

We thank the referee for the constructive comments, which were included in the revised version and improve the quality of this paper. We give detailed replies to those comments that were not incorporated as suggested, or where additional explanation is necessary. The original comments are reproduced in italics.

*General: „Some of the manuscript suffers from reading less like a scientific paper and more like a user-manual. As the authors want to impart their experience into this paper, I appreciate the detailed information presented. However, in several cases there are passages that contain information that is not backed up by data presented in the manuscript. For example: Lines 265-267 discuss the impact of H<sub>2</sub>O and other compounds can have on isotope ratio measurements. While I do not disagree with the authors comment, no data is shown to support this nor is any citation provided.“*

*Lines 536-542 mentions change in instrument linearity with time. Again, I don't disagree with the authors remarks, there is simply no data provided in the manuscript to support the statements or references given.*

Answer: We are aware of the fact that a balance has to be achieved in the level of detailed information that is given in a paper. We think that a method paper in AMT can contain more details than a purely scientific paper. And the referee is right that in some cases we want to share our experience on issues that have not appeared in the literature before. However, we realize that in some cases this is not backed up in a suitable way and we have therefore modified some parts accordingly. We note that referee 1 actually asks for even many more details and explanations, so we also have to find a balance in incorporating the referee comments.

*Lines 309-321 are excessive in terms of description of heating and cooling rates while providing very little actual information on the procedure.*

Answer: We do not think a more detailed description helpful. When using a different control unit the concrete realisation will be quite different. The key point is mentioned „If the compensating counter heating lies above a threshold value then the cooling percentage is decreased (and vice versa)”

This strategy reflects the faster reponse time for the heating control.

*Section 3: The reprocessing of hydrogen (D/H) isodat data is well presented in both rationale and procedure. However, it is unclear to this reviewer why the carbon isotopic composition does not suffer from the same problems. Why would applying such a correction would not also improve the <sup>12</sup>C/<sup>13</sup>C ratio measurements? If it did not, why not?*

Answer: The issue with dependency on the precise level of the background is much less severe for <sup>13</sup>C than for D. This has likely to do with the far lower abundance of D, and the correspondingly lower ion signals. Therefore, the standard ISODAT software can be used and produces good results.

*Section 2.9 and Section 4. In a typical run sequence the value of a sample is determined from the difference between it and the reference gas (SiL). As I read the manuscript, this means that  $dD(SiL)_{meas.}$  varies somewhat from sequence to sequence. What is the variability of this value ( $dD(SiL)_{meas.}$ ) - is it close to the precision of measurement in which case it may be correcting noise; or is it well outside this limit and cannot be controlled with instrument parameters? Also is the uncertainty in SiL propagated to the measurement precision of a sample?*

Answer: The variability in the raw data for the SiL standard is precisely the reason why frequent measurements of the standard are necessary. Relative measurements carried out according to the “Identical Treatment” (IT) principle {Werner, 2001 #1438} can yield much more precise results, because variations in instrument sensitivity and other parameters cancel in the direct comparison. And these variations are outside the noise. The uncertainty of in SiL is not propagated into the sample uncertainty, which is required, however, when comparing results to measurements from other laboratories that may not be measuring on the same scale.

## Minor points

*Section 3. I believe Fig. 5 is not referred to in the discussion*

Answer: It is referred to in line 362 or page 2449, line 6.

*Line 361: „What would constitute a perfect choice of background?“*

Answer: We refer to a background value that does not introduce systematic deviations and / or allow the algorithm to calculate the correct (but unknown) isotope ratio. 'Perfect' did not refer to removing unavoidable measurement uncertainties.

*Lines 376-378: „... . Please clarify what is being optimized here. Is the constant background value from 1) adjusted by an arbitrary constant until linearity is minimized?“*

Answer: Correct. The parameter adjusting the detected background level is altered to minimize the observed non-linearity. - Paragraph has been rewritten.

*Section 3.1.2 How is reproducibility defined here? Is the difference between a measurement and a known value? 1 sigma?*

Answer: The It is the 1 sigma standard deviation of repeated measurements of a sample and evaluation with the different algorithms. It does not include comparison to a known value. So a system may be reproducible but wrong.

*Section 4.2.1 Is there any known or suspected reason that the CH<sub>4</sub>-He mixtures yield a different value from CH<sub>4</sub>-air? (compare referee 1, Page 2453, line 26)*

Answer: The We do now know this, maybe it is related to the preparation procedure of these mixtures.

*Section 4.3 A table providing the calibration of the suite of isotope standards (DCX) measured at the 3 institutions would be useful here for clarity. Also useful in the table would be the number of measurements the assigned value is based on.*

Answer: The table would have two lines and two columns only, since it only refers to the two measurements included in the paper from Bräunlich et al. (2001)

*Figure 4. Is of quite poor quality in the version I have. The top two figures look like screenshots from Isodat which do not reproduce well for a journal. Authors might consider exporting the raw data and representing the chromatogram using different software. The bottom figure (...) has symbols related to mass 2 and 3 traces, but no colour traces (both are black and white). Finally, what are the two poorly shaped peaks that elute after CH<sub>4</sub> on the bottom figure?*

Answer: The figure will be improved in the revised version.

The other minor comments have been taken into account as suggested by the referee.