



# convregion

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## Abstract

This task converts region descriptors from RA and Dec coordinates (or X/Y) to DETX and DETY for the individual EPIC detectors. This task is identical to the pre-SAS-21 *esas* subtask *conv\_reg*.

## 1 Instruments/Modes

Instrument	Mode
EPIC	Imaging

## 2 Use

pipeline processing	no
interactive analysis	yes

## 3 Description

*convregion* creates region descriptions in detector coordinates from input regions in RA and Dec. It operates in three modes where 1) FITS region input and output files are used, 2) ASCII file lists of region descriptors are both input and output, and 3) region descriptors for individual regions are input on the command line and output on the screen.

**Warning and requirements:** *convregion* was originally part of the package *esas*, integrated into SAS, but can be used as a general tool.

## 4 Parameters

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

Parameter	Mand	Type	Default	Constraints
<b>mode</b>	no	int	1	$1 \leq mode < 3$

convregion operational mode:



mode=1 – region fits files are both input and output

mode=2 – ASCII files with region parameters are both input and output

mode=3 – command line input of individual region parameters and screen output

<b>inregion</b>	no	string		
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mode=1,2 only, input FITS/ASCII file name

<b>outregion</b>	no	string		
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mode=1,2 only, output FITS/ASCII file name

<b>imagefile</b>	yes	string		
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Filename image in sky coordinates – used to extract observation position angle.

<b>ra</b>	no	real		none
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mode=3 only RA input

<b>dec</b>	no	real		none
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mode=3 only Dec input

<b>shape</b>	no	string	CIRCLE	none
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mode=3 only region shape input, CIRCLE–ELLIPSE

<b>radius</b>	no	real		none
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mode=3 only, shape=CIRCLE radius for circular region input

<b>semimajor</b>	no	real		none
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mode=3 only, shape=ELLIPSE semimajor axis (in arc minutes) for elliptical region input

<b>semiminor</b>	no	real		none
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mode=3 only, shape=ELLIPSE semiminor axis (in arc minutes) for elliptical region input

<b>rotangle</b>	no	real	0	none
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mode=3 only, shape=ELLIPSE rotation angle (in degrees) for elliptical region input

NOTE: depending on the MODE selected, the task will not work if some optional parameters are not given. E.g.s., for mode=3, if an RA/Dec are not given, an error will occur; for mode=1 or 2 if an input FITS or ASCII region file is not given, an error will occur, BUT, if an RA/Dec are given, along with the FITS/ASCII file, they will be ignored with a warning (because the RA/Dec are extracted from the input file).

## 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.

### **Inregion1** (*error*)



Must enter inregion file for mode = 1

**Inregion2** (*error*)

Must enter inregion file for mode = 2

**noInregion3** (*error*)

No inregion file allowed for mode = 3

**noRadius** (*error*)

You must specify a radius for a CIRCLE shape

**noSemimajor** (*error*)

You must specify a semimajor for an ELLIPSE shape

**noSemimmior** (*error*)

You must specify a semiminor for an ELLIPSE shape

**UnsupportedShape** (*error*)

SHAPE value not CIRCLE or ELLIPSE

**noOpenInRegion** (*error*)

Cannot open region file

**noClobber** (*error*)

Out file exists but noClobber is set

**noOpen** (*error*)

Cannot open input or output file

**noRegionExt** (*error*)

In file has no REGION extension

**noMFORM1** (*error*)

Region FITS file does not have MFORM1 attribute

**NotDET** (*error*)

Region file must have MFORM = X,Y not DETX,DETY

**imgNoPAPNT** (*error*)

Input image has no PAPNT attribute

**noINSTRUME** (*error*)

Input image has no INSTRUMENT attribute

**noLUN** (*error*)

Cannot obtain i/o logical unit number

**badFILEread** (*error*)

Cannot read esky2det/ecoordconv output file

**NOdetpos** (*error*)

esky2det did not create temp file detpos.txt

**NOcoords** (*error*)

ecoordconv did not create temp file coords.txt

**notEPIC** (*error*)

Selected detector is not M1/M2/PN

**noRAdec** (*error*)

Unable to parse RA/Dec from coords.txt

**NoRotangCircle** (*warning*)

Do not enter a rotang for CIRCLE  
*corrective action:* default to 0.

**NoMajorCircle** (*warning*)

Do not enter a semimajor for CIRCLE, ignoring  
*corrective action:* Ignores

**NoMinorCircle** (*warning*)

Do not enter a semiminor for CIRCLE, ignoring  
*corrective action:* Ignores

**NoMinorCircle** (*warning*)

Do not enter a radius for ELLIPSE, ignoring  
*corrective action:* Ignores

**not4elements** (*warning*)

Region file DETX DETY not 4 element vector  
*corrective action:* Tries to use what is there

**GT1000Regions** (*warning*)

Maximum number of regions is 1000  
*corrective action:* Uses first 1000

**sky2detNaN** (*warning*)

esky2det result is NaN  
*corrective action:* set to 0.

## 6 Input Files

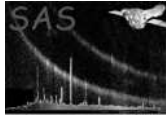
All modes require an input image which is used to extract the position angle of the observation, e.g., for ESAS processing and MOS1 the file mos1S001-fovimt.fits, produced by cheese, can be used.

Mode=1 – a modified FITS region file is used to input the region information. The region file should have the following columns: SHAPE(16A), X(4E), Y(4E), R(4E), ROTANG(4E), COMPONENT (iJ, typically=1). For SHAPE=CIRCLE values, the R is the radius, but for SHAPE=ELLIPSE, the RADIUS is the semimajor and semiminor axes in the 2 elements of that column. Editing of the file can be done with the FITS file viewer fv. The values for the R column should be in arc minutes while the values for the ROTANG column should be in decimal degrees. Deriving these parameters can be done through ds9 and creating the desired regions and then looking at the region information. Currently only circular and elliptical regions are supported. These files are created by cheese and other SAS tasks and if they are created by cheese have the default name form: mos1S002-bkgregtsky.fits.

Mode=2 – an ASCII region file is used to input the region information. The input are in free format with the order of [shape RA Dec Radius] for circular regions and [shape RA Dec Semimajor Semiminor Rotang] for elliptical regions. While these ASCII files contain some of the same information as their FITS mode=1 counterparts, they must not have 'placeholder' extra values as an analog to the 4E vector columns in the FITS versions.

Mode=3 – Input is all on the command line and output is to the screen. Like the mode=2 values, for circular regions enter shape RA Dec Radius as parameters, and for elliptical regions enter shape RA Dec Semimajor Semiminor Rotang.

c.f. XMM ESAS cookbook for examples of each.



## 7 Output Files

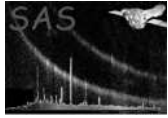
Mode=1 – a FITS region file in detector coordinates which can be used directly in xmmselect or evselect. Note: including data from a list of regions is slightly tricky. For both excluding and including data the “not” should be used for the shape. In this case, the listed regions are excluded if the selection expression is region(outputfile). To include only the data from the listed regions the selection expression is “notted”, i.e., !region(outputfile).

Mode=2 – an ASCII file with the region descriptors in detector coordinates.

All modes: computed values are displayed on screen.

## 8 Algorithm

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Read parameters:
  If mode=3 (command line)
    Read params RA/Dec/Inimage/shape
    if shape=ellipse, read semimajor/semiminor/rotang
    if shape=circle, read radius
  else if mode=2 (ASCII file)
    Read params Inimage/Inregion
    Open ASCII file Inregion
    Read rest of parameters from Inregion
    Open Outregion ASCII file
  else if mode=3 (FITS file)
    Read params Inimage/Inregion
    Open FITS file Inregion
    Read rest of parameters from Inregion
    Open Outregion FITS file (clone of Inregion)
  endif
do i=1,numberOfRegions
  if (mode=1) call ecoordconv to convert X/Y to Ra/Dec
  call esky2det
  read esky2det output temp file, returning detx/dety
  calculate new: Detx/Dety/Radius/Rotang as necessary
  write SHAPE/DETX/DETY/RADIUS/ROTANG/MAJOR/MINOR as necessary
  [write to screen for all, ASCII if mode=2, FITS if mode=1]
end do
if mode=2, close ASCII file
if mode=1, close FITS file
End
```



## 9 Comments

The original code for this task appeared in the *esas* task 2009-2021 as subtask *conv\_reg*. It was removed from the task *esas*, and modularized as a single task for SAS-21. The *esas* task was removed in SAS-21.

## References