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Starlink Project
Starlink User Note 9.1

12.05.81

A set of programs for handling IUE data

1. INTRODUCTION

This note describes the operating procedure for a set of programs that handle data from the IUE satellite.

The Programs can be split into 4 categories :

a) Program ANIUE is a simple IUE tape analysis program that gives a summary of the contents of an IUE tape.

b) STAK and TRAK enable the user to extract both high and low resolution data from the GPHOT image. STAK reads the IUE tape and puts the GPHOT image onto disk in a form suitable for TRAK. TRAK then takes this disk file and extracts the data specified by the user's input data. These programs were written by J.R. Giddings (UCL).

c) TAPERD, SWPLORES and LWRLORES are three programs for extracting low resolution IUE data from the GPHOT image. TAPERD reads the GPHOT image and puts part of it onto disk for use by SWPLORES and LWRLORES. These latter programs extract the low-resolution spectrum from the SWP and LWR (respectively) cameras. These programs were written by M.A.J. Snijders and S.Adams (UCL) .

d) Program DRP is a fairly general data reduction system which will handle IPCS and IUE data. The IUE part of DRP allows absolute calibration of the data and simple measurement facilities. The program was written by S.L. Wright (UCL).

2. SELECTION OF PROGRAMS

This package of IUE programs has two separate sets of programs for extracting the data (described under b, and c, above). Which one should be used for a given set of data ? If you have high resolution data then there is no choice, STAK and TRAK are the programs to use. For low resolution data, both sets of programs will extract it.

Tests have shown that the extracted low resolution spectra from these extraction systems are very similar, so the choice must be made on other grounds. The extraction systems have different ways of extracting the data, determining the background, and rejecting bad data, so your choice may be affected by the techniques used (the LORES programs were specifically written to handle very faint signals, so they may be the most suitable if you have this type of data). The LORES programs perform absolute calibration as well as extraction, so the output can be fed into any other programs directly, whereas STAK and TRAK only extract the data leaving the calibration to DRP, so this may also be a deciding factor. The other main difference between them is the style of use. STAK and TRAK are rather batch-like in operation, whereas the LORES programs are highly interactive.

If you havn't been able to make up your mind using the above considerations then the only solution is to try both systems. You will soon find out which is the best suited to your data (or your temperament !) .

3. OPERATING INSTRUCTIONS

This section gives details of how to run the IUE programs on a Starlink VAX. Details of the programs and how they work are not given here but references to sources of this information are given. All the programs are held in the directory SYS$SYSDISK:[STARPACK.IUE] , which has the logical name IUEDIR .

N.B. Before attempting to use any of the programs in this package it is essential that you execute the command 'IUE'. This will set up the values of various logical names and global symbols used by the package. Regular users can put this statement in their private LOGIN.COM file so that it is executed automatically when they login.

3.1 ANIUE - a program for analysing the contents of IUE tapes

This program analyses the contents of VILSPA IUE tapes. The first 25 lines in the header block are printed to help with identification of the data.

Before running the program, allocate a tape drive in the normal way, i.e.

ALLOCATE MT:

and mount your tape as a foreign tape with logical name ITAPE :

MOUNT/FOR MTAn: Tape ITAPE

where n is the tape drive number which has been allocated (0 or 1). and Tape can be any string (which must be enclosed in double quotes if it contains special characters or blanks).

The program assumes that the tape is rewound at the start. It does not rewind the tape at the end of the analysis.

To run the program create the symbol :

ANIUE :== RUN IUEDIR:ANIUE

(This symbol may have been created for you when you logged in, if so the DCL command : SHOW SYMBOL/GLOBAL ANIUE will confirm the above definition. If not you can put the above definition in your LOGIN.COM file to save typing it each time you run ANIUE.)

ANIUE can now be run by typing :

ANIUE

You will then be interrogated to determine what tape drive is being used (0 or 1), how many files are to be skipped before the analysis starts, how many files are to be analysed, and for a Title to label the analysis output.

All being well the tape will be analysed, with the results written to a file TAPE.LIS . This file can be displayed on a terminal in the usual way i.e.

Type TAPE

3.2 Running STAK and TRAK

The file IUEDIR:STAKTRAK.DOC contains a description of how STAK and TRAK work, and give details of the input data that they require. Thus this information will not be repeated here. It is assumed that the User has created input files for both programs (probably by copying and editing some of the large number of input data files stored in SYS$SYSDISK:[STARPACK.IUE.DATA]) and just wants to know how to run the programs on the VAX.

3.2.1 Running STAK version 1.1

Create the symbol :

```
STAK :== @IUEDIR:STAK
```

(this may have been done for you. If not you can put this definition into your LOGIN.COM file).

To run STAK as an interactive command procedure, type :

```
STAK  tape-id input-file stack-file
```

where tape-id is the name by which the VILSPA tape is known
input-file is the file containing the input data to STAK
stack-file is the name of the file to contain the STAKed image.

e.g. STAK "Tape" STAK1234.SIN LL1234

The Tape-id must be surrounded by " " if it contains special characters. If a file type is not specified for input-file a default type of .SIN is supplied by the command procedure. The file type for stak-file is always .STK (the procedure will override any file type that you supply).

If the arguments are not supplied the command procedure will prompt for the values it requires, (this is probably the best way to run the program) e.g.

```
$  STAK
   Tape-id:   Tape
   Input-file:   STAKSWHI
   stak-file:   SH1234.STK
```

The command procedure will attempt to allocate a tape drive. If successful the message :

_MTAn: ALLOCATED

will appear. If no tape drives are available the message :

Tape Drive not available, try again later.

will appear.

The command procedure will then ask for the tape to be mounted:

Mount tape ... on drive _MTAn:

and then prompt :

Are you ready to continue (Y or N) :

to which the reply Y should be given when the tape has been mounted. The VAX will then mount the tape and give the following messages :

```
$MOUNT-I-MOUNTED, VILSPA mounted on _MTAn:
PREVIOUS LOGICAL NAME ASSIGNMENT REPLACED
PREVIOUS LOGICAL NAME ASSIGNMENT REPLACED
```

The command procedure will then execute STAK, and when finished the message :

Do you want to stak another image (Y or N)

will appear. If you do, then type Y and you will be asked for the new input and output files. Note that any SKIP commands will skip relative to the last position of the tape, not relative to the start of the tape. If you do not wish to stak another image, type N and the message :

End of Stak command procedure

will appear.

A file stak-file.LIS contains the printed output from STAK.

The STAK command procedure can be run as a batch job, in which case the procedure asks the operator to mount the tape. So it should only be run as a batch job if you have an operator. The job is initiated with :

```
$ SUBMIT STAK/PAR=(Tape-id,input-file,stak-file)
```

Remember that the Batch job logs in to your default directory, so you must supply the complete file reference if the files are not in you default directory.

3.2.2 Running TRAK version 1.1

Having created the STAKed direct-access file, TRAK can be run to extract the spectra.

Define the symbol :

```
TRAK :== @IUEDIR:TRAK
```

To run TRAK, type :

```
$ TRAK input-file stak-file output-file
```

where input-file is the file containing the commands to TRAK. If a file type is not given a default type of .TIN is appended. stak-file is the STAKed image file, which always has the file type .STK . output-file will contain the machine readable output from TRAK, the file type will always be .TRK . A file output-file.LIS will contain the printed output from TRAK. TRAK will also prompt for arguments if they are not supplied. e.g.

```
$ TRAK TRAKSWHI.TIN STAR1.STK STAR1.TRK
```

or

```
$ TRAK
    input-file : TRAKLWLO
    stak-file : S1234
    output-file : S1234
```

When TRAK has finished executing the message :

End of TRAK command procedure.

will appear.

3.3 TAPERD, SWPLORES and LWRLORES

The user is referred to the following references for a complete desciption of these extraction programs :

i) M.A.J.Snijders SRC IUE Newsletter No.5 1980
ii) A.Boksenberg&Snijders M.N.R.A.S Vol.194,353 1981

iii)Adams&Snijders SRC IUE Newsletter (to be submitted)

Ref. i) describes the SWP version;
Ref. ii) the removal of noise spikes
Ref. iii) will contain a description of the LWR version.

The processing of an IUE image is a two stage operation:

i) Tranfer the GPHOT image(s) from tape to disk.

ii) Running the extraction program.

3.3.1 Copy images for tape to disk

a) Allocate tape drive:

ALLOCATE MT:

b) Mount tape on tape drive:

MOUNT/FOR MTAn: label ITAPE

ITAPE is the logical name referred to by the program. label is for your own reference.

c) Run tape reading program:

RUN IUEDIR:TAPERD

(It may be convenient to define the symbol : TAPERD :== RUN IUEDIR:TAPERD)

The program prompts for the number of files to be skipped before copying begins. When copying is completed user is asked if more files wanted-if none, the tape is rewound and program ends.

Two disk files are created per image:

HEADER.REC	containing the header record. This can be displayed on the screen.
GPHOT.DAT	containing the GPHOT image. This cannot be displayed on the screen.

NOTE: If more than one image is copied the disk files created are given consecutive version numbers. You are advised to rename them to a more mnemonic form, e.g.

```
, RENAME GPHOT.DAT;3  GPHOT1662.SWP
```

Each GPHOT disk file occupies about 1000 blocks.

When you have finished running TAPERD free the tape drive for others to use:

```
DISMOUNT MTAn        DEALLOCATE MTAn
```

3.3.2 Running lores extraction programs

General

The extraction programs read from the GPHOT disk file created by TAPERD and create a number of output files, named according to image number. Thus the output files produced for SWP 1662 would be:

file name	contents
CARD1662.SWP	Fluxes+wavelengths in 4(F8.3,E10.3)
FLUX1662.SWP	Fluxes, wavelengths, gross & background counts in a table.
IUE1662SWP	Reorganised GPHOT image for display on screen, background before and after noise removal.
PRIN1662.SWP	Rotated GPHOT image for line printer output.
S1662.TRK	Spectrum for DRP
C1662.DAT	Calibration file for DRP

The calibration for the LWR extraction program was determined from 18 images of 5 standard stars . In its preparation, however, an exposure level effect was discovered . With the current version of LWRLORES this is seen as increased flux from underexposed images . An ITF correction (analogous to that in the SWP program) is being calculated and will be available on later versions.

Running the programs

To run the lores extraction programs type

```
RUN IUEDIR:SWPLORES        (or LWRLORES)
```

The user is first prompted for the image number (eg for SWP 1662 enter 1662) and then the name of the file containing the

GPHOT image to be processed (eg GPHOT1662.SWP). Next comes a series of prompts for the following parameters, all of which are read in free-field format:

BAND, WSTAR, WEND — As part of the output in FLUX1662.SWP the fluxes between WSTAR and WEND angstroms are averaged over bandwidths BAND. The program indicates the default values.

NSAMP — NSAMP describes the position of the central pixel in the extraction window. This is varied by the user until the spectrum appears in the centre of the windo Typical values are 449 for SWP and 214 for LWR large aperture images and 490 and 261 for small aperture; early shifted images have NSAMPs of 490 and 260. of 490 for SWP and 260 for LWR.

ISLIT — There are three extraction slits available with this version;

ISLIT = 1	Normal 15 pixel slit
ISLIT = 2	Narrow 9 pixel slit
ISLIT = 3	WIDE 33 pixel slit

For most images the 15 pixel slit will be used. The narrow slit may be required for faint, noisy spectra while the 33 pixel slit is for extended sources.

IAPER

= 1	large aperture
= 2	small aperture

The user is next asked for the exposure time in seconds.

WAVCOR — There is no absolute wavelength calibration available and the user must make the appropriate wavelength correction, WAVCOR, to the properly centred image. It is recommended that WAVCOR is kept to zero until the best NSAMP has been found. WAVCOR is applied to the current wavelength scale.

The program gives an option on the number of pixels to be displayed on the screen. The 19 pixel display gives Flux Numbers (FNs) divided by 100, the 33 pixel display gibes FN/1000.

In addition the SWP version allows the appropriate ITF correction to be made to images.

Once the above parameters have been entered the program reshuffles the image (in about 60 seconds) so that the dispersion direction is in the Y-axis and pixels perpendicular

to the dispersion are in the X-axis. This is then displayed on the screen. The display can be halted with <CTRL>S and restarted with <CNTL>Q.

For the calibration curves to give correct fluxes the image must both be correctly centred and correctly aligned with the wavelength scale. Thus after the image has been shown the user may choose different values of NSAMP, WAVCOR, and ISLIT to line up the image in the extraction window.

When the user is happy with the displayed image the program goes on to calculate the absolute fluxes and creates a file that can be used in the IUE part of DRP.

Finally the user is given the option of recalculating the fluxes with a different slit width. If this facility is used, new CARD, FLUX and DRP files are created (with higher version numbers). Note that in recalculating the fluxes the background is taken to be the same as for the original extraction; thus the fluxes should always be recalculated using a narrower slit.

3.4 DRP

After extracting the IUE data from the image (using either of the above systems) it can be calibrated and measured using the facilities of DRP. Documentation for DRP is in the files :

IUEDIR:DRP.DOC and DRPIUE.DOC

DRPIUE.DOC is the relevant file for the IUE part of DRP but you should read the first part of DRP.DOC to get a general idea of the way DRP works. Note that the facilities described in DRP.DOC (except for the macro system, HELP, RD, RT, QU) CANNOT be used on IUE data sets, but only on IPCS data sets. (This distinction between the data types will be removed in the next version of DRP).

To run DRP create the definition :

```
DRP :== $IUEDIR:DRP.EXE
```

and the logical name :

```
ASSIGN IUEDIR:DRP.HLP DRPHLP
```

(This may already have been done for you, if not put these definitions into your LOGIN.COM file) .

DRP is executed by typing :

```
DRP
```