Introduction (1)

- The existing column to column variation of centroid in the MOS CCDs has been previously demonstrated.

- A possible correction methodology has been copied from Chandra ACIS, and applied to the EPIC MOS data.

- The method could comfortably integrate into the exisiting SAS framework, as a 3rd final correction step.

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ACIS Deviation Map (1)

- The ACIS FI devices demonstrated marked column to column gain variations, similar in appearance to MOS.
- The effect is energy-dependent, lines show larger amplitude variations at high energy than at low energy.
- They developed the concept of a ‘deviation map’ to allow moderate spatial gain adjustments to each event.
- The approach is purely phenomenological, rather than physical, but has been successfully adopted by ACIS.

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ACIS Deviation Map (2)

- Deviations are modelled via a 2D map whose amplitude is dependent on the PHA of each event being corrected.
- $D(X, Y, E) = D_0(X,Y).(1 + gE)$,

  where E = event PHA, g = energy scaling factor, and D_0 is the map of deviations equivalent to 0-adc.
- The zero-energy deviation map D_0 is derived from PHA images of the 3 main *CTI corrected* calibration source lines, 1 pixel binned in X and (currently) 50 pixels in Y.
- The scaling *g* is determined from the linear dependence of the map standard deviations versus 3 line energies.

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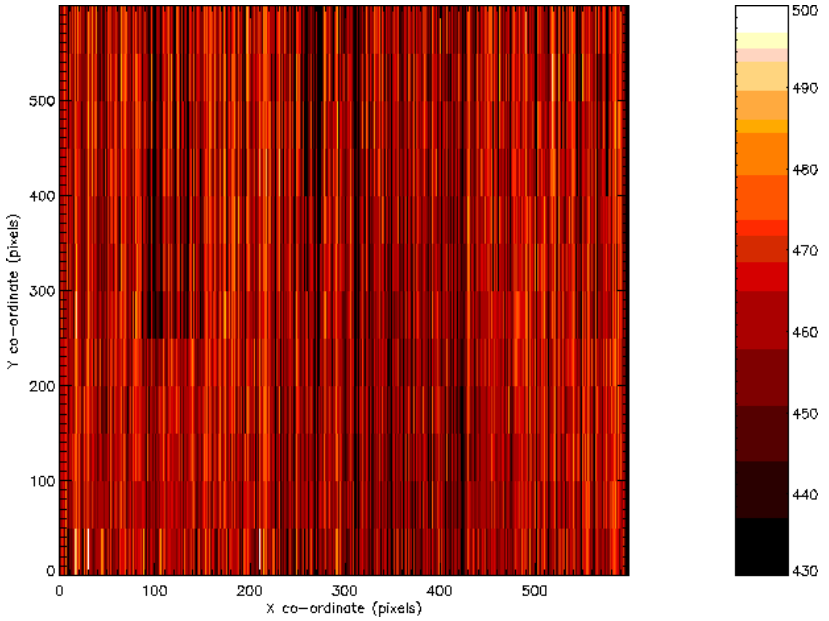
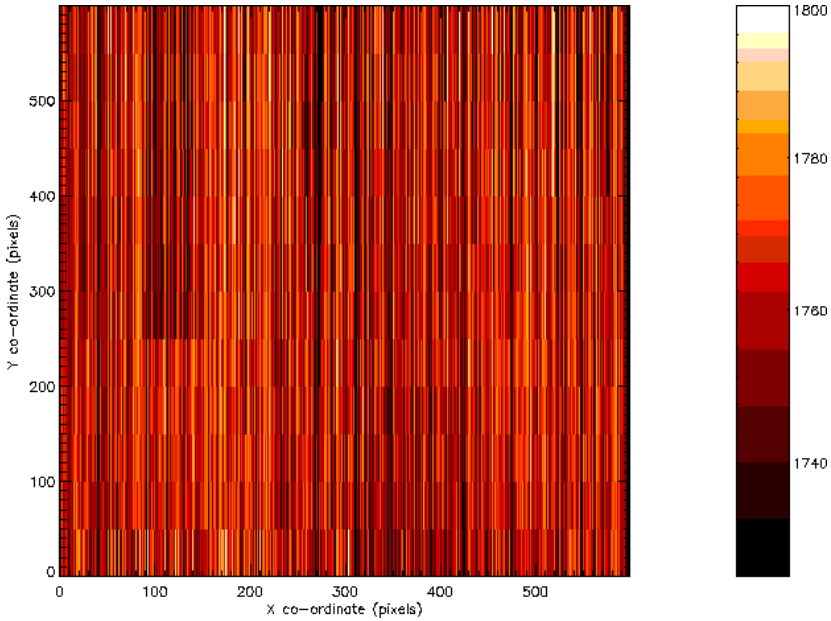
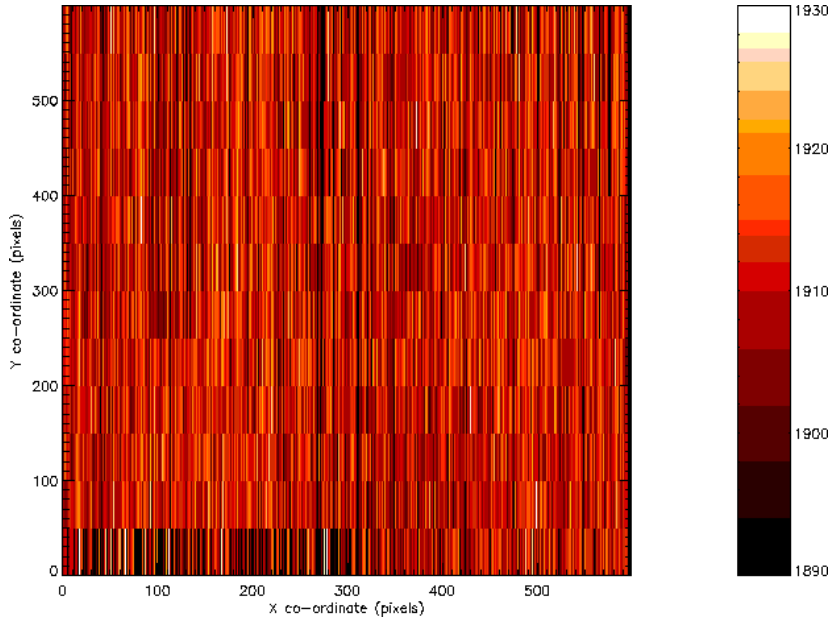


•In an anti-clockwise direction, the Al K-alpha, Mn K-alpha and Mn K-beta PHA maps, the input to the D_0 calculation.





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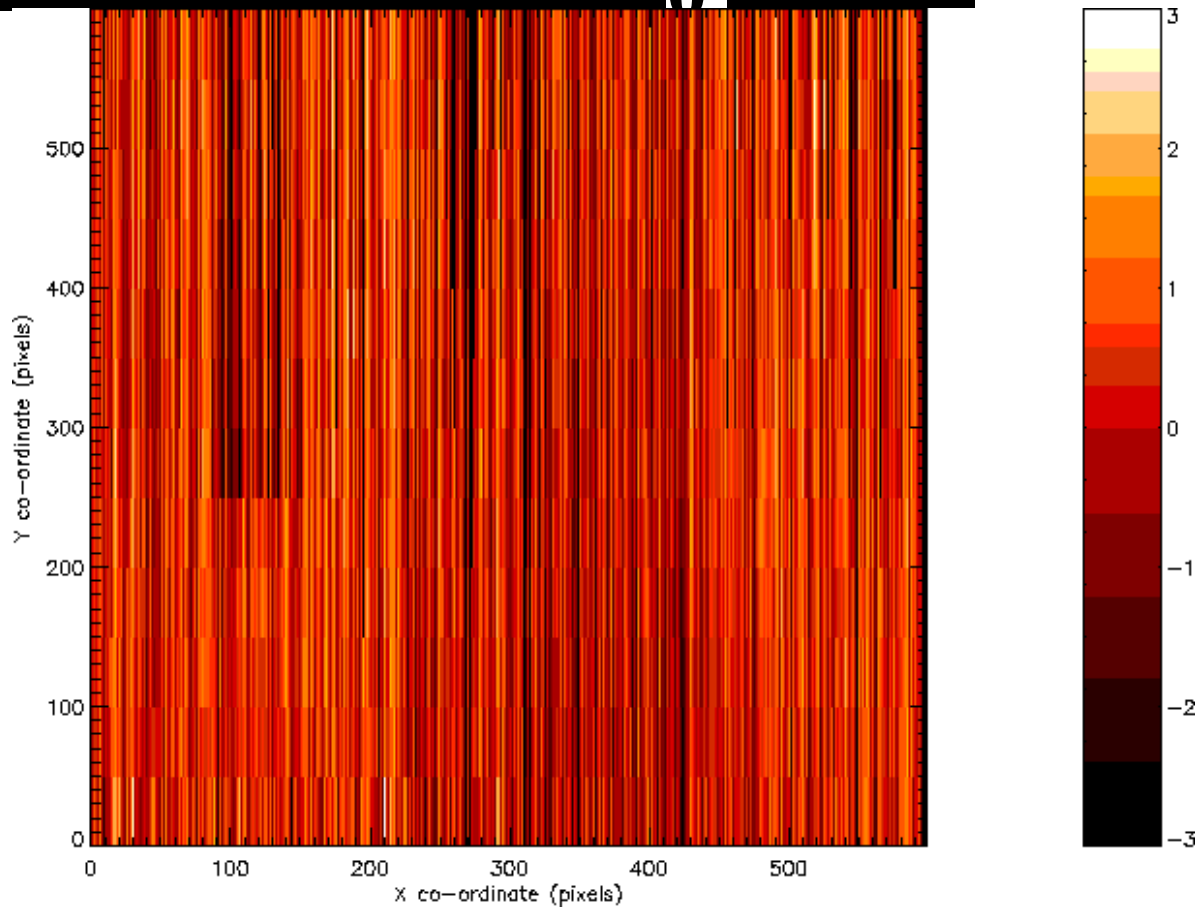
Monday, 12 November 2001

MOS2, CCD1, D_0 Map



•Example D_0 , having calculated scale factor (g) ~0.0027.

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Application

- Our first trial of this D_0 map was encouraging, and successfully homogenised the energies in the columns of a test mono-pixel event list. (Sorry, no more plots.)
- There are still more steps from the ACIS treatment which can be adopted in order to refine the D_0 map.
- Do we expect the deviation map to be time invariant, or to develop with time ? Are the number of low/high columns evolving ? I suspect maps defined at only a few epochs would suffice for the CCF ?

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