rgscombine

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Abstract

Combines a list of spectrum files to create one combined spectrum file, and the corresponding list of response matrices and background spectrum, to create one final response matrix and background spectrum file, for a paticular RGS instrument and spectral order (if they were calculated using beta space) or for both RGS instruments and the same spectral order (if they were calculated using wavelength grid).

1 Instruments/Modes

Instrument	Mode
RGS	Spectroscopy

2 Use

pipeline processing	no
interactive analysis	yes

3 Description

This task adds spectra, background spectra and response matrices of both instruments and same spectral order (wavelength bining), to produce combined files that can be used for quantitative analysis in a spectral fitting package such as Xspec. The component spectra should have been produced by `rgsproc`, using the `spectrumbinning` parameter set to lambda.

The task differs from rgsfluxer, in that it is able to combine response matrices and produce a single response matrix for spectral analysis. The spectra attributes and response values, bar counts, are weighted prior to addition, in terms of the exposure time and areascal of the individual observation. In this way the spectra (NET or TOTAL), including background spectra, can be combined.

4 Parameters

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

Parameter	Mand	Type	Default	Constraints
pha	yes	list of files		

A list of one or more spectrum files, all produced by **rgsspectrum**. The task does not enforce any constraint on the combining of dissimilar spectra.

rmf	no	string		

A list of one or more response matrix files, all produced by **rgsrmfgen**.

bkg	no	string		

A list of one or more background spectrum files, if spectra to be combined are of type TOTAL. Spectra can be in COUNTS or RATE (as produced by **rgsbkgmodel**)

filepha	no	file		

The file name for the output combined spectrum. The default name varies according to the `format`: combinedspectra.ds.

filebkg	no	file		

The file name for the output combined background spectrum if applicable. The default name varies according to the `format`: combinedbkgspec.ds

filermf	no	file		

The file name for the output combined response matrix. The default name varies according to the `format`: combinedrespmat.ds

rmfgrid	no	int	4000	

The number of energy bins in the response matrix. The default is 4000, as is the default from **rgsrmfgen**. All matrices in the observation set must have the same number of bins to be combined.

min	no	real	4	

The minimum wavelength of output for creating the grid over which to combine spectra.

max	no	real	40	

The maximum wavelength of output for creating the grid over which to combine spectra.

bins	no	int	3600	

The number of pha channels in the spectra files.

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.

badResponseGrid *(error)*
The binning of the final response matrix with the parameter rmfgrid, is different from that found as the number for rows, in one of the input individual response matrices

pairing *(error)*
The number of response matrix files does not match the number of spectrum files; there must be a one-to-one pairing.

wrongOrder *(error)*
Either: The `RFLORDER` attribute (reflection order) of the response matrix and background spectra (if applicable) must match the `RFLORDER` of the corresponding spectrum.

wrongInstrument *(error)*
Either: The RGS instrument of the background spectra file does not match that of the pha spectra file, if applicable and adding background spectra, or the order of the response matrix does not match that of the spectra.

badPhaName *(error)*
The name of a response matrix file can be inferred from the name of the corresponding spectrum file only if the final 14 characters of the spectrum file name begin with "SRSPEC".

illegalBkgName *(error)*
The first background spectra file name cannot be "."; it must either be "@" or else be given explicitly.

wrongBinningUnit *(error)*
spectrum was not accumulated in lambda space.

illegalSpectraHDUCLAS *(error)*
A `HDUCLAS` attribute (OGIP), `HDUCLAS2` attribute (TOTAL or NET spectrum) or `HDUCLAS3` attribute (COUNT) is not consistent with a previous file in the pha spectra file list.

Alignment of spectra *(error)*
The pha files are not aligned in terms of wavelength. The task `rgsproc` will have to be called for each pha file with the appropriate attitude parameters (attastyle, attra, attdec, attapos).

Filename parameter *(warning)*
No filename given for results files for either spectrum or response matrix
corrective action: No action required. Defaults used.

6 Input Files

- A list of spectrum files as produced by **rgsspectrum** or **rgsproc**.
- A list of response matrix files, as produced by **rgsrmfgen** or **rgsproc**.
- A list of background spectrum files as produced either by **rgsspectrum** or **rgsbkgmodel**, or by any of the possible derivations of background spectra by **rgsproc** for TOTAL spectra.

7 Output Files

The output spectrum file is a FITS table with the same format as the original spectrum files.

FITS A FITS-compliant DAL dataset with the table placed in an extension named "SPECTRUM". The five columns for a TOTAL spectra file are:

CHANNEL	real32	bin center
COUNTS	real32	total counts for each channel
QUALITY	real32	quality flag as assessed
AREASCAL	int16	weighted areascal
BACKSCAL	int16	weighted backscal

8 Algorithm

```
FOR EACH spectrum and response file:

  totalexposure = totalexposure + EXPOSURE

  FOR EACH spectrum channel:
    IF ( acceptable QUALITY )
      channelexp =  EXPOSURE * AREASCAL
      backscalexp = BACKSCAL
      totalcounts = totalcounts + COUNTS
 Then:
      Accumulate counts, backscalexp and channelexp or staterrquad

    ELSE
      do not add counts

  FOR EACH response bin (rows):
    FOR EACH response channel (columns):
      IF ( corresponding spectrum channel not discarded )
        newresponse = newresponse + MATRIX * EXPOSURE * AREASCAL
```

```
FOR EACH spectrum channel:
  IF (all quality bad over all spectra files)
    Set quality flag to 1

Finalareascal = channelexp / totalexposure
Finalbackscal = backscalexp / totalexposure

Finalresponse = newresponse / Finalareascal
```

9 Comments

- Users must note that the algorithm is very sensitive to small pointing differences in the observations to be added.
- Also, the combination of spectra having very different intensities can give rise to erroneous results.

References