



# emask

January 27, 2025

## Abstract

Creation of detection mask (from exposure images), marking the area on which source searching will be performed.

## 1 Instruments/Modes

Instrument	Mode
EPIC MOS:	IMAGING
EPIC PN:	IMAGING

## 2 Use

pipeline processing	yes
interactive analysis	yes

## 3 Description

Using an exposure image from any of the EPIC instruments, a mask image is constructed, representing the area on the sky which is searched by the source detection tasks. Optionally, circular or (rotated) box regions are excluded from the mask. They are read from a FITS region file which must contain the columns `SHAPE`, `X`, `Y`, and `R` in the extension `REGION`. This format is provided by the SAS task `ds9toxc`. The coordinates in `X`, `Y` must be image pixels. Up to 1000 regions from the region file will be processed. The detection mask is a FITS image containing the integer values 0 and 1, where 1 marks the image area on which source searching will be performed.

## 4 Parameters

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

Parameter	Mand	Type	Default	Constraints
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<b>expimageset</b>	yes	filename	expimage.fits	
Names of exposure images				
<b>detmaskset</b>	yes	filename	detmask.fits	
Name of detection mask file				
<b>detmasktable</b>	no	string	MASK	
Name of detection mask table (may be PRIMARY)				
<b>threshold1</b>	no	float	0.3	[0.0<param<1.0]
Threshold parameter 1: fraction of maximum exposure				
<b>threshold2</b>	no	float	0.5	[0.0<param<10.0]
Threshold parameter 2: threshold for gradient of exposure				
<b>withregionset</b>	no	binary	false	
Read a FITS region file and exclude circular/box regions from the mask				
<b>regionset</b>	no	filename	region.fits	
Name of the FITS region file providing the regions to be excluded				

## 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.

### **ImageMismatch** (*fatal*)

Exposure images from different instruments have different pixel sizes, image sizes, center coordinates (RA, Dec), or north vectors (not yet implemented)

### **FileMismatch** (*error*)

Inconsistent number of input images, instruments, bands, or detector mask(s)

### **MissingParameter** (*error*)

Missing input file name

### **WrongInst** (*error*)

Unknown instrument

### **WrongType** (*error*)

Input image has wrong type

### **ColumnNotFound** (*warning*)

Column X, Y, R or SHAPE missing in region FITS file  
*corrective action:* Ignore region file

### **EmptyTable** (*warning*)

Region table has 0 rows  
*corrective action:* Ignore region file

**TooManyRegions** (*warning*)

Region table has more than 16384 rows

*corrective action:* Truncate region list

**MissingAttribute** (*warning*)

Keyword is missing

*corrective action:* Keyword is not copied to output

## 6 Input Files

1. PPS product (from task **eexpmap**): EPIC exposure image

## 7 Output Files

1. Detection mask (to be used by tasks **eboxdetect**, **esplinemap**, **esensmap**) The detection mask is a FITS image with the same binning as the EPIC FITS images and contains the integer values 0 or 1. By default the mask is written in an extension called MASK.

## 8 Algorithm

Begin subroutine emask

Determine maximum of exposure

Multiply threshold parameters with exposure maximum

Optionally read region file

Loop over image pixels

Set pixels of detection mask to 1 if exposure is above cutoff  
and 0 otherwise.

Set pixels inside excluded regions to 0.

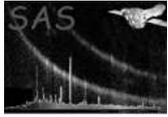
END Loop

Loop over image pixels

Set pixels of detection mask to 0 if gradient of exposure  
is above threshold.

END Loop

End subroutine emask



## 9 Comments

## 10 Future developments

- Add error handling and verbosity control.
- Add capability to operate on multiple exposure maps (see developer notes).

## References