

Atmos. Meas. Tech. Discuss., referee comment RC1
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Comment on amt-2021-133

Anonymous Referee #3

Referee comment on "Mobile and high spectral resolution Fabry Pérot interferometer spectrographs for atmospheric remote sensing" by Jonas Kuhn et al., Atmos. Meas. Tech. Discuss., <https://doi.org/10.5194/amt-2021-133-RC1>, 2021

Review of Kuhn, et al. "Mobile and high spectral resolution Fabry Pérot interferometer spectrographs for atmospheric remote sensing"

The authors advocate for the increased use of Fabry Perot Interferometers (FPI) in trace gas remote sensing. Conceptual comparisons are made between FPI and grating spectrometers (GS) that are more widely used for trace gas remote sensing, with some notional quantification of spectral resolution, signal to noise ratio (SNR) and mass/volume. The authors emphasize the mobility of such an instrument. The case is made that though the SNR is 1%-10% that of a GS, the spectral resolving power can be 30 times greater. A prototype FPI is presented with images visually comparing data and calculations.

General Comments:

The authors attempt a thorough presentation of important FPI features related to the optics in order to compare the resolving power of the GS and FPI. However, for a mobile instrument no mention is made of temperature control/stability of the FPI needed for high resolution systems which would presumably have a significant dependence on the stability of the refractive index of the optics.

The authors fail to mention FPIs are commonly used for observing airglow and auroras. Fiber Bragg-grating versions are also used in receivers for in-elastic scattering lidars.

The authors do not mention grating-prism instruments (aka grisms) that should offer improvements in resolving power over GS with a small increase in volume/mass.

The estimation of SNR for the FPI and GS is somewhat through, but the following discussion concerning level of detection is more vague. Do you have a reference for the statement in line 436 "...the sensitivity increase will be almost linear to the increase in spectral resolution..."

Line 440: In this discussion of reducing the temporal resolution of the FPI are you also reducing the temporal resolution of the "moderate (spectral) resolution DOAS measurement?" Using this dramatic approach to increase the SNR will only work for

certain investigations that can afford such coarse knowledge. Such a direct means of SNR increase does not seem applicable to air-borne based instruments.

There is no dispute that FPIs could be used more widely for trace gas detection. The practical question to answer is whether or not they can achieve the suggested detection capabilities in practice for the mobile scenarios. The prototype instrument is interesting and demonstrated quantitative performance characteristics should be included, in addition to the visual side-by-side comparison of measurements and model results shown in Fig. 5.

Minor Comments:

Line 99 is missing a comma before *water*.

Line 416 should delete "by" to then read "...throughput is about..."