evenergyshift

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Abstract

A task to add an ad-hoc energy shift to evemts in an event file

1 Instruments/Modes

Instrument	Mode
EPIC	IMAGING

2 Use

pipeline processing	no
interactive analysis	yes

3 Description

The SAS calculates the initial energy of the photon arriving in a CCD, using a large number of corrections based on temporal, spatial and energy information. Nevertheless, in some cases the photon energies can still be seen to be shifted from their true positions, when modelling the spectrum in a spectral fitting package. Principally this becomes obvious by residuals which are visible around the Si K_α line at 1.84 keV and the Au-M edge at 2.2 keV and AU-L edge at 11.9 keV.

eveventshift provides the user with an *ad hoc* method of moving the energies to remove these residuals.

The original event energies are stored in a new column called PI_ORIG.

This task is currently restricted to EPIC-pn event files, taken from observations made with the FastTiming or FastBurst modes. The header keyword *SUBMODE* must contain one of those strings for the task to run.

3.1 Algorithm

Up to 3 energies with associated offsets may be provided on the command line. The code interpolates linearly between these energies.

If one offset is supplied then the output energy of an event is given by:

```
PI_out = PI_in + off1
```

where PI_out is the output PI channel value, PI_IN is the input value and off1 is the supplied offset in the `offset1` parameter.

If two offsets are supplied then the output energy of an event is given by:

```
PI_out = PI_in + off1                               for PI_IN <= pi1
PI_out = PI_in + off1 + (off2-off1) * (PI_in-pi1)/(pi2-pi1) for PI_IN >pi1
```

where off2 is the second offset value in eV, pi1 is the PI channel in which the offset should be off1 and pi2 is the PI channel where the offset should be off2. For PI channels higher than pi2 the output value will be extrapolated. NB: This is prone to create large offsets at higher energies if two values are provided at energies with a small separation, e.g. 1.84 and 2.2 keV. If `extrapolate` is *false* then

```
PI_out = PI_in + off2         for PI_IN >pi2
```

If three offsets are supplied then the output energy of an event is given by:

```
PI_out = PI_in + off1                               for PI_IN <= pi1
PI_out = PI_in + off1 + (off2-off1) * (PI_in-pi1)/(pi2-pi1) for pi1<PI_IN <=pi2
PI_out = PI_in + off2 + (off3-off2) * (PI_in-pi2)/(pi3-pi2) for PI_IN >pi2
```

If `extrapolate` is *false* then

```
PI_out = PI_in + off3         for PI_IN >pi3
```

3.2 Examples

A single offset to all events may be applied by providing a value for the `offset1` parameter.

```
evenergyshift table=pntimevts.ds
              outset=pntimevts_shift35.ds offset1=35 pi1=1839
```

This will produce an output file, pntimeevents_shift35.ds, with the same events as the input file but each with a PI value 35 eV higher than the original. The original values are stored in a new column called PI_ORIG.

```
evenergyshift table=pnburstevts.ds
             outset=pnburstevts_shift.ds pi1=1839 offset1=10
             pi2=11919 offset2=30
```

This will produce an output file, pnburstevtsevents_shift.ds, with events of energy up to 1839 eV being shifted upwards in energy by 10 eV and higher energy events being progressively shifted up to 30 eV at 11919 eV and increasingly at higher energies.

```
evenergyshift table=pnburstevts.ds
             outset=pnburstevts_shift.ds pi1=1839 offset1=10
             pi2=11919 offset2=30 extrapolate=false
```

As the previous example but energies greater than 11919 eV will be shifted by exactly 30 eV.

3.3   Caveats

This routine currently works on files containing an extension with events with the column PI stored as a 16 byte Integer. Which is the default produced by the XMM-Newton pipeline and SAS software. It will not work on files where PI is stored as a 32 byte integer or a REAL number.

4   Parameters

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

Parameter	Mand	Type	Default	Constraints

table	yes	dataset		

The name of the input event file. Note that this should be an uncompressed FITS file.

outset	yes	dateset		

The name of the output event file.

offset1	yes	integer		

The offset value for events in units of eV.

pi1	no	integer	1740	

The energy of the offset given by `offset1`.

withoffset2	no	boolean	No	

Whether a second offset has been supplied.

offset2	yes	integer		

The offset value of a second calibration point in eV.

pi2	yes	integer		

The energy of the offset given by `offset2`.

withoffset3	no	boolean	No	

Whether a third offset has been supplied.

offset3	yes	integer		

The offset value of a third calibration point in eV.

pi3	yes	integer		

The energy of the offset given by `offset3`.

extrapolate	no	boolean	No	

Whether to extrapolate the energy shift beyond the highest provided offset energy (true) or to set the shift to the offset of the highest provided energy (false).

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.

NoPIColumnFound *(error)*
　　The input file did not contain a PI column

PIColNotInteger16 *(error)*
　　The PI column was not of type 2-byte Integer

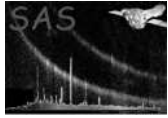**IncompatibleMode** *(error)*
　　The observation has not been made in EPIC-pn Timing or Burst mode

6 Input Files

- an event file with a column, PI, of type Integer*16

7 Output Files

- an event file with a column, PI, whose values have been shifted and a column, PI_ORIG, with the original event energies.

8 Algorithm

9 Comments

References