

LAMBDA LABORATORY

Measurements for biomedical
applications Fiber optic and image-based
solutions for measurements

The Lambda Lab (Laboratory of Measurements for Biomedical Applications) is part of the Measurement and Experimental Techniques area. The main research fields of the group are based on fiber optic and image-based measurements for biomedical applications, along with light-based approaches for minimally invasive therapy and monitoring. The Lambda Lab develops innovative and experimental solutions for thermometry in biological tissues undergoing energy based thermal treatments of tumors (laser, microwave and radiofrequency) and nanoparticles enhanced photothermal treatments. The team works on novel algorithms for temperature-based therapy control, and in the field of hyperspectral imaging for biomedical applications.

INSTRUMENTS & FACILITIES

Interrogators for multipoint fiber optic sensing, static and dynamic full-spectrum analysis, in the ranges 800-900 nm and 1460-1620 nm

Core Alignment Fusion Splicer for optical fibers splicing

Fiber Bragg Grating sensors with custom-made features

Laser sources operating within the therapeutic window (808-1064 nm) in both continuous and non-continuous modes

AvaSpec Spectrometer and light source

Enclosure and systems for laser safety

Infrared imaging for contactless thermal field measurements

Hyperspectral camera working in the range 400-1000 nm (VIS-NIR)

Thermal property analyzer

3D printer

Workstation

Magneto-inertial measurement units

Power meter, thermopile and thermocouples

Different laser applicators (200-300-400-600 μm) and collimators for contact and contactless target irradiation

ACTIVITIES

THERMOMETRY FOR BIOMEDICAL APPLICATIONS

Temperature measurement in tissues undergoing thermal ablation procedures

Sensors-based temperature measurements

Infrared thermometry

Diagnostic imaging for thermometry (Magnetic Resonance Thermometry)

MEASUREMENTS AND TECHNIQUES FOR PHOTOTHERMAL THERAPY

Thermal characterization of nanoparticles-embedded phantoms

Measurement of thermal properties of biological tissues

Hyperspectral-based estimation of biological thermal damage

FEM analysis

FIBER OPTIC-BASED MEASUREMENTS

Thermometry for biomedical applications

Shape sensing, strain for prosthetic devices

Design and prototyping of 3D-Printed samples embedding Fiber Bragg Gratings

Fabrication of fiber optic sensors for biosensing and for environmental monitoring

OTHER EXPERTISE

Experience with cell cultures and in vivo models (accredited)

FEM analysis and Monte Carlo-based simulations of laser-tissue interaction

Biomechanical monitoring for health and sport activities

Collaboration with Companies for characterization of Medical Devices

