IUE Image Processing News

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The IUE Image Processing Center (IPC) has become a busy place, with the group supporting not only the standard IUESIPS processing but also activities in support of the IUE Final Archive. Our last news note detailed several IUESIPS issues (Imhoff and Meylan 1991). Here we also discuss progress on the creation of the IUE Final Catalogue and the IUE Final Archive.

1. Reprocessing Old IUE Images with Missing THDAs

In order to process IUE images properly, the THDAs (camera head amplifier temperatures) at end of the exposure and at the time the image was read are necessary. The current implementation of IUESIPS contains modules which extract this information from the "camera snapshot" portion of the IUE VICAR label. The temperatures are then used in geometric correction routines which help to assure that the image is properly photometrically calibrated and in the assignment of wavelengths.

For IUE data read down at NASA and VILSPA prior to June 7, 1979, the needed data were not transcribed correctly to the binary part of the image header. Consequently, images taken prior to this date do not have easily accessible THDAs to extract for processing. This condition also occurs when a corrupt image is recovered through a history replay, and the label cannot be restored.

When IUESIPS encounters a label without a THDA, the software substitutes a default THDA which amounts roughly to an average THDA over a long period of the spacecraft's life. However, this THDA may be very different from the correct value for that image and various calibrations will be improperly applied. The most noticeable of these is that the wavelength calibration may appear to drift. There are also effects on the photometric corrections, but these are not as extreme. The software, until recently, did not flag the missing THDA, so it was not possible for the Image Processing Center (IPC) to "catch" and correct such images.

Efforts to recover all necessary Core Data Items (CDIs) for NEWSIPS processing of the IUE Final Archive have made available a record of the THDAs for virtually the entire life of the spacecraft. While there are some gaps in this record, it is possible to determine, to a precision better than the current average values, the correct temperature to achieve the best processing.

This will have an effect on all images acquired before June 1979. Therefore, persons

requesting the reprocessing of such archival data should take note. You may wish to request that we reprocess the data with the correct THDAs, since there may be some calibration errors introduced to the outputs derived from images whose labels do not contain the required data.

We currently have an off-line method of providing the correct THDA to IUESIPS for accurate processing. Modifications have been made to the VAX IUESIPS software so that if a THDA is not available from the header, the operator can provide one.

If you would like your IUE data reprocessed with corrected THDAs, please notify us in your reprocessing request. If only a few images are involved, these can be handled without difficulty. If a large number of images are to be corrected, it will be handled as a special request subject to IUE Project approval because of the labor-intensive effort involved.

2. Updated Wavelength Calibration

The new wavelength calibration based described by Garhart (1991) has unfortunately not yet been implemented into IUESIPS. This delay is due to technical problems in implementing it into the VILSPA Telefile IUESIPS system (the Telefile is "clone" of the older Sigma computer and runs on the same ancient operating system). The IUE Project decided to delay implementation until both GSFC and VILSPA could update the wavelength calibration, to avoid causing confusion due to wavelength shifts between data processed at the two stations.

The good news is that VILSPA is working on moving their IUESIPS system to a VAX system similar to Goddard's. Once this is accomplished, we should be able to finally update the wavelength calibration. In the process of moving the software, VILSPA also found a bug in the calculation of the observing time in the VAX IUESIPS software. This bug has been fixed.

Because of the delay, there is a small wavelength error which has crept into data obtained since 1988. A correction can be easily applied by using the differences in the dispersion coefficients. This is available through the RDAF routine DCCOR. The technique is described by Thompson (1988) for the *previous* wavelength calibration update.

3. Corrections to the IUE Data Base and Catalog

In preparation for the Final Archive, the IUE Observatory is correcting and verifying the data base entries for each image in the IUE archives. New fields in the data base will provide additional information that should be helpful to the researcher.

The planned catalog and data base are described by Levay (1990).

A system, known as the Core Data Item Verification System (CDIVS), has been designed to facilitate the creation of the new data base. It runs on a DECstation using the Ingres relational data base and Fortran. The CDIVS permits an operator to inspect the contents of the data base and compare them to the original observing script and to information extracted from the raw image header. The operator makes corrections, adds entries, and flags any unresolved questions for further investigation. The system is being used to correct archival data entries and to record new observation entries.

At this time, nearly all of the Goddard low dispersion images have been verified for the time period 1978 through 1989. Verifications of later data and high dispersion data will begin later this spring. VILSPA is performing verifications of all VILSPA images. The updated information will be exchanged between the two IUE Observatories.

The corrected information is being incorporated by the RDAF into their data base and search routines. Since the CDIVS work is still in progress, the status of the verification each image is flagged (U = unverified, Q = verified with questions, V = verified). Users of the new data base may wish to check the status of the verification before relying on the entries.

If you are aware of an error in the IUE Merged Log or data base, please let us know. We will investigate it and correct it. Please send your corrections to Rick Wasatonic, who is overseeing the verification effort. He can be contacted at IUEGTC::WASATONIC (wasatonic@iuegtc.dnet.nasa.gov; telephone 301-794-1478).

4. Updated Format of Record Zero

There have been several small changes to the scale factor record, known as "Record Zero", in the IUESIPS data files over the past several years. Since the IUE Image Processing Information Manual (Version 2.0) was published in 1984, there have been changes to accomodate the extended line-by-line file (Munoz Peiro 1985), calculation of Julian Dates and heliocentric time corrections (Gass 1986), and the high dispersion absolute calibration (Martin 1990). Table I gives the updated description of Record Zero which incorporates all these changes.

5. NEWSIPS Update

The IPC began processing NEWSIPS data for SWP low dispersion images for the

IUE Final Archive on April 16, 1992. The initial system did not include the spectral extraction, absolute calibration, and generation of FITS output files, so the data were partially processed through the geometric correction and then archived to 4mm DAT tape. Since then, several outstanding issues concerning the signal-weighted extraction, the absolute calibration, and FITS formats have been resolved. At the time of writing, the complete software package is being delivered and tested. Production processing should resume near the beginning of April.

NASA and VILSPA plan to reprocess their respective data sets with the Final Archive software at the same time. Initially we will process the SWP low dispersion data from 1978 to 1990. Once that is successfully completed (near the end of 1993), the data will be released to the astronomical community. In the US, the data will be made available through the NSSDC's NDADS system. Next we will reprocess the long wavelength camera data sets; once each one is completed it will be released to the community.

The developers of the Final Archive system are working on the documentation for users. In addition, the RDAF is upgrading their software to handle the new FITS files. Further details will soon become available.

6. Staff Changes

Tom Meylan has taken on the position of Section Manager for the RDAF and IUE ADS, replacing Nancy Oliversen. Tom has been the IUE Resident Astronomer for Image Processing and the IPC task leader for almost 3 years. Rick Wasatonic has been named the new IPC task leader. Cathy Imhoff continues as Section Manager for the IPC.

If you have any questions or requests, please contact Cathy (IUEGTC::IMHOFF or imhoff@iuegtc.dnet.nasa.gov; telephone 301-794-1470).

References

Garhart, M. P. 1991, *NASA IUE Newsletter*, No. 46, pg. 31.

Gass, J. 1986, *NASA IUE Newsletter*, No. 31, pg. 81.

Imhoff, C. L., and Meylan, T. R. 1991, *NASA IUE Newsletter*, No. 46, pg. 1.

Levay, K. 1990, *NASA IUE Newsletter*, No. 42, pg. 40.

Martin, T. 1990, *NASA IUE Newsletter*, No. 41, pg 147.

Munoz Peiro, J. R. 1985, *NASA IUE Newsletter*, No. 27, pg. 27.

Thompson, R. W. 1988, *NASA IUE Newsletter*, No. 35, 133.

Table I.
Format of Scale Factor Record
(Record Sequence Number Zero)

Item (16-bit halfword)		Quantity
1		Zero (for record 0)
2		1022 (Maximum number of halfword entries in remainder of record 0)
3		Minimum wavelength (truncated to nearest A)
4		Maximum wavelength (rounded to nearest A)
5		Number of orders present
6		Camera number
7		Image number
8		Number of records per group (i.e. per order)
9		Year
10		Day Number of midpoint of
11		Hour observation (GMT)
12		Min
13-16		As 9-12 for time of image processing (GMT)
17		Target aperture (1 = large, 2 = small)
18		Total line shift (pixels * 1000)
19		Total sample shift (pixels * 1000)
20	***	THDA (* 10) used for reseau correction (normally at the time of read)
21		Scaled minimum flux for Gross
22		Scaled maximum flux for Gross
23		J for Gross where actual FN = data on
24		K for Gross tape * J * 2**(-K)
25-28		as in 21-24 for Background
29-32		as in 21-24 for Net
33-36		as in 21-24 for Absolute Net (Low) or Ripple Corrected Net (High)
37	*	"Plate scale" factor for ELBL file (= 1078) (arcseconds * 1000)
38		Julian Date - 2440000 at midpoint of observation
39		Fraction of Julian Date (* 10000) at midpoint of observation
40		Heliocentric correction to Julian Date (* 10000),

		where JD(helio) = item(38) + [item(39) + item(40)]/10000 + 240000.
41		Spare
42-44	NI	Minutes, seconds, milliseconds of exposure in target aperture (not implemented)
45		Hours
46		Minutes — Right ascension of target
47		Seconds (* 10)
48		Degrees
49		Arcminutes — Declination of target
50		Arcseconds
51-53	**	Vx (earth), Vy (earth), Vz (earth) Velocity of earth in celestial coordinates (km/sec * 10)
54-56	**	Vx (IUE), Vy (IUE), Vz (IUE) - same as 51-53 for IUE with respect to earth, at midpoint of exposure
57	**	Net velocity correction applied (km/sec * 10)
58		Omega angle (degrees * 10) (zero for high dispersion)
59		Wavelength scaling factor (5 for low dispersion, 500 for high dispersion) where actual lambda = (lambda on tape)/(scale factor) + lambda(0)
60	*	Background slit height - low dispersion (pixels * 100)
61	*	Background distance from dispersion line - low dispersion (pixels * 100)
62		Dispersion constant ("registration") shift mode (0 = no shift, 1 = auto shift, 2 = manual shift)
63	NI	Bright spot removal threshold DN (not implemented)
64		THDA (* 10) for dispersion constant correction (normally at the time of the end of exposure)
65	**	Scaled minimum flux for ABNET
66	**	Scaled maximum flux for ABNET
67	**	J for ABNET — where actual ABNET = data on
68	**	K for ABNET — tape * J * 2**(-K)
69-70		Spares
71-102		Reserved for use by IUE Regional Data Analysis Facility
103-202		lambda zero, offset wavelengths for each order
203-302		m, order number for each order
303-402		Number of extracted data points for each order
403-502		Slit height for each extracted order (pixels * 100) (only entries 303, 403 used for ELBL)
503		Sign and first 4 digits after decimal of dispersion constant A1

504	Sign and second set of 4 digits after decimal of dispersion constant A1
505	Sign and third 4 digits after decimal of dispersion constant A1
506	Exponent (including sign) of dispersion constant A1 where: A1 = [item(503) * 10**-4 + item(504)* 10**-8 + item(505) * 10**-12] * 10**(item(506)]
507-538	As above, for dispersion constants A2 through A9
539-574	As above, for dispersion constants B1 through B9
575-1024	Spares

*	Low dispersion only
**	High dispersion only
***	Currently implemented only for SWP, not used to correct reseau positions for the LWR or LWP cameras
NI	Not implemented