

# **Evaluation of the Magee/TAPI model AE33/633 "next generation" Aethalometer**

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## INTRODUCTION

- The Problem: Aethalometer data have (sometimes) large artifacts  
Sub-hourly data often *very* noisy
- Spot loading effect: BC on ‘new’ (clean) spot higher than old spot BC
  - “Sometimes”: site/season specific
  - worse in winter than summer (in northeast)
- 1-h error can be as large as a factor of 2  
Worst error on “fresh” BC/when BC dominates fine PM  
Larger BC maximum attenuation (max-atn) ==> larger error!

More details on the spot loading artifact, this conference:

“Aethalometer DataMasher Update: spot loading correction”

Additional background: 2006 Las Vegas NAMC Aeth presentation:

<http://tinyurl.com/2006aeth>

- The Solution: Magee AE33/TAPI 633
  - 2 Aethalometers in 1 box
  - Different flow rates on the 2 sample spots:
    - ==> different rates of aerosol loading
- Near real-time loading artifact correction
  - Difference in BC provides information on loading artifact
- Also: Complete redesign of instrument, 7 ch.
  - Robust mechanics, 21<sup>st</sup> century electronics
  - 4 minute data gap (vs. 9 to 15 min)
  - RH noise cycling problem controlled [!!!]
  - T60 teflon/glass fiber filter media (replaces quartz)

- 3 ways to evaluate the AE33/633spot loading artifact correction
  1. Compare AE33 BC to very spot light loading BC (direct approach)
  2. No BC interference to “DeltaC” (UVC-370nm minus BC-880nm)
  3. Assess K time series (less direct approach)

Aeth Collo Matrix:

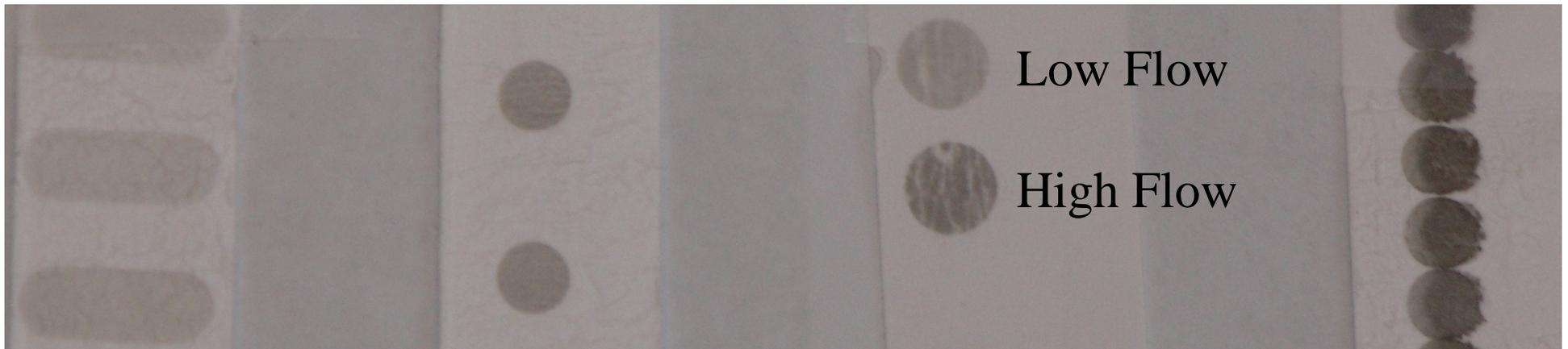
AE22-ER BC  
max-atn=15

AE22-HS 2-ch  
max-atn=125

AE33 7-ch  
max-atn=120

AE21 BC  
max-atn=125

BC max= ~50 (no woodsmoke)



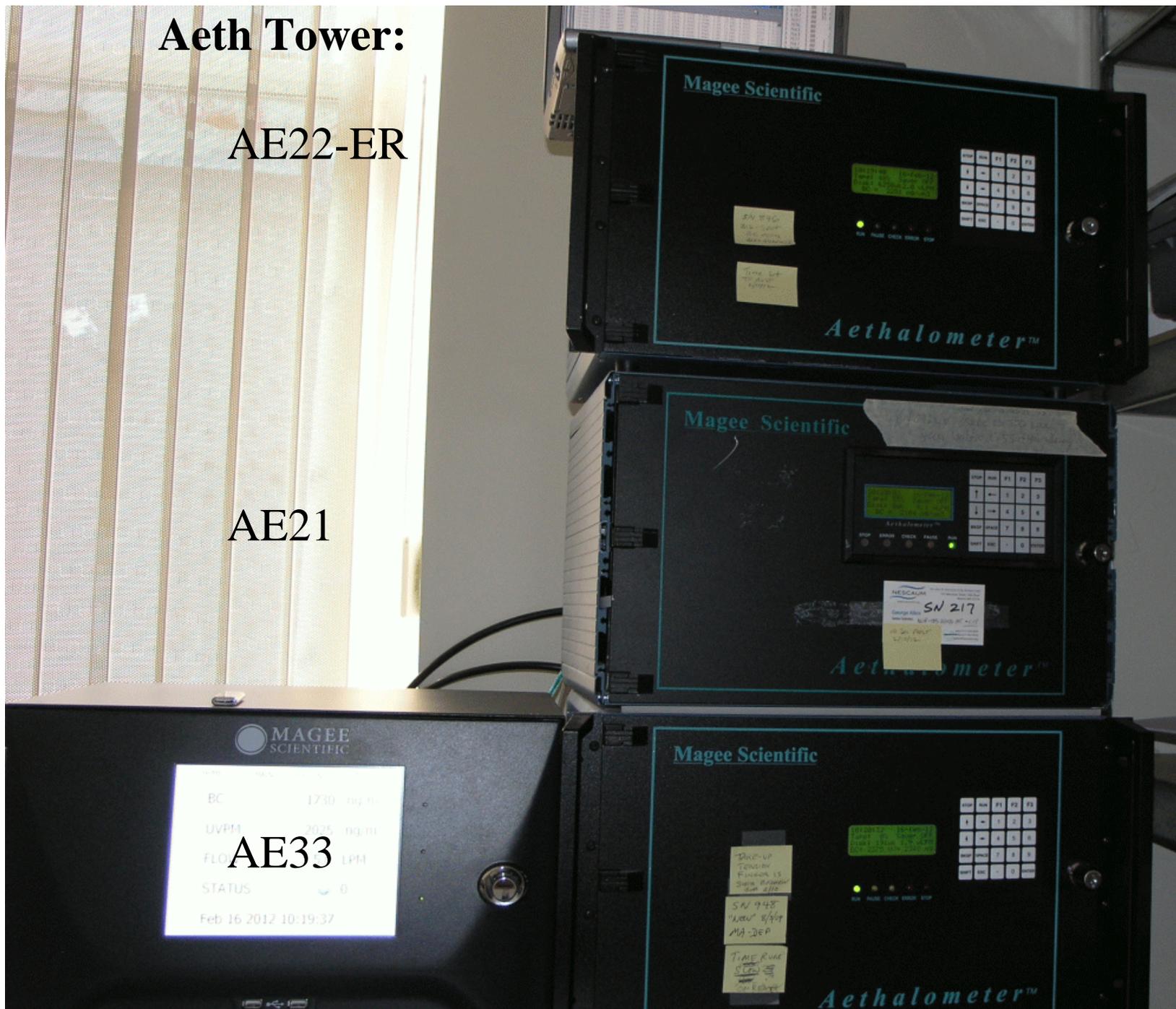
**Aeth Tower:**

**AE22-ER**

**AE21**

**AE33**

**AE22-HS  
on right**



# (1) Direct BC comparison

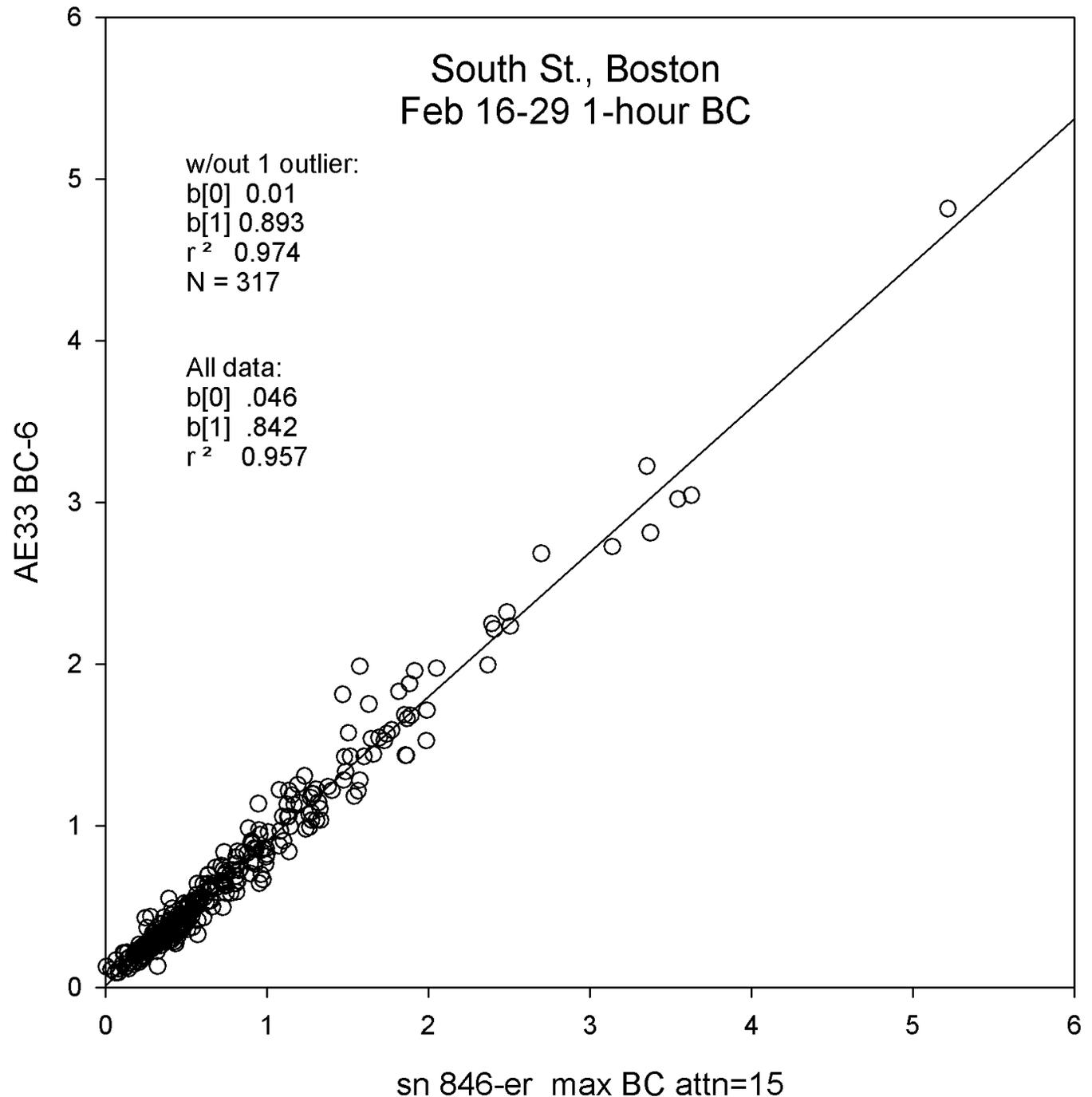
Run collo Aeth with very light loading:

AE22-ER

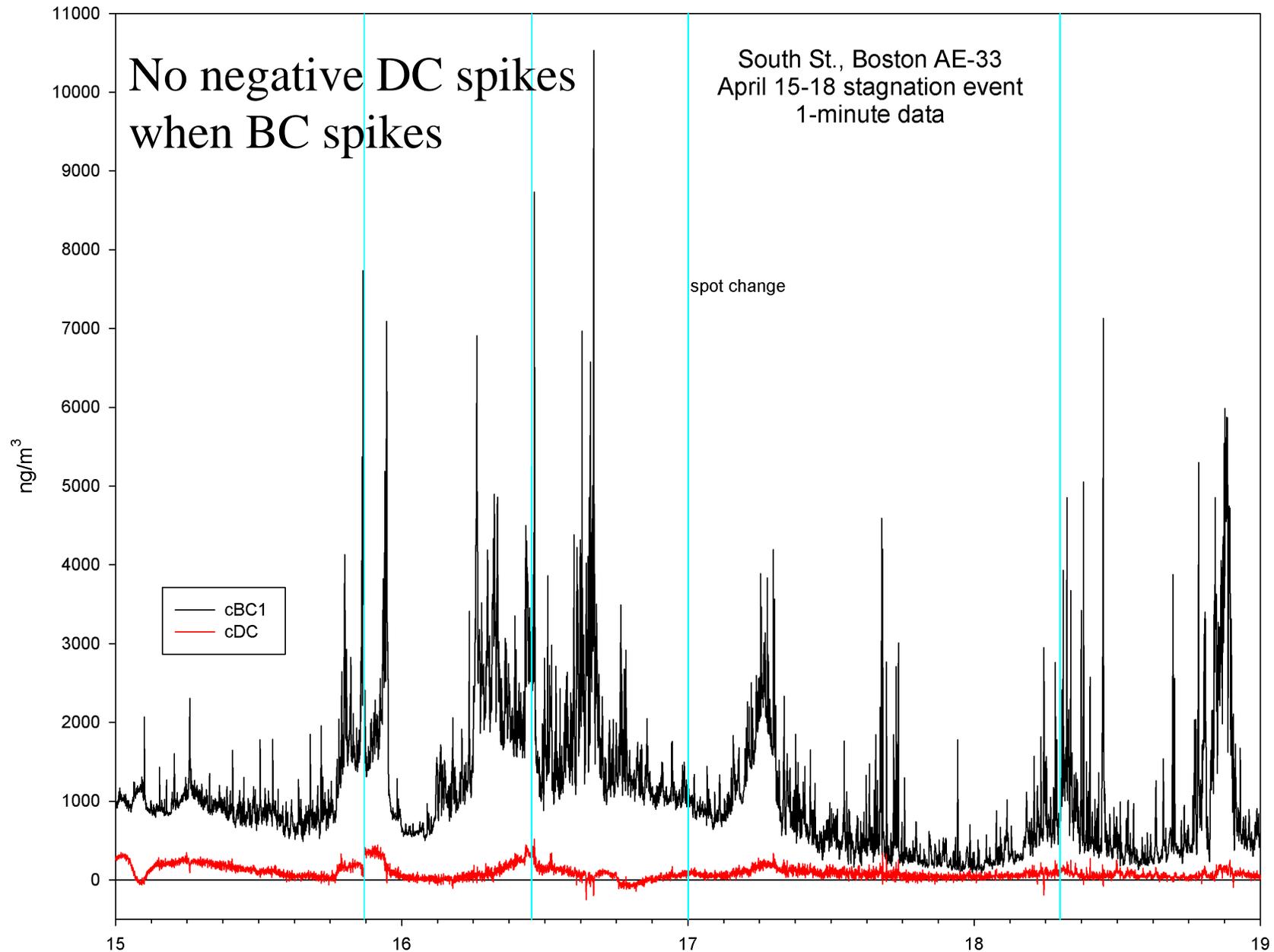
BC only, 2 lpm, max-atn=15 instead of 50 or 125

Data w/minimal error, no correction needed

1-h correlation should be very good



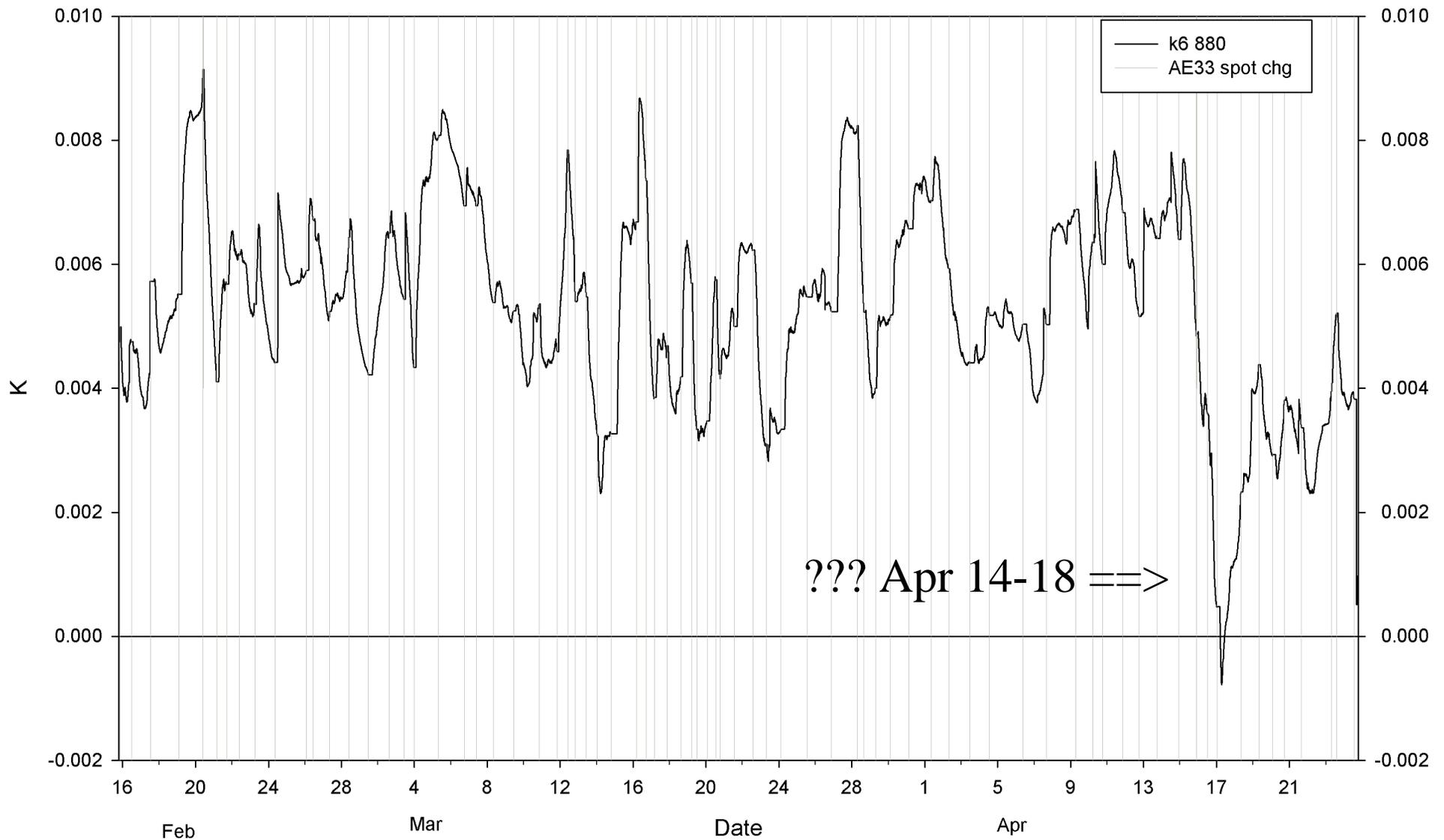
## (2) UVC (370nm) - BC (880nm) when no woodsmoke: DC (red line)



April 2012

### (3) K Timeseries Evaluation (Feb-Apr 2012):

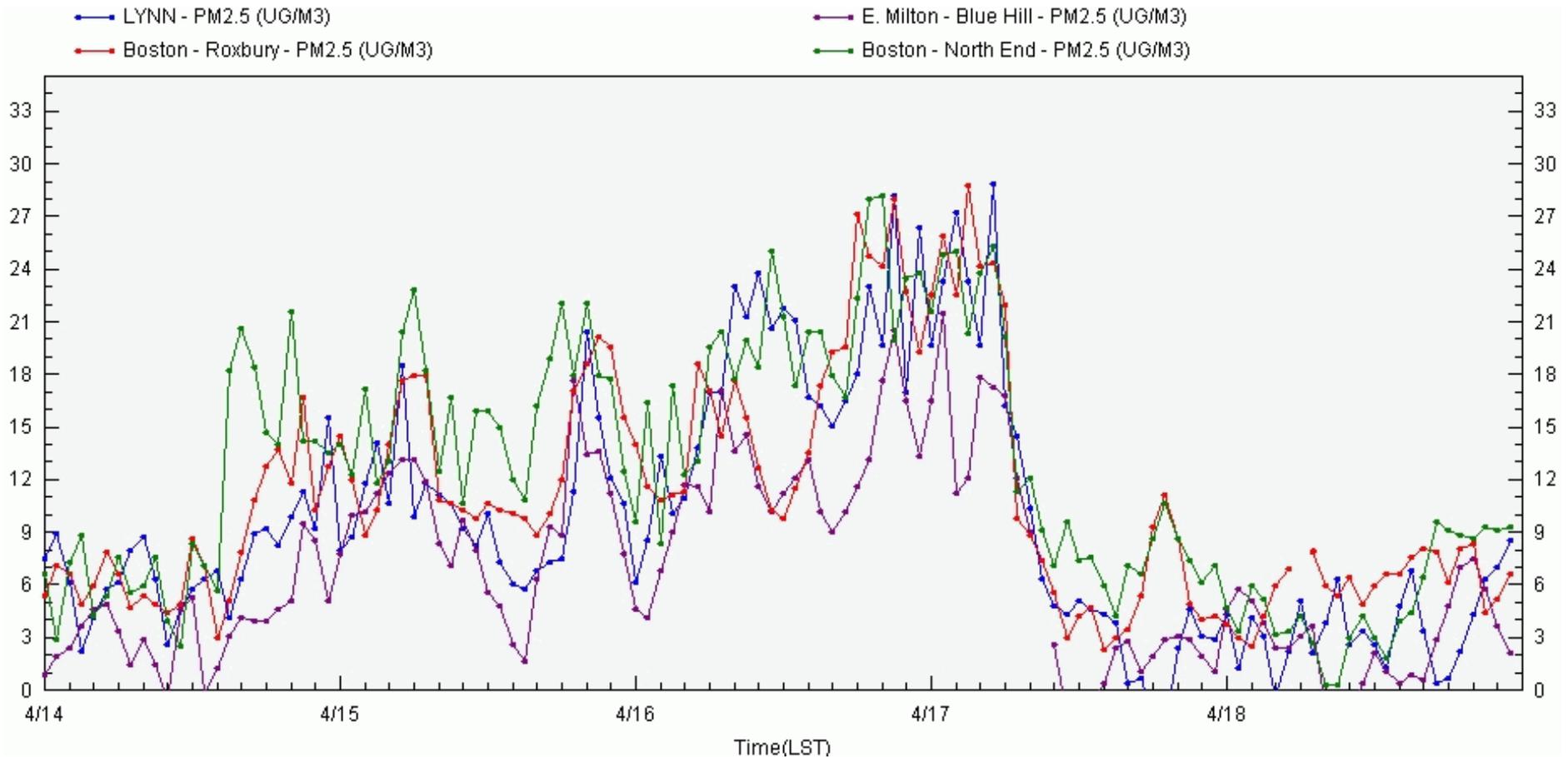
Boston AE33 reprocessed 880 (BC6) K



# Regional PM2.5 event: stagnation/transport

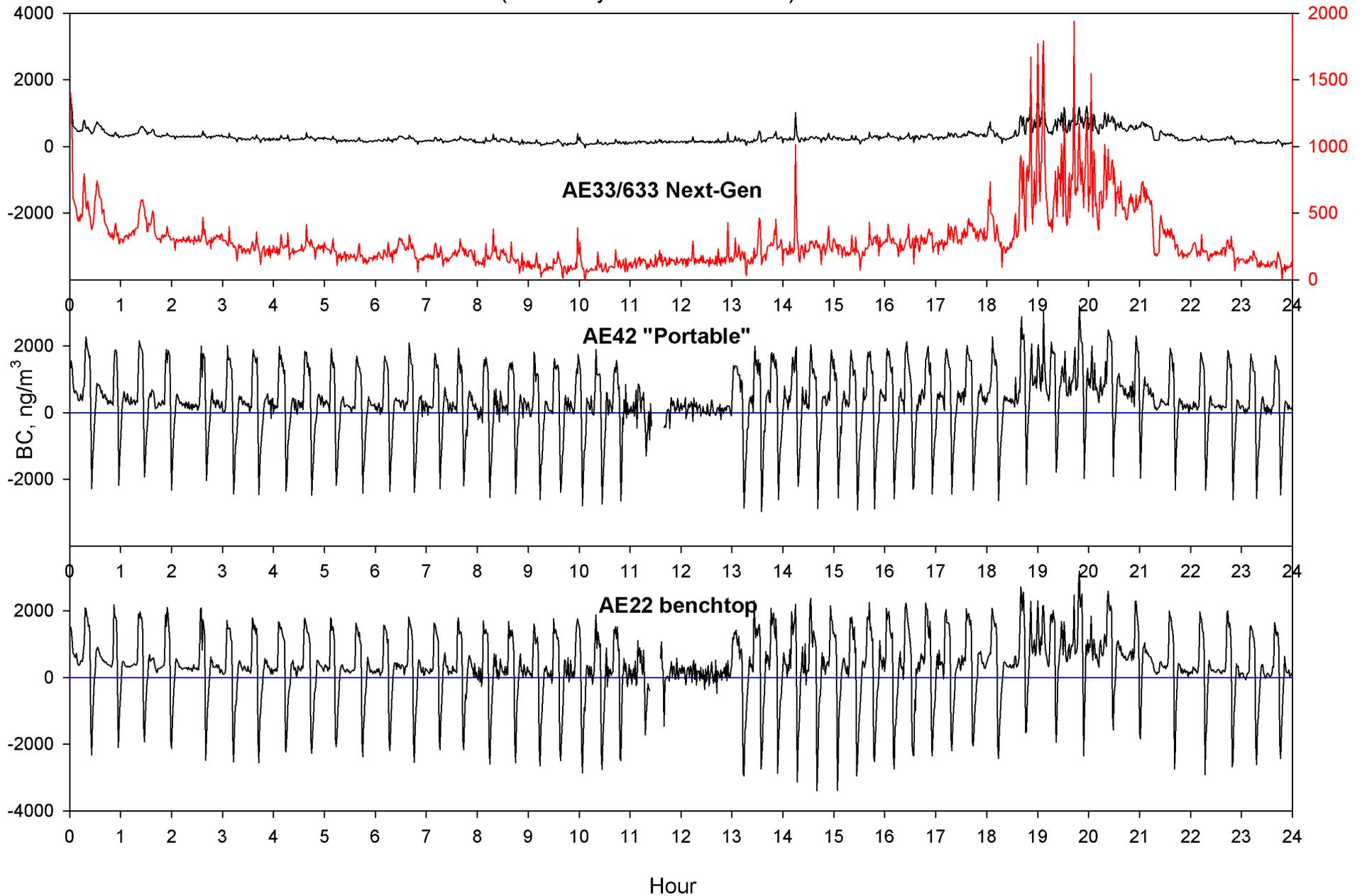
Drives K lower (lots of white aerosol, not much black aerosol)

PM2.5 (preliminary) for 4 Boston area sites, April 14-18, 2012:



# Noise!!!

1-Minute Aethalometer BC data from SCAQMD Test Site, March 11, 2012  
(Courtesy Andrea Polidori)



## CONCLUSIONS

New hardware platform - dramatic improvement

Real-time loading correction: seems to work

Needs further evaluation

Dramatic improvement in short-term noise under field conditions

Makes using very short term (1min or less) practicle

- resolution of source distance (dispersion)

## ACKNOWLEDGMENTS

MageeSci for early production AE-33