



# omthlplot

November 4, 2014

## Abstract

**omthlplot** 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

**omthlplot** reads the OM tracking history FITS file and then plots the intensity of each star as a time series. **omthlplot** 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 been 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.

**omthlplot** 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 **omthlplot** can be seen in Figure 1.



XMM - OM - REDUNDANT - TRACKING - PI NAME : Dr Bernd Asc - OBJECT : A3667\_66 - OBS\_ID : 0105260801  
 START : 2000-10-02T0 - STOP : 2000-10-02T1  
 EXPOSURE DURATION=1600 secs - TIME ZERO : 8.68603e+07 MJD - ORIGINAL BIN SIZE : 20 secs

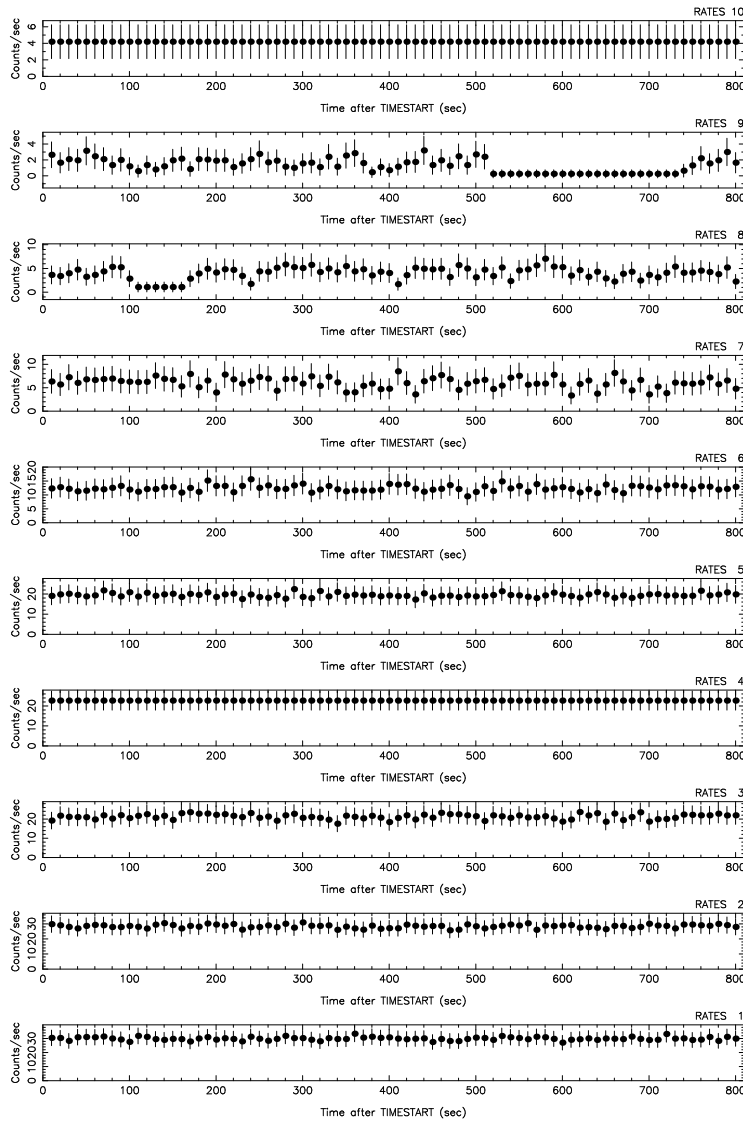


Figure 1: Figure showing a typical output file of `omthlplot`. In this example 10 OM tracking star rate curves are presented on a single page. Observation and exposure information can be found on the left hand side of the plot and each plot is labelled on the top right hand corner, with the column name.

### 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,

```
omthlplot 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
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<b>set</b>	yes	dataset	No default	
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Name of the FITS file containing the time series. Case sensitive.

<b>plotdevice</b>	no	String	"/PS"	Constraint : valid device type
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Device for the output. Not case sensitive.

<b>plotfile</b>	no	String	"plot.ps"	less than 1024 char.
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Name of the output file containing the plot. Case sensitive.

<b>binsize</b>	no	Integer	5	Constraint : positive value
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Number of bins to be combined and displayed in the plots

<b>nplots</b>	no	Integer	10	Constraint : positive value
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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 overwritten 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, **omthlplot** 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



overcrowded, 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 **omthlplot** 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 omthlplot

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 omthlplot

## 9 Comments

- **omthlplot** 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.

### 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.