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Instantaneous Detection of Particles Liberated by Open Detonation Treatments

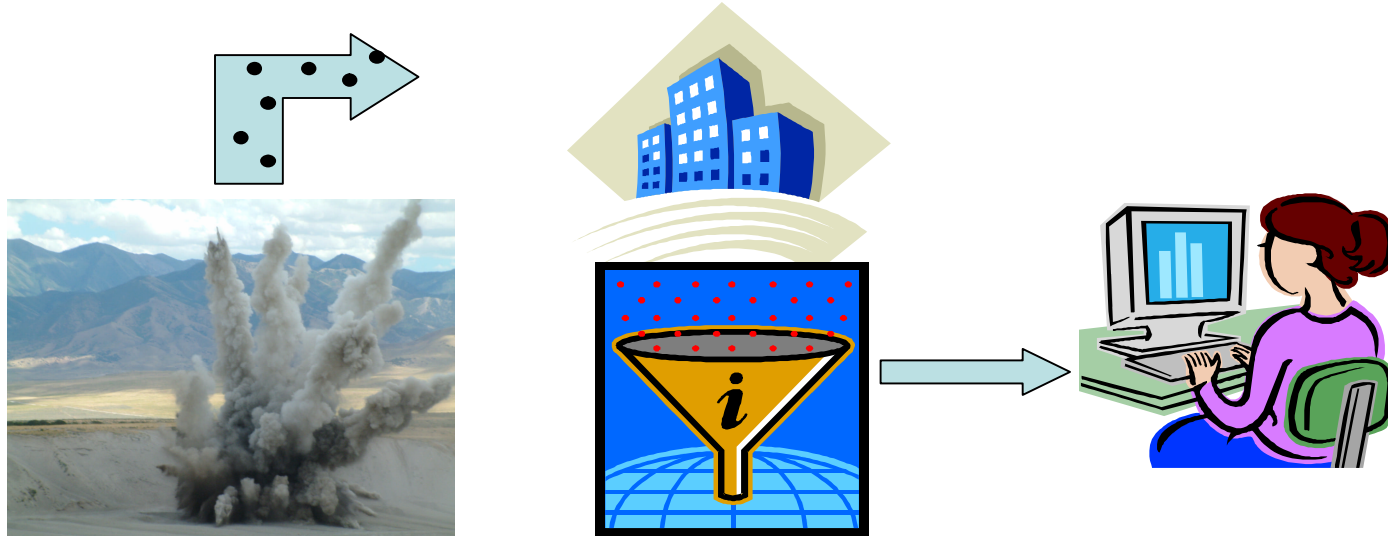
D. P. Fergenson, G. R. Farquar

April 28, 2006

Instantaneous Detection of Particles Liberated by Open
Detonation Treatments
Indianapolis, IN, United States
May 5, 2006 through May 9, 2006

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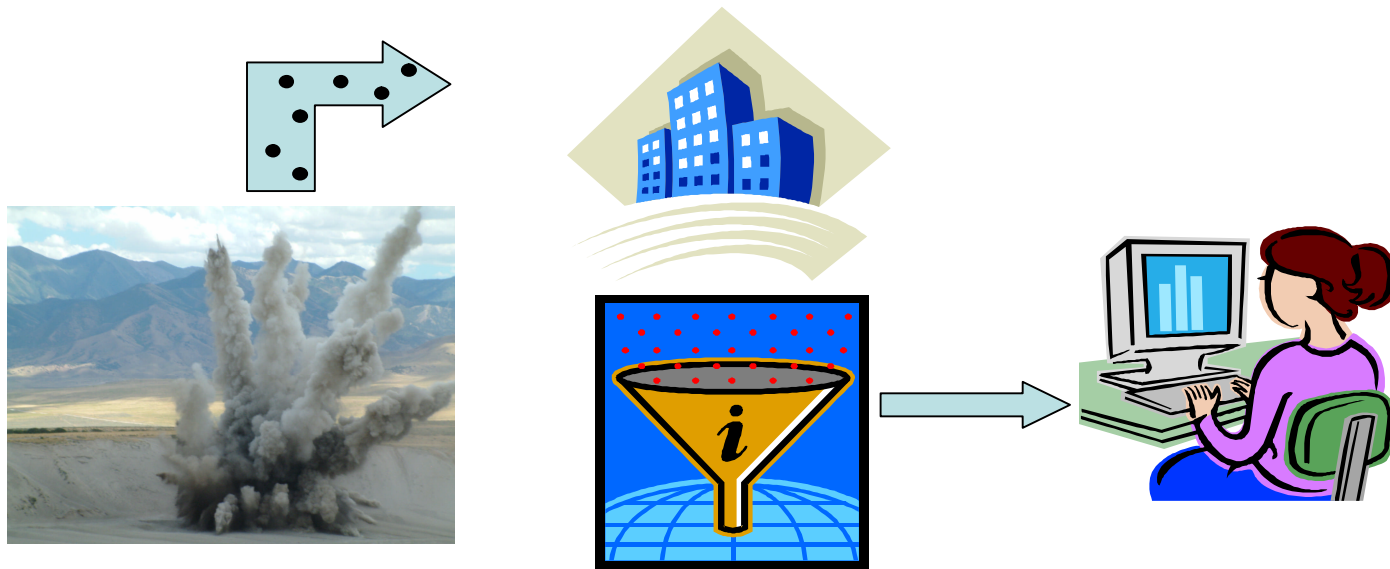


Instantaneous Detection of Particles Liberated by Open Detonation Treatments

Dr. David P. Fergenson and Dr. George R. Farquar
Lawrence Livermore National Laboratory

The Idea:

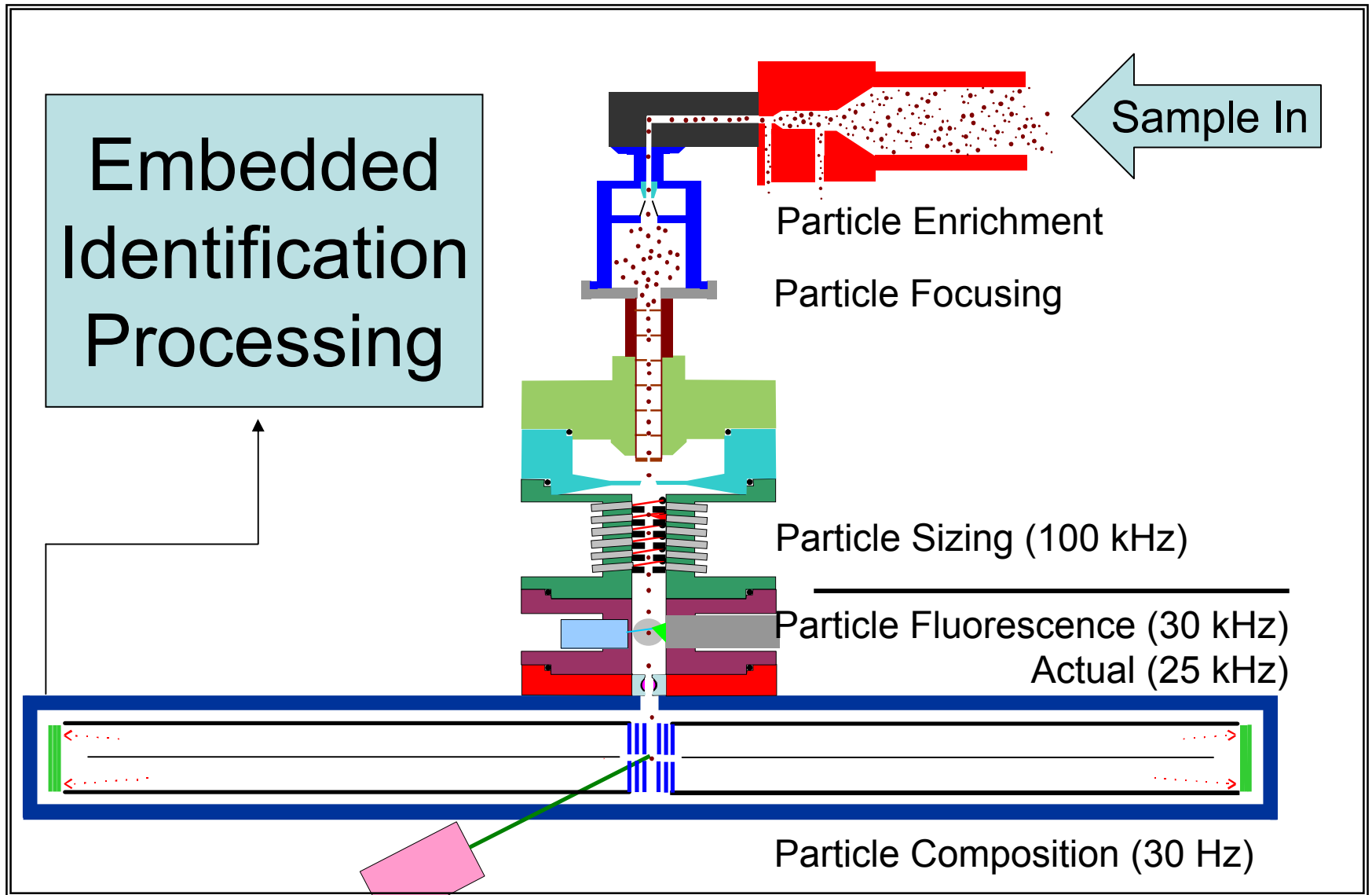
This project supports DAC's effort to increase efficiency of operations.



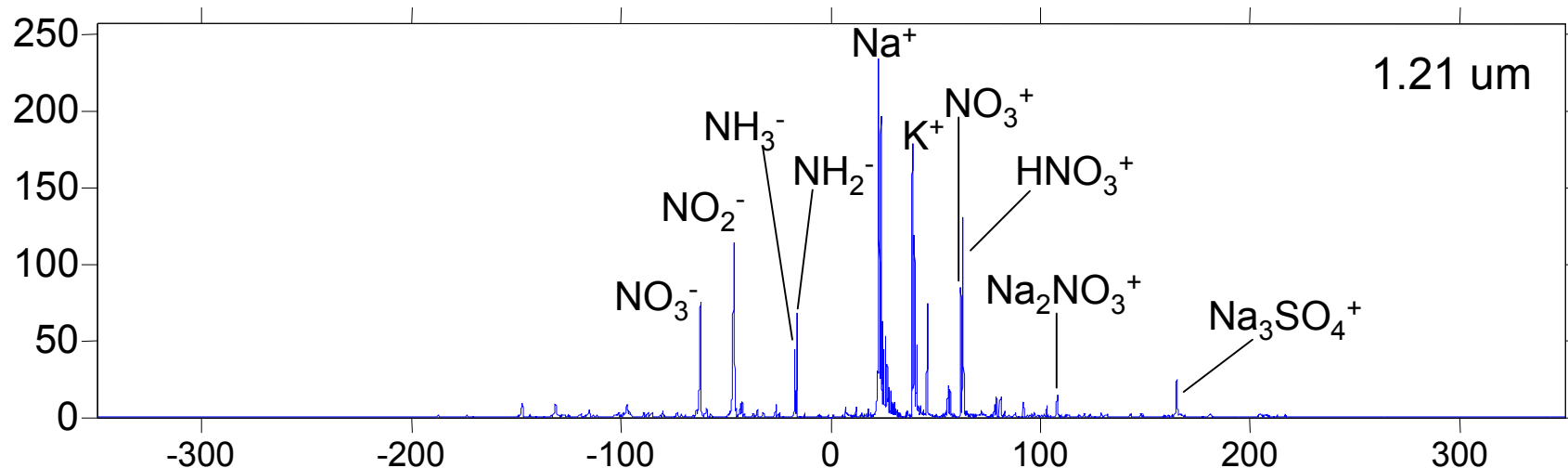
Open Detonation treatments release aerosol particles:

- Characterize the particles generated
- Track these particles in the environment
 - Fencelines
 - Residential areas

Particle Analysis by Mass Spectrometry (PAMS)

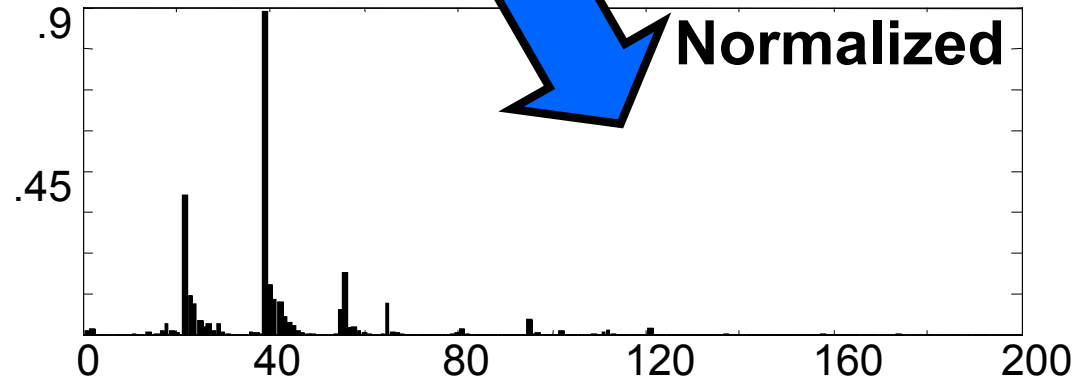
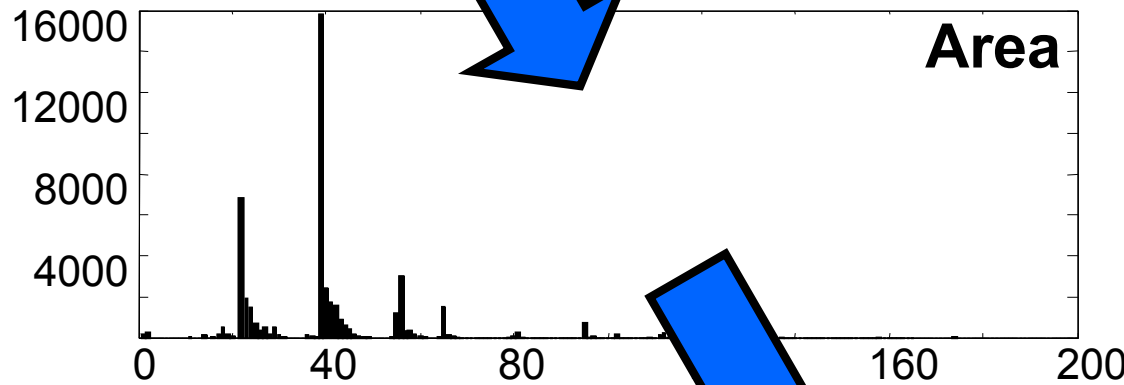
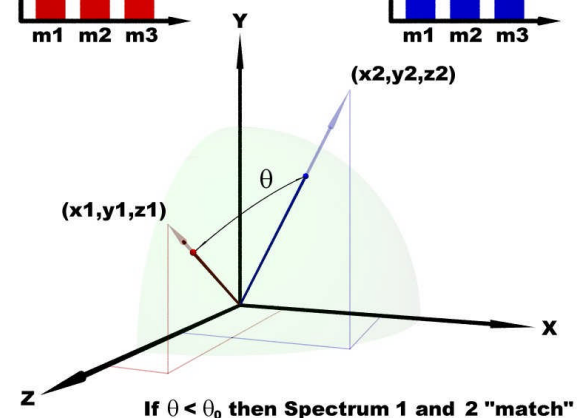
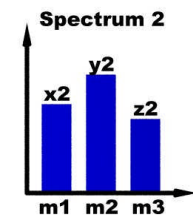
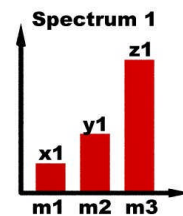
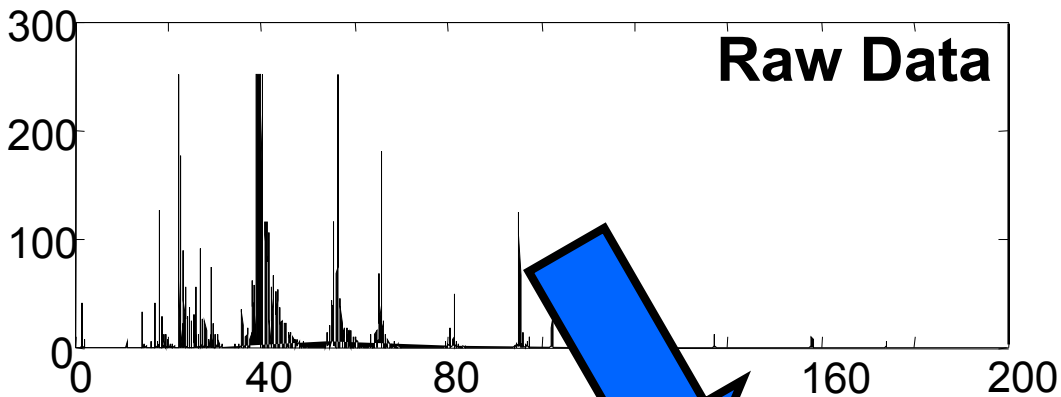


Example of Single Particle Data



- Two complete mass spectra from each particle
- Size and composition returned in real time
- Data analysis can be performed in real time as well

Data Analysis

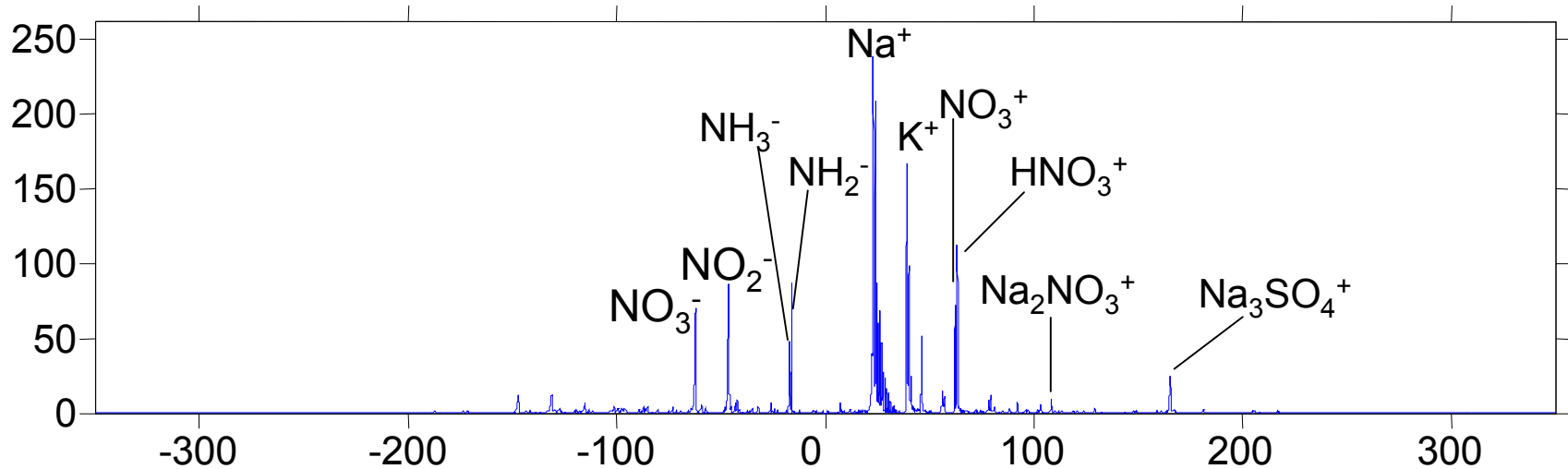


Proving the Concept



LLNL Site 300, Bunker 850

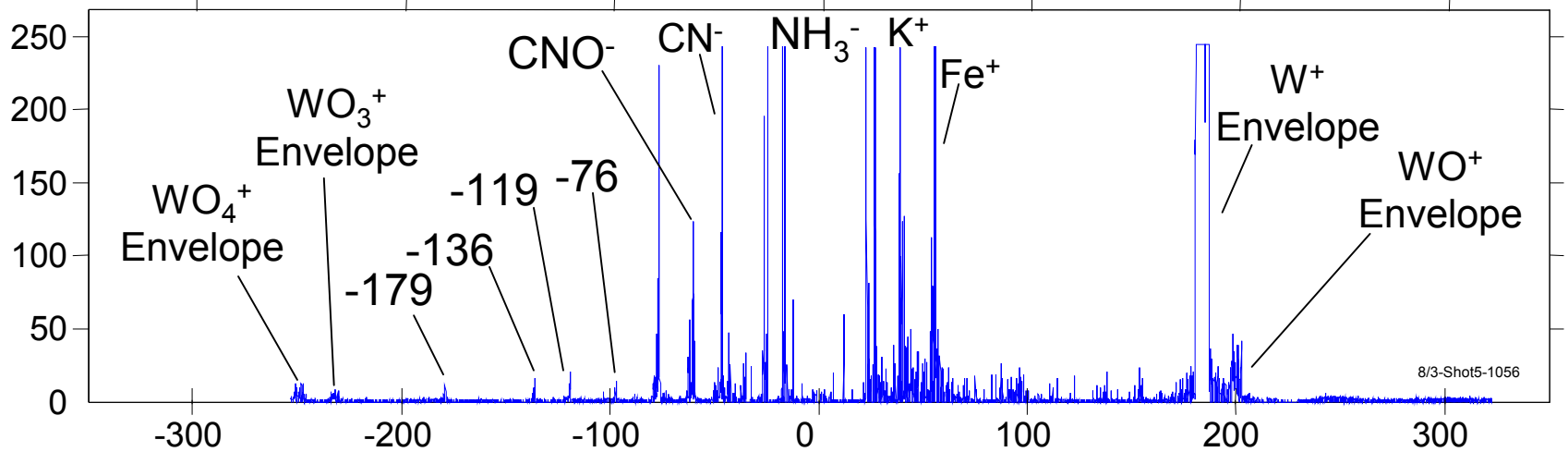
~90% of Site 300 Background:



Classic “Reacted Marine” Particles

- Originated as breaking ocean waves
- Reacted with terrestrial sources of SO_x and NO_x
- Far fewer resuspended crustal particles

45% of Post Det Spectra Contained W

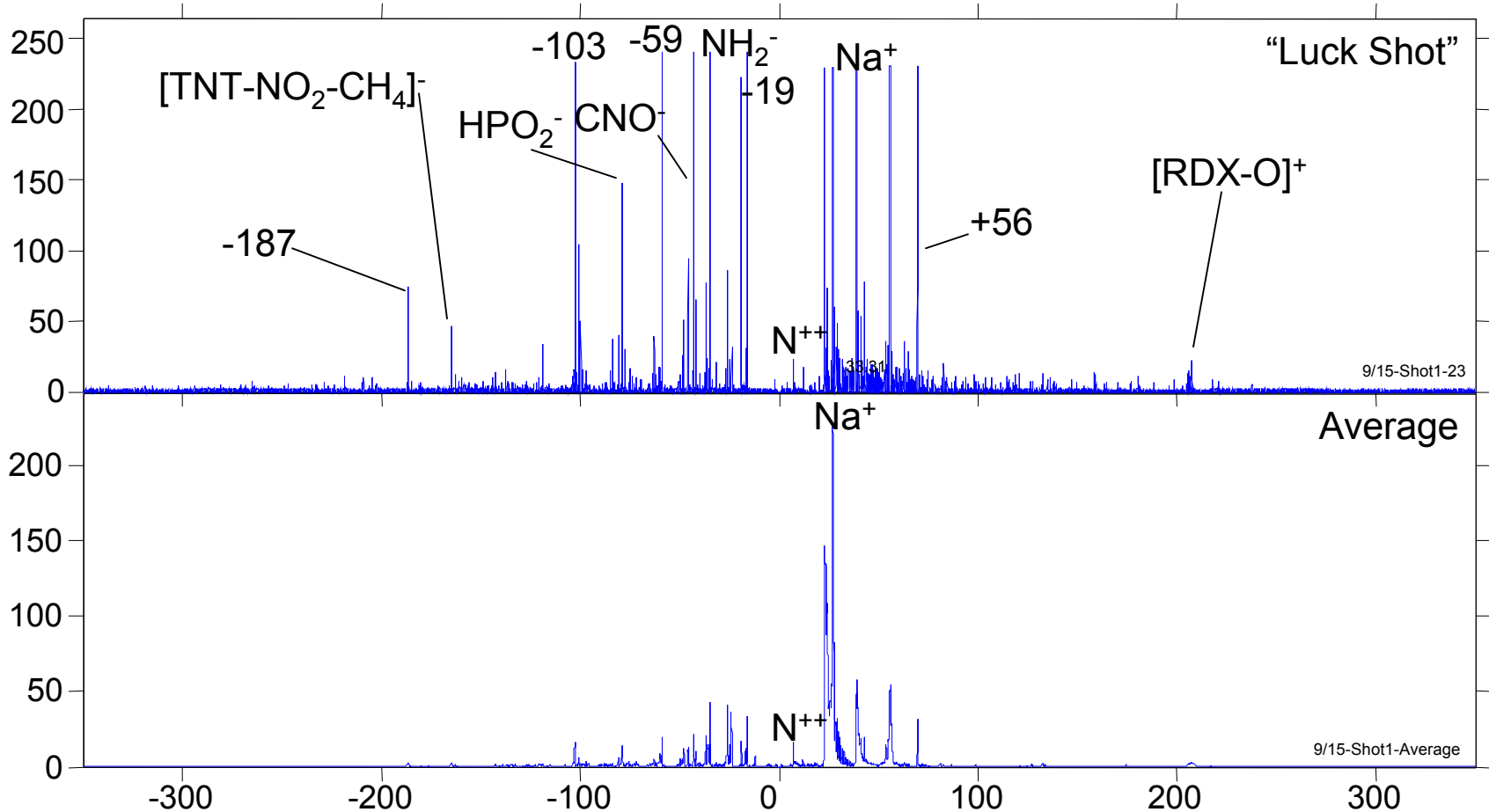


The BAMS at HEAF

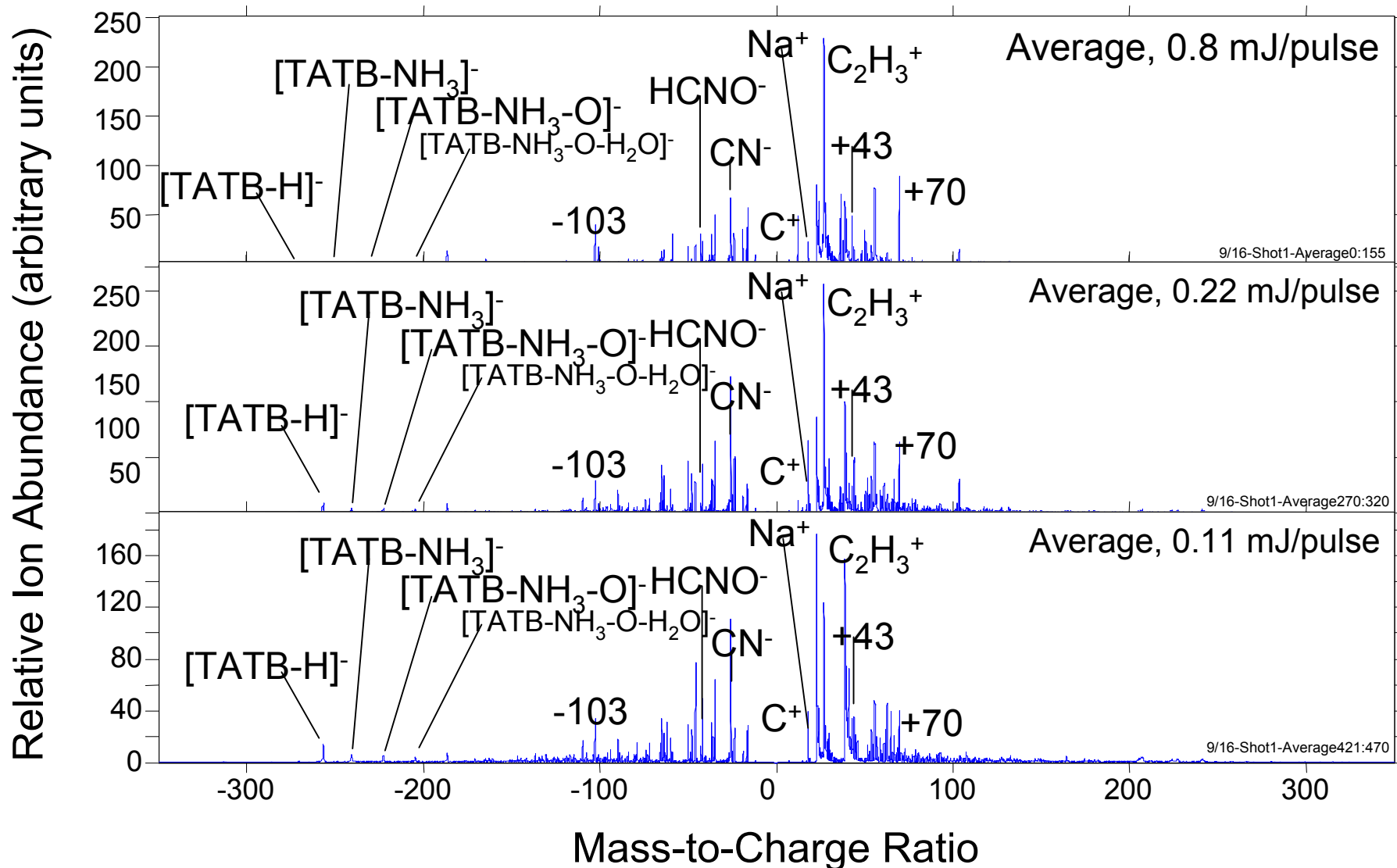


150 mg TNT and LX-17 charges.

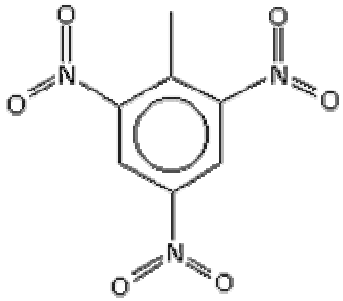
Comp B, 0.9 mJ/Pulse



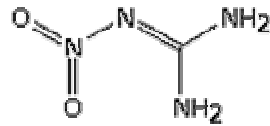
LX-17, Decreasing Laser Power



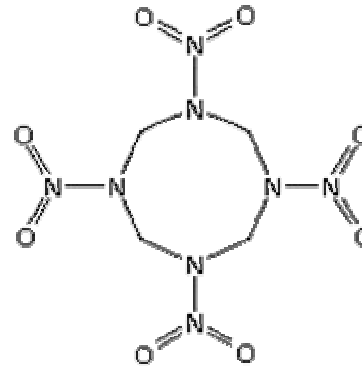
Expanding the Library: 4 pure and 3 mixture explosive



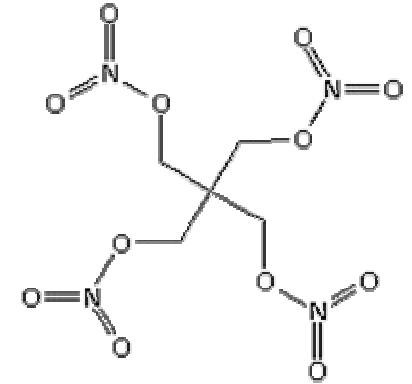
TNT



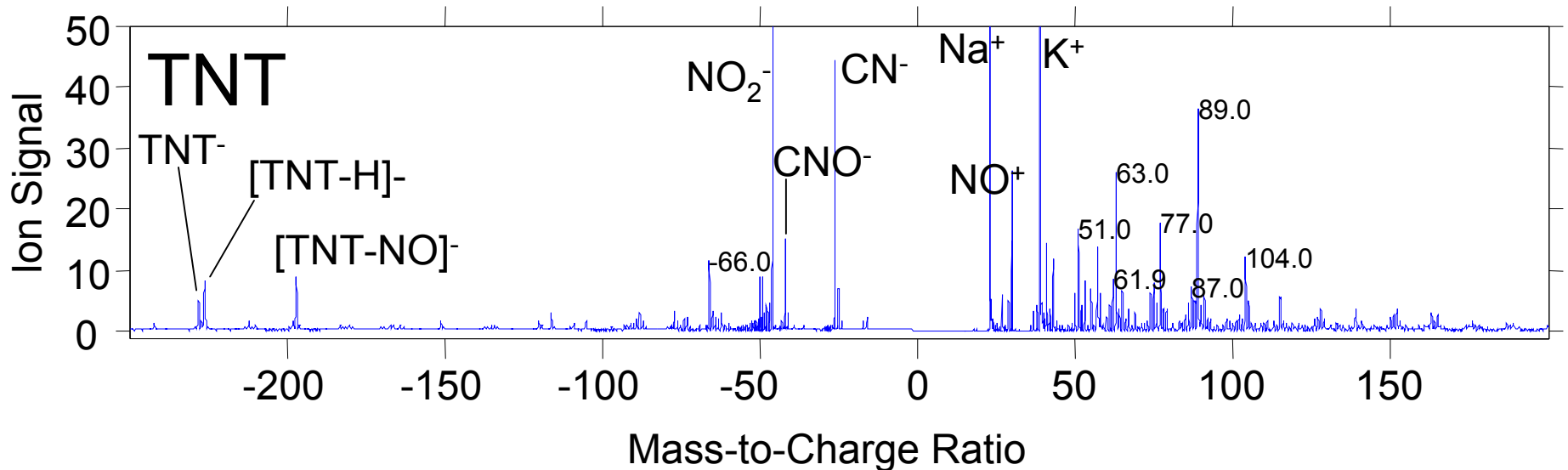
Nitro Guanidine (NQ)



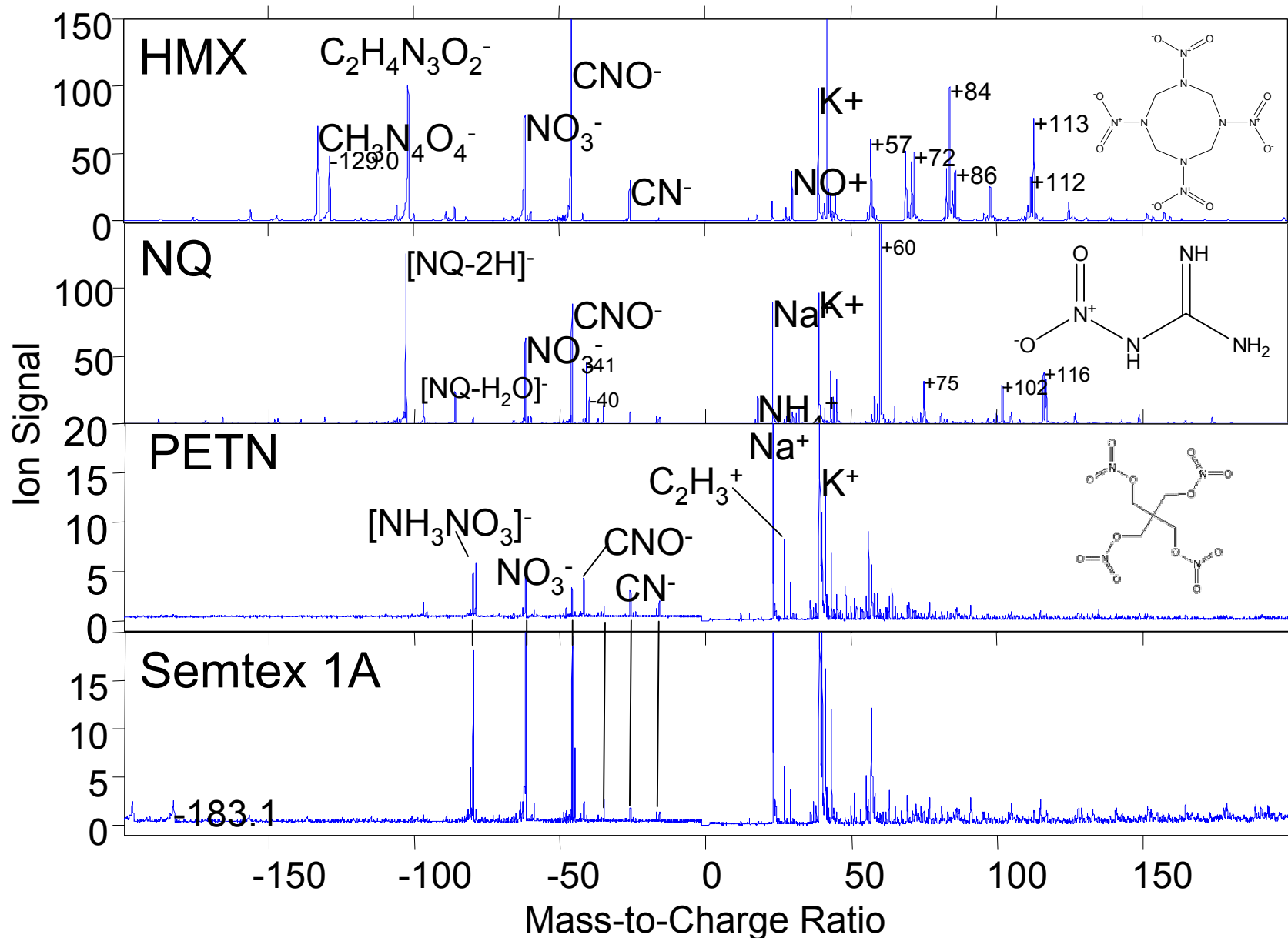
HMX



PETN



Other High Explosive Mass Spectra

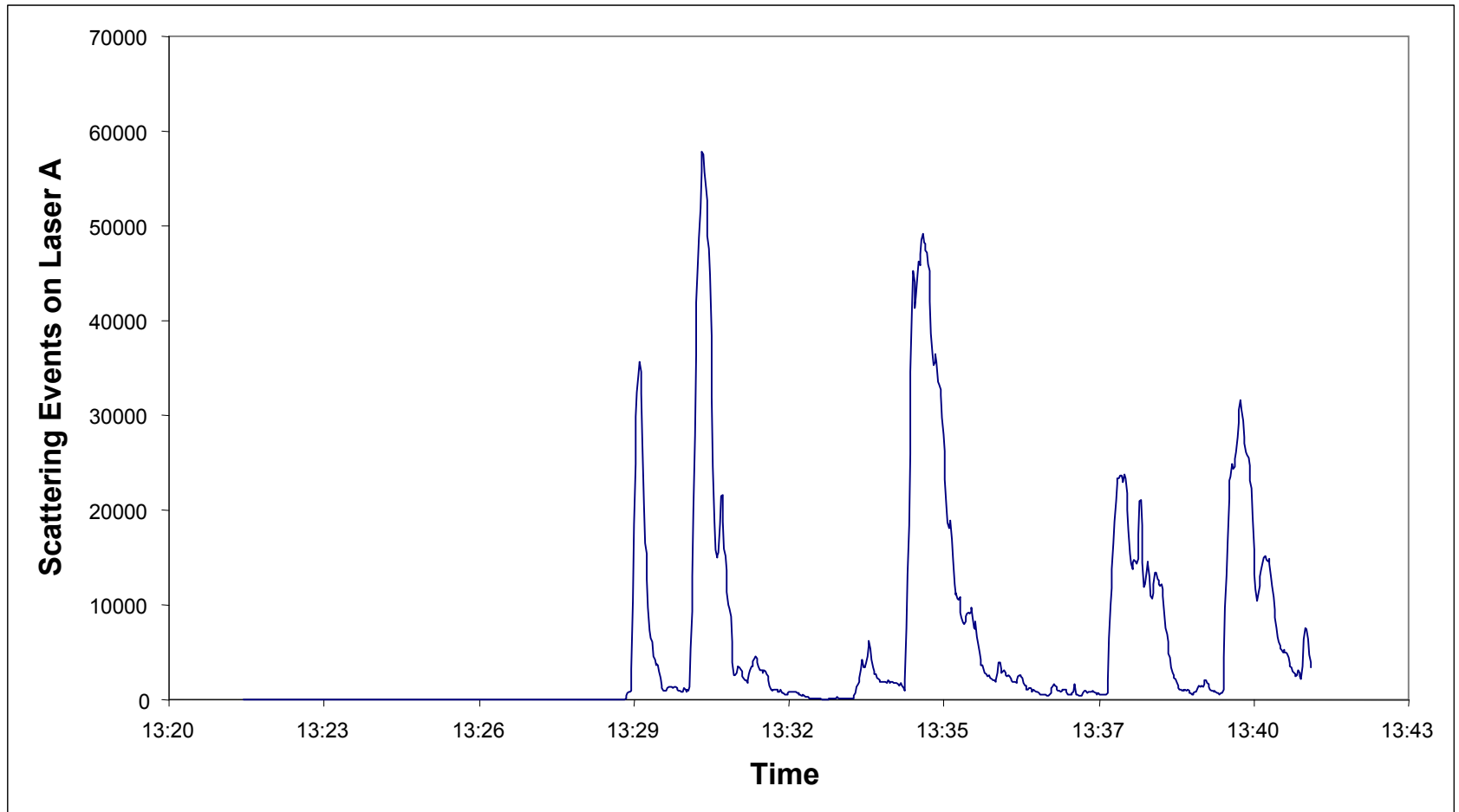


Field Testing

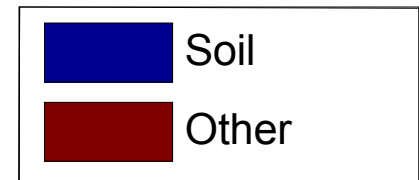
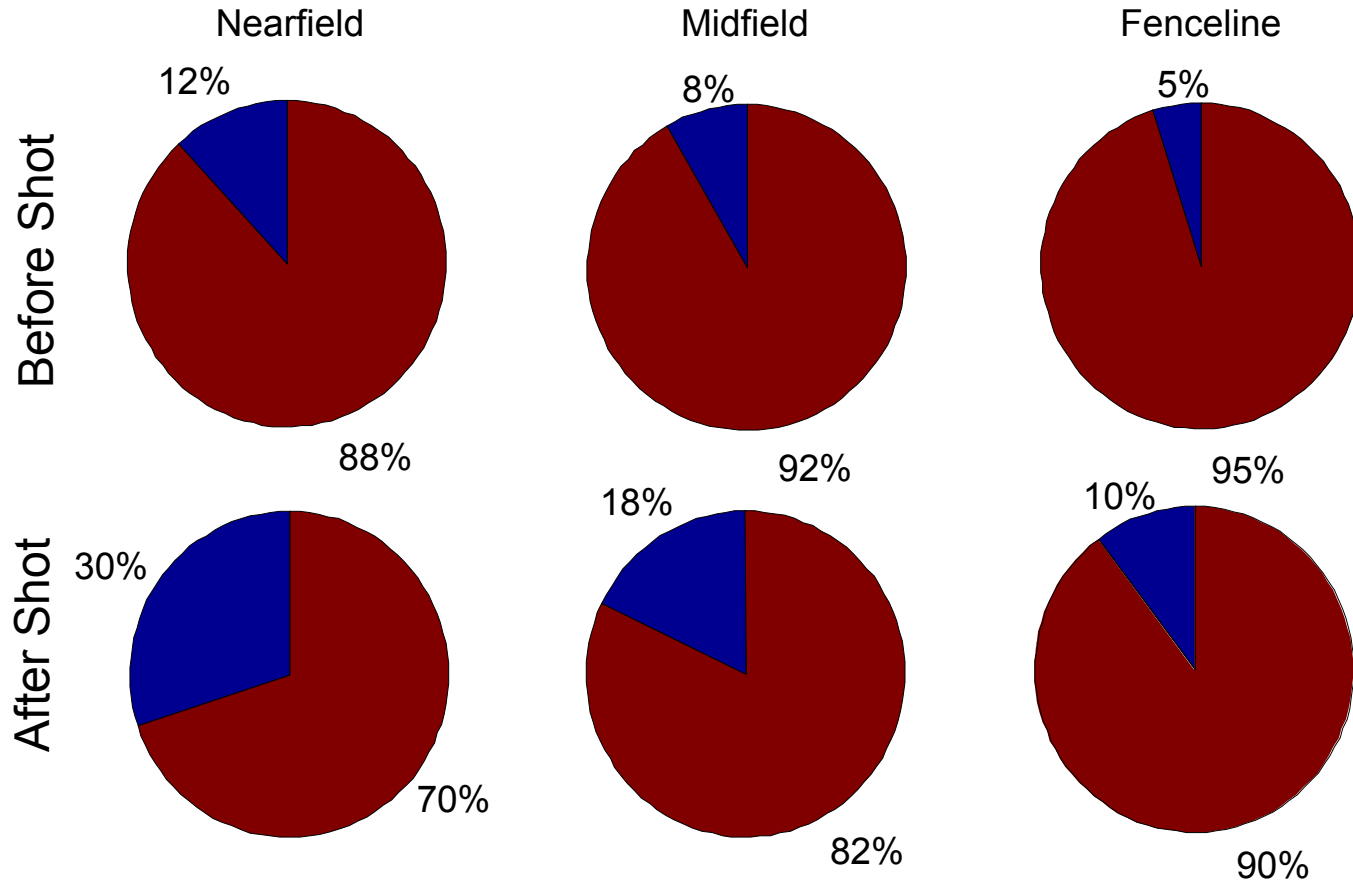
- ONLY
QUALITATIVE
DATA
- TEAD
- 800 lbs NEW
- Comp B/TNT
- 3 distances
 - 70 M
 - ~200 M
 - Fenceline



Plumes

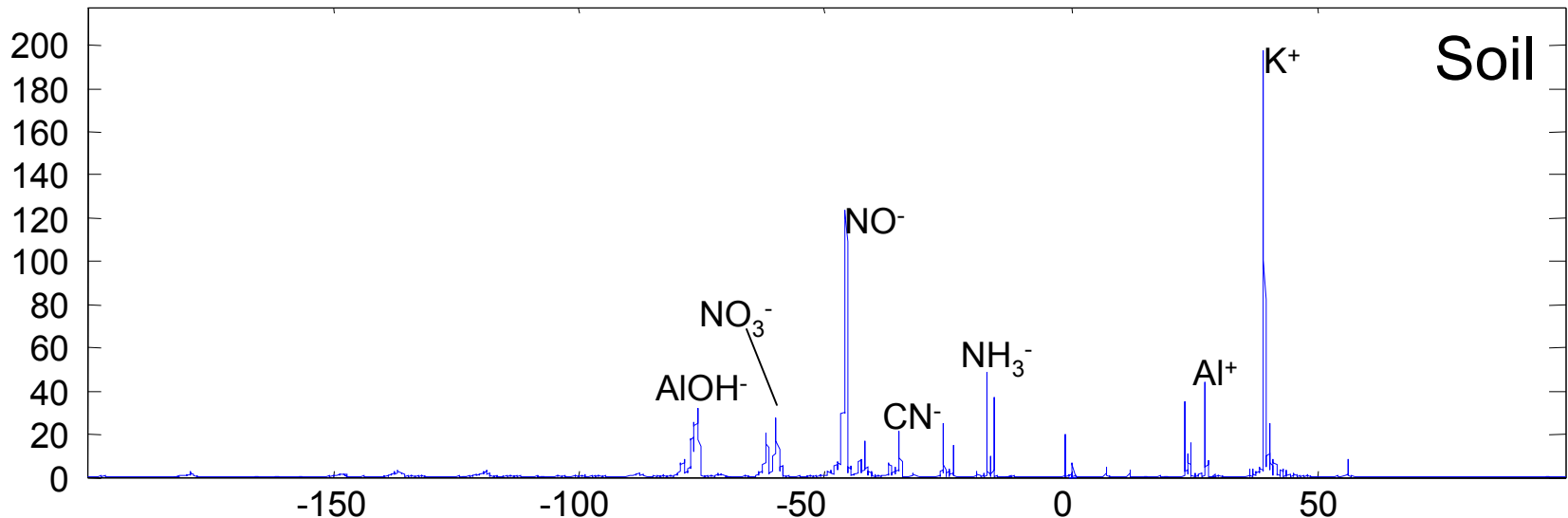


Identified Soil Particles

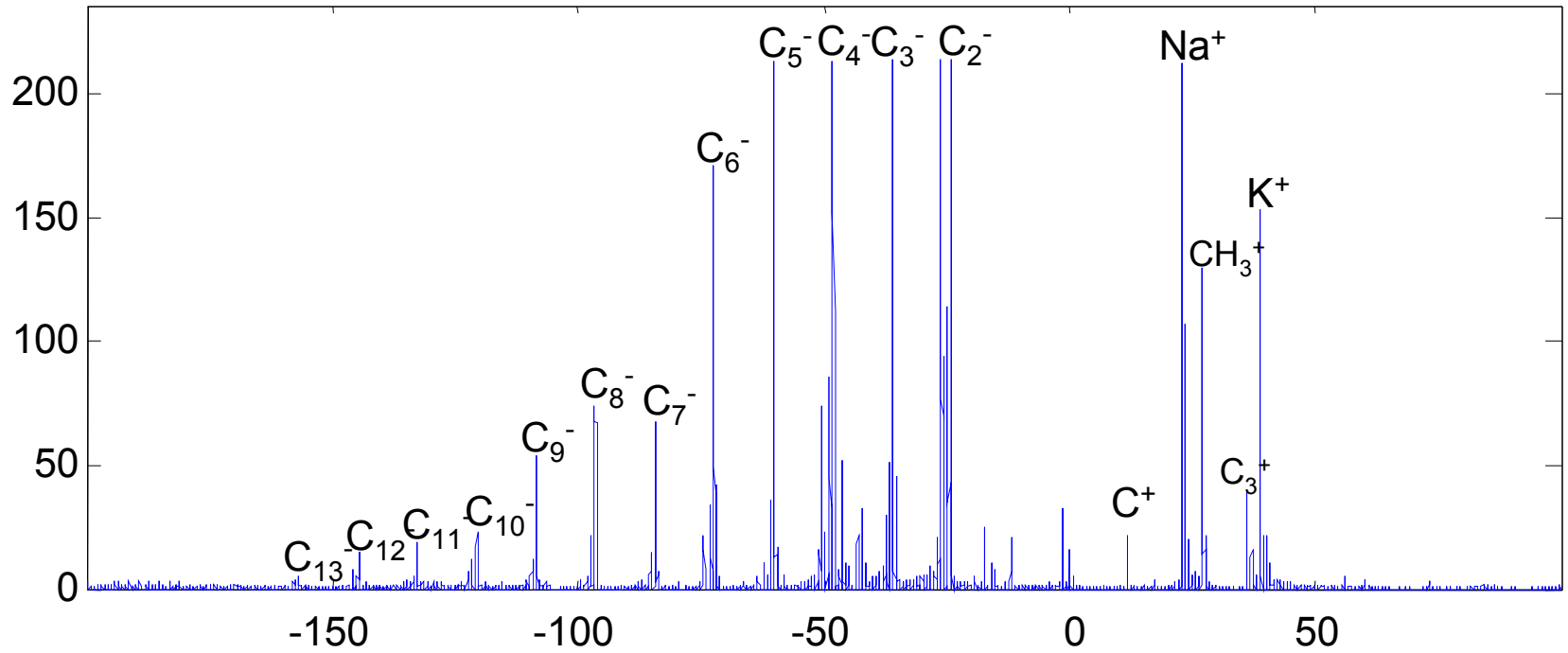


Near Field Data: 70 Meters

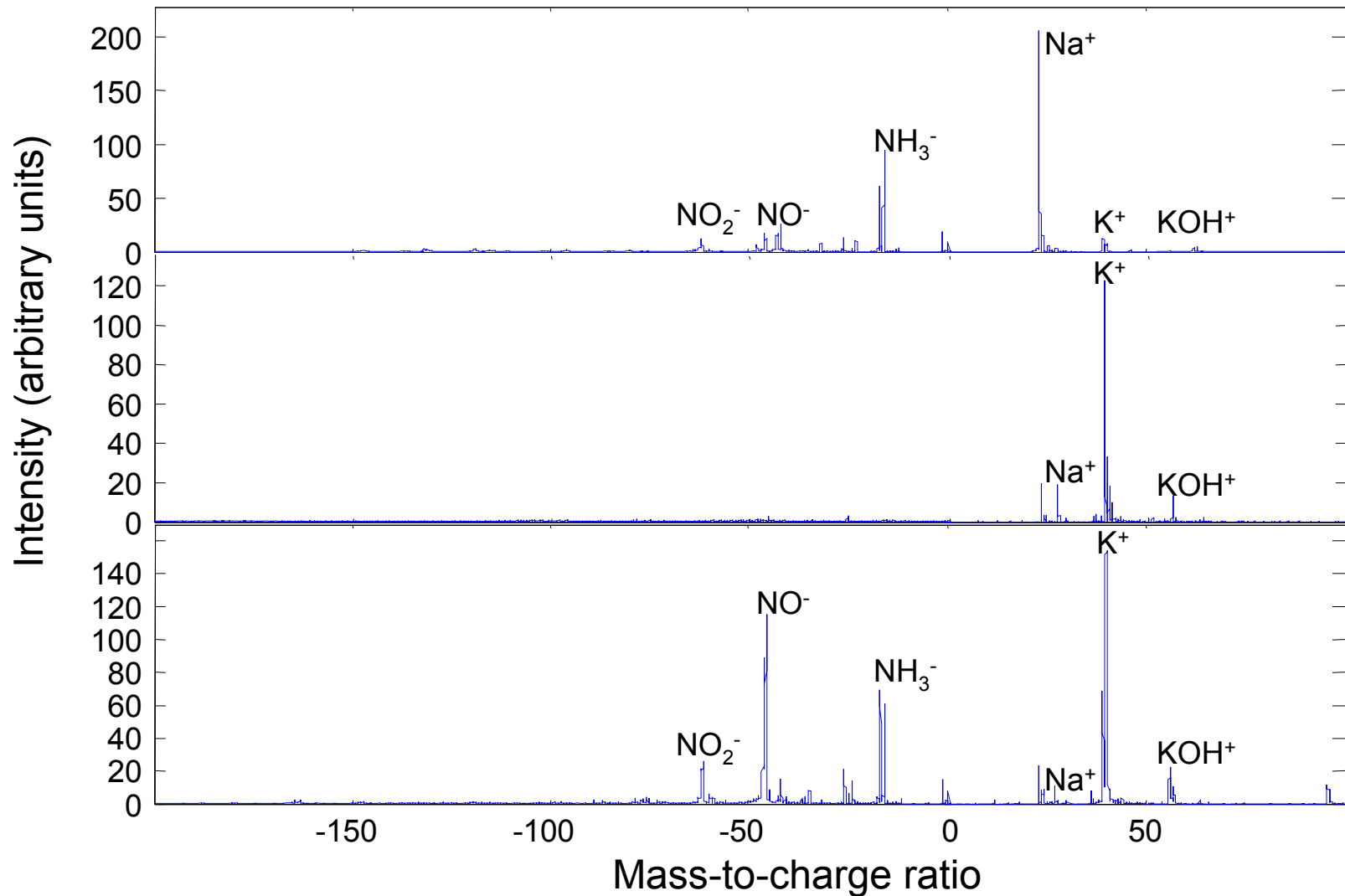
- Background: 1456 Spectra over 21 minutes
- Shot Spectra: 1365 Spectra over ~2 hours
 - Different sampling inlet
- Major Clusters Present:
 - Soil, Soot, Ammonium Nitrate with Salts



Soot

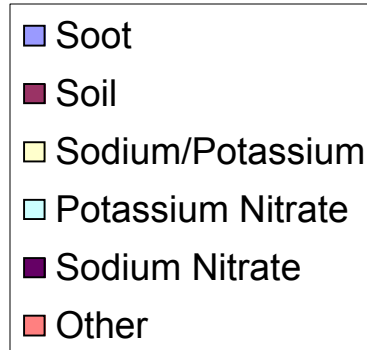
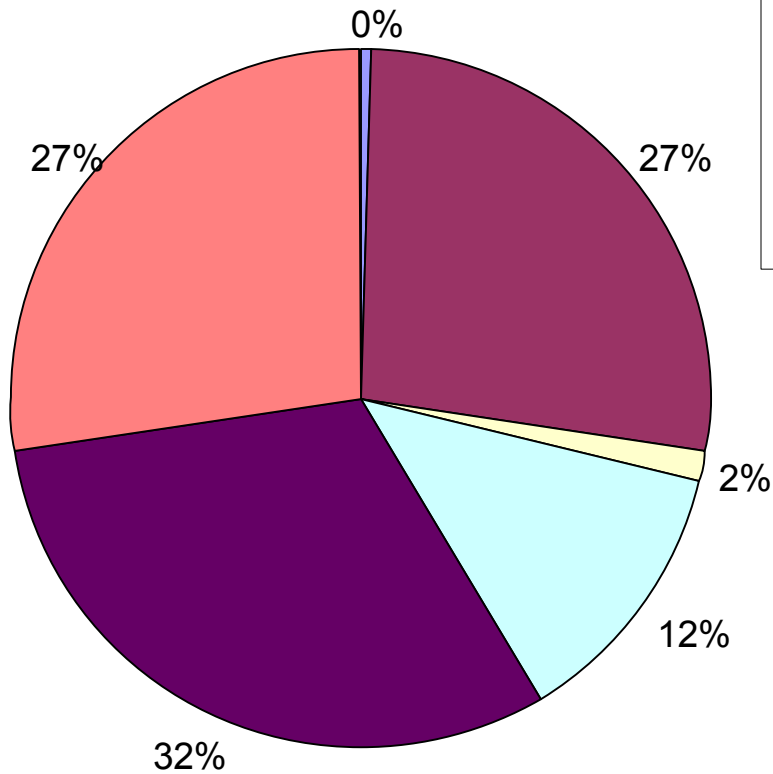


Other Background Particle Classes

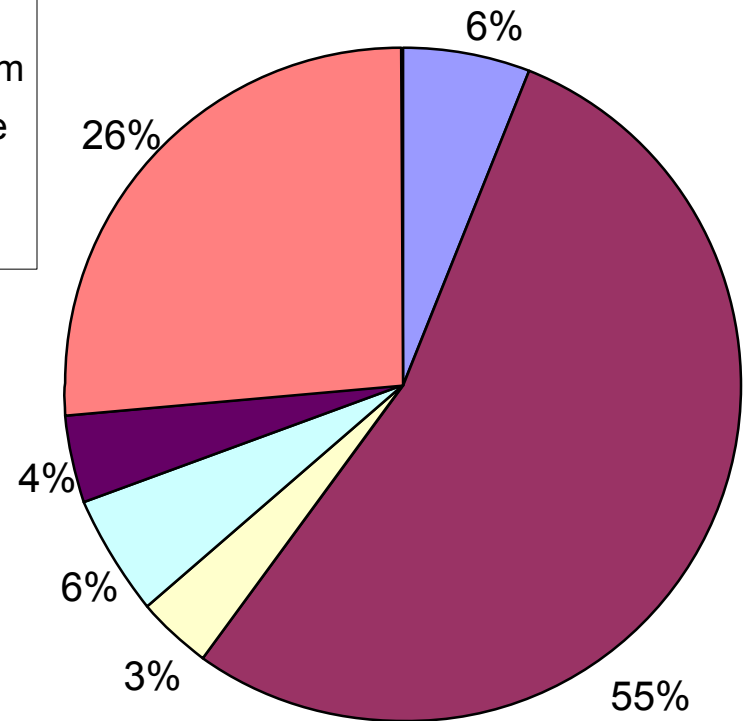


Near Shot Data: Before and After

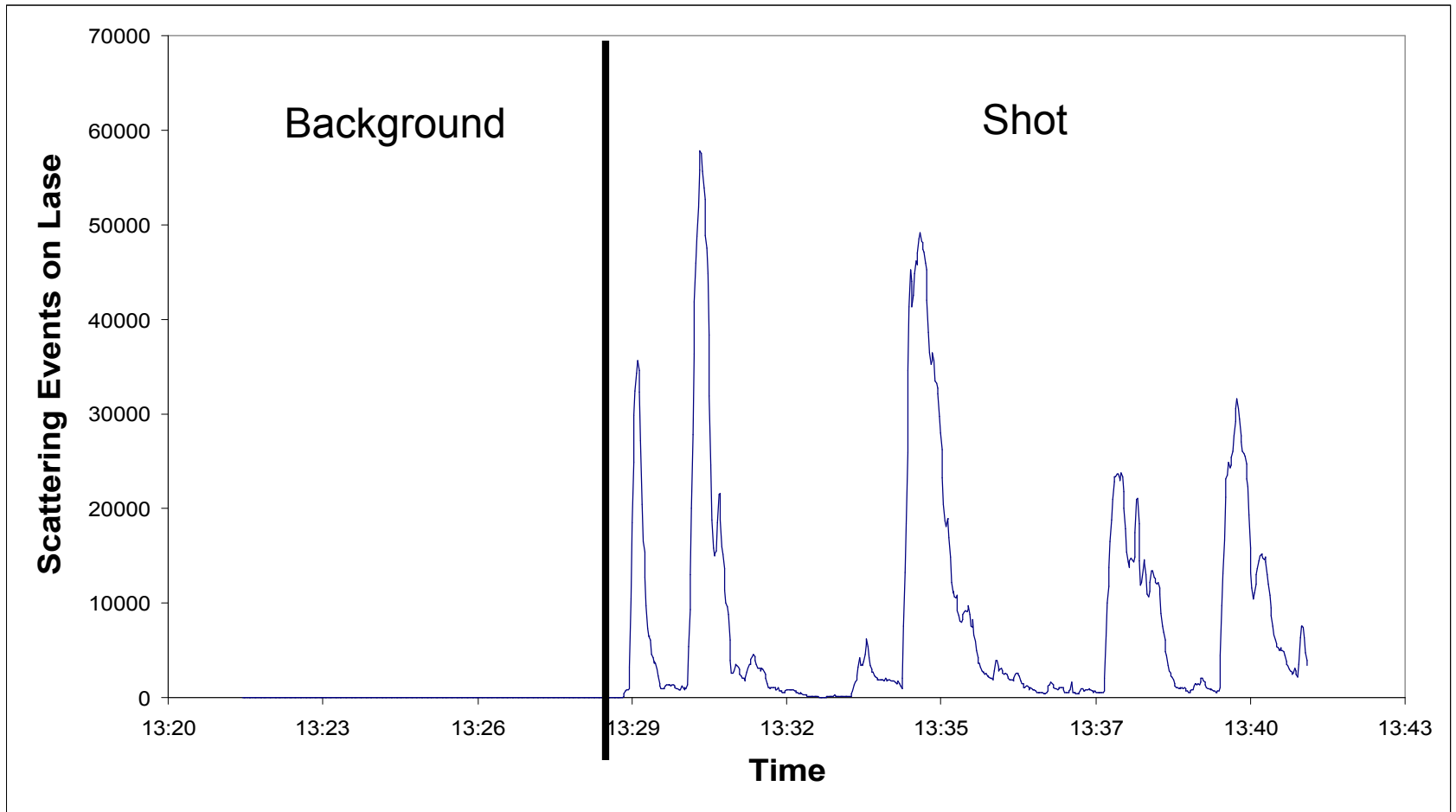
Background Ambient



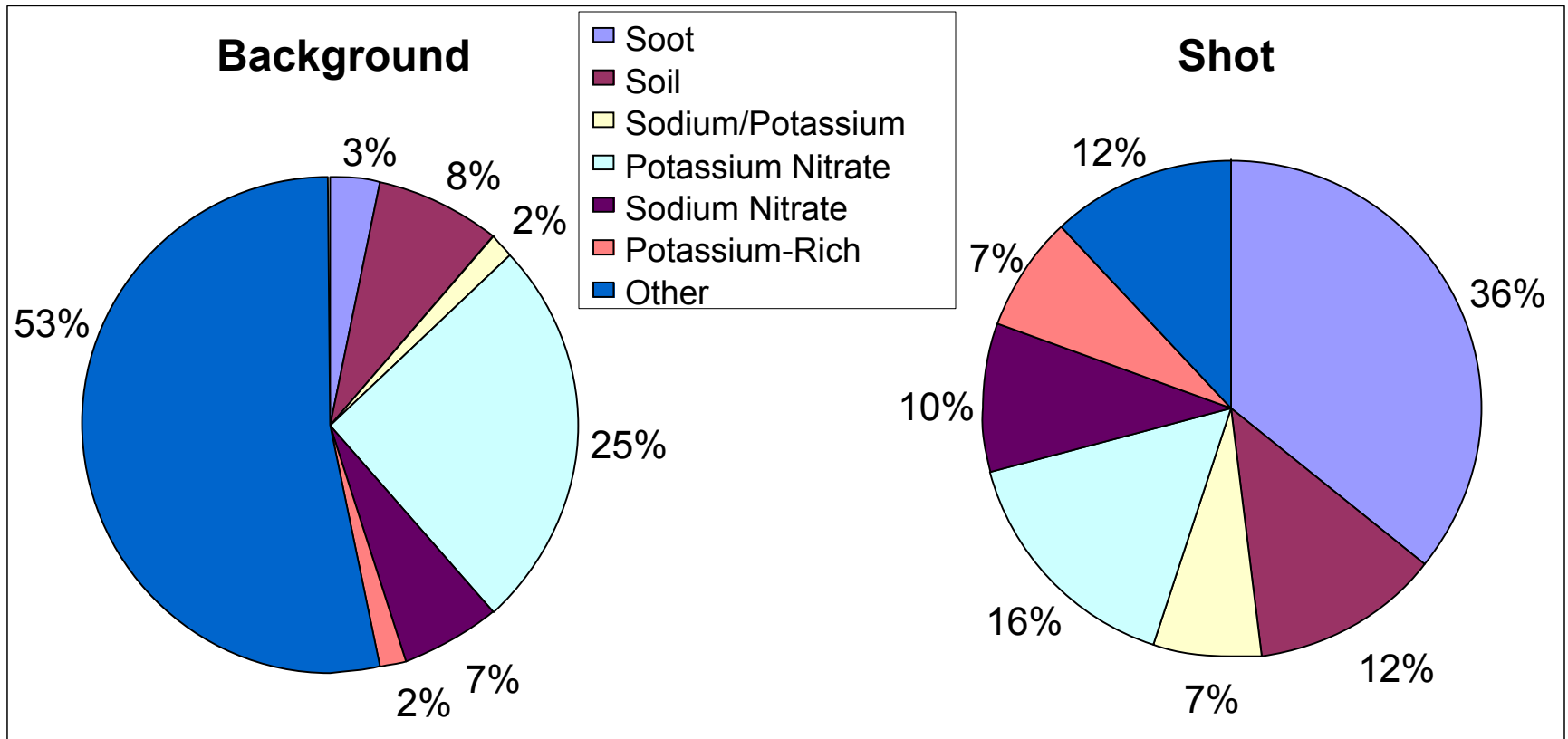
Shot Spectra



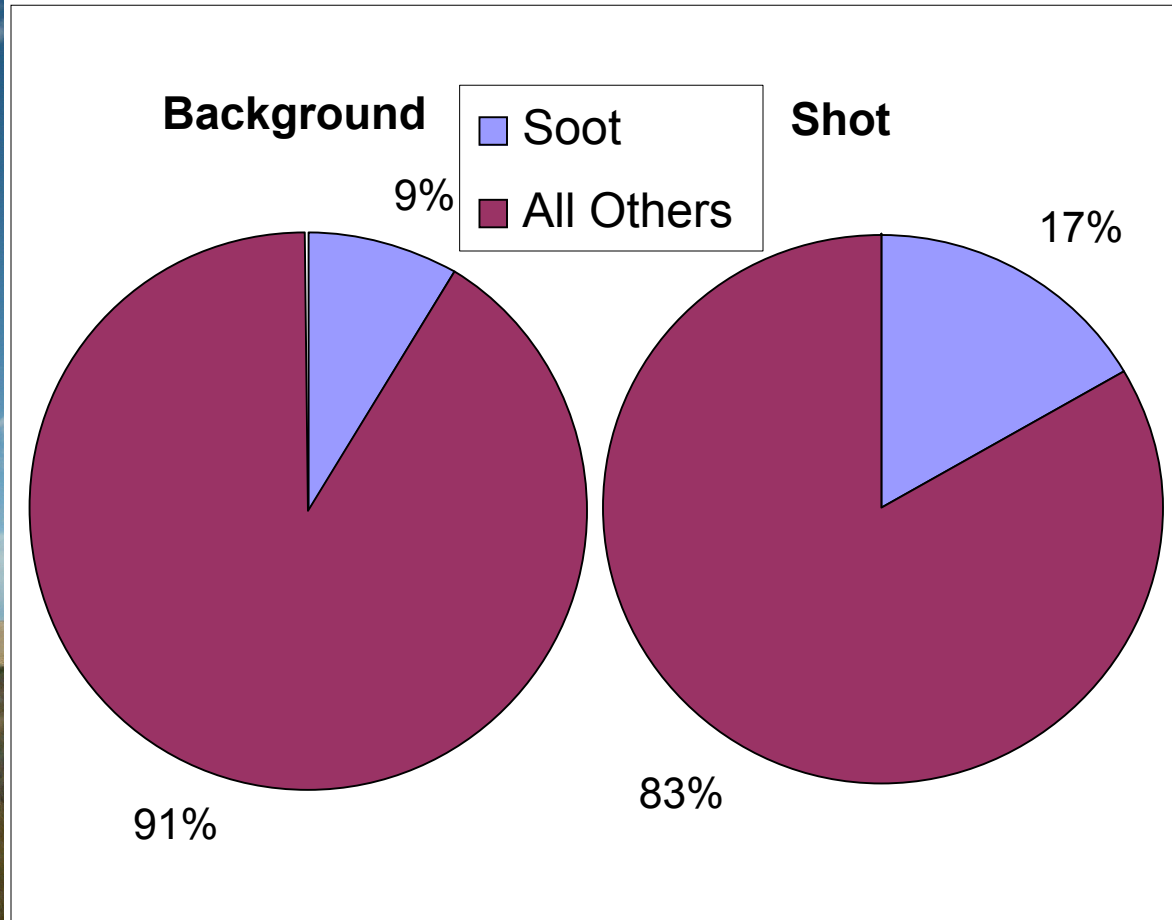
Midfield Plumets



200 Meters from shot

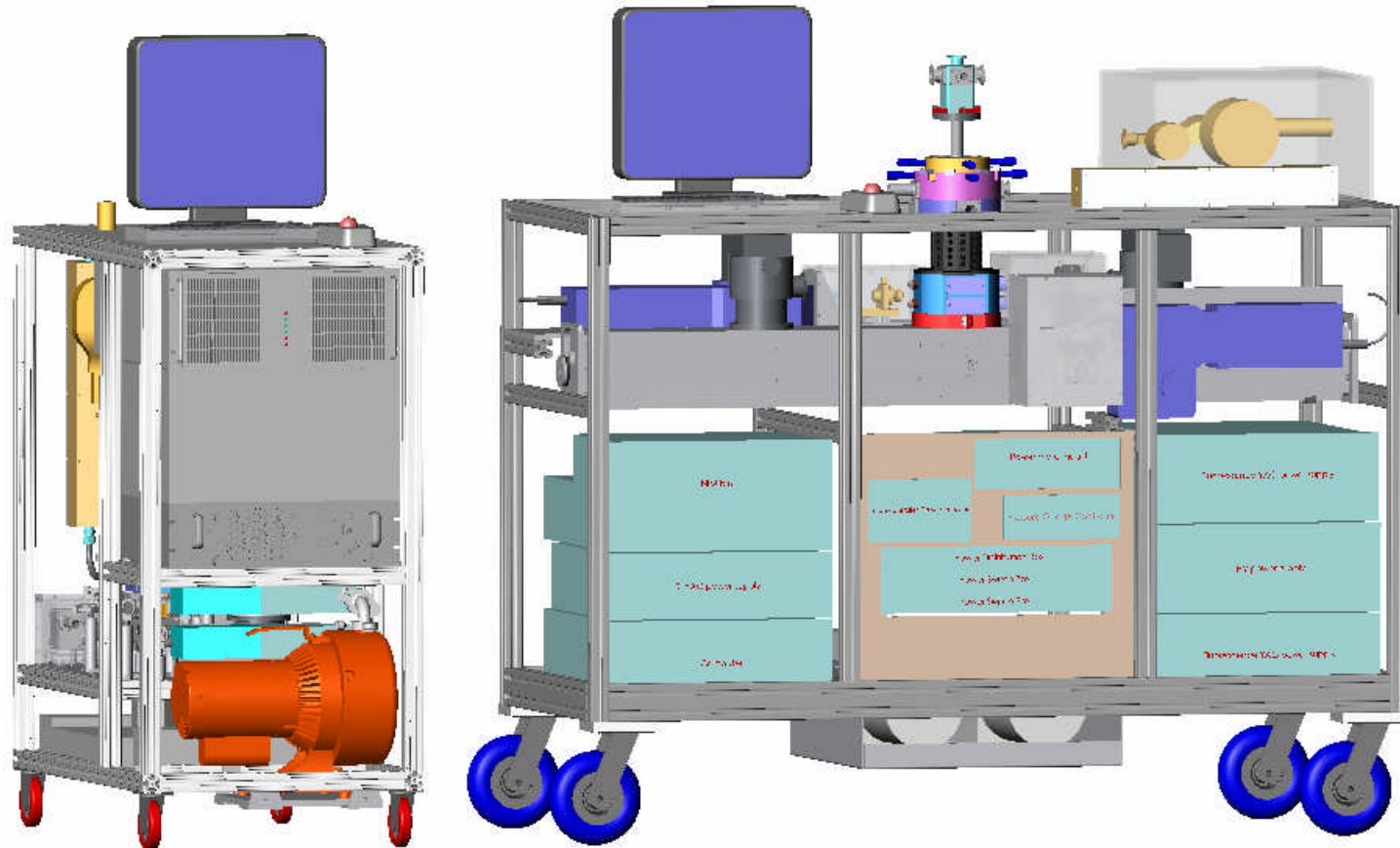


Particle Distributions at Fenceline



Conclusions/Future Research

- We can detect particles liberated from open detonation treatments at fencelines.
- Need to quantify particle concentrations.
- Need to test PAMS 2.0 for this application.



Acknowledgements

- The BAMS Group at LLNL
- Tooele Army Depot
 - Dave Ayala
 - Keith Siniscalchi
 - Spencer Chamberlain
- The funding agencies:
 - DoD Office Of Munitions TCG-IX
 - DARPA
 - TSWG
 - LLNL LDRD
 - DHS



This work was performed under the auspices of the U. S. Department of Energy by the University of California, Lawrence Livermore National Laboratory under Contract No. W-7405-Eng-48.