MESHINING Engineering

PROSESC Conference – Győr
25.10.2011.

Design of light weight electric vehicles from composites

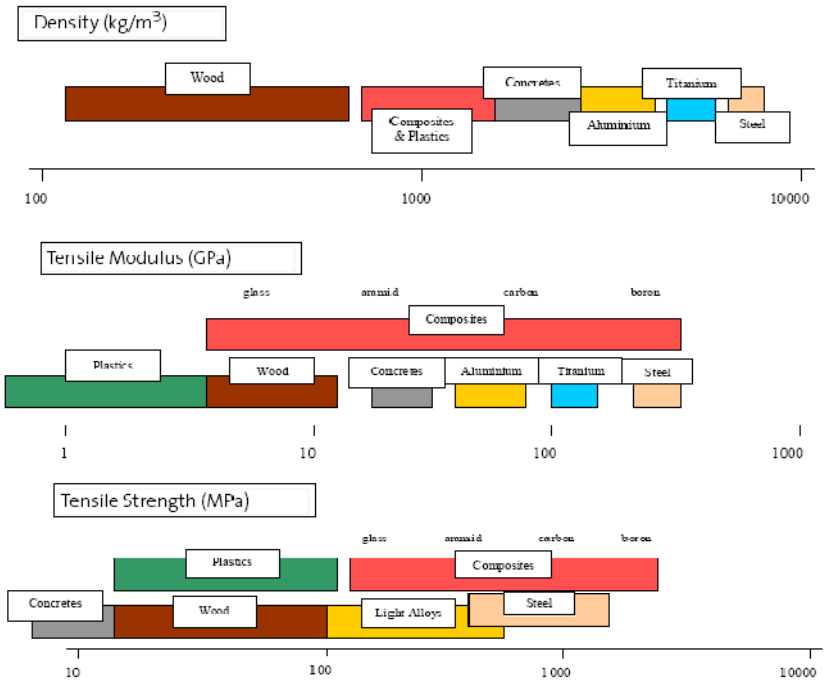
Zoltan Kabacs
MESHINING Engineering

Trends

- **Vehicle mass increasing**
- **New drive and energy storage systems**
- **New safety requirements**
- **New legislations**
- **New functions and services in vehicle**
- **New segments**

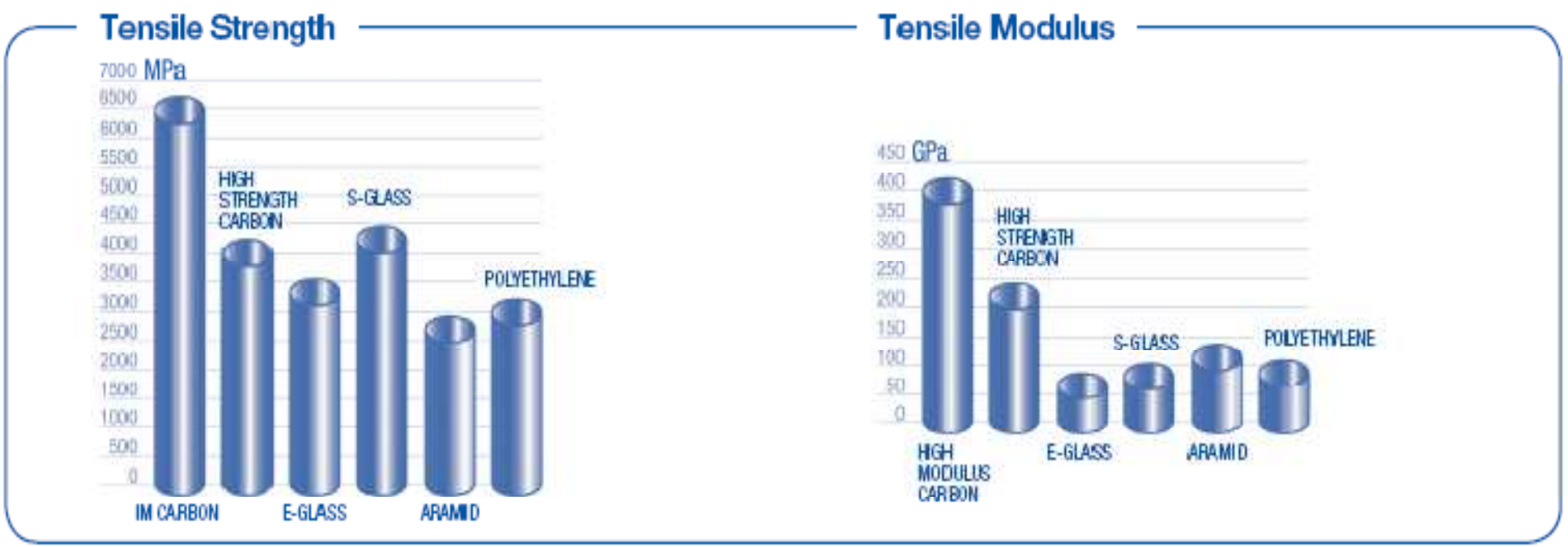
Light weight design

Source: Lamborghini



Source: ACG

Type of composites

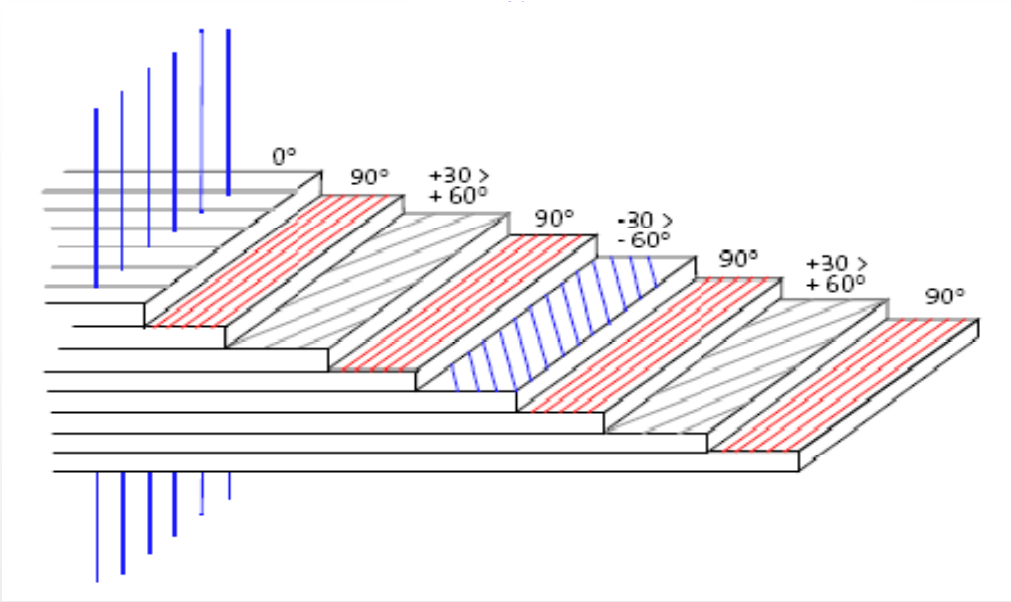


Source: Hexcel

Source: Bugatti

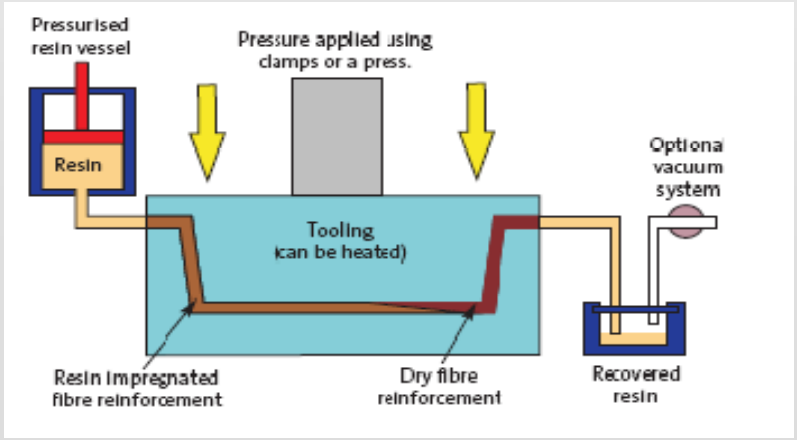
- Core elements
  - Foams (e.g. PUR)
  - Honeycomb
  - Aluminium foam
  - Cork
  - Balsawood

Production technology



- **Wet Lay-Up**
  - Hand laminating
- **Prepreg in Autoclave**
- **RTM / RTM Lite**
- **Resin infusion**
- **Press molding**
- **Injection molding (short)**

Source: Tesla



Sectors / Material caracteristics

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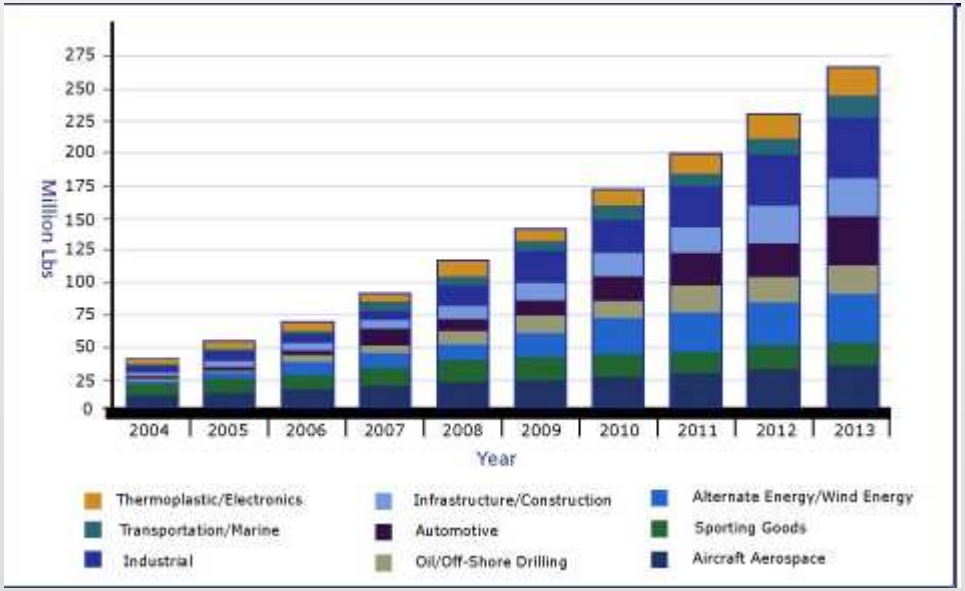
- **Aerospace, Aircraft**
- **Defense**
- **Transportation incl. Marine**
- **Automotive racing**
- **Automotive**
- **Energy**
- **Construction**
- **Sport and recreational**
- **Health and wellfare**

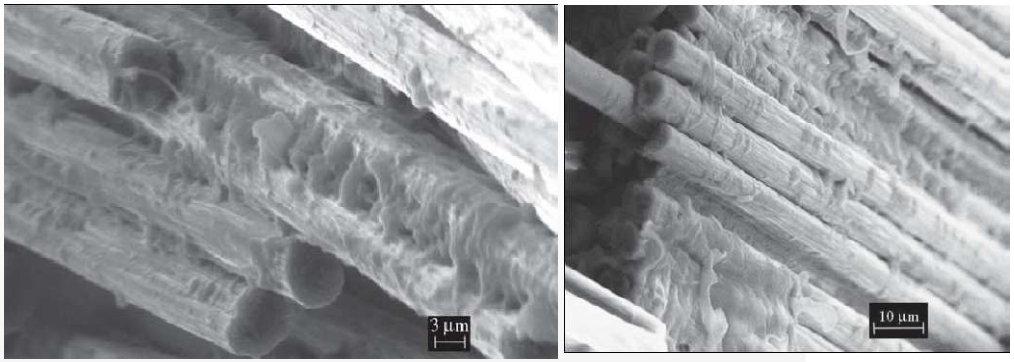
Source: BMW



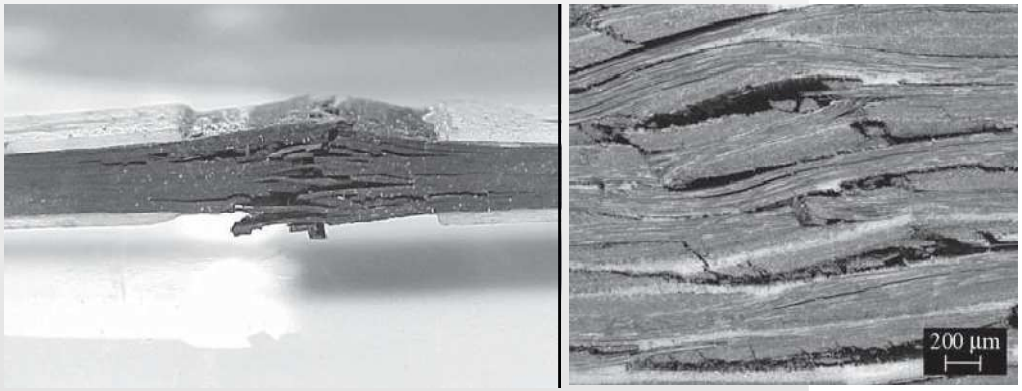
Future growth trends for the carbon fiber industry

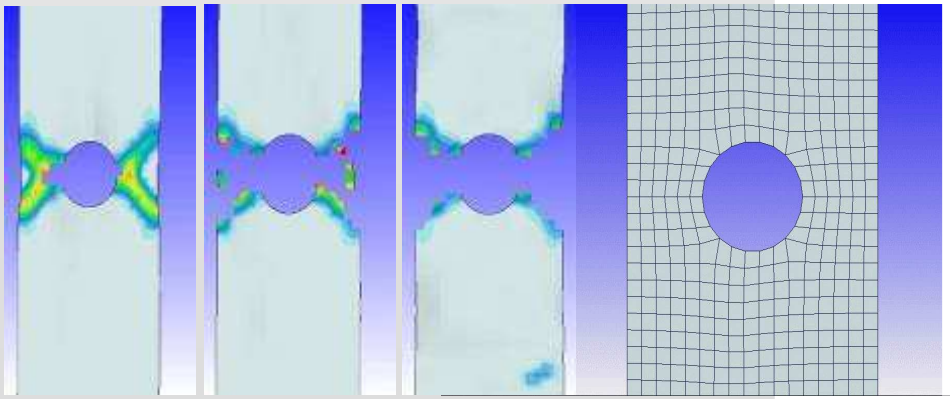
Source: ZOLTEK

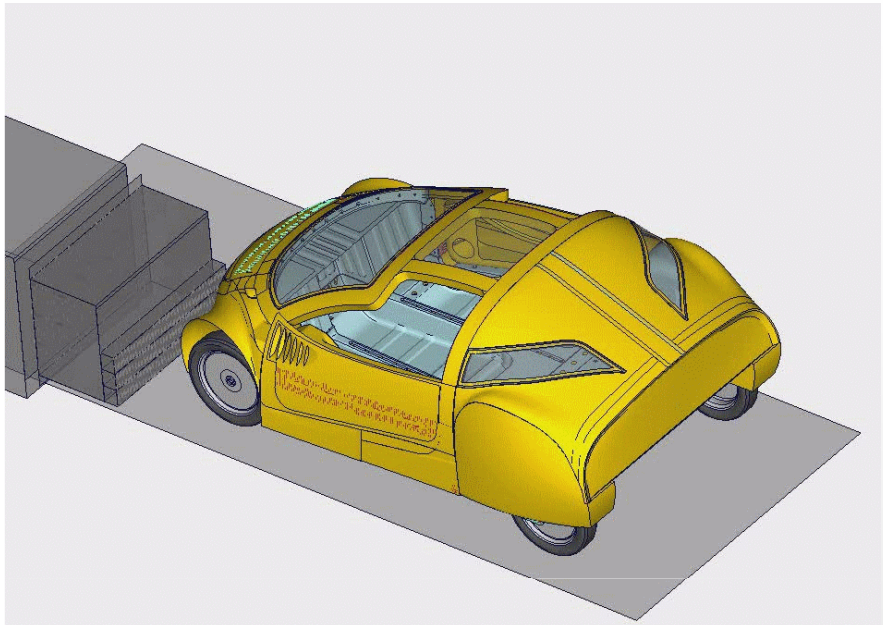
Composites



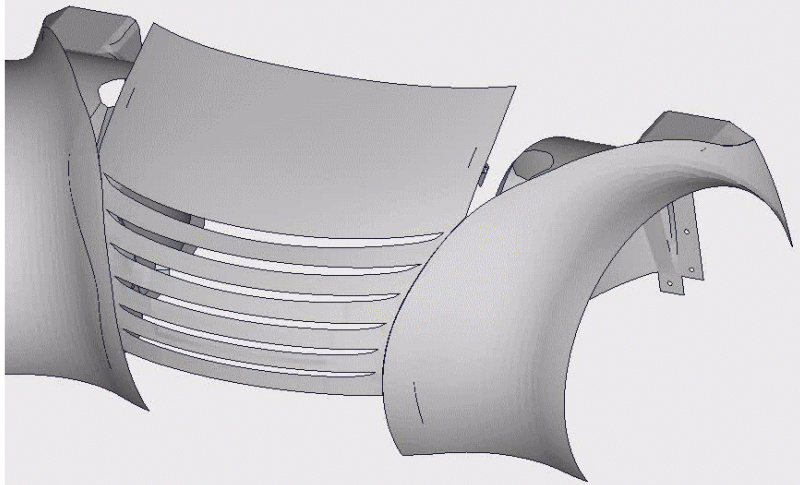
Composite lamina – *2000x*
(adhesive connection between fibers and matrix)







Damage Development



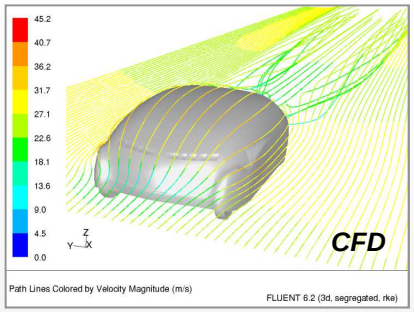
CAD Design

- BIW CAD-Design
- Door Design
- Design suspension

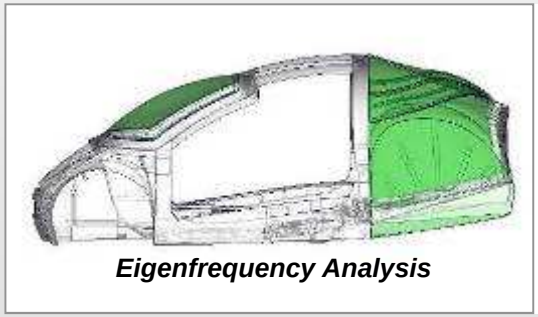
Calculations, simulation

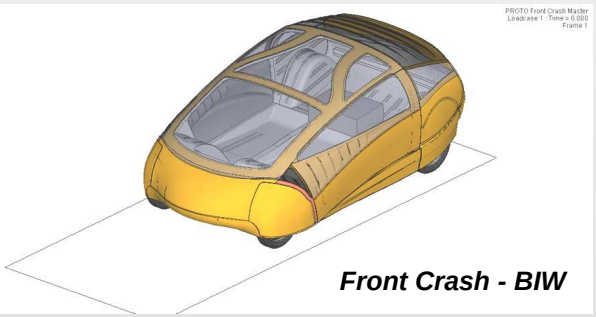
- FEM calculations
- Crash simulation (EURO/NCAP)
- **Composite** calculation (Thermoplastics)
- Optimization
- CFD analysis

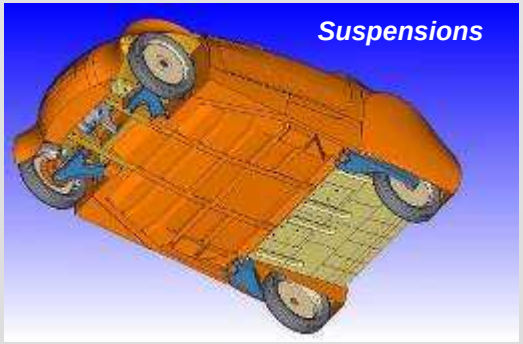
Business plan

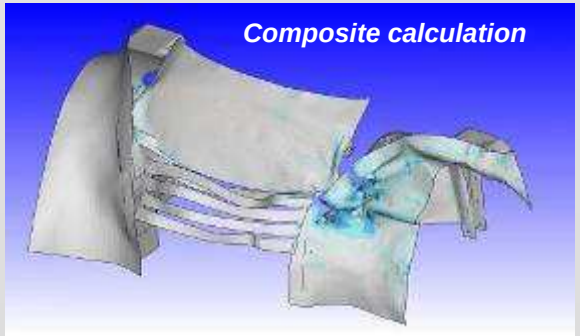


CFD


Eigenfrequency Analysis


Front Crash - BIW


Suspensions


Composite calculation

Realized prototype

Project MOVEO™

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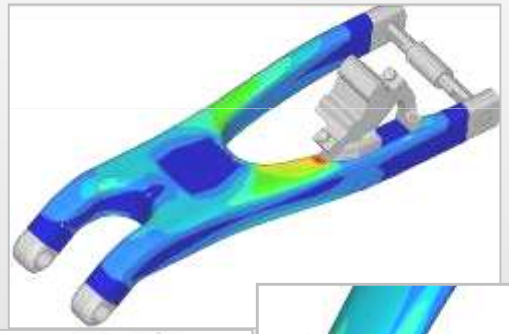
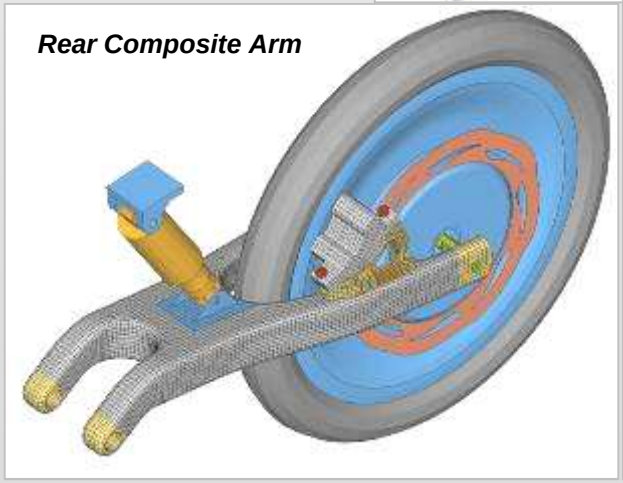
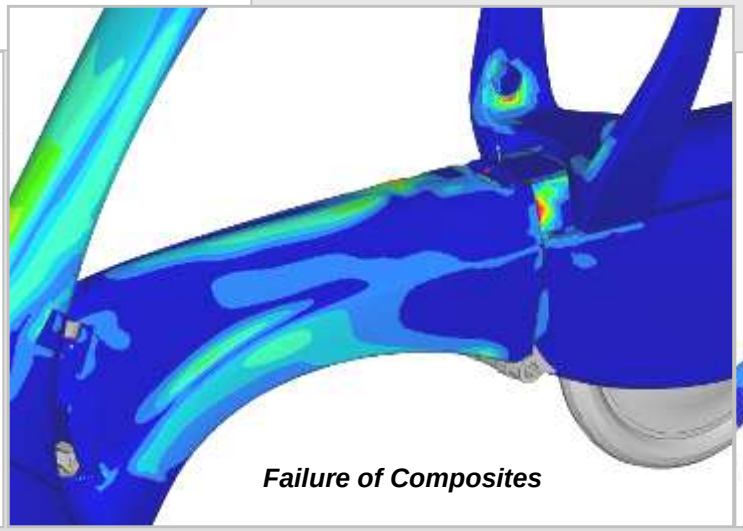
- **Industrial study**
- **Simulation**
  - Static
  - Dynamic
  - Eigen frequency
  - Composite optimization (Thermoset)

MOVEO™



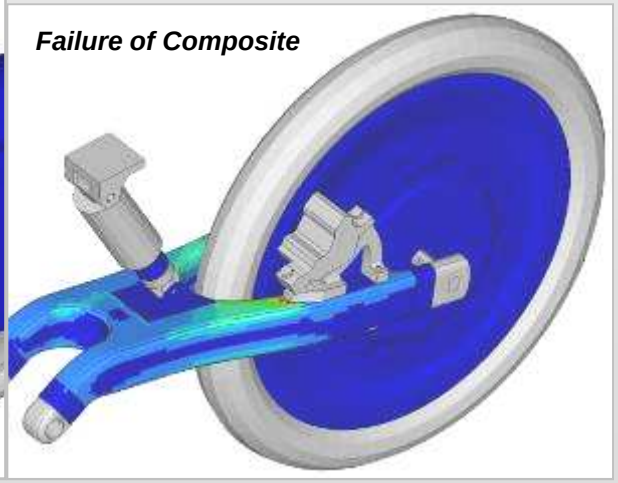
Rear Composite Arm





Failure of Composites

Failure of Composite

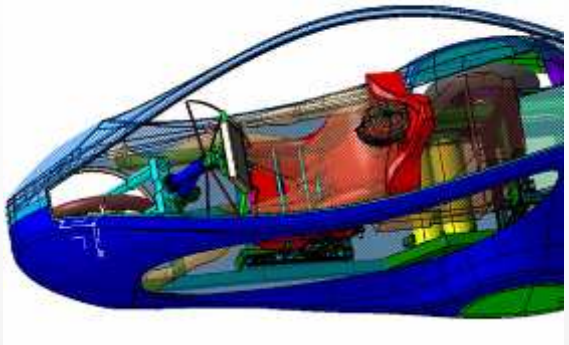


Project Hy-Go™ 2.0

MOOLINVEST

MESHINING Engineering

- **Turn key solution**
  - CAD Design
  - Composite calculation (Thermoset)
  - Realization
    - Manufacturing CFR
    - Assembly



Fuelcell alternative traffic solutions

5th Széchenyi Race
25th April 2010

Category Winner

Special Award –
Most innovative vehicle

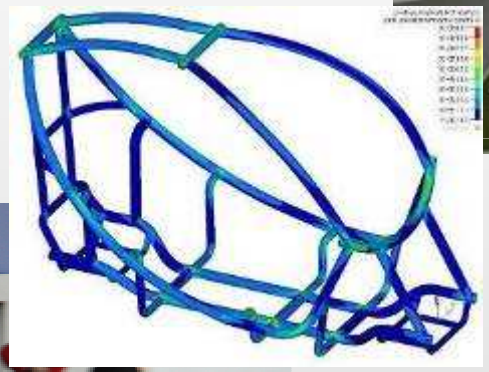
Project MICRON

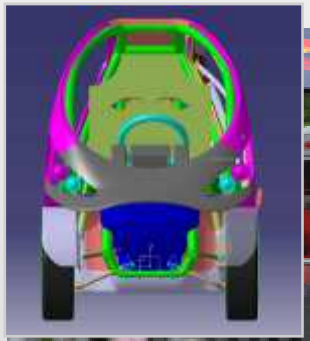
EXID Assistance Aux Projets

MESHINING Engineering

Turn key solution

- Project co-ordination
- Purchasing
- CAD Design
- Analyses Static, Dynamic, Eigenfrequenz
- Prototyping incl.Tooling
  - Exterior GFR / CFR
  - Chassis
  - Assembly





Project start:	15th of September 2010
Delivery proto:	26th of February 2011
Official presentation: **Geneva**	**1st of March 2011**

Test drive:

6th Széchenyi Race, Győr	**1st of May 2011**
47,3 km in 92 Min. ~ average speed	31 km/h

Project M55-Bike

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- **Calculation CFR**
- **Replacement alu parts with CFR**
- **Prototyping CFR**
  - Tooling
  - Proto parts

Project CCB

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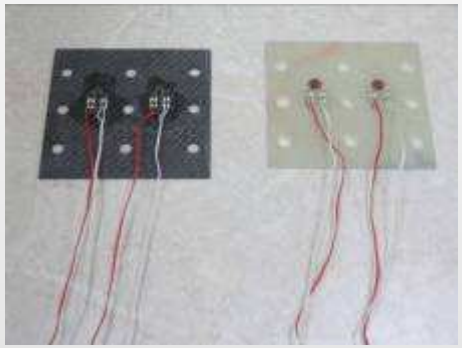
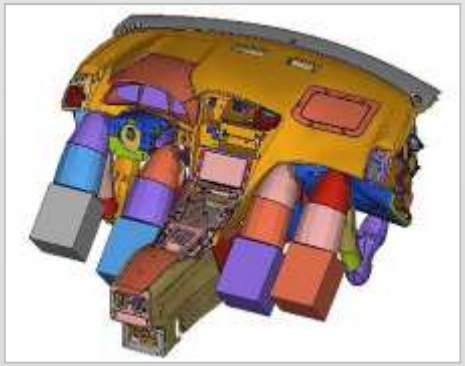
- **Redesign of cross car beam from carbon fiber composite**
- **Co-operation project with Széchenyi István University Győr, Department of Applied Mechanics**
- **Using of standard simulation techniques for material behavior and occupant safety (knee- and head impact)**
- **Material: Prepreg (Thermoset)**





CAE Project example

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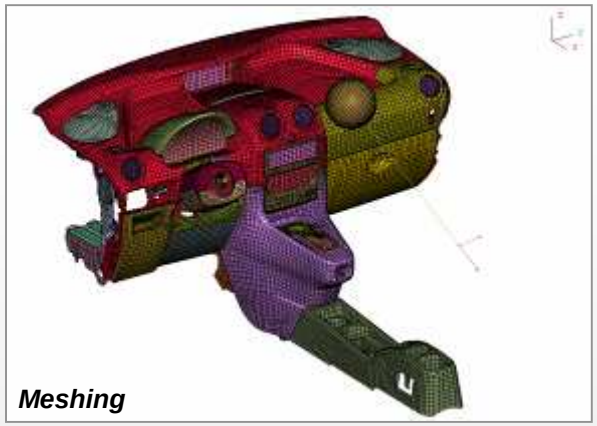
Complex work

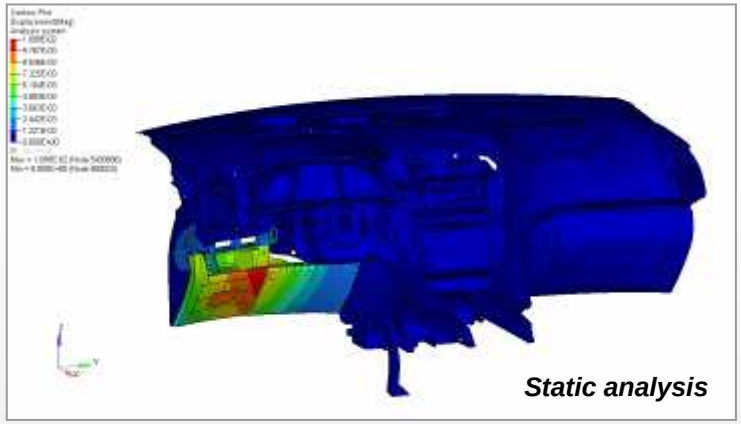
- Meshing
- Static analysis
- Eigen frequency
- Head impact analysis
- Knee impact analysis
- Conclusions
- Optimization if needed
- Final report and file transfer

SW knowledge

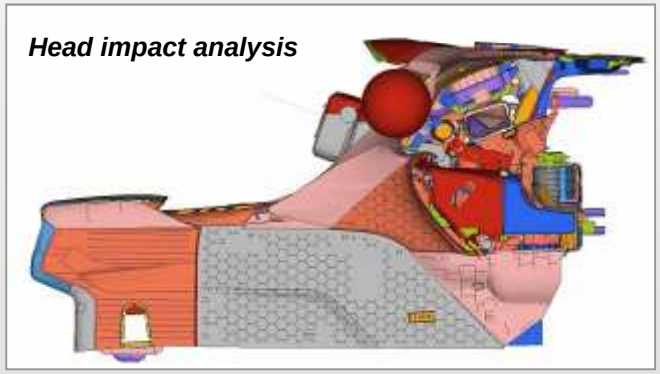
- CAD
  - **Pro/E**
  - **CATIA v4 / v5**
- Pre/Postprocessors
  - **ANSA**
  - **Hypermesh / View**
  - **Visual-Environment (ESI)**
- Solvers
  - **ProMechanica**
  - **PAMCRASH**
  - **MSC Nastran**
  - **Abaqus**



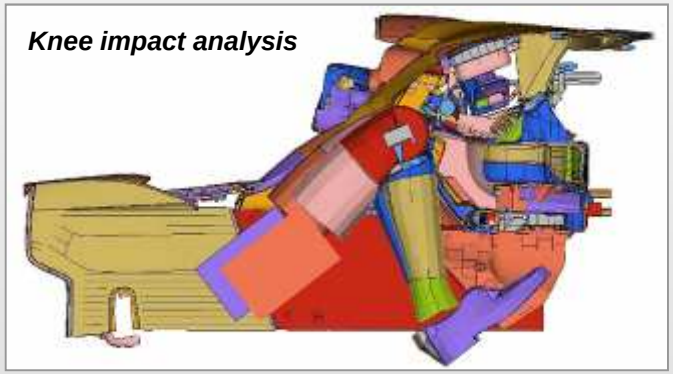
Meshing



Static analysis



Head impact analysis



Knee impact analysis

Optimization

Summary / Reporting

Rollover Kravtex Citadell – PAM/CRASH

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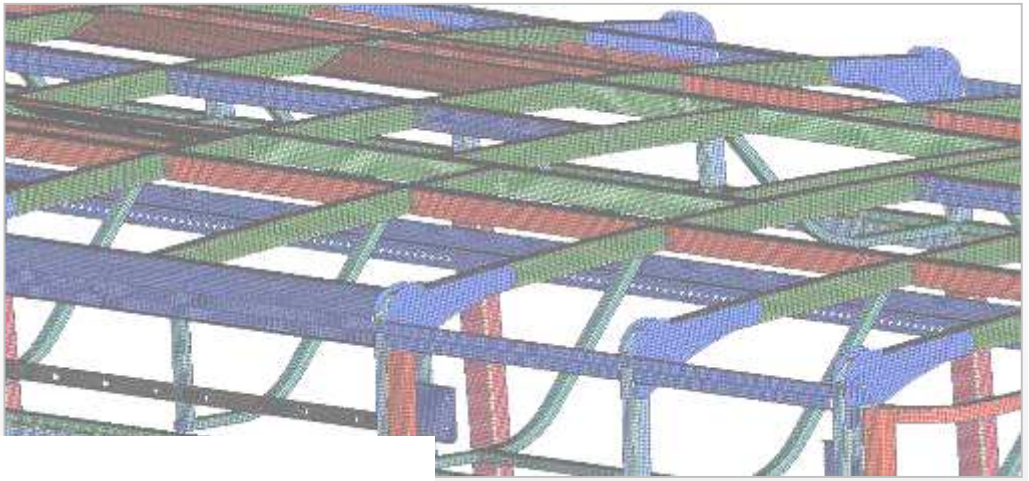
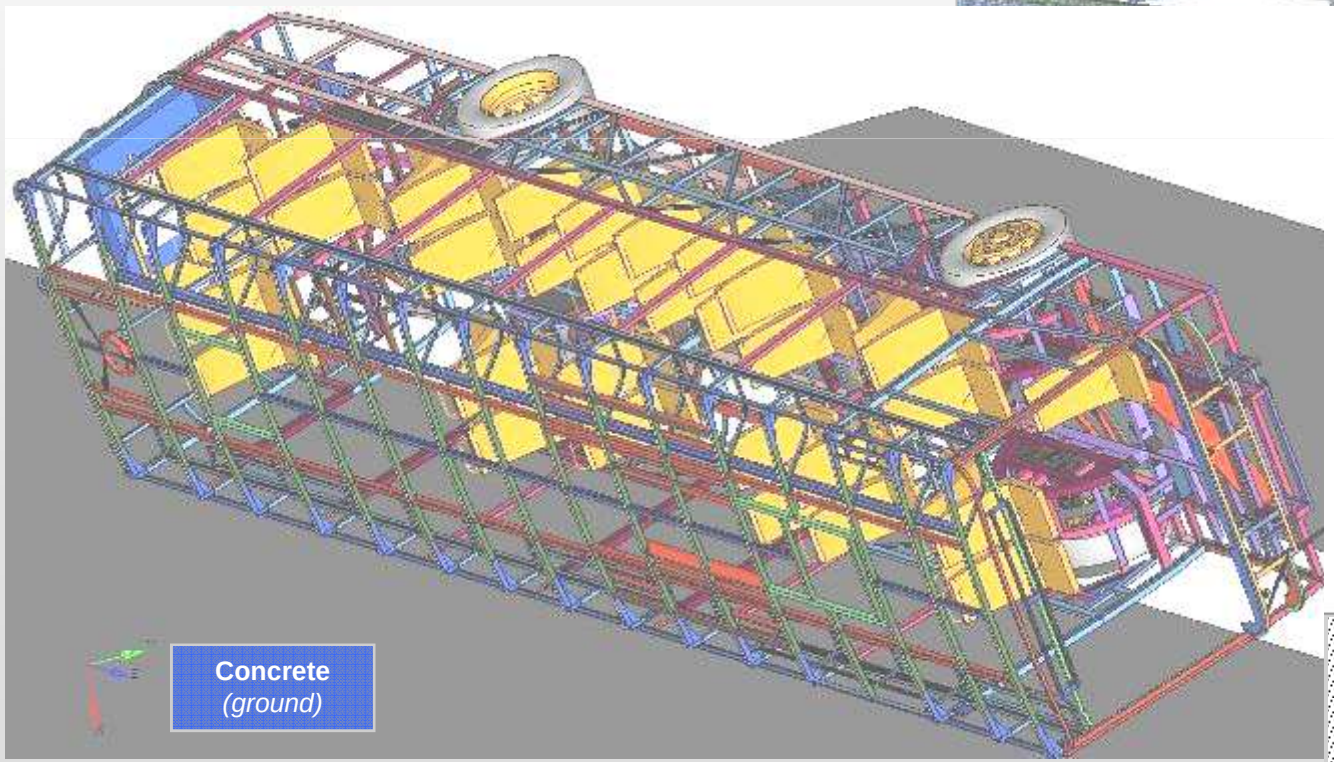
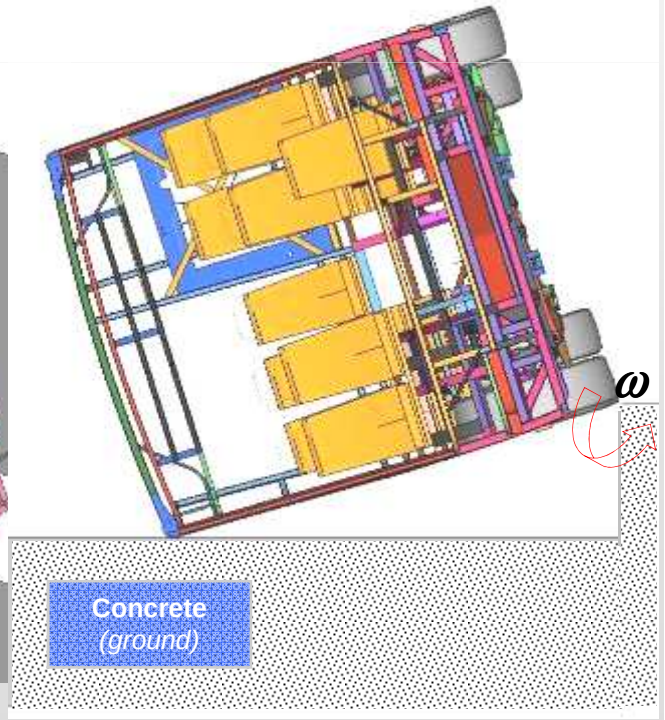
PAMCRASH MODEL:

- *NODE No.: 2094251*
- *ELEMENTE No.: 2109456*
- *ELEMENTE Type:*
  - *PamCrash SHELL (Material 103)*
  - *PamCrash SOLID (Material 1)*
  - *PamCrash BEAM (Material 201)*
  - *PamCrash RBODY (0 type)*
  - *PamCrash MASS*
  - *PamCrash NSMAS*





4.3 PamCrash Model – PamCrash model of SOLO BUS



4.4 PamCrash Model – First contact with ground

Contact

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