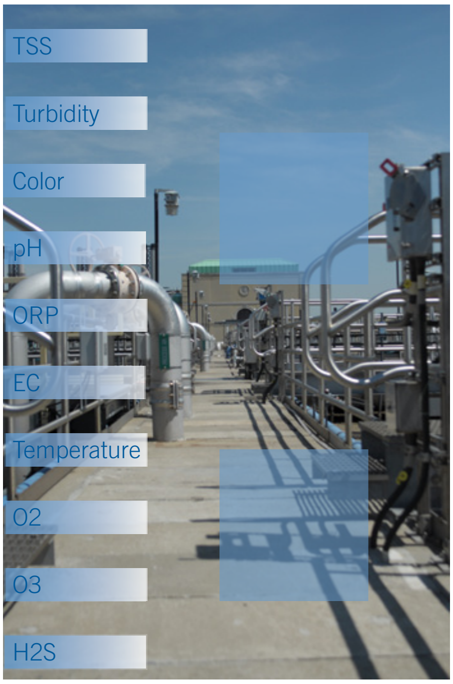
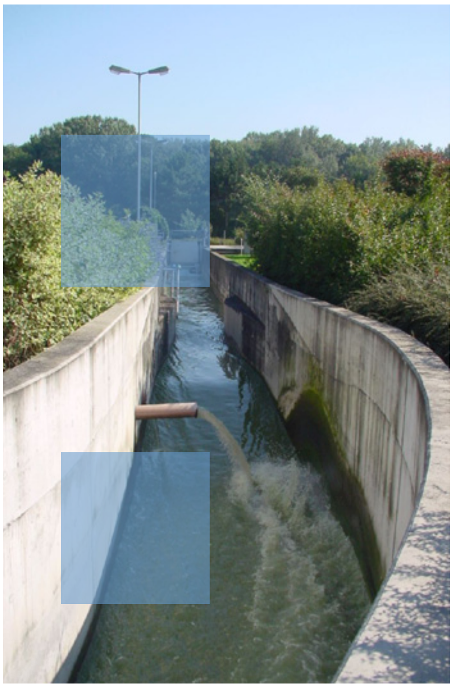
s::can

Intelligent. Optical. Online.

BOD
COD
BTX
TOC
DOC
UV254
NO3
NO2
NH4
K+
Free Chlorine
F-
TSS
Turbidity
Color
pH
ORP
EC
Temperature
O2
O3
H2S
AOC
Fingerprints
Alarm

Applications Waste Water





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1 Introduction

Both national laws and an increasing number of supranational recommendations are prescribing emission limits for waste-water treatment plants (WWTP). In order to be able to control maximum run-off concentrations, for instance, frequent sampling of influent and effluent at WWTP is still usual.

Furthermore, the pollution of waste water at many stages of the treatment process must be determined for purposes of influencing operation and/or control and thus optimizing treatment performance, and thereby minimizing costs and the use of resources, and also optimizing the protection of our environment. For this purpose, it is widely accepted today that substances and substance groups in waste waters should be monitored:

1. continuously and
2. without delay (in "real time")

This is the only way allowing quick reaction to changes in waste-water composition or operational conditions.

Online measurement in waste water using photometric instruments for individual wavelengths, a state-of-the-art technique for some years now, has proved its value – however, only following sophisticated on-site calibration, just for single parameters so far, and often prone to cross-sensitivities.

The spectrometer probes from s::can use the same measuring principle: the absorption of light. Yet they measure not only one or two wave lengths, they measure the a continuous optical spectrum reaching from low ultraviolet to visible light. The result of the measurement is the so called "fingerprint" (see Figure 1).

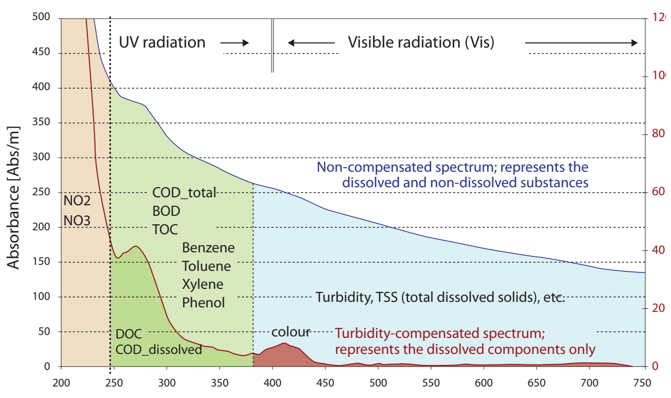


Figure 1: "Fingerprint" - absorption spectrum

This fingerprint contains much more information about the water quality than a single wavelength instrument can provide, allowing more accurate and universal measurements.

The brand-new s::can analyzers can be directly immersed into the medium, making it possible for the first time to combine the advantages of in-situ measurement with those of spectrometry, eliminating such well-known drawbacks as sampling errors, biochemical or physical degradation, etc.

2 Parameters

2.1 Basic Information on Calibration

The s::can calibration methods, developed during many years of cooperative work with university institutes and several chemistry laboratories, make use of the most up-to-date statistical and mathematical procedures. Three calibration methods can be offered:

1) "Global Calibration"

We use this method successively for individual substances and sum parameters. The parameters released are characterized by their particular selectivity, and are largely free from cross-sensitivities and reach almost analytical accuracy. Thus, they are instantly and universally applicable without local calibration. Examples are organic parameters, turbidity and nitrate.

2) Verification by "Local Calibration"

The global calibrations can be adopted to the local water composition. A few local reference samples are used to verify the calibration and improve the accuracy of the results. Also a higher selectivity can be achieved with precise local calibration. This method is clearly advantageous over established UV or Nitrate photometer probes.

3) Validated advanced calibration

If a very accurate analytical-like measurement is wanted, an automated state-of-the art method using PCA (principal component analysis) and PLS (partial least square fit) can be used. The output will be a validated, extremely robust and accurate parameter set for all parameters at the same time, provided that all occurring matrices were sampled at least once. All the spectral information is used simultaneously. The procedure is software-driven.

2.2 Organic Carbon Compounds

Usually sum parameters such as COD, COD_filtered, BOD or SAC are established to quantify the organic load contaminating waste water because the total organics is composed of a multitude of substances. s::can spectrometer probes can continuously measure organic parameters as well as suspended solids in the influent allowing wastewater treatment plants preparing their process control according to the changing contaminant loads. This type of monitoring is essential as peaks in the organic load of the waste water can lead to troubles or even breakdowns of complete treatment processes. Used already in the sewer system the spectrometer probe provides a head start in detecting events and moreover can be employed to localise the origin of peaks in organics concentrations terms of its methodical approach, spectrometry features the advantage of not indirectly measuring oxygen demand, but rather of directly measurement the concentration of oxidizable organically bound carbon.

Standard deviation of COD concentrations from spectral measurement show substantially less dispersion than those measured in the laboratory; the uncertainties pertaining to the COD (above all in the lower concentration region) are well known – they are even intensified by the usual application of standardised batch tests at WWTPs. Thanks to the lower dispersion of measurement values (when determined via UV/VIS spectrometry), a lower detection limit can be achieved.

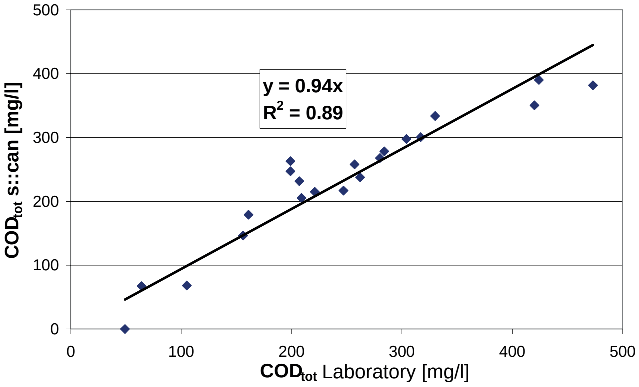


Figure 2: COD – Comparison of spectro::lyser™ with standard laboratory measurement.

Independent laboratories determined the correlation between laboratory COD (total) and the instrument measurement values over a measuring range of 20 to several 1000 mg/l at different measuring points of 16 WWTPs. Depending on the local calibration, the correlation coefficient R^2 was always between 0.78 and 0.98 (cf. Chapter 8, and following example pages). Similarly, the calibration to filtered samples always yields a good and independent correlation.

The estimation of biodegradable carbon (BOD5) using spectrometry is a particularly suitable method. Algorithms for applications in sewers, municipal WWTP and in the paper and diary industry have been available since quite some time.

2.3 Solids, Turbidity

The linear regression between solids concentration and the spectral parameter yields in general very good results (R^2 = 0.85 – 0.99). This good correlation was confirmed at all plants tested so far.

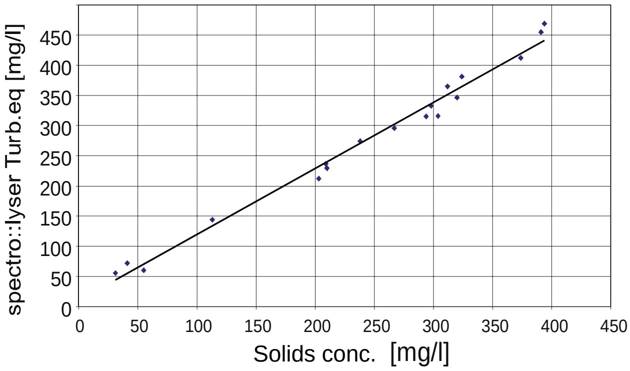


Figure 3: Comparison of solids_eq with lab analysis

2.4 Nitrate

Regressions between nitrate concentrations and spectral extinction parameters similarly yield high correlation coefficients.

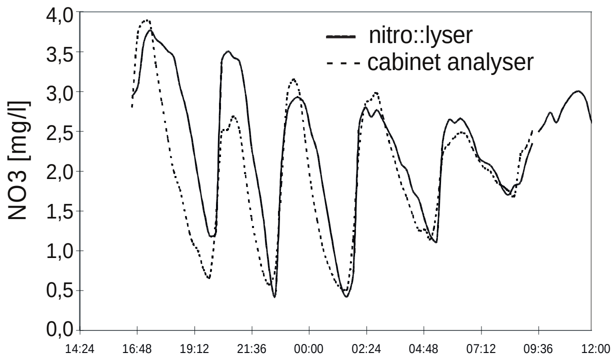


Figure 4: Continuous measurement in the aeration tank

The spectral Nitrate measurement is extremely robust. Opposite to single or dual wavelength photometry, it works well under most conditions, including the aeration tank, and is much less cross-sensitive to organic carbon and turbidity.

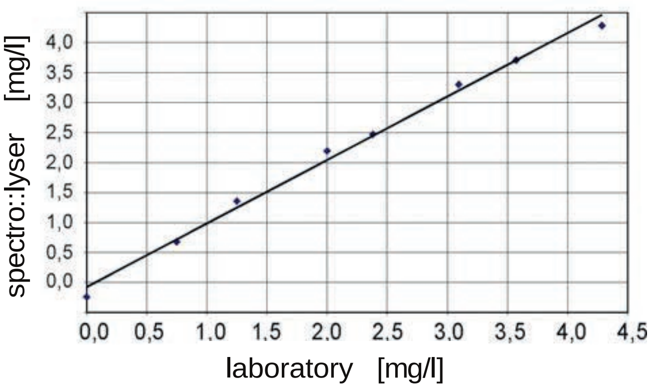


Figure 5: Comparison with laboratory values

2.5 UV/VIS Absorbance Spectrum

The continuous UV/VIS absorbance spectrum features two substantial advantages:

1. Nitrate, turbidity and organic substances can be measured simultaneously
2. Qualitative assessment of waste-water composition is possible

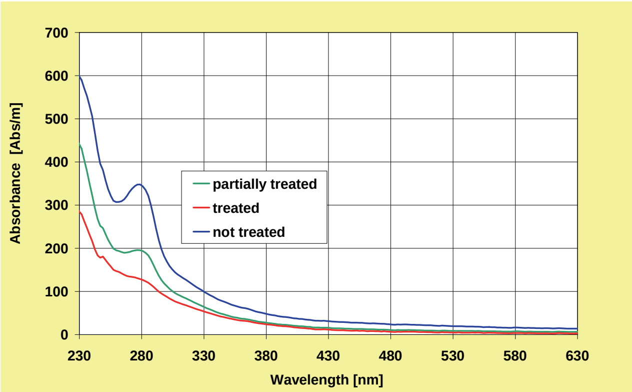


Figure 6: Absorbance spectra of waste-water samples at various measurement points

Figure 6 shows the absorbance spectra in the influent of a WWTP, which is strongly influenced by an industrial paper mill. The peak at the wavelengths around 280 nm reflects degradable organic matter (BOD). Due to biological degradation, it decreases successively from the influent (blue) over the intermediate treatment (green) to the effluent of the after-treatment (red). In this instance, measurement of the SAC 254 alone is inadequate for determining the concentration of BOD compounds since, at 254 nm, absorbance correlates almost exclusively with solid matter (turbidity), but there is almost no selective relationship with BOD at 254 nm. Furthermore, dissolved carbon compounds can only be measured safely after spectral compensation of turbidity. The traditional way of compensation by measuring only one additional wavelength in the visible range is very often not suitable for this purpose because of the changing character of particles and color.

In this instance, measurement of the SAC 254 is inadequate for determining BOD since at 254 nm, absorbance correlates almost exclusively with solid matter.

Using local calibration, various carbon groups can be distinguished by specific features in the fingerprint, in particular as regards their degradability, allowing conclusions to be drawn with respect to the treatment process. Depending on the properties of the waste water, correlation coefficients to the BOD of 0.75 to 0.9 can be anticipated. On-site calibration covering the waste water under consideration leads to correlations of $R^2 = 0.8$ to 0.9. Evidently, simple photometric devices are not capable of identifying characteristics of this type.

3 Advantages of Spectrometry in Comparison with Simple Photometry

Spectral determination of water-quality parameters features the following advantages:

:: **Cost efficient - multiparametric**
Even at minimum specification, the continuous UV/VIS spectrum enables simultaneous measurement of the parameters of organic carbon, nitrate and turbidity, for which only one s::can spectrometer is required, instead of three simple process photometers.

:: **Lower cross-sensitivity on turbidity, coloration, surface growth, etc.**
Potential interference, not detectable by dual wavelength measurement, can nearly always be compensated with the help of spectral information.

Greater precision

Since cross-sensitivity is substantially reduced by this means, heterodyning of measurement signals due to interference/noise is significantly less than with simple photometer devices.

Higher selectivity

Many individual substances and/or substance groups can be allocated to significant spectral features.

Greater reproducibility

These advantages result in very high reproducibility as well as the benefit of universal applicability, without the absolute necessity of local calibration.

Calibration matching other substances and substance groups

Aside from the parameters usually applied in waste-water engineering (COD, BOD, DOC, nitrate, turbidity), s::can offers individual parameter calibrations.

Qualitative evaluation

In addition to the calibrated parameters, the qualitative spectral information (“fingerprint”) can be directly applied for alarm and control systems, etc. Qualitative and quantitative differentiation of carbon fractions (for more detailed assessment of the waste water, e.g. from industrial charges) is possible.

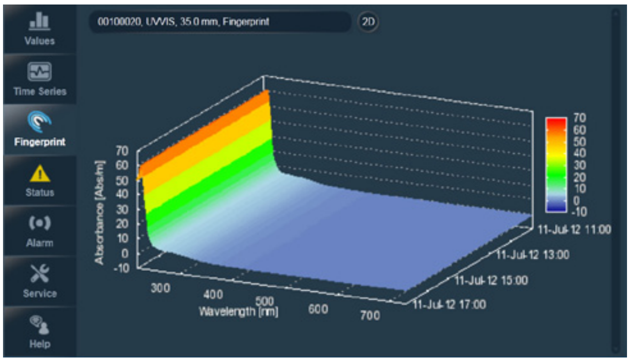


Figure 7: The spectral fingerprint visualized in s::can’s software solution for water quality monitoring - moni::tool

4 Special Advantages of the s::can Measuring Instruments

Measurement dynamics

A special feature of s::can spectrometers is their extreme dynamic range (1:1000 or (0) 1 to 1000 mg/l for COD_eq, up to 1: 5.000 for Nitrate). For example: with the same configuration, measurements can be taken in the sewer, influent, intermediate / after treatment and effluent, as well as in water bodies.

Long-term stability

Dual-beam measurement enables all changes in the measurement system to be captured and compensated. Together with spectral compensation of biological growth on windows and/or turbidity fluctuations, the dissolved substances can be measured with exceptional long-term stability, enabling continuous monitoring of waste-water quality and the operation/control of the treatment process. In cases of high solid-matter content, the (hydraulic) instrument-cleaning unit is connected via an external pressure line. With the help of this extremely effective device, measurements of many months without ever removing the probe from the water are normal.

No maintenance necessary

Maintenance is not even possible because there are no serviceable parts on the hermetically sealed instrument. When no pressure cleaning unit is in use, deposits or biological growth can build up on the windows, although the high energy UV radiation prevents most organisms to grow up. Windows need merely be cleaned from time to time, enabling the user to establish the intervals between cleaning himself.

Field and Outdoor Use

Owing to the lightweight, robust design (all surfaces are anodized), and the absence of moving components in contact with the medium, as well as due to the 12-volt supply and explosion shielding, the instrument is also suitable for use under rough or hazardous environmental conditions

Flexible measurement process

Using intelligent algorithms, microprocessor adapt the hardware (exposure time, oversampling, etc.) and the measurement parameters to changing conditions.

Ease of use

The user remains unaffected by complexity of the measurement process, i.e. he does not need to manipulate the process and he merely receives the definitive measurement figures.

5 Application for the use of s::can spectrometer in waste water

5.1 Assessments and parameters

Measurement of UV/VIS spectra over a wavelength range of approximately 220 – 720 nm

- compensation of turbidity
- simultaneous determination of various substances
- differentiation between various carbon fractions
- detection of irregular charges

5.2 Application and Installation

:: Selection of measuring path length depending on matrix and substance concentration

- 2 mm or 5 mm in the influent
- 1 mm in the aeration tank
- 5 or 35 mm in the effluent

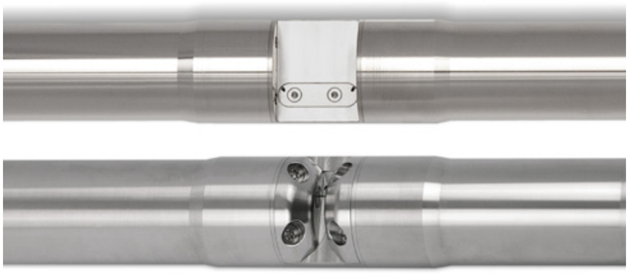


Figure 8: spectro::lyser with 35 mm and 5 mm measuring path length

:: Installation

For purposes of installation in treatment plants, we recommend our simple Aluminum or PVC installation pipes with brackets. The instrument can also be affixed to any standard pipe system with 45 mm clamps or to other standard fixtures, or just be hung on its cable. We check the details of every individual application and would be happy to provide the installation.

:: Evaluation if automatically hydraulic window-cleaning is necessary, using pressurised water or air

- applications with need of very long (several months) maintenance intervals
- in cases of increased biological activity in the waste water, or higher fat contents
- also operational in the sewer system when used in combination with compressed-air or CO2 bottles

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

:: Recommended measurement points

- behind the rake unit and/or sand tank
- before the return sludge feed
- before discharge

6 s::can Monitoring Stations and Systems

6.1 System integration

1. Our interface terminals con::cube and con::lyte allow total system integration and most advanced visualization. They provide analogue and digital interfaces to all kind of other sensors and control systems. Complete monitoring stations can be programmed to completely meet customer´s needs concerning visualization, process control and data exchange.

The con::cube terminal provides advanced data management and visualization.

2. The instrument can be operated and read with any commercial notebook/pc computer via the USB-interface and our proprietary software.

3. The instrument is also operable in data logger mode without any additional periphery. However, no continuous data access is possible in this mode.

4. In addition, s::can offers a waterproof field case (accumulator) for stand-alone operation in the field.

6.2 Operation and data transfer

- Measured values can be integrated into automated processes (operation, control, alarm) via various standard interfaces or databases.

6.3 Simultaneous water-level and temperature measurement

- Sensor for pressure-measurement integrated in the analyzer and the software.
- Estimation of flow-through if level-flow relation is known
- Sensor for temperature measurement integrated in the instrument and the software

6.4 Integration of other sensors

- s::can offers sensors for ammonium, O2, H2S, pH, redox and conductivity that are completely integrated into our measuring systems.

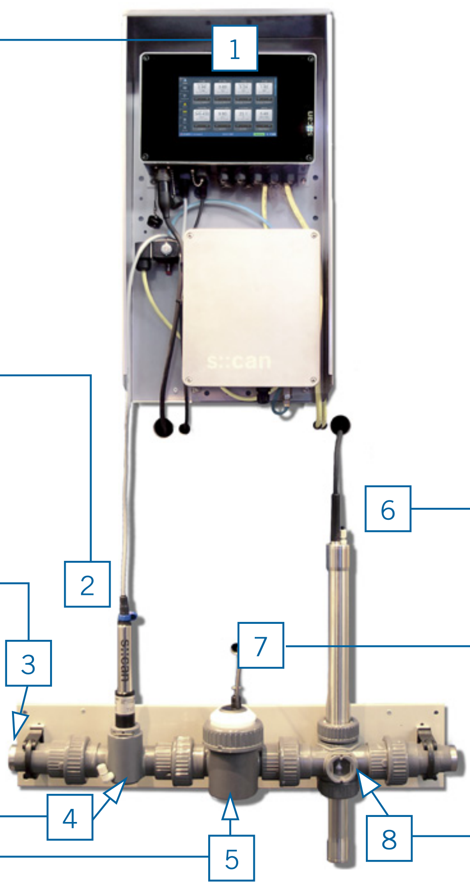
6.5 Measurement in sewer-systems

- Indirect charge control
- Identification and monitoring of charges: the continuous spectrum enables distinction to be made among waters based on differences in their composition, even following irregularities in the overall influent spectrum.
- Exceeding of limit values via charge alarm
- Control of waste-water load during rainwater run-off prior to release into the discharge
- Load-dependent sewer management

6.6 Networking of multiple devices

Multiple measurement points can be united wireless to a centrally operable network. s::can supplies the complete equipment.

7 The s::can micro::station for waste water - system overview



1 Terminal

con::cube terminal with moni::tool software for data acquisition, data display and station control

2 Physical probe

One s::can physical probe can be installed

Possible parameters:

pH, Redox, PSU, conductivity and temperature

3 Process connection 1", PVC

4 Flow cell for physical probe

5 Flow cell for ISE probe or physical probe

6 Spectrometer probe

All s::can spectrometer probes are multi-parameter instruments that can measure a variety of parameters

Possible parameters:

AOC, BOD, BTX, COD, color, DOC, FTU/NTU, H2S, HS, NO2-N, NO3-N, TOC, TSS, UV254, fingerprints and spectral alarms, temperature and pressure

7 Physical probe or ISE probe

oxi::lyser, soli::lyser or one s::can ISE probe (e.g. ammo::lyser) can be installed here

Possible parameters:

K+, NH4-N, NO3-N, O2. pH, TSS, and temperature

8 Flow cell for spectrometer probe

8 Some Reference Measurements

Figure 10: Figure 6: Time series in the influent of a large WWTP.

The spectro::lyser™ has been running in the two months shown in Figure 10 without any maintenance and no trend or drift was recognized. The daily and weekly periods, and also a weak long term trend in most parameters can be seen and was proven by lab measurements. The parameters were checked frequently by laboratory measurements: the correlations R^2 were better than 0,85 for all parameters without any local calibration. After local calibration, all correlations R^2 are between 0,9 an 0,98. This shows that the parameters Nitrate, COD_homogenised, COD_filtrated, and Total Solids can be measured in the influence of a WWTP with one instrument only and stable over many months.

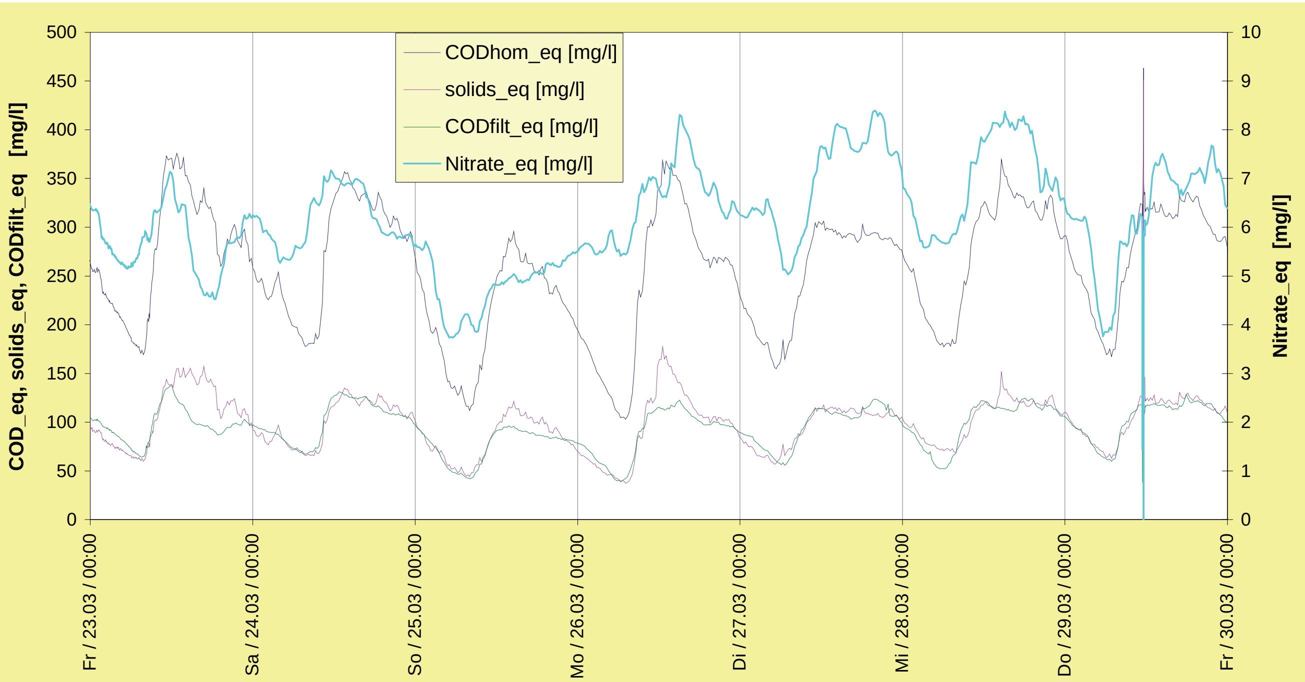


Figure 11: Zooming into one week of this period, the fine resolution of measurement and the independence of the parameters can be evaluated. The clear daily period as well as a weaker weekly period can be distinguished.

The time series of the suspended solids and COD equivalents in the influent (cf. Figure 11) show distinct daily maximums during the late afternoon, which are barely prominent with the filtered COD-filt_eq. The measurement sequence shows that the majority of the COD load is fed into the plant in solid form.

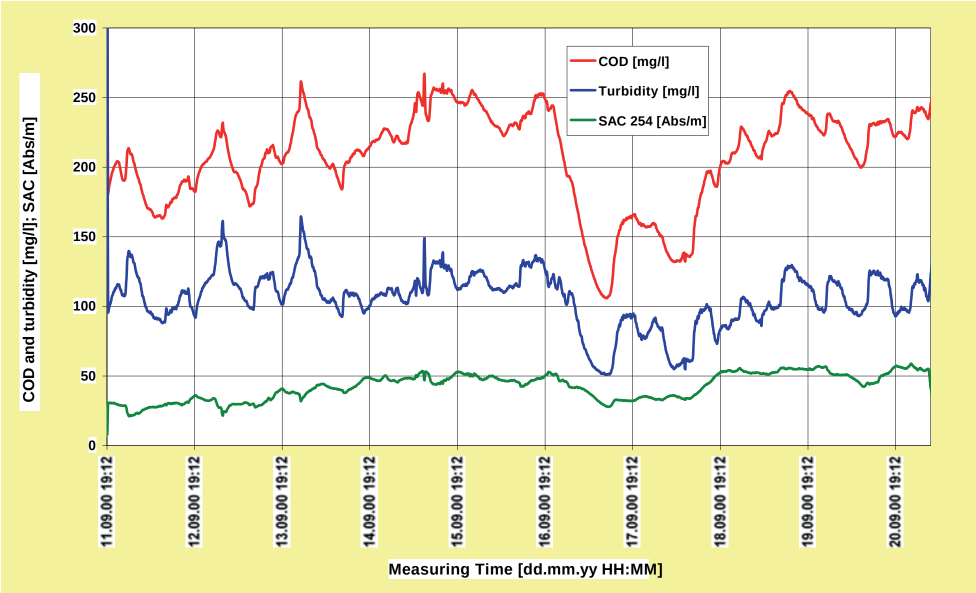


Figure 12: Time series in the aeration tank influent, WWTP A

In the aeration tank influent (Figure 12), the maxima are not visible until night-time, due to the delayed effect of the pre-treatment. The distinct decrease of the COD_eq., solids content and SAC254 on September 17 is due to the weekend in between. As a measure of the dissolved organic substance, the SAC254 once again shows a significantly lower dynamic behavior.

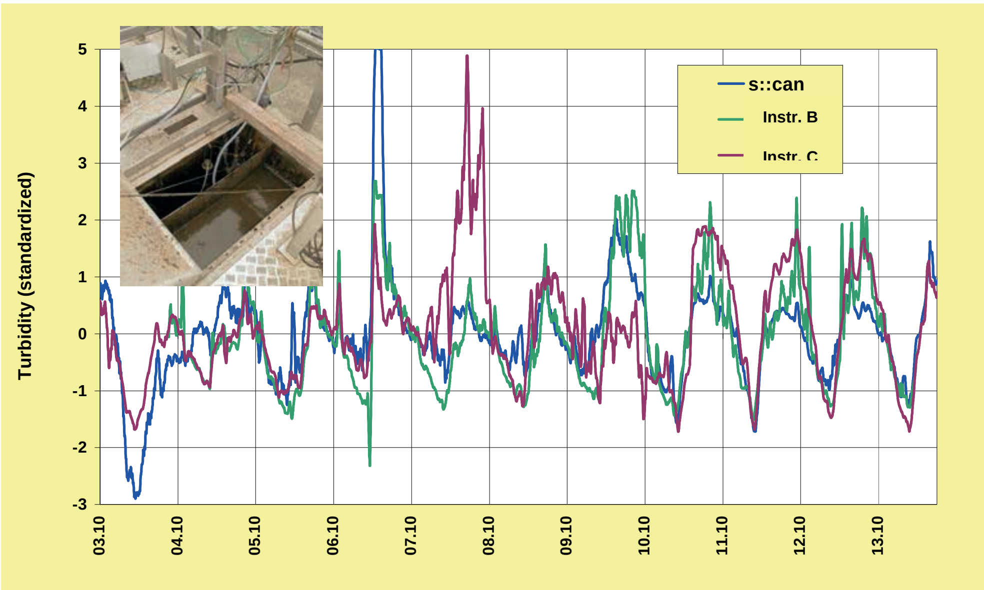


Figure 13: Time series of turbidity in the influent of the aeration tank of municipal WWTP A, in comparison of 3 instruments

The time series were measured within the extended testing programme of a large treatment plant which aimed at the evaluation of all different kinds of online instruments before the complete re-build of the plant. The spectro::lyser™ convinced the test staff not only in case of solids, but also for organic carbon and Nitrate measurements. More details available upon request.

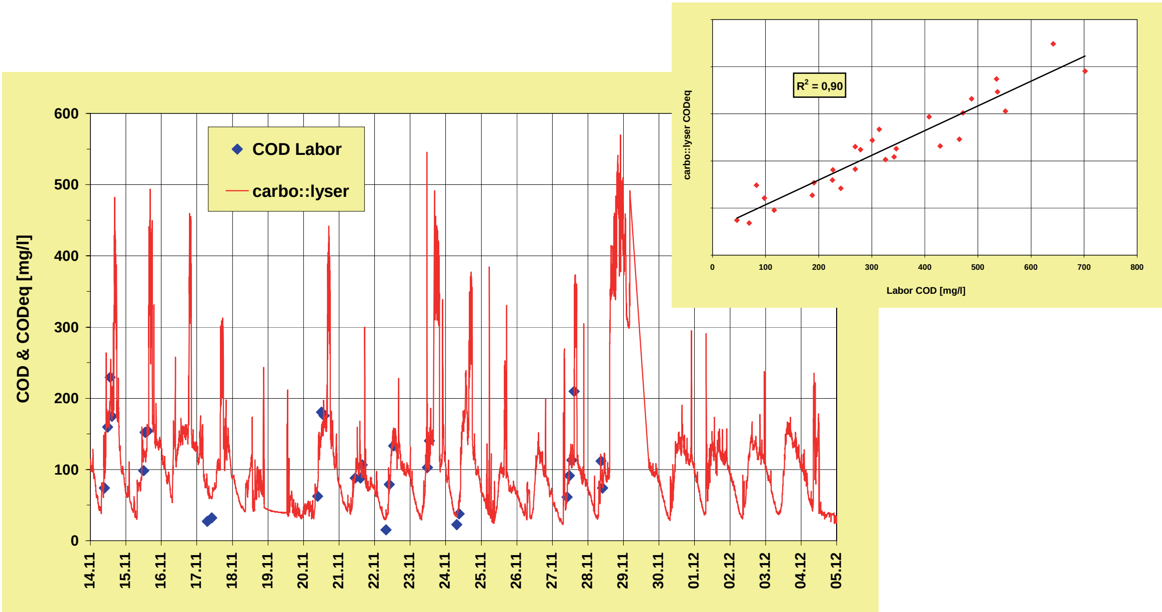


Figure 14: Time series of COD in the influent of plant B, compared to laboratory reference measurements

In Figure 14, a series of COD_eq is printed against time, as well as some laboratory reference measurements. The correlation was better than expected, because the spectro::lyser is situated directly behind the screen, and the disturbance from the screen was high. There has been no drift over the measuring period so far, and the correlation to COD is linear over the whole range which is typical for regular municipal waste water. When studying the daily sequences more closely in Figure 15, the multifarious occurrences (not perceptible using conventional measurement methods and/or measurement solutions) can be observed. The peaks and curves visible here are entirely interpretable and explicable.

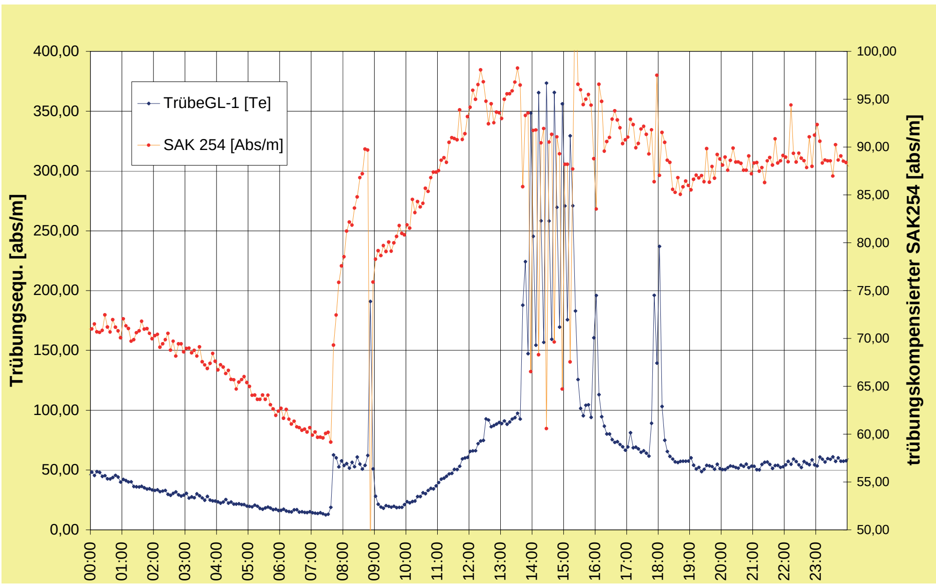


Figure 15: Daily time series in the influent of municipal WWTP B

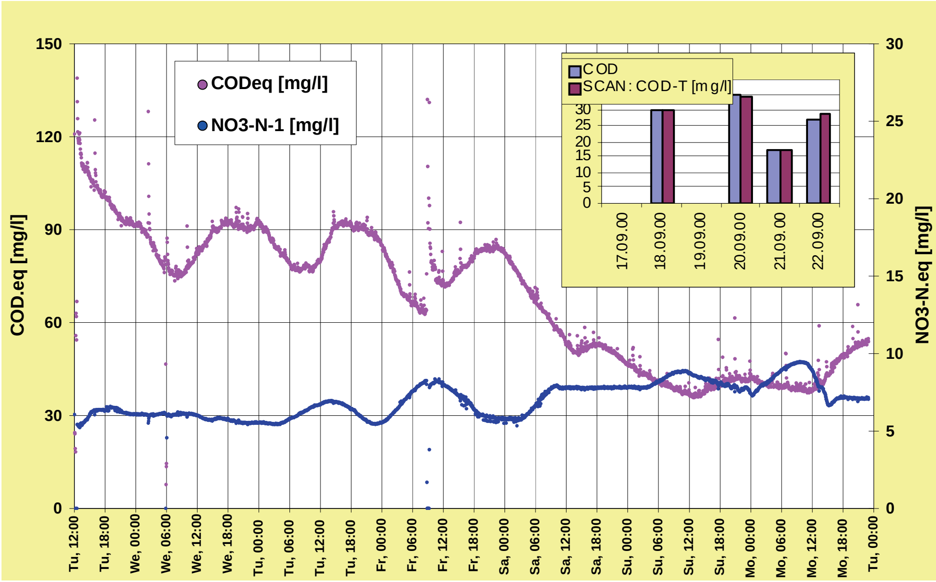


Figure 16: Time series in the effluent of a municipal WWTP C

The time series depicted in Figure 16 show that dynamic behavior also occurs in the concentrations of both nitrate and COD_eq. in a WWTP effluent. Thus, continuous monitoring of loads would be advantageous in terms of logging limit exceeds and minimizing loads.

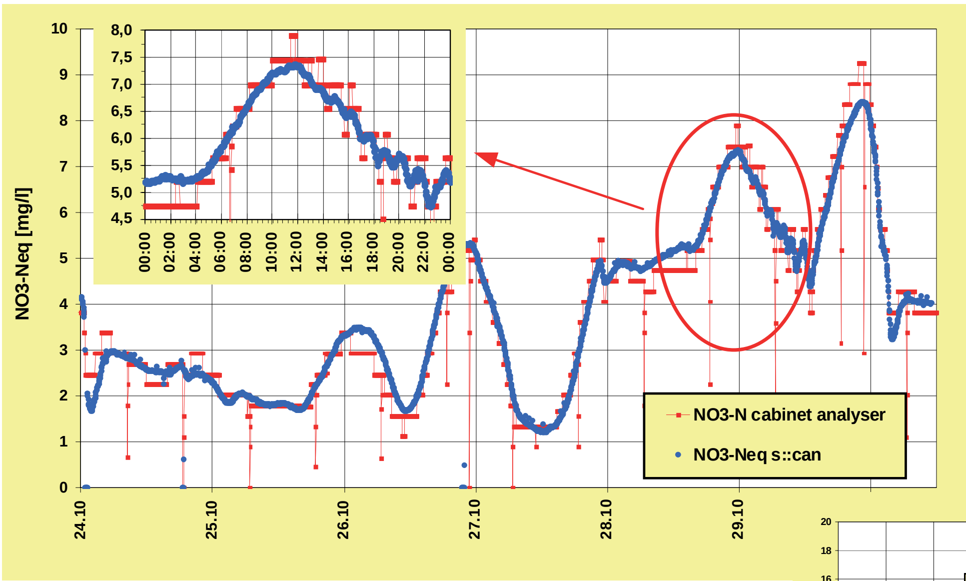


Figure 17: Time series of Nitrate compared to a conventional cabinet analyzer

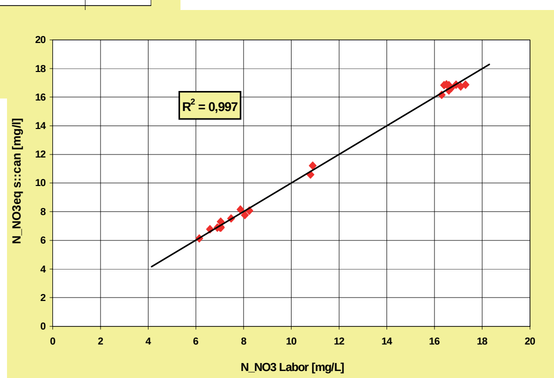


Figure 18: Correlation to laboratory measurements

In Figure 17 and Figure 18 the Nitrate series in the effluent of WWTP A are printed on a weekly and daily basis, this time compared to the results of a batch cabinet analyzer (colorimetric). The much higher measuring resolution, but also less frequent irregular peaks at the spectro::lyser™ data are clearly evident.

9 Examples for typical parameter ranges in different waste water applications (spectro::lyser™)

municipal WWTP influent & sewer

		typical concentration ranges for this application								
		TSS [mg/l]	NO_3-N [mg/l]	COD [mg/l]	CODf [mg/l]	BOD [mg/l]	UV254 [Abs/m]	UV254f [Abs/m]	H_2S [mg/l]	part number
spectro::lyser™ UV-Vis (TSS, NO_3-N, COD, BOD, UV254, UV254f)	min.	0	0	0		0	0	0		Sp1-002-p0-sEX-010 / -075 (incl. Global Calibration i3)
	max.	3000	40	3750		2000	1250	750		
spectro::lyser™ UV-Vis (TSS, NO_3-N, COD, CODf, UV254, UV254f)	min.	0	0	0	0		0	0		Sp1-002-p0-sNO-010 / -075 (incl. Global Calibration i1)
	max.	3000	40	3750	1250		1250	750		
spectro::lyser™ UV-Vis (TSS, NO_3-N, COD, H_2S, UV254, UV254f)	min.	0	0	0			0	0	0	Sp1-002-p0-sNO-010 / -075 (incl. Global Calibration i5)
	max.	3000	40	3750			1250	750	25	

diary WWTP influent

		typical concentration ranges for this application						
		TSS [mg/l]	NO_3-N [mg/l]	COD [mg/l]	CODf [mg/l]	UV254 [Abs/m]	UV254f [Abs/m]	part number
spectro::lyser™ UV-Vis (TSS, NO_3-N, COD, CODf, UV254, UV254f)	min.	100	0	200	100	0	0	Sp1-001-p0-sNO-010 / -075 (incl. Global Calibration m1)
	max.	3000	80	12500	5000	2500	1500	

paper mill WWTP influent

		typical concentration ranges for this application					
		TSS [mg/l]	COD [mg/l]	CODf [mg/l]	UV254 [Abs/m]	UV254f [Abs/m]	part number
spectro::lyser™ UV-Vis (TSS, COD, CODf, UV254, UV254f)	min.	0	875	875	0	0	Sp1-002-p0-sNO-010 / -075 (incl. Global Calibration p1)
	max.	2500	5000	4250	1250	750	

brewery WWTP influent

		typical concentration ranges for this application				
		TSS [mg/l]	COD [mg/l]	UV254 [Abs/m]	UV254f [Abs/m]	part number
spectro::lyser™ UV-Vis (TSS, COD, UV254, UV254f)	min.	0	500	0	0	Sp1-002-p0-sNO-010 / -075 (incl. Global Calibration b1)
	max.	5000	45000	1250	750	

municipal WWTP aeration

		typical concentration ranges for this application							
		TSS [mg/l]	TSS est [mg/l]	NO_3-N [mg/l]	NO_2-N [mg/l]	CODf [mg/l]	UV254 [Abs/m]	UV254f [Abs/m]	part number
spectro::lyser™ UV (TSS est, NO_3-N, CODf, UV254, NO_2-N)	min.		0	0	0	0	0		Sp2-001-p0-sNO-010 / -075 (incl. Global Calibration l1)
	max.		6000	100	500	1000	2500		
spectro::lyser™ UV-Vis (TSS, NO_3-N, CODf, UV254, UV254f)	min.	0		0		0	0	0	Sp1-001-p0-sNO-010 / -075 (incl. Gobal Calibration l1)
	max.	15000		20		400	2500	1500	

municipal WWTP effluent

		typical concentration ranges for this application								
		TSS [mg/l]	TSS est [mg/l]	NO_3-N [mg/l]	NO_2-N [mg/l]	COD [mg/l]	CODf [mg/l]	UV254 [Abs/m]	UV254f [Abs/m]	part number
spectro::lyser™ UV (TSS est, NO_3-N, COD, UV254, NO_2)	min.		0	0	0	0		0		Sp2-005-p0-sNO-010 / -075 (incl. Global Calibration e2)
	max.		300	50	10	500		500		
spectro::lyser™ UV-Vis (TSS, NO_3-N, COD, CODf, UV254, UV254f)	min.	0		0		0	0	0	0	Sp1-005-p0-sNO-010 / -075 (incl. Global Calibration e1)
	max.	500		25		500	300	500	300	

paper mill WWTP effluent

		typical concentration ranges for this application						
		TSS [mg/l]	NO_3-N [mg/l]	COD [mg/l]	CODf [mg/l]	UV254 [Abs/m]	UV254f [Abs/m]	part number
spectro::lyser™ UV-Vis (TSS, NO_3-N, COD, CODf, UV254, UV254f)	min.	0	0	0	0	0	0	Sp1-002-p0-sNO-010 / -075 (incl. Global Calibration q1)
	max.	1000	10	350	350	1250	750	

For more information about the measuring ranges and accuracy of the spectro::lyser and our other s::can probes and sensors, please refer to our product catalogue!

Case study - Thames Water

Since 2007, Thames Water Utilities Ltd (TWU) have been running a network of 143 s::can monitoring stations for nutrient and organics monitoring in waste water. With this, TWU tested a revolutionary concept that gave them a completely new level of insight, control and access to their waste water collection and treatment systems. Because of the great success of the first phase of this plan, it became clear that the concept is expandable, and TWU decided to do so with the new investment period of AMP5. s::can was rated best in the related tender, and now is preferred vendor in the next phase, again.

Parameters monitored:

- COD
- BOD
- NO3
- NH4
- TSS

Facts & Figures

Company:
Thames Water Utilities Ltd

Location:
United Kingdom

Date:
2007 - present

s::can Partner:
Process Measurement & Analysis Ltd.

Application:
Waste Water

Key Products installed:
spectro::lyser
ammo::lyser
con::lyte

Thames Water Utilities Ltd is the largest UK Water company providing best quality drinking water as well as efficient waste water collection and treatment to over 13 million people in the Thames Region. In 2007, the company established an innovative approach of water quality monitoring to ensure that all – even small and unmanned – waste water plants are operated at maximum efficiency, and in compliance with the tight requirements of waste water discharge. This approach was extremely innovative and unique on a global scale, and until today remains unparalleled.

Today, 143 s::can online water quality monitoring stations are located at many treatment plants at the influent and effluent, respectively, to monitor parameters like COD, BOD, NO3, NH4, and TSS in real-time.

Figure 19: Two con::lyte terminals

The sensors provide reliable results at proven accuracy, store them locally and send them to a central database, to conclude operational measures from observed changes of waste water quality. s::can and our UK partner Process Measurement & Analysis Ltd. brought a whole range of innovative hardware and software technology into this project in order to meet this challenging target. Since 2007, a network of 143 nutrient and organics s::can monitoring systems has been running, without the use of 'wet chemistry' systems, and at negligible consumable costs and maintenance efforts.

Figure 20: One of the 143 monitoring sites

It was clear to everybody involved from the start that only innovative, lowest maintenance, solid-state technology as exclusively supplied by s::can would be appropriate to serve the concept of such a large network of monitoring stations.

Reviewing 3 years of operational experience, Thames Water Utilities Ltd, s::can and Process Measurement & Analysis Ltd can look back to a success story that is unmatched, and underlined by impressive operations statistics:

spectro::lysers:

• 95 installed

• appr. 2.0 mio. operating hours

• only 1 defect per 153,500 operation hours / 17.5 operating years

ammo::lysers:

• 84 iinstalled

• appr. 1.8 mio. operating hours

• only 1 defect per 588,000 operation hours / 67 operating years

con::lyte terminals:

• 143 installed

• appr. 3.0 mio. operating hours

• only 1 defect per 1.5 mio. operating hours / 171 operating years

Taking into account the above results from currently operating monitoring stations, Thames Water Utilities Ltd decided to expand their revolutionary concept with another framework of hundreds of monitoring stations. As in the year 2007, s::can demonstrated its leading role again – technically and commercially – and was awarded the preferred vendor status for this project phase. Projects of this size are actually ground-breaking and show the way of the future of water quality monitoring. Some even call it a true “flip of technology”, out of the laboratory, out of consumable-based cabinet analyzers, and into reliable solid-state sensor technology combined with intelligent software. Until very recently, it was commonly believed that running such large networks at reasonable costs and efforts was just impossible. Thames Water Utilities Ltd, s::can and Process Measurement & Analysis Ltd proved it is possible.

Once more, s::can made clear that the time has come for reliable, simple, intelligent and inexpensive sensors and probes, networking for online water quality.

10 Some selected references

List not complete - selection of s::can systems sold to customers; no trials listed;

Customer/Country	Project/Application	Stations/ Systems	Parameters	Product
Vienna WWTP	WWTP aeration control	28	TSS, NO3	nitro::lyser
Austrian Hydro Power; Vienna Sewer Works and many more	WWTP and Industries	>7	NTU, TOC, DOC	spectro::lyser, con::stat
Canal Isabel II Madrid, Spain	Water Quality and Security Network , Waste Water	42	TSS, COD, BOD	spectro::lyser, con::stat
Japan: Kurita Industries	2002-2006	>15	TSS, NO3, COD	spectro::lyser, con::stat
San Francisco	Water Quality Data Analysis 2009	5	TOC, DOC, NO3, Turbidity, spectral alarms, event detection, pH, free Chlorine, NH4	spectro::lyser, con::stat, s::can sensors
Thames Water II	2011-present	150	TSS, COD, BOD, NH4, pH	multi::lyser, ammo::lyser, con::cube
Netherlands: Rijnland Waterboard	2008-2010	>15	NTU, TOC, DOC, BTX, NH4	spectro::lyser, ammo::lyser, con::cube
China: Nantong WWTP, Veolia Shanghai Pudong WTP, Beijing WTP Nr.9, Guangzhou Xizhou WTP, Shenyang Zhangshi WWTP, Taichang WWT and Hohai University Nanjing, and many more	WWTP Influent and Effluent monitoring	>300	TSS, COD, NH4	carbo::lyser, ammo::lyser, con::lyte

s::can Intelligent. Optical. Online.

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