

## Comment on amt-2021-330

Anonymous Referee #2

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Referee comment on "A versatile vacuum ultraviolet ion source for reduced pressure bipolar chemical ionization mass spectrometry" by Martin Breitenlechner et al., Atmos. Meas. Tech. Discuss., <https://doi.org/10.5194/amt-2021-330-RC2>, 2021

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Using a VUV source to produce ions at low pressure for chemical ionization atmospheric analysis is a significant innovation that will prove useful to the field measurement community. This manuscript detailing these methods is well-written and organized. I recommend it be published after the authors address the following minor items. Broadly speaking, the manuscript should include additional detail on the techniques presented.

Throughout the manuscript: counts per second in a TOF are useless numbers without providing an extraction frequency. CPS are useful to contrast with quadrupole instruments and other analyzers, but the extraction frequency at which they are acquired in a TOF must be stated clearly in the text AND in major figures such as Table 2. If the cps/ppt values have been scaled to a shorter extraction frequency, this especially needs to be clarified.

Table 2: A 10 s limit of detection is not particularly useful for an aircraft instrument. What is the LOD at 1 s? This should be listed in the table, as well.

L178: The Vocus PTR source typically operates at a range of 1 to 5 mbar. What modifications were necessary to reach an operating pressure of 9 mbar? Did the authors replace the capillary or skimmers? These details should be added to the manuscript.

Discrepancy between Figure 2 calculations and Table 1 reported values: It's impossible for the reader not to compare the numbers in Table 1 and Figure 2. I understand that instrumental factors will account for the different I/IH<sub>2</sub>O- ratio, but I think that the authors should make the minimal effort to explain this by stating the operational parameters for the BSQ amplitude and frequency, and the magnification interface (if used), and add a transmission curve. This is something that they've likely done already or will need to do for a field deployment. Then the numbers from Table 1 should be added to

Figure 2b as a scalar for comparison.

The reduction in quantitative humidity dependence is impressive, but it's not immediately clear to me why Br<sub>2</sub> sensitivity was shown to go up with increasing RH while in this work it weakly goes down. Could the authors comment on why this might be the case?

L305: It is unclear to me the details of the propene dopant addition. How was the propene added? How much was added? This is a methods paper, so these details are critical and must be included

L315 For clarity, there should be an additional equation before Eq. 10 showing the first step in the reaction which ionizes propane