



## ***Interactive comment on “Performance of a corona ion source for measurement of sulfuric acid by chemical ionization mass spectrometry” by A. Kürten et al.***

### **Anonymous Referee #2**

Received and published: 18 January 2011

Overall this manuscript presents a nice experimental work highlighting an alternative ion generation methodology suitable for certain chemical ionization mass spectrometry (CIMS) methods and applying such technology for the measurement of  $\text{H}_2\text{SO}_4$ . Alternative ion generation sources such as that described here will likely find much greater use in the future as cost and control of radioactive materials used in traditional ion sources continues to increase, along with difficulty in transporting and deploying these radioactive sources in field experiments. This manuscript is suitable for publication in AMT, and I recommend its publication after due consideration of the following comments:

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#### General comments:

1. While only indirectly relevant to the main point of the manuscript, some discussion of the absolute calibration of the  $\text{H}_2\text{SO}_4$  calibration source is needed. I.e. how do you know what the humidity dependence of the calibration is without the absolute calibration of the output as a function of  $\text{H}_2\text{O}$ .
2. A comparison of the S/N for identical  $[\text{H}_2\text{SO}_4]$  and integration periods, as well as the nominal  $\text{H}_2\text{SO}_4$  background levels between the two sources should be included. What was the primary ion count rate for the americium source? What is the duty cycle and integration time for the scanning of the ion masses by the quadrupole. What is the timescale and level of the ‘higher noise’ from the corona source (i.e. does normalization by the primary ion cancel this effect or does it impact the precision of the final measurement as compared with the americium source).
3. Has it been verified that  $[\text{H}_2\text{O}]$  mixing ratio in the discharge does not impact the  $\text{H}_2\text{SO}_4$  determinations, in terms of background stability, and  $\text{SO}_2$  interference?
4. In general the text and grammar can be improved to read more smoothly. I’ll identify some, but not all, of the instances below.

#### Specific comments: Working from print version.

Pg 5296 ln 6: don’t capitalize americium here.

Pg 5296 ln 8: Perhaps use ‘molecules  $\text{cm}^{-3}$ ’ instead of ‘molecules per  $\text{cm}^3$ ’. Also, throughout manuscript.

Pg 5297 ln 17-19:  $\text{HNO}_3$  is referenced in two separate sentences can these be combined?

Pg 5298 ln 2: ‘stable’ perhaps ‘stably’?

Pg 5298 ln 20: ‘old set-up’ perhaps better as ‘original design’?

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Pg 5299 In 4: 'that', reword.

Pg 5299 In 24: Dimensions are mentioned here in the text, but are not shown in Figures 1 or 2 for reference. It would be nice if dimensions or at a minimum a scale bar were added to Figures 1 and 2.

Pg 5300 In 1-2: This is not clear. The needle has been moved backwards relative to what?

Pg 5300 In 13: 'easily'

Pg 5301 P1: It would be good to describe where the discharge occurs? Is it between the needle and the outer cylinder? Is the actual discharge path well-determined, meaning does the arc migrating from the needle to various points locations on the edge of the hole surrounding the needle? If so, would any increase in stability be gained if the exact arc path was determined by destroying the symmetry of the needle with respect to the closest approach of the outer cylinder?

Pg 5301 In 9: perhaps replace 'which is set to a fixed' with 'at a static'

Pg 5302 In 17-20: Related to major point 1. It has not been demonstrated here that the output of the calibration source is linear with  $[H_2O]$  in the calibration source. Without this, I find this sentence lacking support.

Pg 5305 In 10: perhaps change to 'Summary and outlook'

Pg 5306 In 9: 'Stickler' should be 'Stickel'?

Figure 1 and 2: Add dimensions, as mentioned above. Perhaps highlight the region in Figure 1, which is replaced by the apparatus shown in Figure 2.

Figure 3: If this data is shown on a log-log scale would more information be visible? Is the reason for the seeming falloff in sensitivity ratio between the sources at low  $H_2SO_4$  (low  $[H_2O]$ ) understood? Further discussion regarding this is warranted, as the  $H_2SO_4$  calibration levels are substantially above relevant ambient levels.

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Figure 4: 1-minute average curves do not appear 'by eye' to go through the center of 5s data for the m/z 97 and  $[H_2SO_4]$  traces. I suppose this is an artifact of the log scale not showing zero points. This should probably be mentioned in the caption unless there is a better way to display this.

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Interactive comment on *Atmos. Meas. Tech. Discuss.*, 3, 5295, 2010.

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