

Testing the Graded Mode CTI Correction

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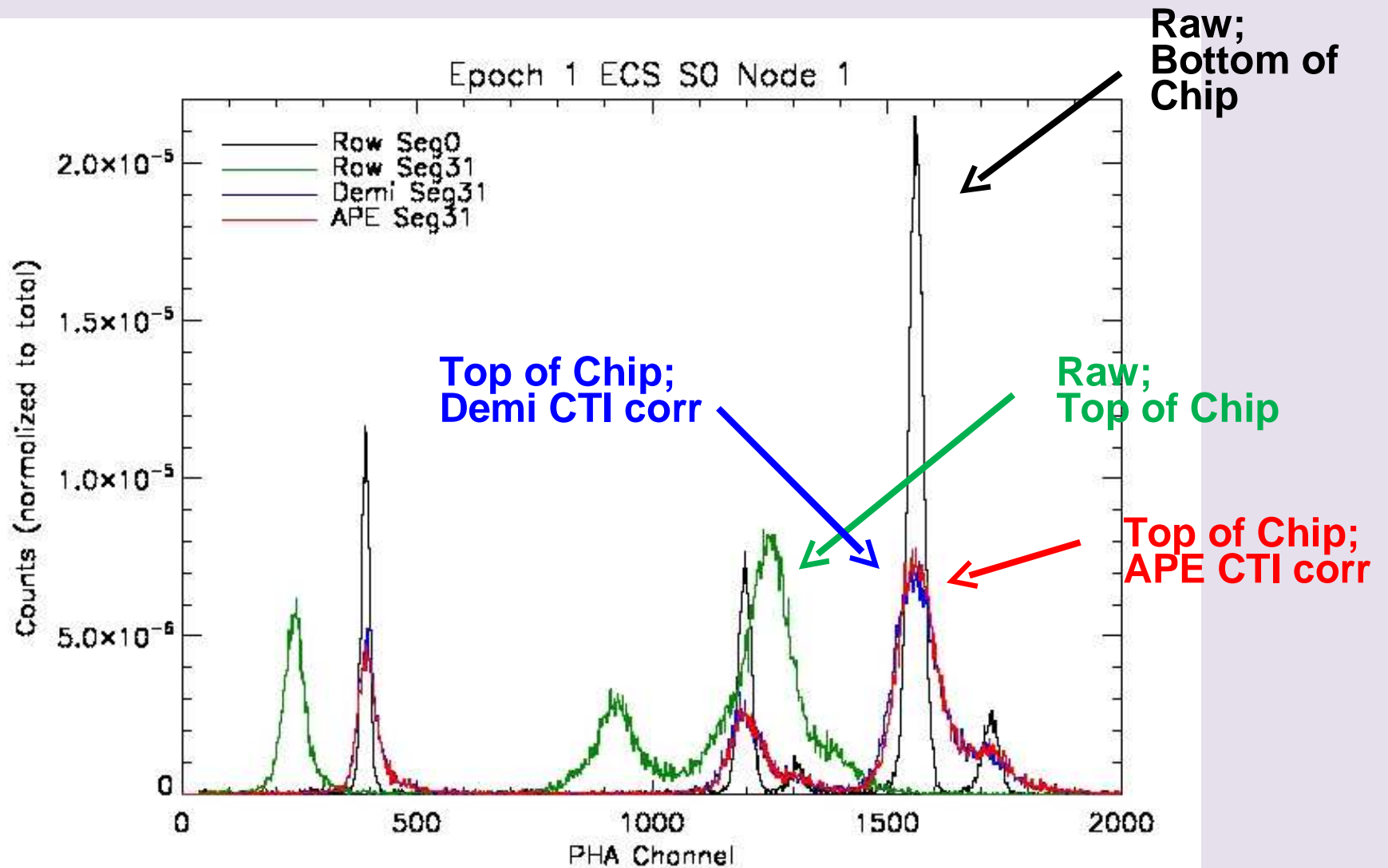
Sources: External Calibration Source (ECS) and 1E0102-72.3

Processing: develop 2 data sets --

5. Faint mode w/ standard processing ("APE") -
 - Acis_process_events w/ CALDB CTI correction
 - Filter on grade=0,2,3,4,6; apply tgain

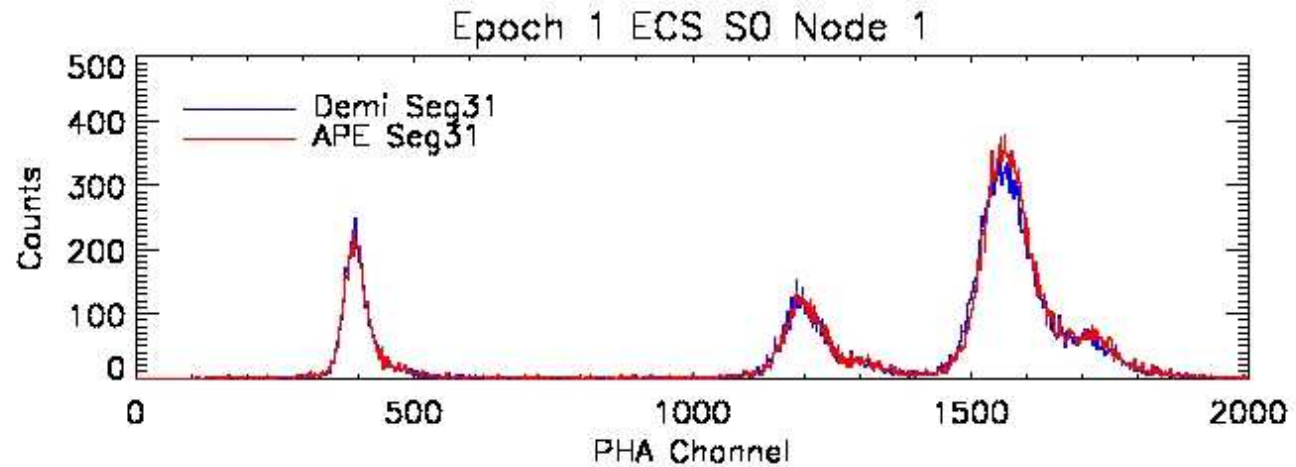
2. Graded mode w/ Alexey's algorithm ("Demi") –
 1. Acis_process_events with no CTI correction and special grade file to convert from Faint to Graded mode
 2. Apply Alexey's Graded mode CTI correction algorithm
 3. Filter on grade=0,2,3,4,6 ; apply tgain

ECS PHA Profiles

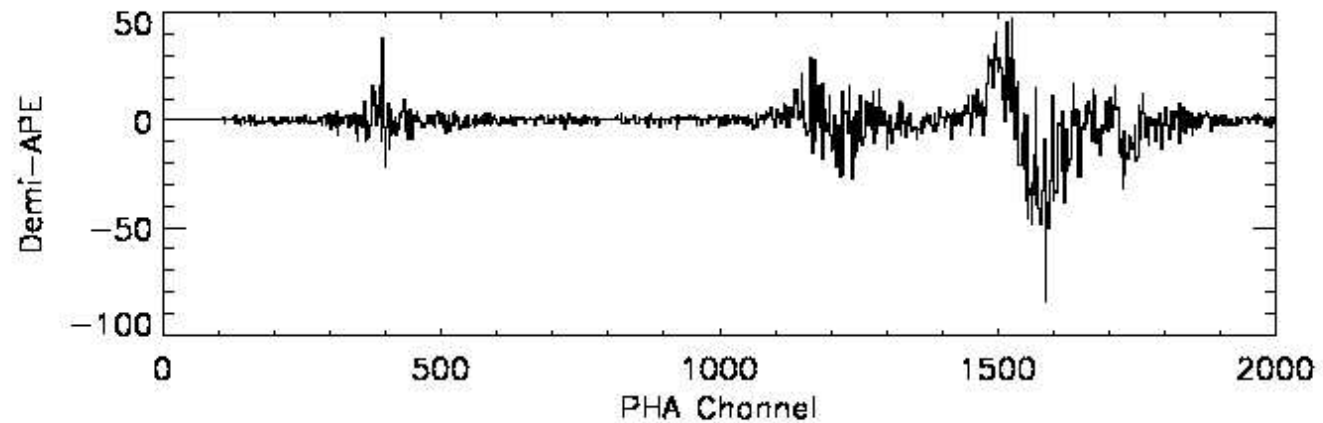


ECS PHA Profiles

Red = APE
Blue = Demi



Demi - APE



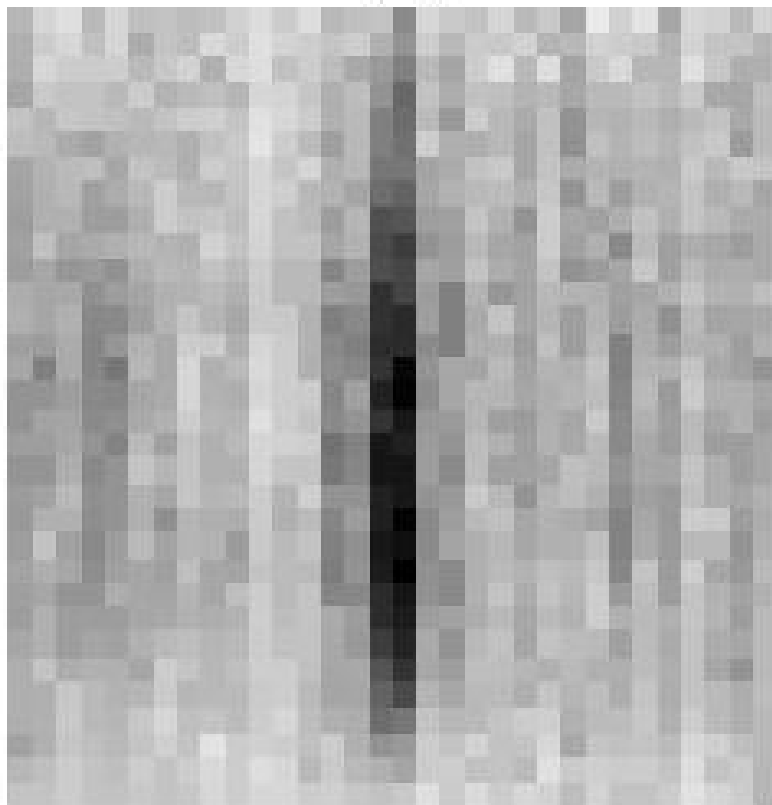
Fitting ECS data

- Epochs 1 and 27; chips S0, S2, and S4
- 32 x 32 pixel regions → 1024 fits per chip
- Model: 5 Gaussians (widths frozen) + powerlaw background component
- Concentrate on results for 2 strongest lines:
 - Al K-alpha (1.487 keV) and Mn K-alpha (5.898 keV)

Fit line energies for Al K-alpha, S2 Epoch 1

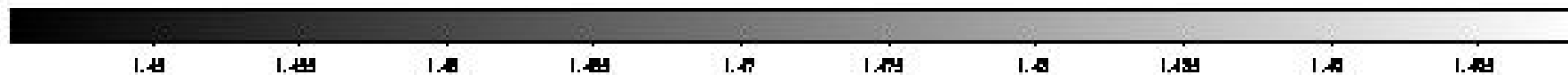
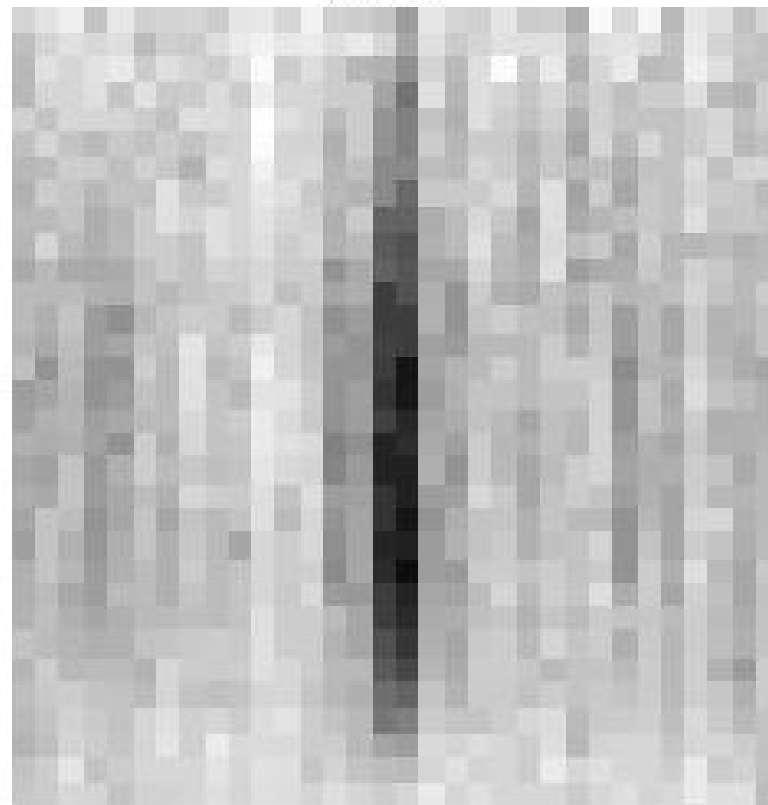
APE

Al (APE)



Al (Demi)

Demi

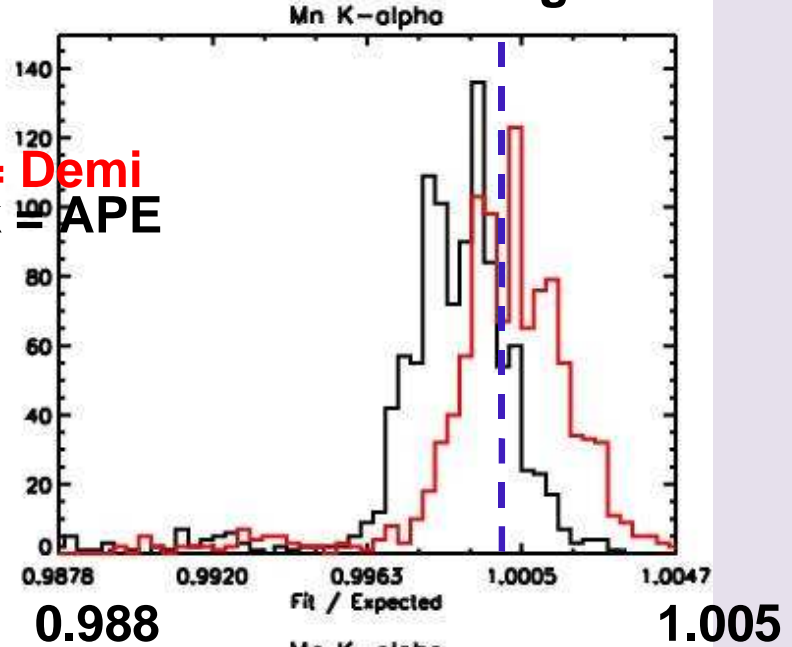
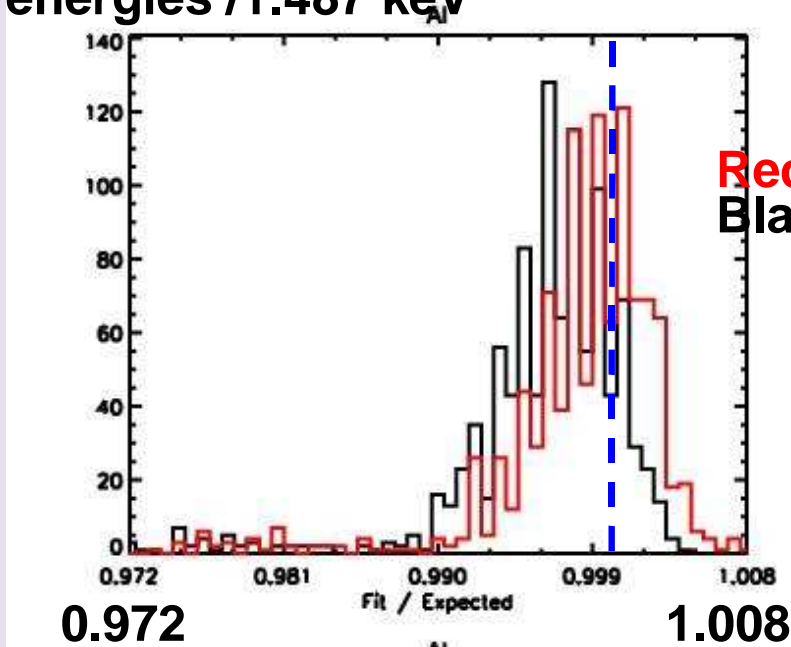


range: 1.445 - 1.498

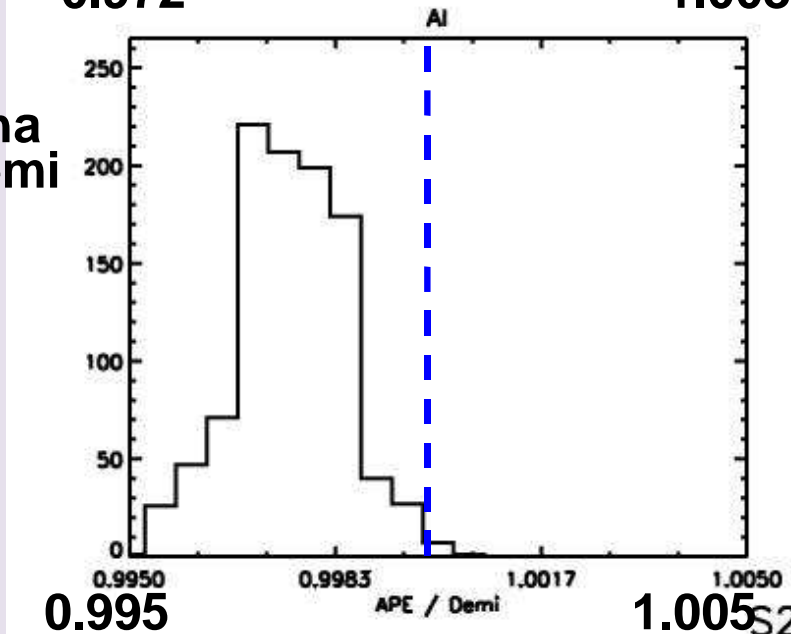
S2 Epoch 1

Al K-alpha
Fit line energies / 1.487 keV

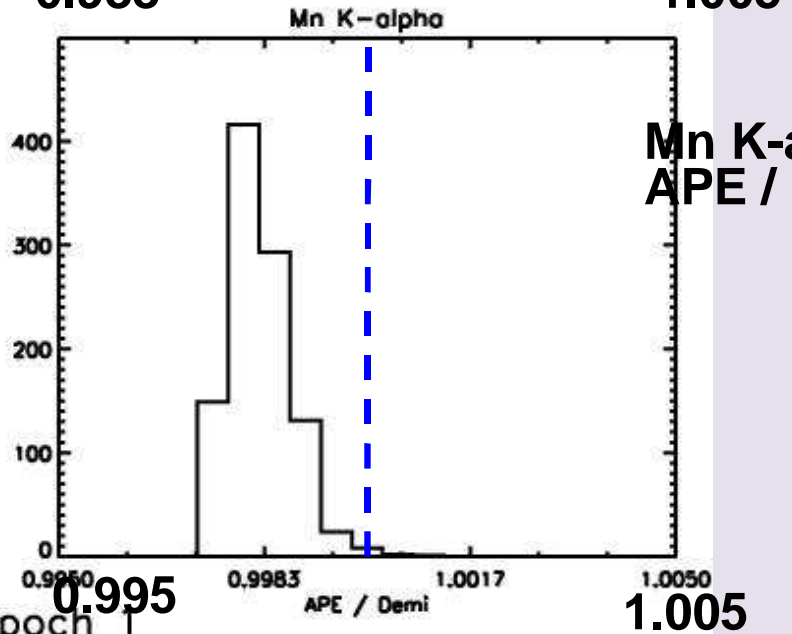
Mn K-alpha
Fit line energies / 5.898 keV



Al K-alpha
APE / Demi



Mn K-alpha
APE / Demi

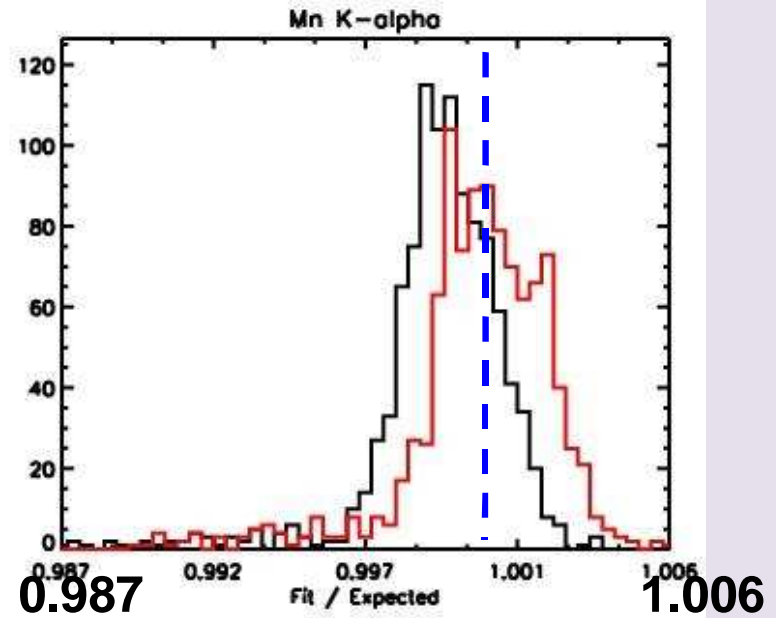
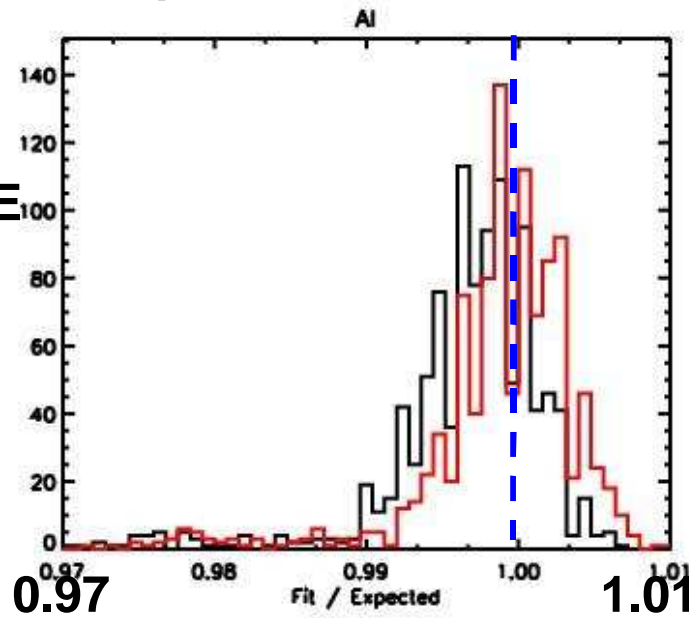


S2 Epoch 27

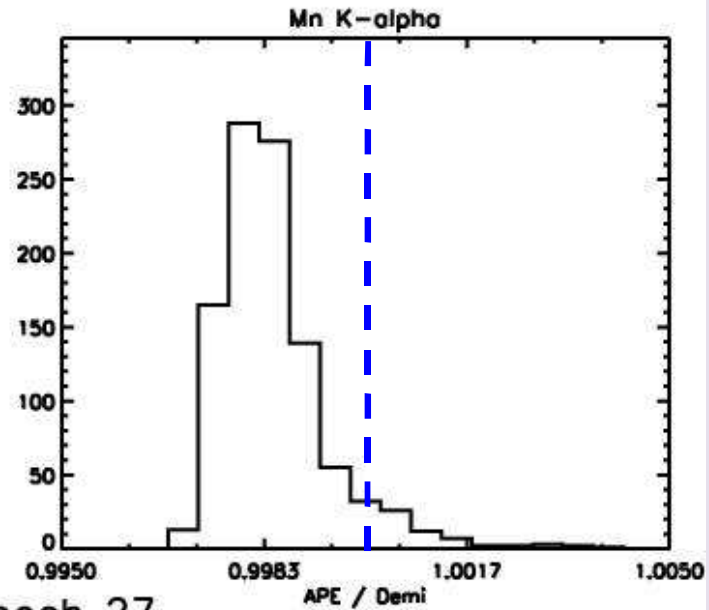
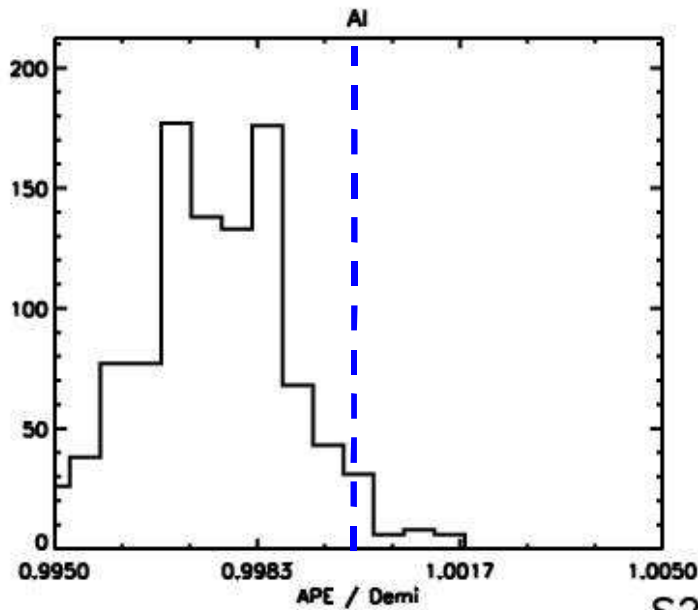
Al K-alpha

Mn K-alpha

Red = Demi
Black = APE



APE / Demi



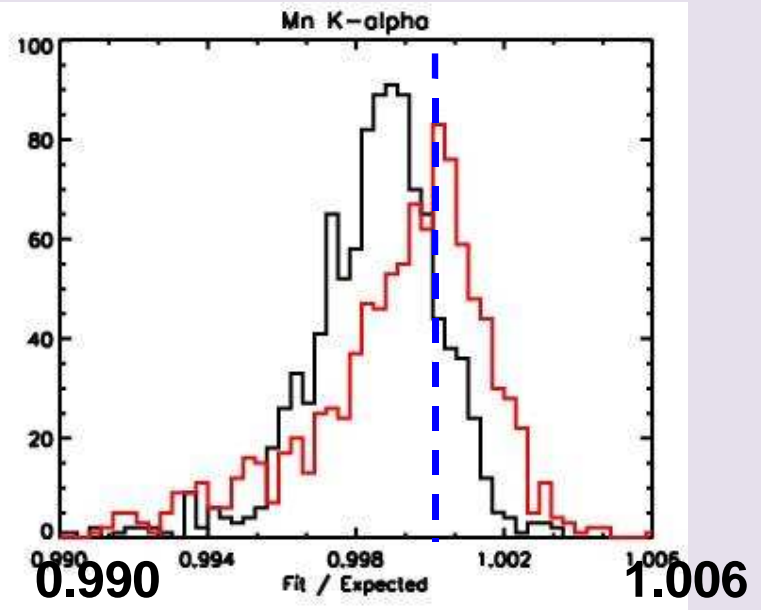
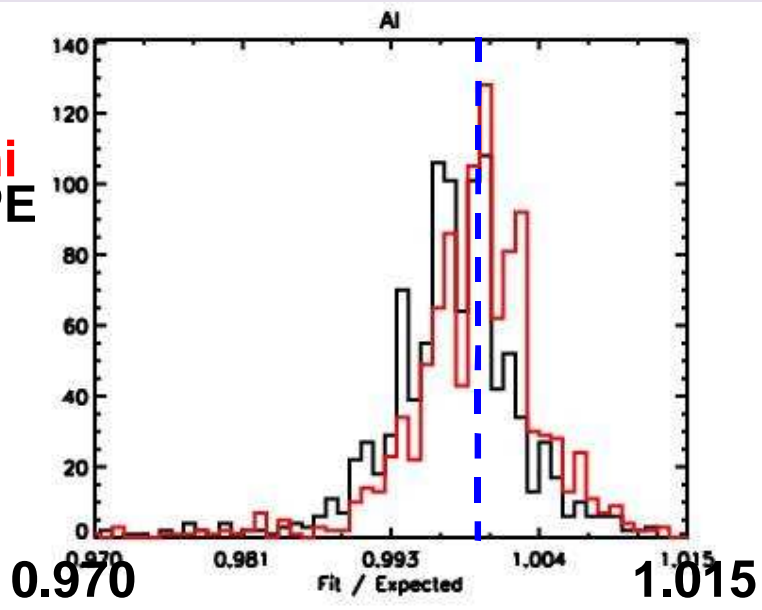
S2 Epoch 27

S0 Epoch 1

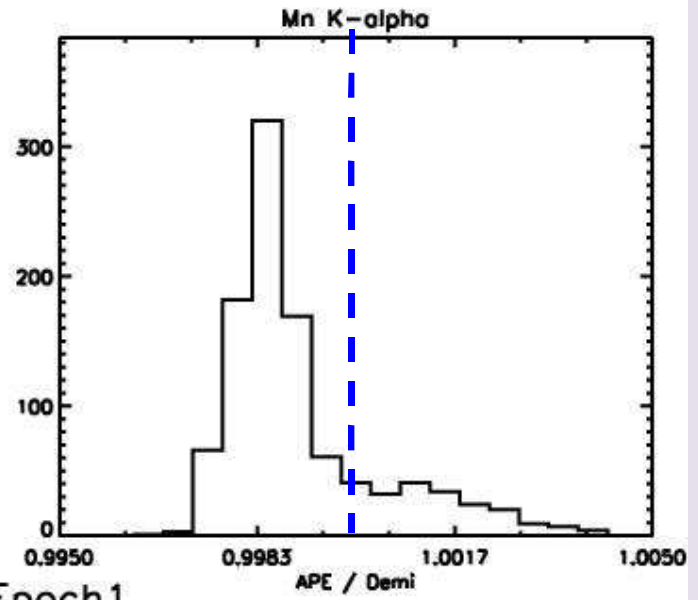
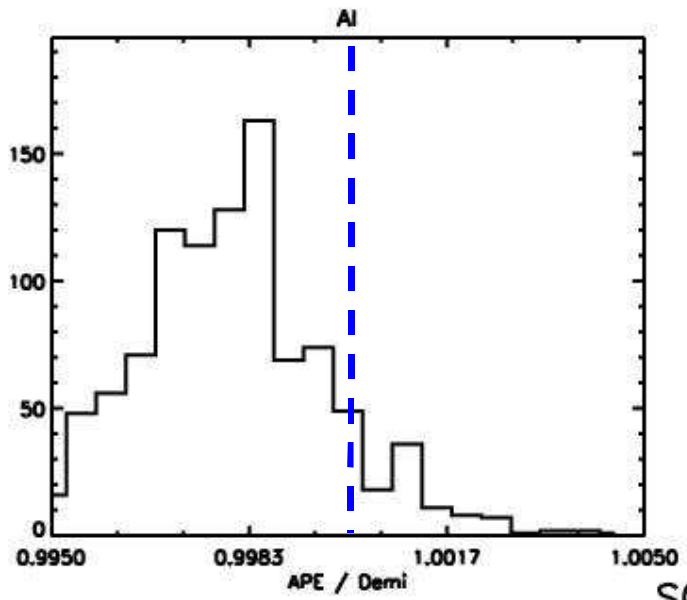
Al K-alpha

Mn K-alpha

Red = Demi
Black = APE



APE / Demi



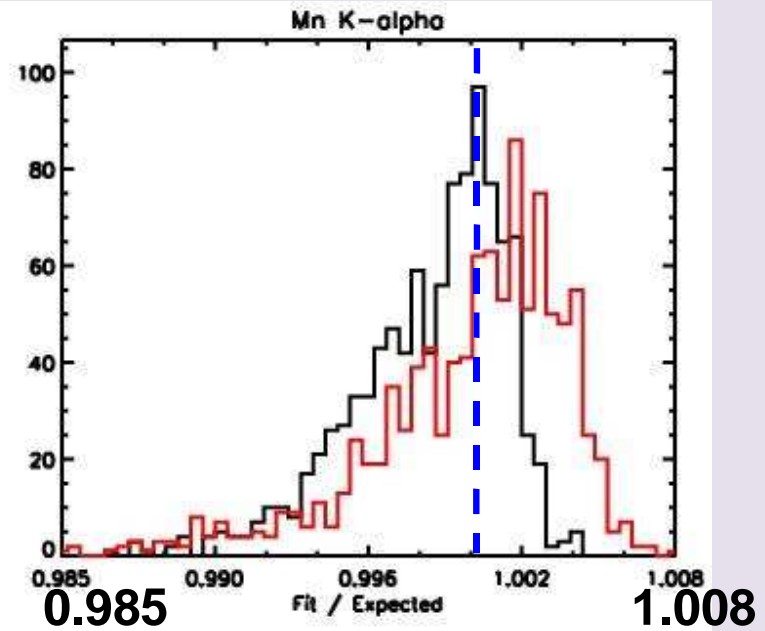
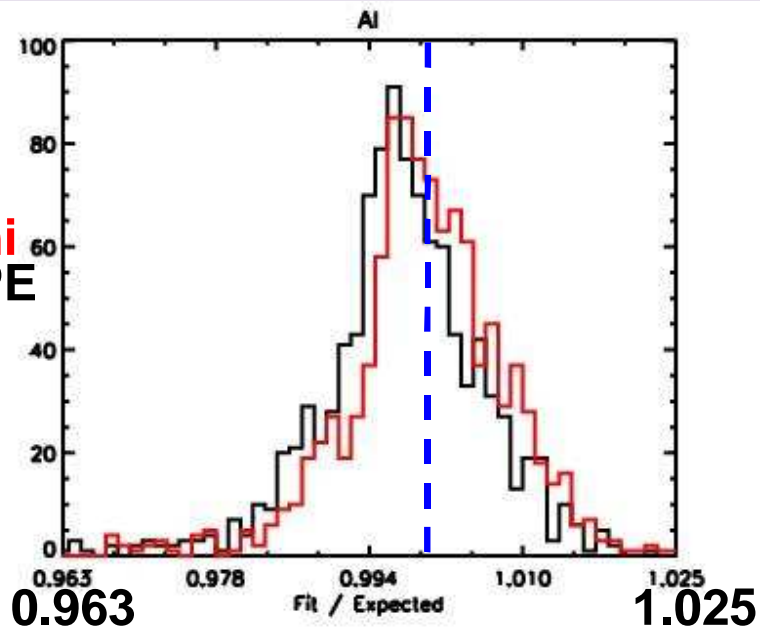
S0 Epoch 1

Al K-alpha

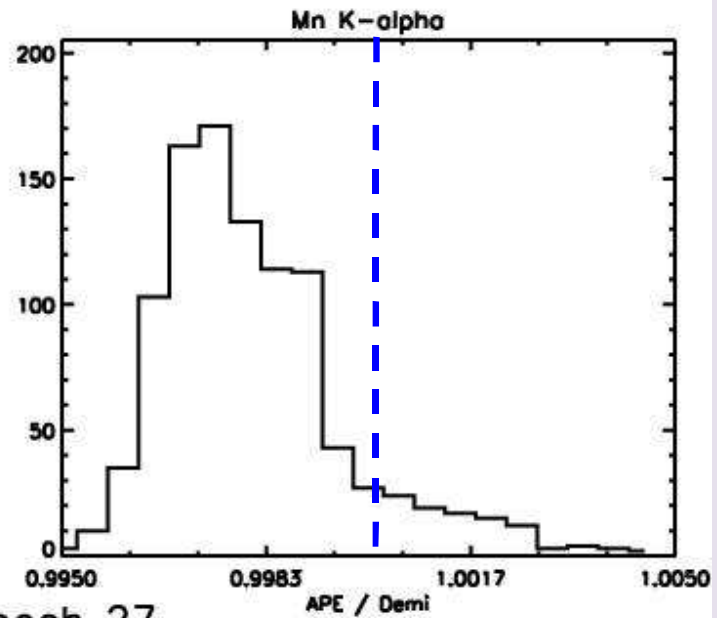
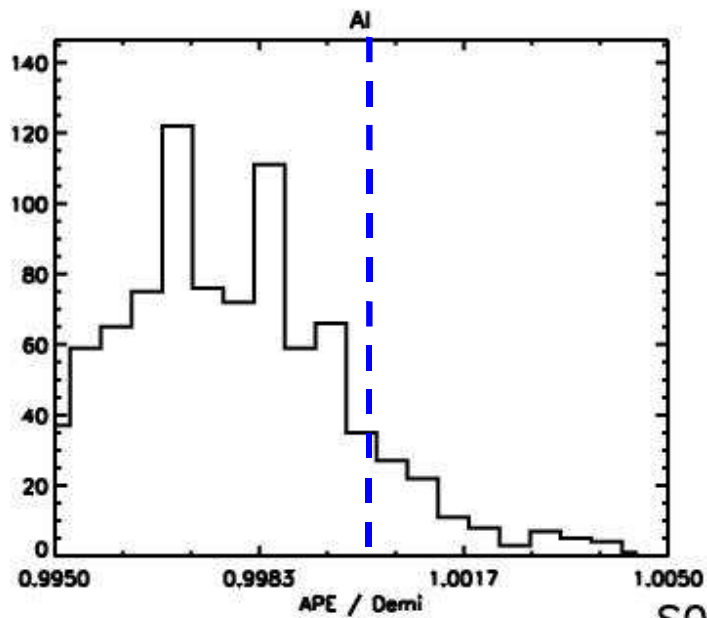
S0 Epoch 27

Mn K-alpha

Red = Demi
Black = APE



APE / Demi



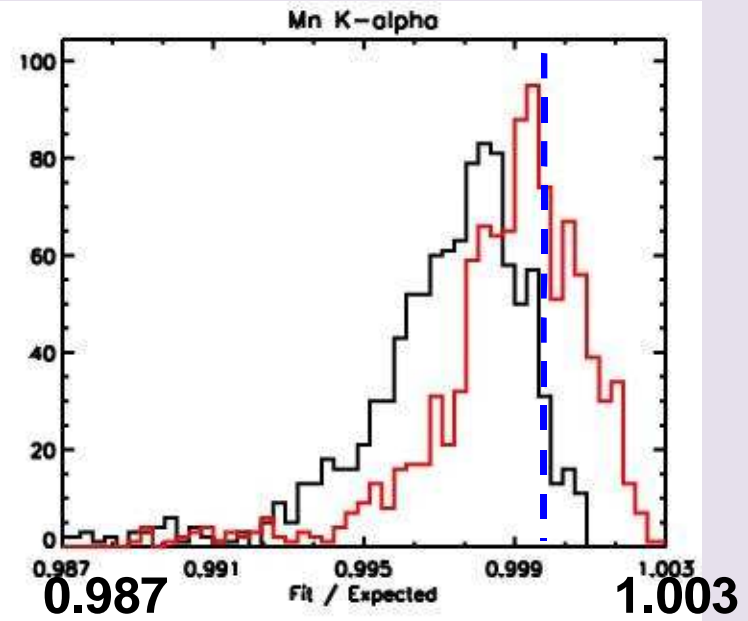
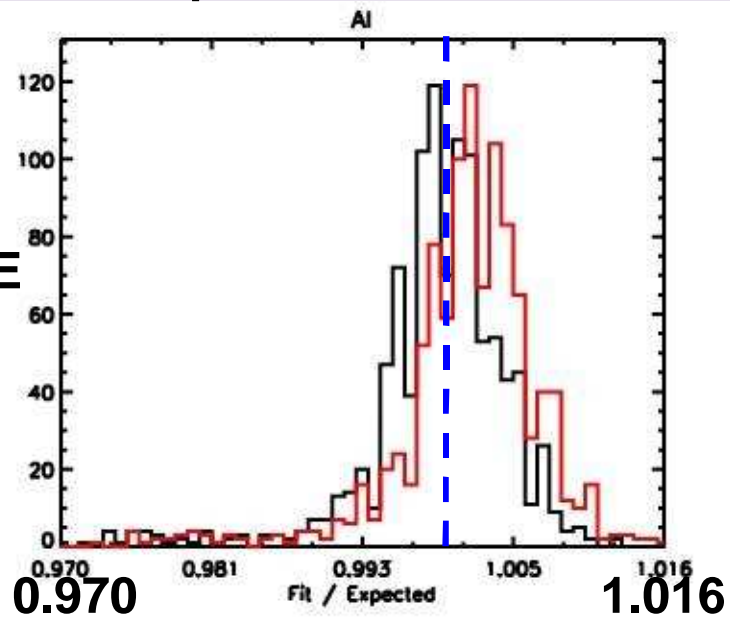
S0 Epoch 27

S4 Epoch 1

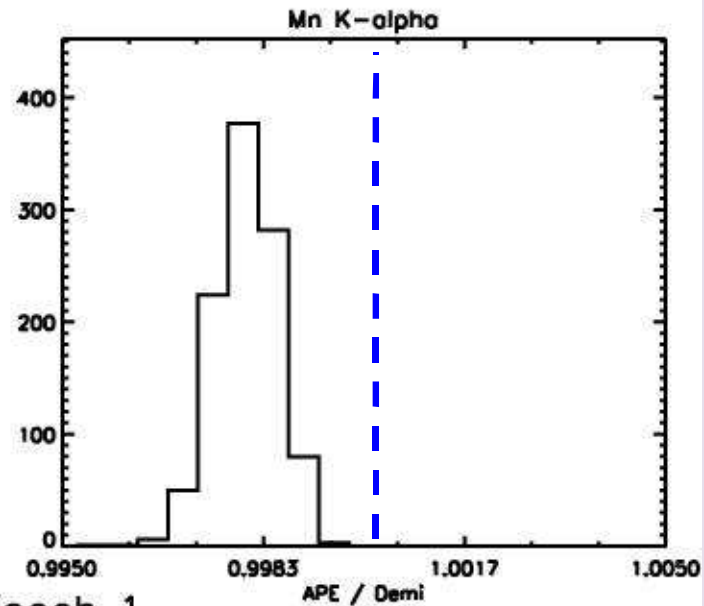
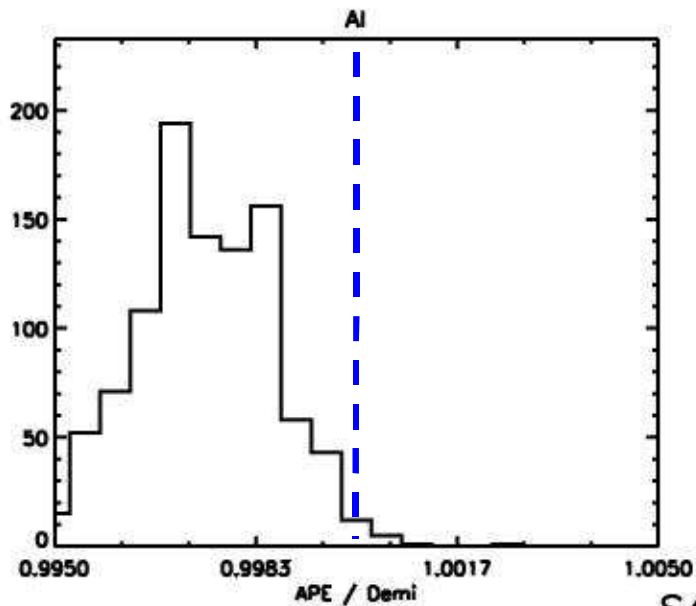
Al K-alpha

Mn K-alpha

Red = Demi
Black = APE



APE / Demi



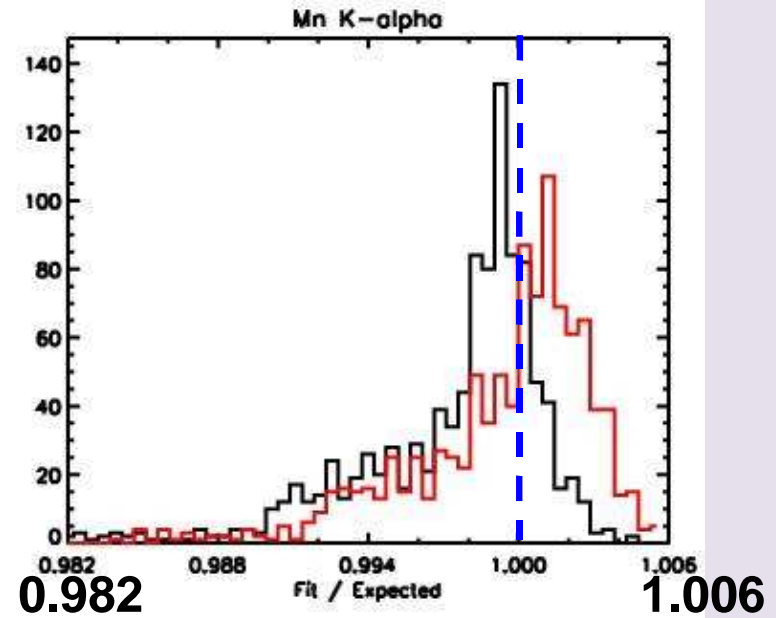
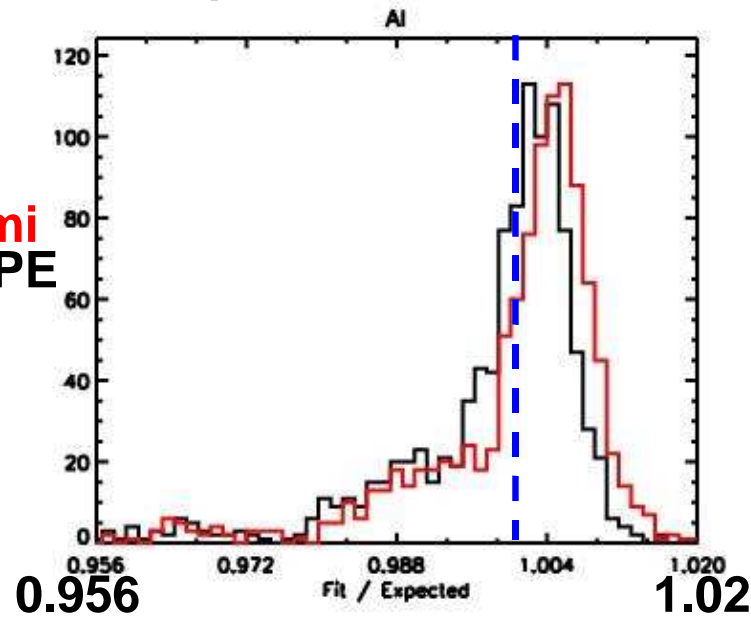
S4 Epoch 1

S4 Epoch 27

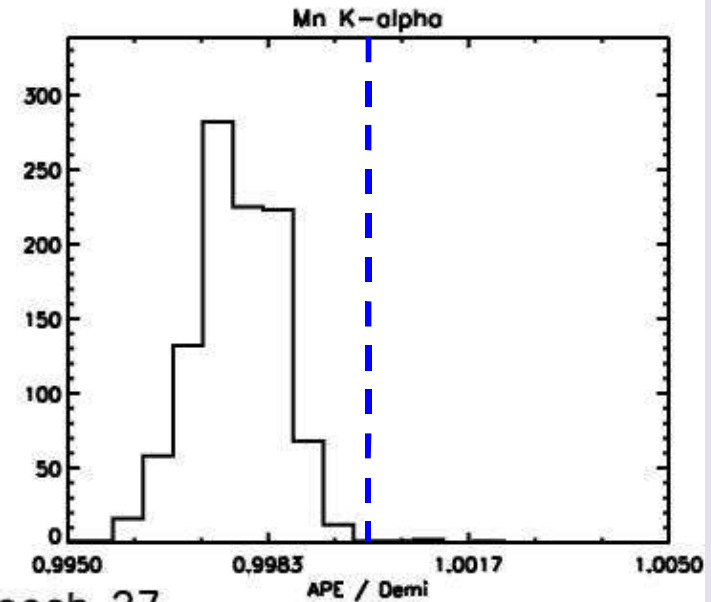
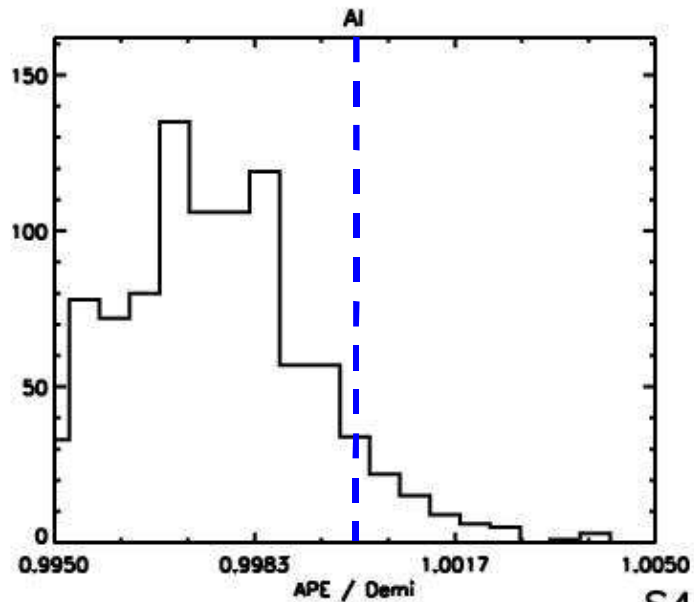
Al K-alpha

Mn K-alpha

Red = Demi
Black = APE



APE / Demi

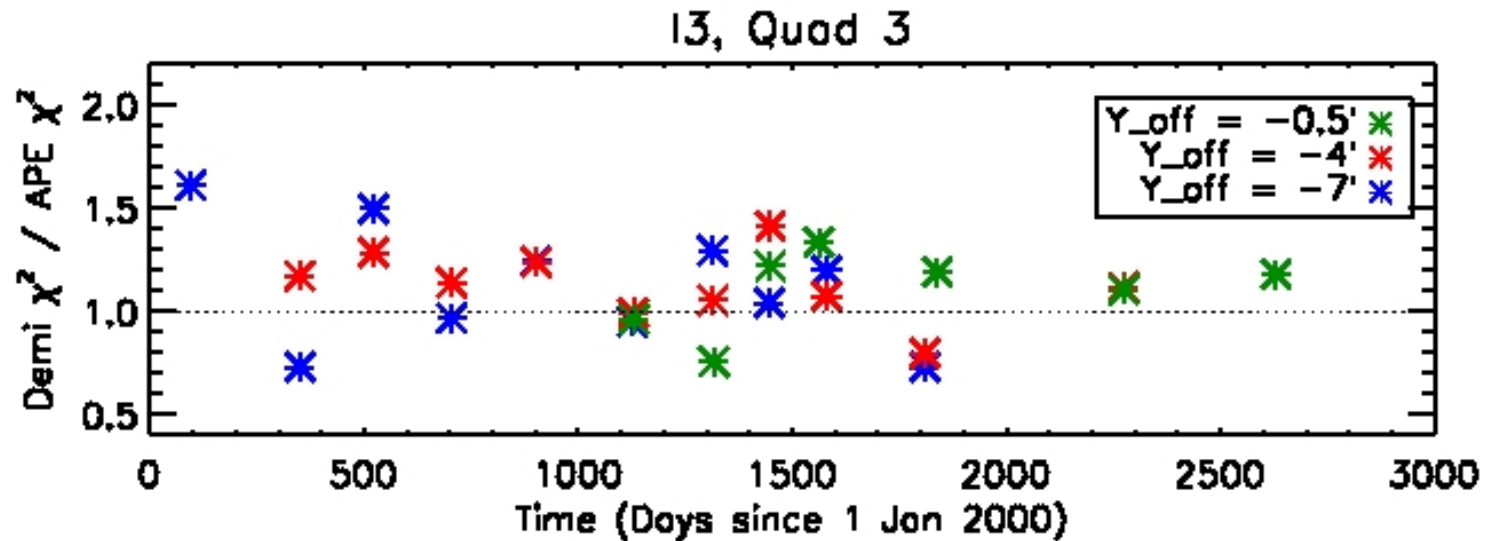
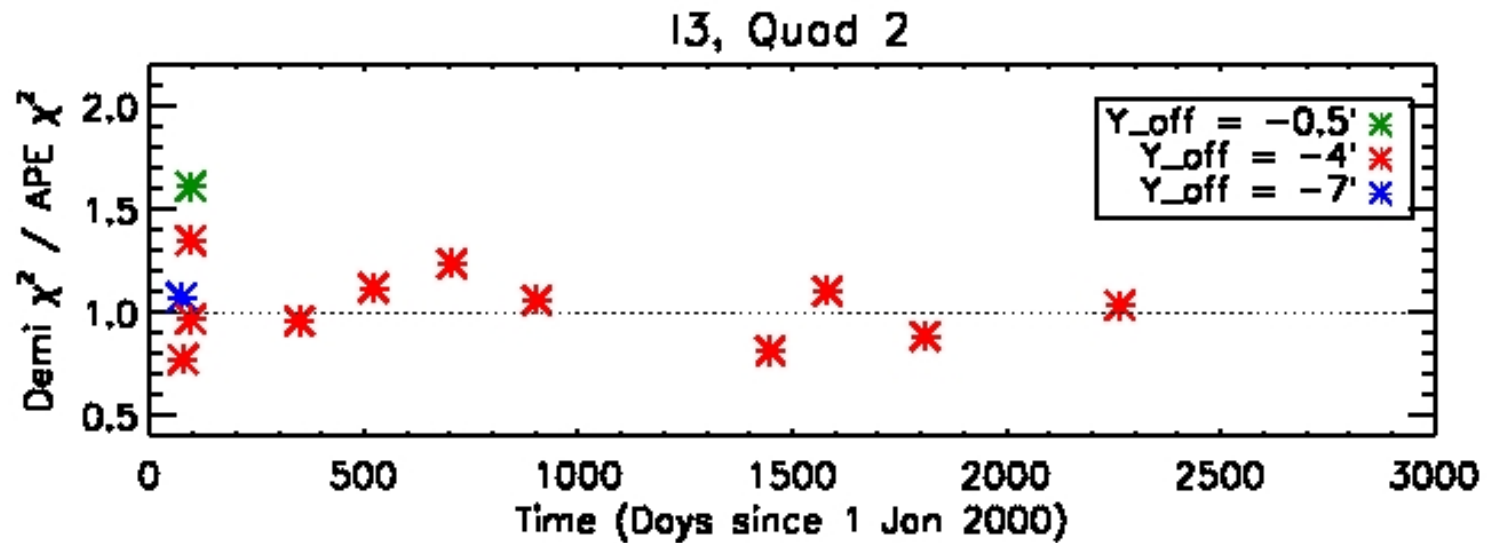


S4 Epoch 27

Fitting E0102 data

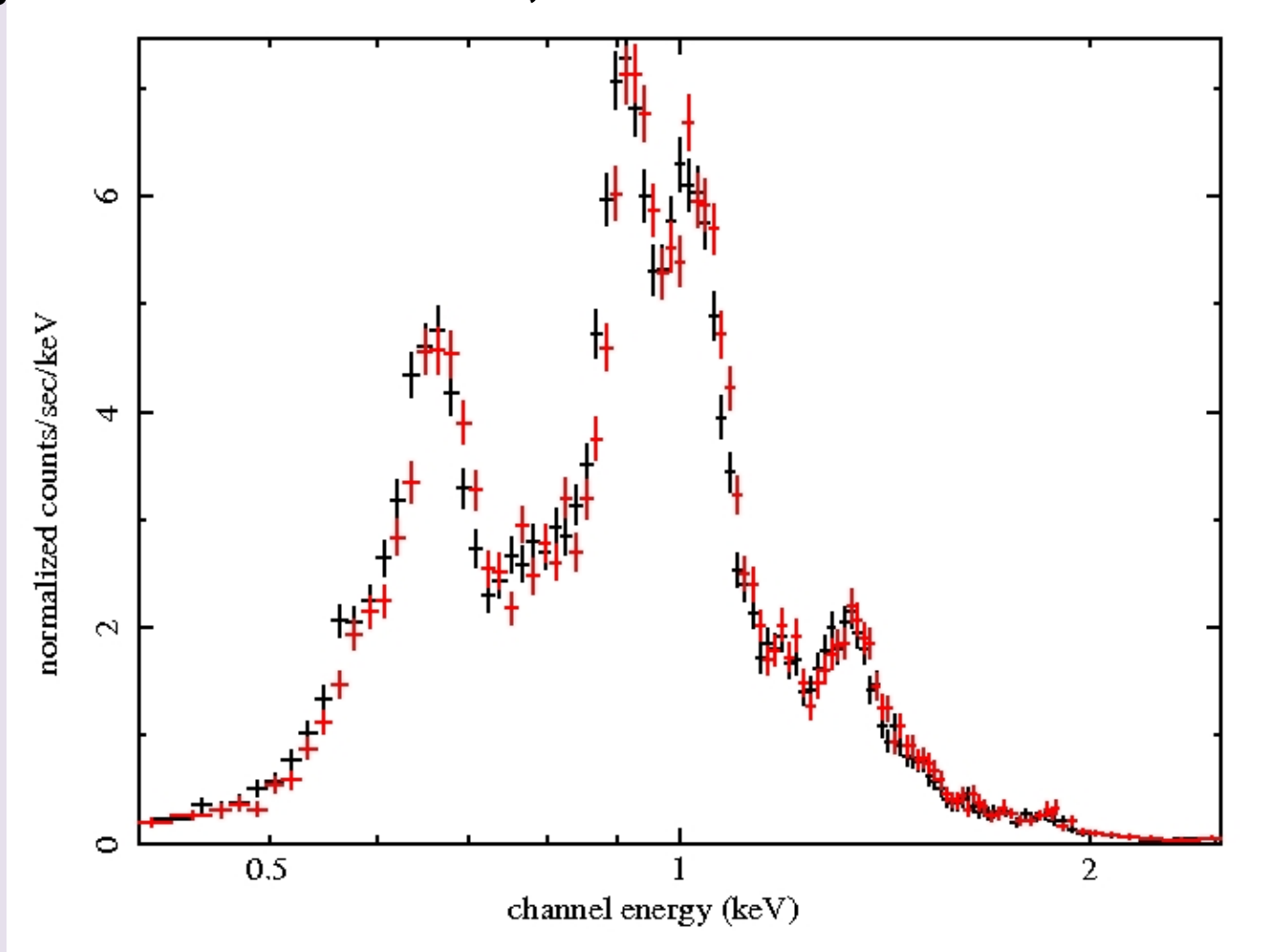
- Will tell us how Graded mode CTI correction does below 1 keV
- 13 observations on all 4 nodes and at different y-offsets (0.5, 4, and 7 arcmin) from aimpoint (near top of chip)
- Model: line energies fixed & line normalizations tied to gratings-derived ratios → compare chi-squared to detect differences in the fits

E0102 Fit Results (on I3)



E0102 “worst case”

By fitting this obsid w/ lines free, we see that shift is ~4 eV or less.



Red = Demi, black = APE

Summary

I. ECS

- Tested chips S0, S2, and S4; epochs 1 and 27
- Fits to Faint mode APE CTI-corrected data and “fake” Graded mode Demi CTI-corrected data agree to w/in $\pm 0.5\%$ for each chip/epoch tested.
- Demi energies systematically higher by $\sim 0.2\%$

Summary

II. E0102

- Looked at all observations on I3
- Compared chi-squared values from fits to Faint mode APE CTI-corrected data and “fake” Graded mode Demi CTI-corrected data
- In worst case Demi spectra shifted by ≤ 4 eV to higher energies ($\sim 0.6\%$)