

MAY 06, 2020
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BIOSENSORS
FOR PANDEMICS



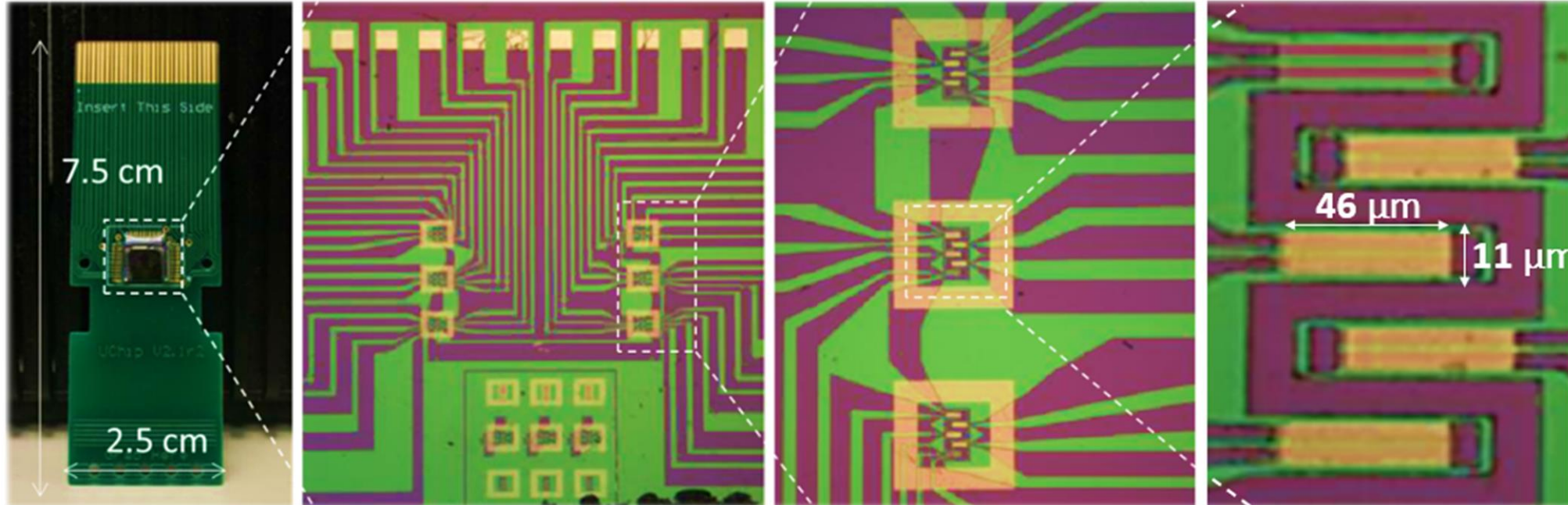
MULTIANALYTICAL POINT-OF-CARE DEVICE FOR THE DIAGNOSIS OF VIRAL INFECTIONS

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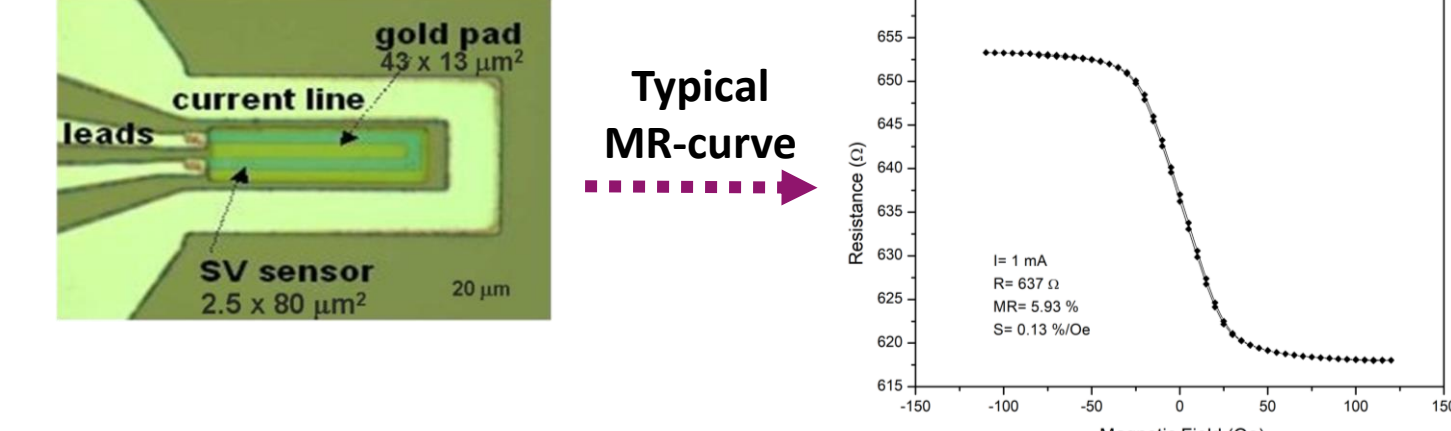
1 Magneto-resistive Biosensing Platform

Magneto-resistive Biochips

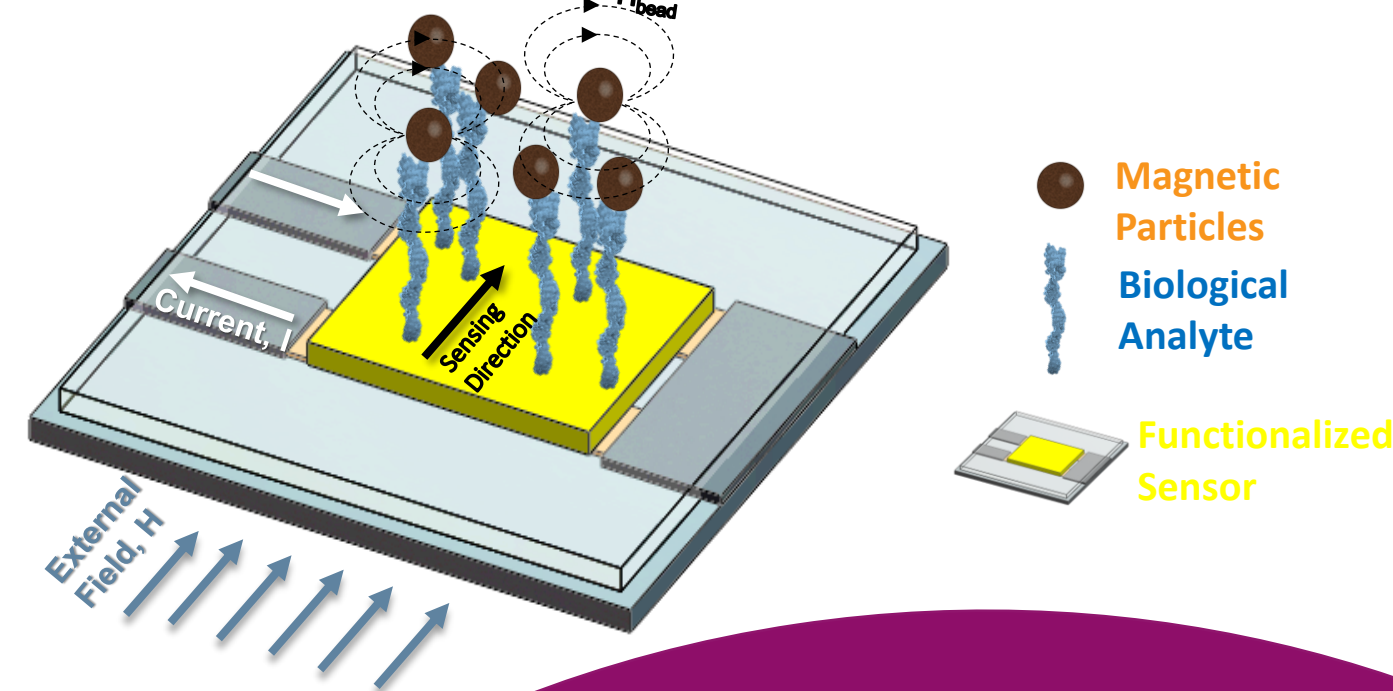


- Highly sensitive (fM for nucleic acids and ng/mL for proteins).
- High density (up to 30 sensors in the same chip).
- Arranged in 6 distinct sensing regions.
- 5 Biological Active Sensors covered with gold layer (Cr 5 nm/Au 40 nm)
- Disposable Biochips

Spin-valve sensors

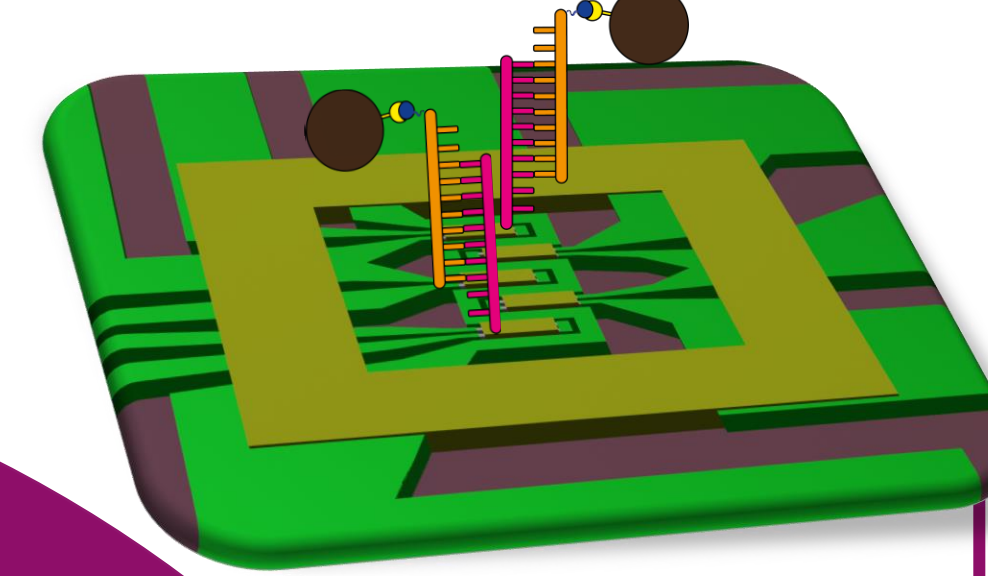


Working Principle



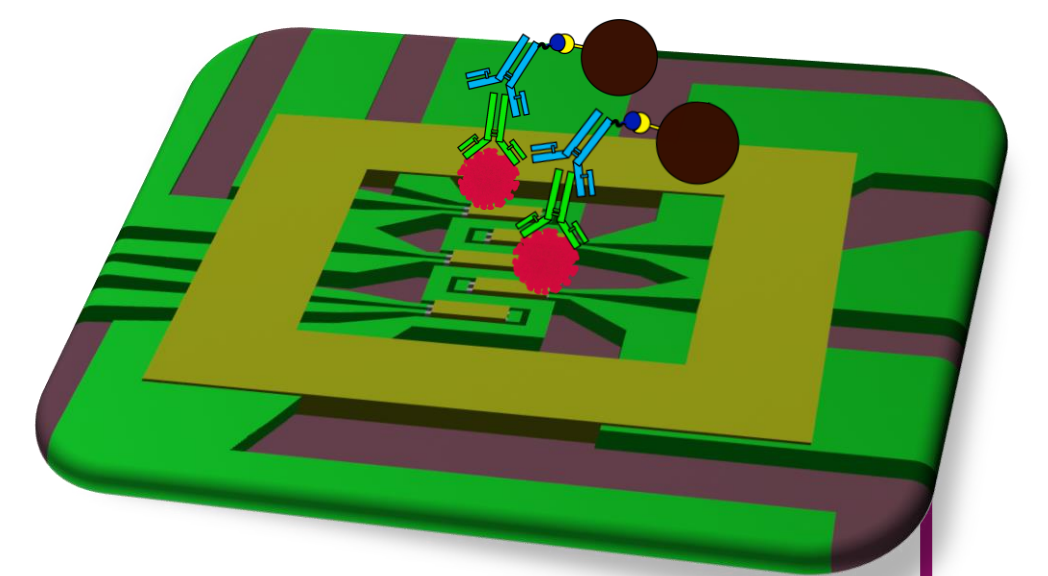
2 Two Parallel Detection Assays

DNA hybridization



- Streptavidin coated Magnetic Particles
- Biotinylated Target DNA
- DNA Probe
- Sensor (UVO Cleaned)

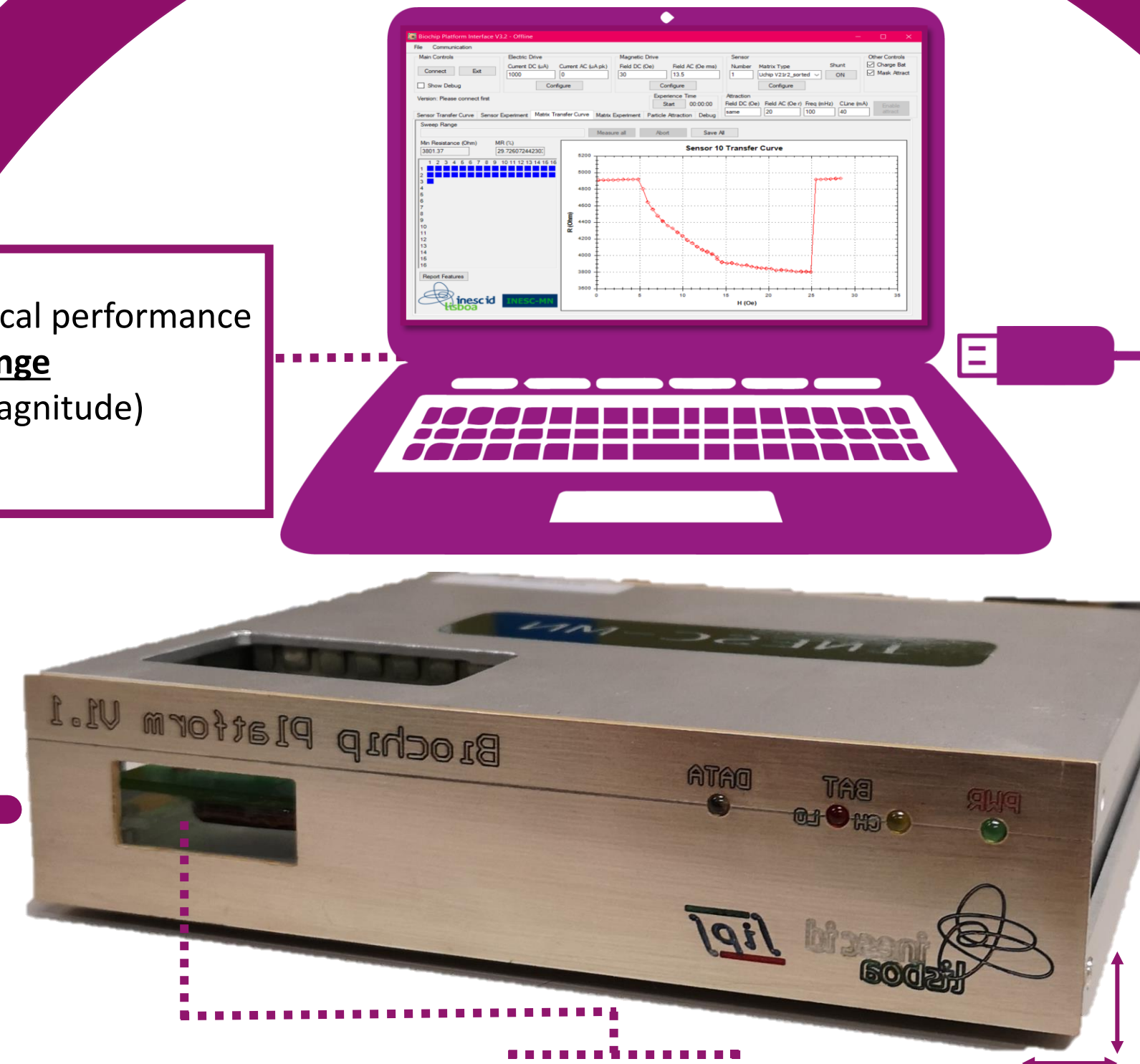
Immunoassays



- Streptavidin coated Magnetic Particles
- Biotinylated Detection Antibody
- Human anti-antigen antibody
- Antigen
- Sensor (UVO Cleaned)

PORTABLE PLATFORM

- Quantitative analytical performance
- Tailored dynamic range (up to 4 orders of magnitude)
- Assay time: 1 h

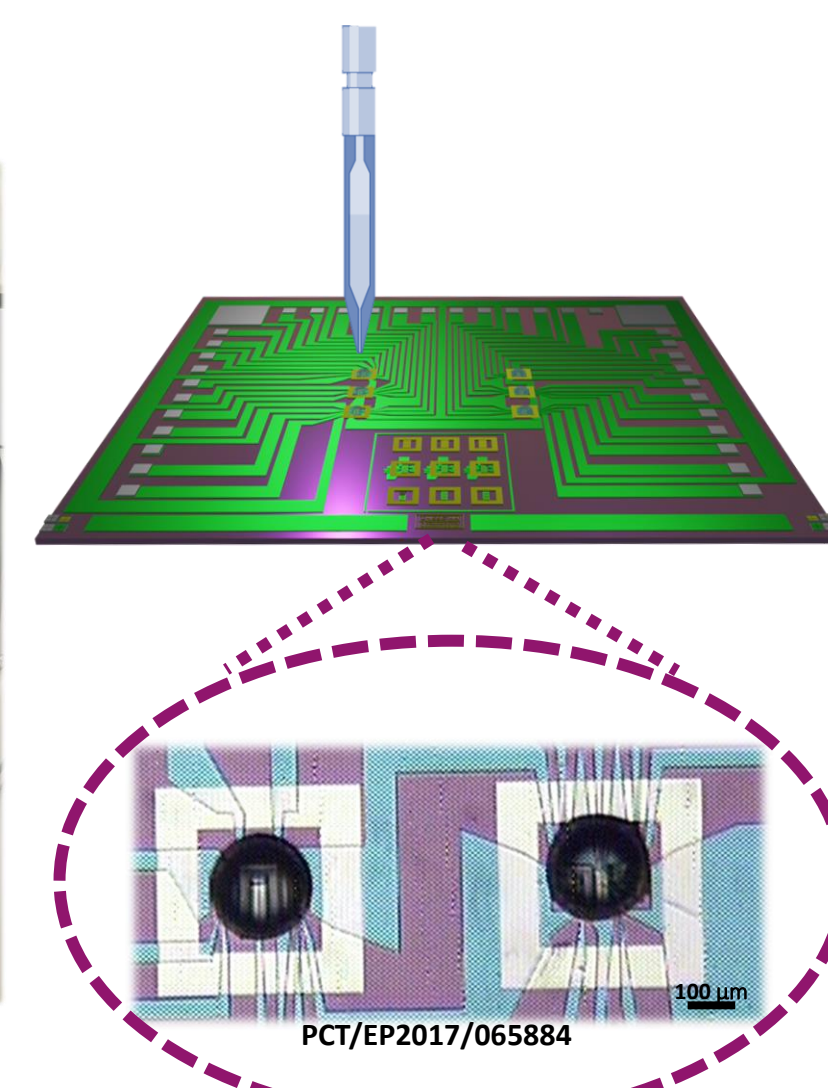


Size: 15x15x3.5 cm

Serological Assay

Viral RNA Assay

3 Micro-spotting



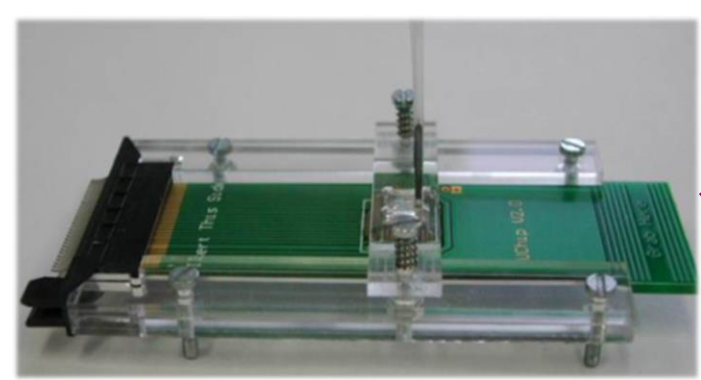
Nano-Plotter™

PCT/EP2017/065884

5 Microfluidic System

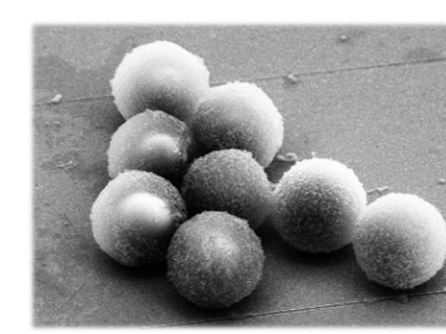
Microfluidics and Microelectronics Compatibility

Possible integration with sample preparation units and CMOS technology for high throughput analysis



PDMS U-channel
Channel Width: 800 μm
Channel Height: 300 μm

4 Magnetic Labels



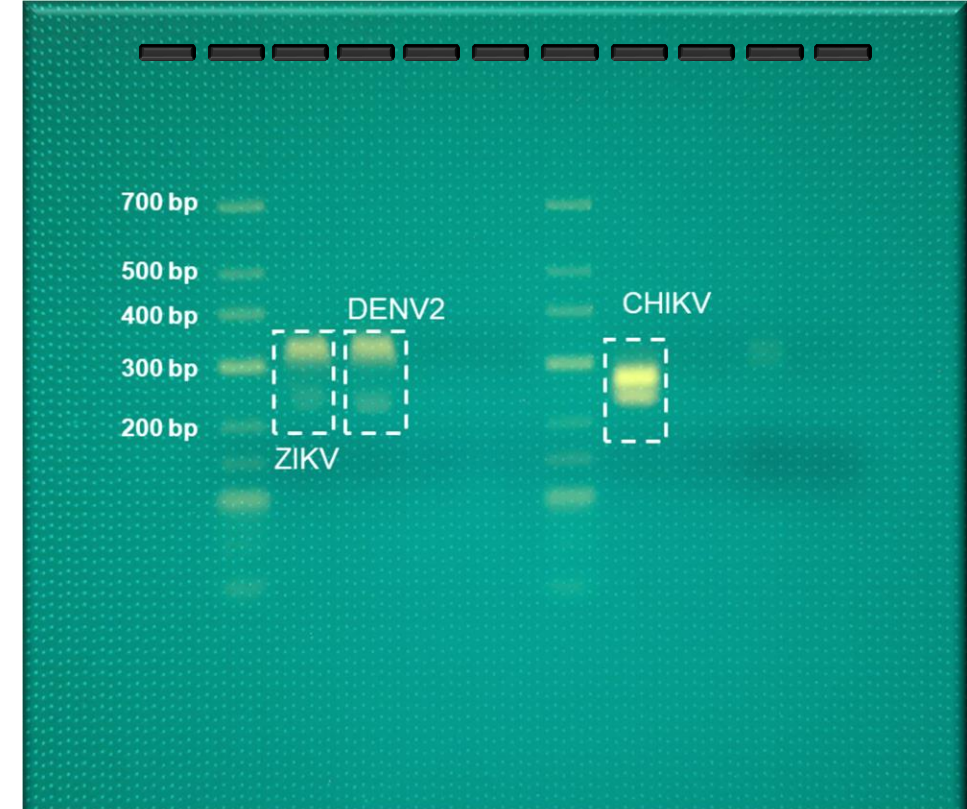
- Size: 250 nm
- Composition: 75-80% magnetite; dextran coated
- Modification: streptavidin
- Protein binding capacity: 450-500 streptavidin molecules per particle.
- Magnetic moment: $1.6 \times 10^{-16} \text{ A}\cdot\text{m}^2$ for H of 1.2 kA/m
- Susceptibility: $\chi \sim 5$

- Micro-spotting of specific probes (e.g. DNA oligos, antibodies, antigens)
- Multiplexing: up to 6 different probes can be immobilized
- Spot droplets with diameter of ~200 μm

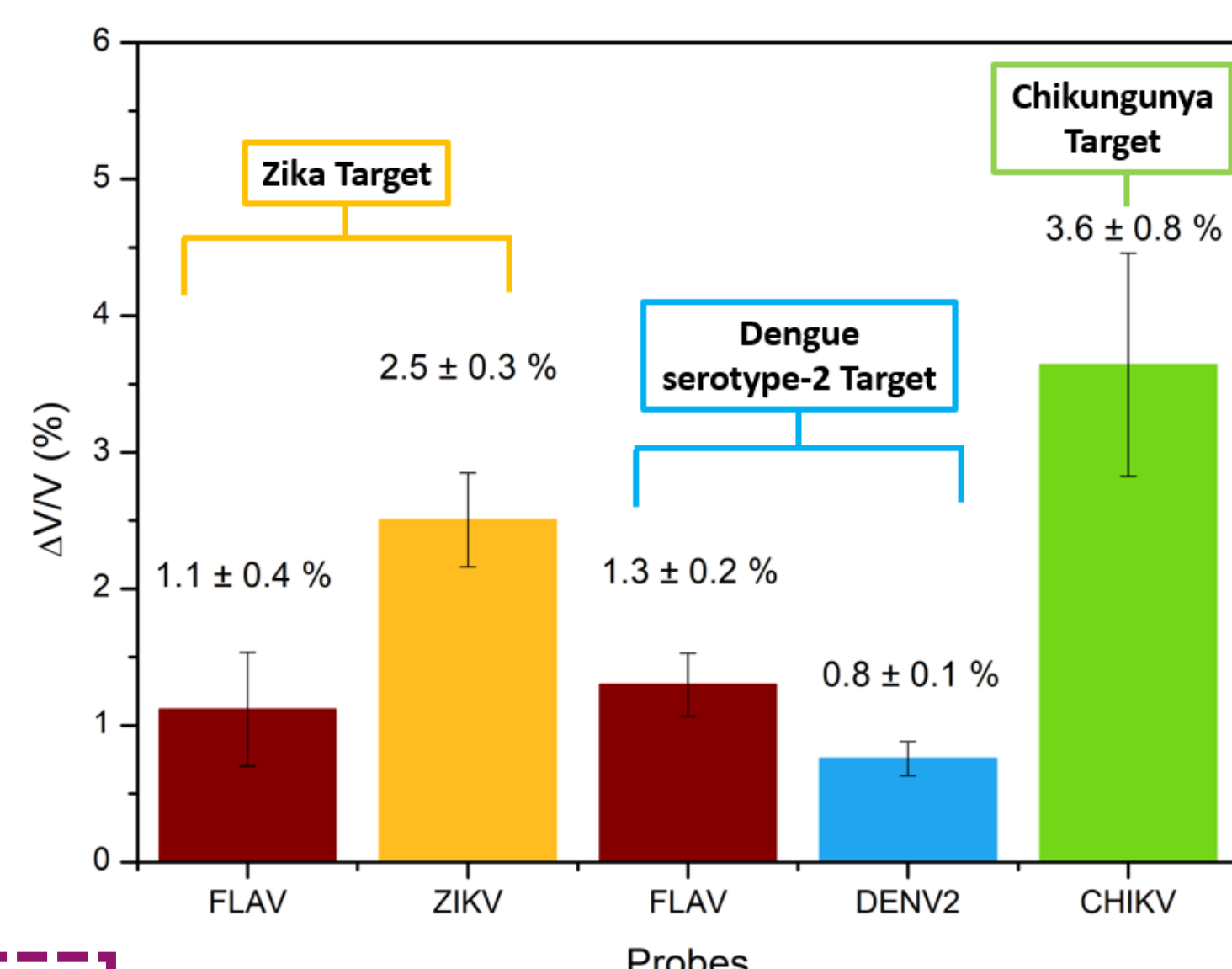
Proof of Concept: Magneto-resistive Detection of 1 Viral genome & 2 Antigens

1 Zika (ZIKV), dengue (DENV) and chikungunya (CHIKV) RNA detection (after RT-PCR amplification)

Agarose Gel Electrophoresis



Specific probes for species and genus (Zika virus (ZIKV), Dengue virus (DENV), Chikungunya virus (CHIKV), and Flavivirus genus (FLAV)).

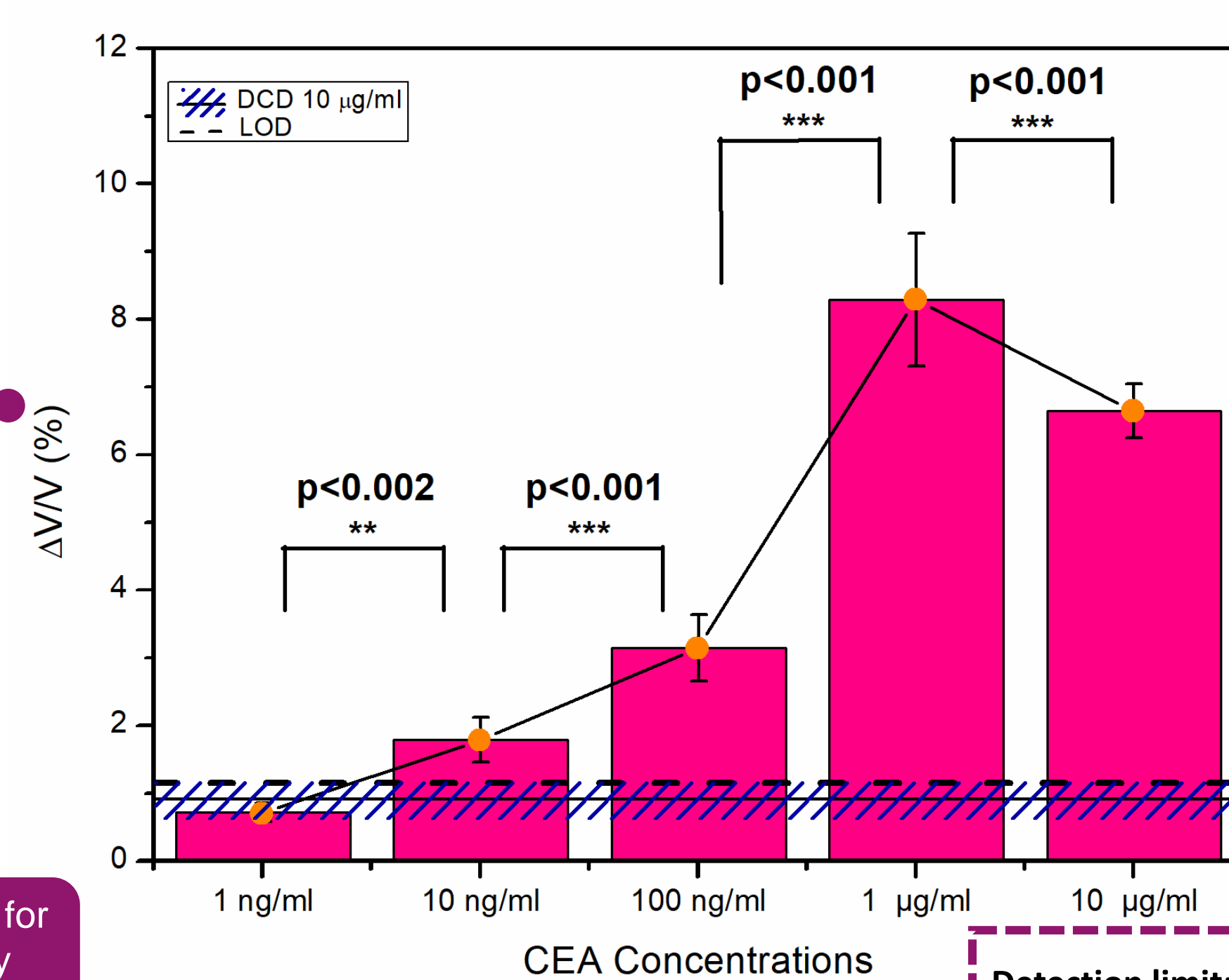


The platform has also been validated for detection of bacteria, microvesicles, other nucleic acids and serum protein biomarkers in ischemic stroke patients. Levels of sensitivity in the order of 10^{-15} mol/L and ng/mL for nucleic acid hybridization and immunoassays, respectively, are reported.

- Low cost (< 10€/test)
- Multiplex (6 probes/test)
- Fast time to results (< 1 h)
- Portable and user-friendly
- Quantitative Assay (ng/ml;fM)

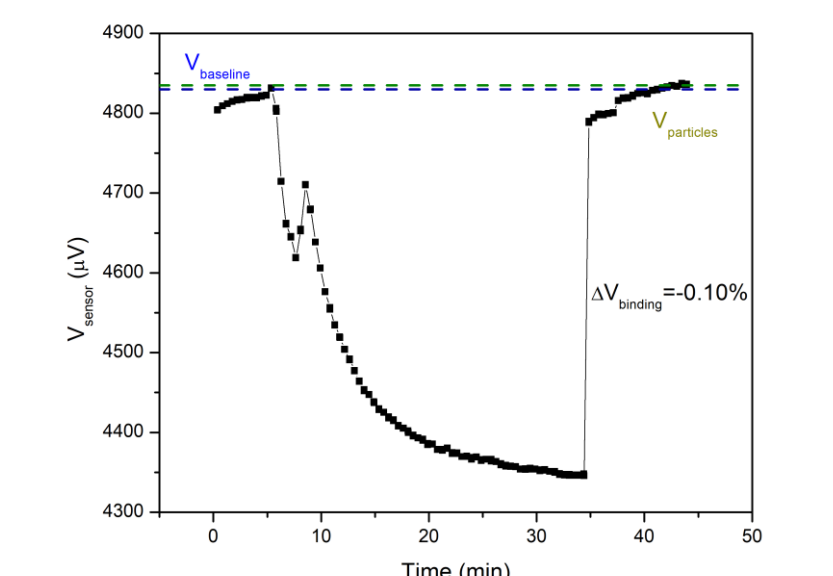
This technology shows great potential for the double diagnostic of Covid-19 by molecular and serological assays.

2 Carcinoembryonic antigen detection by immunoassay

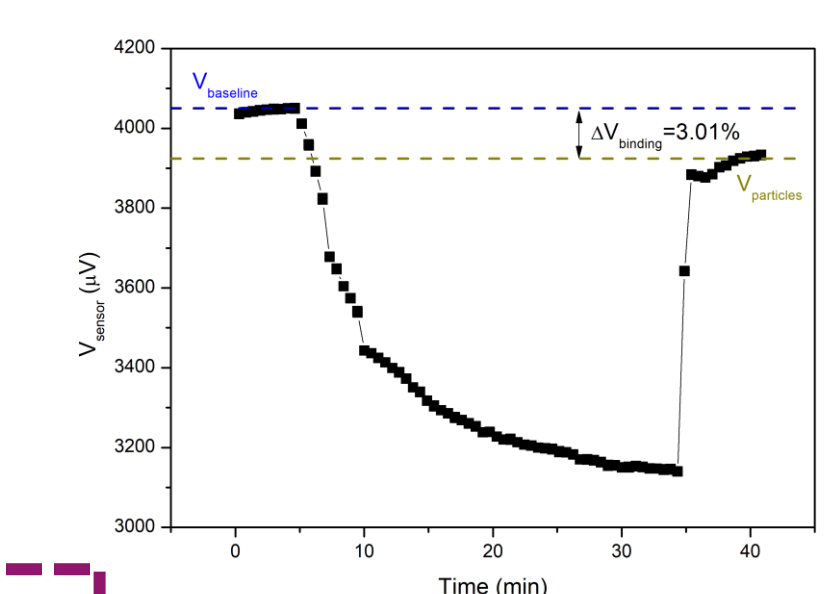


Detection limit: 5 ng/ml

Negative Control (Goat E.coli as Detection Antibody)



CEA 10 ng/ml



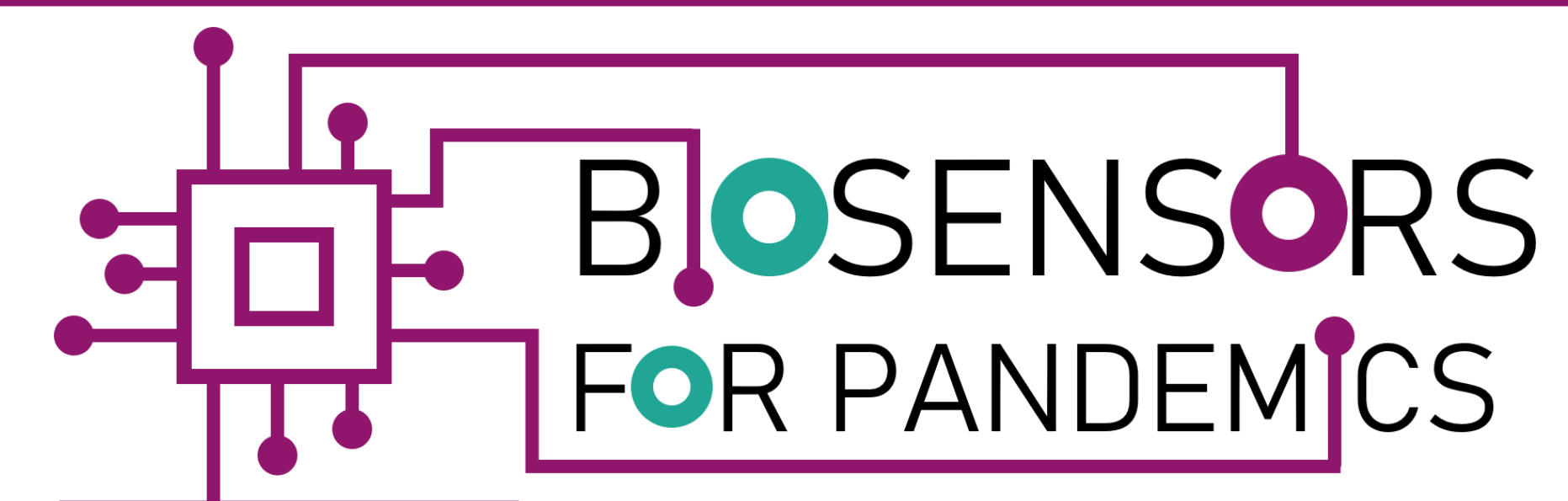
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