MILADO

Multiwavelength Laser for fast Diagnostic in Biomedical and Manufacturing Applications

Revolutionizing Precision Diagnostics with Advanced Multispectral Laser Technology for Biomedical and Industrial Innovations

ISSUE 3
Newsletter

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Duration
36 Months
01/06/2024 - 31/05/2027

Consortium
7 Partners
4 countries

Budget
€ 4.9 Million
100% EU contribution

What happened in the last 6 months...

Consortium Update: sTHESIS joins MILADO, replacing ECLYPIA

Over the last six months, the MILADO consortium has undergone an important change. Our previous use case partner, ECLYPIA, has left the project. We are pleased to welcome sTHESIS, who will now continue and expand upon the key work previously undertaken by ECLYPIA.

sTHESIS will now take the lead in advancing the development of the non-invasive blood glucose and biomarker measurement use case, which was initially launched by ECLYPIA. Building on the groundwork laid so far, sTHESIS aims to further refine and expand this innovative application, ensuring continuity and progress in harnessing MILADO's multispectral laser technology for diagnostic breakthroughs.

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Technical F2F Meeting @CEA-LETI, Grenoble

The MILADO team held a technical meeting on 9–10 October 2025 in Grenoble, France, hosted by CEA-Leti. The consortium discussed work package progress, reviewed upcoming deliverables, and addressed technical interdependencies. **CEA-Leti** also gave a tour of their advanced research facilities in micro- and nanoelectronics. The meeting strengthened collaboration and prepared partners for the end of the first project period, with plans to maintain momentum at the next gathering.

MILADO Period 1 ended on 30th November 2025

As of M18 (November 2025), the MILADO project has concluded its first period, marking the halfway point of the initiative. With the end of P1 also Work Packages 1, 3, 6 and 9 were successfully completed.

WP3 aimed to upscale epitaxial growth of QC heterostructures from 50 to 100 mm InP substrates using a multiwafer production system, increasing yield and throughput and lowering costs for MIR devices in a compatible 200 mm line. Key tasks included designing robust heterostructures and optimizing large-scale growth to reduce defects, improve uniformity, and ensure reproducibility, verified through rapid characterization methods. WP3 sets the foundation for QCL and PIC designs in WP4 and WP5.

WP6 concentrated on the application and validation of the MILADO technology within selected biomedical and manufacturing use cases, ensuring practical relevance and demonstrating impact. These achievements set the stage for further advancements in the next phase of the project.

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MILADO Use Cases

The MILADO project addresses a diverse set of use cases, demonstrating the flexibility and potential of its multispectral laser technology across both biomedical and industrial domains.

Below is a brief overview of each primary use case currently under development or validation within the consortium:

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Use Case 1: Waste anesthetic gas detection:

Waste anesthetic gases (WAGs) encompass nitrous oxide as well as halogenated anesthetics such as halothane, enflurane, isoflurane, desflurane, sevoflurane, and methoxyflurane, all of which are found within the significant IR fingerprint region. A primary challenge with existing measurement technologies is achieving both high sensitivity—down to tens of parts per billion (ppb)—and specificity to minimize cross-interference from other gases. Gasera's patented cantilever-enhanced photoacoustic technology represents the current standard in photoacoustic sensing, offering exceptional sensitivity. Effective gas sensing requires a suitable light source to excite molecules within the photoacoustic measurement cell. MILADO laser sources are integral to this process, delivering the spectral specificity required to address the shortcomings of traditional NDIR technology and enabling more accurate, robust, and cost-effective monitoring solutions.

Use Case 2: Non-invasive blood glucose and biomarker measurements:

For people with Type 1 diabetes, frequent blood glucose checks are vital. While modern Continuous Glucose Monitoring (CGM) sensors using skin-inserted electrodes help automate glucose tracking and insulin delivery, they can still cause discomfort and potential infection. sThesis is working on non-invasive blood glucose monitoring technologies to simplify diabetes management and improve patient quality of life. Despite many attempts over the past two decades, truly continuous, non-invasive glucose monitoring remains a challenge. Recent progress in mid-infrared (MIR) technologies shows promise. sThesis is advancing non-invasive, optoacoustic glucose sensors that use depth-gated MIR optoacoustics to minimize interference from the outer skin layers. While current systems rely on bulky quantum cascade lasers (QCLs), custom QCL arrays could enable the miniaturization needed for portable and wearable medical devices. For widespread adoption, it is essential to develop highly compact QCL arrays operating within the MIR wavelength range and to implement manufacturing processes compatible with industrial production. The MILADO project will advance this objective by enhancing fabrication capabilities through larger wafers and further chip integration, particularly in light beam management and optical power monitoring. Additionally, the platform is intended to support supplementary non-invasive skin measurements, such as water content, albumin, or urea. Collectively, these efforts are aimed at facilitating the development of a continuous, non-invasive blood glucose sensor and advancing the broader field of medical diagnostics.

Use case 3: Chemical process analytics:

Inline sensing solutions can greatly enhance production efficiency by eliminating manual sampling and laboratory testing, allowing for more flexible operations. Spectroscopic sensors, especially those using mid-infrared fingerprint regions, provide chemical feedback to optimize material and energy use. As part of MILADO, RECENDT is developing a sensitive, cost-effective Si-QCL-based edge-sensing device—a programmable sensor integrating chemometrics and versatile QCL laser sources for targeted chemical analysis in production lines. This fully optical, multi-wavelength approach enables direct, flexible detection of multiple chemical species and optical read-out of concentrations. The sensor is designed for inline monitoring of liquid streams, particularly in chemical and pharmaceutical industries.

Use Case 4: Mid-infrared chemical microscopy for digital histopathology and biochemical imaging

Mid-infrared imaging microscopy enables non-destructive chemical analysis of biological samples like tissue sections and cell cultures without added reagents or labels. It works by detecting how mid-infrared light is absorbed by various chemical bonds (DNA, RNA, lipids, proteins). However, current limitations—including slow measurement speeds, bulky equipment, and high costs—have hindered its widespread use in digital spectral histopathology, and the technology remains challenging for non-experts. Machine learning can facilitate image processing and cell classification by analyzing morphological and biochemical features. In the MILADO project, ADMIR aims to create a smart infrared imaging device that integrates novel Si-QCL arrays, PICs, and machine learning to improve and speed up biological analysis. Diagnosis selectivity relies on combining QCL beams at specific wavelengths, but current manufacturing can't reliably produce all needed QCLs. MILADO's QCL fabrication will address this limitation, lowering costs and improving reliability. Illumination characteristics also affect classification efficiency.

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Outlook and next steps

The consortium is currently preparing for the upcoming interim review meeting. This important milestone will provide an opportunity to assess progress, and plan for the next phases of the project.

Work Packages 5 and 7 have recently kicked off, marking the beginning of new activities within MILADO. Meanwhile, ongoing efforts in Work Packages 4 and 8 continue to advance, demonstrating steady progress toward the project's objectives. Stay tuned for forthcoming updates and exciting results as the project moves forward.

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Upcoming Events

All past and upcoming events can be found on the MILADO official webpage:
https://milado.eu/events/

Project Facts

Consortium: 7 partners (4 countries)
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Scientific Leader: Badhise Ben Bakir (CEA Leti)
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