Modifications to Final Reprocessed GHRS Headers before Ingest

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ABSTRACT

The report describes the changes made to the FITS header keywords and the data files before the final reprocessed GHRS data were ingested into the archive

Introduction

In 2006 the GHRS dataset, which consists of 24,272 datasets, containing 298,965 FITS files, was reprocessed using the best available reference files. The dataset contains PODPS Data Quality (PDQ) and Observer Comment (OCX) files, which were produced manually by operations personnel. Both science and non-science (i.e., DARKs, etc.) exposures were reprocessed to produce as homogeneous a dataset as possible. See GHRS ISR-092 (Kamp et al., 2006) for details of the reprocessing.

After reprocessing, the dataset was copied from CADC to ST-ECF and STScI. At STScI, the dataset was placed on disk for direct download, but was not ingested into the archive, nor was the catalog updated. Archive users who searched and downloaded GHRS data from STScI receive the original processed data, not the reprocessed version.

To remedy the situation, we investigated the reprocessed dataset, determined what was needed to allow ingest and cataloging of the data, made the changes and then ingested and cataloged the data. What was done to the keywords and data is detailed below.

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Data Set Definitions

We call the reader's attention to section 2.3, "Uncalibrated Data" from GHRS ISR-092.

"A total of 3949 datasets were left uncalibrated. The old archived version in DADS contained also only uncalibrated files for these datasets. Most of these datasets are target acquisition data that have either no coordinates, no start time, no exposure duration or no targetname specified. For these datasets, the uncalibrated files remained unchanged from the old processing archived in DADS."

Our charge was to ingest the final reprocessed data set into the archive. We did not pursue reprocessing **any** additional data (i.e, the 3949 datasets mentioned in GHRS ISR-092). As they are not included in the ECF set, none of the details in this ISR apply to these files. We did spot check these datasets and confirmed that typically only the standard header packet (shf), unique data log (ulf) and trailer file (trl) are present in the archive. Although part of the science dataset for a typical exposure, these files do not contain data recognized as science data. In cases where a d0f file was present, the data were obtained for engineering purposes (i.e., during orbital verification) and/or with the SAF element in the light path. We did, however, retrieve the OCX and PDQ files for the datasets, made them FITS compliant and ingested them as part of the Augmented Set.

The table below gives the number of datasets and files present in the Archive at the start of this work, in the ECF set and in the Augmented set.

	Original Archive Dataset	Original Archive Files	ECF Dataset	ECF Files	Augmented Dataset	Augmented Files
Science Datasets	24,272	264,220	20,323	245,997	20,323	245,997
OCX* Datasets	10,735	10,735	8,570	8,570	10,734	10,734
PDQ* Datasets	24,010	24,010	20,137	20,137	24,009	24,009
Total (files or datasets)	59,017	298,965	49,030	274,704	55,066	280,740

*The archive contains z2d40105x_ocx.fits and z2dn0101t_pdq.fits, both for DEFCAL's (an automatically scheduled, non-data producing observation whose sole purpose was to center the spectrum on the detector). These files are corrupted and cannot be read or fixed by FITS tools, so they were not included in the Augmented Set. Interested users may retrieve the data and use the linux/unix "more" command to view the content.

Inspection of the above table shows a Science Dataset number difference between the Original Archive (hereafter called Archive) and the Augmented Datasets of 3949

datasets. We have confirmed these are the same 3949 datasets that were **not** recalibrated in the work described in GHRS ISR-092. The difference in the number of total datasets is 3951 because the Archive contains an additional PDQ and OCX dataset that the Augmented Dataset does not. See the footnote on the table.

It was the Augmented Set that was verified, fixed and ingested into the archive.

Inspection and Correction of the GHRS Dataset

The reprocessed dataset consists of a set of FITS files for each exposure. We ran a FITS verifier, *fverify*, on these files to ensure they were valid FITS. A number of errors were received, most of which fell into one of seven types. Typical *fverify* errors are given in the Appendix.

1) File extensions: .c0f, .c1f, .c2f, .c3f, .c4f, .c5f, .cqf, .d0f, .q0f, .shf, .ulf, .x0f, .xqf
      FITS ASCII Table HDU has reserved Image WCS header keys which are not
      allowed in non-Image HDUs.
2) File extensions: .c0f, .c1f, .c2f, .c3f, .c4f, .c5f, .cqf, .d0f, q0f, .ocx, .ulf, .pdq, .shf, .trl, .x0f, .xqf, .ulf
      Data fill area invalid.
3) File extensions: .pdq, .ocx, .trl
      FITS ASCII Table HDU contains non-ASCII-text characters.
4) File extensions: .q0f, .d0f
      FITS ASCII Table HDU TDISP11 value 'L1' is not allowed.
5) File extensions: .q0f, .d0f
      EQUINOX value = J2000 is not a floating point number.
6) File extensions: .c0f, .c1f, .c2f, .c3f, .c4f, .c5f, .cqf, .q0f, .d0f, .d1f
      DATE-OBS date string has illegal format.
7) File extensions: .pdq, .ocx, .trl
      FITS Warning (not error) about column names containing "-" characters.

The following changes were made to bring the data into compliance with the current FITS standard. Following the order of the *fverify* issues above, our solutions to resolve each issue were:

1) For those files with a FITS BINARY/ASCII Table extension (HDU1) which contained a copy of the WCS header keywords, along with a few additional non-WCS keywords, we removed all Image-related WCS keywords. Note that the WCS keywords were also in the primary (Image) header, so they were redundant in Table extension. The following keywords were removed from the Table HDU: DATAMAX, DATAMIN, CTYPE1, CTYPE2, CRPIX1, CRPIX2, CRVAL1, CRVAL2, CD1_2, CD2_1, CD2_2, CD1_1.

2) The "Data fill area invalid" FITS error went away when we opened, fixed, and closed all the headers in all the files. The process of fixing the headers also fixed the FITS block sizes when the headers were written to disk, hence fixing this problem.

3) All non-ASCII-text characters were converted to spaces. We found three such characters throughout the log HDU extensions: unix bells, tabs and nulls. None of these are allowed in ASCII FITS Tables.

4) In some of the FITS ASCII Table HDUs, the header keyword TDISP11 value had to be reset from 'L1' to 'A1' to be FITS-compliant. The display format was for the column MIR_REVR in logical format; the logical display format (L1) is deprecated in FITS and was changed to character type format (A1).

5) The type and value of the EQUINOX keyword was changed from string to floating point, and from 'J2000' to 2000 (float), to bring it into compliance with the current FITS standard.

6) The format of the DATE-OBS keyword was changed to comply with the FITS standard. The comment regarding the DATE-OBS format was similarly updated to 'yyyy-mm-dd'.

7) We also cleaned up FITS Warning messages by deleting the "-" character from the column name: (PDQ-FILE ➔ PDQFILE; OCX-FILE ➔ OCXFILE; TRL-FILE ➔ TRAILERFILE)

Nine OCX and PDQ files in the reprocessed data set were corrupted, incomplete and not readable by FITS tools. These files were also corrupted in the STScI and CADC archives, with the exception of one, z2sr0107t.pdq.fits. We determined that all relevant values in OCX and PDQ files are also present in the CAL data headers, and therefore the PDQ and OCX contain largely redundant information that could be deleted. The following is a list of files that were subsequently removed from the reprocessed set.

z2co0407t.pdq.fits
z2co040at.pdq.fits
z2d40106x.ocx.fits
z2d4010cx.ocx.fits
z2d4010dx.ocx.fits
z2d4010ex.ocx.fits
z2d4010gx.ocx.fits
z3d5030at.pdq.fits

There were two duplicate sets of PDQ files:
      1) z0l70601r.pdq.fits & z0l70601t.pdq.fits

      2) z0l70602r.pdq.fits & z0l70602t.pdq.fits

We checked the "r" version against the "t" version headers and data content and found no differences other than those related to the file name itself. We decided to delete the "r" versions of these files.

Therefore, the <u>final processed FITS file total is **280,740**</u> (280,750 original files minus 8 incomplete PDQ/OCX datafiles, minus two duplicate "r" PDQ files). This is the Augmented Set in the table above.

We used python and shell scripts to make the changes listed above. *Fverify* was re-run after we fixed and cleaned up the data, to be sure no FITS errors remained.

We confirmed that the FITS files were backwards compatible in GEIS format by running the IRAF task 'strfits' on a number of test cases, to be sure no errors occurred. Files were randomly visually inspected in DS9 and FV. The HEASARC FITS diff tool (*fdiff*) was run on a number of test cases in order to be sure that the only differences present were those which were expected; we diff'ed the ECF versions vs our newly processed versions.

Keyword and Catalog Value Differences

The values of the FITS header keywords were compared to the existing values in the database (archive catalog). For the majority of the keywords, values matched between the headers and the database, or the differences were at the level of precision of the value or were a formatting difference. For those cases with a significant difference between the header and the database, an investigation was conducted to determine which should be used.

In the table below we list 88 keywords where a difference was seen between the FITS files and the database, the number of datasets in which each difference was seen and the source (header or database) from which the value will be taken for this ingest.

Header keyword	Number of datasets with differences	Comment
ABSHFILE	3028	Header keyword deemed correct
ADC_CORR	107	Header keyword deemed correct
BCK_CORR	54	Header keyword deemed correct
BMD_CORR	16187	Header keyword deemed correct
CCR3	95	Header keyword deemed correct
CCR5	7663	Header keyword deemed correct
CCR6	692	Header keyword deemed correct
CCR7	7569	Header keyword deemed correct
CCR8	11191	Header keyword deemed correct
CCR9	10820	Header keyword deemed correct
CCRA	13731	Header keyword deemed correct
CCRB	15264	Header keyword deemed correct

CCRC	9177	Header keyword deemed correct
CCRD	8830	Header keyword deemed correct
CCRE	16187	Header keyword deemed correct
DATE-OBS	37	Header keyword deemed correct
DECAPER1	2278	Header keyword deemed correct
DEC_V1	9668	Header keyword deemed correct
DIOFILE	190	Header keyword deemed correct
DIO_CORR	757	Header keyword deemed correct
DOPZER	37	Header keyword deemed correct
DQIFILE	1397	Header keyword deemed correct
DQI_CORR	2149	Header keyword deemed correct
ECH_CORR	5347	Header keyword deemed correct
EXPEND	36	Header keyword deemed correct
EXPSTART	37	Header keyword deemed correct
EXP_CORR	2081	Header keyword deemed correct
FLX_CORR	54	Header keyword deemed correct
GRATING	9	Use database value
GWC_CORR	8880	Header keyword deemed correct
HEL_CORR	54	Header keyword deemed correct
IAC_CORR	3737	Header keyword deemed correct
MAP_CORR	757	Header keyword deemed correct
MAXWAVE	10764	Header keyword deemed correct
MDF_CORR	1	Header keyword deemed correct
MER_CORR	124	Header keyword deemed correct
MINWAVE	10338	Header keyword deemed correct
MNF_CORR	1	Header keyword deemed correct
NETHFILE	3027	Header keyword deemed correct
OPFORMAT	1552	Use database value
PARENTID	1097	Header keyword deemed correct
PA_V3	139	Header keyword deemed correct
PHCFILE	11630	Header keyword deemed correct
PHC_CORR	6402	Header keyword deemed correct
PLY_CORR	28	Header keyword deemed correct
PPC_CORR	2081	Header keyword deemed correct
PR_INV_L	1099	Use database value
RA_APER1	2408	Header keyword deemed correct
RA_V1	9671	Header keyword deemed correct
SAAFILE	312	Header keyword deemed correct
SPEC_1	11	Use database value
SPORDER	107	Header keyword deemed correct
TARGNAME	1806	Use database value
UTC0	55	Header keyword deemed correct
VIGHFILE	7139	Header keyword deemed correct
VIG_CORR	54	Header keyword deemed correct
ZCST	7139	Header keyword deemed correct

ZDEBTF	1771	Header keyword deemed correct
ZDEBTR	1771	Header keyword deemed correct
ZDETT1	1771	Header keyword deemed correct
ZDETT2	1771	Header keyword deemed correct
ZDRT	1771	Header keyword deemed correct
ZET11	1771	Header keyword deemed correct
ZET31	1771	Header keyword deemed correct
ZFIAT	1771	Header keyword deemed correct
ZFIBT	1771	Header keyword deemed correct
ZFICT	1771	Header keyword deemed correct
ZHDC1	1771	Header keyword deemed correct
ZHDC2	1771	Header keyword deemed correct
ZHVPST1	1771	Header keyword deemed correct
ZHVSPT2	1771	Header keyword deemed correct
ZLCOEF1	757	Use database value
ZLCOEF2	757	Use database value
ZMEBT1	1771	Header keyword deemed correct
ZMEBT2	1771	Header keyword deemed correct
ZOBBT	1771	Header keyword deemed correct
ZOBT11	1771	Header keyword deemed correct
ZPABT1	1771	Header keyword deemed correct
ZPABT2	1771	Header keyword deemed correct
ZPCC1	1771	Header keyword deemed correct
ZPCC2	1771	Header keyword deemed correct
ZPCV1	1771	Header keyword deemed correct
ZPCV2	1771	Header keyword deemed correct
ZRIUTA	1771	Header keyword deemed correct
ZRIUTB	1771	Header keyword deemed correct
ZSCT1	1771	Header keyword deemed correct
ZSCT2	1771	Header keyword deemed correct
ZTST11	1771	Header keyword deemed correct

Those keywords whose values were used in calibration (all *CORR, CCR*, *TAB and *FILE keywords) and/or computed by the processing (CRVAL1, CRVAL2, MINWAVE, MAXWAVE) were deemed correct in the headers.

UTC0 reports the base value of the spacecraft clock. The value is corrected from time to time, but is not changing constantly. It is used in the calculations for all other times reported in the FITS headers, including EXPSTART and EXPEND. Most cases, 45, where the database and the headers were different are confined to December 17, 1996, with the other 10 cases occuring on 4 others dates. We could find no problem reports addressing this issue. Because the other times are in agreement and the final processing would have the full set of UTC0 updates available during the processing, we elected to update the database with the UTC0, EXPSTART and EXPEND values from the headers.

The following 7 header keywords were updated with values from the database (as indicated in the table above): GRATING, OPFORMAT, PR_INV_L, SPEC_1, TARGNAME, ZLCOEF1 and ZLCOEF2. For GRATING and SPEC_1, a short term problem in the processing caused the grating name to be truncated in the headers of a small number of datasets. OPFORMAT had trailing blanks, which were removed. The ZLCOEF1 and ZLCOEF2 differences are for PHOTOSCAN exposures, where the database has actual values while the FITS headers have defaults. The actual values were retained. The TARGNAME database values were retained as they result from a long term cleanup effort. PR_INV_L suffered from inadequate handling of common features in some last names, such as apostrophes (i.e, O'Dell). Some early workarounds, while adequate for the database, did not play well with the FITS standard. We discovered the PR_INV_L differences after our initial reprocessing pass to fix the headers; therefore, we ran an additional pass on 1009 .shf.fits. These files have a slightly different processing date and FITS COMMENT block as opposed to the initial pass. Everything is documented in the headers. See below for more details.

The FITSDATE header keyword was updated in all the files which contained this keyword; the value was updated to "**16-DEC-2013**" to reflect the fact that the FITS files were updated on this date, for all but 1009 headers. We updated 1009 .shf.fits FITS file headers with PR_INV_L corrections from the database once more in January 2014. Therefore, for those 1009 .shf.fits files, the FITSDATE is set to "**3-JAN-2014**"

The TARDESCR, TARDESCR2, TARGCAT, TARCAT2, and TARGNAME keywords hold the target description, target categories, target keywords and target name as provided in the proposal. During the first ten or so years of the mission, instructions to the proposers on how to provide this information and the code that packaged the information into keywords that were passed to OPUS (the processing system) changed a number of times. A major effort was undertaken in 2005 to update the archive catalog (database) to bring the target descriptors, target categories and target keywords into agreement with the, by then, approved method of specifying the information. Rather than repeat this work, we elected to update TARGNAME in the header with the value from the database. We removed TARDESCR, TARDESCR2, TARGCAT and TARCAT2 as keywords and placed them in a series of comments in the header. Both the values from the header and the values from the database are contained in the comments add to the shf file of each dataset. An example is show here.

```
COMMENT * ------------------------------ STScI --------------------------------
COMMENT *
COMMENT * Header keywords TARGCAT, TARGCAT2, TARDESCR, TARDESC2 have been
COMMENT * removed from the shf headers;  their values and database values
COMMENT * have been preserved in this comment block (created September 2013).
COMMENT *
COMMENT * Header (old) keyword value TARGCAT:
COMMENT * NULL
COMMENT * Header (old) keyword value TARGCAT2:
COMMENT * NULL
COMMENT * Header (old) keyword value TARDESCR:
COMMENT * NULL
```

COMMENT * Header (old) keyword value TARDESC2:
COMMENT * NULL
COMMENT *
COMMENT * Database (new) keyword value TARGCAT:
COMMENT * CALIBRATION
COMMENT * Database (new) keyword value TARGCAT2:
COMMENT * NULL
COMMENT * Database (new) keyword value TARDESCR:
COMMENT * CALIBRATION;DARK
COMMENT * Database (new) keyword value TARDESC2:
COMMENT * NULL
COMMENT *

Finally, we documented our work in the headers. The following FITS COMMENT block was added to ALL GHRS files except the 1009 headers which had PR_INV_L header fixes (note, shf file has an additional COMMENT block, which is located after the following summary block, see above):

COMMENT * ----------------------------- STScI --------------------------------
COMMENT *
COMMENT * Details on the final header updates can be found in the GHRS ISR 93.
COMMENT * (1) Headers were fixed to be FITS-compliant.
COMMENT * (2) The following header keys were updated with values from the db:
COMMENT *   GRATING, OPFORMAT, SPEC_1, TARGNAME, ZLCOEF1 and ZLCOEF2
COMMENT * (3) Many reserved WCS keywords were removed from the FITS ASCII
COMMENT *   Table extension (HDU1) because they are only allowed in IMAGE
COMMENT *   extensions.
COMMENT * (4) Non FITS compliant characters (bell, tabs, NULLs) were
COMMENT *   removed from HDU1 in ocx, pdq, trl files.
COMMENT *
COMMENT * Final updates performed at STScI in December 2013.
COMMENT * ----------------------------- STScI --------------------------------

The following FITS COMMENT block was added to 1009 GHRS files headers which had PR_INV_L header fixes:

COMMENT * ----------------------------- STScI --------------------------------
COMMENT *
COMMENT * Details on the final header updates can be found in the GHRS ISR 93.
COMMENT * (1) Headers were fixed to be FITS-compliant.
COMMENT * (2) The following header keys were updated with values from the db:
COMMENT *   GRATING, OPFORMAT, PR_INV_L, SPEC_1, TARGNAME, ZLCOEF1, ZLCOEF2.
COMMENT * (3) Many reserved WCS keywords were removed from the FITS ASCII
COMMENT *   Table extension (HDU1) because they are only allowed in IMAGE
COMMENT *   extensions.
COMMENT * (4) Non FITS compliant characters (bell, tabs, NULLs) were
COMMENT *   removed from HDU1 in ocx, pdq, trl files.
COMMENT *
COMMENT * Final updates performed at STScI in January 2014.
COMMENT * ----------------------------- STScI --------------------------------

Ingest Changes

The database was populated from datasets produced by the production pipeline, which produces a standard dataset as follows, where the PDQ and OCX extensions were manually produced. Not every dataset has an OCX and/or PDQ.

z2co0408c_ocx.fits z2co0408t_c3f.fits z2co0408t_pdq.fits z2co0408t_ulf.fits
z2co0408t_c0f.fits z2co0408t_c4f.fits z2co0408t_q0f.fits z2co0408t_x0f.fits
z2co0408t_c1f.fits z2co0408t_cqf.fits z2co0408t_shf.fits z2co0408t_xqf.fits
z2co0408t_c2f.fits z2co0408t_d0f.fits z2co0408t_trl.fits

The final reprocessed datasets were produced using a standalone version of calhrs, the GHRS calibration software.

When data are ingested, the database (archive catalog) is populated by placing the value of the headers keywords into specific tables. Because each dataset consists of a number of files, and some keywords may appear in the headers of more than one of these files, there is a defined order that indicates which file should be the source of the keyword value. The ingest software starts with the first file in the order, if the keyword is found, that value is placed in the database. If the keyword is not found, the next file is opened, and so on. The order of the files is fixed and the value in the database comes from the first instance of the keyword in the ordering.

For pipeline processing the order was c0f, c1f, d0f, shf.

Acknowledgements

References

Kamp, I., Durand, D. and Micol, A. 2006, Instrument Science Report GHRS-92, "Final reprocessing of GHRS data."

Appendix

The following two examples list typical FITS verify errors as discussed in Section 2.

1) Example w.r.t. issues: EQUINOX non-floating point number, DATE-OBS illegal format, WCS Image keys not allowed in Table HDU, Data fill area invalid)

File: z06a0101r.d0f.fits

2 Header-Data Units in this file.

=================== HDU 1: Primary Array ===================

*** Error: Keyword #223, DATE-OBS: (from CFITSIO error stack:)
        input date string has illegal format (ffs2dt):
         9/05/90

*** Error: Keyword #217, EQUINOX: value = J2000 is not a floating point
        number. The value is entered as a string.

 270 header keywords

 32-bit floating point pixels, 2 axes (500 x 3),

=================== HDU 2: ASCII Table ===================

*** Error: Keyword #27, DATAMAX is not allowed in the Bin/ASCII table.
*** Error: Keyword #23, DATAMIN is not allowed in the Bin/ASCII table.
*** Error: Keyword #51, CTYPE1 is not allowed in the Bin/ASCII table.
*** Error: Keyword #15, CRPIX1 is not allowed in the Bin/ASCII table.
*** Error: Keyword #11, CRVAL1 is not allowed in the Bin/ASCII table.
*** Error: Keyword #19, CD1_1 is not allowed in the Bin/ASCII table.
*** Error: checking data fill: Data fill area invalid

 110 header keywords

 Z06A0101R.D0H.TAB (25 columns x 3 rows)

Col#	Name (Units)	Format
1	CRVAL1	D25.16
2	CRPIX1	E15.7
3	CD1_1	E15.7
4	DATAMIN	E15.7
5	DATAMAX	E15.7
6	RA_APER	D25.16
7	DEC_APER	D25.16
8	FILLCNT	I11
9	ERRCNT	I11
10	PKTTIME	D25.16
11	CTYPE1	A8
12	OBSRPT	I11
13	OBSINT	I11
14	YDEF	I11
15	XDEF	I11

```
16 SAMPLE          E15.7
17 DELTAS          E15.7
18 LINE          E15.7
19 EXPOSURE          E15.7
20 BINID          I11
21 CARPOS          I11
22 ZSCOEF1          E15.7
23 ZSCOEF2          E15.7
24 ZSCOEF3          E15.7
25 ZSCOEF4          E15.7
```

+++++++++++++++++++++ Error Summary +++++++++++++++++++++

```
 HDU#  Name (version)     Type          Warnings  Errors
1                  Primary Array   0      2
 2    Z06A0101R.D0H.TAB   ASCII Table    0      7
```

**** Verification found 0 warning(s) and 9 error(s). ****

///
///

2) Example w.r.t. issue: TDISP11 logical 'L1' display format not allowed.

File: z2dn0102t.d0f.fits

2 Header-Data Units in this file.

==================== HDU 2: ASCII Table ====================

*** Error: Keyword #75, TDISP11: Format L1 cannot be used for TFORM "A1".

///
///

3) Example w.r.t. issue: Warning regarding column names with '-' character, non-ASCII-text characters.

File: z06f0102c.ocx.fits

2 Header-Data Units in this file.

=================== HDU 1: Primary Array ===================

 11 header keywords

 Null data array; NAXIS = 0

=================== HDU 2: ASCII Table ===================

*** Warning: Column #1: Name "OCX-FILE" contains character '-' other than
        letters, digits, and "_".
*** Error: row 24 data contains non-ASCII-text characters.
*** Error: This ASCII table contains 1 non-ASCII-text characters
*** Error: String in row #24, column #1 contains non-ASCII text.
        (Other rows may have errors).

 13 header keywords

 z06f0102c.ocx (1 columns x 52 rows)

 Col# Name (Units)   Format
   1 OCX-FILE   A132

++++++++++++++++++++ Error Summary ++++++++++++++++++++

 HDU# Name (version)   Type   Warnings Errors
 1   Primary Array   0   0
 2   z06f0102c.ocx   ASCII Table   1   3

**** Verification found 1 warning(s) and 3 error(s). ****

///
///

4) Specific error for 8 incomplete PDQ/OCX files:

archdevvm1> fverify z2sr0107t.pdq.fits

           FVERIFY V4.0.0 (CFITSIO V3.250)

HEASARC conventions are being checked.
File: z2sr0107t.pdq.fits
*** Error: (from CFITSIO error stack:)
        ffopen could not interpret primary array header of file:
        z2sr0107t.pdq.fits
**** Abort Verification: Fatal Error. ****