AquaLife 2012

FerryBox and a new sensor for phytoplankton detection

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COSYNA

Helmholtz-Zentrum Geesthacht
Zentrum für Material- und Küstenforschung

Outline

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  - Future Prospects
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FerryBox Flow-Through System

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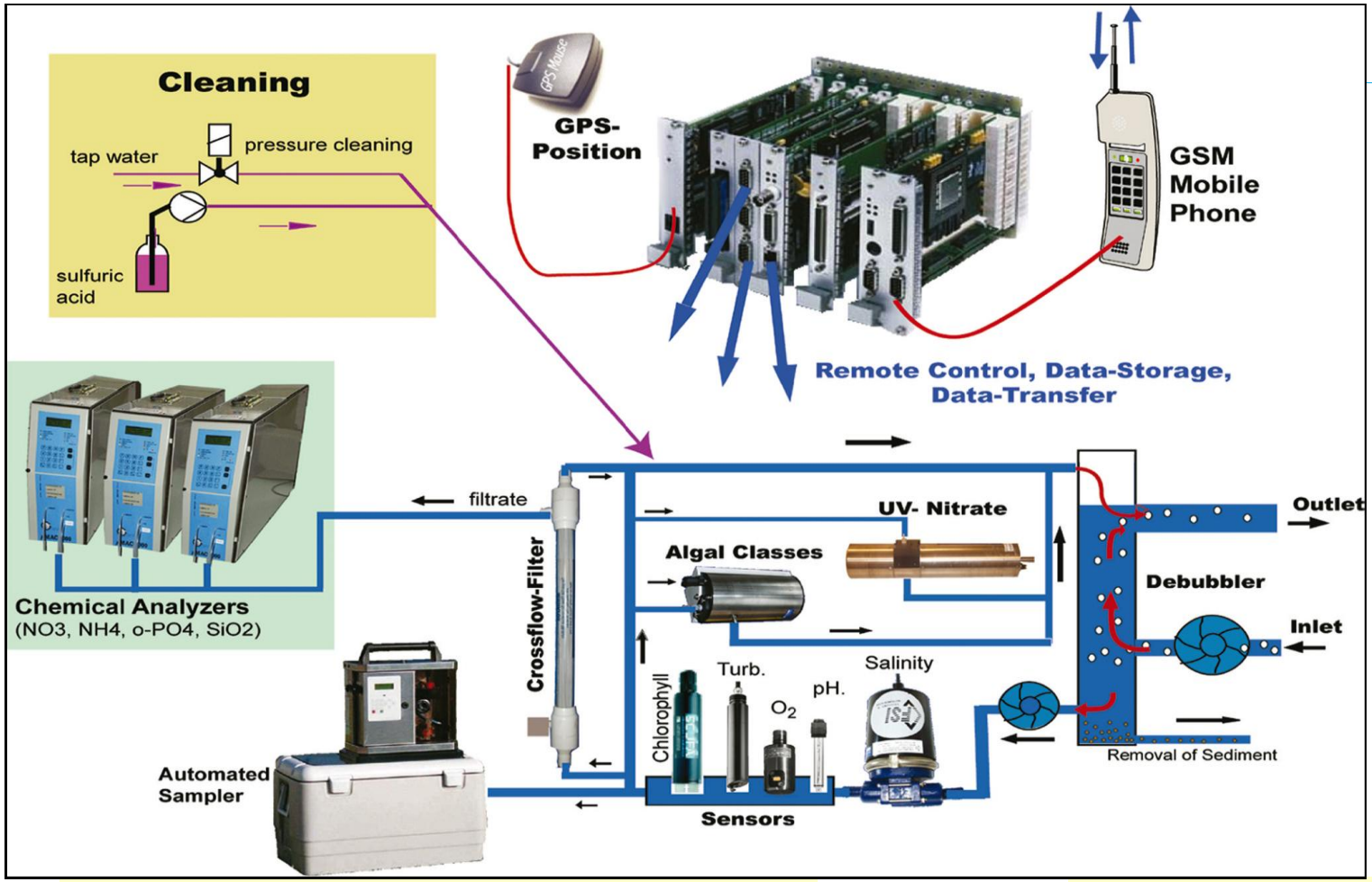

Measured Variables

- temperature
- salinity
- turbidity
- chlorophyll

- oxygen,
- pH
- algal groups
- Nutrients
- pCO2

Main Features:

- running autonomously
- self-cleaning (after each cruise)
- controlled by GPS position

+ automatic water sampler for further lab analysis

Why using Ferries or SoO's as Monitoring Platform?

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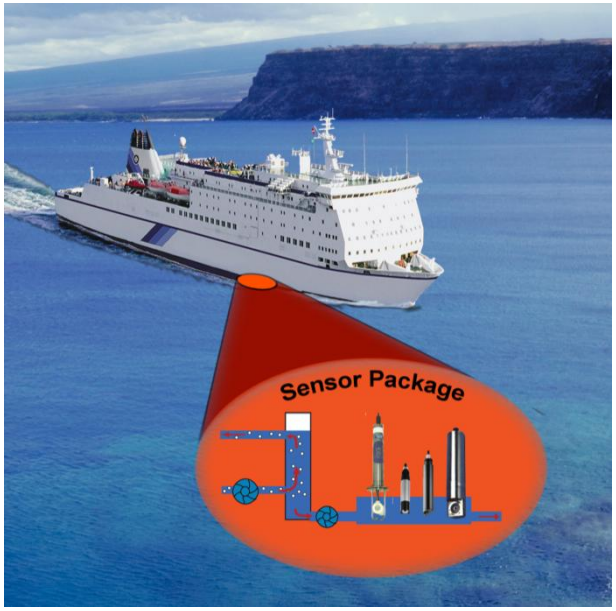

Advantages:

+ high availability
  (protected against harsh environment e.g. waves & currents)

+ bio-fouling can be more easily prevented (inline sensors)

+ low running costs (no cost of operation of the ship)

+ no energy restrictions

+ easier maintenance (platform comes back 'to your doorstep')

+ transect yield much more information compared to buoys

+ high resolution of the data in space and time

Limitations

- data limited to the transect
- no depth profiles

FerryBox Lines in Europe

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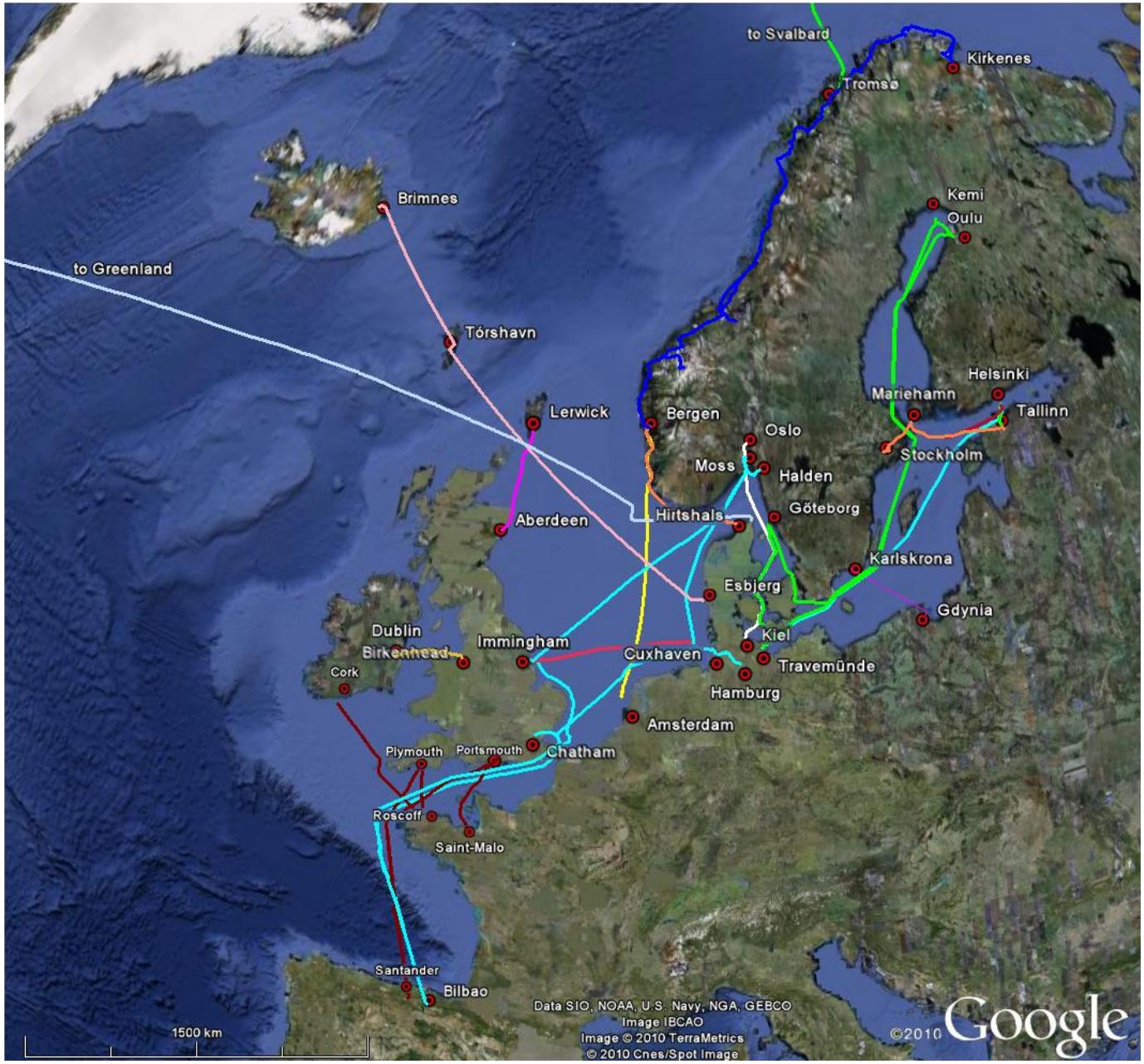
Institutions:

BCCR (NO)
CNRS/INSU (FR)
HZG (DE)
IFREMER (FR)
GSO (US)
IMWM (PL)
LOMI (EE)
Marlab (UK)
NIVA (NO)
NOC (UK)
SMHI (SE)
SYKE (FI)
TTU (EE)



FerryBox Lines currently operated by Helmholtz-Centre Geesthacht (HZG)

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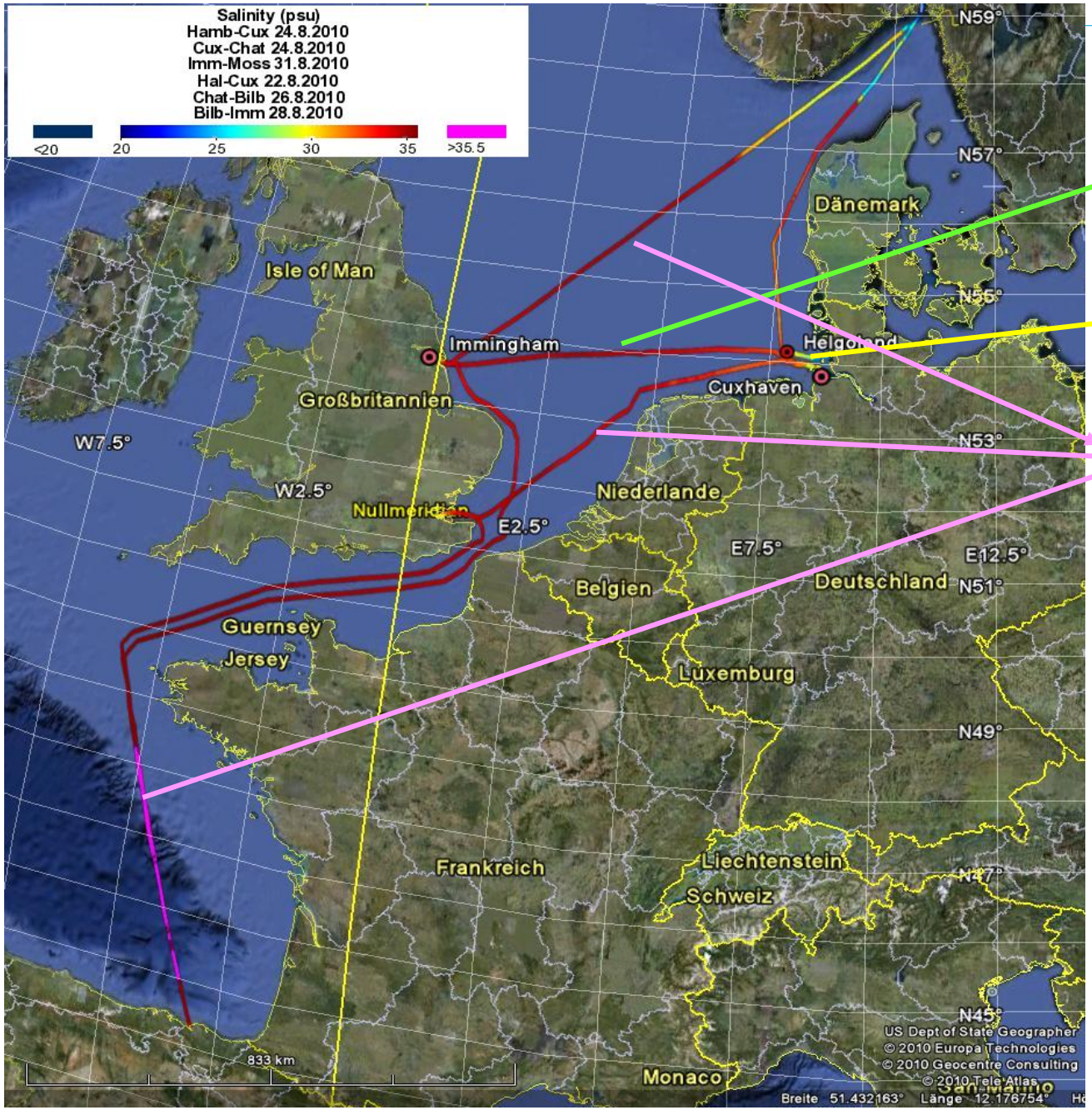

FerryBox Routes (HZG)

1. **TorDania (RoRo ship)**
   Immingham (UK) <-> Cuxhaven (DE)
   ~ 6 transects/week

2. **FunnyGirl (passenger ferry)**
   Helgoland (DE) <-> Büsum (DE)
   ~ 2 transects/day

3. **LysBris (cargo ship)**
   Halden (NO) –> Cuxhaven (DE) -> Chatham (UK) –>
   Bilbao (ES) –>Immingham (UK) –> Moss (NO)
   ~ fortnigthly

Integration of FerryBox lines in the Coastal Observeratory COSYNA (German Bight)

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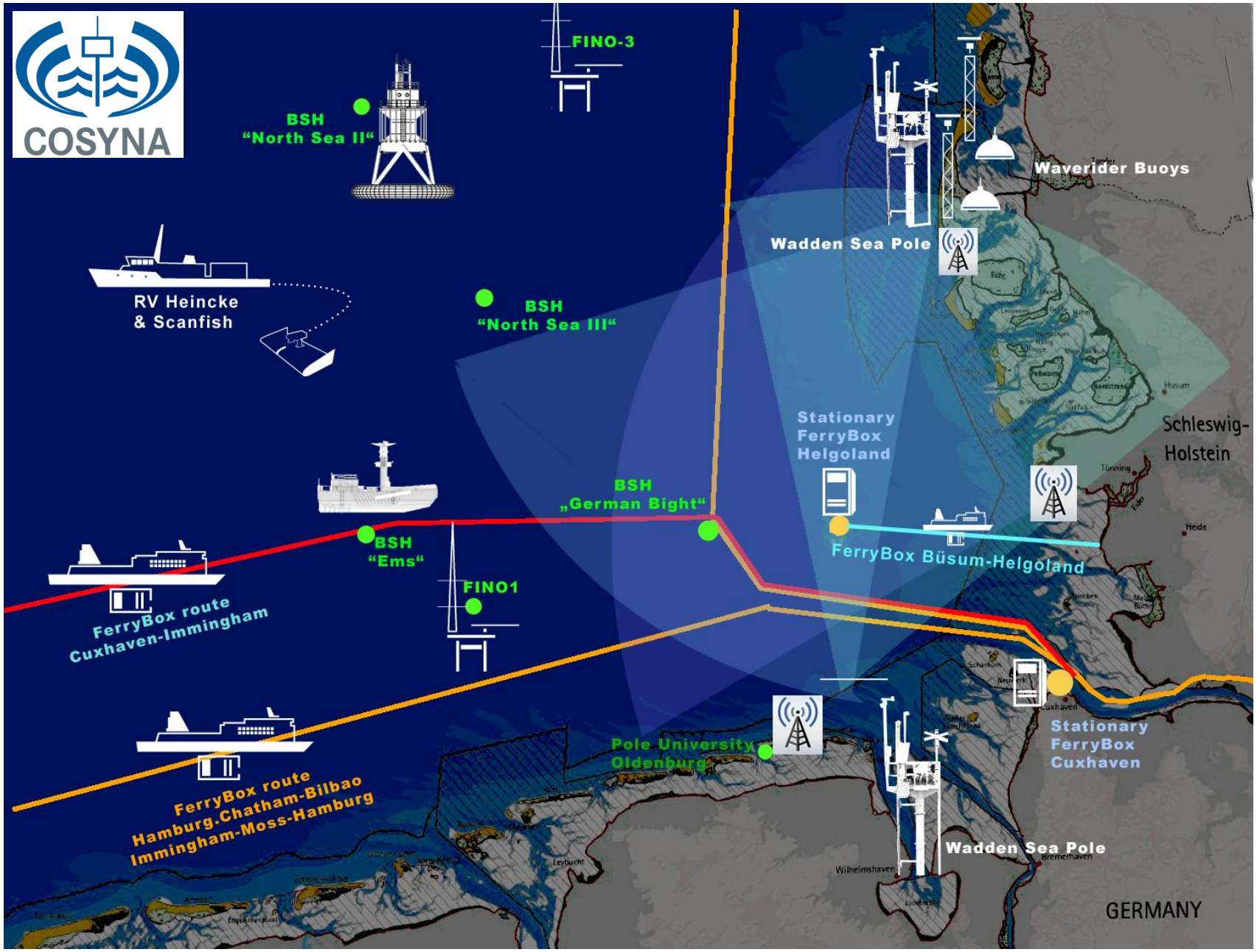

FerryBox – New sensor development

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- FerryBox measurements provide a lot of oceanographic relevant data
- A lot of present changes in marine environment are related to biology
- Productivity and structure of the phytoplanctonic community is of particular interest (basis of marine food web; important player in the carbon cycle)
- To detect and understand changes, automated measurements with high spatial and temporal coverage are necessary
- New sensors for biological parameters should be integrated into the FerryBox to fulfil this task

FerryBox – New sensor development

- Phytoplankton can be detected and quantified (via chl-a as a proxy) by different in situ methods:
  - → Fluorescence
  - → Absorption

- Fluorescence measurements are often influenced by phytoplankton condition, species and light history

- Absorption spectra ought to provide more/better information than fluorescence, but measurements are affected by
  - → scattering on particles
  - → low concentration of absorbing material

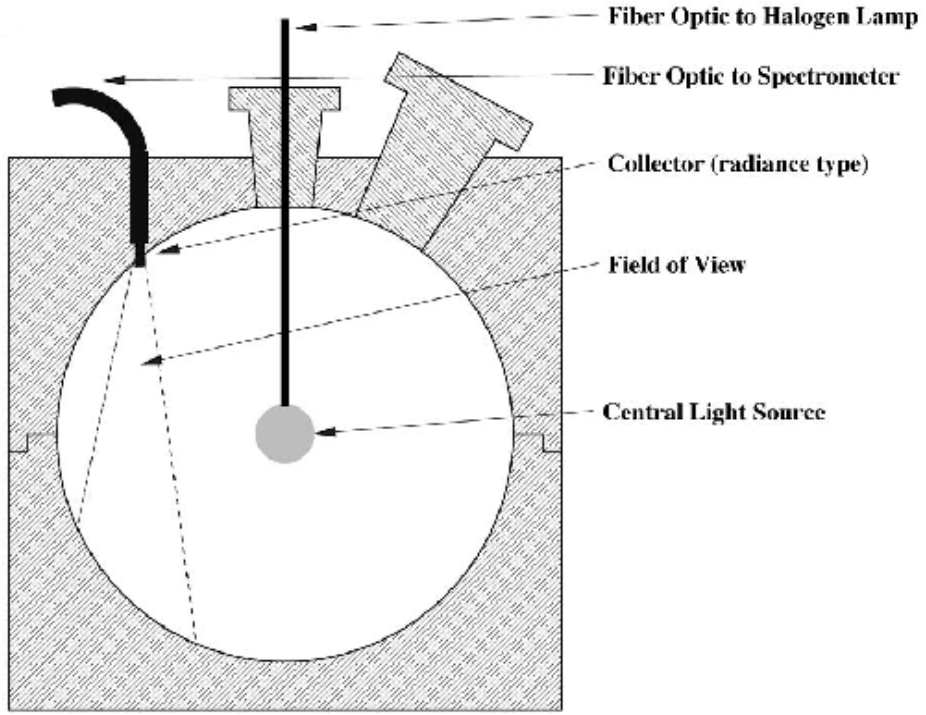
→ Need for the development of a setup for continuous unaffected absorption measurements as a flow-through system

PSICAM – measuring principle

- PSICAM (**p**oint **s**ource **i**ntegrating **c**avity **a**bsorption **m**eter)

- Cavity made of a highly reflective material (Ulbricht´s sphere)

- Water in the cavity is illuminated by a central light source

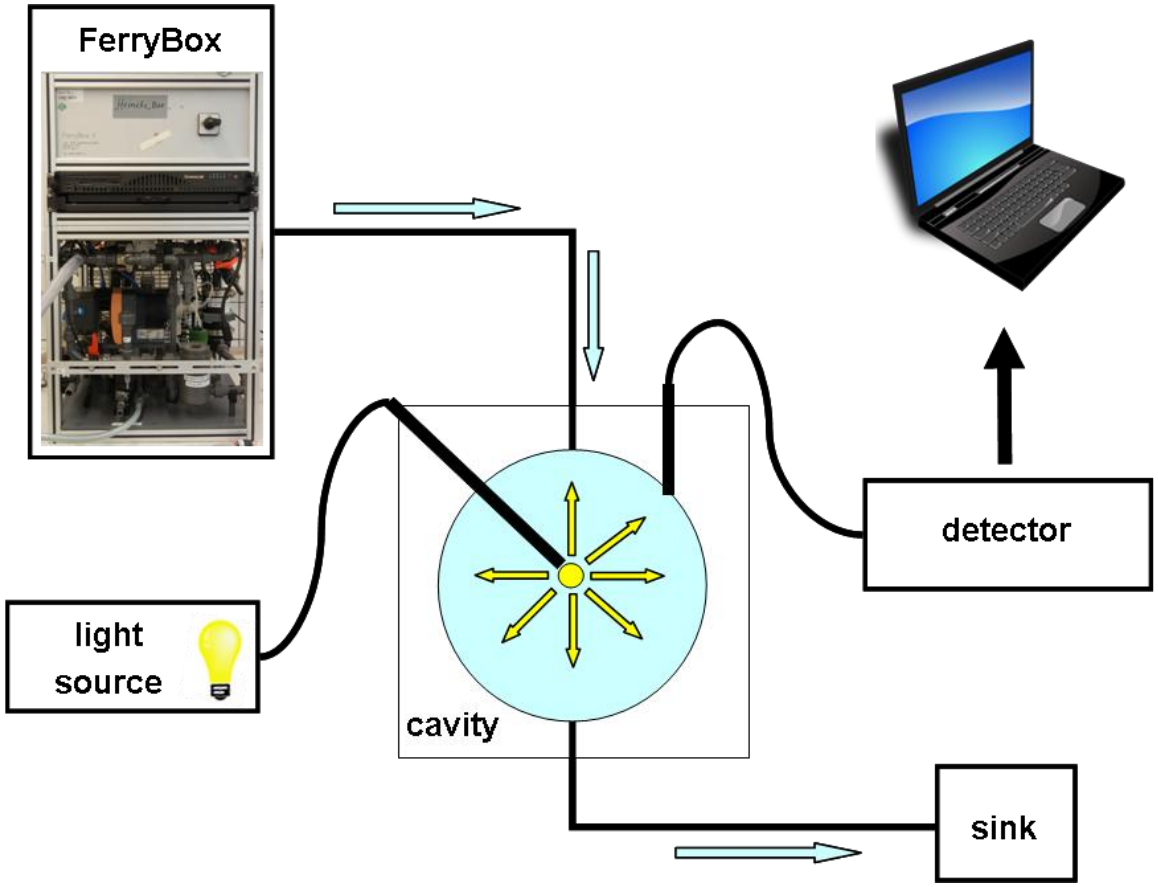


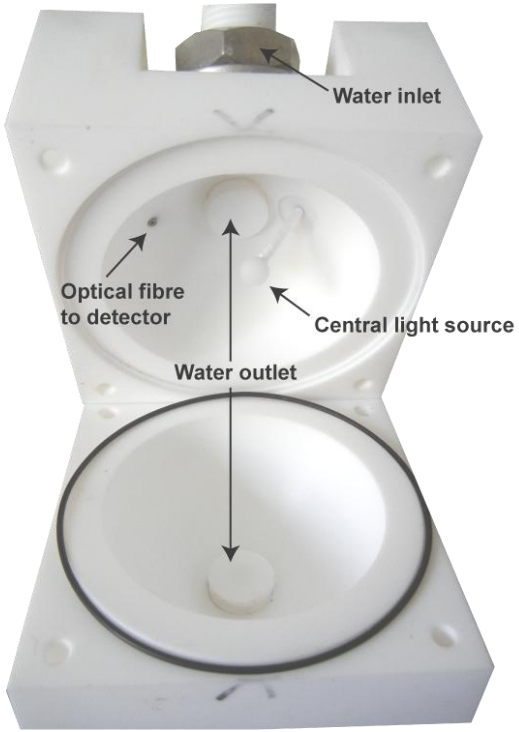
- Loss of light only through absorption, not due to scattering

- High sensitivity due to long optical path lengths

- Adaptation as a **f**low-**t**hrough device → (ft-PSICAM)

ft-PSICAM – setup and measuring principle





Material: Teflon

Light source: 150W halogen bulb

Detector: Ramses UV-vis (TriOs)

Usable wavelengths: ~400 – 710 nm (2 nm steps)

ft-PSICAM vs. conventional PSICAM - an assessment

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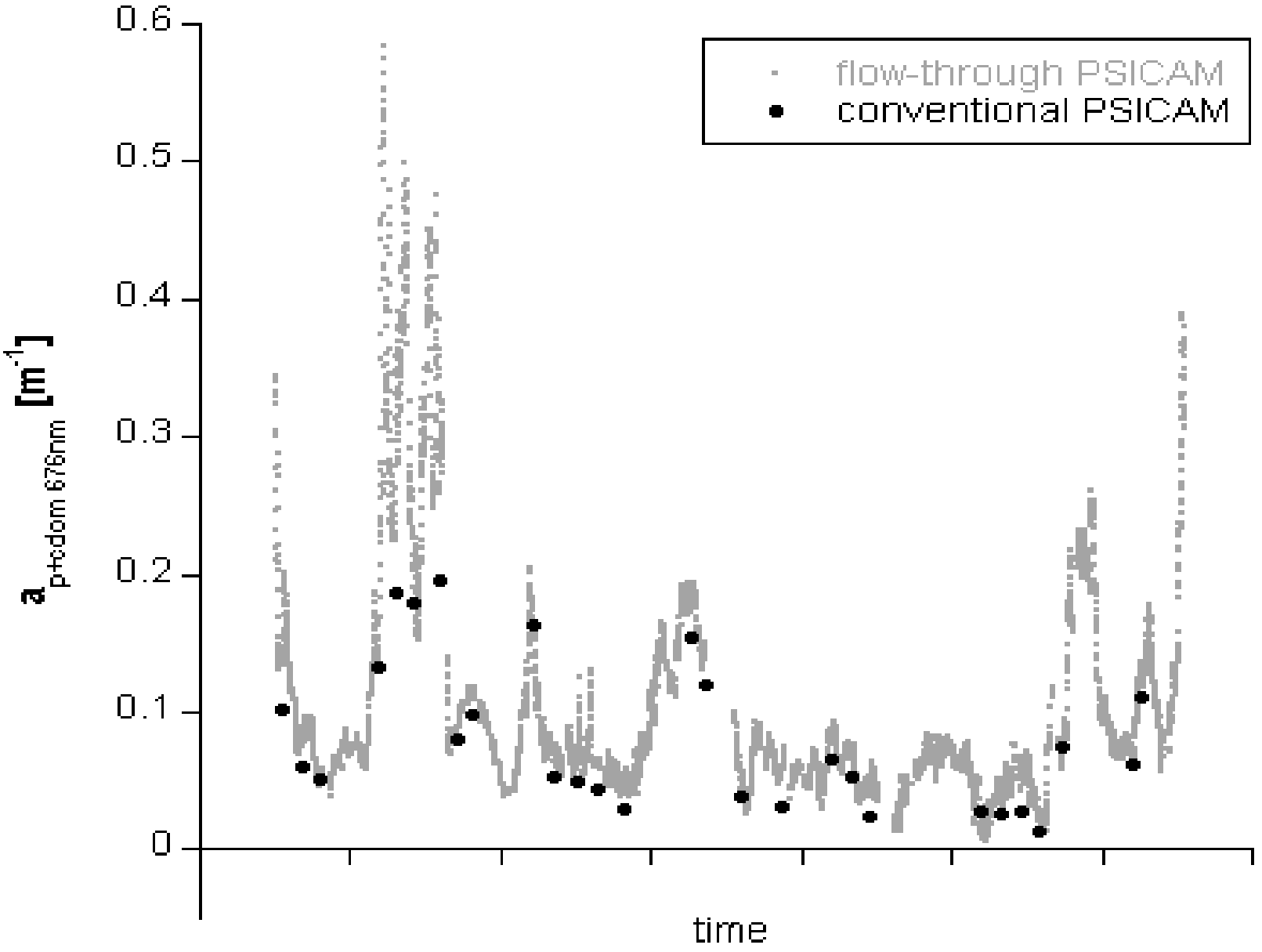

ft-PSICAM vs. fluorescence - an assessment

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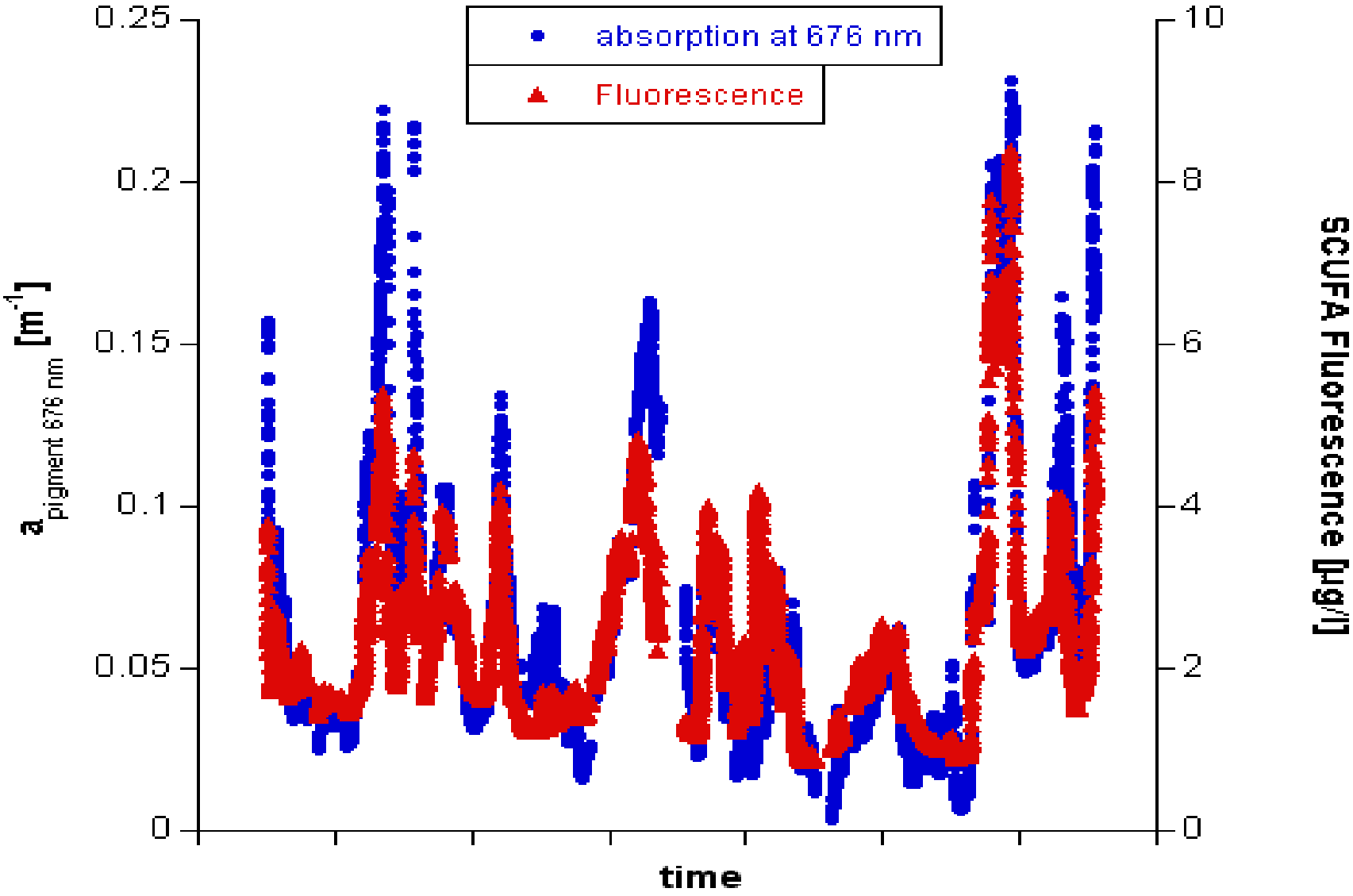

ft-PSICAM – first results

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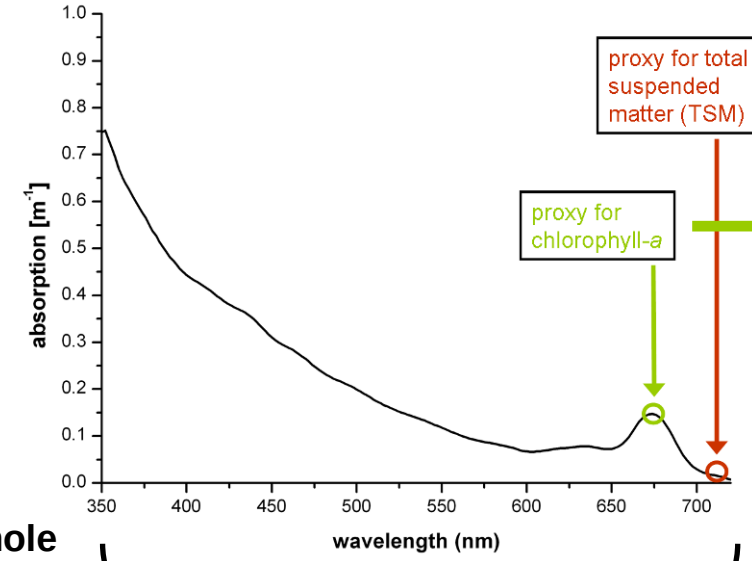
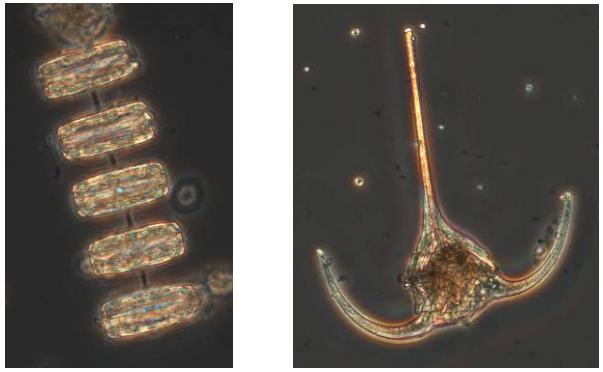
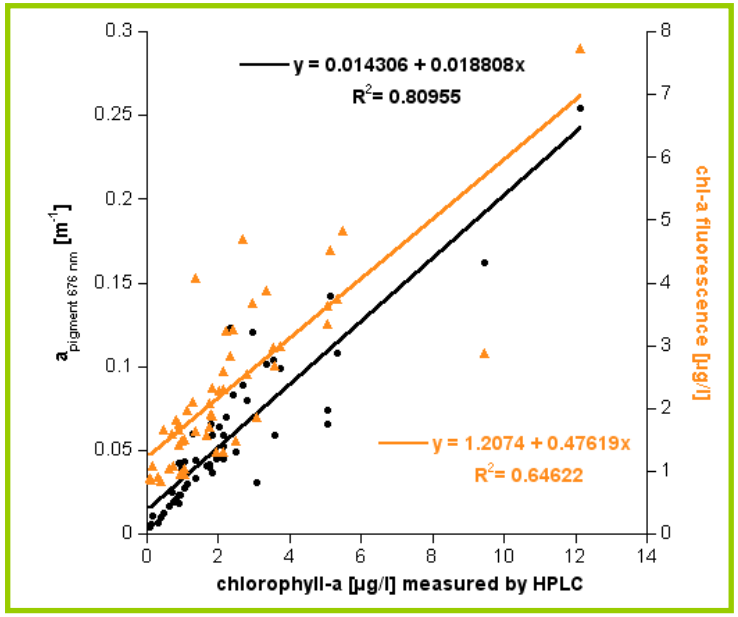


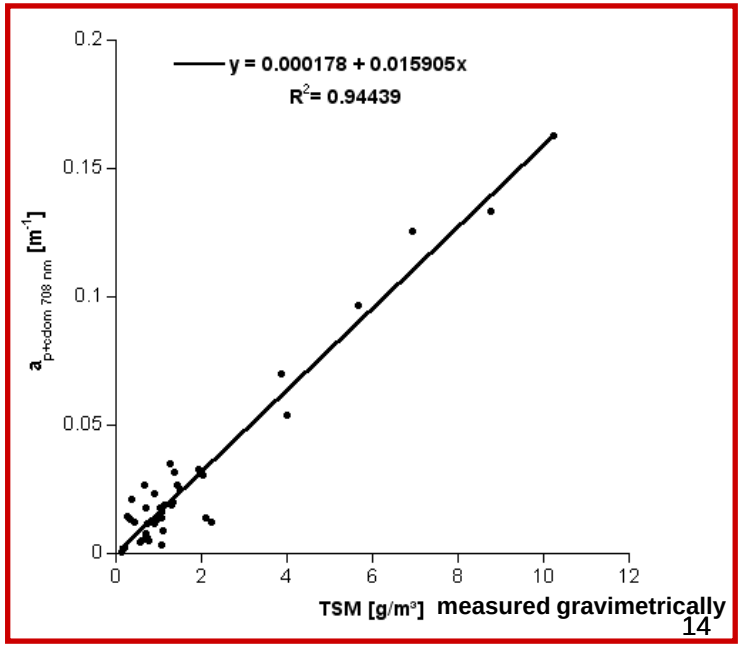
whole spectrum



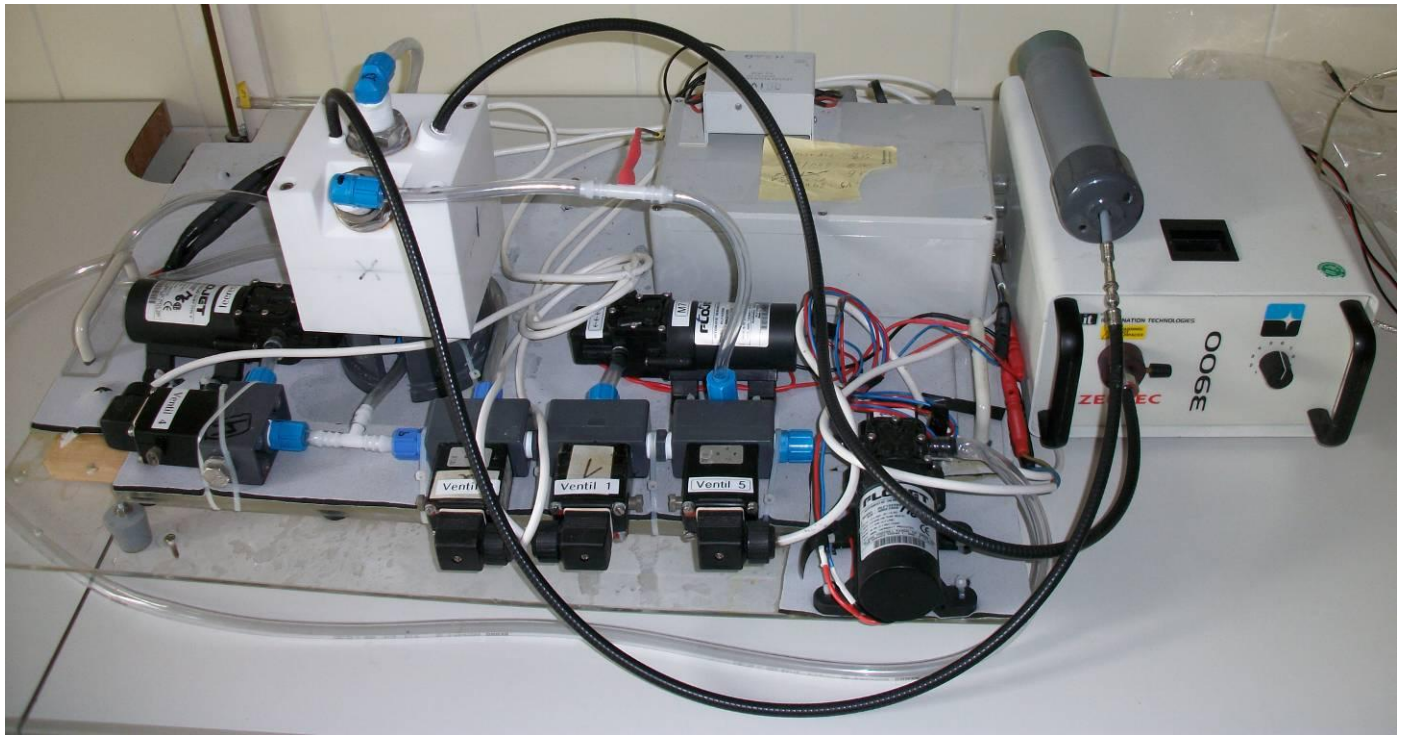
Identification of algae groups

(under development)





ft-PSICAM – future prospects



- Mounting the system in a more user-friendly setup
- Automation of the measuring procedure
- Additional test regarding biofouling during long-term usage
- Differentiation of phytoplankton groups based on reference absorption spectra

Summary

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- FerryBox is a cost-effective platform for obtaining oceanographic valuable data in high temporal and spatial resolution
- Additional to automated sensors for physical or chemical parameters there is also need for biological sensor development
- The ft-PSICAM provides absorption measurements in the whole range of the visible spectrum uneffected by scattering
- From this measurements, chl-a as a proxy for phytoplankton biomass and a proxy for TSM can be derived
- Absorption spectra offer the possibility to differentiate algae classes

Thank you for your attention!