Atmos. Meas. Tech. Discuss., 6, C2992–C2994, 2013
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Atmospheric Measurement Techniques Discussions
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6, C2992–C2994, 2013

Interactive Comment

Interactive comment on "Characterization of an aerodynamic lens for transmitting particles > 1 micrometer in diameter into the Aerodyne aerosol mass spectrometer" *by* L. R. Williams et al.

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Received and published: 21 October 2013

Atmos. Meas. Tech. Discuss., 6, C1952–C1953, 2013 Response to Anonymous Referee #3:

We thank Referee #3 for their careful reading of the manuscript and especially for pointing out places that were confusing.

General Comment: With the higher pressure in the lens, how does that affect the flow regime, and the subsequent effective diameter classification. For a 100nm particle, the Knudsen number is still in the "free-molecular" regime, however, at 1 micron, the

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particles start to be in the transition regime between free-molecular and continuum flow. Does this change introduce errors or other assumptions into size calibration functions, and diameter comparisons with other instruments?

The vacuum aerodynamic diameter is measured in the high vacuum chamber using the time of flight between the chopper and the detector. The higher pressure in the lens imposes higher velocities on the particles, but does not change our ability to calibrate the vacuum aerodynamic diameter.

Specific Comments: (Smaller comments on grammar or easily fixable content) 5035-3: In this context does diameter refer to the aerodynamic diameter or the physical diameter of the particles?

We have inserted the words "vacuum aerodynamic" to clarify the meaning of diameter.

5035-18: References for aerodynamic lens should be introduced here (they are referenced on the next page).

We have added the references for the aerodynamic lens.

5036-10: "too well" is awkward. Suggest rewording or eliminating.

We deleted the words "too well."

5043-10: Could the authors clarify this. If the particles were size selected with a DMA, then presumably they were already charged prior to introduction into the SMPS. Were the particles "re-neutralized" prior to passing through the SMPS? This is not clear.

We have reworded this sentence as: "For particles with dmob < 250 nm, the size distribution was measured with a scanning mobility particle sizer (SMPS, TSI Model 3936)."

5045-5: I suggest replacing "and" with "therefore particle: : :"

We replaced "and" with "therefore particle"

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5045-9/15: This section on beam spreading is confusing to the reader. "Es" should be introduced earlier in this part. Additionally, the "similar lens in Liu et al." phrase could be reworded to more explicitly state that a "standard" lens showed a 10% effect at particle sizes around 40 nm.

We have reorganized this paragraph to make it less confusing. “Using the mass comparison method to measure EL assumes that the bounce (EB) and particle beam spreading (ES) contributions to AMS collection efficiency are negligible. For the sizes of NH4NO3 particles used here, dva = 50 to 300 nm, EB = 1 and therefore particle bounce does not decrease the collection efficiency. Aerodynamic lenses focus larger particles more tightly than smaller particles. For very small particles, i.e., with dva < 70 nm, the particle beam diameter can be larger than the vaporizer diameter, causing a decrease in collection efficiency (ES < 1). We have not applied a correction for ES to the data presented here because the CE for particles smaller than 70 nm is already small (< 0.2) and the correction is probably less than 20% and not well-quantified. The CFD model results indicated that particle beam spreading decreases CE for particle sizes smaller than 60 or 70 nm by 10 to 20%. In addition, experimental results for 40 nm particles with a similar standard lens in Liu et al. (1995b) suggest a 10% decrease in CE for the AMS detector geometry (Huffman et al., 2005).”

Interactive comment on Atmos. Meas. Tech. Discuss., 6, 5033, 2013.

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