

TECHNOLOGICAL HUB

For conformity assessment

TESTING
INSPECTIONS
CERTIFICATIONS
ENGINEERING



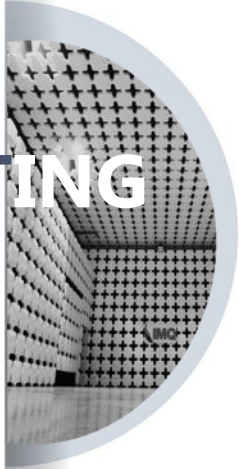


THE IMQ GROUP



MAIN SERVICES

TESTING



CERTIFICATION



INSPECTION



ENGINEERING





AUTOMOTIVE

B.U.



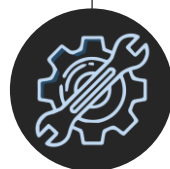
AUTOMOTIVE B.U. **SERVICES**



Testing



CAE



Performance Engineering



Homologation

AUTOMOTIVE B.U.

OUR TESTING FACILITIES



Crash



Powertrain Validation



Pedestrian and
Occupant Protection



Active Safety & ADAS



NVH



E/E -
Validation & EMC



Component Validation



Vehicle Validation



Fire Test

Extended tracks

for

160.000 m²

Support to Euro NCAP rating

Protocol interpretation

Testing monitoring

Results analysis

Countermeasures indications

Score calculation

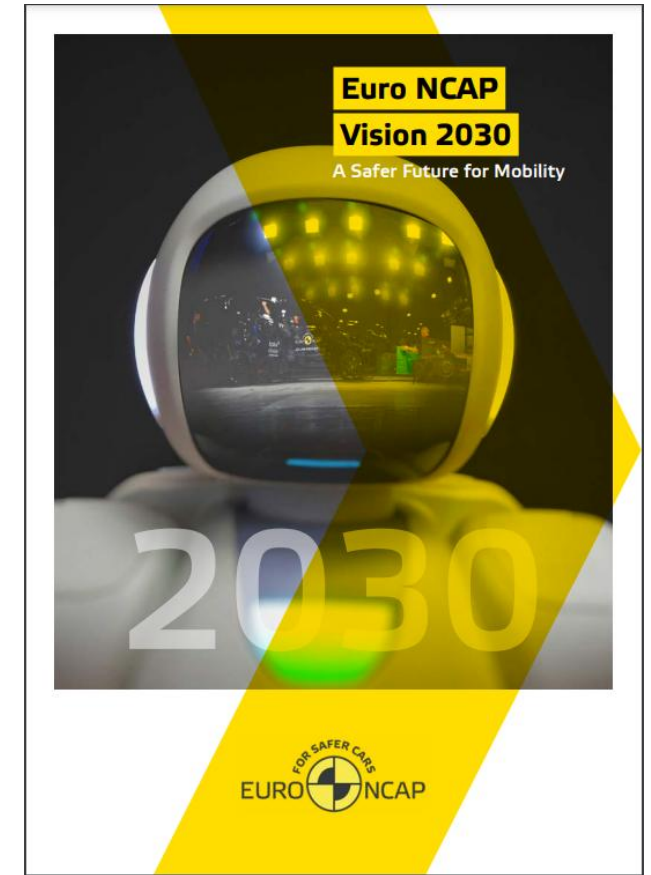
Overall assessment

Virtual Testing
Crashworthiness

EURO  NCAP

Authorised
Test Centre 2025

CSI



Note: Euro NCAP official inspector available in CSI

AUTOMOTIVE B.U. PERFORMANCE ENGINEERING



Testing plan development

- Design and implementation of tests to evaluate the performance of vehicles and their components.

Data analysis and problem solving

- Collection and interpretation of data from tests to identify improvement areas

Vehicle performance optimization

- Implementation of technical solutions to optimize vehicle performance

Integration & best practices application

- Working closely with engineers from other disciplines to ensure vehicle performance meets safety and quality standards

Innovation & performance improvement

- Research and development of new technologies to improve future vehicle performance

REFERENCE PROJECT: HV Hyper-Car

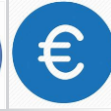
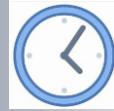
Project Management

Time & Cost management

Customer single contact point

Quality/Performance management

Testing Plan management





AUTOMOTIVE B.U. HOMOLOGATION

Laboratory accredited **ISO 17025**
and **ISO 17020**



Full-Scope Homologation Services: CSI ensures complete homologation capabilities, both **in-house** with dedicated facilities and on-site through full-scale **witness** testing at customer premises.



Authorized for **Initial Assessments:** CSI is assigned to conduct Initial Assessments for NSAI, reinforcing its expertise in regulatory compliance and certification.



Conformity of Production: CSI ensures full compliance with (EU) 2019/959 by providing complete CoP services across all required scopes.



Regulatory Consulting & Global Market Access: CSI supports clients in meeting specific regulatory requirements, ensuring a smooth and seamless market access.



CSI, as an **experienced Technical Service**, processes over 1.500 type approval applications annually, ensuring reliable and efficient certification support.



AUTOMOTIVE B.U. Virtual HOMOLOGATION

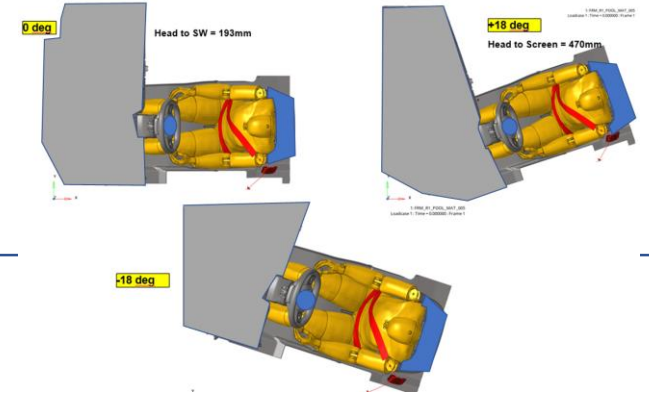


Individual Vehicle Approval (IVA)

According to the strategy agreed with the Car Maker:

- **Vehicle from donor car:** destructive tests simulated in virtual environment (e.g. R94, R95,..) if donor car data available for model validation.
- **Vehicle from scratch:** mix of real and virtual testing:
 - components tests to validate CAE model:
 - R94 and R95 on rolling chassis;
 - a few impact points for PedPro;
 - ...
 - Virtual simulation:
 - R21 sled tests
 - PedPro complete grid
 - R14
 - ...

Support to customer to create own data for the technical service





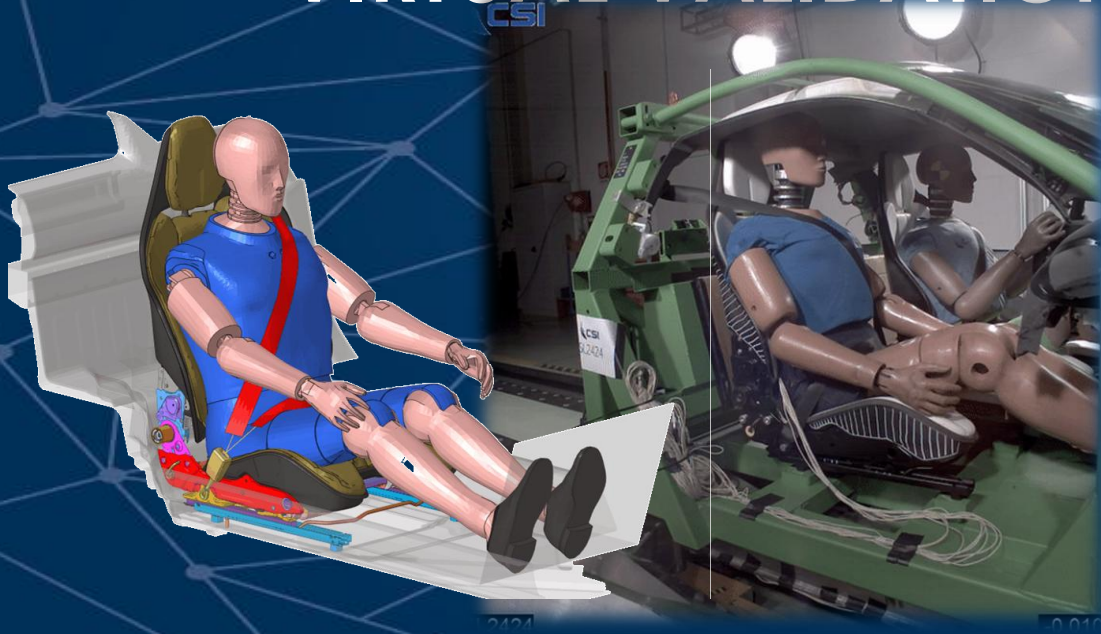
Engineering capabilities

Simone Ghiraldello

Sector Manager

CAE - Automotive

VIRTUAL VALIDATION



SAFETY

CONFORMITY

QUALITY

PERFORMANCE

EXCELLENCE

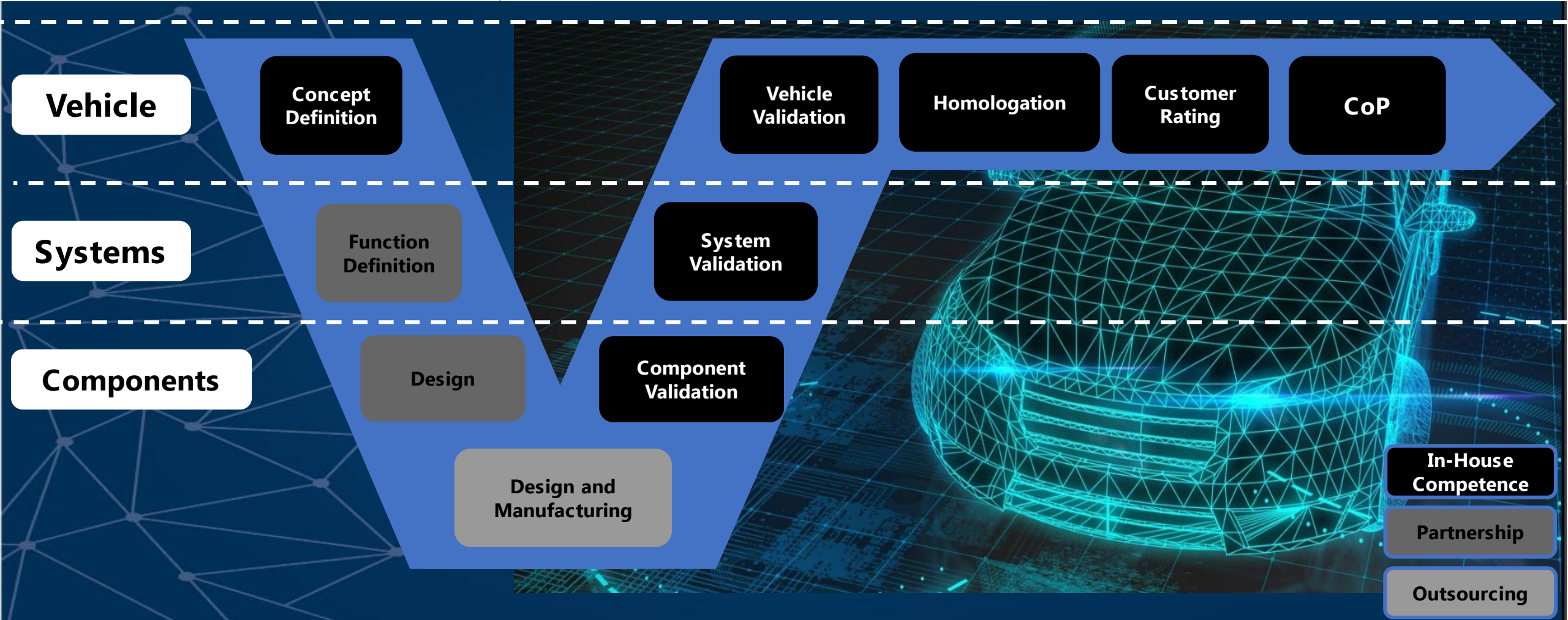
RELIABILITY

AUTHORITATIVENESS



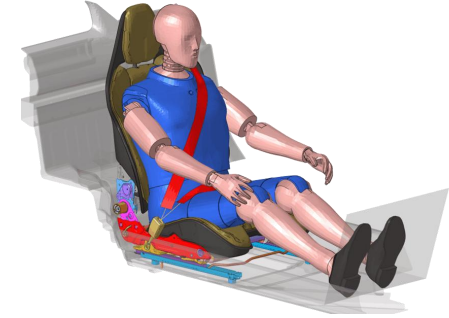
SOCIETÀ DEL GRUPPO IMQ

FROM TESTING TO HOMOLOGATION



CAE & PERFORMANCE ENGINEERING

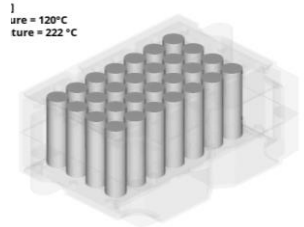
Selected Partner Integration



Top level testing and certification competence with integrated CAE



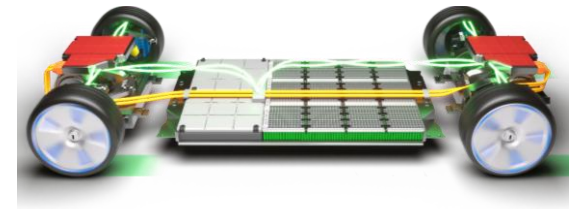
Selected Partner, with high level of competence in Simulation, battery developments, electronics control, AI, and....



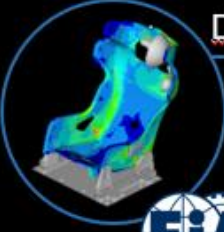
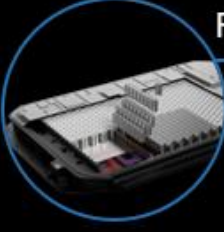
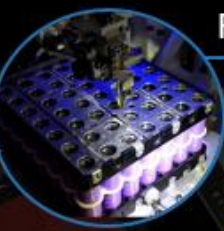
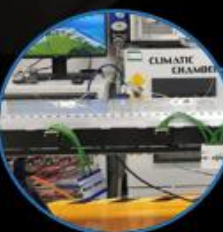
Clear interface between testing and CAE results



Strong capabilities in terms of testing, Simulations, project development and validation



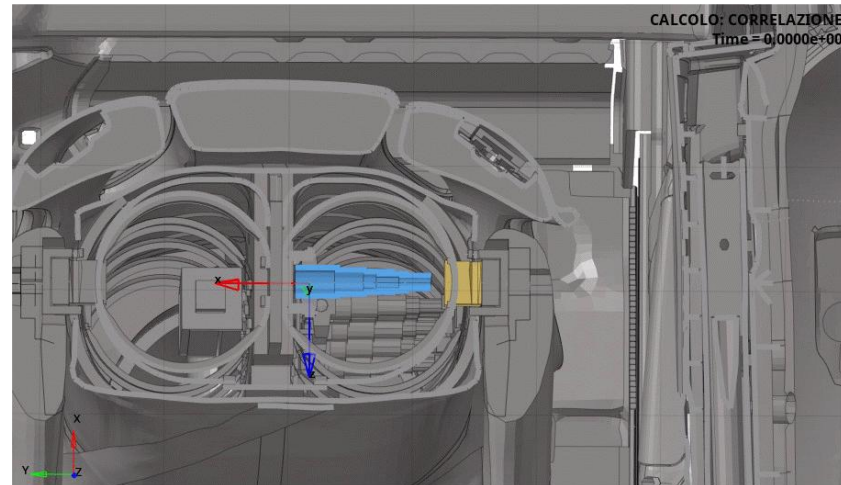
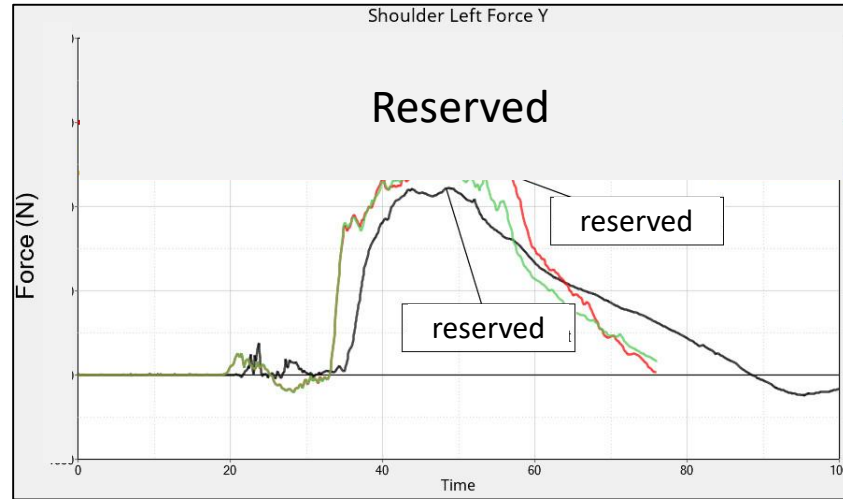
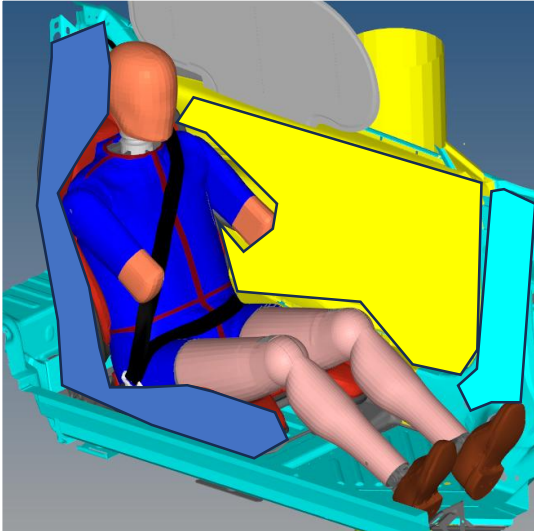
About Beond

ENGINEERING	TESTING	BATTERIES	ELECTRONICS
 Designed to Resist FEM COMPOSITE CRASH  Certified (3 Companies in Italy)	 Designed to Succeed MATERIAL TESTING CARD MATERIAL COMPONENT TESTING PHYSICAL VALIDATION	 Full Development BATTERY DESIGN CASE DESIGN MODULE DESIGN	 BMS & BTMS BMS PRODUCT SUPPLYING ISO26262 FUNCTIONAL SAFETY 
 Designed to Overcome CFD AERODYNAMICS THERMAL MANAGEMENT COOLING	 Designed to Perform PERFORMANCE ENGINEERING DURABILITY CRASH TESTING CUSTOM DATA-LOGGING	 Full Prototyping PRISMATIC + CILYNDRIC + POUCH CELL LASER + ULTRASOUND BONDING COOLING PLATE + IMMERSION COOLING	
 Designed to Integrate DESIGN COMPOSITE STRUCTURE E-POWERTRAIN FUEL CELL PRODUCT CONCEPT	 Full Testing CELL MODULE BATTERY PACK ELECTROCHEMICAL MECHANICAL ABUSE UN 38.3 + ECE100 R		



Testing & CAE correlation: support to improve

Deep Dive in Testing Aspects: e.g. sensors



Testing & CAE methodologies: customized development

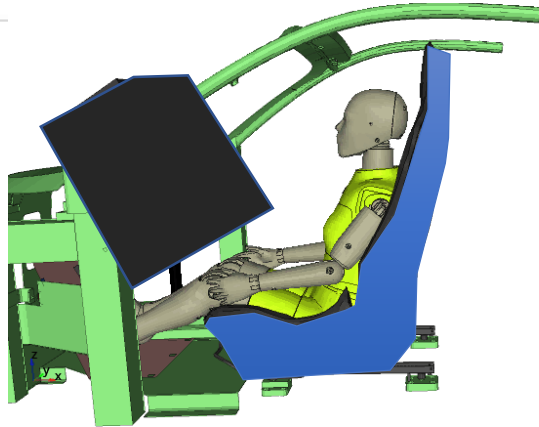
Introduction

Aim of the activity

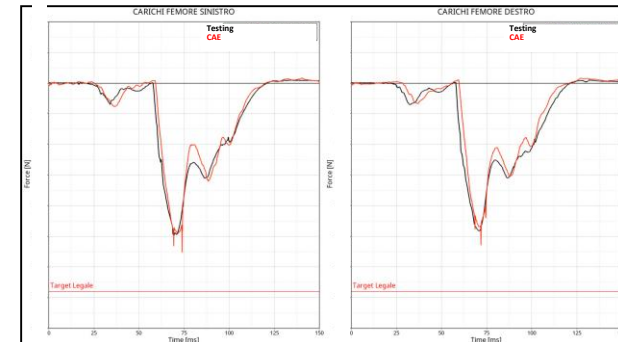
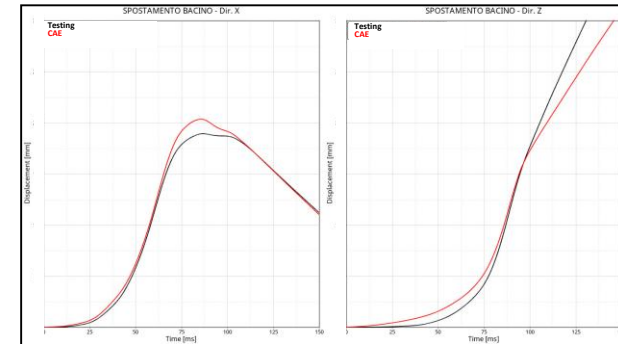
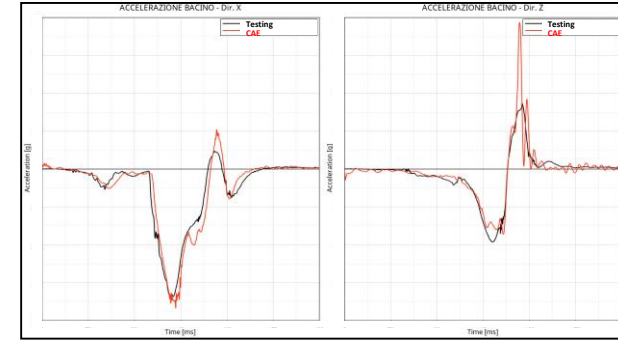
Starting from a full scale simulation, correlated with a sled physical test, define the setup for a sled test as much as simple to maximize the level of repeatability.



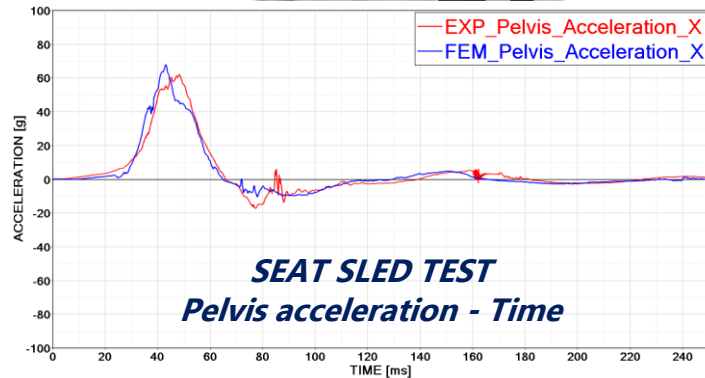
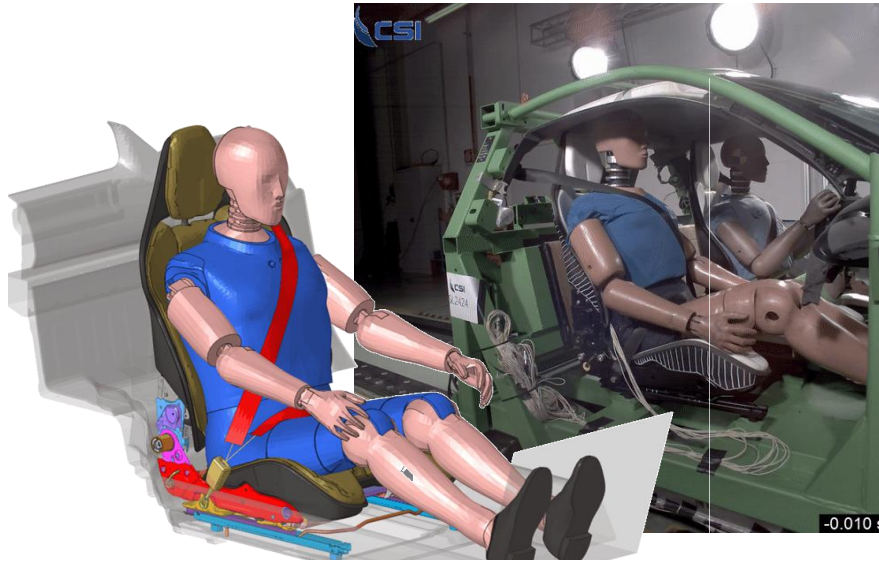
Frontal Sled Test & Simulation to better evaluate Seat behaviour and related predictability.



ID100 - CAE CORRELAZIONE
Time = 0.0000e+00



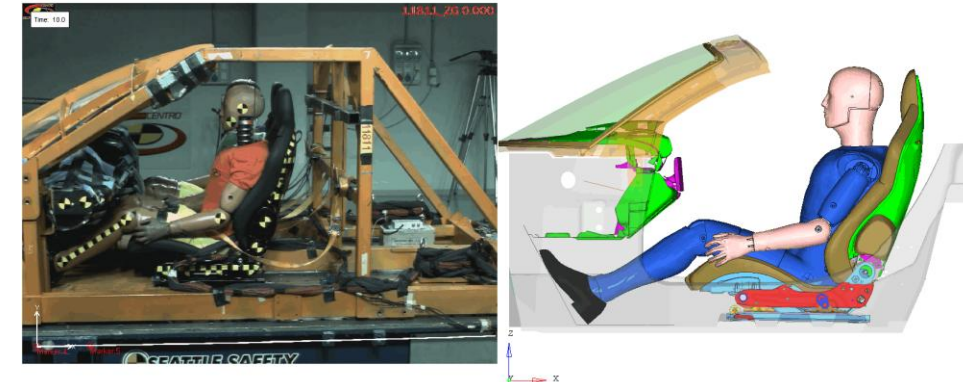
Engineering – Case Study: Front sled tests



VIRTUAL VALIDATION

- Energy absorption & Crash analysis
- Seat development
- Biomechanical evaluation with proper restraint system
- Homologation Test

- Preparation of FEM model with car environment and interior
- Dummy positioning
- Seatbelt setting
- Setting the simulation constraints (BCs and sled acceleration)
- Post-processing for results evaluation:
 - evaluation of accelerations and forces of the dummy
 - biomechanical injury criteria

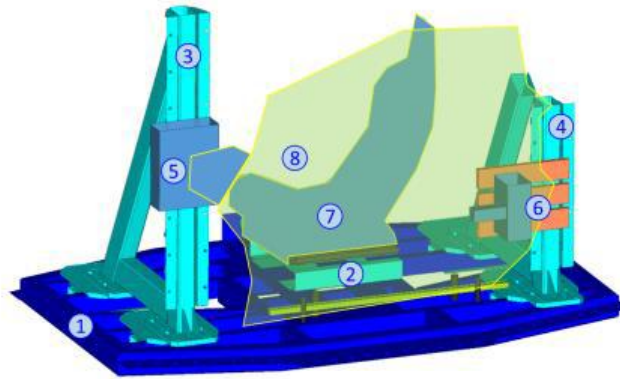


Side Sled Test in Deceleration (barbending)

Sled Components

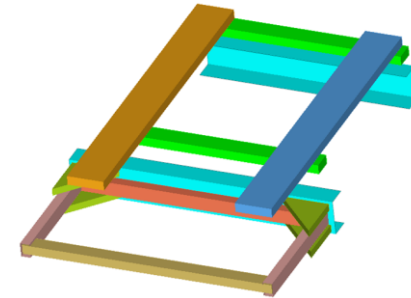
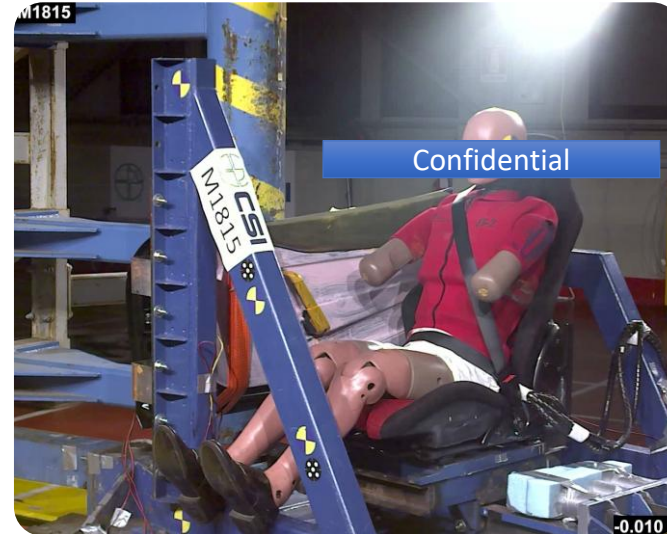
1. Main sled
2. Seat sled
3. Seat
4. Rigid Pillars
5. Pillars simulacrum
6. Door
7. Bar bending brake
8. Pole

CAE & Testing Validation

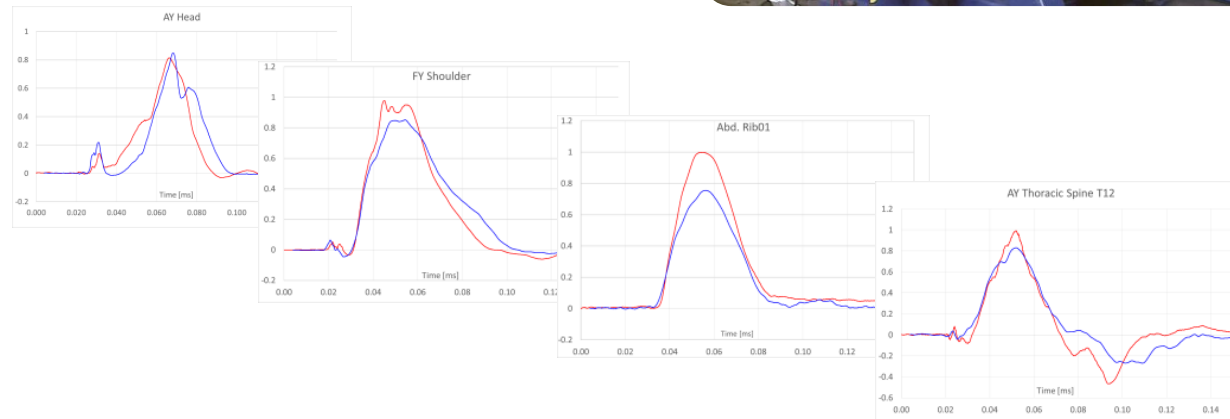
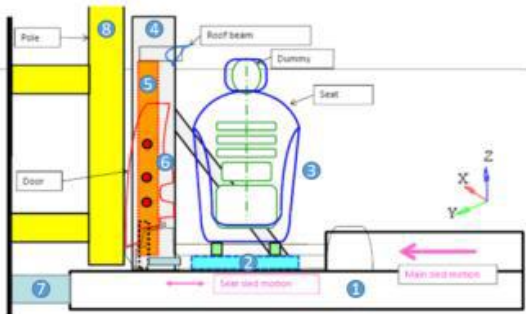


1. Main sled
2. Seat sled
3. Rigid A-pillar
4. Rigid B-pillar
5. Hinges deformables
6. Striker deformables
7. Seat
8. Door

From Concept to Self Certification



Base of the seat



Pedestrian Protection



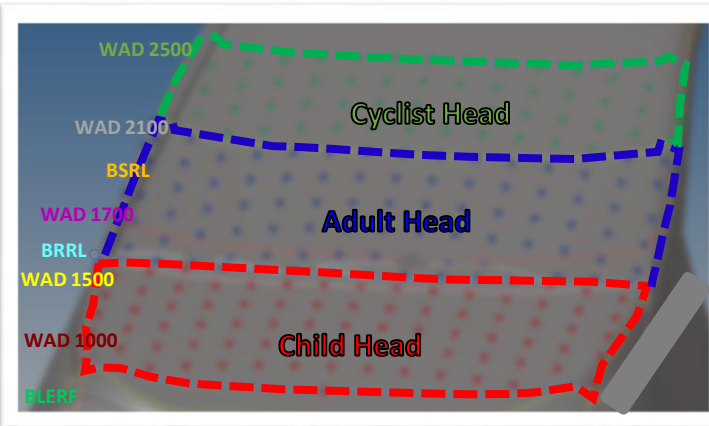
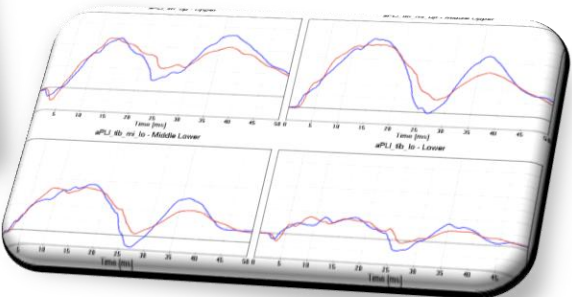
aPLI examples

CAE & Testing Validation

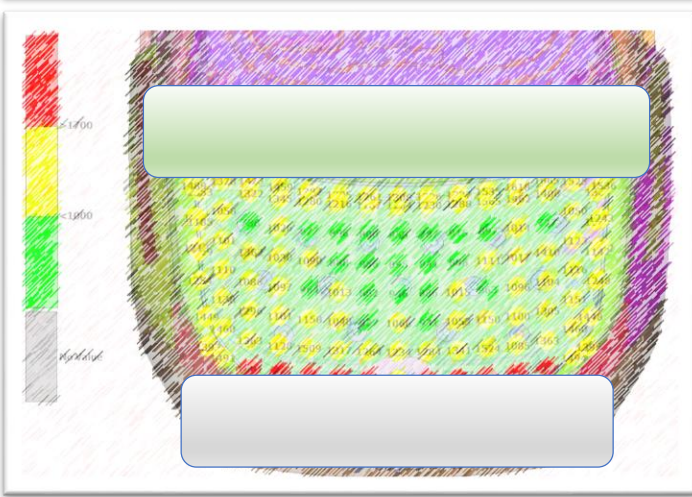
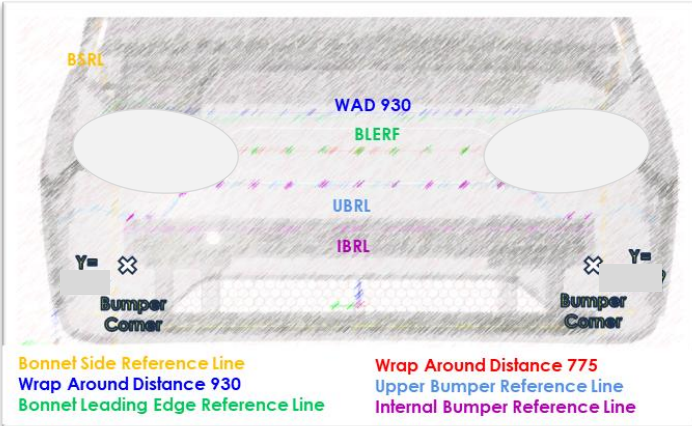


Being part of the Euro NCAP WG, CSI has access and control of new protocols.

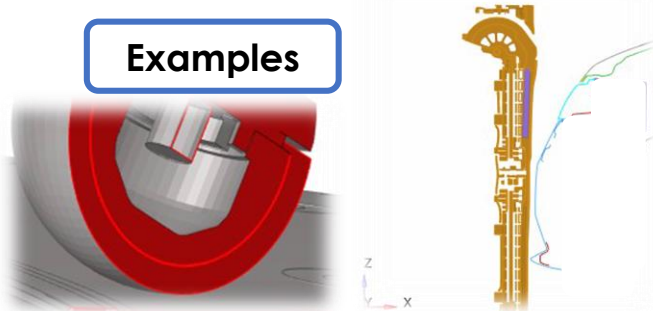
- Results preview & monitoring
- Target Achievement
- Score calculation



Impact area definition (ECER127&Encap)



Examples



Score calculation

Head				Lower leg			Upper leg		
Nominal limits				Nominal limits			Nominal limits		
			Awarded Points		0 pts	1 pt		0 pts	1 pt
650	< HIC <	650	1	Femur bending moments	440Nm	390Nm	Bending moments	350Nm	285Nm
1000	< HIC <	1000	0.75	Tibia bending moments	320Nm	275Nm	Sum of forces	6.0kN	5.0kN
1350	< HIC <	1350	0.5	MCL elongation	32mm	27mm			
1700	< HIC <	1700	0.25	ACL/PCL elongation	10mm	10mm			
	< HIC <		0						

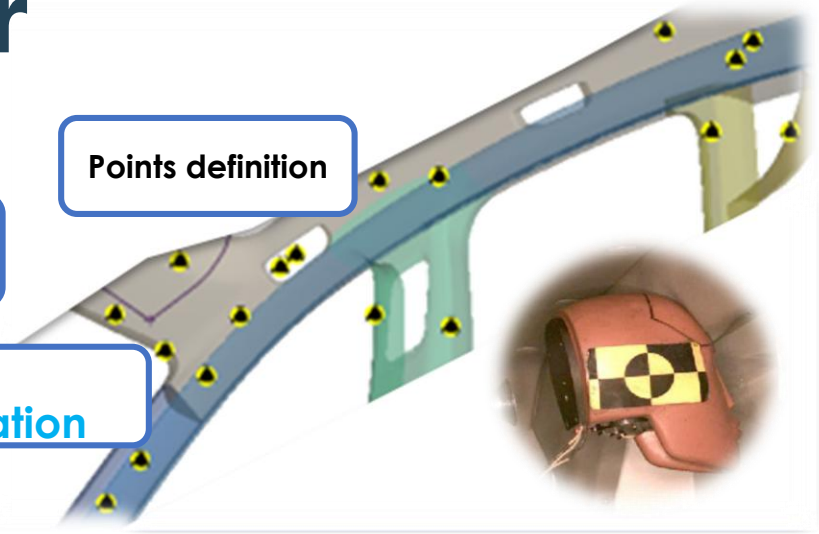
FMVSS201 Upper



CAE & Testing Validation

From **Concept**
to **Self Certification**

Points definition



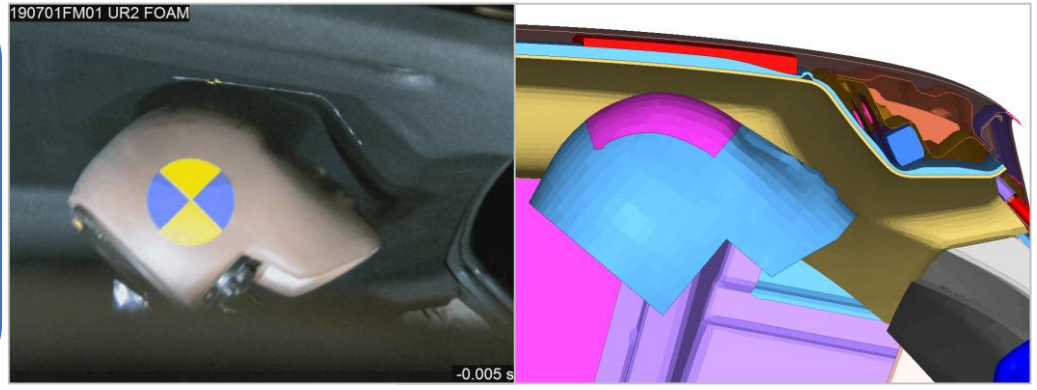
Example of section for
initial clearance
analysis



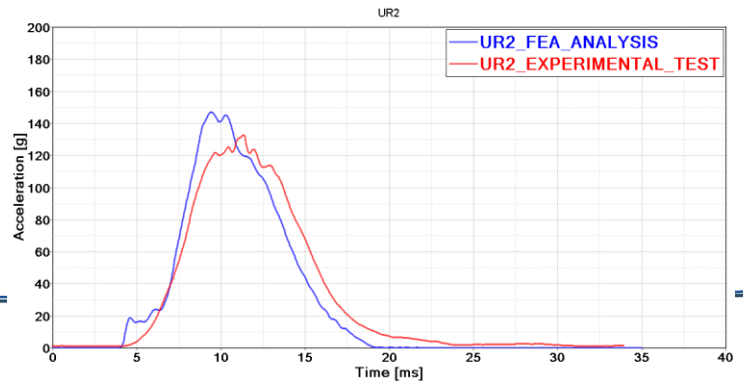
Robustness:
more than 1 direction analysed

Usual activities:

- Preliminary section analysis
- Impact points definition
- Upper roof perimeter
- Project guidelines
- HPC prediction
- Criticalities and Countermeasures



Impact analysis

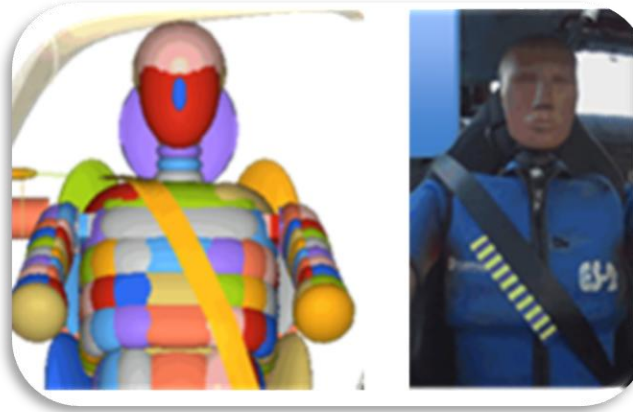


Global overview of the impacts:

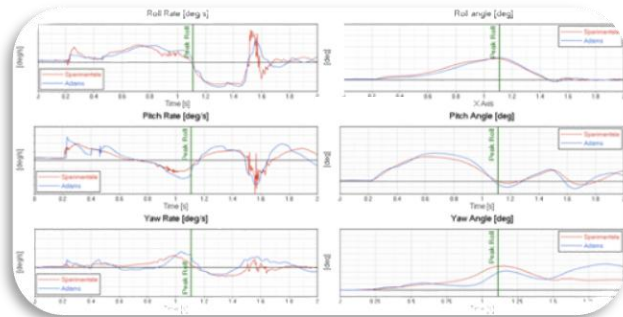
- Point position
- Impact direction
- HIC results

Point	Coordinate [mm]			Rollback		a0 [°]		a1 [°]		a2 [°]		Initial Velocity [km/h]	HIC		
	X	Y	Z	[mm]	V.Angle	H.Angle	V.Angle	H.Angle	V.Angle	H.Angle			a0	a1	a2
AP1															
AP2															
AP3															
BP1															
BP2															
BP3															
BP4															
FH1															
FH2															
SR1															
SR2A															
SR2B															
SR3B															
SR3B_2															
SR3B_3															
SR3B_4															
OPR															
OP2															
RH															
SR30															
URAP_survivor															
URAP_no_survivor															
URAP2_survivor															
URAP3_survivor															
URAP3_no_survivor															
URS1_survivor															
URS1_2_survivor															
URS1_3_survivor															
URS1_3_no_survivor															
URS2A_2															
URS2A_3															
URS2B_3															
URS3B_3															
CEN_C															
CEN_F															

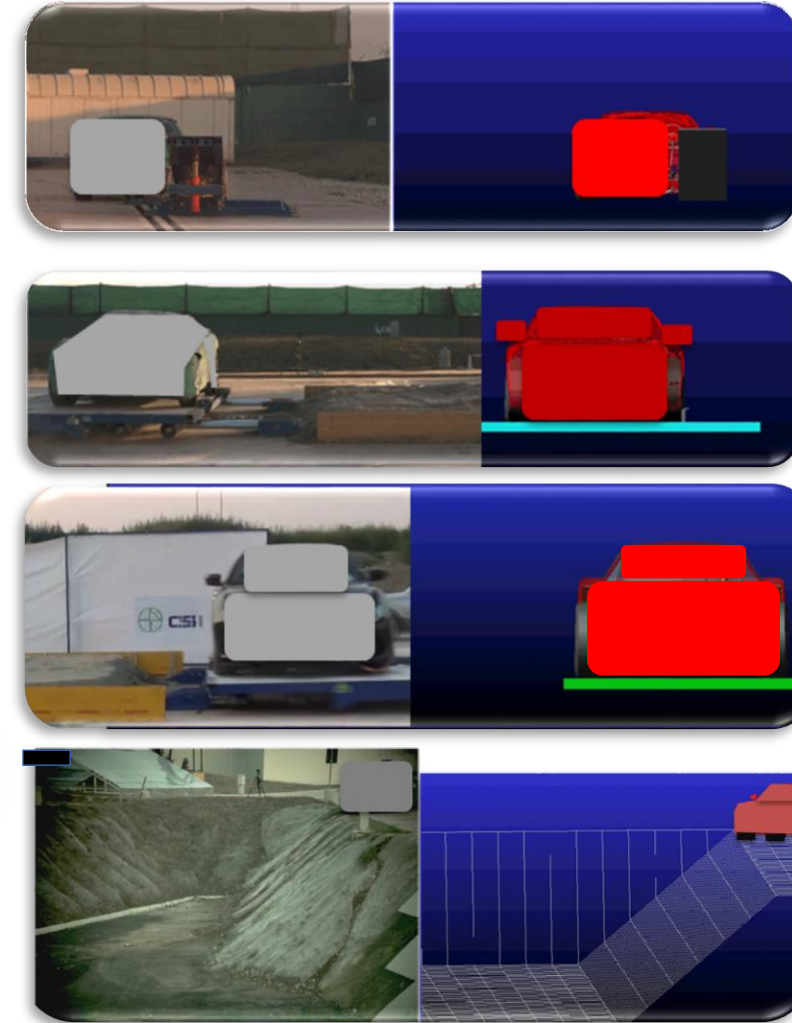
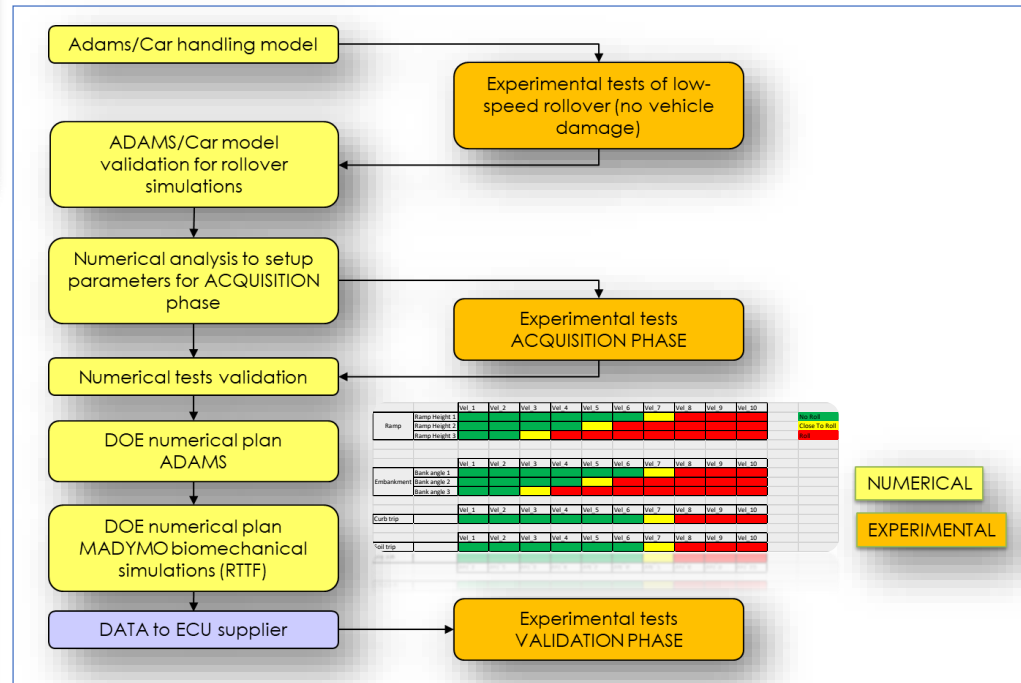
Rollover – Dynamic & Biomechanic



CAE & Testing Validation



Rollover Application

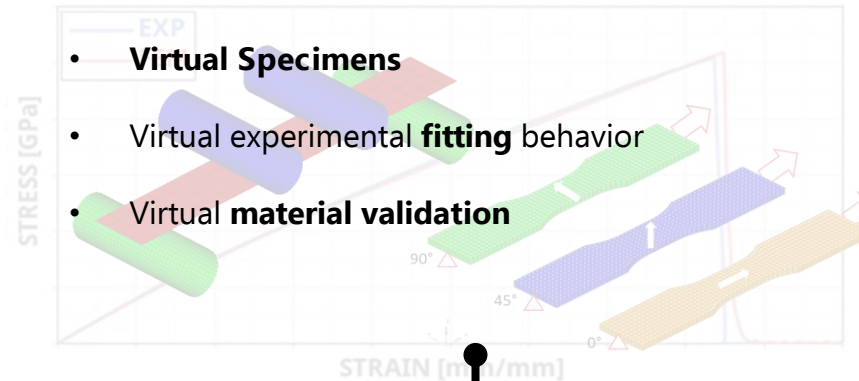


Engineering – Component validation

MATERIAL SELECTION

- Project requirement
- **Manufacturing:**
 - Hand layup - Autoclave
 - RTM
 - FW
- **Resin type**
- **Fiber nature**
- **Warp and weft**

VIRTUAL MATERIALs GENERATION



LOADCASE SETTING AND COMPOSITE OPTIMIZATION

- TEST load setting and run
- Composite Layer by layer analysis
- Evaluation of criticalities
- Material layout **optimization:**
 - **Stack,**
 - **Orientation,**
 - **Patches**

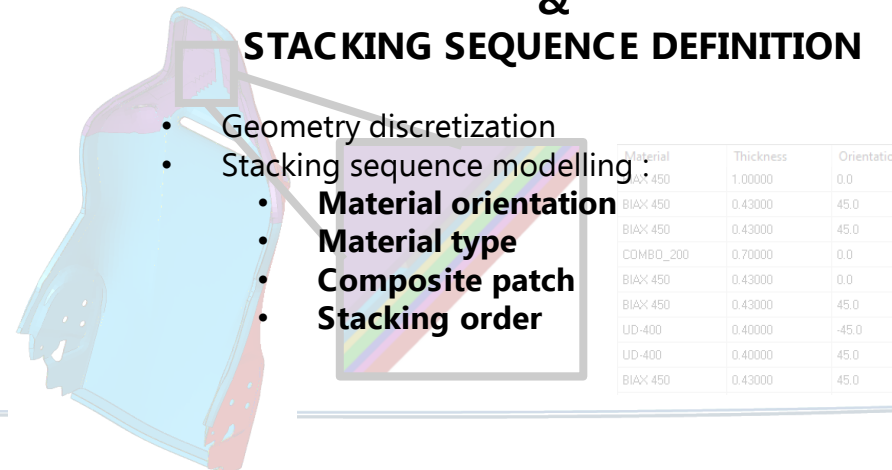
ACCELERATION

COMPONENT VALIDATION

MATERIAL TESTING

- Specimen Shape (ISO Std)
- Specimen testing at **0°, 90° and 45°:**
 - **Tensile**
 - **Compression**
 - **Bending**
 - **Impact**

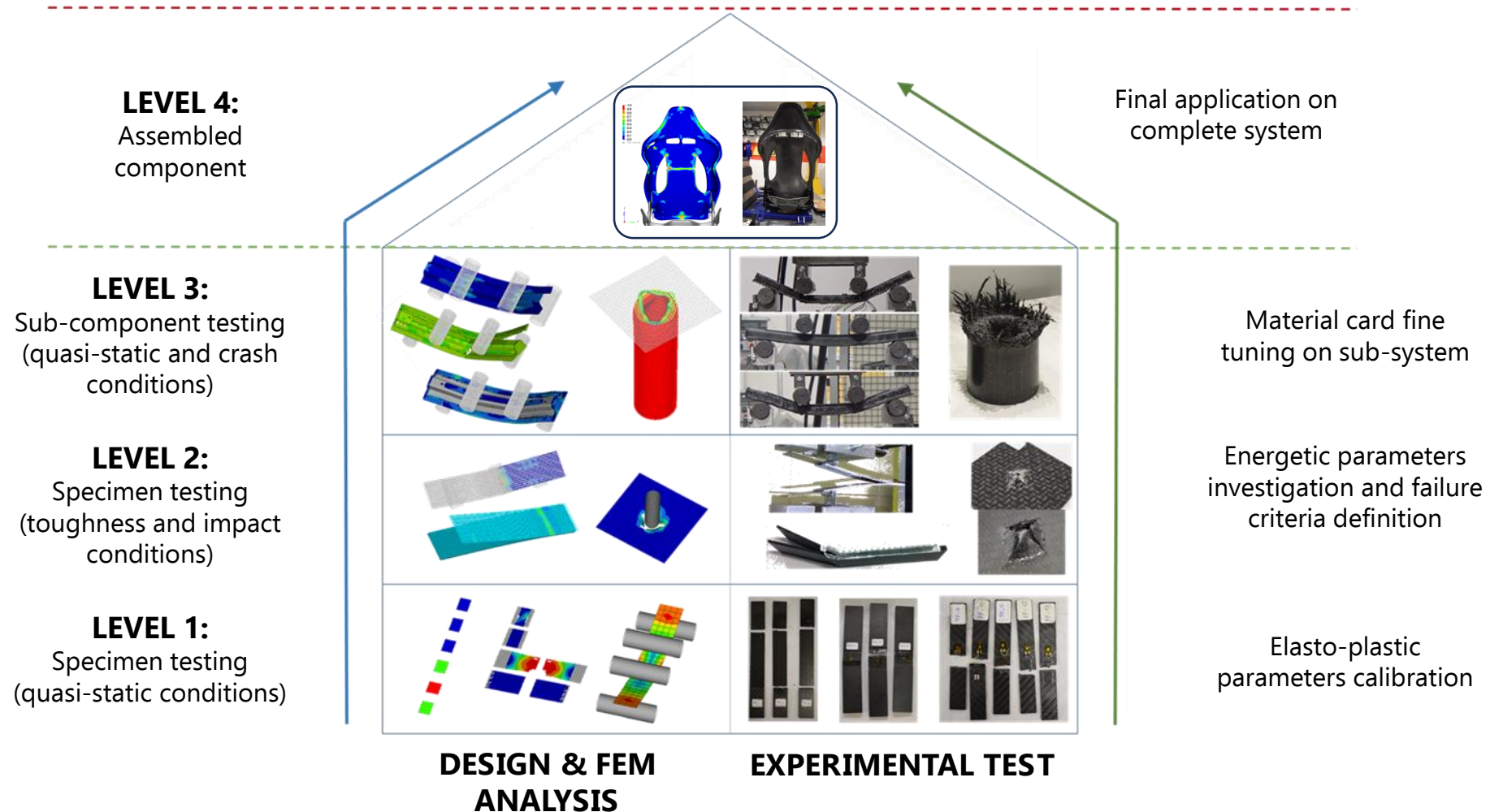
COMPONENT DESIGN, MODELING & STACKING SEQUENCE DEFINITION



COMPONENT TESTING & CORRELATION

- **Physical Test** development
- Virtual to experimental test full **correlation**

Engineering – Composites



Material characterization – Composite

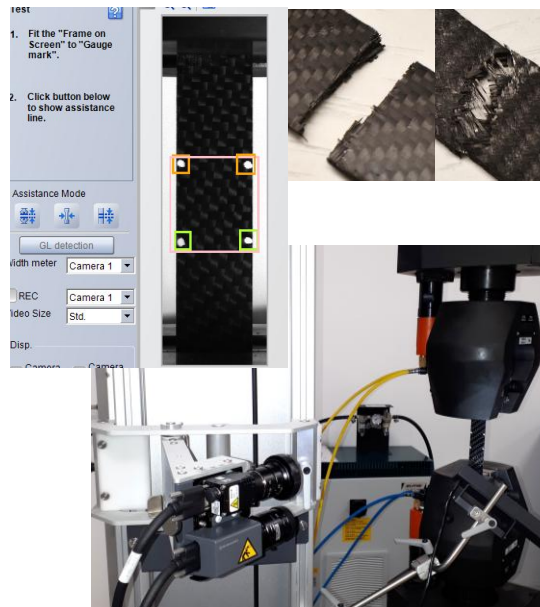
- Material testing and correlation:

- Composite**

- Metal
 - Polymers
 - Ceramics
 - Foam
 - Sandwich
 - Glue
 - Hybrid Joint

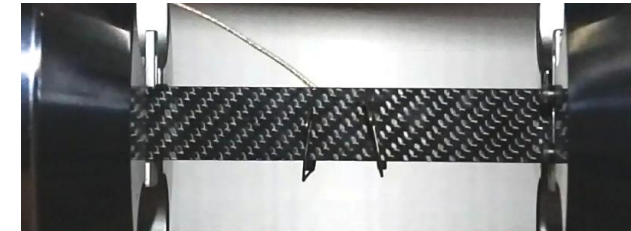
Static Properties

- Tensile/Shear (ASTM D3039 /D3518)
- Compression (ASTM D6641)
- Bending (ASTM D7264)

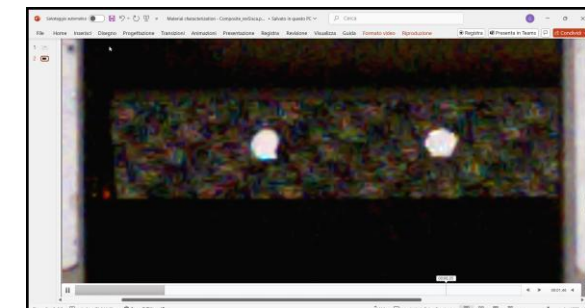


Strain-Rate Properties

- Strain Rate $\sim 1/s$ (Hydraulic Test Machine)



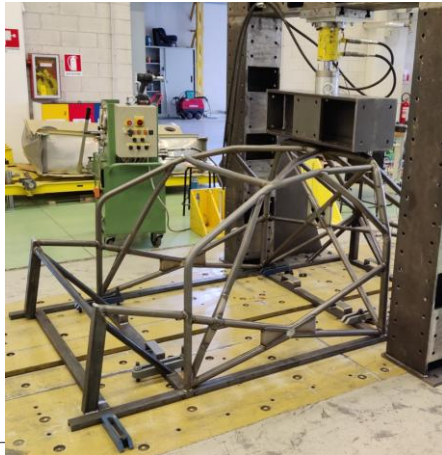
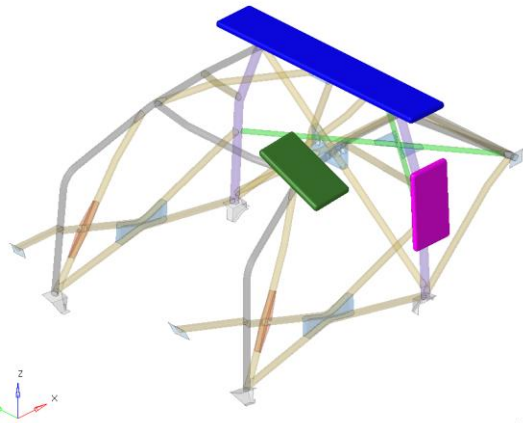
- Strain Rate $\sim 100-200/s$ (Drop-dart Test Machine)



Engineering – Case Study: Motorsport



- Accredited by the **FIA** for roll bar homologation
- Homologation of **roll bar** through FEM simulations



■ STATIC VERTICAL LOAD TEST ON THE MAIN ROLLBAR

■ STATIC LOAD TEST ON THE FRONT ROLLBAR

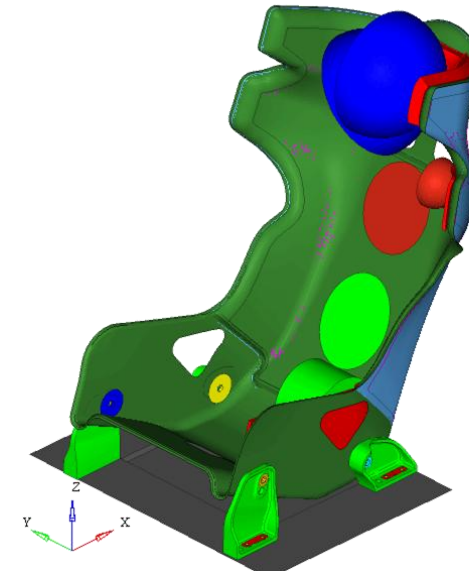
■ STATIC SIDE LOAD TEST ON MAIN ROLLBAR

VIRTUAL VALIDATION

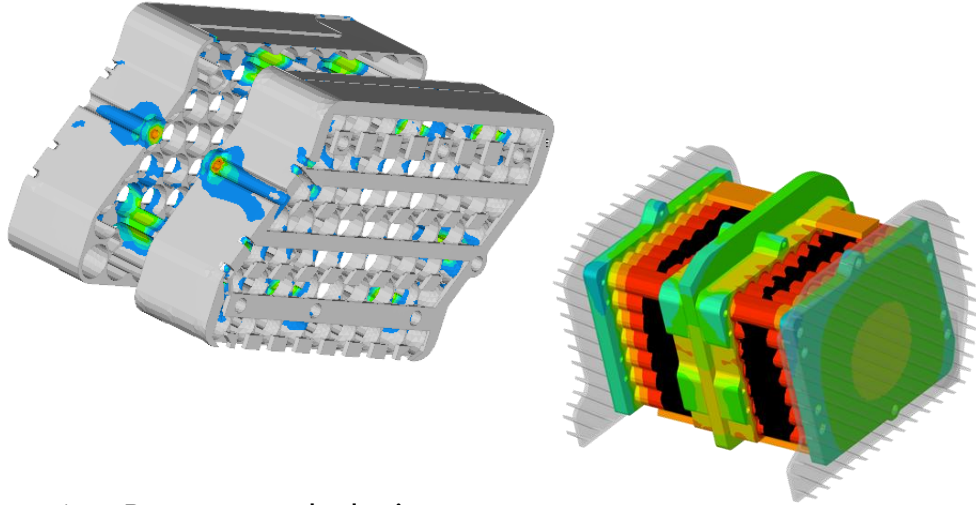
- Stiffness & Quasi-Static test evaluation
- FIA homologation test
- Evaluation of composite component behaviour

Development of motorsport seats

- Development and virtual validation of the motorsport seat according to FIA regulations
- Supporting the experimental test for FIA seat homologation



Engineering – Case Study: Automotive & Motorbike



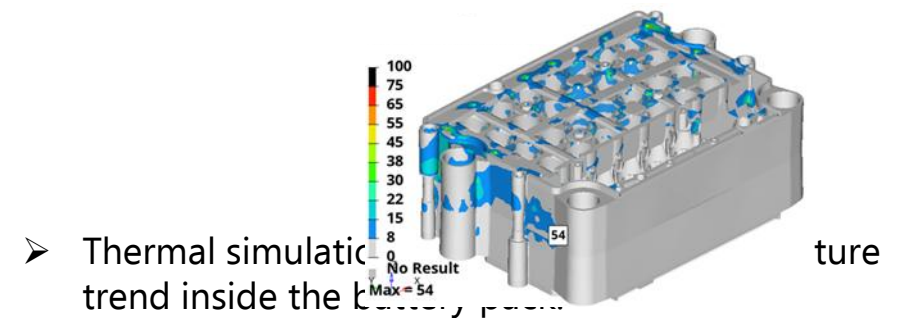
- Battery pack design
- Virtual validation with structural simulations (static and crash) and thermal analysis
- Performing FEM simulations for battery design (UN38.3 and ECE R100)
- Analysis:
 - modal analysis and vibration
 - shock
 - thermal analyses

VIRTUAL VALIDATION

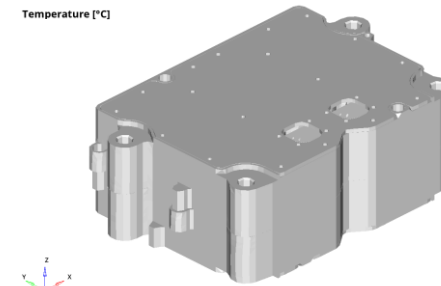
- Static and crash analysis
- Failure analysis
- Target achievement
- UN38.3 & ECE R100 standards (vibration and shock)

Case study: Development of a battery pack: from design to virtual validation through structural and thermal simulations.

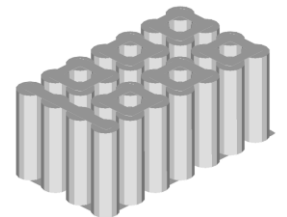
- Structural simulations (vibration and shock) according to UN38.3 standard:



Temperature [°C]

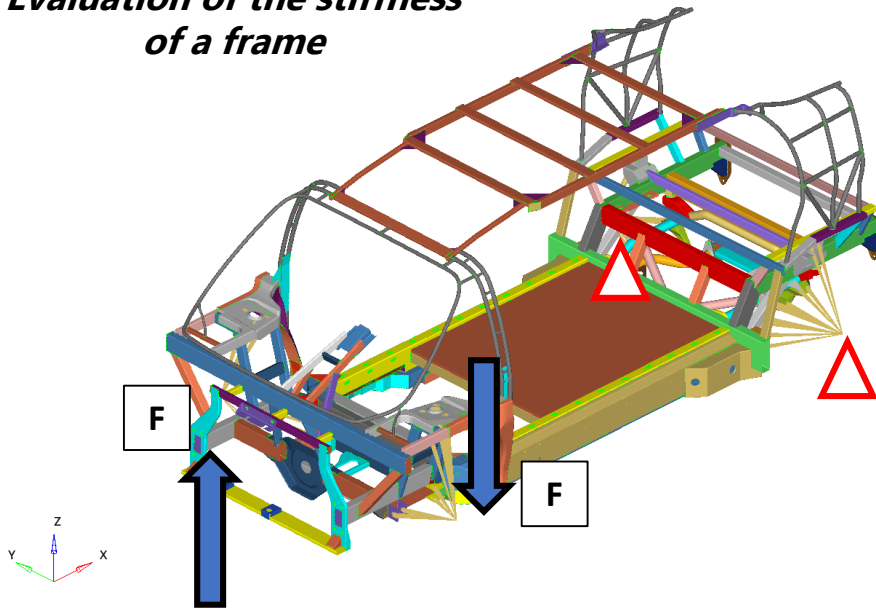


Temperature [°C]



Engineering – Case Study: Automotive

Evaluation of the stiffness of a frame



Calculation of torsional stiffness:

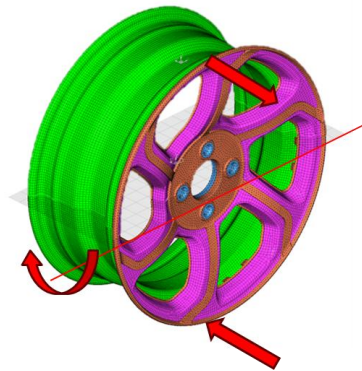
$$\alpha_t = \tan^{-1} \left(\frac{v_A - v_B}{W} \right) \quad K_t = \frac{F W}{\alpha_t}$$

VIRTUAL VALIDATION

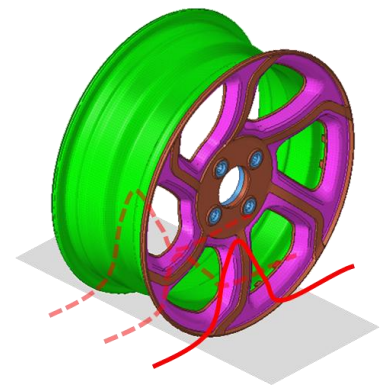
- Stiffness & Quasi-Static test evaluation
- Internal customer regulations
- Evaluation of the stiffness of a frame
- Evaluation of the strength of a rim

Evaluation of the strength of a rim

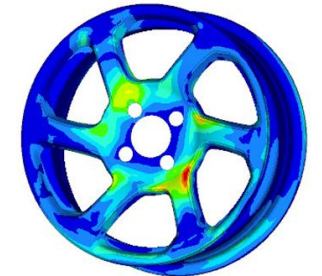
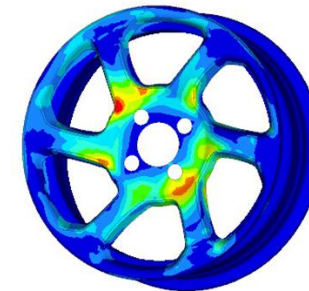
Bending



Rolling



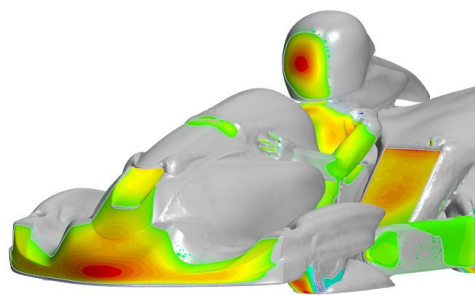
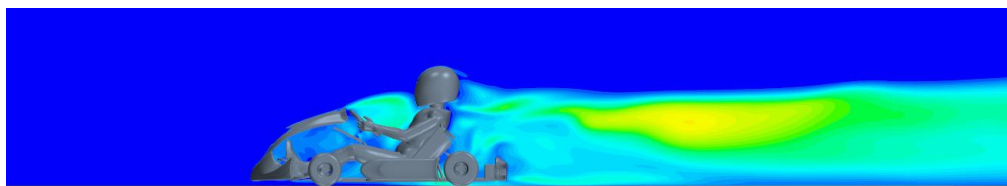
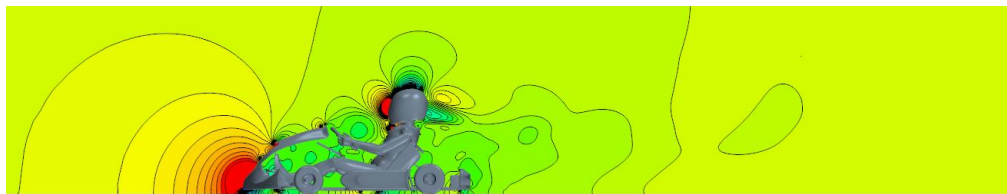
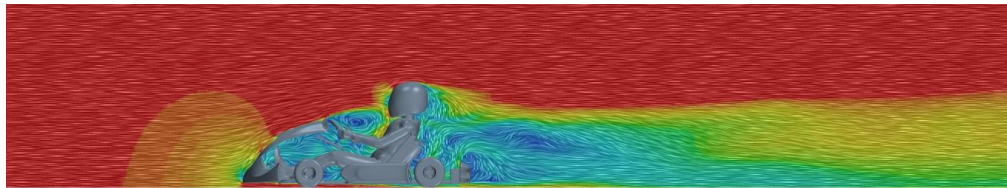
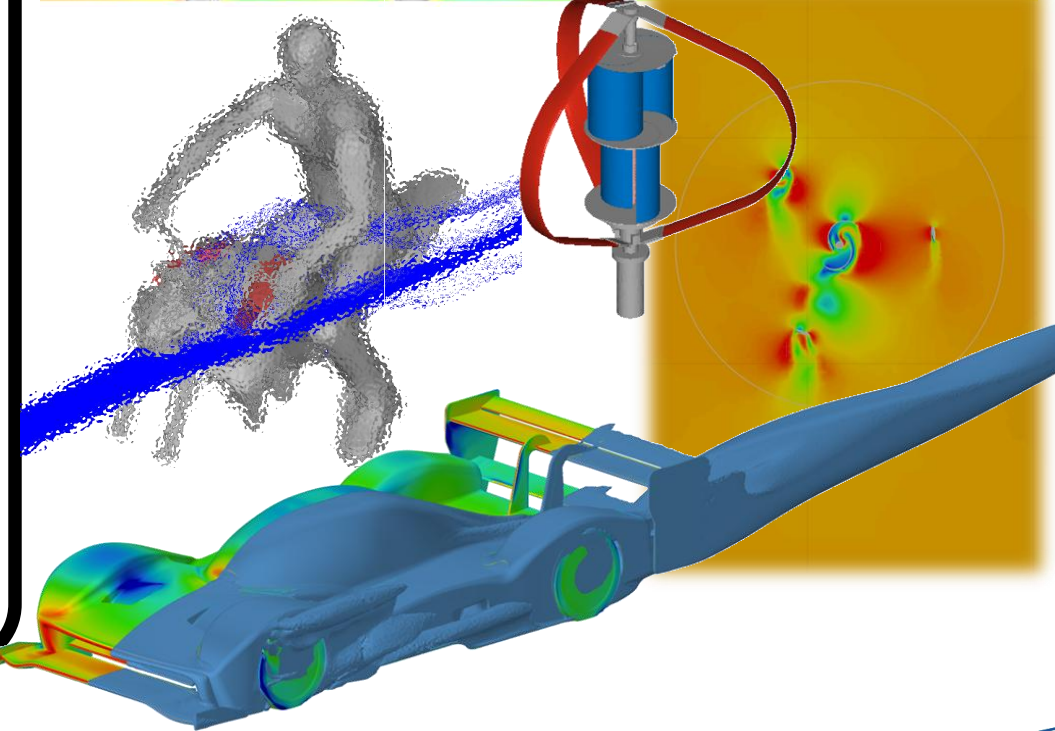
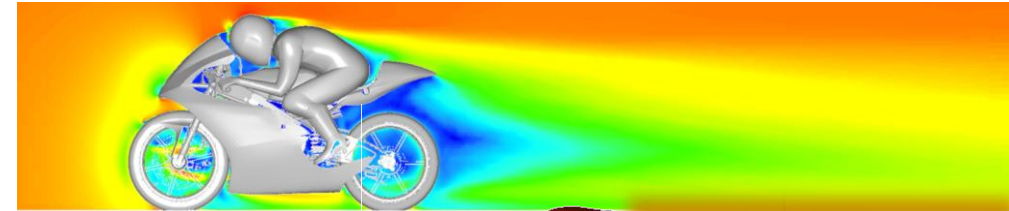
Stress and deformation analysis of the rim



Engineering – Case Study: CFD analysis

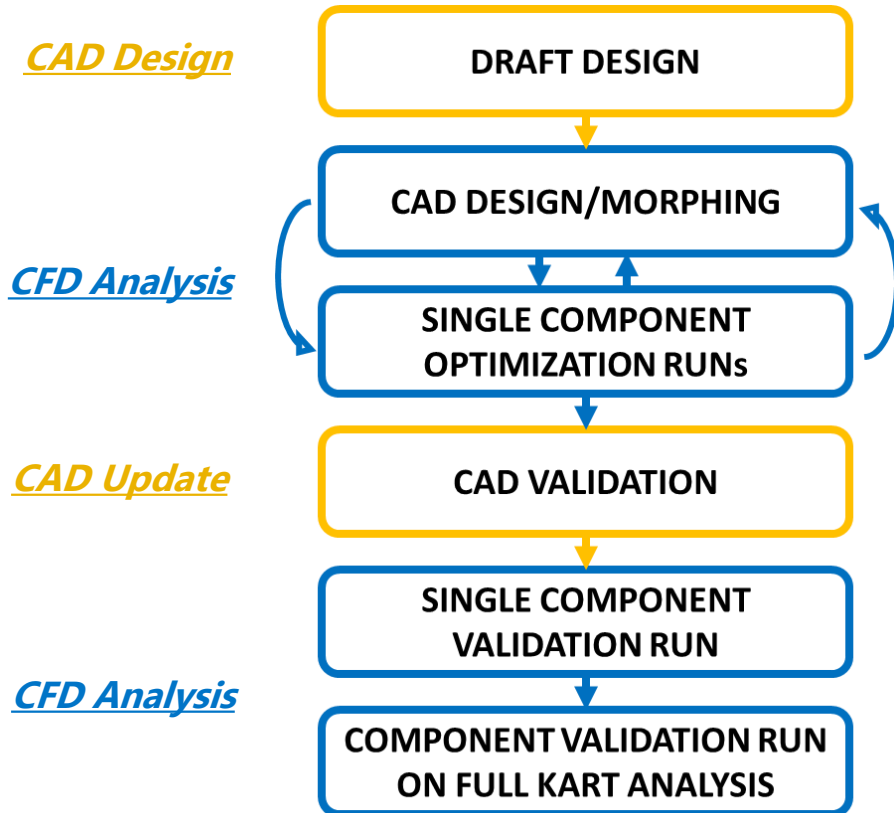
VIRTUAL VALIDATION

- Pressure Field
- Velocity Field
- Streamline Evaluation
- Iso – Surface
- Dynamic Analysis
- HTC Analysis

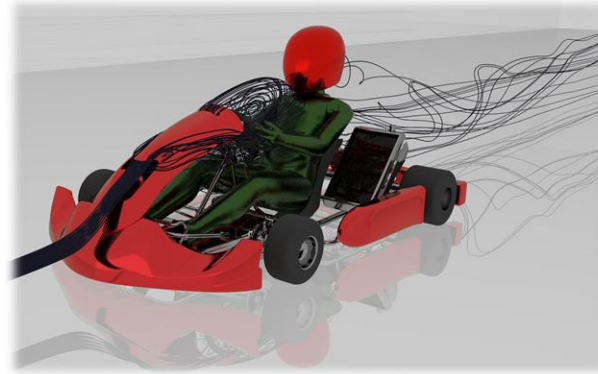


Engineering – Case Study: Motorsport

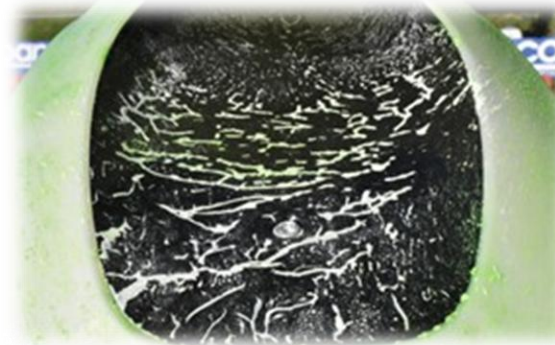
OPTIMIZATION LOOP



SIMULATION



TRACK TESTING

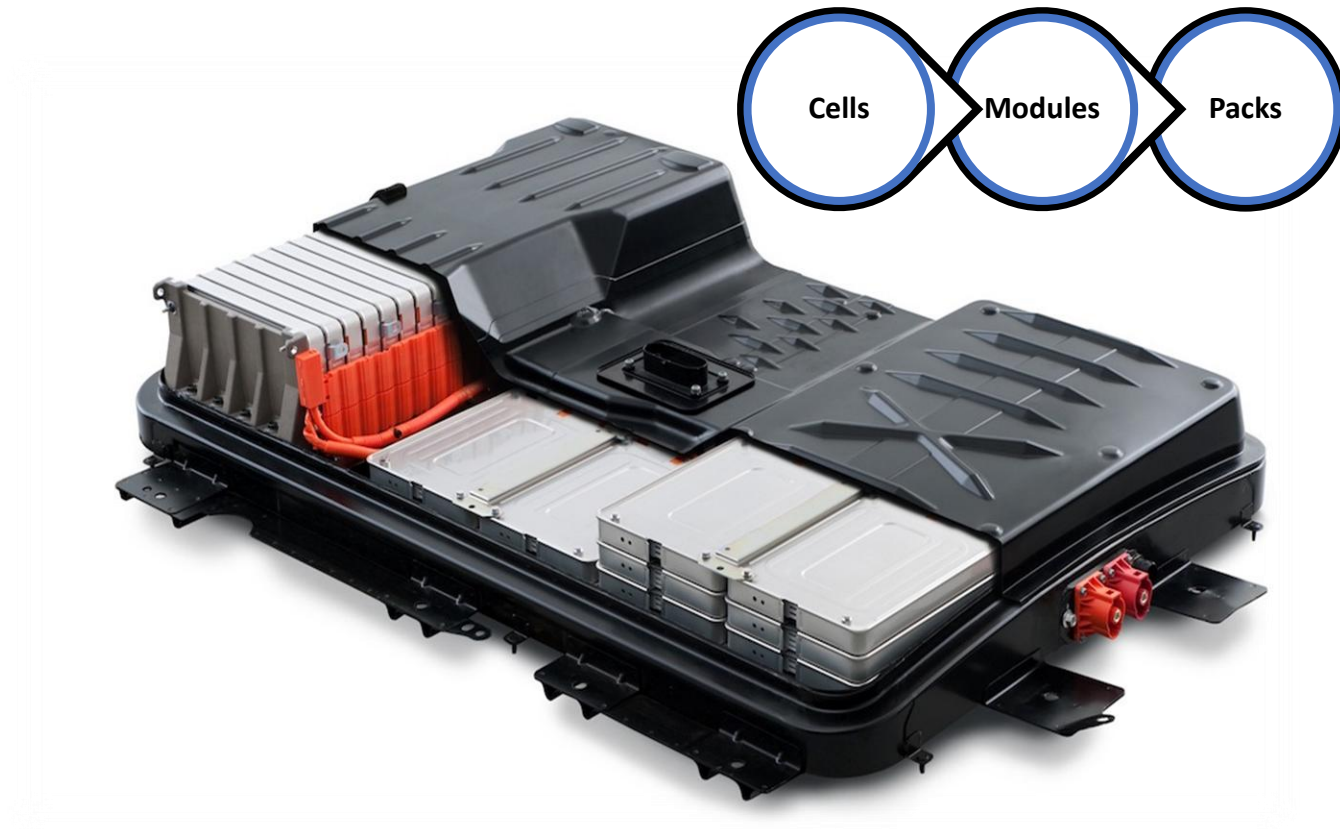


- PREDICTIVE ANALYSIS
- DRAG REDUCTION
- INNOVATIVE DESIGN EXPLORATION

Homologation

Performance & Validation

Safety



Battery Services Homologation

UN ECE-R100

- 9A / Vibration Test
- 9B / Thermal Shock and Cycling Tests
- 9C / Mechanical Shock
- 9D / Mechanical Integrity
- 9E / Fire Resistance
- 9F / External Short-Circuit Protection
- 9G / Overcharge Protection
- 9H / Over-Discharge Protection
- 9I / Over-Temperature Protection

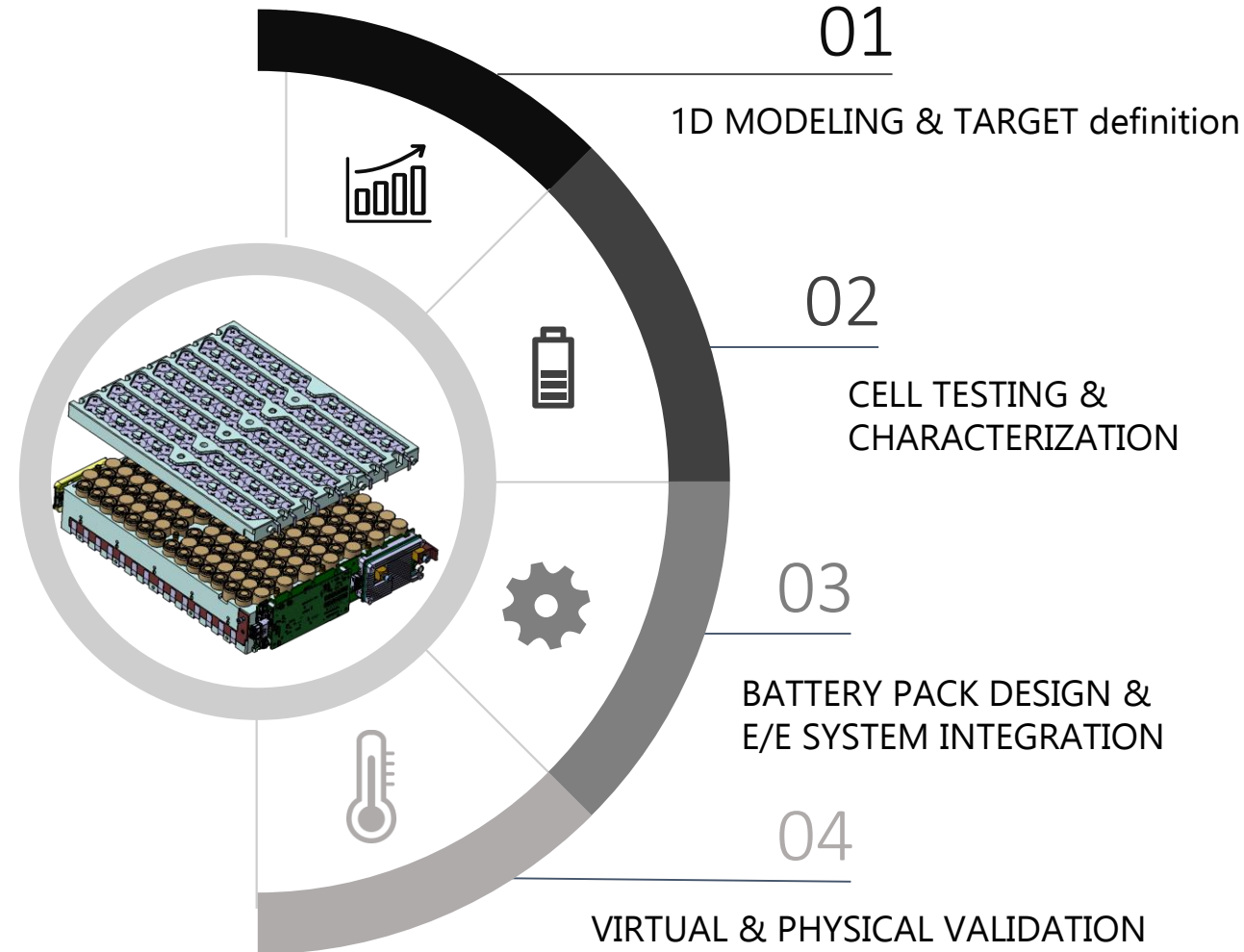
UN 38.3

- T.1 / Altitude Simulation
- T.2 / Thermal Test
- T.3 / Vibration
- T.4 / Shock
- T.5 / External Short Circuit
- T.6 / Impact/Crush
- T.7 / Overcharge
- T.8 / Forced Discharge

UN ECE-R10

Verification of compliance with electromagnetic compatibility requirements for automotive batteries fitted with BMS

Engineering – Battery Pack design



- COMPLETE MODELING OF ELECTRIC POWERTRAIN
- IMPLEMENTATION OF LIMITS AND CONTROLS
- EQUIVALENT CIRCUIT MODEL DEFINITION
- DYNAMICS RESULTS ON DRIVING CYCLES
- MODULAR IN ARCHITECTURE

- CELL PRECONDITIONING TEST
- SPECTROSCOPY TEST
- PERFORMANCE/FUNCTIONALITY TEST
- CHARACTERIZATION TEST
- ABUSE TEST

- CASE, PACKAGING AND MODULE DESIGN
- HV BUSBAR DESIGN
- E/E SYSTEM INTEGRATION, 3D WIRE ROUTING, 2D HARNESS PRODUCTION DRAWING
- COOLING SYSTEM DESIGN

- CELL STRUCTURAL & THERMAL CHARACTERISATION
- MODULE VIRTUAL VS EXPERIMENTAL CORRELATION
- THERMAL MANAGEMENT ANALYSIS
- BATTERY PACK VIRTUAL VALIDATION
- THERMAL RUNAWAY EVENT AND PROPAGATION

The logo for IMQ group, featuring the letters 'IMQ' in a large, bold, white sans-serif font, with the word 'group' in a smaller, white sans-serif font directly below it. The background is a dark blue, futuristic scene with glowing orange and blue bokeh lights and a complex, glowing blue and orange orbital structure that resembles a molecular model or a futuristic atomic structure.

IMQ

group

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IMQ

group

The logo for IMQ, featuring the letters 'IMQ' in a bold, white sans-serif font, preceded by a stylized white icon that resembles a flame or a wing.

IMQ

The logo for CSI, featuring the letters 'CSI' in a bold, white sans-serif font, preceded by a stylized white icon that resembles a flame or a wing.

CSI

The logo for IMQ intuity, featuring the letters 'IMQ' in a bold, white sans-serif font, followed by the word 'intuity' in a smaller, white sans-serif font, preceded by a stylized white icon that resembles a flame or a wing.

IMQ
intuity

The logo for IMQ MINDED SECURITY, featuring the letters 'IMQ' in a bold, white sans-serif font, followed by the words 'MINDED SECURITY' in a smaller, white sans-serif font, preceded by a stylized white icon that resembles a flame or a wing.

IMQ
MINDED
SECURITY

ITALY | CHINA | GERMANY | INDIA | POLAND | SPAIN | TURKEY | UAE | UK

