multixmmselect

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Abstract

GUI meta-task controlling the selection-extraction-viewing cycle for several EPIC event files

1   Instruments/Modes

EPIC event files

2   Use

pipeline processing	no
interactive analysis	yes

3   Description

3.1   Introduction

multixmmselect is a GUI (Graphical User Interface) meta-task which allows the SAS user to control the generation of final products of a set of EPIC event files sharing a common FOV (overlapping fields). The **multixmmselect** task extents the **xmmselect** capabilities to more than one EPIC event list, and at the same time, **multixmmselect** task restricts the **xmmselect** functionalities to only image creation, light curve generation and OGIP spectral products. It is intended to be used in the same way as **xmmselect**, in which the user will want to start from a calibrated event list, as created by the automatic pipeline processing, and generate OGIP-compliant products eligible for the final stages of interactive analysis, such as, spectral fitting with Xspec, and timing analysis with Xronos.

It is important to mention that because the **multixmmselect** task can handle several EPIC event files at the same time, it is mandatory to set, via `calindex` parameter, the corresponding ordered calibration index file list for each of the EPIC event files.

As mentioned before, the **multixmmselect** task is able to manage more than one EPIC event file covering the same FOV, and it is possible to:

1. Filter the event lists under the control of a boolean selection expression

2. Visualize an image containing all EPIC event lists

3. Accumulate a product from the events which pass the given filters

multixmmselect provides functionality to perform this type of processing in a convenient manner.

3.2   General overview

3.2.1   Used tasks

multixmmselect makes use of the following other SAS tasks to perform the above listed functions:

functions	SAS task used
select events	**evselect**
extract images, rate curves	**evselect + emosaic**
generate spectra/ARF/RMF	**multiespecget**
generate single spectra/ARF/RMF	**epicspeccombine**
display rate curves	**dsplot**
display images	**imgdisplay/dsplot**

Users unfamiliar with these packages are advised to consult the relevant documentation prior to reading any further.

3.2.2   Task invocation and GUI initialization

multixmmselect must be invoked with a list of EPIC event files name via the task parameter `table`, and the corresponding ordered calibration index files for each of the EPIC event files via the task parameter `calindexset`. This specified table is first inspected for names,types and numerical limits of existing columns and a list of corresponding pushable buttons with associated check buttons is displayed within the main window (see Sect. 3.3.4).

During the initial scan it is also checked whether or not the table comprises DSS (Data SubSpace) information, i.e., if it has been filtered in a previous **multixmmselect** or **evselect** run. The DSS formalism is a means to store the selection history of a table in a systematic and easily accessible form. For more details on this, please consult the documentation of package **dsslib**. In the particular case of managing several EPIC event files, the DSS information of all the EPIC event files,the DSS information of all the EPIC event files is very complex and large. We recommend the user to skip the dss information.

3.2.3   Column selections

See **xmmselect** task documentation.

3.2.4   Selection expression

See **xmmselect** task documentation.

3.2.5   Product generation and visualization

See **xmmselect** task documentation.

3.2.6   Selections from displayed products

Once a product is displayed the user can interactively define only:

3.2.6.1   Spatial - 2D regions from imgdisplay or dsplot

imgdisplay and **dsplot** support the definition of one or multiple regions on displayed images (please consult the respective documentation if you are not familiar with this feature). When dealing with more than one EPIC event file, the region specifications can only be propagated to the OGIP spectral product generation. Therefore, the EPIC mosaic image generated by **multixmmselect** should be used only to define the source and background regions that will be propagated to **multiespecget** through the OGIP spectral product button.

3.2.6.2   Others - 1D regions from dsplot

One-dimensional selections, like time intervals from rate curves, and make multixmmselect transform these into a boolean selection expression to be used for the OGIP spectral product extraction.

3.3   Detailed layout of GUI

When **multixmmselect** is invoked it comes up with a main window as illustrated in the following figure 3.3:

Figure: Layout of elements in main **multixmmselect** window
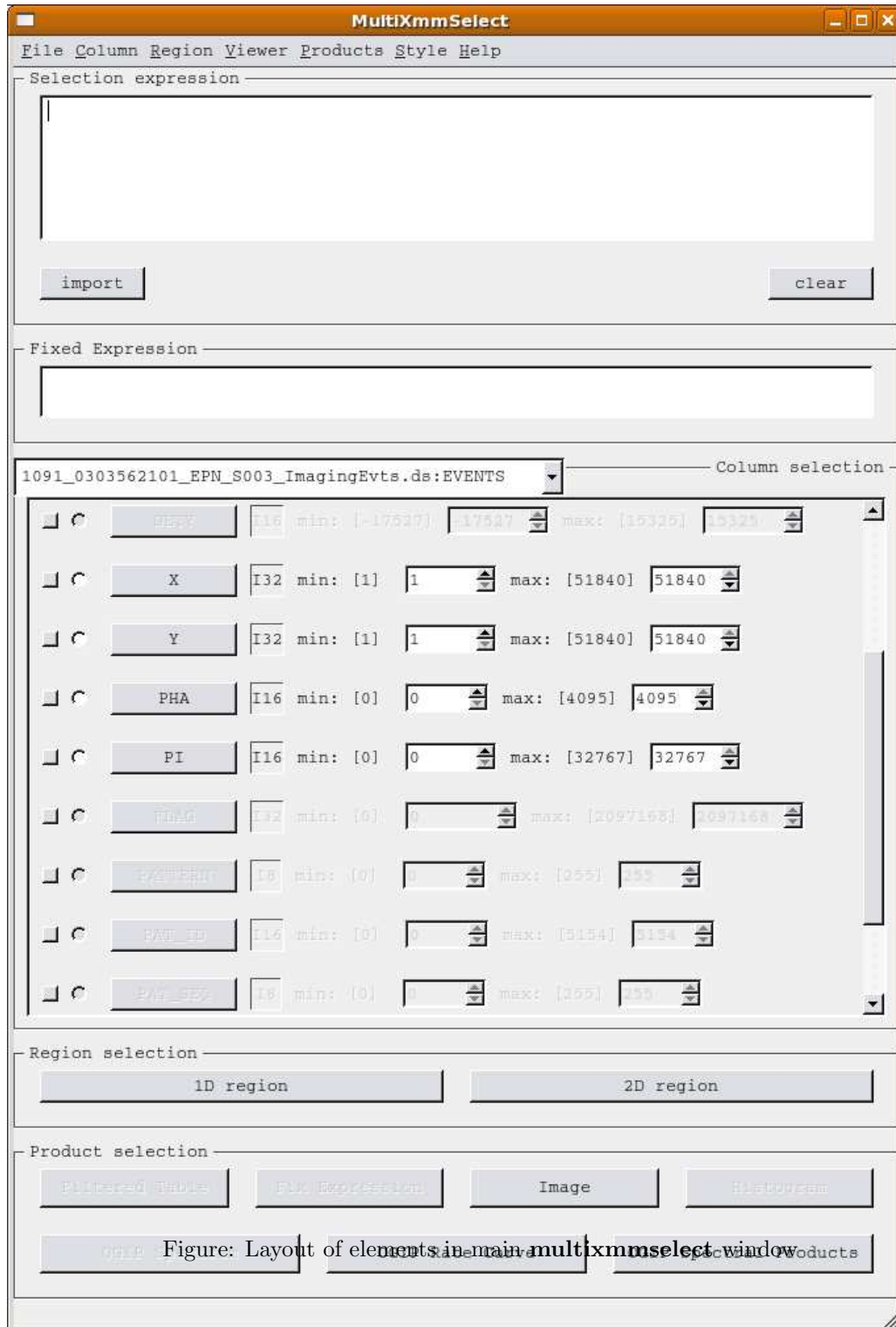
The window consists of the same main areas as in the **xmmselect** task, but in this case, several features, such as: PATTERN, FLAG, etc... selections have been disabled to limit the usage of **multixmmselect** only to OGIP spectral product generation.

3.3.1 Menus

See **xmmselect** task documentation.

3.3.2 Selection expression

See **xmmselect** task documentation.

3.3.3 Fixed Expression

See **xmmselect** task documentation.

3.3.4 Column selection

See **xmmselect** task documentation.

3.3.5 Region selection

See **xmmselect** task documentation.

3.3.6 Product extraction

As mentioned above, the **_Filtered Table_**,**_Fix Expression_**,buttonHistogram, **_OGIP spectrum_** buttons are disabled in the **multixmmselect** task. Only **_Image_**, **_OGIP Rate Curve_**, and **_OGIP Spectral Products_** are enabled.

Pushing either of these will trigger the following actions:

1. Execution of **evselect** with the selection expression in the top expression entry field (see Sect. 3.3.5). Before **evselect** is actually executed, its parameter dialog is presented to give the user full control over the product extraction process, i.e., all of **evselect**'s parameters (e.g. bin size for rates curve extraction, name of output data set, etc.) can be altered (e.g. bin size for rate curve extraction, name of output data set, etc.).

2. Accumulation of the respective product with a default name

3. Except for event lists, execution of a product displayer (either **dsplot** or **imgdisplay**) with the name of the generated product

A prerequisite to the extraction of images, and rate curves is the selection of data set columns which define the primary product axes (see Sect. 3.2.3)), in the case of **multixmmselect** only (X,Y) are allowed

to create the EPIC mosaic image. See the **xmmselect** task documentation for a detailed explanation of the product extraction generation.

3.3.6.1 OGIP spectral products

In **multixmmselect**, the generation of spectral products goes one step beyond, allowing the generation of:

- OGIP spectrum for selected source region

- OGIP spectrum for selected background region

- Redistribution Matrix File (RMF) corresponding to source spectrum

- Auxiliary Response File (ARF) corresponding to source spectrum

for more than one EPIC event list simultaneously. To do this, once the OGIP spectral button is pressed in **multixmmselect**, a call to **multiespecget** is triggered. This task calls **especget** as many times as input files have been introduced.

The only differect in terms of behavior with respect to the OGIP spectral product generation feature in **xmmselect**, is the creation and propagation of the source and background region in sky coordinates (RA,DEC), instead of the standard camera coordinates system (X,Y) used by **xmmselect**.

The primary input to **multiespecget** is a mosaic image made of several EPIC event files and two spatial selection expressions, one indicating an extraction region around the point source of interest and a second one for the source-free background region. These can be generated with **multixmmselect** in a convenient manner:

1. create a mosaic image in sky coordinates as described above

2. when the image is displayed in Ds9 define a circular region around the source of interest

3. make another (not necessarily circular) region that shall comprise only background events. In order for **multixmmselect** to distinguish the source from the background region, the latter must be assigned in Ds9 the attribute *Background*. To do that, double click on the region marker and in the upcoming dialogue box select "Property" and "Background". When done, the border line style should change from solid to dashed.
   Be sure that the "exclude" regions has not been selected.

4. click on ***OGIP Spectral Products***. At this point **multixmmselect** will read the two regions from Ds9 and perform some basic checks for correctness (e.g. there is exactly one source and one background region). In case this fails, an error messages with suggested actions will be presented. If the two regions are successfully read, **multiespecget** will be called with the necessary inputs. In this first version of **multixmmselect**, the optional optimization step have been disabled.

Please note that the production of one single RMF with **especget** is a computationally intensive task and can take several tens of minutes on a moderately loaded workstation. Now, with **multixmmselect**, several RMFs files can be automatically generated, therefore this process can take longer to complete.

3.4 Typical usage scenarios

multixmmselect has been designed to process a list of EPIC tables, e.g.

```
multixmmselect tables=''pn.fits mos1.fits mos2.fits'' calindexsets=''ccf.cif ccf.cif ccf.cif''
```

The following is a collection of common scientific processing problems together with instructions on how to perform them within **multixmmselect**:

- Generate a OGIP spectrum product without doing any selections.

  1. Select the X and Y column for the mosaic image extraction.
  2. Click the image product extraction button at the bottom of the GUI to create the mosaic EPIC iamge and visualize it.
  3. Create the regions (source and background) of interest within the **imgdisplay** window.
  4. Click the OGIP Spectral Product button.

- Generate a OGIP spectrum product with time filter selection.

  1. Select real TIME column
  2. Click the OGIP Rate Curve button and select an appropiate time binning.
  3. Select one or multiple intervals in the displayed window product.
  4. Click the 1D region in the "Region Selection" area of the multixmmselect GUI.
  5. Select the X and Y column for the mosaic image extraction.
  6. click the image product extraction button at the bottom of the GUI to create the mosaic EPIC iamge and visualize it.
  7. Create the regions (source and background) of interest within the **imgdisplay** window.
  8. Click the OGIP Spectral Product button.

4 Parameters

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

Parameter	Mand	Type	Default	Constraints
tables	yes	list		table specifier

a specifier which must point to a list of EPIC tables in a data set.

calindexsets	yes	list		list of ccf files

List of calibration index files.

centerpaneheight	no	integer	8	1 <= centerpaneheight <= 10

initial height of central pane (see Sect. 3.3.4) in units of initially visible column buttons; if the input table

contains more than the specified number of columns a scrollbar will be provided with which the invisible portions of the pane can be brought into view.

5   Preferences

See **xmmselect** documentation.

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.

NoSuchTable *(error)*
> `tables` parameter does not point to an existing table

all errors of all tasks listed above (see Sect. 3.2.1)

7   Input Files

1. a list of data sets with a table to be processed

8   Output Files

1. image (optional)
2. OGIP rate curve (optional)
3. OGIP source + background spectrum (optional)
4. OGIP ARF + RMF file (optional)

9   Comments

None.

References