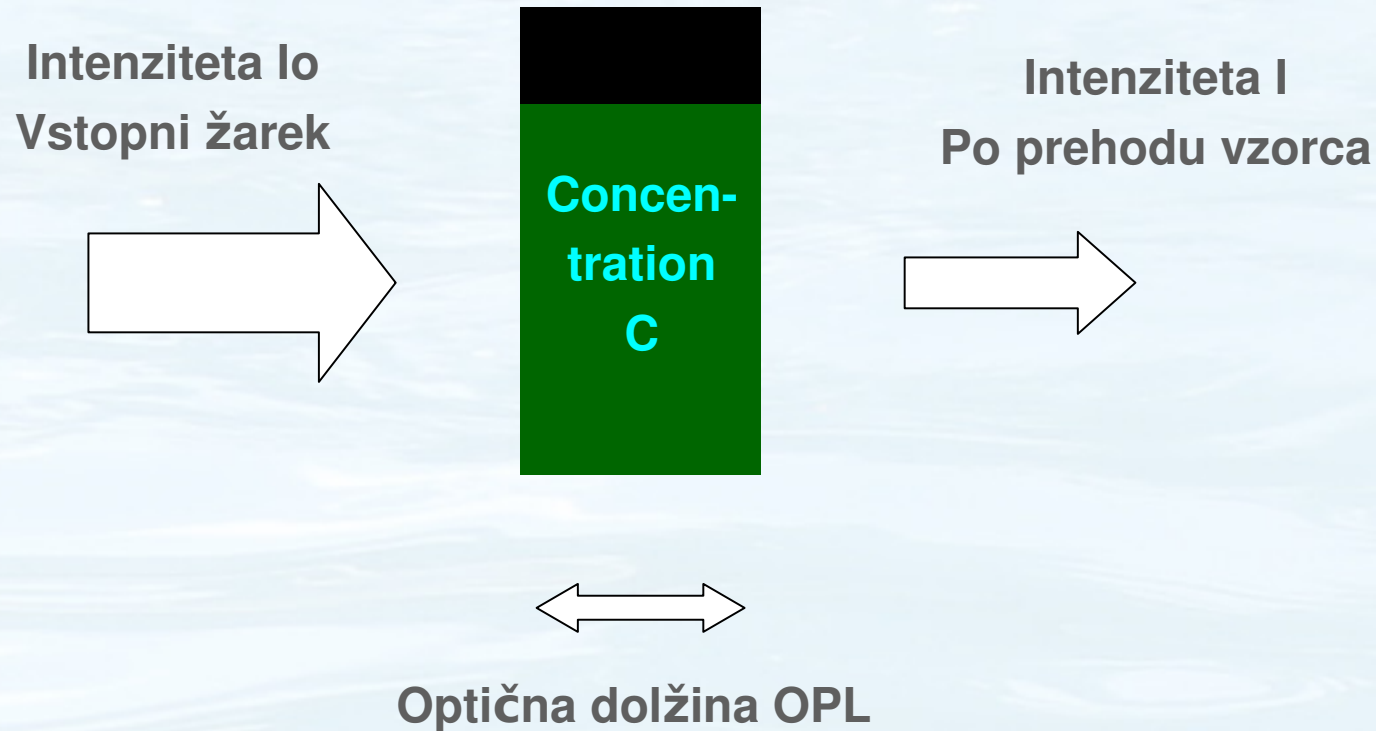


***Uporaba kontinuiranih merilnih
sistemov za določanje onesnaženja
pitnih in odpadnih vod s
spektroskopskimi metodami.***

dr. Andrej Holobar

Princip merjenja – Lambert Beer





Princip merjenja – Lambert Beer

$$\text{Absorbance } A = -\log(I/I_0) = \varepsilon * C * OPL$$

spektrometer meri razmerje med intenziteto I and I₀

I/I₀ - transmisija [%]

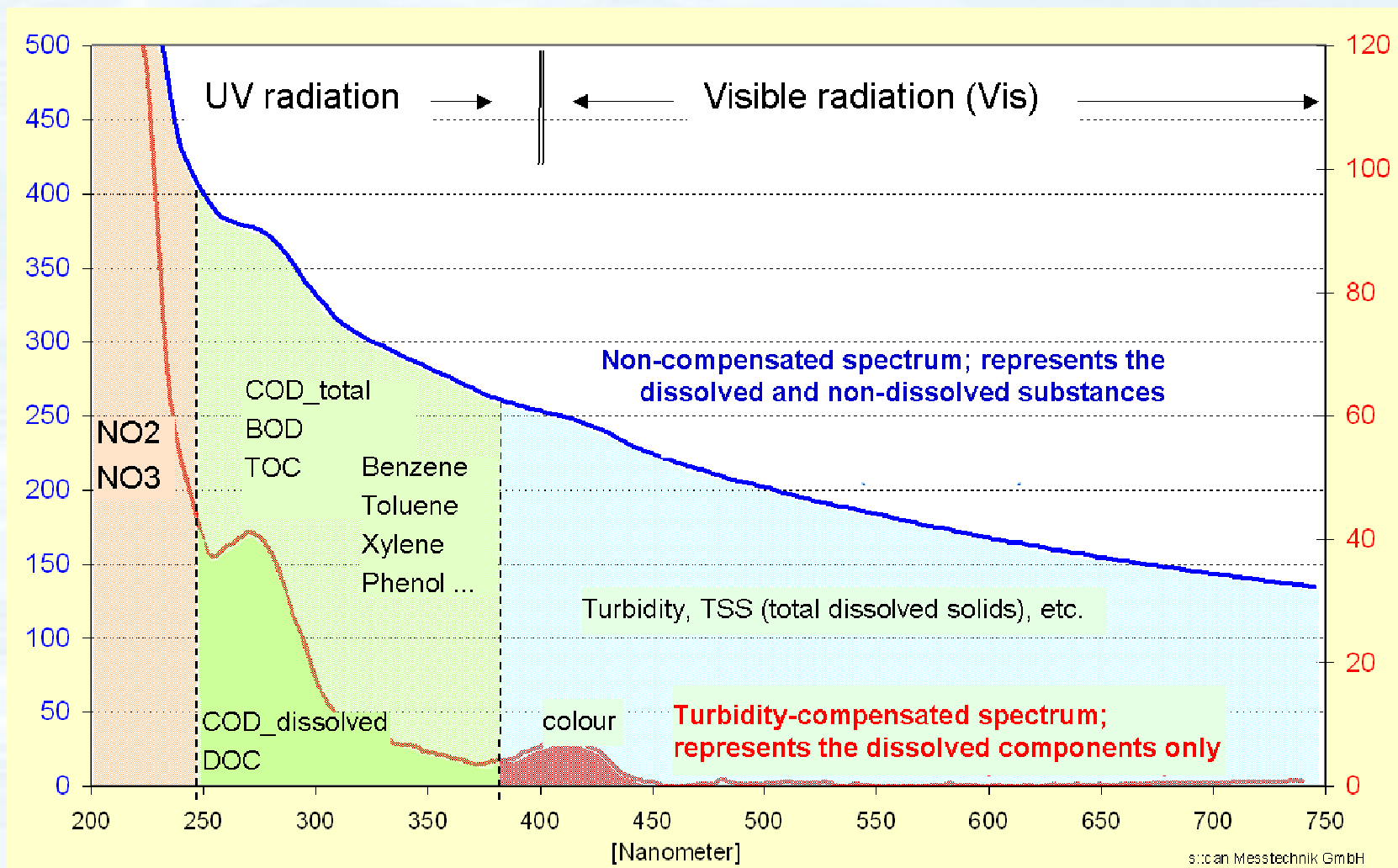
Dolžina optične poti je konstantna OPL

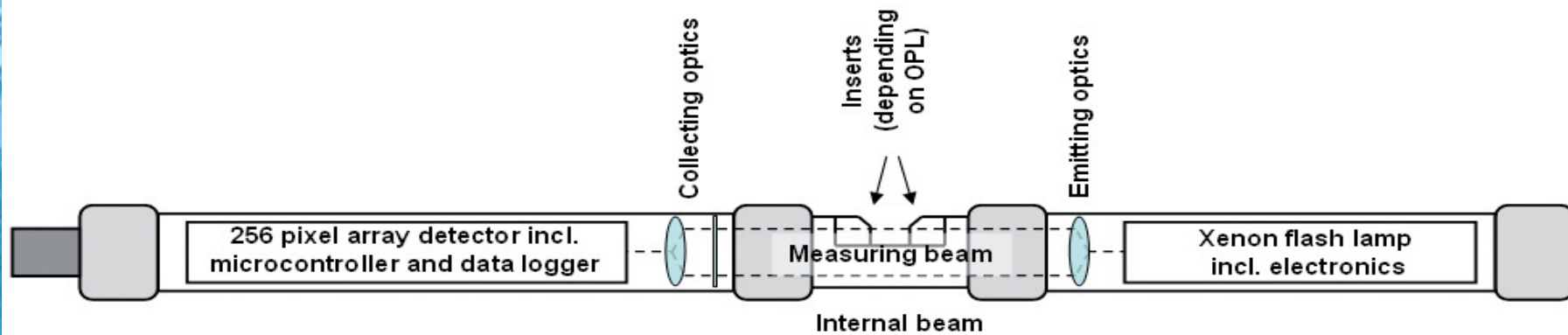
Standard Global Calibrations vsebuje molarni absorpcijski koeficient

ε (= extinction coeff.)

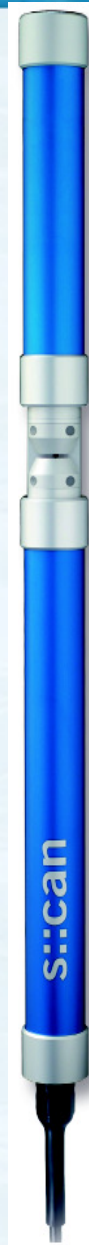
Lahko se napove koncentracija substance C

Pogoj: Substance mora absorbirati v območju UV-VIS











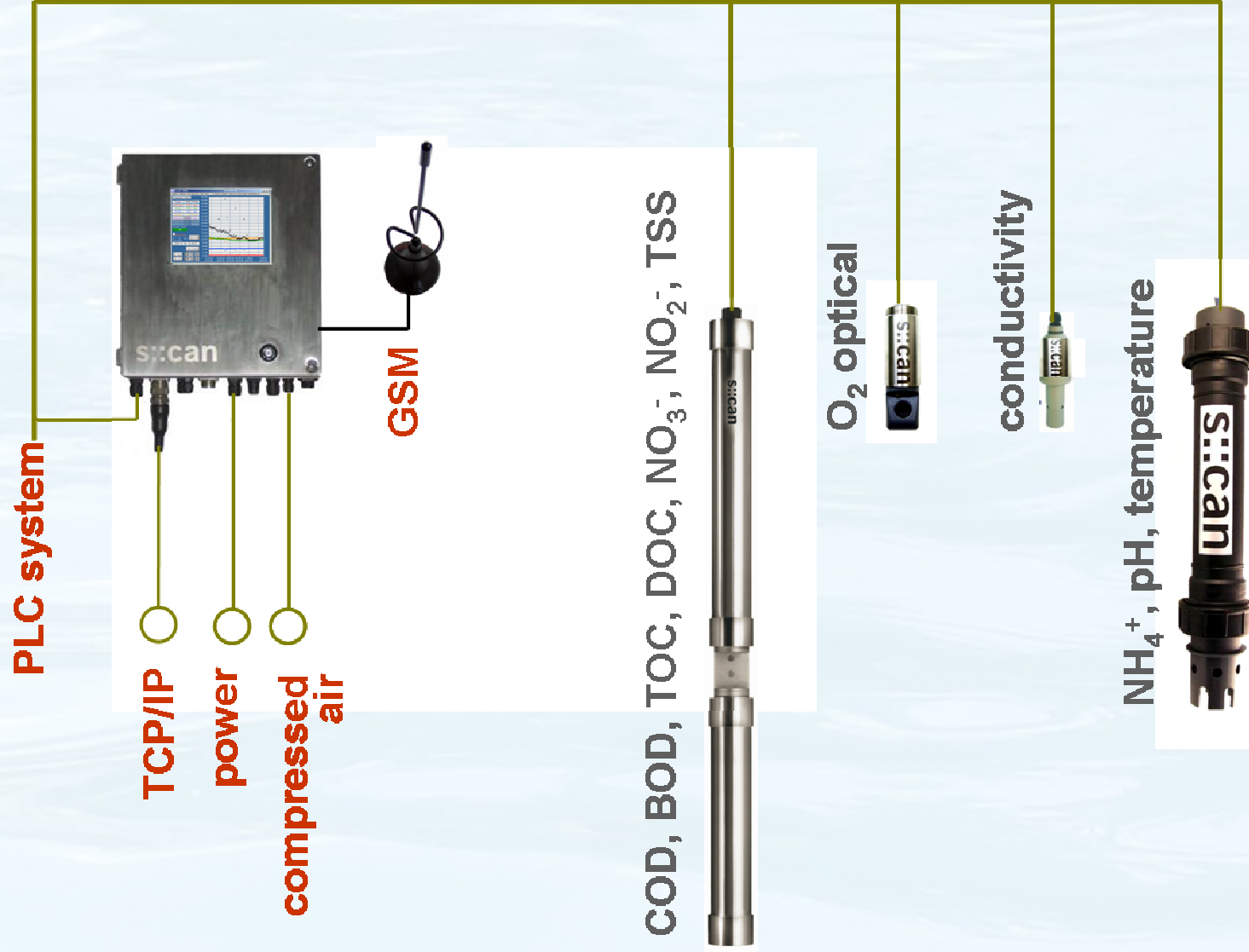
ECHO, d.o.o.; Stari trg 37; Slovenske Konjice, www.echo.si

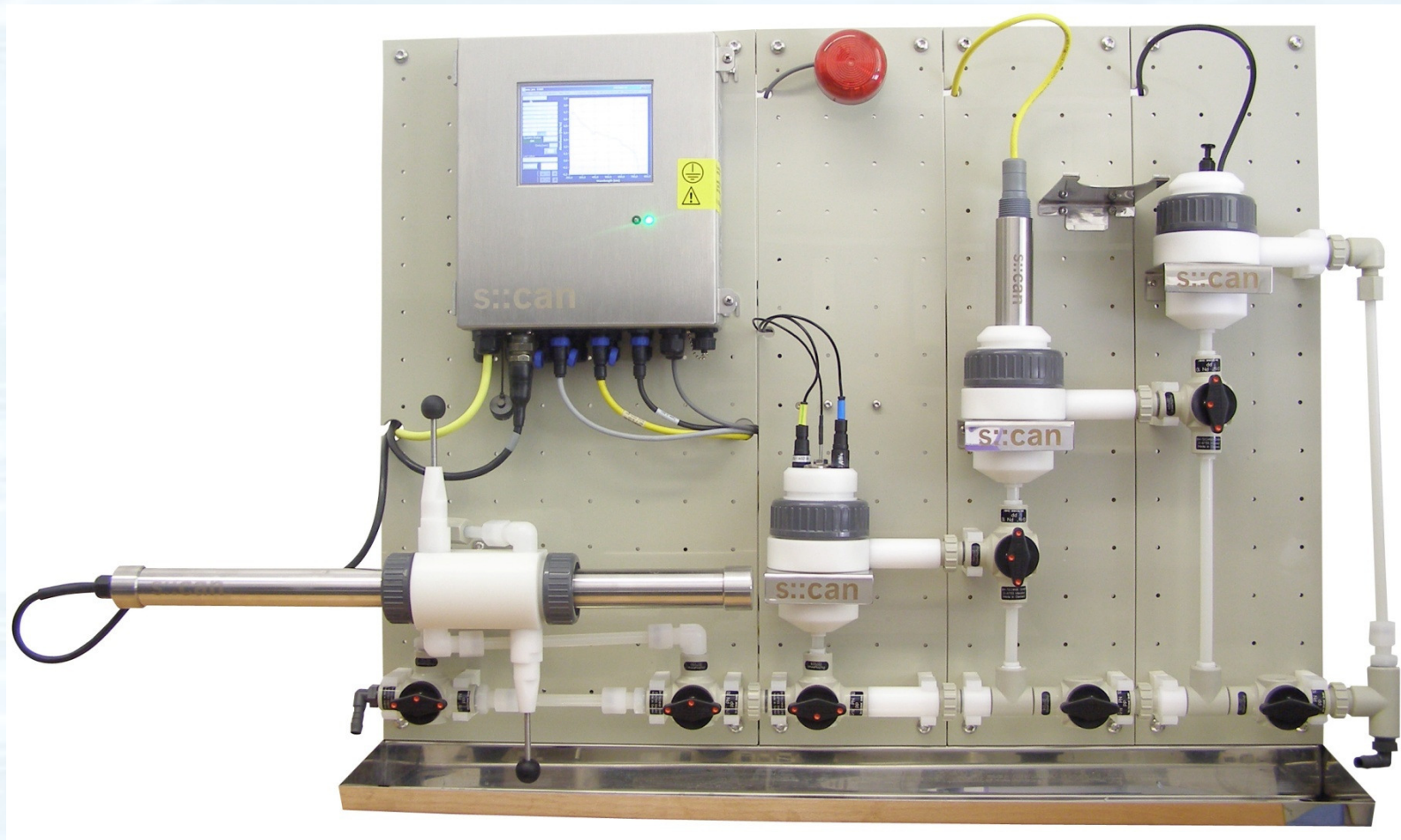


Potopna Spectrometrijska sonda

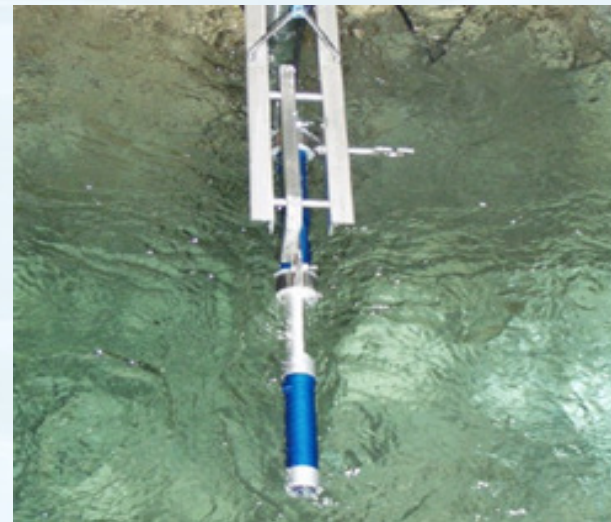
- InSitu & OnLine (brez vzorčevanja, priprave vzorca ...)
- preprosta montaža (potopna; by-pass; ...)
- možnost merjenja v različnih okoljih, baterijsko neodvisno
 - napajanje (12V), vsebuje zajem podatkov
 - avtomatsko čiščenje (komprimiran zrak)
 - brez gibljivih delov
- preprosto in cenovno ugodno vzdrževanje (ni cevi, črpalk, filtrov,....)
 - indirektna metoda, kalibracija v procesu
- parametri: SAC, COD, BOD, Nitrate, Nitrite, Turbidity,
 - BTX, Phenols, etc.

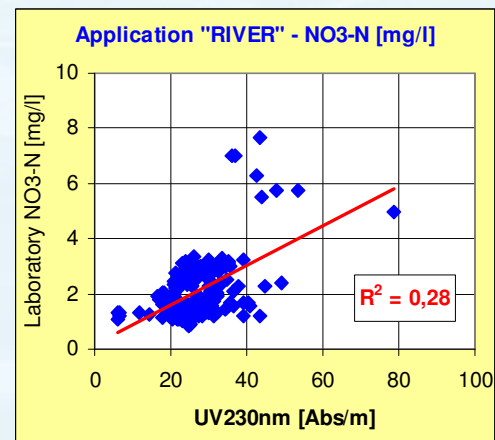
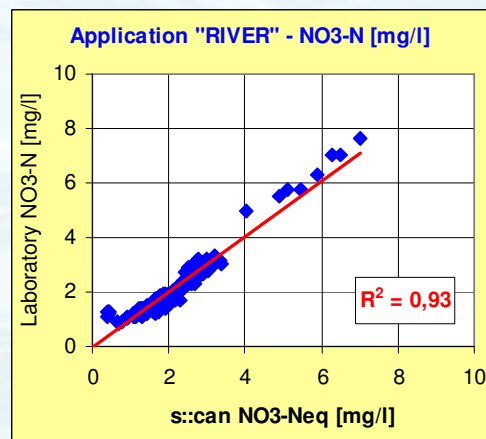
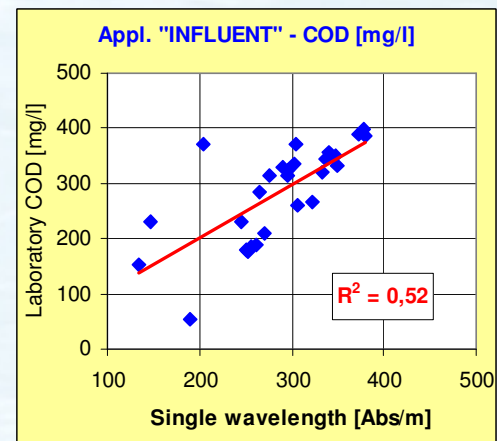
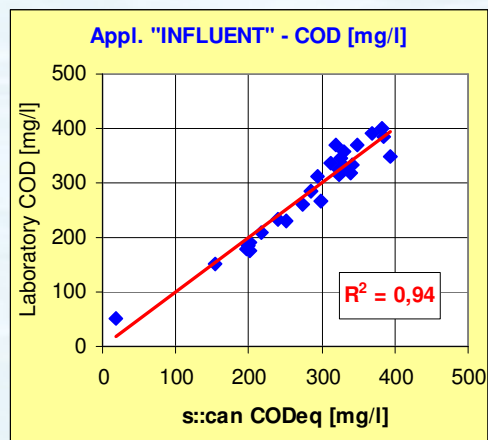
RS485 Bus, 12V, compressed air





ECHO, d.o.o.; Stari trg 37; Slovenske Konjice, www.echo.si





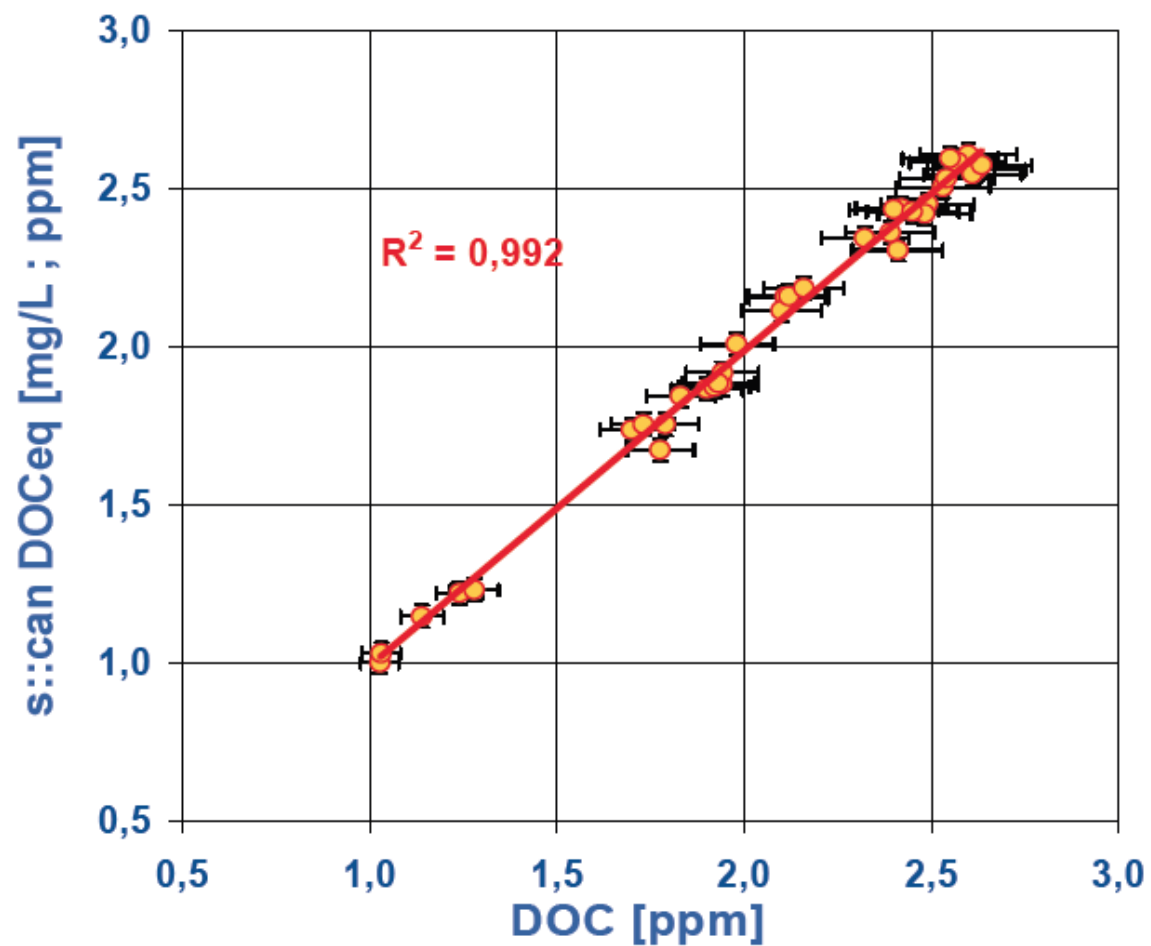
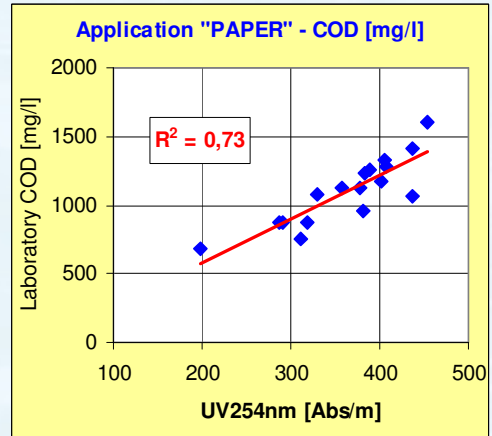
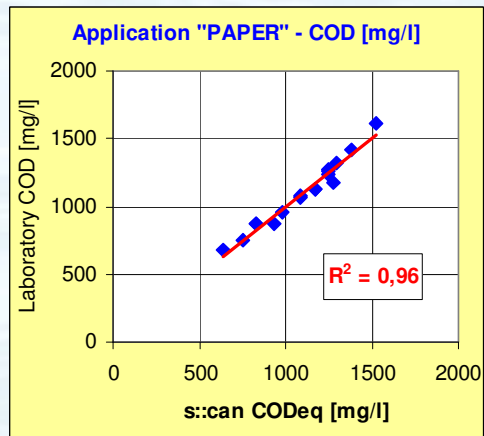
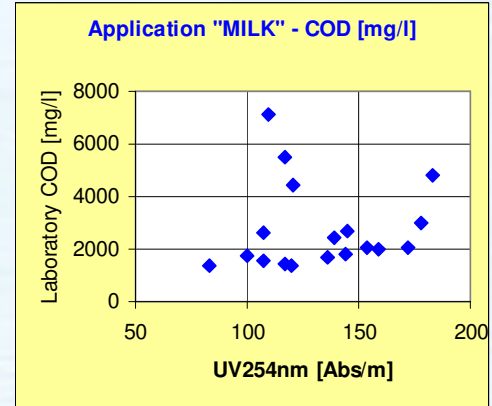
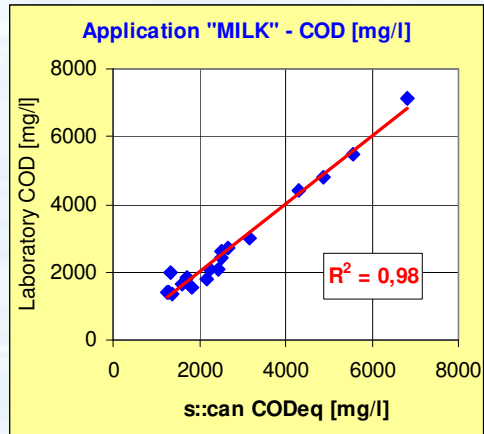
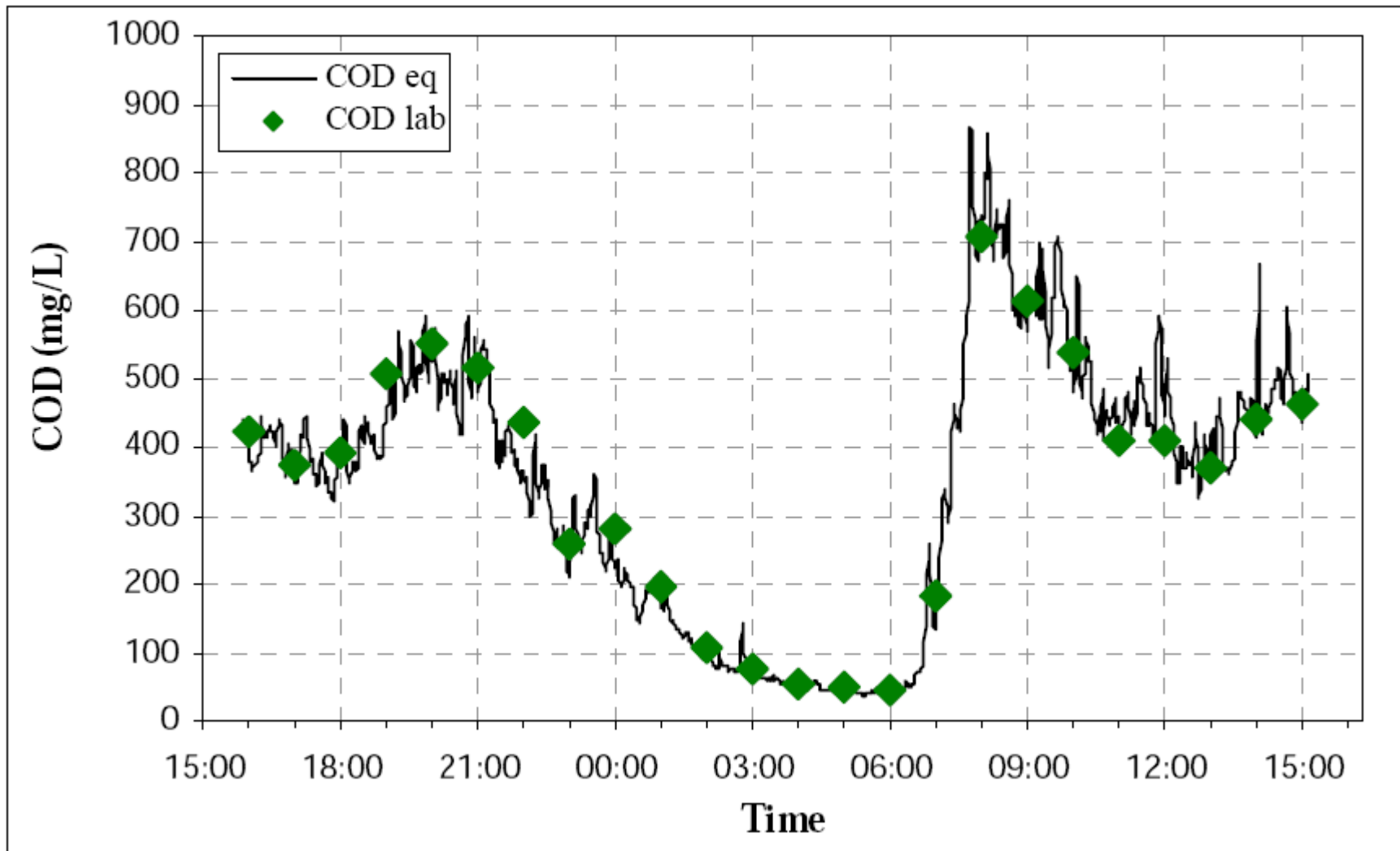
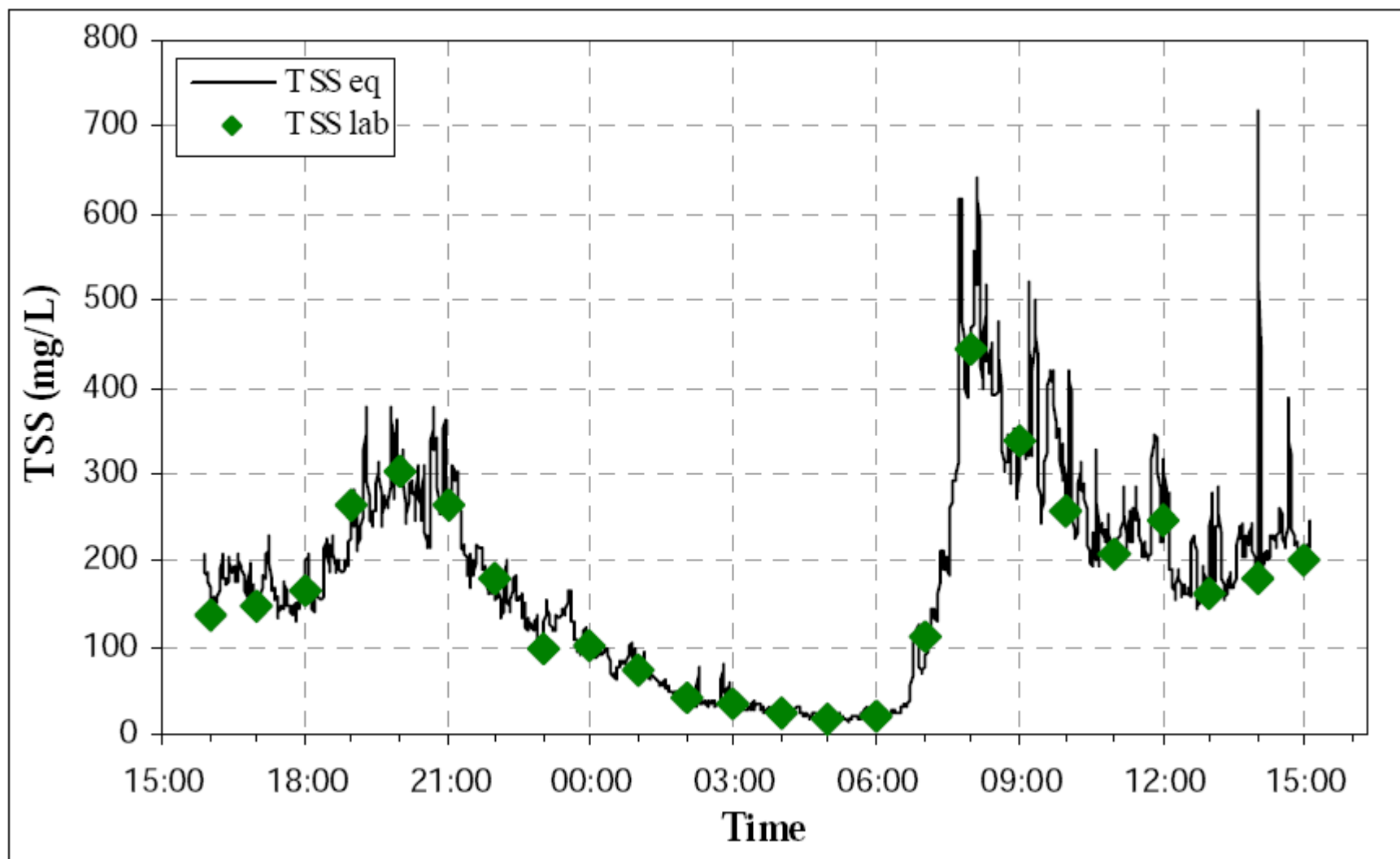


Figure 3: Comparison of spectro::lyser™ DOC equivalents with DOC measurements / LIFE Danube river project; $R^2=0,99$







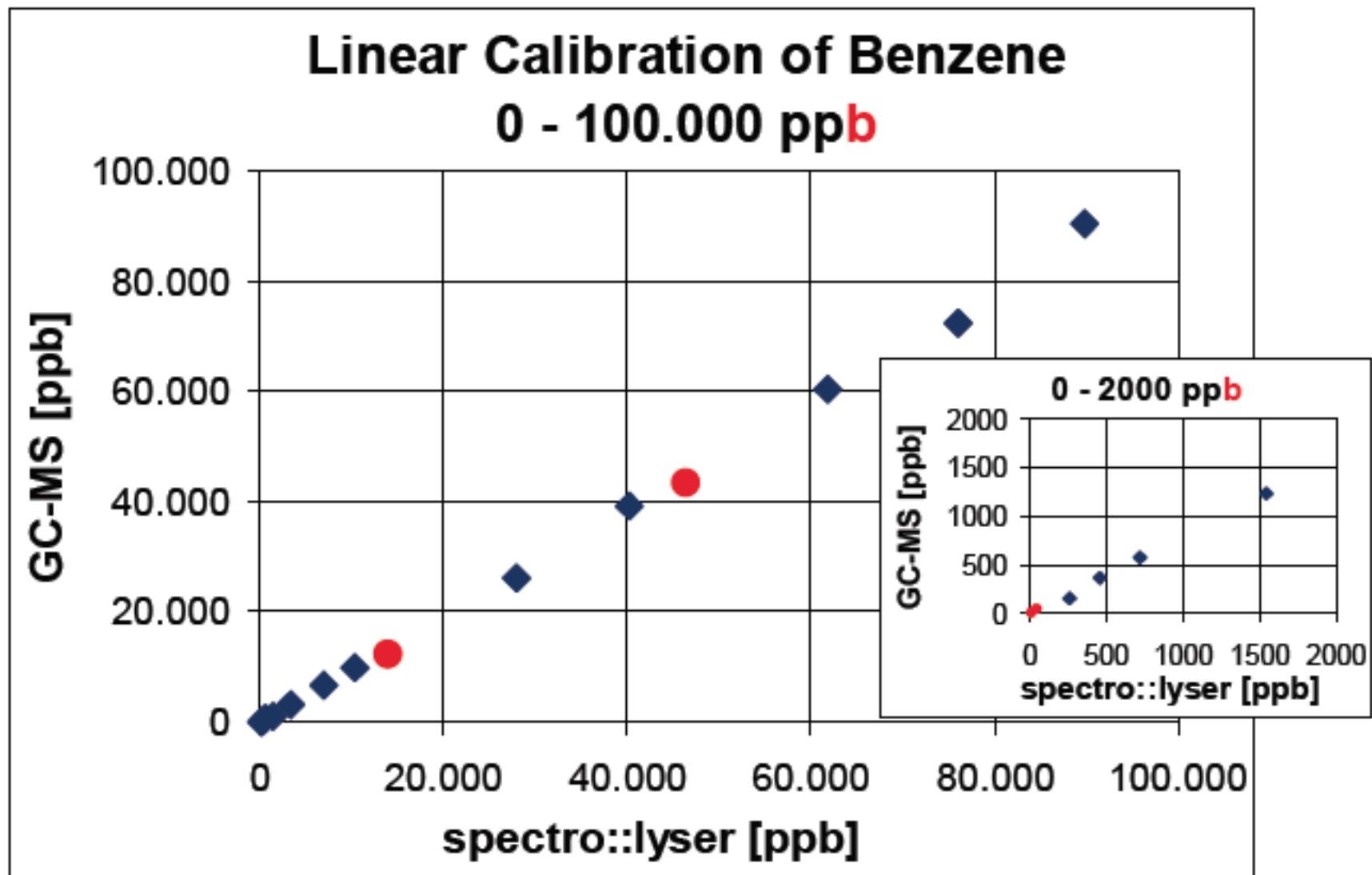
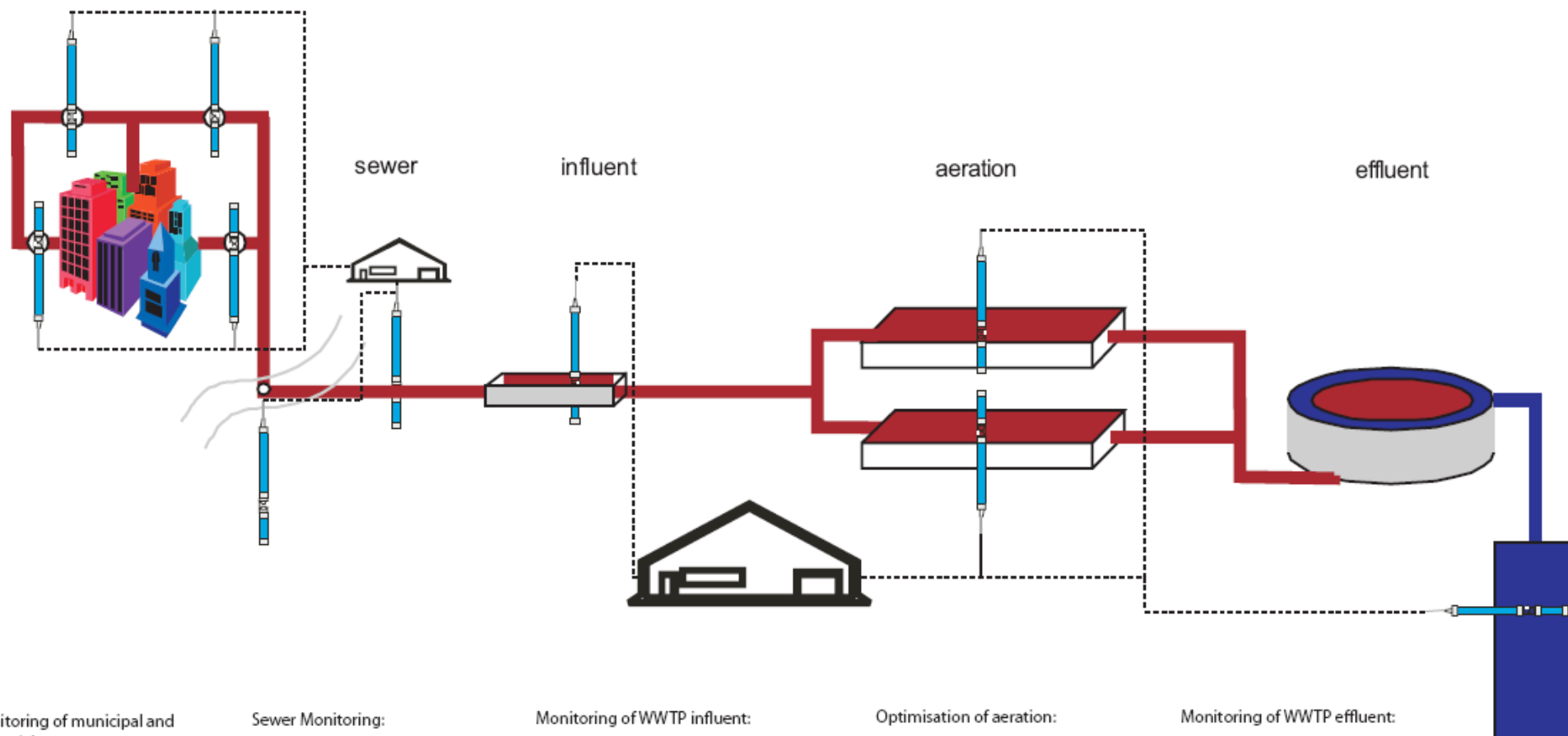


Figure 4: Linear calibration of benzene

industrial / municipal waste water



Monitoring of municipal and industrial waste water:

- Compliance with emission regulation limits
- Determination of process stability
- Determination of problems within/during the process
- Real time dosing
- Determination of product losses
- Effluent monitoring
- TSS
- COD
- NO3
- NH4
- pH
- EC
- ORP

Sewer Monitoring:

- Determination of waste water composition
- Identification of industrial dischargers
- TSS
- COD
- BOD
- NO3
- H2S
- Alarm
- NH4
- pH
- EC
- ORP
- O2

Monitoring of WWTP influent:

- Quantification of load and nutrients
- Judgement of consequences due to indirect dischargers
- Reaction to loadpeaks
- Real time dosing
- TSS
- COD
- BOD
- NO3
- H2S
- Alarm
- NH4
- pH
- EC
- ORP
- O2

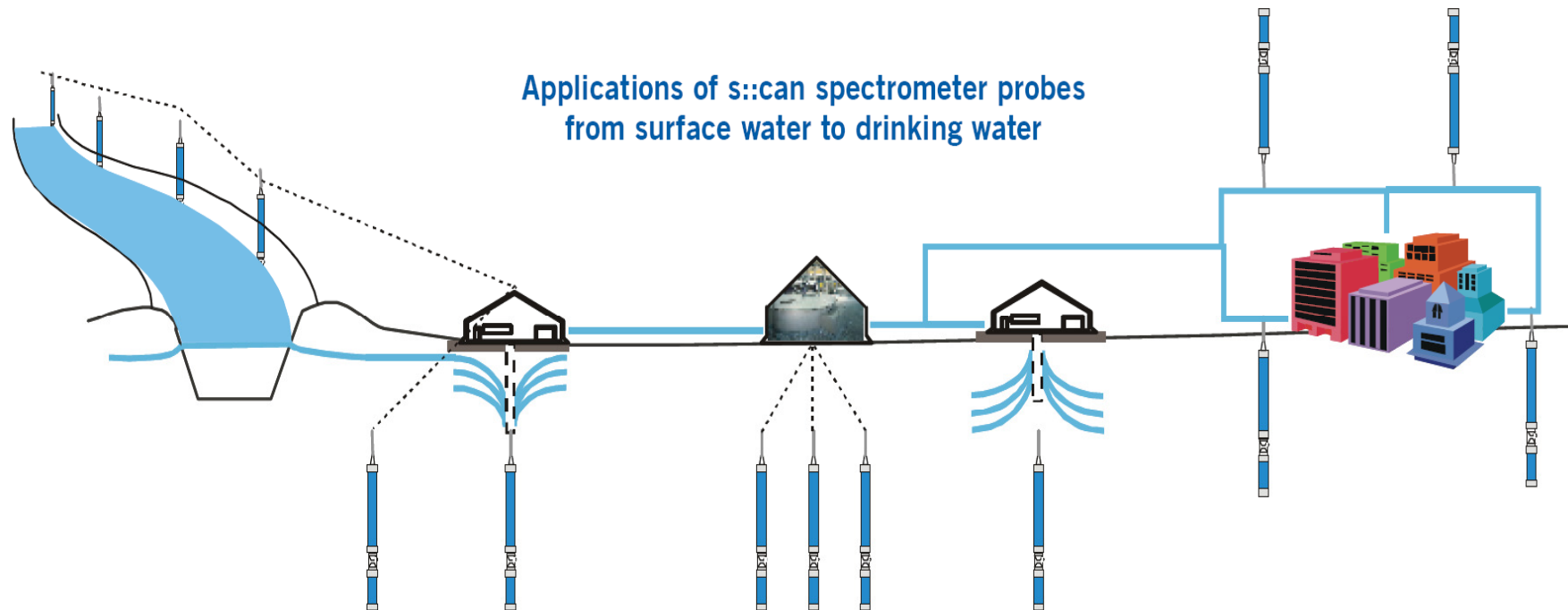
Optimisation of aeration:

- Cost savings due to process optimisation
- Nitrification- und denitrification control in real time
- Reduction of operational costs
- TSS
- NO3
- NO2
- NH4
- TS
- O2
- ORP
- pH

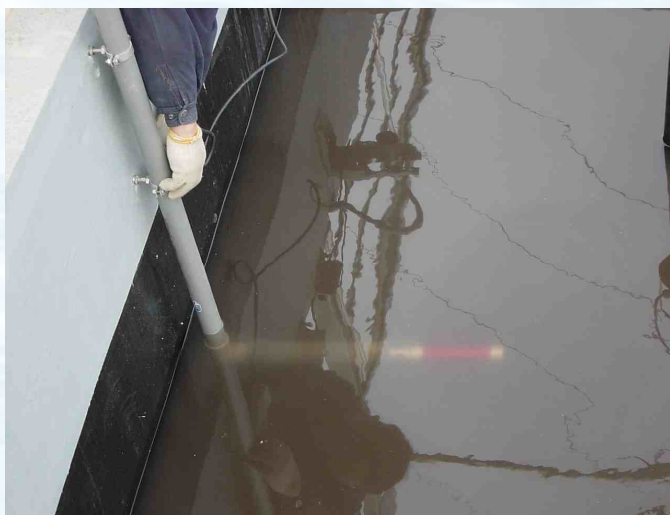
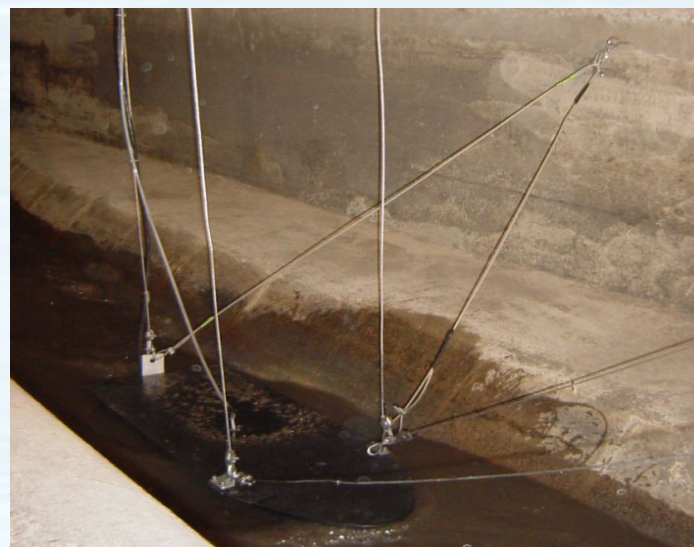
Monitoring of WWTP effluent:

- Determination of efficiency
- Control of cleaning process
- Compliance with emission regulation limits
- TSS
- COD
- BOD
- NO3
- NO2
- NH4

Applications of silicon spectrometer probes
from surface water to drinking water



Spektrometer	Fotometer		Klasični on-line analizatorji
Točnost	***	*	****
Stabilnost (drift)	****	***	**
Kalibracija	***	**	****
Vzdrževanje	****	****	*
Nabavna cena	*****	****	*
Cena vzdrževanja	****	****	*



ECHO, d.o.o.; Stari trg 37; Slovenske Konjice, www.echo.si



ECHO, d.o.o.; Stari trg 37; Slovenske Konjice, www.echo.si



Figure 9: Efficiency of the automatic cleaning - the sensor is dirty but the measuring path is free of fouling


con::cube

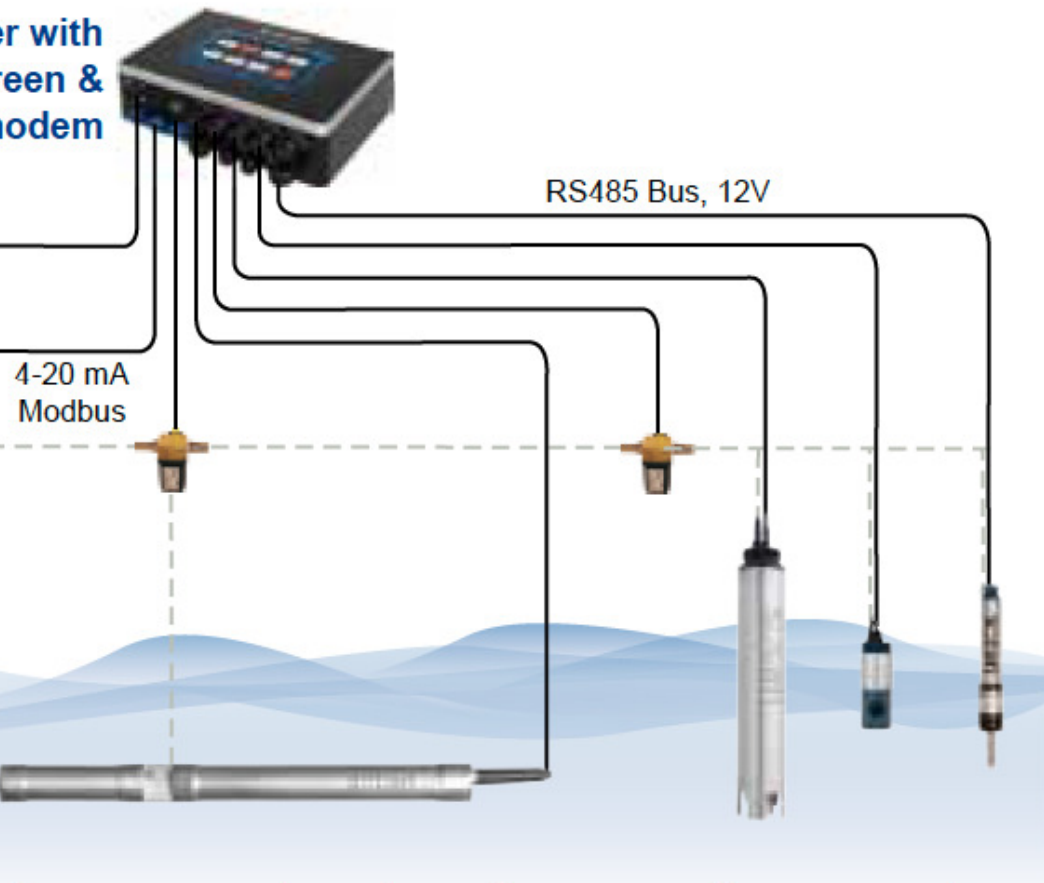
 GSM / GPRS

**datalogger with
touch screen &
modem**

power supply 

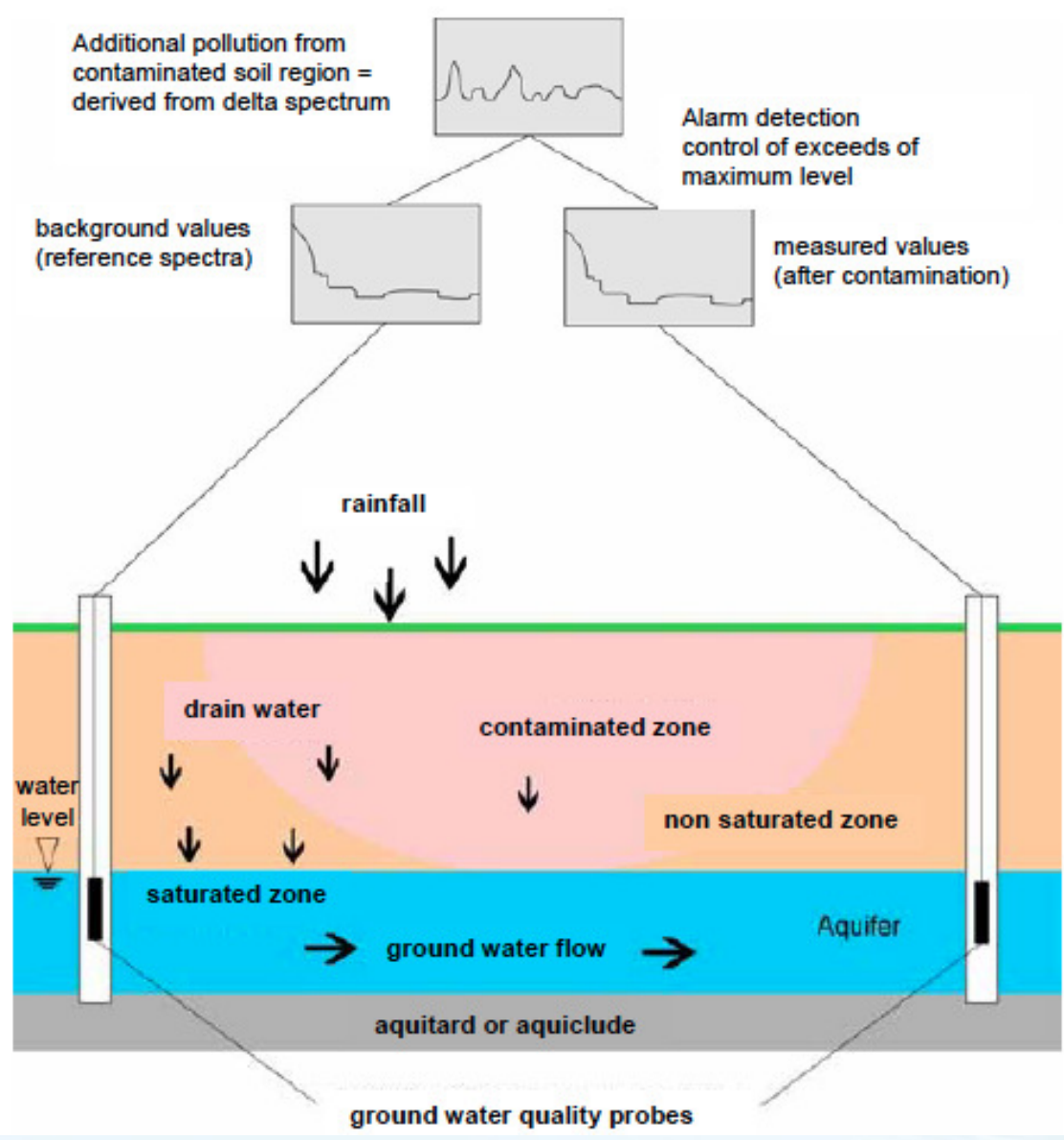
SCADA 

compressed air 



1 x s::can spectrometer probe
(NTU, COD, BOD, NO3)

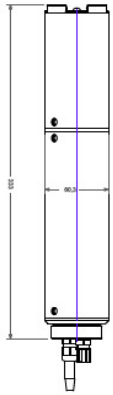
3 x s::can probe
(NH4, Cl-, pH, DO, EC, Temp)



	spectro::lyser™	carbo::lyser™	nitro::lyser™	color::lyser	multi::lyser™	ammo::lyser™ eco	oxi::lyser™	ammo::lyser™ pro	uv::lyser	ozo::lyser	chlori::lyser	condu::lyser	redo::lyser	pH::lyser	soil::lyser	turbi::lyser	
quantity of parameters*	8	4	2	2	4	4	2	4	3	2	1	2	2	2	1	1	
parameter																	
BOD	18	20			24												
COD	18	20			24												
BTX	18																
TOC	18	20			24												
DOC	18	20			24												
UV254	18	20			24			30									
NO ₃ -N	18		26		24	34		34									
NO ₂ -N	18																
NH ₄ -N						36		38									
K ⁺								38									
free chlorine											54						
TSS	18	20	26		24			30							x		
turbidity	18	20	26	22	24			30								52	
color	18			22													
pH						36		38						46			
ORP												48					
conductivity												50					
temperature	18	20	26	22	24	36	44	38	30	28	54	50	48	46			
O ₂							44										
O ₃	18									28							
H ₂ S	18																
AOC	18																
fingerprints	18																
contamination alarm	18																
hydrocarbon alarm	18																
pressure	18	20	26	22	24				30	28							
measuring method																	
spectral UV	X																
spectral UV-Vis	X	X	X	X	X				X	X							
ISE						X		X									
fluorescence							X										
optical / infrared															X	X	
glas electrode												X	X				
amperometric											X						
platinum ring												X					

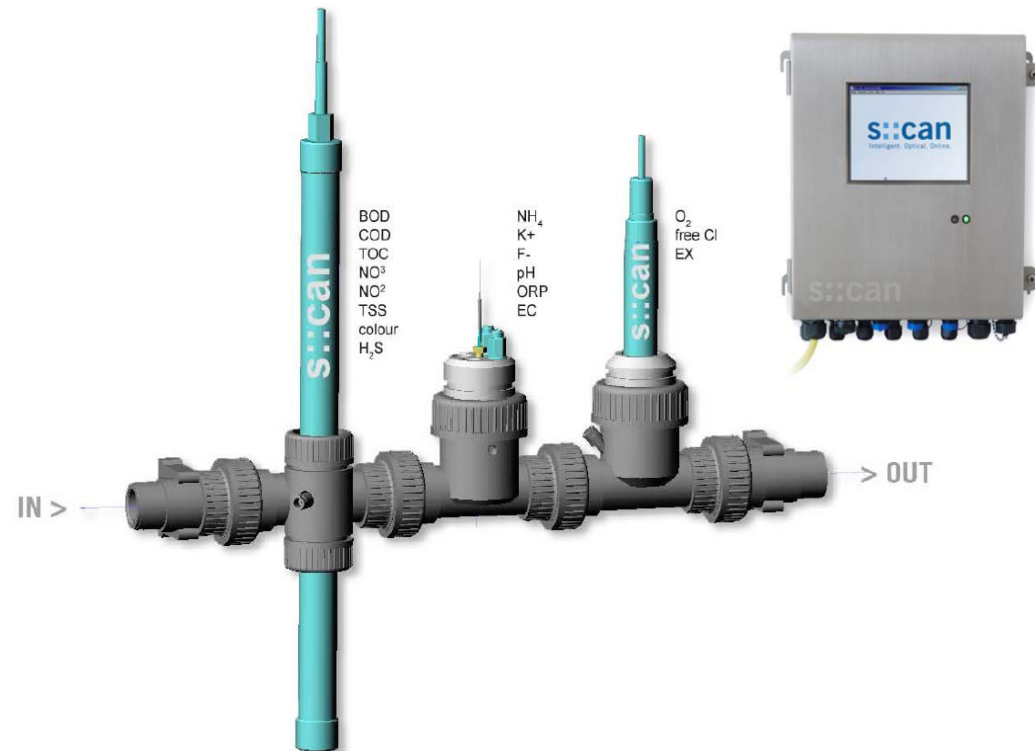


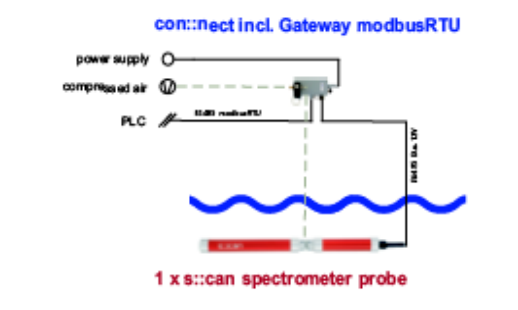
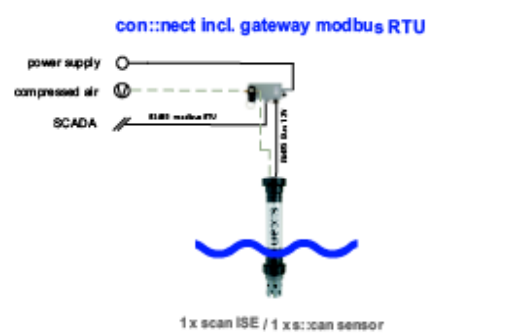
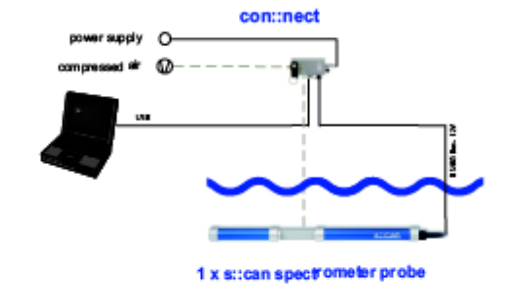
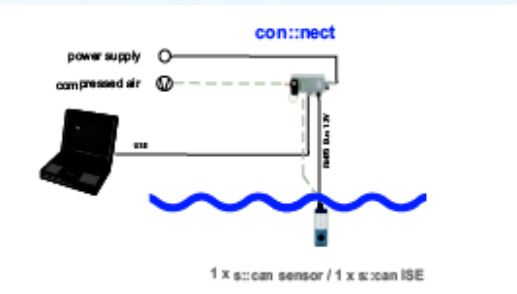
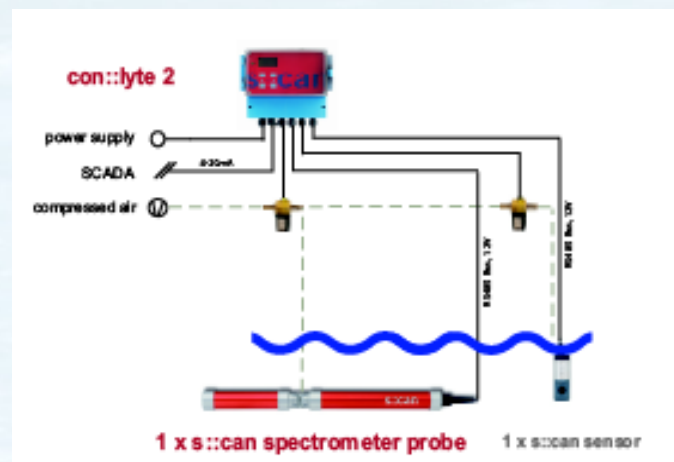
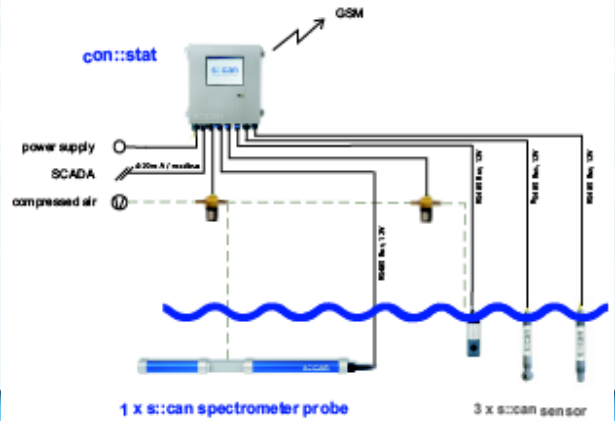
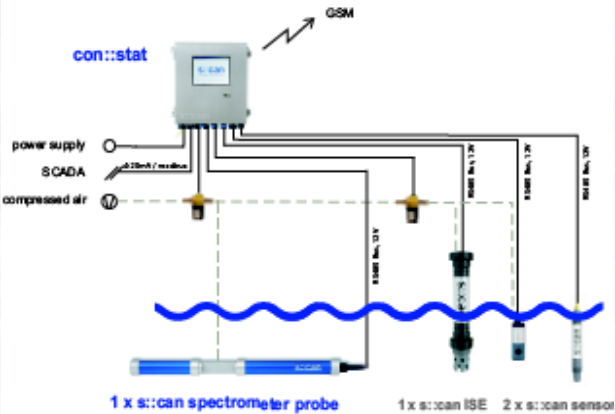
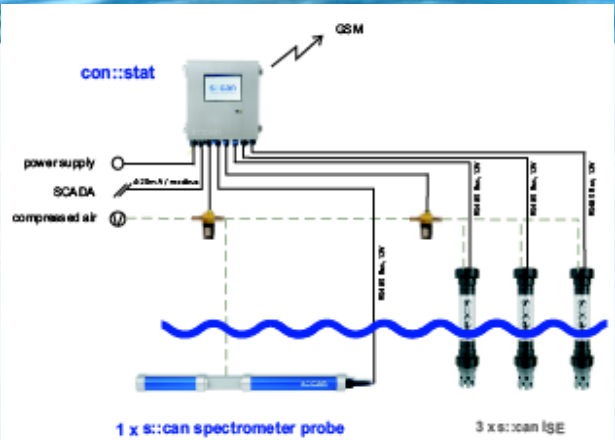
fig.1: ammos:lyzer™ - electrodes



Water Quality Monitoring Station (Waste Water)

- s::can plug & measure: measurement can start immediately after connection of process pipes
- one s::can terminal for all sensors, one data format, easy operation via s::can software
- modular system, wide range of parameter-combinations selectable, eg.: COD, BOD, TOC, DOC, UV254, NO₃-N, TSS, NH₄-N, K, pH, conductivity, H₂S, fingerprints and contaminant-alarms
- different modules available - select any module/parameter combination you need; start with a simple module and add other modules or sensors later at any time, or invest into a complete station and have all parameters available that comprehensively describe your water quality
- minimal requirement on local infrastructure, very little space required
- cost efficient: no reagents or consumable parts (except membranes for ISE probes)
- minimal maintenance of s::can probes, remote diagnostics possible
- for applications in waste water (even untreated waste water)
- all sensors precalibrated ex works
- by far lowest system operation costs on the market





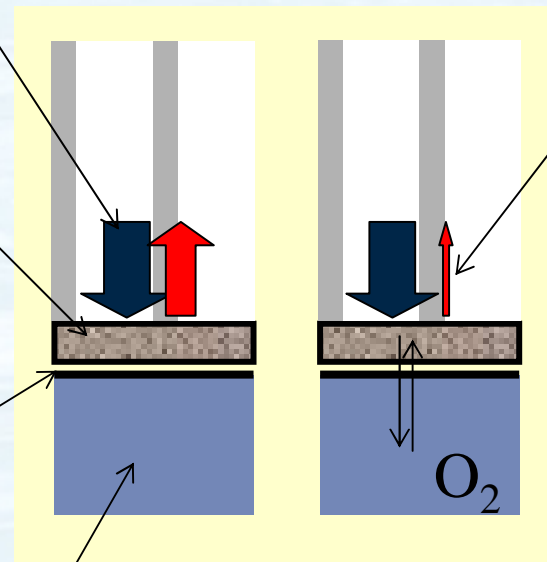
measuring principle

light (specific wavelength, controlled intensity) is transmitted to a ruthenium compound

sol-gel matrix inclusive ruthenium compound

coating of the sensing element

waste water



light emitted **from** the ruthenium compound: the higher the concentration of DO the smaller the energy

“quenching” = signal

technical specification

Measuring principle: Fluorescence intensity
Measuring range: 0.0 to 25.0 ppm
Sensitivity: 0.02 ppm
Precision: 0.02 ppm
Accuracy: 1 % of reading or 0.05 ppm
(whichever is greater)

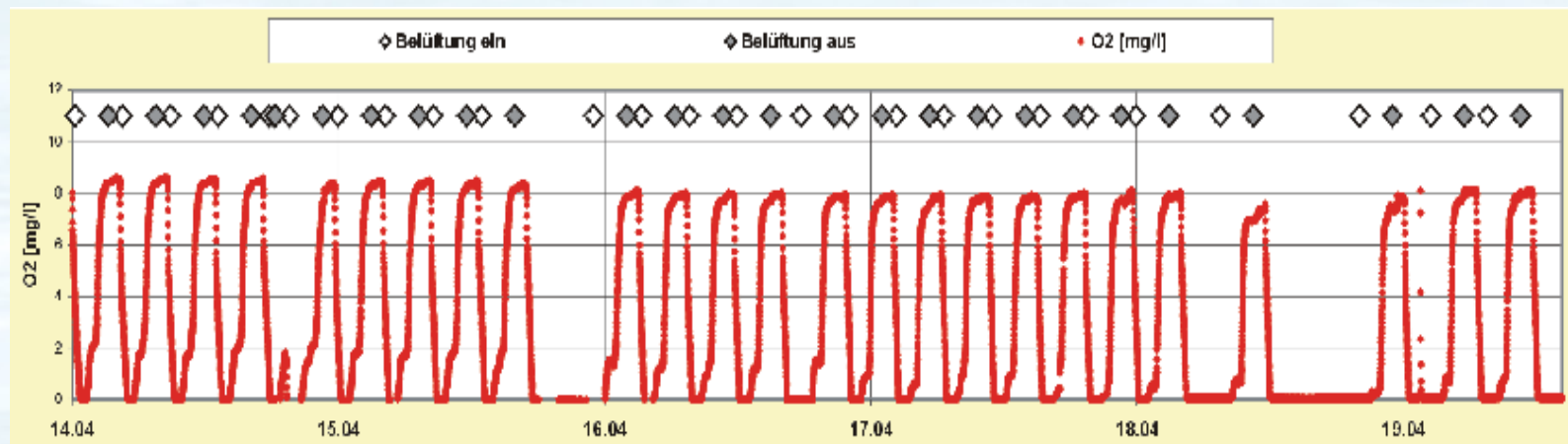
Ambient conditions: 0 - 60° C, 6 bar pressure
Sensor diagnosis: Automatic self diagnostics
Wetted materials: Polyurethane, Epoxy, Silicon
Minimum flow rate: No flow required

Power: 12 V DC (provided by s::can terminals)
Automatic cleaning: often not required
compressed air (controlled by s::can terminals)
Communication: rs485 / ModbusRTU (provided by s::can terminals)

Change of spare parts: not foreseen
Extended Warranty: 3 years



results



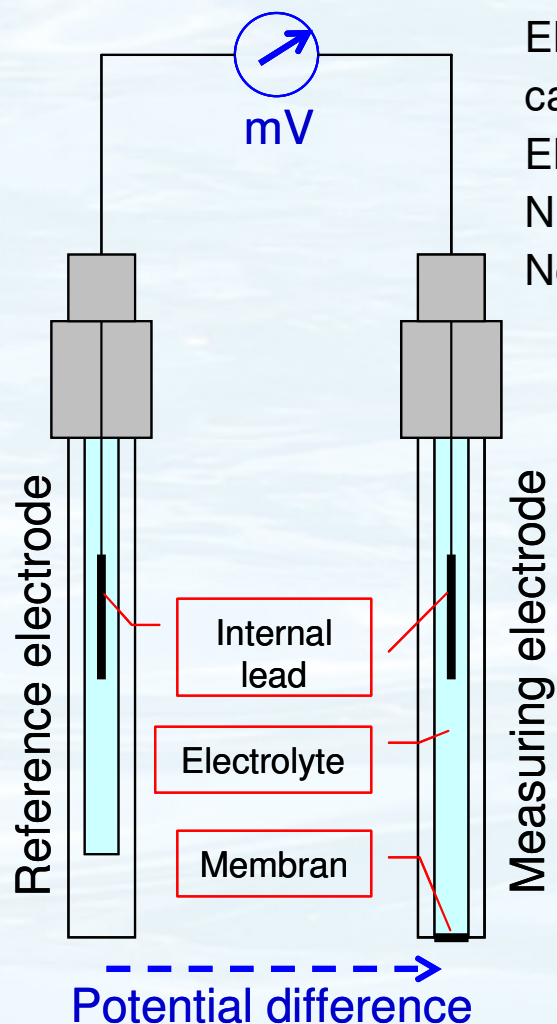
s::can ammo::lyser™



ammo::lyser™ IV
online measurement of

Ammonium (NH₄-N)
Potassium (K)
pH
Temperature

ISE = Ion Selective Electrode

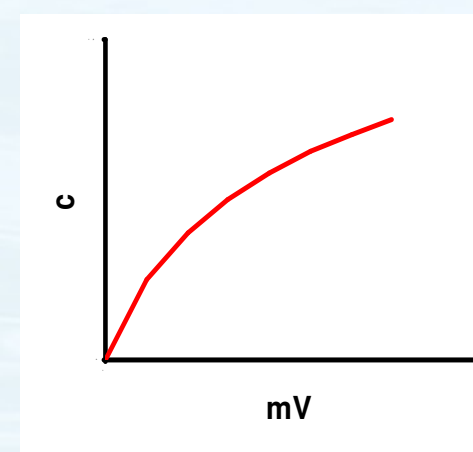
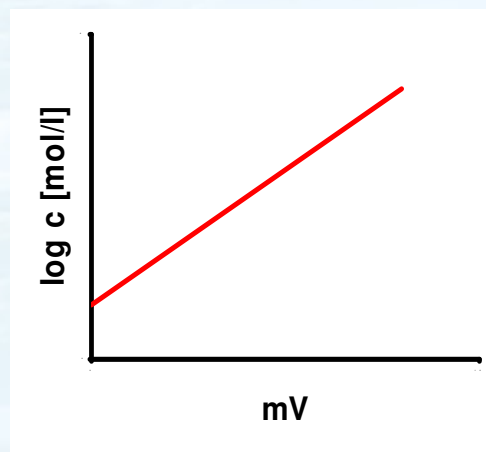


Electrical potential difference to reference electrode can be measured-

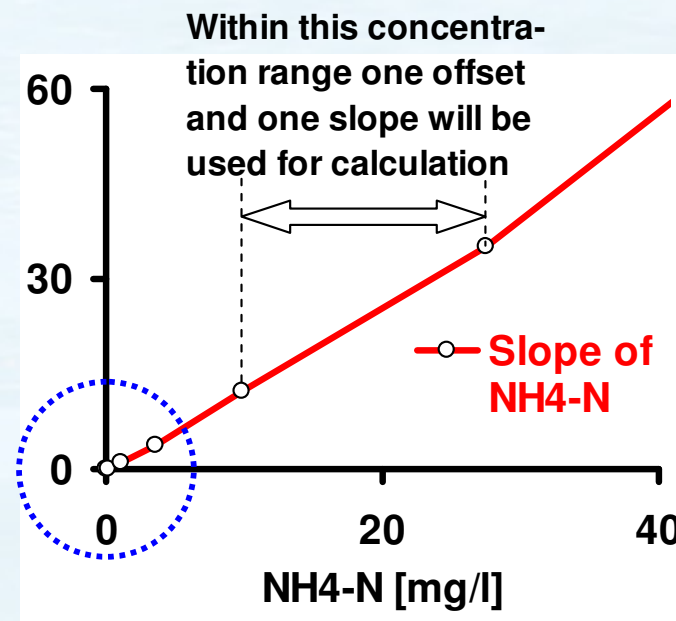
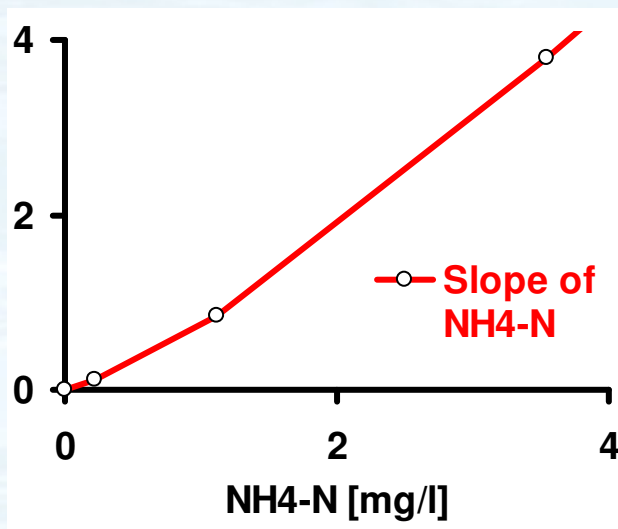
Electrical potential depends on ion's concentration.

NERNST equation (non linear)

Non linear Global Calibration is stored on ammo::lyser™.



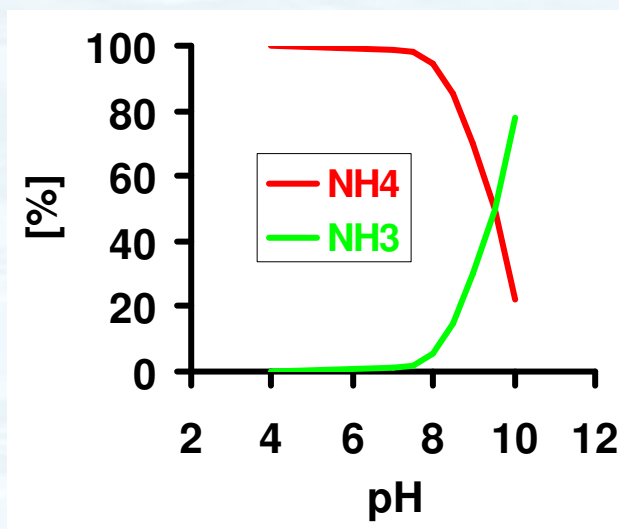
Depending on the actual NH₄-N concentration, the ammo::lyser™ uses different slopes and offsets (“Global Calibration”) to calculate the NH₄-N concentration out of the mV signal, modelling NERNST equation as good as possible.



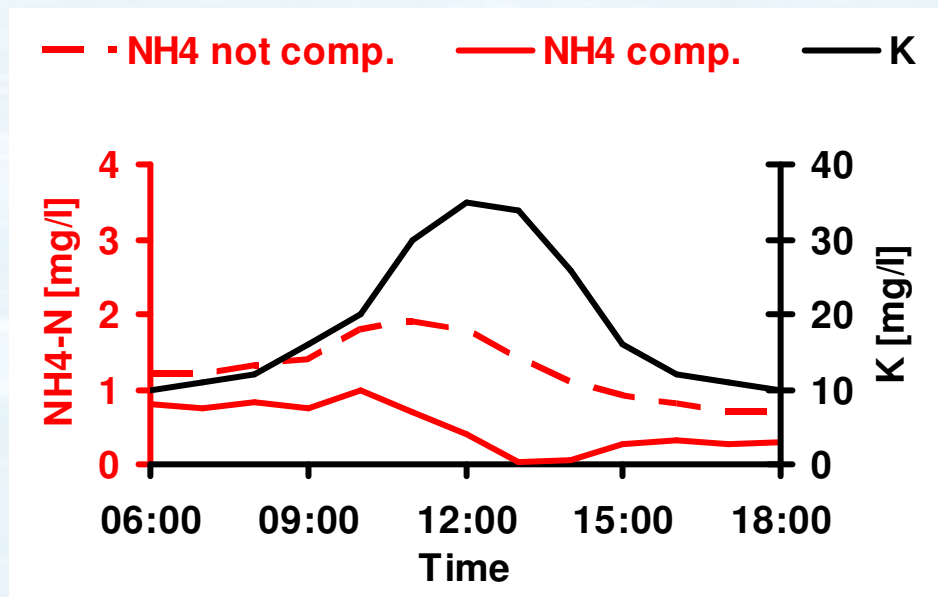
ammo::lyser™ IV – pH and potassium compensation



Ammonium membrane is cross sensitive to potassium (1:25)

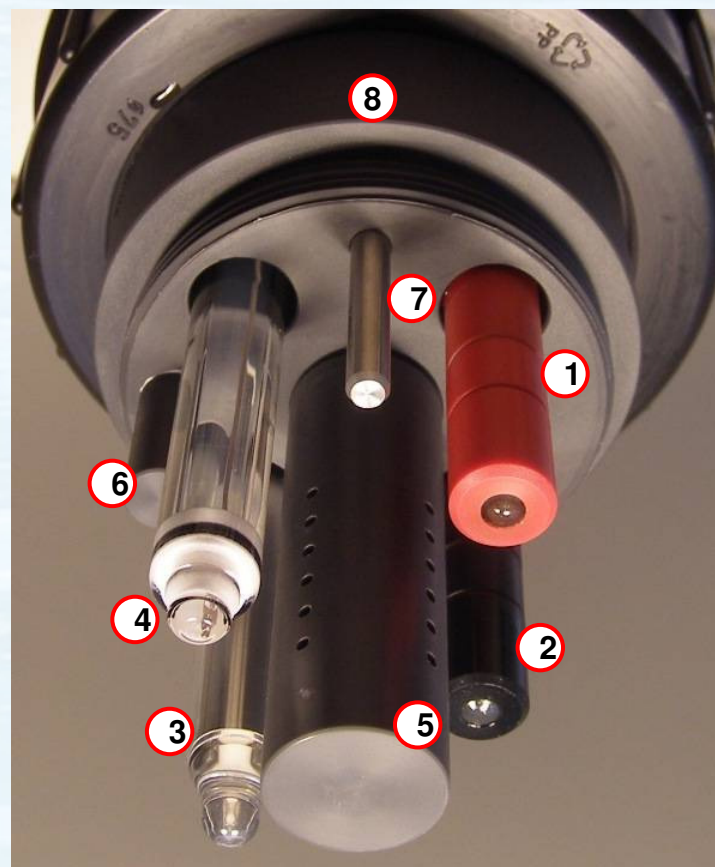


Most important in waters with pH > 8

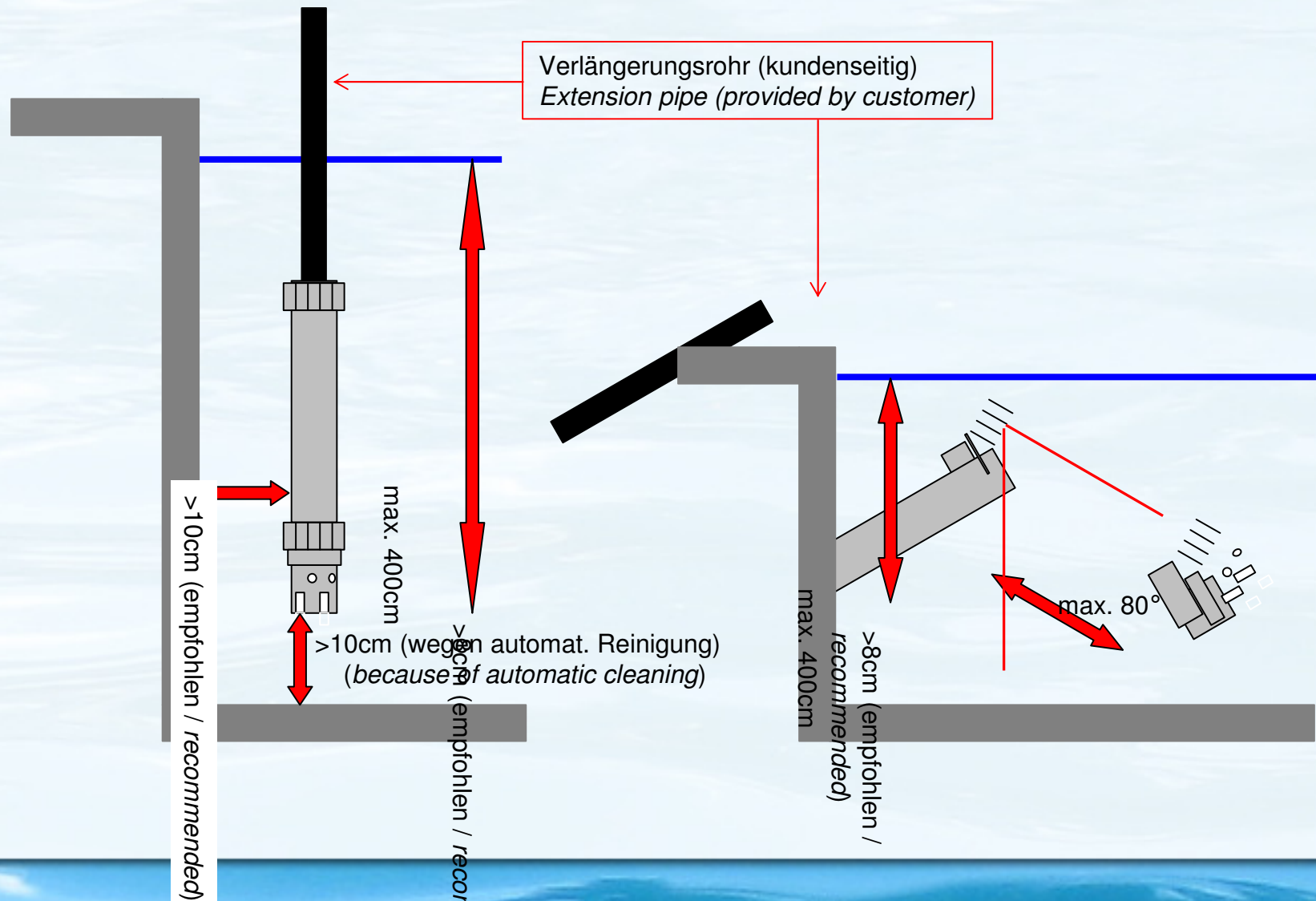


Important in waters with high fluctuation of potassium and / or low ammonium concentration

1. Ammonium electrode
2. Potassium electrode
3. pH electrode
4. Reference electrode
5. Cleaning nozzle
6. Temperature sensor
7. Grounding pin
8. Connecting thread for electrode guard
9. Probe housing
10. Electrode guard
11. Nut for fastening electrode head
12. Connecting thread for probe mounting

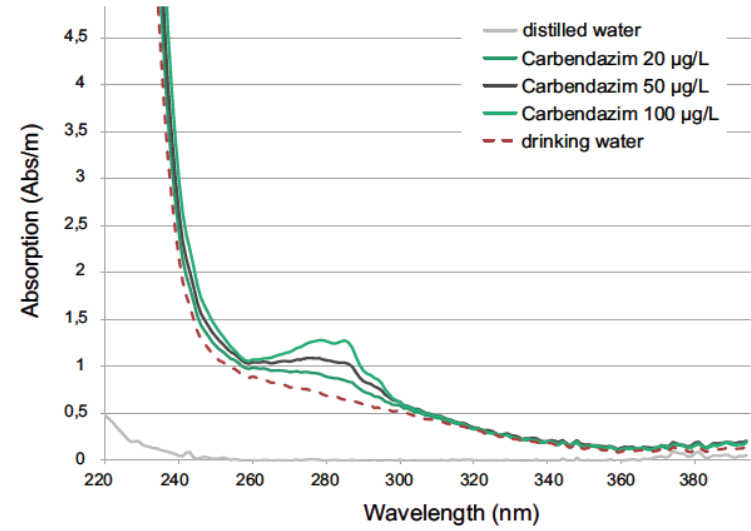


MONTAŽA

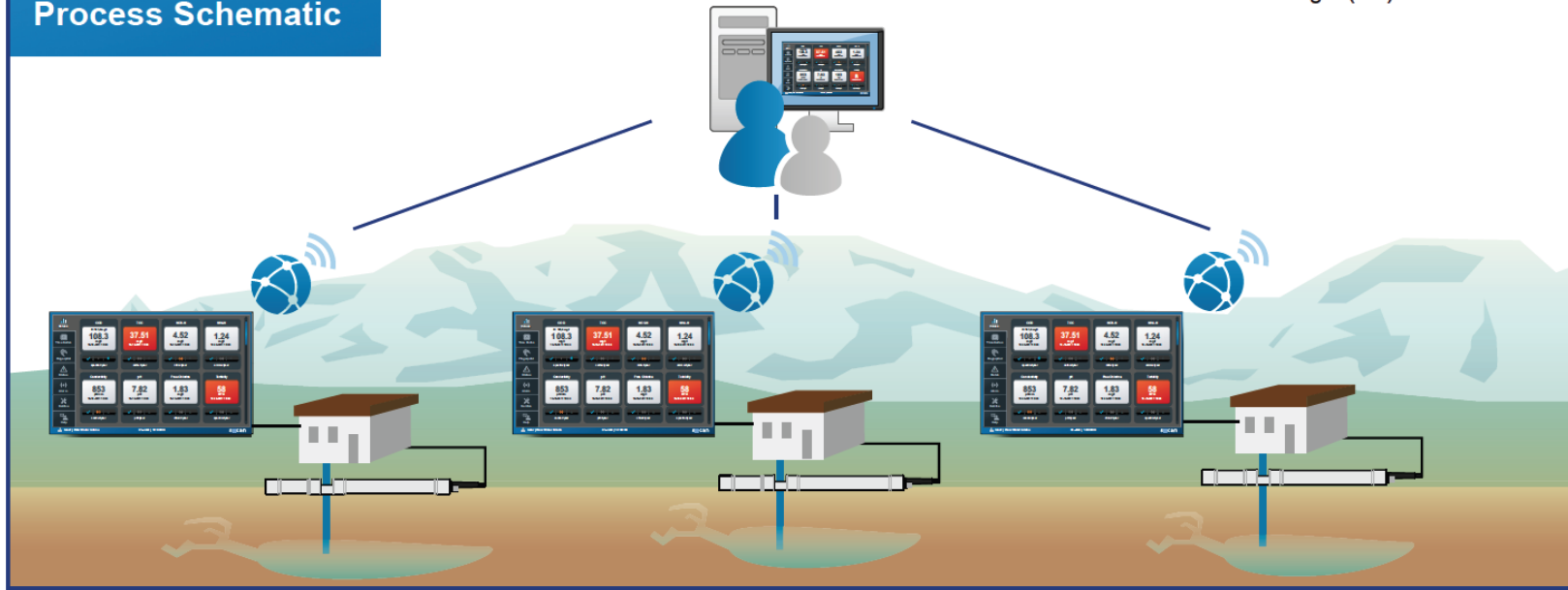




Absorbance spectra for Carbendazim measured with the spectro:lyser during the spike tests

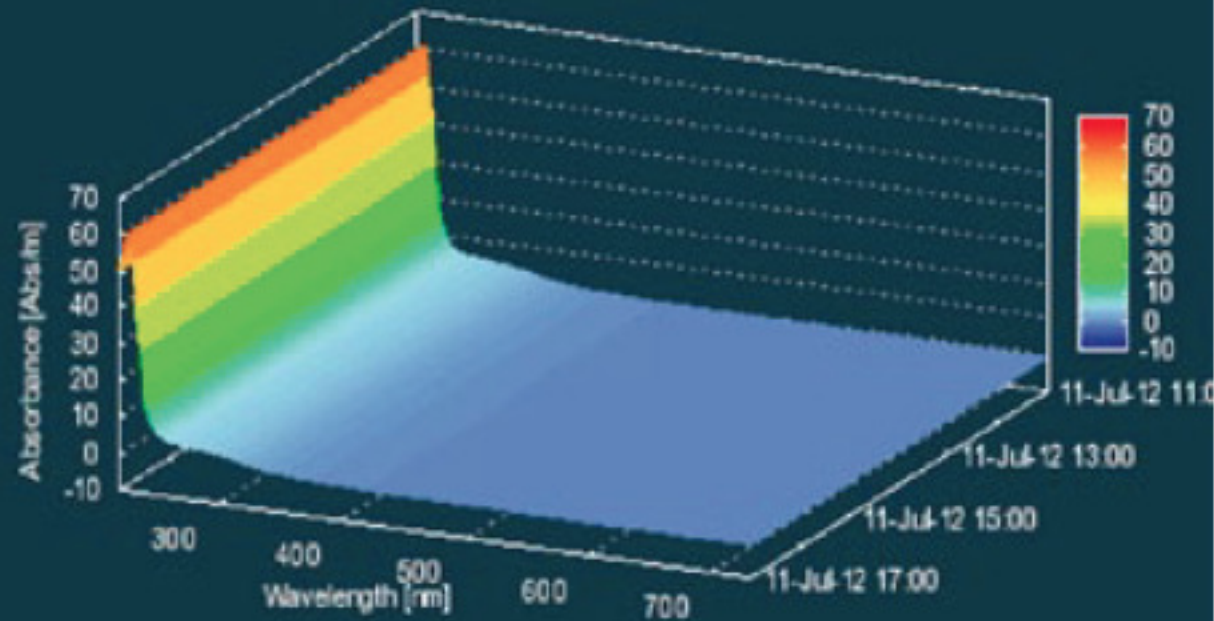


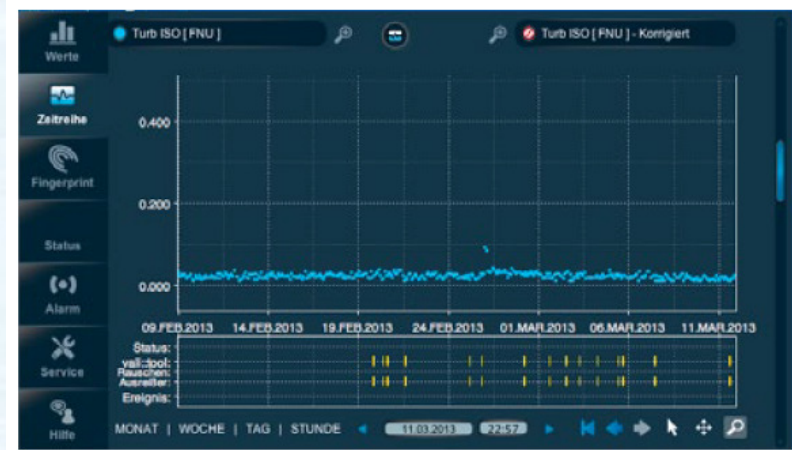
Process Schematic



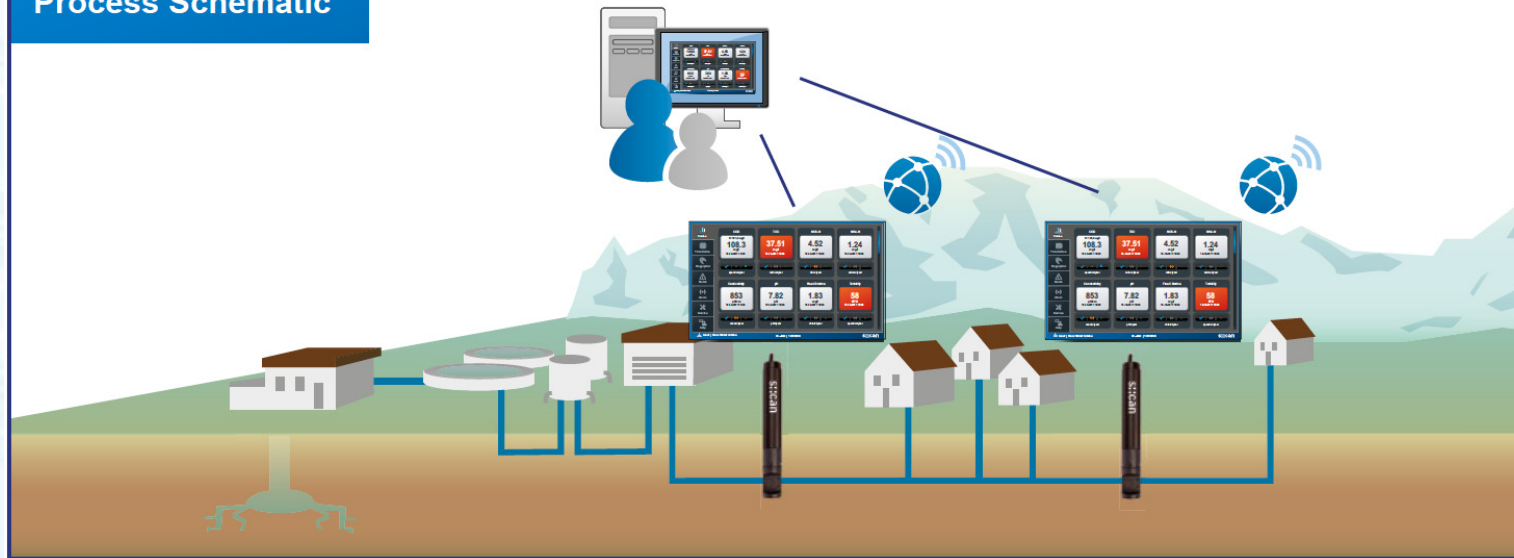
00100020, UVVIS, 35.0 mm, Fingerprint

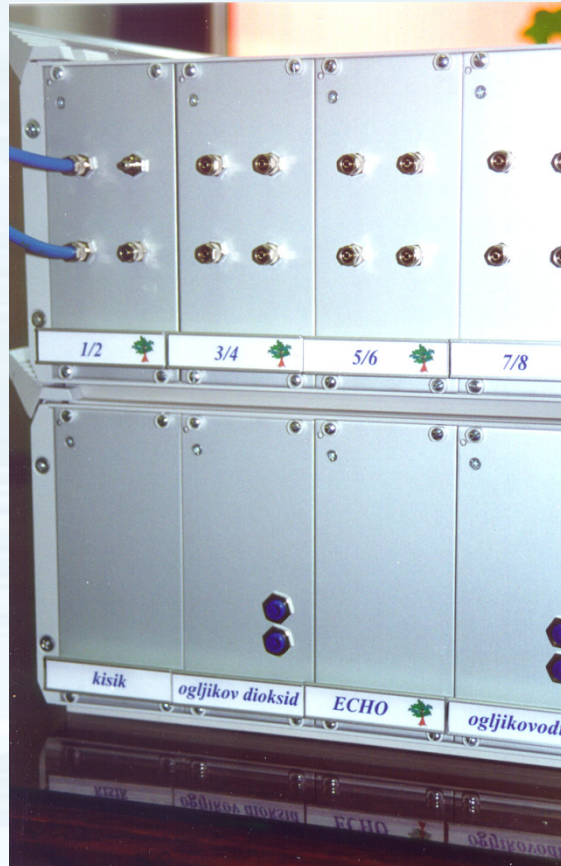
20



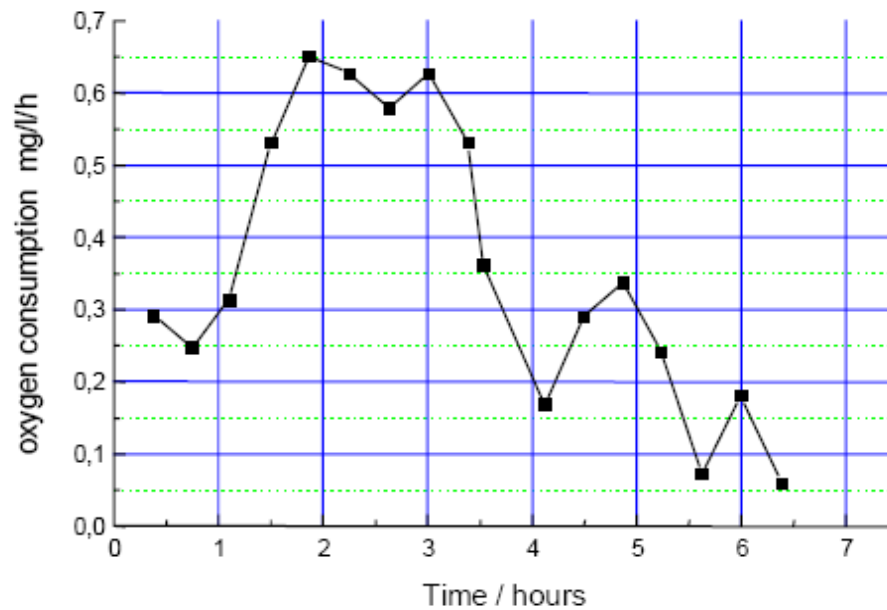
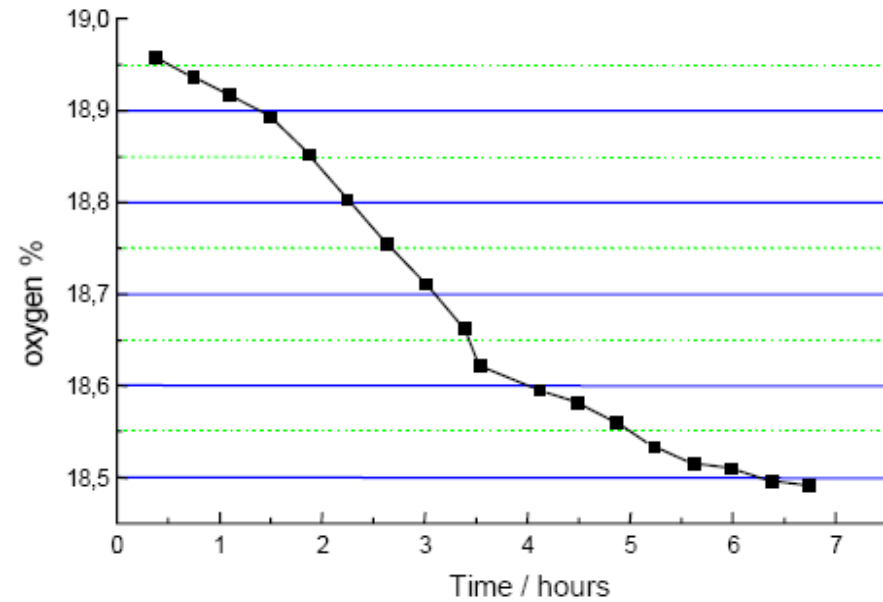
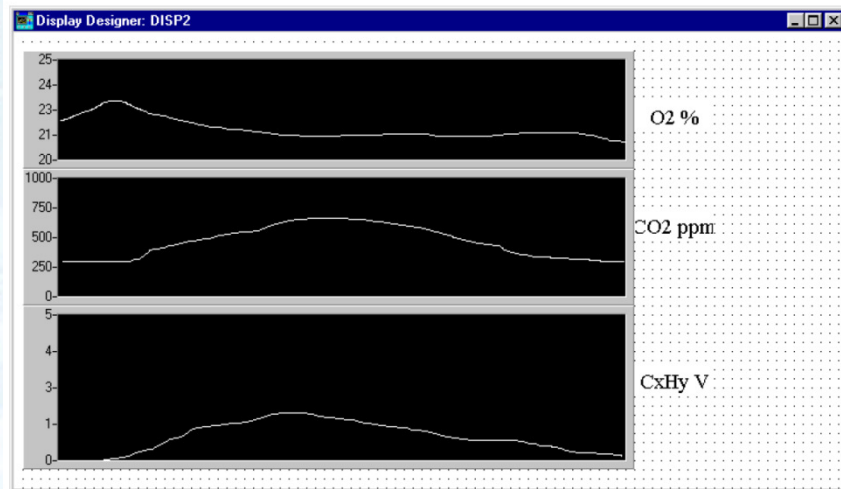


Process Schematic





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ECHO, d.o.o. MERILNIKI VODE



METALYSER FIELDPRO HM3000

PORTABLE HEAVY METALS ANALYSIS
TABLET PC CONTROL TO PPB LEVELS

As Arsenic	Au Gold	Bi Bismuth	Cd Cadmium	Co Cobalt	Cr Chromium	Cu Copper
Fe Iron	Hg Mercury	Mn Manganese	Ni Nickel	Pb Lead	Sn Tin	Zn Zinc

Arsenic (Total As)
Gold
Bismuth
Cadmium
Cobalt
Chromium (VI)
Copper
Iron
Mercury
Nickel
Lead
Tin
Zinc

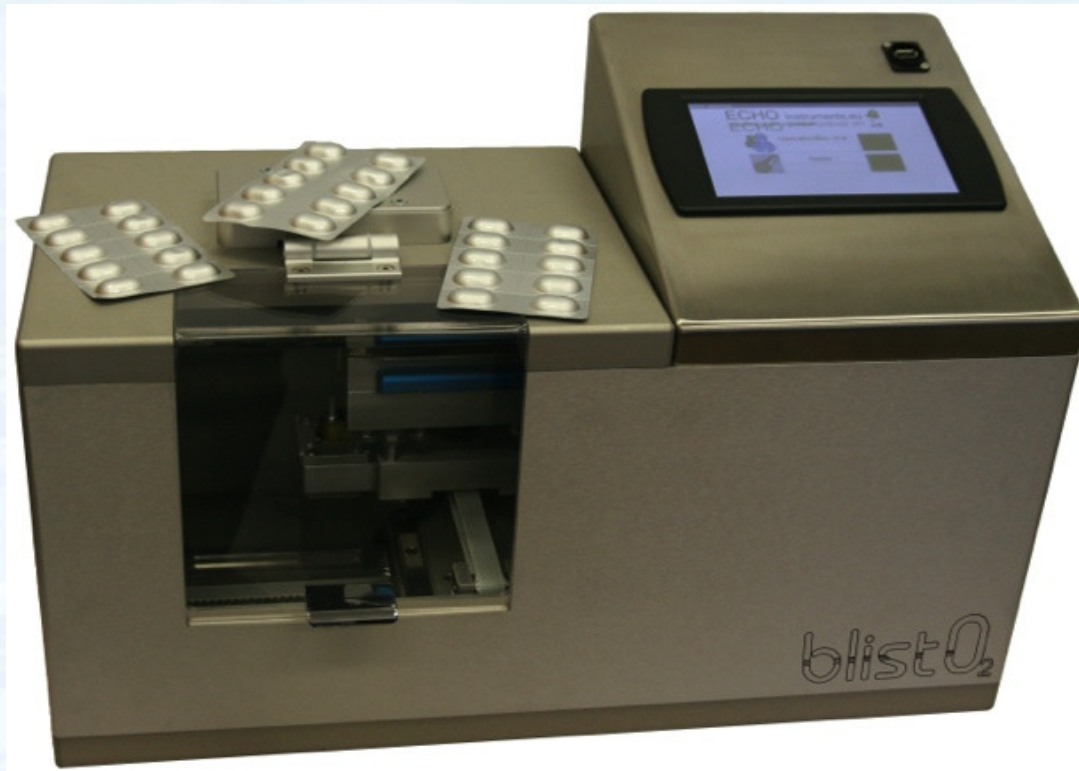


*your first
formula*





ECHO d.o.o., Stari trg 37, SI-3210 Slovenske Konjice, Slovenija, tel.: +386 (0)3 759 2380, fax.: +386 (0)3 759 2381, info@echo.si



V PRAŠANJA ???

