binadaptmerge

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Abstract

This task produces binned count rate and count-rate uncertainty images for merged observations using the output of mosaicmerge. This task combines the pre-SAS-21 *esas* tasks *adapt_merge* and *bin_image_merge*. The algorithm is nearly identical, simply combined. It retains the functionality of both original tasks.

1   Instruments/Modes

Instrument	Mode
EPIC	Imaging

2   Use

pipeline processing	no
interactive analysis	yes

3   Description

binadaptmerge produces binned count rate and count-rate uncertainty images for merged observations using the output of the task *mosaicmerge*. For each unmasked and binned pixel, the program will determine the average count rate and the count rate uncertainty. The assumption is that the uncertainty is dominated by the counting statistics and the the systematics of the background modeling.

Warning and requirements: *binadaptmerge* was part of the singular *esas* package integrated into the SAS, but was made a standalone task for SAS-21. It is limited to work within the *esas* data reduction scheme. This is specially true wrt input files structure and names. In particular, *binadaptmerge* assumes that individual observations have been processed and subsequently mosaicked by the task mosaicmerge.

4   Parameters

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

Parameter	Mand	Type	Default	Constraints

elowlist	no	int	350	$0 <= elowlist <= 11999$

Lower energy limits for the energy band in eV

ehighlist	no	int	750	$1 <= ehighlist <= 12000$

Uper energy limits for the energy band in eV

withpartbkg	no	bool	no	T/F

Particle background control, "yes" to subtract the model QPB particle background image.

withspbkg	no	bool	no	T/F

Soft proton background control, "yes" to subtract the soft proton background image.

withswcxbkg	no	bool	no	T/F

Solar wind charge exchange background control, "yes" to subtract the swcx background image.

withmask	no	bool	no	T/F

Apply an additional mask.

mask	no	dataset	mask.fit	

Additional mask image file name.

withbinning	no	bool	yes	T/F

Apply binning?

binfactor	no	int	2	$1 <= binfactor <= 64$

Binning factor (suggested: 1, 2, or 4)

withsmoothing	no	bool	no	T/F

Apply smoothing?

smoothingcounts	no	int	50	$1 <= smoothingcounts <= 100$

Number of counts to accumulate for smoothing.

maskthresh	no	real	0.02	$0.001 <= maskthresh <= 1.$

The scale factor for excluding regions from the smoothing based on a mask image. In the default mode the average exposure is calculated and then any pixel with exposure less than `fraction*average` value is excluded.

fill	no	int	no	0

Number of passes to fill in empty pixels.

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.

eLowsNEeHighs *(error)*
    Number of elow and ehigh values must be equal

noBinNoSmooth *(warning)*
    withbinning=F and withsmoothing=F is an odd choice unless simply combining inputs
    corrective action: continues

badQDP *(warning)*
    QDP output file could not be opened for write
    corrective action: no RADIAL QDP output done

badQDP *(warning)*
    QDP output file could not be opened for write
    corrective action: no SIZE QDP output done

6   Input Files

The count, exposure, QPB, and SP image products from running `mosaicmerge`, following the particular nomenclature used in the esas package, eg.: *mosaic-fovim-350-800.fits* for a mosaicked image with the first band in that spectral range. Binadaptmerge will create filenames based on parameters input, *elow*, and *ehigh*

Valid input filenames derived are, in the case of a prefix being entered, e.g.:

```
binadaptmerge withspbkg=T withpartbkg=T withswcx=T withmask=T
maskfile=mymaskimage.fits elow=400 ehigh=2000
```

All are produced by mosaicmerge:

mosaic-fovim-400-2000.fits
mosaic-expim-400-2000.fits
mosaic-bkgim-400-2000.fits
mosaic-swcxim-400-2000.fits
mosaic-protim-400-2000.fits
mosaic-maskim-400-2000.fits

If entering more then one energy band, the output file will have the form: mosaic-fovim-elow(1)-ehigh(N).fits

where N is the number of bands entered.

7   Output Files

If withsmoothing=T, binadapt creates an adaptively smoothed, exposure corrected, and background subtracted (any selected) image in SKY coords:

merged-adapt-350-1100.fits

A 900x900 Real32 image of the smoothing FWHM:

merged-size-350-1100.fits

Note: both of the above are also binned if withbinning=T

A QDP plot file of the radial profile of the data for the selected energy band (elow and ehigh) of the selected region:

merged-radfilt-350-1100.qdp

A histogram of the smoothing FWHM:

merged-size-350-1100.qdp

If withsmoothing=F, only these binned, exposure corrected, and background subtracted (any selected) images are created:

The binned count rate uncertainty image for the selected energy band (elow and ehigh) of the selected region in SKY coordinates:

merged-sigma-350-1100.fits

and the binned count rate image for the selected energy band (elow and ehigh) of the selected region in sky coordinates:

merged-rate-350-1100.fits

A QDP plot file of the radial profile of the data for the selected energy band (elow and ehigh) of the selected region:

merged-radfilt-350-1100.qdp

8   Algorithm

```
Read parameters.
Derive appropriate input and output filenames.
Foreach band:
 Open all the files:
   Input image, e.g. mosaic-fovim-350-1100.fits
   Input Exposure Map
   Input Mask if applicable
   Input QPB, SP, SWCX Maps if applicable
   Determine counts for each input image
```

```
Endforeach
Bin the data (withbinning=T)
Adaptively smooth the data (withsmoothing=T)
Plot radial profile and size in QDP
Open two new output files
If withsmoothing=T then
 Write adapted and size arrays to output files
else
 Write rate and sigma arrays to output files
endif
Add coord keywords
Close output files.
```

9 Comments

The original code for this task appeared in the *esas* task 2009-2021 as subtasks *adapt_merge* and *bin_image_merge*. They were merged, removed from the task *esas*, and modularized as a single task for SAS-21. The *esas* task was removed in SAS-21.

References