Econ engineering portfolio

VIRTUAL PROTOTYPING | SIMULATION & TESTING | INDUSTRIAL AUTOMATION

01/09/2024

Intro

Econ Engineering is a cooperative engineering partner engaged in consultation: cutting-edge CAE services, and special-purpose machine design, reliable product development through high-added-value simulation technologies.

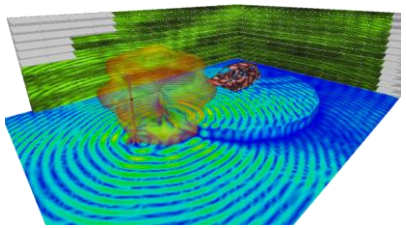
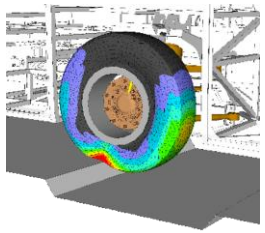
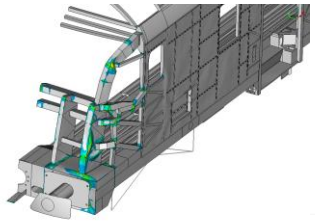
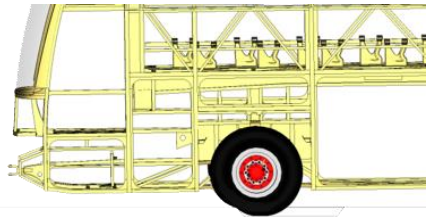
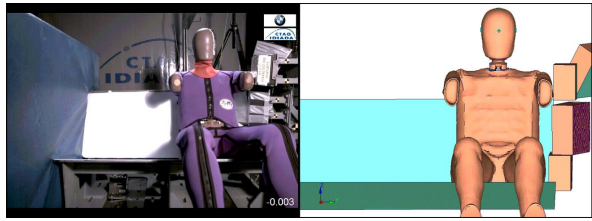
- Independent engineering consulting company
- Founded in 2002, 120 employees
  - Headquarter in Hungary, Budapest
  - German office, Kirchheimbolanden
  - US office in the Space City, Houston, TX
- Fields of expertise — Automotive | Aerospace | Space | Composite | Defence | Healthcare | Energy (Renewable, Oil & Gas) | Agriculture
- Certifications — ISO9001, ISO27001, EN9100, TISAX Level3, GE IT-Security, DOA in progress
- Certified Channel Partner of

Ansys Moldex3D CAST-DESIGNER Upfront design & analysis system for casting Particleworks Particle-based simulation software for CAE CFturbo dante

OUR comprehensive services portfolio

- **FEA software** (Ansys, Moldex3D) Channel Partner since 2002 – complete product portfolio, training and support
- **High-added value** consultancy, outstanding quality, reliability & flexibility
- **Structural** mechanics & dynamics
- **Fatigue** simulations – HF, LF, TMF
- **CFD**, aerodynamic design
- **Electromagnetic** design challenges
  - LF, HF, Thermal management, HFSS, EMC/EMI
- **NVH** – Noise, Vibration, Harshness

- **Cutting-edge composite** knowledge & **Prototyping** of unique composites
- Method and application developments using **AI** & **Machine Learning**
- **Automation** solutions & **production** technology
- In-house **Test & Measurement Laboratory**
- Education & training
- **R&D** capabilities
  - Method developments – composite life-time estimation, virtual blade modelling

WHAT MAKES ECON UNIQUE?

- Application of **new technologies** for the space/aerospace, heavy-duty, defense industries
- Virtual **validation & verification** – Digital Twin
- **High-end engineering** – extensive knowledge in composites
- **Method development** service life evaluation method for composites – **eCon won the JEC Innovation Award**
- **Reduce the development time** and market-entry periods with qualified engineering capabilities
- **Focus** – sustainability

JEC WORLD INNOVATION AWARDS WINNER 2019

Method development

- Advanced materials – e.g. hybrid materials, composites (thermoset and thermoplast),
- Quick and effective concept development in the early phase of product development
  → without physical testing in the prototype-development phase
- Development of the **driver in the loop** → autonomous driving

Explore our case studies

eCon Engineering – Simulation & Testing

Applications

Structural mechanics, dynamics & fatigue

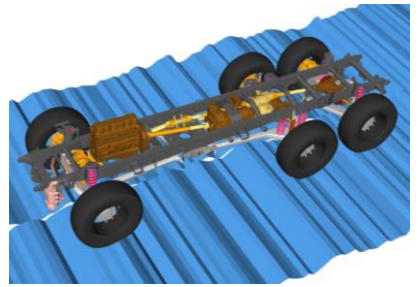
- Assessment of structural mechanical integrity for different materials with respect to lifetime
- Thermo-mechanical investigation, vibration (modal, harmonic,
PSD etc.), multibody simulation, topology optimisation
- Crash simulation method development
- Crash test dummies: validation
of simulation models
- Material model and failure model development of dummy materials
- Integration of HBM (human body models)
in BMW car crash tests

Passenger car NVH simulations

- Structure-born noise
- Improving passenger comfort regarding the acoustic performance of the vehicle chassis

Artificial Intelligence

- Prediction of crash performance of chassis based on available data from the past
- Intelligent material model creator for composites and elastomers
- Data processing of crash tests
- Intelligent Propeller modeling using AI

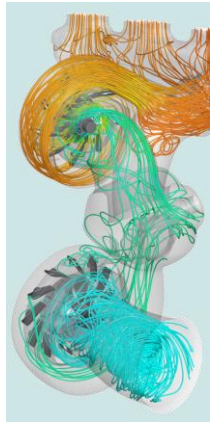


R&D

- Virtual proving ground for heavy-duty- and defence vehicles
- Intelligent Material Characterization System for Reinforced and Unreinforced Materials for Simulation Purposes

CFD

- Assessment of design variants – various turbocharger simulations
- Propeller design & optimization, virtual blade method development
- HVAC

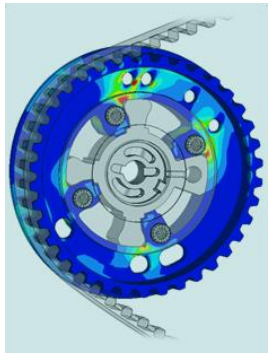


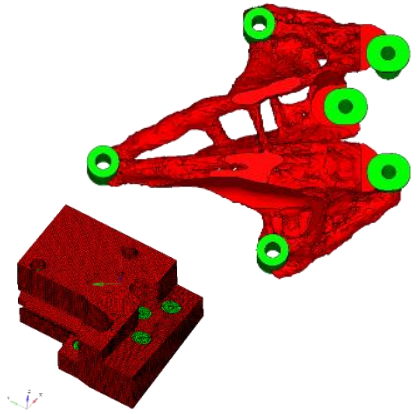
Topics of structural simulations

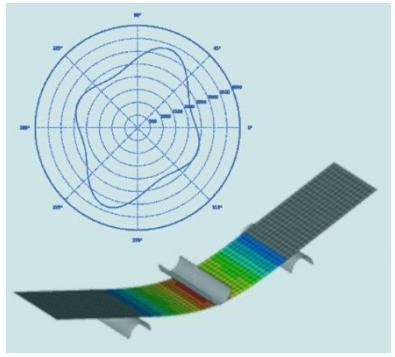
- Assessment of structural mechanical integrity for different materials with respect to lifetime
- Thermo-mechanical investigation, vibration (modal, harmonic, PSD etc.), multibody simulation, topology optimisation
- Development and/or improve of light-weight structures
- Integration to environment, methods
- Development of Python based tools, scripts and methods

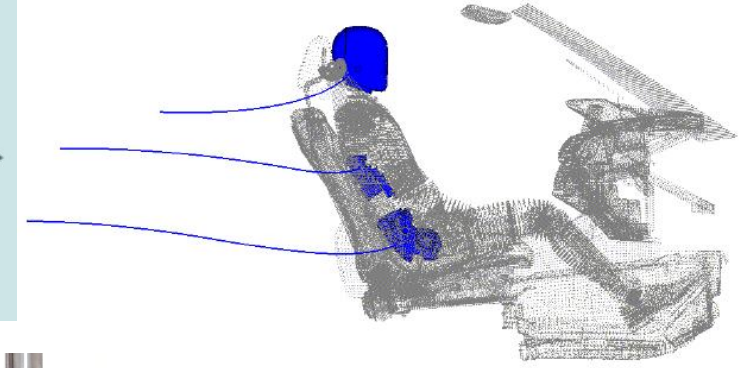
Fatige testing and material characterization – in house laboratory

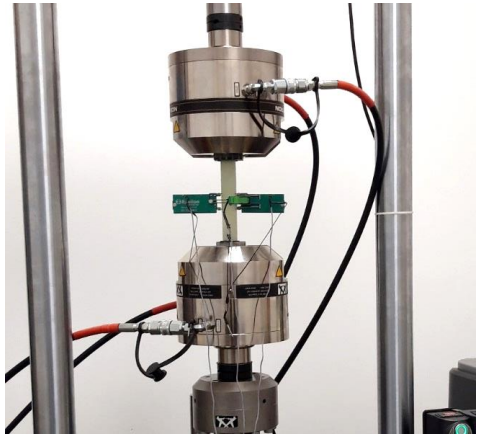
- Universal testing machines
  - 50 kN servo-electric (H&P)
  - 100 kN hydraulic-fatigue (Instron)
- Accessories
  - Tensile, compressive, bending and shear test kits
  - Uni- and biaxial clip-on extensometers
  - Strain gauges with 8-channel amplifier
  - High speed and thermal cameras

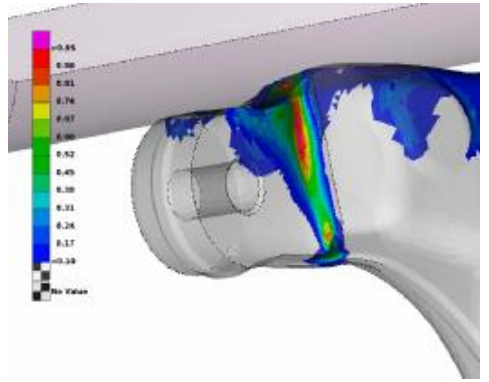






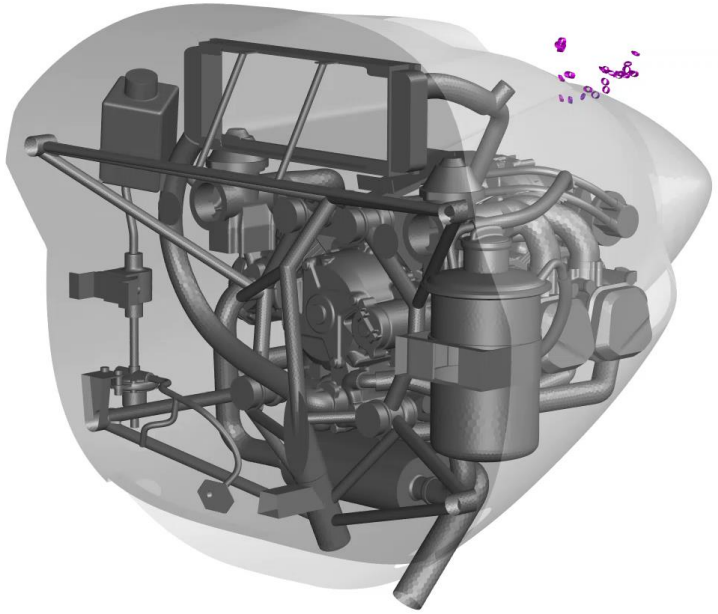


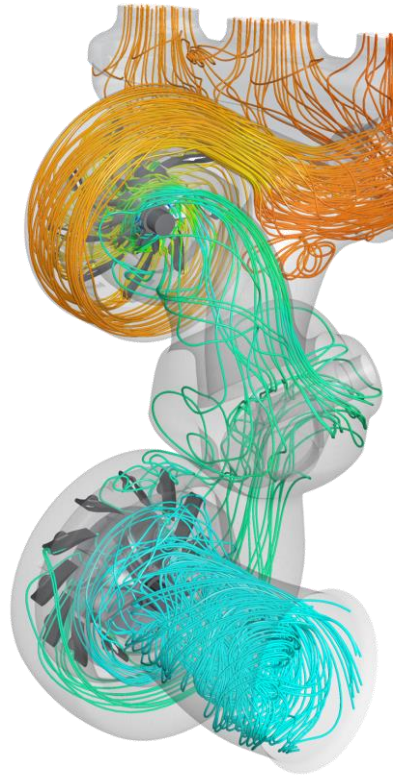


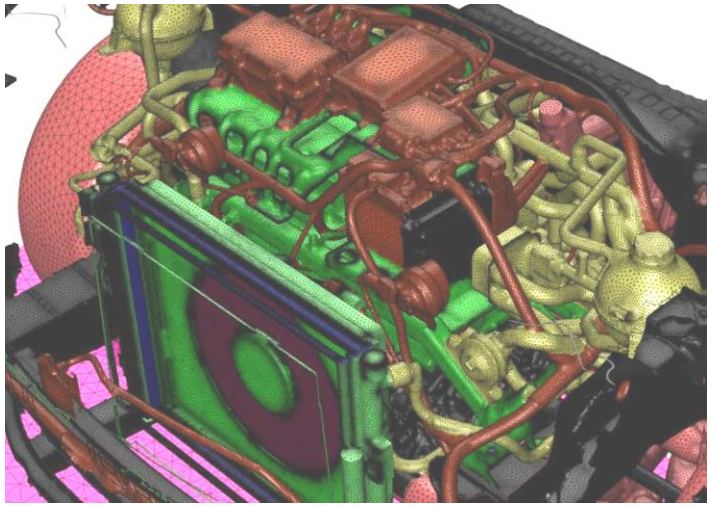


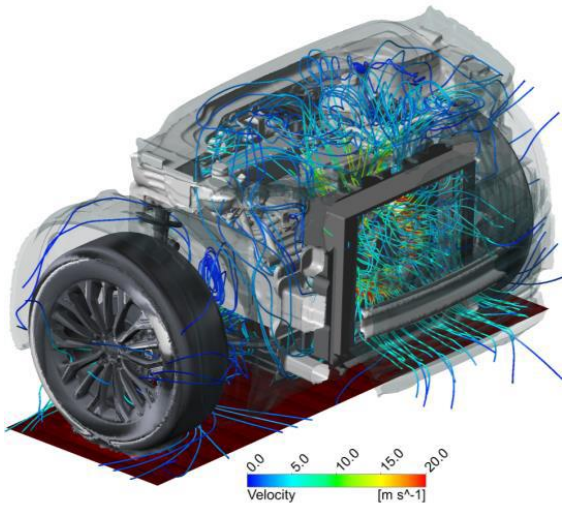
Topics of Fluid DynamiCS

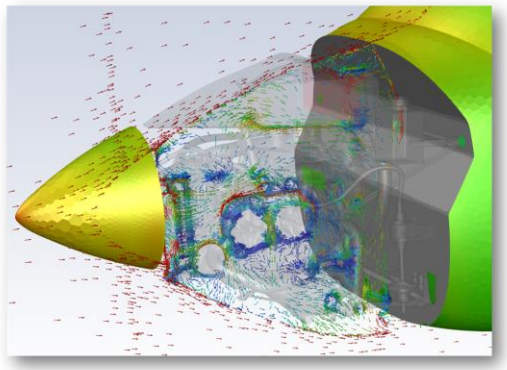
- Turbomachinery
- External Aero
- Heat Transfer assessment
- HVAC / Airconditioning
- Noise

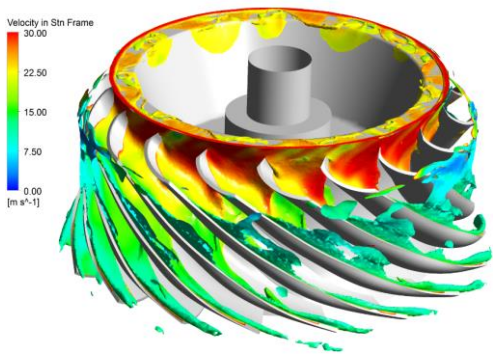






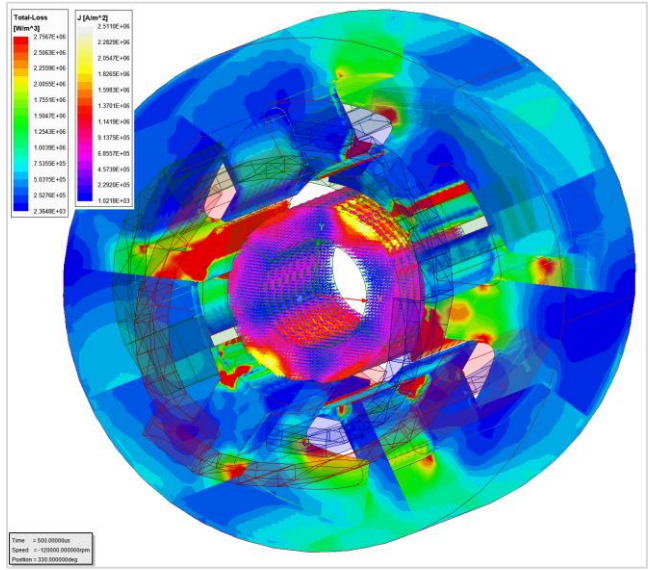


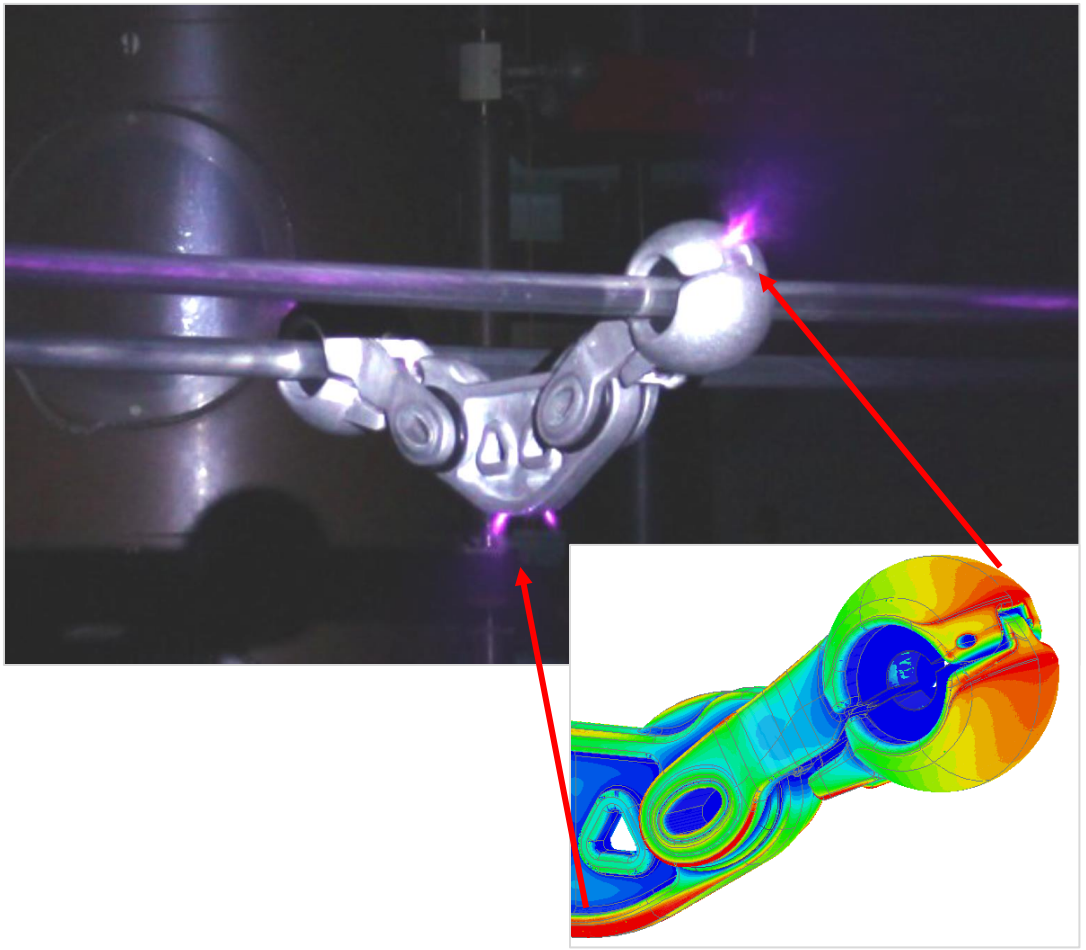


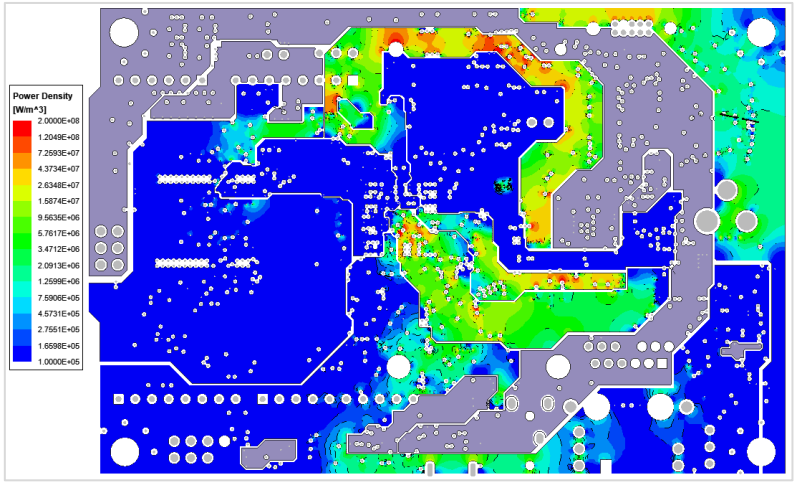


Topics of Electromagnetics

- Low & High Voltage
- Printed Circuit Board
- Antennas / Radiation
- Electro motors
- System integration and system development

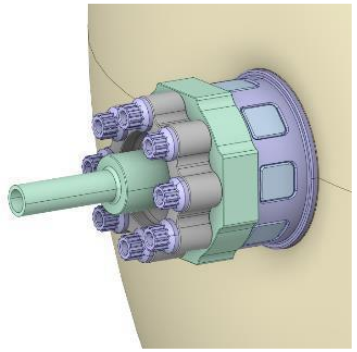


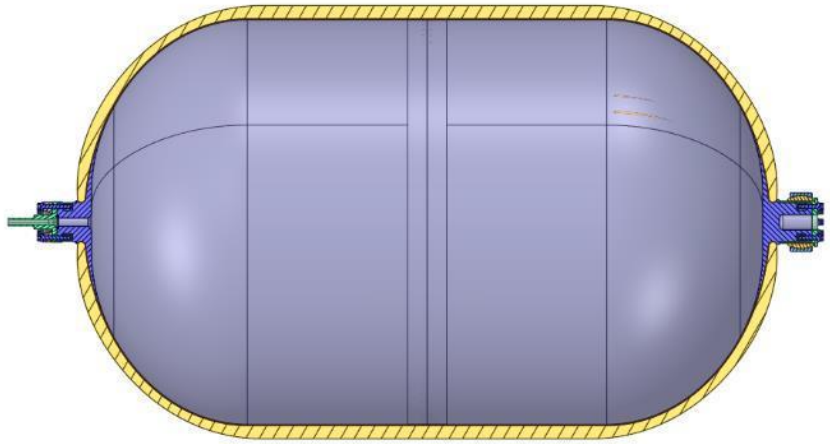




Energy storage for different industries

- Composite Overwrapper Pressure Vessel – COPV
- Thermoplastic carbon fibre composite material
  - Material fitting
  - Sutainibility → use theroplastic raw
- For H2 & He
- Until 700 [bar]
- Design of serial automation
- Test and validation, homologation

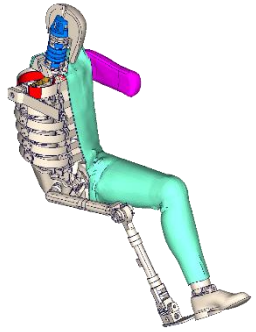




METHOD DEVELOPMENT
BMW VIRTUAL DUMMY LABORATORY – OVERALL CONCEPT

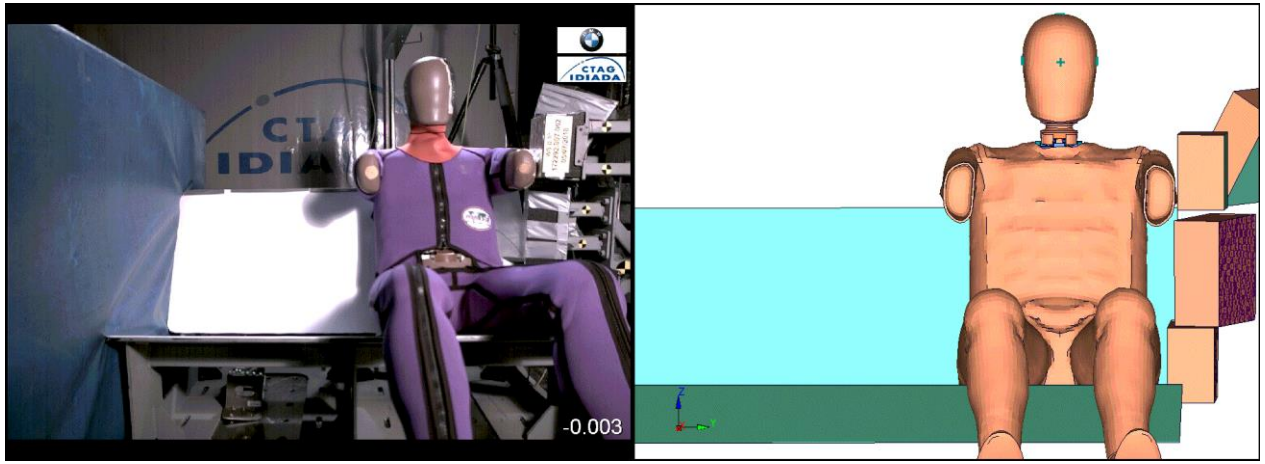
The task of the Virtual Dummy Laboratory is dummy **development, integration and quality assurance** of all dummies in all vehicle projects.

- Development
  - **Centralizing** all dummy model tasks
  - Transparency in **prognosis quality**
  - Determination of need for action
  - **Validation** /certification with standard and BMW-specific load cases
  - **Open access** for dummy model suppliers
- Integration
  - **Integration** to BMW environment
  - Managing cooperation to suppliers
- Quality assurance
  - **QA process** when changing/updating crash code
  - Statistics and forecasting quality improvements



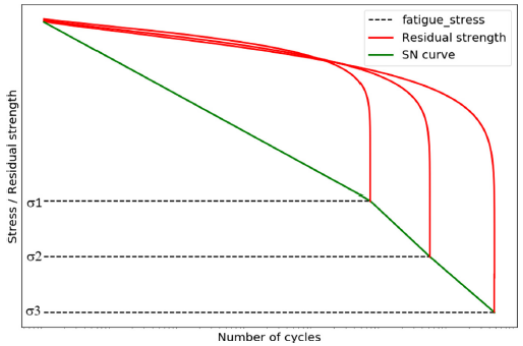
100+ measurement channels

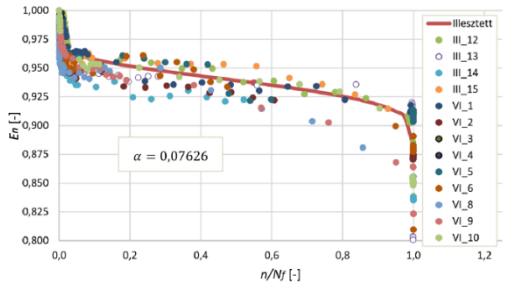
- Acceleration
- Angular Velocity
- Displacement/Angle
- Force/Moment

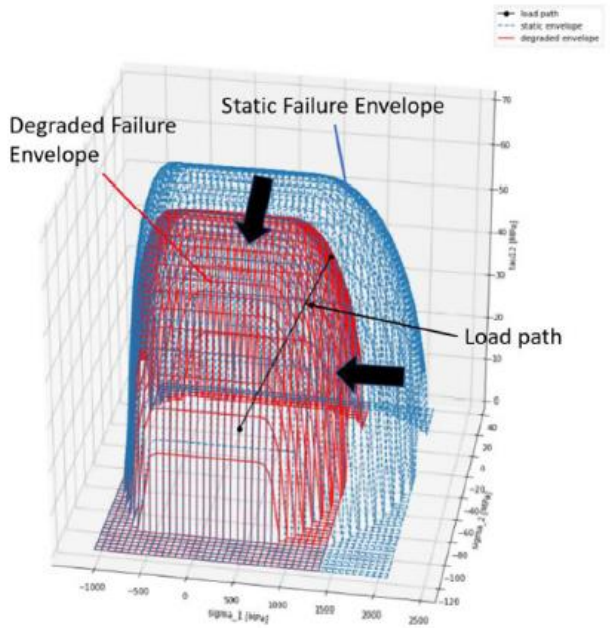


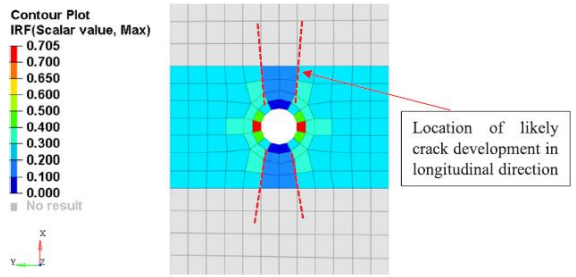
METHOD DEVELOPMENT
SERVICE LIFE EVALUATION METHOD FOR COMPOSITES

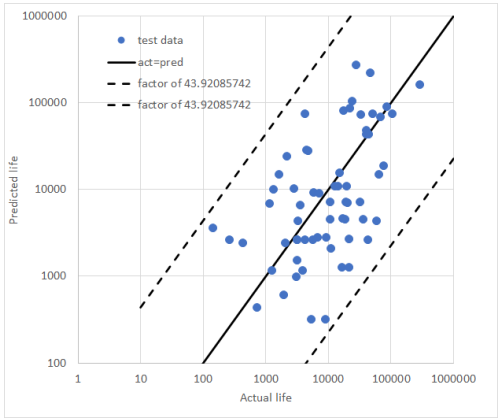
- **Calculation of composite fatigue life in FE environment – no similar solution available on the market**
  - Treats stiffness and strength as characteristics degrading with cycles → fatigue = progressive degradation
  - Combines methods from literature developed for unidirectional loads with a complex failure theory → innovation
  - Complex failure theory and FE based ply stress calculation ensures usability on ANY ply stackups and geometries

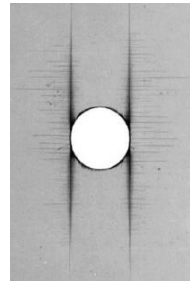


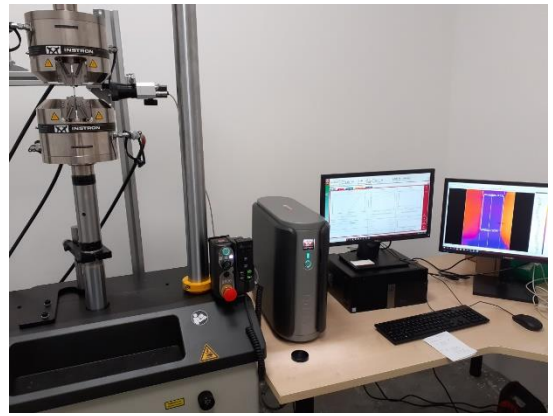






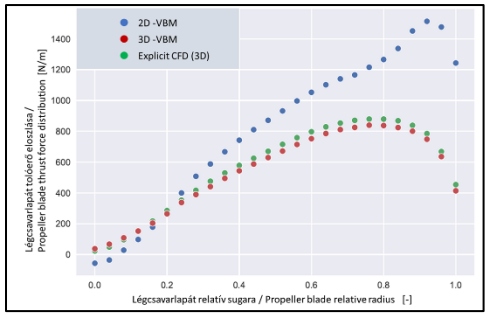


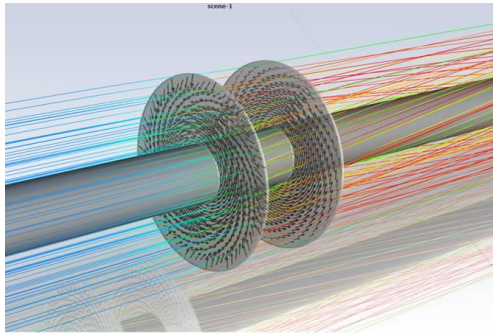


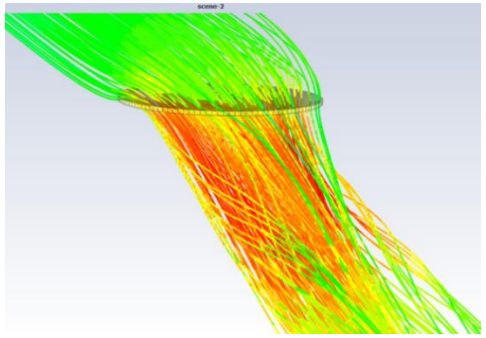


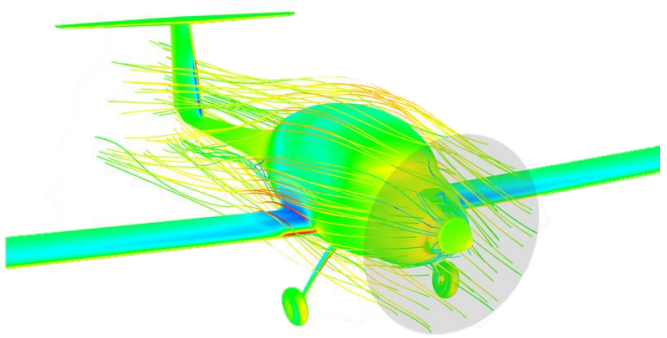
METHOD DEVELOPMENT
DEVELOPMENT OF 3D CORRECTED VIRTUAL BLADE MODEL

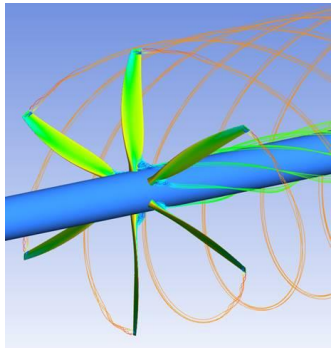
- **Development of Virtual Blade Model** (VBM) with built-in 3D aerodynamic correction using artificial intelligence
  - 3-year R&D project
  - Substitution of explicit propeller models in CFD with VBM to speed up simulations without loosing flow characteristics induced by blades' spanwise 3D load distribution
  - Optimisation of features washed by the propellers' wake becomes feasible
- **Use Of AI FOR MODEL Simplification – 3D-VBM: 3D corrected Virtual Blade Model**
  - Virtual Blade Model (VBM) substitute costly explicit blade modelling
  - Accounts for 3D aerodynamic effects by utilizing special AI model
  - AI is trained based on 3D explicit blade CFD data
  - Allows affordable but still accurate simulation & optimisation of multi-rotor systems
    - Conventional aircraft
    - Drones & multi-copters
    - Wind turbines and wind turbine farms





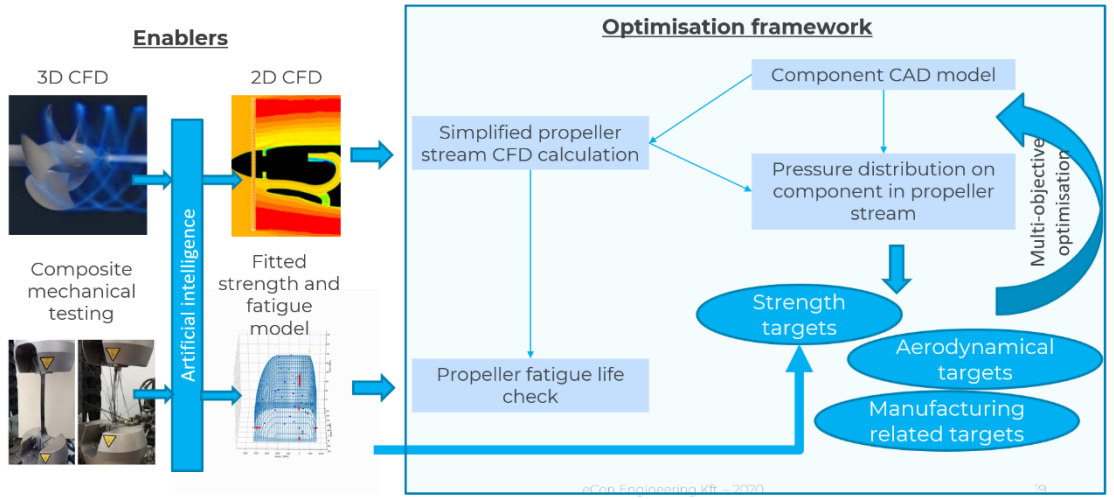


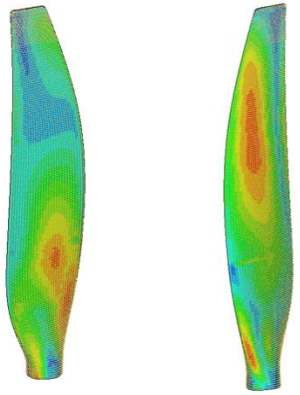




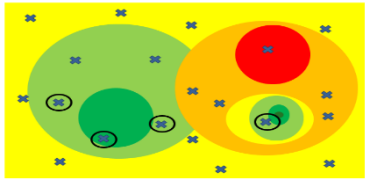
METHOD DEVELOPMENT
AI IN ENGINEERING APPLICATION

- R&D domestic funded project
- Exploiting AI in propeller optimisation from CFD and strength POV
- Two main subprojects:
  - CFD project aims developing 2D to 3D blade correction for 2D based virtual blade modelling
  - FEM project aims developing intelligent composite material parameter fitting methods including static and cyclic strength
- Side project: development of a virtual (numerical) predictive model for the fatigue behaviour of TP matrix based continuous fibre reinforced composites
- All models integrated in an optimisation workflow

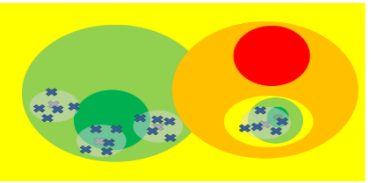




Generation 0



Generation 1



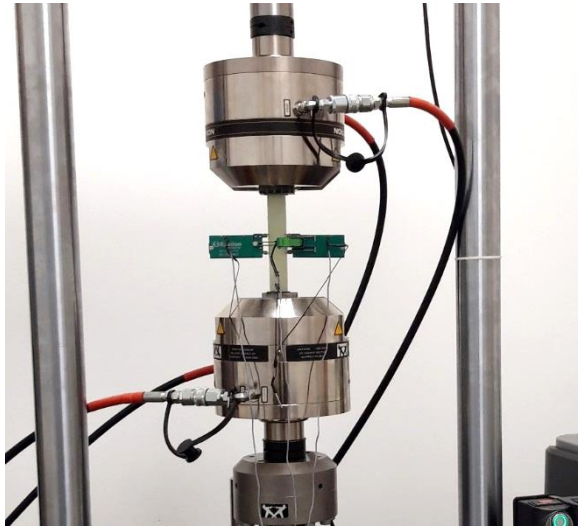
EXPERIENCE IN IN-FLIGHT TESTING

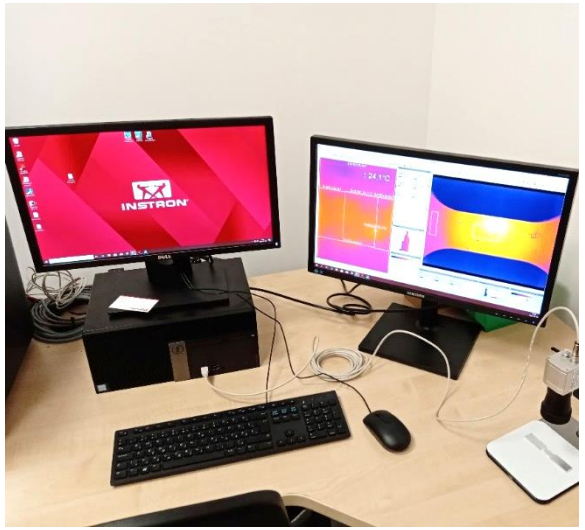
Use Case: Motor-glider and autogyro flight tests

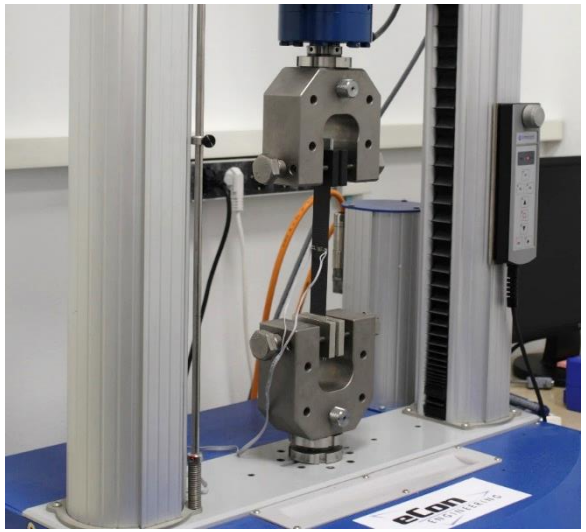
- **Proved and robust method for pressure data acquisition**
  - Robust surface and total-pressure sampling system
  - Wind tunnel calibrated static pressure sensors
  - Calibrated 3D printed Kiel-probes for total-pressure sensing
  - Allows quick verification of CFD models and flow field assessments of aircraft, drones, ground-vehicles or wind turbines

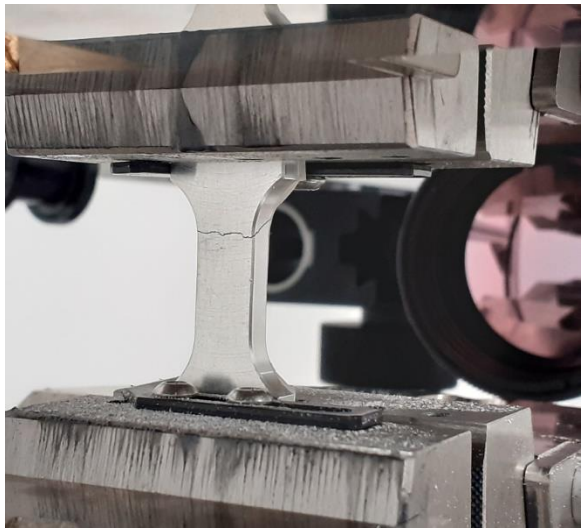
FATIGUE TESTING, MATERIAL CHARACTERISATION

- Universal testing machines
  - 50 kN servo-electric (H&P)
  - 100 kN hydraulic-fatigue (Instron)
- Accessories
  - Tensile, compressive, bending and shear test kits
  - Uni- and biaxial clip-on extensometers
  - Strain gauges with 8-channel amplifier
  - High speed and thermal cameras





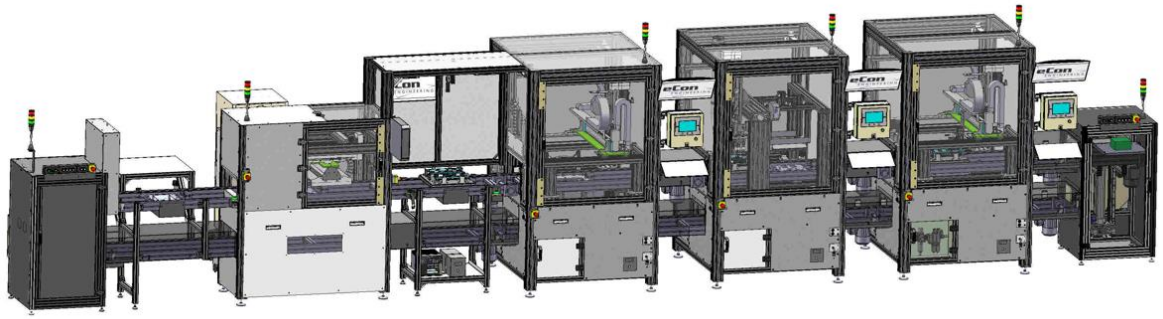


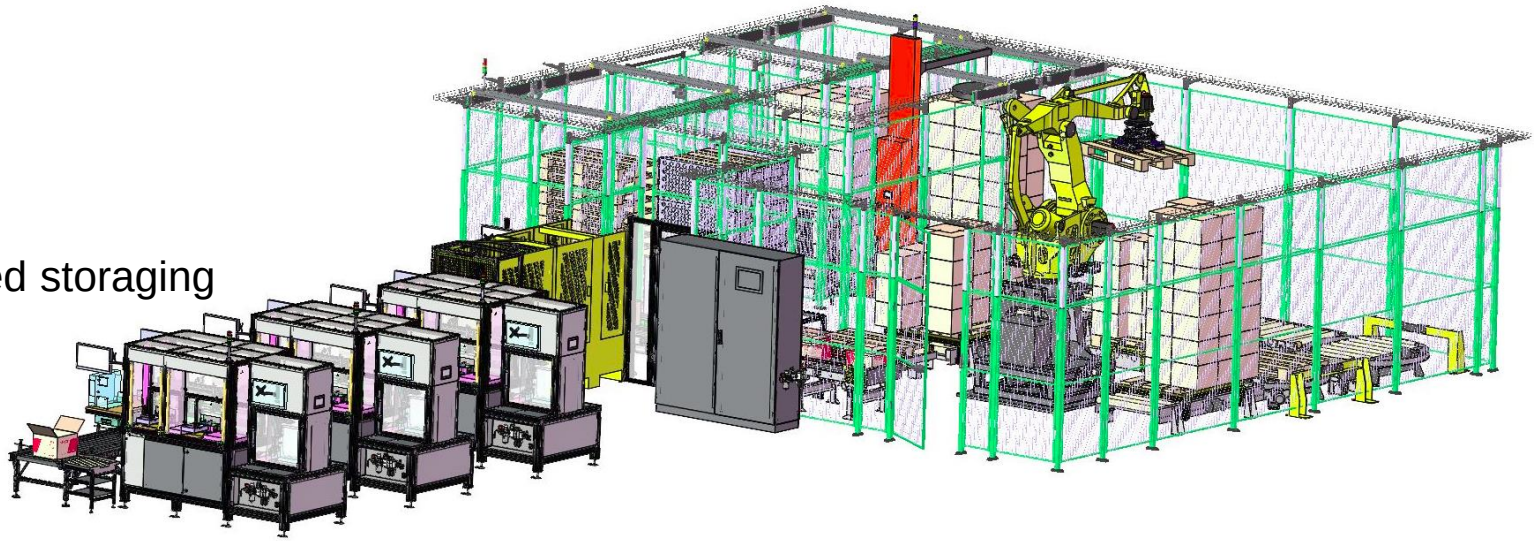


eCon Engineering – Industrial Automation

Automation at eCon Engineering
Typical automation projects

- Semi and full automated assembly solutions
  - Screwing
  - Crimping
  - Riveting
  - Hot air helped „cold” plastic riveting
  - Pick and place solutions
  - Assembly lines for complete solutions
- Material handling
  - Complete palettizing solutions
  - Special grippers
  - Unconventional solutions for automated storaging
- Special robotized solutions





Automation at eCon Engineering

- Automotive
  - Direct automotive industry
  - Tier 1 and Tier 2 customers

HD and LD vehicles

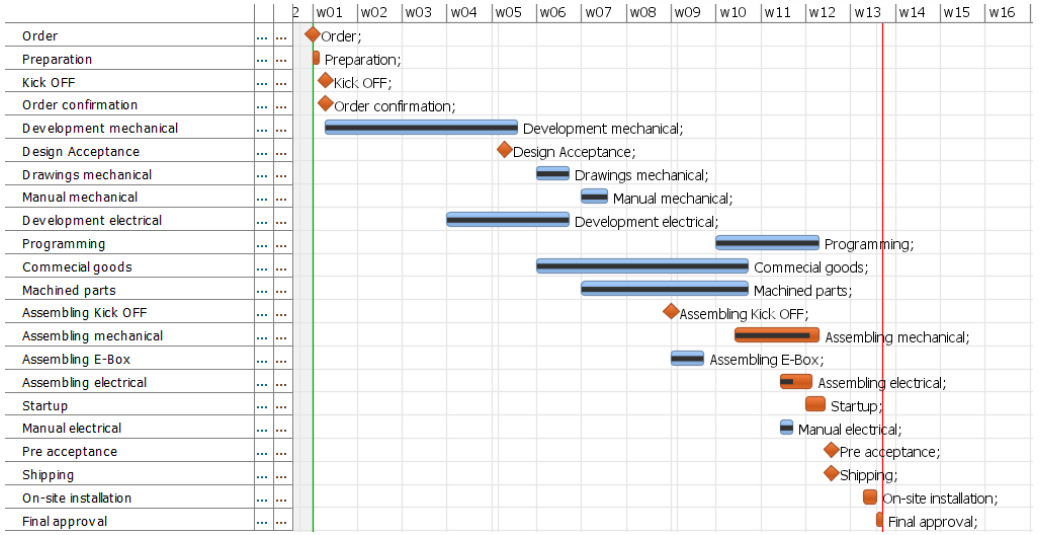
- Production technology developments

BMW – AUDI – DAIMLER - VW – FORD - VOLVO – RENAULT – PEUGEOT - HONDA – NISSAN …..

- Special solutions
  - Wind tunnel for research and development
  - Projects for universities

Methodology of automation projects

- Participation in the development of the specification
  - Working together for the ultimate success
- Continuous analysis and exploration of risks
  - Safety risk analyses
  - FMEA
  - PFMEA
  - Project risk
- Milestones in design for the continous data exchange
  - Kick Off meeting
  - Design acceptance phases
  - Joint process development
  - Trainings for operation and maintenance

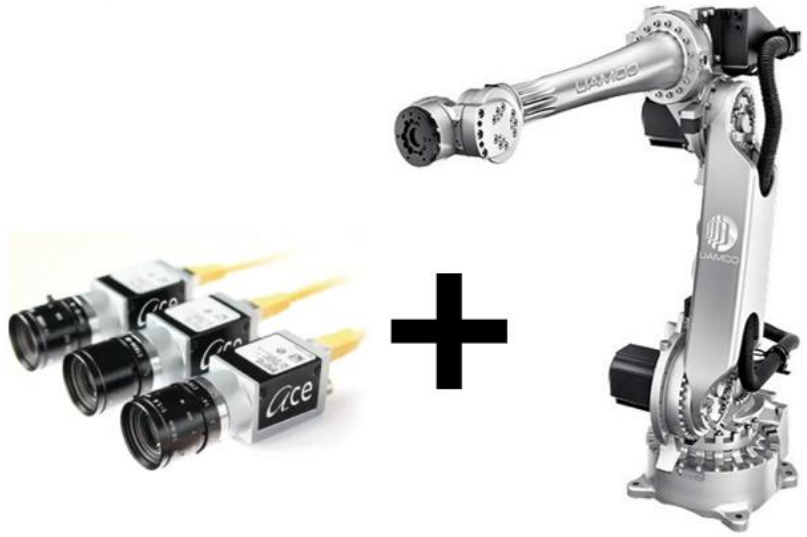


Process Measurement and Control
in typical automation projects

- Pressing for assembly solutions in field of automotive
  - Measurement of force and displacement – process control
  - Registering in data trace system

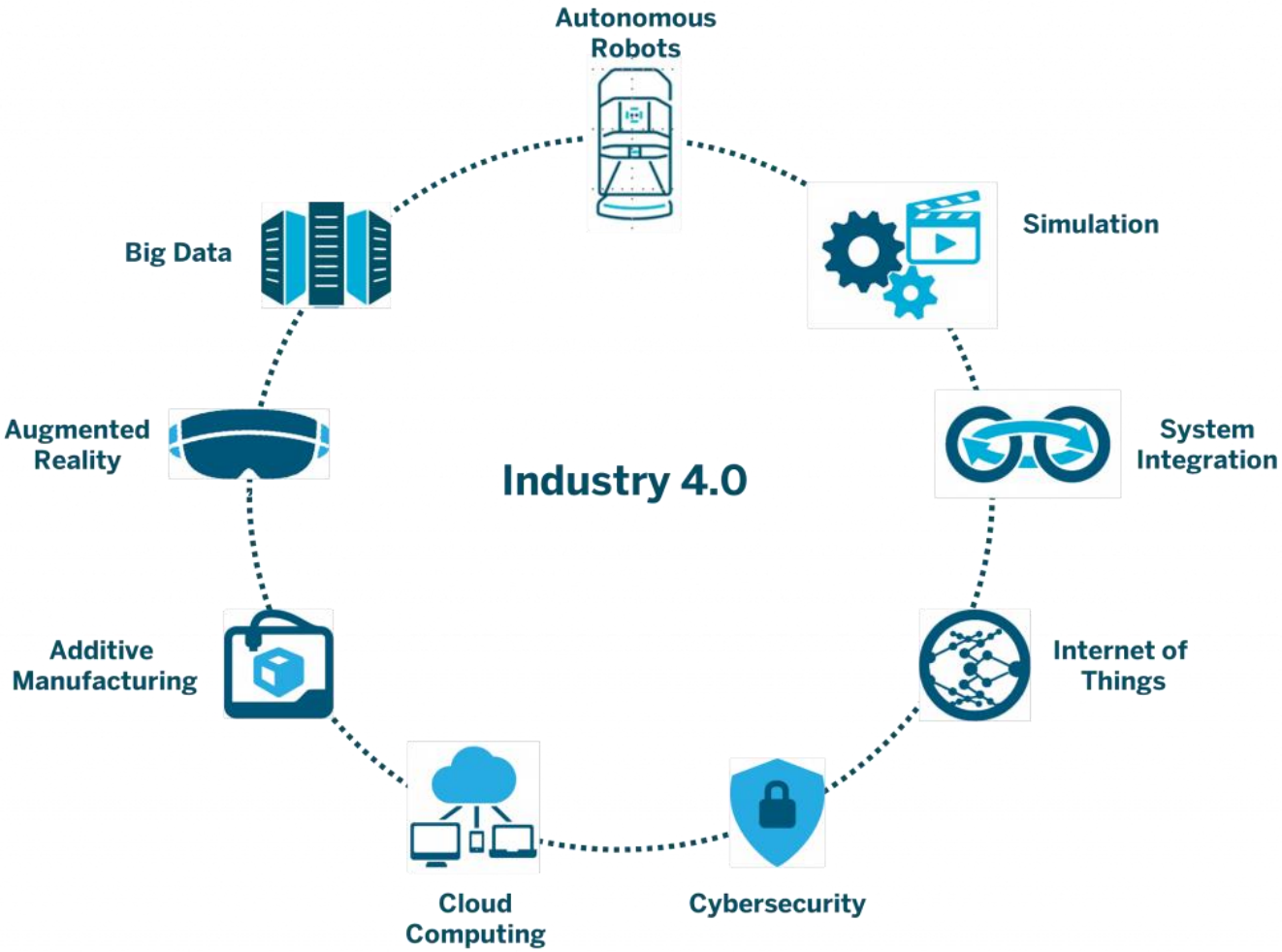
- Hot air helped riveting
  - Continuous process control for requested quality
  - Temperature and air-flow measuring
  - Force and displacement control
  - Final quality check by vision inspection

- Position compensation for assembly solutions
  - Vision inspection
  - Position correction for robot positions



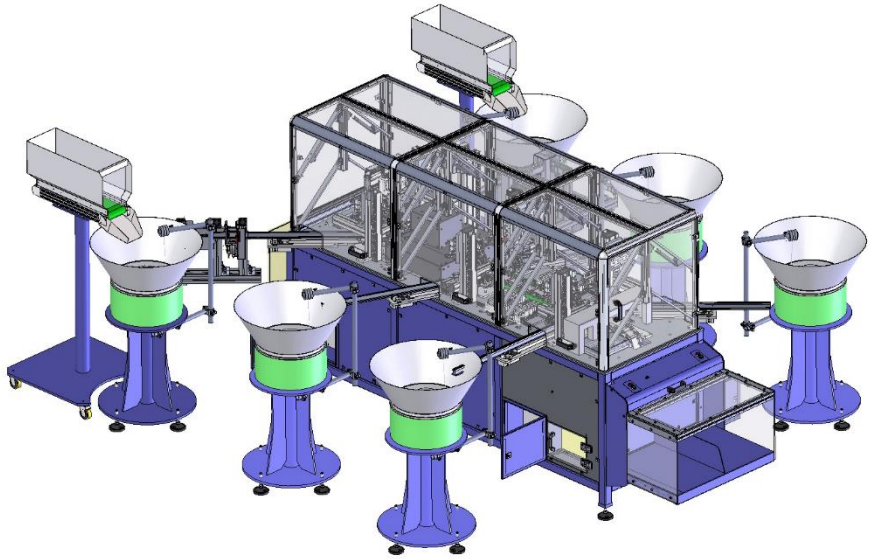
Process Measurement and Control
Industy 4.0

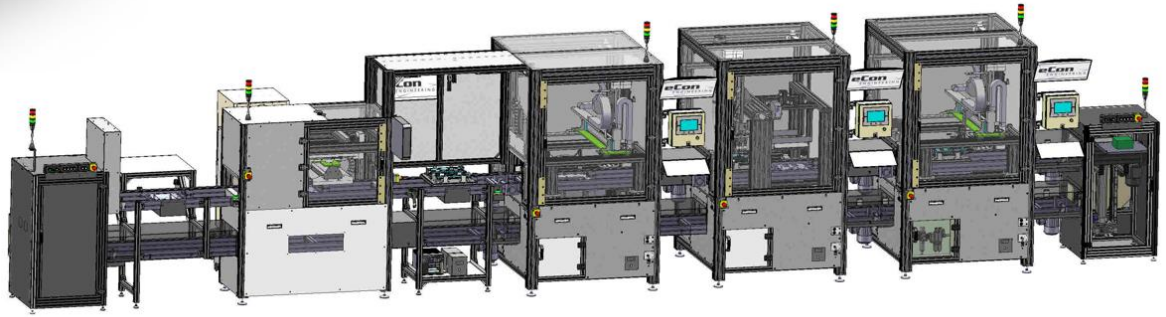
- Lean management
- Complex process control
- Process control
  - Defining the goals
  - Monitoring
  - Measurement
  - Complex data management
- Commitment
  - Customers
  - Suppliers
  - All interested stakeholders



References, examples

- Some of our Customers
  - Continental
  - ALCOA
  - DELPHI
  - Flextronics
  - SDV
  - Suzuki
  - GE
  - SANYO
  - Tyco
  - Bosch
  - Grundfos
  - and more…





Mobil robot solutions
AMR

- Typical use
  - Warehouse management systems
  - Material loading
  - Tool handling

- Special use
  - Combined with a collaborative robot
  - Process automation, not fixed location
  - Handling, not fixed location

Mobil robot solutions
AMR

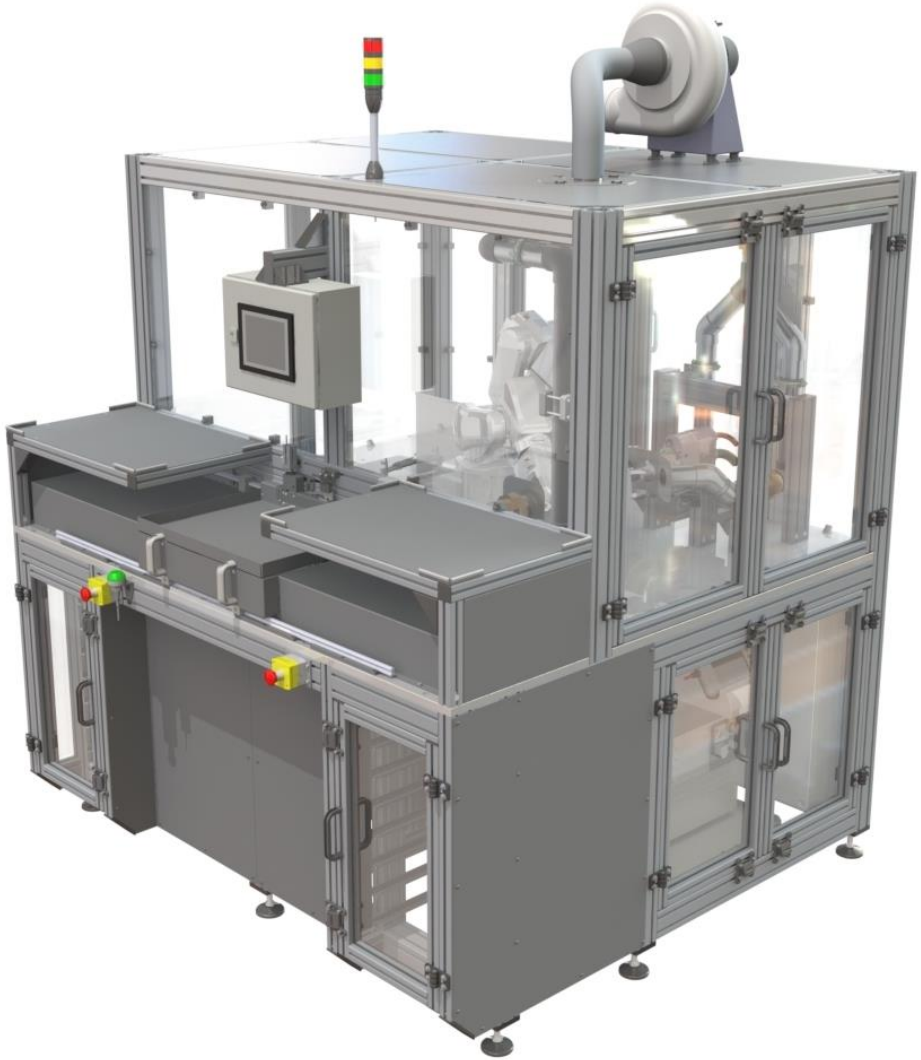
- Possible additions
  - Unique designed rack system
  - Conveyor
  - Lifting solutions for pallets
  - Collaborative robot for process automation

References, examples

- Robotized Pick & Place solutions
  - Vision inspection for position correction
  - Robitizes solution

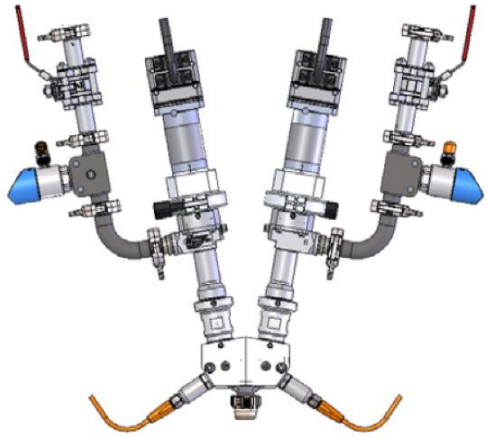
References, examples

- Robotized plasma treatment
  - Robitizes solution
  - Monitored process parameters
  - Continous process control



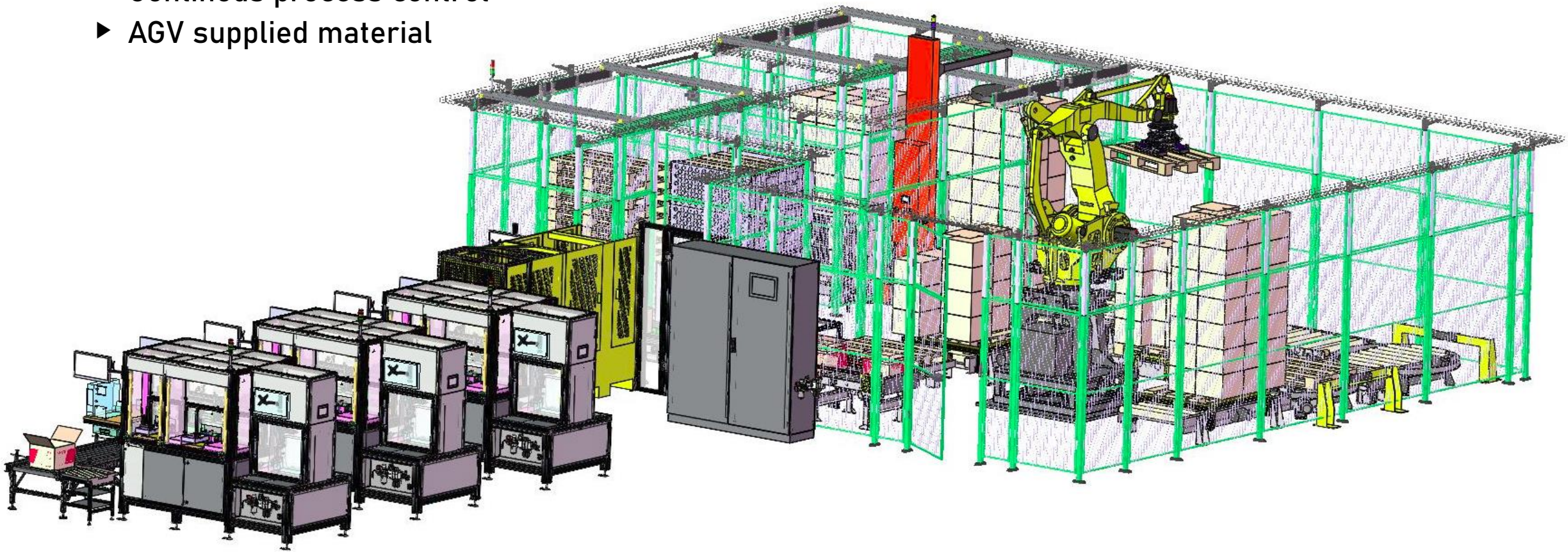
References, examples

- Robotized assembly line
  - Robitized solution
  - Vision helped position correction
  - Dispenser
  - Screwing
  - Pressing
  - Pick & Place
  - Continous quality check and parameter adjustment



References, examples

- Complex automated patettizer
  - Robitized solution
  - Continous process control
  - AGV supplied material



THANK YOU FOR YOUR ATTENTION!

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