

Project Acronym:	Hydroptics
Grant Agreement number:	871529 (H2020-ICT-2019-2)
Project Full Title:	Photonics sensing platform for process optimisation in the oil industry



DELIVERABLE

D9.5 – Report on the implementation of dissemination & communication activities: Final

Dissemination level	PU – Public
Type of Document	Report
Contractual date of delivery	30/11/2023
Deliverable Leader	David Gachet (ALPES)
Status & version	V2.0
WP / Task responsible	WP9 / Alpes Lasers
Keywords:	Dissemination, communication, exploitation

Deliverable Leader:	Alpes Lasers
Contributors:	Sargis Hakobyan (ALPES) Etienne Giraud (ALPES) David Gachet (ALPES)
Reviewers:	David Gachet (ALPES)
Approved by:	David Gachet (ALPES)

Document History			
Version	Date	Contributor(s)	Description
V1.0	15/11/2023	David Gachet (ALPES)	First complete version
V1.1	21/12/2023	David Gachet (ALPES)	Revised version
V2.0	22/12/2023	David Gachet (ALPES)	Final version, after approval by the Coordinator

This document is part of a project that has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 871529. It is the property of the HYDROPTICS consortium and shall not be distributed or reproduced without the formal approval of the HYDROPTICS Management Committee. The content of this report reflects only the authors' view. EC is not responsible for any use that may be made of the information it contains.

Executive Summary

This deliverable describes all the developments done in dissemination and communication activities of HYDROPTICS project as per November 30, 2023 (M48). We discuss in detail the initial goals of the project in the aspect of dissemination and communication, show the obtained results, and discuss the achievements and the issues met during the project.

Table of Contents

Executive Summary	2
Table of Contents	3
1. Introduction	4
2. Awareness raising.....	4
2.1. Website	4
2.1.1. Videos	6
2.1.2. Brochure / Banner	6
2.2. Social Media	7
2.3. Workshops.....	7
2.4. External Advisory Board	10
2.5. Press releases.....	11
2.6. Conference scientific journals.....	14
2.7. KPI.....	19
3. Engagement.....	19
3.1. Dr. Reddy's.....	20
3.2. Synovia	20
3.3. Wintershell DEA.....	20
3.4. ETH Zurich.....	21
4. Covid-19 effect on the project	21
Conclusions.....	22

1. Introduction

Awareness raising and stakeholders' active involvement in the project being critical for the project success, dissemination and communication activities are essential. They were first described in Deliverable D9.2 "Reporting on the implementation of dissemination & communication activities: First" (M24). Here, we give an update of these activities, showing the achievements, difficulties, and strategies to overcome the encountered difficulties.

The dissemination plan is split into two stages as described in the figure below:

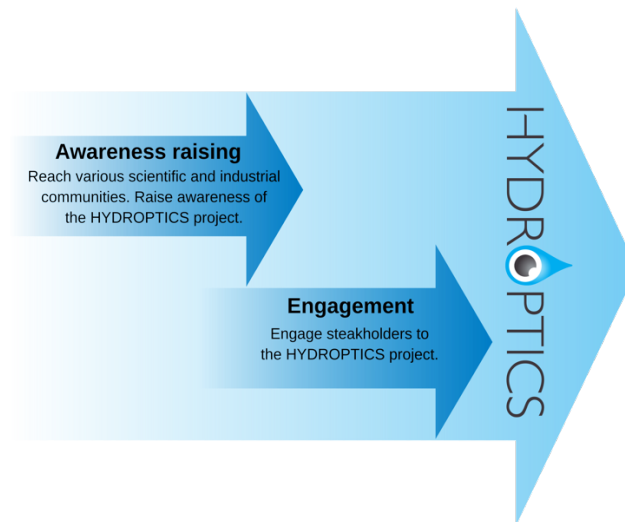


Figure 1: Dissemination plan of the project HYDROPTICS

The first half of the project was mainly devoted to the Awareness raising phase, where we made use of our dissemination channels to raise awareness of our project to the general audience, industrial and scientific communities.

2. Awareness raising

The Consortium has accepted a strategy of awareness raising by online media platforms, the following online channels are used for awareness raising:

- 💧 LinkedIn
- 💧 Twitter
- 💧 Website updates
- 💧 Workshops

We have actively posted new releases on our LinkedIn, Twitter accounts and on the project website with various achievements of our project. Since the M1 to M48 we have posted 40 posts on our online platforms, from which 10 were official press releases with achievements and news on the project. We have also participated into various workshops on presenting the project and its achievements.

2.1. Website

The HYDROPTICS website is accessible at <http://hydroptics.eu/>. The website was continuously updated with newsletters, press releases, events announcements, and public deliverables. The general structure has remained the same since it has proven to be an efficient one. The overview of the pages of our website can be found in the figure below:

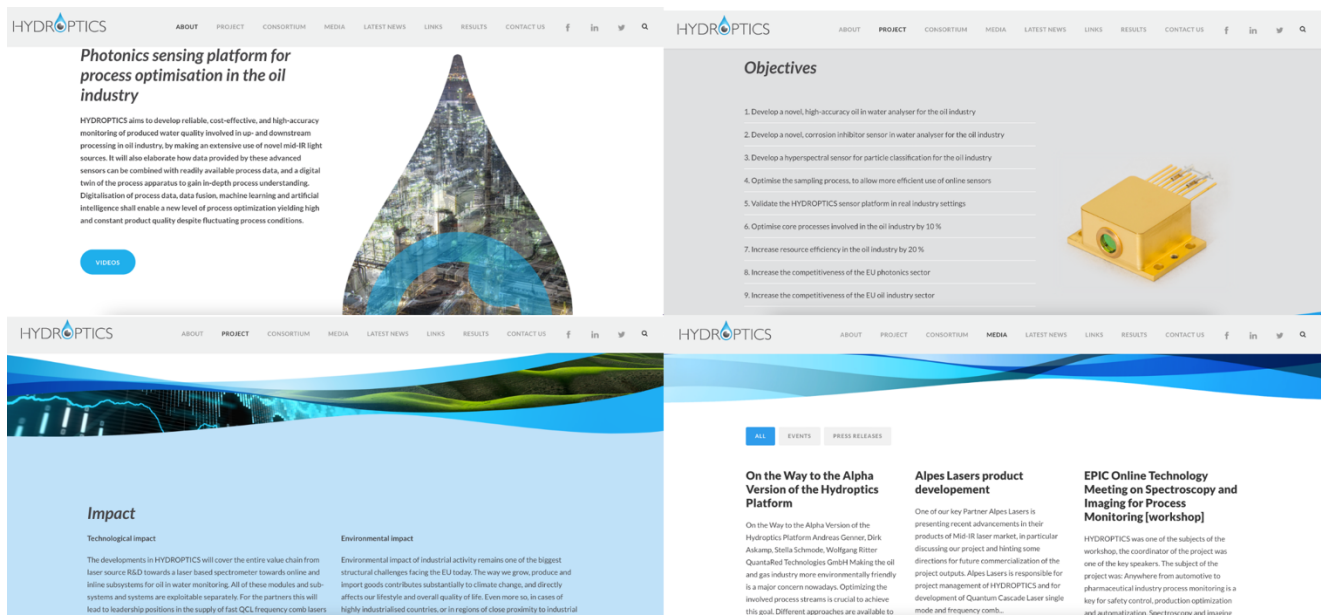


Figure 2: Pages of the HYDROPTICS website.

We used the website as principal platform for dissemination material, we attempted to add all the information related to the project into the website and we linked the website on almost all the social media posts.

The website incorporates all the basic project information, news, press releases, newsletters, events, publications, public deliverables, blog posts, collaboration with similar projects and initiatives and a library including the available promotional material and the project’s general presentation. Information regarding the technical details and content types can be found in the deliverable D9.1 “Dissemination plan and material”.

To reflect the progress of the project and present its results, the content of the website was regularly updated with the contribution of all partners. As of M48 of the project, we reached 27’190 clicks and 40’621 views of the webpage, more detailed analysis of the website can be found in **Error! Reference source not found.** and **Error! Reference source not found.**

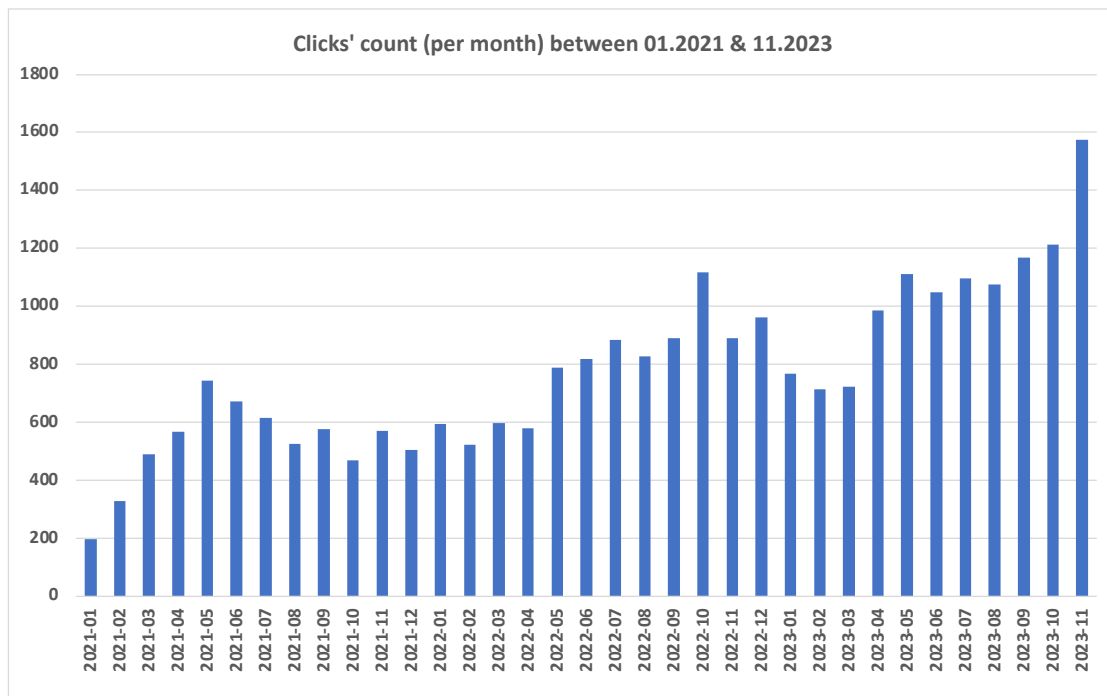


Figure 3: Counts of clicks per month of www.hydroptics.eu since 01.2021.

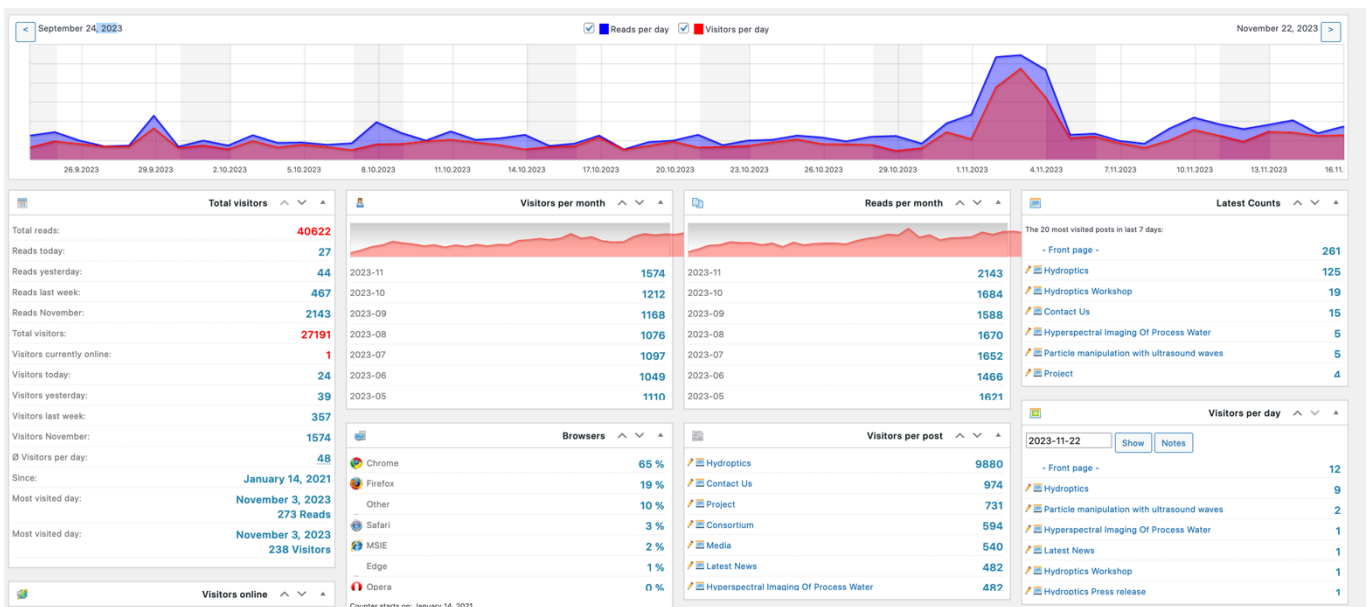


Figure 4: Statistics of the www.hydroptics.eu website since 01.2021

2.1.1. Videos

The project was presented in multiple conferences and workshops and few insightful video materials was produced. As the platform development and field tests were severely impacted by the sudden and unexpected termination of a key partner, the production of a video introducing the project, the field validation results, as well as the innovations developed within the project, was delayed. Once produced, this video will be shared via the project's website and social media.

2.1.2. Brochure / Banner

The HYDROPTICS project developed several versions of brochure and banner. Their final versions are available on our website. By the end of M48, the brochure was downloaded 488 times and the banner 577 times. The brochure and the banner can be seen in **Error! Reference source not found.**, the full quality brochure and banner can be downloaded through the following links:

https://hydroptics.eu/wp-content/uploads/2020/12/HYDROPTICS_brochure.pdf

https://hydroptics.eu/wp-content/uploads/2020/12/Hydroptics_banner.pdf



Figure 5: a) Hydroptics brochure two sides; b) Hydroptics banner.

2.2. Social Media

Social media platforms are key tools for dissemination and exploitation of the project. By the end of the project, we posted 40 posts, with various content to attempt to target different audiences such as Research and academic, marketing, oil & gas industry, spectroscopy industry, and general audience.

Following the first review meeting, measures to engage more specifically the oil & gas sector were undertaken, successfully, as already described in Deliverable D9.2.

2.3. Workshops

HYDROPTICS participated in two workshops organized by the European Photonics Industry Consortium (EPIC):

Photonics Sensors of Safer and Intelligent Oil & Gas Producers:

The workshop was devoted on safe and more intelligent sensors for oil and gas producers, hence it matched perfectly to the subject of project HYDROPTICS. A brief presentation of the project was presented, showing the results, the vision, and the prototype of the project. A lot of interesting connections were developed from this workshop, and we followed up with some key organizations on the activities of the project. The workshop was live broadcasted on YouTube; the full video can be found in the link below:

<https://youtu.be/LimpZKrfYw?t=4158>

More details of the workshop can be found by this link:

<https://www.epic-assoc.com/epic-online-technology-meeting-on-photonics-sensors-for-safer-and-intelligent-oil-gas-producers/>

Online Technology Meeting on Spectroscopy and Imaging for Process Monitoring:

The workshop was devoted to different methods of process monitoring of various industries such as automotive, pharmaceutical, oil refinery, etc.

We were one of the 5 key speakers of this workshop, where the project was fully presented. The workshop was life-streamed on YouTube (link below):

<https://youtu.be/-AVIN3NwEZo?t=7326>

After this workshop we got quite positive feedback from possible stakeholders, from which two of them showed intense interest in starting collaboration. We held discussion with them to see how our systems could be utilized for their use-case.

More details on this workshop can be found through the following link:

<https://www.epic-assoc.com/epic-online-technology-meeting-on-spectroscopy-and-imaging-for-process-monitoring/>

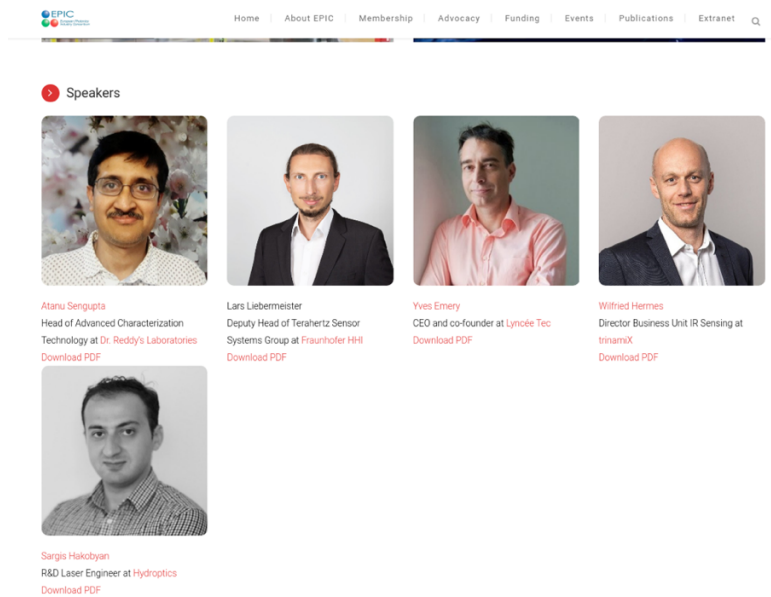


Figure 6: Cover page of the online technology meeting on spectroscopy and imaging process monitoring.

On December 15th, 2023, HYDROPTICS organized a dedicated online workshop entitled:

Photonics-based platform for process optimisation in the oil industry – Presentation of the next generation tools

The goal of this final workshop was to introduce the project and its main achievements to a broad audience. The six speakers were selected among Hydroptics' partners, to give an overview of the projects, its goals, the concept and technologies behind the platform, the tools that were developed in the frame of the project, as well as its main achievements. The agenda was the following:

10'	HYDROPTICS – the challenge and solutions Dr David Gachet, Alpes Lasers SA
20' + 10' Q&A	Coherent control of FM-combs with radio-frequency injection Prof. Benedikt Schwarz, Technical University of Vienna
20' + 10' Q&A	Innovative Integration of Dual-DFB Quantum Cascade Lasers on Silicon Photonics Platform

	Dr Dongbo Wang, IMEC & Ghent University
20' + 10' Q&A	Compact Solution for Continuous Sample Conditioning Dr Bahram Haddadi, Technical University of Vienna
20' + 10' Q&A	Novel mid-IR analyser for the oil industry Dominik Wacht, Technical University of Vienna
20' + 10' Q&A	The Hydroptics particle sensing system Dr Thomas Arnold, Silicon Austria Labs
20' + 10' Q&A	The value of field-testing online analysers Dr Martin Datler, OMV



Figure 7: Banner of the Hydroptics' final workshop

The workshop was recorded and will be soon shared online on YouTube. Before proceeding, we need the formal approval of speakers' organizations.

The workshop attracted in total 65 attendees (from 78 initial registrations), working for universities, R&D centers, and companies active in photonics, mid-infrared spectroscopy, or oil & gas.

More details of the workshop can be found through this link:

<https://hydroptics.eu/workshop/>

Follow-up with participants will be specifically organized to identify organizations potentially interested in the technology.

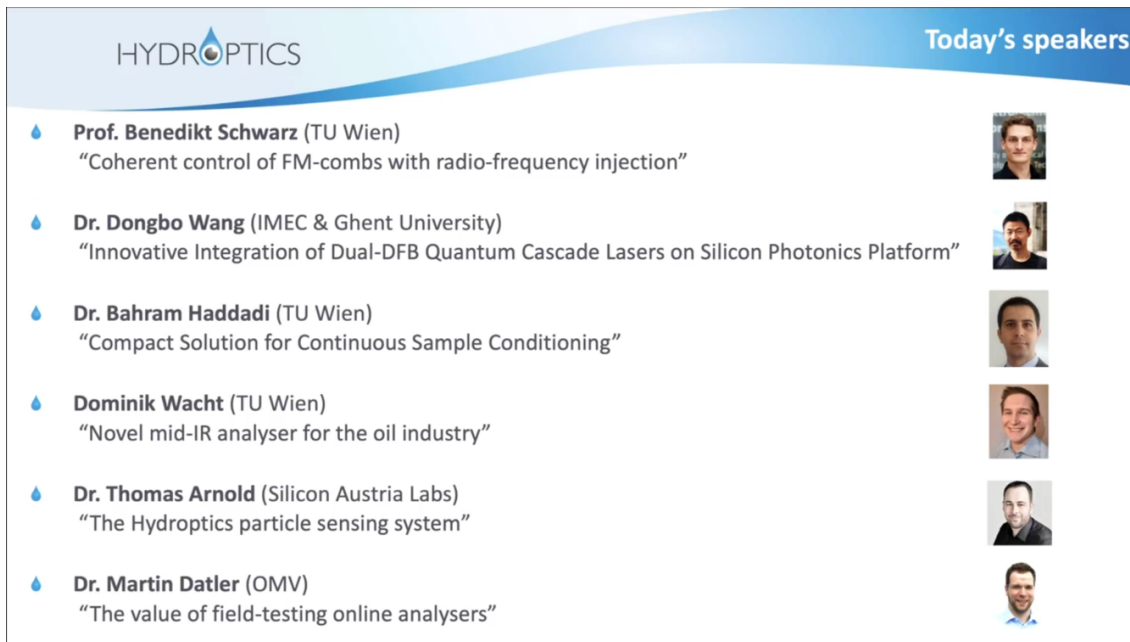


Figure 8: Slide introducing the speakers of the Hydroptics online workshop.

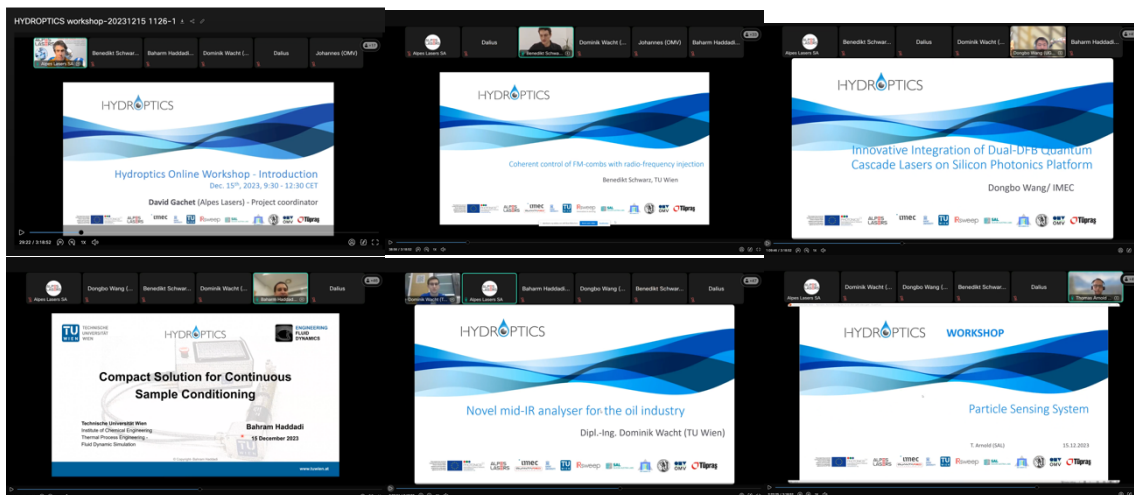


Figure 9: Selected screenshots of the Hydroptics online workshop.

2.4. External Advisory Board

We had very constructive and very useful meetings with our external advisory board member Prof. Giacomo Scari from ETH Zürich and Dr. Mathias Busch from Wintershell DEA. Their input was very useful to understand the actual needs of the market and get first feedback. In particular, the need for novel approaches proposed to be developed in HYDROPTICS project was confirmed by Dr. Busch, as to his knowledge as well, no comparable system is commercially available, thanks to the multi-operationality of the prototype. In particular, the particle analysis with our Hyperspectral Imaging (HSI) adds a significant unique value to the prototype.

Prof. Scari’s inputs were more directed into the laser development and integrated optical circuit side, where he embraced our goals and achievements, and confirmed the potential of such systems to become a very useful tool in research institutions and not only.

2.5. Press releases

We intended to be proactive on press releases all along the project, our belief being that press releases are one of the most efficient methods of awareness raisings, and for attracting people from various fields. We updated our followers of every important event, achievement, and upcoming events of the project. At the end of the project, we initiated and published 10 Press Releases that contained very insightful and interesting information on new findings of the project, as well as related to events participated as a project. After assembly of the final Hydroptics' modules and successful completion of the two pilot tests, we plan to prepare and publish a Final Press Release.

Table 1: List of Press releases with descriptions (updated)

Title	Description	Link
HYDROPTICS Press release	Announces the start of a project HYDROPTICS	https://hydroptics.eu/hydroptics-press-release/
Hydroptics kick-off meeting	Release describing the first kick-off meeting of the project	https://hydroptics.eu/hydroptics-kick-off-meeting/
Photonics21	Scientists use Photonics to Make Wastewater eco-friendly	https://www.photonics21.org/2020/scientists-use-photonics-to-make-wastewater-eco-friendly
Online oil-in water detector	Presenting results on dual-laser balanced detection of oil	https://hydroptics.eu/online-detector/
Dual-Comb spectroscopy for oil detection	Presenting results on dual-comb spectroscopy for oil detection	https://hydroptics.eu/online-oil-in-water-detector/
Multiphase separation of two liquids	Presenting the results on novel centrifugal separator, patent description	https://hydroptics.eu/multiphase-separation-of-two-liquids/
Hyperspectral Imaging of Process Water	Presenting results on newly developed Hyperspectral imaging module for	https://hydroptics.eu/hyperspectral-imaging-of-process-water/
Alpes Lasers product overview	Alpes Lasers describing the latest devices including the developments in the HYDROPTICS projects	https://youtu.be/LfjHhFI-ai4?t=675
On the Way to the Alpha Version of the Hydroptics prototype	Describing the upcoming alpha prototype of the project	https://hydroptics.eu/on-the-way-to-the-alpha-version-of-the-hydroptics-platform/
Particle manipulation with ultrasound waves	Describing the method of particle manipulation with	https://hydroptics.eu/particle_manipulation_with_ultrasound_waves/

	ultrasound waves for efficient imaging	
Final press release <i>(title to be determined)</i>	Announcement of the assembly of the final module and the successful completion of the two pilot tests at partners' premises.	

Technical and scientific press releases:

We published 6 press releases related the significant achievements of the project with the following titles:

- 💧 Online oil-in water detector
- 💧 Dual-Comb spectroscopy for oil detection
- 💧 Multiphase separation of two liquids
- 💧 Hyperspectral Imaging of Process Water
- 💧 On the Way to the Alpha Version of the Hydroptics prototype
- 💧 Particle manipulation with ultrasound waves

These Press releases concentrated on significant technical and scientific achievements of the project. By publishing the scientific achievement of the project, we identified early adapters, and tried already to adapt our system to the demands of the market. These press releases were the backbone of the awareness raising stage since this platform allows to share at the very early stage of the prototype development the results and the vision of the prototype.

Photonics21:

We were featured on Photonics21 journal with a title “Scientists use Photonics to Make Wastewater eco-friendly”.

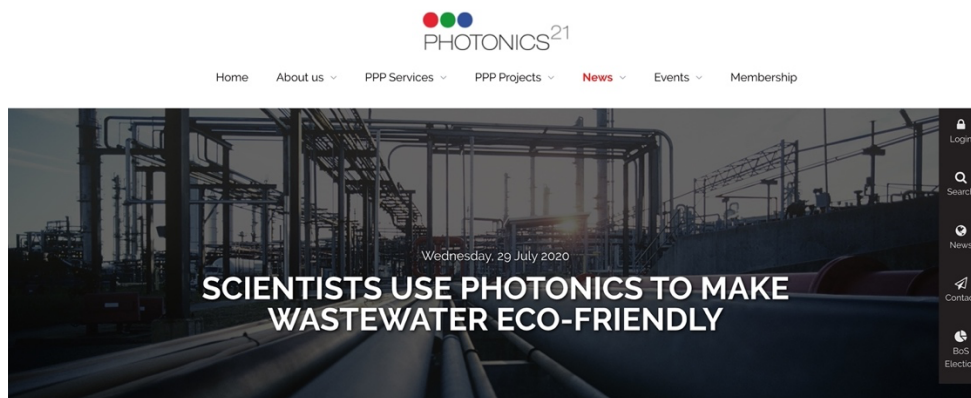


Figure 10: Photonics21 press release on HYDROPTICS.

In this article we discussed the very important aspect of the project namely the ecological aspects. More details can be found through the following link:

<https://www.photonics21.org/2020/scientists-use-photonics-to-make-wastewater-eco-friendly>

2.6. Online showcasing and participation at exhibitions and fairs

The project partners were very active promoting Hydroptics' results, either technical achievements or new products, through online showcasing or participation at exhibitions and fairs.

Table 2: List of online showcases, exhibitions and fairs the partners participated to (updated)

Information / Title	Partner	Events & online showcasing (+link)
Presentation at WWEM. Exhibition focusing on instrumentation and services for water and wastewater process monitoring	QRT	WWEM: Water, Wastewater & Environmental Monitoring 2022
Presentation at Produced Water Workshop (TÜV SÜD): "Development of a New Online Oil-in-Water Analyser Using Mid-IR Sensor"	QRT	Produced Water Workshop (TÜV SÜD) (https://www.tuvsud.com/en-gb/-/media/regions/uk/pdf-files/event-documents/pww/tv-sd-nel-pww-2020.pdf?la=en-gb&hash=FB9DB011A17F41DA214673BC1085F646)
Workshop focusing on water treatment in industrial processes.	QRT	Word Water Conference 2020
General introduction and aim of the Hydroptics project are given in the R&D projects' section of Tüpraş Annual Report 2020	TUPRAS	Tüpraş 2020 Annual report (https://tprstaticfilessa.blob.core.windows.net/assets/uploads/faaliyet-raporlari/Tupras_2020_annual_report.pdf)
General introduction and aim of the Hydroptics project are given in the R&D projects' section of Tüpraş Annual Report 2021	TUPRAS	Tüpraş 2021 Annual report (https://tprstaticfilessa.blob.core.windows.net/assets/uploads/faaliyet-raporlari/tupras_annual_report_2021.pdf)
General introduction and aim of the Hydroptics project are given in the R&D projects' section of Tüpraş Annual Sustainability Report 2020	TUPRAS	Tüpraş 2020 Sustainability Report (https://tprstaticfilessa.blob.core.windows.net/assets/uploads/sustainability/Tupras_2020_Sustainability_Report.pdf)
General introduction and aim of the Hydroptics project are given in the R&D projects' section of Tüpraş Annual Sustainability Report 2021	TUPRAS	Tüpraş 2021 Sustainability Report (https://tprstaticfilessa.blob.core.windows.net/assets/uploads/sustainability/2021_tupras_sustainability_report.pdf)
General introduction and aim of the Hydroptics project are given in the R&D projects' section of Tüpraş Annual Sustainability Report 2022	TUPRAS	Tüpraş 2022 Sustainability Report (https://tprstaticfilessa.blob.core.windows.net/assets/uploads/srapor/2022_tupras_integrated_report.pdf)

<p>Presentation at Horizon Europe Industry Awareness Event 2022</p> <p>Event which was launched in cooperation with Koç Holding, TÜBİTAK and the Directorate for EU Affairs, in order to convey the experiences gained by Koç Group companies in Horizon 2020 to their stakeholders and to increase the participation of the private sector.</p>	TUPRAS	Horizon Europe Industry Awareness Event (2022)
<p>Presentation of Liquid-Liquid extractor and searching for its other possible applications and market</p>	TUW	<p>Hannover Messe 2022</p> <p>(https://www.tuwien.at/fileadmin/Assets/dienstleister/forschungsmarketing/messe/Messe_aktuell/HM2022/Flyer/Flyer_TUWien_HM2022_EPS_Extractor_EN.pdf)</p>
<p>Presentation of the liquid-liquid extractor at the WKO Event "Innovation Map 2023"</p>	TUW	<p>WKO (Wirtschaftskammer Österreich) - Innovation Map 2023</p> <p>(https://www.linkedin.com/posts/tuw-rti_innovationmap-sdgs-humanexpansion-activity-7124636041486942208-QxyM)</p>
<p>On March 2023 IRSweep released the newly developed product IRis-C</p>	IRSWEEP	https://irsweep.com/products/iris-c-spectrometer/
<p>In 2020, ALPES released its beam combiner as a new product</p>	ALPES	https://www.alpeslasers.ch/beam-combiner/

2.7. Conference and scientific journals

The project partners were also very active in scientific communities, participated to many Scientific Conferences, and published six articles, the list of which can be found below. It should be noted that at least two scientific articles are planned to be submitted after the end of the Hydroptics project.

Table 3: Scientific Conference and article publications (updated)

Information / Title	Partner	Journal/conference (+link)
<p>Poster presentation</p> <p>“Development of a micromolar sensitivity dipstick mid-IR ATR sensor for phosphate in water”</p>	TUW	<p>ICAVS11 – 2022 conference</p> <p>(https://publik.tuwien.ac.at/publist.php?nojava=0&perstissid=40676&ext=1&lang=1)</p>
<p>“A Mesoporous Zirconia Coating for Sensing Applications using ATR-FTIR Spectroscopy”</p>	TUW	<p>ICAVS11 – 2022 conference</p> <p>(https://publik.tuwien.ac.at/files/publik_301914.pdf)</p>
<p>Applying QCLs for enhanced spectroscopic analysis of liquids</p>	TUW	Photonic Spectra Conference

		https://www.photonics.com/Webinars/Applying_QCLs_for_Enhanced_Spectroscopic_Analysis/w366)
Presentation at 1st Global Infrared Sessions “Laser Based Mid-IR Dispersion Spectroscopy of Liquid Samples”	TUW	LC talks, 1st Global Infrared Sessions 2020 (https://publik.tuwien.ac.at/files/publik_294530.pdf)
“Mesoporous Silica, Titania and Zirconia for Improved Selectivity and Sensitivity in Evanescent Wave IR Spectroscopy”	TUW	SCIX2021 conference (https://www.scixconference.org/resources/2021%20SciX%20MASTER/SciX%202021%20Abstract%20Book.pdf)
“Polarimetric Balanced Detection: Background-Free Mid-IREvanescent Field Laser Spectroscopy for Low-Noise, Long-termStable Chemical Sensing”	TUW	Article in ACS Sensors (https://pubs.acs.org/doi/10.1021/acssensors.0c01342?ref=pdf)
Largest analytical conference in the DACH (Germany, Austria, Switzerland), many attendants from industry. HYDROPTICS was acknowledged on poster and flash talk and people were encouraged to check out homepage.	TUW	ANAKON 2023 conference (https://www.anakon2023.at/fileadmin/anakon2023/files/Posters.pdf)
Vibrational spectroscopy conference with focus on academia. HYDROPTICS was acknowledged on poster and flash talk and people were encouraged to check out homepage	TUW	ICAVS12 – 2023 conference
Analytical conference with focus on academia. HYDROPTICS was acknowledged on poster and people were encouraged to check out homepage	TUW	Spring SciX 2022 conference
SciX conference with many representatives from Academia and Industry. Presentation in PAT session. Audience was encouraged to interact with HYDROPTICS homepage.	TUW	SciX 2023 conference
"Metal-organic frameworks combined with mid-infrared spectroscopy for the trace analysis of phosphates in water"	TUW	Article in Sensors and Actuators B: Chemical (https://doi.org/10.1016/j.snb.2023.134778)
“Mesoporous Zirconia Coating for Sensing Applications Using Attenuated Total Reflection	TUW	Article in Applied Spectroscopy

Fourier Transform Infrared (ATR FT-IR) Spectroscopy”		(https://doi.org/10.1177/00037028211057156)
<p>CFD related Conference.</p> <p>Presentation on the modelling of separation in centrifugal device with an euler-euler multiphase model with the twoPhaseEulerFoam</p> <p>The project was acknowledged, and the audience was encouraged to check web page, social media, etc.</p>	TUW	<p>16th OpenFOAM Workshop 2021</p> <p>(https://www.ucd.ie/openfoam2021/programme/technicalprogramme/)</p>
“Dynamic Simulation of a Gas and Oil Separation Plant with Focus on the Water Output Quality”	TUW	<p>Article in Energies</p> <p>(https://www.mdpi.com/1996-1073/16/10/4111)</p>
“Modeling and Simulation of 3-Phase Separators in the Oil and Gas Industry with Emphasis on Water Quality”	TUW	<p>Article in Chemical Engineering Transactions</p> <p>(https://doi.org/10.3303/CET2294168)</p>
“Liquid–Liquid Phase Separation of Two Non-Dissolving Liquids - A Mini Review”	TUW	<p>Article in Processes</p> <p>(https://www.mdpi.com/2227-9717/11/4/1145)</p>
<p>SPIE DCS 2022 enables researchers to present their latest research findings, ideas, and applications in the area of sensors and sensing technology.</p> <p>“Development of inspection system for the detection and analysis of solid particles and oil droplets in process water of the petrochemical industry using hyperspectral imaging and fluorescence imaging”</p>	SAL	<p>SPIE DCS 2022 conference</p> <p>(https://doi.org/10.1117/12.2618760)</p>
<p>SPIE 2023 conference with many representatives from Academia and Industry.</p> <p>Hydroptics project was acknowledged and audience was encouraged to interact with HYDROPTICS homepage</p> <p>“Development of a particle analysis system for the process water of the petrochemical industry using hyperspectral imaging, white-light imaging, and fluorescence imaging”</p>	SAL & TUW	<p>SPIE DCS 2023 conference</p> <p>(https://doi.org/10.1117/12.2663912)</p>
<p>SPIE 2024 conference with many representatives from Academia and Industry.</p>	SAL	<p>SPIE DCS 2024 conference</p>

Particle sensing of Hydroptics project will be summarized.		
Introduction to the Hydroptics sensor and the main results achieved at the time "Hydroptics: photonics sensing platform for process optimisation in the oil industry"	ALPES	SPIE Photonics Europe 2022 conference (https://spie.org/Publications/Proceedings/Paper/10.1117/12.2631235)
"Mid-infrared dual-comb QCLs integrated with beam combiner based on Ge-on-Si platform"	IMEC, ALPES & IRS	IEEE Silicon Photonics Conference 2023 (https://ieeexplore.ieee.org/document/10141936)
Presentation at the SPIE Photonics Europe Conference, to disseminate the work on QCL integration on integrated photonic chips within the Hydroptics project, and how this will be further developed within a new Horizon Europe project, M3NIR.	IMEC, ALPES & TUW	SPIE Photonics Europe 2024 conference
"Frequency Comb Generation by Bloch Gain Induced Giant Kerr Nonlinearity" Mention of Hydroptics-related funding	TUW	Article in Physical Review Letters (https://doi.org/10.1103/PhysRevLett.127.093902)
"Spectrally resolved linewidth enhancement factor of a semiconductor frequency comb"	TUW	Article in Optica (https://doi.org/10.1364/OPTICA.428096)
"On-chip liquid sensing using mid-IR plasmonics" Mention of Hydroptics-related funding	TUW	Article in Frontiers in Photonics (https://doi.org/10.3389/fphot.2023.1213434)
"2.7 μm quantum cascade detector: Above band gap energy intersubband detection" Mention of Hydroptics-related funding	TUW	Article in Applied Physics Letters (https://doi.org/10.1063/5.0076856)
Presentation at the Nano and Photonics Mauterndorf 2023 "Integrated mid-infrared semiconductor laser frequency combs"	TUW	Nano and Photonics Mauterndorf 2023 conference (http://hdl.handle.net/20.500.12708/175771)
Invited presentation at SPIE Photonics West 2023 "Quantum cascade laser frequency combs induced by a giant Kerr nonlinearity"	TUW	SPIE Photonics West 2023 conference (http://hdl.handle.net/20.500.12708/187461)
Presentation at the Annual meeting of the ÖPG and SPS 2021	TUW	Annual meeting of the ÖPG and SPS 2021 (http://hdl.handle.net/20.500.12708/77461)

“Phase locking of two free running Quantum Cascade Laser frequency combs”		
Presentation at the Annual meeting of the ÖPG and SPS 2021 “Measuring the Linewidth Enhancement Factor of a Laser Frequency Comb”	TUW	Annual meeting of the ÖPG and SPS 2021 (http://hdl.handle.net/20.500.12708/77463)
Presentation at the Annual meeting of the ÖPG and SPS 2021 “Engineering the spectral bandwidth of quantum cascade laser frequency combs”	TUW	Annual meeting of the ÖPG and SPS 2021 (http://hdl.handle.net/20.500.12708/77464)
Presentation at the Annual meeting of the ÖPG and SPS 2021 “Giant Kerr nonlinearity of intersubband transitions - Origin of self-starting frequency combs”	TUW	Annual meeting of the ÖPG and SPS 2021 (http://hdl.handle.net/20.500.12708/77457)
Presentation at Photonica 2021 “Frequency Comb Generation by Bloch Gain Induced Giant Kerr Nonlinearity”	TUW	Photonica 2021 conference (http://hdl.handle.net/20.500.12708/77437)
Presentation at Photonica 2021 “Measuring the Spectrally-Resolved Linewidth Enhancement Factor”	TUW	Photonica 2021 conference (http://hdl.handle.net/20.500.12708/77436)
Presentation at Photonica 2021 “Optical Phase Locked Loop for Quantum Cascade Laser Frequency Combs”	TUW	Photonica 2021 conference (http://hdl.handle.net/20.500.12708/77435)
Submitted (2023): “Hot-Cavity Linewidth Enhancement Factor of a Quantum Cascade Laser”	TUW, ALPES & IRSWEEP	<i>Article in peer-reviewed journal</i>
Planned (2024): Journal publication on the latest results for QCL integration on integrated photonic chips, together with its packaging in standard HHL packages	IMEC, ALPES & TUW	<i>Journal to be determined</i>
Planned (2024): Journal publication on the latest results for dual DFB laser sensing of Oil in Water	TUW	<i>Journal to be determined</i>
Planned (2024): Journal publication on the Hydroptics prototype	TUW	<i>Journal to be determined</i>

Planned (2024): Journal publication on mesoporous sensing layers for the detection of phosphates in water	TUW	<i>Journal to be determined</i>
Planned (2024): Journal publication on mesoporous sensing layers for the detection of VOCs in the air	TUW	<i>Journal to be determined</i>
Planned (2024): Journal publication on the sensing of film building corrosion inhibitors using SERS	TUW	<i>Journal to be determined</i>

2.8. KPI

At the beginning of the project, we defined certain Key Performance Indicators (KPI) to achieve for efficient dissemination of the project. In the table below can be seen the planned KPIs for the entire lifespan of the project vs the achieved KPIs for the period M1 to M48. We assess the achieved numbers to be sufficient for successful dissemination of the project.

Table 4: List of targeted KPIs and achieved by M48 of project

Metric	Target	Achieved by M48
Number of HYDROPTICS website's views	10,000	27,190
Published articles in technical papers, magazines, newspapers	6	2
Presentation in scientific conferences, trade fairs, exhibitions	4	30
Publications on open access scientific journals	6	10 (+7 to be submitted)
Project website leaflet and/or poster downloads	200	488 → banners 577 → brochures
Number of videos' views	1000	n.a.
Social media posts	50	19 → X (formerly Twitter) 21 → LinkedIn

3. Engagement

Engagement is the second and final stage of the dissemination plan of the project. It started slowly since we slowly started generating very preliminary results on various compartments of the HYDROPTICS prototype. The activities pertaining to this stage were expected to increase significantly once we would demonstrate the first alpha version of the prototype. Unfortunately, early 2023 one of the key Hydroptics' partners terminated its participation to the project, thus slowing down the completion of the Hydroptics platform. A lot of effort was devoted by other Consortium's partners to develop prototypes suitable for tests by end-users. The results could be only disseminated during the Hydroptics' workshop that took place on Dec. 15th, 2023, an event attended by persons working in the oil & gas industry, for companies developing analytical instruments and instrumentation for lasers.

Despite these difficulties, and as mentioned in Deliverable D9.2, we started to see a growing interest towards the project and its prototype, and we initiated multiple discussion with different entities, that could become possible end users of HYDROPTICS.

3.1. Dr. Reddy's

Dr. Reddy's is a multinational pharmaceutical company located in India and represented worldwide. The company has over 190 mediations, 60 pharmaceutical ingredients for drug manufacturing, and biotechnology products. The first contact took place in 2021, and we worked on planning the next steps for collaboration, as we saw a potential of our prototype to be used for their use case. After multiple brain-storming sessions, we identified two potential use cases of Dr. Reddy's that our systems may be capable to apply.

Nano-emulsion:

The chemical solutions in the pharmaceutical production contain a lot of hard particles with sizes varying from nano- to micrometers. The classification of those particles, size distribution verification, and possible identification of chemical compounds of those particles is an ongoing issue that is being tackled by various state-of-the art technologies. We considered our Hyperspectral Imaging module as a valid alternative solution for the aforementioned detection schemes. We started the process of specification transfer between the project and the company.

Residual solvents in water detection:

As most of the injectable pharmaceutical products are based in water solvents, a very important task is to identify and quantify various chemicals in the water solution. Here we believe that our liquid-liquid extraction system with dual-DFB spectrometer can provide a robust solution for the spectroscopy.

The unexpected termination of one of the partners severely delayed the construction of the Hydroptics platform and prevented us from moving further with Dr. Reddy's on these two topics. In addition, management changes at Dr. Reddy's have made specific follow-up very difficult.

3.2. Synova

SYNOVA is a Swiss company located in Duillier that specializes in advanced laser cutting systems. They manufacture precision laser cutting machines with ultrafast femtosecond laser sources using ultra-high pressure water jet for guiding the laser light. HYDROPTICS Consortium was contacted by Synova to discuss their use case, and as they were interested in our prototype. The initial plan was to see if the prototype could be used for spectroscopy of their purified water systems.

Purity of water is of utmost importance for Synova since the high-pressure water jet is used to guide the laser cutting light. Synova already uses a water purifier filtering almost all hard particles and some known chemicals. However, water contamination is possible overtime. Hence, we planned to get more information on spectroscopic fingerprints of their water systems to understand which constituents should be looked at and whether our system could be of use for them. However, delays in the prototype development have prevented us from organizing test sessions. We plan to contact Synova after the end of the project to showcase the latest results, and to assess their current interest in the technology developed in the frame of Hydroptics.

3.3. Wintershell DEA

Wintershell DEA is a German oil and gas producer and is identified to be one of the stakeholders of our project. We had a very productive and interesting discussion with the representative of Wintershell DEA during our External Advisory Board Meeting. We explained in deep detail what the project is aiming at, as well as the capabilities of the project prototype. We asked Wintershell DEA representative an opinion on our development, as well as suggestions from their side to understand whether we were aligned with the market needs.

The feedback was that we were on the right direction and in accordance with the today's market needs.

3.4. ETH Zurich

One of our External Advisory Board members is Prof. Giacomo Scalari, who is an associate Professor at ETH. During the EAB meeting we presented our recent advancements in the integrated dual-DFB laser sources and dual-frequency comb works. The discussion was very insightful and confirmed a potential interest of academic society in such systems. As with Dr. Reddy's and Synova, technical difficulties met during the development of the prototype prevented us from presenting our very last results to the EAB.

4. Effects of Covid-19 and Partner termination on the project

As mentioned in Deliverable D9.2, the COVID pandemic severely impacted the project, slowing down work completion (lockdowns), obliging all Consortium meetings between M5 and M24 to be held remotely, and preventing Partners from physically attending conferences and fairs. The Consortium had to adapt, and most communication and dissemination activities were held online.

In addition, and as mentioned previously in this report, one of the key Hydroptics' partners terminated its participation to the project early 2023, thus slowing down the completion of the Hydroptics platform, and preventing the Consortium from communicating impactful results before the December 2023's workshop.

Conclusions

This deliverable concludes the reporting on the dissemination and exploitation activities performed in the frame of the Hydroptics project, already started with Deliverables D9.1 “Dissemination plan and material (website, logo, etc.)” and D9.2 “Reporting on the implementation of dissemination & communication activities: First”.

We have discussed in detail the two phases of the dissemination and exploitation plan, awareness raising and engagement. The period M1 to M24 was more specifically devoted to raising awareness. It was expected that during the second half of the project (M25 to M48), the Consortium would be actively concentrating on engagement phase of the dissemination and communication plan. However, delays in the technical development of the Hydroptics platform, due to the unexpected termination of one partner, have prevented proper engagement towards stakeholders. However, the final online Workshop that took place at the end of the project (on December 15th, 2023) makes us confident that we have results significant enough to properly follow up with entities we were already in contact with, or to engage new entities.