

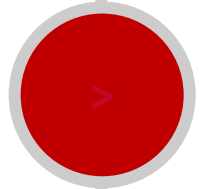
CXI TUL



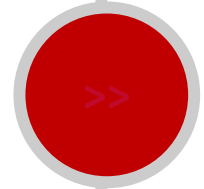


Welcome!

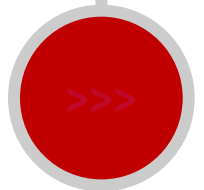
CXI TUL



The Institute for Nanomaterials, Advanced Technologies and Innovations (CXI) is a research center of the Technical University of Liberec. Our goal is to contribute to the development of a region traditionally oriented towards technical industries.



A total of 13 departments concentrate their joint efforts not only in the macro world, but also in a world a million times smaller than a millimeter, the world subjected to different physical rules. The one called the nanoworld.



Every year, around 70 research projects employ more than 160 scientific, technical and administrative staff. Students also cooperate on research projects here.



THE INSTITUTE FOR NANOMATERIALS, ADVANCED TECHNOLOGIES AND INNOVATION (CXI)

The Institute was established within the OP RDI project "Center for Nanomaterials, Advanced Technologies and Innovations" as one of the first centers of this type in the Czech Republic. The CXI building was opened in the year 2012.

In the years 2009 - 2013, a highly sophisticated university research center was built with an emphasis on the applicability of research and development results in practice.

The project supported TUL's long-term activities in the field of industrial innovation with qualified personnel and state-of-the-art equipment.





CXI has more than **160 employees** (22 of whom are foreigners):

- *supervisors and independent researchers (C3 and C4)*
 - *senior researchers (C2)*
 - *junior researchers (C1)*
 - *technicians / lab assistants*
 - *administrative support*
- 98
- 65

The average age is around 41 years. 51 % of CXI employees are women.

CXI collaborates throughout the university and provides also facilities for students.



Nanomaterials in natural sciences focus on research, development, synthesis, behavioral description, and application of advanced materials, especially nanomaterials, mostly in the field of environmental protection and life sciences. A great emphasis is placed on environmentally friendly technologies and „green“ materials.



Competitive engineering focuses on research, development and use of advanced engineering technologies and structures, especially mechatronic systems, power units and other components of machines and vehicles and advanced methods for processing new materials.

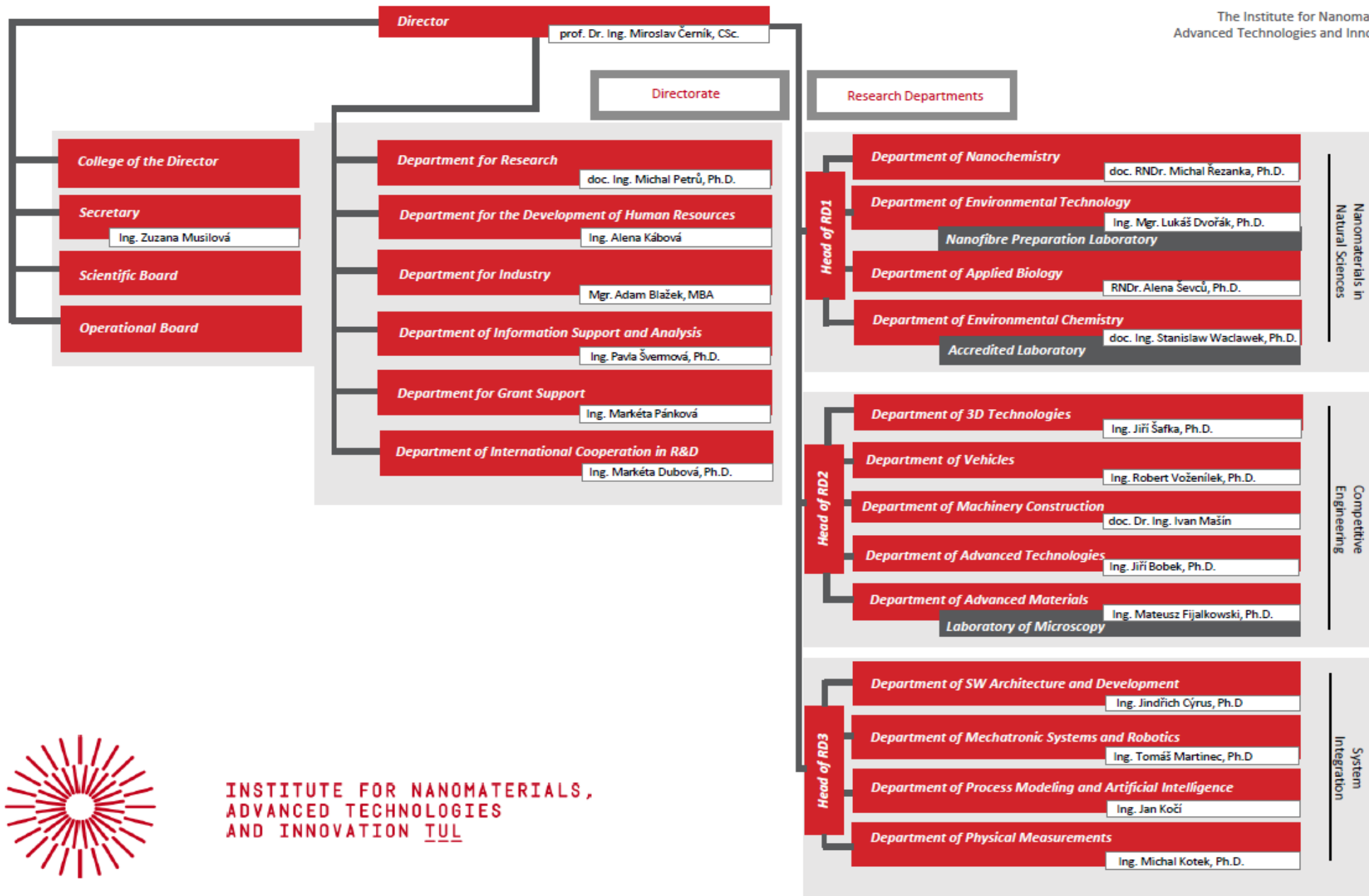


System integration deals with the development of state-of-the-art SW solutions, data processing and integration between systems, providing communication interface for industrial practice. An integral part of the direction is the field of robotics, including the use of collaborative and sensitive robots, design and development of appropriate control software.



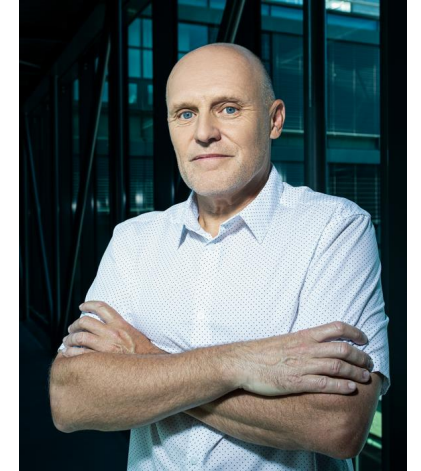
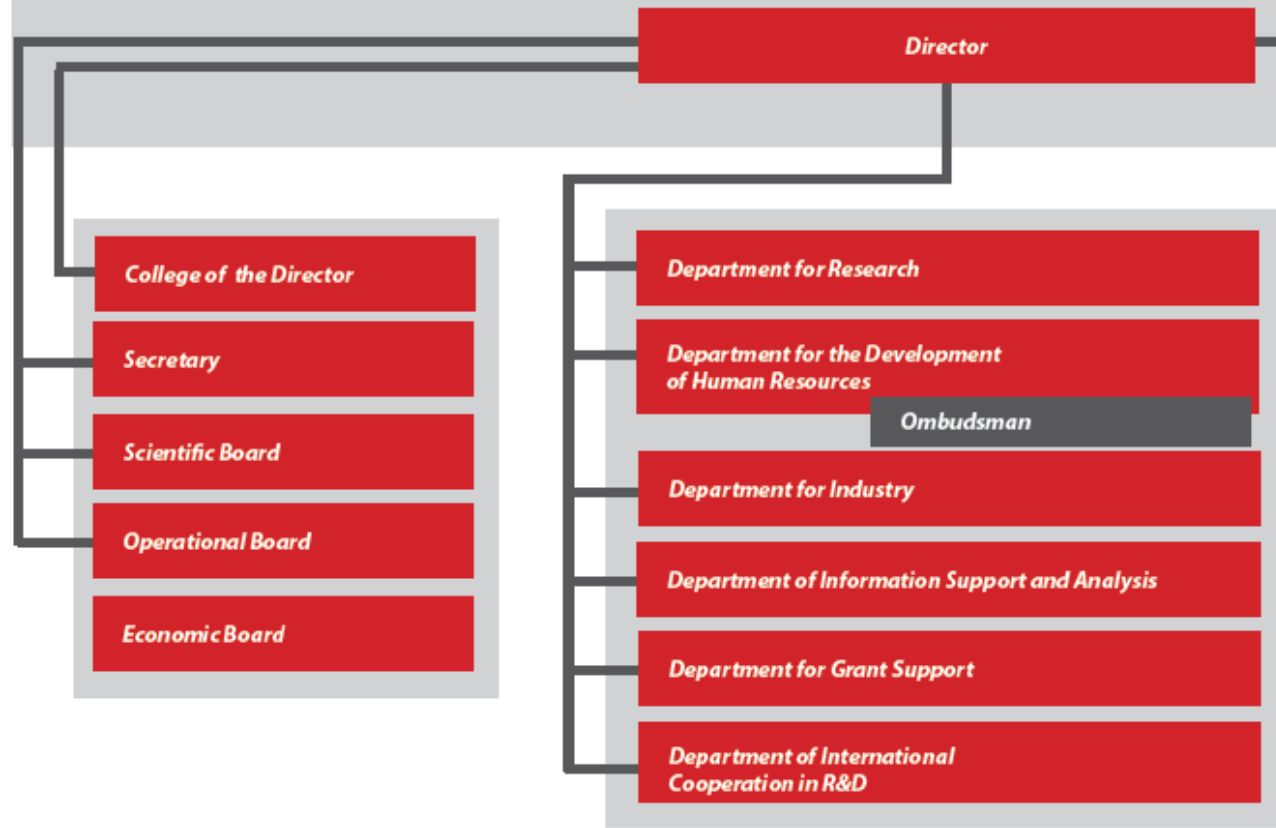
Organizational structure and human resources

CXI TUL





Ing. Z. Musilová



prof. Dr. Ing. M. Černík, CSc.



doc. Ing. M. Petru



Ing. A. Kábová



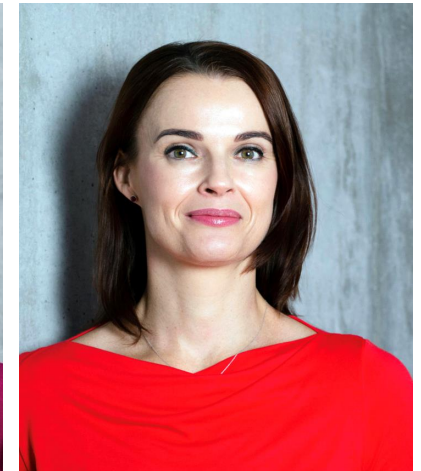
Mgr. A. Blažek, MBA



Ing. P. Švermová, Ph.D.



Ing. M. Pánková



Ing. M. Dubová, Ph.D.



prof. Dr. Ing.
Miroslav Černík, CSc.

Director
CXI TUL



Ing. Zuzana Musilová

Head of the CXI
Director's office



Ing. Alena Kábová

Department for
the Development of HR



Mgr. Adam Blažek, MBA

Department for Industry



Ing. Markéta Pánková

Department for
Grant Support



Ing.
Markéta Dubová, Ph.D.

Department of
International Cooperation
in R&D



doc. Ing.
Michal Petrů, Ph.D.

Department for Research



Ing.
Pavla Švermová, Ph.D.

Information Support and
Analysis Department

RESEARCH DIRECTIONS



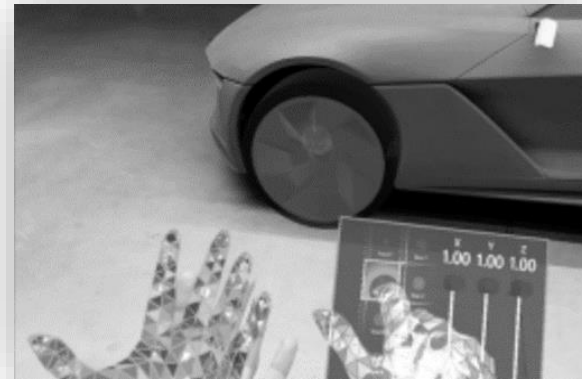
**Nanomaterials in
natural sciences**

Lukáš Dvořák



**Competitive
engineering**

Jiří Šafka



**System
integration**

Jan Kočí



Ing. Mgr. Lukáš Dvořák, Ph.D.

Head of research direction
Nanomaterials
in Natural Sciences and
Department of
Environmental Technology

NANOMATERIALS IN NATURAL SCIENCES



DEPARTMENT
OF NANO CHEMISTRY



DEPARTMENT OF
ENVIRONMENTAL TECHNOLOGY



DEPARTMENT
OF APPLIED BIOLOGY



DEPARTMENT OF
ENVIRONMENTAL CHEMISTRY

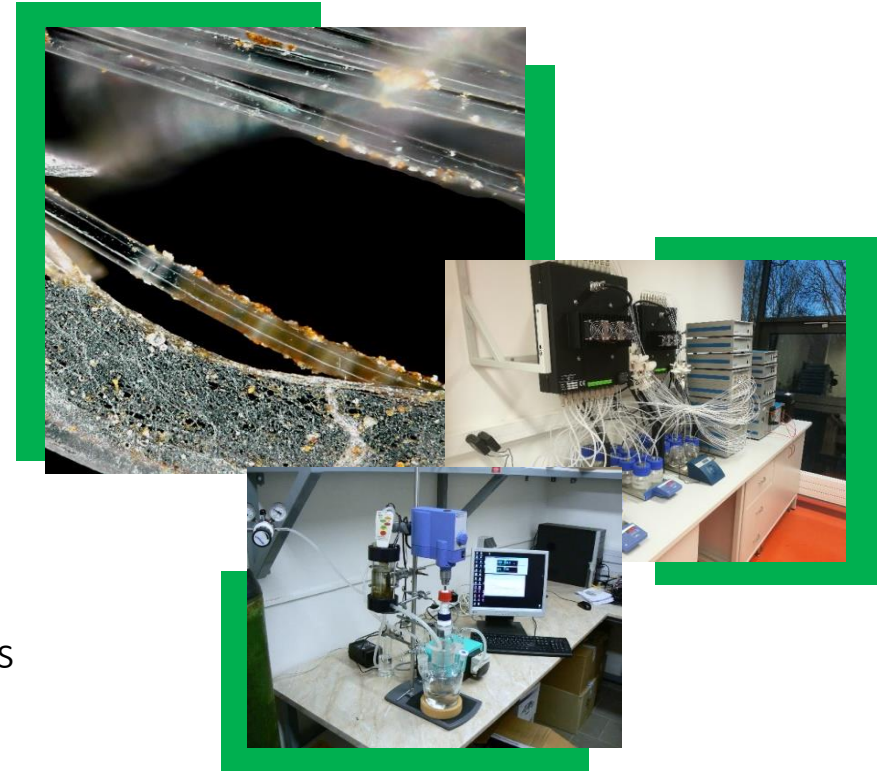
The research direction of **nanomaterials in natural sciences** combines basic and applied research, advanced technologies including hi-tech analysis, not only environmental contaminants. Great emphasis is also put on synthesis and testing of different nanomaterials and their verification in practical application, mainly in water treatment processes.

MAIN RESEARCH ACTIVITIES

- Advanced (waste)water treatment technologies
- Membrane bioreactors and systems with biomass carriers
- Effective groundwater remediation by nano- and microiron
- Application of nanomaterials in various treatment processes and technologies
- Development and testing of nano-based filters

COOPERATION

- Project and contracted R&D in cooperation with industrial partners and stakeholders
- Taylor-made research and development
- Examination and intensification of current treatment processes
- Independent expert evaluation





doc. Ing.
Stanislaw Waclawek, Ph.D.

Department of
Environmental Chemistry



MAIN RESEARCH ACTIVITIES

- Toxic substances in the environment - advanced methods of their monitoring and catalytic elimination
- Nanostructured sorbents for analytical preconcentration of pollutants
- Phytoindications of groundwater pollution (phytoaccumulation, phytoremediation)
- Advanced methods of chemical instrumental analysis

COOPERATION

- Analytical background for internal research groups, external scientists and industrial customers
- Solving common environmental problems with a focus on pollutants





doc. RNDr.
Michal Řezanka, Ph.D.

Department of
Nanochemistry

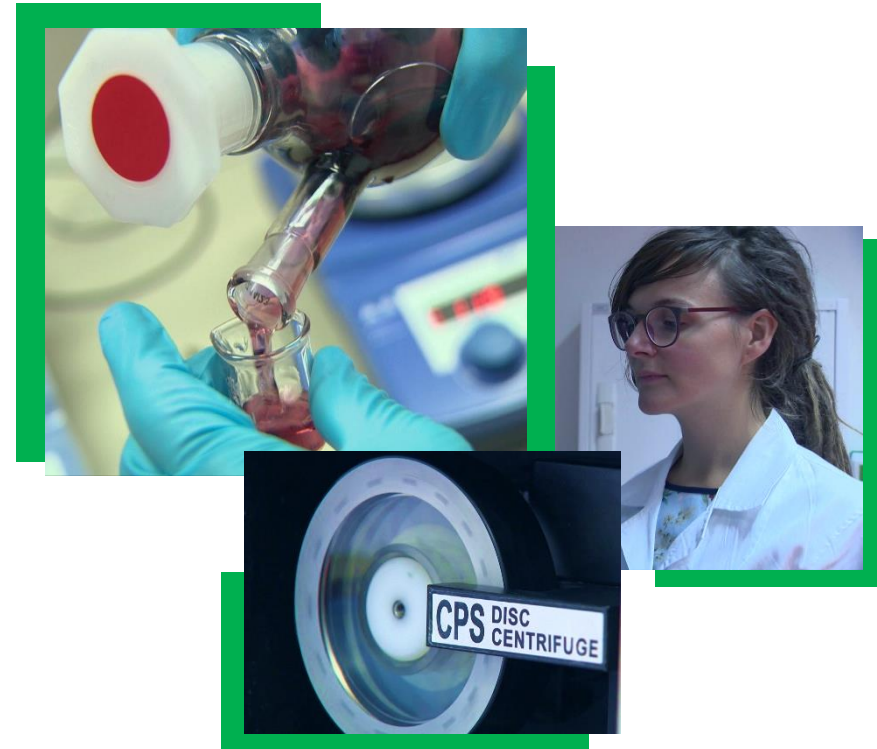


MAIN RESEARCH ACTIVITIES

- Synthesis of chemical compounds
- Use of sol-gel method for preparation of nanomaterials
- Preparation of cyclodextrin-functionalized nanomaterials
- Use of nanomaterials in tissue engineering and catalysis

COOPERATION

- Physico-chemical analyses of (nano)materials
- Synthesis of organic or inorganic compounds
- Preparation of nanoparticles
- (Nano)material functionalization
- Organic and inorganic chemistry consulting





RNDr.
Alena Ševců, Ph.D.

Department of
Applied Biology

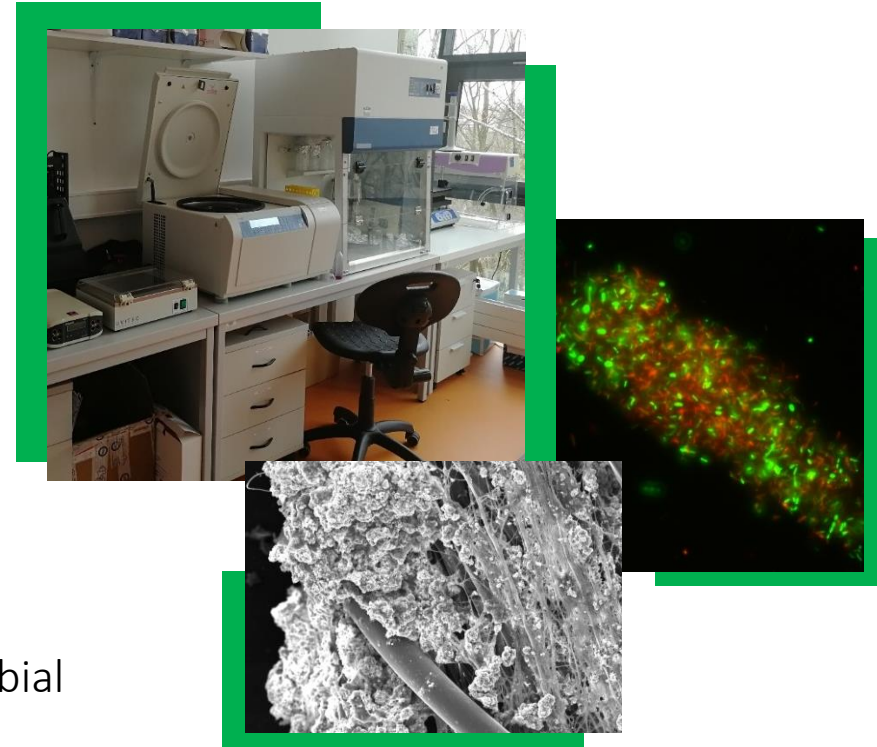


MAIN RESEARCH ACTIVITIES

- Development of nanomaterials and porous structures for regenerative medicine, drug delivery and cosmetics
- Study of microbial activity in relation to the safety of radioactive waste repositories
- Influence of nanomaterials and microplastics on natural microbial communities

COOPERATION

- Verification of antimicrobial efficacy of photocatalytic surfaces
- Bioremediation, the impact of remediation interventions on microbial communities
- Electrospinning, development of nanofiber matrices and nanomaterials
- Risks of nanomaterials
- Evaluation of interactions of nanomaterials with tissue cells



RESEARCH DIRECTIONS



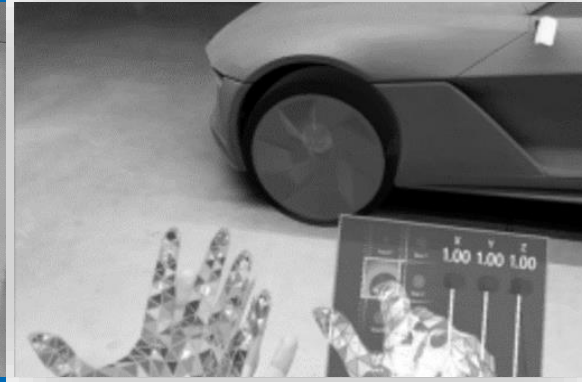
**Nanomaterials in
natural sciences**

Lukáš Dvořák



**Competitive
engineering**

Jiří Šafka



**System
integration**

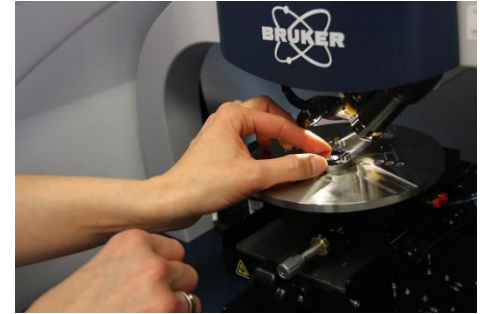
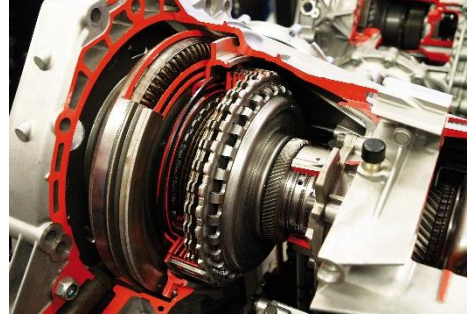
Jan Kočí



Ing. Jiří Šafka, Ph.D.

Head of research
direction Competitive
Engineering and
Department of 3D
Technologies

COMPETITIVE ENGINEERING



DEPARTMENT OF
3D TECHNOLOGIES

DEPARTMENT
OF VEHICLES

DEPARTMENT OF
MACHINES DESIGN

DEPARTMENT OF
ADVANCED TECHNOLOGIES

DEPARTMENT OF
ADVANCED MATERIALS

The research direction of **competitive engineering** combines research and development in the areas of manufacturing and the automotive industry with great application potential. The workplaces support the industrial activities of companies not just in the close-by regions and focus on the application of new technologies and technological procedures to ensure a higher degree of innovation in industrial production.



MAIN RESEARCH ACTIVITIES

- Advanced research in specialized additive technologies
- Comprehensive activities include not only 3D printing using the most appropriate technology concerning the material to be processed and the targeted product properties but also data preparation, optimization of product geometries or their elements (topological optimization), post-processing operations and the development of new sustainable materials for additive technologies
- Investigating different technological approaches to accuracy, and quality of output parts to increase application possibilities and usability of 3D printed products



COOPERATION

- Research and development of 3D printing technologies
- Design of application-specific 3D printing components and topological optimization
- New 3D printing applications in plastics and metals
- Development of new sustainable materials for 3D printing technologies





Ing. Robert Voženílek, Ph.D.

Department of Vehicles

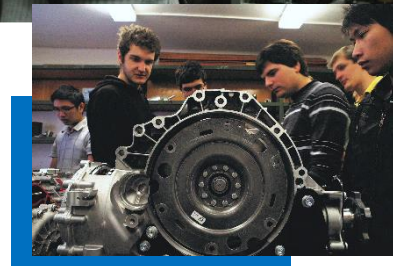


MAIN RESEARCH ACTIVITIES

- Development and testing of propulsion systems and engines
- Research and development in the field of electromobility
- Research of economic-emission properties of petrol and diesel internal combustion engines for liquid, gaseous fuels and their mixtures
- Power transmission systems in classical and hybrid engine arrangements

COOPERATION

- New hybrid drive systems
- Modifications of mobile and stationary devices meeting future EU 6 emission limits and greenhouse gas limits with emphasis on the use of new types of fuels from renewable sources





doc. Dr. Ing.
Ivan Mašín

Department of
Machines Design



MAIN RESEARCH ACTIVITIES

- Human safety and comfort in vehicles (land, air, water)
- Testing of new concepts and constructions of parts of mobile means of transport
- Mechatronic systems with active regulation



COOPERATION

- Custom machine design
- Measurement of physical properties of active and passive vibration-insulating materials
- Implementation of advanced technologies for product and equipment development using new procedures and methods





Ing. Jiří Bobek, Ph.D.

Department of
Advanced Technologies

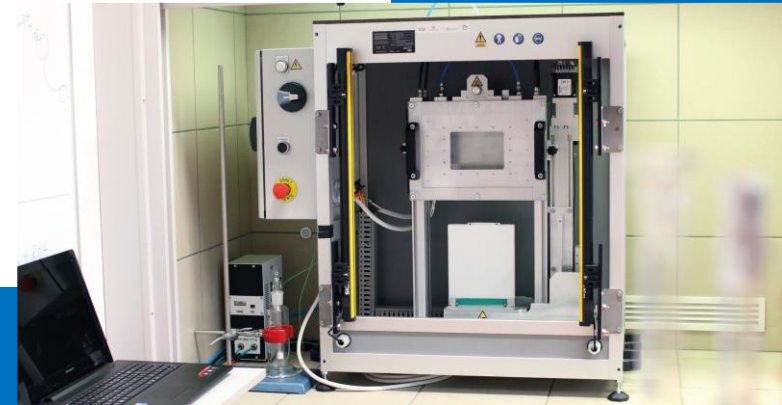


MAIN RESEARCH ACTIVITIES

- Development, research, innovation and application of progressive non-chip technologies for processing plastics, composites, metals and non-ferrous metals (casting, welding, forming and processing of plastics and composites)
- Parametrization of technological processes, optimization of processes with regard to efficiency, economy and the environment

COOPERATION

- Measurement of technological parameters during machining with defined and undefined cutting edge geometry
- Highly specialized measurements with unique devices
- Research, innovation and application of progressive technologies





Ing. Mateusz
Fijalkowski, Ph.D.

Department of
Advanced Materials



MAIN RESEARCH ACTIVITIES

- Optimized unconventional structures of materials with a high degree of functionality, study of these materials and search for new areas of application
- Elaboration of methodology for measuring properties of thin films and coatings
- Machining technology, creating new types of layers and coatings suitable for specific applications

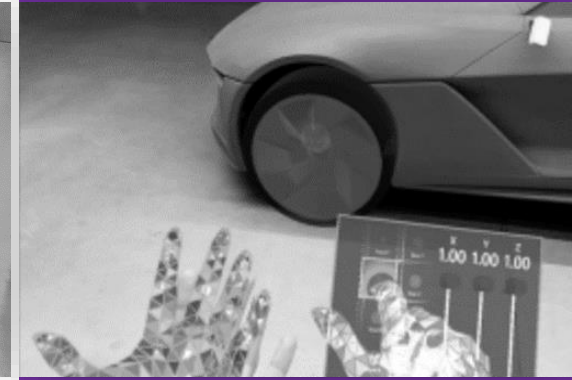


COOPERATION

- Comprehensive analyzes of materials, including microanalysis
- Material research focused on the development of linear and three-dimensional nanofiber structures, study of nanoparticles
- Professional support in solving production and technological issues in the industrial sphere



RESEARCH DIRECTIONS



**Nanomaterials in
natural sciences**

Lukáš Dvořák



**Competitive
engineering**

Jiří Šafka



**System
integration**

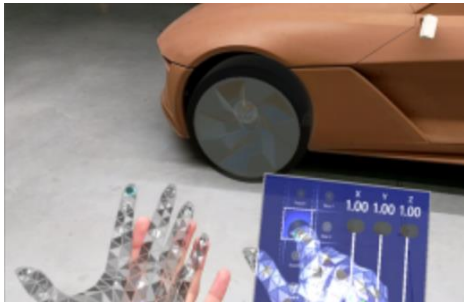
Jan Kočí



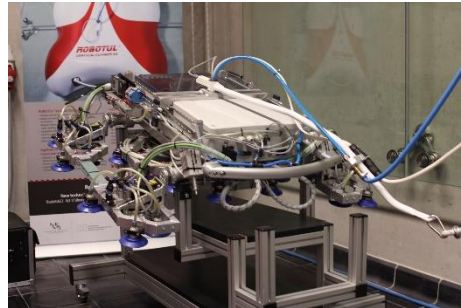
Ing. Jan Kočí

Head of research direction
System Integration and
Department of Process
Modelling & AI

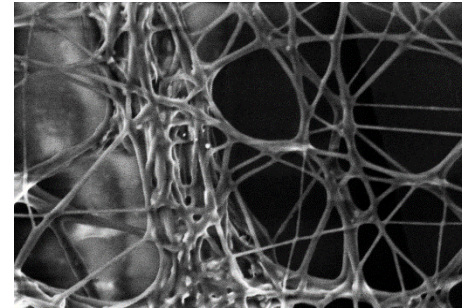
SYSTEM INTEGRATION



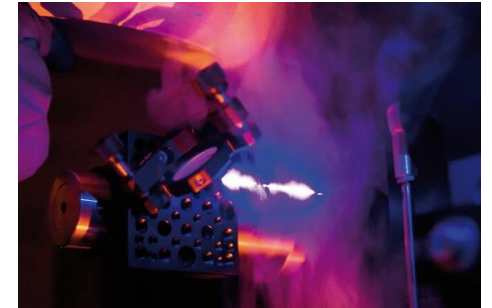
DEPARTMENT OF SW
ARCHITECTURE AND DEVELOPMENT



DEPARTMENT OF MECHATRONIC
SYSTEMS AND ROBOTICS



DEPARTMENT OF
PROCESS MODELING & AI



DEPARTMENT OF
PHYSICAL MEASUREMENTS

The research direction **system integration** focuses on research and development of modern software solutions, system solutions for data processing and integration between systems, and the provision of communication interfaces. An integral part of the direction is the field of robotics, including the use of collaborative or sensitive robots. The emphasis is being put on the introduction of state-of-the-art elements of visualization and projection of measured data, including the use of mixed / augmented reality.



MAIN RESEARCH ACTIVITIES

- Process modelling using mathematical, physical and numerical methods or principles of machine learning and artificial intelligence
- Robot process automation
- Big data storage, processing and analysis
- Complex application of data-driven approach to business or manufacturing processes

COOPERATION

- Image & pattern recognition
- Machine learning & prediction models
- Data storage, analysis, reporting
- Robotic process automation





Ing.
Jindřich Cýrus, Ph.D.

Department of
SW Architecture
and Development

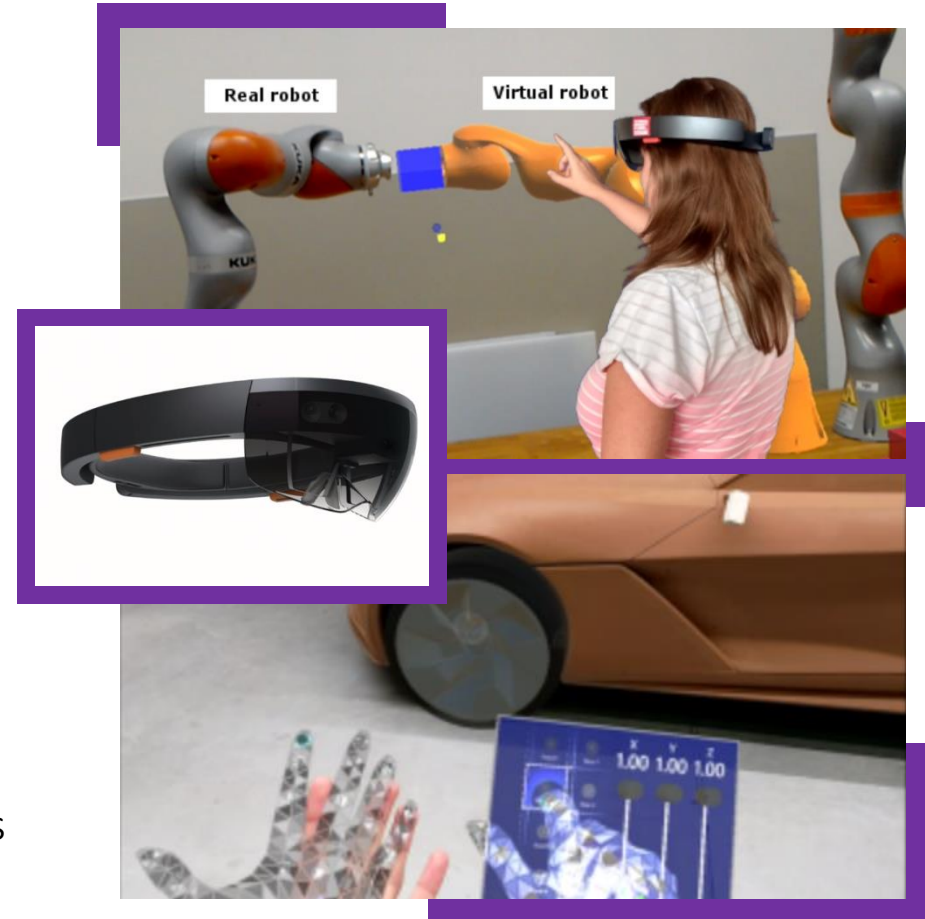


MAIN RESEARCH ACTIVITIES

- Research and development of modern software solutions, system solutions for data processing, integration between systems and communication interfaces
- Design of sw and hw solution architecture, which is implemented in target processes, using IoT devices, Cloud services and augmented reality
- Pillars of Industry 4.0 in product design and development

COOPERATION

- Design and application of IoT Technologies
- Use of augmented and mixed reality
- Design and implementation of artificial intelligence algorithms into processes
- Cloud solutions architecture





Ing. Michal Kotek, Ph.D.

Department of
Physical Measurement

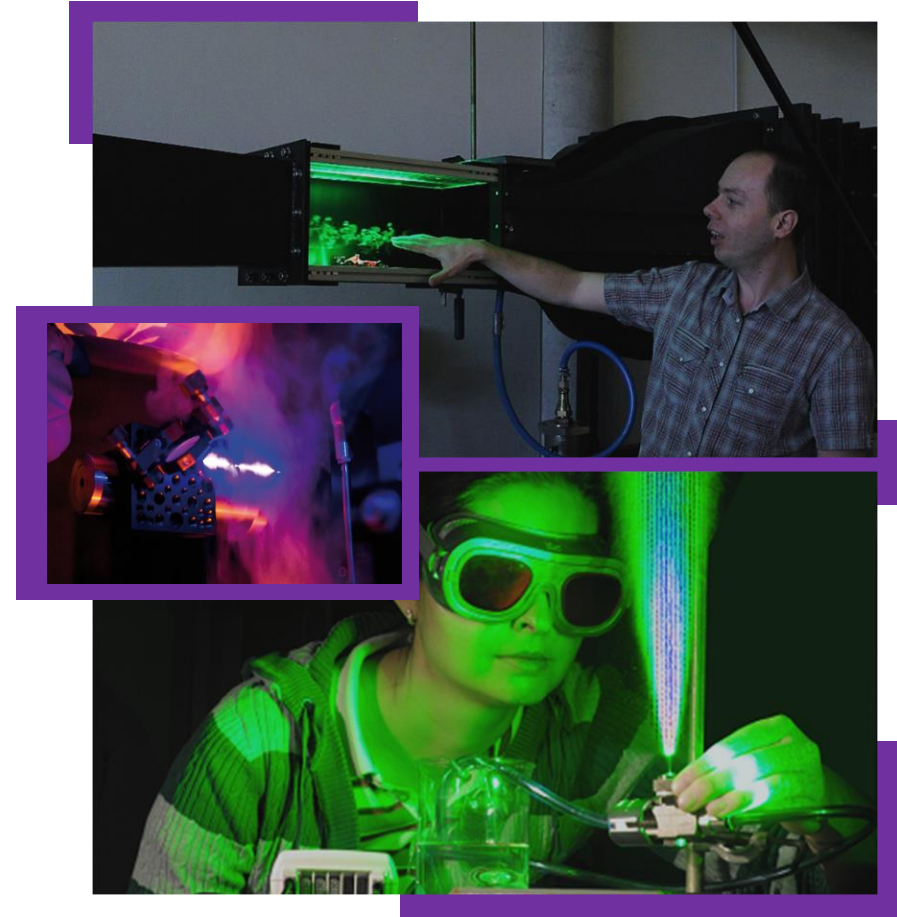


MAIN RESEARCH ACTIVITIES

- Research, development and use of tools and methods for contactless detection and measurement
- Measurement of physical quantities in industrial technological processes
- Experimental research in fluid mechanics with emphasis on non-stationary and multiphase flow
- Image information processing in industry

COOPERATION

- Application of "Global Imaging Methods" (LDA, PIV, microPIV, PLIF, IPI) in experimental fluid mechanics
- Advanced forms of industrial automation
- Monitoring and quality control of industrial products





Ing.
Tomáš Martinec, Ph.D.

Department of Mechatronic
Systems and Robotics



MAIN RESEARCH ACTIVITIES

- Innovative research of autonomous service robots
- Development of partial equipment of robotic technological workplaces and integration into production lines
- Solution of specific structural nodes of industrial robots and their effectors, mechatronic elements of automation technology and peripherals of robotic workplaces

COOPERATION

- Implementation of elements with a high degree of intelligence and new materials in robotic and mechatronic systems with more degrees of freedom and in standard drive topologies
- Rehabilitation robotics (exercise bikes, medical beds, ..)

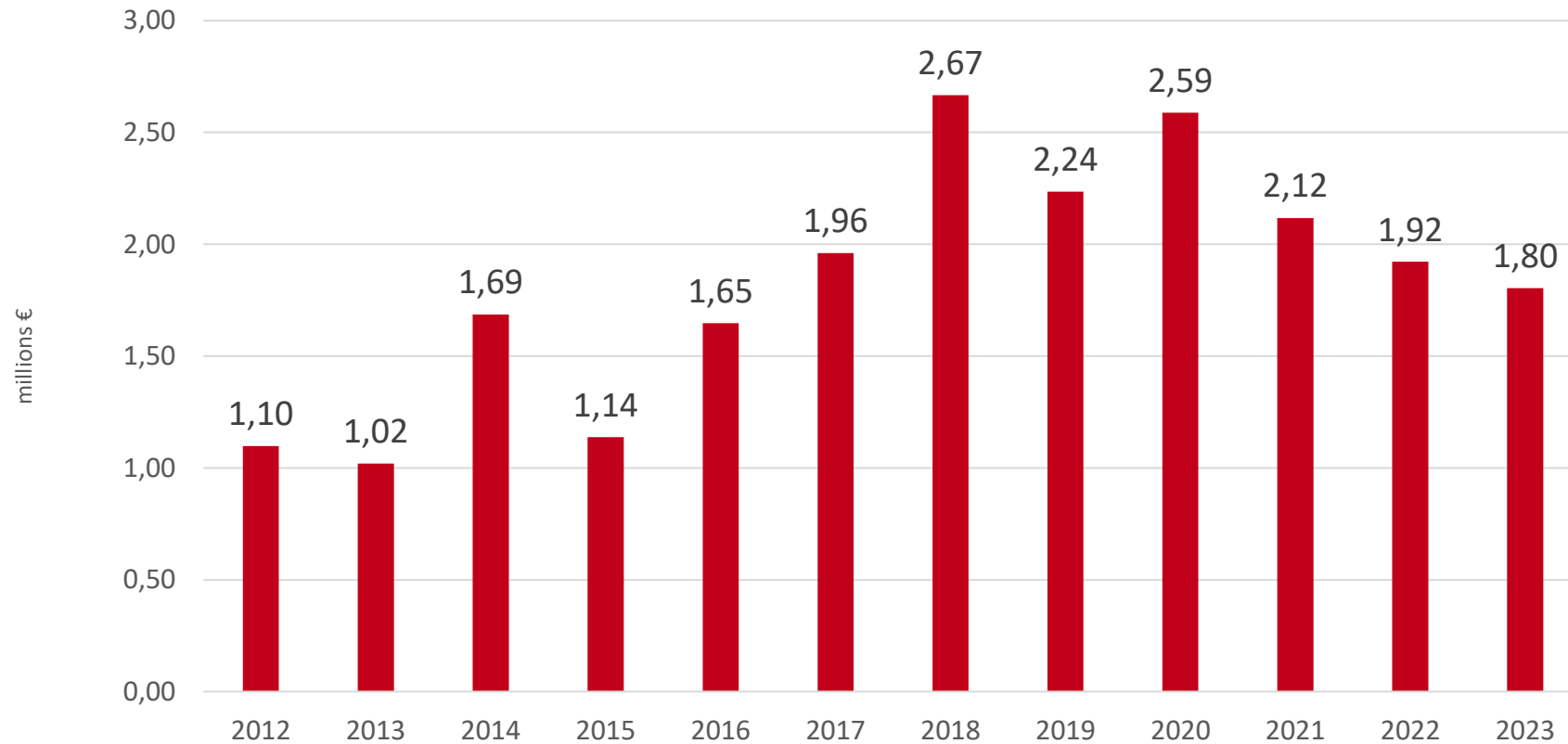




Interesting information

CXI TUL

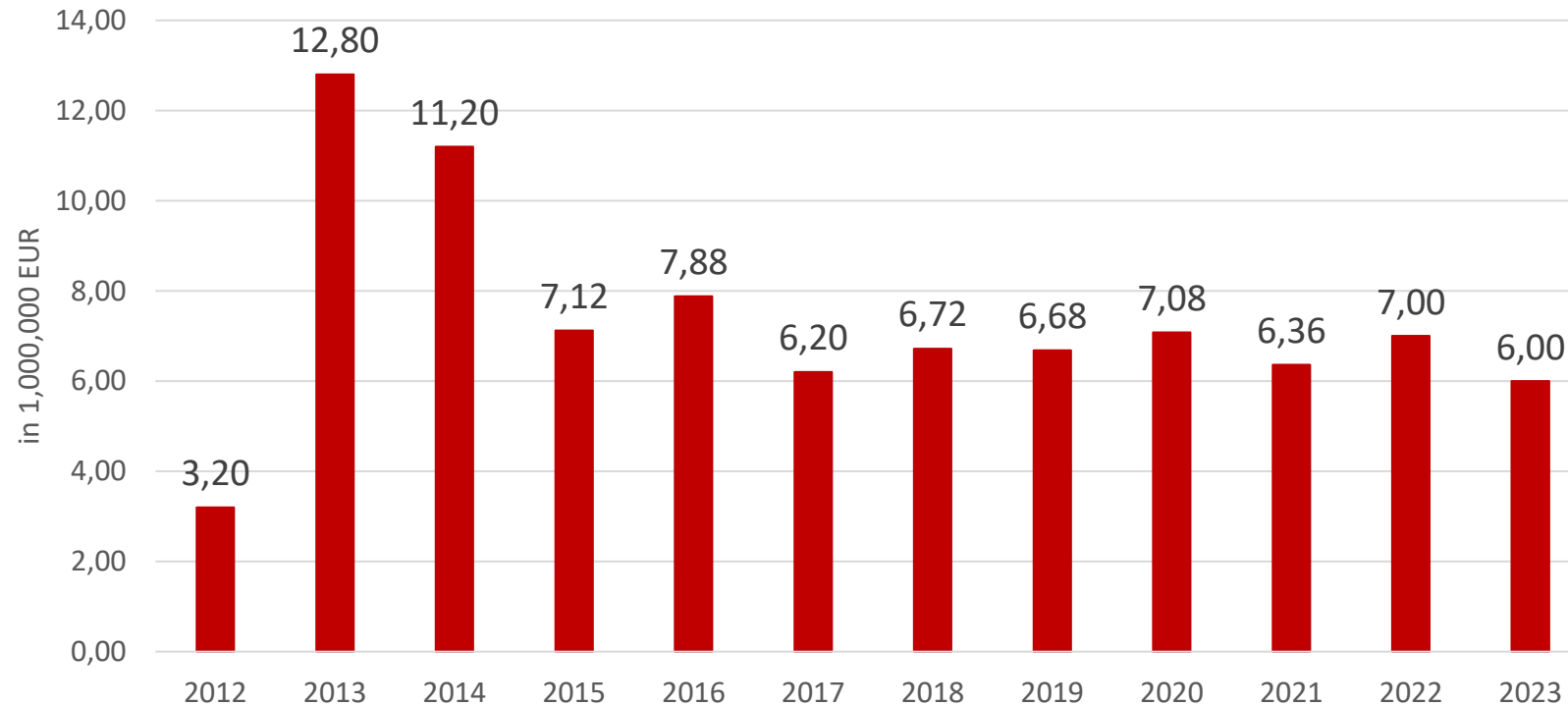
CONTRACT RESEARCH AND COMPLEMENTARY ACTIVITY



- 2016: contract volume **1.65 mil. EUR**
- 2017: contract volume **1.96 mil. EUR**
- 2018: contract volume **2.67 mil. EUR**
- 2019: contract volume **2.24 mil. EUR**

- 2020: contract volume **2.59 mil. EUR**
- 2021: contract volume **2.12 mil. EUR**
- 2022: contract volume **1.92 mil. EUR**
- 2023: contract volume **1.80 mil. EUR**

NATIONAL AND INTERNATIONAL GRANTS



- 2016: **71 projects** in volume of **7.88 mil. EUR**
- 2017: **67 projects** in volume of **6.20 mil. EUR**
- 2018: **82 projects** in volume of **6.72 mil. EUR**
- 2019: **85 projects** in volume of **6.68 mil. EUR**

- 2020: **84 projects** in volume of **7.08 mil. EUR**
- 2021: **77 projects** in volume of **6.36 mil. EUR**
- 2022: **90 projects** in volume of **7.00 mil. EUR**
- 2023: **89 projects** in volume of **6.00 mil. EUR**



More than 100 machines > 13 mil. EUR



FORMS OF COOPERATION



Contractual research

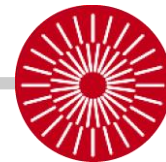
Services



Common projects
Research and Development

Consortium - AMIA

PARTNERS (for example)



BOSCH



SKODA



PRECIOSA



MAGNA

Lersen

JaP
Jacina

SKLOPAN
LIBEREC

BEDNAR

Barum



Volkswagen

NANOPROGRESS
THE NANOTECHNOLOGY CLUSTER

envisipur

ELMARCO
NANO FOR LIFE

etc.

PROJECT SOLUTIONS (e. g.)

JOSEF BOŽEK COMPETENCE CENTER FOR
THE AUTOMOTIVE INDUSTRY



Ing. Robert Voženílek, Ph.D.

e-mail: robert.vozenilek@tul.cz

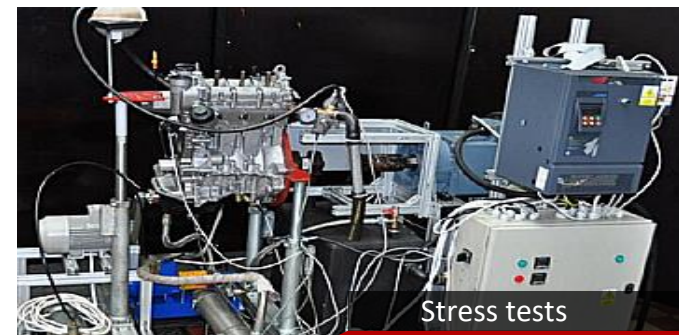
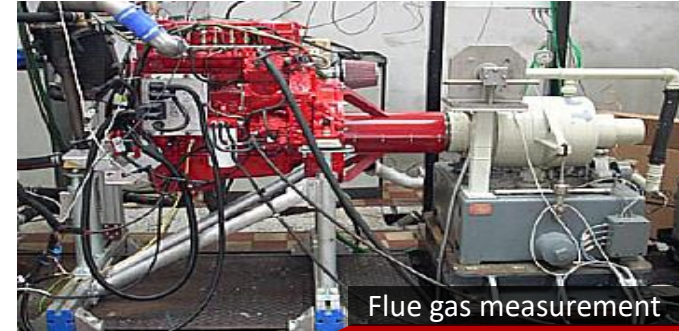
tel.: +420 485 353 376

Goals:

- reducing the consumption of fossil fuels,
- reduction of CO₂ emissions,
- increase safety and comfort.

The Center develops future means of sustainable mobility of road and rail vehicles and further develops the technical levels of fields important for the economy of the Czech Republic.

Connects **4 universities**: TUL, ČVUT, VUT Brno, VŠB,
and **9 industrial partners**: Škoda Auto a.s., TÜV SÜD Czech s.r.o., Ricardo Prague s.r.o., MOTORPAL a.s., Honeywell, spol. s r.o., BRANO a.s., ČZ a.s., AICTA Design Work, s.r.o. and TATRA, a.s.



PROJECT SOLUTIONS (e.g.)

LIFEPOPWAT



prof. Dr. Ing. Miroslav Černík, CSc.

e-mail: miroslav.cernik@tul.cz
tel.: +420 485 353 178



EU LIFE - LIFEPOPWAT



LIFEPOPWAT is a European project that combines chemical and microbiological water treatment technologies. The essence of the demonstration system is the Wetland+ wetland cascade, which removes halogenated pollutants from flowing waters with low operating costs.

The aim of the project is to show the functionality of the technology on a full-scale prototype with a flow rate of over 100,000 m³ per year and to verify the procedures for its optimization aiming at smaller and larger water flows with different chemical composition.

TECHNICAL
UNIVERSITY
OF LIBEREC

PHOTON
WATER

Jaworzno
źródło energii

AARHUS UNIVERSITY

GiG Research
Institute 95

SERPOL
SERFIMDÉPOLLUTION

DIAMO

Ministerstvo životního prostředí

NFOŠIGW



LIFE
POP
WAT



doc. Ing. Michal Petru, Ph.D.

e-mail: michal.petru@tul.cz
tel.: +420 485 353 833



OP VVV - Modular platform for autonomous chassis of specialized electric vehicles for freight and equipment transportation

The aim of the project is the development and experimental verification of a competitive autonomous battery vehicle for the transport of medium and higher weight loads in general terrain.

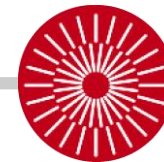
Solutions to the following scientific research problems represent partial goals of the project:

- modular architecture of the chassis using so-called light constructions,
- drives and accumulators for autonomous commercial electric vehicles,
- research in the field of autonomous commercial electric vehicle control systems using shared reality or the Internet of Things to interact with other entities.

Potential users are logistics operations in the general terrain (construction, mining, agriculture, industrial enterprises, special forces).

PROJEKTOVÁ ŘEŠENÍ (např.)

LIFE4ZOO



Ing. Tomáš Lederer, Ph.D.

e-mail: tomas.lederer@tul.cz
tel.: +420 485 353 260



EU LIFE – LIFE4ZOO

LIFE4ZOO

LIFE4ZOO (Water Resources Management in Visitor Attractions - FIT4USE Water Recirculation Technology) is a European project aiming to create a "circular economy" system for water use in visitor attractions such as Zoos.

The benefits of water recirculation are reduced demand on primary water resources, reduced cost-saving, reduced demand on sewerage systems and multiple synergies with better use of energy and water resources.

TECHNICAL
UNIVERSITY
OF LIBEREC



Universitat
de Girona



Fundació Solidaritat
UNIVERSITAT DE BARCELONA



ZOO
LIBEREC





Ing. Jiří Šafka, Ph.D.

e-mail: jiri.safka@tul.cz
tel.: +420 485 353 801

P3DT



CENTRUM
PRO PRŮMYSLOVÝ
3D TISK

NCK TAČR - Centre for Industrial 3D Printing

The main objective is to **increase the potential of additive technologies** through the efficient and environmentally friendly use of raw materials or energy, the development of materials with specific properties and the creation of new products, the design of appropriate technologies and the use of digitalization, enabling a high degree of optimization.

The objective will be achieved by implementing sub-projects involving at least 26 partners, resulting in at least 80 applied research results with high implementation potential.

A secondary objective is **creating a platform** exploiting the multiplier effect of interdisciplinary networking of research organisations and industrial leaders with shared know-how, which will facilitate the long-term and sustainable development of additive technologies in the Czech Republic and thus increase its competitiveness.

PROJECT SOLUTION (e. g.)

SURRI



prof. Dr. Ing. Miroslav Černík, CSc.

e-mail: miroslav.cernik@tul.cz
tel.: +420 485 353 178



EU HORIZON TWINNING - Sustainable Remediation of Radionuclide Impacts on Land and Critical Materials Recovery

The project SURRI aims to establish a multinational shared research agenda and project pipeline for addressing the challenges radionuclides pose to land remediation and materials recovery, with a particular focus on rare earth elements (REE) and other critical elements, in order to facilitate more efficient cycling and management of water, soil and material resources.

The research concept is based on the integration of electrochemical and microbiological interventions, which can be applied, in-situ or ex-situ, to provide new tools to unlock the remediation of radionuclide affected sites.

TECHNICAL
UNIVERSITY
OF LIBEREC



SAPIENZA
UNIVERSITÀ DI ROMA

University of
Southampton

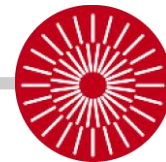


UNIVERSIDAD
DE GRANADA

SURRI



PROJECT SOLUTION (e. g.)



Interreg



Kofinanziert von
der Europäischen Union
Spolufinancováno
Evropskou unií

Sachsen – Tschechien | Česko – Sasko

Projekttitel:

Interdisziplinäre Brücke – InterBridge

Název projektu:

Interdisciplinární most – InterBridge

Hauptziel des Projektes

Hlavní cíl projektu

Die Region Liberec und Sachsen verfügen über ein reiches kulturelles und wissenschaftliches Erbe sowie über begabte Künstler und Wissenschaftler. Deshalb wurde dieses Projekt ins Leben gerufen, um dieses Potenzial zu nutzen und die Zusammenarbeit zwischen Wissenschaft und Kunst auf grenzüberschreitender Ebene zu entwickeln. Das Hauptziel von Interbridge besteht darin, Wissenschaft und Kunst vor allem durch Bildung, neue Technologien und Materialforschung zu verbinden.

Liberecký kraj a Sasko mají bohaté kulturní a vědecké dědictví i talentované umělce a vědce. Proto vznikl projekt, který by umožnil využití tohoto potenciálu a rozvoj spolupráce mezi vědou a uměním na přeshraniční úrovni. Interbridge má jako hlavní cíl propojení vědy a umění především prostřednictvím vzdělávání, nových technologií a materiálového výzkumu.

Leadpartner: Technische Universität in Liberec
Technická univerzita v Liberci

Projektpartner: Technische Universität Chemnitz
Technická univerzita v Chemnitz

Gesamtkosten des Projektes

Celkové náklady projektu

1.190.487,12 Euro



Mehr Informationen über das Programm finden Sie auf unserer Website!
Více informací o programu najdete na našich webových stránkách!





PROJEKT **LasApp**

Průlomové laserové technologie pro chytrou výrobu, vesmírné a biotechnologické aplikace

je spolufinancován **Evropskou unií**.

Rozvoj centra vědecké excelence a kompetence v **laserové** technice se zaměřením na vláknové a tenkodiskové lasery a jejich potenciální **aplikace**.



Spolufinancováno
Evropskou unií



MINISTERSTVO ŠKOLSTVÍ,
MLÁDEŽE A TĚLOVÝCHOVY



We look forward to you!

CXI TUL



INSTITUTE FOR NANOMATERIALS,
ADVANCED TECHNOLOGIES
AND INNOVATION TUL

Studentská 1402/2 | 461 17 Liberec 1 | e-mail: cxi@tul.cz

cxi.tul.cz

Research on the Top