Mobility & System division
Internship R10/2027/n°11

Development and validation of a metrological verification protocol for particle analyzers

Description:

Particle characterization, whether for emissions from transport (exhaust/non-exhaust), certain industrial processes (e.g.: CO_2 capture), battery thermal runaway, or during their atmospheric evolution (secondary aerosol formation), relies on complex analytical techniques to determine number concentration, size distribution, mass and chemical composition.
The equipment required for these characterizations represents a significant investment and requires regular, costly and time-consuming preventive maintenance, calibration and metrological verification. To reduce these costs and operating losses, the laboratory aims to develop a robust methodology to compare the performance of different particle analyzers against a reference instrument, in order to optimize metrological follow-up strategies and reduce preventive maintenance frequencies while ensuring measurement quality.

Internship objectives

Develop and implement in the laboratory an experimental protocol to evaluate the response of different particle analyzers to artificially generated aerosols under controlled exposure conditions.
Work will focus on the following activities:

1. **State-of-the-art literature review**
   - Review scientific, standard and technical literature on methods for verification and validation of aerosol measurement instruments,
   - Identify relevant metrological performance indicators: repeatability, reproducibility, accuracy (trueness), linearity, drift, uncertainty, robustness.
2. **Development of the experimental protocol**
   - Familiarize with experimental means for aerosol generation and characterization,
   - Identify parameters that influence analyzer response,
   - Design the experimental protocol, define test conditions and metrological evaluation/validation criteria,
   - Carry out a proof-of-concept comparison between a reference instrument and a candidate one.

Candidate profile

Master's student (M2) in physical measurements, instrumentation, metrology, aerosol physics or a related field.
Desired qualities

- Interest in aerosol, experimentation, measurement systems and data analysis,
- Knowledge of metrology, experimental data processing and statistics is an asset,
- Autonomy, scientific rigor and initiative,
- Ease reading scientific articles and documentation in English.

Keywords: Aerosols, particles, metrology, size distribution, number concentration, measurement uncertainties, maintenance.
Duration & period: 6 months between February/March and July/August 2027
Location: IFPEN Lyon (Solaize)
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