Review of "A high transmission axial ion mobility classifier for mass-mobility measurements of atmospheric ions" by Leiminger et al. (amt-2022-29)

General comments:

This paper describes an electrical mobility classifier for mass-mobility measurements of atmospheric ions. The authors developed an axial ion mobility classifier (AMC) coupled with sheath flows and achieved high transmission efficiencies to segregate natural ions at comparable sizing resolution to previous devices. The mass-mobility measurement of atmospheric ions was demonstrated by AMC-ioniAPi-TOF. By combining mass spectrometry with mobility classifier technique, fragment ions from cluster ions could be distinguished. I think that this work was well-conducted and that the paper is generally well-written. I recommend this paper to be published in Atmospheric Measurement Techniques after the authors' consideration of my minor comments detailed below.

Specific comments:

(1) Page 1, Line 22 and Page 11, Line 379: In Abstract and Conclusions, the authors used "sub 3 nm", but in the text it is just written that cluster ions of 1 to 4 nm were formed (Page 4, Line 137). Did the authors explain that the improvement of the size resolution was achieved only in the sub 3 nm range in the text? The size of THAB monomer is written to be 1.48 nm (Page 8, Line 287). I think that it is better to show the size of THAB dimer, THAB trimer, THAB pentamer, and TPPAI monomer if possible.

(2) Page 5, Lines 152−153: It is written that the blower was set to voltages from 0 to 5 V in 1 V step. This might mean that there are 6 different conditions. But in the previous sentence, it is written that the calibration was carried out in 5 different blower settings. Are these two sentences consistent each other?

(3) Page 6, Line 187: What is CFD the abbreviation of?

(4) Page 6, Lines 210−211: I couldn't understand the sentence "At a medium sheath flow setting of 55 L/min the impact of aerosol flow rate becomes clear comparing the flow profiles for aerosol flows of 5 and 10 L/min". What became clear?

What is the value of Qsh at the medium sheath flow setting of 55 L/min? I supposed that it was 30 L/min of Qsh because the profile shown in the lower panel of Figure 4 was obtained with 10 L/min sample and 55 L/min sheath flow. But I might be wrong from the caption of Figure 6. If the value of Qsh at the medium sheath flow setting of 55 L/min is 10 L/min, is the lower panel of Figure 4 consist with the results of the upper panel of Figure 4? I was confused.

(5) Page 7, Line 242: I cannot judge if it has a higher resolution at higher sheath flows or not. Did the authors calculate the resolution according to eqn. (3)? Or is the resolution derived from eqn. (3) determined mainly from $z_{1/2}$?

(6) Page 7, Lines 250−251: I felt that the phrase "the previous discussion" here is ambiguous.

(7) Page 8, Line 267: Define "U". Probably it is the same as "AMC voltage" in Figs. 5 and 6.

(8) Page 8, Line 286: In Figs. 5 and 6, the values of the y-axis at AMC voltage ≈ 0 are almost 1 because they are "relative" values. If the authors plot these figures with the absolute transmission efficiency in the y-axis, are values at zero AMC voltage close to 0.7? If so, this information should be better to be mentioned when the authors explain Figure 5.

(9) Page 8, Line 290: I couldn't understand how the authors derived the value of "48.6 %". In which figure does it show?

(10) Page 8, Line 293: In the text (also in Line 273), the ratio Q_{total}/Q_{ac} is mentioned. However, the x-axis of Figure 7 is Q_{sh}/Q_{ac}. Is it ok?

(11) Page 10, Line 341: The results shown in this section are very interesting and valuable. I would like to know the background level of this system.

Technical comments:

(1) Page 1, Line 21: I could not find "Surawaski et al., 2017" in References.

(2) Page 4, Line 129: I could not find "Fu et al., 2019" in References.

(3) Page 5, Line 155: I could not find "Leiminger et al., 2019" in References.

(4) Page 7, Line 257: Fig. 5 → Fig. 6

(5) Page 8, Line 281: Surawaski et al. → Surawski et al., 2017. Is it correct?

(6) Page 9, Line 310: I could not find "Tammet, 2015" in References.

(7) Page 10, Line 342: It is better to mention Fig. 3B here.

(8) Page 10, Lines 362 and 368: "+" should be a superscript.

(9) Page 19, Line 549: "Hideki Kambara" → "Kambara H." and move it to the correct position.

(10) Page S-2 of the Supplementary material, Line 17: I think that the explanation "the sheath flow is set to zero in the first row, and increases from the second to the last row" is wrong. The results of different ions are shown in the different rows.

(11) Page S-2 of the Supplementary material, Line 24: A Germany sentence is inserted.

(12) Page S-3 of the Supplementary material, Line 36: Show Brilke et al. (2019) in Reference of the Supplementary material.