ompsfprofile

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Abstract

Program for computing the OM point-spread function from one or more OM images.

1   Instruments/Modes

Instrument	Mode
OM	IMAGING

2   Use

pipeline processing	no
interactive analysis	yes

3   Description

This program computes a stellar point-spread function profile from **OM** product images and source-list files. If there are more than one images, a mean profile is computed from the profiles computed for each image.

Stellar profiles are computed using images and source-list files of a given **OM** filter and binning factor (2=low-resolution or 1=high-resolution). Only isolated sources are used to compute the profiles and the user can also specify the minimum and maximum significances of the sources to be used. For each computed profile the full-width at half-maximum will be computed.

The program can be given a list of images to be processed in which case all the image files for the given filter and binning factor will be used. Alternatively, the program can be given a list of directories to process in which case a mean stellar-profile will be computed for each directory and also for all directories.

Graphs of the computed profiles are produced using **pgplot** and stored in the file specified through the parameter **plotfile**. A **FITS** 2-d image of the computed profile can also be produced.

A FITS-file with the tables containing individual source profiles, as well as the average PSF-profile is generated.

4 Parameters

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

Parameter	Mand	Type	Default	Constraints
imagesets	no	string		

List of OM product image files

| **srclistsets** | no | string | | |

List of OM product source-list files

Please note that the ordering of the files is important- each source-list file in the list should correspond to the image file at the same position in the list

| **psfset** | no | string | | |

Name of the output image file to store the computed average psf image

| **psfprofileset** | no | string | ompsfprofile.fit | |

Name of the output FITS file to store PSF profiles of individual sources

| **directorylist** | no | string | | |

List of directories to process.

| **filter** | no | string | V | |

Name of the OM filter

| **plotfile** | no | string | ompsfprofile.ps | |

Name of the plot file for the source-variability graphs

| **binning** | no | integer | 2 | 1-2 |

Binning factor of images to be used

| **minsignificance** | no | real | 6 | 02– |

Minimum significance of a source to be used for computing the mean psf.

| **maxsignificance** | no | real | 50 | 02– |

Maximum significance of a source to be used for computing the mean psf.

cumulativetype	no	integer	1	1-2

To allow two different methods of calculating the cumulative counts in the curve of growth.

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.

Could not allocate memory for: *name (fatal)*
> Memory allocation for the named allocatable array failed – report this problem

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

> *corrective action:* Memory deallocation for the named allocatable array failed – report this problem

FileNotFound: *name (warning)*

> *corrective action:* Failed to find a file containing a source-list corresponding to the image to process – please, check whether the source-list file is present in the input data folder; if not, run the task *omdetect* on the input image in order to generate the required source-list;

SkippingFile: *name (warning)*

> *corrective action:* Skipping the image file for which a source-list was not found – see the corrective action above;

No profiles were computed *(warning)*

> *corrective action:* No output results were produced because either OM images or source lists for the given filter were not found in the current directory – please, check whether the input list for the image and source-list files contain the data corresponding to the OM-filter indicated by the parameter *filter*.

6   Usage

- **ompsfprofile filter=V binning=2 minsignificance=20 maxsignificance=50** – processes the V-band low-resolotion image files in the current directory using sources with significances between 20 and 50.

- **ompsfprofile filter=V psfset=psfimage.fits binning=2 minsignificance=20 maxsignificance=50** – processes the V-band low-resolotion image files in the current directory using sources with significances between 20 and 50 and produces an image representing the mean point-spread function.

- **ompsfprofile filter=V psfset=psfimage.fits binning=2 minsignificance=20 maxsignificance=50 plotfile=psfprofile.ps** – processes the V-band low-resolotion image files in the current directory using sources with significances between 20 and 50 and produces an image representing the mean point-spread function. The graphs are stored in file psfprofile.ps

- **ompsfprofile directorylist="test1 test2 test3" filter=V binning=2 minsignificance=20 maxsignificance=50** – processes the V-band low-resolotion image files in the directories test1, test2 and test3 using sources with significances between 20 and 50.

- **ompsfprofile** – processes the images in the current directory using the default parameter values (filter=V, binning=2, minsignificance=6, maxsignificance=50, psfprofileset=ompsfprofile.fit, plotfile=ompsfprofile.ps)

7   Input Files

1. List of OM product raw image files (those produced by **ommodmap**

2. List of OM product source-list files (those produced by **omdetect Please note that this list will only be used if there is a list of image files. Each file in the list has to correspond to the image file at the same position in the list.**

8   Output Files

1. **FITS** 2D image file of the computed psf image (optional)

2. **Post-script** plot file containing 1D averaged radial profiles of the stellar images.

3. **FITS** table containing 1D radial profiles for individual sources, as well the averaged PSF profile for the given image or a set of images

9   Algorithm

9.1   using the list of images in parameter imagesets

If the list of images in the parameter **imagesets** is not empty then the images in each of the directories in the list are processed (**please see sub section image processing**). After the images in a given directory are processed a mean point-spread function profile is computed and also its full-width at half-maximum value.
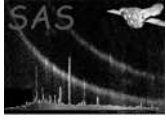
Having processed all the images in all the directories a mean point-spread-function profile is computed from all the mean profiles from each directory.

9.1.1 Image processing

The source parameters for each source in the product source-list file for the image (produced by **omdetect**) are loaded into memory. Any source with either a source-extension flag of 1, a confusion flag greater than zero, a significance no less than the value specified by the parameter **minsignificance** and no greater than than the value specified by the parameter **maxsignificance** and not less than a distance of 14 unbinned pixels from the edge of an image is discarded.

The list of useable sources is then looped through and for each one the mean counts in an circle of given radius is computed and the mean backghround subtracted using an annulus region. The list of background-subtracted counts versus radius is normalized to unity at a radius of zero.

A list of background-subtracted counts versus radius from the centre of the source is thus produced.

9.1.2 Outlier rejection

The outlier rejection algorithm makes use of a robust estimate of the data spread, Sn, computed using the formula

$$Sn = cn \times 1.1926 \times LOMED_i HIMED_i \mid x_i - x_j \mid$$

given in [Rousseeuw, P.J. and Croux, C. (1993), "Alternatives to the Median Absolute Deviation," Journal of the American Statistical Association, Vol. 88, 1273-1283].

Three iterations of this calculation are performed, in each of which the median of the data and the Sn value are computed. Data with an absolute deviation from the median of more than 2.0 times Sn are rejected.

9.1.3 Two methods of calculating the cumulative curve of growth

The task makes use of two possible methods for calculating the cumulative source counts (curve of growth) parameterised by the distance from the source centre. The switching between the two methods is controlled by the task integer parameter *cumulativetype*. The accepted valued of this parameter are 1 and 2, the first one being the default value. With *cumulativetype=1*, the number of counts in a circle with a radius equal to the distance from the source centre is calculated using the image pixels at the edge of this circle. With *cumulativetype=2* the calculation is done straightforwardly by summing the pixel counts inside of the circle.

10   Example of output graphs

Figure 1 shows the mean V-band stellar profile (black line) computed using the product **OM** images from observation 0123920101 (BPM 16274). The blue line is the computed fraction of total counts and the green one that obtained using the function CAL_omPsfEncircledEnergy, which is a subroutine in the XMM Science Analysis System (SAS) that computes the fraction of energy that is contained in a circle

of a given radius centred on a source using data stored in a XMM calibration file. Note that as well as this plot, **ompsfprofile** produces a similar one for each image file.

The command-line to produce this plot was:

ompsfprofile directorylist=/opt/data/ssco2/odf/cycle_0081.

The default filter (V) and binning factor (2, i.e. low-resolution) were used in this case. This directory contained the proceed OM images for the observation 0081_0123920101. The same could have been accomplished by going to the directory /opt/data/ssco2/odf/cycle_0081 and simply typing **ompsfprofile**.
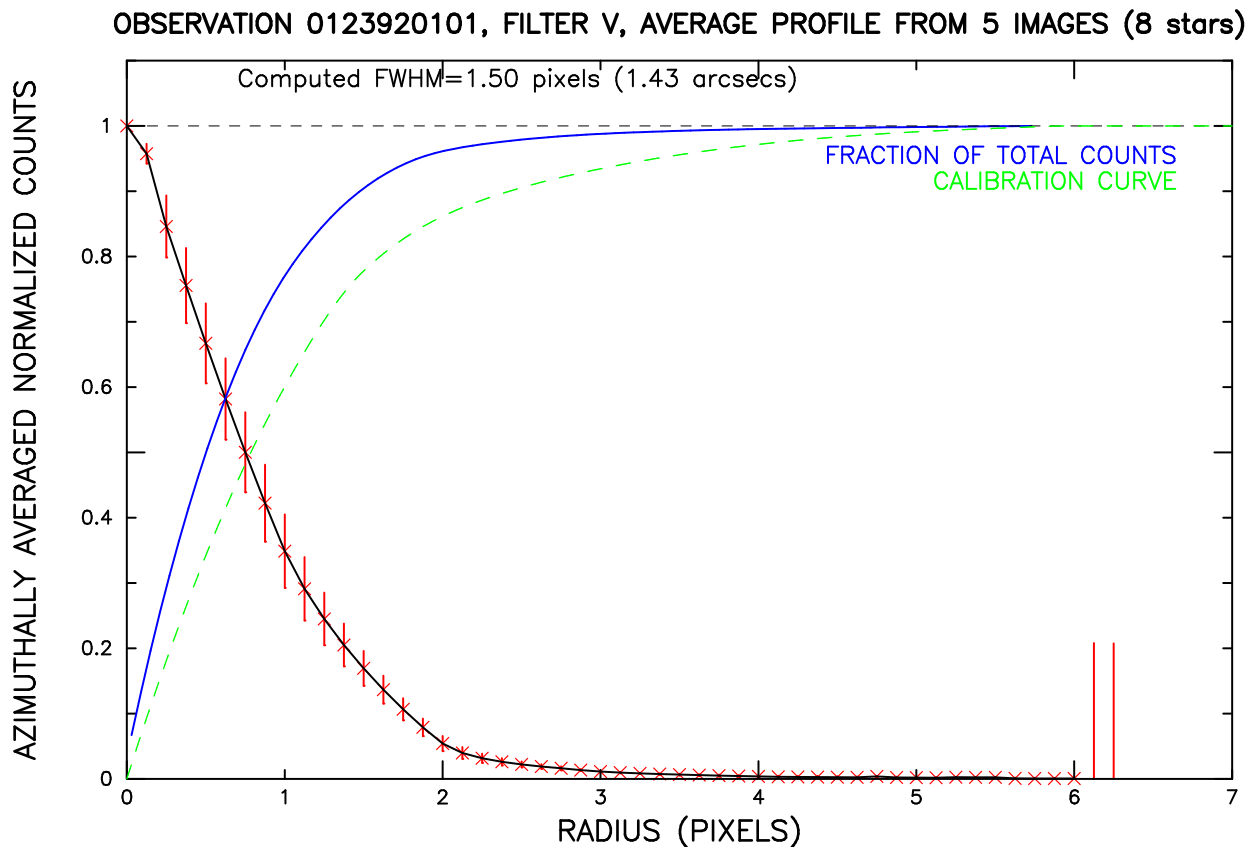

Figure 1: Example of a computed mean V-band profile

Figure 2 shows the distribution of FWHM values from a processing of over 300 observations. As in the previous example, here the default filter (V) and binning factor (2) were used as well.

11 Future developments

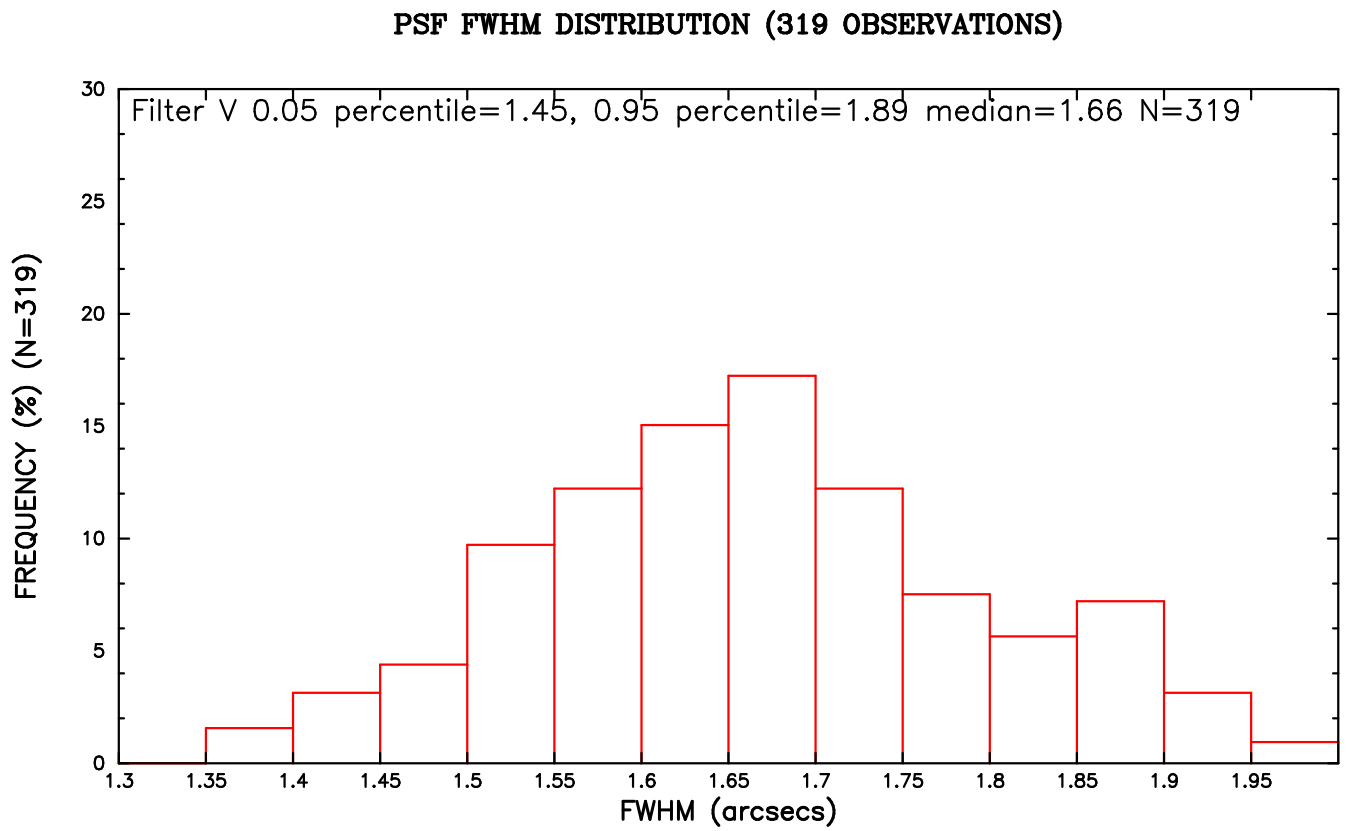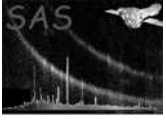Generating PSF-profiles with the user-defined number of points is desirable (currently this parameter is fixed).

PSF FWHM DISTRIBUTION (319 OBSERVATIONS)

Figure 2: Histogram of the distribution of computed FWHM from 319 observations

References