EuroNanoForum 2019

CETAL - Research infrastructure for photonic based technologies

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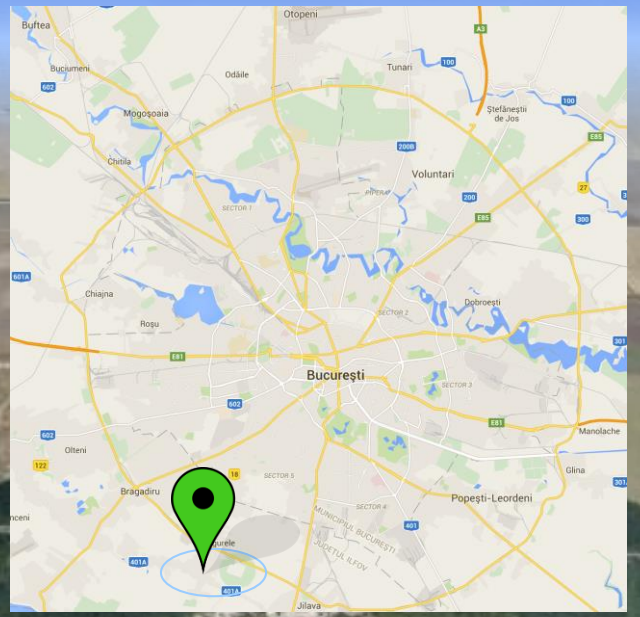
CENTER FOR ADVANCED LASER TEHNOLOGIES

The project CETAL

Project No: 8PM /I 26.11.**2008**
(IMPACT program financed by ANCS)

Project value: 17 MEuros
Building surface: 2700 m^2
End of the Project: **30 Oct 2014**



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Center for Advanced Laser Technologies, CETAL

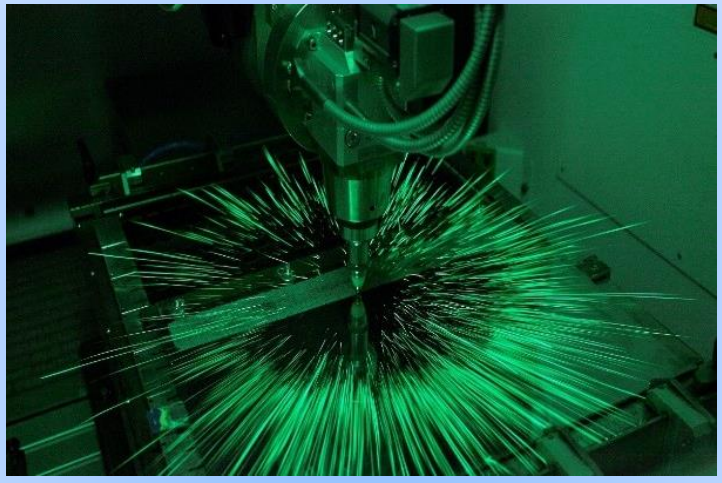
Atomistilor 409, 077125 Măgurele, Romania.

Center for Advanced Laser Technologies - CETAL

High-intensity laser fields Laboratory **CETAL - PW**

Particles Acceleration electrons and protons acc.
Harmonics generation
Radiation Hardening, Matter characterization and damage assessment.

Laser Material Processing Laboratory **LaMP**



Laser macroprocessing: cutting, drilling, welding.
Laser micro and nanoprocessing: microfluidics, micro-optics, metamaterials.
Processing of biomaterials: tissue engineering, bio-nano-material.

Photonic Investigations Laboratory **PhIL**

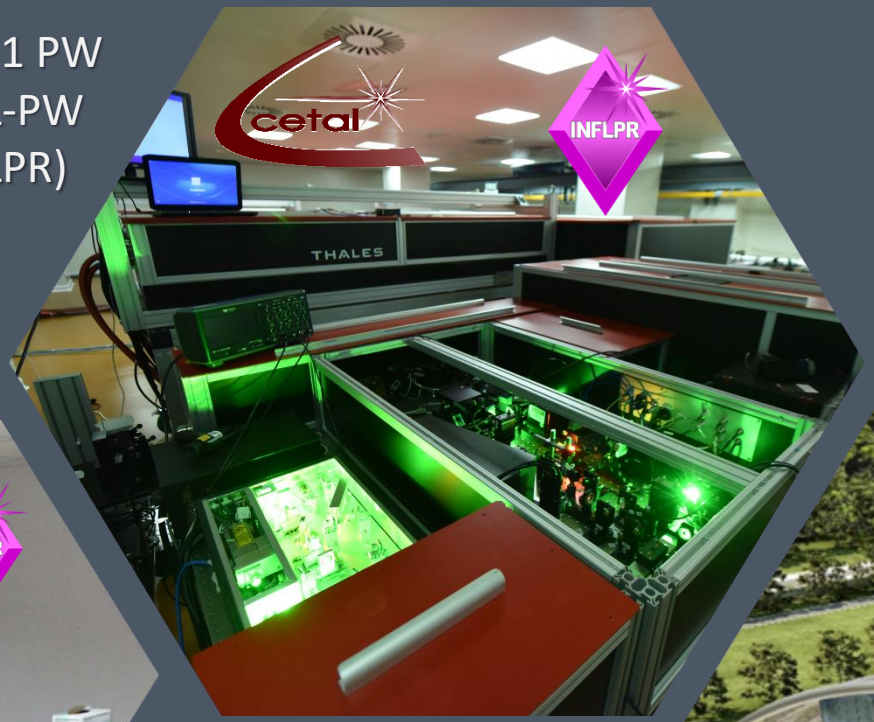
Spectroscopy (from 200 nm to THz)
THz Spectroscopy, Raman, LIBS, Absorption, Vibrometry.
Metrology
Laser beam characterization, Optical frequencies synthesizer.

Follow-up development of ultra-intense lasers in Romania

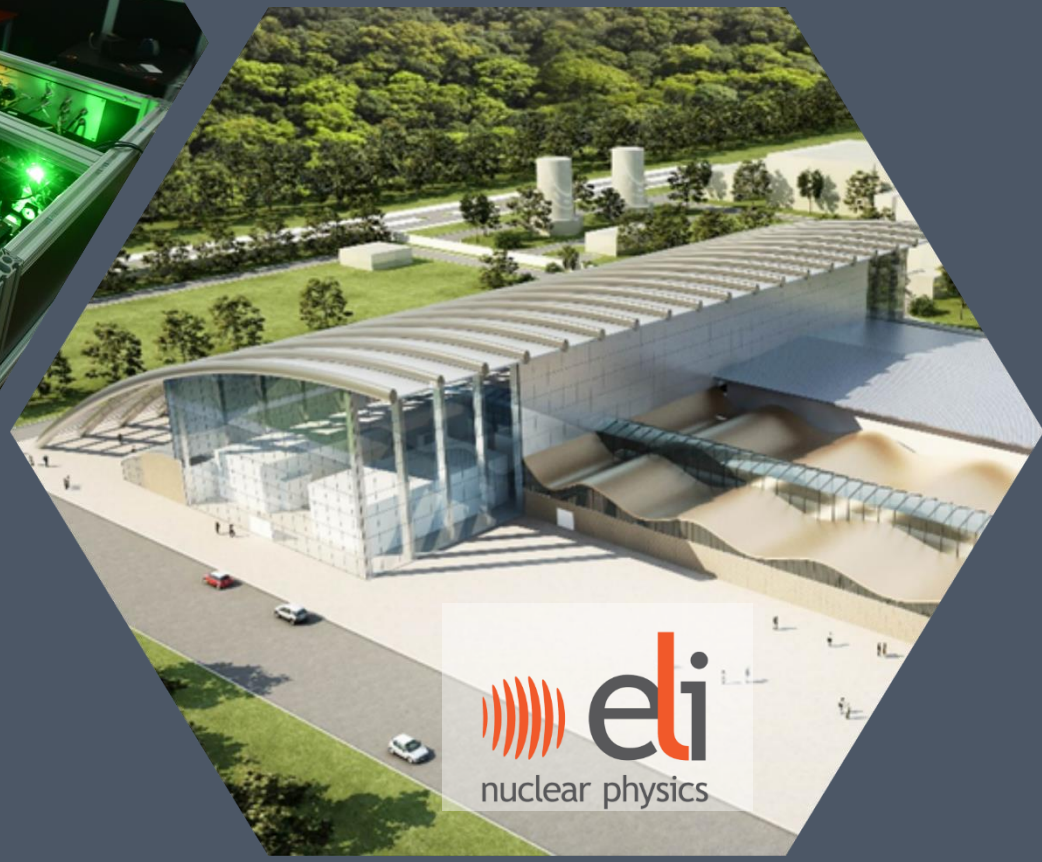
2006 - 3 GW
GIWALAS
(INFLPR)

2009 - 20 TW
TEWALAS
(INFLPR)

2014 - 1 PW
CETAL-PW
(INFLPR)



2019 - 10 PW
ELI-NP



CETAL-PW ultra-intens laser system

Ti:Sapphir laser

max. power: 1 PW @ 0.1 Hz

secondary output: 45 TW @ 10 Hz

ultrashort pulses: 25 fs (1fs = 10^{-15} sec)

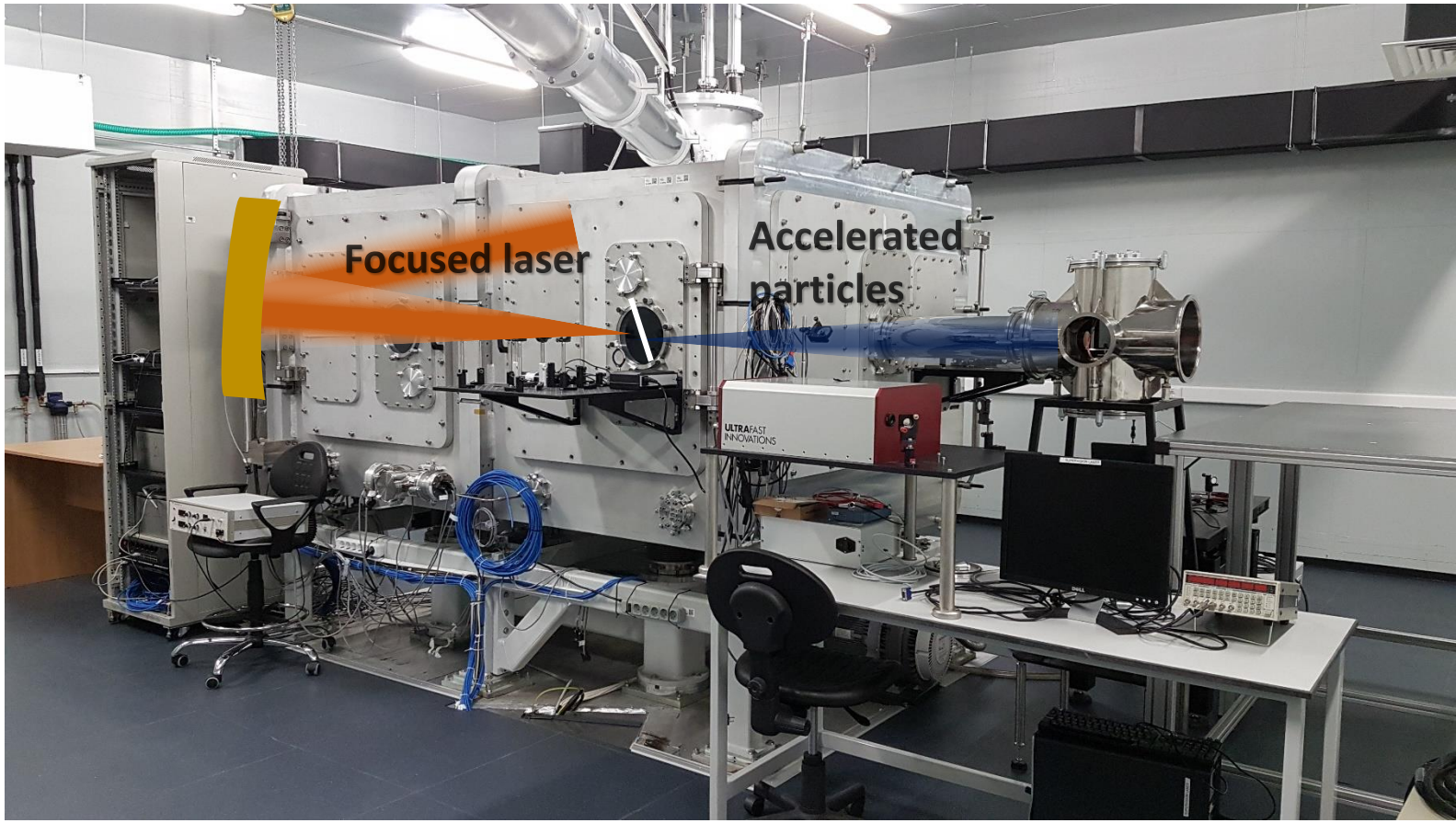
CETAL-PW ultra-intens laser system

interaction chamber

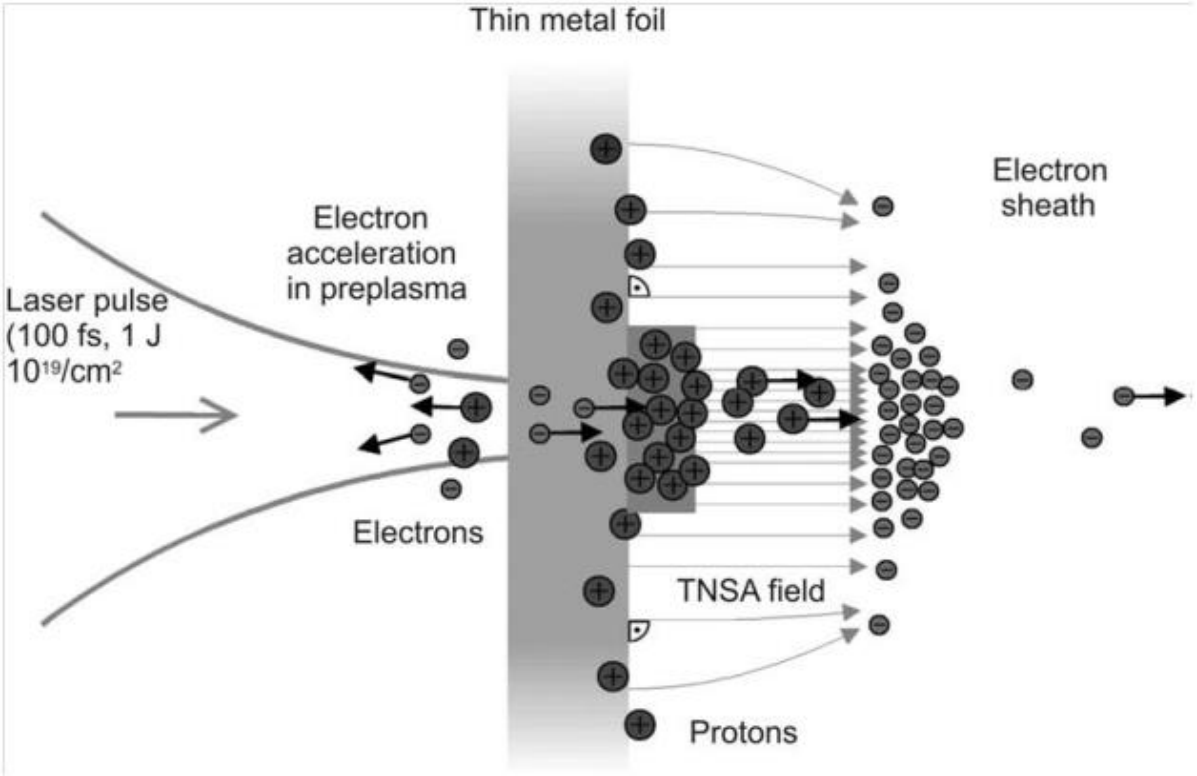
aluminium, volume: 6 m^3,
UHV: 10^{-6} mbar

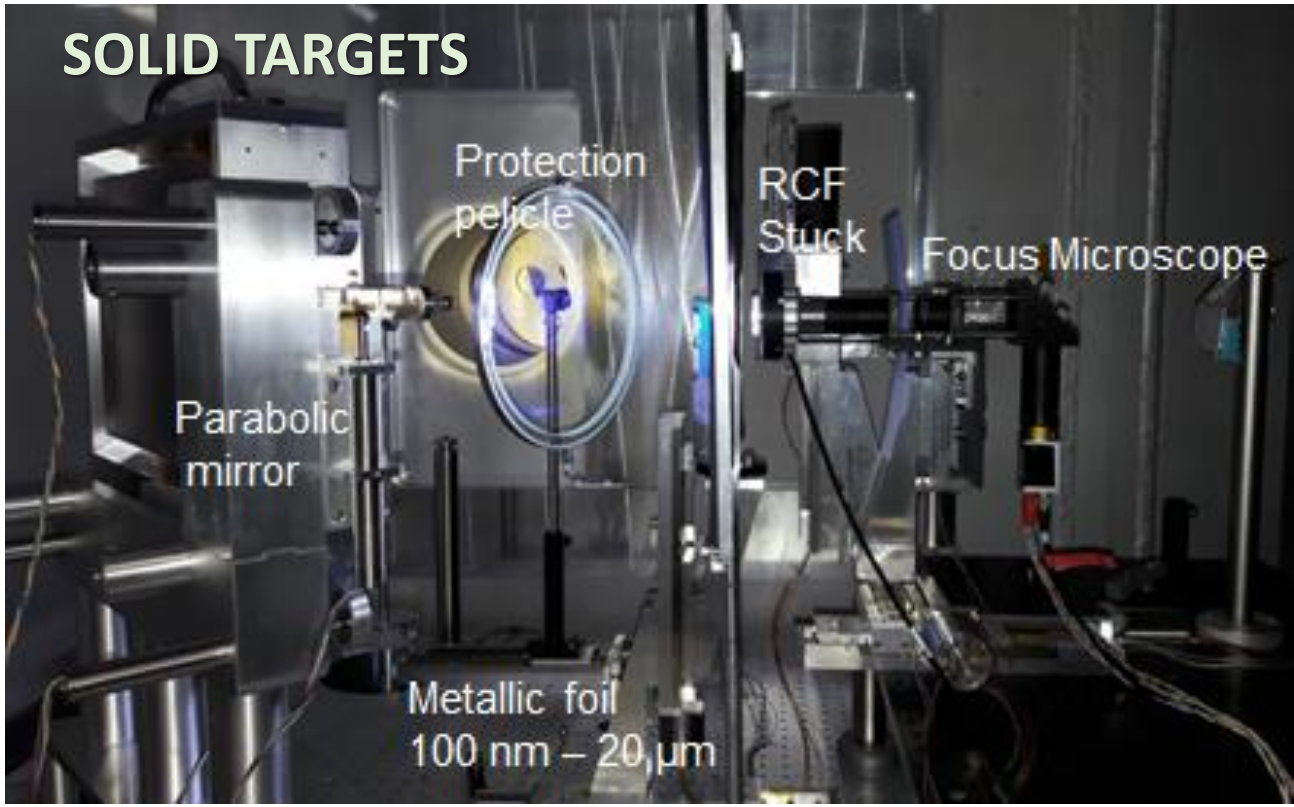
experiments

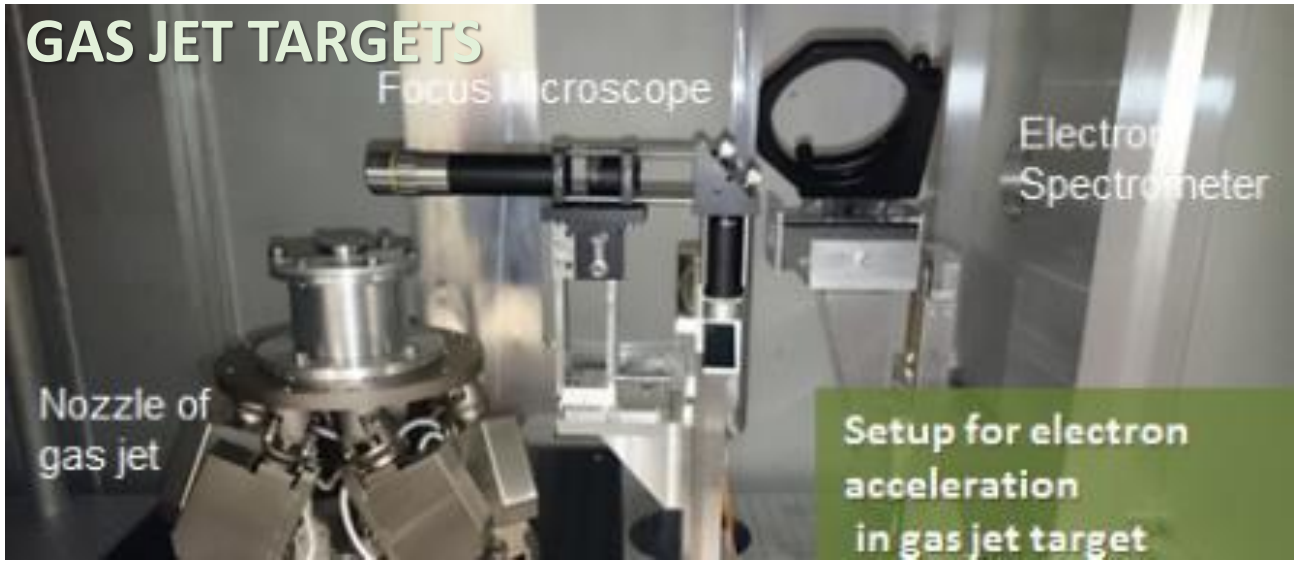
- Particles Acceleration
  electrons and protons acc.
- X-rays generation



laser-driven particle acceleration

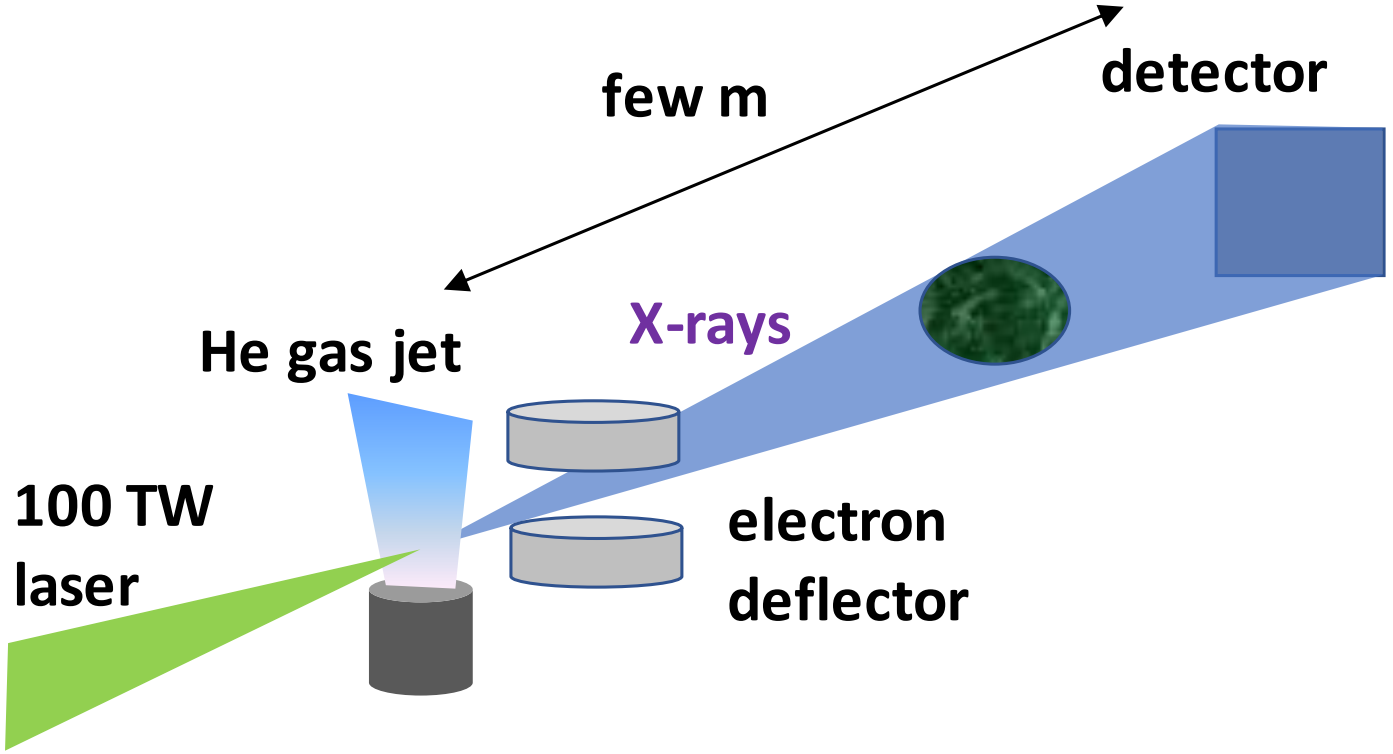




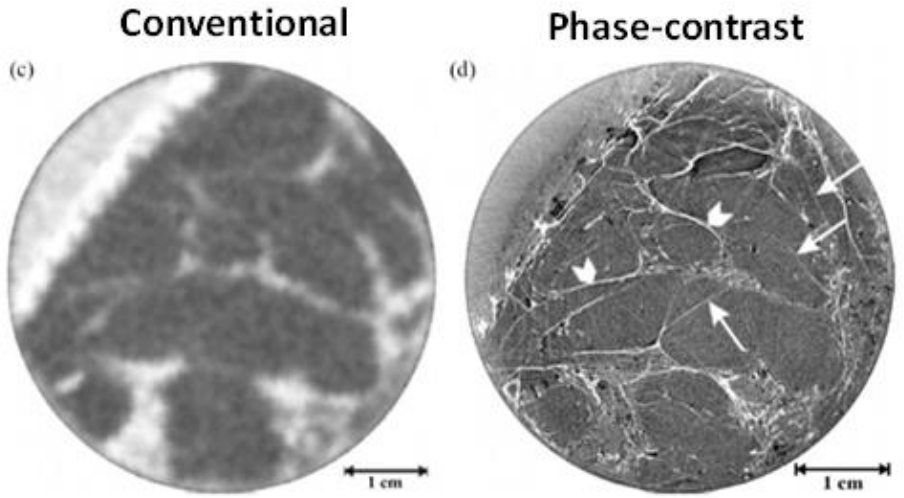


Current experiments at CETAL-PW

Laser betatron source (100 TW laser) for X-rays generation

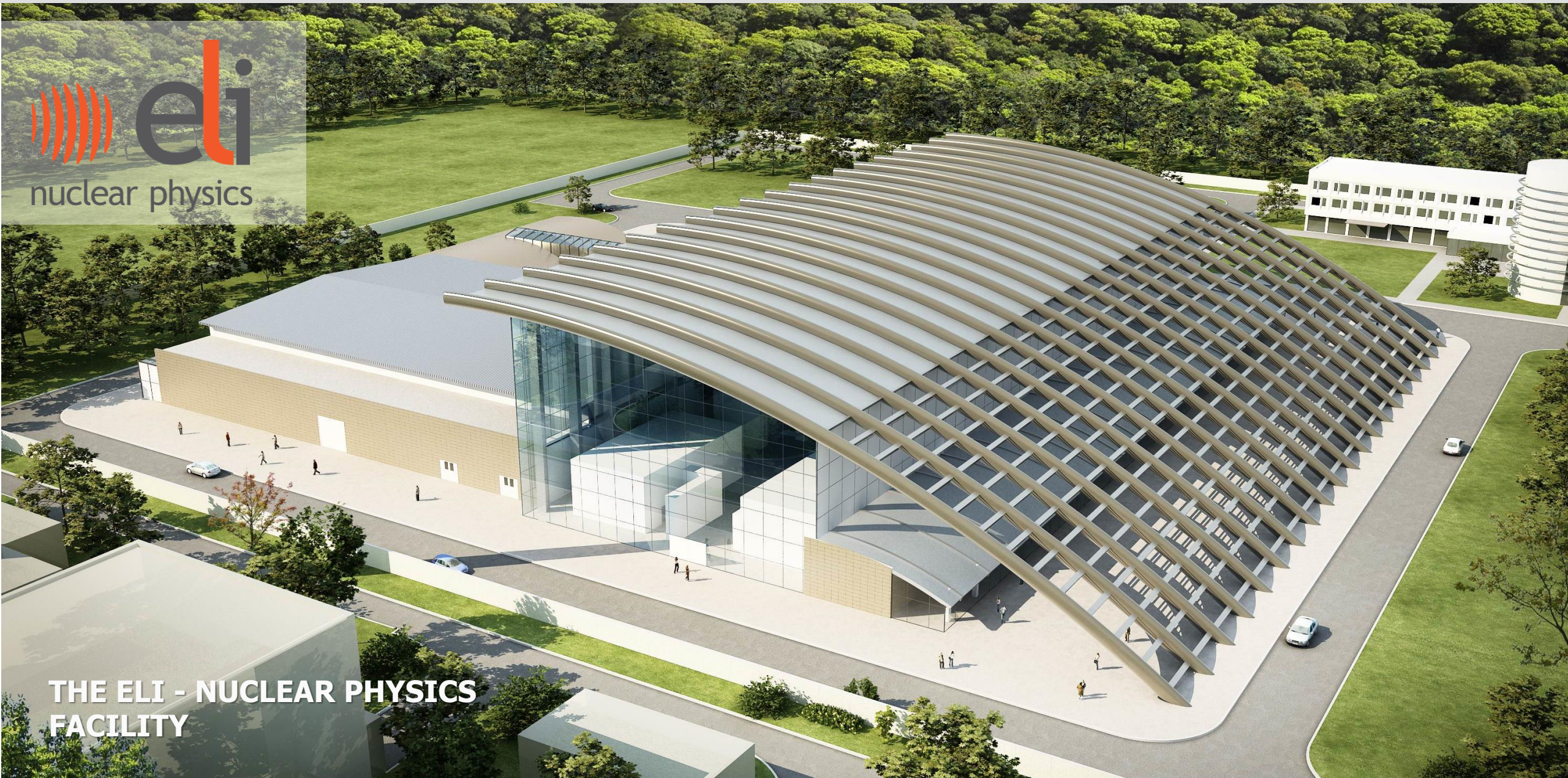


X-ray phase-contrast imaging with μm resolution

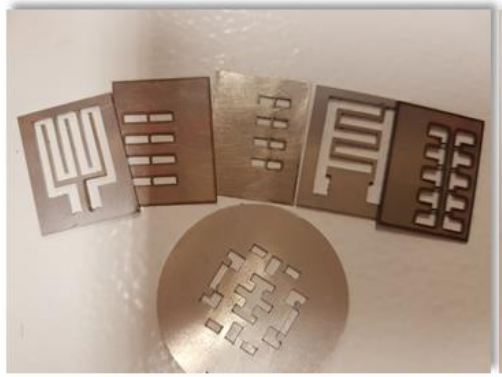
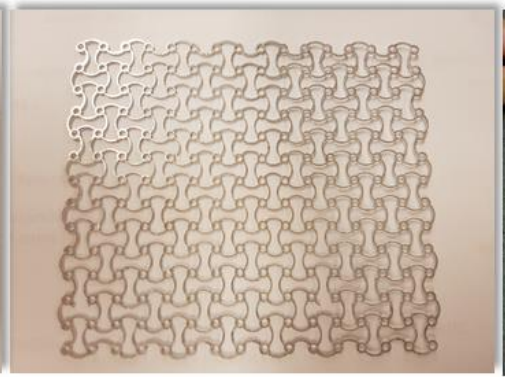
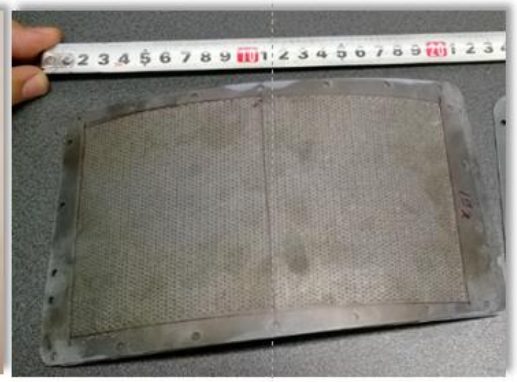


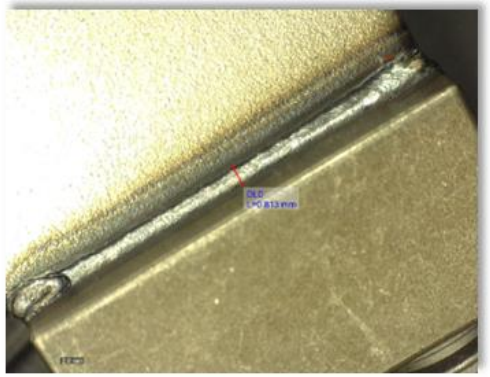
CT of breast tumor
(Keyriläinen et al 2010)

ELI-NP European Research Infrastructure

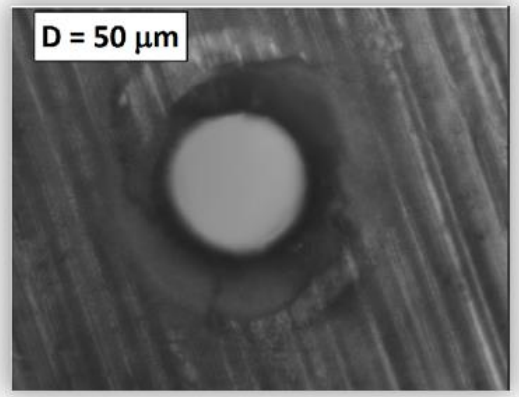


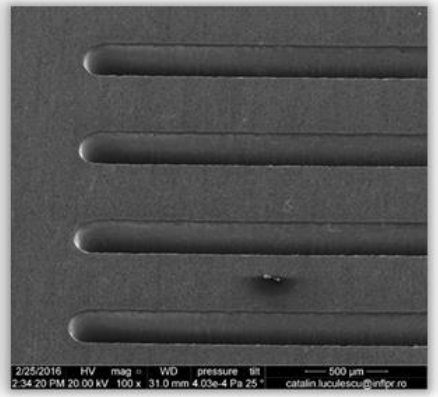
Laser Macro-Processing facility



- Laser cutting, drilling and marking (Ti_6Al_4V, Al, carbon-steel, stainless steel)
- Laser welding and laser welding of dissimilar materials (Al/Cu)
- **Additive manufacturing** of metallic 3D structures (Ti alloys and stainless steel)



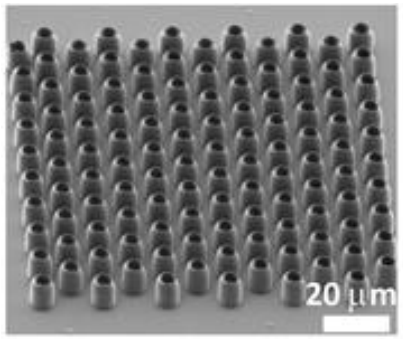


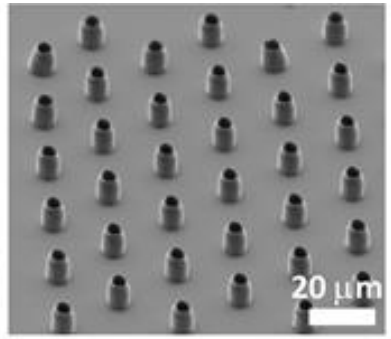


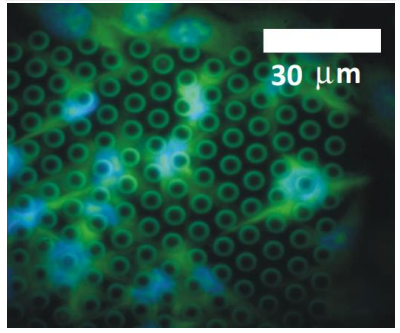
3D laser lithography with sub-micrometer resolution

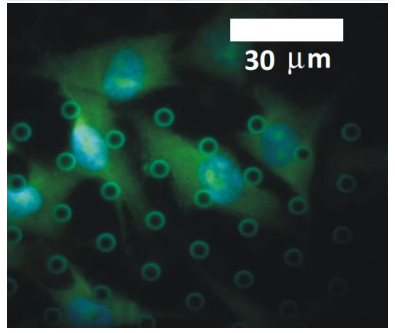
Applications

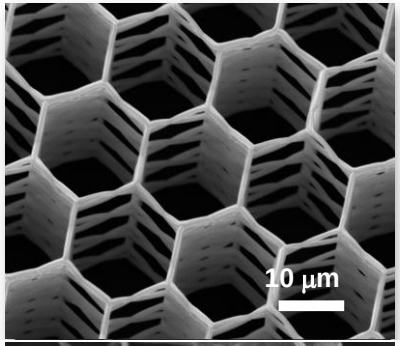
- micro-optics
- photonic crystals and metamaterials
- scaffolds for tissue engineering
- 3D targets for laser-matter interactions
- 2D masks
- micro-fluidics

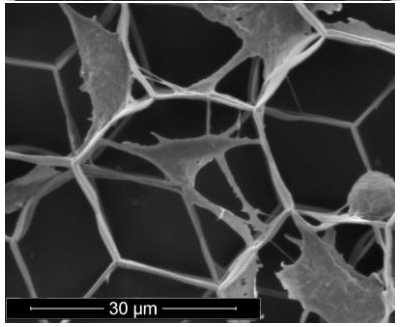


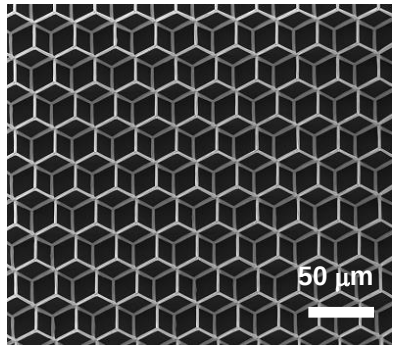


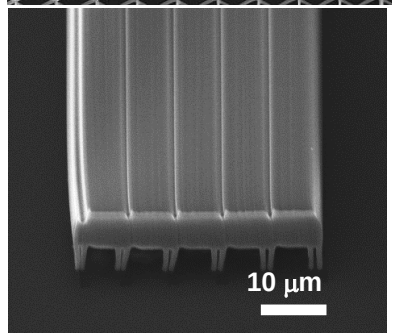


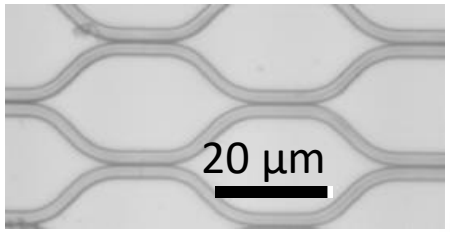


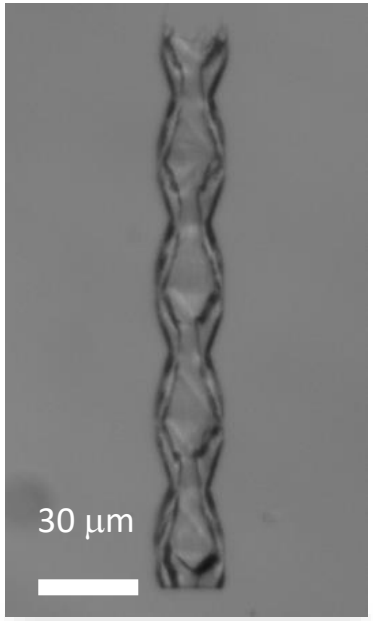


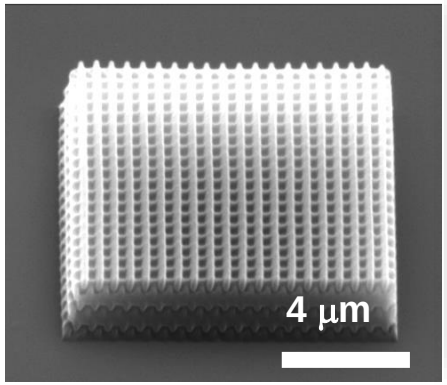


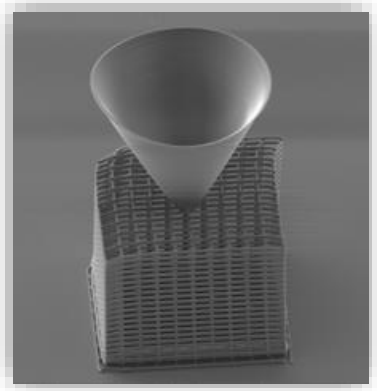


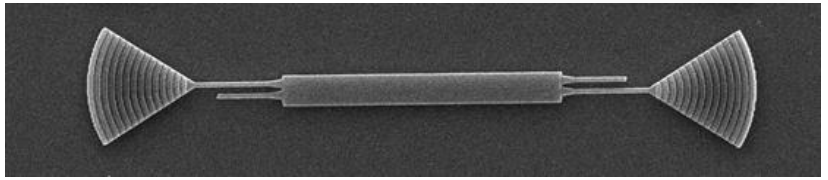




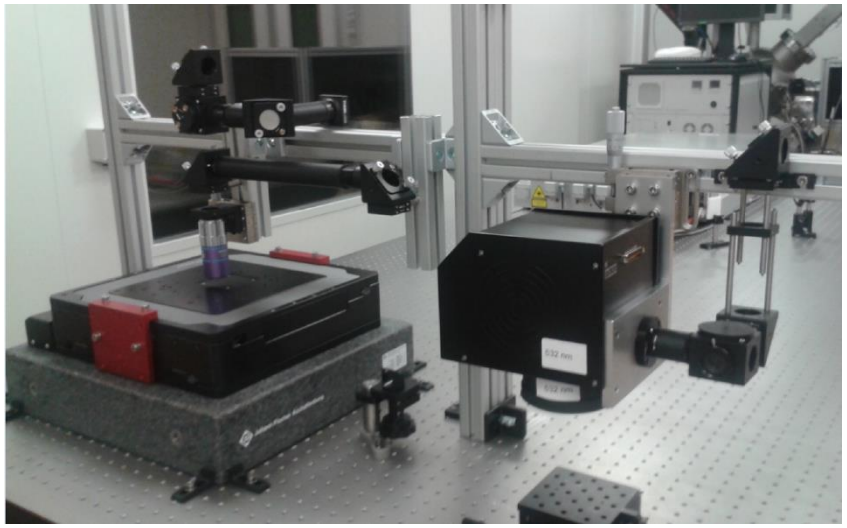




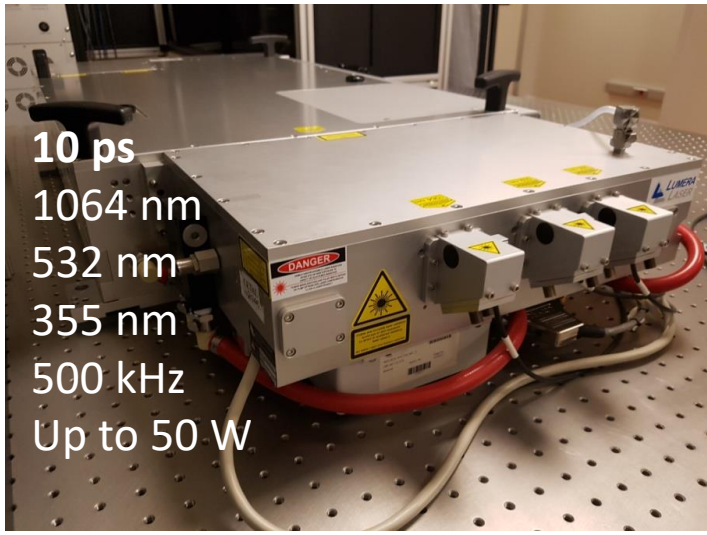




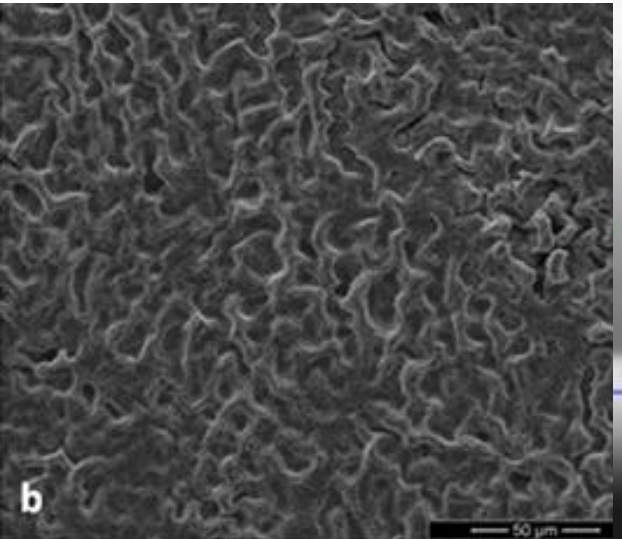
Direct laser writing by ultrafast laser ablation

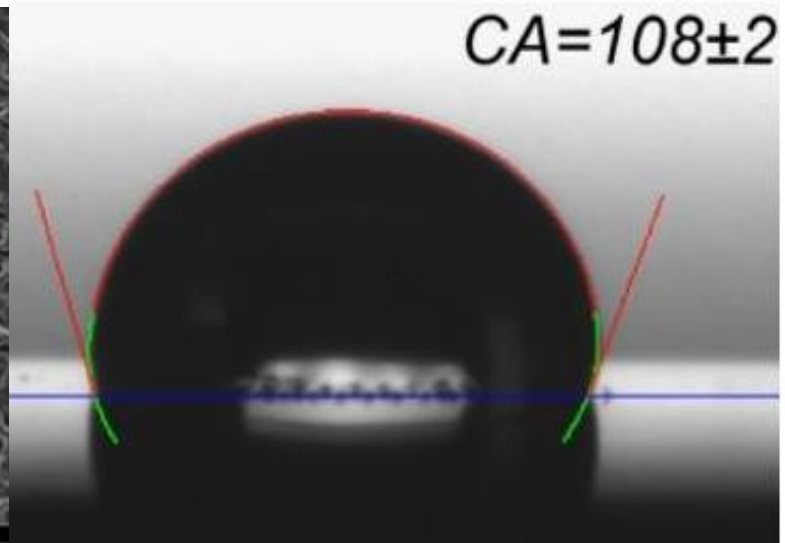


- Laser ablation with sub-micrometer resolution of metals, polymers and glasses

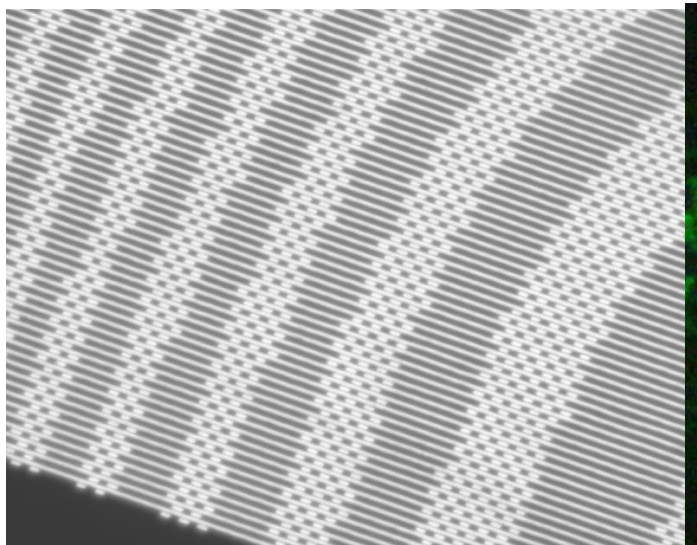


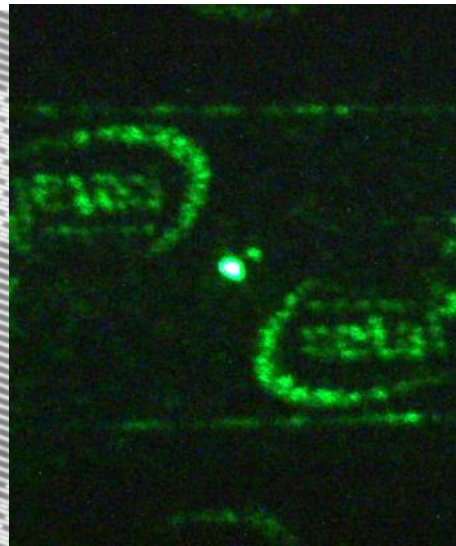
- Surfaces patterning for hydrophobic surfaces





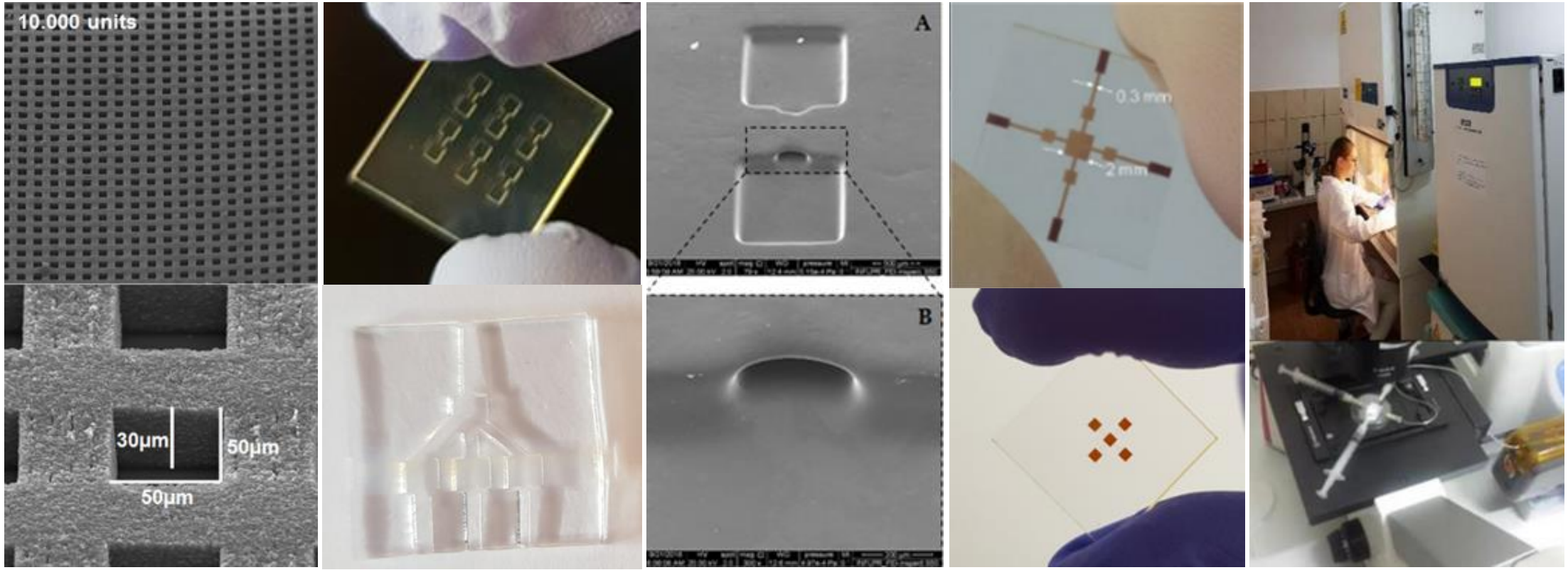
- Holograms and DOE





Lab-on-a-chip biosystems and cell culture testing facilities

- Microfluidic devices fabricated by picosecond laser irradiation of glasses

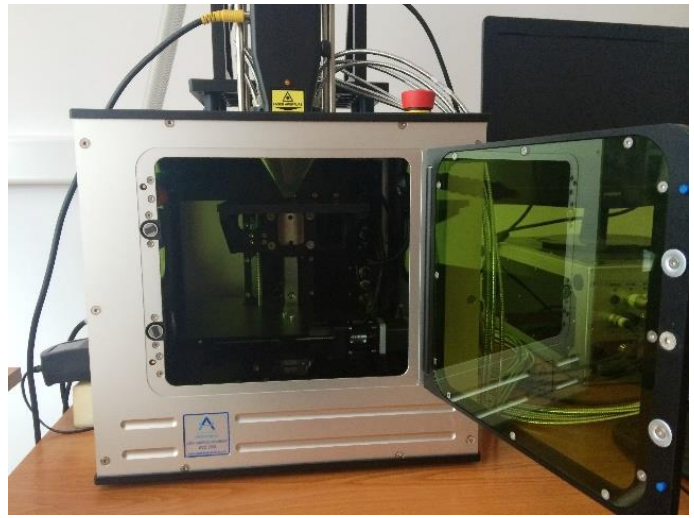


Nanomaterials 8 (8), 583, 2018.

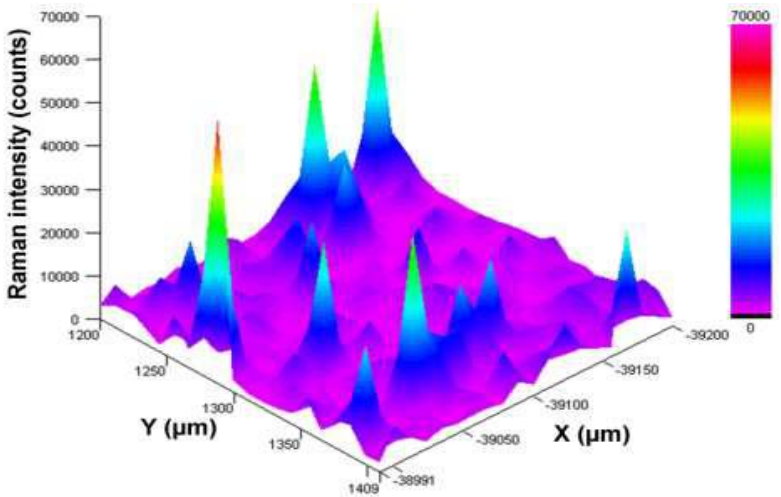
Photonic investigation laboratory - PhIL

Sources and detectors from UV to THz

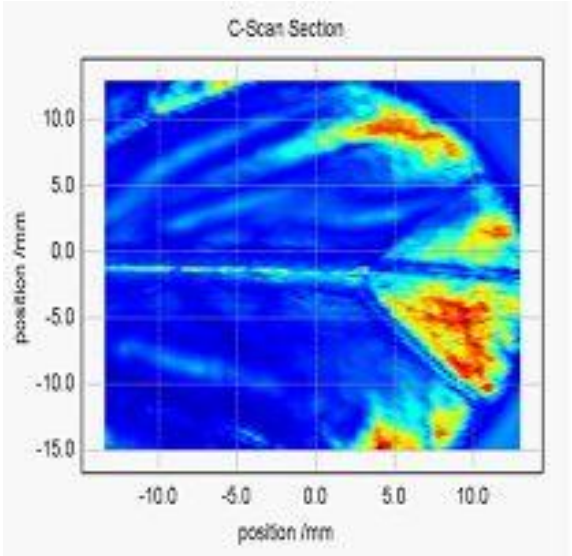
- Testing of optoelectronic components;
- Characterisation of new materials;
- Food and environment safety.



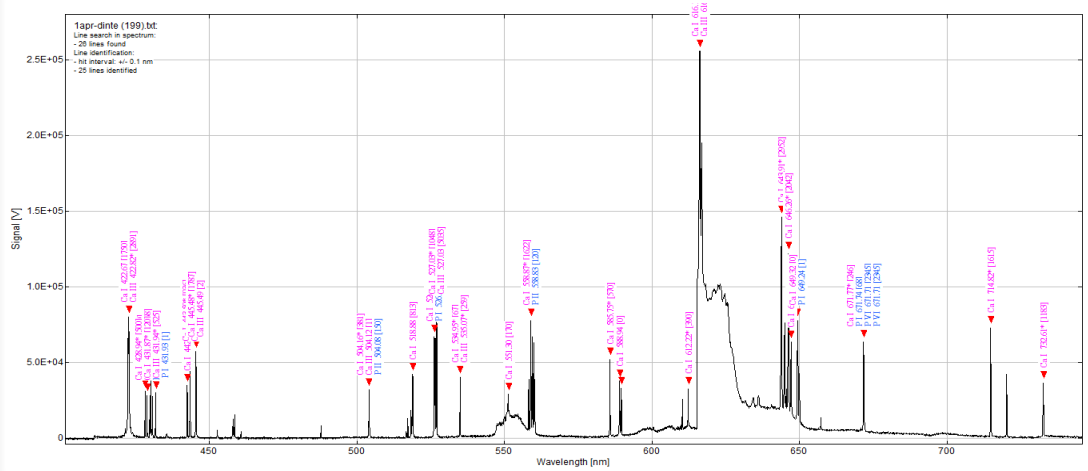
- **Raman Spectroscopy**



- **THz Spectroscopy**



- **LIBS**



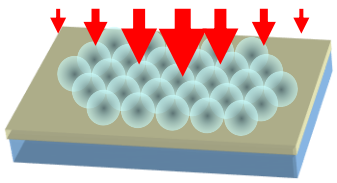
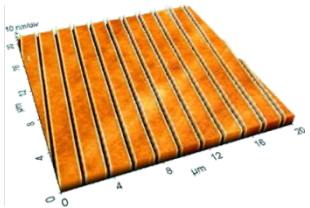
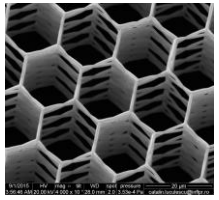
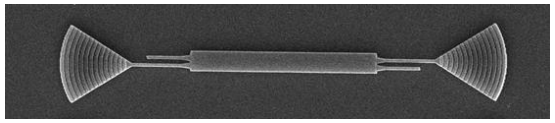
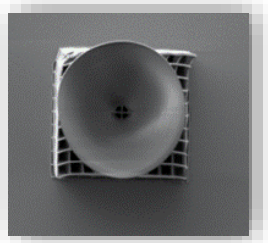
Other facilities at CETAL

- Bunker for experiments with ionizing radiations (accelerated particles from interaction with PW laser).
- Cleanrooms ISO7 an ISO8.
- Anti-vibration platform and electromag. shielded rooms.
- Sound isolated laboratory for vibrations test.

Conclusions

CETAL - laser facility for:

- ➢ Laser-matter interaction in ultraintense regime
- ➢ Integrated optics using 3D laser lithography.
- ➢ 3D targets for laser particle acceleration (application to Radiation Hardening).
- ➢ Laser surface nanotexturing for ultrasensitive sensors.
- ➢ Fabrication of microfluidic devices.
- ➢ Lab-on-a-chip technology of glass portable devices for detection of chemical and biological substances.
- ➢ Laser Cutting and Welding of various materials.
- ➢ Additive manufacturing (laser cladding, 3D printing of metallic parts).
- ➢ Design and construction of laser custom systems for laser processing.
- ➢ Laser safety training and audit.

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