Towards Wearable Sensors for Wireless pH Monitoring in Sweat

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Electrochimica Acta

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In Press, Corrected Proof — Note to users

Disposable solid-contact ion-selective electrodes for environmental monitoring of lead with ppb limit-of-detection

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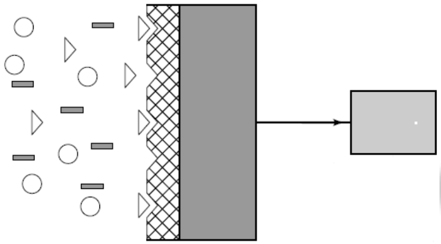
Sensors for the Digital World

Analyte

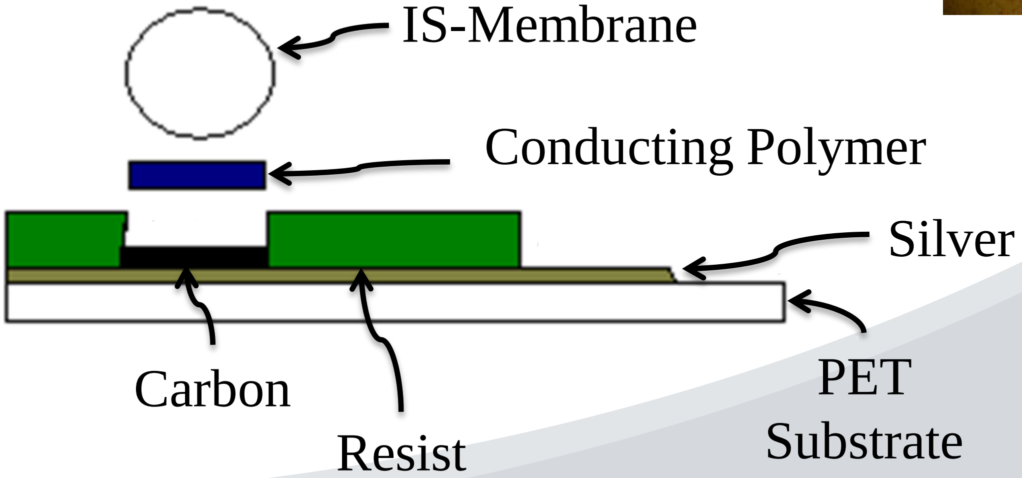


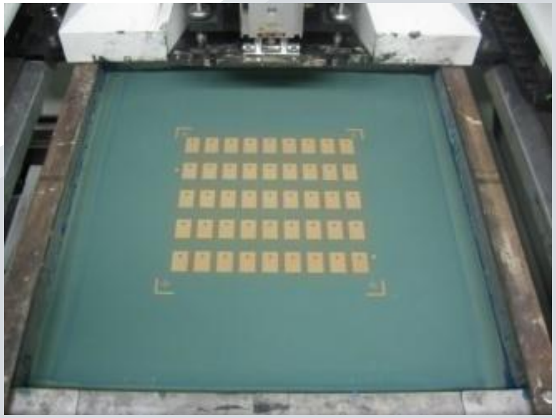
Chemo/Bio Sensing

Wireless data transmission

Sensors for the Digital World

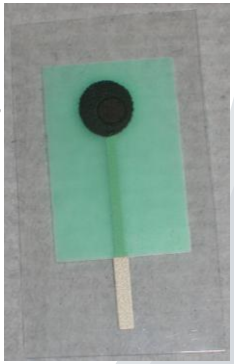
- ✓ Cost
- ✓ Reproducibility
- ✓ Compatible with Wearable & Environmental Applications



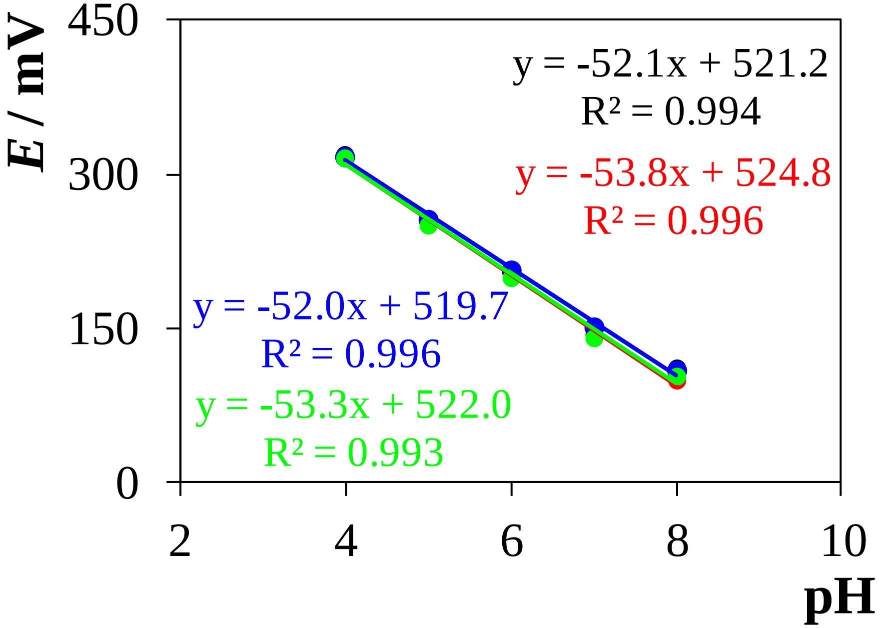


pH ISE – An Initial Design

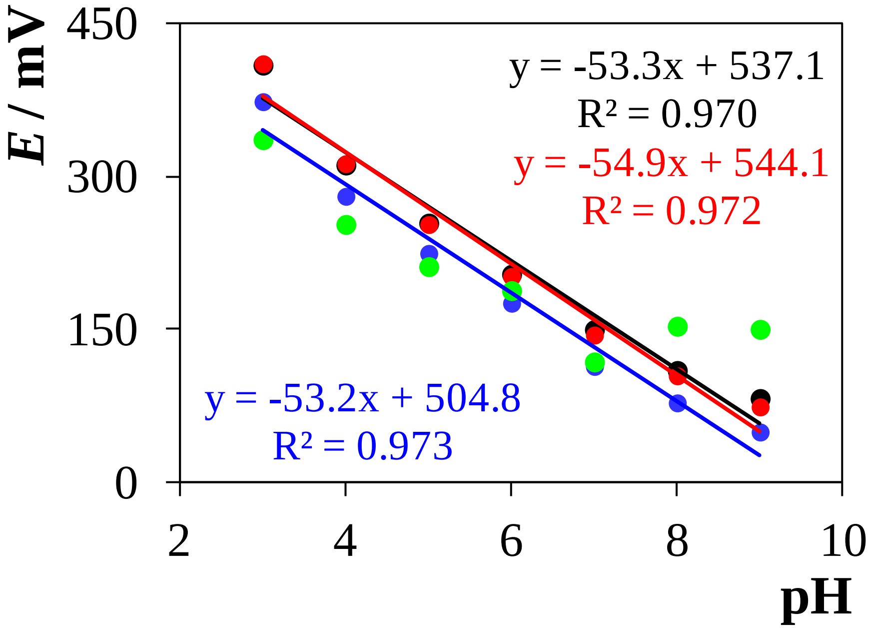
Sensors and Actuators B, **2010**, *146* , 19



1st calibration after overnight conditioning



2nd calibration after 3days in the conditioning solution



Loss of linearity & offset change over time.

May we improve this limit working on SPE fabrication ?

“Initial” *vs* “New” SPE

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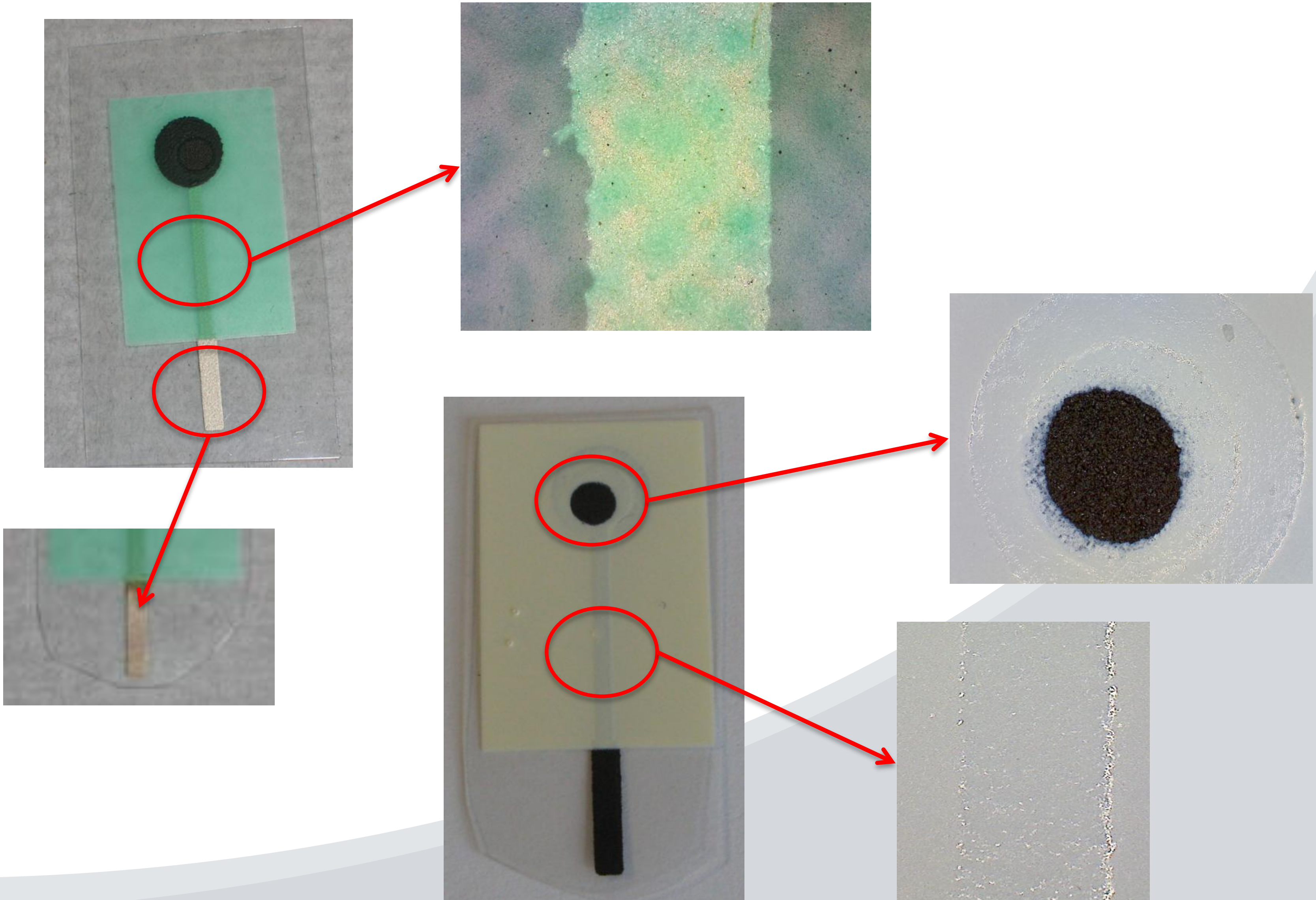
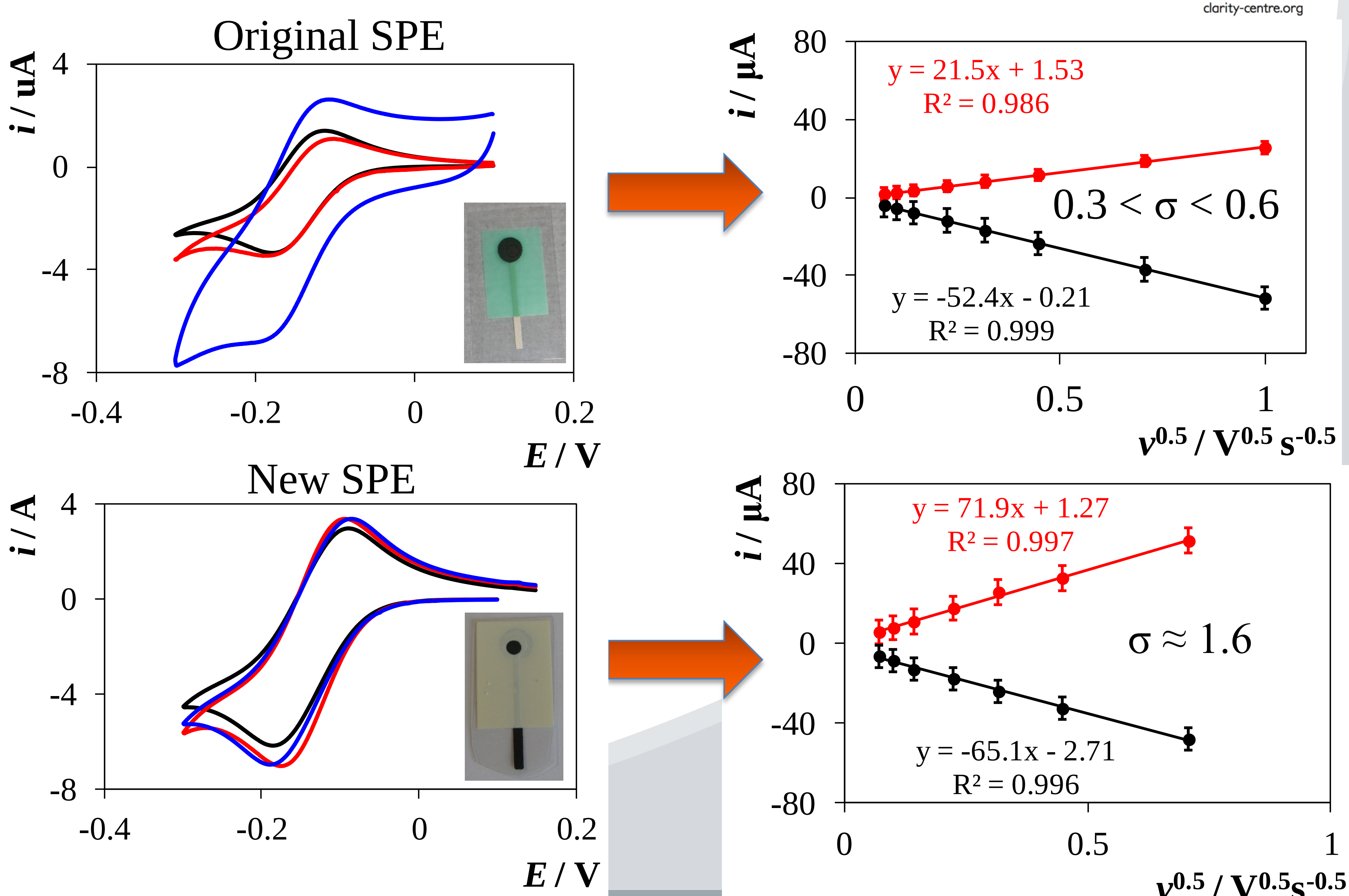


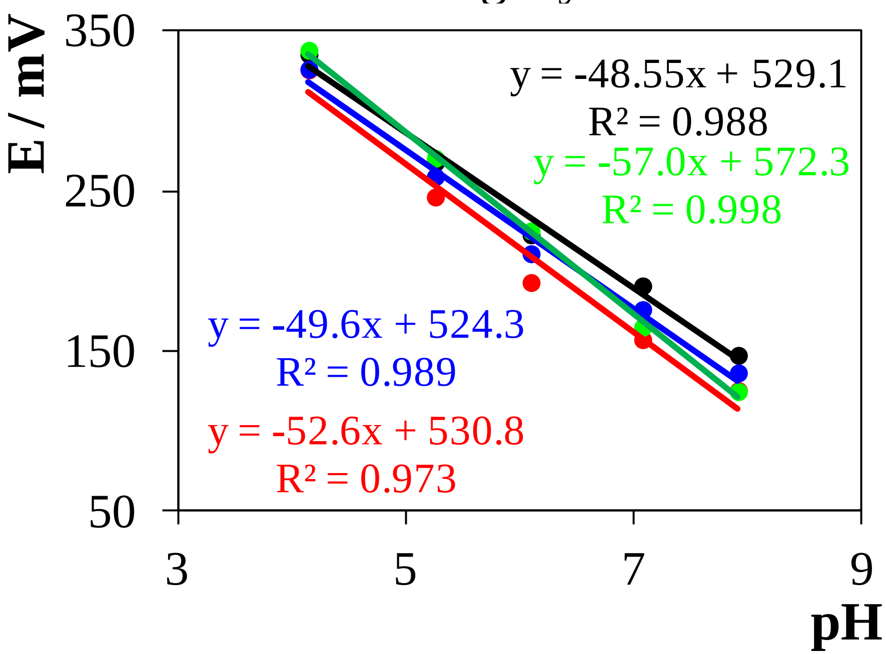
"Original" *vs* "New" SPE



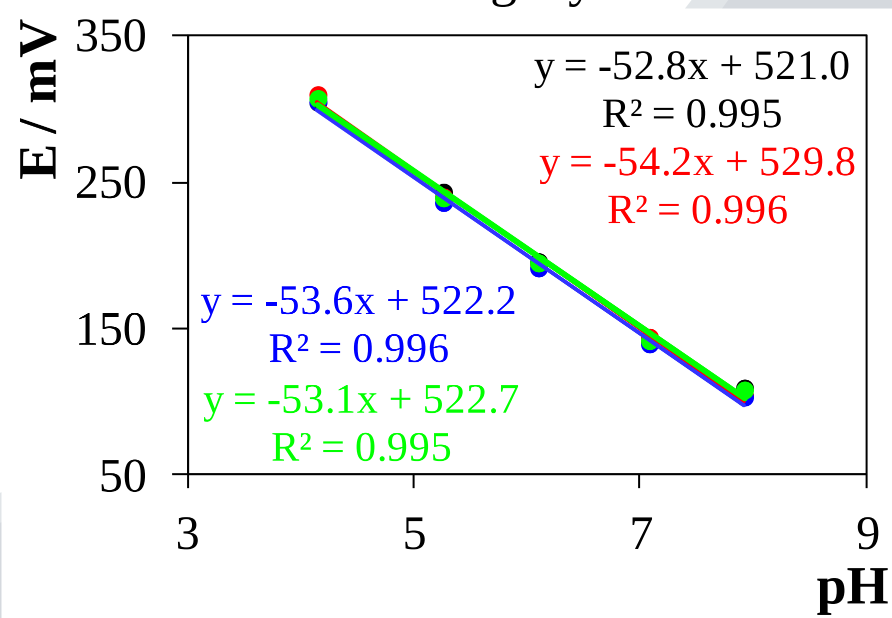
pH ISEs – Silverless-SPE and Membrane Thickness

Carbon prints were masked used PSA and PMMA. PET substrate were laminated with PSA and PMMA after that tracks carbon was screen printed: Integration of ISE within microfluidic system

175 µm PMMA + 50 µm PSA as masking layer



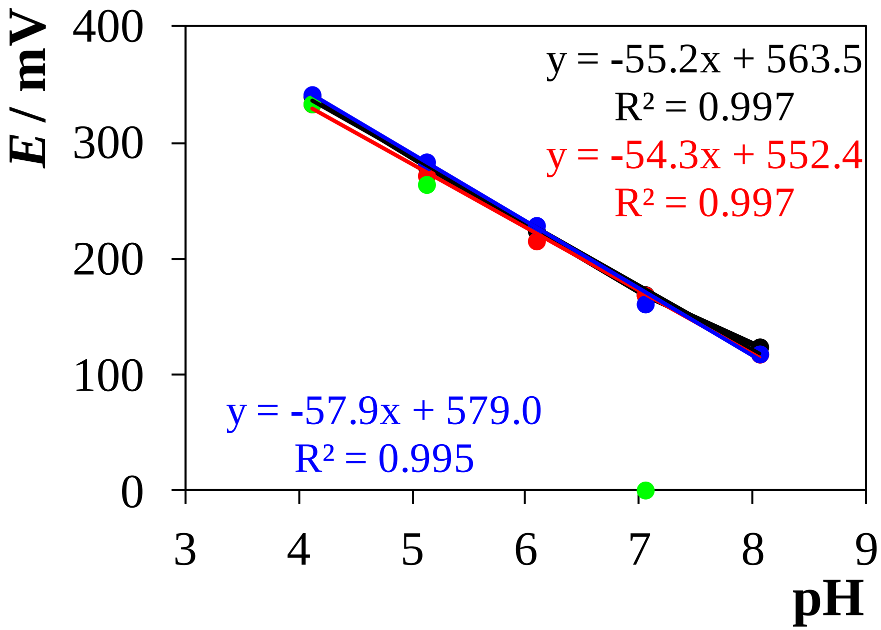
500 µm PMMA + 50 µm PSA as masking layer

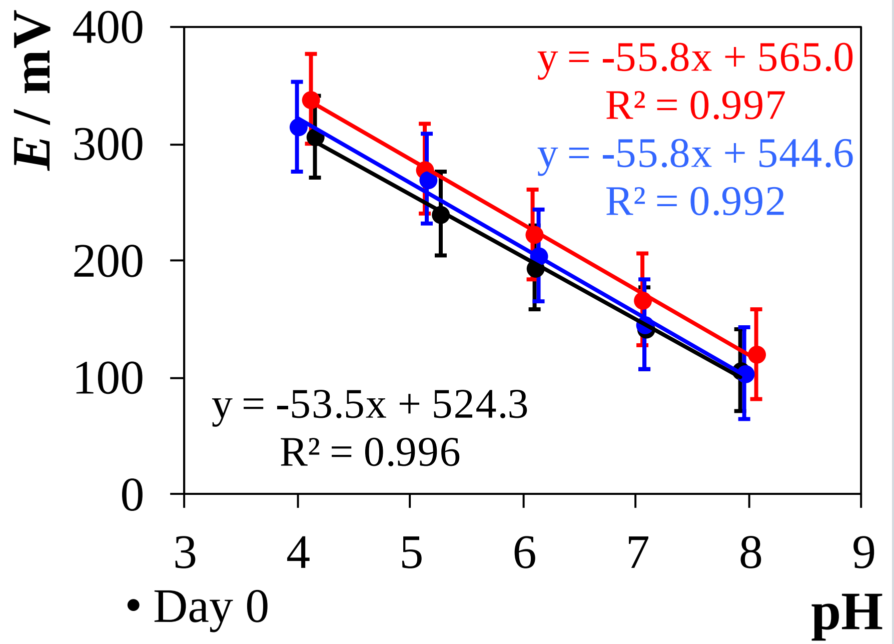


550 µm well allows a better reproducibility !

pH ISEs – Performance over Time & Storage

Calibration repeated after 5 days storage in conditioning solution



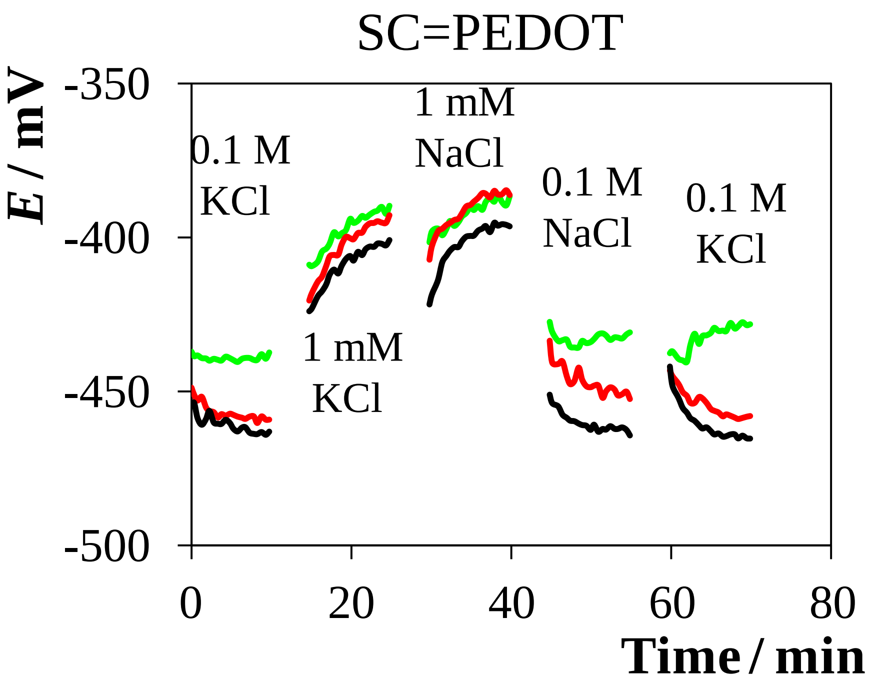


- Day 0
- Day 5 (kept in conditioning solution)
- Day 19 (kept in dry conditions)

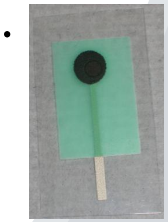
Printing protocols, *e.g.*, presence of Ag,, have a significant impact in sensor reproducibility over time !

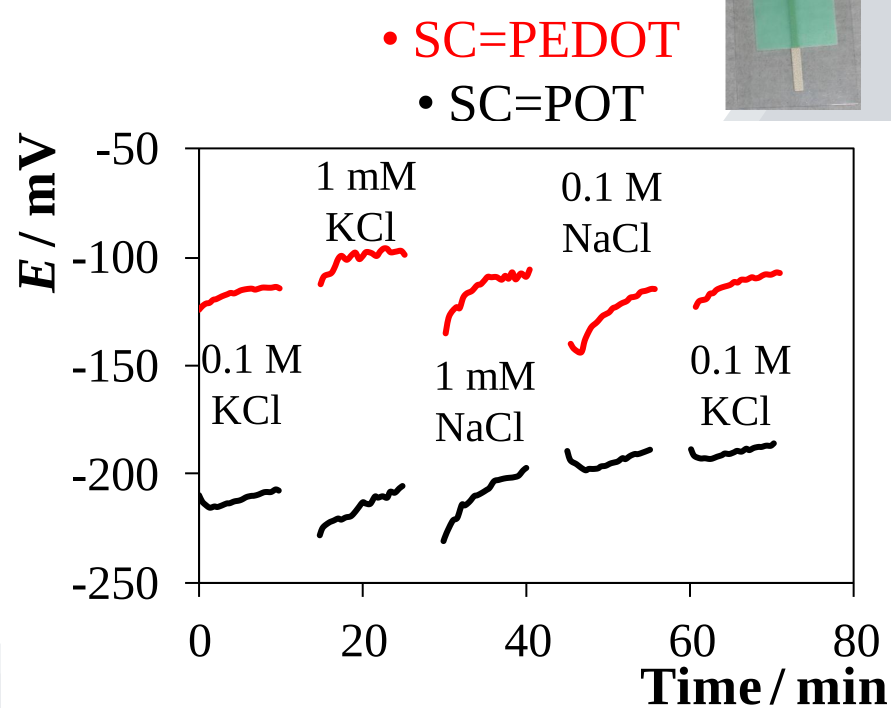
Dry storage may preserve sensor functionality !

Reference Electrodes based on Lipophilic Salts on SPE



U. Mattinen, J. Bobacka, A. Lewenstam, *Electroanalysis* **2009**, *21*, 1955.



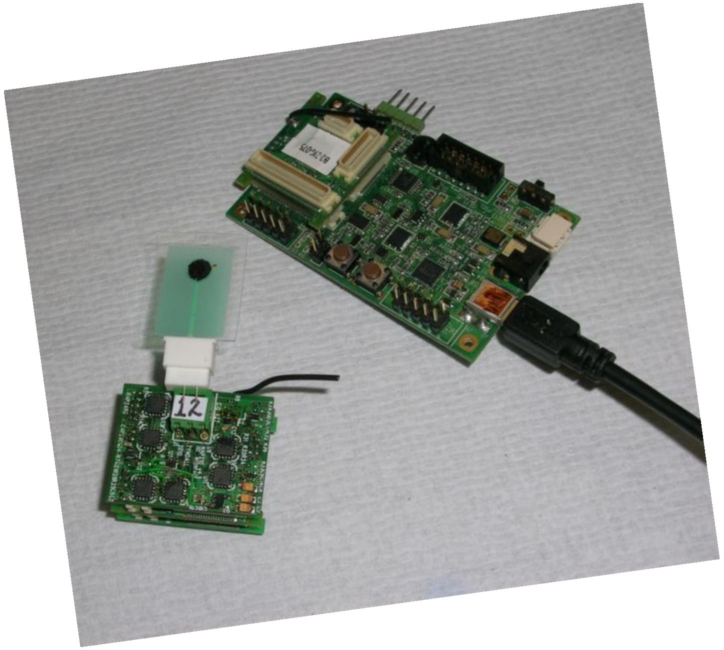


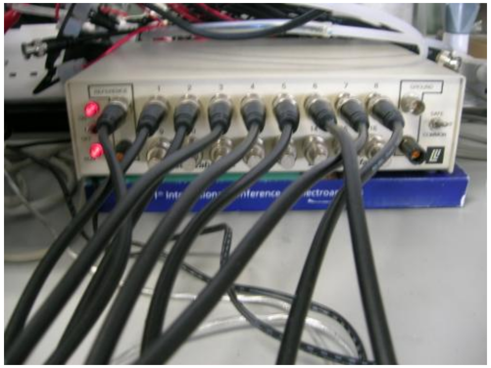
Cl^- ≈ 20 mV/decade

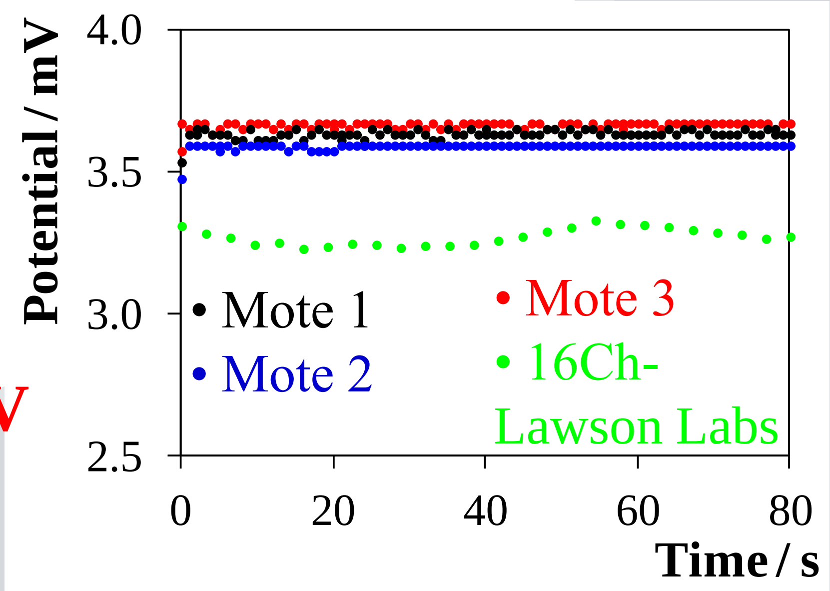
Need optimisation

Possibility for RE where [Cl^-] is constant

Mote Interface and Wireless Communication







- ➢ **Bias between motes and standard instrumentation < 0.3mV**
- ➢ **Bias between motes < 0.1 mV**

Dual SPE – Integration of pH & RE on same substrate

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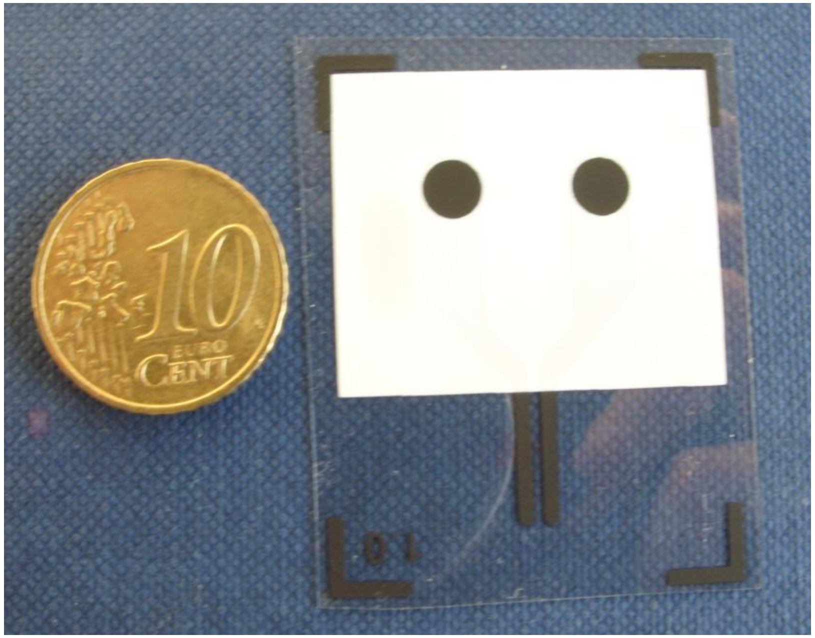

- The two carbon disks printed on the PET substrate will be modified to give a pH and a reference electrode
- The substrate can also be laminated with PSA and PMMA for futher integration within microfluidics.

Work currently under progress to optimize sensor response !!

Wearable pH Sensor – Concept

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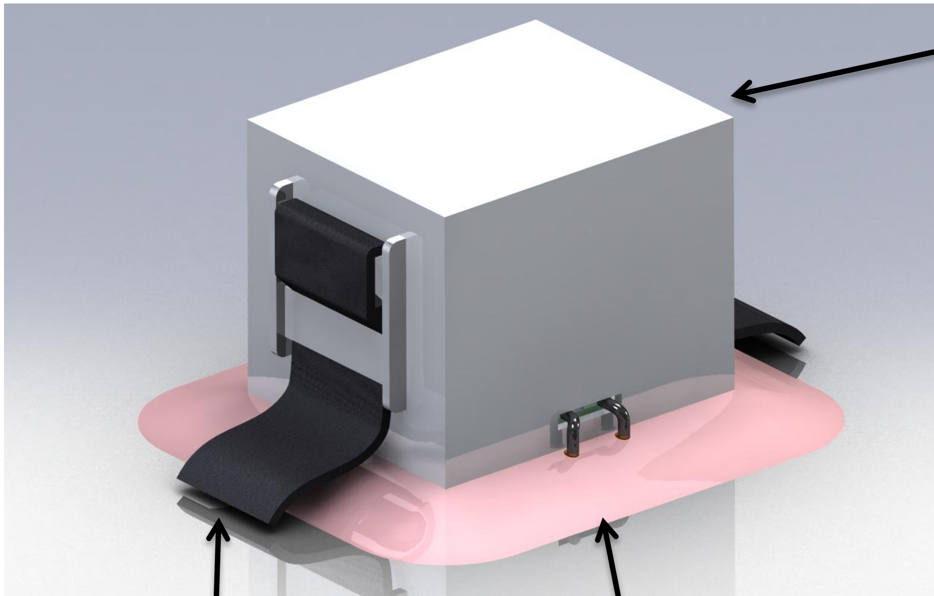
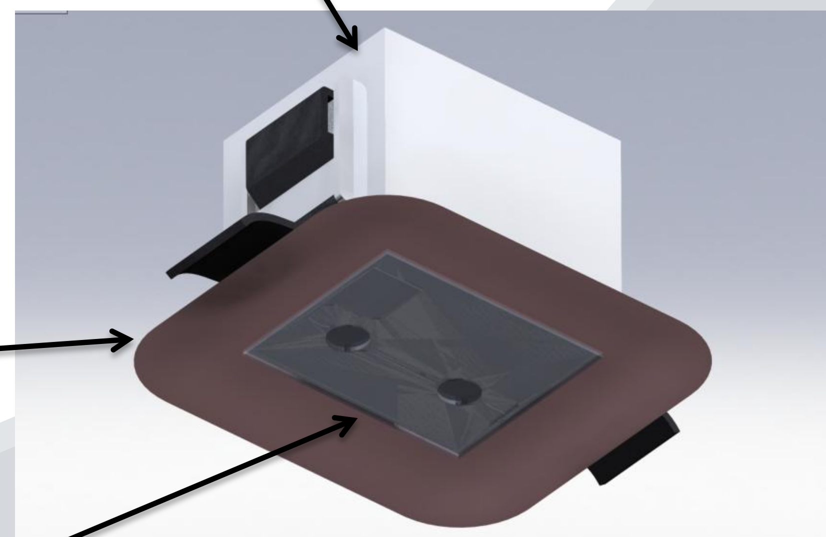


Mote Casing

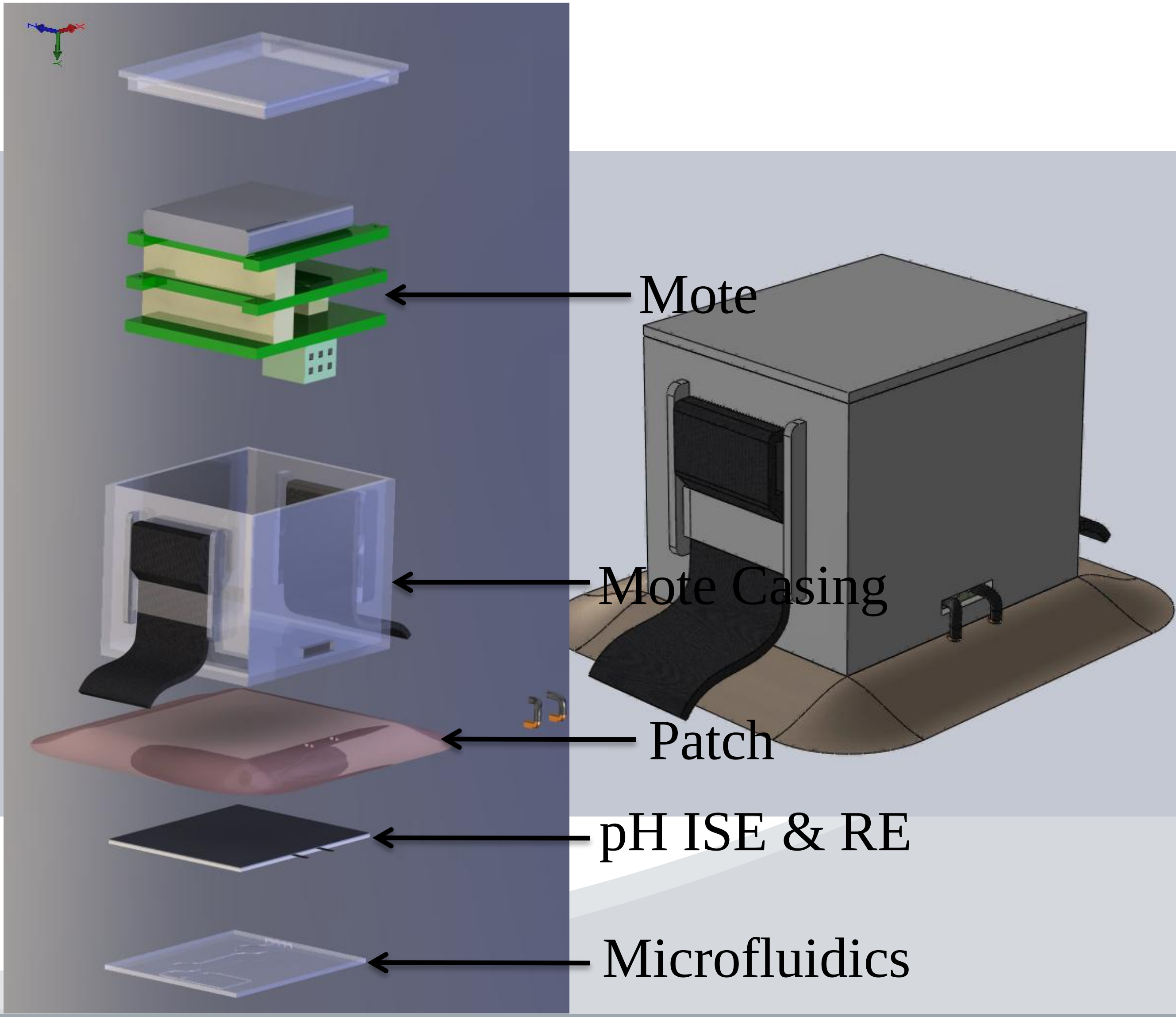


Strap

Patch

Sensor +
Microfluidic

Wearable pH Sensor –Layers



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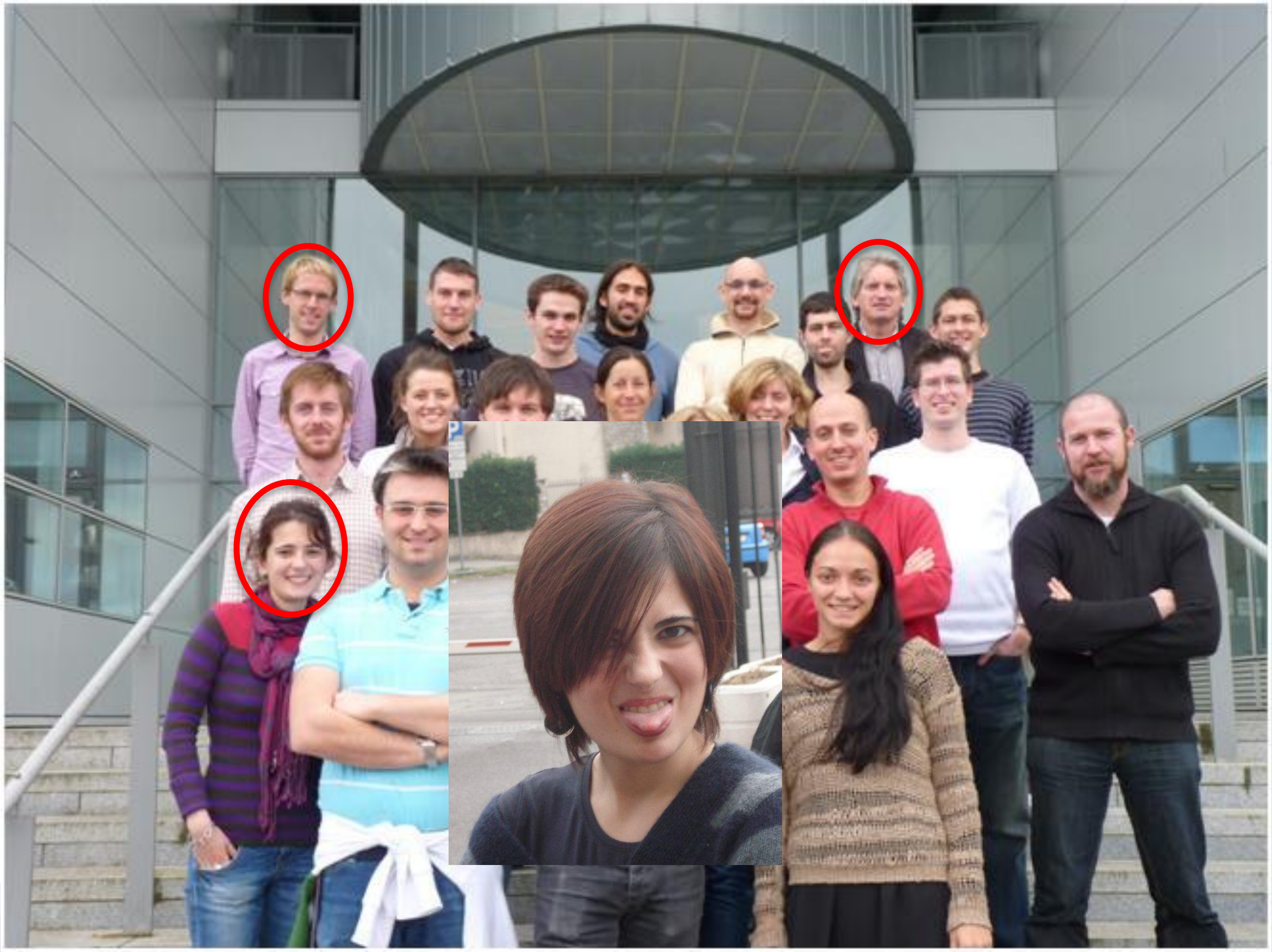

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INDUSTRY COLLABORATORS

SOCIAL/AGENCY COLLABORATORS

CSET CORE

NEUROTESTING

Thank You for Attention

pH ISEs – Role of SPE Design

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A comparison between 1° calibration for (Ag+C) SPE & C (Batch II) SPE