

Progress in coupling a differential mobility analyzer to the source end of a mass spectrometer for IMS-MS studies

ThOF 03:50 pm

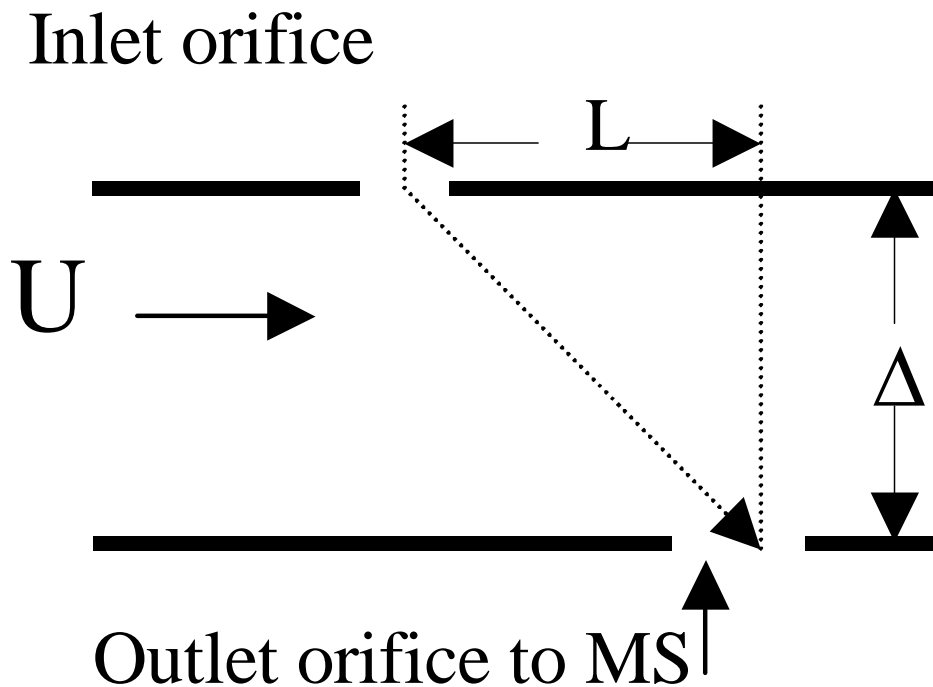
Juan Fernandez de la Mora²; Juan Rus¹; Francisco Estevez¹; Juan Antonio Sillero

² Yale University, Mechanical Engineering Department

¹ SEADM, Boecillo, Valladolid, Spain

The Differential Mobility Analyzer (DMA)

Mobility separation in space



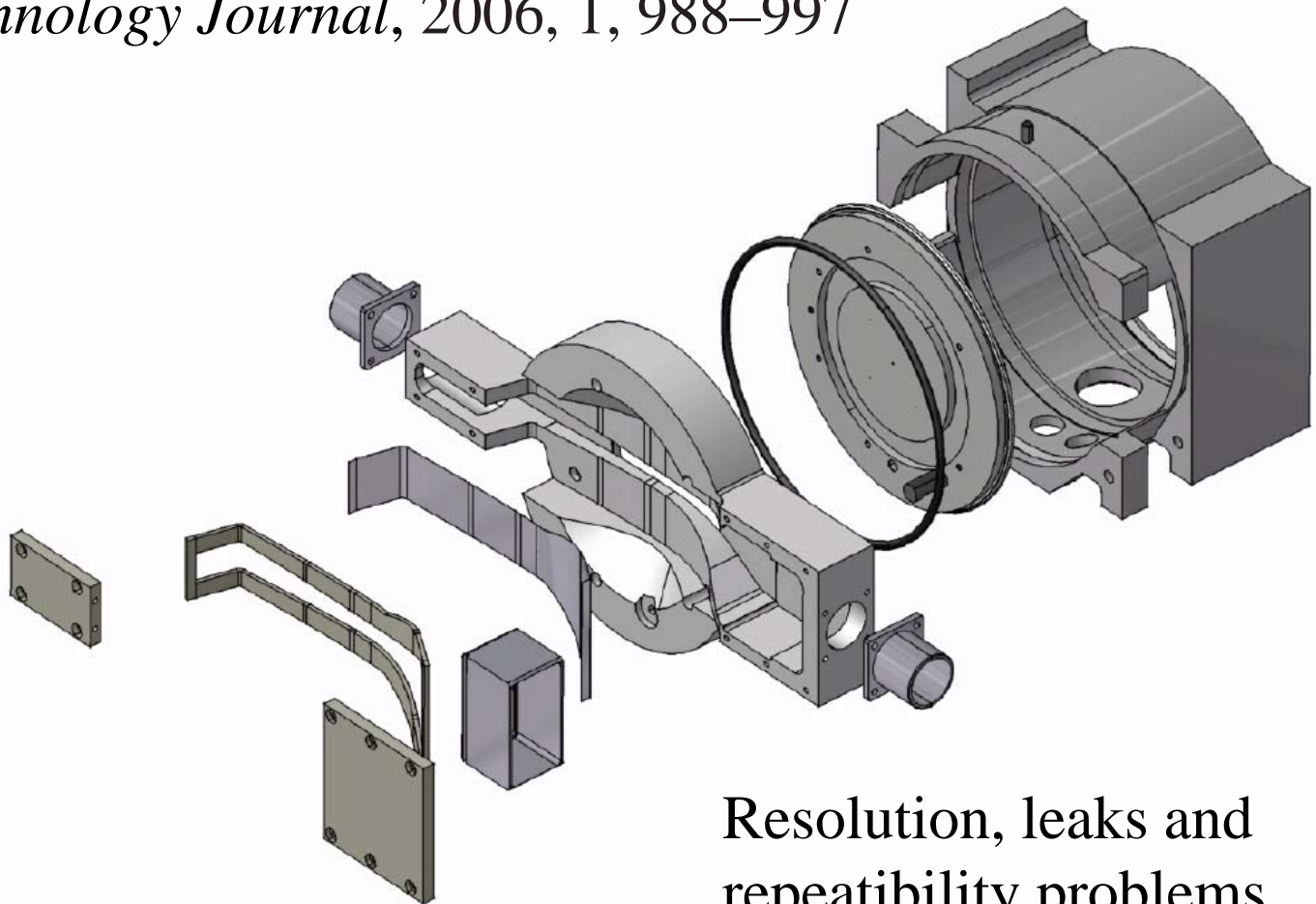
Simple front end to fit any MS with high pressure inlet

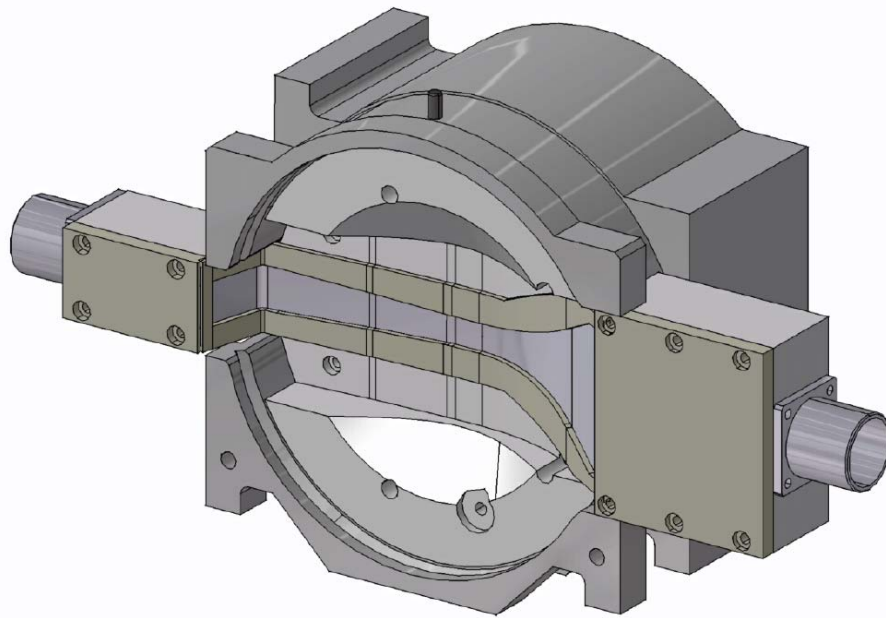
Steady mobility-selected signal (as long as one wants)

High transmission ($\sim 100\%$), fair resolution (50-100)

Prior work with Bruce Thomson (Sciex) and S. Ude:
Coupling a DMA with Sciex's API-365

Biotechnology Journal, 2006, 1, 988–997





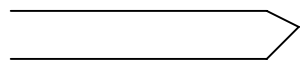
Other than that, the DMA provides a simple front-end mobility separator similar to FAIMS, but with two advantages

- 1) Measures true mobility (Weak-field limit)
- 2) High transmission ($> 50\%$)
- 3) High resolution (50-90)

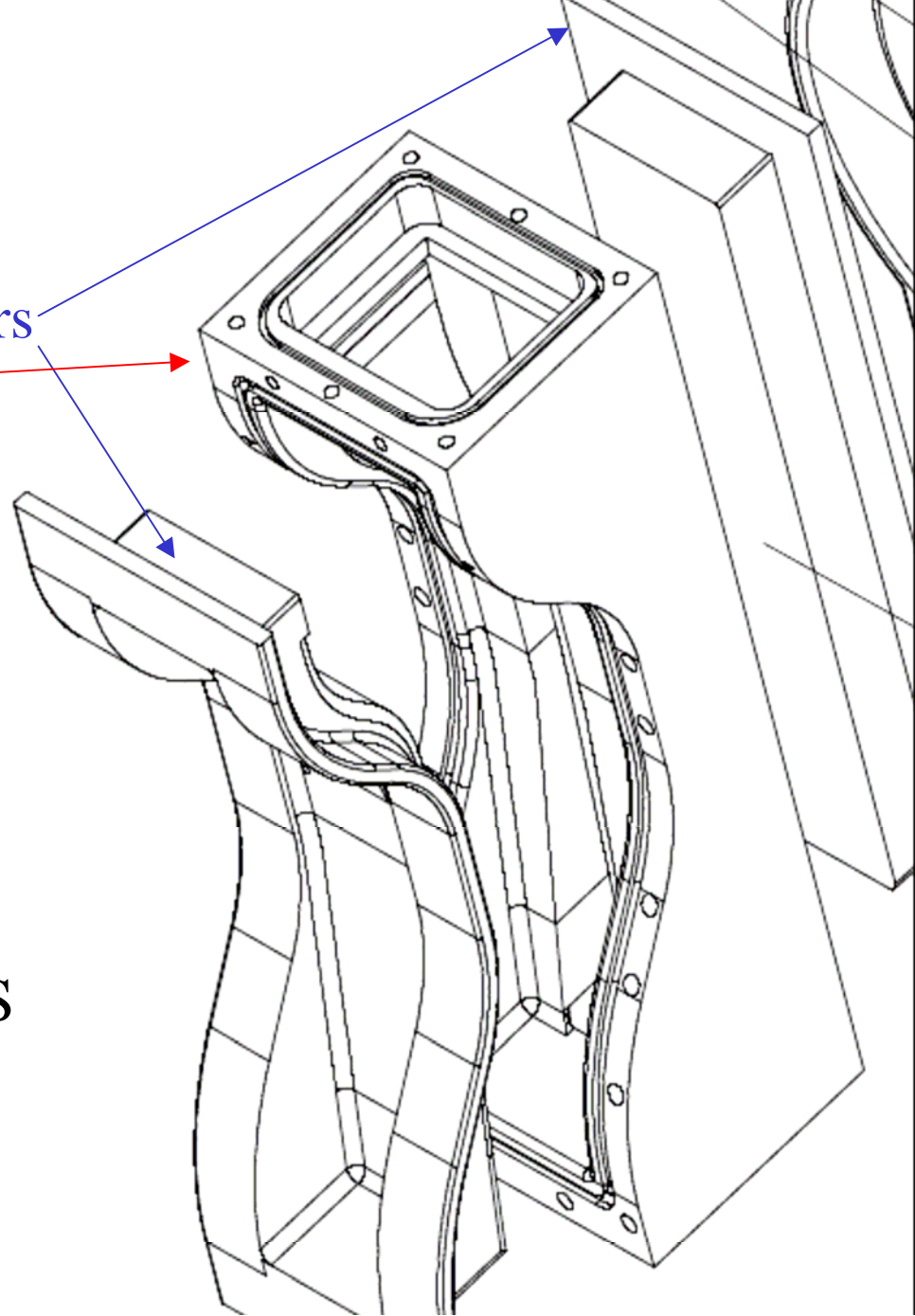
SEADM DMA: Coupled to Sciex's API-365 and q-Star

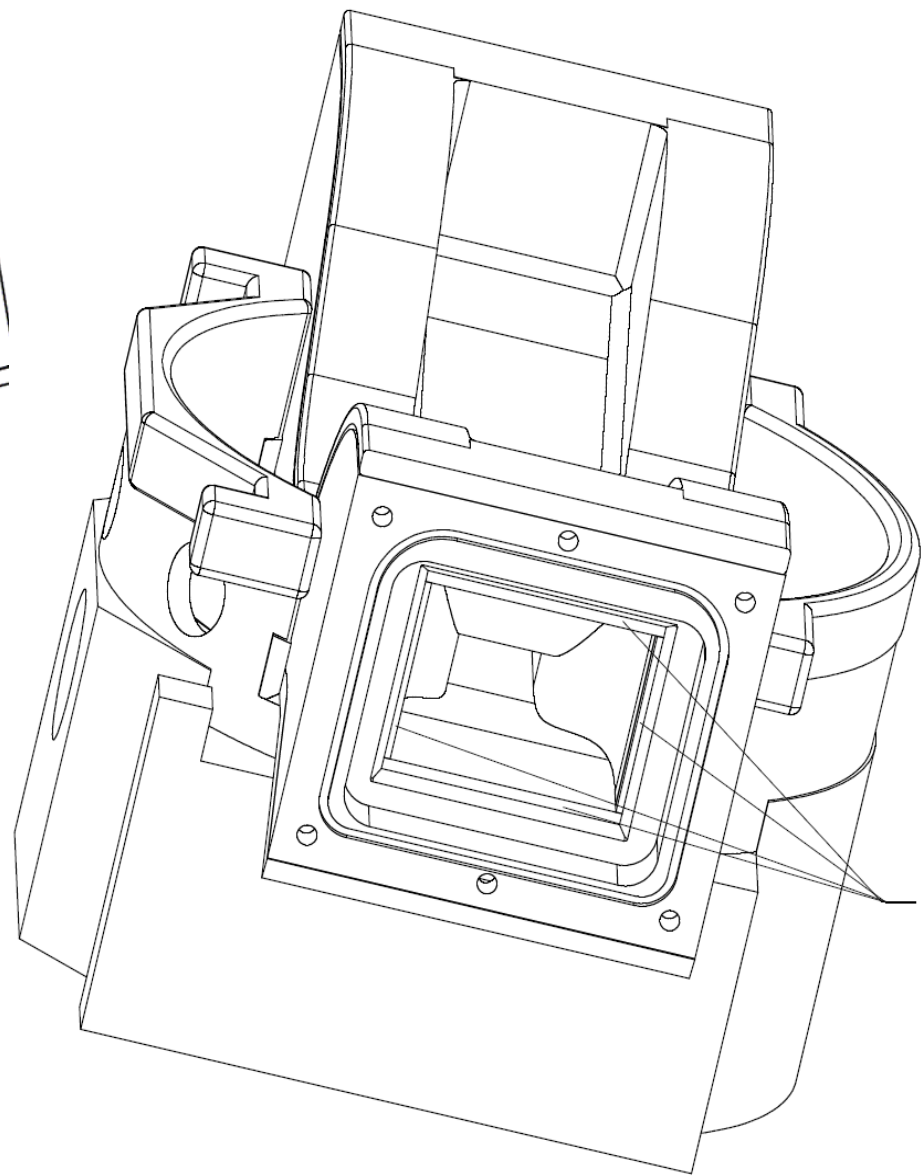
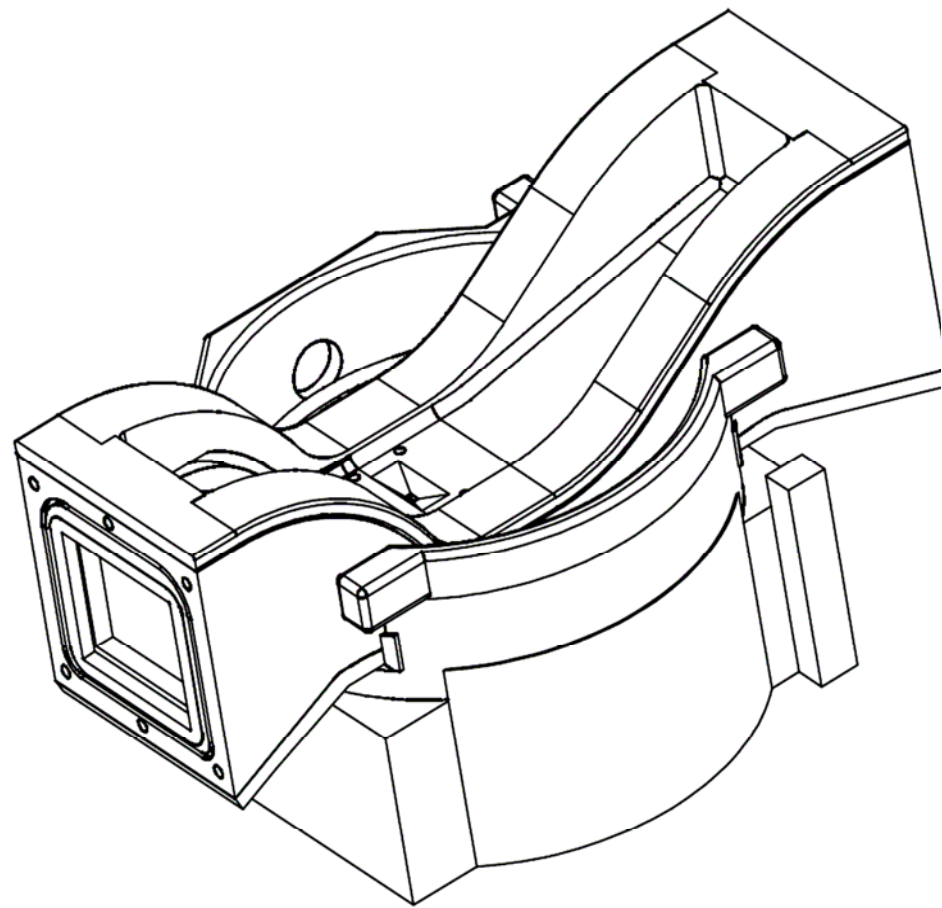
Design based on **two electrode covers**
and **an insulating box**

ES source

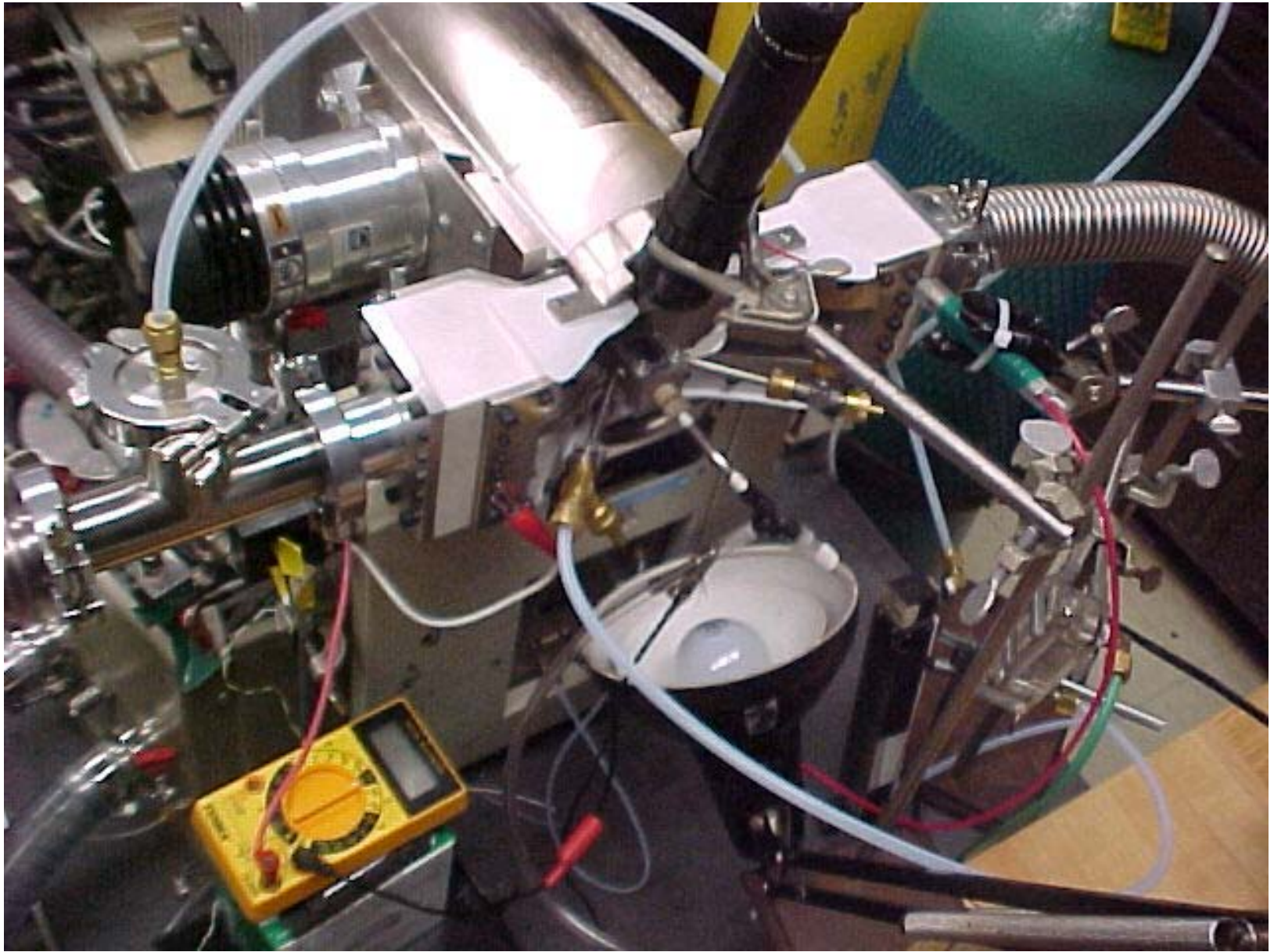


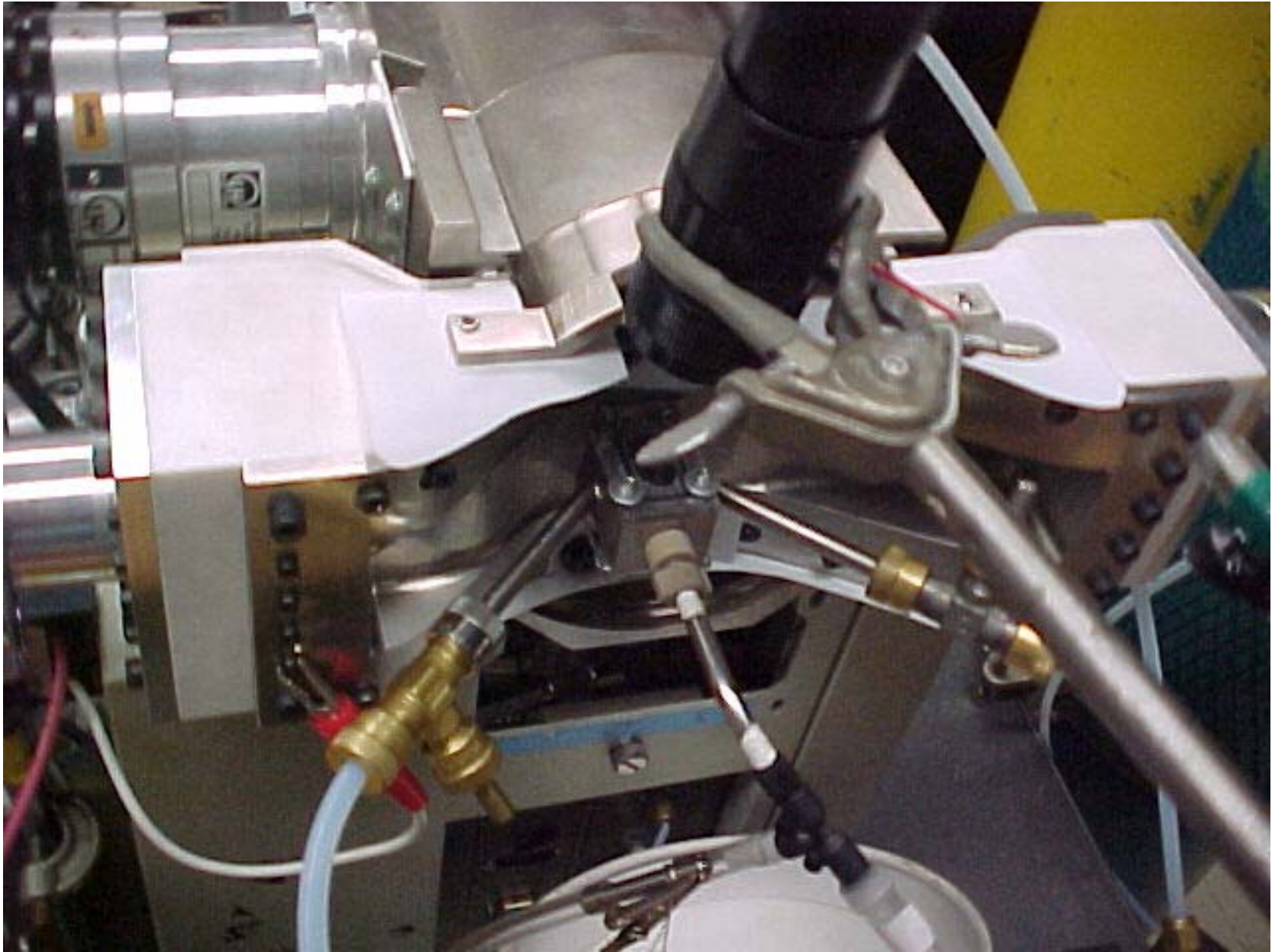
To MS











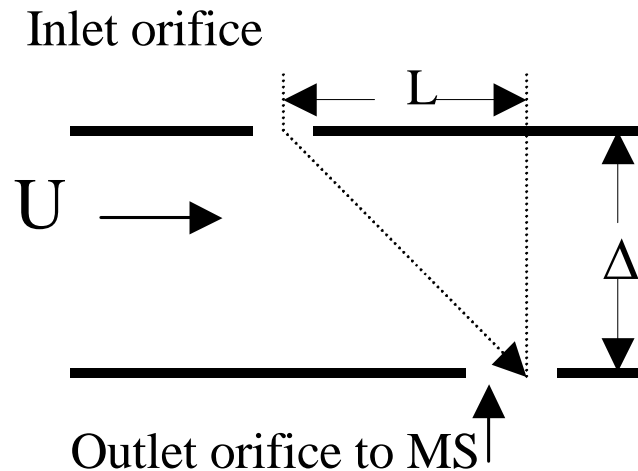
Resolution Limitations:

$$\text{Resolution} = U\Delta / (\frac{1}{2} c \Delta_s) = 2 \text{ Mach } \Delta / \Delta_s$$

If Mach = 1; $\Delta / \Delta_s = 40$ (10 mm/0.25 mm), then

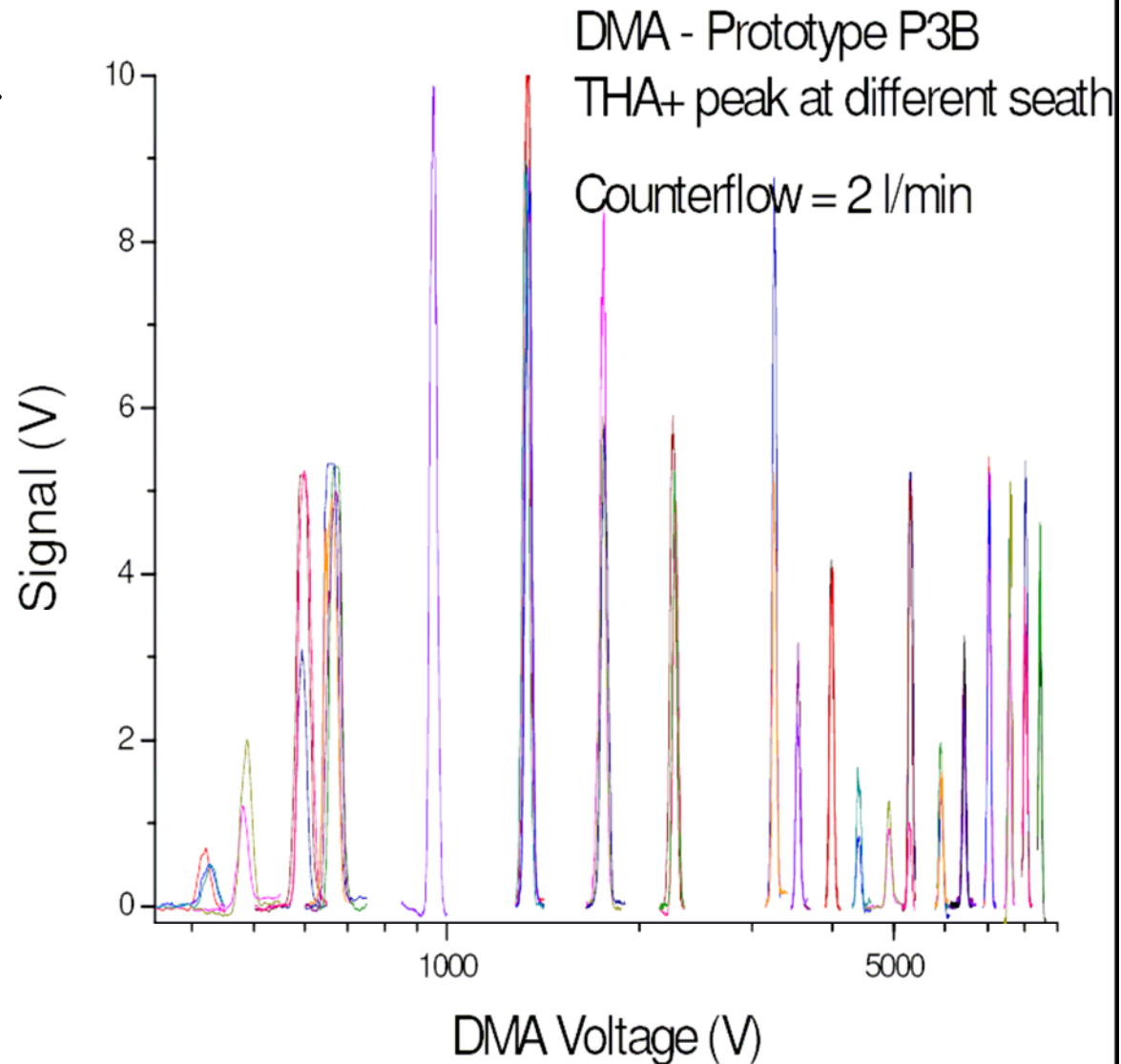
$$\text{Resolution} = 80.$$

Similar values achievable by reduction of Δ_s below MS inlet orifice diameter.



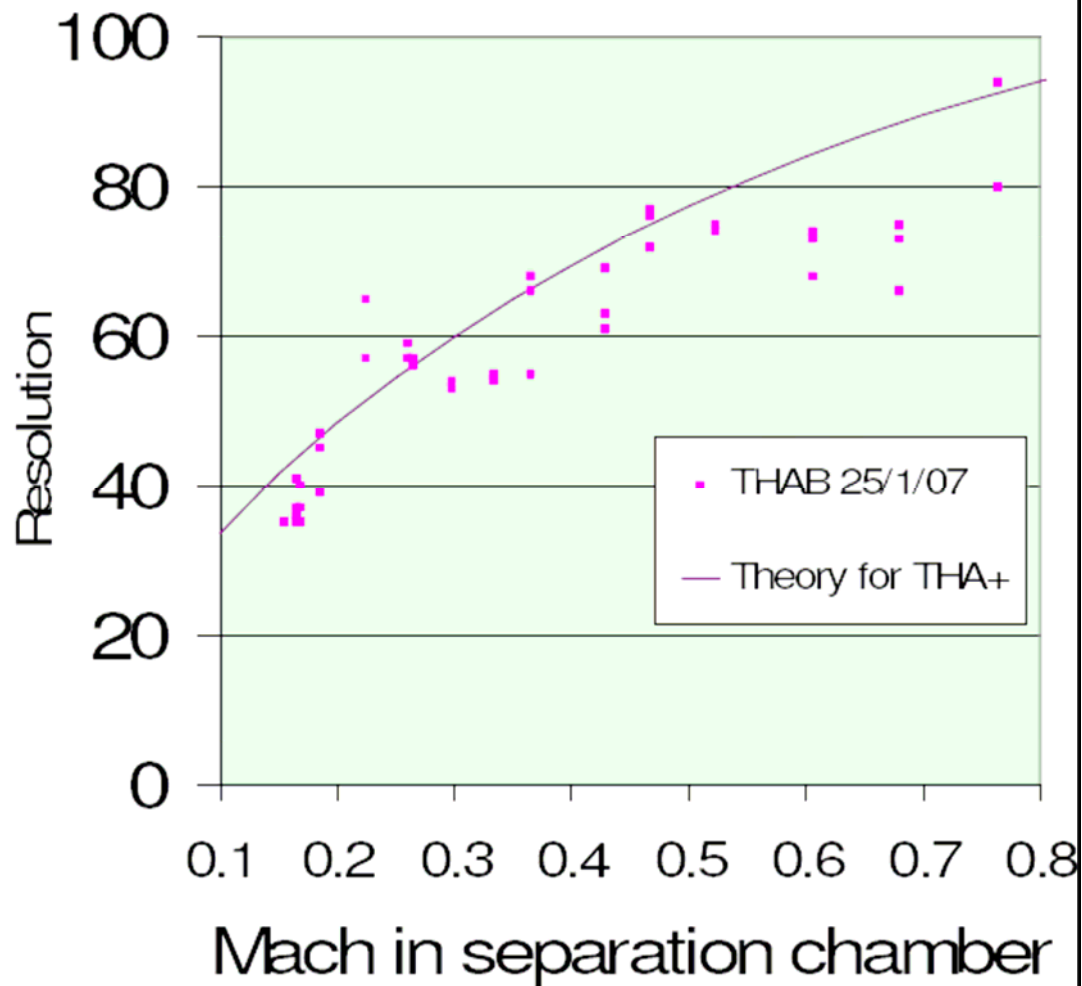
Resolution with tetraheptyl ammonium bromide ions (ES)

Q-Star prototype; Rus et al.
(IMS Session; WPF; Poster
Number: 106



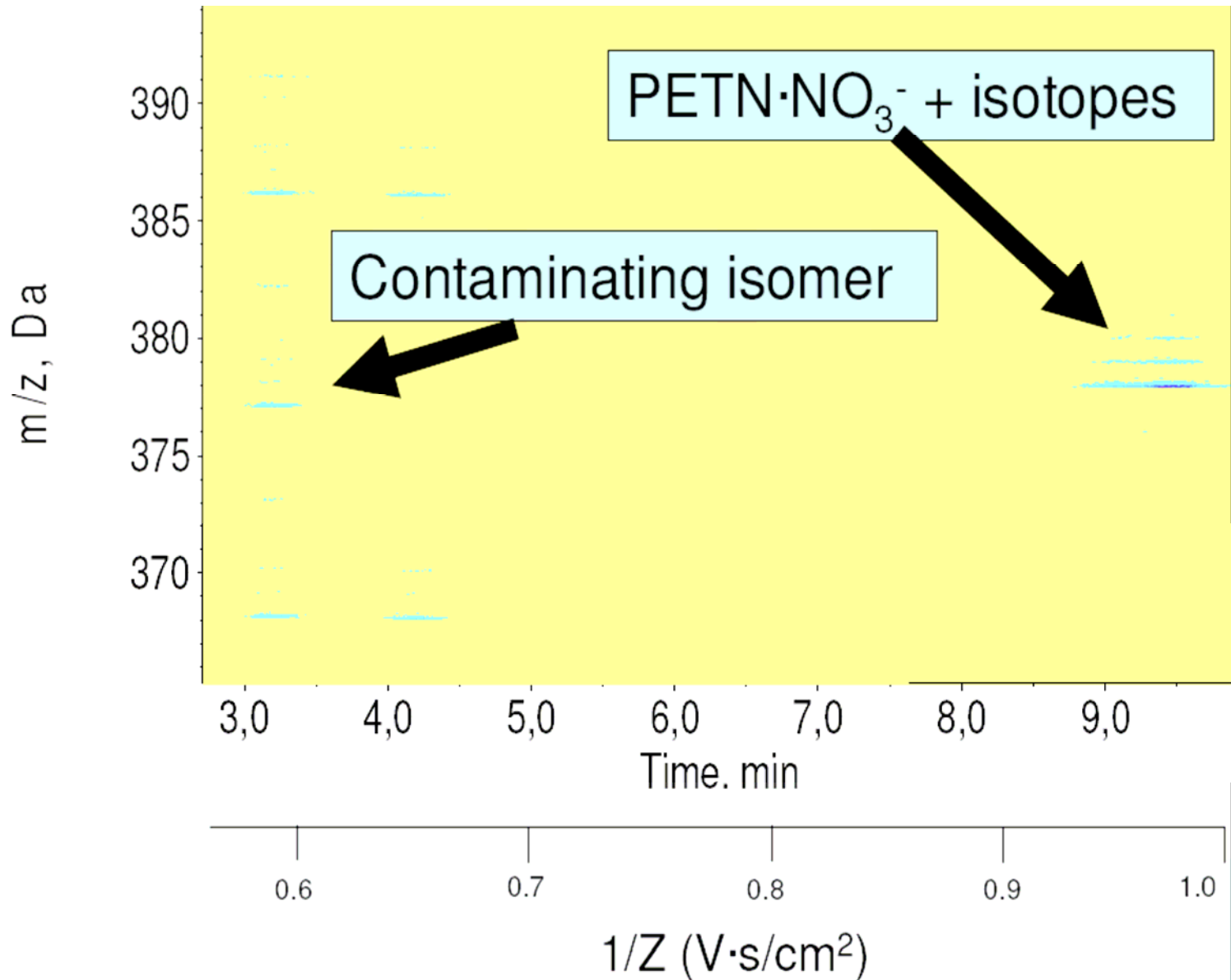
Resolution with tetraheptyl ammonium bromide ions (ES)

Q-Star prototype; Rus et al. (IMS Session; WPF; Poster Number: 106)



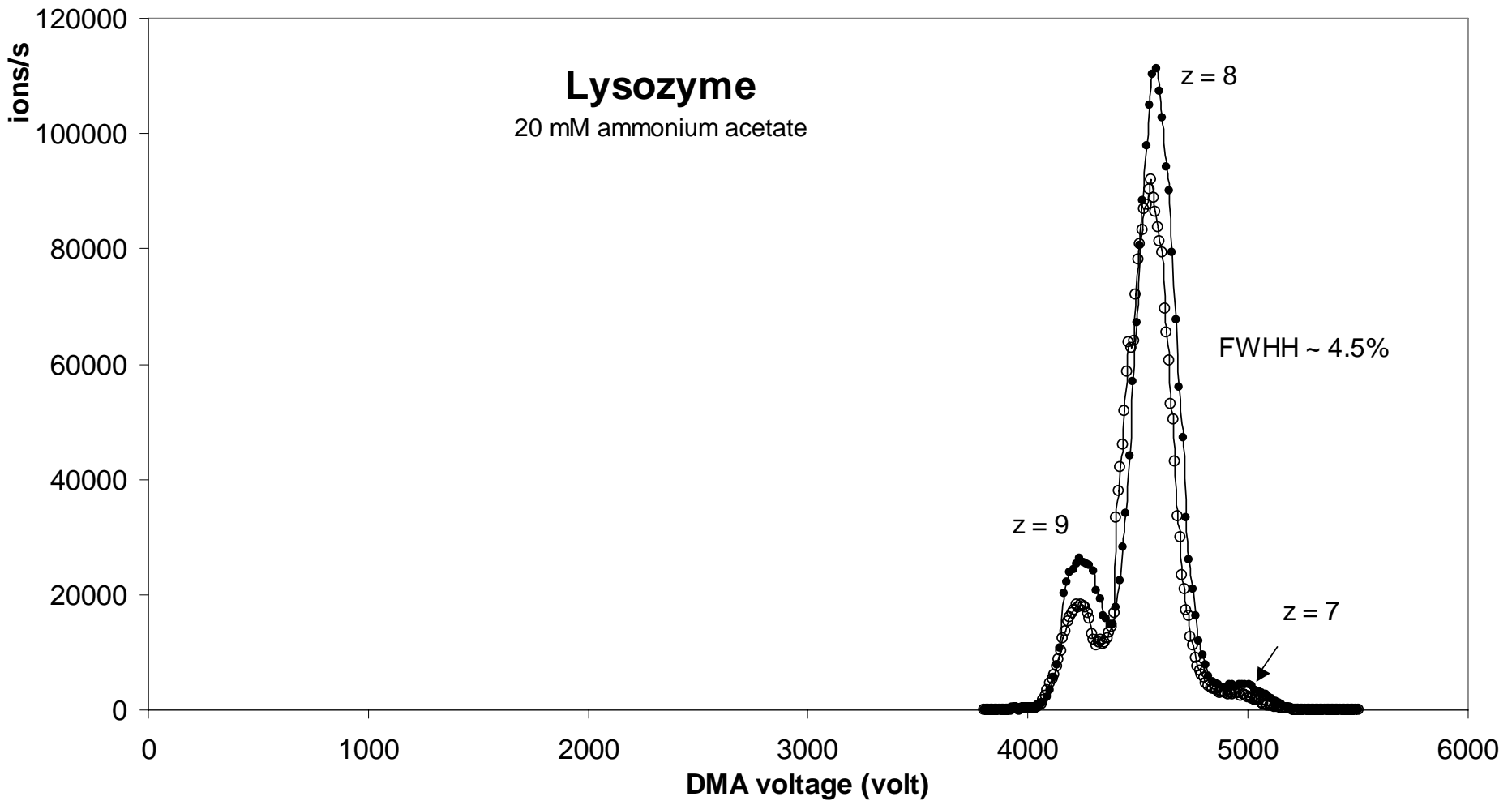
Noise reduction

Q-Star prototype; Rus et al. (IMS Session;
WPF; Poster Number: 106)

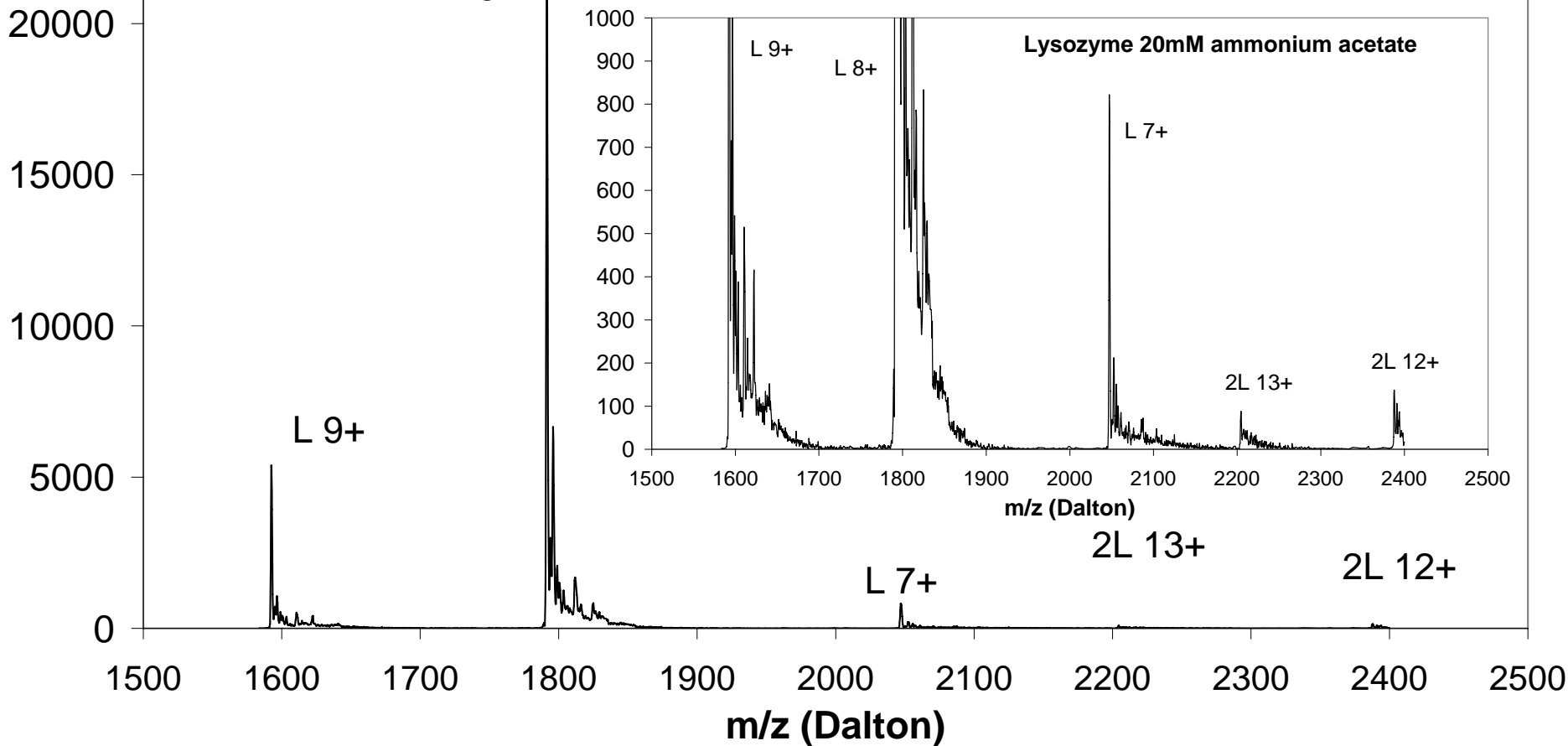


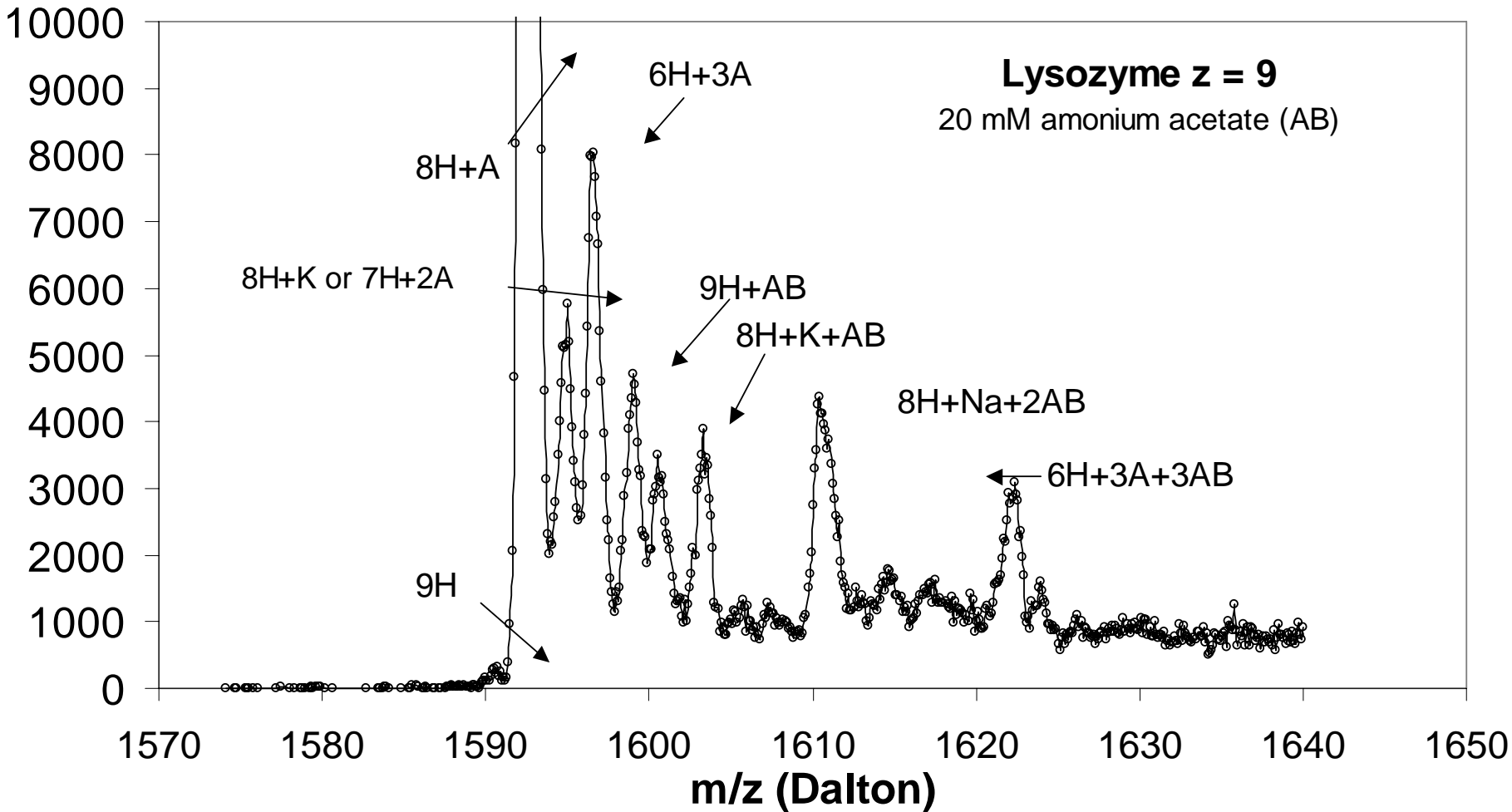
API-365 prototype:

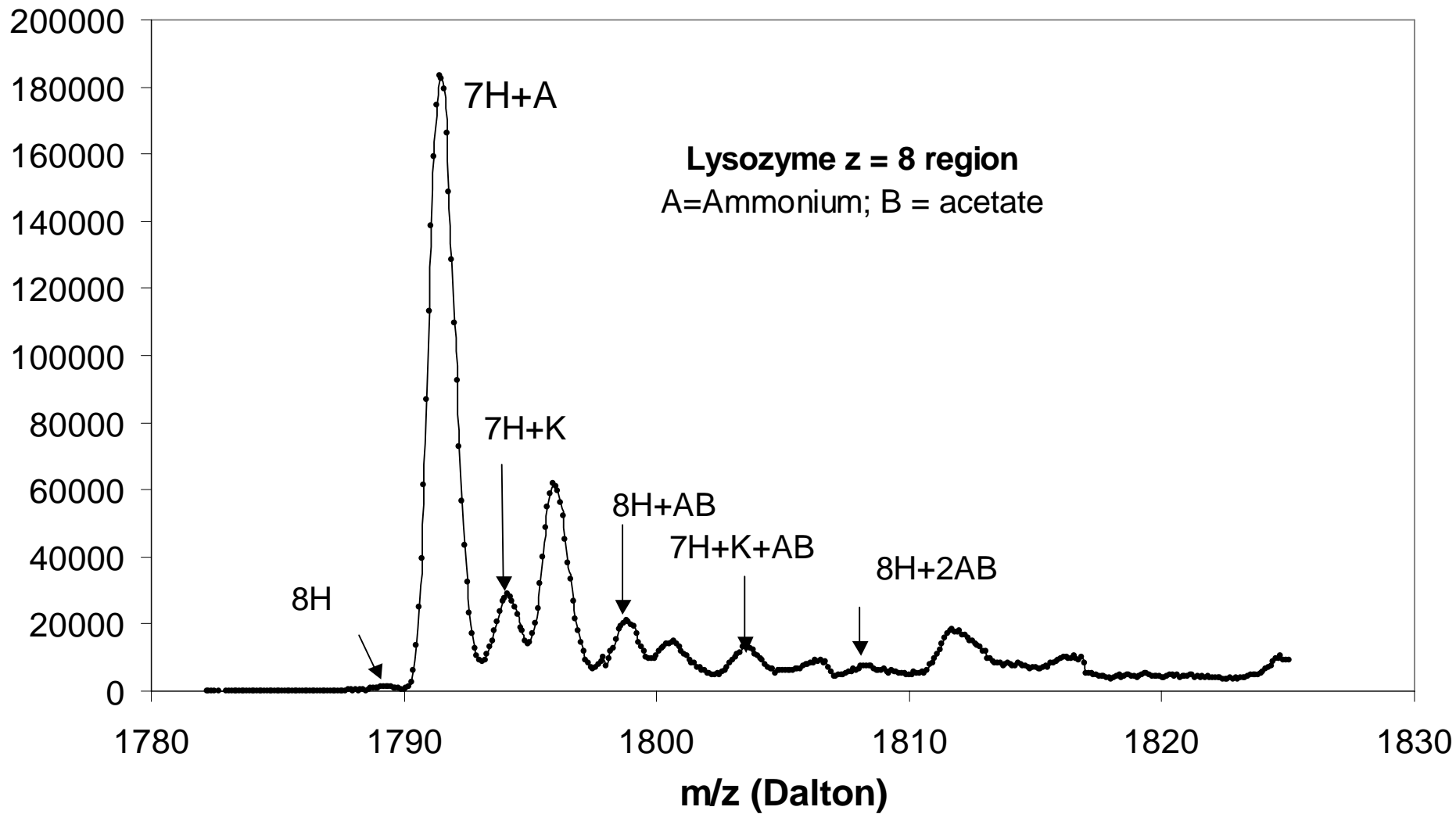
DMA-MS of lysozyme/water/20 mM Ammonium acetate

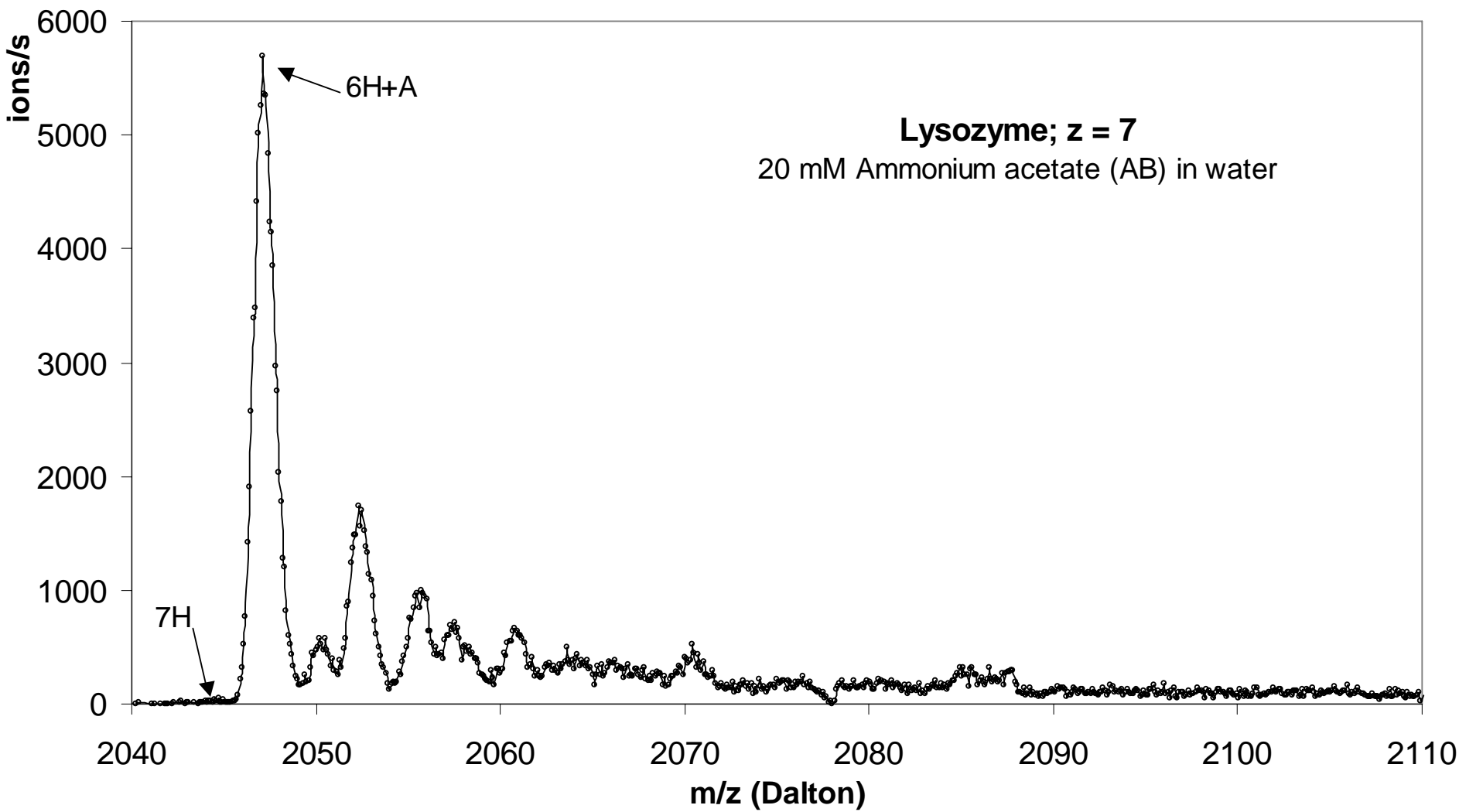


Lysozyme 20mM ammonium acetate









Conclusions:

Practical problems of coupling a planar DMA to a MS with high DMA transmission ($\sim 1/2$) and resolution (> 60) solved.

DMA achieves transonic speeds with inexpensive vacuum cleaner pump

Uses counterflow gas to avoid MS contamination (since MS curtain gas is eliminated)