

DermalInspect®

Non-invasive multiphoton tomography of human skin



In vivo optical biopsies with subcellular spatial resolution based on near infrared femtosecond laser technology for:

- Diagnostics of dermatological disorders
- Melanoma detection
- Tissue engineering
- Cosmetic research
- *In situ* drug monitoring
- Intratissue imaging of pharmaceutical components

DermalInspect®



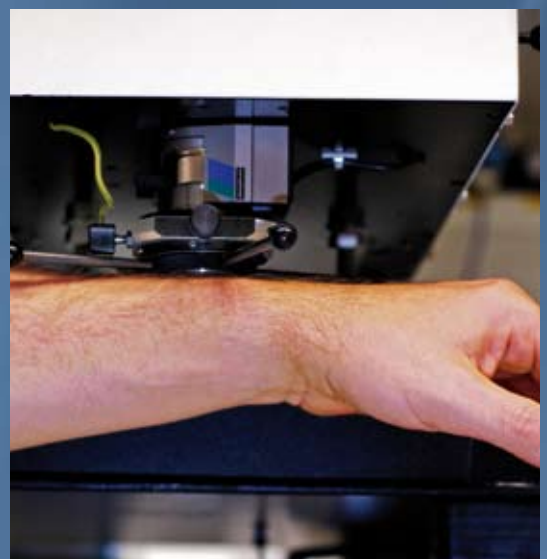
DermalInspect®

A CE-marked system for *in vivo* multiphoton tomography of skin with submicron spatial resolution

Product description

DermalInspect® is a novel imaging device which provides non-invasive *in vivo* optical biopsies of skin with ultrahigh subcellular resolution. The 1M class system uses a femtosecond laser beam for multiphoton excitation of biomolecules like NAD(P)H, flavins, porphyrins, elastin, and melanin. The extracellular matrix element collagen is imaged by its second harmonic generation (SHG). Autofluorescence and SHG signals are recorded by fast PMT detectors.

The system consists of a compact, turn-key tunable femtosecond near infrared (NIR) laser, a beam scanning module with galvoscaners and piezo driven optics, a PMT detector module as well as a control unit including JenLab Image software for 3D, 4D and 5D image processing.



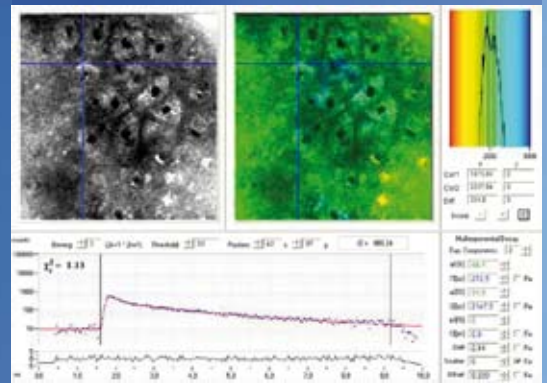
In vivo adaptor

FLIM Technology

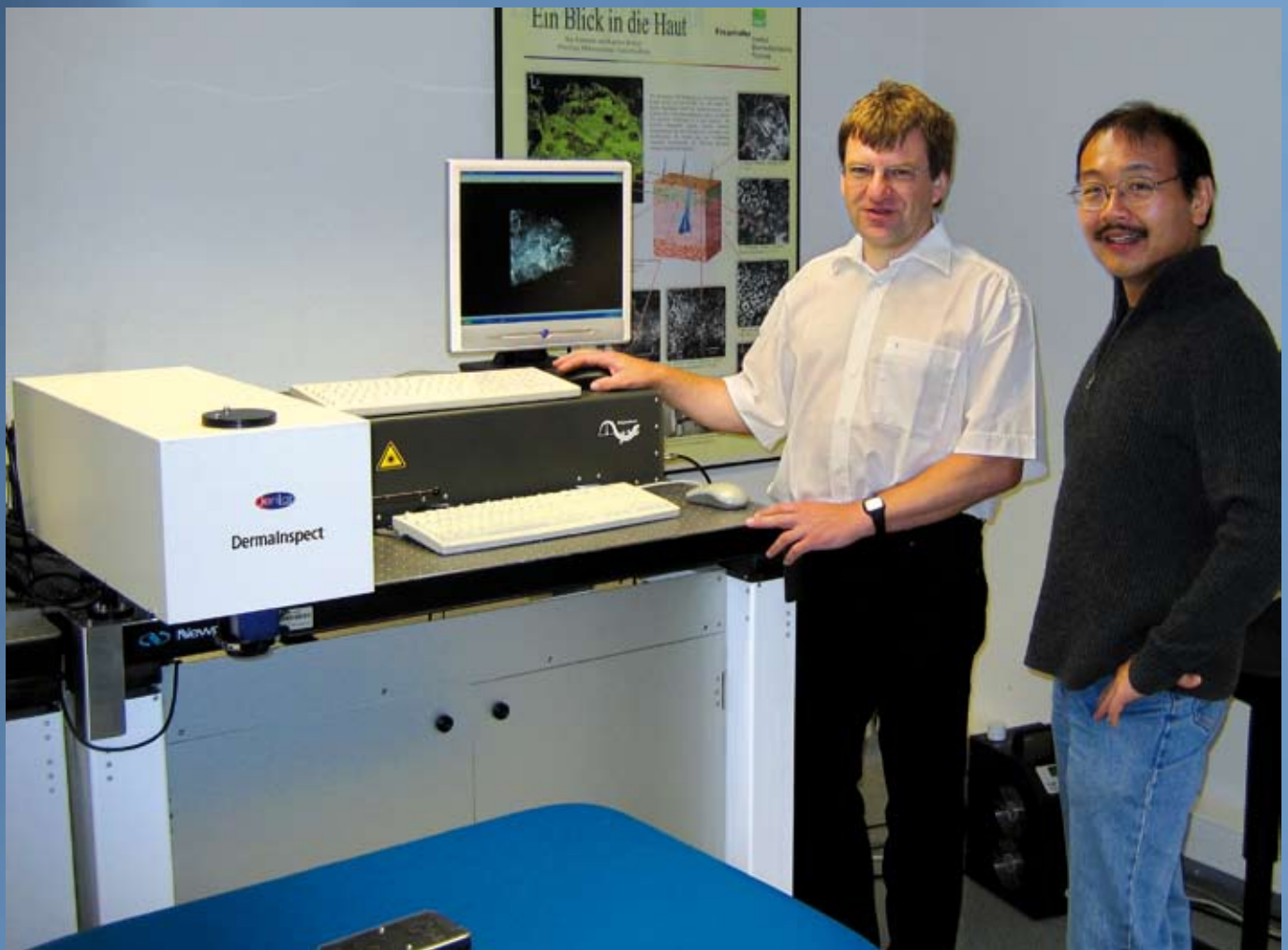
In addition to 3D fluorescence imaging by optical sectioning and monitoring of the fluorescence intensity, Dermalinspect® system can be upgraded with a FLIM module of an external manufacturer for fluorescence lifetime imaging. Dermalinspect® combined with the time correlated single photon counting (TCSPC) module can perform fluorescence lifetime imaging (FLIM) at different tissue depths with a temporal resolution of 250 ps. The fluorescence lifetime τ adds a 4th dimension to the high resolution images and provides information on the type of the fluorescent biomolecule as well as molecular interactions within the microenvironment. For example, typical fluorescence lifetimes of free NADH, NADH-protein complexes and porphyrin monomers are 200 ps, 2 ns, and 10 ns, respectively.

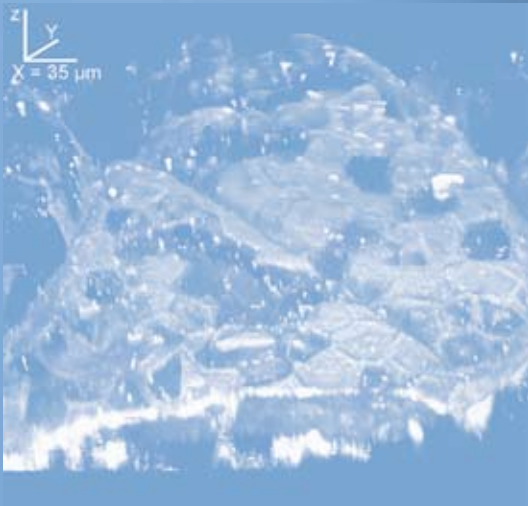
Spectral Imaging

The multiphoton tomograph Dermalinspect® can be further upgraded to a 5D system in order to obtain information on the emission spectrum (spectral imaging with submicron spatial resolution).



Fluorescence intensity image, false-color coded FLIM image, fluorescence lifetime histogram and fluorescence decay kinetics at a particular position





Applications

The major aim for the development of the DermalInspect® was skin cancer diagnosis. Using innovative non-invasive multiphoton technology the physician obtains detailed information on the living intratissue cells and the tissue architecture within their natural environment. Dermatological disorders and melanoma can now be detected with submicron spatial resolution. Having a short acquisition time of seconds, DermalInspect® revolutionizes conventional invasive and highly time consuming diagnostic procedures. The system is used in tissue engineering for the detection of cells and extracellular matrix components, in the research of wound healing and skin aging, in monitoring of therapeutical effects as well as in cosmetic and pharmaceutical research. FLIM and spectral imaging provide further contrast mechanisms for *in situ* drug monitoring. Researchers using this combination will have an exclusive four-dimensional view on biological processes within living tissue.

DermalInspect® is routinely used in various research institutes and hospitals in Europe, Asia and Australia.

References

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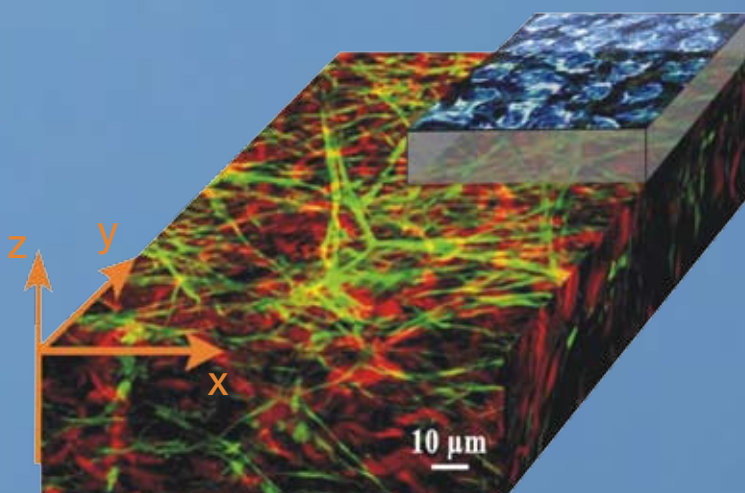
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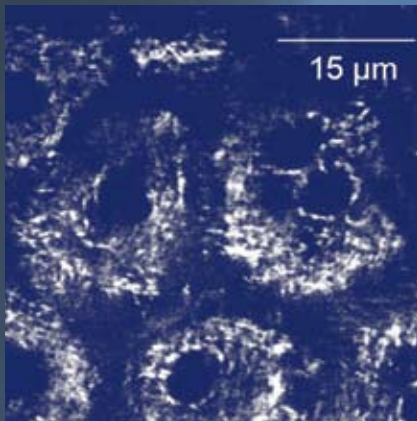
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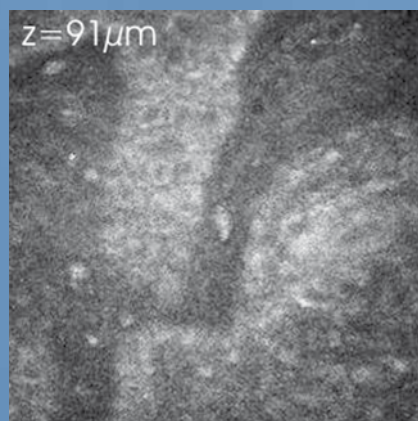
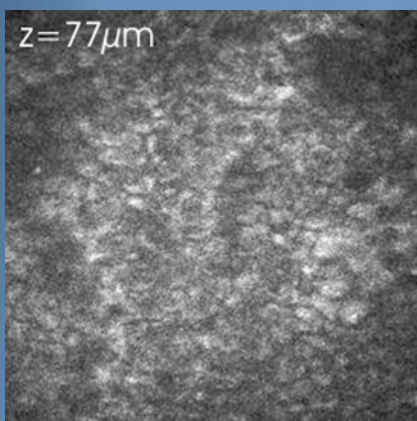
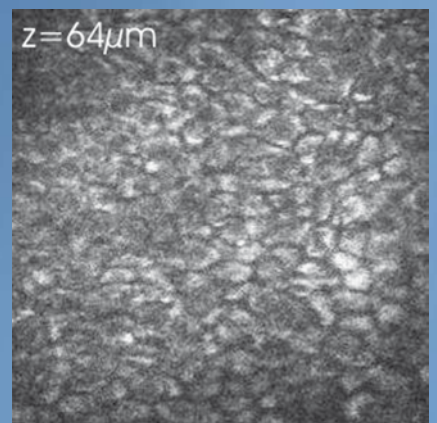
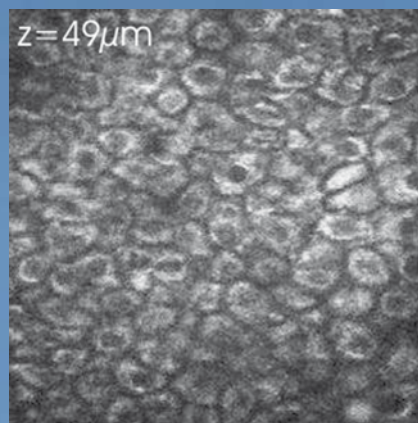
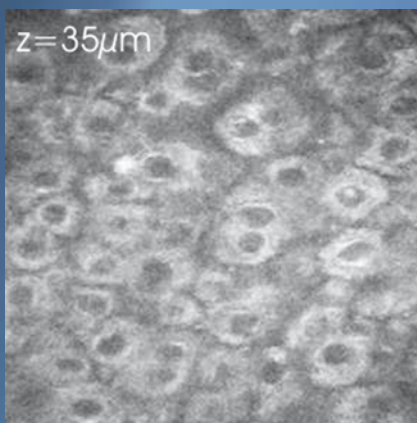
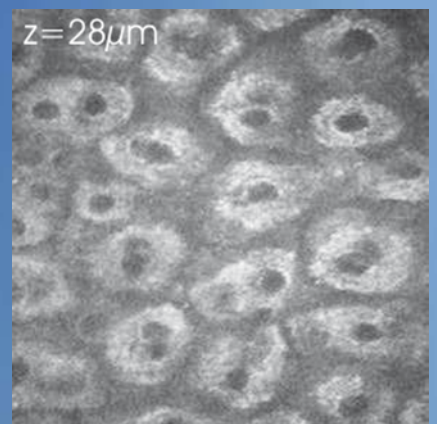
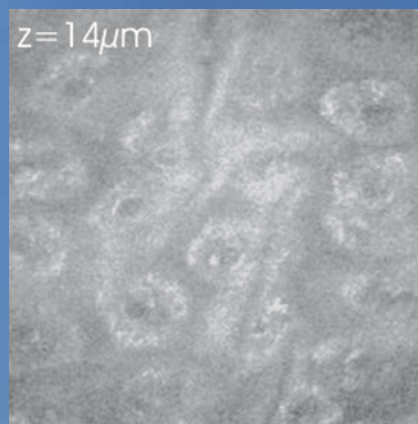
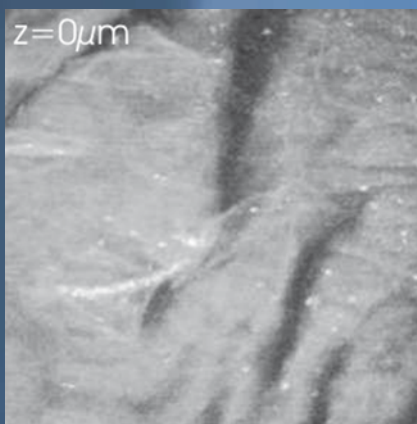
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3D reconstruction of elastin and collagen structures in tissue



Single fluorescent intratissue mitochondria can be imaged within the epidermis



Multiphoton tomography provides a detailed look into the skin
z: tissue depth in μm





Technical data

- compact turn-key tunable Ti:sapphire femtosecond laser
 - laser pulse width: < 100 fs
 - repetition frequency: 80 / 90 MHz
 - mean laser output: 0 ... 1.5 W (typical)
 - wavelength range: 720 ... 920 nm (typical)
- full-frame scanning, region-of-interest (ROI) scanning, line scanning, single-point illumination (spot scan)
- typical scan range:
 - 350 × 350 μ m (horizontal)
 - 200 μ m (vertical)
- spatial resolution:
 - < 1 μ m (horizontal)
 - < 2 μ m (vertical)
- focusing optics:
 - magnification 40×
 - numerical aperture (NA) 1.3
- video adapter for visualization with CCD-camera
- control and image processing software (JenLab scan, JenLab Image)
- operating temperature: 15 ... 35 °C (59 ... 95 °F)
- relative humidity: 5 ... 65 %
- power requirements: 230 VAC (50 Hz) or 115 VAC (60 Hz)
- **CE** certified class 1M medical product

System dimensions (typical)

- workstation: 1200 × 780 × 1100 mm³ 180 kg
- scan module: 615 × 255 × 210 mm³ 16 kg
- control unit: 450 × 460 × 190 mm³ 12 kg
- Ti:sapph laser: 600 × 370 × 180 mm³
 - 42 kg (laser head)
 - 41 kg (power supply)
- chiller: 270 × 200 × 380 mm 20 kg

The complete system needs a minimum space of 8 m². Air-conditioning is recommended. System operation requires reduction of ambient light.

Notes: These specifications are subject to change without notice.
DermalInspect® is not intended as a primary diagnostic means.



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