mosspectra

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Abstract

This task processes the cleaned event file output from *espfilt* to produce intermediate files for the creation of model particle background spectra and images by the task *mosback*. This task was originally a perl subtask of the SAS *esas* task named *mos-spectra* prior to SAS-21 and retains all of its functionality.

1 Instruments/Modes

Instrument	Mode
EPIC	Imaging

2 Use

pipeline processing	no
interactive analysis	yes

3 Description

mosspectra processes the cleaned event file output from *espfilt* to produce intermediate files for the creation of model particle background spectra and images by the task *mosback*.

Warning and requirements: *mosspectra* was part of the package *esas*, integrated into SAS. It is now standalone, but (still) limited to work within *esas*' data reduction scheme (c.f. esas cookbook and/or esas flowchart). This is especially true with respect to input files structure and names. In particular, *mosspectra* assumes that other tasks from the package, *espfilt* for filtering and `cheese` for point source exclusion have been successfully run for the exposures to be used. However, modularization post SAS-20 allows user-chosen filenames as optional parameters, with code-derived names that follow the esas schema created if the user chooses not to enter their own filenames.

4 Parameters

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

Parameter	Mand	Type	Default	Constraints
eventfile	yes	dataset		

Event file (cleaned, created by espfilt from emchain output).

cornerfile	no	dataset	default	

Corners-only eventlist (cleaned, created by espfilt from epchain output).

imagefile	no	dataset	default	

Entire FOV image.

expmap	no	dataset	default	

Exposure map in DET coords.

spmask	no	dataset	default	

Mask for calculating SP scaling.

mask	no	dataset	default	

File to mask out point sources (from cheese).

specfile	no	dataset	default	

Spectral file for FOV, full band.

rmffile	no	dataset	default	

Redistribution matrix file (RMF). Will derive if not entered.

arffile	no	dataset	default	

Ancillary Response File (ARF). Will derive if not entered.

keepinterfiles	no	boolean	true	false|true

Keep intermediary files created?

withregion	no	boolean	true	false|true

Provide region text file for evselect expression?

regionfile	no	string	reg.txt	

A selection expression in a text file. The selection expression for the desired region for the generation of the model background spectrum. If no file with the input name exists, or if the file is empty, then the default is to model the data from the entire field of view. If a specific region is desired, the region expression must be in detector coordinates. For example, a file containing `&&((DETX,DETY) IN circle(201,-219,3600))` would extract the central 3′ of the cluster Abell 1795. Note that the leading "`&&`" are required as the selection expression is added to other constraints.

pattern	no	int	12	

CCD event pattern upper limit. Pattern=0 for single pixel events and pattern=4 for two-pixel events. Pattern=0 is recommended when using the lowest energy bands.

withsrcrem	no	boolean	F	false|true

Perform source exclusion?

masksky	no	dataset	default	

SKY coord mask FITS file name.

maskdet	no	dataset	default	

DET coord mask FITS file name.

elow	no	integer	400	0 <= *elow* <= 11999

Energy low limit (in eV) for the band.

ehigh	no	integer	7200	1 <= *ehigh* <= 12000

Energy high limit (in eV) for the band.

ccds	no	boolean	TTTTTTT	false|true

CCDs to be analyzed. Unselected ccds will be masked out.

badpixelresolution	no	16	real	1 <= *badpixelresolution* <= 64

Bad pixel resolution to pass to backscale (higher values lower mosspectra runtime).

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.

Pre42 *(error)*
Observation was before Rev 42. Cannot analyze.

notMOS *(error)*
Input event list INSTRUME must be EMOS1 or EMOS2

zeroEVENTS *(error)*
Input event file has no EVENTS block

noRENAME *(error)*
Failed to rename mask to finished image

notM1M2PN *(error)*
Instrument is not M1, M2, or even PN

noOPEN *(error)*
Cannot OPEN region file, iostat=N

noREAD *(error)*
Cannot READ region file, iostat=N

noREGIONfile *(error)*
Chosen region file does not exist

FastSubWithCCD1 *(warning)*
Fast SUBMODE incompatable with ccd1=T
corrective action: Reset ccds(1)=F, continue

noLUN *(warning)*
Cannot open LUN for text file read
corrective action: Skip region file

noEXPOSURE *(warning)*
Input file does not contain an EXPOSURE attribute
corrective action: continue

noLIVETInn *(warning)*
Input file does not contain a LIVETInn attribute
corrective action: continue

6 Input Files

1. Cleaned event file as processed by *espfilt*.
2. Cleaned corner-only event file as processed by *espfilt*. Auto-derived and/or created by default.
3. Image file as processed by *espfilt*. Auto-derived and/or created by default.
4. Exposure map as processed by *eexpmap*. Auto-derived and/or created by default.
5. Mask as processed by *cheese*. Auto-derived and/or created by default.
6. Full band FOV spectrum. Auto-derived and/or created by default.
7. Mask for calculating SP scaling Auto-derived and/or created by default.
8. Redistribution Matrix File (RMF). Auto-derived and/or created by default.
9. Auxiliary response File (ARF). Auto-derived and/or created by default.
10. Region (text) file for evselect expression.
11. Sky coord mask for evselect expression.
12. Det coord mask for evselect expression.

    Notes: in previous versions of mos-spectra many of the above files were derived from the 'prefix' input parameter. This has changed. A mandatory input event list is entered and the prefix derived from the INSTRUME and EXPIDSTR attributes within that file. All of the other input files have a 'default' as their filename and are thus optional. If the user does not enter a file name it will be

derived from prefix and in most cases, if it does not exist, it will be created with the default name. E.g. if the FOV image is not given on the command line, the filename *mos+expidstr+fovim.fits* will be created, checked for existence, and either used (if clobber not set), or created and overwritten (if clobber is set).

7 Output Files

- `mos[1-2]`*prefix*`-fovt.pi` – The observation data spectrum from the FOV, full band.
- `mos[1-2]`*prefix*`-fovqN.pi` – The observation data spectrum from the selected region from the individual ccds. The ccd number, "`N`" in the file name, runs from 1 to 7 including only the user-selected MOS ccds.
- `mos[1-2]`*prefix*`-fovfwcqN.pi` – The filter-wheel-closed data spectrum from the selected region from the individual ccds. The ccd number, "`N`" in the file name, runs from 1 to 7.
- `mos`*prefix*`-fovfwcimqN*-`*elow*`-`*ehigh*`.fits` – The image of the filter-wheel-closed data from the selected region from the individual ccds for the selected band. The ccd number, "`N`" in the file name, runs from 1 to 7 and the band limits, `elow` and `ehigh` indicate the energy band.
- `mos`*prefix*`-corqN.pi` – The corner spectrum from the observation data from the individual ccds. The ccd number, "`*`" in the file name, runs from 2 to 7.
- `mos`*prefix*`-corfwcqN.pi` – The corner spectrum from the filter-wheel-closed data from the individual ccds. The ccd number, "`N`" in the file name, runs from 1 to 7.
- `mos`*prefix*`.arf` – The ARF file for the `mos`*prefix*`-obj.pi` spectrum.
- `mos`*prefix*`.rmf` – The RMF file for the `mos`*prefix*`-obj.pi` spectrum.
- `mos`*prefix*`-expimt.fits` – The exposure image for the observation data in sky coordinates from the field-of-view for all selected ccds for the total energy band.
- `mos`*prefix*`-expim-`*elow*`-`*ehigh*`.fits` – The exposure image for the observation data from the selected region for all selected ccds for the selected band. `elow` and `ehigh` indicate the band limits.
- `mos`*prefix*`-expimdet-`*elow*`-`*ehigh*`-ccd1.fits` – The exposure image for the observation data from the selected region for ccd #1 for the selected band. `elow` and `ehigh` indicate the band limits.
- `mos`*prefix*`-maskimdet.fits` – The mask image for the observation data from the field-of-view for all selected ccds for the full energy band.
- `mos`*prefix*`-maskimdet-`*elow*`-`*ehigh*`.fits` – The mask image for the observation data from the selected region for all selected ccds for the selected band. `elow` and `ehigh` indicate the band limits.
- `mos`*prefix*`-maskimdet-`*elow*`-`*ehigh*`-qN.fits` – The mask image for the observation data from the selected region for ccd "`N`" for the selected band. `elow` and `ehigh` indicate the band limits.
- `mos`*prefix*`-fovt.pi` – The observation data spectrum from the selected region.
- `mos`*prefix*`-fovimt.fits` – The image of the observation data in sky coordinates from the full field-of-view for all selected ccds for the full energy band.
- `mos`*prefix*`-fovimt-`*elow*`-`*ehigh*`.fits` – The image of the observation data in sky coordinates from the selected region for all selected ccds for the selected band. `elow` and `ehigh` indicate the band limits.

- `mos`*prefix*`-fovim-`*elow*`-`*ehigh*`-qN.fits` – The image of the observation data from the selected region for ccd "`N`" for the selected band. `elow` and `ehigh` indicate the band limits.
- `mos`*prefix*`-fovspimdet.fits` – Image of the selected region in detector coordinates. This image is used in the task *proton-scale*.
- `mos`*prefix*`-fovimdet-`*elow*`-`*ehigh*`.fits` – The image of the observation data in detector coordinates from the selected region for all selected ccds for the selected band. `elow` and `ehigh` indicate the band limits.

8 Algorithm

```
Read in params

set ccddef evselect expression based on ccds chosen by user

set cornerdef evselect expression for corner-only selections

set ccddef(7) evselect expression for chosen-ccds selections

set fulldef evselect expression for full FOV selections

if maskitsky, set maskitsky filename add bkg-reg to selections

if maskitdet, set maskitdet filename add bkg-reg to selections

if withregion open, read region selection from input reg text file

run atthkgen to create atthk.fits unless it already exists

create corner only event file with evselect from cleaned event file

create FOV image file with evselect from cleaned event file

create FOV exposure map with eexpmap from cleaned event file,
atthk.fits, and FOV image

create FOV mask with emask from FOV image

if (withbands) then

 create FOV image in region in selected band (elow-ehigh) with evselect

 create FOV exposure map with eexpmap from cleaned event file

 create FOV mask with emask from FOV image

end if (withbands)

create spectrum from FOV region, run backscale, generate response

create response from FOV spectrum with rmfgen
```

```
create response from FOV spectrum with arfgen

if (withbands) then
 create FOV image in region in selected band (elow-ehigh) with evselect

 create FOV exposure map with eexpmap from cleaned event file

 create FOV mask with emask from FOV image

endif

foreach ccd selected (1-7)
 create spectrum for FOV of region
 backscale spectrum

 create spectrum for corner-only data
 backscale spectrum

 create temp eventlist from corner-only data (temp_events.fits)
 extract cnts and livetimNN

 rm temp_events.fits

 rate = (cnts/livetime)* 100

 rm temp_events.fits

 create temp eventlist from corner-only data (temp_events.fits)
 PI in 500-800
 extract lowe

 rm temp_events.fits

 create temp eventlist from corner-only data (temp_events.fits)
 PI in 2500-5000
 extract hige

 rm temp_events.fits

 rm temp_events.fits

 calculate hardness ratio:
 hard = hige/lowe

 create spectrum from the region from the FWC data
 backscale spectrum

 create spectrum from the corners from the FWC data
 backscale spectrum

 if (withbands) then
  create image of FWC data for the region and the band

  create FWC mask with emask from FWC image
```

```
  mask FWC image with farith

  rename FWC image:
  mv mos1S002-maskim2-350-1100-mask.fits mos1S002-im2-350-1100.fits

  create FWC mask with emask from FWC OOT image

 end withbands
end foreach ccd

rm intermediary files

end mosspectra
```

9 Comments

The original code for this task appeared in the *esas* task 2009-2021 as the perl subtask *mos-spectra*. It was removed from the task *esas*, converted to f95, and modularized as a single task for SAS-21. The *esas* task was removed in SAS-21.

References