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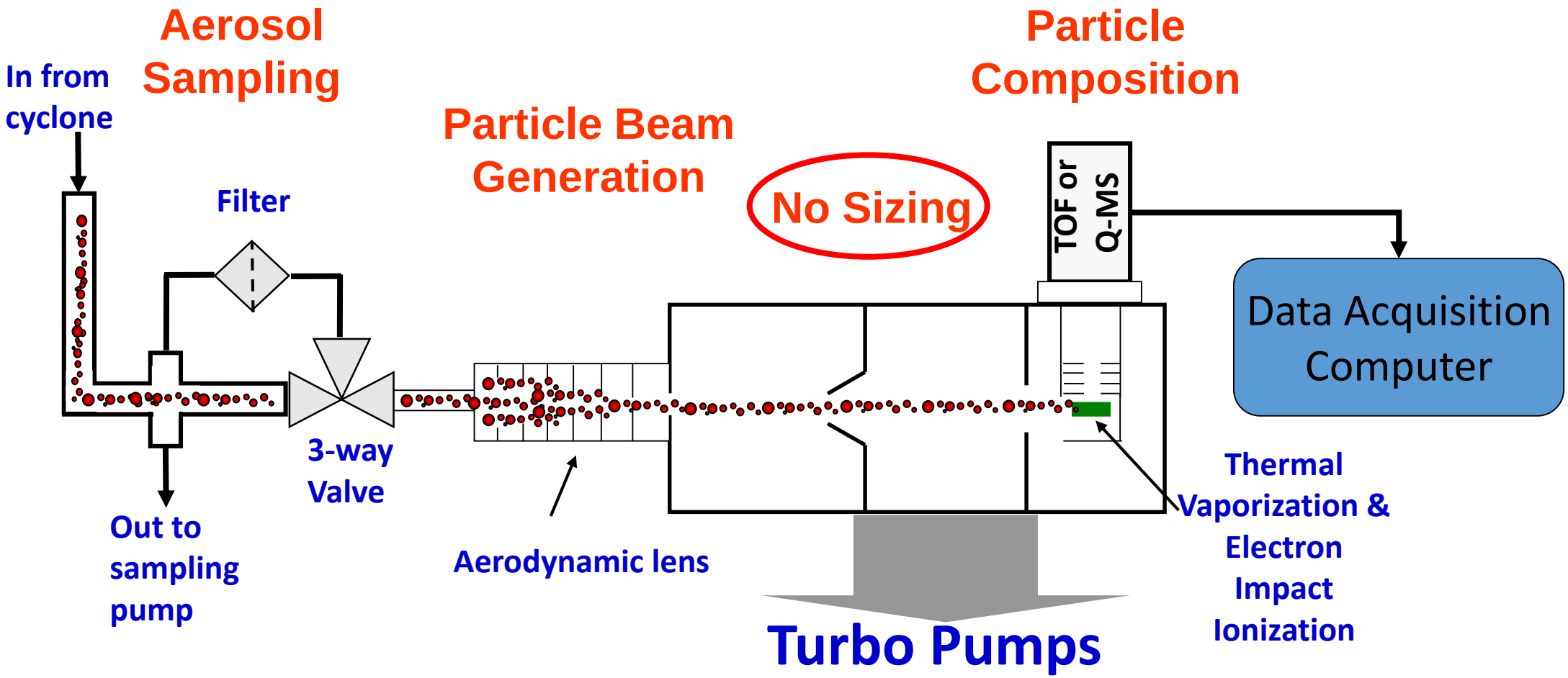
Aerosol Chemical Speciation Monitor (ACSM) Advances

Aerosol Chemical Speciation Monitor (ACSM)



Ng, et al., Aerosol Sci. Technol., 45:7, 770-784, 2011

Quadrupole, Q-ACSM

Time-of-Flight, ToF-ACSM

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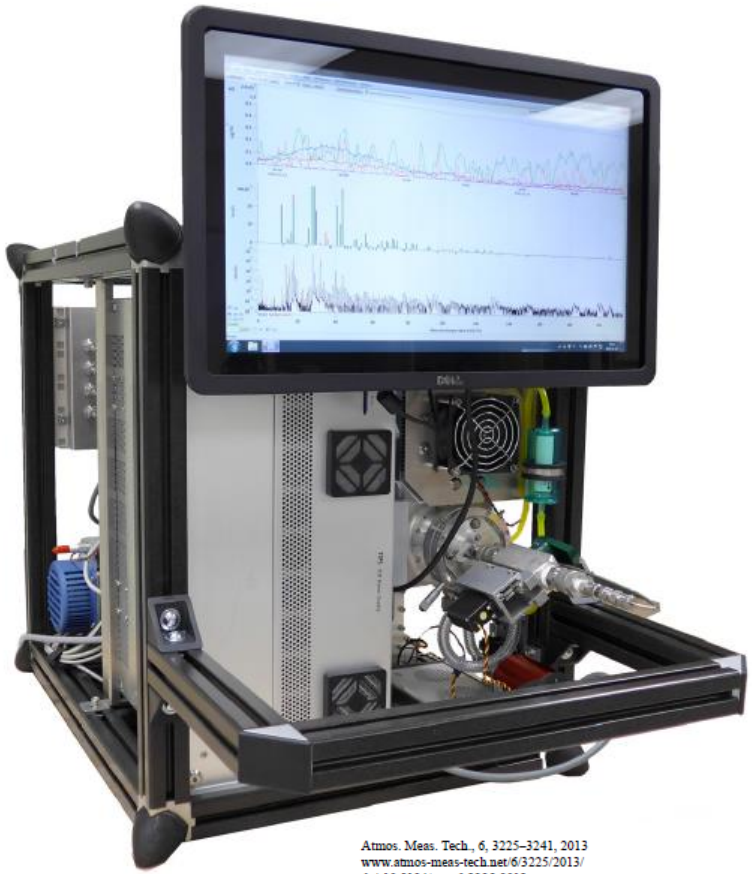

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An Aerosol Chemical Speciation Monitor (ACSM) for Routine Monitoring of the Composition and Mass Concentrations of Ambient Aerosol

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doi:10.5194/amt-6-3225-2013

Atmospheric Measurement Techniques
Open Access

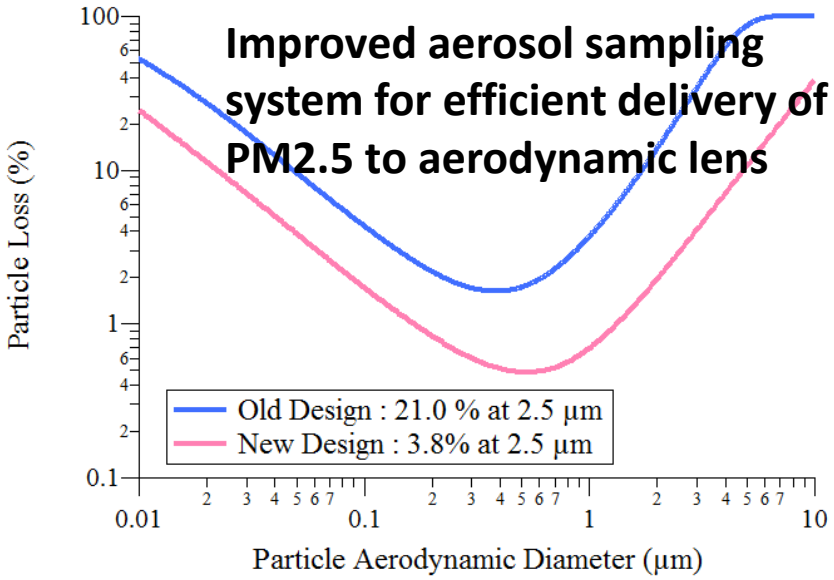
The ToF-ACSM: a portable aerosol chemical speciation monitor with TOFMS detection

R. Fröhlich[1], M. J. Cubison[2], J. G. Slowik[1], N. Bukowiecki[1], A. S. H. Prévôt[1], U. Baltensperger[1], J. Schneider[3], J. R. Kimmel[2,4], M. Gonin[2], U. Rohner[2], D. R. Worsnop[4], and J. T. Jayne[4]

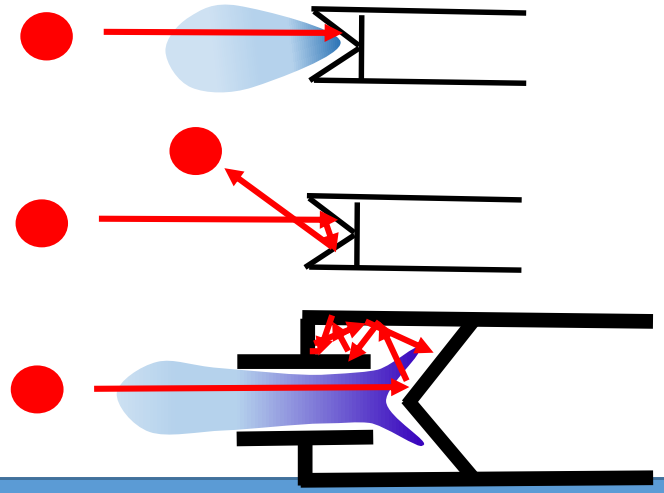
PM2.5 Capable ACSM – Laboratory Characterization

Xu et al., AS&T, 2016

Improved aerosol sampling system for efficient delivery of PM2.5 to aerodynamic lens

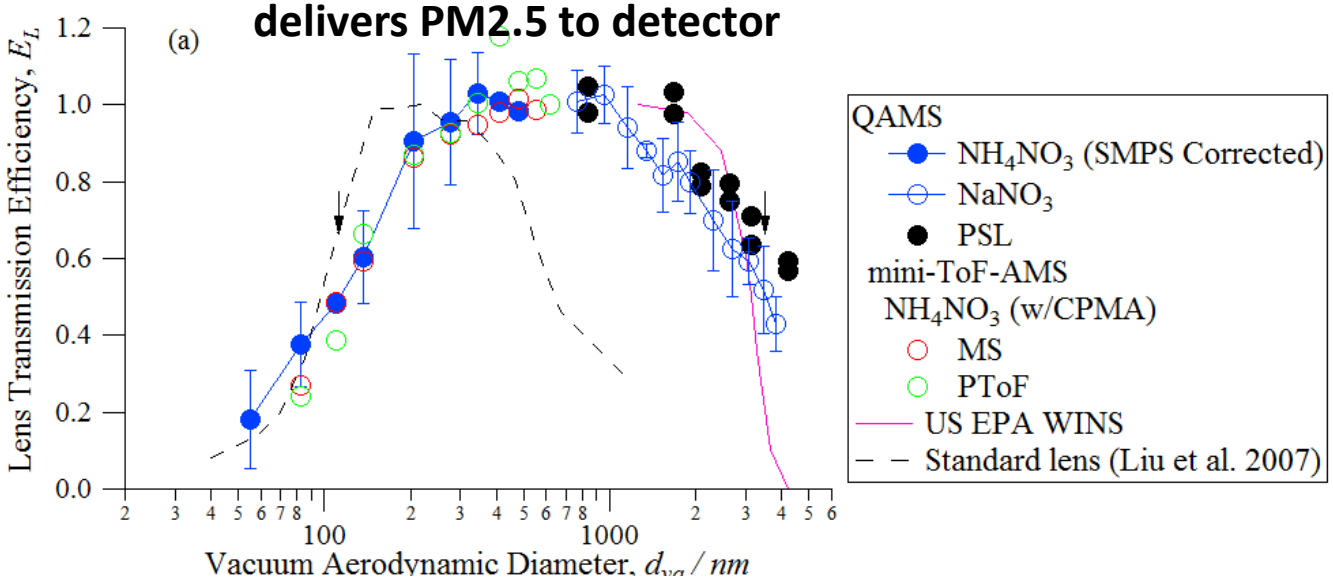


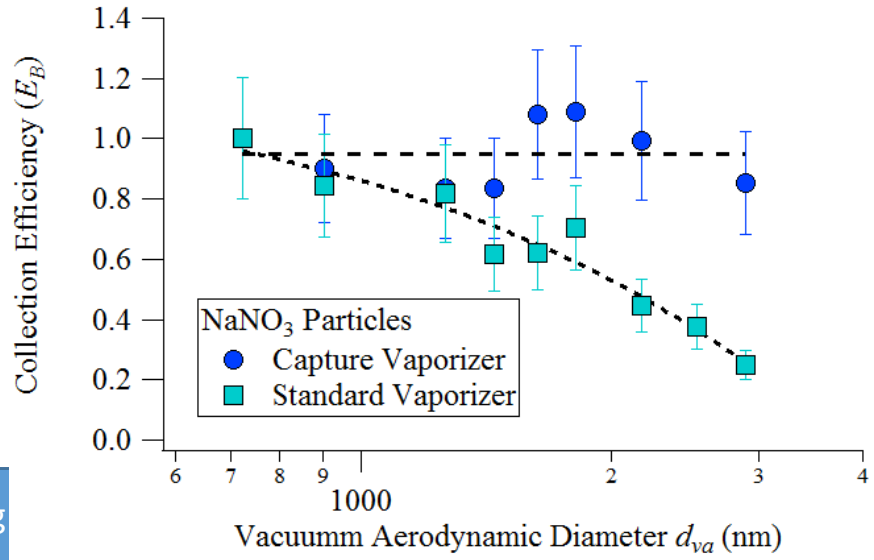
Von der Weiden et al., Atmos. Meas. Tech., 2, 479-494, 2009.



Capture Vaporizer effectively vaporizes all large particles for complete detection of NR-PM2.5

Intermediate Pressure Lens (IPL) delivers PM2.5 to detector

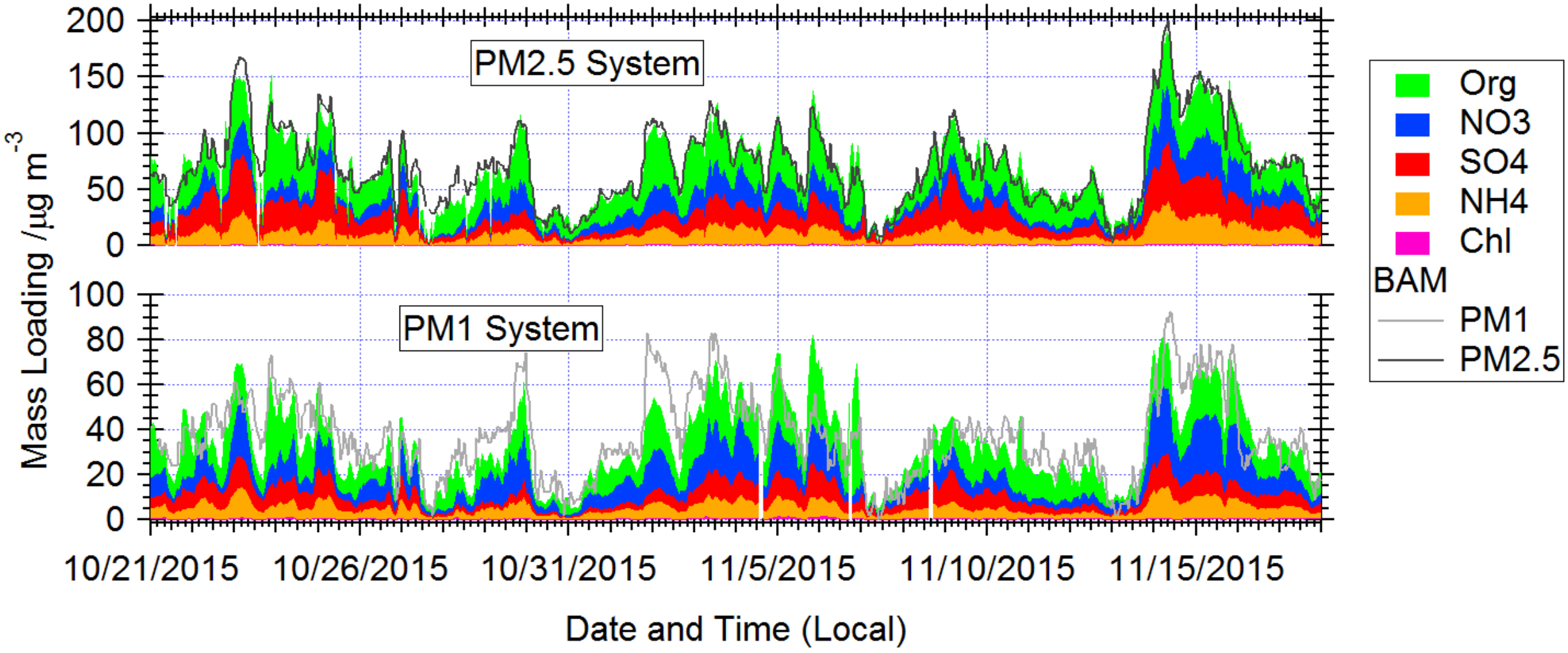




PM2.5 Capable ACSM – Ambient Characterization

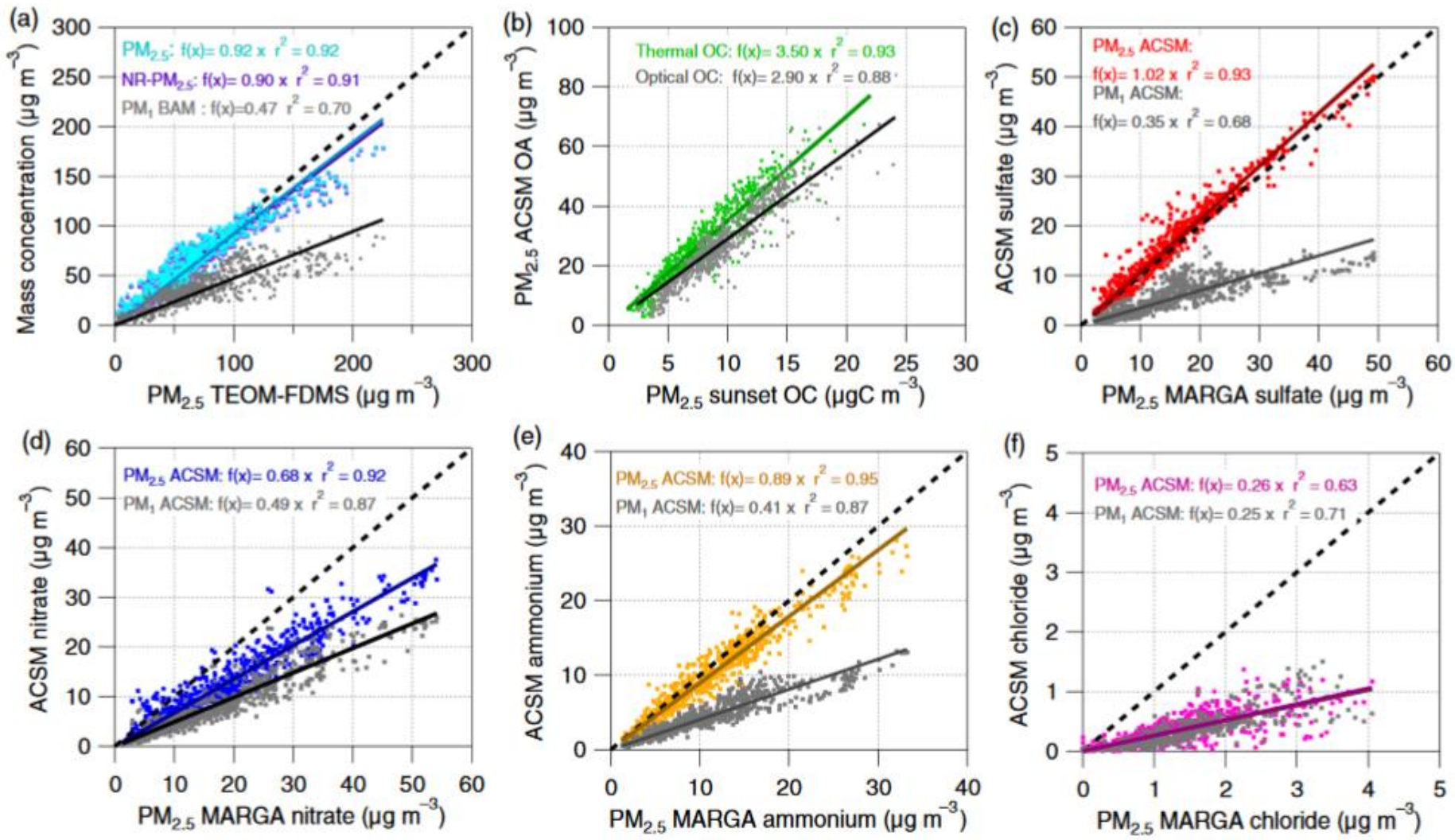
Zhang et al., ACPD, 2017

AERODYNE RESEARCH, Inc.

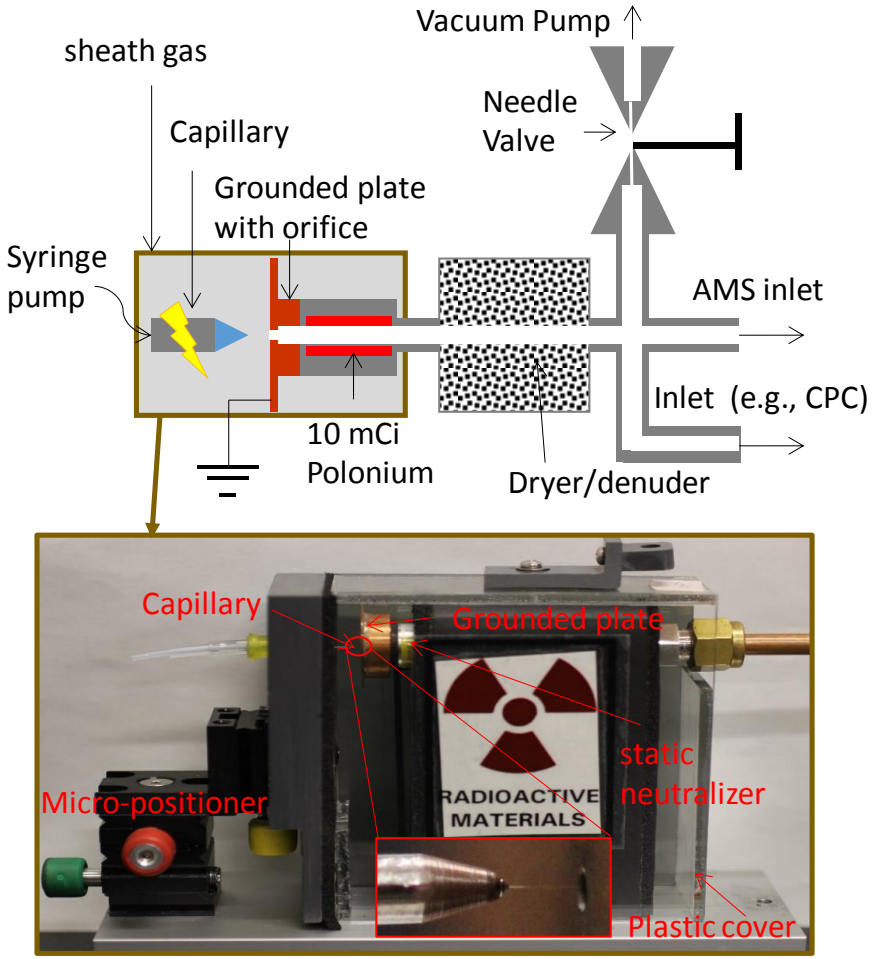


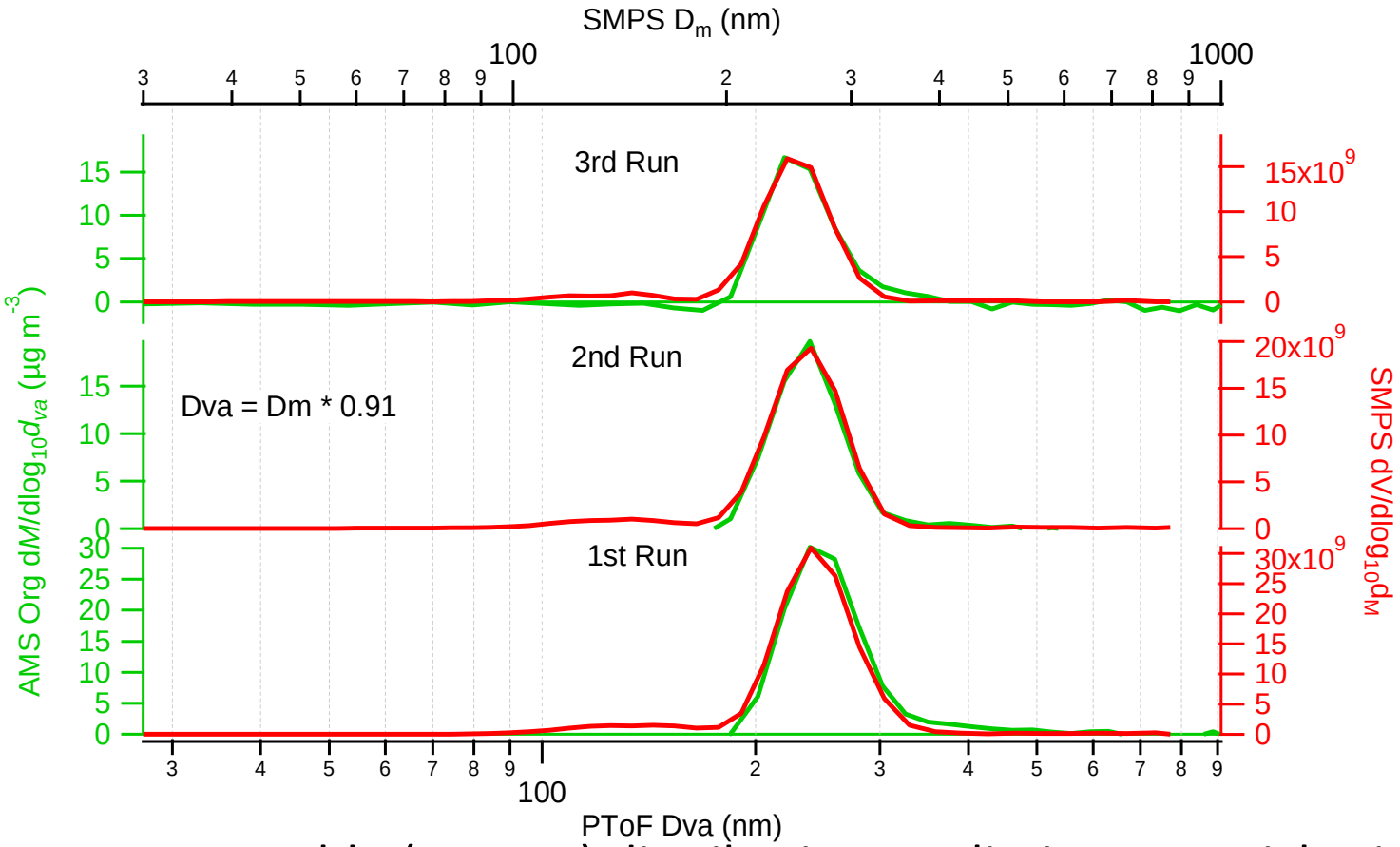
PM2.5 Capable ACSM – Ambient Characterization

Zhang et al., ACPD, 2017



Towards simplified calibration of ACSM - electrospray



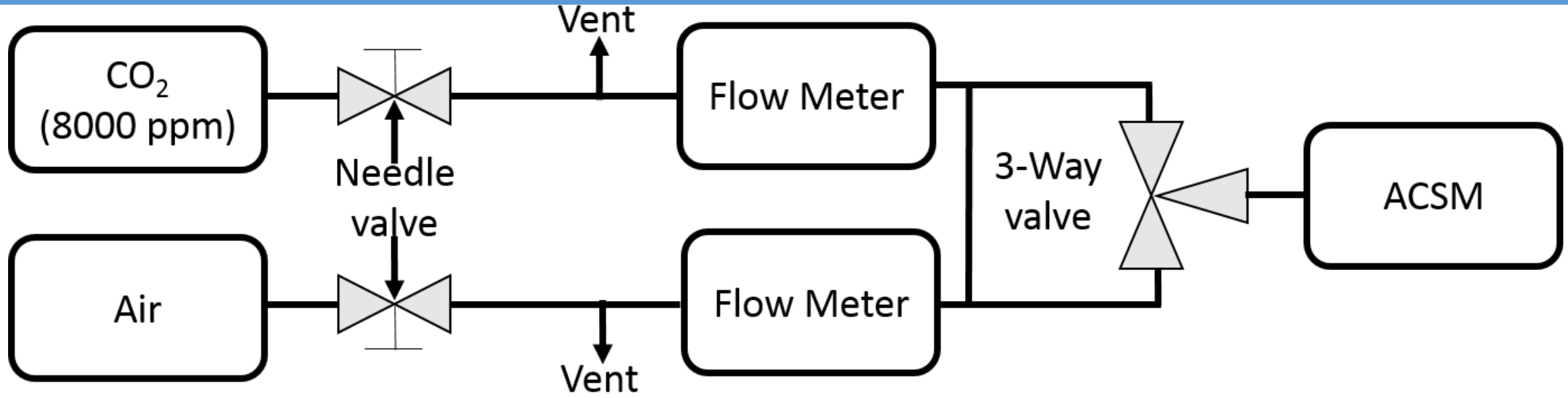


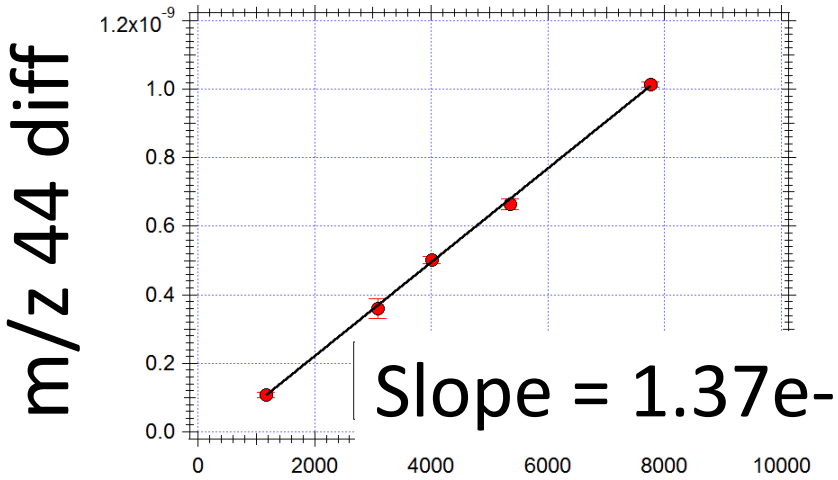
Want repeatable (narrow) distribution to eliminate particle sizing

Worked for oleic acid in acetonitrile but not for aqueous or salts

Practical concerns as well (e.g. radioactive source)

Towards new calibrations techniques – gas introduction



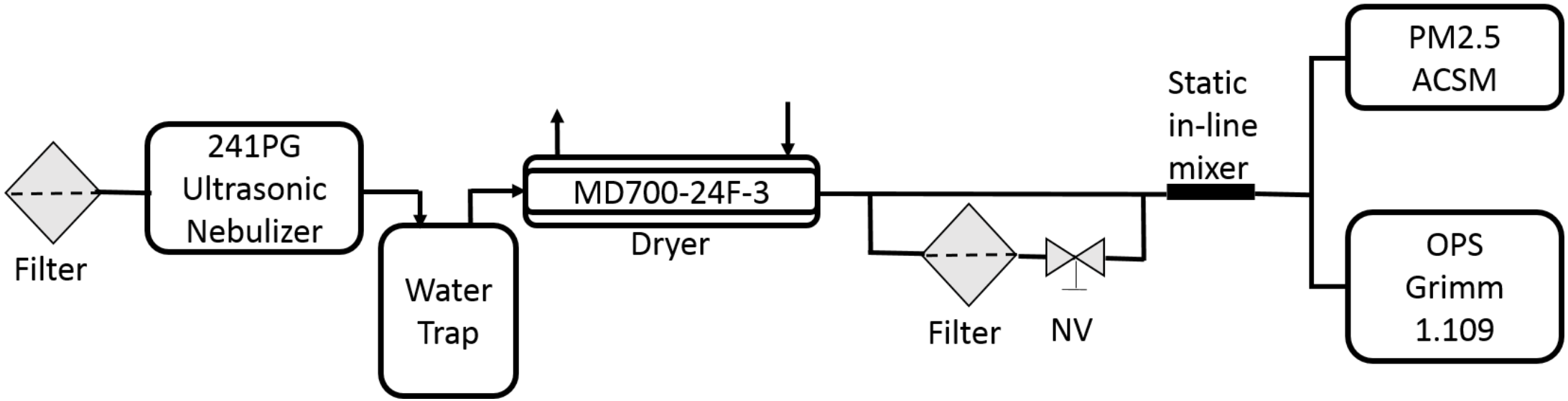


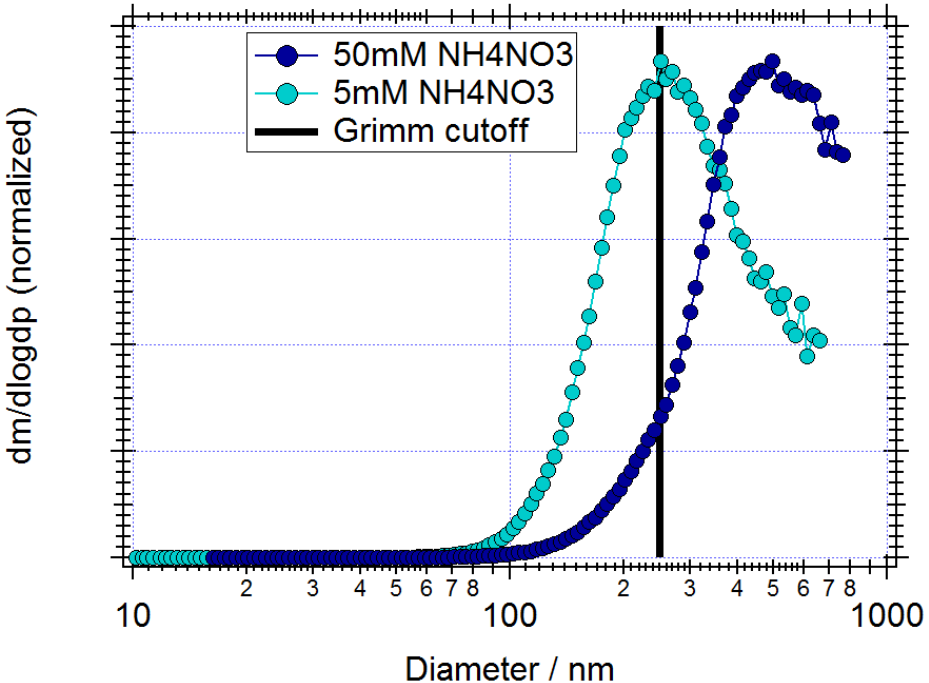
Gases are easier to use for calibration than aerosols (by far).
We get a nice calibration curve at varying CO_2 concentrations.
But what does this add?

1e6*0.78*1.37e-13 amps/ppm = 1.06e-7 amps

Our airbeam signal is 1e-7 amps

Towards simplified calibration – Ultrasonic nebulizer and OPC

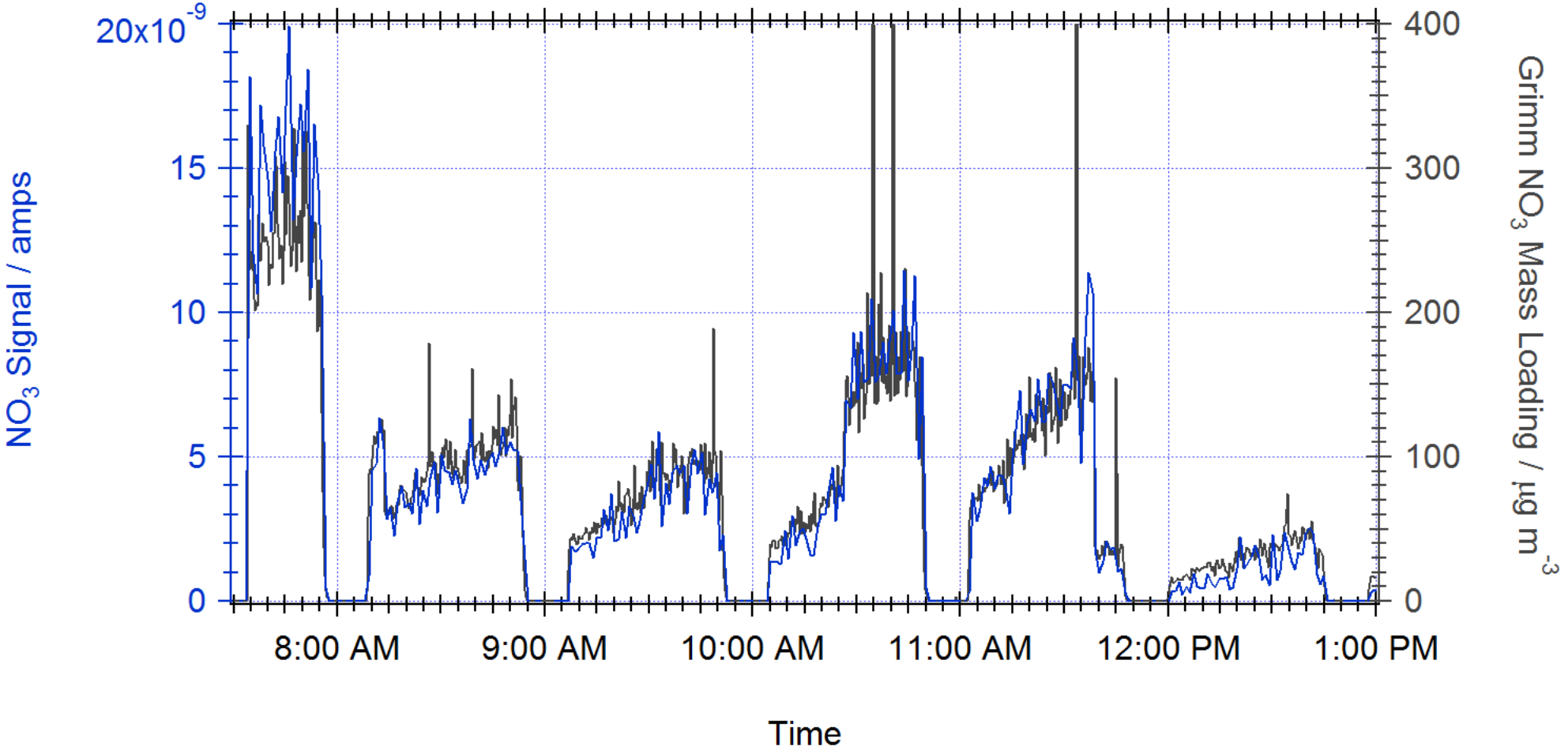




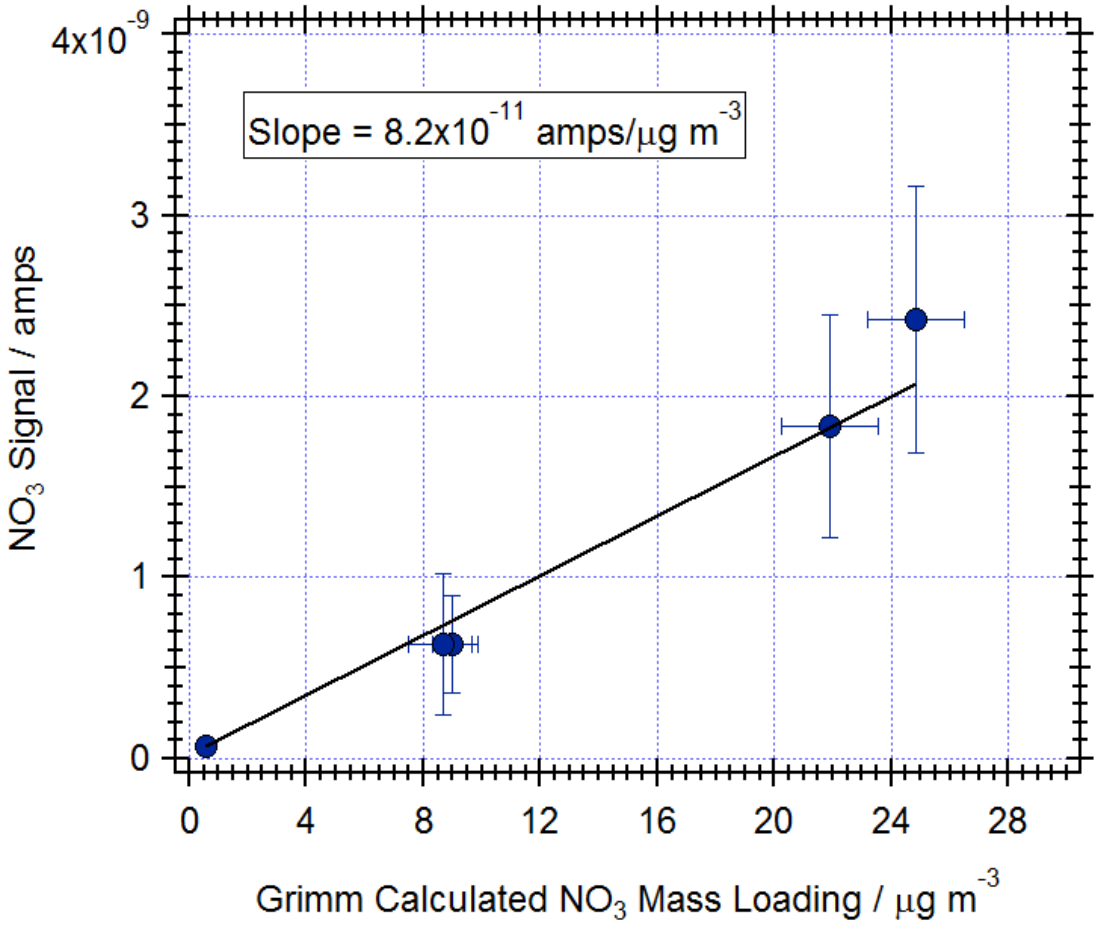
Generate particles with UN that are large enough to be counted by the OPC

Feed ACSM and OPC the polydisperse and integrate the size distribution to calculate the input mass

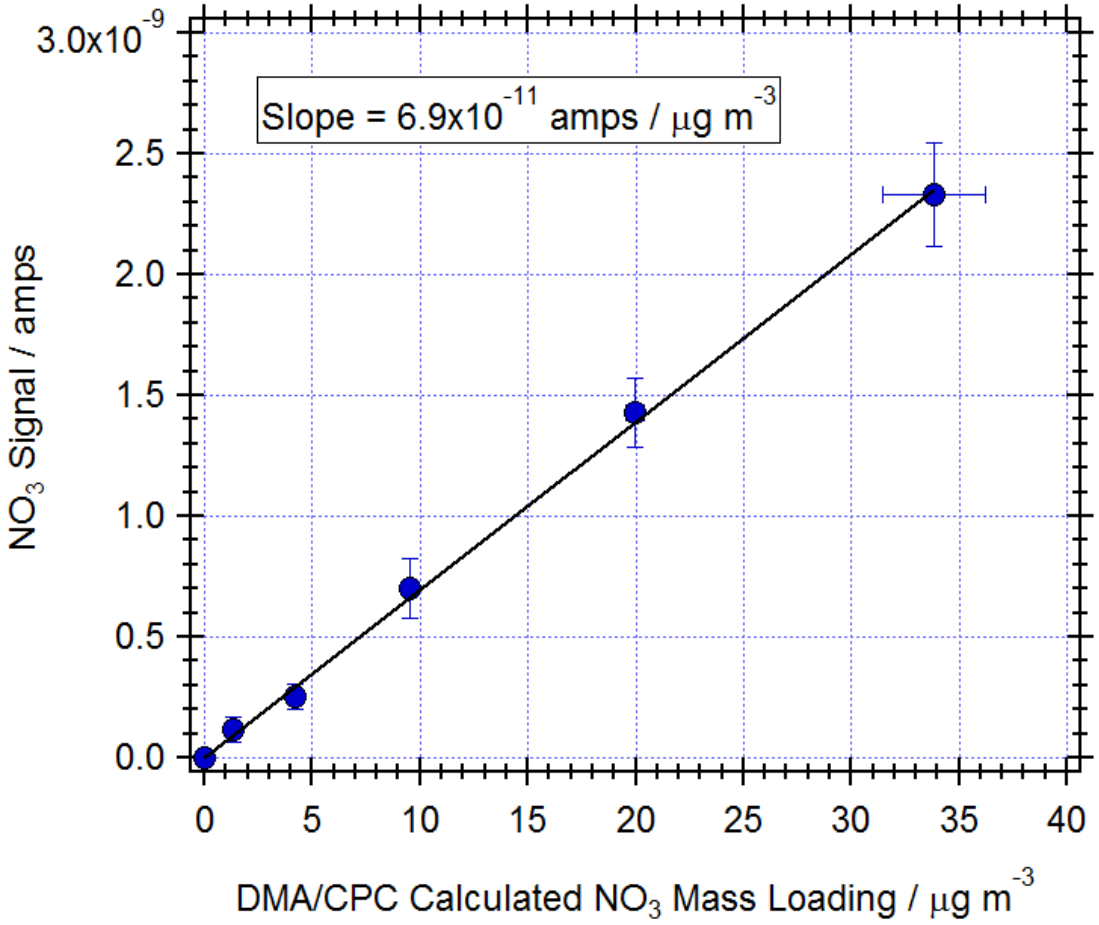
Towards simplified calibration – Ultrasonic nebulizer and OPC



Towards simplified calibration – Ultrasonic nebulizer and OPC



UN/OPC Calibration



Standard ACSM Calibration