eslewchain

June 2, 2019

Abstract

The task **eslewchain** splits an EPIC slew into small sections, roughly one degree in length and generates images and exposure maps for each section. It makes use of the tasks **atthkgen**, **attcalc**, **evselect** and **eexpmap**.

1   Instruments/Modes

Instrument	Mode
EPIC PN	IMAGING

2   Use

interactive analysis	yes
pipeline processing	yes

3   Description

3.1   General

The aim of **eslewchain** is to produce scientifically useful products from an XMM-Newton slew. It is designed to work with data from the EPIC-pn camera.

eslewchain takes as input a slew event file and associated attitude files and produces a series of images and exposure maps. The task divides the event set into chunks of 45 seconds duration (roughly 1 degree long in the direction of the slew motion). These mini event files are then attitude corrected to project them onto the local tangential plane and used to create the products. Data products are produced in a number of photon energy bands
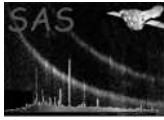
1 = 0.2–0.5 keV
2 = 0.5–1.0 keV
3 = 1.0–2.0 keV
6 = 0.2-2.0 keV
7 = 2.0–12.0 keV
8 = 0.2-12.0 keV

3.2 How to use

eslewchain runs on a processed event list in the current directory. A typical processing sequence would be:

1. Download the slew datafile (SDF) into a clean directory and point to it with the environment variable SAS_ODF.

2. Run **c**cfbuild and point to the CCF with SAS_CCF

3. Run **o**dfingest

4. Run **e**pproc in a working directory

5. Set the SAS_ATTITUDE environment variable to "RAF".

6. Run *eslewchain* in the directory containing the event file produced by epproc.

3.2.1 Interpreting the results

Slew data is particularly susceptible to problems caused by background flares, low-energy noise and halos around bright sources. For a practical guide of the issues to be aware of when interpreting slew data please see Saxton et al. 2008, A&A 480, 611.

A diagnostic file, P"obsid"PNS003UNFDAT8"nnn".ds, where "nnn" is the subimage number, is produced for each sub image position. This is an unfiltered image, containing events with all energies, all patterns and all flags. In this image, problems due to low-energy noise and optical loading can readily be seen. It is worth checking this image for problems before interpreting interesting features in the scientific images.

3.3 Examples

4 Parameters

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

Parameter	Mand	Type	Default	Constraints
withpng	no	string	no	

Whether to produce .png file versions of each subimage

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.
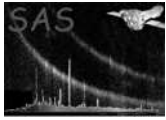
odf *(error)*

The environment variable SAS_ODF must point to the directory which contains the attitude files for the slew which is being processed

evfile *(error)*

The current directory does not contain one and only one slew event file.

TaskFailed *(error)*

The subtask called by the chain has failed

NoFtools *(error)*

The ftools aren't available to eslewchain

SortFailed *(error)*

The 'sort' routine failed

CopyFail *(error)*

Failed to copy file - diskspace problem ?

NoEVFILE *(error)*

evselect failed

EregFail *(error)*

eregionanalyse failed to run to completion

UseRAF *(warning)*

SAS_ATTITUDE should be set to "RAF" when processing slew data
*corrective action:* continue processing

6 Input Files

The input files are those contained in a directory after **odfingest** and an EPIC proc or chain have been run on a slew data file (SDF). In particular the directory must contain:

1. An EPIC event file (only one should be present in the directory).

2. A Raw Attitude File, "rev"_"obsid"_SCX00000RAS.ASC

3. A summary File, "rev"_"obsid"_SCX00000SUM.SAS

7 Output Files

1. EPIC images of name P"obsid"PNS003IMAGE_"b""nnn".ds Where "nnn" is the subimage number and "b" is the energy band:

   1 = 0.2–0.5 keV
   2 = 0.5–1.0 keV
   3 = 1.0–2.0 keV
   6 = 0.2-2.0 keV
   7 = 2.0–12.0 keV
   8 = 0.2-12.0 keV

2. EPIC exposure maps of name P"obsid"PNS003EXPMAP"b""nnn".ds. Only bands 6,7 and 8 are produced.
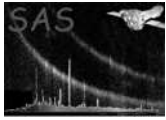
3. Display files of name P"obsid"PNS003IMAGE_"b""nnn".png Only bands 6,7 and 8 are produced.

8   Intermediate Files

1. filtered event files of name P"obsid"PNS003PIEVLI"nnn".ds

9   Algorithm

```
Find an event file in the current directory

Find the time of the start and end of the slew = tbegin and tend
Set tdelta = 45 seconds

for i = 0 to Number_subimages

  tstart = tbegin + i * tdelta
  tstop = tstart + tdelta

  extract an eventfile, largetimefile, from (tstart-tdelta) to (tstop+tdelta)

  Attitude correct largetimefile

  extract an eventfile, timfiltfile, from largetimefile with t between tstart     and tstop

  Find the X,Y range present in timfiltfile = x1, x2, y1, y2

  extract an eventfile, filtfile, from largetimefile in this X,Y range

  Attitude correct filtfile

  Find the X, Y ranges of events in filtfile

  extract images, for each E band, from filtfile with these X,Y boundaries

  create exposure maps for these images (bands 6,7,8)

end loop
```
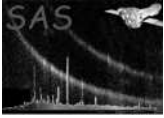
10   Comments

- At points of inflection the interpolation of the attitude curve fails a bit. This produces errors of ~ 1 arcmin at the worst.

- NB: The slew images have very few photons (typically about 100 in half a square degree). To source search these images, the task eboxdetect, should be used with the option *ob-*

smode=slew. Otherwise, a large number of spurious sources will be produced from these images.

11   Future developments

References