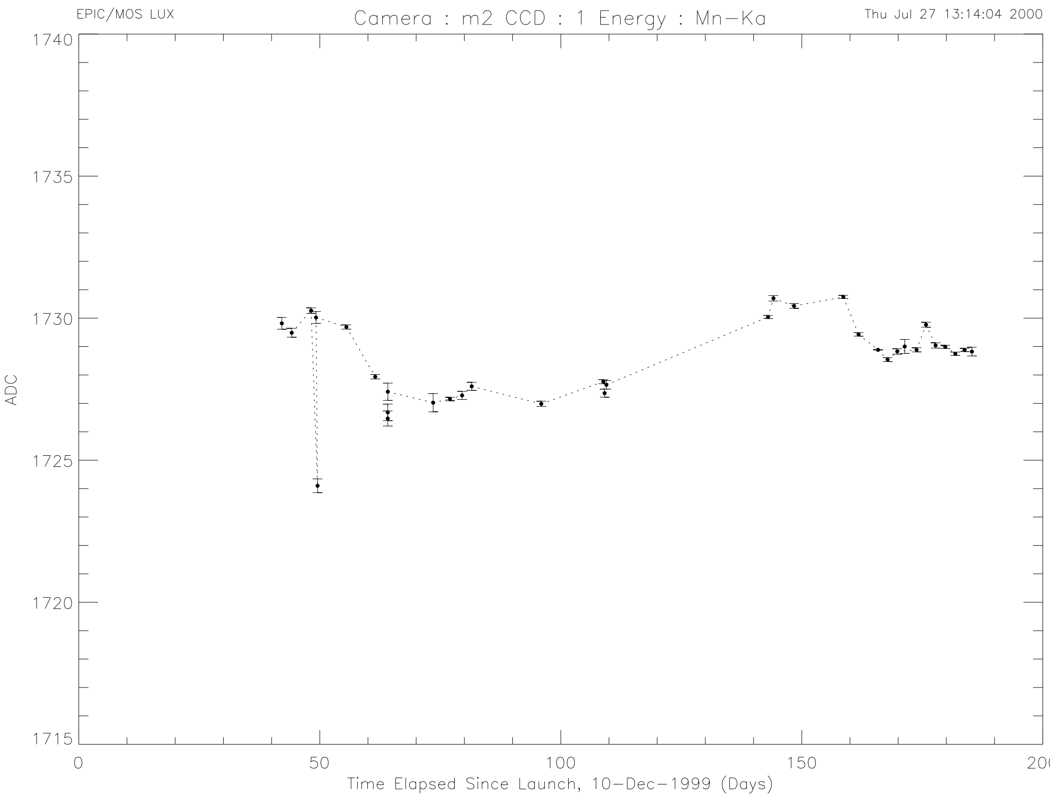
University of Leicester
X-ray Astronomy Group

Line Centroid Scatter

EMCS-2, CCD-1



Our recent note demonstrated scatter in the centroids of the Calibration Source lines.

We have attempted to correlate this scatter with entries in the S/C SPEVAL HK.

We have investigated the correlation with respect to the temperatures of the :

CCD focal plane

Camera head electronics

EMAE electronics

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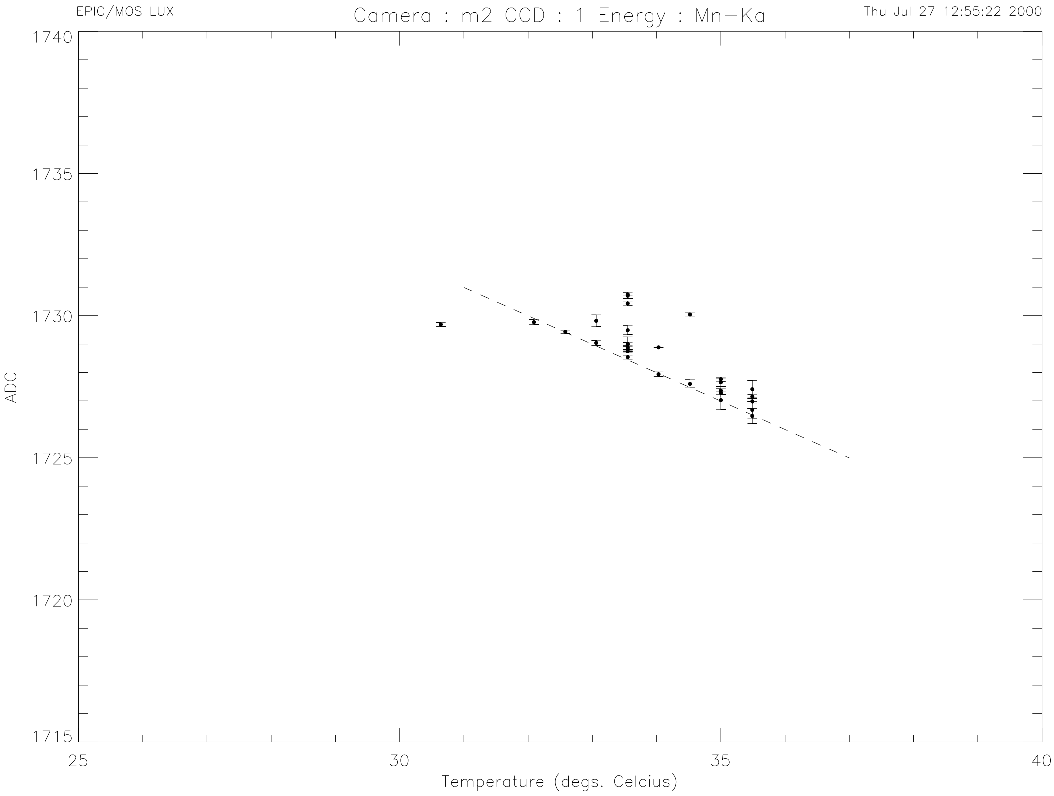

We are unable to analyse most SPEVAL data onwards from rev-57.

In the remaining data, the EMAE electronics temperature (above) correlates.

The correlation produces the well defined lower envelope in our plot.

The plotted line is not an LSQ of all the data, but is intended to guide the eye.

However, scatter remains, and so further correlations remain to be discovered.

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How does the magnitude of this correlation compare with prediction ?

Fact : the measured CCD22 Vod peak/gain stability < 0.006-% per mV

Fact : the measured EMAE Vod voltage stability $= 0.357$-mV per degree

Combined, these measurements would predict peak shifts of < 0.002-% per degree

However, our plotted underlying envelope represents shifts of 0.060-% per degree.

This is a factor of 30 times larger than expected.

Note, this analysis is for only 1 of 14 CCDs.

[Stability measurements quoted from A. Short]

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What is the consequence of allowing this scatter into the science data, uncorrected ?

We envisage 2 scenarios, being the effect on the SAS's ability to reduce :

solitary observations

co-added observations

We consider here how this uncorrected effect would appear in co-added observations.

We modelled the addition of 2 Mn-K lines, as a function of their peak separation.

The Mn-K line has Energy 5899-eV, FWHM 130-eV.

We co-added lines having equal numbers of counts.

Our parameterisation was very simple, and was based on summing single Gaussians.

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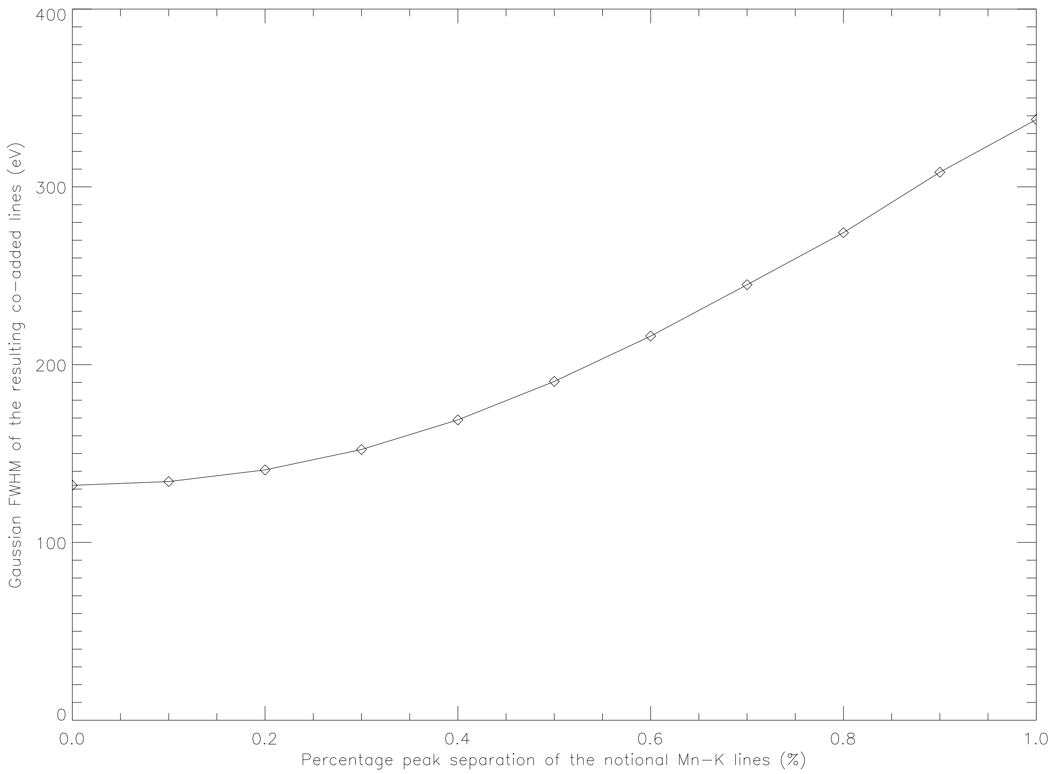

The FWHM of the resulting line is a function of the separation of the co-added input.

Now, variations in EMAE temperature of order 6-degrees C. may not be untypical.

And, in EMCS-2 CCD-1, this would translate to an approx. 0.4-% peak separation.

So, the result of co-adding 2 Mn-K observations having 0.4-% peak separation is :

an apparent blended increase in FWHM from 130-eV to 165-eV

Note, the largest measured peak separation of EMCS-2 CCD-1 so far is only 0.3-%.