

BROMEDIR

BROMEDIR Broadband MEMS-based InfraRed spectrometers:
The core of a multipurpose spectral sensing photonic platform

PROJECT INTRODUCTION

The project aims to innovate by developing a new generation of miniaturized FTIR (Fourier Transform Infrared) and PTS (Photothermal) spectrometers for liquid and gas sensing applications respectively. In addition, a new cloud-based platform will be developed for enabling advanced data analytics. Therefore, the overall system approach intends also to achieve faster data analysis, with results easily accessed from anywhere by the end-user.



KEY OBJECTIVES

- Develop the novel FTIR and PTS spectrometers
- Develop the new integrated and flexible platforms
- Tests and validations of the innovations developed
- Wide-scale but also audience specific communications to demonstrate the results and overall value to all stakeholders

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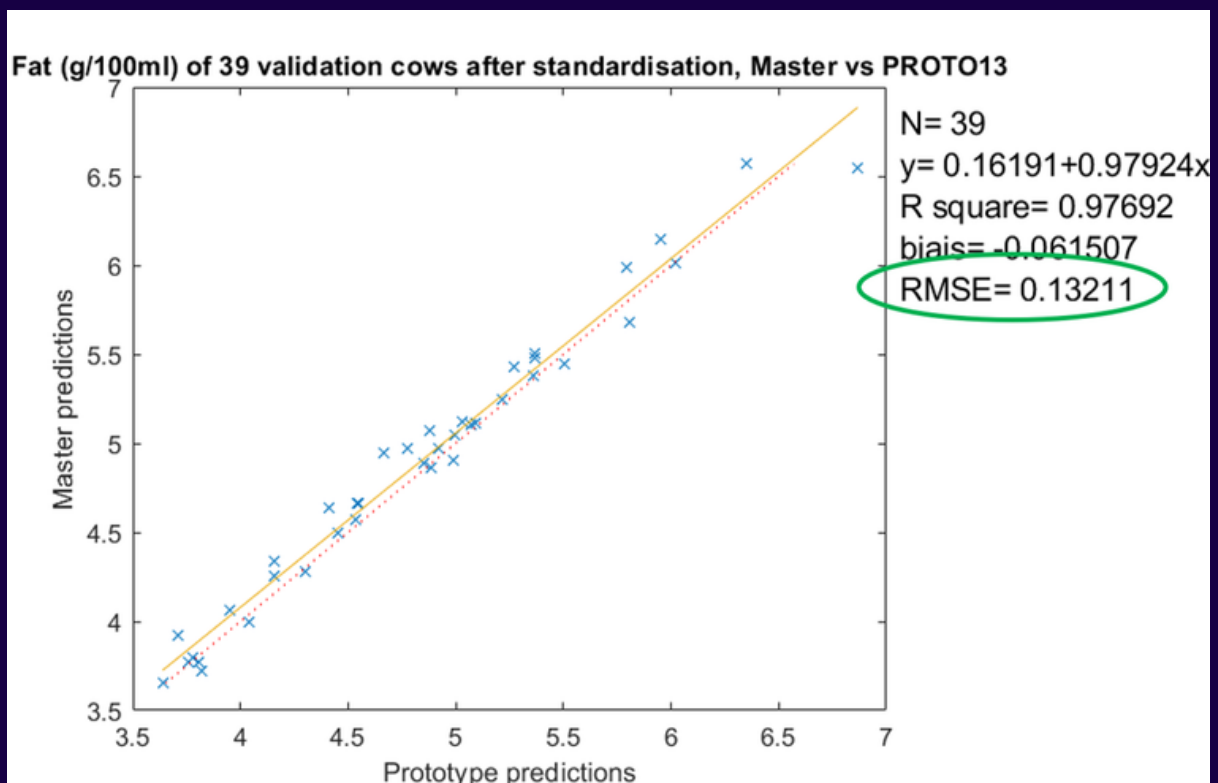
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PROJECT WORK COMPLETED

TECHNICAL UPDATES

Model Transfer to the BROMEDIR Miniaturized FTIR Device

Some existing milk analysis models developed for high-end FTIR benchtop instruments were successfully transferred to the miniaturized FTIR device developed within the BROMEDIR project. Several transferred models showed promising performance, demonstrating the feasibility of obtaining reliable predictions with a compact and cost-effective instrument. While further improvements are needed in specific wavenumber regions and in prototype stability, the results confirm the strong potential of the BROMEDIR miniaturized FTIR technology and mark an important milestone towards its broader adoption in routine milk analysis.



**Analysis of individual raw milk from 39 CRA-W Holstein cows
Both on reference lab instrument and on the prototype (after
standardization)**

PROJECT WORK COMPLETED

TECHNICAL UPDATES

Liquid Cell Integration with FTIR Spectrometer for the Fuel Use Case

A dedicated housing for the liquid cell has been developed to support the fuel use case.

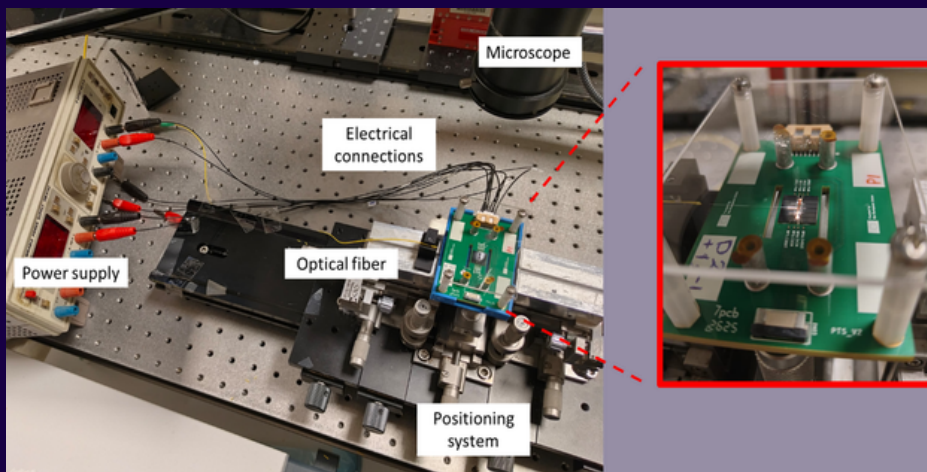
The new structure is designed to accommodate both cooled and uncooled prototype versions, while also allowing integration with different light-source configurations.

The housing includes dedicated control slots and flexible tubing to simplify source alignment, while maintaining a reliable dry-air seal during operation. It also incorporates the required fluidic and purge connections, including the liquid-cell inlet and outlet, as well as a purged-air inlet.



Successful Demonstration of Cavity Tuning for Balanced Photothermal Spectroscopy.

We have successfully demonstrated the cavity tuning mechanism in our photothermal spectrometer, which uses two optical cavities for balanced detection. The tuning was recorded over a full tuning range, including multiple free spectral ranges (FSRs), as well as fine tuning within a single FSR.



The results show two distinct tuning regions:

Region 1, the cavity response is dominated by the electro-thermal effect.

Region 2, tuning is governed by a combination of the electro-thermal effect and thermo-mechanical effects.

PROJECT WORK COMPLETED

TECHNICAL UPDATES

Finalization of the the user interfaces for the milk use case, fuel use case, and hydrogen purity use case

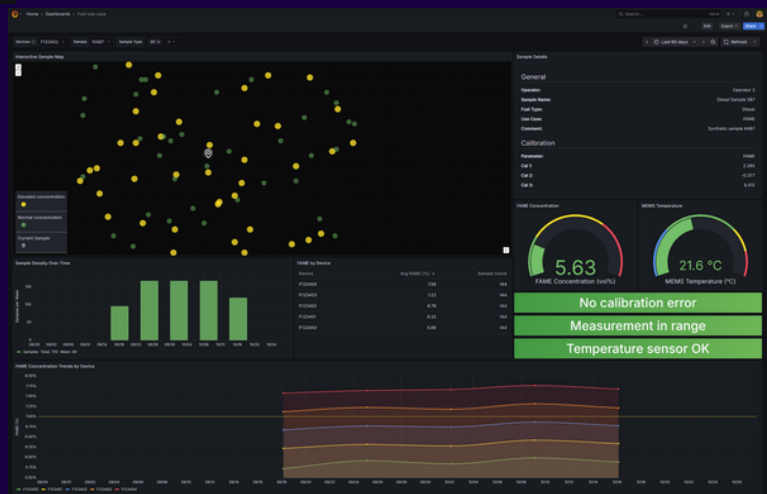


MILK ANALYSIS DASHBOARD

Goal: Identify abnormal samples and visualize trends across all measured values. Compare results against set thresholds with colour-coded indicators, and view the sample mean alongside the current sample's deviation from it.

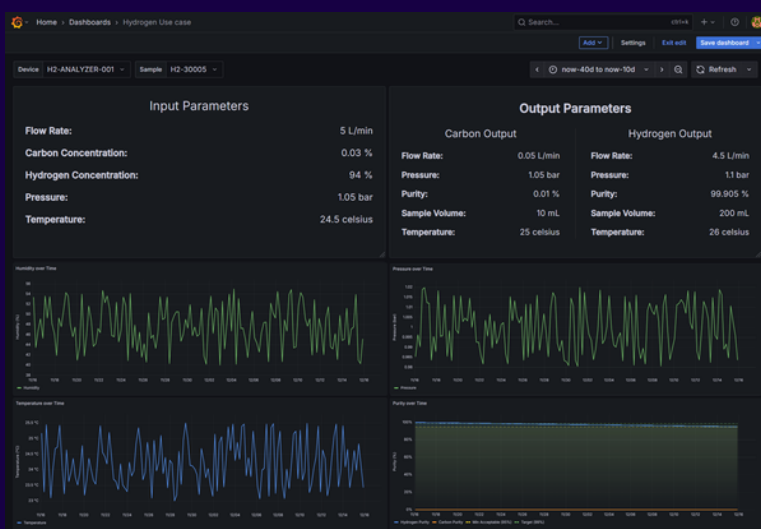
FUEL ANALYSIS DASHBOARD

Provide insight into current samples and device trends through an interactive view of the selected period. The map enables exploration of different samples, while the chart highlights FAME concentration trends across all devices.



HYDROGEN ANALYSIS DASHBOARD

Provide insight into current samples and device trends. The dashboard displays a sample's input parameters alongside its output parameters, separated into carbon and hydrogen output, enabling easy comparison of sample characteristics and results.



PROJECT WORK COMPLETED

TECHNICAL UPDATES

Hydrogen Use Case



The hydrogen demonstration was carried out by TU Wien, bringing together the research groups of Professor Bernhard Lendl and Professor Michael Harasek. By combining photothermal spectroscopy with a hydrogen separator-compressor system, the teams delivered a fully integrated and operational setup capable of monitoring hydrogen quality in real time.

The system demonstrated high sensitivity, detecting even trace levels of impurities in hydrogen. The results confirm that advanced sensing can be directly embedded into hydrogen processing systems, enabling continuous and reliable monitoring.

Fuel Use Case

A second validation campaign addressing jet fuel quality control using a compact Fourier Transform Infrared (FTIR) spectrometer based on Micro-Electro-Mechanical Systems (MEMS) was also held at TU Wien. The system was specifically developed to analyse liquid fuels under practical conditions and was successfully validated during operation. The results demonstrated alignment with established laboratory instruments, suggesting that the approach could support reliable fuel analysis.



**MEMS-based
BROMEDIR FTIR
Spectrometer &
ERASPEC from
Eralytics**

DISSEMINATION & COMMUNICATION

Updates From Events Attended

EuroPACT 2026

BROMEDIR was represented at EuroPACT 2026 in Lyon, France, through an invited plenary talk delivered by Prof. Tarik Bourouina from ESIEE PARIS, Université Gustave Eiffel, CNRS and Si-Ware Systems.

His lecture, titled “Optical Bench on a Silicon Chip Enables Paradigm Shift in FTIR Spectroscopy”, presented research closely connected to BROMEDIR’s work on miniaturised FTIR spectroscopy and silicon-chip-based optical technologies.



The event also brought together BROMEDIR partners, including Prof. Bernhard Lendl from Technische Universität Wien, supporting the project’s continued scientific exchange around compact spectroscopic systems and their real-world applications.

DISSEMINATION & COMMUNICATION

Updates From Events Attended

ICAR 2026

At ICAR 2026 in Verona, we had the opportunity to showcase BROMEDIR in action at the exhibition booth, engaging with industry representatives through live demonstrations and discussions.

The demonstrations highlighted the project's MEMS-based FT-MIR instrument for in-farm milk analysis, demonstrating how compact spectroscopy enables faster and more accessible milk quality assessment directly at farm level.



In parallel, the project was featured in two technical presentations:



BROMEDIR – PART A: Development of a miniaturized FT-MIR instrument for in-farm milk analysis, Presented by Mazen Erfan, Si-Ware Systems



BROMEDIR – PART B: Evaluation of a miniaturized FT-MIR instrument for in-farm milk analysis, Presented by Clément Grelet, CRA-W

DISSEMINATION & COMMUNICATION

Online Workshop

BROMEDIR Workshop Successfully Showcases Advances in Miniaturized Spectroscopy



BROMEDIR
WORKSHOP

Advanced Miniaturized FTIR and PTS Spectrometers and their Applications

Milk analysis Fuel quality control Hydrogen quality control

25 June, 2026
13:30 - 16:00 CET
Online: [Click here to attend](#)

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On 25 June, the BROMEDIR Horizon Europe project, coordinated by CYRIC, successfully hosted its workshop on Advanced Miniaturized FTIR and PTS Spectrometers and their Applications. The event brought together researchers, industry experts, and stakeholders from across Europe to present the latest developments in MEMS-based infrared and photothermal spectroscopy technologies.

Participants explored innovative solutions for portable chemical sensing and discussed real-world applications in sustainable agriculture, fuel quality control, and hydrogen supply chain monitoring. The workshop featured insightful presentations from consortium partners and engaging discussions on how miniaturized spectroscopic systems can enable laboratory-grade analysis in field environments.



Time Slot CET	Description	Presenting Organization
13:30 - 13:40	Welcome and Introduction to BROMEDIR	Cyprus Research & Innovation Center Ltd (CYRIC)
13:40 - 14:00	MEMS-Based Implementations of Mid-IR Spectrometers (FTIR)	Si-Ware Systems / Université Gustave Eiffel
14:00 - 14:15	MEMS - FTIR Spectrometer in Milk Quality Analysis	Walloon Agricultural Research Centre
14:15 - 14:30	MEMS - FTIR Spectrometer in Fuel Quality Control: Biodiesel and Jet Fuel Analysis	Vienna University of Technology (TU Wien)
14:30 - 14:45	Q/A Session	Coordinated by CYRIC
14:45 - 15:00	Coffee Break	—
15:00 - 15:15	Photothermal Spectrometer (PTS) in Hydrogen Purity Analysis	TU Wien
15:15 - 15:35	Photonic Integrated Circuits for Photothermal Spectroscopy.	Université Gustave Eiffel
15:35 - 15:50	Electrochemical Hydrogen Separator-Compressor: Purity Analysis	TU Wien
15:50 - 16:00	Q/A Session	Coordinated by CYRIC

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Final Consortium Meeting

BROMEDIR Consortium Meets in Vienna for Final Project Meeting

The BROMEDIR M42 Consortium Meeting was held on 11–12 June 2026 at Technische Universität Wien (TU Wien), Austria, bringing project partners together to review progress and coordinate final project activities.

Discussions focused on system integration, testing and validation, data analytics, dissemination, and exploitation planning, with particular emphasis on maximizing the long-term impact of BROMEDIR's technologies and results.

The meeting also included technical sessions, a laboratory visit, demo video recordings, and partner interviews, supporting preparations for the project's final phase.

A sincere thank you to Prof. Bernhard Lendl and the TU Wien team for their warm hospitality and excellent organization of the event.



PROJECT CONTACT DETAILS

Since the start of the project, the BROMEDIR Newsletter has provided regular updates on project progress, key achievements, and dissemination activities. As this is the final edition, we thank all our readers and supporters for following the BROMEDIR journey. Previous editions remain available in the Newsletter Archive on the project website, offering a complete overview of the project's developments and impact..

BROMEDIR

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