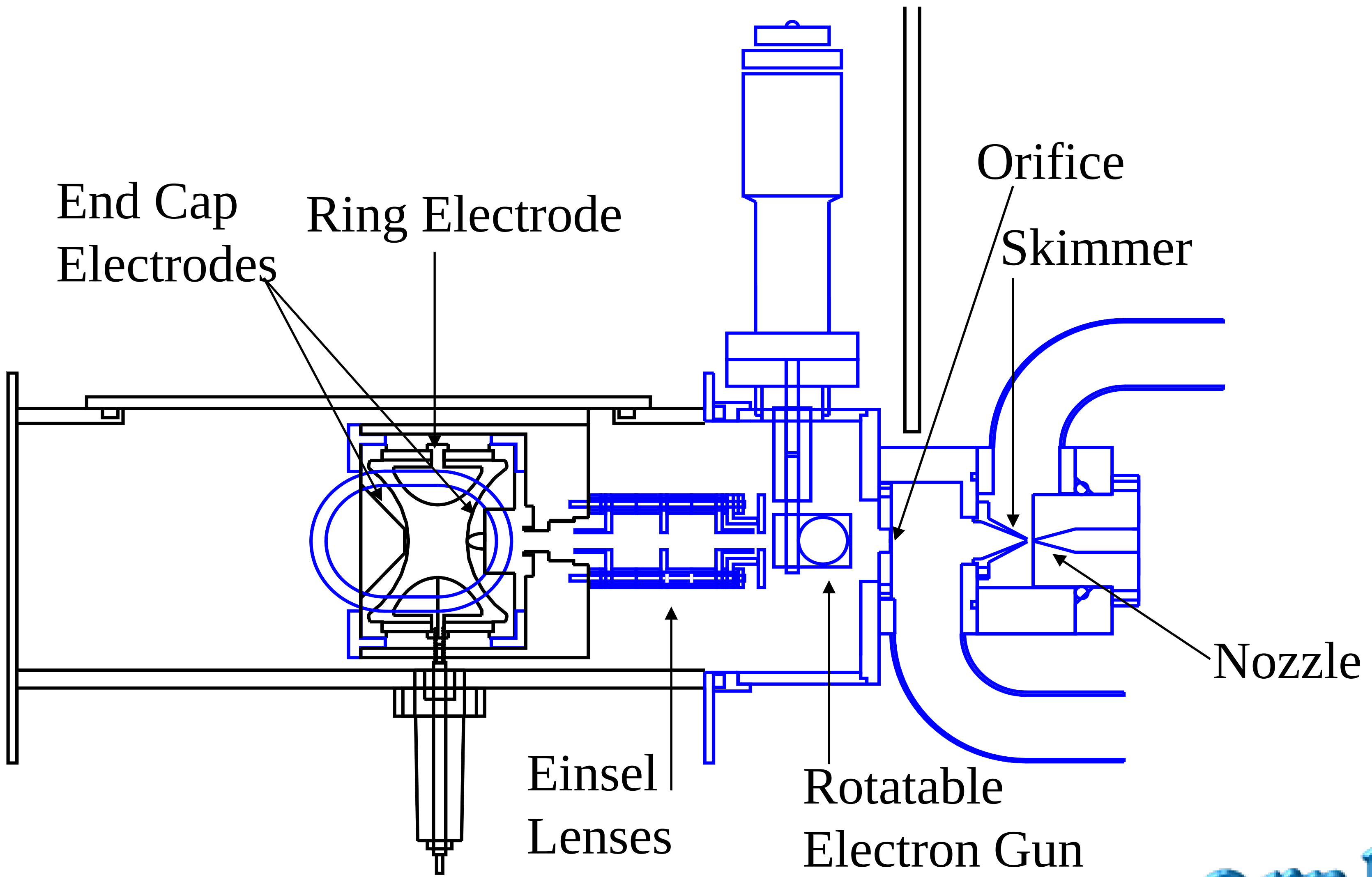
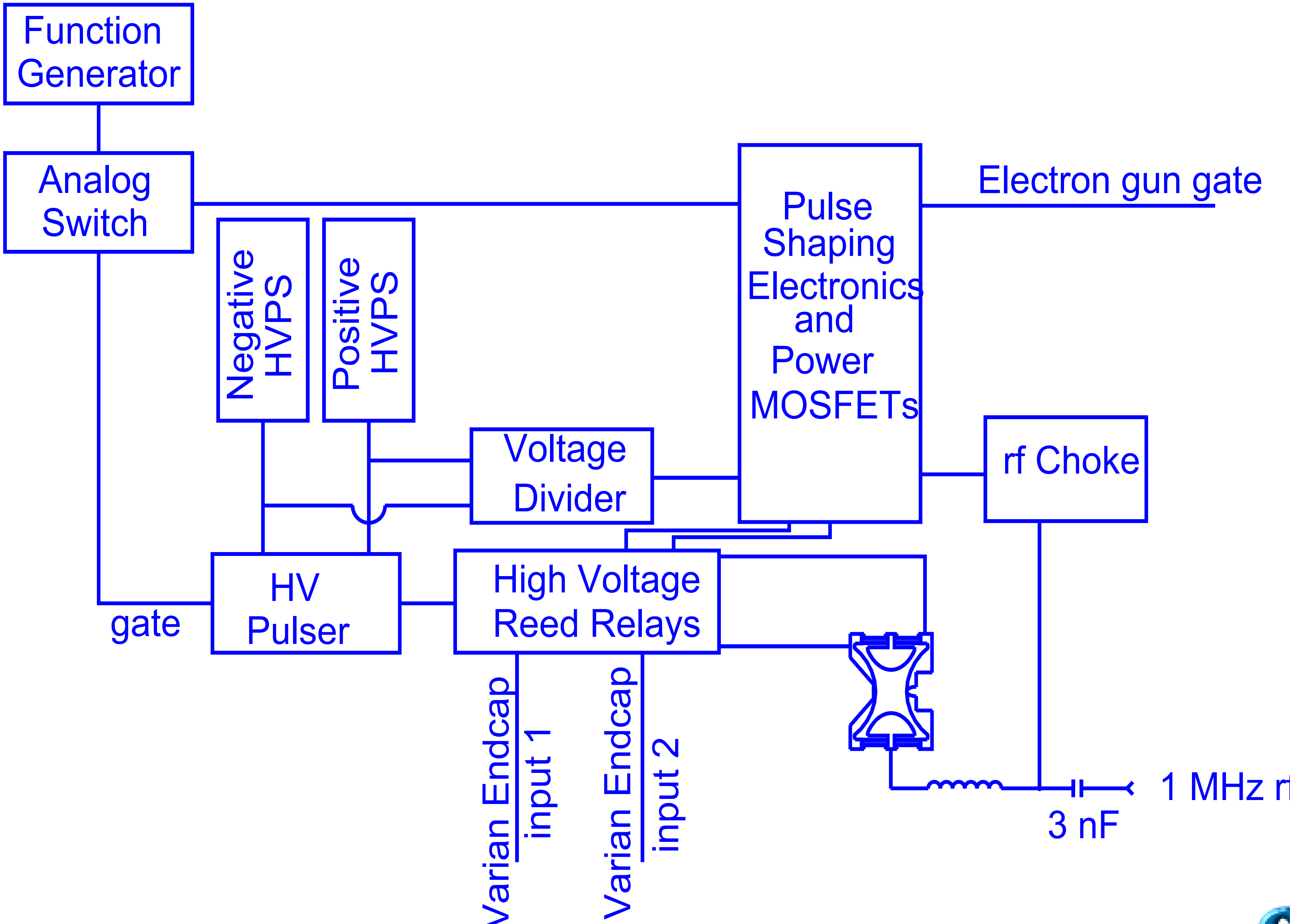
Modification of a Varian Saturn 2000 Ion Trap For Nanoparticles

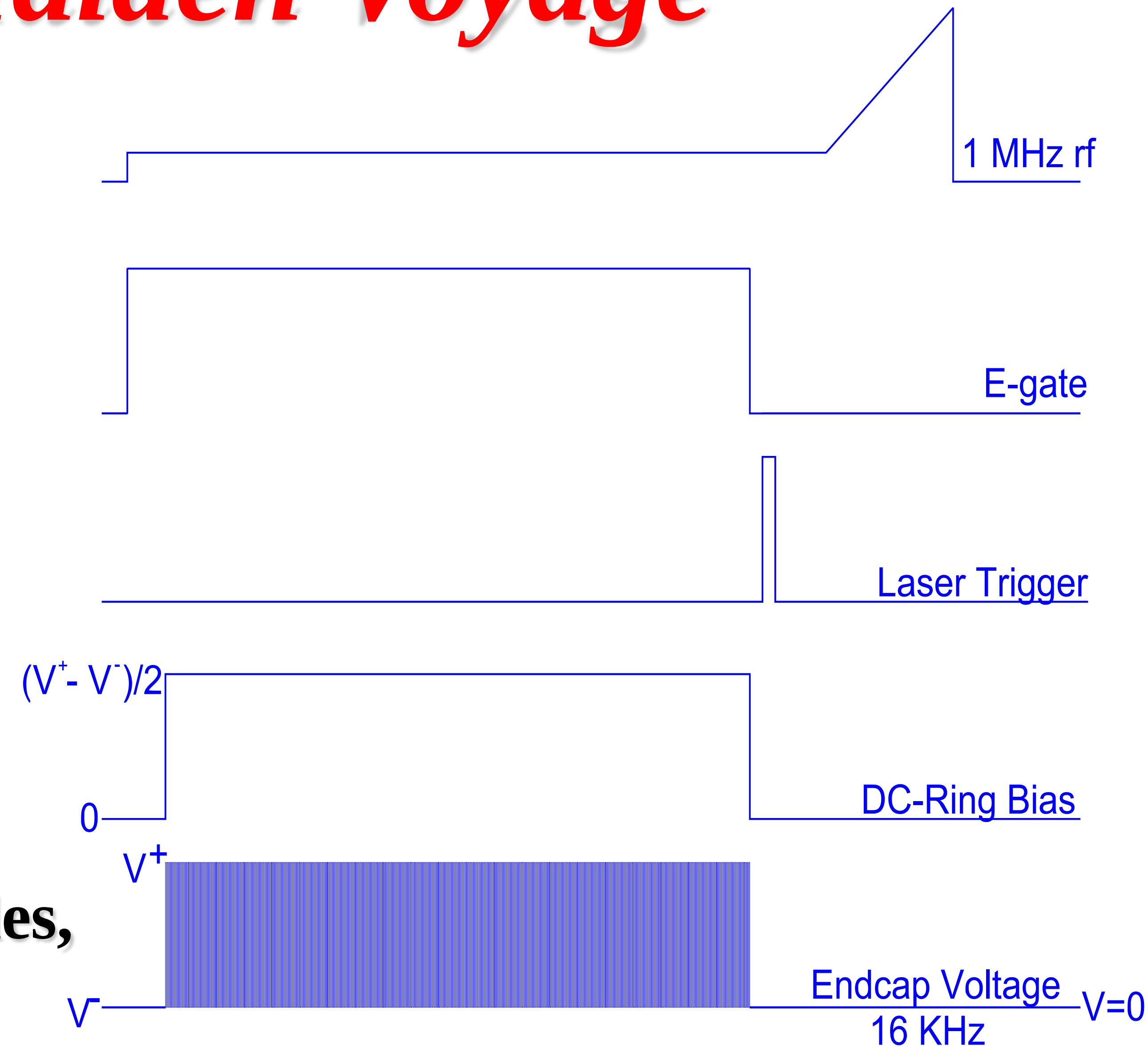


Interface Electronics

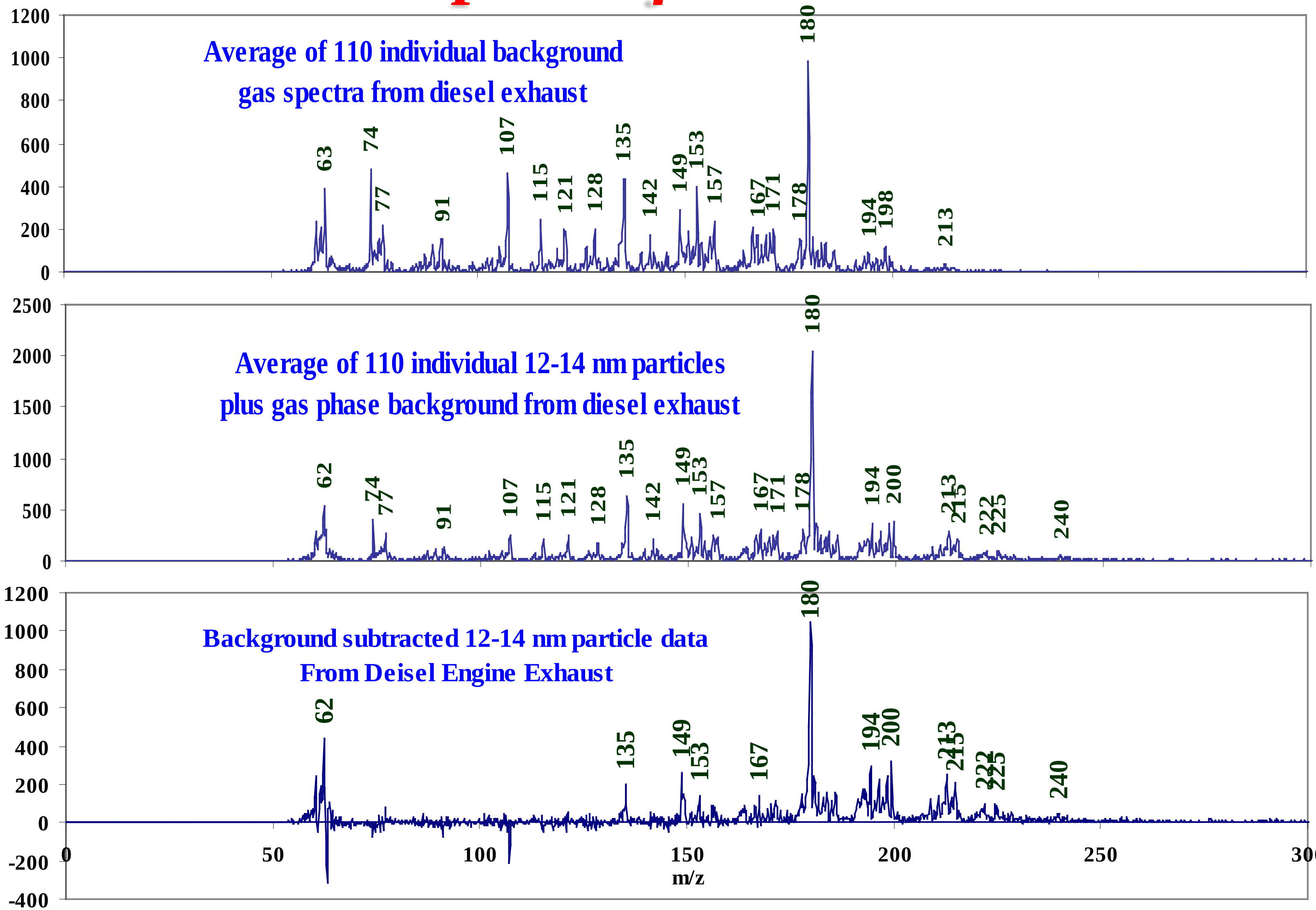


Maiden Voyage

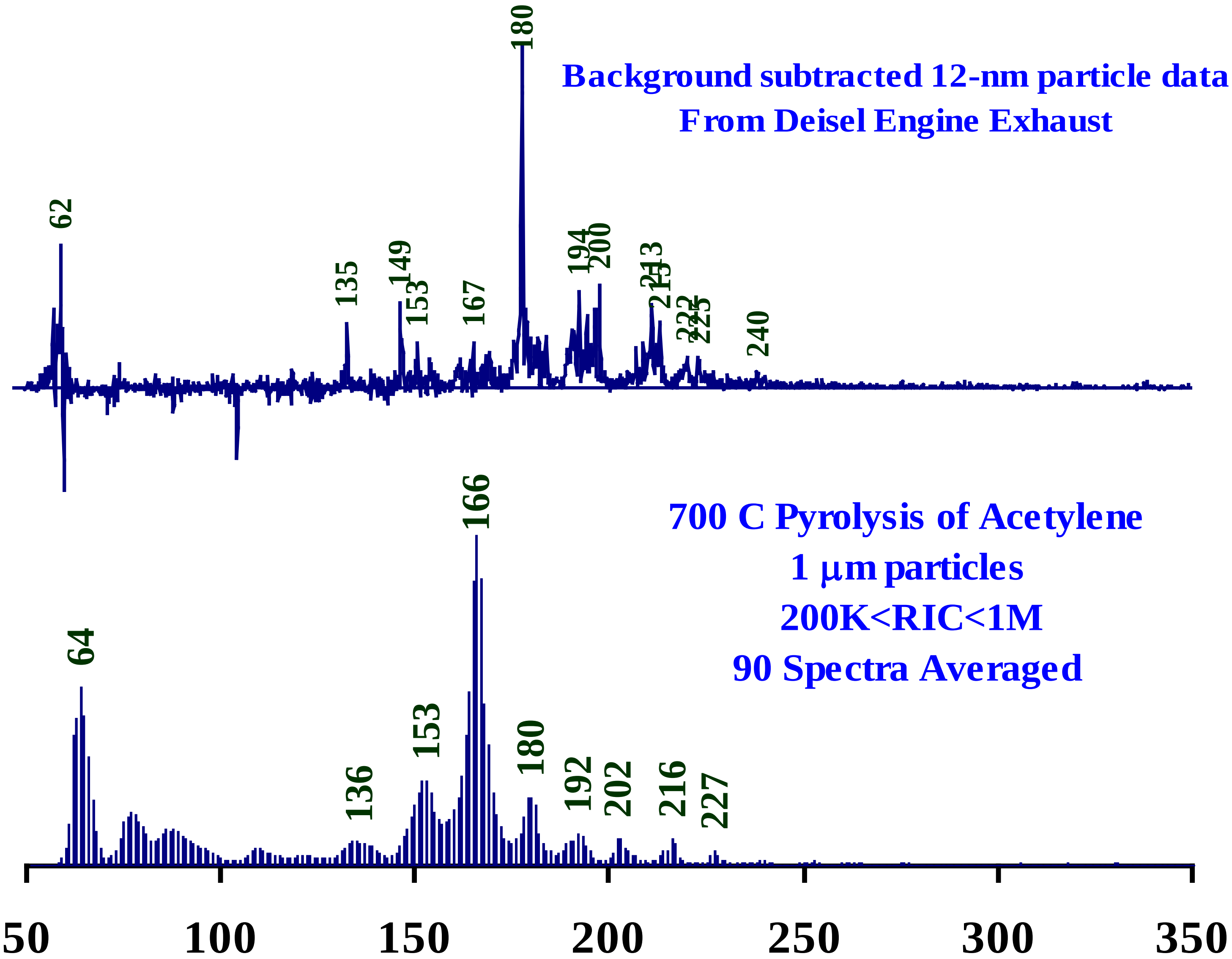
- P_1= 270 mTorr
- P_2=1 mTorr
- P_{trap}=1mtorr He
- DC= 0-400 volts
- AC= 800 volts
- ω=16,000 Hz
- τ=500 ms
- τ_{Laser}=1 ms
- 12-14 nm particles, 80 cm^{-3}



Comparison of 12-14 nm Particle and Gas Phase Spectra from Diesel Exhaust



Comparison of Diesel Exhaust and Low Temperature Acetylene Pyrolysis



Particle Hit Analysis

- One sixth of the spectra showed a high mass intensity increase.
- One particle was captured every 3 seconds of sampling.
- One particle out of 1100 sampled through the nozzle was captured. We can do much better than this.
- The spectra which don’t show an increase in high mass intensity look like the background spectra.
- See no particle spectra when the DC voltage is turned on, only background spectra.
- Background subtracted spectrum is consistent with low temperature pyrolysis of fuel species.

The Possibilities

- **Particles below ~20 nm can easily be electrodynamically trapped. The upper particle size limit depends on the ability of the sampling system to reduce the translation energy of the particle below the trapping potential well depth. Even micron-sized particle can conceivably be trapped in real time with a well designed delivery system. The details of the particle sampling system are currently being worked out.**
- **10 nm particles and greater yield enough signal to be analyzed individually. Particles in the 0-10 nm range can be analyzed by the same methodologies currently applied to biomolecules in ion trap mass spectrometry. This will yield very accurate size and compositional information when development is complete.**

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