Filter

cifbuild

ccf.cif is produced

Odfingest
log/01odfingest.log
2849_0762870601_SCX00000SUM.SAS is produced

Epchain and emchain
These two steps produce an unfiltered event lists, namely mos1S001-ori.fits, mos2S002-ori.fits,pnS003-oot.fits and pnS003-ori.fits. They will be used for filtering

Extraction criteria:
Pattern

To filter out unwanted events, you do the following:

1) Create lightcurves in a certain energy range, i.e. 2.5-12 keV, or 2.5-8.5 keV using mos1S001-ori.fits. Energies > 2.5 keV well avoid cosmic X-ray background and solar wind contaminations. The lightcurves are in units of count rates per second
2) Bin the lightcurves, the default is 60s.
3) Plot a histogram to see the distribution of count rates per second, then make a gaussian fit.
4) Set criteria for filter, e.g. within 3sigma of the best fit. A text file and a fits file containing the good time interval is written in mos1S001_gti.txt and mos1S001_gti.fits
5) Use the good time interval file in fits format to write the final product for all analysis - mos1S001_clean.fits

Everything is done in LC_filter.py. I am repeating the commands here. Now just do
Python LC_filter.py
And the following are produced:

- mos1S001-LC-2.5-12.0.fits and mos1S001-LC-corn-2.5-12.0.fits

FOV and corner LCs in 2.5-12keV for checking for proton flares. The energies can be changed. After 7 keV, the cluster emission is small, so better include high energies

- mos1S001_gti.txt mos1S001_gti.fits good time interval files containing the filtered event times
- mos1S001_2.5_12.0_gti.png a plot showing the count rate histogram for filter and the binned LCs showing selected and unselected events

- mos1S001_clean.fits the final filtered event list you want

1.Lightcurves creation
Let's create the FOV LCs and corner LCs using the following commands:

FOV LCs

evselect table=mos1S001-ori.fits expression='(PATTERN<=12)&&(PI in [2500:8500])&&((FLAG & 0xfb0000) == 0)&&!((DETX,DETY) in BOX(10167,13005,3011,6575,0))' filtertype=expression rateset=mos1S001_LC_2.5-8.5.fits timecolumn=TIME timebinsize=1 maketimecolumn=yes makeratecolumn=yes withrateset=yes

Corner LCs

evselect table=mos1S001-ori.fits withfilteredset=yes expression='(PATTERN<=12)&&(PI in [2500:8500])&&(((FLAG & 0x766a0f63) == 0)||((FLAG & 0x766a0763) == 0))&&!((DETX,DETY) in BOX(13280,-306,6610,6599,0))&&!((DETX,DETY) in BOX(-13169,-105,6599,6599,0))&&((FLAG & 0x766a0f63) == 0)&&!(((DETX,DETY) in CIRCLE(100,-200,17700))||((DETX,DETY) in CIRCLE(834,135,17100))||((DETX,DETY) in CIRCLE(770,-803,17100))||((DETX,DETY) in BOX(-20,-17000,6500,500,0))||((DETX,DETY) in BOX(5880,-20500,7500,1500,10))||((DETX,DETY) in BOX(-5920,-20500,7500,1500,350))||((DETX,DETY) in BOX(-20,-20000,5500,500,0)))' filtertype=expression rateset=mos1S001_LC_corn_2.5-8.5.fits timecolumn=TIME timebinsize=1 maketimecolumn=yes makeratecolumn=yes withrateset=yes

Here are what they look
FOV_rawLC.png and corner_rawLC.png

2. Lightcurves binning
Bin the LCs in 60s
FOV_binned_LC.png and corner_binned_LC.png

3 and 4. Plot a histogram using the binned LCs and make a gaussian fit,then set a selection criteria for events selection.
I set the fitting range to be the [highest histogrambin/1.4,highest histogrambin*1.4]
In espfilt, it is decided by "rangescale", but I don't know the exact algorithm.
As for the selection criteria, I set it to be 2 sigma.

Here is the histogram, FOV LCs and corner LCs with selection indicated from this program and from mos-filter

mos1S001_2.5_12_gti.png esas_qdp.png

I don't know how they do the binning in the histogram. There is some difference in the good time interval selection between my program and mos-filter but they are mostly the same.
My good time interval file and mos-filter's is mos1S001_gti.txt and mos1S001-gti.txt, respectively.

5.Use the good time interval file in fits format to write the final product for all analysis - mos1S001_clean.fits

To create the final filtered event list (i.e.mos1S001_clean.fits), you need the good time interval generated from the previous steps. But it is in txt format. We need to convert it to fits format. We do the following:

ftcreate colname.lis mos1S001_gti.txt mos1S001_gti.fits extname = "STDGTI" clobber=yes

(Ref: https://heasarc.gsfc.nasa.gov/lheasoft/ftools/headas/ftcreate.html)

Colname.lis contains information of the column name, which has to be created in advance. It is just the following;

START D s
STOP D s

Now the fits good time interval is called mos1S001_gti.fits

Finally, to produce the final product - mosS001_clean.fits, we use the following command:

```
evselect table=mos1S001-ori.fits filteredset=tmp.fit
expression='(PATTERN<=12)&&GTI(mos1S001_gti.fits,TIME)&&(((FLAG & 0x766a0f63)==0)||((FLAG &
0x766a0763) == 0))' filtertype=expression
```

To do: add functions to extract FOV and corner image in esas_commands.***