convregion

April 16, 2023

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
mode	no	int	1	$1 <= mode < 3$

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

inregion	no	string		

mode=1,2 only, input FITS/ASCII file name

outregion	no	string		

mode=1,2 only, output FITS/ASCII file name

imagefile	yes	string		

Filename image in sky coordinates – used to extract observation position angle.

ra	no	real		none

mode=3 only RA input

dec	no	real		none

mode=3 only Dec input

shape	no	string	CIRCLE	none

mode=3 only region shape input, CIRCLE—ELLIPSE

radius	no	real		none

mode=3 only, shape=CIRCLE radius for circular region input

semimajor	no	real		none

mode=3 only, shape=ELLIPSE semimajor axis (in arc minutes) for elliptical region input

semiminor	no	real		none

mode=3 only, shape=ELLIPSE semiminor axis (in arc minutes) for elliptical region input

rotangle	no	real	0	none

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

```
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