

## ***Interactive comment on “Level 0 to 1 processing of the imaging Fourier transform spectrometer GLORIA: generation of radiometrically and spectrally calibrated spectra” by A. Kleinert et al.***

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We would like to thank the referee for the valuable comments. We fully agree with most of the comments and have only some further comments/explanations. Relevant referee comments are inserted *in italics*.

### **Specific comments**

*Topics not covered in the paper are:*

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*\* the relationship between the 2- and 3-D position of the observed scene and the spatial coordinates assigned to the Level 1 data*

The line of sight calibration and the geolocation assignments to the measurements is an elaborate task which is out of scope for this paper. A separate publication on the pointing system of GLORIA including the line of sight calibration is in preparation.

*\* a systematic approach to cross-terms of the projections affecting data quality, such as the drift of radiometric gain and offset (which is covered in section 7.1; likely due to mixing of the real world dimension "instrument temperature" into one or several of the instrument output dimensions), scattered light and alignment of the detector (mixing of radiometric signal over spatial dimensions), residual image on the detector (mixing of radiometric signal over the time dimension), etc.*

A lot of further characterisation work is required to address this topic systematically. The characterisation work is still ongoing and further publications are planned when this work is finished.

*As the paper is now, only a brief and mostly qualitative introduction is given of the coupling between the scientific requirements (Level 2 and higher) and the required accuracy of the Level 1 data. It would be very interesting to see the flow-down of the scientific requirements through the Level 2 algorithms to the Level 1 data quality. This is - of course - an extensive exercise and well beyond the scope of the paper. However, without quantitative goals for the Level 1 accuracy, it is difficult to assess the quality of the Level 0 to 1 processing.*

We agree that it would be nice to have a flow-down of the scientific requirements through the Level 2 algorithms to the Level 1 data quality, but as you say this is well beyond the scope of this paper and such a flow-down always holds the problem that this task is highly non-linear and multi-dimensional. Therefore such a flow-down is usually full of assumptions with high uncertainties. For example, the impact of the

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gain error on the level 2 product not only depends on the error amplitude but it also strongly depends on the correlation of this error in the spectral and spatial domain. Furthermore the impact of an error in the level 1 data on the level 2 product also depends on the retrieval setup and it is almost impossible to include all possible error correlations, combinations of different errors and possible retrieval settings in such a study. Therefore our requirements for the level 1 accuracy are mostly based on our experiences with the MIPAS and CRISTA instruments and on studies performed for a satellite borne imaging FTS.

*The non-linearity correction (section 3.2) covers only the case of constant brightness of the light source with variable integration time. During normal operation of the instrument, a variable brightness input signal will be recorded. We recently characterised an infra-red detector where we initially made the assumption that the of non-linearity as function of integration time or input brightness would be identical. However, the check of this assumption failed and a specific input brightness and integration time dependent non-linearity correction was called for. Depending on the radiometric requirement on the Level 1 spectrum, you may want to check whether the implicit assumption on non-linearity for GLORIA is justified.*

In our case the the implicit assumption on non-linearity, that a variable integration time has the same effect as a variable brightness input signal, is justified for the majority of the pixels. The non-linearity correction, which is determined from lab measurements with variable integration time, is applied to interferograms where the integration time is constant and the signal is variable (especially in the ZOPD region). The quality of this non-linearity correction is checked by the size of the non-linearity artefacts in the out-of-band region. As can be seen from the right plot in Fig. 2, these artefacts are reduced to noise level for most of the pixels, showing that the characterisation curve deduced from measurements with variable integration time is applicable. We will make this point more clear in the text. Pixels where the non-linearity correction does not work have currently to be discarded from further processing. Further characterisation work

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is in progress in order to cope with these pixels.

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