

Interactive comment on “A high-resolution mass spectrometer to measure atmospheric ion composition” by H. Junninen et al.

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Background noise and detection limit The APi-TOF has a very low background noise level, which makes it possible to accumulate signal over rather long time periods. Main source of the noise is the counting statistics, but there is a small background noise from lost ions or electrons as well. The instrumental background noise is depicted in figure X1a, where 60 min average of 15 sec spectra have been used. The APi-TOF was sampling from ambient air with ion filter (50 cm silicone tube) in front of the inlet. The signal has been converted to ions/cm³ the same manner as the samples are. Noise is $0.5 \cdot 10^{-3}$ cm⁻³ below 100 Th and decreasing to $0.1 \cdot 10^{-3}$ cm⁻³ for charge to mass ratio of approximately 500 Th. The panel B of the Figure X1 shows the detection limit of the mass spectrometer (note, that this does not include transmission of the

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ions) defined as 3 time standard deviation of averaging period. Power law fit has been used to parameterize the relation to mass. Ion transmission (Figure 5) has to be taken into account for whole instrument detection level determination. We used setting 2 for positive ions (Figure 5) to give an example of the detection levels. In table X1 the mass spectrometer detection limits for calibration substances have been divided by the transmissions corresponding transmission values. Detection limit of the APi-TOF is mass dependent and is below 1 ion/cm³ in the range of 80-1000 Th. However, detection limit is also dependent on voltage settings used in instrument. For example setting nr 2 for positive ions will give for $m/Q=75$ detection limit of 4.6 while settings for negative ions give for $m/Q=80$ detection limit of 0.6 ions/cm³.

Tabel X1. Detection limits (DL) of APi-TOF in ions/cm³ with 95% confidence intervals. Settings refer to Figure 5.

Mass/charge DL (ion/cm³) -95% +95% Setting

75 4.6 4 5.2 pos 2

80 0.6 0.6 0.7 neg*

412 0.6 0.5 0.7 pos 2

672 0.5 0.4 0.5 pos 2

900 0.4 0.3 0.5 pos 2

1392 10.7 9.1 12.6 pos 2

* average of two settings

Figure X1. The background noise and mass spectrometer detection limit of the APi-TOF. 60min average of ambient sample with ion filter in front of the inlet. Panel A, the black dots are 60 min averages of integrated signal in 1 Th resolution and panel B, the black dots are 3 times standard deviation of integrated signal, red solid line is power law fit to the data and red dashed lines are 95% confidence interval levels of the fit.

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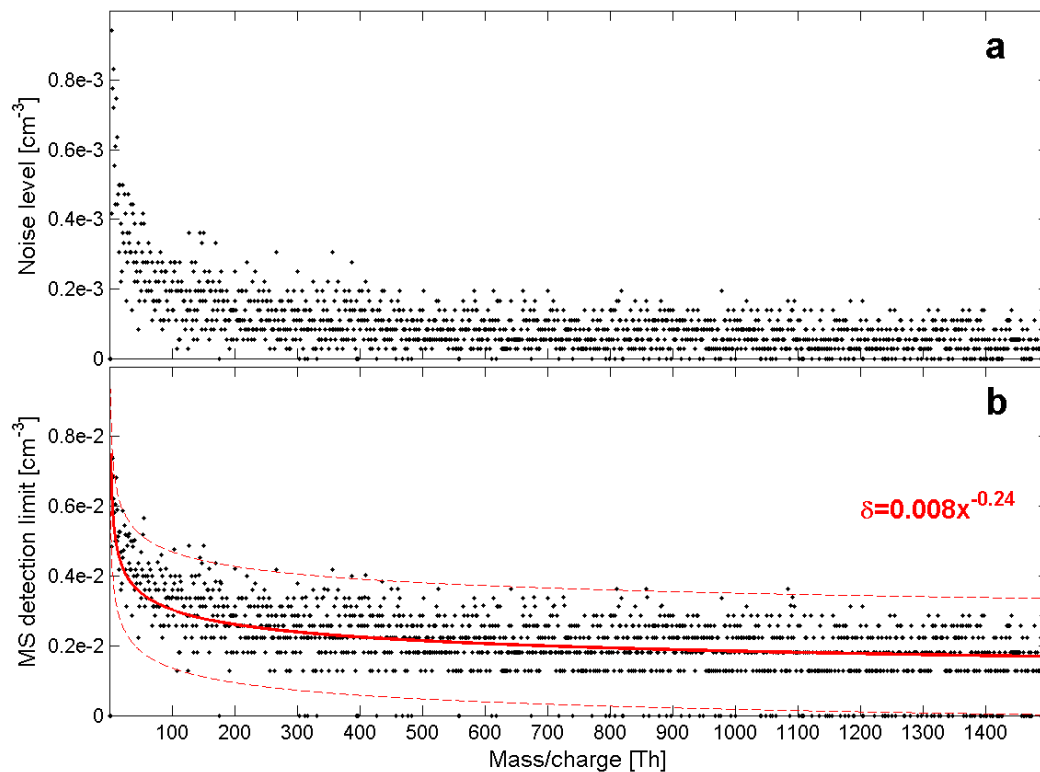


Fig. 1. Figure X1

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