esources

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Abstract

Selects EPIC sources for creation of spectra and time series.

1   Instruments/Modes

Instrument	Mode
MOS	imaging
PN	imaging

2   Use

|	
pipeline processing	yes
interactive analysis	no

3   Description

This task is designed to select those EPIC sources (from the unified list created by the task **srcmatch**) for which spectra and time series (or other source-specific products) are to be extracted in the pipeline. Two other subsidiary functions are performed: (i) widths for the bins of the time series are calculated; (ii) a single pair of start and stop times for all time series is calculated.

3.1   Time bin widths

Although separate time series are made for each EPIC instrument, the same width is used for all, to facilitate comparison between instruments. Choice of the width is complicated by the possibility that, even though a source has passed the selection criteria outlined in subsection 3.2, the counts may be null for as many as 2 out of the 3 EPIC instruments. The algorithm which was chosen checks the instruments in turn in the sequence PN, M2, M1; the first instrument for which the count is neither zero or null is used to set a preliminary, integer-valued bin width w_i as follows:

$$w_i = \text{floor}(c_{\min} t/c)$$
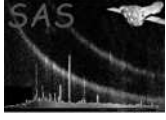
where $c_{\min}$ is the minimum acceptable counts per bin for instrument ii, t is the value of the `ii_ONTIME` column and c is `ii_CTS`; ii here is either PN, M1 or M2. At present, $c_{\min}$ is 'hard-wired' to be 18 for PN and 5 for M1 and M2. The bin width is then rounded up to the nearest multiple of 10 seconds.

3.2 Source inclusion criteria

Criteria for inclusion of a source in the output list are as follows:

- The maximum value of the source ID number is limited by the number of characters allocated to hexadecimal source ID numbers (parameter `numhexchar`). The source ID number is a hexadecimal version of the `SRC_NUM` column.

- No source is considered for which the `ii_CTS` value is null for all three EPIC instruments.

- Sources are included only if a weighted sum C of the `ii_CTS` values c_i exceeds `mintotalcts`. The weight formula is

$$C = \frac{\sum_{i=1}^{3} \delta_i \ c_i}{\sum_{i=1}^{3} \delta_i \ w_i} \tag{1}$$

  where the index i runs over the three EPIC instruments, δ_i equals 0 if c_i is a null value but 1 otherwise, and w_i is a normalized weight associated with the instrument.

- `ii_DET_ML` must be $>$ `mindetml` and `ii_MASKFRAC` must be $>$ `minmaskfrac` for at least one of the instruments ii.

- The calculated width of the time bins must be > 0.

3.3 Start and stop times

Again to facilitate comparison of time series, the same start and stop times are used for all EPIC source time series from a given observation. These times are obtained from `TSTART` and `TSTOP` keywords in the `EVENTS` table headers of the PN, M1 and M2 event lists. The start time is taken as the minimum of the `TSTART` values and the stop time as the maximum of the `TSTOP` values[1].

4 Parameters

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

Parameter	Mand	Type	Default	Constraints

eventsets	yes	dataset		

A list of the event sets which should contribute the the calculation of start and stop times for all time series.

srctab	no	table	srctab.ds:SRCLIST	

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[1]This reference used to state that "these values are then written as `TLMIN` and `TLMAX` keywords to the `TIME` column of all the input event tables". However in pracitice it has never been done due to a bug. Anyhow it would not be desirable, at least in most cases, that the input event lists are modified. Hence as of Version 1.4.1 this feature is officially not the case any more, and the input event files are never modified now.

The input source list (in the format created by **srcmatch**). Note this file will be modified (namely, the SPECTRA and TSERIES columns are written) if `setflags`='yes'.

outsrcset	no	dataset	outsrcset.ds	

The output source list.

mintotalcts	no	real	500	

C in equation 1 must exceed this value for a source to pass.

mindetml	no	real	15	

For a source to pass, `ii_DET_ML` must be $>$ `mindetml` and `ii_MASKFRAC` must be $>$ `minmaskfrac` for at least one of the instruments ii.

minmaskfrac	no	real	0.5	

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numhexchar	no	int	3	

This parameter specifies the number of characters to be allocated to hexadecimal source ID numbers, and thus limits the maximum value of the source ID number.

instweights	no	real	3.5 1.0 1.0	

The (pre-normalization) weights w_i in equation 1. The order is in PN/M1/M2.

setflags	no	bool	no	

Whether to set the SPECTRA or TSERIES columns in the input source 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.

badNumWeights *(error)*
> You must supply 3 values in the list `instweights` (one for each EPIC instrument).

noEventListsSupplied *(error)*
> You didn't supply the names of any event lists in parameter `eventsets`.

binWidthTooSmall *(warning)*
> I'm not sure if this can ever happen.
> *corrective action:* Flags set to zero.

noEp1MlIdCol *(warning)*
> The input source list has no `EP_1_ML_ID` column.
> *corrective action:* Values in column `ML_ID_SRC` of the output set to zero.

srcNumTooLarge *(warning)*
> The maximum number of sources in the output list is restricted by the parameter `numhexchar`.
> *corrective action:* Flags set to zero for the excess sources.

6   Input Files

1. Source list which derives from task **srcmatch**. The actual source list must be a binary table in a FITS file, but the file and table can have any names consistent with FITS conventions. The table must contain the following columns:

   - SRC_NUM
   - RA
   - DEC
   - RA_CORR
   - DEC_CORR
   - PN_CTS
   - M1_CTS
   - M2_CTS
   - PN_ONTIME
   - M1_ONTIME
   - M2_ONTIME
   - PN_DET_ML
   - PN_MASKFRAC
   - M1_DET_ML
   - M1_MASKFRAC
   - M2_DET_ML
   - M2_MASKFRAC
   - (optional) EP_1_ML_ID
   - (if setflags is set) SPECTRA
   - (if setflags is set) TSERIES

2. A single event list from each EPIC instrument. These are again FITS datasets and each must contain an EVENTS binary table extension which has both TSTART and TSTOP keywords.

7   Output Files

1. A FITS dataset which contains a source list in the form of a binary table extension named SRCLIST. This table contains the following columns:

   - SRC_NUM (INTEGER32)
   - RA (REAL64)
   - DEC (REAL64)
   - RA_CORR (REAL64)
   - DEC_CORR (REAL64)
   - TBIN_WIDTH (REAL64)
   - SRC_NUM_HEX (STRING)
   - PROCESS (INTEGER8)
   - EP_CTS (REAL32)
   - PN_CTS (REAL32)

- M1_CTS (REAL32)
- M2_CTS (REAL32)
- ML_ID_SRC (INTEGER32)

2. The SPECTRA and TSERIES columns of the input source table (srctab) are written to if setflags='yes'.

References