

US EPA ARCHIVE DOCUMENT

# Chemical Ionization Mobility and Mass Spectrometry of Aerosols

EPA Progress Review Webinar  
April 28, 2010

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# New methodology for organic analysis

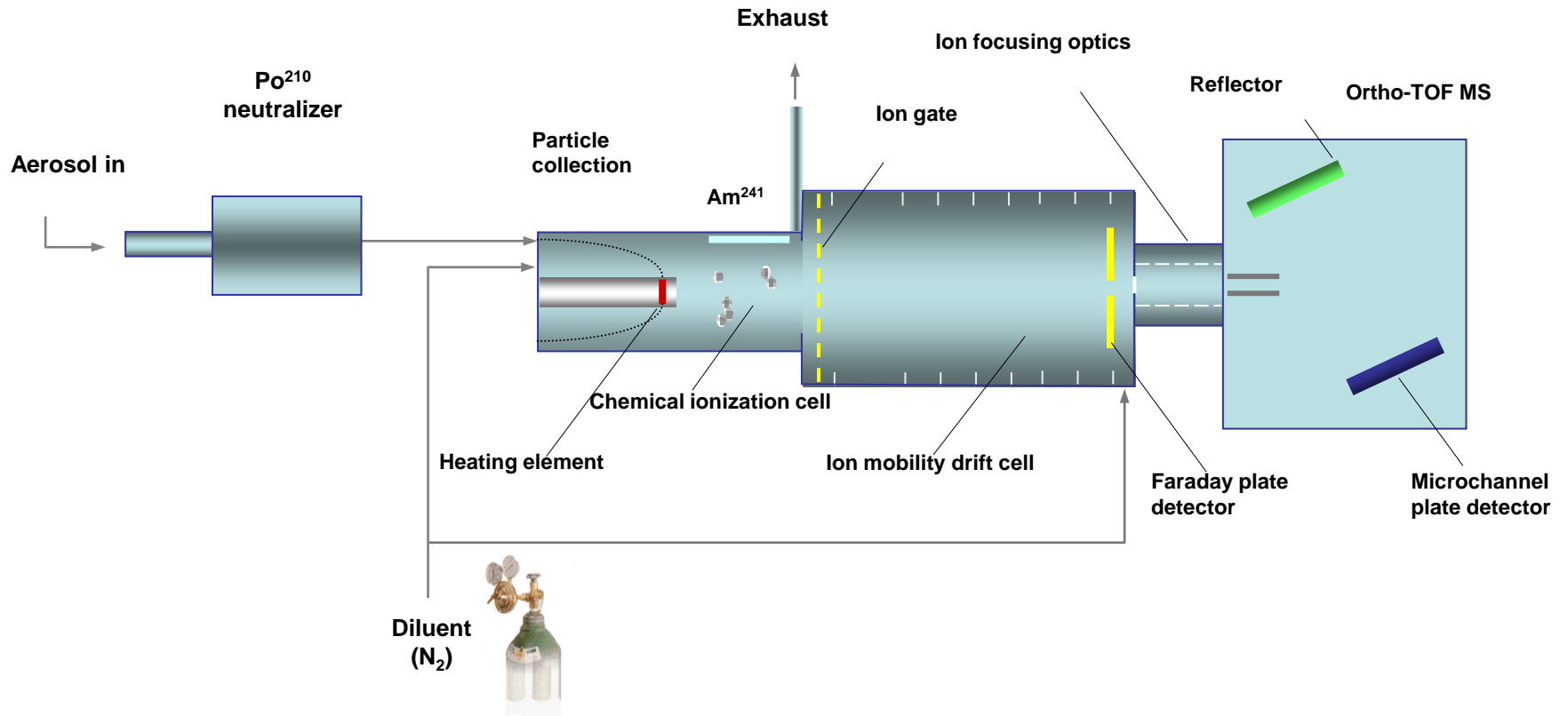
- Size-resolved collection of aerosol at low pressure
- Low pressure chemical ionization

*Low pressure* : ~1 – 10 Torr

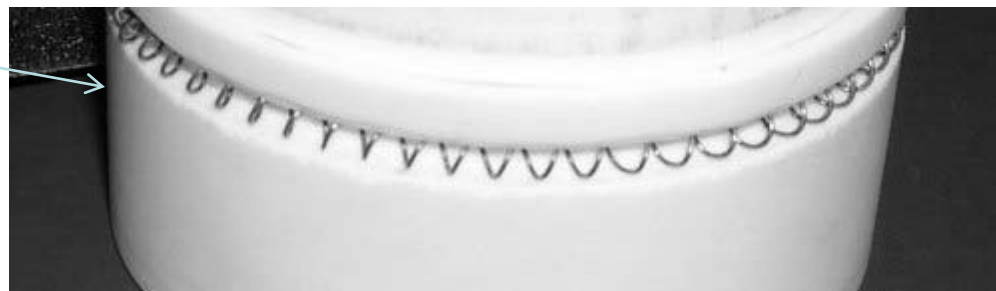
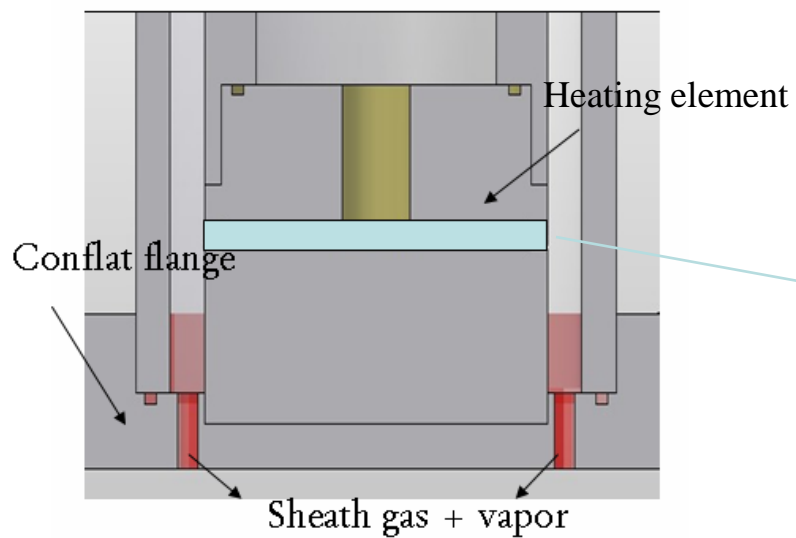
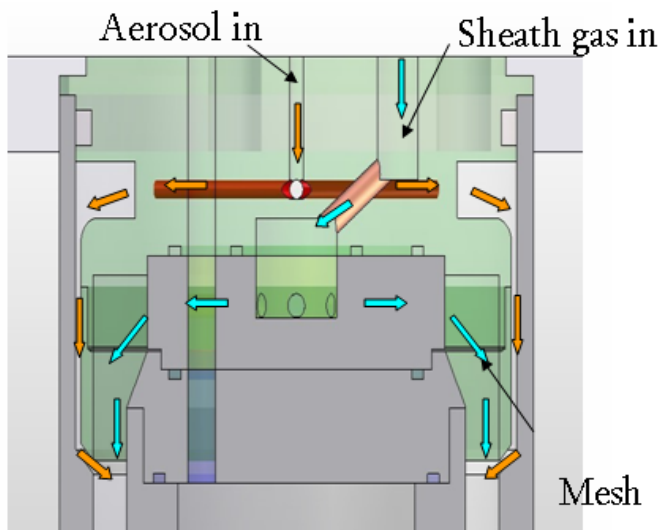
-Minimize clustering of ions

- r-TOF mass spectrometry
- Ion mobility separation?

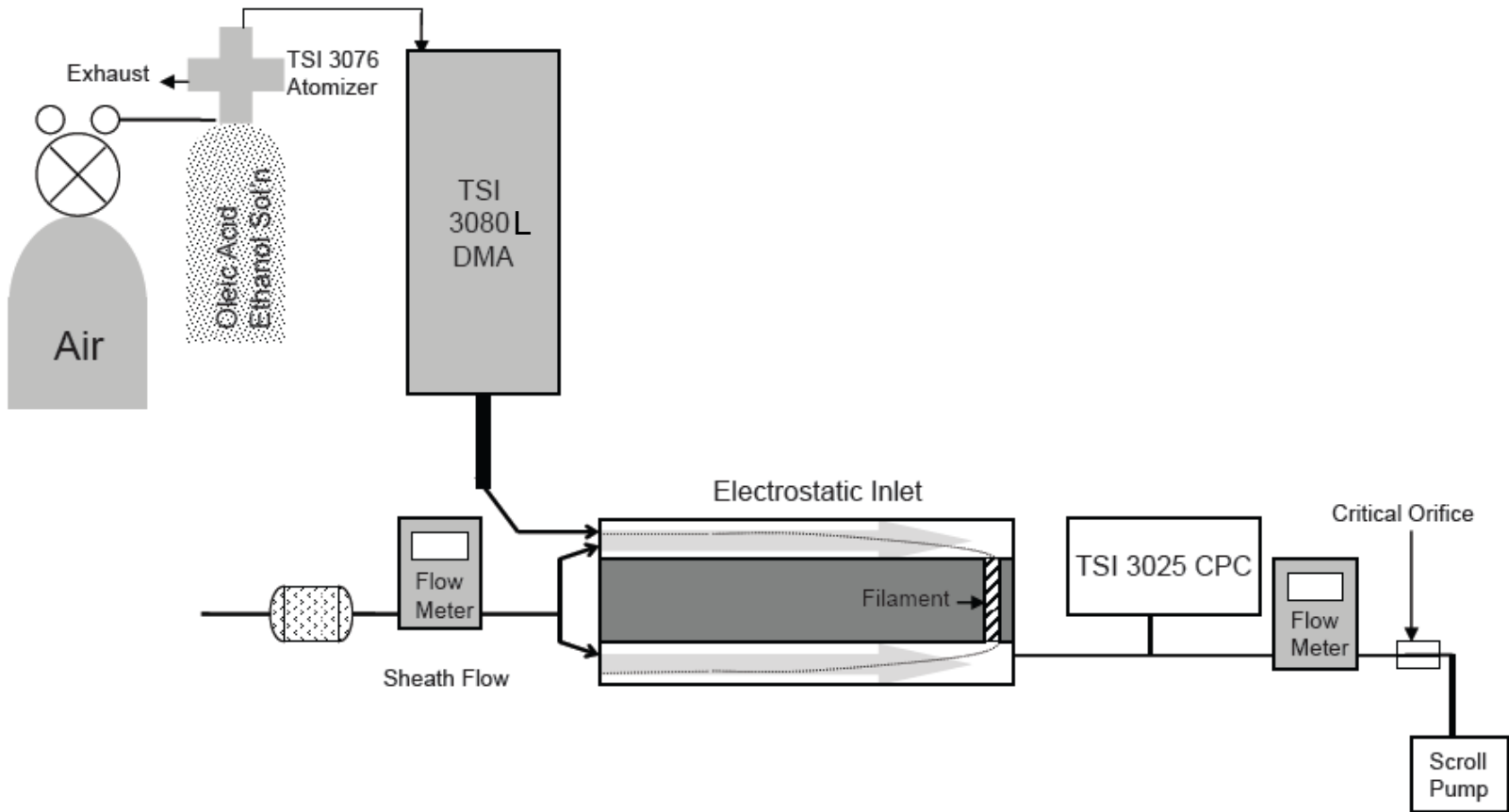
# Proposed Instrument Schematic



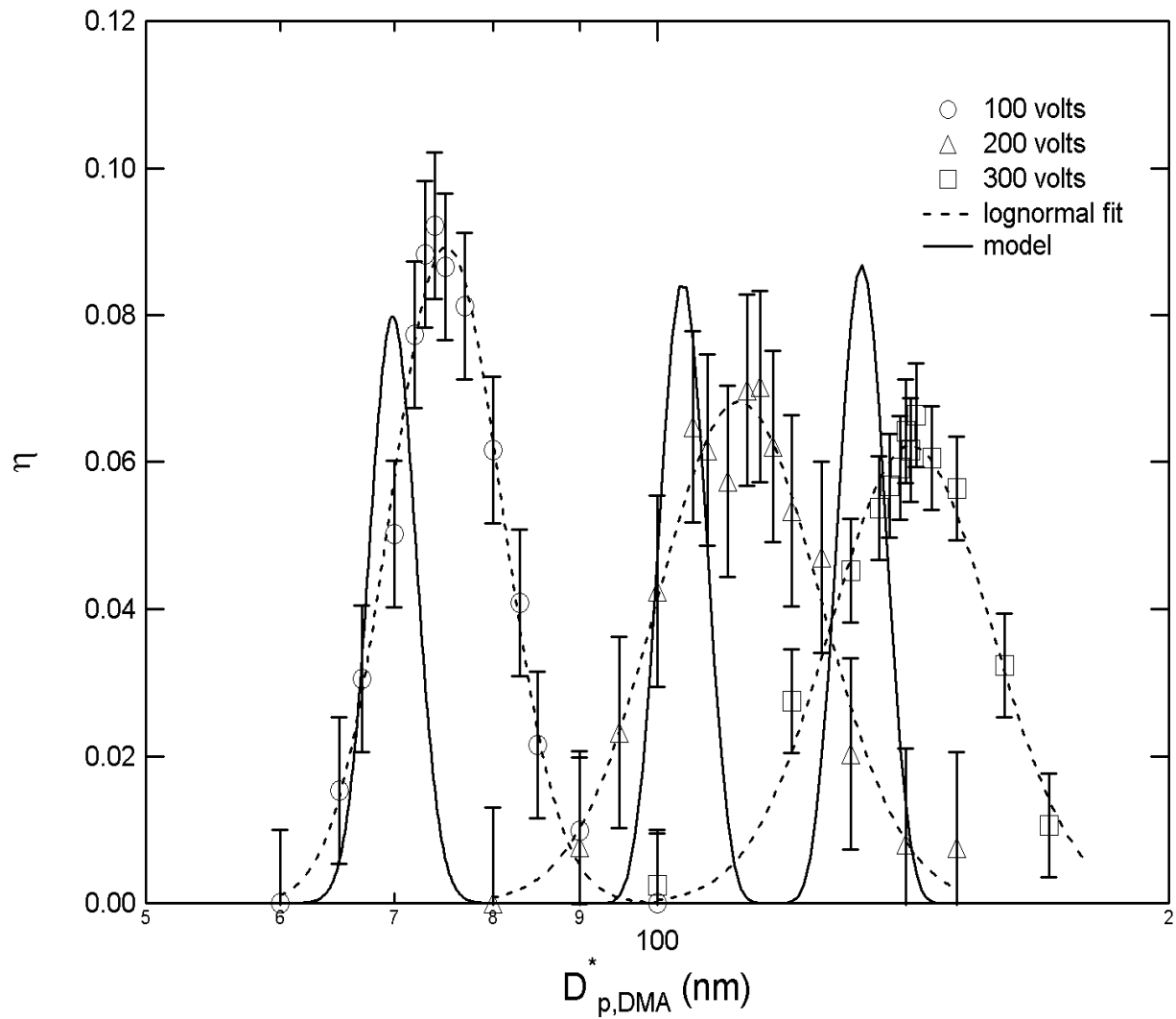
# Inlet Schematic



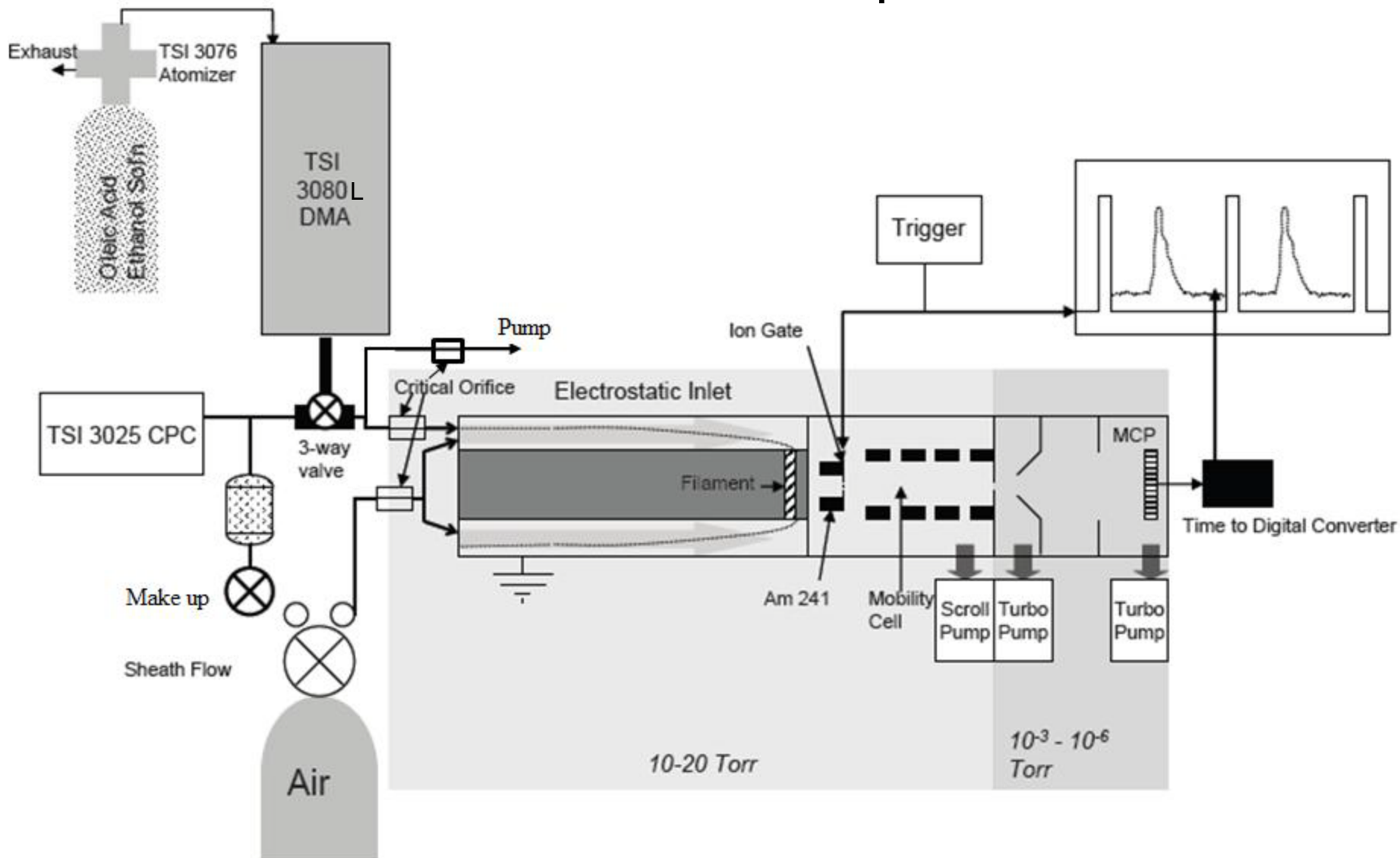
# Size calibration – atmospheric pressure



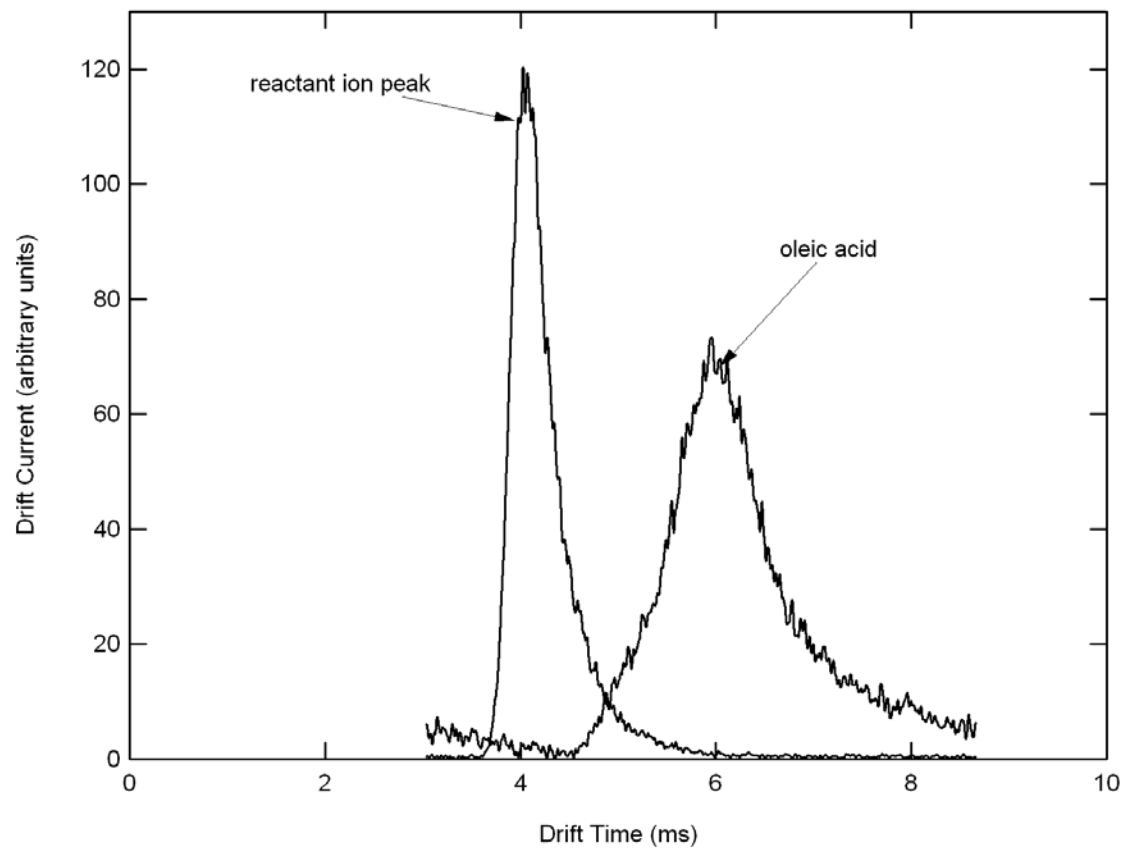
# Atmospheric pressure aerosol size calibration



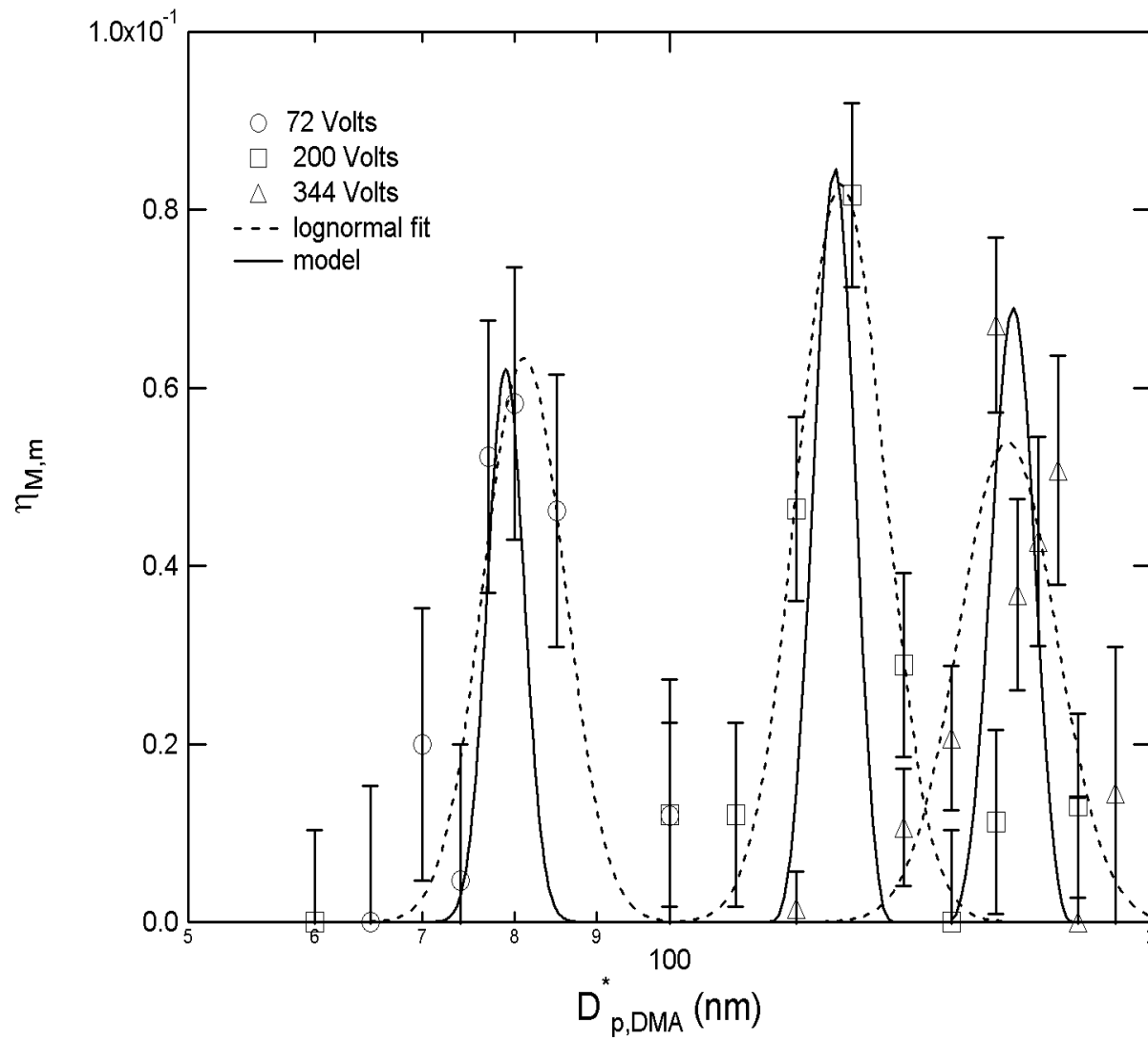
# Size calibration – low pressure



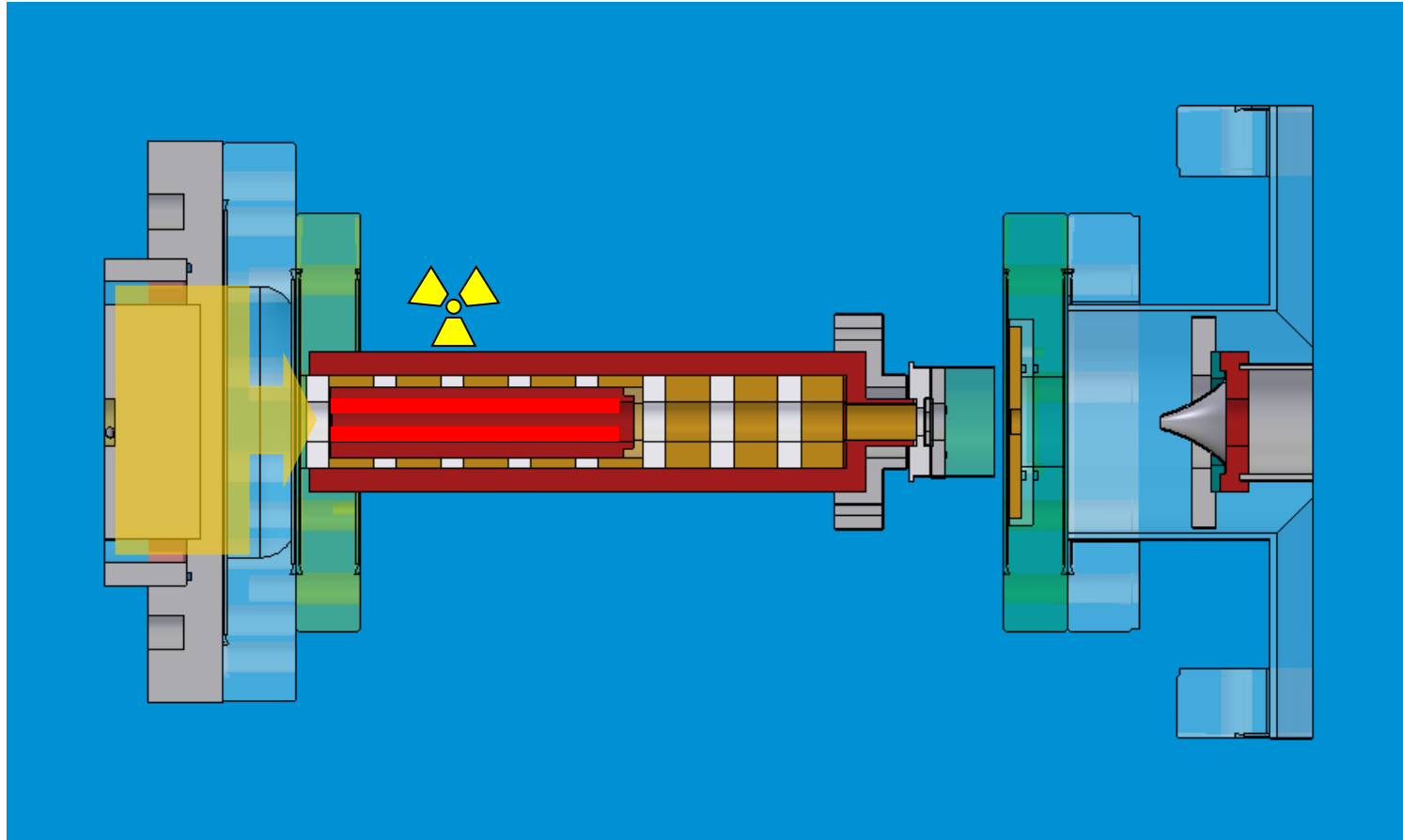




# Low pressure aerosol size calibration

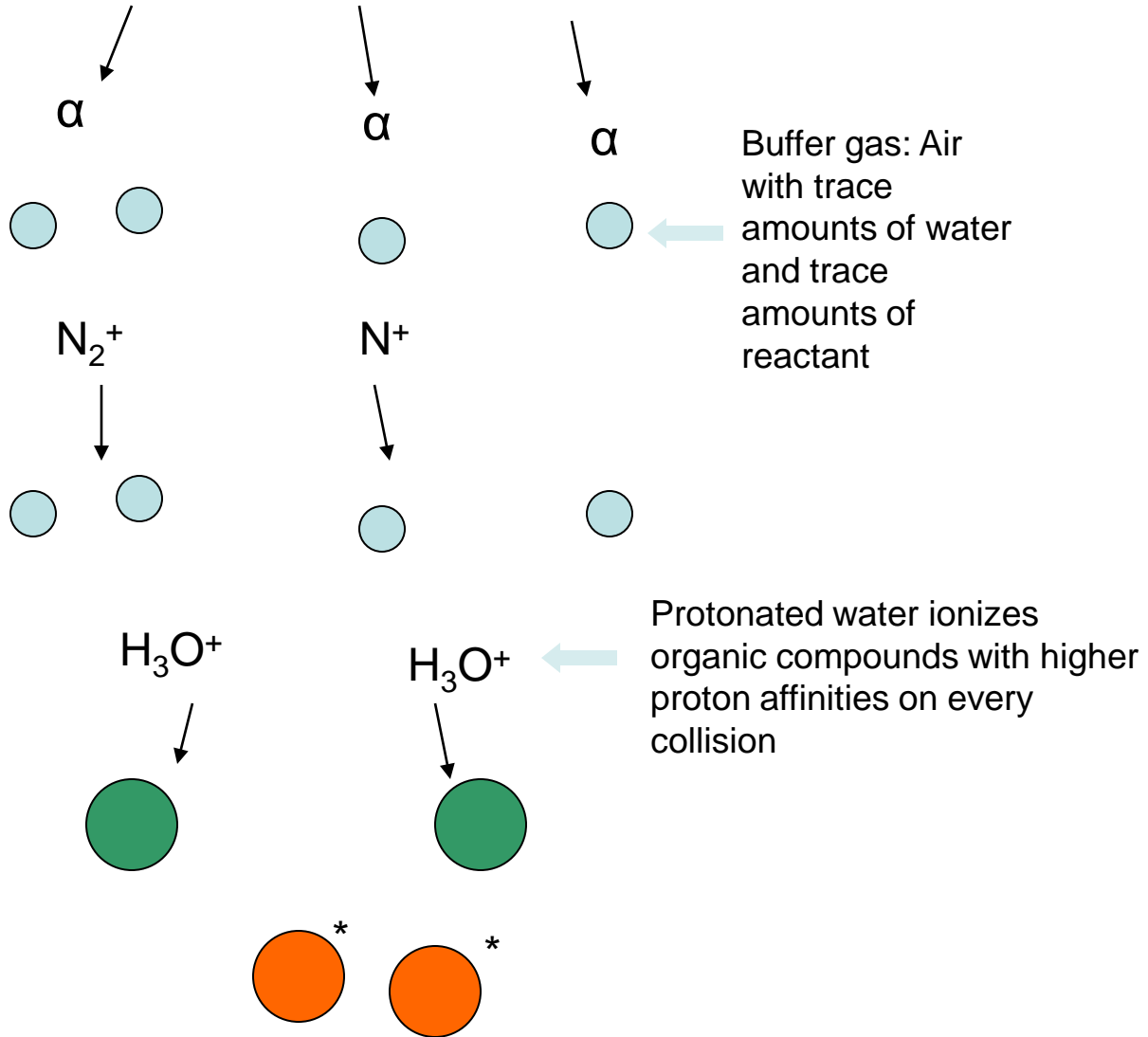


# Chemical Ionization Cell

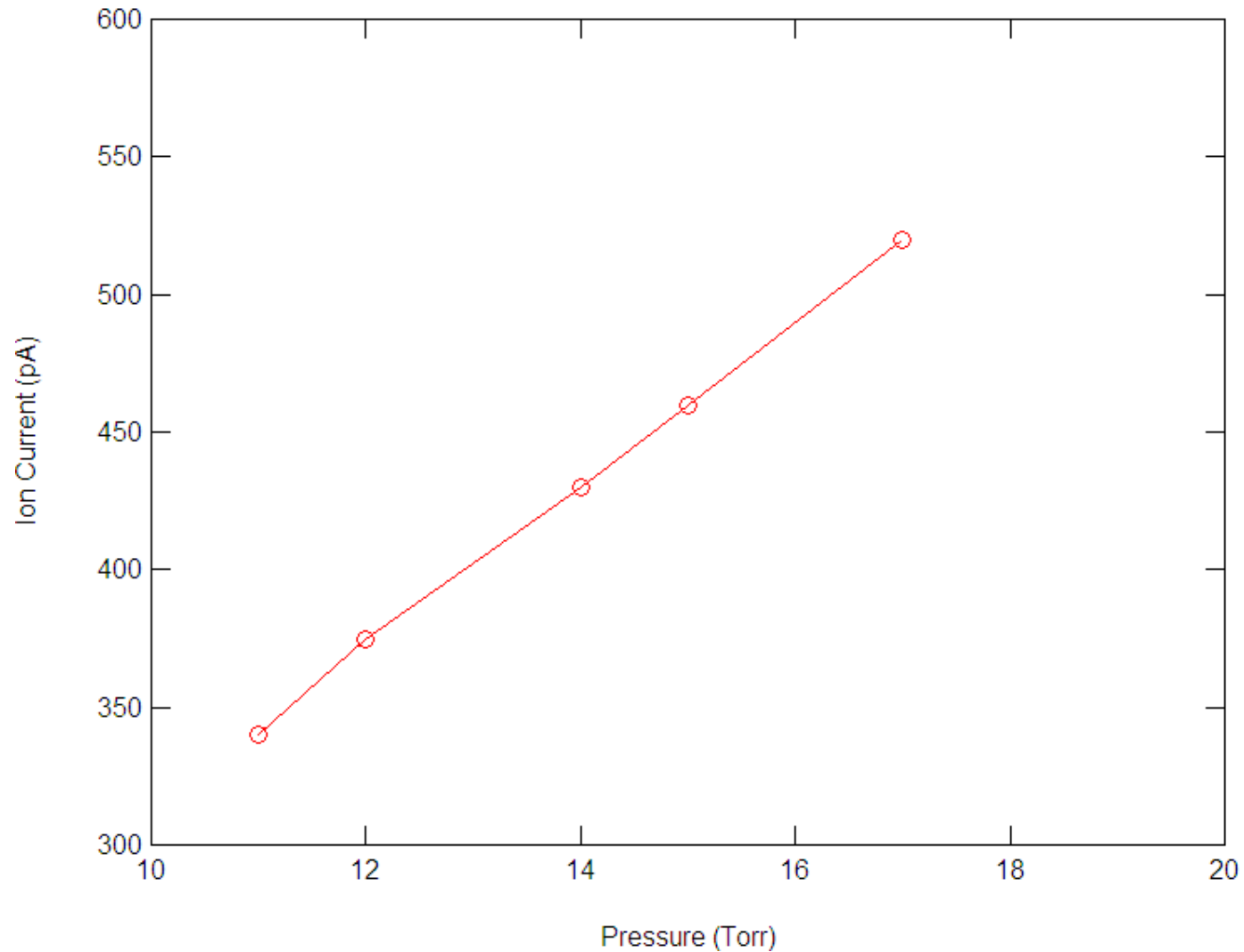


0.5 mCi Am-241 OR cathode discharge

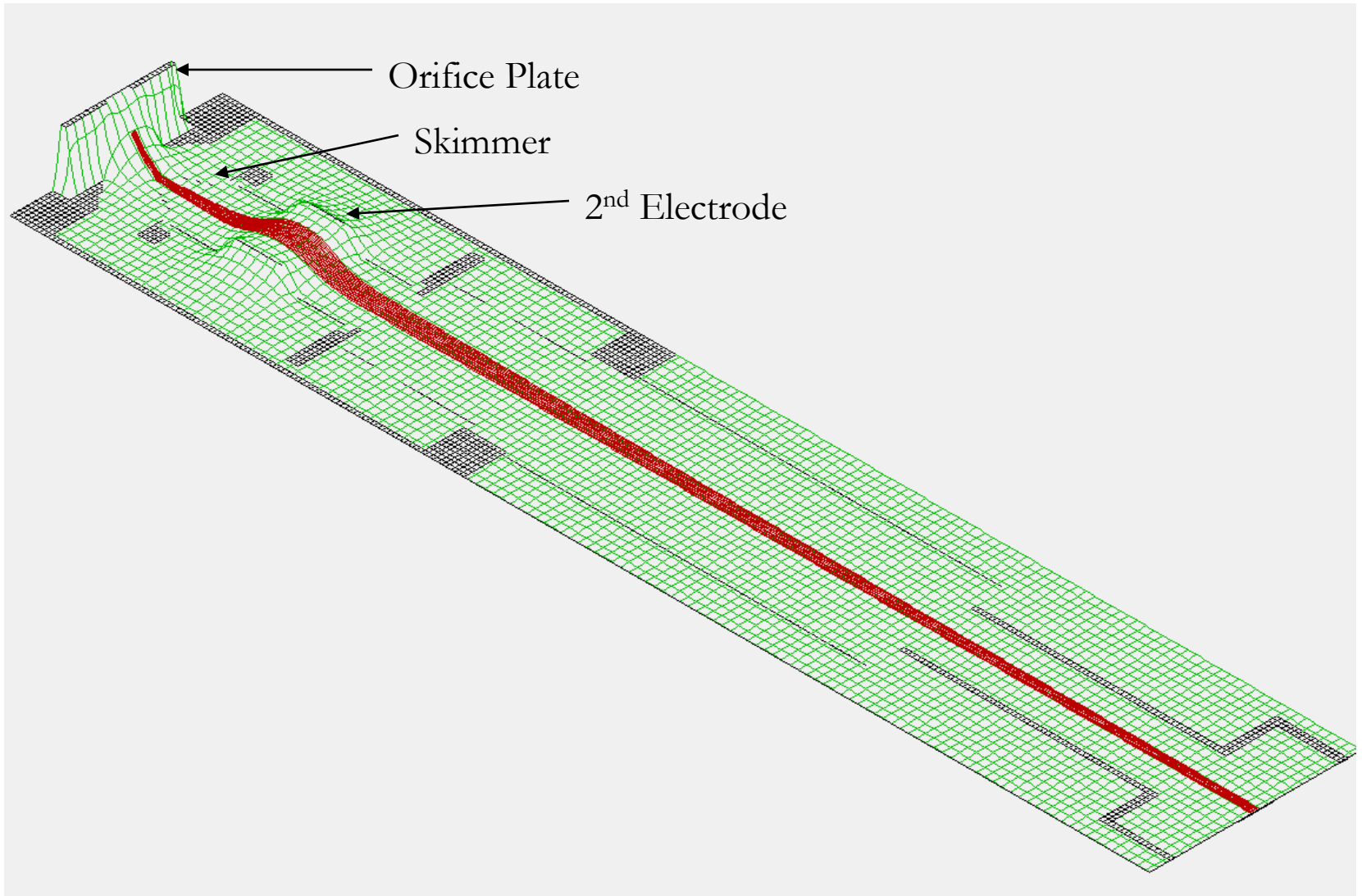
# Am 241

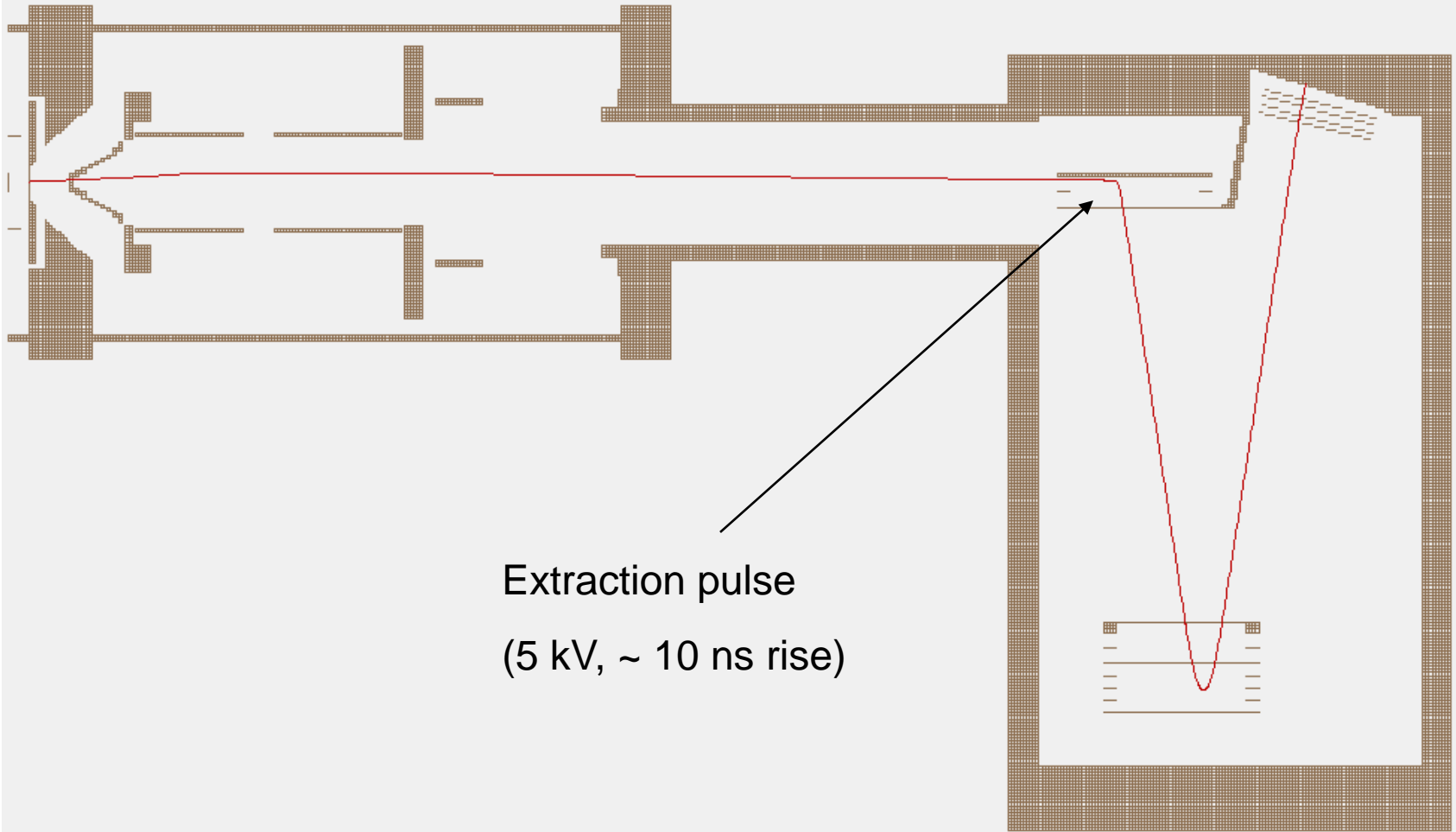


# Ion Production – Faraday plate measurements

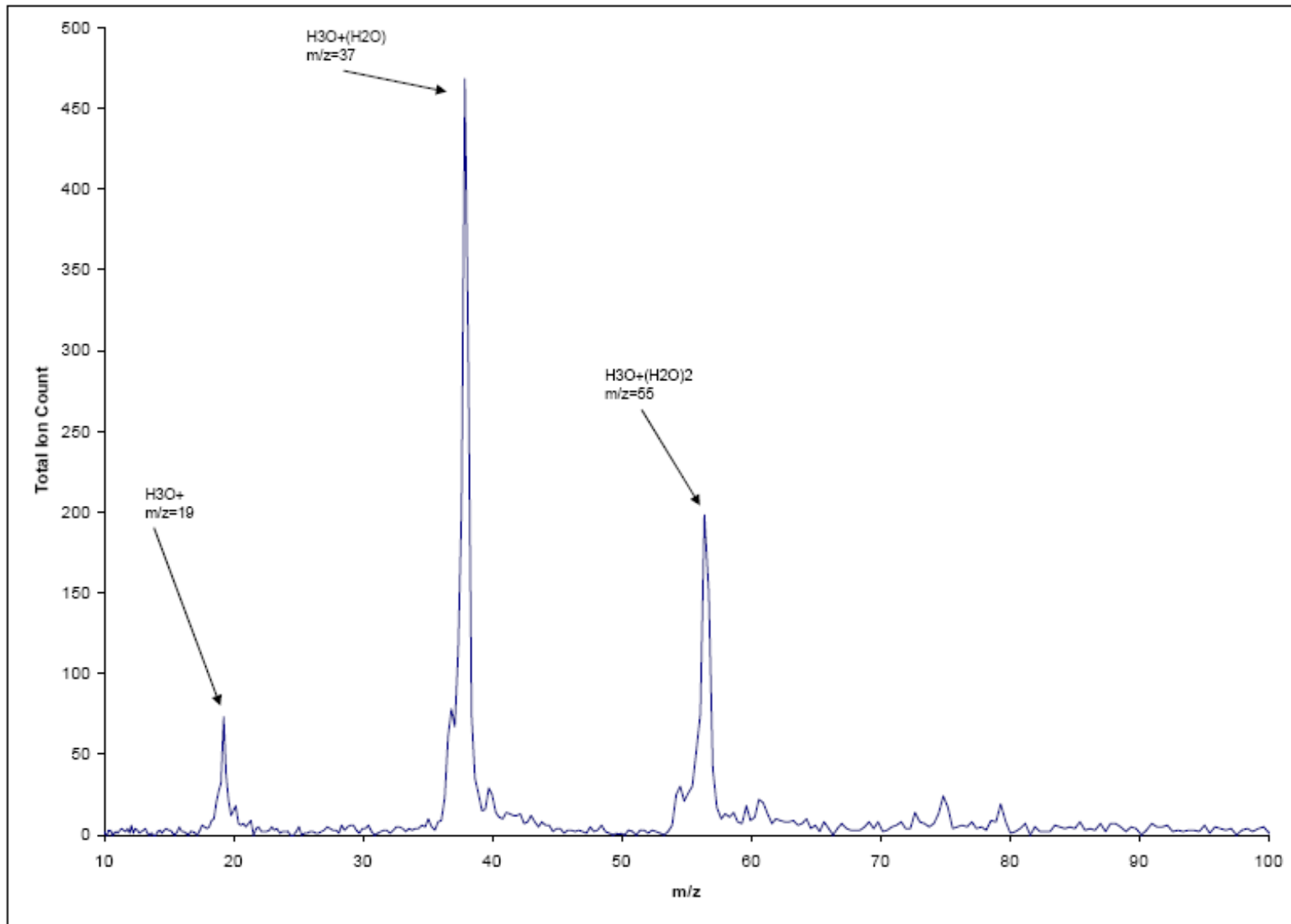


# Ion Focusing Region



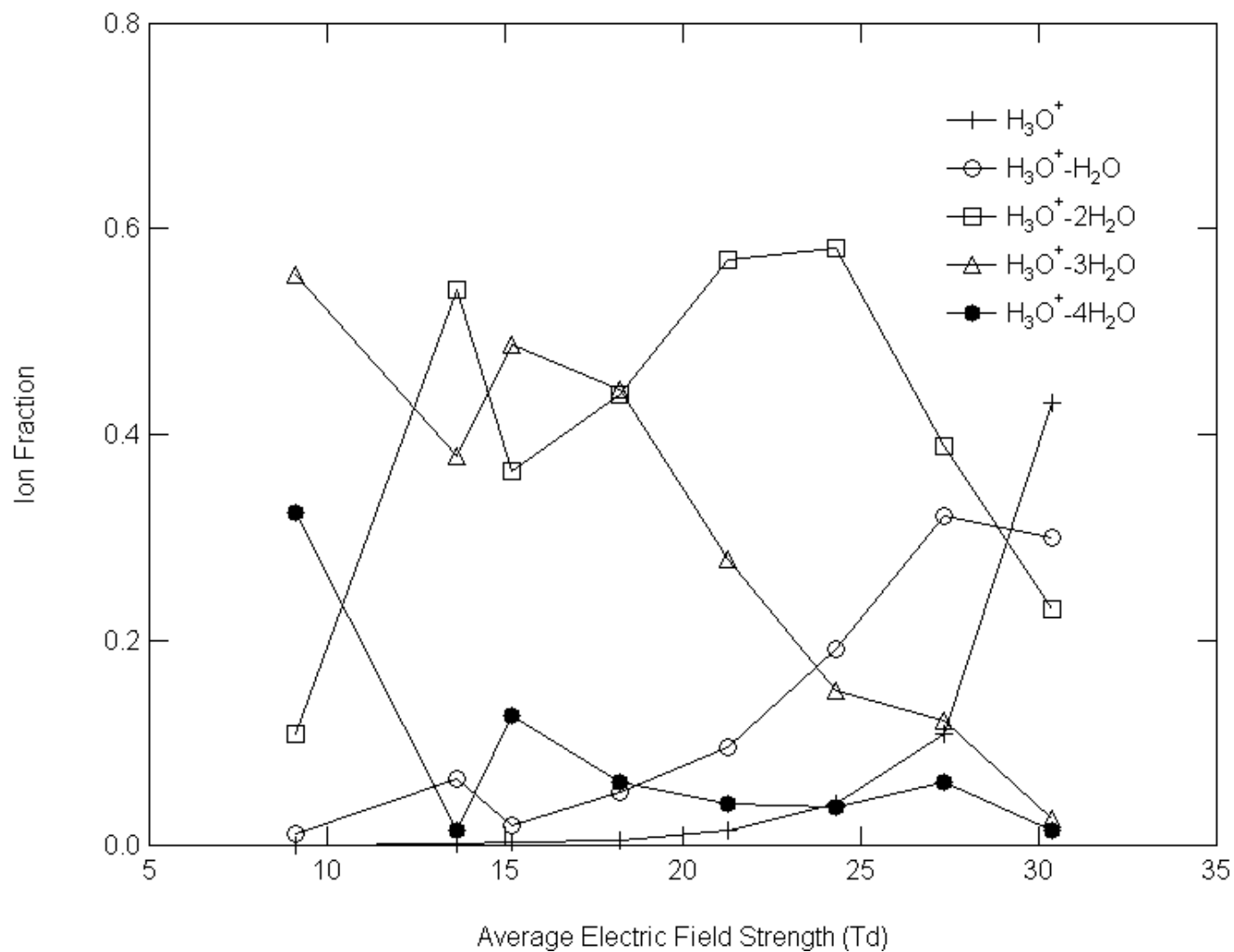


# Reactant ions

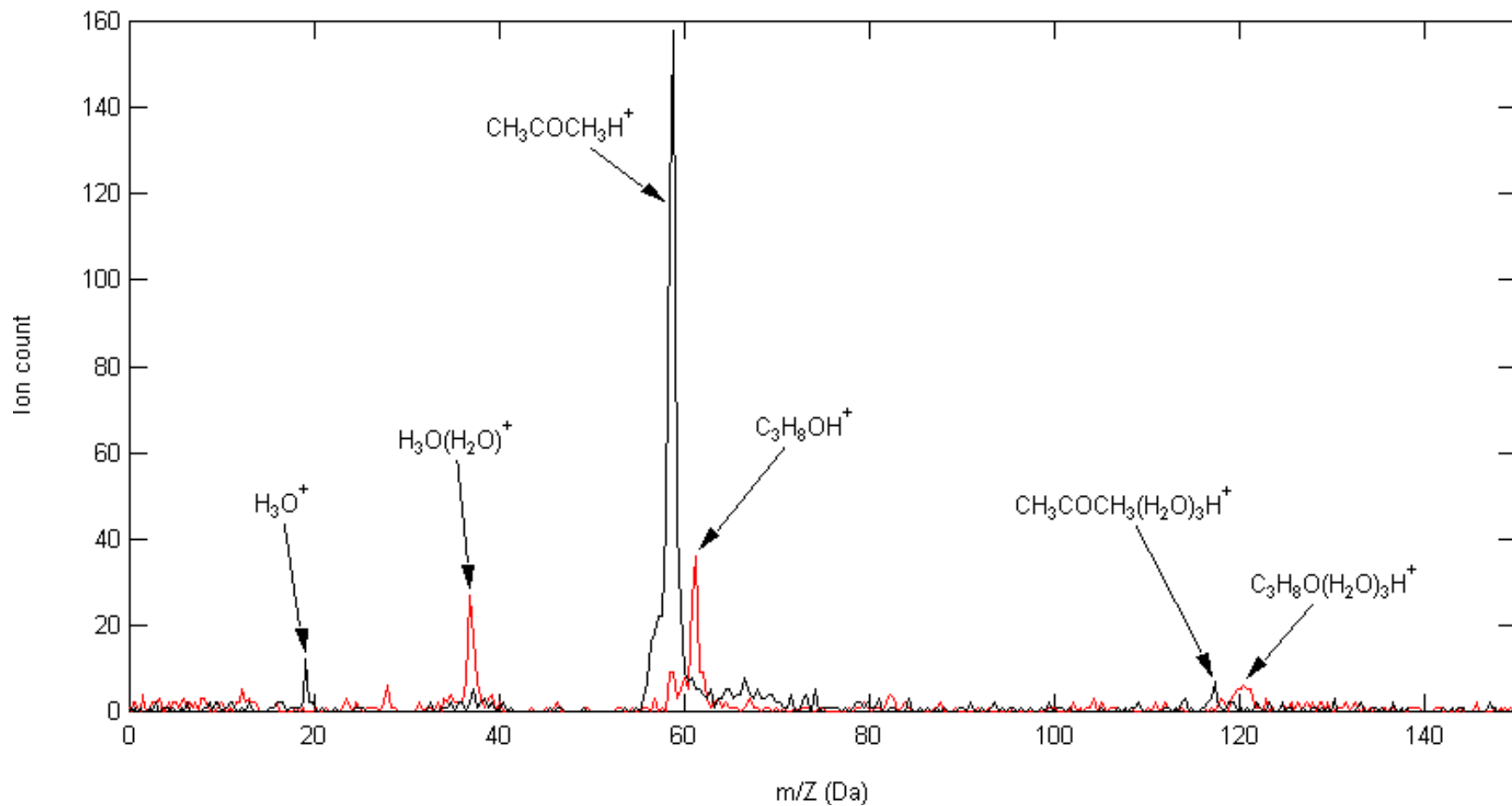




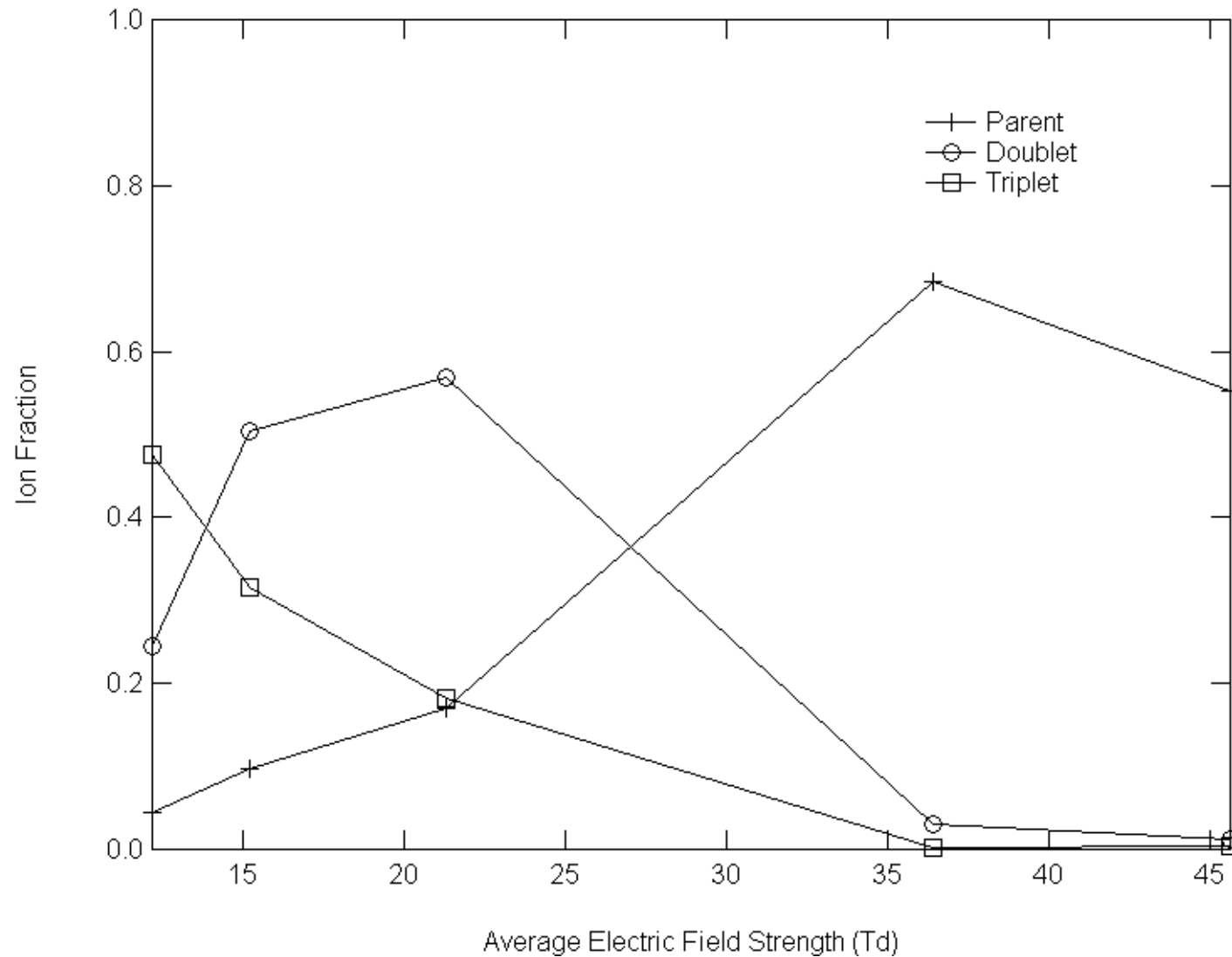
# Reactant ion clusters



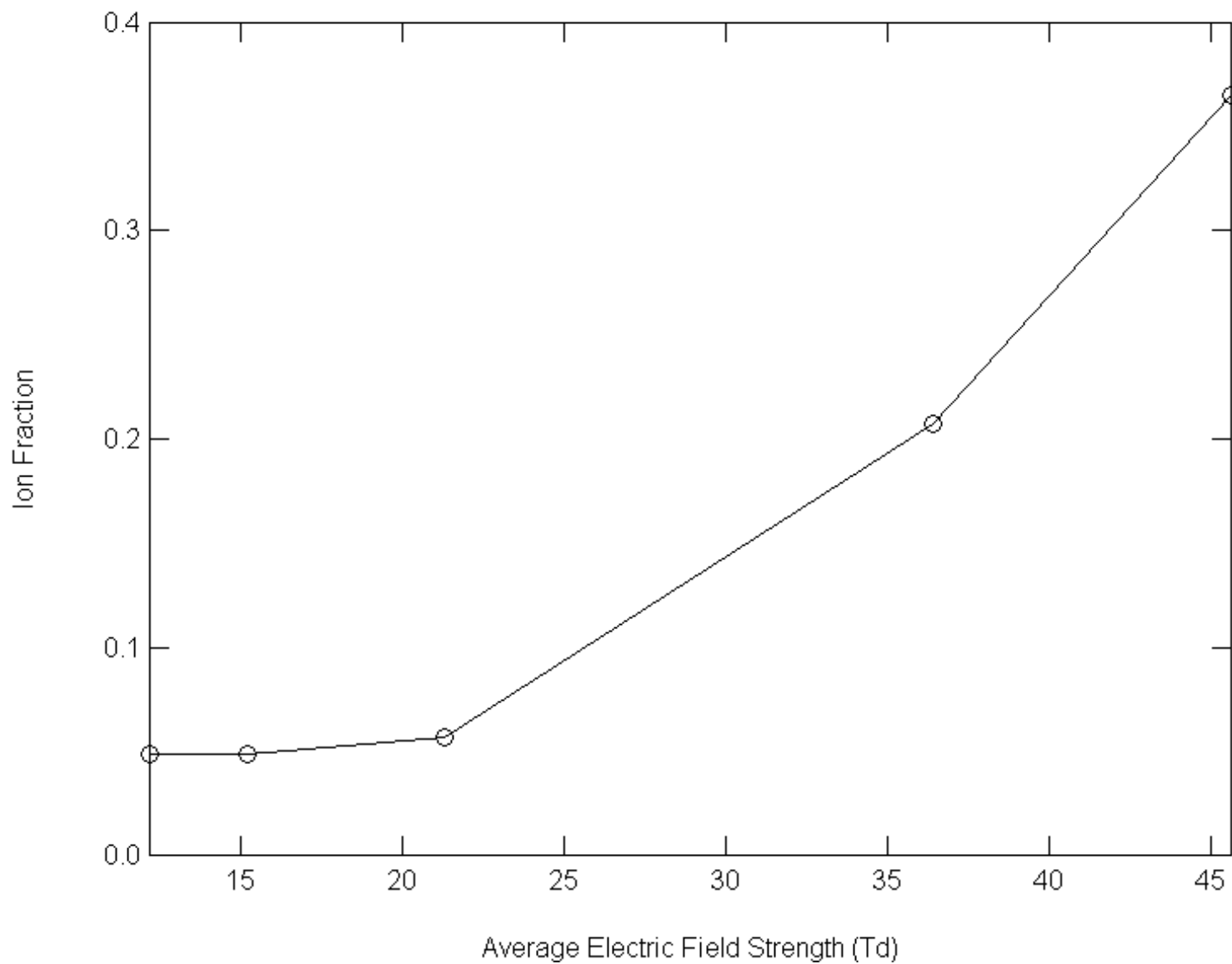
# CIMS spectra of acetone & isopropanol at 12 Torr



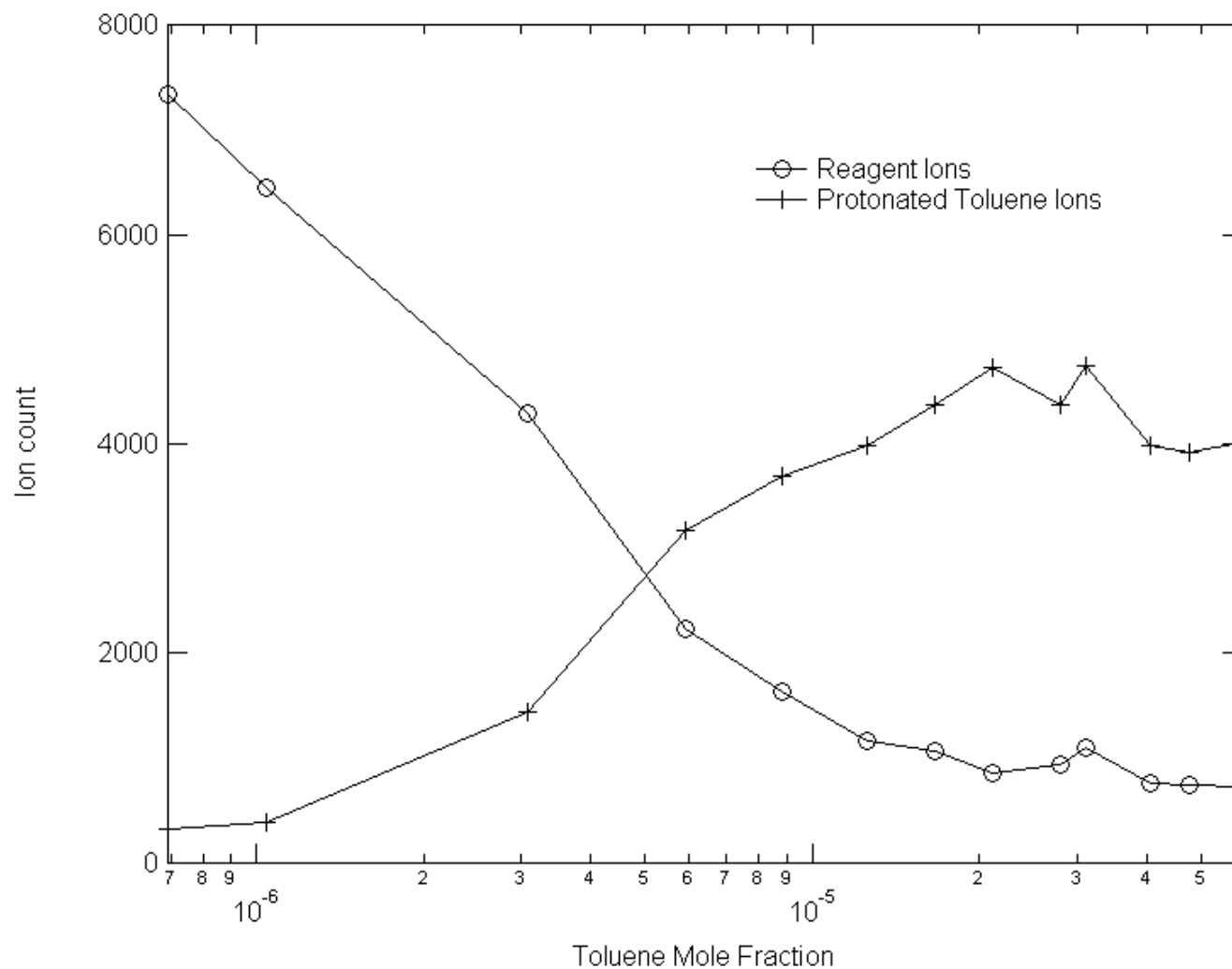
# Dependence of sample ion clustering on field strength (isopropanol)



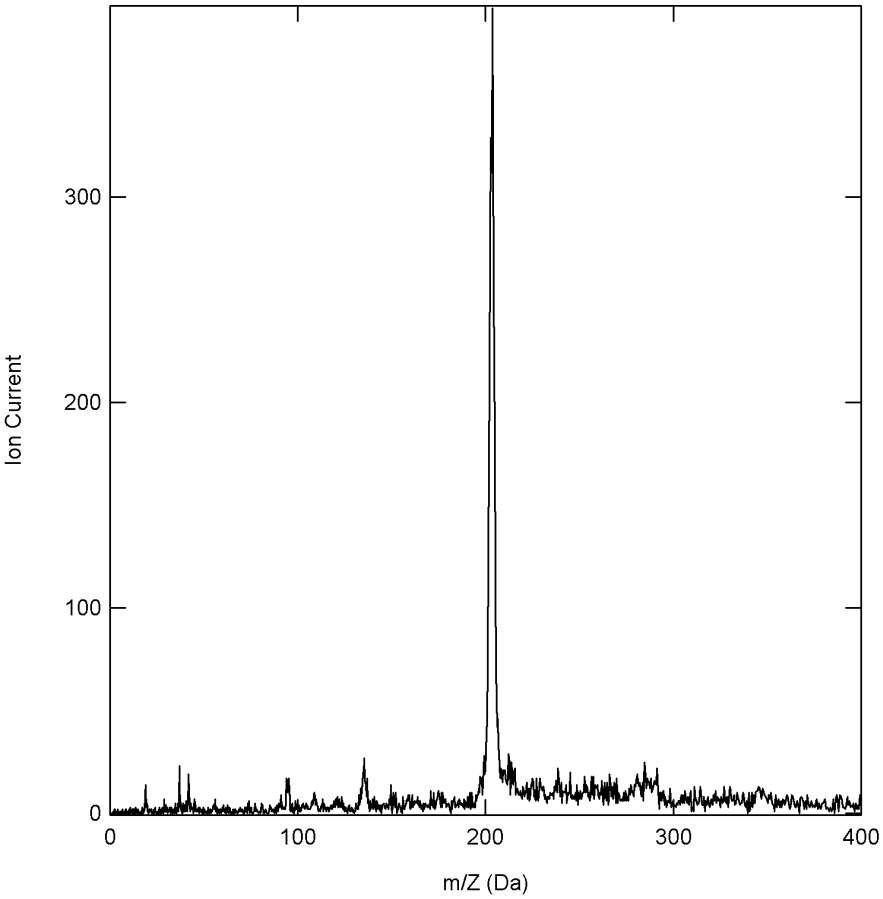
# Dependence of fragmentation on field strength ( $C_3H_7^+$ )



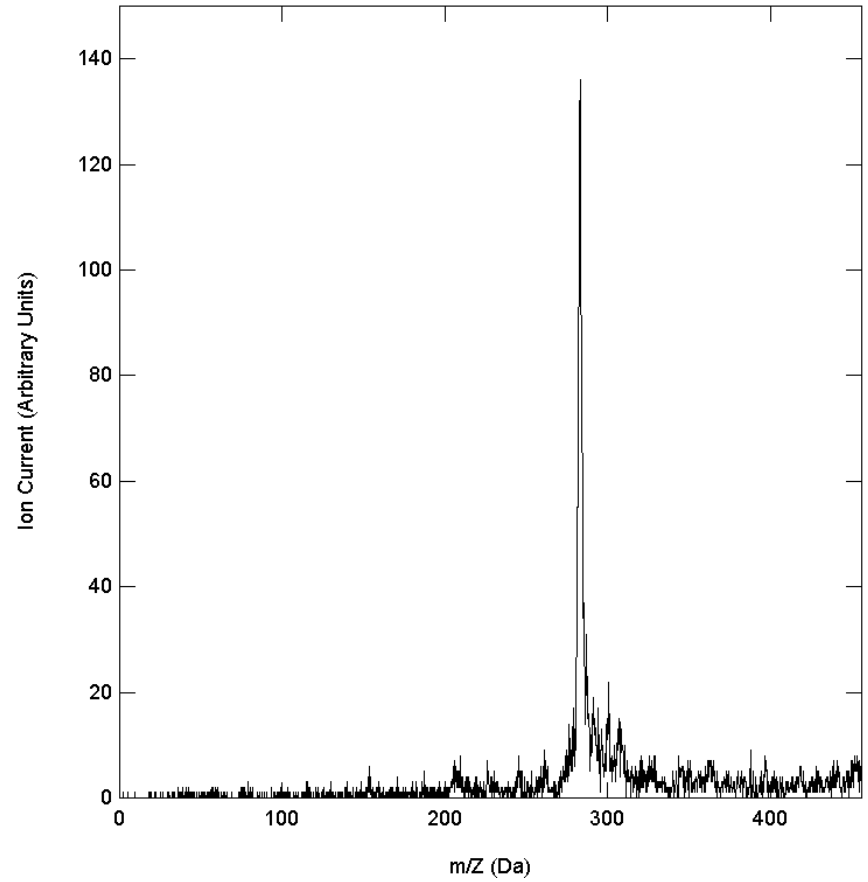
# Sensitivity - toluene



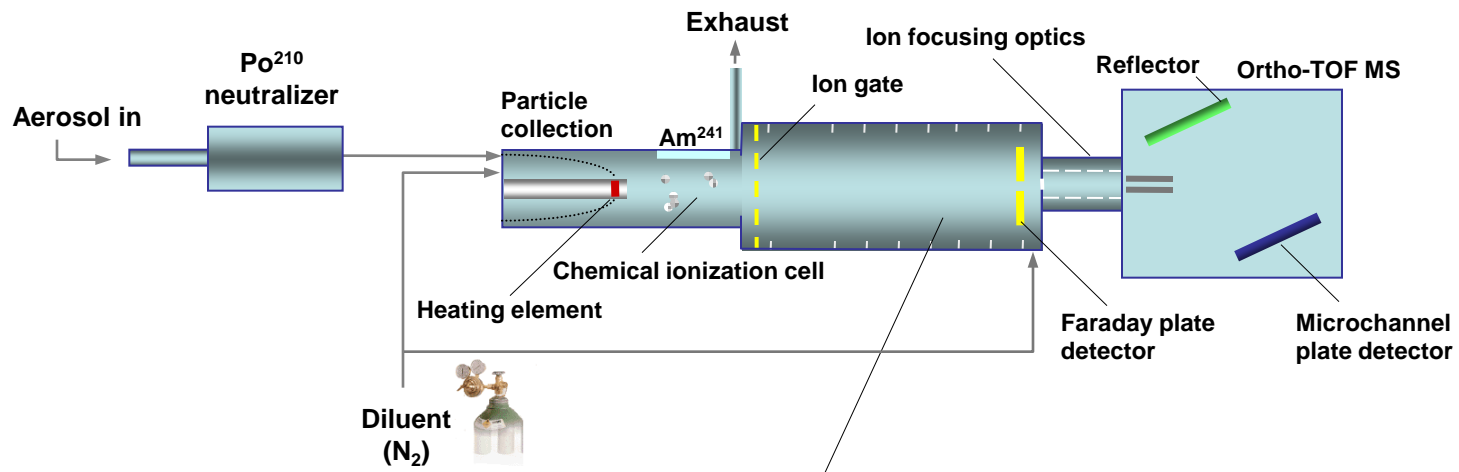
# Organic aerosol standards



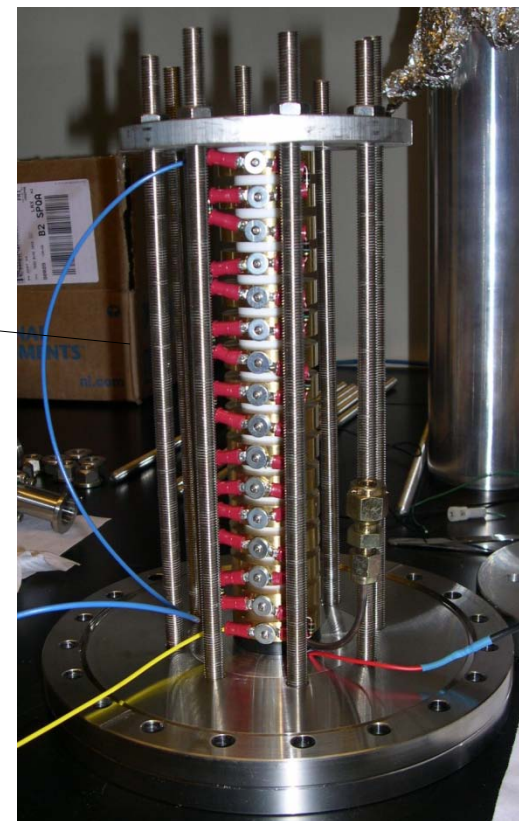
Pyrene



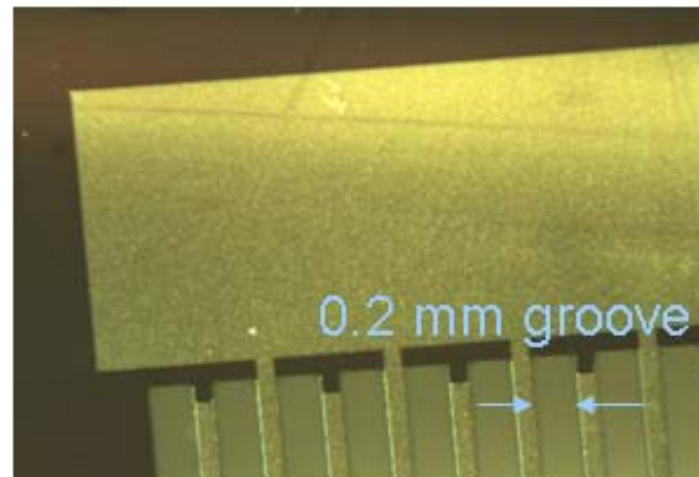
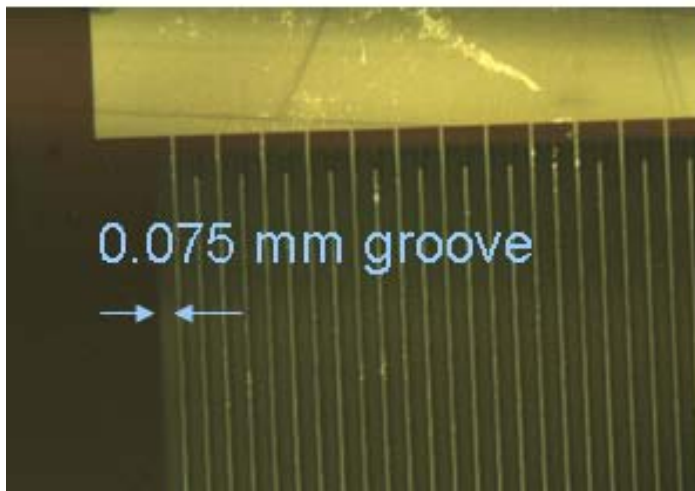
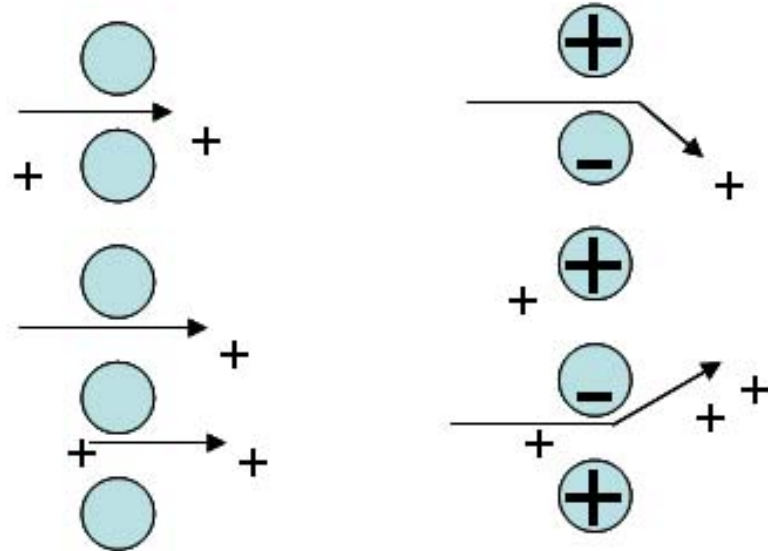
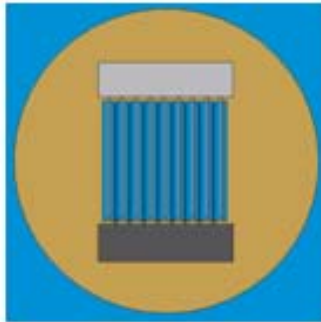
Oleic Acid



Low pressure ion mobility drift cell

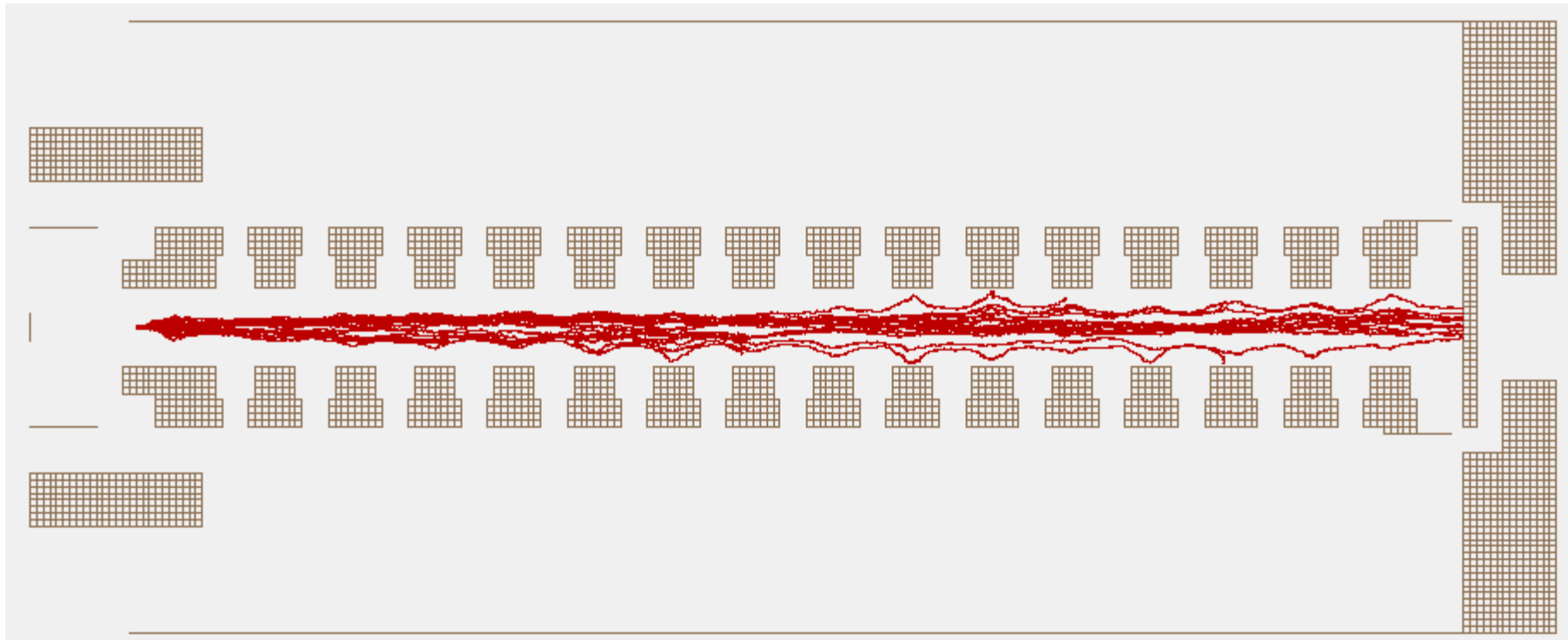


# Bradbury-Nielson Gate (BNG)

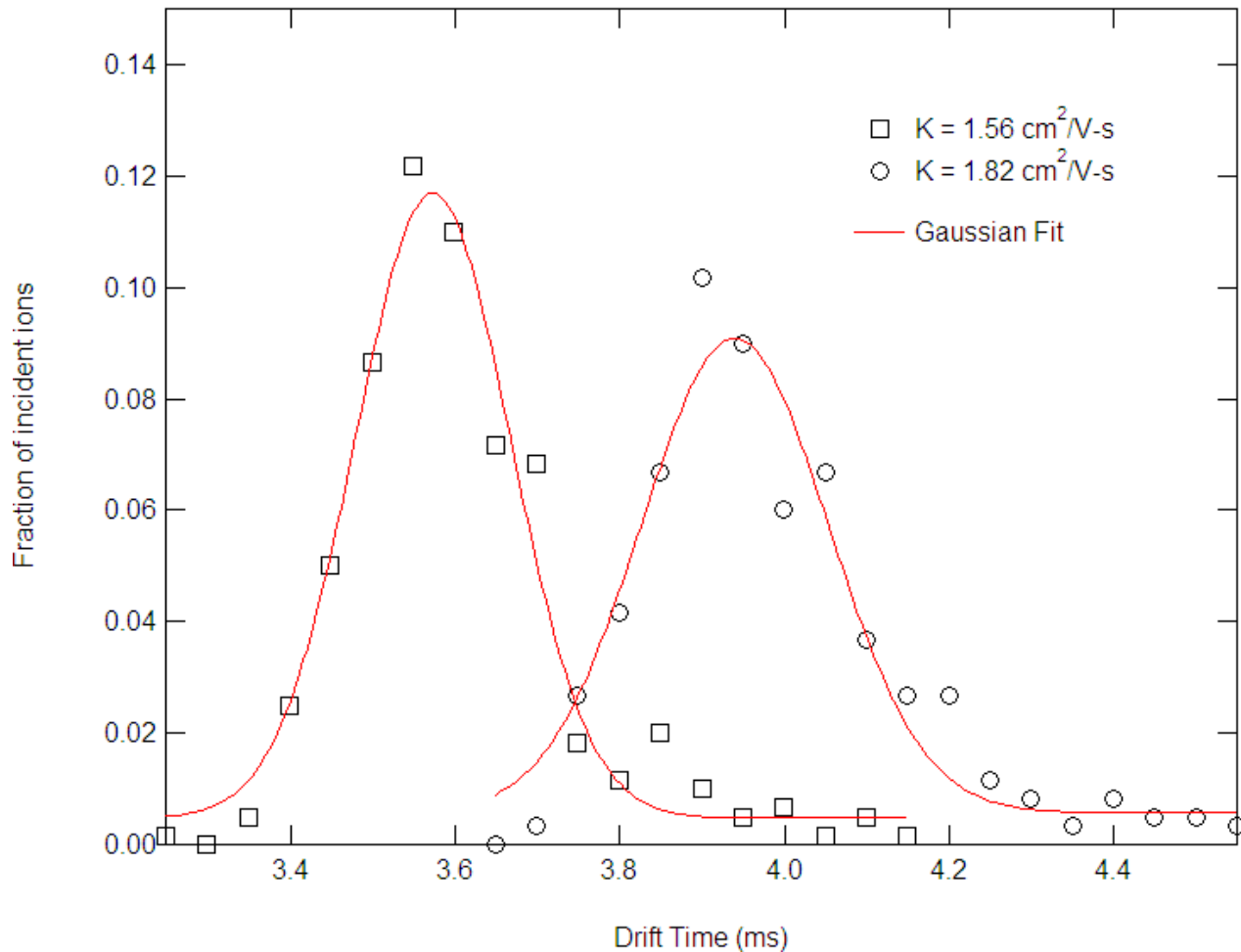




# Modeling of ion trajectories

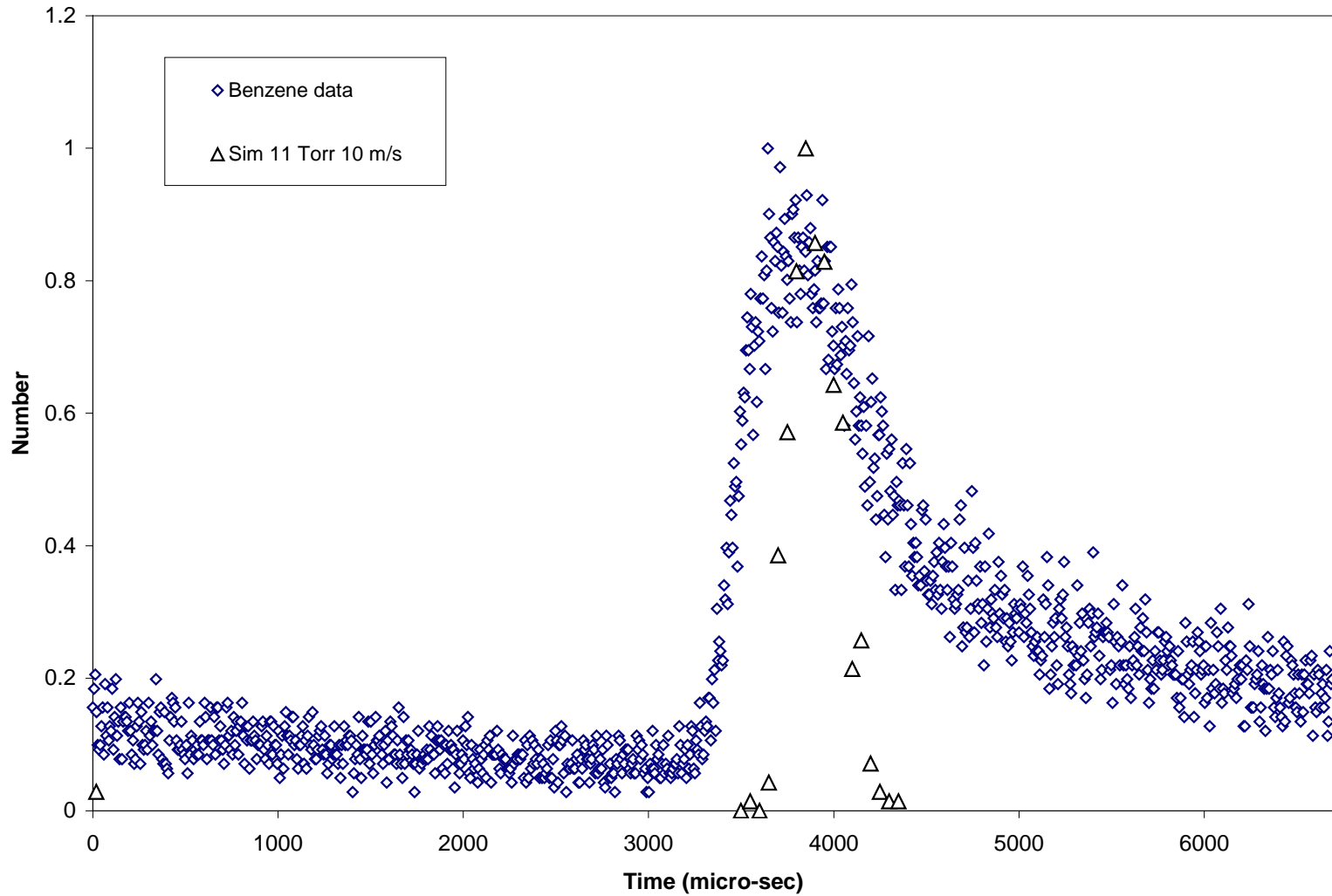


# Predicted ion drift times

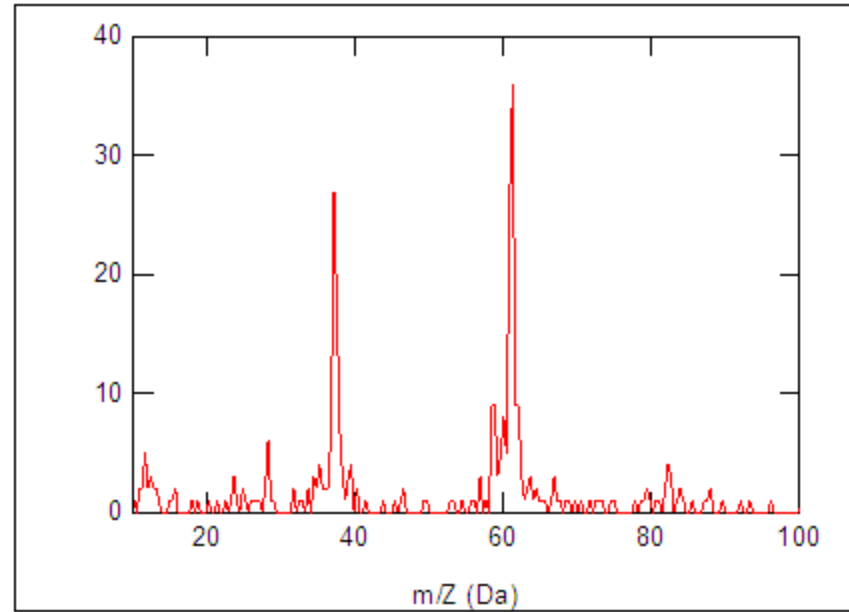
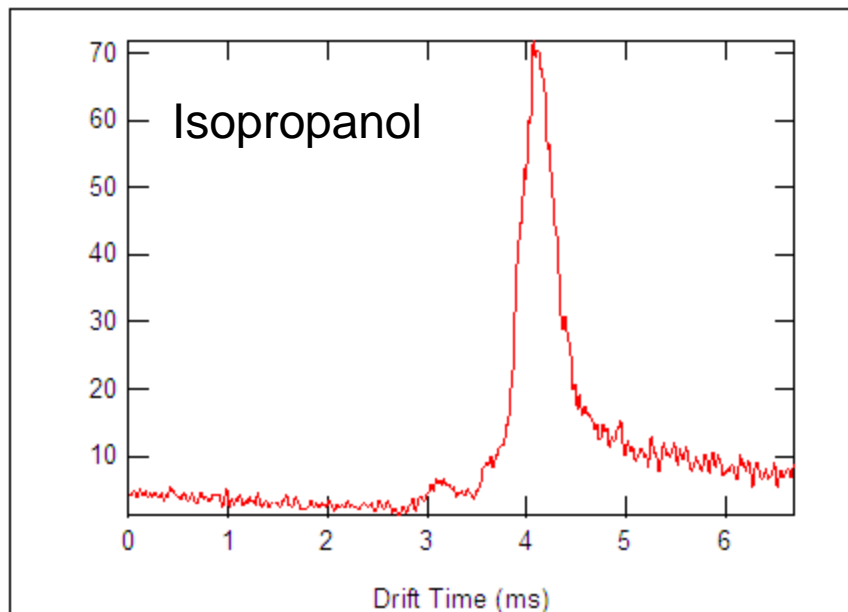
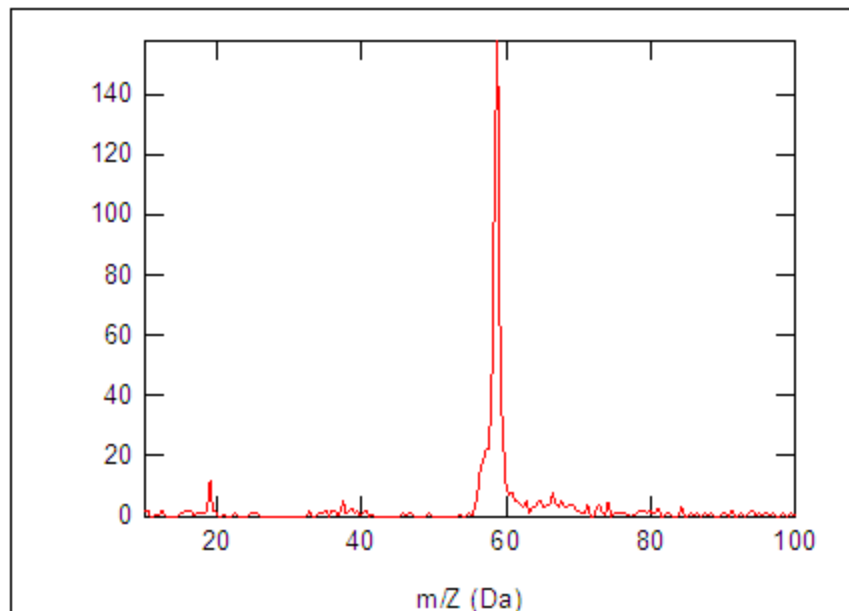
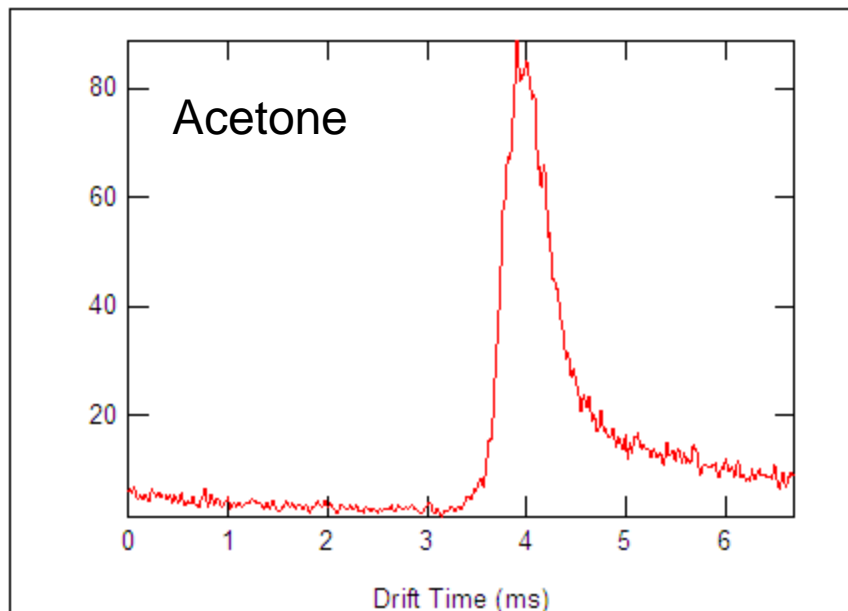


RESOLUTION ~ 10

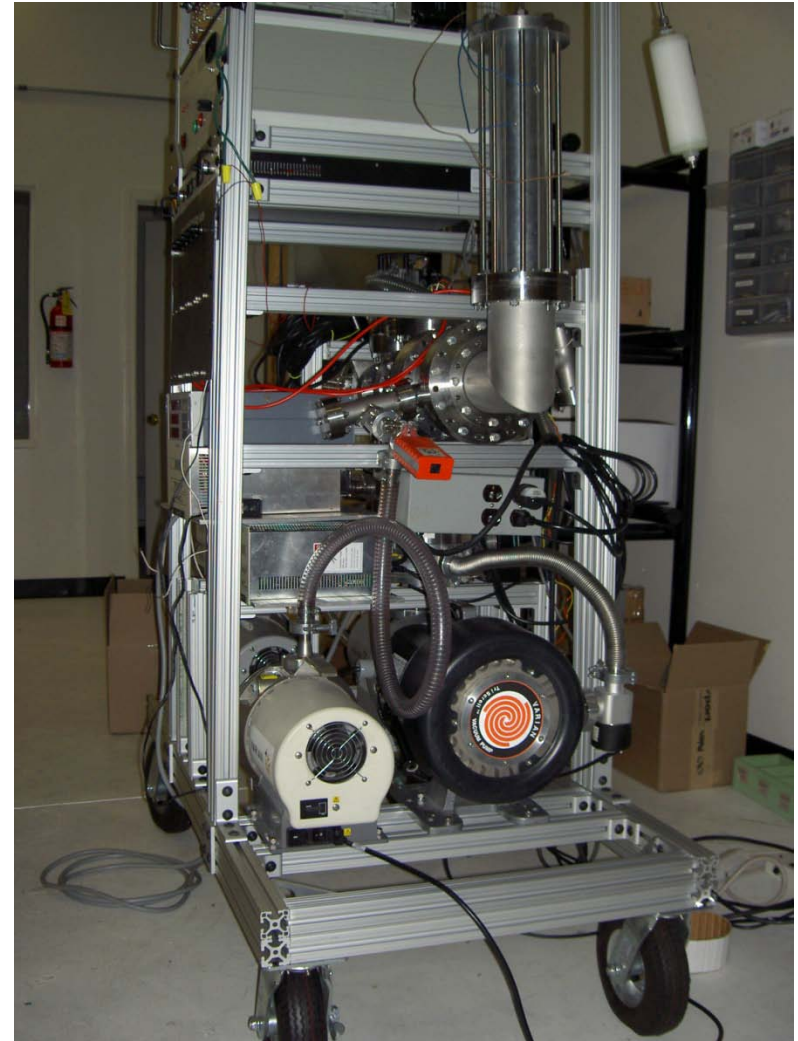
# Mobility spectrum of benzene – experiment vs simulation



## *Ion Mobility Spectra*



# Aerosol CIMS - Deployment



# Mobile Sources (Deployment Possibilities)

- Light Duty Freeway (110, Highland Park)
- Heavy Duty Freeway (710, Downey)
- Port of LA
- LAX
  
- SOA formation evolution (USC → Riverside)
- Currently deployed in Pasadena (CalNEX study)

# Acknowledgments

- **Graduate Students:**  
**Sonya Collier, Angela Shibata**
- **Postdoc:**  
**Gregory Poskrebyshev**
- **Undergraduates:**  
**Gustavo Buenrostro, Matt Mercker**