MOS monitoring

Fading Cal sources

MOS CTI Column Correction
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Problem spotted in 1E0102…
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- Variation in column-to-column counts
- Cause by variations in column-to-column CTI

*left:* Jean’s plot
col320 Vs neighbouring 4 columns
<500eV, effects *embadpixfind*

*Two main problem columns – MOS1 c320, MOS2 c291*
Time dependency?

Energy dependency?

Time dependency…

Predictably, it evolves with time as Jean spotted…

But we can track the time variability in the CalClosed data

Mallorca EPIC Cal Meeting - February 2005
Darren Baskill: http://www.star.le.ac.uk/~dbl
XMM project: http://www.src.le.ac.uk/projects/xmm/
Method:

- Combine many CalClosed observations (inter-flare periods, per >~100 rev)
- Produce a data cube of RawX Vs RawY Vs Energy (after SAS CTI correction)
- Fit Gaussian to each bin (1 column wide, 60 pixels long)
Al Gaussian centroid position offset from the average – individual columns over 6 time periods
Orbital revolution

Energy Offset (adu)

Col 290
Col 291
Col 289

Time dependency

MOS2 Al

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Darren Baskill: http://www.star.le.ac.uk/~dbl
XMM project: http://www.src.le.ac.uk/projects/xmm/
Energy dependency? Do the size of the offsets depend on energy
Stacked rev 718-920 CalClosed's, MOS1 CCD1, sas6.1.0

Each point represents a single column

Energy dependence

\[ y = -0.069 + 0.25x \]

No energy dependence

Mn K\(\alpha\) offset
Which equation should we use?

\[
\text{CTIC PHA} = \text{PHA} + \text{rawX} \cdot (\text{ctiX} + \text{colcorr}) + \text{rawY} \cdot \text{ctiY}
\]

but this an approximation to…

\[
\text{CTIC PHA} = \text{PHA} \cdot (1 + \text{ctiX} / \text{PHA})^{\text{rawX}} \quad \& \quad \text{rawY}
\]

for energy of \(\sim 1\) keV: \(\text{evts.pha} \sim 300\) ADU
with low CTI of 0.01 ADU/transfer …

Approx method = 300 + 300 \times 0.01 = 303
Better method = 300 \times (1 + 0.01/300)^{300} = 303.19
<1 ev difference

For a bad CTI=0.2 ADU/transfer (i.e. a 60 ADU/200 eV shift at 1keV)

Approx method = 300 + 300 \times 0.2 = 360
Better method = 300 \times (1 + 0.2/300)^{300} = 366.391
\sim 20\text{eV difference}
MOS1 col. 320 no Energy dependence in the column offset correct
MOS1 col. 320 Energy dependence in the column offset correct

Energy (10 eV bins)
MOS2 col. 291 no Energy dependence in the column offset correct
MOS2 col. 291 Energy dependence in the column offset correct

Energy (10 eV bins)
EPIC-MOS Monitoring

eV = \text{cons} + \text{linr} \times \text{adu}

Gain
MOS1 - Linear Term

MOS2 linear term also fine…
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MOS1 Mnkα

MOS1 Al
EPIC-MOS Fading Cal sources

- IDL script to merge several CalClosed observations into one
- Should work with all SAS tasks
- If anyone wishes to test it…!
Conclusions…

- Monitoring – update CCFs with new gain constant offset for a couple of CCDs?

- MOS column-by-column doable & accurate – need SAS programming
  - Should column-by-column correction be just an offset or an energy dependent offset?

...and finally....
Please send me your calibration talks!

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