

Field-performance of a New Time-resolved Sampler for Chemical Speciation of Ambient Aerosol

Arantzazu Eiguren-Fernandez

Gregory S. Lewis

Steven R. Spielman

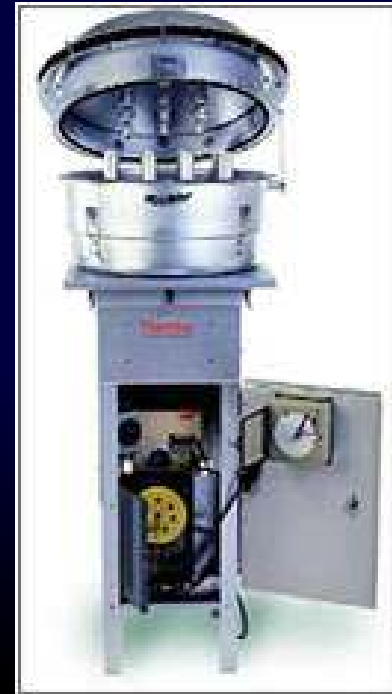
Susanne V. Hering

Aerosol Dynamics Inc.

OVERVIEW

1. Searching for the perfect field sampling system:
what do we need?
2. “Jackson” Description
3. Performance

1. Perfect system ?



Perfect system?

1) Small and portable: light, quiet,

2) Cheap

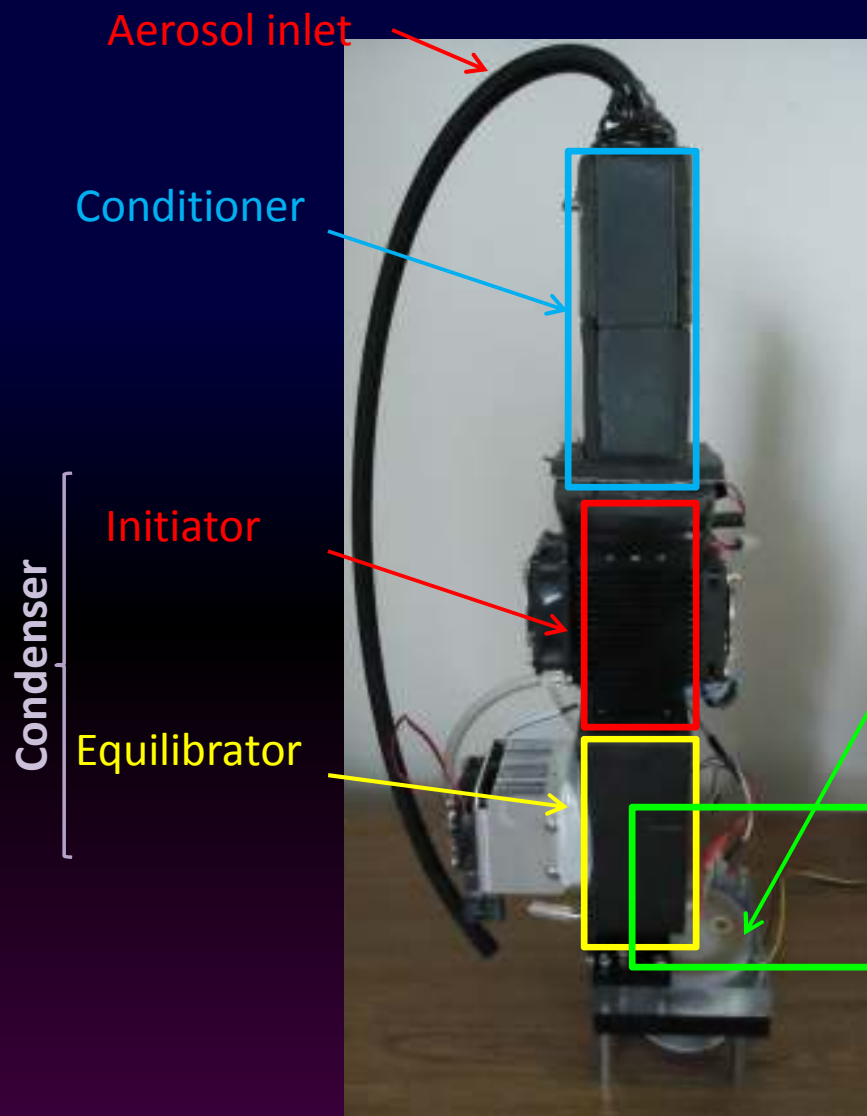
3) Versatile: variable flow, collection matrices,

4) Free from artifacts

5) Reliable and Easy to handle

We still do not have a system like this!

2. "Jackson"



Sample collection chamber

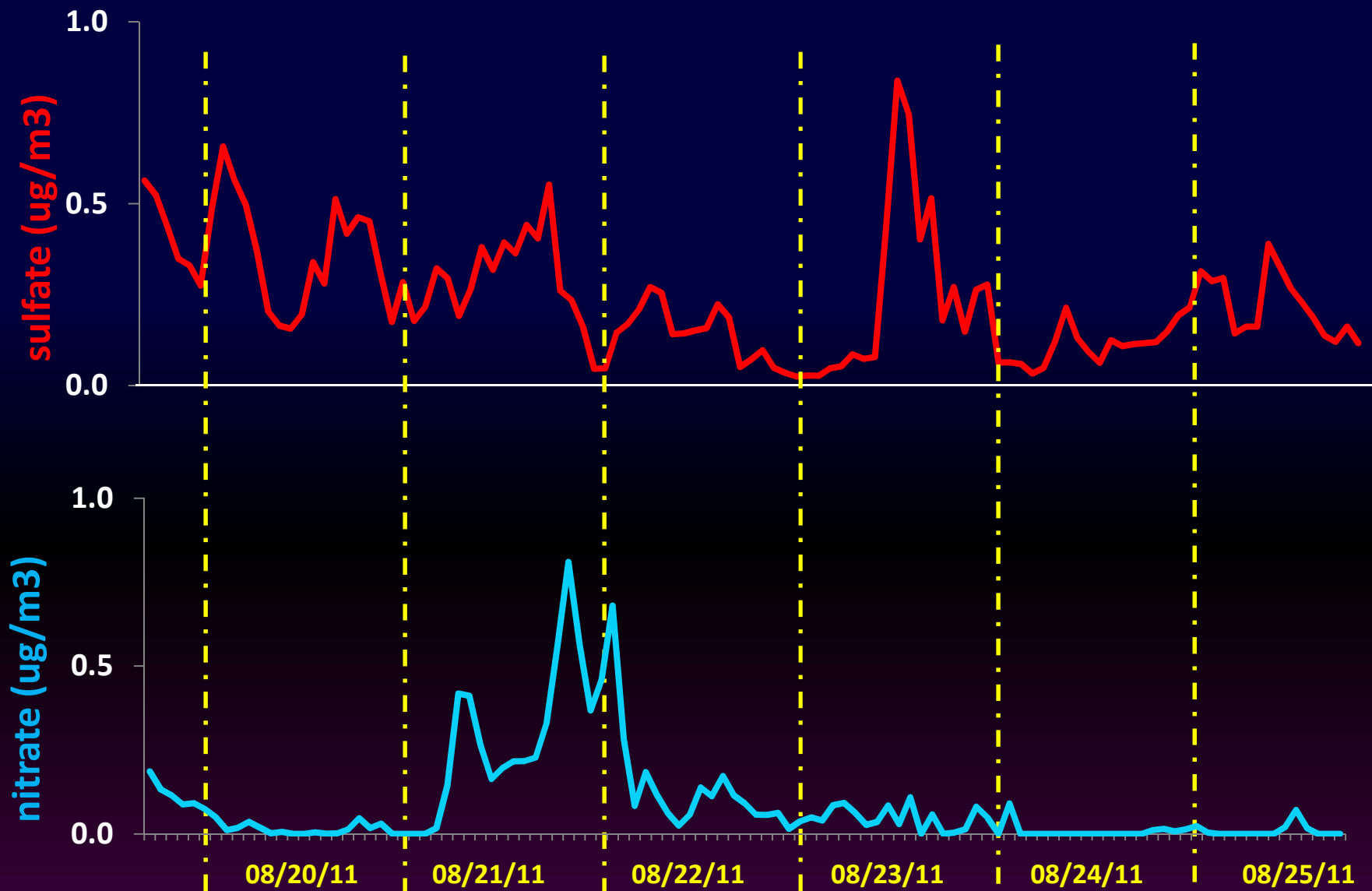


Dry collection at 26°C

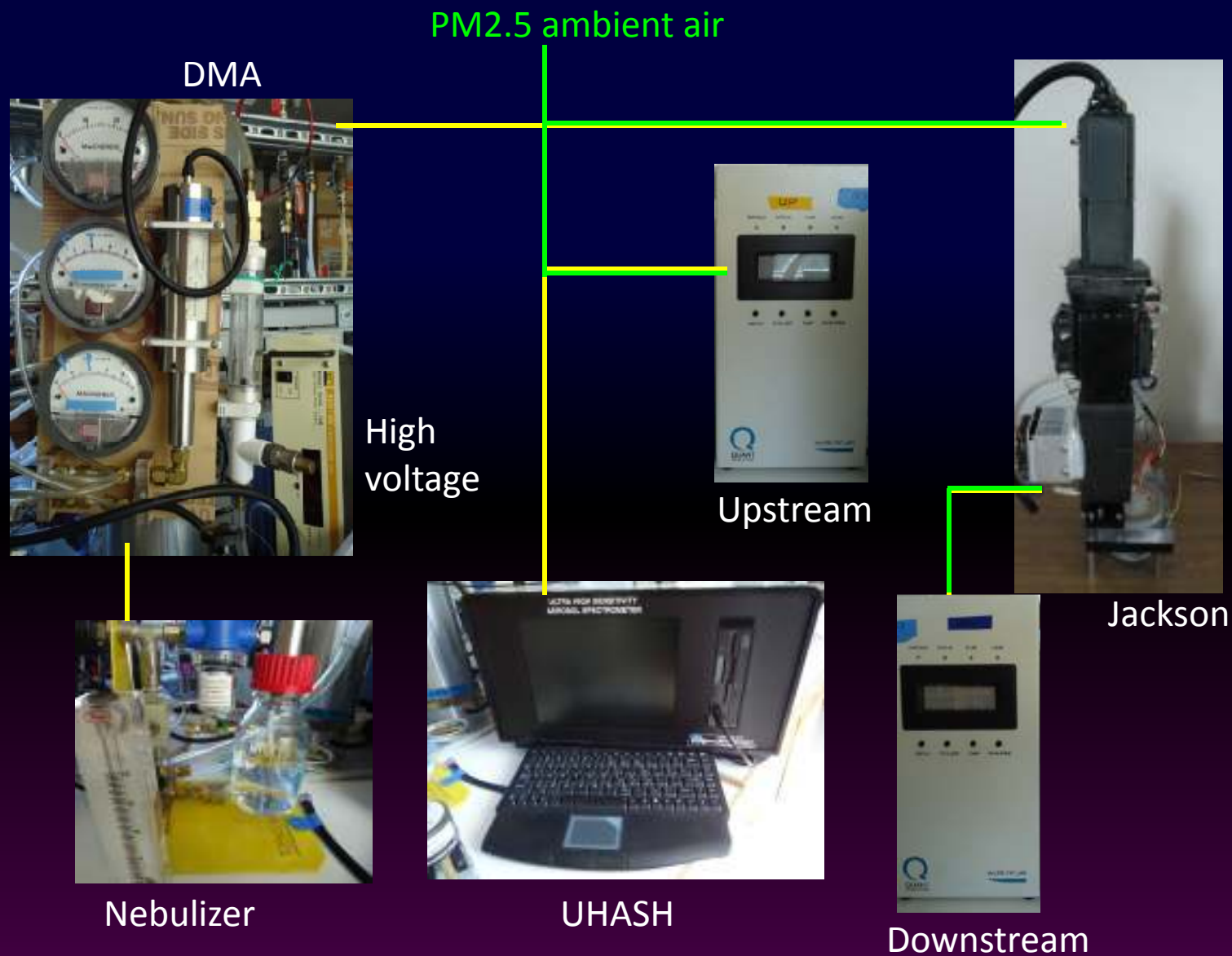
Chemical Analysis -Autosampler



What kind of data do we get?

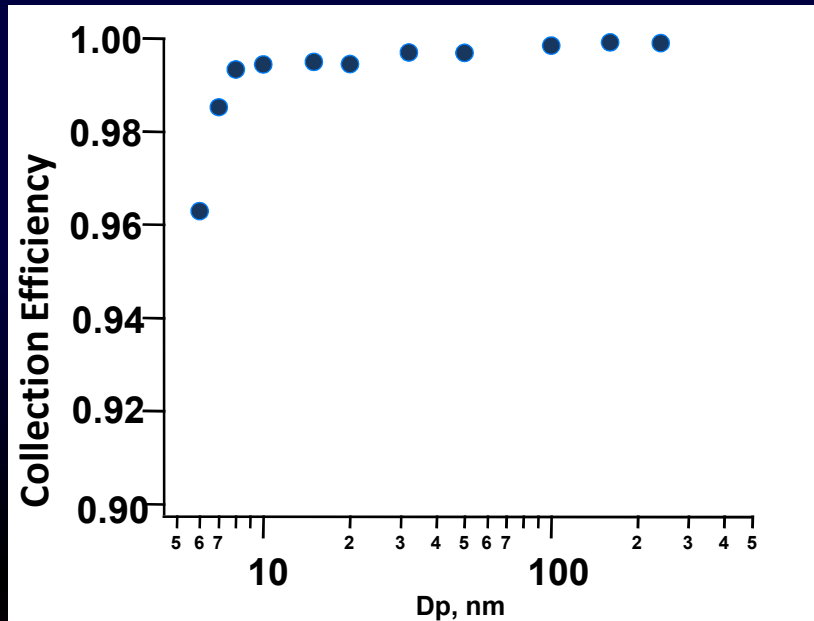


Performance characterization



a) Collection Efficiency

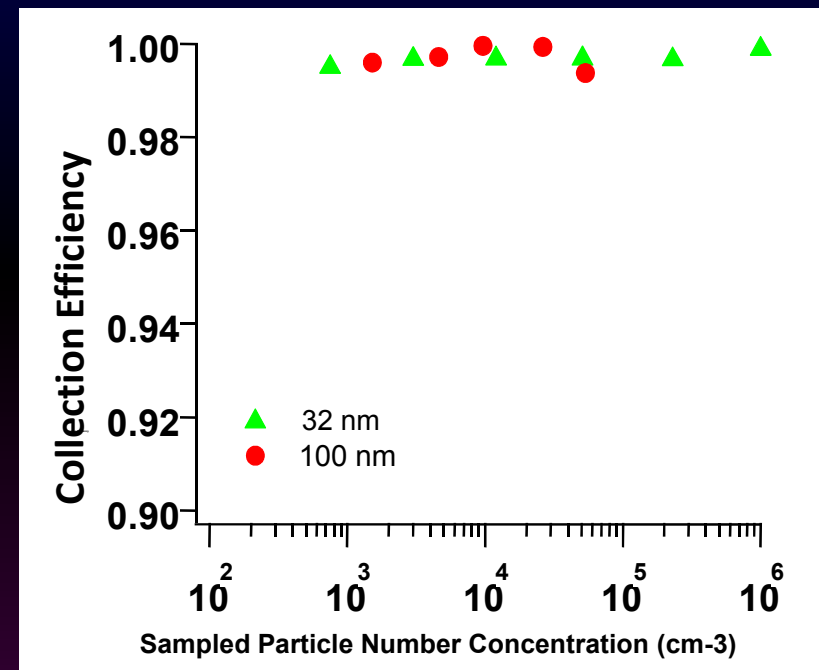
Lab generated aerosol: $\text{NH}_4(\text{SO}_4)_2 + \text{NH}_4\text{NO}_3$



Collection Efficiency with particle size

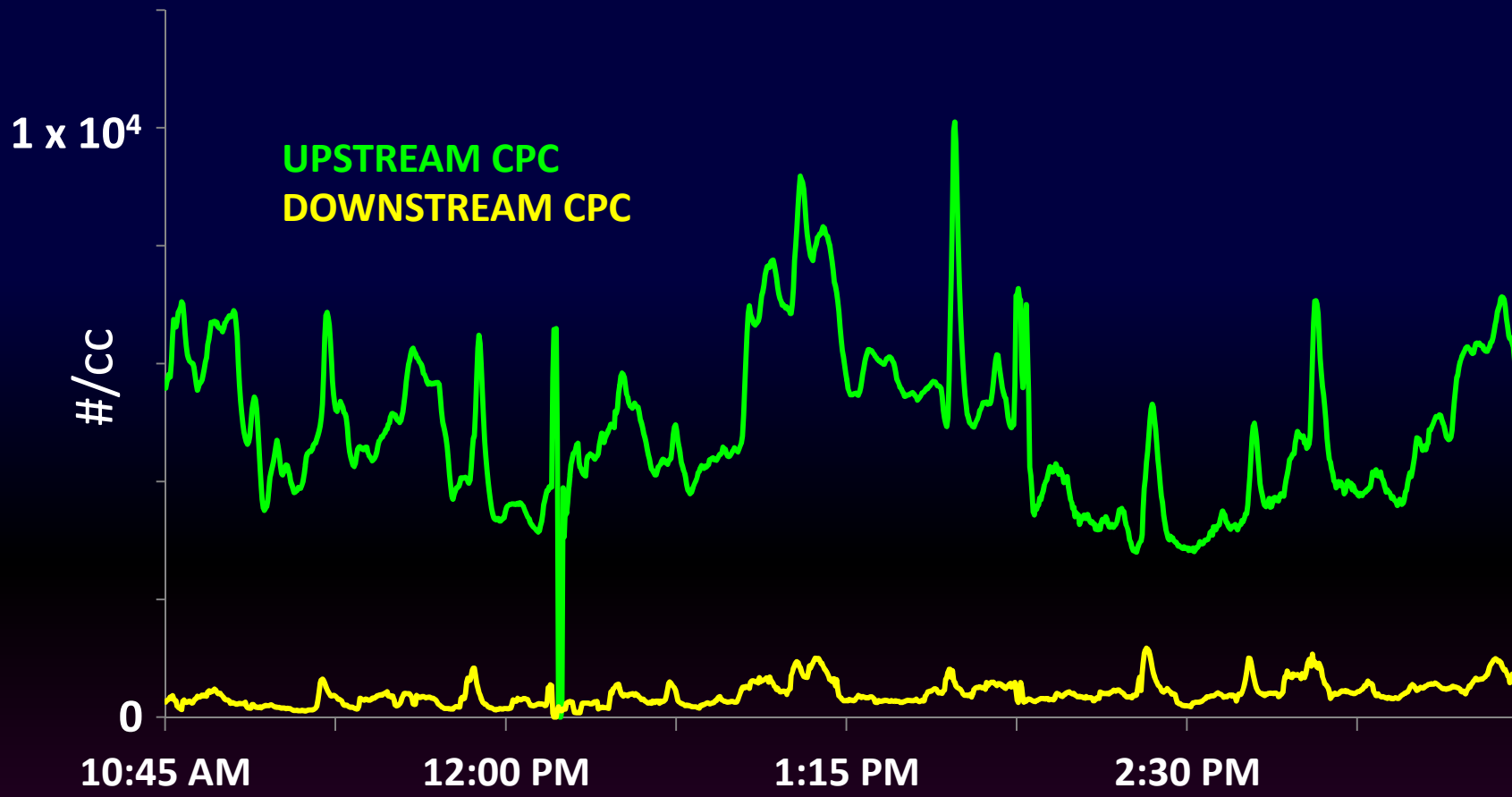
Efficiency of 99% was obtained for concentrations varying between 1000-1000000

Efficiency of 99% was obtained for particles between 10 nm and 260nm (Dp)



Collection Efficiency with concentration

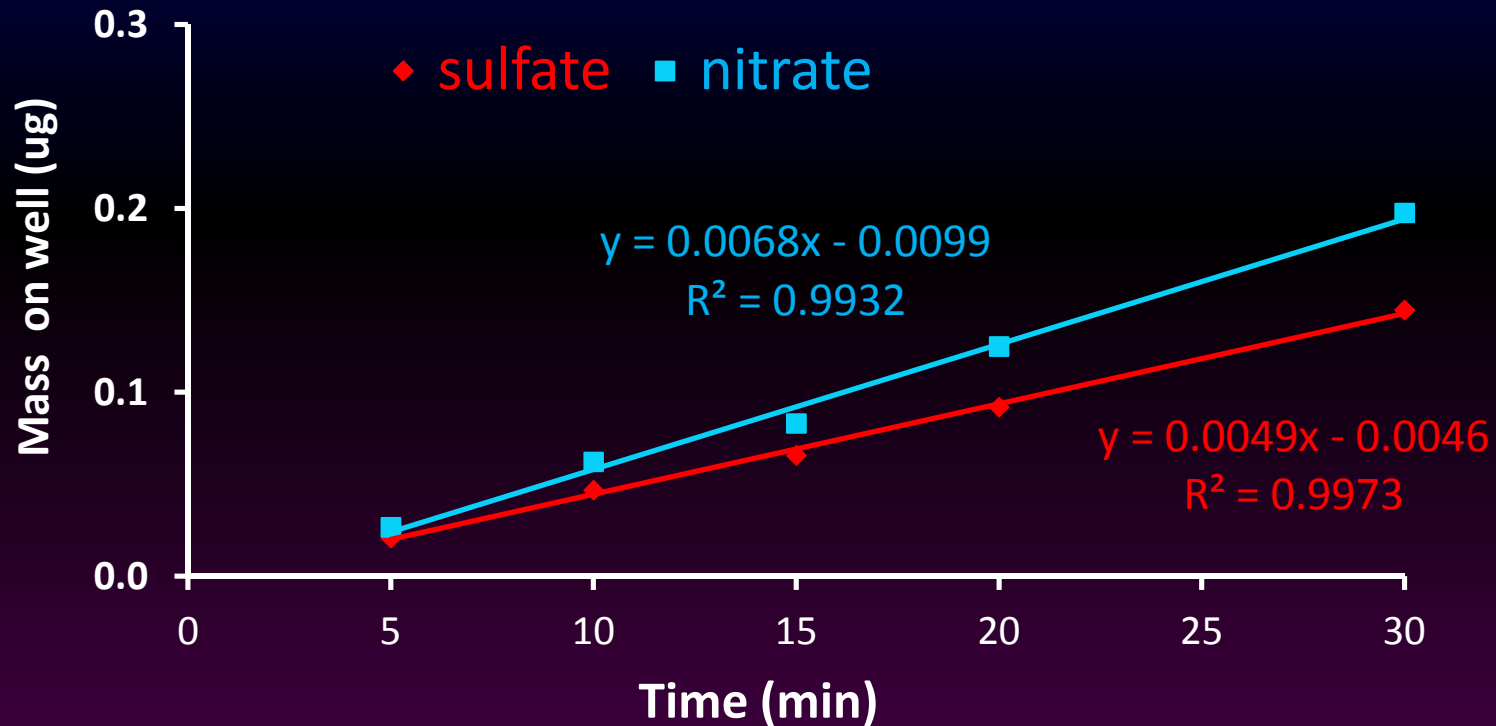
Ambient PM_{2.5}



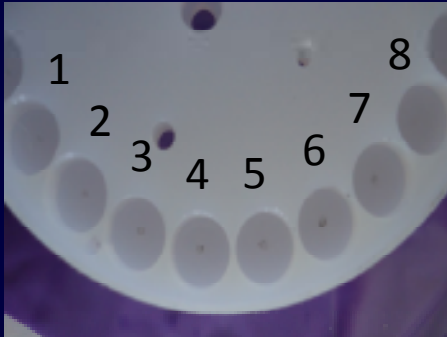
b) Reproducibility

Time (min)	5 (n=6)	30 (n=6)
Sulfate (%STDEV)	4.21	3.52
Nitrate (%STDEV)	5.36	4.25

c) Linearity



d) Loss of volatiles during collection

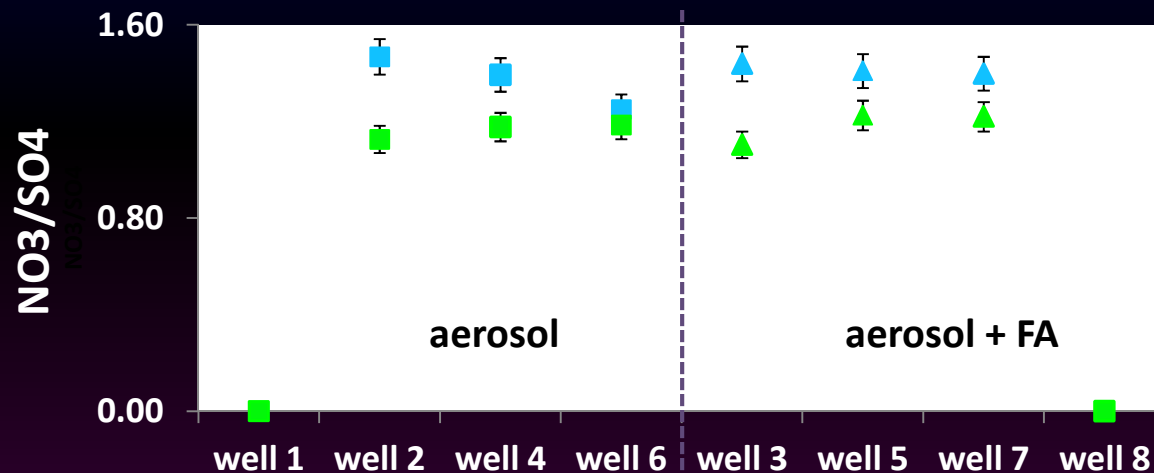


09/13/11

	well 1	well 2	well 3	well 4	well 5	well 6	well 7	well 8
Aerosol (min)	0	10	10	10	10	10	10	0
Filter air (min)	0	0	10	0	10	0	10	10
NO ₃ /SO ₄	0	1.13	1.10	1.18	1.23	1.19	1.22	0

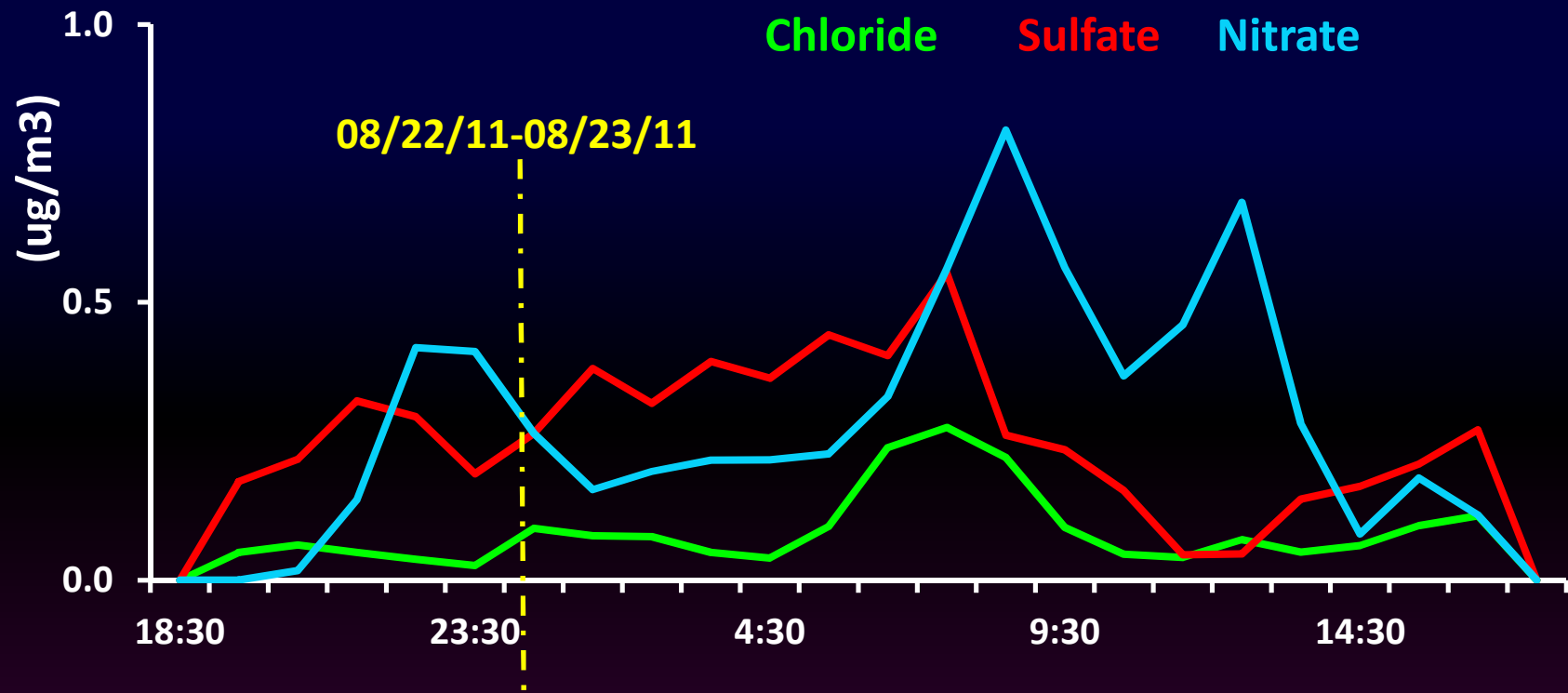
09/15/11

	well 1	well 2	well 3	well 4	well 5	well 6	well 7	well 8
Aerosol (min)	0	10	10	10	10	10	10	0
Filter air (min)	0	0	10	0	10	0	10	10
NO ₃ /SO ₄	0	1.47	1.44	1.39	1.41	1.25	1.40	0



Losses were not significant (differences in measured concentrations were between the %STDEV of the collection and analytical methods)

e) Hourly ambient PM_{2.5}



Pros:

- ✓ Small and portable
- ✓ Versatile
 - variable sampling flow: 0.2-6 lpm
 - collection plates: PEEK, HDPE, Aluminum
 - time resolved collection: from minutes to hours
- ✓ RELIABLE and EASY to handle
- ✓ No need for extraction steps prior to analysis: compatible with standard autosamplers

Cons:

- ✗ Low flows
- ✗ Collects only PM

To be determined:

- ? Cheap
- ? Artifact free

Near Future

- Portable cassette and easy well-exchange system
- Sample/well sealing to eliminate cross-contamination
- Comparison with other commercially available instruments: filters, PILS
- Use for other chemical analysis: PAHs
- Couple with a lab-on-a-chip system (capillary electrophoresis) (poster **2A.29** - *ASHLEY EVANOSKI*)

For other applications of the sampler see posters **2A.33** (*W Henry Benner*) and **5A.22** (*Scott Noblitt*)

Acknowledgements

Colorado State University

Dr. Jeffrey Collett

Dr. Amy Sullivan

Eppco

Joe Predti

NIH grant: 1 RC3 ES019081-01