emanom

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Abstract

EPIC MOS anomalous chip state determination tool

1 Instruments/Modes

Instrument	Mode
EPIC	IMAGING, TIMING

2 Use

pipeline processing	yes
interactive analysis	yes

3 Description

Emanom is a general tool for determining whether an EPIC MOS chip is likely to be in an anomalous state, that is, having an anomalously high quiescent particle background(QPB) below $\sim$ 1.0 keV. It is part of the goflib library of functions, subroutines, and tasks. It is generally used with Extended Source Analysis Software (ESAS) analyses. The algorithm is based on an updated version of Kuntz & Snowden (2008) which relies upon the 2.5-5.0 keV/0.4-0.8 keV hardness ratio to identify observations where the low energy band is anomalously high. The object of this routine is to identify the chips whose QPB spectrum, for this observation, is significantly different from their normal QPB spectrum. This routine uses rather restrictive criteria and may not be suitable for other uses. The work upon which this algorithm is based will be published shortly.

For each chip experiencing anomalous states (currently MOS1-4, MOS1-5, MOS2-2, and MOS2-5) this algorithm calculates the 2.5-5.0 keV/0.4-0.8 keV hardness ratio and compares that values to the `noan_lim` and `anom_lim` values for that chip. If the hardness ratio is >`noan_lim` the chip is considered good (G), and the QPB background spectrum should be well characterised. If the hardness ratio is <`anom_lim` then the chip is considered bad (B), and the QPB background spectrum cannot be constructed for this chip. If the hardness ratio falls between `noan_lim` and `anom_lim`, then the chip is considered intermediate (I), and the standard method for constructing the QPB spectrum *may* be sufficient, but the user should exercise caution. If there are so few counts in the spectrum that the hardness ratio is not defined then

the chip is considered to be in an unknown state (U), and if the chip is not active it is considered to be off (O).

The values for anom_lim and noam_lim are as follows:

MOS1, CCD4, anom_lim: 2.75 MOS1, CCD4, noam_lim: 3.00

MOS1, CCD5, anom_lim: 2.25 MOS1, CCD5, noam_lim: 3.60

MOS2, CCD2, anom_lim: 2.10 MOS2, CCD2, noam_lim: 2.50

MOS2, CCD5, anom_lim: 2.00 MOS2, CCD5, noam_lim: 4.00

The hardness ratios, the uncertainty in the hardness ratios, and the flag (B, G, I, O, or U) are recorded in the header keywords `ANOMHRn`, `ANOMHEn`, and `ANOMFLn` respectively if *writekeys* is true.

Note that chips that are in anomalous states still have useable spectra at energies greater than 1 keV.

4 Parameters

This section documents the parameters recognized by this task (if any).

Parameter	Mand	Type	Default	Constraints
eventfile	yes	filename	mosevli.fits	

Name of input EPIC MOS event list

cornerfile	no	filename	moscorn.fits	

Name of output EPIC MOS corner-only event list

writekeys	no	boolean	TRUE	

Write ANOM keywords to eventset file?

writelog	no	boolean	TRUE	

Write HR and State results to text log file?

keepcorner	no	boolean	TRUE	

Retain (save) corner-only event list?

5 Errors

This section documents warnings and errors generated by this task (if any). Note that warnings and errors can also be generated in the SAS infrastructure libraries, in which case they would not be documented here. Refer to the index of all errors and warnings available in the HTML version of the SAS documentation.

badMode *(error)*
Cannot open eventlist in READ/WRITE/MODIFY mode requested

wrongInstrume *(error)*
INSTRUME is neither EMOS1 or EMOS2

wrongFilter *(error)*
FILTER attrbute is none of: Thick/Medium/Thin1/Closed

noFilter *(error)*
FILTER attrbute is not in input event list

noLUN *(warning)*
Do not write text log file
corrective action: Could not get LUN for text write

6 Input Files

1. Standard EPIC MOS event list (obtained in many ways, e.g. the PPS, emchain, evselect, xmmselect, etc.).

7 Output Files

1. Standard EPIC MOS event list with hardness ratios, hardness ratio errors, and anomalous state flags for each chip added as header keywords.
2. Standard EPIC MOS Corner-pixels-only event list.
3. Log file of hardness ratios, hardness ratio errors, and anomalous state flags for each chip

8 Algorithm

- Open EPIC MOS Event List
- Extract INSTRUME and FILTER attributes from EPIC MOS Event List for error checking
- Use evselect to create EPIC MOS Event List of **corner-only** chip pixel events.
- Loop through chips 2-7 (since chip 1 has no corner data):
  - Extract LIVETI0n attribute from header.
  - Filter corner-only Event List for current chip in low band (400-800 keV).
  - Filter corner-only Event List for current chip in high band (2500-5000 keV).
  - Calculate hardness ratio of corner-only high_band/low_band counts.
  - From hardness ratio (HR) set anomalous set flag accordingly.
    - G: HR $>$ `noan_lim`, chip is good.
    - I: `noan_lim` $>$ HR $>$ `anom_lim`, chip may be useable for $E < 1$ keV.
    - B: HR $<$ `anom_lim`, chip is not useable for $E < 1$ keV.
    - O: chip is not in use.
    - U: the count rate is too low to determine the chip state.

9 Comments

This task will attempt to create a text log file unless specifically requested not to with writelog=F. It will attempt to create a default file name of the form "mos[1—2][S—U]nnn-anom.log"', e.g. mos1S001-anom.log. This will create unique filenames within an ODF.

9.1 Future developments

10 Usage and Examples

1. Simplest example with all defaults (see parameters section):

```
emanom eventset=P0123456789M1S001MIEVLI0000.FIT
```

2. Do not save output logfile of Hardness Ratio and Anomalous State:

```
emanom eventset=P0123456789M1S001MIEVLI0000.FIT writelog=F
```

3. Do not write Hardness Ratio and Anomalous State to event list:

```
emanom eventset=mos1S001-ori.fit writekeys=F
```

4. Do not keep the corner-only event lists created:

```
emanom eventset=mos1S001-ori.fit keepcorner=F
```

References