

Response to comments from Referee 2 (Dr. Arndt Meier)

Black: Referee's comments; Blue: Authors' answers

We thank referee #2, Dr. Arndt Meier, for the review and for support of the paper.

Referee:

I wish to congratulate the authors on this well researched and well carried out scientific work.

The manuscript is well and clearly structured, concise, relevant, appropriately illustrated, easy to follow and demonstrates a very good command of the English language.

A pleasure to read.

Thank you very much!

The work presented fits well within the scope of this journal. The work exposes, describes and resolves one of those nagging problems that have been a stone in the shoe of many researchers in this specialist field. The novelty and relevance lies primarily in discussing the issues caused by undesired optical resonances not from the perspective of an individual instrument but on a measurement network wide concise analysis and quantification of the variability and amplitude of these issues and how relevant these are to the overall error budget of trace gases reported by the NDACC (and TCCON) network. The authors include the principal manufacturer of the commonly used spectrometers (Bruker Optics) in the study. This is a good approach and a reflection of decades of good dialogue between cutting edge research and industry to mutual benefit. The authors also discuss and suggest practical technical solutions to the benefit of all affected.

The scientific work has been carried out diligently and the conclusions are sound and relevant. Proper credit is given to past investigations as well as the contributing community who are seemingly all included as co-authors. Abstract and title are appropriate and concise.

Below I have a short list of very minor comments and suggestions that the authors may wish to consider for the final version to improve clarity and readability, but it is nothing that should delay the publication of the final version even if left unconsidered.

- Page 3, section 2, Line 91 "Equation (1) is used to assign..." replace 'assign' with 'identify'

Done.

- Line 94 correct spelling is "a harmonic" (not an harmonic)

Corrected.

- Line 104, description of Figure 1: Consider adding "where 'l' is denoted 'd' in equation (1)"

Done.

- Line 137 " Then, the background was normalized and a straight line was subtracted using Origin™ software" How was the normalization carried out? Or did the authors mean to say ' Then, the background was normalized by subtracting a straight line (from the laboratory spectra) using Origin™ software'?

Is clarified in the text and in the caption of Fig. 2:

The background was normalized by dividing a straight line that connects the ends of the spectrum using ORIGIN™ software (red line in Fig.2a). The resulting quotient minus 1 (Fig. 2b) was used to perform a FFT analysis.

- page 14, section 5, Line 235 Comment: I wouldn't stress this as an impediment. As long as no pellicle beam splitters are in use, and which seems to be the case for the NDACC (and I believe the TCCON as well) which are the focus of this study, there is no issue as long as the only or at best two beam splitters in use for a given instrument have the same air gap wedge of say 2 degrees. I'm not sure if an additional glass beam splitter is in use for the optical alignment of the FTS, in which case the same wedge would have to be used for that one, too.

Correct, for the standard alignment procedure a second beam splitter (CaF₂ or glass) is needed to observe Haidinger fringes with a telescope. We agree that exclusion of a pellicle beam splitter is not a show stopper for the NDACC and TCCON community, at least when purchasing a new instrument.

New colleagues buying a new instrument might not know this option. For existing instruments, however, switching to beam splitters with larger wedge means an investment of two beam splitters and moreover, a full re-alignment of the spectrometer!

- Line 238: "Such a systematic performance analysis is needed for improving the trace gas retrievals and for calculating complete error budgets." Comment: consider adding "also in order to improve the consistency and quality of the products across the NDACC network"

Done.

- Line 242 Comment: Perhaps a rough indication of typical relative absorption strengths of the weak absorbers listed by the authors would be helpful to put the channeling error amplitudes reported into perspective, possibly earlier in the discussion rather than here.

Added.

- Line 249 Consider replacing "leading one" with "dominating one"

Replaced.

Given that Axel and Denis from Bruker Optics are among the co-authors it would be nice to have And indication (or ideally commitment) that beam splitters with a larger air gap of say 2 degrees are available as an option - if necessary at a small surcharge - for new orders or a modification service for existing beam splitters. That would be great to know even for users outside the NDACC community that may also be affected by channeling in their work.

Agreed. Since recently and as a result of this study the standard air wedge of Bruker beam splitters is 0.8° instead of 0.5°. Beam splitters with an air wedge of 2 degrees are available on request if there is

a joint order of a sufficient number of pieces. Up to now this item (beam splitter with 2° air gap) is not included in the price list and is available on request only. A modification service is also available. We agree this option is hard to know for users outside the NDACC community or for newcomers. Therefore, a sentence on availability has been added.