A planar DMA coupled to a MS for tandem IMS-MS separation at high transmission, with IMS resolution approaching 100

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Overview

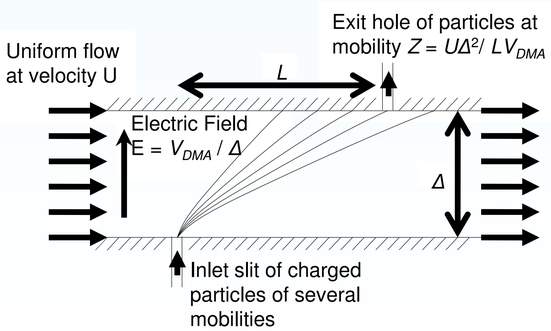
The resolution tests of a new DMA ready to be coupled to a MS with high transmission are presented

Resolution tests have usually excluded mass analysis, by replacing the conical skimmer (sampling the gas from the supersonic free jet formed at the MS inlet orifice) with a collecting electrode connected to an electrometer

Improved aerodynamic design with respect to a prior DMA presented in this conference by Fernández de la Mora et al. results in higher speeds attained and substantial increase in resolution

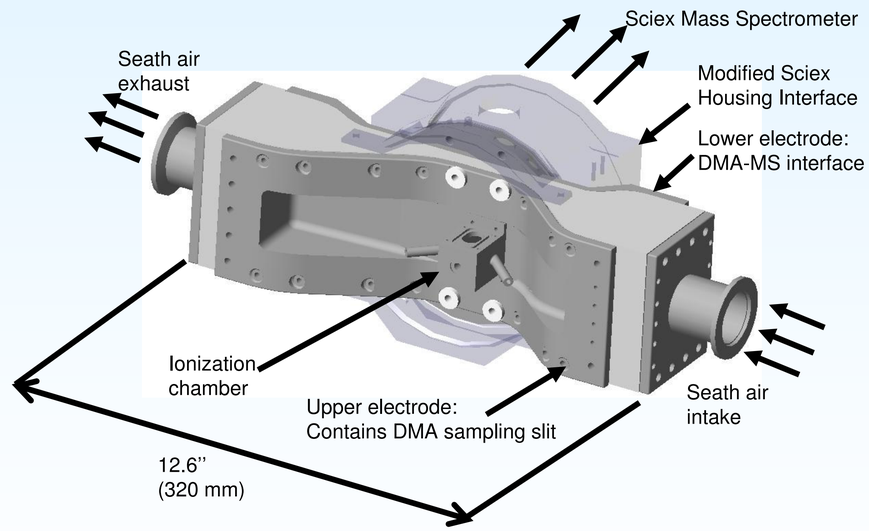
Mobility separation in a planar DMA

- Separation of ions is based on electrical mobility (IMS)
- Mobility spectra is obtained by scanning over the voltage difference between two parallel plates: V_{DMA}
- Planar design allows for delivery of mobility-selected ions with high transmission from the electrospray source to the DMA inlet, and from the DMA outlet to the MS
- Aerodynamic design is key to operate in high speed-high resolution conditions



Introduction

- The first commercial IMS system based on a differential mobility analyzer has been coupled to Sciex's Q-Star MS to enable two-dimensional mobility-mass separation
- The DMA accepts ions from an ES source through an inlet orifice, separates them in space by combining an electric and a gas flow field between two parallel plates, and feeds mobility selected ions into the inlet orifice of the MS with high transmission efficiency.
- No change is required in the MS other than removing the conventional interface piece and substituting it with a modified interface that fits on one side with the MS and on the other with the DMA.
- The plate containing the MS inlet hole coincides with the lower DMA electrode.

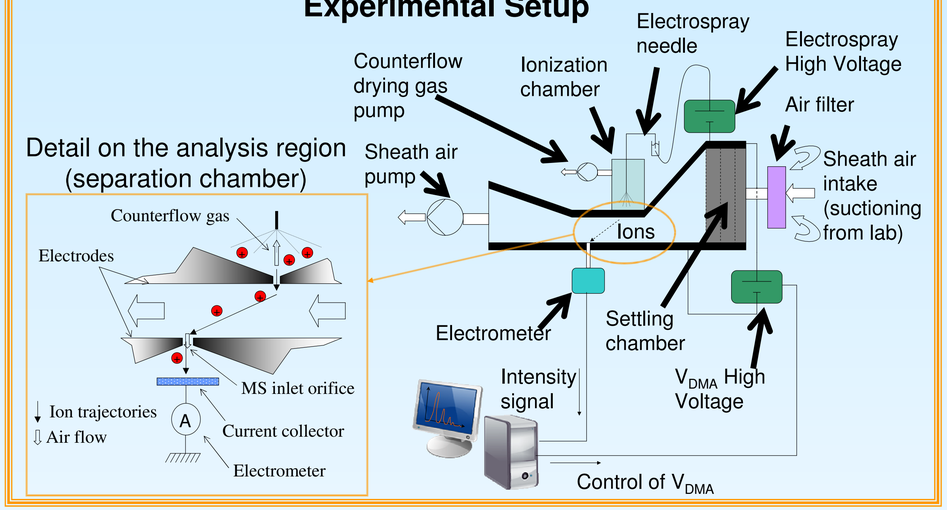


Conclusions

Record speed (M = 0.75) and record resolution (60-80) for mobility separation in DMA-MS coupling has been achieved.

Improvements are still required in the laminarization of the air flow at the DMA intake

Experimental Setup



Results

Consistent resolutions (R = 1/FWHH) of 60 to 80 are obtained for a wide operating range, increasing with air speed in the separation region, and reaching values of 80-85 for tetraheptylammonium+ (Mach ~ 0.6-0.8, DMA voltage ~ 7-8 kV)