

International Laser Center

What is behind ... ?

ILC

Interdisciplinary organization, focused on training, research and development in the areas of progressive methods and technologies of *photonics*.

Established on January 1997 by Ministry of Education of Slovak republic as an independent (educational) institution on the ground of Faculty of Electrotechnics and Informatics of Slovakian Technical University and Faculty of Mathematics, Physics and Informatics of the Comenius University in Bratislava.

Main objectives

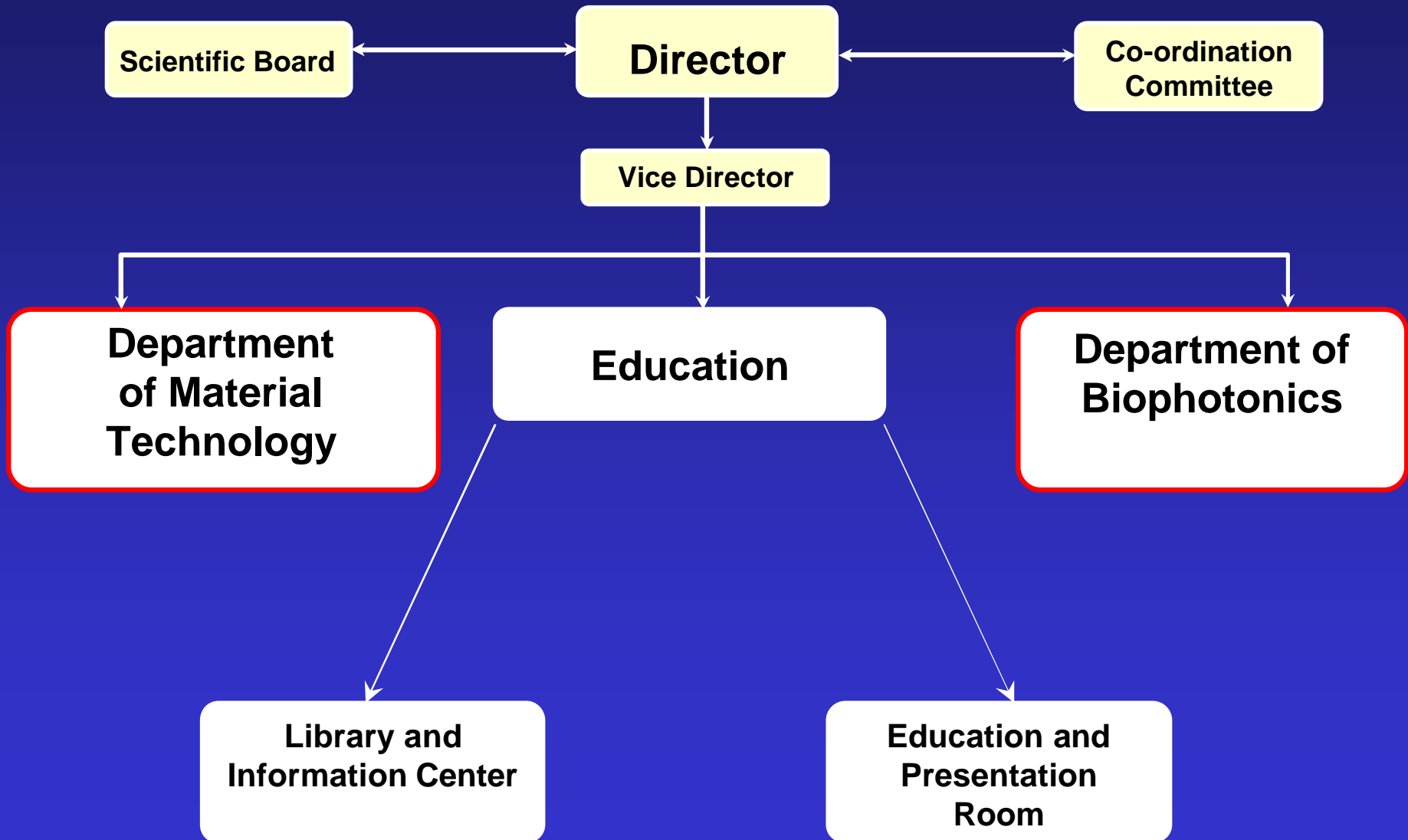
To provide the platform for technology transfer and to create contacts among scientists, engineers and other specialists sharing interest in the field of photonics

To solve actual scientific and technological projects

To realize training courses in co-ordination with universities and enterprises in pre- and post-gradual education

To provide consultation and information services, presentation of scientific and technical results

Organization Structure of ILC



Department of Material Technology

Laboratory of Laser Microtechnology

Development of methods and technologies of laser deposition and high-precision processing of solid materials, investigation of laser ablation using lasers of different types

Laboratory of Material Analysis

Photoluminescence spectral analysis, semiconductor lasers diagnostics
photocurrent spectroscopy

Laboratory of Information Technology

Analysis and functional testing of telecommunication fiber-optic lines

Department of Material Technology

Laboratory of Femtosecond Technology

Fluorescence study for OLED and semiconductor heterostructures development, fluorescence study of host-guest molecular complexes, supercontinuum generation in photonic crystal fibers, pump-probe spectroscopy of metal nanoparticles

Laboratory of Laser Metrology and Holography

development and application of the holographic, interferometric, and nonlinear-optical methods for contactless measurements of motions and deformations of objects

Department of Biophotonics

Rapid prototyping and reverse engineering

noncontact optical measurement of surface and geometry
reconstruction of surface and volumetric structures

Biomedical imaging and visualization

optical tomography (OT, OCT, AOT), laser induced luminescence (macro, micro), numerical and graphical techniques for data visualization, modeling of biosystems (cardio-vascular, cancer),

Laser and scanning microscopy

3D (multispectral) imaging and analysis of processes in isolated cells and tissues imaging and control of nanostructures

Department of Biophotonics

Laser spectroscopy

Laser induced luminescence in solids, chemical and biological structures, femtosecond time-resolved and non-linear spectroscopy

Clinical and applied pharmacology

Molecular biology, applied photonics

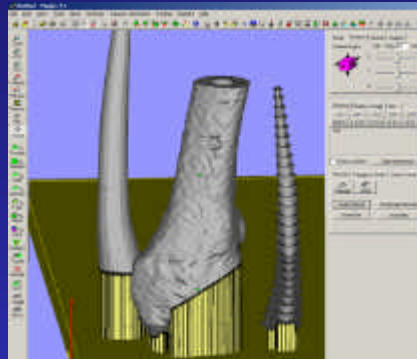
Applied biophysics

Raman spectroscopy and imaging
Photodynamic therapy

Rapid prototyping and reverse engineering (Project APVT-20-014602)



real object



virtual model



model object



3D scanners,
photogrammetry,
LSM, OCT...



HW and SW
for reverse engineering

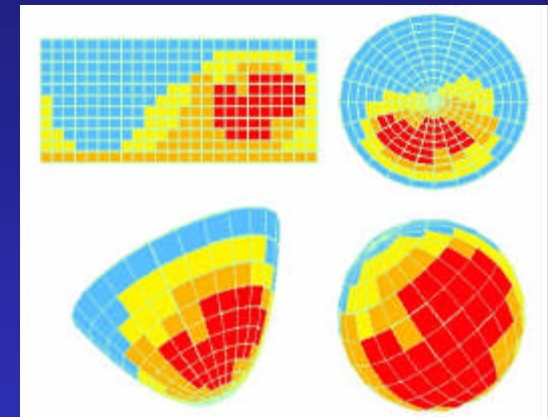
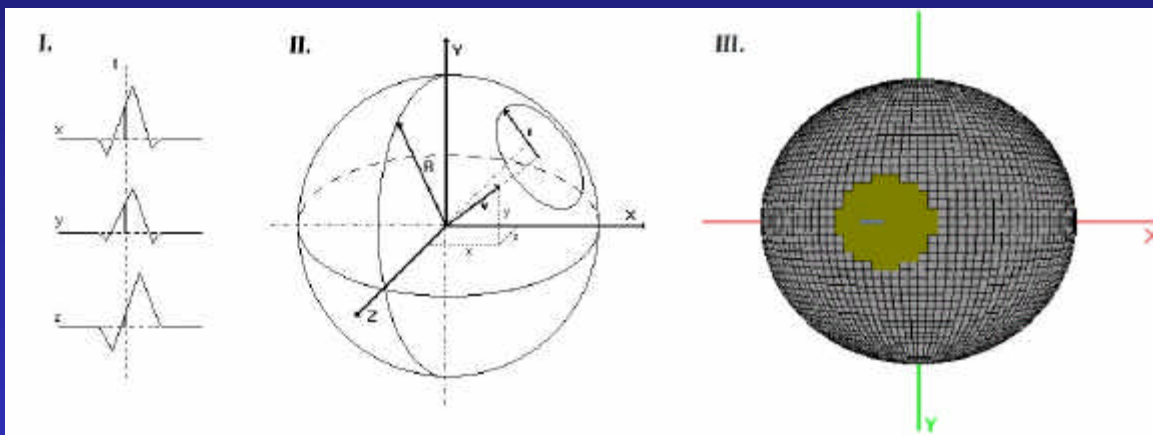


3D stereolithography

Modelling of biomedical systems

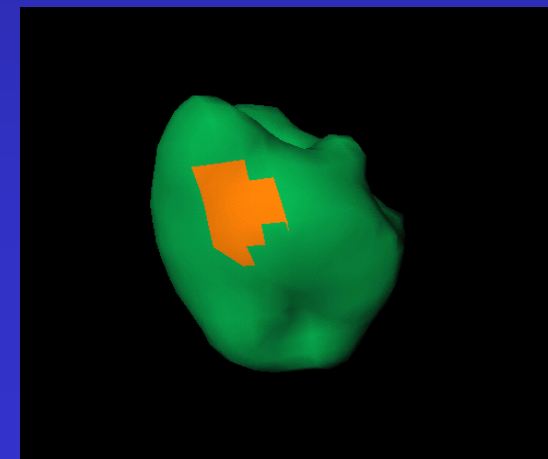
Topographic presentation of heart electrical field

2D / 3D projections

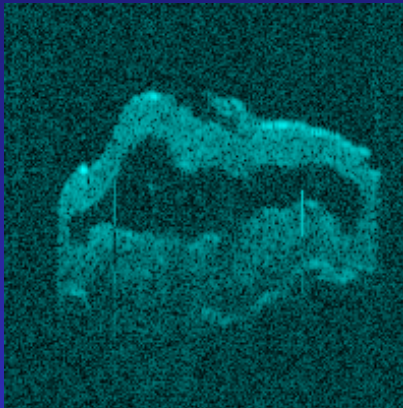


Superposition of anatomical, structural and functional characteristics of the heart: ECG + SPECT (MRI)

Applications – location and scale of MI during ischemic heart disease



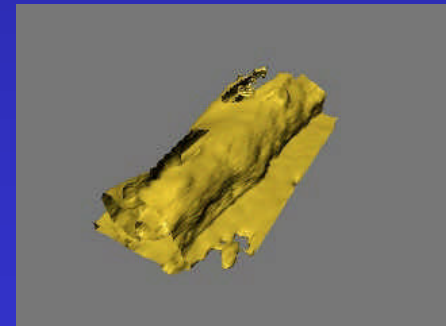
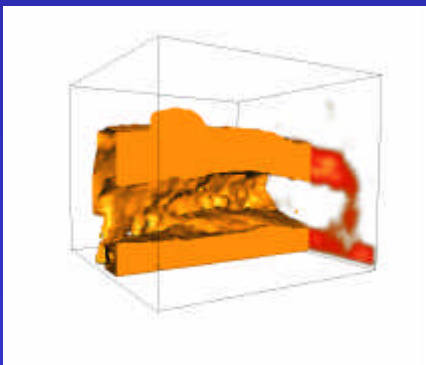
Optical tomography



Optical coherence tomography (OCT) - optical biopsy / superficial tissue structures

Optoacoustics microscopy (sub-mm resolution)

Diffusion Optical Tomography (mm resolution)

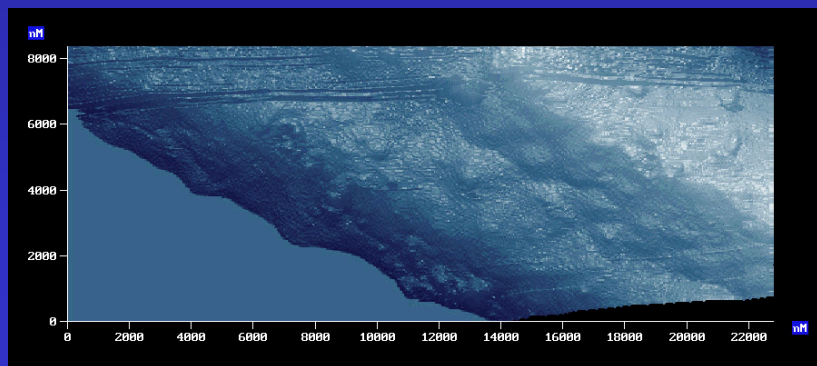


Optical, laser and scanning microscopies

Optical microscopy - image processing, video processing

SPM (SNOM, AFM) - surface visualization

SEM - surface and composition

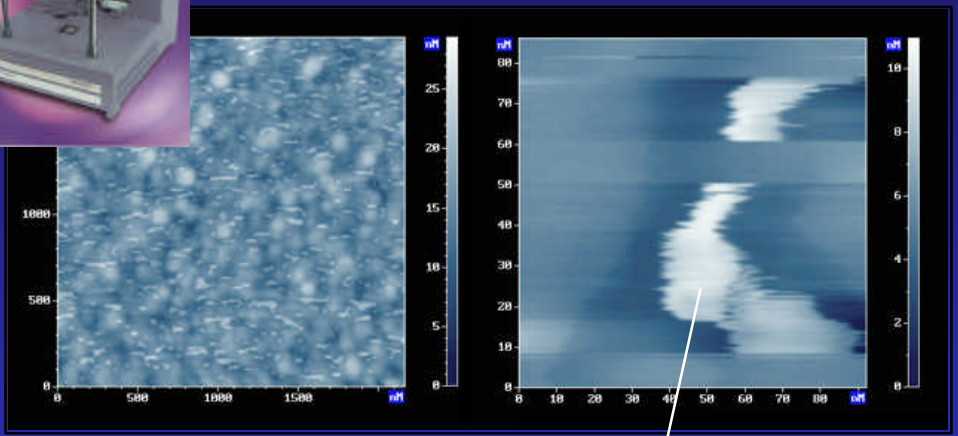


analysis of features

2,5D surface visualization

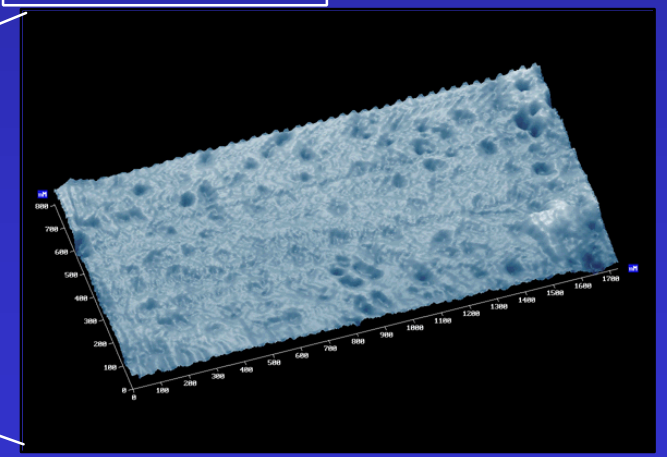
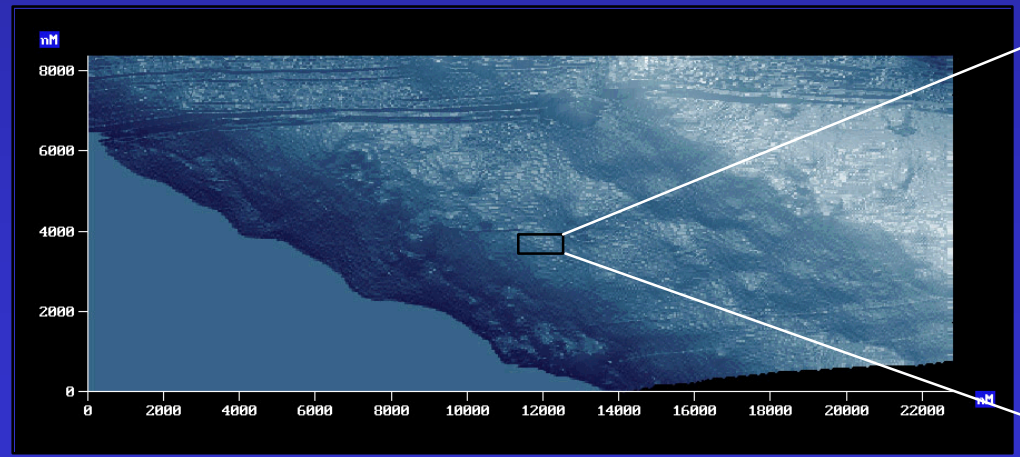
3D visualization

Microscopy with scanning probe



Measuring modes:
Contact AFM/ LFM/ ResonantMode AFM (semicontact)
Phase Imaging/ Force Modulation AFM (Force) Lithography
Spectroscopy (semicontact)

DNA fragment



Cell membrane

Laser scanning multispectral confocal microscopy



Areas of activity

multi-parametric characterisation of biological systems in physiological conditions, material analysis, fusion of molecular / single-cell / tissue techniques, emission fingerprinting, FRAP, FRET

Mapping of physiological processes in living cells

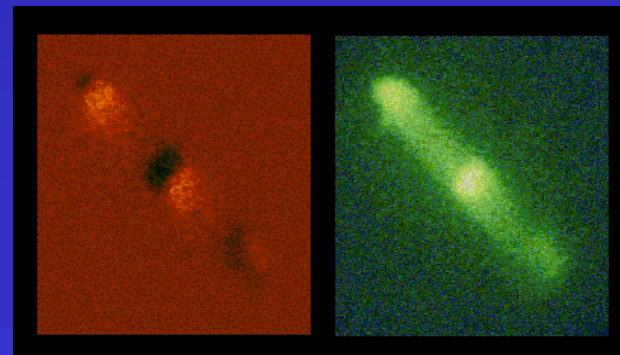
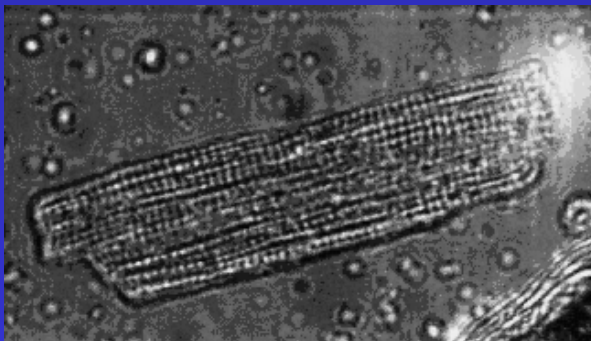


sample conditioning

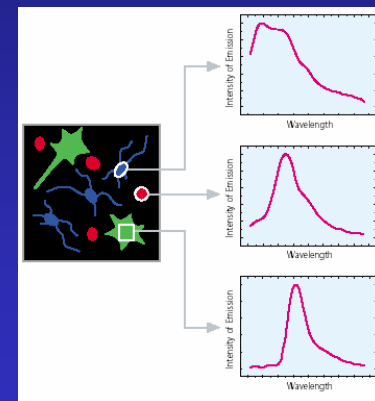
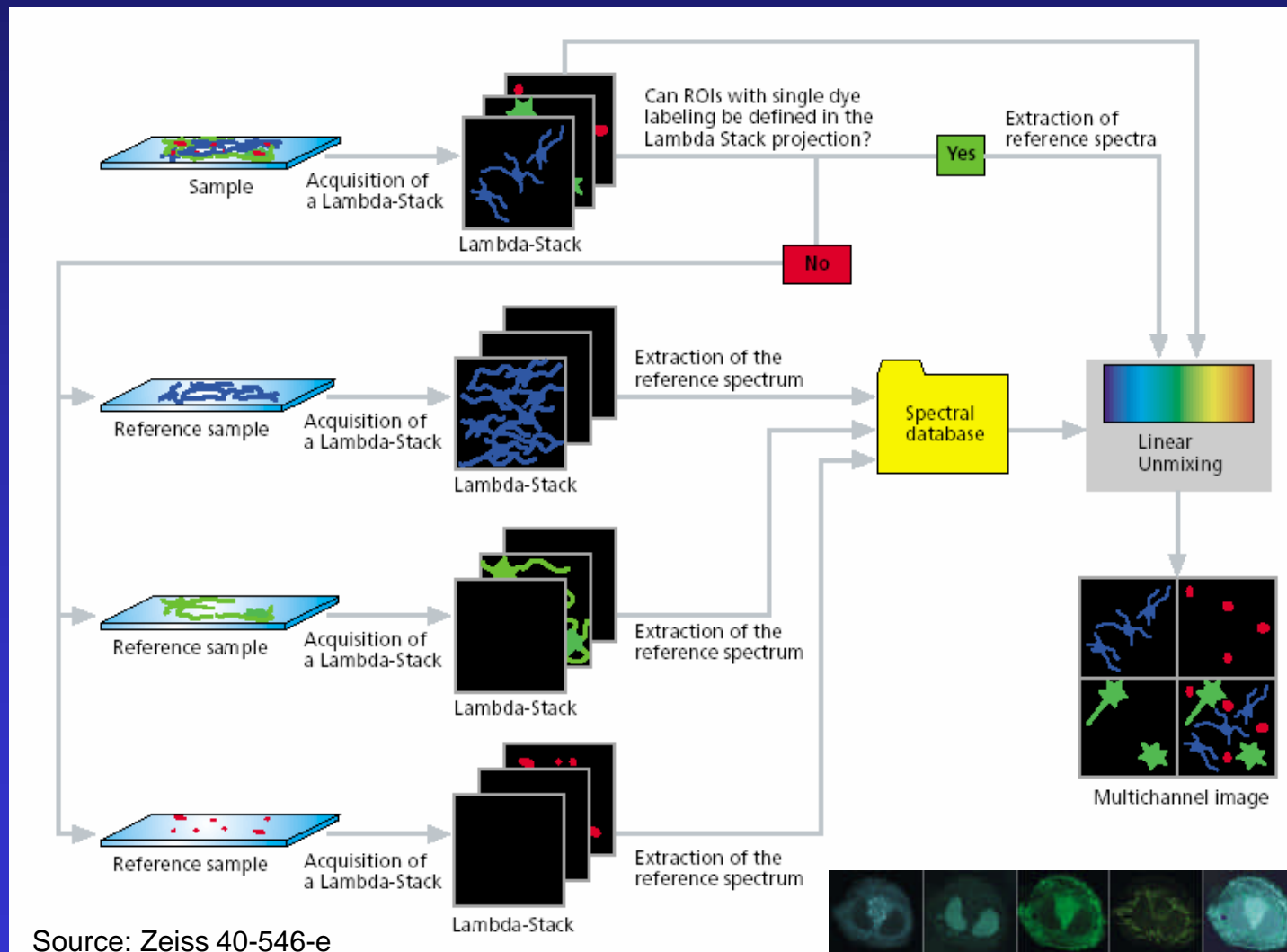
temperature control
incubation / perfusion
under physiological conditions
+ Facility for cell cultivation

automatisation

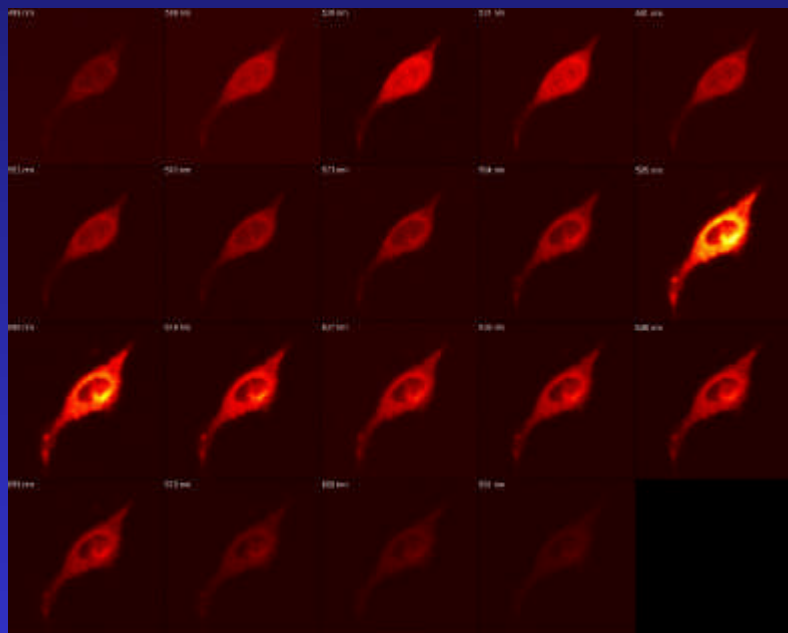
Programmable experiment protocols
and data-processing procedures



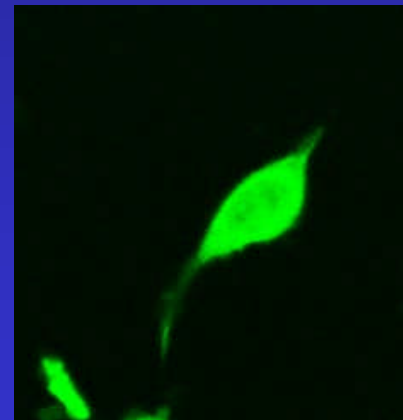
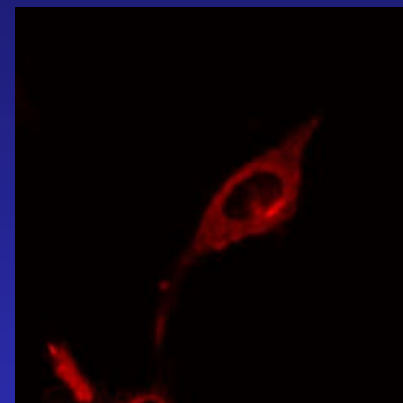
Emission fingerprinting (? microscopy)



Distribution of compounds in cells

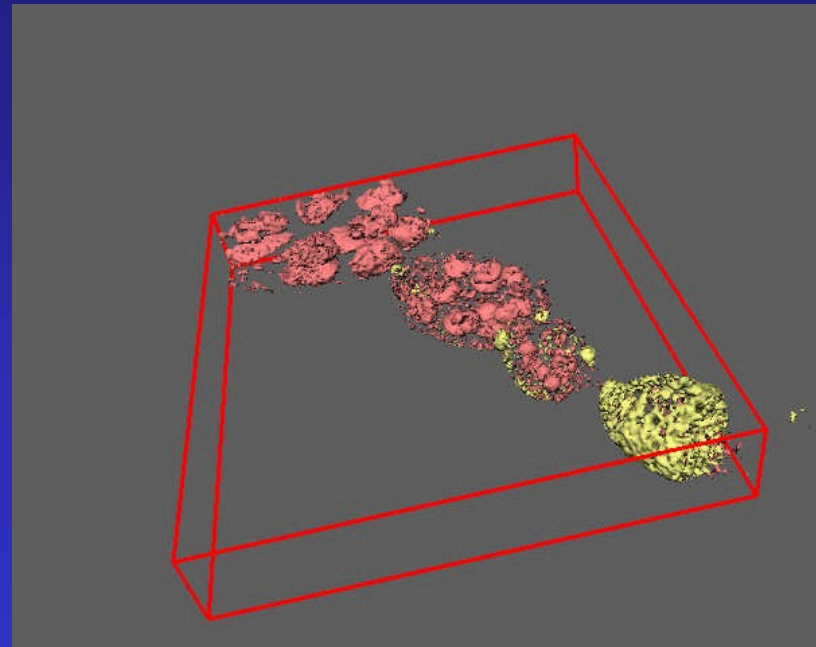
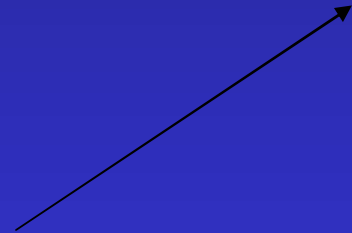
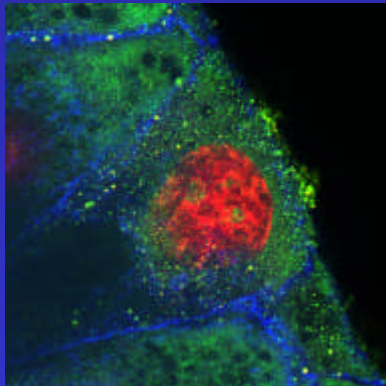
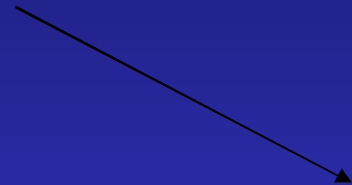
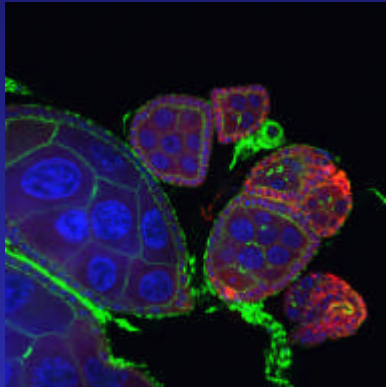


Spectrally resolved
images



Unmixed images

Expression of various proteins and their location in cells



3D reconstruction

3D stack of images

Problems

3D reconstruction

Visualization of volume data sets

3D deconvolution methods for microscopy

Visualization of multidimensional data sets

Quantification and analysis of multidimensional data sets

What we using..

Software

IRIS Explorer for data visualization, numerical libraries from NAG (symmetric and parallel version), Statistica, ProEngineer, Magics software, 3D Max, Maya

Hardware

16 Intel Xeon 2.8 processor cluster + 6 Sparc processor cluster, standard PC