

Metrology Lab of the ICOS Atmospheric Thematic Centre: Role in ICOS and platform for GHG instrument performance assessment.

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ICOS ATC Metrology Lab

In order to provide harmonized high precision data for advanced research on carbon cycle and greenhouse gas (GHG) budgets over Europe, the European Research Infrastructure ICOS through its **Atmosphere Thematic Centre (ATC)**, located at LSCE in Gif-sur-Yvette, France, has implemented standard protocols for GHG measurement and the corresponding data processing.

In addition, the ICOS ATC has implemented a **Metrology Laboratory** which aims to:

- Carry out a **continuous Technical watch** in order to track the market, test and select the analyzer (model/Brand) compliant to the ICOS specifications.
- **Test all the ICOS GHG analyzers** before their deployment in the ICOS network in order to verify their compliancy with the ICOS performance specifications and determine specific calibration and correction (H₂O).
- **Assist Research lab and manufacturer** to develop and improve new technology and/or analyzer.
- **Develop testing protocol and measurement procedure** for lab and field applications.



Environmental test chamber

Testing Facility Access

ICOS ATC Metrology Lab has **tested more than 200 GHG analyzers and sensors from more than 30 manufacturers** and research Labs.

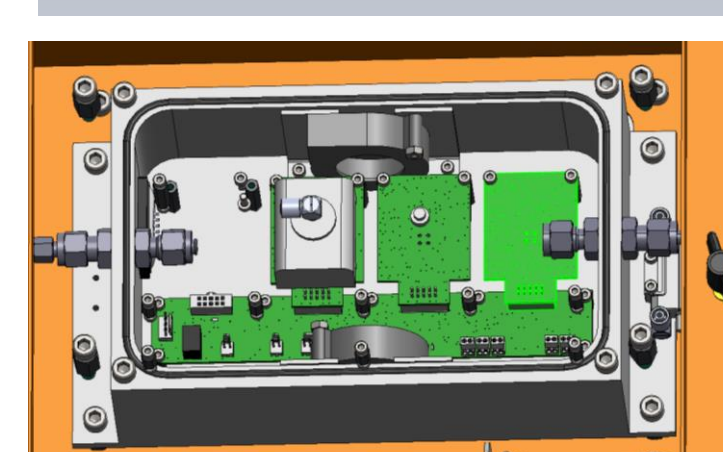
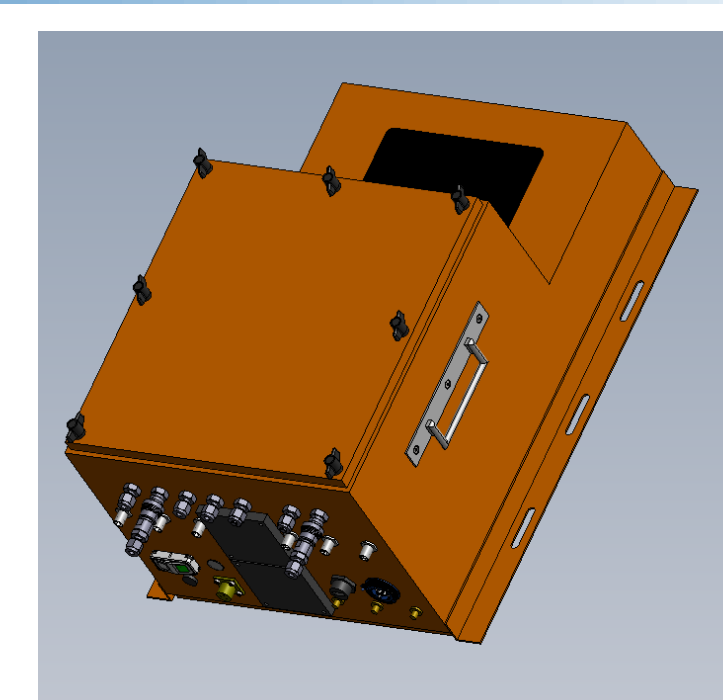
For such activities, this testing facility have at its disposal:

- WMO international calibration gas calibration set (secondary scale from NOAA and ICOS CAL) for CO₂, CH₄, N₂O and CO. CO₂ and CH₄ stable isotope working standards.
- Hundreds of quality control and working standard gas including specific spans for cross sensitivity assessment
- Gas tank filling/preparation facility
- Environmental test chambers (UVSQ PIT)
- Humidifying system unit for water vapor correction assessment
- Reference high precision GHG analyzers

Through ICOS related projects such as ICOS-Cities, ATC Metrology Lab has developed a **testing facility dedicated for low cost GHG sensor** (and few relevant Air Quality sensors): **AtmoBox**.

GHG analyzers (ICOS MLab) and low cost sensors (AtmoBox) testing are both available through AtmoAccess services:

TNA available for testing at LSCE within the AtmoAccess
<https://www.atmo-access.eu/access-to-services/>



AtmoBox :
Low Cost sensor testing unit

Testing Protocol

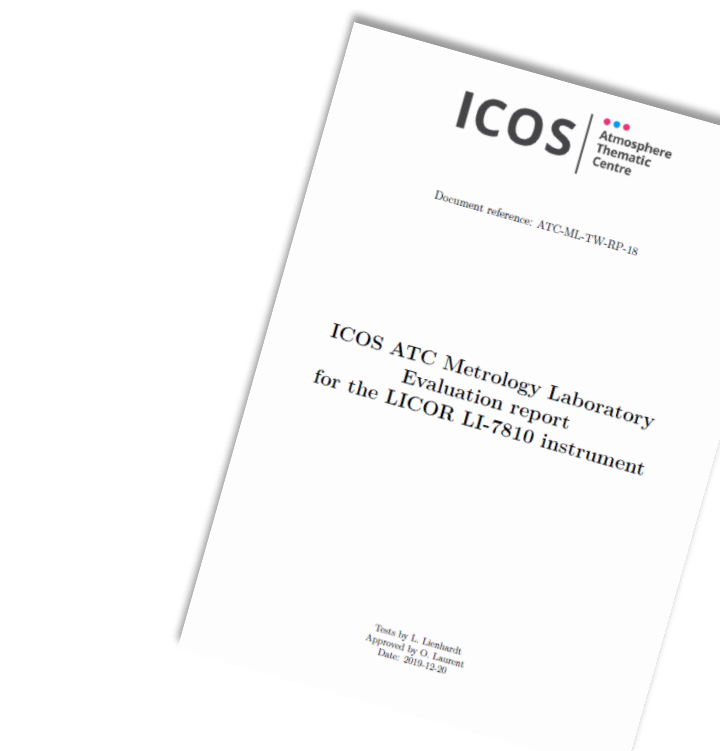
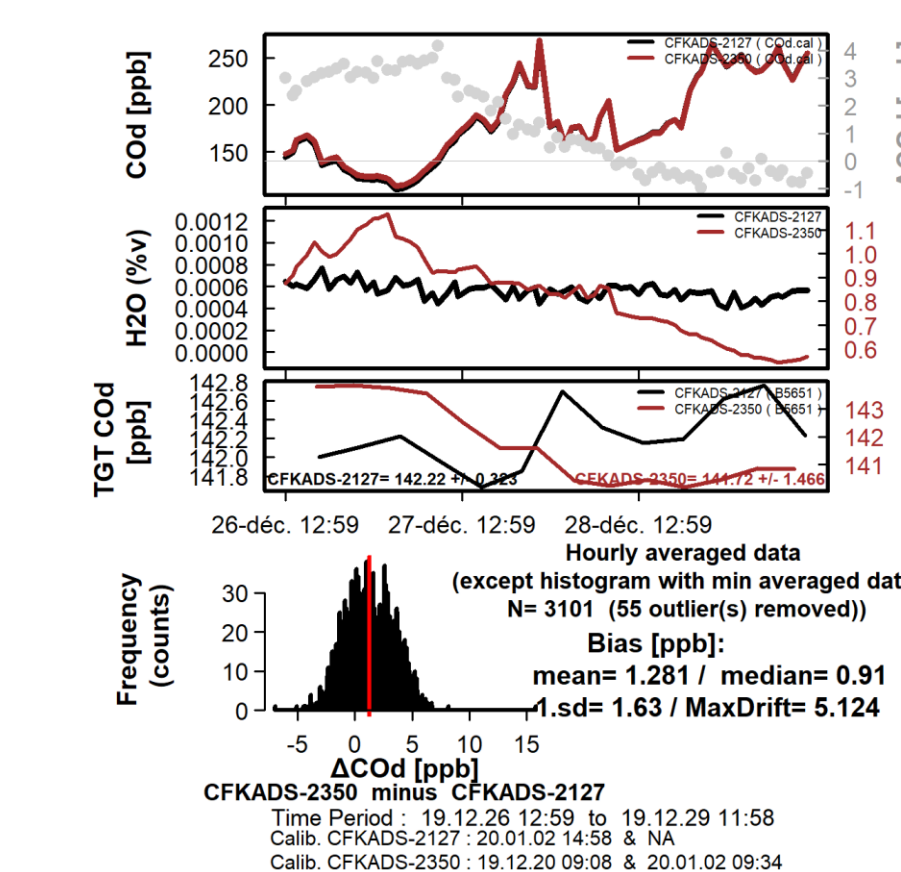
ICOS ATC, has developed a standard protocol to assess the performance of GHG instruments and sensors.

The Standard testing protocol consists in (non exhaustive):

- Short and long term repeatability
- Allan deviation study
- Water vapor correction assessment/determination
- Sensitivity to environmental parameters (Temperature, pressure)
- Linearity
- Cross sensibility with atmospheric compounds
- Response time
- Stabilization time study
- Final comparison with reference high precision analyzer
- ...

See *Yver et al* AMT paper (DOI: 10.5194/amt-8-3867-2015).

The protocol can be adapted to the type of sensor and the final application.



Quality Management System

ICOS ATC is implementing a Quality Management system according to ISO 17025 standard for its GHG testing activity. As there is currently no existing testing standard for GHG, LSCE ISO 17025 accreditation will rely on ICOS ATC standards.

under progress



Benchmarking

With such metrological assessment activity over the last decade, ICOS ATC MLab has tested a large number of instruments/sensors according standards in connection with manufacturers, research labs and institutions.

This ICOS activity which is relevant to guaranty the data quality and maintain ICOS knowledge on state-of-the-art GHG metrology, tends to become also a reference for GHG benchmarking.

Indeed, each manufacturer are testing and providing their instruments specifications according their own procedure and standards.

Because of such test and specifications heterogeneity, it might be challenging to compare the performance of different instrument from different manufacturer.

Testing according a **standardized protocol by an independent laboratory** offer an interesting tool for instrument selection according to the applications and a standardized contribution for uncertainty study.

