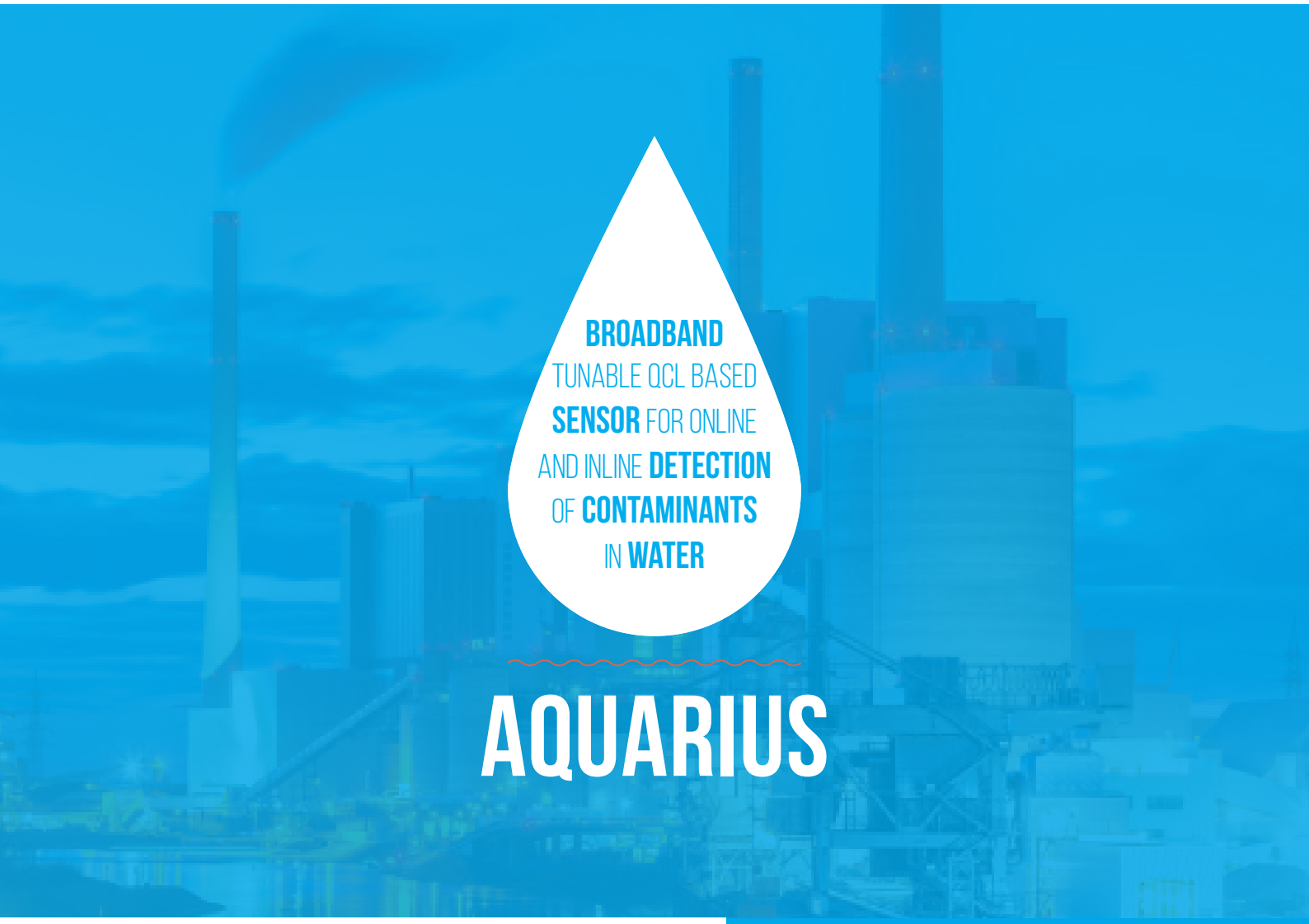


BROADBAND TUNABLE QCL BASED **SENSOR** FOR ONLINE AND INLINE **DETECTION** OF **CONTAMINANTS** IN **WATER**

AQUARIUS

REVIEW/FLASHBACK

With this sixth and final issue of the AQUARIUS newsletter, we revisit the past 4 years and summarize the project achievements.

About four years ago the H2020 project AQUARIUS was launched. Eight partners from five different European countries including three SMEs, two industrial companies, two research organizations, and one university forged the consortium which would work together to achieve the ambitious goals of the project.

Consortium
8 Partners (5 Countries)

Project Coordinator
Dr. Klaus-Michael Koch
coordination@aquarius-project.eu

Technical Lead
DI Wolfgang Ritter
w.ritter@quantared.com

Project number	**731465**
Project website	**www.aquarius-project.eu**
Project start	**1st January, 2017**
Project duration	**4 years**
Total costs	**EUR 3,891,263.75**
EC contribution	**EUR 3,891,263.75**

The project leading to this application has received funding from the European Union under grant agreement No 731465. This project is an initiative of the Photonics Public Private Partnership.

REVIEW/FLASHBACK

Aquarius concluded at the end of 2020 but partners can earnestly look back at an endeavour which can safely be called a success. Not to say there were no challenges along the way but the consortium acted professionally to keep things on track in the face of adversity.

THE AQUARIUS PROJECT

The goal of AQUARIUS (Broadband Tunable QCL based Sensor for Online and Inline Detection of Contaminants in Water) was to provide an on- and inline capable mid-IR sensing solution to meet legal provisions for industrial waste water and drinking water monitoring.

The AQUARIUS project addressed 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 were 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 was the detection of hydrocarbon contaminations in water (Oil-in-Water contaminations). AQUARIUS aimed to provide improved on- and inline sensors in terms of quality and effectiveness, allowing for a reliable and continuous real-time monitoring on site. The new sensors will become possible by the use of a new class of external cavity (EC) quantum cascade lasers (QCL) and detectors.

The AQUARIUS project objectives:

- Enhancement of broadband tuneable quantum cascade lasers in terms of spectral coverage and noise (TRL increase: from 4 to 6)
- Realisation of a fully functional spectrometer sub-system consisting of a µEC-QCL and a fast MCT detector including data acquisition (TRL increase: from 3 to 6)
- Advance Oil-in-Water (OiW) monitoring capabilities from offline (state-of-the-art) to online (TRL increase: from 3 to 6)
- Test of the online OiW system at industrial end users (TRL 7)
- Realisation of integrated optical circuits (IOCs) for waveguide based sensing and inline capable sensing configuration (TRL increase: from 2 to 4)
- Assembly and test of the inline OiW system in a laboratory environment (TRL increase: from 2 to 4)

AQUARIUS SUMMED UP

In the past four years quite a bit has happened. Project partners can proudly look back at an angaged, collaborative and productive time with many ups and a few downs. All project partners were committed; the cooperation within the consortium was stable throughout the project and all partners worked tirelessly to ensure project goals were reached.

The consortium worked unquestionably well together. Synergies were developed and unwavering teamwork pushed the consortium to achieve goals and to deal with all the issues that emerged during the project lifetime. The Consortium is proud of the main achievements reached within the Project.

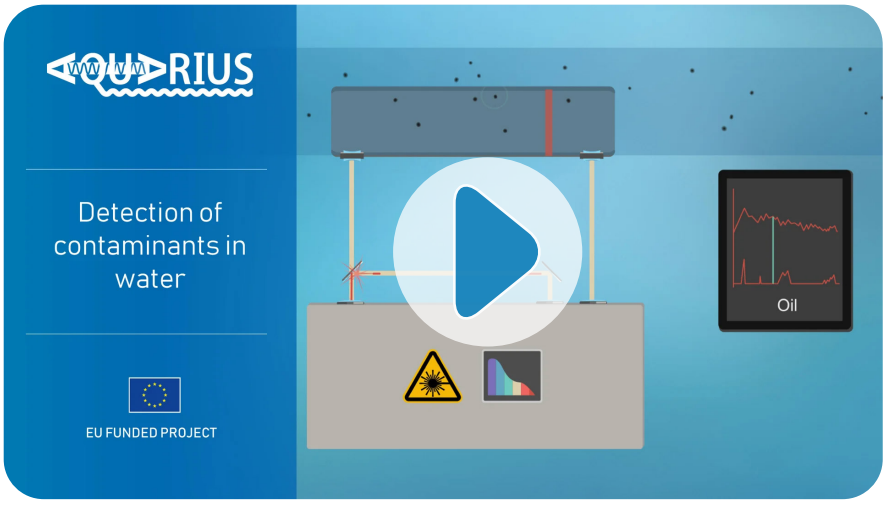
Major steps towards on- and in-line measurements

- Improved external cavity quantum cascade lasers (EC-QCLs)
- EC-QCL based spectrometer
- On-line Oil in Water analyser by automatic extraction
- Functionalized sensor for in-line Oil in Water spectroscopy

MEDIA PRODUCTIONS

AQUARIUS VIDEO

The project AQUARIUS addresses the development of a new generation of photonic sensing solution, in response to the need for pervasive sensing for a safer environment. The Project is described in detail in the following video:



AQUARIUS PODCASTS

In addition, four Podcasts were produced. All give a more detailed insight into the Project, its results and the markets which might be addressed:

EPISODE 01 - WITH ANATOL EHRLICH (QRT)

The first podcast was recorded with Anatol from QuantaRed. Anatol talks about the project in general and what the consortium is trying to do in AQUARIUS.

The big picture in AQUARIUS is the clean water and the specific goals are actually how we can monitor to get this clean water. There is one way to get clean water which would be hands on experience so by developing a process to refine water that it starts you can get it cleaner and then there's a different approach which would be monitoring the clean water process. In the AQUARIUS project we're talking about the monitoring. We want to make an analyser that monitors the quality of the water. The way we do this is that we develop a spectrometer - a very compact spectrometer - which is also easy to use and with the spectrometer we can actually target specific molecules which give a good indication of whether a process stream or whether water is actually clean or not.

EPISODE 02 - WITH HAKAN (QRT)

What does the average taxpayer in Europe get from the AQUARIUS project?

Important for the average taxpayer in Europe is the protection of his environment. So to have clean water, that's the statement we want to have. One of the applications we talked about is process water, which is basically water which is used in a certain process. So after the process, this water is discharged to the environment. And we want to have a statement regarding how clean the water is regarding the oil contamination.
For example, you want to understand how much oil is inside of the water, so one is able use the oil, but important for the average taxpayer in Europe is definitely to protect the environment. And when we bring back the water to the environment, we need to understand what contamination of the water it is. So stay tuned for the contamination and despoil continent contamination is one part of the statement.

EPISODE 03 - JOEP FROM (KWR)

What is the biggest advantage of AQUARIUS?

There are really two main benefits from the developments in the project. So one is the continuous monitoring. So indeed, not having to take a sample, put it in a bottle and bring it to a laboratory, which might be on site if we talk about an industrial location where typically there are facilities to analyse samples like that. But for environmental monitoring, typically, you would take the sample to a lab that would be stored until they have enough samples to perform the analysis which might be the next day or it might be a month later. So basically what you what you get that as you get information about one specific point in time, you have no idea what happened with what quality between those samples. And this is where the AQUARIUS sensor could really help to get continuous impression of what is happening in a water system.

The other thing that's really new with Aquarius is that we will have a relatively ultimately, of course, we talk about the commercial product, a relatively affordable system that can say something about the nature of the compounds in the water.

EPISODE 04 - CHRISTOPH PULS (OMV)

What is success for the AQUARIUS project?

Success would be the development of a workable and robust online sensing system for oil and wate.This would be a great first step in the direction of the kind of analysis system we target with the project. Since there are already commercial systems for oil in water monitoring of the market, we would of course target high sensibility and especially a high collectiveness to minimise wrong readings by interfering water constituents or other changes in the sample stream.

Follow AQUARIUS on:

The project leading to this application has received funding from the European Union under grant agreement No 731465. This project is an initiative of the Photonics Public Private Partnership.