IUE esa

NEWSLETTER

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IUE ESA Newsletter:

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OBSERVATORY CONTROLLER MESSAGE

At its last meeting of June 21st the ESA Science Programme Committee has unanimously approved the continuation of IUE operations during 1984. Indeed IUE is still performing very satisfactorily and a recent analysis of the natural decrease of the power output from the solar panels indicates that in mid '86 the satellite will still be able to operate between 140 and 80 degrees from the Sun. Moreover, the new operating software which makes use of the Fine Sun Sensor and of only two gyroscopes for attitude determination, is now completed and will be installed in the unfortunate eventuality of a further gyro's failure.

Last May EXOSAT was launched successfully: its check out and calibration phase is already completed and normal observation just started. As a consequence we have scheduled, starting in August, the IUE programmes which require coordinated EXOSAT observations. The whole schedule had to be rearranged and we apologize for any inconvenience we may have caused. I am confident everybody will agree that the unique opportunity of simultaneous X-ray and UV observations deserves special attention.

The call for proposals for the 7th round of IUE observations has been already issued and it is repeated here (page 4). Please note the deadline of October 28th: proposals not at VILSPA by that date <u>will</u> <u>not</u> be accepted for the seventh round. We include in this issue the microfiches containing the Merged Log of Observations covering the period April 78 - March 83. We recommend a careful consultation of the Log for the preparation of new proposals, because the Allocation Committee is very keen in avoiding unnecessary duplication of observations. On the same subject we are pleased to announce a new service aimed to provide customer tailored excerpts of the Merged Log (see page 9).

The Observatory Staff keeps changing: at the end of September we will say farewell to Carla Cacciari, who moves to the ST Science Institute in Baltimore. We ought to thank her for the important contributions she provided in running the Observatory, and we all whish her the best success in her new activity. Cecile Gry, a french astronomer from Verrieres-le-Buisson, has taken up duty as Resident Astronomer last April and two more R.A.s are expected at VILSPA the 1st of September: Barbara Hassall from Cambridge, UK, and Roberto Gilmozzi, from Frascati, Italy. With their arrival the IUE Observatory will be back at its normal staffing level.

NEW PERSONAL AT VILSPA

In May this year Cecile Gry has joined the astronomical staff at VILSPA as Resident Astronomer. Cecile is French and 26 years old. She studied Astronomy and Mathematics at the University of Paris, Orsay. Her Doctorate was based on studies done at the Laboratoire de Physique Stellaire et Planetaire in Verrieres. Her research has been concerned with the Analysis of Copernicus data. The main subject of her thesis was related to Stellar Winds which she found puffing. Strange as it sounds, the results had implications for big-bang and galactic evolution models. She confesses that she does spend her free time in an enjoyable way.

<u>DEPARTURES</u>

C. Blades - 30/11/1982

C. Cacciari - 30/09/1983

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PROPOSALS FOR OBSERVATIONS WITH IUE IN 1984

Dear Colleague

The International Ultraviolet Explorer (IUE) spacecraft is currently operating very successfully and continues to provide valuable UV spectroscopic data in the 1200 to 3000 Å wavelength region. Such data are obtained on a routine basis, 8 hours per day at the ESA Villafranca IUE Observatory and 16 hours per day at the NASA IUE Observatory at Goddard in Maryland. The observing programmes carried out have been those recommended by the relevant European and US selection committees.

The present observing programmes extend to April 1984. Thereafter an additional year of observations will be initiated. In preparation for this, the European Selection Committee (a single committee which has replaced the separate ESA and SERC Selection Committees) will meet later this year to review those observing proposals which have been received by October 28, 1983. The recommendations of this committee will be the basis for the one year European observing programme starting April 1984.

We therefore invite European astronomers to submit proposals for IUE observations in accordance with the procedures set out in the attached papers.

Yours sincerely

Professor R J Bonnet
Director of Scientific Programmes
European Space Agency

Dr B Martin
Head of Astronomy, Space and Radio Division
UK Science and Engineering Research Council

esa

serc

Dear Colleague

As previous users know, the International Ultraviolet Explorer (IUE) is an astronomical satellite designed to obtain ultraviolet spectra in the region from about 1200 to 3000 Angstroms. Its characteristics and performance have been described by Boggess, et al. in Nature, volume 275, pages 372 and 377, 1978. The satellite was built jointly by NASA, ESA and SERC and is operated 16 hours each day by NASA from a control center at the Goddard Space Flight Center and eight hours each day for ESA and SERC observers from the ESA control center at Villafranca.

The observing program for IUE is based on unsolicited proposals for use of the satellite. Proposals may be submitted at any time but, as a matter of practice, those in hand by 28 October 1983 will be reviewed in order to establish the year's observing program starting the following April. While proposals of a genuine emergency nature may be dealt with more promptly, other proposals received too late will be saved for subsequent review the following year. Applications are accepted both from observers proposing new programs and from current IUE observers who wish to apply for more time than they have currently been allotted.

Normally, the observer is expected to be present at either the Goddard or Villafranca control center. Observing procedures are flexible and adaptable to individual needs, the observer being able to direct his own program, monitor it in real time, and alter it if necessary to enhance its scientific value. Responsibility for actual operation of the spacecraft, however, lies with a trained operations staff. Scientists from all countries may apply to use the IUE. Those interested in observing with this facility should send a letter requesting current proposal instructions to the most appropriate one of the following addresses:

The Operations Scientist
Code 685
Goddard Space Flight Center
Greenbelt, MD 20771
USA

IUE Observatory Controller
ESA Villafranca Satellite
Tracking Station
Apartado 54065
Madrid, SPAIN

Note: SERC and ESA have agreed to combine their allocating procedures with the administrative aspects handled by ESA.

Responders will receive additional information regarding the satellite operations and proposal submission procedures for the seventh observing episode.

Sincerely,

Yoji Kondo	Piero Benvenuti	Robert Wilson
NASA/IUE Project Scientist	ESA/IUE Observatory Controller	SERC/IUE Project Director

ISTITUTO ASTROFISICA SPAZIALE
Cas. Post. 67 - 00044 FRASCATI (ITALIA)
Tel. (06) 9425651/52/53/54/55

TELEGRAFO ASTRO - FRASCATI
TELEX CNR FRA 68 04 89

FOURTH EUROPEAN IUE CONFERENCE

Roma, 15-19 May 1984

Dear Collegue:

We would like to inform you that the Istituto Astrofisica Spaziale, Frascati, is organizing the Fourth **European IUE Conference** in Roma, Italy, from May 15th to 19th, 1984. The Conference is cosponsored by the European **Space Agency** and the **Consiglio Nazionale** delle Ricerche.

The Conference is aimed to emphasize the inpact of **IUE** Observations on different astrophysical problems, and on the perspectives of the UV Astronomy. Reviews on major results from **IUE** data are welcome. Poster Sessions will also be available. All the papers will be included in the Conference Proceedings to be published by **ESA**.

Please fill in the enclosed form, and return it not later than **November 15th, 1983**, to:

IUE Conference
Istituto Astrofisica Spaziale
Casella Postale 67
I 00044 Frascati, Italy

Further details about accomodation and the Conference Program will be given in the Second Announcement. For any questions, write to the LOC at the IAS, Frascati.

The Local Organizing Committee:

A. Altamore
V. Caloi
A. Cassatella
F. Giovannelli
R. Viotti (chairman)

Frascati, 1 August 1983

FOURTH EUROPEAN IUE CONFERENCE

Roma, 15-19 May 1984

REGISTRATION FORM

Deadline: November 15th, 1983

NAME (capital letters) : ....

AFFILIATION : ....

FULL POSTAL ADDRESS : ....

....

....

I intend to participate to the Conference : YES

YES POSSIBLY

NO

I intend to present a contributed paper : YES

NO

I would prefer : Oral presentation

Poster presentation

Title of paper : ....

....

Authors : ....

Deadline for submission of titles : November 15th, 1983.

Please fill in and return to:

IUE Conference
Istituto Astrofisica Spaziale
Casella Postale 67
I 00044 Frascati, Italy

NEW SERVICE FROM VILSPA: EXCERPTS FROM THE IUE MERGED LOG

As has been announced in a previous ESA IUE Newsletter (#15, page 52), a computerized interrogation facility (ADABAS) for the IUE Merged Log has been, on a trial basis, in operation at VILSPA. On-station operations have now entered a routine stage and the use of ADABAS has been judged favourably by those Guest Observers who have had the chance to operate it. A thorough study of the Merged Log can have significant impact on the actual observing program of a G.O.. Even though the observation preparation time usually is long enough to solve most problems arising, it occurs at times that a closer look at the Merged Log results in surprises, seriously affecting the Observing.

To avoid such situtations and also to make the information contained in the Merged Log more accessible to IUE users specifically and the Astronomical Community in general, we will start <u>on a trial basis</u> a new service. This consist in opening up the possibility for Astronomers to request from the ESA IUE Observatory, directed searches through the IUE Merged Log. The way in which such searches should be chosen is explained extensively in ESA IUE Newsletter #15, page 52-58.

The results of the requested searches will be returned by mail in the form of a computer printout.

A few items worthwhile to keep in mind are the following:

1) Requests should be formulated such that a directed search can really be done e.g.:

   "I would like all information on IUE spectra taken of α Lyrae in High resolution through the small aperture".

   (see also list of available search words in appendix).

2) If a request is made for information on a specific object, the 1950 coordinates of this object should be incorporated in the request.

3) Requests resulting in a too large number of log items will not be considered. At present no absolute maximum has been set. However a request for e.g. all

spectra of interacting binaries will definetely not be considered.
If anyone would like to study the Merged Log ordered by class rather than by R.A. and DEC. (see enclosed Microfiche) a Microfiche containing the complete Merged Log, ordered by class, can be obtained through the SERC. Requests for this should be directed to the UK Resident Astronomer at VILSPA, Dr. A.W. Harris.

4) We would like to stress that the here announced service is, at present, available on a trial basis. We will however do our best to fullfill all reasonable requests on a rapid turnover basis.

We hope that this procedure will facilitate access to the Merged Log and the IUE Database for the Astronomical community. Anybody interested in requesting a directed search through the IUE Merged Log should send his request <u>in writing</u> to the R.A. in charge of the Database, Dr. A. Cassatella at VILSPA.

APPENDIX

TABLE OF SEARCH WORDS FOR ADABAS

Date of Observation

Camera

Image Number

Apertures

Dispersion

Observing Station

Processing Date

Program Identification

Exposure time in Large Aperture

Exposure time in Small Aperture

Object Class

Right Ascension

Declination

REVISION OF THE ABSOLUTE CALIBRATION OF THE LWP CAMERA IN LOW DISPERSION

A provisional absolute calibration curve for the LWP camera in low dispersion, together with a brief description of the procedure used to derive it, has been presented in previous IUE Newsletters (ESA IUE Newsletter No. 15, November 1982, p. 38 and NASA IUE Newsletter No. 21, May 1983, p. 62). It should be noted, however, that this curve suffers from inaccuracies at the extreme short and long wavelength ends due to the use of some truncated spectra in its derivation. The calibration has since been completely revised, using the same procedure, and the new curve is given here with a table of S_λ^{-1} values binned at 50 A intervals.

In the range 1950-3150 A inclusive the S_λ^{-1} values are almost unchanged. The few per cent differences that do occur are due to binning at 50 A intervals instead of at 25 A and the use of 4 more standard-star spectra in the later derivation. Outside this range the differences reflect the improvements obtained in the revised calibration. The 3350 A value is a linear extrapolation from the 3250 and 3300 A points.

A detailed account of the calibration procedure is in preparation for publication elsewhere. The revised version presented here will be installed in IUESIPS at VILSPA shortly.

A. Cassatella
A.W. Harris

CALIBRATION FOR THE LONG WAVELENGTH PRIME CAMERA (LWP) IN LOW RESOLUTION

λ (A)	S_λ^{-1} *
1850	16.24
1900	6.19
1950	3.11
2000	2.42
2050	2.04
2100	1.98
2150	2.00
2200	1.98
2250	1.80
2300	1.50
2350	1.27
2400	1.04
2450	.879
2500	.741
2550	.630
2600	.578
2650	.514
2700	.503
2750	.502
2800	.502
2850	.552
2900	.566
2950	.652
3000	.795
3050	1.08
3100	1.48
3150	2.17
3200	3.35
3250	5.72
3300	10.59
3350	15.46**

** extrapolated value

* The units for S_λ^{-1} are: 10^{-14} ergs cm^{-2} A^{-1} FN^{-1}

IUE DATA REDUCTION

XXX. Implementation of New Dispersion Constants

Introduction

On September 21, 1982, (GMT 264:17:20) updated dispersion constants were implemented in production processing at GSFC for the LWR, SWP, and LWP cameras. These calibration files replace those originally implemented for the LWR and SWP cameras on March 3, 1981 in low dispersion and on April 30, 1981 in high dispersion. These original files, and their time/temperature corrections which were implemented on March 3, 1981 for low dispersion and on May 19, 1981, for high dispersion, were described in IUE Data Reduction Memo XXI*(NASA IUE Newsletter No. 15). The previously implemented LWP dispersion constant files first used on August 17, 1981 were generated using only a single wavelength calibration image and were not documented in a NASA IUE Newsletter report. An evaluation of the new calibration files is described below.

Long Wavelength Prime Camera (LWP)

As shown in Table 1 the updated LWP dispersion constants represent the mean of dispersion constants generated from 14 wavelength calibration images obtained between June 17, 1980 and August 17, 1982. The actual coefficients are shown in Table 3 in the same format used in IUE Data Reduction Memo XXI. These terms define the sample (S) and line (L) position of a given wavelength (λ, in Å) and order (m) using the following formulae for the high dispersion case:

$$S = a_1 + a_2 m\lambda + a_3 (m\lambda)^2 + a_4 m + a_5 \lambda + a_6 m^2 \lambda + a_7 m\lambda^2 \quad (1)$$

$$L = b_1 + b_2 m\lambda + b_3 (m\lambda)^2 + b_4 m + b_5 \lambda + b_6 m^2 \lambda + b_7 m\lambda^2 \quad (2)$$

In low dispersion ($m = 1$), only the first two terms are used. The differences in the predicted positions of the low and high dispersion Pt-Ne emission lines using the old and new dispersion relations are shown in Figures 1.1 and 1.2 respectively. In these figures the diamond symbols represent the positions predicted using the old dispersion constants. The scaled vectors represent the displacements to the positions predicted using the new dispersion constants. The large (2-pixel) displacement presumably

* Forthcoming in ESA IUE Newsletter # 18

reflects the large difference in time and mean temperature between the two dispersion relations. (The old dispersion constants file represents the earliest dispersion constants used in generating the new means and was obtained at the lowest recorded temperature).

An analysis of the 14 LWP dispersion constant files was made to determine whether shifts in the spectral format (with respect to the grid of reseaux) were correlated with time and/or variations in the LWP head amplifier temperature (THDA). Although the data in Table 2 show that a correction for time and THDA could result in a reduction in the scatter of the predicted emission-line positions, it was decided that there were insufficient data available to warrant its implementation. This decision was also influenced by the large temperature variations observed during the acquisition of the LWP calibration images which would tend to make the temperature correlations less reliable. Therefore, until more images are available for analysis, the implemented LWP mean dispersion constants will not be corrected for time and temperature.

In addition to the studies described above, tests were made to verify that the new dispersion files were appropriate (i.e., improved the wavelength assignments) for recently obtained images. The evaluation was based on running the wavelength calibration processing schemes on recent Pt-Ne calibration images using both old and new dispersion constant files for the "preliminary dispersion relation". As described in the IUE Image Processing Information Manual (CSC/TM-79/6301 and CSC/TM-81/6268), the preliminary dispersion relation is used to initiate the cross-correlation search used for locating each of the Pt-Ne lines listed in the current IUE line library. The results showed that for every emission line the new dispersion constants resulted in initial search locations closer to the actually found line positions than those determined using the old dispersion constants. It was concluded that the new LWP dispersion relation more accurately describes the location of the LWP spectral format for recently obtained IUE images.

Long Wavelength Redundant Camera (LWR)

Tables 1-3 and Figures 2.1 and 2.2 show the same data for the LWR camera as described above for LWP. In addition, Table 3 contains the updated temperature and time correlation coefficients. As explained in Memo XXI, the corrected dispersion constants are the means plus a value

W where W(S) and W(L) are the corrections to equations 1 and 2 respectively, such that

$$W = W_1 + W_2T + W_3t \qquad (3)$$

where

T = head amplifier temperature (THDA, in C°) and
t = number of days since January 1, 1978.

A comparison of the correlation coefficients in Table 3 with those in Table 6 of Memo XXI shows that although the temperature dependence remains nearly unchanged, the time dependence has decreased. This can also be seen in Figures 2.3-2.4 which show the low and high dispersion LWR spectral format shifts along and perpendicular to the dispersion after correction for temperature, as a function of time. The straight lines shown are the result of a least squares fit to the points marked with a "+" symbol and represent the updated time dependence. Note that if the earlier points were used rather than the later ones, the time dependence would be described by a different line. The reason for this change is unknown; however, it is the main justification for updating the dispersion constants and the temperature and time correlations. It should also be pointed out that the feature evident between days 1300 and 1450 is considered an anomaly and cannot be explained. Images taken during this period were found consistently to contain larger-than-expected (i.e., 3 σ) errors in their wavelength assignments.

The wavelength calibration tests described above for the LWP camera were also performed for the LWR and (see below) SWP camera with the additional step that the temperature and time corrections appropriate for the wavelength calibration image were applied prior to determining the initial search positions. The results for LWR showed that not only were the temperature and time corrections (that were applied to the means) smaller using the new dispersion constants and correlation coefficients but, as for LWP, the initial search positions were closer to the actually found Pt-Ne line positions. The smaller temperature and time corrections using the new means were to be expected since the mean time for these dispersion constants was closer to the time of acquisition of the calibration images. The improved starting search positions signify that the variation in the time dependence warranted updating the dispersion relation.

Short Wavelength Prime Camera (SWP)

As for LWR, Tables 1-3 and Figures 3.1-3.4 describe the new SWP mean dispersion constants and correlation coefficients. A comparison of the correlation coefficients in Table 3 with those given in Table 6 of Memo XXI suggest small changes have occurred in the time and temperature dependence although the significance of these changes is not clear. The reason for this is that although Figures 3.3-3.4 would suggest that the new means and correlation coefficients better describe the location of the spectral format for recent images, the wavelength calibration tests performed as described for LWR showed little difference between the old and new dispersion relations (the temperature and time corrections, however, were smaller, as expected, using the new means). We conclude that, except for the mean time, the new SWP dispersion constants are basically equivalent to the old.

Header Label Information

The time period of images used to define the mean dispersion constants, the number of images used in the evaluation, and the residual 1 σ scatter in the line and sample direction (all of which are contained in the label line beginning "MEAN DC") have been modified to describe the newly implemented dispersion relations. It should be noted that the sigmas in the header label describe the residual scatter after time and temperature regardless of whether a correction was applied to the particular image. Therefore, if the phrase "MEAN DC USED" appears in the line describing the THDA for spectrum motion, the sigmas pertinent to the dispersion constants used would be those listed in Table 2 under the heading "no correction".

Conclusion

As described above, the new dispersion constant files implemented on September 21, 1982 show definite improvements in describing the location of the spectral format for the LWP and LWR cameras. Although the tests for the SWP camera were less conclusive, the new relations are at least as good as the previously implemented dispersion relations in describing the spectral format. Guest Observers can determine that their images were processed with the new dispersion relations from the processing date or the dispersion constant information added to the image header label as described in Memo XXI.

R.W. Thompson
B.E. Turnrose

Table 1

Dispersion Constant Statistics

	LWP		LWR		SWP	
	low	high	low	high	low	high
# Disp. Cnsts.	14	14	46	47	44	45
mean time	3/4/82	3/4/82	4/1/81	3/26/81	4/2/81	3/27/81
start	6/17/80	6/17/80	1/1/80	1/1/80	1/1/80	1/1/80
end	8/17/82	8/17/82	8/10/82	8/10/82	8/10/82	8/10/82
mean THDA(C°)	8.3	9.0	13.45	13.50	8.78	8.82
lowest	6.2	6.8	9.2	9.5	5.1	5.1
highest	10.5	11.2	18.3	18.3	13.2	12.8
slope ($^{DL}/_{DS}$)	-.8603	1.20*	.7464	-1.38*	-.8066	1.28*

*m=100

Table 2

Error (1σ in Pixels) for Corrections to the Mean Dispersion Constants

Dispersion Direction	No Correction	THDA and Time
SWP high		
parallel	.69	.25
perpendicular	.35	.15
SWP low		
parallel	.45	.20
perpendicular	.61	.32
LWR high		
parallel	1.39	.37
perpendicular	.29	.20
LWR low		
parallel	.34	.23
perpendicular	1.37	.36
LWP high		
parallel	.90	.51
perpendicular	.43	.18
LWP low		
parallel	.50	.31
perpendicular	.85	.53

Table 3

Updated Coefficients Defining the Dispersion Relations

for the Small Aperture

	SWP High	SWP Low	LWR High	LWR Low	LWP High	LWP Low
$_1$	621.889	983.125	4877.918	-299.088	7092.434	1045.484
$_1$	-7263.345	-263.382	15409.031	-264.404	-102.733	-272.238
$_2$	-17231.887(-5)	-466.493(-3)	14727.910(-5)	302.228(-3)	-18332.296(-5)	-286.471(-3)
$_2$	-11679.486(-5)	376.252(-3)	-27745.744(-5)	225.597(-3)	-13694.831(-5)	246.469(-3)
$_3$	12730.463(-10)		5522.146(-10)		6804.252(-10)	
$_3$	12173.485(-10)		9077.724(-10)		5902.048(-10)	
$_4$	2.769(-2)		Ø.745(-2)		1675.931(-2)	
$_4$	-.0867(-2)		5.926(-2)		Ø	
$_5$	-465.440(-3)		276.735(-3)		374.701(-3)	
$_5$	398.810(-3)		226.099(-3)		330.485(-3)	
$_6$	-1.991(-7)		Ø.0292(-7)		-721.526(-7)	
$_6$	.2124(-7)		-Ø.0802(-7)		180.210(-7)	
$_7$	-1.312(-8)		11.105(-8)		-284.761(-8)	
$_7$	-17.260(-8)		Ø.4017(-8)		-36.529(-8)	
$_1$(S)	-2.243	-2.239	5.279	5.348		
$_1$(L)	-2.586	-1.633	-8.648	-8.601		
$_2$(S)	.02709	.001985	-.2945	-.2516		
$_2$(L)	.2170	.1546	.5826	.5316		
$_3$(S)	1.696(-3)	1.870(-3)	-1.102(-3)	-1.652(-3)		
$_3$(L)	.569(-3)	Ø.233(-3)	.6621(-3)	1.222(-3)		
late cale per pixel)	7.697 kms^{-1}	1.669Å	7.236 kms^{-1}	2.652Å	7.223 kms^{-1}	2.646Å

he values listed should be multiplied by the power of 10 given in parentheses. The alues are to an accuracy such that the contribution of each term can be computed to 0.001 pixel in the range of interest.

Figure Captions

Fig. 1.1 - Predicted positions of the low dispersion LWP Pt-Ne emission lines using the old and new dispersion relations. The diamond symbols represent the mean positions predicted using the old dispersion constants. The scaled vectors represent the displacements to the mean positions predicted using the new dispersion constants.

Fig. 1.2 - Same as Fig. 1.1 for high dispersion.

Fig. 2.1 - Same as Fig. 1.1 for LWR

Fig. 2.2 - Same as Fig. 1.2 for LWR

Fig. 2.3 - Relative spectral format shifts along and perpendicular to the dispersion for a particular LWR low dispersion wavelength after correction for temperature, as a function of time. The straight lines shown are the result of a least squares fit to the points marked with a '+' symbol and represent the updated time dependence.

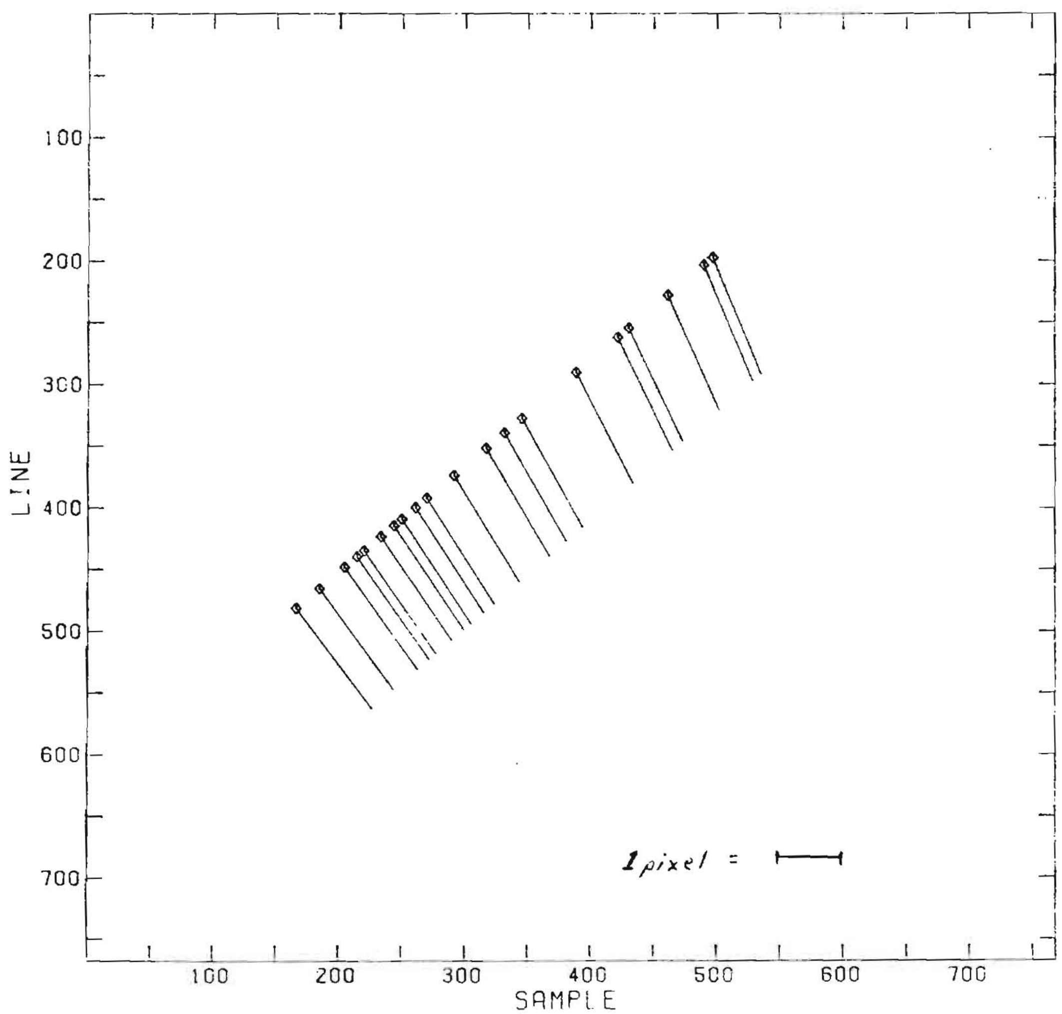
Fig. 2.4 - Same as Fig. 2.3 for high dispersion with the addition of some more recently obtained data points.

Fig. 3.1 - Same as Fig. 1.1 for SWP

Fig. 3.2 - Same as Fig. 1.2 for SWP

Fig. 3.3 - Same as Fig. 2.3 for SWP

Fig. 3.4 - Same as Fig. 2.4 for SWP



18:00 AUG 24.'82

Figure 1.1

LWP CAMERA

MAGNIFICATION = 50.00

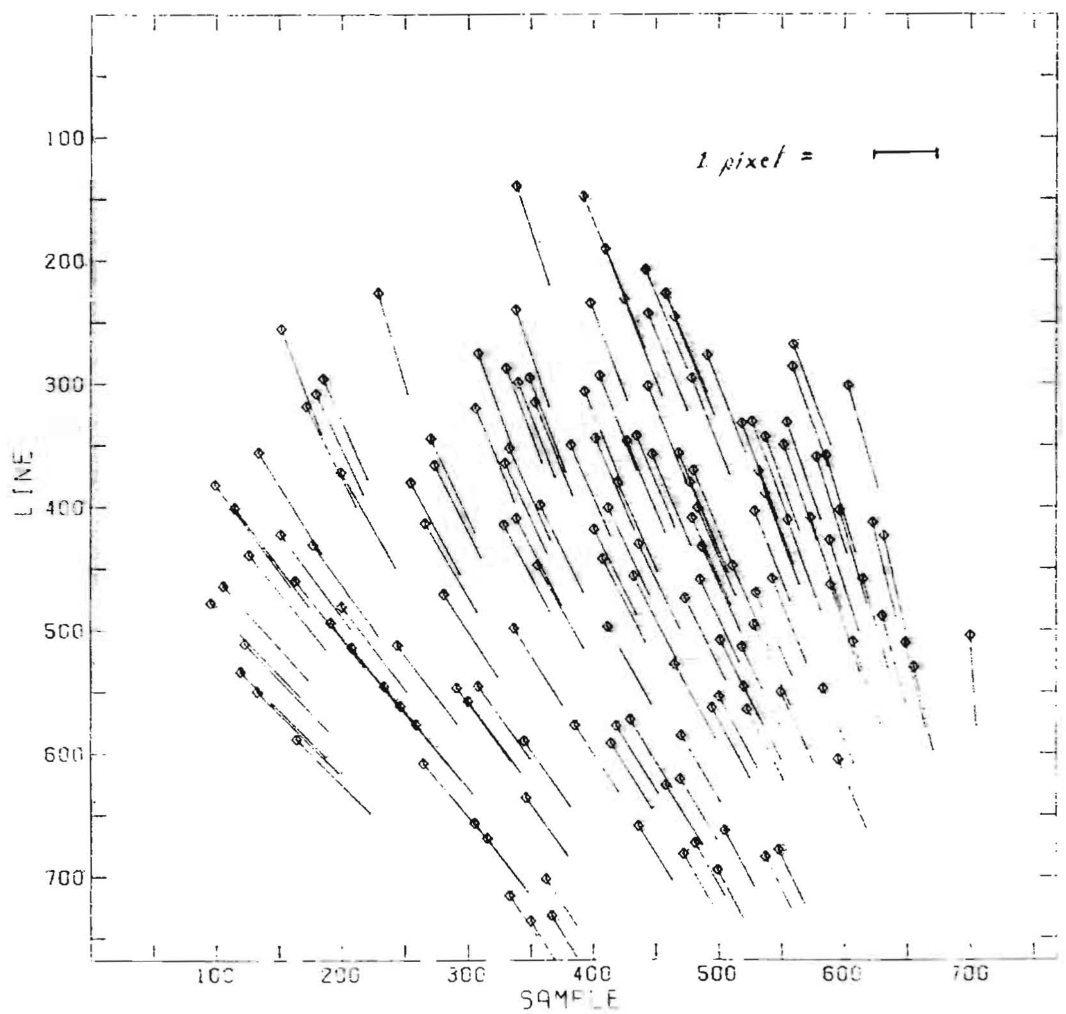
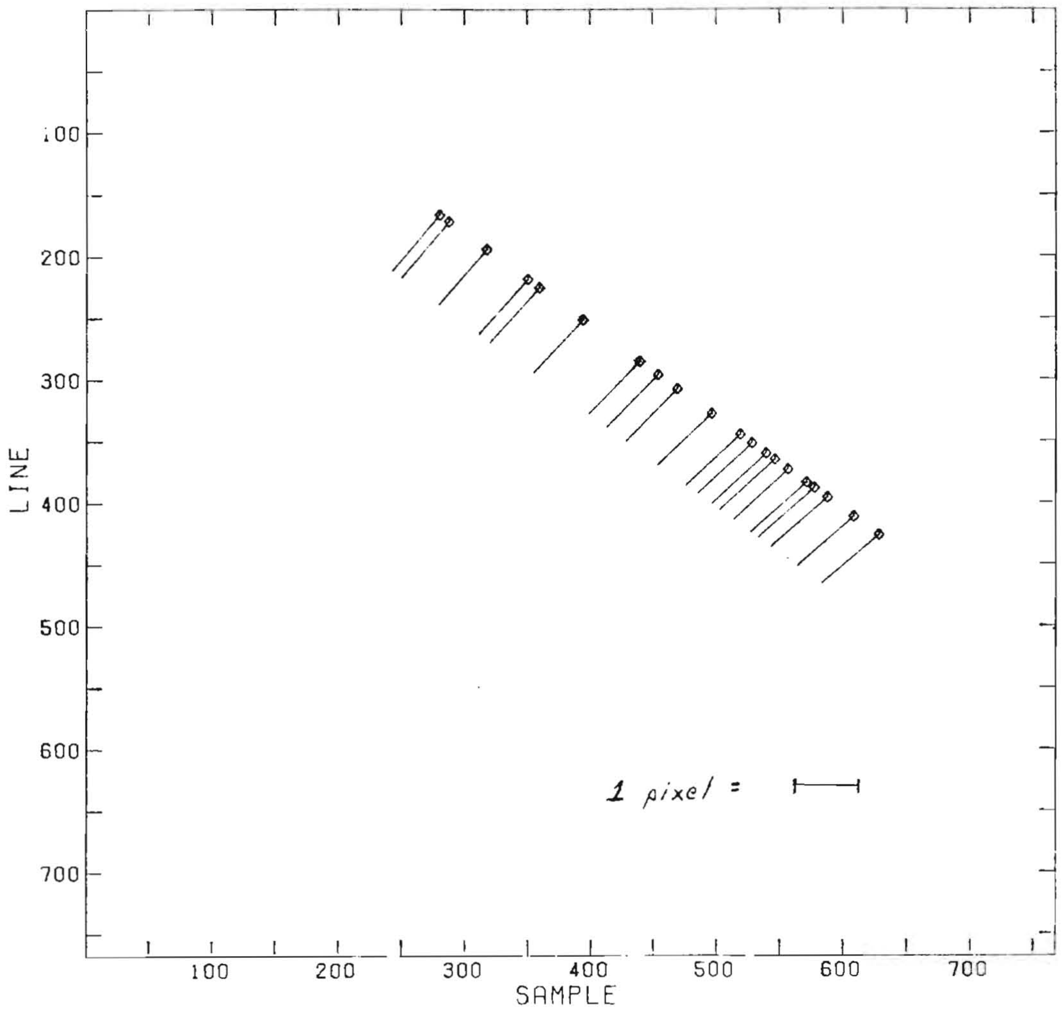


Figure 1.2

LWP CAMERA

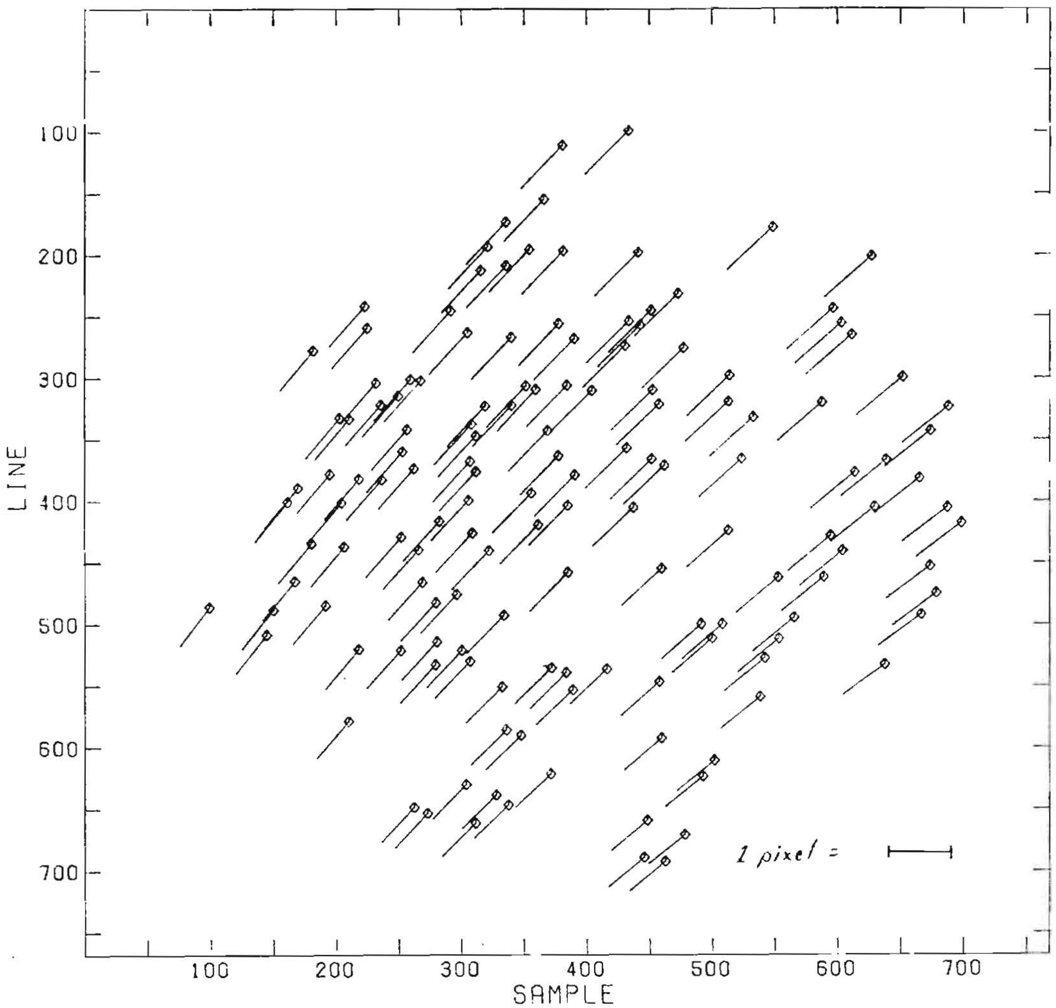


18:08 AUG 24, '82

Figure 2.1

LWR CAMERA

MAGNIFICATION = 50.00



17:39 AUG 26.'82

Figure 2.2

LWR CAMERA

MAGNIFICATION = 50.00

Low Dispersion

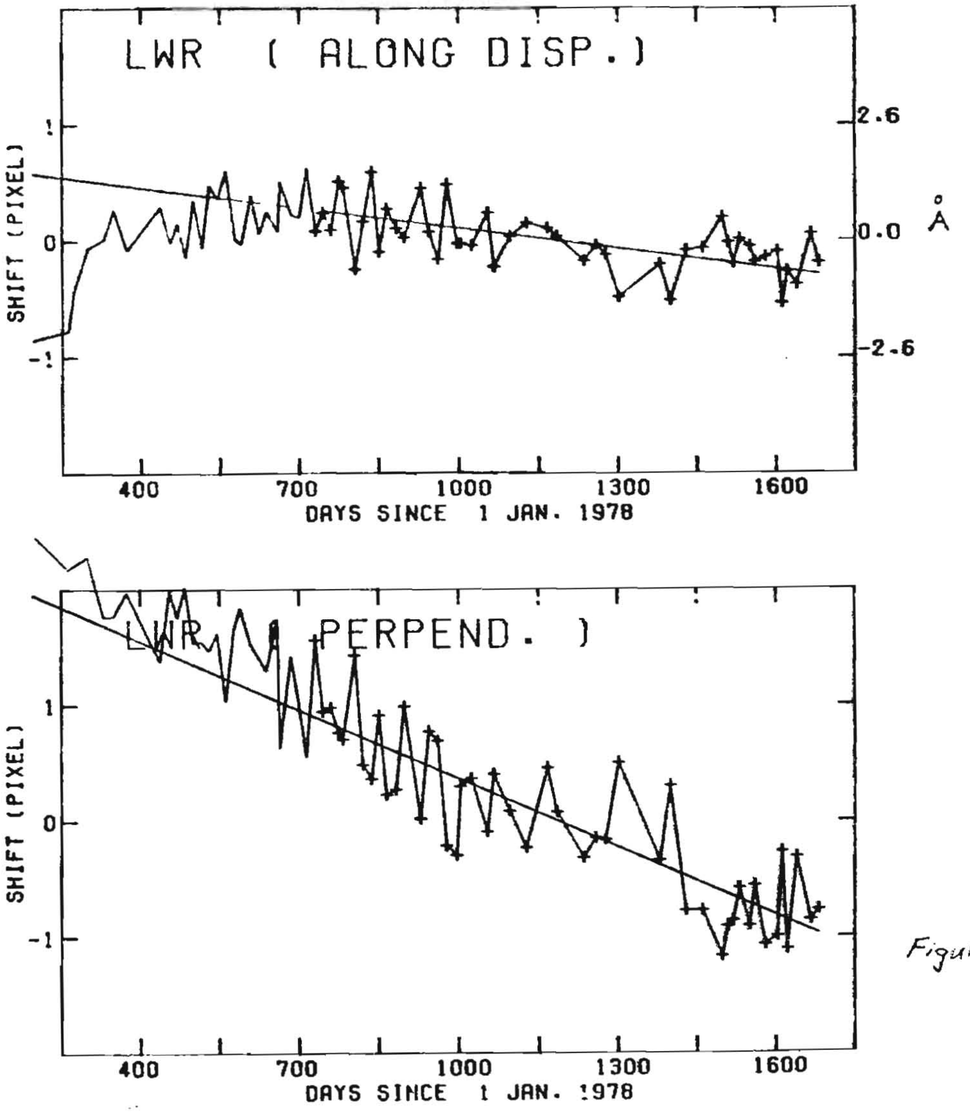
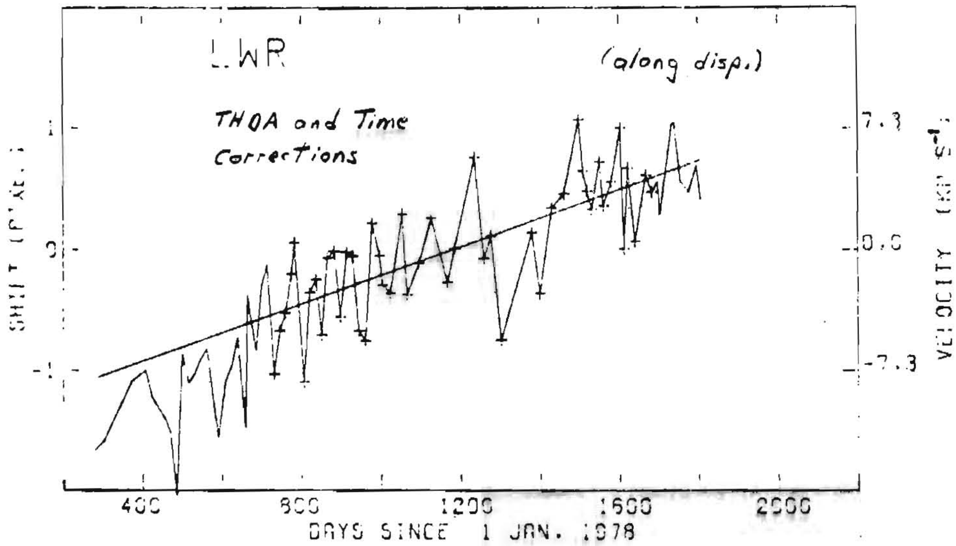


Figure 2.3

High Dispersion



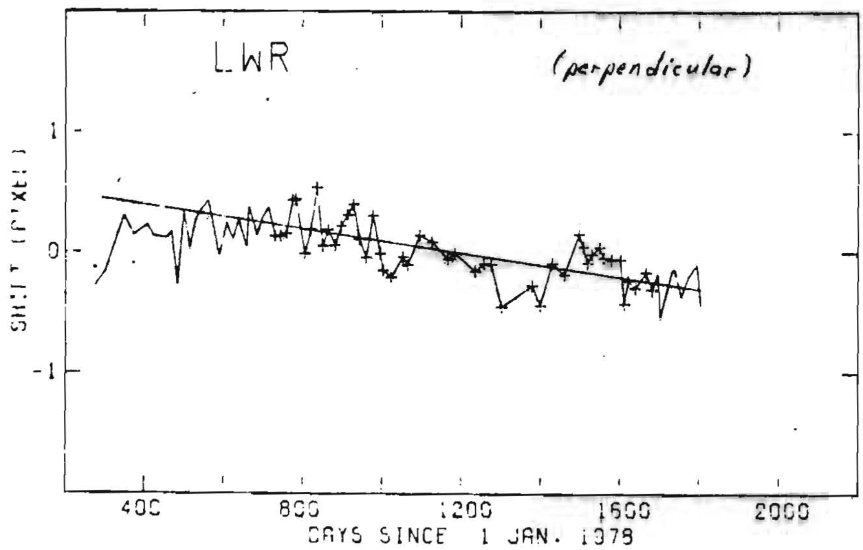
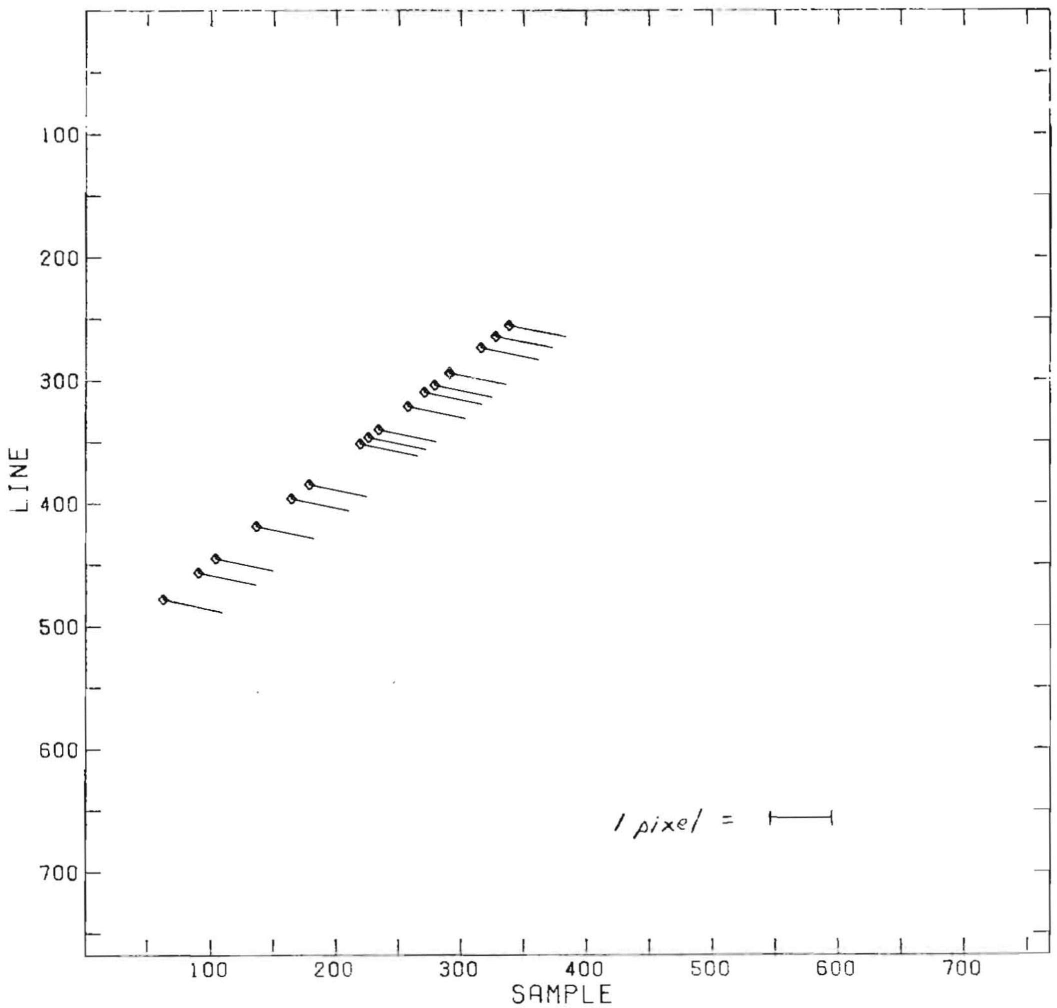


Figure 2.4

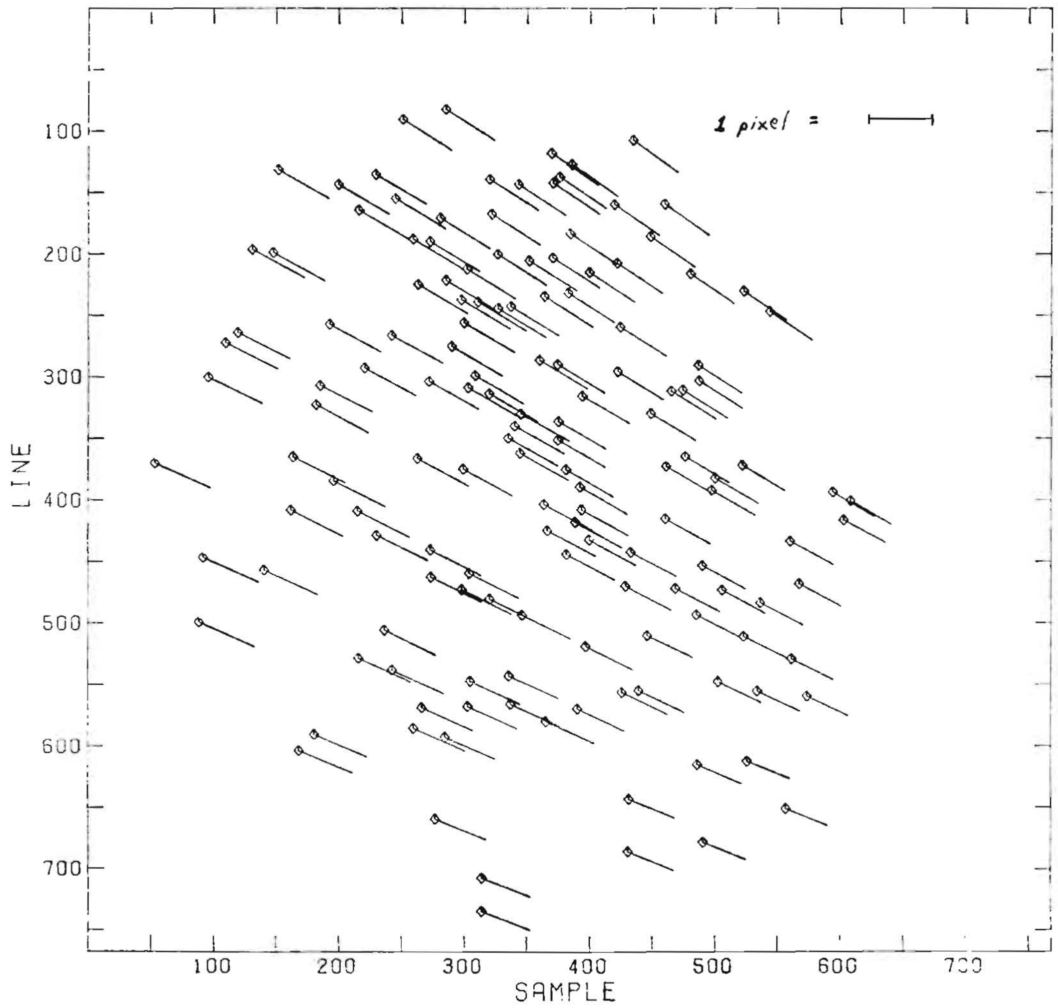


18:11 AUG 24.'82

Figure 3.1

SWP CAMERA

MAGNIFICATION = 50.00



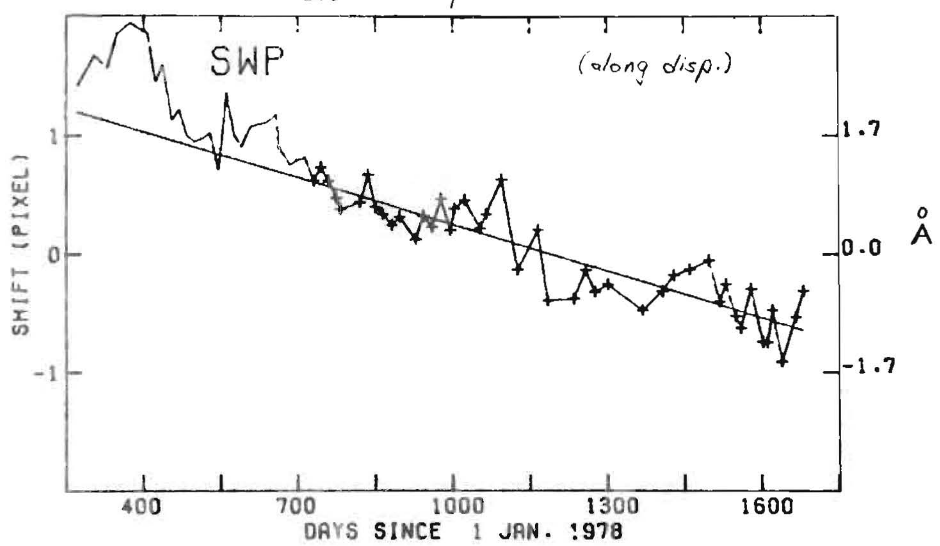
17:13 AUG 26.'82

Figure 3.2

SWP CAMERA

MAGNIFICATION = 50.00

Low Dispersion



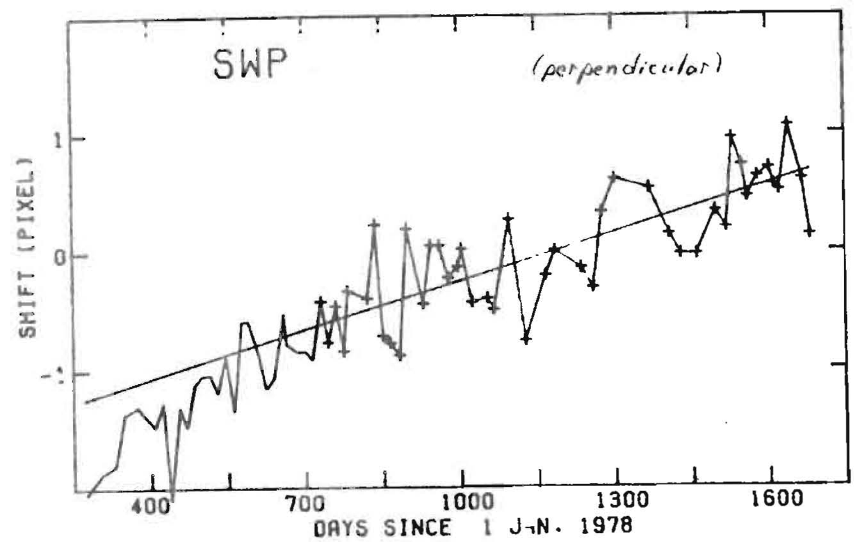
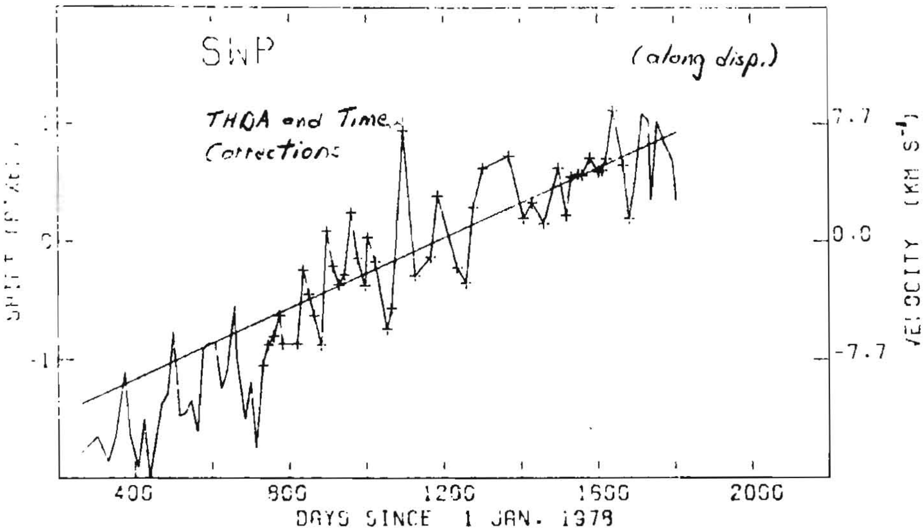


Figure 3.3

High Dispersion



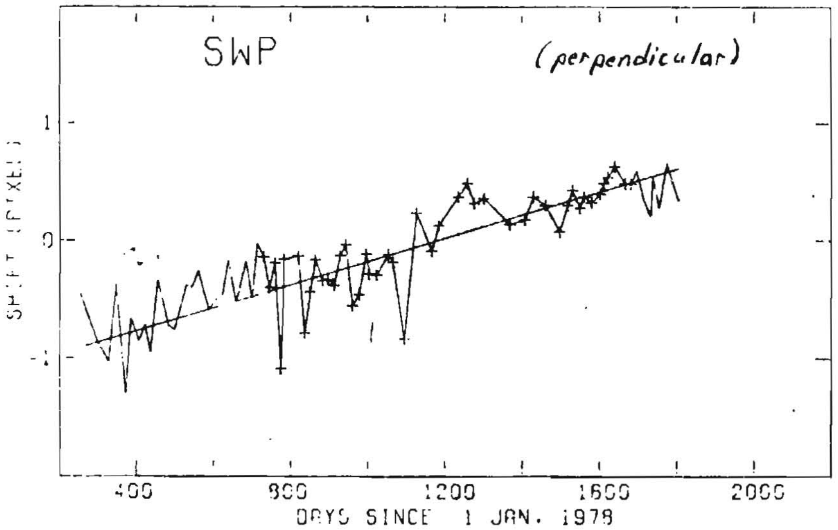


Figure 3.4

XXVIII. Recent Software Modifications Affecting Post-Extraction Processing for High Dispersion IUE Images

Several improvements and corrections have been made to the high dispersion post-extraction routine POSTHI since its implementation in production processing on November 10, 1981. A description of these changes, listed chronologically, is given below. Further information describing the impact on the Guest Observer (GO) tape files will be found in updates to the Time History of IUESIPS Configurations (ESA IUE Newsletter #14) to be published in the near future.

1. Incomplete Final Spectral Record

An error existed in POSTHI in which the program failed to read the last physical record of the gross and background flux input files (extracted by the program SPECHI). This resulted in part of the last extracted order being deleted from the MEHI file on the GO tape and also occasionally resulted in the omission of the last 1 or 2 orders from the CalComp plots. Since the last data record contains a variable number of extracted data points, the exact amount of missing data is not constant. In one Short Wavelength Prime (SWP) test run, only 4 data points were found to be missing in the MEHI file. The error was corrected on May 5, 1982 (GMT 125:16:45).

2. Incomplete Search for End-of-Exposure Time

An error which would presumably cause a heliocentric velocity correction error in a small number of extracted images was corrected on May 5, 1982 (GMT 125:16:45). In order to estimate the midpoint of observation, the program POSTHI searches the event-status entries of the image science header to determine the end-of-exposure time. Once this time is extracted, the program subtracts half of the exposure time and assumes the resulting time represents the midpoint of observation. The problem that existed was that POSTHI failed to search for the single event status entry in line 10 of the image header. Therefore, if the end-of-exposure entry happened to appear in line 10, the program would either search for and possibly use another end-of-exposure entry or, if such were not found, not apply any velocity correction at all. The history portion of the MEHI file label can be used to determine whether an error occurred since it contains the calculated midpoint of observation (described as observation date) and the applied velocity correction.

3. Improper Treatment of Negative Declinations

The heliocentric velocity correction procedure was found to contain a slight error for targets with negative declination values. This occurred because the declination was calculated by adding the minutes and seconds of declination (as positive quantities) to the degrees of declination regardless of whether the degree term was positive or negative. This could result in a possible error of up to 2 degrees in the calculation of the declination, which in turn would cause a small error in the velocity correction. Another result of this coding error was that the sign for negative declinations did not appear in the portion of the processing history label where the target coordinates used are specified. Both errors were corrected on August 5, 1982 (GMT 217:14:40).

4. Scaling Error of Net Ripple-Corrected Fluxes

VILSPA personnel discovered an error in the scaling of the ripple-corrected net spectral fluxes contained in the MEHI file generated by POSTHI. POSTHI was scaling the ripple-corrected net flux according to the minimum and maximum values of the uncorrected net flux. This would cause an error in any ripple-corrected net flux values outside the range of the net flux. The correction was implemented on August 5, 1982 (GMT 217:14:40).

5. Improved Ripple Correction

The echelle ripple correction algorithm described by T. Ake in NASA IUE Newsletter No. 19, p. 37, was implemented in production processing on August 27, 1982 (GMT 239:19:45). The second-order equation describing the echelle order dependence of the ripple constant (k) and the adjustable α parameter are contained in the history portion of the MEHI header.

6. "Optimal" Noise-Conditioning Filter for LWP

An "optimal filter" for smoothing long wavelength prime (LWP) high dispersion extracted spectra as determined by F. Schiffer was implemented on October 11, 1982 (GMT 284:13:30). The rationale for such noise-conditioning filtering in the SWP and long wavelength redundant (LWR) cameras was described by Bohlin and Turnrose in ESA IUE Newsletter No. 13, p. 8 , and similar arguments apply to LWP. the filter weights of .0017, .0076, .1027, .7760, .1027, .0076, .0017 replace the weights 0, 0, 0, 1, 0, 0, 0 previously used for LWP.

R.W. Thompson
B.E. Turnrose

Effective Date: 27 August 1982
GMT 239:19:45

IUE DATA REDUCTION

XXIX. Processing of Partial-Read Images

I. Introduction

"Partial-read" images are images for which only a portion of the vidicon target is readout. The resulting image contains the entire low dispersion spectral format and represents a subset of the standard 768x768-pixel array. Since the IUE low dispersion spectral format does not encompass a full image, the savings in time associated with reading out makes the partial-read capability a potentially valuable technique in situations where rapid-fire low dispersion spectra must be obtained.

Currently, a testing program is being carried out by the operations and calibration groups of the Three Agencies to evaluate the use of partial-read images, to investigate what, if any, photometric consequences arise from the use of partial-reads and to establish guidelines for future use of partial reads by Guest Observers. Current plans include the use of standard definitions for the boundaries of the partial-read areas, which are rectangular or square arrays determined separately for each camera according to the location of the low dispersion spectral format.

In anticipation of the eventual use of partial-read images, the IUESIPS programs INSERT and PHOTOM have been modified as discussed below to deal with standard partial-read (PREAD) images in an efficient way. The PREAD parameters being evaluated for operational use (Table 1) were checked to insure that all portions of the data extracted in the line-by-line file will be contained within the portion of the image read by the PREAD procedures. This check was made for the LWP, LWR, and SWP cameras by measurement of 200μ Photowrites on which a double-aperture wavelength overlay was superposed. The truncation, in certain cases, of the corners of the photometrically corrected swath was in itself not regarded as a problem as long as extracted data were not affected.

II. INSERT

INSERT imbeds the partial image at the proper position within a full 768x768 array of zero DN so that subsequent processing may be done by IUESIPS. The default parameters in INSERT were changed to correspond to the PREAD parameters in Table 1. With these standard values as defaults, parameters need not be entered manually for routine processing.

III. PHOTOM

The program PHOTOM was changed so that for all low dispersion images, in addition to the constraint which results in the photometric correction being applied only within a swath around the spectral order, pixels outside of the PREAD boundaries are left uncorrected (raw DN). This insures that for partial-read images, the zero-DN pixels added on to fill a full frame will be left as zeroes, rather than being extrapolated meaninglessly to negative FN levels if they happen to fall within the low-dispersion PHOTOM swath. By imposing this additional constraint on all low dispersion images (whether partial-read or not), it is not necessary to treat the partial-read images in any special way after the INSERT step. With this change, all low dispersion images will have the corners of the photometrically corrected region truncated wherever the PREAD boundaries impinge upon the standard PHOTOM swath. This truncation, as discussed in Section I, does not affect the extracted data and is illustrated schematically in Figure 1.

B.E. Turnrose

Table 1 - Standard PREAD Parameters

Camera	Starting Line	No. of Lines	Starting Sample	No. Samples
LWP	99	528	31	576
LWR	73	528	123	624
SWP	36	528	33	528
SWR	135	480	175	576

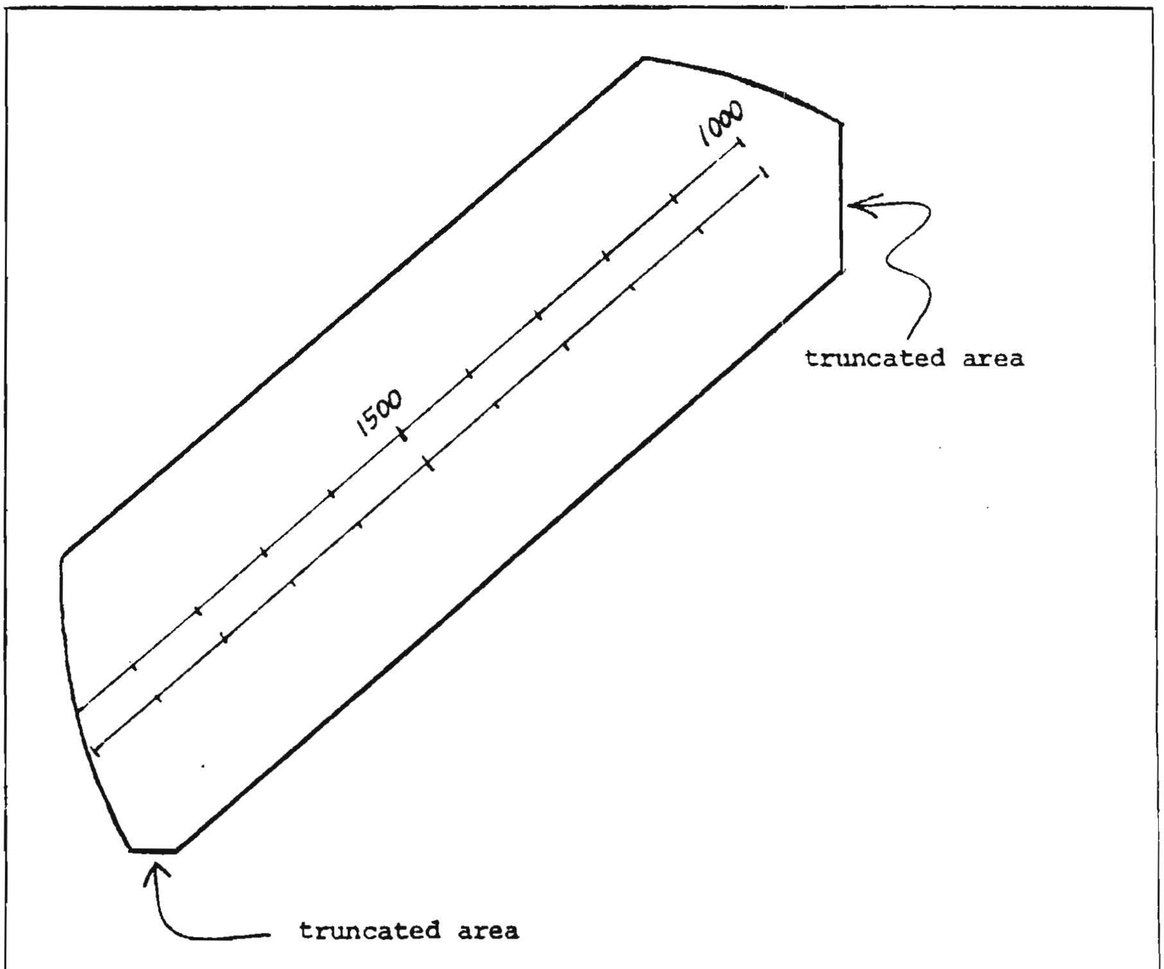


Figure 1 - Schematic representation of the truncation to the photometrically corrected swath in low dispersion (SWP in this example) induced by changes for partial-read processing.

IUE DATA REDUCTION

XXVII. Improvements to the Visibility of Spectral Features on IUE Photowrites

R.W. Thompson, B.E. Turnrose, and R.C. Bohlin

I Introduction

The IUE photowrite system currently produces the quick-look (SOC) photowrites which display the raw image at a scale of 200 $\mu m\ px^{-1}$, and the reduced photowrites which consist of three 100 $\mu m\ px^{-1}$ images displaying the raw image, the raw image with a wavelength scale overlay, and the photometrically corrected image. Both types of photowrites are produced on Kodak 2474 or 2476 Linagraph Shellburst film using one of two Optronics International P-1500 photowrite systems and developed in D-19 with a Colenta automatic processor. In addition, two contact prints are made from the reduced photowrite original using Kodak 2421 Aerial Duplicating film.

The Optronics photowrite software system has the capability of allowing the user to modify the effective system response relating digital input values to exposure level on the film. This is done by using a table lookup function called a "transfer characteristic" to map the input digital data values to a new set of digital data values before exposing the film. In many applications this capability is used to correct for non-linearities in the exposure and processing of the film so that a linear relationship then exists between the input digital data number (DN) and the output film density. This capability to modify the system response is not limited to the linearizing case, however. For example, last year a transfer characteristic was implemented in the production of the reduced photowrite original films to assure that the contact prints were produced with the same contrast as the quick-look 200 μm photowrites although it was not intended to remove any non-linearities in the system response (Mallama, 1981). Given this use of transfer characteristics, the following situations existed:

1) although the reduced contact prints matched the quick-look films in providing a high level of contrast at low DN values, the system response for each type of product was such that spectral features were often poorly distinguishable from the underlying continuum for continuum levels above DN ~100 (See Figure 1 in Section III);

2) the only means of modifying the image contrast on the quick-look films (and hence on the contact-print films which were forced to match the quick-looks) was to adjust the development process;

3) since photowrites were routinely underdeveloped to produce reasonable contrast and densities (e.g. 5 min. development compared to the recommended 8 min. for 2474 film) the quality of the photowrites was more sensitive to changes in the development temperature.

The purpose of this study, therefore, was to determine a transfer characteristic resulting in a system response which would improve the contrast and consistency of both the reduced photowrite contact prints and the quick-look (SOC) photowrite originals. In order to accomplish these goals a desired system response was selected according to the criterion that a test wedge containing 16 equally spaced input DN intervals spanning the range from 0 to 255 should result in 16 visually distinguishable gray levels on film developed for the recommended time in D-19*. The process of defining the final transfer characteristic and system response was an iterative one as described below.

II Method

An applications program was written to generate suitable gray scale test-wedge images on the Sigma-9 computer in various steps from 0 to 255 DN. These images could then be written to tape and processed as standard quick-look photowrite images using the recommended development time for D-19 and evaluated both visually and photometrically.

A continuous function representing a relation between input DN and final photographic density was defined to represent a trial system response presumably satisfying the desired criterion. Data describing the trial system response and the original default system response (determined from averaging density measurements from several test wedge images produced in the default mode, i.e., without a transfer characteristic) were fed into a computer program which generated the corresponding transfer characteristic needed to realize the trial system response. With this test transfer characteristic programmed into the photowrite system, a 16-step test wedge was generated and evaluated. If all 16 gray levels

* D-19 was used because it is the only recommended developer with a film capacity suited to the processing equipment used.

were not visually distinguishable the trial system response was modified and the above process repeated until a satisfactory system response and corresponding transfer characteristic were determined.

Having defined the transfer characteristic described above, which resulted in the desired system response for quick-look images, a second transfer characteristic was generated so that the final contact print copies of the reduced photowrite films also achieved the same desired system response (see the discussion of Figure 1 in Section III).

III Results

Figure 1 shows diffuse photographic density as a function of input intensity (in DN) for the original (default) system response, the response of the contact print made from the original, and the final desired response which produces the 16 distinguishable gray levels. Since the contrast is proportional to the slope of the curve, one can see how the original system response produced images with good contrast at low DN levels and rather little contrast at DN levels greater than ~ 100. The default contact print response was just the opposite of the original, producing little contrast at DN levels below 160. As discussed in Section I, this contact print response was modified for production work in 1981 (Mallama, 1981) to agree with the original default system response.

The newly implemented transfer characteristics modify both the original and the contact print responses to agree (typically, to within 0.1 density units) with the final desired response designated by the solid line in Figure 1. The intent of this desired response is to produce a photowrite with approximately visually equal contrast at all DN levels. Although the contrast achieved at lower DN levels with the new response is less than it was with the original response, it is felt that the new response is a better overall compromise and produces a more useful "roadmap" of IUE images.

The transfer characteristics described above were implemented at GSFC in the production of the quick-look (SOC) photowrites on August 10, 1981 and in the production of the reduced photowrites on October 19, 1981.

Any future changes to film batch characteristics or the development process can now be compensated for by appropriate adjustment of these transfer characteristics to assure a consistent system response .

References

Mallama, A.D., 1981 NASA IUE Newsletter No. 12, p. 27.

Figure Captions

Figure 1: Various system response functions expressed in terms of diffuse photographic density as a function of intensity for Kodak 2476 film developed in D-19 for 12 min. The three curves shown represent the original default system response, the empirically determined desired response and the response of the Kodak 2421 copy of the original before correction. After implementation of the new transfer functions the original and copy responses should approximate the desired response.

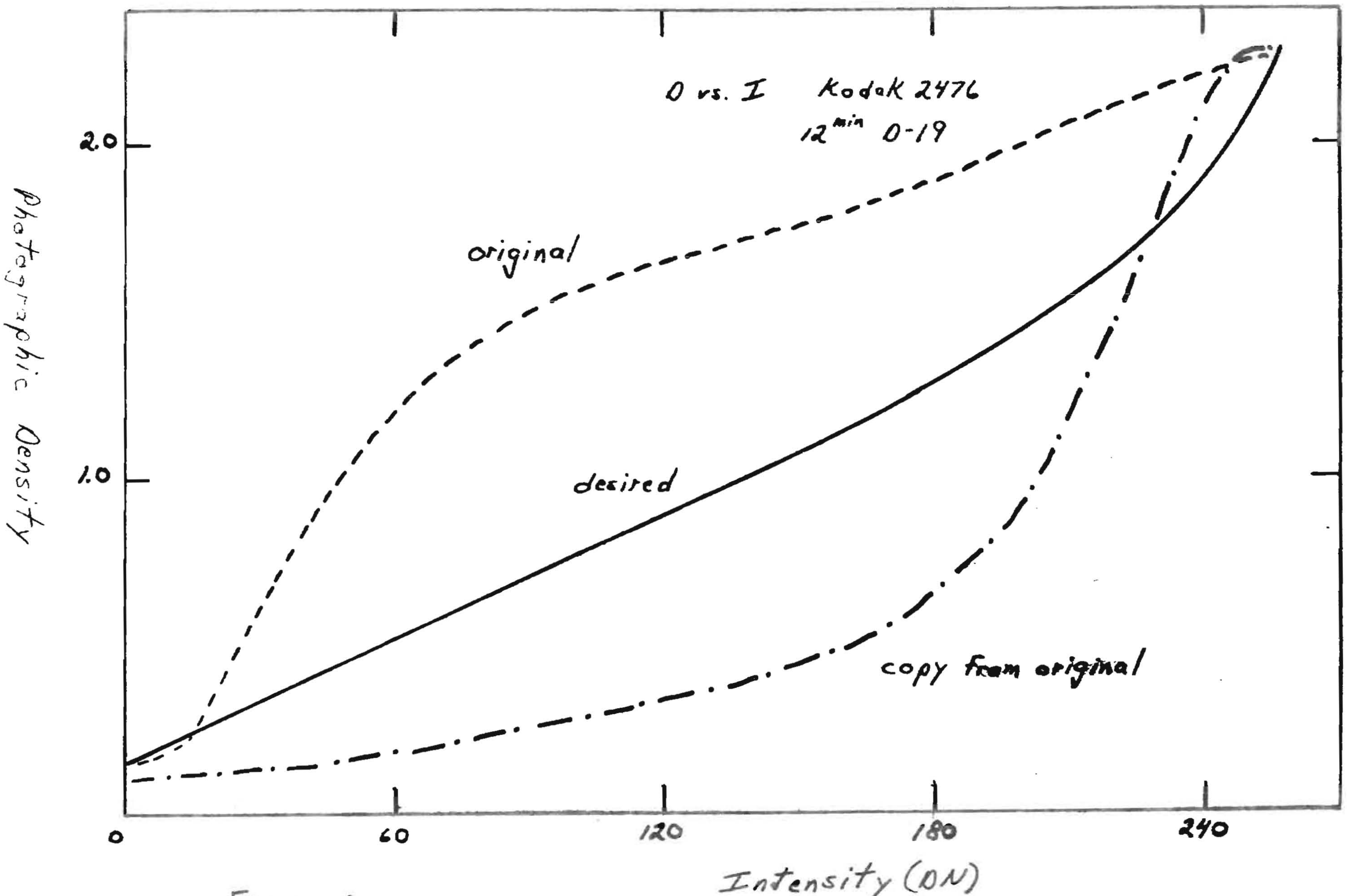

D vs. I Kodak 2476
12 min D-19
original
desired
copy from original
Photographic Density
2.0
1.0
0
60
120
180
240
Intensity (DN)

Figure 1

PHOTOMETRIC CALIBRATION OF THE IUE

IX. Photometric Stability in High Dispersion

R. C. Bohlin and B. T. Coulter

I. Introduction

Previous issues in this series have dealt primarily with the photometric properties and absolute calibration in low dispersion. Now, the photometric stability in high dispersion has been studied in conjunction with the implementation of the new high dispersion extraction software (Bohlin and Turnrose 1982).

The repeatability in high dispersion for bandpasses large compared to an individual sample is similar to the result for low dispersion found by Bohlin et al. (1980), where the one σ scatter was 3% for LWR and 2% for temperature corrected SWP data. All data in this study are corrected for temperature by $-0.5\%C^{-1}$ for SWP and $-1.1\%C^{-1}$ for LWR (Schiffer 1982).

II. Results

The spectra used in this analysis are all of the photometric standard ηUMa (B3V) taken in the large aperture and spaced over the lifetime of the IUE. The data consist of 18 SWP spectra with exposures usually of 5.73 s (13) or 6.96 s (2). The three exposures of 3.69, 9.83, and 11.88 s are included and flagged in the top panel of Fig. 1. Due to non-linearities in the IUE intensity transfer function (ITF), inclusion of these extreme exposures have increased the scatter slightly over what would be expected for data all at the same exposure level. The LWR data are 15 spectra with exposures generally of 5.73 s and with extremes of 3.69 and 11.88 s. In these two cases, the extreme LWR data do not exhibit the non-linearities that often arise in LWR, especially where the background is high.

In this study, the high dispersion data are averaged in 9 bins for each spectral order m, to find the mean response in IUE FN per unit time, R_i, for each bin and, R, for the overall average for an order. Fig. 1 shows the results for the whole orders R(108) and R(83) for the two cameras. Unity represents the average of all the plotted points in each panel. The orders m=108 and 83 are chosen, because the new automatic registration technique (Thompson and Bohlin 1982) implemented on Nov. 24, 1981 at GSFC uses order 108 as the prime registration fiducial. Fig. 1 shows results for the new software using this new registration technique. The points represent the response R for individual spectra divided by the mean for each set and are connected by lines for visual clarity. The scatter is higher for order 108 than for 83 because the background is difficult to extract between the close lying orders, despite the fact that order 108 was the registration fiducial. The 1σ scatter is worse at higher orders than at order 108; however, the σ=2.4% for the well-spaced order 83 is comparable to the results in low dispersion. The scatter of σ=1% for m=83 in LWR may be spuriously low, since only 8 of the 15 spectra were useful due to chronic microphonics or saturation in this order. The decrease in sensitivity with time that is suggested for LWR in Fig. 1 is consistent with the results of Schiffer (1982).

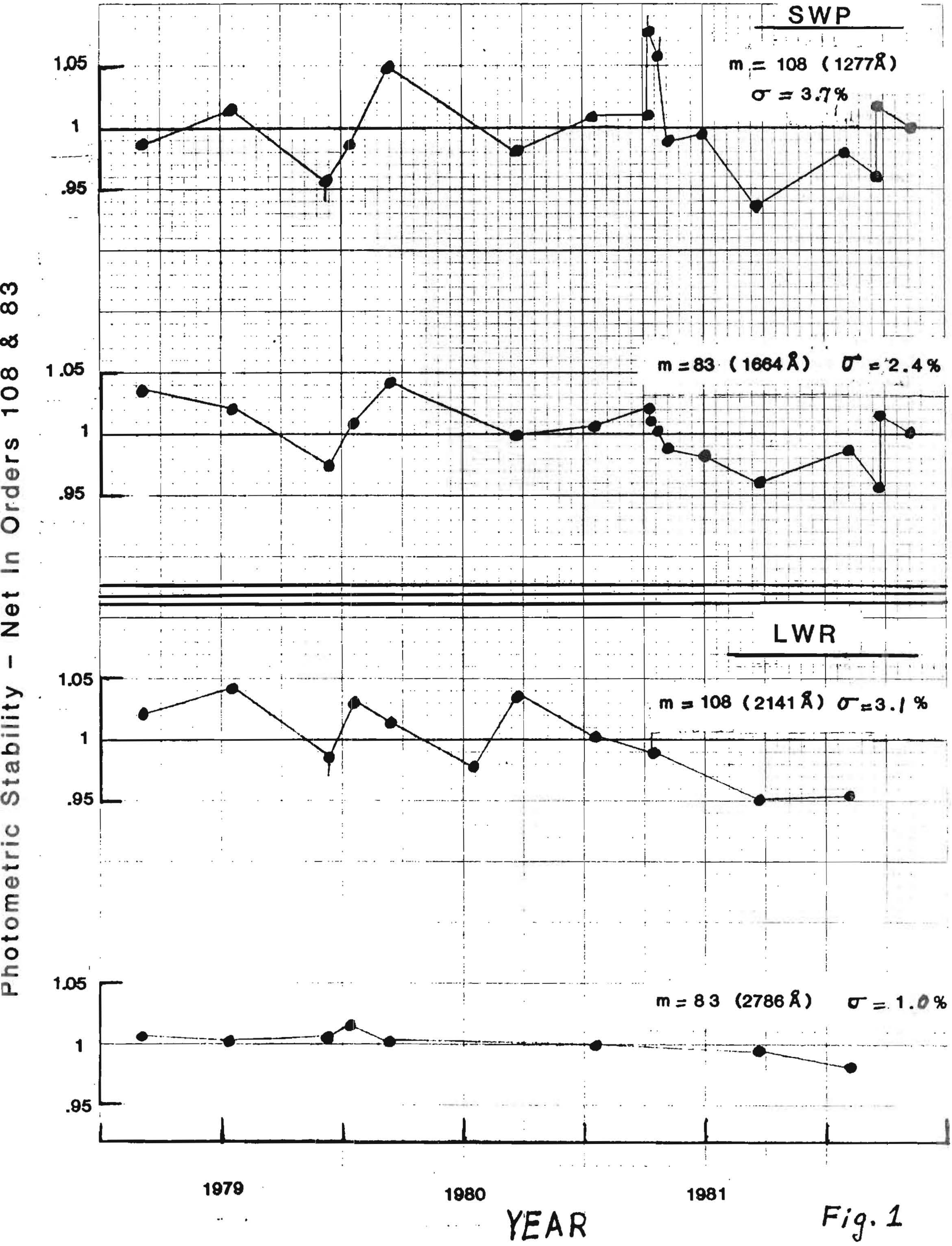

SWP
m = 108 (1277Å)
σ = 3.7%
m = 83 (1664Å) σ = 2.4%
LWR
m = 108 (2141Å) σ = 3.1%
m = 83 (2786Å) σ = 1.0%
1.05
1
.95
Photometric Stability - Net In Orders 108 & 83
1979
1980
1981
YEAR

Fig. 1

As a severe test of the new software, a bin R_L is examined at the long wavelength end of order 108, where the net signal has fallen from the peak by about a factor of 2. The same uncertainty in the extracted background causes larger photometric variations in this lower net R_L for both cameras. The lowest panels of Figs. 2 and 3 show the scatter for the new software in the same style as Fig. 1 for the 2 different cameras. Also shown in Figs. 2 and 3 for SWP and LWR, respectively, is the scatter for this same bin R_L (centered at 1283Å for SWP and 2151Å for LWR) in the cases of 1.) top panel-old software as originally processed and in the archives and 2.) middle panel-old software reprocessed in late 1981 using the new auto registration technique of Thompson and Bohlin (1982).

Note that the new software is somewhat better than the old software with the same auto registration, i.e., σ=4.6 vs. 5.2% for SWP and 5.4% vs. 7.7% for LWR, because of the improved treatment of the background in the new software. However, the most important point for the astronomer with high dispersion data processed before the effective date for the improved auto registration technique of Nov. 24, 1981 (at GSFC) is the large scatter in R_L of 10 to 15% typical before that time. Note also the occasional excursions up to $\sim$30% photometric error in R_L for archival data. Astronomers attempting to use high dispersion data where photometric reproducibility is required should beware! Old data at higher orders than 108 or for higher background relative to signal should have even worse scatter than found for R_L and ηUMa.

III. Conclusions

With the implementation at GSFC of the new high dispersion software on Nov. 10, 1981 and the new automatic registration technique on Nov. 24, 1981, high dispersion IUE data have become reasonably photometric.

This conclusion has two important corollaries:

1. A correction for the IUE echelle ripple exists, i.e., reproducible spectral shapes are obtained with the new software extraction techniques. See Ake (1981) with additional details in Ake (1982 in preparation).

2. The absolute calibration in high dispersion can be found and applied with some confidence. The old calibration of Cassatella et al. (1981) is no longer valid because of the increase in net signal extracted by the new high dispersion software (Bohlin and Turnrose 1982). The new ripple correction, which should be implemented in the near future, may also affect the derivation of a new absolute calibration. Work is continuing on lowering the extracted background, which is too high due to order overlap and the curvature of the orders in the spectral format. If the order overlap is reduced to zero, then the absolute calibration in high dispersion should agree for both continuum and line emission sources. Perhaps further work on high dispersion absolute calibration should follow the final resolution of the order overlap problem.

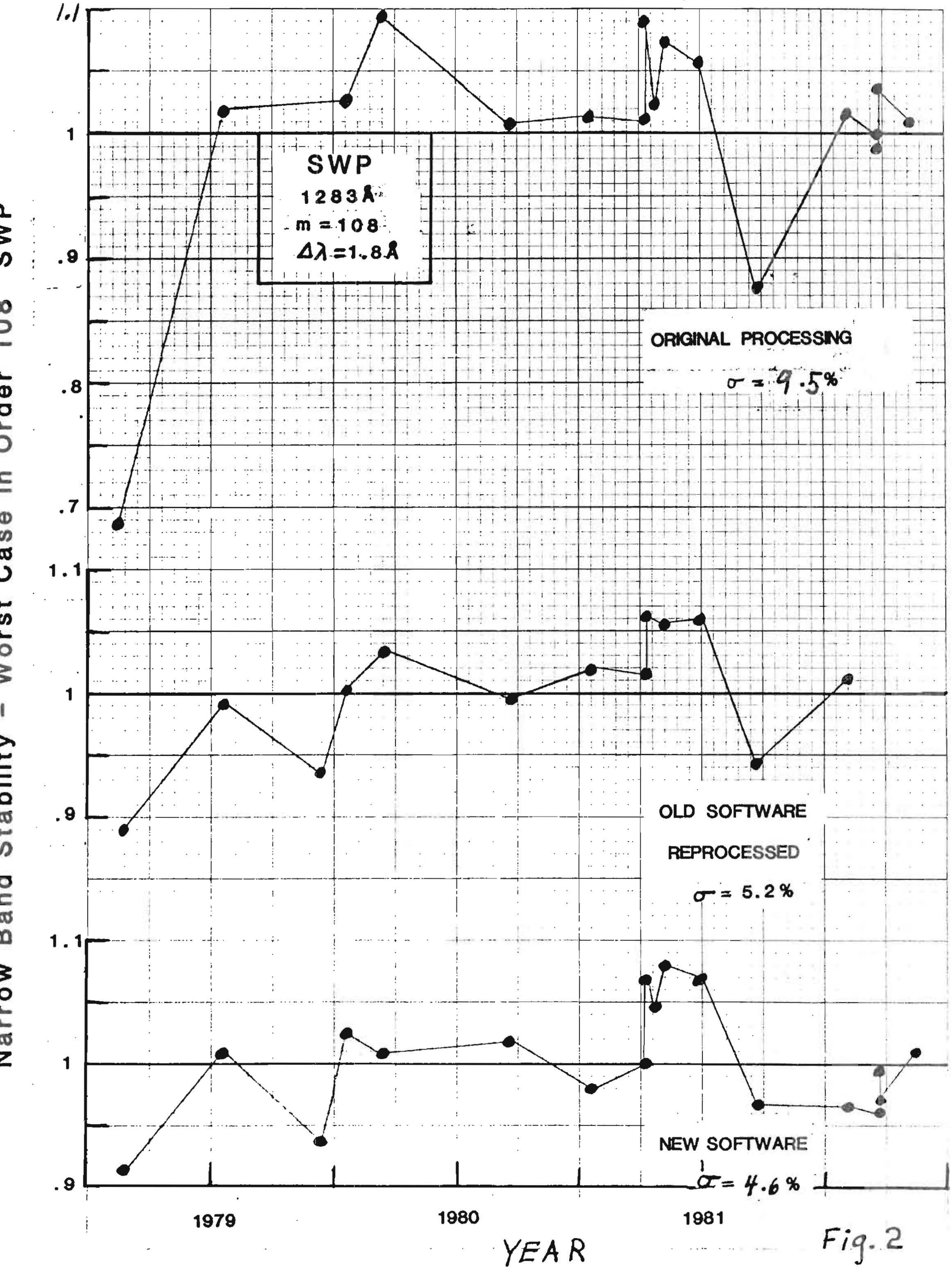

Narrow Band Stability - Worst Case in Order 108 SWP
SWP
1283Å
m = 108
Δλ=1.8Å
ORIGINAL PROCESSING
σ = 9.5%
OLD SOFTWARE
REPROCESSED
σ = 5.2%
NEW SOFTWARE
σ = 4.6%
1.1
1
.9
.8
.7
1979
1980
1981
YEAR

Fig. 2

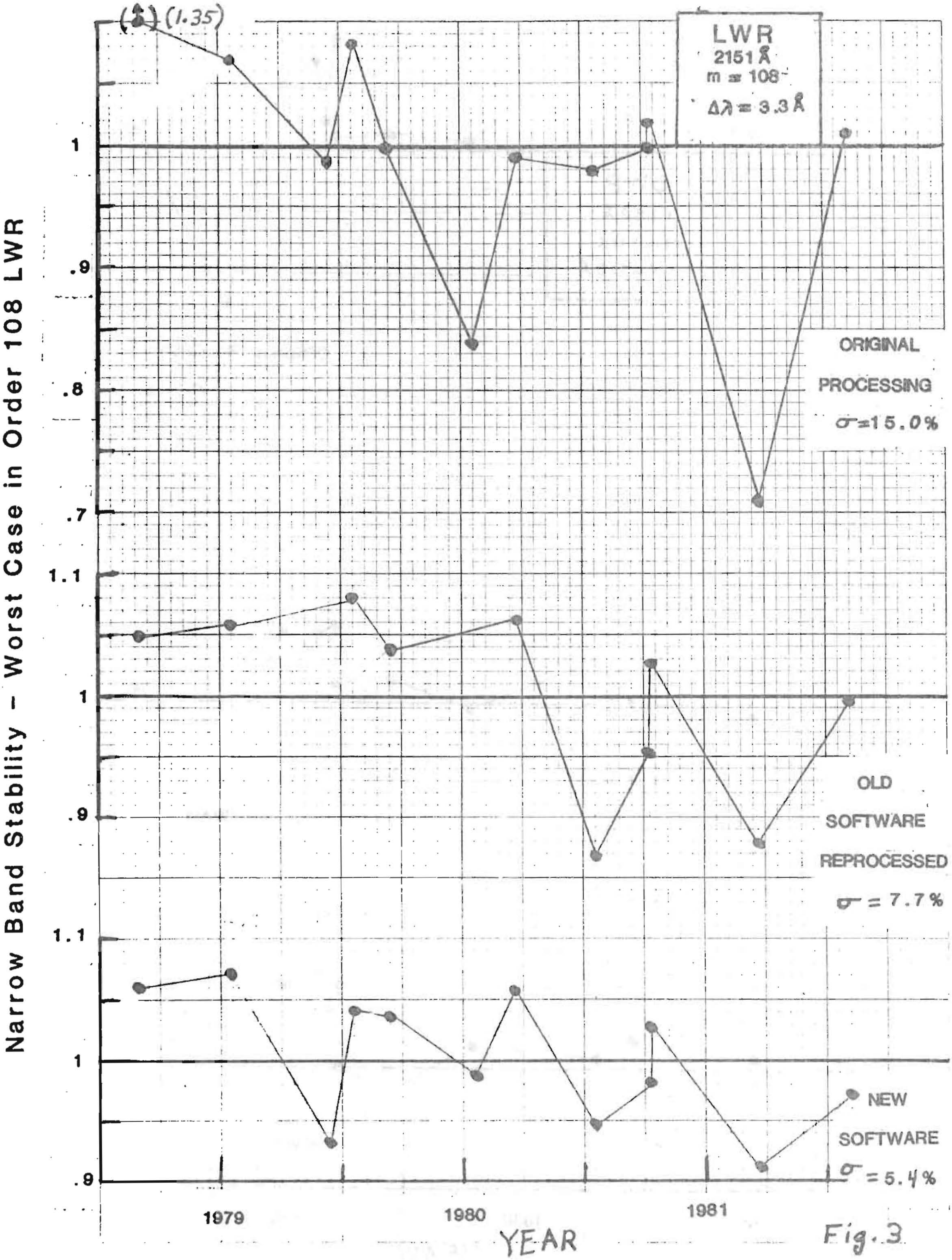

(1.35)
LWR
2151 Å
m = 108
Δλ = 3.3 Å
ORIGINAL
PROCESSING
σ=15.0%
OLD
SOFTWARE
REPROCESSED
σ = 7.7%
NEW
SOFTWARE
σ = 5.4%
Narrow Band Stability - Worst Case in Order 108 LWR
1
.9
.8
.7
1.1
1
.9
1.1
1
.9
1979
1980
1981
YEAR

Fig. 3

REFERENCES

Ake, T. B. 1981, "Toward an Improved High Dispersion Ripple Correction," NASA IUE Newsletter No. 15, p. 60.

Bohlin, R. C., and Turnrose, B. E. 1982, "IUE data Reduction XXV. Implementation Of Basic Improvements to Extraction of High Dispersion Spectra,"ESA IUE Newsletter No.13. p. 8 .

Bohlin, R. C., Holm, A. V., Savage, B. D., Snijders, M. A. J., and Sparks, W. M. 1980, Astron. and Astrophys., 85, 1.

Cassatella, A., Ponz, D., and Selvelli, P. L. 1981, ESA IUE Newsletter No. 10, p. 31.

Schiffer, F. H. 1982, "Quick Look Sensitivity Monitoring," NASA IUE Newsletter No. 18, p. 64.

Thompson, R. W., and Bohlin, R. D. 1982, "IUE Data Reduction XXVI. Automatic Registration of the Extraction Slit with the Spectral Format," ESA IUE Newsletter No. 13, p. 32.

IUE Data Reduction

XXXII. Temperature Correction of LWP Dispersion Constants

On April 12, 1983 (GMT 102:16:12) the temperature correction of updated LWP dispersion constants was implemented in production processing at GSFC. The LWP dispersion constant files utilized previously did not include either a temperature or time correction, primarily because insufficient data existed for defining meaningful correlations. The updated LWP dispersion constants replace those originally implemented on September 21, 1982 and described in IUE Data Reduction Memo XXX (ESA IUE Newsletter No. 17, pg. 16.

Statistics for the dispersion constants and the standard deviations before and after correction for temperature are shown in Table 1. The actual dispersion constants and correlation coefficients for all operational cameras are listed in Tables 2 and 3. Note that Tables 2 and 3 incorporate corrections to numerical errors which appeared in Table 3 of IUE Data Reduction Memo XXX. These terms define the sample (S) and line (L) position of a given wavelength (λ, in Å) and order (m) using the following formulae for the high dispersion case:

$$S = a_1 + a_2 m\lambda + a_3(m\lambda)^2 + a_4 m + a_5\lambda + a_6 m^2\lambda + a_7 m\lambda^2 \quad (1)$$

$$L = b_1 + b_2 m\lambda + b_3(m\lambda)^2 + b_4 m + b_5\lambda + b_6 m^2\lambda + b_7 m\lambda^2 \quad (2)$$

In low dispersion (m = 1), only the first two terms are used.

The correction for temperature and time is applied by adding a value W where W(S) and W(L) are the corrections to equations 1 and 2 respectively, such that

$$W = W_1 + W_2 T + W_3 t \quad (3)$$

where

T = head amplifier temperature (THDA, in C°) and

t = number of days since January 1, 1978.

The correlation coefficients W above are defined such that the mean time and temperature correspond to a correction of zero. Note that for the LWP camera the W_3 coefficients are set to zero, signifying that no correction for time is appplied for this camera.

R.W. Thompson

Table 1

LWP Dispersion Constant Statistics

	low	high
Number of dispersion solutions	28	28
Mean time	7/20/82	7/20/82
start	6/17/80	6/17/80
end	3/21/83	3/21/83
Mean THDA(C°)	8.5	9.1
lowest	6.2	6.5
highest	11.5	11.8
Slope (DL/DS)	-.8600	1.20*
Raw scatter (1σ in pixels)		
parallel	.43	.78
perpendicular	.72	.39
Scatter after THDA correction (1σ in pixels)		
parallel	.32	.44
perpendicular	.48	.18

* m = 100

Table 2

Updated Coefficients Defining the Dispersion Relations

for the Small Aperture (High Dispersion)

DISPERSION CONSTANTS

	LWP HIGH	LWR HIGH	SWP HIGH
A1	6.519567430691839E 03	-4.877917909118001E 03	6.218892050975904E 02
A2	-1.778483034226251E-01	1.472791022260271E-01	-1.723188694946298E-01
A3	6.674819991848808F-07	-5.522146305212622E-07	1.273046286227277E-06
A4	1.598582672397747E 01	7.449215787825510E-03	2.768587190334483E-02
A5	3.553799013108267E-01	2.767349997273978E-01	-4.654400112925802E-01
A6	-6.882926804695988E-05	2.920103076528571E-09	-1.991352524783476E-07
A7	-2.764837136203847E-06	1.110510384889110E-07	-1.311560455819058E-08
B1	1.204170348210633E 03	1.540903104020054E 04	-7.263344544922493E 03
B2	-1.481415791069993E-01	-2.774574415612283E-01	-1.167948613338929E-01
B3	6.141328065489587E-07	9.077724306570848E-07	1.217348513144755E-06
B4	3.920442560853582E-03	5.925811878052170E-02	-8.673599101745499E-04
B5	3.214292514202579E-01	2.260993410233010E-01	3.988096737403947E-01
B6	4.968180685794447E-08	-8.019420360642425E-09	2.123655462298873E-08
B7	-3.245305013106521E-07	4.017085561525235E-09	-1.725994284098098E-07

CORRELATION COEFFICIENTS

	LWP HIGH	LWR HIGH	SWP HIGH
W1(S)	-9.397546052932739E-01	5.279257774353027E 00	-2.243103027343750E 00
W2(S)	1.034402847290039E-01	-2.944609522819519E-01	2.709355205297470E-02
W3(S)		-1.101587899029255E-03	1.696390565484762E-03
W1(L)	-4.678806304931641E 00	-8.647566795349121F 00	-2.585970878601074E 00
W2(L)	5.145044326782227E-01	5.825527310371399E-01	2.170356512069702E-01
W3(L)		6.621174979954958E-04	5.693519487977028F-04

Table 3

Updated Coefficients Defining the Dispersion Relations

for the Small Aperture (Low Dispersion)

DISPERSION CONSTANTS

	LWP LOW	LWR LOW	SWP LOW
A1	1.045978073509556E 03	-2.990875719313456E 02	9.831253793383688E 02
A2	-2.866200015671855E-01	3.022277020991960E-01	-4.664930974754992E-01
A3			
A4			
A5			
A6			
A7			
B1	-2.722438935715519E 02	-2.644043768193267E 02	-2.633819950912196E 02
B2	2.465021881612769E-01	2.255967850073182E-01	3.762518274366946E-01
B3			
B4			
B5			
B6			
B7			

CORRELATION COEFFICIENTS

	LWP LOW	LWR LOW	SWP LOW
W1(S)	-7.499701976776123E-01	5.347592353820801E 00	-2.239044189453125E 00
W2(S)	8.839589357376099E-02	-2.516177892684937E-01	1.984719652682543E-03
W3(S)		-1.652141334488988E-03	1.870391191914678E-03
W1(L)	-3.398871421813965E 00	-8.600588798522949E 00	-1.632983207702637E 00
W2(L)	4.001707434654236E-01	5.316009521484375E-01	1.545836925506592E-01
W3(L)		1.222184859216213E-03	2.332759177079424E-04

IUEDR - IUE DATA REDUCTION ON STARLINK

1. INTRODUCTION

IUEDR is a program that provides facilities which can be used by Astronomers to reduce their IUE data. It addresses the problem of working from the IUE Guest Observer Tape through to a calibrated spectrum that can be used in scientific analysis. The program offers a pleasant and effective environment which removes some of the "painful" aspects normally associated with data reduction.

The purpose of this short note is to give an indication of what IUEDR can do and its availability.

2. FACILITIES

Here is a brief summary of what can be done using IUEDR:

Tape Analysis:
The contents of IUE tapes can be examined interactively to find what images are present, and so to plan the data reduction.

Reading IUE Images:
RAW, GPHOT and PHOT images can be read from IUE tape into IUEDR data sets stored on disk.

Spectrum Extraction:
This uses techniques that are a major enhancement of those present in the TRAK program (Giddings, 1981). Spectra exposed in either resolution mode (HIRES or LORES) can be extracted from RAW, GPHOT or PHOT images (the latter being the new style Photometric images that retain geometric distortion). It is possible to correct photometric LORES images obtained with the SWP and LWR cameras for defects in the original ITF calibration. Further details given in the next Section.

Spectrum Calibration:
Fully calibrated spectra can be produced. This includes various forms of wavelength corrections, absolute calibration, and (for HIRES), ripple correction. There is also a semi-empirical correction for the HIRES (order-overlap) background problem (c.f. Bianchi and Bohlin, 1983).

Graphical Display:
Graphical display facilities are provided to aid spectrum extraction and calibration operations. A number of different types of graphics terminals can be used.

Spectrum Averaging:
It is possible to combine the spectra from groups of Echelle orders (HIRES) or from different apertures (LORES) by mapping and averaging them onto an evenly spaced wavelength grid.

Output Products:
Various output products (raw and calibrated spectra, mean spectra, "line by line spectra", etc) can be output to disk files which can be made available to separate spectrum analysis programs.

Figure 1 shows a spectrum plot produced by IUEDR for the region 1200 to 1250 (A). This has been obtained by interpolating the fluxes associated with individual echelle orders onto a common, evenly-spaced wavelength grid.

3. SPECTRUM EXTRACTION

Although the spectrum extraction techniques in IUEDR are "based" on those of the TRAK program (Giddings, 1981), there are sufficient additional features to warrant a fairly complete description.

IUEDR essentially deals with 3 coordinate systems:

(S,L)	Actual image coordinates (S=sample, L=line)
(X,Y)	Geometric image coordinates (X=sample, Y=line)
(R,W)	Spectrum coordinates (R=perpendicular distance from spectrum, W=wavelength).

Only in the case of a GPHOT image are (S,L) and (X,Y) identical. In the case of RAW and PHOT images, the relation between (S,L) and (X,Y) is determined by the image distortion.

The large scale image distortion is defined by the "standard" positions of reseau marks after (in the case of SWP and LWR) corrections for THDA (Thompson, Turnrose and Bohlin, 1982). The distortion is represented by a

2-dimensional Chebyshev Polynomial with 5 terms along each axis. Small scale geometric distortions are handled separately.

The relation between (X,Y) and (R,W) for a particular spectrum (order or aperture) is defined by the dispersion constants provided by the Ground Station. Known variational effects of THDA and date are removed (c.f. Thompson, Turnsose and Bohlin, 1982). However, most images (particularly those exposed through LAP) suffer from "shifts" which require an empirical (linear) correction to these dispersion constants. This can be achieved interactively in IUEDR by graphical display of scans made perpendicular to dispersion (e.g. Figure 2), and subsequent use of a cursor to locate the spectrum. Global shifts of this kind are used to complement more detailed spectrum location techniques based on the object signal or pre-defined templates.

Spectrum extraction is performed on individual LORES apertures or HIRES orders. The spectrum is produced on a wavelength grid, the sampling rate of which is specified in terms of a given number of geometric pixels. Values of 1.414 and 0.707 geometric pixels correspond to the old and new IUESIPS.

Object and background channels are given default positions and widths, based on the camera/resolution/aperture/order however, these can be specified explicitly, possibly being based on cursor measurements obtained from a graphics display.

The background level is obtained by folding the intensities of pixels in the background channels with a triangle function (default FWHM of 30 geometric pixels). The background determination is an iterative process, with the option of rejecting pixels which are outside a given number of standard deviations (default of 2 s.d.).

Pixel intensities in the object channel are folded with a triangle function of FWHM equal to the wavelength grid spacing. Regardless of the image geometry and wavelength sampling rate, the net spectrum intensities are scaled so that they correspond to a surface integral over a "slit" of extent 1.414 geometric pixels along the wavelength direction. This has been done so that for LORES, the same absolute calibration tables as IUESIPS (old and new) may be used.

Small scale geometric effects lead to the centroid position of the object departing from that defined by the dispersion constants. The component of this distortion perpendicular to dispersion can be determined from the object signal itself. Alternatively, if the object signal is too weak to determine this, a pre-defined "template" can be employed, with the actual centroids being used to provide a simple linear shift.

In the case of LORES images affected by ITF faults (e.g. SWP and LWR cameras) appropriate photometric corrections can be performed during spectrum extraction; the correction is optional, so that its effect can be seen.

In the case of extended objects observed through LAP, where spatial information is required, it is possible to produce an array corresponding to the IUESIPS "line-by-line-spectrum" (LBLS); this being an array with axes along the R and W directions. The LBLS can naturally incorporate corrections for small scale distortions in the same way as for point source extraction.

4. USER INTERFACE

IUEDR is very "user-friendly". It is driven by commands which can be typed in at the terminal, or read from a file (possibly in Batch mode). In this simple example, the user input is underlined:

```
TRACK DATASET=SWP3196

? APERTURE=LAP

(Extracts LAP spectrum from image and prints
   information)

      PF

(Plots Flux calibrated LAP spectrum on
 graphics display)
```

TRAK is the spectrum extraction command, and has a large number of associated parameters which allow quite detailed control over what it does, fortunately, nearly all of these parameters can take on sensible defaults! In the case where no default exists, the user is prompted for a value (e.g. APERTURE above). Default values are normally retained for the remainder of an IUEDR session so that data reduction "flows" very smoothly, without the need to continually prompt the user for information.

A number of other facilities (on-line HELP, log file, etc.) make IUEDR really nice to use. An important part of the "user-interface" is the User Guide which gives a thorough description of how to use IUEDR.

5. AVAILABILITY

IUEDR has been implemented to run on the range of VAX 11 (/730, /750, /780) computers, and is available on the network of SERC STARLINK nodes (UK). STARLINK have also distributed it to a number of other sites/ networks, including (for example)the Anglo Australian Observatory, ASTRONET nodes in Italy (via Trieste), and Observatoire de Meudon. Institutions which wish to obtain a copy of the released STARLINK version of IUEDR should please contact:

The Software Librarian
STARLINK
Rutherford Appleton Laboratory
Chilton
Didcot
Oxon OX11 0GX
UNITED KINGDOM

It should be stressed that implementations on non-VAX computers are NOT possible at this time.

6. FUTURE

IUEDR is still under development, and it is planned to add further spectrum extraction techniques and calibration methods.

Major enhancements to image display are expected to follow implementation of IUEDR within the STARLINK Software Environment.

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REFERENCES

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Giddings, J.R.: 1981, ESA IUE Newsletter, 12, 22

Thompson, R.W., Turnrose, B.E., and Bohlin, R.C.: 1982, Astron. and Astrophys., 107, 11-22

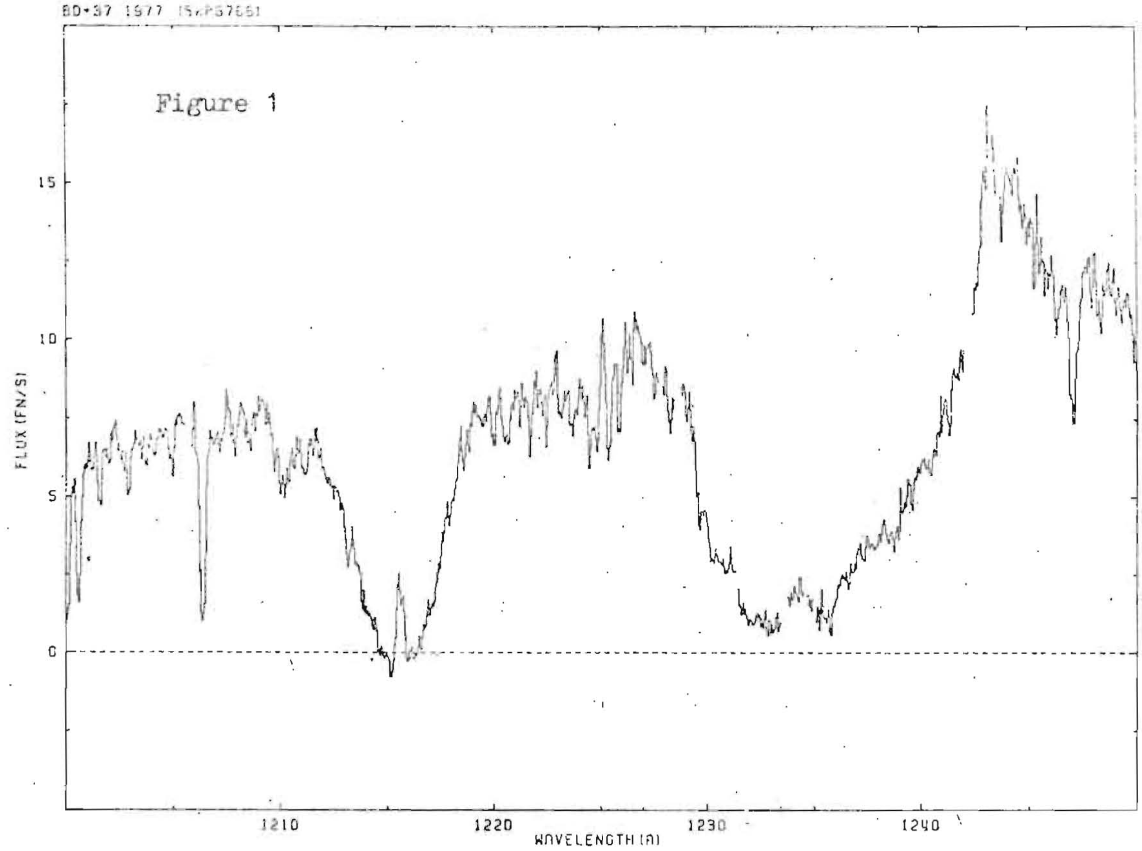

Figure 1

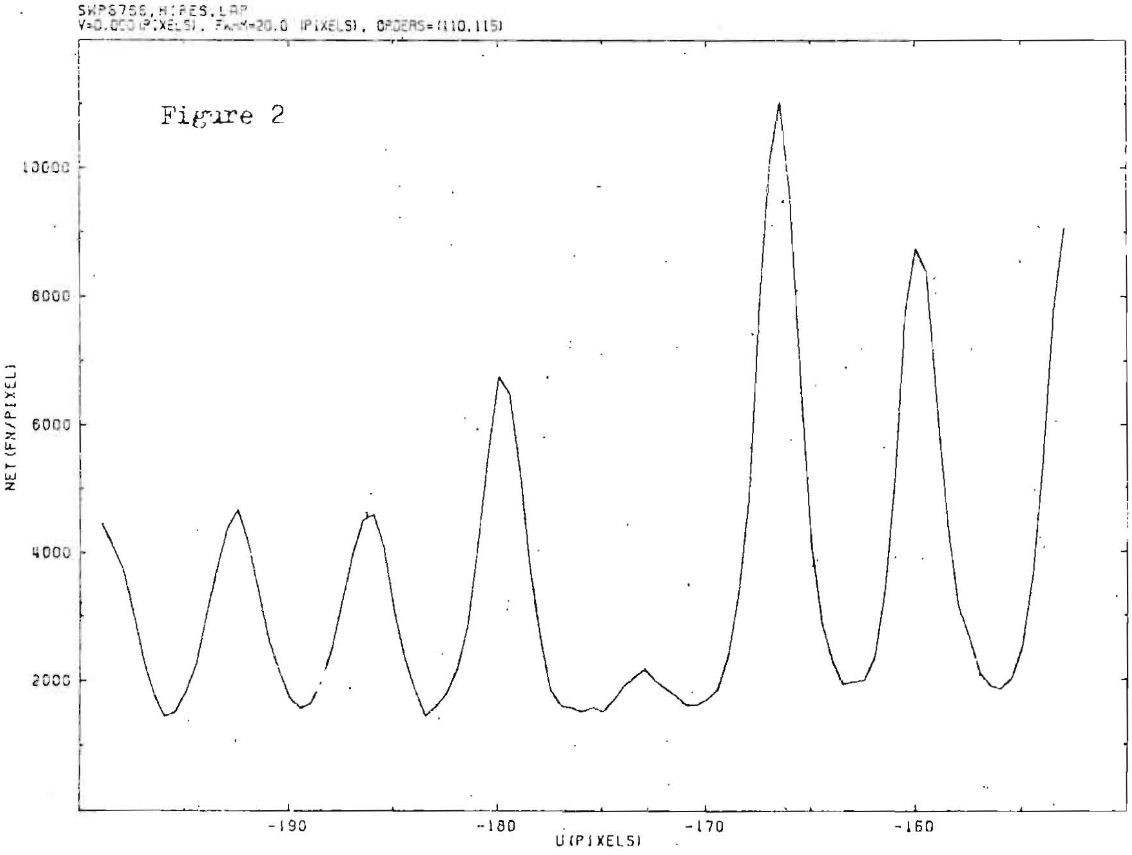

Figure 2

CHRONOLOGY OF MODIFICATION TO IUESIPS OUTPUT PRODUCTS

The following table lists the most important of the modifications to the IUESIPS data reduction system which have had an effect on the output products delivered to the Guest Observer (G.O.). The changes made are listed in strict chronological order for GSFC and approximate chronological order for VILSPA. The table covers the period 5 April 1978 to 31 March 1983 and gives the effective dates at GSFC and VILSPA of each modification, along with a brief explanation of its nature. Those modifications that are not applicable to, or will not be made at, an installation are indicated by a dash in the date column. A date entry may be left blank for either of the following reasons:

(i) the change has not been made, but may be made in the future;

(ii) the modification concerns reduction of calibration images, which are not processed by VILSPA.

Modifications made only at VILSPA are grouped together at the end of the table.

This table replaces an earlier version published in ESA IUE Newsletter #11, pg. 75 (August 1981). A considerably more detailed history of IUESIPS changes affecting magnetic tape output was published as a separate document entitled "Techniques of Reduction of IUE Data: Time History of IUESIPS Configurations" in ESA IUE Newsletter No. 14. That document addressed changes through March 1981; an updated version is currently in preparation.

D.F. Stone

Chronology of Modification to IUESIPS

Output Products

GSFC - VILSPA Date	Modification
05 Apr 78 - 17 Apr 78	• Eliminate auto-scaling of net ripple-corrected CalComp plot (set $F_{MAX}=10^5$).
20 Apr 78 - 17 Apr 78	• Extend SWP low dispersion extraction to $\lambda=2000$ Å.
20 Apr 78 - 14 Jun 78	• Correct problem of corrupted data at ends of smoothed background spectra.
25 Apr 78 - 17 Apr 78	• Change F_{MAX} to $2x10^5$ for net ripple-corrected plot.
26 Apr 78 - 14 Jun 78	• Correct problem in integer-scaling routine ITOE which caused certain large fluxes to be negative on tape due to rounding error.
04 May 78 - 14 Jun 78	• Add processing dates to CalComp plots.
08 May 78 - 14 Jun 78	• Eliminate "CUTMERGE" step from high dispersion processing.
10 May 78 - 14 Jun 78	• Eliminate plot of unsmoothed background in high dispersion.
11 May 78 - 14 Jun 78	• Limit ripple correction at ends of orders to factor of 15.8 in SWP and 17.2 in LWR.

Chronology of Modification to IUESIPS

Output Products

GSFC - VILSPA Date	Modification
15 May 78 - 14 Jun 78	• Determine dispersion relations via new "WAVECAL2" (uses fractional pixel locations).
18 May 78 - 14 Jun 78	• Correct 1-pixel error in "OSCRIBE" overlay program.
22 May 78 - 14 Jun 78	• Use new averaged ITFs (contains SWP errors; see 7 July 1979).
22 May 78 - 14 Jun 78	• Use "EXTLOW" for low dispersion extraction instead of "COMPARE".
22 May 78 - 14 Jun 78	• Accomplish registration by shifting dispersion constants instead of image.
22 May 78 - 14 Jun 78	• Correct 2-pixel error in reseau flagging.
22 May 78 - 14 Jun 78	• Flag "saturated pixels" (DN=255) in plots, and change to plotting without lifting pen.
01 Jun 78 - 01 Feb 79	• Improve reseau flagging in smoothed spectra.
09 Jun 78 - 01 Feb 79	• Use reseaux measured on low dispersion image for both low and high dispersion wavelength calibrations (SWP).

Chronology of Modification to IUESIPS Output Products

GSFC - VILSPA Date	Modification
16 Jun 78 - 25 Jan 79	• Delete 55-line image segment from photowrites (low dispersion).
20 Jun 78 - 25 Jan 79	• Produce one doubly-oscribed photowrite image for the double-aperture case, instead of 2 singly-oscribed images.
20 Jun 78 - 25 Jan 79	• Change LWR high dispersion oscribe overlay to pass through order 83 (Mg 2795, 2803).
01 Jul 78 - 01 Feb 79	• Use reseaux measured on low dispersion image for both low and high dispersion wavelength calibrations (LWR).
06 Jul 78 - 25 Jan 79	• Create all oscribes on "GEOM'D" images (not photometrically corrected images).
07 Jul 78 - 14 Jun 78	• Change LWR ripple parameters to K=231,150 A=0.09 instead of K=231,300 A=0.08. This changes the limiting ripple correction factor to 16.4.
01 Aug 78 - 14 Jun 78	• Create "extended source" reduction capability in low dispersion (HT=15, DIST=11).
04 Aug 78 - 7 Jul 82	• Change IUEPLOT to streamline x-axis and plot key to symbols used. (At VILSPA this change was made to NEWPLOT.)

Chronology of Modification to IUESIPS Output Products

GSFC - VILSPA Date	Modification
08 Aug 78 - 01 Feb 79	• Correct bug in "ETOEM" to transmit image number to extracted spectrum files.
30 Aug 78 (low) / 31 Aug 78 (high) - 01 Feb 79	• Change standard LWR pixel offsets to transfer dispersion relations from small-to-large aperture as follows: $\Delta S=-17.5$ samples, $\Delta L=+19.5$ lines replaces $\Delta S=-21.1$ samples, $\Delta L=+25.1$ lines
17 Aug 78 - 01 Feb 79	• For "extended source" reduction, change min and max plotted fluxes for "log net" to 3.0 and 6.0 (replacing 2.0 and 5.0).
09 Sep 78 - 01 Feb 79	• Begin using automatic order-finding software (DSPCON), where possible, to determine spectral registration.
20 Sep 78 - ________	• Fix "ETOEM" to read only byte 50 (not 49 and 50) of first label record to obtain camera number for scale-factor record of extracted spectrum.
21 Sep 78 - 01 Feb 79	• Begin using improved low dispersion wavelength calibration line libraries.
25 Sep 78 - 01 Feb 79	• Move background location to "DIST=11" for low dispersion "point-source" reductions in large aperture (e.g., suppress geocoronal Lyα).

Chronology of Modification to IUESIPS Output Products

GSFC - VILSPA Date	Modification
09 Nov 78 - ________	• 2 Å/inch high dispersion CalComp eliminated except by special authorization.
10 Dec 78 (low), 13 Dec 78 (high) - 07 Mar 79	• Photometrically correct only a circular region of image ("FICOR5") in SWP high and low dispersion, LWR low dispersion.
13 Dec 78 - 25 Jan 79	• Change "EXTLOW" and DATEXTH2 to write line and sample shifts into label in auto registration case.
13 Dec 78 - 05 Jun 79	• Change "EXTLOW" to write "omega", "hback" and "distance" into the labels of extracted spectra.
19 Dec 78 - 14 Feb 79	• Eliminate processing of order 65 in SWP high dispersion.
04 Jan 79 - 07 Mar 79	• Photometrically correct only a circular region of image ("FICOR5") in LWR high dispersion (FICOR5 now used throughout).
30 Mar 79 - ________	• 10 Å/inch high dispersion CalComp eliminated in cases were 2 A/inch plot is authorized.
05 Apr 79 - 01 Feb 79	• Correctly enter line & sample shifts into label for the case of MANUAL registration.

Chronology of Modification to IUESIPS Output Products

GSFC - VILSPA Date	Modification
05 Apr 79 - Sep 78	• Suppress excess label-plotting on CalComp plots.
30 Apr 79 -	• Begin writing raw image to tape for images designated "Do Not Process".
25 May 79 -	• Add plotter registration benchmark symbols at start and end of each plot.
02 Jun 79 - ________	• Add tape contents summary log at end of G.O. tape labelprints.
08 Jun 79 - 12 Jul 79	• Correct error in integer-scaling routine ("ITOE") for extracted-spectrum files, so that all negative fluxes are converted properly. (See NASA IUE Newsletter No. 7).
15 Jun 79 - 10 Jan 80	• Create "extended source" reduction capability in high dispersion (HT=7).
19 Jun 79 -	• Eliminate redundant tape files in the case of calibration-image reduction.

Chronology of Modification to IUESIPS Output Products

GSFC - VILSPA

Date	Modification
30 Jun 79 - 01 Feb 80	• Begin plotting high dispersion net ripple-corrected spectra with "CUTMERGE" to suppress noise at ends of orders and allow auto-scaling of flux axis (applies ONLY to CalComp plots; G.O. tapes unchanged).
02 Jul 79 - ________	• Begin writing identifying header file on G.O. tapes (for data management accounting purposes).
07 Jul 79 - 07 Aug 79	• Correct error in SWP ITF.
08 Jul 79 - 10 Mar 81	• Change ΔS and ΔL pixel offsets for large aperture dispersion relations to correspond to actual object placement point. (See NASA IUE NEWSLETTER No. 6.)
27 Jul 79 - ________	• Begin use of new CalComp plotter hardware. Plots are more precise and on wider paper, but still 10-inch full scale grid.
06 Aug 79 - 10 Mar 81	• Change ΔS and ΔL pixel offsets for large aperture dispersion relations to correspond to physical center of large aperture. (In coordination with telescope operations change, so that offsets still correspond to object

Chronology of Modification to IUESIPS
Output Products

GSFC - VILSPA

Date	Modification
	placement. Change refers to all data acquired as of 1 August 1979. (See NASA IUE NEWSLETTER No. 6).
28 Sep 79 - 01 Feb 80	• Modify the program "OSCRIBE" to generate overlay more efficiently and suppress overlay entirely outside of tube face. (See 11 Nov 79 entry).
08 Oct 79 - ________	• Begin producing computer-generated GO data product receipts.
11 Oct 79 - ________	• Upgrade tape contents summary log at end of GO tape labelprints to include additional information.
30 Oct 79 - ________	• Begin use of mean dispersion constants for low dispersion spectra. (See NASA IUE NEWSLETTER No. 7).
11 Nov 79 - 01 Feb 80	• Correct problem in version of OSCRIBE implemented 28 Sept 79 in order to place overlay over entire image for large aperture spectra.
23 Nov 79 - 10 Mar 81	• Begin using improved high dispersion wavelength calibration line libraries.

Chronology of Modification to IUESIPS Output Products

GSFC - VILSPA

Date	Modification
08 Jan 80 - 01 Sep 78	• Eliminate 10 Å/inch plot of net ripple corrected spectrum in high dispersion and make 2 Å/inch plot of same the standard.
08 Jan 80 - 01 Feb 80	• Begin using FICOR6 photometric correction program which extrapolates the ITF at or near the upper limit. (See NASA IUE NEWSLETTER No. 8).
08 Jan 80 -	• Change symbol key on CalComp plots to allow "+" to mean either "saturated, or limited extrapolation".
09 Jan 80 - 02 Apr 80	• Begin producing absolutely calibrated net spectra in low dispersion (See NASA IUE NEWSLETTER No. 8), using LWR calibration revised at 1900 Å.
01 Mar 80 - 06 Mar 80	• Begin using EXTLOW2 to place background extraction further from center of order by a factor of $\sqrt{2}$. (See NASA IUE NEWSLETTER No. 9).
18 Apr 80 - ________	• Begin using further improved high dispersion wavelength calibration line libraries.

Chronology of Modification to IUESIPS Output Products

GSFC - VILSPA

Date	Modification
22 Apr 80 -	• Begin using improved cross-correlation template for large reseau in FNDRES and add 2 more reseaux in LWR and 3 more reseaux in SWP.
31 May 80 -	• Begin finding reseaux on TFLOOD images instead of low dispersion platinum-plus-TFLOOD images.
18 Jul 80 - 10 Mar 81	• Begin use of mean reseau sets and mean high and low dispersion constants. (See NASA IUE NEWSLETTER No. 11).
18 Aug 80 - 30 Dec 80	• Correct two minor errors in automatic registration programs DSPCON and DCSHIFT: properly convert integer pixel values to real values, and properly generate a perpendicular shift.
28 Aug 80 -	• Begin use of mean positions of lines to start preliminary wavelength solutions.
28 Aug 80 - ________	• Correct the OSCRIBE problem for large aperture spectra (See 11 Nov. 79 entry) which inadvertantly infiltrated

Chronology of Modification to IUESIPS
Output Products

GSFC - VILSPA

Date	Modification
	production system on 30 Jul 80 when program was recompiled for system reasons.
29 Aug 80 -	• Begin using final improved versions of high dispersion wavelength calibration line libraries.
18 Sep 80 - 30 Sep 80	• Change program ETOEM to correctly write 5-digit image sequence numbers in scale-factor record ("record zero") of extracted spectra.
04 Nov 80 - 10 Mar 81	• Begin use of new low dispersion software (See NASA IUE NEWSLETTER No. 12).
04 Nov 80 -	• Modify manual registration program REGISTER (new name = REG) to calculate shifts which are exactly perpendicular to the dispersion from operator inputs.
04 Nov 80 - 10 Mar 81	• Flag shifts as either "manual" or "auto" in image headers in new low dispersion software.

Chronology of Modification to IUESIPS Output Products

GSFC - VILSPA

Date	Modification
04 Nov 80 - ________	• Change labelprinting program to use new low-dispersion file nomenclature; use "PI" instead of "GPI" even for high dispersion photometrically corrected image (still old software).
04 Nov 80 - 10 Mar 81	• Put scheme name in output file labels in high and low dispersion.
04 Nov 80 - 30 Jan 81	• Flag shifts as either "manual" or "auto" in image headers in current high dispersion software.
26 Nov 80 - ________	• Correct an error in the registration program REG so that shifts for the SWP camera will be perpendicular to the dispersion.
22 Dec 80 - ________	• Modify program VBBLK so that the values of starting sample and starting line in the RAW image label will be 001 and 001 instead of 895 and 895. This change only affects tapes sent to the National Space Science Data Center (NSSDC).

Chronology of Modification to IUESIPS Output Products

GSFC - VILSPA

Date	Modification
16 Jan 81 - 17 Jun 81	• Modify program SPECLO to put the correct declination of southern objects in the output label, and to output correct line and sample shift information.
19 Jan 81 - 17 Jun 81	• Correct small registration error (~0.4 pixels) for SWP-HIGH, LWR-LOW and all trailed images.
03 Mar 81 - 11 Mar 82	• Use temperature correction algorithm and new mean dispersion constants for LOW dispersion calibration files. Modify labels to reflect this change.
03 Mar 81 - 17 Jun 81	• Begin use of an improved center and radius in PHOTOM defining region of photometric correction for LOW dispersion processing. The new radius is smaller than the preliminary one and was chosen to accommodate eventual high dispersion processing.
05 Mar 81 - 17 Jun 81	• Modify the LOW dispersion program SPECLO to test the quality of each pixel for photometric correction before using in an extracted flux computation.
06 Mar 81 - 5 May 81	• Modify LOW dispersion program POSTLO so that it blank-fills unused portions of the IUESIPS label of extracted spectra.

Chronology of Modification to IUESIPS Output Products

GSFC - VILSPA Date		Modification
22 Apr 81 -	•	Correct program TRACE to place wavelength overlay over entire image for large aperture spectra.
30 Apr 81 - 17 Apr 80	•	Replace program 'CUTMERGE' by program 'CORTAME', which only cuts bad data from orders and leaves some order overlap on plots (SWP and LWR cameras only at this time).
6 May 81 - 7 Jul 82	•	Add new DN step wedge on photowrite prints.
19 May 81 - 11 Mar 82	•	Implement temperature/time correction of displacement files and dispersion constants in high dispersion.
11 Jun 81 - 30 Dec 80	•	Use program ESMOOTH for background smoothing in high dispersion. Implements a median-plus-mean smoothing similar to new low dispersion S/W.

Chronology of Modification to IUESIPS

Output Products

GSFC - VILSPA Date		Modification
11 Jun 81 -		• Begin labeling gray scales on photowrites (see 6 May 81 change) with corresponding DN values.
17 Jun 81 -		• Implement automatic flux scaling of LOG ABNET plots in low dispersion.
22 Jun 81 -		• Suppress flagging of contaminated points on CalComp plots of the smoothed background in low dispersion.
10 Jul 81 -		• Implement new ITF extrapolation algorithm in photometric correction program PHOTOM ("new" software only). See NASA IUE Newsletter No. 15.
24 Jul 81 -		• Correct center and radius value in photometric correction program PHOTOM back to the values of 3 Mar 81 which were inadvertantly changed with 10 Jul 81 modification of PHOTOM.
30 Jul 81 -	10 Mar 81	• Begin producing 2-color CalComp plots.
10 Aug 81 -		• Implement new SOC photowrite transfer function to reduce contrast at low DN levels and increase contrast at high DN levels.

Chronology of Modification to IUESIPS

Output Products

GSFC - - VILSPA Date		Modification
17 Aug 81 - 10 Mar 81	•	Implement schemes and software for processing LWP camera images in both high and low dispersion.
25 Aug 81 - 11 Oct 79	•	Provide an option to ignore Geocoronal Lyman α in scaling SWP low dispersion GROSS and ABNET plots.
28 Aug 81 - 11 Mar 82	•	Modify method of automatic registration of high dispersion images so as to measure the shift at the closely-spaced orders.
28 Aug 81 - 12 Jul 79	•	Begin producing bar-type CalComp plots in low dispersion.
28 Sep 81 - 11 Mar 82	•	Implement flagging of LWR camera microphonics noise on tape and CalComp plots, low dispersion only at this time.

Chronology of Modification to IUESIPS Output Products

GSFC - VILSPA Date	Modification
5 Oct 81 - 12 Jul 79	• Begin producing bar-type CalComp plots in high dispersion
19 Oct 81 -	• Implement new transfer function for photowrite contact prints to match the effective response achieved for SOC (quick look) photowrites. (See 10 Aug 81 change and NASA IUE Newsletter No. 18.)
3 Nov 81 -	• Modify automatic registration program under new software (DCSHIFT) so as to improve the registration of trailed images, ignore areas of image affected by microphonic noise, and allow larger shifts.
3 Nov 81 -	• Begin using LWP ITF1 which differs from previously used ITF0 in changing effective exposure time for second level from 20.22 seconds to 23.00 seconds.
10 Nov 81 - 11 Mar 82	• Begin use of new high dispersion software for SWP and LWR. (See NASA IUE Newsletter No. 18).
10 Nov 81 - 11 Mar 82	• Implement flagging of LWR camera microphonics noise on tape and CalComp plots for high dispersion (implemented 28 Sep 81 for low dispersion)

Chronology of Modification to IUESIPS
Output Products

GSFC - VILSPA Date	Modification
10 Nov 81 -	• Make CalComp plots an optional data product (previously created automatically).
10 Nov 81 - 10 Mar 81	• Install option to ignore Geocoronal Lyman α in scaling SWP high dispersion plots.
13 Nov 81 - 11 Mar 82	• Modify automatic registration software (DCSHIFT) to improve shift for trailed images.
16 Nov 81 - 11 Mar 82	• Correct minor roundoff error in writing dispersion constants into scale factor record of the low dispersion extracted spectrum files (MELO and LBLS).
23 Nov 81 - ________	• Add to label of found reseau position file the camera and image sequence number of the image from which the positions were derived.
24 Nov 81 - 11 Mar 82	• Further modify automatic registration software (DCSHIFT) to allow more trailed images to be treated automatically. (See NASA IUE Newsletter No. 18).
7 Jan 82 - 11 Mar 82	• Begin use of new high dispersion software for LWP.
27 Jan 82 - 11 Mar 82	• Modify TRACE to limit wavelength grid overlay to area defined by center and radius used for photometric correction in high dispersion.

Chronology of Modification to IUESIPS

Output Products

GSFC - VILSPA Date	Modification
1 Feb 82 -	• Alter details of calculating preliminary dispersion solution for WAVECAL images so as to account for temperature/time effects. Little impact on final WAVECAL solutions expected.
8 Feb 82 -	• Begin using smaller cross-correlation search area in finding emission lines on WAVECAL images. This change is made possible by the change of 1 Feb, but also has little expected impact on final solutions.
16 Feb 82 -	• Reduce volume of printed output for flat-field BOXSTATS processing.
3 Mar 82 - 10 Mar 81	• Install VILSPA partial read program INSERT. (At VILSPA install as part of all low dispersion schemes.)
5 Mar 82 -	• Modify the utility tape input program ULTPIN to zero fill lines which have unrecoverable read errors.
29 Apr 82 -	• Correct program VBBLK so that it no longer adds an extraneous L in the next to the last line of the image header.
5 May 82 - 7 Jul 82	• Correct program POSTHI to consistently include spectral order 72 for high dispersion LWR images.

Chronology of Modification to IUESIPS

Output Products

GSFC - VILSPA

Date	Modification
5 May 82 - 7 Jul 82	• Correct program POSTHI to use the event status entry from line 10 in searching for the end of exposure time for use in the heliocentric correction.
6 May 82 - 7 Jul 82	• Correct program SPECLO to use the event status entry from line 10 in searching for the end of exposure time.
5 Aug 82 - 19 Oct 82	• Correct the method in program POSTHI for handling negative declination values.
5 Aug 82 - 16 Jul 82	• Correct program POSTHI to scale the ripple corrected net spectral data according to the appropriate minimum and maximum flux values.
27 Aug 82 - 19 Oct 82	• Modify program PHOTOM to photometrically correct only the area inside the partial read boundaries for all low dispersion images.
27 Aug 82 - 19 Oct 82	• Modify program PHOTOM to improve the centering of the swath which is photometrically corrected for low dispersion images.
27 Aug 82 - 19 Oct 82	• Implement the new ripple correction algorithm as defined by T. Ake (see NASA IUE Newsletter No. 19).

Chronology of Modification to IUESIPS
Output Products

GSFC - VILSPA

Date	Modification
02 Sep 82 - 19 Oct 82	• Modify INSERT to make defaults for partial-read parameters agree with those used by operations.
21 Sep 82 - 19 Oct 82	• Modify LWP large aperture offsets in TCCAL and master calibration schemes.
21 Sep 82 - 19 Oct 82	• Implement new mean dispersion constants for LWP, LWR, and SWP using data from 1/1/80 to 8/29/82. Implement new temperature and time correlation coefficients for LWR and SWP.
11 Oct 82 - 19 Oct 82	• Modify POSTHI to use the 7-point "optimal" filter for LWP high dispersion images.
19 Nov 82 - 19 Oct 82	• Implement BSPOT using flagging mode only.
19 Nov 82 - 10 Apr 81	• Modify NEWPLOT to flag bright spots as detected by BSPOT.
24 Feb 83 -	• Modify TCCAL to extract the correct head amplifier temperature from the image header when the GMT date changes between the time an image is exposed and the time it is read.
24 Feb 83 -	• Update the angles of the spectral orders, as specified in the program REG, to correspond with the recently implemented dispersion relations.

Chronology of Modification to IUESIPS

Output Products

GSFC - VILSPA Date		Modification
________	- 17 Apr 78	• LWR ripple parameters K=231 075 and A=0.09 used.
________	- 06 Jul 78	• Change high dispersion CalComp from 2 Å/inch to 1 Å/cm.
________	- 12 Jul 79	• Begin producing absolutely calibrated net spectra in low dispersion (using original A & A calibration).
________	- 16 Nov 79	• Correct error in printer output from "EXTLOW" so gross-background given with correct sign.
________	- 10 Jan 80	• Write camera, image and aperture identifier on all plots. (This information has always been present on GSFC plots.)
________	- 28 Feb 80	• Produce plots on narrow paper as standard, wide paper available by special request.
________	- 10 Mar 81	• Modify and standardize format of labels inserted during processing.

Chronology of Modification to IUESIPS

Output Products

GSFC - VILSPA

Date	Modification
________ - 10 Mar 81	• Revise plotting program to improve plot layout and appearance. Box drawn around plot area, tick marks placed inside box, all data now plotted inside box, titling information repositioned and object catalog designation added, alternate high dispersion orders plotted in contrasting colors. (See 30 Jul 81 GSFC.)

ANNOUNCEMENT

Availability of IUE Spectral Atlas

The "ATLAS OF HIGH RESOLUTION IUE SPECTRA OF LATE-TYPE STARS, 2500 - 3230 Å", by Robert F. Wing, Kenneth G. Carpenter, and Glenn M. Wahlgren of the Ohio State University, is now available.

The Atlas presents high-resolution IUE spectra of 13 late-type stars — 12 giants and supergiants of types G, K, and M, and a solar-type dwarf — at a scale of 0.2 Å/mm (50 Å/page) from 2500 to 3230 Å. Most of the exposures are sufficiently deep to show photospheric absorption lines as well as chromospheric emission lines. The accompanying text describes the data reduction procedures and gives an absolute calibration of the fluxes. A list of emission lines identified in the spectrum of γ Cru (M3 III) is also given.

The Atlas has been published by Perkins Observatory as Special Publication No. 1 and is being sold for $5.00. To obtain a copy, make your check or purchase order payable to The Ohio State University and mail it to:

ATLAS
Astronomy Department
Ohio State University
174 West 18th Avenue
Columbus, OH 43210.

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