PAN 3 - THE HPD DIAGNOSTIC PROGRAM

R. GLASSER* and S.J. McCARROLL

CERN, Geneva

PAN 3 is a program used for testing the HPD system for some of the more common faults which have occurred. The program consists of FORTRAN and FAP coded subroutines loaded with the FORTRAN BSS loader.

Before describing the program, I will describe briefly the operation of the HPD from the point of view of the data presented to the computer. The film is fixed on a stage which moves along either the X-axis or the W-axis. In the following, the position of this stage, regardless of the direction of scan is referred to as the X-coordinate and the non-measuring coordinate as W. An X-coordinate has a marker bit in the 18th position and may have up to 17 bits for the value.

The HPD mechanical flying spot traces a line across the film perpendicular to the direction of the stage. Every time a point is found, the position of the flying spot is digitized as the X-coordinate in a 15 bit number. The 11 high-order bits of this number are from a counter whose units correspond to a 25.4μ spacing, and the 4 low-order bits are from an interpolation by 16 between counts.

Before each scan line, the HPD transmits the X-coordinate n times to the read-out buffer. The number, n, of these sequential X-values is fixed on the HPD at 1, 2, 4 or 8 and should always be the same (usually 8 for bubble chamber film). n is determined by the expected number of the Y-coordinates and is used in other programs to scan the incoming data to find the next X-coordinate.

The first set of X's is followed by the W-coordinate which gives the position of the stage relative to the flying spot. This coordinate also has the 18 bit marker and is transmitted only once. Then an unknown number of Y's are transmitted followed by the full grating count which gives a measure of the length of the flying spot path and should be constant.

* Present address : Code 7232, US Naval Research Laboratory, Washington 25 D.C.
The program (see Flow charts) checks the number and value of the X's, the order of the Y's, and the grating count. It keeps a histogram of the least significant hexadecimal digit in the Y-coordinates, and it checks that the X-increment lies between 20 and 120, a minimum and maximum that are set in the program and can be changed.

The program simultaneously reads from the HPD and processes the data until an End of File signal is received signaling the end of one picture. It then prints out the parameters for the run and any error messages it has found plus detailed information if desired. The main program is a FORTRAN program which calls the PAP subroutines FSD and DDOSW. FSD does all the checking of the data and saves all information for printing. It then calls FSOUT, a FORTRAN program, to print all the results. DDOSW sets the required transfer vector in the trap cells and deals with the trapping.

Four PAP subroutines are used for various conversions. ADRF converts the address and DECF the decrement of the argument to an integer in the entire word. XADRIF converts the address and XDECFF the decrement of the argument to an integer in the decrement of the word.

The output of PAN 3 for each picture gives the total number of scan lines, the total number of digitizations, the W-coordinate, the initial X-coordinate, the initial number of X-coordinates for each line, and the value of the initial full grating count. Then it lists the average value of the X-increment (the X-translation between lines) and the r.m.s. deviation of this number and the minimum and maximum X-increment which occur within the prescribed limits. This is followed by a histogram of the LSD in hexadecimal for the Y-coordinates. All output is in octal except the line count, the number of X-values in a sequence, the r.m.s. deviation of the X-increments, and the numbers in the histograms.

Following the heading is a list of all errors found or the statement that none were found. For each error the printout contains the line number at which the error occurred, the X-coordinate of that line, and the error message. The errors looked for and the output are:

1. *NO OF X-S CHANGES followed by the new number
2. X-VALUES DIFFER followed by the new one
3. Y OUT OF ORDER followed by the two Y values out of order
4. DEL-X TOO BIG followed by the value of the offending X-increment
5. *GRATING COUNT BAD followed by the new grating count
6. LSD = 17 followed by the Y-coordinate
The two errors indicated by the stars in the list above change the standard of comparison. Thus if a single line has a bad full grating count the error message is printed twice, once when the error occurs and once when the correct value is reestablished. The Y OUT OF ORDER error is also given for equal values of Y.

As a further aid to tracing the source of errors one can print out the contents of the lines containing errors. For the Y out of order only the line in question is saved, for all other errors the line containing the error, the preceding line and the following line are all saved.

To operate PAN 3 one loads the program deck with a BSS loader and FORTRAN I/O subroutines into the card reader, followed by a set of cards giving the orders to be transmitted to the HPD. Press the "LOAD CARDS" button on the 709 console. There will be a halt after the program is loaded. Press START and the program writes the message "the 709 is ready for the HPD" on the on-line printer. The computer then reads a card from the card reader and if sense line 7 has been activated sends the HPD its orders and starts to read in coordinates. If not, the computer delays until the sense line is on. The data from a single picture is read in blocks of 2000 words and checked before any output is initiated. At the conclusion of the output for one frame the program recycles and reads in the next card.

The program normally reads the data from the HPD on-line and prints the output on-line. By depressing sense switch 3 it will read tape B1 for input and write on tape A3. The data on tape B1 must be in records of 2000 words and there is no limit to the number of records in the file.

Detailed information on the errors found is printed out when sense switch 1 is depressed. If errors are found on any frame and sense switch 1 is not depressed the program stops after printing the message "Depress sense switch 1 for fuller print".

The orders to the HPD are input to the program on cards identical with those used by the 411 program. The cards are standard absolute row binary cards. The decrement of the first word (9 left) contains the word count (number of orders to be transmitted). The remainder of the 9 row and 8 left word are ignored and the orders are read starting from the 8 right word on the card. These are numbers in the first half of the word as detailed in DD/DEV/63/l. If data is read from tape, sense switch 3 down, there is no input at all.
Changes to the standard procedure: since the computing for the above checks takes too much time on the 709 we cannot keep up if the HPD operates at full density and low speed (its normal operating conditions). It is possible to suppress the histogram check on the L.S.D. by depressing sense switch 2. This will probably become obsolete as soon as the 7090 arrives.
Figure captions

Fig. 1  Flow chart of main processing subroutine "FSD".

Fig. 2  Flow chart of FSD exit and error saving routines.

Fig. 3  Flow chart of MAIN LOOP of FSD subroutine.
ENTRY

Save index reg.

Set EOF indicator = 0

Clear histogram tables

Test S52

down

Express histogram check

Set for histogram

ENABLE TRAPS

down

Test S52

up

Read HPD commands from Cond Reader

Clear indicators for Channel D

Hold until S5L7 is set for HPD operation

Set index for # of buffers being used

Read d record

A

A

Initialize program parameters

Initialize index reg. for error table

WAIT

Hold until Trap

WAIT+1

Store channel

Was there an EOF on last read?

Yes

no

Read next record

Set addresses for this buffer

Compute # of words read in, and set in Counter

Is # of words read in = 0?

Yes

No

Initialize line saving routine

MAIN LOOP
(see detailed flow chart)

FINI

Was there an EOF in last read?

PRINT

Yes

No

Was just the last buffer?

Reset index for buffer count

WAIT+1

Has Trap occurred?

Figure 1
DISCUSSION

HALL: How is it that the X-coordinate can't be one count
different on a scan line? Our X's can sometimes differ by one
least count.

POWELL: We strobe the contents of the X-counter into a re-
gister and then copy it 8 times into the memory.

HALL: Ours is strobed 8 times directly from the Ferranti-
scaler.

POWELL: We really have had all these errors occurring. I
would like to emphasize that in my opinion the computer is the ideal
way of checking for these errors - so why not use it? I think this
could be one reason why on-line devices will do better than off-line
film scanning devices.