qpbselect

April 16, 2023

Abstract

Quiescent particle background product creator

1 Instruments/Modes

Instrument	Mode	SubMode
EPIC PN	IMAGING	FULL FRAME WINDOW

2 Use

pipeline processing	yes
interactive analysis	yes

3 Description

The task **qpbselect** creates an EPIC-pn spectrum or image from Quiescent Particle Background (QPB) events (for a description of the background components please see the user guide for the task **evqpb**). These products can be used to subtract the QPB background. It works by first creating an event file from all of the events in the Filter Wheel Closed (FWC) event files (using **evqpb**). A scaling factor is calculated dependent on the discarded lines and the exposure time, such that:

```
Scale_factor = mean_bkg_rate_obs * exposure_time_obs
               mean_bkg_rate_fwc * exposure_time_fwc
```

where mean_bkg_rate_obs is the mean background rate in the observation which can be calculated from the discarded line rate by:

```
mean_bkg_rate_obs = (c0 + c1 * DLMEAN_obs)
```

where c0 and c1 are coefficients that have been calculated for each observing mode and are stored in the EPN_FWC_xxxx.CCF file. The mean discarded line rate for the observation, DLMEAN_obs, is calculated when the input product is produced by **evselect** and stored in a header keyword, DLMEAN.

When the QPB product is created by **qpbselect** it consists of all the selected FWC counts with the output product exposure time adjusted for the scaling factor such that the final count rate e.g. as seen in a spectral fitting program is correctly scaled for the background conditions of the input product. The applied scaling factor, is stored in the EWEIGHT column of the event file and is the same for each event.

The task runs **evqpb** which takes as input a science EPIC event list. By default it obtains attitude information, needed to convert events from detector to sky coordinates, from header keywords in the input event file. Alternatively, time-dependent attitude information can be taken from a supplied attitude file if the parameter `useodfatt` is set to *true* (note that the SAS_ODF environment variable needs to be set to point to the ODF data in this case). **evselect** is then run, using the event file produced by **evqpb**, with the same selection expression as was used to produce the original science product, e.g. subsetting on PI channel, pattern and FLAG.

The input product must contain the DLMEAN keyword, which will be automatically written if the product has been created with **evselect** version 3.69 or later.

4 Examples

A science product (image or spectrum) should first be created using **evselect** with the required source selection expression.

Then the QPB product can be created by:

qpbselect table=3222_0804720405_EPN_S003_ImagingEvts.ds productname=pnspec_src.ds outevfile=QPBevfile.fits outprod=QPBspectrum.fits

where pnspec_src.ds is the name of an input source spectrum and QPBspectrum.fits is the name of the QPB spectrum that will be produced.

Alternatively an attitude file can be supplied, in which case SAS_ODF should be set to point to the directory containing the ODF.

qpbselect table=3222_0804720405_EPN_S003_ImagingEvts.ds productname=pnspec_src.ds outevfile=QPBevfile.fits outprod=QPBspectrum.fits useodfatt=yes attfile=P0804720405OBX000ATTTSR0000.FIT

A similar command would be used to produce a QPB image:

qpbselect table=3222_0804720405_EPN_S003_ImagingEvts.ds productname=pnimage.ds outevfile=QPBevfile.fits outprod=QPBimage.fits

5 Parameters

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

Parameter	Mand	Type	Default	Constraints

table	yes	filename		table specifier

EPIC Full Frame event list

useodfatt	no	boolean	no	

Whether to use an attitude file for the astrometry

attfile	no	filename		Attitude History file

Attitude History file of the current exposure (used if useodfatt=yes)

productname	yes	filename		Name of science product

Name of the science product (image or spectrum) to use as a template for the QPB output product

outevfile	no	filename	QPBevfile.fits	

Name of output QPB event file

outprod	no	filename	QPBproduct.fits	

Name of output QPB product

overwritesubmode	no	boolean	no	

Overwrite full frame submode check?

calctlmax	no	boolean	no	

Calculate the max TL value within attcalc?

6 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.

WrongInstrument *(error)*
qpbselect only works with EPIC-pn data

WrongInstSubmode *(error)*
qpbselect can only be used in Full Frame Mode

"NoExposureTime" *(error)*
input science product does not contain the EXPOSURE keyword in its header

"NoDLMEAN" *(error)*
input science product does not contain the DLMEAN keyword in its header

"NoExpression" *(error)*
input science product does not contain the SLCTEXPR keyword in its header

"CantMakeQPBProduct" *(error)*
Failed to make QPB output product

SubmodeCheckingDisabled *(warning)*
This should be only used for testing purposes.
corrective action: This warning only appears if parameter overwritesubmode is enabled.

7 Input Files

1. An event file from an observation
2. An attitude file for the observation (optional)
3. A science product created from the same observation

8 Output Files

1. A QPB event file with scaling factor
2. a QPB product (image or spectrum)

9 Algorithm

10 Comments

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References