List of Figures

1. Figure 1 shows three FAIMS models in which the micro-fabricated FAIMS geometry in the model "a", "b" and "c" are identical (L =15 mm and g = 0.5 mm). The models defer in the detector assembly. In model "a" single vertical detector electrode is placed at 14.99 mm; in model "b" two parallel electrodes (L = 5 mm) separated by 0.5 mm were placed 5 mm away from the FAIMS electrodes; in model 3 the detector electrodes were replaced by a capillary (L = 60 mm and i.d = 0.5 mm) 0.5 mm away from the FAIMS electrodes.

2. Figure 2. Shows a flow chart of key computational steps involved in simulating a FAIMS spectrum using SIMION-SDS-FDMC.

3. Figure3a. Shows the trajectory of an A type ion, $H^+(H_2O)_3$, over a few waveform cycles in the p-FAIMS gap that causes a radial displacement per cycle (x) towards the top electrode; b. Summary of the $H^+(H_2O)_3$ trajectory over several cycles of the waveform with an incorrect $CV_{E/N}$ of 1.01 Td (12.0 V); c. the trajectory with correct $CV_{E/N}$ of 0.90 Td (10.7 V) to allow the ion to travel along the center of the FAIMS gap.

4. Figure 4. CV spectra of hydrated proton showing the effects of diffusion, coulumbic repulsion and DV (750V) on I_{output} (pA) and FWHM in micro-fabricated p-FAIMS.

5. Figure 5a. Plot of $CV_{E/N}$ versus ion transmission for Leucine (0.29 Td, 3.2 V) and Hydroxyproline (0.34 Td, 4.0 V) at various gas flow rates ranging from 0.5 $L.min^{-1}$ to 2.0 $L.min^{-1}$; b. Comparison of theoretical (--) and SIMION (*) calculated parabolic flow profile that was derived from Navier-Stokes equation; c. a comparison of CV elution profile of hydrated proton with linear gas flow (--) and parabolic gas flow (—) that was applied across the FAIMS gap (±h).

6. Figure 6a shows a comparison of experimental (broken line) and simulated (squares) dispersion plot ($CV_{E/N}$ versus $DV_{E/N}$) of $O_2^-(H_2O)_3$ (I), $(C_3H_6O)_2H^+$ (II), and $(C_{12}H_{24}O)_2H^+$ (III). The $DV_{E/N}$ range translates to ~8Td to ~80 Td; b) shows a comparison of simulated and experimental plot of $CV_{E/N}$ versus ion transmission of $O_2^-(H_2O)_3$ at selected E/N: 16.85 Td (200V), 33.70 Td (400V), 50.55 Td (600V), and 59.0 Td (700V). CV was scanned from 0 V to 14 V, d = 0.3 and $f = 0.83$ MHz .

7. Figure 7a shows the effect of fringe field on the transmission of $O_2^-(H_2O)_3$ between the p-FAIMS terminus and the detector plates (Figure 1, model "b"). Figure 7b and c shows the transmission of $O_2^-(H_2O)_3$ between p-FAIMS and the capillary inlet (Figure 1, model "c") with and without the correction of fringe fields, respectively.