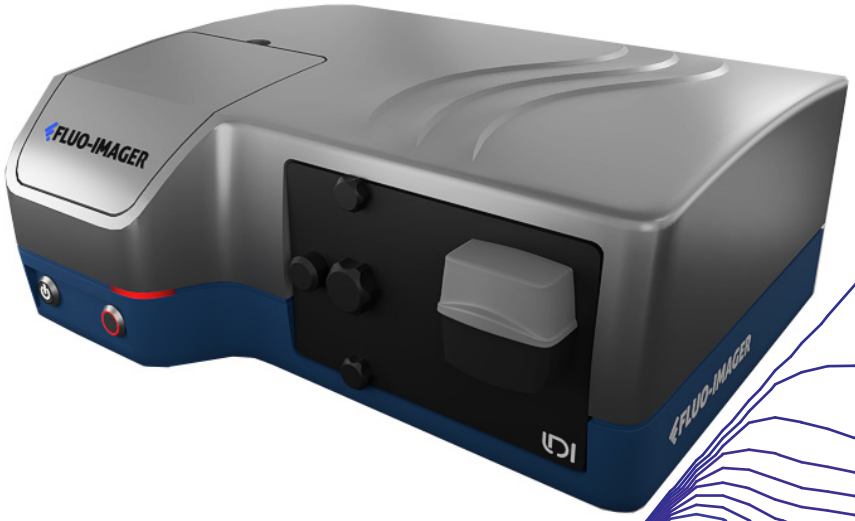
FLUO-IMAGER

Fluorescence & Absorbance Fingerprints Analyser



INTRODUCTION

Fluo-Imager™ analyser offers express detection and identification of organic compounds in liquid samples. The technology is based on Spectral Fluorescence Signatures (SFS) and pattern recognition. This direct measurement method provides quantitative and qualitative information on a wide range of parameters without the need for sample pre-treatment.

SFS Method

The principle of SFS is based on measuring the fluorescence intensity of a sample at different excitation and emission wavelengths. With the intensity of light induced fluorescence on a sample, as a function of excitation and emission wavelengths, a 3D SFS pattern is generated. Within this pattern, the standard color palette varies from blue (minimum fluorescence intensity) to white (maximum intensity). The fluorescence intensity serves to measure relative substance quantity.

Various chemical substances have different characteristic excitation/emission fluorescence spectra with unique SFS patterns. To analyse an unknown sample, the new SFS pattern can be matched to a customised SFS pattern library using Fluo-Imager's ExpertSystem software. The SFS Library and its database will need to be compiled and calibrated beforehand. The software looks for similarities between spectral patterns for sample identification. This technique can be referred to as spectral chromatography.

FLUO-IMAGER FEATURES

COMBINED FLUORESCENCE & ABSORPTION MEASUREMENT
Fluo-Imager performs simultaneous SFS (Excitation and Emission matrix EEM) and absorption measurements at preset wavelengths. This is important to detect non-fluorescent compounds; for samples in water, this added absorption data is considered in the multivariate calibration of water quality parameters.

BUILT-IN TEMPERATURE CONTROL
For temperature sensitive samples, Fluo-Imager has a built-in temperature control feature. Able to steadily raise and hold temperatures between15 - 40°C (59 - 104°F), this feature provides added value and flexibility, especially for microbiology experiments under in-vivo conditions.

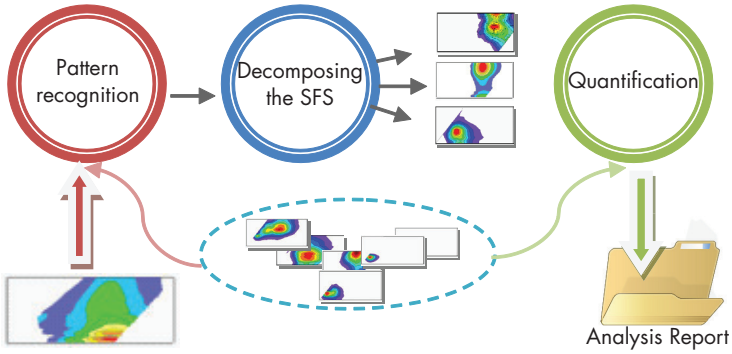
NO CHEMICALS REQUIRED
Using direct measurement technique has the advantage that no chemical pre-treatments are required. This allows quick analyses direct from source without creating waste, as samples may only need dilution.

CONTINUOUS BACKGROUND CORRECTION - INNER FILTER EFFECT (IFE)
Spectral fluorescence is inherently limited by higher sample concentrations, as the excitation beam is attenuated by what is near the surface and centre of the cuvette. Fluo-Imager can correct this by compensating with absorbance data as well as the natural background fluorescence from solvents. Water, for example, contains humic and fulvic acids, whose SFS patterns can be negated by the ExpertSystem when measuring organic samples in water solvent.

PURPOSE-BUILT SFS LIBRARY
The customisable library allows users to develop and refine applications according to evolving requirements. Fluo-Imager is designed to measure a wide range of liquid samples and gather unique SFS data patterns in its ExpertSystem program. By developing your own calibration standards, the SFS library can be used to quantify and qualify unknown samples. This is the principal behind fluorescence fingerprinting. Fluo-Imager provides a combination of investigative power and steady monitoring to ensure samples meet quality assurance standards.

PERISTALTIC FLOW-THRU PUMP
Fluo-Imager can accomodate an optional Flow-Thru cell to allow continuous, on-line monitoring. This means continuous flow samples are measured in real-time, changes can be detected and threshold alarms can be programmed.

OPERATIONS



Fluo-Imager starts with self-diagnostics to verify the light source intensity, detector sensitivity, excitation and emission wavelength scales, to compensate for any variations in operational parameters. By default, Fluo-Imager measures the SFS pattern in a standard UV-VIS spectral window. Advanced mode allows measurements at pre-selected fixed wavelengths for excitation and emission spectra.

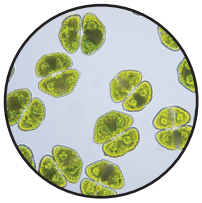
Measuring optical absorption allows Fluo-Imager to detect non-fluorescing compounds. Absorption data takes into account multivariate calibrations of integrated sample quality parameters.

INDUSTRIAL
Oil spills can result in litigation for the offending party. Fluo-Imager's ExpertSystem software can investigate and match oil types according to its customisable and growing database providing early evidence.

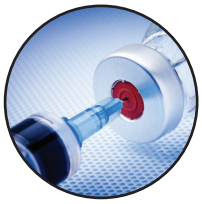
MATERIAL SCIENCES
Heavy metals (Cd^{2+}, Ni^{2+}, Cu^{2+} etc) from industry can contaminate drinking water downstream. Using fluorescent chelators, these metals can be detected and quantified using Fluo-Imager.

MOLECULAR BIOLOGY
Microplastics can accumulate up the food chain in the form of bisphenol A. With fluorescent probes, Fluo-Imager can detect minute traces of BPA for serological toxicity screening.

FOOD & BEVERAGE
Rapid quantification of riboflavin and tryphophan in dairy can assertain the quality and source of the product. Milk from grass or grain fed cows can be differentiated on chlorophyll metabolites.

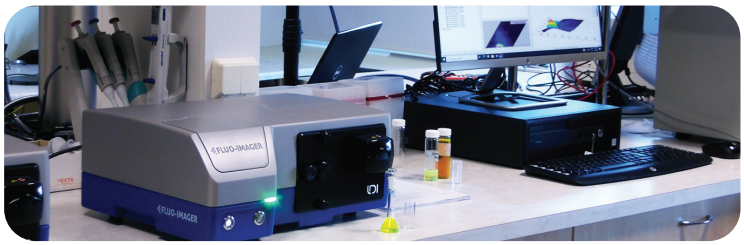


ENVIRONMENTAL
Fluorescence fingerprinting allows quick on-site algae detection, quantification and even identificaton. Different algae can be classified according to their chlorophyll signatures.



PHARMACEUTICALS
Vaccine quality control from production to transportation and storage are critical for drug viability. Fluo-imager can characterise subtle changes in vaccine structure and protein aggregation.

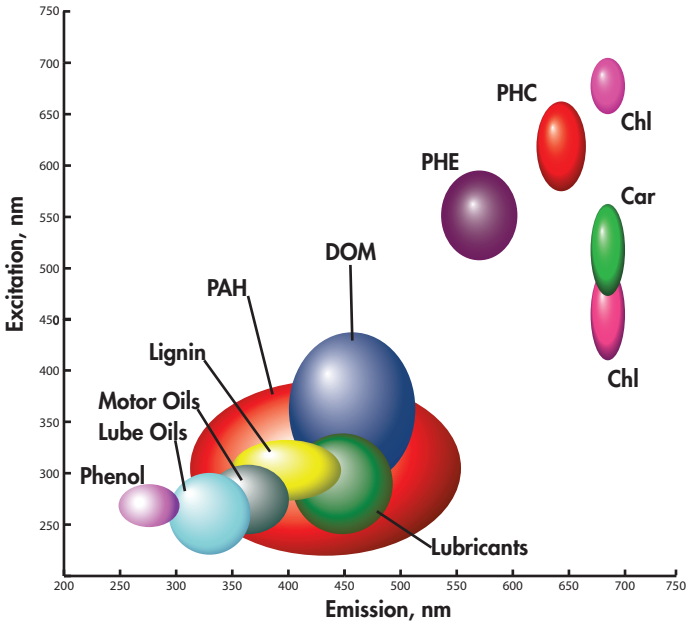
APPLICATIONS



TYPICAL DETECTION LIMITS *

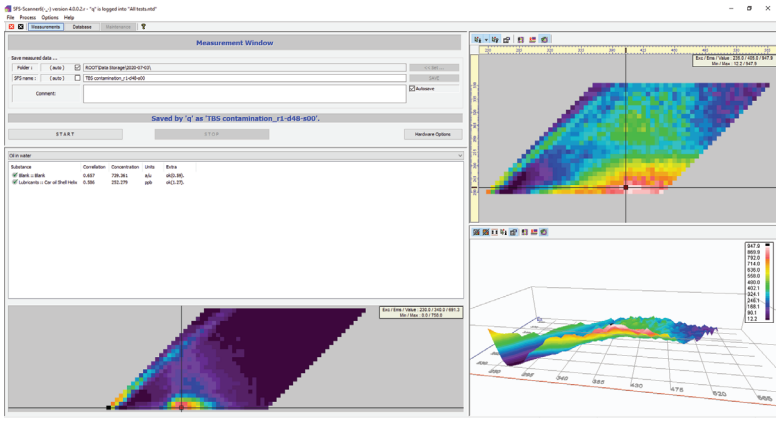
Crude oil	Heavy	0.2 mg/l
	Medium	0.5 mg/l
	Light	0.3 mg/l
Fuels	Kerosene	0.1 mg/l
	Petrol	0.5 mg/l
	Diesel	0.5 mg/l
	Gasoline	0.2 mg/l
Lubricants	Car oils	0.5 mg/l
	Turbine oils	0.5 mg/l
Phenols	Phenols	2 µg/l
	m-Cresol	100 µg/l
	Thymol	50 µg/l
PAH	Anthracene	1 µg/l
	Naphthalene	5 µg/l
	Benzo(a)pryene	1 µg/l
Phytoplankton	Chlorophyll	1 µg/l
DOM	FDOM	6 µg/l
	Quinine sulfate	0.4 µg/l

*In water without sample treatment



FI EXPERTSYSTEM

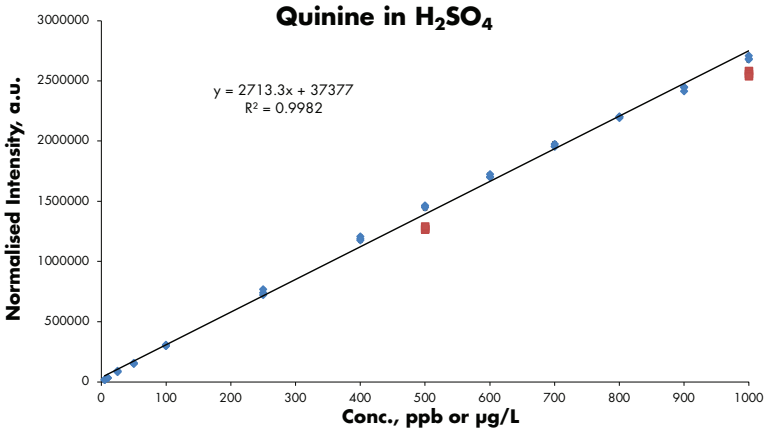
Our software provides all the tools to build your SFS Library. Different fluorescence compounds have unique SFS patterns and Ex/Em locations as shown on our hydrocarbon database (right). The more calibration tests performed, the larger and more comprehensive the SFS Library becomes. Take for example an unknown oil spill into a harhour. Measuring the source sample directly, with pre-treatment, the ExpertSystem software quickly negates the interference from dissolved organic matter (DOM) in water and identifies the unknown oil as Shell Helix displaying a probability output and estimated concentration based on database match. The Fluo-Imager is adaptable. Different measurement setups and libraries may be created and used depending on the application.



CALIBRATION CURVES

SENSITIVITY

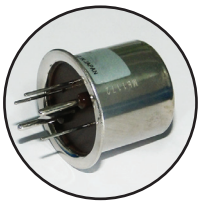
The heart of any spectral fluorescence instrument is governed by its performance: sensitivity to minute concentrations and comparison to established standards. The right graph shows Fluo-Imager measuring quinine down to single ppb levels and comparison to known standards (red dots).



ACCESSORIES

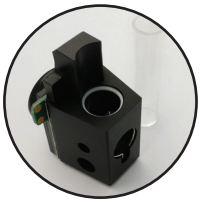
OPTIONAL COMPONENTS

The Fluo-Imager can be equipped with optional components to extend its operational life and capabilities. These items are easy-to-install, snap-in-place components for user convenience.

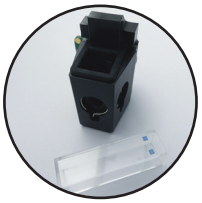


Xenon lamp

Flow-thru cell with extendable tube



Round cuvette holder



Square cuvette holder

Standard samples

FLUO-IMAGER

Multi-purpose spectral analyser for express detection and identification of fluorescent compounds in liquid samples.

TECHNICAL SPECIFICATIONS

MEASURING principle	Spectral Fluorescence Signature (SFS) & Absorbance
Measuring cycle time	47 s (standard window λex/λem 230 – 350 / 250 – 565 nm, accumulation 1)
Light source	Pulsed Xenon lamp, 20 W; Easily replaceable after 100,000 scans
Spectral unit	Scanning excitation / emission monochromators
Spectral range	220 – 650 nm excitation with 1 nm step 240 – 730 nm emission with 1 nm step
Absorption spectral range	220 – 650 nm with 1 nm step
Spectral resolution	10 nm
Detector type	Photo Multiplier Tube
Sample cell	UV Quartz flow-through & standard laboratory
Cell volume	Standard square UV quartz cell (12.5 x 12.5 x 45 mm) UV quartz flow-through (12 x 10 x 40 mm) (OD x ID x H) UV quartz round cell (12 x 10 x 51 mm) (OD x ID x H)
Automated temperature control	Ramping from +15 to +40°C with Peltier device with 0.1°C step (attention not higher than ±20°C from operating outside temperature)
OPERATIONS verification	Automatic, based on internal standard
Ambient temperature	+10°C to +40°C (50 - 104°F)
Voltage	88 - 264 VAC, 47 - 63 Hz
Power consumption	80 W
Dimensions (H x W x D)	20 x 44 x 36 cm (7.87 x 17.32 x 14.17 in)
Weight	12.8 kg (26.46 lb)
Control unit	Built-in processor controller
SOFTWARE operating system	Windows 7 or higher
Access level control	Login/Password protection for access data storages
Data storage	Microsoft Engine Database
Digital Output	.TXT, .ISP
Data analysis	Correlation, adjustable by user based on SFS library and ExpertSystem program
PUMP type (built-in)	Peristaltic
Pump velocity	190 rpm
Pumping depth	Up to 5 m (127 ml/min)
Pumping intervals	From 2 s up to 100,000 s between measurements
Pumping tube material	Pumpsil* tubing 4.8mm bore x 1.6mm wall thickness 5*m length (customisable)

Laser Diagnostic Instruments (LDI) specialises in photonics and software algorithm creating advance fluorescence-based instruments. Located in Estonia (E.U.), LDI is a R&D company and a Manufacturer since 1991. All our products are designed and produced in-house. We hold nine core technology patents and continue to innovate our products. As such, you can count on our support for years to come.

LDI +372 5911 2255 sales@ldi.ee www.ldi.ee Laser Diagnostic Instruments AS