SWISS–POLISH Cooperation Programme

NCBR National Centre for Research and Development

SWIRLS

Sensitive Wideband Infrared Laser Spectroscopy

Lukasz A. Sterczewski
Programme Component Operator

24/06/2025

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SWIRLS:

- Programme Component Operator:
  - **Wroclaw University of Science and Technology**
- Programme Component Partners:
  - **Military University of Technology**
  - **VIGO Photonics S.A.**
  - **Swiss Federal Institute of Technology Zürich**
- Duration of the project: **1.10.2025 - 30.09.2028**
- Total project cost**: 1 035 657.07 CHF / 4 644 714.85 PLN**
- Total project funding: **973 860.21 CHF / 4 367 568.28 PLN**

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Sensitive Wideband
Infrared Spectroscopy

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ETH zürich

SWIRLS People:

Prof. Giacomo Scalari from the Physics Department at ETH, Zürich - an expert in quantum optoelectronics (quantum cascade lasers and novel light sources)

Programme Component Partners

Dr. Karolina Maciak, a project manager representing one of the leading photonics companies in the world: VIGO Photonics - a manufacturer of epitaxial wafers, infrared detectors and detection modules

VIGO PHOTONICS

Prof. Piotr Martyniuk, Solid State Physics Department (SSPD) at Institute of Applied Physics, Military University of Technology (MUT) in Warsaw. An expert in InAsSb and type-II superlattice (T2SL) infrared detectors.

Military University of Technology

Dr. Lukasz A. Sterczewski will lead the consortium - a young scientist (7 years after receiving a PhD). A recipient of the ERC starting grant (2023) focused on room-temperature terahertz spectrometers and infrared spectroscopy.

Wrocław University of Science and Technology

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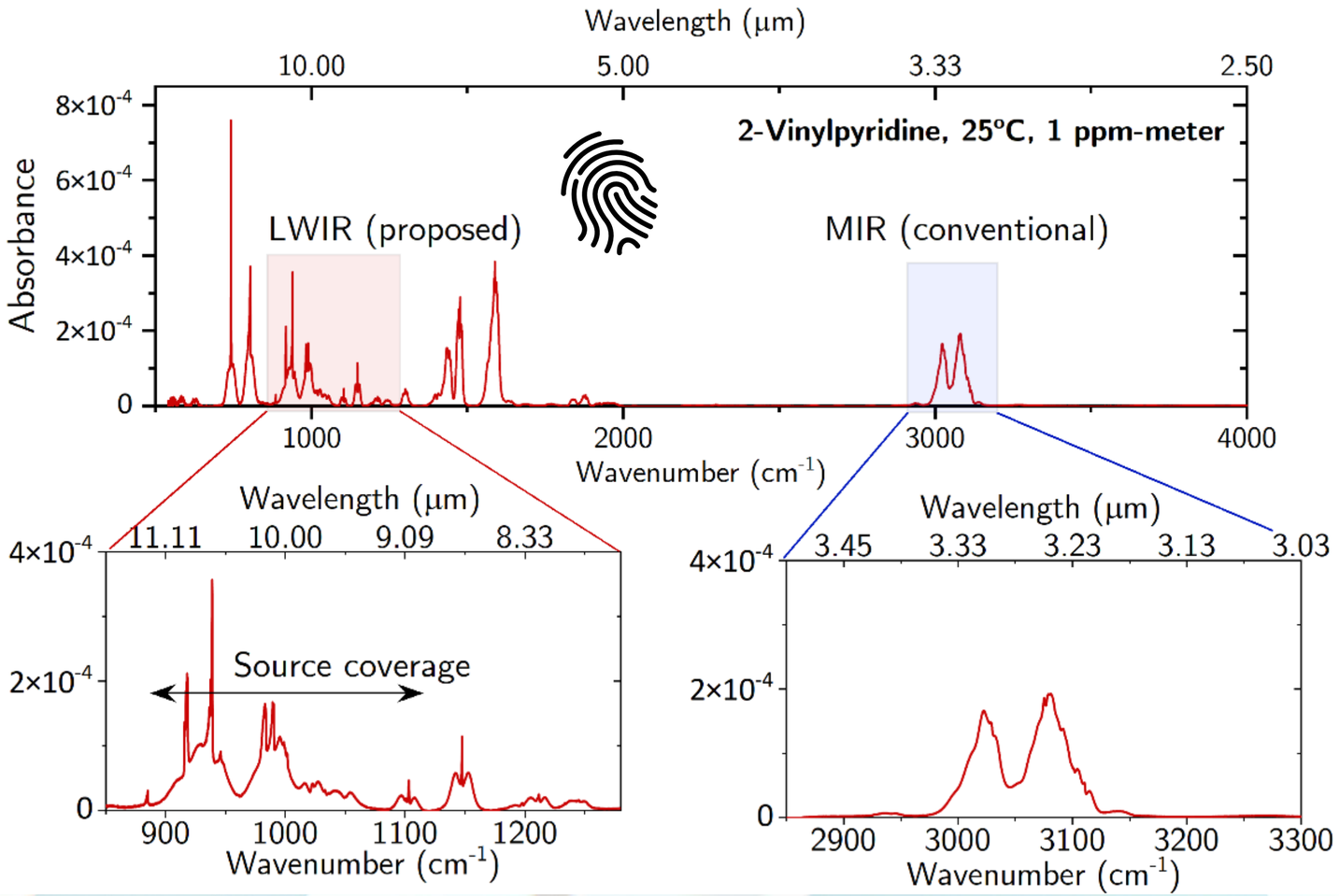
Project objectives:

Many organic molecules like non-methane volatile organic compounds (NMVOCs) or persistent organic pollutants (POP) pose a threat to human health.



Vinylpyridine - a component of tobacco smoke emitted in biomass burning that affects vegetation and irritates the human respiratory system

Objective:

Develop a fast-scanning broadband and high-resolution optical instrument capable of detecting trace amounts of gaseous species using the Fourier transform spectroscopy technique.

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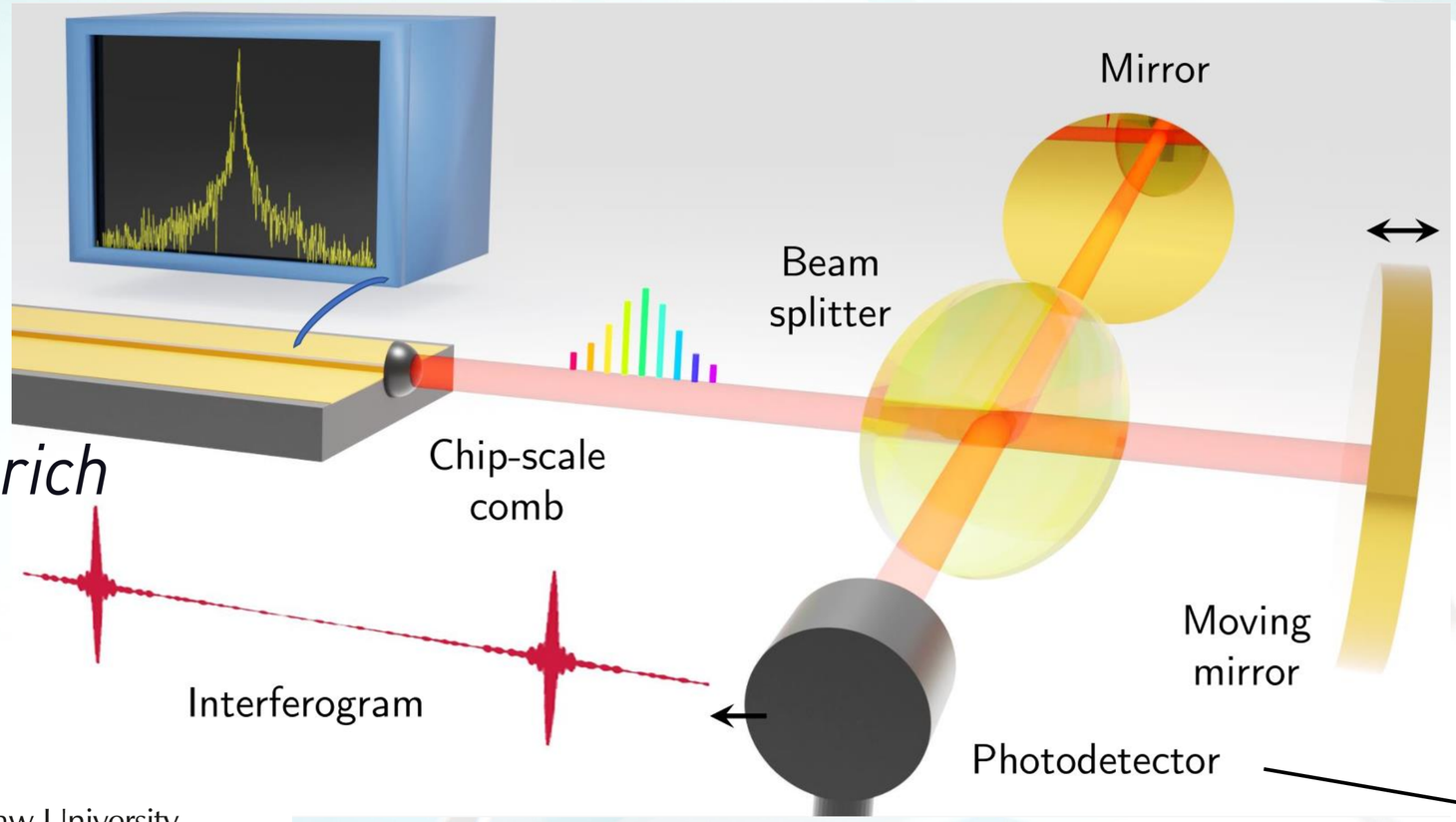
Methods, approach and concept:



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Methods, approach and concept:

ETH Development of novel, broadband light sources based on quantum cascade lasers (quantum walk combs and semi-coherent broadband emitters).

WUST ETH Design and development of novel mechanical solutions for rapid scanning of the interferometer.

WUST Integration into an instrument (mechanical design, electronics, software).

VIGO Design and assembly of a balanced infrared photodetector module.

MUT Development of room-temperature T2SL photodetector chips

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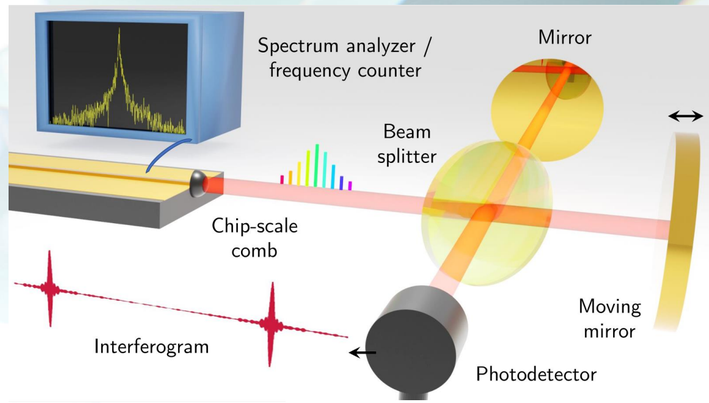

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Planned project outcomes (short term):

- Unique opportunity for leaders in the field to talk and optimize the critical parts of the instrument. This is in stark contrast to the typical scenario, where off-the-shelf components are put together with sub-optimal performance.
- Doctoral and post-doctoral students in Switzerland and Poland, and employees at VIGO Photonics: opportunity to better understand the complexity of interdisciplinary character of each part constituting the final system.
- Joint publications and conference contributions – competence building and improving recognizability.
- Marketable innovation: broadband (4-12 μm) uncooled photodetector – expansion of VIGO's product portfolio.

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Planned project outcomes (long term):

- Addressing a critical demand imposed by the National Emissions Ceilings (NEC) Directive (2016/2284/EU), which is broadband monitoring non-methane volatile organic compounds (NMVOCs).
- Wide social and environmental impact: elimination of mercury in the photodetection chip aligns well with the EU Regulation (EU) 2017/852 (harm to the environment).
- Fourier spectrometer: scalable solution for monitoring the concentration of volatile organic compounds required by the EU beyond 2030: the improvement of quality of life of citizens in large cities and countryside.

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