



# emproc

June 2, 2019

## Abstract

Process the EPIC MOS part of an Observation Data File.

## 1 Instruments/Modes

Instrument	Mode
EPIC MOS	IMAGING, TIMING, COMPRESSED IMAGING, COMPRESSED TIMING

## 2 Use

pipeline processing	no
interactive analysis	yes

## 3 Description

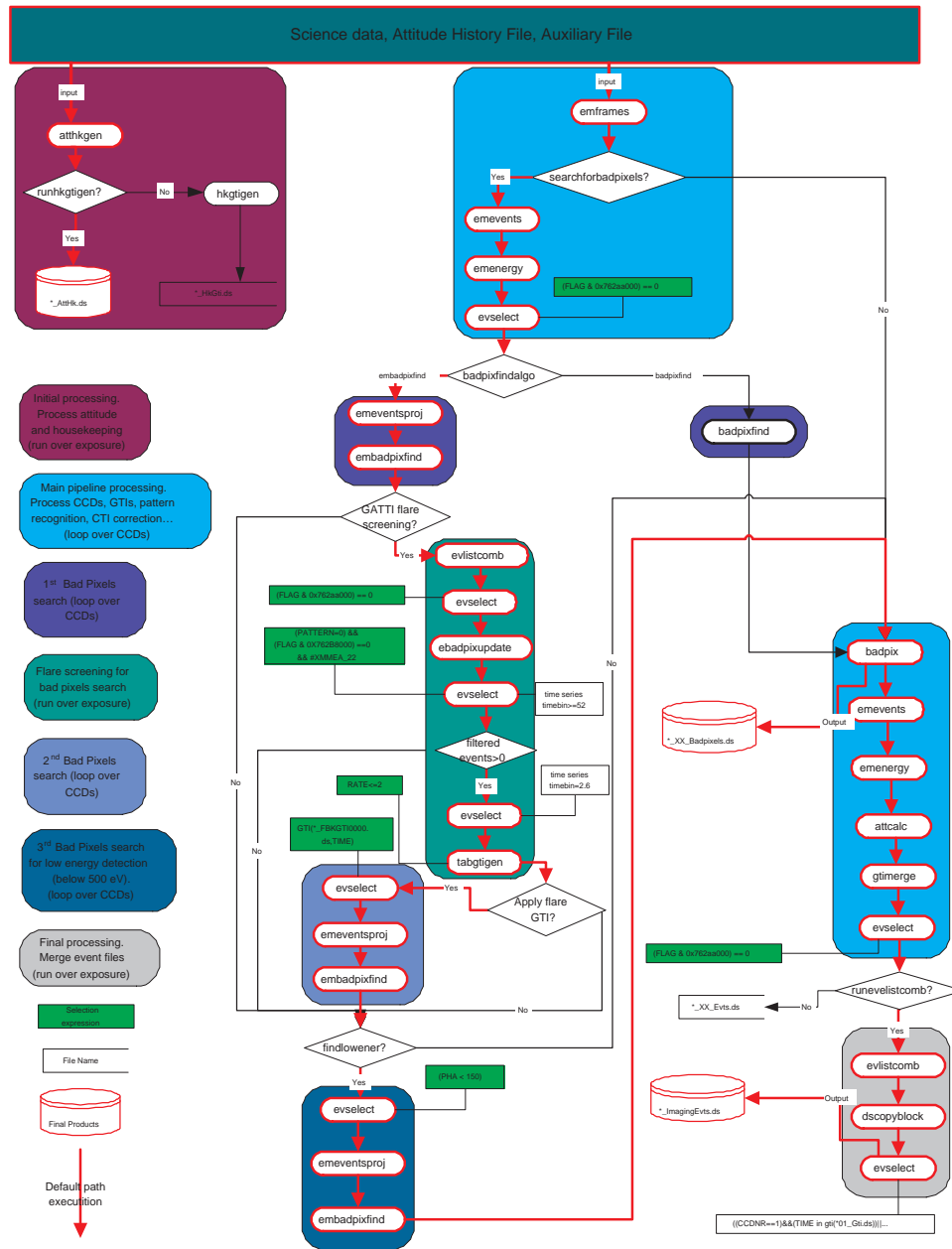
**emproc** is one of the two tasks in the SAS package **epicproc**. Please refer to the documentation in **epicproc** for information on most of the functionality available in **emproc**.

In the following we describe some of the MOS-specific task parameters. These can be found in the parameter dialog box labeled *Details*, but there are a few exceptions to this rule as noted below. The following subsections are titled as the panes in the parameter dialog.

The parameter dialog box is automatically displayed if the task is run from the SAS graphical user interface **sas**. On the command line one can achieve the same effect by typing **emproc -d**. (See also the documentation of package **taskmain**.)

### 3.1 Flow Chart

In the figure 3.1 there is a sketch of the pipeline with all the tasks that **emproc** execute. A default execution of **emproc** can be easily tracked, just simply following the red arrows.



emproc pipeline.

### 3.2 Bad Pixels

**emproc** has a more sensitive algorithm for bad pixels detection which is **embadpixfind** (refer to this task for further information). This task has been developed for finding bad pixels in an EPIC-MOS image in a completely automatic way.

If part of the exposure is affected by flares, this can seriously reduce the power of the bad pixels search (flares act as noise for the bad pixels and make detecting them more difficult). Therefore an intermediate flare screening is necessary (Fig ??). The bright pixels (which can perturb the flare screening) are flagged using **ebadpixupdate**. The resulting files are used to generate Good Time Intervals outside flares. Then the bad pixel search is run a second time on the data outside flares, in incremental mode.



Before applying this flare screening, we check the data quality inspecting the field of view value of each CCD (GATTI flare screening in Fig 3.1). If we obtain a value greater than 3 arcmin, we consider that the flare screening can be applied.

For `embadpixfind` the algorithm is called a third time (incrementally) on energies below 500 eV (and after flare screening), unless `findlowener=N`. This sometimes detects bad pixels more easily, because most appear at low energy.

Parts of the observation can be excluded from the search for bad pixels by giving `emproc` an additional GTI file via the parameters `withbadpixgti` and `badpixgti`.

For instance:

```
emproc withbadpixgti=yes badpixgti=mygti.ds
```

### 3.3 Details

In general there is no need to modify any of the parameters described in this section.

#### 3.3.1 emframes

#### 3.3.2 emevents

The following `emevents` parameters can be altered: `keepsifluor`, `randomizeposition`, `rejectrows`, `maxeventsperror`, and `randomizetime`.

#### 3.3.3 emenergy

The following `emenergy` parameters can be altered: `useccfdarkframe`, `randomizeenergy`, `correctcti`, `correctgain` and `ontimepha`.

### 3.4 Examples

- `emproc selectinstruments=yes emos1=yes`  
Process only the imaging exposures for EMOS1.
- `emproc timing=yes withsrccoords=yes srcra=xxx srcdec=xxx`  
Process also the timing exposures. The source coordinates should be given. (See also the task `emframes`.)

## 4 Parameters

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

Parameter	Mand	Type	Default	Constraints
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<b>selectinstruments</b>	no	b	false	yes	no
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Select one of the cameras?

<b>emos1</b>	no	b	false	yes	no
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Process EMOS1 data

<b>emos2</b>	no	b	false	yes	no
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Process EMOS2 data

<b>removetemporaries</b>	no	b	true	yes	no
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Remove temporary data sets?

<b>removeintermediategtis</b>	no	b	true	yes	no
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Remove intermediate GTI data sets?

<b>removeintermediateeventlists</b>	b	true	yes	no
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Remove the intermediate CCD/node-based event lists?

<b>withinstexpids</b>	no	b	false	yes	no
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Select exposures to process?

<b>instexpids</b>	no	S	'M1S001 M2S001'	
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List of exposures to process.

<b>selectccds</b>	no	b	false	yes	no
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Select the CCDs to process? false = process all CCDs.

<b>ccd1</b>	no	b	false	yes	no
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Process data for CCD 1?

<b>ccd2</b>	no	b	false	yes	no
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Process data for CCD 2?

<b>ccd3</b>	no	b	false	yes	no
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Process data for CCD 3?

<b>ccd4</b>	no	b	false	yes	no
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Process data for CCD 4?

<b>ccd5</b>	no	b	false	yes	no
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Process data for CCD 5?

<b>ccd6</b>	no	b	false	yes	no
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Process data for CCD 6?

<b>ccd7</b>	no	b	false	yes	no
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Process data for CCD 7?

<b>selectmodes</b>	no	b	true	yes	no
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Select the modes to process? false = process all modes.

<b>imaging</b>	no	b	true	yes	no
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Process imaging mode exposure?

<b>rimaging</b>	no	b	true	yes	no
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Process reduced imaging mode exposure?

<b>timing</b>	no	b	true	yes   no
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Process timing mode exposures?

<b>ctiming</b>	no	b	false	yes   no
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Process compressed timing mode exposures?

<b>withgtiset</b>	no	b	false	yes   no
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Use an external GTI dataset to be used when filtering the data?

<b>gtiset</b>	no	e	gti.ds	
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Name of the external GTI dataset to be used when filtering the data.

<b>runhkgtigen</b>	no	b	false	yes   no
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Generate a GTI dataset based on housekeeping?

<b>runatthkgen</b>	no	b	true	yes   no
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Pre-process attitude data through atthkgen?

<b>referencepointing</b>	no	s	object	nominal   object   mean   median   user
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Coordinates of the reference pointing used for the calculation of the sky coordinates

<b>ra</b>	no	u	0.0	$\geq 0.0 - \leq 360.0$
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User-specified right ascension of s/c attitude (deg)

<b>dec</b>	no	u	0.0	$\geq -90.0 - \leq 90.0$
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User-specified declination of s/c attitude (deg)

<b>posangle</b>	no	u	0.0	$\geq -180.0 - \leq 180.0$
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User-specified astronomical position angle of s/c attitude (deg)

<b>filterevents</b>	no	b	true	yes   no
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Filter the event lists?

<b>flagfilteredevents</b>	no	b	false	yes   no
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Flag the events that match the filter expression instead of removing them?

<b>rungtimerge</b>	no	b	no	yes   no
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Merge GTIs from each CCD

<b>applygti</b>	no	b	true	yes   no
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Apply GTI filter to the event lists?

<b>runevlistcomb</b>	no	b	true	yes   no
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Merge CCD-level event lists into exposure-level event lists (by mode)?

<b>searchforbadpixels</b>	no	b	yes	yes   no
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Search for bad pixels?

<b>badpixfindalgo</b>	no	s	embadpixfind	emabadpixfind   badpixfind
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Algorithm for bad pixels

<b>searchforbadcolumns</b>	no	b	true	yes   no
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Look for bad columns?



<b>withbadpixgti</b>	no	b	false	yes   no
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Search for bad pixels only in the given good time intervals?

<b>badpixgti</b>	no	e	bapixgti.ds	
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Good time intervals to use while searching for bad pixels.

<b>thresholdlabel</b>	no	s	rate	peak—rate—counts
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Thresholds choice - as percentage of PEAK, as count RATE or pure COUNTS [!badpixfind]

<b>lothresh</b>	no	r	0.0	$\geq 0.0$
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Low threshold to search for dead pixels [badpixfind]

<b>hithresh</b>	no	r	0.005	$\geq 0.0$
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High threshold to search for hot pixels [!badpixfind]

<b>columnsearchlabel</b>	no	s	median	median—total
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Columnsearch thresholds choice - refer to TOTAL column value or MEDIAN column value [badpixfind]

<b>locolthresh</b>	no	r	0.0	$\geq 0.0$
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Low threshold to search for dead columns [badpixfind]

<b>hicolthresh</b>	no	r	0.002	$\geq 0.0$
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High threshold to search for hot columns [badpixfind]

<b>flickertimesteps</b>	no	i	1	$\geq 1$
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Number of timesteps to search for flickering pixels [badpixfind]

<b>flickerksthresh</b>	no	r	0.55	$\geq 0 - \leq 1$
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K-S threshold for low count flickering pixels [badpixfind]

<b>flickerchisqthresh</b>	no	r	15.0	$\geq 0$
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Reduced Chi-sq threshold for high count flickering pixels [badpixfind]

<b>backgroundrate</b>	no	r	-1	none
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Background rate (ct/s/pix) - if negative, mean over entire field assumed [!badpixfind]

<b>narrowerthanpsf</b>	no	r	3	$\geq 0.0$
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PSF-pixel(s) comparison - 1:equal to PSF,  $\geq 1$ :more compact [!badpixfind]

<b>threshabovebackground</b>	no	b	no	yes   no
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High thresholds as values above background [badpixfind]

<b>loenergythresh</b>	no	r	0	$\geq 0 - \leq 30.0$
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Low energy threshold for searching (keV) [badpixfind]

<b>hienergythresh</b>	no	r	30.0	$\geq 0 - \leq 30.0$
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Hi energy threshold for searching (keV) [badpixfind]

<b>useccfdarkframe</b>	no	b	no	yes   no
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Use dark frame in CCF [emenergy]

<b>randomizeenergy</b>	no	b	yes	yes   no
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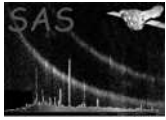
Randomize PHA within one ADU bin [emenergy]



<b>keepsifluor</b>	no	b	no	yes   no
Keep as one event diagonals with Si fluorescence [emevents]				
<b>randomizeposition</b>	no	b	yes	yes   no
Randomize DETX/DETY within one pixel [emevents]				
<b>rejectrows</b>	no	b	yes	yes   no
Throw away rows/frames with too many events [emevents]				
<b>maxeventsperrow</b>	no	i	4	$\geq 1$
Maximum number of events per row/frame [emevents]				
<b>randomizetime</b>	no	b	true	yes   no
Randomize TIME within one frame [!emevents]				
<b>withsrccoords</b>	no	b	no	yes   no
Provide source coordinates (Timing only) [emframes]				
<b>srcra</b>	no	u	0.	none
Source right ascension (J2000) [emframes]				
<b>srcdec</b>	no	u	0.	none
Source declination (J2000) [emframes]				
<b>withparameters</b>	no	b	false	yes   no
Specify explicit list of HK parameters? [hkgtigen]				
<b>parameters</b>	no	S		
List of HK parameters to consider [hkgtigen]				
<b>except</b>	no	b	false	yes   no
Consider all parameters except those specified [hkgtigen]				
<b>withoverrideparameters</b>	no	b	false	yes   no
Specify list of additional parameters? [hkgtigen]				
<b>overrideparameters</b>	no	S		
List of override/additional parameters [hkgtigen]				
<b>findlowener</b>	no	b	yes	yes   no
Additional run of embadpixfind below 500 eV.				
<b>analyzingSciSimdata</b>	no	S		
Set up the configuration to analyze SciSim data with emproc				

## 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.



**SubTaskError** (*warning*)

**emproc** has detected an error from one of the sub-tasks.

*corrective action:* The processing of the current data set is abandoned.

**NoEventListsToMerge** (*warning*)

There are no event lists to merge into an exposure-level data set. This can be caused by errors in some of the tasks. Examine the output of **emproc**. See also the warning **SubTaskError**.

*corrective action:* none

**IntermediateEventListsNotRemoved** (*warning*)

The user set `runevlistcomb` and `removeintermediateeventlists` to true, and the event list combination stage failed. As a consequence **emproc** does not remove the intermediate event lists.

*corrective action:* The intermediate event lists are not removed.

## References