

Monitoring seasonal dynamics of selected harmful algae in the North Sea using molecular methods

Introduction of a fully automated biosensor

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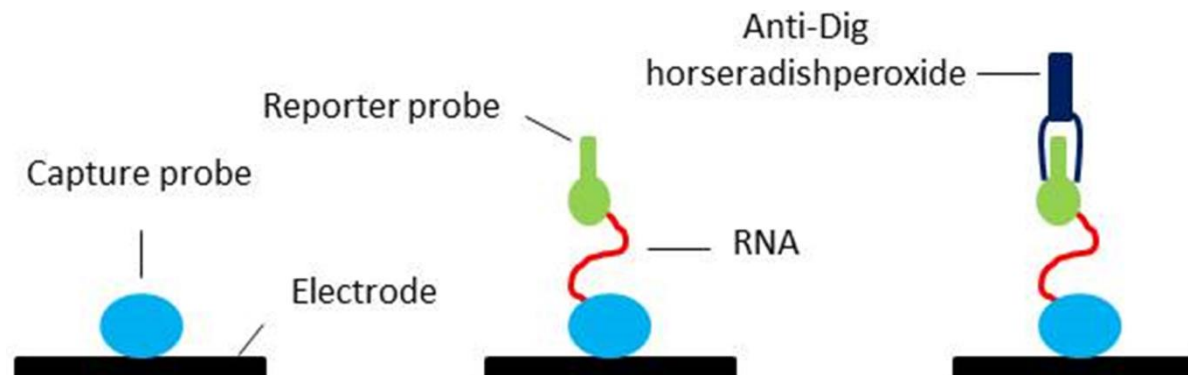
- Introduction
- Biosensor
- Calibration
- Outlook

- Monitoring of harmful algae
 - Microscope
- Other potential methods
 - RNA microarrays (Taylor et al., 2014)
 - DNA chromatography chip (Nagai et al., 2016)

- PhD project part of EnviGuard
 - `Development of highly specific and precise in-situ measurement device for man-made chemical contaminants and biohazards (microorganisms and toxins from biological sources) which are currently hard to measure`
 - Modular system
 - Calibration of biosensor for harmful algae

- *Dinophysis*
 - Occurrence around Helgoland (Löder et al., 2012)
 - Low levels of Dinophysis toxins found in German Bight (Krock et al., 2013)
- *Alexandrium sp.*
 - Occurrence around Scotland (Toebe et al., 2013)
 - Harmful blooms at Orkney Islands
- *Protoceratium reticulatum*
 - Hoppenrath (2004) found cells at Helgoland using light microscopy

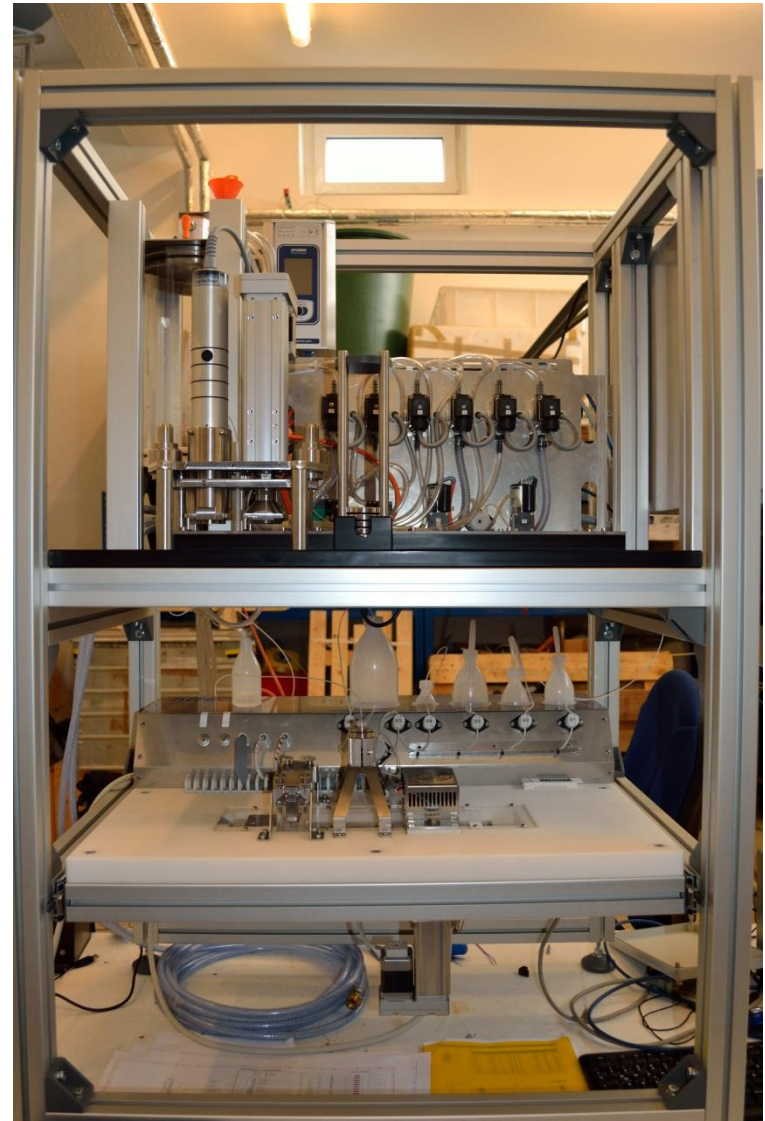
- Electrochemical detection of harmful algae
 - Reaction takes place on disposable sensorchip
 - Based on sandwich hybridisation.
 - Capture and reporter probe
 - First used by Metfies et al., 2005



- ALGADEC (Diercks et al., 2011)
 - First semi-automated device
 - Size of a small suitcase
 - Using a PalmSens interface
 - Measuring time: approx. 2-2.5 hours



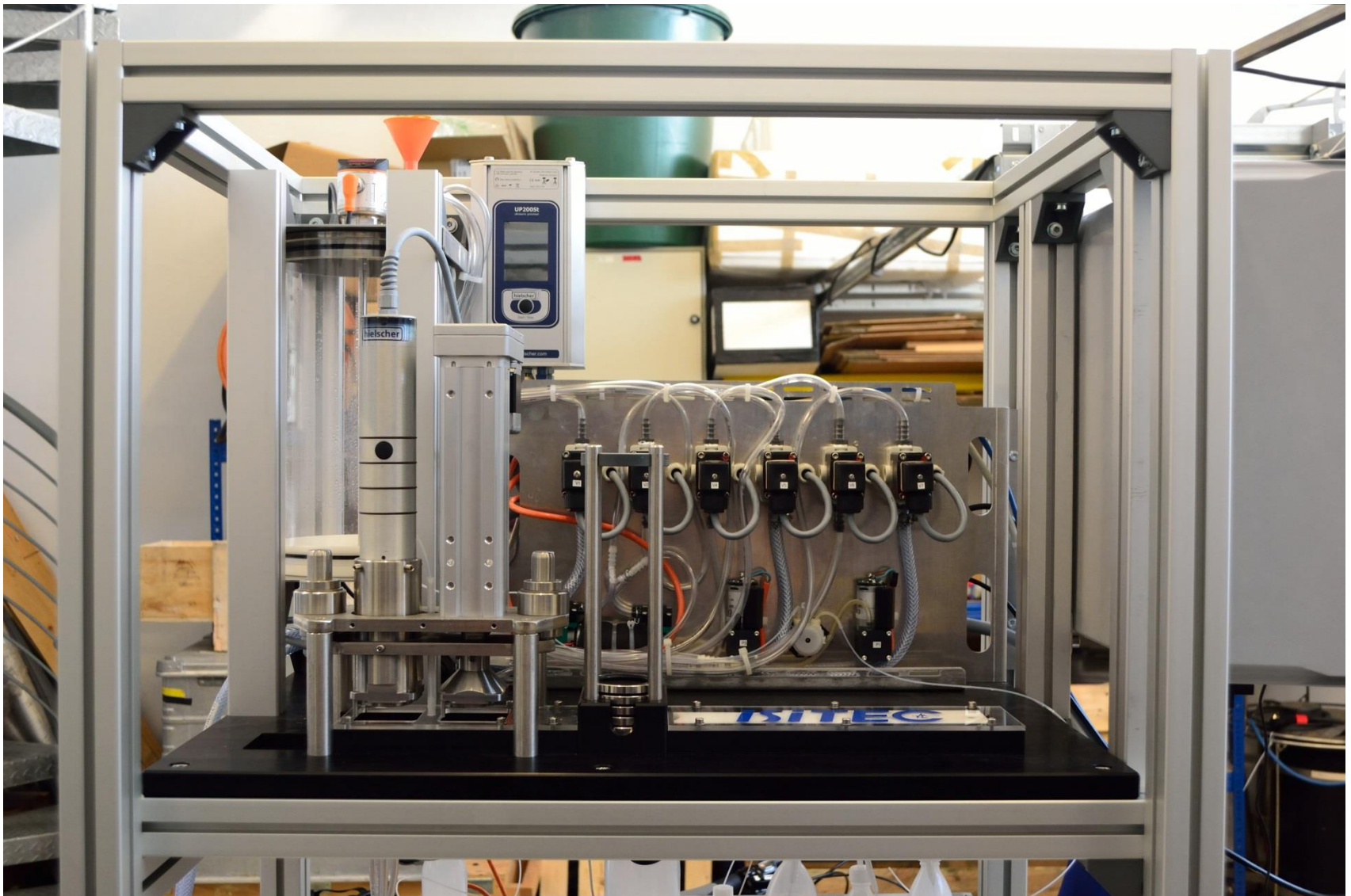
- AutoFiM and BioSens
 - Fully automated biosensor
 - Modular system consisting out of
 - AutoFiM → filtration, sample preparation
 - BioSens → detection



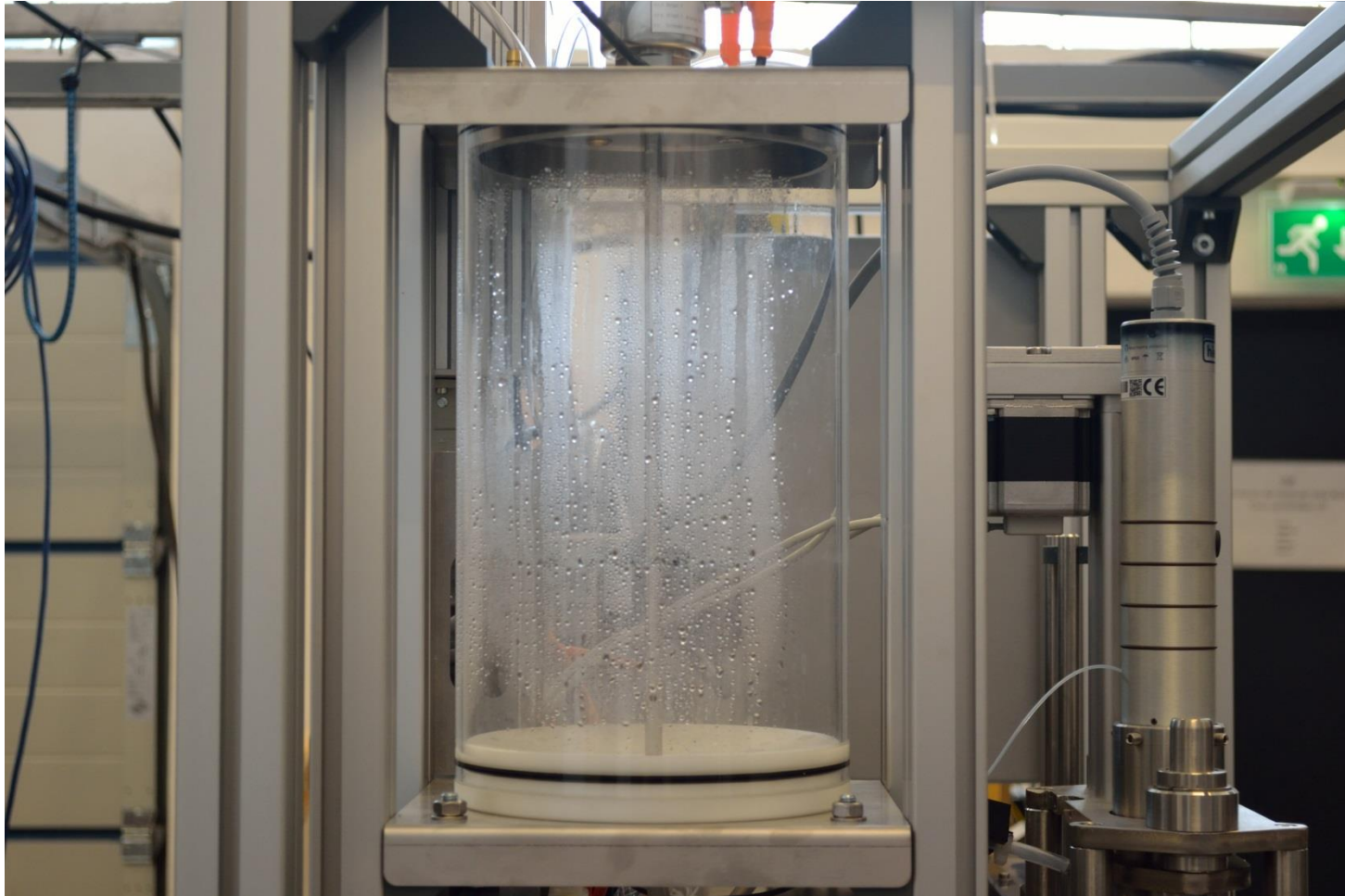
AutoFiM



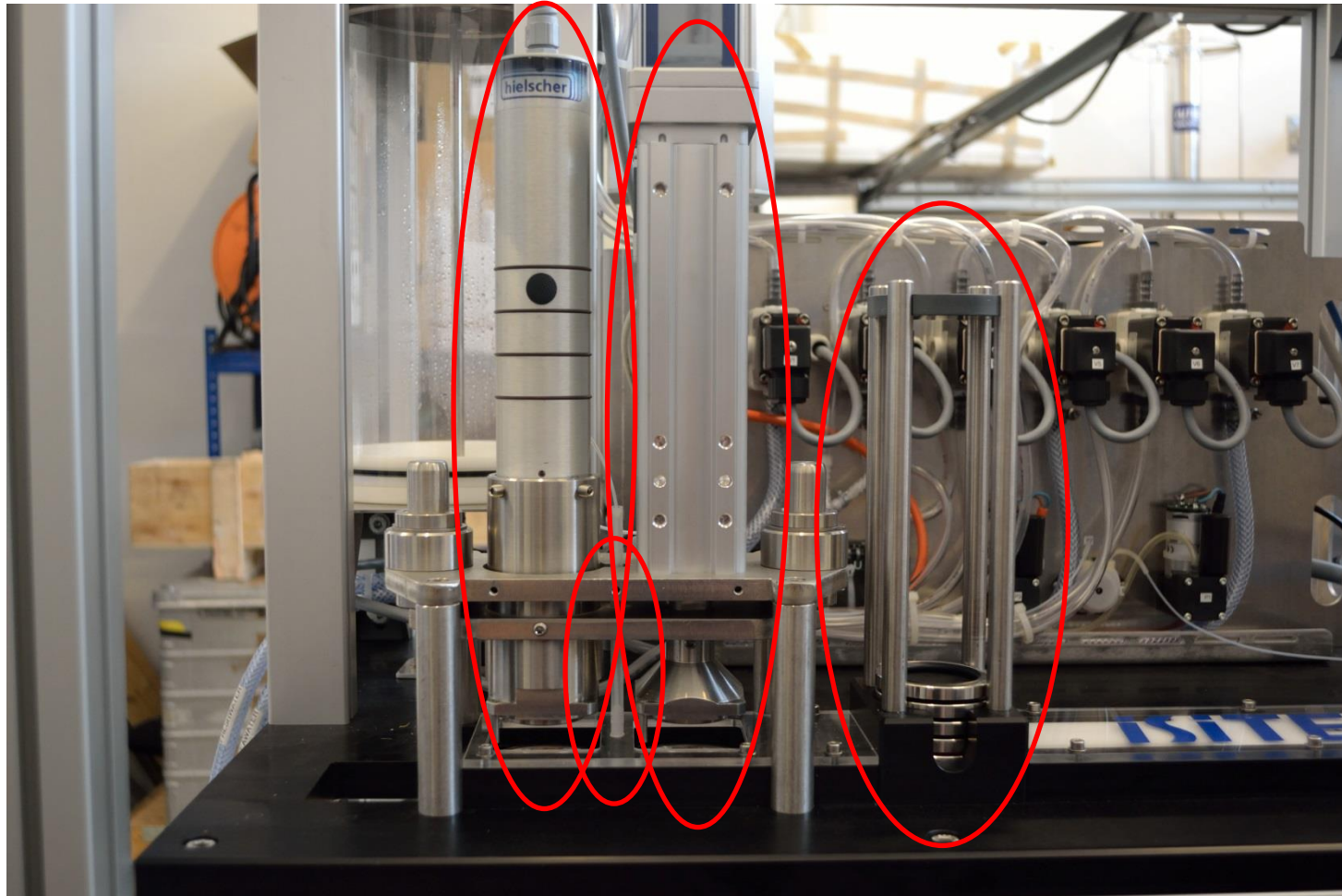
- Fully automated sampling
- Water reservoir of 5 liter
- Can store up to 12 filters
- Possibility to add preservative/lysis buffer
- Ultrasonic device to break down cells



- Sampling reservoir



- Filtration

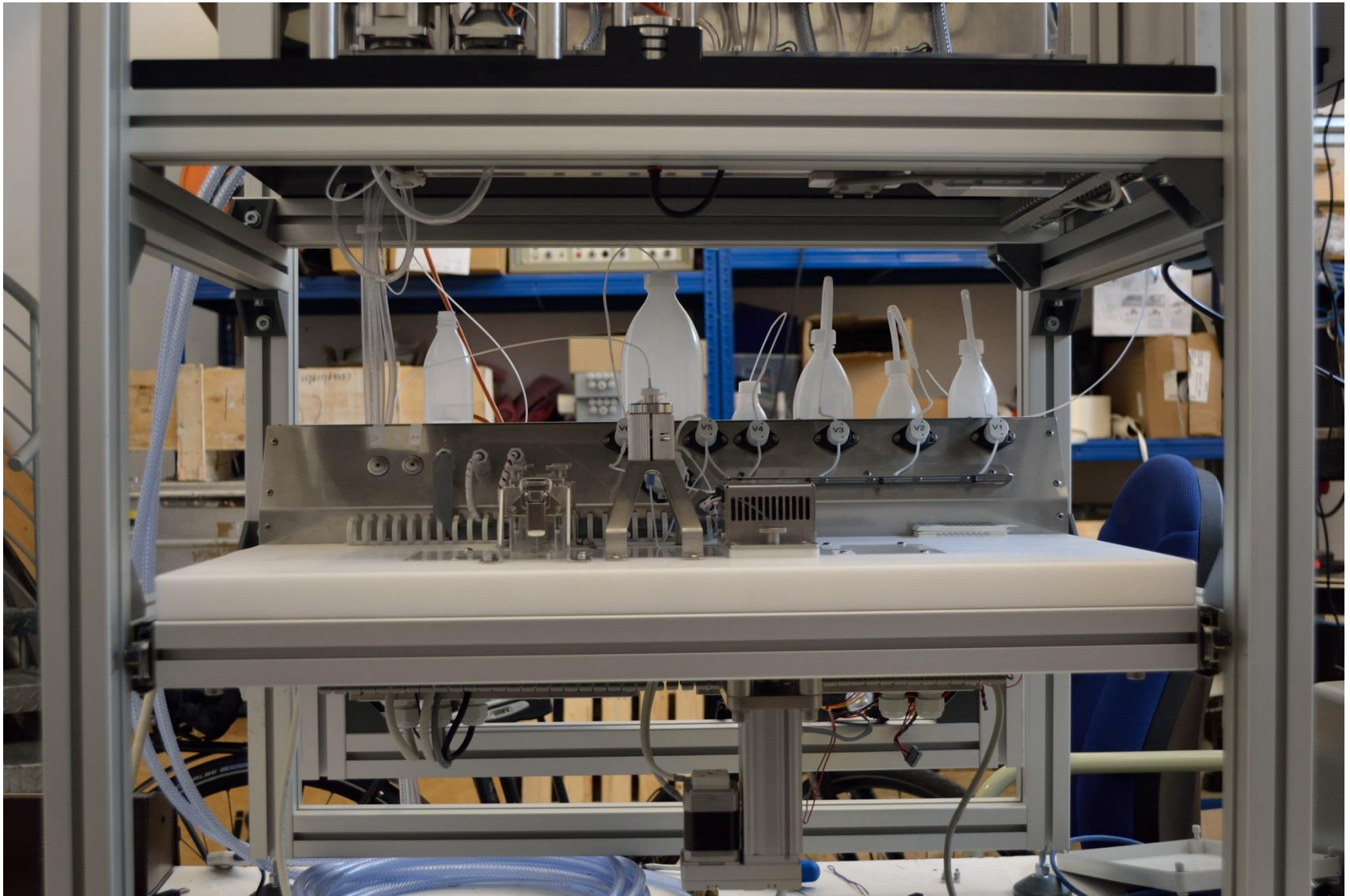


- Ultrasonic device

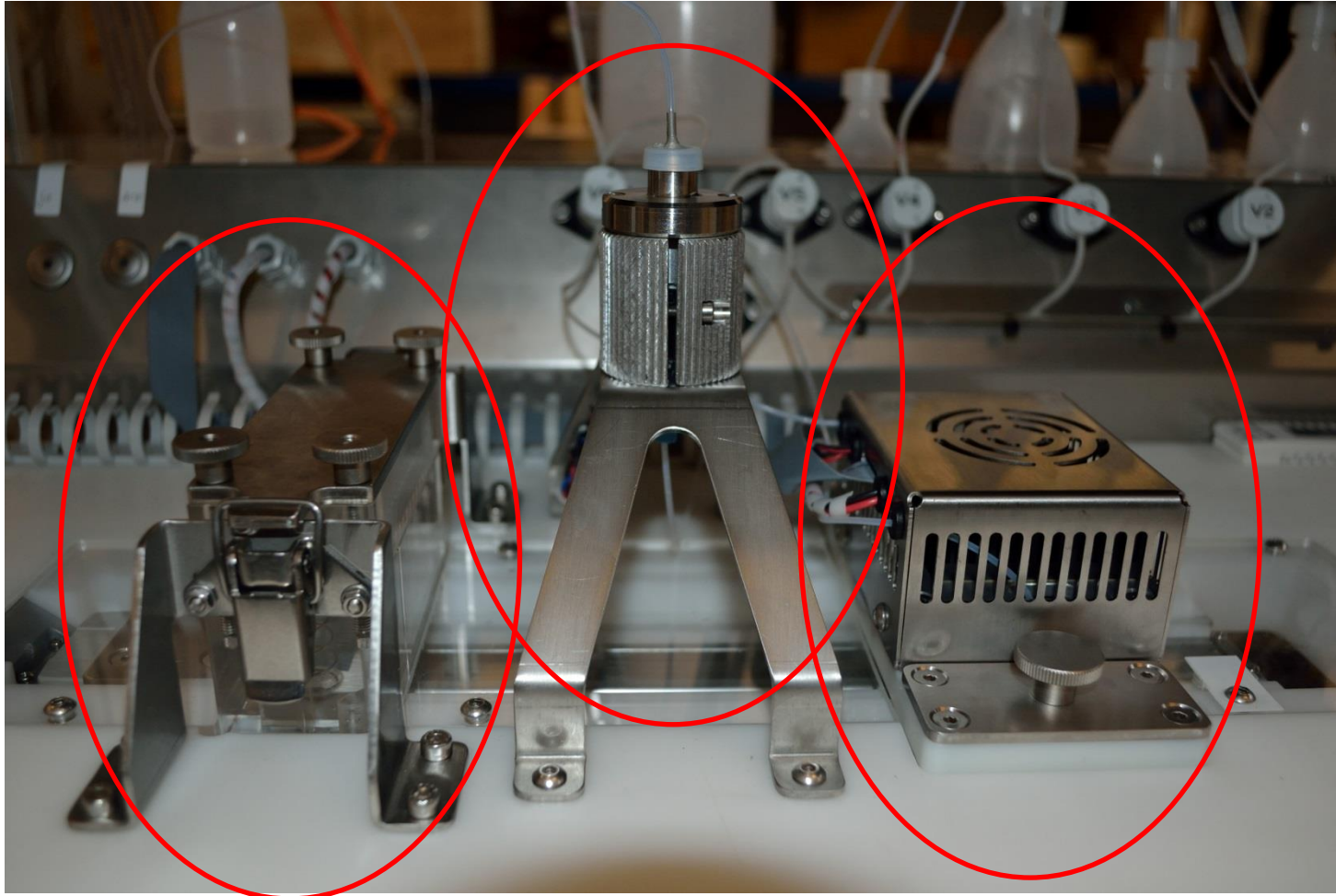


- Fully automated biosensor
- Easy to remove cassette with biochips
- Based on ALGADEC

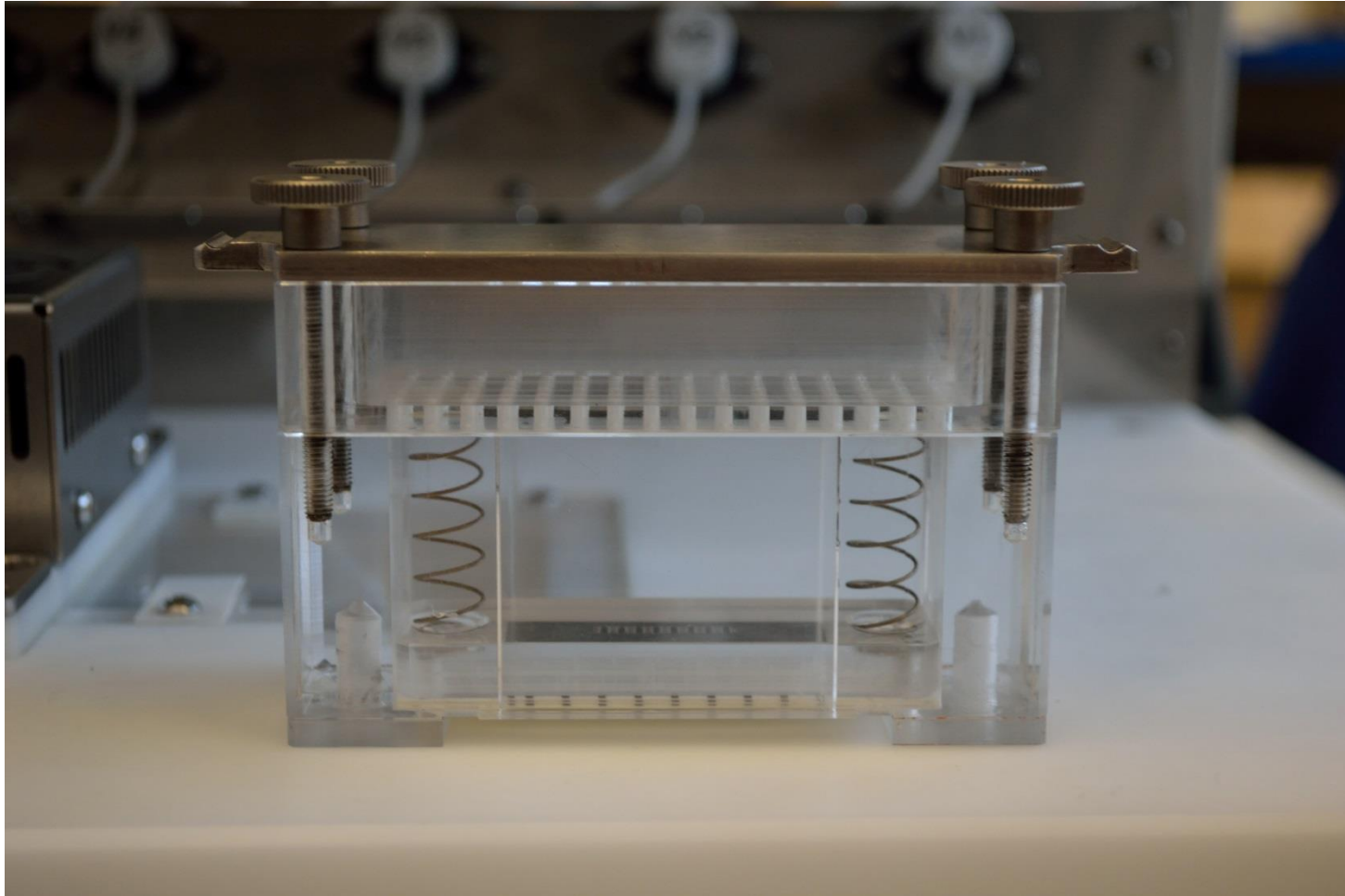
BioSens



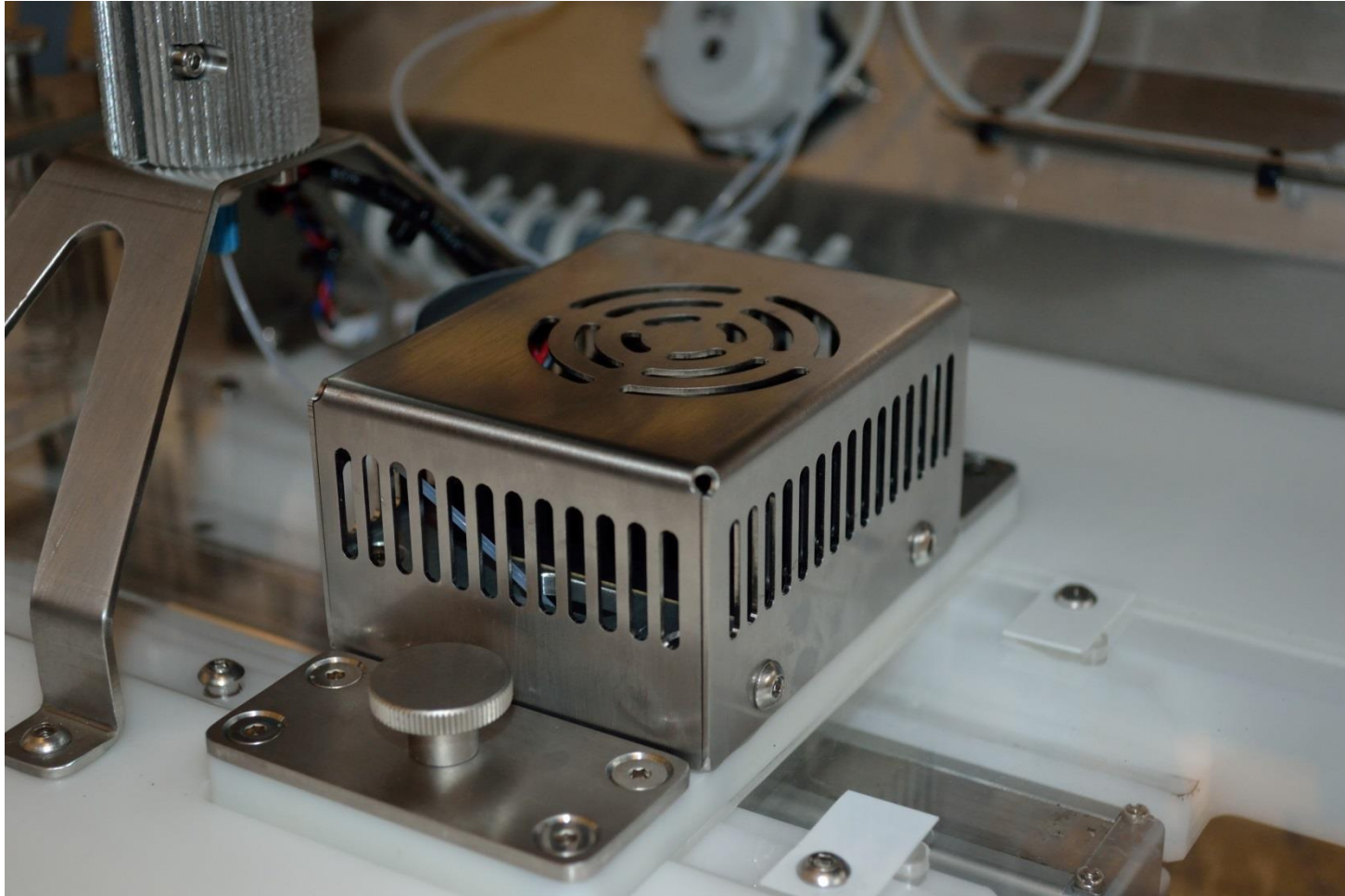
- Overview



- Chipcassette



- Measuring chamber

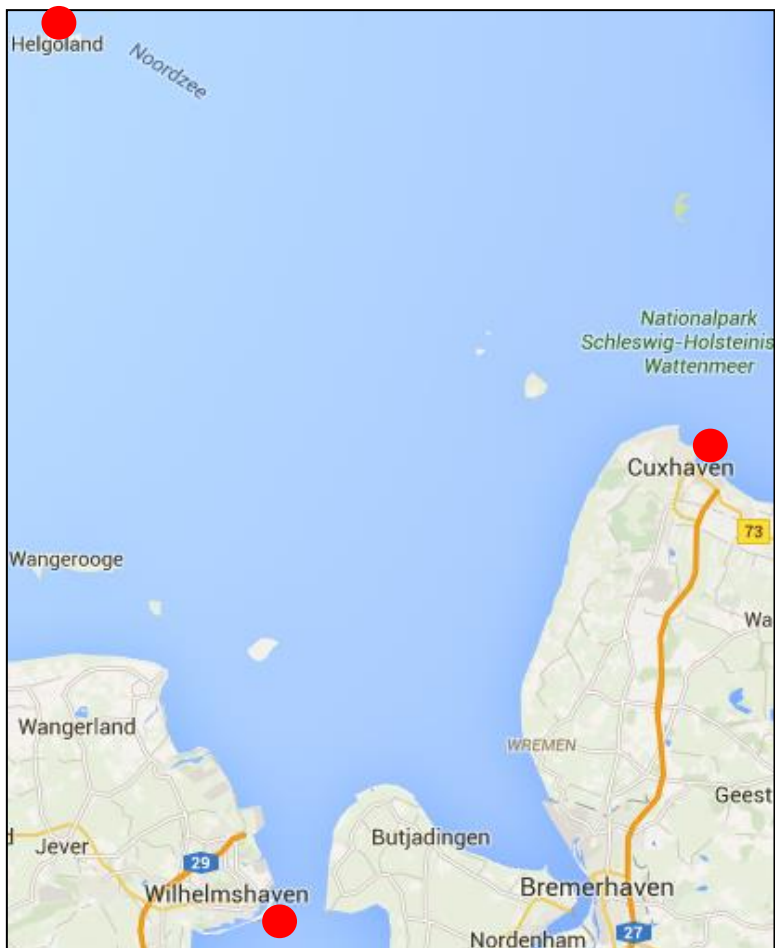


- Computer



- Calibrate with different toxic algae
 - Counted culture
 - Filter
- Run tests with spiked samples
- Test with field samples

- Sampling locations



← German Bight

Orkney Islands



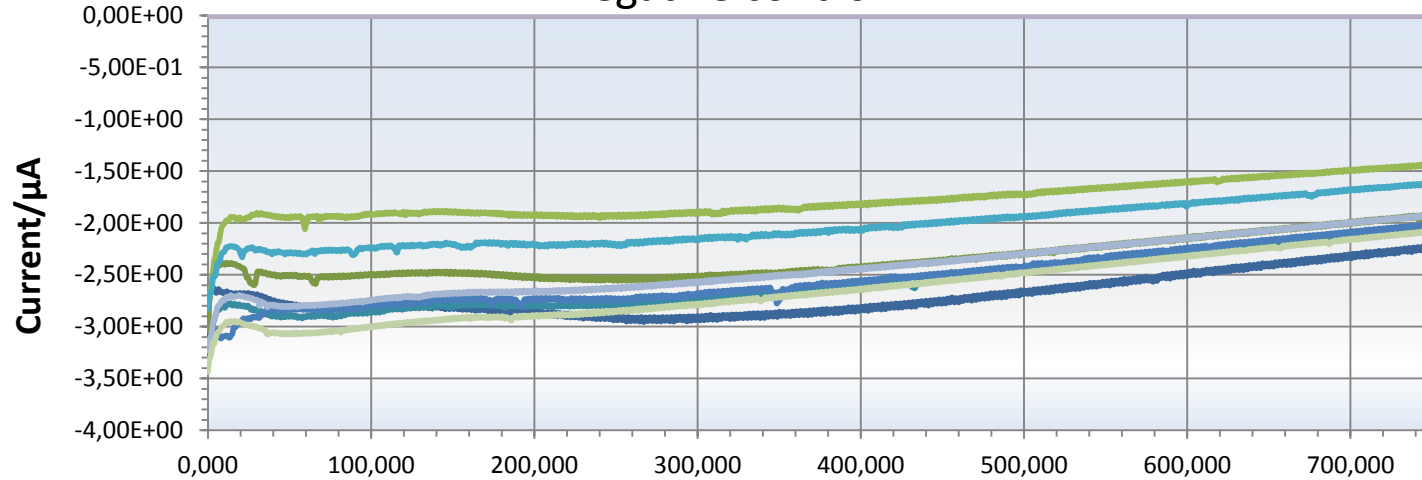
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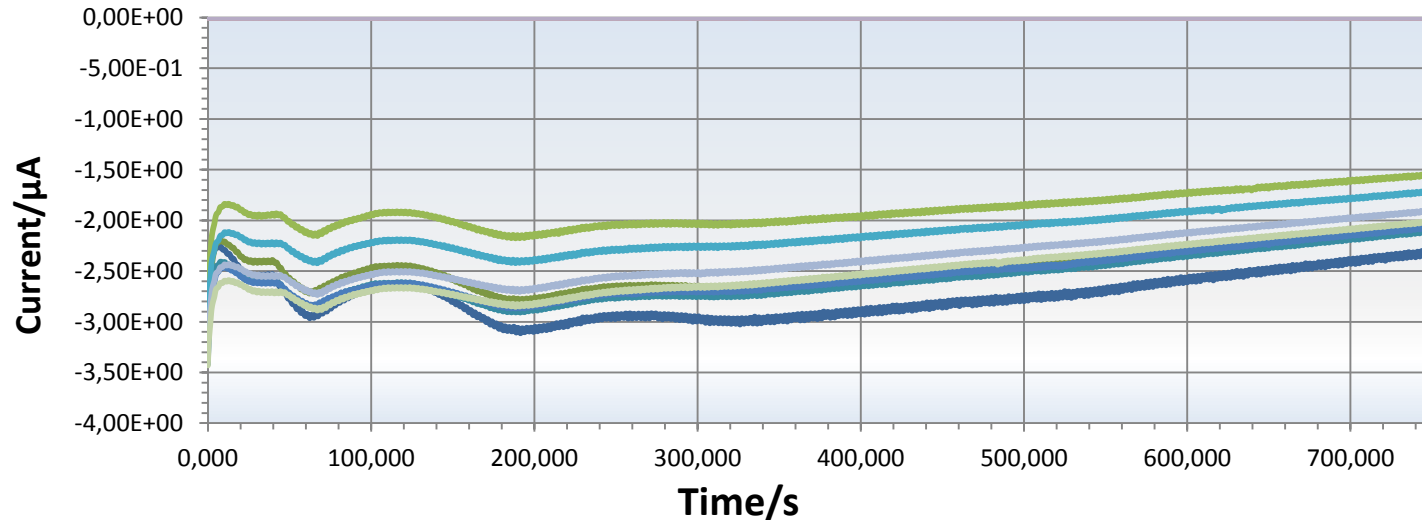
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20

Negative control



Sample



- Averages
 - Negative = -2,28 μA
 - Sample = -2,35 μA
 - Difference = 0,07 μA

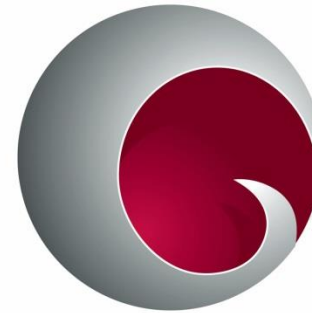
- Interested in the difference
 - Dependent on biomass

- Further testing and calibration of Biosensor
- Field testing starting in March 2017
 - Helgoland

Thank you for your attention!

Many thanks to.....

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ADVANCED MATERIAL SYSTEMS



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