



Supplement of

A high-transmission axial ion mobility classifier for mass–mobility measurements of atmospheric ions

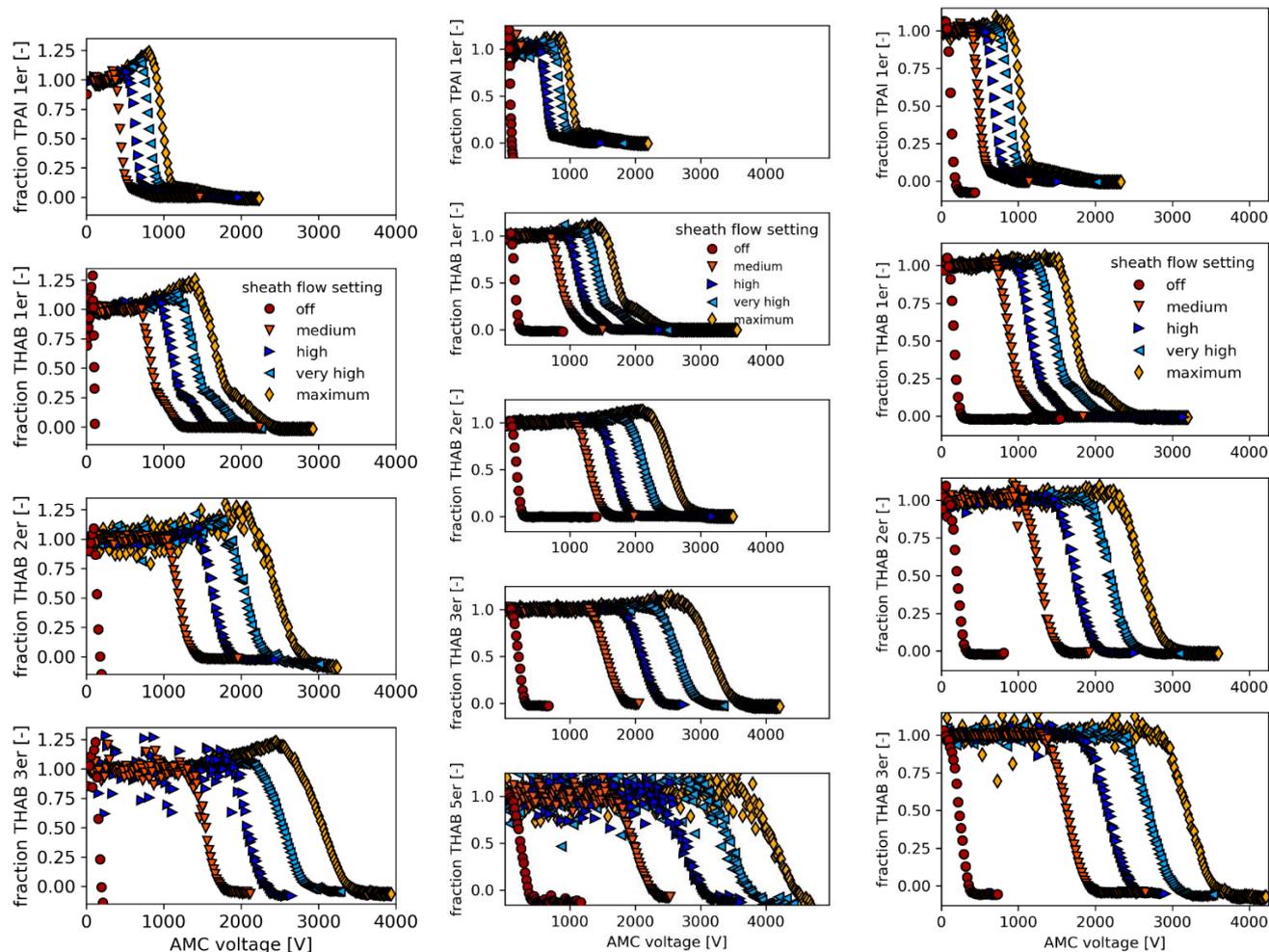
Markus Leiminger et al.

Correspondence to: Gerhard Steiner (gerhard.steiner@grimm.durag.com) and Armin Hansel (armin.hansel@uibk.ac.at)

The copyright of individual parts of the supplement might differ from the article licence.

14 **1 Collection of AMC characterization experiments**

15

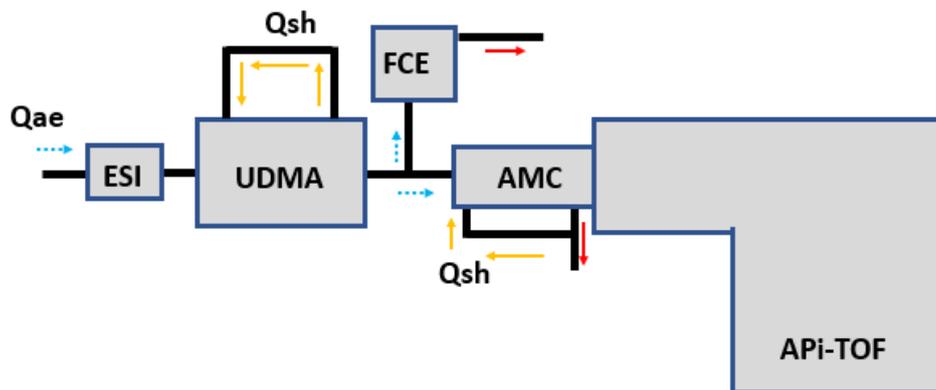


16

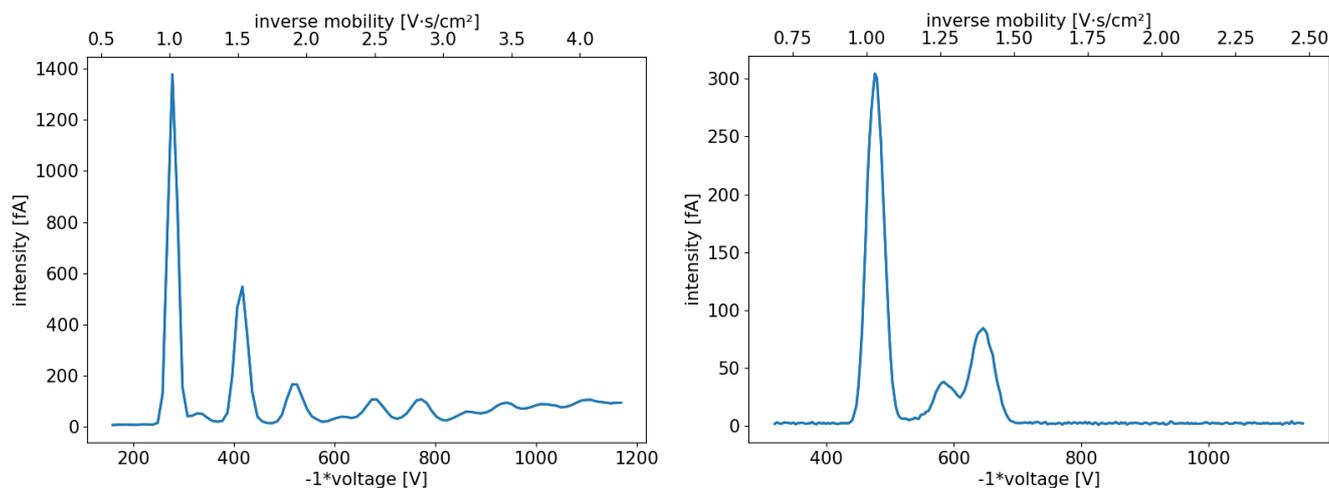
17 Figure S1. Additional data of all other experiments about the characterization of the AMC. In the left column, the data is acquired for a
 18 sample flow setting of 5 L/min, whereas the sample flow rate is about 9.6 L/min in the middle and 12.4 L/min on the right. For each ion, the
 19 AMC voltage is scanned for different sheath flow settings (off: 0 L/min, medium: 50 L/min, high: 70 L/min, very high: 85 L/min, maximum:
 20 105 L/min). The figure shows pre-processed data prior electrometer offset correction.

21 2 Tandem experiments investigating the slope of monomer ions

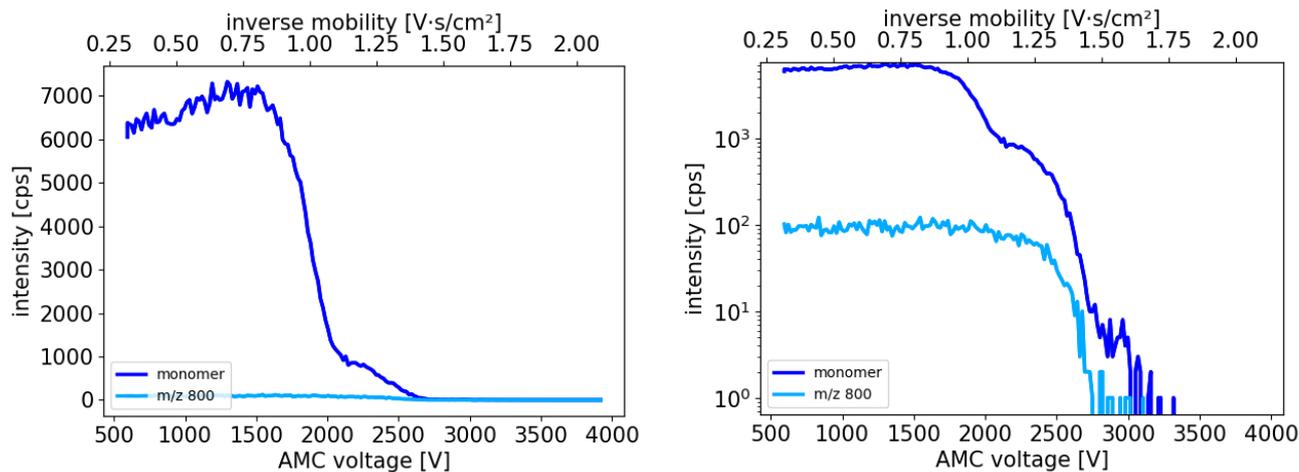
22 We conducted experiments of a tandem UDMA-AMC-ioniAPi-TOF setup, Fig. S2. These revealed a second peak at an inverse
23 mobility of roughly 1.25 Vs/cm^2 and in this case also a third peak at 1.4 Vs/cm^2 as shown in Fig. S3. Results from a tandem
24 experiment of UDMA-AMC-ioniAPi-TOF 1000 presented in Fig. S4 reproduced the slope of the impurity at an inverse
25 mobility of 1.25 Vs/cm^2 . In linear scale, the slope in the carried-out AMC scan of THAB monomer resembles the slopes in
26 Figure 6 and Figure S4. In the mass spectrum, we found a peak at m/z 800 that most likely is a cluster consisting of the THAB
27 monomer and an impurity from the setup. This becomes evident in the AMC mobility spectrum on the right in Fig. S4. So far,
28 we did not find any meaningful composition of this cluster. We guess that it might be coming from our setup, either a siloxane
29 or a compound of our electrospray setup.



30
31 Figure S2. Setup of the tandem UDMA-AMC-ioniAPi-TOF experiments. The sample aerosol flow Q_{ae} is colored in blue, the sheath flow
32 Q_{sh} in yellow and the exhaust flow in red.
33



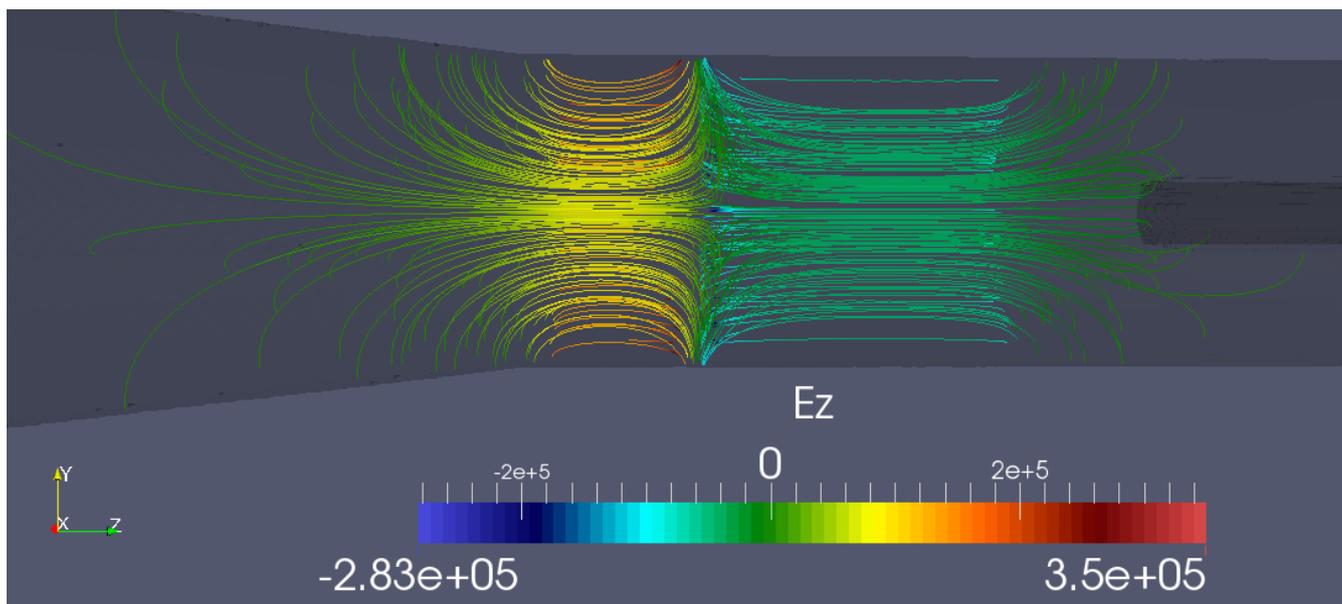
34
35 Figure S3. Results from the tandem UDMA-1 UDMA-4 experiments: mobility spectrum from first stage UDMA-1 on the left, and mobility
36 spectrum from second stage UDMA-4 for THAB monomer on the right. Even though only the THAB monomer peak is classified with
37 UDMA-1, accompanying peaks in the mobility spectrum after the second UDMA, UDMA-4, are detected in the FCE. Experimental setup
38 is introduced in Brilke et al. (2020).



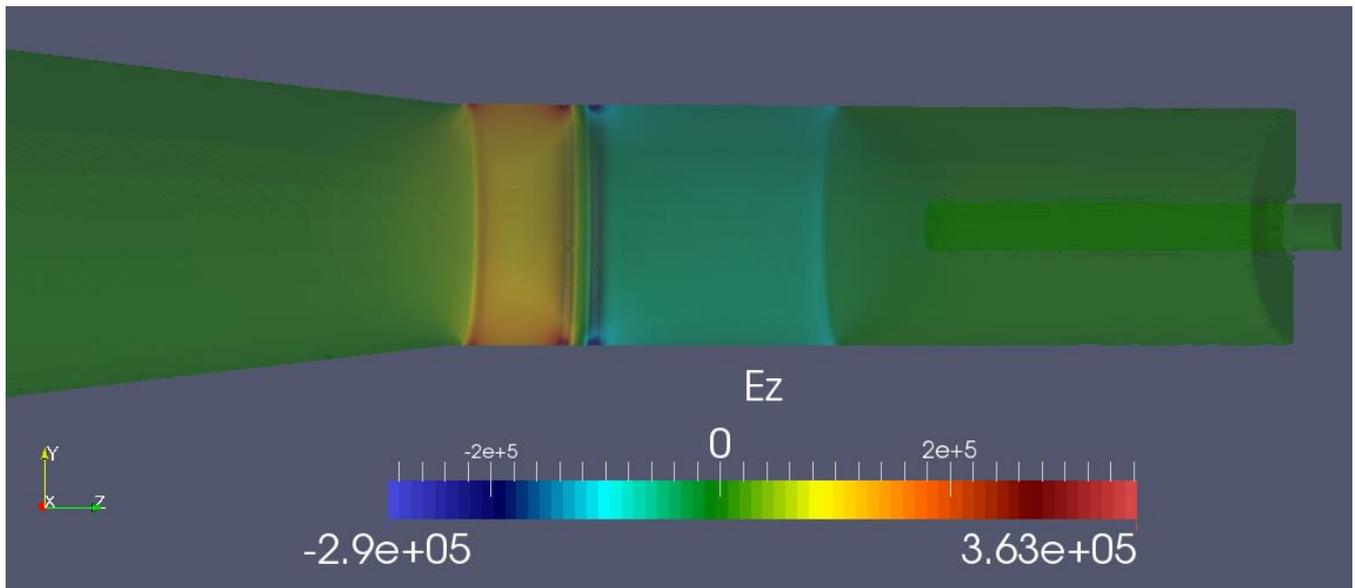
39
 40 Figure S4. Results from the tandem UDMA-AMC-ioniAPi-TOF experiments in linear scale on the left, and in log scale on the right. Mobility
 41 scan of the AMC with the THAB monomer being classified by UDMA-4. Impurity peak at m/z 800 seems to contribute to the second slope
 42 of the THAB monomer mobility peak. During ion transfer in the APi-TOF, m/z 800 seems to dissociate to a major fraction into the THAB
 43 monomer.
 44

45 3 Exemplary computational fluid dynamic (CFD) results

46

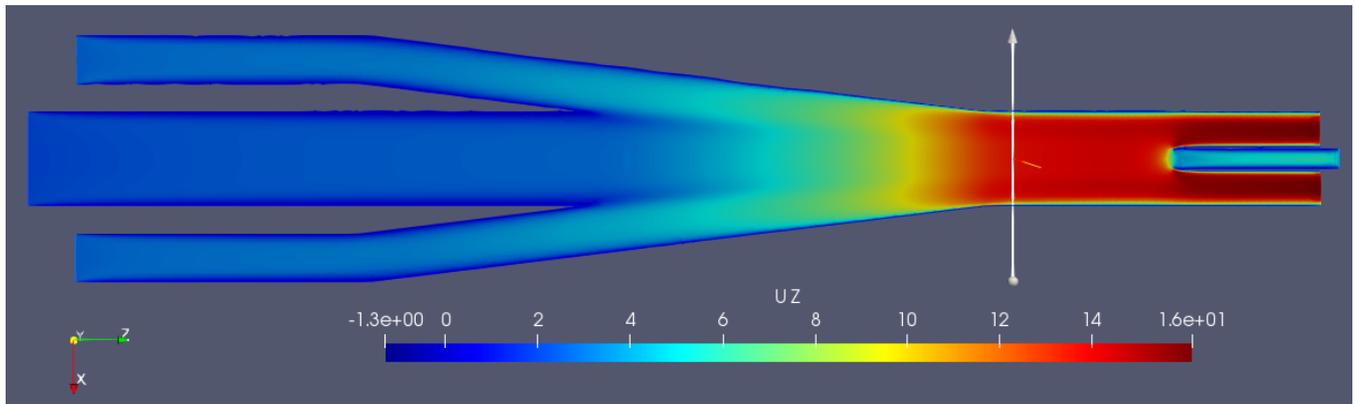


47
 48 Figure S5. 3D view of the electric field lines in the AMC inlet for exemplary 800 V. The magnitude of the electric field is given in units of
 49 V/cm. In the center of the tube, where the size segregation is supposed to happen, the lines are parallelly aligned for a preferably homogenous
 50 electric field. The core sampling inlet is shown on the right. In the laboratory experiments the distance from AMC electrode to the core
 51 sampling is much larger than shown here.



52
53 Figure S6. 2D view of the electric field magnitude in the AMC inlet for exemplary 800 V.

54



55
56 Figure S7. Side view of the flow field simulation in the AMC inlet. Velocity in z-direction U_z is given in units of m/s. Inlets are on the left
57 and outlets on the right. The sample flow enters in the central tube and is mixed with the sheath flow as a coaxial jet flow in the tapered
58 region. The arrow marks the position of interest for the size segregation. The coaxial outlets are on the right. Sample air of 1 L/min is drawn
59 into the core sampling whereas the rest of sample and sheath flow leave through the outer tube.

60 References

- 61 Brilke, S., Resch, J., Leiminger, M., Steiner, G., Tauber, C., Wlasits, P. J., and Winkler, P. M.: Precision
62 characterization of three ultrafine condensation particle counters using singly charged salt clusters in the 1–4 nm
63 size range generated by a bipolar electrospray source, *Aerosol Sci. Technol.*, 54, 396–409,
64 <https://doi.org/10.1080/02786826.2019.1708260>, 2020.