OGIP Memo OGIP/92-007a

The OGIP Spectral File Format Addendum: Changes log

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SUMMARY

This addendum to OGIP/92-007 lists the changes which have been made to the format & keywords of the 'Spectrum' extension of the OGIP spectral file. Intended audience: primarily OGIP programmers, hardware teams & authors of spectral analysis s/w.

[1] http://legacy.gsfc.nasa.gov/docs/bios/imgeorge.html
[2] http://legacy.gsfc.nasa.gov/docs/bios/arnaud.html

LOG OF SIGNIFICANT CHANGES

Release Date	**Sections Changed**	**Brief Notes**
1993 Dec 29		Last Major update
1994 Nov 30	All	Made compatible with `LaTeX2HTML` software
1998 Dec 2	All	Removed inconsistencies with OGIP/92-007

1 INTRODUCTION

The memo OGIP/92-007 (Arnaud, George & Tennant 1992) described the general design criteria and structure of a 'PHA' file, namely that it consisted of a FITS file with a 'null' primary array and the following extensions:

- a Data Extension - containing the PHA dataset
- a Detector extension - containing instrument-specific information
- a Good Time Interval (GTI) extension
- a (Selector) History extension

The memo then gave the detailed format of the Data (or 'Spectrum') Extension. Since the adoption of the format given in Arnaud *et al* , a number of conventions/rules have been introduced within the OGIP to help clarify & unify a multi-mission, multi-application approach to the design of FITS files. Specifically, the OGIP FITS Working Group (OFWG) was created and started making recommendations. Many of the changes which have been made to the format of the spectrum extension reflect such rulings of the OFWG. In this addendum we list all such format changes along with the corresponding value of the HDUVERS keyword.

2 ALLOWED FORMATS

A summary of the changes which have been made to this format are listed in Table 2, along with the version of XSPEC with which they are compatible.

Table 1: Log of changes to the OGIP format for a single PHA dataset

HDUVERS1	**Date**	**XSPEC version**	**Comments**
1.0.0	1992 July	>8.0	Original Arnaud *etal* format
1.1.0	1993 Sept	>8.0	Small changes to optional keywords

2.1 HDUVERS1 = 1.0.0

THIS FORMAT HAS BEEN SUPERCEDED BY HDUVERS1 = 1.1.0 AND SHOULD NO LONGER BE USED (see Section 2.2)

This was first format for a FITS extension to contain a PHA dataset fully-approved by the OGIP. It's detailed structure, keywords *etc* are described in the memo OGIP/92-007 , which was also published in *Legacy* (Arnaud *et al* 1992). It should be noted that this format is commonly refered to as 'PHAVERSN = 1992a'. Essentially the FITS extension consists of a BINTABLE extension containing the PHA dataset & errors, along with 'grouping' & quality information. The following keywords/values were listed as mandatory:

- EXTNAME (= SPECTRUM) - the name (*i.e.* type) of the extension
- TELESCOP - the "telescope" (*i.e.* mission/satellite name).
- INSTRUME - the instrument/detector.
- FILTER - the instrument filter in use (if any)
- EXPOSURE - the integration time (in seconds) for the PHA data (assumed to be corrected for deadtime, data drop-outs *etc.*)
- AREASCAL - the area scaling factor (see Arnaud *et al* for details).
- BACKFILE - the name of the corresponding background file (if any)
- BACKSCAL - the background scaling factor.
- CORRFILE - the name of the corresponding correction file (if any)
- CORRSCAL - the correction scaling factor.
- RESPFILE - the name of the corresponding (default) redistribution matrix file (RMF; see George *et al.* 1992), supplied by BLDRSP.
- ANCRFILE - the name of the corresponding (default) ancillary response file (ARF; see George *et al.* 1992), supplied by BLDRSP.
- XFLTXXXX - the XSPEC selection filter descriptor, where XXXX is a number (see Arnaud *et al* for details).
- PHAVERSN - the OGIP version number of the FITS format in use to store the PHA data (in this case 1992a).
- POISSERR - whether Poissonian errors are appropriate to the data (see Arnaud *et al* for details).
- CHANTYPE - whether the channels used in the file have been corrected in anyway (see Arnaud *et al* for details).

- DETCHANS - the total number of detector channels available.

And the following optional keywords recommended to supply further information (primarily for the human reader):

- OBJECT - the observed object.
- RA-NOM - the nominal Right Ascension of the object (in decimal degrees)
- DEC-NOM - the nominal declination of the object (in decimal degrees)
- EQUINOX - the equinox of the above celestial co-ordinate (RA & DEC) specifications
- RADECSYS - the coordinate frame used for EQUINOX
- DATE-OBS - nominal U.T. date when integration of this PHA data started (yyyy-mm-dd). Old files may have dd/mm/yy format which will be interpreted as 19yy-mm-dd.
- TIME-OBS - nominal U.T. time when integration of this PHA data started (hh:mm:ss).
- DATE-END - nominal U.T. date when integration of this PHA data ended (yyyy-mm-dd). Old files may have dd/mm/yy format which will be interpreted as 19yy-mm-dd.
- TIME-END - nominal U.T. time when integration of this PHA data ended (hh:mm:ss).

2.2 HDUVERS = 1.1.0

The following changes were made to reflect recommendations R1, R3, R6, R7 & R8 of the HFWG (see HFWG Recommendations).

The following mandatory keywords have been added

- HDUCLASS = 'OGIP' - indicating the organization which devised the file format in use
- HDUCLAS1 = 'SPECTRUM' - indicating extension contains data relating to a PHA dataset
- HDUVERS = '1.1.0' - indicating the version of the HDUCLAS1 format in use.

The following keywords are mandatory if the channel numbering-scheme for an instrument does **NOT** start at unity:

- TLMIN*nnn* - giving the minimum legal value for the values in the column *nnn* named 'CHANNEL' (ie. the lowest PHA channel possible for the instrument under the current operational mode, irrespective of whether or not that channel is stored as part of the PHA dataset).

- TLMAX*nnn* - giving the maximum legal value for the values in the column *nnn* named 'CHANNEL' (ie. the highest PHA channel possible for the instrument under the current operational mode, irrespective of whether or not that channel is stored as part of the PHA dataset).

These keywords are optional for datasets for which the channel numbering scheme starts at channel one (and hence the value of the TLMAX*nnn* keyword should equal the value of the DETCHANS keyword), but are recommended for clarity.

The following changes have been made to the list of (optional) keywords given by Arnaud *et al* :

- RA-NOM - is no longer used, but replaced by: RA_OBJ - the Right Ascension of the object (in decimal degrees)

- DEC-NOM - is no longer used, but replaced by: DEC_OBJ - the declination of the object (in decimal degrees)

The following optional (but strongly suggested) keywords have been added:

- CREATOR - to indicate the name & version number of the s/w task which created the PHA dataset. The suggested format is:
  CREATOR = `'{progname} v{i.j.k}'`
  where `{progname}` is the task name, and `i.j.k` its version number (i, j & k integers; k changing most rapidly).
- HDUCLAS2 - indicating the type of data stored.
  Allowed values are:
  - 'TOTAL' for a gross PHA Spectrum (source + bkgd)
  - 'NET' for a bkgd-subtracted PHA Spectrum
  - 'BKG' for a bkgd PHA Spectrum
- HDUCLAS3 - indicating further details of the type of data stored.
  Allowed values are:
  - 'COUNT' for PHA data stored as counts (rather than count/s)
  - 'RATE' for PHA data stored in count/s
- HDUVERS1 = 1.1.0 will maintain compatibility with older software that looks for HDUVERS1 rather than the correct HDUVERS.

These keywords will be used by downstream software to help locate & understand the origin & content of the dataset. The values also allow a number of checks to be performed by downstream tasks and provide warning messages if it appears that the user is attempting to use the dataset incorrectly (*eg* attempting to subtract background from a background-subtracted dataset).

REFERENCES

Arnaud, K.A., George, I.M., & Tennant, A.F., 1992. *Legacy*, **2**, 65. (OGIP/92-007)
George, I.M, Arnaud, K.A, Pence, W. & Ruamsuwan, L., 1992. *Legacy*, **2**, 51. (CAL/GEN/92-002)
George, I.M, *et al* 1993. *Legacy*, **4**, 72. (OFWG/93-001)