IMPROVE
Particle Monitoring Network:
Network Operations

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University of California, Davis
Glacier National Park, June 2004





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2003 Sample Recovery (A Channel, $PM_{2.5}$ Teflon)

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- 96% Q1
- 94% Q2
- 94% Q3
- 96% Q4
- 95% Annual A Channel (2002 was 94%)

2003 Sample Recovery (All channels, ABCD)

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- 94% Q1
- 91% Q2
- 91% Q3
- 94% Q4
- 93% Annual ABCD (2002 was 91%)

Reasons for Sample Losses

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Of the 7% of lost samples (ABCD):

- 27% Equipment problems
- 22% Operator no-show
- 22% Incorrect filter cassette installation
- 20% Power outages
- 8% Torn or damaged filter
- 1% Clogged filter

Regional Haze Rule Requirements

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A “complete” site has, for ABCD:

- >75% annual recovery
- >50% recovery in each quarter
- <11 consecutive missed samples

8 sites failed in 2003

- Most failed due to consecutive missed samples
- Only 1 site (HECA) failed due to operator neglect

Sites Failing Regional Haze Rule Requirements

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- Cohutta, GA (IMPROVE)
  - Faulty pump
- Death Valley, CA (Protocol)
  - D Module flow inadvertently adjusted by operator
  - Very low flowrate, corrupted flashcard data

Sites Failing Regional Haze Rule Requirements (cont.)

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- Glacier, MT (IMPROVE)
  - Forest fire
  - Sampler removed for a week in late July
  - Many clogged filters during August
- Guadalupe Mountains, TX (IMPROVE)
  - Faulty controller
  - Problem complicated by 4 consecutive samples lost due to power outage

Sites Failing Regional Haze Rule Requirements (cont.)

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- Hells Canyon, ID (IMPROVE)
  - Many lost samples in first half of year
  - New operators started in summer, but began with several bad installs
- Indian Gardens, AZ (Protocol)
  - Ongoing power problems due to location
  - NPS has been working to improve power

Sites Failing Regional Haze Rule Requirements (cont.)

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- Point Reyes, CA (IMPROVE)
  - Leakage in D Module; water damage to filters
- Sequoia, CA (IMPROVE)
  - Many power outages in first half of year, rectified by UC Davis in July
  - Several bad installs in summer by seasonal operator

Steps to Remedy Regional Haze Rule Deficiencies

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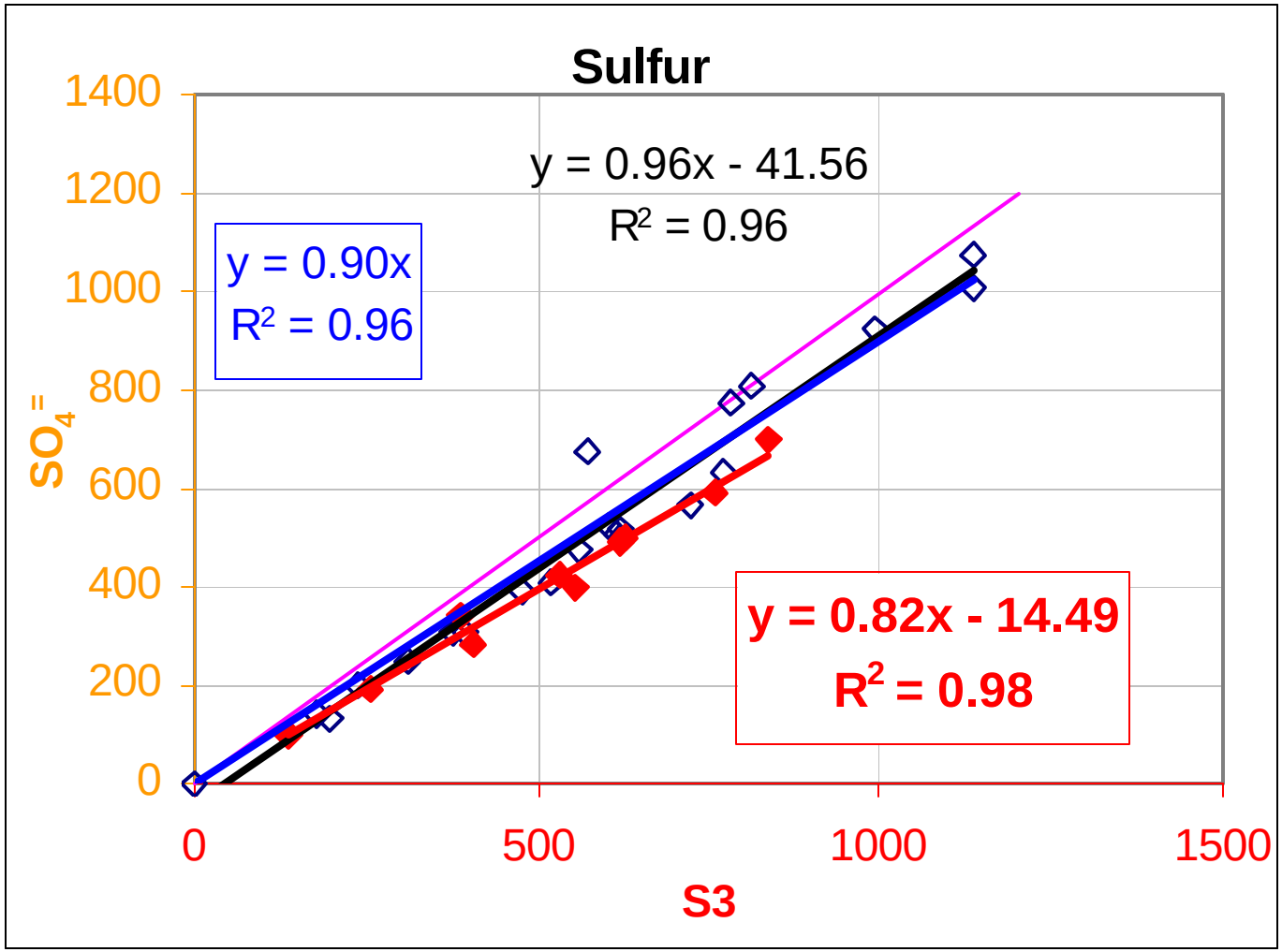
- Stress 10 consecutive sample loss limit to site operators
- Be more aggressive in replacing faulty equipment, especially if 10 sample limit is approaching
- Send UCD staff to site if 10 sample limit is approaching and other remedies have failed

Data status and schedule

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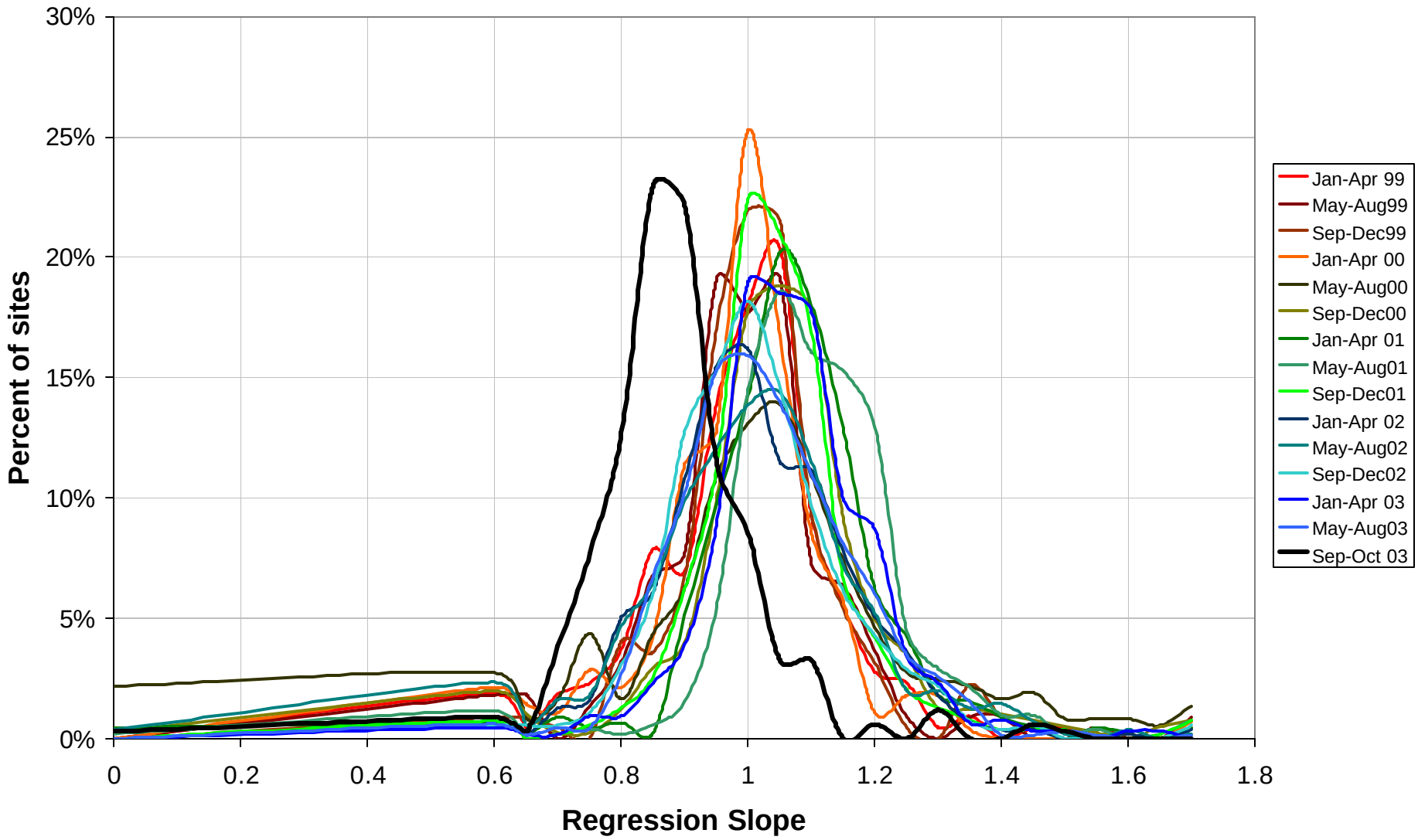
- Expected delivery schedule
  - September/October 2003 data completed; delayed due to QC concerns
  - November 2003 data expected by mid-June
  - Six-month lag between last collection and data delivery

Bryce Canyon

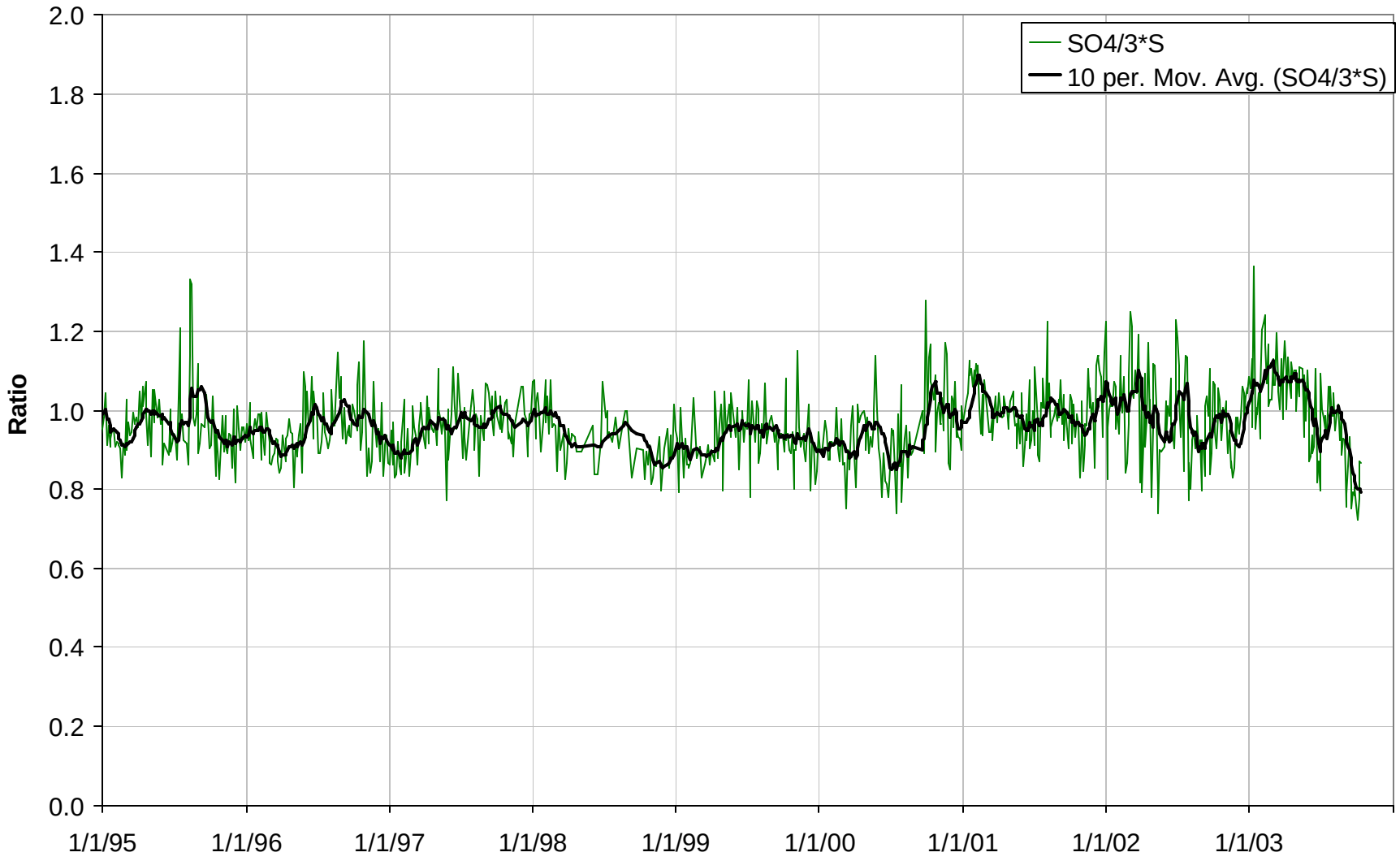


Distribution of $SO_4^=/3*S$ Slopes

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Mammoth Cave $SO_4^=/3*S$ Ratio

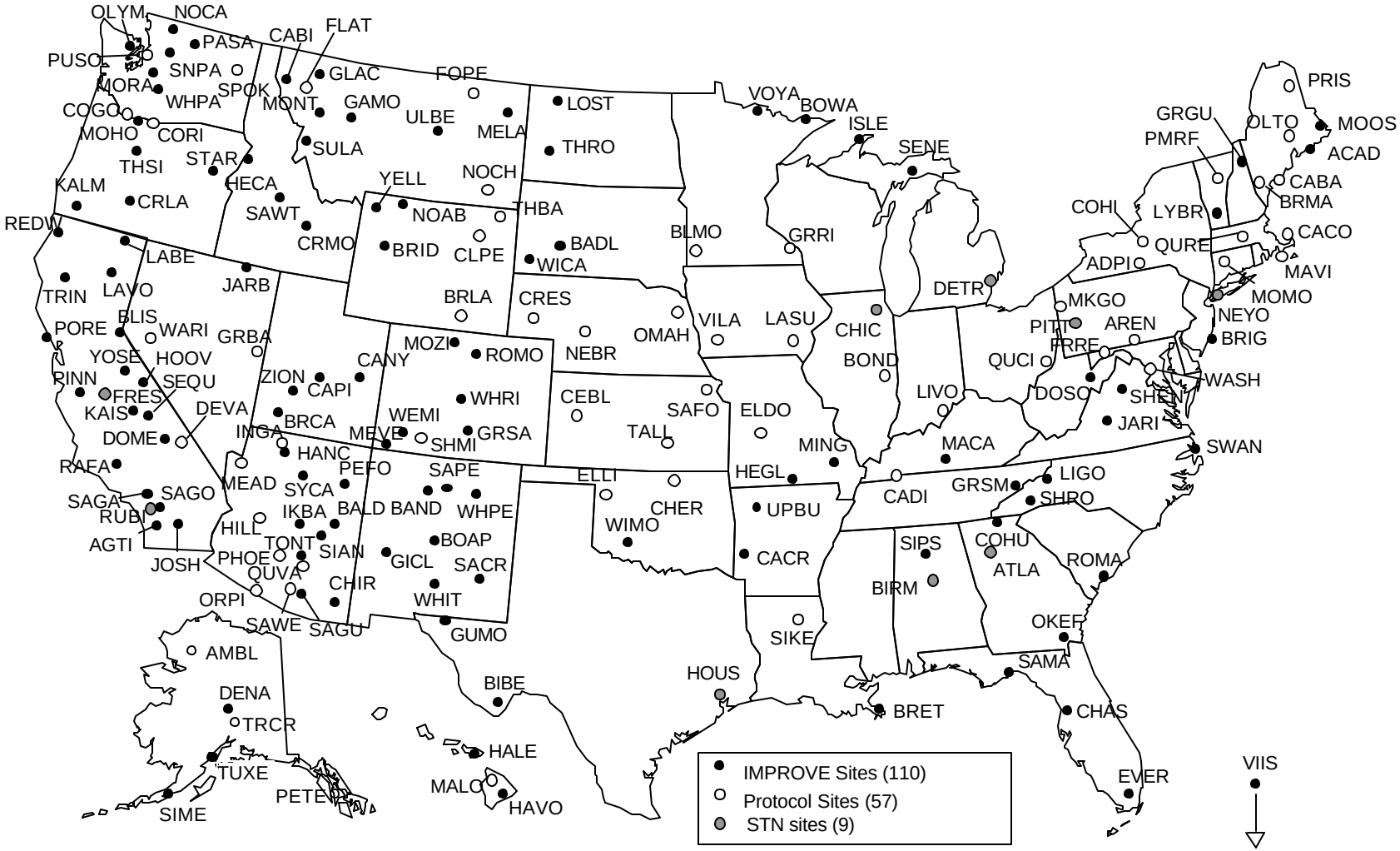


Validation Steps

- $SO_4^=$ blank subtraction
  - Ruled out
- Nylon filter lot
  - Changed mid-July 2003, used through December
  - Extracts can be reanalyzed if needed
- Sampler flow rates (modules A and B)
  - Ruled out
- XRF analysis
  - Tests in progress
    - New detector installed for August analysis

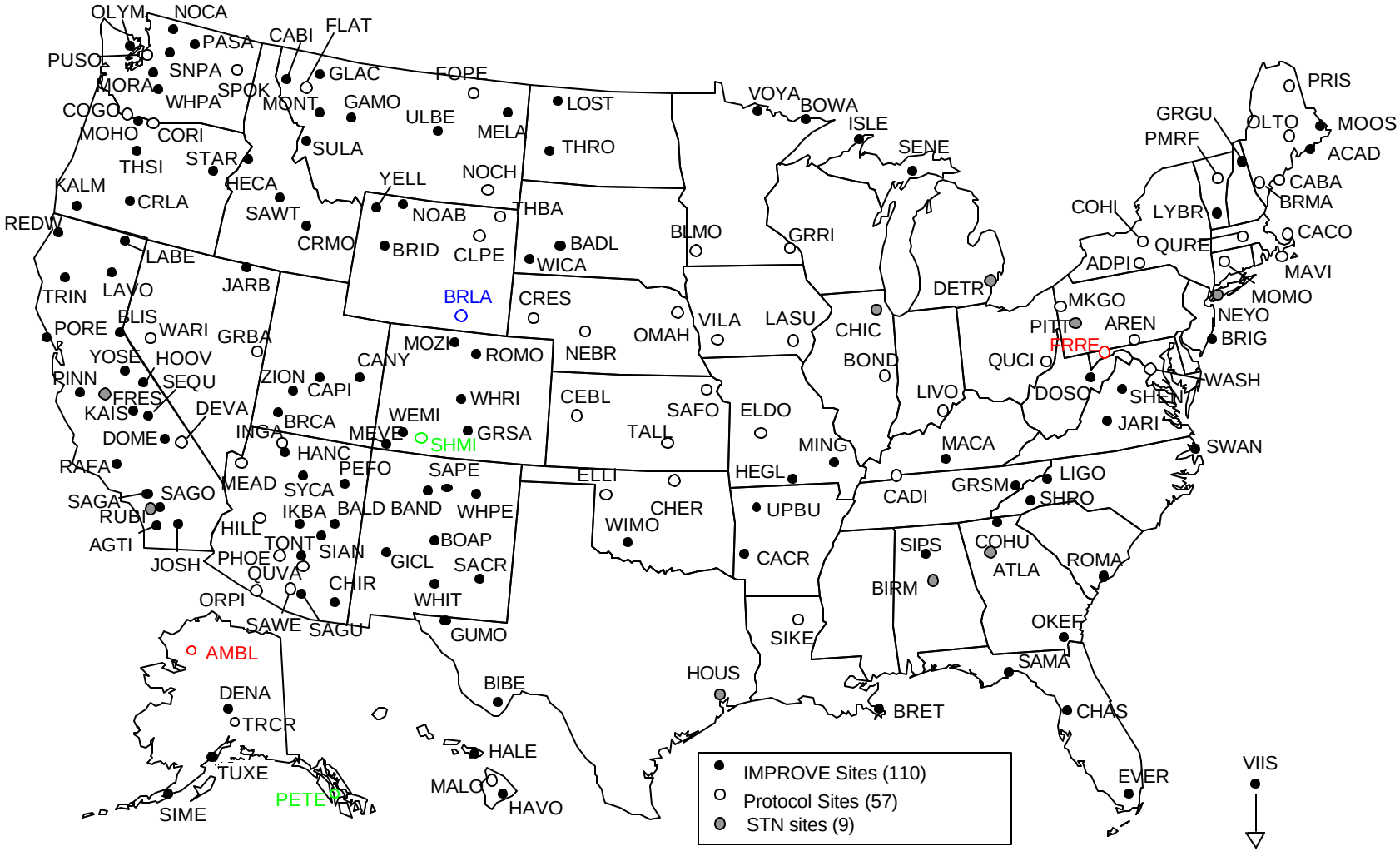
IMPROVE Network
Summer 2004 – 176 Sites

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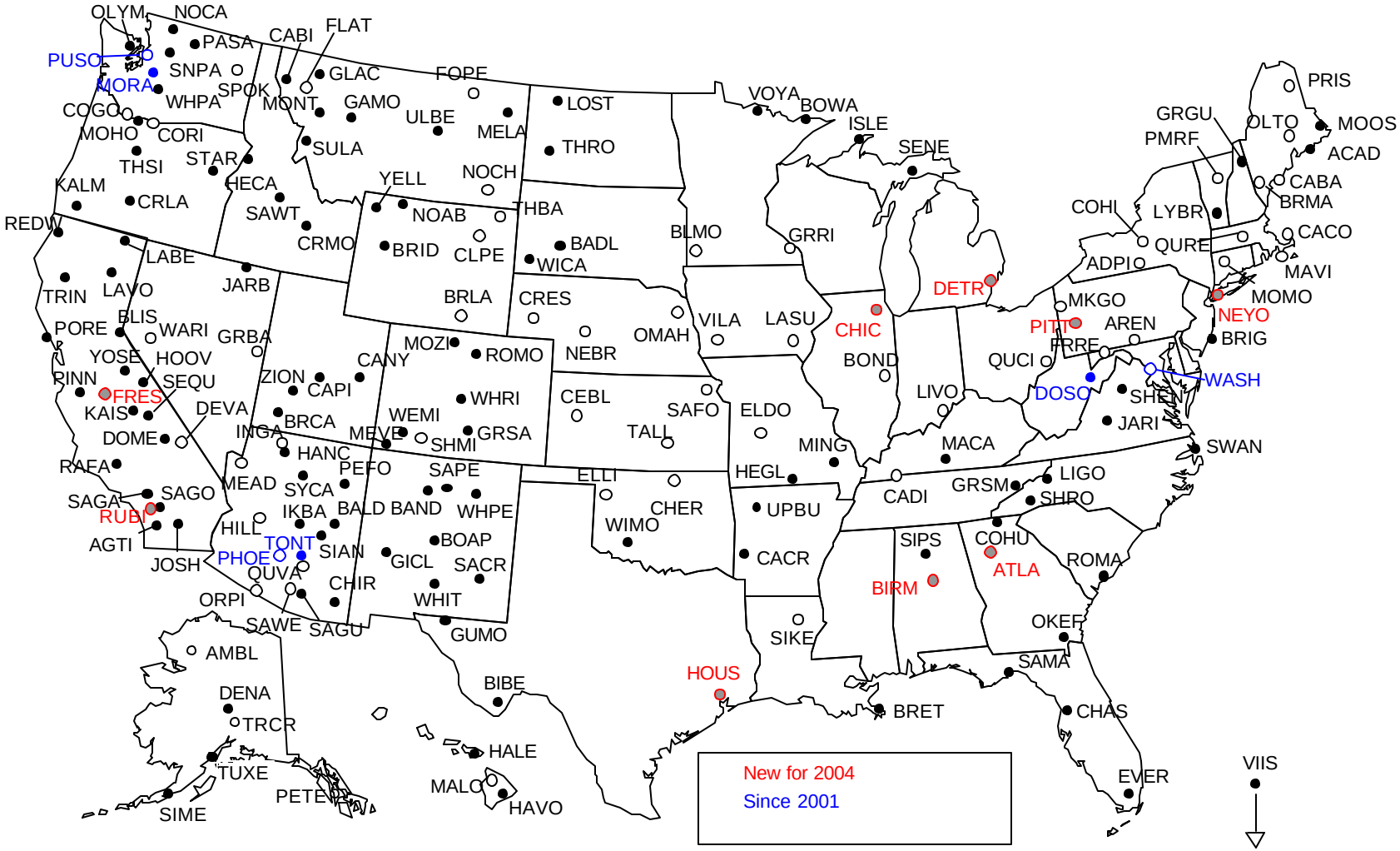
IMPROVE Network
New Protocol Sites

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IMPROVE Network
STN Collocated Sites

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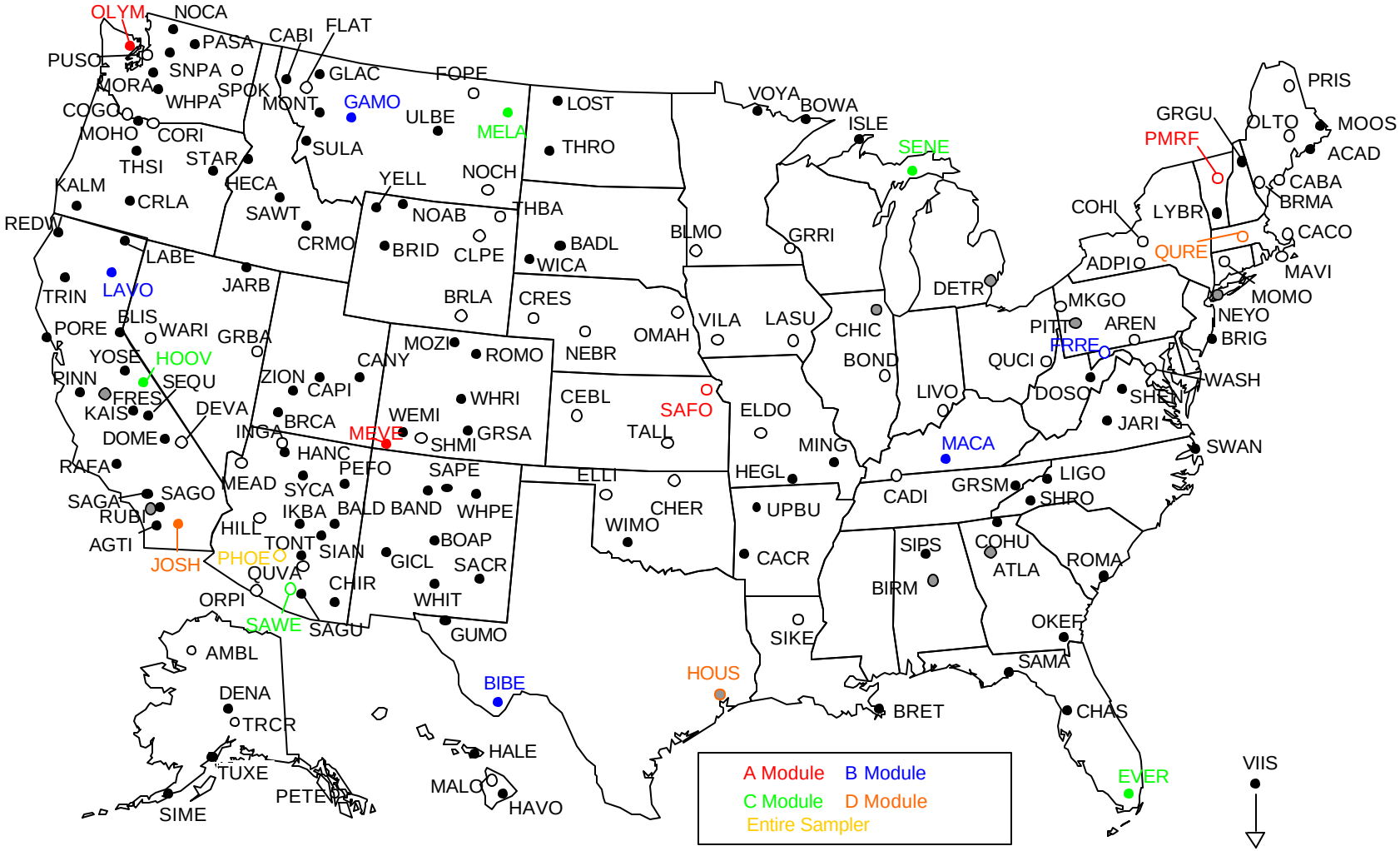
Site Relocations

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- San Gorgonio, August 2003
- Mt. Rainier, November 2003
- Zion, January 2004

IMPROVE Network
Collocated QA Modules

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Paired Sampler Statistics

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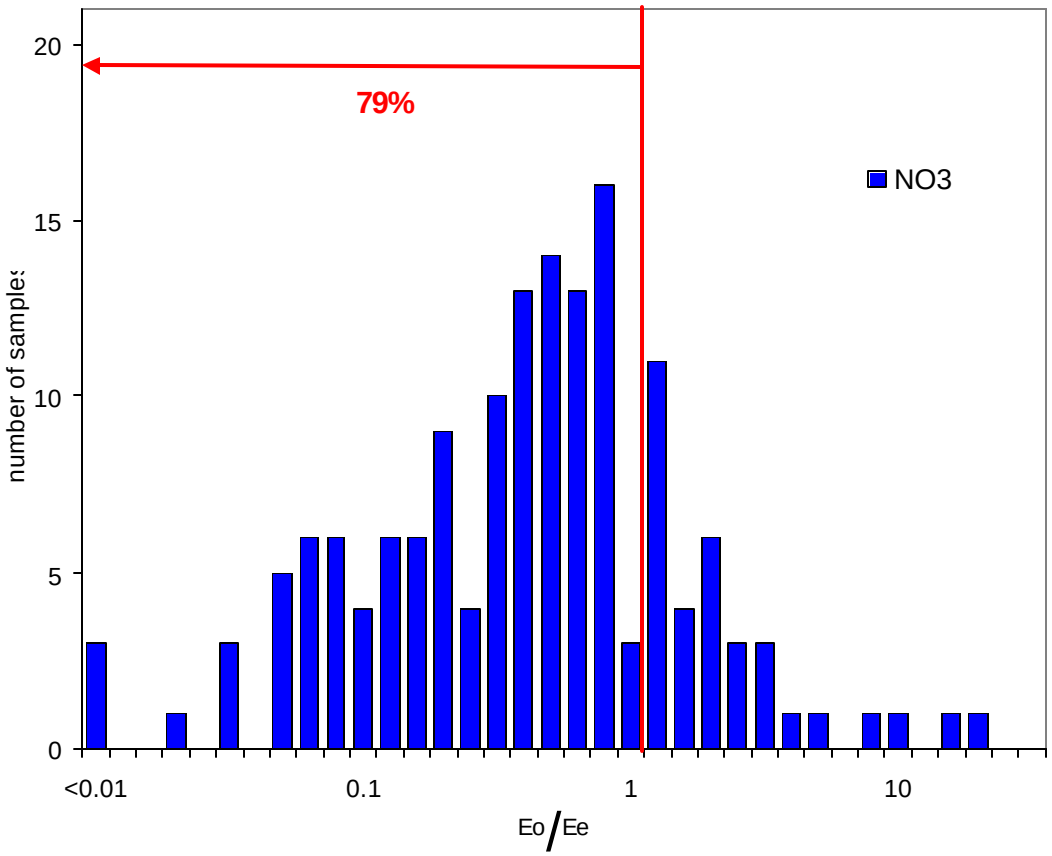
- Estimated Error – Based on reported uncertainties of the two measurements
- Observed Error – Based on difference between the two measured concentrations
- % of Observed Error within Estimated Error (ideal is 68%)

Collocated "B" Modules (152 data pairs, 4 sites)

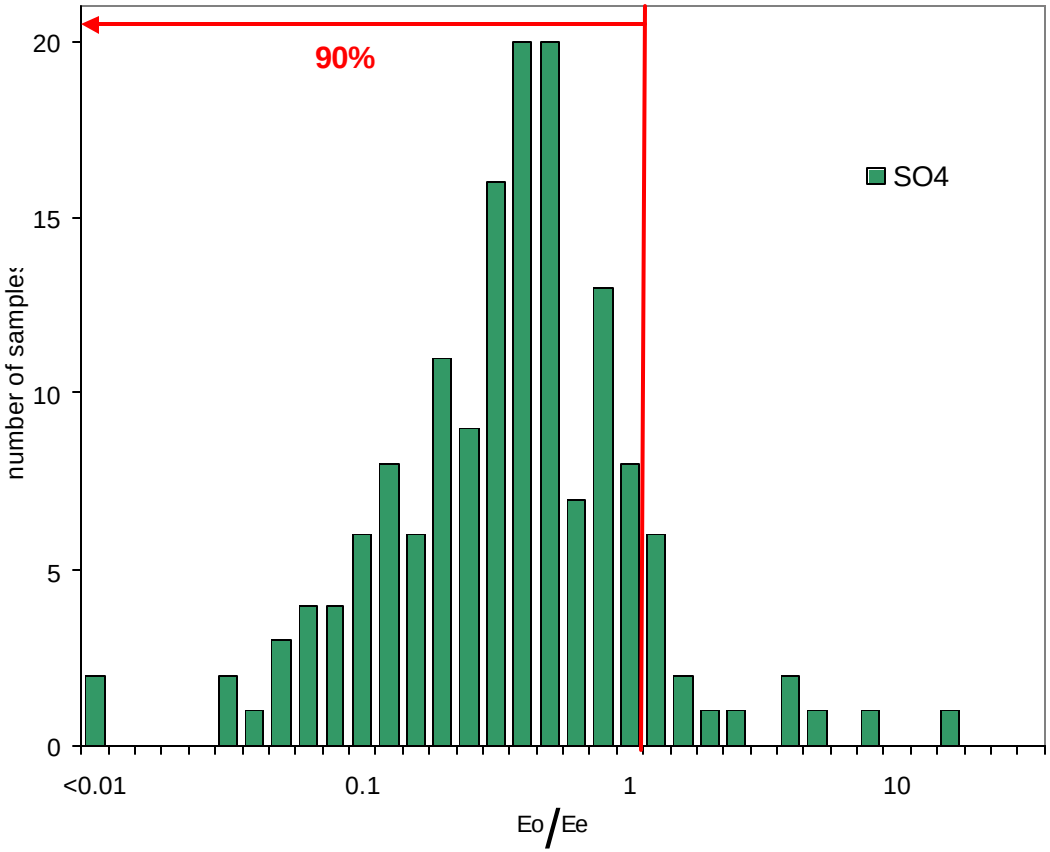
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Species	% Error Estimated	% Error Observed	% of Eo within Ee
$NO3^-$	15%	25%	79%
$SO4^=$	6%	3%	90%
$NH4^+$	4%	5%	68%

Collocated "B" Modules Paired NO_3^- Data

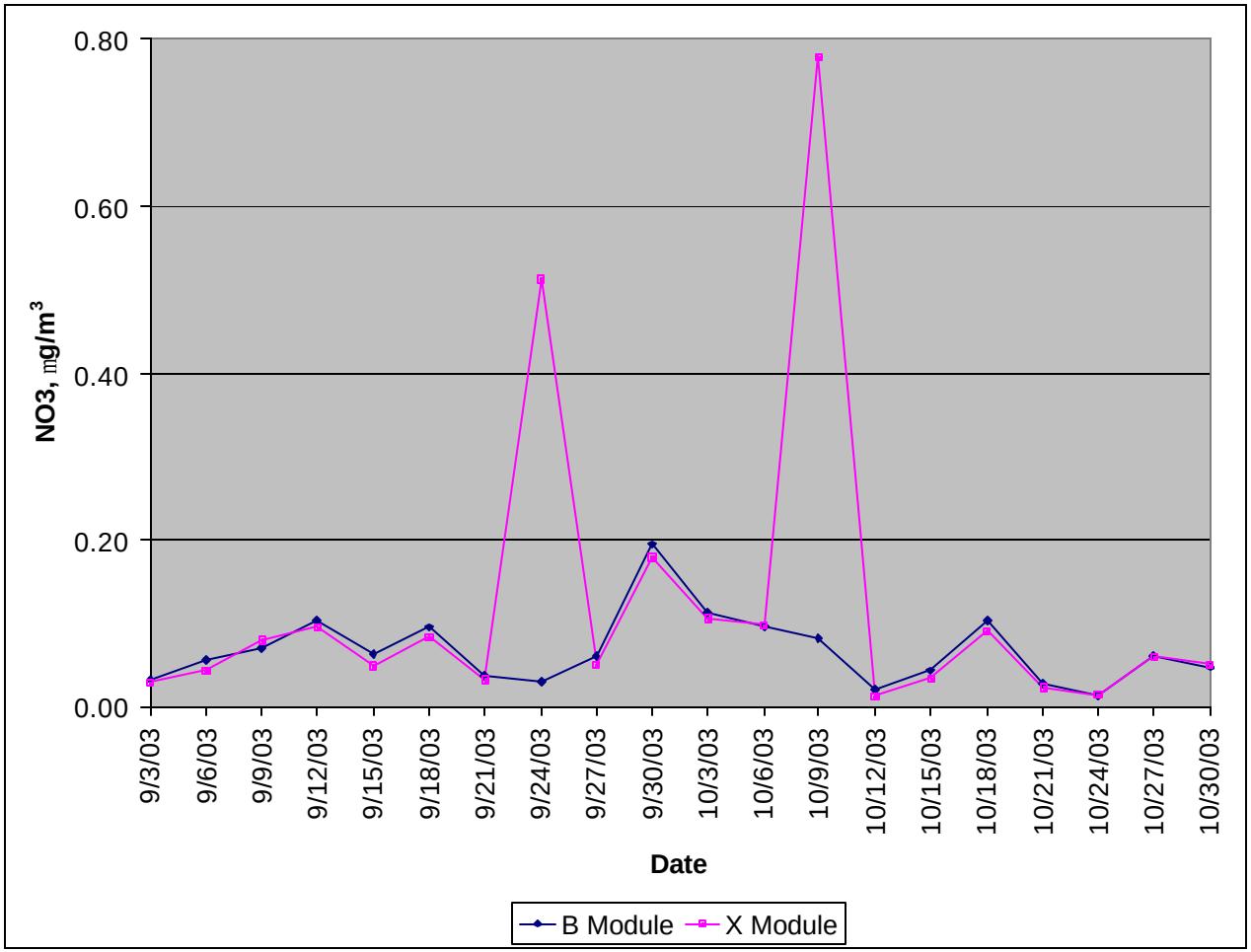


Collocated "B" Modules Paired $SO4^{=}$ Data



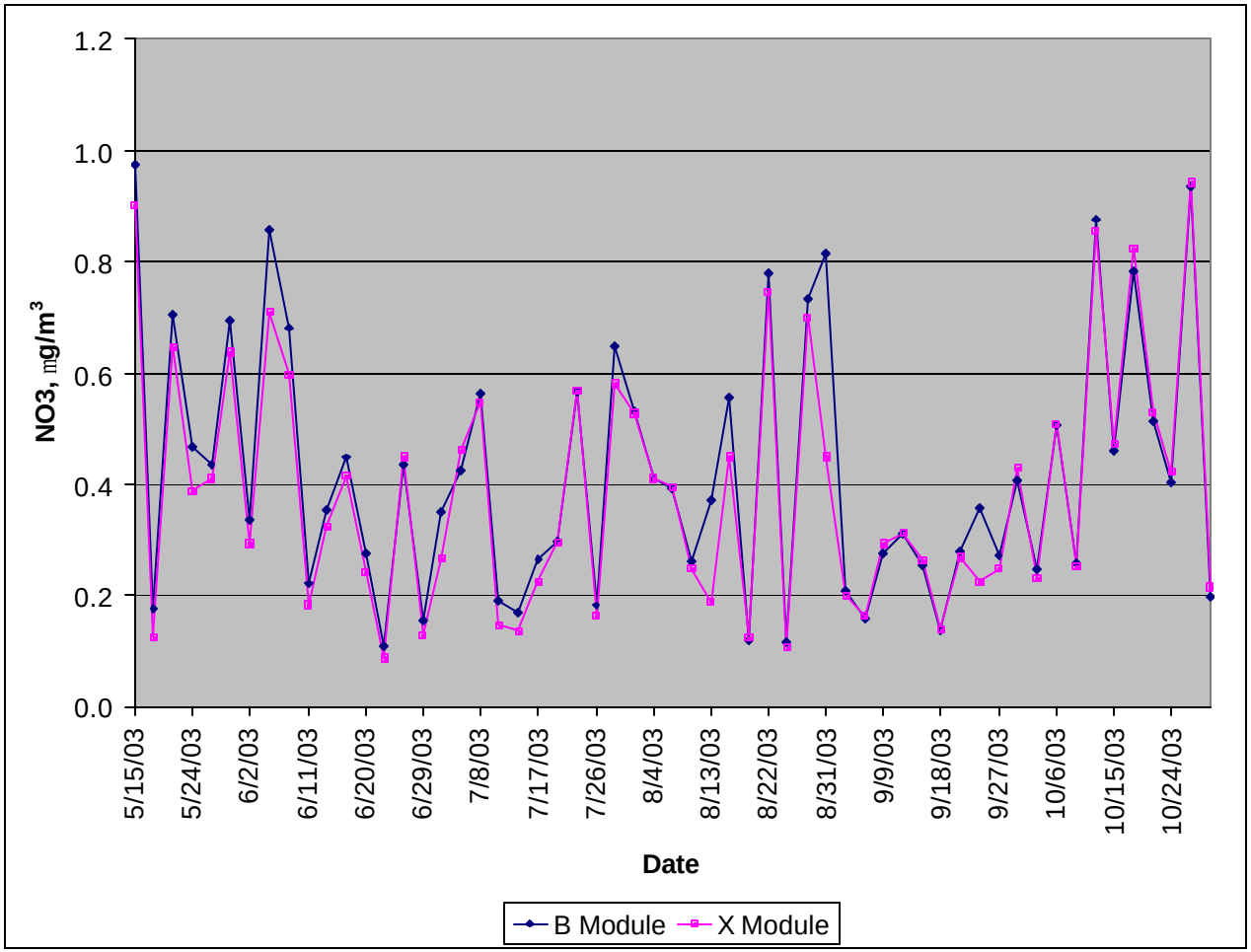
Collocated "B" Modules
Big Bend NO_3^-

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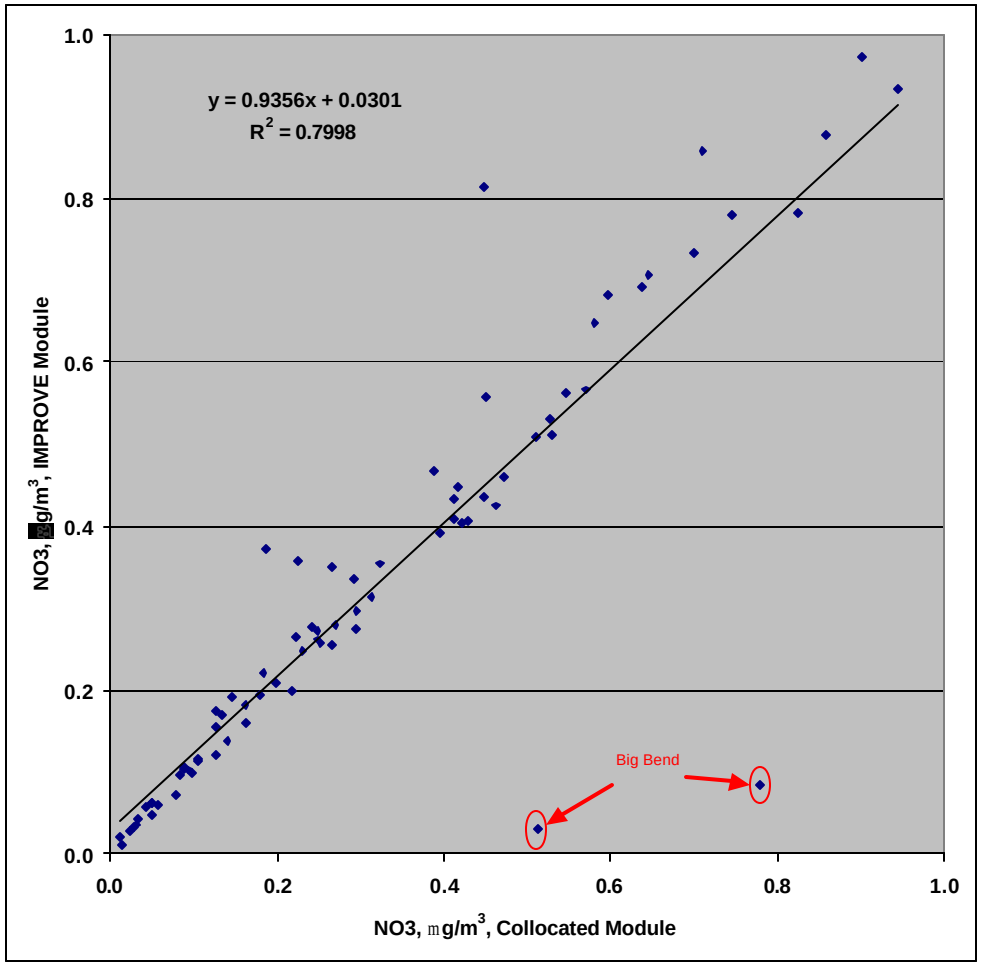
Collocated "B" Modules Mammoth Cave NO_3^-

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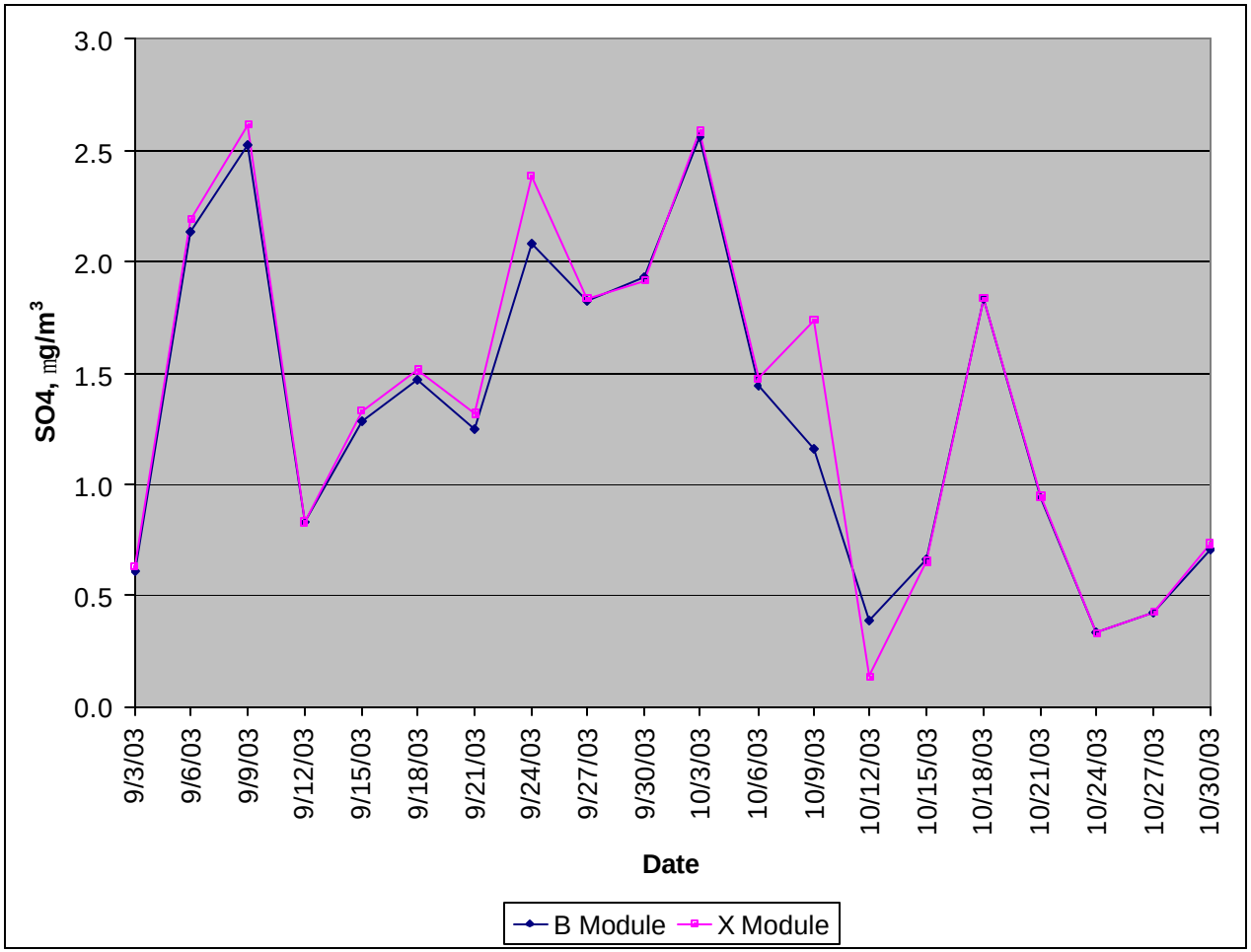
Collocated "B" Modules
BIBE & MACA NO_3^-

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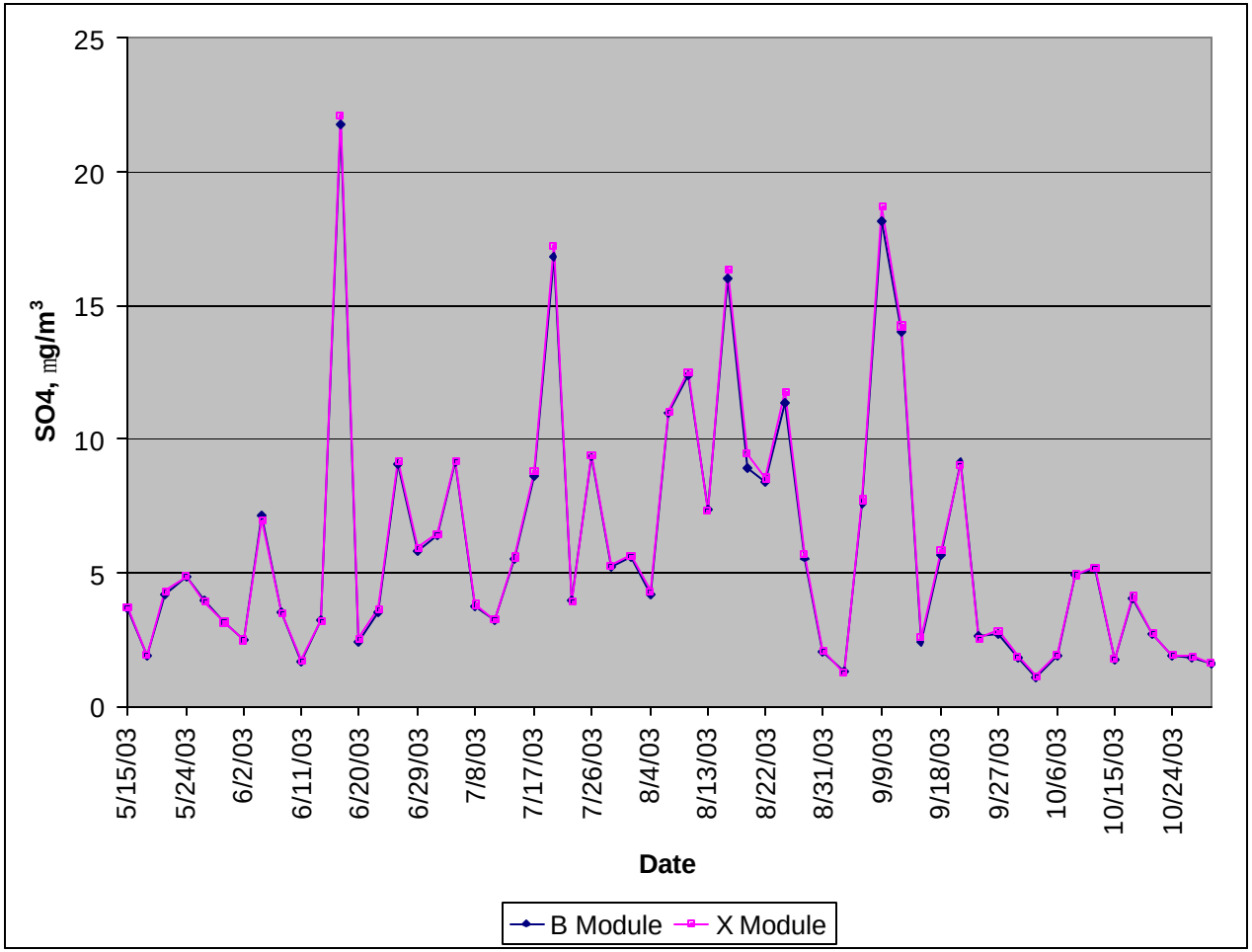
Collocated "B" Modules
Big Bend $SO4^{=}$

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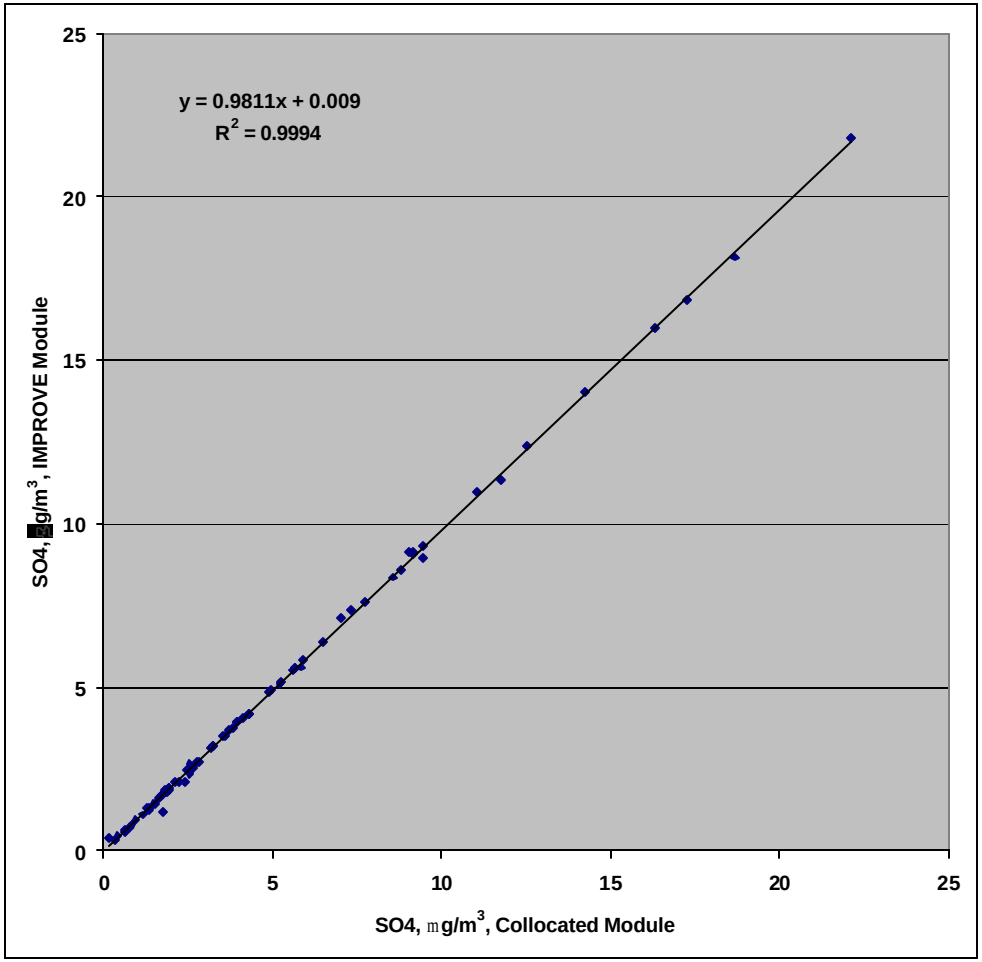


Collocated "B" Modules Mammoth Cave $SO4^{=}$

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Collocated "B" Modules
BIBE & MACA $SO4^{=}$



Collocated Modules: Summary

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- 24 modules by end of summer
- To operate indefinitely
- Later this year, sufficient data to begin drawing conclusions
- Will apply a variety of statistical tests

IMPROVE Network
STN Collocated Sites

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