

HiLASE Centre Introduction



- Cutting-edge lasers
- Advanced laser applications technologies
- High-skilled experts
- Tracked collaboration with industry and R&D centers around the globe

www.hilase.cz

HiLASE VIRTUAL TOUR

The HiLASE R&D Centre holds **several world records** e.g. in **multi-beam laser nanostructuring** and in the **speed production of laser-induced periodic nanostructures on a stainless steel surface** and has earned the esteemed title of **Centre of Excellence**. Another **world record** was earned by the high-energy DPSSL system BIVOJ, which has reached the level of 146 J at a repetition rate of 10 Hz at a wavelength of 1030 nm.

RESEARCH PROGRAMMES

Industrial Laser Applications | Scientific Laser Applications | Advanced Laser Development

HIGH-TECH LASER TECHNOLOGIES

- High-power (up to 1 kW) lasers
- High-energy – tens of Js lasers
- Advanced laser surface functionalization (up to 40000 beams simultaneously)
- Advanced metallic components strengthening by high-energy lasers – Laser Shock Peening
- Hybrid solutions – Laser with Traditional or other Laser technologies
- LIDT – ISO certified or customized tests

KEY RESEARCH AREAS



ADVANCED LASER PROCESSING & PRODUCTION TECHNOLOGIES

Laser surface treatment, laser micro/nano machining and structuring, industrial process development etc.



SPACE-BORNE LASER TECHNOLOGIES

Lasers qualified for space applications – asteroid mining, optical communication, satellite protection, defense applications and laser propulsion.



SMART & SAFE SOLUTIONS FOR LASER SYSTEMS & APPLICATIONS

Materials and components testing on laser irradiation, laser mass spectroscopy.



LASER NANOTECHNOLOGY

Pulsed laser deposition of 2D materials, laser-annealing synthesis of 2D materials, laser direct printing of 2D materials, pulsed laser fabrication of biocompatible interfaces.



LASER TECHNOLOGIES FOR COMPACT PARTICLE & RADIATION SOURCES

High-power laser sources, adaptive optics, predictive thermo-optical modeling, laser beam engineering/shaping.

INDUSTRIES WE SERVED

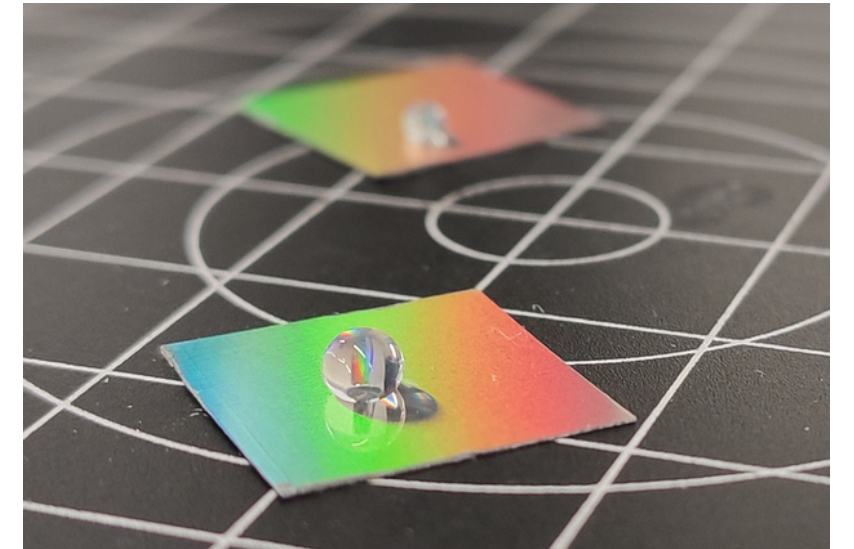
- Photonics
- Semiconductor
- Aerospace
- Defense & Space
- Automotive
- Tooling
- Energy
- Biomedical
- Material processing for glass, plastic, metal, semiconductor, and other industries

HILASE CENTRE OFFERS:

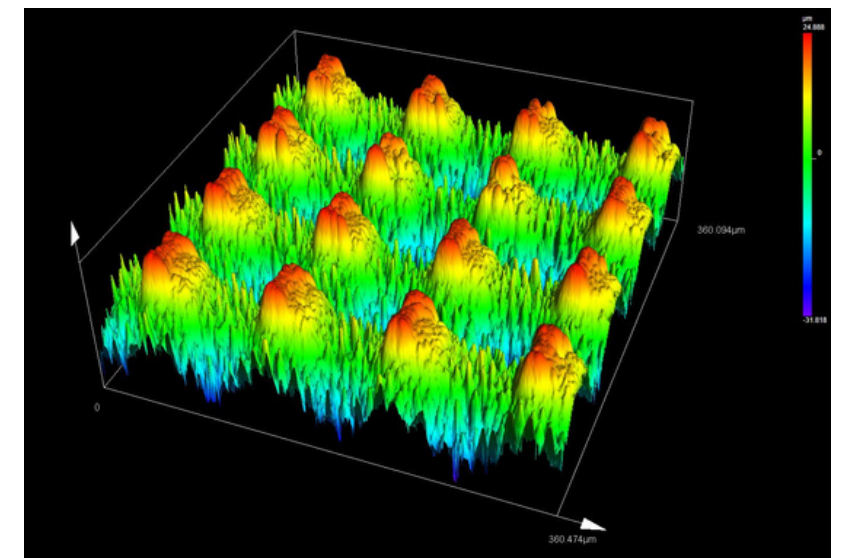
ADVANCED MICROMACHINING TEST-BEFORE-INVEST STATION

Unique micromachining station accommodating unique **optical processing heads for beam parallelization and shaping**. All technologies are combined on a **single workspace with 5-axis processing option** to combine several technologies.

Application Domain	Demonstrated Results & Potential Advancements
Space Industry	Micro-drilling with sub-micron precision in graphite and ceramics
Semiconductors	Pioneered multi-beam glass drilling; Breakthroughs in silicon wafer cutting
Healthcare	Creation of biocompatible structures; Antibacterial structures
Energy	3D electrode structuring; microdrilling of composites
Manufacturing	Development of wear-resistant functional structures, structures for improved adhesion, modified wettability; Advanced removal of superthin layers and coatings



Device	Key Parameters
Perla Laser System	Power: 100W; Pulse Duration: 1ps; Pulse Energy: 2mJ; Wavelengths: 1030nm, 515nm (with planned extensions to 345nm and 257nm), M2<1.1
Galvanometric Scanners	2D Scanning Speed: 30 m/s; Precision: 1 μm
2 & 4-beam Interference Stations	Structure detail < 0.5 μm; Productivity > 2000 cm ² /min; Line or dot-like patterns.
DOE Processing System	Beam splitting: Up to 40,000 individual beams; DLITe option with beamsize of 5μm (IR), integrated with galvo scanners.
Data Acquisition Suite	Includes: Confocal sensors, Diffractometers, High-resolution cameras, microscope, microphone, spectrometer
5-axis Positioning System	Workspace: 600x600mm (XY); - Acceleration: 2g; Precision < 1μm; Gimball



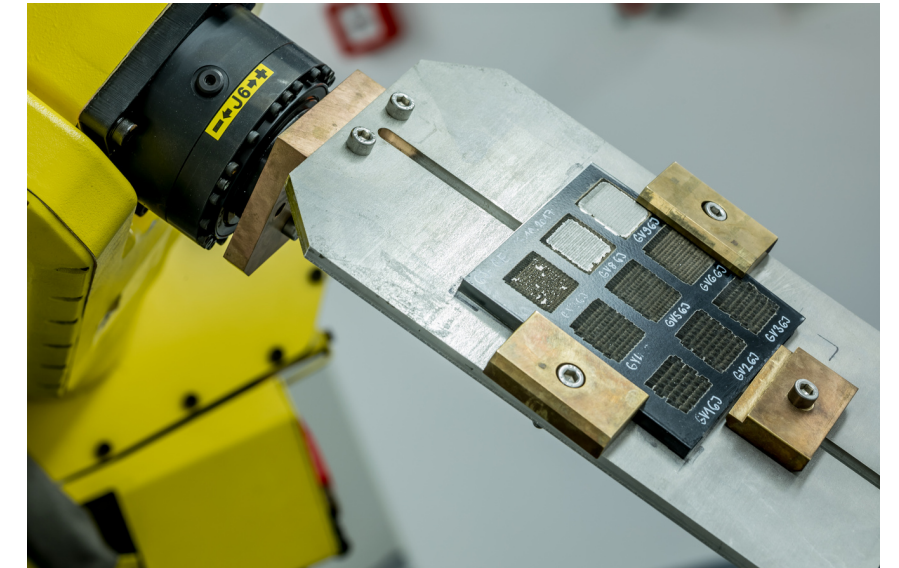
Horizon-CL4-2024 – DIGITAL-EMERGING-01-55: Photonics Innovation Factory for Europe

HILASE CENTRE OFFERS:

LASER SHOCK PEENING (LSP)

Advanced laboratory dedicated to Laser Shock Peening R&D activities as well as processing, including cutting-edge lasers with proper beam quality and all necessary characterization equipment for proper process development.

Application Domain	Demonstrated Results & Potential Advancements
Aerospace	Up to 10 times Fatigue life prolongation for various components, including the most critical components
Tooling	Productivity improvement of forging and casting dies
Energy	Lifetime improvement of critical parts, including welds; pump cavitation prevention, corrosion stress cracking prevention; safety and reliability improvement
Additive manufacturing	Post-processing of additive manufacturing parts enabling usage of additive manufacturing for more demanding applications
Hybrid laser processing	Combining Laser Shock Peening with Laser Hardening for the most demanding application in energy and other sectors



Device	Key Parameters
Various type of lasers	Energy up to 10J, rep rate up to 10 Hz, pulse width up to 15 ns with necessary beam quality
Fully automated LSP cells	Fully automated two LSP cells
Robots	Load up to 35 kg with a precision of 60 μm
Characterization and quality control equipment	XRD stress analyzer, Hole drilling machine, roughness meter, profilometer
Sample preparation cell	Metallography laboratory for the sample preparation

