

Atmospheric Remote Sensing and Molecular Spectroscopy (Vietnam School of Earth Observation)

Quy Nhon, Vietnam, 26-31 August 2018

Gas cell spectrum study and determination of the concentration of carbon monoxide inside the gas cell

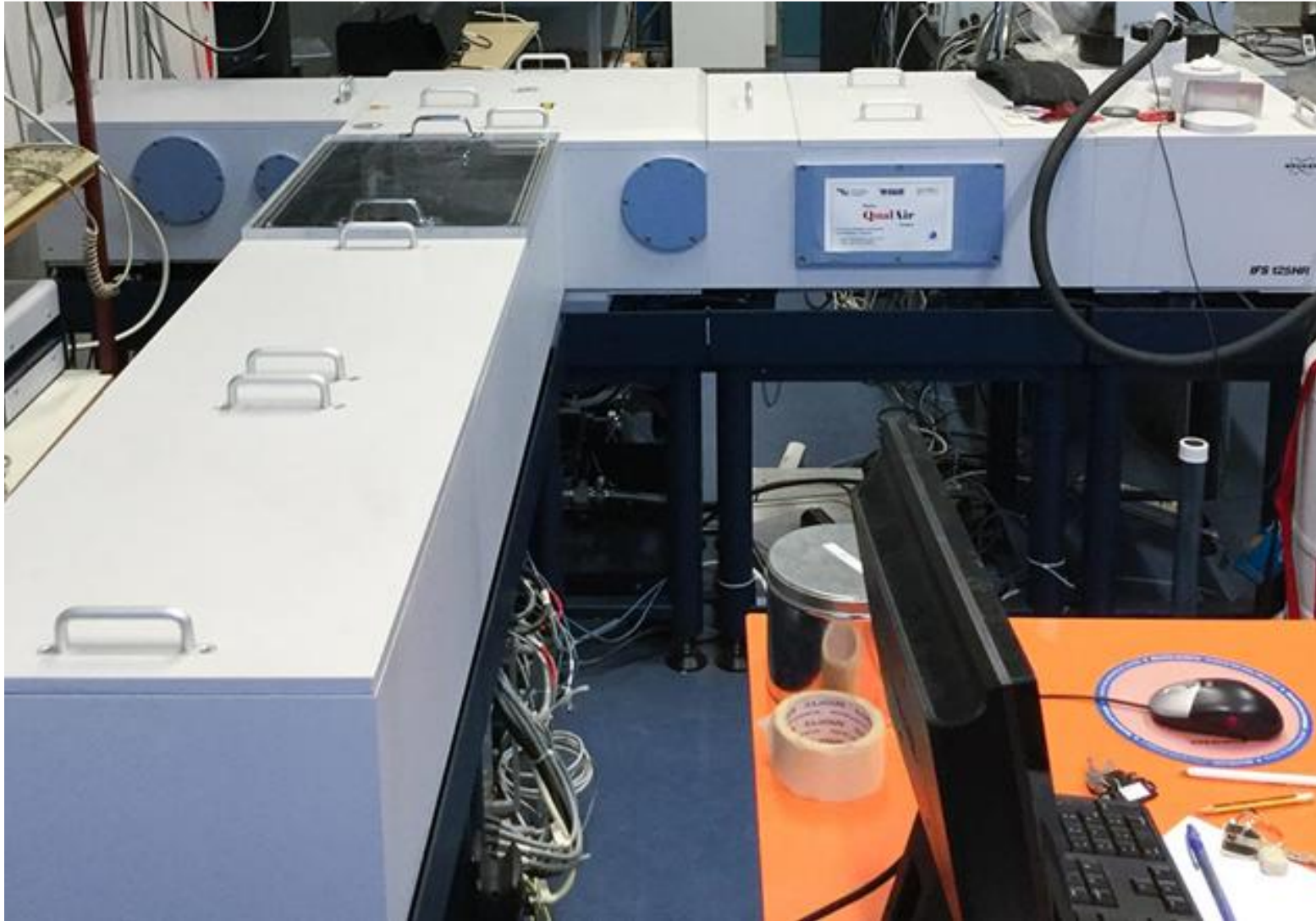
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LERMA-IPSL, SU/CNRS/Observatoire de Paris/IPSL, UMR 8112
Case 76, 4 Place Jussieu, 75005 Paris, France**

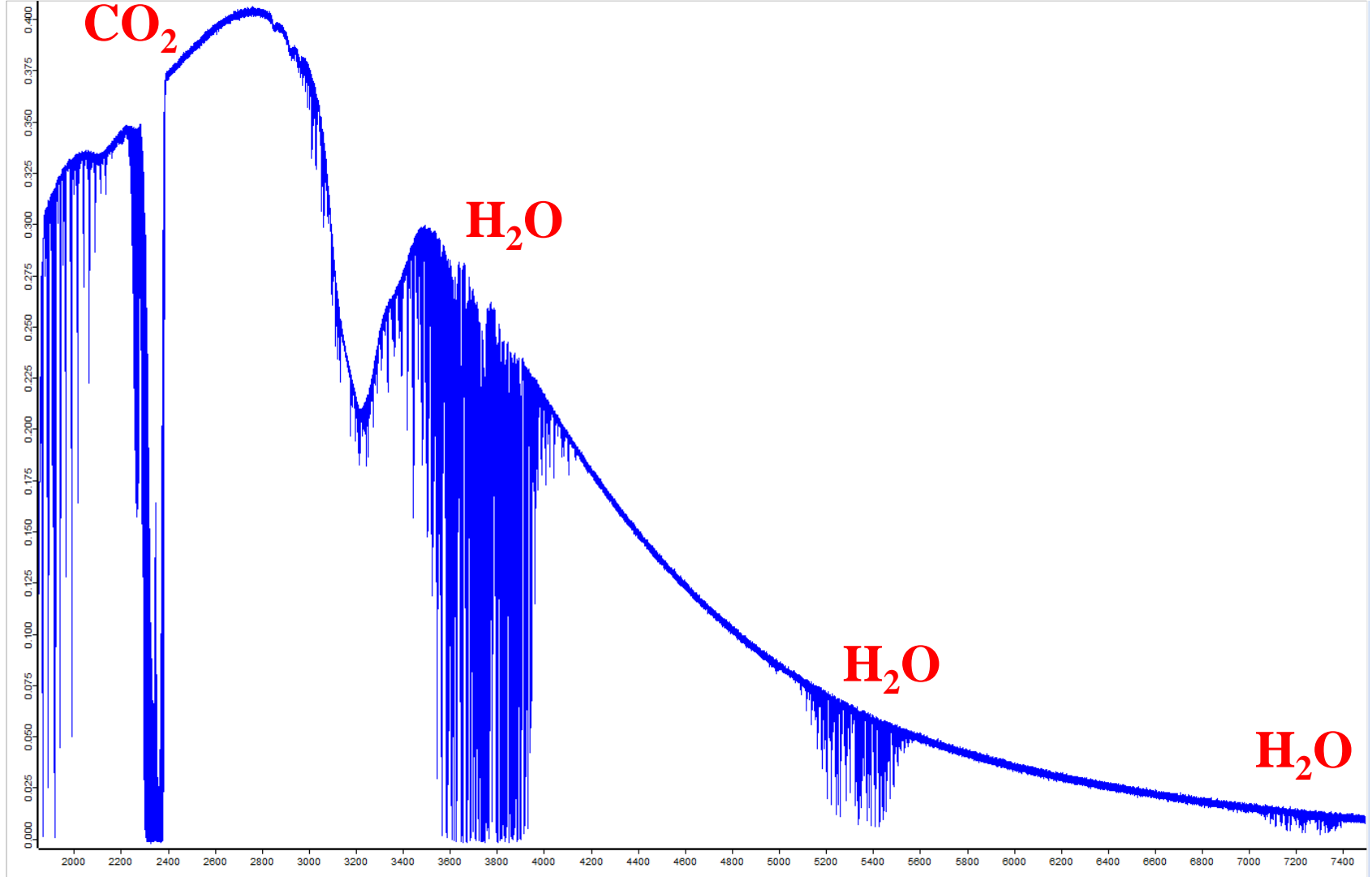
An aerial photograph of a modern urban courtyard. The central focus is a tall, cylindrical glass skyscraper with a grid-like facade. To its left and right are other modern buildings with similar architectural styles, featuring large windows and glass panels. The courtyard is landscaped with green grass, small trees, and paved walkways. A few people can be seen walking on the paths. The sky is clear and blue.

Recording of the gas cell spectrum

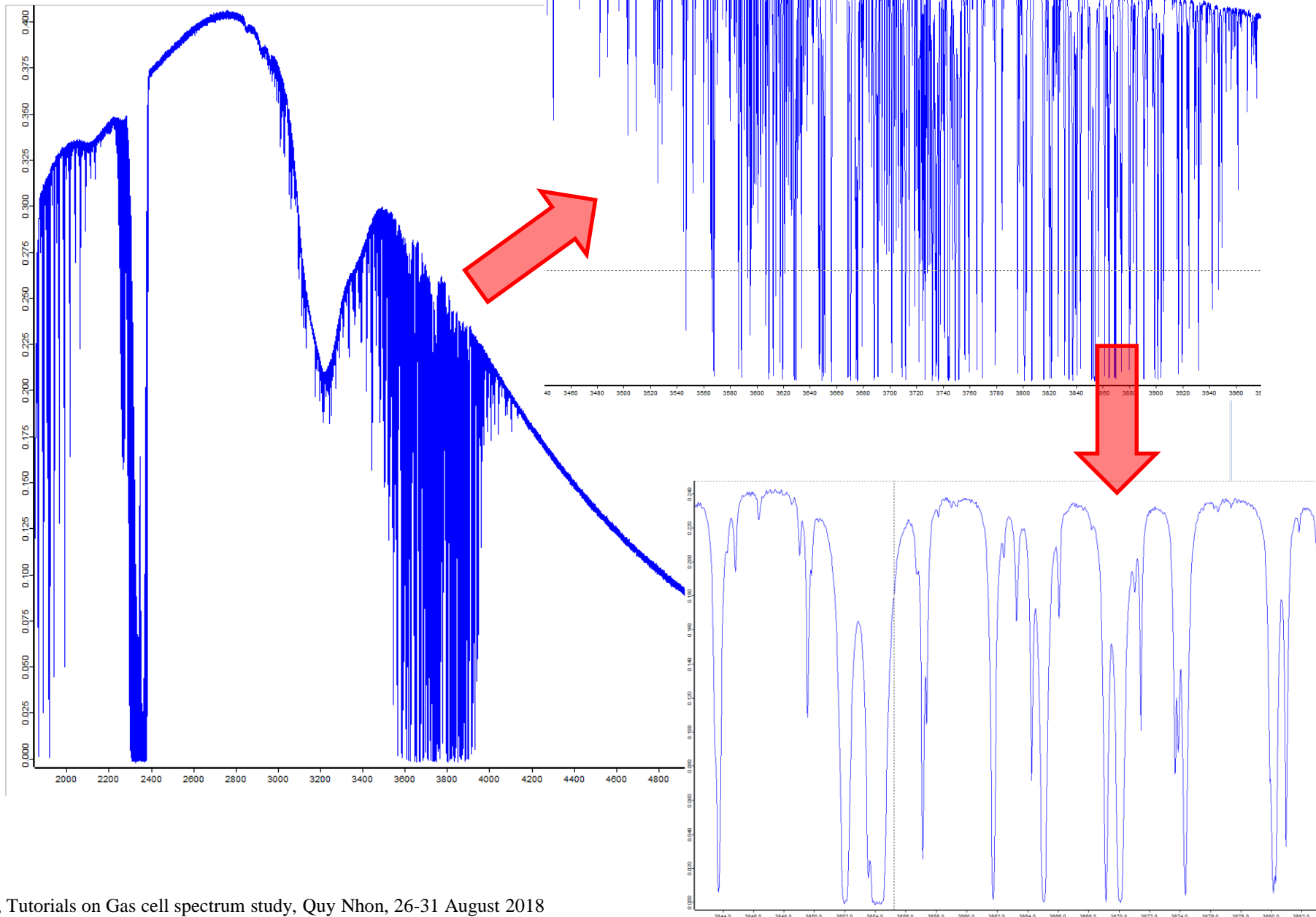
Picture of the FTS-Paris spectrometer

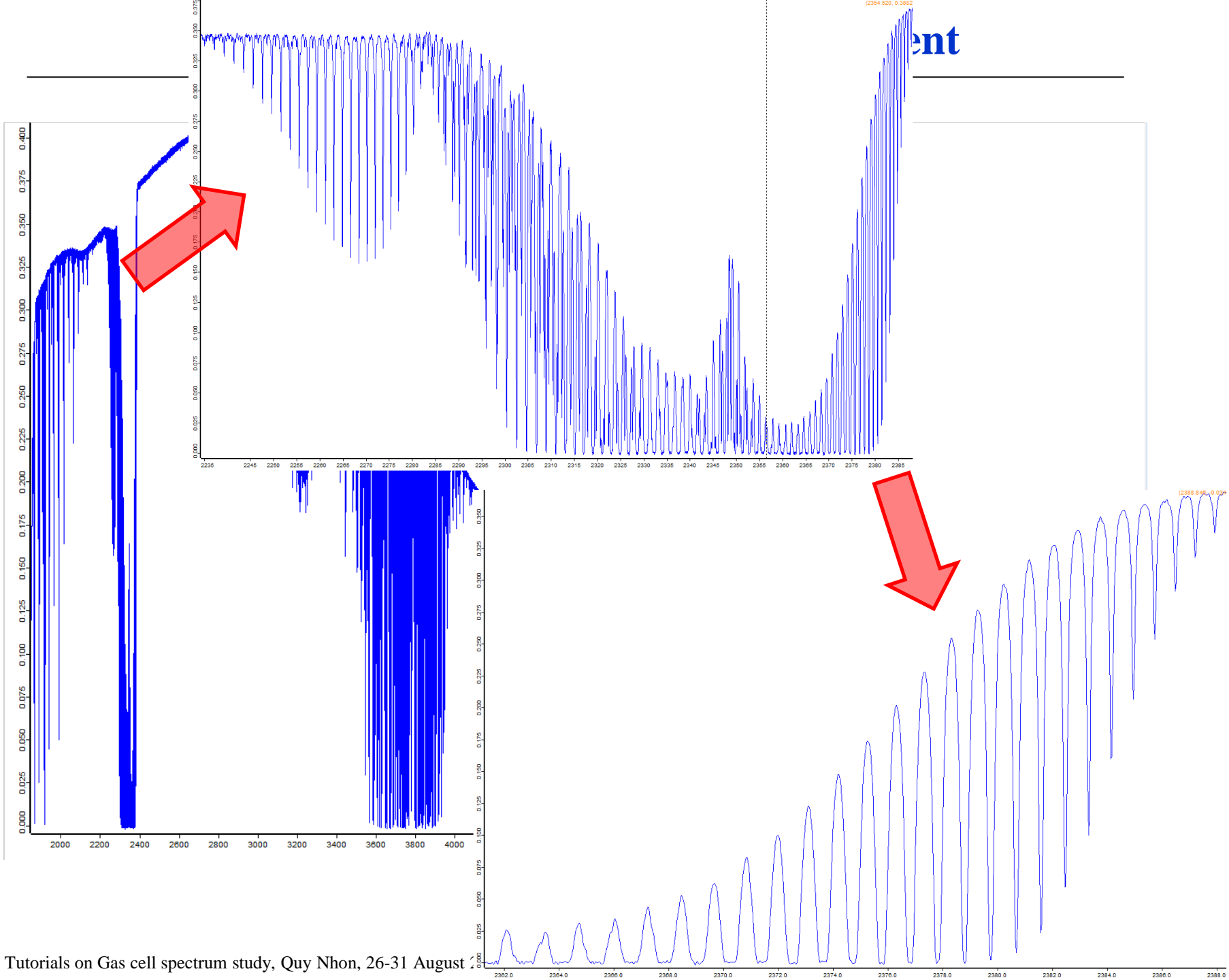


IR spectrum of the FTS-Paris instrument

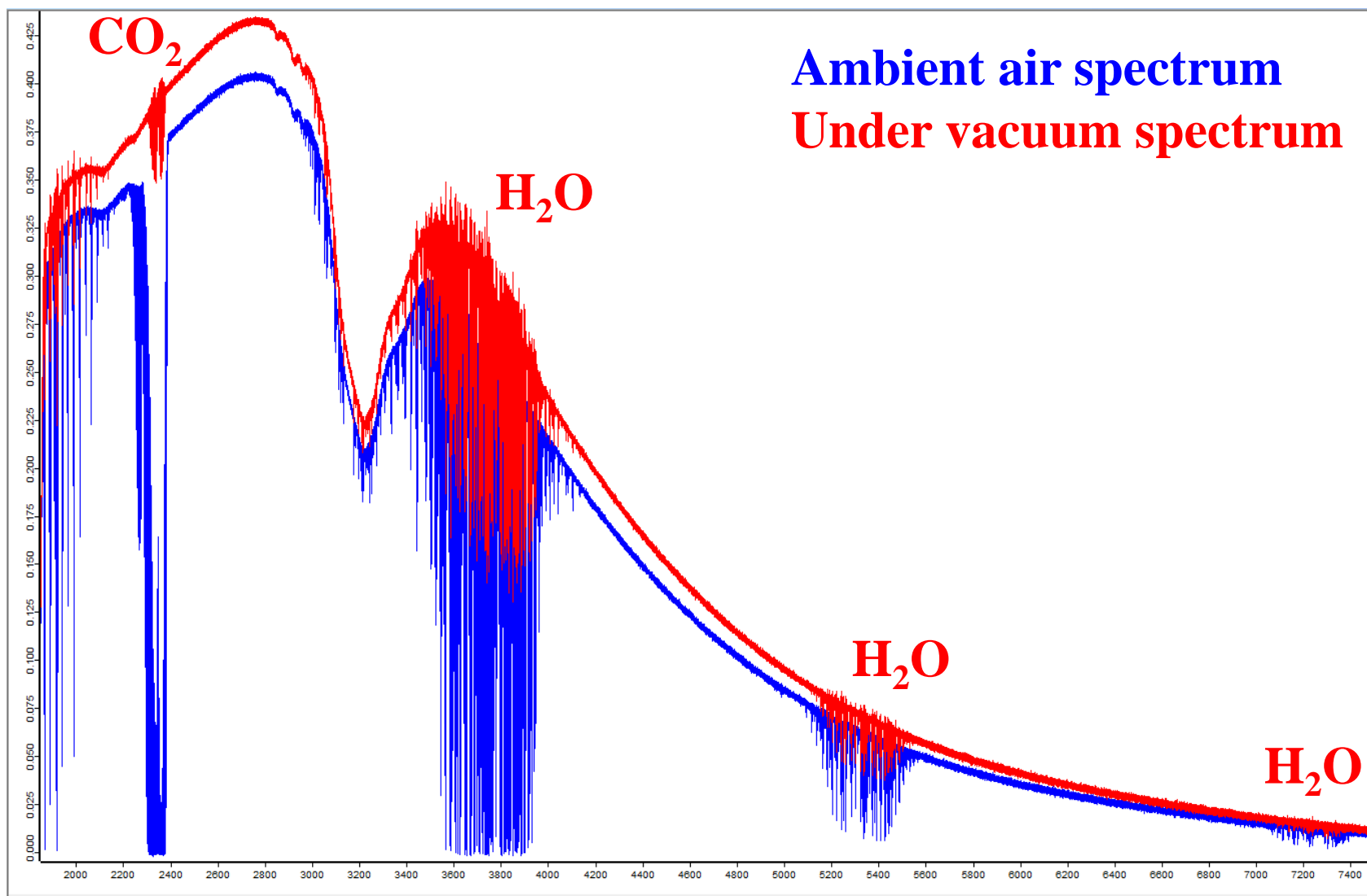


IR spectrum of th

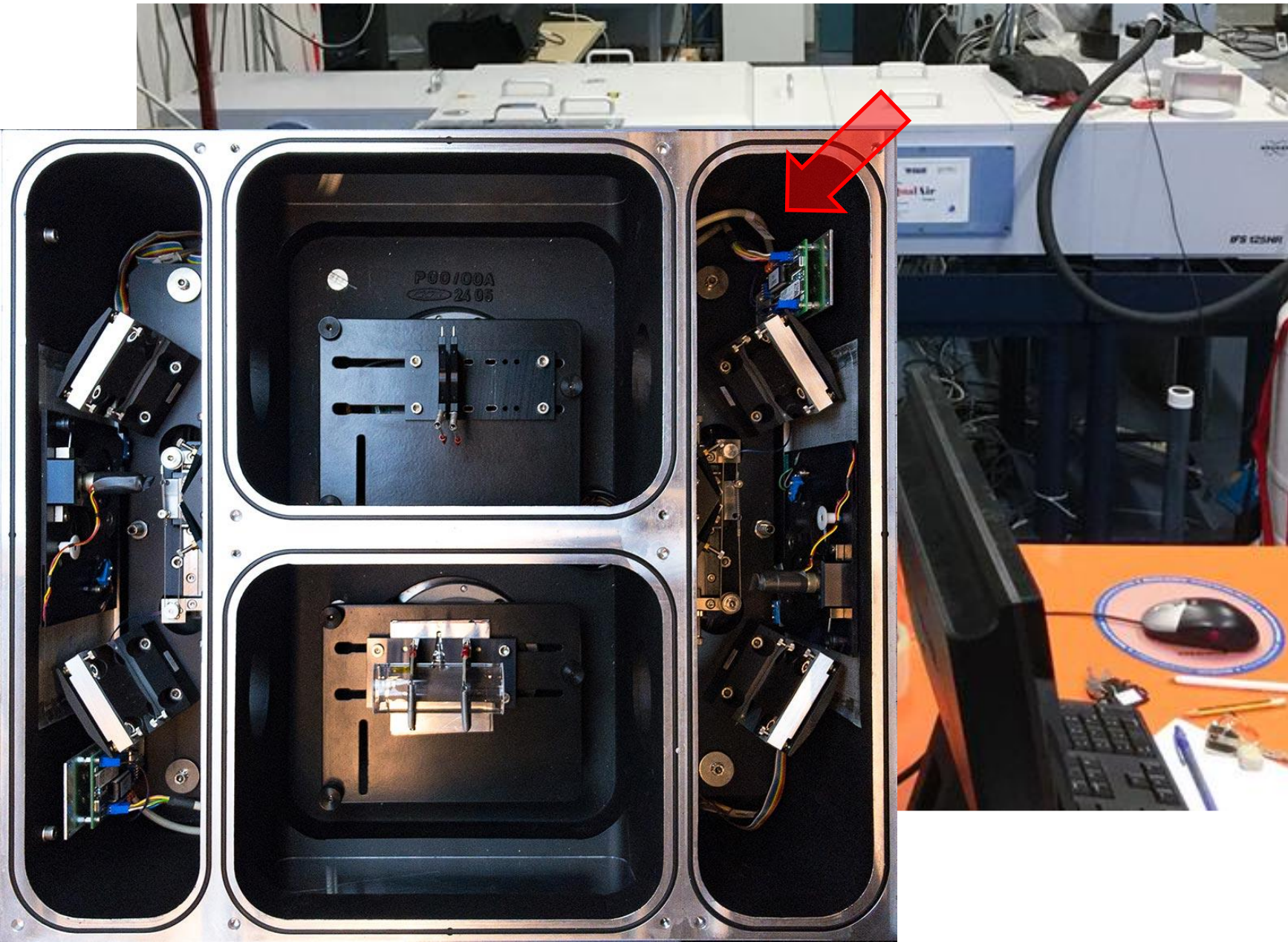




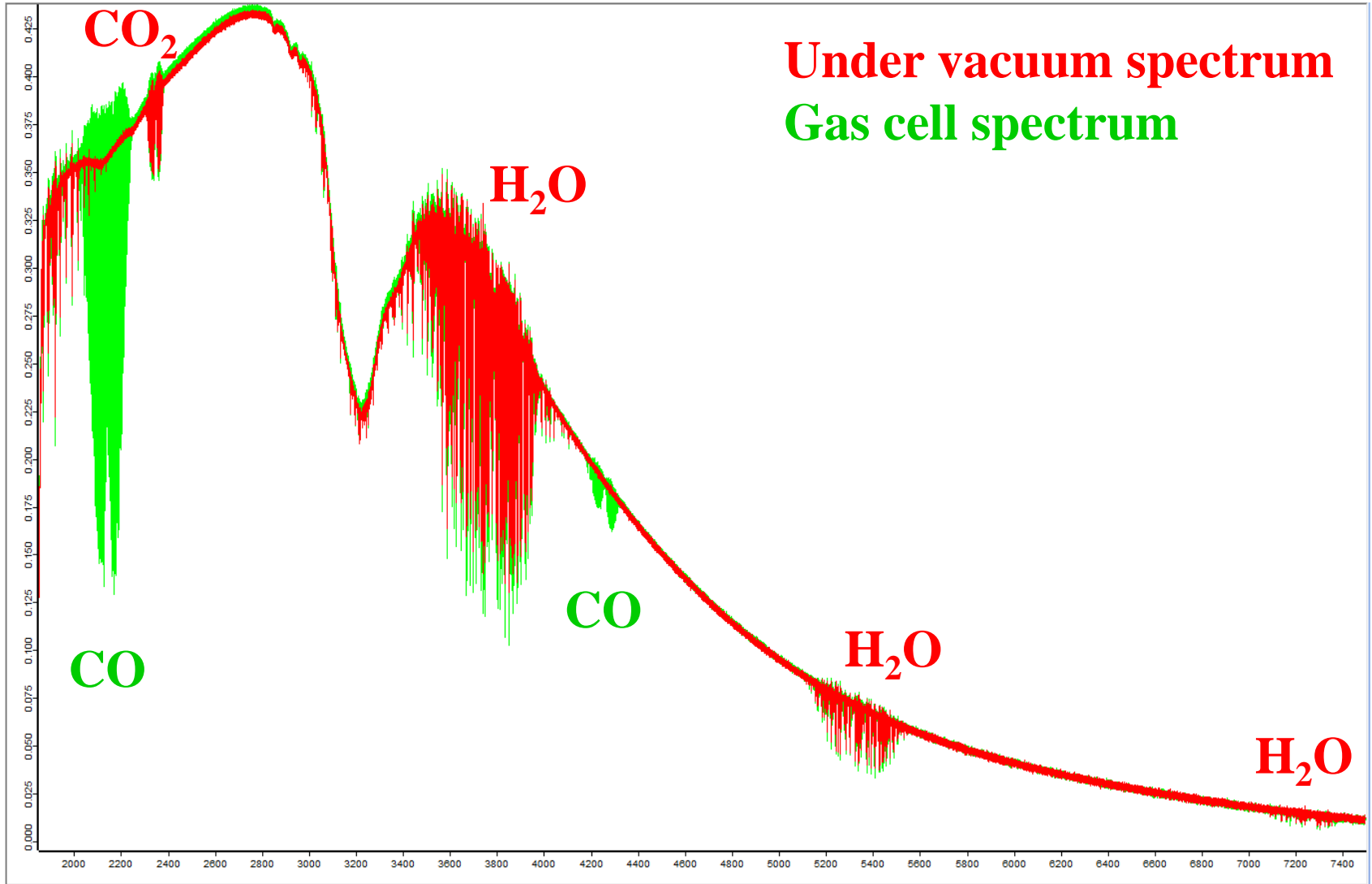
IR spectrum of the FTS-Paris instrument under vacuum



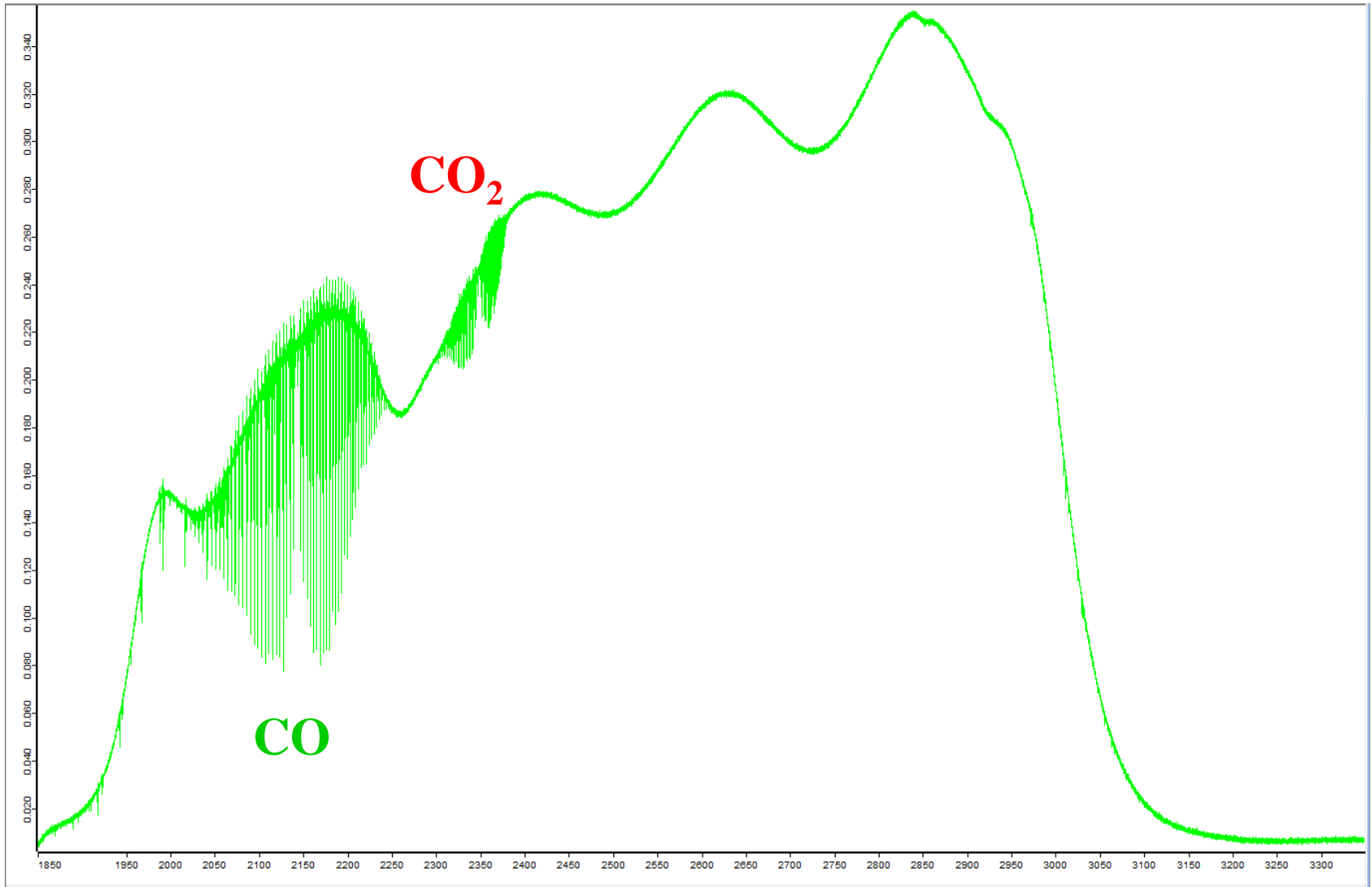
Gas cell inside the FTS-Paris spectrometer



Gas cell spectrum recorded by of the FTS-Paris instrument



Gas cell spectrum + optical filter

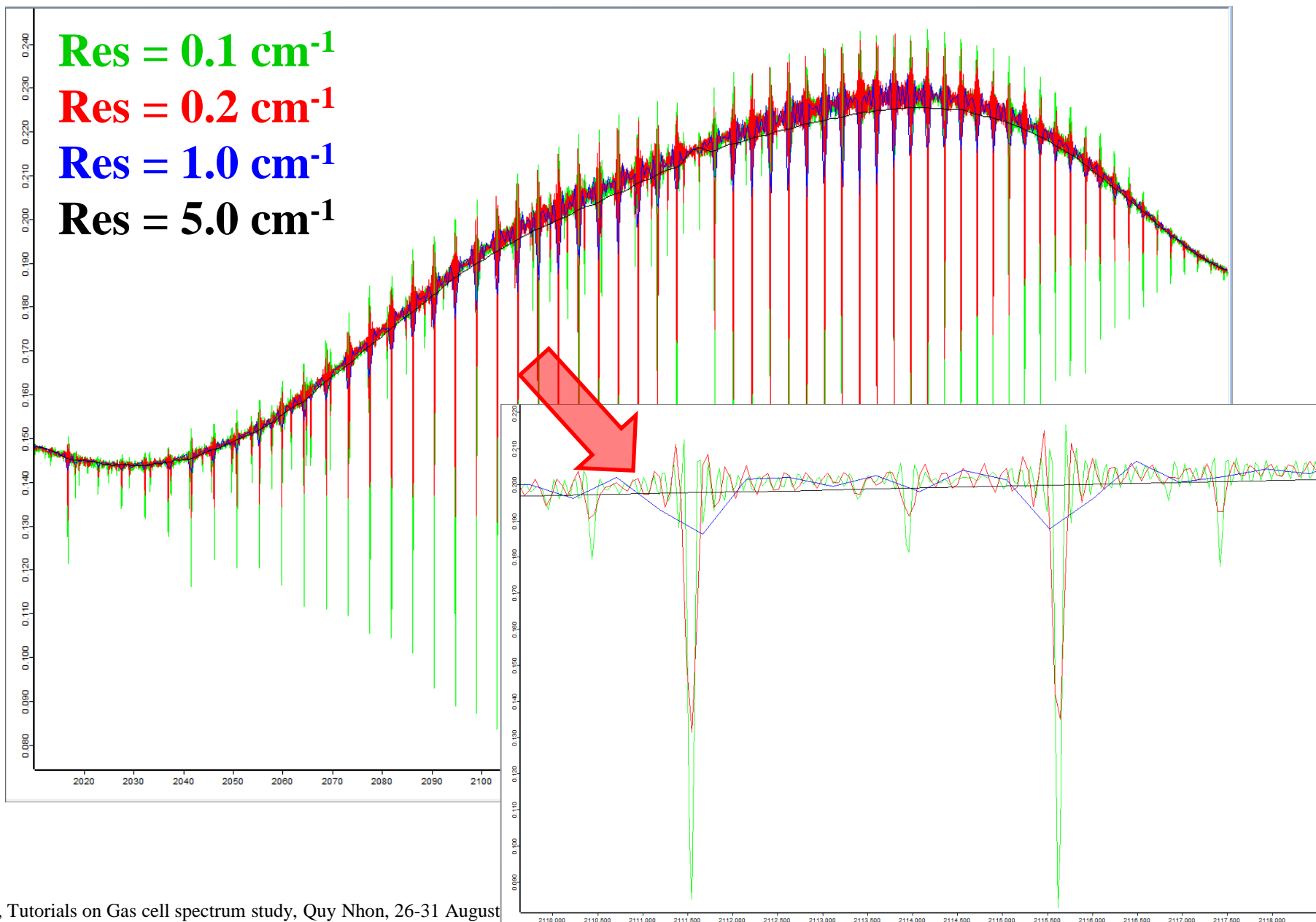


An aerial photograph of a modern urban courtyard. The central focus is a tall, cylindrical glass skyscraper with a grid-like facade. To its left and right are other modern buildings with similar architectural styles, featuring large windows and flat roofs. The courtyard is landscaped with green grass, small trees, and paved walkways. A few people can be seen walking on the paths. The sky is clear and blue. A semi-transparent yellow banner with a green border is overlaid across the middle of the image, containing the text "Effect of spectral resolution".

Effect of spectral resolution

Gas cell spectrum + optical filter

[resolution]

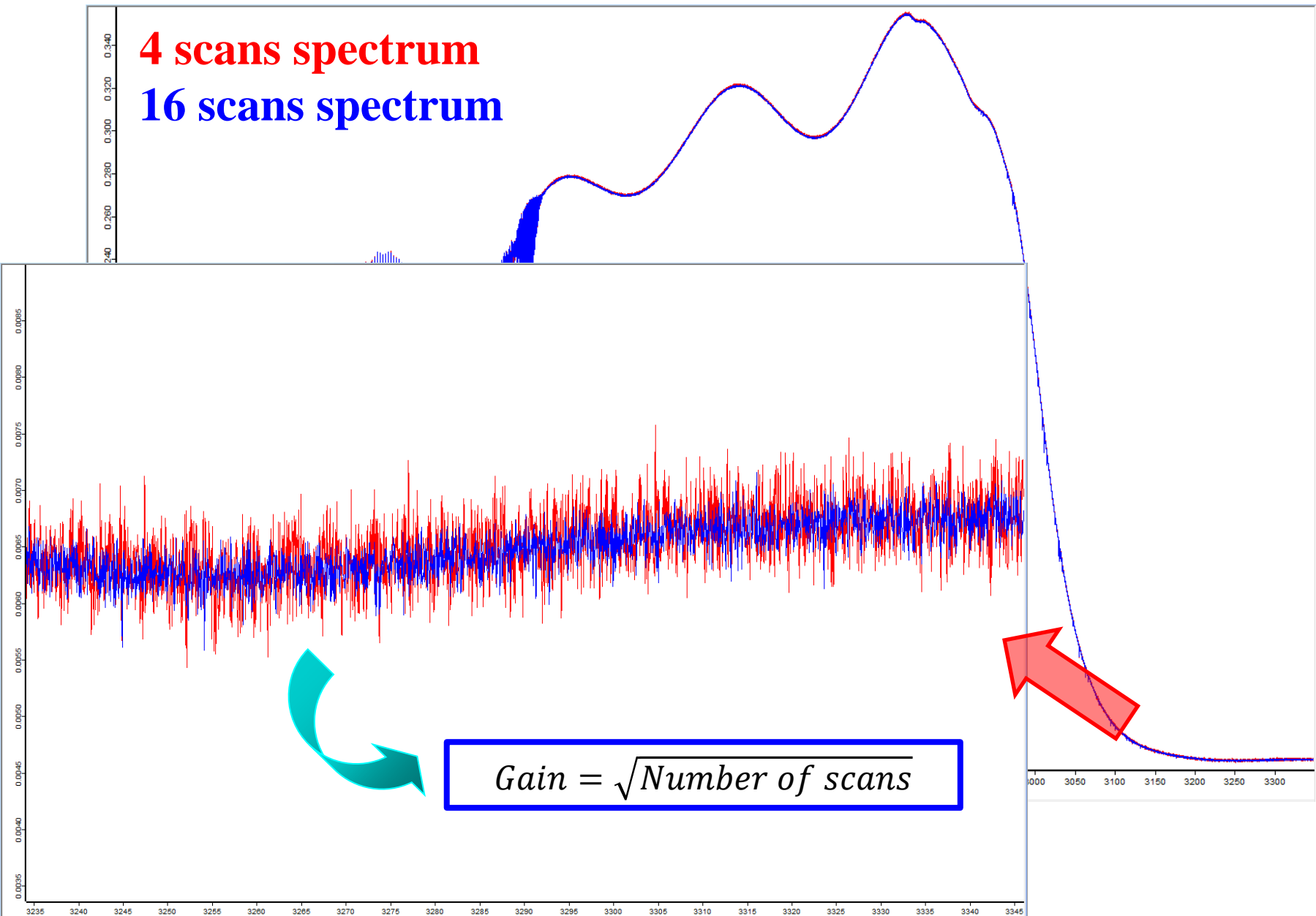


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Effect of integration time

Gas cell spectrum + optical filter

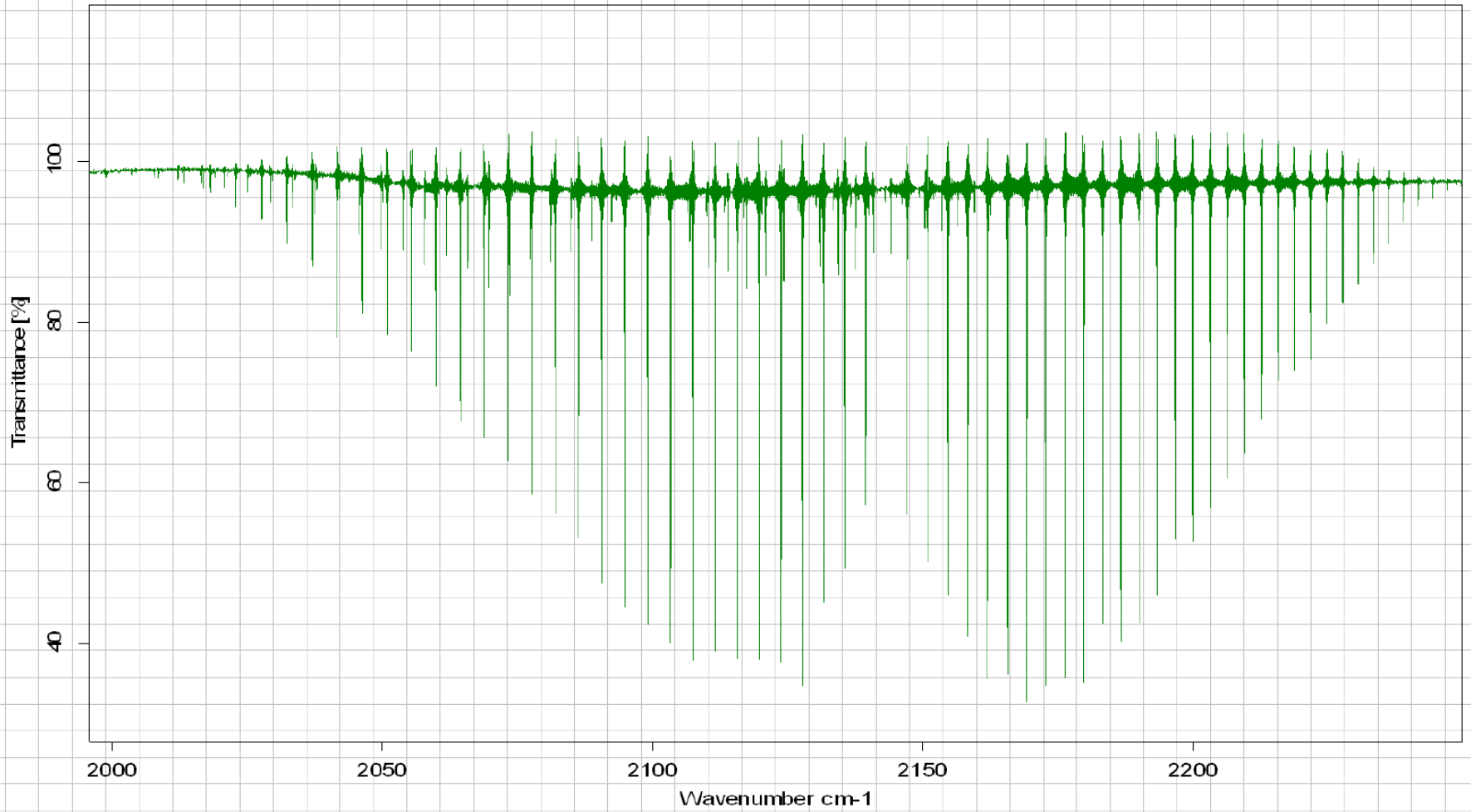
[co-addition]



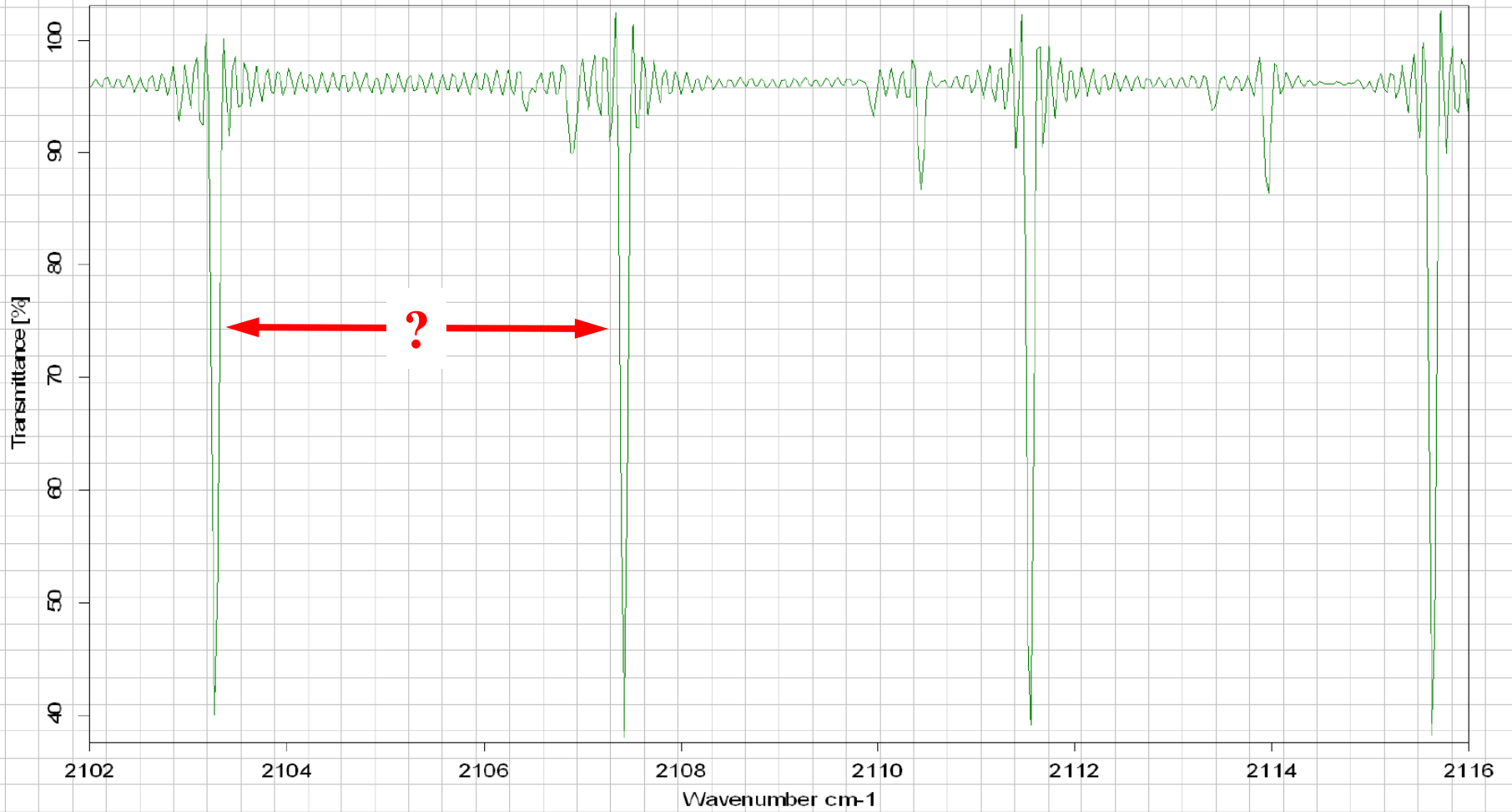
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Analyse of the gas cell spectrum

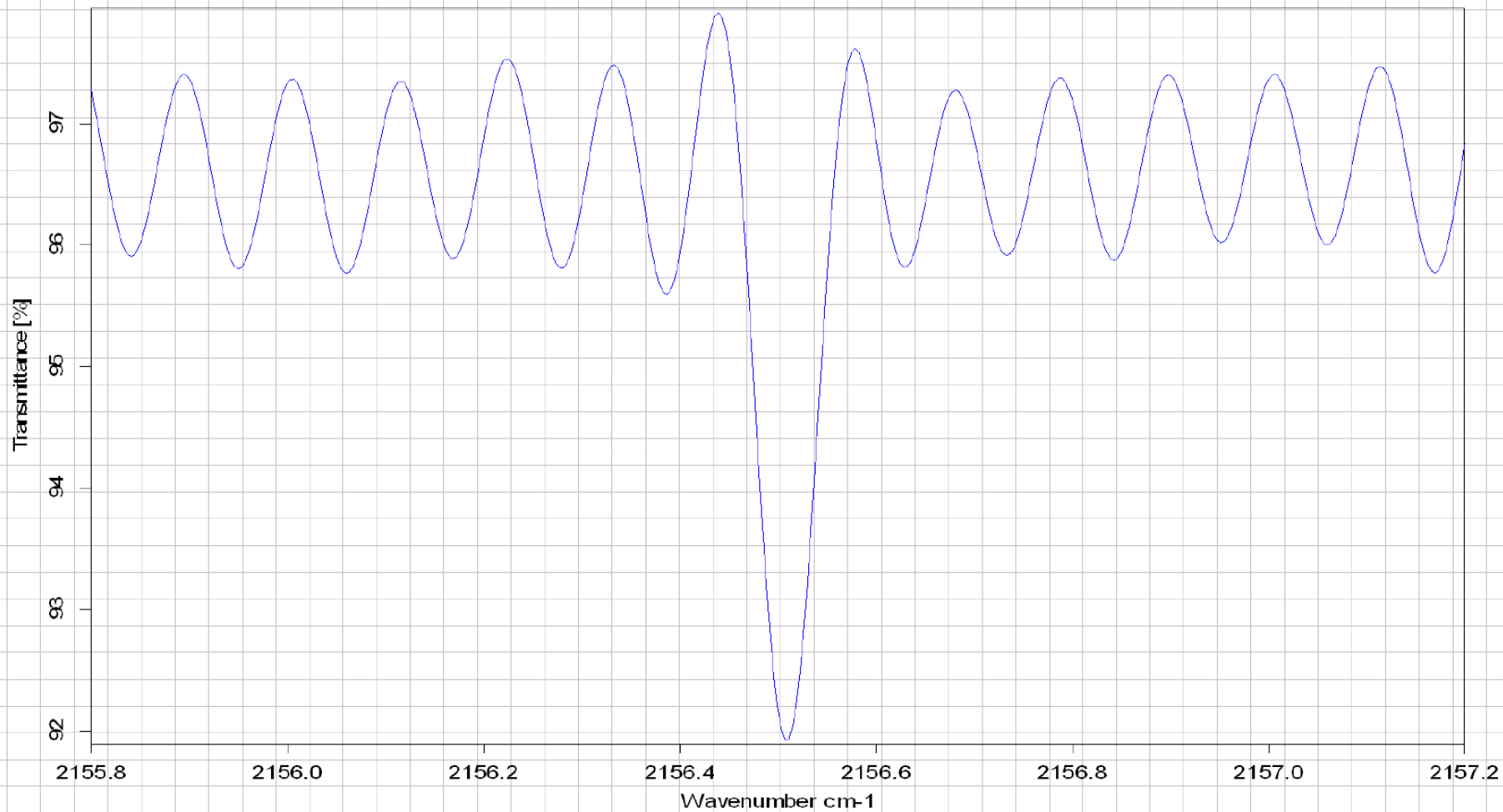
Transmission spectrum of gas cell



Transmission spectrum of gas cell



Study of the absorption line R(17)



How to determine the CO concentration from the R(17) line ?

Instructions and Hints

1 - Remember the Beer-Lambert law

2 - For small absorption :

- First order approximation of $e^{-n\sigma_{\tilde{\nu}}L}$

- Integration of $(1 - I/I_0)$ introducing $S = \int_0^{\infty} \sigma_{\tilde{\nu}} d\tilde{\nu}$

3 - Calculation of the absorption line area in units of squares

4 - Determine the physical units of one square on the paper

5 - Determine the particle number density n (m^{-3}) and then the CO partial pressure inside the cell

$$L = 20 \text{ cm}$$

$$S = 1.153 \times 10^{-21} \text{ cm}^{-1}/(\text{molecules} \cdot \text{cm}^{-2})$$

$$k = 1.38 \times 10^{-38} \text{ m}^2 \cdot \text{kg} \cdot \text{s}^{-2} \cdot \text{K}^{-1}$$

$$T = 295 \pm 1 \text{ K}$$

NDACC-IRWG and TCCON Annual Meeting 2018 Cocoyoc, México

Thank you for your attention

