omichain

February 1, 2016

Abstract

This document describes how to use the **omichain** perl script to reduce **OM IMAGING** mode data, how it works and what output it produces. Some advisory checks on the output are also discussed.

1 Instruments/Modes

Instrument	Mode
OM	Imaging

2 Use

pipeline processing	yes
interactive analysis	no

3 Description

This package contains a PERL script which takes a set of imaging mode OM ODF files in a single directory and processes them in a pipeline to produce OM imaging mode pipeline products. Given a directory with a set of ODF files that conform to the filename specification given in the ODF ICD the PERL script will process the image files and produce output files conforming to the ICD specifications.

4 Running the Omichain

The location of the ODF files to be processed is specified by either setting the environment variable SAS_ODF (setenv SAS_ODF directory_path, c-shell), or by specifying the input directory (omichain inpdirectory=directory path), or by setting the environment variable SAS_ODF to a SAS summary file. For the latter, the omichain will extract the directory path from the SAS summary file. It is a good idea to ensure that the SAS environment variable **SAS_VERBOSITY** is set to 5 (**setenv SAS_VERBOSITY 5**, so that all messages, warnings and errors from the omichain are displayed. It is also useful to redirect the output to a log file (**omichain ..... > & omichain.log &**, c-shell). All ODF files should be in an uncompressed state (otherwise some functions in the omichain won't work properly).

1. Use command 'omichain' to process the ODF data set in the current directory or to where SAS_ODF has been set to, and to place the product files in the current directory.
2. Use command 'omichain inpdirectory=input-directory-path' to process the OM ODF data set in the specified directory, and to place the product files in the current directory. In the following, the term **output file** refers to a file created by one one of the **OM SAS** programs during the running of the omichain. Apart from two files, which are ps (PostScript) and pdf (Portable Document Format) files, all the other output files are **FITS** (Flexible Image Transport System) files.
3. Use command 'omichain outdirectory=output-directory-path' to process the ODF data set in the current directory or to where SAS_ODF has been set to, and to place the output files in the specified directory.
4. Use command 'omichain inpdirectory=input-directory-path outdirectory=output-directory-path' to specify both the location of the ODF data set and the directory where the output files are to be placed.

   Using the default parameter settings the omichain will process all the image files in the data directory. However, if only the images of particular exposures are required to be processed, or the images for particular filters, the parameters **exposures** and **filters**, respectively, can be used to achieve this as follows:

   (a) To specify which filter/filters to process add the parameter **filters="filter1 filter2 ...** to any of the previous commands.

   (b) To specify which exposure/exposures to process add the parameter **exposuress="exposure1 exposure2 ...** to any of the previous commands.
5. To perform source-detection on the mosaiced sky-images add the argument **processmosaicedimages=t** to the command-line.

(In the event that the SAS summary files does not exist, it can be created by running the SAS program odfingest.)

Some of the parameters for individual tasks can be set using the appropriate omichain parameter - the parameter names are the same as the task parameter names, prefixed with the name of the task - **Please see Section 9.0.**

4.1 Decreasing processing time

For **ODFs** with **Engineering 2/4 data** (ie images of dimension 1024x1024 and 2048x2048, respectively), the time taken to process the data may become considerable (in excess of one hour). If time is of importance to you, and you are only interested in the "brighter sources", a considerable reduction in processing time can be achieved by setting the parameter "**omdetectnsigma**" to 2.01. For this setting the algorithms in **omdetect** that search for "faint" sources will be bypassed.

5 OPERATION

The following describes the way that an ODF is processed in the default mode. Figure 1 shows the overall operation of the omichain. It is split up into 3 separate pipelines:

- The tracking-history pipeline that processes the spacecraft tracking-history information for each exposure (as shown in Figure 2).

- The imaging pipline that processes the image from each exposure (as shown in Figure 3).
- The image-stacking and mosaicing pipeline that processes the mosaiced sky-images for each filter (as shown in Figure 4).

5.1 Initial processing

1. The SAS summary file is examined to produce a list of the OM filters that were used in the observation, and for each filter a list of the exposures for that particular filter is also produced.
2. A flatfield (currently a plain flat, with each pixel having the value 1, from the CAL data) is then created by the task **omflatgen**.
3. The chain then scans the input directory to check that the necessary auxilliary files (e.g. tracking history, window files, housekeeping files etc) are present, exiting with an error message if any key files are absent.

5.2 Processing of the data for each filter

The **omichain** cycles through the filters in the filter list and for each one processes each exposure in the exposure list for that filter. The following summarizes the steps taken by the **omichain** in this stage.

1. First it checks to see if the exposure is a full-frame low-resolution mode image (**Engineering 2**), and if so it runs **omcomb** to combine the four separate image segments into a single full-frame image, which is then processed instead of the individual image segments.
2. The tracking-history pipeline (please see Figure 2) is first run to produce tracking history information using **omprep**, **omdrifthist** and **omthconv**.
3. The imaging pipeline (Figure 3) is then run to process the image for this exposure, and the following programs are executed in turn:
   (a) **omprep** - converts the image from **integer** to **real** and adds some key-words to the header.
   (b) **omcosflag** - adds the quality array to the image.
   (c) **omflatfield** - flatfields the image.
   (d) **ommodmap** - attempts to correct for mod-8 patterning.
   (e) **omdetect** - detects sources, computes source positions, source moments (semi-major, minor and position angle), raw and corrected count rates, and sets some flags for each source.
   (f) **omqualitymap** - transfers source quality-flag information from the source-list table to the **QUALITY** image of the image file.
   (g) **ommag** - computes instrumental magnitudes for each source.
   (h) **omatt**. - computes celestial coordinates (Right-Ascension and declination) from the X and Y pixel coordinates and produces a "sky-image". If a USNO catalogue fits file is available, and the parameter **usecat** is set to **true** then it will also correct the astrometry for any offset between the OM and USNO RA and dec axes, adding the columns **RA_CORR** and **DEC_CORR** to the source-list. Details about the catalogue fits file are given in the documentation on **omatt** and **omsrclistcomb**.It should be noted that in the case when the USNO subset catalogue is not available bu the parameter

usecat is set to **true** then the task **omatt** will attempt to generate its own subset of the USNO catalagoe by using the *scat* tool from the package WCSTOOLS, which in this case should be installed on the user's computer.If the package WCSTOOLS is not installed, the task **omatt** will skip aspect-correcting stage of processing and the output image and source lists will remain uncorrected.

5.3 Production of the mosaiced sky-image

When all the exposures for a given filter have been processed, **ommosaic** is used to combine the low-resolution sky-coordinate images into a single image. **ommosaic will only run if there is at least one sky image for the filter.)** Before using an image the **RA** and **DEC** the astrometric corrections computed by **omatt** are applied to the reference pixel coordinates.

5.4 Production of the combined source-list

Finally, when all the data for each filter has been processed, **omsrclistcomb** runs to combine the source lists from separate exposures into a single master list, to compute source fluxes, standard and AB magnitudes, and to set source flags. As for **omatt**, if a **USNO** catalogue fits file is available, and the parameter **omsrclistcombusecat** is set to **TRUE** then it will also correct the astrometry (using the combined source-list) for any offset between the OM and USNO RA and dec axes, adding the columns **RA_CORR** and **DEC_CORR** to the combined source-list. For more details, please see the documentation on **omsrclistcomb**.

The **omatt** computed astrometric offsets are ignored by **omsrclistcomb**. This is because **omatt** cannot always do an astrometric correction (particularly in the UV) and the **OM** pointing is generally very stable during an observation. **Omsrclistcomb** can generally do a more accurate astrometric correction, but those done by **omatt** are useful as a check on the pointing stability.

The parameter **omsrclistcombalignaxes** is used to set the **omsrclistcomb's** parameter **alignaxes** and defaults to **true**. In the default case **omsrclistcomb** attempts to align the **RA** and **DEC** axes of the input source-list files before constructing the combined source-list containing the unique sources from the multiple detections of a unique source. This can improve the astrometry and reduce the chances of erroneous source matches. Once the combined source-list has been formed an astrometric correction will be computed using the sources in the list. **This parameter should only be set to false if the user has a very good reason that it has not worked very well.**

5.5 Processing of the mosaiced sky-images

This functionality was introduced into **SAS 9** to allow source-detection on the mosaiced sky-images. It will only occur if the optional parameter **processmosaicedimages** is set to true (default is false).

The way in which the mosaiced sky-images are processed is shown in Figure 4 and it works in the following way:

1. Loop through each OM filter present and:
   - Run **omdetect** on the mosaiced sky-image file to produce an output **FITS** source-list file. The **SRCLIST** FITS table in this file will contain **RA** and **Dec** coordinates, computed using the WCS keywords in the FITS header. The photometry will have

been done using the mosaiced **EXPOSURE** image in the sky-image file, **and no corrections will have been done for coincidence-losses**.

- Run **ommag** on the source-list file to add instrumental magnitudes to it.
- Run **omqualitymap** to set source-quality flags using the **QUALITY** image in the mosaiced sky-image file.

2. Run **omsrclistcomb**, using these new source-list files (one per filter) as the input files, to produce a second observation source-list file.
3. Run **ommergelists** to create a third observation source-list file from the merging of the first two.

6 Checking the output

When the omichain has finished processing the odf it will list the product files that have been created (product image, source-list and tracking-history files (**all those beginning with P0**). It is a good idea to do some checking of the output and the following are recommended:

- Use **ds9** to view each product image and display the detected sources on the image by selecting the corresponding **region file**. It may be found that some faint sources have not been detected, in which case it may be worthwhile to re-process the data using the **parameter omdetectnsigma set to 1**, or run the task **omsource** to manually select sources.
- Use **fv** to inspect each **product source-list file**.
- Create a region file from the combined source-list file using the task **slconv**, and then use **ds9** to view a mosaiced image and display the sources by selecting the region file.
- Look at the tracking-history plot file- bad tracking may effect the astrometry and photometry.

7 Parameters

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

Parameter	Mand	Type	Default	Constraints
inpdirectory	no	string	current directory	

Path/name of the input files directory

outdirectory	no	string	inpdirectory	

Path/name of the output files directory

comment	no	string	User comment	

User comment to output

filters	no	List of filters		

List of OM filters to be processed

exposures	no	List of exposures		

List of OM exposures to be processed

ommodmapnbox	no	integer	16	

ommodmap - Size of sliding box in units of 8 pixels

ommodmapnsig	no	integer	3	

ommodmap - Significance level for sigma clipping

omdetectnsigma	no	float	2.	1.0:

omdetect - number of σ above background mode required for a pixel to be regarded as being part of a source

omdetectdetectextended	no	boolean	T	

omdetect - Run the algorithm that looks for extended sources

omdetectminsignificance	no	float	3.	1.0:

omdetect- Minimum significance of a source to be included in the source-list file

usecat	no	boolean	T	

omatt - Use the USNO-SA 1 catalog for correcting the star positions

catfile	no	string	usno-catalogue file	usnocat.fits

Name of usno-catalogue fits file

omattrotateimage	no	boolean	T	

omatt - Create the rotated sky-image

omsrclistcombnsigma	no	float	3.0	

omsrclistcomb- Used in source-matching number of σ above which two sources are treated as different

omsrclistcombusecat	no	boolean	T	

omsrclistcomb - Use the USNO-SA 1 catalog for correcting the star positions

omsrclistcombalignaxes	no	boolean	T	

omsrclistcomb - If true (default) omsrclistcomb attempts to align all the images to a common RA/DEC origin.

maxradecerr	no	real	1.0	

Maximum allowed RA/dec error in astrometry fit.

maxrmsres	no	real	1.5	

Maximum allowed rms residual in astrometry fit.

processmosaicedimages	no	boolean	F	

Process the mosaiced sky-images

ommergelistsregionfile	no	string		

Region file name for ommergelists

ommergelistsplotfile	no	string		

File name for ommergelists plot file

ommergeliststolerance	no	float	2.	1.0:10.0

Tolerance (arcsecs) used by ommergelists in source-matching

psfphotometryenabled	no	boolean	F	

Allows using the PSF-photometry method by the task omdetect; If true then sources with close neighbours will have their photometry recomputed using point-spread-function fitting. Please note that in the current version of omdetect this method is under development ansd its use is currently disabled.

backgroundmethod	no	integer	1	1:7

Specifies the method for the point-source background determination by the omdetect task (related the PSF-photometry parameter).

maxrawcountrate	no	float	50.	0.0:

A count-rate shreshold limiting the applicability of the PSF-photometry method in the task *omdetect*.

rawattitude	no	integer	1	0:2

Specifies the usage of attitude data by the task *omprep*: if set to 0, the attitude data is used according to the system variable SAS_ATTITUDe (either RAF or AHF); if set to 1, the raw attitude data (RAF) averaged over the first 20 seconds of exposure are used, if set to 2 then the raw atitude data are used averaged over the entire exposure.

8 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.

Unable to open SAS SUMMARY File *(fatal)*
The SAS summary file (ie the summary file produced by odfingest that contains a summary of the observations and odf data files) could not be opened, probably because it is not located in the directory where **omichain** expected it to be. **The most common reason for this is that the envoronment variable SAS_ODF has not been set properly.)** In the event that this file has been deleted, it can be created using the task **odfingest**.

Task Failure *(fatal)*
There has been a failure in the specified task, preventing the **omichain** from continuing

Unable to open inp_directory *(fatal)*
The specified input directory for the ODF files could not be opened, probably because it has been incorrectly specified

The ODF does NOT contain a Periodic Housekeeping file *(fatal)*
The **omichain** cannot proceed further because it needs to use information from the periodic housekeeping file

The ODF does NOT contain a Non-Periodic Housekeeping file *(fatal)*
The **omichain** cannot proceed further because it needs to use information from the non-periodic housekeeping file

9 Input Files

Except for the **SAS** summary file, which is an ascii file, all the other ones are **FITS** files.

1. rrrr_iiiiiiiii_SCX00000SUM.SAS - SAS summary file- produced by odfingest
2. rrrr_iiiiiiiii_SCX00000NPH.FIT - OM Non-periodic Housekeeping file
3. rrrr_iiiiiiiii_SCX00000PEH.FIT - OM Periodic Housekeeping file
4. rrrr_iiiiiiiii_SCX00000TCS.FIT - Spacecraft time correlation file

5. rrrr_iiiiiiiiii_SCX00000ATS.FIT - Spacecraft attitude history file
6. rrrr_iiiiiiiiii_SCX00000RFX.FIT - Spacecraft priority reference-frame data.

For each exposure to be processed there are also files:

1. rrrr_iiiiiiiiii_OMSeeewwTHX.FIT - OM Tracking History Data Auxiliary file
2. rrrr_iiiiiiiiii_OMSeeewwWDX.FIT - OM Priority Window Data Auxiliary file

where **rrrr** is the 4 digit XMM rev. number, **iiiiiiiiii** is the 10 digit observation id, **eee** is the exposure number (e.g. 006 etc.), and **ww** is the window identifier (00 or 01).

If **THX**-file are not present, no tracking corrections can be applied but this is often not critical since XMM's tracking appears to be good to around 1 arc-second. If **THX** files are absent, a dummy file is created by *omprep*.

10 Pipeline Processing System (PPS) Product Files

Nearly all the product files are in **FITS** file format, with the extension **FIT**, and all begin with the letter **P**. In the following examples of file names, **XX** represents a code for an **OM** filter- **XX=U for U filter, B for B filter, V for V filter, WL for WHITE (unfiltered), W1 for UVW1, M2 for UVM2 and W2 for UVW2**. In what follows, **OSW** stands for **OM** Science Window.

10.1 Flatfield file

1. PPS OSW full-frame Flatfield Image (produced by omflatgen) - eg P00700123700101X000FLAFLD0000.FIT

Please note that the all the pixels of the flatfield image contained in this file have a value of 1.

10.2 Tracking-history files

1. PPS Tracking History plot postscrip file (produced by omdrifthist) - eg P0123700101OMS004TSHPLT0000.ps
2. PPS Tracking History Plot pdf file (produced using ps2pdf) - eg P0123700101OMS004TSHPLT0000.PDF
3. PPS Track Star Time Series (fits file) (produced by omthconv) - eg P0123700101OMS004TSTRTS0000.FIT

Please note that occasionally tracking-history information is unavailable for an exposure and in such cases these files will not be absent.

10.3 Images

1. PPS OSW Image (unrotated, produced by **ommodmap**) - eg P0123700101OMS004IMAGE_1000.FIT
2. PPS OSW Sky-coord Image (rotated, produced by **omatt**) - eg P0123700101OMS004SIMAGE2000.FIT
3. PPS Mosaiced sky-image for each filter (produced by **ommosaic**) - eg P0123920101OMS000RSIMAGXX.FIT

10.4 Source-list files- all FITS format

1. Exposure Source-list (file produced by omdetect, ommag and omatt) - eg P0123700101OMS005SWSRLI2000.FIT
2. Observation source-list file produced by omsrclistcomb using exposure source-list) - eg P0123920101OMCOMBOBSMLI0000.FIT

The following files will only be produced if the parameter **processmosaicedimages** is set to true.

1. Source-list produced from source-detection on mosaiced sky-image - eg P0123920101OMS000RSISWSS.FIT
2. Observation source-list produced by **omsrclistcomb** using mosaiced-detection source-lists - eg P0123920101OMCOMBOBSMOS0000.FIT
3. Observation source-list produced by **ommergelists** - eg P0123920101OMCOMBOBSMER0000.FIT

10.5 Mod-8 corrected image file

Ommodmap produces a **mod-8 corrected** image from the intermediate image produced by **omprep**.

1. **Mod-8 corrected image produced by ommodmap**- eg P0123920101OMS006IMAGE_1000.FIT or P0135720601OMS017FIMAG_V000.FIT

The latter will be produced if **omcomb** has run on **engineering-2 data.**

10.6 Rotated sky images (FITS files)

Omatt produces a rotated sky-image (RA-DEC). The **SAS** task **slconv** can be used to produce a **ds9** region file from the source-list file produced by **omatt**, and then the sky image can be displayed using **ds9** and the sources displayed using the region file. **Ommosaic** produces a sky image, for a given filter, from all the sky-images produced by **omatt** for that filter.

1. Sky image produced by **omatt** - eg P0123920101OMS006SIMAGE1000.FIT
2. Sky image produced by **ommosiac** for a given filter - eg P0123920101OMS000RSIMAGV.FIT

10.7 Source-list files (fits)

Omatt produces the first **product** source-list file, for a given exposure number and window identifier. When all the images have been processed, **omsrlistcomb** produces a combined-source list file by merging all the data in the individual product source lists.

1. Product source-list files produced by **omatt** - eg P0123920101OMS006SWSRLI1000.FIT
2. Product combined source-list file produced by **omsrclistcomb** - eg P0123920101OMCOMBOBSMLI0000.FIT

10.7.1 Region files

A **ds9** region file can be produced from either of these source-list files by running the **SAS** task **slconv**, which can then be used to display the sources when ds9 is used to display a rotated image.

11 Example output from the omichain

The following is an example of a listing of the product files produced by the omichain. The column **Astrometry correction** indicates if a successful astrometry correction was performed (**YES** or **NO**). The observation product files are first listed (apart from the flatfield image file, since all the image pixels are unity), followed by the product files for each filter and then finally tracking-history product files. **If no tracking-history information was available, there will be none of the latter files**.

There can be up to three product observation source-list files:

- If source-detection was only performed on the exposure images (default- **processmosaiced-images=false**), there will only be one observation source-list file (**TYPE EXPOSURES** in the output below).
- If, however, source-detection was also performed on the mosaiced sky-images (**processmosaicedimages=true**) then there will be two more observation source-list files:
  - One obtained from the processing of the mosaiced sky-images (**TYPE MOSAICED** in the output below), and
  - One obtained from the merging of the two previous observation source-list files into one by **ommergelists** (**TYPE MERGED** in the output below).

```
omichain:- ******************************************************
omichain:- Product Files produced by the omichain
omichain:- ******************************************************
omichain:-                TYPE       Observation source-list file       Astrometry correction
omichain:-   1)             MERGED   P0123920101OMCOMBOBSMLI_MER.FIT               YES
omichain:-   2)            MOSAICED  P0123920101OMCOMBOBSMOS0000.FIT              YES
omichain:-   3)           EXPOSURES  P0123920101OMCOMBOBSMER0000.FIT              YES
omichain:- Filter UVM2
omichain:- Mosaiced sky-image=P0123920101OMS000RSIMAGM.FIT, source-list=P0123920101OMS000RSISWSM.FIT
omichain:-                        Image file                  Sky-image file                Source-list file      Astrometry correction
omichain:-   1)   P0123920101OMS011IMAGE_0000.FIT  P0123920101OMS011SIMAGE0000.FIT  P0123920101OMS011SWSRLI0000.FIT               NO
omichain:-   2)   P0123920101OMS011IMAGE_1000.FIT  P0123920101OMS011SIMAGE1000.FIT  P0123920101OMS011SWSRLI1000.FIT               NO
omichain:-   3)   P0123920101OMS505IMAGE_0000.FIT  P0123920101OMS505SIMAGE0000.FIT  P0123920101OMS505SWSRLI0000.FIT               NO
omichain:-   4)   P0123920101OMS505IMAGE_1000.FIT  P0123920101OMS505SIMAGE1000.FIT  P0123920101OMS505SWSRLI1000.FIT               NO
omichain:-   5)   P0123920101OMS506IMAGE_0000.FIT  P0123920101OMS506SIMAGE0000.FIT  P0123920101OMS506SWSRLI0000.FIT               NO
omichain:-   6)   P0123920101OMS506IMAGE_1000.FIT  P0123920101OMS506SIMAGE1000.FIT  P0123920101OMS506SWSRLI1000.FIT               NO
omichain:-   7)   P0123920101OMS507IMAGE_0000.FIT  P0123920101OMS507SIMAGE0000.FIT  P0123920101OMS507SWSRLI0000.FIT               NO
omichain:-   8)   P0123920101OMS507IMAGE_1000.FIT  P0123920101OMS507SIMAGE1000.FIT  P0123920101OMS507SWSRLI1000.FIT               NO
omichain:-   9)   P0123920101OMS508IMAGE_0000.FIT  P0123920101OMS508SIMAGE0000.FIT  P0123920101OMS508SWSRLI0000.FIT               NO
omichain:-  10)   P0123920101OMS508IMAGE_1000.FIT  P0123920101OMS508SIMAGE1000.FIT  P0123920101OMS508SWSRLI1000.FIT               NO
omichain:- Filter UVW1
omichain:- Mosaiced sky-image=P0123920101OMS000RSIMAGL.FIT, source-list=P0123920101OMS000RSISWSL.FIT
omichain:-                        Image file                  Sky-image file                Source-list file      Astrometry correction
omichain:-   1)   P0123920101OMS010IMAGE_0000.FIT  P0123920101OMS010SIMAGE0000.FIT  P0123920101OMS010SWSRLI0000.FIT               NO
omichain:-   2)   P0123920101OMS010IMAGE_1000.FIT  P0123920101OMS010SIMAGE1000.FIT  P0123920101OMS010SWSRLI1000.FIT              YES
omichain:-   3)   P0123920101OMS501IMAGE_0000.FIT  P0123920101OMS501SIMAGE0000.FIT  P0123920101OMS501SWSRLI0000.FIT               NO
omichain:-   4)   P0123920101OMS501IMAGE_1000.FIT  P0123920101OMS501SIMAGE1000.FIT  P0123920101OMS501SWSRLI1000.FIT              YES
omichain:-   5)   P0123920101OMS502IMAGE_0000.FIT  P0123920101OMS502SIMAGE0000.FIT  P0123920101OMS502SWSRLI0000.FIT               NO
omichain:-   6)   P0123920101OMS502IMAGE_1000.FIT  P0123920101OMS502SIMAGE1000.FIT  P0123920101OMS502SWSRLI1000.FIT              YES
omichain:-   7)   P0123920101OMS503IMAGE_0000.FIT  P0123920101OMS503SIMAGE0000.FIT  P0123920101OMS503SWSRLI0000.FIT               NO
omichain:-   8)   P0123920101OMS503IMAGE_1000.FIT  P0123920101OMS503SIMAGE1000.FIT  P0123920101OMS503SWSRLI1000.FIT              YES
omichain:-   9)   P0123920101OMS504IMAGE_0000.FIT  P0123920101OMS504SIMAGE0000.FIT  P0123920101OMS504SWSRLI0000.FIT               NO
omichain:-  10)   P0123920101OMS504IMAGE_1000.FIT  P0123920101OMS504SIMAGE1000.FIT  P0123920101OMS504SWSRLI1000.FIT              YES
omichain:- Filter UVW2
```

```
omichain:- Mosaiced sky-image=P0123920101OMS000RSIMAGS.FIT, source-list=P0123920101OMS000RSISWSS.FIT
omichain:-                        Image file                  Sky-image file                Source-list file      Astrometry correction
omichain:-   1)   P0123920101OMS012IMAGE_0000.FIT  P0123920101OMS012SIMAGE0000.FIT  P0123920101OMS012SWSRLI0000.FIT               NO
omichain:-   2)   P0123920101OMS012IMAGE_1000.FIT  P0123920101OMS012SIMAGE1000.FIT  P0123920101OMS012SWSRLI1000.FIT               NO
omichain:-   3)   P0123920101OMS509IMAGE_0000.FIT  P0123920101OMS509SIMAGE0000.FIT  P0123920101OMS509SWSRLI0000.FIT               NO
omichain:-   4)   P0123920101OMS509IMAGE_1000.FIT  P0123920101OMS509SIMAGE1000.FIT  P0123920101OMS509SWSRLI1000.FIT               NO
omichain:-   5)   P0123920101OMS510IMAGE_0000.FIT  P0123920101OMS510SIMAGE0000.FIT  P0123920101OMS510SWSRLI0000.FIT               NO
omichain:-   6)   P0123920101OMS510IMAGE_1000.FIT  P0123920101OMS510SIMAGE1000.FIT  P0123920101OMS510SWSRLI1000.FIT               NO
omichain:-   7)   P0123920101OMS511IMAGE_0000.FIT  P0123920101OMS511SIMAGE0000.FIT  P0123920101OMS511SWSRLI0000.FIT               NO
omichain:-   8)   P0123920101OMS511IMAGE_1000.FIT  P0123920101OMS511SIMAGE1000.FIT  P0123920101OMS511SWSRLI1000.FIT               NO
omichain:-   9)   P0123920101OMS512IMAGE_0000.FIT  P0123920101OMS512SIMAGE0000.FIT  P0123920101OMS512SWSRLI0000.FIT               NO
omichain:-  10)   P0123920101OMS512IMAGE_1000.FIT  P0123920101OMS512SIMAGE1000.FIT  P0123920101OMS512SWSRLI1000.FIT               NO
omichain:-        Tracking-history time-series file          Tracking-history ps file          Tracking-history pdf file
omichain:-   1)      P0123920101OMS012TSTRTS000.FIT      P0123920101OMS010TSHPLT000.ps     P0123920101OMS010TSHPLT000.PDF
omichain:-   2)      P0123920101OMS509TSTRTS000.FIT      P0123920101OMS501TSHPLT000.ps     P0123920101OMS501TSHPLT000.PDF
omichain:-   3)      P0123920101OMS510TSTRTS000.FIT      P0123920101OMS502TSHPLT000.ps     P0123920101OMS502TSHPLT000.PDF
omichain:-   4)      P0123920101OMS511TSTRTS000.FIT      P0123920101OMS503TSHPLT000.ps     P0123920101OMS503TSHPLT000.PDF
omichain:-   5)      P0123920101OMS512TSTRTS000.FIT      P0123920101OMS504TSHPLT000.ps     P0123920101OMS504TSHPLT000.PDF
omichain:- ************************************************************************
omichain:- Finished running SAS task OMICHAIN V1.48 Tue Mar 31 11:16:56 UTC 2009
omichain:- ***********************************************
```

12 Intermediate Output Files

All intermediate files begin with the letter **I**.

12.1 Exposure Flatfield

One flatfield per exposure is produced by **omflatfield**

1. eg I0123920101OMS006FLATF1000.FIT

Please note that the flatfield image contained in this file will have all pixels set to 1.

12.2 Unrotated image-files (fits)

Omprep produces the first intermediate image file, by converting the **integer** image in a raw image file into a **real** image and adding some keywords to the fits header. **Omcosflag** then adds a **Quality image** to this same file. **Omflatfield** then flatfields this image by dividing it by the master flatfield produced by **omflatgen**.

1. Real image file produced by omprep - eg I0123920101OMS006IMAGE10000.FIT
2. Image file modified by omcosflag - eg I0123920101OMS006IMAGE10000.FIT
3. Image file produced by **omflatfield** - eg I0123920101OMS006IMAGE20000.FIT
4. Image file produced by **omcomb** - eg I0135720601OMS01700E2I.FIT

Please note that the latter image is only produced if there are 3 or 4 engineering-2 exposures.

12.3 Flat-field file

1. Flat-field file produced by **omflatfield** - eg I0123920101OMS006FLATF1000.FIT

12.4 Mod-8 tile image map

1. Mod-8 tile image map produced by ommodmap- eg I0123920101OMS488MOD81000.FIT

12.5 Source-list files (fits)

Two intermediate source-list files are produced for each image- the first is produced by omdetect and then this is modified by ommag (magnitudes are added).

1. Intermediate source-list file produced by omdetect - eg I0123920101OMS006SWSRLI10000.FIT
2. Intermediate source-list file produced by ommag - eg I0123920101OMS006SWSRLI10001.FIT

12.6 Region files (ascii)

A region file is produced by omdetect, and this can be used to display the sources when a sky-image is displayed using ds9.

1. Region file produced by omdetect I0000110101OMS004REGION0000.ASC

12.7 Level-image files (fits)

This image-file is produced by omdetect and the image shows the pixels assigned to each source- the value assigned to each pixel corresponds to the number of the source in the source-list file.

1. Intermediate level-image file produced by omdetect - eg I0123920101OMS493LEVELIMAGE1000.FIT

12.8 Background-image files (fits)

This image-file is produced by omdetect and the image shows the final background map it produced after running the source-detection algorithms.

1. Intermediate background-image file produced by omdetect - eg I0123920101OMS493BCKIMAGE1000.FIT

12.9 Engineering-2 data

1. For engineering-2 mode data, the four image segments are combined into a composite image by **omcomb** (fits file, eg I0135720601OMS01700E2I.FIT) which is then processed in the normal way.

13 Comments

- Pipeline product filenames have the extensions **ps**, **PDF** and **FIT**.

14 Future developments

Presently, the tabulated source positions suffer from an unknown offset in RA and declination, which could be up to 10 arcsecs or more. The program omatt, which calculates the equatorial coordinates of the sources, can in fact calculate these offsets and correct the positions, but only if it has access to a star catalogue. Unfortunately, at present no catalogue is available and hence no correction can be applied. It is hoped that in the near future a catalogue will be provided with each ODF set, enabling an astrometric correction to be made.

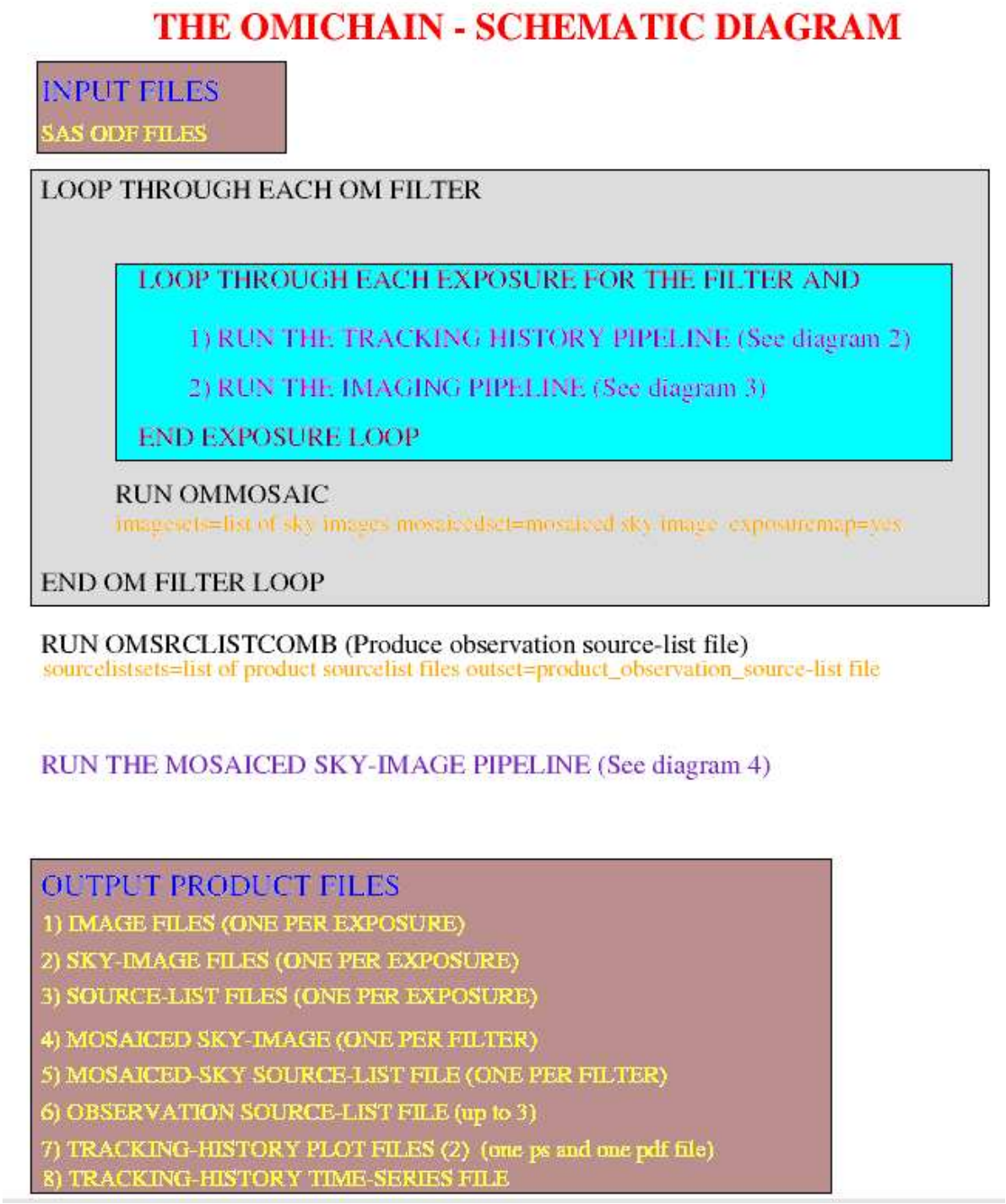

Figure 1: Task sequence of the omichain

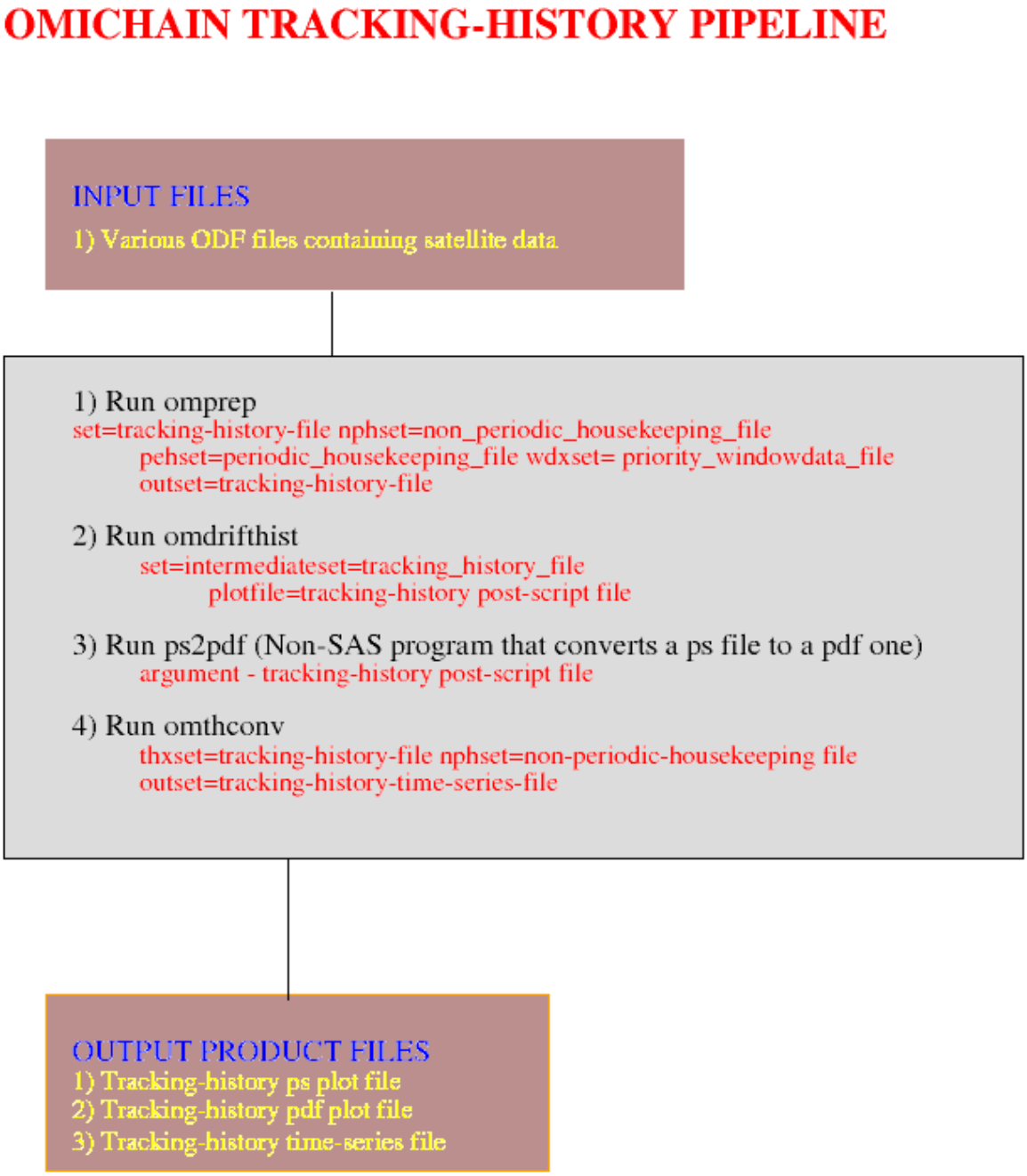

Figure 2: Task sequence of the omichain tracking-history pipeline

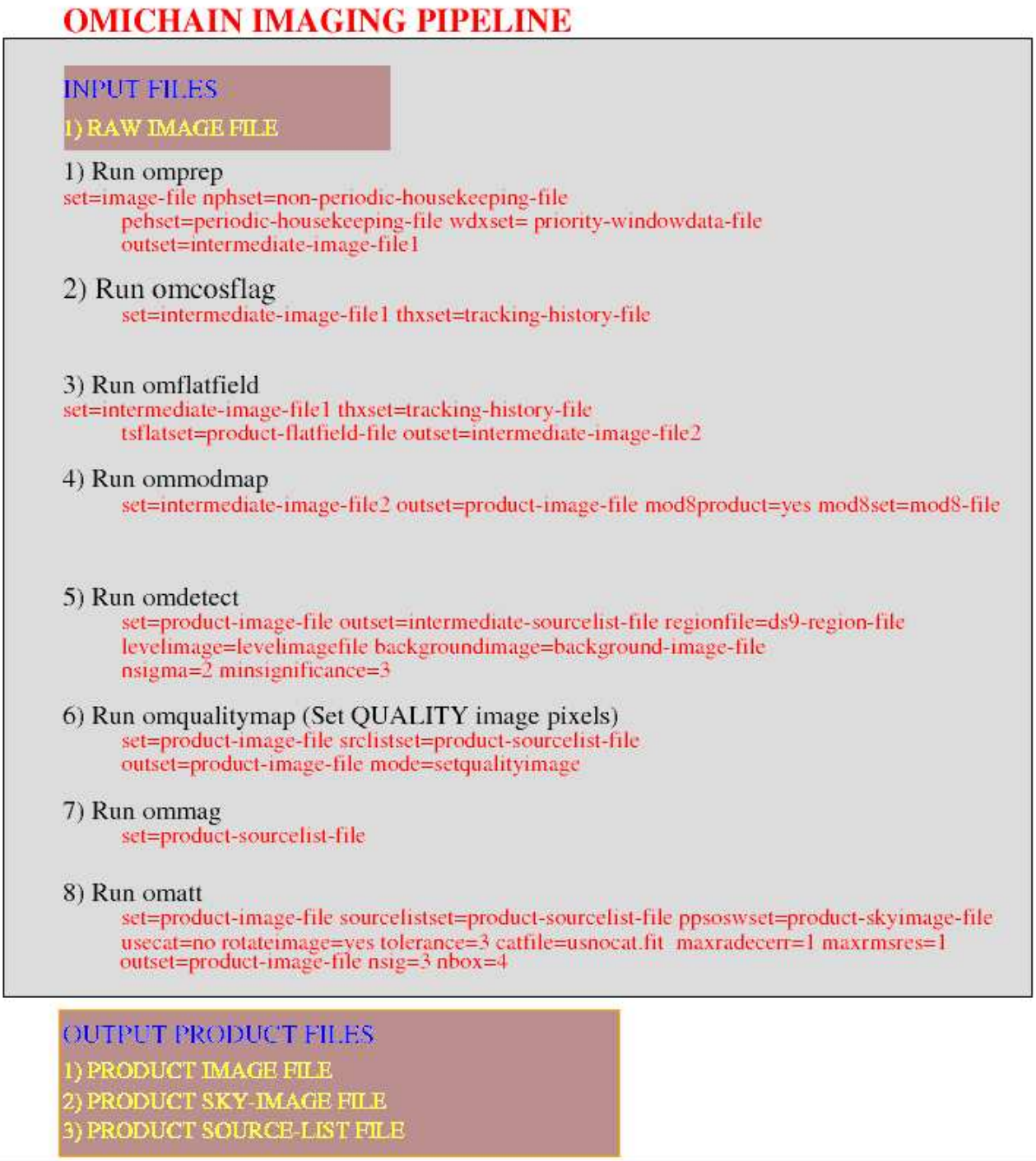

Figure 3: Task sequence of the omichain imaging pipeline

OMICHAIN MOSAICED -IMAGING CHAIN

OBJECTIVE- To increase the detection limiting-magnitude by source-detection on the mosaiced sky images

INPUT PRODUCT FILES

1) Mosaiced sky image (from ommosaic- one per filter)
2) Observation source-list file (from omsrclistcomb)

Stage 1 - For each mosaiced sky-image

1) Run omdetect
set=mosaicedimage outset=mosaicedsrclist nsigma=2 minsignificance=3
outset=mosaicedsrclist

2) Run omqualitymap (set source quality flags)
set=mosaicedimage srclistset=mosaicedsrclist mode=usequalityimage
outset=mosaicedsrclist

3) Run ommag
set=mosaicedsrclistset

Stage 2 - Creating a list of the new sources

1) Run omsrclistcomb
sourcelistsets="mosaicedsrclistset1 ..." usecat=true catfile=usnocat.fits
outset=obssrclist2

2) Run ommergelists
srclist1=obssrclist1 srclist2=obssrclist2
outset=obssrclist3

NEW PRODUCT FILES

1) Source-list file (one per mosaiced sky image)
2) Second observation source-list file
3) Third observation source-list file

Figure 4: Task sequence of the omichain mosaiced-imaging pipeline

References