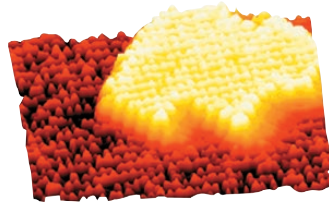




Board of the  
Swiss Federal  
Institutes of  
Technology  
ETH Board



TOP NANO 21 ◀



**Experience applied  
nanotechnologies!**

1<sup>st</sup> October 2002

Kursaal Bern

Demonstrators,  
developed in TOP NANO 21

An Initiative of the ETH Board for Implementation by  
the Commission for technology and innovation (CTI)

**The special exhibition of demonstrators opens the gate to the nanometer world also to non-specialists.**

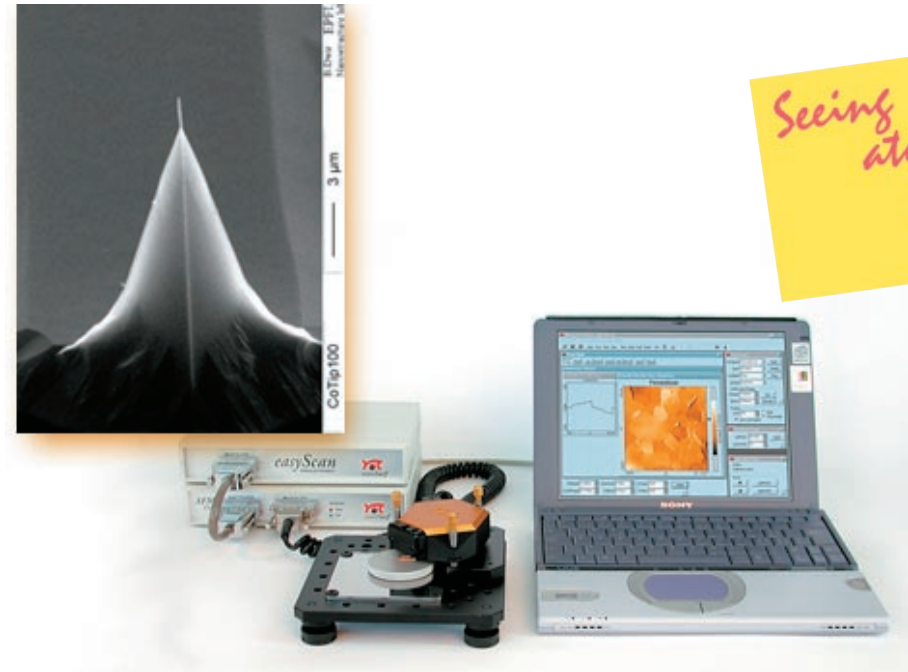
**Various instruments and tools, which have all been developed in the course of TOP NANO 21, will allow you to grasp the dimension of the nanometer in the real sense of the word:**

**The nanometer as close as never!**

**Please, visit the special demonstrator exhibition in the hall Bella Vista, from 9 am to 5 pm.**

**Superficially seen, just a magnifying glass. easyScanAFM**

As an imaging surface control instrument, the easyScan Scanning Force Microscope offers the ultimate high-resolution view of the surface and thus its composition and workability – with manageable tools and without specialized knowledge. Wear less diamond tips – to be developed within the TOP NANO 21 program – are planned to considerably increase the time of sensor operation.



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A Scan mechanism makes precise guidance of micrometer sized tip possible, for the gentle sensing of a surface. The structure is digitally visualized.

Used in research for the characterization of new products for nanotechnology, the Scanning Force Microscope is utilised increasingly in industry for the improvement of fabrication and coating processes.

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### Nanomanipulation of mesoscopic object

NanoFeel™ 300 is a force feedback manipulator coupled with a closed-loop Atomic Force Microscope, enabling the manipulation of mesoscopic objects.



Manipulation at the nano-scale is made accurate and easy through: a large workspace ( $\varnothing 300$  mm, which means a reduction factor of the order of 100 000), a force ranging from human sensitivity to 2.5 kg, the possibility to feel, at any time, the force experienced by the probe, a non-propagating error design of the manipulator, a seamless integration with the Atomic Force Microscopes. The software allows any modes of operation and predefined motion.



### Sigma 6: dynamic ultra-high precision 6 degrees of freedom robot

This robot prototype is based on the use of flexible articulations (bending metallic beams), parallel kinematics (reduced inertia of moving parts), direct drive electromagnetic linear actuators (contactless) and interpolated incremental optical sensors. Its single stage actuation configuration makes the classical use of an additional small-stroke piezo scanning stage unnecessary. Coupled geometry and dynamics have been successfully modeled and implemented.

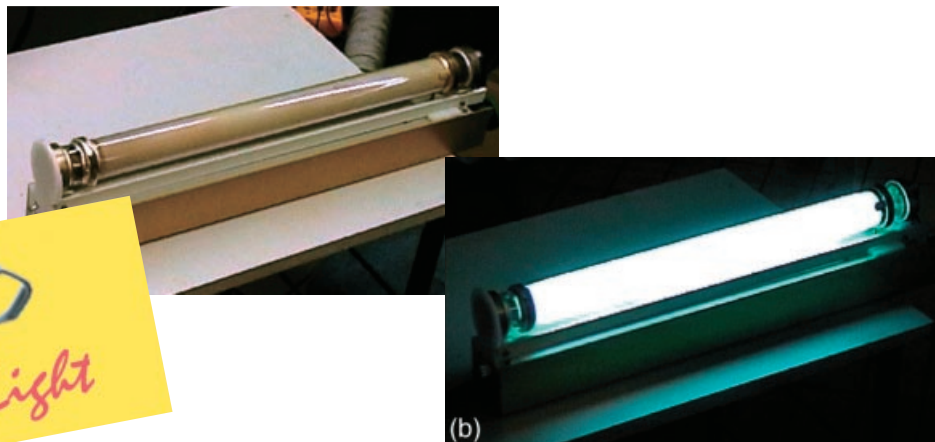
The Sigma 6 robot offers 3 translations/3 rotations for positioning, scanning, manipulation and assembly tasks requiring nanometer repeatability ( $\pm 5$  nm/ $\pm 100$  nrad). Motion ranges are  $\pm 5$  mm/ $\pm 5^\circ$  and the usable bandwidth exceeds 200 Hz.

The system has zero friction and zero backlash, allowing nanometer repeatability and high dynamics (scanning) continuously over the full motion range.



### Cold cathode fluorescent lamps for general lighting based on carbon nanotube field emitters

Carbon-based materials, and especially carbon nanotubes, have been used recently as cold electron emitters in a variety of devices aiming at lighting applications. We present here a luminescent tube where a phosphor layer produces visible light through electron bombardment. The electrons are field emitted by carbon nanotubes that are directly deposited by chemical vapor deposition on a wire that is stretched in the center of the tube.



Light

The luminescent tube is controlled by a portable high voltage power supply, which delivers a fixed 20 W of power at variable current and voltage. The tube starts instantly and can be continuously dimmed, with good homogeneity and high stability.

Our prototype provides an alternative to the usual fluorescent tubes, which provide a very mature technology but have a light output limited to 10 000 cd/m<sup>2</sup>, poor dimming capability, and contain mercury.

### High Performance Nanocrystalline Photovoltaics for Indoor Applications

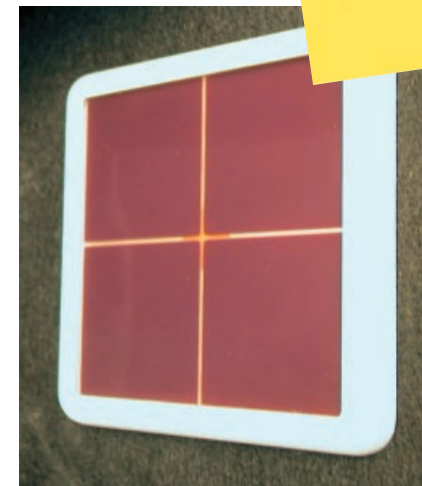
This innovative photovoltaic device with enhanced sensitivity at low light levels uses an electroactive dye to absorb light and deliver electricity; the dye is adsorbed on a semiconductor in contact with an electrolyte, in contrast with conventional all-solid-state devices

Electrochemical photovoltaic devices maintain their conversion efficiency under low light conditions indoors where conventional solid state cells perform poorly.

Power

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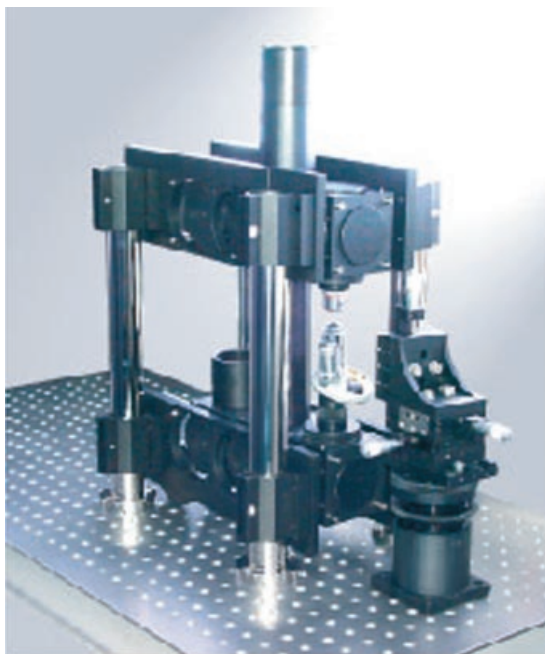


**DHM, a new instrument for cell characterization and imaging at the nanometric scale by digital holographic microscopy**

A prototype of a DHM instrument demonstrating the Imaging capabilities of Optical Digital Holography (DHM) will be presented. DHM provides an accurate 3D imaging of biologic materials, down to the nano-scale. The method has been developed to yield a very precise determination of cells, tissues morphology and, indirectly, composition. The system will be shown in ordinary working conditions in a biology and medicine laboratory.

Quantitative data on the cell morphology and dielectric properties can be obtained by DHM. Thickness resolution of approximately 40 nanometers and a transverse resolution of 360 nm have been obtained for living cells in cultures.

DHM offers diverse and important applications in medicine and biology: diagnosis based on the non perturbing observation of living tissues and cells, and functional image of cells in culture for drug screening in pharmaceutical industry.



**Conformation and Molecular Interaction of Proteins at Nanoscale Patterned Interfaces of Biomaterials and Biosensors**

Novel chemical activation layers are tuned to allow optimal immobilization of peptides, proteins, or receptor molecules on the surface of planar optical wave guides, the platform and technology basis of Zeptosens' microarray products. Surfaces equally permit optimal functionality of recognition elements as well as minimized non-specific adsorption of matrix molecules leading to higher sensitivity of multiplexed biochemical assays with applications in the life science industry and academia.

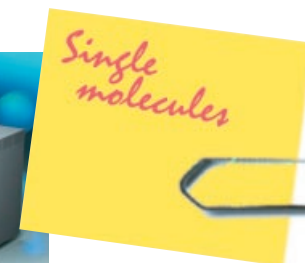
The Zepto™-product line comprises highest sensitivity, high throughput instrumentation, DNA and protein microarrays with user friendly microfluidics and methodology for fluorescence-based bioassays using Planar Wave Guide (PWG) technology featuring:



«**Array-of-microarrays**» with integrated, individually addressable microfluidics for ease of operation



**High performance fluorescence imaging system and microarray-based assays** with improved biological information enabled through highest sensitivity



**Proprietary surface chemistry** in conjunction with planar wave guides adapted to the specific requirements of assay and functionality featuring extremely low non-specific binding.

### Non-wetting surface coatings for precision optics

Lowest surface roughness is essential for precision optics to avoid light scattering. Stray light decreases contrast in imaging optics and beam quality in laser optics. On the other hand increased roughness of hydrophobic surfaces increases nonwettability by liquids. The optimum is obtained by realization of an ultrathin chemical coating of smooth substrates. The result is a weather resistant dust repellent coating without optical losses.

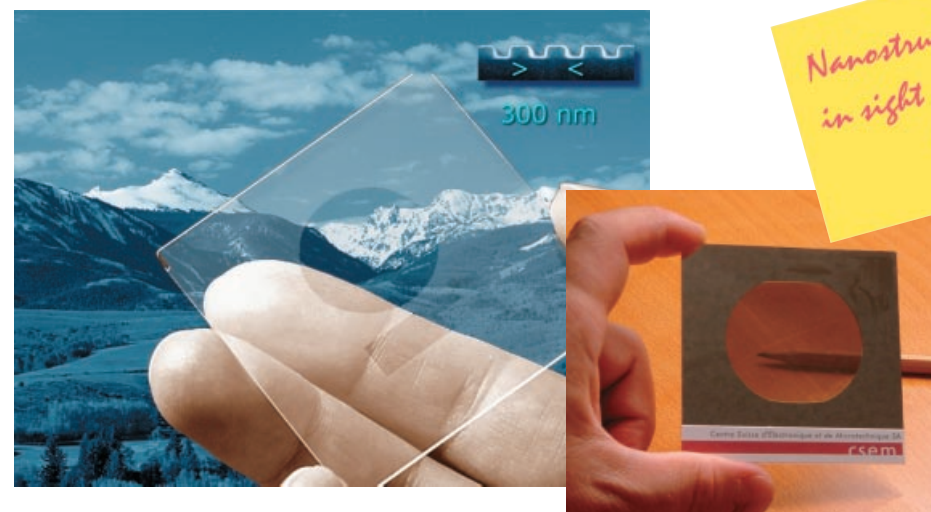


The perfluorosilanization of smooth glass or other mainly SiO<sub>2</sub> containing substrate surfaces results in surfaces with lowest wettability by liquids (twice lower than Teflon™) without optical losses.

The main advantage of the coatings is the strongly reduced contamination of precision optics. Cleaning efforts of optical elements is strongly reduced.

### Nanostructures for Optical Devices and Elements NODE2

- Subwavelength grating grid polariser fabricated by the slope evaporation of metal onto a replicated grating nanostructure.
- Smoke detector unit (Siemens Building Technologies): Potential application of nanostructured polariser to improve sensitivity of detector.
- Anti-reflection surface – application of grating nanostructure to reduce the reflectivity of an optical surface.



#### Functionality

- Polarisers: applications in optical instruments such as Smoke Detectors to enhance the signal to noise.
- Anti-reflection surfaces: Applications in optical elements and microsystems.

#### Customer benefit

- Polarisers: Reduction in cost in mass-production. Improvement in environmental stability (temperature, humidity ...).
- Anti-reflection surfaces: Reduced absorption and improved lifetime for Deep UV applications.



## Exhibitors

### Hall Bella Vista

- Superficially seen, just a magnifying glass. easyScanAFM
- Nanomanipulation of mesoscopic object
- Sigma 6: dynamic ultra-high precision 6 degrees of freedom robot
- Cold cathode fluorescent lamps for general lighting based on carbon nanotube field emitters
- High Performance Nanocrystalline Photovoltaics for Indoor Applications
- DHM, a new instrument for cell characterization and imaging at the nanometric scale by digital holographic microscopy
- Conformation and Molecular Interaction of Proteins at Nanoscale Patterned Interfaces of Biomaterials and Biosensors
- Non-wetting surface coatings for precision optics
- Nanostructures for Optical Devices and Elements NODE2

## Information about TOP NANO 21



BUNDESAMT FÜR BERUFSBILDUNG UND TECHNOLOGIE **BBT**  
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