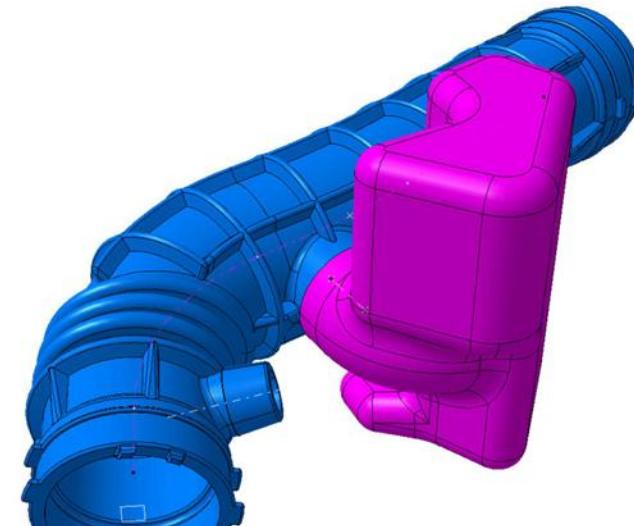
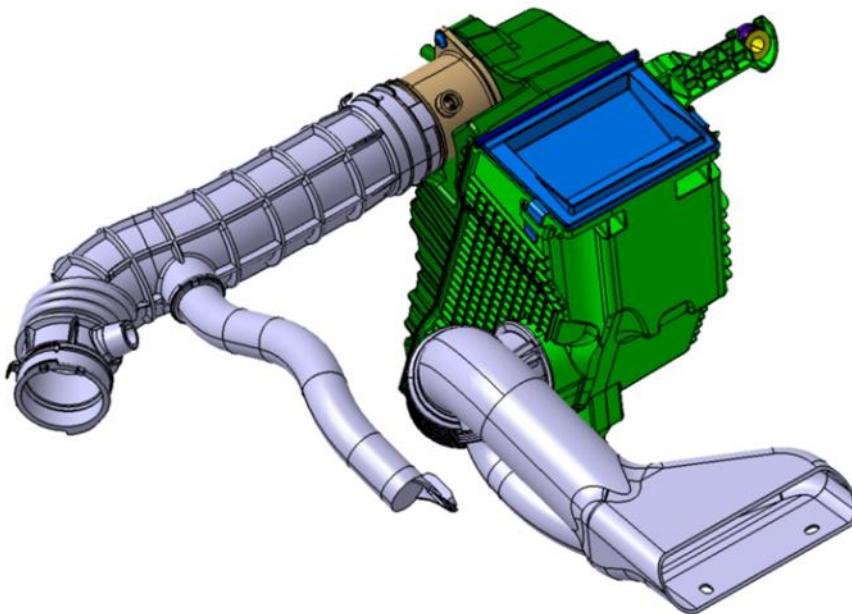


Clean Side

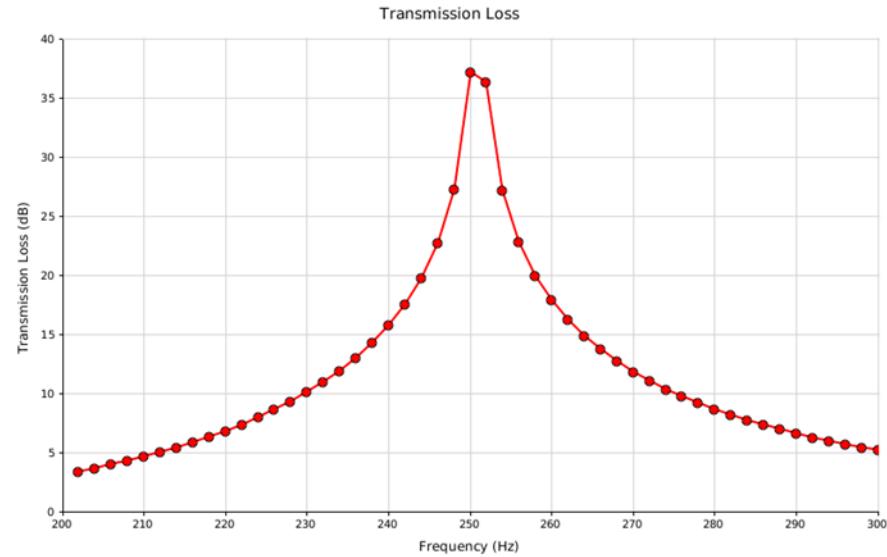
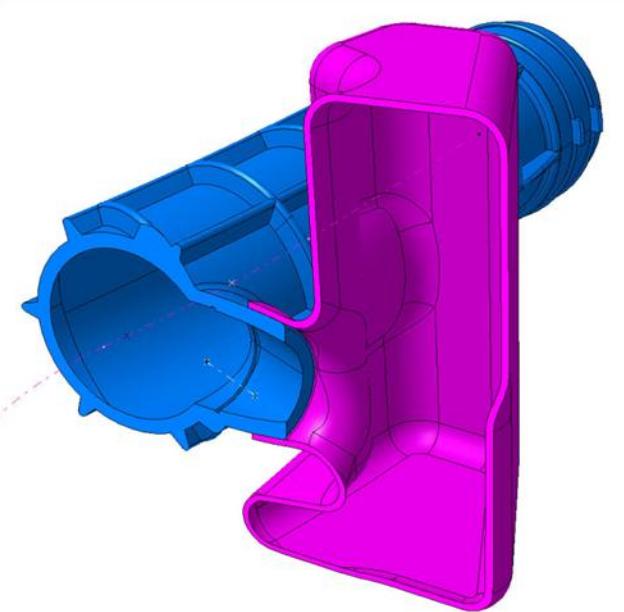
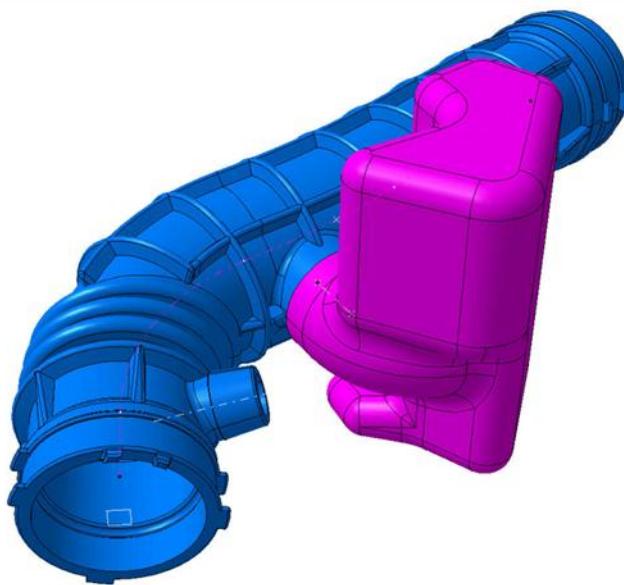


Air Inlet Design

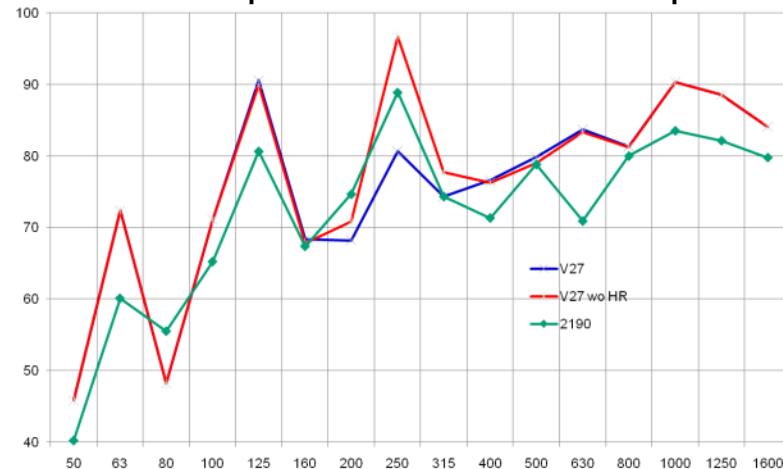
FROM NUMBER TO KNOWLEDGE



Helmholz Resonator Design

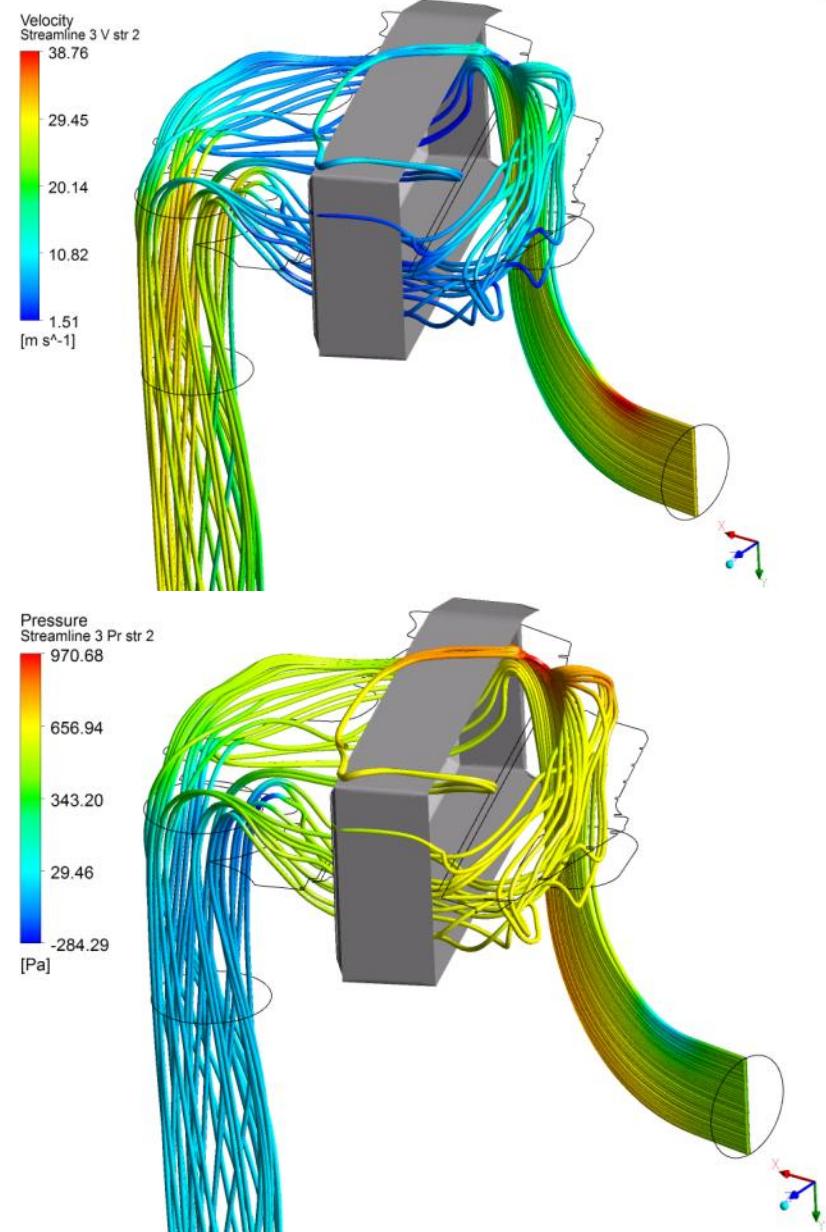
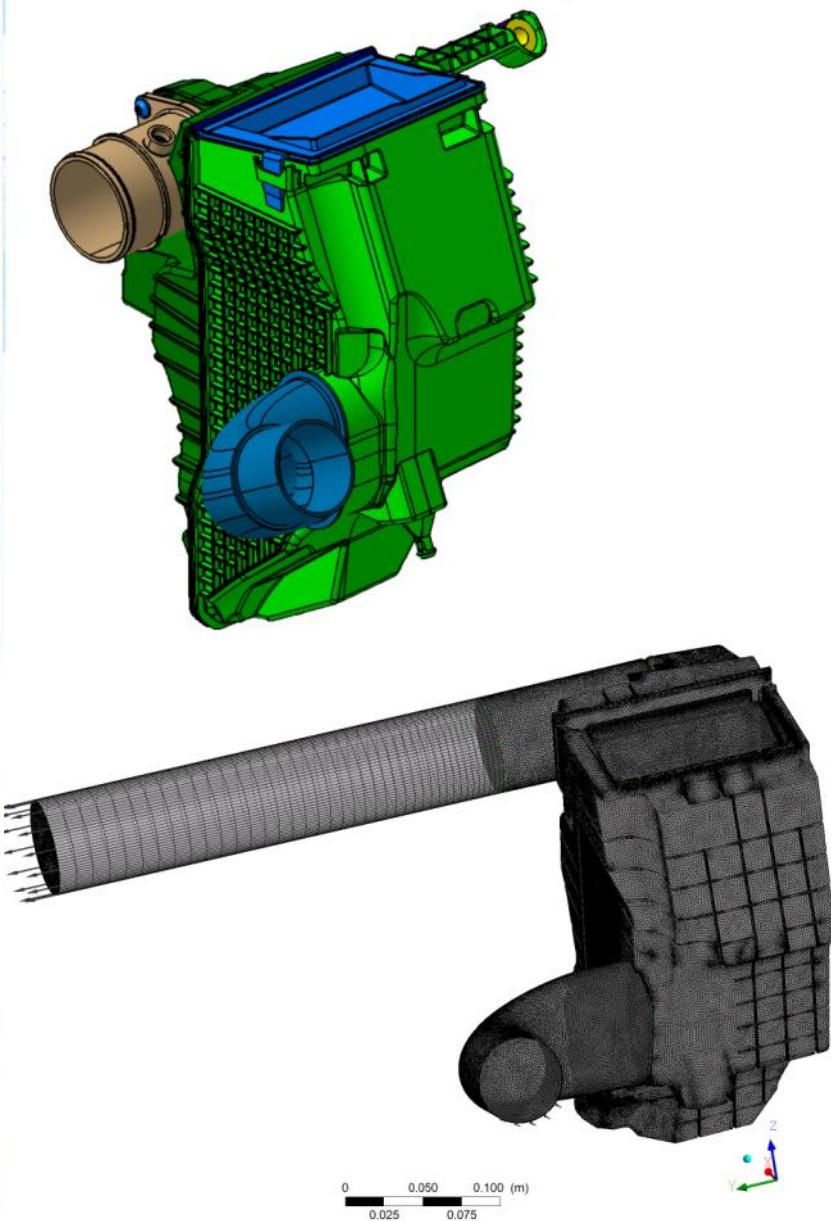


Ширина полосы: 16 Гц

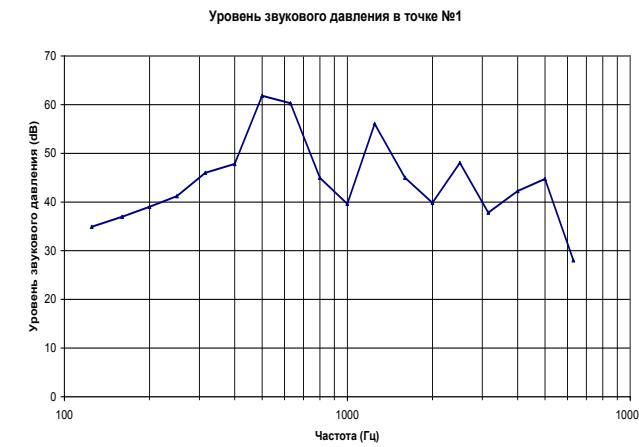
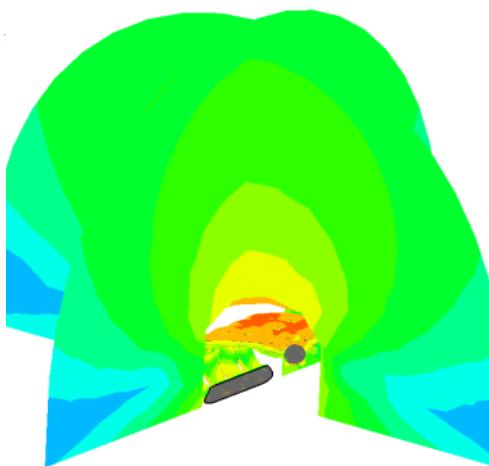
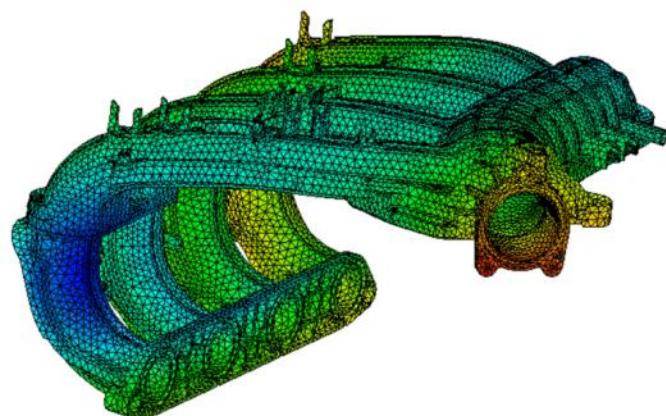
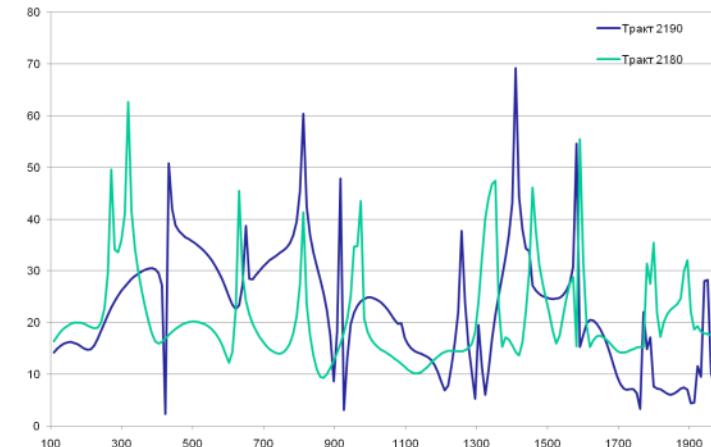
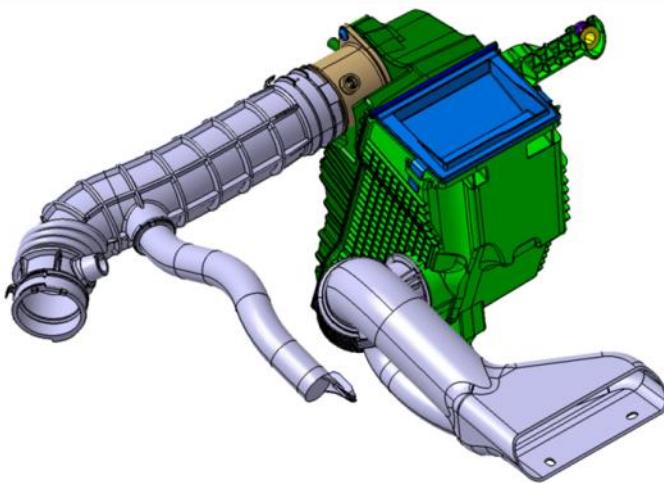


SPL wo Resonator , dB	95.9
SPL with Resonator, dB	99.1
Best SPL, dB	92

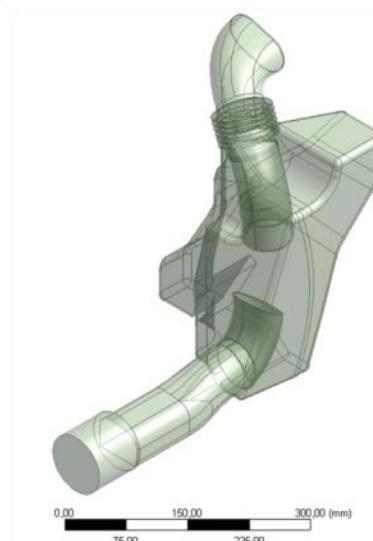
CFD Filter Analysis (Renault)



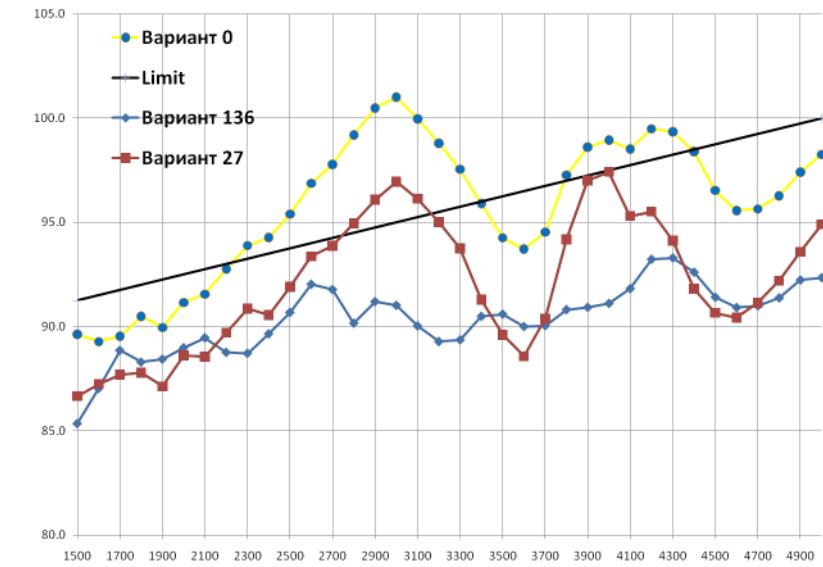
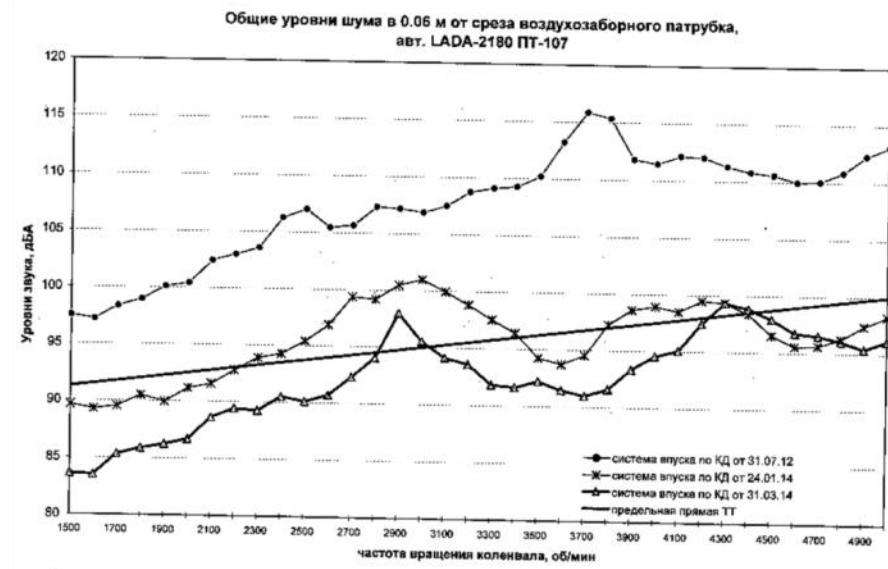
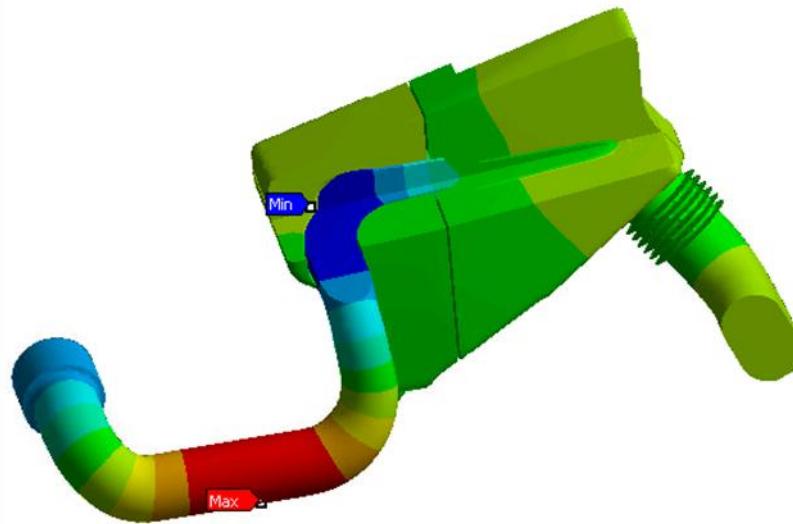
Design, research and optimization of Inlet system and Intake manifold



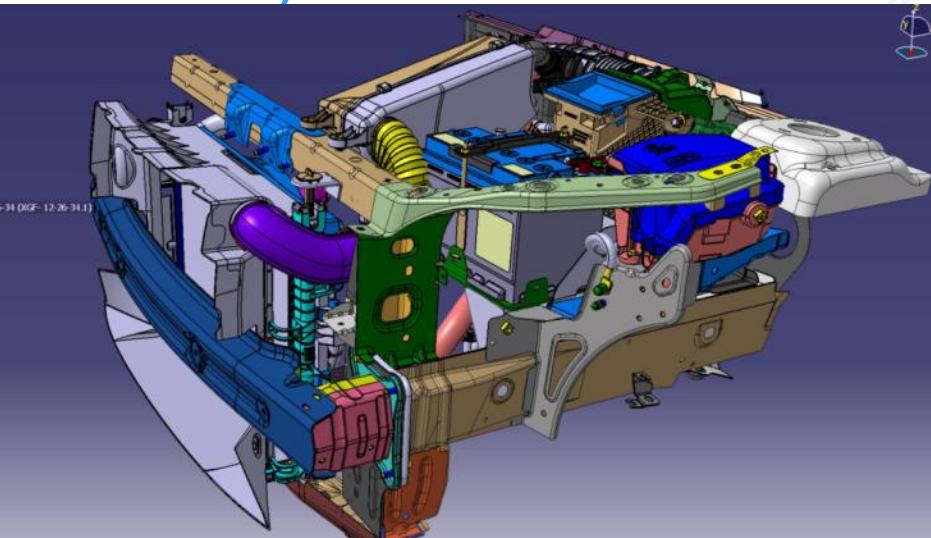
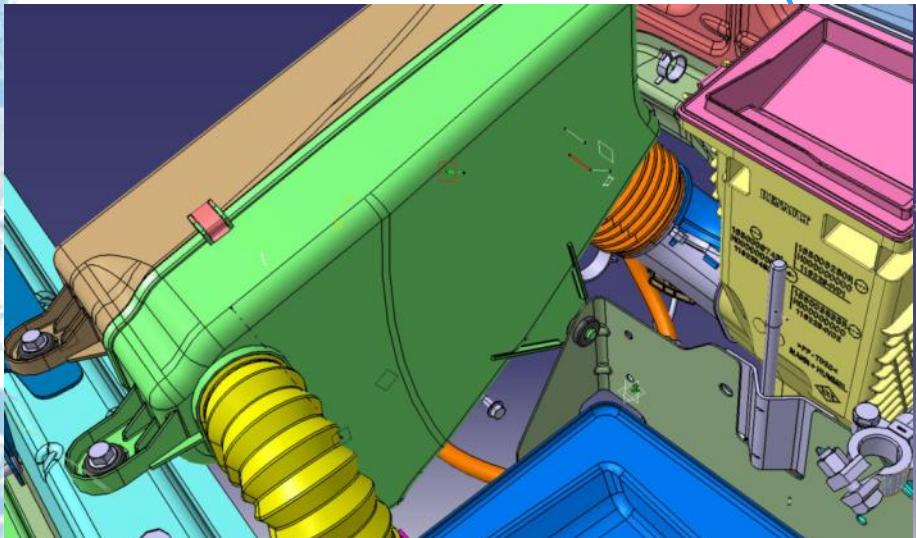
Design, research and optimization of acoustic of Inlet system



Форма 5 Частота 655 Гц

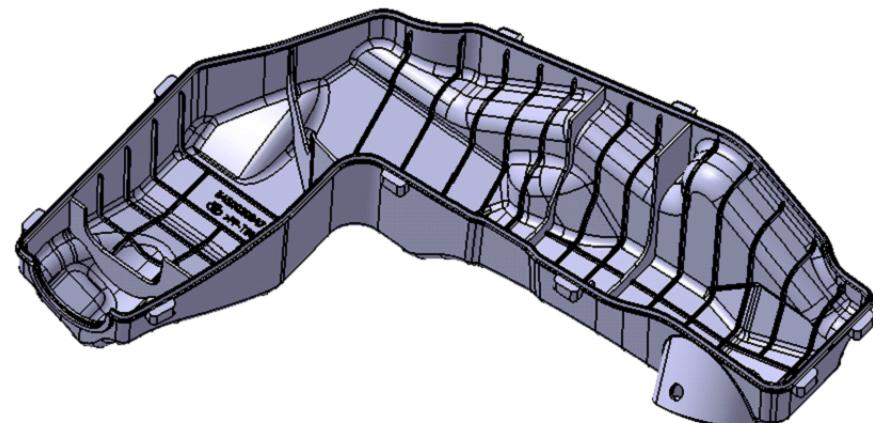
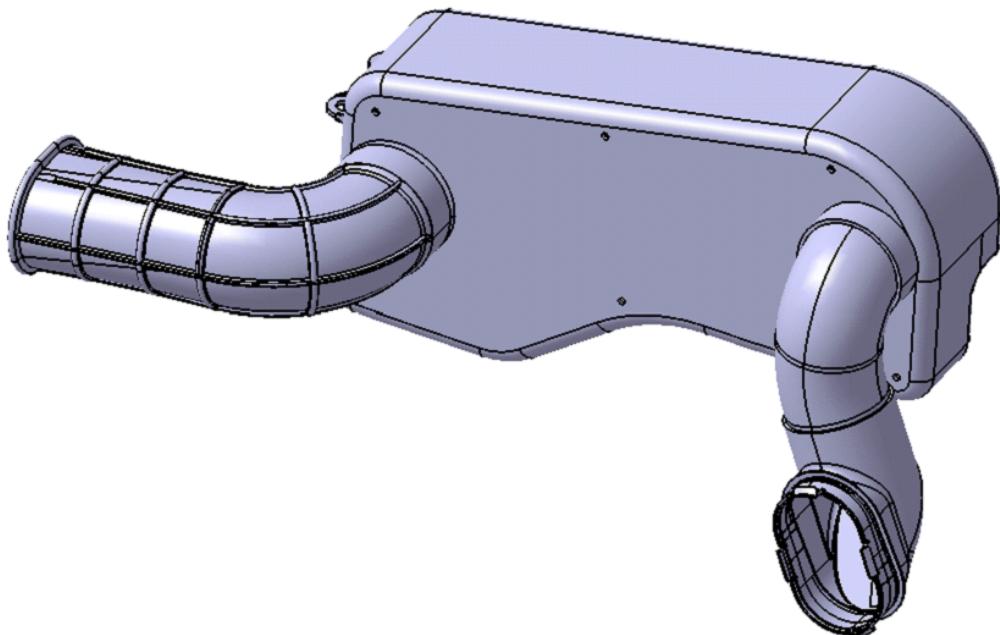
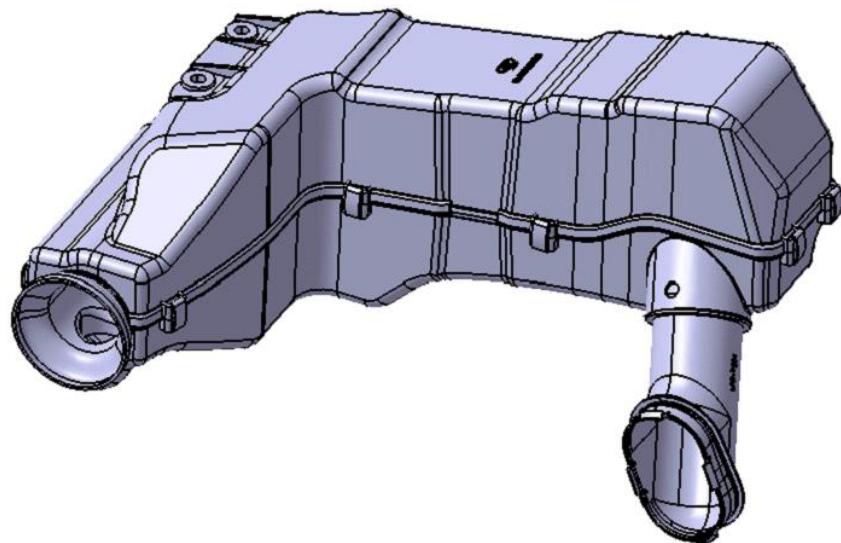
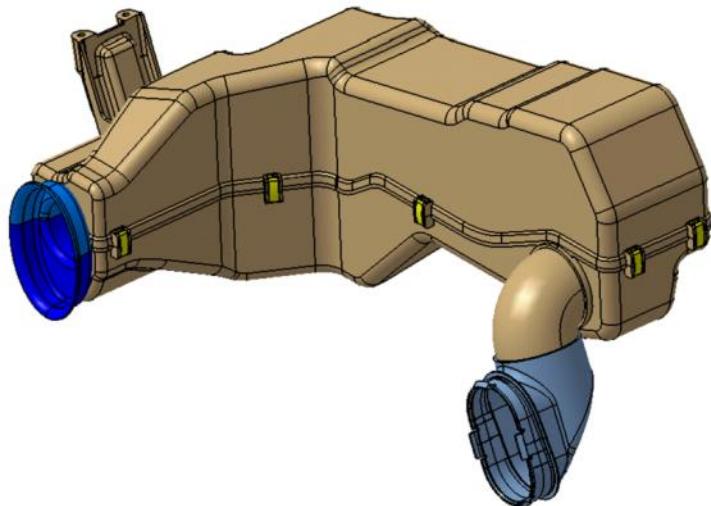


AirInlet System (LADA Vesta)

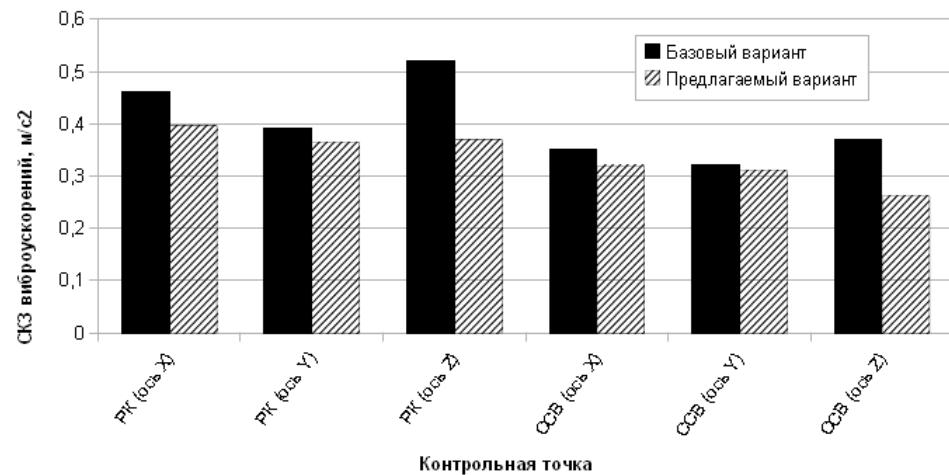
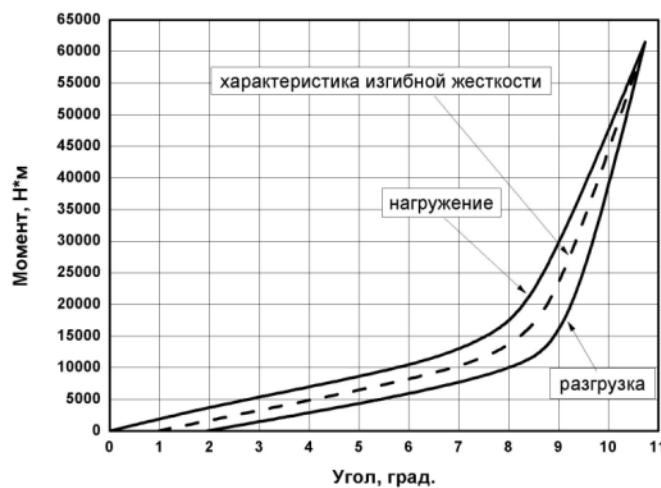
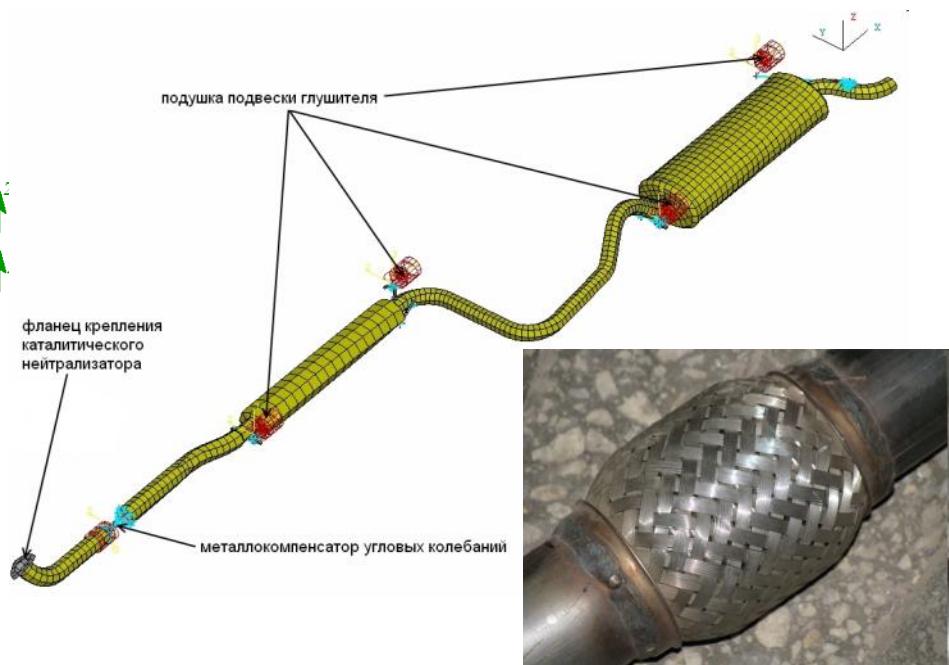
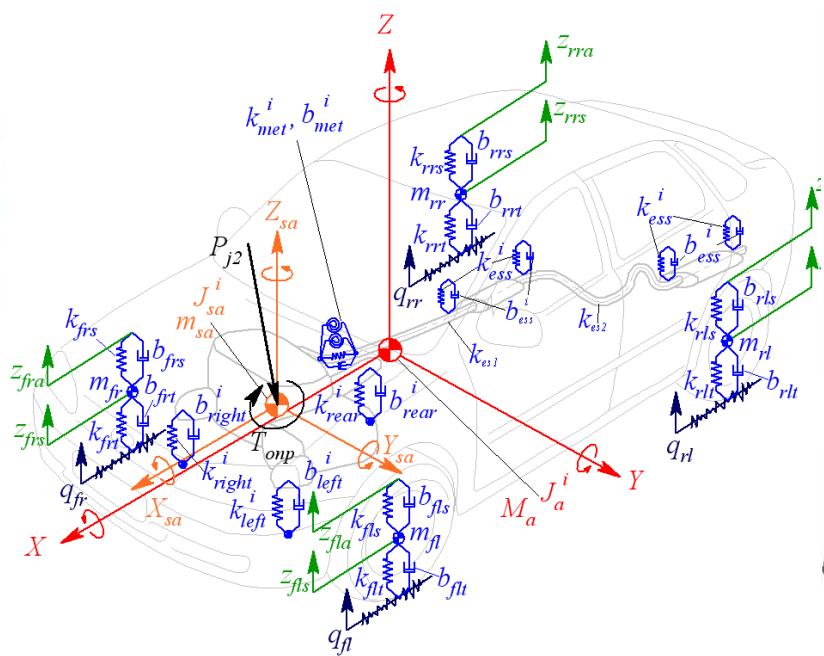


AirInlet System (LADA XRAY, LADA Largus)

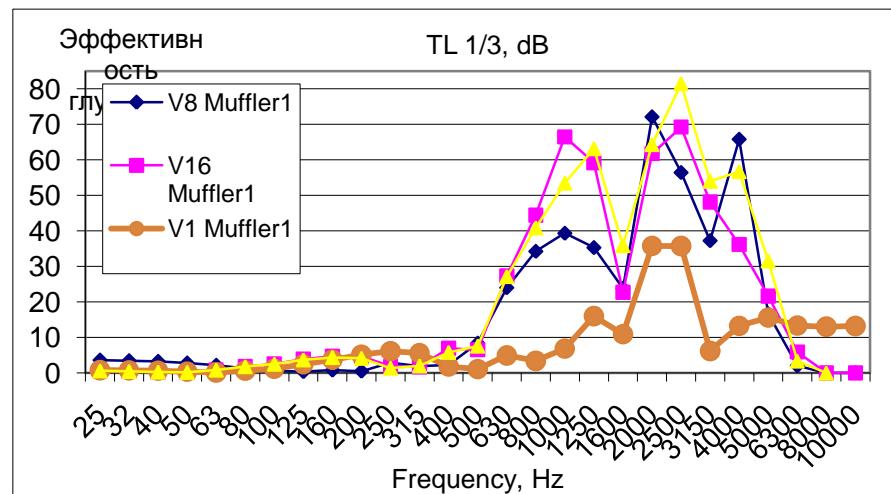
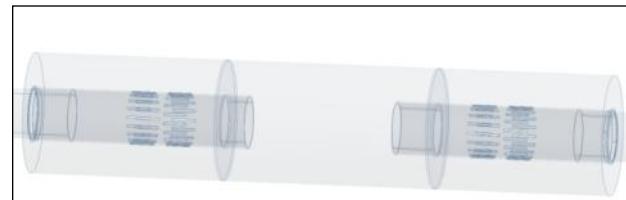
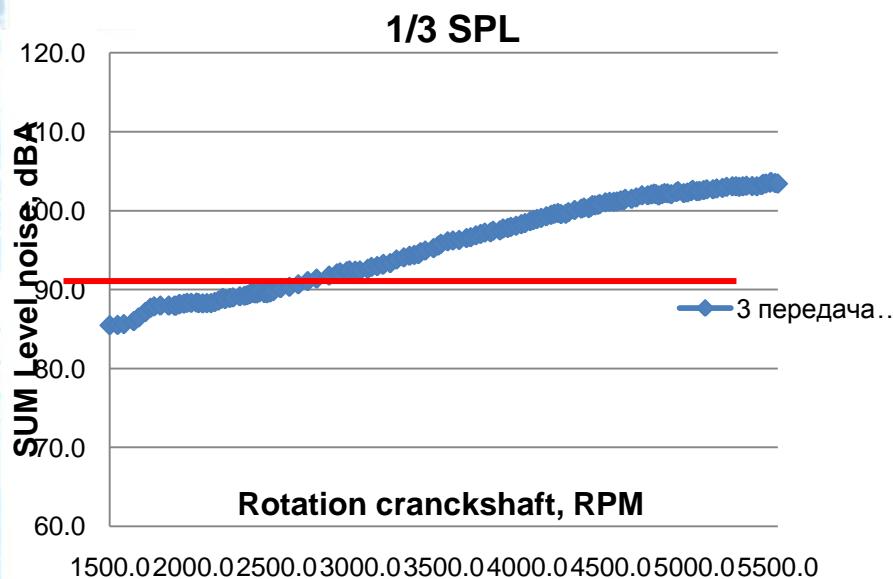
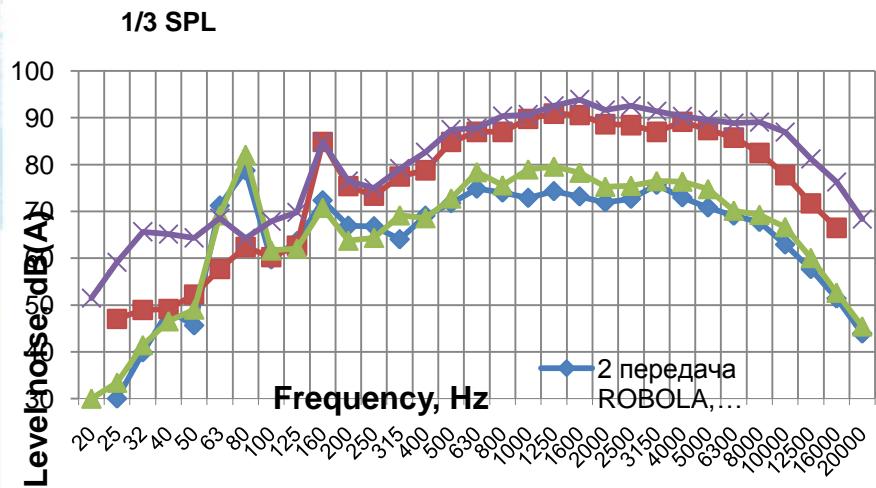
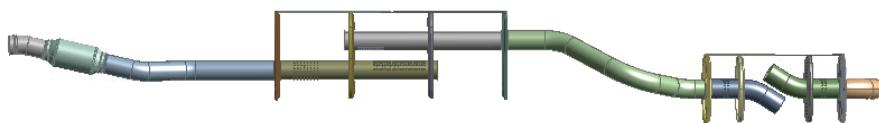
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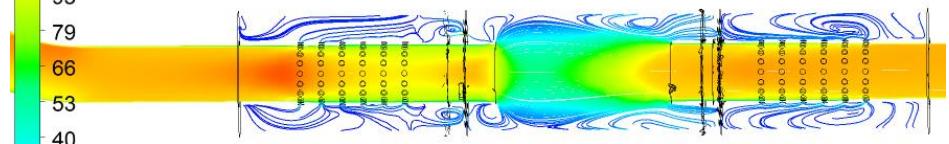
NVH analysis of Exhaust system



Exhaust Design for LADA 4x4. SPL Analysis



CFD analysis of Exhaust System for LADA 4x4

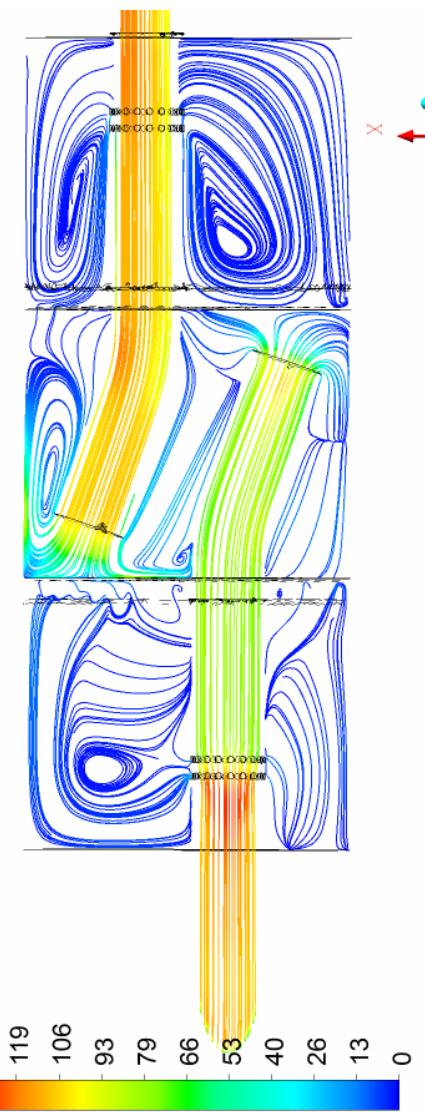
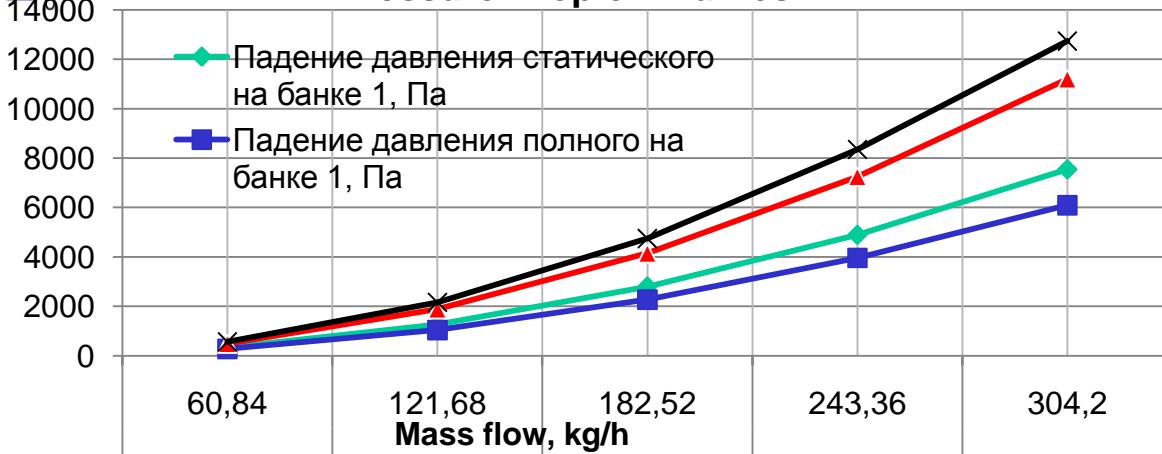


X
Y
Z

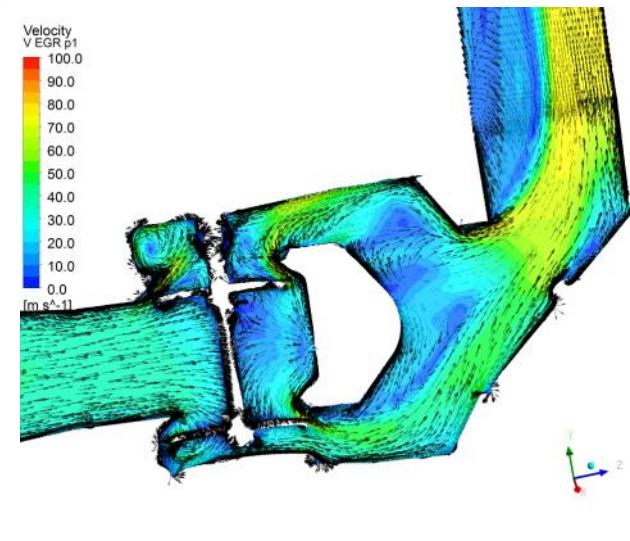
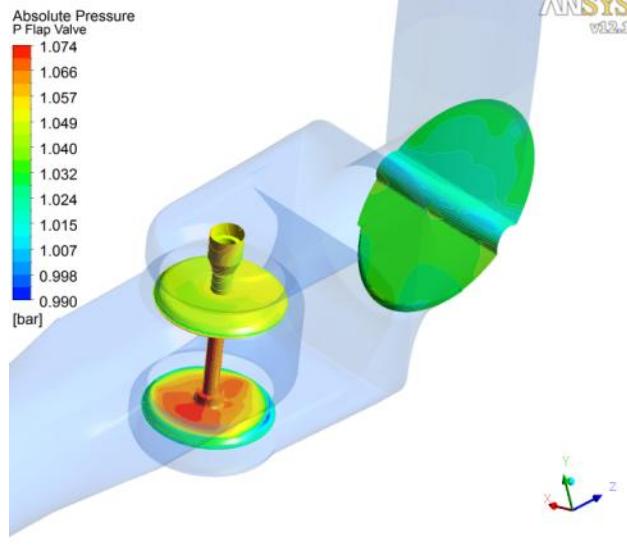
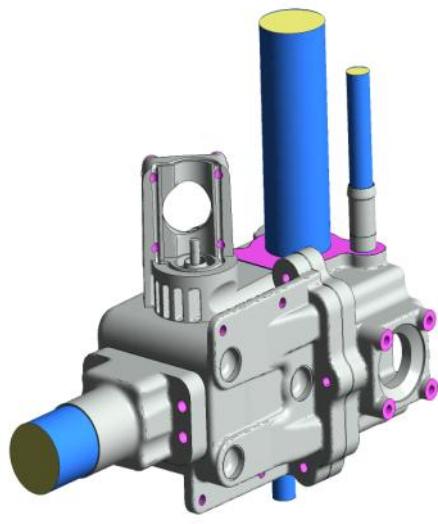
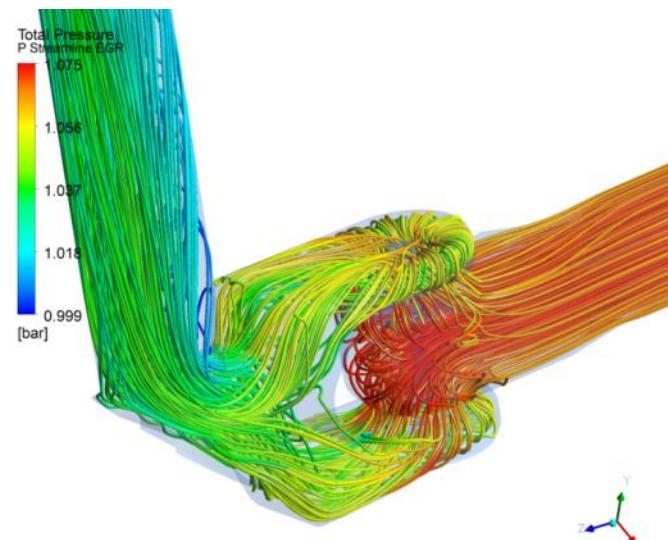
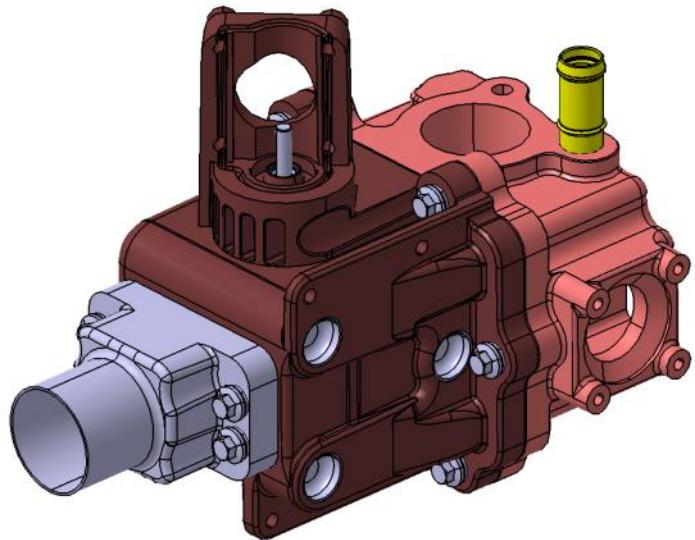
X
Y
Z

Pressure Drop on Muffles

Падение давления, Па

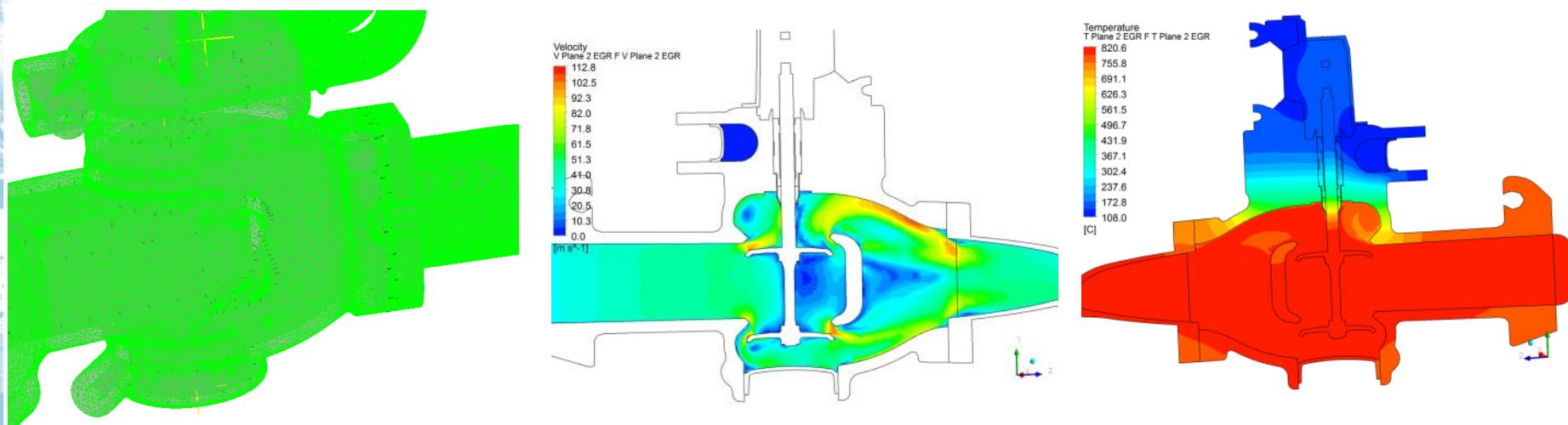
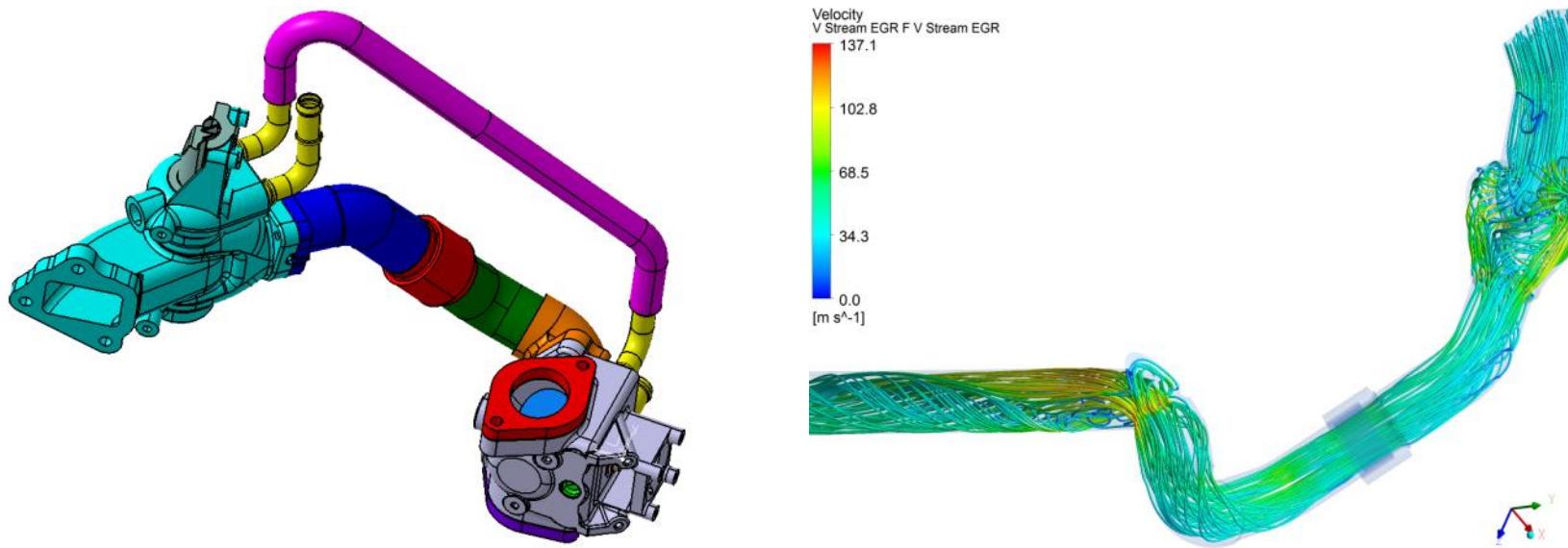


CFD analysis of EGR System (Pierburg – GM)

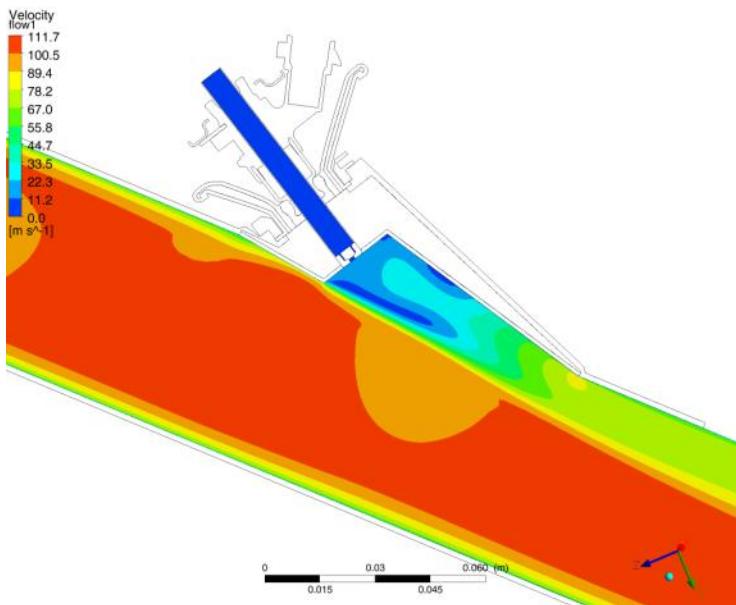
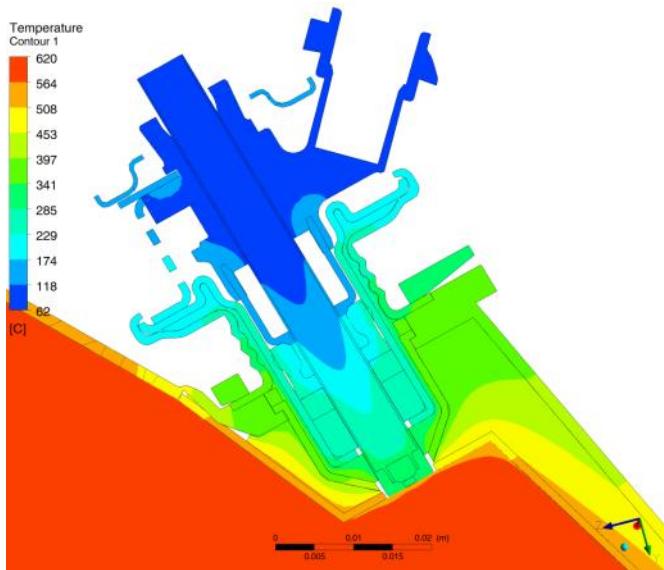
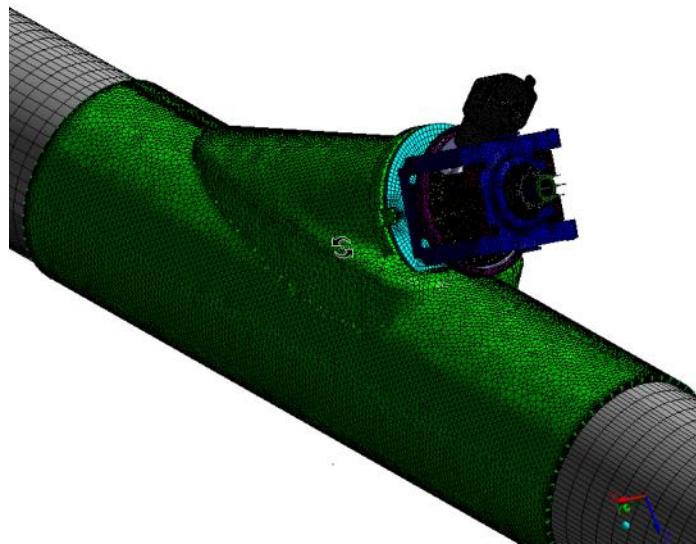
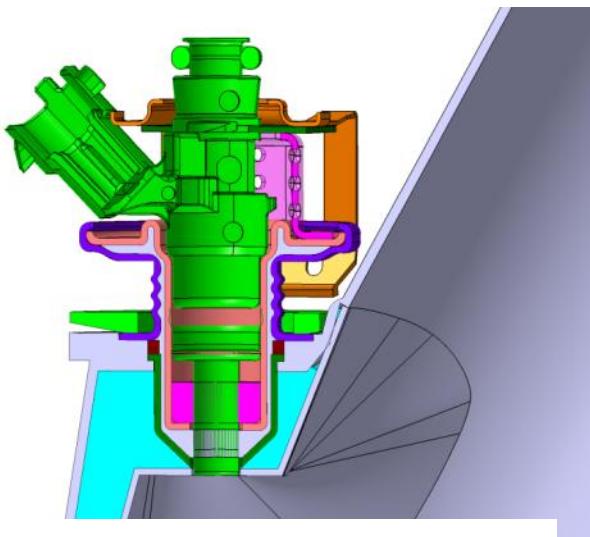


EGR-system

CFD+Thermal Strength Analysis

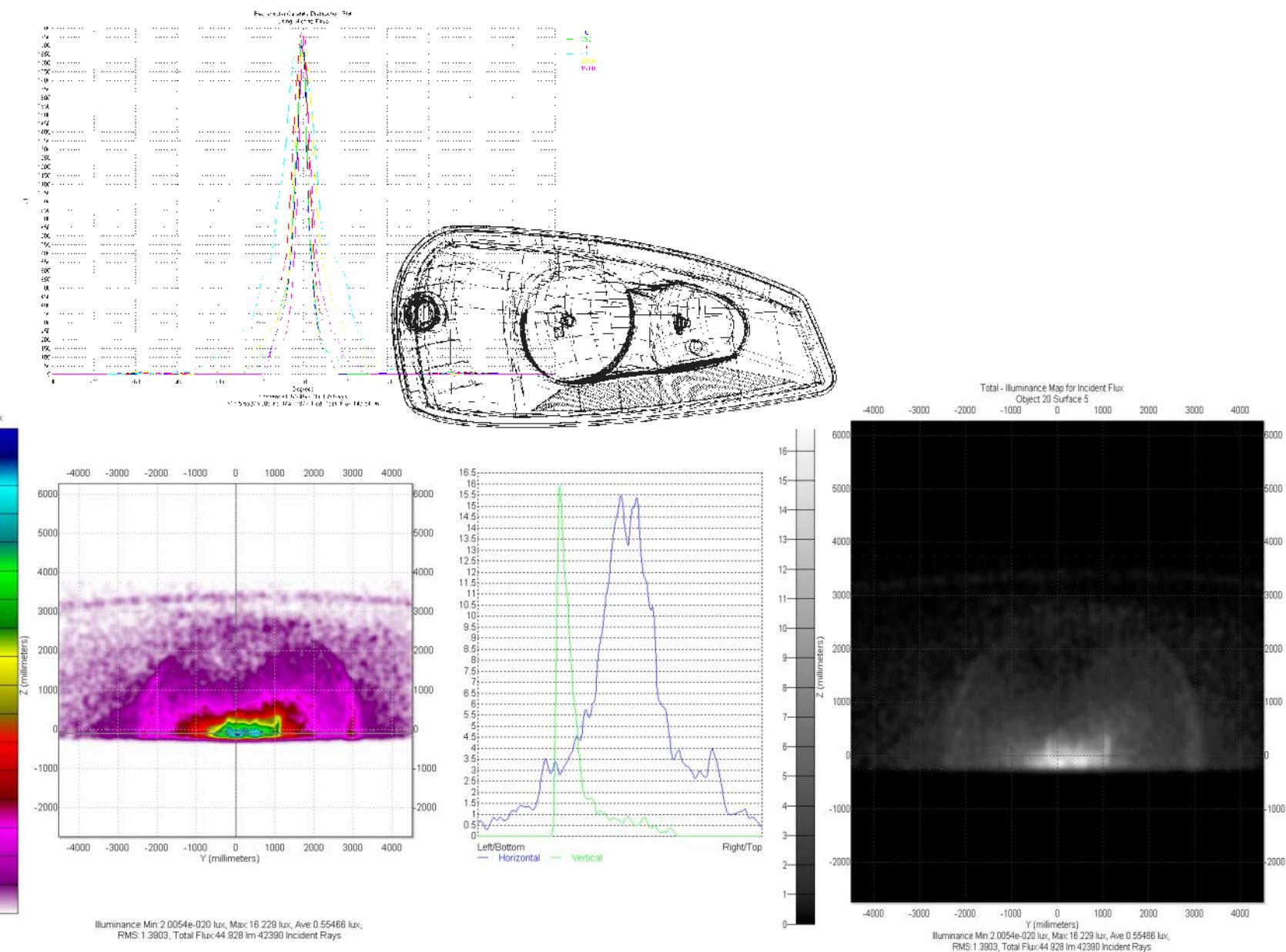


AdBlue Injector Thermal and CFD Analysis



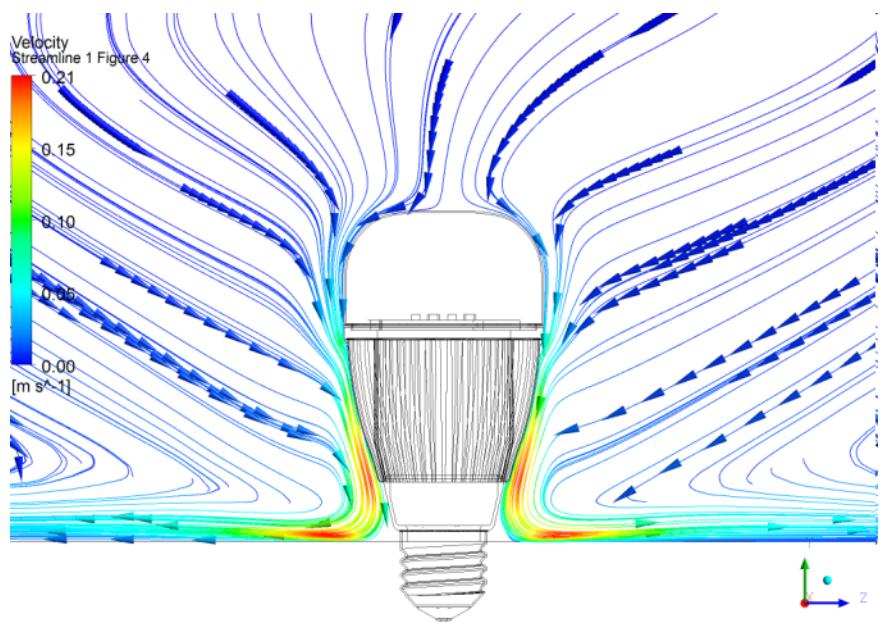
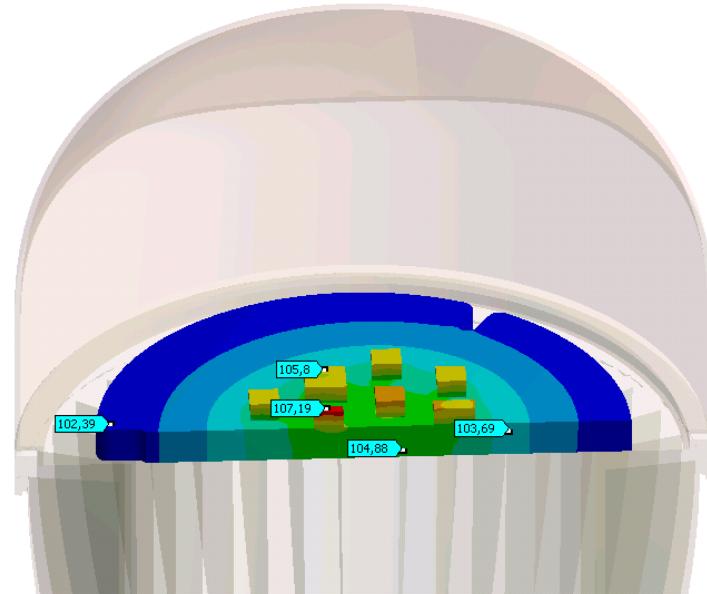
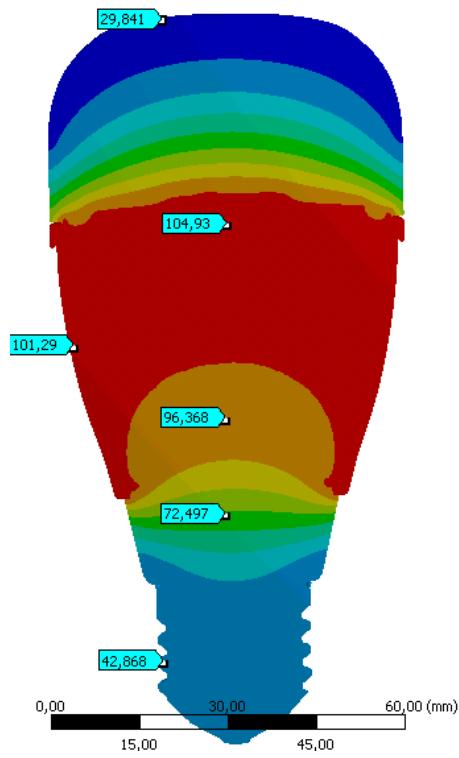
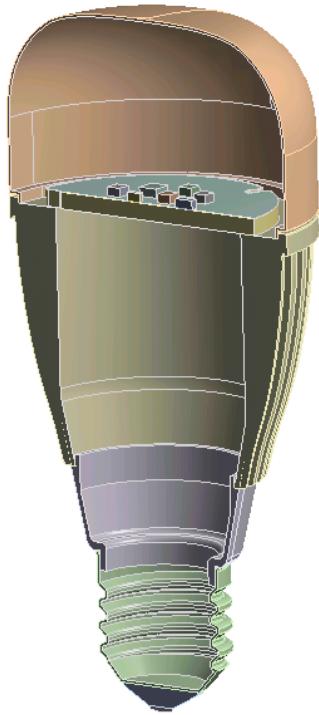
Illumination Analysis

FROM NUMBER TO KNOWLEDGE

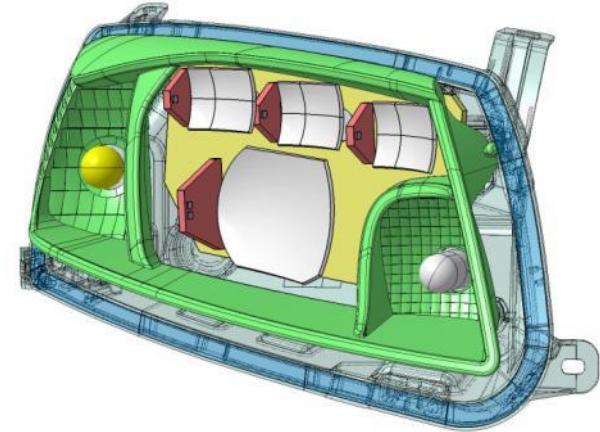
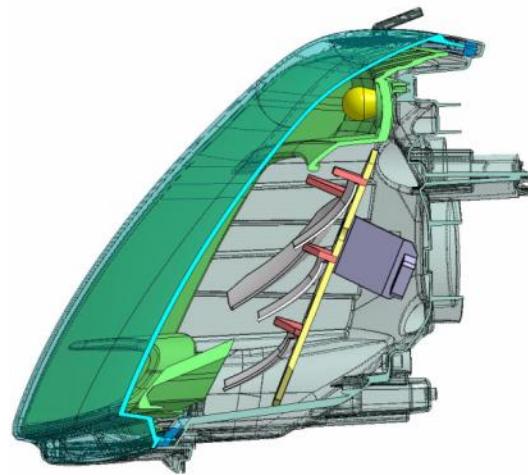
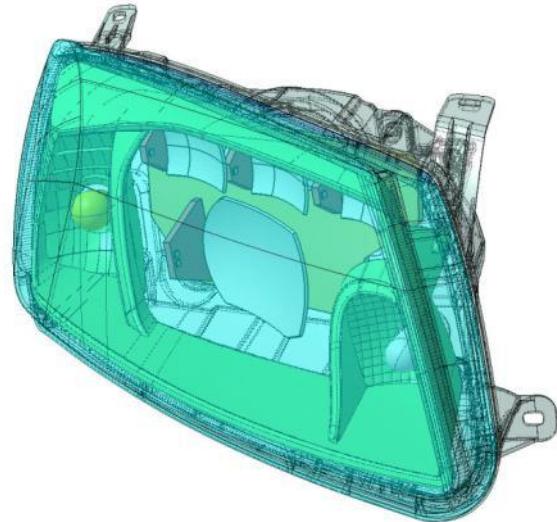


LED Lamp Design

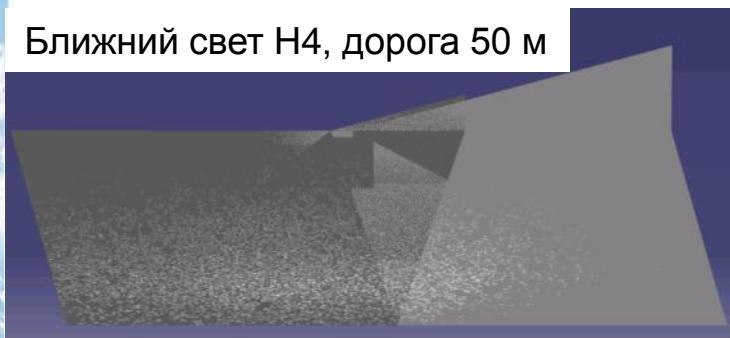
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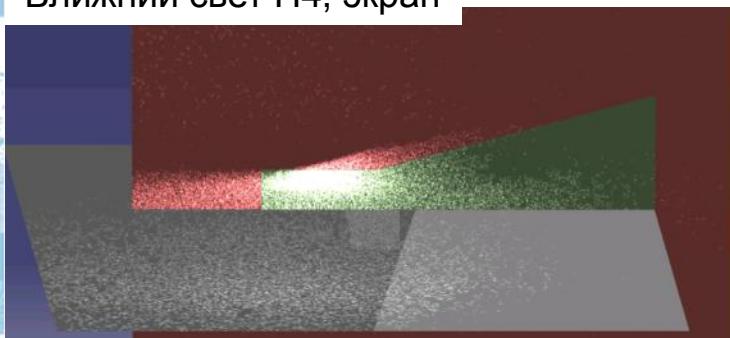
LED Lamp for Vehicle Design



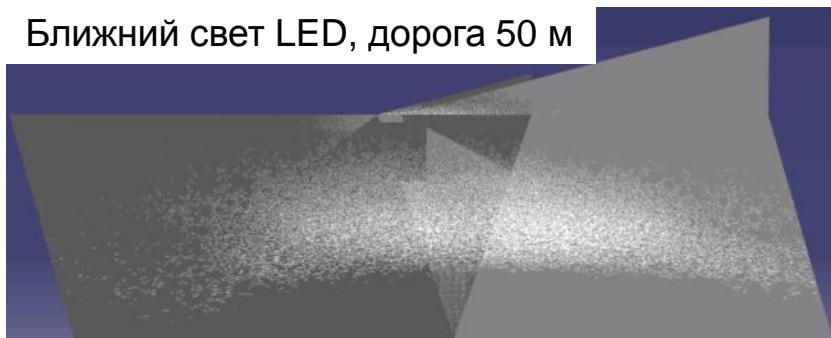
Ближний свет Н4, дорога 50 м



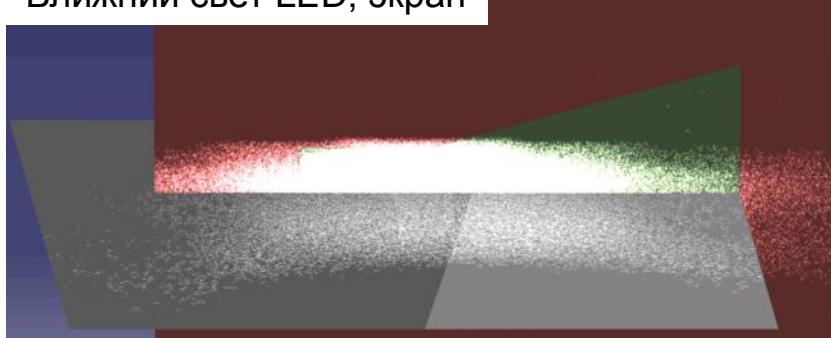
Ближний свет Н4, экран



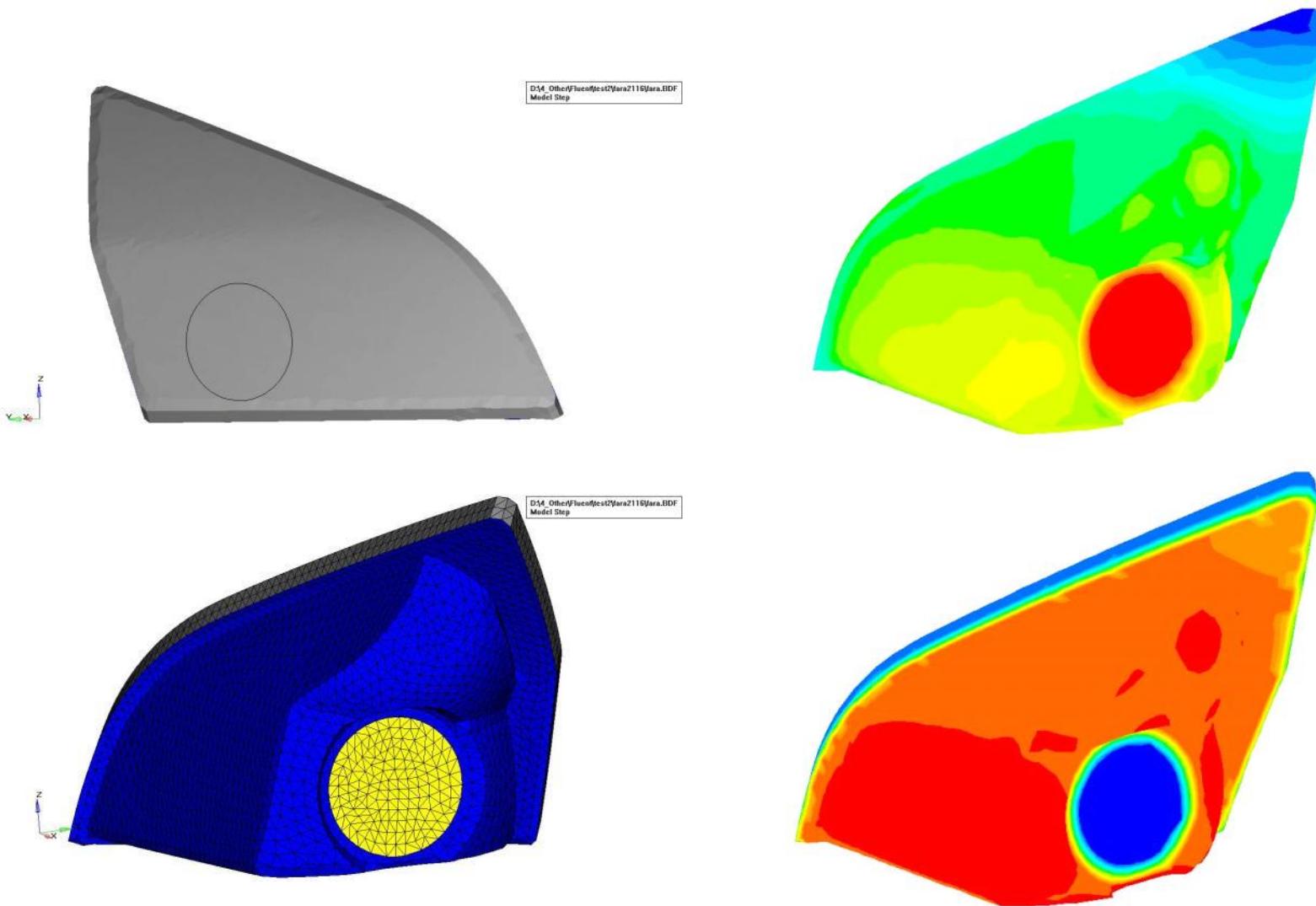
Ближний свет LED, дорога 50 м



Ближний свет LED, экран

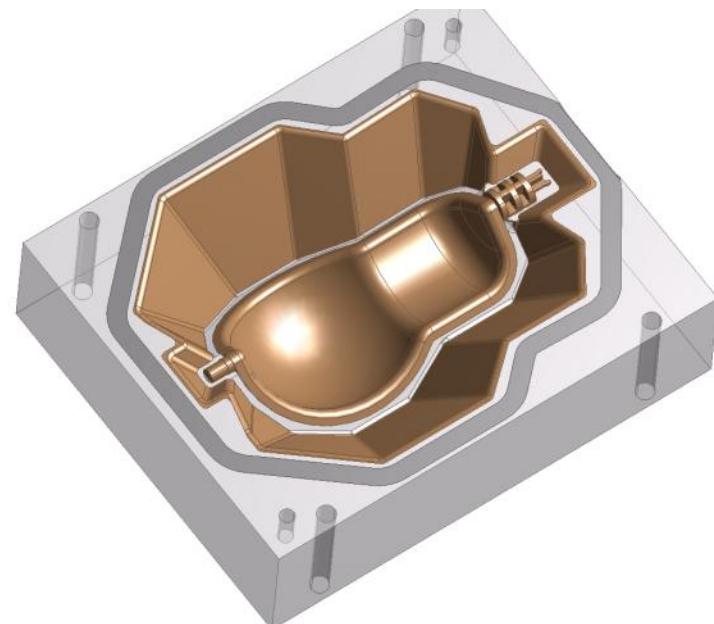
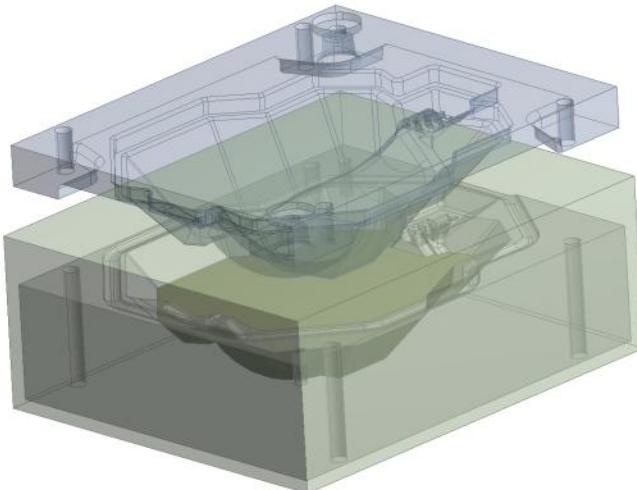
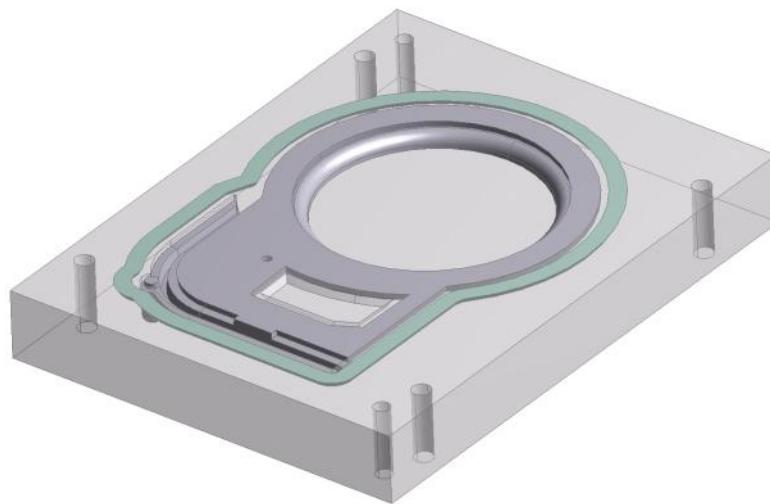
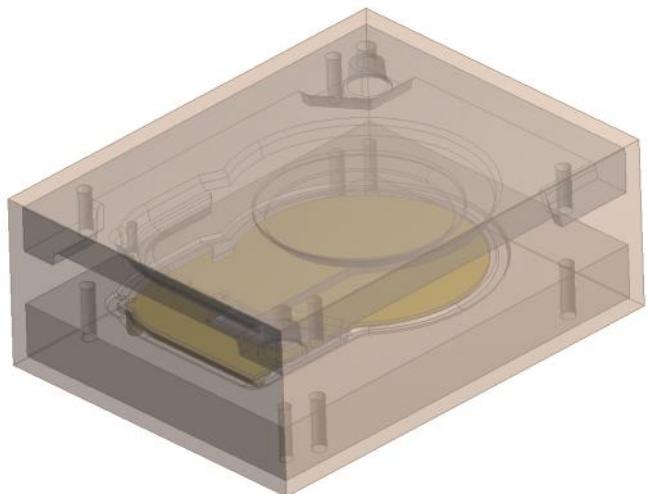


Thermal Lamp Analysis



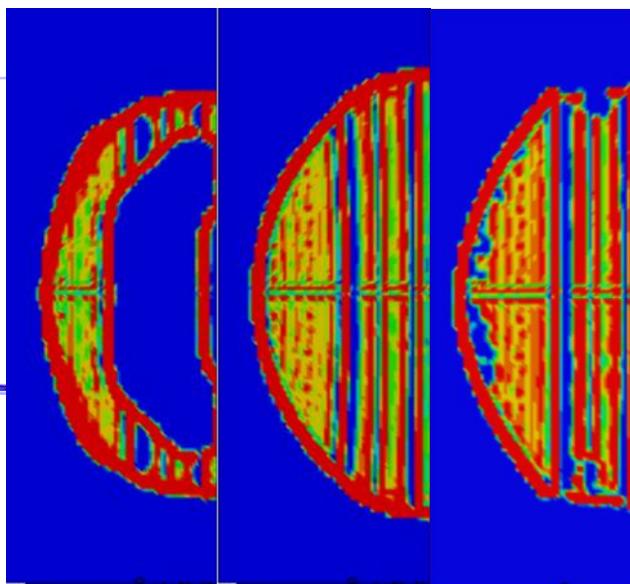
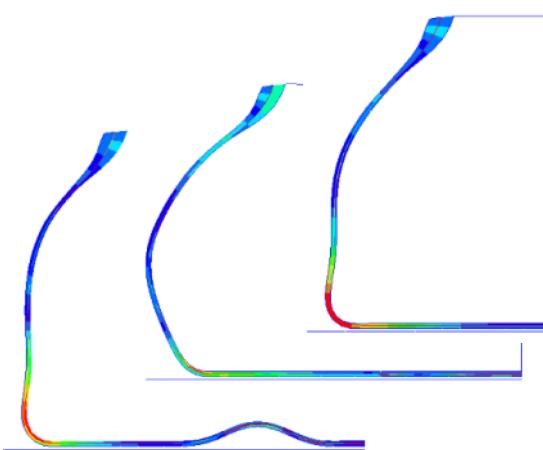
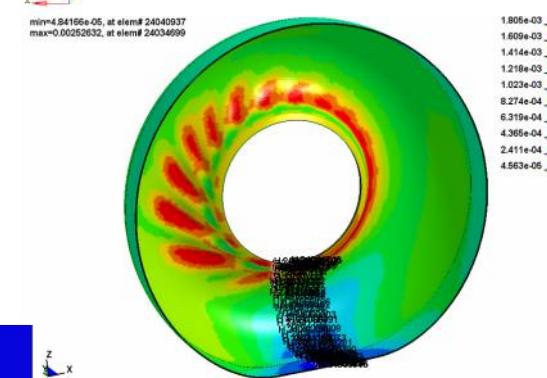
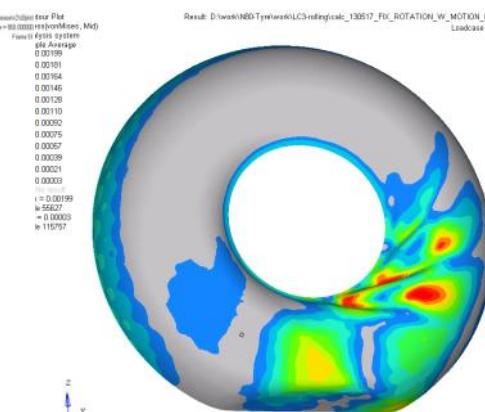
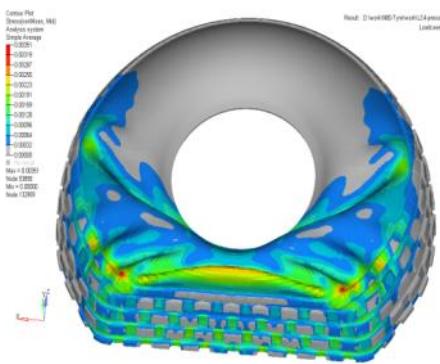
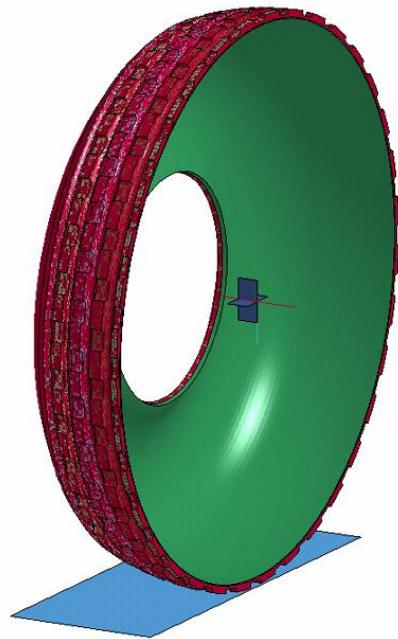
Mold Tool Design for RIM

FROM NUMBER TO KNOWLEDGE



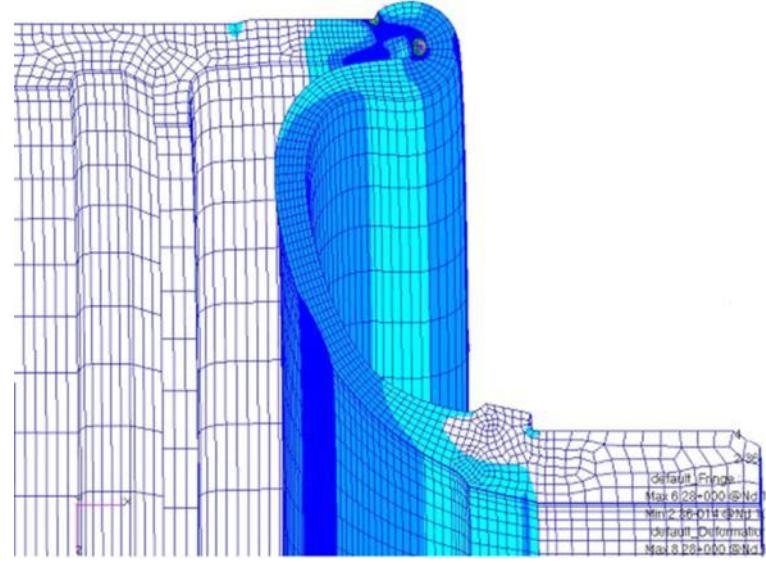
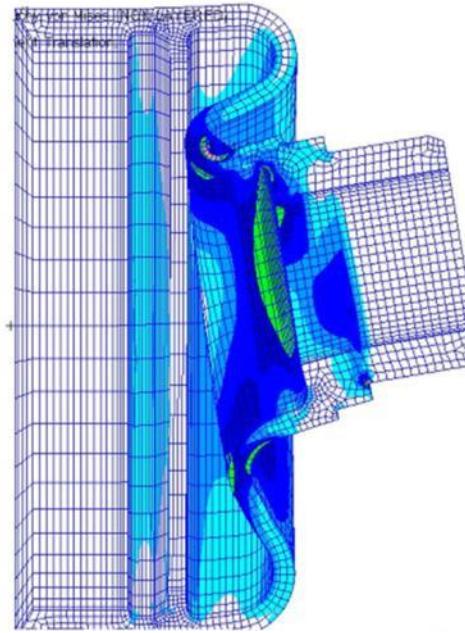
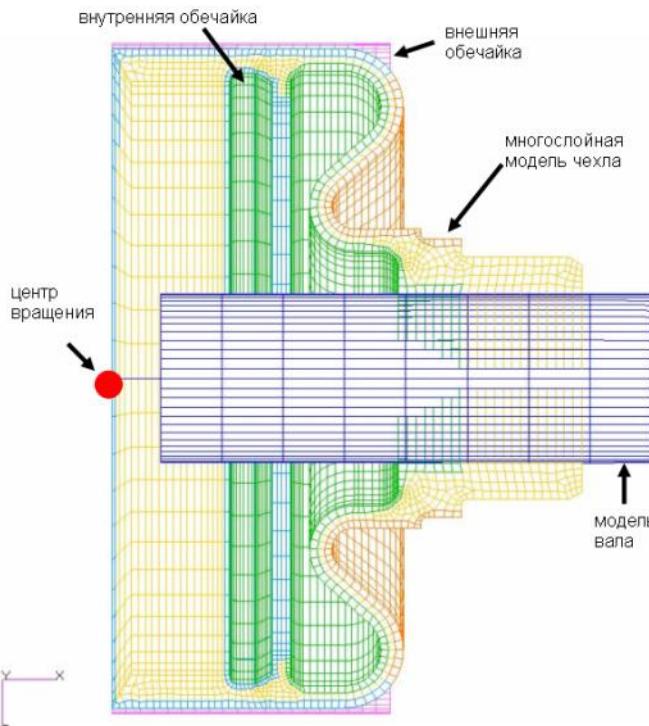
Low Pressure Tyre Design

FROM NUMBER TO KNOWLEDGE

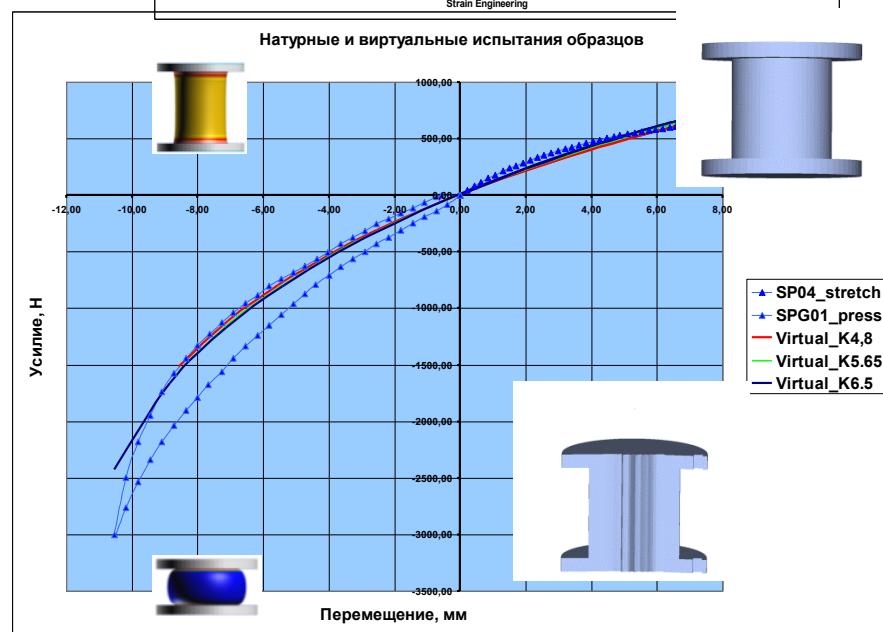
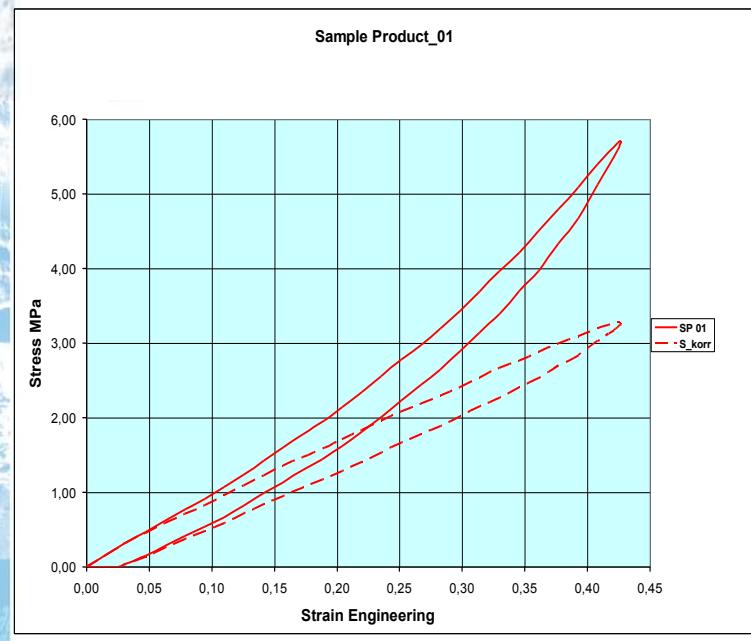
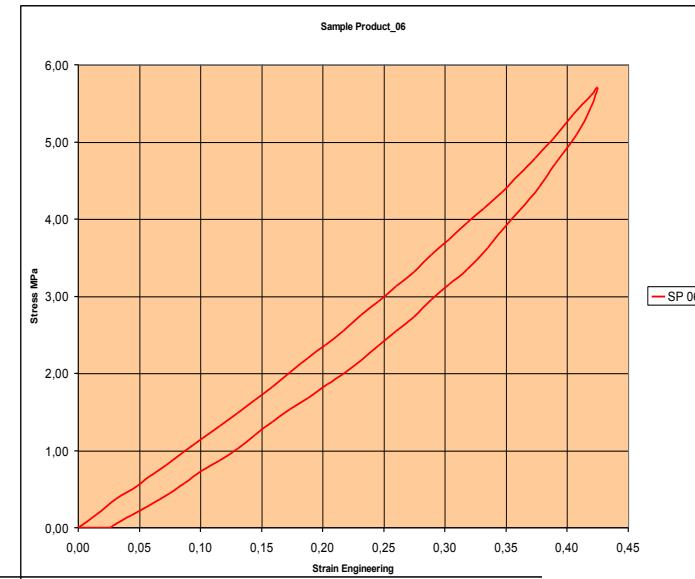
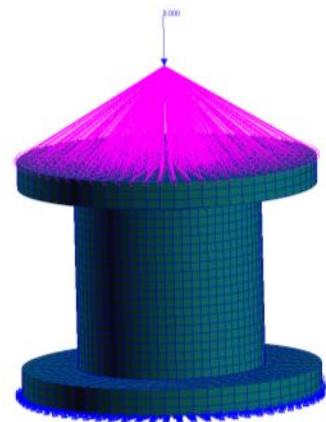


Rubber Cover Design

FROM NUMBER TO KNOWLEDGE

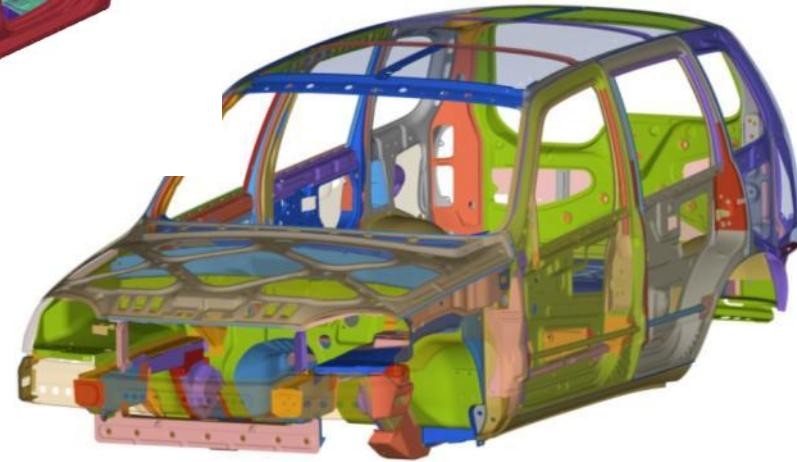
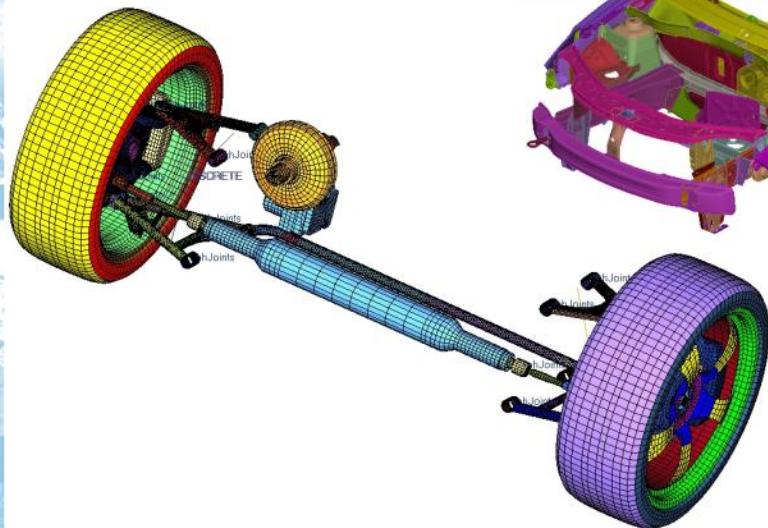
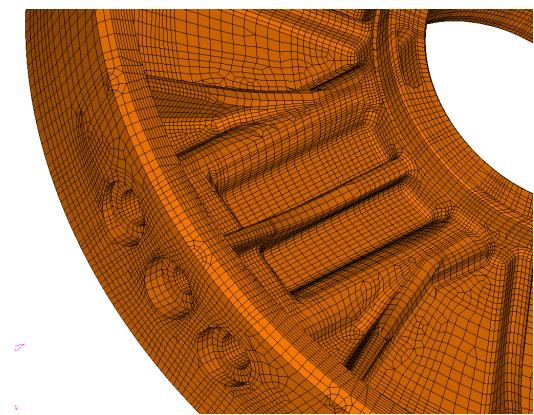
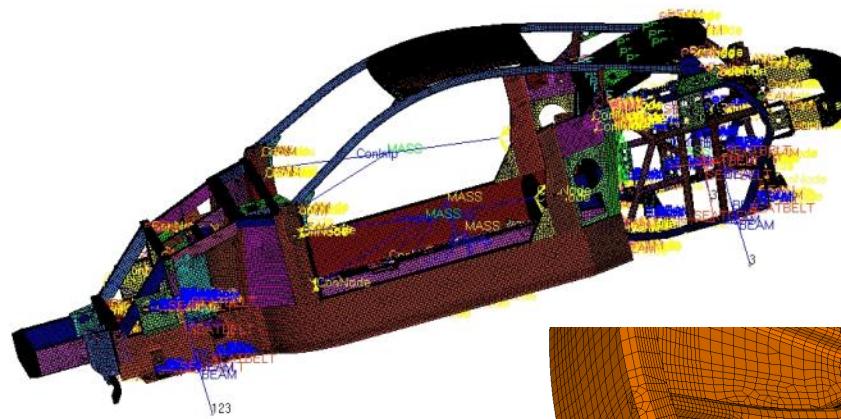
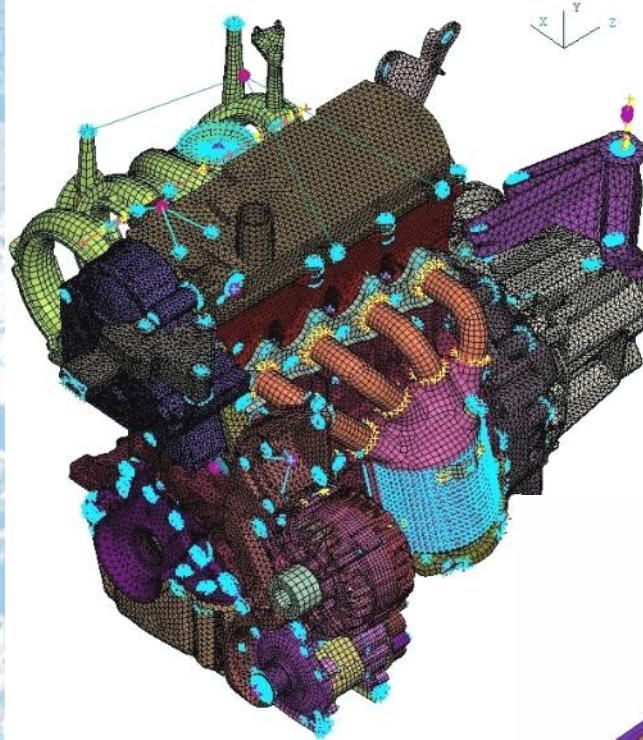


Tests and Validation of Rubber

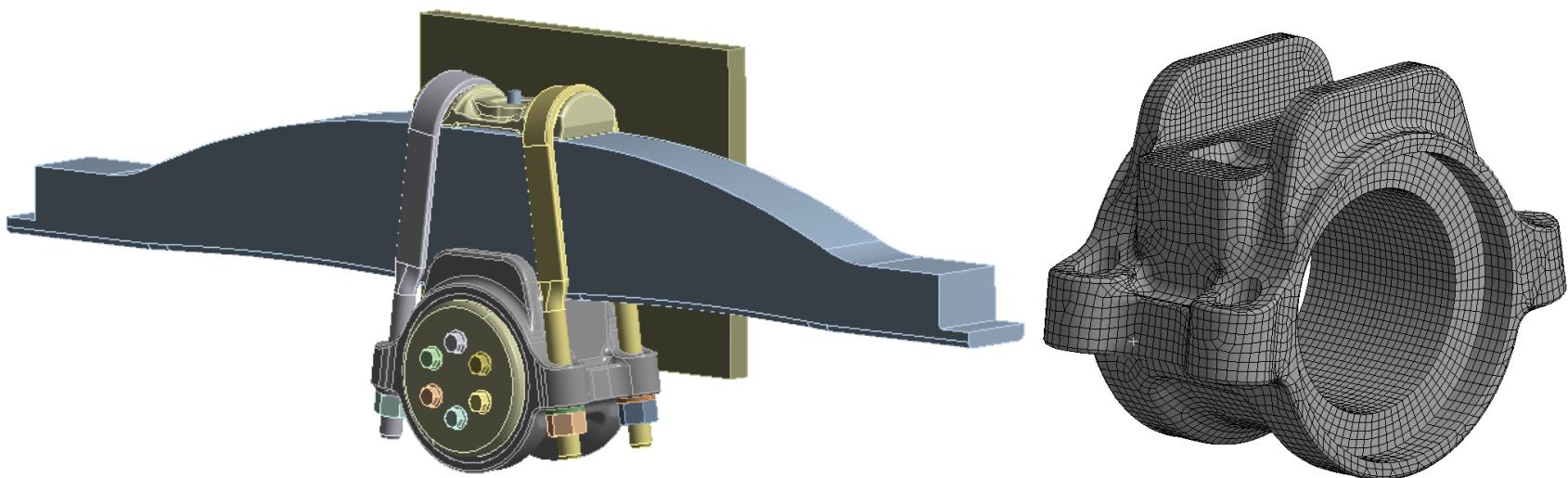


FEM Examples

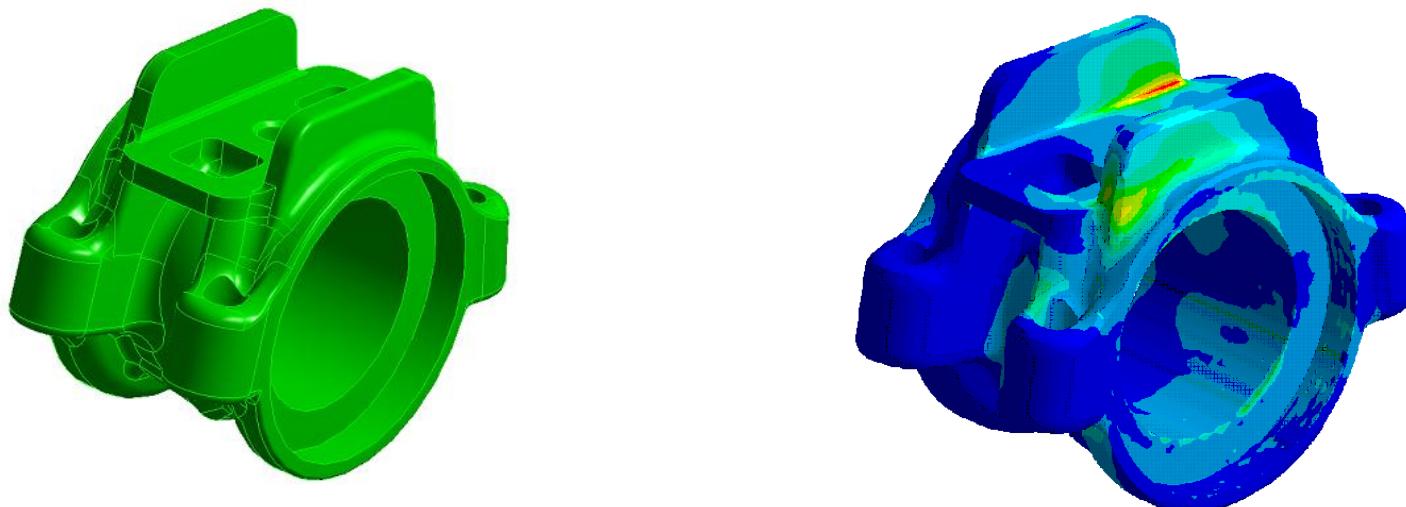
FROM NUMBER TO KNOWLEDGE



Seat Spring Optimization



Original version of geometry



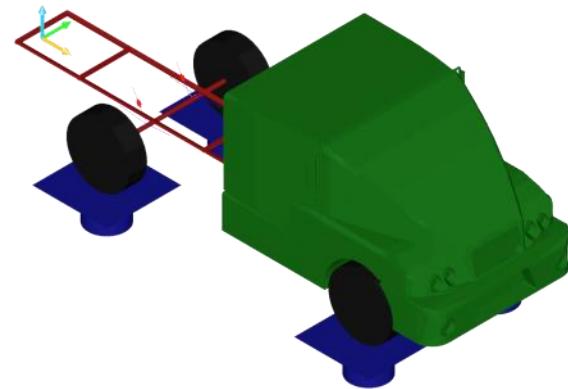
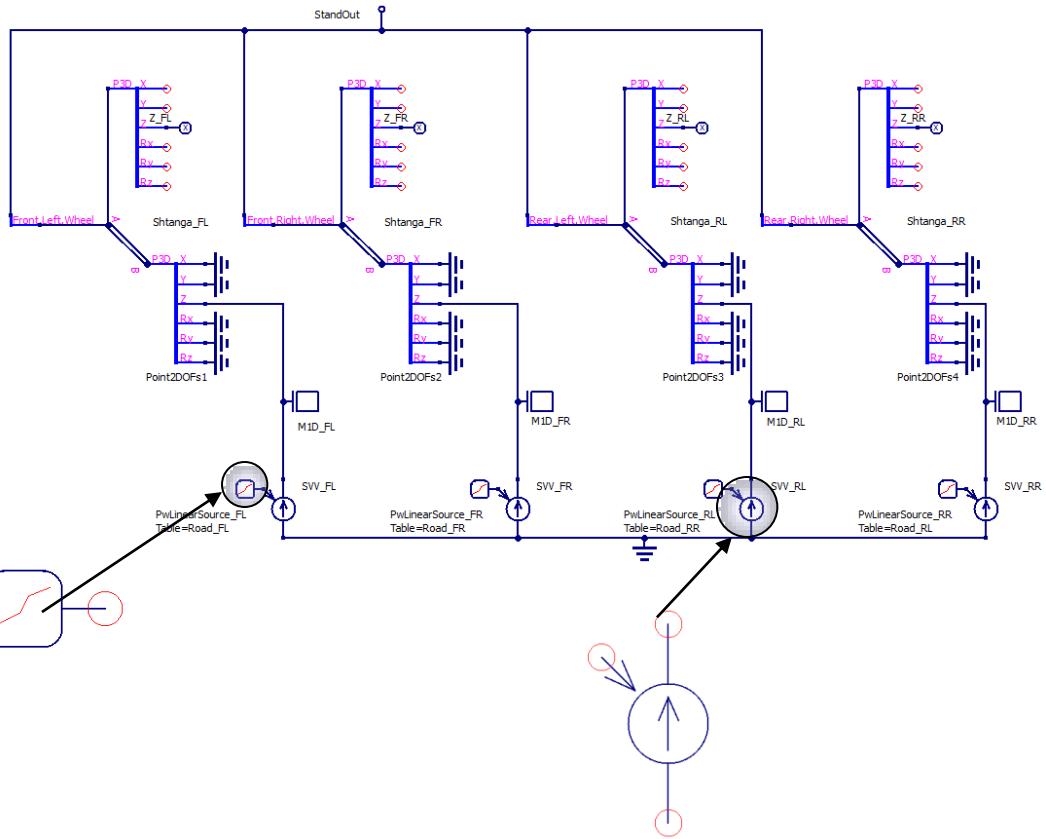
Optimized version of geometry

The seat mass was decreased on 23%

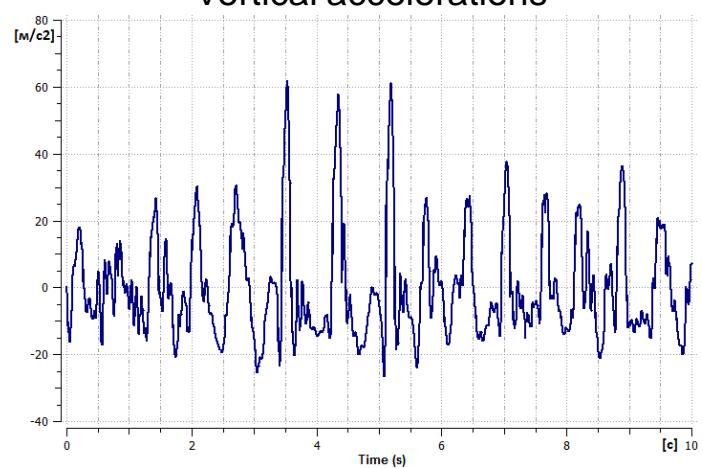
Smoothness analysis of Suspension

Virtual stand for different road profile

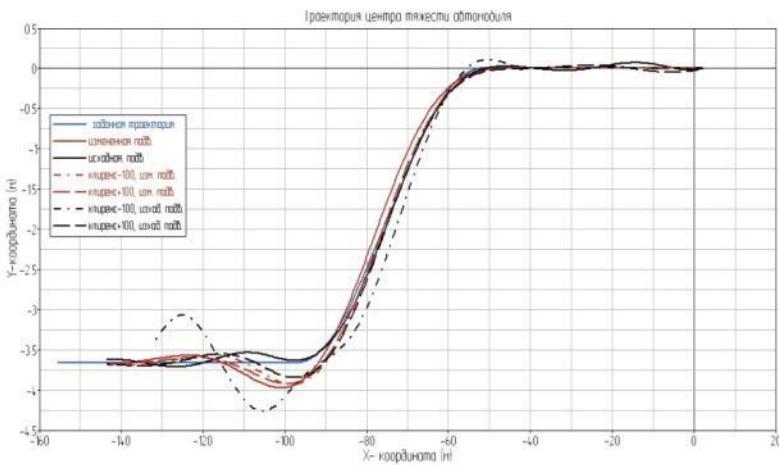
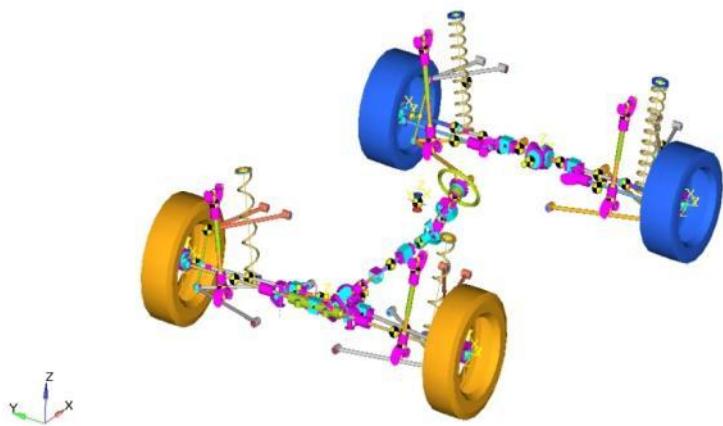
Scheme of Stand



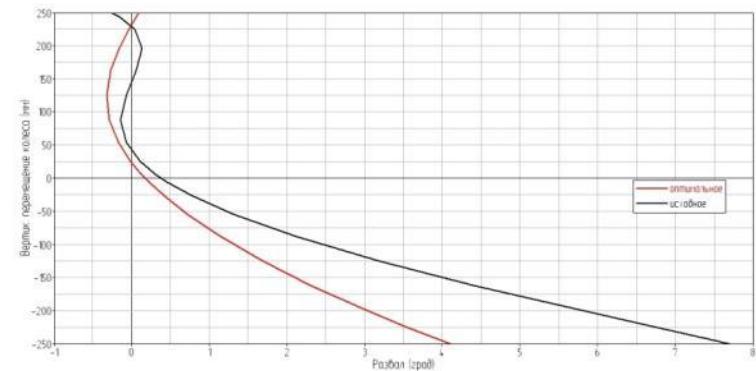
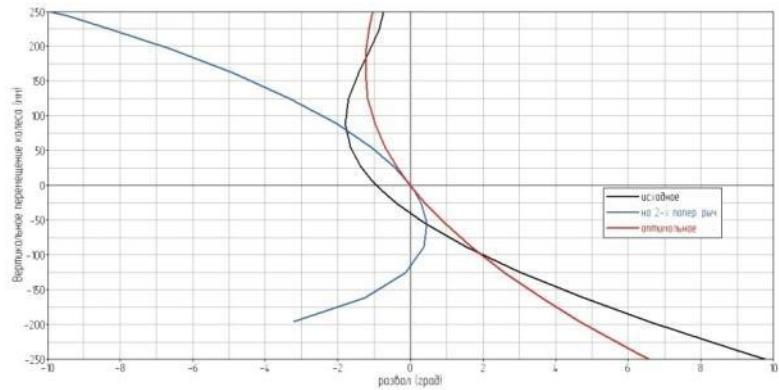
Vertical accelerations



Analysis and Optimization for Buggy Suspension

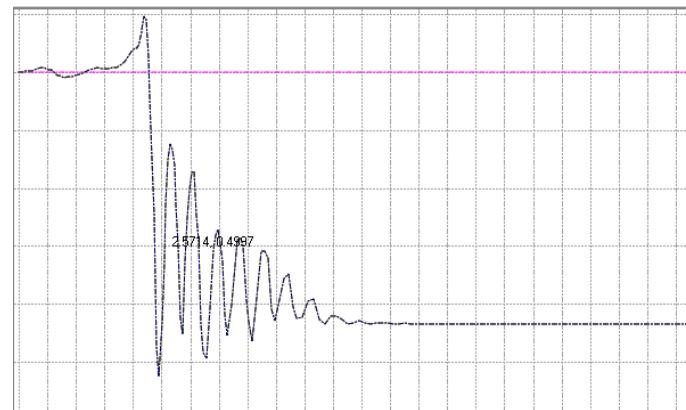
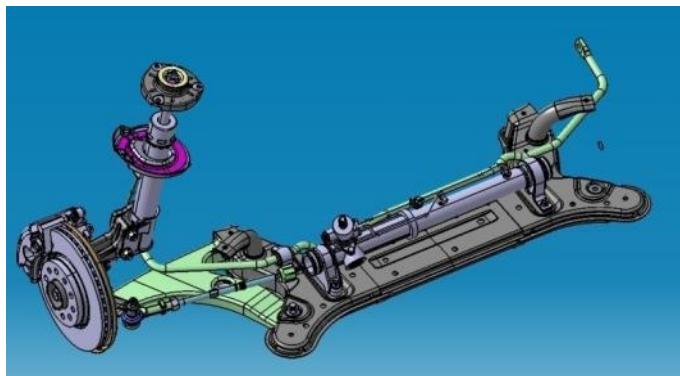


Change Line Maneuvre



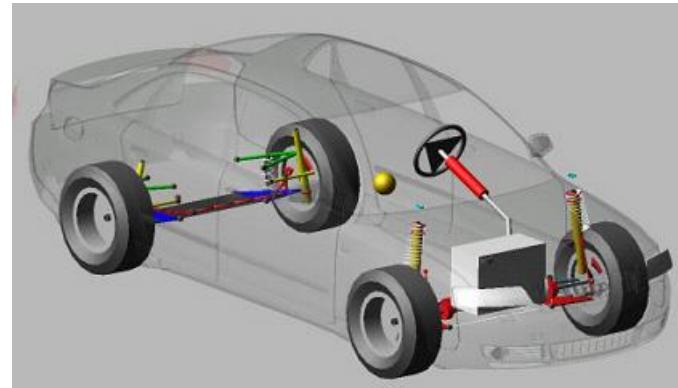
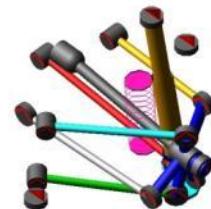
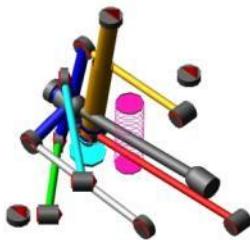
Angles changing

Analysis and optimization of Loads on Body

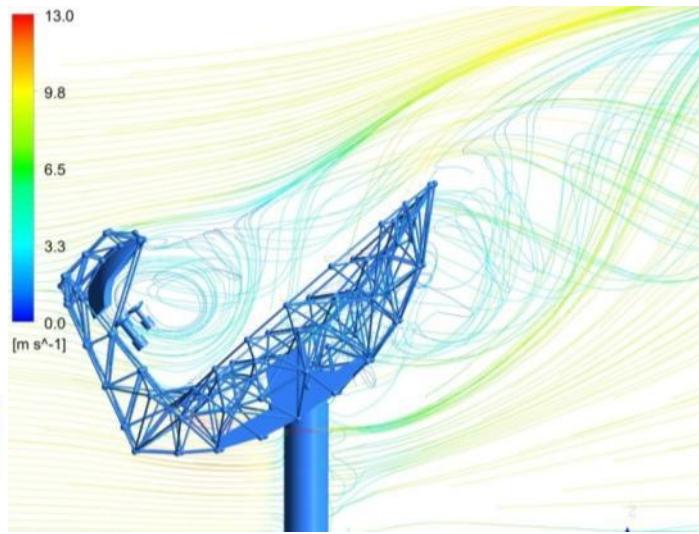
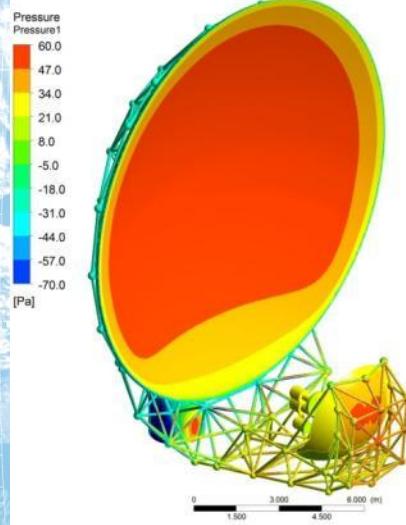
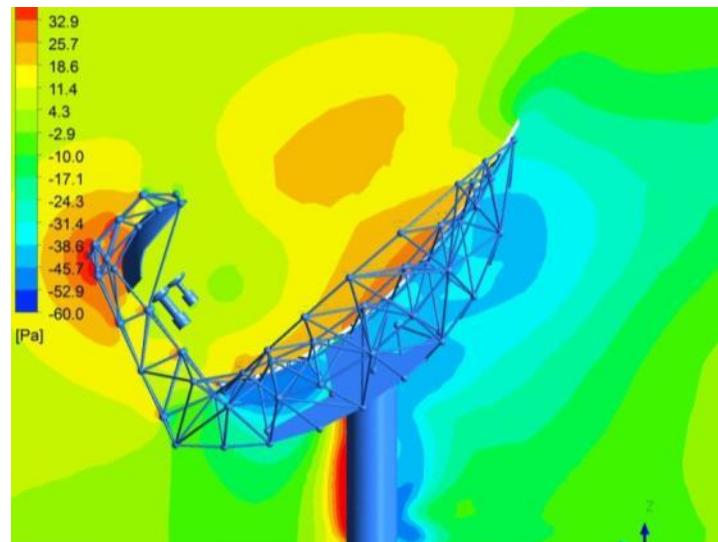
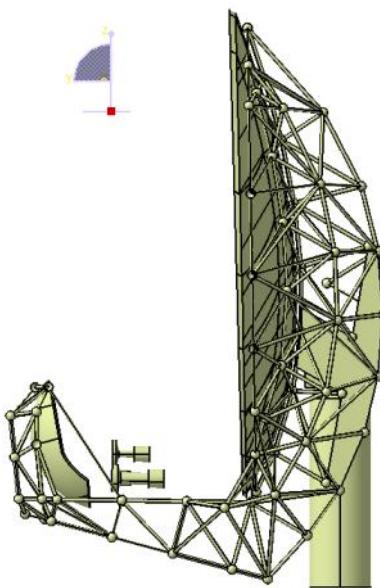


13 load cases

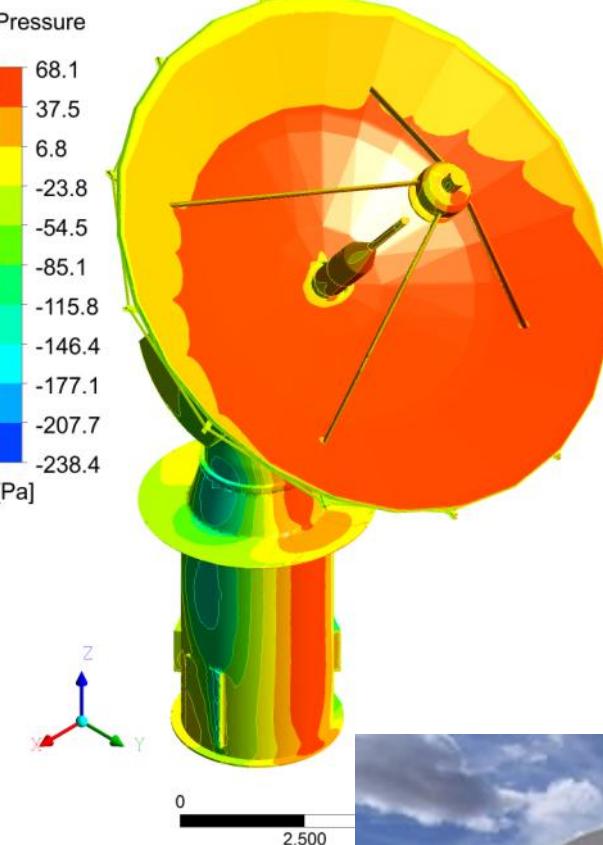
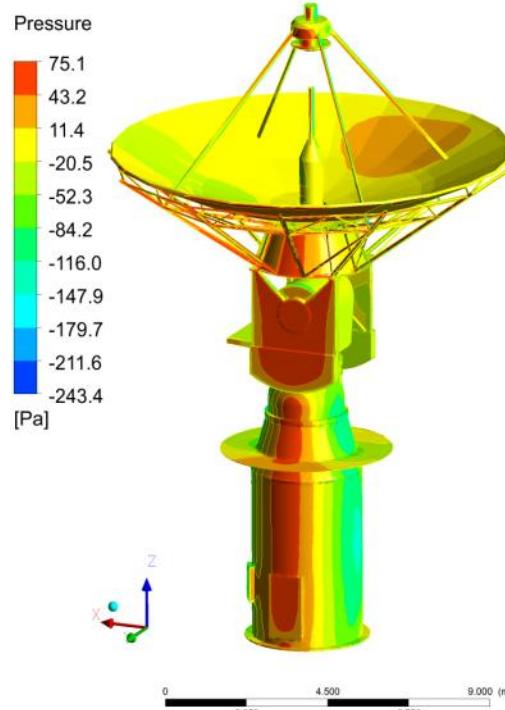
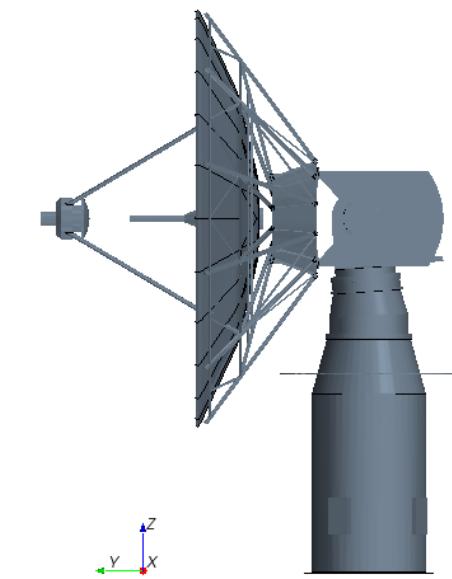
Define mount points position -> loads decreasing for 50%



Radio Telescope CFD analysis. MeerKAT

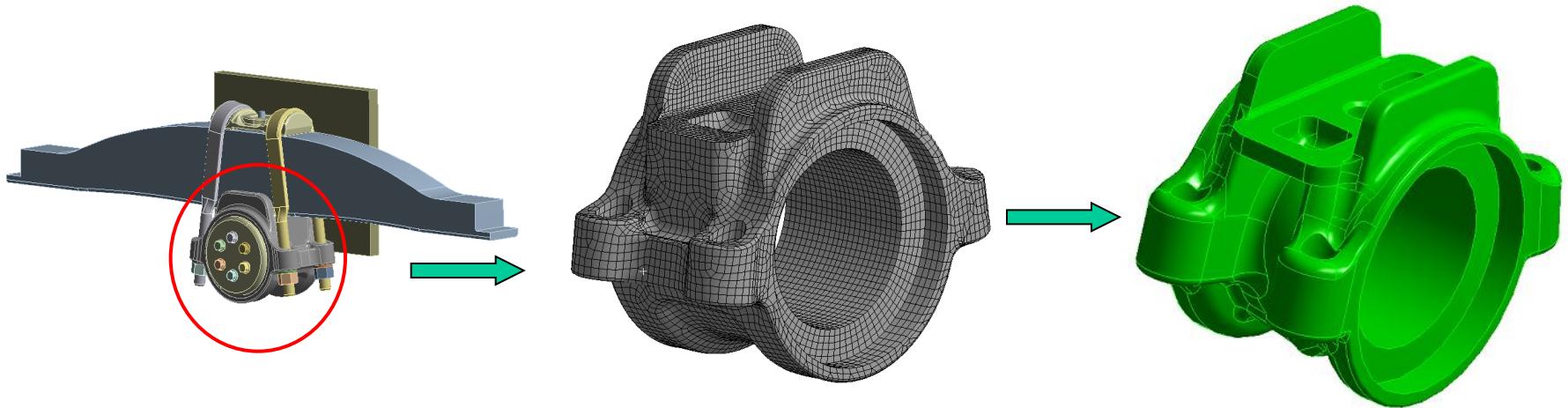
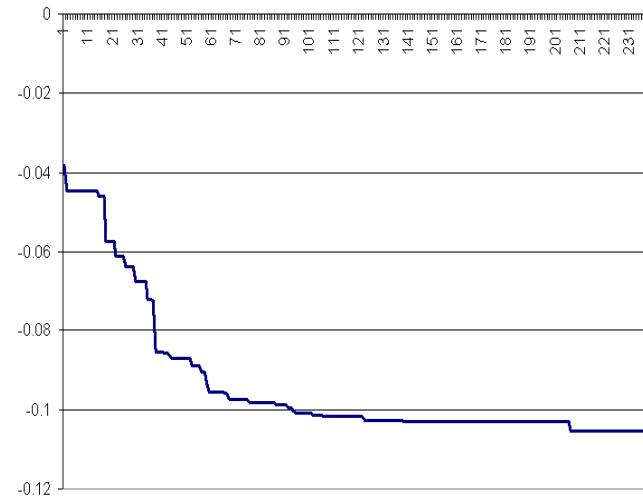


Radio Telescope CFD analysis. MeerKAT

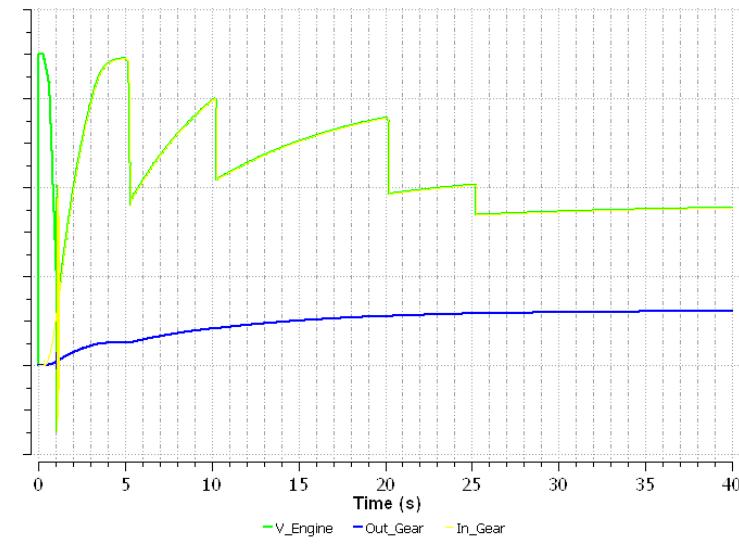
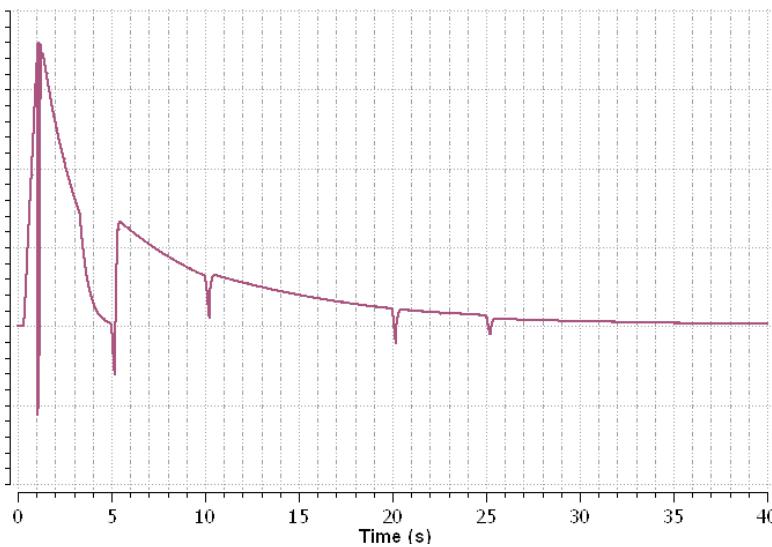
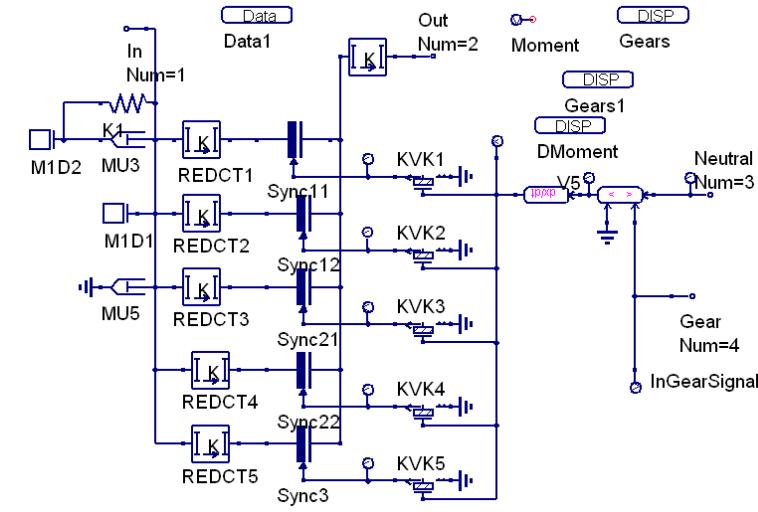
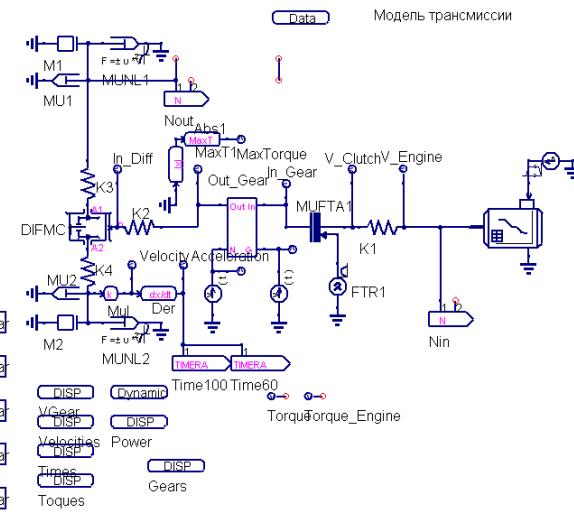


Optimization

- ▶ Parametric optimization of design
- ▶ Material optimization
- ▶ Shape optimization
- ▶ Topology and topography optimization
- ▶ Mass optimization
- ▶ Frequency optimization
- ▶ Crash-test optimization
- ▶ Robust optimization
- ▶ Sensitivity analysis



Concept Design and System simulation of Robotics GearBox

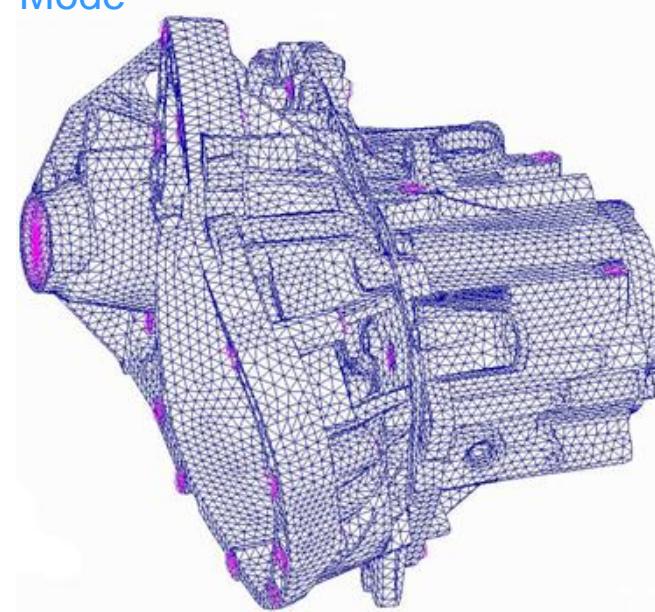


Modal analysis of GearHousing

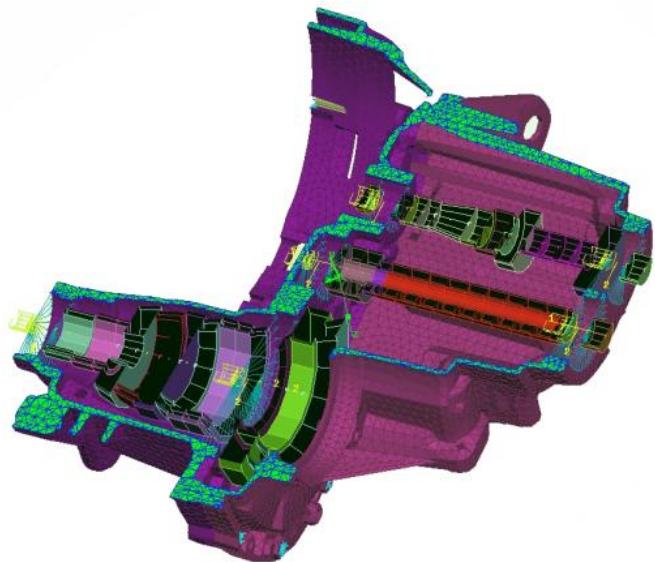
FEM



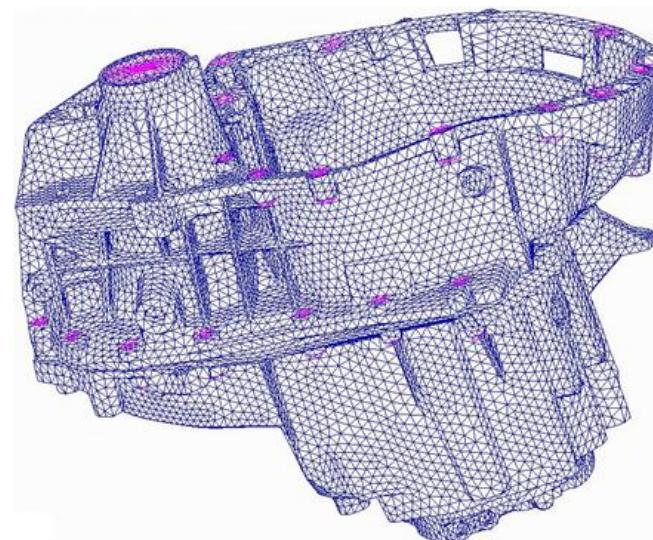
1st Mode



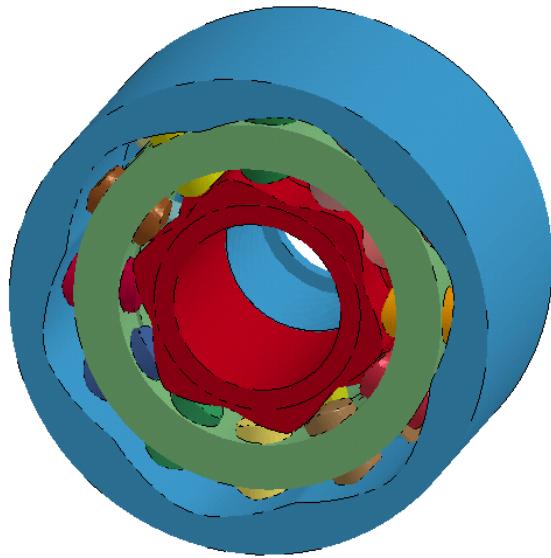
FEM



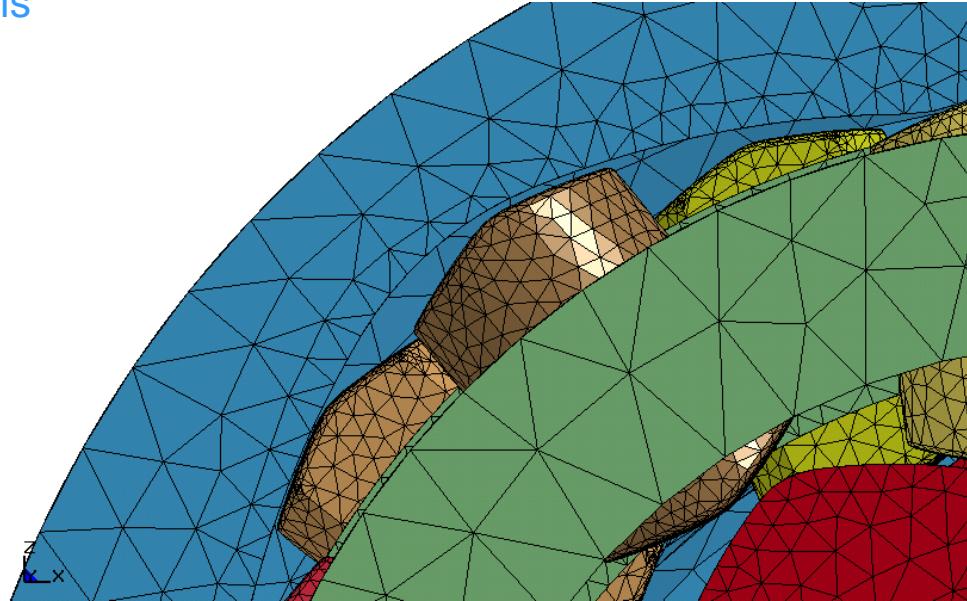
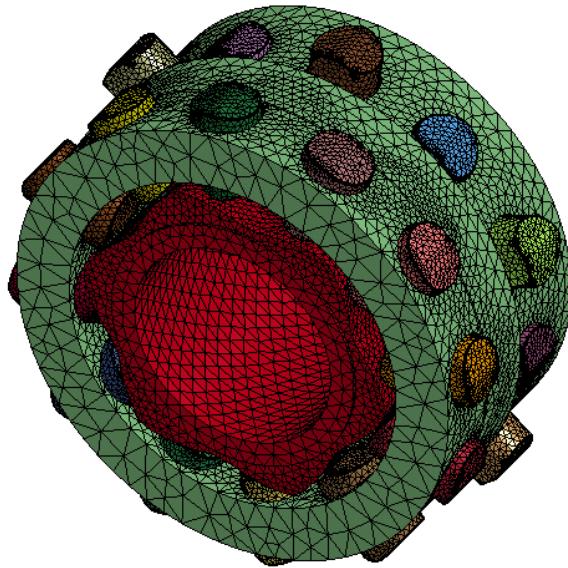
2nd Mode



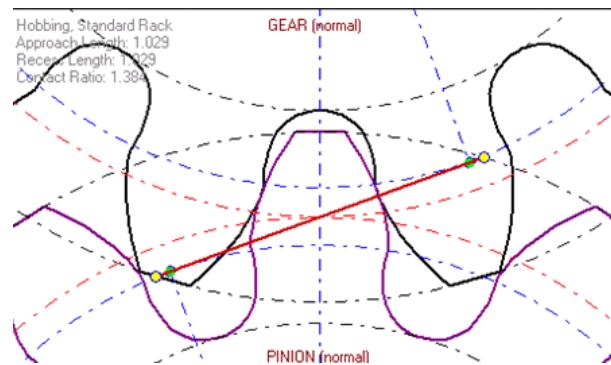
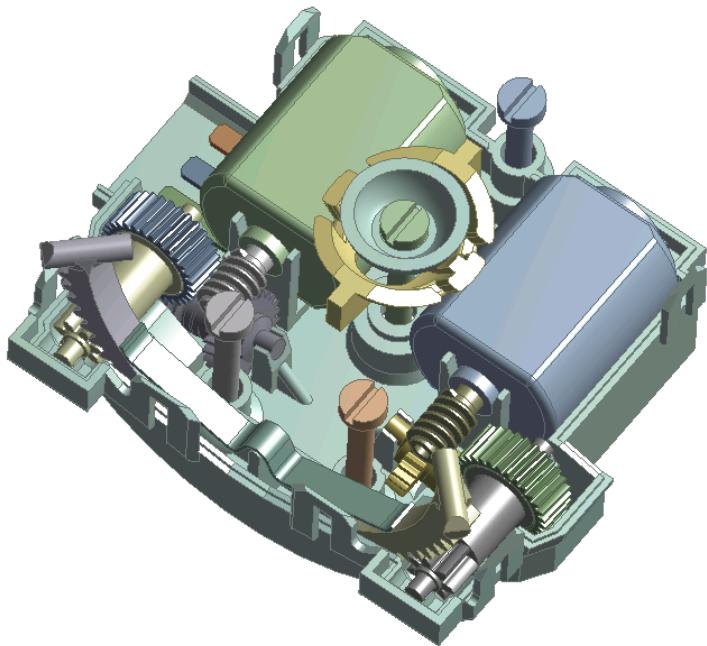
Design



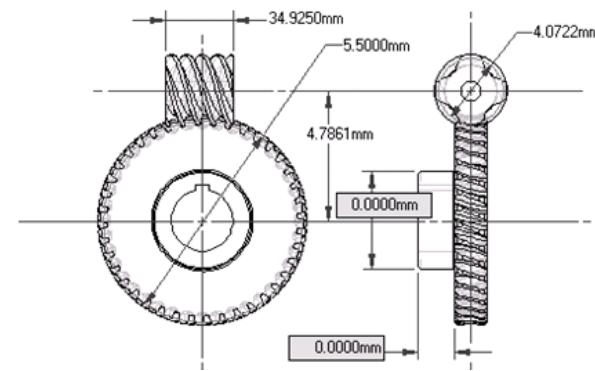
Dynamic Analysis



Motor-gear Design for Mirror

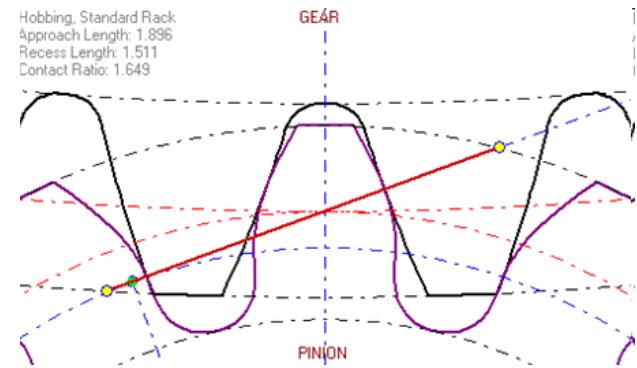


1-я,2-я ступень. Косозубая передача



3-я ступень. Червячная передача

Hobbing, Standard Rack
Approach Length: 1.896
Recess Length: 1.511
Contact Ratio: 1.649



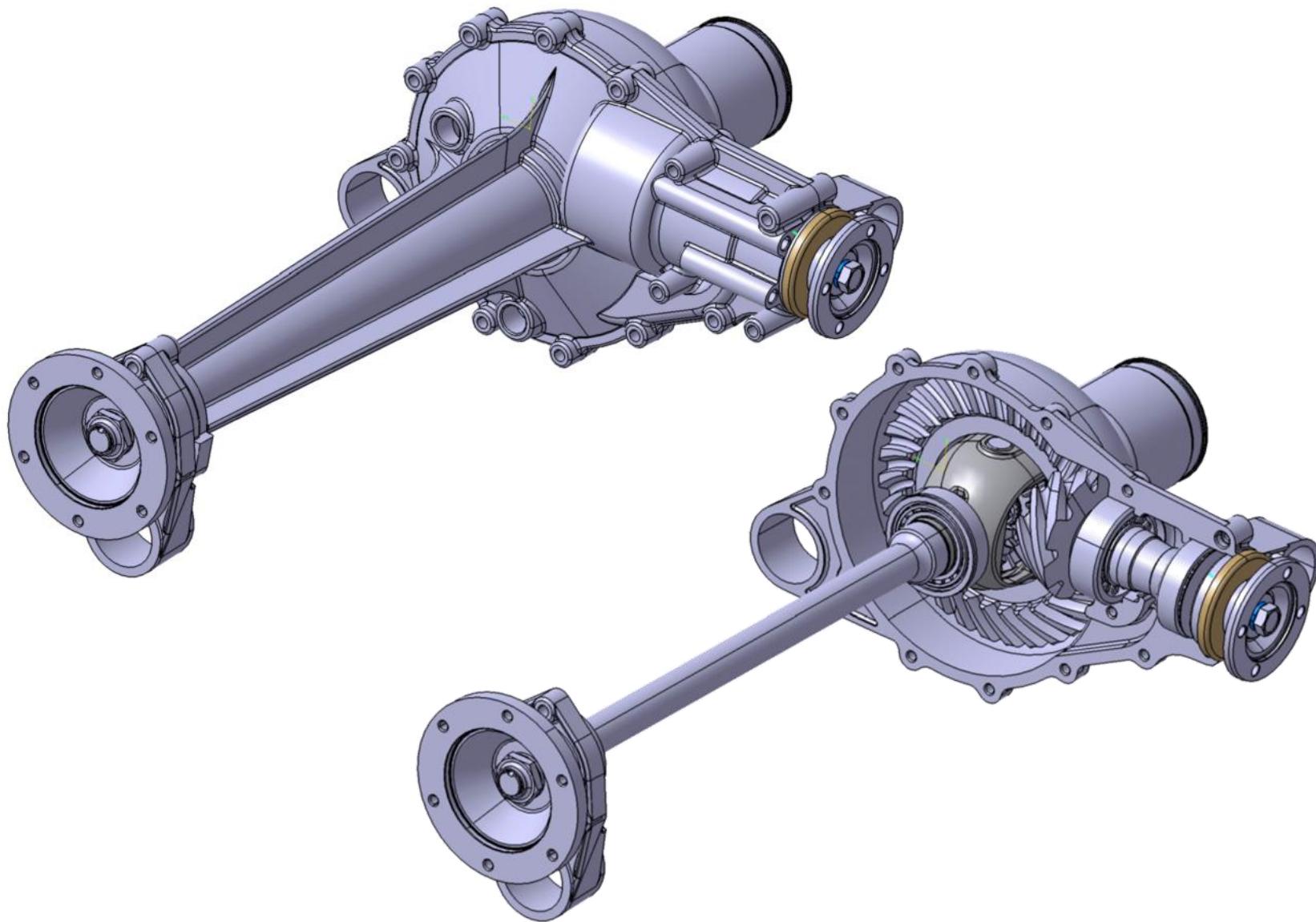
4-я ступень. Прямозубая передача

Общее передаточное число редуктора: $N = 13 \cdot 13 \cdot 13 \cdot 6 = 13182$

Wheel Gear Design for ATV

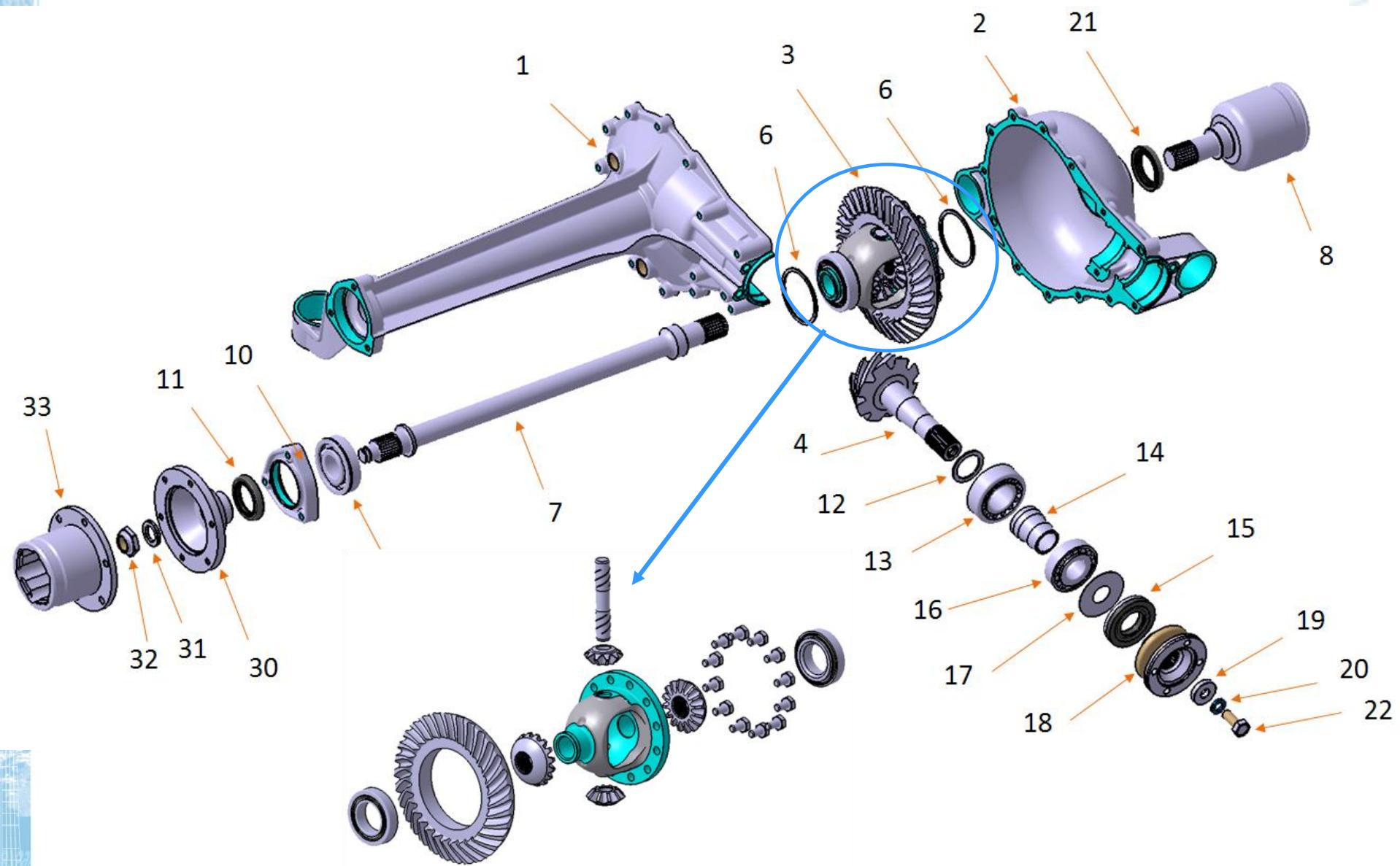


Проектирование переднего редуктора главной передачи

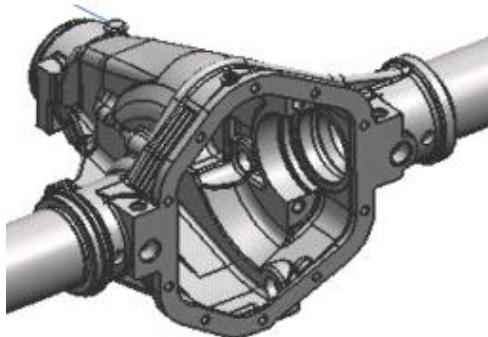


Final Drive Design for SUV

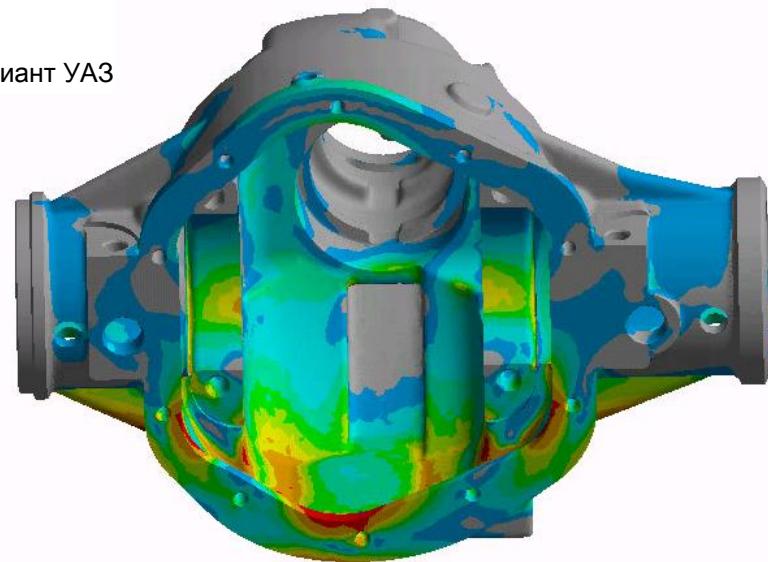
FRONT



Final Drive Design (UAZ)



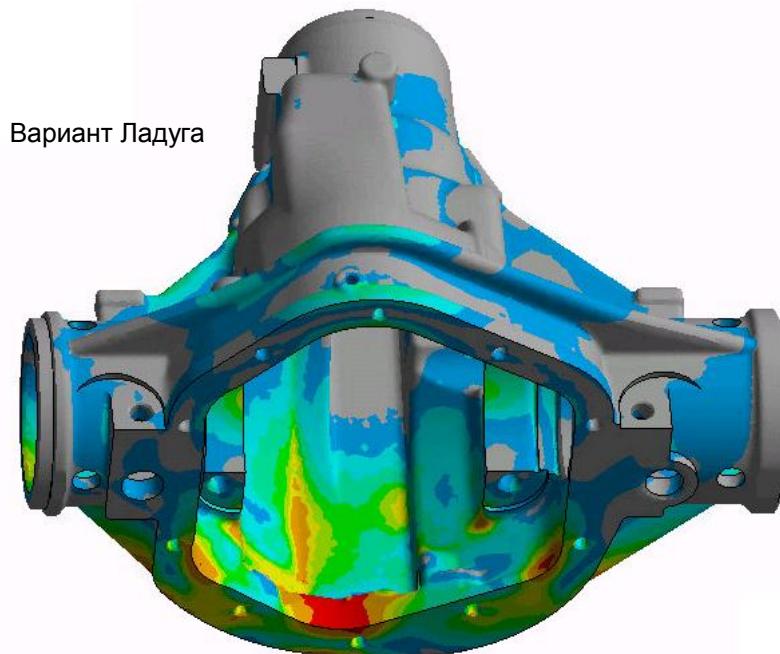
Вариант УАЗ



	Loadcase 1		Loadcase 2		Mass
	ΔS , mm	σ , MPa	ΔS , mm	σ , MPa	M, kg
Variant 1	2,38	267	7,1	332	17.458
Variant 2	1,97	280	6,38	333	16.610

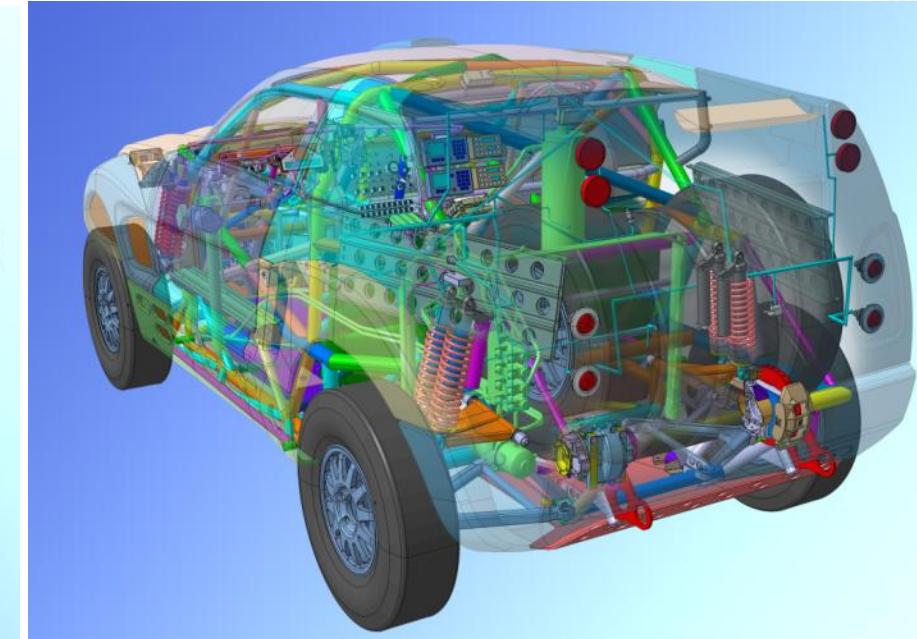
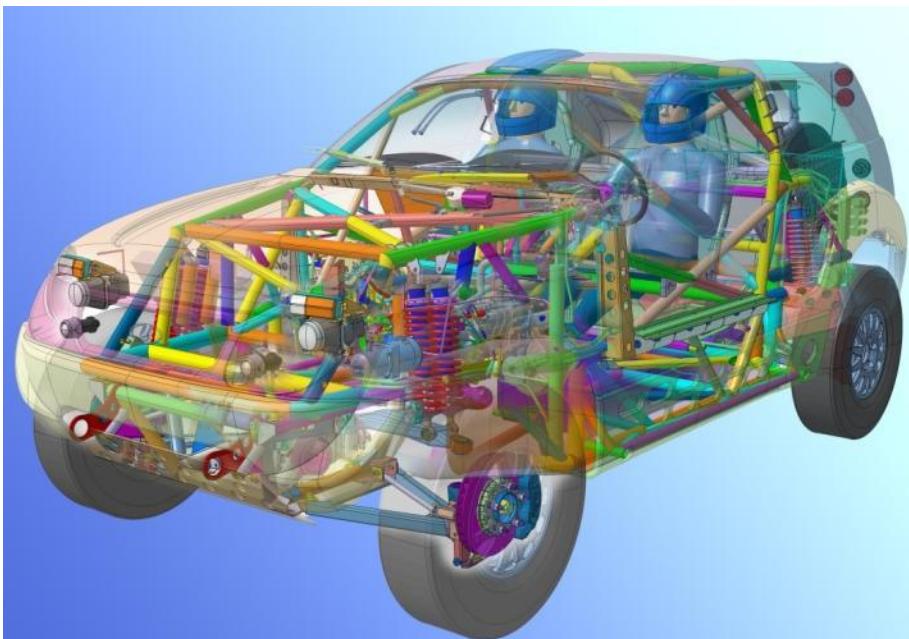
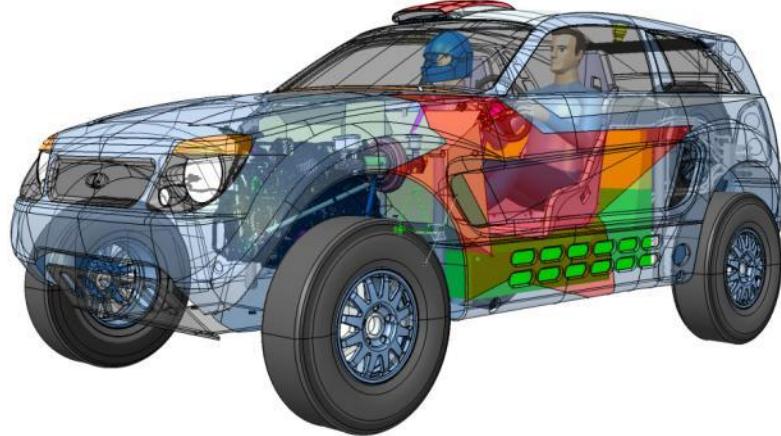


Вариант Ладуга

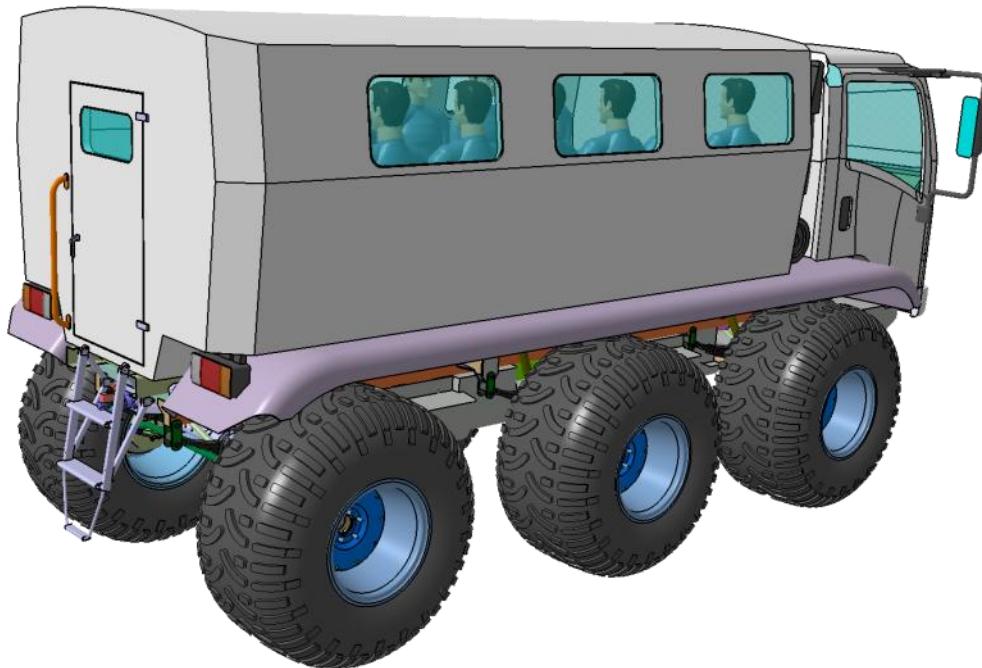
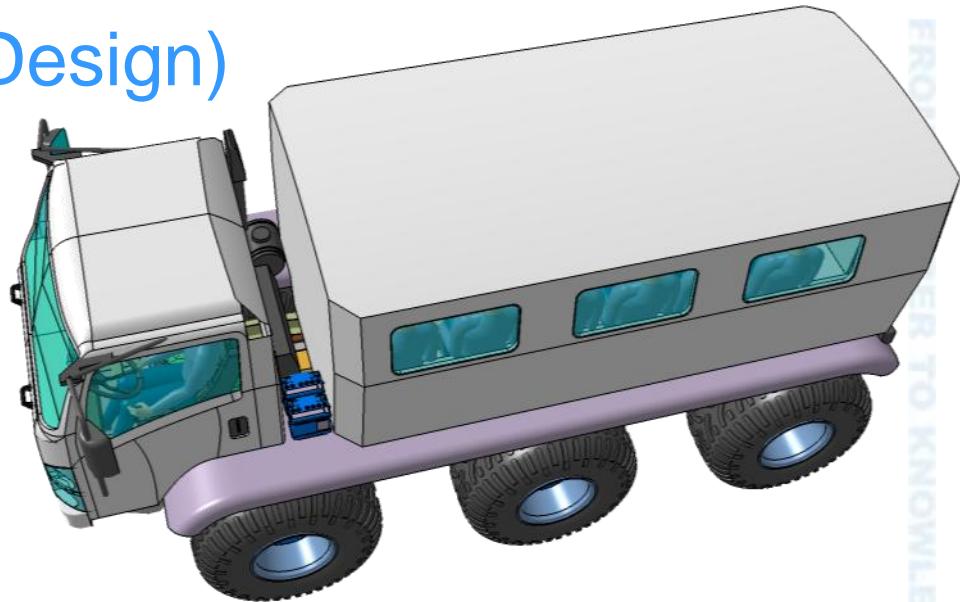


LADA Paris-Dakar (Packaging)

FROM NUMBER TO KNOWLEDGE

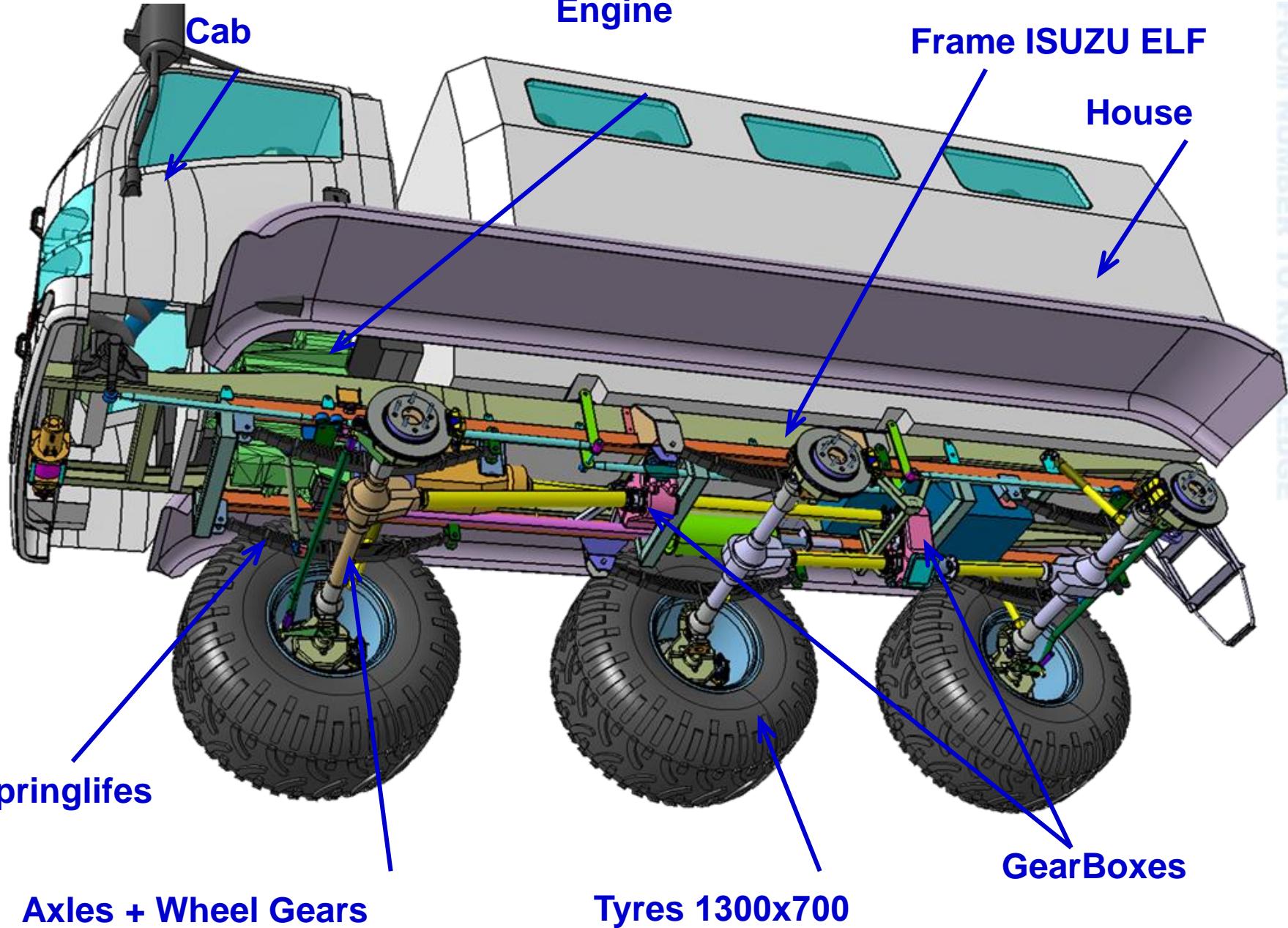


Arctic ATV (Design)

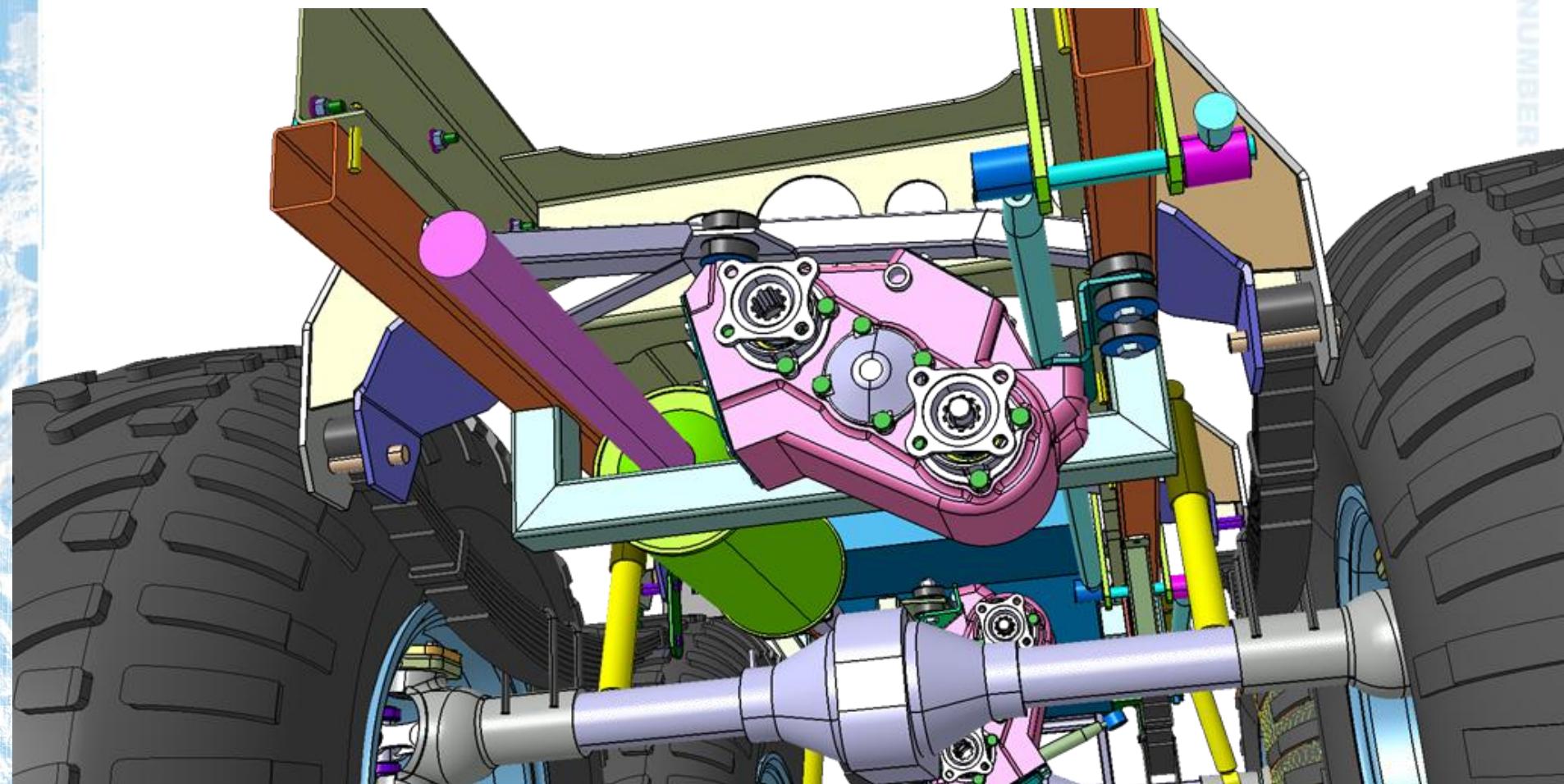


ATV Package Scheme

Engine



GearBox of ATV



Arctic Truck Design



THANK YOU FOR YOUR ATTENTION

LADUGA Ltd.

FROM NUMBERS TO KNOWLEDGE