omthlcplot

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Abstract

omthlcplot produces rate plots of the OM tracking star's intensities. The plots can be presented on a single page or on several pages, where the total counts can be binned up as required.

1 Instruments/Modes

Instrument	Mode
OM	IMAGE

2 Use

pipeline processing	yes
interactive analysis	yes

3 Description

omthlcplot reads the OM tracking history FITS file and then plots the intensity of each star as a time series. **omthlcplot** is flexible enough to present each time series on a separate page, on several pages or all the time series may be presented on a single page, specified using the parameter `nplots`. The data can be presented in its original form, or binned up, by a factor given by the user, using the parameter `binsize`.

The input FITS files, such as those that have ben produced by **omthconv**, can contain between 1 and 99 rates columns, with equi-spaced time bins. The bin width is given by the keyword `TIMEDEL` and should be found in the RATES header extension.

Plots give time after `TSTART` (keyword in the FITS file) on the X-axis against count rates on the Y-axis.

omthlcplot allows the user to input the device type (e.g. Xwindow, Postscript, ...) for the output file.

As described in [1], light curves will be rebinned if necessary to limit the number of plotted data points to 500.

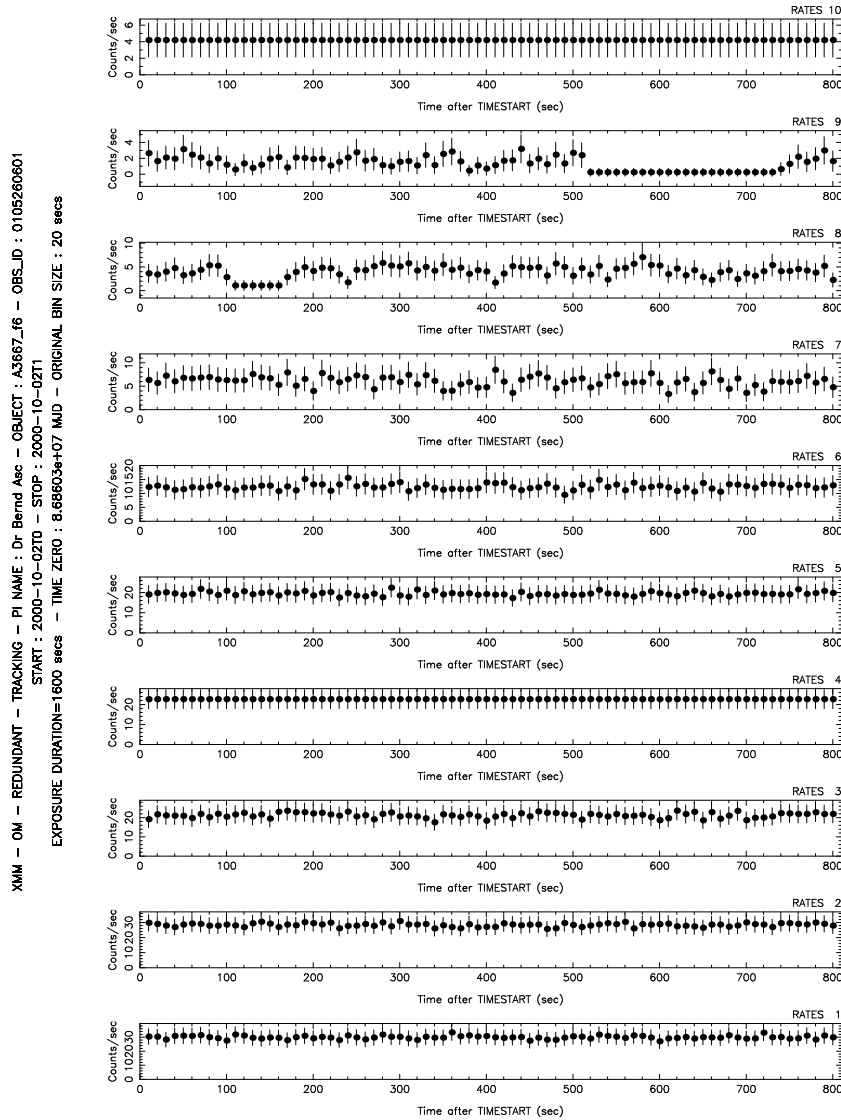A typical output of **omthlcplot** can be seen in Figure 1.

Figure 1: Figure showing a typical output file of **omthlcplot**. In this example 10 OM tracking star rate curves are presented on a single page. Observation and exposure information can be found on the left hand side of the plot and each plot is labelled on the top right hand corner, with the column name.

3.1   Example

To create a postscript plot, called plot.ps, with the intensity of each star as a time series, from the FITS file 'lightcurve.ds', where the counts are binned up by a factor 2, with 10 plots per page, a command such as,

```
omthlcplot set="lightcurve.ds" plotdevice="/VPS" plotfile="plot.ps" binsize=2 nplots=10
```

can be used.

4   Parameters

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

Parameter	Mand	Type	Default	Constraints

set	yes	dataset	No default	

Name of the FITS file containing the time series. Case sensitive.

plotdevice	no	String	"/PS"	Constraint : valid device type

Device for the output. Not case sensitive.

plotfile	no	String	"plot.pdf"	less than 1024 char.

Name of the output file containing the plot. Case sensitive. If the filename is given with the extension ".ps" then both a postscript (created by PGPLOT) and a PDF file (created by Python) will be generated.

binsize	no	Integer	5	Constraint : positive value

Number of bins to be combined and displayed in the plots

nplots	no	Integer	10	Constraint : positive value

Number of plots to be presented on each page

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.

Keyword TIMEDEL missing *(error)*
    The keyword TIMEDEL is missing

Keyword TSTART missing *(error)*
    The keyword TSTART is missing

Keyword TSTOP missing *(error)*
    The keyword TSTOP is missing

Existing output file cannot be overwritten *(error)*
    The output file exists, and cannot be overwitten because the SAS_CLOBBER variable is set to 0

Unavailable default device type and/or output file *(error)*
    Unavailable default device type and/or output file

Input file has null or negative bin width *(error)*
    The keyword TIMEDEL is zero or has a negative value. This must be a positive value and indicates an error in the TIMEDEL value

Unavailable device type and/or output file *(warning)*
    The device type and output file are set to the defaults. In this way, **omthlcplot** can be executed
    corrective action: No corrective action is required, although subsequent executions of the task should use a valid output device type

Data points to plot must not exceed 500 *(warning)*
    Plotting more than 500 data points, results in a very large output file and plots which are over-crowded, hence the number of points are limited
    corrective action: The binsize is automatically increased until the number of points to plot is lower than 500 [1]

Keywords are missing from the input file *(warning)*
    Some header keywords are missing or inconsistent. Key words expected are `TSTART`, `TIMEDEL` and `TSTOP` and the values `OGIP`, `TOTAL`, `LIGHTCURVE`, and `RATE` in the attributes `HDUCLASS`, `HDUCLAS1`, `HDUCLAS2`, and `HDUCLAS2` respectively
    corrective action: A warning is raised and the task tries to proceed

Binning_Factor must be positive *(warning)*
    The binning factor specified by the user, is less than unity. This must be at least unity
    corrective action: The binning factor is automatically set to unity. Future executions of **omthlcplot** should use a binning factor of at least unity

6   Input Files

1. OM FITS Time Series [1] (generated by **omthconv**)

7   Output Files

1. PDF format [1] (Deliverable PPS product)

8   Algorithm

```
Subroutine omthlcplot


    Recover parameters (File names, Device type, Binning factor, Plots
                                            per page, Ouput file)


    Read source time series FITS file :
       Get dataset and table.
       Check important keyword consistency (notably TSTART and TIMEDEL).
       Call an error if necessary.

    Recover all light curves included in the table
    Net source rates are recorded in an array of dimensions: number of
                                        bins * number of light curves.

    Open plot : create view surface in specified device format (check
                                                its validity).

    For each light curve :
       Generate labels to add to the plots, so that all the relevant
```

```
            header information is displayed on the plots page.
      Increase binsize if necessary to limit the number of points to 500.
      Rebin rate data by binsize and generate error columns, where
      the error is the the square root of the RATES values.  The
               errors and the time are also subsequently rebinned.

      Create labelled plot pages separated into the number of
        panels specified by the user, in which time is graduated on
        X-axis (see Comments), and count rates on Y-axis (in counts/sec).

   Release memory.

   Close plot.

End subroutine  omthlcplot
```

9   Comments

- **omthlcplot** is designed to produce plots of light curves measured by the OM. However, any file containing a RATES header extension with 1-99 columns can be plotted with this task.

- If the output file is postscript, the optimum presentation can be achieved using A4 portrait. However, no more than 15 plots per page are recommended as it then becomes difficult to view the individual plots.

- Error rates are rebinned following a quadratic scheme (Central limit theorem).

- Time intervals all have the same length, the first one is [TSTART , TSTART + Binsize*TIMEDEL] where `TIMEDEL` is the bin width read from the file [1].

- We note in [1] that the keyword `TIMEDEL` is specified in MJD. We have assumed it to be given in seconds.

- Time on the X-axis is given, beginning from T-TSTART, in seconds.

- The output devices are those of the PGPLOT library. The device list is governed by the drivers access to PGPLOT. By default these deviced are not used and the output is in PDF format.

9.1   Future developments

- None

9.2   CAL usage

- None

References

[1] Julian Osborne. Data products specifications. Technical Report SSC-LUX-SP-0004, SSC, 2000.