1.5 Setup for data products

Copy a file */your_data_path*/**pipe/scripts/paraminput** into your */your_data_path*/**pipe/data**/*objname/obsid/* directory and edit the parameters **obsdate** and **pnmode** to match your data. You can find this information by looking at the event file with a fv-tool, typing "**fv PN.FITS.gz**" (keywords **DATE-OBS** and **SUBMODE** in the header)

From now on, the scripts are run at a new location, */your_data_path*/**data** . Copy a file */your_data_path*/**scripts/run_sas.par** there. Edit the keywords to match your data (see Table 1.1). Each line in the files defined as *objnamelist* and *obsidlist* contains the name of the object and observation ID that will be processed in a single run, referred later as *"name"* and *"obsid"*. These files must be located at */your_data_path*/**data**.

Execute "source run_sas.par" after executing "sas" in the beginning of a SAS session.

Table 1.1: Parameters in the "run_sas.par" - file

objnamelist	Name of a file containing a list of the names of the objects
obsidlist	Name of a file containing a list of the names of the observation IDs
outdirname	optional directory under which the data tree will be created, i.e. */your_data_path/data/outdirname/name(*)/obsid(*)/* will be created. If *outdirname* is an empty string, */your_data_path/data/name(*)/obsid(*)/* will be created
pntimebin	PN light curve bin size in seconds
mostimebin	MOS light curve bin size in seconds
lclimcode	code to be added to the name of the light curve limit files
EPICID	which EPIC instruments will be used: P = PN ; M1 = MOS1 ; M2 = MOS2 ; M = MOS ; PM = PN + MOS
detimbinsize	bin size in pixels for the detector map to be used in response generation, 600 often adequate
source_region	Name of the file containing the region definitions (e.g. 'circles.reg')
source_name	Name of the file containing the names of the regions defined in source_region (e.g. circles.name)

Chapter 2

Light curves

2.1 Creating light curves

The Stage 1 of the processing is run by executing

```
run_sas gt10 1
```

where "**gt10**" refers to hard band (>10 keV band) filter and "1" to stage 1. Do not change these! The program creates a directory */your_data_path/***data***/name/obsid* where *"name"* and *"obsid"* are the different lines in the files defined as *objnamelist* and *obsidlist* in the file "**run_sas.par**" .

The program uses SAS routines **"cifbuild"** and **"odfingest"** to organize the calibration information and data files relevant for the observation in hand.

The program performs the basic filtering using a) patterns 0-4 for PN (0-12 for MOS), and b) FLAG==0 filtering to pipeline products.

The program makes sky coordinate (***XY***) and detector coordinate (***DETXY***) images in the 0.8-7.0 keV band (***0870*** with binsize of 60 and 600 pixels. The hard band images are done in >10 keV band (***gt10***). For PN, additionally images are created for the out-of-time events (***oot***) and the out-of-time correction is done to the images.

The program produces light curves in the >10 keV band from the full FOV with time bin size defined as *pntimebin* in the "**run_sas.par**" file. The file has a name **pn_***pntimebin***s_gt10.lc**. The light curve data (time v.s. counts) are printed into ascii files with the above names appended with "**.asc**". Look at the light curve with a **FPLOT** tool (plot **COUNTS** v.s. **TIME**).

2.2 Flare filtering

The XMM-Newton background is highly variable due to solar particle flares. Thus you need to exclude all photons accumulated during such periods when the background exceeds a given level. This can be done by using the light curves created above to produce GTI (Good Time Intervals) files that will later be used to filter the event file. For creating GTI:s, you need to define the lower and upper limits for the light curve values (i.e. number of counts in a bin) a given instrument and band: E>10 keV (keyword *filter* = **gt10**). These values should be placed in a directory

/your_data_path/**data** in files
*lclimcode_pn*__gt10_*xx*__**lim.list** (where xx is "lo" or "up") in case you use only E>10 keV for filtering. Each line in these files corresponds to a pointing defined by keywords *objnamelist* and *obsidlist*. *lclimcode* was defined in the "**run_sas.par**" file. Estimate the limits as ±20% lower and higher than the quiescent level from the plot.

2.3 Good time intervals

Now that you have the "***lim.list**" files, you can proceed by executing the Stage 3 as follows:

```
run_sas gt10 3
```

The program produces GTI files named "**GTI_pn**_*timebinsize*__s_*_*lolim-uplim*__.fits__" where *timebinsize* is set in **run_sas.par**, *lolim* and *uplim* are given by the values in the above lists. You can get an estimate of the useful exposure time that survived the filtering by applying a FTOOLS command **"gtisum"** on the GTI-files. The GTI-files are located at */your_data_path*/**data**/*name/obsid/PN*.