Atmos. Meas. Tech. Discuss.,
doi:10.5194/amt-2018-243-AC3, 2019

Atmospheric Measurement Techniques Discussions

Interactive comment on "B3010: A Boosted TSI 3010 CPC for Airborne Studies" *by* David Picard et al.

David Picard et al.

d.picard@opgc.univ-bpclermont.fr

Received and published: 20 March 2019

article

General comments

We, the authors, would like to thank Anonymous Reviewer # 4 for his/her interest in our work, and for making interesting suggestions.

Specific comments

Reviewer : "I am skeptical of the claims 'Widely available on the second-hand market' ; from where ?"

Printer-friendly version

Discussion paper

Some companies specialize in used instrument retail, *e.g.* in the USA. Instruments of the TSI 3010 family are still available today.

Reviewer : "it would have been extremely useful to have compared this instrument directly across all main measurement metrics, with TSI's 3756, which measures down to 2.5nm. Figure 9 would have been very interesting with such a comparison."

The counting efficiency of the TSI 3776 is plotted in Fig. 9. Its cut-off diameter is 2.5 nm as well.

Reviewer : "Figure 10b shows a systematic error to my eye; the B3010 is always undercounting, not just above 1E4/cc. I would like to see this plot on a log-log axis, and again - does the B3010 agree with a 3025 for say PSL at 300nm? There we should be getting 1:1 agreement to within 5% at least. Commercial CPCs can agree to within 1-2%, and though it's useful to push the detection limit as low as possible, if the detection efficiency at larger diameters is not 100% then there's limited use for a modified CPC"

We would like to draw the attention of reviewer #4 to the reply to RC1 : Fig. 10 will be updated with a new data set. The new time series figure shows that the total counting efficiency of the B3010, at concentrations lower than $10,000\ \#/cm^3$, is much higher than that of the TSI 3025, whose cut-off diameter is 3 nm. This, and Fig. 9, show that the efficiency does rise up to 1, with increasing particle diameters.

Reviewer : "I think you should comment, or take measurements of, the rise-time."

Our B3010 took part in Enroth et al. 2017, where it was found that the B3010 has a response time similar to that of the TSI 3010, *i.e.* about 2.3 s. This is not surprising, since both models share the same geometry.

Reviewer : "Figure 4 shows that the CPC never detects all particles, but. . . surely it must do at large enough diameters? I would like to see figure 4 expanded to 500nm for example."

As said in the paper (p9, lines 1-4), the molecular standards bear a lot of multiple charges that increase the current in the electrometer, hence the low plateau.

As detailed in reply to RC1, the Herrmann-type DMA has a very high resolution of about 0.1 nm at smaller particle diameters. This performance is obtained by a very high sheath flow rate of about 1000 l/min. At such a high sheath flow rate, the voltage required to select particles bigger than 5-6 nm produces electric arcs in the DMA, and thus sets the upper limit. Besides, the principle of linking the DMA voltage and actual particle size prevents to change the sheath flow rate during the experiment.

As a consequence, it is absolutely impossible to extend this plot up to 500 nm.

Reviewer : "I think the conclusions need expansion and are generally lacking."

We will rework the conclusion in the final version.

Our message is that designers can imagine non-sheathed, yet performing CPC geometries. Our work could also help users select a model to purchase, and get the most out of their non-sheathed CPC with a simple tweak.