TIXIER-MITA LAB.

[Bio and Chemical CMOS/MEMS Platforms]

Center for Interdisciplinary Research on Micro-Nano Methods (CIRMM)

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Research Center for Advanced Science and Technology (RCAST)

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# Platforms for Cells and Chemical Analyses

How to improve the detection of disease or to investigate new approaches for further understanding of cells interactions or cells diseases?

Precise and sensitive tools are needed. In particular platforms with integrated electronics allow further investigation in the biomedical field for: diseases detection, new drugs development, or fundamental understanding of biological phenomena. Here, new tools are proposed: they are hybrid systems with integrated micro-electronics, micro-fluidics, and sensors. They allow a multitude of investigation approaches: electrical, optical, chemical and biological.

◆ Electronics integration by LSI or TFT technology: gives a 2D surface, for cells culture, with a dense array of independently controllable electronic components.

◆ Miniaturization and micro–structurization, thanks to micro–fabrication: improvement of portability and sensitivity.

◆ Array of sensors with zeolites as sensitive layer: a highly selective Electronic–Nose.
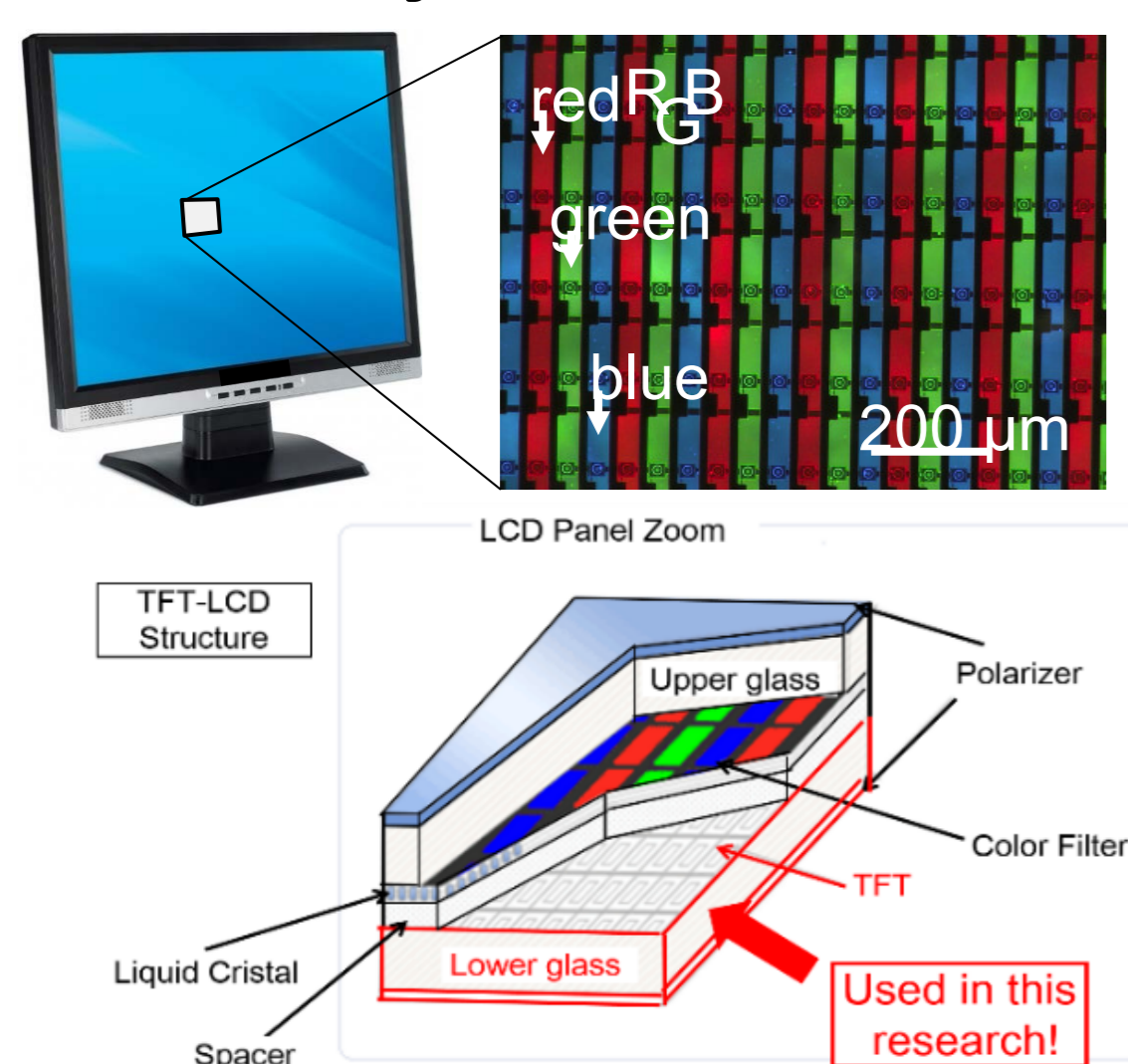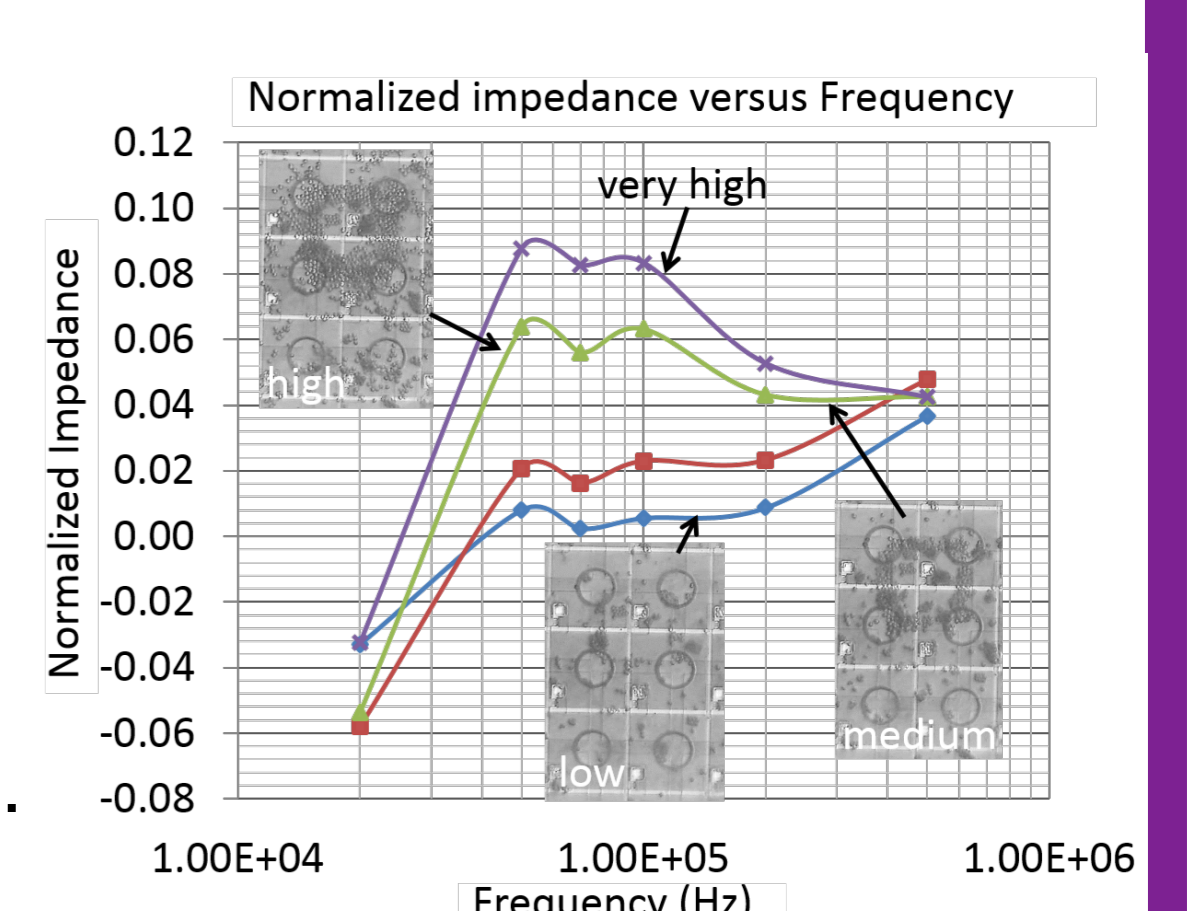

TFT/LCD display used as a substrate for a 2D platform for investigation on biological cells.
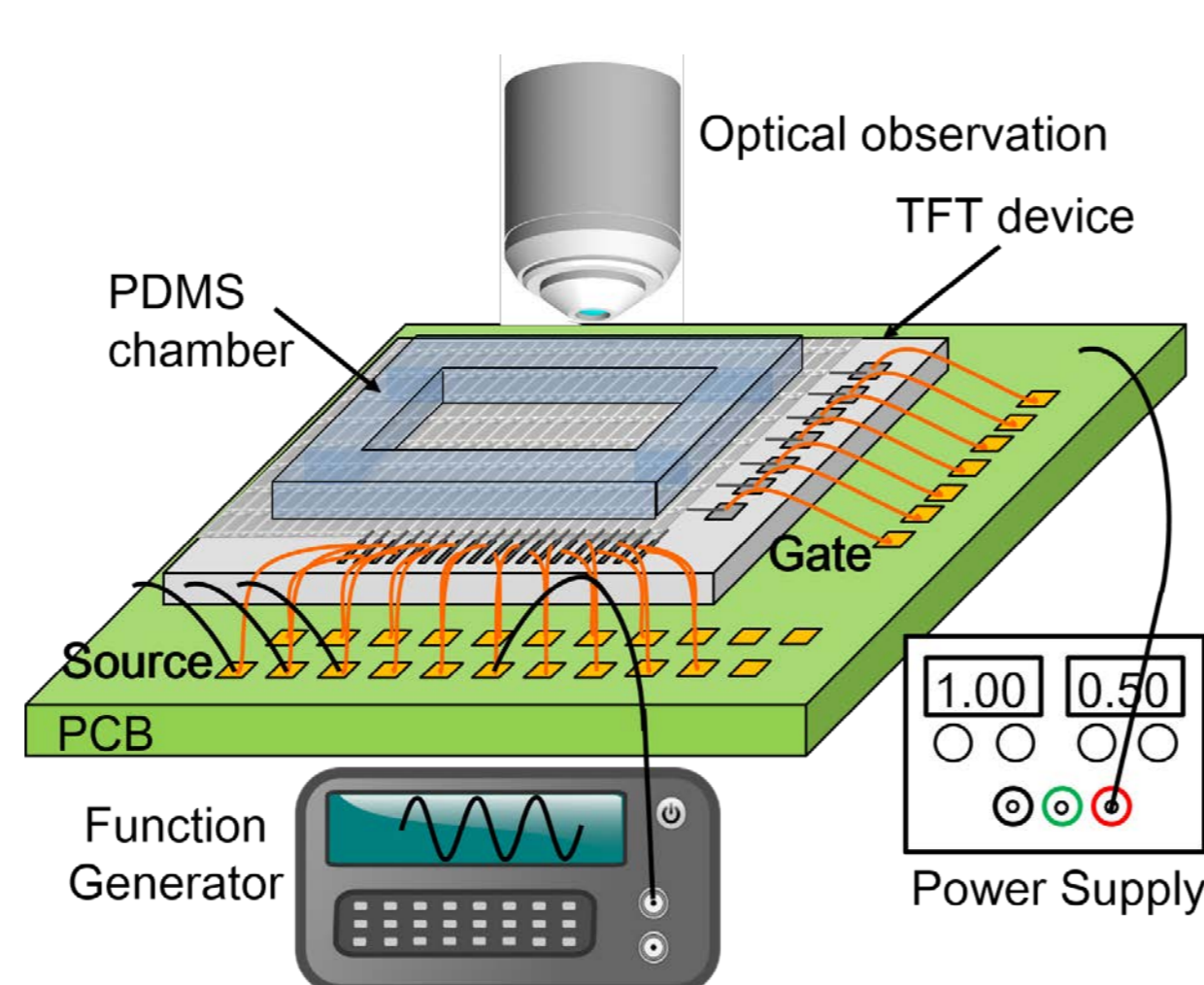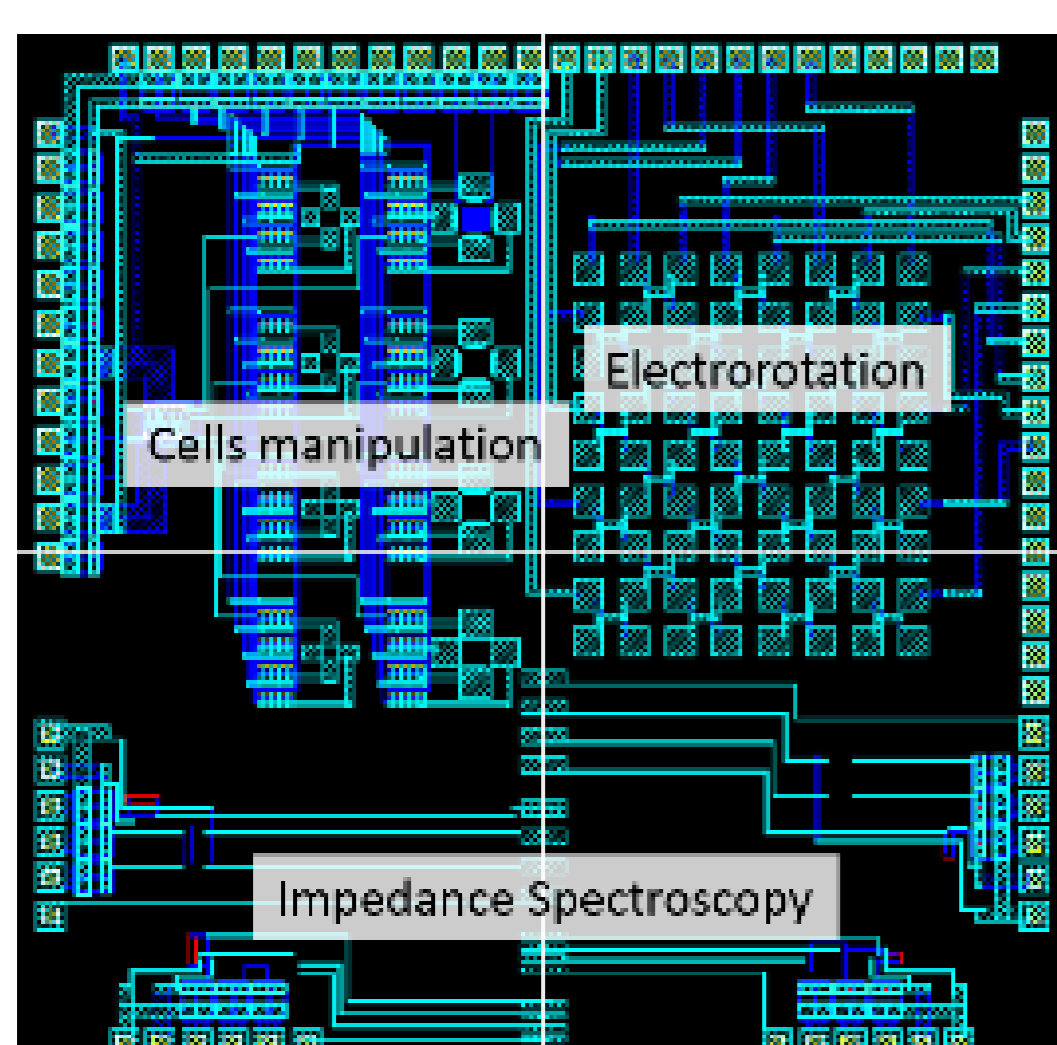

Set-up of the TFT system. The TFT substrate is transparent: observation through the substrate is possible.

Yeast Cells:
Positive DEP.
Gate: 3V
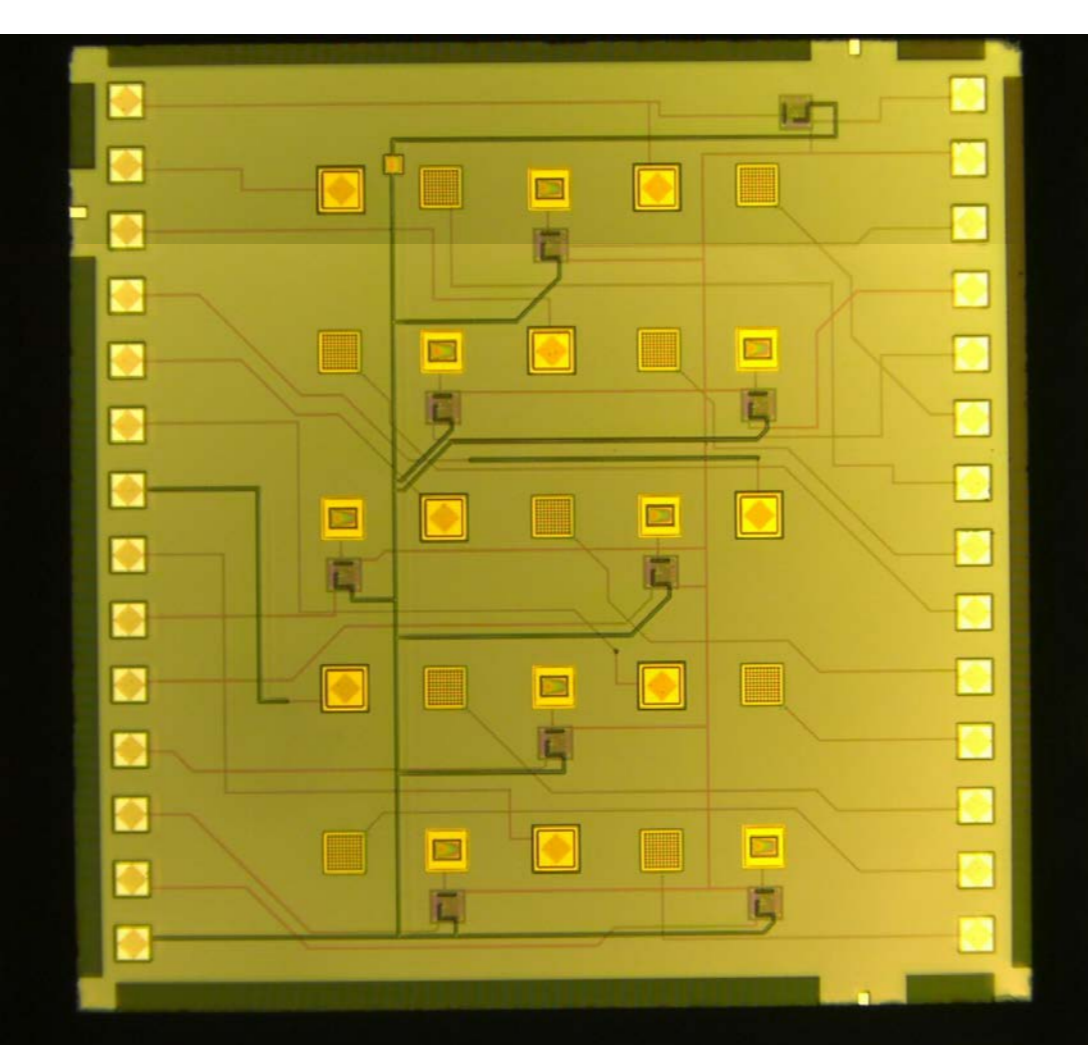Source: 1V, 100kHz
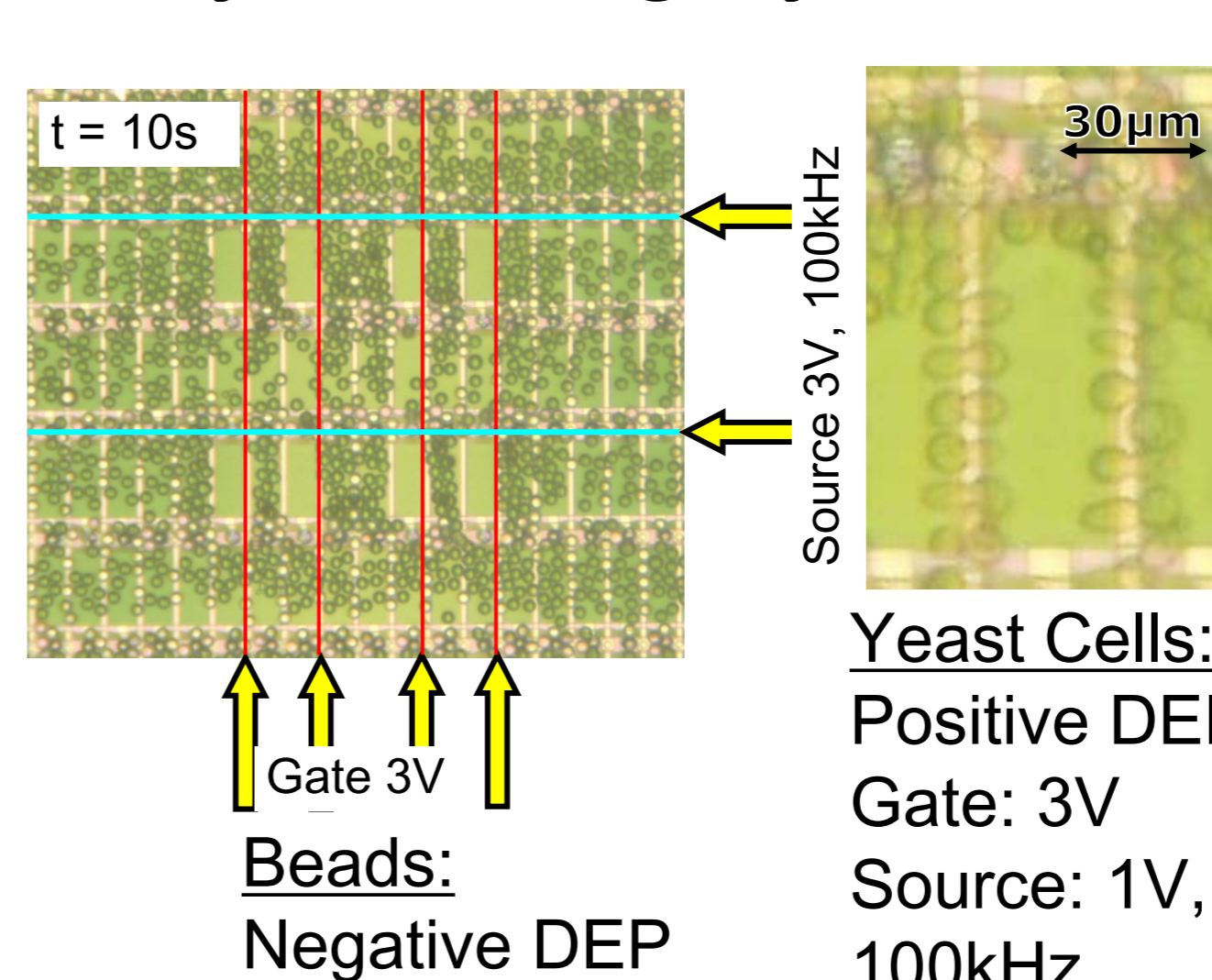
Beads:
Negative DEP

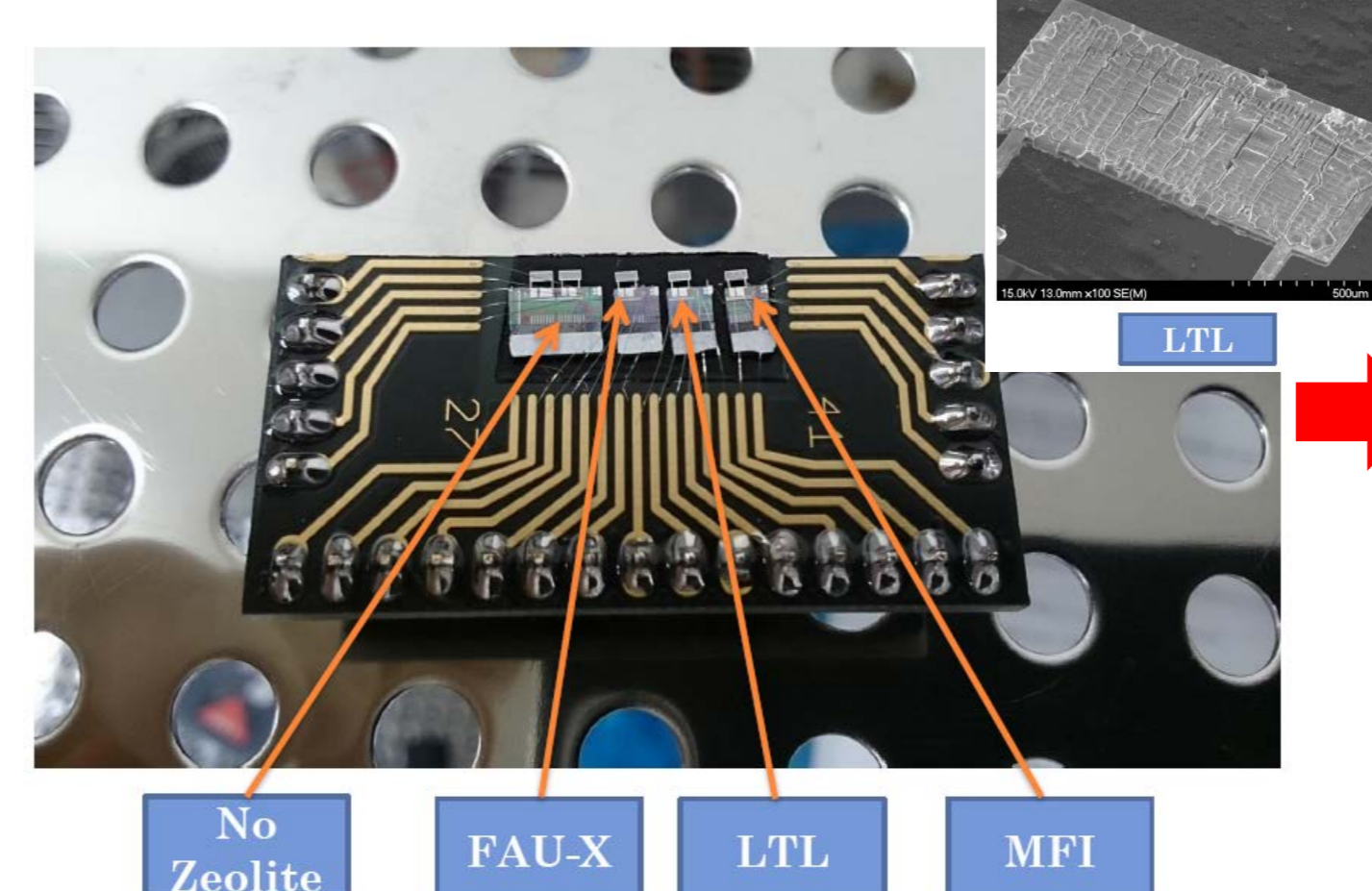Micro-beads and yeast cells manipulation on the TFT substrate, by dielectrophoresis.

Impedance spectroscopy with TFT substrates, to monitor cells culture, death, size…
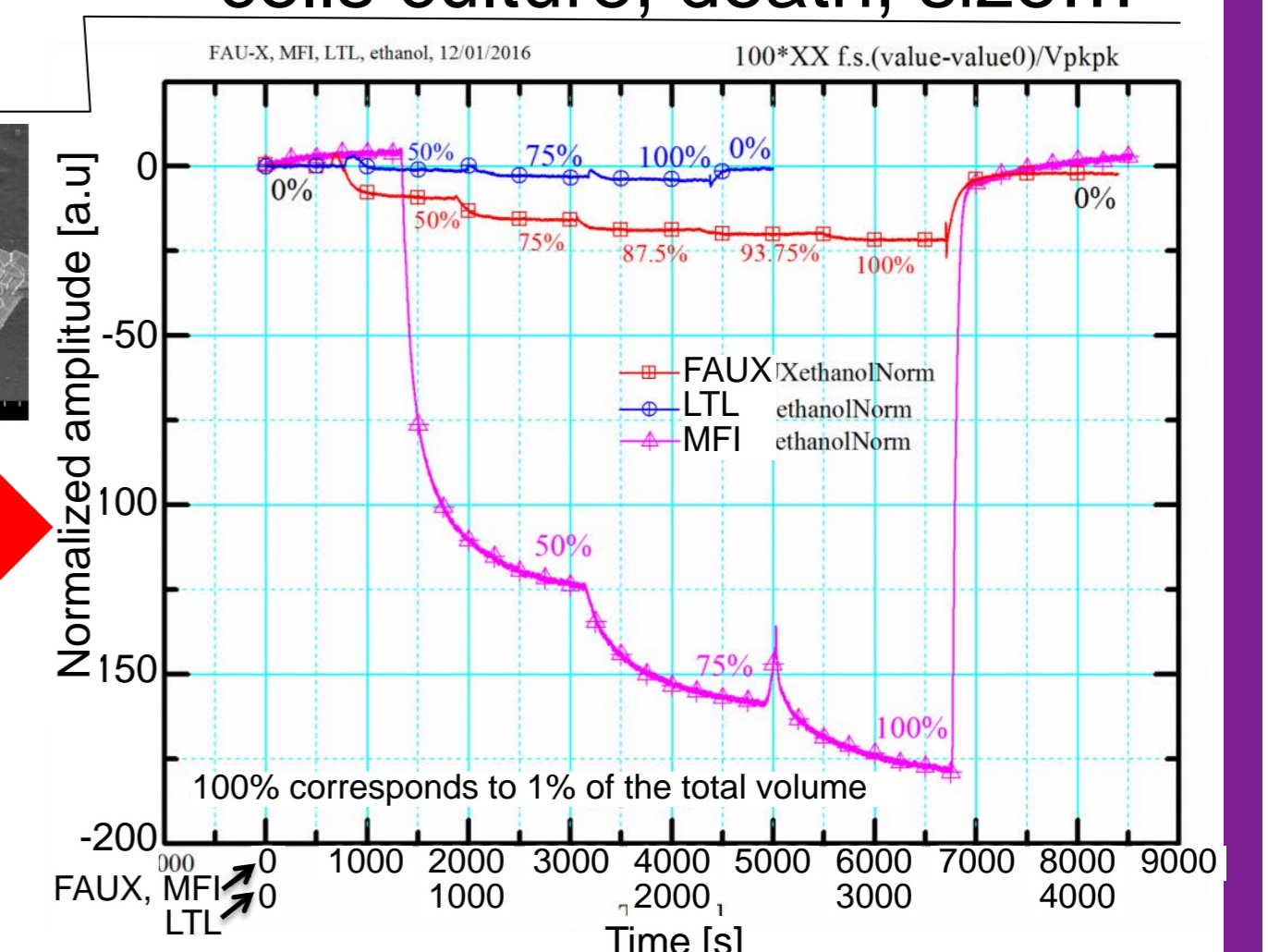

LSI device for cells manipulation and sensing.

Neurons on LSI chip as an interface with an artificial neuron system.

Electronic-nose prototype: array of 4 sensors, with different zeolites. No-zeolite: reference. FAUX-X: hydrophilic zeolite. LTL: hydrophobic zeolite. MFI: ethanol sensitive zeolite.

Results of ethanol sensing: only the MFI zeolite sensor gives a strong response for 0.5%, 0.75% and 1% ethanol concentration. The objective is to reach the ppm to ppb level of detection.