PhotonHub Demo Centre

Course 01

Frontier trace gas sensors addressing industrial challenges for environment, health, safety and security

Course Provider

National Institute of Optics (INO)
Italian National Research Council (CNR)
Headquarters of Florence - Italy

Course Overview

Gas monitoring (industrial, medical, and environmental) requires sensitive, fast, and reliable measurement systems. Optical technologies can provide different effective solutions, targeted on specific applications.

Our Demo Centre offers training on different state-of-the-art spectroscopic techniques for trace gas sensing, combining interactive tutorials with hands-on experiences.

The course will be divided into four main part:

1) Introductory tutorial on basic principles of spectroscopy and key-interest applications.
2) Interactive tutorial and practical laboratory demonstration on the principles of operation of photoacoustic sensors and their applications (Demo 1).
3) Interactive laboratory experience on absorption spectroscopy for monitoring and safety matched with a practical hands-on demonstration for measuring CO, CO_2 and CH_4 in air or breath (Demo 2).
4) Interactive tutorial and hands-on training on the Saturated-absorption CAvity Ring-down (SCAR) ^{14}C analyser, and its applications for industrial purposes (Demo 3).

Target Audience

The course primarily targets producers potentially interested in the exploitation of spectroscopic gas sensing solutions for industrial applications in different fields, such as health diagnostics, environmental monitoring, and security surveillance.

A background in spectroscopic methods is not essential, although it might be advantageous. Knowing the degree of participants' expertise on the training subjects will assist us in delivering training that is appropriate for the audience's background.

Expected Outcomes

1) Understanding fundamental spectroscopic and sensing methodology (interactive activity)
2) Observing, analysing, and utilising trace gas spectroscopic setups (hands-on activity)
3) Observing and analysing an operating photoacoustic sensor (hands-on activity)
4) Round table on trace gas sensing applications to industrial challenges

Course Schedule

Time	Demo Activity
09:00 - 9:40	Registration & Course Introduction (Arcetri premises)
9:40 - 10:30	Tutorial on the principles of spectroscopy and key-interest applications
10:30 - 10:50	Coffee Break
10:50 - 12:10	Demo 1: Interactive tutorial and practical laboratory demonstration on photoacoustic sensors
12:10 - 14:00	Lunch Break and transfer to the SCAR analyser laboratories (Sesto Fiorentino Train Station)
14:00 - 15:20	**GROUP 1** - Demo 2: Interactive laboratory experience on absorption spectroscopy for monitoring and safety matched with a practical hands-on demonstration **GROUP 2** - Demo 3: Interactive tutorial and hands-on training on SCAR analyser
15.20 - 16:40	**GROUP 2** - Demo 2: Interactive laboratory experience on absorption spectroscopy for monitoring and safety matched with a practical hands-on demonstration **GROUP 1** - Demo 3: Interactive tutorial and hands-on training on SCAR analyser
16:40 - 17:40	Coffee & chat: Discussion on trace gas sensing applications to industrial challenges
17:40 - 18:20	Greetings & conclusion

Course Trainers

Course Director: Tecla Gabbrielli

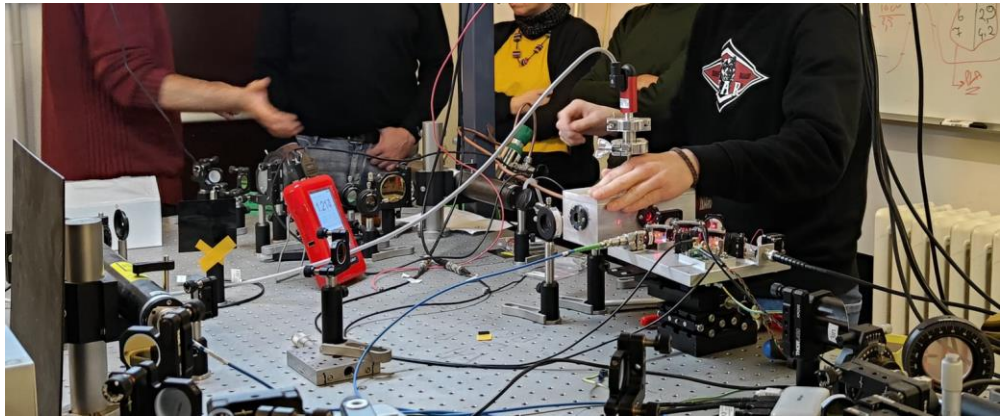
Course Manager: Daniela Selisca

Trainers:

Francesco D'Amato (introduction tutorial + Demo 2)

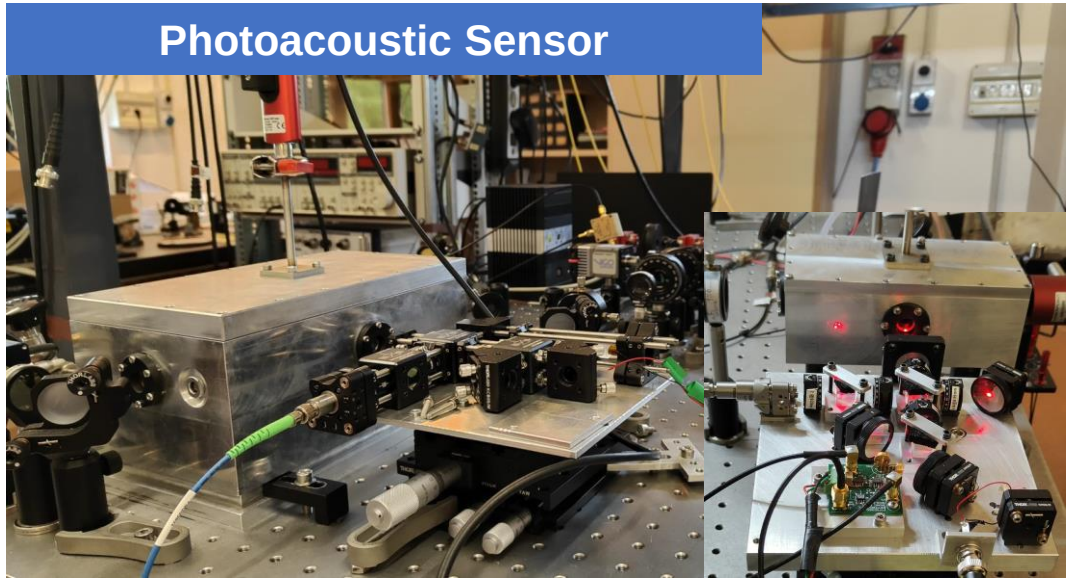
Simone Borri & Jacopo Pelini (Demo 1)

Davide Mazzotti & Iacopo Galli (Demo 3)

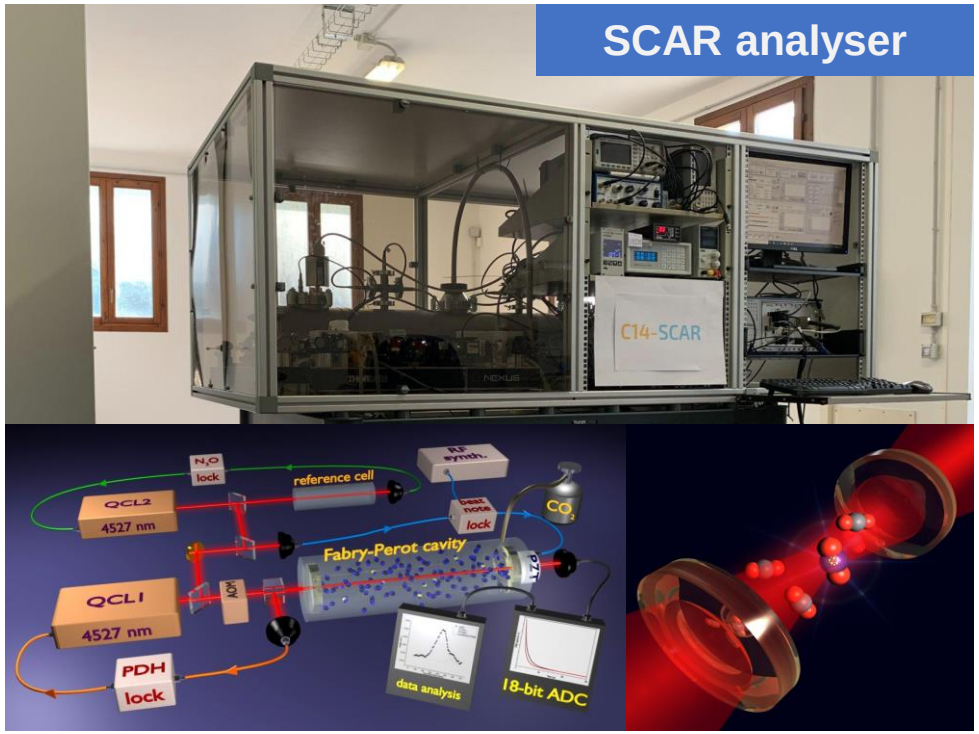


Course Demonstrators

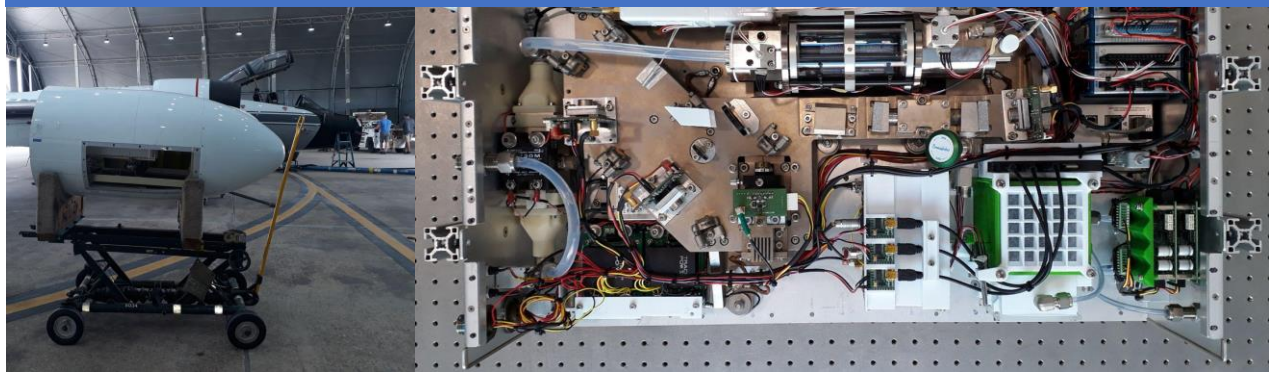
Photoacoustic Sensor



SCAR analyser



Absorption spectroscopy for monitoring and safety



Course Material (technical handouts)

- Course slides provided in PDF
- List of in-depth research materials and course bibliography:
  - textbooks
  - conference proceedings
  - scientific papers
  - patent references

Course Location, Schedule & Cost

Location:
National Institute of Optics (INO) of the Italian National Research Council (CNR):

- Headquarters, Largo E. Fermi 6, Florence - Italy
- SCAR Lab, Viale L. Ariosto 492/B Sesto Fiorentino - Italy

- Course schedule: June, 17 2024
- Maximum number of attendees per course: 10
- Course cost: € 200 per person (€ 150 for early birds - May, 10 2024) (includes catering and project consumables)
- Deadline for registration: June, 10 2024

Further Information

- daniela.selisca@ino.cnr.it / tecla.gabbrielli@ino.cnr.it
- https://www.ino.cnr.it/
- https://www.ino.cnr.it/?page_id=16594&p=a3 (sensor and spectroscopy research activities at CNR-INO)

Keywords

Gas sensors, Absorption spectroscopy, Photoacoustic spectroscopy, Cavity ring-down spectroscopy, Hybrid photonic systems, Security & safety, Medical diagnostics, Nuclear surveillance, Pharmaceutical drug development, Pollution monitoring, High-sensitivity laser spectroscopy, Semiconductor mid-infrared lasers, Environmental monitoring, Greenhouse gases, Radiocarbon, Biogenic materials