Working with the ASM Data Products

Recipes from the RXTE Cook Book

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When you use ASM data products in a paper or talk, please include the phrase: "results provided by the ASM/RXTE teams at MIT and at the RXTE SOF and GOF at NASA's GSFC."

Introduction

The RXTE ASM Data Products consist of light curves and color files in FITS format for each of the ~ 300 sources in the ASM catalogue. These files can be analyzed using the ftools, or they may be converted to ascii files for analysis by the user's own tools. Light curves and color files are collected for both the Quicklook results derived from the real-time data collected in the SOF, and for the Definitive results obtained through analysis of the processed data by the RXTE ASM team at MIT. The Quicklook products cover only the previous two weeks, and are superceded by the Definitive products, which are updated approximately weekly.

An important feature of the light curves and color files is that because two of the ASM Scanning Shadow Cameras (SSCs) have overlapping fields of view and because data from each camera are analyzed independently, it is often the case that sources may have multiple intensity measurements at the same time. These measurements are, however, independent and may be combined as such.

For further details about how the ASM data are analyzed to produce the light curves, see ***The XTE All Sky Monitor Data Products*** which is available via anonymous FTP as the PostScript file `asm_products_v140.ps`.

Obtaining ASM Data Products

The ASM products are available in either FITS or ASCII format. The latest status of the products is given on the ASM Data Products page.

The **FITS formatted files** are accessible via anonymous FTP from this page in the following subdirectories of **`/xte/data/archive/ASMProducts`**.

- **The Definitive Products** may be found in:
    - **Light curves:** `definitive_1dwell/lightcurves`

- **Colors:** `definitive_1dwell/colors`
- **Pointings:** `definitive_1dwell/supplemental/pointings`

- **The Quicklook Products** may be found in:
  - **Light curves:** `realtime_current/lightcurves`
  - **Colors:** `realtime_current/colors`
  - **Pointings:** `realtime_current/supplemental/pointings`

Direct anonymous FTP access via **legacy.gsfc.nasa.gov** is also available. The FITS formatted files may also be obtained via W3Browse.

ASCII formatted files may be obtained from MIT's ASM Light Curves Overview page. Customized ASCII formatted files may be obtained from the FITS files by using **fdump** or **fv**.

In addition, the most recent data may be obtained in ASCII format from RXTE ASM X-ray Weather Map.

ASM Light Curve files

Plotting Lightcurves

ASM light curve files can be plotted readily using **fplot**, with TIME as the x-axis, RATE as the y-axis, and ERROR as the uncertainties on the intensities. Note that since independent solutions for each SSC are included in the file, there may exist more than one intensity value at a given time. fplot will plot the intensity from each 90 s dwell without any rebinning.

The light curve files may also be used in the Xronos ftools. However, because the Xronos ftools use Truncated Julian Days (TJD = JD - 2440000.5) whereas XTE times are given in Modified Julian Days (MJD = JD - 2400000.5) the first digit of the MJD reference date in the light curve file is truncated. This causes the values on the time axis to be misleading. This can overcome by using the stX option to shift the times.

As an example of plotting an ASM light curve file using the Xronos ftool **lcurve**:

```
> lcurve tunit=3

lcurve 1.0 (xronos5.1)

Number of time series for this task[1]
Ser. 1 filename +options (or @file of filenames +options)[]xa_gx1+4_d1.lc st-935

....
```

Using tunit=3 forces the time axis on the plot to be in days. Using st-9353 reckons the time axis to XTE Mission Days, which start on Jan 1, 1994.

lcurve will compute an unweighted average of any data binned together. Note that because of the

uneven sampling inherent in the ASM light curves, using the negative binning option (e.g. -1) to bin in multiples of the data's inherent binning will not work. If you wish a plot of the unbinned data points, use **fplot**.

Computing Power Spectra

Because the sampling for any particular source is uneven, you may find it difficult to compute the power spectrum using **powspec**, which rejects intervals if many bins are empty. One way to get around this is to use **xronwin** to change the exposure criterion for the interval from its default value of 50 % to something smaller.

```
> xronwin
[T]  Change TIME Windows
[P]  Change PHASE Windows
[F]  Change FLUX Windows
[E]  Change EXPOSURE Windows
[R]  READ an Input file
[S]  SHOW All Defined Windows
[C]  CLEAR All Defined Windows
[W]  WRITE Window file
[Q]  QUIT Window Program
[DS] Define Series Number (Currently 1)
[DB] Define Bin Type (Currently Orig. Bins)
[DE] Define Epoch for Phase Windows (Currently Undefined)
[DP] Define Period for Phase Windows (Currently Undefined)
[DW] Copy Defined Windows from Series to Series
```

First, change the bin type to Interval:

```
Choose an action: db
Current bin type is: Orig. Bins
[O] original bin windows
[N] new bin windows
[I] interval windows
Bin type ( to main menu): i
Current bin type is: Intervals
[O] original bin windows
[N] new bin windows
[I] interval windows
Bin type ( to main menu): <CR>
```

Now redefine the interval exposure criterion:

```
Choose an action: e
Current Exposure Window for series 1, Intervals is:
0.00            50.0
[#] Minimum exposure
[-] Delete this window
<RETURN> to main menu.
Action: 0.0
Input maximum exposure: 25.0
Current Exposure Window for series 1, Intervals is:
0.0             25.0
[#] Minimum exposure
[-] Delete this window
<RETURN> to main menu.
```

Write the result to an output file:

```
Choose an action: w
What should I call your output window file: temp
```

Input the file temp.wi as the window file in powspec.

A preferred means of computing power spectra is to use **perdgrm**, which uses a periodogram method and performs no binning on the light curve. To speed up the processing, you may specify a minimum period to search, instead of using the default value of 0. The units for inminp is the same as the time unit in the file, i.e. days for ASM files.

```
> perdgrm inminp=0.25
Name of FITS file and [ext#][testg.lc] xa_smcx1_d1.lc
Name of output FITS file[testg.ft] xa_smcx1_d1.ft
min & max time ranges for intervals to be analyzed[-]
RMS error of fit for subtracting polynomial[-5]
perdgrm3.6.1 :     866 Instances of duplicate times

>
```

perdgrm counts the number of instances it finds more than one data point occuring at the same time. However, these data points are used in computing the periodogram.

Creating Customized ASCII Files

Customized ASCII formatted files may be obtained from the FITS files by using **fdump** or **fv**. Customarily you will dump the TIME, RATE, and ERROR columns. Other potentially useful columns include SSC_NUMBER (which identifies which SSC the intensity was derived from) and RDCHI_SQ (which gives the reduced chi squared for the fit).

ASM Color files

The ASM color files contain the data from each of three colors for each SSC. The energy bands for the colors are 1.3-3.0 keV, 3.0-5.0 keV, and 5.0-12.1 keV. The color files may be split into separate light curve files using **asmchannel**:

```
> asmchannel
ASMCHANNEL V1.0

Input name of ASM color file:
xa_smcx1_d1.col

writing xa_smcx1_d1_ch1.lc
writing xa_smcx1_d1_ch2.lc
writing xa_smcx1_d1_ch3.lc

all done
>
```

The resulting three files may then be analyzed as light curve files (see above), or may be input to lcurve

to simultaneously plot the three light curves or to create color-color diagrams.

If you have a question about RXTE, please send email to one of our help desks. This page is maintained by the RXTE GOF and was last modified on Friday, 16-May-97 16:09:27 EST.

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