Memoirs of the Faculty of Science, Kyoto University, Series of Physics, Astrophysics, Geophysics and Chemistry, Vol. XXXVII, No. 1, Article 3, 1986

The Kwasan Image Processing System

By

Yoshihiro NAKAI, Reizaburo KITAI*, Tadashi ASADA and Kyosuke IWASAKI**

Kwasan and Hida Observatories, Yamashina, Kyoto 607, Japan

(*Received May 23, 1986*)

Abstract

The Kwasan Image Processing System is a general purpose interactive image processing and analyzing system designed to process a large amount of photographic and photoelectric data. The hard ware of system mainly consists of a PDS MICRO-10 microdensitometer, a VAX-11/750 minicomputer, a 456 M bytes Winchester disk and a VS11 color-graphic terminal. Some of the most important designning features of the system are to permit the astronomer 1) quick analysis of his data in both photographic and electromagnetic media, 2) easy access to his data in both visual image and graphic display in response interactively to the available menu of optional programs. Our application programs "PDS, KIPS, STII" enable users to analyze spectrographic plates and 2 dimensional images without site-special knowledge of programming.

Keywords: Image processing, Microdensitometer, Computer.

1. Introduction

The Kwasan digital image processing system, KIPS, was planned in 1979, in order to digitalize and/or analyze a lot of photographic solar images, spectra and data from photoelectric detectors, which would be produced by observations.

As a hardware configuration of the system, a combination of the Micro-10 microdensitometer system with a 0–4D photomultiplier, the VAX-11/750 minicomputer and the VS11 19 inch color graphic display system was selected by the points of view for their high performance, reliability and flexibility.

According to our design policy to save labor and to shorten the wasteful time of users, KIPS image handling utility programs were developed and installed. These are available to the user for operations and can be executed interactively from any terminal. In addition to KIPS, STII (System de Traitement Interactif d'Image) and PDS (Scansalot_Plus) were modified and installed. Above two utility packages include comprehensive programs for spectroscopic analysis and PDS control applications.

Present Address

*) Hida Observatory, Kamitakara, Gifu, Japan, 506–13.

**) Yahata University, Yahata-higasiku, Kitakyushu, Japan, 805.

2. Hardware

Figure 1 shows general view of the KIPS system in the computer room, and Figure 2 presents a configuration of the system hardware. The system consists mainly of the PDS Micro-10 microdensitometer, the VAX-11/750 minicomputer, a line printer, a magnetic tape drive, graphic terminals, video terminals and plotters.

The PDS Micro-10 (Perkin Elmer, Data Acquisition system), a well-known measuring machine, is controlled by Model 6800 Microprocessor Control System. The Data acquisition system is consisting of the microdensitometer itself, the M 6800 control system, LA120 hard-copy terminal and the magnetic tape system, and is originally designed to be operated as a stand-alone system by using internal programs stored in its ROM. And in this case the processor automatically controls stage motions and monitors x and y stage positions, and then initiates A/D conversions and stores the informations in the data buffer memory. The processor formats these signals and sends the results to the magnetic tape unit.

In our case, as is shown in Figure 2, Micro-10 is linked to the VAX-11/750 CPU through a combination of a DMA parallel interface and a RS232C serial interface. The Perkin Elmer provides standard interface, X-10, which consists of a parallel I/O card and a serial I/O card. They are connected respectively to a DR11-W DMA interface and a DZ11 interface of a host computer VAX-11/750. Bi-directional 16 bit parallel direct memory interface is provided for the purpose of sending byte

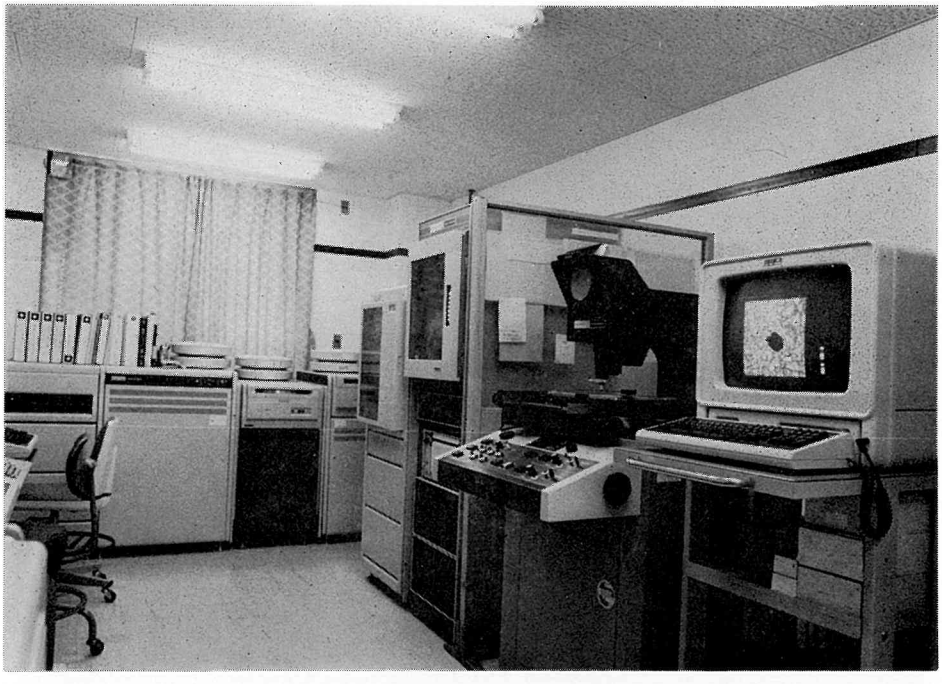

Fig. 1. General view of the Kwasan Image Processing System in the computer room. There are VS11 19″ color-graphic terminal, the PDS micro-10 microdensitometer, the Magnetic drive of PDS, the Magnetic drive of VAX, VAX-11/750 CPU and disk drives. RA81 456 Mbytes Winchester-disk is behinde the magnetic tape drives.

serial signals quickly from Micro-10 to host computer and exchanging signals each other for handshake. The size of each density datum is 16 bits (2 bytes). A serial interface is provided to enable the host to send command to control Micro-10 and receive information consists of status, responses and acknowledgements from Micro-10.

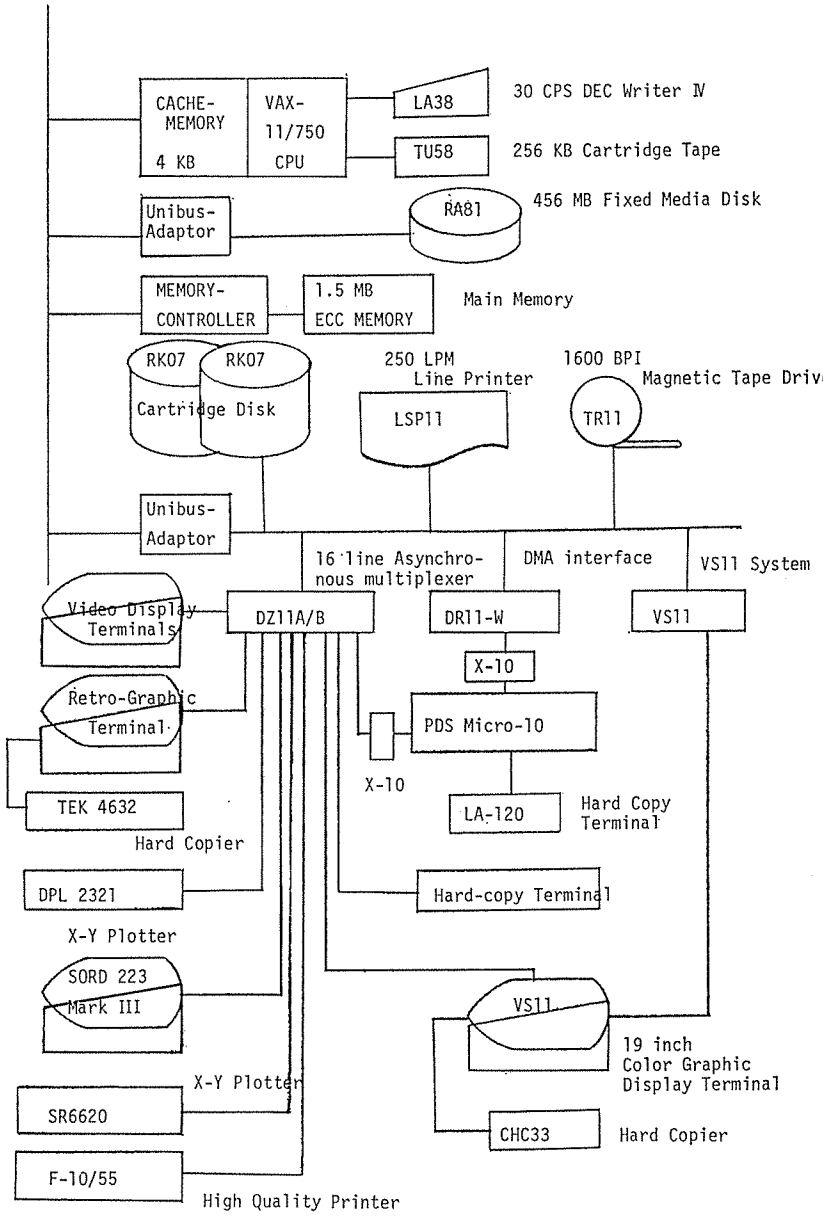

Fig. 2. Configurations of the Kwasan Image Processing System. In the upper part: VAX-11/750 dual RK07 package system and RA81 option. In the lower left part: Video display terminals and X-Y plotters are connected to the asynchronous communication lines. In the lower right part: PDS Micro-10 and VS11 is connected to the unibus via DMA interfaces.

At the user's options, the destination and format of the output data from the PDS can be selected among SAD, MT, DISK and PDSMBX. Usually, users select DISK option and the data are written on the current default directory in the format of a direct access file, one row per record. The file type is IMG. A header file is also written in ASCII format and its file type is HDR.

At the beginning, we started with such a minimum system as the VAX-11/750 CPU with 0.5 MB main memory, the dual RK07 disk subsystem (removable cartridge disk, 28 MB each), a DZ11A 8-line asynchronous multiplexer, a TR11 1600 BPI magnetic subsystem, a LSP11 line printer and a Retro-Graphic display terminal. Our planned standard image size is full 24×36 mm format and then number of data points with the scanning pitch of 10 microns becomes to 6.4 milion pixels of 16-bits density. The user's disk, one of the dual RK07 disks, has large enough Quota size to store one image data of 12.8 M bytes, but it is impracticablly long to process such a large data with 0.5 MB main memory.

Many trials to tune the system parameters were persuaded to adjust the system for better resource utilization and the best performance. But their results do not show remarkable improvements. Then we came to a conclusion that the resources of the system comparing with loads were too small to meet our expectation. Then VAX-11/750 8USER dual RK07 system was expanded with additions of an 1 MB ECC MOS memory, RA81 456 MB Winchester disk subsystem and a DZ11B 8-line asynchronous multiplexer. The VS11 color graphic system, plotters and video terminals were added.

The Retro-Graphic VT640 is a graphic enhancement for the VT100 video terminal. In the VT640 mode, system offers full graphic capabilities and utilizes a 480×640 plotting resolution on a 14 inch CRT screen, and is compatible with Tektronix 4010 series model using PLOT-10 software. A hardcopy of the picture on the CRT screen can be made with a Tektronix video hardcopy unit 4632 in less than 18 seconds.

The VS11 raster graphics system consists of an image rpocessor, two image memory modules, a sync generator 19 inch color video monitor, keyboard and a joystick. Each image memory module is a complete video frame buffer with half a million bit of memory. Two image memory modules in this system allows a maximum capability of a 512×512 resolution of 4 bits deep with which the system can show an interlaced 16-color static graphics. The system, being a DMA device, the image processor can transfer image data to the image memory rapidly. Input data rate to memory is 1 pixel per 640 nanoseconds, corresponding to 0.16 s with an image of 512×512 pixels. A color hardcopy of 7 steps can be made with a Shinko color hardcopy unit model CHC-33 within about 45 s.

Two different type intelligent X-Y plotters are provided. One is an Iwatsu drum type plotter model DPL-2321, and its maximum drawing area becomes to 1000 by 270 mm according to the use of long roll recording paper. Another is an Iwatsu flat-bed type plotter model SR-6620, whose drawing area is 400 by 275 mm. Both plotters provided RS232C interfaces for data transfer from VAX-11/750.

Seven Video terminals are provided. Some of them are equipped with hardcopy printers connected to each printer port.

3. Software

Historically, the practical work of making KIPS system begins with purchasing of Micro-10 on March, 1981. Since then, and about one year until the introduction of VAX-11/750, software developments of the image processing and analyzing had been made at the Data Processing Center of Kyoto University. The expansion of hardwares was carried on by annual step of the program. Developments of softwares were carried on in parallel with system developments, and as a natural result, algorithms and methods of data handling are strongly stimulated by the other system configurations provided at that time.

As shown in Figure 3, data flows are divided broadly into two categories depending on the way of data acquisition. One of the data acquisition systems is the

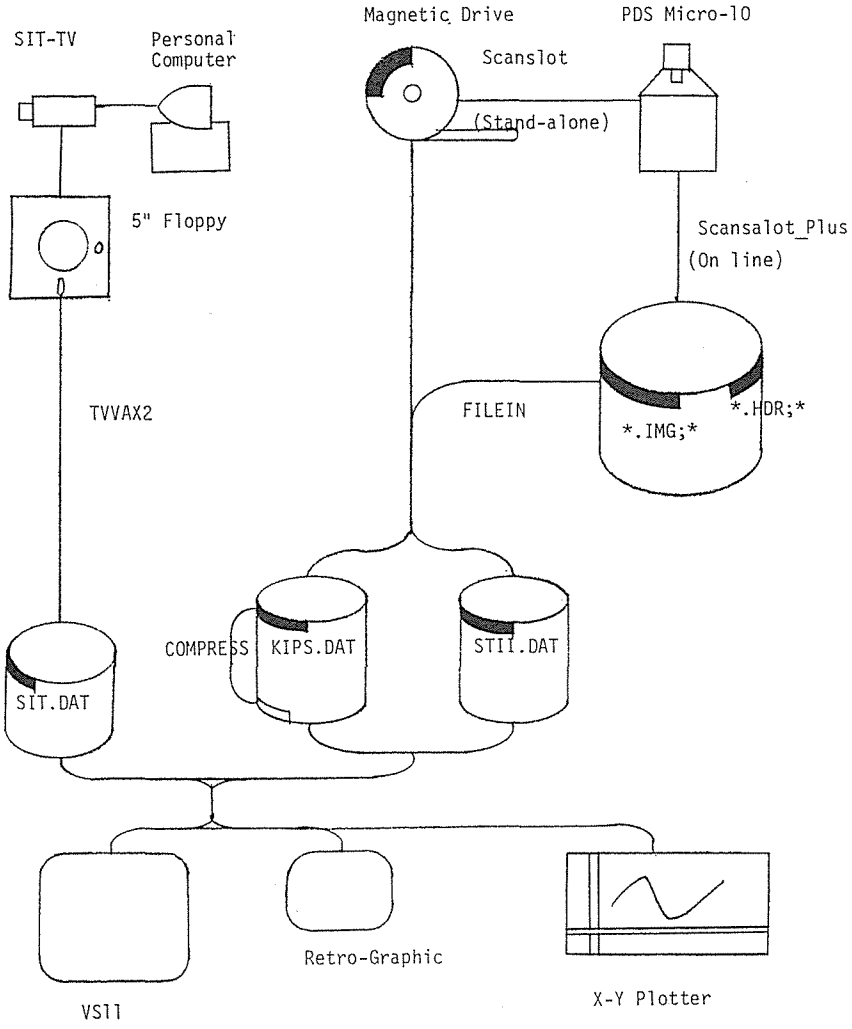

Fig. 3. Schematic diagram of the KIPS data flows.

PDS, and another, the SIT TV-camera. In the former case, plates or films to be measured are set properly on the platen stage and the PDS itself is calibrated and stabilized precisely for starting operation. There are two modes to operate the Micro-10. One is stand-alone mode described in section 2, and another, on-line mode accompanied with VAX-11/750 host-computer. In the former mode, Scansalot program controls scanning motion and data transfer and then saves the density data on the magnetic tape. In the latter mode, Scansalot_Plus program is running under VAX/VMS to facilitate the automatic operation, and an operator can set parameters and execute scanning motions and saving data on to the current default directory in interactive mode. File types are HDR and IMG respectively. KIPS UTILITY FILEIN can convert the data file on the MT or on the disk, which is saved in proper record format and size respectively, to standard format disk file.

In the latter case, Sord 223 Mark III personal computer controls the SIT-TV camera set on the Domeless Solar Tower Telescope at the Hida Observatory and collects and saves one or two dimensional data on the 5″ floppy disc. KIPS UTILITY TVVAX2 reads it and writes standard format disk file on the VAX-11/750 disk.

The operator can process and analyze data files and display the results on any one among the VS11 color graphic terminal, the B/W Retro-graphic terminal and X-Y plotters using KIPS and/or STII utilities. Fundamental and necessary programs at present are created and installed in the VAX system. These system utilities are available to the users for these operations and can be run from any terminal. For convenience of users, programs will respond with a menu table and on-screen help. Users can manipulate and display results only by their response-input to self-explanatory question one by one.

3.1 File Formats

3.1.1 KIPS standard data file supports two picture sizes whose data points are $256\times\times256$ and 512×512 respectively. The former is a 512 bytes fixed-length record (256 data points) format sequential file. Each datum is an 2 byte signed integer which is made of multiplying density value by 100 times. The number of data record must be less than 256. An 512 bytes header record includes 40 characters comments for identification, a number of data points in each record and a number of records. The latter is the same with exception of maximum data size by 4 times. Header- and data-record length is 1024 bytes respectively and maximum number of records is 512.

3.1.2 STII standard data file supports free picture size even larger than 512×512 points. When data points of one scanning exceed 256 points, data are stored into 512 bytes fixed length record segments successively. Each datum is a 2 byte signed integer which is made of multiplying density value by 200 times. The header record is 512 bytes and inlcudes 80 characters comments, a number of data points in one scan and other scanning parameters.

3.1.3 Picture data of SIT camera is composed of 256×127 data points, and its data file is same as KIPS standard small size file. The header format is made according to the format of STII file.

3.2 Utility programs

During our progarm development, version of the VAX/VMS operating system has been updated from 2.3 to 3.7. Layered programs popularly in use are Fortran 77 and PL/1.

3.2.1 SCANSALOT_PLUS is a PDS control program installed in VAX-11/750 for the purpose of remote controlling of the scanning motion of the PDS and density data acquisition in interactive mode.

To start Scansalot_Plus, it is very simple to type PDS after the prompt of DCL, $, and then the operator can execute program, set up parameters and store data in several different formats according to the user's needs. In the course up to end, help utilities make for ease of use.

Figure 4 shows an example. As a result of execution, selecting DISK option for formatting the output data from the PDS, program creates some files in the default directory. A header file, a file of scanning parameter and an information are written in ASCII format: SCAN2.HDR;1. A setup parameters file is created after each setup option: SETUP.SVE;1. A density data file is a direct access file on disk: SCAN2.IMG;1. A pattern file is a file containing the number of points to scan and the coordinates of those points: PDS026.PAT;1 (default name). Figure 5 shows files in my default directory, contents of PDS026.PAT;1, SCAN2.HRD;1 and SETUP. SVE;1.

3.2.2 KIPS Image Processing programs

One purpose of the KIPS programs is to convert 2 dimensional data file taken by PDS and SIT camera to KIPS or STII standard format file. Another purpose is to analyze and display it on several terminals at the user's choice. These data flows are shown in Figure 3. KIPS utilities can be started by typing KIPS after the prompt of DCL, $, and the main menu is displayed as is shown in Figure 6. In the column from left to right, there are program number, program name, name of media, file types in the default directory and destination of output. Following the example, operator selects, utility number 16, FILEIN, which can convert data file on the PDS magnetic tape or PDS data file in the default directory to KIPS- or STII-standard file. In this case original data file is of 1000×500 on the disk and as an output 256×256 KIPS standard file is choosen. Followings are interactive process to decide parameters, a size and a name, and finally 256×250 KIPS standard file is closed up from SCAN2.IMG;1. Figure 7 shows the process of conversion from PDS data tape to KIPS standard file of 256×256. Figure 8 shows successive process to display. Using utility 4, PLOT, standard KIPS file is processed to output isophote on the X-Y plotter. The results are shown in Figure 9.

3.2.3 STII Image processing and analyzing programs

These utilities are owed to "System de Traitment Interactif d'Image" of Paris Observatory. Originally running under the RT11-M operating system with PDP11 and Tektronix 4014 graphic terminal. Souces of these programs were kindly handed over and installed in the system and are running under VAX/VMS after some modification applied.

```
COPYRIGHT 1983 DEARING ASSOCIATES
Welcome to VAX/SCANSALOT-PLUS.
         **************
          VAX/PDS V3.6

            K.I.P.S.
         **************

Do you need instructions (Y/N)? N
Are you ready to start (Y/N)? Y
TO SET LOCAL ORIGIN:  Set pds to manual,
                      position stage to desired location,
                      and press <CR>.
Enter one:
          REgister
          SEtup
          SS (Setup from Sve file)
          SCan
          HElp
          CHange
          GO
          ZEro (Reset local zero)
          GRipe (Suggestions, bugs, etc.)
          MArk (Mark points for a PAT file
          EXit
PDS> SE

          PDS SETUP  7/27/85:      <CR> - DEFAULT OK
                                    ^Z - GO BACK TO PREVIOUS QUESTION
                                    ENTER NEW VALUE.

Density/Transmission (Default is D)?
Pixel type I2 or R4 (Default is R4)? I2
Data destination (SAD, DISK, USER, OR MT , SAD is default)? DISK
Enter object id: SCAN2
Enter your name: NAKAI
Enter date of observation (MM/DD/YY): 06/23/83
Enter instrument type: DST
Enter id of observer: IK
Comments (Y/N)? Y
Enter comments (4 sixty character comments)
COMMENT 1: FLAT BACK GROUND ABOUT D=3.5
COMMENT 2:
COMMENT 3:
COMMENT 4:
Type of scan (FLIP/EDGE)? EDGE
Do you have a pattern file (Y/N)? N
How many points do you want to scan on (max 1000)? 1
TO MARK A POINT:  Set pds to manual,
                  move stage to point position,
                  enter star number (default is       1):1
Do you want to save these coordinates in a file (Y/N)? N
Is this a center scan? N
Enter two parameter sets,  the third will be figured.
Number of X points (0 < X < 3200 for Flip scan in x): 1000
Number of Y points (0 < Y < 3200 for scan in y): 500
Step size in X direction (max is 4095): -10
          in Y direction (max is 4095): 10
X distance is : 10000 Y distance is :  5000
Enter scan speed (default.is 80, max is 255): 80
Enter one:
          REgister
          SEtup
          SS (Setup from Sve file)
          SCan
          HElp
          CHange
          GO
          ZEro (Reset local zero)
          GRipe (Suggestions, bugs, etc.)
          MArk (Mark points for a PAT file
          EXit
PDS> SC

SCAN #    1 COMPLETED: 00:23:17.1
Enter one:
          REgister
          SEtup
          SS (Setup from Sve file)
          SCan
          HElp
          CHange
          GO
          ZEro (Reset local zero)
          GRipe (Suggestions, bugs, etc.)
          MArk (Mark points for a PAT file
          EXit
PDS> EX
END PDS
$
```

Fig. 4. An list of interactive process to manipulate the PDS in the online mode using SCANSALOT_PLUS program. This example shows Q and A from the starting program to the end.

```
Directory DUA0:[NAKAI.PDS]

223603.DAT;1          K2539WG22.HDR;1      K2539WG22.IMG;1      K25PDS.DAT;1
PDS026.PAT;1          SCAN1.HDR;1          SCAN1.IMG;1          SCAN2.HDR;1
SCAN2.IMG;1           SETUP.SVE;1

Total of 10 files.
$ TYPE PDS026.PAT;1
   1 F F
 170496  101376          1
$

TYPE SCAN2.HDR;1
 SIMPLE  =                    T       / STANDARD FITS TAPE
 BITPIX  =                   16       / 2-BYTE TWOS COMPL.
 NAXIS   =                    2       / 2-AXIS DATA
 NAXIS1  =                 1000       / NUMBER OF X_POINTS
 NAXIS2  =                  500       / NUMBER OF Y_POINTS
 CVAL1   =               170496       / STARTING X ENCODER VALUE
 CDELT1  =                  -10       / X DIRECTION AND STEP
 CVAL2   =               101376       / STARTING Y ENCODER VALUE
 CDELT2  =                   10       / Y DIRECTION AND STEP
 PDSPEED =                   80       / SCAN SPEED
 SCNTYP  = '            EDGE  '       / RASTER, FLIP, EDGE
 BACKUP  =                   'F       / CENTER - T, CORNER - F
 BUNIT   = '                  D'       / AMPLIFIER USED
 BSCALE  =                             / DATA TO TRUE CONV. SCALE
 BZERO   =                             / DATA TO TRUE ZERO SCALE
 BLANK   =                             / UNDEFINED DATA DEFAULT VALUE
 OBJECT  =' SCAN2                '     / OBJECT ID
 DATE_SCN='  7/27/85'                  / DATE OF SCAN
 ORIGIN  =' SCANSALOT+'                / SCAN ORIGIN
 OPERATOR=' NAKAI                '     / OPERATOR ID
 DATE_OBS=' 06/23/83'                  / DATE OF OBSERV.
 INSTRUME=' DST                  '     / TELESCOPE, CAMERA, SPECTROGRAPH, ETC
 OBSERVER=' IK                   '     / OBSERVER ID
 COMMENT ='          FLAT BACK GROUND ABOUT D=3.5
'
 COMMENT ='
'
 COMMENT ='
'
 COMMENT ='
'
 END
$

TYPE SETUP.SVE;1
D

D
SCAN2      .
NAKAI
06/23/83
DST        .
IK
Y
FLAT BACK GROUND ABOUT D=3.5



E
Y
PDS026.PAT
N
X
1000
500
-10
10
80



DUMP/WORD/DECIMAL/RECORD SCAN2.IMG;1


Dump of file DUA0:[NAKAI.PDS]SCAN2.IMG;1 on 29-JUL-1985 18:20:38.67
File ID (3897,4,0)    End of file block 1954 / Allocated 1954

Record number 1 (00000001), 2000 (07D0) bytes

  2965  2973  2969  2969  2967  2975  2975  2973 ................      0
  2969  2971  2975  2975  2965  2973  2975  2967 ................     16
  2975  2975  2975  2969  2975  2971  2973  2969 ................     32
  2969  2975  2975  2971  2969  2975  2973  2973 ................     48
  2969  2969  2971  2969  2969  2973  2971  2971 ................     64
  2975  2971  2969  2969  2965  2975  2969  2971 ................     80
  2971  2971  2973  2971  2973  2971  2971  2971 ................     96
```

Fig. 5. As a result of the execution of PDS SCANSALOT_PLUS, SCAN2. HDR; 1, SCAN2. IMG; 1, SETUP.SVE; 1, PDS026.PAT; 1 are created on the default directory of the user; [NAKAI.PDS]. Followings are their contents.

```
Directory DUA0:[NAKAI.PDS]

223603.DAT;1        K2539WG22.HDR;1     K2539WG22.IMG;1     K25PDS.DAT;1
PDS026.PAT;1        SCAN1.HDR;1         SCAN1.IMG;1         SCAN2.HDR;1
SCAN2.IMG;1         SCAN2.PAT;1         SETUP.SVE;1

Total of 11 files.
$ KIPS

Do you need KIPS MENU table (Y/N)?: Y

   Program      MT,Floppy   File on def-dir     OUTPUT
-------------------------------------------------------------
 1)  TATMTS      PDS-MT                        RETRO,kips.DAT
 2)  ISO1,2      PDS-MT                        kips.DAT,VS11
 3)  PICTURE                 kips.DAT          RETRO
 4)  PLOT                    kips.DAT          XY-PLOTTER
 5)  CHARAC      PDS-MT                        I/D.DAT
 6)  STARDI                  I/D.DAT+kips.DAT  I kips.DAT
 7)  VSCOMET                 kips.DAT          VS11
 8)  PDSISO      PDS-MT                        XY-PLOTTER
 9)  PDSVS11     PDS-MT                        VS11
10)  TVVAX2      5 inch disk(Sord)             sit.DAT
11)  VSTVVAX2                sit.DAT           VS11
12)  STIIISO                 stii.DAT          XY-PLOTTER
13)  INSTVS                  instvs.DAT        VS11
14)  STIIVSIN                stii.DAT          VS11,instvs.DAT
15)  MTHIST      PDS-MT(special)               TT
16)  FILEIN      PDS-MT      pds.IMG,pds.HDR   kips-,stii.DAT
17)  PDSIDN      PDS-MT(read contents)         TT
18)  CMPRESS                 kips.DAT(512^2)   kips.DAT(256^2)
                             stii.DAT          stii.DAT cooked
19)  DOPP                    sit.DAT(R&B)      sit.DAT(R-B)
    ***** If you like to end, key in 00 and <CR> *****
Enter KIPS Utility Number  : 16


Which data volume do you choose, Tape(1) or Disk(2) ?: 2
Previous logical name assignment replaced

**********************************************

PDS DATA (Destination=DISK)  modify to KIPS file

Two dimensional image data will be stored in any of
 a 256 X 256 array (1) or a 512 X 512 array (2) or
 a full data array (3)

     Which size do you use ?
           (1) 256 X 256
           (2) 512 X 512
           (3) full data
     Enter 1 , 2  or 3 : 1

**********************************************
```

```
-------------------------------------------------------
 Beginning of  on 29-JUL-85 at 19:20:12
-------------------------------------------------------
PDS file, which you wish to copy.
File name > SCAN2
Version number > 1
      Identification
FLAT BACK GROUND ABOUT D=3.5
Points/line =  1000  Line(s) =   500
Delta X =   -10  Delta Y =     10
Starting Point: X=     170496 Y=     101376
Not agree=1 >
I agree.
Region specification : Close-up or Whole ? (C/W) > C
** You can specify a region by the parameters :
   XBGN,XEND,XSTEP
   YBGN,YEND,YSTEP
** Enter the parameters so that the data points
   could be stored in an array of 256 X 256 size.
   XBGN  ? > 1
   XEND  ? > 512
   XSTEP ? > 2
   YBGN  ? > 1
   YEND  ? > 500
   YSTEP ? > 2
-------------------------------------------------------
Region  :
  XBGN,XEND,XSTEP :     1  512    2
  YBGN,YEND,YSTEP :     1  500    2
  XSIZE X YSIZE   :   256  250
-------------------------------------------------------
```

```
Region specification O.K. ? (Y/N) > Y
Creation of disk file.
File name > SCAN2
PDS file SCAN2
will be copied on : SCAN2
Wait a minute, operation need a certain time.
Start at 19:27:24
   100  th record is read in at 19:27:28
   200  th record is read in at 19:27:32
   300  th record is read in at 19:27:36
   400  th record is read in at 19:27:39
   500  th record is read in at 19:27:43
End of copy.
-------------------------------------------
Do you wish to copy another file ?
No=1/RETURN > 1
No more files to be treated.
** End of PDSKIPS2E **
-------------------------------------------
 End of  on 29-JUL-85 at 19:28:04
-------------------------------------------

Do you try another KIPS utility (Y/N)?:
```

Fig. 6. A list of interactive process to execute KIPS utility, FILEIN, which converts SCAN2.IMG; 1 original PDS data file accompanied with SCAN2.HDR; 1 to the KIPS standard file SCAN2.DAT; 1. Q and A are self-explanatory.

```
     ***** If you like to end, key in 00 and <CR> *****
Enter KIPS Utility Number : 16


Which data volume do you choose, Tape(1) or Disk(2) ?: 1
Please,load PDS MT on MSA0:

And, type <RET> when ready.:

Which format  do you choose, KIPS(1)or STII(2) ?: 1
%MOUNT-I-WRITELOCK, volume is write locked
%MOUNT-I-MOUNTED,  mounted on _MSA0:
Previous logical name assignment replaced

***********************************************

     DATA TRANSFER FROM MT.TO DISK

          Two dimensional image data will be stored
either in a 256 X 256 array or in a 512 X 512 array.

     Which size do you use ?
           (1) 256 X 256
           (2) 512 X 512
     Enter 1 or 2 : 1

***********************************************


***** WOULD YOU ANSWER FOLLOWING QUESTIONS ? ************

 Rewind the MT ? (Y/N)  N

 Relative No. of the file in the MT ? 10

 Total Record Number ? . 551

 Data number of 1 Record ?.1151

 Region specification : Close-up or Whole ? (C/W) C

 ** You can specify a region by the parameters :

    XBGN,XEND,XSTEP
    YBGN,YEND,YSTEP

 ** Enter the parameters so that the data points
 could be stored in an array of 256 X 256 size.

 XBGN,XEND,XSTEP ? 351,862,2

 YBGN,YEND,YSTEP ? 40,551,2

-------------------------------------------------------------

 Region  :

  XBGN,XEND,XSTEP :              351            862            2

  YBGN,YEND,YSTEP :               40            551            2

  XSIZE X YSIZE   :              256            256

-------------------------------------------------------------

 Region specification O.K ? (Y/N) Y

Output file name? 223603

*************************************************************
NFILE =                      10
NFILE =                       9
NFILE =                       8
NFILE =                       7
NFILE =                       6
NFILE =                       5
NFILE =                       4
NFILE =                       3
NFILE =                       2

Start at        16:37:09.54
          100    TH RECORD IS READ IN AT       16:37:20.87
          200    TH RECORD IS READ IN AT       16:37:35.36
          300    TH RECORD IS READ IN AT       16:37:49.87
          400    TH RECORD IS READ IN AT       16:38:04.35
          500    TH RECORD IS READ IN AT       16:38:18.85
Write-out is completed !

Do you continue (FILEIN) routine with same tape ? (Y/N): N

Do you try another KIPS utility (Y/N)?: Y
```

Fig. 7. A list also shows FILEIN utility process. In this example, the data file on the Magnetic tape saved in stand-alone mode is converted to the 256×256 KIPS standard file on the disk. Original data size are 1151×551 points and situated 10th from the beginning on the tape. File-name on the default directory is 223603. DAT.

```
     ***** If you like to end, key in 00 and <CR> *****
Enter KIPS Utility Number  : 4
 Selection of plotter device
 DPL2321 (D) or SR6620 (S)

 Enter D or S : S
Previous logical name assignment replaced

************************************************

 First check the size of your data file.

***** WOULD YOU ANSWER FOLLOWING QUESTIONS ? *****

File Name ? 223603

************************************************

Identification :        26JUNE83 223603 M-40

XSIZE=            256    YSIZE=                  256
************************************************

 Type 1, if xsize X ysize <= 256 X 256.
 Type 2, if 256 X 256 < xsize X ysize <= 512 X 512.

 Please enter 1 or 2: 1

***** WOULD YOU ANSWER FOLLOWING QUESTIONS ? *****

File Name ? 223603

Smoothing ? (Y/N) Y

How many steps ? 15

Size of output diagram ( X(mm) x Y(mm) ) ?

Enter X and Y 200 100

************************************************

26JUNE83 223603 M-40

Try again same routine (Y/N)?: N

Do you try another KIPS utility (Y/N)?: N
```

Fig. 8. A list shows PLOT utility processes. In this example, PLOT manipulates 223603.DAT file and display it's isophote of 15 steps on the X-Y plotter. Results is shown in Figure 9.

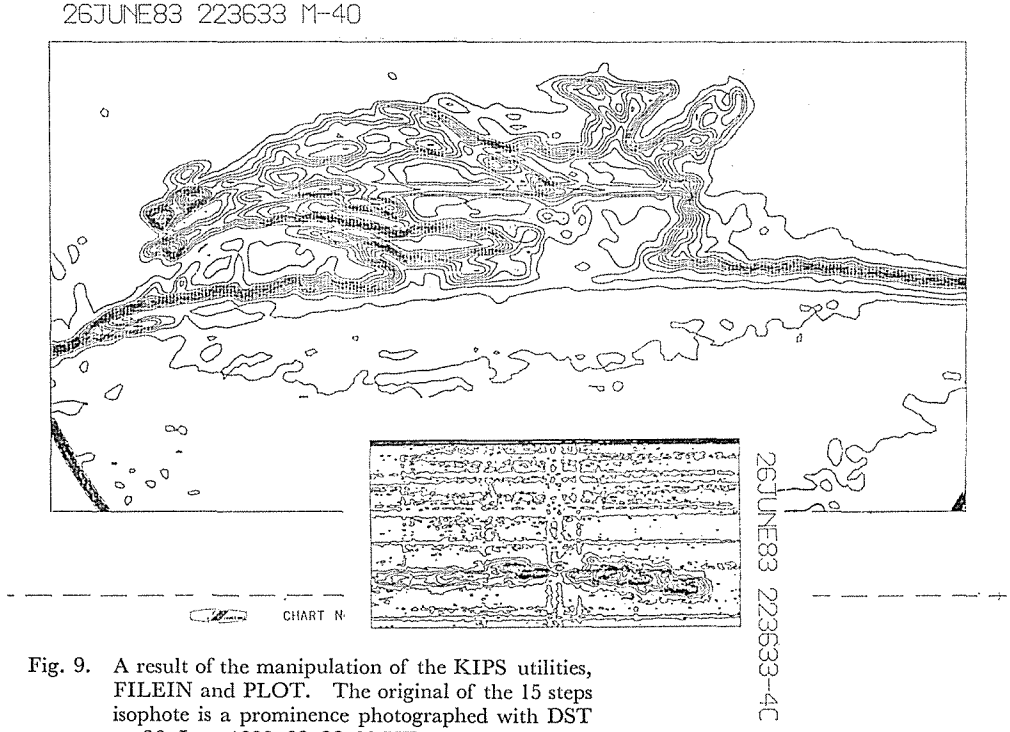

Fig. 9. A result of the manipulation of the KIPS utilities, FILEIN and PLOT. The original of the 15 steps isophote is a prominence photographed with DST on 26, June 1983, 22:36:03 UT.

```
STII

 *******   S.T.I.I.  *******

  Please set RETRO-power on.

  Ready (Y/N) ?: Y

 ****************************

  _TTA0: allocated

** Enter one of STII commands, MENU, HELP or EXIT: MENU

************************************************************

 Branches of STII commands :

   1) File manipulation
   2) D-I conversion
   3) Filtering ( 1-dim )
   4) Filtering ( 2-dim )
   5) Image display ( 1-dim )
   6) Image display ( 2-dim )
   7) Analysis of spectra
   8) Statistical analysis
   9) Miscellaneous utilities

************************************************************

** Enter  branch-no., 99 ( branch-table ) or RET ( exit ):

** Enter one of STII commands, MENU, HELP or EXIT: HELP

  Information available:

  APPROX     BDCAPB     BDCO1      BDCON      BDCOPY     BDCOR      BDDEF1
  BDDEF2     BDDFP      BDDIA      BDDIAT     BDDP2      BDEXA      BDFG2
  BDFIL      BDFP2      BDGAUS     BDGRAF     BDHIS      BDISO      BDISP
  BDIXY      BDJOIN     BDLISE     BDMIKI     BDMOY      BDMOYE     BDRELF
  BDRGAU     BDRI       BDROT      BDTDI      BDUNI      CDCAFITS   CORSAY
  FALLI      FICHIERS   FITS       FITSCDCA   GRAFSET    GRIS16     HELP
  I2TOI4     INVERSE    LISTE      NEWSIZE    ORETA      RSINT      RTDXY
  RTTABL     SUGGEST    TOBIGDYN   TOSMALDYN  TRADEN     VAXMAX     ZOOM

** Enter one of STII commands, MENU, HELP or EXIT: LISTE

Previous logical name assignment replaced
     5      0
-------------------------------------------------------
 Beginning of LISTE      on 30-JUL-85 at 18:11:22
-------------------------------------------------------
File name ? : > SCAN2S
-------------------------------------------------------
File name :SCAN2S
Points/line =  1000  Line(s) =   500
Delta X =      -10  Delta Y =       10
Start from : X0 =         0.00 Y0 =         0.00
Identification of the file:
FLAT BACK GROUND ABOUT D=3.5
-------------------------------------------------------
Line number > 1
Line number :      1
Line number :      1
      1 !    2 !    3 !    4 !    5 !    6 !    7 !    8 !    9 !   10 !
     +------+------+------+------+------+------+------+------+------+------+
   0*!  743!  743!  743!  741!  742!  742!  743!  741!  741!  743!
  10*!  743!  741!  743!  743!  742!  742!  742!  743!  742!  743!
  20*!  742!  743!  743!  743!  743!  743!  743!  742!  742!  743!
  30*!  743!  742!  742!  742!  743!  742!  742!  742!  742!  742!
  40*!  742!  742!  743!  741!  742!  742!  742!  743!  742!  742!
  50*!  742!  743!  742!  743!  742!  742!  742!  742!  743!  742!
  60*!  743!  742!  743!  742!  743!  742!  742!  742!  743!  742!
  70*!  742!  743!  742!  742!  742!  742!  742!  743!  742!  742!
  80*!  742!  743!  743!  742!  743!  743!  742!  742!  742!  742!
  90*!  743!  742!  742!  742!  743!  742!  742!  742!  743!  742!
 100*!  742!  741!  742!  741!  741!  743!  743!  742!  744!  743!
 110*!  743!  743!  742!  743!  743!  742!  742!  742!  743!  742!
 120*!  743!  743!  742!  742!  742!  743!  743!  742!  743!  743!
 130*!  743!  743!  742!  743!  743!  742!  742!  743!  742!  742!
 140*!  743!  743!  742!  742!  742!  743!  742!  743!  742!  743!
 150*!  743!  742!  742!  743!  743!  743!  743!  741!  743!  742!
 160*!  742!  743!  743!  742!  742!  743!  743!  743!  742!  744!
 170*!  743!  742!  743!  742!  743!  743!  742!  743!  742!  742!
 180*!  742!  743!  743!  742!  741!  742!  742!  743!  742!  743!
 190*!  742!  742!  742!  743!  743!  742!  742!  742!  743!  743!
Type RETURN to stop listing. Type SPACE to continue.
Line number > 8
Line number :      8

** Enter one of STII commands, MENU, HELP or EXIT: EXIT

** All the TT output during this STII session  **
** are stored in a temporary backup file.      **

** Do you want to get hard-copy of them ? (Y/N): N
$
```

Fig. 10. An list shows one of processes in STII utilities, LISTE option to make a density list of SCAN2S.DAT. At first sight it is clear that the menu and help libraries can be used easily.

STII is the utility to analyze the one- or two-dimensional data taken by the PDS. Analysis can be processed interactively referring to the display on the Retro-graphic terminal and HELP facilities if necessary. Final results displayed on the Retro-graphic terminal can be copied by the Tektronix 4632 Hardcopier.

STII Utilities can be started by typing STII after the prompt of DCL, $. And these are consisting of the menu and adequate help that makes for ease of use. As is in the Figure 10, in the course of processing with LISTE option to list a portion of SCAN2S file, the menu and help table are displayed according to the user's needs.

STII utilities,as shown in the menu table in the Figure 10, are consisting of 1) File managements and handling, 2) D-I conversion with data of the step-wedge, the tube-sensitometer and manual input table, 3), 4) 1- or 2-dimensional filtering, 5), 6) 1- or 2 dimensional graphic display, 7) Analysis of the spectra, and 8) Statistical analysis.

4. Conclusion

ESO PLATE MEASURING FACILITIES (Melnik 1979) in Geneva provided for European astronomers a first class facility for the digitalization and analysis of photographic and electrographic materials. ESO plate measuring facilities are open to astronomers from all countries, and they can manipulate system using application program IHAP.

ESO facilities and our KIPS were designed by the same philosophy that the facility should be open to all scientists and any one can digitalize and reduce plates by executing programs from a console interactively. In Japan, KIPS is only one plate measuring facility equipped with utilities in the system and open to any scientist. Our utilities are consisting of image and spectroscopic analysises and programs in the field of statistical astronomy have been developing now.

5. Acknowledgements

We are grateful to Director, Professor, Dr. I, Kawaguchi for supporting the project to build and develope Kwasan Image Processing System from the beginning up to now. We thanks Dr. M. Kanno and Dr. S. Saito for their kind suggestions and discussions. We also acknowledge kind helps of Paris Observatory giving us STII utilities. This work was supported in part by Gran-in-Aid for scientific Research (No. 59420003) from the Ministry of Education, Science, and Culture.

Reference

Melnick, J., 1980, in Proc. of the ESO workshop on Two Dimensional Photometry, held at Noordwijkerhout, eds. P. Crane and K. Kjaer, p53–62.