evlistcomb

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Abstract

Merge event lists from all CCD/nodes into a single event file.

1 Instruments/Modes

Instrument	Mode
EPIC MOS	IMAGING, TIMING
EPIC PN	IMAGING, TIMING, BURST
RGS	SPECTROSCOPY, HIGH TIME RESOLUTION

2 Use

pipeline processing	yes
interactive analysis	yes

3 Description

The MOS, PN or RGS chains are applied separately to event lists attached to a single CCD (or CCD/node for MOS). **evlistcomb** builds a global calibrated event list (PPS product) for one EPIC or RGS camera from their outputs. This is done by taking in all input files the extension whose name is specified by the `maintable` parameter (called 'merged extension' in what follows) and merging the columns into a single output extension of the same name. A `CCDNR` column is added to the extension to keep track of all events' origin. Its contents is taken from the `CCDID` keyword (and `QUADRANT` for EPIC PN). For EPIC MOS only (not RGS) the node (`CCDNODE` keyword) is coded into the CCD number by adding 10 if the redundant node is used.
Actually two calibrated event lists are built if all CCDs are not operated in the same mode. The mode is recognized by the `DATAMODE` keyword, which must be one of both values specified in the `xxxdatamodes` parameter. The first `DATAMODE` keyword is associated with the `imagingset`, `xxximgcolnames`) and `xxximgcoltypes` parameters (it need not be IMAGING, for example it is used for RGS SPECTROSCOPY mode). The second keyword in `xxxdatamodes` is associated with the `timingset`, `xxxtimcolnames`) and `xxxtimcoltypes` parameters.
The `xxxdatamodes` parameter is only a way to tell **evlistcomb** the name of the modes. It cannot be

used to select which mode you want in output, and should not be set differently in the various instrument modes.

When used in default mode, **evlistcomb** propagates only that subset of the original columns, specified in the Data Products ICD. The columns are converted into the type of the ICD if need be. This is done by specifying the `instrument` parameter to 'emos', 'epn' or 'rgs'. The task will then use the default list of modes (`xxxdatamodes`), column names (`xxxyyycolnames`) and types (`xxxyyycoltypes`), where xxx is the 3 or 4-letter instrument symbol and yyy the mode symbol ('img' or 'tim'). The columns appearing in the list but not present in the input files are not created. When transtyping **evlistcomb** checks for overflow and sets to null the data which overflow the output type.

In order to generate an output file with other columns, one needs to specify by hand the `xxxyyycolnames` and `xxxyyycoltypes` parameters for the instrument and mode(s) one is interested in. The correspondance between the column names and types is done simply by order of appearance.

The task also copies over the secondary extensions specified by the `othertables` parameter for all files into extensions with the same name (truncated to 6 characters) followed by nn (the 2-digit `CCDNR`). This works both for tables and arrays. Except their name, those extensions are copied without change and entirely (data and keywords).

The compatibility of the files is checked through a number of primary keywords, specified by the `primarychecks` parameter. Those keywords must exist in all files. All files in the list which do not share the first file's setting are rejected. All keywords (not only those in `primarychecks`) present in the primary header of any of the input files are propagated to the primary header of the output file, except `FILENAME` which is clearly file-specific. In practice this means a keyword takes the value it has in the last file of the list (of that mode) where it is present. All those (global) keywords are also copied to all output extensions, except those specified in `primaryonly`.

Some keywords in the merged extensions (`extensionchecks` parameter) may also be checked for compatibility between files. Those do not have to exist, but will be propagated if they do. Other keywords (specified by the `mainattributes` parameter) may also be propagated to the merged extensions. Those will take the value they have in the last file of the list where they are present. Yet other keywords in the merged extensions may be maximised (`maxattributes`) or minimised (`minattributes`).
The four sets of parameters (`extensionchecks`, `mainattributes`, `maxattributes`, `minattributes`) may include column specific keywords as well.

All keywords in the merged extensions are not automatically propagated, as those keywords are usually different for each CCD/node. If CCD-dependent keywords are needed down the line, they must be propagated by means of one of the secondary extensions (**evlistcomb** does not do that automatically).

The standard column specific keywords (`TNULL`, `TUNIT`) are taken from the first valid file where they are set. All subsequent files which have those keywords set to a different value are rejected (files with keywords not set are accepted). To propagate other column specific keywords, they must be specified manually via the `extensionchecks`, `mainattributes`, `maxattributes` and `minattributes` parameters (see above).

It is possible to merge several extensions (`maintable` may be a list). In that case all keyword operations (`extensionchecks`, `mainattributes`, `maxattributes`, `minattributes`) are done on all extensions. It is not possible to specify a specific list of columns for each of the extensions to merge. All columns to be merged (in all extensions) must appear in the `xxxyyycolnames` and `xxxyyycoltypes` parameters (but they don't have to exist).

evlistcomb will also accept in input files generated by a previous call to **evlistcomb**. In that case the `CCDNR` column will be propagated as a normal column (but need not be specified in the list of columns to propagate), and all the secondary extensions whose first 6 characters are common with one

of `othertables` will be propagated.

In the PPS, **evlistcomb** must be followed by a call to **evselect** which will apply the selection on Good Time intervals and add the `EXPOSURE` keyword. **evlistcomb** can be applied as is to slew data.

4 Parameters

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

Parameter	Mand	Type	Default	Constraints
eventsets	yes	dataset list	' '	none
list of input events files				
instrument	yes	string	emos	emos/epn/rgs
select parameter name				
imagingset	no	dataset	'merged.img'	none
name of output event file for IMAGING or SPECTROSCOPY mode				
timingset	no	dataset	'merged.tim'	none
name of output event file for TIMING, BURST or HTR mode				
maintable	no	list of upper-case strings	EVENTS	none
names of tables to be merged				
othertables	no	list of upper-case strings	BADPIX EXPOSURE STDGTI	none
names of secondary tables or arrays to propagate				
primarychecks	no	list of strings	TELESCOP INSTRUME OBS_ID EXP_ID	none
primary attributes to check for compatibility				
primaryonly	no	list of strings	ORIGIN	none
primary attributes which should not be propagated to extensions				
extensionchecks	no	list of strings	TIMESYS MJDREF TIMEUNIT TIMEREF TASSIGN DET_SYST TCRPX TCTYP TCRVL TCDLT TCROT TCUNI	none
attributes to check for compatibility of the merged extensions				

minattributes	no	list of strings	TSTART TLMIN TDMIN	none

attributes to minimise in the merged extensions

maxattributes	no	list of strings	TSTOP TLMAX TDMAX	none

attributes to maximise in the merged extensions

mainattributes	no	list of strings		none

attributes to propagate to the merged extensions

emosdatamodes	no	list of strings	IMAGING TIMING	none

modes (DATAMODE keyword) to distinguish among input files

emosimgcolnames	no	list of uppercase strings	TIME RAWX RAWY DETX DETY X Y PHA PI FLAG PATTERN OFFSETX OFFSETY	none

columns to propagate in merged extensions (Imaging mode)

emosimgcoltypes	no	list of strings	double int16 int16 int16 int16 int32 int32 int16 int16 int32 int8 int16 int16	int8/int16/int32/single/double/boolean/str

output type of Imaging mode columns

emostimcolnames	no	list of uppercase strings	TIME RAWX PHA PI FLAG PATTERN OFFSETX	none

columns to propagate in merged extensions (Timing mode)

emostimcoltypes	no	list of strings	double int16 int16 int16 int32 int8 int16	int8/int16/int32/single/double/boolean/str

output type of Timing mode columns

epndatamodes	no	list of strings	IMAGING TIMING	none

modes (DATAMODE keyword) to distinguish among input files

epnimgcolnames	no	list of uppercase strings	TIME RAWX RAWY DETX DETY X Y PHA PI FLAG PATTERN PAT_ID PAT_SEQ OFFSETX	none

columns to propagate in merged extensions (Imaging mode)

epnimgcoltypes	no	list of strings	double int16 int16 int16 int16 int32 int32 int16 int16 int32 int8 int16 int8 int16	int8/int16/int32/single/double/boolean/str

output type of Imaging mode columns

epntimcolnames	no	list of upper-case strings	TIME RAWX PHA PI FLAG PATTERN	none

columns to propagate in merged extensions (Timing mode)

epntimcoltypes	no	list of strings	double int16 int16 int16 int32 int8	int8/int16/int32/single/double/boolean/str

output type of Timing mode columns

rgsdatamodes	no	list of strings	SPECTROSCOPY 'HIGH TIME RESOLUTION'	none

modes (DATAMODE keyword) to distinguish among input files

rgsimgcolnames	no	list of upper-case strings	TIME CHIPX CHIPY BETA XDSP BETA_CORR XDSP_CORR BETA_CHANNEL XDSP_CHANNEL PHA PI FLAG SHAPE GRADE	none

columns to propagate in merged extensions (Spectroscopy mode)

rgsimgcoltypes	no	list of strings	double int16 int16 single single single single int16 int16 int16 int16 int32 int8 int8	int8/int16/int32/single/double/boolean/str

output type of Spectroscopy mode columns

rgstimcolnames	no	list of upper-case strings	TIME CHIPX BETA BETA_CORR BETA_CHANNEL PHA PI FLAG	none

columns to propagate in merged extensions (HTR mode)

rgstimcoltypes	no	list of strings	double int16 single single int16 int16 int16 int32	int8/int16/int32/single/double/boolean/str

output type of HTR mode columns

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.

main02 *(error)*
no valid input event file

readColParams05 *(error)*
lists of columns and of types do not have the same length

getGoodFiles10 *(warning)*
missing, invalid or incompatible input event file. Skip that file
corrective action: check that file

testColKeywords12 *(warning)*
column units, keywords or null values in input event file not compatible with previous files. Skip that file
corrective action: check that file

testMode11 *(warning)*
unrecognized data mode. Skip that file
corrective action: check the `DATAMODE` keyword in that file

sortFiles13 *(warning)*
not same unit for `TSTART` and `TSTOP`. Continue, but do not compute `TELAPSE`
corrective action: check those keywords

sortFiles14 *(warning)*
the output event list is empty. Continue anyway
corrective action: check nothing went wrong

copyData10 *(warning)*
One column does not exist in one of the input files. Continue, set to null in output
corrective action: check input file

copyData11 *(warning)*
It was asked to change an input boolean or string column to some other type, or some other type into boolean or string. Continue, set to Null in output
corrective action: modify output type for that column

copyCcdExtension10 *(warning)*
CCD number could not be retrieved from an extension. Continue, do not copy that extension to the output file
corrective action: check keywords in that extension

copyCcdExtension12 *(warning)*
two extensions would have the same name in output file. Continue, keep only the first one
corrective action: check how that conflict could happen

6 Input Files

- EPIC MOS event files (from **emenergy**, format described in **emevents**).
- EPIC PN event files (from **epevents**).
- RGS event files (from **rgsevents**).
- Already merged files (from **evlistcomb**).

Uses keywords

1. `INSTRUME`, `DATAMODE` (if present) from primary header.
2. `TSTART`, `TSTOP`, `DATATYPE` (if no `DATAMODE`) from merged extension.
3. `INSTRUME`, `CCDID`, `CCDNODE` (MOS only) from secondary tables.

7 Output Files

Imaging (or Spectroscopy) and Timing (or HTR) event files (for PRODUCT: EPIC or RGS event list and **evselect**, [1]) with following items:

- primary header propagated from input files, with additional `DATAMODE` (if not already present) and keyword.
- merged extension(s) (`maintable` parameter) with columns defined by the `xxxyyycolnames` and `xxxyyycoltypes` parameters (xxx is the instrument symbol and yyy the mode symbol), an additional `CCDNR` column, some keywords (`extensionchecks`, `mainattributes`, `maxattributes` and `minattributes` parameters), plus the `XMMEA_nn` keywords identifying the flags and the column-specific keywords. `TELAPSE` is recomputed if need be.
- secondary extensions (`othertables` parameter) with names truncated to 6 characters and `CCDNR` added at the end of the name.

8 Algorithm

```
subroutine evlistcomb

Read the file names of event files (input and output)
Read all parameters.

Open files
Sort them according to DATAMODE

Loop over input event files
   Open merged extension
   Get keyword values
   Read selected columns
   Write them to output file and add CCDNR (= nn)
   Copy secondary extensions, adding CCDNR to their name.
end loop

close files

end subroutine  evlistcomb
```

9 Comments

None.

10 Future developments

Could allow merging files irrespective of their mode.

References

[1] SSC. XMM Survey Science Centre to Science Operations ICD for SSC Products. Technical Report XMM-SOC-ICD-0006-SSC Issue 2.1, SSC, Mar 2000.