eslewchain

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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, MOS	IMAGING

2 Use

pipeline processing	yes
interactive analysis	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 or EPIC MOS cameras.

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 72000 sky pixels (roughly 1 degree) in either the X or Y dimension, depending on the direction of the slew. These mini event files are then attitude corrected to project them onto the local tangential plane and then 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
4 = 2.0–12.0 keV
5 = 0.2-2.0 keV
0 = 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, I"rev"_"obsid"_"ra"_"dec"_wartsnall.ds 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

None

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)*
SAS_ODF environment variable does not exist or data directory invalid

evfile *(error)*
The SAS_ODF directory does not contain an event file. Has the chain/proc been run ?

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 I"rev"_"obsid"_"ra"_"dec"_b"band".ds Where band is the energy band: 1 = 0.2–0.5 keV
   2 = 0.5–1.0 keV
   3 = 1.0–2.0 keV
   4 = 2.0–12.0 keV
   5 = 0.2-2.0 keV
   0 = 0.2-12.0 keV

2. EPIC exposure maps of name E"rev"_"obsid"_"ra"_"dec"_b"band".ds Only bands 0,4 and 5 are produced.

8 Intermediate Files

1. filtered event files of name filt_"X"_"Y".fits

9 Algorithm

```
Find an event file in SAS_ODF

Find the celestial position of the start of the slew

If (X range of event file > Y range) {
   NRANGES = (XMAX - XMIN) / 72000 + 1
else
   NRANGES = (YMAX - YMIN) / 72000 + 1
}

for i=1 to NRANGES

  Calculate the minimum and maximum for the main axis:
   ax1min = (XMIN or YMIN) + 72000 * (i-1)
   ax1max = ax1min + 72000

  find ranges in second axis which have value of ax1 between min and max
  NB: There can be >1 range if the slew doubles back

  for j=1 to Nranges_ax2

     Filter the event file with this X and Y range:
      evselect table=eventfile
               expression=(X in [$x1:$x2])&&(Y in [$y1:$y2])
               withfilteredset=yes filteredset=<filtfilename>

     Attitude correct the filtered event file to the centre pixel:
      attcalc eventset=<filtfilename> refpointlabel=user
      nominalra=<ra> nominaldec=<dec>

     Find the X, Y range of the attitude-corrected event file

     Get the RA, DEC of the centre of the filtered file

     Create an image name stem from the central RA and DEC
      Iname = I<rev><obsid><ra><dec>

     Create an unfiltered image from this event file as a diagnostic:
      evselect table=<filtfilename> imageset=<Iname"_wartsnall.ds">

     Create images in each energy band
      evselect table=<filtfilename> imageset=<Iname"_b1.ds">
               expression=(FLAG==0)&&(PI in [200:500])&&(PATTERN==0)

      evselect table=<filtfilename> imageset=<Iname"_b2.ds">
```

```
                expression=(FLAG==0)&&(PI in [501:1000])&&(PATTERN<=4)

        etc.

       Make exposure maps
        eexpmap imageset=Idel.fits eventset=<filtfilename>
                expimageset=$expb4 $expb5 $expb0",
                "pimin=2000 200 200","pimax=12000 2000 12000"

       Add together 0.2-0.5, 0.5-1.0, 1.0-2.0 and 2-12 keV images to
       make the b0 and b5 images using "farith"

    } End of Second Axis loop
  } End of First axis loop
```

10 Comments

- Slews which are very curved can produce exhorbitantly large images which do not maintain the flat projection and hence contain points with increasingly inaccurate astrometry. This happens in about 1% of slews.
- AT points of inflection the interpolation of the 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). For reasons which are not fully understood the more recent versions of the source detection chain produce a large number of spurious sources from these images. At the moment it is recommended to use SAS 6.1 to source search slew images.

11 Future developments

References