omlcbuild

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Abstract

Constructs an OM OSW FITS source timeseries from separate source and background rates files produced by evselect

1 Instruments/Modes

Instrument	Mode
OM	FAST

2 Use

pipeline processing	yes
interactive analysis	yes

3 Description

This task constructs the PPS product OM OSW FITS source timeseries from two rate files (source and background) produced by separate runs of EVSELECT on a tracking-shifted, QE-corrected OM fast-mode event-list. The output timeseries has 4 columns (background subtracted source rate & error, background rate & error). All rates are in counts/s.

In addition to the two rate files, the two region files (generated by OMREGION) are read to deduce the extraction areas. The following procedure is performed for each time bin. The counts measured in the source and 'background' regions, together with the PSF function evaluated over the corresponding regions, are used to set up equations which are then solved to yield source and background rates evaluated for the nomimal coincidence-loss region (r=12 pixels). Note that allowance is made for proximity of the source to the edge of the OSW - the fraction of PSF which falls out of the window is restored. These rates are separately corrected for coincidence loss. Subsequent background subtraction, followed by corrections for dead-time and any PSF beyond 12 pixels, leads to the final source rate. The code allows for cases where the time-binning of the source and 'background' rate files differ a little - linear interpolation is employed and the binning and timing alignment of the emerging source light curve matches that of the input source rate file.

Errors are computed assuming Poisson statistics though a systematic error of 2% is later included as a measure of non-Poissonian effects at high count rates.

4 Parameters

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

Parameter	Mand	Type	Default	Constraints
srcrateset	yes	string		

Source rates file (output from EVSELECT)

srcregionset	yes	string		

Source region (output from OMREGION)

bkdrateset	yes	string		

Background rates file (output from EVSELECT)

bkgregionset	yes	string		

Background region file (output from OMREGION)

sourcelistset	yes	string		

Source list filename (output from OMDETECT)

wdxset	yes	string		

OSW window data filename

outset	yes	string		

Name of output rates file

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.

Block RATE does not exist in the background rates file *(warning)*

corrective action: Issue a warning. Background corrections are not applied

Input background rates table is empty *(warning)*

corrective action: Issue a warning. Background corrections are not applied

Source and background rates files from different exposures *(warning)*

corrective action: Issue a warning. Check the ODF files

Background rates and region files have different EXP_IDs *(warning)*

corrective action: Issue a warning. Check the ODF files

High value of the source rate *(warning)*

corrective action: Issue a warning; set the count rate to the maximal possible value corresponding to the current frame time.

Background subtracted rate has negative values *(warning)*

corrective action: Issue a warning

Block RATE does not exist in the source rates file *(warning)*

corrective action: Issue a warning. Check the ODF files

6 Input Files

1. OM source rates file (output from EVSELECT)
2. OM background rates file (output from EVSELECT)
3. OM OSW window data file (ODF)
4. OM ASC compatible FITS detected source list file (output from OMDETECT)
5. OM ASC compatible FITS source region file (output from OMREGION)
6. OM ASC compatible FITS background region file (output from OMREGION)

7 Output Files

1. PPS product OM OSW FITS source timeseries

8 Algorithm

```
subroutine omlcbuild

  read parameters
```

```
     loop i=0, nSources

       get handle on source rates file

       get handle on source region file
       if (exposure IDs are different) issue warning

       get handle on background rates file

       get handle on background region file
       if (exposure IDs are different) issue warning

       if (exposure ID source != exposure ID background) call fatal

       get source extraction radius = s_radius

       get CAL coincidence loss correction radius = cal_radius

       get photometry radius = ph_radius

       calculate the instrumental limiting magnitude from the
       detection limit count rate

       compute area of source region = s_area

       compute area of background region = b_area

       tStart = max(tBack[0], tSource[0])
       eEnd = min(tBack[nBack-1], tSource[nSource-1]
       tDel = (tEnd - tStart)/(nSource-1)


       determine the PSF fraction within the source extraction region
       determine the PSF fraction within the 'background' extraction region

%      calculate the ratio between counts inside and outside OSW:
%      PSF fraction = sum(PSF inside OSW)/ sum(complete PSF inside s_radius area)


       loop i = 0, ntimebins

         newTime = tStars + i * tDel

%          linear interp to get source rate
         linear interp to get background rate for each source bin
%          compute background subtracted rate error
         compute source rate error
         compute background rate error

%          scale background counts to the source area:
%          backround count rate = background count rate * source area / b_area

%          subtract background from the source:
%          background subracted rate = source rate - background count rate
```

```
%         correct source counts for the PSF fraction inside extraction area
%         (correction is to value expected within CAL (r=12 pixels) aperture):
%  source = source / PSF_fraction


 set up equations for counts recorded in each region. These allow
         for (point) source contamination of the 'background' region:
         C(S+B) = PSF(S+B) *S   +   NPIX(S+B) * Bpix
         C(B)   = PSF(B)   *S   +   NPIX(B)   * Bpix

         solve these for S, the source counts over the coincidence loss (CL)
         region (ie the CAL aperture) and for Bpix, the background counts
         per pixel.

 scale background to the CAL aperture area:
         bkgnd count rate = background count rate * cal_radius area / s_area

 recombine these bkgnd and source rates (now determined for the
         CAL aperture)

         apply CL correction to the source+bkgnd rate

         apply CL correction to the bkgnd rate

         CL corrected source rate = source+bkgnd rate - bkgnd rate

 correct result for dead time

 correct for PSF beyond the 12 pixel Cal aperture (mainly for UV)

       end loop

     write time keywords to header

     write output rates file

     release handle

   end loop

   end subroutine omlcbuild
```

9 Comments

10 Future developments

- Eventually the areas of the extraction regions will be available from the input rates file in the form of data subspace keywords.

References