# omsrclistcomb

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**Abstract**

Combines OSW source list into an observation source list

## 1 Instruments/Modes

| Instrument | Mode |
|---|---|
| OM | FAST |
| OM | IMAGING |

## 2 Use

| | |
|---|---|
| pipeline processing | yes |
| interactive analysis | yes |

## 3 Description

This task takes the output source lists from each OSW (filenames listed in input listFile) and combines them to form the whole-observation source list (outFile), which is the pipeline deliverable product OM observation source list. The OSW source lists will previously have been magnitude calibrated (in the instrumental system, task ommag) and have RA-DEC coordinates (task omatt)

This primarily involves identifying which source is which in each list, combining the positions from each pass-band/exposure to give a best estimate and a refined error, and calculating the optical/UV colours for those sources observed with multiple filters in both the instrumental and standard systems. The magnitudes in the OSW source lists are in the instrumental (natural) system, and a call to the CAL extracts the current colour transformation matrix, which is applied to the instrumental magnitudes to give magnitudes in the standard system. Other information (e.g. quality flags) is also propagated.

A new column (SRC-ID) is added to each OSW source list, containing the observation source list number for the OSW source.

The combined source list is sorted into ascending Right-Ascension order. For sources in a particular colour that the program has identified as being identical (using the parameter nsigma and the position errors of the sources), the average magnitude of the sources is computed using the source fluxes and

weighted by the source fluxes errors. The computed error is the weighted standard-deviation of the flux measurments, converted back to a magnitude.

# 4 Instrumental Magnitudes and Colours

The tabulated magnitudes are those that have been computed by ommag- as mentioned in the previous section, omsrclistcomb will have averaged all the magnitudes from sources that it considers to be the same. Omsrclistcomb uses a colour table that it loops through to see if the relevant instrumental magnitudes (one of U, B, V, UVW2, UVW1, UVW2 and UVM2) are present for the calculation of the instrumental colour. The colour list is :-U-B, B-V, U-V, UVW2-UVW1, UVW2-UVM2, UVM2-UVW1, UVW2-U, UVW2-B, UVM2-U, UVM2-B, UVM2-V, UVW1-U, UVW1-B, UVW1-V

# 5 Standard Magnitudes and Colours

Standard magnitudes can only be computed for the U, B and V filters and hence the only standard colours that can be calculated are U-B, B-V and U-V. An important point to note, is that these standard colours can be computed using the following instrumental colours - U-B, B-V, U-V, (UVW1-U), (UVW1-B), (UVW1-V), (UVW2-B) and (UVW2-V). Omsrclistcomb computes all possible standard magnitudes for each of the U, B and V filters and displays them in a vector column.

The program loops through these colours and if the relevant instrumental magnitudes are present computes the standard magnitudes and standard colour. Since it is possible that a particular source may have a standard magnitude computed twice for the same filter (eg standard B from U-B and B-V), the program will add, if necessary, a column for each of these standard magnitudes. These values should, of course, be identical to within the errors, but discrepancies may arise due to a number of reasons (eg an inaccurate instrumental magnitude).

# 6 Astrometric correction

In a similar fashion to the task **omatt**, if the task parameter **usecat** is set to true, and the parameter **catfile** is set to the name of the fits catalogue file (or it has the default name usnocat.fit), **omsrlistcomb** will attempt to correct the source RAs and Decs in the combined-souce list. If successful, the columns **RA_CORR and DEC_CORR** will contain the corrected RAs and DECs, respectively, the key-word **POSCOROK** will be set to **t** and the key-words **RAOFFSET, RAOFFERR, DEOFFSET, DEOFFERR, ROT_CORR, ROT_ERR, NMATCHES, RMSRESID** will contain the computed RA offset, RA offset error, DEC offset, DEC offset error, rotation, rotation error, the number of sources used in the astrometric fit and the root-mean-square residual of the fit, respectively. If the fit was unsuccessful then **POSCORROK** will be set to **f** and the columns **RA_CORR and DEC_CORR** will be set equal to the uncorrected values.

The user can use the task parameters **maxradecerr** and **maxrmsres** to change the settings that decide if an astrometric fit is okay **POSCORROK=t** or not **POSCORROK=f**.

# 7 General source table layout

In order to reduce the size of the table, some columns are in fact vector columns, which, when the expand button is clicked, display a sub-table. In order to ascertain what each column in a vector column represents, the user should read the comments in the **SRCLIST** header.

The first column in the table is just a reference number. This is followed by astrometric columns - ie columns for the Right Ascension, declination, position error, galactic longitude and galactic latitude.

There then follows a vector column for the computed significance (signal-to-noise) of each source for each of the filters present.

Vector columns for the instrumental magnitudes and colours for each filter, follow.

Vector columns for the standard magnitudes and errors, for each filter, follow. Since the standard colour may be calculated from more than one instrumental colour, all the standard magnitudes that have been computed are given in seperate columns, and the colour that was used in the calculation is given at the end of the label string. Standard colours and errors then follow.

There then follows vector columns for the parameterisation of the shapes of the sources (ie the semi-major and semi-minor axes and the position-angle of the major axis), for eash filter.

Finally, for each filter there are columns for the quality and confusion flags (Please see further below).

# 8 Comments on Individual Table Columns

- **RA** - No correction has been made for the offset between the measured and true pointing direction.
- **DEC** - As above
- **NB The next 2 columns will only be present if the parameter usecat has been set to true**
- **RA_CORR** The corrected RAs computed by comparing the input RAs and Decs with the star-catalogue data
- **DEC_CORR** The corrected Decs computed by comparing the input RAs and Decs with the star-catalogue data **NB if the keyword POSCORROK=f then the values in RA_CORR and DEC_CORR will be identical to those in RA and DEC**

  LII and bII Galactic longitude and latitude computed from the RA_CORR and DEC_CORR columns if **POSCORROK**=true or the **RA** and **DEC** columns, otherwise.

  Source parameters such as count-rates, magnitudes and semi-major axes, are given in sub-tables-eg the column **CORR_RATE** is actually a vector column containing the values for each filter. In order to identify what a particulay column of a vector column contains the user should look at the **SRCLIST** header, where he or she will find comments for each column and additional **COMMENTS** for vector columns
- **M_STD** - The standard magnitudes computed for filter **M** using the allowed colour combinations - NB THE FILTERS FOR ALL COLOURS ARE THE XMM CODES LISTED EARLIER).
- **QUALITY FLAGS** Each source has an associated "quality flag". The flag settings are:
- **Bit set integer value reason**

- **0 1 Source lies above one or more bad pixels**
- **1 2 Source may be affected by a read-out streak**
- **2 4 Source may be affected by a smoke-ring**
- **3 8 Source may be affected by a star diffraction spike**
- **4 16 Very bright source with a strong modula 8 pattern**
- **5 32 Source lies near to another bright source**
- **6 64 Source lies within central enhanced region**
- For example, a source with a bad pixel and lying on or close to a read-out streak would have bits 0 and 1 set and thus have a quality flag of 3.
- **QFLAG** The quality flag for each source in each filter obtained from the input source-lists.
- **QFLAG_COMB** The quality flag for each source in each filter obtained using the combined source-list.
- **CONFUSION FLAGS** Each source has an associated "confusion flag". The flag settings are:
- **Bit set integer value reason**
- **0 1 Point source has one or more sources within a radius of 6-12 unbinned pixels**
- **1 2 Point source has one or more sources within a radius of 3-6 unbinned pixels**
- **2 4 Source lies near to an edge of the image**
- **3 16 Point source lies partly or totally within an extended region**

# 9 Parameters

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

| Parameter | Mand | Type | Default | Constraints |
|---|---|---|---|---|
| **sourcelistsets** | yes | string | none | |

comma separated list of OSW source lists

| | | | | |
|---|---|---|---|---|
| **outset** | yes | string | none | |

name of output PPS product OM observation source list

| | | | | |
|---|---|---|---|---|
| **nsigma** | no | real | 3.0 | |

number of $\sigma$ above which two sources are treated as different

| | | | | |
|---|---|---|---|---|
| **usecat** | no | boolean | F | |

Attempt to do the astrometry correction using the usno catalogue data.

| | | | | |
|---|---|---|---|---|
| **plotoffsets** | no | boolean | F | |

Plot the computed RA/DEC offsets - currently disabled

| | | | | |
|---|---|---|---|---|
| **catfile** | no | string | usnocat.fit | |

name of the USNO catalogue fits

| | | | | |
|---|---|---|---|---|
| **maxradec** | no | real | 1.0 | |

Maximum allowed RA/dec error in the computed astrometric offsets

| | | | | |
|---|---|---|---|---|
| **maxrmsres** | no | real | 1.5 | |

Maximum allowed rms residual in the computed astrometric offsets

# 10 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.

**Could not allocate memory for : name** *(fatal)*
Memory for an array could not be allocated

**Failed to release memory for : name** *(warning)*

*corrective action:* Memory for an array could not be deallocated

**two sources matched in same OSW** *(warning)*
warn user and use nearest source
*corrective action:*

**colExist** *(warning)*

*corrective action:* The source-ID column already exists in one of the input source-list files

# 11 Input Files

1. OM OSW source lists (produced by omatt). These files have an extra column added by omsrclistcomb.

# 12 Output Files

1. PPS product OM observation source list

# 13 Algorithm

```
subroutine omsrclistcomb


Read in all OSW source lists


Collate all sources into a main list

For each source in the list, i

  if this source has not been identified with other sources
         list-of-same-sources(1) = i
         no-of-same-sources = 1
   endif

   Loop over all other sources in the main list, j

          if ( i /= j) then

          If the position of source i is the same as position of source j
          (to within  tolerance nsigma and systematic error) then

                no-of-same-sources++
                list-of-same-source(no-of-same-sources) = j

          Endif
   End loop

   Loop over same sources list, m

      Loop over rest of same source list, n

         if source m and n are in the same OSW

             flag as being in the same OSW

         endif
      end loop
   end loop

   Loop over sources in same OSW

        use nearest source and delete others from list_of_same_sources

   end loop
```

```
   now we have a list of sources that are the same


end for

create an index array giving the order of the sources in increasing
Right-Ascension.


create a matrix of magnitudes containing n independent sources and m filters

set matrix to NaN

Loop over all independent sources

   find weighted mean of source position

   For each filter

     if source has been observed in filter more than once
        find mean position and magnitude.
     endif

     add entry to magnitude matrix

   end for

end loop


Loop over matrix

    compute colours in standard system from CAL colour transformation
    matrices

end loop


define possible colours (mag1-mag2) e.g. (B-V) and (U-B) etc

for each colour combination

      if ANY(matrix(mag1) /= NaN) and ANY(matrix(mag2) /= NaN) then
           compute colour and error
       endif

endfor


for each independent source

  Convert any undetermined (eg standard magnitude, colour) parameter value
  to NULL and then insert the source information at its correct Right-Ascension
  position in table.
```

```
Endfor

add a SRC-ID column to each OSW source list
for each OSW source
 write the appopriate source number from the observation source list
endfor

end subroutine omsrclistcomb
```

## References