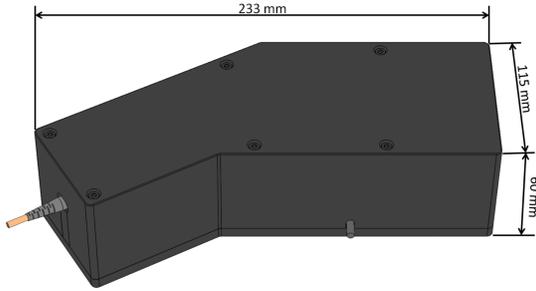




A compact, high Resolution Multichannel Optical Interrogator based on an Integral Field Spectrometer for Label-free Monitoring of Toxins in Oceanic Water

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The spectrometer has been developed during the EnviGuard project funded by the European Commission within the seventh framework programme.

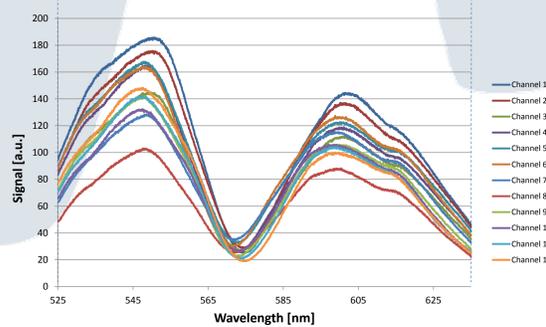
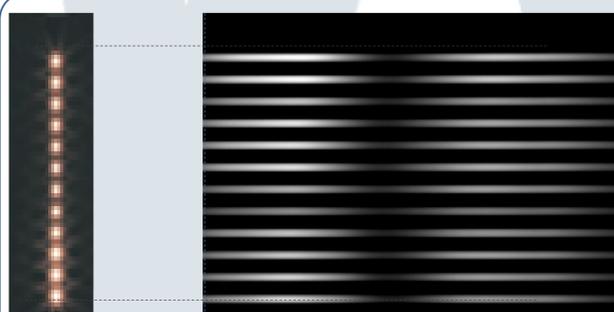
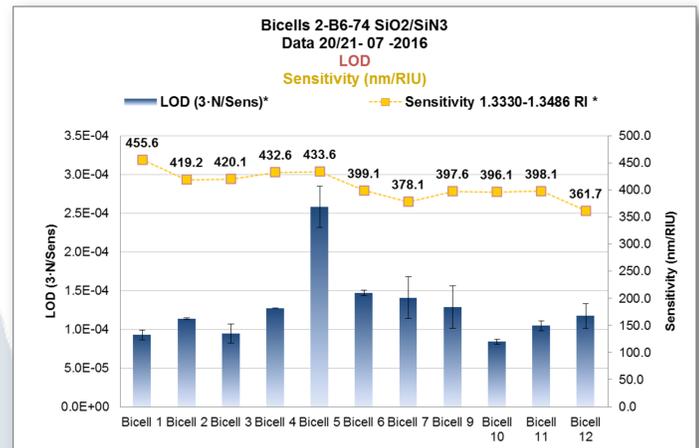
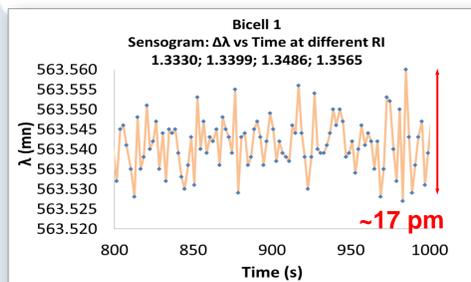
In the scope of the chemical detection unit, the aim is to monitor the toxins Saxitoxin and Okadaic Acid produced by harmful algal bloom as well as the dioxin-like polychlorinated biphenyls (PCB) 126 and 169.

The detection can be done in real time and the method is label-free. For an multianalyte analysis a multiplexed chip is needed and the spectrometer is designed to analyze 12 spectra at the same time. Due to the automation, the module can work for at least one week autonomously.

Spectrometer specs:

- Spectral range: 110 nm
- Resolution: 68 pm/pixel
- Peak fitting precision: 17 pm
- Limit of Detection: $1.3 \cdot 10^{-4}$ RIU (BiCell sensitivity of 400 nm/RIU)
- Automatic image processing
- Peak finding by non-linear fitting
- Sensogram acquisition on 12 channels in parallel
- 1 set of spectra per second
- Non-linear data fitting for all channels
- Small form factor (233 x 115 x 60 mm)
- Low power consumption
- Communication (ethernet, wifi, serial)

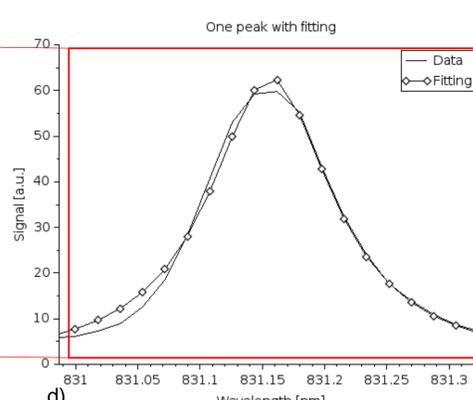
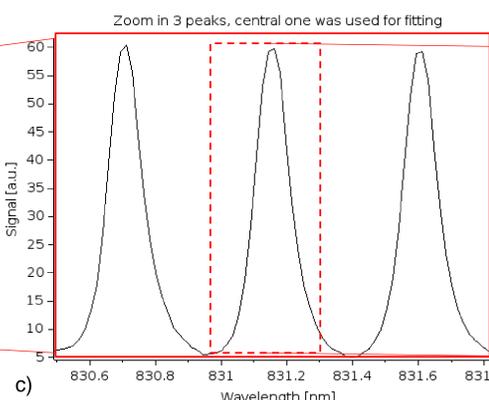
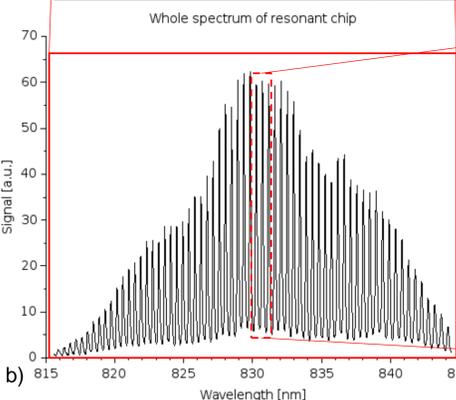
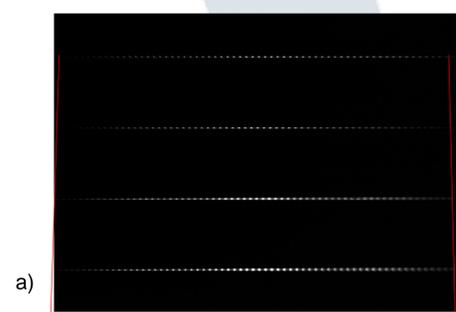
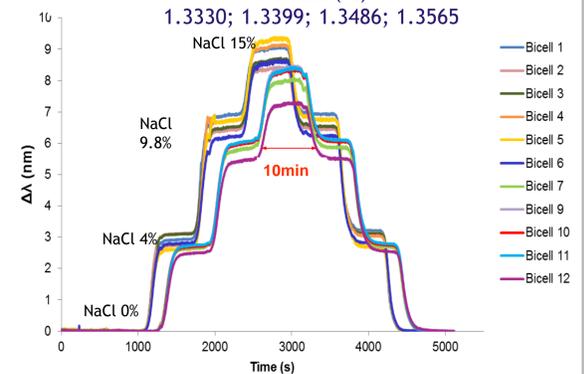
Peak fitting precision over time



Transition from input signal to a graphical representation on the output.

- **Bicells Bulk Sensitivity** (in the range of RI 1.33-1.35) is: **408±27 nm/RIU**
- **Average Limit of Detection** ($3 \cdot N/Sensitivity$): **$1.3 \cdot 10^{-4}$ RIUs**

Real time sensogram: λ_{min} shift ($\Delta\lambda$) vs. Time (s) at different Refractive indices (RI)



These images represent a raw measurement (a), the translation into a signal (b), a zoom into 3 peaks (c), and the fitting of one peak (d) done by the software.

For a demonstration of our multichannel spectrometer, please also visit our stand in **Hall 2, booth #266**.

The advantages of this spectrometer over other commercial spectrometers are the small form factor, the possibility of capturing 12 spectra in parallel including the pretreatment of the data and the low cost of below 10.000 €.

For a lower noise level, the software will be updated to increase the frame rate by a factor of 5, which allows averaging of 5 images. A new setup has been tested, but not yet implemented, that can increase the resolution by a factor of 10, which has a lower spectral range as a trade-off.