

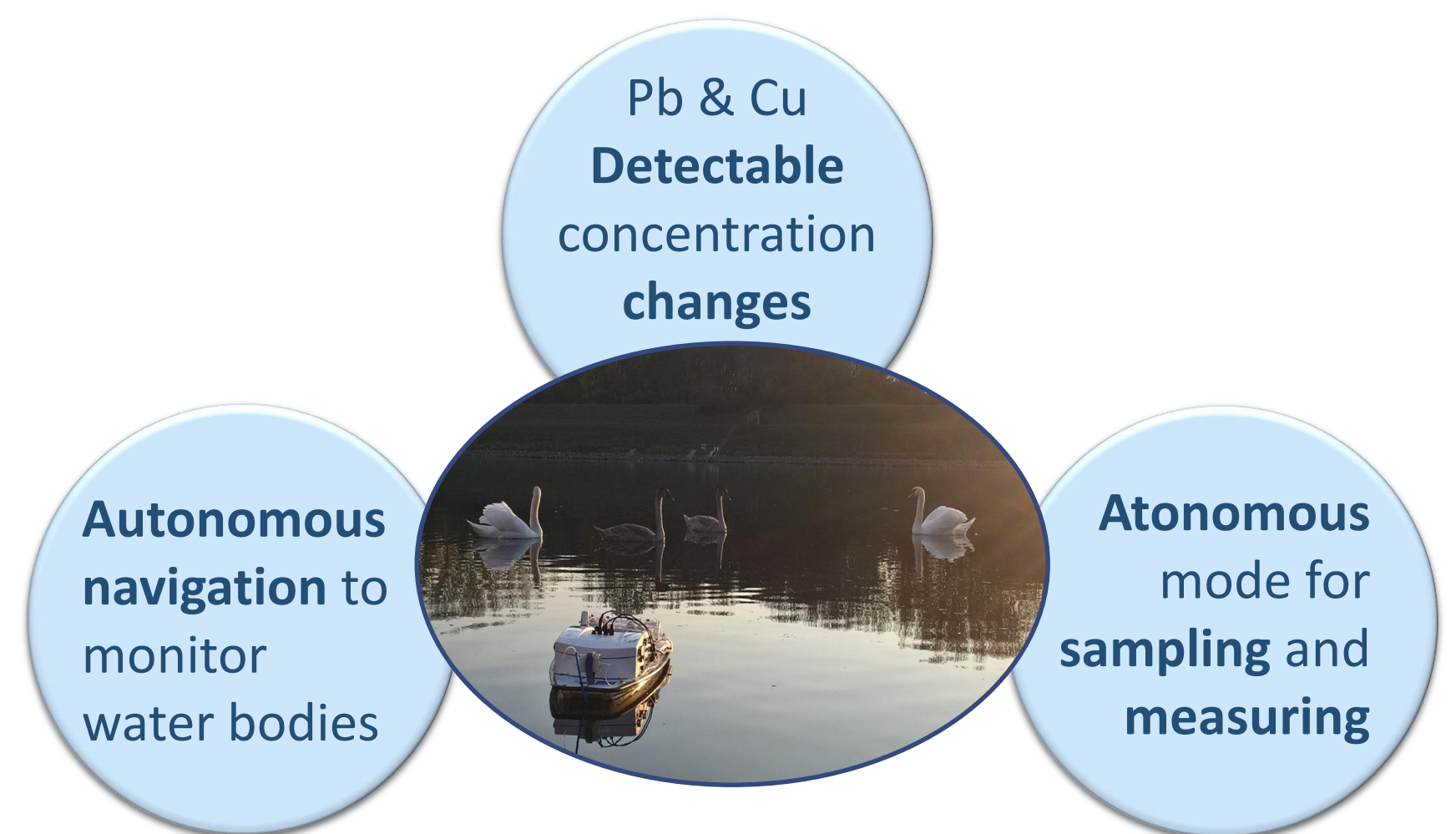
Innovative heavy metal detection sensor implemented on an autonomous surface vehicle

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INTRODUCTION

- Point or diffuse pollution from industries, wastewater treatment plants, runoffs, etc.
- Heavy metal pollution in water bodies – neurotoxicity, kidney toxicity, carcinogenity.
- Need of smart monitoring, using innovative technologies

OUTCOMES



METHODS

Integrated system



- Autonomous surface vehicle
- Autonomous sampling device
- Filtering system
- Heavy metal detection device

RESULTS

In-situ navigation & measurement

Autonomous navigation

- Start / stop function
- Vehicle velocity
- Navigation path
- Way points
- Paths shapes
- Homecoming



Autonomous measuring

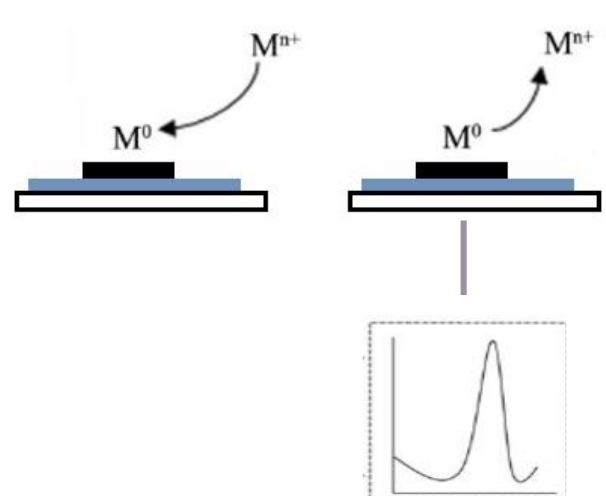
- Start / stop function
- Measurement mode
 - Single
 - Continuous
- Automatically sampling

Heavy metal detection device



Screen printed sensor

- Carbon silver based



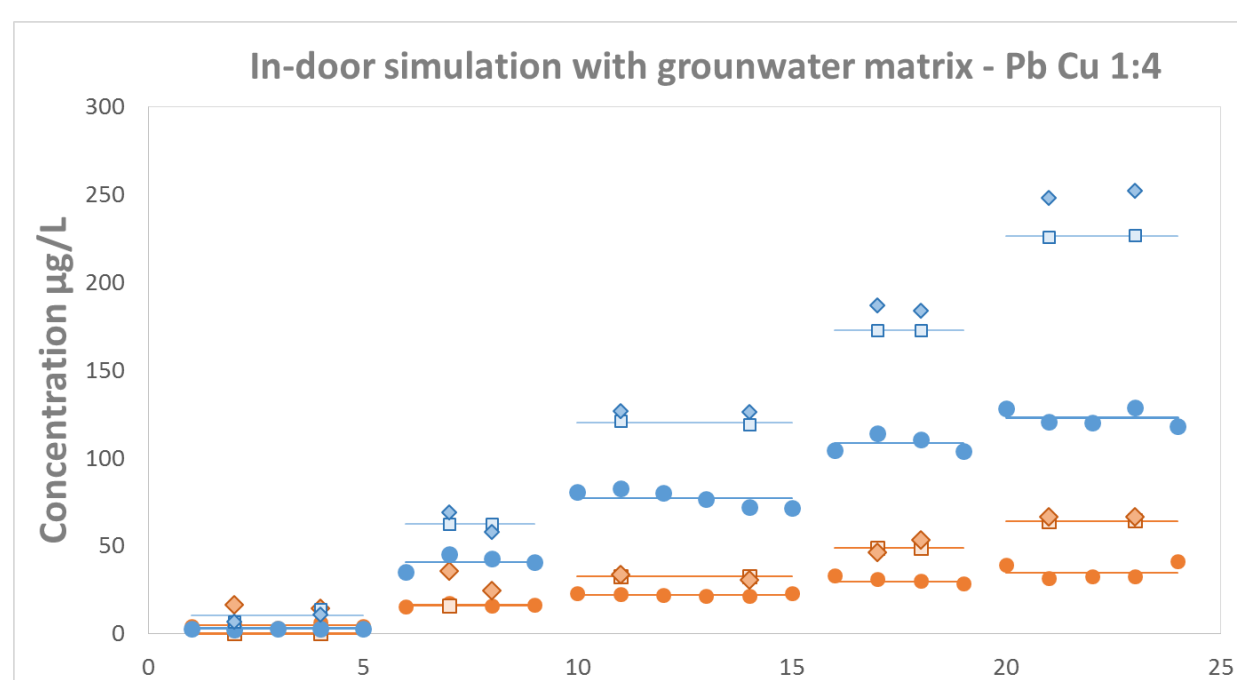
Anodic stripping voltammetry

- Deposition of heavy metal ions
- Stripping of heavy metal ions
- Peak **potential** ⇒ specific for each metal
- Peak **intensity** ⇒ Metal concentration

Characteristics of the integrated system

	Pb	Cu
	MV	MV
Limit of detection (µg/L)	4	7
Limit of quantification (µg/L)	14	22
Lowest detectable change (µg/L)	4-5	6-7
Recovery (%)	75	65

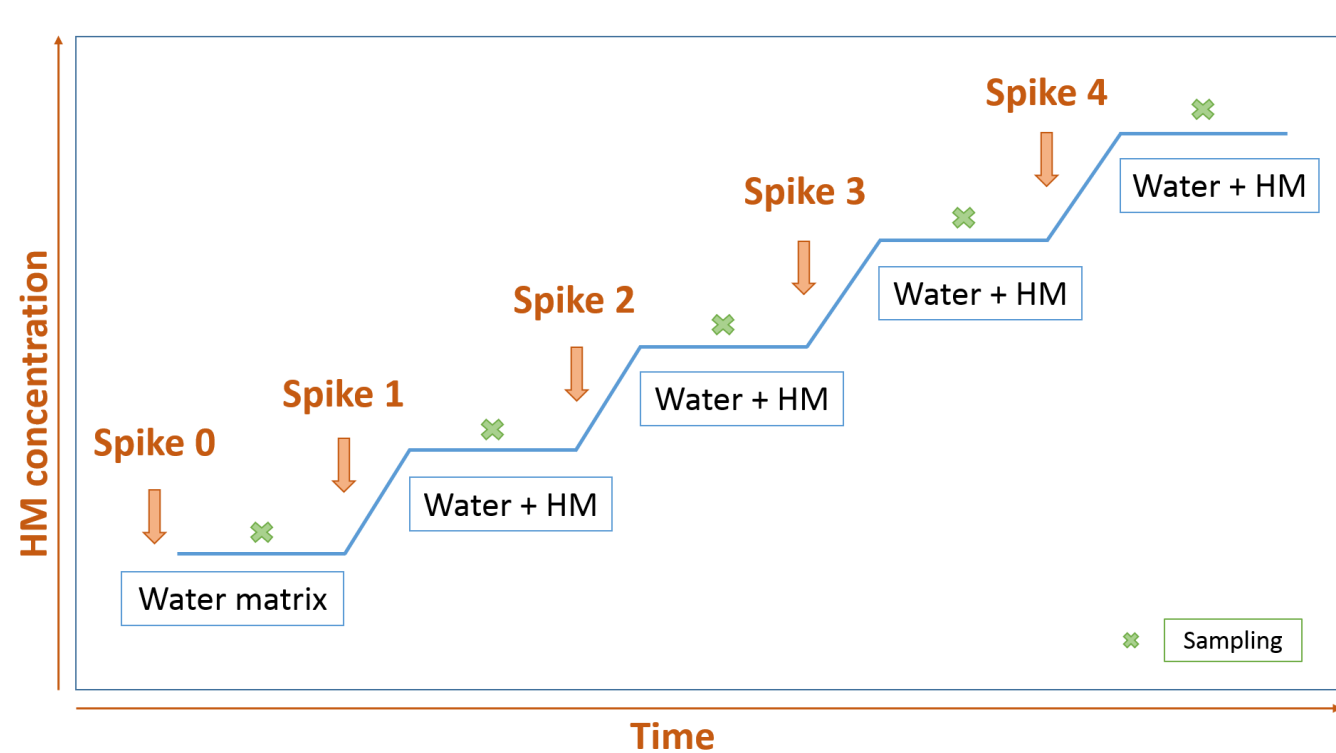
Detection of concentration changes



- Sensor values Pb
- Sensor values Cu
- Reference 1 Pb
- Reference 2 Pb
- Reference 1 Cu
- Reference 2 Cu

Validation of system performance

In-door simulation of real-world scenarios for Pb & Cu



Water matrix
Ground/Danube water

Spiking levels
Pb/Cu 1:4
Spike 0 0/0 µg/L
Spike 1 25/100 µg/L
Spike 2 50/200 µg/L
Spike 3 75/300 µg/L
Spike 4 100/400 µg/L

Measurement
~7min x10

References

TCHOUNWOU, P. B. et al. (2012): Heavy metal toxicity and the environment. *Experientia supplementum* (2012) 101: 133-164
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 ISO15839. (2003). *Water quality - On-line sensors/analysing equipment for water - Specifications and performance tests.*
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