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Instantaneous Detection of Particles Liberated by Open Detonation Treatments

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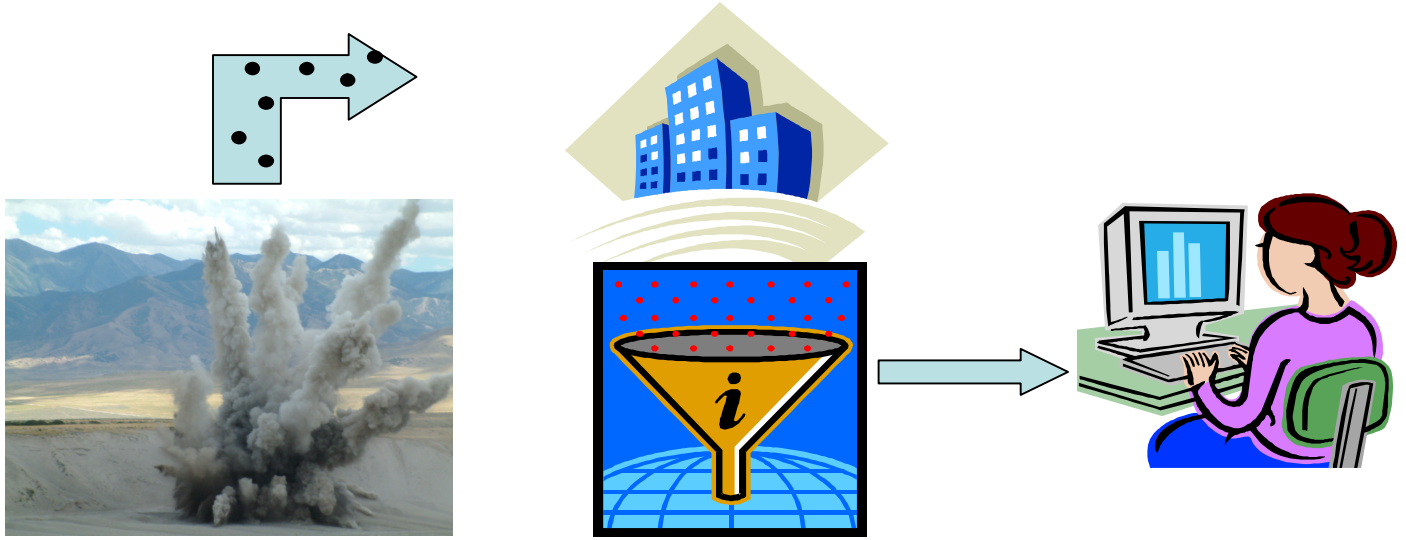
Indianapolis, IN, United States
May 5, 2006 through May 9, 2006

Disclaimer

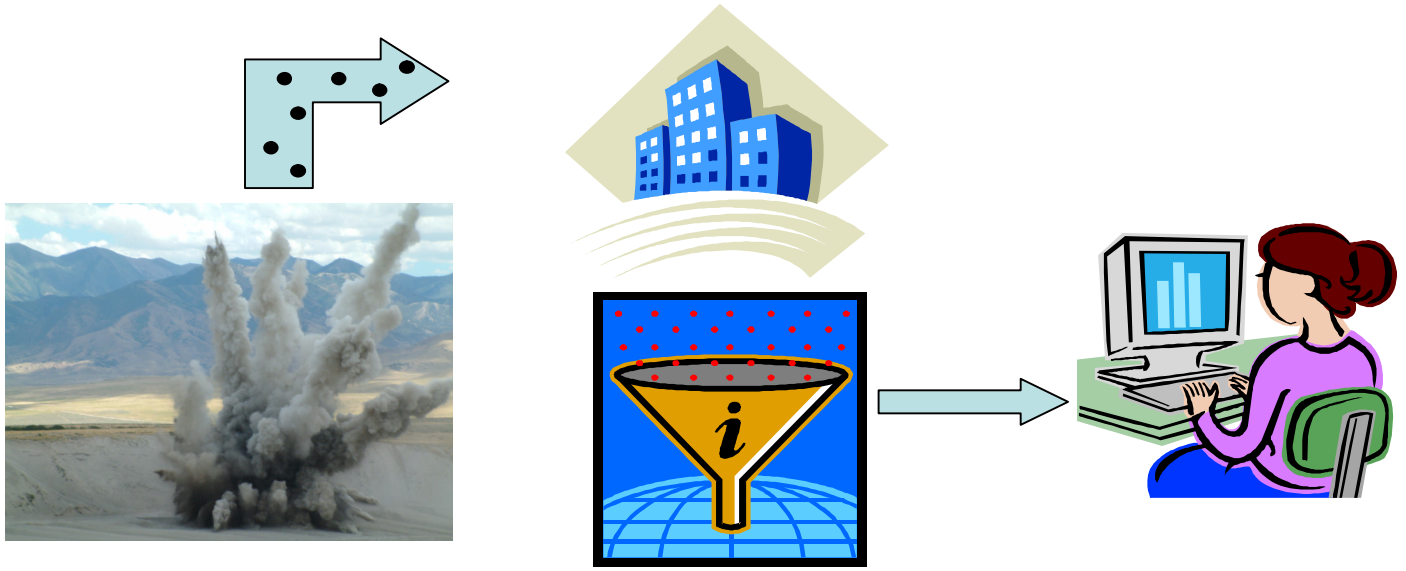


Instantaneous Detection of Particles Liberated by Open Detonation Treatments

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

The Idea:

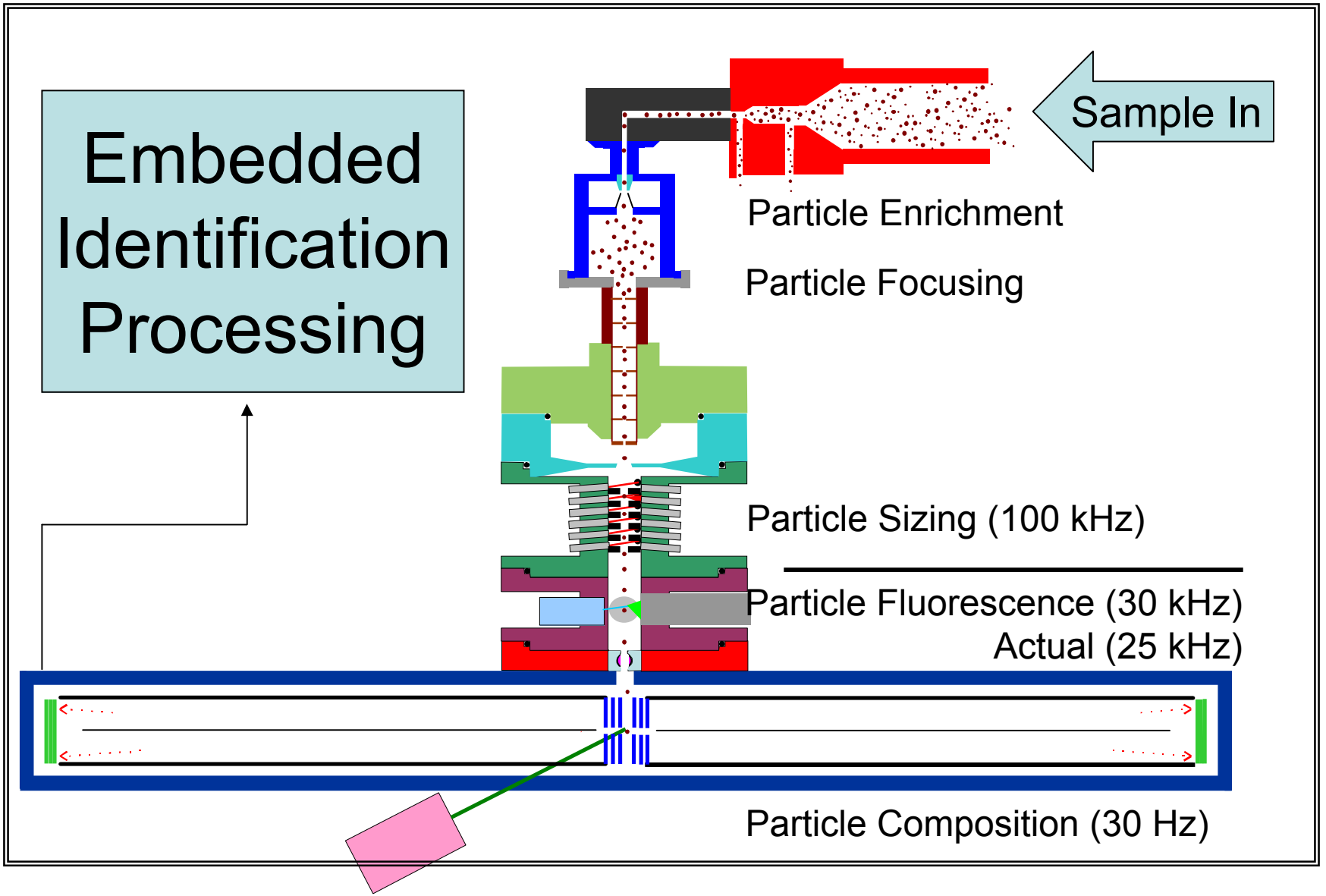
This project supports DAC's effort to increase efficiency of operations.



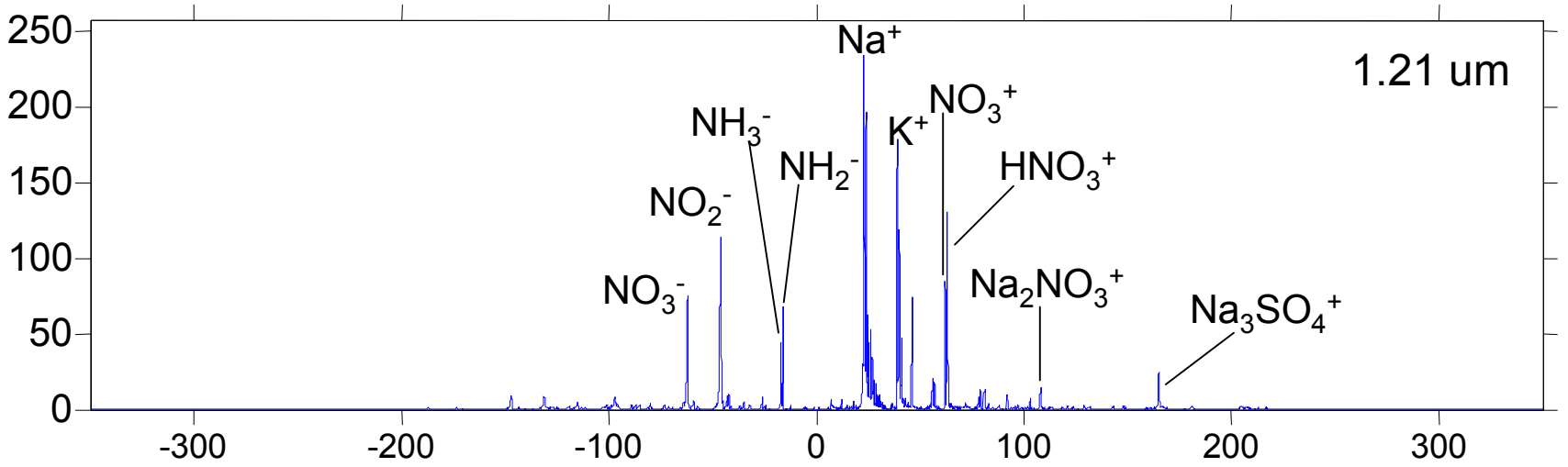
Open Detonation treatments release aerosol particles:

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

Particle Analysis by Mass Spectrometry (PAMS)

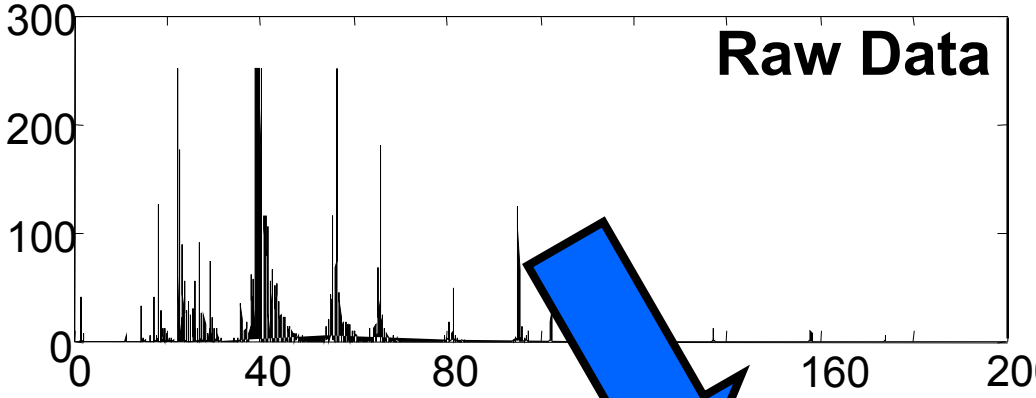


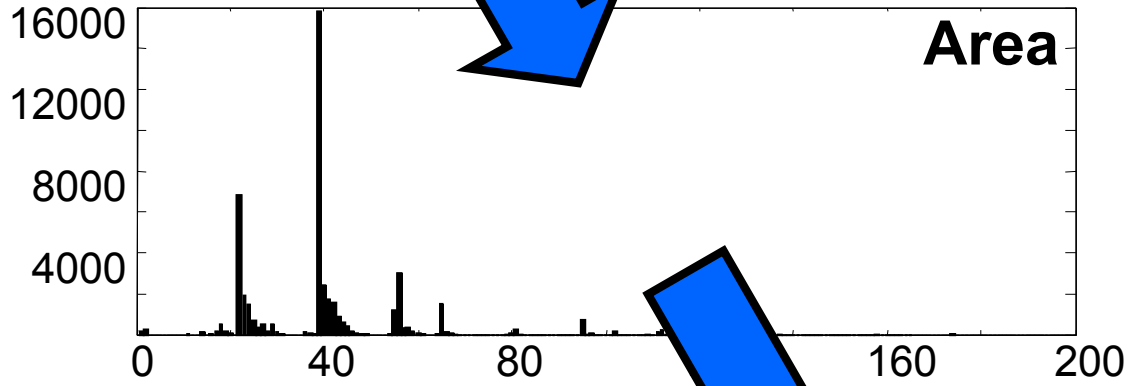
Example of Single Particle Data

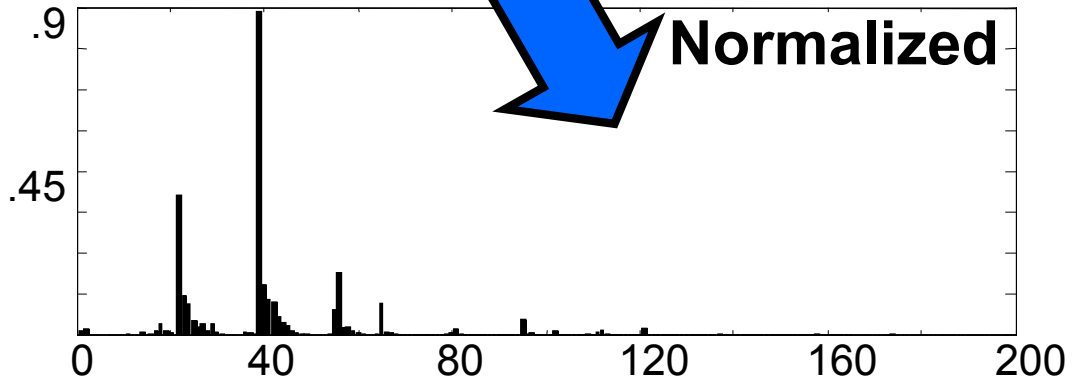


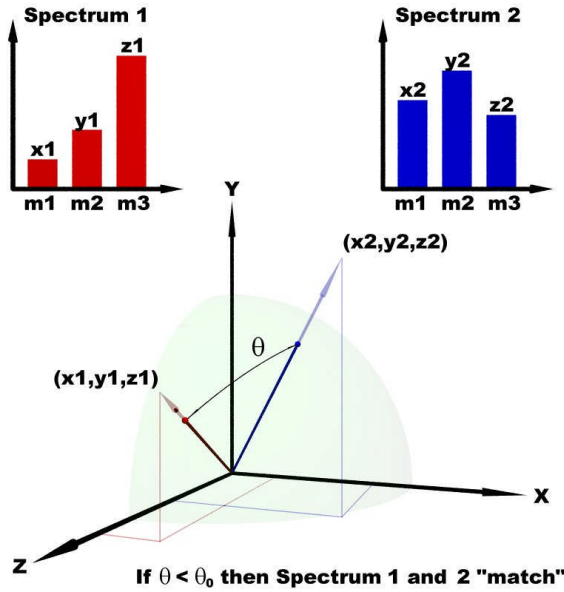
- Two complete mass spectra from each particle
- Size and composition returned in real time
- Data analysis can be performed in real time as well

Data Analysis





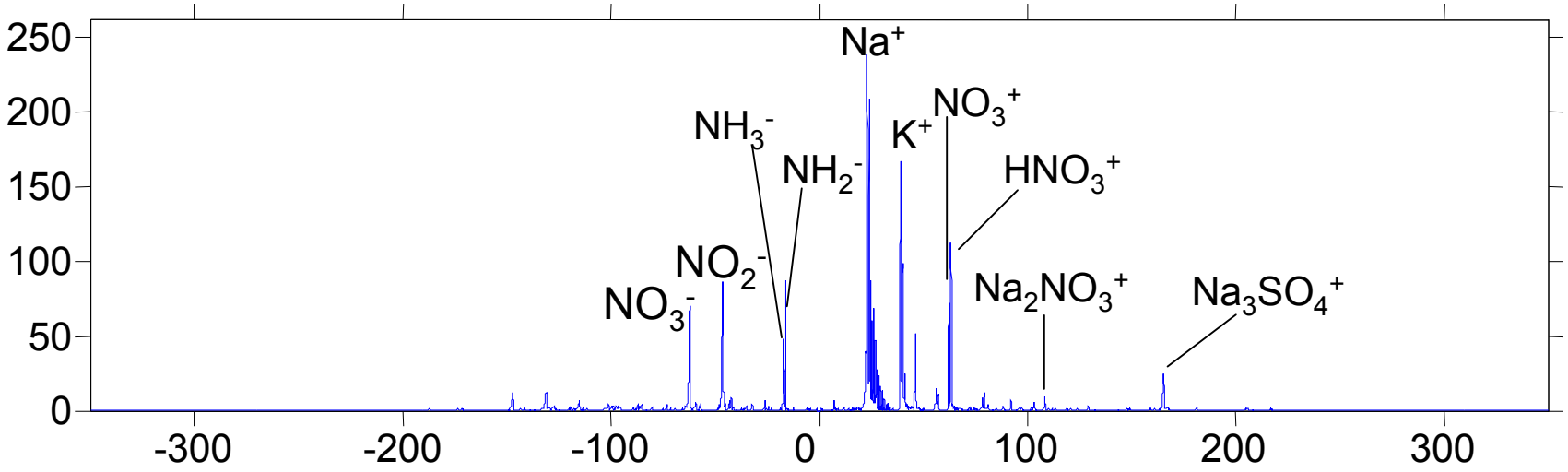




Proving the Concept

LLNL Site 300, Bunker 850

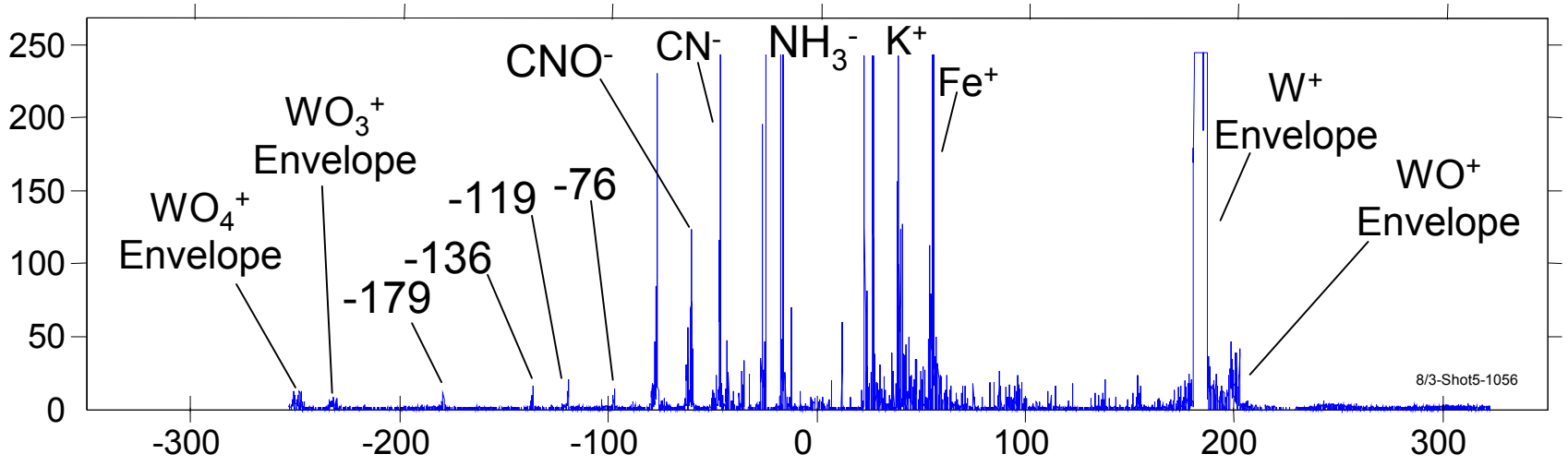
~90% of Site 300 Background:



Classic “Reacted Marine” Particles

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

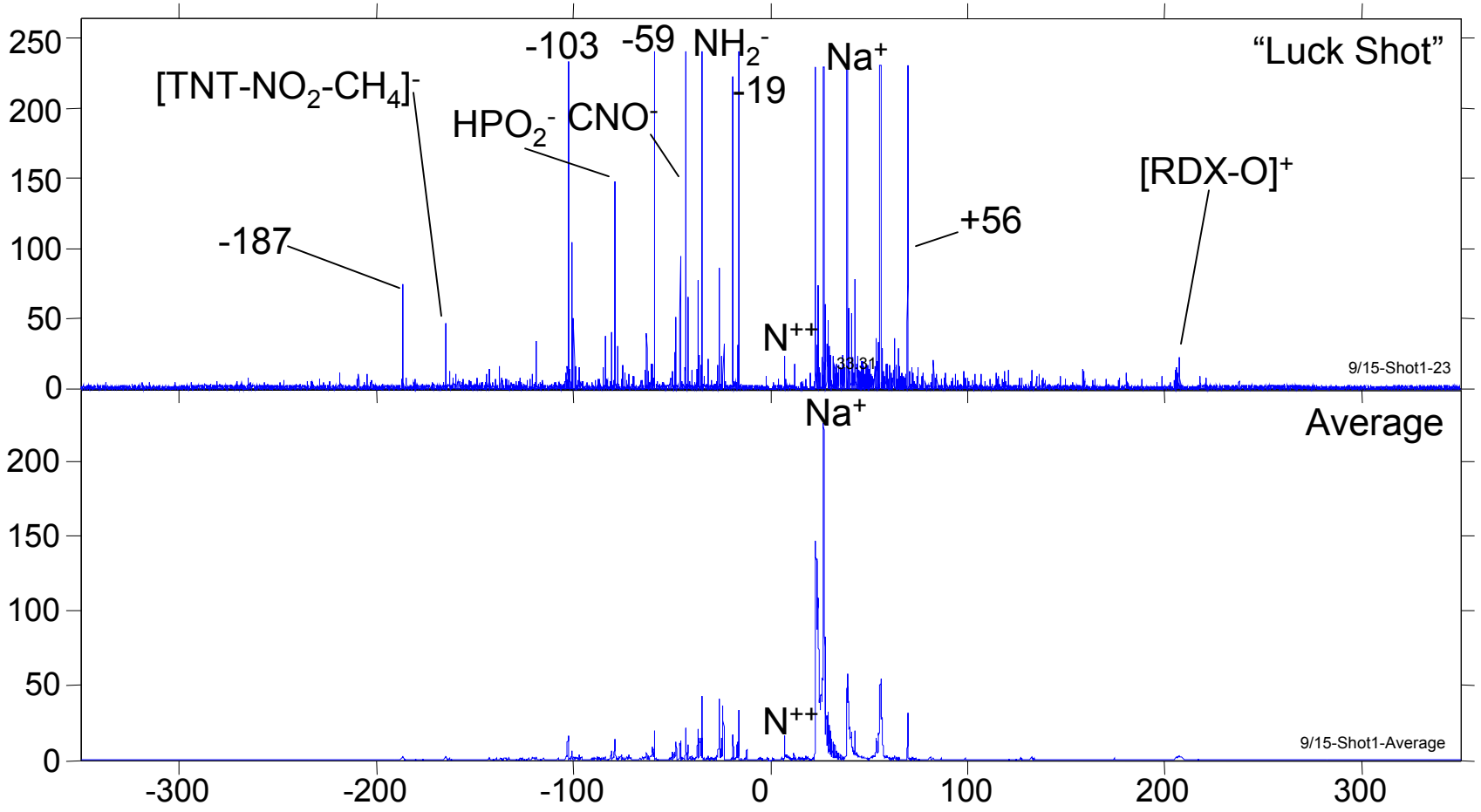
45% of Post Det Spectra Contained W



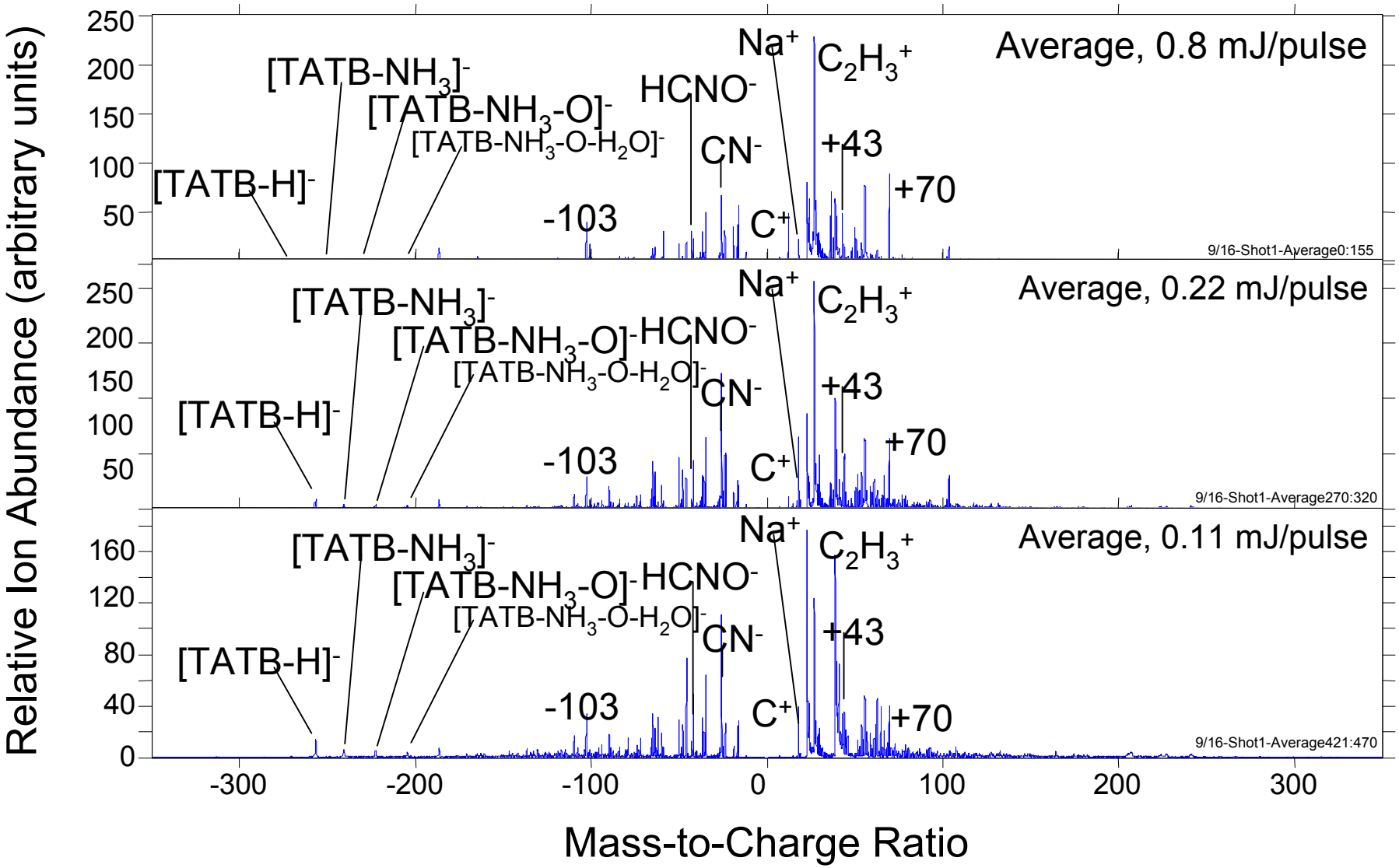
The BAMS at HEAF

150 mg TNT and LX-17 charges.

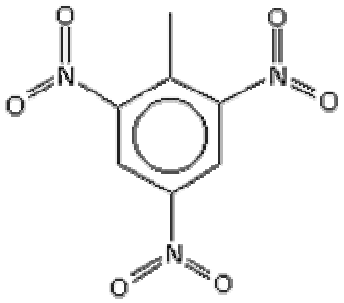
Comp B, 0.9 mJ/Pulse



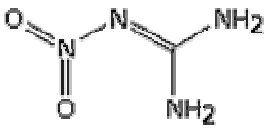
LX-17, Decreasing Laser Power



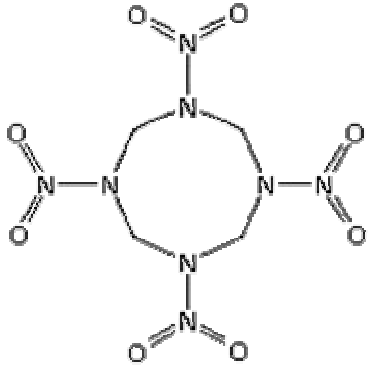
Expanding the Library: 4 pure and 3 mixture explosive



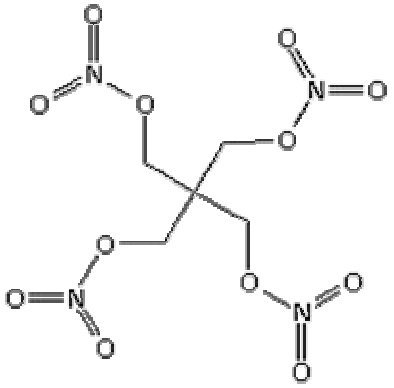
TNT



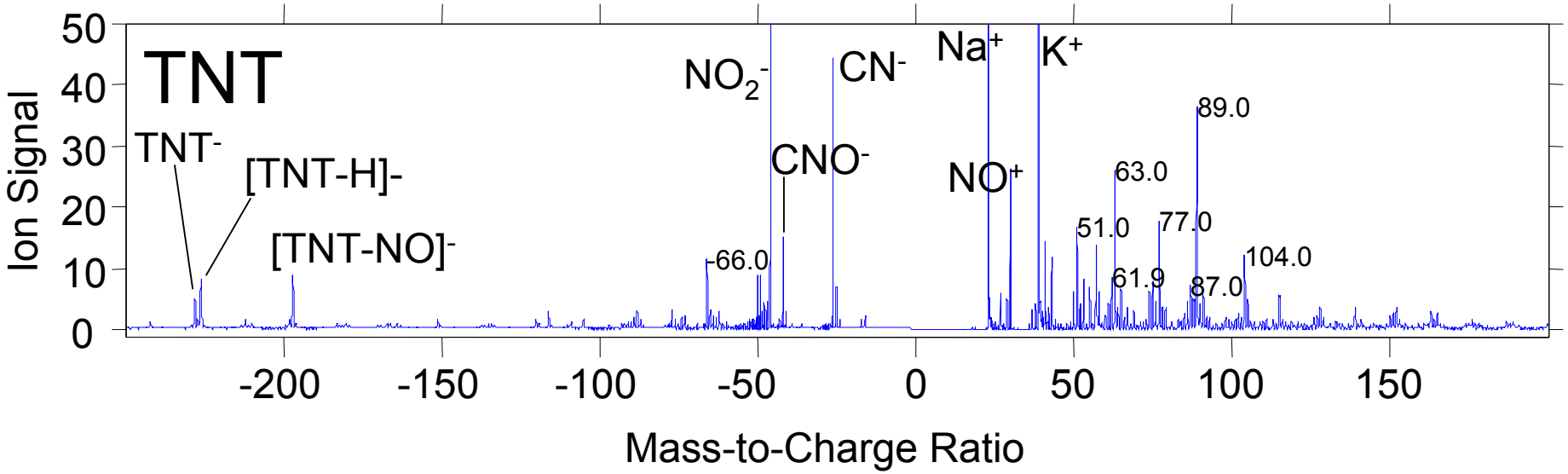
Nitro Guanidine (NQ)



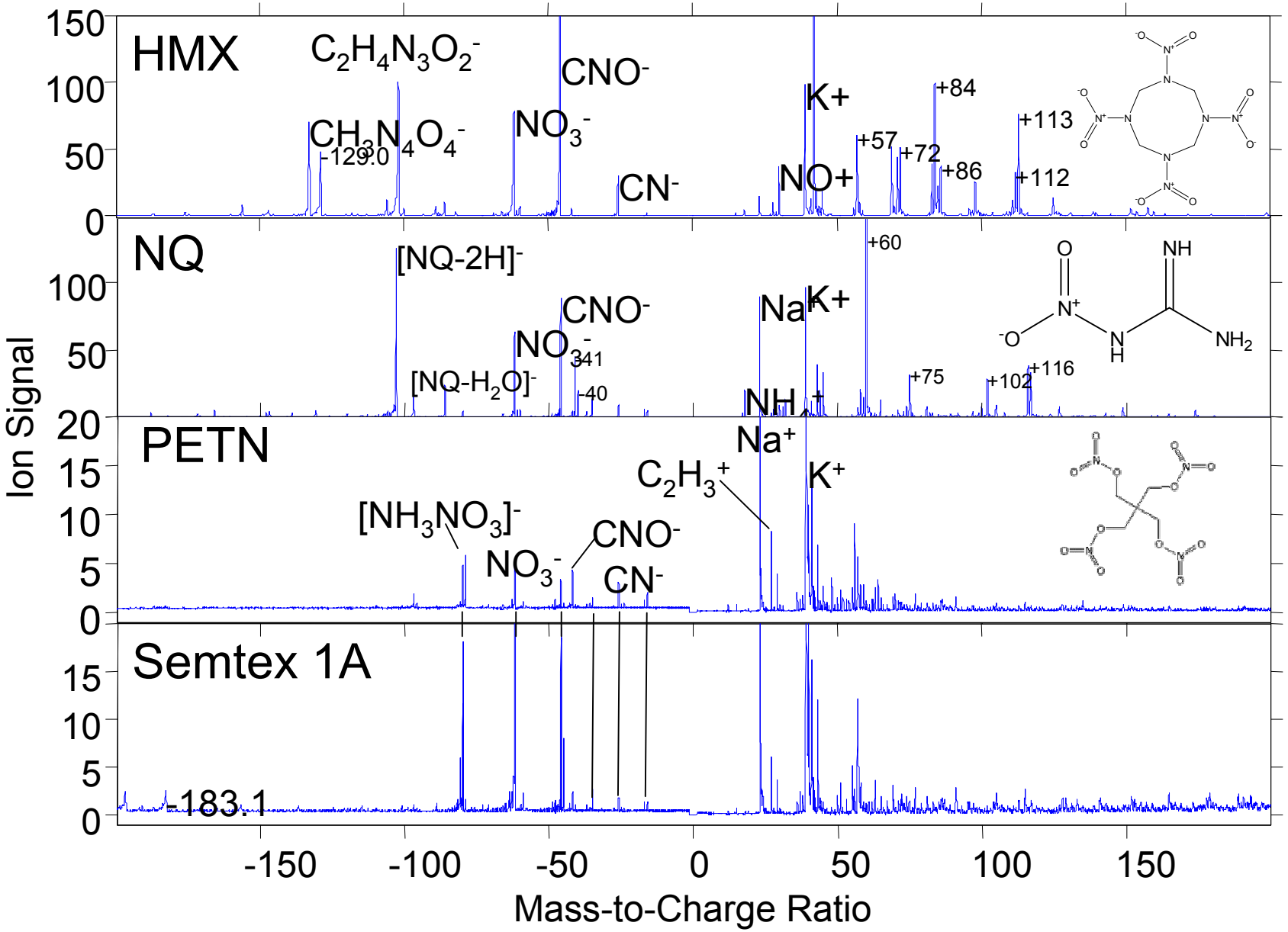
HMX



PETN



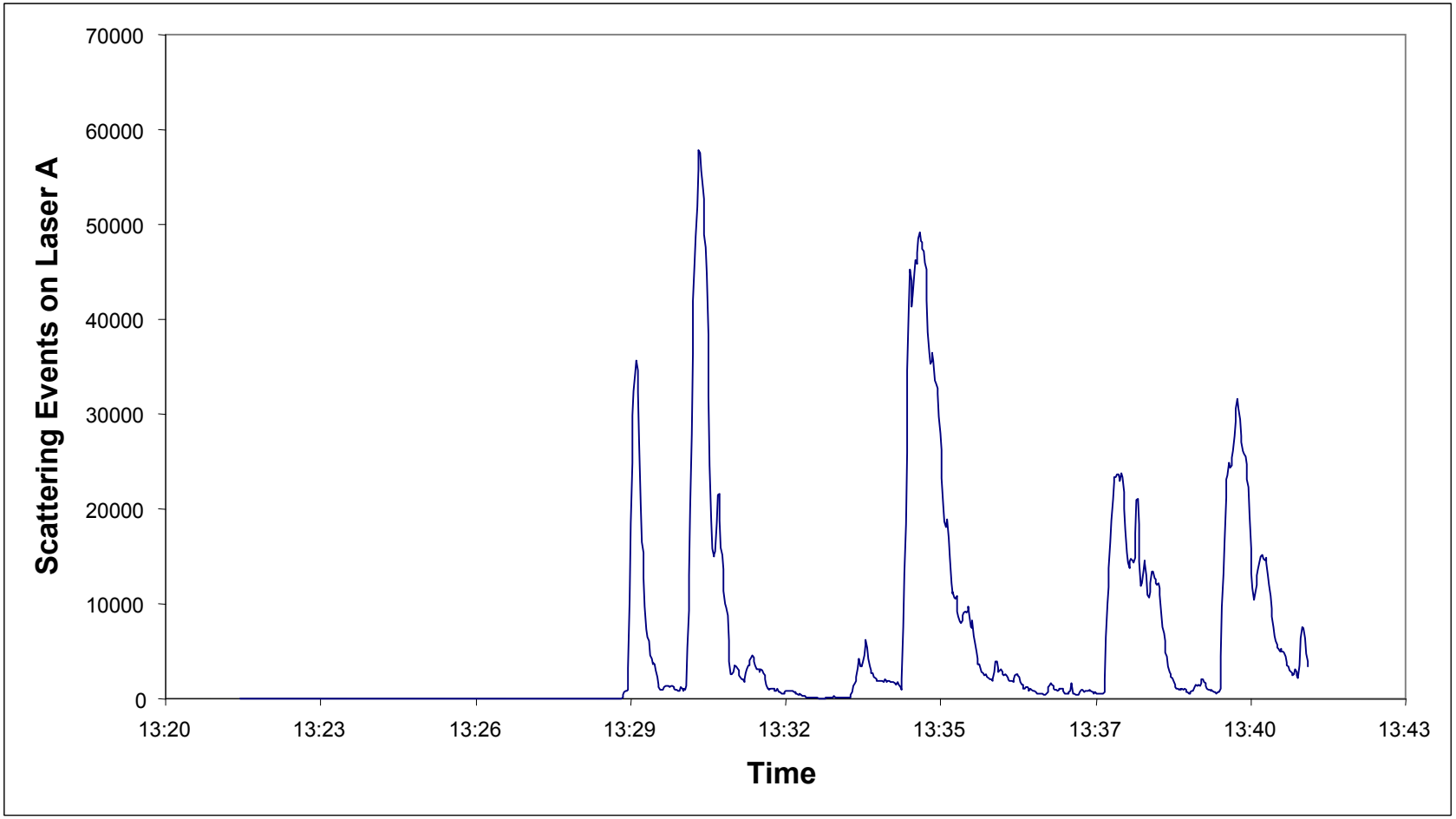
Other High Explosive Mass Spectra



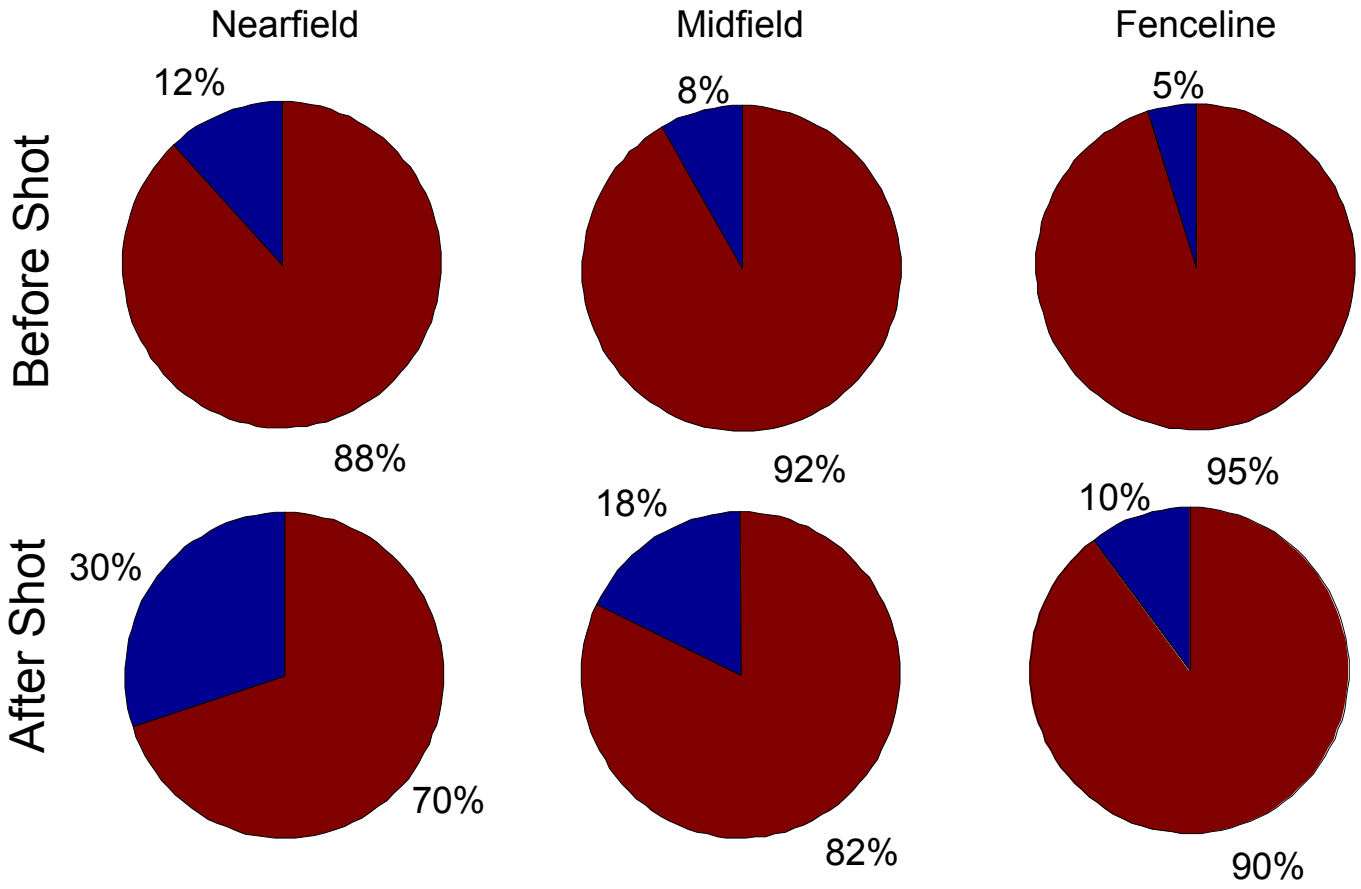
Field Testing

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

Plumes


Scattering Events on Laser A
70000
60000
50000
40000
30000
20000
10000
0
13:20
13:23
13:26
13:29
13:32
13:35
13:37
13:40
13:43
Time

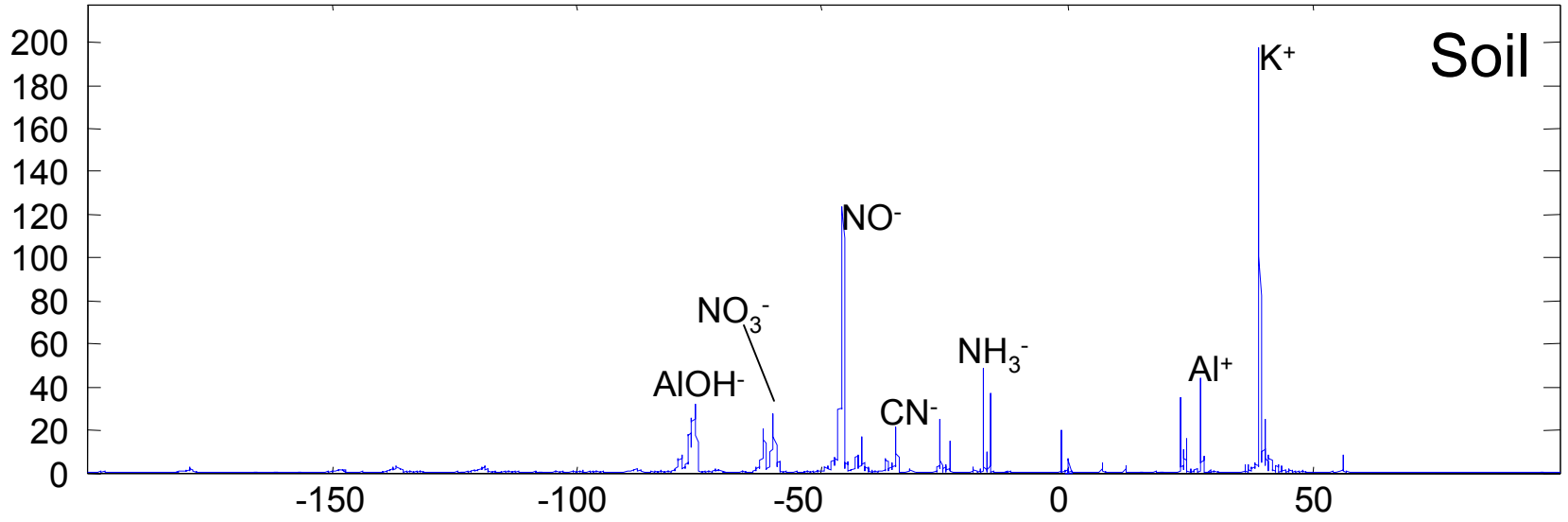
Identified Soil Particles



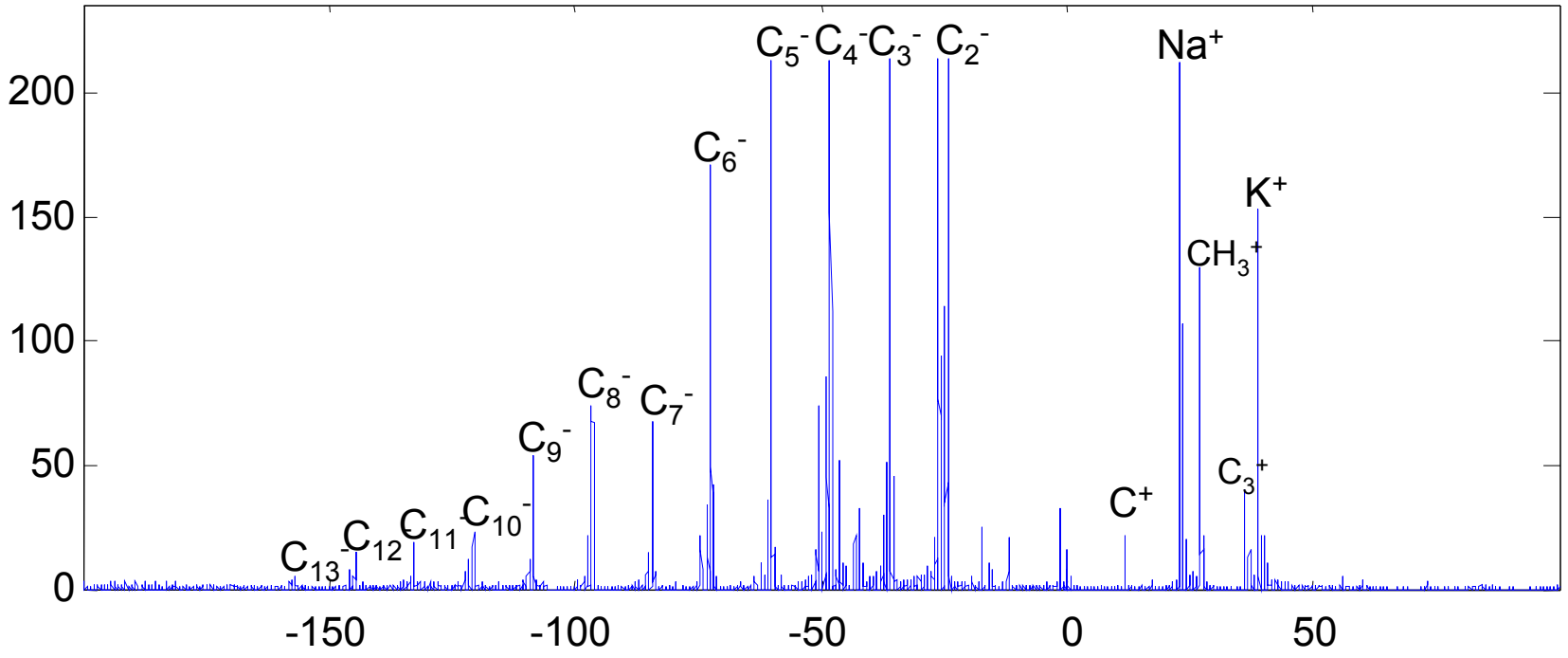
Soil
Other

Near Field Data: 70 Meters

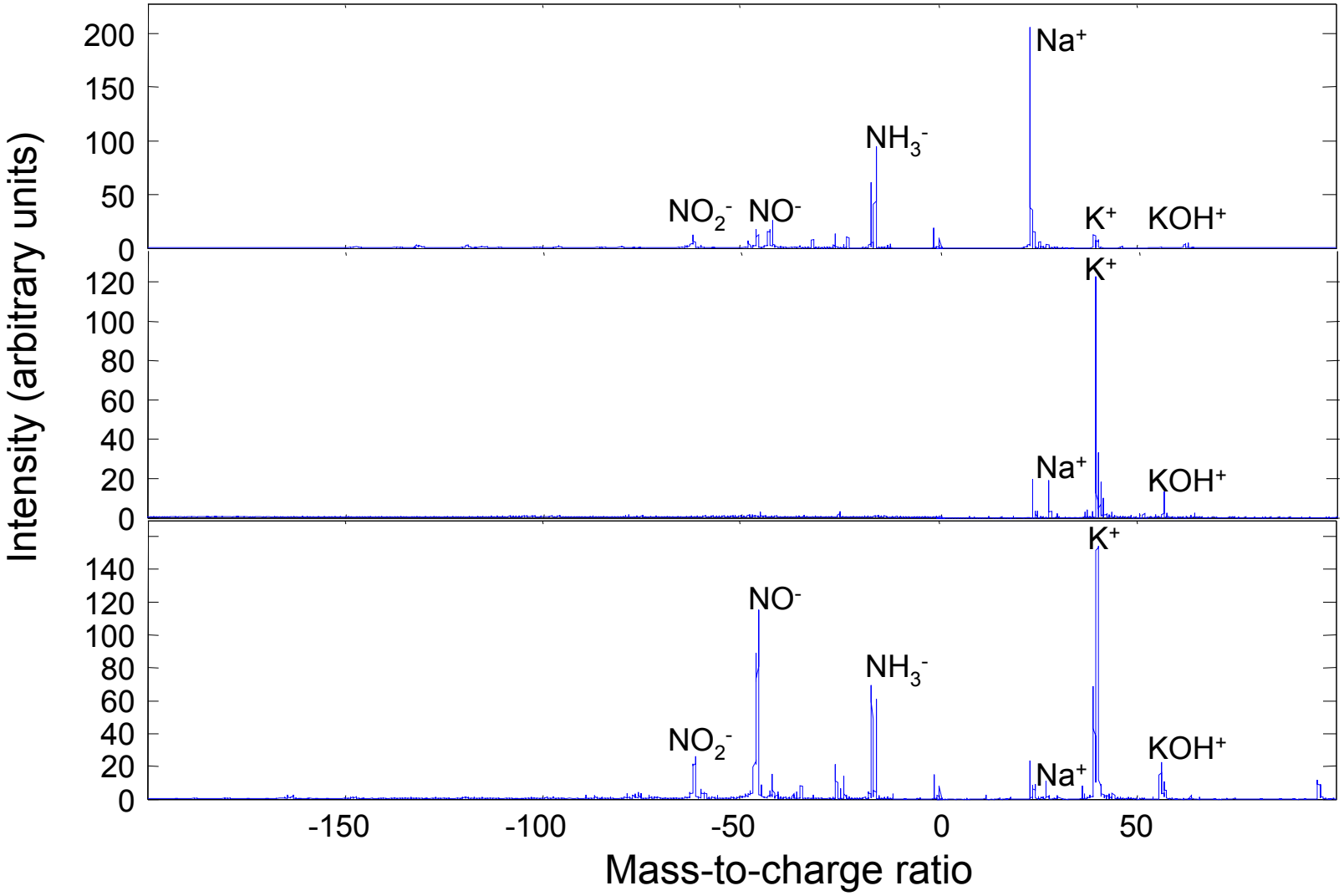
- Background: 1456 Spectra over 21 minutes
- Shot Spectra: 1365 Spectra over ~2 hours
  - Different sampling inlet
- Major Clusters Present:
  - Soil, Soot, Ammonium Nitrate with Salts



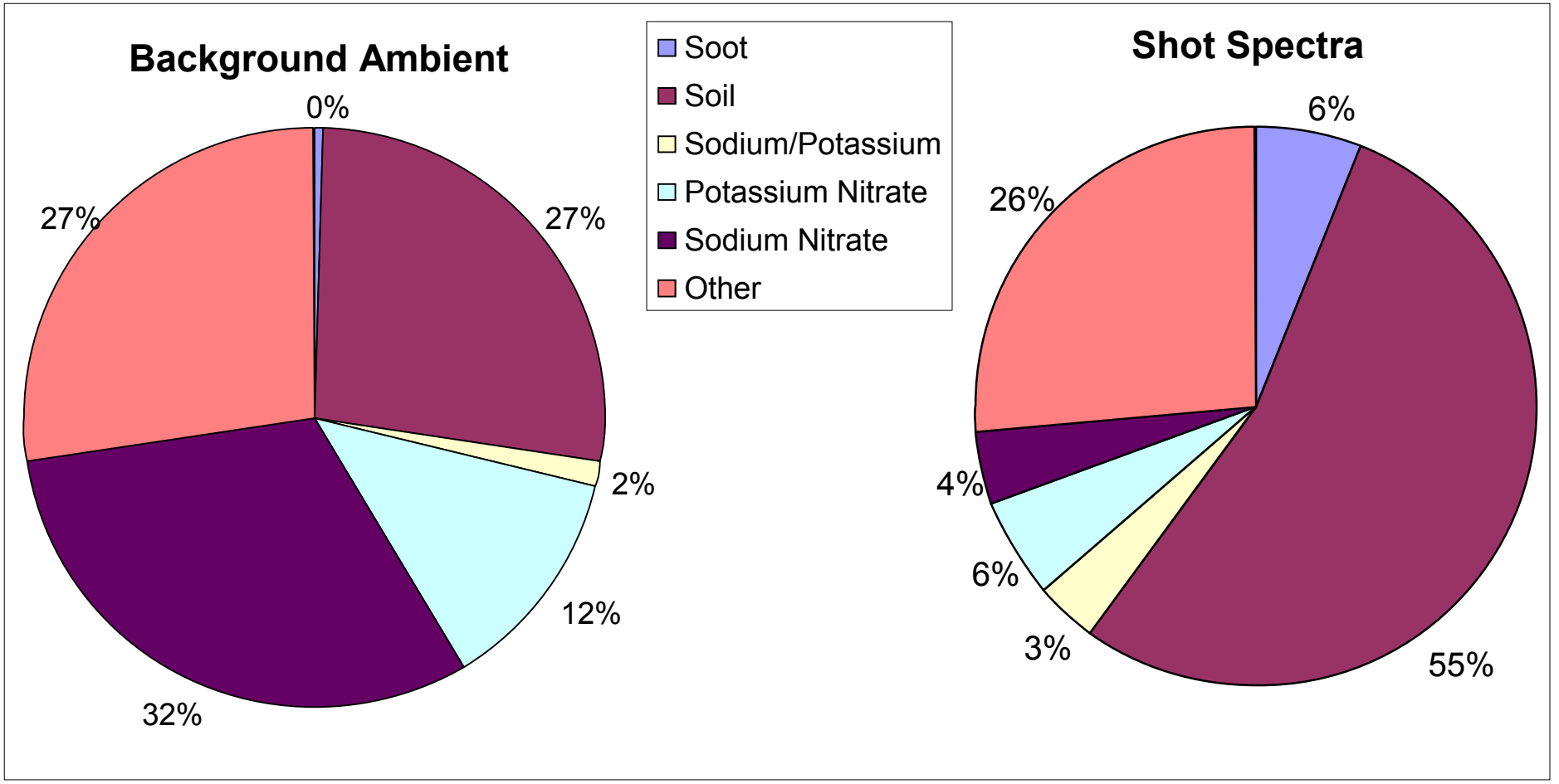
Soot


200
150
100
50
0
-150
-100
-50
0
50
C_{13}^-
C_{12}^-
C_{11}^-
C_{10}^-
C_9^-
C_8^-
C_7^-
C_6^-
C_5^-
C_4^-
C_3^-
C_2^-
C^+
Na^+
C_3^+
CH_3^+
K^+

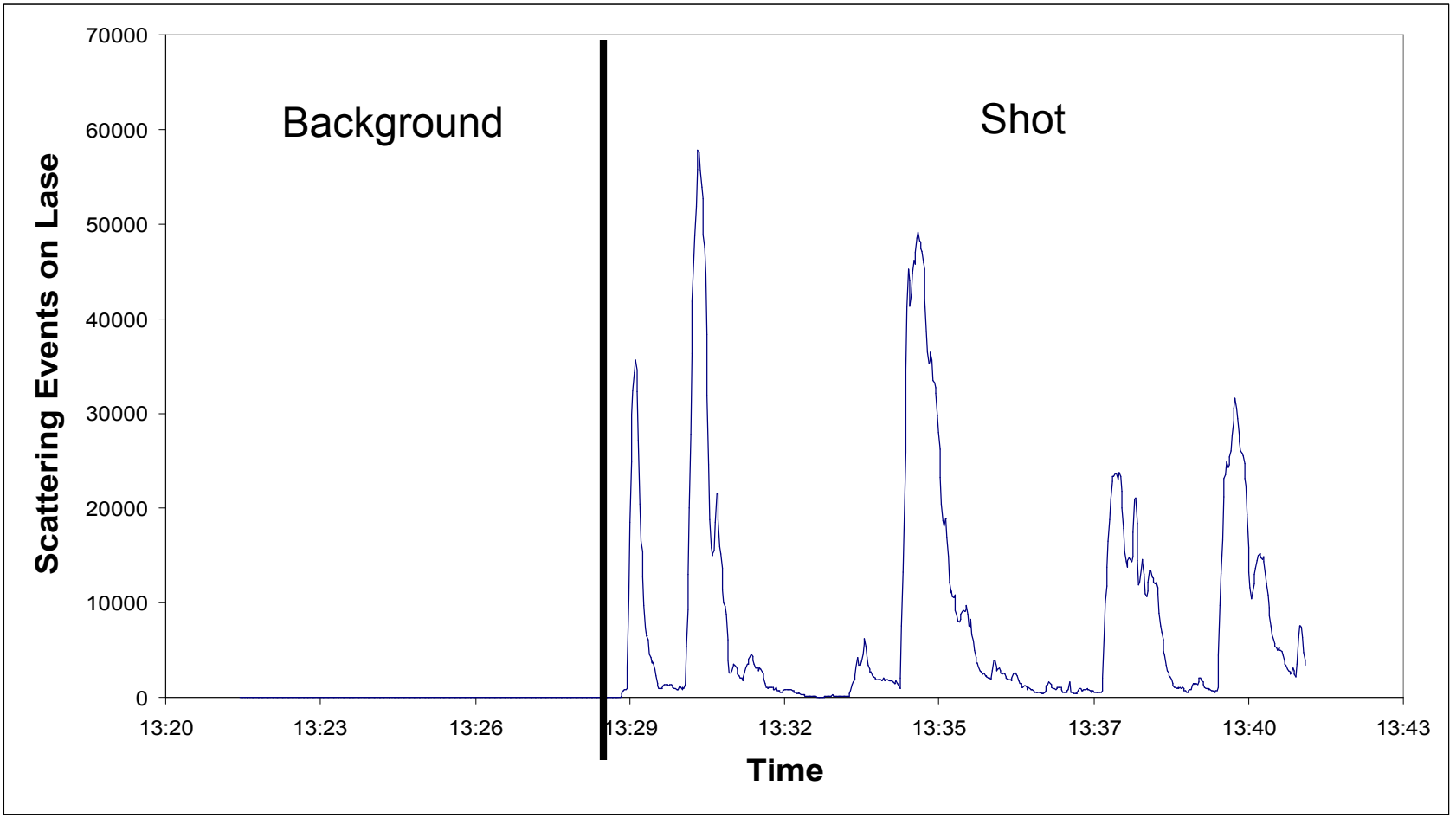
Other Background Particle Classes



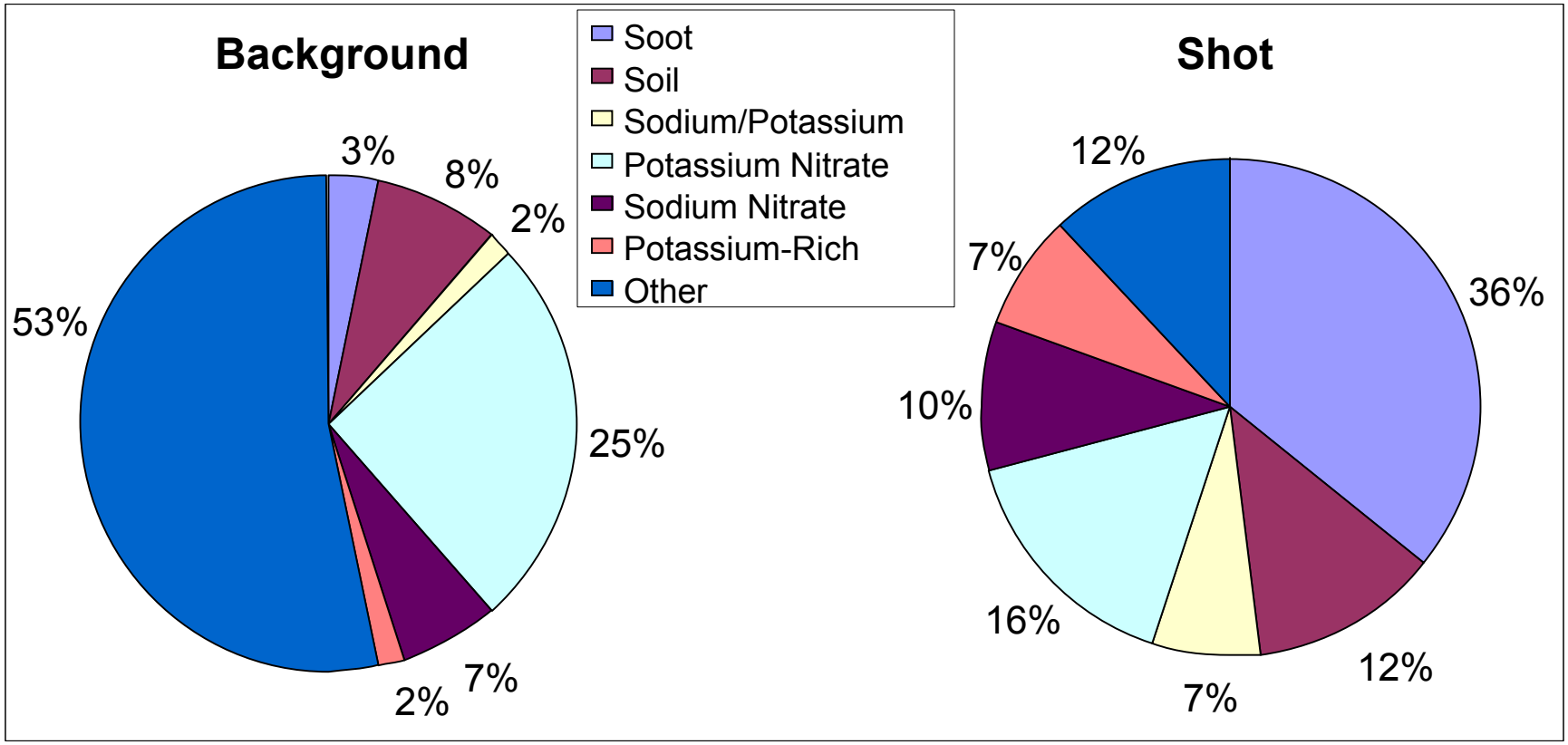
Near Shot Data: Before and After



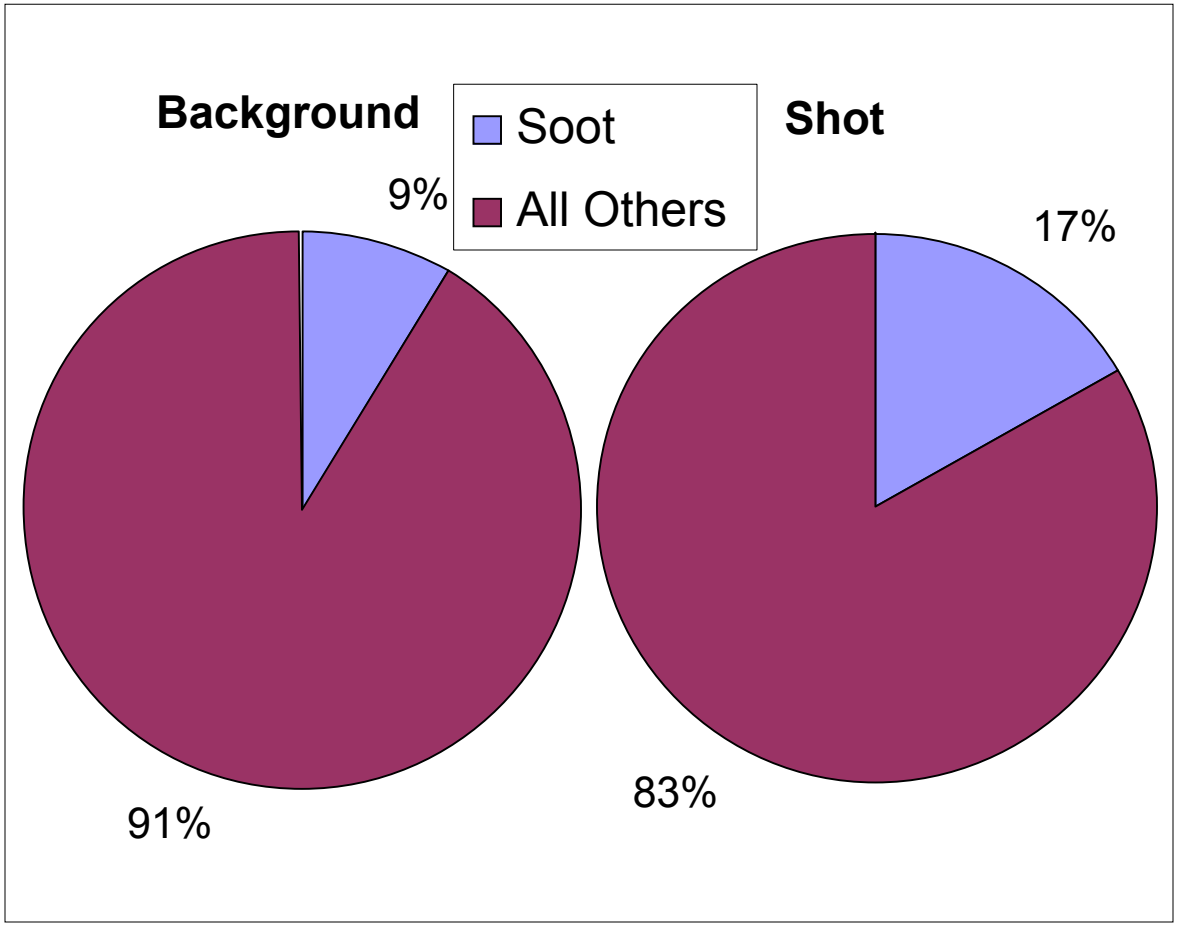
Midfield Plumes



200 Meters from shot

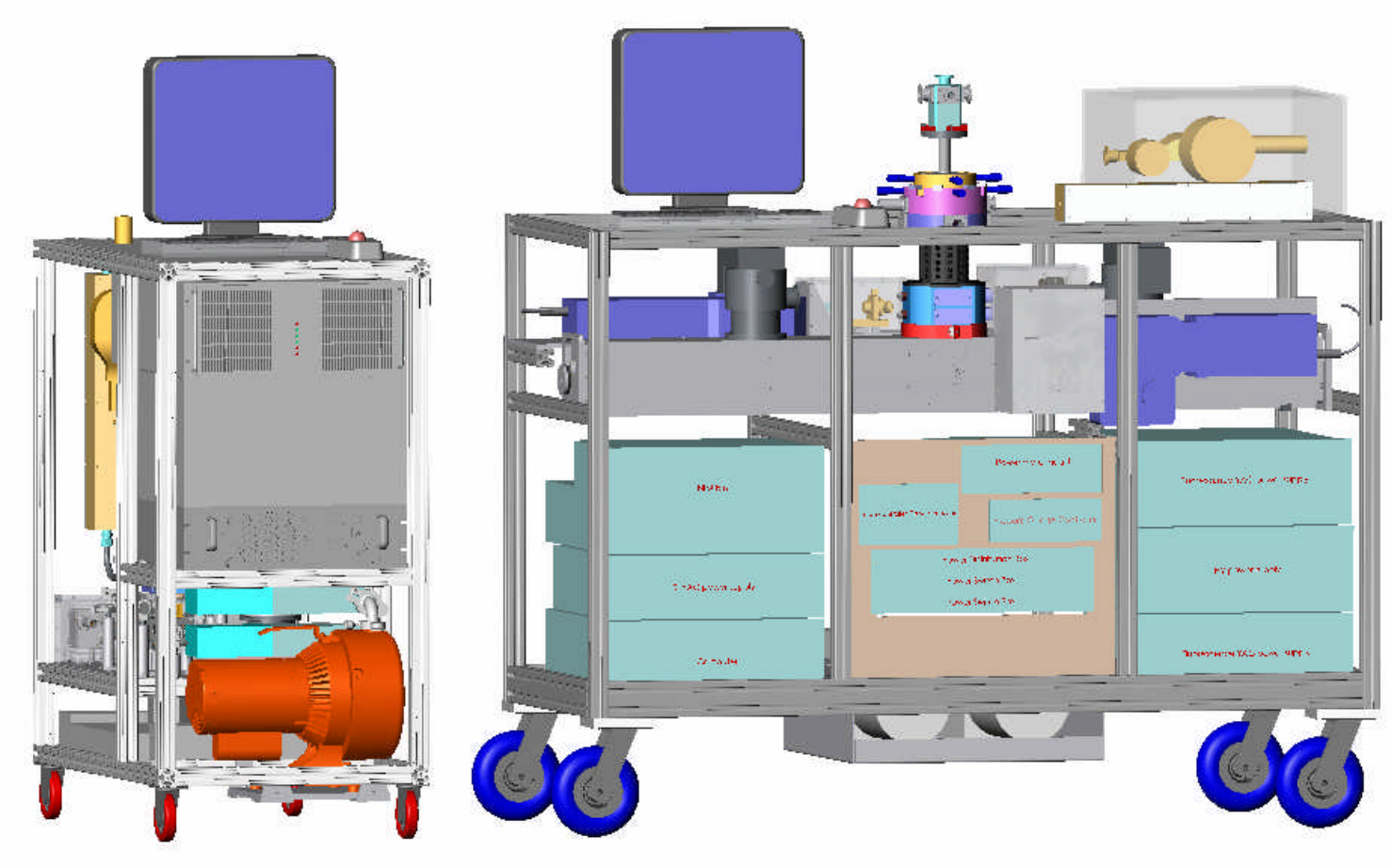


Particle Distributions at Fenceline



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

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  - Dave Ayala
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  - Spencer Chamberlain
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  - DoD Office Of Munitions TCG-IX
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  - DHS

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