Czech University of Life Sciences Prague
Faculty of Engineering

Research infrastructure at Faculty of Engineering

assoc. prof. Ing. Jiří Mašek, Ph.D., Dean of FE

assoc. prof. Ing. Rostislav Chotěborský, Ph.D., Vice-dean for research of FE

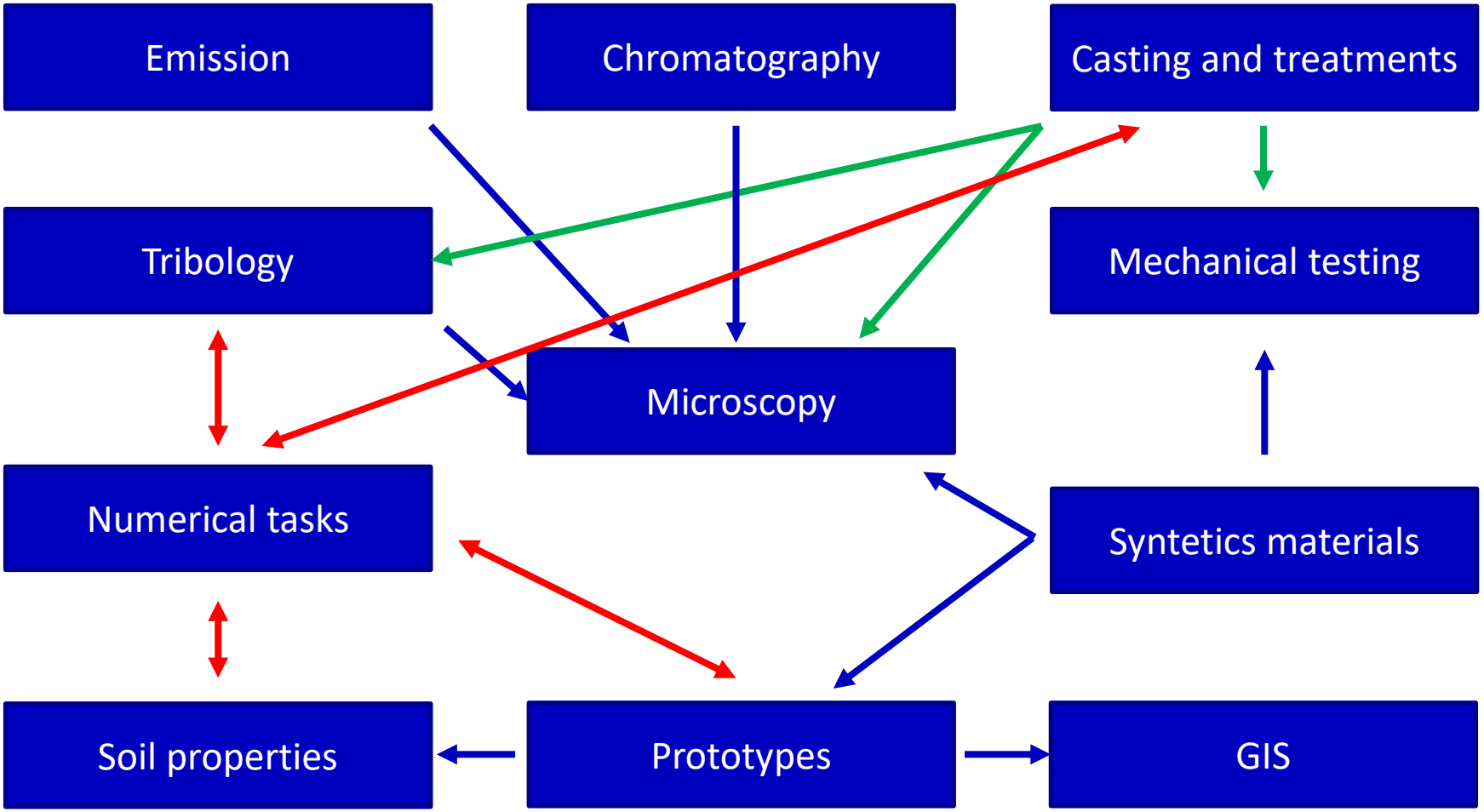
Technical equipment of FE lab

Shared laboratories

1. Chromatography
2. Emission
3. Microscopy
4. Numerical tasks
5. Soil properties
6. Precision Farming
7. ProLab
8. Robotics
9. Tribology
10. Mechanical testing
11. Fluid Power
12. Syntetics materials
13. Casting and treatments
14. Formula Student
15. Bioenergy and renewables
16. Experimental research brewery

Czech University of Life Sciences Prague
Faculty of Engineering

Colaborations



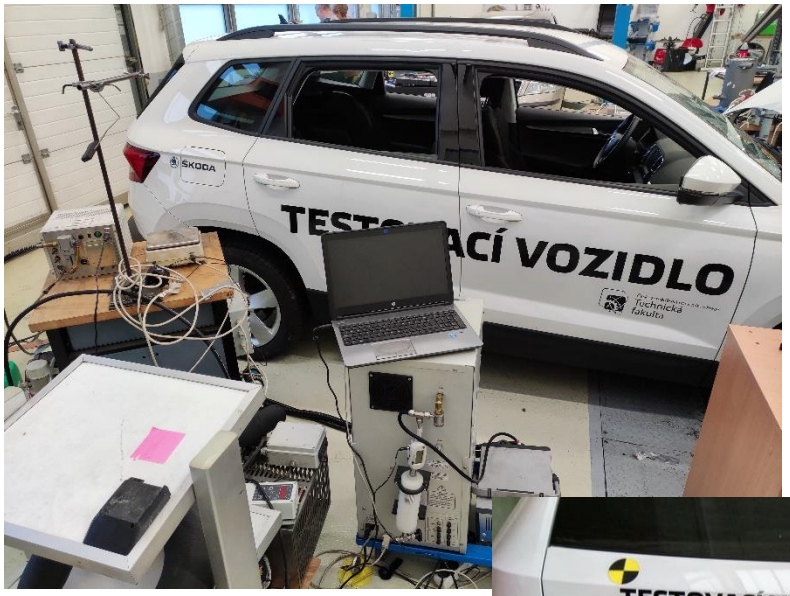
Czech University of Life Sciences Prague
Faculty of Engineering

Chromatography

- Analytical equipment for determination of carbon, hydrogen, sulphur and nitrogen in the biological materials.
- Analytical equipment for determination of specific heat, moisture content and trash in biological materials.

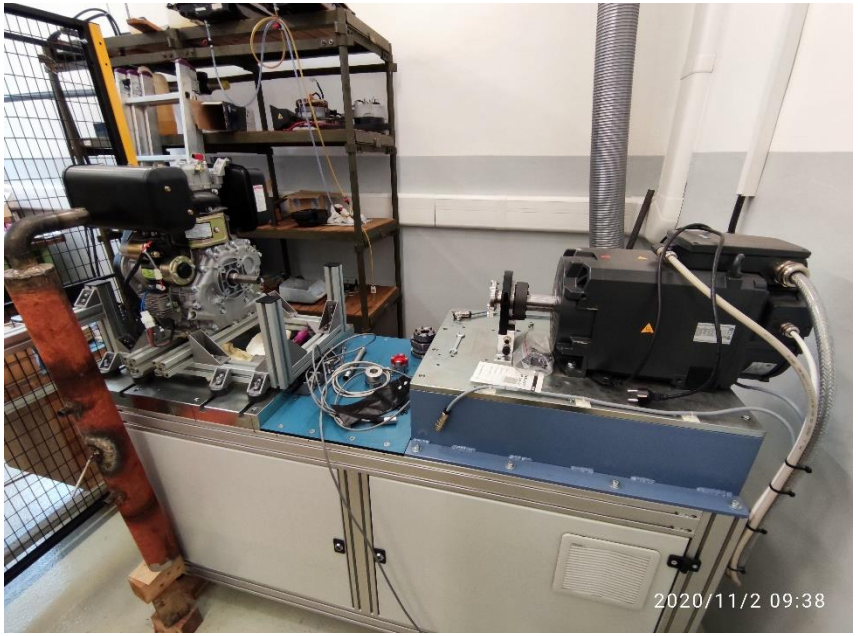
Emission

- Particle analysis, exhaust analysis
- Testing car (Škoda)



Emission

Power engine testbed – for small and big power engines
Equipment for data processing: Labview, DAQ card (USB, PCI)



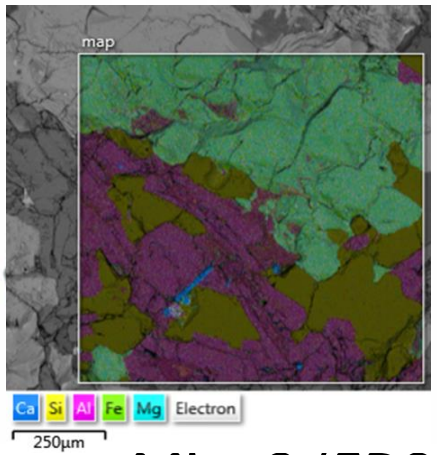
Emission

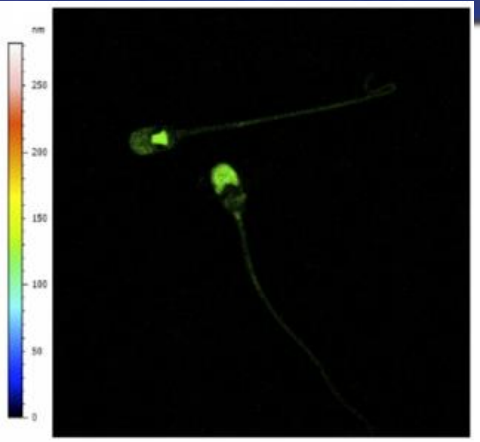
Powertrain testbed for tractors

Equipment for preparing and testing of experimental biofuels. Emison and consumption incl.

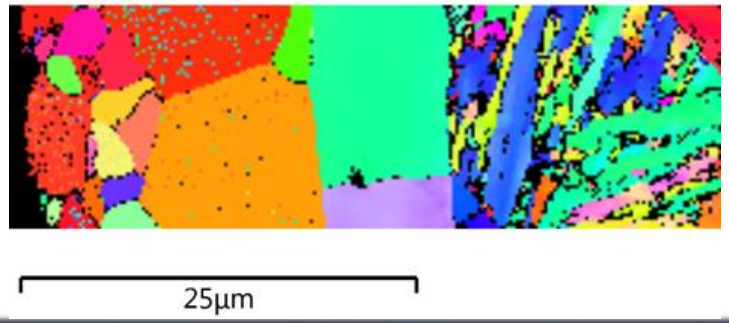
Czech University of Life Sciences Prague
Faculty of Engineering

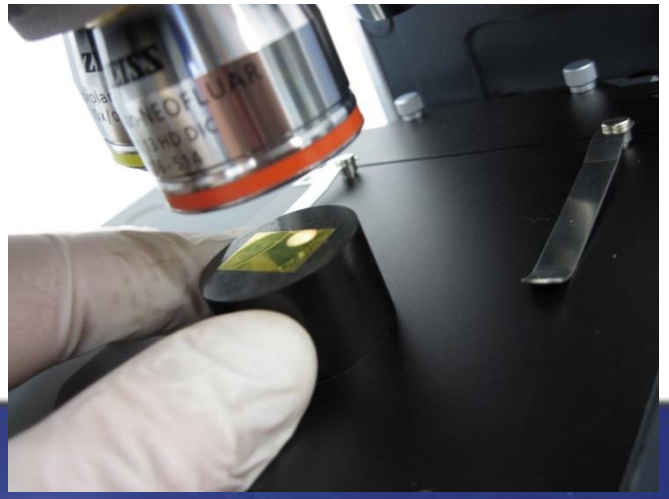
Microscopy





- Scanning electron microscopy Tescan Mira 3 (EDS, EBSD)
- Confocal laser microscopy Zeiss
- Equipment for preparing of samples Struers
- Optical microscopy Zeiss





Czech University of Life Sciences Prague
Faculty of Engineering

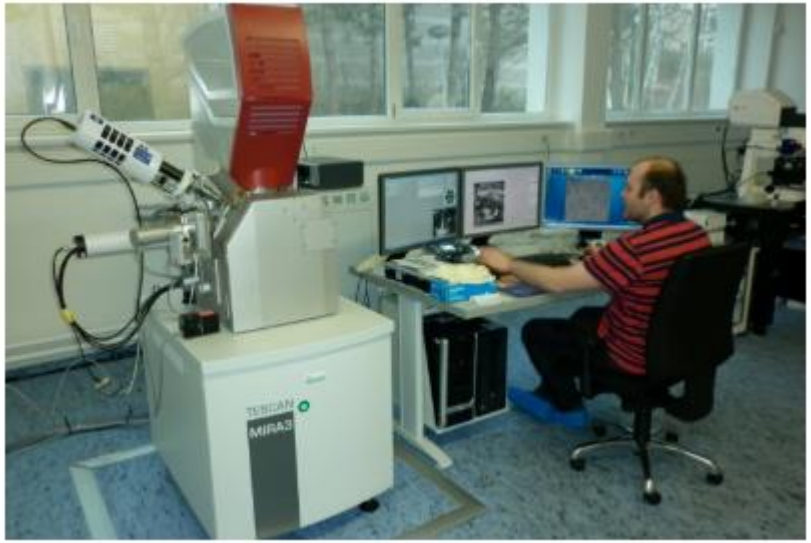
Microscopy

Equipment for preparing metallic samples, cutting, grinding, polishing and electropolishing and electroetching, sonic-cleaning. Automatical and hand system.

Czech University of Life Sciences Prague
Faculty of Engineering

Microscopy

Scanning electron microscopy Tescan Mira
EDS + EBSD Oxford Instrument

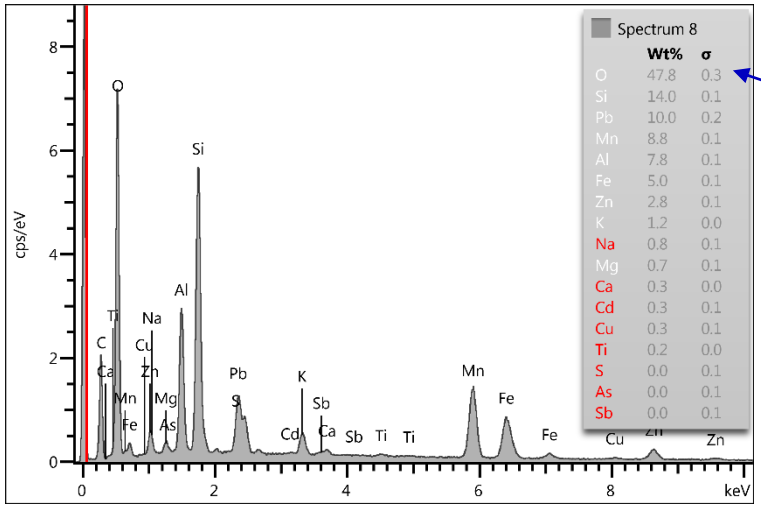


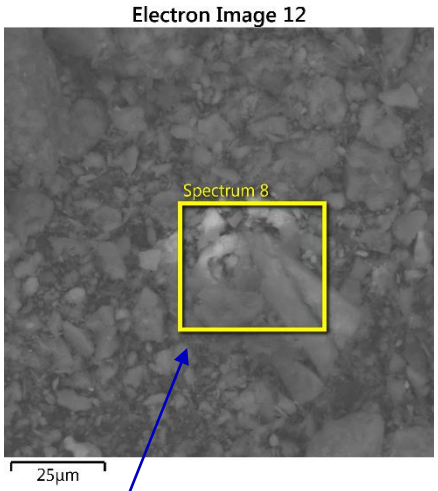
Metallography, fractography, EDS analysis of metallic (high vakuum) and nonmetallic (low vakuum) materials, crystallography (EBSD).

Light optical microscopy Zeiss LM800

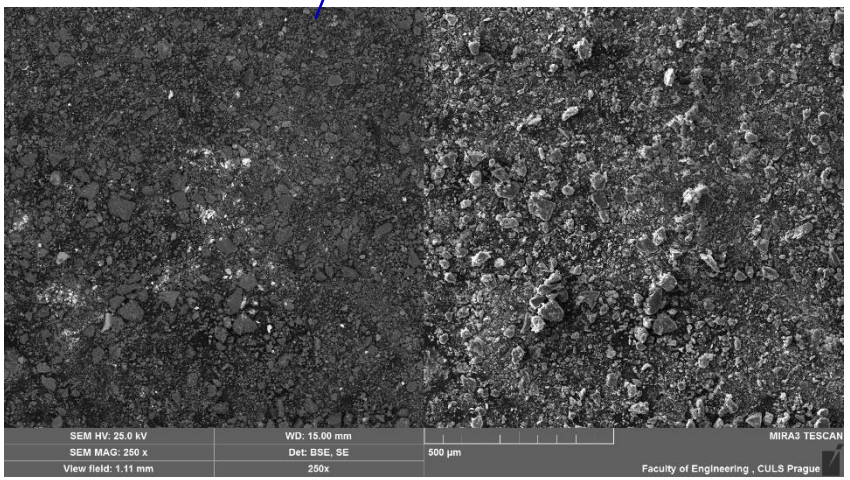
Czech University of Life Sciences Prague
Faculty of Engineering

Microscopy – collaboration within CULS



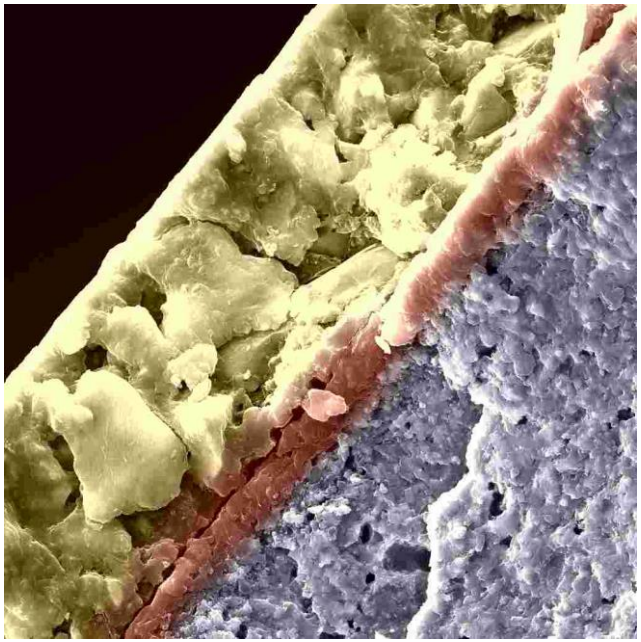


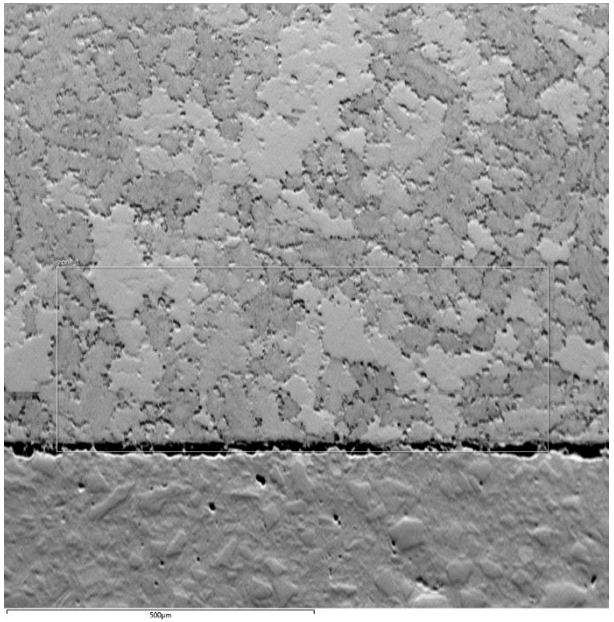
Determination of heavy metals in the soil.
Cooperation with FES, Phd students

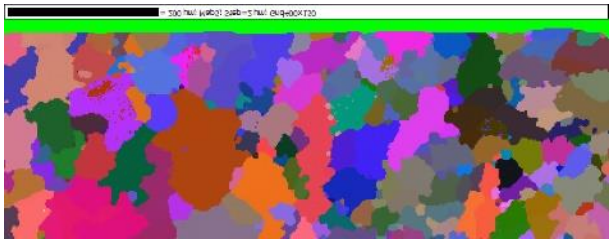


Microscopy – ex. collaboration FE TUB

Ni alloy – determination of misorientation grain

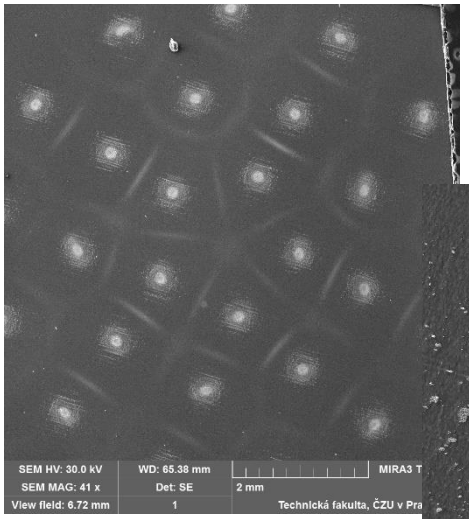


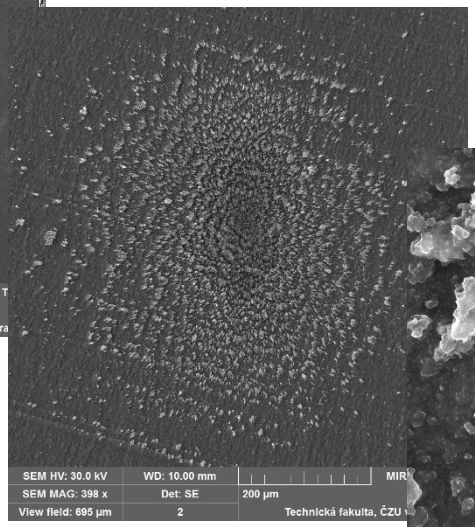


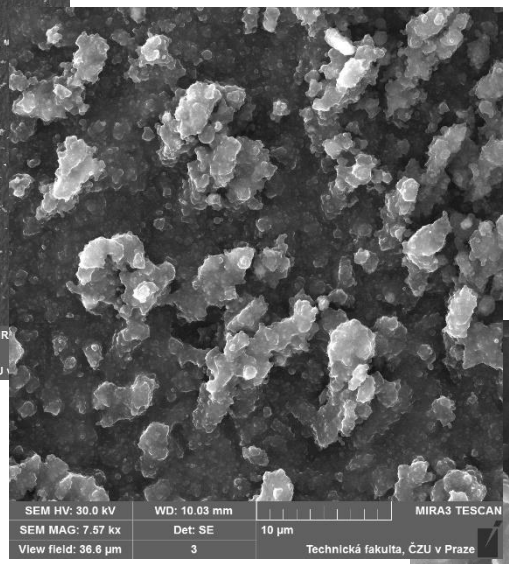


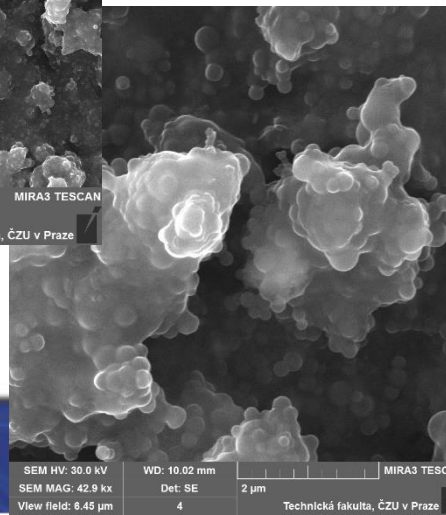
Czech University of Life Sciences Prague
Faculty of Engineering

Microscopy - emmision





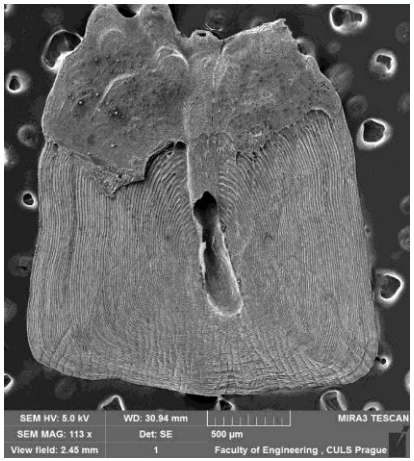




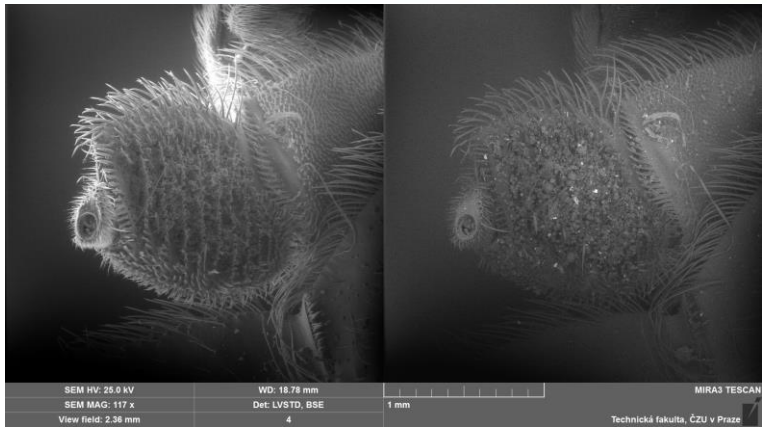
Particle from DPF

Czech University of Life Sciences Prague
Faculty of Engineering

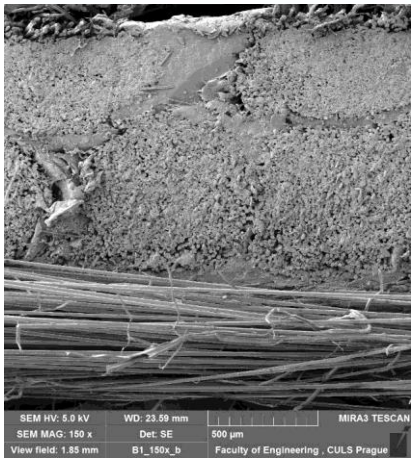
Microscopy – colaboration in life science



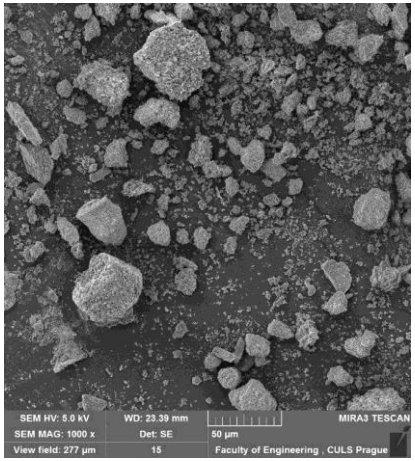
Fish scale



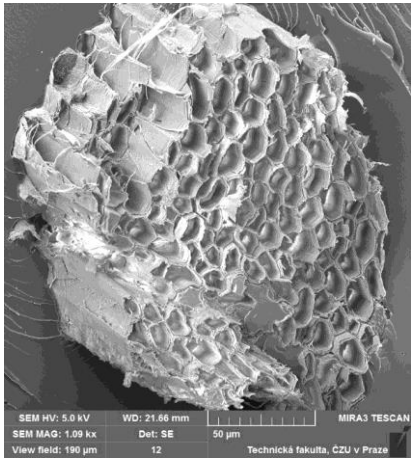
Bee



Rubber textile



Ash



False banana fiber in compostite

Colaboration:
Faculty of Agrobiology, Food and Natural Resources
Faculty of Environmental Sciences
Technical University of Liberec
….

Numerical Tasks

- Ansys Multiphysics 10/100 (research/teaching licences), +HPC
- LS-Dyna - 1 comercial licence, 20 teaching licences
- RockyDEM – 1 associated licence (8 cores or 1 GPU), 5 research licences (16 cores or 2 GPU), 25 teaching licences (only 4 cores per task).
- 1 server system (72 cores, 3 TB RAM, 30 TB HDD, 2xGPU nVidia P100), 1 PC (16 cores, 64 GB RAM, 2 TB SSD, GPU nVidia QV100)
- 4 PC for preprocessing and postprocessing (8 cores, 128 GB RAM, 6 TB HDD, 1 TB SSD)

Czech University of Life Sciences Prague
Faculty of Engineering

Numerical Tasks - Hardware

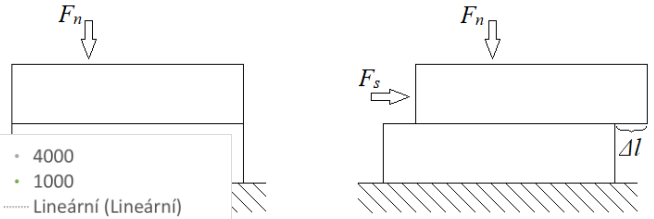
HP Superdome Flex
1x HPE SD Flex Rack Management Controller
1x HPE Superdome Flex 4s Base Chassis
1x HPE SD Flex PCIe FH 12-slot 3 Riser Kit
1x HPE SD Flex DVD-R Drive
4x HPE Superdome Flex Xeon-G 6154 Kit
12x HPE SD Flex DDR4 256GB (4x64GB) Mem Kit
2x HPE 480GB SATA 6G MU SFF RW DS SSD, R1
1x HPE NVIDIA Tesla P100 PCIE 16GB Module + HPE SD Flex P100 Enablement Kit
1x HPE Ethernet 10Gb 2-port 562SFP+ Adptr + HPE BLc 10G SFP+ SR Transceiver Kit
1x HPE 3154-8e RAID Controller
1x HPE D3610 w/12 4TB 12G SAS 7.2K LFF (3.5in) Midline Smart Carrier HDD 48TB Bundle
2x HPE External 4.0m (13ft) Mini-SAS HD 4x to Mini-SAS HD 4x Cable
2x RHEL HPC Comp Node+SM 2 Skt 3yr Flx LTU, 3Y SW support
1x HPE Foundation SW 2 RHEL Lic RTU + PE Foundation SW 2 RHEL Media

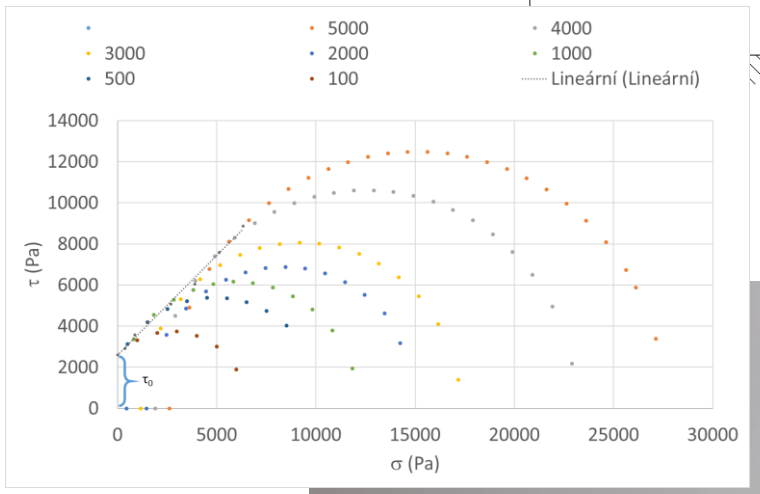
Processor & Chipset

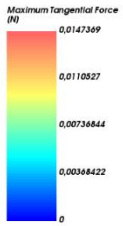
Chipset Manufacturer	NVIDIA
Chipset Line	Tesla
Chipset Model	P100
Number of GPUs	1
NVIDIA CUDA® Cores	3584
Double-Precision Performance	4.7 TeraFLOPS
Single-Precision Performance	9.3 TeraFLOPS
Half-Precision Performance	18.7 TeraFLOPS

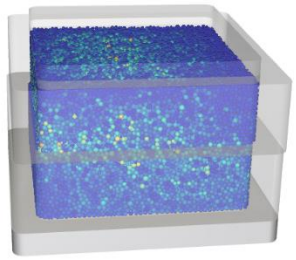
Numerical tasks – supported equipments

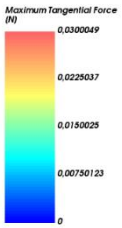
- Shear test of bulk matter

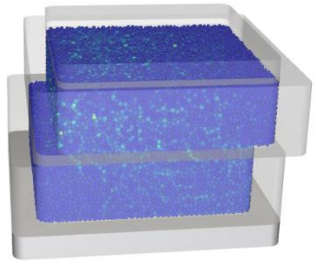


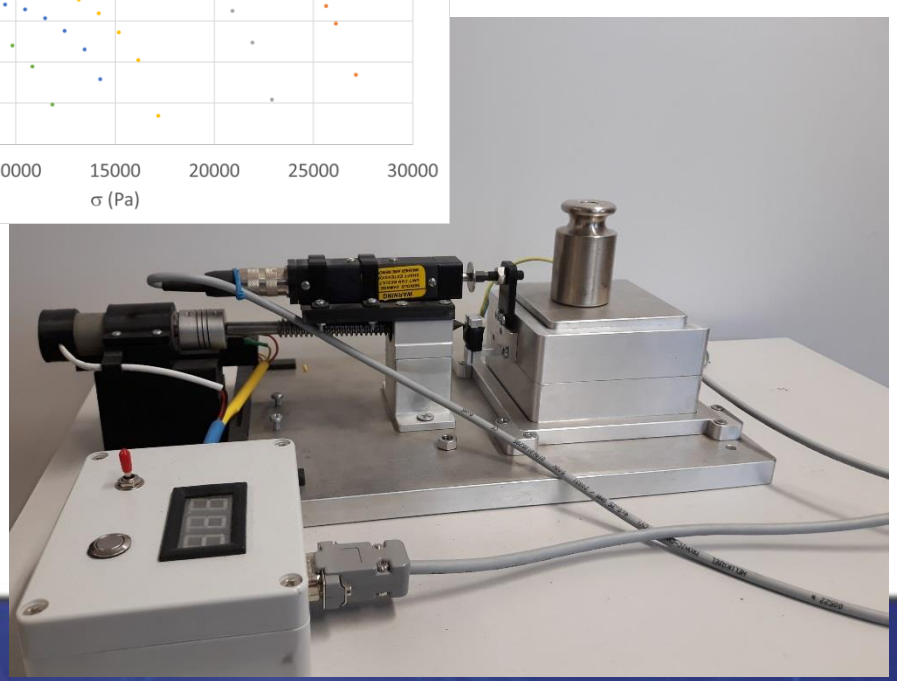






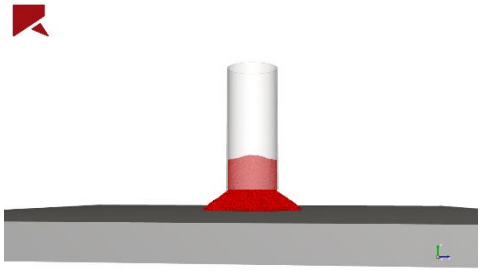


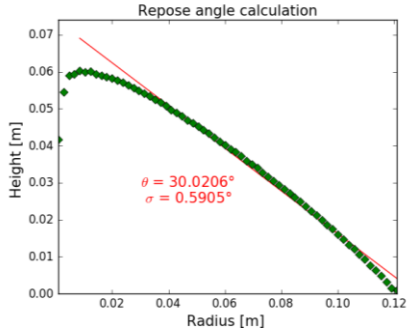


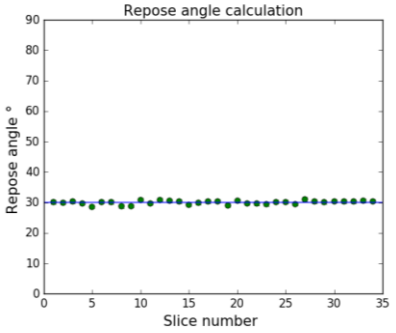


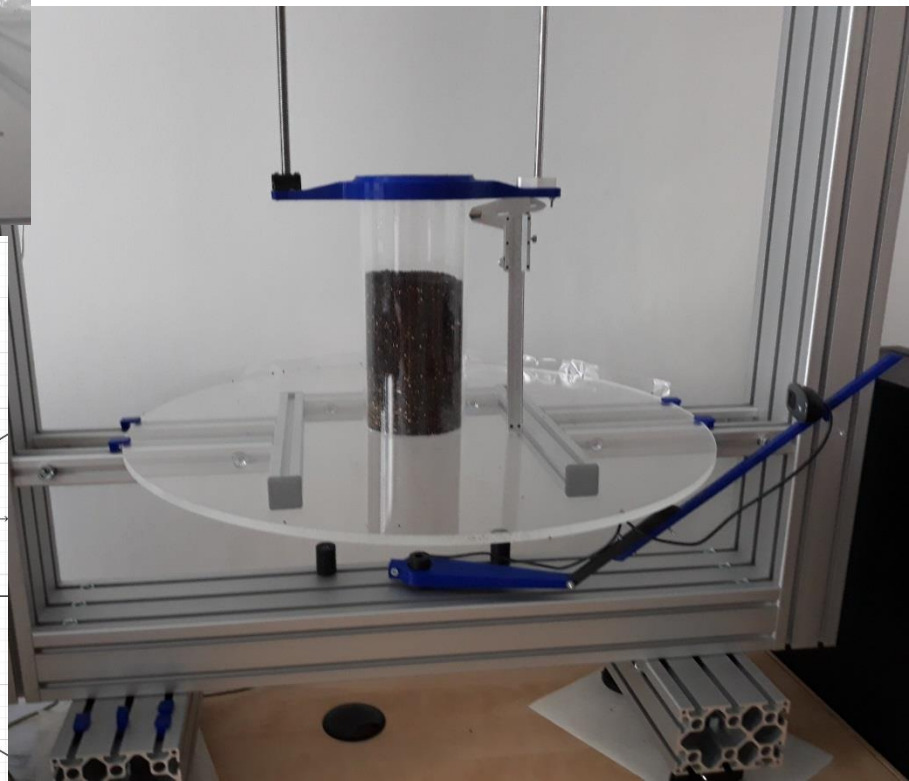
Czech University of Life Sciences Prague
Faculty of Engineering

Numerical tasks



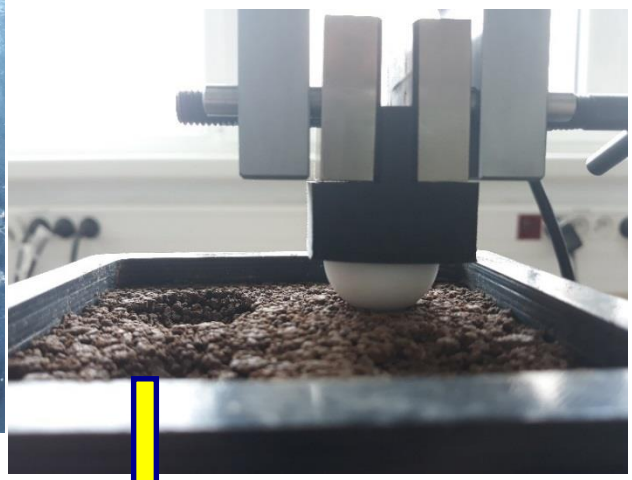


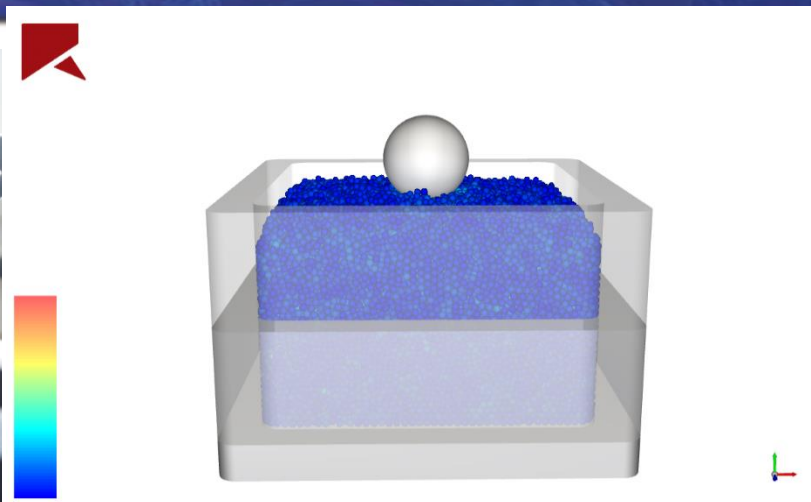


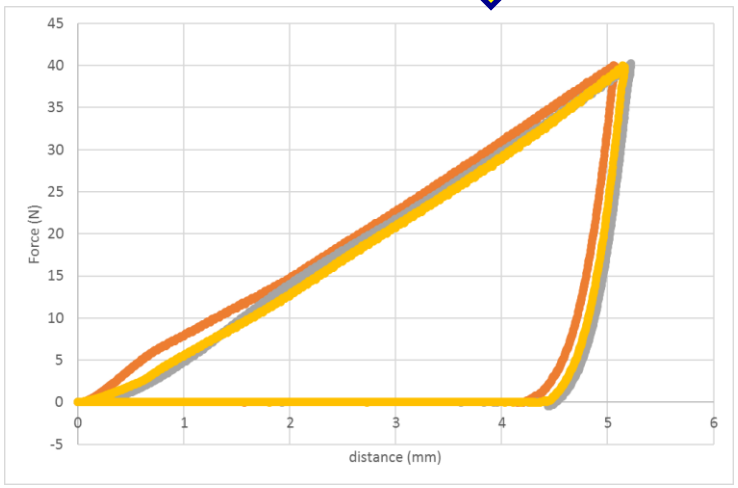


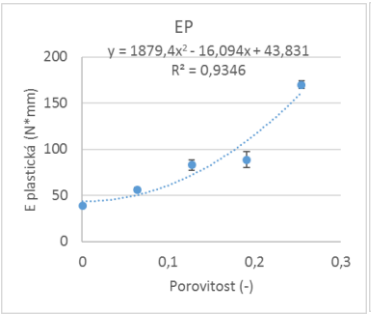
Czech University of Life Sciences Prague
Faculty of Engineering

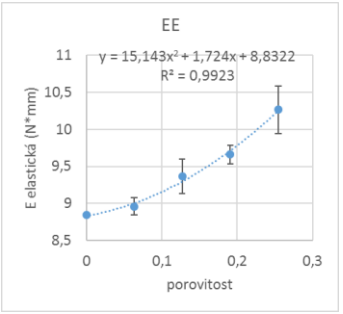
Numerical Tasks - Adhession of bulk matter

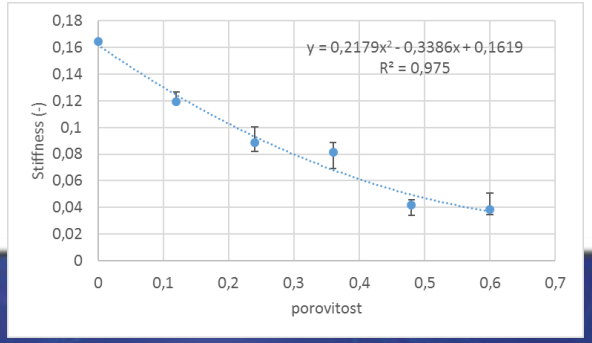






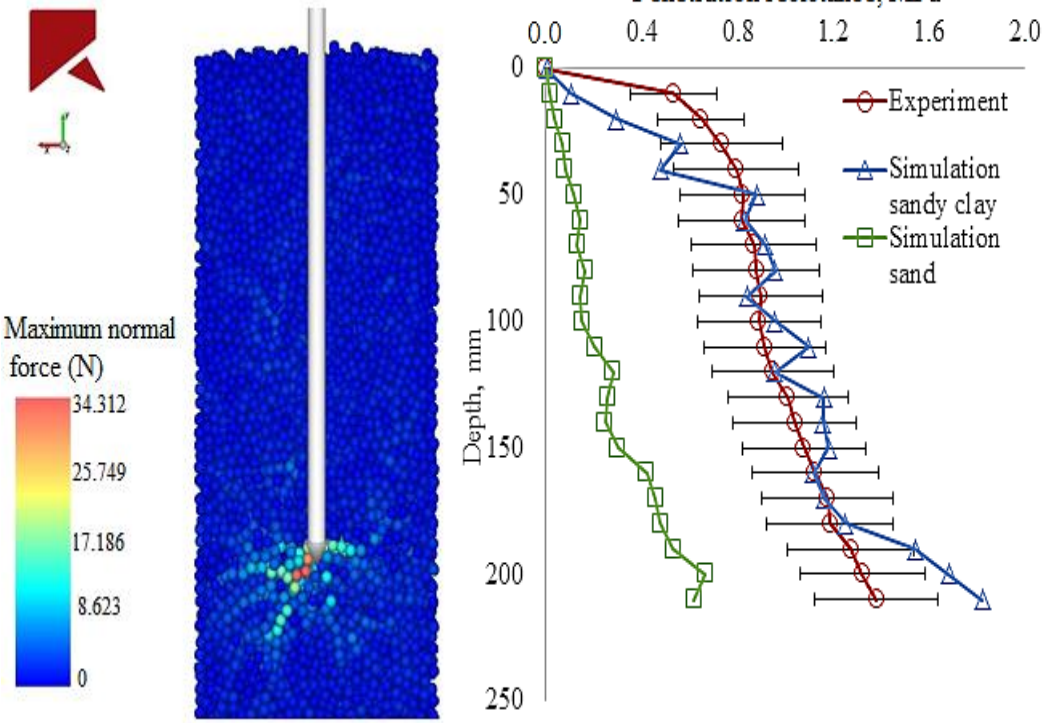


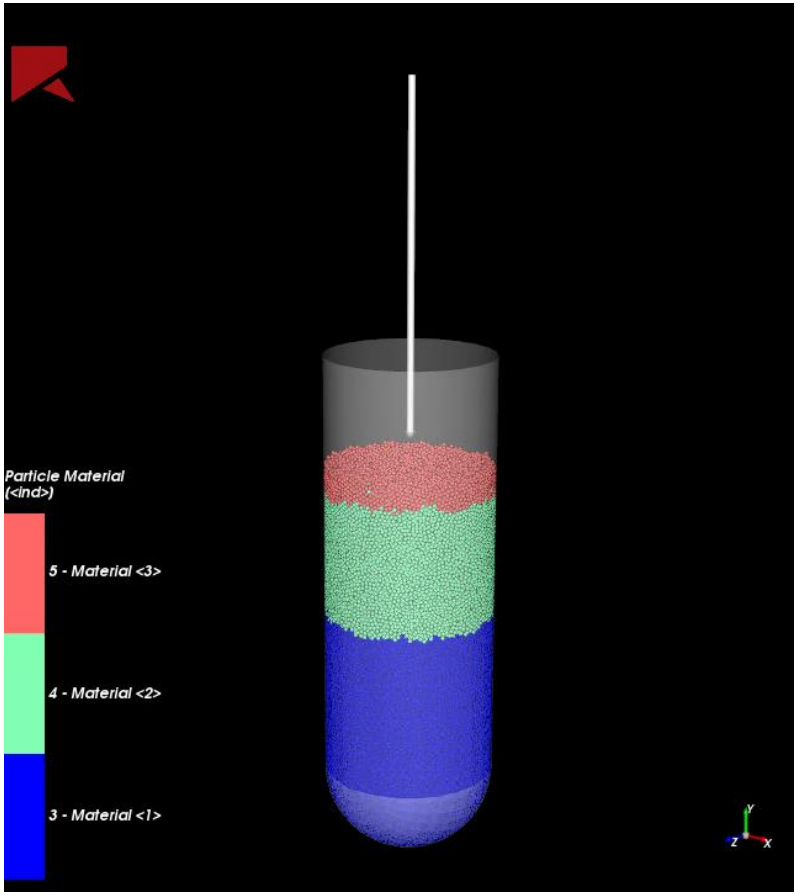




Numerical tasks -Penetration resistance testing

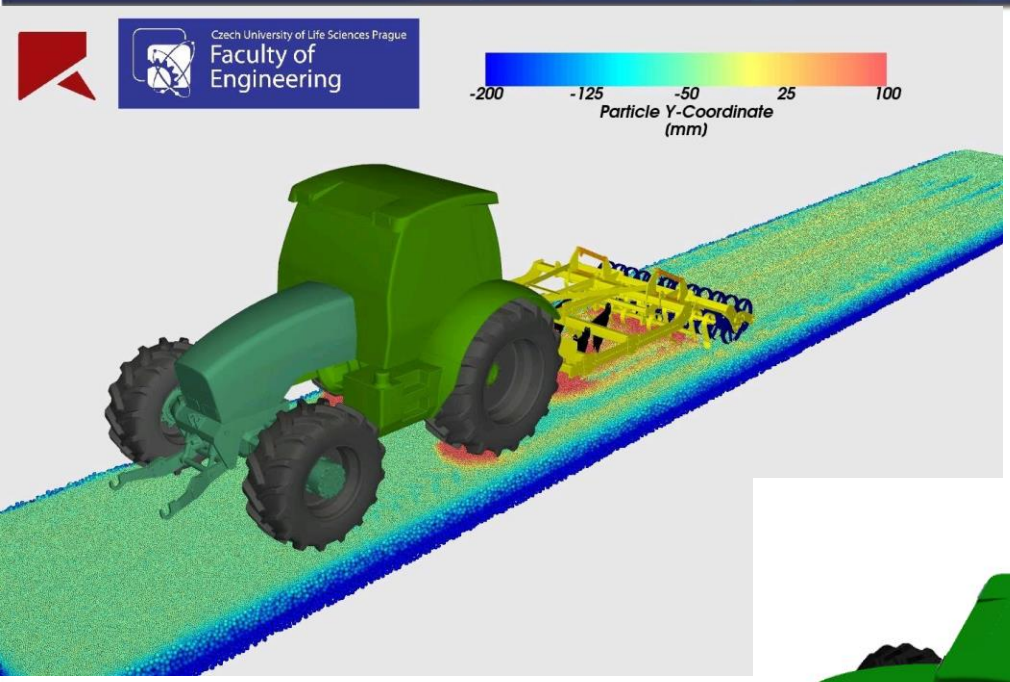
- penetrometer

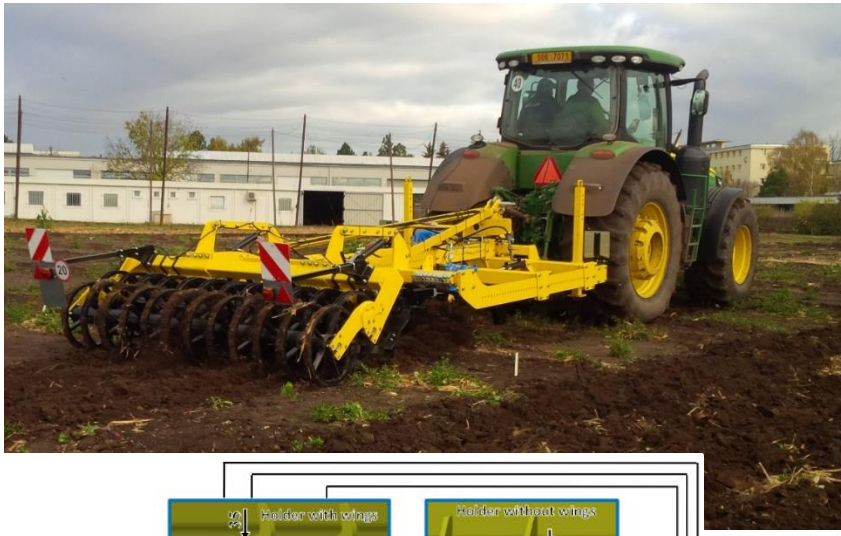


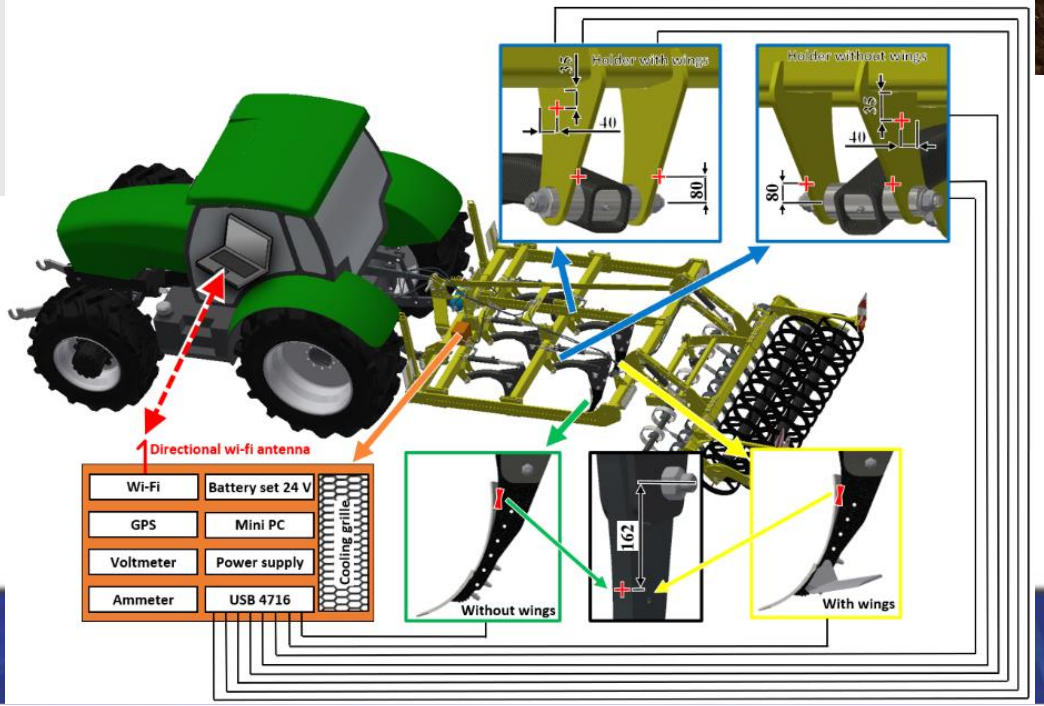


Czech University of Life Sciences Prague
Faculty of Engineering

Numerical Tasks - Process Modeling



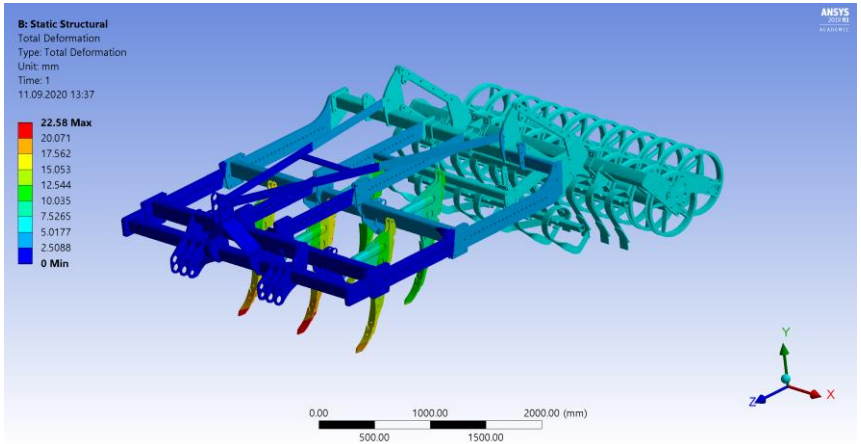




DAQ advantech 5xUSB 1716
Mini PC
Strain gauge (semicontuctor)

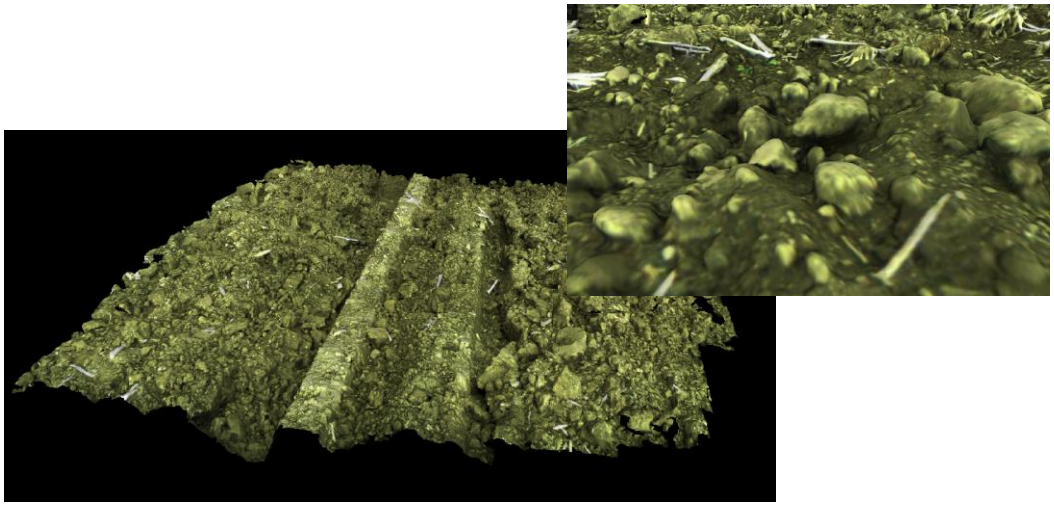
Czech University of Life Sciences Prague
Faculty of Engineering

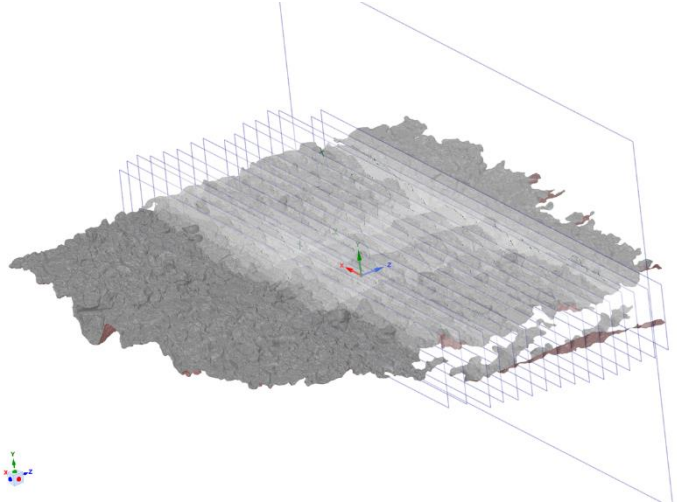
Numerical Tasks - evaluation

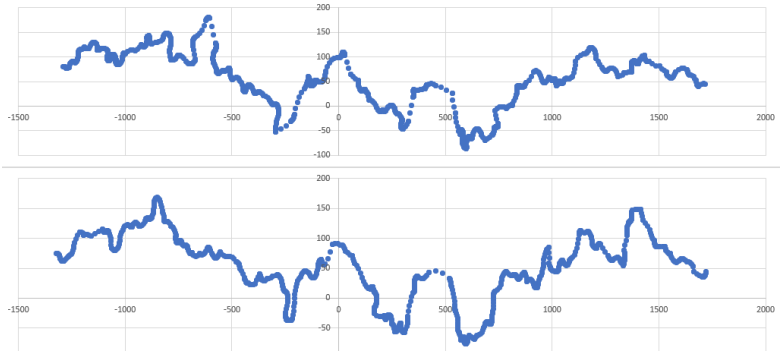


Czech University of Life Sciences Prague
Faculty of Engineering

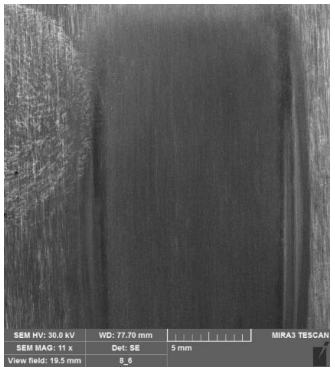
Numerical Tasks - process modeling

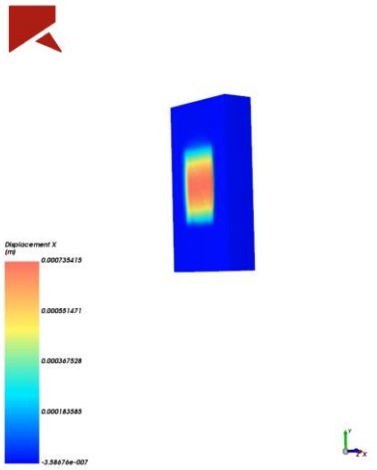






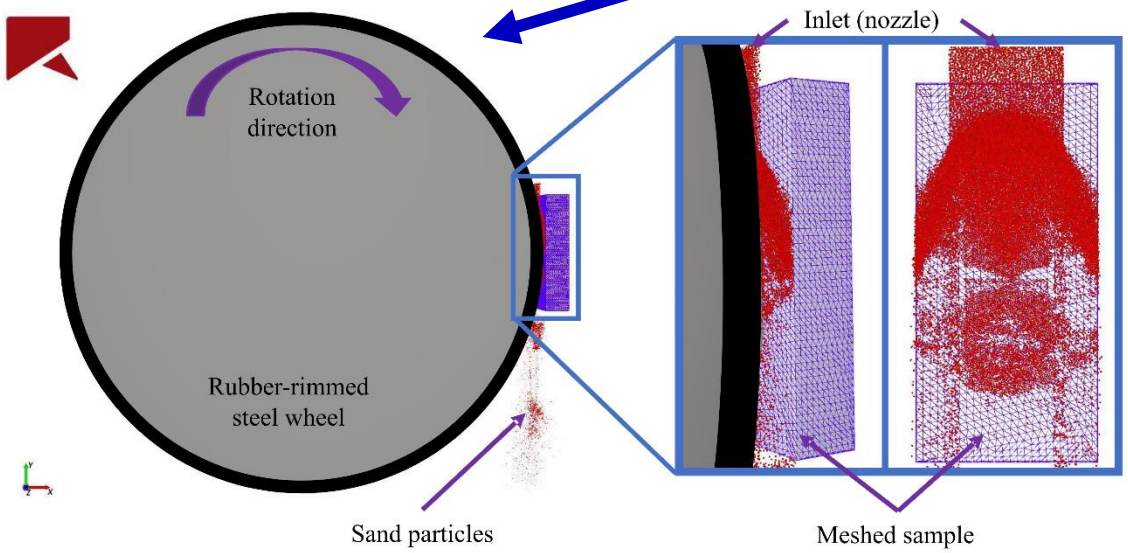
Numerical Tasks - wear

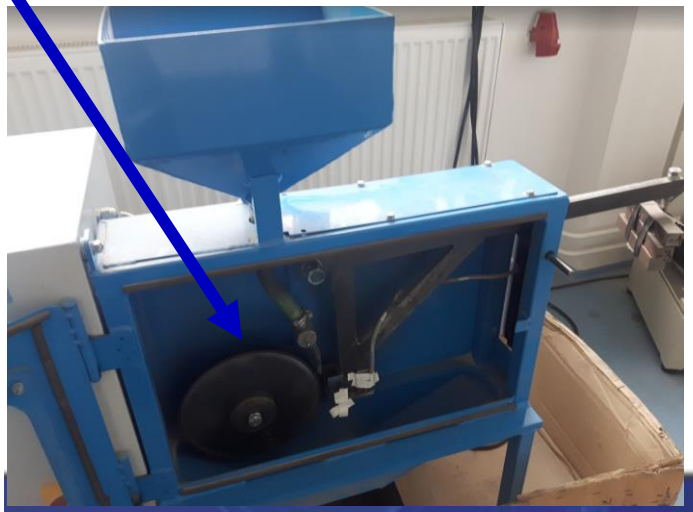




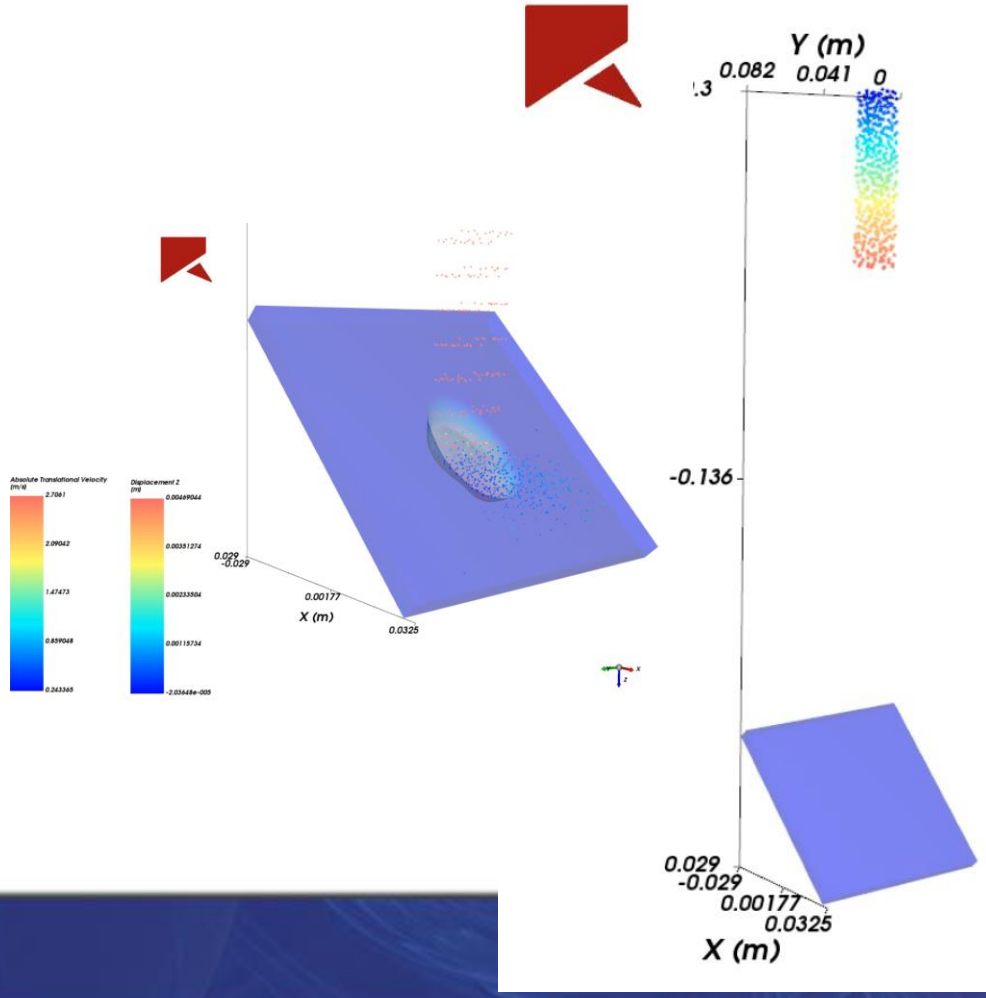
- ASTM G65:

rubber



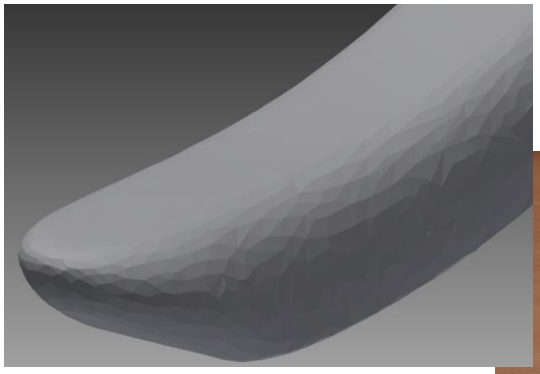


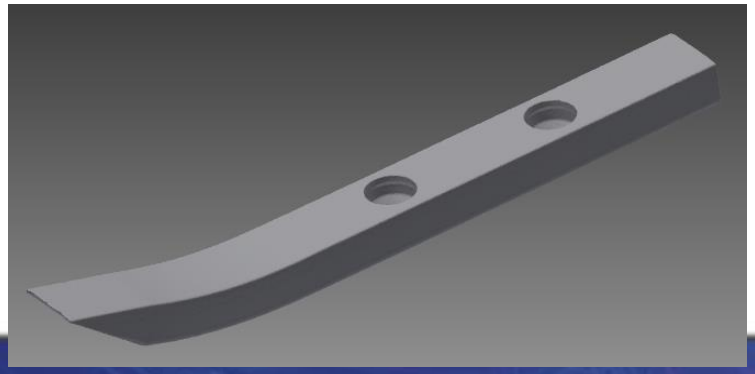
Numerical Tasks - errosion

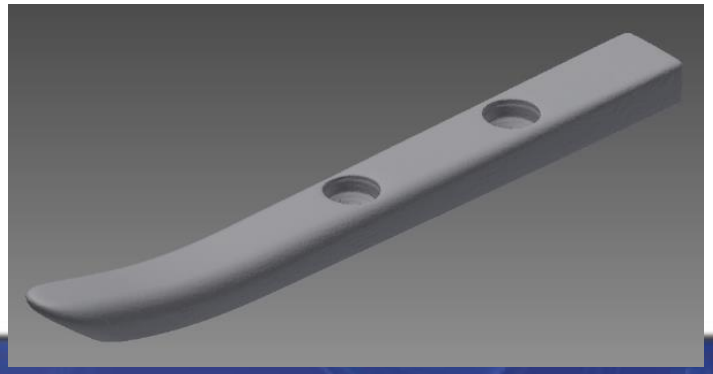


Czech University of Life Sciences Prague
Faculty of Engineering

Numerical tasks - Analysis of worn tools by 3D scanning (red and blue laser)







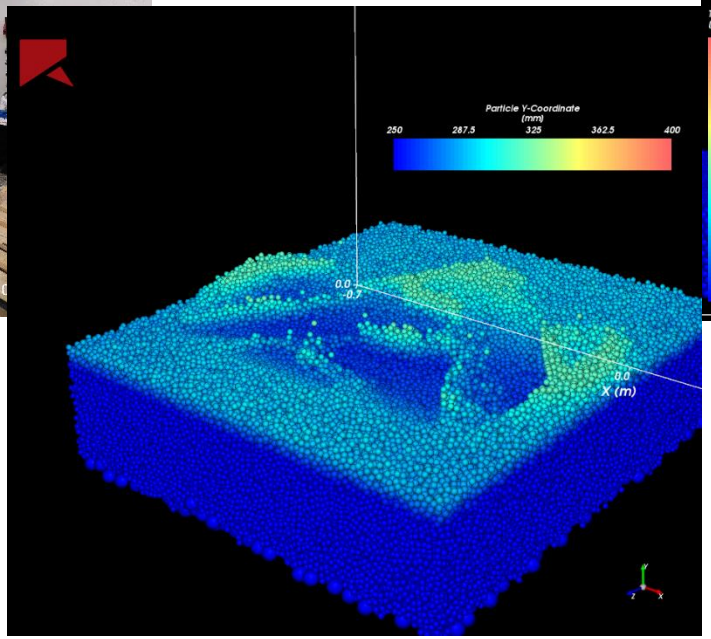
Soil properties

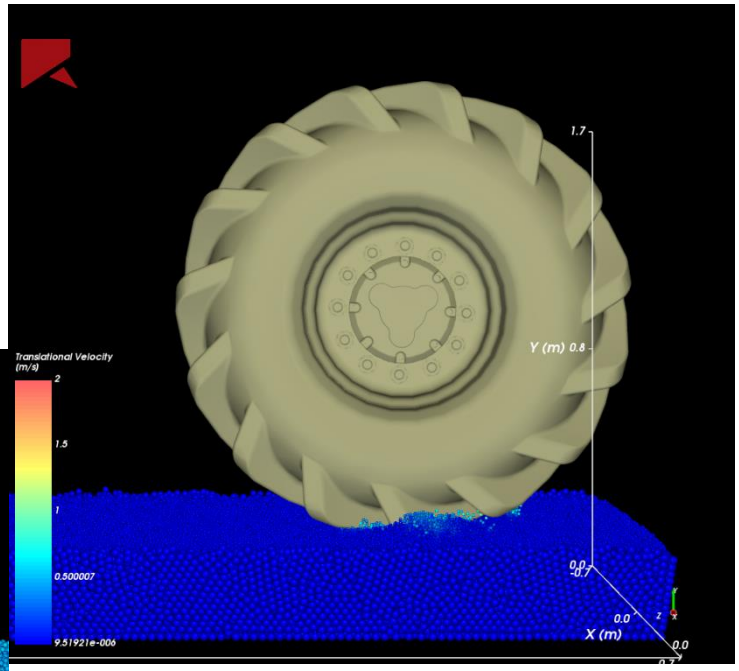
- Soil trough
- Gravimetries

- Support:
- Complementary: numerical tasks

Czech University of Life Sciences Prague
Faculty of Engineering

Soil properties - Interaction





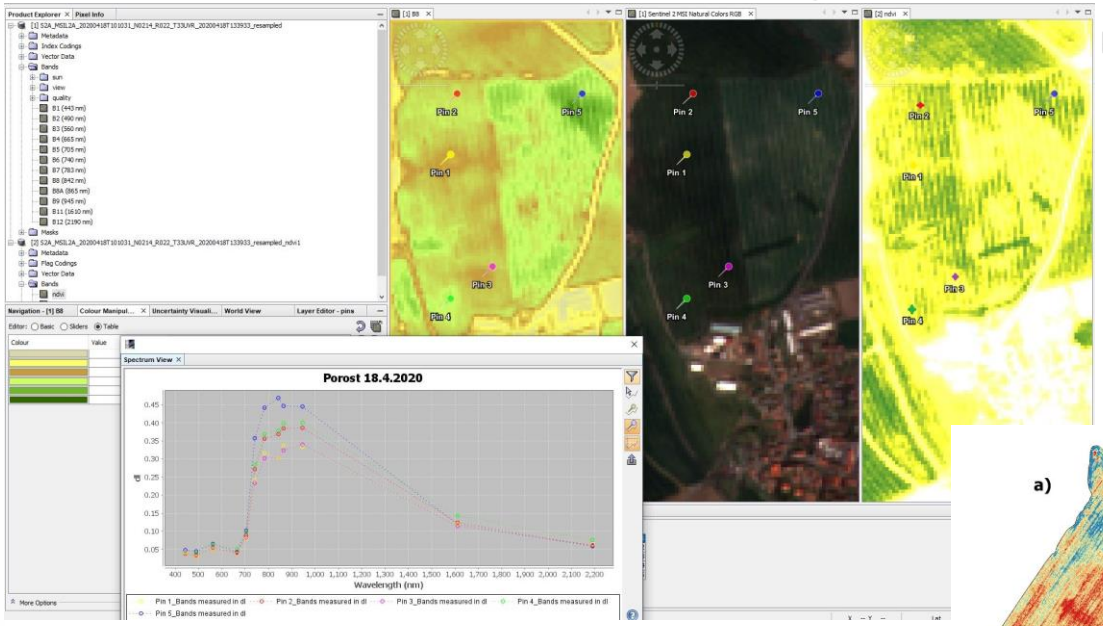
Soil properties - Interaction

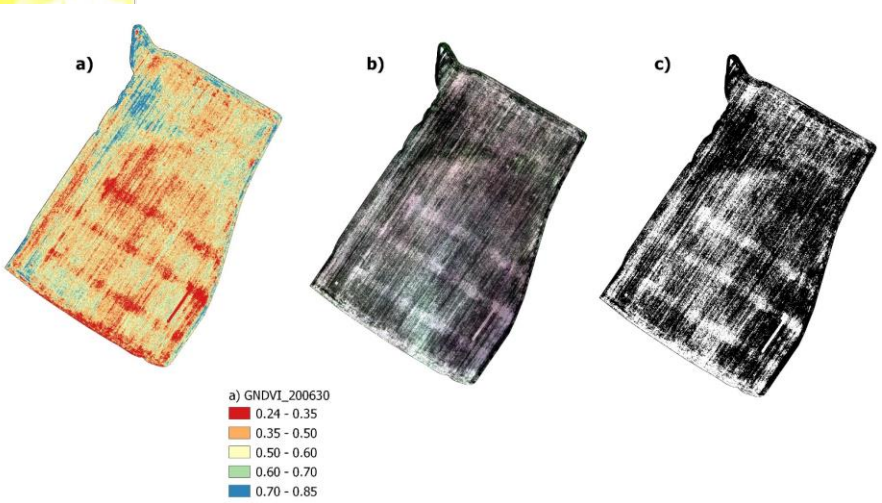
Small scale and big scale soil trough

Czech University of Life Sciences Prague
Faculty of Engineering

Precision farming

UAV – eBee X, GIS, Remote Sensing





Prototype laboratory - ProLab

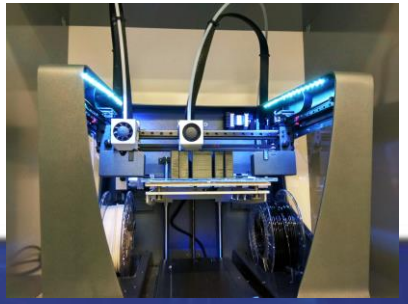
Prototype lab

- 3D printing (FFT and DLP)
- 3D scanning (laser and optical)
- CNC laser
- CNC machining
- Rapid prototyping
- Drilling, milling, cutting, waterjet cutting…

Czech University of Life Sciences Prague
Faculty of Engineering

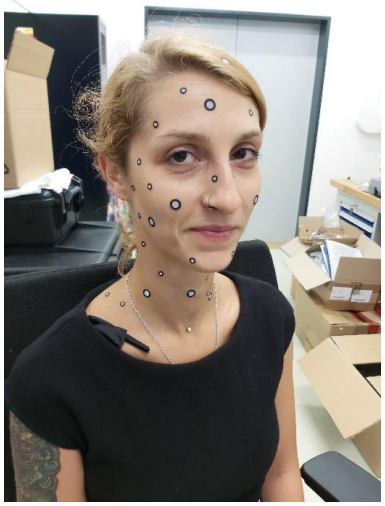
Prototype laboratory - ProLab

Complementary:
Soil properties, numerical tasks, GIS



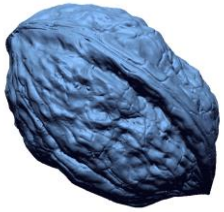
Czech University of Life Sciences Prague
Faculty of Engineering

Prototype laboratory - ProLab



3D scanning → postprocessing → 3D printing

Simulation FEM and DEM



Complementary:
Numerical tasks

Czech University of Life Sciences Prague
Faculty of Engineering

Prototype laboratory - ProLab

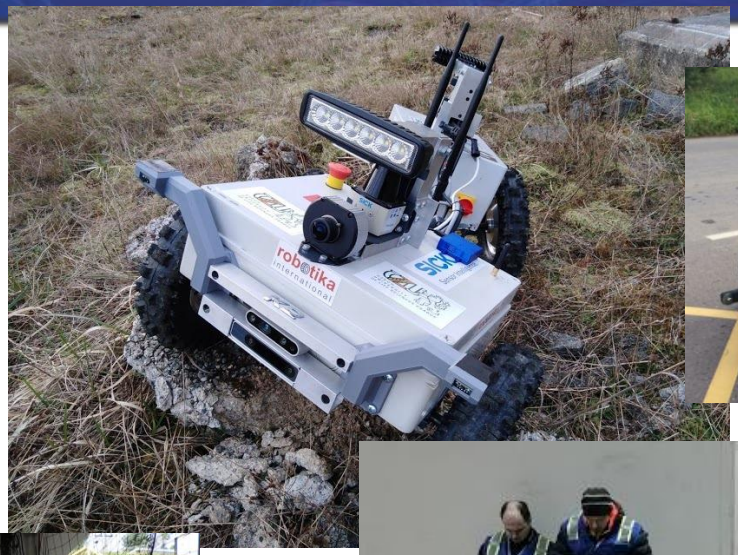
Application in drons and other robotics.
Support : OpenCV, arduino, netduino, cameras and sensors
Compementarry : GIS (ArcGIS etc.)

Czech University of Life Sciences Prague
Faculty of Engineering

Robotics

Czech University of Life Sciences Prague
Faculty of Engineering

Robotics

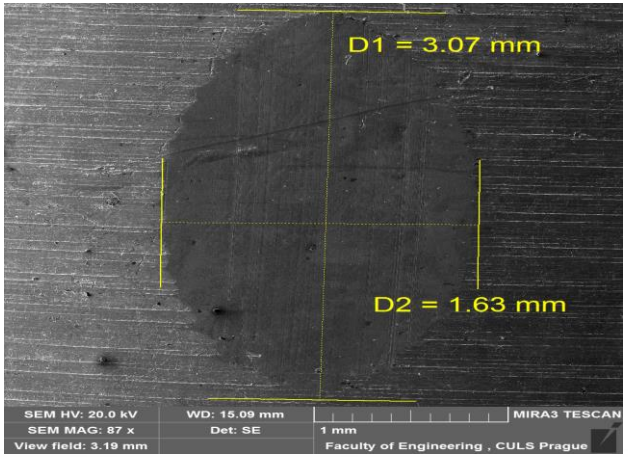


Czech University of Life Sciences Prague
Faculty of Engineering

Tribology

- Abrasive wear tester
- Friction tester

Reichert test and ferrography



Mechanical testing

- UTS 500 kN - hydraulical, 50 kN – mechanical with temperature cell -70°C up to 300 °C, 5 kN, 50 N
- Hardness tester (Rockwell, Brinell, Vickers)
- Charpy 300 J, 150 J, 100 J, 50 J and instrumented 25 J microCharpy

Czech University of Life Sciences Prague
Faculty of Engineering

Mechanical testing

Determination of wear – dry sand rubber wheel test

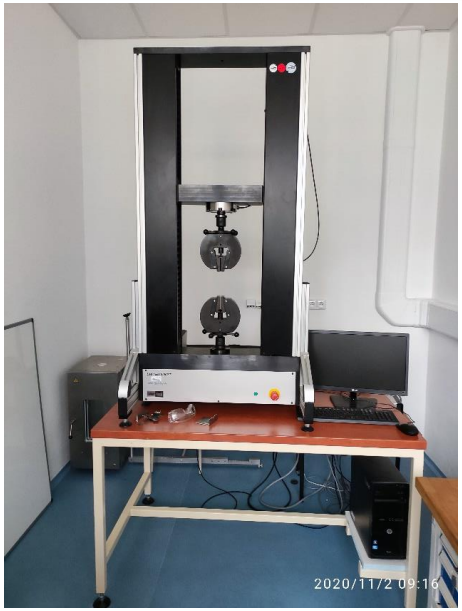
Designed at Faculty of Engineering CULS

Complementary:
Casting and treatments, numerical tasks

Czech University of Life Sciences Prague
Faculty of Engineering

Mechanical testing

UTS 500 kN



UTS 50 kN

UTS 5 kN

Instrumented (micro)Charpy hammer 25 J
Desing Faculty of Engineering ČZU

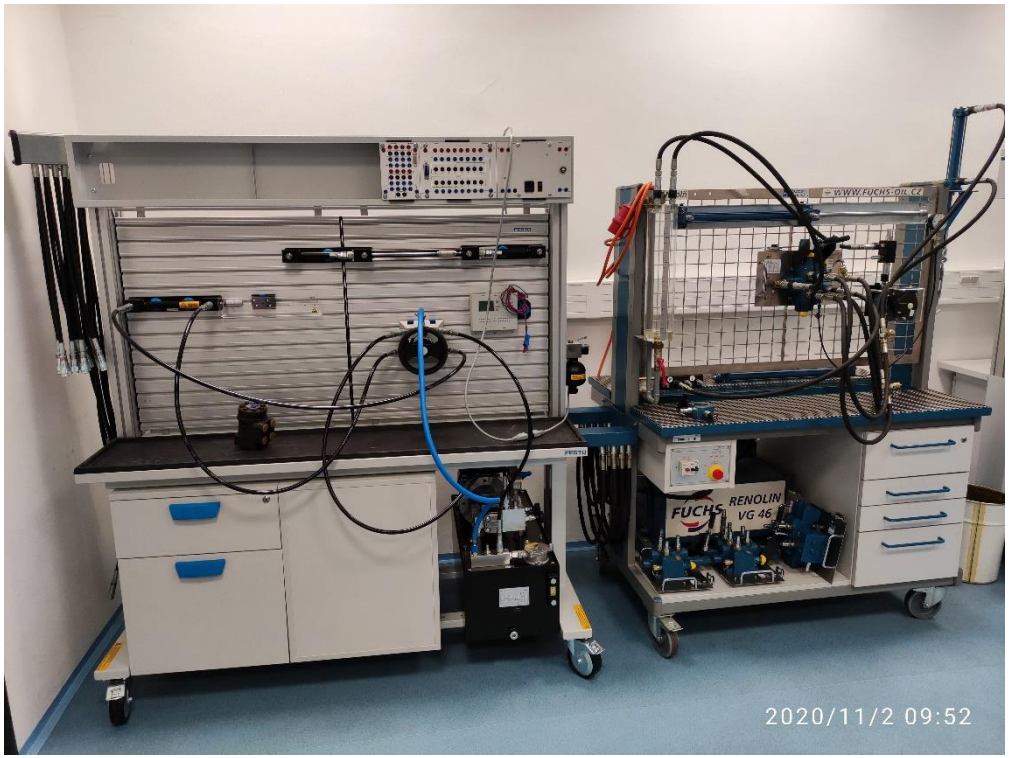
Czech University of Life Sciences Prague
Faculty of Engineering

Mechanical testing

Implementation of mechanical properties of biological material (ex. oil seeds) in pressing.
Determination of oil point, energy, etc.
Collaboration: Farmet company

Czech University of Life Sciences Prague
Faculty of Engineering

Lab of Fluid Power



- **Bosch testbed for hydraulics**
- **FESTO testbed for hydraulics and pneumatics**
- **PARKER Fluid measurement kit**

Czech University of Life Sciences Prague
Faculty of Engineering

Syntetics materials

- Microtom – cutting of relative soft samples,
- Vibration breakage,
- characteristic of particle size frequency,
- plastics compounding,
- plastic molding injection machine.

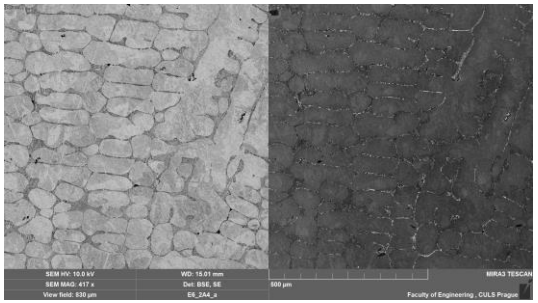
Complementary: mechanical testing, microscopy

Casting and treatment

- Vacuum induction furnace for casting (1 kg)
- Furnace for quenching and tempering (1x 30l up to 1300°C with inerted gas, 1x 35 l up to 1000°C, 1x70l up to 950°C, 1x 5l up to 1000°C, 2x 2l up to 1000°C.
- Quenching media watter, oil, salts bath for thermal quenching or isothermal treatment.
- DAQ for temperature acquisition, programable small furnaces.

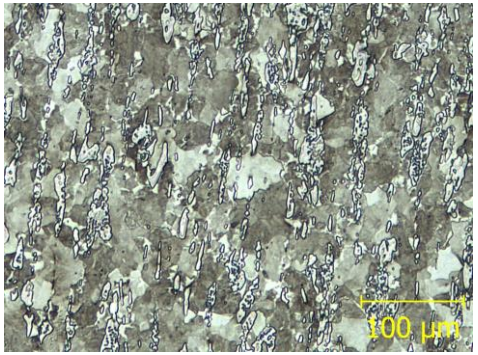
Czech University of Life Sciences Prague
Faculty of Engineering

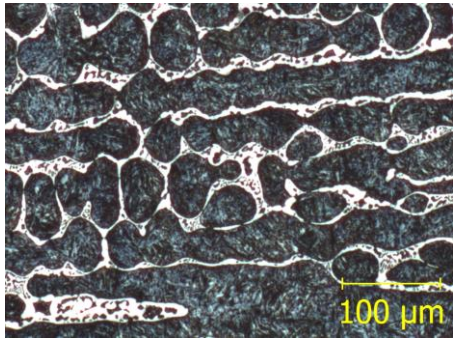
Casting and treatments – ex. inovation of abrasive resistant materials



Casting, Fe-B-C alloys

forging



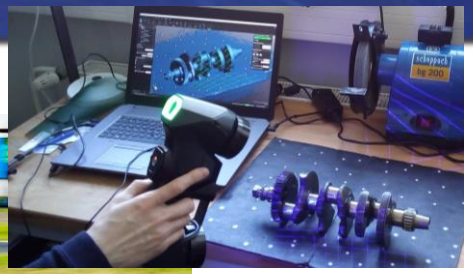


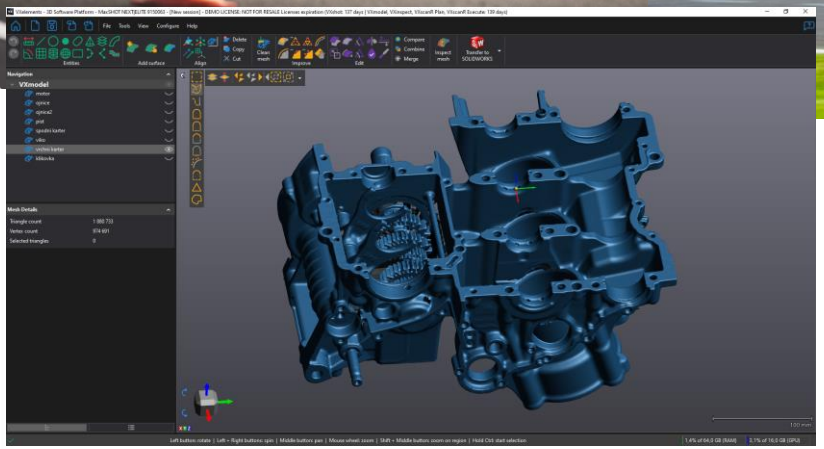
Quenching and tempering

Complementary: Microscopy, Tribology, Numerical tasks

Czech University of Life Sciences Prague
Faculty of Engineering

Formula Student





It is a kite-mark for real-world engineering experience, combining practical engineering experience with soft skills including business planning and project management. At FE CULS since 2010.

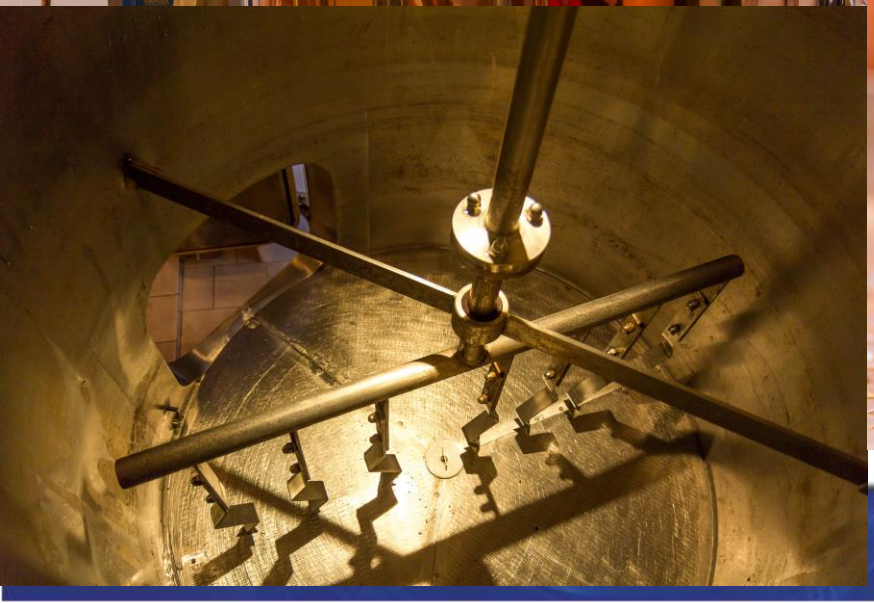
Czech University of Life Sciences Prague
Faculty of Engineering

Bioenergy and renewables

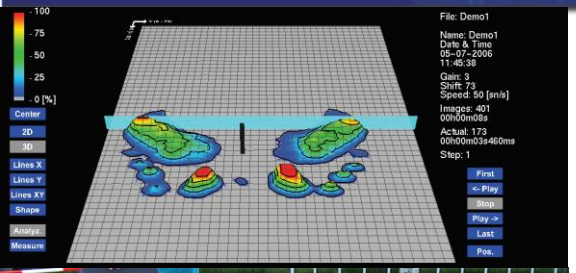
- Biochar experiments
- Biogas production evaluation
- Emission laboratory
- Solar energy

Czech University of Life Sciences Prague
Faculty of Engineering

Experimental Research Brewery



Czech University of Life Sciences Prague
Faculty of Engineering



Thank you for your kind attention!