XRF Analysis
at UC Davis, 2009-10

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University of California, Davis
Stevenson, Washington
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University of California, Davis

Calibration standard checks track performance

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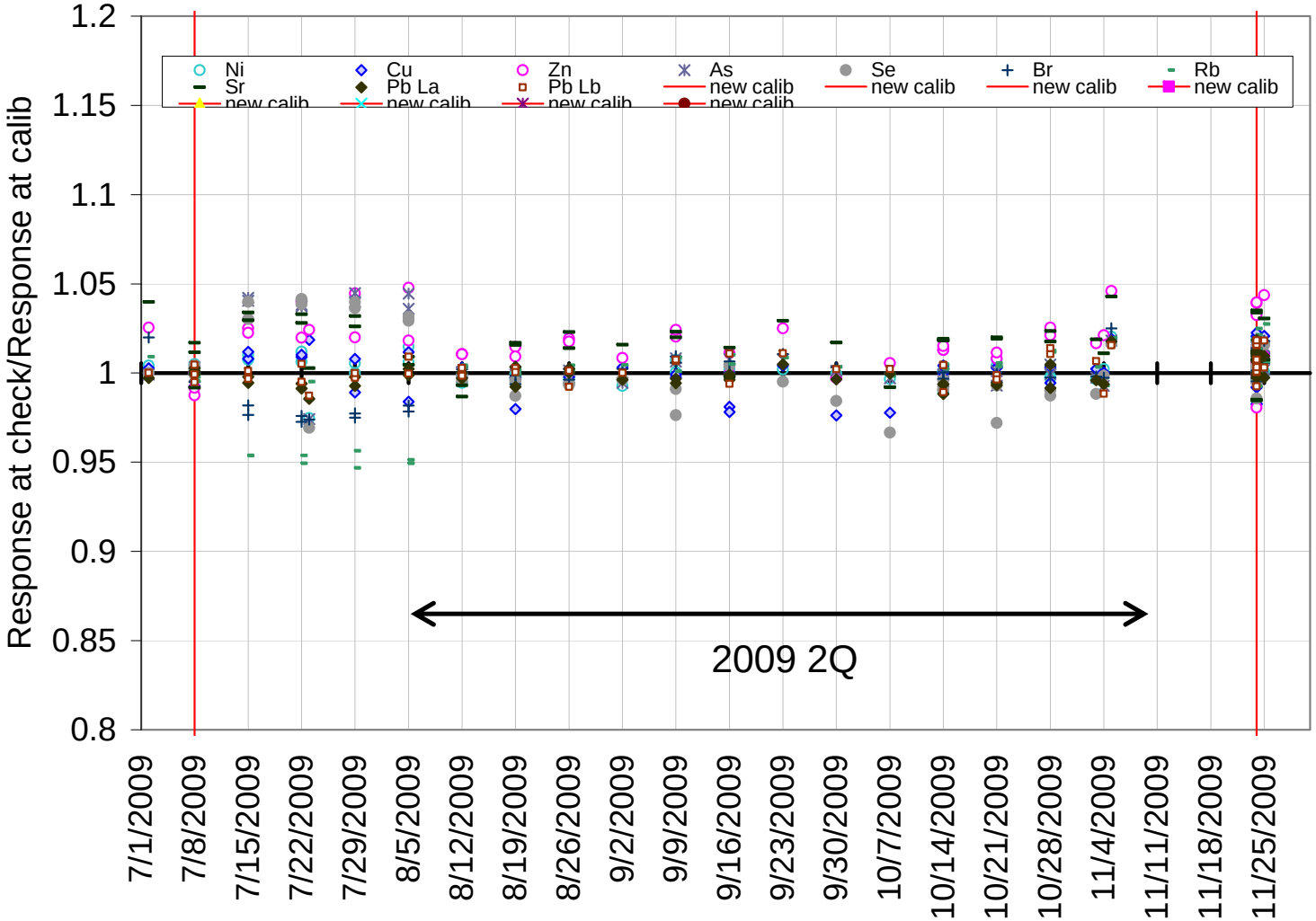
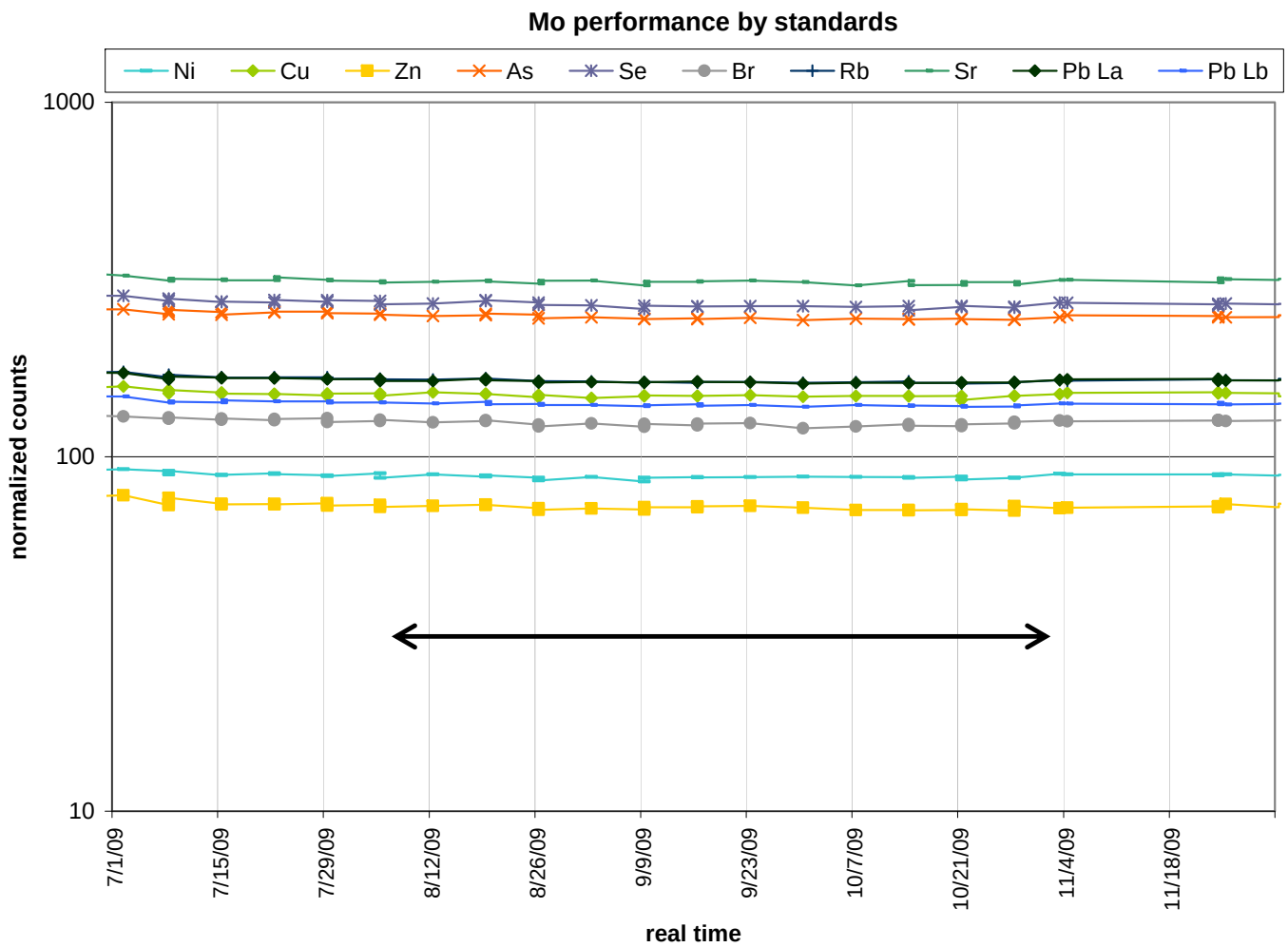
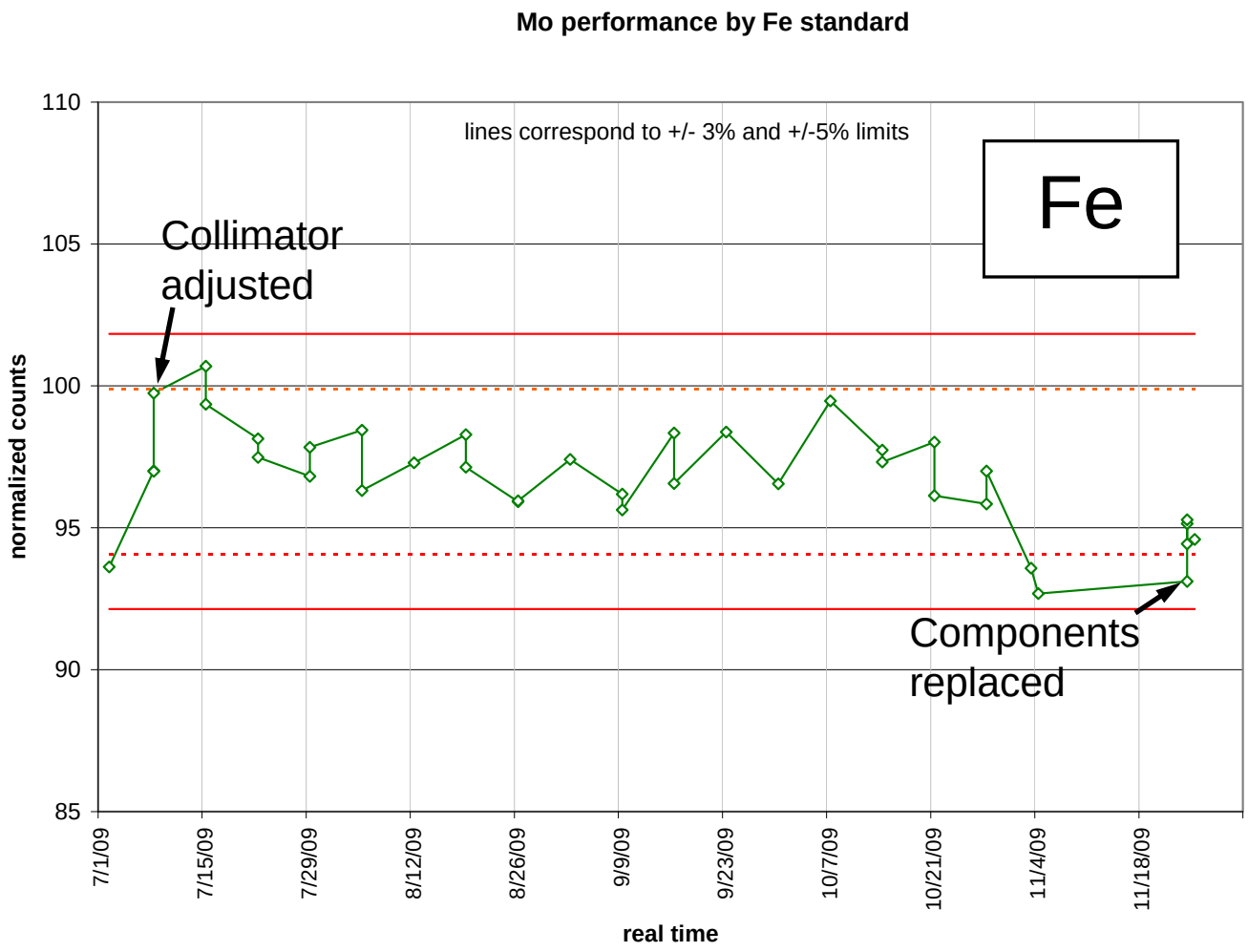


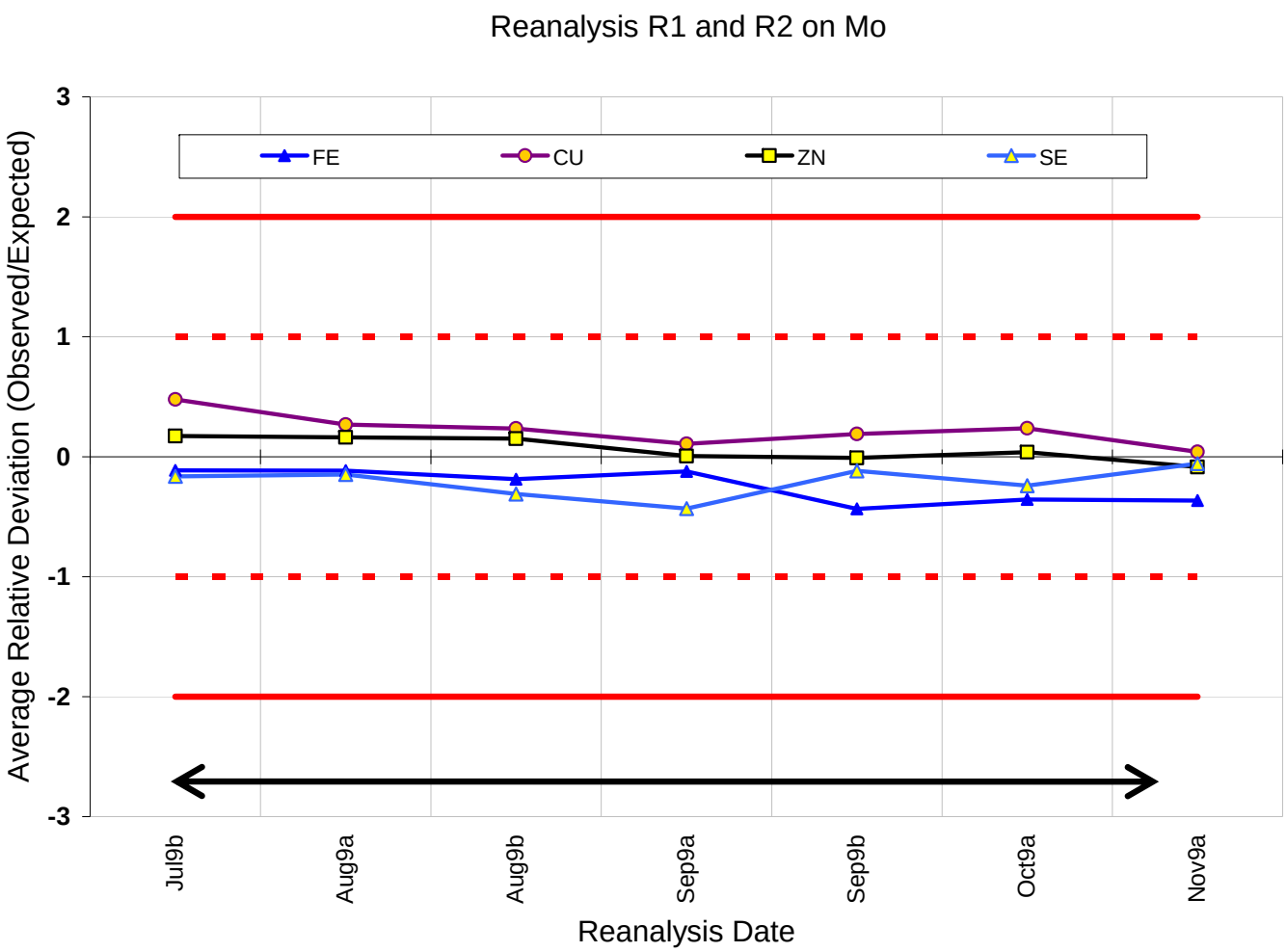
New counts-based checks track system stability



Elements are tracked individually



A set of reanalysis filters is analyzed frequently



Fe & Ca are compared across the Mo and Cu XRF Systems

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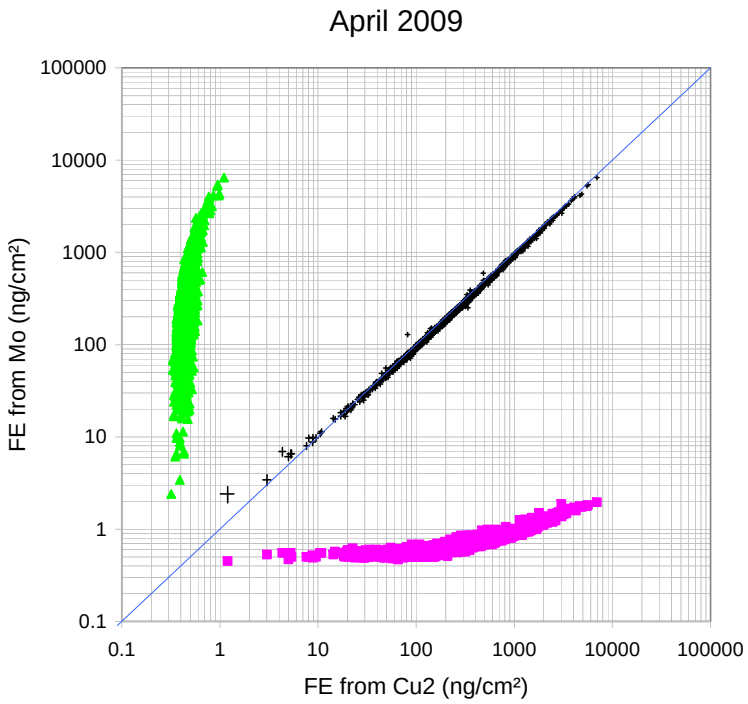

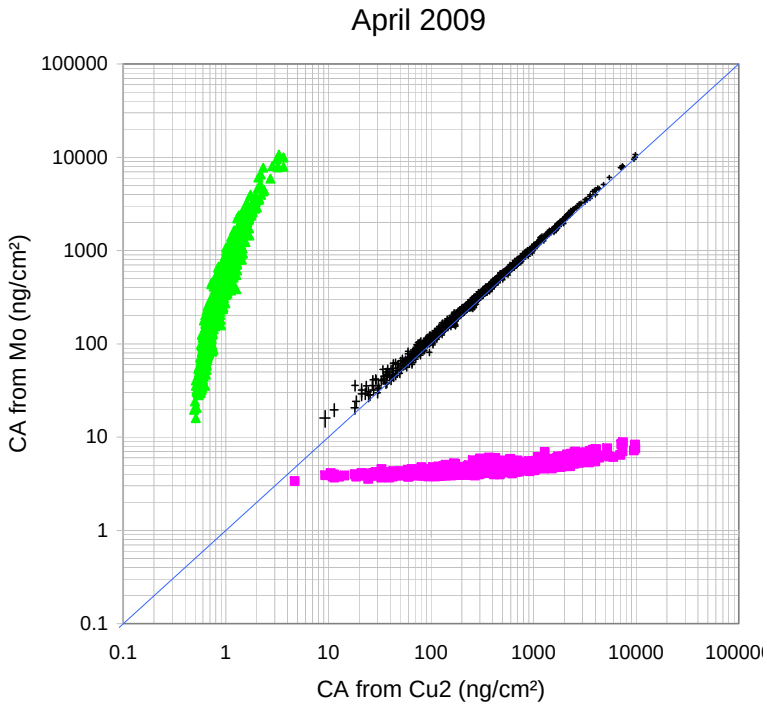

Adjustments & Calibrations
Mo Anode XRF System

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- May 2009 – Cleaned detector & installed shielding on Mo anode
- June 2009 – New standards
- July 2009 – Adjusted detector collimator
- November 2009 – Replaced electronic components
- March 2010 – Refurbished detector
- June 2010 – New Mo anode (down 3 months prior)
- July 2010 – Adjusted detector collimator

Adjustments & Calibrations
Cu Anode XRF System

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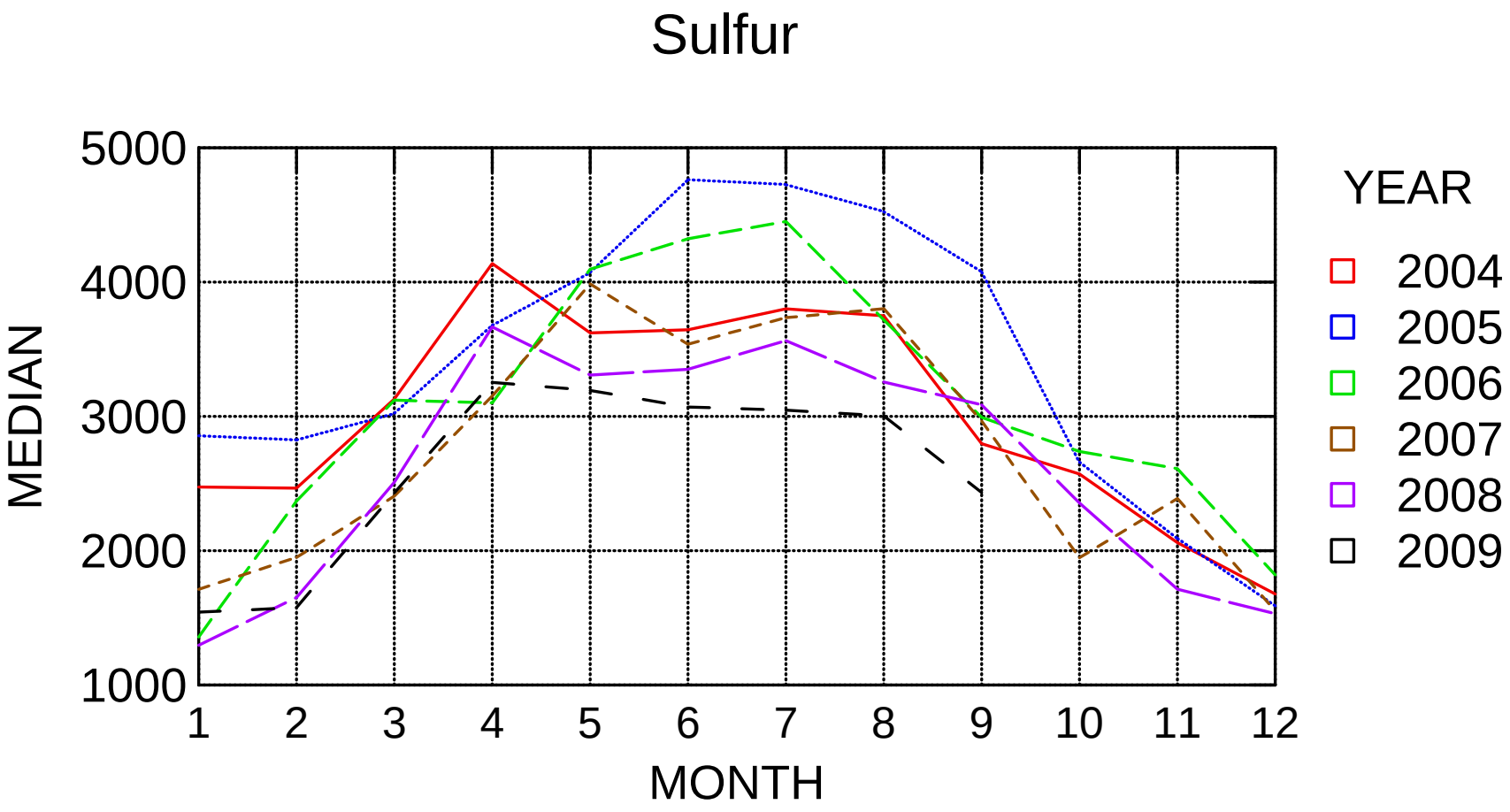
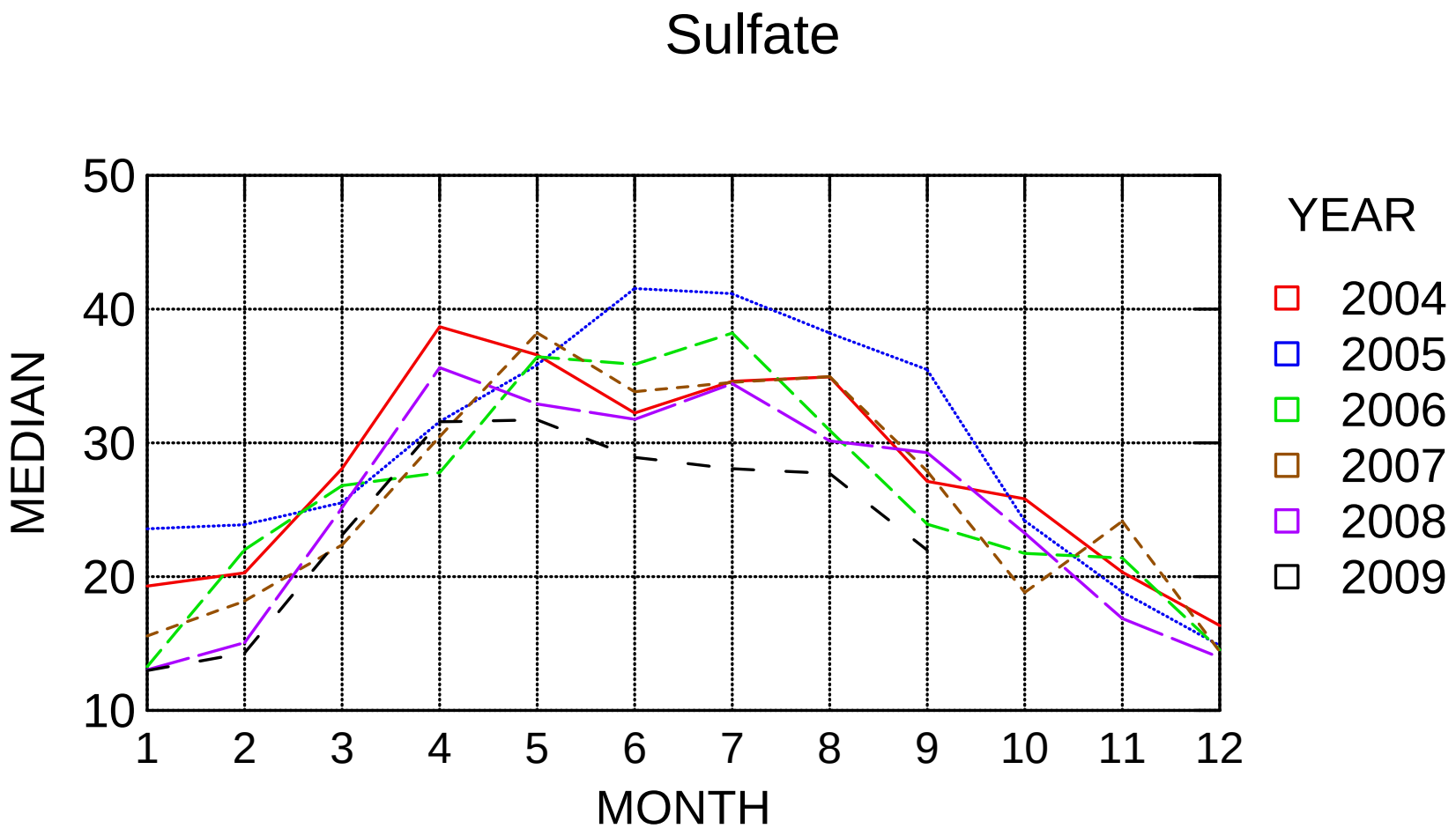
- March 2009 – Cleaned detector
- June 2009 – New standards
- August 2009 – Adjusted amplifier restorer
- March 2010 – Cleaned detector
- Only 1 Cu XRF system used for routine analyses for past 2 years

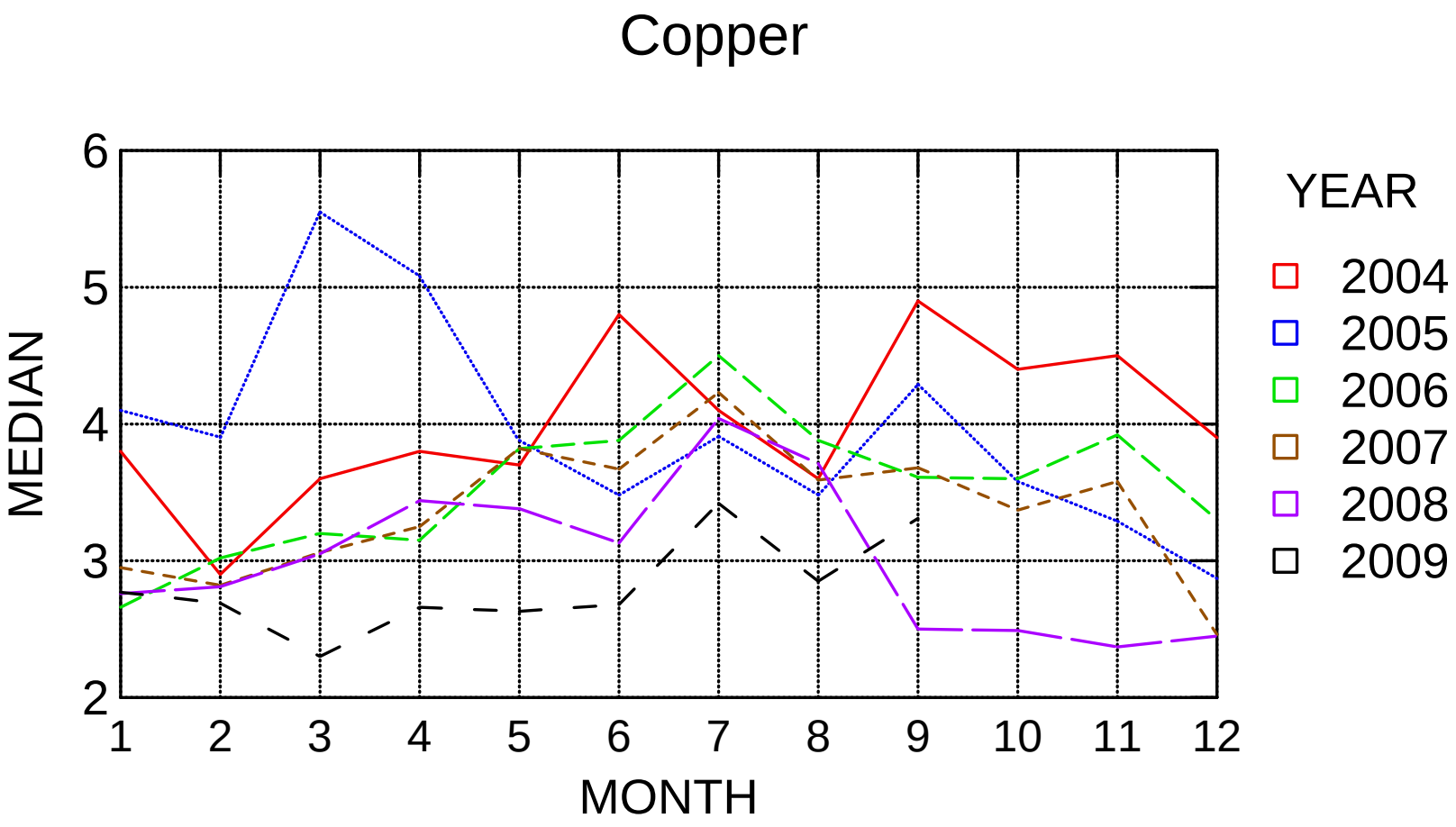
Multi-year checks on analytical data



Independent measurements can identify atmospheric effects



Elements from the Mo system also show 2009 as a clean year



Analysis of ~15 years of filters

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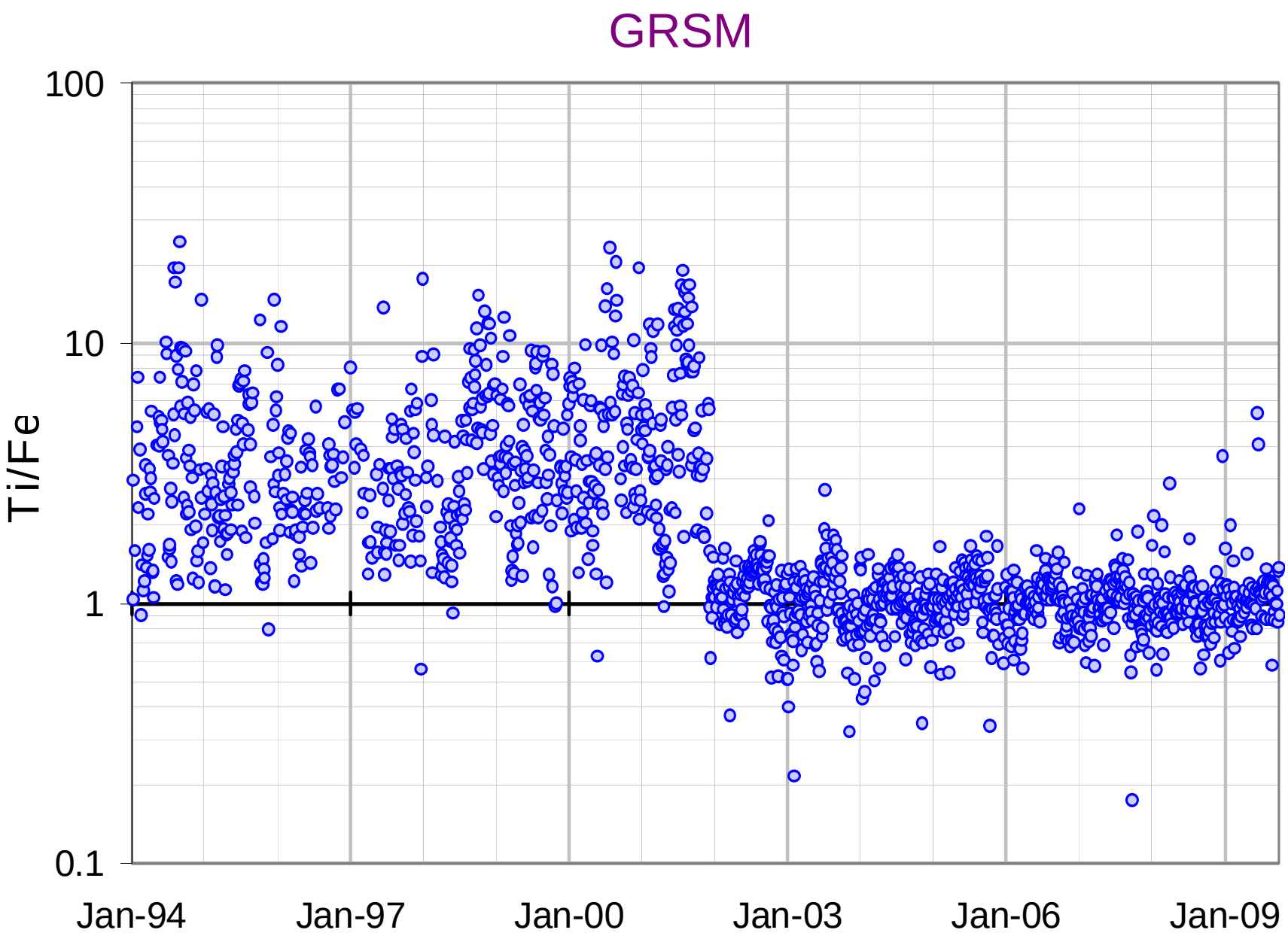
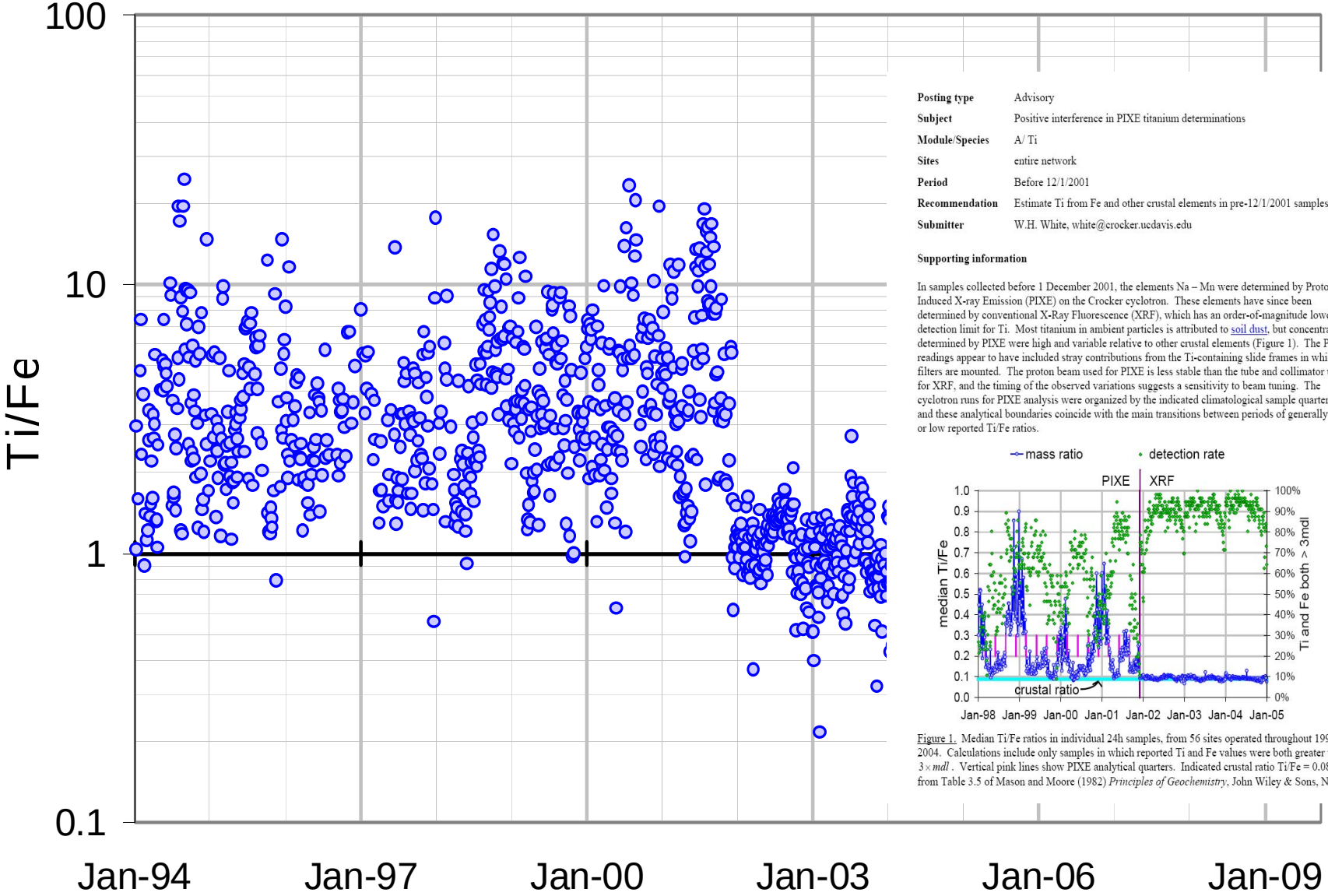
- Great Smoky Mountains, Mount Rainier, Point Reyes
- XRF and laser light absorption
- Sample dates begin ~1994
- Spans PIXE and various XRF changes
- Analysis under a single set of conditions and a single calibration
- Long-term uncertainties not reflected in our precision or collocated measurements


GRSM
100
10
1
0.1
Ti/Fe
Jan-94
Jan-97
Jan-00
Jan-03
Jan-06
Jan-09

GRSM

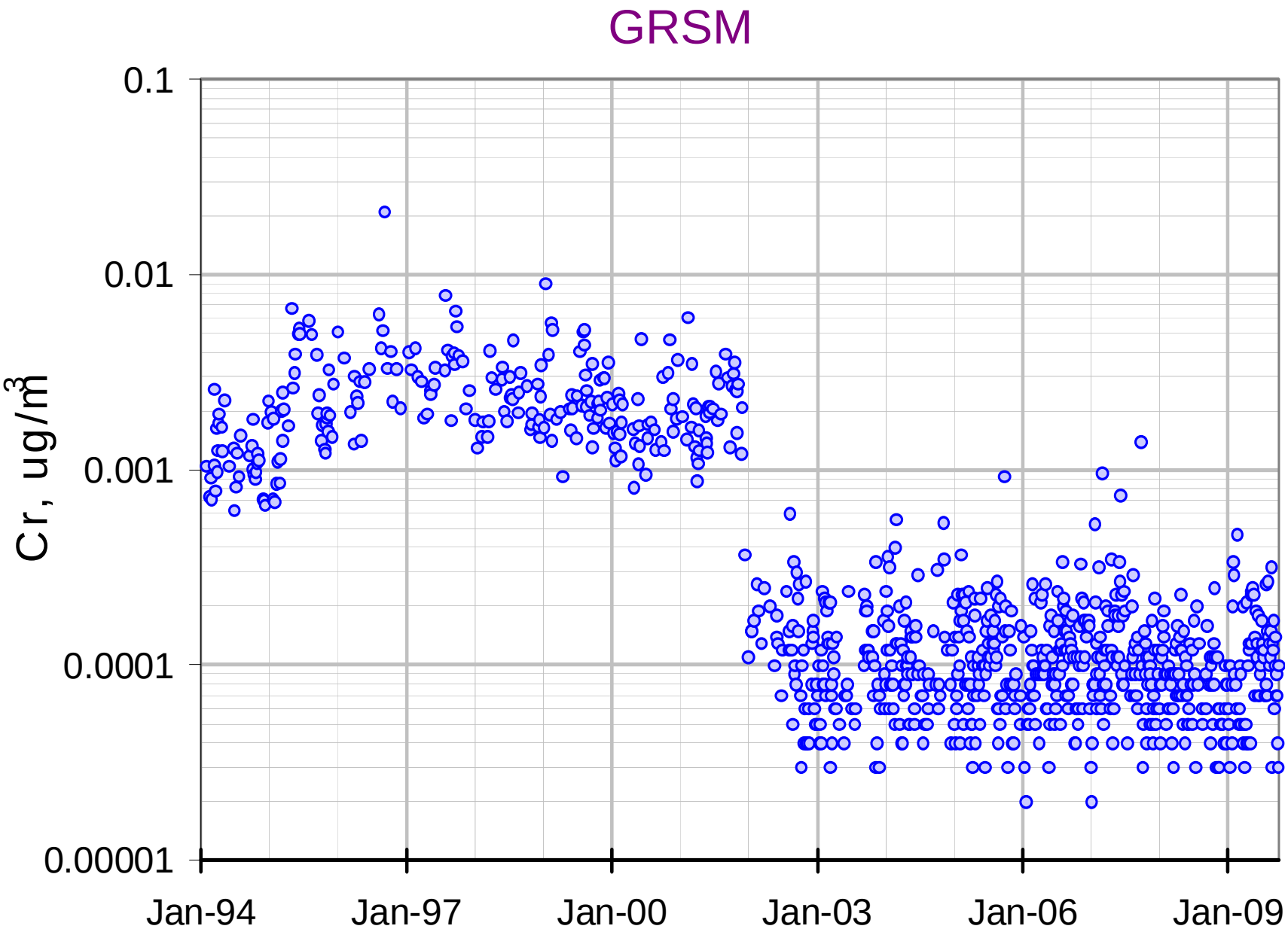


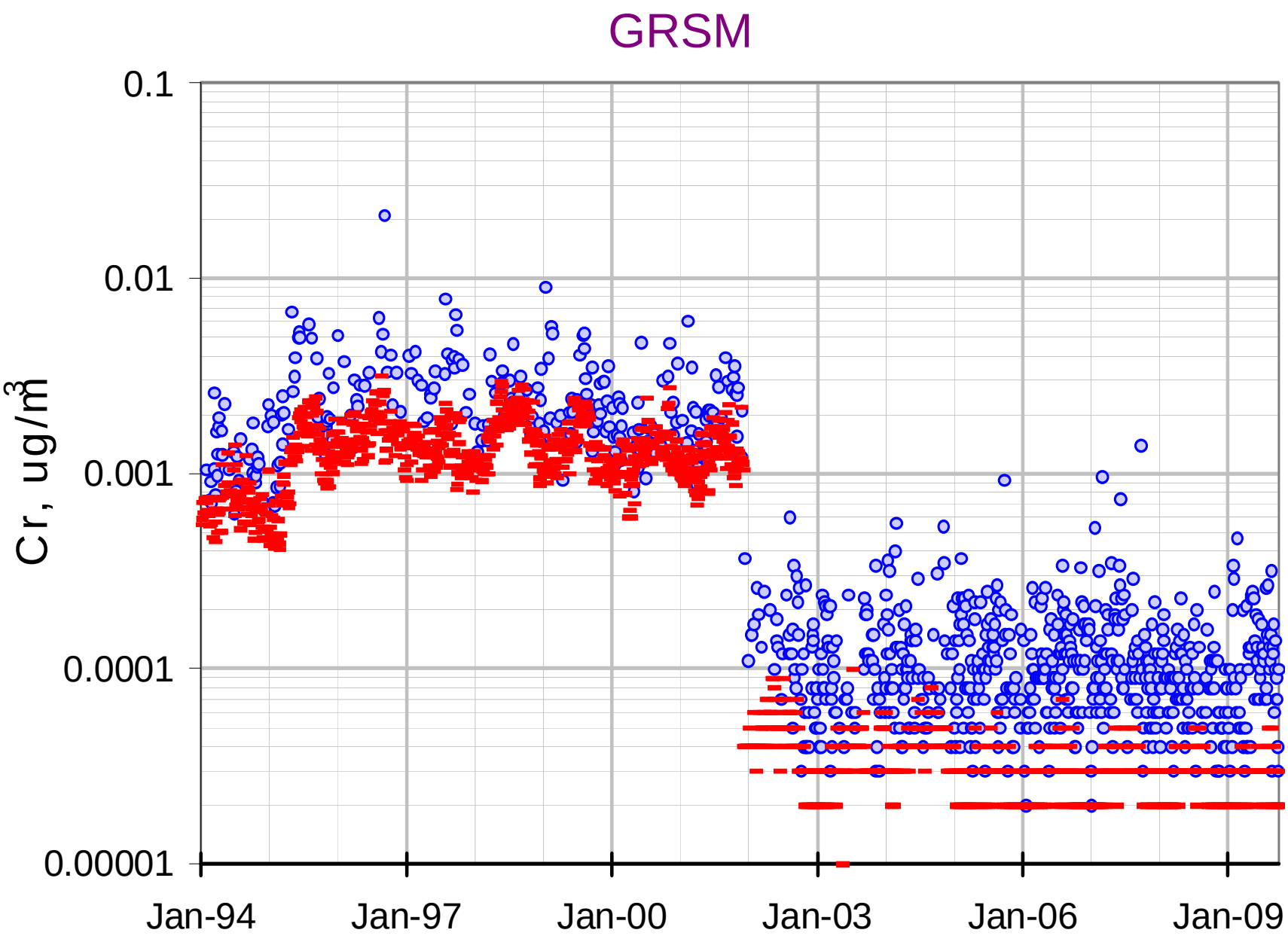
Posting type	Advisory
Subject	Positive interference in PIXE titanium determinations
Module/Species	A/ Ti
Sites	entire network
Period	Before 12/1/2001
Recommendation	Estimate Ti from Fe and other crustal elements in pre-12/1/2001 samples.
Submitter	W.H. White, white@crocker.ucdavis.edu

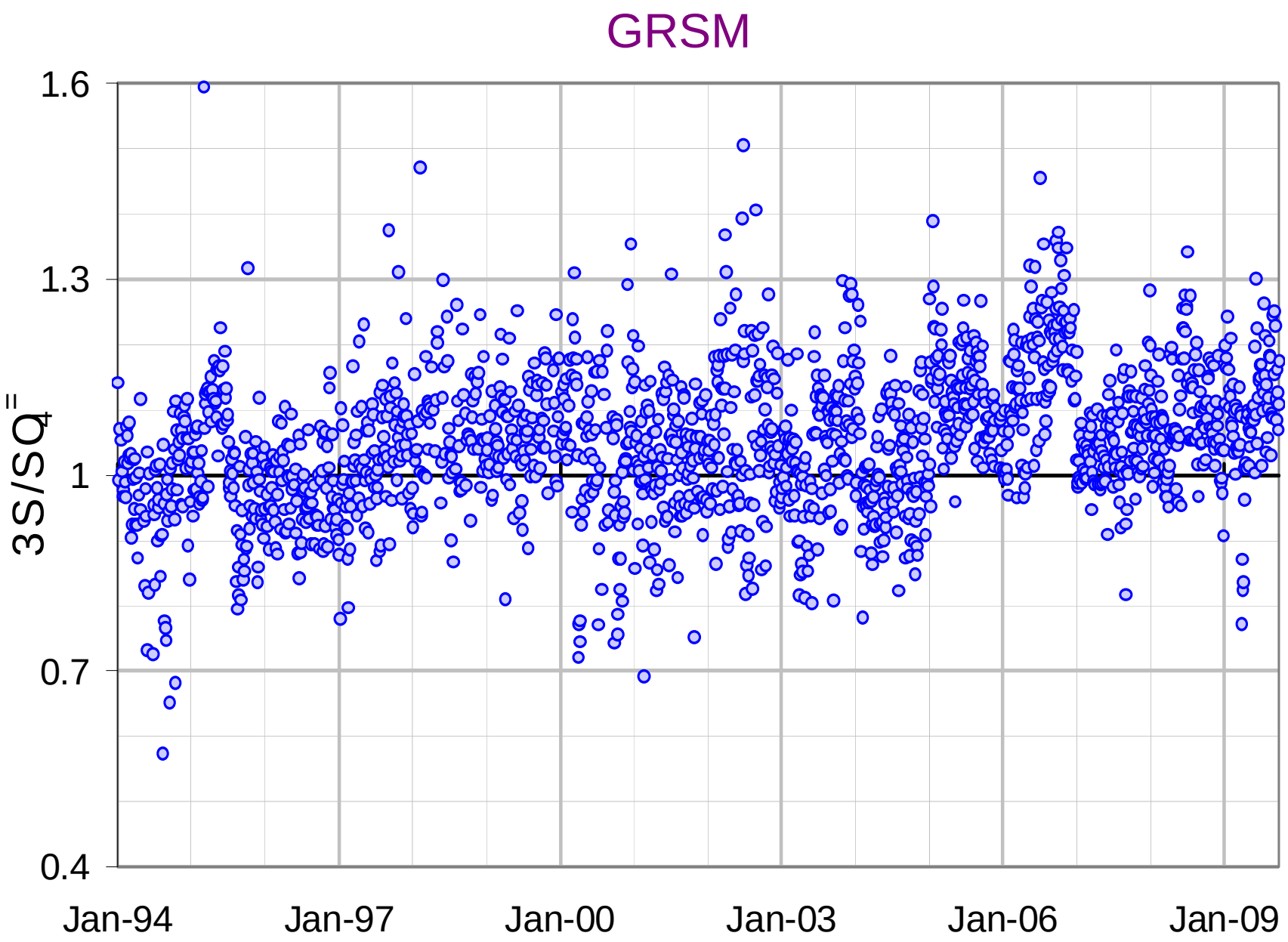
Supporting information

In samples collected before 1 December 2001, the elements Na – Mn were determined by Proton-Induced X-ray Emission (PIXE) on the Crocker cyclotron. These elements have since been determined by conventional X-Ray Fluorescence (XRF), which has an order-of-magnitude lower detection limit for Ti. Most titanium in ambient particles is attributed to soil dust, but concentrations determined by PIXE were high and variable relative to other crustal elements (Figure 1). The PIXE readings appear to have included stray contributions from the Ti-containing slide frames in which filters are mounted. The proton beam used for PIXE is less stable than the tube and collimator used for XRF, and the timing of the observed variations suggests a sensitivity to beam tuning. The cyclotron runs for PIXE analysis were organized by the indicated climatological sample quarters, and these analytical boundaries coincide with the main transitions between periods of generally high or low reported Ti/Fe ratios.

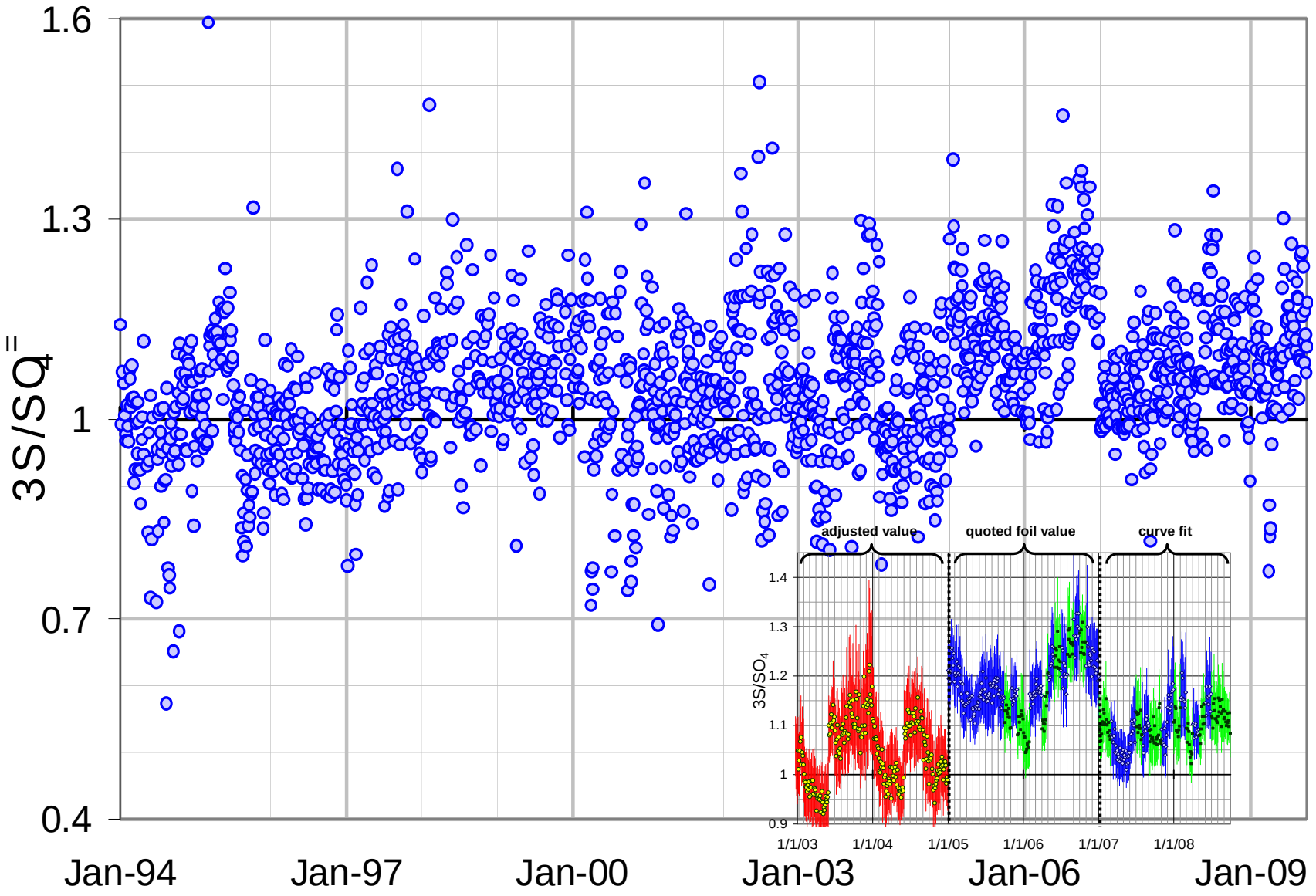
Figure 1. Median Ti/Fe ratios in individual 24h samples, from 56 sites operated throughout 1998 – 2004. Calculations include only samples in which reported Ti and Fe values were both greater than $3 \times mdl$. Vertical pink lines show PIXE analytical quarters. Indicated crustal ratio Ti/Fe = 0.088 is from Table 3.5 of Mason and Moore (1982) *Principles of Geochemistry*, John Wiley & Sons, NY.

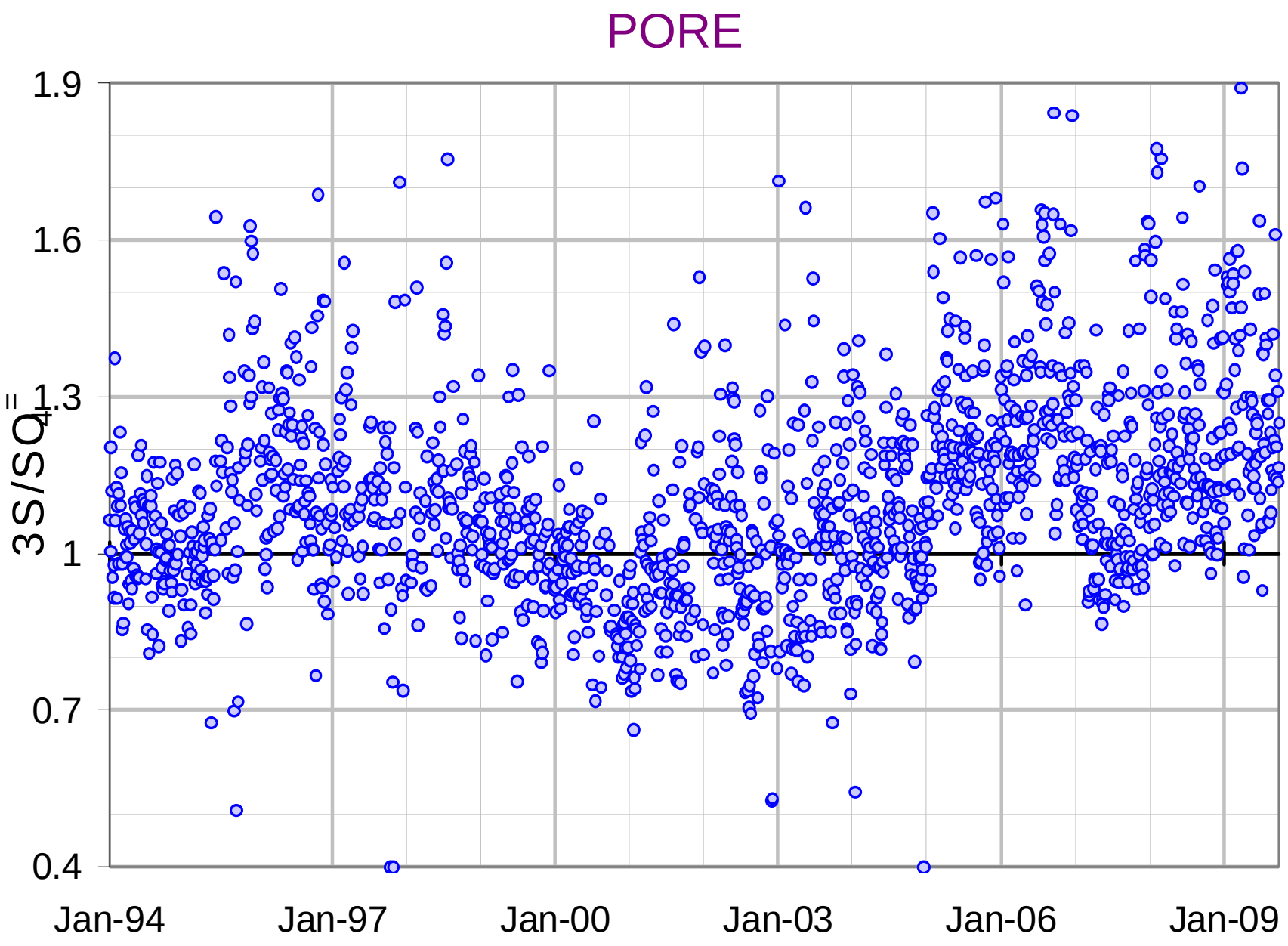

GRSM
0.1
0.01
0.001
0.0001
0.00001
Cr, ug/m3
Jan-94
Jan-97
Jan-00
Jan-03
Jan-06
Jan-09

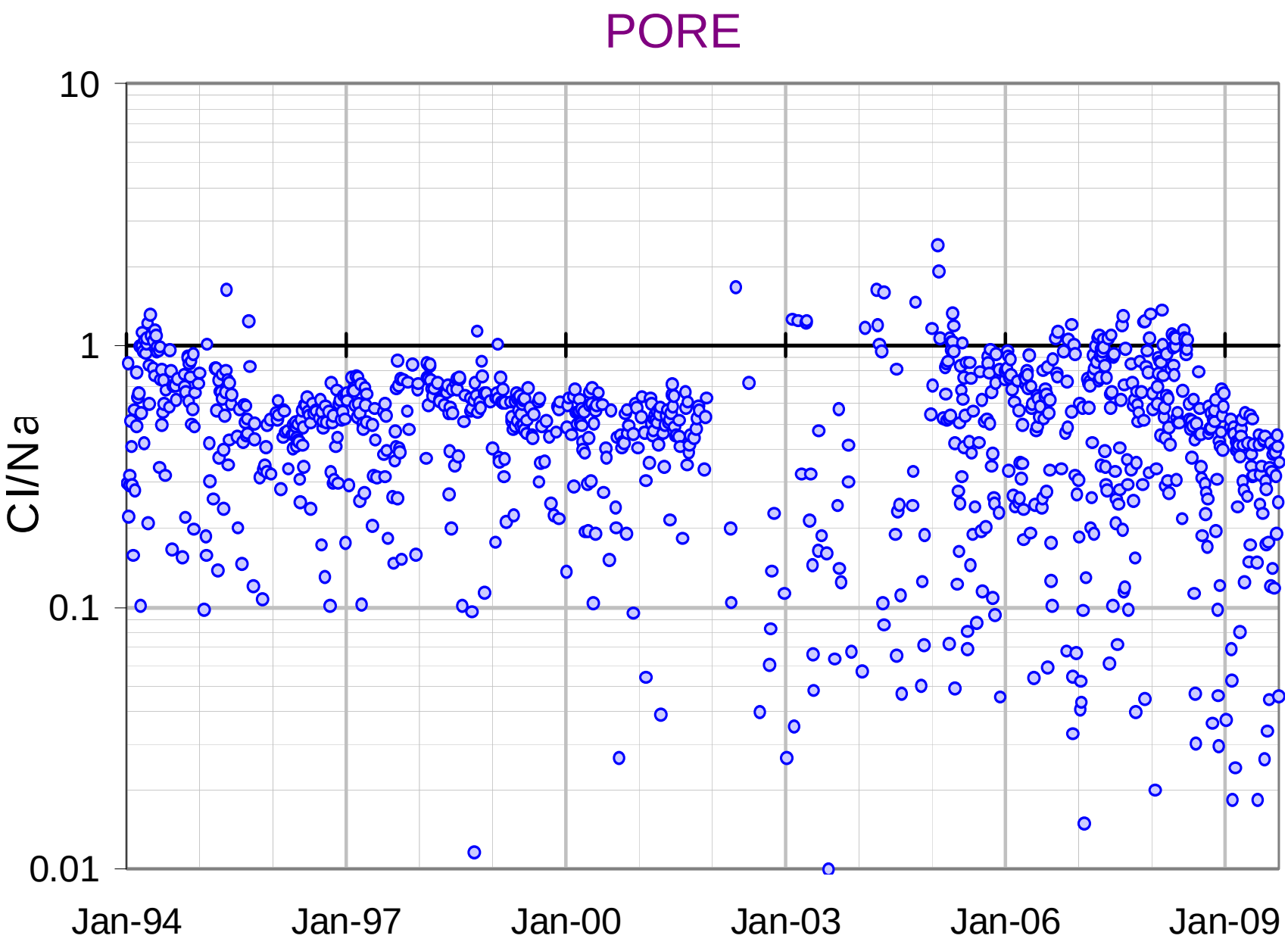

GRSM
0.1
0.01
0.001
0.0001
0.00001
Cr, ug/m3
Jan-94
Jan-97
Jan-00
Jan-03
Jan-06
Jan-09

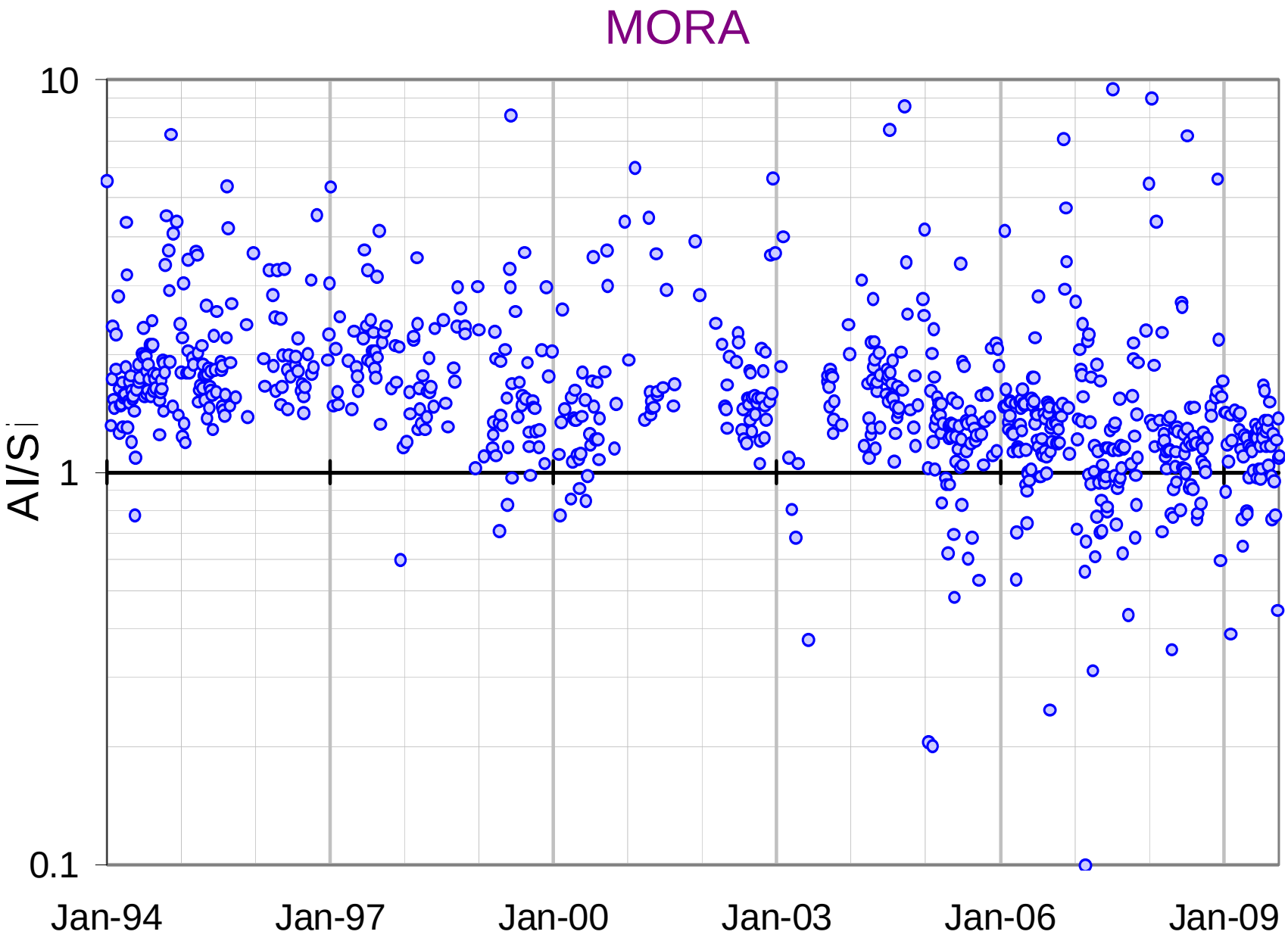

GRSM
1.6
1.3
1
0.7
0.4
3S/SO4=
Jan-94
Jan-97
Jan-00
Jan-03
Jan-06
Jan-09

GRSM


1.6
1.3
1
0.7
0.4
3S/SO4=
Jan-94
Jan-97
Jan-00
Jan-03
Jan-06
Jan-09
adjusted value
quoted foil value
curve fit
1.4
1.3
1.2
1.1
1
0.9
3S/SO4
1/1/03
1/1/04
1/1/05
1/1/06
1/1/07
1/1/08


PORE
1.9
1.6
1.3
1
0.7
0.4
3S/SO4=
Jan-94
Jan-97
Jan-00
Jan-03
Jan-06
Jan-09


PORE
10
1
0.1
0.01
Cl/Na
Jan-94
Jan-97
Jan-00
Jan-03
Jan-06
Jan-09


MORA
10
1
0.1
AI/Si
Jan-94
Jan-97
Jan-00
Jan-03
Jan-06
Jan-09