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Specifications for individual SSC data products

Revision History

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Issue 1.0	29-02-00	Julian Osborne (Editor)	Consists of XMM-SOC-ICD-0006-SSC issue 1.1 plus DCPs 1-73, and made consistent with XMM-SOC-ICD-0006-SSC issue 2.0
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Contents

1 Preface

This is the reference document describing the individual SSC data product files. It is intended to be of use to software developers, and to scientists analysing XMM data. Please see the SSC data products Interface Control Document (XMM-SOC-ICD-0006-SSC, issue 2.1) for a description the product group files and other related files that are sent to the SOC.

Changes with respect to the previous issue of this document are marked by change bars.

This document will continue to evolve through subsequent issues, under indirect control from the SAS and SSC configuration control boards.

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2 Acronym list

AMS	Archive Management Subsystem
ASCII	American Standard Code for Information Interchange
AHF	(ODF) Attitide History File
ASU	Astronomical Server URL
BSM	Baseline Spectroscopy Mode
CCD	Charge Coupled Device
CCW	Counter ClockWise
CD-ROM	Compact Disk - Read-Only Memory
CDS	Centre de Données astronomiques de Strasbourg
CGS	Centimetre Gramme Second
DCP	Document Change Proposal
DEC	Declination
EPIC	European Photon Imaging Camera
ERMS	EPIC Radiation Monitor System
FITS	Flexible Image Transport System
FOV	Field Of View
FWHM	Full Width at Half Maximum
GB	GigaBytes
GIF	Graphics Interchange Format
GO	Guest Observer
GSFC	Goddard Space Flight Center
GTI	Good Time Interval
HDU	Header Data Unit
HK	House-Keeping
HST	Hubble Space Telescope
HTML	Hyper-Text Markup Language
HTRM	High Time Resolution Mode
ICD	Interface Control Document
ID	IDentifier
KB	KiloBytes
MB	MegaBytes
MCP	Micro-Channel Plate
MIP	Minimum Ionising Particle
MJD	Modified Julian Date
MOS	Metal Oxide Semiconductor
OAL	Observation Access Layer
ODF	Observation Data File
ODS	Observation Datafile Subsystem
OGIP	Office for Guest Investigator Programs
OM	Optical Monitor
OSW	OM Science Window
PHA	Pulse Height Analyser
PI	Position Invariant
P-N	Positive-Negative
PNG	Portable Network Graphics
PPS	Pipeline Processing System
PSF	Point Source Function
RA	Right Ascension
RGS	Reflection Grating Spectrometer
SAS	Science Analysis System

SIMBAD	Set of Identifications, Measurements, and Bibliography for Astronomical Data
SDF	Slew Data File
SOC	Science Operation Centre
SSC	Survey Science Centre
TBD	To Be Decided
URL	Uniform Resource Locator
USNO A2	United States Naval Observatory catalogue of Astronomical standards V2.0
UTC	Universal Time, Coordinated
WWW	World Wide Web
XID	X-ray IDentification programme
XMM	X-ray Multi-Mirror

3 Reference documents

R-1 XMM-SOC-ICD-0004-SSD Interface Control Document: Observation and Slew Data Files - Issue 2.4

R-2 XMM-PS-GM-13 Software Specification Document for the XMM Science Analysis System - Issue 2.0

R-3 XMM-PS-TN-13 Aspects of OM Flatfield Calibration - Issue 1.0

R-4 XMM-SOC-ICD-0006-SSC XMM SSC to SOC Interface Control Document for SSC Data Products - Issue 2.1

4 Introduction

One of the main roles of the SSC within the XMM project is the creation of a variety of data products, both from the XMM observations and from the SSC follow-up/identification programme. This document specifies these products.

There are 3 major classes of SSC data product:

- PPS products
- XID products
- The XMM catalogue

The PPS products are the results of pipeline processing of individual observation and slew data filesets (ODFs and SDFs). They include summary information, calibrated cleaned event lists, the positions and brightnesses of detected sources, high-level data products (e.g. images and spectra), catalogue cross-correlation information, quality information and an executable log file. Slew data are used only to make an archive of OM flat-field exposures for use in the OM pipeline processing.

The XID products are the result of the SSC's task of identification of newly detected serendipitous X-ray sources. They will consist of a variety of data products (primarily ground-based optical imaging and spectroscopy) related to the follow-up/identification programme. The SSC plan for optical–X-ray classification is summarised in the XID products section.

The XMM catalogue will list the primary characteristics of all sources detected by XMM. It will be re-issued at intervals to account for the continuously increasing sky area covered by XMM in orbit. Non-proprietary data, as processed by PPS tools (and subsequently screened by the SSC), will be used to create the XMM catalogue.

Files relating to the XMM catalogue will be presented in a future issue of this document.

The SSC product files are grouped into `tar` files before being transmitted from the SSC to the SOC, and it is these product group files which are stored in the XMM archive. The SSC to SOC interface is defined in [R-4]. PPS products will be made available to the SOC within 30 working days of SSC receipt of the ODF/SDF in normal circumstances. XID data and the XMM catalogue will be made available to the SOC when they are ready.

The SSC data products are subject to quality control before delivery to the SOC. Products may be flagged if there are doubts about their validity. Products that cannot be made reliably will not be delivered. Thus this document describes the set of all possible SSC data products, the pipeline processing of individual observations may not generate the full set of products described here.

Access to the data products described here is the responsibility of the SOC, and is expected to be provided via the AMS for both XMM principle guest observers, and, after the proprietary period has elapsed, archival researchers from the whole scientific community. The AMS catalogue contents can be browsed using a web browser, allowing SSC product group files (and possibly individual product files) to be downloaded via the internet or delivered on CD-ROM.

5 The SSC products

5.1 SSC product formats

Each SSC product is contained within a single file. The following file formats will be used:

5.1.1 FITS

FITS is the format that will be used for bulk data destined for further analysis (e.g. event lists, images, source lists, etc). FITS files will be OGIP compliant where possible. For FITS files where OGIP FITS standards are not applicable or available, new standards closely following the OGIP approach are used. Extensions to the OGIP FITS standards adopted by other projects have been carefully considered. Our aim is to ensure that the usage of FITS for SSC data products conforms to a coherent standard in order to provide maximal compatibility with a range of existing analysis systems. All FITS files are supplied compressed by Unix GNU `gzip`.

5.1.2 PDF

Intrinsically compressed PDF files will be used for the display of line graphics. When these files are derived from product files in FITS format the PDF file will be significantly smaller than the FITS file, and/or will contain annotations providing a user-friendly summary of the FITS file.

5.1.3 PNG

PNG will be used for the display of pixel images. Like the GIF format it was intended to replace, PNG is an intrinsically compressed format capable of being included as in-lined images in WWW pages. In some cases, these graphics files will be derived, at least in part, from product files in FITS format. In these cases the PNG files will be significantly smaller than their FITS files and/or will contain annotations providing a user-friendly summary of the FITS file.

5.1.4 HTML

HTML will be the standard format for files which provide overview or summary-type text information. Important PPS results will not be presented only in HTML files, and thus some information may be found in more than one type of file.

5.1.5 ASCII

ASCII files will be used to present script and some tabular information. Some ASCII files will be supplied compressed using Unix GNU `gzip`.

5.2 The use of URLs

HTML files offer the possibility to provide structure to the collected PPS products of an observation through the use of hyperlinks. Web browsers can then provide a nice interface to the products, both on-line and on CD-ROM.

5.2.1 External URLs

Links within the SSC products point to external services to provide added value. Due to worries about security of supply, URLs to external sites will be limited to links to the SIMBAD family of servers only (for which CDS will ensure support throughout the life of the SSC). These links will provide reference data only, they will not provide access to bulk data. Thus the XMM archive of SSC products will be self-contained.

The use of external URLs not only provides ancillary information (such as original references) at the click of a button, but also allows the information to be updated. Indeed, the provision of catalogue links via the ASU protocol allows users to re-perform their source cross-correlations at a later date, accessing the more recent catalogue data that would then exist.

5.2.2 Internal URLs

The use of internal links (i.e. those pointing to SSC products within the XMM archive) can provide a quick and user-friendly mechanism for navigating around a product set. For example, it would clearly be very useful for a user to be able to click on a source ID in a list of detected sources to retrieve other products relating to that source (e.g. a spectrum or a timeseries). We anticipate that this function will be particularly useful in the cross-correlation PPS products. Such internal links will be provided in HTML PPS and XID products.

Within a PPS observation product set (i.e. those belonging to a single ODF) HTML links will be self-contained, that is there will be no link to destinations outside of the product set, apart from the external URLs already described. Thus there will be no HTML links between an XID product set and any PPS product set.

5.3 Access to SSC products

General user access to SSC products is expected to be via the AMS, this acts as a front end to the XMM archive. The AMS will have querying capabilities via keyword value searches, and will have a web user-interface allowing archive browsing and requests for CD-ROM delivery of datasets.

All but one of the individual SSC product file types are aggregated (using Unix `tar`) into groups by the SSC for transmission to the AMS at the SOC. The product groups, their associated keywords, and the mechanism for transmitting them to the SOC are defined in [R-4]. The XMM archive stores the products in these groups. Graphics (and possibly other) groups will be unpacked on the AMS server to allow on-line browsing of individual products within the group.

6 PPS products

The products of the pipeline processing of XMM observations and slews are described in this section. Here, and in section 10.2, typical product file sizes are given.

6.1 The division of the data: observations and exposures

With one single exception, the PPS treats every ODF and SDF in isolation. An ODF will contain data from a single observation only, and the PPS makes no attempt to combine data across ODF boundaries. An observation is taken to be a continuous pointing at a fixed position, with at least one of the EPIC, RGS or OM taking data, and following the operational sequence created from a single proposal. An ODF will contain data from all operational instruments, the data from the various instruments will to some small extent be analysed together (e.g. RGS processing may depend on EPIC or OM data). There will be no attempt to make the PPS wait for data apparently missing from an ODF. PPS products will relate to data from single observations only.

The same general considerations apply to the slew data in SDFs: an SDF will contain data from a single maneuver from one observation to another (possibly in more than one slew leg), and the PPS will treat SDFs separately. No slew data is analysed for its celestial content, in fact only OM slew data is analysed. During slews the OM detector will be lit by an internal lamp, and this data will be used to accumulate flat field images. These have to be combined in the OM pipeline (using a large number of exposures) in order to provide sufficient signal to noise in the calibration of the observation dataset [R-3].

An observation consists of a sequence of exposures for each instrument. For an individual instrument (e.g. EPIC MOS 1), exposures form a non-overlapping sequence. The exposures of different instruments may start and end independently, however, and thus partially overlap in time. During an exposure the commanded state of the individual instrument is unchanged, no important hardware or data acquisition mode changes occur, and the data thus have a fixed format. An exposure is necessarily something which occurs in a single individual instrument. It is the task of the ODS (which makes the ODFs) to divide the XMM instrument telemetry into files of single exposures.

For most purposes the PPS treats individual exposures separately, most PPS products will be derived from data taken during a single exposure. However, in the later stages of the processing of EPIC and OM data separate exposures within an instrument observation are combined. The primary example of this is the source detection stage of the PPS, where all available data is combined to achieve ultimate sensitivity.

It may be that EPIC observations will include a number of calibration-type exposures. These may include offset maps and gain-determining radioactive source exposures. Such exposures could be analysed by the PPS and the results applied to the science exposures. At this early stage it is not yet clear if these calibration-type exposures require the creation of specific PPS products. No such products are included in this document.

ERMS data are not processed by the PPS for its scientific content and there are no ERMS products. The data from the ERMS may however be made use of in the PPS in the same way as the HK data, to define good time intervals for the other instruments. In this case a plot of the ERMS data may be included in the HK summary products.

6.2 Common FITS headers and extensions

6.2.1 Standard primary header keywords

In every FITS file produced as part of the product set the primary header will contain the following mandatory keywords (the values shown are for example only)

```
SIMPLE  =                    T / File does conform to FITS standard
BITPIX  =                   32 / Number of bits per data pixel
NAXIS   =                    0 / Number of data axes
EXTEND  =                    T / FITS dataset may contain extensions
TELESCOP= 'XMM'                / Telescope (mission) name
INSTRUME= 'EMOS1'              / Instrument name
DETNAM  = 'PRIME'              / PRIME or REDUNDANT
DATAMODE= 'IMAGING'            / Instrument mode (IMAGING, TIMING, FAST, etc.)
FILTER  = 'NONE'               / Filter ID
OBS_MODE= 'POINTING'           / Observation mode (pointing or slew)
OBS_ID  = '017424'             / Observation identifier
EXP_ID  = '1'                  / Exposure identifier
CONTENT = 'EPIC IMAGE'         / Content of file
ORIGIN  = 'Leicester/SSC'      / origin of FITS file
DATE    = '1999-09-21'         / FITS file creation date (yyyy-mm-dd)
OBJECT  = 'CEN A'              / Name of observed object
RA_PNT  =          202.3487324 / RA of instrument pointing
DEC_PNT =          -43.2394871 / DEC of instrument pointing
ROLL_PNT=                  0.0 / ROLL angle of instrument pointing
RADECSYS= 'FK5'                /
EQUINOX =               2000.0 / Equinox of celestial coord system
EXPOSURE=              32243.4 / Exposure (secs)
CREATOR = 'EVSELECT V10.2'     / Program that created this FITS file
DATE-OBS= '1999-08-14T05:12:15' / Date observations were made
DATE-END= '1999-08-15T05:40:15' / Date observations ended
OBSERVER= 'N. E. Body'         / Name of PI
```

Additional keywords specific to each instrument or each product may also be defined in the primary header.

For products extracted on a source-by-source basis (spectra, time-series, etc.) an additional keyword (SRCNO) will be present.

6.2.2 Good-time interval (GTI) extension

- This extension lists time intervals during which valid data are present in a data file.
- The extension header contains the following keywords to identify the extension:

```
EXTNAME = 'STDGTI  '          / name of this binary table extension
HDUCLASS= 'OGIP    '          / File conforms to OGIP/GSFC conventions
HDUCLAS1= 'GTI     '          / File contains Good Time Intervals
HDUCLAS2= 'STANDARD'          / File contains Good Time Intervals
```

- The extension contains a binary table with the following columns:

Name	Type	Description
`START`	8-byte REAL	Start time (seconds)
`STOP`	8-byte REAL	Stop time (seconds)

- Times in the GTI extension are specified in seconds after a reference time given in a header keyword.

6.2.3 Detector description extension

This extension will describe the detector(s) used to obtain the data present in a file, along with operating modes where relevant. The content is TBD.

6.2.4 Selection history extension

This extension will describe all selection and manipulation applied to the data in the file. The content is TBD. It may not be a true extension at all, rather a group of keywords appended to one of the extensions in the data file.

6.3 Observation summary products

6.3.1 PRODUCT: Observation summary

- This summary will list details of the observation, e.g. name of the GO, target name, start and end time of the observation, pointing position, etc.
- For each instrument, the summary will contain details of the individual exposures in the observation, this list will include start and end time, filter wheel position, instrument mode and important instrument mode parameters.
- The summary will not contain PPS results. All necessary information is available in the ODF headers.
- The observation summary will be delivered in HTML.
- This is a product of class `PPSOBS`.
- There will be one observation summary per observation. File size will be 20 KB.

6.3.2 PRODUCT: Attitude time series

- This product re-presents the data from the ODF Spacecraft Attitude History and OM Tracking History Data files in the form of attitude values (as supplied by the OAL), and attitude differences, in uniform time steps.
- These files will be identified using the keyword

  `CONTENT = 'ATTITUDE TIME SERIES'`

  in the primary header.
- This is a product of class `PPSOBS`.
- The `ATTHK` extension will a binary table with the following columns:

Name	Type	Description
`TIME`	8-byte REAL	Time (seconds)
`AHFRA`	8-byte REAL	AHF Right Ascension (degrees)
`AHFDEC`	8-byte REAL	AHF Declination(degrees)
`AHFPA`	8-byte REAL	AHF position angle (degrees)
`OMRA`	8-byte REAL	OM Right Ascension(degrees)
`OMDEC`	8-byte REAL	OM Declination (degrees)
`OMPA`	8-byte REAL	OM position angle (degrees)
`DAHFNOM`	8-byte REAL	Pointing difference AHF-NOM (degrees)
`DOMNOM`	8-byte REAL	Pointing difference OM-NOM (degrees)
`DAHFOM`	8-byte REAL	Pointing difference AHF-OM (degrees)

- This is a science product, it is used by SAS tasks which need access to the XMM attitude.
- There will be one file per observation. The product will be supplied in FITS format, a typical file will be 5MB uncompressed.

6.4 OM products

This section describes the OM pipeline products derived from XMM OM pointed and slew data. The OM will not view the sky during slews, so there will be no products directly related to OM slews. However, calibration observations are made during slews. Data from these are combined into observation-specific PPS products. Analysis of OM grism data is not foreseen in the PPS, there will be no PPS products associated with grism data.

OM PPS products include files used to calibrate the observation, FITS and PNG images, source lists and source time-series.

6.4.1 OM general FITS products header

The primary header of all OM FITS products will contain the mandatory FITS keywords defined in section 6.2.1. The `DETNAM` keyword in the primary header will assume the values `PRIME` or `REDUNDANT`, and the `DATAMODE` keyword will be `IMAGE` or `FAST` or `TRACKING` (for tracking star products).

As the OM is an optical instrument the OGIP FITS standards are not strictly applicable (being defined for use with data from high-energy astrophysics experiments). The products defined here follow the spirit of the OGIP conventions as closely as possible, and `HDUCLAS`*n* keywords are included where the OM product is thought sufficiently similar to its OGIP analogue.

6.4.2 OM image products

This section describes image data products to be generated for pointed observations. The science products are left in detector co-ordinates with a transformation to sky co-ordinates available from the SAS. This is done to facilitate comparison with the cosmetics maps and flat fields. Preview products will be transformed to sky coordinates to allow easy comparison with the corresponding EPIC images (and overlay of EPIC X-ray contours).

For OM FITS image products the following instrument specific header keywords will be present:

```
BINBPE= T          / BPE binning enabled
BINAX1= 2          / DPU x-axis binning 2**N
BINAX2= 2          / DPU y-axis binning 2**M
OSW_ID = '1'       / Identifier for current OSW
```

6.4.2.1 PRODUCT: OM OSW FITS image

- Each OM exposure may have up to five science windows or OSWs, although there are typically expected to be only 2 per exposure. Each OSW is stored as a pair of arrays. The image itself stored as the primary data array, and the quality array stored as `IMAGE` extension `EXTNAME = 'QUALITY'`.
- Although `FAST` data are acquired in the form of an events stream, the SSC pipeline will generate an image from the whole `FAST` event stream.

- The SSC PPS will compute the limiting flux for the OSW and write it as a keyword (`MAGLIMIT`) in the FITS header.
- These files will be identified using the keyword

  ```
  CONTENT = 'OM OSW IMAGE'
  ```

  in the primary header.
- The OGIP filetype will be defined by the keywords

  ```
  HDUCLASS= 'OGIP    '           / Format conforms to OGIP/GSFC conventions
  HDUCLAS1= 'IMAGE   '           / File contains an image
  HDUCLAS2= 'TOTAL   '           / Total counts
  ```

  in the primary header.
- This is a product of class `OMOSW`.
- This is a science product containing the primary scientific data from the OM. It is suitable for use in further data analysis.
- For the typical situation of 2 windows per exposure, the files will average XX MB uncompressed.

6.4.2.2 PRODUCT: OM OSW FITS sky image

- The FITS format OM OSW images will be rotated and rebinned to North-aligned sky coordinates.
- The files will be identified using the keyword

  ```
  CONTENT = 'OM OSW SKY IMAGE'
  ```

- This is a product of class `OMOSW`.
- This product will be used for comparison between optical and X-ray images (also in sky coordinates). It will be used in the production of OM OSW PNG images.
- There will be one OM OSW FITS sky image for each OM OSW FITS image, and each file will occupy 570 kB uncompressed.

6.4.2.3 PRODUCT: OM flatfield

Owing to the depressive effect of bright stars in the FOV on the MCP gain, global sensitivity flats for the OM must be taken frequently and a number of them co-added to make a flatfield image. This data is expected to be taken during slews. The OM flatfield image will be drift corrected for each science window of the observation before being applied in the pipeline processing.

- The flat field image is held in the primary image array in 1024×1024 4-byte reals. The individual flat fields used to compile the observation flatfield are referenced by their slew names.

- The flat field covers the entire OM.
- These files will be identified using the keyword

  ```
  CONTENT = 'OM FLATFIELD'
  ```

  in the primary header.
- The OGIP filetype will be defined by the keywords

  ```
  HDUCLASS= 'OGIP    '           / Format conforms to OGIP/GSFC conventions
  HDUCLAS1= 'IMAGE   '           / File contains an image
  HDUCLAS2= 'DETMAP  '           / Detector map
  ```

  in the primary header.
- This is a product of class `OMOBS`.
- This is a science product. The OM flatfield may vary from observation to observation, and so is necessary for the correct analysis of OM data.
- There will be one file per observation. The file will be FITS format, with a size of 4 MB uncompressed.

6.4.3 OM Timeseries products

This section describes timeseries (lightcurve) data products to be generated from pointed observations.

6.4.3.1 PRODUCT: OM OSW FITS source timeseries

- OM source timeseries are only produced for OSWs in `FAST` mode.
- There will be one timeseries per source for each OSW in an exposure.
- The OM pipeline will nominally produce timeseries with bins evenly spaced at the same intervals as the `FAST` mode time-slices.
- Timeseries will only be provided for those sources which are either above some magnitude threshold and/or which show variability above some (parameterised) limit.
- These files will be identified using the keyword

  ```
  CONTENT = 'OM OSW SOURCE TIMESERIES'
  ```

  in the primary header.
- This is a product of class `OMSRC`.
- The OGIP filetype will be defined by the keywords

  ```
  HDUCLASS= 'OGIP'                / Format conforms to OGIP/GSFC conventions
  HDUCLAS1= 'LIGHTCURVE'          / File contains a time-series
  HDUCLAS2= 'TOTAL'               / Not background subtracted
  HDUCLAS3= 'RATE'                / Exposure corrected (ie.  count rate)
  ```

  in the header of the `RATE` extension.
- The `RATE` extension will a binary table with the following columns:

Name	Type	Description
`RATE`	4-byte REAL	Count rate (count/s)
`ERROR`	4-byte REAL	Error (count/s)
`BACKV`	4-byte REAL	Background count rate (count/s)
`BACKE`	4-byte REAL	Background error (count/s)

- This is a science product. The OM OSW source timeseries flags variability for all sources in the field.
- There will be one file per selected source per OSW per exposure. The product will be supplied in FITS format, a typical file will be 360KB uncompressed.

6.4.3.2 PRODUCT: OM OSW PDF source timeseries

- There will be a PDF preview product containing the source and background timeseries for selected sources.
- The plot will be derived from the FITS source timeseries. The timeseries will be binned before plotting to reduce the product size.
- This is a product of class `OMSRC`.
- This is a preview product suitable for use in an online browser. There will be one file per selected source per OSW per exposure. Each file will be approximately 45KB.

6.4.3.3 PRODUCT: OM FITS tracking star timeseries

- The tracking star timeseries are produced from the OM tracking star data.
- Each file contains one binary table extension which contains the timeseries for all of the tracking stars.
- There is no background or exposure time timeseries as this information is not available for tracking stars.
- Tracking star timeseries are produced irrespective of the OM mode (i.e. both `IMAGE` and `FAST`).
- The OM tracking star timeseries will give serendipitous information on tracking star variability.
- These files will be identified using the keyword

  `CONTENT = 'OM TRACKING STAR TIMESERIES'`

  in the primary header.
- This is a product of class `OMEXP`.
- The OGIP filetype will be defined by the keywords

  ```
  HDUCLASS= 'OGIP'             / Format conforms to OGIP/GSFC conventions
  HDUCLAS1= 'LIGHTCURVE'       / File contains a time-series
  HDUCLAS2= 'TOTAL'            / Not background subtracted
  HDUCLAS3= 'RATE'             / Exposure corrected (ie.  count rate)
  ```

  in the header of the `RATE` extension.
- The `RATE` extension will a binary table with the following columns. There is one column per tracking star, and up to 10 tracking stars in total:

Name	Type	Description
RATE1	4-byte REAL	Counts per bin
RATE2	4-byte REAL	Counts per bin
...	...	” ’
RATEn	4-byte REAL	Counts per bin

- There will be 1 FITS files per exposure, each file will be 1MB uncompressed.

6.4.3.4 PRODUCT: OM PDF tracking star timeseries

- This product will be a PDF plot derived from the tracking star timeseries. The timeseries will be binned before plotting to reduce the product size.
- This is a preview product, giving the user access to serendipitous variable tracking star source information for preliminary analysis.
- This is a product of class `OMEXP`.
- There will be one file per exposure. It will include data on all tracking stars. Each file will be approximately 170kB.

6.4.4 OM Source list products

This section describes the OM source list products to be generated from pointed observations.

6.4.4.1 PRODUCT: OM OSW source list

The SSC OM pipeline will produce a source list for each OSW it processes.

Note that the data in `FAST` mode OSWs are summed into single images (one per OSW) from which the source list is produced.

- The source detection list will be supplied in FITS format.
- These files will be identified using the keyword

  `CONTENT = 'OM OSW SOURCE LIST'`

  in the primary header.
- This is a product of class `OMOSW`.
- The OGIP filetype will be defined by the keywords

  ```
  HDUCLASS= 'OGIP    '          / Format conforms to OGIP/GSFC conventions
  HDUCLAS1= 'SRCLIST '          / File contains a source list
  ```

  in the header of the `SRCLIST` extension.
- This is a science product. The OM OSW source list is the first stage analysis of the OSW.
- The data extension (`EXTNAME = 'SRCLIST'`) will contain a binary table with the following columns:

Name	Type	Description
`XPOS`	4-byte REAL	X-pixel position
`YPOS`	4-byte REAL	Y-pixel position
`RA`	8-byte REAL	Source Right Ascension
`DEC`	8-byte REAL	Source Declination
`POSERR`	4-byte REAL	Positional error (arcsec)
`RATE`	4-byte REAL	Count rate
`RATE_ERR`	4-byte REAL	Count rate error
`MAG`	4-byte REAL	Magnitude
`MAGERR`	4-byte REAL	Error on magnitude
`PSFWIDTH`	4-byte REAL	PSF width (arcsec)
`PSFOFFSET`	4-byte REAL	PSF offset (arcsec)
`REDCHI`	4-byte REAL	Reduced chi-squared
`QFLAG`	1-byte INTEGER	Quality flag
`CFLAG`	1-byte INTEGER	Confusion flag
`EFLAG`	1-byte INTEGER	Extension flag
`LII`	8-byte REAL	Source Galactic longitude
`BII`	8-byte REAL	Source Galactic lattitude

- There will be one file per OSW per exposure. Each file will typically be 250KB uncompressed.

6.4.4.2 PRODUCT: OM observation source list

The whole-observation source list is the result of processing the information in the OM OSW source lists (see section 6.4.4.1). Source position and position error are derived from the detections in various filters (if present). Quality, confusion and extension flags are given for all filters used, and colours are computed where possible. A variability measure (e.g. reduced chi-squared) is given if `FAST` mode has been used. Count-rates for the source and background are omitted, as are the source detector coordinate positions (these are available in the OSW source lists).

- These files will be identified using the keyword

  `CONTENT = 'OM OBSERVATION SOURCE LIST'`

  in the primary header.

- This is a product of class `OMOBS`.

- The OGIP filetype will be defined by the keywords

  ```
  HDUCLASS= 'OGIP    '          / Format conforms to OGIP/GSFC conventions
  HDUCLAS1= 'SRCLIST '          / File contains a source list
  ```

  in the header of the `SRCLIST` extension.

- The source list will be contained in a binary table extension `EXTNAME='SRCLIST'`. The number of columns in the table will depend on the number of filters used during an observation and on whether `FAST` mode was used.

Name	Type	Description
`RA`	8-byte REAL	Source Right Ascension
`DEC`	8-byte REAL	Source Declination
`POSERR`	4-byte REAL	Positional error (arcsec)
`MAG_`*xx*	4-byte REAL	Magnitude for filter *xx*
`MAGERR_`*xx*	4-byte REAL	Error on magnitude for filter *xx*
`REDCHI_`*xx*	4-byte REAL	Reduced chi-squared
`QFLAG_`*xx*	1-byte INTEGER	Quality flag
`CFLAG_`*xx*	1-byte INTEGER	Confusion flag
`EFLAG_`*xx*	1-byte INTEGER	Extension flag
⋮	⋮	⋮
`COLOUR_`*yy*	4-byte REAL	Source colour
`COLERR_`*yy*	4-byte REAL	Error in source colour
⋮	⋮	⋮
`LII`	8-byte REAL	Source Galactic longitude
`BII`	8-byte REAL	Source Galactic lattitude

There will be a set of columns `MAG_`*xx*, `MAGERR_`*xx*, `REDCHI_`*xx*, `QFLAG_`*xx*, `CFLAG_`*xx* and `EFLAG_`*xx* for each filter used in the observation, with *xx* replaced by the filter ID. Similarly there will be a colour and colour error computed (columns `COLOUR_`*yy* and `COLERR_`*yy*) for each pair of filters for which it is scientifically sensible. The *yy*'s will be replaced with a colour designation.

- This is a science product. The OM observation source list is the first analysis of the observation.
- There will be one file per observation, supplied in FITS format. The file will typically be 300KB uncompressed.

6.4.5 OM PPS summary and miscellaneous products

6.4.5.1 PRODUCT: OM tracking history plot

- The tracking history plot is a vector diagram summarising the jitter detected by the OM over the course of the observation.
- Included on the plot (in PDF) are statistics which characterise the motion, e.g. average offset, characteristic width, number of exclusions beyond three times the characteristic width and so on.
- This is a product of class `OMEXP`.
- There will be one file per exposure, approximately 140KB.

6.4.5.2 PRODUCT: OM housekeeping summary

- The housekeeping summary file will comprise a PDF plot which will summarise, as a function of time, important parameter values from the following:
  1. Housekeeping data
  2. Derived-housekeeping data
  3. Attitude data
  4. Orbit data
  5. PPS accept/reject flag for data accumulation
- This is a product of class `OMOBS`.
- There will be one OM housekeeping summary per observation. Each file will be 35 KB.

6.4.5.3 PRODUCT: OM HTML summary page

- A summary of all OM products will be provided in HTML.
- The preview frames in PNG format will be viewable using these HTML pages, as will all products in PDF.
- This is a product of class `OMOBS`.
- There will be 1 summary page per observation. File size will be 64 KB.

6.5 EPIC products

EPIC PPS products include a housekeeping summary, FITS and PNG images, detected source lists, source spectra and time-series, and calibrated event lists.

References in this section to `IMAGING` and `TIMING` modes shall be taken to include `REDUCED IMAGING` (EPIC MOS) and `COMPRESSED TIMING` (EPIC MOS) and `BURST` (EPIC p-n) modes respectively.

6.5.1 EPIC general products header

The primary header of all EPIC products will contain the mandatory FITS keywords defined in section 6.2.1. The `DATAMODE` keyword will assume the values `IMAGING` or `TIMING`.

6.5.2 EPIC Image data products

This section describes the image data products to be generated from pointed and slew observations.

6.5.2.1 General conventions

- Where FITS is specified as a file format, the OGIP guidelines will be adopted when appropriate.
- The following extensions will be present in the file:
  1. A good time interval extension (6.2.2).
  2. A detector description extension (6.2.3).
  3. A (selection) history extension (6.2.4).
- All images will be presented in tangent plane projection of equatorial sky coordinates, centred on the nominal pointing position. The second (Y) axis will be aligned to local Celestial North at the image centre.
- The images will be 640×640 pixels, with a pixel size of 4×4 arcseconds (compared to a PSF FWHM $\sim 10''$). The image will therefore be 42.66 arcminutes square, which will encompass the entire EPIC field-of-view and accommodate some spacecraft jitter and telescope boresight errors.
- Images will be produced in a number of energy bands, covering the full energy range ("total band") and narrower bands. These energy bands will be defined by pulse-invariant (PI) channels which will have a fixed channel-energy relation throughout the life of the mission. The FITS header keyword BAND will be used to define the energy band of a data product. There are 6 planned values of `BAND` for general images:

Band no.	Energy range (keV)	Used in
1	0.2-0.5	images (not three-colour image)
2	0.5-2.0	images (not three-colour image)
3	2.0-4.5	images (not three-colour image)
4	4.5-7.5	images (not three-colour image)
5	7.5-12.0	images (not three-colour image)
6	0.2-2.0	timeseries
7	2.0-12.0	timeseries
8	0.1-12.0	images, timeseries, other products

Bands 1,2,3,4,5,8 are image energy bands. Bands 6,7,8 are timeseries bands.

- EPIC source lists use a BAND of 0 to denote information relating to all analysed bands combined
- EPIC source lists include hardness ratios which are ratios of count rates in the energy bands defined above. The hardness ratios used are:

Hardness ratio	Range	Definition
HR1	soft	(band 2 - band 1)/(band 2 + band 1)
HR2	mid	(band 3 - band 2)/(band 3 + band 2)
HR3	hard	(band 4 - band 3)/(band 4 + band 3)

6.5.2.2 PRODUCT: EPIC FITS image

- The raw (i.e. not exposure corrected) images will be produced by accumulating all valid events in an exposure from all camera CCDs operating in `IMAGING` mode. Events collected in other instrument modes (eg. `TIMING` mode) will not be used.
- A set of raw images will be produced for each EPIC camera (2 MOS and 1 p-n).
- These images will be accumulated from intervals of low particle background.
- The physical unit of the pixel data will be counts.
- These images are science products suitable for use in data analysis.
- The raw images will be supplied in FITS format. The image data array will be 8-bit, 16-bit or 32-bit integers, depending on the maximum value of the data in the array.
- These files will be identified using the keyword

  ```
  CONTENT = 'EPIC IMAGE'
  ```

  in the primary header.
- This is a product of class `EPICEXP`.
- The OGIP filetype will be defined by the keywords

```
HDUCLASS= 'OGIP    '           / Format conforms to OGIP/GSFC conventions
HDUCLAS1= 'IMAGE   '           / File contains an image
HDUCLAS2= 'TOTAL   '           / Total counts
```

in the primary header.

- For each exposure there will be one image per image energy band listed in section 6.5.2.1. Assuming 32-bit image pixels, each FITS image will be approximately 1.7 MB uncompressed.

6.5.2.3 PRODUCT: EPIC PNG images

- Annotated raw images will be supplied in PNG format. These images will be derived from the FITS format raw photon images, annotated with a sky grid and text to identify the observation, exposure ID, camera and energy band.
- The field-of-view of the RGS instruments will be overlaid on the image.
- These images are preview products suitable for use in an online browser.
- For each exposure there will be one image per image energy band listed in section 6.5.2.1. Each image will be 40 KB.

6.5.2.4 PRODUCT: EPIC FITS observation image

- This exposure-corrected image will be made from all IMAGING mode data taken during an observation.
- There will be one image which includes data from all EPICs which operated in IMAGING mode. The image will include data from the entire energy range (ie band 8 listed in section 8.5.2.1).
- The physical unit of the pixel data will be counts per second
- The image will be supplied in FITS format, with the image data stored as single precision reals, and with the image data in the primary HDU.
- The files will be identified using the keyword

```
CONTENT = 'EPIC OBSERVATION IMAGE'
```

- This is a product of class `EPICOBS`
- The OGIP filetype will be defined by the keywords

```
HDUCLASS= 'OGIP    '
HDUCLAS1= 'IMAGE   '
HDUCLAS2= 'TOTAL   '
```

in the primary header

- There will be one file per observation. Assuming 32-bit real image pixels, each FITS image will be approximately 1.7 MB uncompressed.

6.5.2.5 PRODUCT: EPIC PNG observation image

- The EPIC FITS observation image will be used as a basis for this PNG format image. It will be annotated with sky coordinate information and text to identify the observation.
- This image is a preview product suitable for use in an online browser.
- There will be one image which includes data from all EPICs which operated in IMAGING mode.
- This is a product of class `EPICOBS`
- There will be one file per observation, being approximately 40 KB.

6.5.2.6 PRODUCT: EPIC exposure map

- Exposure maps will be produced which will reflect (at least) spatial variations in quantum efficiency of the detectors, bad pixels, inter-CCD gaps and the mirror vignetting.
- These maps are science products suitable for use in data analysis. They may be used to "flat field" the corresponding FITS format raw photon images.
- A set of exposure maps will be produced for each EPIC camera (2 MOS and 1 p-n).
- Exposure maps will be produced covering the total energy band, and the chosen narrower bands.
- The physical unit of the pixel data will be seconds.
- The exposure maps will be supplied in FITS format.
- These files will be identified using the keyword

  ```
  CONTENT = 'EPIC EXPOSURE MAP'
  ```

  in the primary header.
- This is a product of class `EPICEXP`.
- The OGIP filetype will be defined by the keywords

  ```
  HDUCLASS= 'OGIP    '           / Format conforms to OGIP/GSFC conventions
  HDUCLAS1= 'IMAGE   '           / File contains an image
  HDUCLAS2= 'EXPOSURE'           / Exposure map
  ```

  in the primary header.
- For each exposure there will be six exposure maps. Assuming 32-bit REAL image pixels, each FITS image will be approximately 1.7 MB uncompressed.

6.5.2.7 PRODUCT: EPIC exposure sensitivity map

- This image will be a map of the minimum source flux (count rate) detectable by the point source detection task eboxdetect. The sensitivity value will be zero for regions for which there is no sensitivity.
- These maps are science products and may be used to determine upper-limit fluxes on undetected sources within the FOV and for the calculation of coverage correction curves.
- The product will contain sensitivity values relating to a single EPIC image mode exposure.
- The sensitivity values will relate to a single energy band, the core-XID band (0.5-4.5 keV).
- The unit of the pixel data will be counts per second.
- The product will be supplied in FITS format.
- These files will be identified using the keyword

  ```
  CONTENT = 'EPIC EXPOSURE SENSITIVITY MAP'
  ```

  in the primary header.
- This is a product of class `EPICEXP`.
- The OGIP filetype will be defined by the keywords

  ```
  HDUCLASS= 'OGIP    '     / Format conforms to OGIP/GSFC conventions
  HDUCLAS1= 'IMAGE   '     / File contains an image
  HDUCLAS2= 'GENERIC'      / Miscellaneous type
  ```

  in the primary header.
- There will be one EPIC exposure sensitivity map per image mode exposure. Assuming 32-bit real image pixels, each product will be approximately 1.7 MB uncompressed.

6.5.2.8 PRODUCT: EPIC camera sensitivity map

- This image will be a map of the minimum source flux (count rate) detectable by the point source detection task eboxdetect when analysing all image mode exposures from a single EPIC camera. The sensitivity value will be zero for regions for which there is no sensitivity.
- These maps are science products and may be used to determine upper-limit fluxes on undetected sources within the FOV and for the calculation of coverage correction curves.
- The product will contain sensitivity values relating to the combination of all image mode exposures from a single EPIC.
- The sensitivity values will relate to a single energy band, the core-XID band (0.5-4.5 keV).
- The unit of the pixel data will be counts per second.
- The product will be supplied in FITS format.

- These files will be identified using the keyword

  `CONTENT = 'EPIC CAMERA SENSITIVITY MAP'`

  in the primary header.

- This is a product of class `EPICOBS`.
- The OGIP filetype will be defined by the keywords

```
HDUCLASS= 'OGIP    '     / Format conforms to OGIP/GSFC conventions
HDUCLAS1= 'IMAGE   '     / File contains an image
HDUCLAS2= 'GENERIC'      / Miscellaneous type
```

  in the primary header.

- There will be one EPIC camera sensitivity map per EPIC camera having more than one image mode exposure. This circumstance may be rare, and so this product will frequently be absent. Assuming 32-bit real image pixels, each product will be approximately 1.7 MB uncompressed.

6.5.2.9 PRODUCT: EPIC sensitivity map

- This image will be a map of the minimum source flux (count rate) detectable by the point source detection task eboxdetect when analysing all EPIC imaging mode exposures. The sensitivity value will be zero for regions for which there is no sensitivity.
- These maps are science products and may be used to determine upper-limit fluxes on undetected sources within the FOV and for the calculation of coverage correction curves.
- The product will contain sensitivity values relating to the combination of all EPIC image mode exposures in an observation.
- The sensitivity values will relate to a single energy band, the core-XID band (0.5-4.5 keV).
- The unit of the pixel data will be counts per second.
- The product will be supplied in FITS format.
- These files will be identified using the keyword

  `CONTENT = 'EPIC SENSITIVITY MAP'`

  in the primary header.

- This is a product of class `EPICOBS`.
- The OGIP filetype will be defined by the keywords

```
HDUCLASS= 'OGIP    '     / Format conforms to OGIP/GSFC conventions
HDUCLAS1= 'IMAGE   '     / File contains an image
HDUCLAS2= 'GENERIC'      / Miscellaneous type
```

  in the primary header.

- There will be one EPIC sensitivity map per observation (assuming at least two EPICs had image mode exposures). Assuming 32-bit real image pixels, each product will be approximately 1.7 MB uncompressed.

6.5.2.10 PRODUCT: EPIC three-colour image

- This image will be generated by combining images in three independent energy bands. The image representing the lowest energy band will be encoded red, the middle energy band will be encoded green and the highest energy band encoded blue. The intensity of each pixel will represent of the overall image intensity in the total band, and the colour of each pixel will represent the X-ray colour. The three energy bands used will be 0.1 – 0.5, 0.5 – 2.0 and 2.0 – 10.0 keV.
- These images are preview products suitable for use in an online browser. Three colour images quickly convey information about the spectrum of point sources in the field (ie. whether they are spectrally hard or soft, or heavily absorbed).
- The three-colour images will be annotated with a sky grid and text identifying the observation, exposure ID and camera.
- A three-colour image will be generated for each EPIC camera (2 MOS camera and 1 p-n).
- This is a product of class `EPICEXP`.
- The three-colour images will be supplied in PNG format.
- For each exposure there will be 1 file. Each file will be approximately 60KB.

6.5.2.11 PRODUCT: EPIC variability image

- This image will represent the value of a variability statistic at each pixel. The apparent brightness of each pixel will be proportional to the excess X-ray variability in that pixel.
- A variability image will be produced for each EPIC camera (2 MOS and 1 p-n), covering the total energy band.
- These images are preview products suitable for use in an online browser. The variability image quickly conveys information about the level of variability of the sources within the field of view. The sources flagged as variable in the timing analysis will be marked on the image.
- The variability images will also be annotated with a sky grid and text identifying the observation, exposure ID and camera.
- This is a product of class `EPICEXP`.
- The variability images will be supplied in PNG format.
- There will be one file per exposure, each approximately 50KB.

6.5.3 EPIC Time-series and timing analysis products

This section describes time-series (lightcurve) data products to be generated from pointed observations.

6.5.3.1 General conventions

- Where FITS is defined as the file format, the OGIP standard defined by OGIP/93-003 will be followed. A FITS file will have the following basic structure:
  1. Primary header with null primary array.
  2. The "Rate" extension (`EXTNAME = 'RATE'`), containing the time-series.
  3. A time correction extension (`EXTNAME = 'TIMEREF'`) which lists the correction from MJD in the local frame to the geocentric, heliocentric and barycentric frames for selected times within the exposure.
  4. A good time interval extension (6.2.2).
  5. A detector description extension (6.2.3).
  6. A (selection) history extension (6.2.4).
- The reference time, exposure start and stop times will be specified in MJD. Bin times will be specified in seconds relative to the start of the exposure.
- Products will be produced in a number of energy bands, covering the full energy range, and narrower ranges. These energy bands will be defined by pulse-invariant (PI) channels which will have a fixed channel-energy relation throughout the life of the mission. The FITS header keyword BAND will be used to define the energy band of a data product. There are 3 planned values of BAND for timeseries, they are given in section 6.5.2.1.

6.5.3.2 PRODUCT: EPIC FITS source time-series

- Time-series will be delivered for all bright (> 100 counts) unconfused point sources in the EPIC field sufficiently far from inter-CCD gaps to avoid occultation.
- A source time-series will be accumulated by use of a spatial filter on valid events in an exposure from CCDs operating in `IMAGING` or `TIMING` mode.
- A source time-series file will contain the exposure corrected, background subtracted intensity and associated error of the detected EPIC source in each energy band. It will also contain the background timeseries.
- The time-series will follow a regular binning scheme (i.e. equispaced time bins).
- The width of the time bins will be determined from the mean count rate with the aim of ensuring good average photon statistics in the total flux band (e.g. an average of 10 counts per bin).
- In accordance with FITS conventions, gaps in the time-series will be denoted by inserting the IEEE NaN constant in the relevant time bin.
- For each candidate source, one time-series file will be produced for each EPIC camera covering $0.1 - 2.0$, $2.0 - 10.0$ and $0.1 - 10.0$ keV.

- Source time-series will be delivered in FITS format.
- These files are science products which may be used in further data analysis.
- These files will be identified using the keyword

  ```
  CONTENT = 'EPIC SOURCE TIMESERIES'
  ```

  in the primary header.
- This is a product of class `EPICSRC`.
- The OGIP filetype will be defined by the keywords

  ```
  HDUCLASS= 'OGIP'                / Format conforms to OGIP/GSFC conventions
  HDUCLAS1= 'LIGHTCURVE'          / File contains a time-series
  HDUCLAS2= 'TOTAL '              / Not background subtracted
  HDUCLAS3= 'RATE'                / Exposure corrected (i.e. count rate)
  ```

  in the header of the `RATE` extension.
- The `RATE` extension will be a binary table with the following columns:

Name	Type	Description
RATE	3×4-byte REAL	Count rate (count/s)
ERROR	3×4-byte REAL	Error (count/s)
BACKV	3×4-byte REAL	Background count rate (count/s)
BACKE	3×4-byte REAL	Background error (count/s)

- At least the following FITS keywords will be present:

  ```
  1CTYP1 = 'CHANNEL'              / For column 1: RATE
  1CTYP2 = 'CHANNEL'              / For column 2: ERROR
  1CTYP3 = 'CHANNEL'              / For column 3: BACKV
  1CTYP4 = 'CHANNEL'              / For column 4: BACKE
  ```

- For each exposure there will be one FITS file per selected source in the EPIC field. For an exposure of 15 ksec with 30 second time bins a time-series file will be approximately 24KB uncompressed.

6.5.3.3 PRODUCT: EPIC PDF source time-series

- This product will be produced from the FITS format source time series. The background subtracted source time series and background time series will be plotted in each energy band.
- The data from the FITS timeseries will be binned by a factor five to ensure good signal-to-noise in each data point, and further binned if necessary to limit the number of plotted data points to 500.
- This is a preview product suitable for use in an online browser.

- This is a product of class `EPICSRC`.
- The product will be supplied in PDF format.
- There will be one file per selected source per exposure. Each file will be approximately 4KB.

6.5.3.4 PRODUCT: EPIC source FFT plot

- This product will be a plot of an FFT of the source lightcurve. It will produced for all sources for which time-series are produced.
- The FFT plot is a preview product suitable for use in an online browser.
- This is a product of class `EPICSRC`.
- There will be one file per source per exposure. It will be provided in PDF format.
- Each file will be approximately 17KB.

6.5.3.5 PRODUCT: EPIC global background time-series

- This product will be created by masking out all the detected point-sources in the EPIC field-of-view, then creating a time-series using the remaining photons.
- This is a science product, which will be useful for the characterisation of instrumental background in the EPIC cameras. The files will be FITS format.
- These files will be identified using the keyword

  ```
  CONTENT = 'EPIC GLOBAL BACKGROUND TIMESERIES'
  ```

  in the primary header.
- This is a product of class `EPICEXP`.
- The OGIP filetype will be defined by the keywords

  ```
  HDUCLASS= 'OGIP    '          / Format conforms to OGIP/GSFC conventions
  HDUCLAS1= 'LIGHTCURVE'        / File contains an time-series
  HDUCLAS2= 'TOTAL   '          / Not background subtracted
  HDUCLAS3= 'RATE    '          / Exposure corrected
  ```

  in the header of the `RATE` extension.
- The `RATE` extension will a binary table with the following columns:

Name	Type	Description
`RATE`	4-byte REAL	Count rate (count/s)
`ERROR`	4-byte REAL	Error (count/s)

- These time-series will be produced in the same five energy bands as the EPIC image products.
- For each exposure there will be five FITS files per EPIC CAMERA. For an exposure of 15 ksec with 30 second time bins a time-series file will be approximately 4kB uncompressed.

6.5.4 EPIC Spectral products

This section describes the spectral data products to be generated from pointed and slew observations.

Source and background spectra will be supplied. Spectral response matrices will not be supplied, these can be made by the user from the information in the spectrum file header. *There will be no spectral fitting products produced by the PPS.*

6.5.4.1 General conventions

- Where FITS is specified as a file format, the OGIP standards defined by OGIP/92-007 (and amended by OGIP-92/007a) will be followed where appropriate. Such a FITS file will have the basic structure:
  1. Primary header with null primary array.
  2. Data extension (`EXTNAME = 'SPECTRUM'`).
  3. A good time interval extension (6.2.2).
  4. A detector description extension (6.2.3).
  5. A (selection) history extension (6.2.4).
- The spectral channels in these files will be of the PI (position invariant) type. The corresponding keyword will be set in the FITS header (`CHANTYPE = 'PI'`).
- Spectra will contain 2048 channels.
- Spectra will not be background-subtracted.

6.5.4.2 PRODUCT: EPIC FITS source spectrum

- A source spectrum will be generated for each EPIC source which is found to be unconfused and sufficiently bright to yield a useful spectrum.
- A source spectrum will be accumulated by use of a spatial filter on valid events in an exposure from CCDs operating in `IMAGING` and `TIMING` mode.
- For each candidate source a spectrum will be produced for each EPIC camera (2 MOS and 1 p-n).
- No systematic error or grouping information will be included in the spectrum file. The statistical error will be defined by Poisson errors on the counts in the channel (ie. `POISSERR=T` and table column `STAT_ERR` omitted). Quality information may be included in the file.
- The data will be stored as counts, not count rate. The exposure time will be stored in a separate keyword in the header (`EXPOSURE`).
- The source spectra will be supplied in FITS format.
- This is a science product suitable for use in further data analysis.
- These files will be identified using the keyword

  `CONTENT = 'EPIC SOURCE SPECTRUM'`

in the primary header.

- This is a product of class `EPICSRC`.
- The OGIP filetype will be defined by the keywords

```
HDUCLASS= 'OGIP    '           / Format conforms to OGIP/GSFC conventions
HDUCLAS1= 'SPECTRUM'           / Extension contains an spectrum
HDUCLAS2= 'TOTAL   '           / Gross PHA spectrum (source + bkg)
HDUCLAS3= 'COUNT   '           / Data stored as counts
```

in the header of the `SPECTRUM` extension.

- The `SPECTRUM` extension will contain a binary table (one row per channel) with the following columns:

Name	Type	Description
`CHANNEL`	2-byte INTEGER	Detector channel number
`COUNTS`	4-byte INTEGER	Observed counts

- For each exposure there will be one source spectrum file per selected source in the EPIC field. The files will be approximately 15KB uncompressed.

6.5.4.3 PRODUCT: EPIC FITS source background spectrum

- A background spectrum will be generated for each detected EPIC source for which a source spectrum is generated.
- The background spectrum will be generated either by accumulation of detected events in a source-free region of the field-of-view, or by an empirical model of the instrument background, or by a combination of these techniques.
- For each candidate source a background spectrum will be produced for each EPIC camera (2 MOS and 1 p-n).
- No systematic error or grouping information will be included in the spectrum file. The statistical error will be defined by Poisson errors on the counts in the channel (ie. `POISSERR=T` and table column `STAT_ERR` omitted). Quality information may be included in the file.
- The data will be stored as counts, not count rate.
- Background spectra will be supplied in FITS format.
- These files will be identified using the keyword

```
CONTENT = 'EPIC SOURCE BACKGROUND SPECTRUM'
```

in the primary header.

- This is a product of class `EPICSRC`.
- The OGIP filetype will be defined by the keywords

```
HDUCLASS= 'OGIP    '          / Format conforms to OGIP/GSFC conventions
HDUCLAS1= 'SPECTRUM'          / Extension contains an spectrum
HDUCLAS2= 'BKG     '          / Background spectrum
HDUCLAS3= 'COUNT   '          / Data stored as counts
HDUVERS1= '1.1.0   '          / Version number of the format
```

in the header of the `SPECTRUM` extension.

- The `SPECTRUM` extension will contain a binary table (one row per channel) with the following columns:

Name	Type	Description
`CHANNEL`	2-byte INTEGER	Detector channel number
`COUNTS`	4-byte INTEGER	Observed counts

- For each exposure there will be one background spectrum file per selected source in the EPIC field. The files will be approximately 15KB uncompressed.

6.5.4.4 PRODUCT: EPIC source spectrum plot

- This product is an annotated plot of the background subtracted, exposure corrected source spectrum. The data will be grouped to ensure good statistics in each data point before plotting. The plot will show flux (count/s/cm^2/keV) versus energy (keV).
- The background spectrum will also be plotted in this product.
- This is a preview product suitable for use in an online browser. It will be supplied in PDF format.
- This is a product of class `EPICSRC`.
- There will be a single file per selected source per exposure. Each file will be approximately 17KB.

6.5.4.5 PRODUCT: EPIC global background spectrum

- This product will be produced by masking all detected sources in the EPIC field-of-view, then accumulating the remaining detected photons in a spectrum.
- The spectral file will contain multiple accumulated spectra at a range of off-axis angles.
- This is a science product, which will be useful for the characterisation of the instrumental background in the EPIC cameras.
- These files will be identified using the keyword

  ```
  CONTENT = 'EPIC GLOBAL BACKGROUND SPECTRUM'
  ```

  in the primary header.
- This is a product of class `EPICEXP`.

- The OGIP filetype will be defined by the keywords

```
HDUCLASS= 'OGIP    '          / Format conforms to OGIP/GSFC conventions
HDUCLAS1= 'SPECTRUM'          / Extension contains an spectrum
HDUCLAS2= 'TOTAL   '          / Gross PHA spectrum (source + bkg)
HDUCLAS3= 'COUNT   '          / Data stored as counts
```

  in the header of the `SPECTRUM` extension.

- The `SPECTRUM` extension will contain a binary table (one row per channel) with the following columns:

Name	Type	Description
`CHANNEL`	2-byte INTEGER	Detector channel number
`COUNTS`	4-byte INTEGER	Observed counts

- There will be one file per EPIC camera exposure. Assuming 10 off-axis angle bins, each file will be approximately 160kB uncompressed.

6.5.4.6 PRODUCT: EPIC fluctuations spectrum

- This product will be produced by masking all detected sources in the EPIC field-of-view, then subtracting the spectrum due to below average count detect cells from the spectrum due to above average count detect cells.
- The spectral file will contain multiple accumulated spectra at a range of off-axis angles.
- This is a science product, which will be useful for the characterisation of the spectrum of the sources too faint to be detected in the EPIC cameras. It thus provides information on the level of the systematic errors in faint source spectra.
- These files will be identified using the keyword

```
CONTENT = 'EPIC FLUCTUATIONS SPECTRUM'
```

  in the primary header.

- This is a product of class `EPICEXP`.
- The OGIP filetype will be defined by the keywords

```
HDUCLASS= 'OGIP    '          / Format conforms to OGIP/GSFC conventions
HDUCLAS1= 'SPECTRUM'          / Extension contains an spectrum
HDUCLAS2= 'NET     '          / A bkgd-subtracted PHA Spectrum
HDUCLAS3= 'COUNT   '          / Data stored as counts
```

  in the header of the `SPECTRUM` extension.

- The `SPECTRUM` extension will contain a binary table (having one spectrum per row, ie OGIP PHA II format using vector arrays) with the following columns:

Name	Type	Description
`SPEC_NUM`	2-byte INTEGER	Spectrum number
`CHANNEL`	2-byte INTEGER	Channel number
`COUNTS`	4-byte REAL	No of counts in channel
`STAT_ERR`	4-byte REAL	Statistical error on no of counts
`ROW_ID`	20-byte CHAR string	Spectrum label (eg off-axis value)
`BACKSCAL`	4-byte REAL	Background scaling factor
`RESPFILE`	20-byte CHAR string	Response file
`ANCRFILE`	20-byte CHAR string	Ancillary file

- There will be one file per EPIC camera exposure. Assuming 10 off-axis angle bins, each file will be approximately 160kB uncompressed.

6.5.5 EPIC source list and image analysis products

This section describes the EPIC source list and image analysis products. The PPS uses two tasks to detect sources: eboxdetect & emldetect. The task eboxdetect can run in 'local' or 'map' mode. The output file format of the two tasks is similar (regardless of eboxdetect mode). Both source detection tasks are run 2 or 3 times per observation, making products with different names but having the same file structure on each occasion. Specifically, the detection tasks are run on 1) individual imaging mode exposures, 2) all imaging mode exposures from an individual EPIC camera (if there is more than one exposure in the observation), and 3) all imaging mode exposures from all EPIC cameras (if there is more than one EPIC in image mode). There may thus be up to 9 primary source detection product file types per observation (see sections 8.5.5.2 to 8.5.5.10). In each case, images from a number of distinct event energy bandpasses are analysed together; the products give only total-band source positions, while other measured parameters are band-specific. The emldetect source lists will also include one result set for the core-XID band (0.5-4.5 keV).

The emldetect primary source detection products are summarised, internally cross-correlated, and may be position-rectified in the secondary source list products. Position rectification is a process of varying the ensemble of raw source positions until position residuals with respect to an astrometric catalogue are minimised, it may not be possible for all observations. Also added are information on related OM sources, EPIC source variability, and whether sources have spectral or timeseries products. There are 2 such secondary source list products per observation (described in sections 8.5.5.11 and 8.5.5.12).

Lastly, a fluctuations histogram product is made as a graphics file, the histogram is calculated from the pixel value distribution in an image.

6.5.5.1 General conventions

- Where FITS is specified, the file will have the basic structure:
  1. Primary header with null primary array.
  2. Data table (BINTABLE extension)
- The following keywords will be present in the primary header to identify the file type:

```
HDUCLASS= 'OGIP    '            / Format conforms to OGIP/GSFC conventions
HDUCLAS1= 'SRCLIST '            / Extension contains an image
```

6.5.5.2 PRODUCT: EPIC exposure box-local source list

- This file will contain the full information on all source detections from the eboxdetect pipeline analysis task as run on individual EPIC imaging mode exposure image sets in 'local' mode. The input image sets will consist of non-overlapping energy band images from a single imaging mode exposure.
- The product will contain a single position for each source detected in the combined image set. It will contain other measured source parameters on an energy band-specific basis.
- The product will be supplied in FITS format
- The product will be identified using the keyword

```
CONTENT = 'EPIC EXPOSURE BOX-LOCAL SOURCE LIST'
```

in the primary header.

- This is a product of class `EPICEXP`.
- The mode in which the eboxdetect task was run will be specified by the keyword in the binary table extension

```
BOXMODE = 'LOCAL'
```

- The single binary table data extension will have the name

```
EXTNAME = 'SRCLIST'
```

- The following columns will make up the binary table extension:

Name	Type	Description
BOX_ID_SRC	4-byte INTEGER	eboxdetect source number
ID_INST	4-byte INTEGER	ID of instrument (e.g.,0: all, 1:PN, 2: MOS1, 3: MOS2)
ID_BAND	4-byte INTEGER	ID of energy band (0...N, 0: all bands, 1: lowest band)
SCTS	4-byte REAL	source counts per band/total
SCTS_ERR	4-byte REAL	source counts error
X_IMA	4-byte REAL	X source position (image pixels)
Y_IMA	4-byte REAL	Y source position (image pixels)
X_IMA_ERR	4-byte REAL	X position error
Y_IMA_ERR	4-byte REAL	Y position error
SIGMA	4-byte REAL	signal to noise of detection
BG_MAP	4-byte REAL	value of background map at source location
EXP_MAP	4-byte REAL	value of exposure map at source location
FLUX	4-byte REAL	flux in erg/cm^2/s using ECF from parameter file
FLUX_ERR	4-byte REAL	flux error
RATE	4-byte REAL	vignetting corrected source count rate (count/s)
RATE_ERR	4-byte REAL	rate error
RA	8-byte REAL	right ascension of source position (deg)
DEC	8-byte REAL	declination of source position (deg)
RADEC_ERR	4-byte REAL	1 sigma position error
LII	8-byte REAL	Galactic lattitude of source
BII	8-byte REAL	Galactic longitude of source
HR1	4-byte REAL	hardness ratio 1 (only for ID_BAND=0)
HR1_ERR	4-byte REAL	1σ error in hardness ratio 1
HR2	4-byte REAL	hardness ratio 2 (only for ID_BAND=0)
HR2_ERR	4-byte REAL	1σ error in hardness ratio 2
HR3	4-byte REAL	hardness ratio 3 (only for ID_BAND=0)
HR3_ERR	4-byte REAL	1σ error in hardness ratio 3
DIST_NN	4-byte REAL	distance from nearest neighbour (arcsec)
BOX_SIZE	4-byte REAL	detection box size (image pixels)

- There will be one row for each detection of a source in an energy band (or combined band). For 5 independent energy band images input to the eboxdetect task there will be 6 rows per detected 'real' source (1 per band and 1 for the total band).
- There will be one product per image mode exposure if eboxdetect is run in 'local' mode. The task will be run in at least one of the two modes. The size of the file will depend on the number of sources detected and the number of energy bands used. For 100 sources and 6 rows per detected 'real' source, the product will be 67 KB uncompressed.

6.5.5.3 PRODUCT: EPIC exposure box-map source list

- This file will contain the full information on all source detections from the eboxdetect pipeline analysis task as run on individual EPIC imaging mode exposure image sets in 'map' mode. The input image sets will consist of non-overlapping energy band images from a single imaging mode exposure.
- The product will contain a single position for each source detected in the combined image set. It will contain other measured source parameters on an energy band-specific basis.
- The product will be supplied in FITS format
- The product will be identified using the keyword

  `CONTENT = 'EPIC EXPOSURE BOX-MAP SOURCE LIST'`

  in the primary header.
- This is a product of class `EPICEXP`.
- The mode in which the eboxdetect task was run will be specified by the keyword in the binary table extension

  `BOXMODE = 'MAP'`
- The single binary table data extension will have the name

  `EXTNAME = 'SRCLIST'`
- The following columns will make up the binary table extension:

Name	Type	Description
BOX_ID_SRC	4-byte INTEGER	eboxdetect source number
ID_INST	4-byte INTEGER	ID of instrument (e.g.,0: all, 1:PN, 2: MOS1, 3: MOS2)
ID_BAND	4-byte INTEGER	ID of energy band (0...N, 0: all bands, 1: lowest band)
SCTS	4-byte REAL	source counts per band/total
SCTS_ERR	4-byte REAL	source counts error
X_IMA	4-byte REAL	X source position (image pixels)
Y_IMA	4-byte REAL	Y source position (image pixels)
X_IMA_ERR	4-byte REAL	X position error
Y_IMA_ERR	4-byte REAL	Y position error
SIGMA	4-byte REAL	signal to noise of detection
BG_MAP	4-byte REAL	value of background map at source location
EXP_MAP	4-byte REAL	value of exposure map at source location
FLUX	4-byte REAL	flux in erg/cm^2/s using ECF from parameter file
FLUX_ERR	4-byte REAL	flux error
RATE	4-byte REAL	vignetting corrected source count rate (count/s)
RATE_ERR	4-byte REAL	rate error
RA	8-byte REAL	right ascension of source position (deg)
DEC	8-byte REAL	declination of source position (deg)
RADEC_ERR	4-byte REAL	1 sigma position error
LII	8-byte REAL	Galactic lattitude of source
BII	8-byte REAL	Galactic longitude of source
HR1	4-byte REAL	hardness ratio 1 (only for ID_BAND=0)
HR1_ERR	4-byte REAL	1σ error in hardness ratio 1
HR2	4-byte REAL	hardness ratio 2 (only for ID_BAND=0)
HR2_ERR	4-byte REAL	1σ error in hardness ratio 2
HR3	4-byte REAL	hardness ratio 3 (only for ID_BAND=0)
HR3_ERR	4-byte REAL	1σ error in hardness ratio 3
DIST_NN	4-byte REAL	distance from nearest neighbour (arcsec)
BOX_SIZE	4-byte REAL	detection box size (image pixels)

- There will be one row for each detection of a source in an energy band (or combined band). For 5 independent energy band images input to the eboxdetect task there will be 6 rows per detected 'real' source (1 per band and 1 for the total band).
- There will be one product per image mode exposure if eboxdetect is run in 'map' mode. The task will be run in at least one of the two modes. The size of the file will depend on the number of sources detected and the number of energy bands used. For 100 sources and 6 rows per detected 'real' source, the product will be 67 KB uncompressed.

6.5.5.4 PRODUCT: EPIC exposure ml source list

- This file will contain the full information on all source detections from the emldetect pipeline analysis task as run on individual EPIC imaging mode exposure image sets with the associated box source list. The input image sets will consist of non-overlapping energy band images from a single imaging mode exposure.
- The product will contain a single position for each source detected in the combined image set. It will contain other measured source parameters on an energy band-specific basis.

- The product will be supplied in FITS format
- The product will be identified using the keyword

  `CONTENT = 'EPIC EXPOSURE ML SOURCE LIST'`

  in the primary header.
- This is a product of class `EPICEXP`.
- The mode in which the eboxdetect task was run to make the input source list will be identified by the keyword

  `BOXMODE = 'LOCAL' or 'MAP'`

- The single binary table data extension will have the name

  `EXTNAME = 'SRCLIST'`

- The following columns will make up the binary table extension:

Name	Type	Description
ML_ID_SRC	4-byte INTEGER	emldetect source number
BOX_ID_SRC	4-byte INTEGER	eboxdetect source number
ID_INST	4-byte INTEGER	ID of instrument (e.g., 0: all; 1: PN, 2: MOS1, 3: MOS2)
ID_BAND	4-byte INTEGER	ID of energy band (1...N, 0: all bands, 1: lowest band)
ID_CLUSTER	4-byte INTEGER	cluster ID (same for sources fit simultaneously)
SCTS	4-byte REAL	source counts per band/total
SCTS_ERR	4-byte REAL	1σ source counts error
X_IMA	4-byte REAL	X source position (image pixels)
Y_IMA	4-byte REAL	Y source position (image pixels)
X_IMA_ERR	4-byte REAL	1σ X position error
Y_IMA_ERR	4-byte REAL	1σ Y position error
EXT	4-byte REAL	extent (image pixels)
EXT_ERR	4-byte REAL	1σ error of extent
DET_ML	4-byte REAL	likelihood of existence in band/total
EXT_ML	4-byte REAL	likelihood of extent in band/total
BG_MAP	4-byte REAL	value of background map at source location
EXP_MAP	4-byte REAL	value of exposure map at source location
FLUX	4-byte REAL	flux in 10^{-15} erg/cm^2/s using ECF from parameter file
FLUX_ERR	4-byte REAL	1σ flux error
RATE	4-byte REAL	vignetting corrected source count rate (count/s)
RATE_ERR	4-byte REAL	1σ rate error
RA	8-byte REAL	right ascension of source position (deg)
DEC	8-byte REAL	declination of source position (deg)
RADEC_ERR	4-byte REAL	1σ position error (arcsec)
LII	8-byte REAL	Galactic lattitude of source
BII	8-byte REAL	Galactic longitude of source
HR1	4-byte REAL	hardness ratio 1 (only for ID_BAND=0)
HR1_ERR	4-byte REAL	1σ error in hardness ratio 1
HR2	4-byte REAL	hardness ratio 2 (only for ID_BAND=0)
HR2_ERR	4-byte REAL	1σ error in hardness ratio 2
HR3	4-byte REAL	hardness ratio 3 (only for ID_BAND=0)
HR3_ERR	4-byte REAL	1σ error in hardness ratio 3
CUTRAD	4-byte REAL	cut out radius for events used in PSF fit
DIST_NN	4-byte REAL	distance to nearest neighbour (arcsec)
VAL_FLAG	12-byte CHAR	Validation flags
VER_FLAG	12-byte CHAR	Verification flags
VER_COMM	40-byte CHAR	Verification comment

- There will be one row for each detection of a source in an energy band (or combined band). For 5 independent energy band images input to the emldetect task, there will be 7 rows per detected 'real' source (1 per band, 1 for the core-XID band, and 1 for the combined band).
- There will be one product per image mode exposure. The size of the file will depend on the number of sources detected and the number of energy bands used. For 100 sources and 7 rows per detected 'real' source, the product will be 130 KB uncompressed.

6.5.5.5 PRODUCT: EPIC camera box-local source list

- This file will contain the full information on all source detections from the eboxdetect pipeline analysis task as run on all imaging mode exposure image sets from an individual EPIC in 'local' mode. The input image sets will consist of non-overlapping energy band images from each imaging mode exposure.
- The product will contain a single position for each source detected in the combined image set. It will contain other measured source parameters on an energy band-specific basis.
- The product will be supplied in FITS format
- The product will be identified using the keyword

  `CONTENT = 'EPIC CAMERA BOX-LOCAL SOURCE LIST'`

  in the primary header.
- This is a product of class `EPICOBS`.
- The mode in which the eboxdetect task was run will be specified by the keyword in the binary table extension

  `BOXMODE = 'LOCAL'`
- The single binary table data extension will have the name

  `EXTNAME = 'SRCLIST'`
- The following columns will make up the binary table extension:

Name	Type	Description
BOX_ID_SRC	4-byte INTEGER	eboxdetect source number
ID_INST	4-byte INTEGER	ID of instrument (e.g.,0: all, 1:PN, 2: MOS1, 3: MOS2)
ID_BAND	4-byte INTEGER	ID of energy band (0...N, 0: all bands, 1: lowest band)
SCTS	4-byte REAL	source counts per band/total
SCTS_ERR	4-byte REAL	source counts error
X_IMA	4-byte REAL	X source position (image pixels)
Y_IMA	4-byte REAL	Y source position (image pixels)
X_IMA_ERR	4-byte REAL	X position error
Y_IMA_ERR	4-byte REAL	Y position error
SIGMA	4-byte REAL	signal to noise of detection
BG_MAP	4-byte REAL	value of background map at source location
EXP_MAP	4-byte REAL	value of exposure map at source location
FLUX	4-byte REAL	flux in erg/cm^2/s using ECF from parameter file
FLUX_ERR	4-byte REAL	flux error
RATE	4-byte REAL	vignetting corrected source count rate (count/s)
RATE_ERR	4-byte REAL	rate error
RA	8-byte REAL	right ascension of source position (deg)
DEC	8-byte REAL	declination of source position (deg)
RADEC_ERR	4-byte REAL	1 sigma position error
LII	8-byte REAL	Galactic lattitude of source
BII	8-byte REAL	Galactic longitude of source
HR1	4-byte REAL	hardness ratio 1 (only for ID_BAND=0)
HR1_ERR	4-byte REAL	1σ error in hardness ratio 1
HR2	4-byte REAL	hardness ratio 2 (only for ID_BAND=0)
HR2_ERR	4-byte REAL	1σ error in hardness ratio 2
HR3	4-byte REAL	hardness ratio 3 (only for ID_BAND=0)
HR3_ERR	4-byte REAL	1σ error in hardness ratio 3
DIST_NN	4-byte REAL	distance from nearest neighbour (arcsec)
BOX_SIZE	4-byte REAL	detection box size (image pixels)

- There will be one row for each detection of a source in an energy band (or combined band). For 5 independent energy band images input to the eboxdetect task there will be 6 rows per detected 'real' source (1 per band and 1 for the total band).
- There will be one product per EPIC camera with image mode exposures if eboxdetect is run in 'local' mode. The task will be run in at least one of the two modes. The size of the file will depend on the number of sources detected and the number of energy bands used. For 100 sources and 6 rows per detected 'real' source, the product will be 67 KB uncompressed.

6.5.5.6 PRODUCT: EPIC camera box-map source list

- This file will contain the full information on all source detections from the eboxdetect pipeline analysis task as run on all imaging mode exposure image sets from an individual EPIC in 'map' mode. The input image sets will consist of non-overlapping energy band images from each imaging mode exposure.
- The product will contain a single position for each source detected in the combined image set. It will contain other measured source parameters on an energy band-specific basis.

- The product will be supplied in FITS format
- The product will be identified using the keyword

  `CONTENT = 'EPIC CAMERA BOX-MAP SOURCE LIST'`

  in the primary header.
- This is a product of class `EPICOBS`.
- The mode in which the eboxdetect task was run will be specified by the keyword in the binary table extension

  `BOXMODE = 'MAP'`
- The single binary table data extension will have the name

  `EXTNAME = 'SRCLIST'`
- The following columns will make up the binary table extension:

Name	Type	Description
`BOX_ID_SRC`	4-byte INTEGER	eboxdetect source number
`ID_INST`	4-byte INTEGER	ID of instrument (e.g.,0: all, 1:PN, 2: MOS1, 3: MOS2)
`ID_BAND`	4-byte INTEGER	ID of energy band (0...N, 0: all bands, 1: lowest band)
`SCTS`	4-byte REAL	source counts per band/total
`SCTS_ERR`	4-byte REAL	source counts error
`X_IMA`	4-byte REAL	X source position (image pixels)
`Y_IMA`	4-byte REAL	Y source position (image pixels)
`X_IMA_ERR`	4-byte REAL	X position error
`Y_IMA_ERR`	4-byte REAL	Y position error
`SIGMA`	4-byte REAL	signal to noise of detection
`BG_MAP`	4-byte REAL	value of background map at source location
`EXP_MAP`	4-byte REAL	value of exposure map at source location
`FLUX`	4-byte REAL	flux in erg/cm^2/s using ECF from parameter file
`FLUX_ERR`	4-byte REAL	flux error
`RATE`	4-byte REAL	vignetting corrected source count rate (count/s)
`RATE_ERR`	4-byte REAL	rate error
`RA`	8-byte REAL	right ascension of source position (deg)
`DEC`	8-byte REAL	declination of source position (deg)
`RADEC_ERR`	4-byte REAL	1 sigma position error
`LII`	8-byte REAL	Galactic lattitude of source
`BII`	8-byte REAL	Galactic longitude of source
`HR1`	4-byte REAL	hardness ratio 1 (only for ID_BAND=0)
`HR1_ERR`	4-byte REAL	1σ error in hardness ratio 1
`HR2`	4-byte REAL	hardness ratio 2 (only for ID_BAND=0)
`HR2_ERR`	4-byte REAL	1σ error in hardness ratio 2
`HR3`	4-byte REAL	hardness ratio 3 (only for ID_BAND=0)
`HR3_ERR`	4-byte REAL	1σ error in hardness ratio 3
`DIST_NN`	4-byte REAL	distance from nearest neighbour (arcsec)
`BOX_SIZE`	4-byte REAL	detection box size (image pixels)

- There will be one row for each detection of a source in an energy band (or combined band). For 5 independent energy band images input to the eboxdetect task there will be 6 rows per detected 'real' source (1 per band and 1 for the total band).
- There will be one product per EPIC camera with image mode exposures if eboxdetect is run in 'map' mode. The task will be run in at least one of the two modes. The size of the file will depend on the number of sources detected and the number of energy bands used. For 100 sources and 6 rows per detected 'real' source, the product will be 67 KB uncompressed.

6.5.5.7 PRODUCT: EPIC camera ml source list

- This file will contain the full information on all source detections from the emldetect pipeline analysis task as run on all imaging mode exposure image sets from an individual EPIC with the associated box source lists. The input image sets will consist of non-overlapping energy band images from each imaging mode exposure.
- The product will contain a single position for each source detected in the combined image set. It will contain other measured source parameters on an energy band-specific basis.
- The product will be supplied in FITS format
- The product will be identified using the keyword

  `CONTENT = 'EPIC CAMERA ML SOURCE LIST'`

  in the primary header.
- This is a product of class `EPICOBS`.
- The mode in which the eboxdetect task was run to make the input source list will be identified by the keyword

  `BOXMODE = 'LOCAL' or 'MAP'`
- The single binary table data extension will have the name

  `EXTNAME = 'SRCLIST'`
- The following columns will make up the binary table extension:

Name	Type	Description
`ML_ID_SRC`	4-byte INTEGER	emldetect source number
`BOX_ID_SRC`	4-byte INTEGER	eboxdetect source number
`ID_INST`	4-byte INTEGER	ID of instrument (e.g., 0: all; 1: PN, 2: MOS1, 3: MOS2)
`ID_BAND`	4-byte INTEGER	ID of energy band (1...N, 0: all bands, 1: lowest band)
`ID_CLUSTER`	4-byte INTEGER	cluster ID (same for sources fit simultaneously)
`SCTS`	4-byte REAL	source counts per band/total
`SCTS_ERR`	4-byte REAL	1σ source counts error
`X_IMA`	4-byte REAL	X source position (image pixels)
`Y_IMA`	4-byte REAL	Y source position (image pixels)
`X_IMA_ERR`	4-byte REAL	1σ X position error
`Y_IMA_ERR`	4-byte REAL	1σ Y position error
`EXT`	4-byte REAL	extent (image pixels)
`EXT_ERR`	4-byte REAL	1σ error of extent
`DET_ML`	4-byte REAL	likelihood of existence in band/total
`EXT_ML`	4-byte REAL	likelihood of extent in band/total
`BG_MAP`	4-byte REAL	value of background map at source location
`EXP_MAP`	4-byte REAL	value of exposure map at source location
`FLUX`	4-byte REAL	flux in 10^{-15} erg/cm^2/s using ECF from parameter file
`FLUX_ERR`	4-byte REAL	1σ flux error
`RATE`	4-byte REAL	vignetting corrected source count rate (count/s)
`RATE_ERR`	4-byte REAL	1σ rate error
`RA`	8-byte REAL	right ascension of source position (deg)
`DEC`	8-byte REAL	declination of source position (deg)
`RADEC_ERR`	4-byte REAL	1σ position error (arcsec)
`LII`	8-byte REAL	Galactic lattitude of source
`BII`	8-byte REAL	Galactic longitude of source
`HR1`	4-byte REAL	hardness ratio 1 (only for ID_BAND=0)
`HR1_ERR`	4-byte REAL	1σ error in hardness ratio 1
`HR2`	4-byte REAL	hardness ratio 2 (only for ID_BAND=0)
`HR2_ERR`	4-byte REAL	1σ error in hardness ratio 2
`HR3`	4-byte REAL	hardness ratio 3 (only for ID_BAND=0)
`HR3_ERR`	4-byte REAL	1σ error in hardness ratio 3
`CUTRAD`	4-byte REAL	cut out radius for events used in PSF fit
`DIST_NN`	4-byte REAL	distance to nearest neighbour (arcsec)
`VAL_FLAG`	12-byte CHAR	Validation flags
`VER_FLAG`	12-byte CHAR	Verification flags
`VER_COMM`	40-byte CHAR	Verification comment

- There will be one row for each detection of a source in an energy band (or combined band). For 5 independent energy band images input to the emldetect task, there will be 7 rows per detected 'real' source (1 per band, 1 for the core-XID band, and 1 for the combined band).

- There will be one product per EPIC camera with image mode exposures. The size of the file will depend on the number of sources detected and the number of energy bands used. For 100 sources and 7 rows per detected 'real' source, the product will be 130 KB uncompressed.

6.5.5.8 PRODUCT: EPIC observation box-local source list

- This file will contain the full information on all source detections from the eboxdetect pipeline analysis task as run on all imaging mode exposure image sets from all EPICs in 'local' mode. The input image sets will consist of non-overlapping energy band images from each imaging mode exposure.
- The product will contain a single position for each source detected in the combined image set. It will contain other measured source parameters on an energy band-specific basis.
- The product will be supplied in FITS format
- The product will be identified using the keyword

  `CONTENT = 'EPIC OBSERVATION BOX-LOCAL SOURCE LIST'`

  in the primary header.
- This is a product of class `EPICOBS`.
- The mode in which the eboxdetect task was run will be specified by the keyword in the binary table extension

  `BOXMODE = 'LOCAL'`
- The single binary table data extension will have the name

  `EXTNAME = 'SRCLIST'`
- The following columns will make up the binary table extension:

Name	Type	Description
BOX_ID_SRC	4-byte INTEGER	eboxdetect source number
ID_INST	4-byte INTEGER	ID of instrument (e.g.,0: all, 1:PN, 2: MOS1, 3: MOS2)
ID_BAND	4-byte INTEGER	ID of energy band (0...N, 0: all bands, 1: lowest band)
SCTS	4-byte REAL	source counts per band/total
SCTS_ERR	4-byte REAL	source counts error
X_IMA	4-byte REAL	X source position (image pixels)
Y_IMA	4-byte REAL	Y source position (image pixels)
X_IMA_ERR	4-byte REAL	X position error
Y_IMA_ERR	4-byte REAL	Y position error
SIGMA	4-byte REAL	signal to noise of detection
BG_MAP	4-byte REAL	value of background map at source location
EXP_MAP	4-byte REAL	value of exposure map at source location
FLUX	4-byte REAL	flux in erg/cm^2/s using ECF from parameter file
FLUX_ERR	4-byte REAL	flux error
RATE	4-byte REAL	vignetting corrected source count rate (count/s)
RATE_ERR	4-byte REAL	rate error
RA	8-byte REAL	right ascension of source position (deg)
DEC	8-byte REAL	declination of source position (deg)
RADEC_ERR	4-byte REAL	1 sigma position error
LII	8-byte REAL	Galactic lattitude of source
BII	8-byte REAL	Galactic longitude of source
HR1	4-byte REAL	hardness ratio 1 (only for ID_BAND=0)
HR1_ERR	4-byte REAL	1σ error in hardness ratio 1
HR2	4-byte REAL	hardness ratio 2 (only for ID_BAND=0)
HR2_ERR	4-byte REAL	1σ error in hardness ratio 2
HR3	4-byte REAL	hardness ratio 3 (only for ID_BAND=0)
HR3_ERR	4-byte REAL	1σ error in hardness ratio 3
DIST_NN	4-byte REAL	distance from nearest neighbour (arcsec)
BOX_SIZE	4-byte REAL	detection box size (image pixels)

- There will be one row for each detection of a source in an energy band (or combined band). For 5 independent energy band images input to the eboxdetect task there will be 6 rows per detected 'real' source (1 per band and 1 for the total band).
- There will be one product per observation if eboxdetect is run in 'local' mode and at least 2 EPICs made image mode exposures, otherwise this product will not be made. The task will be run in at least one of the two modes. The size of the file will depend on the number of sources detected and the number of energy bands used. For 100 sources and 6 rows per detected 'real' source, the product will be 67 KB uncompressed.

6.5.5.9 PRODUCT: EPIC observation box-map source list

- This file will contain the full information on all source detections from the eboxdetect pipeline analysis task as run on all imaging mode exposure image sets from all EPICs in 'map' mode. The input image sets will consist of non-overlapping energy band images from each imaging mode exposure.
- The product will contain a single position for each source detected in the combined image set. It will contain other measured source parameters on an energy band-specific basis.

- The product will be supplied in FITS format
- The product will be identified using the keyword

  `CONTENT = 'EPIC OBSERVATION BOX-MAP SOURCE LIST'`

  in the primary header.
- This is a product of class `EPICOBS`.
- The mode in which the eboxdetect task was run will be specified by the keyword in the binary table extension

  `BOXMODE = 'MAP'`
- The single binary table data extension will have the name

  `EXTNAME = 'SRCLIST'`
- The following columns will make up the binary table extension:

Name	Type	Description
`BOX_ID_SRC`	4-byte INTEGER	eboxdetect source number
`ID_INST`	4-byte INTEGER	ID of instrument (e.g.,0: all, 1:PN, 2: MOS1, 3: MOS2)
`ID_BAND`	4-byte INTEGER	ID of energy band (0...N, 0: all bands, 1: lowest band)
`SCTS`	4-byte REAL	source counts per band/total
`SCTS_ERR`	4-byte REAL	source counts error
`X_IMA`	4-byte REAL	X source position (image pixels)
`Y_IMA`	4-byte REAL	Y source position (image pixels)
`X_IMA_ERR`	4-byte REAL	X position error
`Y_IMA_ERR`	4-byte REAL	Y position error
`SIGMA`	4-byte REAL	signal to noise of detection
`BG_MAP`	4-byte REAL	value of background map at source location
`EXP_MAP`	4-byte REAL	value of exposure map at source location
`FLUX`	4-byte REAL	flux in erg/cm^2/s using ECF from parameter file
`FLUX_ERR`	4-byte REAL	flux error
`RATE`	4-byte REAL	vignetting corrected source count rate (count/s)
`RATE_ERR`	4-byte REAL	rate error
`RA`	8-byte REAL	right ascension of source position (deg)
`DEC`	8-byte REAL	declination of source position (deg)
`RADEC_ERR`	4-byte REAL	1 sigma position error
`LII`	8-byte REAL	Galactic lattitude of source
`BII`	8-byte REAL	Galactic longitude of source
`HR1`	4-byte REAL	hardness ratio 1 (only for ID_BAND=0)
`HR1_ERR`	4-byte REAL	1σ error in hardness ratio 1
`HR2`	4-byte REAL	hardness ratio 2 (only for ID_BAND=0)
`HR2_ERR`	4-byte REAL	1σ error in hardness ratio 2
`HR3`	4-byte REAL	hardness ratio 3 (only for ID_BAND=0)
`HR3_ERR`	4-byte REAL	1σ error in hardness ratio 3
`DIST_NN`	4-byte REAL	distance from nearest neighbour (arcsec)
`BOX_SIZE`	4-byte REAL	detection box size (image pixels)

- There will be one row for each detection of a source in an energy band (or combined band). For 5 independent energy band images input to the eboxdetect task there will be 6 rows per detected 'real' source (1 per band and 1 for the total band).
- There will be one product per observation if eboxdetect is run in 'map' mode and at least 2 EPICs made image mode exposures, otherwise this product will not be made. The task will be run in at least one of the two modes. The size of the file will depend on the number of sources detected and the number of energy bands used. For 100 sources and 6 rows per detected 'real' source, the product will be 67 KB uncompressed.

6.5.5.10 PRODUCT: EPIC observation ml source list

- This file will contain the full information on all source detections from the emldetect pipeline analysis task as run on all imaging mode exposure image sets from all EPICs with the associated box source lists. The input image sets will consist of non-overlapping energy band images from each imaging mode exposure.
- The product will contain a single position for each source detected in the combined image set. It will contain other measured source parameters on an energy band-specific basis.
- The product will be supplied in FITS format
- The product will be identified using the keyword

  `CONTENT = 'EPIC OBSERVATION ML SOURCE LIST'`

  in the primary header.
- This is a product of class `EPICOBS`.
- The mode in which the eboxdetect task was run to make the input source list will be identified by the keyword

  `BOXMODE = 'LOCAL' or 'MAP'`
- The single binary table data extension will have the name

  `EXTNAME = 'SRCLIST'`
- The following columns will make up the binary table extension:

Name	Type	Description
ML_ID_SRC	4-byte INTEGER	emldetect source number
BOX_ID_SRC	4-byte INTEGER	eboxdetect source number
ID_INST	4-byte INTEGER	ID of instrument (e.g., 0: all; 1: PN, 2: MOS1, 3: MOS2)
ID_BAND	4-byte INTEGER	ID of energy band (1...N, 0: all bands, 1: lowest band)
ID_CLUSTER	4-byte INTEGER	cluster ID (same for sources fit simultaneously)
SCTS	4-byte REAL	source counts per band/total
SCTS_ERR	4-byte REAL	1σ source counts error
X_IMA	4-byte REAL	X source position (image pixels)
Y_IMA	4-byte REAL	Y source position (image pixels)
X_IMA_ERR	4-byte REAL	1σ X position error
Y_IMA_ERR	4-byte REAL	1σ Y position error
EXT	4-byte REAL	extent (image pixels)
EXT_ERR	4-byte REAL	1σ error of extent
DET_ML	4-byte REAL	likelihood of existence in band/total
EXT_ML	4-byte REAL	likelihood of extent in band/total
BG_MAP	4-byte REAL	value of background map at source location
EXP_MAP	4-byte REAL	value of exposure map at source location
FLUX	4-byte REAL	flux in 10^{-15} erg/cm^2/s using ECF from parameter file
FLUX_ERR	4-byte REAL	1σ flux error
RATE	4-byte REAL	vignetting corrected source count rate (count/s)
RATE_ERR	4-byte REAL	1σ rate error
RA	8-byte REAL	right ascension of source position (deg)
DEC	8-byte REAL	declination of source position (deg)
RADEC_ERR	4-byte REAL	1σ position error (arcsec)
LII	8-byte REAL	Galactic lattitude of source
BII	8-byte REAL	Galactic longitude of source
HR1	4-byte REAL	hardness ratio 1 (only for ID_BAND=0)
HR1_ERR	4-byte REAL	1σ error in hardness ratio 1
HR2	4-byte REAL	hardness ratio 2 (only for ID_BAND=0)
HR2_ERR	4-byte REAL	1σ error in hardness ratio 2
HR3	4-byte REAL	hardness ratio 3 (only for ID_BAND=0)
HR3_ERR	4-byte REAL	1σ error in hardness ratio 3
CUTRAD	4-byte REAL	cut out radius for events used in PSF fit
DIST_NN	4-byte REAL	distance to nearest neighbour (arcsec)
VAL_FLAG	12-byte CHAR	Validation flags
VER_FLAG	12-byte CHAR	Verification flags
VER_COMM	40-byte CHAR	Verification comment

- There will be one row for each detection of a source in an energy band (or combined band). For 5 independent energy band images input to the emldetect task, there will be 7 rows per detected 'real' source (1 per band, 1 for the core-XID band, and 1 for the combined band).

- There will be one product per observation if at least 2 EPICs made image mode exposures, otherwise the product will not be made. The size of the file will depend on the number of sources detected and the number of energy bands used. For 100 sources and 7 rows per detected 'real' source, the product will be 130 KB uncompressed.

6.5.5.11 PRODUCT: EPIC FITS summary source list

- This file will contain summarised information from the previously described primary EPIC ml source lists. Detections of the same physical source will be combined on the basis of position coincidence, so that there will be a single entry per source.
- Source parameters will be derived from the primary EPIC ml source lists. They will include references back to the entries in those source lists, and, where possible, improved celestial positions based on a best match of the source positions to the positions of objects in an astrometric catalogue. Total band and XID band count rates and standard hardness ratio values are provided, as well as measures of extent and variability. In addition, information on the nearest OM counterpart sources and the creation of EPIC spectral and timeseries products is included.
- The product will be supplied in FITS format.
- The file will be identified using the keyword

  `CONTENT = 'EPIC SUMMARY SOURCE LIST'`

  in the primary header.
- This is a product of class `EPIC OBS`.
- The single binary table extension will have the name

  `EXTNAME = 'SRCLIST'`
- There will be a single row for each distinct celestial source.
- The following columns will make up the binary table extension:

Name	Type	Description
SRC_NUM	4-byte INTEGER	source number
PN_ML_ID_SRC	4-byte INTEGER	pn ML source list source ID
M1_ML_ID_SRC	4-byte INTEGER	mos 1 ML source list source ID
M2_ML_ID_SRC	4-byte INTEGER	mos 2 ML source list source ID
EP_ML_ID_SRC	4-byte INTEGER	epic ML source list source ID
PN_BOX_ID_SRC	4-byte INTEGER	pn box source list source ID
M1_BOX_ID_SRC	4-byte INTEGER	mos 1 box source list source ID
M2_BOX_ID_SRC	4-byte INTEGER	mos 2 box source list source ID
EP_BOX_ID_SRC	4-byte INTEGER	epic box source list source ID
RA	8-byte REAL	RA (2000) of source (degr)
DEC	8-byte REAL	DEC (2000) of source (degr)
RA_CORR	8-byte REAL	RA corrected by cat X-corr
DEC_CORR	8-byte REAL	DEC corrected by cat X-corr
RADEC_ERR	4-byte REAL	source position error
LII	8-byte REAL	Galactic longitude of RA,DEC
BII	8-byte REAL	Galactic latitude of RA,DEC
LII_CORR	8-byte REAL	Gal. longitude of RA_CORR,DEC_CORR
BII_CORR	8-byte REAL	Gal. latitude of RA_CORR,DEC_CORR
PN_TOT	4-byte REAL	pn total band counts/sec
PN_TOT_ERR	4-byte REAL	
M1_TOT	4-byte REAL	mos 1 total band counts/sec

Name	Type	Description
M1_TOT_ERR	4-byte REAL	
M2_TOT	4-byte REAL	mos 2 total band counts/sec
M2_TOT_ERR	4-byte REAL	
EP_TOT	4-byte REAL	all epic total band counts/sec
EP_TOT_ERR	4-byte REAL	
PN_XID	4-byte REAL	pn XID band counts/sec
PN_XID_ERR	4-byte REAL	
M1_XID	4-byte REAL	mos 1 XID band counts/sec
M1_XID_ERR	4-byte REAL	
M2_XID	4-byte REAL	mos 2 XID band counts/sec
M2_XID_ERR	4-byte REAL	
EP_XID	4-byte REAL	all epic XID band counts/sec
EP_XID_ERR	4-byte REAL	
PN_DET_ML	4-byte REAL	pn detection max likelihood
M1_DET_ML	4-byte REAL	mos 1 detection max likelihood
M2_DET_ML	4-byte REAL	mos 2 detection max likelihood
EP_DET_ML	4-byte REAL	all epic detection max likelihood
PN_EXTENT	4-byte REAL	pn extent (arcsec)
PN_EXT_ERR	4-byte REAL	
PN_EXT_ML	4-byte REAL	pn extent max likelihood
M1_EXTENT	4-byte REAL	mos 1 extent (arcsec)
M1_EXT_ERR	4-byte REAL	
M1_EXT_ML	4-byte REAL	mos 1 extent max likelihood
M2_EXTENT	4-byte REAL	mos 2 extent (arcsec)
M2_EXT_ERR	4-byte REAL	
M2_EXT_ML	4-byte REAL	mos 2 extent max likelihood
EP_EXTENT	4-byte REAL	all epic extent (arcsec)
EP_EXT_ERR	4-byte REAL	
EP_EXT_ML	4-byte REAL	all epic extent max likelihood
PN_HR1	4-byte REAL	pn hardness ratio #1
PN_HR1_ERR	4-byte REAL	
PN_HR2	4-byte REAL	pn hardness ratio #2
PN_HR2_ERR	4-byte REAL	
PN_HR3	4-byte REAL	pn hardness ratio #3
PN_HR3_ERR	4-byte REAL	
M1_HR1	4-byte REAL	mos 1 hardness ratio #1
M1_HR1_ERR	4-byte REAL	
M1_HR2	4-byte REAL	mos 1 hardness ratio #2
M1_HR2_ERR	4-byte REAL	
M1_HR3	4-byte REAL	mos 1 hardness ratio #3
M1_HR3_ERR	4-byte REAL	
M2_HR1	4-byte REAL	mos 2 hardness ratio #1
M2_HR1_ERR	4-byte REAL	
M2_HR2	4-byte REAL	mos 2 hardness ratio #2
M2_HR2_ERR	4-byte REAL	
M2_HR3	4-byte REAL	mos 2 hardness ratio #3
M2_HR3_ERR	4-byte REAL	
EP_HR1	4-byte REAL	all epic hardness ratio #1
EP_HR1_ERR	4-byte REAL	
EP_HR2	4-byte REAL	all epic hardness ratio #2
EP_HR2_ERR	4-byte REAL	
EP_HR3	4-byte REAL	all epic hardness ratio #3

Name	Type	Description
EP_HR3_ERR	4-byte REAL	
VAR_STAT	4-byte REAL	value of the variability statistic
N_BINS	4-byte INTEGER	number of bins in the lightcurve
P_VAR	4-byte REAL	probability of variability statistic
VAR_EXP_NO	4-byte INTEGER	exposure no of originating lightcurve
OM_ID1	4-byte INTEGER	
OM_ID1_DIST	4-byte REAL	OM-EPIC source distance in arcsec
OM_ID2	4-byte INTEGER	
OM_ID2_DIST	4-byte REAL	OM-EPIC source distance in arcsec
OM_ID3	4-byte INTEGER	
OM_ID3_DIST	4-byte REAL	OM-EPIC source distance in arcsec
OM_ID4	4-byte INTEGER	
OM_ID4_DIST	4-byte REAL	OM-EPIC source distance in arcsec
OM_ID5	4-byte INTEGER	
OM_ID5_DIST	4-byte REAL	OM-EPIC source distance in arcsec
N_OPT_CO	4-byte INTEGER	number of OM counterparts
OMFLAG	CHARACTER*10	OM data availability
SPECTRA	LOGICAL	one or more EPIC spectra made
TSERIES	LOGICAL	one or more EPIC timeseries made
VAL_FLAG	12-byte CHAR	Validation flags
VER_FLAG	12-byte CHAR	Verification flags
VER_COMM	40-byte CHAR	Verification comment

- There will be one product per observation. Assuming 100 sources, the file will be 155 KB uncompressed.

6.5.5.12 PRODUCT: EPIC HTML summary source list

- This product is derived from the EPIC FITS summary source list, and will take the form of an HTML table.
- This is a products of class `EPICOBS`.
- There will be one product per observation. Assuming 100 sources, the file will be 2147 KB.

6.5.5.13 PRODUCT: EPIC wavelet map

- Wavelet coefficient maps will be created which will characterise large extended X-ray sources not detected by the Maximum Likelihood point source detection tasks.
- 3 wavelet maps, covering different size scales, will be created for each filter wheel position used.
- The wavelet maps will cover the total energy band of EPIC.
- The wavelet maps will be in FITS format.

- The files will be identified using the keyword

  `CONTENT = 'EPIC WAVELET MAP'`

  in the primary header.
- This is a product of class EPICDET.
- The OGIP filetype will be defined by the keywords

```
HDUCLASS= 'OGIP'
HDUCLAS1= 'IMAGE'
HDUCLAS2= 'WAVELET' in the primary header.
```

- There will be three wavelet maps per filter wheel position used, i.e. this product will cover all 3 EPICs. Assuming 4-byte REAL image pixels, each FITS image will be approximately 1 MB uncompressed.

6.5.5.14 PRODUCT: EPIC wavelet source list

- The file will contain source parameters on all sources detected by the WAVELET source detection task.
- The source detection list will be supplied in FITS format.
- The files will be identified using the keyword

  `CONTENT = 'EPIC WAVELET SOURCE LIST'`

  in the primary header.
- This is a product of class EPICDET.
- The data extension will contain a binary table containing one table row per detected source.
- There will be one source detection list per filter wheel position used, i.e. this product will cover all 3 EPICs. The size of the file will depend on the number of sources found in the EPIC field. For 100 sources the file size will be approximately 20 KB uncompressed.

6.5.5.15 PRODUCT: EPIC HTML observation source list

- This product will be derived from the EPIC FITS observation source list, and will take the form of an HTML table.
- This is a product of class `EPICOBS`.
- There will be a single observation source list per EPIC camera per observation. Each file will typically be 150KB.

6.5.5.16 PRODUCT: EPIC PDF intensity histogram

- This product will be derived from the EPIC FITS images.
- For each energy band a histogram plot will show the distribution of image detect cell count rates.
- The product will provide information on the significance of faint sources in the image.
- A single PDF file will containing the plots for all energy bands.
- This is a product of class `EPICEXP`.
- There will be one intensity histogram product per EPIC camera per exposure. Each file will typically be 50KB.

6.5.6 EPIC calibrated events list

6.5.6.1 General conventions

- Event lists will be delivered in FITS format. The OGIP guidelines for defining event lists will be followed (OGIP/94-003).
- These event lists are science products suitable for use in further data analysis.
- The event files defined here are for pointed observations only.
- Each event file will contain events from one EPIC camera only. For each EPIC camera there will be a single file containing events from CCDs operating in `IMAGING` modes, and a single file containing events from the CCD operating in a `TIMING` mode (where appropriate). Imaging modes are: Full Window and Partial Window. Timing modes are: Timing and, for EPIC pn only, Burst.
- The structure of the FITS file will be:
  1. Primary header with null primary array.
  2. A single binary table extension containing the event data (`EXTNAME='EVENTS'`).
  3. Binary table extensions containing exposure data (`EXTNAME='EXPOSUnn'`).
  4. Binary table extensions containing bad pixel data (`EXTNAME='BADPIXnn'`).
  5. Binary table extensions containing good-time interval (GTI) data (`EXTNAME='STDGTInn'`).
- Apart from the `EVENTS` extension, there will be one binary table extension of each type per active CCD (per active CCD node for EPIC MOS). The values of `nn` will be the CCD number (for the EPIC MOS the first digit is the node number). These multiple extensions have the same table format for both EPIC MOS and EPIC pn.
- Event times will be specified in seconds after a reference time specified in a header keyword.
- Calibrated event lists do not have intervals of high particle background removed.

6.5.6.2 Format of the EXPOSUnn extensions

- This extension gives the CCD frame exposure and mode information.
- There will be one extension per CCD in the relevant mode (IMAGING or TIMING) during the exposure.
- The following keywords will be present in all cases:

```
CCDID   =                    0 / CCD Identifier
FRMTIME =                   73 / Nominal frame integration time
WINDOWX0=                    0 / X coordinate of bottom left corner of window
WINDOWY0=                    0 / Y coordinate of bottom left corner of window
WINDOWDX=                   64 / Size, along x-axis, of window
WINDOWDY=                  200 / Size, along y-axis, of window
```

- In addition, the following keywords will be present in EPIC pn EXPOSUnn extensions:

```
QUADRANT=                    0 / Quadrant Identifier
QUADMODE=                    0 / Quadrant mode
CCDMODE =                    1 / CCD mode
SINGLES =                14959 / number of single events
DOUBLES =                 1829 / number of double events
TRIPLES =                   24 / number of triple events
QUADRUPL=                    0 / number of quadruple events
NOTRECEV=                 3958 / number of not recognized events
NOTRECPA=                  235 / number of not recognized patterns
MAXPAT  =                    3 / maximum pattern size
MIPS    =                    0 / number of MIPs found
RECPHOTO=                16812 / number of recognized photons
ANALYSED=                16812 / number of analysed events
```

- For MOS event lists this extension contains the following columns:

Name	Type	Description
TIME	8-byte REAL	Frame start time (seconds since reference time)
TIMEDEL	4-byte REAL	Duration of frame time (seconds)
FRACEXP	4-byte REAL	Fractional exposure of frame

- For pn event lists this extension contains the following columns:

Name	Type	Description
TIME	8-byte REAL	Frame start time (seconds since reference time)
FRACEXP	4-byte REAL	Fractional exposure of frame

6.5.6.3 Format of the BADPIXnn extensions

- This extension gives the pixels identified as bad in the event list.
- There will be one extension per CCD in the relevant mode (IMAGING or TIMING) during the exposure.
- For EPIC pn BADPIXnn extensions the following keywords will be present:

```
CCDID   =                    1 / ccd in use
QUADRANT=                    1 / quadrant in use
```

- For EPIC MOS BADPIXnn extensions the following keywords will be present:

```
CCDID   =                    1 / ccd in use
CCDNODE =                    1 / CCD node in use
```

- This extension contains the following columns:

Name	Type	Description
RAWX	2-byte INTEGER	pixel
RAWY	2-byte INTEGER	pixel
TYPE	2-byte INTEGER	
YEXTENT	2-byte INTEGER	
BADFLAG	2-byte INTEGER	

6.5.6.4 Format of the STDGTInn extensions

- This extension gives the good time intervals for the event list.
- There will be one extension per CCD in the relevant mode (IMAGING or TIMING) during the exposure.
- The following keywords will be present:

```
EXPOSURE= 3.99970894657885E+04 / [s] Total good time
HDUCLASS= 'OGIP    '           / File conforms to OGIP/GSFC conventions
HDUCLAS1= 'GTI     '           / File contains Good Time Intervals
HDUCLAS2= 'STANDARD'           / File contains Good Time Intervals
```

- This extension contains the following columns:

Name	Type	Description
START	8-byte REAL	seconds (since reference time)
STOP	8-byte REAL	seconds (since reference time)

6.5.6.5 PRODUCT: EPIC MOS IMAGING mode event list

- For MOS camera CCDs operating in IMAGING and REDUCED IMAGING modes the EVENTS extension will contain a binary table (one row per event) with the following columns:

Name	Type	Description
TIME	8-byte REAL	Event time (seconds)
RAWX	2-byte INTEGER	Raw CCD pixel of event (X axis)
RAWY	2-byte INTEGER	Raw CCD pixel of event (Y axis)
DETX	2-byte INTEGER	Linearised camera coordinate of
DETY	2-byte INTEGER	event. Units of $0.05''$.
X	4-byte INTEGER	Projected sky coordinates of event, relative
Y	4-byte INTEGER	to nominal pointing position. Units of $0.05''$.
PHA	2-byte INTEGER	Uncorrected event energy
PI	2-byte INTEGER	Corrected event energy
FLAG	4-byte INTEGER	Event quality flag
PATTERN	1-byte INTEGER	Event pattern ID
CCDNR	1-byte INTEGER	CCD ID number

- There will also be EXPOSUnn, BADPIXnn, and STDGTI extensions as described above. nn will be the CCD number (for EPIC MOS the first digit is the node number).
- These files will be identified using the keyword

  CONTENT = 'EPIC MOS IMAGING MODE EVENT LIST'

  in the primary header.
- This is a product of class EPICEXP.
- The OGIP filetype will be defined by the keywords

```
HDUCLASS= 'OGIP    '          / Format conforms to OGIP/GSFC conventions
HDUCLAS1= 'EVENTS  '          / Extension contains an event list
HDUCLAS2= 'ALL     '          / All, accepted or rejected events only
```

in the header of the `EVENTS` extension.

- There will be one EPIC MOS image mode events file per EPIC MOS `IMAGING` mode exposure. The file size will typically be 4 MB uncompressed.

6.5.6.6 PRODUCT: EPIC pn IMAGING mode event list

- For pn CCDs operating in `IMAGING` mode the `EVENTS` extension will contain a binary table (one row per event) with the following columns:

Name	Type	Description
`TIME`	8-byte REAL	Event time (seconds)
`RAWX`	2-byte INTEGER	Raw CCD pixel of event (X axis)
`RAWY`	2-byte INTEGER	Raw CCD pixel of event (Y axis)
`DETX`	2-byte INTEGER	Linearised camera coordinate of
`DETY`	2-byte INTEGER	event. Units of 0.05″.
`X`	4-byte INTEGER	Projected sky coordinates of event, relative
`Y`	4-byte INTEGER	to nominal pointing position. Units of 0.05″.
`PHA`	2-byte INTEGER	Uncorrected event energy
`PI`	2-byte INTEGER	Corrected event energy
`FLAG`	4-byte INTEGER	Event quality flag
`PATTERN`	1-byte INTEGER	Combined pattern info 2
`PAT_ID`	2-byte INTEGER	Combined pattern info 1
`PAT_SEQ`	1-byte INTEGER	Pattern sequence
`FLAG`	4-byte INTEGER	Event quality flag
`CCDNR`	1-byte INTEGER	CCD number

- There will also be `EXPOSUnn`, `BADPIXnn`, and `STDGTI` extension as described above.
- These files will be identified using the keyword

```
CONTENT = 'EPIC PN IMAGING MODE EVENT LIST'
```

in the primary header.

- This is a product of class `EPICEXP`.
- The OGIP filetype will be defined by the keywords

```
HDUCLASS= 'OGIP    '          / Format conforms to OGIP/GSFC conventions
HDUCLAS1= 'EVENTS  '          / Extension contains an event list
HDUCLAS2= 'ALL     '          / All, accepted or rejected events only
```

in the header of the `EVENTS` extension.

- There will be one EPIC pn image mode events file per EPIC pn `IMAGING` mode exposure. The file size will typically be 4 MB uncompressed.

6.5.6.7 PRODUCT: EPIC TIMING mode event list

- For MOS camera CCDs operating in `TIMING` and `COMPRESSED TIMING` modes and p-n CCDs operating in `TIMING` and `BURST` modes the `EVENTS` extension will contain a binary table (one row per event) with the following columns:

Name	Type	Description
`TIME`	8-byte REAL	Event time (seconds)
`RAWX`	2-byte INTEGER	Raw CCD pixel of event (X axis)
`PHA`	2-byte INTEGER	Uncorrected event energy
`PI`	2-byte INTEGER	Corrected event energy
`PATTERN`	1-byte INTEGER	Event pattern ID
`CCDNR`	1-byte INTEGER	Overall CCD number
`FLAG`	4-byte INTEGER	Event quality flag

- These files will be identified using the keyword

  ```
  CONTENT = 'EPIC TIMING MODE EVENT LIST'
  ```

  in the primary header.

- This is a product of class `EPICEXP`.

- The OGIP filetype will be defined by the keywords

  ```
  HDUCLASS= 'OGIP    '          / Format conforms to OGIP/GSFC conventions
  HDUCLAS1= 'EVENTS  '          / Extension contains an event list
  HDUCLAS2= 'ACCEPTED'          / Accepted events only
  ```

  in the header of the `EVENTS` extension.

- There will be one timing mode events file per `TIMING` mode exposure. The file size will be 20000 KB uncompressed.

6.5.7 EPIC PPS summary products

6.5.7.1 PRODUCT: EPIC housekeeping summary

- The housekeeping summary file will comprise a PDF plot which will summarise, as a function of time, important parameter values from the following:
    1. Housekeeping data
    2. Derived-housekeeping data
    3. Attitude data
    4. Orbit data
    5. ERMS data
    6. PPS accept/reject flag for data accumulation
- This is a product of class `EPICOBS`.
- There will be one file per EPIC per observation. Each file will be 35 KB.

6.5.7.2 PRODUCT: EPIC HTML summary page

- A summary of all EPIC products will be provided in HTML.
- The preview frames in PNG format will be viewable using these HTML pages, as will all products in PDF.
- This is a product of class `EPICOBS`.
- There will be 1 summary page per observation. File size will be 10 KB.

6.6 RGS products

There are two scientific modes of operation of the RGS instrument. RGS Baseline Spectroscopy Mode (`BSM`) is the standard scientific exposure mode. The other is High Time Resolution Mode (`HTRM`), which will be used for high time resolution spectroscopy and may also be used to avoid pile-up with bright sources.

RGS products include FITS and graphics images formed in aspect-corrected dispersion vs cross-dispersion and CCD energy vs dispersion spaces, a calibrated event list and aspect-corrected exposure map, a list of sources and spectra and spectral plots for selected sources.

RGS spectral extraction depends on the EPIC source list, only bright objects in the RGS FOV will have spectra extracted.

6.6.1 RGS general products header

The primary header of all RGS products will contain the mandatory FITS keywords defined in section 6.2.1. The following instrument specific header keywords will also be present:

```
OCB      =                    1 / On-chip binning (1..5)
```

6.6.2 RGS image products

6.6.2.1 PRODUCT: RGS FITS image

- An image in aspect-corrected dispersion vs cross-dispersion angles.

- These files will be identified using the keyword

  ```
  CONTENT = 'RGS IMAGE'
  ```

  in the primary header.

- This is a product of class `RGSEXP`.

- The OGIP type of the file will be defined by the keywords

  ```
  HDUCLASS= 'OGIP    '          / Format conforms to OGIP/GSFC conventions
  HDUCLAS1= 'IMAGE   '          / Extension contains an image
  HDUCLAS2= 'TOTAL   '          / Gross Image
  HDUVERS1= '1.1.0   '          / Version of format
  ```

- This is a science product suitable for use in further data analysis. Potential uses include the overlaying of EPIC detections to locate any weak spectra.

- There will be one file per exposure. Each file will be 1.5 MB uncompressed.

6.6.2.2 PRODUCT: RGS PNG image

- Annotated RGS images will be supplied in PNG format. Annotations will identify the observation, exposure ID, etc., and will show the extraction regions used in making the RGS source spectra.
- These images are preview products suitable for use in an online browser.
- This is a product of class `RGSEXP`.
- There will be one file per exposure. Each file will be 110 KB.

6.6.2.3 PRODUCT: RGS FITS energy-dispersion image

- An image in aspect-corrected CCD PI energy channel vs dispersion angle. Bright sources appear as hyperbola-like curves, with higher orders offset vertically. Bright regions due to the calibration sources may also be visible.
- These files will be identified using the keyword

  ```
  CONTENT = 'RGS ENERGY-DISPERSION IMAGE'
  ```

  in the primary header.
- This is a product of class `RGSEXP`.
- The OGIP type of the file will be defined by the keywords

  ```
  HDUCLASS= 'OGIP    '          / Format conforms to OGIP/GSFC conventions
  HDUCLAS1= 'IMAGE   '          / Extension contains an image
  HDUCLAS2= 'TOTAL   '          / Gross Image
  HDUVERS1= '1.1.0   '          / Version of format
  ```

- This is a science product suitable for use in further data analysis. Potential uses include the overlaying of EPIC detections to locate any weak spectra.
- There will be one file per exposure. Each file will be 1.5 MB uncompressed.

6.6.2.4 PRODUCT: RGS PNG energy-dispersion image

- Annotated RGS energy-dispersion images will be supplied in PNG format. Annotations will identify the observation, exposure ID, etc., and will show the extraction regions used in making the RGS source spectra.
- These images are preview products suitable for use in an online browser.
- This is a product of class `RGSEXP`.
- There will be one file per exposure. Each file will be 80 KB.

6.6.2.5 PRODUCT: RGS exposure map

- A FITS image dispersion vs cross-dispersion coordinates giving the total active time per pixel over an entire RGS CCD array.
- These files will be identified using the keyword

  `CONTENT = 'RGS EXPOSURE MAP'`

  in the primary header.
- This is a product of class `RGSEXP`.
- This is a science product suitable for use in further data analysis.
- There will be one FITS file per exposure. Each file will be 2.3 MB uncompressed.

6.6.3 RGS spectral products

This section describes the spectral data products to be generated from pointed observations.

Source and background spectra will be supplied for the brightest point sources in the RGS (in nearly all cases this will be just one source). Spectral response matrices will not be supplied, these can be made by the user from the information in the spectrum file header.

6.6.3.1 General conventions

- Where FITS is specified as a file format, the OGIP standards defined by OGIP/92-007 (and amended by OGIP-92/007a) will be followed as far as is appropriate. Such a FITS file will have the basic structure:
  1. Primary header with null primary array.
  2. Data extension (`EXTNAME = 'SPECTRUM'`).
- The spectra will be binned into a set of dispersion angle bins, these being determined by the off-axis angle of the source in the FOV. The width of the bins will be constant in terms of wavelength, and thus a continuous function of energy. The number of bins is 3400.

6.6.3.2 PRODUCT: RGS FITS source spectrum

- For each source two spectrum files will be created, one for each of the first and second dispersion orders.
- No spectra will be made for extended or confused sources.
- The spectra are background subtracted after channel-by-channel exposure correction of source and background.
- The spectra are integrated over the entire exposure.
- These files will be identified using the keyword

```
CONTENT = 'RGS SOURCE SPECTRUM' / File content
```

- This is a product of class `RGSSRC`.
- The `SPECTRUM` extension will contain a binary table (one row per channel) with the following columns:

Name	Type	Description
`CHANNEL`	2-byte INTEGER	Dispersion channel
`RATE`	4-byte REAL	Counts/sec
`STAT_ERR`	4-byte REAL	Statistical error
`QUALITY`	4-byte REAL	Quality flag

- The order and source of the spectrum is identified by the following keywords in the `SPECTRUM` extension:

```
SOURCEID=                      3
RFLORDER=                      1 / RGS order number (1 or 2)
```

- The following keywords are relevant in the `SPECTRUM` extension to identify the file:

```
HDUCLASS= 'OGIP    '           / Format conforms to OGIP/GSFC conventions
HDUCLAS1= 'SPECTRUM'           / Extension contains an spectrum
HDUCLAS2= 'NET     '           / Net spectrum (source - background)
HDUCLAS3= 'RATE    '           / Data stored as counts/sec
HDUVERS = '1.1.0   '           / Version number of the format
HDUVERS1= '1.1.0   '           / Version number of the format
```

- This is a science product suitable for use in further data analysis.
- There will be two FITS files per source (one for each order). Each file will be approximately 70KB uncompressed.

6.6.3.3 PRODUCT: RGS FITS background spectrum

- For each source spectrum a corresponding background spectrum file will be created.
- These files will be identified using the keyword

  ```
  CONTENT = 'RGS SOURCE BACKGROUND SPECTRUM' / File content
  ```

  in the primary header.
- The `SPECTRUM` extension will contain a binary table (one row per channel) with the following columns:

Name	Type	Description
CHANNEL	2-byte INTEGER	Dispersion channel
RATE	4-byte REAL	Counts/sec
STAT_ERR	4-byte REAL	Statistical error
QUALITY	4-byte REAL	Quality flag

- The order of the spectrum and the source for which this is the background are identified by the following keywords in the SPECTRUM extension:

```
SOURCEID=                    3
RFLORDER=                    1 / RGS order number (1 or 2)
```

- The following keywords are relevant in the SPECTRUM extension to identify the file:

```
HDUCLASS= 'OGIP    '          / Format conforms to OGIP/GSFC conventions
HDUCLAS1= 'SPECTRUM'          / Extension contains an spectrum
HDUCLAS2= 'BKG     '          / Background spectrum
HDUCLAS3= 'RATE    '          / Data stored as counts
HDUVERS = '1.1.0   '          / Version number of the format
HDUVERS1= '1.1.0   '          / Version number of the format
```

- This is a product of class RGSSRC.
- This is a science product suitable for use in further data analysis.
- There will be two FITS files per source (one for each order). Each file will be approximately 70KB uncompressed.

6.6.3.4 PRODUCT: RGS PDF spectrum

- This product comprises a pair of plots of the source spectrum in first and second order. Axes are overlaid showing energy and wavelength scales.
- The source spectrum in this product is background subtracted.
- This is a summary product supplied in PDF format.
- These files are preview products suitable for use in an online browser.
- This is a product of class RGSSRC.
- There will be one file per source. File size will be 300 KB.

6.6.4 RGS event list & source list products

6.6.4.1 PRODUCT: RGS event list

- For each RGS detector there will be a single file containing events from CCDs operating in `BSM`, and a single file containing events from CCDs operating in `HTRM` (where appropriate).
- The structure of the FITS file will be:
  1. Primary header with null primary array.
  2. A binary table extension containing event data (`EXTNAME='EVENTS'`).
  3. Per CCD, a bad pixel extension (`BADPIXnn`, where `nn` is the CCD number: 01 - 09).
  4. Per CCD, an extension `EXPM0_nn`
  5. Per CCD, an extension `EXPM1_nn`
- Event times will be specified in seconds after a reference time specified in a header keyword.
- These files will be identified using the keyword

  `CONTENT = 'RGS EVENT LIST'`

  in the primary header.
- This is a product of class `RGSEXP`.
- The `EVENTS` extension will comprise a binary table extension with the following columns:

Name	Type	Description
`BETA_CORR`	4-byte REAL	Attitude corrected dispersion angle (radians)
`XDISP_CORR`	4-byte REAL	Attitude corrected cross-disp angle (radians)
`TIME`	8-byte REAL	Frame timestamp
`FLAG`	4-byte INTEGER	Event attribute flags
`BETA`	4-byte REAL	Uncorrected dispersion angle
`XDSP`	4-byte REAL	Uncorrected cross-dispersion angle
`CHIPX`	2-byte INTEGER	Chip X coordinate (pixel)
`CHIPY`	2-byte INTEGER	Chip Y coordinate (pixel)
`PHA`	2-byte INTEGER	Total telemetered energy
`SHAPE`	BYTE	Event shape identifier
`GRADE`	BYTE	Total number of pixels
`BETA_CHANNEL`	2-byte INTEGER	BETA_CORR (radians)
`XDSP_CHANNEL`	2-byte INTEGER	XDISP_CORR (radians)
`PI`	2-byte INTEGER	Total corrected CCD event energy
`CCDNR`	BYTE	CCD ID number (1/14)

- The `BADPIXnn` extension will comprise a binary table extension with the following columns:

Name	Type	Description
CHIPX	2-byte INTEGER	Chip X coordinate (pixel)
CHIPY	2-byte INTEGER	Chip Y coordinate (pixel)
YEXTENT	2-byte INTEGER	Extent of badness in Y (pixel)
TYPE	2-byte INTEGER	Type of badness
BADFLAG	2-byte INTEGER	Data source flag

- The `EXPM0_nn` extension will an image extension containing the exposure map for CCD `nn`, node 0.
- The `EXPM1_nn` extension will an image extension containing the exposure map for CCD `nn`, node 1.
- There will be a single event file per exposure. The event lists will typically be 52 MB uncompressed

6.6.4.2 PRODUCT: RGS source list

- This product lists bright sources detected by EPIC which fall in the RGS field of view. EPIC and RGS positions are given, as well as RGS spatial and energy-dispersion angle extraction regions for the sources and a background region.
- These files will be identified using the keyword

  `CONTENT = 'RGS SOURCE LIST' / File content`

  in the primary header.
- There are two binary table extensions (`SOURCES` & `RGSn_BACKGROUND`), plus a further three binary table extensions per source (`RGSn_SRCm_SPATIAL`, `RGSn_SRCm_ORDER_1` & `RGSn_SRCm_ORDER_2`, where `n` is the number of the RGS (1 or 2) and `m` is the number of the source.
- The `SOURCES` extension has the following columns:

Name	Type	Description
INDEX	4-byte INTEGER	Source index number starting from 1
LABEL	CHARACTER string	Label for the source (e.g. proposal/on-axis/epic)
IGNORE	LOGICAL	Is the source to be considered for processing?
RA	8-byte REAL	Right Ascension (degrees)
DEC	8-byte REAL	Declination (degrees)
RADIUS	4-byte REAL	(arcmin)
ML_ID_SRC	4-byte INTEGER	ID number from EPIC source list
ID_BAND	4-byte INTEGER	Energy band number from EPIC SOURCE LIST
RATE	4-byte REAL	Counts per sec from PEIC source list
RGS_DISP	4-byte REAL	Posn of source in dispersion direction
RGS_XDSP	4-byte REAL	Posn of source in cross-disp direction
FOV_PHI	4-byte REAL	Polar coord of source in FOV
FOV_R	4-byte REAL	Polar coord of source in FOV
IPRIME	4-byte REAL	Quality factor from brightness
SRC_SELECT	BYTE	Event status: 0/1 - selected/non-selected
BACK_SELECT	BYTE	Event status: 0/1 - selected/non-selected

- The RGSn_BACKGROUND extension contains an ASC region specification for an uncontaminated background region.
- The following keywords are relevant to the RGSn_BACKGROUND extension

```
HDUCLASS= 'ASC     '
HDUCLAS1= 'REGION  '
HDUCLAS2= 'STANDARD'
```

- The RGSn_BACKGROUND extension has the following columns:

Name	Type	Description
SHAPE	CHARACTER string	(e.g. polygon)
X	4-byte REAL vector	
Y	4-byte REAL vector	
COMPONENT	BYTE	

- The structure of the three binary table extensions created per source (RGSn_SRCm_SPATIAL, RGSn_SRCm_ORDER_1 & RGSn_SRCm_ORDER_2) is identical.
- These extensions are ASC region specifications for source number m, respectively the spatial (dispersion vs cross-dispersion), order 1 (energy vs dispersion) and order 2 (energy vs dispersion) extraction regions.
- The HDUCLASn keyword set is the same as for the RGSn_BACKGROUND extension.
- These extensions have the following columns:

Name	Type	Description
SHAPE	CHARACTER string	(e.g. polygon)
X	4-byte REAL vector	
Y	4-byte REAL vector	

- This is a product of class RGSEXP.
- This is a science product suitable for use in further data analysis.
- There will be one FITS file per source exposure. Each file will be approximately 100 KB uncompressed.

6.6.5 RGS PPS summary products

6.6.5.1 PRODUCT: RGS housekeeping summary

- The housekeeping summary file will comprise a PDF plot which will summarise, as a function of time, important parameter values from the following:
  1. Housekeeping data
  2. Pseudo-housekeeping data
  3. Attitude data

4. Orbit data
5. PPS accept/reject flag for data accumulation

- This is a product of class `RGSOBS`.
- There will be one file per RGS per observation. File size will be 35 KB.

6.6.5.2 PRODUCT: RGS HTML summary page

- A summary of all RGS products will be provided in HTML.
- The graphics products will be viewable using these HTML pages.
- This is a product of class `RGSOBS`.
- There will be 1 file per observation. File size will be 8 KB.

6.7 Catalogue and archive products

6.7.1 Introduction

This section describes the content and format of PPS data products created by the cross-correlation of EPIC source positions with archival data. Archival material includes both catalogues of objects and sky pixels. There is no cross-correlation of OM sources in the PPS.

6.7.2 The cross-correlation process

The cross-correlation takes place in two distinct steps: the first correlates the raw EPIC source positions against an astrometric catalogue with a large number of stellar entries, the second step correlates the corrected EPIC source positions against a large collection of archival data (catalogues and pixel data) to make the bulk of the cross-correlation products. The first step may not always occur. All cross-correlation products will specify whether corrected or uncorrected EPIC source positions were used.

The cross-correlation process answers two distinct questions: 1) Is there an object in the error circle which could be the counterpart of the X-ray source? 2) Are there objects which should have been detected by EPIC but were not?

For the purpose of visual inspection and/or follow-up observations, we shall also provide optical images (finding charts) of the area of sky around EPIC sources.

6.7.2.1 Search around raw EPIC positions

The raw EPIC source positions will be correlated against a large astrometric catalogue, probably initially the USNO A2 catalogue, and probably changing eventually to the second generation HST Guide Star Catalogue. Correlation results will be provided for a large enough region around each EPIC source to allow the correct EPIC-catalogue correlations to be distinguished from the random EPIC-catalogue positional associations. This correlation process creates a product which can be used to correct the EPIC source positions to the astrometric frame. These corrected EPIC source positions are then used in making the other cross-correlation products.

6.7.2.2 Search around EPIC positions

The number of catalogues systematically searched for positional coincidence with each EPIC source may be of the order of one hundred or more. Assuming a 1σ position error of 5 arcsec, and a search radius of say 26 arcsec corresponding to a conservative $1\text{-}10^{-6}$ confidence level implies a search area of 0.6 arcmin^2 per source or 60 arcmin^2 for a typical 100 sources per EPIC observation. This is less than a tenth of the total nominal EPIC FOV.

The PPS products provide, for each EPIC source, the list of entries contained in the catalogues scanned, together with their measurements, sorted by increasing distance to the best X-ray position up to a given confidence radius.

6.7.2.3 Search in the whole EPIC field of view

Considering the larger area involved, the number of catalogues queried for the whole EPIC field of view has to be restricted to those containing the highest level of information on the astronomical content of the EPIC field of view and those containing known X-ray sources. The minimum set of catalogues for which a whole field search is performed comprises all X-ray catalogues (including ROSAT all-sky survey and pointings) and SIMBAD.

The corresponding PPS products will consist of a list of all entries (summary and all catalogue measurements) together with some graphical representation of their location on the sky. Catalogued X-ray sources not detected by EPIC will be highlighted.

6.7.3 Format of the PPS cross-correlation products

The need to provide both human and machine readable information implies the delivery of products in different formats as no one format can reasonably fulfill both requirements. FITS is the best machine readable format for most tables and image cross-correlation data products. For products which need to be human readable, the PPS provides data mainly in HTML format. This is the cheapest way to organize rather complex information into an easily browsable structure.

6.7.4 General cross-correlation products

These PPS cross-correlation products list the names of all catalogues searched (both around each EPIC position and in the whole EPIC field) and describe the format of their output.

6.7.4.1 PRODUCT: main cross-correlation page

- This HTML product is a front page to the other cross-correlation HTML and graphics pages, providing links to these products.
- There will be one file per observation.
- This is a product of class `CATOBS`.
- File size: 4 KB

6.7.4.2 PRODUCT: searched catalogues

- This HTML product is a summary of all catalogues searched.
- A character flag at the beginning of each line will indicate whether the catalogue was also searched in the whole EPIC field of view.
- There will be one file per observation.
- This is a product of class `CATOBS`.
- File size: 8 KB

6.7.4.3 PRODUCT: catalogue descriptions

- A detailed description will be only made for those catalogues having a match in the current observation.
- A comprehensive description of the content of each column/measurement and notes is required for easy reading. The catalogue description and format proposed here is an HTML version of the human readable ASCII standard catalogue description.

- This product contains the main catalogue title, general description, date, file summary, byte-by-byte description of the file, notes, history, etc.
- This HTML product may contain external URLs.
- There will be one file per matching catalogue in the observation.
- This is a product of class `CATCAT`.
- File size: 8 KB

6.7.5 Cross-correlation products associated with EPIC source detections

6.7.5.1 PRODUCT: FITS EPIC source raw position cross-correlation results

This product gathers in a single file all entries in a searched catalogue which match raw EPIC source positions.

The FITS file will contain a binary table extension. The format of this table will depend on the catalogue from which the data are drawn, and so is not specified here.

The extension name will be `EXTNAME` = '`RAWRES` '

This products will be identified by the FITS header keyword

```
CONTENT = 'EPIC SOURCE RAW POSITION CROSS-CORRELATION RESULTS'
```

There will be one file per observation (relating to a single catalogue).

This is a product of class `CATCAT`.

Assuming 50 matches per EPIC source with 200 bytes per match and 100 sources per observation, this file will be approximately 1MB uncompressed.

6.7.5.2 PRODUCT: HTML EPIC source cross-correlation summary

- This product presents an overview of the cross-correlation results EPIC source.
- For each EPIC source we list a summary of the X-ray data: position, 1 sigma error radius, count rate and a selection of hardness ratios.
- The EPIC source summary is followed by the group of all entries found in the catalogues searched, sorted by increasing distance to the best EPIC position.
- For each catalogue entry matching the EPIC position we list: catalogue name, full entry name, position, error on entry position, distance to EPIC position, a 'standard' catalogue measurement (e.g. V magnitude) in two columns, nature and value.
- URLs:
  - EPIC source number to EPIC summary
  - Catalogue name to catalogue descriptions
  - Catalogue entry name to HTML EPIC source catalogue measurement
  - SIMBAD name to ASU formatted real time query (external URL)

  - Button to finding charts

- There will be one file per observation.
- This is a product of class CATOBS.
- The file size will be approx. 300KB.

6.7.5.3 PRODUCT: FITS EPIC source cross-correlation summary

- This summary product holds an overview of the cross-correlation results.
- It is similar in content to the product HTML EPIC source cross-correlation summary, but does not contain URLs nor the detailed EPIC information.
- This product will be identified by the FITS header keyword

  CONTENT = 'EPIC SOURCE CROSS-CORRELATION SUMMARY'

- The file will be FITS format, containing a binary table extension of with the following columns:

Name	Type	Description
SRC_NUM	4-byte INTEGER	Source number
RA	8-byte REAL	Source right ascension (deg)
DEC	8-byte REAL	Source declination (deg)
RADEC_ERR	4-byte REAL	Source 1σ position error (arcsec)
CAT_NAME	CHARACTER string	Catalogue name
CAT_ENTRY	CHARACTER string	Full entry name
CAT_RA	8-byte REAL	Entry right ascension (deg)
CAT_DEC	8-byte REAL	Entry declination (deg)
CAT_RADEC_ERR	4-byte REAL	1σ position error (arcsec) on entry
D_EPIC_CAT	4-byte REAL	Distance to EPIC position (arcsec)
CAT_MEAS	CHARACTER string	Catalogue measurement description
CAT_VAL	8-byte REAL	Catalogue measurement value
CAT_NUM	4-byte INTEGER	Unique catalogue entry number

- The extension name will be EXTNAME = 'SRCSUM '
- There will be one file per observation
- This is a product of class CATOBS
- The file size will be approx. 300 KB uncompressed.

6.7.5.4 PRODUCT: HTML EPIC source cross-correlation results

- This HTML product gathers in a single file all entries in a searched catalogue which match EPIC sources.
- The basic layout of the HTML page will be that of the CDS VizieR extractions, i.e. a first line of description followed by catalogue measurements.

- EPIC source reference name is in first column.
- Catalogue entries matching with different EPIC sources are repeated
- URLs:
  - EPIC source name to EPIC summary
  - catalogue name to catalogue descriptions
  - Column labels to specific explanations in catalogue descriptions
  - Button to finding charts
- There will be one file per observation
- This is a product of class CATOBS
- The file size will be approx. 300 KB.

6.7.5.5 PRODUCT: FITS EPIC source cross-correlation results

- This product gathers in a single file all entries in a searched catalogue which match EPIC sources.
- The FITS file will contain a binary table extension. The format of this table will depend on the catalogue from which the data are drawn, and so is not specified here.
- This product will be identified by the FITS header keyword

  `CONTENT = 'EPIC SOURCE CROSS-CORRELATION RESULTS'`

- The extension name will be `EXTNAME` = '`SRCRES` '
- There will be one file per observation
- This is a products of class `CATOBS`
- The file size will be approx. 300 KB uncompressed.

6.7.5.6 PRODUCT: finding chart

Finding charts (i.e. optical images of small areas of the sky) will be a valuable scientific add-on to the XMM PPS products. This is because we cannot be fully confident that the systematic object search and extraction processes by which catalogues are made do not miss objects which are faint, extended or have complex shapes.

- While the provision of small finding charts (a few arcminutes centred on each EPIC source) is less efficient than the provision of 1 large file, the more direct applicability and smaller individual size of such files argues strongly in their favour.
- 4×4 arcminute finding charts with 1 arcsecond pixels will be provided for each EPIC source.
- The finding chart is a one colour image.

- EPIC flux contours or source position error circles are overlaid on the sky image.
- File structure:

Product Name	Finding Chart
Number of files	~100 per observation
Format	PDF

- This is a product of class `CATSRC`.
- File size = 81KB

6.7.6 Cross-correlation products associated with the whole EPIC field of view

6.7.6.1 PRODUCT: HTML EPIC field of view summary

- This is a summary product listing all SIMBAD and X-ray catalogued objects present in the EPIC field of view independently of their detection in X-rays in the current observation.
- The catalogues considered in this case are a subset of those searched around each EPIC source.
- Catalogue entries are sorted by right ascension.
- This product allows the astronomer to get an overview of the astronomical content of the EPIC field. It is also a means to find previously known X-ray sources which are not detected in the XMM observation.
- For each catalogue entry with a position in the EPIC field of view we list: catalogue name, full entry name, position, error on entry position, a 'standard' catalogue measurement (e.g. V magnitude in two columns; nature and value and when possible the name of a matching EPIC source.
- URLs:
  - Catalogue name to catalogue descriptions
  - Entry name to HTML EPIC field of view catalogue measurement
  - SIMBAD name to ASU real time query (external URL)
  - Where applicable, EPIC source name to EPIC summary
- There will be one file per observation.
- This is a product of class `CATOBS`.
- File size: Number of entries $\times$ 200KB = 40KB.

6.7.6.2 PRODUCT: FITS EPIC field of view summary

- This product contains similar information to that in the product HTML EPIC field of view summary, but in machine readable FITS format.
- These files will be identified using the keyword

CONTENT = 'EPIC FOV CROSS-CORRELATION SUMMARY'

in the primary header.

- The extension name will be EXTNAME = 'FOVSUM '
- There will be one file per observation.
- This is a product of class CATOBS.
- File size: Number of entries × 200B = 40KB uncompressed
- The binary table of the FITS file will contain the following columns:

Name	Type	Description
SRC_NUM	4-byte INTEGER	Source number
CAT_NAME	20-byte Character string	Catalogue name
CAT_ENTRY	30-byte Character string	Full entry name
CAT_RA	8-byte REAL	Source right ascension(deg)
CAT_DEC	8-byte REAL	Source declination (deg)
CAT_RADEC_ERR	4-byte REAL	1 sigma catalogue posn error (arcsec)
CAT_MEAS	10-byte Character string	Catalogue measurement description
CAT_VAL	8-byte REAL	Catalogue measurement value
CAT_NUM	4-byte INTEGER	Unique catalogue entry number

6.7.6.3 PRODUCT: HTML EPIC field of view cross-correlation results

- This HTML product gathers in a single file all entries found in the EPIC field of view in a single catalogue.
- The basic layout of the HTML page will be that of CDS Vizier extractions, i.e. a first line of description followed by catalogues measurements.
- Possibly matching EPIC source are in first column.
- URLs:
  - Catalogue name to detailed catalogue descriptions
  - Column labels to specific explanations in catalogue descriptions
  - EPIC source name to EPIC summary (in case of EPIC source match)
  - Button to finding charts (in case of EPIC source match)
- There will be one file per catalogue per observation.
- This is a product of class CATCAT.
- File size: Number of matching entries × 200B = 40KB

6.7.6.4 PRODUCT: FITS EPIC field of view cross-correlation results

- This FITS product contains similar information to that in the product HTML EPIC field of view cross-correlation results.
- These files will be identified using the keyword

  `CONTENT = 'EPIC FOV CROSS-CORRELATION RESULTS'`

  in the primary header.
- The extension name will be `EXTNAME` = '`FOVRES` '
- There will be one file per observation.
- This is a product of class `CATOBS`.
- File size: Number of matching entries $\times$ 200B = 40KB uncompressed.

6.7.6.5 PRODUCT: EPIC catalogue plot

- This is a graphic representation of whole field of view catalogue extractions overlaid on the EPIC image. This should allow a good visualization of content of the EPIC full field of view measurements product.
- There will be one PDF file per observation.
- This is a product of class `CATOBS`.
- File size: 20KB

6.7.6.6 PRODUCT: XMM-rosat image

- This product provides a graphic comparison between the EPIC and ROSAT images in order to better assess potential non-detected X-ray sources and large scale extended sources.
- EPIC source positions and flux contours are overlaid on a ROSAT image.
- There will be one PDF file per observation.
- This is a product of class `CATOBS`.
- File size: 36KB

6.8 PPS run products

6.8.1 PRODUCT: PPS script log

- This file will contain the log of the PPS run, i.e. every executable invocation will be listed, together with important output information (e.g. error messages).
- Non-executable lines will be prefixed by `#`
- This file will identify the version(s) of each PPS task module used in the processing of the data, including the version(s) of the PPS control software.
- It will list the date and time of pipeline execution.
- It will contain the parameter file data used by PPS tasks during the PPS run.
- This product is of class `PPSOBS`.
- This product will be delivered in compressed ASCII format.
- There will be one file per observation. File size will be 400 KB uncompressed.

6.8.2 PRODUCT: PPS run message

- This file will contain a text description of the PPS run, this will act as the basis for an e-mail message to be sent to the proposing observer when the PPS products are accepted into the XMM archive.
- The file will identify which instruments have been processed, and if the PPS run is subsequent to the initial run for a particular observation, the reason for the new PPS run.
- This is the one product that is not included in a product group.
- This product is of class `PPSOBS`.
- This product will be delivered in ASCII format.
- There will be one file per PPS run. File size will be 5 KB.

6.8.3 PRODUCT: PPS run summary

- This file will act as a home page for the products created in the PPS run, it will provide links to the top level pages of the various types of products (e.g. OM HTML summary page).
- This product is of class `PPSOBS`.
- This product will be delivered in HTML format.
- There will be one file per PPS run. File size will be 5 KB.

6.8.4 PRODUCT: PPS HTML index

- PPS HTML index files include links, with brief explanations, to every file within the product group in which they sit (see section 9). There are no links to files external to the product group.
- The product will be delivered in HTML format
- This is the only PPS product not listed in the PPS product index product. It thus does not have a product class.
- There will be one file per product group. For a product group with 49 data products the file size will be 10kB.

6.8.5 PRODUCT: PPS product index

- The PPS product index lists every product created in the pipeline analysis of the observation (including itself, but excluding the PPS HTML index files).
- The product will be delivered in FITS format
- There will be one FITS extension per product class (see section below), each will contain a binary table listing all the PPS products which fall in that class. The extension names will be those of the product classes. The names and formats of the data columns will vary from class to class. Extensions may be absent if no products of the relevant class have been produced.
- In each class extension there will be one row per product. The columns will list database keyword values associated with the product.
- There will be one additional extension, named INSTSUMM, which will give brief details of the structure of the observation (eg number of exposures in each instrument). This extension has one row per instrument, ie 6 rows.
- This file will be identified using the keyword

  `CONTENT = 'PPS PRODUCT INDEX'`

  in the primary header.
- This product is of class `PPSOBS`
- There will be one file per observation. File size will be 1MB uncompressed.
- The data products are divided into the following product classes:

Product class	*Product description* Product name
`OMOBS`	*OM products at the observation level* OM observation source list OM flatfield
(continued on next page)	

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Product class	*Product description* Product name
	OM housekeeping summary OM HTML summary page
`OMEXP`	*OM products at the exposure level* OM FITS tracking star timeseries OM PDF tracking star timeseries OM tracking history plot
`OMOSW`	*OM products at the OSW level* OM OSW FITS sky image OM OSW FITS image OM OSW source list
`OMSRC`	*OM products at the individual source level* OM OSW FITS source time-series OM OSW PDF source time-series
`EPICOBS`	*EPIC products at the observation level* EPIC FITS observation image EPIC PNG observation image EPIC camera sensitivity map EPIC sensitivity map EPIC camera box-local source list EPIC camera box-map source list EPIC camera ml source list EPIC observation box-local source list EPIC observation box-map source list EPIC observation ml source list EPIC FITS summary source list EPIC HTML summary source list EPIC housekeeping summary EPIC HTML summary page
`EPICEXP`	*EPIC products at the exposure level* EPIC FITS image EPIC PNG image EPIC exposure map EPIC exposure sensitivity map EPIC three-colour image EPIC variability image EPIC global background time-series EPIC FITS source background spectrum EPIC fluctuations spectrum EPIC exposure box-local source list EPIC exposure box-map source list EPIC exposure ml source list EPIC PDF intensity histogram EPIC MOS IMAGING mode event list

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Product class	*Product description* Product name
	EPIC PN IMAGING mode event list EPIC TIMING mode event list
`EPICSRC`	*EPIC products at the individual source level* EPIC FITS source time-series EPIC PDF source time-series EPIC source FFT plot EPIC FITS source spectrum EPIC FITS source background spectrum EPIC source spectrum plot
`RGSOBS`	*RGS products at the observation level* RGS housekeeping summary RGS HTML summary page
`RGSEXP`	*RGS products at the exposure level* RGS FITS image RGS PNG image RGS FITS energy-dispersion image RGS PNG energy-dispersion image RGS exposure map RGS event list RGS source list
`RGSSRC`	*RGS products at the individual source level* RGS FITS source spectrum RGS FITS background spectrum RGS PDF spectrum
`CATOBS`	*Catalogue (cross-correlation) products at the observation level* Searched catalogues HTML EPIC source cross-correlation summary FITS EPIC source cross-correlation summary HTML EPIC source cross-correlation results HTML EPIC field-of-view summary FITS EPIC field-of-view summary HTML EPIC field-of-view cross-correlation results PNG catalogue plot PNG XMM-ROSAT image
`CATCAT`	*Catalogue products at the catalogue level* Catalogue descriptions FITS EPIC source raw position cross-correlation results FITS EPIC source cross-correlation results FITS EPIC field-of-view cross-correlation results
`CATSRC`	*Catalogue products at the individual source level* Finding chart

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Product class	*Product description* Product name
PPSOBS	*Miscellaneous PPS products at the observation level* Observation summary Attitude time series PPS script log PPS run message PPS run summary Calibration index file SSC logo 1 SSC logo 2 CDS logo 1 CDS logo 2 CDS logo 3 XMM logo 1 ESA logo 1 PPS product index

- The tables in the following sections describe the columns for each extension:

6.8.5.1 EPICOBS extension

Column name	Format	Fixed	Enum	Description
INSTRUMENT	CHAR*5		Y	Instrument name
OBS_MODE	CHAR*8	Y	Y	XMM observation mode
OBS_ID	CHAR*10	Y		XMM observation ID
OBS_START	CHAR*24	Y		Date and time of observation start (UTC)
OBS_STOP	CHAR*24	Y		Date and time of observation end (UTC)
OBS_DURATION	REAL	Y		Duration of observation (sec)
CONTENT	CHAR*40		Y	Description of file content
RA_PNT	DOUBLE	Y		RA of XMM pointing (J2000.0)
DEC_PNT	DOUBLE	Y		Dec. of XMM pointing (J2000.0)
PA_PNT	DOUBLE	Y		Position angle of XMM (CCW from North)
LII_PNT	DOUBLE	Y		Galactic longitude of XMM pointing
BII_PNT	DOUBLE	Y		Galactic latitude of XMM pointing
OBSERVER	CHAR*40	Y		Name of PI
OBJECT	CHAR*40	Y		Name of target object
VVFLAGS	CHAR*8			Validation & verification flags
PROCREVISION	CHAR*8	Y		Processing revision
PROCDATE	CHAR*24	Y		Processing date (UTC)
SASVERSION	CHAR*20	Y		SAS version identifier
PPSVERSION	CHAR*24	Y		PPS configuration version identifier
FORMAT	CHAR*4		Y	File format
NAME	CHAR*31			File name

6.8.5.2 EPICEXP extension

Column name	Format	Fixed	Enum	Description
INSTRUMENT	CHAR*5		Y	Instrument name
DATAMODE	CHAR*7		Y	Instrument mode
EPIC_FILTER	CHAR*16		Y	EPIC filter
OBS_MODE	CHAR*8	Y	Y	XMM observation mode
OBS_ID	CHAR*10	Y		XMM observation ID
OBS_START	CHAR*24	Y		Date and time of observation start (UTC)
OBS_STOP	CHAR*24	Y		Date and time of observation end (UTC)
OBS_DURATION	REAL	Y		Duration of observation (sec)
EXP_ID	INTEGER			Exposure number within observation
CONTENT	CHAR*40		Y	Description of file content
RA_PNT	DOUBLE	Y		RA of XMM pointing (J2000.0)
DEC_PNT	DOUBLE	Y		Dec. of XMM pointing (J2000.0)
PA_PNT	DOUBLE	Y		Position angle of XMM (CCW from North)
LII_PNT	DOUBLE	Y		Galactic longitude of XMM pointing
BII_PNT	DOUBLE	Y		Galactic latitude of XMM pointing
EXP_START	CHAR*24	Y		Date and time of exposure start (UTC)
EXP_STOP	CHAR*24	Y		Date and time of exposure end (UTC)
EXP_DURATION	REAL			Duration of exposure (sec)
BAND	INTEGER			Energy band (0-8, 0=NULL)
OBSERVER	CHAR*40	Y		Name of PI
OBJECT	CHAR*40	Y		Name of target object
VVFLAGS	CHAR*8			Validation & verification flags
PROCREVISION	CHAR*8	Y		Processing revision
PROCDATE	CHAR*24	Y		Processing date (UTC)
SASVERSION	CHAR*20	Y		SAS version identifier
PPSVERSION	CHAR*24	Y		PPS configuration version identifier
FORMAT	CHAR*4		Y	File format
NAME	CHAR*31			File name

6.8.5.3 EPICSRC extension

Column name	Format	Fixed	Enum	Description
INSTRUMENT	CHAR*5		Y	Instrument name
DATAMODE	CHAR*7		Y	Instrument mode
EPIC_FILTER	CHAR*16		Y	EPIC filter
OBS_MODE	CHAR*8	Y	Y	XMM observation mode
OBS_ID	CHAR*10	Y		XMM observation ID
OBS_START	CHAR*24	Y		Date and time of observation start (UTC)
OBS_STOP	CHAR*24	Y		Date and time of observation end (UTC)
OBS_DURATION	REAL	Y		Duration of observation (sec)
EXP_ID	INTEGER			Exposure number within observation
CONTENT	CHAR*40		Y	Description of file content
RA_PNT	DOUBLE	Y		RA of XMM pointing (J2000.0)
DEC_PNT	DOUBLE	Y		Dec. of XMM pointing (J2000.0)
PA_PNT	DOUBLE	Y		Position angle of XMM (CCW from North)
LII_PNT	DOUBLE	Y		Galactic longitude of XMM pointing
BII_PNT	DOUBLE	Y		Galactic latitude of XMM pointing
EXP_START	CHAR*24	Y		Date and time of exposure start (UTC)
EXP_STOP	CHAR*24	Y		Date and time of exposure end (UTC)
EXP_DURATION	REAL			Duration of exposure (sec)
BAND	INTEGER			Energy band (0-8, 0=NULL)
SRC_NUM	INTEGER			Source number (from observation source list)
RA_OBJ	DOUBLE			RA of source (2000.0)
DEC_OBJ	DOUBLE			Declination of source (2000.0)
LII_OBJ	DOUBLE			Galactic longitude of source
BII_OBJ	DOUBLE			Galactic latitude of source
EPIC_RATE	REAL			All-EPIC source count rate
EPIC_RATE_ERR	REAL			Error on EPIC source count rate
EPIC_HR1	REAL			All-EPIC hardness ratio 1
EPIC_HR1_ERR	REAL			Error on EPIC hardness ratio 1
EPIC_HR2	REAL			All-EPIC hardness ratio 2
EPIC_HR2_ERR	REAL			Error on EPIC hardness ratio 2
EPIC_HR3	REAL			All-EPIC hardness ratio 3
EPIC_HR3_ERR	REAL			Error on EPIC hardness ratio 3
EPIC_VARSTAT	REAL			All-EPIC source variability statistic
OBSERVER	CHAR*40	Y		Name of PI
OBJECT	CHAR*40	Y		Name of target object
VVFLAGS	CHAR*8			Validation & verification flags
PROCREVISION	CHAR*8	Y		Processing revision
PROCDATE	CHAR*24	Y		Processing date (UTC)
SASVERSION	CHAR*20	Y		SAS version identifier
PPSVERSION	CHAR*24	Y		PPS configuration version identifier
FORMAT	CHAR*4		Y	File format
NAME	CHAR*31			File name

6.8.5.4 OMOBS extension

Column name	Format	Fixed	Enum	Description
INSTRUMENT	CHAR*5	Y	Y	Instrument name
DETECTOR	CHAR*9	Y	Y	Detector name
OBS_MODE	CHAR*8	Y	Y	XMM observation mode
OBS_ID	CHAR*10	Y		XMM observation ID
OBS_START	CHAR*24	Y		Date and time of observation start (UTC)
OBS_STOP	CHAR*24	Y		Date and time of observation end (UTC)
OBS_DURATION	REAL	Y		Duration of observation (sec)
CONTENT	CHAR*40		Y	Description of file content
RA_PNT	DOUBLE	Y		RA of XMM pointing (J2000.0)
DEC_PNT	DOUBLE	Y		Dec. of XMM pointing (J2000.0)
PA_PNT	DOUBLE	Y		Position angle of XMM (CCW from North)
LII_PNT	DOUBLE	Y		Galactic longitude of XMM pointing
BII_PNT	DOUBLE	Y		Galactic latitude of XMM pointing
OBSERVER	CHAR*40	Y		Name of PI
OBJECT	CHAR*40	Y		Name of target object
VVFLAGS	CHAR*8			Validation & verification flags
PROCREVISION	CHAR*8	Y		Processing revision
PROCDATE	CHAR*24	Y		Processing date (UTC)
SASVERSION	CHAR*20	Y		SAS version identifier
PPSVERSION	CHAR*24	Y		PPS configuration version identifier
FORMAT	CHAR*4		Y	File format
NAME	CHAR*31			File name

6.8.5.5 OMEXP extension

Column name	Format	Fixed	Enum	Description
INSTRUMENT	CHAR*5	Y	Y	Instrument name
DETECTOR	CHAR*9	Y	Y	Detector name
DATAMODE	CHAR*7		Y	Instrument mode
OM_FILTER	CHAR*16		Y	EPIC filter
OBS_MODE	CHAR*8	Y	Y	XMM observation mode
OBS_ID	CHAR*10	Y		XMM observation ID
OBS_START	CHAR*24	Y		Date and time of observation start (UTC)
OBS_STOP	CHAR*24	Y		Date and time of observation end (UTC)
OBS_DURATION	REAL	Y		Duration of observation (sec)
EXP_ID	INTEGER			Exposure number within observation
CONTENT	CHAR*40		Y	Description of file content
RA_PNT	DOUBLE	Y		RA of XMM pointing (J2000.0)
DEC_PNT	DOUBLE	Y		Dec. of XMM pointing (J2000.0)
PA_PNT	DOUBLE	Y		Position angle of XMM (CCW from North)
LII_PNT	DOUBLE	Y		Galactic longitude of XMM pointing
BII_PNT	DOUBLE	Y		Galactic latitude of XMM pointing
EXP_START	CHAR*24	Y		Date and time of exposure start (UTC)
EXP_STOP	CHAR*24	Y		Date and time of exposure end (UTC)
EXP_DURATION	REAL			Duration of exposure (sec)
OBSERVER	CHAR*40	Y		Name of PI
OBJECT	CHAR*40	Y		Name of target object
VVFLAGS	CHAR*8			Validation & verification flags
PROCREVISION	CHAR*8	Y		Processing revision
PROCDATE	CHAR*24	Y		Processing date (UTC)
SASVERSION	CHAR*20	Y		SAS version identifier
PPSVERSION	CHAR*24	Y		PPS configuration version identifier
FORMAT	CHAR*4		Y	File format
NAME	CHAR*31			File name

6.8.5.6 OMSW extension

Column name	Format	Fixed	Enum	Description
INSTRUMENT	CHAR*5	Y	Y	Instrument name
DETECTOR	CHAR*9	Y	Y	Detector name
DATAMODE	CHAR*7		Y	Instrument mode
OM_FILTER	CHAR*16		Y	EPIC filter
OBS_MODE	CHAR*8	Y	Y	XMM observation mode
OBS_ID	CHAR*10	Y		XMM observation ID
OBS_START	CHAR*24	Y		Date and time of observation start (UTC)
OBS_STOP	CHAR*24	Y		Date and time of observation end (UTC)
OBS_DURATION	REAL	Y		Duration of observation (sec)
EXP_ID	INTEGER			Exposure number within observation
OSW_ID	INTEGER			OSW number within exposure
CONTENT	CHAR*40		Y	Description of file content
RA_PNT	DOUBLE	Y		RA of XMM pointing (J2000.0)
DEC_PNT	DOUBLE	Y		Dec. of XMM pointing (J2000.0)
PA_PNT	DOUBLE	Y		Position angle of XMM (CCW from North)
LII_PNT	DOUBLE	Y		Galactic longitude of XMM pointing
BII_PNT	DOUBLE	Y		Galactic latitude of XMM pointing
EXP_START	CHAR*24	Y		Date and time of exposure start (UTC)
EXP_STOP	CHAR*24	Y		Date and time of exposure end (UTC)
EXP_DURATION	REAL			Duration of exposure (sec)
OBSERVER	CHAR*40	Y		Name of PI
OBJECT	CHAR*40	Y		Name of target object
VVFLAGS	CHAR*8			Validation & verification flags
PROCREVISION	CHAR*8	Y		Processing revision
PROCDATE	CHAR*24	Y		Processing date (UTC)
SASVERSION	CHAR*20	Y		SAS version identifier
PPSVERSION	CHAR*24	Y		PPS configuration version identifier
FORMAT	CHAR*4		Y	File format
NAME	CHAR*31			File name

6.8.5.7 OMSRC extension

Column name	Format	Fixed	Enum	Description
INSTRUMENT	CHAR*5	Y	Y	Instrument name
DETECTOR	CHAR*9	Y	Y	Detector name
DATAMODE	CHAR*7		Y	Instrument mode
OM_FILTER	CHAR*16		Y	EPIC filter
OBS_MODE	CHAR*8	Y	Y	XMM observation mode
OBS_ID	CHAR*10	Y		XMM observation ID
OBS_START	CHAR*24	Y		Date and time of observation start (UTC)
OBS_STOP	CHAR*24	Y		Date and time of observation end (UTC)
OBS_DURATION	REAL	Y		Duration of observation (sec)
EXP_ID	INTEGER			Exposure number within observation
OSW_ID	INTEGER			OSW number within exposure
CONTENT	CHAR*40		Y	Description of file content
RA_PNT	DOUBLE	Y		RA of XMM pointing (J2000.0)
DEC_PNT	DOUBLE	Y		Dec. of XMM pointing (J2000.0)
PA_PNT	DOUBLE	Y		Position angle of XMM (CCW from North)
LII_PNT	DOUBLE	Y		Galactic longitude of XMM pointing
BII_PNT	DOUBLE	Y		Galactic latitude of XMM pointing
EXP_START	CHAR*24	Y		Date and time of exposure start (UTC)
EXP_STOP	CHAR*24	Y		Date and time of exposure end (UTC)
EXP_DURATION	REAL			Duration of exposure (sec)
SRC_NUM	INTEGER			Source number (from observation source list)
RA_OBJ	DOUBLE			RA of source (2000.0)
DEC_OBJ	DOUBLE			Declination of source (2000.0)
LII_OBJ	DOUBLE			Galactic longitude of source
BII_OBJ	DOUBLE			Galactic latitude of source
MAGNITUDE	REAL			Source magnitude
VARSTAT	REAL			Source variability statistic
OBSERVER	CHAR*40	Y		Name of PI
OBJECT	CHAR*40	Y		Name of target object
VVFLAGS	CHAR*8			Validation & verification flags
PROCREVISION	CHAR*8	Y		Processing revision
PROCDATE	CHAR*24	Y		Processing date (UTC)
SASVERSION	CHAR*20	Y		SAS version identifier
PPSVERSION	CHAR*24	Y		PPS configuration version identifier
FORMAT	CHAR*4		Y	File format
NAME	CHAR*31			File name

6.8.5.8 RGSOBS extension

Column name	Format	Fixed	Enum	Description
INSTRUMENT	CHAR*5		Y	Instrument name
OBS_MODE	CHAR*8	Y	Y	XMM observation mode
OBS_ID	CHAR*10	Y		XMM observation ID
OBS_START	CHAR*24	Y		Date and time of observation start (UTC)
OBS_STOP	CHAR*24	Y		Date and time of observation end (UTC)
OBS_DURATION	REAL	Y		Duration of observation (sec)
CONTENT	CHAR*40		Y	Description of file content
RA_PNT	DOUBLE	Y		RA of XMM pointing (J2000.0)
DEC_PNT	DOUBLE	Y		Dec. of XMM pointing (J2000.0)
PA_PNT	DOUBLE	Y		Position angle of XMM (CCW from North)
LII_PNT	DOUBLE	Y		Galactic longitude of XMM pointing
BII_PNT	DOUBLE	Y		Galactic latitude of XMM pointing
OBSERVER	CHAR*40	Y		Name of PI
OBJECT	CHAR*40	Y		Name of target object
VVFLAGS	CHAR*8			Validation & verification flags
PROCREVISION	CHAR*8	Y		Processing revision
PROCDATE	CHAR*24	Y		Processing date (UTC)
SASVERSION	CHAR*20	Y		SAS version identifier
PPSVERSION	CHAR*24	Y		PPS configuration version identifier
FORMAT	CHAR*4		Y	File format
NAME	CHAR*31			File name

6.8.5.9 RGSEXP extension

Column name	Format	Fixed	Enum	Description
INSTRUMENT	CHAR*5		Y	Instrument name
DATAMODE	CHAR*7		Y	Instrument mode
OBS_MODE	CHAR*8	Y	Y	XMM observation mode
OBS_ID	CHAR*10	Y		XMM observation ID
OBS_START	CHAR*24	Y		Date and time of observation start (UTC)
OBS_STOP	CHAR*24	Y		Date and time of observation end (UTC)
OBS_DURATION	REAL	Y		Duration of observation (sec)
EXP_ID	INTEGER			Exposure number within observation
CONTENT	CHAR*40		Y	Description of file content
RA_PNT	DOUBLE	Y		RA of XMM pointing (J2000.0)
DEC_PNT	DOUBLE	Y		Dec. of XMM pointing (J2000.0)
PA_PNT	DOUBLE	Y		Position angle of XMM (CCW from North)
LII_PNT	DOUBLE	Y		Galactic longitude of XMM pointing
BII_PNT	DOUBLE	Y		Galactic latitude of XMM pointing
EXP_START	CHAR*24	Y		Date and time of exposure start (UTC)
EXP_STOP	CHAR*24	Y		Date and time of exposure end (UTC)
EXP_DURATION	REAL			Duration of exposure (sec)
OCB	INTEGER			On-chip binning factor
OBSERVER	CHAR*40	Y		Name of PI
OBJECT	CHAR*40	Y		Name of target object
VVFLAGS	CHAR*8			Validation & verification flags
PROCREVISION	CHAR*8	Y		Processing revision
PROCDATE	CHAR*24	Y		Processing date (UTC)
SASVERSION	CHAR*20	Y		SAS version identifier
PPSVERSION	CHAR*24	Y		PPS configuration version identifier
FORMAT	CHAR*4		Y	File format
NAME	CHAR*31			File name

6.8.5.10 RGSSRC extension

Column name	Format	Fixed	Enum	Description
INSTRUMENT	CHAR*5		Y	Instrument name
DATAMODE	CHAR*7		Y	Instrument mode
OBS_MODE	CHAR*8	Y	Y	XMM observation mode
OBS_ID	CHAR*10	Y		XMM observation ID
OBS_START	CHAR*24	Y		Date and time of observation start (UTC)
OBS_STOP	CHAR*24	Y		Date and time of observation end (UTC)
OBS_DURATION	REAL	Y		Duration of observation (sec)
EXP_ID	INTEGER			Exposure number within observation
OCB	INTEGER			On-chip binning factor
CONTENT	CHAR*40		Y	Description of file content
RA_PNT	DOUBLE	Y		RA of XMM pointing (J2000.0)
DEC_PNT	DOUBLE	Y		Dec. of XMM pointing (J2000.0)
PA_PNT	DOUBLE	Y		Position angle of XMM (CCW from North)
LII_PNT	DOUBLE	Y		Galactic longitude of XMM pointing
BII_PNT	DOUBLE	Y		Galactic latitude of XMM pointing
EXP_START	CHAR*24	Y		Date and time of exposure start (UTC)
EXP_STOP	CHAR*24	Y		Date and time of exposure end (UTC)
EXP_DURATION	REAL			Duration of exposure (sec)
RGSORDER	INTEGER			Dispersion order
SRC_NUM	INTEGER			Source number (from observation source list)
RA_OBJ	DOUBLE			RA of source (2000.0)
DEC_OBJ	DOUBLE			Declination of source (2000.0)
LII_OBJ	DOUBLE			Galactic longitude of source
BII_OBJ	DOUBLE			Galactic latitude of source
EPIC_RATE	REAL			All-EPIC source count rate
EPIC_RATE_ERR	REAL			Error on EPIC source count rate
EPIC_VARSTAT	REAL			All-EPIC source variability statistic
OBSERVER	CHAR*40	Y		Name of PI
OBJECT	CHAR*40	Y		Name of target object
VVFLAGS	CHAR*8			Validation & verification flags
PROCREVISION	CHAR*8	Y		Processing revision
PROCDATE	CHAR*24	Y		Processing date (UTC)
SASVERSION	CHAR*20	Y		SAS version identifier
PPSVERSION	CHAR*24	Y		PPS configuration version identifier
FORMAT	CHAR*4		Y	File format
NAME	CHAR*31			File name

6.8.5.11 CATOBS extension

Column name	Format	Fixed	Enum	Description
OBS_MODE	CHAR*8	Y	Y	XMM observation mode
OBS_ID	CHAR*10	Y		XMM observation ID
OBS_START	CHAR*24	Y		Date and time of observation start (UTC)
OBS_STOP	CHAR*24	Y		Date and time of observation end (UTC)
OBS_DURATION	REAL	Y		Duration of observation (sec)
CONTENT	CHAR*40		Y	Description of file content
RA_PNT	DOUBLE	Y		RA of XMM pointing (J2000.0)
DEC_PNT	DOUBLE	Y		Dec. of XMM pointing (J2000.0)
PA_PNT	DOUBLE	Y		Position angle of XMM (CCW from North)
LII_PNT	DOUBLE	Y		Galactic longitude of XMM pointing
BII_PNT	DOUBLE	Y		Galactic latitude of XMM pointing
OBSERVER	CHAR*40	Y		Name of PI
OBJECT	CHAR*40	Y		Name of target object
VVFLAGS	CHAR*8			Validation & verification flags
PROCREVISION	CHAR*8	Y		Processing revision
PROCDATE	CHAR*24	Y		Processing date (UTC)
SASVERSION	CHAR*20	Y		SAS version identifier
PPSVERSION	CHAR*24	Y		PPS configuration version identifier
FORMAT	CHAR*4		Y	File format
NAME	CHAR*31			File name

6.8.5.12 CATCAT extension

Column name	Format	Fixed	Enum	Description
OBS_MODE	CHAR*8	Y	Y	XMM observation mode
OBS_ID	CHAR*10	Y		XMM observation ID
OBS_START	CHAR*24	Y		Date and time of observation start (UTC)
OBS_STOP	CHAR*24	Y		Date and time of observation end (UTC)
OBS_DURATION	REAL	Y		Duration of observation (sec)
CONTENT	CHAR*40		Y	Description of file content
RA_PNT	DOUBLE	Y		RA of XMM pointing (J2000.0)
DEC_PNT	DOUBLE	Y		Dec. of XMM pointing (J2000.0)
PA_PNT	DOUBLE	Y		Position angle of XMM (CCW from North)
LII_PNT	DOUBLE	Y		Galactic longitude of XMM pointing
BII_PNT	DOUBLE	Y		Galactic latitude of XMM pointing
CATNAME	CHAR*40			Catalogue name
OBSERVER	CHAR*40	Y		Name of PI
OBJECT	CHAR*40	Y		Name of target object
VVFLAGS	CHAR*8			Validation & verification flags
PROCREVISION	CHAR*8	Y		Processing revision
PROCDATE	CHAR*24	Y		Processing date (UTC)
SASVERSION	CHAR*20	Y		SAS version identifier
PPSVERSION	CHAR*24	Y		PPS configuration version identifier
FORMAT	CHAR*4		Y	File format
NAME	CHAR*31			File name

6.8.5.13 CATSRC extension

Column name	Format	Fixed	Enum	Description
OBS_MODE	CHAR*8	Y	Y	XMM observation mode
OBS_ID	CHAR*10	Y		XMM observation ID
OBS_START	CHAR*24	Y		Date and time of observation start (UTC)
OBS_STOP	CHAR*24	Y		Date and time of observation end (UTC)
OBS_DURATION	REAL	Y		Duration of observation (sec)
CONTENT	CHAR*40		Y	Description of file content
RA_PNT	DOUBLE	Y		RA of XMM pointing (J2000.0)
DEC_PNT	DOUBLE	Y		Dec. of XMM pointing (J2000.0)
PA_PNT	DOUBLE	Y		Position angle of XMM (CCW from North)
LII_PNT	DOUBLE	Y		Galactic longitude of XMM pointing
BII_PNT	DOUBLE	Y		Galactic latitude of XMM pointing
PLATE_RA	DOUBLE			Finding chart plate centre RA
PLATE_DEC	DOUBLE			Finding chart plate centre declination
PLATE_FILTER	CHAR*20			Finding chart plate filter
PLATE_ID	CHAR*20			Finding chart plate identifier
PLATE_ORIGIN	CHAR*32			Finding chart plate origin
OBSERVER	CHAR*40	Y		Name of PI
OBJECT	CHAR*40	Y		Name of target object
VVFLAGS	CHAR*8			Validation & verification flags
PROCREVISION	CHAR*8	Y		Processing revision
PROCDATE	CHAR*24	Y		Processing date (UTC)
SASVERSION	CHAR*20	Y		SAS version identifier
PPSVERSION	CHAR*24	Y		PPS configuration version identifier
FORMAT	CHAR*4		Y	File format
NAME	CHAR*31			File name

6.8.5.14 PPSOBS extension

Column name	Format	Fixed	Enum	Description
OBS_MODE	CHAR*8	Y	Y	XMM observation mode
OBS_ID	CHAR*10	Y		XMM observation ID
OBS_START	CHAR*24	Y		Date and time of observation start (UTC)
OBS_STOP	CHAR*24	Y		Date and time of observation end (UTC)
OBS_DURATION	REAL	Y		Duration of observation (sec)
CONTENT	CHAR*40		Y	Description of file content
RA_PNT	DOUBLE	Y		RA of XMM pointing (J2000.0)
DEC_PNT	DOUBLE	Y		Dec. of XMM pointing (J2000.0)
PA_PNT	DOUBLE	Y		Position angle of XMM (CCW from North)
LII_PNT	DOUBLE	Y		Galactic longitude of XMM pointing
BII_PNT	DOUBLE	Y		Galactic latitude of XMM pointing
OBSERVER	CHAR*40	Y		Name of PI
OBJECT	CHAR*40	Y		Name of target object
VVFLAGS	CHAR*8			Validation & verification flags
PROCREVISION	CHAR*8	Y		Processing revision
PROCDATE	CHAR*24	Y		Processing date (UTC)
SASVERSION	CHAR*20	Y		SAS version identifier
PPSVERSION	CHAR*24	Y		PPS configuration version identifier
FORMAT	CHAR*4		Y	File format
NAME	CHAR*31			File name

6.8.5.15 INSTSUMM extension

Column name	Format	Enum	Description
INSTRUMENT	CHAR*5	Y	Instrument name
ACTIVE	LOGICAL		Instrument active flag
NEXPOSURES	INTEGER		Number of exposures in the instrument
PRIORITY	INTEGER		Instrument priority

6.8.5.16 Enumerated data types

Keyword:	INSTRUMENT
Values:	EMOS1, EMOS2, EPN, RGS1, RGS2, OM

Keyword:	OBS_MODE
Values:	POINTED, SLEW

Keyword:	FORMAT
Values:	FITS, HTML, PDF, PNG

Keyword:	DATAMODE
Values:	???

Keyword:	DETECTOR
Values:	PRIME, REDUNDANT

Keyword:	EPIC_FILTER
Values:	CLOSED, THICK, MEDIUM, THIN1, THIN2, OPEN

Keyword:	OM_FILTER
Values:	BLOCKED, UVW2, UVW1, U, B, V, WHITE, MAGNI, GRISM1, GRSIM2, BARRED_U

Keyword:	CONTENT
Values:	OM OSW SKY IMAGE OM OSW IMAGE OM OSW SOURCE TIMESERIES OM TRACKING STAR TIMESERIES OM OSW SOURCE LIST OM OBSERVATION SOURCE LIST OM TRACKING HISTORY PLOT OM FLATFIELD OM HOUSEKEEPING SUMMARY OM OBSERVATION SUMMARY EPIC IMAGE EPIC FITS OBSERVATION IMAGE EPIC PNG OBSERVATION IMAGE EPIC EXPOSURE MAP EPIC EXPOSURE SENSITIVITY MAP EPIC CAMERA SENSITIVITY MAP EPIC SENSITIVITY MAP EPIC THREECOLOUR IMAGE EPIC VARIABLILITY IMAGE EPIC SOURCE TIMESERIES EPIC SOURCE FFT PLOT EPIC GLOBAL BACKGROUND TIMESERIES EPIC SOURCE SPECTRUM EPIC SOURCE BACKGROUND SPECTRUM EPIC SOURCE SPECTRUM EPIC GLOBAL BACKGROUND SPECTRUM EPIC FLUCTUATIONS SPECTRUM EPIC EXPOSURE BOX-LOCAL SOURCE LIST EPIC EXPOSURE BOX-MAP SOURCE LIST EPIC EXPOSURE ML SOURCE LIST EPIC CAMERA BOX-LOCAL SOURCE LIST EPIC CAMERA BOX-MAP SOURCE LIST EPIC CAMERA ML SOURCE LIST EPIC OBSERVATION BOX-LOCAL SOURCE LIST EPIC OBSERVATION BOX-MAP SOURCE LIST EPIC OBSERVATION ML SOURCE LIST EPIC SUMMARY SOURCE LIST EPIC WAVELET SOURCE LIST EPIC WAVELET MAP EPIC INTENSITY HISTOGRAM EPIC MOS IMAGING MODE EVENT LIST EPIC PN IMAGING MODE EVENT LIST

(continued on next page)

(continued from previous page)	
Keyword:	CONTENT
	EPIC TIMING MOMDE EVENT LIST EPIC HOUSEKEEPING SUMMARY EPIC OBSERVATION SUMMARY RGS IMAGE RGS ENERGY-DISPERSION IMAGE RGS EXPOSURE MAP RGS SOURCE SPECTRUM RGS SOURCE BACKGROUND SPECTRUM RGS EVENT LIST RGS SOURCE LIST RGS HOUSEKEEPING SUMMARY RGS OBSERVATION SUMMARY SEARCHED CATALOGUES MAIN CROSS CORRELATION PAGE CATALOGUE DESCRIPTIONS EPIC RAW SOURCE POSITION CROSS-CORRELATION RESULTS EPIC SOURCE CROSS-CORRELATION SUMMARY EPIC SOURCE CROSS-CORRELATION RESULTS FINDING CHART EPIC FOV CROSS-CORRELATION SUMMARY EPIC FOV CROSS-CORRELATION RESULTS EPIC CATALOGUE PLOT XMM-ROSAT IMAGE PPS OBSERVATION SUMMARY ATTITUDE TIME SERIES PPS SCRIPT LOG PPS RUN MESSAGE PPS RUN SUMMARY CALIBRATION INDEX FILE SSC LOGO 1 SSC LOGO 2 CDS LOGO 1 CDS LOGO 2 CDS LOGO 3 XMM LOGO 1 ESA LOGO 1 PPS PRODUCT INDEX

6.8.6 PRODUCT: Calibration Index File

- This file will consist of the calibration index file used in the PPS run to make the products with added primary header keywords.
- The file will be identified using the keyword

```
CONTENT = 'CALIBRATION INDEX FILE'
```

in the primary header.

- This product is of class `PPSOBS`
- This product will be delivered in FITS format, having one bintable extension with extension name `CALINDEX`. The table columns will be

TTYPE	TFORM	TUNIT	DESCRIPTION
TELESCOP	4A		Telescope
SCOPE	6A		Calibration scope
TYPEID	32A		Calibration data type
ISSUE	I		Constituent issue number
VALDATE	19A	yyyy:dd:mmZhh:mm:ss	Start of validity
FNAME	256A		Constituent file path
DATE	19A	yyyy:dd:mmZhh:mm:ss	Creation date
FSIZE	J	byte	Constituent size
SUBDATE	19A	yyyy:dd:mmZhh:mm:ss	Submission date
EXTSEQU	32A		Extension sequence
EXTSEQID	256A		Extension sequence identifiers
MD5	32A		MD5 digital signature
CREATOR	64A		File creator

- There will be one file per PPS run. File size will be 100KB uncompressed.

6.8.7 PRODUCT: SSC logo 1

- This file will contain a schematic image of the XMM telescope front end
- This is a product of class `PPSOBS`
- The product will be delivered in PNG format
- There will be one file per observation. File size will be 3KB.

6.8.8 PRODUCT: SSC logo 2

- This file will contain a graphic with the words 'XMM survey science centre'
- This is a product of class PPSOBS
- The product will be delivered in PNG format
- There will be one file per observation. File size will be 3KB.

6.8.9 PRODUCT: CDS logo 1

- This file will contain a graphic with the word 'NED'
- This is a product of class PPSOBS
- The product will be delivered in PNG format
- There will be one file per observation. File size will be 1KB.

6.8.10 PRODUCT: CDS logo 2

- This file will contain a graphic with the words 'Vizier'
- This is a product of class `PPSOBS`
- The product will be delivered in PNG format
- There will be one file per observation. File size will be 5KB.

6.8.11 PRODUCT: CDS logo 3

- This file will contain a graphic with the words 'Simbad'
- This is a product of class `PPSOBS`
- The product will be delivered in PNG format
- There will be one file per observation. File size will be 6KB.

6.8.12 PRODUCT: XMM logo 1

- This file will contain a graphic of the ESA XMM logo
- This is a product of class `PPSOBS`
- The product will be delivered in PNG format
- There will be one file per observation. File size will be 3KB.

6.8.13 PRODUCT: ESA logo 1

- This file will contain a graphic of the ESA logo with the words 'esa science'
- This is a product of class PPSOBS
- The product will be delivered in PNG format
- There will be one file per observation. File size will be 10KB.

7 XID products

7.1 Introduction

A major role of the SSC is to identify new serendipitously detected X-ray sources. However, in fulfilling this role, the SSC has to take into consideration the likely desires of the guest observers, the accessibility of telescope time and the utility of archival material. With these points in mind, the SSC has started to elaborate an XID plan which is based on observing sufficient numbers of sources such that the class identifications established for these objects can be applied to the unidentified XMM sources. SSC plans for the XID programme will continue to evolve over the next 18-24 months.

The current baseline strategy adopted by the SSC in the XID programme can be summarised as follows:

- at both high and low Galactic latitude: in each of 3 flux bands 1000 objects will be identified (6000 objects in total)
- identification will be made on the basis of 3-colour imaging and spectra of likely X-ray counterparts
- at the faint and medium flux levels, 10 and 100 EPIC fields respectively will need to be fully imaged. At bright fluxes, individual X-ray source field images will be needed, archival material may be sufficient

This is the minimum programme envisaged. A larger sample of sources will be included in the follow-up/ID programme if sufficient telescope time is available.

The products of the XID programme will thus include at minimum

- optical CCD images (covering all or part of selected EPIC fields: FITS format)
- optical spectra of counterparts to individual EPIC sources (FITS format)

XID products from wavelengths other than the optical band may also be made.

The XID programme will take place over $\sim$3 years after the launch of XMM, there being significant uncertainty as to how long such an ambitious programme will take to execute. XID products will become available during and after this time.

7.2 PRODUCT: XID observation summary

- The summary will carry a cross reference or link to the XMM pointing.
- This file will list the filenames of all products (eg images, spectra, time series), under the following headings
  - product serial number
  - field centre
  - target

  - telescope
  - instrument
  - filter
  - central wavelength
  - resolution
  - exposure time
  - seeing
  - sky transparency

- It will be delivered in HTML.
- This is a product of class `XIDOBS`.
- There will be one observation summary per XMM pointing. File size will be 50KB. The total data volume will be 56 Mbyte.

7.3 PRODUCT: XID reduced FITS image

- This will be the reduced images after applying the appropriate flat field, bias and dark frame corrections to the cosmic filtered image.
- They will be identified with the keyword

  ```
  CONTENT = 'XID REDUCED IMAGE'
  ```

  in the primary header
- The primary header keywords will be:

```
SIMPLE   = T                              / file does conform to FITS standard
BITPIX   = -32                            / number of bits per data pixel
NAXIS    = 2                              / number of data axes
NAXIS1   = 2048                           /
NAXIS2   = 2048                           /
EXTEND   = F                              / FITS dataset may contain extensions
CONTENT  = 'XID REDUCED IMAGE'            / content of file
DATE     = '1999-09-23'                   / FITS file creation date (yyyy-mm-dd)
ORIGIN   = 'AIP/SSC'                      / origin of FITS file
TELESCOP = 'Subaru'                       / telescope used for observation
INSTRUME = 'FOS'                          / instrument used for observation
DETNAM   = 'CCD_array_1'                  / detector identification
SUBIMFMT = '2,2'                          / mosaic format
SUBIM_ID = '2,1'                          / subimage identification
FILTER   = 'Johnson_B'                    / filter identification
OBJECT   = 'Cen A'                        / name of target
RA_PNT   = 202.3487324                    / nominal RA of optical telescope pointing
DEC_PNT  = -43.2394871                    / nominal Dec of optical telescope pointing
```

```
ROLL_PNT = 180.0                          / roll-angle of optical telescope (deg CCW from N)
LII_PNT  = 86.5308753                     / Galactic longitude of optical telescope pointing
BII_PNT  = -23.04786                      / Galactic latitude of optical telescope pointing
EQUINOX  = 2000.0                         / equinox of celestial coordinate system
FWHM     = 2.3                            / mean full-width-half-maximum of point sources
PLATELIM = 24.3                           / plate limit for image (magnitudes)
DATAMAX  = 23560.0                        / Maximum data value in primary array
DATAMIN  = 251.0                          / Minimum data value in primary array
EXPOSURE = 250.00                         / total exposure time (secs)
DATE-OBS = '1999-09-21T12:15:08'          / UT Date and time of exposure sequence start
DATE-END = '1999-09-21T12:19:18'          / UT Date and time of exposure sequence end
NSEQ     = '3'                            / number of exposures combined
HISTORY  = 'included file = 19990921_23'  / ref of file used to create image
HISTORY  = 'included file = 19990921_24'  / ref of file used to create image
HISTORY  = 'included file = 19990921_25'  / ref of file used to create image
HISTORY  = 'flatfield = 19990921_0'       / ref of file used for flatfield
HISTORY  = 'bias = 19990921_1'            / ref of file used for bias
HISTORY  = 'dark = 19990921_2'            / ref of file used for dark frame
CTYPE1   = 'RA---TAN'                     / TAN projection used
CRPIX1   = 1024                           / pixel of reference point
CRVAL1   = 202.3487324                    / RA at the reference point
CDELT1   = -0.00013889                    / increment per pixel (degrees)
CUNIT1   = 'deg '                         / physical units of axis 1
CTYPE2   = 'DEC--TAN'                     / TAN projection used
CRPIX2   = 1024                           / pixel of reference point
CRVAL2   = -43.2394871                    / RA at the reference point
CDELT2   = 0.00013889                     / increment per pixel (degrees)
CUNIT2   = 'deg '                         / physical units of axis 1
MJD-OBS  = 51442.5105092                  / Date of the observation
```

- The following keywords may also be present:

```
PC001001 = 1.0                            / Coord. Descrp. Matrix
PC002002 = 1.0                            / Coord. Descrp. Matrix
PC001002 = 0.0                            / Coord. Descrp. Matrix
PC002001 = 0.0                            / Coord. Descrp. Matrix
```

- This is a product of class XIDOBS.
- Each image will be up to 2K x 2K pixels, and will occupy up to 16MB uncompressed. The expected compression ratio is 1.2. The total compressed data volume will be 27GB.

7.4 PRODUCT: XID reduced PNG image

- Those reduced FITS images which are direct imaging of target fields will be rotated to North-aligned sky coordinates, converted to PNG format and annotated. EPIC flux contours or EPIC source error circles will be overlaid.

- This is a product of class `XIDOBS`.
- This is a preview product. These images will give the GO a first look at the XID images and will be used in the HTML summary page.
- There will be one PNG file for each FITS file, occupying up to 100kB. The data volume will be 200 MB.

7.5 PRODUCT: XID fluxed FITS spectrum

- These will be spectra extracted from images, fluxed to CGS units (ergs/cm^2/s/Angstrom) and placed on a wavelength scale (Angstroms).
- They will be identified with the keyword

  ```
  CONTENT = 'XID FLUXED SPECTRUM'
  ```

  in the primary header
- The primary header keywords will be:

```
SIMPLE   = T                          / file does conform to FITS standard
BITPIX   = -32                        / number of bits per data pixel
NAXIS    = 0                          / number of data axes
EXTEND   = T                          / FITS dataset may contain extensions
CONTENT  = 'XID FLUXED SPECTRUM'      / content of file
DATE     = '1999-09-23'               / FITS file creation date (yyyy-mm-dd)
ORIGIN   = 'AIP/SSC'                  / origin of FITS file
TELESCOP = 'Subaru'                   / telescope used for observation
INSTRUME = 'FOS'                      / instrument used for observation
DETNAM   = 'CCD_array_1'              / detector identification
FILTER   = 'OG570'                    / filter identification (used for order sorting)
OBJECT   = 'Cen A GC 232'             / name of target
RA_OBJ   = 202.3487324                / nominal RA of optical telescope pointing
DEC_OBJ  = -43.2394871                / nominal Dec of optical telescope pointing
LII_OBJ  = 86.5308753                 / Galactic longitude of optical telescope pointing
BII_OBJ  = -23.04786                  / Galactic latitude of optical telescope pointing
RA_PNT   = 202.3487324                / nominal RA of optical telescope pointing
DEC_PNT  = -43.2394871                / nominal Dec of optical telescope pointing
ROLL_PNT = 180.0                      / roll-angle of optical telescope (deg CCW from N)
LII_PNT  = 86.5308753                 / Galactic longitude of optical telescope pointing
BII_PNT  = -23.04786                  / Galactic latitude of optical telescope pointing
DATAMAX  = 23560.0                    / Maximum data value in primary array
DATAMIN  = 251.0                      / Minimum data value in primary array
EQUINOX  = 2000.0                     / equinox of celestial coordinate system
RESOLN   = 1.5                        / resolution of spectrum (Angstroms)
EXPOSURE = 250.00                     / total exposure time (secs)
DATE-OBS = '1999-09-21T12:15:08'      / UT Date and time of exposure sequence start
DATE-END = '1999-09-21T12:19:18'      / UT Date and time of exposure sequence end
```

```
NSEQ     = '3'                             / number of exposures combined
HISTORY  = 'included file = 19990921_23'   / ref of file used to create image
HISTORY  = 'included file = 19990921_24'   / ref of file used to create image
HISTORY  = 'included file = 19990921_25'   / ref of file used to create image
HISTORY  = 'flatfield = 19990921_0'        / ref of file used for flatfield
HISTORY  = 'bias = 19990921_1'             / ref of file used for bias
HISTORY  = 'dark = 19990921_2'             / ref of file used for dark frame
HISTORY  = 'mask = 19990921_3'             / ref of mask file to extract spectrum
HISTORY  = 'arc = 19990921_12'             / ref of arc file for wavelength range
HISTORY  = 'flux = 19990921_13'            / ref of flux standard data file
HISTORY  = 'cal = 19990921_cal1'           / ref of instrumental calibration file
```

- The spectrum extension will have the following keywords

```
XTENSION = 'BINTABLE'                      / binary table extension
BITPIX   = 8                               / 8-bit bytes
NAXIS    = 2                               / 2-dimensional binary table
NAXIS1   = 2048                            / Number of rows in spectrum
NAXIS2   = 8                               / Number of bytes per row
PCOUNT   = 0                               / size of special data area
GCOUNT   = 1                               / one data group (required keyword)
TFIELDS  = 2                               / Number of columns
EXTNAME  = 'SPECTRUM'                      / binary table is a spectrum
TFORM1   = E                               / data format of field:  4-byte REAL
TTYPE1   = 'Wavelength'                    / label
TUNIT1   = 'Angstroms'                     / units for wavelength scale
TFORM2   = E                               / data format of field:  4-byte REAL
TTYPE2   = 'Spectrum'                      / label
TUNIT2   = 'ergs/cm^2/sec/Ang'             / units for fluxes
XIDXSOU  = 1                               / X-ray source number it relates to
XIDOSOU  = 328                             / optical source number
XIDOID   = T                               / Is this the counterpart of that X-ray source?
XIDCLASS = 'AGN '                          / Classification of this source
XIDSUBCL = 'Sy1 '                          / Sub-class
REDSHIFT = 0.1                             / Redshift
```

- This is a product of class XIDSRC.
- Each spectrum will be up to 2K pixels, and will occupy up to 32KB uncompressed. The compression ratio is expected to be 1.2. The total compressed data volume will be 20 MB.

7.6 PRODUCT: XID fluxed PDF spectrum

- These will be the FLUXED FITS SPECTRUMs converted to PDF format.
- This is a preview product. These images will give the GO a first look at the XID images and will be used in the HTML summary page.

- This is a product of class `XIDSRC`.
- There will be one file for each FITS file, occupying typically 4kB in size. The total data volume will be 7MB.

7.7 PRODUCT: XID PNG finding chart

- There may be one of these for each X-ray source in each observation. In principle, only those XMM observations in the medium and faint samples will have this products, and perhaps those on the imaging programme. The counterparts of the X-ray sources in the bright sample will mostly be in the cross-correlation finding charts.
- This image will be a section of a reduced XID FITS image rotated to North-aligned sky coordinates, converted to PNG and annotated.
- The FITS image it comes from (9.4) will be stated.
- EPIC source error circles will be overlaid. Optical/IR sources appearing in the magnitude table will be also annotated with their XIDOSOU number. The counterpart (if known) will be also indicated.
- This is a product of class `XIDSRC`.
- This will be a preview product, giving the GO a deeper and higher angular resolution look at the areas around the X-ray sources, compared with the cross-correlation finding charts. It will also give the GO a visual impression of the morphology of the sources whose magnitudes are given in the tables.
- If spectra are available, it will indicate the counterpart, if known. The galaxies belonging to a cluster counterpart will be also annotated.
- To estimate the sizes of these images, I have assumed 2'x2' and 0.25"/pixel. A 480x480 pixels GIF image with 256 colours has a size of 125kb, so 3000 finding charts (all sources in the extragalactic faint and medium samples, plus all sources in the galactic sample) would be about 375 Mb.

7.8 PRODUCT: XID magnitude table

- These will be the magnitudes and colours derived using standard aperture or profile fitting software and applying the colour equations and extinction corrections.
- The each derived magnitude and colour will be listed separately against the observation date, so that there will in general be several entries for each source, corresponding to exposures in different filters or at different times.
- They will be identified with the keyword

  `CONTENT = 'XID MAGNITUDE TABLE'`

  in the primary header

- The primary header keywords will be:

```
SIMPLE  =                    T / file does conform to FITS standard
BITPIX  =                  -32 / number of bits per data pixel
NAXIS   =                    0 / number of data axes
EXTEND  =                    T / FITS dataset may contain extensions
CONTENT = 'XID MAGNITUDE TABLE'    / content of file
DATE    = '1999-09-23'       / FITS file creation date (yyyy-mm-dd)
ORIGIN  = 'AIP/SSC'            / origin of FITS file
RA_PNT  =          202.3487324 / nominal RA of optical telescope pointing
DEC_PNT =          -43.2394871 / nominal Dec of optical telescope pointing
ROLL_PNT=                180.0 / roll-angle of optical telescope
                                 (deg CCW from N)
LII_PNT =           86.5308753 / Galactic longitude of optical
                                 telescope pointing
BII_PNT =            -23.04786 / Galactic latitude of optical
                                 telescope pointing
EQUINOX =               2000.0 / equinox of celestial coordinate system
HISTORY = 'included file = file1' / ref of reduced FITS image used in table
HISTORY = 'included file = file2' / ref of reduced FITS image used in table
:
:
HISTORY = 'included file = filen' / ref of reduced FITS image used in table
HISTORY = 'extinctions file = fileo' / ref of extinctions file
                                       used for table
HISTORY = 'colour table = filep'  / ref of colour equations used for table
HISTORY = 'source search  = fileq' / ref of source search algorithm
                                     used in table
```

- The sourcelist extension will have the following keywords

```
XTENSION= 'TABLE   '           / ASCII table extension
BITPIX  =                    8 / 8-bit ASCII characters
NAXIS   =                    2 / 2-dimensional ASCII table
NAXIS1  =                  185 / width of table in characters
NAXIS2  =                    1 / number of rows in table
PCOUNT  =                    0 / no group parameters (required keyword)
GCOUNT  =                    1 / one data group (required keyword)
TFIELDS =                   21 / number of fields in each row
TTYPE1  = 'UT Date '           / UT date (yyyy-mm-dd)
TBCOL1  =                    1 / beginning column of field   1
TFORM1  = 'A10     '           / Fortran-77 format of field
TTYPE2  = 'UT Time '           / UT time (hh:mm:ss.s)
TBCOL2  =                   12 / beginning column of field   2
TFORM2  = 'A10     '           / Fortran-77 format of field
TTYPE3  = 'RA (2000)'          / RA (2000) (hh:mm:ss.s)
TBCOL3  =                   23 / beginning column of field   3
TFORM3  = 'A10     '           / Fortran-77 format of field
```

```
TTYPE4  = 'Dec (2000)'         / Dec (2000) (+dd:mm:ss.s)
TBCOL4  =                   34 / beginning column of field   4
TFORM4  = 'A11     '           / Fortran-77 format of field
TTYPE5  = 'RA uncertainty'     / RA uncertainty (arcsec)
TBCOL5  =                   46 / beginning column of field   5
TFORM5  = 'A4      '           / Fortran-77 format of field
TTYPE6  = 'Dec uncertainty'    / Dec uncertainty (arcsec)
TBCOL6  =                   51 / beginning column of field   6
TFORM6  = 'A4      '           / Fortran-77 format of field
TTYPE7  = 'Filter  '           / filter
TBCOL7  =                   56 / beginning column of field   7
TFORM7  = 'A10     '           / Fortran-77 format of field
TTYPE8  = 'Magnitude'          / magnitude (+mm.mmm)
TBCOL8  =                   67 / beginning column of field   8
TFORM8  = 'A7      '           / Fortran-77 format of field
TTYPE9  = 'Magnitude uncertainty' / magnitude uncertainty (m.mmm)
TBCOL9  =                   75 / beginning column of field   9
TFORM9  = 'A10     '           / Fortran-77 format of field
TTYPE10 = 'FWHM    '           / full-width-half-maximum of image, arcsec (ss.s)
TBCOL10 =                   86 / beginning column of field  10
TFORM10 = 'A4      '           / Fortran-77 format of field
TTYPE11 = 'Plate limit'        / plate limit, magnitudes (+mm.mm)
TBCOL11 =                   91 / beginning column of field  11
TFORM11 = 'A6      '           / Fortran-77 format of field
TTYPE12 = 'Telescope'          / telescope
TBCOL12 =                   98 / beginning column of field  12
TFORM12 = 'A15     '           / Fortran-77 format of field
TTYPE13 = 'Instrument'         / instrument
TBCOL13 =                  114 / beginning column of field  13
TFORM13 = 'A15     '           / Fortran-77 format of field
TTYPE14 = 'Seeing  '           / Seeing FWHM arcsec (ss.ss)
TBCOL14 =                  130 / beginning column of field  14
TFORM14 = 'A5      '           / Fortran-77 format of field
TTYPE15 = 'Conditions Flag'    / Sky conditions flag
TBCOL15 =                  136 / beginning column of field  15
TFORM15 = 'A10     '           / Fortran-77 format of field
TTYPE16 = 'XIDXSOU '           / X-ray source number it relates to
TBCOL16 =                  147 / beginning column of field  16
TFORM16 = 'A3      '           / Fortran-77 format of field
TTYPE17 = 'XIDOSOU '           / optical source number
TBCOL17 =                  151 / beginning column of field  17
TFORM17 = 'A3      '           / Fortran-77 format of field
TTYPE18 = 'XIDOID  '           / Is this the counterpart of that X-ray source?
TBCOL18 =                  155 / beginning column of field  18
TFORM18 = 'A1      '           / Fortran-77 format of field
TTYPE19 = 'XIDCLASS'           / Classification of this source
TBCOL19 =                  157 / beginning column of field  19
TFORM19 = 'A10     '           / Fortran-77 format of field
```

```
TTYPE20 = 'XIDSUBCL'          / Sub-class
TBCOL20 =                 168 / beginning column of field  20
TFORM20 = 'A10     '          / Fortran-77 format of field
TTYPE21 = 'REDSHIFT'          / Redshift
TBCOL21 =                 179 / beginning column of field  21
TFORM21 = 'A7      '          / Fortran-77 format of field
EXTNAME = 'SOURCELIST'        / table is a source list
```

- This is a product of class XIDOBS.
- Each table will be < 5MB uncompressed. The compression ratio is expected to be 1.2. The total data volume will be 925 MByte.

7.9 PRODUCT: XID HTML MAGNITUDE table

- These will be the magnitudes and colours derived using standard aperture or profile fitting software and applying the colour equations and extinction corrections.
- The each derived magnitude and colour will be listed separately against the observation date, so that there will in general be several entries for each source, corresponding to exposures in different filters or at different times.
- This is a preview product.
- The table headings will be:

UT Date	UT date (yyyy-mm-dd)
UT Time	UT time (hh:mm:ss.s)
RA (2000)	RA (2000) (hh:mm:ss.s)
Dec (2000)	Dec (2000) (+dd:mm:ss.s)
RA uncertainty	RA uncertainty (arcsec)
Dec uncertainty	Dec uncertainty (arcsec)
Filter	filter
Magnitude	magnitude (+mm.mmm)
Magnitude uncertainty	magnitude uncertainty (m.mmm)
FWHM	fill-width-half-maximum of image, arcsec (ss.s)
Plate Limit	plate limit, magnitudes (+mm.mm)
Telescope	telescope
Instrument	instrument
Seeing	Seeing FVWM arcsec (ss.ss)
Conditions Flag	Sky conditions flag

- The appended to the table will be information on the following

Date	the file creation date (yyyy-mm-dd)
RA	the nominal RA of optical telescope pointing
DEC	nominal Dec of optical telescope pointing
EQUINOX	equinox of celestial coordinate system

- This is a product of class XIDOBS.
- Each table will be < 5MB. The total data volume will be 1110 MB.

7.10 PRODUCT: XID HTML index

- XID HTML index files include links, with brief explanations, to every file within the product group in which they sit (see section 9). There are no links to files external to the product group.
- The product will be delivered in HTML format
- There will be one file per product group. For a product group with 49 data products the file size will be 10kB.

8 File names

SSC product file names will include sufficient information to determine at least the following:

- product type
- product version
- file type
- XMM observation identifier

XMM observation identifiers are not applicable to XID products.

The form of the XMM observation/slew identifier has been defined in the ODF ICD [R-1], PPS data products will use at least part of this in making the product filename.

8.1 File name conventions

SSC product filenames will comply with ISO 9660 level 2, and are subject to additional constraints also.

- Filenames will be up to 27 characters, followed by a dot, followed by 3 characters.
- All filename characters are upper case.
- Where a fixed number of digits are specified, leading zeros will be present if the field would not otherwise be filled.
- Allowed characters include only A-Z, 0-9 and the underscore character (_).

8.2 PPS product file names

PPS data product filenames take the 27.3 character form:

POOOOOOOOOODDUEEETTTTTTSXXX.FFF

P	The character `P`, to identify the files as a PPS product file
OOOOOOOOOO	Observation identifier (10 characters = `pppppposll` in [R-1], section 5.3.1.1)
DD	Data source identifier (2 characters)
U	Exposure flag (1 character = S (sched), U (unsched), X (not applicable))
EEE	Exposure number within the instrument observation (3 digits)
TTTTTT	Product type (6 characters)
S	Data subset number (1 character, differentiates energy bands, OSWs, etc.)
XXX	Source number (3 characters, hexadecimal)
FFF	File format (3 characters)

The allowed values of the data source and format fields are shown below, as is the source keyword of the data subset number.

DD Value	Meaning
OM	OM
R1	RGS 1
R2	RGS 2
RG	both RGSs combined
M1	EPIC MOS 1
M2	EPIC MOS 2
PN	EPIC PN
EP	all EPICs combined
CA	Catalogue cross-correlation
OB	Observation
FFF Value	Meaning
PNG	PNG file
FTZ	Gzipped FITS file
HTM	HTML file
IND	Index HTML file
PDF	PDF file
ASZ	Gzipped ASCII file
ASC	ASCII file

The individual product filenames are listed in section 10.1, where the associated DD, TTTTTT and FFF field values are given.

Product class	Source of S value
OMOSW	OSW_ID
OMSRC	OSW_ID
EPICOBS	BAND
EPICEXP	BAND
EPICSRC	BAND
RGSSRC	RGSORDER

8.3 XID product file names

XID product file names take the following form:

X_TTTTTTT_NNNNNNNNNNNN_V.FFF

X	The character X, to identify the files as XID products
TTTTTTT	Product type (7 characters)
NNNNNNNNNNNN	Sequence number (12 digits)
V	File version (1 character)
FFF	File format (3 chars, eg FTZ)

9 Product groups

With one exception, the individual PPS and XID product files are grouped into Unix `tar` product group files before they are sent to the SOC. The exception is the PPS run message product file. The product group names, but not the product group constituents, are defined in [R-4]. The group constituents are specified here.

Groups include all specified files for the entire observation. The two exceptions are the EPIC and XID source-specific groups, which include all files for a specific X-ray source; thus there may be more than one of these groups in an observation product set.

All product group files include at least one file: either the PPS HTML index or the XID HTML index. These files include links to all the other files in their group, so as to allow on-line browsing of the SSC products from the AMS.

9.1 Constituents of the pipeline product group files

The data product files which are included in the pipeline product group files are listed here. The format and the expected number of file instances in the group are also given, in some cases this number is quite uncertain. FITS format files will be individually compressed with GNU `gzip`.

Product group	Constituent files	Format	Typical number
EPIC event list group	EPIC MOS imaging mode event list	FITS	2
	EPIC PN imaging mode event list	FITS	1
	EPIC timing mode event list	FITS	0
	PPS HTML index	HTML	1
EPIC sky image group	EPIC image	FITS	18
	EPIC observation image	FITS	1
	PPS HTML index	HTML	1
EPIC ancillary group	EPIC exposure map	FITS	18
	EPIC sensitivity map	FITS	1
	EPIC exposure sensitivity map	FITS	3
	EPIC camera sensitivity map	FITS	0
	EPIC global background spectrum	FITS	3
	EPIC fluctuations spectrum	FITS	3
	PPS HTML index	HTML	1
EPIC source list group	EPIC exposure box-local source list	FITS	3
	EPIC exposure box-map source list	FITS	3
	EPIC exposure ml source list	FITS	3
	EPIC camera box-local source list	FITS	0
	EPIC camera box-map source list	FITS	0
	EPIC camera ml source list	FITS	0
	EPIC obs box-local source list	FITS	1
	EPIC obs box-map source list	FITS	1
	EPIC obs ml source list	FITS	1
	EPIC FITS summary source list	FITS	1

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Product group	Constituent files	Format	Typical number
	PPS HTML index	HTML	1
EPIC source-specific group	EPIC FITS source timeseries	FITS	2
	EPIC source timeseries	PDF	2
	EPIC source FFT plot	PDF	2
	EPIC FITS source spectrum	FITS	3
	EPIC FITS source bkground spectrum	FITS	3
	EPIC source spectrum plot	PDF	3
	PPS HTML index	HTML	1
OM images	OM OSW FITS image	FITS	32
	OM flatfield image	FITS	1
	PPS HTML index	HTML	1
OM source lists group	OM OSW source list	FITS	32
	OM observation source list	FITS	1
	PPS HTML index	HTML	1
OM timeseries group	OM OSW FITS source timeseries	FITS	16
	OM OSW source timeseries	PDF	16
	OM FITS tracking star timeseries	FITS	16
	PPS HTML index	HTML	1
RGS event list group	RGS event list	FITS	2
	RGS source list	FITS	2
	PPS HTML index	HTML	1
RGS exposure group	RGS exposure map	FITS	2
	PPS HTML index	HTML	1
RGS image group	RGS FITS image	FITS	2
	RGS FITS energy-dispersion image	FITS	2
	PPS HTML index	HTML	1
RGS spectrum group	RGS FITS source spectrum	FITS	4
	RGS FITS source background spectrum	FITS	4
	PPS HTML index	HTML	1
Cross-correlation group	FITS source cross-corr summary	FITS	1
	FITS source cross-corr results	FITS	100
	FITS FOV cross-corr summary	FITS	15
	FITS FOV cross-corr results	FITS	15
	FITS source raw posn cross-corr results	FITS	1
	PPS HTML index	HTML	1
PPS data group	PPS product index	FITS	1
	Calibration index file	FITS	1
	Attitude time series	FITS	1
	PPS script log	ASCII	1
	PPS HTML index	HTML	1
PPS graphics group	EPIC PNG image	PNG	15
	EPIC PNG observation image	PNG	1
	EPIC three-colour image	PNG	3

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Product group	Constituent files	Format	Typical number
	EPIC variability image	PNG	3
	EPIC intensity histogram	PDF	3
	EPIC housekeeping summary	PDF	3
	EPIC global background timeseries	PDF	5
	EPIC HTML summary source list	HTML	1
	EPIC HTML summary page	HTML	1
	EPIC total graphics image	PNG	1
	OM tracking history plot	PNG	16
	OM tracking star timeseries	PDF	32
	OM housekeeping summary	PDF	1
	OM total graphics image	PNG	3
	OM HTML summary page	HTML	1
	RGS image plot	PNG	2
	RGS energy-dispersion image plot	PNG	2
	RGS housekeeping summary	PDF	2
	RGS auxiliary data plot	PDF	2
	RGS HTML summary page	HTML	1
	RGS spectrum plot	PDF	2
	Cross-corr catalogue descriptions	HTML	100
	Main cross-corr page	HTML	1
	Cross-corr searched catalogues	HTML	1
	HTML source cross-corr summary	HTML	1
	HTML source cross-corr results	HTML	1
	HTML FOV cross-corr summary	HTML	15
	HTML FOV cross-corr results	HTML	15
	EPIC catalogue plot	PDF	1
	XMM-rosat image plot	PDF	1
	Finding chart plot	PDF	100
	Observation summary	HTML	1
	SSC logo1	PNG	1
	SSC logo2	PNG	1
	CDS logo1	PNG	1
	CDS logo2	PNG	1
	CDS logo3	PNG	1
	ESA logo1	PNG	1
	XMM logo1	PNG	1
	PPS summary	HTML	1
	PPS HTML index	HTML	1

9.2 Constituents of the XID product group files

The data product files which are included in the XID product group files are listed here. The format and the expected number of file instances in the group are also given, in some cases this number is quite uncertain. FITS format files will be individually compressed with GNU `gzip`.

Product group	Constituent files	Format	Typical number
XID field data group	XID reduced FITS image	FITS	30
	XID magnitude table	FITS	1
	XID HTML index	HTML	1
XID source-specific group	XID finding chart	PNG	1
	XID fluxed spectrum	PDF	2
	XID FITS spectrum	FITS	2
	XID HTML index	HTML	1
XID field graphics group	XID observation summary	HTML	1
	XID reduced PNG image	PNG	30
	XID magnitude table	HTML	1
	XID HTML index	HTML	1

10 Summary SSC product information

10.1 PPS products and their filenames

This section relates PPS product names to the names of the files containing the products by listing the characters that make up fields of the file name (see section 8). Each file is one product and each product is one file.

10.1.1 OM product filenames

Product name	File name field		
	DD	TTTTTT	FFF
OM OSW FITS image	OM	IMAGE_	FTZ
OM OSW FITS sky image	OM	SIMAGE	FTZ
OM OSW FITS source timeseries	OM	TIMESR	FTZ
OM OSW PDF source timeseries	OM	TIMESR	PDF
OM FITS tracking star timeseries	OM	TSTRTS	FTZ
OM PDF tracking star timeseries	OM	TSTRTS	PDF
OM OSW source list	OM	SWSRLI	FTZ
OM observation source list	OM	OBSMLI	FTZ
OM tracking history plot	OM	TSHPLT	PDF
OM flatfield	OM	FLAFLD	FTZ
OM housekeeping summary	OM	HKPLOT	PDF
OM products HTML summary page	OM	SUMMAR	HTM

10.1.2 EPIC product filenames

Product name	File name field		
	DD	TTTTTT	FFF
EPIC FITS image	(note 1)	`IMAGE_`	`FTZ`
EPIC PNG image	(note 1)	`IMAGE_`	`PNG`
EPIC FITS observation image	(note1)	`OIMAGE`	`FTZ`
EPIC PNG observation image	(note1)	`OIMAGE`	`PNG`
EPIC exposure map	(note 1)	`EXPMAP`	`FTZ`
EPIC exposure sensitivity map	(note 1)	`EXSNMP`	`FTZ`
EPIC camera sensitivity map	(note 1)	`CASNMP`	`FTZ`
EPIC sensitivity map	(note 1)	`OBSNMP`	`FTZ`
EPIC three-colour image	(note 1)	`3COLIM`	`PNG`
EPIC variability image	(note 1)	`VARIAB`	`PNG`
EPIC source timeseries	(note 1)	`SRCTSR`	`FTZ`
EPIC source timeseries plot	(note 1)	`STSPLT`	`PDF`
EPIC source FFT plot	(note 1)	`SFFTPL`	`PDF`
EPIC global background timeseries	(note 1)	`GBKTSR`	`PDF`
EPIC source spectrum	(note 1)	`SRSPEC`	`FTZ`
EPIC source background spectrum	(note 1)	`BGSPEC`	`FTZ`
EPIC source spectrum plot	(note 1)	`SPCPLT`	`PDF`
EPIC global background spectrum	(note 1)	`GBSPEC`	`FTZ`
EPIC fluctuations spectrum	(note 1)	`FLSPEC`	`FTZ`
EPIC exposure box-local source list	(note 1)	`EBLSLI`	`FTZ`
EPIC exposure box-map source list	(note 1)	`EBMSLI`	`FTZ`
EPIC exposure ml source list	(note 1)	`EMSRLI`	`FTZ`
EPIC camera box-local source list	(note 1)	`CBLSLI`	`FTZ`
EPIC camera box-map source list	(note 1)	`CBMSLI`	`FTZ`
EPIC camera ml source list	(note 1)	`CMSRLI`	`FTZ`
EPIC observation box-local source list	(note 1)	`OBLSLI`	`FTZ`
EPIC observation box-map source list	(note 1)	`OBMSLI`	`FTZ`
EPIC observation ml source list	(note 1)	`OMSRLI`	`FTZ`
EPIC FITS summary source list	(note 1)	`OBSMLI`	`FTZ`
EPIC HTML summary source list	(note 1)	`OBSMLI`	`HTM`
EPIC wavelet map	(note 1)	`WVSMAP`	`FTZ`
EPIC wavelet source list	(note 1)	`WVSRLI`	`FTZ`
EPIC PDF intensity histogram	(note 1)	`INTHIS`	`PDF`
EPIC MOS IMAGING mode event list	(note 1)	`MIEVLI`	`FTZ`
EPIC PN IMAGING mode event list	(note 1)	`PIEVLI`	`FTZ`
EPIC TIMING mode event list	(note 1)	`TIEVLI`	`FTZ`
EPIC housekeeping summary	(note 1)	`HKPLOT`	`PDF`
EPIC HTML summary page	(note 1)	`SUMMAR`	`HTM`

note 1 DD may take the values `M1`, `M2`, `PN` or `EP` (all EPICs combined).

10.1.3 RGS product filenames

Product name	File name field		
	DD	TTTTTT	FFF
RGS FITS image	(note 2)	IMAGE_	FTZ
RGS PNG image	(note 2)	IMAGE_	PNG
RGS FITS energy-dispersion image	(note 2)	ORDIMG	FTZ
RGS PNG energy-dipersion image	(note 2)	ORDIMG	PNG
RGS exposure map	(note 2)	EXPMAP	FTZ
RGS FITS source spectrum	(note 2)	SRSPEC	FTZ
RGS FITS background spectrum	(note 2)	BGSPEC	FTZ
RGS PDF spectrum	(note 2)	SRCSPEC	PDF
RGS event list	(note 2)	EVENLI	FTZ
RGS source list	(note 2)	SRCLI_	FTZ
RGS housekeeping summary	(note 2)	HKPLOT	PDF
RGS HTML summary page	(note 2)	SUMMAR	HTM

note 2 DD may take the values `R1`, `R2` or `RG` (both RGSs combined).

10.1.4 Catalogue product filenames

Product name	File name field		
	DD	TTTTTT	FFF
Main cross-correlation page	CA	XCORRE	HTM
Searched catalogues	CA	SRCHD_	HTM
Catalogue descriptions	CA	D*xxxxa*	HTM
FITS EPIC source raw position cross-correlation results	CA	R*zzzza*	FTZ
HTML EPIC source cross-correlation summary	CA	SRCSUM	HTM
FITS EPIC source cross-correlation summary	CA	SRCSUM	FTZ
HTML EPIC source cross-correlation results	CA	SRCRES	HTM
FITS EPIC source cross-correlation results	CA	S*xxxxa*	FTZ
Finding chart	CA	FCHART	PDF
HTML EPIC FOV cross-correlation summary	CA	FOVSUM	HTM
FITS EPIC FOV cross-correlation summary	CA	FOVSUM	FTZ
HTML EPIC FOV cross-correlation results	CA	FOVRES	HTM
FITS EPIC FOV cross-correlation results	CA	F*yyyya*	FTZ
EPIC catalogue plot	CA	CATPLT	PDF
XMM-rosat image	CA	ROSIMG	PDF

note 3	*xxxx* will take differing values according to the names of the catalogues searched. There will be ~100 catalogues searched.
note 4	*yyyy* will take differing values according to the names of the catalogues searched. There will be ~15 catalogues searched.
note 5	*zzzz* will take on differing values according to the catalogues searched. There will be ~2 catalogues searched.
note 6	*a* will take the value `T` where results are drawn from a table, and the values `A,B,C` etc. to represent real catalogue numbers.

10.1.5 Observation summary and PPS run product filenames

Product name	File name field		
	DD	TTTTTT	FFF
Observation summary	`OB`	`SUMMAR`	`HTM`
Attitude time series	`OB`	`ATTTSR`	`FTZ`
PPS script log	`OB`	`SCRLOG`	`ASZ`
PPS run message	`OB`	`PPSMSG`	`ASC`
PPS run summary	`OB`	`PPSSUM`	`HTM`
PPS HTML index	`OB`	see below	`IND`
PPS product index	`OB`	`PINDEX`	`FTZ`
Calibration index file	`OB`	`CALIND`	`FTZ`
SSC logo 1	`OB`	`SSCLG1`	`PNG`
SSC logo 2	`OB`	`SSCLG2`	`PNG`
CDS logo 1	`OB`	`CDSLG1`	`PNG`
CDS logo 2	`OB`	`CDSLG2`	`PNG`
CDS logo 3	`OB`	`CDSLG3`	`PNG`
XMM logo 1	`OB`	`XMMLG1`	`PNG`
ESA logo 1	`OB`	`ESALG1`	`PNG`

The TTTTTT field values for the PPS HTML index products are the values of the same field of the product group filename for the product group in which they sit. Group membership is specified in section 9. The product group filenames are defined in [R-4], and are repeated here:

TTTTTT	Product group name
EEVLIS	EPIC event lists group
ESKYIM	EPIC sky images group
EANCIL	EPIC ancillary group
ESRLIS	EPIC source lists group
ESOURC	EPIC source-specific group
OMIMAG	OM images group
OMSLIS	OM source lists group
OMSRTS	OM timeseries group
REVLIS	RGS event lists group
REXPIM	RGS exposure images group
RIMAGE	RGS images group
RSPECT	RGS spectrum group
CRSCOR	Cross-correlation group
PPSDAT	PPS data group
PPSGRA	PPS graphics group

10.2 The size and frequency of PPS products

This section presents estimates or measurements of the number of times that the various product files will occur during a single observation product set. Approximate data volumes are also given, these are estimates for the total volume of each given file type per observation. FITS files and some ASCII files are delivered compressed, so compressed sizes are presented here for these files. Uncompressed files sizes are given in the sections describing the individual products. File size estimates are naturally uncertain.

In estimating the size and frequency of data product files the following assumptions have been made:

1. An observation lasting 15ksec, comprising a science single exposure in EPIC and RGS. (Exposures for the purpose of contemporaneous calibration generate no deliverable PPS products.)
2. Two OSWs per exposure and 16 exposures per observation in the OM.
3. There is a fast mode window in 10% of OM exposures. Time-series are extracted for ten OM sources per fast mode window.
4. Time-series are extracted for the 50% of EPIC sources which are variable.
5. Spectra are extracted for 75% of EPIC sources.
6. An average compression ratio of 3:1 for FITS files (but 1:1 for event lists), and 2:1 for ASCII files. Measured values are given where available.
7. 100 sources per EPIC field-of-view.
8. 1000 sources observed in the OM per exposure.
9. Volume estimate for EPIC TIMING mode event list assumes a single source with a count rate of 100 count/s. For the RGS event list a source of 1 count/s is assumed.

10.2.1 OM product rates and sizes

Product	Frequency (per observation)	Volume per observation (compressed, MB)
OM OSW FITS image	32	20.0
OM OSW FITS sky image	32	6.08
OM OSW FITS source timeseries	16	1.92
OM OSW PDF source timeseries	16	0.69
OM FITS tracking star timeseries	16	5.33
OM PDF tracking star timeseries	16	2.67
OM OSW source list	32	2.22
OM observation source list	1	0.05
OM tracking history plot	16	0.53
OM flatfield	1	1.33
OM housekeeping summary	1	0.03
OM HTML summary page	1	0.00

10.2.2 EPIC product rates and sizes

Product	Frequency (per observation)	Volume per observation (compressed, MB)
EPIC FITS image	18	0.94
EPIC PNG image	18	0.12
EPIC FITS observation image	1	0.05
EPIC PNG observation image	1	0.04
EPIC exposure map	18	5.24
EPIC exposure sensitivity map	3	1.20
EPIC camera sensitivity map	0	0.00
EPIC sensitivity map	1	0.40
EPIC three-colour image	3	0.18
EPIC variability image	3	0.15
EPIC FITS source time-series	150	1.20
EPIC PDF source time-series plot	150	0.50
EPIC source FFT plot	150	2.50
EPIC global background timeseries	3	0.01
EPIC FITS source spectrum	225	1.13
EPIC FITS source background spectrum	225	1.13
EPIC source spectrum plot	225	3.75
EPIC global background spectrum	3	0.16
EPIC fluctuations spectrum	3	0.02
EPIC exposure box-local source list	3	0.07
EPIC exposure box-map source list	3	0.07
EPIC exposure ml source list	3	0.13
EPIC camera box-local source list	0	0.0
EPIC camera box-map source list	0	0.0
EPIC camera ml source list	0	0.0
EPIC observation box-local source list	1	0.02
EPIC observation box-map source list	1	0.02
EPIC observation ml source list	1	0.04
EPIC FITS summary source list	1	0.05
EPIC HTML summary source list	1	2.15
EPIC wavelet map	3	1.00
EPIC wavelet source list	1	0.00
EPIC PDF intensity histogram	3	0.15
EPIC MOS IMAGING mode event list	2	8.00
EPIC PN IMAGING mode event list	1	4.00
EPIC TIMING mode event list	1	20.00
EPIC housekeeping summary	3	0.10
EPIC HTML summary page	1	0.01

10.2.3 RGS product rates and sizes

Product	Frequency (per observation)	Volume per observation (compressed, MB)
RGS FITS image	2	0.32
RGS PNG image	2	0.22
RGS FITS energy-dispersion image	2	0.26
RGS PNG energy-dispersion image	2	0.16
RGS exposure map	2	0.24
RGS FITS source spectrum	4	0.13
RGS FITS background spectrum	4	0.13
RGS PDF spectrum	2	0.60
RGS event list	2	64.0
RGS source list	2	0.02
RGS housekeeping summary	2	0.07
RGS HTML summary page	1	0.00

10.2.4 Catalogue product rates and sizes

Product	Frequency (per observation)	Volume per observation (compressed, MB)
Main cross-correlation page	1	0.00
Searched catalogues	1	0.00
Catalogue descriptions	100	0.00
FITS EPIC source raw position cross-corr results	1	0.33
HTML EPIC source cross-correlation summary	1	0.3
FITS EPIC source cross-correlation summary	1	1.50
HTML EPIC source cross-correlation results	1	0.3
FITS EPIC source cross-correlation results	100	1.50
Finding chart	100	8.10
HTML EPIC FOV cross-correlation summary	15	0.20
FITS EPIC FOV cross-correlation summary	15	0.20
HTML EPIC FOV cross-correlation results	1	0.20
FITS EPIC FOV cross-correlation results	15	0.20
EPIC catalogue plot	1	0.02
XMM-rosat image	1	0.04

10.2.5 Observation summary and PPS run product rates and sizes

Product	Frequency (per observation)	Volume per observation (compressed, MB)
Observation summary	1	0.01
Attitude time series	1	0.25
PPS script log	1	0.14
PPS run message (see note 6)	1	0.00
PPS run summary	1	0.00
PPS HTML index	90	0.90
PPS product index	1	0.33
Calibration index file	1	0.01
SSC logo 1	1	0.00
SSC logo 2	1	0.00
CDS logo 1	1	0.00
CDS logo 2	1	0.00
CDS logo 3	1	0.00
XMM logo 1	1	0.00
ESA logo 1	1	0.01

note 6 This product is not compressed.

10.2.6 Total PPS products data volume

Here finally is an estimate of the total compressed volume of the PPS data products for a single observation. This estimate is naturally uncertain, please note the assumptions of section 10.2.

Product type	Volume per observation (compressed, MB)
OM	40.9
EPIC	54.5
RGS	66.2
Catalogue	12.9
Obs. sum. &PPS run	1.7
TOTAL	174.1

10.3 XID products and their filenames

Product name	File name field		
	DD	TTTTTT	FFF
XID observation summary	XD	SUMMARY	HTM
XID reduced FITS image	XD	RDIMAGE	FTZ
XID reduced PNG image	XD	RDIMAGE	PNG
XID fluxed FITS spectrum	XD	SPECTRM	FTZ
XID fluxed PDF spectrum	XD	SPECTRM	PDF
XID PNG finding chart	XD	FCHART	PNG
XID magnitude table	XD	MGTABLE	FTZ
XID HTML magnitude table	XD	MGTABLE	HTM
XID HTML index	XD	see below	IND

The TTTTTT field values for the XID HTML index products are the values of the same field of the product group filename for the product group in which they sit. Group membership is specified in section 9. The product group filenames are defined in [R-4], and are repeated here:

TTTTTT	Product group name
XIDFLD	XID field data group
XIDSOU	XID source-specific group
XIDGRA	XID field graphics group

10.4 The size of XID products

Product	Total volume (compressed, MB)
XID observation summary	56
XID reduced FITS image	26800
XID reduced PNG image	201
XID fluxed FITS spectrum	20
XID fluxed PDF spectrum	1
XID PNG finding chart	375
XID magnitude table	925
XID HTML magnitude table	925
XID HTML index	??

The sizes in this table are estimates of the total volume of XID data for the entire XID programme.

11 Appendix A

11.1 PPS product creation tasks

This section identifies the PPS task(s) from the list in [R-2] responsible for the creation of each PPS product. Here creation does not necessarily mean initial creation, nor does the table necessarily list the last task to interact with a product. Rather the table lists the tasks that make the major contribution to the products.

The origin of the data which is input to the creating tasks is listed as one of: ODF – only ODF files are used; PPS – intermediate PPS output files are used; data product name – only a deliverable data product is used.

11.1.1 OM product creation tasks

Product	Creation task(s)	Origin of data
OM OSW FITS image	`omsens, omflatflield`	PPS
OM OSW FITS sky image	`omatt`	PPS
OM OSW FITS source timeseries	`omcurve`	PPS
OM OSW PDF source timeseries	`lcplot`	OM OSW FITS source timeseries
OM FITS tracking star timeseries	`omthconv`	ODF
OM PDF tracking star timeseries	`lcplot`	OM FITS tracking star timeseries
OM OSW source list	`omsrclistcomb`	PPS
OM observation source list	`omsrclistcomb`	PPS
OM tracking history plot	`omdrifthist`	ODF
OM flatfield	`omflatgen`	PPS slew archive
OM housekeeping summary	`hkparplot`	PPS
OM products HTML summary page	`omsumm`	PPS

11.1.2 EPIC product creation tasks

Product	Creation task(s)	Origin of data
EPIC FITS image	`evselect`	EPIC event list
EPIC PNG image	`eimplot`	EPIC event list
EPIC FITS observation image	`mosaic`	EPIC FITS images, exposure map
EPIC PNG observation image	`eimplot`	EPIC FITS observation image
EPIC exposure map	`eexpmap`	EPIC event list
EPIC exposure sensitivity map	`esensmap`	Exposure, background & detection maps
EPIC camera sensitivity map	`esensmap`	Exposure, background & detection maps
EPIC sensitivity map	`esensmap`	Exposure, background & detection maps
EPIC three colour image	`e3colimplot`	EPIC event list
EPIC variability image	`evarimplot`	EPIC event list
EPIC source time-series	`expcorr`	PPS
EPIC source time-series plot	`lcplot`	EPIC FITS source time-series
EPIC source FFT plot	`efftplot`	EPIC FITS source time-series
EPIC global background timeseries	`expcorr`	PPS
EPIC FITS source spectrum	`evselect, region`	PPS
EPIC FITS source background spectrum	`evselect, backcorr`	PPS
EPIC source spectrum plot	`especplot`	EPIC FITS source (and background) spectra
EPIC global background spectrum	`evselect`	PPS
EPIC fluctuations spectrum	`arithmetic, evselect`	PPS
EPIC exposure box-local source list	`eboxdetect`	EPIC FITS images
EPIC exposure box-map source list	`eboxdetect`	EPIC FITS images
EPIC exposure ml source list	`emldetect`	EPIC FITS images
EPIC camera box-local source list	`eboxdetect`	EPIC FITS images
EPIC camera box-map source list	`eboxdetect`	EPIC FITS images
EPIC camera ml source list	`emldetect`	EPIC FITS images
EPIC observation box-local source list	`eboxdetect`	EPIC FITS images
EPIC observation box-map source list	`eboxdetect`	EPIC FITS images
EPIC observation ml source list	`emldetect`	EPIC FITS images
EPIC FITS summary source list	`srcmatch`	EPIC ml source lists
EPIC HTML summary source list	`srcmatch`	EPIC summary source list
EPIC PDF intensity histogram	`inthist`	EPIC FITS image
EPIC MOS IMAGING mode event list	`evselect`	ODF
EPIC PN IMAGING mode event list	`evselect`	ODF
EPIC TIMING mode event list	`evselect`	PPS
EPIC housekeeping summary	`hkparplot`	PPS
EPIC HTML summary page	`esumm`	PPS

11.1.3 RGS product creation tasks

Product	Creation task(s)	Origin of data
RGS FITS image	`evselect`	RGS event list
RGS PNG image	`rgsimplot`	RGS FITS image
RGS FITS energy-dispersion image	`evselect`	RGS event list
RGS PNG energy-dispersion image	`rgsimplot`	RGS FITS energy-dispersion image
RGS exposure map	`rgsexpcomb`	RGS event list
RGS FITS source spectrum	`rgsspectrum`	RGS event list
RGS FITS background spectrum	`rgsspectrum`	RGS event list
RGS PDF spectrum plot	`rgsspecplot`	RGS FITS source & background spectra
RGS event list	`evlistcomb`	CCD-specific event lists
RGS source list	`rgssources`	EPIC ML source list
RGS housekeeping summary	`hkparplot`	PPS
RGS HTML summary page	`rgssumm`	PPS

11.1.4 Catalogue product creation tasks

Product	Creation task(s)	Origin of data
Main cross-correlation page	ACDS	catalogue HTML & graphics products
Searched catalogues	ACDS	ACDS catalogues
Catalogue descriptions	ACDS	ACDS catalogues
FITS EPIC source raw position cross-correlation results	ACDS	ACDS catalogues, EPIC summary source list
HTML EPIC source cross-correlation summary	ACDS	equivalent FITS product
FITS EPIC source cross-correlation summary	ACDS	equivalent FITS results product
HTML EPIC source cross-correlation results	ACDS	equivalent FITS product
FITS EPIC source cross-correlation results	ACDS	ACDS catalogues, EPIC summary source list
Finding chart	ACDS	ACDS archival data
HTML EPIC FOV cross-correlation summary	ACDS	equivalent FITS product
FITS EPIC FOV cross-correlation summary	ACDS	equivalent FITS results product
HTML EPIC FOV cross-correlation results	ACDS	equivalent FITS product
FITS EPIC FOV cross-correlation results	ACDS	ACDS catalogues, EPIC summary source list
PNG catalogue plot	ACDS	ACDS catalogues
PNG XMM-rosat image	ACDS	EPIC observation image & ACDS archival data

11.1.5 Observation summary and PPS run product creation tasks

Product	Creation task(s)	Origin of data
Observation summary	obssumm	ODF
Attitude time series	atthkgen	ODF
PPS script log	PPS control s/w	PPS
PPS run message	ppsmsg	PPS
PPS run summary	ppssumm	PPS
PPS HTML index	PCMS	PPS
PPS product index	PCMS	PPS-DB
Calibration index file	cifbuild	CCF
SSC logo 1	–	library file
SSC logo 2	–	library file
CDS logo 1	–	library file
CDS logo 2	–	library file
CDS logo 3	–	library file
XMM logo 1	–	library file
ESA logo 1	–	library file

12 Appendix B

12.1 XID product creation tasks

Product	Creation task(s)	Origin of data
XID observation summary	XID system	XID programme
XID reduced FITS image	XID system	XID programme
XID reduced PNG image	XID system	XID programme
XID fluxed FITS spectrum	XID system	XID programme
XID fluxed PDF spectrum	XID system	XID programme
XID PNG finding chart	XID system	XID programme
XID magnitude table	XID system	XID programme
XID HTML magnitude table	XID system	XID programme
XID HTML index	XID system	XID programme