esrcselect

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Abstract

Select EPIC sources for product generation

1 Instruments/Modes

Instrument	Mode
EPIC	Imaging

2 Use

pipeline processing	yes
interactive analysis	no

3 Description

In the pipeline processing of XMM data, products will be created for individual sources detected in the EPIC cameras. The source products (spectra and time-series) will only be produced for a selected number of the detected sources (typically the brightest), and only in circumstances where the source products can be generated reliably.

The task `esrcselect` will make the decision on which sources are candidates for source product generation. The task accepts two sources lists: the observation source list and the exposure source list. The positions used to define source and background regions are drawn from the exposure-level source list.

The source selection criteria may differ depending on whether a spectrum or a time-series is to be produced, which is specified using the `operationmode` parameter. Currently there are no differences in the selection criteria, the operation mode merely defines which column in the observation source list will be updated to reflect the production of products.

The conditions for the selection of a source are currently anticipated to be:

1. Distance from its nearest neighbour (from exposure source list) greater than a specified threshold, to avoid producing products for confused sources

2. Count rate (from observation source list) exceeding a specified minimum, to ensure good statistics in a time-series
3. Count rate (from observation source list) not exceeding a specified maximum, to avoid extracting products for piled-up sources
4. Number of source counts (from exposure source list) exceeding a specified minimum, to ensure good statistics in a spectrum

Furthermore a limit can be placed on the number of sources selected. If the number of candidates would otherwise exceed this limit, the brightest sources in the observation will be preferrentially selected.

Additional conditions may be necessary; these will be added as needed after in-flight experience has been gained (see section 10).

For some instrument configurations (eg. observations including windowed or timing modes) sources in the observation source list may not have a counterpart in the exposure source list. In such cases the source will not be selected for source product generation.

The output from the task is a list of the selected sources, which is used as input to the task `region`. For each select source the file lists the source ID number (from the observation source list) and the source coordinates (from the exposure source list). The task also updates the observation source list, setting a flag for each source which has been selected for product generation.

4 Parameters

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

Parameter	Mand	Type	Default	Constraints
obssourcelist	yes	table		

Name of observation source list

expsourcelist	yes	table		

Name of exposure source list

operationmode	yes	string		spectrum|timeseries

Mode of operation

minsourcerate	yes	real		

Minimum source count rate (counts/sec, full EPIC band) of selected sources

maxsourcerate	yes	real		

Maximum source count rate (counts/sec, full EPIC band) of selected sources

minsourcecounts	yes	real		

Minimum number of source counts (in full EPIC band) in selected sources

minsourceseperation	yes	real		

Minimum distance from nearest neighbour (arcseconds) for selected sources

maxsources	yes	integer		

Maximum number of sources in the selected 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.

badInstrument *(error)*
INSTRUME keyword in exposure list is one of EMOS1, EMOS2 or EPN

setNotFound *(error)*
Exposure list supplied was not referenced during the creation of the observation list

6 Input Files

1. EPIC observation summary source list
2. EPIC exposure source list

7 Output Files

1. EPIC observation summary source list
2. List of selected sources. This file contains a table, called `SRCLIST`, with the following columns:

Name	Type	Description
SRC_NUM	Integer	Source ID from observation source list
RA	Double	RA from exposure source list
DEC	Double	Declination from expoure source list
RATE	Real	Count rate from observation source list
COUNTS	Real	Number of source counts, from exposure source list
DIST_NN	Real	Nearest-neighbour distance from observation source list

8 Algorithm

```
Read observation source list
Sort into order of descending count rate

Read names of exposure lists used to create observation list
   from keywords in observation list
Check that supplied exposure list was used to create observation list

Read exposure source list
Find index into ML_ID_SRC vector columns for the given exposure list

while (source count rate > threshold && selected sources < maximum)
   Check nearest neighbour threshold

   Locate source in exposure source list

   Check source counts against threshold
   Check source count rate against threshold

   Add source to selected list if all checks passed

end while

Write selected list
```

The correspondence between sources in the observation source list and the detections in the exposure list is determined as follows:

- The observation source list contains a set of keywords M1_SET1, M1_SET2, M1_SETn, ..., M2_SET1, M2_SET2, ..., defining the names of the exposure lists which were used to create it.
- The observation source list contains columns M1_ML_ID_SRC, M2_ML_ID_SRC and PN_ML_ID_SRC which are vector columns. The nth element of the vector defines the value of ML_ID_SRC in the nth for the detection of that source in the exposure list for that instrument.

9 Comments

10 Future developments

Further enhancements may be necessary in the light of in-flight experience, eg.

- location of the source within the camera field-of-view, to avoid CCD boundaries)
- the nearest-neighbour distance threshold may need to be a function of source brightness, to alleviate problems with multiple detection of bright sources (this depends on the performance of the source detection software)

References