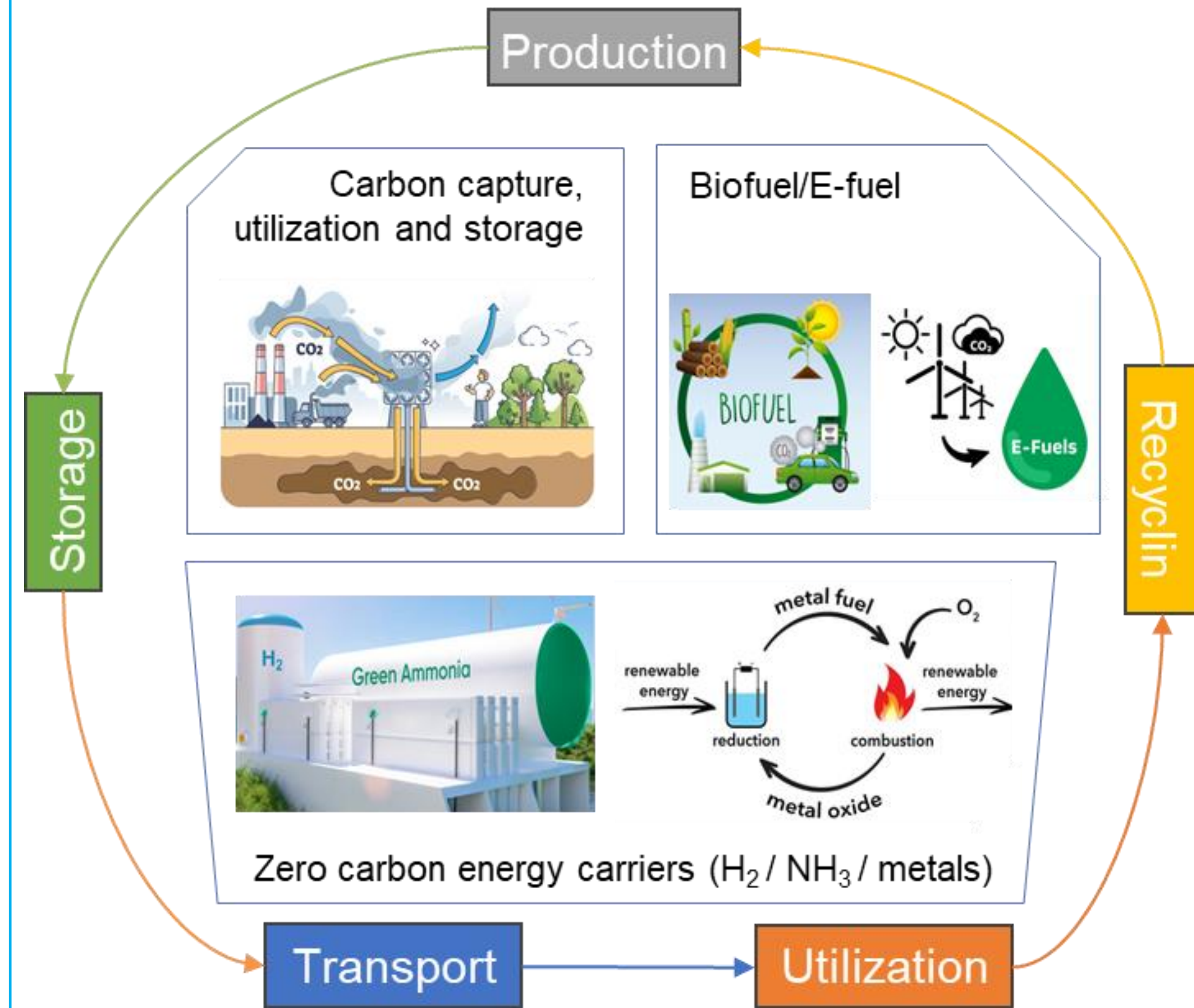


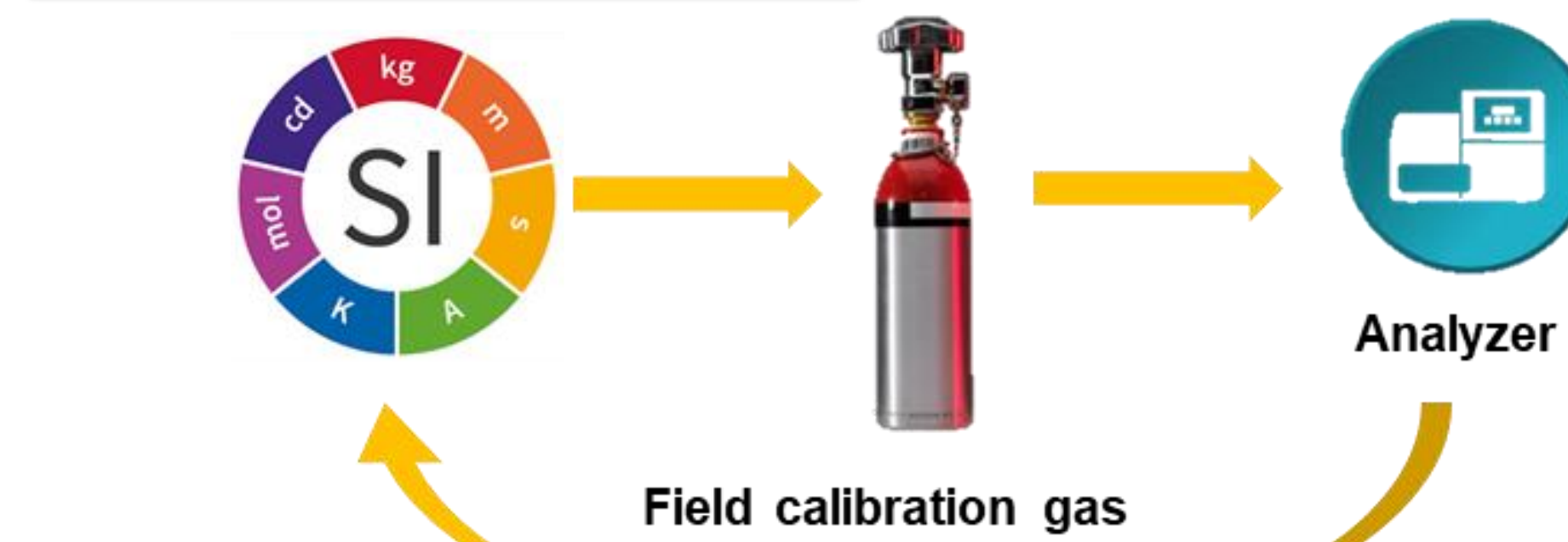
Potential Primary Standard – traceable laser absorption spectroscopy for hydrogen and ammonia analysis

Introduction



Reference gas VS spectroscopy

With calibration gases

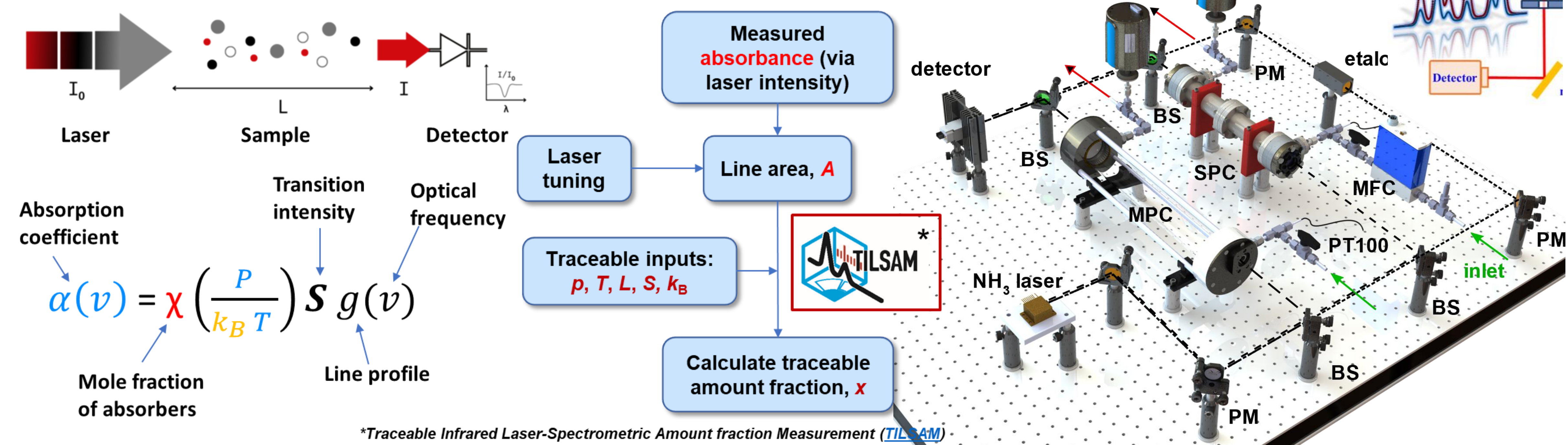


Without calibration gases



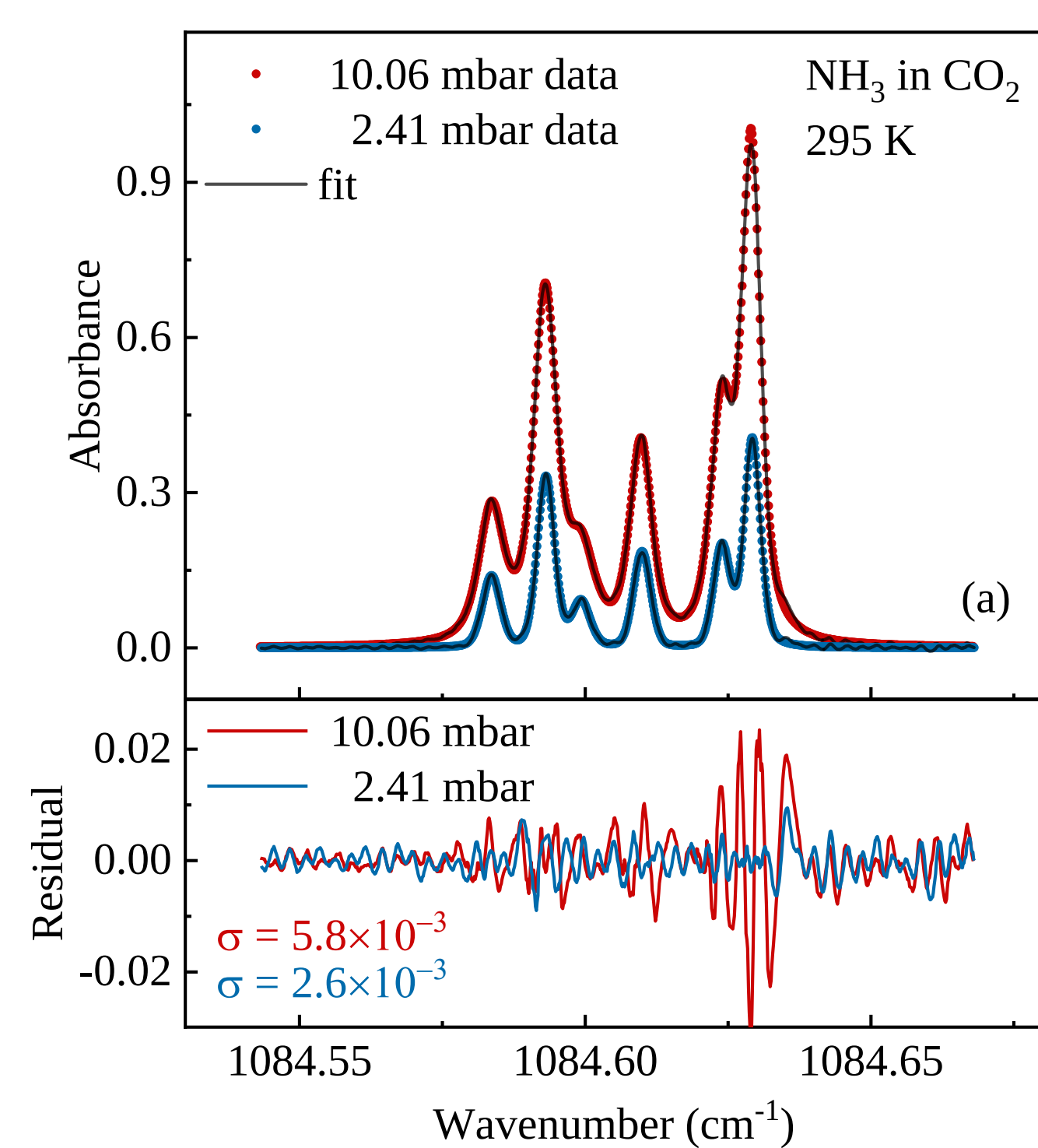
Traceable laser absorption spectroscopy

CCQM GAWG Task Group on Advanced Spectroscopy

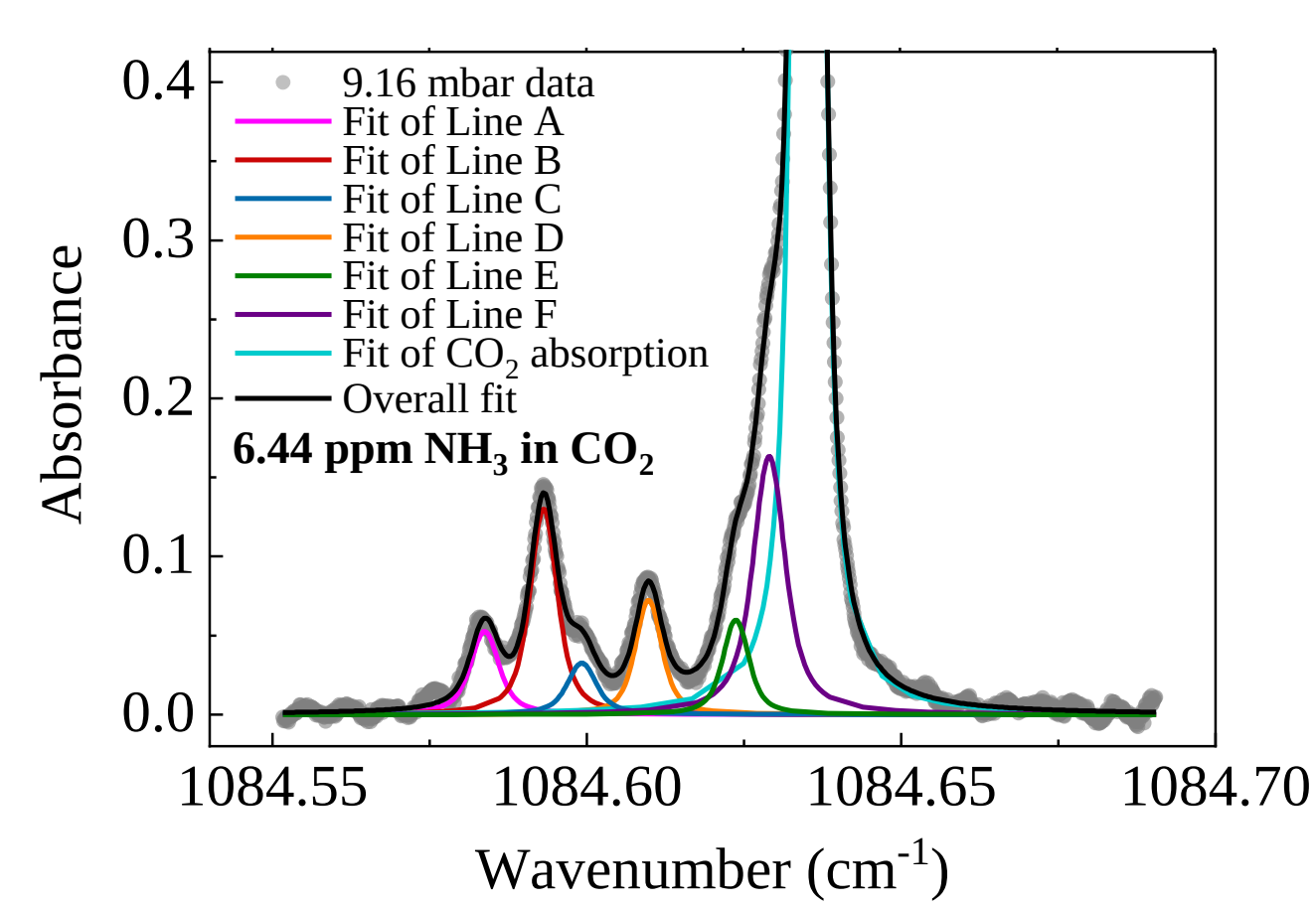


Traceable NH₃ spectrometer

six NH₃ absorption transitions near 9.2 μm;
NH₃ QCL scanning at 140 Hz.

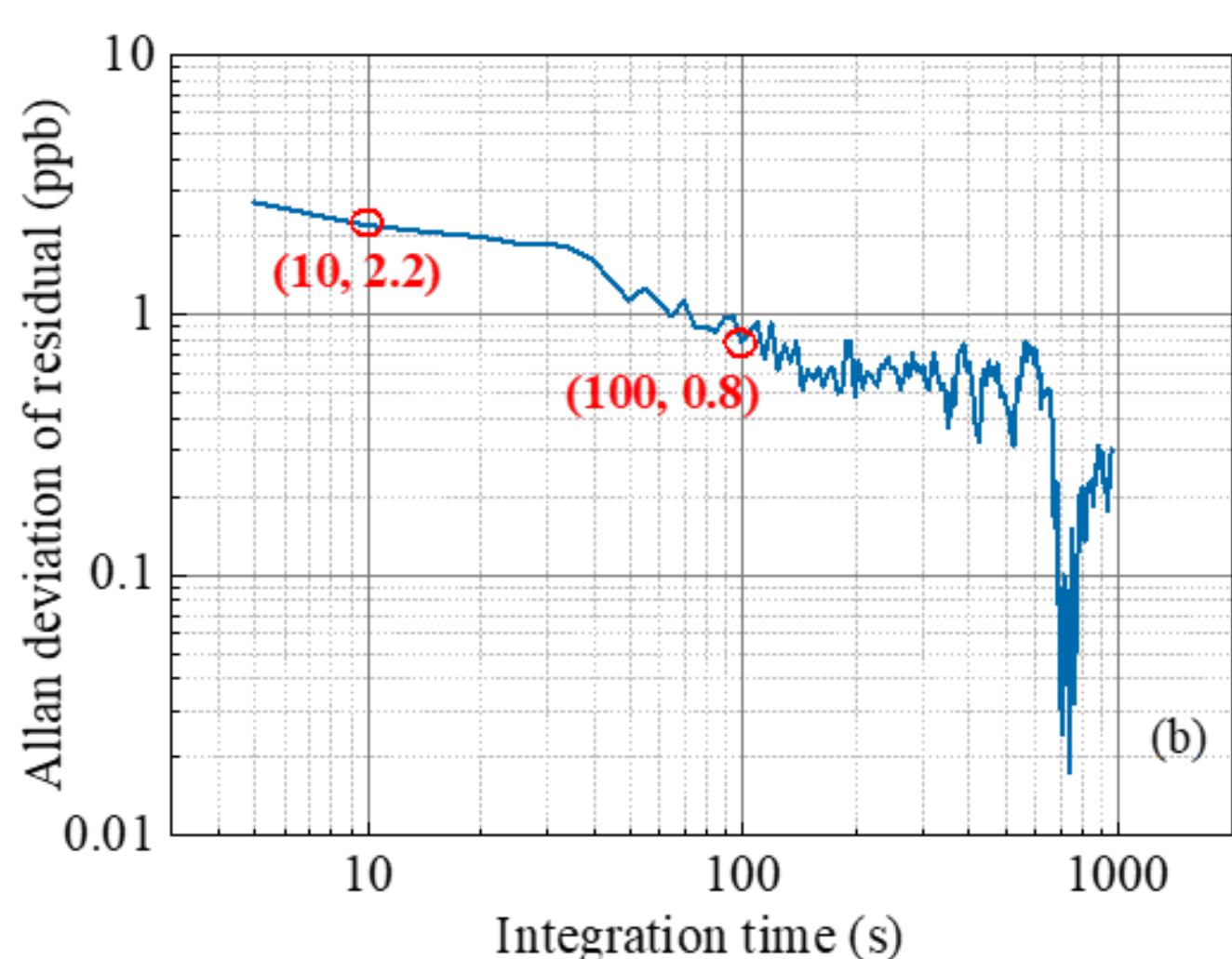


CCUS: ISO 27913:2016
NH₃ limitation: 10 ppm



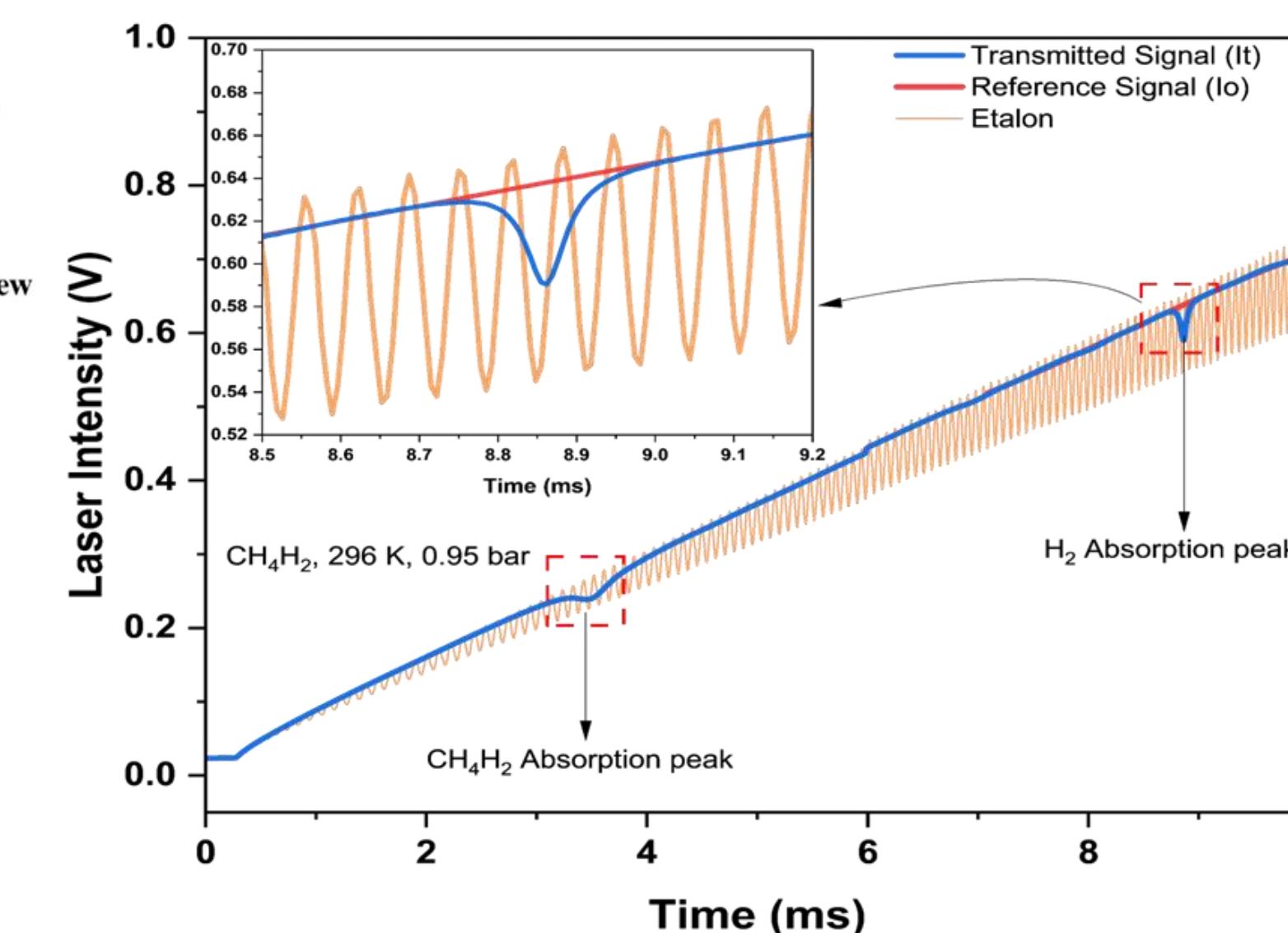
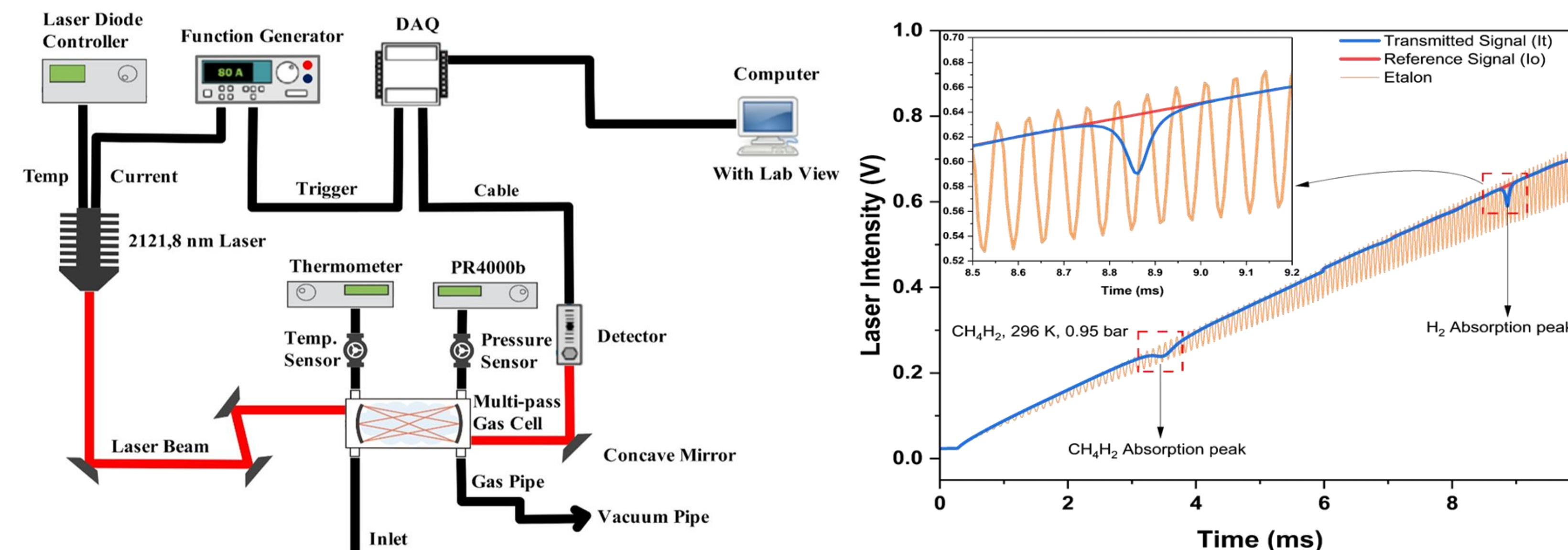
- Multi-line fitting algorithm to extract NH₃ absorption peaks from strong CO₂ absorption interferences.
- The NH₃-TDLAS can meet the ISO requirement.

Hydrogen: ISO 14687:2019
NH₃ limitation: 100 ppb

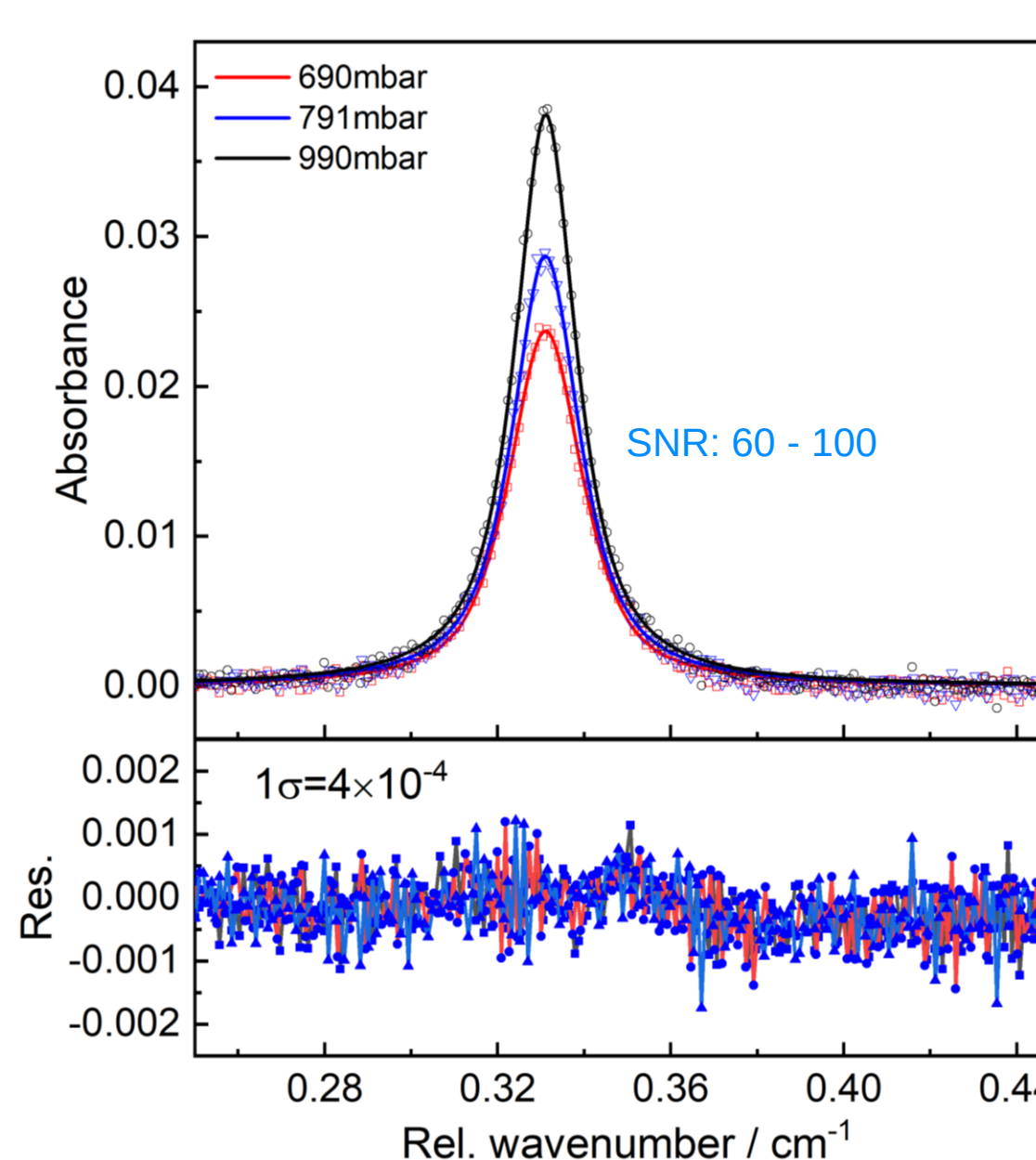


- The LOD of the NH₃-OGS is 2.2 ppb @ 10 s; 0.8 ppb @ 100 s.
- The measurement repeatability is 0.13 ppb (SEM) over a period of 48 min.

Traceable H₂ spectrometer

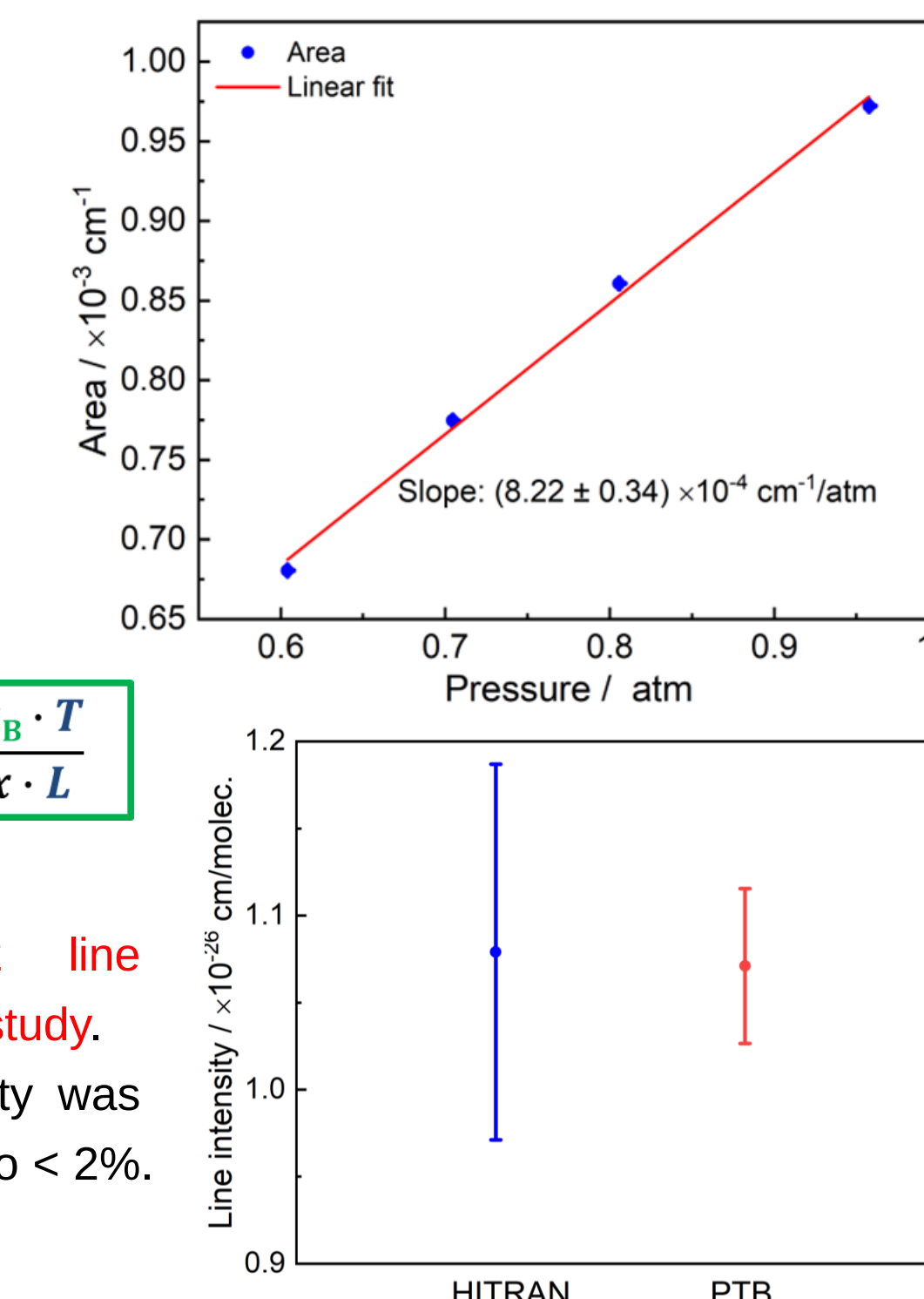


Hydrogen spectra VS pressure



$$S = \frac{A \cdot k_B \cdot T}{p \cdot x \cdot L}$$

- The H₂ line intensity study.
- Uncertainty was reduced to < 2%.



Summary

Traceable laser absorption spectroscopy can

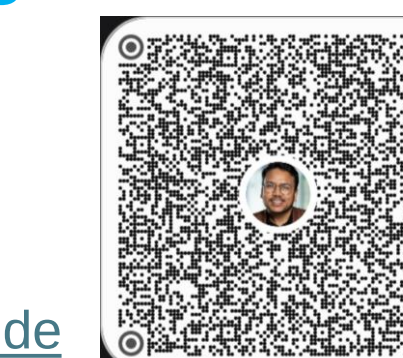
- serve as SI-traceable instruments;
- complement gas Reference Materials;
- be used for field measurements;
- provide SI-traceable spectral parameters;
- run without reference gas calibration;
- serve as Primary Standard.

Contact

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