PERFORMANCE CHARACTERIZATION OF A NEWLY DEVELOPED ATMOSPHERIC PRESSURE INTERFACE TIME OF FLIGHT MASS SPECTROMETER (APi-TOF MS)

[†]Fabian Schmidt-Ott[1,2], Dimitris Papanastasiou[3], Alexander Lekkas[3], George Biskos[1,4], Anne Maisser[1]

[1]Climate and Atmosphere Research Centre, The Cyprus Institute, 2121 Nicosia, Cyprus
[2]University of Helsinki, 00014 Helsinki, Finland
[3]Fasmatech, 15341 Athens, Greece
[4]Faculty of Applied Sciences, Delft University of Technology, NL-2629 HZ Delft, The Netherlands
Keywords: cluster ions, mass spectrometry, API-TOF MS, DMA-MS
Contact presenting author[†]: f.schmidt-ott@cyi.ac.cy

The Atmospheric Pressure Interface Time of Flight Mass Spectrometer (APi-TOF MS) has proven itself as a useful tool for the chemical characterization of atmospheric ions and clusters, largely contributing toward a better understanding of new particle formation in the atmospheric environment (Junninen et al., 2010). Here we describe a preliminary characterization of a newly developed APi-TOF MS that, according to the manufacturer (Fasmatech), is capable of providing high mass resolution, high duty cycle and high sensitivity.

The instrument consists of an aerolens - ion funnel configuration installed in the fore vacuum region (> 1mbar), followed by a segmented RF ion guide to thermalize and trap ions at 10^{-2} mbar and a low-pressure RF hexapole ion guide combined with a set of DC lenses to deliver ions into the extraction region of an orthogonal TOF mass analyser (cf. Fig. 1). The design of the instrument allows for versatile measurement and the coupling of a high-flow/high-resolution parallel-plate Differential Mobility Analyzer (DMA) at the inlet capillary (SEADM Mode P5) for two-dimensional ion mobility – mass-to-charge ratio measurements. The DMA-MS setup allows for detailed studies on the physiochemical characterization of clusters and their stability, relevant for fundamental studies on atmospheric nucleation and aerosol-based nanotechnology.

Preliminary measurements have shown a mass resolving power up to 40,000 (full-width-half-maximum). A mass detection range between 30 and 2100 Da has been experimentally confirmed for RFs of 2.36 and 1.43 MHz. The mass accuracy of the instrument is ±3 ppm after external mass calibration. These specifications exceed those reported by commercial aerosol mass spectrometers. Preliminary measurements also showed a maximum transmission of 0.2% for ionic clusters of 410 Da.

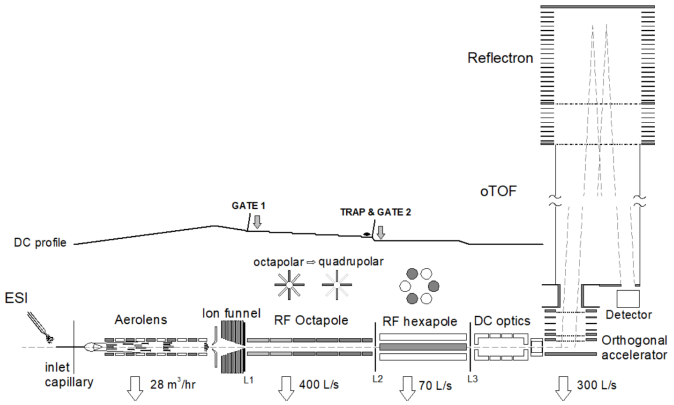

Fig. 1 Schematic layout of the API-TOF MS, including the DC profile along the path of the sampled ions in the instrument.

Junninnen, H., Ehn, M., Petäjä, Luosujärvi, L, Ktiaho, T., Rohner, U., Gonin, M., Fuhrer, K., Kulmala, M., Worsnop, D.R., (2010), Atmos. Meas. Tech., **2**, 1039-1053