

# Sustainable measuring strategies for the Ocean

*OceanPack: Robust, Flexible and Cost-efficient "Autonomous Underway  
Measurement System" in Operation*



B.Sc. Saskia Heckmann  
Scientist

Dipl.-Phys. Stefan Marx  
Director

**LI-COR**  
Lifesciences

inside

**NM  
EA** National Marine  
Electronics Association

**OceanoScientific**

# SubCtech - The Team



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 Uni Mar.Tech Bremerhaven (Prof. Zielinski)  
 Uni of the Sunshine Coast Australia  
 Nau GmbH



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 Neptun Industries  
 Contros



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 GKSS (HZG, Dr. Schroeder)  
 4H-Jena eng.  
 Director & Founder of Contros



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 IFM-GEOMAR (Prof. Körtzinger)  
 Raytheon Anschutz  
 bbe MOLDAENKE



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 Uni of Applied Science (Prof. Eisle)  
 Marine Tech. Air-Force  
 BS at Contros



**Foreman Sven Müller**  
 Capsum  
 Contros

# SubCtech - Background

## Former Projects & Jobs



Illustration: Dr. Schroeder, © HZG (GKSS)

**EU-417 MERMAID  
Monitoring Network**



**EU FerryBox**



Illustration: Dr. Knutz, © IAP  
**2000m ARGOS float**



**Our team has developed previously:**

OceanPack+  
2007

OceanPack/Micro  
2009

OceanPack/RACE  
2010

OceanPack MK2  
2010



**by Contract:**

- OceanPack
- Power (Li-Ion)
- DataLogger
- Nutrients (Systea)
- Aquaculture
- SailingOne



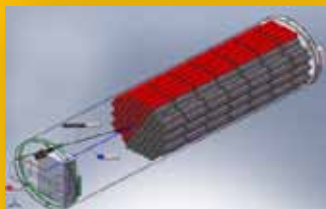
**Spin-Off  
Jan.2010**



# SubCtech - Business Units

## Subsea Power

- Li-Ion, Li-Polymer
- System Design
- Subsea Logger



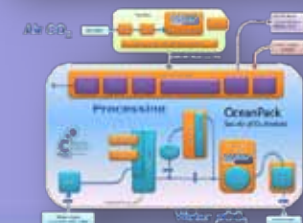
## Environmental

- FerryBox
- $p\text{CO}_2$  systems
- Monitoring





## Consulting

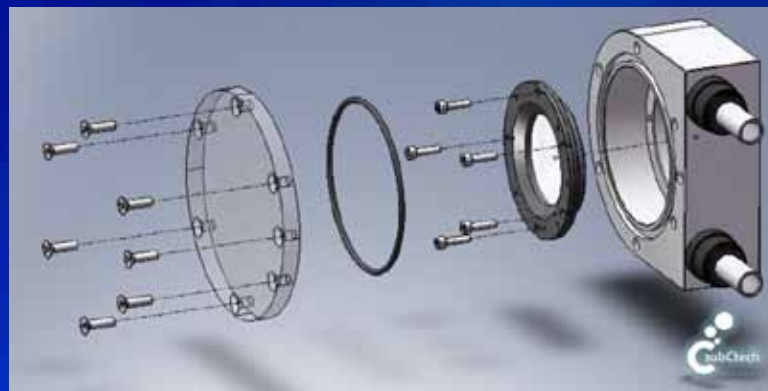
- Design
- Advising / Survey
- Distribution



## OceanPack

### Underway Technology:

- Optimized engineering: less leaks à less calibration required
- Optimized components: valves, pumps, membranes are produced specifically
- Best analyzer: developed in cooperation with  , already fully integrated
- Integrated automatic zero calibration, results are already processed
- Simply replaceable Flat-Membrane-Equilibrator, patent pending
- Open standard: integrated CF-Card Datalogger speaks  National Marine Electronics Association NMEA-0183 ASCII
- Open system design: flexible interfaces to other sensors, samplers or analyzers
- Marine environmental friendly: little effect of fouling, sedimentation or shocks



## *OceanPack*

### **Objectives:**

- Highly accurate measurements
- New markets such as small boats
- Applications under extreme conditions
- Small price
- Easy integration - ready to use :
  - Just connect Water in, Water out, Power - and get the Data
- Unattended operation, optionally automatic cleaning
- Very little maintenance for  $p\text{CO}_2$ :
  - No reference gases are needed while sailing
  - 1-button span calibration
  - Cassette membrane equilibrator
- Flexible and scalable system design

## Additional Components for the OceanPack

- Oxygen sensor (e.g. AADI Optode)
- Turbidity sensor (e.g. Wetlabs, Seapoint)
- Fluorometer (e.g. TriOS, Turner, Wetlabs)
- Thermosalinograph (e.g. Seabird SBE-45)
- Water Temperature (e.g. Seabird SBE-38)
- pH electrode (e.g. SubCtech Ocean-pH)
- Nutrients (e.g. SYSTEA Micromac)
- .....

### And special equipment

- TOP-Box for IRIDIUM, INMARSAT, ARGOS, GPS, Metrologic Sensors (e.g. BATOS)
- External Pumps, Valves, Water tanks...
- Debubbler, suitable for  $p\text{CO}_2$  analyzers
- Online Passenger Display
- Automatic Water sampler with sealed bottles
- Automatic Cleaning



Automatic cleaning filter for Nutrient Analyzers on SubCtech's OceanPack.



SYSTEA's Nutrient Analyzers with the marine adaption made by SubCtech.

# OceanoScientific® System:

## OceanoScientific

- Wind direction
- Wind speed
- Atmospheric pressure
- Air temperature
- Air humidity
- Radiation
- Sea surface fluorescence
- Sea surface power of hydrogen - pH
- Sea surface partial pressure of carbon dioxide -  $p\text{CO}_2$
- Sea surface salinity
- Sea surface temperature



© Photo SailingOne - www.oceanoscientific.org

OceanoScientific® Kit - October 2010

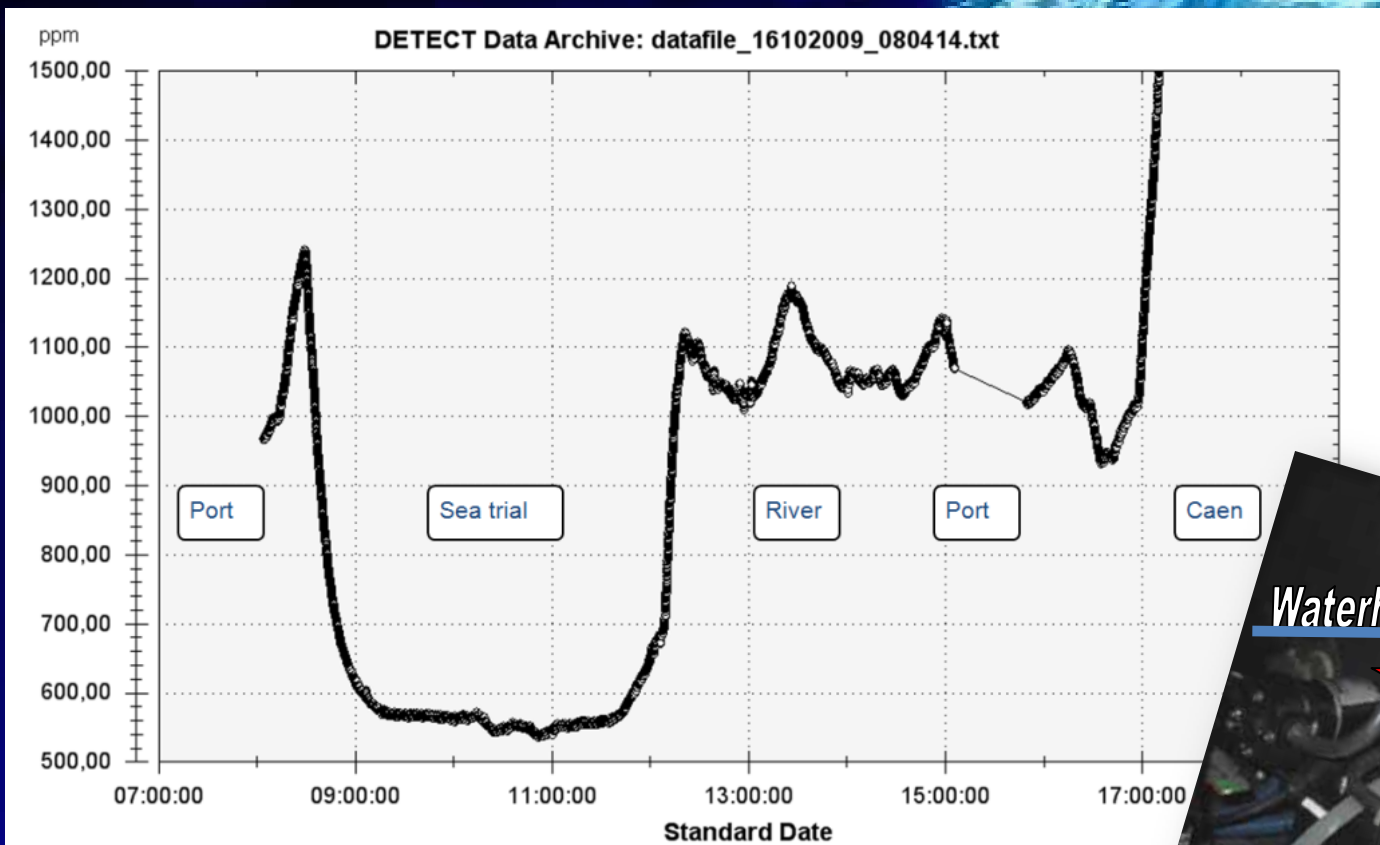


# Implementation on small vessels (like SolOceans<sup>®</sup> OneDesign):



[www.oceanoscientific.org/en](http://www.oceanoscientific.org/en)

Video: [www.youtube.com/watch?v=8CvUdUNcdsI&feature=related](http://www.youtube.com/watch?v=8CvUdUNcdsI&feature=related)



*First tests:*

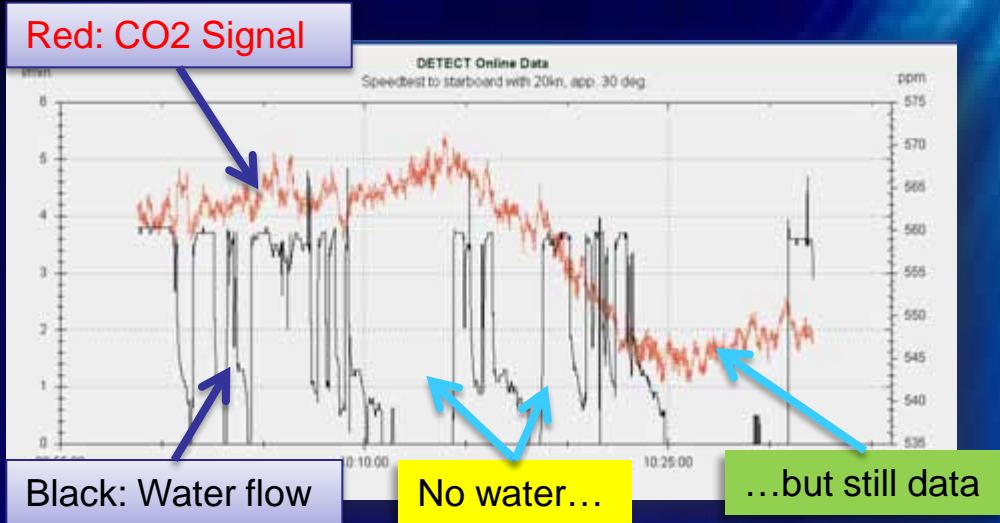
**Waterhorizon / Reservoir level**

**Ship roll angle**



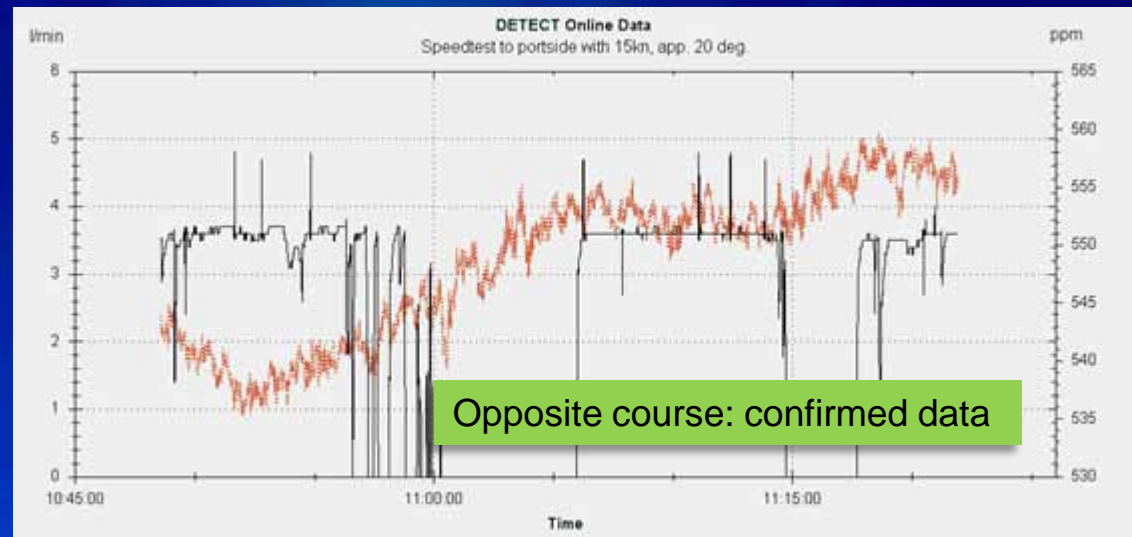
Caen – Orne river à Channel à Orne river - Caen

# Testing BREST:



Verification at opposite course  
Unprocessed raw data at 1 Hz

Worst-case „speed“ test



# Meereswettbewerb 2011: RV ALDEBARAN



Vessel and Campaign

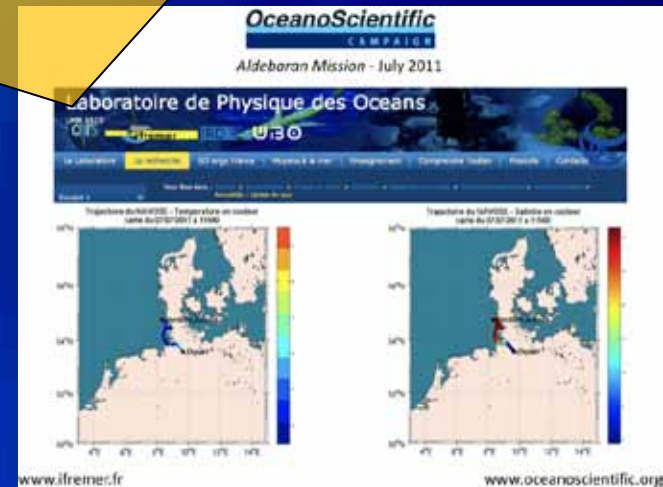


Team of young scientist

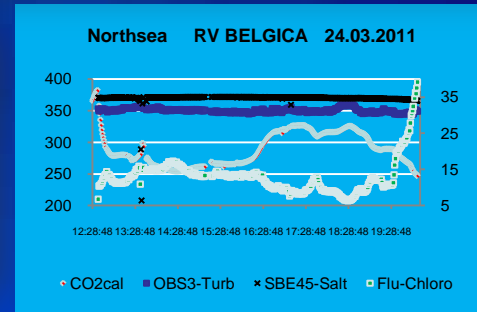
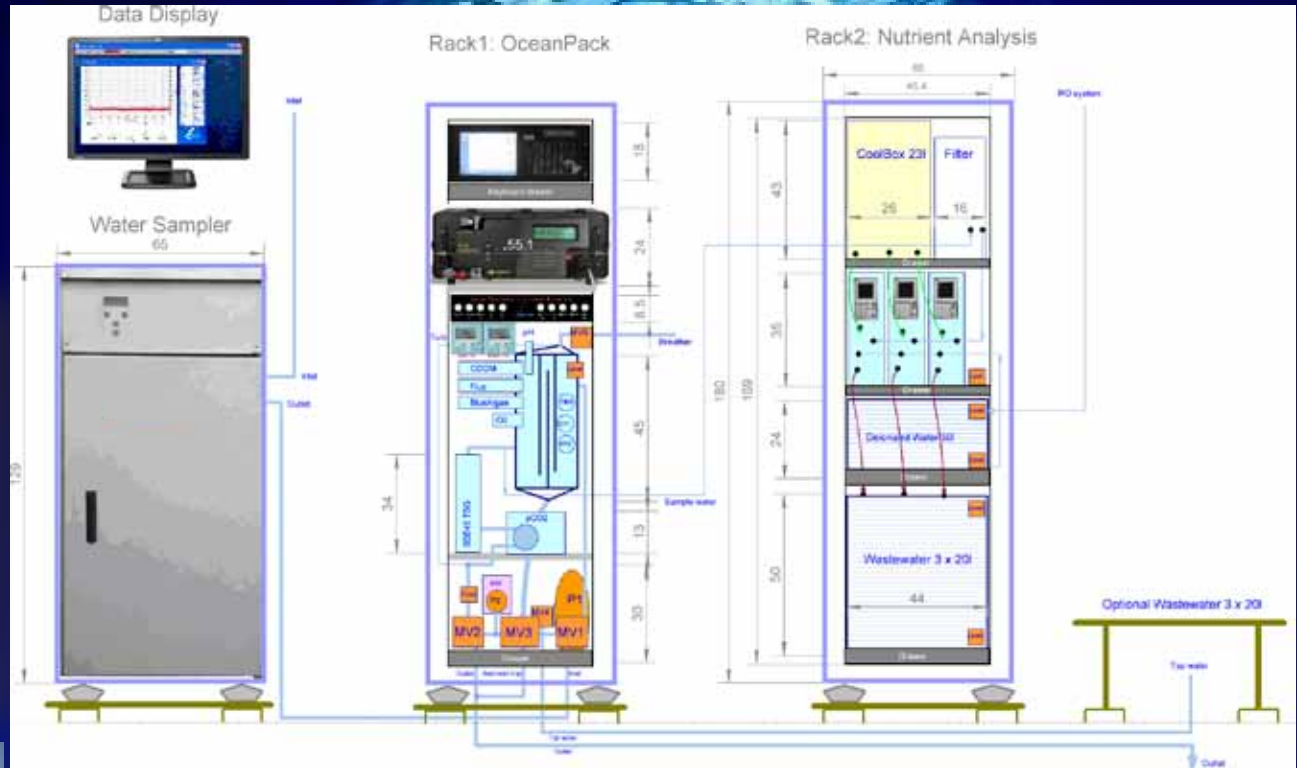
Technology:  
Fast to install,  
Easy to use,  
Modular,  
**Mobile**



[www.meereswettbewerb.de](http://www.meereswettbewerb.de)  
[www.aldebaran.org](http://www.aldebaran.org)



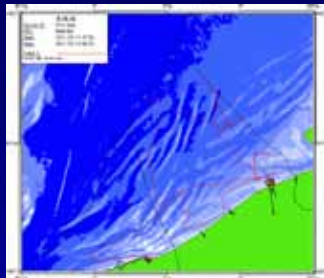
And in the evening input to  
the weather forecast



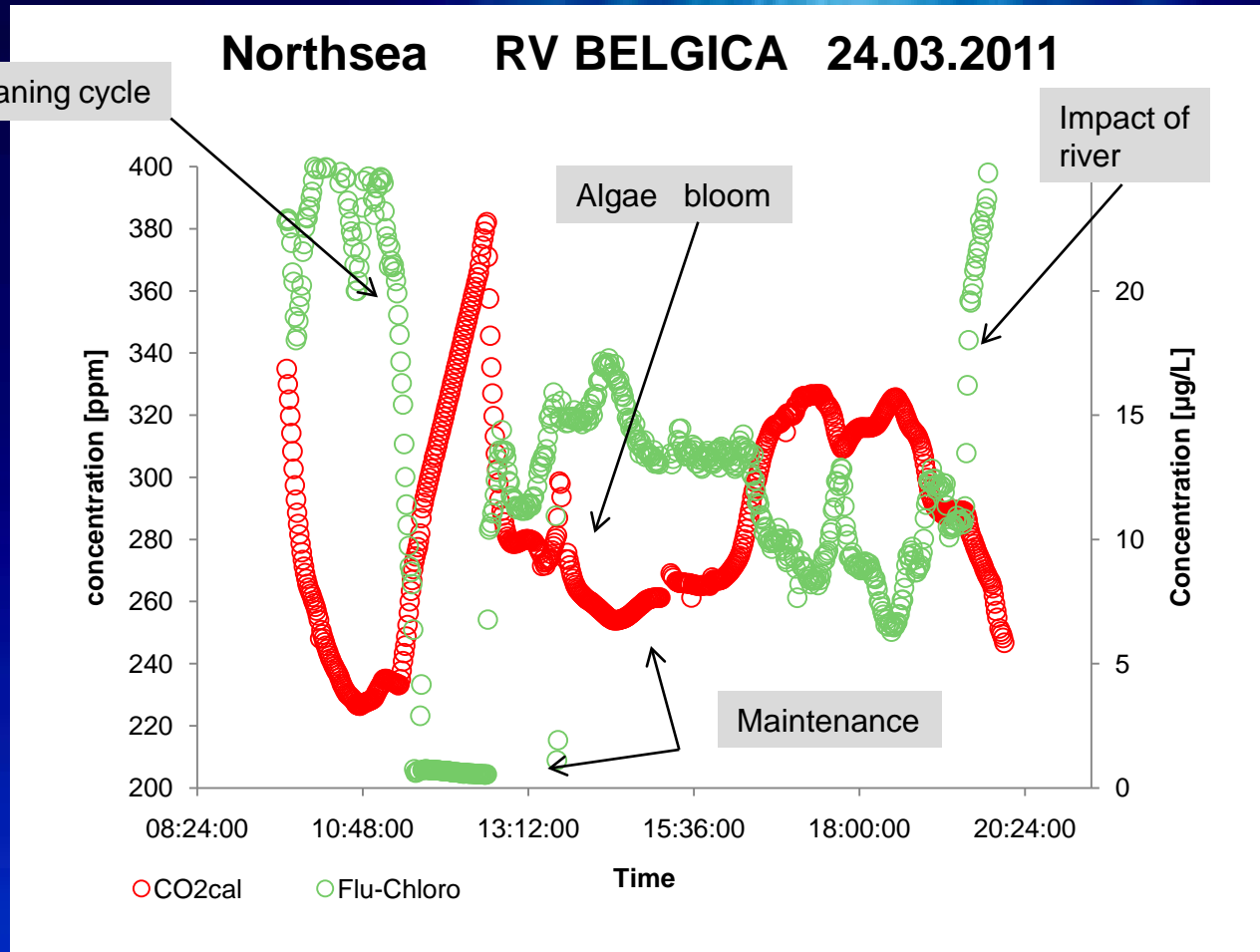
Complete water quality monitoring system  
(RV BELGICA)

# RV Belgica finished the 3 Weeks unsupervised cruise

UK



Belgium



Data provided by J.Baker,

Management Unit of the North Sea Mathematical Models

MUMM | BMM | UGMM

Department VI of the Royal Belgian Institute of Natural Sciences

Snapshot: an inter-calibration using 3 underway analyzers has just started yesterday.

Completed in 3 hours, time for coffee...

Will be installed since 3 days, still not finished





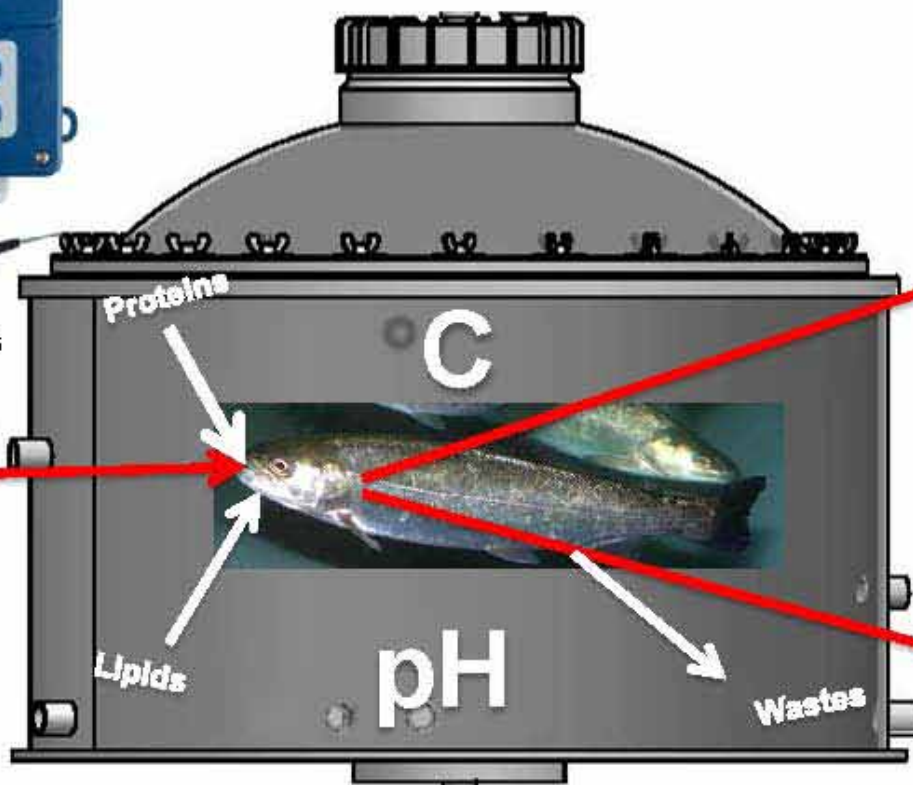
Gesellschaft für  
Marine  
Aquakultur  
Büsum

CAU

Christian Albrechts  
Universität zu Kiel

# How to measure the gas metabolism of ammoniotelic aquatic organisms?

## Stationary Application



**O<sub>2</sub>**

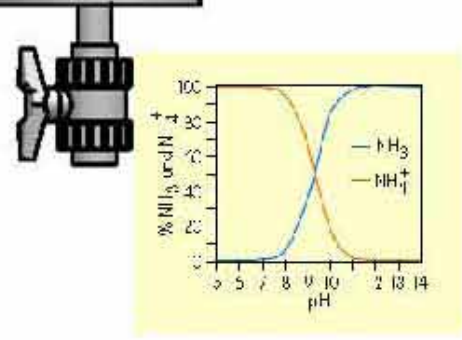
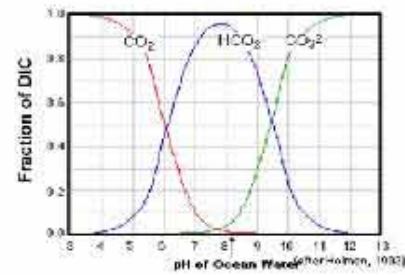
**CO<sub>2</sub>**

**NH<sub>3</sub>**

In cooperation with SubCtech Germany we develop a fast CO<sub>2</sub> meter for aquaculture applications.



Problem!! We need a very accurate pH measurement..



© SYSTEVA S.p.A



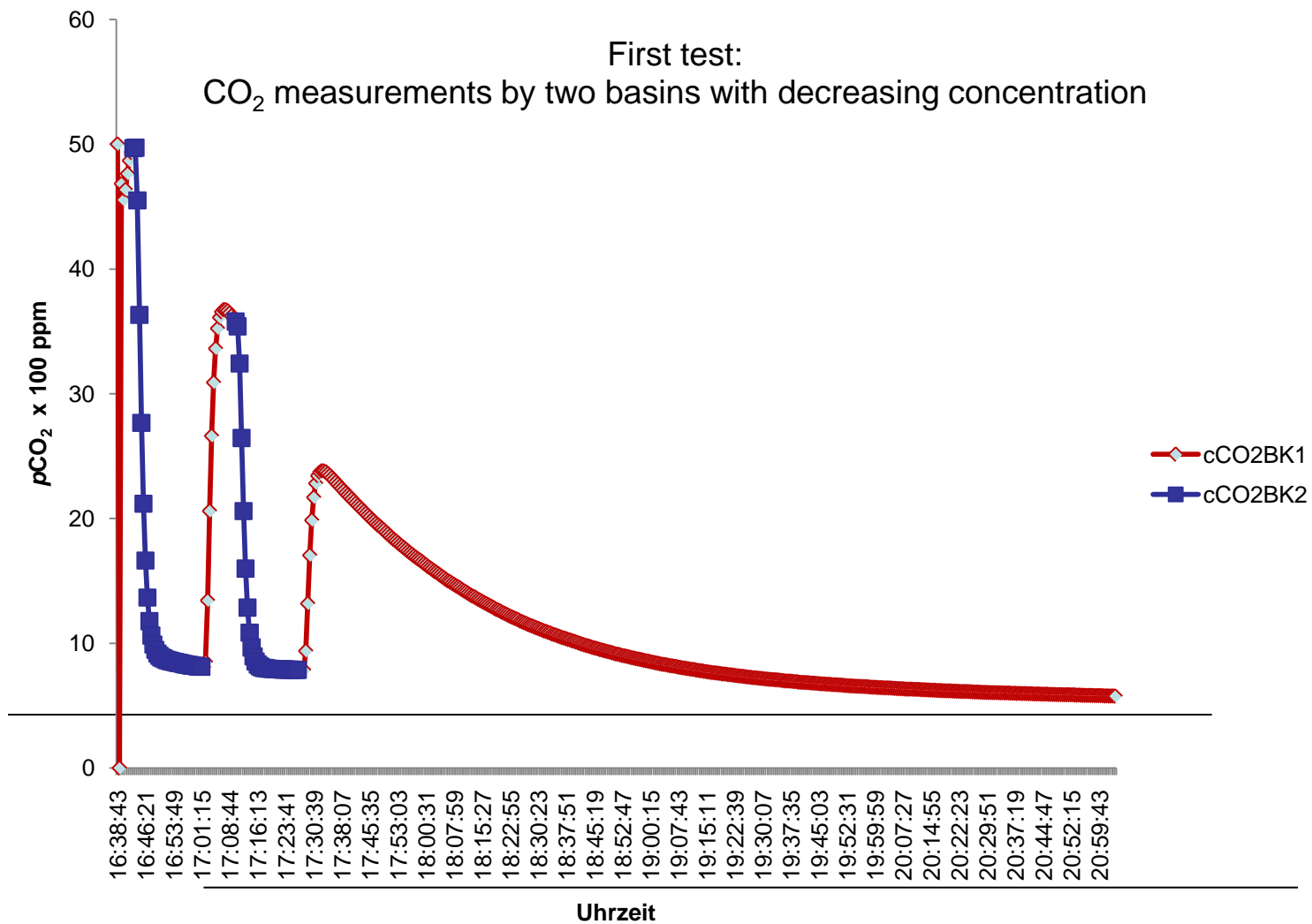


Gesellschaft für  
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Büsum

C | A | U

Christian Albrechts  
Universität zu Kiel

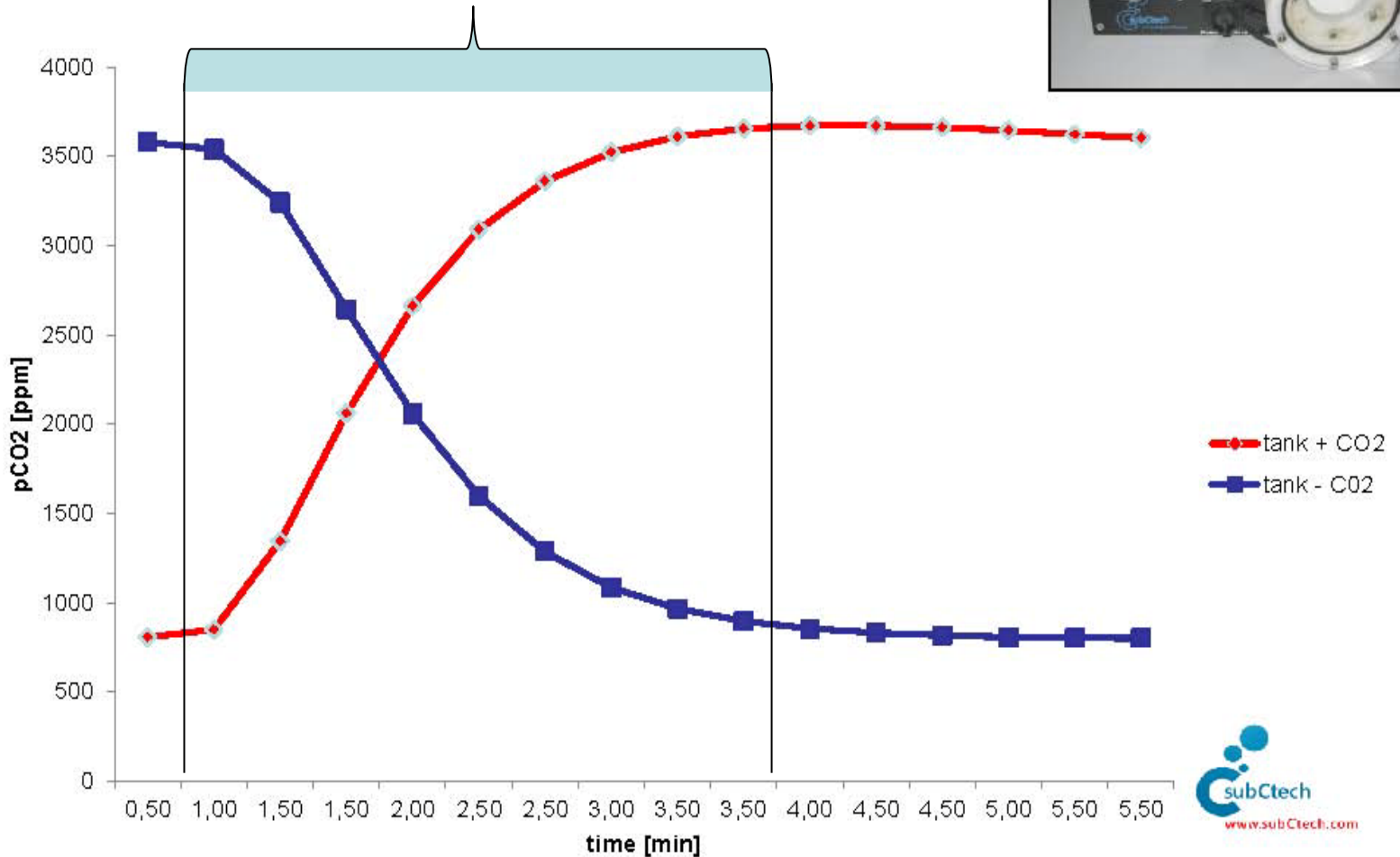
### First test: CO<sub>2</sub> measurements by two basins with decreasing concentration



FTZ Westküste der Universität Kiel in Büsum



First results:  
 New fast CO<sub>2</sub> analyzing method realized  
 3 Minutes T99 @ ΔC = 3000ppm



Further development of an online-controlled housing system to detect metabolic activity in fish (WeOStoFi)





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