The reliable partner for research, development and innovations since 2000

- Independent self-financed university institute since 2000
- State of the art computing and lab equipment
- Multinational team of 130 experienced, reliable and motivated researchers
- Cutting edge research and development - from the idea to the prototype
- Strong focus on industrial cooperation

Selected International R&D Co-operation with Research Institutions:

- ✓ **University of Cergy-Pontoise,** France
- ✓ **Ludwig-Maximilians-Universität München**, Germany
- ✓ **University of Technology, Delft**, Holland
- ✓ **University of Technology Hannover**, **Institut für Statik und Dynamik**, Germany
- ✓ **University of Technology, Department of Photovoltaic Materials and Equipment**, Holland
- ✓ **Department of Electro-technology of the University of Technology, Czestochowa**, Poland
- ✓ **Institute of Applied Physics, Warsaw University of Technology**, Poland
- ✓ **Institut Für Chemische Verfahrenstechnik, Universitat Stuttgart**, Germany
- ✓ **Helmholtz Institute Freiberg for Resource Technology, Freiberg**, Germany
- ✓ **German Research Centre for Aeronautics and Astronautics, Braunschweig**, Germany
- ✓ **German Aerospace Centre (DLR), Institute of Technical Thermodynamics, Stuttgart**, Germany
- ✓ **Tampere University of Technology**, Finland
- ✓ **Fraunhofer Institute in Dresden,** Germany
- ✓ **Laboratoire National de Métrologie et d'Essais Paris**, France
- ✓ **Groupe de Recherches sur l'Energétique des Milieux Ionisés, Université d'Orléans**, France
- ✓ **Department of Electronic and Electrical Engineering, University of Strathclyde**, Glasgow, UK
- ✓ **Institute of Electronics and Photonics, Slovak University of Technology**, Slovak Republic
- ✓ **International Laser Centre**, **Bratislava**, Slovak Republic
- ✓ **Oslo and Akershus University College of Applied Sciences**, Research Group on Responsible Innovation, Norway
- ✓ **Gjøvik University College, Faculty of Health, Care and Nursing**, Norway
- ✓ **Nagaoka University of Technology in Niigata**, Japan
- ✓ **Tianjin University of Science and Technology,** China

Selected International R&D Co-operation with Commercial Entities:

- ✓ **Frentech Aerospace, Thales Alenia Space, European Space Agency** – Development of a method for measuring material emissivity for future use in development of surface finishes of new telecommunication satellites.
- ✓ **Continental, Powertrain Division,** Germany – Research on technologies for laser processing of plastics.
- ✓ **Volkswagen Aktiengesellschaft**, Germany
  - ✓ Computer simulation of the behaviour of battery systems for specified input parametres
  - ✓ Preparation of an 1D cooling circuit model
  - ✓ CFD analysis of heat flow and transfer through a traction battery module
- ✓ **Lyondelbasell industries**, Germany – Modification of morphological surfaces; problems in manufacturing with degassing.
- ✓ **SABIC Petrochemicals B.V**., Holland – Scanning of polymer samples to micro-CT.
- ✓ **Automotive Lighting Reutlingen GmbH**, Germany – Functionality verification of paint removal technology.
- ✓ **FuMA-Tech**, Germany – Diagnostics of materials in PEM fuel cells
- ✓ **Ideevolutie**, Netherlands – Design of HTPEM fuel cell stack focused on space applications
- ✓ **TRW Alfdorf** – lap belt performance analyses
- ✓ **ZF Engineering** – computational fluid dynamics

EU Programmes

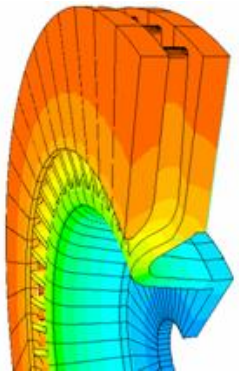
- **6th Framework Programme**
  - APROSYS FP6-PLT-506503 *Advanced Protective Systems* (PI - TNO)
  - SLC TIP4-CT-2005-516465 *SuperLightCar* (PI - Volkswagen AG)
  - SIM FP6-031348 *Safety In Motion* (PI - PIAGGIO)
  - MYMOSA MRTN-CT-2006-035965 *Motorcycle and Motorcyclist Safety* (PI - UNIFI)
- **INTERREG IVC**
  - TIAM I4W 05-TIAM *Toolkits for hazard identification, risk assessment and prevention of work-related musculoskeletal disorders based on a collaborative platform* (PI - Technical University of Catalonia)
- **7th Framework Programme**
  - THOMO 218643 *Development of a Finite Element Model of the Human Thorax and Upper Extremities* (PI - CEESAR)
  - MOTORIST 608092 *Motorcycle Rider Integrated Safety* (PI - University of Florence)
- **COST**
  - OC532.002 *The influence of thermally sprayed coatings microstructure on their tribological characteristics* (PI - UWB)
  - MP1306 *Multi code approach towards theoretical spectroscopy of new materials*
  - TU1407 *Scientific and technical innovations for safer Powered Two Wheelers (PTW)*
- **EU Structural Funds - Czech Bavarian Cooperation**
  - Research and innovation in the field of energy efficiency and combined heat and power
  - Thermoplastic composite structures
  - Virtual human body modeling for prevention of shoulder injury
- **Other** - Czech-Norwegian Research Programme – Naturalness in Human Cognitive Enhancement (PI - UWB)

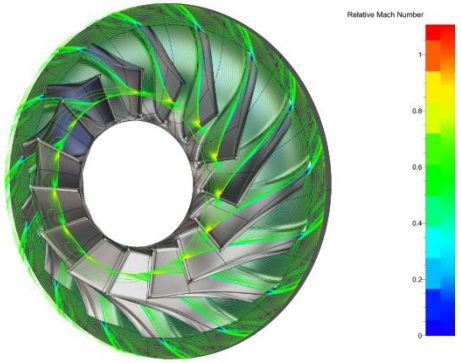
NTC - KEY R&D FIELDS

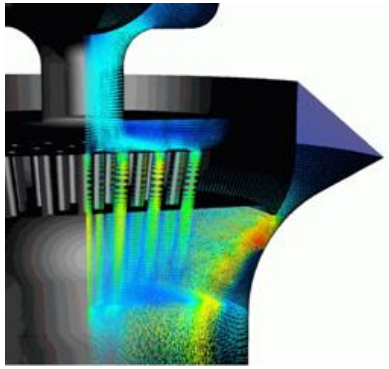
- Computational Fluid Dynamics and Flow and Heat Transfer Measurement
- Deformation and Dynamic Processes Modelling
- **Computational and Experimental Design of Advanced Materials with New Functionalities**
- **Egineering of Special Materials**
- **Biomechanical Models of Human Body**
- Thermomechanics and Thermography Applications
- Laser Technologies
- Materials Research and Technologies
- Energy Storage

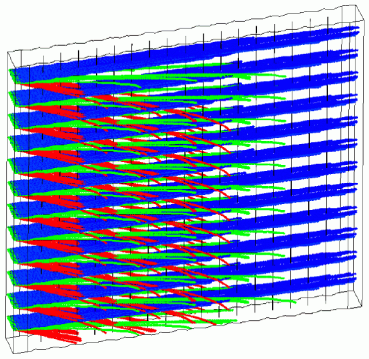
MODELLING AND MEASUREMENT OF INTERACTIONS IN TECHNICAL SYSTEMS

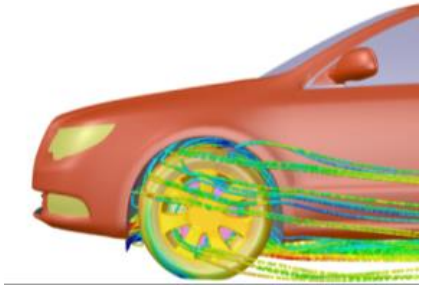
- Focus on applied research for industrial partners
- Flexible approach to problems in the field of Computation of Fluid Dynamics, coupled problems and experimental analyses
- Numerical simulations
- Experimental analyses
- Power engineering
- Automotive industry
- Aviation technology





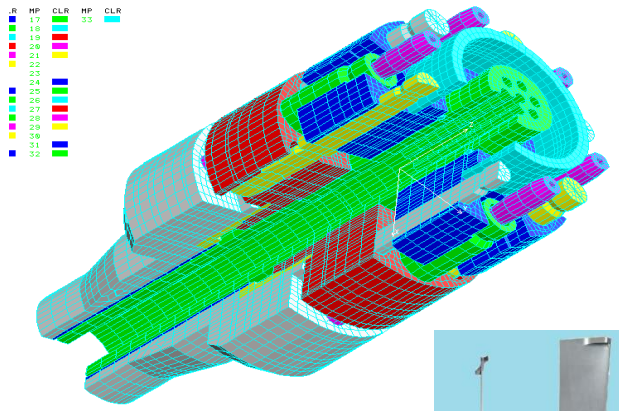


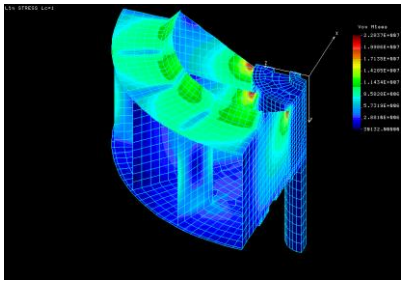


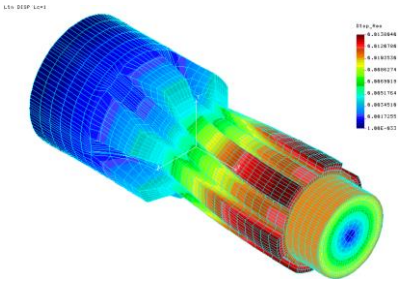


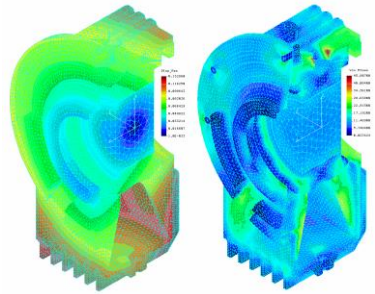
DEFORMATION AND DYNAMIC PROCESSES MODELLING

- Strength, thermal and dynamic computations
- Analysis of strength and lifetime of mechanical equipment
- References from the field of nuclear power engineering and the automotive industry









BIOMECHANICAL HUMAN BODY MODELS

- Quick analysis of impacts (motion of a vehicle's occupants)
- Inverse dynamics (analysis of muscular tension)
- Description of injuries, including clinical applications (tissue tension during childbirth)
- Hybrid approach (combination of MBS and FEM), scalable models of a desired weight, age and sex
- Development of a unique FEM solver (http://sfepy.org) for modelling materials with a complex inner structure and redistribution of mass

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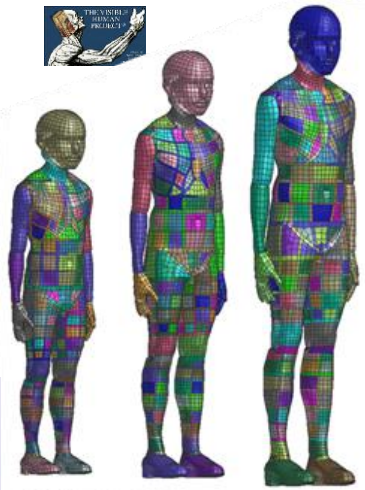
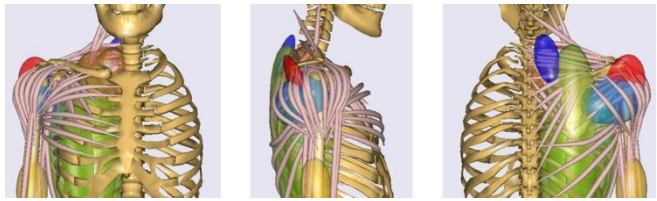
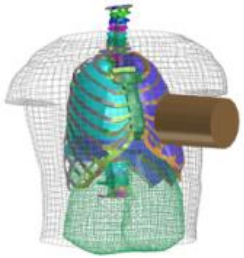
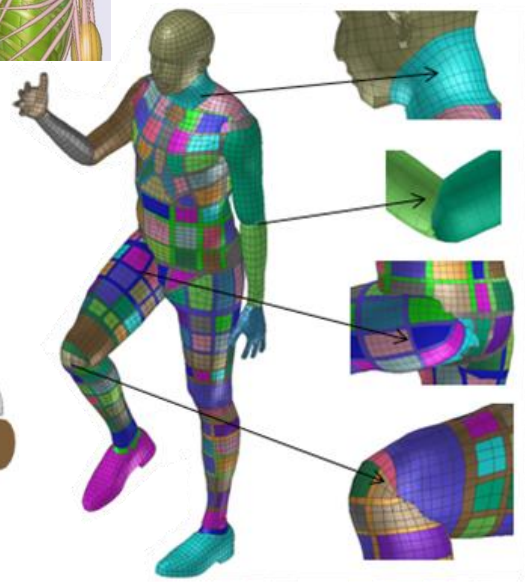


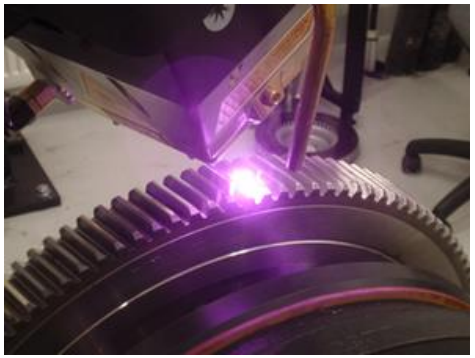


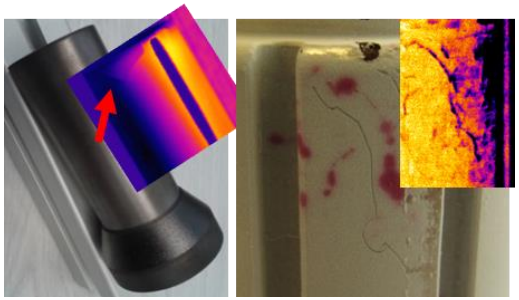


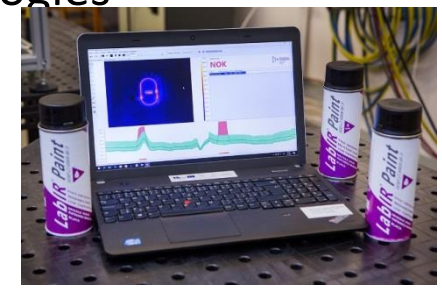


THERMOMECHANICS OF TECHNOLOGICAL PROCESSES & LASER TECHNOLOGIES

- Application of powerful lasers to develop manufacture systems in the field of welding of plastics and metals, thermal processing and coating, micromachining and marking
- Application of thermal imaging methods in process control and non-destructive verification
- Development of technological procedures, prototyping of components, piloting of technologies







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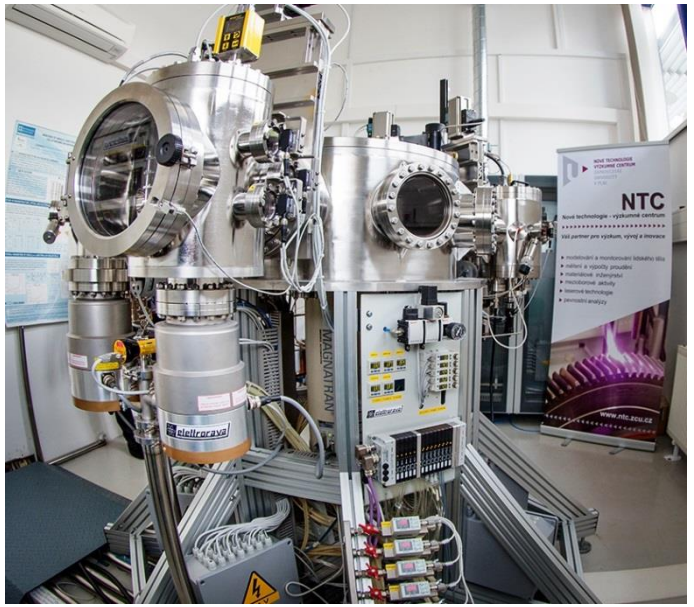
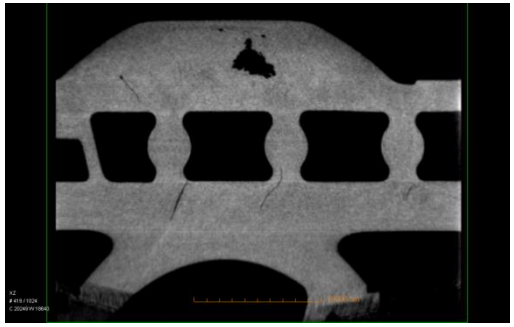
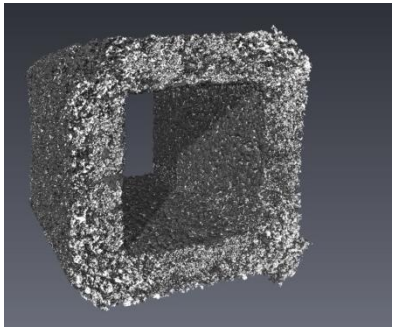
2007-13
OP Výzkum a vývoj pro inovace

MATERIALS RESEARCH AND TECHNOLOGIES

- Silicon-based materials for 3rd generation solar cells, technologies of transparent conductive oxides for photovoltaics, photonics and microsystems technology
- Thin-film depositions using PVD and CVD technologies
- X-ray diffraction and spectroscopy
- Electron and optical microscopy
- Defectoscopy - Computational tomography
  - Imaging method of the internal structure of materials - 3D thomography



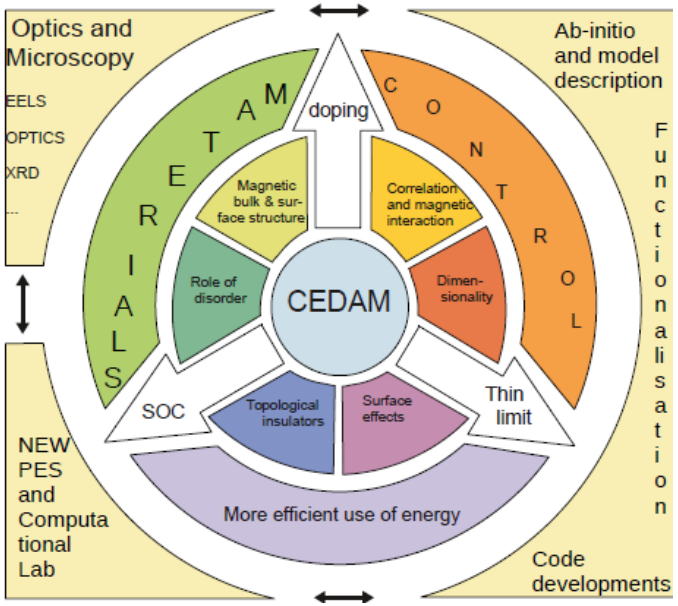




COMPUTATIONAL AND EXPERIMENTAL DESIGN OF ADVANCED MATERIALS

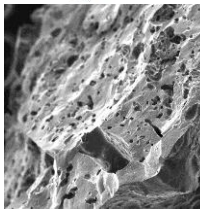
Researching novel nano-materials for promising environmental friendly production, their utilisation by optimizing performance and its control. The research concentrates on analysis of microscopic mechanisms which underlie physical properties of materials.

- Materials for energy production
- More efficient use of energy (prediction of new material for LED industry)
- Control of integrating optoelectric elements – spin transport



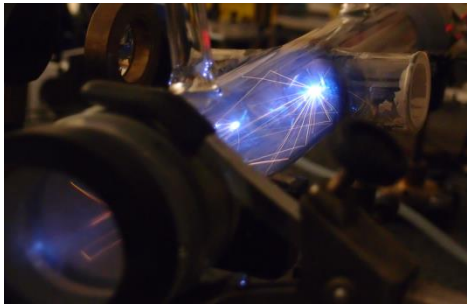
Thermal Analysis

- Thermal/thermomechanical properties of aluminosilicate systems (TGA, TMA)
- Kinetics of hardening and rheological properties of mixtures (DSC, ARES)
- Mineralogical / chemical composition and phase transitions characterization (XRF, XRD, STA)
- Microstructural design and characterization of cellular ceramics.



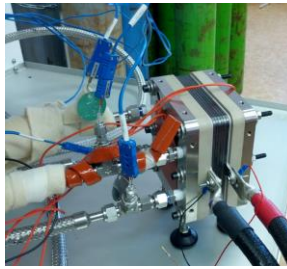
Laser ablation in applied and fundamental research

- Immiscible alloys
- Amorphous metals
- Metastable crystalline phases



Polymer Technologies

- Modification of commercial Nafion based ion conductive membranes
- Synthesis of new materials on polyvinyl alcohol and polyimide/amide bases
- Software development for system control and for artificial degradation of fuel cell individual components



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Vanadium redox flow battery (VRFB)

- ✓Power (kW) separated from capacity (kWh)
- ✓High over-all efficiency (over 80%)
- ✓Long-life (over 20 years ≈ 10 000 cycles)
- ✓Fast respond time (tens of ms)
- ✓Accessible price

NTC

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New Technologies – Research Centre

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