

**BROADBAND**  
TUNABLE QCL BASED  
**SENSOR** FOR ONLINE  
AND INLINE **DETECTION**  
OF **CONTAMINANTS**  
IN WATER



# AQUARIUS

Project number: **731465**  
Project website: **[www.aquarius-project.eu](http://www.aquarius-project.eu)**  
Project start: **1st January, 2017**  
Project duration: **3 years**  
Total costs: **EUR 3,891,263.75**  
EC contribution: **EUR 3,891,263.75**



PHOTONICS PUBLIC PRIVATE PARTNERSHIP



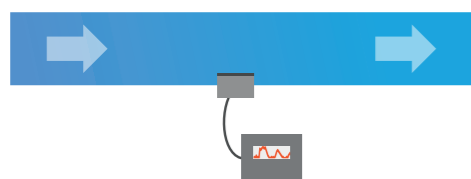
# MISSION

**AQUARIUS will provide an on- and inline capable mid-IR sensing solution to meet legal provisions for industrial waste water and drinking water monitoring.**

Significant enhancement in sensitivity will be achieved by further advancement of the laser source and the detector as well as an innovative combination of sample extraction and preparation with polymer functionalized waveguides.

The **AQUARIUS** sensing solution will be developed along the entire value chain towards integration in industrially proven online devices for water control driven by strong industrial commitment in this consortium.

Inline



Online



## MOTIVATION

Sufficient and clean freshwater is under pressure worldwide, although fresh water is essential for human wellbeing and plays an important role in the world economy.

Water is the most abundant substance on the Earth's surface and essential for all forms of life and used in almost every industrial process, directly or indirectly, but fresh water comprises only a small fraction of the total amount of water.

Therefore, ensuring good quality of this resource is paramount. The variety and concentration of chemical species in the aquatic systems can be quite diversified, presenting a challenge in terms of

both water purification strategies and water quality control.

These contaminants are a challenge to the water sector. Increasingly effective laboratory detection techniques reveal the presence, in surface water for instance, of low concentrations of contaminants, whose presence was previously unknown.

To assure a safe environment, novel water monitoring technologies are needed for all types of water and shall enable pervasive water monitoring which can replace and compliment currently employed laboratory based off-line methods by online or inline monitoring strategies.

## APPLICATION

AQUARIUS will focus on innovative sensor solutions for monitoring oil contaminations in water.

**Typical fields of application are**

- 💧 Industrial process and waste water control
- 💧 Water treatment and purification (incl. environmental water monitoring)
- 💧 Drinking water supply



## CONCEPT

The **AQUARIUS** project addresses the development of a **new generation of photonic sensing solution**, in response to the need for pervasive sensing for a safer environment.

In particular components, modules, sub-systems and systems shall be developed for enhanced sensitivity and specificity measurements in water monitoring

following the requirements of regulatory bodies, as well as the needs of selected end-users such as waterworks and the oil producing industry.

Specifically addressed within the **AQUARIUS** project is the detection of hydrocarbon contaminations in water (Oil-in-Water contaminations). Today, in most cases, highly sensitive

Oil-in-Water analysis requires the samples to be taken at e.g. a waterworks facility and then transferred to an analytical laboratory.

While most current laboratories with analytical techniques can in principle handle these tasks, they are often labour and cost intensive, but above all time consuming.

**AQUARIUS** addresses the

requirement for on- and inline analytical sensors with high sensitivity and will enable reliable and continuous real-time monitoring on site.

## OBJECTIVES

- 💧 Enhancement of broadband tunable quantum cascade lasers in terms of spectral coverage and noise
- 💧 Realisation of a fully functional spectrometer sub-system consisting of a  $\mu$ EC-QCL and a fast MCT detector including data acquisition
- 💧 Advance Oil-in-Water (OiW) monitoring capabilities from offline (state-of-the-art) to online
- 💧 Test of the online OiW system at industrial end users
- 💧 Realisation of integrated optical circuits (IOCs) for waveguide based sensing and inline capable sensing configuration
- 💧 Assembly and test of the inline OiW system in a laboratory environment



## CONTACTS

### Project Coordinator

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## CONSORTIUM

It is a thoroughly selected **mix of partners from five different countries** who complement each other with their competencies, experience and ambition at high level. Due to excellent cooperation in the proposal creation, the basis for a very promising collaboration has already been set.

### 1 TECHNIKON

Technikon Forschungs- und Planungsgesellschaft mbH, Austria [Villach]

### 2 QUANTARED TECHNOLOGIES

QuantaRed Technologies GmbH, Austria [Vienna]

### 3 Fraunhofer IAF

Fraunhofer-Institut für Angewandte Festkörperphysik, Germany [Freiburg]

### 4 Fraunhofer IPMS

Fraunhofer-Institut für Photonische Mikrosysteme, Germany [Dresden]

### 5 OMV

OMV Exploration & Production GmbH, Austria [Vienna]

### 6 VIGO SYSTEM

VIGO System S.A., Poland [Ozarów Mazowiecki]

### 7 imec embracing a better life

Interuniveritair Micro-electronicacentrum IMEC VZW, Belgium [Heverlee]

### 8 TU WIEN TECHNISCHE UNIVERSITÄT WIEN

Technische Universität Wien, Austria [Vienna]

### 9 KWR Watercycle Research Institute

KWR Water B.V., The Netherlands [Nieuwegein]

