Contents and structures of event and HK files in the SAX/LEGSPC data analysis system

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			experiment configuration parameter keywords

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1 Introduction

This document describes the contents and structures of various types of

1. event, and
2. Housekeeping (HK)

data files that represent the basic input/output entities of the SAX/LEGSPC data analysis system (SAXLEDAS) [1]. Regarding the format of the files that are read and written by the individual SAXLEDAS modules it has been established to utilize *exclusively* FITS, i.e., there is no other ad-hoc self-defined file format whatsoever. This decision was made, taking account of

- the wide acceptance of the FITS file format [2, 3] in the astronomical community,
- the availability of numerous S/W tools that operate on FITS files (especially the FTOOLS [4] package from NASA/HEASARC), and
- the self-descriptive nature of FITS files.

Although FITS provides a rough framework for storing data in a portable and machine-independent manner, the structural details of the data arrangements have still to be individually defined. In the following this is first done for the so-called raw event and HK files which are created by the *ingestor* module from either Final Observation Tapes (FOTs), or EGSE packet files. Several of the SAXLEDAS modules process the raw files and extend and/or modify their structure, i.e., output *derived* event/HK files that slightly differ from the raw versions. These differences will be described here as well.

The SAXLEDAS FITS files are compliant with the FITS standards as defined by the NASA Office of Standards and Technology [2]. Furthermore, all available standards and recommendations issued by the NASA/OFWG (e.g. [5]) have been carefully considered in order to be compatible with existing and forthcoming S/W tools from NASA/OGIP. This mainly pertains to the choice of FITS header keywords.

Note that in the following, the reader is supposed to be acquainted with the basic notions of FITS, e.g. Bintable, primary header, etc.

2 Basics

2.1 Event files: general contents and structure

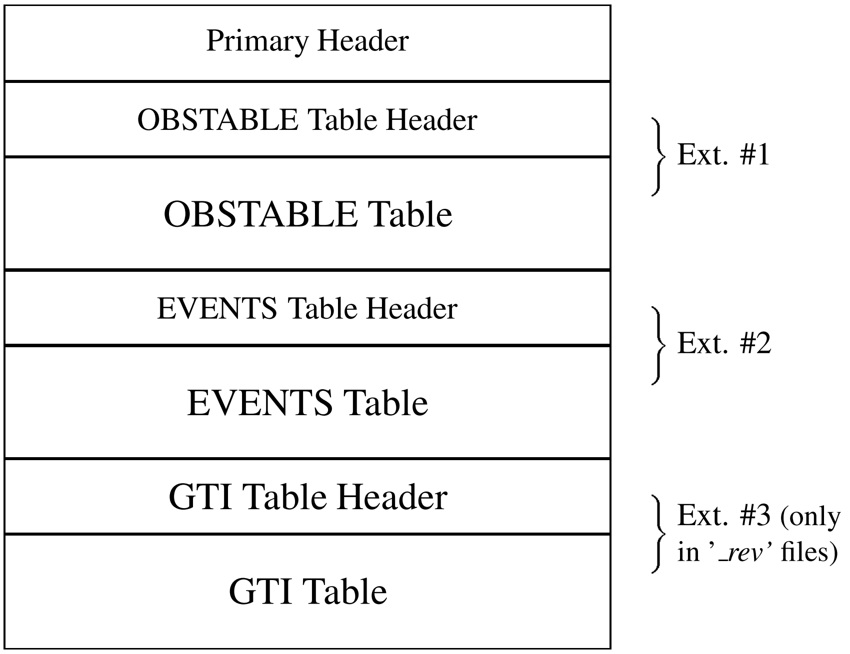
The LEGSPC instrument can be operated in basically three different modes that are *Direct Mode* (DM), *Image Mode*, and *Spectral Mode*. In DM — the only one which is of relevance here — the characteristic data of each individually detected photon are recorded by the EU and, later on, stored into corresponding DM telemetry packet files. The available physical photon data are:

- arrival time with a resolution of $\approx 15.25\,\mu$s
- Pulse Height Amplitude (PHA) in units of detector channels (0–1023)
- X-coordinate in units of detector pixels (0-255)
- Y-coordinate in units of detector pixels (0-255)

- burst length (BL) signal in units of detector channels (0–255)
- VETO signal in units of detector channels (0-255)

Roughly spoken, the PHA is a measure for the photon energy, the BL value determines the penetration depth of the photon in the gas cell, and the VETO signal is a measure for the light distribution seen by the PMT. More precise definitions of those quantities can be found in [**?**].

A FITS event file is now basically a time-ordered list of those data from all photons that have been detected during a certain exposure time. The data are arranged in the form of a FITS Binary Table (FBT), also simply called Bintable, where each row has a fixed column structure and represents a valid photon event. More precisely, an event file in the SAXLEDAS consists of a primary header with an empty primary array followed by a so-called Obstable extension. This extension is likewise a FBT whose structure and semantics is discussed in Sec. 3.2. The actual event table forms the second extension of the FITS file. It's detailed structure is presented in Secs. 3.3 and 5.1 for the *raw* and *linearized* forms respectively. Raw event list files finally possess a Good Time Interval (GTI) table which constitutes the third extension of each corresponding FITS files (Sec. 3.4). The following figure gives a schematic depiction of a SAXLEDAS event file:



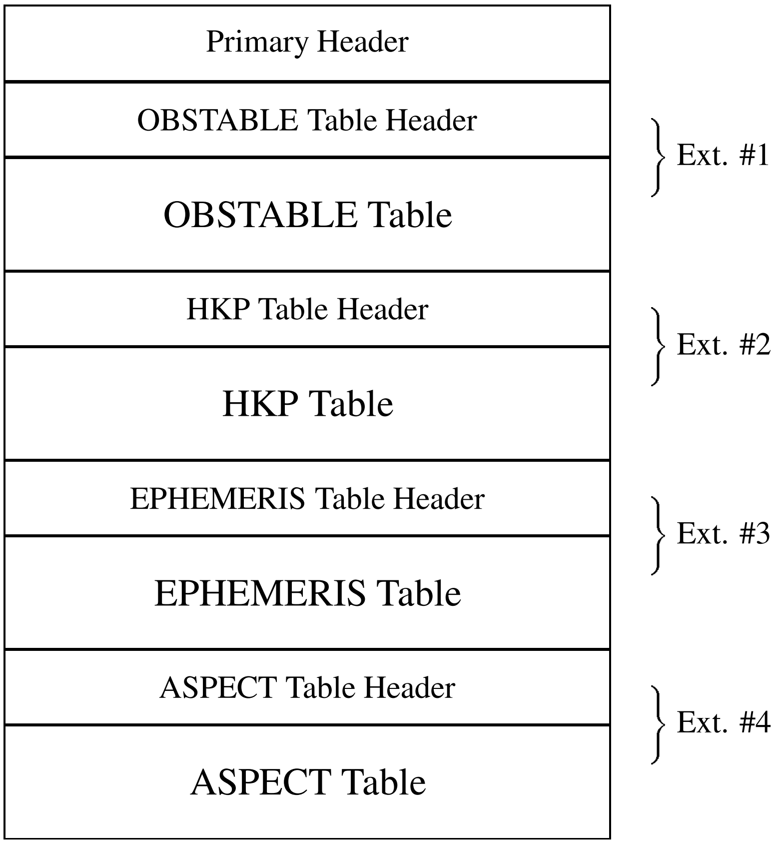
2.2 HK files: general contents and structure

The SAXLEDAS HK files contain all data that are not of actual scientific interest but which provide auxiliary information needed by various modules that operate on event lists. The various categories of HK parameters with relevance for the scientific data analysis are

- time and duration of observation intervals ($\longrightarrow$ OBSTABLE)
- instrumental HK parameter ($\longrightarrow$ HKP)

- spacecraft ephemeris data ($\longrightarrow$ EPHEMERIS)
- spacecraft attitude data ($\longrightarrow$ ASPECT)

Just as in the case of event data, the most natural choice for representing the various HK data sets is the FBT form. Thus, a SAXLEDAS HK file is composed of a primary header with a corresponding empty primary array, followed by a sequence of four FBT extensions. The names of those extensions are given in parenthesis in the enumeration above or can be inferred from the following schematic figure:



2.3 File naming convention

The name of a SAXLEDAS file consists of three parts, the basename, the type-, and the format extension. The basename can be any valid Unix file name, the type extension is a '_' followed by a unique three-letter identification, and the format extension is *always* '*.fits*'. Example:

'*kv183_kv551_rev.fits*'

is the full name of a FITS file '*kv183_kv551*' of type '*_rev*'.

2.4 Types of event and HK files

The so-called *ingestor* is the most basic module of the SAXLEDAS. It can be viewed as a program to create "literal copies" of the data on a FOT or in the EGSE packet files into FITS format. These original FITS files represent the basic input to the analysis chain and are *raw* event and HK files whose structure follow the scheme above. In the course of processing the raw files it proves unavoidable to modify and/or extend their structure which leads to various *types* of event and HK files. The following table provides an overview of the various types of FITS files in the SAXLEDAS whose contents and structures is detailed in this document.

type ext.	name of 2. Bintable ext.	Description	input to module(s)	output from module(s)
_rev	`RAW EVENTS`	Raw EVents file	*evelin*, *calcgain*	*foting*, *egseing*
_lev	`EVENTS`	Linearized EVents file	*evelin*	*evelin*
_rhk	`RAW HKP`	Raw HouseKeeping file	*eng2phys*, *hkplot*	*foting*, *egseing*
_hkp	`HKP`	HouseKeeping file with Physical values	*calcgain*, *hkplot*	*eng2phys*
_hkg	`HKP+GAIN`	HouseKeeping file with Gain related columns	*evelin*, *hkplot*	*calcgain*
_xhk	`PANTER HK`	auXiliary HouseKeeping file	*hkplot*	*pantering*

3 Raw event file

3.1 Primary Header

The primary header is a standard FITS file header that comprises three types of keyword-values pairs. In the first instance, it contains all keywords that are mandatory for a primary header such as `BITPIX` and `NAXIS` [2]. Furthermore, values are defined for several keywords that are designated as *reserved* by the FITS standard, e.g., `INSTRUMEN` and `TELESCOP`. Finally, the third category of keywords provides additional information about the data stored in the FBT extensions following the primary HDU. An example is `N_OBIS` which holds the number of observation intervals (OIs) that have been concatenated in this event file (see Sec. 3.2).
The header comprises various timing related keywords which are repeated in each table header. This block of keywords defines the observation boundaries and the exact reference frame for all time-tagged data stored in the FBT. The keywords are:

keyname	description
TIMESYS	definition of mission reference time = zero point for all time tags; nominal value is '1994 1 1 00:00:00'
TIMEUNIT	the time unit for the keywords TSTART, TSTOP, TELAPSE; nominal value is 's'
TIMEREF	defines the general time reference frame — is either 'LOCAL' or 'SOLARSYSTEM' if times refer to satellite position or the barycenter of the solar system respectively; the nominal value is 'LOCAL'
TASSIGN	defines the location where the time assignment was made — will always be 'SATELLITE'
CLOCKAPP	boolean value specifying whether spacecraft clock drifts have been taken into account — will always be T
MJDREF	the Modified Julian Day (MJD) number corresponding to mission reference time defined in TIMESYS; value is 49353.0
MJD-OBS	the MJD number corresponding to the observation start
TSTART	observation start time in s relative to MJDREF
TSTOP	observation end time in s relative to MJDREF
TELAPSE	the difference TSTOP − TSTART, i.e., the total time in s elapsed during the whole observation; any gaps due earth occultation, SAA passages, etc. are included
SCSEQBEG	the hexadecimal value of the S/C clock [**?**] at the observation start in the format *XXXX.YYYY,* XXXX being the integer s-part
SCSEQEND	the hexadecimal value of the S/C clock [**?**] at the observation end in the same format as SCSEQBEG; note that due to wrap-arounds SCSEQEND can be lower than SCSEQBEG
DATE-OBS	UTC date of observation start
TIME-OBS	UTC time of observation start
DATE-END	UTC date of observation end
TIME-END	UTC time of observation end

The value of the CONTENT keyword in the primary header of event list files is 'EVENT LIST'. A sample primary header is given in Sec. A.1. Each keyword/value has a corresponding comment, thus, the header is self-explanatory.

The SAXLEDAS event files do not contain any primary array data, hence, the NAXIS keyword has always the value 0.

3.2 Observation interval table

The observation interval table (Obstable) forms the first extension in a SAXLEDAS event file and consists of a Bintable header followed by the corresponding FBT. The data stored in an Obstable have the following meaning: Ideally, the observation of a single X-ray target during a certain observation period (OP) results into merely one, possibly quite large DM file on the FOT. However, if the observation conditions alter during the OP, for instance, due to changes in the experiment configuration (SAA passages, earth eclipse, S/C roll manoeuvres, etc.) the OP is split into corresponding observation intervals (OBIs) each of which is marked by a time boundary. In many cases it is desirable to concatenate all OBIs of the actual OP and build up a single large event list from all those data. If this has been done, the Obstable contains the original time boundaries of the individual OBIs. The table has 7 columns with a total row width of 50 bytes.

col. #	col. name	form[1]	unit	description
1	OBI_NUM	I	—	observation interval number
2	OBIB	9A	s	S/C clock at beginning of OBI
3	OBIE	9A	s	S/C clock at end of OBI
4	START_DATE	8A	—	UTC date of OBI start
5	START_TIME	12A	—	UTC time of OBI start
6	STOP_DATE	8A	—	UTC date of OBI end
7	STOP_TIME	12A	—	UTC time of OBI end
		60 byt.		

In case of the *egseing* ingestor, where non-flight EGSE data are converted to FITS, the Obstable consists only of a single row. It represents the arrival times of the first and last photon in the EGSE DM packet files respectively.
A sample Obstable header is given in Sec. A.2. Each keyword/value has a corresponding comment, thus, the header is self-explanatory.

3.3 Event list table

The event list table (ELT) forms the second extension of a SAXLEDAS event file and consists of a Bintable header followed by the corresponding FBT. As already discussed in Sec. 2.1 the ELT contains the actual scientific data where each detected photon is represented by a separate row in the FBT. The table has 6 columns with a resulting row width of 18 bytes:

col. #	col. name	type	unit	description
1	TIME	D	s	the photon arrival time in seconds since MJDREF
2	PHA	I	chan	the Pulse Height Amplitude, i.e., energy channel of the photon
3	RAWX	I	pixel	the unlinearized X-coordinate of the photon in the focal plane
4	RAWY	I	pixel	the unlinearized Y-coordinate of the photon in the focal plane
5	BL	I	chan	the BL value of the photon in detector channels
6	VETO	I	chan	the VETO value of the photon in detector channels
		18 byt.		

In addition to the block of timing keywords discussed in Sec. 3.1, the ELT header contains two new time-related keywords, viz. ONTIME and TIMEDEL. The value of the former specifies the total time in seconds the S/C was actually pointing 'on-source'. The value is identical to the sum of all GTIs defined in the FBT following the ELT (see Sec. 3.4). Corrections for instrumental dead time effects are not included in ONTIME. TIMEDEL is set to the instrumental time resolution $15.25\,\mu$s.

[1] I: 2-byte integer, J: 4-byte integer, E: 4-byte real, D: 8-byte real, L: logical, xA: x-byte character

A sample ELT header is given in Sec. A.3. Each keyword/value has a corresponding comment, thus, the header is self-explanatory.

3.4 Good Time Interval table

In the case of a raw event list file (type '*_rev*') the ELT is followed by a GTI table which forms the third FBT extension. This table consists of one or multiple time intervals defined by a start and stop time respectively. Each photons whose arrival time falls within one of those intervals is considered to be a 'scientifically valid' X-ray event. The sum of all GTI intervals is equals the value of the `ONTIME` keyword in the ELT header. The structure of the GTI table is:

col. #	col. name	type	unit	description
1	`START`	D	s	lower GTI boundary
2	`STOP`	D	s	upper GTI boundary
		16 byt.		

A sample GTI header is given in Sec. A.5. Each keyword/value has a corresponding comment, thus, the header is self-explanatory.

4 Raw Housekeeping parameter file

4.1 Primary Header

The primary header is identical with the one in the event list file (see Sec. 3.1) except for the value of the `CONTENT` keyword which is here `'HK PARAMETER'`.

4.2 Observation interval table

The observation interval table (header+data) is identical with the one in the event list file (see Sec. 3.2).

4.3 HK parameter table

The HK parameter table is the second extension in a SAXLEDAS HK file. It contains the values of various instrument specific quantities in the form of a time ordered list, i.e., a FBT with each row representing a set of instrument HK parameters at a certain time. In total there are 55 parameters many of which are *physical* quantities such as temperatures and voltages. Note that, nevertheless, in the raw HK file all parameters are stored in unscaled digital units as they are read out by the EU. The conversion to physical units is done at a later stage with a specialized SAXLEDAS module *eng2phys* which outputs a derived HK file (see Sec. 6). The following table provides a quick overview of the HK parameter table structure. The description of each parameter is deliberately kept brief — for more details on the meaning of the parameters, see [**?**].

col. #	colum name	type	description
1	TIME	D	time tag in seconds since MJDREF
2	GETT_ENBL_SW	L	getter enable software flag (T if enabled)
3	MEM_MOD_ENBL	L	memory modify software flag (T if enabled)
4	GETT_ENBL	L	getter enable status taken before relay RS04 (T if enabled)
5	SHUT_CLOSE	L	window protection shutter closed position status (T if shutter closed)
6	SHUT_OPEN	L	window protection shutter open position status (T if shutter open)
7	PMT_CURR	L	PMT current flag (T if excessive current on PMT)
8	GU_SAFETY	L	gas cell pressure safety flag (T if pressure exceeded limit)
9	VALVE_SUPPLY	L	GU valve supply after RS05 (T if valve supply enabled)
10	GETT_SUPPLY	L	getter supply status after relay RS04 (T if getter supply enabled)
11	HV_POWER	L	HV power supply status after relay RS03 (T if HV is enabled)
12	HV_ENBL	L	HV enable status after relay RS03 (T if 28V supply is present)
13	FEE_-15V	L	FEE -15V power status after relay RS01 (T if enabled)
14	FEE_+15V	L	FEE +15V power status after relay RS01 (T if enabled)
15	ST_EQ	I	self-test error counter; if set to 15, more than 15 errors occured since last readout
16	S_EQ	I	system error counter; if set to 15, more than 15 errors occured since last readout
17	O_EQ	I	operational error counter; if set to 15, more than 15 error occured since last readout
18	QEP_RATEMETER	I	qualified event pulse counter
19	EVENT_READ_RATEMETER	I	event input buffer counter
20	EVENT_LOST_RATEMETER	I	counter for events that have not been transfered to DE
21	BASETIME	J	basetime of the S/C clock for the actual HK parameter set
22	DEADTIME_RATEMETER	I	count of the dead time accumulated in the AE
23	E_MIN_RATEMETER	I	count of the output of the LLD
24	E_MAX_RATEMETER	I	count of the output of the Ra discriminator

25	POS_RATEMETER	I	count of the output of the Rx and Ry discriminators
26	BL_RATEMETER	I	count of the output of the BL discriminator
27	VETO_RATEMETER	I	count of the output of the Rv discriminator
28	CELL_PRESSURE	I	current pressure in the gas cell
29	RESERVOIR_PRESSURE	I	current pressure in the GU
30	GAS_VALVE1_OPERATION	I	gas valve 1 operation cycle counter
31	GAS_VALVE2_OPERATION	I	gas valve 2 operation cycle counter
32	STANDBY_MODE	L	T if LEGSPC is in STANDBY mode
33	RUNNING_MODE	L	T if LEGSPC is in RUNNING mode
34	NORM_INTERR_HANDLER	L	T if DE normal input interrupt handler is active
35	HT_INTERR_HANDLER	L	T if DE high-throughput interrupt handler is active
36	DIRECT_MODE_PROC	L	T if DE DM event processing task is active
37	SPEC1_MODE_PROC	L	T if DE spectrum mode processing task is active
38	IMAGE1_MODE_PROC	L	T if DE image mode processing task is active
39	ENG_HK_GENERATION	L	T if DE generates engineering HK packets
40	HK_COLLECTION	L	T if DE HK collection task is active
41	MACROCOM_PROC	L	T if DE macroprocessing task is active
42	PROT_TASK	L	T if DE protection task is active
43	RTMS	L	T if real-time monitoring system is active
44	CELL_TEMPERATURE	I	current temperature in the gas cell
45	RESERV_TEMPERATURE	I	current temperature in the GU
46	EU_TEMPERATURE	I	current temperature of the EU
47	CELL_HIGH_VOLTAGE	I	cell HV monitor
48	PMT_HIGH_VOLTAGE	I	PMT HV monitor
49	LOW_VOLTAGE_+5V	I	+5V DC/DC converter voltage monitor
50	LOW_VOLTAGE_+6V	I	+6V DC/DC converter voltage monitor
51	LOW_VOLTAGE_+15V	I	+15V DC/DC converter voltage monitor
52	LOW_VOLTAGE_-15V	I	-15V DC/DC converter voltage monitor
53	LOW_VOLTAGE_+28V	I	+28V DC/DC converter voltage monitor
54	COMMAND_COUNTER	I	DE processed macrocommand counter
55	PMT_CURR_FLAG_COUNTER	I	PMT current flag counter
		93 byt.	

A sample raw HK parameter header is given in Sec. A.6. Each keyword/value has a corresponding comment, thus, the header is self-explanatory.

4.4 Ephemeris table

The ephemeris table (ET) forms the third extension of a SAXLEDAS HK file. Basically it contains the S/C's essential orbit data as a function of time, i.e., the position and velocity of the satellite sampled at a rate of 1/s. The data are arranged in a 17-column FBT with a total width of 86 bytes:

col. #	col. name	type	unit	description
1	`TIME`	D	s	time tag relative to `MJDREF`
2	`SAT_X`	D	km	X-component of the S/C position vector
3	`SAT_Y`	D	km	Y-component of the S/C position vector
4	`SAT_Z`	D	km	Z-component of the S/C position vector
5	`VEL_X`	D	km/s	X-component of the S/C velocity vector
6	`VEL_Y`	D	km/s	Y-component of the S/C velocity vector
7	`VEL_Z`	D	km/s	Z-component of the S/C velocity vector
8	`LEAP_SEC`	I	s	difference between TAI and UTC in s
9	`SAA_FLAG`	L	—	flag indicating whether S/C is within SAA
10	`SAA_TIME`	E	min	depending on `SAA_FLAG` = T/F: minutes elapsed since S/C entered/exited SAA
11	`DAYSIDE_FLAG`	L	—	flag indicating whether S/C is on earth dayside or not
12	`DAYSIDE_TIME`	E	min	depending on `DAYSIDE_FLAG` = T/F: minutes elapsed since S/C entered/exited from earth dayside
13	`FOV_FLAG`	I	—	instrument pointing direction: 0 = sky, 1 = bright earth, 2 = night earth
14	`EARTH_ANG`	E	deg	minimum angle between instrument axis and limb of the earth
15	`BREARTH_ANG`	E	deg	minimum angle between instrument axis and the day/night terminator on earth
16	`SUN_ANG`	E	deg	angle between instrument axis and the direction to the sun
17	`COR_MIN`	E	GeV/c	minimum geomagnetic cut-off rigidity at the S/C's location
		86 byt.		

In the case of ground data stemming from the EGSE the data section of the ET extension is empty, i.e., the number of rows in the FBT is 0.
A sample ET header is given in Sec. A.9. Each keyword/value has a corresponding comment, thus, the header is self-explanatory.

4.5 Aspect table

The aspect table (AT) forms the fourth extension of a SAXLEDAS HK file. It comprises the essential data concerning the S/C's attitude, i.e., pointing direction of the NFIs as a function of time (granularity: 0.5 s). As in the case of the ET the data are arranged as a FBT. Each row consists of 8 columns with a resulting width of 64 bytes:

col. #	col. name	type	unit	description
1	`TIME`	D	s	time tag relative to `MJDREF`
2	`RA_SCX`	D	deg	right ascension of the ACA X axis
3	`DEC_SCX`	D	deg	declination of the ACA X axis
4	`RA_SCY`	D	deg	right ascension of the ACA Y axis
5	`DEC_SCY`	D	deg	declination of the ACA Y axis
6	`RA_SCZ`	D	deg	right ascension of the ACA Z axis
7	`DEC_SCZ`	D	deg	declination of the ACA Z axis
8	`ROLL_ANG`	D	deg	instrumental roll angle
		64 byt.		

In the case of ground data stemming from the EGSE the data section of the AT extension is empty, i.e., the number of rows in the FBT is 0.

A sample AT header is given in Sec. A.10. Each keyword/value has a corresponding comment, thus, the header is self-explanatory.

5 Derived event list files

5.1 Linearized event list file

Linearized event list files (type ext.: "*_lev*") are created by the SAXLEDAS module *evelin* and have the same overall structure as raw event files, i.e., consist of a primary header/empty primary array followed by the Obstable and the actual event extension (see Sec. 2.1). The latter differs from the raw version in the following manner:

1. Five FBT columns have been added:

col. #	col. name	type	unit	description
1–6				same as for raw event extension
7	`PI`	I	chan	the Pulse Invariant of the photon derived from the PHA value by applying temporal and spatial gain corrections (see [1] for more information)
8	`DETX`	E	pixel	linearized X coordinate of the photon in the focal plane (see [1] for more information)
9	`DETY`	E	pixel	linearized Y coordinate of the photon in the focal plane (see [1] for more information)
10	`X`	I	pixel	projected X-position of photon on sky
11	`Y`	I	pixel	projected Y-position of photon on sky
		32 byt.		

2. The standard block of timing keywords (Sec. 3.1) plus `ONTIME` (Sec. 3.3) is completed by three time related keywords:

   `LIVETIME` The total time in seconds pointed 'on-source' corrected for instrumental dead-time effects.

   `EXPOSURE` The total time in seconds on source corrected for any relevant quantities to compute the correct count rate.

   `DEADC` The dead time correction factor in the range $0.0 - 1.0$ which equals the ratio `LIVETIME`/`ONTIME`.

3. Standard World-Coordinate-System (WCS) [7, 8] header keywords have been added. The values of those keywords enable corresponding FITS readers such as *Ximage* or the standard FTOOLS task *xy2sky* to compute from the X and Y sky image coordinates the R.A. and Decl. values of each photon in the ELT.

On top of that various header keywords and history records have been added to the ELT header. The value of those keywords mainly provide details about the possessing steps that have been performed by the *evelin* task [9].
A sample linearized event-file header is given in Sec. A.4. Each keyword/value has a corresponding comment, thus, the header is self-explanatory.

6 Derived HK parameter files

6.1 Physical HK parameter file

Physical HK parameter files (type ext.: "*_hkp*") are generated by the SAXLEDAS module *eng2phys* and have the same overall structure as raw HK files, i.e., consist of a primary header/empty primary array, followed by the Obstable extension, the actual HK-, the ephemeris, and the attitude extension (see Sec. 2.2). The essential difference to the raw version is that several parameters in the HK parameter extension have been scaled from digital to physical units using calibration relations provided in [?]. As a consequence, the type of certain table columns has changed:

col. #	colum name	type	unit
18	QEP_RATEMETER	E	count/s
19	EVENT_READ_RATEMETER	E	count/s
20	EVENT_LOST_RATEMETER	E	count/s
22	DEADTIME_RATEMETER	E	count/s
23	E_MIN_RATEMETER	E	count/s
24	E_MAX_RATEMETER	E	count/s
25	POS_RATEMETER	E	count/s
26	BL_RATEMETER	E	count/s
27	VETO_RATEMETER	E	count/s
28	CELL_PRESSURE	E	mbar
29	RESERVOIR_PRESSURE	E	mbar
30	GAS_VALVE1_OPERATION	E	count/s
31	GAS_VALVE2_OPERATION	E	count/s
44	CELL_TEMPERATURE	E	Celsius
45	RESERV_TEMPERATURE	E	Celsius
46	EU_TEMPERATURE	E	Celsius
47	CELL_HIGH_VOLTAGE	E	V
48	PMT_HIGH_VOLTAGE	E	V
49	LOW_VOLTAGE_+5V	E	V
50	LOW_VOLTAGE_+6V	E	V
51	LOW_VOLTAGE_+15V	E	V
52	LOW_VOLTAGE_-15V	E	V
53	LOW_VOLTAGE_+28V	E	V

A sample physical HK header is given in Sec. A.7. Each keyword/value has a corresponding comment, thus, the header is self-explanatory.

6.2 HK parameter gain file

The HK parameter gain (HKG) file (type ext.: "*_hkg*") is derived from the physical HK file (see last section) i.e., it has the same overall structure and the first 55 columns of the HK parameter extension are identical in the two cases. In a HKG file, however, the FBT possesses additional columns which are related to the computation of the temporal energy gain performed with the SAXLEDAS module *calcgain* [1]. In brevity, the following information is provided:

col. #	col. name	type	unit	description
1–55				same as for HKP extension
56	PHA1	E	chan	centroid of fitted Gaussian for calibration source 1
57	FWHM1	E	chan	FWHM of fitted Gaussian for calibration source 1
58	CHISQ1	E	—	reduced χ^2 value of the Gaussian fit for calibration source 1
59	GAIN1	E	—	energy gain of calibration source 1
60	PHA2	E	chan	centroid of fitted Gaussian for calibration source 2
61	FWHM2	E	chan	FWHM of fitted Gaussian for calibration source 2
62	CHISQ2	E	—	reduced χ^2 value of the Gaussian fit for calibration source 2
63	GAIN2	E	—	energy gain of calibration source 2
64	GAIN12	E	—	ratio GAIN1/GAIN2
65	GAIN_AVG	E	—	average gain of the two calibration sources
66	CHISQAVG	E	—	reduced χ^2 value of GAIN_AVG
67	BCKGND1	E	count/s/cm^2	normalized background countrate in spatial window 1
68	BCKGND2	E	count/s/cm^2	normalized background countrate in spatial window 2
		191 byt.		

For more information on the additional table columns see [1].
A sample HKG file header is given in Sec. A.8. Each keyword/value has a corresponding comment, thus, the header is self-explanatory.

A FITS headers

A.1 Primary header

```
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 = 'EVENT LIST'         / this is an event list file
REVISION=                    1 / revision number of processed data
ORIGIN  = 'ESA/SSD '           / processing site
DATE    = '11/12/95'           / FITS file creation date (DD/MM/YY)
CREATOR = 'foting v1.4.0'      / name of code that generated this file
TELESCOP= 'SAX     '           / mission name
INSTRUME= 'LECS    '           / instrument name
OBS_MODE= 'POINTING'           / observ. mode: POINTING, SLEW, or CALIBRATION
OBJECT  = 'svt1    '           / name of object pointed at
RA_OBJ  =  5.0000000000000E+00 / nominal RA of target (deg)
DEC_OBJ =  6.0000000000000E+00 / nominal DEC of target (deg)
RADECSYS= 'FK5     '           / World Coordinate System
EQUINOX =  2.0000000000000E+03 / equinox
OBS_ID  = '1       '           / observation number in current observing period
OBSERVER= 'Mr. X-ray'          / name of observer or principal investigator
OBS_NO  =                    1 / observer ID sequence number
TAPE_ID = '000038  '           / FOT sequence number
TIMESYS = '1994 1 1 00:00:00'  / all times measured from this reference date
TIMEUNIT= 's       '           / unit for TSTART, TSTOP, TELAPSE, ONTIME
TIMEREF = 'LOCAL   '           / reference frame for reported time values
TASSIGN = 'SATELLITE'          / location of time assignment
CLOCKAPP=                    T / Time corrected for clock drift?
MJDREF  =  4.7161000000000E+04 / mission reference time: 01/01/94 00:00:00 UTC
MJD-OBS =  4.7313884027778E+04 / observation UTC start time (MJD)
TSTART  =   1.320568919745E+07 / data start time relative to MJDREF (s)
TSTOP   =   1.321026224730E+07 / data end time relative to MJDREF (s)
TELAPSE =   4.573049850464E+03 / difference: TSTOP - TSTART (s)
DATE-OBS= '01/06/94'           / UTC date of observation start (DD/MM/YY)
TIME-OBS= '21:13:00.000'       / UTC time of observation start (HH:MM:SS)
DATE-END= '01/06/94'           / UTC date of observation end (DD/MM/YY)
TIME-END= '22:32:00.000'       / UTC time of observation end (HH:MM:SS)
SCSEQBEG= '9999.9999'          / spacecraft clock (s) at observation start
SCSEQEND= '9999.9999'          / spacecraft clock (s) at observation end
N_OBIS  =                    1 / number of observation intervals (OBIs)
COMMENT
COMMENT   Contents of comment field in FOT tape directory:
COMMENT   Data from SVT1 at ESTEC
COMMENT
END
```

A.2 OBSTABLE Binary Table header

```
XTENSION= 'BINTABLE'           / binary table extension
BITPIX  =                    8 / 8-bit bytes
NAXIS   =                    2 / 2-dimensional binary table
NAXIS1  =                   60 / width of table in bytes
NAXIS2  =                    1 / number of rows in table
PCOUNT  =                    0 / size of special data area
GCOUNT  =                    1 / one data group (required keyword)
TFIELDS =                    7 / number of fields in each row
EXTNAME = 'OBSTABLE'           / name of this binary table extension
HDUCLASS= 'SAXLEDAS'           / SAX/LEGSPC DA System (follows OGIP conventions)
HDUDOC  = 'SAX/LEDA/0002'      / format specifications
HDUVERS = '1.1.0   '           / version of format
HDUCLAS1= 'TEMPORALDATA'       / these are temporal data ...
HDUCLAS2= 'OBSTABLE'           / ... forming the Obstable extension
TELESCOP= 'SAX     '           / mission name
INSTRUME= 'LECS    '           / instrument name
OBS_MODE= 'POINTING'           / observ. mode: POINTING, SLEW, or CALIBRATION
OBJECT  = 'svt1    '           / name of object pointed at
RA_OBJ  =  5.0000000000000E+00 / nominal RA of target (deg)
DEC_OBJ =  6.0000000000000E+00 / nominal DEC of target (deg)
RADECSYS= 'FK5     '           / World Coordinate System
EQUINOX =  2.0000000000000E+03 / equinox
OBS_ID  = '1       '           / observation number in current observing period
TIMESYS = '1994 1 1 00:00:00'  / all times measured from this reference date
TIMEUNIT= 's       '           / unit for TSTART, TSTOP, TELAPSE, ONTIME
TIMEREF = 'LOCAL   '           / reference frame for reported time values
TASSIGN = 'SATELLITE'          / location of time assignment
CLOCKAPP=                    T / Time corrected for clock drift?
MJDREF  =  4.7161000000000E+04 / mission reference time: 01/01/94 00:00:00 UTC
MJD-OBS =  4.7313884027778E+04 / observation UTC start time (MJD)
DATE-OBS= '01/06/94'           / UTC date of observation start (DD/MM/YY)
TIME-OBS= '21:13:00.000'       / UTC time of observation start (HH:MM:SS)
DATE-END= '01/06/94'           / UTC date of observation end (DD/MM/YY)
TIME-END= '22:32:00.000'       / UTC time of observation end (HH:MM:SS)
SCSEQBEG= '9999.9999'          / spacecraft clock (s) at observation start
SCSEQEND= '9999.9999'          / spacecraft clock (s) at observation end
TTYPE1  = 'OBI_NUM '           / Observation Interval Number
TFORM1  = 'I       '           / data format of the field: 2-byte INTEGER
TTYPE2  = 'OBIB    '           / start time of the OBI
TFORM2  = '9A      '           / data format of the field: ASCII character
TUNIT2  = 's       '           / SC time of OBI start (hex)
TTYPE3  = 'OBIE    '           / end time of the OBI
TFORM3  = '9A      '           / data format of the field: ASCII character
TUNIT3  = 's       '           / SC time of OBI end (hex)
TTYPE4  = 'START_DATE'         / UT date of OBI start (DD/MM/YY)
TFORM4  = '8A      '           / data format of the field: ASCII character
TTYPE5  = 'START_TIME'         / UT time of OBI start (HH:MM:SS)
TFORM5  = '12A     '           / data format of the field: ASCII character
TTYPE6  = 'STOP_DATE'          / UT date of OBI end (DD/MM/YY)
TFORM6  = '8A      '           / data format of the field: ASCII character
TTYPE7  = 'STOP_TIME'          / UT time of OBI end (HH:MM:SS)
TFORM7  = '12A     '           / data format of the field: ASCII character
END
```

A.3 RAW EVENTS Binary Table header

```
XTENSION= 'BINTABLE'           / binary table extension
BITPIX  =                    8 / 8-bit bytes
NAXIS   =                    2 / 2-dimensional binary table
NAXIS1  =                   18 / width of table in bytes
NAXIS2  =                32045 / number of rows in table
PCOUNT  =                    0 / size of special data area
GCOUNT  =                    1 / one data group (required keyword)
TFIELDS =                    6 / number of fields in each row
EXTNAME = 'RAW EVENTS'         / name of this binary table extension
HDUCLASS= 'SAXLEDAS'           / SAX/LEGSPC DA System (follows OGIP conventions)
HDUDOC  = 'SAX/LEDA/0002'      / format specifications
HDUVERS = '1.1.0   '           / version of format
HDUCLAS1= 'EVENTS  '           / event list data
HDUCLAS2= 'ALL     '           / all events included
HDUCLAS3= 'RAW     '           / raw data - no processing steps performed
TELESCOP= 'SAX     '           / mission name
INSTRUME= 'LECS    '           / instrument name
OBS_MODE= 'POINTING'           / observ. mode: POINTING, SLEW, or CALIBRATION
OBJECT  = 'svt1    '           / name of object pointed at
RA_OBJ  =  5.0000000000000E+00 / nominal RA of target (deg)
DEC_OBJ =  6.0000000000000E+00 / nominal DEC of target (deg)
RADECSYS= 'FK5     '           / World Coordinate System
EQUINOX =  2.0000000000000E+03 / equinox
OBS_ID  = '1       '           / observation number in current observing period
DATAMODE= 'DIRECT  '           / instrument operational mode
SUBMODE =                    1 / submode of DATAMODE
TIMESYS = '1994 1 1 00:00:00'  / all times measured from this reference date
TIMEUNIT= 's       '           / unit for TSTART, TSTOP, TELAPSE, ONTIME
TIMEREF = 'LOCAL   '           / reference frame for reported time values
TASSIGN = 'SATELLITE'          / location of time assignment
CLOCKAPP=                    T / Time corrected for clock drift?
MJDREF  =  4.7161000000000E+04 / mission reference time: 01/01/94 00:00:00 UTC
MJD-OBS =  4.7313884027778E+04 / observation UTC start time (MJD)
TSTART  =  1.3205689197449E+07 / data start time relative to MJDREF (s)
TSTOP   =  1.3210262247299E+07 / data end time relative to MJDREF (s)
TELAPSE =  4.5730498504639E+03 / difference: TSTOP - TSTART (s)
DATE-OBS= '01/06/94'           / UTC date of observation start (DD/MM/YY)
TIME-OBS= '21:13:00.000'       / UTC time of observation start (HH:MM:SS)
DATE-END= '01/06/94'           / UTC date of observation end (DD/MM/YY)
TIME-END= '22:32:00.000'       / UTC time of observation end (HH:MM:SS)
SCSEQBEG= '9999.9999'          / spacecraft clock (s) at observation start
SCSEQEND= '9999.9999'          / spacecraft clock (s) at observation end
ONTIME  =  4.5730498504639E+03 / total on-source time (s)
TIMEDEL =       .0000152500000 / time granularity of data (size of time bin)
INSTRACT=                    F / Is the instrument active?
GUPOW   =                    F / Is the GU powered?
HVPOW   =                    F / Is the HV on?
AEPOW   =                    T / Is the AE powered?
CELLON  =                    F / Is the gas cell on?
PMTON   =                    T / Is the PMT on?
CELLHV  =               -12000 / nominal value of cell HV
PMTHV   =                  800 / nominal value of PMT HV
LED     =                    T / Is LED on?
GETTER  =                    F / Is the getter active?
DIRECT  =                    T / Is the DM task active?
SPEC1   =                    F / Is the SPEC1 task active?
IMAGE1  =                    T / Is the IMAGE1 task active?
SPEC2   =                    F / Is the SPEC2 task active?
IMAGE2  =                    T / Is the IMAGE2 task active?
HANDLER =                    F / BL correction performed?
```

```
DM_CONT = '0x2ff   '           / the DM contents word
PAR_SEL =                    T / parameter selection (T if all present)
THR_SEL =                    T / threshold selection (T if applied) see below
BL_CORR =                    F / BL correction by DM task (T if applied)
T_FLAG  =                    T / event time flag (T if the parameter is present)
BL_FLAG =                    T / event BL flag (T if present)
X_FLAG  =                    T / event X flag (T if present)
Y_FLAG  =                    T / event Y flag (T if present)
V_FLAG  =                    T / event VETO flag (T if present)
FT_FLAG =                    T / event fine time flag (T if present)
BABT_FLA=                    T / event burst amplitude & base time flag
AE_EMIN =                    9 / most frequent AE discriminator value for Emin
AE_EMAX =                  253 / most frequent AE discriminator value for Emax
AE_XMIN =                    0 / most frequent AE discriminator value for Xmin
AE_XMAX =                  253 / most frequent AE discriminator value for Xmax
AE_YMIN =                    0 / most frequent AE discriminator value for Ymin
AE_YMAX =                  253 / most frequent AE discriminator value for Ymax
AE_VMIN =                    0 / most frequent AE discriminator value for Vmin
AE_VMAX =                  253 / most frequent AE discriminator value for Vmax
AE_BLMIN=                    0 / most frequent AE discriminator value for BLmin
AE_BLMAX=                  253 / most frequent AE discriminator value for BLmax
DM_EMIN =                    0 / DM discriminator value for Emin
DM_EMAX =                 1023 / DM discriminator value for Emax
DM_XMIN =                    0 / DM discriminator value for Xmin
DM_XMAX =                  255 / DM discriminator value for Xmax
DM_YMIN =                    0 / DM discriminator value for Ymin
DM_YMAX =                  255 / DM discriminator value for Ymax
DM_VMIN =                    0 / DM discriminator value for Vmin
DM_VMAX =                  255 / DM discriminator value for Vmax
DM_BLMIN=                    0 / DM discriminator value for BLmin
DM_BLMAX=                  255 / DM discriminator value for BLmax
TTYPE1  = 'TIME    '           / event arrival time
TFORM1  = 'D       '           / data format of the field: DOUBLE PRECISION
TUNIT1  = 's       '           / physical unit of field
TTYPE2  = 'PHA     '           / Pulse Height Amplitude
TFORM2  = 'I       '           / data format of the field: 2-byte INTEGER
TUNIT2  = 'chan    '           / physical unit of field
TLMIN2  =                    0 / minimum legal value for parameter 2
TLMAX2  =                 1023 / maximum legal value for parameter 2
TNULL2  =                   -1 / illegal value for column 2
TTYPE3  = 'RAWX    '           / event raw X-coordinate
TFORM3  = 'I       '           / data format of the field: 2-byte INTEGER
TUNIT3  = 'pixel   '           / physical unit of field
TLMIN3  =                    0 / minimum legal value for parameter 3
TLMAX3  =                  255 / maximum legal value for parameter 3
TNULL3  =                   -1 / illegal value for column 3
TTYPE4  = 'RAWY    '           / event raw Y-coordinate
TFORM4  = 'I       '           / data format of the field: 2-byte INTEGER
TUNIT4  = 'pixel   '           / physical unit of field
TLMIN4  =                    0 / minimum legal value for parameter 4
TLMAX4  =                  255 / maximum legal value for parameter 4
TNULL4  =                   -1 / illegal value for column 4
TTYPE5  = 'BL      '           / event burst length
TFORM5  = 'I       '           / data format of the field: 2-byte INTEGER
TUNIT5  = 'chan    '           / physical unit of field
TLMIN5  =                    0 / minimum legal value for parameter 5
TLMAX5  =                  255 / maximum legal value for parameter 5
TNULL5  =                   -1 / illegal value for column 5
TTYPE6  = 'VETO    '           / event VETO signal
TFORM6  = 'I       '           / data format of the field: 2-byte INTEGER
TUNIT6  = 'chan    '           / physical unit of field
TLMIN6  =                    0 / minimum legal value for parameter 6
TLMAX6  =                  255 / maximum legal value for parameter 6
```

```
TNULL6  =                   -1 / illegal value for column 6
END
```

A.4 EVENTS Binary Table header

```
XTENSION= 'BINTABLE'           / binary table extension
BITPIX  =                    8 / 8-bit bytes
NAXIS   =                    2 / 2-dimensional binary table
NAXIS1  =                   32 / width of table in bytes
NAXIS2  =                    1 / number of rows in table
PCOUNT  =                    0 / size of special data area
GCOUNT  =                    1 / one data group (required keyword)
TFIELDS =                   11 / number of fields in each row
EXTNAME = 'EVENTS  '           / name of this binary table extension
HDUCLASS= 'SAXLEDAS'           / SAX/LEGSPC DA System (follows OGIP conventions)
HDUDOC  = 'SAX/LEDA/0002'      / format specifications
HDUVERS = '1.1.0   '           / version of format
HDUCLAS1= 'EVENTS  '           / event list data
HDUCLAS2= 'ALL     '           / all events included
HDUCLAS3= 'LINEARIZED'         / linearized data
TELESCOP= 'SAX     '           / mission name
INSTRUME= 'LECS    '           / instrument name
OBS_MODE= 'POINTING'           / observ. mode: POINTING, SLEW, or CALIBRATION
OBJECT  = 'svt1    '           / name of object pointed at
RA_OBJ  =  5.0000000000000E+00 / nominal RA of target (deg)
DEC_OBJ =  6.0000000000000E+00 / nominal DEC of target (deg)
RADECSYS= 'FK5     '           / World Coordinate System
EQUINOX =  2.0000000000000E+03 / equinox
OBS_ID  = '1       '           / observation number in current observing period
DATAMODE= 'DIRECT  '           / instrument operational mode
SUBMODE =                    1 / submode of DATAMODE
TIMESYS = '1994 1 1 00:00:00'  / all times measured from this reference date
TIMEUNIT= 's       '           / unit for TSTART, TSTOP, TELAPSE, ONTIME
TIMEREF = 'LOCAL   '           / reference frame for reported time values
TASSIGN = 'SATELLITE'          / location of time assignment
CLOCKAPP=                    T / Time corrected for clock drift?
MJDREF  =  4.7161000000000E+04 / mission reference time: 01/01/94 00:00:00 UTC
MJD-OBS =  4.7313884027778E+04 / observation UTC start time (MJD)
TSTART  =  1.3205689197449E+07 / data start time relative to MJDREF (s)
TSTOP   =  1.3210262247299E+07 / data end time relative to MJDREF (s)
TELAPSE =  4.5730498504639E+03 / difference: TSTOP - TSTART (s)
DATE-OBS= '01/06/94'           / UTC date of observation start (DD/MM/YY)
TIME-OBS= '21:13:00.000'       / UTC time of observation start (HH:MM:SS)
DATE-END= '01/06/94'           / UTC date of observation end (DD/MM/YY)
TIME-END= '22:32:00.000'       / UTC time of observation end (HH:MM:SS)
SCSEQBEG= '9999.9999'          / spacecraft clock (s) at observation start
SCSEQEND= '9999.9999'          / spacecraft clock (s) at observation end
ONTIME  =  4.5730498504639E+03 / total on-source time (s)
TIMEDEL =  1.5250000000000E-05 / time granularity of data (size of time bin)
INSTRACT=                    F / Is the instrument active?
GUPOW   =                    F / Is the GU powered?
HVPOW   =                    F / Is the HV on?
AEPOW   =                    T / Is the AE powered?
CELLON  =                    F / Is the gas cell on?
PMTON   =                    T / Is the PMT on?
CELLHV  =               -12000 / nominal value of cell HV
PMTHV   =                  800 / nominal value of PMT HV
LED     =                    T / Is LED on?
GETTER  =                    F / Is the getter active?
DIRECT  =                    T / Is the DM task active?
SPEC1   =                    F / Is the SPEC1 task active?
IMAGE1  =                    T / Is the IMAGE1 task active?
SPEC2   =                    F / Is the SPEC2 task active?
IMAGE2  =                    T / Is the IMAGE2 task active?
HANDLER =                    F / BL correction performed?
```

```
DM_CONT = '0x2ff   '           / the DM contents word
PAR_SEL =                    T / parameter selection (T if all present)
THR_SEL =                    T / threshold selection (T if applied) see below
BL_CORR =                    F / BL correction by DM task (T if applied)
T_FLAG  =                    T / event time flag (T if the parameter is present)
BL_FLAG =                    T / event BL flag (T if present)
X_FLAG  =                    T / event X flag (T if present)
Y_FLAG  =                    T / event Y flag (T if present)
V_FLAG  =                    T / event VETO flag (T if present)
FT_FLAG =                    T / event fine time flag (T if present)
BABT_FLA=                    T / event burst amplitude & base time flag
AE_EMIN =                    9 / most frequent AE discriminator value for Emin
AE_EMAX =                  253 / most frequent AE discriminator value for Emax
AE_XMIN =                    0 / most frequent AE discriminator value for Xmin
AE_XMAX =                  253 / most frequent AE discriminator value for Xmax
AE_YMIN =                    0 / most frequent AE discriminator value for Ymin
AE_YMAX =                  253 / most frequent AE discriminator value for Ymax
AE_VMIN =                    0 / most frequent AE discriminator value for Vmin
AE_VMAX =                  253 / most frequent AE discriminator value for Vmax
AE_BLMIN=                    0 / most frequent AE discriminator value for BLmin
AE_BLMAX=                  253 / most frequent AE discriminator value for BLmax
DM_EMIN =                    0 / DM discriminator value for Emin
DM_EMAX =                 1023 / DM discriminator value for Emax
DM_XMIN =                    0 / DM discriminator value for Xmin
DM_XMAX =                  255 / DM discriminator value for Xmax
DM_YMIN =                    0 / DM discriminator value for Ymin
DM_YMAX =                  255 / DM discriminator value for Ymax
DM_VMIN =                    0 / DM discriminator value for Vmin
DM_VMAX =                  255 / DM discriminator value for Vmax
DM_BLMIN=                    0 / DM discriminator value for BLmin
DM_BLMAX=                  255 / DM discriminator value for BLmax
TTYPE1  = 'TIME    '           / event arrival time
TFORM1  = 'D       '           / data format of the field: DOUBLE PRECISION
TUNIT1  = 's       '           / physical unit of field
TTYPE2  = 'PHA     '           / Pulse Height Amplitude
TFORM2  = 'I       '           / data format of the field: 2-byte INTEGER
TUNIT2  = 'chan    '           / physical unit of field
TLMIN2  =                    0 / minimum legal value for parameter 2
TLMAX2  =                 1023 / maximum legal value for parameter 2
TNULL2  =                   -1 / illegal value for column 2
TTYPE3  = 'RAWX    '           / event raw X-coordinate
TFORM3  = 'I       '           / data format of the field: 2-byte INTEGER
TUNIT3  = 'pixel   '           / physical unit of field
TLMIN3  =                    0 / minimum legal value for parameter 3
TLMAX3  =                  255 / maximum legal value for parameter 3
TNULL3  =                   -1 / illegal value for column 3
TTYPE4  = 'RAWY    '           / event raw Y-coordinate
TFORM4  = 'I       '           / data format of the field: 2-byte INTEGER
TUNIT4  = 'pixel   '           / physical unit of field
TLMIN4  =                    0 / minimum legal value for parameter 4
TLMAX4  =                  255 / maximum legal value for parameter 4
TNULL4  =                   -1 / illegal value for column 4
TTYPE5  = 'BL      '           / event burst length
TFORM5  = 'I       '           / data format of the field: 2-byte INTEGER
TUNIT5  = 'chan    '           / physical unit of field
TLMIN5  =                    0 / minimum legal value for parameter 5
TLMAX5  =                  255 / maximum legal value for parameter 5
TNULL5  =                   -1 / illegal value for column 5
TTYPE6  = 'VETO    '           / event VETO signal
TFORM6  = 'I       '           / data format of the field: 2-byte INTEGER
TUNIT6  = 'chan    '           / physical unit of field
TLMIN6  =                    0 / minimum legal value for parameter 6
TLMAX6  =                  255 / maximum legal value for parameter 6
```

```
TNULL6  =                   -1 / illegal value for column 6
TTYPE7  = 'PI      '           / Pulse Invariant
TFORM7  = 'I       '           / data format of the field: 2-byte INTEGER
TUNIT7  = 'chan    '           / physical unit of field
TLMIN7  =                    0 / minimum legal value for parameter 7
TLMAX7  =                 1023 / maximum legal value for parameter 7
TNULL7  =                   -1 / illegal value for column 7
TTYPE8  = 'DETX    '           / linearized photon X-coordinate
TFORM8  = 'E       '           / data format of the field: REAL
TUNIT8  = 'pixel   '           / physical unit of field
TLMIN8  =       .00000000E+00 / minimum legal value for parameter 8
TLMAX8  =      2.55000000E+02 / maximum legal value for parameter 8
TTYPE9  = 'DETY    '           / linearized photon Y-coordinate
TFORM9  = 'E       '           / data format of the field: REAL
TUNIT9  = 'pixel   '           / physical unit of field
TLMIN9  =       .00000000E+00 / minimum legal value for parameter 9
TLMAX9  =      2.55000000E+02 / maximum legal value for parameter 9
TTYPE10 = 'X       '           / projected X position of photon on sky
TFORM10 = 'I       '           / data format of the field: 2-byte INTEGER
TUNIT10 = 'pixel   '           / physical unit of field
TTYPE11 = 'Y       '           / projected Y position of photon on sky
TFORM11 = 'I       '           / data format of the field: 2-byte INTEGER
TUNIT11 = 'pixel   '           / physical unit of field
CORRMODE=                  127 / coded value for applied corrections
RMEVOFOV=                    T / events outside FOV removed?
TEMPGAIN=                    T / temporal gain correction performed?
SPATGAIN=                    T / spatial gain correction performed?
BLVTSELE=                    T / BL-Veto selection performed?
LINCOORD=                    T / linearized detector coordinates?
DEADTIME=                    T / Dead-time correction performed?
SKYCOORD=                    T / sky coordinates created?
PHTFRAC =       .9000000000000 / fraction of photons retained in PI-BL selection
HISTORY
HISTORY   The following block of parameters refers to the boundaries used in
HISTORY   the performed Veto/PI-BL selection. If there are more than one
HISTORY   block, the last one reflects the current values.
HISTORY
HISTORY      Veto selection interval        : [30, 65]
HISTORY      Number of PI-BL selection boxes: 11
HISTORY      Boxes' coordinates             : #     PI-Int       BL-Int
HISTORY                                       1 [0000, 0022], [134, 211]
HISTORY                                       2 [0023, 0038], [146, 215]
HISTORY                                       3 [0039, 0068], [150, 201]
HISTORY                                       4 [0069, 0113], [152, 197]
HISTORY                                       5 [0114, 0162], [153, 190]
HISTORY                                       6 [0163, 0231], [154, 187]
HISTORY                                       7 [0232, 0346], [153, 182]
HISTORY                                       8 [0347, 0453], [144, 178]
HISTORY                                       9 [0454, 0538], [155, 178]
HISTORY                                      10 [0539, 0657], [154, 177]
HISTORY                                      11 [0658, 1023], [145, 175]
HISTORY
EXPOSURE=   .0000000000000E+00 / fully corrected total on-source time (s)
LIVETIME=   .0000000000000E+00 / dead-time corrected total on-source time (s)
DEADC   =   .0000000000000E+00 / dead-time correction factor = LIVETIME/ONTIME
TCTYP9  = 'RA---TAN'           / coordinate projection: TAN
TCRPX9  =         128.50000000 / sky X axis reference pixel
TCRVL9  =       5.0000000000000 / sky X coordinate at reference pixel (degrees)
TCDLT9  =      -.0048333333333 / sky X pixel scale (degrees/pixel)
TLMIN9  =                    1 / first X pixel in aspected sky image
TLMAX9  =                  256 / last X pixel in aspected sky image
TCTYP10 = 'DEC--TAN'           / coordinate projection: TAN
TCRPX10 =         128.50000000 / sky Y axis reference pixel
```

```
TCRVL10 =      6.0000000000000 / sky Y coordinate at reference pixel (degrees)
TCDLT10 =       .0048333333333 / sky Y pixel scale (degrees/pixel)
TLMIN10 =                    1 / first Y pixel in aspected sky image
TLMAX10 =                  256 / last Y pixel in aspected sky image
RA_PNT  =  5.0000000000000E+00 / average right ascension of S/C Z-axis
SDDRAPNT=   .0000000000000E+00 / standard deviation of RA_PNT
DEC_PNT =  6.0000000000000E+00 / average declination of S/C Z-axis
SDDDCPNT=   .0000000000000E+00 / standard deviation of DEC_PNT
ROLLANG = -6.3420980799720E+01 / average S/C roll angle
SDDROLL =  3.3534910149607E-05 / standard deviation of ROLLANG
END
```

A.5 GTI Binary Table header

```
XTENSION= 'BINTABLE'           / binary table extension
BITPIX  =                    8 / 8-bit bytes
NAXIS   =                    2 / 2-dimensional binary table
NAXIS1  =                   16 / width of table in bytes
NAXIS2  =                    1 / number of rows in table
PCOUNT  =                    0 / size of special data area
GCOUNT  =                    1 / one data group (required keyword)
TFIELDS =                    2 / number of fields in each row
EXTNAME = 'ALLGTI  '           / name of this binary table extension
HDUCLASS= 'SAXLEDAS'           / SAX/LEGSPC DA System (follows OGIP conventions)
HDUDOC  = 'SAX/LEDA/0002'      / format specifications
HDUVERS = '1.1.0   '           / version of format
HDUCLAS1= 'GTI     '           / good time intervals
HDUCLAS2= 'ALL     '           / standard GTI table
TELESCOP= 'SAX     '           / mission name
INSTRUME= 'LECS    '           / instrument name
OBS_MODE= 'POINTING'           / observ. mode: POINTING, SLEW, or CALIBRATION
OBJECT  = 'svt1    '           / name of object pointed at
RA_OBJ  =  5.0000000000000E+00 / nominal RA of target (deg)
DEC_OBJ =  6.0000000000000E+00 / nominal DEC of target (deg)
RADECSYS= 'FK5     '           / World Coordinate System
EQUINOX =  2.0000000000000E+03 / equinox
OBS_ID  = '1       '           / observation number in current observing period
TIMESYS = '1994 1 1 00:00:00'  / all times measured from this reference date
TIMEUNIT= 's       '           / unit for TSTART, TSTOP, TELAPSE, ONTIME
TIMEREF = 'LOCAL   '           / reference frame for reported time values
TASSIGN = 'SATELLITE'          / location of time assignment
CLOCKAPP=                    T / Time corrected for clock drift?
MJDREF  =  4.7161000000000E+04 / mission reference time: 01/01/94 00:00:00 UTC
MJD-OBS =  4.7313884027778E+04 / observation UTC start time (MJD)
TSTART  =  1.3205689197449E+07 / data start time relative to MJDREF (s)
TSTOP   =  1.3210262247299E+07 / data end time relative to MJDREF (s)
TELAPSE =  4.5730498504639E+03 / difference: TSTOP - TSTART (s)
DATE-OBS= '01/06/94'           / UTC date of observation start (DD/MM/YY)
TIME-OBS= '21:13:00.000'       / UTC time of observation start (HH:MM:SS)
DATE-END= '01/06/94'           / UTC date of observation end (DD/MM/YY)
TIME-END= '22:32:00.000'       / UTC time of observation end (HH:MM:SS)
SCSEQBEG= '9999.9999'          / spacecraft clock (s) at observation start
SCSEQEND= '9999.9999'          / spacecraft clock (s) at observation end
ONTIME  =  4.5730498504639E+03 / total on-source time (s)
TTYPE1  = 'START   '           / label for field 1
TFORM1  = 'D       '           / data format of the field: DOUBLE PRECISION
TUNIT1  = 's       '           / physical unit of field
TTYPE2  = 'STOP    '           / label for field 2
TFORM2  = 'D       '           / data format of the field: DOUBLE PRECISION
TUNIT2  = 's       '           / physical unit of field
END
```

A.6 RAW HKP Binary Table header

```
XTENSION= 'BINTABLE'           / binary table extension
BITPIX  =                    8 / 8-bit bytes
NAXIS   =                    2 / 2-dimensional binary table
NAXIS1  =                   93 / width of table in bytes
NAXIS2  =                 2607 / number of rows in table
PCOUNT  =                    0 / size of special data area
GCOUNT  =                    1 / one data group (required keyword)
TFIELDS =                   55 / number of fields in each row
EXTNAME = 'RAW HKP '           / name of this binary table extension
HDUCLASS= 'SAXLEDAS'           / SAX/LEGSPC DA System (follows OGIP conventions)
HDUDOC  = 'SAX/LEDA/0002'      / format specifications
HDUVERS = '1.1.0   '           / version of format
HDUCLAS1= 'TEMPORALDATA'       / non-science quantities versus time
HDUCLAS2= 'HKP     '           / housekeeping parameters
HDUCLAS3= 'FULL    '           / non-compressed
HDUCLAS4= 'ENGINEERING'        / parameters in engineering units
TELESCOP= 'SAX     '           / mission name
INSTRUME= 'LECS    '           / instrument name
OBS_MODE= 'POINTING'           / observ. mode: POINTING, SLEW, or CALIBRATION
OBJECT  = 'svt1    '           / name of object pointed at
RA_OBJ  =  5.0000000000000E+00 / nominal RA of target (deg)
DEC_OBJ =  6.0000000000000E+00 / nominal DEC of target (deg)
RADECSYS= 'FK5     '           / World Coordinate System
EQUINOX =  2.0000000000000E+03 / equinox
OBS_ID  = '1       '           / observation number in current observing period
TIMESYS = '1994 1 1 00:00:00'  / all times measured from this reference date
TIMEUNIT= 's       '           / unit for TSTART, TSTOP, TELAPSE, ONTIME
TIMEREF = 'LOCAL   '           / reference frame for reported time values
TASSIGN = 'SATELLITE'          / location of time assignment
CLOCKAPP=                    T / Time corrected for clock drift?
MJDREF  =  4.7161000000000E+04 / mission reference time: 01/01/94 00:00:00 UTC
MJD-OBS =  4.7313884027778E+04 / observation UTC start time (MJD)
TSTART  =  1.3243140000000E+07 / data start time relative to MJDREF (s)
TSTOP   =  1.3246742000000E+07 / data end time relative to MJDREF (s)
TELAPSE =  3.6020000000000E+03 / difference: TSTOP - TSTART (s)
DATE-OBS= '01/06/94'           / UTC date of observation start (DD/MM/YY)
TIME-OBS= '21:13:00.000'       / UTC time of observation start (HH:MM:SS)
DATE-END= '01/06/94'           / UTC date of observation end (DD/MM/YY)
TIME-END= '22:32:00.000'       / UTC time of observation end (HH:MM:SS)
SCSEQBEG= '9999.9999'          / spacecraft clock (s) at observation start
SCSEQEND= '9999.9999'          / spacecraft clock (s) at observation end
TIMEDEL =     1.0000000000000 / time granularity of data (size of time bin)
SCALFLAG=                    F / HK parameter values scaled to physical units?
TTYPE1  = 'TIME    '           / time tag (since MJDREF)
TFORM1  = 'D       '           / data format of the field: DOUBLE PRECISION
TUNIT1  = 's       '           / physical unit of field
TTYPE2  = 'GETT_ENBL_SW'       / Getter Enable Software flag (T if enabled)
TFORM2  = 'L       '           / data format of the field: LOGICAL
TTYPE3  = 'MEM_MOD_ENBL'       / Memory Modify Software flag (T if enabled)
TFORM3  = 'L       '           / data format of the field: LOGICAL
TTYPE4  = 'GETT_ENBL'          / Getter Enable before RS04 (T if enabled)
TFORM4  = 'L       '           / data format of the field: LOGICAL
TTYPE5  = 'SHUT_CLOSE'         / Shutter Closed Position (T if closed)
TFORM5  = 'L       '           / data format of the field: LOGICAL
TTYPE6  = 'SHUT_OPEN'          / Shutter Open Position (T if open)
TFORM6  = 'L       '           / data format of the field: LOGICAL
TTYPE7  = 'PMT_CURR'           / PMT Current Flag (T if set)
TFORM7  = 'L       '           / data format of the field: LOGICAL
TTYPE8  = 'GU_SAFETY'          / Gas Unity Safety flag (T if set)
TFORM8  = 'L       '           / data format of the field: LOGICAL
```

```
TTYPE9  = 'VALVE_SUPPLY'       / Valve Supply after RS05 (T if enabled)
TFORM9  = 'L      '            / data format of the field: LOGICAL
TTYPE10 = 'GETT_SUPPLY'        / Getter Supply after RS04 (T if enabled)
TFORM10 = 'L      '            / data format of the field: LOGICAL
TTYPE11 = 'HV_POWER'           / HV Power Supply after RS03 (T if enabled)
TFORM11 = 'L      '            / data format of the field: LOGICAL
TTYPE12 = 'HV_ENBL '           / HV Enable status before RS03 (T if enabled)
TFORM12 = 'L      '            / data format of the field: LOGICAL
TTYPE13 = 'FEE_-15V'           / FEE -15V power after RS01 (T if enabled)
TFORM13 = 'L      '            / data format of the field: LOGICAL
TTYPE14 = 'FEE_+15V'           / FEE +15V power after RS01 (T if enabled)
TFORM14 = 'L      '            / data format of the field: LOGICAL
TTYPE15 = 'ST_EQ   '           / Self Test Errors (0xf: > 14 errors occurred)
TFORM15 = 'I      '            / data format of the field: 2-byte INTEGER
TLMIN15 =                    0 / minimum legal value for parameter 15
TLMAX15 =                   15 / maximum legal value for parameter 15
TNULL15 =                   -1 / illegal value for column 15
TTYPE16 = 'S_EQ    '           / System Errors (0xf: > 14 errors occurred)
TFORM16 = 'I      '            / data format of the field: 2-byte INTEGER
TLMIN16 =                    0 / minimum legal value for parameter 16
TLMAX16 =                   15 / maximum legal value for parameter 16
TNULL16 =                   -1 / illegal value for column 16
TTYPE17 = 'O_EQ    '           / Operational Errors (0xf: > 14 errors occurred)
TFORM17 = 'I      '            / data format of the field: 2-byte INTEGER
TLMIN17 =                    0 / minimum legal value for parameter 17
TLMAX17 =                   15 / maximum legal value for parameter 17
TNULL17 =                   -1 / illegal value for column 17
TTYPE18 = 'QEP_RATEMETER'      / Qualified Event Pulse counter
TFORM18 = 'I      '            / data format of the field: 2-byte INTEGER
TLMIN18 =                    0 / minimum legal value for parameter 18
TNULL18 =                   -1 / illegal value for column 18
COMMENT
COMMENT      The QEP Ratemeter counts for all the events with:
COMMENT
COMMENT         Emin < E < Emax
COMMENT         Xmin < X < Xmax
COMMENT         Ymin < Y < Ymax
COMMENT         Vmin < Veto < Vmax
COMMENT         BLmin < BL < BLmax
COMMENT
TTYPE19 = 'EVENT_READ_RATEMETER' / Event Input Buffer counter
TFORM19 = 'I      '            / data format of the field: 2-byte INTEGER
TLMIN19 =                    0 / minimum legal value for parameter 19
TNULL19 =                   -1 / illegal value for column 19
TTYPE20 = 'EVENT_LOST_RATEMETER' / DE not transferred event counter
TFORM20 = 'I      '            / data format of the field: 2-byte INTEGER
TLMIN20 =                    0 / minimum legal value for parameter 20
TNULL20 =                   -1 / illegal value for column 20
TTYPE21 = 'BASETIME'           / BT value at the Essential HK param. sampling
TFORM21 = 'J      '            / data format of the field: 4-byte INTEGER
TLMIN21 =                    0 / minimum legal value for parameter 21
TNULL21 =                   -1 / illegal value for column 21
TTYPE22 = 'DEADTIME_RATEMETER' / Dead Time counter
TFORM22 = 'I      '            / data format of the field: 2-byte INTEGER
TLMIN22 =                    0 / minimum legal value for parameter 22
TNULL22 =                   -1 / illegal value for column 22
TTYPE23 = 'E_MIN_RATEMETER'    / LLD output counter
TFORM23 = 'I      '            / data format of the field: 2-byte INTEGER
TLMIN23 =                    0 / minimum legal value for parameter 23
TNULL23 =                   -1 / illegal value for column 23
TTYPE24 = 'E_MAX_RATEMETER'    / Ra discriminator output counter
TFORM24 = 'I      '            / data format of the field: 2-byte INTEGER
TLMIN24 =                    0 / minimum legal value for parameter 24
```

```
TNULL24 =                   -1 / illegal value for column 24
TTYPE25 = 'POS_RATEMETER'      / Ry & Rx discriminator counter
TFORM25 = 'I       '           / data format of the field: 2-byte INTEGER
TLMIN25 =                    0 / minimum legal value for parameter 25
TNULL25 =                   -1 / illegal value for column 25
TTYPE26 = 'BL_RATEMETER'       / Burst-Length discriminator counter
TFORM26 = 'I       '           / data format of the field: 2-byte INTEGER
TLMIN26 =                    0 / minimum legal value for parameter 26
TNULL26 =                   -1 / illegal value for column 26
TTYPE27 = 'VETO_RATEMETER'     / Rv discriminator counter
TFORM27 = 'I       '           / data format of the field: 2-byte INTEGER
TLMIN27 =                    0 / minimum legal value for parameter 27
TNULL27 =                   -1 / illegal value for column 27
TTYPE28 = 'CELL_PRESSURE'      / Cell pressure monitor
TFORM28 = 'I       '           / data format of the field: 2-byte INTEGER
TLMIN28 =                    0 / minimum legal value for parameter 28
TLMAX28 =                  255 / maximum legal value for parameter 28
TNULL28 =                   -1 / illegal value for column 28
TTYPE29 = 'RESERVOIR_PRESSURE' / Reservoir pressure monitor
TFORM29 = 'I       '           / data format of the field: 2-byte INTEGER
TLMIN29 =                    0 / minimum legal value for parameter 29
TLMAX29 =                  255 / maximum legal value for parameter 29
TNULL29 =                   -1 / illegal value for column 29
TTYPE30 = 'GAS_VALVE1_OPERATION' / gas valve 1 operation cycle counter
TFORM30 = 'I       '           / data format of the field: 2-byte INTEGER
TLMIN30 =                    0 / minimum legal value for parameter 30
TLMAX30 =                  255 / maximum legal value for parameter 30
TNULL30 =                   -1 / illegal value for column 30
TTYPE31 = 'GAS_VALVE2_OPERATION' / gas valve 2 operation cycle counter
TFORM31 = 'I       '           / data format of the field: 2-byte INTEGER
TLMIN31 =                    0 / minimum legal value for parameter 31
TLMAX31 =                  255 / maximum legal value for parameter 31
TNULL31 =                   -1 / illegal value for column 31
TTYPE32 = 'STANDBY_MODE'       / LEGSPC in STANDBY mode
TFORM32 = 'L       '           / data format of the field: LOGICAL
TTYPE33 = 'RUNNING_MODE'       / LEGSPC in RUNNING mode
TFORM33 = 'L       '           / data format of the field: LOGICAL
TTYPE34 = 'NORM_INTERR_HANDLER'  / Normal Input Interrupt (T if active)
TFORM34 = 'L       '           / data format of the field: LOGICAL
TTYPE35 = 'HT_INTERR_HANDLER'  / High Throughput Input Interrupt Handler
TFORM35 = 'L       '           / data format of the field: LOGICAL
TTYPE36 = 'DIRECT_MODE_PROC'   / DIRECT Mode Event Processing (T if active)
TFORM36 = 'L       '           / data format of the field: LOGICAL
TTYPE37 = 'SPEC1_MODE_PROC'    / SPEC1 Mode Processing (T if active)
TFORM37 = 'L       '           / data format of the field: LOGICAL
TTYPE38 = 'IMAGE1_MODE_PROC'   / IMAGE1 Mode Processing (T if active)
TFORM38 = 'L       '           / data format of the field: LOGICAL
TTYPE39 = 'ENG_HK_GENERATION'  / Engineering HK Packet generation (T if active)
TFORM39 = 'L       '           / data format of the field: LOGICAL
TTYPE40 = 'HK_COLLECTION'      / HK Data collection (T if active)
TFORM40 = 'L       '           / data format of the field: LOGICAL
TTYPE41 = 'MACROCOM_PROC'      / Macrocommand Processing (T if active)
TFORM41 = 'L       '           / data format of the field: LOGICAL
TTYPE42 = 'PROT_TASK'          / Protection Task (T if active)
TFORM42 = 'L       '           / data format of the field: LOGICAL
TTYPE43 = 'RTMS    '           / Real Time Monitoring System (T if active)
TFORM43 = 'L       '           / data format of the field: LOGICAL
TTYPE44 = 'CELL_TEMPERATURE'   / Cell Temperature monitor (-55 to 150 C)
TFORM44 = 'I       '           / data format of the field: 2-byte INTEGER
TLMIN44 =                    0 / minimum legal value for parameter 44
TLMAX44 =                  255 / maximum legal value for parameter 44
TNULL44 =                   -1 / illegal value for column 44
COMMENT
```

```
COMMENT       Specific Conversion Table required for parameter 44
COMMENT
TTYPE45 = 'RESERV_TEMPERATURE'  / Reservoir Temperature monitor (-55 to 150 C)
TFORM45 = 'I       '            / data format of the field: 2-byte INTEGER
TLMIN45 =                     0 / minimum legal value for parameter 45
TLMAX45 =                   255 / maximum legal value for parameter 45
TNULL45 =                    -1 / illegal value for column 45
COMMENT
COMMENT       Specific Conversion Table required for parameter 45
COMMENT
TTYPE46 = 'EU_TEMPERATURE'      / EU Temperature monitor (-55 to 150 C)
TFORM46 = 'I       '            / data format of the field: 2-byte INTEGER
TLMIN46 =                     0 / minimum legal value for parameter 46
TLMAX46 =                   255 / maximum legal value for parameter 46
TNULL46 =                    -1 / illegal value for column 46
COMMENT
COMMENT       Specific Conversion Table required for parameter 46
COMMENT
TTYPE47 = 'CELL_HIGH_VOLTAGE'   / Cell HV monitor  (0 - 20 kV)
TFORM47 = 'I       '            / data format of the field: 2-byte INTEGER
TLMIN47 =                     0 / minimum legal value for parameter 47
TLMAX47 =                   255 / maximum legal value for parameter 47
TNULL47 =                    -1 / illegal value for column 47
TTYPE48 = 'PMT_HIGH_VOLTAGE'    / PMT HV monitor (0 - 1.5kV)
TFORM48 = 'I       '            / data format of the field: 2-byte INTEGER
TLMIN48 =                     0 / minimum legal value for parameter 48
TLMAX48 =                   255 / maximum legal value for parameter 48
TNULL48 =                    -1 / illegal value for column 48
TTYPE49 = 'LOW_VOLTAGE_+5V'     / +5V DC/DC Converter Voltage monitor
TFORM49 = 'I       '            / data format of the field: 2-byte INTEGER
TLMIN49 =                     0 / minimum legal value for parameter 49
TLMAX49 =                   255 / maximum legal value for parameter 49
TNULL49 =                    -1 / illegal value for column 49
TTYPE50 = 'LOW_VOLTAGE_+6V'     / +6V DC/DC Converter Voltage monitor
TFORM50 = 'I       '            / data format of the field: 2-byte INTEGER
TLMIN50 =                     0 / minimum legal value for parameter 50
TLMAX50 =                   255 / maximum legal value for parameter 50
TNULL50 =                    -1 / illegal value for column 50
TTYPE51 = 'LOW_VOLTAGE_+15V'    / +15V DC/DC Converter Voltage monitor
TFORM51 = 'I       '            / data format of the field: 2-byte INTEGER
TLMIN51 =                     0 / minimum legal value for parameter 51
TLMAX51 =                   255 / maximum legal value for parameter 51
TNULL51 =                    -1 / illegal value for column 51
TTYPE52 = 'LOW_VOLTAGE_-15V'    / -15V DC/DC Converter Voltage monitor
TFORM52 = 'I       '            / data format of the field: 2-byte INTEGER
TLMIN52 =                     0 / minimum legal value for parameter 52
TLMAX52 =                   255 / maximum legal value for parameter 52
TNULL52 =                    -1 / illegal value for column 52
TTYPE53 = 'LOW_VOLTAGE_+28V'    / +28V DC/DC Converter Voltage monitor
TFORM53 = 'I       '            / data format of the field: 2-byte INTEGER
TLMIN53 =                     0 / minimum legal value for parameter 53
TLMAX53 =                   255 / maximum legal value for parameter 53
TNULL53 =                    -1 / illegal value for column 53
TTYPE54 = 'COMMAND_COUNTER'     / DE processed macrocommand counter
TFORM54 = 'I       '            / data format of the field: 2-byte INTEGER
TLMIN54 =                     0 / minimum legal value for parameter 54
TNULL54 =                    -1 / illegal value for column 54
TTYPE55 = 'PMT_CURR_FLAG_COUNTER'  / PMT CurrentFlag counter
TFORM55 = 'I       '            / data format of the field: 2-byte INTEGER
TLMIN55 =                     0 / minimum legal value for parameter 55
TNULL55 =                    -1 / illegal value for column 55
END
```

A.7 HKP Binary Table header

```
XTENSION= 'BINTABLE'           / binary table extension
BITPIX  =                    8 / 8-bit bytes
NAXIS   =                    2 / 2-dimensional binary table
NAXIS1  =                  139 / width of table in bytes
NAXIS2  =                 2607 / number of rows in table
PCOUNT  =                    0 / size of special data area
GCOUNT  =                    1 / one data group (required keyword)
TFIELDS =                   55 / number of fields in each row
EXTNAME = 'HKP     '           / name of this binary table extension
HDUCLASS= 'SAXLEDAS'           / SAX/LEGSPC DA System (follows OGIP conventions)
HDUDOC  = 'SAX/LEDA/0002'      / format specifications
HDUVERS = '1.1.0   '           / version of format
HDUCLAS1= 'TEMPORALDATA'       / non-science quantities versus time
HDUCLAS2= 'HKP     '           / housekeeping parameters
HDUCLAS3= 'FULL    '           / non-compressed
HDUCLAS4= 'PHYSICAL'           / parameters in physical units
TELESCOP= 'SAX     '           / mission name
INSTRUME= 'LECS    '           / instrument name
OBS_MODE= 'POINTING'           / observ. mode: POINTING, SLEW, or CALIBRATION
OBJECT  = 'svt1    '           / name of object pointed at
RA_OBJ  =  5.0000000000000E+00 / nominal RA of target (deg)
DEC_OBJ =  6.0000000000000E+00 / nominal DEC of target (deg)
RADECSYS= 'FK5     '           / World Coordinate System
EQUINOX =  2.0000000000000E+03 / equinox
OBS_ID  = '1       '           / observation number in current observing period
TIMESYS = '1994 1 1 00:00:00'  / all times measured from this reference date
TIMEUNIT= 's       '           / unit for TSTART, TSTOP, TELAPSE, ONTIME
TIMEREF = 'LOCAL   '           / reference frame for reported time values
TASSIGN = 'SATELLITE'          / location of time assignment
CLOCKAPP=                    T / Time corrected for clock drift?
MJDREF  =  4.7161000000000E+04 / mission reference time: 01/01/94 00:00:00 UTC
MJD-OBS =  4.7313884027778E+04 / observation UTC start time (MJD)
TSTART  =  1.3243140000000E+07 / data start time relative to MJDREF (s)
TSTOP   =  1.3246742000000E+07 / data end time relative to MJDREF (s)
TELAPSE =  3.6020000000000E+03 / difference: TSTOP - TSTART (s)
DATE-OBS= '01/06/94'           / UTC date of observation start (DD/MM/YY)
TIME-OBS= '21:13:00.000'       / UTC time of observation start (HH:MM:SS)
DATE-END= '01/06/94'           / UTC date of observation end (DD/MM/YY)
TIME-END= '22:32:00.000'       / UTC time of observation end (HH:MM:SS)
SCSEQBEG= '9999.9999'          / spacecraft clock (s) at observation start
SCSEQEND= '9999.9999'          / spacecraft clock (s) at observation end
TIMEDEL =  1.0000000000000E+00 / time granularity of data (size of time bin)
SCALFLAG=                    T / HK parameter values scaled to physical units?
TTYPE1  = 'TIME    '           / time tag (since MJDREF)
TFORM1  = 'D       '           / data format of the field: DOUBLE PRECISION
TUNIT1  = 's       '           / physical unit of field
TTYPE2  = 'GETT_ENBL_SW'       / Getter Enable Software flag (T if enabled)
TFORM2  = 'L       '           / data format of the field: LOGICAL
TTYPE3  = 'MEM_MOD_ENBL'       / Memory Modify Software flag (T if enabled)
TFORM3  = 'L       '           / data format of the field: LOGICAL
TTYPE4  = 'GETT_ENBL'          / Getter Enable before RS04 (T if enabled)
TFORM4  = 'L       '           / data format of the field: LOGICAL
TTYPE5  = 'SHUT_CLOSE'         / Shutter Closed Position (T if closed)
TFORM5  = 'L       '           / data format of the field: LOGICAL
TTYPE6  = 'SHUT_OPEN'          / Shutter Open Position (T if open)
TFORM6  = 'L       '           / data format of the field: LOGICAL
TTYPE7  = 'PMT_CURR'           / PMT Current Flag (T if set)
TFORM7  = 'L       '           / data format of the field: LOGICAL
TTYPE8  = 'GU_SAFETY'          / Gas Unity Safety flag (T if set)
TFORM8  = 'L       '           / data format of the field: LOGICAL
```

```
TTYPE9  = 'VALVE_SUPPLY'       / Valve Supply after RS05 (T if enabled)
TFORM9  = 'L       '           / data format of the field: LOGICAL
TTYPE10 = 'GETT_SUPPLY'        / Getter Supply after RS04 (T if enabled)
TFORM10 = 'L       '           / data format of the field: LOGICAL
TTYPE11 = 'HV_POWER'           / HV Power Supply after RS03 (T if enabled)
TFORM11 = 'L       '           / data format of the field: LOGICAL
TTYPE12 = 'HV_ENBL '           / HV Enable status before RS03 (T if enabled)
TFORM12 = 'L       '           / data format of the field: LOGICAL
TTYPE13 = 'FEE_-15V'           / FEE -15V power after RS01 (T if enabled)
TFORM13 = 'L       '           / data format of the field: LOGICAL
TTYPE14 = 'FEE_+15V'           / FEE +15V power after RS01 (T if enabled)
TFORM14 = 'L       '           / data format of the field: LOGICAL
TTYPE15 = 'ST_EQ   '           / Self Test Errors (0xf: > 14 errors occurred)
TFORM15 = 'I       '           / data format of the field: 2-byte INTEGER
TLMIN15 =                    0 / minimum legal value for parameter 15
TLMAX15 =                   15 / maximum legal value for parameter 15
TNULL15 =                   -1 / illegal value for column 15
TTYPE16 = 'S_EQ    '           / System Errors (0xf: > 14 errors occurred)
TFORM16 = 'I       '           / data format of the field: 2-byte INTEGER
TLMIN16 =                    0 / minimum legal value for parameter 16
TLMAX16 =                   15 / maximum legal value for parameter 16
TNULL16 =                   -1 / illegal value for column 16
TTYPE17 = 'O_EQ    '           / Operational Errors (0xf: > 14 errors occurred)
TFORM17 = 'I       '           / data format of the field: 2-byte INTEGER
TLMIN17 =                    0 / minimum legal value for parameter 17
TLMAX17 =                   15 / maximum legal value for parameter 17
TNULL17 =                   -1 / illegal value for column 17
TTYPE18 = 'QEP_RATEMETER'      / Qualified Event Pulse counter
TFORM18 = 'E       '           / data format of the field: REAL
TUNIT18 = 'count/s '           / physical unit of the field
COMMENT
COMMENT       The QEP Ratemeter counts for all the events with:
COMMENT
COMMENT          Emin < E < Emax
COMMENT          Xmin < X < Xmax
COMMENT          Ymin < Y < Ymax
COMMENT          Vmin < Veto < Vmax
COMMENT          BLmin < BL < BLmax
COMMENT
TTYPE19 = 'EVENT_READ_RATEMETER' / Event Input Buffer counter
TFORM19 = 'E       '           / data format of the field: REAL
TUNIT19 = 'count/s '           / physical unit of the field
TTYPE20 = 'EVENT_LOST_RATEMETER' / DE not transferred event counter
TFORM20 = 'E       '           / data format of the field: REAL
TUNIT20 = 'count/s '           / physical unit of the field
TTYPE21 = 'BASETIME'           / BT value at the Essential HK param. sampling
TFORM21 = 'J       '           / data format of the field: 4-byte INTEGER
TLMIN21 =                    0 / minimum legal value for parameter 21
TNULL21 =                   -1 / illegal value for column 21
TTYPE22 = 'DEADTIME_RATEMETER' / Dead Time counter
TFORM22 = 'E       '           / data format of the field: REAL
TUNIT22 = 'count/s '           / physical unit of the field
TTYPE23 = 'E_MIN_RATEMETER'    / LLD output counter
TFORM23 = 'E       '           / data format of the field: REAL
TUNIT23 = 'count/s '           / physical unit of the field
TTYPE24 = 'E_MAX_RATEMETER'    / Ra discriminator output counter
TFORM24 = 'E       '           / data format of the field: REAL
TUNIT24 = 'count/s '           / physical unit of the field
TTYPE25 = 'POS_RATEMETER'      / Ry & Rx discriminator counter
TFORM25 = 'E       '           / data format of the field: REAL
TUNIT25 = 'count/s '           / physical unit of the field
TTYPE26 = 'BL_RATEMETER'       / Burst-Length discriminator counter
TFORM26 = 'E       '           / data format of the field: REAL
```

```
TUNIT26 = 'count/s '            / physical unit of the field
TTYPE27 = 'VETO_RATEMETER'      / Rv discriminator counter
TFORM27 = 'E       '            / data format of the field: REAL
TUNIT27 = 'count/s '            / physical unit of the field
TTYPE28 = 'CELL_PRESSURE'       / Cell pressure monitor
TFORM28 = 'E       '            / data format of the field: REAL
TUNIT28 = 'mbar    '            / physical unit of the field
TTYPE29 = 'RESERVOIR_PRESSURE'  / Reservoir pressure monitor
TFORM29 = 'E       '            / data format of the field: REAL
TUNIT29 = 'mbar    '            / physical unit of the field
TTYPE30 = 'GAS_VALVE1_OPERATION' / gas valve 1 operation cycle counter
TFORM30 = 'E       '            / data format of the field: REAL
TUNIT30 = 'count/s '            / physical unit of the field
TTYPE31 = 'GAS_VALVE2_OPERATION' / gas valve 2 operation cycle counter
TFORM31 = 'E       '            / data format of the field: REAL
TUNIT31 = 'count/s '            / physical unit of the field
TTYPE32 = 'STANDBY_MODE'        / LEGSPC in STANDBY mode
TFORM32 = 'L       '            / data format of the field: LOGICAL
TTYPE33 = 'RUNNING_MODE'        / LEGSPC in RUNNING mode
TFORM33 = 'L       '            / data format of the field: LOGICAL
TTYPE34 = 'NORM_INTERR_HANDLER'  / Normal Input Interrupt (T if active)
TFORM34 = 'L       '            / data format of the field: LOGICAL
TTYPE35 = 'HT_INTERR_HANDLER'   / High Throughput Input Interrupt Handler
TFORM35 = 'L       '            / data format of the field: LOGICAL
TTYPE36 = 'DIRECT_MODE_PROC'    / DIRECT Mode Event Processing (T if active)
TFORM36 = 'L       '            / data format of the field: LOGICAL
TTYPE37 = 'SPEC1_MODE_PROC'     / SPEC1 Mode Processing (T if active)
TFORM37 = 'L       '            / data format of the field: LOGICAL
TTYPE38 = 'IMAGE1_MODE_PROC'    / IMAGE1 Mode Processing (T if active)
TFORM38 = 'L       '            / data format of the field: LOGICAL
TTYPE39 = 'ENG_HK_GENERATION'   / Engineering HK Packet generation (T if active)
TFORM39 = 'L       '            / data format of the field: LOGICAL
TTYPE40 = 'HK_COLLECTION'       / HK Data collection (T if active)
TFORM40 = 'L       '            / data format of the field: LOGICAL
TTYPE41 = 'MACROCOM_PROC'       / Macrocommand Processing (T if active)
TFORM41 = 'L       '            / data format of the field: LOGICAL
TTYPE42 = 'PROT_TASK'           / Protection Task (T if active)
TFORM42 = 'L       '            / data format of the field: LOGICAL
TTYPE43 = 'RTMS    '            / Real Time Monitoring System (T if active)
TFORM43 = 'L       '            / data format of the field: LOGICAL
TTYPE44 = 'CELL_TEMPERATURE'    / Cell Temperature monitor (-55 to 150 C)
TFORM44 = 'E       '            / data format of the field: REAL
TUNIT44 = 'Celsius '            / physical unit of the field
TTYPE45 = 'RESERV_TEMPERATURE'  / Reservoir Temperature monitor (-55 to 150 C)
TFORM45 = 'E       '            / data format of the field: REAL
TUNIT45 = 'Celsius '            / physical unit of the field
TTYPE46 = 'EU_TEMPERATURE'      / EU Temperature monitor (-55 to 150 C)
TFORM46 = 'E       '            / data format of the field: REAL
TUNIT46 = 'Celsius '            / physical unit of the field
TTYPE47 = 'CELL_HIGH_VOLTAGE'   / Cell HV monitor  (0 - 20 kV)
TFORM47 = 'E       '            / data format of the field: REAL
TUNIT47 = 'V       '            / physical unit of the field
TTYPE48 = 'PMT_HIGH_VOLTAGE'    / PMT HV monitor (0 - 1.5kV)
TFORM48 = 'E       '            / data format of the field: REAL
TUNIT48 = 'V       '            / physical unit of the field
TTYPE49 = 'LOW_VOLTAGE_+5V'     / +5V DC/DC Converter Voltage monitor
TFORM49 = 'E       '            / data format of the field: REAL
TUNIT49 = 'V       '            / physical unit of the field
TTYPE50 = 'LOW_VOLTAGE_+6V'     / +6V DC/DC Converter Voltage monitor
TFORM50 = 'E       '            / data format of the field: REAL
TUNIT50 = 'V       '            / physical unit of the field
TTYPE51 = 'LOW_VOLTAGE_+15V'    / +15V DC/DC Converter Voltage monitor
TFORM51 = 'E       '            / data format of the field: REAL
```

```
TUNIT51 = 'V       '           / physical unit of the field
TTYPE52 = 'LOW_VOLTAGE_-15V'   / -15V DC/DC Converter Voltage monitor
TFORM52 = 'E       '           / data format of the field: REAL
TUNIT52 = 'V       '           / physical unit of the field
TTYPE53 = 'LOW_VOLTAGE_+28V'   / +28V DC/DC Converter Voltage monitor
TFORM53 = 'E       '           / data format of the field: REAL
TUNIT53 = 'V       '           / physical unit of the field
TTYPE54 = 'COMMAND_COUNTER'    / DE processed macrocommand counter
TFORM54 = 'I       '           / data format of the field: 2-byte INTEGER
TLMIN54 =                    0 / minimum legal value for parameter 54
TNULL54 =                   -1 / illegal value for column 54
TTYPE55 = 'PMT_CURR_FLAG_COUNTER' / PMT CurrentFlag counter
TFORM55 = 'I       '           / data format of the field: 2-byte INTEGER
TLMIN55 =                    0 / minimum legal value for parameter 55
TNULL55 =                   -1 / illegal value for column 55
END
```

A.8 HKP+GAIN Binary Table header

```
XTENSION= 'BINTABLE'           / binary table extension
BITPIX  =                    8 / 8-bit bytes
NAXIS   =                    2 / 2-dimensional binary table
NAXIS1  =                  191 / width of table in bytes
NAXIS2  =                 2607 / number of rows in table
PCOUNT  =                    0 / size of special data area
GCOUNT  =                    1 / one data group (required keyword)
TFIELDS =                   68 / number of fields in each row
EXTNAME = 'HKP+GAIN'           / name of this binary table extension
HDUCLASS= 'SAXLEDAS'           / SAX/LEGSPC DA System (follows OGIP conventions)
HDUDOC  = 'SAX/LEDA/0002'      / format specifications
HDUVERS = '1.1.0   '           / version of format
HDUCLAS1= 'TEMPORALDATA'       / non-science quantities versus time
HDUCLAS2= 'HKP     '           / housekeeping parameters
HDUCLAS3= 'FULL    '           / non-compressed
HDUCLAS4= 'PHYSICAL+GAIN'      / physical unit + gain columns
TELESCOP= 'SAX     '           / mission name
INSTRUME= 'LECS    '           / instrument name
OBS_MODE= 'POINTING'           / observ. mode: POINTING, SLEW, or CALIBRATION
OBJECT  = 'svt1    '           / name of object pointed at
RA_OBJ  =  5.0000000000000E+00 / nominal RA of target (deg)
DEC_OBJ =  6.0000000000000E+00 / nominal DEC of target (deg)
RADECSYS= 'FK5     '           / World Coordinate System
EQUINOX =  2.0000000000000E+03 / equinox
OBS_ID  = '1       '           / observation number in current observing period
TIMESYS = '1994 1 1 00:00:00'  / all times measured from this reference date
TIMEUNIT= 's       '           / unit for TSTART, TSTOP, TELAPSE, ONTIME
TIMEREF = 'LOCAL   '           / reference frame for reported time values
TASSIGN = 'SATELLITE'          / location of time assignment
CLOCKAPP=                    T / Time corrected for clock drift?
MJDREF  =  4.7161000000000E+04 / mission reference time: 01/01/94 00:00:00 UTC
MJD-OBS =  4.7313884027778E+04 / observation UTC start time (MJD)
TSTART  =  1.3243140000000E+07 / data start time relative to MJDREF (s)
TSTOP   =  1.3246742000000E+07 / data end time relative to MJDREF (s)
TELAPSE =  3.6020000000000E+03 / difference: TSTOP - TSTART (s)
DATE-OBS= '01/06/94'           / UTC date of observation start (DD/MM/YY)
TIME-OBS= '21:13:00.000'       / UTC time of observation start (HH:MM:SS)
DATE-END= '01/06/94'           / UTC date of observation end (DD/MM/YY)
TIME-END= '22:32:00.000'       / UTC time of observation end (HH:MM:SS)
SCSEQBEG= '9999.9999'          / spacecraft clock (s) at observation start
SCSEQEND= '9999.9999'          / spacecraft clock (s) at observation end
TIMEDEL =  1.0000000000000E+00 / time granularity of data (size of time bin)
SCALFLAG=                    T / HK parameter values scaled to physical units?
TTYPE1  = 'TIME    '           / time tag (since MJDREF)
TFORM1  = 'D       '           / data format of the field: DOUBLE PRECISION
TUNIT1  = 's       '           / physical unit of field
TTYPE2  = 'GETT_ENBL_SW'       / Getter Enable Software flag (T if enabled)
TFORM2  = 'L       '           / data format of the field: LOGICAL
TTYPE3  = 'MEM_MOD_ENBL'       / Memory Modify Software flag (T if enabled)
TFORM3  = 'L       '           / data format of the field: LOGICAL
TTYPE4  = 'GETT_ENBL'          / Getter Enable before RS04 (T if enabled)
TFORM4  = 'L       '           / data format of the field: LOGICAL
TTYPE5  = 'SHUT_CLOSE'         / Shutter Closed Position (T if closed)
TFORM5  = 'L       '           / data format of the field: LOGICAL
TTYPE6  = 'SHUT_OPEN'          / Shutter Open Position (T if open)
TFORM6  = 'L       '           / data format of the field: LOGICAL
TTYPE7  = 'PMT_CURR'           / PMT Current Flag (T if set)
TFORM7  = 'L       '           / data format of the field: LOGICAL
TTYPE8  = 'GU_SAFETY'          / Gas Unity Safety flag (T if set)
TFORM8  = 'L       '           / data format of the field: LOGICAL
```

```
TTYPE9  = 'VALVE_SUPPLY'       / Valve Supply after RS05 (T if enabled)
TFORM9  = 'L       '           / data format of the field: LOGICAL
TTYPE10 = 'GETT_SUPPLY'        / Getter Supply after RS04 (T if enabled)
TFORM10 = 'L       '           / data format of the field: LOGICAL
TTYPE11 = 'HV_POWER'           / HV Power Supply after RS03 (T if enabled)
TFORM11 = 'L       '           / data format of the field: LOGICAL
TTYPE12 = 'HV_ENBL '           / HV Enable status before RS03 (T if enabled)
TFORM12 = 'L       '           / data format of the field: LOGICAL
TTYPE13 = 'FEE_-15V'           / FEE -15V power after RS01 (T if enabled)
TFORM13 = 'L       '           / data format of the field: LOGICAL
TTYPE14 = 'FEE_+15V'           / FEE +15V power after RS01 (T if enabled)
TFORM14 = 'L       '           / data format of the field: LOGICAL
TTYPE15 = 'ST_EQ   '           / Self Test Errors (0xf: > 14 errors occurred)
TFORM15 = 'I       '           / data format of the field: 2-byte INTEGER
TLMIN15 =                    0 / minimum legal value for parameter 15
TLMAX15 =                   15 / maximum legal value for parameter 15
TNULL15 =                   -1 / illegal value for column 15
TTYPE16 = 'S_EQ    '           / System Errors (0xf: > 14 errors occurred)
TFORM16 = 'I       '           / data format of the field: 2-byte INTEGER
TLMIN16 =                    0 / minimum legal value for parameter 16
TLMAX16 =                   15 / maximum legal value for parameter 16
TNULL16 =                   -1 / illegal value for column 16
TTYPE17 = 'O_EQ    '           / Operational Errors (0xf: > 14 errors occurred)
TFORM17 = 'I       '           / data format of the field: 2-byte INTEGER
TLMIN17 =                    0 / minimum legal value for parameter 17
TLMAX17 =                   15 / maximum legal value for parameter 17
TNULL17 =                   -1 / illegal value for column 17
TTYPE18 = 'QEP_RATEMETER'      / Qualified Event Pulse counter
TFORM18 = 'E       '           / data format of the field: REAL
TUNIT18 = 'count/s '           / physical unit of the field
COMMENT
COMMENT          The QEP Ratemeter counts for all the events with:
COMMENT
COMMENT             Emin < E < Emax
COMMENT             Xmin < X < Xmax
COMMENT             Ymin < Y < Ymax
COMMENT             Vmin < Veto < Vmax
COMMENT             BLmin < BL < BLmax
COMMENT
TTYPE19 = 'EVENT_READ_RATEMETER' / Event Input Buffer counter
TFORM19 = 'E       '           / data format of the field: REAL
TUNIT19 = 'count/s '           / physical unit of the field
TTYPE20 = 'EVENT_LOST_RATEMETER' / DE not transferred event counter
TFORM20 = 'E       '           / data format of the field: REAL
TUNIT20 = 'count/s '           / physical unit of the field
TTYPE21 = 'BASETIME'           / BT value at the Essential HK param. sampling
TFORM21 = 'J       '           / data format of the field: 4-byte INTEGER
TLMIN21 =                    0 / minimum legal value for parameter 21
TNULL21 =                   -1 / illegal value for column 21
TTYPE22 = 'DEADTIME_RATEMETER' / Dead Time counter
TFORM22 = 'E       '           / data format of the field: REAL
TUNIT22 = 'count/s '           / physical unit of the field
TTYPE23 = 'E_MIN_RATEMETER'    / LLD output counter
TFORM23 = 'E       '           / data format of the field: REAL
TUNIT23 = 'count/s '           / physical unit of the field
TTYPE24 = 'E_MAX_RATEMETER'    / Ra discriminator output counter
TFORM24 = 'E       '           / data format of the field: REAL
TUNIT24 = 'count/s '           / physical unit of the field
TTYPE25 = 'POS_RATEMETER'      / Ry & Rx discriminator counter
TFORM25 = 'E       '           / data format of the field: REAL
TUNIT25 = 'count/s '           / physical unit of the field
TTYPE26 = 'BL_RATEMETER'       / Burst-Length discriminator counter
TFORM26 = 'E       '           / data format of the field: REAL
```

```
TUNIT26 = 'count/s '           / physical unit of the field
TTYPE27 = 'VETO_RATEMETER'     / Rv discriminator counter
TFORM27 = 'E       '           / data format of the field: REAL
TUNIT27 = 'count/s '           / physical unit of the field
TTYPE28 = 'CELL_PRESSURE'      / Cell pressure monitor
TFORM28 = 'E       '           / data format of the field: REAL
TUNIT28 = 'mbar    '           / physical unit of the field
TTYPE29 = 'RESERVOIR_PRESSURE' / Reservoir pressure monitor
TFORM29 = 'E       '           / data format of the field: REAL
TUNIT29 = 'mbar    '           / physical unit of the field
TTYPE30 = 'GAS_VALVE1_OPERATION' / gas valve 1 operation cycle counter
TFORM30 = 'E       '           / data format of the field: REAL
TUNIT30 = 'count/s '           / physical unit of the field
TTYPE31 = 'GAS_VALVE2_OPERATION' / gas valve 2 operation cycle counter
TFORM31 = 'E       '           / data format of the field: REAL
TUNIT31 = 'count/s '           / physical unit of the field
TTYPE32 = 'STANDBY_MODE'       / LEGSPC in STANDBY mode
TFORM32 = 'L       '           / data format of the field: LOGICAL
TTYPE33 = 'RUNNING_MODE'       / LEGSPC in RUNNING mode
TFORM33 = 'L       '           / data format of the field: LOGICAL
TTYPE34 = 'NORM_INTERR_HANDLER'  / Normal Input Interrupt (T if active)
TFORM34 = 'L       '           / data format of the field: LOGICAL
TTYPE35 = 'HT_INTERR_HANDLER'  / High Throughput Input Interrupt Handler
TFORM35 = 'L       '           / data format of the field: LOGICAL
TTYPE36 = 'DIRECT_MODE_PROC'   / DIRECT Mode Event Processing (T if active)
TFORM36 = 'L       '           / data format of the field: LOGICAL
TTYPE37 = 'SPEC1_MODE_PROC'    / SPEC1 Mode Processing (T if active)
TFORM37 = 'L       '           / data format of the field: LOGICAL
TTYPE38 = 'IMAGE1_MODE_PROC'   / IMAGE1 Mode Processing (T if active)
TFORM38 = 'L       '           / data format of the field: LOGICAL
TTYPE39 = 'ENG_HK_GENERATION'  / Engineering HK Packet generation (T if active)
TFORM39 = 'L       '           / data format of the field: LOGICAL
TTYPE40 = 'HK_COLLECTION'      / HK Data collection (T if active)
TFORM40 = 'L       '           / data format of the field: LOGICAL
TTYPE41 = 'MACROCOM_PROC'      / Macrocommand Processing (T if active)
TFORM41 = 'L       '           / data format of the field: LOGICAL
TTYPE42 = 'PROT_TASK'          / Protection Task (T if active)
TFORM42 = 'L       '           / data format of the field: LOGICAL
TTYPE43 = 'RTMS    '           / Real Time Monitoring System (T if active)
TFORM43 = 'L       '           / data format of the field: LOGICAL
TTYPE44 = 'CELL_TEMPERATURE'   / Cell Temperature monitor (-55 to 150 C)
TFORM44 = 'E       '           / data format of the field: REAL
TUNIT44 = 'Celsius '           / physical unit of the field
TTYPE45 = 'RESERV_TEMPERATURE' / Reservoir Temperature monitor (-55 to 150 C)
TFORM45 = 'E       '           / data format of the field: REAL
TUNIT45 = 'Celsius '           / physical unit of the field
TTYPE46 = 'EU_TEMPERATURE'     / EU Temperature monitor (-55 to 150 C)
TFORM46 = 'E       '           / data format of the field: REAL
TUNIT46 = 'Celsius '           / physical unit of the field
TTYPE47 = 'CELL_HIGH_VOLTAGE'  / Cell HV monitor  (0 - 20 kV)
TFORM47 = 'E       '           / data format of the field: REAL
TUNIT47 = 'V       '           / physical unit of the field
TTYPE48 = 'PMT_HIGH_VOLTAGE'   / PMT HV monitor (0 - 1.5kV)
TFORM48 = 'E       '           / data format of the field: REAL
TUNIT48 = 'V       '           / physical unit of the field
TTYPE49 = 'LOW_VOLTAGE_+5V'    / +5V DC/DC Converter Voltage monitor
TFORM49 = 'E       '           / data format of the field: REAL
TUNIT49 = 'V       '           / physical unit of the field
TTYPE50 = 'LOW_VOLTAGE_+6V'    / +6V DC/DC Converter Voltage monitor
TFORM50 = 'E       '           / data format of the field: REAL
TUNIT50 = 'V       '           / physical unit of the field
TTYPE51 = 'LOW_VOLTAGE_+15V'   / +15V DC/DC Converter Voltage monitor
TFORM51 = 'E       '           / data format of the field: REAL
```

```
TUNIT51 = 'V       '           / physical unit of the field
TTYPE52 = 'LOW_VOLTAGE_-15V'   / -15V DC/DC Converter Voltage monitor
TFORM52 = 'E       '           / data format of the field: REAL
TUNIT52 = 'V       '           / physical unit of the field
TTYPE53 = 'LOW_VOLTAGE_+28V'   / +28V DC/DC Converter Voltage monitor
TFORM53 = 'E       '           / data format of the field: REAL
TUNIT53 = 'V       '           / physical unit of the field
TTYPE54 = 'COMMAND_COUNTER'    / DE processed macrocommand counter
TFORM54 = 'I       '           / data format of the field: 2-byte INTEGER
TLMIN54 =                    0 / minimum legal value for parameter 54
TNULL54 =                   -1 / illegal value for column 54
TTYPE55 = 'PMT_CURR_FLAG_COUNTER' / PMT CurrentFlag counter
TFORM55 = 'I       '           / data format of the field: 2-byte INTEGER
TLMIN55 =                    0 / minimum legal value for parameter 55
TNULL55 =                   -1 / illegal value for column 55
COMMENT
COMMENT   The following columns contain information concerning the computed
COMMENT   time-dependent energy gain of the two fixed Fe calibration sources
COMMENT   inside the SAX/LEGSPC. For a description of the utilized algorithm
COMMENT   and computed quantities see the SAX Data Analysis Software User
COMMENT   Manual.
COMMENT
TIMEGRAN=  1.0006673633400E+01 / time granularity of gain values
NMPHAFE1=  4.1000000000000E+02 / nominal PHA of calibration source #1
NMPHAFE2=  4.1000000000000E+02 / nominal PHA of calibration source #2
TTYPE56 = 'PHA1    '           / center of fitted spectrum for cal. source #1
TFORM56 = 'E       '           / data format of the field: REAL
TUNIT56 = 'chan    '           / physical unit of field
TTYPE57 = 'FWHM1   '           / FWHM of fitted Gaussian for cal. source #1
TFORM57 = 'E       '           / data format of the field: REAL
TUNIT57 = 'chan    '           / physical unit of field
TTYPE58 = 'CHISQ1  '           / chi^2 of Gaussian fit to calculate GAIN1
TFORM58 = 'E       '           / data format of the field: REAL
TTYPE59 = 'GAIN1   '           / gain of calibration source #1
TFORM59 = 'E       '           / data format of the field: REAL
TTYPE60 = 'PHA2    '           / center of fitted spectrum for cal. source #2
TFORM60 = 'E       '           / data format of the field: REAL
TUNIT60 = 'chan    '           / physical unit of field
TTYPE61 = 'FWHM2   '           / FWHM of fitted Gaussian for cal. source #2
TFORM61 = 'E       '           / data format of the field: REAL
TUNIT61 = 'chan    '           / physical unit of field
TTYPE62 = 'CHISQ2  '           / chi^2 of Gaussian fit to calculate GAIN2
TFORM62 = 'E       '           / data format of the field: REAL
TTYPE63 = 'GAIN2   '           / gain of calibration source #2
TFORM63 = 'E       '           / data format of the field: REAL
TTYPE64 = 'GAIN12  '           / ratio GAIN1/GAIN2
TFORM64 = 'E       '           / data format of the field: REAL
TTYPE65 = 'GAIN_AVG'           / average gain
TFORM65 = 'E       '           / data format of the field: REAL
TTYPE66 = 'CHISQAVG'           / chi^2 of Gaussian fit to calculate GAIN_AVG
TFORM66 = 'E       '           / data format of the field: REAL
TTYPE67 = 'BCKGND1 '           / background flux outside FOV in box #1
TFORM67 = 'E       '           / data format of the field: REAL
TUNIT67 = 'count/s/cm**2'      / physical unit of field
TTYPE68 = 'BCKGND2 '           / background flux outside FOV in box #2
TFORM68 = 'E       '           / data format of the field: REAL
TUNIT68 = 'count/s/cm**2'      / physical unit of field
END
```

A.9 EPHEMERIS Binary Table header

```
XTENSION= 'BINTABLE'           / binary table extension
BITPIX  =                    8 / 8-bit bytes
NAXIS   =                    2 / 2-dimensional binary table
NAXIS1  =                   86 / width of table in bytes
NAXIS2  =                46801 / number of rows in table
PCOUNT  =                    0 / size of special data area
GCOUNT  =                    1 / one data group (required keyword)
TFIELDS =                   17 / number of fields in each row
EXTNAME = 'EPHEMERIS'          / name of this binary table extension
HDUCLASS= 'SAXLEDAS'           / SAX/LEGSPC DA System (follows OGIP conventions)
HDUDOC  = 'SAX/LEDA/0002'      / format specifications
HDUVERS = '1.1.0   '           / version of format
HDUCLAS1= 'TEMPORALDATA'       / non-science quantities versus time
HDUCLAS2= 'EPHEM   '           / spacecraft orbit data
TELESCOP= 'SAX     '           / mission name
INSTRUME= 'LECS    '           / instrument name
OBS_MODE= 'POINTING'           / observ. mode: POINTING, SLEW, or CALIBRATION
OBJECT  = 'svt1    '           / name of object pointed at
RA_OBJ  =  5.0000000000000E+00 / nominal RA of target (deg)
DEC_OBJ =  6.0000000000000E+00 / nominal DEC of target (deg)
RADECSYS= 'FK5     '           / World Coordinate System
EQUINOX =  2.0000000000000E+03 / equinox
OBS_ID  = '1       '           / observation number in current observing period
TIMESYS = '1994 1 1 00:00:00'  / all times measured from this reference date
TIMEUNIT= 's       '           / unit for TSTART, TSTOP, TELAPSE, ONTIME
TIMEREF = 'LOCAL   '           / reference frame for reported time values
TASSIGN = 'SATELLITE'          / location of time assignment
CLOCKAPP=                    T / Time corrected for clock drift?
MJDREF  =  4.7161000000000E+04 / mission reference time: 01/01/94 00:00:00 UTC
MJD-OBS =  4.7313884027778E+04 / observation UTC start time (MJD)
TSTART  =  1.3199400000000E+07 / data start time relative to MJDREF (s)
TSTOP   =  1.3246200000000E+07 / data end time relative to MJDREF (s)
TELAPSE =  4.6800000000000E+04 / difference: TSTOP - TSTART (s)
DATE-OBS= '01/06/94'           / UTC date of observation start (DD/MM/YY)
TIME-OBS= '21:13:00.000'       / UTC time of observation start (HH:MM:SS)
DATE-END= '01/06/94'           / UTC date of observation end (DD/MM/YY)
TIME-END= '22:32:00.000'       / UTC time of observation end (HH:MM:SS)
SCSEQBEG= '9999.9999'          / spacecraft clock (s) at observation start
SCSEQEND= '9999.9999'          / spacecraft clock (s) at observation end
TIMEDEL =      1.0000000000000 / time granularity of data (size of time bin)
TTYPE1  = 'TIME    '           / time tag (time since MJDREF)
TFORM1  = 'D       '           / data format of the field: DOUBLE PRECISION
TUNIT1  = 's       '           / physical unit of field
TTYPE2  = 'SAT_X   '           / X component of the S/C position vector
TFORM2  = 'D       '           / data format of the field: DOUBLE PRECISION
TUNIT2  = 'km      '           / physical unit of field
TTYPE3  = 'SAT_Y   '           / Y component of the S/C position vector
TFORM3  = 'D       '           / data format of the field: DOUBLE PRECISION
TUNIT3  = 'km      '           / physical unit of field
TTYPE4  = 'SAT_Z   '           / Z component of the S/C position vector
TFORM4  = 'D       '           / data format of the field: DOUBLE PRECISION
TUNIT4  = 'km      '           / physical unit of field
TTYPE5  = 'VEL_X   '           / X component of the S/C velocity vector
TFORM5  = 'D       '           / data format of the field: DOUBLE PRECISION
TUNIT5  = 'km/s    '           / physical unit of field
TTYPE6  = 'VEL_Y   '           / Y component of the S/C velocity vector
TFORM6  = 'D       '           / data format of the field: DOUBLE PRECISION
TUNIT6  = 'km/s    '           / physical unit of field
TTYPE7  = 'VEL_Z   '           / Z component of the S/C velocity vector
TFORM7  = 'D       '           / data format of the field: DOUBLE PRECISION
```

```
TUNIT7  = 'km/s    '           / physical unit of field
TTYPE8  = 'LEAP_SEC'           / difference between TAI and UTC
TFORM8  = 'I       '           / data format of the field: 2-byte INTEGER
TUNIT8  = 's       '           / physical unit of field
TTYPE9  = 'SAA_FLAG'           / is S/C inside SAA?
TFORM9  = 'L       '           / data format of the field: LOGICAL
TTYPE10 = 'SAA_TIME'           / time elapsed since S/C entered/exited SAA
TFORM10 = 'E       '           / data format of the field: REAL
TUNIT10 = 'min     '           / physical unit of field
TTYPE11 = 'DAYSIDE_FLAG'       / is S/C on earth's dayside?
TFORM11 = 'L       '           / data format of the field: LOGICAL
TTYPE12 = 'DAYSIDE_TIME'       / time elapsed since S/C entered/exited dayside
TFORM12 = 'E       '           / data format of the field: REAL
TUNIT12 = 'min     '           / physical unit of field
TTYPE13 = 'FOV_FLAG'           / pointing direction: sky/bright-/dark earth
TFORM13 = 'I       '           / data format of the field: 2-byte INTEGER
TTYPE14 = 'EARTH_ANG'          / angle: instrument axis <-> earth limb
TFORM14 = 'E       '           / data format of the field: REAL
TUNIT14 = 'deg     '           / physical unit of field
TTYPE15 = 'BREARTH_ANG'        / angle: instrument axis <-> day/night terminator
TFORM15 = 'E       '           / data format of the field: REAL
TUNIT15 = 'deg     '           / physical unit of field
TTYPE16 = 'SUN_ANG '           / angle: instrument angle <-> direction to sun
TFORM16 = 'E       '           / data format of the field: REAL
TUNIT16 = 'deg     '           / physical unit of field
TTYPE17 = 'COR_MIN '           / minimum geomagnetic cut-off rigidity
TFORM17 = 'E       '           / data format of the field: REAL
TUNIT17 = 'GeV/c   '           / physical unit of field
END
```

A.10 ASPECT Binary Table header

```
XTENSION= 'BINTABLE'           / binary table extension
BITPIX  =                    8 / 8-bit bytes
NAXIS   =                    2 / 2-dimensional binary table
NAXIS1  =                   64 / width of table in bytes
NAXIS2  =                79200 / number of rows in table
PCOUNT  =                    0 / size of special data area
GCOUNT  =                    1 / one data group (required keyword)
TFIELDS =                    8 / number of fields in each row
EXTNAME = 'ASPECT  '           / name of this binary table extension
HDUCLASS= 'SAXLEDAS'           / SAX/LEGSPC DA System (follows OGIP conventions)
HDUDOC  = 'SAX/LEDA/0002'      / format specifications
HDUVERS = '1.1.0   '           / version of format
HDUCLAS1= 'TEMPORALDATA'       / non-science quantities versus time
HDUCLAS2= 'ASPECT  '           / spacecraft aspect data
TELESCOP= 'SAX     '           / mission name
INSTRUME= 'LECS    '           / instrument name
OBS_MODE= 'POINTING'           / observ. mode: POINTING, SLEW, or CALIBRATION
OBJECT  = 'svt1    '           / name of object pointed at
RA_OBJ  =  5.0000000000000E+00 / nominal RA of target (deg)
DEC_OBJ =  6.0000000000000E+00 / nominal DEC of target (deg)
RADECSYS= 'FK5     '           / World Coordinate System
EQUINOX =  2.0000000000000E+03 / equinox
OBS_ID  = '1       '           / observation number in current observing period
TIMESYS = '1994 1 1 00:00:00'  / all times measured from this reference date
TIMEUNIT= 's       '           / unit for TSTART, TSTOP, TELAPSE, ONTIME
TIMEREF = 'LOCAL   '           / reference frame for reported time values
TASSIGN = 'SATELLITE'          / location of time assignment
CLOCKAPP=                    T / Time corrected for clock drift?
MJDREF  =  4.7161000000000E+04 / mission reference time: 01/01/94 00:00:00 UTC
MJD-OBS =  4.7313884027778E+04 / observation UTC start time (MJD)
TSTART  =  1.3246199900000E+07 / data start time relative to MJDREF (s)
TSTOP   = '        '           / data end time relative to MJDREF (s)
TELAPSE =  4.6799800000001E+04 / difference: TSTOP - TSTART (s)
DATE-OBS= '01/06/94'           / UTC date of observation start (DD/MM/YY)
TIME-OBS= '21:13:00.000'       / UTC time of observation start (HH:MM:SS)
DATE-END= '01/06/94'           / UTC date of observation end (DD/MM/YY)
TIME-END= '22:32:00.000'       / UTC time of observation end (HH:MM:SS)
SCSEQBEG= '9999.9999'          / spacecraft clock (s) at observation start
SCSEQEND= '9999.9999'          / spacecraft clock (s) at observation end
TIMEDEL =       .5000000000000 / time granularity of data (size of time bin)
TTYPE1  = 'TIME    '           / time tag (time since MJDREF)
TFORM1  = 'D       '           / data format of the field: DOUBLE PRECISION
TUNIT1  = 's       '           / physical unit of field
TTYPE2  = 'RA_SCX  '           / right ascension of ACA X axis
TFORM2  = 'D       '           / data format of the field: DOUBLE PRECISION
TUNIT2  = 'deg     '           / physical unit of field
TTYPE3  = 'DEC_SCX '           / declination of ACA X axis
TFORM3  = 'D       '           / data format of the field: DOUBLE PRECISION
TUNIT3  = 'deg     '           / physical unit of field
TTYPE4  = 'RA_SCY  '           / right ascension of ACA Y axis
TFORM4  = 'D       '           / data format of the field: DOUBLE PRECISION
TUNIT4  = 'deg     '           / physical unit of field
TTYPE5  = 'DEC_SCY '           / declination of ACA Y axis
TFORM5  = 'D       '           / data format of the field: DOUBLE PRECISION
TUNIT5  = 'deg     '           / physical unit of field
TTYPE6  = 'RA_SCZ  '           / right ascension of ACA Z axis
TFORM6  = 'D       '           / data format of the field: DOUBLE PRECISION
TUNIT6  = 'deg     '           / physical unit of field
TTYPE7  = 'DEC_SCZ '           / declination of ACA Z axis
TFORM7  = 'D       '           / data format of the field: DOUBLE PRECISION
```

```
TUNIT7  = 'deg     '           / physical unit of field
TTYPE8  = 'ROLL_AN '           / instrumental roll angle
TFORM8  = 'D       '           / data format of the field: DOUBLE PRECISION
TUNIT8  = 'deg     '           / physical unit of field
END
```

B Auxiliary files: Panter HK data

Following the LEGSPC calibration plan, during November '94 the instrument was run at the X-ray testing facility Panter near Munich. In the course of these activities it turned out to be desirable to have the HK parameters files created by the Panter operating system S/W available in FITS format. Consequently, the SAXLEDAS was supplemented by a corresponding conversion module called *pantering* which creates from binary Panter HK packet files FITS files (type ext.: "*_xhk*") that have the same general structure as the instrument HK files. Thus, it consists of a primary header with an empty primary array, a dummy FBT that corresponds to the Obstable extension in the case of an instrument HK file, followed by the actual HK parameter extension. The latter is a conventional FBT with 38 columns and a row width of 129 bytes. In the following the headers of a sample Panter HK file are shown. Again all keyword/value pairs are commented, hence, the header should be self-explanatory.

```
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 = 'ANCILLARY'          / data content of the file
REVISION=                    1 / revision number of processed data
ORIGIN  = 'ESA, SSD'           / processing site
DATE    = '05/01/95'           / FITS file creation date (DD/MM/YY)
CREATOR = 'pantering v1.0.6'   / name of FITS generating code
TELESCOP= 'SAX     '           / mission name
INSTRUME= 'LEGSPC  '           / instrument name
FILTER  = 'NONE    '           / filter ID: always NONE
DATAMODE= 'DIRECT  '           / instrument operational mode
OBS_MODE= 'POINTING'           / observ. mode: POINTING, SLEW, or CALIBRATION
OBJECT  = 'ARTIFICIAL'         / name of object pointed at
OBSERVER= 'SSD, SAX-TEAM'      / principal investigator
OBS_ID  = '00000001'           / observation ID
TIMESYS = 'MJD     '           / time system in use: Modified Julian Days
TIMEUNIT= 's       '           / time units for TSTART, TSTOP, TELAPSE
MJDREF  =       4.96630000E+04 / MJD corresponding to midnight of obs. start
MJD_OBS =       4.96633643E+04 / observation UTC start time (MJD)
TSTART  =       3.14730000E+04 / data start time relative to MJDREF (s)
TSTOP   =       1.02223000E+05 / data end time relative to MJDREF (s)
TELAPSE =       7.07500000E+04 / globally elapsed time (s) during observation
DATE-OBS= '07/11/94'           / UT date of observation start (DD/MM/YY)
TIME-OBS= '08:44:33'           / UT time of observation start (HH:MM:SS)
DATE-END= '08/11/94'           / UT date of observation end (DD/MM/YY)
TIME-END= '04:23:43'           / UT time of observation end (HH:MM:SS)
COMMENT
COMMENT   The second extension of this FITS file is a binary table comprising
COMMENT   HK parameter values that are specific for the X-ray testing facility
COMMENT   Panter, Munich. The first extension is purely dummy and only present
COMMENT   to have the same overall file structure as for the instrument HK
COMMENT   files.
COMMENT
END

XTENSION= 'BINTABLE'           / binary table extension
BITPIX  =                    8 / 8-bit bytes
NAXIS   =                    2 / 2-dimensional binary table
NAXIS1  =                    2 / width of table in bytes
NAXIS2  =                    0 / number of rows in table
PCOUNT  =                    0 / size of special data area
GCOUNT  =                    1 / one data group (required keyword)
TFIELDS =                    1 / number of fields in each row
EXTNAME = 'DUMMY   '           / name of this binary table extension
```

```
TTYPE1  = 'DUMMY   '           / this is a dummy column
TFORM1  = 'I       '           / data format of the field: 2-byte INTEGER
END

XTENSION= 'BINTABLE'           / binary table extension
BITPIX  =                    8 / 8-bit bytes
NAXIS   =                    2 / 2-dimensional binary table
NAXIS1  =                  129 / width of table in bytes
NAXIS2  =                 7076 / number of rows in table
PCOUNT  =                    0 / size of special data area
GCOUNT  =                    1 / one data group (required keyword)
TFIELDS =                   38 / number of fields in each row
CONTENT = 'ANCILLARY'          / data content of the file
EXTNAME = 'PANTER HK'          / name of this binary table extension
TELESCOP= 'SAX     '           / mission name
INSTRUME= 'LEGSPC  '           / instrument name
FILTER  = 'NONE    '           / filter ID: always none
DATAMODE= 'DIRECT  '           / instrument operational mode
OBS_MODE= 'CALIBRATION'        / obs mode: POINTING, SLEW, or CALIBRATION
MJDREF  =       4.96630000E+04 / MJD corresponding to midnight of obs. start
MJD_OBS =       4.96633643E+04 / observation UTC start time (MJD)
TSTART  =       3.14730000E+04 / data start time relative to MJDREF (s)
TSTOP   =       1.02223000E+05 / data end time relative to MJDREF (s)
TELAPSE =       7.07500000E+04 / observation length (s)
DATE-OBS= '07/11/94'           / UT date of observation start (DD/MM/YY)
TIME-OBS= '08:44:33'           / UT time of observation start (HH:MM:SS)
DATE-END= '08/11/94'           / UT date of observation ned (DD/MM/YY)
TIME-END= '04:23:43'           / UT time of observation end (HH:MM:SS)
TTYPE1  = 'TIME    '           / time tag (since MJD_OBS)
TFORM1  = 'D       '           / data format of the field: DOUBLE PRECISION
TUNIT1  = 's       '           / physical unit of field
TTYPE2  = 'RQ1_HIGH_VOLT'      / RQ1 high voltage
TFORM2  = 'I       '           / data format of the field: 2-byte INTEGER
TUNIT2  = 'V       '           / physical unit of field
TTYPE3  = 'RQ1_EMISS_CURR'     / RQ1 emission current
TFORM3  = 'I       '           / data format of the field: 2-byte INTEGER
TUNIT3  = 'uA      '           / physical unit of field
TTYPE4  = 'RQ1_HEAT_VOLT'      / RQ1 heater voltage
TFORM4  = 'I       '           / data format of the field: 2-byte INTEGER
TUNIT4  = 'mV      '           / physical unit of field
TTYPE5  = 'RQ1_HEAT_CURR'      / RQ1 heater current
TFORM5  = 'I       '           / data format of the field: 2-byte INTEGER
TUNIT5  = 'mA      '           / physical unit of field
TTYPE6  = 'RQ1_DIFF_VOLT'      / RQ1 cathode difference voltage
TFORM6  = 'I       '           / data format of the field: 2-byte INTEGER
TUNIT6  = 'mV      '           / physical unit of field
TTYPE7  = 'RQ1_FILTER_WHEEL'   / RQ1 filter wheel position
TFORM7  = 'I       '           / data format of the field: 2-byte INTEGER
TTYPE8  = 'RQ2_HIGH_VOLT'      / RQ2 high voltage
TFORM8  = 'I       '           / data format of the field: 2-byte INTEGER
TUNIT8  = 'V       '           / physical unit of field
TTYPE9  = 'RQ2_EMISS_CURR'     / RQ2 emission current
TFORM9  = 'I       '           / data format of the field: 2-byte INTEGER
TUNIT9  = 'uA      '           / physical unit of field
TTYPE10 = 'RQ2_SHUTTER'        / RQ2 shutter: T/F: open/closed
TFORM10 = 'L       '           / data format of the field: LOGICAL
TTYPE11 = 'RQ2_FILTER_WHEEL'   / RQ2 filter wheel position
TFORM11 = 'I       '           / data format of the field: 2-byte INTEGER
TTYPE12 = 'XRAY_ENERGY'        / X-ray energy
TFORM12 = 'I       '           / data format of the field: 2-byte INTEGER
TTYPE13 = 'MANIPULATOR01'      / manipulator #01
TFORM13 = 'J       '           / data format of the field: 4-byte INTEGER
TTYPE14 = 'MANIPULATOR02'      / manipulator #02
```

```
TFORM14 = 'J       '           / data format of the field: 4-byte INTEGER
TTYPE15 = 'MANIPULATOR03'      / manipulator #03
TFORM15 = 'J       '           / data format of the field: 4-byte INTEGER
TTYPE16 = 'MANIPULATOR04'      / manipulator #04
TFORM16 = 'J       '           / data format of the field: 4-byte INTEGER
TTYPE17 = 'MANIPULATOR05'      / manipulator #05
TFORM17 = 'J       '           / data format of the field: 4-byte INTEGER
TTYPE18 = 'MANIPULATOR06'      / manipulator #06
TFORM18 = 'J       '           / data format of the field: 4-byte INTEGER
TTYPE19 = 'MANIPULATOR07'      / manipulator #07
TFORM19 = 'J       '           / data format of the field: 4-byte INTEGER
TTYPE20 = 'MANIPULATOR08'      / manipulator #08
TFORM20 = 'J       '           / data format of the field: 4-byte INTEGER
TTYPE21 = 'MANIPULATOR09'      / manipulator #09
TFORM21 = 'J       '           / data format of the field: 4-byte INTEGER
TTYPE22 = 'MANIPULATOR10'      / manipulator #10
TFORM22 = 'J       '           / data format of the field: 4-byte INTEGER
TTYPE23 = 'MANIPULATOR11'      / manipulator #11
TFORM23 = 'J       '           / data format of the field: 4-byte INTEGER
TTYPE24 = 'MANIPULATOR12'      / manipulator #12
TFORM24 = 'J       '           / data format of the field: 4-byte INTEGER
TTYPE25 = 'MANIPULATOR13'      / manipulator #13
TFORM25 = 'J       '           / data format of the field: 4-byte INTEGER
TTYPE26 = 'MANIPULATOR14'      / manipulator #14
TFORM26 = 'J       '           / data format of the field: 4-byte INTEGER
TTYPE27 = 'MANIPULATOR15'      / manipulator #15
TFORM27 = 'J       '           / data format of the field: 4-byte INTEGER
TTYPE28 = 'MANIPULATOR16'      / manipulator #16
TFORM28 = 'J       '           / data format of the field: 4-byte INTEGER
TTYPE29 = 'MANIPULATOR17'      / manipulator #17
TFORM29 = 'J       '           / data format of the field: 4-byte INTEGER
TTYPE30 = 'MANIPULATOR18'      / manipulator #18
TFORM30 = 'J       '           / data format of the field: 4-byte INTEGER
TTYPE31 = 'MANIPULATOR19'      / manipulator #19
TFORM31 = 'J       '           / data format of the field: 4-byte INTEGER
TTYPE32 = 'MANIPULATOR20'      / manipulator #20
TFORM32 = 'J       '           / data format of the field: 4-byte INTEGER
TTYPE33 = 'MANIPULATOR21'      / manipulator #21
TFORM33 = 'J       '           / data format of the field: 4-byte INTEGER
TTYPE34 = 'MANIPULATOR22'      / manipulator #22
TFORM34 = 'J       '           / data format of the field: 4-byte INTEGER
TTYPE35 = 'CHAMB_TEMP'         / chamber temperature
TFORM35 = 'I       '           / data format of the field: 2-byte INTEGER
TTYPE36 = 'CHAMB_PRESS'        / chamber pressure
TFORM36 = 'I       '           / data format of the field: 2-byte INTEGER
TUNIT36 = 'nbar    '           / physical unit of field
TTYPE37 = 'BCKGND_MONITOR1'    / count rate background monitor #1
TFORM37 = 'J       '           / data format of the field: 4-byte INTEGER
TUNIT37 = 'count/s '           / counts/s averaged over last 10 s
TTYPE38 = 'BCKGND_MONITOR2'    / count rate background monitor #2
TFORM38 = 'J       '           / data format of the field: 4-byte INTEGER
TUNIT38 = 'count/s '           / counts/s averaged over last 10 s
END
```

C List of acronyms

ACA	Attitude Control Axis
AE	Analogue Electronics assembly
AT	Aspect Table
BL	Burst Length
DC	Direct Current
DE	Digital Electronics assembly
Decl.	Declination
DM	Direct Mode
EGSE	Electrical Ground Support Equipment
ELT	Event List Table
ET	Ephemeris Table
EU	Electronics Unit
F	False
FBT	FITS Binary Table
FEE	Front End Electronics
FITS	Flexible Image Transport System
FOT	Final Observation Tape
FOV	Field Of View
FWHM	Full Width Half Maximum
GTI	Good Time Interval
GU	Gas Unit
HEASARC	High Energy Astrophysics Science Archive Research Center
HDU	HeaDer Unit
HK	HouseKeeping
HV	High Voltage
LEGSPC	Low-Energy Gas Scintillation Proportional Counter
LLD	Lower Level Discriminator
MJD	Modified Julian Day (JD - 2400000.5)
NASA	National Aeronautics and Space Administration
NFI	Narrow Field Instrument
OBIs	OBservation Intervals
OFWG	OGIP FITS Working Group
OGIP	Office for Guest Investigation Programs
OI	Observation Interval
OP	Observation Period
PHA	Pulse Height Amplitude
PMT	PhotoMultiplier Tube
R.A.	Right Ascension
SAA	South Atlantic Anomaly
SAX	Satellite per Astronomia X (X-ray Astronomy Satellite)
SAXLEDAS	SAX/LEGSPC Data Analysis System

S/C SpaceCraft
S/W Software
T True
TAI International Atomic Time
UT Universal Time
UTC Coordinated Universal Time
WCS World Coordinate System

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