etimeget

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Abstract

A procedure to generate source and background time series.

1 Instruments/Modes

Instrument	Mode
EPIC	IMAGING, TIMING

2 Use

pipeline processing	yes
interactive analysis	yes

3 Description

etimeget is a metatask which runs **evselect** to extract time series from an XMM-EPIC observation.

The essential input parameters are the name of the XMM events table and a selection expression for the source and optionally background areas, e.g. `srcexp`="((DETX,DETY) IN circle(572,-635,1340))" `backexp`="((DETX,DETY) IN circle(2572,-1635,1340))". The minimum selection required in the source and background expressions is the spatial region, which may be specified in sky (X/Y) or detector coordinates. Other selections are defaulted as shown in Table 1. These defaults may be further restricted by including additional selections in the input expressions, e.g. `srcexp="((DETX,DETY) IN circle(572,-635,1340))&& PATTERN==0"`. **NB:** The source and background expressions should use the same pattern and flag selections. The expressions must be compliant with the **selectlib** standard.

4 Time series binning

The bin width of the light curve is controlled by two input parameters `timebinstyle` and `timebinwidth`. If `timebinstyle` is set to *intrinsic* then the light curve is binned at the frame time of the observation. This may be overridden by setting `timebinstyle`=*parameter* in which case the bin width is taken from the `timebinwidth` parameter, e.g. for a 10 second binning

Table 1: **Default event selections**

Parameter	Camera	
	MOS	PN
PATTERN	0–12	0–4
FLAG	XMMEA_EM[a]	0

[a] The selection #XMMEA_EM represents a conglomerate of flags; see **evatt**.

```
etimeget timebinstyle=parameter timebinwidth=10
```

For EPIC-pn observations the frame time is set using the observing mode and a look-up table (taken from A&A, 365, L20). The relationship between frame time and observing mode is not constant for the MOS and so the frame time is read from the keyword FRMTIME present in the EXPOSU extensions of the event file.

The start and end times for the source and background light curves may be defined using the `timemin` and `timemax` parameters.

4.1 Examples

4.1.1 A light curve with 10 second binning

```
etimeget filestem=myagn srcexp="((DETX,DETY) IN circle(572,-635,800))"
table=P0129360201M1S004MIEVLI0000.FIT timebinstyle=parameter timebinwidth=10
```

This command line produces the file `myagn_srcrate.lc` and `myagn_bgdrate.lc`

4.1.2 Setting the output filenames explicitly

The names of the output files may be set individually by:

```
etimeget srcexp="((DETX,DETY) IN circle(572,-635,800))"
table=P0129360201M1S004MIEVLI0000.FIT srcrateset='Mylightcurve.li"
bckrateset="Mybackgnd.li"
```

4.1.3 Using the intrinsic frame time as a bin width

```
etimeget filestem=myhmxb srcexp="((X,Y) IN circle(25572,-24635,1200))"
backexp="((X,Y) IN circle(23000,-28000,1340))"
table=P0129360201PNS020PIEVLI0000.FIT timebinstyle=intrinsic
```

This command will produce a source and background time series binned at the frame time of the observation, e.g. 0.07336 seconds for Full Frame EPIC-pn.

4.1.4 Defining the patterns and flags to use

```
etimeget filestem=myagn
srcexp="FLAG==0&&PATTERN==0&&((DETX,DETY) IN circle(572,-635,1340))"
backexp="FLAG==0&&PATTERN==0&&((DETX,DETY) IN annulus(572,-635,1600,3000))"
table=P0129360201M1S004MIEVLI0000.FIT
```

This will create source and background light curves from events of pattern zero having `FLAG=0`. Restricting the pattern range to 0 can be useful when the source is piled up.

4.1.5 Defining the spatial area with a region file

```
etimeget filestem=myagn srcexp="(region(src.reg,X,Y))"
backexp="(region(bck.reg,X,Y))"
table=P0129360201M1S004MIEVLI0000.FIT:EVENTS
```

A region file (e.g. created by the command **regions** or **ds9**) may be used to specify the spatial selection.

4.1.6 Setting the time range

```
etimeget filestem=mystar srcexp="((X,Y) IN circle(25572,-24635,1200))"
backexp="((X,Y) IN circle(23000,-28000,1340))"
table=P0129360201PNS020PIEVLI0000.FIT timemin=1000 timemax=5000
```

Will extract a source and background light curve from 1000 to 5000 seconds after the observation start. These parameters may also be defined in mjd, jd, "CAL" (e.g. Thu Jan 1 00:15:36.816 1998) or "FITS" (e.g. 1998-01-01T00:15:36.816) format.

5 Parameters

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

Parameter	Mand	Type	Default	Constraints
withfilestem	no	boolean	yes	

Whether to specify the output file names using the `filestem` parameter.

filestem	no	string	lcurve	

Stem for the output filenames. A value "lcurve" will produce the files, *lcurve_srcrate.lc, lcurve_bgdrate.lc*

srcrateset	no	string	srcrate.lc	

Name of the output source light curve. This is only used if `withfilestem` is false in which case it becomes mandatory.

bckrateset	no	string	bckrate.lc	

Name of the output background light curve. Only used if `withfilestem` is false in which case it becomes mandatory.

srcexp	yes	string		

Expression for extracting the source events.

backexp	yes	string		

Expression for extracting the background events.

table	yes	table specifier		event list table specifier

A table specifier which must point to an event list table in a data set. It must be in either of the forms `setname` or `setname:tableid` where `setname` must be the name of an existing data set and `tableid` the name of a table in the specified data set. If the first form, `setname`, is used, the event data are sought in the *first* block of the named data set.

timebinstyle	no	string	intrinsic	intrinsic,parameter

How to define the time bin widths. Set to "intrinsic" this tells the task to bin the light curve at the resolution of the frame time. Set to "parameter" it tells the task to use the value in the parameter `timebinwidth` to define the bin width.

timebinwidth	no	real	1.0	

The bin width for the light curve in seconds. This is only used if `timebinstyle`=parameter.

timemin	no	time		

The start time of the light curve.

timemax	no	time		

The end time of the light curve.

6 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.

InvalidExpression *(error)*
The input expression for this spatial region was not valid.

InvalidTimebinstyle *(error)*
The parameter `timebinstyle` contains an unrecognised value

invalidInstrument *(error)*
The Epic camera description contained in the INSTRUME keyword isn't recognised

NoEventsTable *(error)*
The input table didn't contain an EVENTS extension

UnknownModeString *(warning)*
If the spectrum contains an observing mode (in the keyword SUBMODE) which is not recognised then the software assumes that the common PrimeFullWindow mode was in use. The observing mode is used to calculate the frame time for PN observations
corrective action:

7 Input Files

- an EPIC calibrated events list from the pipeline, the e*proc or e*chain tasks.

8 Output Files

- A source light curve of name `filestem`_srcrate.lc or `srcrateset`
- A background light curve of name `filestem`_bgdrate.lc or `bckrateset`

9 Algorithm

```
set output filenames: src_rate, bck_rate
             depending on values of <withfilestem> and related params.

Create a source time series

   expression = <srcexp> + PATTERN + FLAG selections
   evselect table=<table> expression=<expression>
            withrateset=yes rateset=src_rate

Create a background time series

   expression = <backexp> + PATTERN + FLAG selections
   evselect table=<table> expression=<expression>......
            withrateset=yes rateset=bck_rate
```

10 Comments

References