CTI and Time Dependent Gain Corrections for ACIS

Norbert S. Schulz and the CXC/MIT ACIS Team

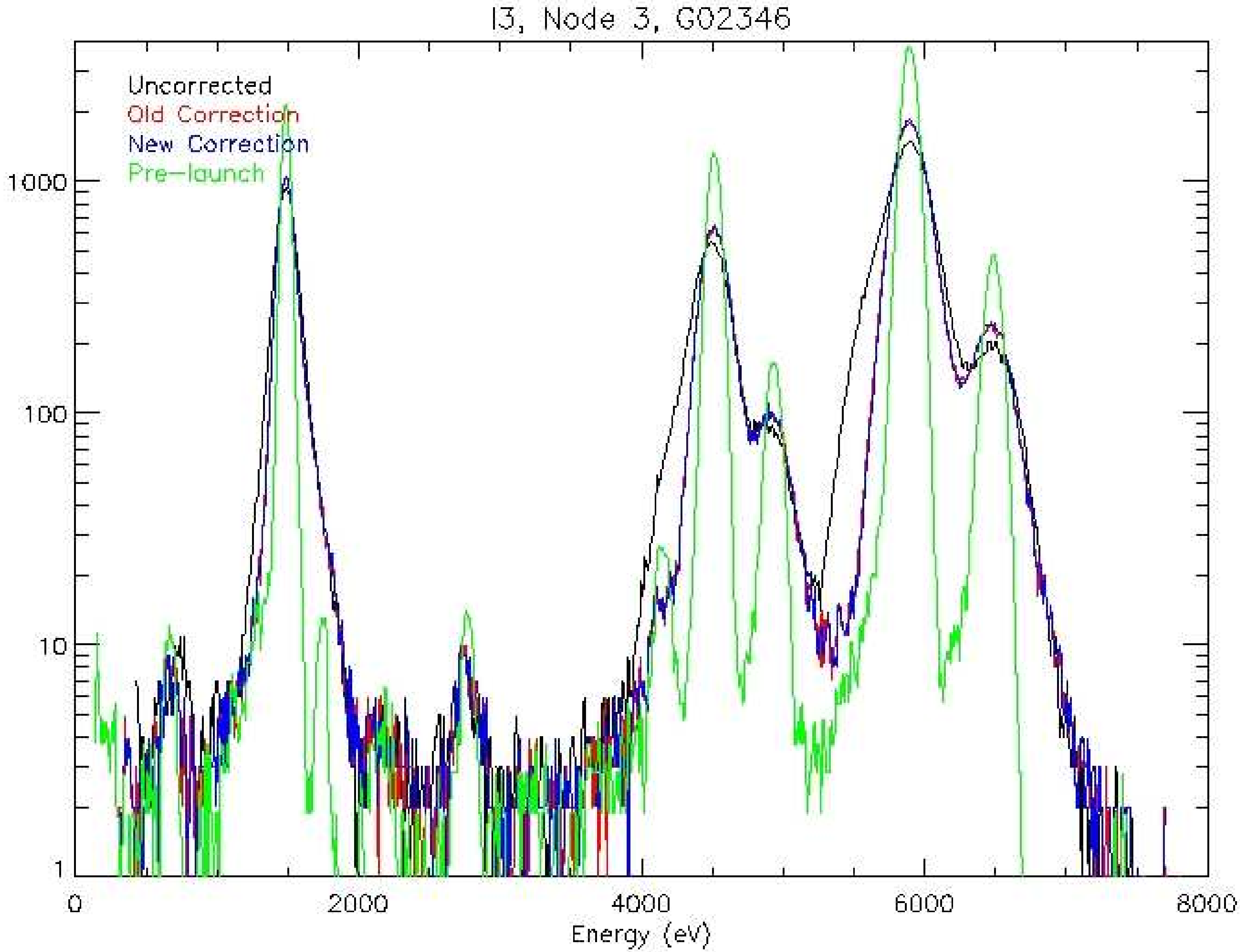
External Calibration Source

Definition of Epochs and Gain Drift with Time

CTI Correction: Implementation of New Trap Maps

New High Resolution Time Dependent Gain Corrections

ECS Spectra

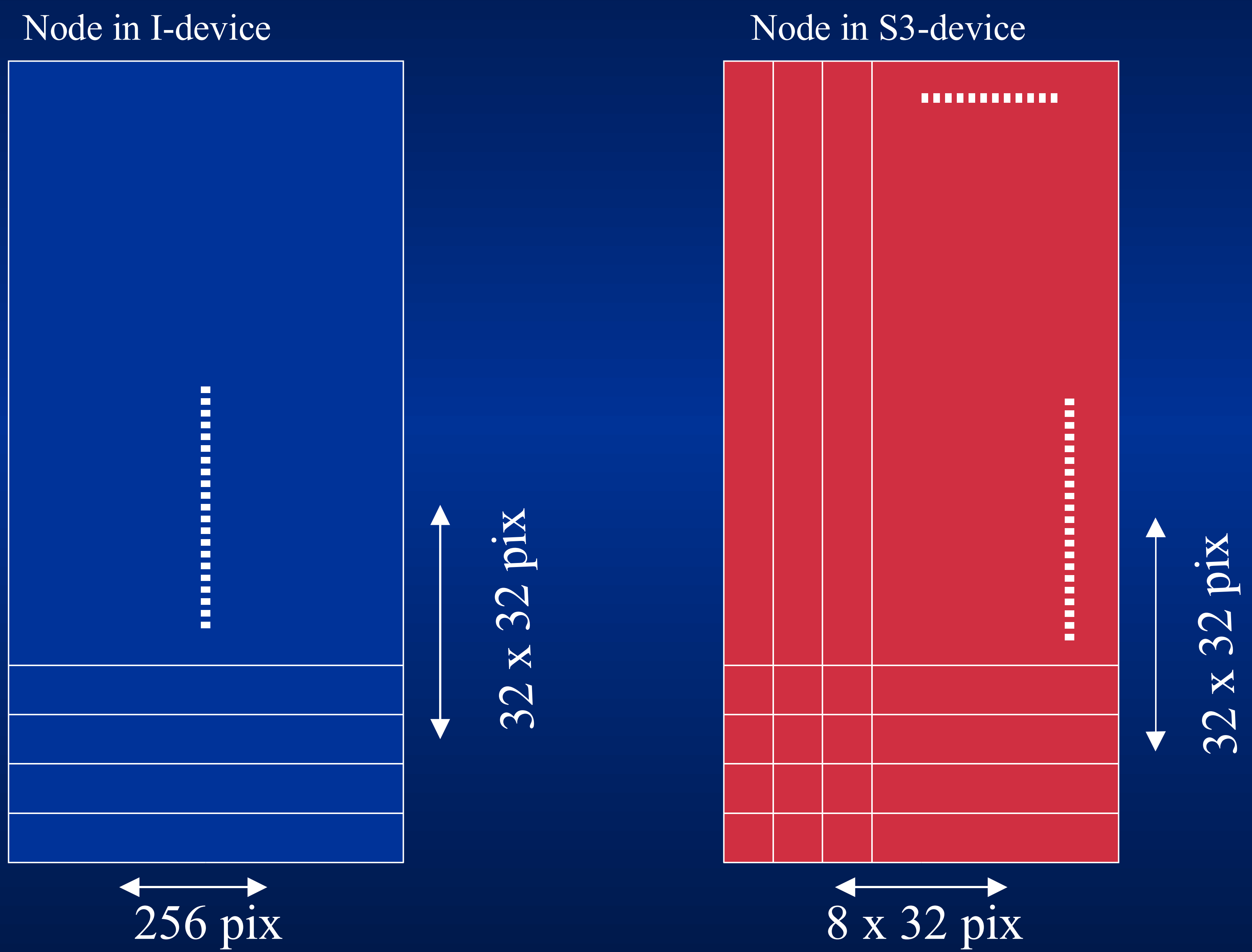


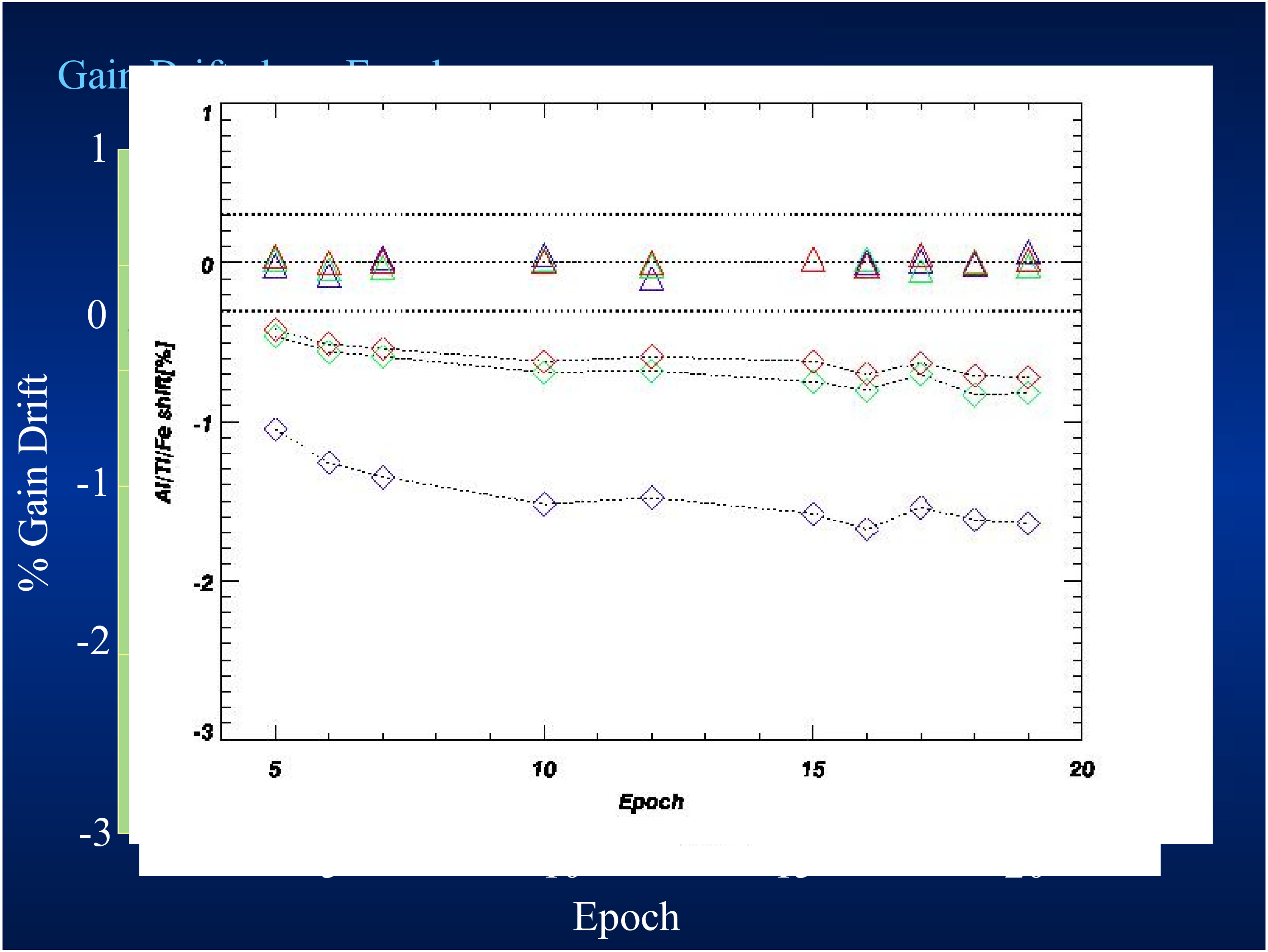
From: *http://space.mit.edu/home/cgrant/cticorr*

Definition of Epochs:

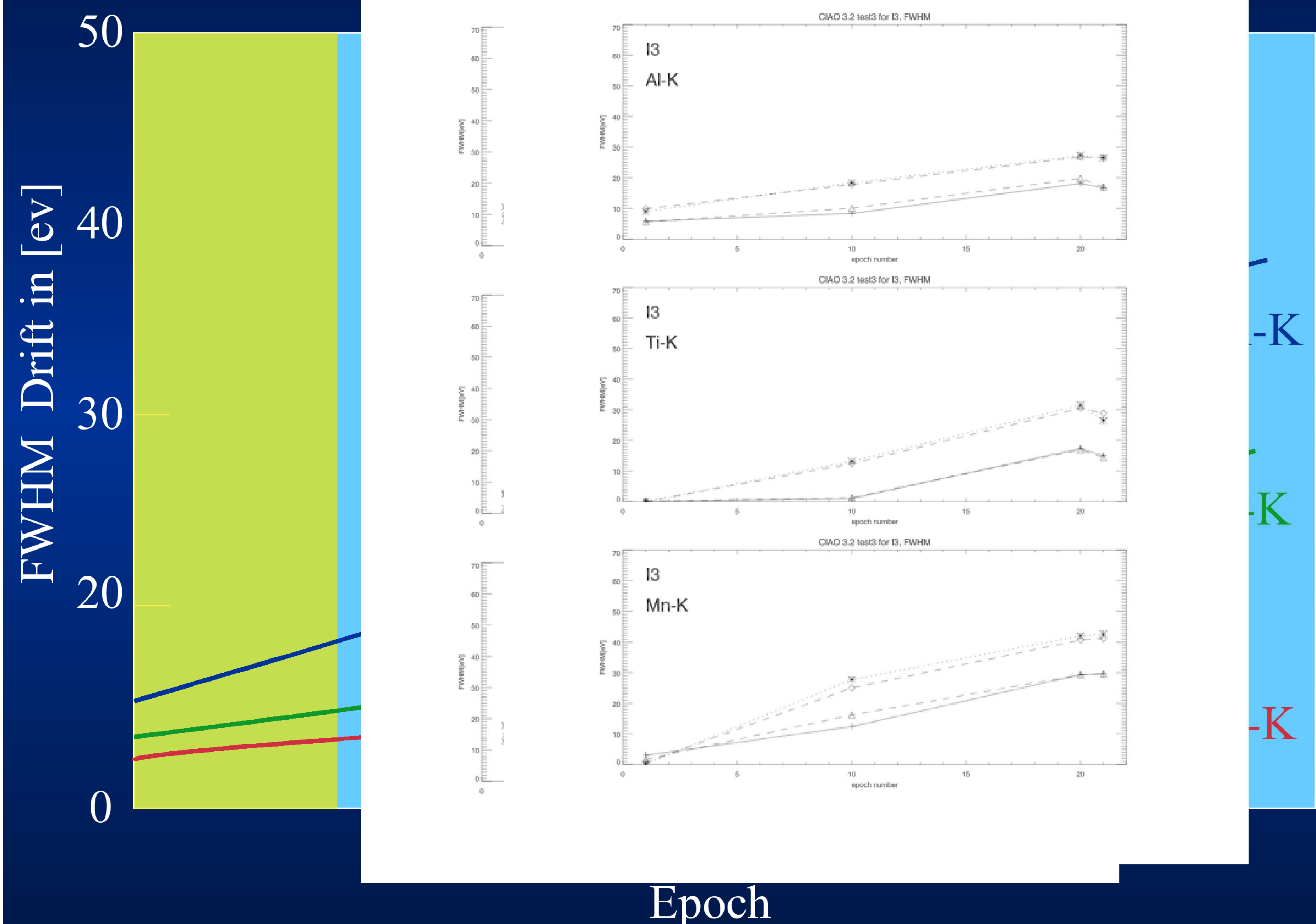
Epoch 1 : 01-29-2000
Epoch 2 : 05-01-2000
Epoch 3 : 08-01-2000
Epoch 4 : 11-01-2000
Epoch 5 : 02-01-2001
Epoch 6 : 05-01-2001
Epoch 7 : 08-01-2001
Epoch 8 : 11-01-2001
Epoch 9 : 02-01-2002
Epoch 10: 05-01-2002
Epoch 11: 08-01-2002
Epoch 12: 11-01-2002
Epoch 13: 02-01-2003
Epoch 14: 05-01-2003
Epoch 15: 08-01-2003
Epoch 16a: 10-28-2003
Epoch 16b: 11-05-2003
Epoch 16c: 01-01-2004
Epoch 17 : 02-01-2004
Epoch 18 : 05-01-2004
Epoch 19 : 08-01-2004
Epoch 20 : 11-01-2004
Epoch 21 : 02-01-2005
Epoch 22 : 05-01-2005
Epoch 23 : 08-01-2005
Epoch 24 : 11-01-2005
Epoch 25 : 02-01-2006
Epoch 26 : 05-01-2006
Epoch 27 : 08-01-2006

Tile Structure for I- and S3-Devices:

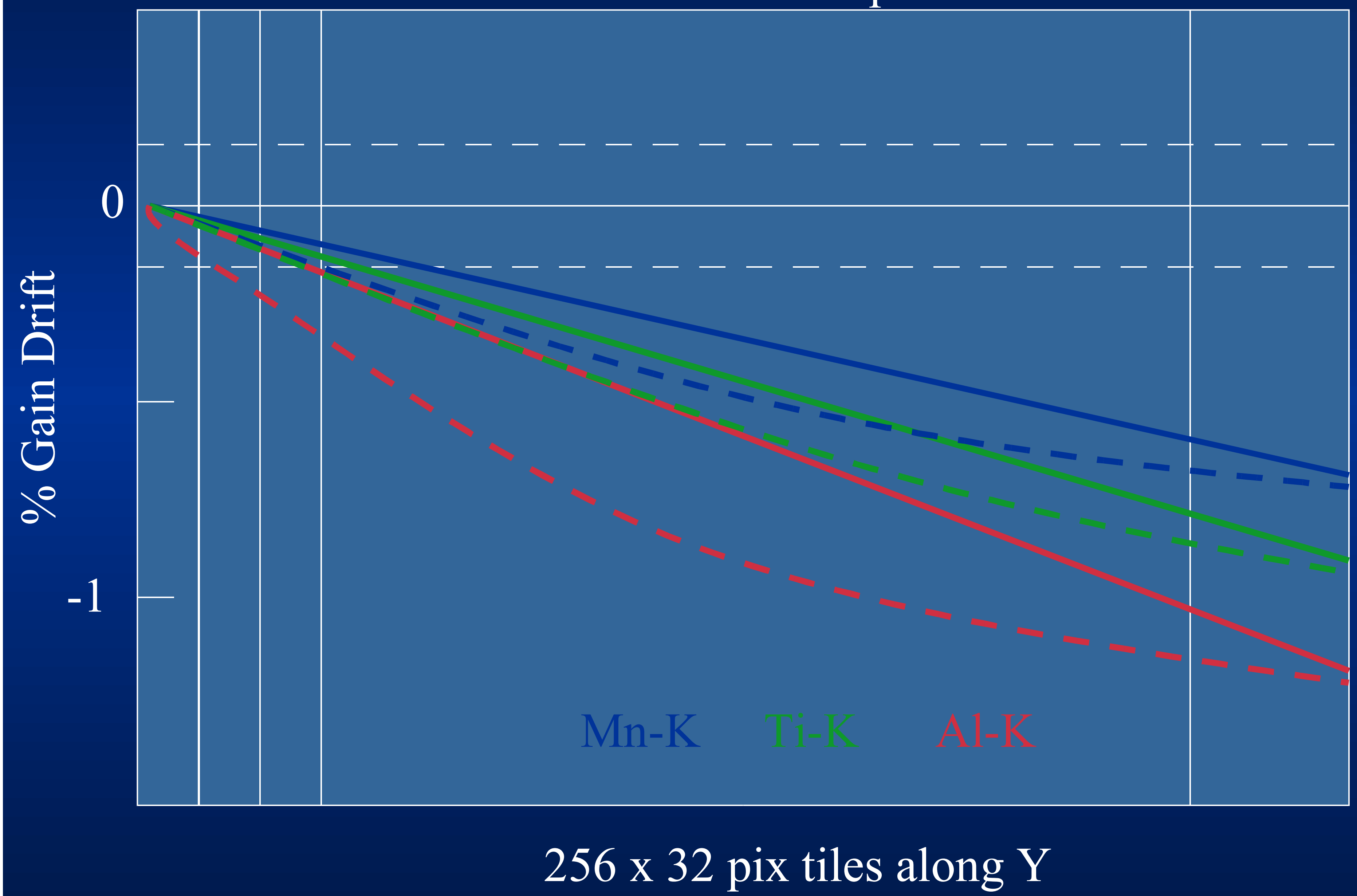


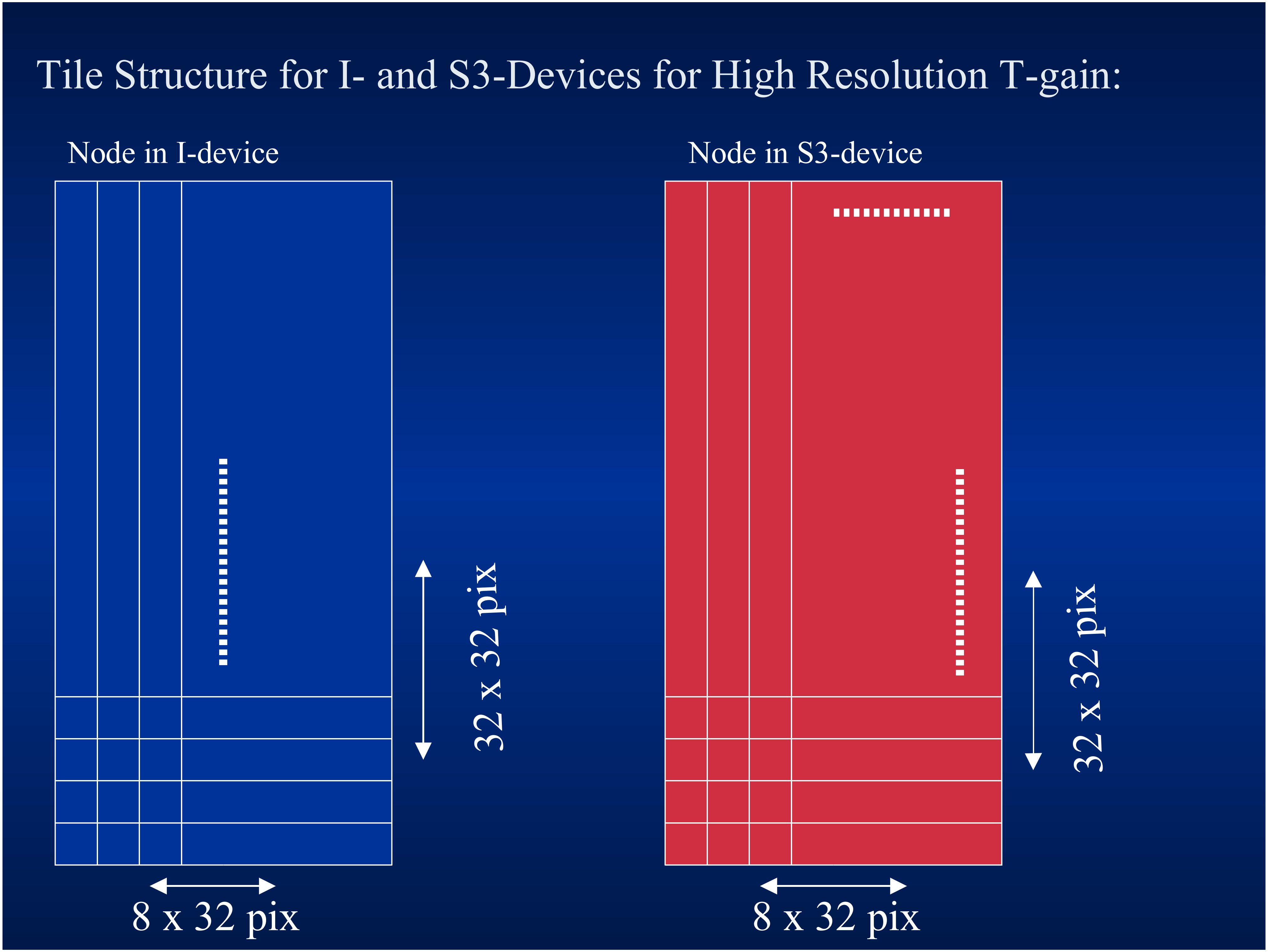

Gai
1
0
-1
-2
-3
% Gain Drift
Epoch
Al/Ti/Fe shift[%]
Epoch
5
10
15
20

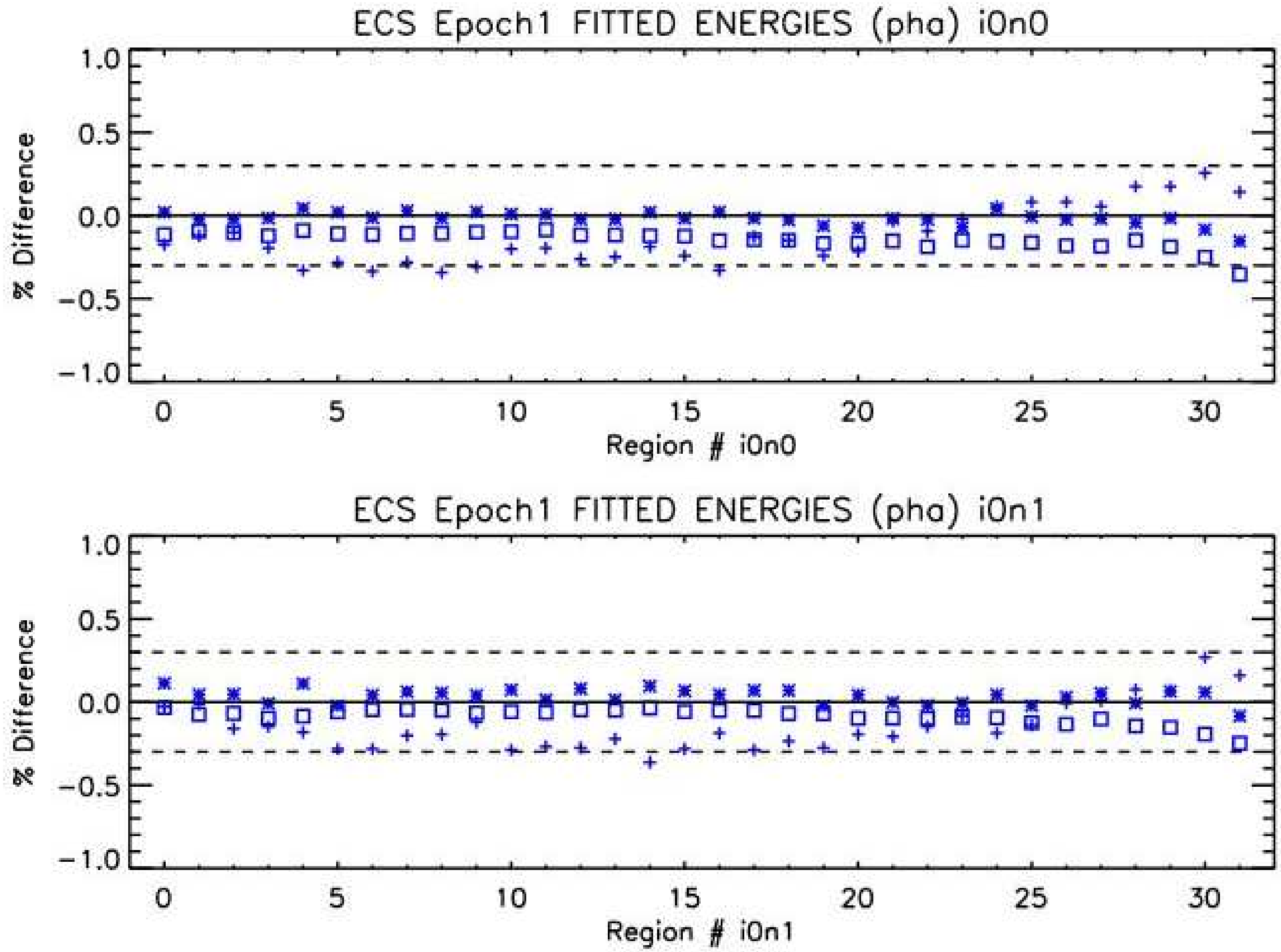
FWHM Drift al

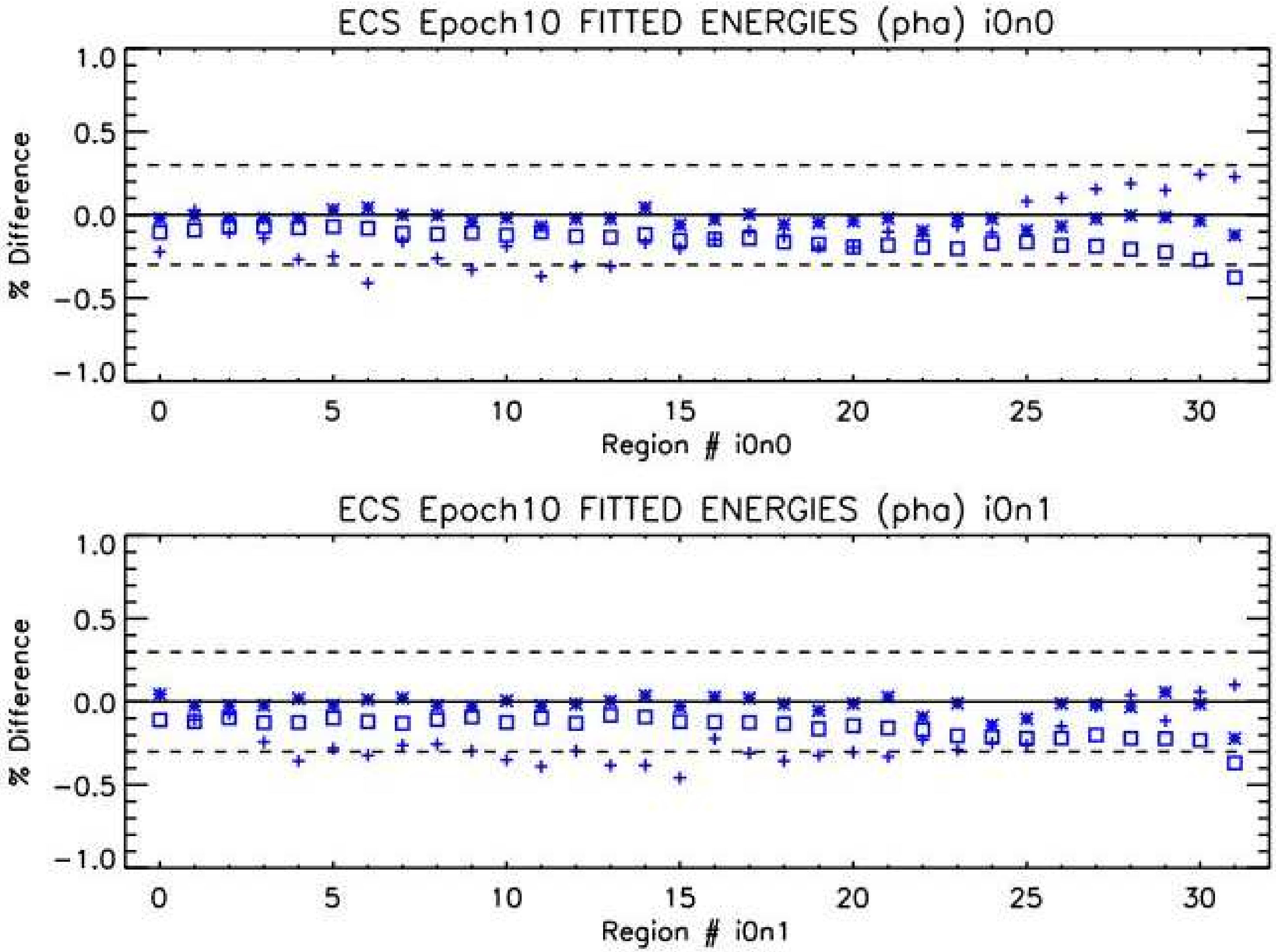


Gain Drift in Chip-Y: Performance sag in middle of tile in later Epochs

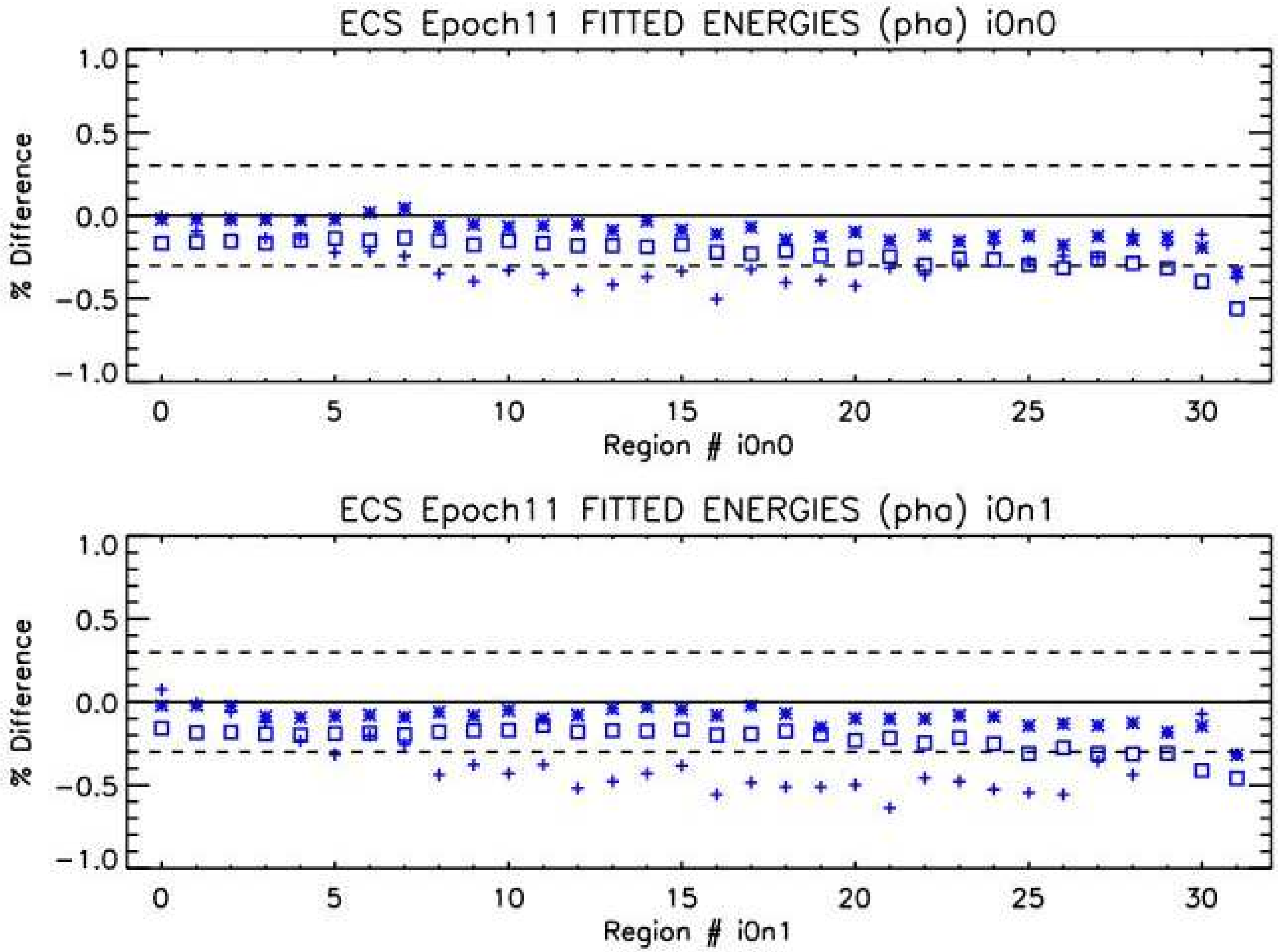


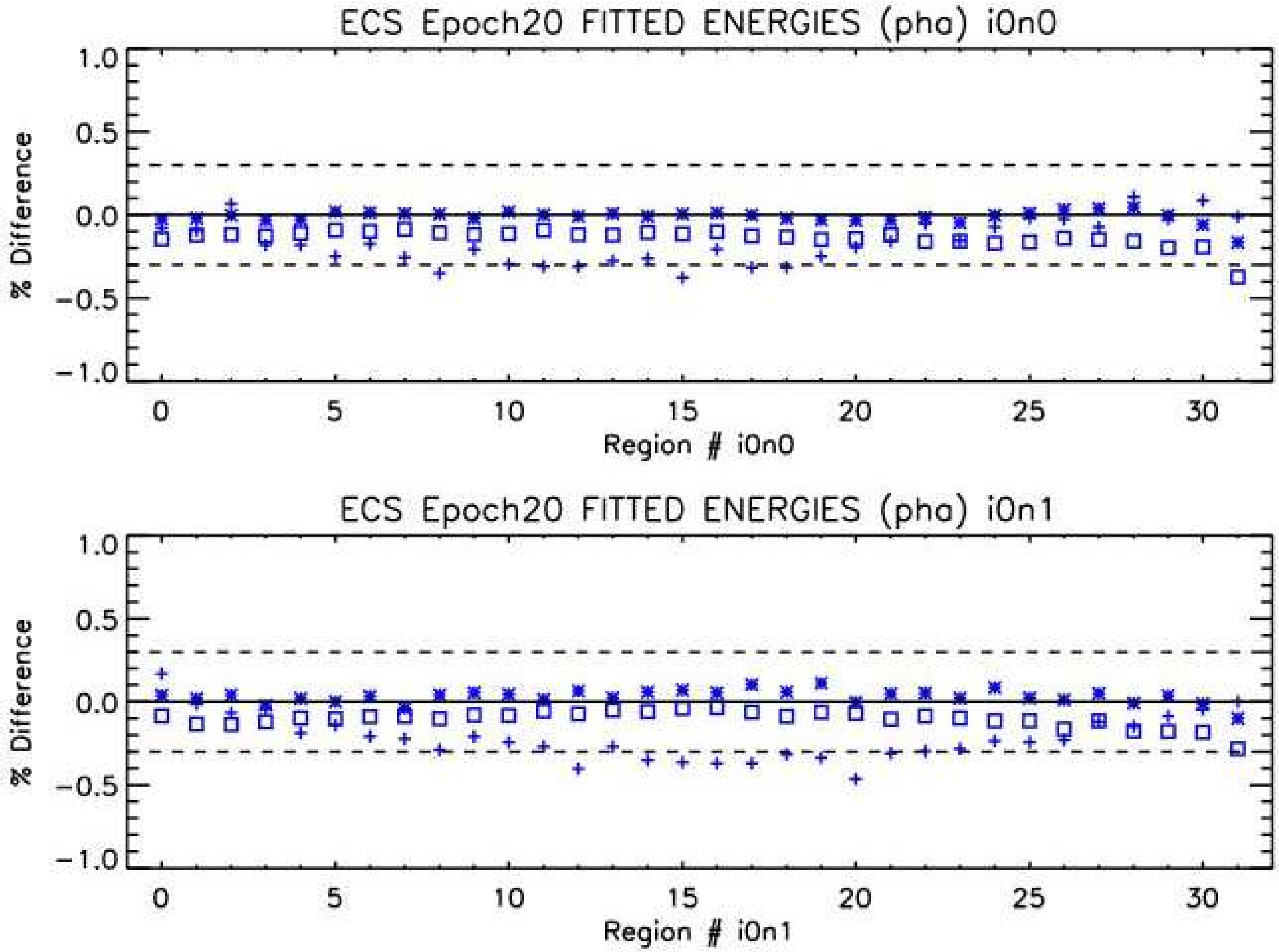

Tile Structure for I- and S3-Devices for High Resolution T-gain:
Node in I-device
Node in S3-device
32 x 32 pix
32 x 32 pix
8 x 32 pix
8 x 32 pix

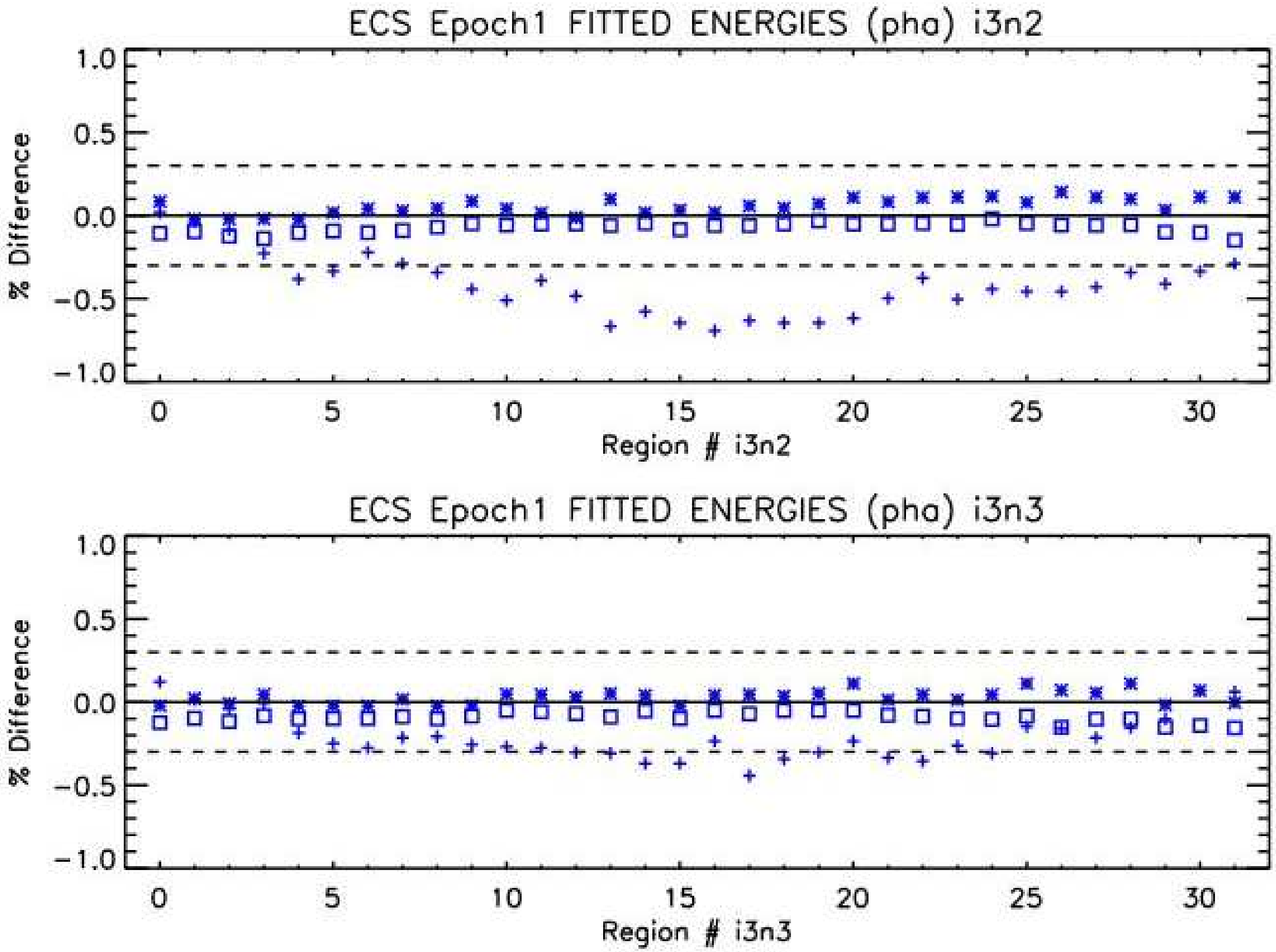

ECS Epoch1 FITTED ENERGIES (pha) i0n0
% Difference
Region # i0n0
ECS Epoch1 FITTED ENERGIES (pha) i0n1
% Difference
Region # i0n1

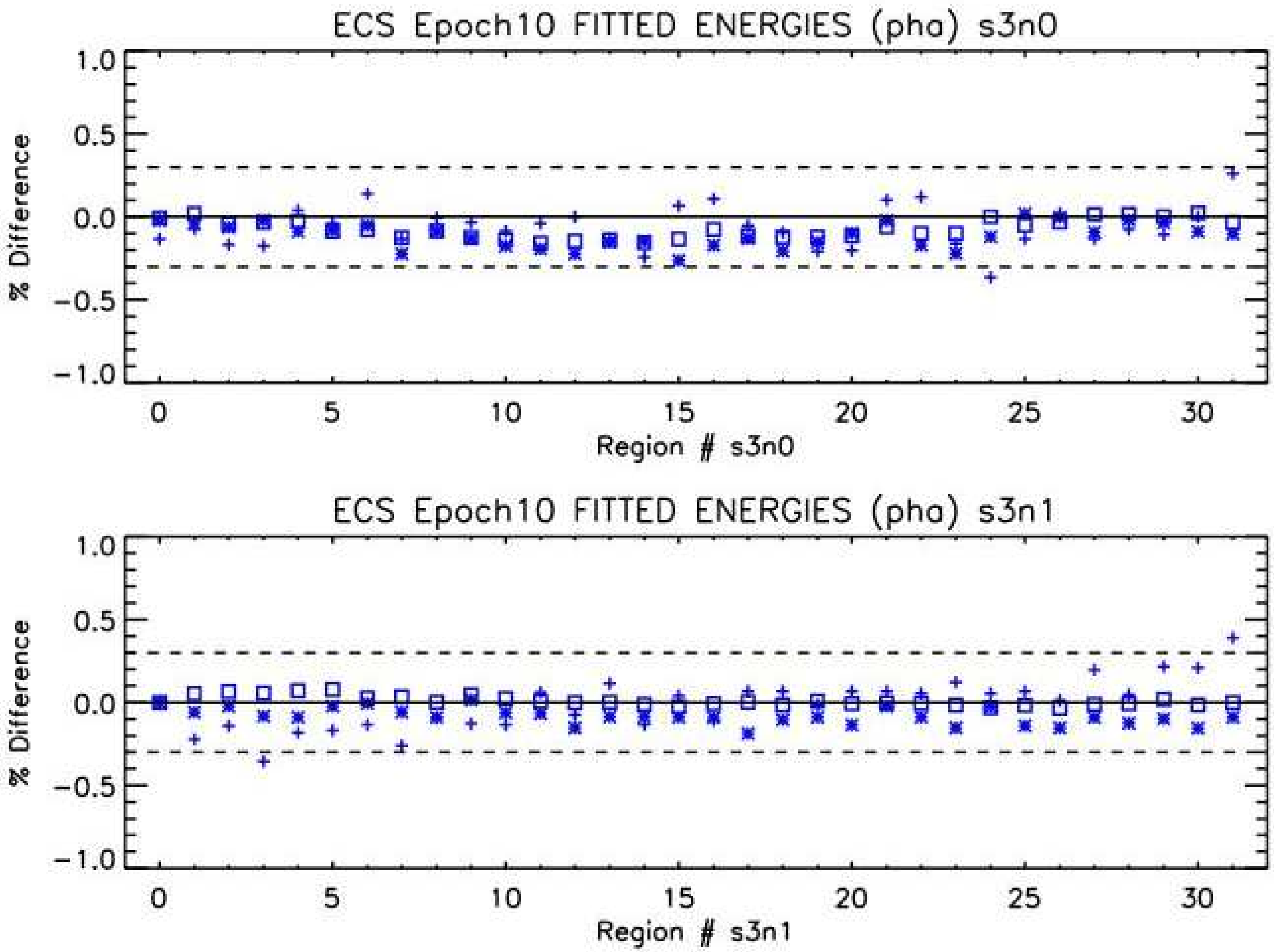


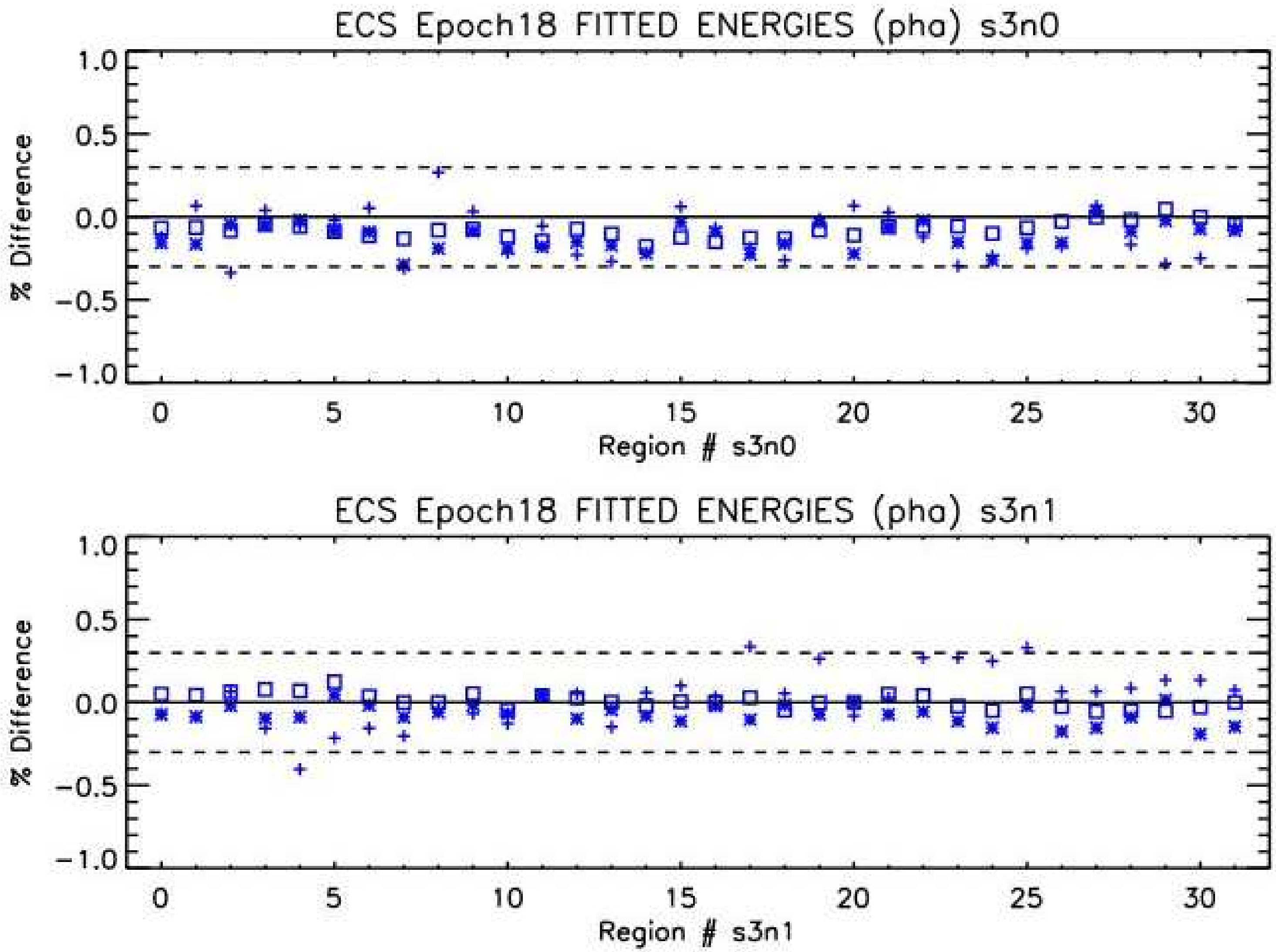
ECS Epoch10 FITTED ENERGIES (pha) i0n0
% Difference
Region # i0n0
ECS Epoch10 FITTED ENERGIES (pha) i0n1
% Difference
Region # i0n1


ECS Epoch11 FITTED ENERGIES (pha) i0n0
% Difference
Region # i0n0
ECS Epoch11 FITTED ENERGIES (pha) i0n1
% Difference
Region # i0n1

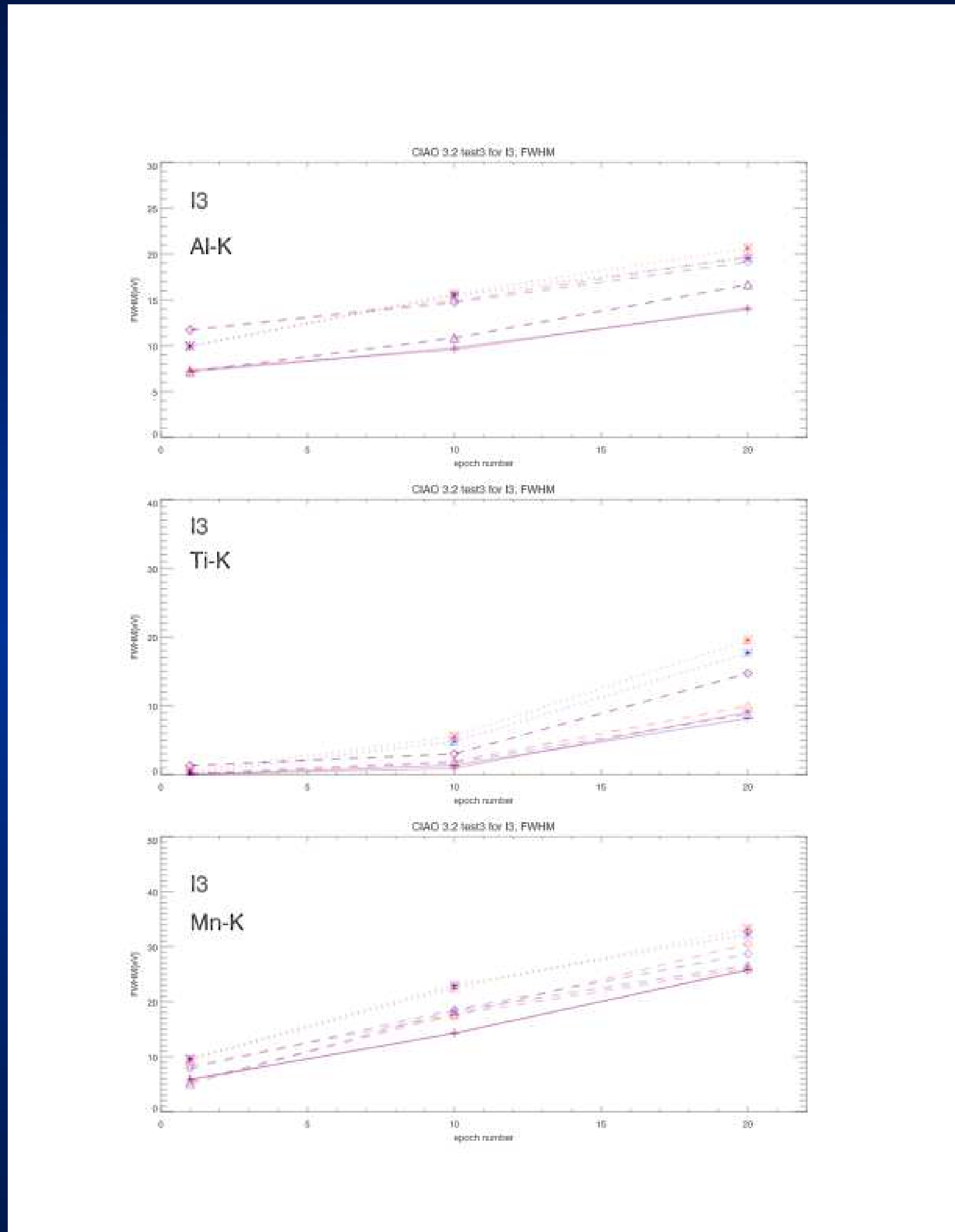

ECS Epoch20 FITTED ENERGIES (pha) i0n0
% Difference
1.0
0.5
0.0
−0.5
−1.0
0
5
10
15
20
25
30
Region # i0n0
ECS Epoch20 FITTED ENERGIES (pha) i0n1
% Difference
1.0
0.5
0.0
−0.5
−1.0
0
5
10
15
20
25
30
Region # i0n1


ECS Epoch1 FITTED ENERGIES (pha) i3n2
% Difference
Region # i3n2
ECS Epoch1 FITTED ENERGIES (pha) i3n3
% Difference
Region # i3n3


ECS Epoch10 FITTED ENERGIES (pha) s3n0
% Difference
Region # s3n0
ECS Epoch10 FITTED ENERGIES (pha) s3n1
% Difference
Region # s3n1



ECS Epoch18 FITTED ENERGIES (pha) s3n0
% Difference
Region # s3n0
ECS Epoch18 FITTED ENERGIES (pha) s3n1
% Difference
Region # s3n1



CIAO 3.2 test3 for I3, FWHM
I3
Al-K
FWHM(eV)
epoch number
CIAO 3.2 test3 for I3, FWHM
I3
Ti-K
FWHM(eV)
epoch number
CIAO 3.2 test3 for I3, FWHM
I3
Mn-K
FWHM(eV)
epoch number

Mn-K

Summary

CTI and T-gain correction for ALL devices

New trap map and T-gain reset at Epoch 11

Mn-K

T-gain for FI devices applied on high resolution basis

FI gain performance > 1 keV < 0.3% with a few areas < 0.5%

S3 gain performance > 1 keV < 0.3% throughout

Response (FWHM) drift at Al-K < 20 eV (~1%)
Ti-K < 20 eV (<1%)
Mn-K < 30 eV (~0.05%)

Need to monitor response vs. time

Need to monitor out-og-temperature effects

Done:

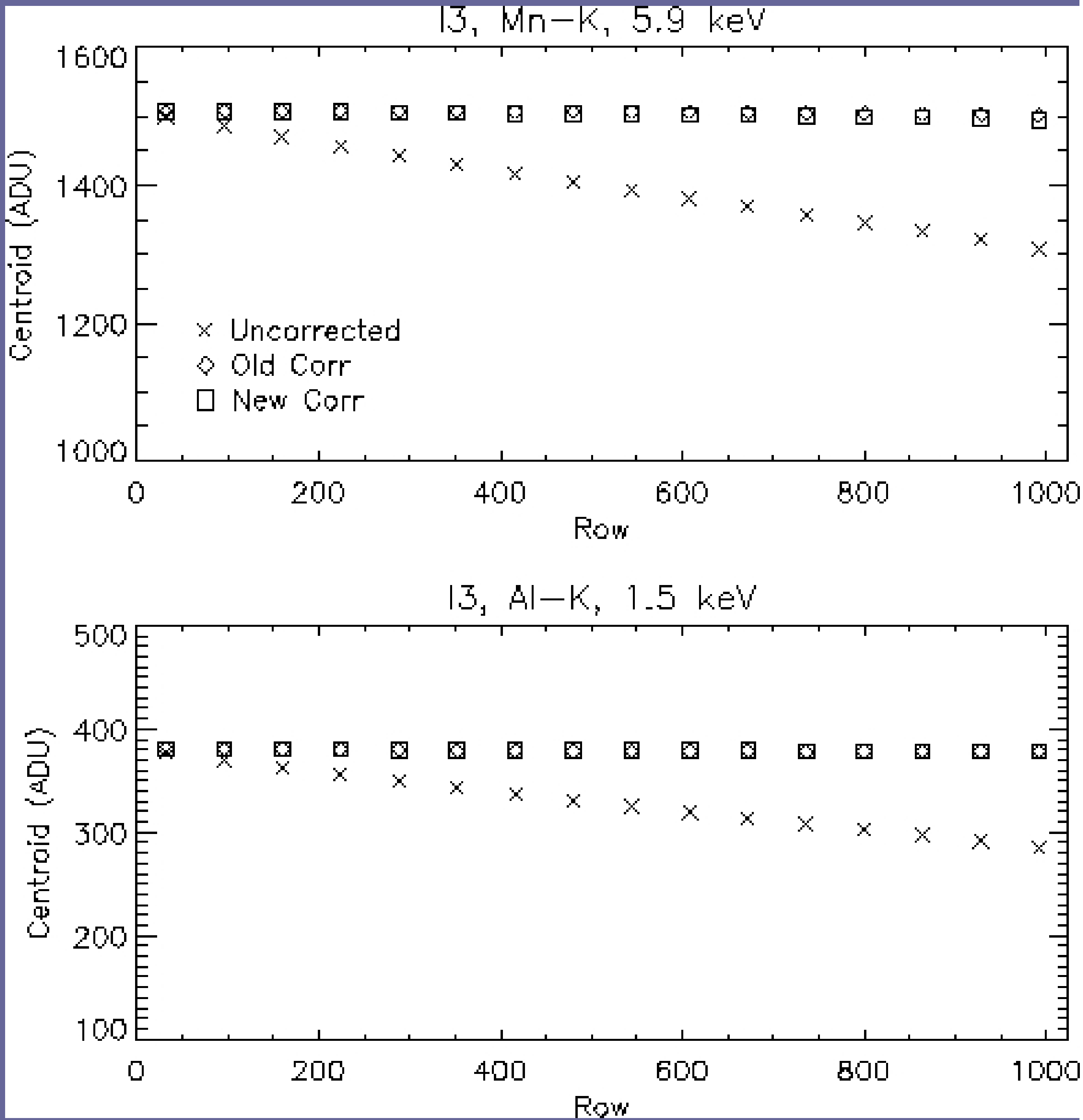
I0 - 3, S2, S0

In progress:

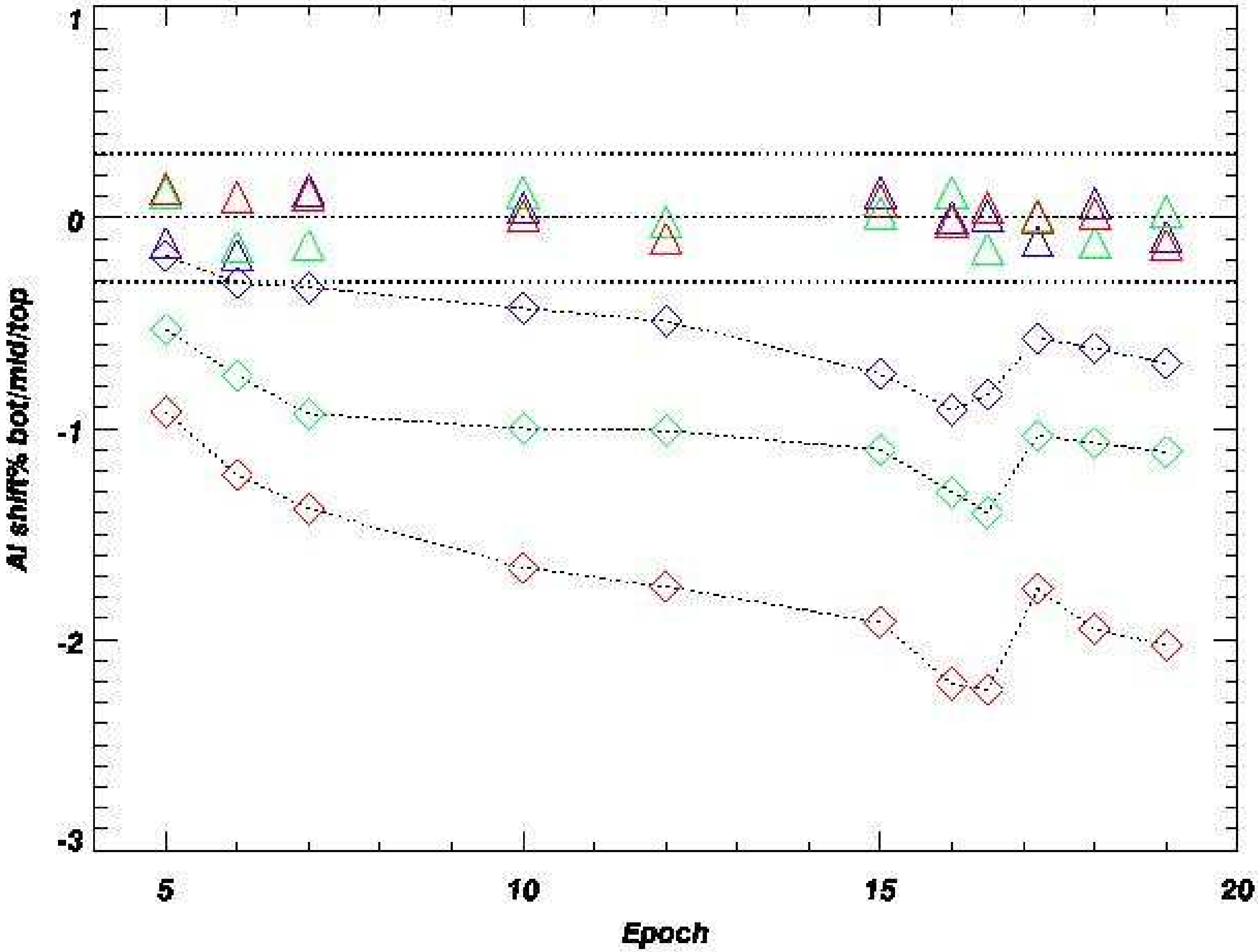
S4, S5

BI-devices:

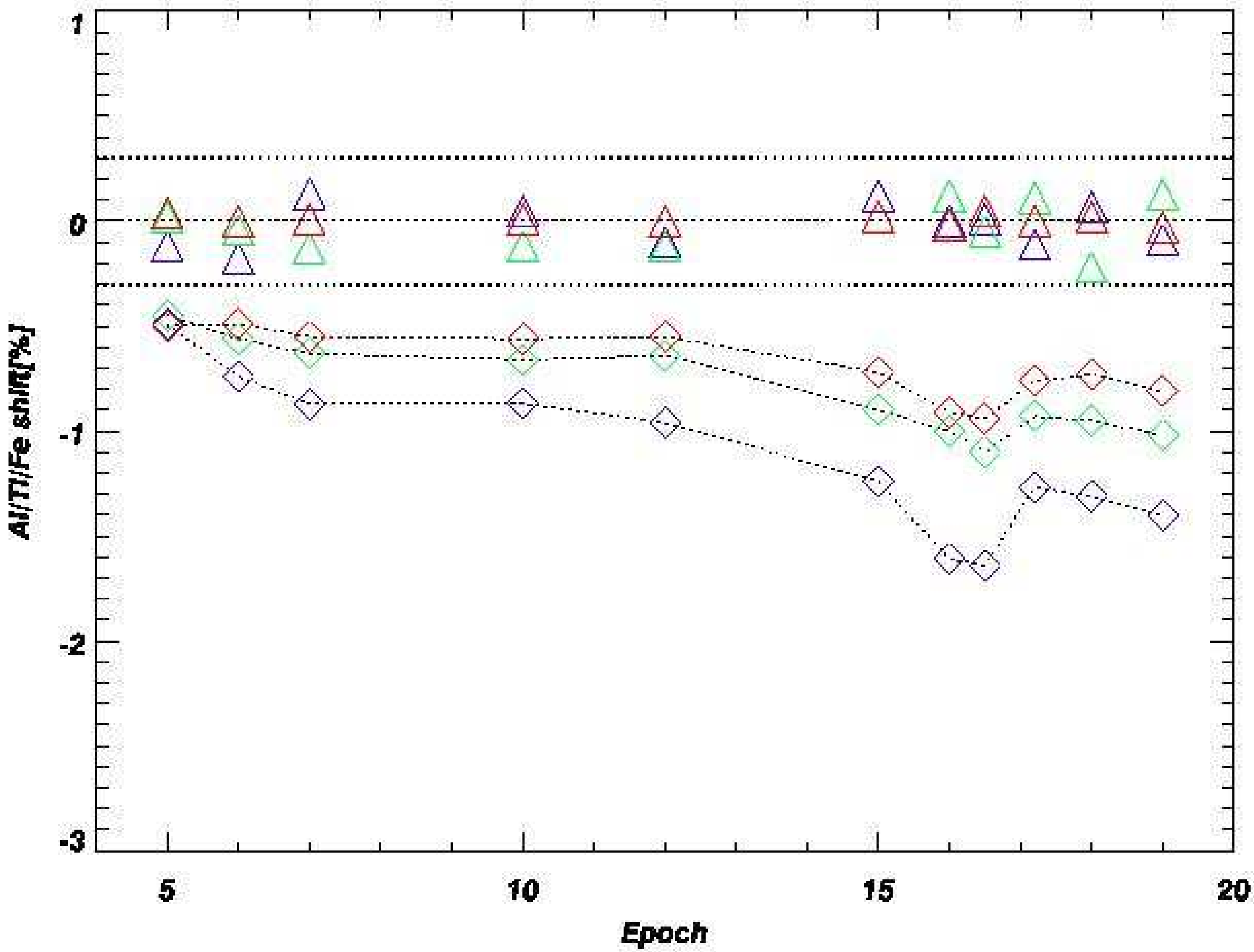
none

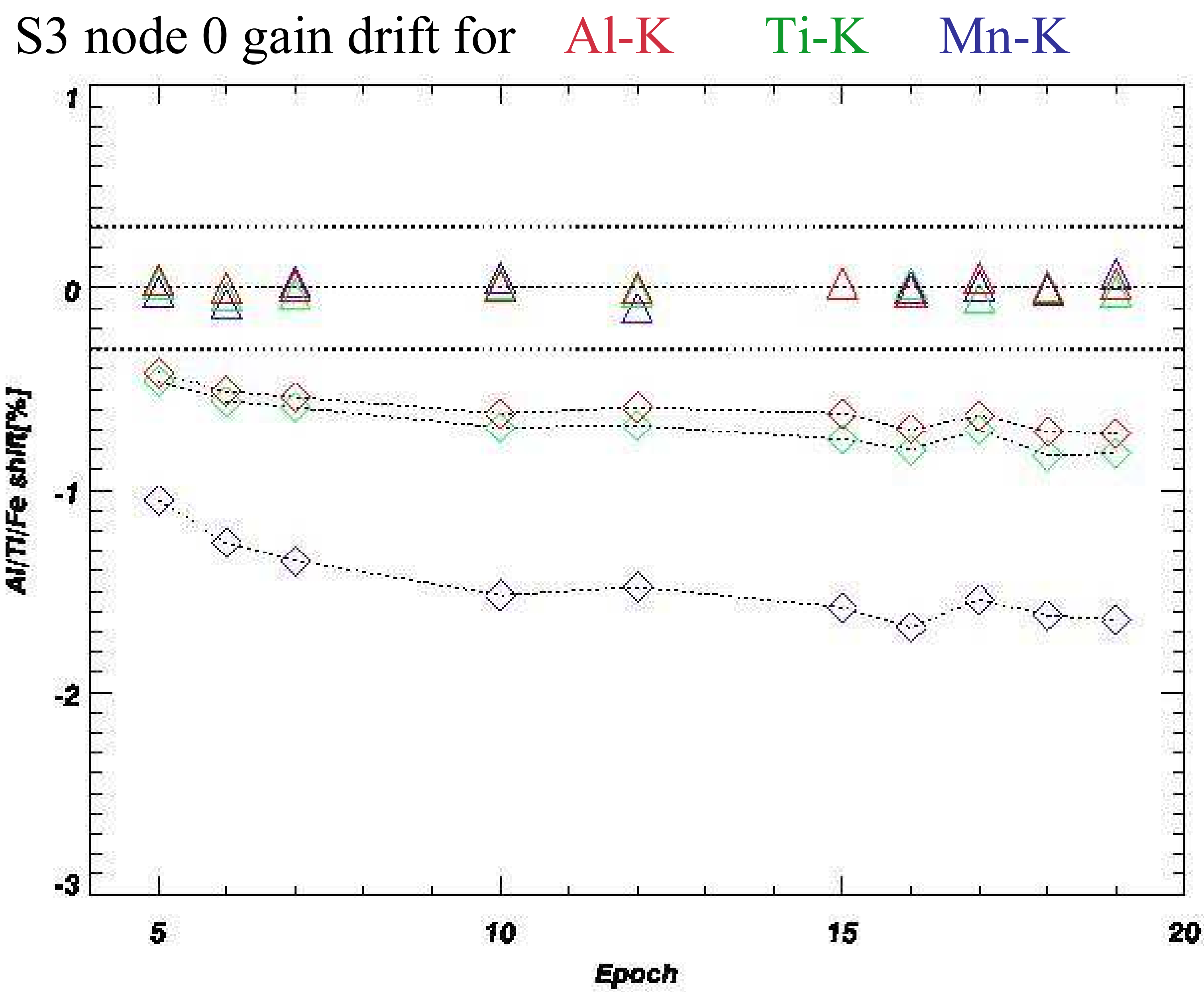


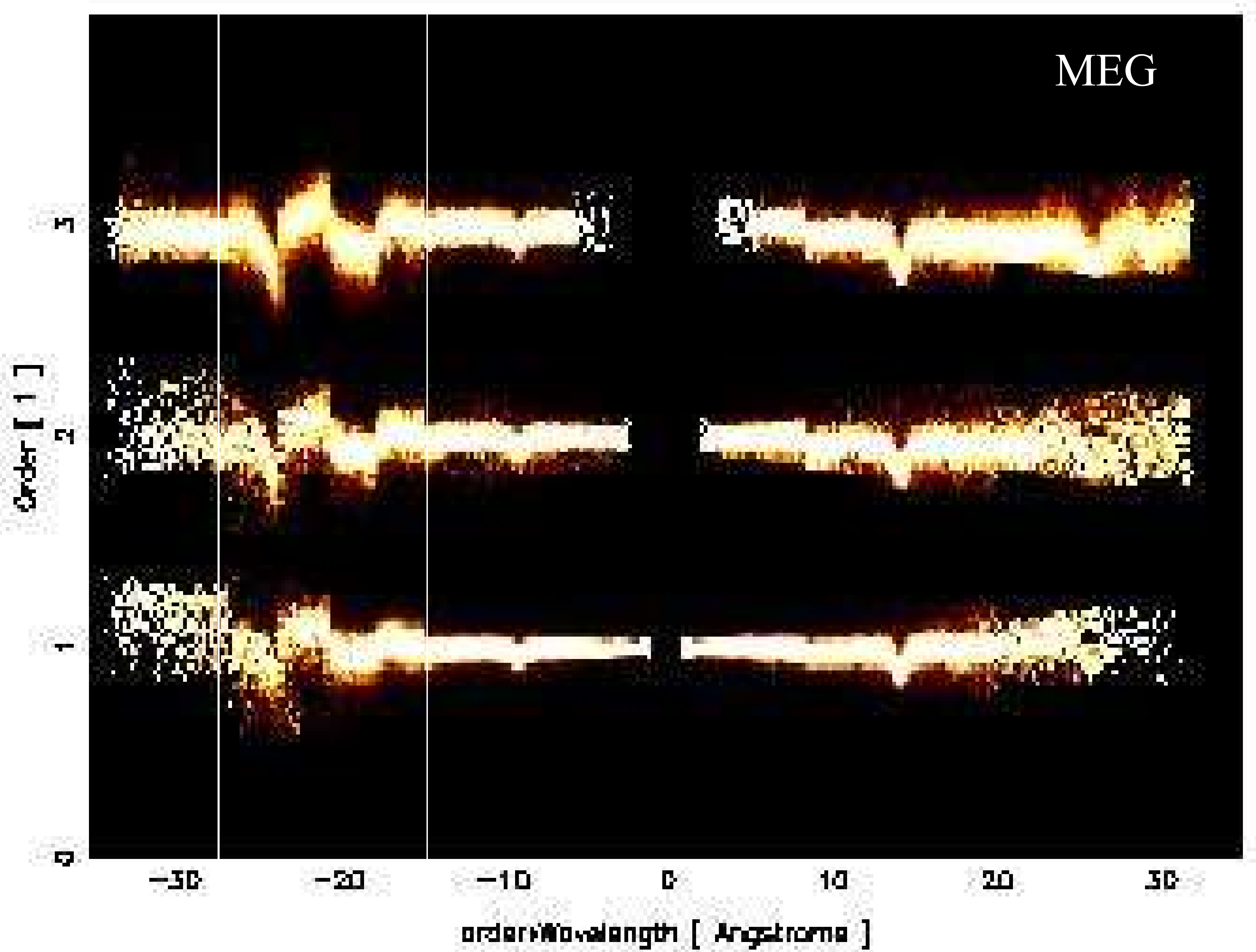
I0 node 0 gain drift for Al-K Ti-K Mn-K



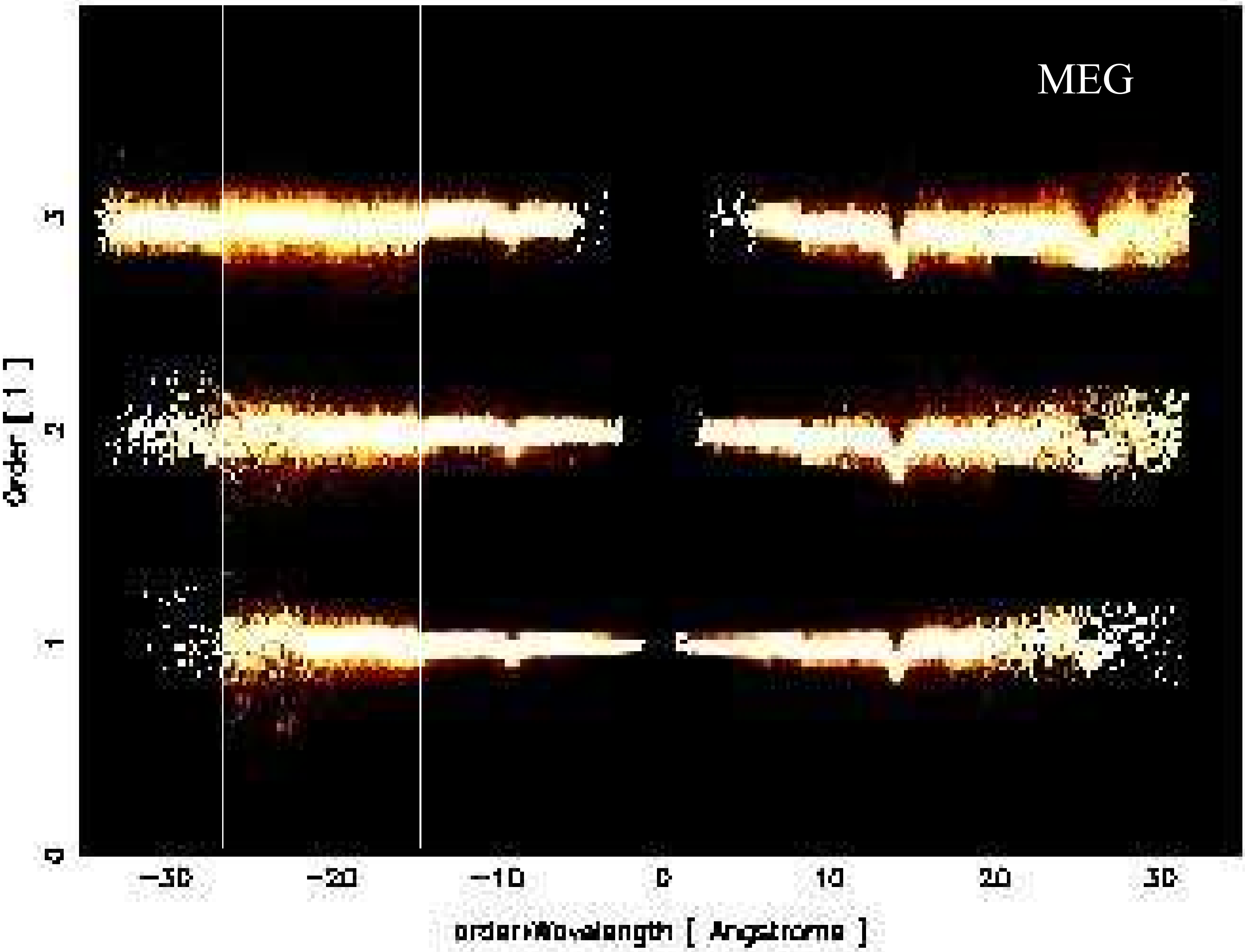
I0 node 0 gain drift for bottom middle top



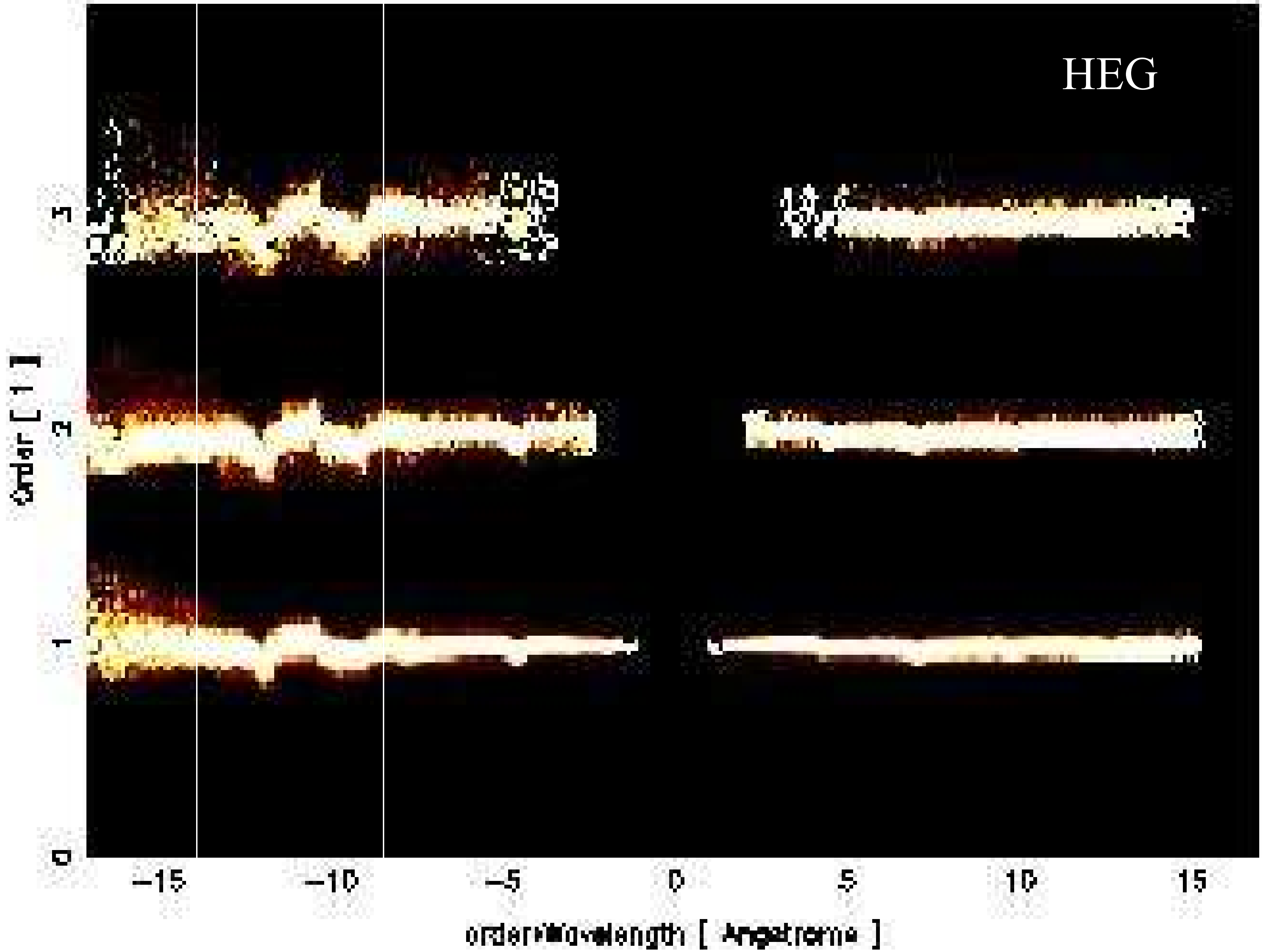

S3 node 0 gain drift for Al-K Ti-K Mn-K
1
0
-1
-2
-3
Al/Ti/Fe shift[%]
5
10
15
20
Epoch



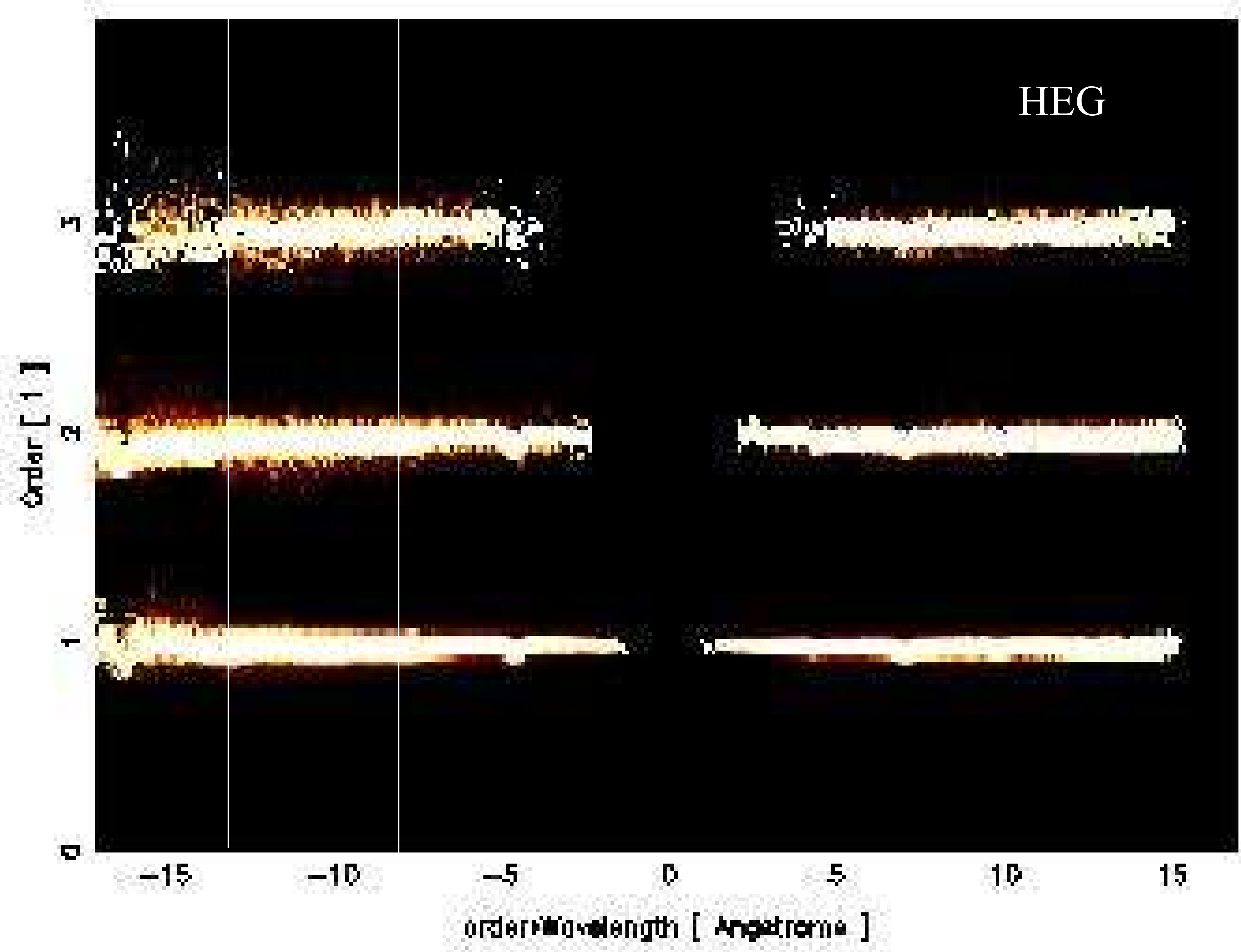
MEG
Order [1]
0
1
2
3
−30
−20
−10
0
10
20
30
order*Wavelength [Angstroms]



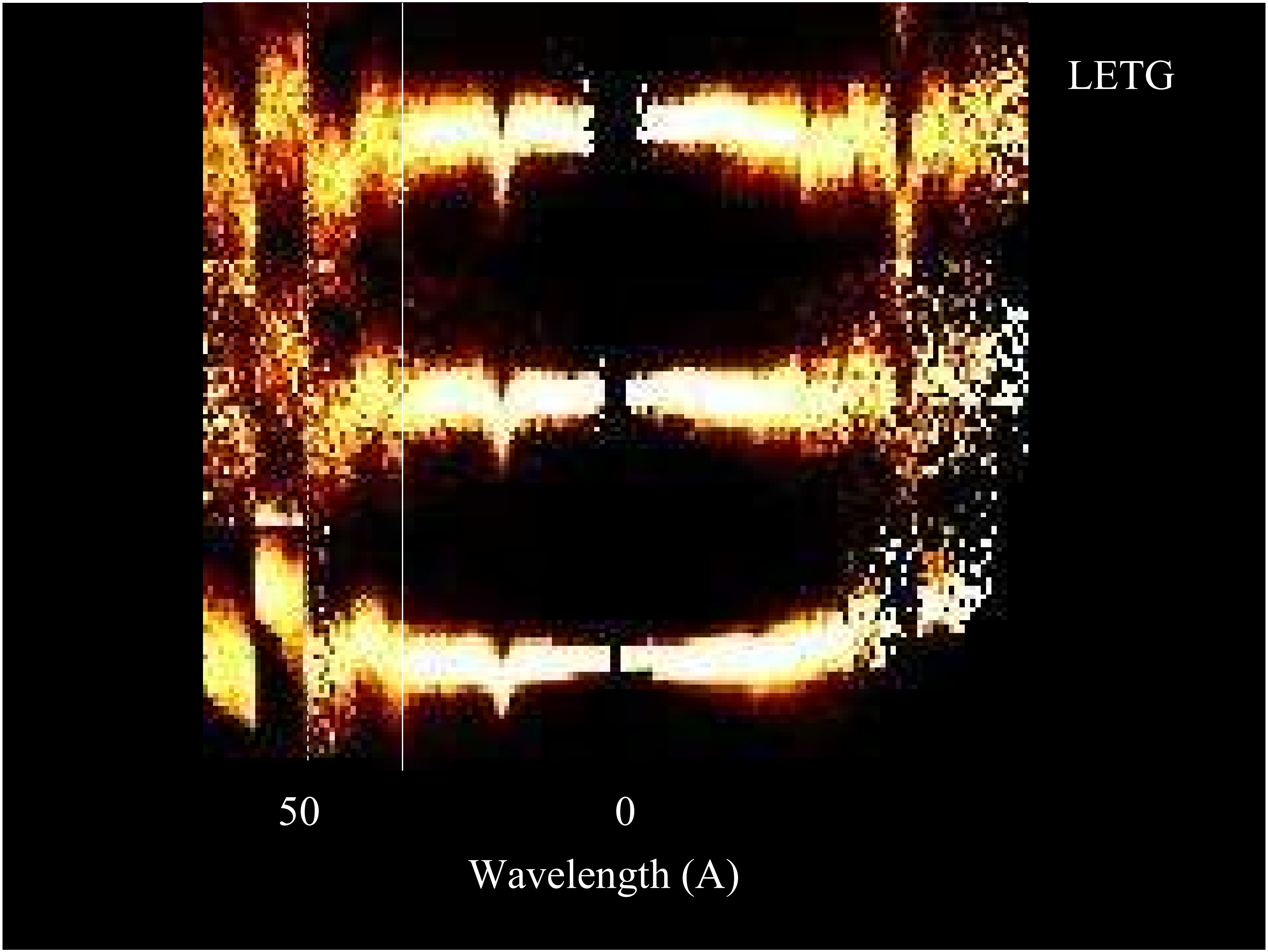
MEG
Order [1]
0
1
2
3
−30
−20
−10
0
10
20
30
order*Wavelength [Angstroms]



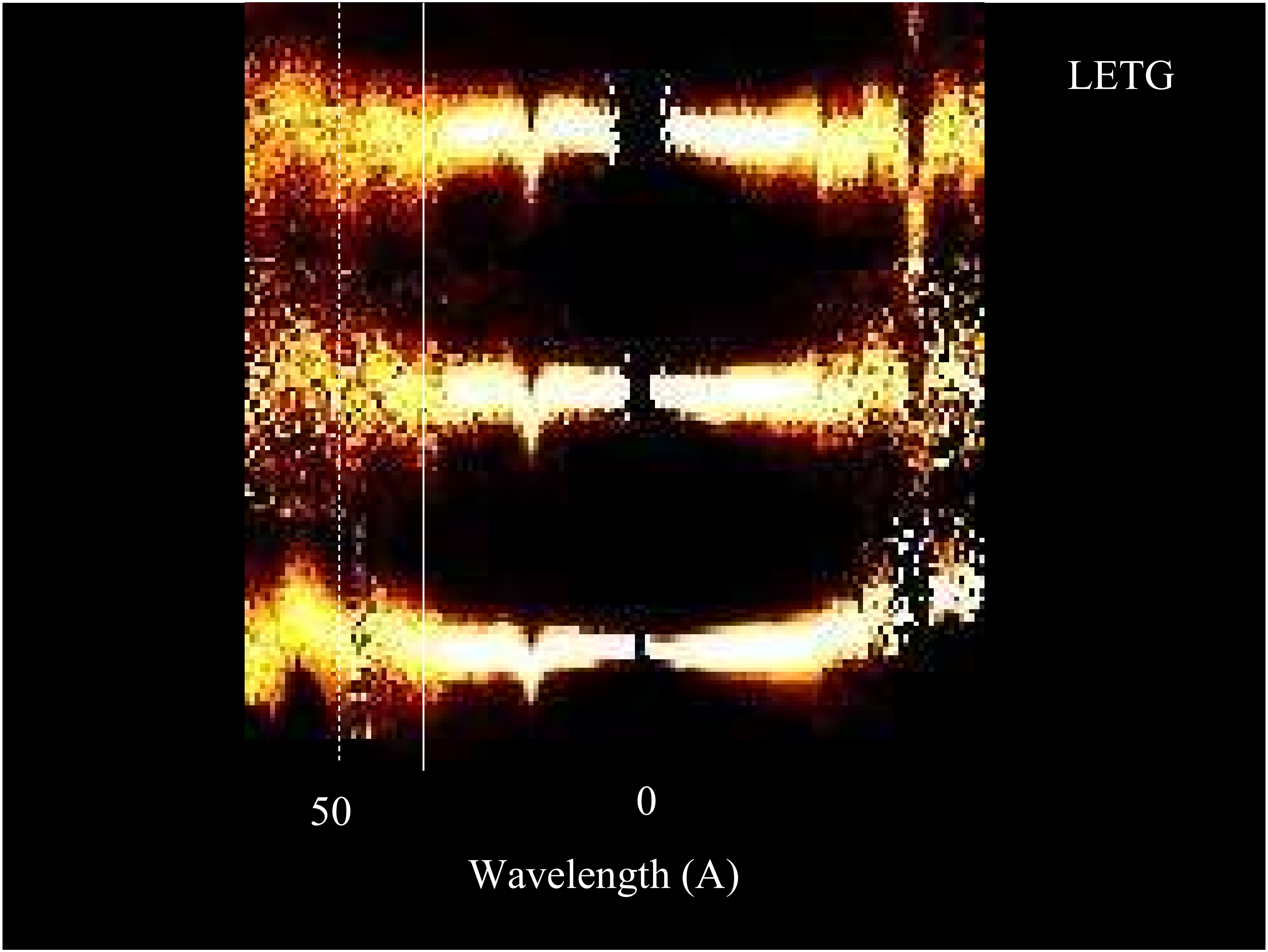
HEG
Order [1]
0
1
2
3
−15
−10
−5
0
5
10
15
order*Wavelength [Angstroms]



HEG
Order [1]
0
1
2
3
−15
−10
−5
0
5
10
15
order*Wavelength [Angstroms]



LETG
50
0
Wavelength (A)


LETG
50
0
Wavelength (A)