A Study of the Quiescent Particle Background

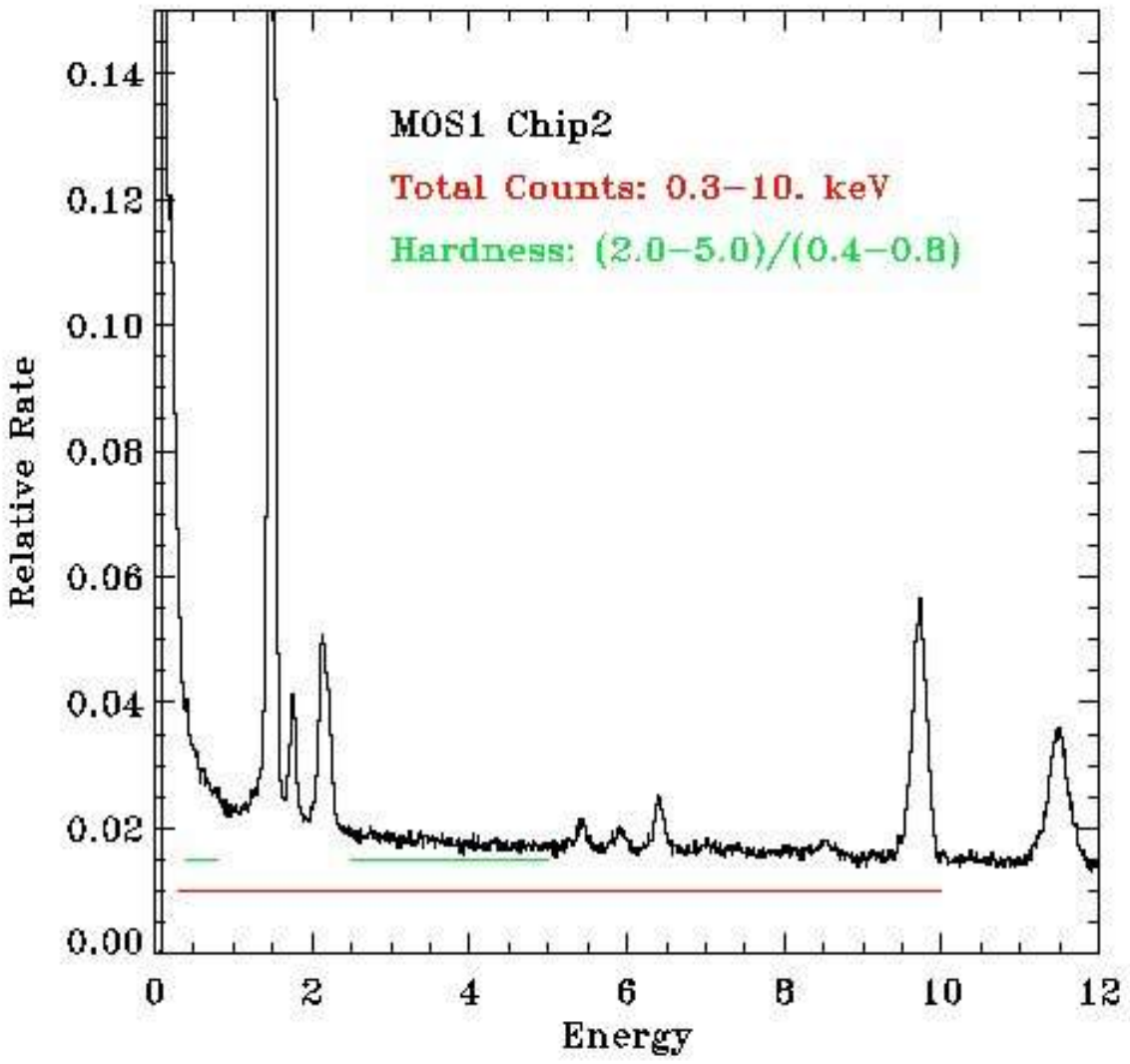
A Study of the “ Corner Spectra” from the public archive:

- 3625 obsids that were public as of 20 July 2005

For each obsid we created a lightcurve in the 2.5-8.0 keV band

- binned by 51 seconds for the entire FOV
- determined the quiescent level in a quasi-automated manner
- removed all time intervals with emission > 2.5 sigma
- all lightcurves visually inspected to ensure good fits
- extracted spectra from the corner pixels only from good times
    - spectra extracted on a chip-by-chip basis

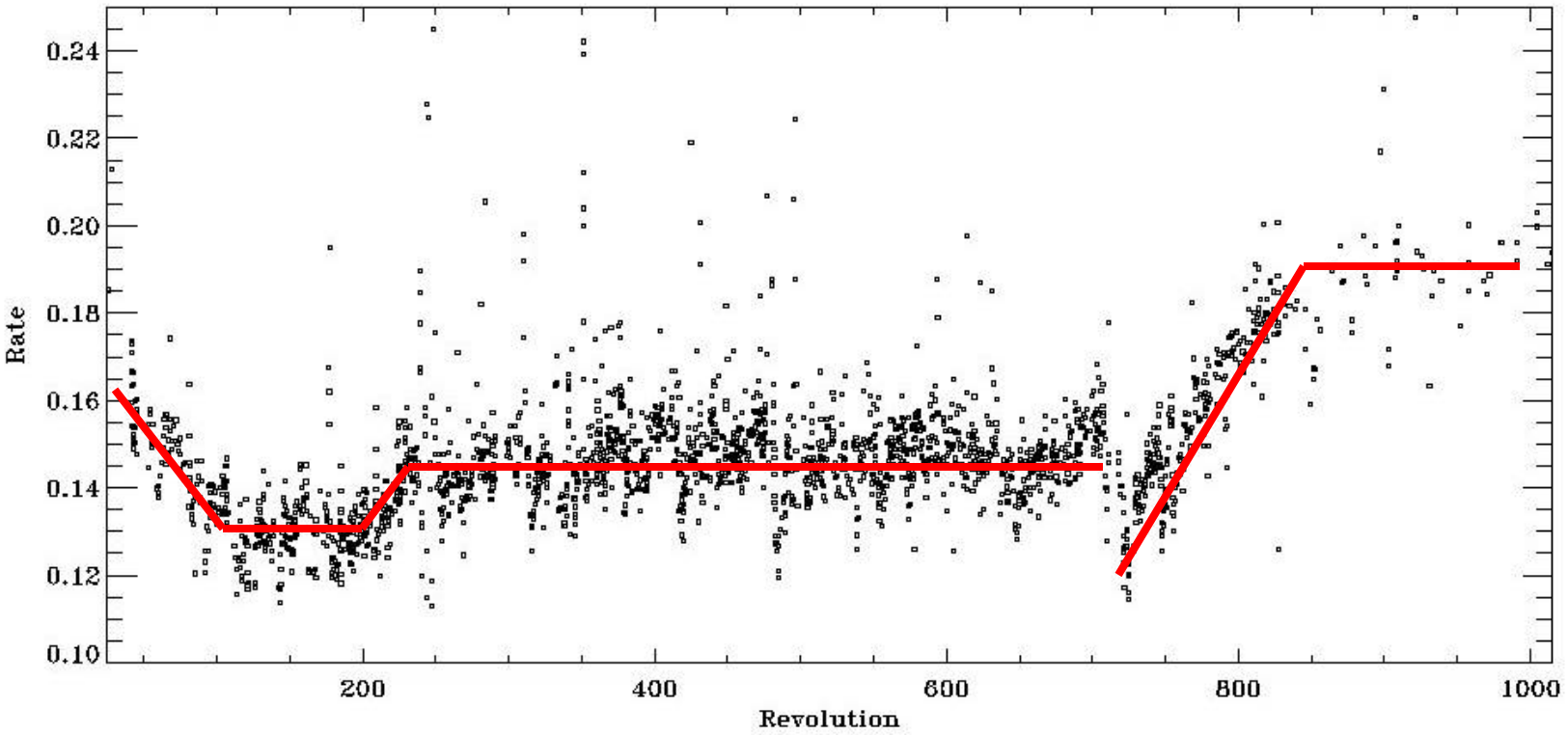
A Typical Particle Background Spectrum



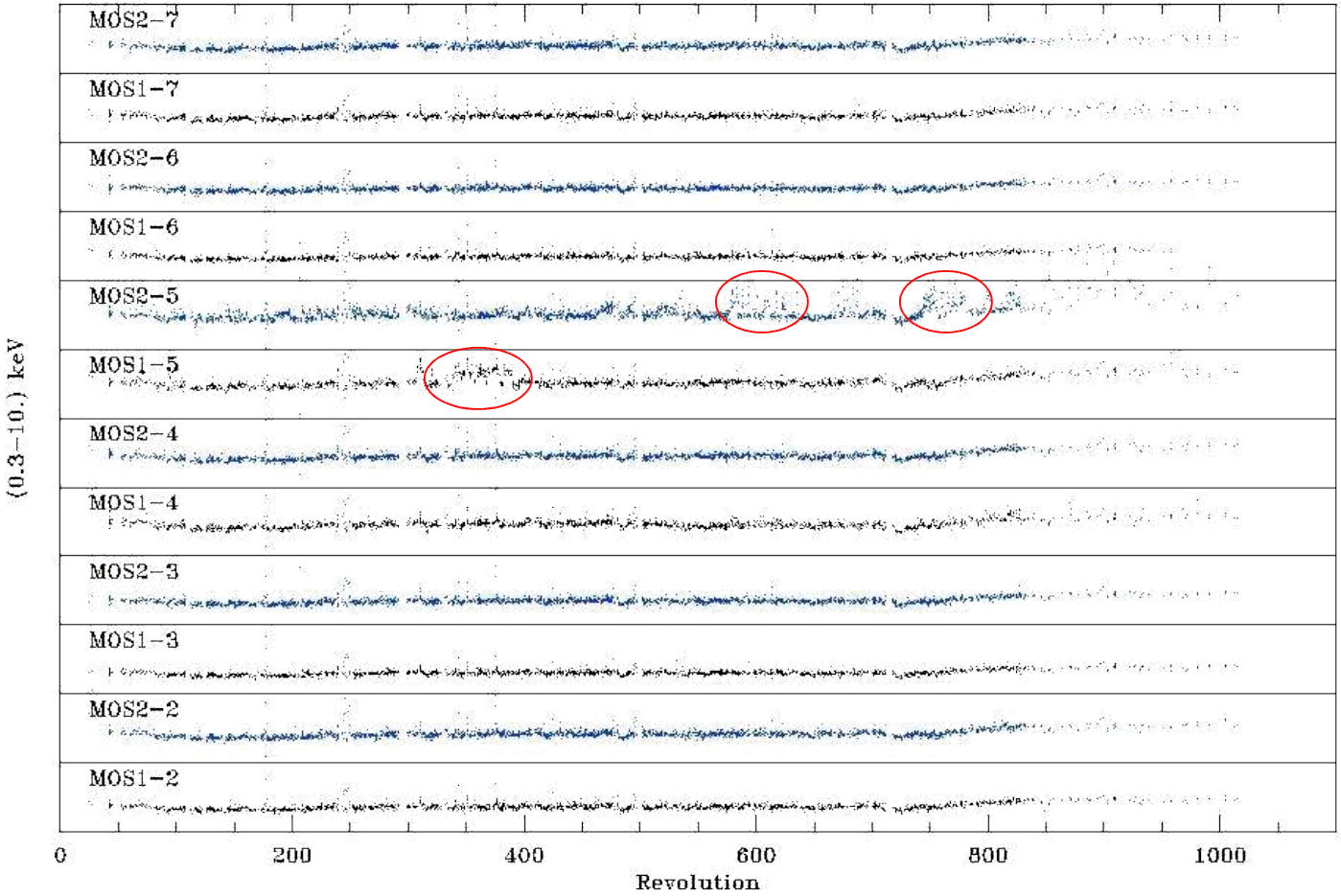
For the quiescent particle background spectrum we define two quantities:

The total background rate in the 0.3-10.0 keV band and a hardness:
(2.5-5.0 keV)/(0.4-0.8 keV)

Time Evolution of the QPB



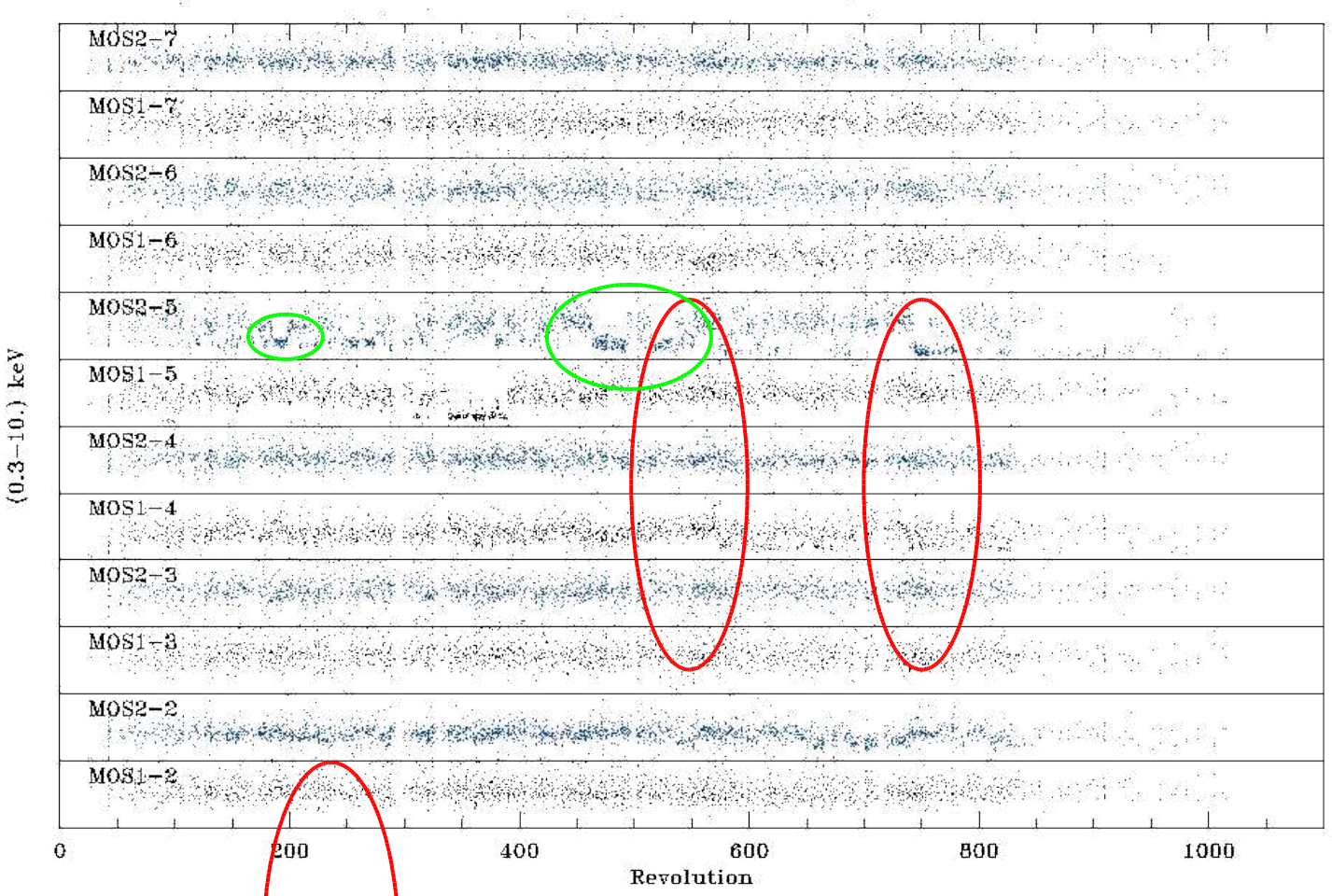
Time Evolution of the QPB



All of the chips have similar long-term light curves:

But note the exceptions!

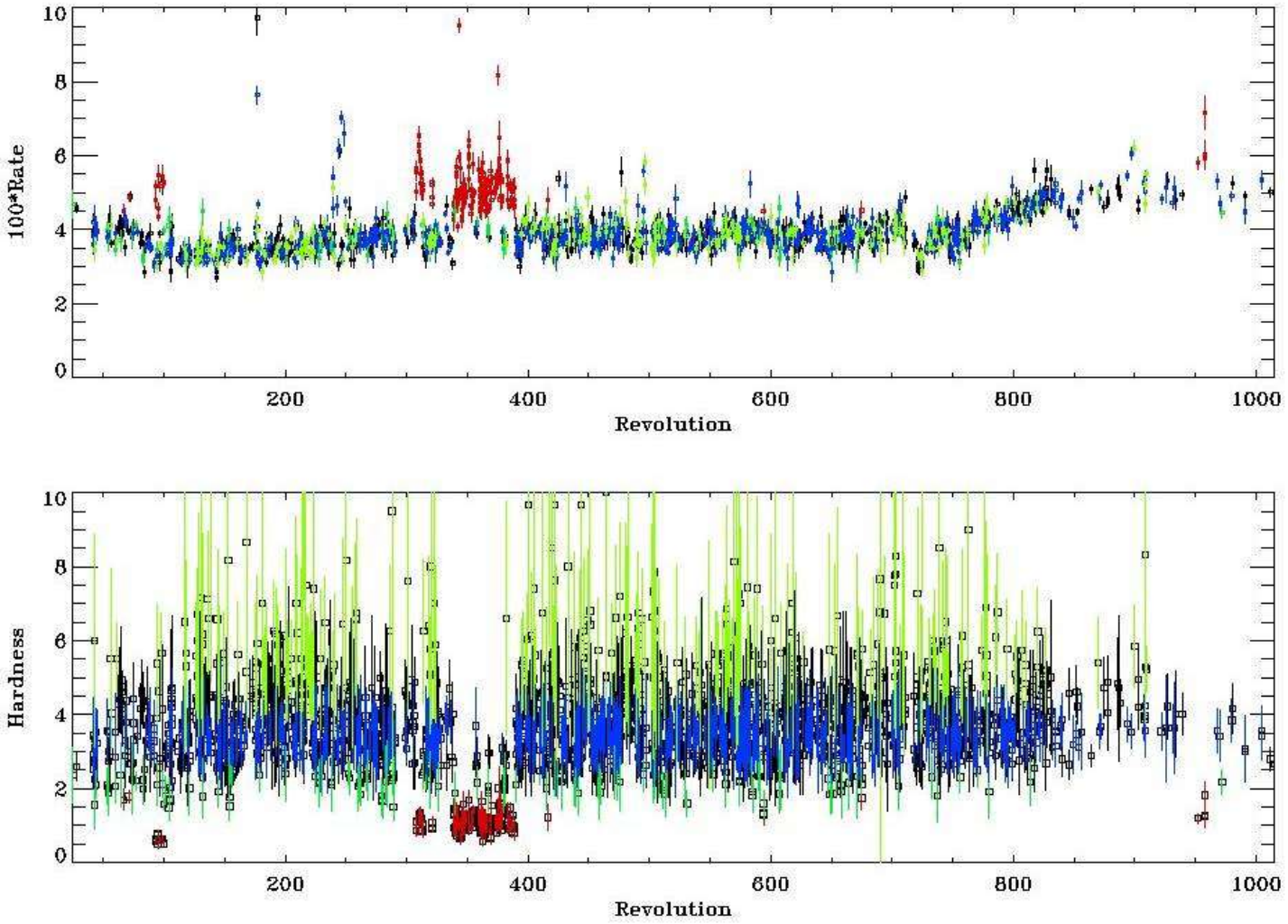
Time Evolution of the QPB



Most of the exceptions have show changes in the hardness.

There are some detectors that show strong changes of hardness with changes in rate.

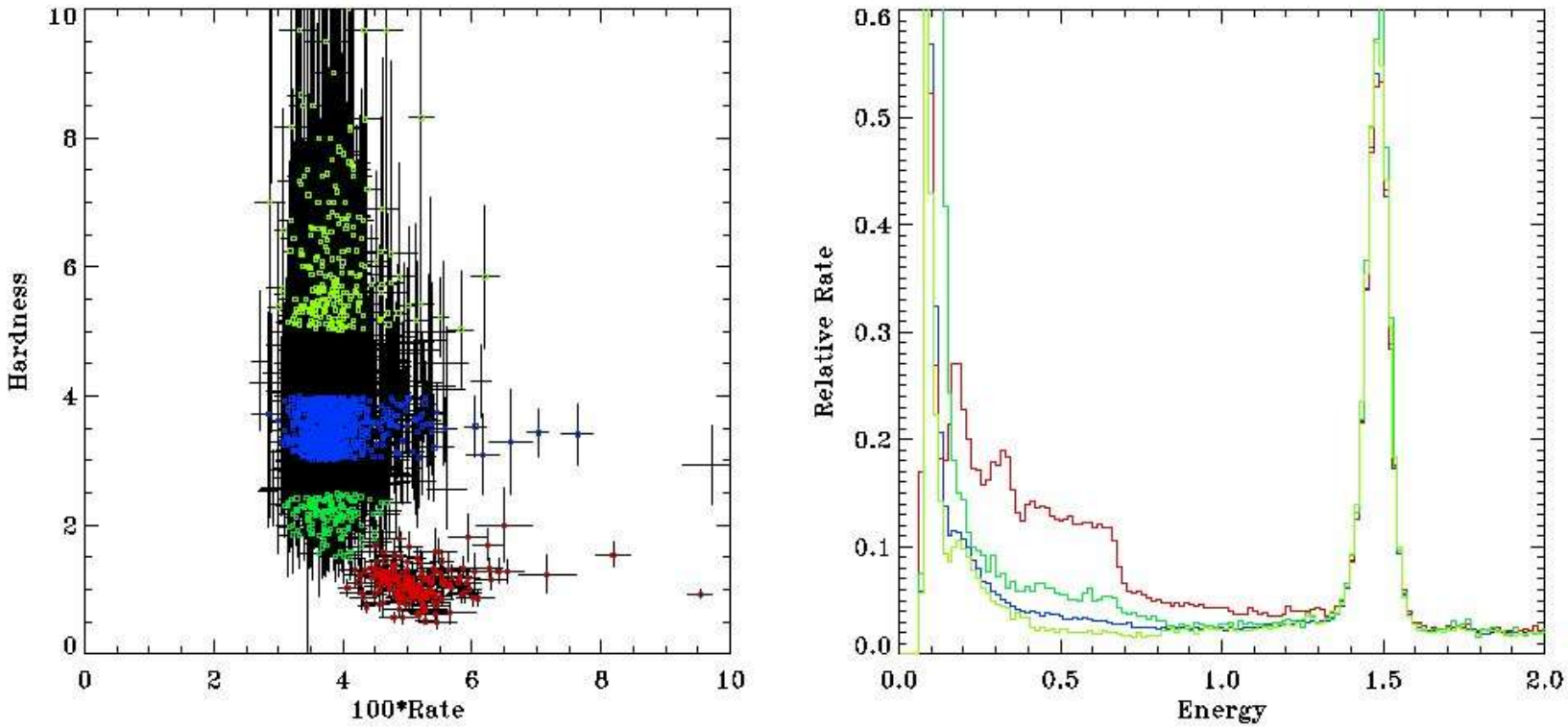
The Case of MOS1 Chip 5



An anomalous increase in rate clearly correlated with a change in hardness.

The points are colour-coded by their hardness.

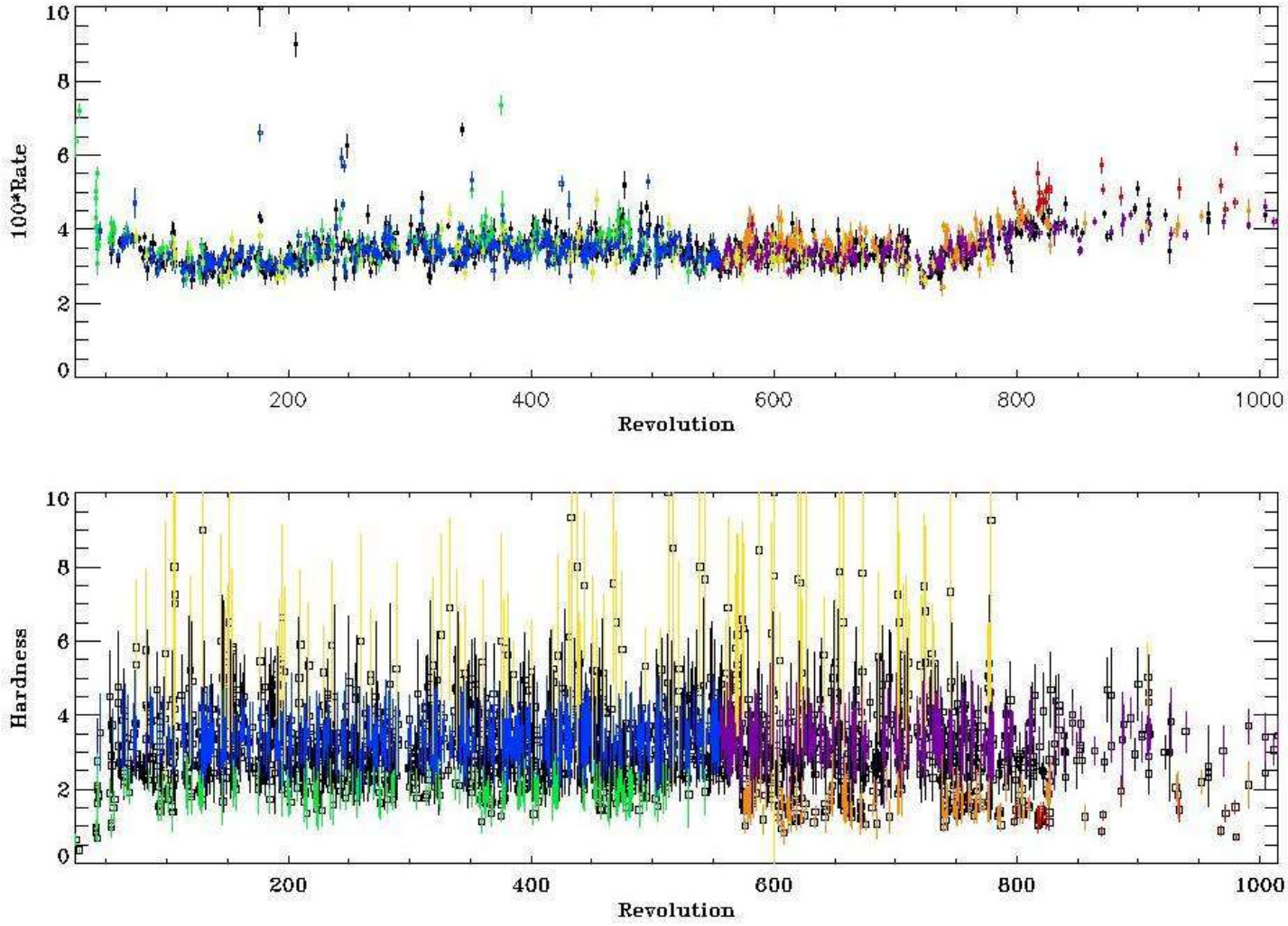
The Case of MOS1 Chip 5



Anomalous points (red) clearly separated from the others; spectrum characterized by an additional component, the " soft plateau" below 0.7 keV.

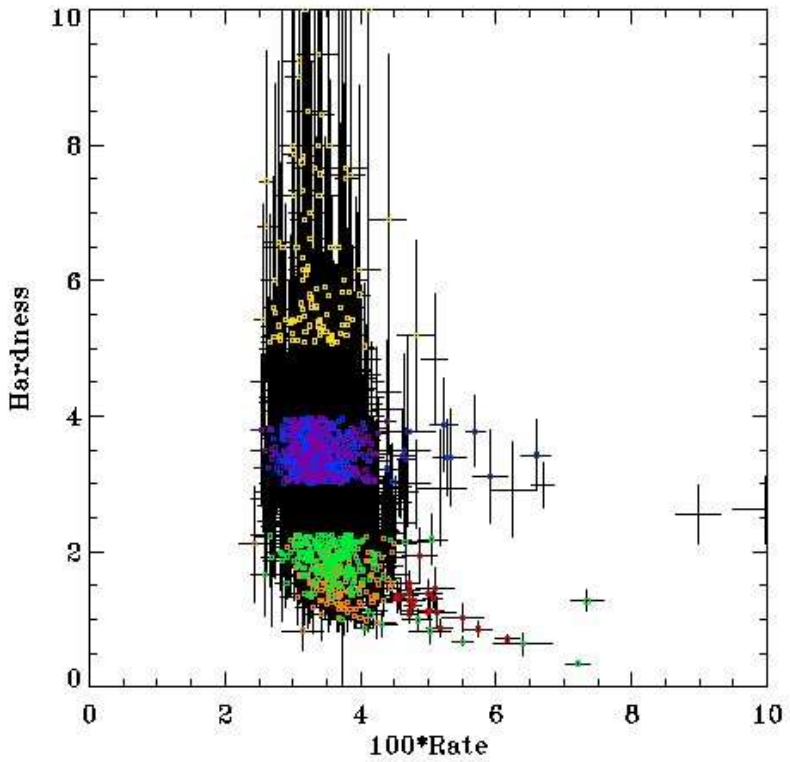
Note that the anomalous points come from a limited number of episodes.

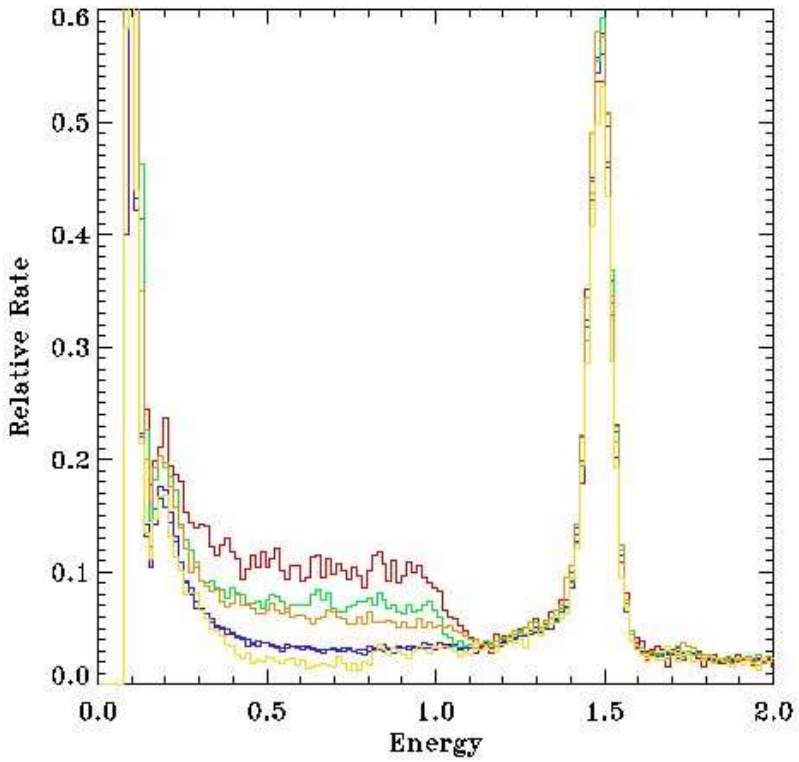
The Case of MOS1 Chip 4



The orange/red points with low hardness and slightly elevated rates begin after revolution 555. Note the green points with also have low hardness.

The Case of MOS1 Chip 4



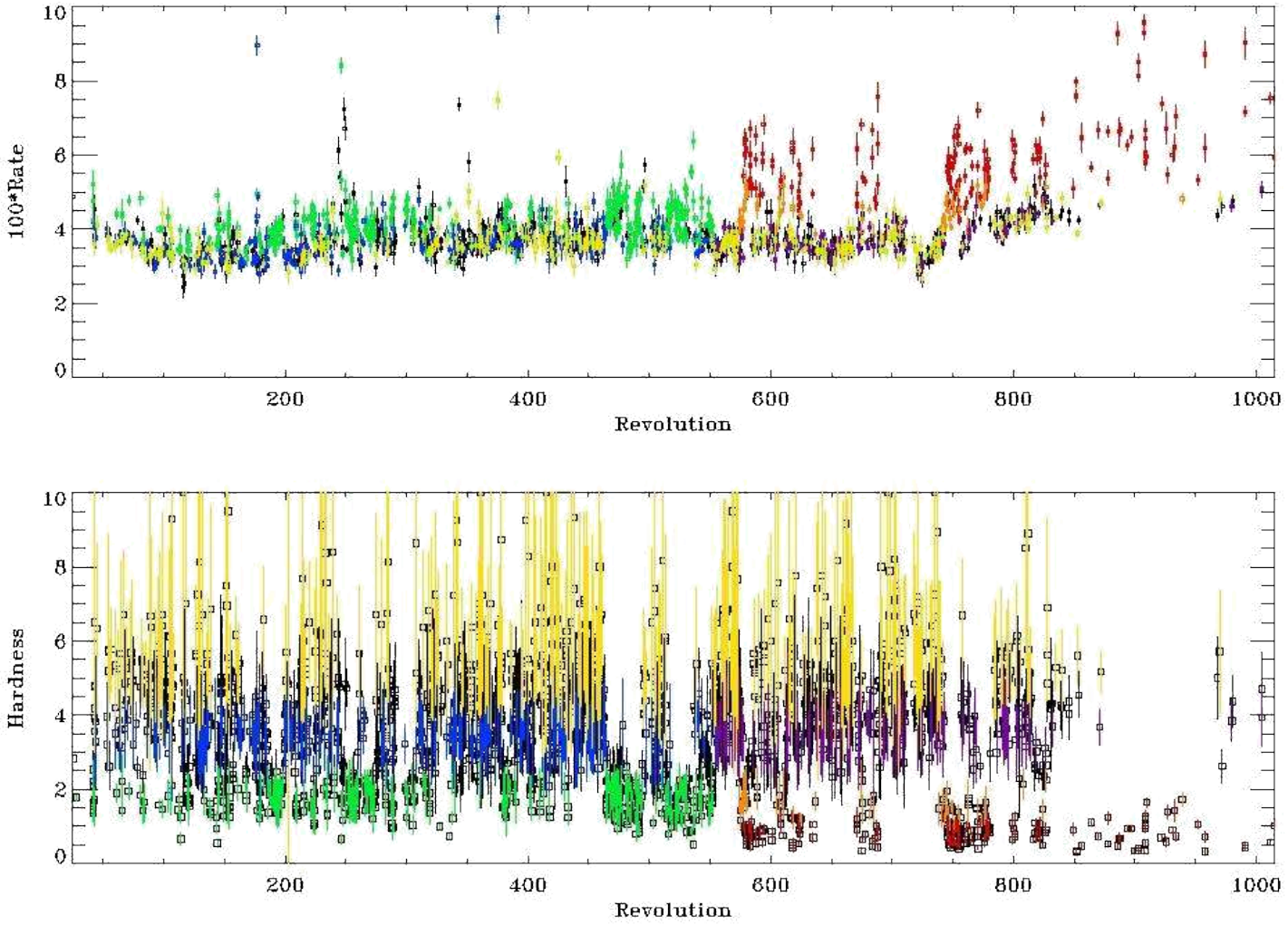


Anomalous points (red) clearly separated from the others; spectrum characterized by an additional component, the " soft plateau" below 1.0 keV.

Low hardness points (green and orange) also have " soft plateau" .

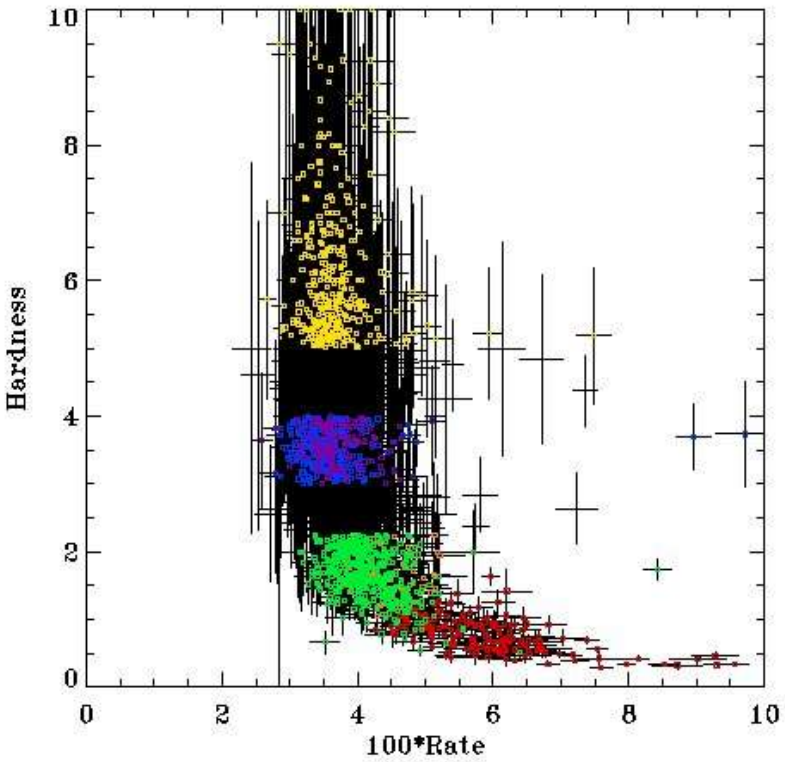
- the " soft plateau" spectra do *not* come from a limited number of episodes

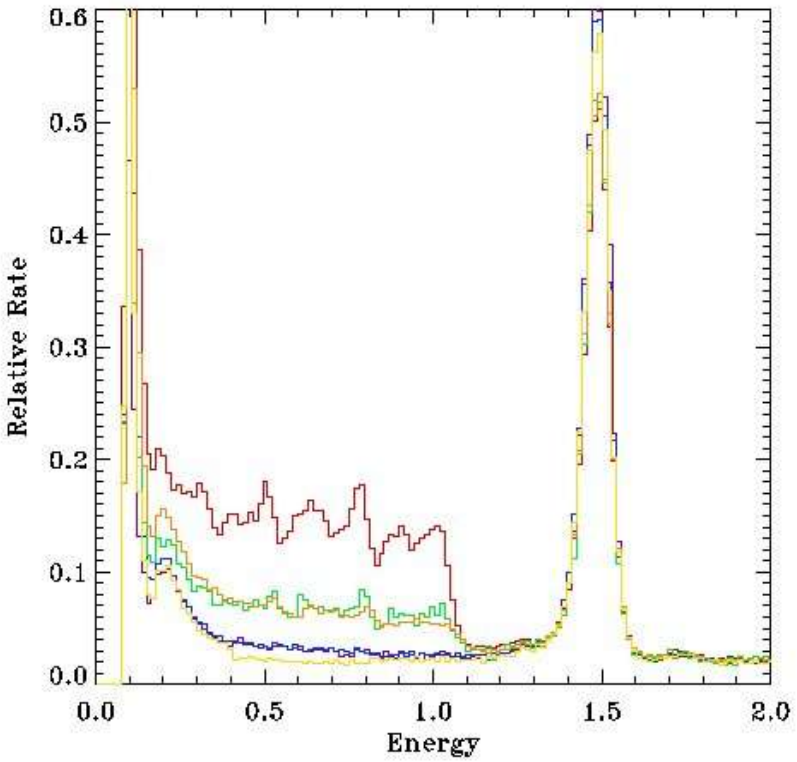
The Case of MOS2 Chip 5



The orange/red points with low hardness and elevated rates begin after revolution 555. Note the green points with also have low hardness.

The Case of MOS2 Chip 5





Anomalous points (red) *not* clearly separated from the others; spectrum characterized by an additional component, the " soft plateau" below 1.1 keV.

Low hardness points (green and orange) also have " soft plateau" .

- the " soft plateau" spectra do *not* come from a limited number of episodes

A Study of the Quiescent Particle Background

We do observe a long term change in the QPB as recorded by the detectors (i.e. the development of very low hardness states in the MOS1 Chip 4 and MOS2 Chip 5)

For a given hardness state we do not observe *strong* temporal evolution of the shape of the underlying spectrum, but such evolution may exist (i.e. the difference between green and orange spectra for MOS1 Chip 4).

Open issues (for the instrument scientists)

- What is the underlying cause of the temporal change of the average QPB rate?

- What is the underlying cause of the “ anomalous states?”

A Study of the Quiescent Particle Background

Open issues (for those attempting to calibrate the background)

- The temporal variation is shown for corner pixels.
- How does the response as a function of position on the chip change?

There is a relatively small amount of filter-wheel-closed data available with which to study this variation.

Corner/FOV ratio does seem to show a difference for MOS2-5